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## **A methodology for the incorporation of social inclusion into transport policy**

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### **Abstract**

Social exclusion is an area of increasing concern. The UK Government requires local authorities to take it into account when formulating and implementing transport policies. However, there is no well-defined methodology to enable them to do so. This paper is concerned with the development of a tool to assist in this process. This research is part of a larger research programme entitled 'Accessibility and User Needs in Transport in Sustainable Urban Environments (AUNT-SUE)' in which benchmarks to help define social exclusion will be defined, and transport designs and operations to help reduce social exclusion will be developed. These will feed into the design of the tool. The tool will consist of an accessibility model overlain by GIS to facilitate effective input and output. Its development will be carried out with the active co-operation of a local authority. When the tool has been developed it will be used to address a variety of policy issues and to examine the impacts of various possible transport designs and operations on social exclusion, by examining the changes in the number of people above the benchmark. There are a number of interesting research questions which are discussed in the paper.

Keywords: social exclusion; GIS; transport; sustainability; accessibility

Topic area: SIG-10 Urban Transport Policy Instruments

### **1 Introduction**

There is increasing concern about the exclusion from society of increasing numbers of people. Exclusion may arise from multiple factors including poverty, disability, inability to communicate, and poor accessibility. In order to move towards a fairer and more just society, action needs to be taken at all levels of government.

This paper focuses on aspects of social inclusion that relate to levels of accessibility. Improvements to the transport system can come about through combinations of better policy, design and operations. In particular, the paper will consider the influence of transport policies on social inclusion. The UK Government

requires local authorities to consider their transport policies in terms of social inclusion (Department of the Environment, Transport and the Regions, 2000b). However, there is no well-defined methodology for doing so. This paper will consider the issues that need to be addressed in incorporating social inclusion into transport policy, and the development of a methodology that will enable planners to do so.

In the next section the nature of social exclusion is discussed. Then the actions being taken by the UK Government to analyse the issues, and the actions they require local authorities to take, are considered. The need for a systematic methodology is then examined, followed by the approaches being used by local government. After this, the context of the research leading to this paper is described, then the design of a new methodology, and some research issues that need to be addressed.

## **2 Social exclusion**

According to TRaC (2000) the term ‘social exclusion’ was originally coined in 1974, and first used by the European Commission in 1989 when the Council of Ministers requested the European Commission to study policies to combat social exclusion. Research into poverty has been conducted for many years, for example, analysis of the adverse effects of the industrial revolution was conducted during the nineteenth century. Whilst there is considerable overlap between the concepts of poverty and social exclusion they are not synonymous. For example, a person in a wheelchair may be excluded from all sorts of activities and so feel excluded from society irrespective of their wealth (but it should be recognised that money can help to overcome many barriers). Oppenheim (1998) suggests that social exclusion is multi-causal and includes intangibles such as the lack of status, power, self-esteem and expectations.

According to the website of the UK Government’s Social Exclusion Unit (<http://www.socialexclusionunit.gov.uk/>) social exclusion can occur when people or areas suffer from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime environments, bad health and family breakdown. Some of these issues relate to the ability of people to access various services, such as jobs and shops. Others, such as family breakdown, do not have very much to do with accessibility (although there may be cases where family breakdown stems from problems related to poverty, which in turn could be addressed through higher incomes which would require access to employment). Essentially, this paper will focus on the aspects of social inclusion which are related to accessibility to opportunities.

## **3 Action to address the issue of social exclusion in Britain**

Social exclusion policy formulation and research for England is primarily undertaken by the Social Exclusion Unit (SEU). The UK Prime Minister established the Social Exclusion Unit in 1997 to undertake cross-departmental work related to social exclusion. Social exclusion issues which fall entirely within the remit of a single department are dealt with by the department concerned, for example, transport issues by the Department for Transport (DfT), and health issues by the Department of Health (DH). Since May 2002 the Social Exclusion Unit has been located within the Office of the Deputy Prime Minister, along with departments such as the

Neighbourhood Renewal Unit and the Homelessness Directorate. Social exclusion in Scotland, Wales and Northern Ireland is dealt with by the devolved administrations.

One of the major projects undertaken by SEU looked at the connections between transport and social exclusion. The findings of this work were published in the SEU (2003) report 'Making the Connections: Transport and Social Exclusion'. The report suggests that transport contributes to social inclusion by providing access to work, education, healthcare, food shops, social, cultural and sporting activities. It also highlights the impact of traffic on deprived communities, particularly on the numbers of road traffic accidents and child pedestrian casualties.

