Factors influencing trip mode choice

Prepared for Traffic Safety and Environment Division, Highways Agency

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TRL Report TRL568

First Published 2003
ISSN 0968-4107

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Executive Summary

This report presents the results of a research project entitled 'Factors influencing trip mode choice', undertaken by TRL Limited on behalf of the Highways Agency (HA) and the Strategic Rail Authority. The purpose of the project is to improve understanding of the reasons for mode choice for medium-length and long-distance journeys, and indicate how mode choice might be influenced by various types of development in transport services.

Specific objectives of the research were to:

- Identify reasons for mode choice.
- Relate these reasons to the relevant characteristics of journeys and transport systems.
- Establish what possible improvements to transport systems might influence mode choice and how cost-effective they might be.

An unusual feature of this study is its examination, for each individual journey included in the research, of the chosen mode of transport, possible alternative modes, and the reasons for the choice. This approach provides a means of explaining *current* mode choice in terms of individual travel needs, preferences and constraints which are impossible to incorporate in a satisfactory manner in a conventional, aggregate transport model. It also forms the basis of further work designed to predict how *in the future* peoples' choices might be affected by possible changes in transport systems and hence to estimate the effectiveness of various measures designed to increase the proportion of journeys made by public transport.

The scope of the study was restricted to longer journeys within Great Britain which, if made by car, are likely to involve use of the motorway and trunk road network or, if made by public transport, are more likely to involve trains than buses. We are concerned both with regular journeys (made at least three times per week) of at least five miles (one-way) and any other journey at least 15 miles long. To qualify for inclusion in the study an individual had to have made one of these types of journey not more than one month previously, and have had the option of travelling by car, even if public transport was chosen for the journey.

Seven study areas were chosen so as to reflect a representative range of area types, demographic factors, transport infrastructure and public transport provision. They were in residential parts of Birmingham, Bromley, Burnley, Chelmsford, Plymouth, Reading and Trafford.

The sites in London, greater Manchester and Birmingham are all decidedly suburban, while in Plymouth and Reading we have been able to find suitable sites fairly close to central areas. All five sites have good public transport links to main line railway stations and airports, offering people a real choice between travel modes. The Chelmsford and Burnley sites are more remote and suburban in character, but appear typical of modern residential development in many medium-sized towns.

In four of the study areas (Birmingham, Burnley, Chelmsford and Reading) attention was focussed on journeys at least 15 miles long (one way). In the other three areas (Bromley, Plymouth and Trafford) regular journeys (made at least three times per week) of five miles or more (one way) were also included.

In each study area the research comprised the following components:

- *First traveller survey* designed to reveal journey patterns, discover relevant details of the journeys people actually made, establish perceptions of chosen and alternative transport modes, and to enquire into reasons for the choices of modes for these journeys. Some 2800 travellers were interviewed during this survey.
- *Alternative mode analysis'.* Details of public transport alternatives to car travel were obtained by reference to published material (timetables and web-sites) and calls to appropriate enquiry offices (National Rail Enquiry Service and Traveline). Allowances were made for time spent travelling to and from bus stops and railway stations and waiting for buses or trains.

  This information was used to compare the relative merits of the different transport modes, if any, which would have been available to each traveller. This provides an objective background to individual mode selection and reasons given for it.
- *Second traveller survey.* This was designed to determine whether different modes might have been chosen had better alternative transport systems been available. It was aimed mainly at car travellers who might, if public transport were improved sufficiently, be persuaded to use it instead of travelling by car. The objective was to establish what are the main deficiencies in public transport networks and services, and to categorise these across all study areas. This survey incorporated Transfer Value (TV) and Stated Preference (SP) exercises with selected respondents from the First Traveller Survey, exploring their evaluations of possible changes in modal characteristics.

A total of 595 respondents participated in the Second Traveller Survey.

- *Mode choice modelling.* The results of the Second Traveller Survey were used to develop mode choice models for predicting what proportion of people might use public transport rather than cars if various forms of public transport improvement could be effected.

Over all seven study areas there was an overwhelming preference for travel by car, rather than by public transport. This applies across all groups of travellers (defined by sex, age and income) and all journey purposes. Further, there are few significant differences in propensity to use public transport. A possible exception lies in large, congested urban areas, where public transport can be competitive with car travel in terms of costs and journey times and parking can be difficult and costly. Here, regular travellers are more likely than those elsewhere to use public transport.

Most peoples' choices can be explained quite simply in terms of differences in journey times and costs. Other factors are also considered and may be critical in a small minority of cases. Of these factors, the most often mentioned are public transport reliability, lack of services timed to match desired travel times, preference for direct journeys rather than those involving interchange, and dislike of long walking distances in the course of journeys.

The mode choice models, based on the results of stated preference interviews with selected travellers, are designed to take these factors into account, Separate models have been developed for different sample segments, to distinguish between:

- Regular and other journeys.
- Income bands (combined household incomes above and below £40000 per annum).
- Journey purposes (commuting/business trips and other purposes).
- Journey length (above and below 30 miles).
- Age (above and below 65).

Comparison of model coefficients between segments gives a good indication of the relative importance of different attributes of transport options. It is no surprise that journey time and cost emerge as the most significant factors, but inclusion of other factors improves the extent to which current modal choices can be explained.

Analysis of the survey results has lead to the following conclusions on factors other than time and cost:

- Over 70 per cent of respondents know that there are public transport alternatives to car travel for the journeys they make, but they appear not to have accurate information on the costs and travel times by alternative modes.
- Respondents perceive public transport as unreliable: most estimate that services run on time for fewer than 80 per cent of journeys.
- When directly asked, over 25 per cent said they would pay more than current fares to use current public transport services. Given that most know about the available alternative modes, this implies that direct questioning tends to overestimate how much they would be willing to pay.
- Higher income households have a stronger underlying preference for travelling by car, as opposed to bus, for regular journeys. But higher income households are more likely to switch to rail travel.
- There were distinct differences between the study areas in the factors that influence mode choice. These appear to stem from differences in socio-economic factors and current levels of public transport provision.
- The value of time for rail users was generally consistent, between £5 and £6 per hour.
- Rail users are less concerned about the availability of seats on short rail journeys (such as those between Bromley and central London). For longer journeys, rail travellers may be willing to pay more for comfort.

The final part of this research (after calibration of models to ensure that they reproduced current modal shares adequately) was used to predict the effects of a number of possible types of public transport improvement. These include:

- *Improved service reliability*. This appears to be the most effective means of increasing the public transport share of the market. It is estimated that if travellers were fully confident of adherence to service schedules then some 12 percent of long-distance travellers and six per cent of regular travellers might switch modes from car travel to public transport.
- *Reduced fare levels* might also produce significant shifts. For example, a 50 per cent across-the-board reduction in public transport fares might be enough for eleven per cent of long distance travellers and three per cent of regular travellers to change modes.
- *Reduction in public transport journey times*. This would appear to be equally effective for both types of traveller. For example, a 20 per cent reduction in overall journey times is estimated to produce a six per cent diversion from car travel to public transport.
- *Improved access to and egress from railway stations and bus stops*. If these linking journeys could be made substantially quicker public transport might become more attractive, especially for long-distance travellers. Complete elimination of these linking journeys might produce a switch of some three per cent of long-distance car users, although more practicable measures (such as integrated feeder services) would have less impact.
- Elimination of interchanges to provide direct services. If long-distance journeys by public transport could be accomplished with no more than one interchange, and regular journeys made with no interchanges, then some two per cent of travellers might be diverted from car use.
- *Better, more accessible passenger transport information* would make journey planning and public transport use easier for some travellers, and could possibly attract some two per cent of them from their cars.
- *Increasing public transport service frequencies* appears to be the least effective of the measures tested. It is estimated that increasing frequencies to four services per hour might produce modal shifts of the order of one per cent.

The results of the modelling process should not be taken as precise forecasts. They are intended more to indicate the relative effectiveness of different public transport policies and strategies, not all of which would be practicable everywhere. Where any significant improvements in public transport can be achieved, they are likely to result in significant modal shift from cars to public transport.

1 Introduction

This report presents the results of a research project entitled 'Factors influencing trip mode choice', undertaken by TRL Limited on behalf of the Highways Agency (HA) and the Strategic Rail Authority. The purpose of the project is to improve understanding of the reasons for mode choice for medium-length and long-distance journeys, and indicate how mode choice might be influenced by various types of development in transport services.

1.1 Study objectives

Specific objectives of the research were to:

- Identify reasons for mode choice.
- Relate these reasons to the relevant characteristics of journeys and transport systems.
- Establish what possible improvements to transport systems might influence mode choice and how cost-effective they might be.

1.2 Approach to the research

An unusual feature of this study is its examination, for each individual journey included in the research, of the chosen mode of transport, possible alternative modes, and the reasons for the choice. This approach provides a means of explaining *current* mode choice in terms of individual travel needs, preferences and constraints which are impossible to incorporate in a satisfactory manner in a conventional, aggregate transport model. It also forms the basis of further work designed to predict how *in the future* peoples' choices might be affected by possible changes in transport systems and hence to estimate the effectiveness of various measures designed to increase the proportion of journeys made by public transport.

An outline of the methodology employed in this research is presented in the next section of this report; a detailed account is given in a separate report (Project Report PR/T/111/02).

This report combines the findings for each of the seven study areas investigated (see Section 2.1) comparing results for different areas where appropriate. A supplementary report (Project Report PR/T/126/02) presents the results for each area in more detail.

2 Outline of methodology

The scope of the study was restricted to longer journeys within Great Britain which, if made by car, are likely to involve use of the motorway and trunk road network or, if made by public transport, are more likely to involve trains than buses. We are concerned both with regular journeys (made at least three times per week) of at least five miles (one-way) and any other journey at least 15 miles long. To qualify for inclusion in the study an individual had to have made one of these types of journey not more than one month previously, and have had the option of travelling by car, even if public transport was chosen for the journey. In principle, subjects could have been selected randomly from all areas of the country. In practice it was considered more beneficial to use clustered samples in a number of selected study areas in order to be able to compare the choices made by different individuals with similar options, and to facilitate the investigation of what options were in fact available.

2.1 Study area selection

The general locations of the study areas were chosen so as to reflect a representative range of area types, demographic factors, transport infrastructure and public transport provision. It was also necessary to secure statistically adequate samples of travellers who had the option of using cars or public transport for their journeys. Accordingly, the area selection was somewhat weighted in favour of larger urban areas, but included some medium-sized free-standing towns. Predominantly rural areas were excluded on the ground that few residents would consider longer-distance travel by the limited public transport services available to be a realistic alternative to car travel.

The choice of study areas within each general location was based on generally available information about transport and geographical factors, discussions with relevant local authorities, and site visits. Our choices are not intended to provide a typical cross-section of residents of each general area. Instead, we have tried to ensure that the populations to be questioned are likely to be affluent enough to be able to afford to make longer-distance trips, to own cars (otherwise their mode choice may be very limited) and to be in occupations which require some business travel.

These criteria have led us to areas where residential properties tend to be privately owned, and most households have at least one car. This has led to a slight bias toward suburban areas, particularly in the larger conurbations. This reflects the spread of urban development in recent decades, and the distribution of the kind of people we wish to question. Against this we have tried to incorporate as much variety as possible, to reflect differences in character between areas.

The sites in London, greater Manchester and Birmingham are all decidedly suburban, while in Plymouth and Reading we have been able to find suitable sites fairly close to central areas. All five sites have good public transport links to main line railway stations and airports, offering people a real choice between travel modes. The Chelmsford and Burnley sites are more remote and suburban in character, but appear typical of modern residential development in many medium-sized towns.

Details of each site, listed in Table 1, are presented in the supplementary report (PR/T/126/02).

In four of the study areas (Birmingham, Burnley, Chelmsford and Reading) attention was focussed on journeys at least 15 miles long (one way). In the other three areas (Bromley, Plymouth and Trafford) regular journeys (made at least three times per week) of five miles or more (one way) were also included.

Table 1 Study areas

Urban area	*Postcode district*	*Locality*	*Long journeys (≥15 miles)*	*Regular journeys (≥ 3 per week; ≥ 5 miles)*
Birmingham	B75 6	Sutton Coldfield & Four Oaks	●	
Bromley	BR5 1	Petts Wood	●	●
Burnley	BB10 2	Harle Syke	●	
Chelmsford	CM1 6	Springfield	●	
Plymouth	PL3 4&5; PL4 6	Mannamead	●	●
Reading	RG30 2	West Reading	●	
Trafford	WA15 6	Timperley	●	●

2.2 Fieldwork and analysis

In each study area the research comprised the following components:

- First traveller survey.
- Alternative mode analysis.
- Examination of factors influencing mode choice.
- Second traveller survey.
- Mode choice modelling.

The *first traveller survey* was designed to reveal journey patterns, discover relevant details of the journeys people actually made, establish perceptions of chosen and alternative transport modes, and to enquire into reasons for the choices of modes for these journeys.

It was also used to identify those respondents to be invited to participate in the second traveller survey.

After the first traveller survey, each journey identified was subjected to a process of '*alternative mode analysis'*. This had two purposes. The first was to allow comparison of the relative merits of the different transport modes, if any, which would have been available. This provides an objective background to individual mode selection and reasons given for it. The second purpose was to provide a realistic basis for the second traveller survey.

This alternative mode analysis consisted of establishing how each journey could have been made by public transport, with similar arrival or departure times (depending on which was more constrained). Details of public transport journeys were obtained by reference to published material (timetables and web-sites) and calls to appropriate enquiry offices (National Rail Enquiry Service and Traveline). Allowances were made for time spent travelling to and from bus stops and railway stations, and waiting for buses or trains.

Bus travel was considered as an alternative mode only where it appeared to be quicker than train travel.

Standard fares, or ordinary discounted day-return fares, were used for train journeys, according to the time of day. Equivalent fares were derived for season ticket or travelcard holders. Appropriate allowances were made where several people travel together.

Details of local bus fares were not available from Traveline, so estimated fares were based on distances and national average fare levels.

The *second traveller survey* was designed to determine whether different modes might have been chosen had better alternative transport systems been available. It was aimed mainly at car travellers who might, if public transport were improved sufficiently, be persuaded to use it instead of travelling by car. The objective was to establish what are the main deficiencies in public transport networks and services, and to categorise these across all study areas.

Relevant respondents, selected according to their responses to the first survey, were invited to participate in Transfer Value (TV) and Stated Preference (SP) exercises. In the former their evaluations of possible changes in modal characteristics were explored, and in the latter they made choices between sets of private and public transport options for journeys they had made. The options were based on characteristics of hypothetical public transport services which might result from possible future transport developments. These hypothetical services might compare favourably with those currently provided in terms of journey times, service frequencies, fares, through journeys, accessibility (perhaps through more intensive local transport networks of dedicated feeder services), integrated ticketing and seat reservations, etc. Another stated preference exercise was conducted with existing rail passengers in order to give some indication of priorities for improvement in rail services.

Analysis of these results is aimed at developing *mode choice models* for predicting what proportion of people might use public transport rather than cars if various forms of public transport improvement could be effected. Ideally these models would apply to the generality of respondents across the study areas, grouped into 'sectors' according to sex, journey purpose, and possibly other factors (like access to public transport networks) identified in earlier phases of the project. In practice if there were some significant differences between individual study areas which limited the scope for pooling results in this way.

3 First traveller surveys: Results

The Bromley study was treated as a pilot for the rest of the project, with all stages of fieldwork and analysis being completed between July and November 2001. After some consequential refinement of the survey questionnaires, fieldwork in the other six areas commenced in February 2002, and was completed by mid June.

A small number (52) of interviewees in the pilot survey in Bromley were asked about both long and regular journeys. The questionnaire was subsequently modified to avoid overloading interviewees, and in the other six study areas different individuals were asked about EITHER long OR regular journeys.

The total sample sizes achieved over all seven study areas are shown in Table 2.

Table 2 Sample sizes for first traveller surveys

	Journeys recorded	
	Long (≥15 miles)	*Regular (≥3 per week, ≥5 miles)*
Single destination journeys	1670	661
Multi-destination journeys	391	123
Total	2061	784

Most journeys are to single destinations, followed by returns to starting points. Only 16 per cent of regular journeys, and 19 per cent of long journeys, have multiple destinations. These have proved difficult to analyse in an objective, systematic manner, and, as we shall show later, are much less likely than the single-destination journeys to involve public transport use. They are discussed briefly in Section 3.4, but throughout most of this report attention is limited to single-destination journeys.

It is also convenient to present discussion of long and regular journeys separately in Sections 3.1 and 3.2.

3.1 Long-distance journeys

3.1.1 Traveller characteristics

Subjects for the first traveller survey were screened to ensure that they had recently made relevant journeys, and that they could have made them by car, even if they chose not to. Other characteristics of the sample are shown in Table 3. There are minor discrepancies between some of the subtotals in this table. These arise where interviewees fail or refuse to provide clear answers to some questions (for example, some people are reluctant to reveal income information). Where possible in this report we have used percentages instead of actual numbers to avoid confusion, giving sample sizes where appropriate.

The sample for each area was almost equally divided between the sexes, except in Trafford where there was an abundance of females. Young people (under 30) were poorly represented in all areas, especially Plymouth. This may reflect the types of housing in the chosen study areas (possibly fewer starter homes, flats etc than elsewhere), or life-styles of the under-thirties (evening entertainment making them difficult to contact at home). There was considerable variation between the areas in income distribution. For example, some 52 per cent of Bromley interviewees claimed to be in households with combined incomes of more than £40000, but the corresponding proportion for Burnley, Plymouth and Trafford ranged between 16 and 18 per cent.

