

## Development Department Research Programme

# Scottish Household Survey Analytical Topic Report: Accessibility and Transport

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The Scottish Executive commissioned research from a team led by Transport Research Institute, Napier University on Accessibility and Transport using data from the Scottish Household Survey (SHS) for 1999-2003. Multivariate statistical analyses were used to examine the inter-linking of person and household characteristics with travel availability measures looking at variations in the accessibility of transport and accessibility by transport in the light of current policy concern with social inclusion. The Report focuses on car and bus travel.

## Main Findings

- The 2001 Census showed 66% of Scottish households with and 34% without access to a car. The SHS data shows 55% of respondents living within 3 minutes and 85% within 6 minutes walk of their nearest bus stop and 20% reporting a high frequency service (one every 10 minutes or better) from that stop, though another 20% did not know the frequency of service from their nearest bus stop.
- Previous analysis of SHS data showed that in 2003 around 70% of adults reported journeys were by car or van. In 2002/03 40% had used their local bus in the previous month. Other recent research for the Scottish Executive however has shown that most Scottish adults (97%) are multi-modal travellers, with just 3% using only one mode and half having used 7 or more transport modes.
- Two analyses of SHS Travel Diary data show first that while trip duration varies with mode and trip purpose the distribution of trip durations (deterrence functions) illustrate how access to a car increases activity space; and second that distance travelled by car and bus varies with personal variables such as age and gender, household variables such as income and number of children, and opportunity variables such as accessibility of destinations and urban/rural location, but that only distance travelled by car, not bus, varies with transport access variables such as cars per adult and walk time to and service frequency from nearest bus stop.
- Quality of life measures of: rated convenience of local 'life-support' facilities (e.g., bank, shop, GP); mobility; income; social networks; use of sports/cultural facilities; neighbourhood tranquillity; civic participation and health status varied much more between those from households with and without car access than between those with better and worse bus access.
- Access to the bus, whether a long walk to the nearest bus stop or frequency of service from that stop, varies substantially between urban and rural locations. It does not vary between those with and without a disability curtailing their daily activities, though fewer older respondents and more single parents live close to a bus stop.
- Factor analysis of those with a disability affecting their transport use found two factors; one grouping difficulty with bus use with difficulties standing, walking and climbing stairs; one grouping together difficulty with taxi, car, train and bus. Further research on the practical implications of this distinction would be germane.
- SPSS Answer Tree modelling found access to a car the most powerful predictor of recent bus use, followed by difficulty using a bus and then frequency of service and walk time to bus stop.

## Introduction

2001 Census figures show Scotland with a population of just over 5 million people in 2.2 million households with 2.0 million cars or vans owned or available for use by these households and ownership varying markedly between rural and urban areas. While there were thus 93 cars for every 100 households in Scotland, one third (34%) of Scottish households did not have access to a car. Mobility is the potential for movement and accessibility the potential for interaction with desired social and economic opportunities so reduction in or absence of either mobility or accessibility is a reduction in a person's potential. Transport-related social exclusion occurs where individuals or households are unable to fully participate in society as a result of inadequate or unaffordable transport.

Recent research in Scotland for the Scottish Executive has shown that most people are multi-modal travellers, meeting their transport needs via a mix of modes, and that mode use varies with, inter alia, age, gender and income.

## Variations in duration of travel by mode and purpose

Using data from the SHS Travel Diary for 1999-2003 to compare travel time decay distributions – deterrence functions – for car, bus and walk trips for five different journey purposes showed variation in the distribution of travel times between modes and, within each mode, between journey purposes. These revealed preferences, the duration of journeys actually made by respondents, show how the opportunities actually accessed are a function of journey time. The distributions of journey times are a useful aid in accessibility planning. The shape of the deterrence functions determines the scope for behaviour change and this is important for policies on modal shift, social inclusion and economic development. Acquisition of a car increases the 'activity space' or travel horizons of a person compared to those dependent on non-motorised modes and public transport. If services such as shops and opportunities such as work are not close at hand, such people are at greater risk of social exclusion than their car-using counterparts.

## Distance travelled by car and bus and accessibility

Using SHS Travel Diary data two regression analyses looked at how distance travelled varies with socio-economic circumstance, access to transport resources and other indicators of opportunity, comparing bus and car trips.

