TRANSPORT and ROAD
RESEARCH LABORATORY

Department of the Environment
Department of Transport

SUPPLEMENTARY REPORT 641

THE ELASTICITIES OF PASSENGER DEMAND FOR BUS SERVICES: A CASE STUDY IN TELFORD

by

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Special Research Branch
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Crowthorne, Berkshire
1981
ISSN 0305–1315

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ABSTRACT

The substantial changes in bus fares and service levels which were introduced in Telford, Shropshire on 1 April, 1978 provided a suitable context in which to estimate elasticities of bus passenger demand using data collected in special surveys before and after the implementation of the changes.

The study found evidence that shopping trips by bus had been redistributed between the various shopping centres in Telford in response to changes in relative fares and service levels. When a method of estimating elasticities which eliminated redistribution effects was used, fare elasticities for shopping trips were estimated to lie in the range −0.58 to −0.80. Shopping seemed to be fairly insensitive to changes in service frequency, but elasticities with respect to a weighted combination of walking, waiting and in-vehicle time were estimated in the range −0.55 to −0.71.

The surveys indicated that trips made for non-shopping purposes (approximately two-thirds of which were work and education trips) are generally less sensitive to fares than shopping trips. For these trips, fare elasticities ranged between −0.32 and −0.46. Elasticities for non-shopping trips with respect to buses per hour were between 0.29 and 0.37 while elasticities relative to the combined walk, wait and in-vehicle times varied between −0.43 and −0.76.

1. INTRODUCTION

A knowledge of the elasticity of demand for bus travel is helpful in explaining and predicting the responses of passengers to service and fares changes. This type of information is useful to most departments within the average bus company, from those concerned with the operation and staffing of services to those involved in financial and investment planning. It is also of importance to those involved in more general transport planning in central and local government, since revenue support for unremunerative bus services is provided from public funds.

Past studies of the elasticities of demand for bus travel (see, for example, references 1 and 2) have generally been based on trend analyses which have tended to show that passengers are more responsive to changes in service levels than to changes in fares. Such analyses have however been criticised[3] for not distinguishing clearly between cause and effect in the case of service cuts, which must be part cause and part effect of falling passenger demand.

This consideration suggested a need for a study of bus passenger demand in a situation where differences of cause and effect could be readily separated and where a wide spectrum of changes in both fares and service levels was available for analysis. Such a situation was available for study in the town of Telford, Shropshire. Before April 1978 bus services in the town were provided by a number of different operators charging different fare scales and providing different frequencies of service. On 1 April, 1978 a substantial reorganisation of services took place causing considerable changes in service levels and fares. The scale of the changes varied between different parts of the town. Some parts of the town had an improved bus service, while others experienced some reduction in the level of service. Similarly, while fares were reduced in some areas of the town, they were increased in others.

The study took the form of a comparison of the situations before and after reorganisation of the bus services in Telford. By estimating the changes in the number of bus trips and the factors affecting bus tripmaking, such as fares and the other travel 'costs' including in-vehicle time, walking times to and from the bus stop and waiting time, it was possible to make estimates of demand elasticities. The background to the study, the methodology used and the results obtained are summarised in this report*.

2. BACKGROUND

2.1 *Urban structure of Telford*

Telford is a town in Shropshire situated between Shrewsbury and Wolverhampton. Although designated as a New Town, the area includes both old-established centres predominantly in the north, such as Wellington, Donnington and Oakengates, and the newer housing estates mainly situated in the south, such as Woodside, Stirchley and Brookside. The new town centre in the middle of the area was partly complete at the time of the study and is intended eventually to be the main shopping centre of the New Town. The population of the designated area in 1978 was 99,000 and was increasing in the newer housing estates, but declining slightly in some of the older settlements. Industrial jobs are concentrated in a number of estates and complexes throughout the area. The whole town was therefore polynucleated at the time of the study with no single shopping or employment centre.