The SEU (2003) report concentrates on the accessibility to services and activities. In the report a service or activity is regarded as being accessible if it can be accessed "at reasonable cost, in reasonable time and with reasonable ease" (p2). They suggest that accessibility depends on whether transport exists between the people and the activities in which they wish to partake; on perceptions of reliability and safety of the transport; whether people are physically and financially able to use the transport available and the distance that they are required to travel to reach services and activities, which is a product of both a person's time horizons and the location of services.

Whilst the SEU (2003) report is not explicitly about the role of public transport in reducing social exclusion, problems using public transport and solutions relating to public transport, and in particular buses, both conventional fixed route and demand responsive, dominate it. Overall, the report emphasises difficult journeys as a result of the isolated or remote nature of communities, high transport costs, dispersed activities, and infrequent and unreliable bus services. Walk trips are mentioned in relation to crime around transport hubs and child pedestrian casualties.

The UK Government strategy for tackling social exclusion issues related to transport is also outlined in SEU (2003). The strategy has two main thrusts: the new framework for accessibility planning and a mixture of national policy changes aimed at improving accessibility and reducing the impacts of traffic on poorer neighbourhoods. These policies include:

- Improve mainstream public transport;
- Accessibility will be given greater weight in land-use planning decisions;
- Tackle the concentrations of road casualties in disadvantaged neighbourhoods;
- Encourage those developing local crime reduction strategies to tackle crime and fear of crime around transport routes and hubs;
- Increase the help offered to jobless people to enable them to get to work opportunities;
- To assess the accessibility of all further education institutions;
- Changes will be made to specialist travel to healthcare services so that it is organized around the patient; and
- The new Directors of Public Health within each Primary Care Trust will be asked to play a leading role in improving access to food and nutrition.

(SEU, 2003 p5/6).

Social exclusion is also being tackled by individual government departments. The UK Department for Transport (DfT) under a previous incarnation as the Department of the Environment, Transport and the Regions (DETR), published the results of a study by TRaC of the University of North London on the effect of the provision and availability of public transport on social exclusion. TRaC (2000) found 'clear connections' between transport and social exclusion, particularly among certain groups. These included unemployed people, families with young children, young people, older people and those on low incomes. Key issues were the affordability of public transport provision, and the availability of public transport and its accessibility.

The study made a number of recommendations. These included, along with measures such as better integration and co-ordination of the different types of transport provision, a review of concessionary fares eligibility and faster adoption of accessible buses, recommendations that local authorities make comprehensive assessments of the transport needs of socially-excluded people, and conduct 'needs and supply audits' of transport provision and demand; and that non-transport policies should be audited for their transport implications. The study went on to highlight a number of areas which needed further research. These included defining the levels of transport provision, mobility and access that are deemed to be adequate, and establishing benchmarks against which transport provision could be evaluated.

#### **4 Requirements of the UK Government on local authorities**

Local Authorities in Britain are required to produce a Local Transport Plan (LTP) every five years. Local Transport Plans are partly a bidding document for Central Government funds for transport investment and partly a strategic planning document. Local Transport Plan objectives are required to be consistent with the UK Government's Integrated Transport Policy and the transport objectives underlying the New Approach to Appraisal (NATA) (Department of the Environment, Transport and the Regions, 2000b). The most relevant of these objectives for tackling social exclusion is to promote accessibility to everyday facilities for all, especially for those without a car.

Issues covered by local transport plans includes: 'widening travel choices' (this section includes policies related to the quality of provision for the car, bus, community and voluntary transport, rail, cycling, walking, mopeds and motorcycles); traffic management and demand restraint; integrated transport; planning and managing the highway network; rural transport; sustainable distribution; and integration with wider policies - including the promotion of social inclusion and action on climate change, local air quality management and noise (Department of the Environment, Transport and the Regions, 2000b). Of these sections, widening travel choices and integration with wider policies are the most obvious areas that are relevant to urban transport related social exclusion.

National government guidance on the production of Local Transport Plans is available (Department of the Environment, Transport and the Regions, 2000b) covering all these issues. Additional government guidance is provided about women's transport needs, the transport needs of older people, people from different religious and ethnic minority communities and people living in areas of social exclusion.