Average distance travelled was significantly greater for car trips than for bus trips. Distance travelled increased with reducing access to opportunities as measured by a geographical access to services index derived for each ward in Scotland as part of the development of the Scottish Index of Multiple Deprivation. Obligations to be at destinations generate a need to travel.

Distance travelled by car increased with number of cars available to the household and to a lesser extent with increases in walk time to the nearest bus stop and reduction in frequency of bus services. Distance travelled by car initially increased with age and then fell with advancing years, decreased with rising number of children in the household, and was lower for females. The lower the availability of local bus services the greater the distance driven. In comparison with large urban areas, small accessible towns, accessible rural locations and remote rural locations were found to result in more travel by car. Very remote (typically Island) locations generated less car travel.

Distances travelled by bus were substantially smaller within large urban areas than in other accessible locations. Bus travel was found to increase with decreasing access to local services and, in comparison with large urban areas, small accessible towns, very small remote towns, accessible rural locations, remote rural locations and very remote rural locations were found to result in greater distances travelled by bus. Bus travel decreased with increasing age, possession of a driving licence and higher household income. No clear pattern emerged from this analysis of the effect of walk time to the nearest bus stop and frequency of service was not statistically significant once other variables had entered the regression equation.

## Variations in ratings of convenience of destination access to local services

SHS ratings of the convenience of access to vital local 'life-maintenance' facilities – hospital outpatients, GP surgery, chemist, grocery shop, bank and post office – were analysed for variations across population sub-groups and by transport accessibility measures.

Rated convenience of access varied across the six types of service, with less than 1 in 10 rating post office and grocery shopping as inconvenient while a third rate access to their hospital outpatients department as inconvenient.

Inconvenience of access is worse for those from households without access to a car, but not by much save in the case of outpatients department where the difference is substantial; and rated inconvenience is greater for those with a long walk to their nearest bus stop and with an infrequent service from that stop.

Overall, half the respondents said they found access to none of their local services inconvenient and 3% that they find them all inconvenient. This 3% rises to 11% for single pensioners with a long-standing illness, health problem or disability, though 42% of single pensioners with such difficulties say none of the six services are inconvenient for them.

From their ratings, those in small towns appear to be best served in terms of convenience of access to local services, while those in rural locations, both remote and accessible, appear the least well served.

## Variation in quality of life measures with transport availability

A range of other measures of quality of life covering mobility, financial well-being, social interaction, use of sports and cultural facilities, tranquillity of neighbourhood, civic participation and health co-varied with availability of transport. Whilst covariation does not imply a causal relationship, all measures of well-being varied between those from households with and without access to a car, sometimes substantially, and generally varied much less so with differences in bus access. Patterns of variation are summarised in Table 1.

For mobility, a quarter of those from non-car households (26%) held a current driving licence suggesting that some aspired to car ownership. Two thirds of those from non-car households and a quarter of those from car households had used their local bus service in the past month. More of those without a car had walked to a purpose (to work, shopping or friends) while more of those with a car had walked for pleasure.

A relatively long walk to the nearest bus stop (more than 14 minutes) and a very low frequency of service (one bus every 31 minutes or less often) was associated with more car use (household access to a car, possession of a driving licence), less walking to a purpose and more walking for pleasure, and less use of the bus, though a long walk and an infrequent service does not reduce bus use to zero.

On finances, access to a car varied substantially across income quintiles, from 97% of households in the top quintile to 32% in the bottom quintile.

On social interaction with friends and relatives, more of those with access to a car engaged in all such activities, save being visited by relatives. While 58% of both groups had been visited by relatives in the previous 14 days, 70% of those with access to a car compared to 53% of those without had visited relatives, suggesting inequalities of reciprocity. Differences in access to the local bus service made a meaningful difference only to the proportions going out with relatives and friends, with poorer access associated with less of this activity.

