MAKING ACCESSIBILITY BETTER FOR OLDER PEOPLE

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ABSTRACT

Transport planners are increasingly concerned with ensuring that all groups of society, including the elderly, have good access to services and facilities. Low levels of accessibility may affect people's ability to access essential services and support networks, thus may impact on their quality of life. Public Consultation and accessibility indicators are two of the main tools used by transport planners to identify areas where accessibility needs to be improved. However, accessibility indicators as typically used by transport planners and policy makers do not reflect accessibility as perceived and experienced by older people in terms of the types of activity and services represented, the threshold travel times used and the journey characteristics captured. The UK National Core Accessibility Indicators are no exception. The results from public consultation, whilst providing useful insights, do not generally allow options for improving accessibility to be compared in terms of best value.

As part of the AUNT-SUE (Accessibility and User Needs in Transport in Sustainable Urban Environments) project, a methodology has been developed for measuring accessibility which incorporates many of the journey characteristics deemed important by older people and those with disabilities such as being able to reach a destination without having to transfer between buses, the presence of places to sit en route when walking, and availability of suitable crossing points. The methodology can also be used as part of a consultation process.

This paper compares accessibility indicators generated using the AUNT-SUE methodology with the UK national core threshold accessibility indicators, for the case of St Albans, UK. It

also examines the extent to which the AUNT-SUE indicators incorporate the experiences of older people when navigating the built environment.

INTRODUCTION

Transport planners are increasingly concerned with tackling issues such as social inclusion, unemployment, poor skills levels and bad health by increasing access to services and facilities such as jobs, education and healthcare for all groups of society. To identify accessibility gaps and monitor progress various indicators and targets are used, for example, the UK Department for Transport (DfT) uses a range of indicators based on journey times to various services and facilities by different modes (Table 1) [DfT, 2009]. These indicators are being used to judge nationally the success of accessibility policies and to determine the level of funding provided to local authorities for schemes to improve access. A review of 15 Local Authorities in England [TRaC, 2009] showed that the majority of accessibility indicators being used for transport planning were also of the form:

Population A within X minutes of B range of services (or location C) by Y mode(s).

Additional services covered, beyond those included in the DfT indicators, include access to dentists, town centres, and leisure facilities. Variations include specifying new housing developments instead of population, and specify particular days of the week (i.e. access on a Saturday) and travel times (i.e. during the morning peak, evenings).

These types of indicators say nothing, however, about what individuals can actually access given their unique sets of capabilities and constraints, nor about what they might actually need [Handy and Niemeier, 1997; Oppenheim, 1998].

Another type of indicator that was widely used by the Local Authorities was output based. Examples include: Number of fully accessible bus services, percentage of road crossings with facilities for disabled people, proportion of footways identified as being in poor condition, percentage of buses running to the timetable. These concentrate on specific elements of the transport network and say nothing about how these individual elements link together to affect the ease with which a journey can be undertaken.

Only a few Local Authorities used outcomes-based indicators. Nottingham, for example, monitors the percentage of bus users who feel safe when using the bus at night (after 7pm) [Nottingham City Council and Nottinghamshire County Council, 2006] and Plymouth City Council [2006] monitors the number of missed Outpatient hospital appointments. However, the performance of these indicators may not be related to changes in accessibility.

Work carried out in the context of the AUNT-SUE (Accessibility and User Needs in Transport in Sustainable Urban Environments) project found that the DfT indicators did not reflect the travel patterns of older people and those with disabilities, their perceptions, or their aspirations [Titheridge and Solomon, 2007]. This work went on to develop a series of accessibility benchmarks, through focus groups with older people, which reflected their

needs and aspirations (Table 2). However, embedded within these benchmarks was the concept that journeys could be made "with reasonable ease"; what constitutes reasonable ease is very subjective and can vary considerable between individuals, depending on their capabilities, confidence and past experiences, amongst others. Thus a key problem faced by planners is how can accessibility be measured and monitored objectively, in order to form a sound basis for making decisions regarding potential improvements, whilst taking into account the subjective and very individual aspects of accessibility?