3.1.2 Journey destinations

It is impracticable to use a common matrix of origin and destination zones for all seven study areas: many cells would be void, or contain numbers too small for useful analysis. Destination maps are contained in the individual study area reports, and the distribution of destinations of long-distance journeys from each study area is shown in Table 4. The classification of destinations this table is necessarily arbitrary, but it serves to give a reasonable impression of journey patterns.

Both the Birmingham and Bromley study areas are sufficiently far from the centres of their respective conurbations for substantial proportions (24 and 23 per cent) of journeys of 115 miles or more to be made within these conurbations. In contrast, the Trafford study area is closer to the conurbation centre, and there are fewer opportunities for long journeys within greater Manchester. Greater London attracts 18 per cent of long journeys from Chelmsford and 16 per cent from Reading, while greater Manchester attracts a similar proportion (22 per cent) from

Table 3 Characteristics of long-distance travellers

	Birmingham	*Bromley*	*Burnley*	*Chelmsford*	*Plymouth*	*Reading*	*Trafford*	*All areas*
Sex								
Male	49.2%	53.8%	47.7%	47.2%	52.5%	51.0%	41.5%	48.6%
Female	50.8%	46.2%	52.3%	52.8%	47.5%	49.0%	58.5%	51.4%
Sample size	303	171	302	307	345	304	347	2079
Age								
17-29	8.3%	9.9%	9.3%	9.4%	5.5%	17.8%	5.2%	9.1%
30-45	13.9%	24.0%	28.8%	34.2%	22.0%	37.2%	27.6%	26.9%
46-59	32.3%	31.6%	30.8%	29.6%	33.9%	23.0%	32.0%	30.5%
60+	45.5%	34.5%	31.1%	26.7%	38.6%	22.0%	35.2%	33.4%
Sample size	303	171	302	307	345	304	347	2079
Income								
<£9500	6.6%	2.5%	12.1%	7.4%	10.9%	5.4%	11.9%	8.6%
£9500 - £17499	17.9%%	6.8%	20.9%	14.4%	21.5%	14.6%	23.3%	18.0%
£17500 - £24999	16.6%	11.9%	19.3%	20.9%	22.2%	19.0%	18.1%	18.8%
£24500 - £39999	30.6%	27.1%	31.4%	31.3%	27.6%	28.7%	28.9%	29.5%
£40000 - £60000	18.8%	27.1%	12.1%	13.9%	13.5%	19.4%	13.3%	16.0%
£61000 - £80000	4.4%	11.0%	2.5%	7.4%	3.3%	10.1%	2.6%	5.4%
£81000 - £100000	1.7%	6.8%	1.3%	1.7%	1.0%	2.4%	1.5%	2.0%
>£100000	3.4%	6.8%	0.4%	3%	0%	0.4%	0.4%	1.6%
Sample size	229	118	239	230	275	247	270	1608

Table 4 Destinations of long-distance, single-destination journeys

Journeys from:		*Sample size*
Birmingham to:		
West Midland metropolitan area	24%	230
Rest of W Midlands	23%	
Elsewhere	53%	
Bromley to:		
Central London	5%	171
Inner London	10%	
Outer London	8%	
Elsewhere	77%	
Burnley to:		
Greater Manchester	22%	231
Lancashire	42%	
Elsewhere	36%	
Chelmsford to:		
Essex	49%	242
Greater London	18%	
Rest of SE	14%	
Elsewhere	20%	
Plymouth to:		
Devon & Cornwall	64%	245
Rest if SW	14%	
SE	12%	
Elsewhere	10%	
Reading to:		
Reading postcode area	21%	244
Greater London	16%	
Rest of SE	42%	
Elsewhere	21%	
Trafford to:		
Greater Manchester	9%	275
Rest of NW	40%	
Elsewhere	51%	

Burnley. Fewer long trips from Reading are attracted to the Reading Postcode Area (mostly adjacent to the Thames Valley and the M4 corridor) than to Essex from Chelmsford, with more of the Reading long trips destined for the rest of the South East and other regions. However, these differences are more a reflection of the positions of the study areas with respect to fairly arbitrary boundaries than an indication of fundamental differences in travel behaviour. It is not possible, unless an unreasonably devious route is taken, to make a 15 mile journey from the Plymouth study area to anywhere else in the Plymouth urban area. Consequently, nearly two thirds of the Plymouth-based long journeys are to destinations outside Plymouth but in Devon or Cornwall, and the rest to more remote destinations.

3.1.3 Journey purposes

Interviewees were asked to state the main purpose of each journey. Their responses are summarised in Table 5.

Over half of all journeys are for the optional purposes of visiting friends or relatives, or entertainment. In every area the proportion of journeys made for these purposes exceeds those made for commuting and business. Unfortunately, there is evidence that some commuting trips were mis-classified as business trips, so that we shall combine these two purposes in further analysis, except where there is a special reason to treat them separately. The apparently low figure for commuting trips from Bromley reflects the distribution of journey lengths in this area: substantial numbers of journeys to Central and Inner London, and a significant number of those to Outer London, are less than 15 miles long. The remarkably high proportion of business journeys from Bromley may reflect differences in employment patterns between this and the other areas.

Personal business and shopping account for 17 per cent of all long trips, whereas education and escorting other people and participation in sport together amount to only four percent. This suggests that long-distance journeys to schools and sports facilities are comparatively rare.

3.1.4 Choice of modes for long-distance journeys

Of the 1651 long-distance single-destination trips were recorded, 1527 (92 per cent) were made wholly by car, by drivers or passengers. The remaining 124 (eight per cent) were made wholly by public transport, or partly by public transport and partly by car, with cars typically being used for access to and from railway stations.

Proportions of travellers of each sex and in different age and income groups are shown in Table 6.

There is no significant difference between the sexes in propensity to use public transport. The results appear to suggest some correlation between public transport use and

Table 5 Journey purposes of long-distance single-destination journeys

	Birmingham	*Bromley*	*Burnley*	*Chelmsford*	*Plymouth*	*Reading*	*Trafford*	*All areas*	*Sample size*
Commuting	9%	5%	11%	16%	4%	16%	4%	10%	158
Business	10%	36%	17%	10%	11%	18%	15%	16%	261
Education	1%	0%	2%	1%	1%	2%	0%	1%	16
Escort	2%	2%	3%	0%	1%	1%	1%	2%	26
Shopping	4%	1%	15%	10%	5%	2%	8%	7%	110
Personal business	13%	5%	14%	10%	7%	10%	9%	10%	164
Visiting friends/relatives	37%	26%	16%	34%	34%	33%	44%	32%	536
Entertainment	22%	19%	20%	15%	33%	15%	16%	20%	333
Sport	0%	1%	0%	3%	2%	0%	0%	1%	17
Other	0%	5%	1%	1%	1%	2%	3%	2%	29
Sample size	246	171	239	262	260	251	222		1651

Table 6 Mode choice by sex, age and income – proportion of long-distance trips wholly or partly by public transport

	All trips	*Proportion by public transport*
Sex		
Male	1010	6.6%
Female	1069	6.5%
Age		
17-29	190	4.7%
30-45	560	6.4%
46-59	634	5.7%
60+	695	7.9%
Income		
<£40k	1206	5.3%
≥£40k	402	8.2%

income, but because or the relatively small sample sizes the statistical significance of any differences is doubtful. It is arguable that the age effect could be related to smaller numbers of business trips, which tend to be financed by employers, in the oldest group, and that people on higher incomes may be better able to afford public transport. These hypotheses are not supported by this evidence, but they are tested at the modelling stage of the research.

Table 7 shows how modal choice may be related to journey purpose, and, to a limited extent, how this relationship may differ between study areas.

This table shows, where appropriate, the percentage of journeys in each study area/journeys purpose cell (eg Plymouth/visiting friends and relatives) made by public transport. Where no percentage is shown, this indicates that the sample was too small to produce a statistically meaningful. The confidence intervals[1] for the percentages which are shown are in some cases substantial.

The final column suggests that overall there is little real variation between journey purposes. Business and commuting trips seem most likely to be made by public transport. The greater propensity to use public transport for business journeys is consistent with costs for such trips being borne by employers rather than individuals. However, business travellers are also likely to have greater values of time, and be attracted to public transport only where it is quicker than the alternative. This explanation is unlikely to apply to commuters, who generally pay their own fares, but for many Bromley commuters journey times for car travel and costs are greater than for public transport, and the Bromley results tend to dominate those for other areas.

The final row indicates that the highest proportion of public transport trips occurs in Bromley, and the second highest in Plymouth. The small differences between the proportion of trips made by public transport in these other five areas are not significant.

[1] *Ninety-five per cent confidence intervals, derived assuming binomial distributions.*

Table 7 Percentage of journeys by public transport for each area and journey purpose

Journey purpose	*Study area*							
	Birmingham	*Bromley*	*Burnley*	*Chelmsford*	*Plymouth*	*Reading*	*Trafford*	*All areas*
Commuting		67% ±31%		10% ±9%				9% ±5%
Business		26% ±11%			18% ±14%	9% ±8%		11% ±4%
Education								
Escort								
Shopping								6% ±5%
Personal business								8% ±4%
Visiting friends / relatives		13% ±10%			9% ±6%		5% ±4%	6% ±2%
Entertainment		13% ±11%			9% ±6%			7% ±3%
Sport								
Other								
All journey purposes	5% ±3%	20% ±6%		7% ±3%	11% ±4%	5% ±3%	5% ±3%	8% ±1%

There are no significant differences between the other journey purposes. This suggests that in developing mode choice models for long journeys, business travellers might be segregated from others, but there is no case for further segregation of the data by journey purpose.

3.1.5 Reasons for mode choice for long-distance journeys

People who had made long journeys exclusively by car were asked whether they could have travelled by public transport and, if so, how. Only 976 people (47 per cent of those making long journeys) indicated that they had public transport options. These are listed in Table 8.

Table 8 Alternative transport modes (for long-distance car travellers)

Alternative mode	*Number of responses*
Rail	627
Bus	323
Coach	49
Tram	13
Underground	1
Taxi	12
Aeroplane	6
Bike	0
Total	1031
Total interviewees*	976

* *The total number of responses exceeds the number of respondents, some of whom gave more than one answer.*

Rail was the most widely perceived public transport alternative to car travel, but a substantial minority nominated bus. It is not clear at this stage whether this reflects a real preference for bus travel among some travellers, or the availability of rail services for their journeys. This question is addressed later in this report. Other modes, including coach, constitute only a small proportion (about eight per cent) of the alternatives mentioned.

Reasons given by these car travellers for their choice of mode are listed in Table 9.

Table 9 Reasons for preference for car rather than public transport travel (long-distance journeys)

Reason for car preference	*Number of responses*
Shorter journey time	382
Lower cost	245
Public transport Interchange	59
Handling luggage on public transport	97
No public transport service at desired time of travel	44
Public transport unreliability	45
Public transport comfort or cleanliness	51
Public transport overcrowding	14
Excessive walking distances	44
Total	981
Total interviewees*	924

* *The total number of responses exceeds the number of respondents, some of whom gave more than one answer.*

Differences in journey time and cost are given as reasons for preference for car travel in nearly two thirds of cases. Problems of carrying luggage on public transport are an obvious deterrent for some people, but, surprisingly, dislike of interchange, lack of conveniently timed services and unreliability are mentioned by only small minorities.

All car travellers (including those who perceived no current alternative to car use), were asked what, if any, improvements to public transport services might encourage them to consider using it. Their responses are shown in Table 10.

Table 10 Improvements to public transport which might encourage consideration of its use for long-distance journeys

	Number of responses	
Type of improvement	*Respondents with public transport alternatives*	*Respondents with no alternative*
Fewer interchanges	298	329
Lower fares	160	266
Reliability	128	214
More frequent services	123	158
Overall journey time	79	112
Cleanliness	30	46
Seat availability/comfort	25	56
Safety (vehicles)	3	11
Feeder services	7	16
Passenger information	13	4
Luggage handling facilities	22	32
Safety (at stops)	16	22
Total	933	1237
Total interviewees*	904	1089

* *The total number of responses exceeds the number of respondents, some of whom gave more than one answer.*

There are some interesting contrasts with Table 9. Overall journey time, although still significant, is seen as a less important consideration than reduction in the number if interchanges required in the course of journeys, improved reliability and increased service frequencies. Fare levels are still a major concern. Less easily quantifiable factors, like safety, comfort and passenger information are mentioned only by quite small minorities.

Those interviewees who had made journeys by public transport were asked why they preferred it to car travel. Their responses are shown in Table 11.

The more common responses relate to negative aspects of car travel associated with congestion and parking costs. They are important enough to weigh the balance in favour of public transport for only a small minority of travellers, particularly those travelling between Bromley and Central London.

Only small numbers mention the benefits of public transport, for example not having to drive and the possibility of relaxing or working on train journeys.

3.1.6 Comparisons of travel options

So far we have examined modal choice using aggregate statistics and people's own perceptions of the properties of alternative transport services. In this section we make

Table 11 Reasons for public transport use (long distance journeys)

Reason for choice of public transport	*Number of responses*
Dislike of driving in heavy traffic	36
Difficulty/cost of parking	29
Car slower than public transport	31
Car more expensive than public transport	25
Prefer to rest on the journey	12
Too far to drive in a day	18
Leave car for use by others	9
Prefer to work/read on journey	11
Total	171
Total interviewees*	137

* *The total number of responses exceeds the number of respondents, some of whom gave more than one answer.*

individual cost and time comparisons between actual car journeys and possible public transport alternatives, regardless of whether car users were aware of these alternatives. For purposes of other parts of the study we have made enquiries about public transport alternatives to the journeys actually made by car, establishing what services are available, arrival and departure times, overall travelling times, details of interchanges (where appropriate) and fares.

Respondents have themselves estimated times and distances for their car journeys. Costs are more problematical, especially as the majority of respondents (80 per cent) claimed not to concern themselves with motoring costs when deciding how to travel. From estimates made by those who were more cost-conscious we have established reasonable linear relationships between fuel cost and journey length. These formulae (described in detail in separate study area reports) imply marginal fuel costs ranging from about nine to eleven pence per mile, which is of the expected magnitude for a typical car. They obviously overstate the perceived cost of car travel for many motorists, but a minority may consider fuel cost, together with other costs, when comparing transport options. Here the formulae are used merely as a starting point for discussion; variations in perceived cost are considered in due course.

Differences between fares for public transport alternatives for long-distance journeys and fuel costs for car journeys derived from the formulae are plotted against corresponding differences in overall journey times in Figure 1[2].

Also shown in Figure 1 are lines of ‘equal generalised cost’, for various notional values of time. For a trip represented by a point above one of these lines, the trade-off between cost and time is in favour of car travel over public transport; the converse holds for points below the lines.

Most of the points lie well to the right of the vertical axis and above the horizontal axis implying that most public transport trips would be slower and more expensive than car trips. An overwhelming majority lie above the ‘equal generalised cost’ lines. If only time and cost were considered, car travel would be the rational choice of all but a handful of people, if their value of time were as low as 5p/minute (£3.00/hour). For people with higher values of time, the choice of car would be almost unanimous.

The outlying points to the left of the vertical axis represent a few seemingly inordinately slow car journeys

[2] *Cost differences are taken as total public transport fare (for all members of groups travelling together) minus fuel costs, and overall travel time differences by public transport minus car travel time.*

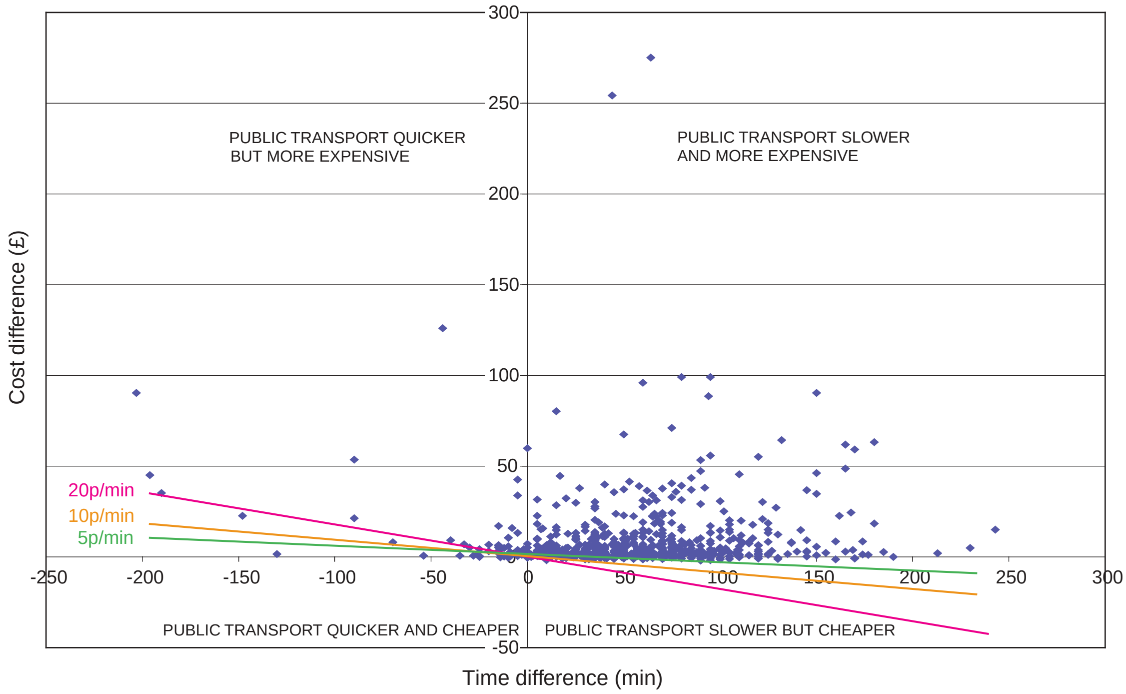

Figure 1 Public transport car comparisons (long-distance journeys by car from all study areas)

(rather than exceptionally quick public transport options) made for leisure purposes which may have involved stops for meals, visits to tourist attractions etc along the route. In these cases comparison with the fastest public transport options would appear irrelevant.