A new framework of accessibility planning will be built into the next round of Local Transport Plans (SEU, 2003). This will be led by the local transport authorities, enabling them (and other agencies) to assess systematically whether people can get to key activities, and to work more effectively together on solving accessibility problems. The process for achieving this will involve local transport authorities carrying out an audit identifying disadvantaged groups and areas with poor access to key services. A resources audit assessing the level of potential or existing resources that are available for tackling accessibility problems, will also be produced. From these two audits, the local authorities will be able to develop action plans to tackle these problems.

The accessibility audit would assess whether people can get to centres of employment, healthcare, educational facilities and shops. Other key destinations such as sports facilities and pharmacies may also be included. Consideration would be given to journey times, cost, safety and reliability and would consider all modes. Journeys across the local authority boundary will also be taken into account. The assessment would focus primarily on disadvantaged groups and deprived areas. GIS-based mapping of data on socio-demographics, deprivation and car availability in relation to transport routes and facility locations will form an essential part of the assessment. Consultation with local communities will be another essential element of the accessibility audit.

From the SEU (2003) report and the accessibility planning web-site ([www.accessibilityplanning.gov.uk](http://www.accessibilityplanning.gov.uk)) which has been set up by the DfT, it does not seem as though accessibility modelling will be a requirement. However, an example of modelling and mapping of accessibility using GIS by Surrey County Council is highlighted as good practice in the SEU report and in 2003 the DfT commissioned MVA Consultants to develop an accessibility planning software tool which includes accessibility algorithms. This suggests, that accessibility modelling, though not essential will be highly recommended and widely used.

## **5 Social exclusion in the appraisal process**

Appraisal of the impacts of transport policy on social inclusion at a national level is currently carried out on an ad hoc basis. There is a wide array of different appraisal frameworks in use (see <http://www.policyhub.gov.uk/>), none of which relate specifically to social inclusion, but many of which could cover impacts on social inclusion including: rural proofing (Countryside Agency, 2002), regulatory impact assessment (Cabinet Office, 2003), sustainable development, risk (HM Treasury, 2003), public health and safety, consumer impact assessment and policy appraisal for equal treatment. Policy appraisal for equal treatment (Strategy Unit, 2002) is perhaps the assessment method most obviously relevant to social exclusion/inclusion. The guidance refers to several documents under this heading: Gender Impact Assessment (Cabinet Office, Women and Equality Unit, undated), Better Government for Older People Programme ([www.bettergovernmentforolderpeople.gov.uk](http://www.bettergovernmentforolderpeople.gov.uk)); Core Principles of the involvement of children and Young People (Department for Education and Skills, 2001); and the Race Relations Amendment Act 2000.

The 'New Approach to Appraisal' (NATA), which was adapted and improved for the appraisal of the multi-modal studies (Department of the Environment,

Transport and the Regions, 2000a), uses a combined cost-benefit analysis (CBA) and environmental impact assessment (EIA) approach (Department of the Environment, Transport and the Regions, 1998). NATA is used in the appraisal of major transport infrastructure projects. Impacts are entered into an appraisal summary table (AST). The AST provides a framework for assessing the impact of a proposal on various objectives including social inclusion. More detailed analysis is undertaken to show the equity and distributional effects of the proposal through an accessibility appraisal. The accessibility appraisal is a 'qualitative assessment' based on the numbers of pedestrians and public transport users affected by the scheme and on changes in the duration and quality of their journeys. The effect of the scheme on community severance is also assessed.

At a local level, appraisal of local travel plans follows the NATA framework, which includes accessibility objectives (Department of the Environment, Transport and the Regions, 2000b). Interviews with officers from Hertfordshire County Council suggest that a lack of detailed information on who is socially excluded and where socially-excluded people reside, and an absence of clear methodologies for appraisal of LTPs in this context, have prevented social exclusion from being tackled effectively. This perception was borne out by the analysis of Hertfordshire County Council's LTP, which showed that the social inclusion strategy within the LTP did not address all aspects of transport provision or all (potentially) socially-excluded people (Titheridge and Mackett, 2003).

## **6 What local authorities are doing**

Accessibility measurement in the UK has been dominated in recent years by developments in the field of town planning. This has been driven by Government policy for an integrated approach to transport and land-use planning. In particular, Planning Policy Guidance Note 13 (Department of the Environment, Transport and the Regions, 2001) encourages local development plans that promote locations that are accessible by public transport, walking and cycling. The guidance also advocates "the use of public transport accessibility criteria for regionally or sub-regionally significant levels or types of development".