**Table 1: Relative size of differences on quality of life measures with car and bus availability**

	Access versus no access to Car	Good versus poor access to Bus
Inconvenience of access to local services	little difference save for access to hospital outpatients	long walk time makes large difference; low service frequency makes large difference to PO, shops and chemist
Mobility	difference to bus use; no difference to train use; less purposeful, more leisure walking; higher bicycle access	difference to bus use; small difference to train use; more purposeful, less leisure walking; lower bicycle access
Finances	large differences across annual household income quintiles	little difference across annual household income quintiles
Social networks	differences in frequency of contact with relatives and friends	little difference in frequency of contact with relatives and friends
Sports and cultural	large difference in frequency of visits to sports and cultural destinations	no difference in frequency of visits to sports and cultural destinations
Neighbourhood	large differences in neighbourhood tranquillity	large differences in neighbourhood tranquillity
Civic participation	differences in community involvement, volunteering and recycling; no difference in voting	differences in community involvement, volunteering and recycling; no difference in voting
Health	differences in health status	no differences in health status

On access to sports and cultural facilities, around twice as many of those from households with access to a car had visited museums, used sports or leisure facilities or used swimming pools in the past year, and around half as many more had used a library or parks. Variations in bus service availability access were not associated with systematic differences in level of use of these sports and cultural destinations.

Those from households with access to a car lived in more tranquil neighbourhoods, reporting fewer noisy neighbours, vandalism, graffiti, drinking and drugs, rubbish and litter, and youths hanging about. This pattern repeated for those with a long walks to and an infrequent service from their nearest bus stop.

On measures of civic participation, more of those with access to a car and more of those with long walks to their nearest bus stop and infrequent daytime services rated themselves as community involved, had volunteered for unpaid charitable work, had recycled, and marginally more had voted at the local and Scottish Parliament elections of 1999 though marginally fewer had voted at the European Parliament elections later in the same year.

The proportions reporting poorer health status, a long-standing illness, health problem or disability that constrained their daily activity, reported difficulty using a bus, difficulty walking for 10 minutes, and difficulty standing for 10 minutes were higher for those from households without access to a car. There were no systematic differences in health or disability between those with different walk times or service frequencies.

## Variation in access to bus services across population sub-groups and geographical areas

85% of those completing the SHS between 1999 and 2003 lived within 6 minutes walk, and 55% within 3 minutes walk, for an able-bodied interviewer, of a bus stop. 10% lived within 3 minutes walk of a bus stop, which has, they perceived, a daytime service frequency of one bus every 21-30 minutes. Just below 10% lived within 3 minutes walk of a bus stop but did not know the frequency of service from that stop.

1 in 5 believe a bus runs from their nearest stop every 10 minutes or more often, half (47%) believe there is one every 20 minutes or better. However 1 in 5, while knowing how far away their nearest bus stop is, say they do not know the frequency with which buses run from that stop.

Fewer persons from single pensioner households and from older, smaller households live within 3 minutes walk of a bus stop and somewhat more single parents and single adults do. Fewer single parent households than other household types are unaware of the service frequency from their nearest stop, perhaps because they make more use of it as more of them report using local bus services.

Those living in very remote small towns are best served by proximity to a bus stop, with 63% living within 3 minutes walk of their nearest stop, perhaps as a consequence of the compact size of such settlements. Those in remote rural, very remote rural and accessible rural locations are the least likely to live within 3 minutes walk of a bus stop.

**Figure 1: Access to local bus service by location showing percent with a long walk (14 minutes or more) and a very infrequent service (less than one every half hour)**