It is arguable that that the fuel costs for car journeys are overestimated by the formulae, since many people claim that they do not consider fuel costs. If so, the cost differences in Figure 1 are too small, and the number of travellers who might rationally choose public transport, although small, is overestimated.

At this stage it is not possible to quantify apparently important factors such as the disutility of public transport interchange, or (perceived) service unreliability. Their effects are explored in the stated preference exercises which are discussed later in this report. However, neither of these factors is likely to improve the probability of public transport choice, so the impression given by Figure 1 almost certainly exaggerates the numbers of car users who should, if their decision making were 'rational', be travelling by public transport.

Figure 2 shows the corresponding plot for journeys made by public transport. This is based on public transport journey times and costs reported by the travellers, and estimated times and costs car alternatives. These are based on estimates of distance and time obtained from the AA Milemaster Plus package[3], and The perceived fuel cost formulae described above.

Figure 2 indicates that there is a substantial proportion of travellers who prefer to use public transport, even though it is slower and more expensive than car travel. Similarly, there are others whose choice, if only time, cost and value of time were considered, would be car travel.

[3] *By kind permission of the Automobile Association and Navtech Inc.*

These people must be influenced in their choices by other factors, such as those listed in Table 11.

Assuming a value of time of 5p/minute, 46 per cent of these public transport users made a choice consistent with cost and time differences; this fraction falls to 32 per cent if time is valued at 20p/min.

Table 12 indicates that public transport appears both quicker and cheaper than car travel for only a minority of these public transport users, whether they live on Bromley or elsewhere. However, a substantial proportion (36%) of the Bromley respondents appear willing to pay more for public transport if it is quicker, compared with only nine per cent of those elsewhere. Conversely, only 21 per cent of Bromley respondents accept a slower public transport journey if it is cheaper compared with 42 per cent of those living in other areas.

Table 12 Cost-time trade-off for long-distance public transport users

	Public transport slower, more expensive	*Public transport slower, cheaper*	*Public transport quicker, more expensive*	*Public transport quicker, cheaper*	*Totals*
Bromley	6 (21%)	6 (21%)	10 (36%)	6 (21%)	28
Elsewhere	20 (38%)	22 (42%)	5 (9%)	6 (11%)	53
All areas	26 (32%)	28 (35%)	15 (19%)	12 (15%)	81

Table 11 suggests that costs of parking may be a crucial factor in some cases. This is most likely to be true in central city areas where parking spaces can be hard to find and expensive. This would apply particularly to central London and would seem to be at least a partial explanation of why the Bromley travellers are more likely to use public transport than those elsewhere. In order to test this hypothesis, we have, in the absence of information on

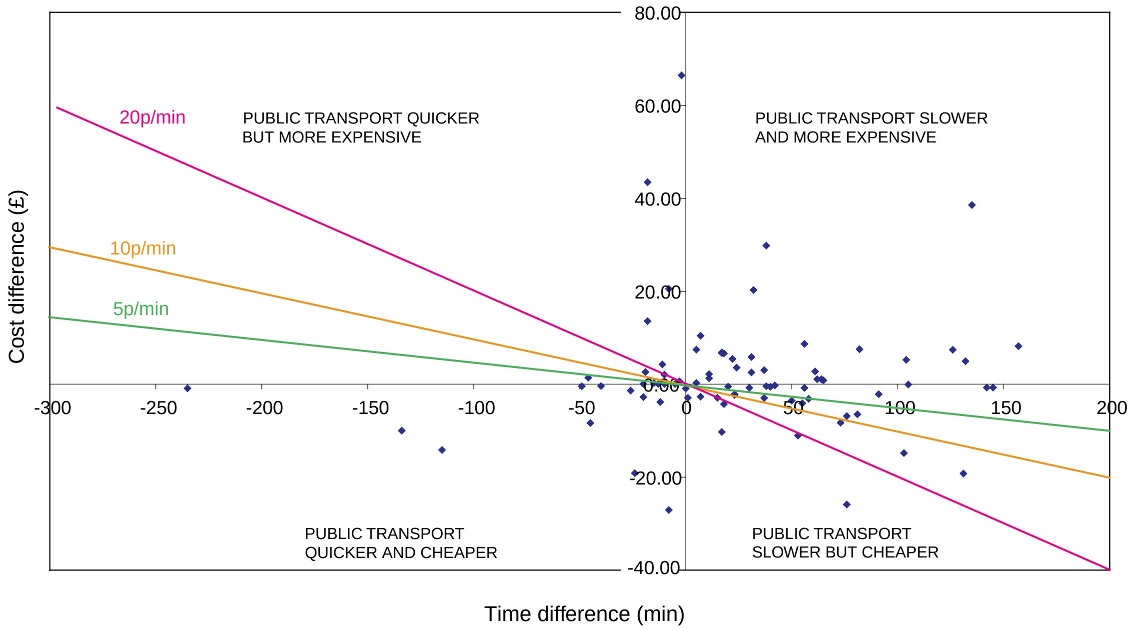

Figure 2 Public transport–car comparisons (long-distance journeys by public transport from all study areas)

parking charges at destinations of public transport journeys, assigned notional parking charges for journeys to the London area: £30 for central London and £10 for Inner London. This has the effect of reducing the differences in generalised cost between public transport and car travel for some people, and increasing the proportion whose choice of public transport can be explained simply in terms of times and costs. With these notional charges, the proportion of cases which are consistent with time and costs differences rises to 51 per cent for a value of time of 5p/minute, and 36 per cent at a value of 20p/minute.

We are therefore presented with the inescapable conclusion that for the great majority of long-distance journeys time and cost considerations lead to preference for car travel. However, for a small minority (some four per cent) other factors, such as dislike of driving long distances or on congested roads, may contribute to decisions to use public transport.

3.4 Regular, medium distance journeys

We now turn our attention to journeys of five miles or more in length (one-way) and which are made at least three times per week. The presentation and discussion of results in this section follows the pattern adopted for the long-distance journeys in Section 3.1.

3.4.1 Traveller characteristics

Subjects for the first traveller survey were screened to ensure that they had recently made relevant journeys, and that they could have made them by car, even if they chose not to. Other characteristics of the sample are shown in Table 13. There are minor discrepancies between some of the subtotals in this table, as in Table 3. These arise where interviewees fail or refuse to provide clear answers to some questions (for example, some people are reluctant to reveal income information. Where possible we have used percentages instead of actual numbers to avoid confusion, giving sample sizes where appropriate.

Table 13 Characteristics of regular travellers

	Bromley	*Plymouth*	*Trafford*	*All areas*
Sex				
Male	55.1%	58.7%	47.0%	53.5%
Female	44.9%	41.3%	53.0%	46.5%
Sample size	185	259	251	695
Age				
17-29	15.1%	8.5%	10.0%	10.8%
30-45	29.7%	37.5%	43.0%	37.4%
46-59	29.2%	30.9%	26.7%	28.9%
60+	26.0%	23.2%	20.3%	22.9%
Sample size	185	259	251	695
Income				
<£9500	2.3%	6.7%	6.2%	5.5%
£9500 - £17499	6.9%	17.6%	13.5%	13.7%
£17500 - £24999	8.5%	27.2%	15.5%	18.6%
£25000 - £39999	31.5%	25%	34.2%	29.8%
£40000 - £60000	28.5%	13.8%	23.8%	20.8%
£61000 - £80000	11.5%	5.8%	4.2%	6.6%
£81000 - £100000	5.4%	2.2%	2.1%	2.9%
>£100000	5.4%	1.3%	0.5%	2.0%
Sample size	130	224	193	547

Males slightly outnumbered females except in Trafford. As for long-distance journeys, young people were poorly represented, presumably for the same reasons, and there were considerable differences in income distribution between the study areas: some 51 per cent of Bromley interviewees were from households with total incomes of at least £40000 per annum, while the corresponding proportions for Plymouth and Trafford were 23 and 31 per cent respectively.

3.4.2 Journey destinations

Destination maps are contained in the individual study area reports, and the distribution of destinations of regular journeys from each study area is shown in Table 14. As for the long-distance trips, the classification of destinations this table is necessarily arbitrary, but it serves to give a reasonable impression of journey patterns.

Table 14 Destinations of regular, single-destination journeys

Journeys from:		*Sample size*
Bromley to:		
Central London	18%	185
Inner London	17%	
Outer London	41%	
Elsewhere	24%	
Plymouth to:		180
Plymouth urban area	67%	
Elsewhere	33%	
Trafford to:		
Greater Manchester	77%	239
Rest of NW	21%	
Elsewhere	2%	

Predictably, most regular trips have destinations within the urban area containing each study area. Both Bromley and Trafford are located fairly near the outer boundaries of their conurbations, encouraging a significant proportion of external trips. External trips from Plymouth tend to be to major towns in Devon and Cornwall, particularly Exeter and Torbay.

3.4.3 Journey purposes

Proportions of regular journeys for each main purpose are shown in Table 15.

Commuting is by far the most common purpose of regular journeys, especially in Trafford where the proportion of entertainment trips is much lower than in Bromley and Plymouth. Education trips are uncommon, suggesting that he majority of trips to schools and colleges may be shorter than five miles.

3.4.4 Choice of modes for regular journeys

A total of 589 regular, single-destination trips were recorded, of which 572 (87 per cent) were made exclusively by car, by drivers or passengers. The remaining 77 trips were made wholly or partly by public transport.

Table 15 Journey purposes of regular single-destination journeys

	Bromley	Plymouth	Trafford	All areas	Sample size
Commuting	57%	56%	74%	63%	370
Business	6%	7%	4%	6%	34
Education	2%	3%	1%	2%	12
Escort	2%	2%	1%	2%	9
Shopping	5%	5%	5%	5%	29
Personal business	4%	3%	3%	3%	20
Visiting friends/relatives	8%	6%	8%	7%	43
Entertainment	10%	15%	2%	9%	52
Sport	4%	2%	1%	2%	14
Other	2%	1%	1%	1%	6
All journeys	185	195	209		589

Proportions of travellers of each sex and in different age and income groups are shown in Table 16.

The only group to make an atypical proportion of public transport trips is the 17-29 age group. Admittedly this is a small sample, but the difference between it and the other groups appears to be significant. The proportion recorded for the higher income group appears not to be significantly higher than that for the other groups, between which there are no significant differences.

Table 16 Mode choice by sex, age and income – proportion of regular trips wholly or partly by public transport

	All trips	*Proportion by public transport*
Sex		
Male	372	13.4%
Female	323	10.8%
Age		
17-29	75	24.0%
30-45	260	10.8%
46-59	201	11.9%
60+	159	9.1%
Income		
<£40k	370	9.2%
≥£40k	177	15.8%

Table 17 shows how modal choice may be related to journey purpose.

As in the corresponding table for long-distance journeys (Table 7) we have shown only percentages which are statistically valid, and indicated the 95 per cent confidence intervals.

These results, which are strongly influenced by the Bromley statistics, suggest that education and commuting trips are most likely to be made by public transport. Differences shown between other journey purposes are not significant

This suggests that in developing mode choice models for regular journeys, commuters might be segregated from other travellers, but there are too few education trips for this approach. There is no case for further segregation of the data by journey purpose.

Table 17 Percentage of regular journeys by public transport for each area and journey purpose

	Study area			
Journey purpose	*Bromley*	*Plymouth*	*Trafford*	*All areas*
Commuting	41% ±9%		7% ±4%	15% ±4%
Business				
Education				50% ±28%
Escort				0% 0%
Shopping				14% ±13%
Personal business				
Visiting friends/relatives				
Entertainment	28% 21%			10% ±8%
Sport				
Other				
All journeys	30% ±7%	3% ±2%	7% ±3%	13% ±3%

3.4.5 Reasons for mode choice for regular journeys

People who made regular journeys exclusively by car were asked whether they could have travelled by public transport and, if so, how. Only 298 people (38 per cent of those making regular journeys) indicated that they had public transport options. These are listed in Table 18.

Table 18 Alternative transport modes (for regular car travellers)

Alternative mode	*Number of responses*
Rail	71
Bus	203
Coach	3
Tram	30
Underground	2
Taxi	8
Aeroplane	0
Bike	1
Total	318
Total interviewees*	298

* *The total number of responses exceeds the number of respondents, some of whom gave more than one answer.*

Bus was the most widely perceived public transport alternative to car travel, but a substantial minority nominated some form of rail (including tram and underground which could have been options for some Bromley and Trafford travellers. Other modes, including coach, constitute only a small proportion (less than four per cent) of the alternatives mentioned.

Reasons given by these car travellers for their choice of mode are listed in Table 19.

Table 19 Reasons for preference for car rather than public transport travel (regular journeys)

Reason for car preference	*Number of responses*
Shorter journey time	149
Lower cost	70
Public transport interchange	19
Handling luggage on public transport	34
No public transport service at desired time of travel	30
Public transport unreliability	26
Public transport comfort or cleanliness	17
Public transport overcrowding	8
Excessive walking distances	29
Total	382
Total interviewees*	360

* *The total number of responses exceeds the number of respondents, some of whom gave more than one answer.*

Differences in journey time and cost are given as reasons for preference for car travel in 57 per cent of cases. Problems of carrying luggage on public transport are an obvious deterrent for some people, and service frequency, accessibility and reliability seem to be significant concerns. As with long-distance travellers interchange does not seem to be a major deterrent to people who are aware of public transport options.

All car travellers (including those who perceived no current alternative to car use), were asked what, if any, improvements to public transport services might encourage them to consider using it. Their responses are shown in Table 20. The most important areas for improvement seem to be the provision of more direct services (by reducing the number of interchanges necessary), fare levels, service reliability, service frequencies and overall journey times.

Those interviewees who had made journeys by public transport were asked why they preferred it to car travel. Their responses are shown in Table 21.

As for long-distance travellers, the greatest group of responses relates to negative aspects of car travel associated with congestion and parking costs.

3.4.6 Comparisons of travel options

So far we have examined modal choice for regular journeys using aggregate statistics and people's own perceptions of the properties of alternative transport services. In this section we make individual cost and time comparisons between actual car journeys and possible public transport alternatives, regardless of whether car users were aware of these alternatives. As for the long-distance travellers we have made enquiries about public transport alternatives to the journeys actually made by car, establishing what services are available, arrival and departure times, overall travelling times, details of interchanges (where appropriate) and fares.

Table 20 Improvements to public transport which might encourage consideration of its use for regular journeys

Type of improvement	*Number of responses*
Fewer interchanges	227
Lower fares	102
Reliability	87
More frequent services	109
Overall journey time	65
Cleanliness	14
Seat availability/comfort	13
Safety (vehicles)	7
Feeder services	11
Passenger information	4
Luggage handling facilities	10
Safety (at stops)	12
Total	661
Total interviewees*	605

* *The total number of responses exceeds the number of respondents, some of whom gave more than one answer.*

Table 21 Reasons for public transport use (regular journeys)

Reason for public transport preference	*Number of responses*
Dislike of driving in heavy traffic	40
Difficulty/cost of parking	36
Car slower than public transport	27
Car more expensive than public transport	14
Prefer to rest on the journey	5
Too far to drive in a day	3
Leave car for use by others	5
Prefer to work/read on journey	0
Total	130
Total interviewees[2]	87

* *The total number of responses exceeds the number of respondents, some of whom gave more than one answer.*

Respondents have themselves estimated times and distances for their car journeys, and we have estimated costs using the same methods as those described in Section 3.1.6.

Differences between fares for public transport alternatives for regular journeys and estimated fuel costs for car journeys are plotted against corresponding differences in overall journey times in Figure 3[4].

