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An assessment and critique of capabilities for examining the long-term social sustainability of transport and land-use strategies

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ABSTRACT

When transport and land-use strategies are developed they tend to rely, to a large degree, on the inputs from large strategic models. Whilst it is commonplace for such models to assess the economic and environmental impacts of transport strategies, very few provide any real understanding of their social impacts. This paper reports on a study that aims to improve how we consider the social sustainability of transport strategies. The study is part of a wider project to improve our assessment of the overall sustainability of transport decisions. It describes the four-staged method that was adopted.

The approach is pioneering, focusing as it does on accessibility to key services and facilities as a primary measure of social sustainability. Nevertheless, there are a number of serious limitations in the approach, both in selecting indicators and applying them in practice. It is also clear from our experiences of adapting the outputs of state-of-the-art models that the technical capacity for assessing the social implications of transport continue to fall well short of those that assess the economic and environmental impacts of strategies. A series of recommendations to improve capacity in this respect is provided.

INTRODUCTION

There is great concern about the long-term 'sustainability' of the transport sector both nationally and globally (1) (2). The tension between transport investment to improve economic growth and standard of living on the one hand and subsequent environmental degradation on the other has been at the forefront of debate for at least the past 20 years. Increasingly social sustainability, and the degree to which transport interventions permit the development of new social structures and behaviours, or destroy, damage or impair the continuity of existing ones is an emerging issue (3).

This paper describes one element of a wider UK study to identify and validate a set of indicators to assess the social sustainability of transport decisions (4). The work was undertaken in parallel with a similar process for the environmental and economic pillars of sustainable development. The aim of the overall project is to develop a tool that can be practically applied by decision-makers in both national and local government contexts to assess the sustainability impacts of transport policies and projects. Although the focus of the research is UK based, its findings may be of relevance to other countries wishing to make more evident the *interactive* impacts of different transport decisions on the economy, the environment and society.

METHOD

The method comprised four stages. In stage one, an understanding of the requirements of a set of indicators capable of capturing the social impacts of transport and land-use interventions was developed through a review of the available literature. This informed stage two, which initially involved sifting through indicators of social sustainability already in the public domain and then revising and refining these. Entirely new indicators were developed only where existing indicators were inadequate for the purposes of the project. As discussed later on, one of the key requirements for the later testing stage of the project was that the social indicators needed to be suitable for inclusion in forecasting models, in order to compete on a level playing field with the selected environmental and economic indicators (5). In stage three, we undertook a series of consultations was with stakeholder in key UK government departments, advisory bodies and environmental and lobby groups to refine the list. The final stage of the project involved applying the indicators to a real case study of a metropolitan area in the UK using data produced by a state-of-the-art land use-transport interaction model. Each of these stages is discussed in more detail below, before conclusions are drawn about the implications of the work.

IDENTIFYING APPROPRIATE SOCIAL INDICATORS OF SUSTAINABLE DEVELOPMENT

Whereas the interactions between transport and the economy and environment are reasonably well understood and are increasing encapsulated within existing evaluation frameworks, the positive and negative social impacts of transport systems are still relatively poorly understood. It was clear from a review of the relevant literature that a wide range of social indicators have been included in transport evaluation frameworks in

the past (6) (7). In most instances, the indicators that have been previously used are very distant from the actual transport effect (e.g. measurements of the take up of new employment or improvements in educational achievement or improvements in health). Evidently, changes in social trends such as these occur over very long time spans and, thus, are not only extremely difficult to track within time series datasets generally, but also virtually impossible to attribute to transport interventions (4). In the UK, the figures are also usually not available at a sufficiently small geographical scale to make them useful for gauging the impact of transport projects on individuals or communities.

As it was the intention of the project to operationalise indicators in the final phase of the project, all these considerations needed to be accounted for in the selection of appropriate indictors. Initially, we aimed to identify the *direct* interactions between the transport sector (both its negative and positive impacts) and the 'social aims' of sustainable development. The social aims of sustainable development were identified consistently throughout the literature as threefold, namely:

- Social progress,
- Equity (or equality of opportunity) and
- Justice (in terms of policy outcomes).