2.2 *Bus services before reorganisation*

Before the reorganisation of bus services in Telford, services were provided by the Midland Red Omnibus Company (a subsidiary of the National Bus Company) and by a number of much smaller private operators. In total there were thirteen bus operators with stage services wholly or partly within the area. Midland Red provided almost 70 per cent of all the stage services available to the public in Telford, operating some 60 buses from its Wellington garage: nearly half of these services were provided purely for Telford and did not extend outside the designated area. Approximately 20 per cent of scheduled bus mileage was provided exclusively by the various private operators, with the remaining 10 per cent being operated by the Shropshire Omnibus Association, a consortium of Midland Red and seven private operators formed to provide services on a 'rota' basis on particular routes.

There was a very significant difference between the fare levels charged on Midland Red services and those charged by the private operators. In general, Midland Red fares were two to three times as expensive as those of the private operators.

2.3 *Bus services after reorganisation*

Following the completion of the Telford Short Term Bus Study[4], which examined various options for the provision of bus services in Telford, most of the private operators relinquished their stage licences to Midland Red. The new pattern of services operated by Midland Red from 1 April, 1978, provided a general improvement in the

* A more detailed account is contained in Working Paper WP/SRB11 'Estimation of Elasticity of Demand for Bus Services in Telford'. This document is unpublished, but a limited number of copies is available on written request to the Head of Special Research Branch, TRRL.

level of service, although some areas of the town suffered a slight reduction in bus service frequency, usually on roads where frequencies had been relatively high. The main beneficiaries of improved frequencies were the new housing estates in the south of the town. The new timetable reduced the 'peaking' of services, in many cases making the frequency offered in the interpeak period similar to that provided in the morning and evening peaks, although service frequencies were reduced considerably after the evening peak.

Operation of the entire Telford stage network by a single operator also enabled the provision of more through routes, thereby achieving economies in vehicle operation and giving potential passengers in areas formerly served by the private operators a wider choice of destinations – particularly for shopping purposes. The services most affected by the reorganisation were the urban services operating entirely within the study area.

Inevitably, changes in fare levels were required to integrate the relatively cheap fares charged in the parts of the town formerly served by the private operators with the relatively more expensive fares charged in areas covered by Midland Red. The overall result was a raising of fare levels in the former areas and a lowering in the latter.

3. SURVEYS AND DATA

3.1 *Bus passenger surveys*

The study method involved carrying out two surveys of bus passengers in Telford: the first, undertaken in June–July 1976, represented the situation before the reorganisation of the bus services, while the second, undertaken in June–July 1978, represented the situation after the reorganisation of the bus services. The two year gap between surveys was a result of a postponement of the reorganisation because of delays in completing the procedures necessary for Midland Red to purchase the stage licences from the private operators. Both surveys were undertaken at the same time of the year to eliminate any distortion which might be caused by seasonal variations in bus patronage.

An example of the passenger survey form is shown in Appendix 1.

3.2 *Survey data*

The data collected in the surveys were processed by means of a suite of computer programs to edit and expand the data and produce a set of tabulations of bus passenger trips. The study area was split into 21 zones, as shown in Figure 1, and the tabulations were produced on this basis. The zoning system was based on a grouping of the 117 fine zones used in the Telford Transportation Study[5].

The following tabulations were produced using data from the 'before' and 'after' surveys:–

i) a generation-attraction matrix of bus trips between each pair of zones, disaggregated by four journey purposes (work, shopping, education, other) and three time periods (before 0900, 0900 to 1530, after 1530)

ii) a matrix of mean fares paid between each pair of zones

iii) a matrix of mean in-vehicle journey times between each pair of zones, disaggregated into the three time periods

iv) a table of mean walk times from passenger origin to boarding bus stop for each zone, disaggregated by the four journey purposes

v) a table of mean walk times from alighting bus stop to passenger destination for each zone, disaggregated by the four journey purposes.

3.3 *Additional data*

The following additional data were required for use in the regression equations:–

i) Resident population in each zone in 1976 and 1978. These data were supplied by Telford Development Corporation from surveys undertaken by the Corporation.

ii) A 'service-frequency' index for each pair of zones. This was calculated as the average hourly number of bus journeys operated in either direction between each pair of zones. Individual indices were calculated for each of the three time periods for the 'before' and 'after' situations respectively by reference to the published passenger timetables.

iii) 'Generalised time' variables for each zone pair based on the walk and ride time data obtained from the surveys and wait times estimated from the number of buses operated per hour between the zones. The term 'generalised time' is used here to refer to a weighted sum of the walk, wait and in-vehicle time components of the total journey time. The weights were chosen to represent the relative inconvenience or discomfort of the different components: thus, walking and waiting times are weighted more heavily than riding. Two definitions were used, the difference between each depending on the weighting of the individual time components adopted*.