The majority of points lie in the upper right quadrant of this diagram, where public transport alternatives to car journeys are both slower and more expensive. However, there is also a substantial number of points in the lower right quadrant, where public transport is cheaper, but slower than cat travel. But most of these points lie above the equal generalised cost line for values of time of five pence per minute ((£3.00/hour), and nearly all are above

[4] *Cost differences are taken as total public transport fare (for all members of groups travelling together) minus fuel costs, and overall travel time differences by public transport minus car travel time.*

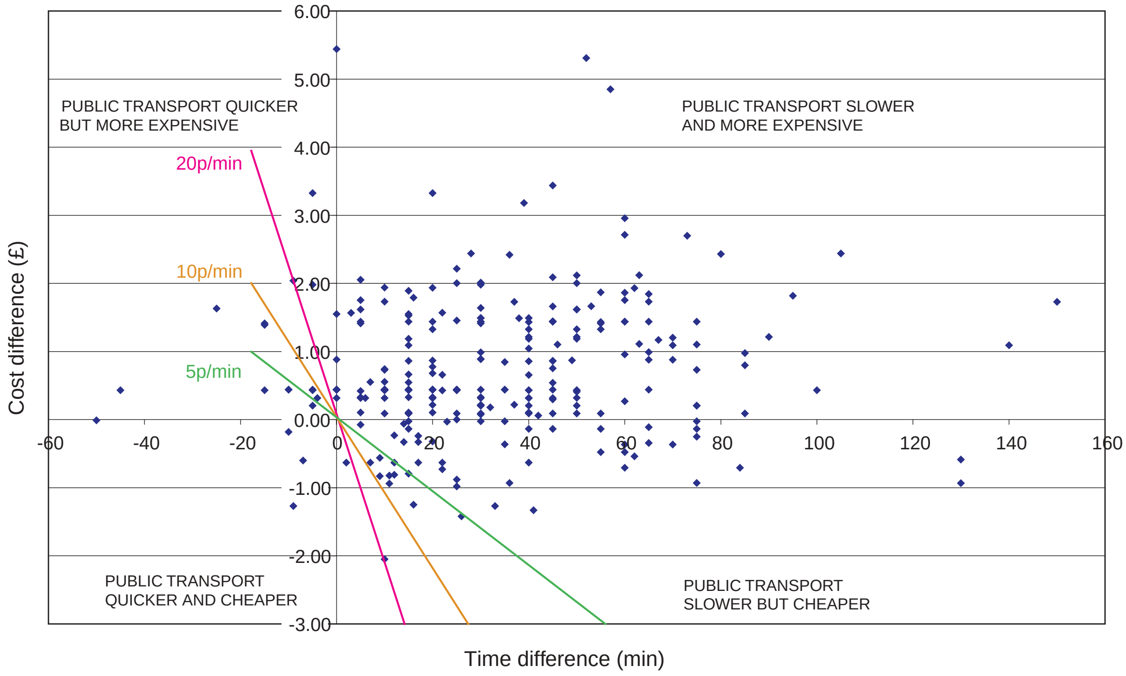

Figure 3 Public transport–car comparisons (regular car journeys from all study areas)

the 10p/minute line. The implication is that most people are not prepared to spend significantly more time travelling in order to save a pound or two. The points to the left of the vertical axis represent a small minority of people whose choice of car travel cannot be explained solely in terms of time and cost, and may be influenced by prejudice against or ignorance of public transport, or other factors listed in Table 19.

Figure 4 shows the corresponding plot for regular journeys made by public transport, with time and costs differences being estimated the same method as that used to derive Figure 2.

Only a minority of points lie in the first quadrant, indicating that a smaller proportion of travellers who use public transport regularly do so when it is slower and costlier than car travel. The proportions of travellers whose choices of public transport are consistent with time and cost differences are 65 per cent if time is valued at 5p/minute, and 59 per cent at 20p/minute.

As for the long-distance travellers (Table 12) there

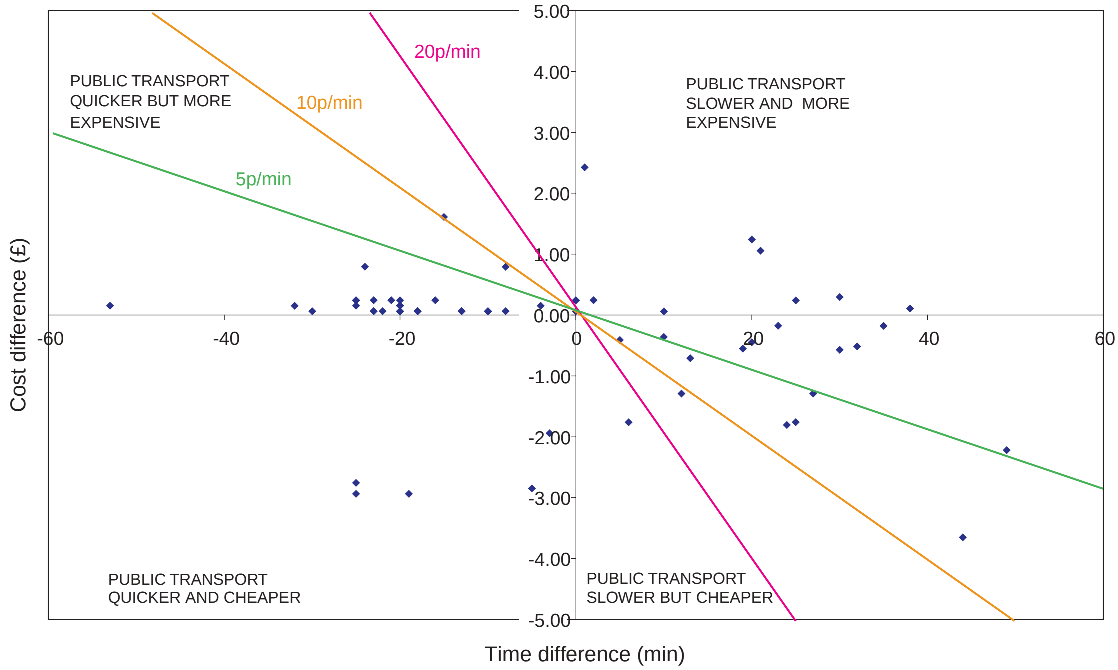

Figure 4 Public transport–car comparisons (regular journeys by public transport)

Table 22 Cost-time trade-off for regular medium-distance public transport users

Public transport slower, more expensive	*Public transport slower, cheaper*	*Public transport quicker, more expensive*	*Public transport quicker, cheaper*	*Totals*
Bromley				
5 (11%)	3 (7%)	33 (72%)	5 (11%)	46
Elsewhere				
3 (18%)	12 (77%)	0 (0%)	1 (6%)	17
All areas				
8 (13%)	16 (25%)	33 (53%)	6 (10%)	63

seems to be a marked difference between respondents in Bromley and those elsewhere. The majority of those in Bromley (72 per cent) appear willing to pay more for public transport if it is quicker than car travel. Elsewhere the majority (77 per cent) seem willing to use slower public transport modes if they are cheaper. In view of the small overall sample size, this observation must be treated with some caution.

As with the long-distance public transport users we have attempted to gauge sensitivity to parking costs by assuming the same notional parking charges (£30 for central London, £10 for Inner London). This increases the proportion of travellers whose choices appear consistent with time and cost considerations (76 per cent if time is valued at 5p/min, 68 per cent at 20p/min).

Comparison of these results with those in Section 3.1.6 suggests that regular travellers in larger urban areas (the sample being taken from Bromley, Plymouth and Trafford) are more likely to find public transport options which compete favourably with car travel.

3.5 Multi-destination journeys

So far we have discussed the factors influencing modal choice for people making simple single-destination return journeys. In this section we examine more complex journeys.

For each journey reported, the respondent was asked the number of distinct destinations visited. On closer examination a few of these appeared not to comply with a useful definition of a multi-destination trip: some people nominated motorway service areas, or stations where they changed trains, as destinations, and in some cases the two destinations were so close together that the journeys were essentially simple return journeys. Having excluded such cases, and one or two others with insufficiently precise information for analysis, we are left with 514 examples of plausible multi-destination trips (391 long-distance and 123 regular), as shown in Tables 23 and 24.

The proportion of long-distance trips to more than one destination varies between nine per cent in Bromley to 25 per cent in Trafford, averaging 19 per cent. We have not been able to find a statistically sound explanation for this variation, but it is noticeable that in some areas (particularly Trafford) it is fairly common for people to drive to relatives' homes and then take them shopping or on leisure outings.

Over all only 15 (four per cent) of these multi-destination trips involve public transport use; this is about half the corresponding proportion for single-destination trips (Table7).

Table 24 shows the corresponding statistics for regular multi-destination trips. These constitute 16 per cent of all regular trips, and only three per cent of them involve public transport use, compared with 13 per cent for single-destination trips (Table 17).

Several factors may contribute to this low level of public transport use for multi-destination journeys. These include unavailability of return fares and difficulty in co-ordinating services over different legs of the journey.

Table 24 Mode choice for regular, multi-destination journeys

	Bromley	*Plymouth*	*Trafford*	*All areas*
Single destination	192 (97%)	195 (76%)	209 (86%)	596 (85%)
Multi-destination	6 (3%)	62 (24%)	34 (14%)	102 (15%)
All trips	198	257	243	698
Multi-destination:				
By car only	5	61	34	100
By public transport	1	1	0	2 (2%)

Table 23 Mode choice for long, multi-destination journeys

	Birmingham	*Bromley*	*Burnley*	*Chelmsford*	*Plymouth*	*Reading*	*Trafford*	*All areas*
Single destination	246 (82%)	190 (91%)	239 (79%)	262 (85%)	260 (76%)	251 (83%)	222 (75%)	1670 (81%)
Multi-destination	56 (18%)	18 (9%)	63 (21%)	45 (15%)	83 (24%)	53 (17%)	73 (25%)	391 (19%)
All trips	302	208	302	307	343	304	295	2061
Multi-destination:								
By car only	55	17	61	43	80	48	72	376
By public transport	1	1	2	2	3	5	1	15 (4%)

A further complication is the tendency of people making optional car journeys to divert from direct routes to visit secondary destinations such as restaurants and tourist attractions. Opportunities for this type of diversion during journeys by public transport are rare. There is therefore a question of cause and effect: is mode choice determined by intermediate destinations, or is the option of making this kind of journey largely limited to those who travel by car?

It would appear that multi-destination trips would be the most difficult to make more attractive by public transport, and in view of the relatively small numbers involved, and the problems of classification, we have not attempted more detailed analysis.

3.6 Input to second traveller survey

The qualitative findings derived from the first traveller survey and the limited quantitative analysis suggest that if public transport systems are to secure a greater market share they will need substantial improvement (unless conditions for car travel are made worse through increasing congestion or policies of deterrence). Possible areas for improvement are:

- overall journey times;
- provision of more direct services with fewer interchanges (which could contribute to journey time reductions);
- reliability;
- fares;
- higher service frequencies;
- public perception of safety;
- cleanliness, comfort and reduction of overcrowding;
- links between stations and people's actual destinations;
- arrangements for handling heavy luggage.

The next stage of this study was designed to investigate the relative importance of improvements in these areas, and to provide an indication of how effective they might be in influencing modal choice.

4 Predicted evaluations and reactions

Previous sections have examined how people are currently travelling and the underlying reasons for their choices. They are basing their decisions on perceptions of the current alternatives. Questioning also provided information on the decision-making process used in a person's choice for a given journey. Some of the elements (or *factors*) behind it can be:

- the car is more convenient;
- the car is required at the destination;
- it takes too long to travel by public transport;
- it is too expensive to travel by train;
- the trip requires a difficult interchange;
- there are no viable alternatives for the trip.

Alternatively, the decision can be flawed through either not knowing of an alternative, or not having the correct information about it.

This section examines the underlying decision making process in more depth, finding travellers' relative values of different components (cost, time, number of interchanges etc) of their journeys. From this it is possible to examine the effect on modal choice of changing the components of their current journey both for their current mode and an alternative. Questioning people *directly* about their reactions to changes, especially when considering alternative modes is flawed. They will tend to bias their answers to their current preferred method of travelling. To circumvent this problem the technique of stated preference was developed. This method presents participants with a series of travel choices: each between alternative methods of travelling. This technique reduces the problems of bias by forcing the participant to trade-off improvements in one factor against other changes. For example, a person currently travelling by car may have to consider their reaction to the petrol costs increasing by 50%, but the travel time by public transport significantly decreasing. The technique uses a number of these types of questions to explore the boundaries of each person's decision: i.e. the point at which they would alter their mode of transport.

The trade-off questions are taken from one of a number of standard designs. Each question in a design sets every factor to one of a number of values (or *levels*). A level can either be of the form of say a 50% increase in current cost, or a fixed value (e.g. 'One Interchange During The Journey'). The designs are fractional factorial, that is they allow models to be formed on the responses that estimate the main order effects of the factors, and in some cases, the interactions of the factors.

Generally, the options improve the alternative mode and place penalties on the current mode to look for the points at which the respondent changes. An underlying assumption is that people have chosen the best option under the current conditions, so the alternatives need to be relatively improved.

With a number of people making these decisions, a LOGIT[5] model can be developed to locate the overall 'boundary values'. These are the points at which the participants in the sample would be expected to change their travel mode. The model produces equations for the relative utilities of the two modes (or travel options). That is, equations of the form below are obtained. In this case the choice is between a journey made by car or public transport:

$$U_{CAR} = aCOST + bTIME + \ldots$$

$$U_{Public\ Transport} = cCOST + dTIME + eINTERCHANGE + \ldots$$

Travellers are then assumed to choose whichever mode has the higher utility.

Each of the fitted coefficients (a, b etc) can be related to cost in order to establish the 'value' of each element of the journey. For example, if the resulting model's coefficient of having an interchange (compared with having none) is three times that of the cost's coefficient in pounds, then the value

[5] *PROBIT models were also tested, but the additional complication produced no improvement in estimation of model parameters. LOGIT modelling was therefore used exclusively in the course of this research.*

of making an interchange is £3. That is, the cost would have to decrease by £3 in order to counteract a journey with an interchange. Using this technique the relative values of the elements of a journey can be assessed.

Alternatively, it is possible to consider the effect of packages of improvements to public transport. The values of each of the variables in the equation (car cost, train cost, car time, train time etc) can be entered for each individual under a hypothetical set of conditions: e.g. the improvement of rail services, possibly at the expense of the car journeys. The mode with the highest utility is the one that each individual would be expected to use. Therefore the effect of the changes on population can be predicted, and modal split investigated.

4.1 Segmentation of the sample

Creating a stated preference model over a number of individuals, effectively estimates the average value they associate with each element of the journey. Such an approach is correct if people's evaluations are approximately the same, but can provide inaccurate results if they vary wildly in the sample. Certain variables are known to affect peoples' willingness to pay for convenience and comfort, and therefore affect their modal choice and evaluations. Some of these include:

- Gender.
- Age.
- Socio-economic group.
- Car availability.
- Income.
- Journey purpose.
- Distance travelled.

To obtain a more accurate picture of peoples' evaluations and correctly model their reactions to changes in the modes of transport, it is necessary to segment the sample: that is, create separate models for different categories of respondent.

However, as the model forms an average value for the respondents in the sample, it is necessary that those included in the segment are not influenced by other factors. In this analysis the approach has been to form models for each individual area. The predicted valuations have then been compared across the study areas to find geographical regions with similar values. Where possible the data is pooled and then segmented according to a selection of the above variables to examine their effect on the relative valuations.

Also, outliers (extreme observations) can influence the values formed. The main source of these is people who refuse to alter their mode of transport under any circumstances. These have been eliminated from the model by initial filter questions before the stated preference. Such people are considered totally separately from the rest when modelling the reaction to changes in the modes of transport.

4.2 Developed stated preference exercises

Three types of traveller were investigated in this study:

- People performing regular journeys by car.
- People performing long journeys by car.
- Rail passengers.

Each would be expected to have different considerations, and evaluations, when making a travel decision. For this reason three stated preference exercises were designed and tuned to the traveller type. The questionnaire structure that streamed respondents into these stated preference exercises and the models formed on them are shown in Figure 5.

All rail respondents that were willing to pay increased fares for significant improvements in their journeys took part in their stated preference exercise. The model fitted to their responses only depended on the segmentation applied. Current car users only took part in the stated preference exercise if they would not have used the current public transport alternative, and they would consider using public transport in the future. Those included were therefore making current decisions correctly and were willing to consider travelling by other modes and so should trade correctly in the stated preference exercise. Models were fitted to their responses according to the segmentation applied.

4.3 Perceived need for improvements in public transport

Stated preference values different elements of a journey by causing the traveller to trade improvements against cost. Variables of similar value should be presented in any given exercise, otherwise a respondent will generally ignore those of lower value when making their decision. Such behaviour results in incorrect evaluations or the removal of the lesser variables from the developed model.

4.3.1 Current car users

The stated preference exercise aimed to establish the improvements required for current car users to switch to using public transport: rail for long journeys and bus for medium-distance regular trips. An exercise was therefore required that presented a better public transport alternative and addressed the perceived issues preventing them from using it under the current circumstances.

Questions from the first survey established the main reasons for preference for travel by car rather than by public transport. Interviews with people making regular medium-distance and with those making long journeys produced the same underlying factors that were:

- Journey time.
- Cost.

The next important elements of the journey were:

- Problems with interchanges.
- Service reliability.
- No service at time of travel (frequency).

Lesser reasons for not using public transport were:

- Handling luggage.
- Comfort and cleanliness.
- Overcrowding.