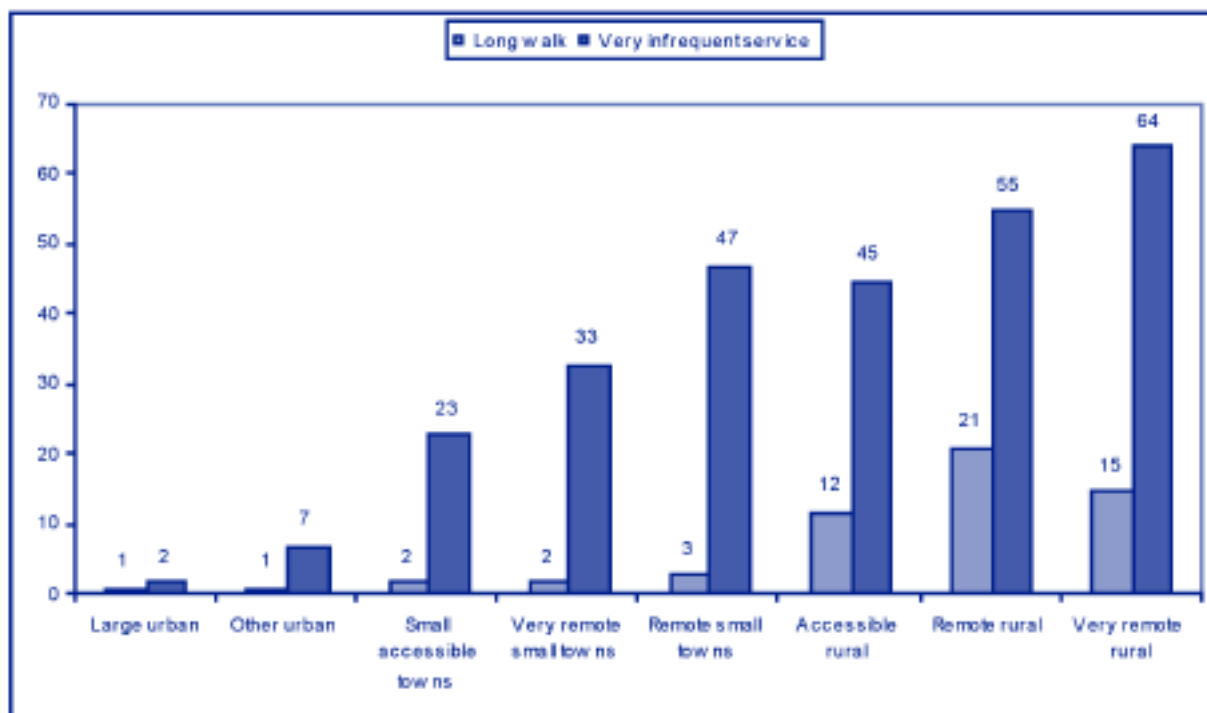


Figure 1 shows the distribution of long walks and infrequent service across locations. The largest difference between local bus services in urban and rural areas is in service frequency, with the proportion with a high frequency service (one bus every 10 minutes or better from nearest bus stop) ranging from 36% of those living in large urban areas to 0.1% of those in remote rural locations. The proportions who don't know the frequency of service from their nearest stop rises from 17% in large urban to 40% in remote rural areas.

There were no systematic differences in walk time or service frequency between those with and without a constraint on daily activity due to long-standing illness, health problem or disability nor those with and without difficulty using the bus, difficulty walking for 10 minutes and difficulty standing for 10 minutes.

Access to a car is higher for those who have a long walk to their nearest bus stop and for those with an infrequent bus service.

## Variation in bus use with transport access and disability measures

SHS data from 2002-03 found 4 in 10 having used their local bus service in the last month and 1 in 5 having ever used their local bus service in the evening. Both fell as walk time increased and service frequency decreased.

While 4 in 10 of those from households with access to a car who had not used their local bus in the last month gave 'I use my own car' as a reason, 6 in 10 of these did not give this as a reason. More people from car households gave as a reason for not using the local bus more often inconvenience, lack of service, takes too long and no direct route, suggesting the bus service does not meet their particular destination access needs.

More of those without access to a car who had not used their local bus in the last month cited prefer to walk, live centrally within walking distance, for ill-health reasons and difficulty with access onto buses as reasons for not using their local bus service more often.

Frequency of service and walk time to bus stop were cited infrequently as reasons for not using the bus more often by both those with and without access to a car.

A quarter of respondents (26.6%) reported having "any long-standing illness, health problem or disability that limits your daily activities or the kind of work that you can do". 7.6% of the sample reporting difficulty using a bus, 10.9% difficulty standing for 10 minutes and 11.9% difficulty walking for 10 minutes. Factor analysis found difficulty using a bus sharing variance with two separate groups of items: one factor grouping difficulty with bus use with difficulties standing, walking and climbing stairs, activities typically needed to access and use a bus. A second factor grouped together all four transport modes – taxi, car, train, bus – suggesting they present a common difficulty to some people.