Accessibility measurement and appraisal of transport policies are less widespread than in the field of town planning. Evidence of accessibility measures being used by transport authorities and executives other than simply to identify gaps in the public transport network is limited. A survey of Scottish organisations found that the current practice of policy appraisal for integrated transport relies mainly on qualitative techniques. However, 80% of the local authorities interviewed either made use of, or were in the early stages of, developing contour-type measures (DHC, 2000). In comparison, a survey of local planning authorities in Wales (National Assembly for Wales, 2001) found that twelve out of the nineteen planning authorities surveyed used quantitative methods to assess the accessibility of different locations. Nine of the twelve used isochrones around locations, four measured access to the public transport network and four measured either the quality or quantity of opportunities available within a given travel time or distance. Three-quarters of the local authorities only measured accessibility by public transport; very few considered all modes (for example, walk, cycle, car, PT and freight).

A number of local authorities, mainly within the London region, use the Public Transport Accessibility Level (PTAL) index to measure access to the public transport network (local accessibility). The PTAL index is a function of the walk time to a bus stop or train station and the average wait time at that stop. The closest bus stop and rail station are given a greater weighting than less accessible stops. Stops over a specified distance from the residential or other location are excluded. Several authorities are now including the PTAL measure into their development control policy (Hillman and Pool, 1997). The London Borough of Hammersmith and Fulham, for example, uses the PTAL index to determine the maximum plot ratio (the ratio of the volume of development to the area of the site) to which a particular site can be developed. Standards for car parking provision are also varied according to the PTAL index and plot ratio (London Borough of Hammersmith and Fulham Council, 2003).

Buckinghamshire County Council and Wycombe District Council have linked parking standards and public transport accessibility to developer contributions. Public transport accessibility is banded into five zones of accessibility based on the number of people who can reach particular destinations within 35 minutes travel time, on peak hour timetables and frequencies, and taking into account walk times, wait times, in-vehicle times and interchange times (Wycombe District Council, 2002).

An increasing number of local authorities use the ACCMAP software to both calculate local accessibility using the PTAL system and network accessibility, measured by ACCMAP as total travel time along the network between an origin and destination, including walk time from the origin to the public transport stop, time spent waiting at the stop, on-board travel time, waiting at interchanges and time spent walking to the destination. Users of the ACCMAP software include the London Borough of Croydon, Surrey County Council, Cardiff County Council, Greater Manchester Passenger Transport Executive (GMPTE) and Northern Ireland DOE (Hillman and Pool, 1997; Wixey et al, 2004). As well as using the software to assess the accessibility of a new sports arena, LB Croydon has also used ACCMAP to assess the effects of a new tram service on accessibility and to plan mobility bus routes (Hillman and Pool, 1997). Cardiff County Council has used both PTALs and network accessibility functions to compare the changes in accessibility of fourteen different locations over a year (between 1998-1999) (Wixey et al, 2004).

Another package that measures network accessibility used by several local authorities is TRANSAM. TRANSAM produces travel time contours for a variety of modes (walk, cycle, bus, rail, and car) based on the lowest generalised cost route (Robbins, 1999). The model has been applied to Llanelli to test the impact of a variety of network improvements; to make recommendations for improving multi-modal access to a number of key locations in Basingstoke; and to model the effect of proposed cycle land improvements on journey times in the Horley, Crawley and Gatwick Airport area.

A number of rural local authorities (including Shropshire, Telford and Wrekin, Cumbria, Lincolnshire and Somerset) make use of SONATA (Social Needs and Transport Accessibility) developed by Steer Davies Gleave in the late 1980s during a project for Somerset County Council (Helm, 1999). Somerset County Council wanted an objective appraisal of its supported bus network following deregulation, in order to identify gaps in the network that might need additional support, to monitor the impact

of service changes and to identify those services which were most valuable in meeting travel needs. SONATA uses a mix of social indicators and local surveys to assess travel needs. SONATA allocates total travel needs to specific journey purposes based on percentages derived from travel survey data. Different social groups have different needs in terms of types of journey purpose they need to make. Minimum access criteria are established for each journey purpose, for example, for the journey to work a Monday to Friday service with frequent departures before 9.00am is likely to be required. SONATA then determines for each location (or zone) whether the services go to appropriate destinations and whether those services meet the minimum criteria for time and frequency. This establishes for each social group whether their travel needs are met, unmet or partially met (services go to appropriate destinations, at appropriate times but are of insufficient frequency). Lincolnshire used the model to identify unmet transport needs across the county. However, they found that the model was too coarse to be used as a planning tool at the micro-level (Wixey et al, 2004).