Table 1: UK Department for Transport Core National Accessibility Indicators [DfT, 2009]

Education Indicators	The number and percentage of children aged 5 to 10 years within 15 and 30 minutes of a primary school by public transport/walking, by cycling, and by car.
	The number and percentage of children aged 5 to 10 years in receipt of free school meals within 15 and 30 minutes of a primary school by public transport/walking, by cycling, and by car.
	The number and percentage of children aged 11 to 15 years within 20 and 40 minutes of a secondary school by public transport/walking, by cycling, and by car.
	The number and percentage of children aged 11 to 15 years in receipt of free school meals within 20 and 40 minutes of a secondary school by public transport/walking, by cycling, and by car.
	The number and percentage of children aged 16 to 19 years within 30 and 60 minutes of futherr education college by public transport/walking, by cycling, and by car.
Employment Indicators	The number and percentage of people of working age (16-74) within 20 and 40 minutes of a location with more than 500 jobs by public transport/walking, by cycling, and by car.
	The number and percentage of people in receipt of Jobseekers' allowance within 20 and 40 minutes of a location with more than 500 jobs by public transport/walking, by cycling, and by car.
Health Indicators	The number and percentage of households within 30 and 60 minutes of a hospital by public transport/walking, by cycling, and by car.
	The number and percentage of households without access to a car within 30 and 60 minutes of a hospital by public transport/walking, by cycling, and by car.
	The number and percentage of households within 15 and 30 minutes of a GP by public transport/walking, by cycling, and by car.
	The number and percentage of households without access to a car within 15 and 30 minutes of a GP by public transport/walking, by cycling, and by car.
Supermarket Indicators	The number and percentage of households without access to a car within 15 and 30 minutes of a supermarket by public transport/walking, by cycling, and by car.
	The number and percentage of households within 15 and 30 minutes of a supermarket by public transport/walking, by cycling, and by car.

As part of the AUNT-SUE project a software tool (AMELIA – A Methodology to Enhance Life by Increasing Accessibility) is being developed in the Centre for Transport Studies at University College London. The purpose of AMELIA is to help local transport planners determine whether their policies help increase social inclusion by seeing how many more people can reach various types of opportunity such as those identified in the benchmarks for older people such as food stores, medical centres, social and leisure facilities, and post offices [Titheridge and Solomon, 2007]. AMELIA is described in more detail in [Mackett et al, 2010]. Within AMELIA we have attempted to incorporate the concept of "reasonable ease" by combining data on the capabilities of individuals (based on data from the Survey of Disabled Adults) [OPCS, 1989] with standards taken from sources such as the Inclusive Mobility Guidelines [DfT, 2005] which gives guidance, for example, on footway widths and gradients of dropped kerbs [Titheridge et al, 2009].

Table 2: Accessibility Benchmarks for Older People [Titheridge and Solomon, 2007]

Activity	Number of journeys required
Food shopping	twice a week
Comparison shopping	twice a month
Social or recreational activity	twice a week
Post Office	Once a week
Medical trip (all, e.g. feet, teeth, doctor, hospital, chemist etc.) and visits to friends and relatives.	Once a week
Holiday	twice a year
Structured day time activity appropriate to need[1]	2-10 times a week

The use of AMELIA also allows for a higher level of detail in the analysis of accessibility for different socio-demographic groups, even when using accessibility indicators of more typical form, as per, for example, the UK Department for Transport Core National Accessibility Indicators [DfT, 2009]. One added value of the methodology lies in adding new elements to the analysis of an otherwise standardised measure of accessibility for a given population.

It is hypothesised that in the case of older people or people with disabilities the specific conditions at the micro level like obstructions on the pavement, steps and access to buildings might make certain destinations inaccessible. The development of a more detailed analysis is then the identification of mobility-related inequalities that might be overlooked by more general and aggregated indicators.

This paper compares accessibility indicators generated using the AUNT-SUE methodology – AMELIA with the UK National Core Threshold Accessibility Indicators, for the case of St

1 This might be, for example, a visit to a day centre or attendance at religious services and is dependent on individual needs.

Albans, UK. It then goes on to examine the extent to which the AMELIA indicators incorporate the experiences of older people when navigating the built environment.

