NOTE

Essex LTP Monitoring Surveys

Minnerva

Networked
Wisdom

Sampling Strategy

1　Introduction and Summary

1.1　Purpose and Structure of this Note

This note defines a strategy for surveys to monitor periodically the effectiveness of the Essex Local Transport Plan over its five year period of operation.

The note has the following main sections:

- A summary, which immediately follows this section
- Considerations for the design of the sampling strategy
- Analysis of suitable levels of sampling
- Points for field sampling procedures.

Supporting details are provided in an Appendix.

1.2　Summary

The sampling strategy is focused on obtaining data that, as far as possible, is directed at the specific issues and policies relevant to the Local Transport Plan (LTP). At the same time, there is recognition of the need to maximise the value obtained from the survey data, notably so that it can be used to support the modelling of transport within Essex.

The form of the survey is largely that of a conventional household-based transport survey but it is supplemented by considerations of ensuring the satisfactory survey of key groups for the LTP and of key effects arising from it.

The performance of the LTP is assessed with reference to Essex as a whole, but there are natural interests in its impact on specific localities within the County. This is an issue that has significant budget implications, as discriminating effects between parts of the County requires a much greater level of sampling than assessing changes through time over the County as a whole.

The sampling strategy deals with this matter by making it easier to conduct locale-specific surveys, when there is a particular requirement, that can be related to the County-wide surveys. This is achieved through using person-type and area-type characteristics as a means to combine information from surveys.

The monitoring of changes requires a baseline to be established. This exists in some measure from existing survey results, but the sampling strategy defined here seeks to add precision where it is most needed. This change from the baseline implies an element of inconsistency, but the judgement is made that the change is still worthwhile.

The monitoring of change is challenging for the survey, as significant but small changes can arise that are within the error limits of standard sample sizes. Increasing sample sizes addresses this matter but such extra precision can be costly and raises value-for-money concerns. In broad terms, the requisite size of the sample for a given level of precision is dictated by the number of monitoring parameters rather than the size of the population. The sampling strategy is therefore aimed at providing information on the changes for a limited number of monitoring parameters. The nature of the Essex LTP policies means that modal change is a key parameter. This can be examined with regard to area type or person type,
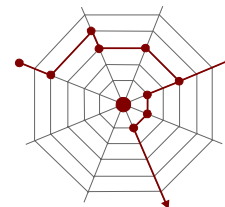
that is, which types of people or which types of areas in Essex reflect transport-related changes from the LTP. These, in turn, can be linked to LTP policy objectives of social inclusion and economic regeneration.

The primary sampling strategy uses a multi-stage sampling procedure based on a set of Primary Sampling Units (PSUs) that are defined. These are organised into two categories of 'trip origin' and 'trip destination' based PSUs.

The trip origin PSUs constitute the main set and are organised hierarchically, with the lowest set represented by Wards. The Wards are categorised into 'Locality Types' that aim to reflect the characteristics of the locality in terms of the average profile of the population living in each Ward. The information on the profiles is based on Census data estimated for 1998. The Wards are aggregated into 'Transport Area Types' that reflect the characteristics of the Wards with respect to transport, including policy interests of the LTP. These characteristics include land use development and economic regeneration that are relevant to transport.

The Postcode Address File (PAF, in the form of Address Manager) is used to obtain a random sample of households in PSUs that are sampled in the earlier stages.

The monitoring is done with respect to person types.

Some LTP policy interests are directed more at the destination end of trips, which can pose difficulties in ensuring that origin based PSUs sample relevant trips to a sufficient extent. This is most clearly the case for education trips, where suitably high samples can clearly be obtained by sampling at educational establishments in Essex. Thus, because the LTP seeks to alter the travel mode of trips of students (and their escorts), educational establishments are defined as trip destination PSUs.