These three core social principles for sustainable development can be traced back to the Brundtland definition and more recent UK policy interpretations (1, 8). It is clear, however, that all three of these broad concepts can be interpreted in different ways in terms of setting policy goals. It was, therefore, necessary to 'unpack' the meaning of each of them in the context of UK policy literature, in order to ensure our indicators were consistent with policy intention.

Definitions of social progress

Much of the contemporary academic and policy literature on social progress is loosely derived from Beveridge's five 'great evils' of want, squalor, idleness, ignorance and disease (9):

- Want = poverty (and in particular childhood poverty),
- Squalor = housing and crime,
- Idleness = (un)employment,
- Ignorance = (literacy) education and
- Disease = health

This list was used to form the conceptual basis for developing the social progress indicators. Initially, a review of key policy documents and other relevant literature pertaining to these indicators was undertaken. From this, it was possible to identify the main thrust of the policy UK agenda against these five overarching social themes.

Identifying the contribution of transport to social progress

Next direct transport interactions with these five aspects of social progress were identified. For example, in respect of the Poverty indicators, the main interaction was deemed to be *household travel expenditure as a proportion of household income*, to

denote both affordability and over-expenditure. For employment, health and education the key transport interaction was deemed to be *the physical ability to access these activities, i.e. entry-level jobs, healthcare and educational facilities* and *the affordability of that trip*. Additional considerations for the 'health indicators' were *transport-related accidents* (currently included under the economic pillar), *exposure to noise and air pollution* (currently included under the environment pillar), *access to healthy affordable food* and *the health benefits of walking and cycling*.

In terms of housing, the influence of transport spending on housing, affordability vs. mobility trade-offs, spatial mismatches between housing location, employment opportunities and local services and amenities, and the problem of severance we deemed to be the key interactions. The impact of *fear of crime on walking trips and when using public transport* was also identified as a factor the indicators should address.

Identifying equality of opportunity (distributional effects)

Having identified these social interactions with the transport system, the next step was to consider potential points of disaggregation (e.g. by household size, social group, geographical area), in order to gain a measure of the distribution and thus equality of outcome of any registered change within each indicator. Household income, levels of car ownership and geographical locations based on indices of deprivation were all identified as potentially powerful ways of expressing (in)equities in the distribution of outcomes. Travel choice, i.e. the various travel options that are available to an individual or area, is another potential area for disaggregation.

At this stage, it became apparent that similar disaggregations would also need to be applied to some of the environmental (e.g. noise or air pollution) and economic (e.g. journey-time savings) indicators being developed in other parts of the project, so that a more complete picture of the 'social sustainability' of an outcome could be fully assessed. This recommendation was passed on to the relevant team members working on other parts of the project and duly informed their specifications for the final indicator set.

Determining the justice of policy outcomes

According to our rationale for determining the social sustainability of transport decisions, as described above, the indicators also needed to encapsulate some measure of the 'justice' or fairness of policy outcomes. The social policy literature suggests this can be expressed as a comparative measure in relation to the average population (11). Discussions about the use and setting of minimum baselines and maximum figures were therefore important to this part of the selection process. As far as possible, these were identified with reference to the relevant policy literature. For example, the UK Family Expenditure survey identifies that the average expenditure on transport within households is 15% of total weekly expenditure. For our indicator specification in this instance, therefore, this was taken as the baseline figure for expenditure and an amount in excess of this identified as an 'unjust' level of expenditure if experienced by a low-income household.

Developing indicators

Initially some forty plus potential indicators were identified through the review process, but it was clear that many of these would not be functional or easy to apply in ex-ante appraisal. Indicators were immediately rejected where it was not possible to identify a *direct and meaningful* relationship between any possible transport intervention and a 'social progress outcome' (either positive or negative).