CASE STUDY AREA – ST ALBANS

The area of study chosen for comparing the national indicators and the AUNT-SUE methodology was the city of St. Albans in the county of Hertfordshire, an area immediately north of London. The micro-level data is based on street audits made in the area of downtown St. Albans in 2008 [Mackett et al., 2008]. This dataset includes detailed information regarding footways width, existence of dropped kerbs, gradients in ramps, pavements conditions and access barriers for visually handicapped. Moreover, additional information of specific buildings including number of steps and the availability of ramps are considered in search of an inside-to inside indicator beyond the classic door-to-door approach.

This area was selected building on previous research done with the aid of AMELIA as part of the AUNT-SUE initiative. In this case, the analyses are made exclusively for selected output areas inside and adjacent to the city centre, where most of the infrastructure data is available. The data was entered into a GIS database that included the information from the Ordnance Survey, location of selected destinations and existing geo-statistical data of Bus Stops locations and attributes.

COMPARISON BETWEEN CORE INDICATORS AND AUNT-SUE INDICATORS

Ten locations were chosen in central St. Albans in search for the closest population centroids to the detailed pedestrian network. The following analyses and calculations were made for specific destinations of relevance for the population groups of study, which include GP Surgeries, Hospitals, Food Stores and Further Education institutions. The core of the analysis is then walking trips conducted by older people and people with reduced mobility, including both wheelchair users and people with visual restrictions.

The disaggregated results for the AUNT-SUE calculations are compared with the estimations for the core indicators for the case study. The central parameters used in the calculation of journey times for each approach are highlighted in Table 3. These are based on the Methodology Note of the National Accessibility Indicators [DfT, 2012] and the main assumptions considered in the AUNT-SUE methodology.

In general, the algorithms for travel time calculation for walking trips are rather similar in both cases. In the case of the DfT Indicators, time travel calculations are based on building up paths considering available road alternatives for adding them incrementally. Something similar is done within AMELIA. However, in our method the paths are added considering available footway/pavement alternatives and also barriers for different users.

Table 3 – Main Parameters AUNT-SUE vs. DfT

Parameter	AUNT-SUE	DfT
Walking Speed	Elderly/disabled - 0.6m/s Others - 1.0m/s	1.34m/s
Definition of Road Network	Identification of Road and Footpath Walking network in the Integrated Transport Network (for other areas) + Manually digitised footways (pavements) for town centres	Identification of Road and Footpath Walking network in the Integrated Transport Network
Types of roads excluded for walking displacements	Motorways	Motorways
Maximum distance to public transport Stop/Access point	Elderly/disabled - 300m/600m Others - 500m/1000m	1931m
Waiting time at bus stop/station	-	20 mins
Maximum number of Interchanges	2	3
Minimum Interchange Time	5 mins	10 mins

The barriers considered within AMELIA varied for different users. In the case of older people the availability of availability of dropped kerbs, pavement and crossing conditions were considered constraints; in the case of wheelchair users the most important elements considered as restrictions were footway width, kerb gradient and condition, and type of crossing. For visually impaired users, based on consultations with residents from St Albans, particular sections of footway were identified as inaccessible for a variety of reasons such as overcrowding, uneven surfaces, presence of temporary obstructions and general illegibility.

The indicator estimation process for public transport trips is also similar in both cases. For the national indicators, according to the methodology description [DfT, 2012], travel time paths are built out from each public transport access node starting from the nodes with the highest frequencies of public transport services and working down to the nodes with the lowest frequencies. These paths are added incrementally until no better path can be found. In the case of AMELIA, the travel time calculation is made considering bus stops accessible and within time thresholds from each public transport access node within maximum walking distance of origin. These bus stops are time stamped with the quickest bus route option and the maximum walking distance threshold from each time stamped bus stop is used to determine accessible areas. In the case of public transport the main difference between the two methods also lies in the level of detail of the pedestrian network, which might make some bus stops inaccessible thus limiting the level of choice and access of specific users groups.