In order to monitor the effectiveness of LTP policies directed at issues of social exclusion[1], it is necessary to ensure that this, difficult-to-define group, is adequately represented in the sample. It is possible to associate social exclusion with poverty, and so strata of the sampling include Wards with social deprivation indicators suggested by the 1998 Census estimates. However, the 'transport socially excluded' can be taken to include those with no car available, which is a much broader category than the socially deprived.
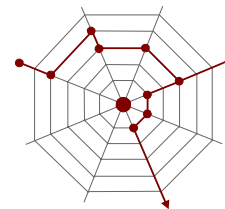
Care is therefore required in defining the sampling strata for the socially excluded. There is no acknowledged approach to this, partly because the statistical analysis of social excluded groups is a relatively young field[2]. It is proposed, therefore, that surveys made at shopping centres, small and large, at non-peak times are used as a means of increasing the representation of those living in Essex who are not economically active and who may be more representative of the socially excluded groups targeted by LTP policies. This is clearly an approximation, but one considered worthwhile to address this sector.

The sampling of students and socially-excluded groups requires their identification at the destination end of trips for subsequent follow-up by household surveys. This approach can be extended, where required, to other groups, for example, to identify households with one or more occupants affected by employer based Green Travel Plans.

It is normal for these trip destination surveys to be conducted independently of household surveys, but forging the connection allows the analysis of the household surveys to be made statistically more significant for the policy interests of the Local Transport Plan. The innovation of the approach therefore offers important value for money benefits.

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[1] or its positive obverse, 'social inclusion'.
[2] The Cabinet Office's Social Exclusion Unit has recently commissioned a study into transport-related social exclusion that may provide a source of guidance in the future.

2   Considerations for the Sampling Strategy

2.1 Policy Concerns

The survey needs to be directed at the main transport policy concerns of the Essex LTP, which are:

- Environment and safety
- Accessibility and integration
- Economy and efficiency.

The LTP identifies a number of sub-objectives and related transportation issues for each of these broad headings, which can broadly be summarised as referring to:

- social inclusion (helping people with restricted transport options)
- modal change (encouraging travel without use of a car; being safer, environmentally better), and
- economy (regeneration: assisting villages and town centres to thrive).

It is therefore useful from a policy perspective for any changes to be classified according to attributes associated with trips:

- trips in rural or urban areas; these relevant to social inclusion and economic policies
- Traveller person type; this is relevant to social inclusion.
- Car availability for travellers; this is relevant to social inclusion.
- Proximity of trip origin and destination to a public transport corridor; this is relevant to modal change.
- Distance from schools and universities; this is relevant to modal change of education trips.

The main policy issues are therefore predominantly those of modal change (that is, limiting use of the car), and the effects of LTP policies on different person types as it affects issues of social inclusion. Economic effects on different types of areas are also important.

2.2 Survey Objectives

Budget considerations mean that there is an interest in minimising the number of variables that have to be monitored, so we interpret the objectives of the monitoring as:

detecting changes in the modal split of travel in Essex, as a result of the Local Transport Plan (LTP), as it affects different types of people and different types of areas.

That is, detecting changes in annual average values of private vehicle-kilometres and passenger-kilometres.

The monitoring role of these surveys means, significantly, that the primary interest lies in changes from a baseline. This is different from cross-sectional transport surveys that are designed to describe a pattern of behaviour for use in the context of modelling.

The monitoring surveys cannot identify the extent to which the LTP or other factors are responsible for change, so it is appropriate to consider that a diary of external effects and incidents is maintained as an adjunct to the process we define here.
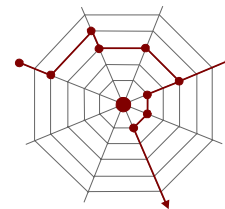
2.3 Criteria of Sample Design

The criteria that the sample design should ensure are:

- It should be representative of the population of the study area.
- The achieved sample should be as free as possible from geographical and temporal biases.
- The sample design and issue procedures should not be burdensome on the fieldwork operation.

These criteria have a bearing on the:

- sample frame that is adopted,
- stratification of samples,
- treatment of multi-stage sample issue to the field and the selection of top-up samples.

We discuss these considerations below.

2.4 The Sampling Procedure

With the above considerations in mind, it is possible to define the following procedure for the sampling of interviews suited to the aims of the monitoring surveys.

1) Define the set of Primary Sampling Units (PSUs)

2) Stratify the population within each PSU

3) Sample from the population according to the stratification.