4. THE ANALYSIS

The data obtained from the surveys in June–July 1976 and June–July 1978 were analysed using a multiple regression technique.

4.1 *Form of the regressions*

The behavioural model underlying the regressions was

$$Q = A F^{\beta} S^{\gamma} \qquad \ldots\ldots\ldots\ldots \qquad (1)$$

* A wider definition of generalised time has often been used to include the fare paid, converted into units of equivalent time according to a monetary valuation placed on time, in addition to the time components, but such a combination of time with money has not been considered in the analyses reported here.

where Q = number of passenger trips (or trips per head of population) made between a pair of zones by passengers living in one of the zones

A = factor to represent effects of employment, car ownership, income and other demographic aspects

F = mean fare between the zone pair

S = service frequency between the zone pair

β = fare elasticity

γ = service elasticity

Using subscripts 1 and 2 to denote the before and after situations respectively, equation (1) yields

$$\frac{Q_2}{Q_1} = \left(\frac{A_2}{A_1}\right)\left(\frac{F_2}{F_1}\right)^{\beta}\left(\frac{S_2}{S_1}\right)^{\gamma} \quad \ldots\ldots\ldots \quad (2)$$

which can be transformed for the purpose of linear regression to:

$$q = \alpha + \beta f + \gamma s \quad \ldots\ldots\ldots \quad (3)$$

where $q = \ln\left(\frac{Q_2}{Q_1}\right)$, $f = \ln\left(\frac{F_2}{F_1}\right)$, $s = \ln\left(\frac{S_2}{S_1}\right)$

and α = trend term $\left(= \ln\left(\frac{A_2}{A_1}\right)\right)$

The regressions, therefore, were based on equation (3) using q, f and s for different zone pairs as observations.

The observations included in the regressions were weighted so that zone pairs with a high number of trips were given more importance in the regressions than zone pairs with relatively few trips.

4.2 *Dependent variables*

Two dependent variables (Q) were used:–

i) the number of trips
ii) the number of trips per head (number of trips ÷ population of generating zone).

The dependent variables were disaggregated into different trip-purpose categories, namely:–

i) shopping
ii) work
iii) non-shopping (ie work, education and other).

4.3 *Independent variables*

The independent variables used were ratios for the two survey years of:–

i) real fare between zones

ii) number of buses per hour between zones

iii) generalised time measured in minutes with the individual components of time weighted as follows:–

wait time = 2
walk time = 2
ride time = 1
} This combination is referred to as generalised time variable I

iv) generalised time measured in minutes and weighted as follows:–

wait time = 3
walk time = 2
ride time = 1
} This combination is referred to as generalised time variable II

Each regression included two independent variables: the fare ratio and a measure of the 'level of service' operated which was either the ratio of the number of buses per hour (ie service frequency) or one of the two generalised time ratios.

5. RESULTS OF THE ANALYSIS

The results summarised in this report are the culmination of a series of intermediate stages in which data were checked for inconsistencies and alternative elasticity model formulations were tested using the data disaggregated in a variety of ways. The main results are shown in Table 1.

5.1. *Shopping trips*

The results of the initial regressions of shopping trips are shown in Table 1 for the various model formulations.

It can be seen that none of the elasticities in formulations 1 to 6 has an implausible sign. All of the elasticities estimated for 'shopping trips' and the fare elasticities for 'shopping trips per head' are significant at the 99 per cent level. Only in the case of the generalised time elasticity in model formulation 5 does the significance level fall to 90 per cent. The values of R^2 (0.43 to 0.58), although by no means high, are considered to be acceptable. In all formulations, there is a low degree of correlation between the independent variables.