SPSS Answer Tree was used to build a multivariate model of person, household and transport availability factors influencing whether respondents had used the bus in the last month. Whether the respondent's household did or did not have access to a car emerged as the most powerful predictor of bus use in the previous month. Amongst those with no car access, difficulty with using a bus made the most differentiation. Amongst those with access to a car, the number of cars (1: 2 or more), possession of a driving licence or frequency of driving provided further differentiation. Then perceived frequency of service and, subsequently, walk time to bus stop differentiated further amongst some segments in the model. Despite the presence of such disincentives, for none of the segments was bus use reduced to zero.

Figures 2 and 3 show two illustrative segments from the analysis. Figure 2 shows those from households without car access who report difficulty using the bus. Difficulty using the bus cuts usage from 67% to 20%; better service frequency differentiates (32%: 20%: 6%) and difficulty walking makes a difference to those with reasonable service

frequency (44%: 29%) while difficulty standing makes a difference to those with a low frequency service (28%: 17%)

Figure 3 shows bus use for those from 1-car households who do not hold a driving licence. Difficulty using a bus makes a difference to usage levels (61%: 18%) and service frequency then differentiates within both these groups (77%: 51%: 32%; 23%: 6%).

Perceived frequency of service from nearest bus stop made a difference to the proportion of a segment that had used their local bus in the past month only after more powerful disincentives to bus use – access to a car, difficulty using a bus for those without such access, having a licence to drive for those with such access – had entered the model.

Walk time to nearest bus stop also exercised a deterrent effect, but where proximity to nearest bus stop did make a difference in the proportions that have recently used their local bus, it did so only after frequency of service from that stop had entered the analysis.

**Figure 2: Percent using bus in last month for respondents from households without access to car and reporting difficulty in using the bus**

Overall	40%		
No car in household	67%		
Difficulty using bus	20%		
High/Medium frequency service		32%	
No difficulty walking			44%
Difficulty walking			29%
Low frequency service		20%	
No difficulty standing			28%
Difficulty standing			17%
Don't know service frequency		6%	

**Figure 3: Percent using bus in last month for respondents from 1-car households without a driving licence**

Overall	40%		
One car in household	31%		
No driving licence	56%		
No difficulty using bus	61%		
High frequency service		77%	
Medium frequency service		51%	
Don't know service frequency		32%	
Difficulty using bus	18%		
High/medium/low frequency service		23%	
Don't know service frequency		6%	

## Conclusions and policy implications

Fewer older persons, from single pensioner households and from older, smaller households, live within 3 minutes walk of a bus stop and somewhat more single parents and single adults do. Fewer single parent households than other household types are unaware of the service frequency from their nearest stop, and more of them use the bus.

Living in small accessible towns, accessible rural locations and remote rural locations generates greater distances travelled by both car and bus; those in small towns appear to be best served in terms of convenience of access to local services perhaps because of compact settlement size, while those in rural locations, both remote and accessible, appear the least well served; those living in very remote small towns are best served by proximity to a bus stop, with 63% living within 3 minutes walk of their nearest stop, again no doubt as a consequence of settlement size; those in remote rural, very remote rural and accessible rural locations are the least likely to live within 3 minutes walk of a bus stop; the largest difference between local bus services in urban and rural areas is in service frequency, with the proportion with a high frequency service (one bus every 10 minutes or better from nearest bus stop) ranging from 36% of those living in large urban areas to 0.1% of those in remote rural locations.

The data demonstrate the clear association between access to a car and people's self-reported well-being. While access to a car is not the sole vehicle of social inclusion its absence is characteristic of disadvantaged groups. The key policy implication for government is the need to consider how improvements to the alternatives to car use, for example reductions in the cost of public transport through concessionary fares for certain groups, can substitute for the destination accessibility, speed, autonomy, comfort and convenience that the car appears, from the results of these analyses, to continue to carry.

A case can be made for saying that those who do not have convenient access to local life-maintenance services, are less mobile, poorer, socially isolated, do not avail themselves of sports and cultural facilities, live in more stressful neighbourhoods, are not involved in civic or community affairs and not in good health are disadvantaged. How transport policy can best assist in ameliorating such inequality is a challenge currently facing transport policy-makers.

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ISBN 0-7559-2745-1



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