We describe these elements of the procedure in more detail in the following sections. The procedure varies according to the trip origin based interviews, i.e. household based, and the trip destination based interviews for education and shopping areas.

## 2.5 Stratification

2.5.1   Purpose of Stratification

The use of stratified samples provides a means of ensuring enhanced precision from the survey data where it is most required. Because monitoring changes is demanding of the precision of surveys it is necessary for the stratification to be sensitive to those categories in which change is most likely to occur. Consideration of the LTP policy objectives implies that these categories should be by type of person and by type of location.

The person type categories need to identify those groups for whom change is most likely to occur. These may include numerically small groupings.

The location (or geographical) categories need to reflect where the transport system is altered. Developments in the east of the County, say, may have little or no bearing on travel in the west. The location of economic and land use development is also relevant to transport issues.

2.5.2   Policy Sensitive Groups

Sampling should be increased where it is necessary to have more representatives of particular person types that would otherwise be under-reported and which are significant in terms of the LTP policies. In some cases, these groups are more easily identified at the destination end of trips. It is therefore valuable to have sample interviews selected according to the destination end of trips (rather the home origin) where this relates to relevant person types.
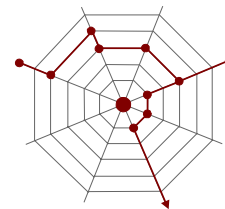
2.5.3 Defining Primary Sampling Units

The first stage is to define regions of Essex based on the area classifications, namely Transport Area Types and Locality Types, given in Sections 2.5.7 and 2.5.8 below.

We define three types of PSUs. The origin-based PSUs are defined as contiguous aggregations of post code sectors containing approximately 3000 postal delivery points and coinciding with the boundaries of the formed by Transport Area Types and Wards.

The education, destination-based PSUs correspond to schools, colleges, and universities within Essex.

The shopping areas destination-based PSUs correspond to local shopping areas, district and town centre shopping areas, supermarkets and hypermarkets.

2.5.4 Stratifying the Sample

The sample is stratified according to person type and two geographic categories.

2.5.5 Person Type Categories

Policy concerns, including those of social inclusion, mean that it is valuable for 'person type' to be defined in as clear a manner as possible. The classification of person type should include:

- Gender
- Age/life cycle (e.g. young and old dependants)
- Socio-economic status
- Car availability
- Level of health and disability
- Cultural references (e.g. newspaper read, Internet usage, mother tongue).

Identification of suitable person types ('profiles') allows the possibility of transferring observations from one area to another on the basis that 'similar people' will behave consistently between areas.

2.5.6 Geographical Categories

The issue of stratification by geographical category is particularly difficult on account of the changes that may occur over the years of the LTP's monitoring period, and because some of the definitions include a subjective element. Two geographical categories are defined.

2.5.7 Transport Area Types

The Transport Area Type geographical category is defined to reflect a number of factors relevant to the LTP:

1) Rural context (country and towns)
2) Coastal towns
3) LTP Transport Priority Improvement Area (TPIA)
4) Transport hub/economic centre
5) London influence (London fringe/commuter town)
6) Proximity to a transport corridor

Transport Area Types for Essex are defined in more detail in Appendix A4.
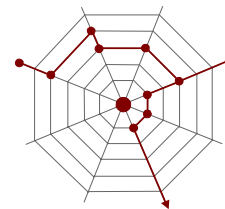
2.5.8 Locality Types

The Locality Types are defined according to the population profiles of Wards as given by the 1998 estimates of Ward population. These include information on population age, employment-related data and a 2000 Index of (relative) Deprivation.

The Locality Types that have been defined are:

1) Deprived

2) Average

3) Average - Elderly

4) Affluent – Young

5) Affluent – Elderly

6) Town Centre

These locality definitions are necessarily broad is scope but, when coupled with the Transport Area types, serve to provide a basis for discriminating different parts of Essex.

Data for Wards in Chelmsford District is reproduced in a table in Appendix A5, with the last column of the table illustrating the Locality Types that are defined for selected Wards.

2.6 Multi-Stage Sampling and Clustering

Multi-stage sampling and clustering are relevant to consideration of the travel times and costs for surveys taken across a region as large as Essex.

