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From footway design to the street environment: removing the barriers to walking.

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Abstract

Barriers to mobility do not just include aspects of the physical environment such as the width of footways, and provision and gradient of dropped kerbs. Many other features (or lack thereof) of the urban environment play a role in preventing people from walking as much as they wish, and therefore reaching as many opportunities as they would like. These include the provision of places to stop and rest, provision of public toilets, and levels of street lighting, amongst others.

These issues are being explored in a research project being carried out being carried at University College London in which a GIS-based tool AMELIA (A Methodology for Enhancing Life by Increasing Accessibility) is being developed to examine how transport policies can increase social inclusion by allowing more people to reach opportunities including shops, employment, leisure facilities, and medical and welfare centres, taking into account various mobility guidelines. The city of St Albans in Hertfordshire is being used as a case study for the walking analysis.

Previously at Walk21 (Mackett et al, 2008a) we have examined the cost-effectiveness of three policy actions in the city centre of St Albans: providing dropped kerbs, reducing the gradient on dropped kerbs, and providing wider pavements. The effects were considered for the population of St Albans aged 65 and over. However, this analysis was limited as data on the Elderly population of St Albans was only available aggregated to Census output areas (approximately 100 households in each area) and there was a lack of information about the capabilities of the population.

In this paper, we describe improvements that have been made to AMELIA to overcome these limitations. Using micro-simulation techniques, combining aggregate Census of Population data for St Albans, a national sample of population data at the household level, locations of residential buildings and data from the OPCS survey of disability in Great Britain, it has been possible to disaggregate the population of St Albans to the

level of individual dwellings. Disaggregating the population data increases the sensitivity of AMELIA to micro-level policy actions such as improving pedestrian crossings, or increasing the number of benches provided. Combining the population data with information about disabilities allows a more realistic assessment of the number of people who will benefit from a particular policy action than has previously been possible.

AMELIA is then used to illustrate the effect of improving various features of the street environment, such as provision of benches, public toilets and street lighting, on the number of people who can walk to and around the city centre of St Albans, taking into account footway obstructions.

Brief biographies of the authors

Helena Titheridge is a Lecturer in the Centre for Transport Studies at University College London. She has over ten years of research experience in the areas of land use, transport and GIS research and has been involved in a number of projects related to measuring and modelling accessibility as experienced by different socially disadvantaged groups.

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Introduction

An important aspect of making city centres more attractive to pedestrians and of encouraging people to walk more is ensuring that city centres are accessible to everybody and that they are a pleasant and secure environment to walk around and that a range of amenities are provided which give people the confidence to get out and about. There are many barriers to movement for different individuals (Smith et al, 2006) which transport and other policies can be adopted to help overcome. The difficulties faced by some of the people who find it difficult to get about, particularly for the walking element of any journey, are very micro, for example, obstacles on the pavement which can hinder access in a wheelchair. Hence, micro level details may cause difficulties in the implementation of policies which have been designed at the macro or strategic level (Mackett et al 2007). However, barriers to mobility do not just include aspects of the physical environment such as the width of footways, and provision and gradient of dropped kerbs. Many other features (or lack thereof) of the urban environment play a role in preventing people from walking as much as they wish, and therefore reaching as many opportunities as they would like. These include the provision of places to stop and rest, provision of public toilets, and levels of street lighting, amongst others.

In the UK in recent years there has been a steady decline in the number of public toilets provided by the local authorities. Over 50% of public toilets in the UK have closed since 1995, creating some local authority areas that are "toilet deserts" (Greed, 2003). Estimates of levels of incontinence suggest that 1 in 10 men and 1 in 4 women suffer from some form of incontinence during their lives (Greed, 2003). However, access to public toilets is not just an issue that concerns those with incontinence; it affects anyone who is moving through the streets beyond a distance where it is convenient to go home, to their hotel or back to their workplace should they be "caught short". Anyone wishing to spend a few hours out of their home or office may well to need to make use of public toilets.

Greed (2003) suggests that public toilets should be provided at all main railway stations, bus stations and heavily used bus stops, at large car parks, in central areas and local shopping centres, amongst others - basically at all locations where significant numbers of pedestrians are walking past, standing or waiting (for buses, for shops to open). Some of the gap in public toilet provision could be (and is being) met by private facilities in shopping malls, department stores and fast food outlets. However, many such establishments make it clear that the facilities are for the use of customers only. Even where this is not the case, some people may feel uncomfortable using private facilities when they are not a customer. A scheme in Borehamwood, Hertfordshire encourages retail and food and drink outlets to allow access to their toilets to customers and non-customers alike. Participating establishments display a sign on their door to show that their toilet facilities are available for public use.