City of Edinburgh Council (Halden, 2002) used accessibility analysis to measure the effect of road user charging on accessibility for both car and non-car users for different journey purposes and times of day. The model used 49 zones covering Edinburgh, the Lothians, and central Fife to produce a number of opportunity and value based measures. The results were used to assess the level of transport investment needed to maximise the benefits from the scheme to all sectors of society.

Transport for London has developed its own accessibility model, CAPITAL (Calculator for Public Transport Accessibility in London). As the name suggests it measures accessibility by public transport, taking into account walk access time, waiting time, in-vehicle time and interchange time. Walk access times are calculated along the road network (London Transport, 1999). This is an approach adopted by a number of accessibility models due to the lack of easily-available quality data on the footpath networks. The other most common approach used is to base walk times on Euclidean distance. This approach has been adopted in the Accessibility Mapping Package (AMP) developed for West Yorkshire Public Transport Executive (WYPTE). AMP calculates the accessibility to opportunities using the bus network. Accessibility is based on single-leg trips only, and other public transport modes, in particular rail, are excluded; there are plans to incorporate these features in the future (Wixey et al, 2004). Both Transport for London and WYPTE are currently investigating with the University of Westminster ways in which their models can be adapted and improved to better represent the travel and activity needs of specific socially disadvantaged groups.

To date there are very few examples of models being used within local authorities which measure network accessibility by a variety of modes (public and private, motorised and non-motorised), taking into account the differing circumstances and needs of individuals. There are even fewer examples of these models being used to assess the effects of transport policy.

## **7 The research context**

In 2001 the UK Engineering and Physical Sciences Research Council (EPSRC) set up a research programme entitled 'Towards a Sustainable Urban



Environment' (SUE) with the objectives of improving the quality of life of the UK's citizens, supporting the sustainable development of the UK economy and society, and helping to meet the needs of users of EPSRC-funded research in industry, commerce and the service sector. One of the five specific themes of the SUE programme was 'social exclusion'. (The others were: 'Towards a new physical infrastructure', 'The sustainable built environment', 'Waste, pollution and urban land use', and 'Urban transport and urban design'). The UK research community was invited to submit expressions of interest to receive funding to carry out work in these areas. The bids were considered and the bidders were invited to one of four initial scoping workshops on the themes of: 'Urban and built environment', 'Waste, water and land management', 'Transport' and 'Metrics, Knowledge Management and Decision Making'. Social exclusion was included within some of the workshops, particularly the one on transport. At the workshops research consortia were formed. At the Transport workshop four consortia were formed, one of which was entitled Accessibility and Use Needs in Transport in a Sustainable Urban Environment (AUNT-SUE). In this consortium social exclusion is a major theme. Part of this work forms the basis of this paper.

AUNT-SUE consists of researchers from London Metropolitan University, University College London, the University of Loughborough and the University of Westminster, plus representatives from Hertfordshire County Council, the London Borough of Camden and the Royal National Institute for the Blind. For budgetary reasons, EPSRC decided to fund consortia in the 'Urban and built environment' and 'Waste, water and land management' themes initially, providing funding for scoping studies for the other consortia, with a view to bids being received later. Each consortium is guaranteed funding for some 'core' research projects, providing that they are approved under a peer review procedure. Further projects are competing against projects from other consortia on the same theme. Bids from the transport consortia, including AUNT-SUE, were submitted in October 2003 with a view to work starting during 2004 for a period of up to five years.

The overall structure of the research programme of the AUNT-SUE consortium is shown in Figure 1. There are four main processes. The first one is 'The development of benchmarks' where mobility and accessibility benchmarks appropriate to different individuals, locations, and journey purposes will be developed, and compared with people's expectations. The second process is concerned with the establishment of the requirements of central and local government to incorporate social inclusion into the planning process and the development of a tool to help meet these requirements, using the benchmarks. This paper is concerned with this part of the research. The benchmarks and policies incorporating social exclusion will be used in the third process on 'The design of improved transport designs and operations', which will feed back design guidance and draft revisions to standards based on performance criteria. The improved transport designs, operations and policies will be evaluated against the benchmarks in the fourth process to see if they meet the policy objectives, initially in the two testbed areas. There will be feedback to the design and operations if they do not appear to achieve the policy objectives or meet the benchmarks, and to the policy process to provide advice to policy-makers.