2.6.1 Multi-Stage Sampling Process

The multi-stage origin-based sampling involves a staged sampling of the PSUs:

1) Transport Area (see Section 2.5.7)

2) Locality (see Section 2.5.8)

3) Households

In the case of destination-based sampling, there is an extra stage to locating households, but the Transport Area and Locality are not re-sampled from those used in the origin-based sampling.

1) Transport Area Type

2) Locality Type

3) Educational establishment/Shopping Centre

4) Households

2.6.2 Clustering

It is a practical necessity that sampling is geographically more clustered than is desirable from statistical considerations. This means that a higher level of sampling is required from each cluster. In order to minimise the increases in sampling levels, the aim is to define economical clusters which maintain heterogeneity in the parameters to be estimated.

2.6.3 Sampling from the Population

The PSUs are then sampled using systematic sampling to produce a stratified sample. However, it should be observed that the scope for sampling of Transport Area is limited by the fact that there are few instances of each type. For instance, there are only two Transport Hubs (Chelmsford and Colchester).
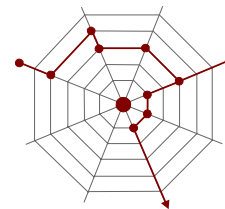
The aim is to ensure an even chance of an address being selected, noting that an address is the home address in the case of trip destination based interviews (education and shops).

The sampling from households is pre-defined, but destination based trips require that the number of origin addresses inside and outside of Essex is monitored so that adequate sampling rates for the Essex population are ensured.

2.7 Sampling Frames

The multi-stage sampling involves a number of sampling frames.

2.7.1 Transport Area Types

The sampling frame for Transport Area Types is derived from the LTP and is defined, in draft form and at the level of Districts only, in Appendix A4.

2.7.2 Locality Types

The sampling frame for Locality Types is provided by Ward data, as illustrated for Chelmsford in Appendix A5.

2.7.3 Households

For a sampled Ward, households are sampled using Consignia's Postcode Address File (Small User PAF), as provided by Address Manager software. This is regularly updated to provide an accurate and unbiased set of addresses that can be sampled randomly.

2.7.4 Educational Establishments

The sampling frame for educational establishments is simply provided by the set of such establishments in Essex.

2.7.5 Socially Excluded

The identification of an unbiased sampling frame for socially excluded groups is less easy to define. Particular groups might be associated with old peoples' clubs, community and youth clubs, and so on, but these are likely to be biased. One definition of social exclusion involves those who cannot participate in regular economic activity. It is therefore suggested that brief interviews/contacts are made at a sample of shopping centres during mid-working hours (e.g. 10am – 12 am and 2.30pm – 3.30 pm on week days) to obtain sample addresses for home interviews. The sample of shopping centres should be determined geographically and not on the basis of the size of the shopping centre.

It is necessary to ensure that the home interviews arising from trip destination contacts maintain the required sampling rates for the stratification categories discussed above. One approach is to sample the trip destination contacts first and then ensure that origin based samples provide the level of sampling that is needed for establishing characteristics of the general Essex population; these being more controllable than the destination based contacts. Alternatively, the sampling could be made sufficient for obtaining general population characteristics, and specific 'policy relevant groups' (i.e. students, socially excluded) are treated as a supplementary sample. This alternative is more flexible, but involves a greater number of interviews.

2.8 Locale Specific Surveys

Obtaining results for a specific area within Essex requires a level of sampling that is not much less, in general, from that required for the whole county. Where surveys are undertaken of specific areas, adoption of the same sampling frames defined here will aid the possibilities of using Bayesian approaches to combine information from the monitoring and the locale specific surveys.
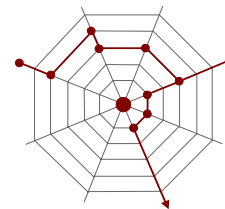
3 Sampling Levels

3.1 Approaches to defining sampling levels

Statistical theory provides the basis for defining appropriate levels of sampling using several well-established procedures. However, this is only applicable to rather simple surveys and, for practical applications, it needs to be supplemented with reference to previous experience. Furthermore, the more complex the survey, the greater the sampling that is required, so one factor is the level of complexity. The fact that this is a monitoring survey that needs to compare information between two surveys (e.g. the base and the current) also places its own demands on the required level of sampling.