Better street lighting is another feature of the built environment which could provide people with greater confidence to walk more. According to the British Crime Survey (1994), a third of people feel unsafe if out alone after dark. DETR (2001) found that this feeling of being unsafe and vulnerable after dark increases progressively with age. Jones et al (2006) found that people were willing to walk between 3 and 5 times further to get to a bus stop or train station to avoid using poorly lit streets. However, there is mixed evidence on the links between street lighting and crime. Farrington and Welsh (2002) found, through meta-analysis of before and after studies, that improving street lighting reduced overall crime by, on average 20%, although there was no difference between night-time and day-time crime reduction levels. This lead the authors to conclude that the reduction in crime associated with improved street lighting is more likely to be due to improved lighting indicating an increasing community pride than due to improving visibility and surveillance levels. It should be noted that improved visibility and surveillance levels, whilst not reducing crime directly, may reduce people's fear of crime. Work by Fujiyama et al (2005) suggests that in order to feel comfortable after dark, pedestrians need to be able to recognise facial features of other pedestrians at a distance of 8m. This is not possible under current British Standards for street lighting for residential roads and pedestrian areas. The British Standards are thought to be based on achieving facial recognition at 4m (Fujiyama et al 2005).

Research being carried out in the Centre for Transport Studies at University College London as part of the work programme of the AUNT-SUE consortium (Accessibility and User Needs in Transport in a Sustainable Urban Environment) (see http://www.aunt-sue.info/) is exploring these issues. In part of the programme, a software tool, AMELIA (A Methodology for Enhancing Life by Increasing Accessibility) is being developed to test the extent to which transport policies can increase social inclusion. Previous papers (Mackett et al, 2007; 2008a) have discussed how AMELIA can be used to analyse how streets can be made more accessible to those with limited mobility. This paper attempts to assess the effect of improving two features of the street environment, i.e. the provision of public toilets and street lighting.

AMELIA

The software tool AMELIA (A Methodology for Enhancing Life by Increasing Accessibility) is, in effect, a user-friendly interface to a GIS (Geographical Information System) for use by local transport planners to test whether their policies increase social inclusion (Mackett et al, 2007, 2008a). The overall objective of AUNT SUE is to develop and test sustainable policies and practice that will deliver effective socially inclusive design and operation in transport and the associated public realm from macro down to micro level (see http://www.aunt-sue.info/).

Implementing policy objectives to increase accessibility involves defining policy actions to overcome barriers to movement. The purpose of AMELIA is to present the user with a set of possible policy actions given the characteristics of the population and the local environment, and then to quantify and map the effects of the policy actions to help the user make a judgement as to the most effective. Sometimes a specific mode of travel such as walking may be specified. Alternatively, the policy objective might be formulated in terms of overcoming a barrier to movement. AMELIA requires data on the population in the group being considered (the elderly, those in wheelchairs and so on), the nature of the facilities that they wish to reach (shops, jobs, health facilities and so on) and how they can travel there. AMELIA can then be used to see how many more of this group can reach the opportunities as a result of a variety of policy actions. In order to assess whether a policy action is effective it is necessary to use benchmarks representing a 'reasonable' level of access (Titheridge and Solomon, 2007). AMELIA is used to see how many members of the group meet the benchmark with and without the intervention represented by the policy action. The key elements of AMELIA are shown in Figure 1.