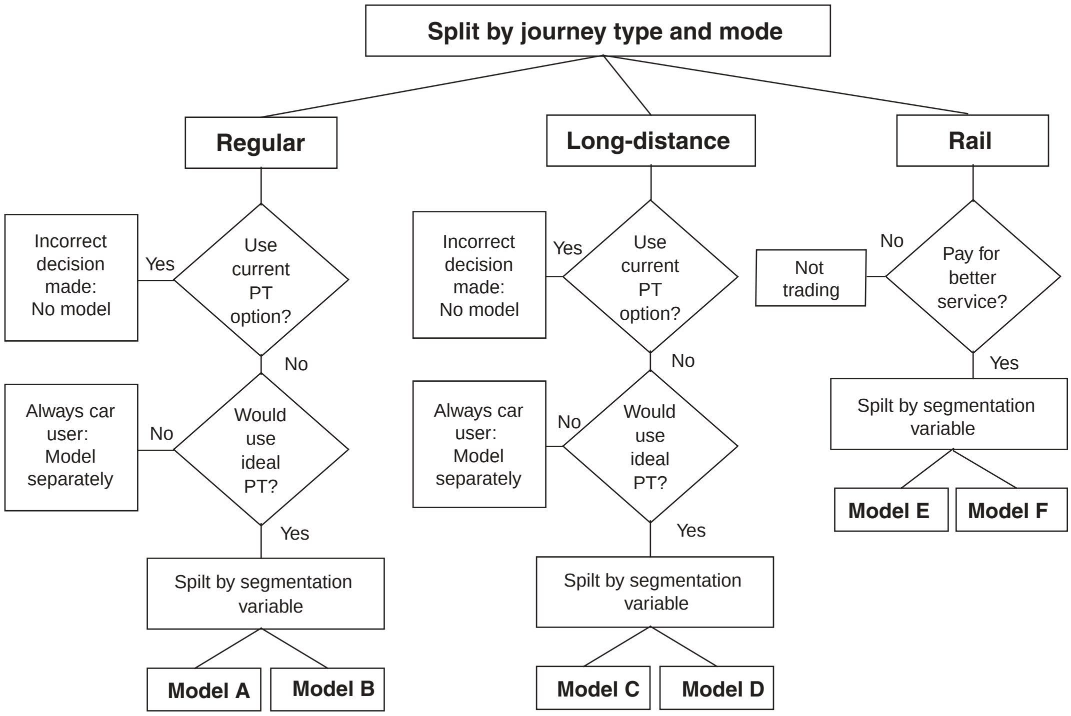

Figure 5 Streaming and model used

The design aimed to establish the valuations associated with the five most important factors in deciding the mode of travel. Including further variables would have required a large increase in the number of questions presented to the respondent and would have been unlikely to provide useful answers.

4.3.2 Rail passengers

Rail passengers were not questioned on their modal choice. The stated preference exercise investigated the value they associate with improvements to their journey. In particular it was designed to examine their reaction to:

- Having a guaranteed seat on the train.
- Being able to travel closer to their preferred time.

5 Sample sizes

The number of completed stated preference survey forms according to area and type of traveller is summarised in Table 25. Nearly six hundred questionnaires were answered, split between:

- People making regular car trips and could have used bus service(s).
- People making regular car trips and could have used rail service(s).
- People making regular car trips and could have used metro service(s) - Trafford only.
- People making long car trips and could have used rail service(s).
- People currently travelling by rail.

Table 25 Total sample sizes

Area	*Bus for regular trips*	*Rail for regular trips*	*Metro for regular trips*	*Rail for long trips*	*Current rail*	*All*
Trafford	29	–	27	59	4	119
Birmingham	–	–	–	70	4	74
Bromley	6	27	–	32	24	89
Burnley	–	–	–	29	1	30
Chelmsford	–	–	–	55	11	66
Plymouth	58	1	–	66	12	137
Reading	–	–		70	10	80
All	93	28	27	381	66	595

Not all of these respondents took part in the stated preference exercise. Current car travellers were excluded if:

- They would have travelled by public transport if they had known of the alternative
- They would not use public transport under any circumstances

And current rail travellers were excluded if they were unwilling to pay a small increase in fare for improvements to the service. Tables 26 and 27 give the details of the number of respondents that were excluded from the Stated Preference questions due to not being able to trade when presented with better travel alternatives.

Respondents generally seemed either well informed about the current available alternatives for regular trips, or they were unwilling to use the current option without improvements: just under 10% of respondents would have used public transport if they had known of the alternative. For longer, less regular journeys, about 8% of the

Table 26 Would have used current alternative if known about it

Area	*Bus for regular trips*	*Rail for regular trips*	*Metro for regular trips*	*Rail for long trips*	*Current rail*	*All*
Trafford	3	–	3	1	–	7
Birmingham	–	–	–	7	–	7
Bromley	0	3	–	4	–	7
Burnley	–	–	–	5	–	5
Chelmsford	–	–	–	4	–	4
Plymouth	5	–	–	3	–	8
Reading	–	–	–	7	–	7
All	8	3	3	31	–	45

Table 27 Never use ideal alternative

Area	*Bus for regular trips*	*Rail for regular trips*	*Metro for regular trips*	*Rail for long trips*	*Current rail*	*All*
Trafford	6	–	12	16	0	34
Birmingham	–	–	–	20	0	20
Bromley	1	3	–	10	4	18
Burnley	–	–	–	4	0	4
Chelmsford	–	–	–	22	3	25
Plymouth	28	–	–	34	0	62
Reading	–	–	–	21	1	22
All	35	3	12	127	8	185

respondents stated they would have used the public transport alternative if they had known about it.

In most areas between 10 and 20% of respondents making regular trips would be unwilling even to consider travelling by bus or rail. The exception is Plymouth where nearly 50% of respondents would not consider travelling by bus. Furthermore, the same percentage would not consider rail for long trips from this area, indicating a reluctance to use public transport in general.

Generally, 25 to 40% of respondents making long trips would not consider even a highly improved rail service. In Burnley the percentage was only 13%; however, the sample size was smaller.

The resulting sample sizes available for the stated preference analysis are shown in Table 28. However, some of these respondents were excluded from the model due to inconsistent answers in the stated preference section of the questionnaire.

The resulting sample sizes allow segmentation of the sample for a single area by the alternative mode but not by any of the other influencing factors discussed in Section 4.1. The approach was to form the individual area models for each of the modes of transport, then to look for similar models for which the data could be pooled. With sufficient sample size in the pooled data it would then be possible to examine other influencing factors (segments) in the data.

Table 28 Overall stated preference sample sizes

	Current car users					
Area	*Bus for regular trips*	*Rail for regular trips*	*Metro for regular trips*	*Rail for long trips*	*Current rail*	*All*
Trafford	20	–	12	42	4	78
Birmingham	–	–	–	43	4	47
Bromley	5	21	–	18	20	64
Burnley	–	–	–	20	1	21
Chelmsford	–	–	–	29	8	37
Plymouth	25	1	–	29	12	67
Reading	–	–	–	42	9	51
All	50	22	12	223	58	365

6 Evaluations of current car users

This section of the questionnaire focused on respondents currently making trips by car: either a long trip over 15 miles, or a regular medium distance trip. In each case it asked sixteen questions of those willing to trade as part of a stated preference exercise. Each question enabled them to consider the relative value they associate with different aspects of their journey by deciding their preferred mode under different circumstances. For example, in one choice the travel time by public transport could be one hour, but in a similar question it may be 30 minutes. The respondent had to consider whether they might use the public transport alternative rather than the car under each of these conditions.

Sample sizes for individual areas (Table 28) indicate it is only possible to calculate overall stated preference models without any segmentation. That is, it is not possible to take account of the different types of trips being made and the various categories of people making them (e.g. whether the trip was for business or pleasure, and the age of the person travelling). Furthermore, results where sample sizes are 20 or below should be treated with caution. In two cases, short trips by bus in Bromley and short metro trips in Trafford the sample sizes were insufficient to form any model.

6.1 Public transport for regular trips

People making medium-distance regular car trips were questioned in three of the study areas: Trafford, Bromley and Plymouth. Bus, rail and metro (in the case of Trafford) were possible public transport alternatives for respondents making regular short trips by car. The trip times for these respondents were calculated from timetables and the best alternative used as a basis for the stated preference exercise.

6.1.1 Area models

As explained in Section 5 the approach was initially to form individual area models for these regular medium distance trips. The results for individual areas are contained in Table 29 for respondents whose best alternative was a bus service and Table 30 for those with a viable rail alternative.

Table 29 Stated preference: Bus alternative for regular medium distance trips

Value of attribute (£)	*Trafford*	*Birmingham*	*Bromley*	*Burnley*	*Chelmsford*	*Plymouth*	*Reading*
Car time	7.55	–	–	–	–	7.45	–
Public transport time	16.62	–	–	–	–	6.33	–
Interchange	3.82	–	–	–	–	0.88	–
Frequent service	2.35	–	–	–	–	0.20	–
Reliable service	4.27	–	–	–	–	No fit	–
Car over public transport	1.14	–	–	–	–	-0.47	–

Table 30 Stated preference: Rail alternative for regular medium distance trips

Value of attribute (£)	*Trafford*	*Birmingham*	*Bromley*	*Burnley*	*Chelmsford*	*Plymouth*	*Reading*
Car time	–	–	10.53	–	–	–	–
Public transport time	–	–	7.97	–	–	–	–
Interchange	–	–	3.04	–	–	–	–
Frequent service	–	–	1.14	–	–	–	–
Reliable service	–	–	0.30	–	–	–	–
Car over public transport	–		-2.62	–	–	–	–

Shorter regular trips are generally associated with work, and therefore have the expected high values of times. Car drivers prefer travelling by rail than car if all other aspects of the journey are the same, however, they prefer travelling by car than bus under the same circumstances.

The high value associated with time on buses in Trafford implies that respondents in that area would only accept a bus alternative that is significantly faster than their current car alternative. Their high value for reliability indicates that they do not consider that buses in the area are currently reliable and they are also unlikely to consider a bus trip with an interchange.

Evaluations in Plymouth are small and this could be indicative of the willingness to pay for bus services in the area.

Bromley car users highly value (at approximately £3 a trip) not having to change trains, however they value having a frequent or reliable service less. This is possibly because they already perceive the rail services in London as reliable and frequent.

6.1.2 Effect of travel distance, journey purpose, income and age on valuations of bus trips

In this section the respondents from Trafford and Plymouth are pooled to provide a large enough sample for the influences of trip type and socio-economic factors to be investigated. This analysis investigated differences between respondent groups according to the following:

- Household income less than, or at least, £40,000.
- Distance travelled on regular journey less than, or at least 6 miles.
- Age of respondent less than , or at least 30.
- Whether the trip was for work (business trip or commuting), or for another purpose.

The fitted models are shown in Table 31.

It was not possible to form a full model for respondents below the age of 30, however, the model fitted did not indicate any significant differences between these respondents and the one over 30. There was a slight indication that the value of time of those over 30 was slightly higher, and that they valued not having to make an interchange at 76 pence more.

The main difference between the higher income households is that they prefer to travel by car rather than bus, whilst those with household incomes below £40,000 prefer the bus option. The values of time indicate that the higher income households are more sensitive to relative improvements in public transport time, but on medium distance journeys the relative time of buses is unlikely to improve to an extent that would overcome the underlying preference for car travel.

The relative values of time for longer journeys implies that bus journey times would need to be relatively better (compared to travelling by car) for it to be the preferred mode, than for shorter journeys. As expected having a more reliable, frequent service with limited interchanges is more highly valued for longer journeys.

Table 31 Segregated bus trips for Trafford and Plymouth

Value of attribute (£)	*Overall*	*Income <40k*	*Income >=40k*	*Distance <= 5 miles*	*Distance > 5 miles*	*Non-work trip*	*Work trip*
Car time	6.37	6.03	7.45	7.27	6.04	18.65	4.76
Public transport time	8.81	10.02	4.48	8.67	12.55	10.43	8.44
Interchange	1.41	1.57	1.14	0.58	1.60	1.15	4.53
Frequent service	0.77	0.78	0.99	0.22	1.38	0.77	0.75
Reliable service	0.35	0.54	No fit	0.10	0.63	0.12	0.47
Car over public transport	-1.61	-2.11	1.87	-1.20	-0.56	-1.58	-1.41

The relative values of time imply a greater reluctance to travel by bus for work trips. As expected an interchange for work trips has a high valuation against using the bus.

6.2 Public transport for long trips

People making occasional long car trips were questioned in all of the study areas. The only feasible public transport alternative for these respondents was found to be rail, although coach was considered.

6.2.1 Area models

People making a long car trips were questioned in all study areas. Rail and coach were possible public transport alternatives for these respondents. Their trip times were calculated from timetables and the best alternative used as a basis for the stated preference exercise. The results for individual areas are contained in Table 32.

Examination of the values of time indicate that it is possible to group the areas into the following types:

1 *Bromley (Area Type 1):* London travellers' relative values of time indicate that duration of the rail alternative must be good compared to the car travel time for them to consider changing modes. The regression constant (car over public transport) was positive. This can be interpreted as the travellers preferring to travel by car than by rail in this area, all other elements of the journey being equal Also, the values they associate with making an interchange and having a frequent service are higher than in the other areas.

2 *Burnley (Area Type 2):* As in Bromley the regression constant was positive. Also, car users valued time on trains at about 50% more than time in cars. This implies that current car users in Burnley would be expected to respond more favourably to improvements in rail travel times than in fares. Burnley's current rail network has limited useful destinations, and this appears to have highly influenced the perception and hence evaluations.

3 *Birmingham and Plymouth (Area Type 3):* The stated preference models for respondents in these areas predict that they have high values of time for car journeys. That is, significantly increasing journey time is more likely to cause a change from car to rail than increasing travelling costs. It is possible that respondents in these areas encounter less congested conditions than in Area Type 4 (Reading etc). This could have influenced their sensitivity.

4 *Reading, Chelmsford and Trafford (Area Type 4):* Valuations of time by both car and rail are similar in these areas: within 15% of each other. Relative evaluations of other journey conditions are of similar relative values except the evaluation order of frequent and reliable rail services in Chelmsford which are reversed. However, these are relative evaluations - all improvements are compared with current standards. Consequently, it appears that car users in Chelmsford consider their rail services to be less frequent but more reliable.

6.2.2 Effect of travel distance, journey purpose, income and age on valuations of long rail trips

In this section the respondents from Area Types 3 and 4 are pooled to provide a large enough sample for the influences of trip type and socio-economic factors to be investigated. This analysis investigated differences between respondent groups according to the following:

- Household income less than, or at least, £40,000.
- Distance travelled on regular journey less than, or at least 6 miles.
- Age of respondent less than , or at least 30.
- Whether the trip was for work (business trip or commuting), or for another purpose.

The fitted models are shown in Table 33 for Area Type 3 and Table 34 for Area Type 4.

Relative valuations of time indicate that the higher income households are more likely than others to switch to rail for long trips if the travel times by rail improve relative to the time by car. However, the valuations of frequency, reliability and having an interchange do not vary in any great, or consistent, manner between the two groups.

Surprisingly, the valuations for work based and other purposes do not greatly differ in any consistent way.

Differences in responses were found between age groups in the first questionnaire. This was explored in this analysis and the result of segmenting according to different age groups is shown in Table 35.

Differences between the age groups are generally small, and not consistent between the two areas.

7 Evaluation of rail users

This section of the questionnaire focused on respondents currently making trips by rail. In each case it asked fifteen questions of those willing to trade as part of a stated preference exercise. Each question enabled them to consider the relative value they associate with different aspects of their journey (journey time, having a seat and leaving within 5 minutes of their preferred time). They did

Table 32 Stated preference: Rail alternative for long trips

Value of attribute (£)	*Trafford*	*Birmingham*	*Bromley*	*Burnley*	*Chelmsford*	*Plymouth*	*Reading*
Car time	4.62	8.01	6.61	4.67	5.79	13.22	5.52
Public transport time	4.15	5.82	14.46	7.05	6.54	5.03	4.88
Interchange	2.25	3.96	5.77	2.03	2.90	4.26	1.52
Frequent service	0.63	4.60	7.48	3.35	1.81	1.08	0.81
Reliable service	2.48	0.72	0.80	0.21	0.26	1.13	3.12
Car over public transport	-5.09	-7.51	7.39	9.05	-2.07	-1.01	-3.88

Table 33 Segregated rail trips for Area Type 3

Value of attribute (£)	*Overall*	*Income <40k*	*Income >=40k*	*Distance <= 30 miles*	*Distance > 30 miles*	*Non-work trip*	*Work trip*
Car time	8.46	6.16	16.63	4.82	9.34	8.29	11.62
Public transport time	4.63	4.06	9.76	4.69	4.59	4.36	7.14
Interchange	3.73	3.77	3.34	1.85	4.02	4.14	2.58
Frequent service	3.82	3.95	3.33	1.98	3.98	3.26	5.10
Reliable service	0.80	1.29	0.12	0.36	0.97	0.98	0.36
Car over public transport	-5.22	-6.39	-3.92	-1.35	-5.65	-3.51	-8.52

Table 34 Segregated rail trips for Area Type 4

Value of attribute (£)	*Overall*	*Income <40k*	*Income >=40k*	*Distance <= 30 miles*	*Distance > 30 miles*	*Non-work trip*	*Work trip*
Car time	5.16	4.06	7.97	3.47	5.75	5.13	5.19
Public transport time	4.60	3.97	6.30	4.42	4.63	4.16	6.13
Interchange	2.04	1.85	2.42	0.70	3.02	1.87	2.82
Frequent service	2.44	2.08	3.22	0.90	3.50	2.45	2.00
Reliable service	0.39	0.06	1.27	0.11	0.66	0.35	0.72
Car over public transport	-3.94	-3.11	-6.38	-3.73	-4.65	-3.69	-1.58

Table 35 Age dependence for rail trips in Area Type 3 and 4

	Area Type 3		*Area Type 4*	
Value of attribute (£)	*46 to 59*	*All other ages*	*46 to 59*	*All other ages*
Car time	8.16	8.63	5.19	5.13
Public transport time	4.03	8.64	6.13	4.16
Interchange	0.97	4.92	2.82	1.87
Frequent service	3.36	3.97	2.00	2.45
Reliable service	0.65	0.82	0.72	0.35
Car over public transport	-6.72	-4.38	-1.58	-3.69

this them choosing their preferred journey given two possible trips by rail with differing levels.