TABLE 1

Regression results

Dependent variable	Model formulation	Number of observations	Trend factor** (% change per annum)	Elasticity (standard error in brackets)				R^2
				Fare	Buses/ hour	Generalised time I*	Generalised time II*	
Shopping trips (zone pairs)	1	24	0.79 (−10.5%)	−2.60 (0.32)	0.44 (0.09)			0.58
	2	24	0.83 (−8.5%)	−2.18 (0.35)		−1.39 (0.35)		0.54
	3	24	0.82 (−9%)	−2.24 (0.34)			−1.28 (0.30)	0.55
Shopping trips per head (zone pairs)	4	24	0.68 (−16%)	−2.53 (0.38)	0.28 (0.11)			0.45
	5	24	0.71 (−14.5%)	−2.30 (0.40)		−0.79 (0.40)		0.43
	6	24	0.70 (−15%)	−2.33 (0.39)			−0.73 (0.35)	0.43
Shopping trips per head (each zone to all other zones)	7	20	0.76 (−12%)	−0.80 (0.11)	−0.06 (0.06)			0.22
	8	20	0.76 (−12%)	−0.58 (0.12)		−0.55 (0.22)		0.24
	9	20	0.78 (−11%)	−0.58 (0.10)			−0.71 (0.16)	0.29
Work trips (zone pairs)	10	16	0.83 (−8.5%)	−0.16 (0.35)	0.08 (0.11)			0.01
Work trips per head (zone pairs)	11	16	0.79 (−10.5%)	−0.17 (0.35)	−0.09 (0.11)			0.03
Non-shopping trips (zone pairs)	12	33	0.79 (−10.5%)	−0.42 (0.15)	0.37 (0.05)			0.21
	13	33	0.70 (−15%)	−0.32 (0.17)		−0.65 (0.20)		0.07
	14	33	0.71 (−14.5%)	−0.39 (0.16)			−0.76 (0.16)	0.12
Non-shopping trips per head (zone pairs)	15	33	0.75 (−12.5%)	−0.46 (0.16)	0.29 (0.06)			0.15
	16	33	0.68 (−16%)	−0.39 (0.17)		−0.43 (0.20)		0.06
	17	33	0.69 (−15.5%)	−0.44 (0.16)			−0.55 (0.17)	0.08

Notes:– * Generalised time variable I II

Weights:– wait time 2 3

walk time 2 2

ride time 1 1

** Trend factor is defined as antiln. α – see equation (3) in Section 4.1. In interpreting the estimated values, it should be remembered that a period of two years elapsed between the 'before' and 'after' surveys; the approximate annual percentage change implied by each trend factor is shown in brackets.

The fare elasticities are very high, ranging from −2.18 to −2.60 with very little difference between the values obtained using shopping trips and those based on shopping trips per head. The generalised time elasticities in the formulations based on shopping trips (−1.28 and −1.39) are considerably higher than those from formulations based on shopping trips per head (−0.73 and −0.79), but the value of the generalised time elasticity varies only slightly with the definition of generalised time used. The elasticities with respect to buses per hour are lower (numerically) than the other elasticities (0.44 in the shopping trips formulation and 0.28 in the shopping trips per head formulation): insofar as the buses per hour elasticities measure the response of passengers to changes in waiting time, it is to be expected that they will be smaller than the generalised time elasticities, since waiting time is only one component of generalised time.

The values of the trend factors suggest that, quite apart from the effects of changing fares and service levels, passengers have declined by 16–32 per cent over the two years between the studies, or 8–16 per cent per annum. The formulations of shopping trips per head indicate a higher trend decline than the equations of shopping trips. This is consistent with *a priori* expectations, since the population of Telford increased between the dates of the two surveys. However, it is less easy to explain the relatively high trend decline.

The high estimates of shopping fare elasticities may have resulted from the redistribution of trips between the various shopping centres in Telford in response to different percentage fare changes between different zone pairs. It is feasible that such a redistribution of shopping trips should arise, because Telford is a multi-centred town with a hierarchy of shopping centres: the main centres lie in the developing Town Centre and the established towns of Wellington and Oakengates; then there are the smaller district centres such as Dawley and Madeley, and finally several local shopping centres, such as Woodside and Sutton Hill. If such a redistribution of trips took place, the method of estimating elasticities, based on flows of passengers between individual zone pairs, would give an exaggerated impression of the effect of fares on overall patronage, since the high elasticities would merely indicate the ease with which a fares rise between two zones might switch shoppers to an alternative shopping zone to which the fares were increased by a smaller amount, or even reduced.