We now discuss the implications of each of these considerations.

3.2 Complexity of the Survey

In this context, the complexity of the survey corresponds to the intended use of the survey. The primary use is for monitoring the LTP, which itself has many complexities. These complexities can be approached by recognising that, as discussed in Section 2.1, many of the transport objectives can be related to matters of **modal change** and social inclusion issues that, in turn, concern **which type of people** are affected. The geographical location, by **area type**, taking account of the location and type of changes in the Essex transport system is also relevant. By focusing on these elements, it is possible to limit the amount of sampling required for suitable monitoring of the core concerns of the LTP.[3]

The design of the survey produces information that is relevant to transport demand modelling. This has broader requirements than the specific elements we have identified for LTP monitoring, and so the sampling is not necessarily adequate for this application of the survey. However, repetition of the monitoring survey will allow the accumulation of data that, with care and some statistical processing, can be useful to transport modelling.

3.3 Statistical Theory

3.3.1 Precision of Estimates

Increased levels of sampling improve the statistical precision of the mean values that are estimated from the survey data. This improvement is governed by a square root law, which means that relative improvements in precision require considerably increased amounts of sampling, and hence of survey costs.

In section A1 of the Appendix we present some sample calculations in a set of three tables. These tables come from a spreadsheet that can be used to explore design issues. The data are data (mainly) taken from recent data for Essex[4], although some representative values are included for illustrative purposes. The tables may be understood as follows.

Table 1 is used for inputting the various elements that have particular influence in the design. The example shown is for surveying 1,500 households in 5 strata, each of 300 households.

Table 2 provides values of previously surveyed values for example sets of household, person, and trip data. Data is expressed either as a mean value, together with its standard deviation (S.D.), or as a proportion.

Table 3 gives the range within which the survey would estimate values with a 95% level of confidence. (Proportions are expressed in percentage terms in this table.)

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[3] A rule of thumb is that each new variables that it is wished to estimate, the sample size should be increased by about 40.
[4] Essex Travel Diary 1999/2000; 1998 Census Projections (ONS)
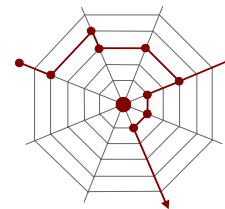
The typical range can be seen to be of the order of 2%; the significance of this level of precision clearly depends on the expected levels of change within the period of the LTP. These calculations do not take account of 'design factor effects' that mean increased ranges (e.g. by 20% – 40%) are used in practice.

3.3.2 Hypothesis Testing

Another way of approaching sample sizes is to consider the survey as a means of detecting whether change has occurred as a result of the LTP (or other factors). Section A2 of the Appendix presents the results of calculations to determine the sample size required to detect a change of a certain size (the 'critical region') with a small chance of incorrectly coming to the conclusion that change has occurred when in fact it has not ('Type 1 Errors' in the standard statistical terminology).

There are several reasons in practice why the calculations under-estimate the sample size, so the 'design factor' is used to compensate for this. Table 4 shows sample sizes in the range 237 to 2017, arising from a variety of assumptions about the critical region and the acceptable level of Type 1 Errors.

These results apply to just one variable, so they must be used with caution in the context of a survey collecting many variables, but they offer some indicators of sampling for a particular stratum.

3.4 Other Experience

The Transport Statistics Personal Travel Division of DTLR has published guidance on the effect of different household sample sizes. We reproduce a summary table, Table 5, in Appendix A3. This shows 95% confidence intervals for a variable measure as a percentage (e.g. percentage of households with one car) obtained for sample sizes of 1,000, 2,000, and 4,000 households respectively.

The National Travel Survey aims to survey some 10,000 households over a period of two years.

Other experience also comes from the major travel survey for London, LATS 2001, which aims to survey some 12,000 households.

These sample sizes are determined by the focus on estimating a large number of variables (around 125). While this capability would be useful for Essex, both for LTP monitoring and transport modelling, as we have argued in Section 3.2 above, the number of variables for relevant to core Essex LTP objectives can be considerably less than this.