In many instances it was not possible to identify *any* existing indicators that would actually be capable of capturing the direct interactions between transport interventions and social progress. For this reason, the team needed to develop entirely new indicators that:

- Would initially be capable of appropriately *capturing* social progress resulting from changes in transport provision;
- Could then be *dissagregated* at a sufficiently small spatial scale to determine the geographical distribution (and thus population affected) by that outcome; and
- Could set an *upper or lower level of provision* based on an established policy agreement of that limit regarding the social justice or fairness of that provision.

On the basis of the various considerations discussed above, five core indicators to assess the social sustainability of transport were put forward for presentation to the stakeholders at the consultation phase of the research (see Table 1 in the Appendix of this paper). The following sections of this paper offer a more detailed discussion of the considered merits of these indicators.

i) Poverty

Household travel expenditure as a proportion of household income was identified as an appropriate measure of transport poverty within households, as it captures both affordability and over-expenditure. Household expenditure on transport would also go down if bus and rail fares, for example, were too high and people chose to stay at home.

Disaggregation

The indicator is disaggregated by households below 60% of contemporary median household income vs. all households, which denotes the poverty line in the UK. Household expenditure on travel is a regressive figure, hence the focus on households below the poverty line. Average motoring costs are significantly lower for the richest 20% as a proportion of income than the poorest and also for public transport and taxis, although the difference is less significant (10) (11).

Direction of change

15% is the average household expenditure on transport as identified by the UK Annual Family Expenditure survey. In order to achieve greater equity, interventions should aim to bring the level of spending in relation to income down for the lowest income group and levelled out as a minimum for all households.

ii) Employment, Health, Education = Accessibility to key services

In terms of social progress in relation to employment, health and education the key direct transport interaction was deemed to be both the physical ability to access these activities, i.e. entry-level jobs, healthcare and educational facilities and the affordability of that trip.

Weighted journey times (as a continuous measure) have been used as the proxy measure of accessibility as this will also record a level of trade-off between walking, cycling, waiting and in-transit elements of the journey. Using a continuous measure of accessibility avoids the use of thresholds, which are problematic in the absence of research or policy to determine desirable and/or acceptable levels of travel.

Disaggregation

From the policy literature, the key services were identified as: employment, primary health care, education and food shops and the indicator is proposed to be disaggregated by non-car owning and car owning households (can also be disaggregated by key relevant population sectors e.g. for disabled people, children, etc.).

Disaggregation by relevant social/cohort groups is also highly recommended (e.g. for people with disabilities across all destinations, and, e.g. health care facility by % of people suffering Chronic Heart Disease; primary school by % of children under 11 years; etc.) and also potentially by housing tenure.

Direction of change

Lack of a car remains the single greatest barrier to accessibility, with people who are dependent on other modes taking, on average, twice as long to travel the same distances as drivers. The aim would be to reduce the disparities between car and public transport journeys to these destinations, with a preference on levelling up public transport journey times.

iii) Health - Safety

Aspects of health are considered within several other indicators in the framework (e.g. access to health facilities and healthy affordable food, transport-related accidents (currently included under the economic pillar), exposure to noise and air pollution (currently included under the environment pillar).

The number of child pedestrian accidents by social class provides a good representation of the extent to which the most vulnerable are protected from the externalities of transport and is directly linked to that effect. This is also a useful proxy for exposure to traffic related noise and air pollution. Road traffic accidents are the biggest single accidental cause of lost years of life and are an issue still requiring much attention.

The impact of fear of crime (as reported in local surveys) on walking trips and when using public transport were also identified as issues that the indicators should include. Recorded incidences and fear of crime on and waiting for public transport was considered the closest available and appropriate secondary source of information relating to fear of crime without resorting to satisfaction surveys. It is recognized that recorded crime levels are consistently below recoded levels for survey reported fear of crime, but the two indicators are highly correlated in terms of their geographical distribution (12).

Disaggregation

Total accidents had already been included in the overall indicator framework within the economy pillar, so this section concentrates on refining this indicator in order to include a social measure of progress. The 2003 SEU report (11) has

identified that children in Social Class V are five times more likely to be knocked down in a traffic accident than their counterparts in Social Classes I and II. Most of these children also live in households that do not have access to a car. There are, therefore, both strong equity and justice arguments for including this indicator.