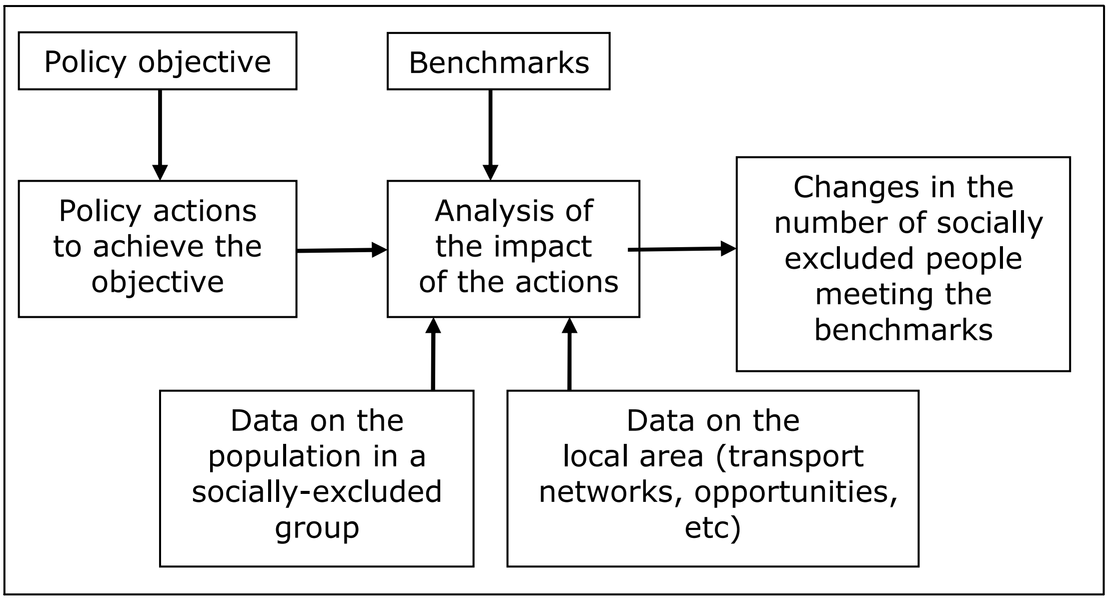

Figure 1 The components of AMELIA

Figure 2 shows how AMELIA is used. Having set the general policy objective of increasing accessibility, it can be focussed on particular groups in society or modes of travel by selecting the relevant characteristics. These will be used by AMELIA to identify some suitable policy actions. Some of these can take different values, such as the angle on dropped kerbs, so suitable values need to be selected. Guidance is provided on this, drawing on various sources such as the Inclusive Mobility Guidelines (Department for Transport, 2005). Cost data are also provided for some policy actions, since this may influence the scale of implementation. The data for testing the policy action then have to be set up by making appropriate changes to the GIS representing the study area. Advice is provided on how to do this through a 'help' system. A suitable benchmark has to be selected, on the basis of judgement, for example, about a 'reasonable' level of expenditure of time or money. AMELIA is then run and results examined, possibly in the light of the cost of implementing the policy action. Then AMELIA can be run again using different values for the policy action or another policy action. The user can repeat this process until satisfied that a policy action has been identified which is effective in meeting the accessibility needs of the group being considered.