3.5 Sampling Levels

This section has aimed to provide the basis on which a decision on required levels of sampling will be taken. The decision, in practice, is very much conditioned by budgetary considerations, which means finding ways of maximising the sample for the available budget. However, it is possible to state that 1,500 sampled households should be regarded as a minimum target level for basic monitoring. Increasing this number will be more relevant to improving the ability to refine the analysis, in terms of the number of variables that are considered, than to increasing the precision of the estimates.
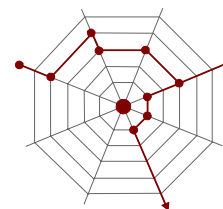
3.6 Using the Results of the Survey

The sampling frames mean that information will be available for different person types by Transport Area type and Locality type. This can be envisaged as a 'results grid' illustrated in Table 3.1.

Transport Area Type↓	Locality Type →					
	1	2	3	4	5	Total
1	60	60	60	60	60	300
2	60	60	60	60	60	300
3	60	60	60	60	60	300
4	60	60	60	60	60	300
5	60	60	60	60	60	300
Total	300	300	300	300	300	1500

Table 3.1 Results Grid

The grid indicates an 'ideal' set of survey results for each of five Transport Area Types and five Locality Types. Thus a particular cell of the grid might represent a 'Deprived' area in a 'Transport Hub'. The grid indicates 300 samples for each Transport Area and also for each Locality, giving a total number of 1500 samples. In the case shown, each of the cells has the same number of 60 interviews. From the discussion on the required sampling, 300 samples would be a sufficient basis to indicate change between the base and a new survey. This is clearly more than the values in the cells, even if the distribution is not even as shown, but does allow results to be reported by Transport Area or Locality type, but not both.

The content of the cells may vary by person type, say by gender, but this will generally require information on either Transport Area or Locality type to be combined so that the relevant row or column total was of the order of 300 samples.

4 Field Sampling Procedures

We have aimed to make the sampling procedures consistent, where reasonable, with those used in the National Travel Survey and we note in this section elements of the NTS Sampling Procedure that are suitable to this work.

4.1 The allocation of PSUs to interviewer quotas

To reduce unnecessary travelling between addresses by the interviewers, all the addresses selected in a PSU are allocated as a single quota of work for an interviewer.

4.2 Multi-household procedures

A concealed multi-household procedure is used to ensure that all households at multi-household addresses had an equal chance of selection where interviewers came across multi-household addresses. At these addresses interviewers are instructed to include all households up to a maximum of three. At addresses with more than three households interviewers use concealed multi-household selection grids to select three from the number present.

To limit the extent to which an interviewer's quota can be inflated by the occurrence of several concealed and/or pre-sampled multi-households, interviewers are instructed to interview at no more than four extra households from concealed addresses.

4.3 Ineligible addresses

Three types of addresses may be classified as ineligible:

- Non-residential addresses and institutions

  (i.e. residential addresses that did not contain a private household). An institution is defined as: 'an address at which four or more unrelated people slept; while they may not have eaten communally, the establishment must have been run by a person (or persons) employed for this purpose, or by the owner'.

  Private households with separate accommodation within an institution are included in the survey.

- Residential accommodation not used by a household as their main address (e.g. a holiday home or second home). This group is excluded to avoid double counting households occupying these accommodation already have a chance of selection at their permanent address.

- Addresses in the PAF that do not exist because they had been demolished, not yet been built, or perhaps two converted flats had been recombined into one house.