Table 4 – DfT parameters for threshold indicators

Destinations	User Definition		Travel Time Thresholds		Consideration of 'At Risk' User limitations	Range of accessible facilities within given travel times
	User	Vulnerable user ('At-Risk')	Lower	Upper		
Employment Centres	16-74 year olds	Number of people in receipt of jobseekers allowance	20	40	No Evidence/Indirectly observed through age averages	Between 0 and 10
Primary Schools	5-10 year olds	Number of 5-10 year olds known to be eligible for free school meals	15	30	No Evidence	Between 1 and 5
Secondary Schools	11-15 year olds	Number of 11-15 year olds known to be eligible for free school meals	20	40	No Evidence	Betwwen 1 and 5
Further Education Inst.	16-19 year olds	-	30	60	No Evidence	Between 1 and 10
GPs	Households (Grl. Household members)	Number of households without a car	15	30	No Evidence/Indirectly observed through age averages	Between 1 and 5
Hospitals	Households (Grl. Household members)	Number of households without a car	30	60	No Evidence/Indirectly observed through age averages	Between 1 and 5
Food Stores	Households (Grl. Household members)	Number of households without a car	15	30	No Evidence/Indirectly observed through age averages	Between 1 and 10
Town Centres	Households (Grl. Household members)	Number of households without a car	15	30	No Evidence/Indirectly observed through age averages	Between 1 and 10

Results and analysis

Comparisons were made between the two types of indicators for 4 types of destinations: GP Surgeries, Food Stores, Higher Education institutions and Hospitals. Core indicators for selected Lower Super Output Areas (LSOA) in central St. Albans are compared with the aggregated results of the AUNT-SUE methodology. Four types of restrictions in the pedestrian networks were considered in the analysis: first, no restrictions; second, wheelchair restrictions that combine constraints posed by lack of dropped kerb, steep kerb gradients and narrow pavement widths; third, visual restrictions that make certain roads inaccessible; and finally dropped kerb restrictions that might represent constraints for older, less mobile pedestrians. Table 5 presents the results for GP Surgeries. Tables 8-10 at the end of this paper give the results for Food Stores, Higher Education institutions and Hospitals respectively.

Table 5 – Results for GP Surgeries

	DfT PT/Walking		AUNT SUE Walking Summary					
LSOA Code	**15 min**	**30 min**	**Location**	**Restrictions (0= none, 1 = wheel, 2 = Visual, 3 = dkerb)**	**15 min**	**15 minutes Average**	**30 min**	**30 minutes Average**
E0102 3676	3.6	5	1	0	4	3.3	5	5
				1	3		5	
				2	4		5	
				3	2		5	
E0102 3728	4.83	5	2, 5	0	5	5.0	5	5
				1	5		5	
				2	5		5	
				3	5		5	
E0102 3727	4.71	5	3, 4, 6, 7	0	3	3.0	5	5
				1	3		5	
				2	3		5	
				3	3		5	
E0102 3726	3.5	5	8	0	2	2.0	5	5
				1	2		5	
				2	2		5	
				3	2		5	
E0102 3743	4.08	5	9	0	2	2.0	5	5
				1	2		5	
				2	2		5	
				3	2		5	
E0102 3745	3.26	5	10	0	4	3.3	5	5
				1	3		5	
				2	3		5	
				3	3		5	

In general, the results showed a considerable difference between the indicators of the AUNT-SUE methodology and the core indicators, particularly at the lower threshold. In most cases, the walking summary (the average for the 4 different combinations of restrictions) from AMELIA shows a lower access level in comparison with the DfT aggregate indicators for the same LSOA in central St. Albans. Depending on the type of destination, results showed differences of between 15% and 80%, especially when applying major restrictions of infrastructure for wheelchair users. In the case of visual restrictions the extent of the limitations is either similar or lower than in the case of people requiring major infrastructure facilities.

A further level of detail was then incorporated into AMELIA – the type of access available to enter into the building. This data had been gathered in previous research for the majority of buildings in central St. Albans that the general public may wish to access. The data included whether access to the building was level, via a slope, via a ramp or up steps. The number of

steps and their rise was also recorded. A selection of buildings of different categories were analysed in order to incorporate the effect of physical restrictions to accessing the buildings into the accessibility indicators. The results are presented in Table 6.