## 8 Design of the new tool

The purpose of the new tool is to enable transport planners to see whether the policies they are implementing increase or decrease social inclusion. This means that it must be able to incorporate the following:

- Transport and related policies;
- The characteristics of the population, including the characteristics that may make them socially excluded;
- The benchmarks that specify social inclusion;
- Output measures that can be compared with the benchmarks;
- An explicit relationship between the population and the output measures in some form of model;
- A suitable method for integrating the concepts and presenting the outcomes.

The approach that will be used will be as follows. The heart of the methodology would be the accessibility model outlined below. Accessibility models are often used in the evaluation of land-use and transport strategies (Geurs and van Wee, 2004). In order to specify the model correctly in this study, for example in terms of ensuring that appropriate policies are incorporated and the outputs are in a form that is useful to practitioners and politicians, there will be some background analysis. Documents issued by Central Government will be examined to establish exactly what it requires from local authorities in terms of social inclusion in the local transport and related planning processes. Also, procedures such as the methods for appraising highway schemes will be examined, since these impinge on local communities, and influence social exclusion. For example, the Guidance on Multi-Modal Studies (Department of Transport, Environment and the Regions, 2000a) identifies three aspects to the accessibility objective (one of the Government's five key objectives for transport): option values, severance and access to the transport system. Social inclusion needs to be incorporated much more explicitly, and the findings from this project will help inform that process.

The local policy-making process will be examined in detail in the testbed area, which initially will be Hertfordshire, to establish where social inclusion is, or could be, taken account of in the process. This will involve talking to Hertfordshire County Council officers and politicians, examining documents and observing meetings.

A review will be carried out of the relevant policy analysis tools will be carried out to see what can be learnt for example in terms of interface design, spatial scale, and indicators. A data base will be set up using, as far as possible, data that the local authority already has.

It is proposed to use a GIS (Geographic Information System) underpinned by an accessibility model as the basis of the tool. The model will be an extended version of the accessibility model proposed by Hansen (1959):

$$A_i = \sum_j W_j / c_{ij}^\beta$$

where:

$A_i$  is the accessibility of people in zone  $i$

$W_j$  is a measure of the opportunities in zone  $j$

$c_{ij}$  is a measure of the ease of travel from  $i$  to  $j$

$\beta$  is a parameter

This will be extended as follows to include the population being considered ( $O_{ib}$ ), with appropriate disaggregation to represent social inclusion, using an exponential function rather than a power function:

$$A_{br} = \sum_i O_{ib} \sum_j [W_{jr} / \sum_{k \in \mu(b)} \exp(\beta_{br} C_{ijkb})]$$

where:

$A_{br}$  is the accessibility of people of type  $b$  to opportunity type  $r$

$O_{ibr}$  is the number of people of type  $b$  who live in area  $i$  who use opportunity of type  $r$

$W_{jr}$  is the number of opportunities of type  $r$  in area  $j$

$\beta_{br}$  is a parameter that represents the propensity of people type  $b$  to make trips of particular generalised cost lengths for opportunity type  $r$

$C_{ijkb}$  is the cost of travel in generalised cost units between area  $i$  and area  $j$  by mode  $k$  by people of type  $b$

$\mu(b)$  is the set of modes available to people of type  $b$

The value of the generalised cost (in time units) is given by:

$$C_{ijkb} = t_{ijkb} + m_{ijkb}/v_{br} + t_{ikb} + t_{jkb} + m_{ikb}/v_{br} + m_{jkb}/v_{br}$$

where:

$t_{ijkb}$  is the travel time between area  $i$  and area  $j$  by mode  $k$  by people of type  $b$

$t_{ikb}$  is the travel time for accessing mode  $k$  by people of type  $b$  living in zone  $i$

$t_{jkb}$  is the travel time for egressing mode  $k$  by people of type  $b$  travelling to zone  $j$

$m_{ijkb}$  is the monetary cost of travel between area  $i$  and area  $j$  by mode  $k$  by people of type  $b$

$m_{ikb}$  is the monetary cost of travel for accessing mode  $k$  by people of type  $b$  living in zone  $i$

$m_{jkb}$  is the monetary cost of travel for egressing mode  $k$  by people of type  $b$  travelling to zone  $j$

$v_{br}$  is the value of time for people of type b for opportunity type r

The value of  $\beta_{br}$  could be obtained by a formal calibration process or by using the approximation proposed by Hyman (1969):

$$\beta_{br} = 1.5 / \hat{C}_{br}$$

where  $\hat{C}_{br}$  is the average distance travelled for opportunity type r by people of type b.