Sample sizes for individual areas (see Table 28) indicate it is not possible to calculate individual area models for rail. Further, the analysis in Section 6 indicates significant differences between the areas. The production of an overall stated preference model confirmed this by the poor fit obtained. The area types identified in Section 6.2.1 for car travellers who could have made their journey by rail were applied to the current rail users. The results of this analysis are contained in Table 36.

Table 36 Stated preference: Current rail travellers

Value of attribute (£)	*Area Type 1 (Bromley)*	*Area Type 3 (Birmingham and Plymouth)*	*Area Type 4 (Reading, Chelmsford and Trafford)*
Time (Option A)	3.64	5.23	6.28
Time (Option B)	6.17	5.22	7.16
Guaranteed Seat	1.57	18.58	4.33
Travelling 5 mins before preferred time instead of 30 mins	3.37	7.25	4.92

Values of time are generally consistent in all the areas at between £5 and £6 per hour. However, there are significant differences in the evaluations of comfortable and convenient travel.

In Bromley (Outer London) most of the current trips by rail are relatively short to the centre of London, so the value of having a seat on these journeys is smaller. Trips from Reading and Chelmsford are the next longest taking on average approximately one hour, and the average for all three areas in Area Type 4 is 90 minutes. Trips from Birmingham and Plymouth are the longest averaging over 2 hours and 15 minutes in each area. It can be clearly seen that passengers are willing to pay more to guarantee a seat as the length of the journey increases, and also the cost of the rail fare increases.

Similarly, the longer the journey and the higher the fare, the more travellers are willing to pay to be able to start their journey at a time that suits them, though the valuation is more uniform than that associated with a guaranteed seat.

8 Travellers' stated evaluations (transfer price)

Car users were presented with the details of trip they had made and information of the alternative that was available to them. They were asked to predict the *maximum* public transport fare that would cause them to switch modes. These values were converted into the percentage of the actual fare that was calculated in the reconstruction interviews. The ranges of values they would pay are shown in Figure 6 for long rail trips and Figure 7 for medium distance regular bus trips.

Figure 6 shows that a significant proportion of the respondents claimed they were willing to pay greater than the actual fare to travel by rail on long journeys. This appears initially to be contrary to expectation given that they had been informed of the true fare. The percentages according to area are shown in Table 37.

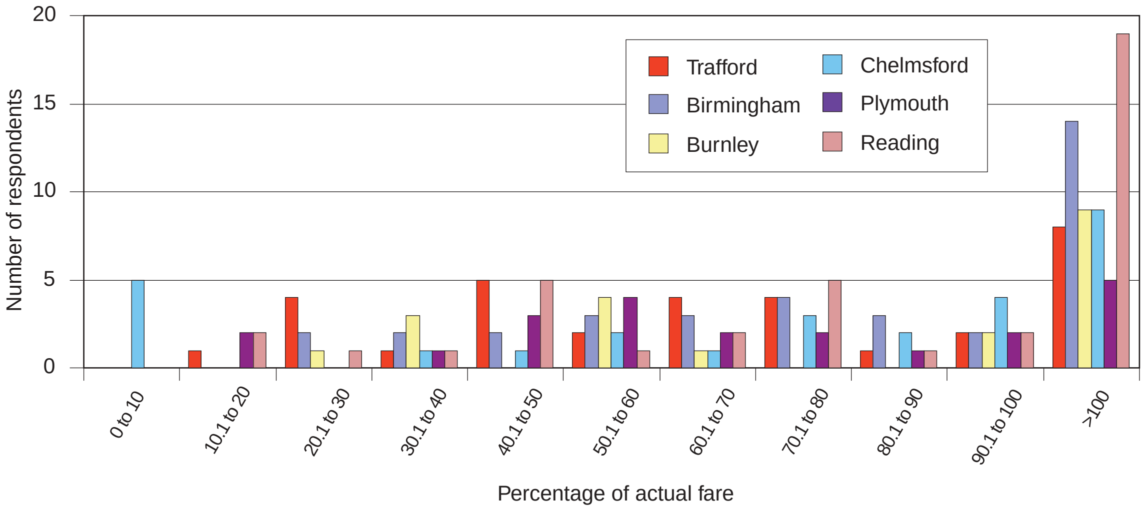

Figure 6 Amount willing to pay for rail on long trips

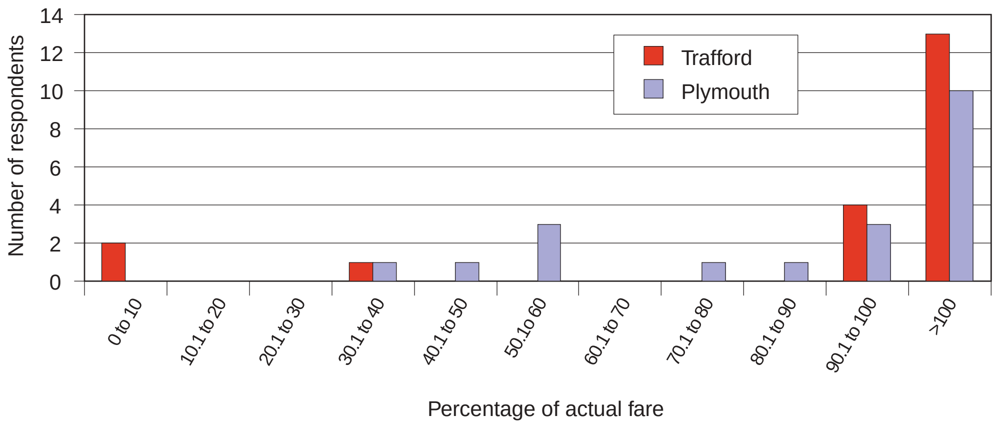

Figure 7 Amount willing to pay for buses on short trips

Table 37 Percentage of respondents willing to pay more than actual fare to travel by train

Area	*Percentage*
Trafford	24
Birmingham	40
Burnley	45
Chelmsford	32
Plymouth	23
Reading	49

Although the variation between the areas appears large, the differences are not significant given the small sample sizes. Those that stated they would pay more than current fares were examined more closely. Table 38 shows the percentages of these who, before they were informed of the true fare, also overestimated the fare for the journey.

It would appear that some respondents forgot the true fare in the short time between being told it and being asked for the maximum they would pay for the journey. They were therefore assessing the most they would pay against their overestimated travel cost.

Tests have been performed on those respondents who overestimated rail fares for long trips. Significant differences (at the 95% confidence level) indicated that respondents were more likely to overestimate peak fares (before 0930) and fares for shorter trips.

Between 25 and 50% of the respondents stated that they would use the public transport alternative and pay at least the current fare. This is inconsistent with the 10 to 20% of the sample (Section 5) who said they would consider using public transport alternatives had they been aware of the necessary details.

Table 38 Percentage of respondents willing to pay more than actual fare who had previously overestimated the actual fare

Area	*Percentage*
Trafford	88
Birmingham	93
Burnley	89
Chelmsford	100
Plymouth	100
Reading	89

The average amount they stated is shown in Figure 8 for long rail journeys and Figure 9 for medium distance regular bus journeys. In addition, the amount each respondent stated was divided by the calculated length of their journey to give the pence per mile that they would consider for public transport.

Respondents were asked to state the maximum fare they would consider if their public transport alternatives were improved. The improvements they were to consider included:

1 No interchanges during the journey.

2 A frequent service.

3 A reliable service.

The differences between the values stated to these questions and the amount given for the current public transport alternative were calculated. Valuations where respondents gave smaller values for an improved service were excluded from the analysis. Averages were calculated across the other respondents. The results of this analysis are shown in Figures 8 and 9.

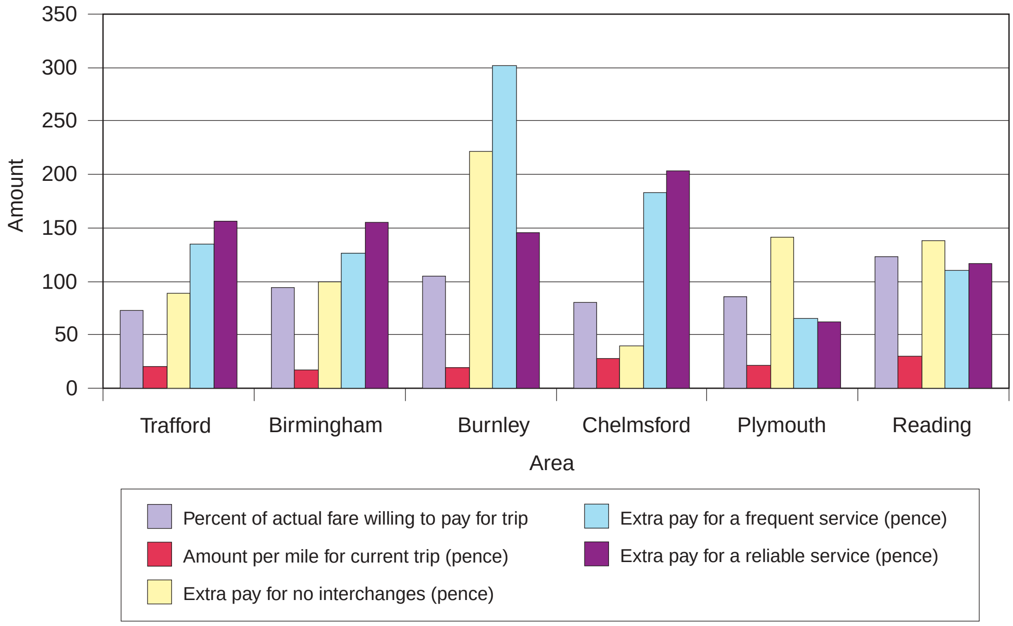

Figure 8 Average user evaluations – long rail trips

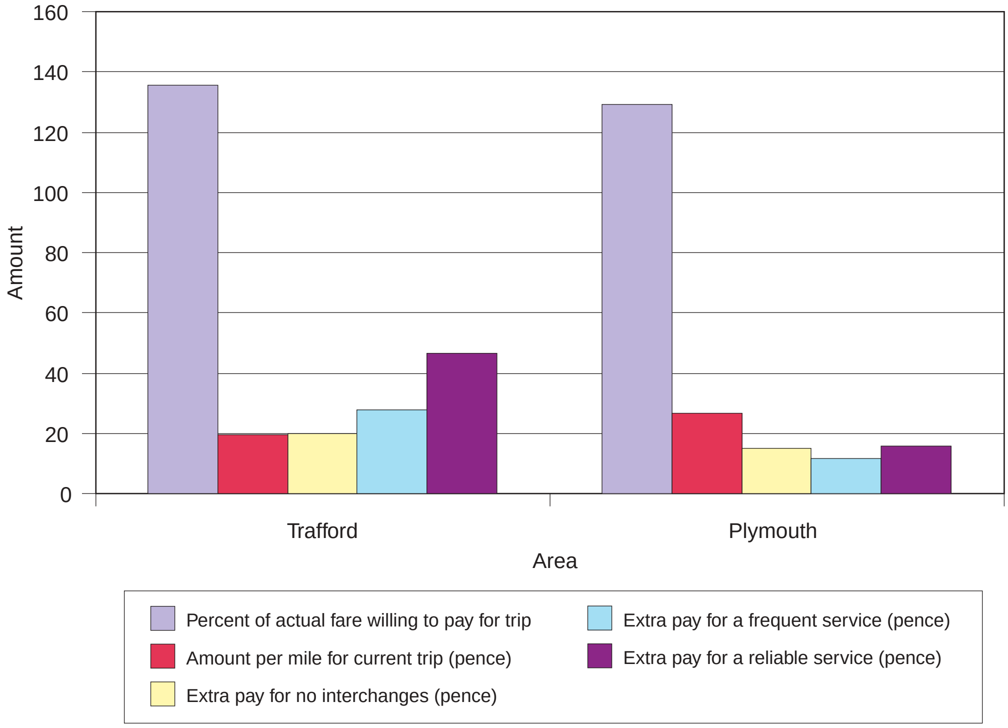

Figure 9 Average user evaluations – short bus trips

Generally car users valued the use of and improvements to rail for long journeys at the same order of magnitudes. They valued the current services at between 18 and 30 pence a mile, with only Chelmsford and Reading exceeding 20 pence a mile. Burnley valued all improvements to the rail service at higher than the other areas, this is probably due to the current size and quality of the network available. The lowest valuations came from Plymouth and Reading and probably stem from a combination of the current services available and the socio-economic reasons. Most improvements are considered to be worth between one and two pounds a journey.

The amount users stated they were willing to pay per mile for a medium distance bus trips is in line with the amount for a long rail journey: approximately 20 pence a trip. However, car users are not willing to pay as much for improvements: generally between 15 and 30 pence a trip. This in part will be due to the smaller length of the journeys made by bus and hence the smaller fares they are judging the improvements against.

9 Current perceptions

Respondents were informed that they could have made the journey by an alternative means, and told whether it was bus, rail, metro or coach. They were then asked if they had known about this alternative. Their replies are summarised in Figures 10 and 11.

Both figures show that the majority of the respondents were aware of the alternative way of making their trips.

They were then asked what they thought the trip would cost and how long it would take. Their estimates have been taken from the actual times calculated in the reconstructed interviews and are shown in Figures 12 to 15.

Clearly, respondents may know of the alternative but are not well informed about their cost or the travel times involved: tending to overestimate cost but underestimate travel time. For example, in Birmingham 65% overestimated the cost, and 55% underestimated travel time for long rail trips.

They were also asked how often they thought the service would be on time. Their replies are summarised in Figures 16 and 17.