Table 6 – Access restrictions for selected buildings

Name	Steps	Rise (cm)	Destination class	Access Types	Number of locations affected by removal of this destination	
					15 minutes	30 minutes
St Albans City Hospital	0	0	Hospital	Level	N/A as level access	N/A as level access
Tesco Metro	0	0	Food Store	Slope	10	10
Ellis	1	2	Food Store	Steps	5	10
Londis	1	14	Food Store	Steps	7	10
University of Hertfordshire (School of Law)	11	0	Education University	Ramp & Steps	9	10
Age Concern Old Folks	0	0	GP's Surgery	Level	N/A as level access	N/A as level access
The Maltings Surgery	1	13	GP's Surgery	Steps	10	10
The Lodge Surgery	0	0	GP's surgery	Slope	2	10

The analysis of this limited number of buildings shows that in several cases restrictions that are not generally considered in more general measurements can represent an important difference in terms of accessibility. Results show that restricted buildings are accessible (within reach) within the 15 and 30 minute thresholds by a large number of the origins analysed. If places with either steps or slope were to be excluded from the results showed in Tables 5, 8, 9 and 10, the average accessibility scores would be reduced for most of the LSOA, representing an important difference in terms of the accuracy of the indicators when applied for older people or those with disabilities. This can represent an important step forward in determined the importance of adding additional levels of detail in accessibility analyses in specific areas of the country, particularly in urban areas.

COMPARISON OF ACCESSIBILITY AS MEASURED BY PLANNERS AND ACCESSIBILITY AS EXPERIENCED BY OLDER PEOPLE AND THOSE WITH DISABILITIES

As with all accessibility models and measures, and as discussed in the preceding section, AMELIA embodies a number of assumptions about accessibility by different individuals and groups in society. In the final phase the AUNT-SUE project, work was undertaken to assess the validity of the assumptions embedded in AMELIA. Having developed the tool we tested, through a series of meetings with older people and people with disabilities whether:

- Our measures of access are the correct ones (especially given that we had to adapt our original benchmarks based on data availability),
- We incorporated the correct barriers,
- A binary (or absolute) approach to modelling barriers is a reasonable approach.

A series of four focus group meetings were held. The focus group consisted of five older people and one younger adult, all with various disabilities. One carer and an observer from the Disability Information Service for Hertfordshire (DISH) also participated in the meetings. The disabilities of members of the group included visual impairment, being in a wheelchair, communication difficulties and hearing impairment. The participants were recruited through the St Albans District Access Group. It is a voluntary group of individuals interested in access matters. Many of its members are also representatives of other disability organisations. The focus group meetings were held over the period June 2009 to January 2010. All the meetings took place at the Civic Centre in the centre of St Albans. Table 7 summaries our findings. A detailed description of the methodology used and the results are given in Titheridge et al [2010].

Table 7: A comparison of different elements of accessibility as measured by planners and experienced by older people and those with disabilities

Journey element	**Transport Planners and Policy makers' Views**	**Views of older people and people with disabilities**
Travel time	Important, occurs in many accessibility indicators.	Not seen as particularly important.
Journey cost	Seen as important, but rarely included in accessibility indicators due to data problems.	Relatively unimportant for older people as they are entitled to free bus travel.
Destinations, places	Access to employment, health care, education, food shops are seen as priorities.	Concerned with being able to "get out and about", to get to post offices, libraries, friends and family, social and leisure activities.
Physical obstacles and barriers	Often treated as absolute barriers (even when they are not) and in isolation.	The effect of an obstacle on accessibility varies depending on the individual, their journey and other circumstances. Obstacles that individually can be coped with can combine to become a barrier to movement.
Reliability	Generally not included in accessibility indicators. Emphasis on public transport running to timetable.	Reliability is more than just buses running on time, it is about being confident that every stage of the journey can be completed with ease.
Information provision	Not included in accessibility indicators. Emphasis on providing real-time information and several formats of public transport timetables.	Need tailored information about every aspect of the journey; both in advance of undertaking a journey and during the course of a journey.

It is clear from the results of the discussion group meetings that older people and those with disabilities perceive and experience accessibility (or lack of accessibility) differently from transport planners and policy makers (as evidenced from the way in which accessibility is measured) (Table 7). That is not to say that transport planners do not understand that accessibility is about much more than journey times to a select list of destinations, or about meeting mobility guidelines and standards, but that pragmatism, data and resource limitations, and a one-size-fits-all approach to developing indicators has led to a situation where what is measured is a far cry from what is experienced or what is important to many of those that the use of such indicators is supposed to help.

CONCLUSIONS

Accessibility indicators should enable transport planners, local authorities and other agencies to assess systematically whether people can get to places that are important to society and for an individual's well-being. One of the dangers then of poorly specified indicators is that they fail to identify correctly those most in need of help. Policy actions and funding can become geared towards showing improvements in accessibility levels as measured by the indicators, rather than improving the lives of vulnerable and disadvantaged people.