The values of the variables would be taken from the GIS, supplemented by other sources where appropriate.

The model described above will be programmed in a suitable computing language. The GIS will be set up for the area and interfaces designed, both between the model and the GIS, and between the integrated system and the user. The benchmarks will be incorporated into the model. Appropriate output indicators will be developed.

The system will be validated by comparing its outputs against the perceptions and values of the sample of socially-excluded individuals used to establish the benchmarks. Then the outputs from the system in terms of what it says a policy will do will be compared with their perceptions of the effect. The GIS-model system will be adjusted in the light of their comments. The system will also be validated against the knowledge of the officers and politicians.

The system will be applied to other areas with comparable databases to see how well it can be transferred, and to ensure that the methodology is as general as is practical. It will be tested against the knowledge of local officers and transport users.

## **9 Use of the tool**

The tool will be used to examine a range of transport policies, designs and operations. These will come from a variety of sources:

- The policy and related documents of Hertfordshire County Council (for example, the LTP), plus ideas from the officers;
- Ideas from various interested parties, such as representatives of disability groups;
- Ideas from the socially-excluded people included in the benchmarking surveys;
- Designs and operations proposed in other parts of AUNT-SUE;
- Policies, designs and operations identified from the literature, for example, ideas tried by other local authorities and from central government;
- Ideas from the research team.

These will be tested using the tool to examine a variety of outputs. These will evolve as the tool is developed, but the initial list includes the following:

- Examination of who is affected, shown by disaggregating the population into various groups such as car owners and non-car owners, and by identifying various

groups by location, to see how many are affected in terms of cost, duration and quality of journey;

- Analysis of transport networks to identify activities and areas that are not accessible by various means, for example, by people in wheelchairs and those unable to climb steps, or which involve travelling through places that are regarded as unsafe;
- Development of contour maps of accessibility from various locations and to various activities, so that the local authority and others can identify the best places to locate activities or where the transport networks need to be improved;
- Measures of access to the public transport network, in terms of the nearest bus stop or station to various locations, taking into account the frequency and reliability of the service;
- Measures of the quality of the provision of bus, rail, cycling and walking facilities, singly and in combination, from various locations.

Then the model will be used to address a variety of questions, such as:

- Can various key activities (jobs, schools, shops and so on), be reached within the benchmarks from various locations by various modes?
- How can accessibility to these activities be increased for various groups, including those without access to a car, so that more people meet the benchmarks?
- Which transport and designs are most effective in increasing the numbers meeting the benchmarks?
- What are the effects of transport policies (for example, congestion charging, low-floor buses and bus priority schemes) and other policies (for example, opening and closing schools), on the number of people who meet the benchmarks;
- What are the effects of traffic (noise, atmospheric pollution and so on) on the local environment in terms of the numbers affected, particularly are socially-excluded people affected more than others?
- Are there gaps in the public transport network?

By trying to answer these types of question with the tool with the various outputs mentioned above, it will be possible see which policies, designs and operations are likely to do most to increase social inclusion, and where investment should be made to help achieve this objective.

## **10 Research issues to be addressed**

Whilst intuitively one has an awareness of what social exclusion is, considering how to incorporate it into some form of systematic tool raises many questions, because the concepts have to be specified sufficiently precisely to be quantified and programmed. Addressing them may help to sharpen the nature of debate in the whole field of social exclusion. The issues are discussed below.

The term ‘social exclusion’ is widely used, and it seems likely that, given information about a set of people, many researchers in the field could say which of them, if any, are socially excluded in some sense, or which of them are the most socially excluded. But, if the objective is to say that some change that is being proposed, for example, a new policy or new infrastructure, is going to reduce social

exclusion then a clear measure of it is required. In this project, benchmarks will be defined; then it will be possible to see whether there is an increase or decrease in the number of people above the benchmarks.

A related issue concerns the extent to which social exclusion is about perceptions, and how much is it about reality that can be measured objectively. If someone lacks all sorts of material goods, but is happy and does not feel excluded from society, is he or she socially excluded? Suppose a neighbour has more material wealth, but feels more socially excluded. Which of these two people would benefit more from some measure to reduce social exclusion? Which would society regard as being in more need of help? The key question is, is it sufficient to rely on objective measures of social exclusion, as represented by data, or does there need to be understanding of how socially-excluded people feel about the various concepts represented by the data (for example, access to work, an uncluttered pavement, and so on).