An attempt was made to assess the extent of the redistribution effect by redefining the dependent variables (Q) in equation (1) in Section 4.1 as the number of shopping trips per head of population from each zone to all other zones in the study area, so that the analysis could be based on total, rather than partial, patronage. The independent variables for fare (F) and service quality (S) were likewise redefined as the flow-weighted average fare and average service level between the zone and all other zones in the study area. Linear regression was undertaken using the transformation shown in equation (3) in Section 4.1. There were 20 sets of observations: one for each of the 21 study zones except one, which was undeveloped at the time of the 'before' survey and therefore generated no shopping trips.

The results are summarised in Table 1 (Model Formulations 7, 8 and 9, which should be compared with Formulations 4, 5 and 6 respectively). In each case the estimate of the fare elasticity using the revised variable definitions is substantially lower than the original estimate (the revised estimates range between −0.58 and −0.80 compared with the original estimates of between −2.30 and −2.53). These results are consistent with the hypothesis that redistribution of shopping trips between different shopping centres had taken place.

It is considered that the revised elasticities measured in the way described provide a reasonable comparison with elasticities measured in other studies since these also commonly contain (or conceal) the effects of redistribution between destinations/fare bands. Any differences are therefore not of kind but arise from the quantity of redistribution observed in Telford. This quantity is plainly larger than the redistribution effect of the more uniform fare changes (sometimes on single services and almost always applying to all travel purposes) which form the basis of many other trend and before-and-after studies. The greater likelihood of redistribution of shopping trips in situations where fares/service levels are changing in a non-uniform way and where a choice of shopping centre exists argues for care in the use of elasticity models for forecasting purposes. Though such models may predict total trips accurately if used in an aggregate way, disaggregation by origin/destination pair, shopping centre or fare band could lead to distorted estimates of future patronage. In such a situation some kind of distribution model might be more useful than simple elasticity estimates.

The values of both the generalised time elasticities (by contrast with the fares elasticities) were changed very little as a result of the new model formulation, though the estimated buses per hour elasticity was not significantly different from zero. This finding suggests that the redistribution of shopping trips between different centres is more likely to be due to changes in the relative fares between zones than to changes in the relative levels of service. The revised estimates of the annual trend decline, although still high, were between 2.5 per cent and 4.0 per cent less than the original estimates.

5.2 *Work trips*

Model formulations 10 and 11 of Table 1 show the disappointing results of the regressions in which work trips were considered separately. The coefficients of the two elasticities are insignificant even at the 70 per cent level and the multiple correlation coefficients are close to zero. The degree of multi-collinearity between the independent variables was high in relation to the values of R^2.

Scrutiny of the data indicated that some trips had been wrongly classified with regard to trip purpose, possibly because of biases in the samples (the 'before' survey was based on a sample of bus journeys). It was desirable therefore to combine work trips with education trips and trips for 'other' purposes in a single 'non-shopping' trip purpose category.

5.3 *Non-shopping trips*

Model formulations 12–14 in Table 1 are the regressions of non-shopping trips, while formulations 15–17 refer to non-shopping trips per head. All of the non-shopping elasticities were estimated using data for zone pairs. It was not considered necessary to make separate estimates of non-shopping elasticities using data for each zone to all other zones (as was the case for shopping trips), because there is much less scope for passengers making work and education trips to change the destination of their bus trips in response to relative changes in fares and service levels respectively.

All of the elasticities have plausible signs and the level of significance of the regression coefficients is generally high. The values of R^2 are low, ranging between 0.06 and 0.21. Correlation between the independent variables is low in all the formulations.

The fare elasticities vary between –0.32 and –0.46. The values found in the analysis based on total non-shopping trips are slightly smaller than the corresponding values obtained from the analysis based on non-shopping trips per head. The generalised time elasticities are higher than the fare elasticities, with the values in the formulations based on total non-shopping trips (–0.65 and –0.76) being slightly higher than those based on non-shopping trips per head (–0.43 and –0.55). The value of the generalised time elasticity varies only slightly with the weighting attached to the components of generalised time. The elasticities with respect to buses per hour have similar values to those estimated for shopping: 0.37 in the formulation based on non-shopping trips and 0.29 in that based on non-shopping trips per head.