The AUNT-SUE methodology (AMELIA) was developed to address some of these concerns. AMELIA enables more detailed accessibility indicators to be modelled that better represent the experiences and perceptions of different populations including older people and people with disabilities. The comparison between the outputs from AMELIA and the DfT core national accessibility indicators highlighted the differences in results that are produced when using a higher level of detail in the analysis of accessibility for older people and those with disabilities. Variations at the micro level can make certain destinations inaccessible. Clearly a more disaggregated, highly detailed approach to measuring accessibility reveals important differences in the accessibility likely to be experienced by different people in different locations that would be missed if using more aggregated indicators.

However, the results from the focus groups shows that output from AMELIA still falls short of measuring accessibility as perceived and experienced by older people and those with disabilities. To measure accessibility as really perceived and experienced by older people and people with disabilities, we would need to model each and every person separately, taking into account their state of health and mind at a particular moment in time. Obviously this is just not possible or plausible. However, we do need to re-evaluate the measures of accessibility that we use as transport planners and how we use them to ensure that actions we take to improve accessibility are the right ones.

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REFERENCES

DfT 2005 "Inclusive Mobility". Available from http://www.dft.gov.uk/stellent/groups/dft_mobility/documents/page/dft_mobility_503282.hcsp. Last accessed 16/05/08

DfT 2009 "2008 Core National Local Authority Accessibility Indicators" Final Report, November 2009. Available from http://www.dft.gov.uk/pgr/statistics/datatablespublications/ltp/coreaccessindicators2020. Last accessed 01/03/10

DfT 2012 "Transport Statistics notes and guidance: Transport accessibility" https://www.gov.uk/transport-statistics-notes-and-guidance-transport-accessibility. Last accessed 20/02/13

Handy, S. and Niemeier, D. 1997 "Measuring Accessibility: An exploration of issues and alternatives". *Environment and Planning A*, 297, 1175-1194.

Jones, P., Titheridge, H., Wixey, S. and Christodoulou, G. 2006 "'WALC': Measuring pedestrian access to local bus and rail stations, taking into account traveller perceptions". *Paper presented at the 11th International Conference on Travel Behaviour Research*, Kyoto, August 2006.

Mackett,R.L., Achuthan,K., and Titheridge,H. 2008. AMELIA: Making streets more accessible for people with mobility difficulties. Urban Design International 13(2), 81-89.

Mackett, R.L., Achuthan, K. and Titheridge, H. 2010. "Increasing accessibility cost-effectively for people who are socially excluded. Paper to be presented at 12th International Conference on Mobility and Transport for Elderly and Disabled Persons (TRANSED 2010), 2-4 June 2010, Hong Kong.

Matthews, H., Beale, L., Picton, P. and Briggs, D. 2003 "Modelling Access with GIS in Urban systems MAGUS: capturing the experience of wheelchair users", *Area*, 35 1, 34-45.

Nottingham City Council and Nottinghamshire County Council, 2006. "Local Transport Plan for Greater Nottingham 2006/7 to 2010/11" Final Plan, March 2006. Available from http://www.nottinghamcity.gov.uk/index.aspx?articleid=848. Last accessed 01/03/2010.

Office of Population Censuses and Surveys, 1989. "Social Survey Division, Survey of Disabled Adults in Private Households, 1985 [computer file]". UK Data Archive [distributor], Colchester, Essex, March 1989, SN: 2577.

Oppenheim, C. 1998 "An Inclusive Society: strategies for tackling poverty", Institute for Public Policy Research, London.

Plymouth City Council, 2006. "Local Transport Plan 2006 to 2011". Available from http://www.plymouth.gov.uk/ltp2006-2011. Last accessed 01/03/2010.

Reneland, M. 2005 "Accessibility Calculations in six Swedish Towns". In *Sustainable Development and Planning II*, Kungolos, A.G., Brebbia, C.A., Beriatos, E. eds Southampton: WIT Press, Vol. 2, 903-912.

Titheridge, H. and Solomon, J. 2007 "Benchmarking Accessibility for Elderly Persons". *Proceedings of the 11th International Conference on Mobility and Transport for Elderly and Disabled Persons*, Montreal, Canada, June 18-21

Titheridge, H., Achuthan, K., Mackett, R.L. and Solomon, J. 2009 "Assessing the extent of transport social exclusion among the elderly". *Journal of Transport and Land Use* 2,2, pp31-48.