In addition to accident risk, levels of crime and fear of attack on the street are also important. However, a previous study (12) demonstrated that it is difficult to gain access to crime figures at a small enough spatial scale to make them meaningful, so this indicator may prove to be problematic at the operational stage of the study. No disaggregation is recommended.

Direction of change

Reduce number injured by 50% by 2010 compared with the average for 1994-98 plus reduced disparity between social groups.

iv) Quality of Life

It was clear from the literature review that the issue of improved quality of life is of prime importance to the social progress aspects of sustainable development. Numerous documents have recorded that residents' ability to walk safely and easily within their local area is seen as immensely important in this respect. It is also an aspect of policy that falls firmly within the realms of transport policy-makers to affect. The indicator that was selected was the percentage of residents living within 1000m or 15-minute 'safe walk' (determined by an official safe route as approved by UK Government). A safe cycle route to these destinations could also be included to key destinations

Disaggregation

Whilst the accessibility indicators above provide a measure of wider opportunities, the local focus of this indicator is representative of the 'liveability' of a community and its ability to conduct basic functions outside the home within the boundaries of that community (14).

Direction of Change

Up, though the development of a minimum percentage, as with accessibility, would be a considerable step forward.

v) Housing

In terms of housing, the influence of transport spending on housing, affordability vs. mobility trade-offs, spatial mismatches between housing location, employment opportunities and local services and amenities, and the problem of severance are all key interactions. For example, there is a clear interaction between transport and property market and land values, but equally huge uncertainties about the impact of this on social progress (e.g. an increase in house prices could be positive for the overall economy but negative for low-income families aspiring to become home owners) and how to capture this effect through the indicator framework.

Conversely, in some areas where entry-level house prices are high (e.g. London) a trade-off appears to be occurring between the increased journey distances and house ownership (i.e. people are choosing to travel further to benefit from lower house prices and/or improved lifestyles). There may be a conflict between social progress and sustainability in this case. For this reason, it was

considered important to include a measure of this trade-off within the social indicator set. Initially, it was difficult to determine what this measure should be, but following consultation with stakeholders (see following section below) it was decided that the lowest 10% value of house prices within x minutes (based on average local journey times to employment) of: a) the town centre and b) key centres of employment would be appropriate.

Disaggregation

The most important social difference in this instance was seen to be the differences in journey times (and distances travelled) between those using cars to access these facilities and those reliant on public transport.

Direction of Change

The aim would be to reduce the disparities between car and public transport journeys to these destinations, with a preference on levelling up public transport journey times.

STAKEHOLDER FEEDBACK ON INDICATORS

We interviewed a wide range of stakeholders from the relevant UK Government departments and other national level interest groups, such as the Sustainable Development Commission and the Transport 2000 lobby group. All were generally supportive of the social indicator set that we had developed. They recognised that indicators of the contribution of transport to social sustainability and the interactions between this and economic and environmental outcomes are the least developed and understood. For this reason, there is still a large degree of uncertainty amongst policy makers about what constitutes a sustainable way forward in this respect. The UK HM Treasury noted the importance of transport achieving social objectives, especially as we move away from subsidized transport schemes.

We received some specific comments from stakeholders on how the indicators could be further refined and on the basis of these and the more general discussions we had with them, a number of final revisions were made to the set of social indicators before they were operationalised in a practical case study setting (see column four in Table 1). Full details of the stakeholder feedback are available in the full project report for the study (4).

TESTING THE INDICATORS IN A PRACTICAL CASE STUDY SETTING

There is no one right way of setting up an assessment of the sustainability of a set of policies and so a series of value judgements have to be acknowledged in deciding what should be incorporated into a sustainability indicator set, as discussed above. A further series of compromises have to be reached in monitoring and, in the case of long-term transport investments, forecasting their impacts. As we were interested in establishing whether looking at transport assessments through a more comprehensive sustainability framework makes a difference to the types of schemes and decisions that are approved,

we were constrained to following a process that broadly mirrors that adopted today (see for example (15) and (16)).