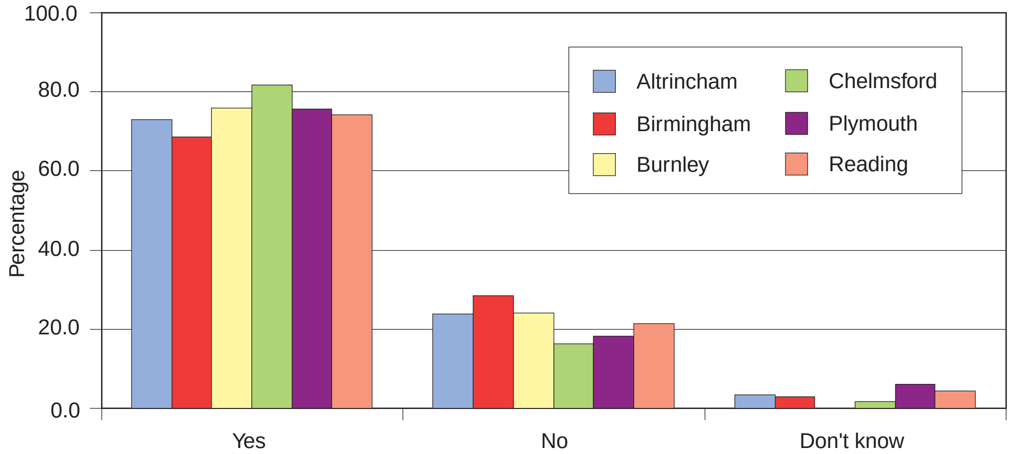

Figure 10 Percentage knowing of alternative – long rail trips

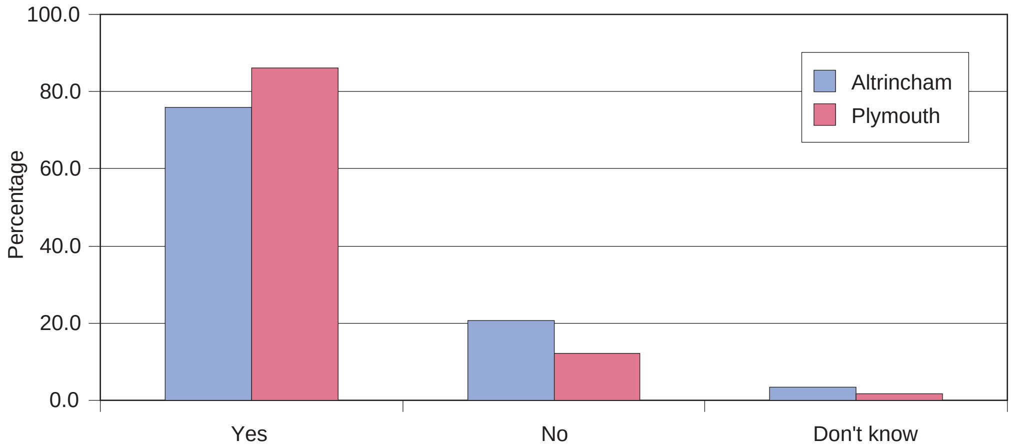

Figure 11 Percentage knowing of alternative – regular bus trips

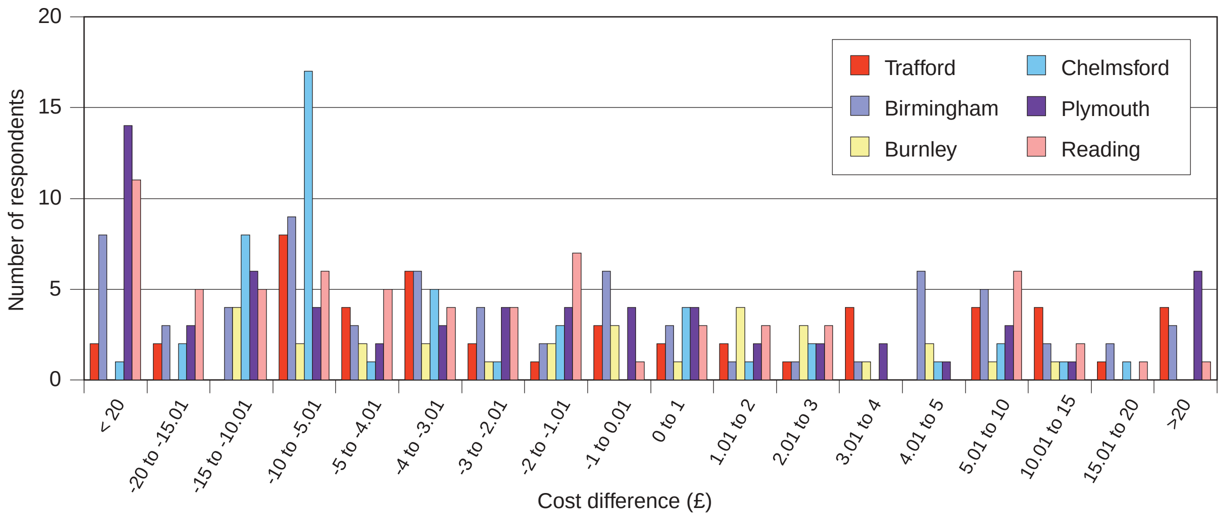

Figure 12 Actual minus estimated travel cost – long rail trips

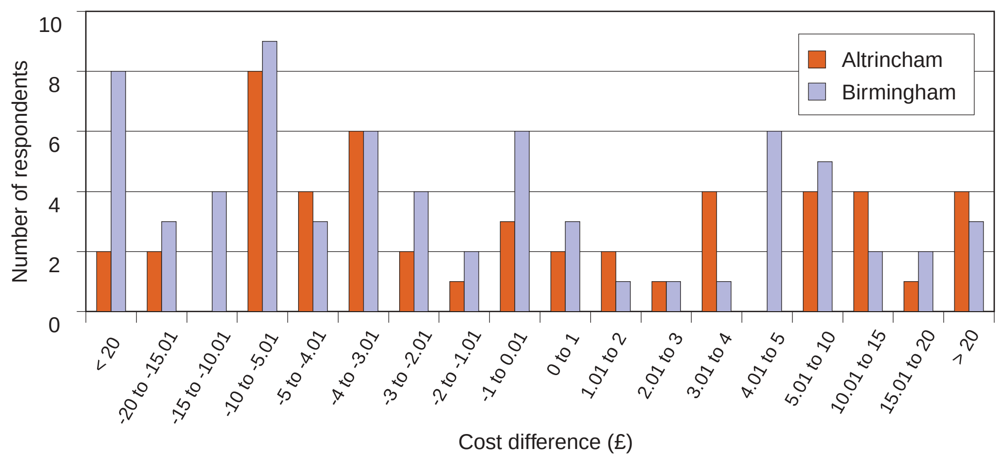

Figure 13 Actual minus estimated travel cost – regular bus trips

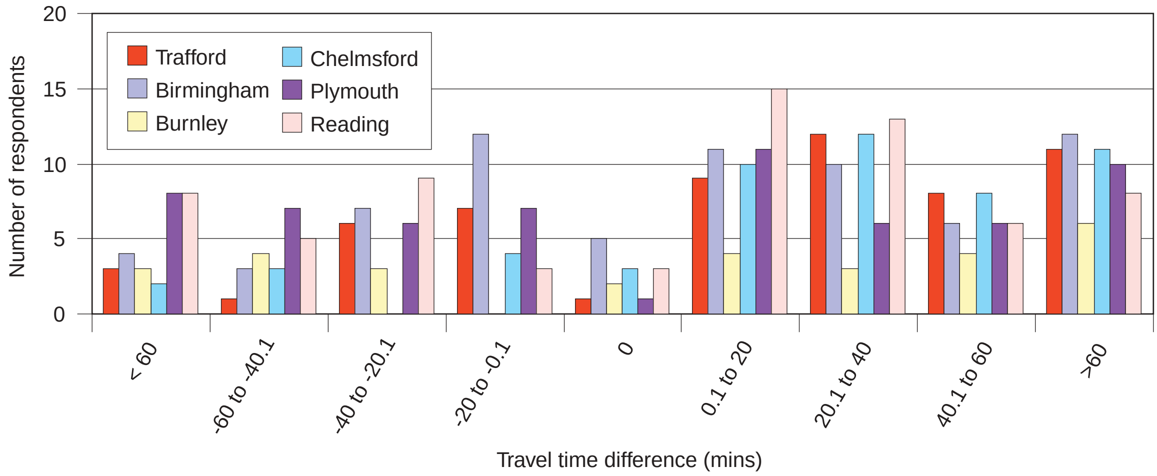

Figure 14 Actual minus estimated travel time – long rail trips

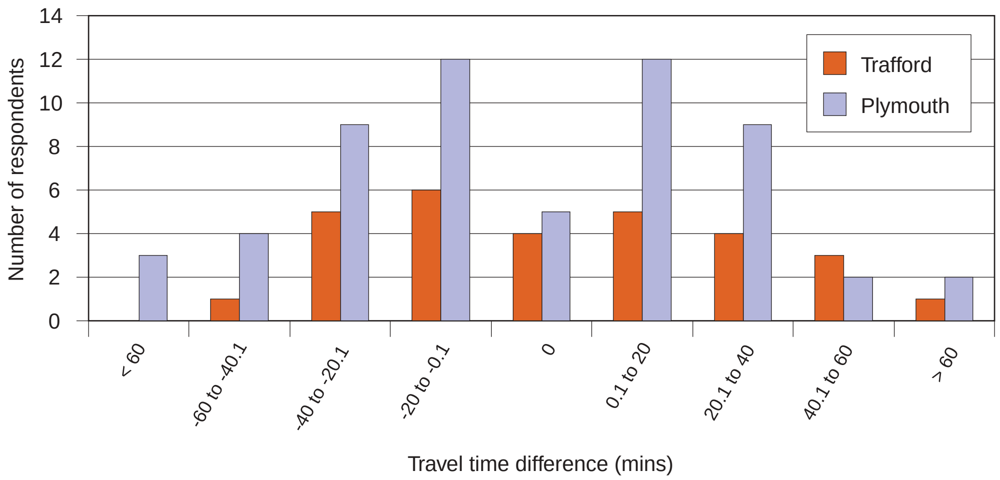

Figure 15 Actual minus estimated travel time – regular bus trips

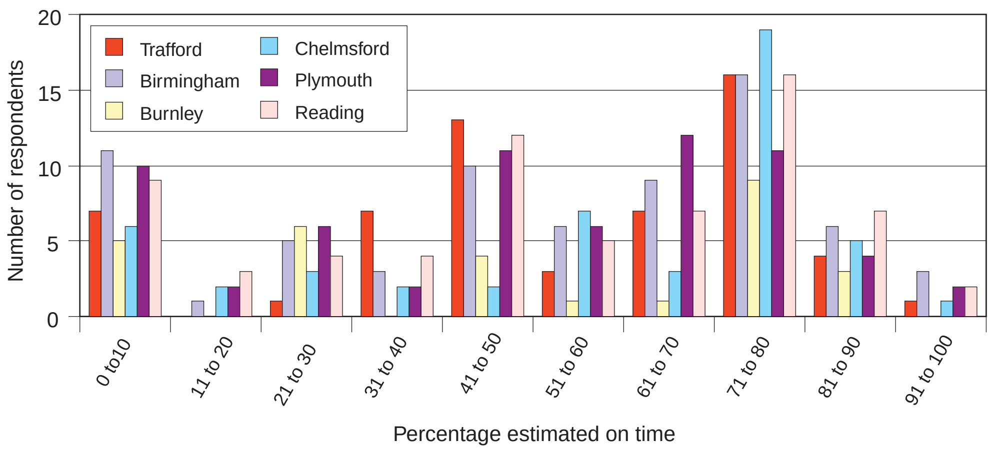

Figure 16 Perceived reliability of public transport – long rail trips

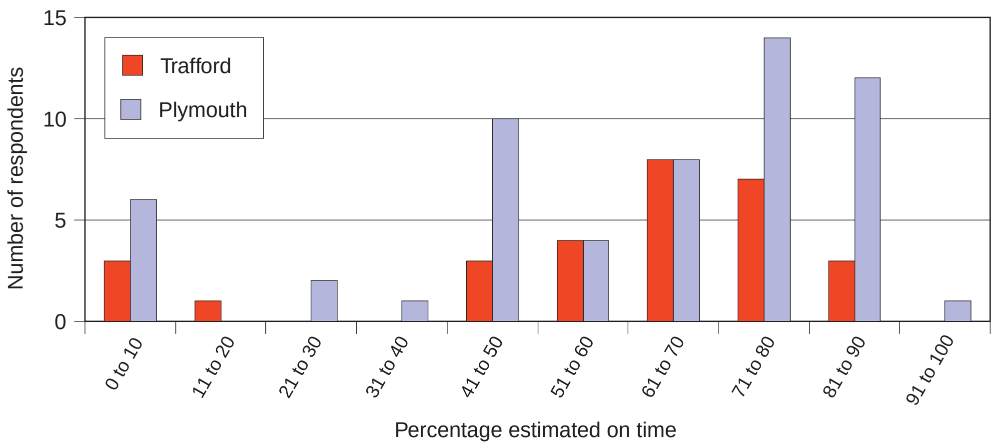

Figure 17 Perceived reliability of public transport – regular bus trips

The majority of car users believe public transport to be on time between 70 and 80% of the time. The average reliability is significantly less than this: for example in Birmingham the long rail trips are expected to be on time for 55% of the time. Similarly in Trafford the average reliability expected of bus services is 62%.

10 Effects of public transport improvements

The models developed to explain preferences of car users may now be used to estimate how those car users might be influenced to switch travel modes by any of a range of types of improvements in public transport services. Possible improvements considered are:

- Greater service frequencies.
- Elimination of interchanges (more direct services).
- Greater reliability of services.
- Better links between trip ends and public transport stations and stops.
- Lower fares.
- Shorter overall journey times.
- Better, more accessible information on public transport services.

The effects of the first six of these forms of improvement were explored using models based on analysis of the results of the stated preference exercises undertaken as part of the second traveller surveys. The seventh was also based on the second traveller surveys, in which people were asked whether they might have used public transport had they been fully aware of the relevant available services. Those who gave affirmative answers to this question were excluded from stated preference samples, along with those who averred that they would not have used public transport however much services were improved.

10.1 Model validation

The models derived from the results of the stated preference surveys were applied to all the car users identified in the first traveller survey for whom there were feasible public transport alternatives to car travel. The sample thus included those who would have chosen public transport travel given better knowledge of it, those who said they would choose car travel regardless of any improvements in public transport, as well as those who took part in the stated preference exercises.

The models used for this purpose were the appropriate multiple-area models for travellers with rail alternatives (Section 6.2.1) and an overall model for travellers with bus alternatives in Plymouth and Trafford (Section 6.1.1). These models were tested by using them to estimate proportions of actual car users who would have preferred car travel to the appropriate public transport alternatives, but with service frequencies standardised at two per hour (to avoid the complication of assigning equivalent frequencies to services not run at regular headways throughout the day). The results, shown in Table 39, are consistent with observed mode choice (100 per cent by car) allowing for people who lacked necessary information about public transport options, and for some whose existing public transport services ran at lower frequencies than two per hour.

Table 39 Percentage of car users predicted to travel by car under current conditions

	Public transport alternative			
	Long trips	*Medium-distance regular trips*		
Study area	*Rail*	*Bus*	*Rail*	*Metro*
Trafford	98.6	89.5		94.6
Birmingham	93.3			
Bromley	100.0		97.8	
Burnley	92.5			
Chelmsford	100.0			
Plymouth	95.7	87.8		
Reading	91.1			
All	95.7	88.4	97.8	94.6

Tests were also performed with the individual study area models, however, the predictions varied only slightly from the more robust multiple area models.

The results in Table 39 are used as a baseline with which to compare modal shares which might obtain if the various public transport improvements considered were effected.

10.2 Increasing service frequency

A public transport timetable is defined not only by the overall service frequency, but also by the length of time during the day over which services are offered. Frequency increases *per se* may not help travellers for whom the first departures are too late for their journey purposes, or too late for return journeys. However, only two respondents out of nearly 3000 in the first traveller survey volunteered comments to this effect. We are therefore unable to pursue this question, but it seems unlikely that efforts to extend timetables would be rewarded.

We have therefore explored the possible effects of simple frequency increases, with services run at 15 minute and 5 minute intervals.

Since the stated preference model was created to test the effects of 30 and 15 minute frequencies only, it was necessary to extrapolate the relationship between frequency and the utility of public transport in order to estimate the effects of offering a five minute frequency. The data available was insufficient to justify anything more complicated than a linear extrapolation, which must therefore be viewed as an approximation. The model results are shown in Tables 40 and 41.

Increasing frequency for long trips is predicted to reduce the number of current car drivers using cars by 1.2% when changed from 30 to 15 minutes, but only another 0.8% when further improved to every 5 minutes. However, the changes seem to be highly dependent on area, with the percentage remaining unaltered in two of the areas. The

Table 40 Increasing frequency to every 15 minutes (percentages of car users who would not switch to public transport)

	Public transport alternative			
	Long trips	*Medium-distance regular trips*		
Study area	*Rail*	*Bus*	*Rail*	*Metro*
Trafford	97.3	89.5		94.6
Birmingham	92.2			
Bromley	100.0		97.8	
Burnley	92.5			
Chelmsford	100.0			
Plymouth	94.6	86.5		
Reading	87.8			
All	94.5	87.5	97.8	94.6

Table 41 Increasing frequency to every 5 minutes (percentages of car users who would not switch to public transport)

	Public transport alternative			
	Long trips	*Medium-distance regular trips*		
Study area	*Rail*	*Bus*	*Rail*	*Metro*
Trafford	97.3	89.5		91.9
Birmingham	91.1			
Bromley	100.0		97.8	
Burnley	92.5			
Chelmsford	98.6			
Plymouth	93.5	86.5		
Reading	86.7			
All	93.7	87.5	97.8	91.9

largest change when providing a 15 minute service was predicted to occur in Reading (reducing the percentage of car drivers using cars by 3.3%) however, a further improvement to a service every 5 minutes only reduced the percentage by a further 0.9%.

10.3 Eliminating interchanges

The stated preference model was used to predict the effect of ensuring that each traveller only made one interchange on long journeys and had none for medium length regular trips. The effect on traveller's modal choice, given a public transport frequency of every 15 minutes is summarised in Table 42.

The reduction to the number of interchanges for many travellers (though some travellers already have a small number of interchanges in their journey) has a similar effect to reducing the frequency from 15 to 5 minutes. The most notable exception is Burnley for long rail trips where the interchange improvements are predicted to cause 5% of current car drivers to switch modes. This may reflect the indirect rail service to Manchester (the most popular destination for Burnley travellers) involving an interchange at Blackburn and taking nearly 90 minutes to cover a crow-fly distance of 25 miles.

Table 42 15 minute frequency with no/one interchange (percentages of car users who would not switch to public transport)

	Public transport alternative			
	Long trips	*Medium-distance regular trips*		
Study area	*Rail*	*Bus*	*Rail*	*Metro*
Trafford	97.3	86.8		91.9
Birmingham	90.0			
Bromley	100.0		97.8	
Burnley	87.5			
Chelmsford	98.6			
Plymouth	94.6	86.5		
Reading	86.7			
All	93.3	86.6	97.8	91.9

10.4 Improving reliability

The estimated effects on mode choice of making the public transport services highly reliable (to the extent that travellers would be fully confident that services would run as advertised and depart and arrive on time) are summarised in Table 43.

Table 43 15 minute frequency with highly reliable service (percentages of car users who would not switch to public transport)

	Public transport alternative			
	Long trips	*Medium-distance regular trips*		
Study area	*Rail*	*Bus*	*Rail*	*Metro*
Trafford	95.9	86.8		91.9
Birmingham	77.8			
Bromley	100.0		97.8	
Burnley	82.5			
Chelmsford	94.4			
Plymouth	73.1	82.4		
Reading	73.3			
All	83.6	83.9	97.8	91.9

Reliability improvements generally have a greater effect on modal choice than either frequency or decreasing the number of interchanges for long rail trips. However, the effect is highly variable, possibly reflecting differences between areas in perceived reliability. The least effect is in Bromley (no change) whilst the greatest is in Plymouth (a 22.6% change).

The effect on medium distance trips is smaller: zero in Bromley (rail), 2.7 per cent (bus and metro) in Trafford), and 5.4 per cent (bus) in Plymouth.