Titheridge, H., Mackett, R.L., and Achuthan, K. 2010 "A comparison of accessibility as measured by planners and accessibility as experienced by older people and those with disabilities". *The 12th International Conference on Mobility and Transport for Elderly and Disabled Persons (TRANSED 2010)*, Hong Kong, 02 Jun 2010 - 04 Jun 2010

TRaC, 2009. "Accessibility indicators and benchmarks in Local Transport Plans". AUNT-SUE working document, London Metropolitan University, London.

Table 8 – Results for Food Stores

	DfT PT/Walking		AUNT SUE Walking Summary					
LSOA Code	15 min	30 min	Location	Restrictions (0= none, 1 = wheel, 2 = Visual, 3 = dkerb)	15 min	15 minutes Average	30 min	30 minutes Average
E0102 3676	8.4	10	1	0	2	2.0	6	5.5
				1	2		5	
				2	2		6	
				3	2		5	
E0102 3728	9.3	10	2, 5	0	2	1.5	5.5	4.875
				1	1.5		4	
				2	1.5		5	
				3	1.5		5	
E0102 3727	9.9	10	3, 4, 6, 7	0	3.25	3.1	6.5	6.125
				1	2.75		6	
				2	3.25		6.5	
				3	3		5.5	
E0102 3726	9.1	10	8	0	3	3.0	7	6
				1	3		5	
				2	3		7	
				3	3		5	
E0102 3743	5.9	10	9	0	2	2.0	5	4.75
				1	2		4	
				2	2		5	
				3	2		5	
E0102 3745	4.2	10	10	0	2	2.0	5	4.75
				1	2		4	
				2	2		5	
				3	2		5	

Table 9 – Results for Higher Education Institutions

	DfT PT/Walking		AUNT SUE Walking Summary					
LSOA Code	**30 minutes**	**60 minutes**	**Location**	**Restrictions (0= none, 1 = wheel, 2 = Visual, 3 = dkerb)**	**30 minutes**	**30 minutes Average**	**60 minutes**	**60 minutes Average**
E01023676	10.0	10	1	0	1	1.0	1	1.0
				1	1		1	
				2	1		1	
				3	1		1	
E01023728	10.0	10	2, 5	0	1	1.0	1	1.0
				1	1		1	
				2	1		1	
				3	1		1	
E01023727	10.0	10	3, 4, 6, 7	0	1	1.0	1	1.0
				1	1		1	
				2	1		1	
				3	1		1	
E01023726	10.0	10	8	0	1	1.0	1	1.0
				1	1		1	
				2	1		1	
				3	1		1	
E01023743	10.0	10	9	0	1	1.0	1	1.0
				1	1		1	
				2	1		1	
				3	1		1	
E01023745	10.0	10	10	0	1	1.0	1	1.0
				1	1		1	
				2	1		1	
				3	1		1	

Table 10 – Results for Hospitals

	DfT PT/Walking		AUNT SUE Walking Summary					
LSOA Code	30 min	60 min	Location	Restrictions (0= none, 1 = wheel, 2 = Visual, 3 = dkerb)	30 min	30 minutes Average	60 minutes	60 minutes Average
E01023676	2.8	5	1	0	2.0	2.0	2	2.0
				1	2.0		2	
				2	2.0		2	
				3	2.0		2	
E01023728	2.9	5	2, 5	0	2.0	2.0	2	2.0
				1	2.0		2	
				2	2.0		2	
				3	2.0		2	
E01023727	3.0	5	3, 4, 6, 7	0	1.3	1.1	2	2.0
				1	0.8		2	
				2	1.3		2	
				3	1.3		2	
E01023726	2.3	5	8	0	2.0	2.0	2	2.0
				1	2.0		2	
				2	2.0		2	
				3	2.0		2	
E01023743	2.2	5	9	0	2.0	2.0	2	2.0
				1	2.0		2	
				2	2.0		2	
				3	2.0		2	
E01023745	2.0	5	10	0	2.0	2.0	2	2.0
				1	2.0		2	
				2	2.0		2	
				3	2.0		2	