As transport and land-use policies and impacts are so closely interwoven (17) we opted to use an existing state-of-the-art transport and land-use interaction model maintained for one of the major metropolitan areas in England. Hunt et al. (18) provide a thorough state-of-art review of the coverage and assumptions behind these models. With particular regard to the coverage of social interactions they find that:

- Non-transport services are not explicitly represented
- Models are household based with only a few household types used
- Demographic processes need to be modelled externally
- Car ownership is also external (p370-372)

The model available for use was based around an integrated land-use transport modelling suite (DELTA/START). The model concerned covered a target population of around 3 million people and was divided up into 47 zones (with 15 further zones). Travel to take part in activities in different zones occurs, in part, based on the location and accessibility of facilities. The model produces estimates of, amongst other things, flows, speeds, public transport ridership, revenues, location of business and residential activities. We also had at our disposal the Geographic Information System (GIS) model: Accession™ of the public transport network for the area with all routes, public transport stops and schedules for 2006 and a series of activity locations for key services (General Practitioners, Primary and Secondary schools, Further Education centres, major employment sites and major food shops.

Three different scenarios were run for us to use as the basis for our comparison of the impact on sustainability of different transport interventions:

- Scenario 1 – Investment at current levels including some road widening, small extensions to existing light rail, improvements in bus services and free fares for old age pensioners. Some reductions in travel forecast to be due to behavioural change methods (17) were also included.
- Scenario 2 – As for scenario 1 but substantially enhanced bus and rail frequency and adding new light rail and bus lines
- Scenario 3 – As for scenario 2 but with a cordon congestion charge of £4 assumed for 2016 rising slightly over the period to 2021.

Despite the very advanced nature of this model compared to many available within UK local authorities, by selecting a strategic model there is no detailed network representation and therefore no easy way to connect zonal results to particular communities within a zone. There is also no pedestrian network and no calibrated consideration of public realm improvements, as we would have liked.

Whilst the model does consider housing location decisions the housing market model is also not sophisticated enough nor sufficiently integrated with house prices and social housing datasets to allow the recommended housing indicator to be tested. An initial sweep of our constrained list of indicators therefore suggests that, although intuitively appealing and useable in post-hoc evaluations, many are still practically beyond reach in terms of their ability to be formulated and used in ex-ante evaluations.

For these reasons, the principal investigations for the social indicators at stage four of the project focused solely on the accessibility and safety indicators. The transport land-use model outputs were integrated with the GIS Accession software.

Accessibility

The results from the comparison of general accessibility for the whole of the metropolitan area are shown below in Table 2. It shows a very good level of baseline accessibility for the whole of the metropolitan area. The proposed public transport interventions, therefore, make very little difference to overall accessibility levels under the three scenarios. Figures 1 and 2 show the accessibility time threshold plots for access to major employment sites (sites employing 500 and over).

It should be noted when measuring accessibility that the Accession model does not include consideration of the quality or opportunity of the nearest appropriate destination. This means that a person may have very good access to a local shop but the quality of its products may be poor. Similarly, the job opportunities on offer may not match the skills of the residents being assessed. Whilst further disaggregation of the results by income type could have been undertaken, it was felt that the baseline levels of accessibility are so high that this would not add anything to the assessment. More sophisticated techniques can be applied to investigate accessibility problems for local neighbourhoods using Accession and other means (with greater attention given to specific services for example). However, such an undertaking is not possible due to the difficulties in forecasting these changes over the long-time periods studied in this example. This is discussed further below.

It was also not possible to use the cost function of the model at the present time as the complex nature of fare structures is not yet captured by the software (e.g. walk-on fares, day passes, monthly passes, etc.) and this prevented any evaluation of the relative affordability of different travel options. Analysis of journey cost is further undermined by the very complex ticketing arrangements for multi-operator journeys within the deregulated bus market in the UK, outside of London.