10.5 Reducing access time to public transport

The stated preference model was used to predict the effect of making the public transport services more accessible. In order to provide an indication of the upper limit to what might be achievable in practice, the extreme hypothesis used was that access and egress times to and from stations and stops were negligible. For each traveller the public transport total travel time was set at the time on the main mode, estimated for all journeys in the first traveller survey for input to the second. The necessary data were recorded only for long-distance journeys so this exercise was limited to them

The effect on traveller's modal choice is summarised in Table 44.

Table 44 15 minute frequency with zero access time to public transport (percentages of car users who would not switch to public transport)

	Long trips
Study area	*Rail*
Trafford	97.3
Birmingham	85.4
Burnley	87.5
Chelmsford	88.7
Plymouth	88.5
Reading	76.7
All	86.9

The effect of this change is slightly less than that of making the services highly reliable. The smallest effect is predicted to be in Trafford (a 1.3% change in modal split), and the largest in Reading (a 14.4% change). A possible explanation for this is that for travellers from Reading to London, the access and egress times are disproportionately high compared with the actual train journey times on this high-speed route. In practice it may not be practicable to improve journey times between Paddington and destinations scattered over London.

10.6 Effect of reducing public transport travelling cost

The effect of keeping all travelling conditions at current values, but reducing the cost of using public transport has been modelled. The percentage of current long-distance car travellers still using cars for different reductions in public transport fare is shown in Figure 18.

Halving the cost of travelling is predicted to cause some 11 per cent of current car travellers to change modes. It is only radical changes that cause larger alterations in trip making behaviour.

Corresponding results for regular medium-distance journeys are much less significant: halving fares would cause only 3.6 per cent of car users to switch to bus, and 0.8 per cent to metro; halving rail fares would have no effect.

10.7 Effect of reducing public transport travelling time

The effect of keeping all travelling conditions at current values, but reducing the travel time by public transport has been modelled. The percentages of current car travellers still using car for different reductions in public transport journey times are shown in Figure 19 for regular medium-distance trips and Figure 20 for long trips.

Halving bus and metro travel times would have a substantial effect on modal split, but are unlikely to be achievable in practice. More realistic measures, such as bus priority schemes improving overall speeds by 20 per cent, might cause of the order of five per cent of car users to switch modes. Achievable improvements in commuter rail journey times are likely to have only marginal effects.

For long trips the effects of reducing rail travel times are varied. In some areas even halving the travel time by rail would cause only a few per cent of current car drivers to alter their mode of travel; in others the resulting modal shift would be substantial. However, more practicable speed increases would produce more modest effects.

10.8 Improving passenger information

It is arguable that some travellers may use cars for trips that they would find more satisfactory by public transport – if only they were aware of necessary details of public transport alternatives. To test this hypothesis and, if it holds, to quantify it , a simple question was included in the second traveller survey. Respondents with reasonably acceptable public transport alternatives were given relevant information and asked whether they would have used the alternatives if this information had been available to them when planning their journeys. Percentages of respondents who gave affirmative answers are shown in Table 45.

Taken at face value, these results suggest that in the region of eight per cent of car drivers who had a rail alternative for a long trip would have used it if they had known about it. Similarly, about 10 per cent of car users

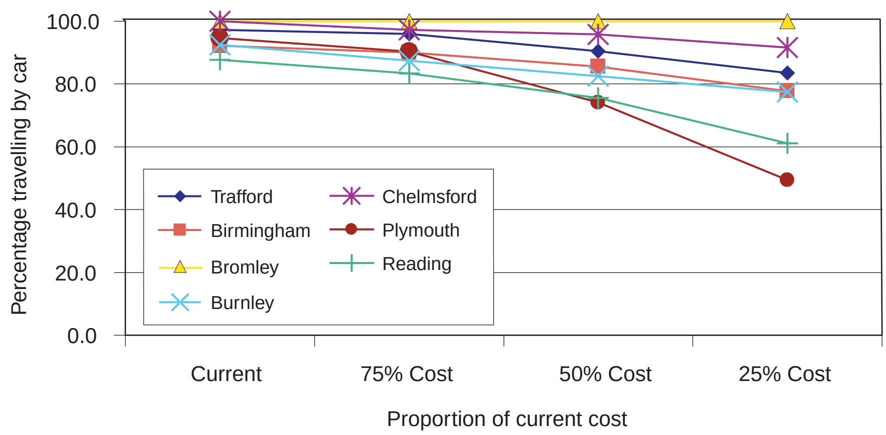

Figure 18 Effect of reducing public transport cost – long trips

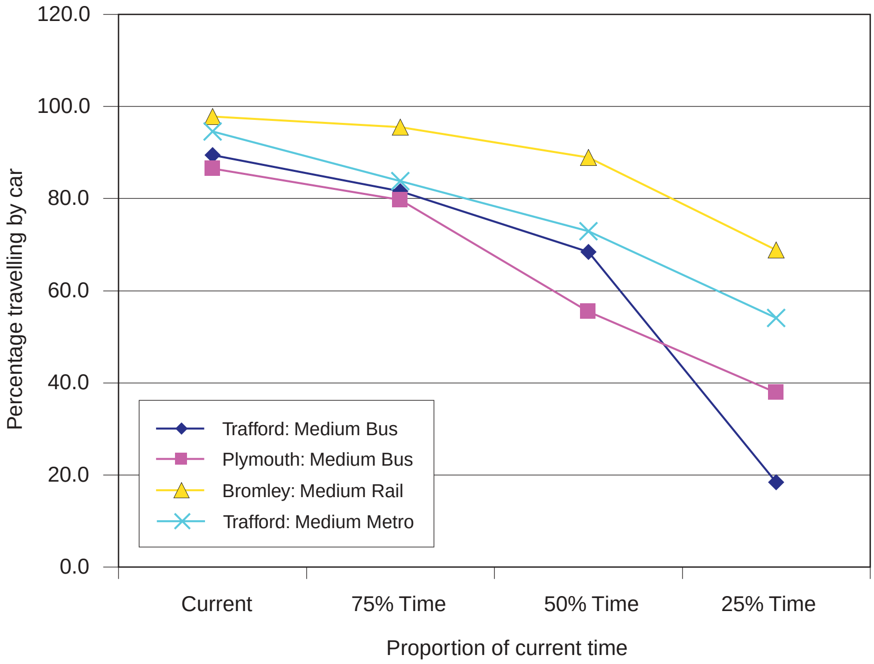

Figure 19 Effect of reducing public transport time – medium trips

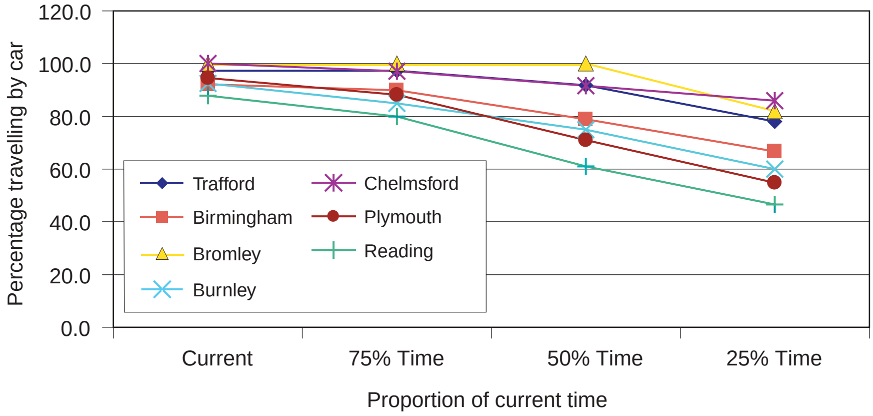

Figure 20 Effect of reducing public transport time – long trips

Table 45 Percentage of car travellers who, given appropriate passenger information, would have travelled by public transport

	Public transport alternative					
	Long trip		*Medium regular trip*			
	Rail		*Bus*		*Metro*	
Study area	*Percent*	*Sample size*	*Percent*	*Sample size*	*Percent*	*Sample size*
Trafford	1.7	59	10.3	29	11.1	27
Birmingham	10.0	70				
Burnley	17.2	29				
Chelmsford	7.3	55				
Plymouth	4.5	66	8.6	58		
Reading	10.0	70				
All	7.7	349	9.2	87	11.1	27

with public transport alternatives for regular medium-length trips would switch modes if they had full details of how to make the trip via public transport.

However, as a result of the filtering processes used in selection of stated preference samples, only a minority of long-distance car travellers (about 18 per cent) were asked this question, as were 19 per cent of regular medium-distance travellers. The scope for mode-shifting through improved passenger information would thus be no more than about two per cent, even if respondents' unverifiable answers could be regarded as wholly reliable.

10.9 Relative effectiveness of public transport improvements

Table 46 ranks the various improvements considered according to the percentage of car users who might make consequential mode switches. The percentage changes shown are averages over all seven study areas for long-

Table 46 Ranking of different types of public transport improvement

Long-distance journeys		*Regular medium-distance journeys*	
Public transport improvement	*Car users likely to switch to public transport (%)*	*Public transport improvement*	*Car users likely to switch to public transport (%)*
Completely reliable services	12	Journey times reduced by 20%	6
Fares reduced by 50%	11	Completely reliable services	4
Journey times reduced by 20%	6	Fares reduced by 50%	3
Reduced travel times to/from stations/stops	3	Fewer interchanges	2
Fewer interchanges	2	Better passenger information	2
Better passenger information	2	Increased service frequencies	1
Increased service frequencies	1		

distance travellers, and over Plymouth and Trafford for regular medium distance travellers. They are estimated using the results of the stated preference modelling, with two exceptions: the effect of reducing access times to a practicable level has been interpolated from the estimate of the effect of eliminating access times altogether, and the effect of providing all necessary passenger information to travellers is based on responses to one question in the second traveller survey. The averaging used here is unweighted, and obscures variations between areas. The results in Table 46 are therefore very approximate, but they give a broad indication of the relative importance of the measures considered.

The most influential change, for long-distance travellers would be elimination of unreliability of services. This may reflect current public perceptions of railway operations, which have been the target of much hostile (and not wholly undeserved) media attention over recent years. Improvements in rail journey times could also have a significant impact on mode choice.

The results for medium-distance journeys suggest that improvements in overall public transport journey times may be more effective than improving reliability, but both types of improvement (largely dependent on traffic engineering measures) would be worthwhile.

Substantial fare reductions would also appear to be influential for both types of travel, but are unlikely to find acceptance under current economic conditions.

The other areas for improvement (access, interchange, passenger information and service frequencies) seem less influential, and differences between them are probably not very significant. Such measures could however contribute to the success of overall packages. For example, increases in rail capacity could improve service reliability, reduce journey times and allow more frequent, or more direct services.

Although the percentage diversion rates from car use in Table 46 appear small, they are not insignificant, in view of the existing imbalance between journeys by private and public transport. For example, if only one per cent of annual person miles by car had been shifted to surface rail, the increase in passenger miles carried by rail would have increased by 15 per cent[6].

[6] *Table 1.2 of Transport Statistics Geat Britain, 2002 Edition, Department forTransport 2002.*

11 Conclusions

In the research described in this report we have examined journey patterns and sought explanations of the modal choices travellers make in the context of currently available transport systems. This led to the development of mode choice models which have been used in the final stage of the project to predict the extent to which modal choice might be influenced by a variety of improvements in public transport systems.

Two types of journey were included in this study:

- Long-distance journeys (at least 15 mile one-way).
- Regular, medium-distance journeys (at least three times per week, and at least five miles one-way.

All the journeys included were made by people who travelled by car (as drivers or passengers) or who could have done so but chose not to.

Over all seven study areas there was an overwhelming preference for travel by car, rather than by public transport. This applies across all groups of travellers (defined by sex, age and income) and all journey purposes. Further, there are few significant differences in propensity to use public transport. A possible exception lies in large, congested urban areas, where public transport can be competitive with car travel in terms of costs and journey times and parking can be difficult and costly. Here, regular travellers are more likely than those elsewhere to use public transport.

Most peoples' choices can be explained quite simply in terms of differences in journey times and costs. Other factors are also considered and may be critical in a small minority of cases. Of these factors, the most often mentioned are public transport reliability, lack of services timed to match desired travel times, preference for direct journeys rather than those involving interchange, and dislike of long walking distances in the course of journeys.

The mode choice models, based on the results of stated preference interviews with selected travellers, are designed to take these factors into account, Separate models have been developed for different sample segments, to distinguish between:

- Regular and other journeys.
- Income bands (combined household incomes above and below £40000 per annum.
- Journey purposes (commuting/business trips and other purposes).

- Journey length (above and below 30 miles).
- Age (above and below 65).

Comparison of model coefficients between segments gives a good indication of the relative importance of different attributes of transport options. It is no surprise that journey time and cost emerge as the most significant factors, but inclusion of other factors improves the extent to which current modal choices can be explained.

Analysis of the survey results has lead to the following conclusions on factors other than time and cost:

- Over 70 per cent of respondents know that there are public transport alternatives to car travel for the journeys they make, but they appear not to have accurate information on the costs and travel times by alternative modes.
- Respondents perceive public transport as unreliable: most estimate that services run on time for fewer than 80 per cent of journeys.
- When directly asked, over 25 per cent said they would pay more than current fares to use current public transport services. Given that most know about the available alternative modes, this implies that direct questioning tends to overestimate how much they would be willing to pay.
- Higher income households have a stronger underlying preference for travelling by car, as opposed to bus, for regular journeys. But higher income households are more likely to switch to rail travel.
- There were distinct differences between the study areas in the factors that influence mode choice. These appear to stem from differences in socio-economic factors and current levels of public transport provision.
- The value of time for rail users was generally consistent, between £5 and £6 per hour.
- Rail users are less concerned about the availability of seats on short rail journeys (such as those between Bromley and central London). For longer journeys, rail travellers may be willing to pay more for comfort.

The final part of this research (after calibration of models to ensure that they reproduced current modal shares adequately) was used to predict the effects of a number of possible types of public transport improvement. These include:

- *Improved service reliability*. This appears to be the most effective means of increasing the public transport share of the market. It is estimated that if travellers were fully confident of adherence to service schedules then some 12 percent of long-distance travellers and six per cent of regular travellers might switch modes from car travel to public transport.
- *Reduced fare levels* might also produce significant shifts. For example, a 50 per cent across-the-board reduction in public transport fares might be enough for eleven per cent of long distance travellers and three per cent of regular travellers to change modes.
- *Reduction in public transport journey times*. This would appear to be equally effective for both types of traveller. For example, a 20 per cent reduction in overall journey times is estimated to produce a six per cent diversion from car travel to public transport.
- *Improved access to and egress from railway stations and bus stops*. If these linking journeys could be made substantially quicker public transport might become more attractive, especially for long-distance travellers. Complete elimination of these linking journeys might produce a switch of some three per cent of long-distance car users, although more practicable measures (such as integrated feeder services) would have less impact.
- Elimination of interchanges to provide direct services. If long-distance journeys by public transport could be accomplished with no more than one interchange, and regular journeys made with no interchanges, then some two per cent of travellers might be diverted from car use.
- *Better, more accessible passenger transport information* would make journey planning and public transport use easier for some travellers, and could possibly attract some two per cent of them from their cars.
- *Increasing public transport service frequencies* appears to be the least effective of the measures tested. It is estimated that increasing frequencies to four services per hour might produce modal shifts of the order of one per cent.

The results of the modelling process should not be taken as precise forecast. They are intended more to indicate the relative effectiveness of different public transport policies and strategies, not all of which would be practicable everywhere. Where any significant improvements in public transport can be achieved, they are likely to result in significant modal shift from cars to public transport.

12 References

Balcombe R J, York I O and Webster D C (2002). *Factors influencing trip mode choice: Supplementary report*. Project Report PR/T/111/02. Crowthorne: TRL Limited. *(Unpublished report available on direct personal application only)*

Balcombe R J, York I O and Webster D C (2002). *Factors influencing trip mode choice: Methodology report.* Project Report PR/T/126/02. Crowthorne: TRL Limited. *(Unpublished report available on direct personal application only)*

Abstract

This research project, undertaken on behalf of the Highways Agency and the Strategic Rail Authority, was designed to improve understanding of the reasons for mode choice for long-distance and regular medium-distance journeys, and indicate how mode choice might be influenced by various types of development in public transport services. Some 2800 travellers, living in seven study areas, were questioned about recent journeys and reasons for mode choice. The public transport alternatives available to car users were also examined and compared with travel by car. This analysis provided a means of explaining current mode choice in terms of individual travel needs, preferences and constraints.

Some 600 of these then took part in further interviews, including Transfer Value and Stated Preference exercises, to establish how they might react to possible future changes in public transport services. This led to the development of mode choice models. Finally, these models were used to compare the relative effectiveness, in terms of mode shifts from car travel to public transport, of different possible types of improvement in transport systems.

Related publications

TRL190 *Review of trip generation studies* by M Dasgupta, N Raha and K Sharman. 1996 (price £35, code J)

LR1097 *A disaggregate modelling study of modal choice for the journey to work* by R J Tunbridge and R L Jackson. 1983 (price £20)

LR501 *A modal split model for long distance travel* by M Ramsey Wigan and D A Walmsley. 1972 (price £20)

CT135 Transport demand and modal shift (1995-1998) *Current Topics in Transport: selected abstracts from TRL Library's database* (price £25)

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