The values of the constant term suggest a trend decline of between 11 per cent and 16 per cent per annum which, although very high, is consistent with the trend declines estimated for shopping trips.

5.4 *Comparison between elasticities for shopping and non-shopping trips*

Irrespective of the method used to estimate shopping trip elasticity, the fare elasticities for shopping trips are higher than those for non-shopping trips. Except for the buses per hour elasticity for non-shopping trips per head, the service elasticities for shopping trips are also higher than the corresponding elasticities for non-shopping trips. This finding is consistent with expectations, since around two-thirds of non-shopping trips were made for the purposes of work and education, which are essential in nature and therefore likely to be less sensitive to changes in fare or bus service level.

6. CONCLUSIONS

Reorganisation of bus services in Telford in April 1978, following the takeover by the Midland Red Omnibus Company of a number of private operators in the area, afforded an opportunity to study the effects of changes in fares and service levels in different parts of the town.

Despite the extensive data collection undertaken there was evidence that sampling of bus journeys during the 'before' on-bus surveys had led to some biases and the results need to be interpreted with this in mind. The abnormally large amount of redistribution of destinations which this pattern of fare changes induced must also be borne in mind. The ranges of elasticities found in the study are summarised in Table 2 which shows that fares elasticities ranged from –0.32 to –0.8 and generalised time elasticities from –0.43 to –0.76. The table also appears to show a clear difference between the fare and service level elasticities of shopping trips and those of trips for other purposes. This accords with common sense which suggests that whereas persons making trips to work and education are likely to be tied to a single destination and captive to the bus, shoppers may be very ready to change the shopping centre used (particularly when a good choice exists) and to use the bus more or less frequently.

The evidence that changes in relative fares had caused shopping trips by bus to be redistributed between the various shopping centres in Telford meant that regression analysis based on shopping trips between zone pairs substantially overestimated the elasticity of total demand for shopping and produced a value that was incompatible with those measured in other studies. Respecification of the variables to eliminate this problem produced much lower estimates of the fares elasticities (in the range –0.58 to –0.8), though the values obtained for elasticities with respect to 'generalised time', ie a weighted combination of walking, waiting and riding times, were only slightly

changed. The elasticity with respect to bus frequency was not significantly different from zero after respecification of the model.

TABLE 2

Summary of elasticity values

Elasticity with respect to:	Shopping trips	Non-shopping trips
Fares	−0.58 to −0.80	−0.32 to −0.46
Service frequency	−0.06*	0.29 to 0.37
Generalised travel time	−0.55 to −0.71	−0.43 to −0.76

* Not significantly different from zero

No significant elasticities were obtained for work journeys alone mainly because of the distortions to the purpose split introduced by the sampling of bus journeys in the 'before' survey. It was therefore decided to group all non-shopping journey purposes together. The resulting fare elasticities for non-shopping trips were generally lower than those for shopping trips. The frequency elasticity for non-shopping trips was, as would be expected, less than the generalised time elasticity and was much closer to the more 'usual' values than the very low value obtained for shopping trips. This may again be a reflection of the different characteristics of shopping trips and other trips – shoppers appear to be sensitive to fares but prepared to adapt to service frequency changes, whereas those going to work and school are less sensitive to fares and less able to adapt to frequency changes.

7. ACKNOWLEDGEMENTS

The work described in this report was carried out under contract to the Special Research Branch of the Transport Operations Department of the Transport and Road Research Laboratory. The authors would like to thank Dr F V Webster, Dr P H Bly and Mr R H Oldfield of the TRRL for their comments and guidance throughout the course of the study. They would also like to express their gratitude to officers of Telford Development Corporation and the Midland Red Omnibus Company and to representatives of the private bus operators for their help during the study.