Appendix

Indicative Sample Size Calculations

A1   Precision for a Given Sampling Strategy

Sample Size Design Parameters

Number of strata =	5	
Households in sample per strata =	300	
Persons in sample per strata =	762	
(assuming	2.54	persons per household)
Trips in sample per strata =	3,048	
(assuming	4	trips per person)
Population size =	1,294,700	
Level of Confidence =	95%	=> z= 1.96
Total households in sample =	1,500	
Total survey cost =	£112,500	
(assuming	£75	per responding household)

Table 1 Design Parameters

Expected Population Values for Key Variables

Household Variables	Proportion	Mean	S.D.
Persons per Household		2.45	1.50
Vehicles per Household		1.50	0.80
Households without Vehicles	0.11		
Trips per Household		12.00	5.00

Person Variables	Proportion	Mean	S.D.
% Male	0.5		
% Driver's licence	0.63		
% SEG 4,5	0.2		
% Not employed	0.23		

Trip Variables	Proportion	Mean	S.D.
% not car driver	0.54		
% slow/other mode	0.27		

Table 2 Example Values for Population

Precision of Sample Estimates

Household Variables

The estimated value of	Persons per Household	lies between	2.37 and	2.53
The estimated value of	Vehicles per Household	lies between	1.46 and	1.54
The estimated value of	Households without Vehicles	lies between	10.5% and	11.5%
The estimated value of	Trips per Household	lies between	11.75 and	12.25

Person Variables

The estimated value of	% Male	lies between	49.2% and	50.8%
The estimated value of	% Driver's licence	lies between	62.3% and	63.7%
The estimated value of	% SEG 4,5	lies between	19.5% and	20.5%
The estimated value of	% Not employed	lies between	22.4% and	23.6%

Trip Variables

The estimated value of	% not car driver	lies between	53.6% and	54.4%
The estimated value of	% slow/other mode	lies between	26.7% and	27.3%

Table 3 Precision of Sample Estimates

A2 Sample Sizes for Hypothesis Testing

Sample sizes for One-tailed Type 1 Hypothesis Testing

Proportion of variable	Variance	Critical Region, %	Critical Region, Z	Type 1 Errors	Sample Size	Including Design Factor
0.54	0.2484	5%	1.645	5.0%	269	323
0.24	0.1824	5%	1.645	5.0%	197	237
0.54	0.2484	5%	1.645	2.0%	1,680	2,017
0.54	0.2484	5%	1.645	3.0%	747	896
0.46	0.2484	5%	1.645	5.0%	269	323
0.54	0.2484	2%	2.06	5.0%	422	506

Table 4 Sample Sizes for Different Values

A3   Sample Sizes for Hypothesis Testing

Table 5 Examples of 95% confidence intervals obtained from different household sample sizes[1]

Proportion measured[2]	Sample size 1,000		Sample size 2,000		Sample size 4,000	
%	%		%		%	
5	3.7	to 6.3	4.1	to 5.9	4.4	to 5.6
10	8.2	to 11.8	8.8	to 11.2	9.2	to 10.8
15	12.9	to 17.1	13.5	to 16.5	14.1	to 15.9
20	17.6	to 22.4	18.4	to 21.6	18.9	to 21.1
25	22.4	to 27.6	23.2	to 26.8	23.9	to 26.1
30	27.3	to 32.7	28.1	to 31.9	28.8	to 31.2
35	32.1	to 37.9	33.1	to 36.9	33.7	to 36.3
40	37.1	to 42.9	38.0	to 42.0	38.7	to 41.3
45	42.0	to 48.0	43.0	to 47.0	43.7	to 46.3
50	47.0	to 53.0	48.0	to 52.0	48.7	to 51.3
55	52.0	to 58.0	53.0	to 57.0	53.7	to 56.3
60	57.1	to 62.9	58.0	to 62.0	58.7	to 61.3
65	62.1	to 67.9	63.1	to 66.9	63.7	to 66.3
70	67.3	to 72.7	68.1	to 71.9	68.8	to 71.2
75	72.4	to 77.6	73.2	to 76.8	73.9	to 76.1
80	77.6	to 82.4	78.4	to 81.6	78.9	to 81.1

1 Assuming local authority population over 16,000, and simple random samples
2 Household variable, such as proportion of households with no car