It is very important for the analyst to avoid, as far as possible, imposing his or her own cultural values and aspirations on those regarded as socially excluded and being patronising towards those that are anticipated will benefit from the research. It also has to be recognised that those who participate in any exercises to reduce social exclusion may, by taking part, reduce their social exclusion, for example by becoming more aware of opportunities. It is also very important to recognise that the barriers that make some people socially excluded may also prevent their participation in the research exercise.

In some situations, it is possible that one way to reduce social exclusion is to increase accessibility by helping to overcome the financial barriers to travel, for example by giving the people concerned travel vouchers or even a car. If this is so, a simpler way to do this, is to give them money with which to buy accessibility in some sense: this is empowering them to make their own decisions about how they want to reduce their social exclusion, and so reducing the risk of the planners imposing their ideas. But they might choose to spend the money on something else other than buying access to the facilities that it is perceived that they are deprived of, for example, electrical goods, to make their lives more enjoyable or easier. On the basis of the measures used to define social exclusion they may be no better off, particularly if social exclusion is conceived in terms of accessibility, but logically they must be better off because they have more material wealth. This issue can be addressed by specifying how the money is spent, such as via vouchers of some sort, but this looks rather patronising because it implies that the planners know better than they do what they need in life.

There are many aspects of social exclusion that have nothing to do with travel. Some of these can be handled by incorporating them into the Hansen-type accessibility measure discussed above. For example, considering various location patterns for new jobs can be tested, as can increases in income, if they can be translated into availability of funds for travelling. However, it must be recognised that some aspects of social exclusion cannot be addressed by this approach, but that is not a reason not to tackle the aspects that can be addressed

Social exclusion is a multi-dimensional concept, with many different measures. In order to establish how socially excluded somebody is, it is necessary to be able to combine the various measures for that person: for example, this could be some measure of the physical difficulty they have getting onto buses, the fact their job location has a poor bus service, the fact that they are afraid to go out at night, and their lack of knowledge of transport services (plus lots of other non-transport measures). This needs to be done in order to be able to compare this person with another person, in order to see where to focus effort and resources to reduce social exclusion, and in order to compare their situation before and after a supply-side change. It is not enough to divide society up into groups (teenagers, the visually impaired, those in wheelchairs and so on) and then deal with each separately (but that may be a good starting point).

Following on from the above, it is necessary to be able to aggregate across individuals. If an outcome of this work is findings about ways of reducing social exclusion it is important to be able to assess the overall impact, and to be able to discriminate between the impact of various measures. A simple example: which is better: a measure which increases significantly the social inclusion of a small number of people, or one that increases social inclusion slightly for a much larger number? Obviously, it will depend on the particular context, but that this is the type of question that this research will need to address.

Taking this further, it is possible to conceive of situations where one measure (policy, new infrastructure, and so on) will make one group of socially-excluded people much better off, and other groups not much better off (or possibly worse off), while another measure will make a different group much better off (but a different number of them, and to a different degree), and not do much for others. This research will need to address this type of trade-off issue.

## **11 Conclusions**

Social exclusion is an area of concern at all levels of government. In particular, in Britain, central government requires local government to consider how its policies affect social exclusion. There are a number of tools currently in use within local government that can help in this process. However, these tools are at present very limited in the extent to which they can adequately assess the impact on individuals of the wide range of possible policy instruments for tackling social exclusion through the transport and land-use system. Given, the current push towards accessibility planning, there is a need for a comprehensive tool based upon systematic research into the needs of socially-excluded people and related to benchmarks of reasonable levels of access. Such a tool is being developed in the research described in this paper. It will use a comprehensive accessibility model overlain by a GIS for effective input and output. Its development will be carried out with the active co-operation of a local authority and researchers developing new transport designs and operations which can be tested with the tool, and their effectiveness at a strategic level fed back to them. The tool will be developed using the results from surveys of socially-excluded people, and they will be part of the validation process.

It is recognised that this tool cannot address all the accessibility-related problems of all socially-excluded people, and that there are a number of interesting research

questions to be addressed. What is clear is that can be a very useful method for improving the lives of large numbers of people, and that is very worthwhile.

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Figure 1 The relationship of policy-making to the other processes in the AUNT-SUE research programme