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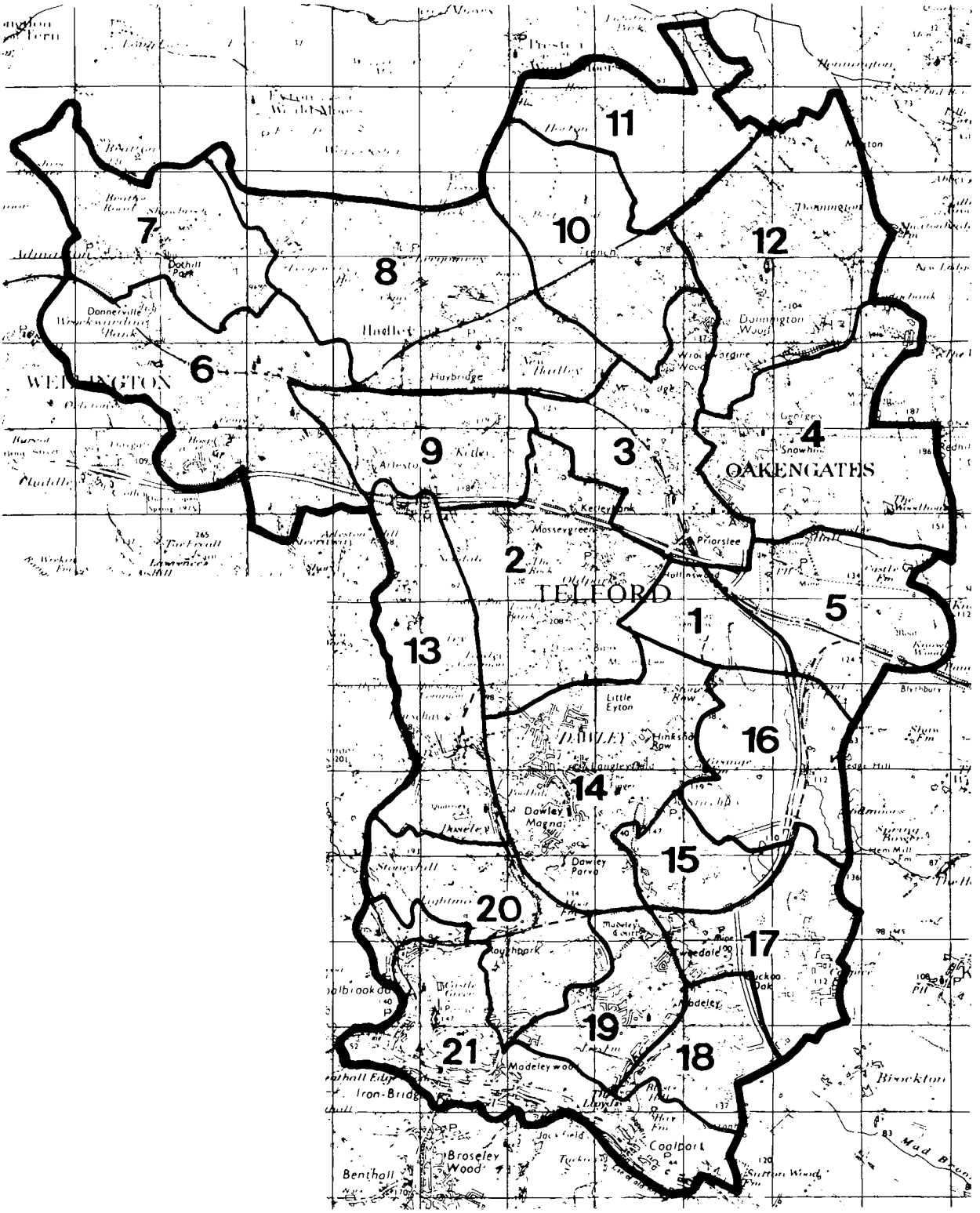

Based on an Ordnance Survey map

Fig. 1 STUDY ZONES

9. APPENDIX 1

Bus passenger survey form

BUS PASSENGER SURVEY

We are carrying out this Bus Passenger Survey to improve bus services where necessary in your area.
We would appreciate it if you would answer ALL the questions as accurately as possible. For most questions this means marking the relevant box with an ☒. If you need help, please ask the surveyor. You should hand this form to the surveyor when you leave the bus but not before.
On the back of this form is a question about the timing convenience of this journey, together with space for adding any general comments about your bus service.