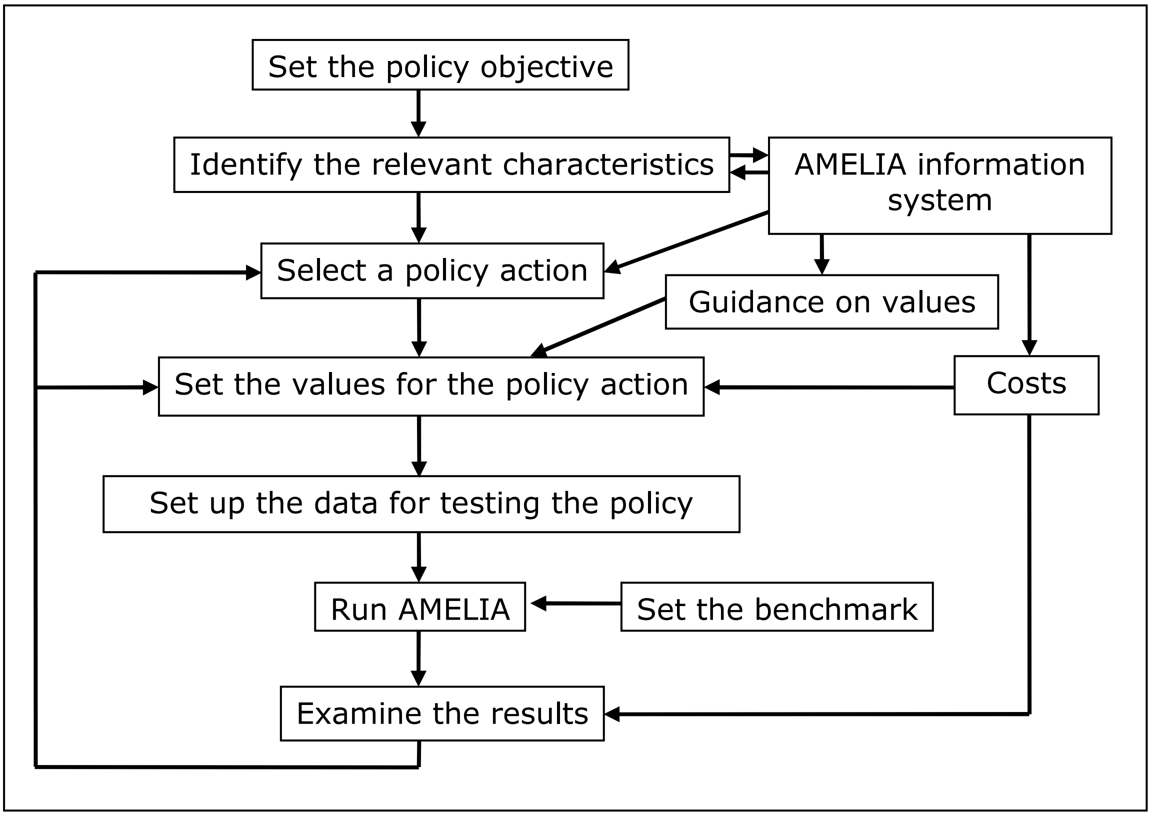

Figure 2 The procedure for using AMELIA

In order to aid the development process, AMELIA has been set up for the county of Hertfordshire, which is the county immediately north of London. Micro-level data based upon street audits, including details such as steps, slopes, access to individual buildings and obstructions on the pavement are being incorporated into the database. These more detailed data are only for the city of St Albans since it is not feasible to collect such data for the whole of Hertfordshire (Mackett et al, 2008b). (Alternative sources of such data are being investigated). Macro-level data based upon the local authority's information systems and other sources such as the 2001 Census of Population have been assembled for the whole county.

The most comprehensive and reliable source of information about population in the United Kingdom is that derived from the 2001 Census of Population. However, there are several limitations when using this data for modelling accessibility. Firstly, the data is now 8 years out of date. Secondly, the data is only available in aggregated form – the smallest unit for which data is available is the Census Output Area (OA) which covers around 100 households. In low density regions an OA can cover a considerable area, making it unsuitable for modelling the walk element of a journey. Finally, the census only contains extremely limited amount of information on health and disability.

To overcome these problems it is necessary to disaggregate the population data to individual buildings, to incorporate data on disability, and to update the census of population 2001 data using 2008 estimates of population. This has been achieved using micro-simulation techniques. For each Census Output Area (OA) the numbers of households of different family composition (based on Census 2001 classifications) are projected to household numbers in 2008 using housing statistics provided by the UK Government (DCLG, 2008). It was not possible to obtain a perfect match between the projected number of households based on Government estimates and the number of dwelling locations. The mismatch between these two data sets is due to differences in treatment of vacant dwellings, multiple occupancy dwellings, and data collection techniques. The 2008 household projections were treated as correct. Within each OA, each household of particular family composition was then randomly populated with data from a household with matching family composition taken from the Census of Population 2001 Sample of Anonymised Records (SAR). For each OA, the SAR data on households and their members was then assigned randomly to a dwelling listed in the OS Address Point dataset until either all households had been allocated. Where the number of households in a particular OA was less than the number of dwellings, remaining dwellings were left as vacant. Where the projected number of households was greater than the number of dwellings, remaining households were randomly assigned to "occupied" dwellings to create multiple occupancy dwellings.

The derived disaggregated population data was then matched with data from the OPCS Survey of Disabled Adults in Private Households in Great Britain (OPCS 1985) based on the age of individuals, to simulate the capabilities of individuals within the population in terms of steps, walk distances, and continence.

Modelling the impact of environmental improvements

This section describes the results of an attempt to use AMELIA to assess the potential of removing the barriers to mobility of poor street lighting and lack of public toilets to increasing the level of access to shops and other services.

For each of the policy actions discussed below the benchmark used to for comparison was the percent of shops (or pubs and restaurants in the case of street lighting) within the city centre that could be accessed. For simplicity, we report the number of people aged 65 and over who can comfortably reach 0-24%, 25-49%, 50-74% and 75-100% of the city centre facilities.