A4   Categorisation of Transport Area Types

District	Ref.	Location	Status in Brief	Rural?	Status in LTP	Priority Re-generation Area?	Transport Characteristic
Braintree	1	Braintree	Principal Town		Main Urban		Transport Corridor/ Rural
	14	Witham	Secondary Town		Main Urban		
	15	Halstead	Secondary Town	Yes	Large Town		
	36	Hedingham		Yes			
	37	Yeldham		Yes			
Basildon	2	Basildon	Principal Town		Main Urban	Yes	PTIA
	16	Wickford	Secondary Town		Main Urban		
	17	Billericay	Secondary Town		Main Urban		
Brentwood	3	Brentwood	Principal Town		Main Urban		London Influence
Castle Point	4	Canvey Island	Principal Town		Main Urban	Yes	PTIA
	5	South Benfleet	Principal Town		Main Urban	Yes	
Chelmsford	6	Chelmsford	Principal Town		Main Urban		Transport Hub
	18	South Woodham Ferrers	Secondary Town		Large Town		

District	Ref.	Location	Status in Brief	Rural?	Status in LTP	Priority Re-generation Area?	Transport Characteristic
	19	Danbury	Secondary Town	Yes			
Colchester	7	Colchester	Principal Town		Main Urban		Transport Hub
	20	Tiptree	Secondary Town	Yes			
	51	West Mersea		Yes			
Epping Forest	8	Loughton	Principal Town		Main Urban		London Influence
	21	Epping	Secondary Town		Large Town		
	22	Waltham Abbey	Secondary Town		Large Town	Yes ??	
	Not in sample	Chigwell			Large Town		
	32	Chipping Ongar		Yes			
	38	Roding		Yes			
	39	Easter Axis		Yes			
Harlow	9	Harlow	Principal Town		Main Urban	Yes	London Influence
Maldon	10	Maldon	Principal Town		Large Town		Rural
	23	Burnham on Crouch	Secondary Town	Yes			
	35	Tillingham		Yes			
	40	Maylandsea		Yes			
	41	Southminster Axis		Yes			
Rochford	11	Rayleigh	Principal Town		Main Urban		Rural
	24	Hockley	Secondary Town		Main Urban		
	25	Rochford	Secondary Town		Main Urban		
Tendring	12	Clacton	Principal Town		Main Urban	Yes	Coastal
	26	Frinton	Secondary Town		Large Town)	Yes	
	27	Walton	Secondary Town		Large Town)	Yes	
	52	Harwich	Secondary Town	Part	Large Town	Yes	
	34	Tendring		Yes			
	53	Brightlingsea	Secondary Town	Yes			
	42	Weeley		Yes			
	43	Great Bentley		Yes			
Uttlesford	13	Saffron Waldon	Principal Town		Large Town		Transport Corridor/ Rural
	30	Stansted Mountfitchet	Secondary Town	Yes	Main Urban (Airport)		
	46	Great Dunmow	Secondary Town	Yes			
	33	Bardfield		Yes			
	44	Finchingfield		Yes			

District	Ref.	Location	Status in Brief	Rural?	Status in LTP	Priority Re-generation Area?	Transport Characteristic
	45	Thaxted Axis		Yes			

Appendix

A5 Categorisation of Wards by Locality

Name of Ward	Ward Code	Resident population, mid 1998 (numbers)	Percentage of the resident population who were aged under sixteen, mid 1998	Percentage of the resident population aged 16-59, mid 1998	Percentage of the resident population aged 60 or over, mid 1998	Total live births, 1998 (numbers)	Total deaths, 1998 (numbers)	Primary School pupils average Key Stage 2 score, Summer 1998 (target level = 4)	Income Support claimants, August 1998 (numbers)	Total number of VAT registered enterprises by employment sizeband, March 2000 (numbers)	All employee jobs, September 1998 (numbers)	Indices of Deprivation 2000, rank of index of multiple deprivation rank (out of 8414 wards)	Locality Type
All Saints	22UFFA	5900	22	64	14	68	59	3.66	365	210	7000	2702	Deprived
Baddow Road and Great Baddow Village	22UFFB	7300	16	58	26	66	67	3.94	320	165	2200	5840	
Boreham	22UFFC	3600	23	59	18	40	29	4	140	95	900	6636	
Broomfield, Pleshey and Great Waltham	22UFFD	6300	19	59	23	64	61	3.81	200	175	4700	6307	
Cathedral	22UFFE	5700	19	60	20	66	58	6.198	140	95	900a(1)5.8(e).4(5840)TJ66T10 1 Tf64.5908 -1.3665TD0.03		