OFFICE USE ONLY — Interview Number 009219

1. Where were you coming from ?
Home ☐1 Work ☐2 Education ☐3 Shopping ☐4 Medical ☐5 Social ☐6 Other ☐7

2. At . . .
Street: .....
Town or area: .....

3. How did you get to the bus stop for THIS bus ?
Walk ☐1 Bus ☐2 Train ☐3 Car ☐4 Other ☐5

4. If you walked to the bus stop, how many minutes did it take ?
Under 1 ☐1 | 1 or 2 ☐2 | About 5 ☐3 | About 10 ☐4 | About 15 ☐5 | About 20 ☐6 | About 25 ☐7 | About 30 ☐8 | Over 30 ☐9

5. Where are you going to ?
Home ☐1 Work ☐2 Education ☐3 Shopping ☐4 Medical ☐5 Social ☐6 Other ☐7

6. At . . .
Street: .....
Town or area: .....

7. How will you get to your destination when you get off this bus ?
Walk ☐1 Bus ☐2 Train ☐3 Car ☐4 Other ☐5

8. How many minutes will you have to walk when you get off this bus ?
Under 1 ☐1 | 1 or 2 ☐2 | About 5 ☐3 | About 10 ☐4 | About 15 ☐5 | About 20 ☐6 | About 25 ☐7 | About 30 ☐8 | Over 30 ☐9

9a What type, or types of ticket have you got ?
Single ☐1 Return ☐2 Scholars Pass ☐3 Tellus Ticket ☐4 West Midlands Travelcard ☐5 Other ☐6

9b Where were you issued with your ticket ?
On THIS bus ☐1 On an EARLIER bus ☐2 From an OFFICE or by POST ☐3

10. If you paid in cash or OAP tokens for yourself ON THIS BUS, please indicate how much.
.....pence Tick if you used tokens ☐

11. Is there someone in your household who OWNS or has USE of a car ?
Yes ☐1 No ☐2

12. Did YOU have a car available for THIS journey ?
Yes ☐1 No ☐2

13. Are you . . .
Male ☐1 Female ☐2

14. In which age group are you ?
5 – 15 ☐1 | 16 – 24 ☐2 | 25 –59 ☐3 | 60 – 64 ☐4 | Over 64 ☐5

PLEASE TURN OVER

OFFICE USE ONLY
From address ☐☐☐☐☐☐☐☐☐ To address ☐☐☐☐☐☐☐☐☐ Ticket ☐ Fare ☐☐☐ Off Bus Stop No. ☐☐☐☐☐

15. We would like to run this bus at a time which would best suit your needs.

Please write down . . .

The IDEAL time, in your opinion, for this bus to leave the stop where you have boarded .....

The EARLIEST alternative time you could accept for this journey .....

The LATEST alternative time you could accept for this journey .....

GENERAL COMMENTS

PLEASE HAND IN THIS FORM WHEN YOU LEAVE THE BUS, NOT BEFORE

Thank You For Your Help

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ABSTRACT

THE ELASTICITIES OF PASSENGER DEMAND FOR BUS SERVICES: A CASE STUDY IN TELFORD: *G B Urquhart PhD and C M Buchanan (Colin Buchanan and Partners):* Department of the Environment Department of Transport, TRRL Supplementary Report 641: Crowthorne, 1980 (Transport and Road Research Laboratory). The substantial changes in bus fares and service levels which were introduced in Telford, Shropshire, on 1 April, 1978 provided a suitable context in which to estimate elasticities of bus passenger demand using data collected in special surveys before and after the implementation of the changes.

The study found evidence that shopping trips by bus had been redistributed between the various shopping centres in Telford in response to changes in relative fares and service levels. When a method of estimating elasticities which eliminated redistribution effects was used, fare elasticities for shopping trips were estimated to lie in the range –0.58 to –0.80. Shopping seemed to be fairly insensitive to changes in service frequency, but elasticities with respect to a weighted combination of walking, waiting and in-vehicle time were estimated in the range –0.55 to –0.71.

The surveys indicated that trips made for non-shopping purposes (approximately two-thirds of which were work and education trips) are generally less sensitive to fares than shopping trips. For these trips, fare elasticities ranged between –0.32 and –0.46. Elasticities for non-shopping trips with respect to buses per hour were between 0.29 and 0.37 while elasticities relative to the combined walk, wait and in-vehicle times varied between –0.43 and –0.76.

ISSN 0305–1315

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