The population being considered in this paper is the 23,617 residents of St Albans who are aged 65 years or over living in private residences. Table 1 shows the numbers of people aged 65 or over living in St Albans assumed to be capable of walking various distances. The analysis assumed that those who could not walk at all would use wheelchairs which would enable them to travel 402m but require footways with sufficient width and dropped kerbs at crossings. In order to be inclusive the most pessimistic assumptions were made: for example, where the Survey of Disabled Adults (OPCS 1985) showed people could walk between 46 and 183m it was assumed that 46m was the maximum distance they could walk. It was assumed that none of the toilets provided at eating and drinking establishments would be wheelchair accessible.

Table 1 The population of St Albans aged 65 and over living in private residences with different walking capabilities

Walking capabilities	Population 65 and over
Cannot walk at all	3070
Can walk 46-183 metres	1417
Can walk 183-402 metres	945
Can walk 402 metres or more	18185

It was necessary to estimate how these people would have been likely to travel to the city centre. It was assumed that all those who, according to our micro-simulation (described above), lived within 402m of the centre of St Albans would have walked there (or travelled there by wheelchair). The rest were assumed to travel by bus or car (Table 2). They were split between the two modes based on the relative usage of the two modes by people aged 65+ according the Great Britain National Travel Survey (Department of the Environment, Transport and the Regions, 2003a,b). Those assumed to be coming by bus were allocated to the most appropriate bus stop within 400m of the city centre according to where they live. Those assumed to be coming by car were allocated to car parks within 400m of the city centre in proportion to the size of the car park.

Table 2 The population of St Albans aged 65 and over living in private residences by city centre access mode

Access mode	Population 65 and over
Walk	422
Bus	8551
Car	14644

Public Toilets

AMELIA was used to assess the effect of increasing public toilet provision within St Albans city centre, based on a scheme similar to the one in Borehamwood (described above). Three options were considered: 1) do nothing – toilet provision is limited to existing public toilets only; 2) encourage larger stores such as department stores to make their toilets accessible for customers and non-customers alike; 3) extend the scheme to include not only larger stores but also all establishments that provide refreshment (food and drink). Figure 3 show the location of toilets, large stores and eating establishments assumed to be included in the scheme.

It was assumed that 7.5% of people aged 65 and over would be deterred from moving around the city centre if that meant they would be more than a 5 minute walk away from a public toilet. (No guidance or legislation was found on distances to public conveniences in the public realm). The numbers of elderly people for whom lack of public toilets was assumed to be a barrier was based on numbers of older people who suffer from continence problems (OPCS 1985). It should be noted that OPCS only considers those who have suffered an accident at least once during the few months prior to being surveyed as have continence problems.

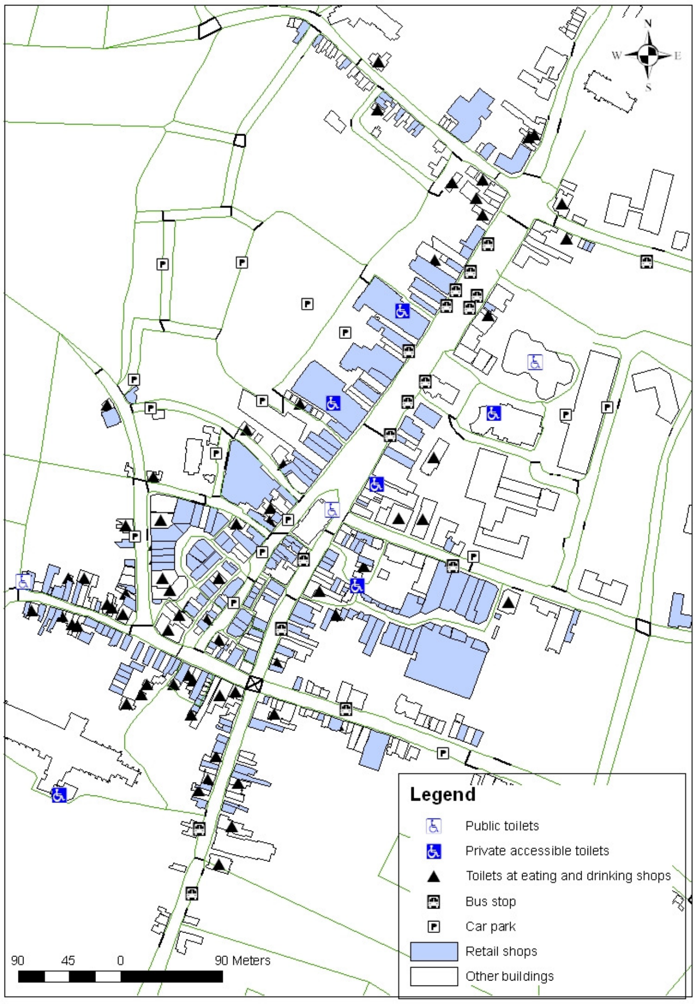

Figure 3: Location of public toilets and private accessible toilets in St Albans city centre

Lighting

Two options for street lighting in St Albans city centre were considered: 1) do nothing – street lighting is maintained at current British Standards, and 2) street lighting is improved along key routes from bus stops, car parks and residential areas (see Figure 4)

Figure 4: Streets considered to be well lit under different policy actions

It was assumed that half of adults aged 65 and over would be deterred from moving around the city centre if that meant using poorly lit streets. It was assumed that streets were lit to meet British Standards and thus all residential streets, pedestrian only streets and subsidiary streets would be considered poorly lit based on the standard of facial recognition at a distance of 8m as suggested by Fujiyama et al (2005).

Results

Of those older people estimated to be severely affected by toilet provision, under current provision the majority can access less than 25% of the city centre shops whilst remaining within a comfortable distance of a public toilet (Table 3). None of those with continence issues would be able to access all city centre shops whilst remaining within a 5 minute walk of a public toilet. Increasing the number of toilets that are clearly identified as being available for the general public to use by including those within the larger stores, halves the numbers of people for whom less than 25% of the shops within St Albans city centre are available. Extending the scheme to include the majority of eating and drinking establishments within the city centre, halves this number again. The most dramatic improvements were for those arriving by car.

Table 3: Number of older people with continence issues who can reach different percentages of shops within St Albans city centre with differing levels of toilet provision

Policy Action	0-24%	25-49%	50-74%	75-100%
Do Nothing (existing public toilets)	1517	71	181	0
Existing + big stores toilets	666	780	185	138
Existing + big stores + food outlets	337	322	785	325

It should be noted that the policy actions relating to public toilet provision considered here may not be effective for everyone. Many ethnic groups and religious people would not enter a premises serving alcohol, non-halal/kosher food. Some premises may not be suitable for children to enter. Often such facilities are unsuitable for those with mobility impairments and other disabilities. Finally the availability of toilets within these types of establishments is limited to the opening hours of the establishment.

Existing levels of street lighting in St Albans city centre places a considerable restriction on the numbers of pubs and restaurants that can be accessed by older people who feel unsafe after dark, particularly on streets with low lighting levels; seventy percent of whom can access less than 25% of pubs and restaurants in the area (Table 4). Those travelling into the city centre by car have particularly difficulties as many of the routes from the car parks to the main thoroughfares have low levels of lighting under British Standards. By providing better lighting along key routes, including routes from the major car parks onto the high street, the numbers with very low levels of access (able to reach less than 25% of the pubs and restaurants) around the city centre decreases by 75%. The numbers of older people who feel unsafe after dark and can reach over 75% of the pubs and restaurants increases from 0 to 924 when better lighting is provided.

Table 4: Number of older people who feel unsafe walking after dark who can reach different percentages of pubs and restaurants within St Albans city centre at night

Policy Action	0-24%	25-49%	50-74%	75-100%
Do Nothing (existing street lighting)	8287	1993	1530	0
Provide better lighting along key routes	2293	6907	1741	924

Conclusions

AMELIA has been used to assess the affect of improved levels of public toilet provision and street lighting on levels of accessibility amongst older people in St Albans city centre. It was found that, even with the conservative number of people assumed to be affected by lack of these amenities, increasing the levels of both these amenities had a considerable impact on accessibility. Low levels of public toilets and street lighting do not just affect older people, so benefits would also be seen in other sectors of society.

It is recognised that many assumptions were made during the process of using AMELIA to assess these policy actions. Aspects such as opening times, availability of an attendant, provision of changing facilities, etc., need to be taken into account when considering the benefits of increasing toilet provision through shops and eating establishments. Simply improving street lighting may not be sufficient to give many people the confidence to go out after dark. Anti-social behaviour, increased levels of policing, etc., may also be needed.

Acknowledgements

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