Safety

An analysis was also conducted of the safety impacts of the different strategies using outputs from the DELTA/START package. The model does not provide estimates of accident numbers and this is not an easy measure to forecast. A different approach was therefore taken based on the calculation of accident rates in the current year (using known accident levels and traffic flows) and in the future year (using forecast traffic levels and target levels of accidents). The analysis therefore ignores the potential impacts of small speed changes on safety in the urban area as a result of the investment strategies.

In the UK, local authorities are required to set targets for reducing the number of total Killed and Seriously Injured (KSI), Child KSI and total slight accident rate by 2011. A comparative measure of the likely accident impacts of each scenario was made by comparing the accident rates (accidents/vehicle km travelled) for 2011. The results of this analysis are shown in Table 3 for total KSI figures.

The results, unsurprisingly, demonstrate that the highest public transport and demand restraint measure (Scenario 3) provide the best results, with a smaller percentage reduction in accident rate being required to hold KSI accidents down to the target level of

681. Whilst this analysis does not provide a direct measure of the distribution of accidents across the urban area, it can be used as a proxy measure for the investment needed to keep accidents at a given level. The data essentially allows the decision-maker to consider how much more money would be required in a business as usual (Scenario 1) to cut the accident rate by 46% as opposed to 41% in Scenario 3. This is an economic rather than a social outcome but it has strong distributional implications.

DISCUSSION OF FINDINGS

One of the main purposes of this research was to develop and operationalise a set of indicators that could in some way capture the social sustainability of longer-term transport interventions. The final set of indicators that were operationalised at stage four of the project was substantially constrained by data availability and/or the capabilities of existing models. This is in large part a result of the models being set up to capture aggregate economic benefits with little consideration of how to study the distribution of impacts spatially and across diverse social groups. We would suggest that even making *some* assessment of social impacts is better than none at all. However, the very narrow set of practicable indicators falls so far short of a complete analysis of social impacts that it can only inform equality assessments in a very limited manner. There is a pressing need for this to change within the present policy climate. In the UK for example it is now a requirement for authorities seeking to conduct congestion charging pilots to consider the distributional effects of different design project options. The policy and political need for such tools appears to be running ahead of technical capacity.

The key practical issues that have prevented this analysis from delivering the results we set out with the aim to achieve were:

- The GIS data representation of accessibility is a model of idealised reality. In the model all buses run to time, all users are fully informed of the opportunities available to them and cost is not a barrier. This grossly oversimplifies many of the key barriers to social participation as they are understood today. If modelled accessibility in our case study area is so good then why is transport still a barrier to participation in key activities?
- The approach taken in this work was to keep the core activities that people travelled to the same in each scenario. This is also unlikely to be true in the real-world (e.g. changes in employment structure, school closures and openings). Some of the patterns of location will be directly affected by the policies considered. Lifestyles and activity patterns are also changing across social groups. Whilst advances are being made in activity modelling the cost and complexity of such approaches renders it beyond the reach of most authorities. Greater integration between the activities sub-modules of LUTI models and accessibility to developments by different social groups would be helpful.
- It has proven extremely time-consuming to change the baseline public transport network within the model. Whilst comparatively simple to add a new route with a regular timetable within the model, it is difficult to modify the evening and early morning services of each route to mimic the slow but steady withdrawal of non-

profit making services. Indeed, in this set of runs no such changes were made, which overestimates the accessibility of the future scenarios.

- There is no practical connection between the strategic large zone land-use transport model and the tools available to process social data. Variations in house prices across a zone would be too coarse to be meaningful for example. There is inevitably a balance to be struck between size of metropolitan area to be modelled, the number of zones and the time to run and analyse outputs. Advances in computing power are increasingly reducing this problem with the next generation model for the urban area studies here having almost five times as many zones.

Despite the serious limitations of the approach, making explicit the direct contributions of transport to social objectives is clearly a necessary step for future transport appraisal, as stakeholders from the UK Treasury pointed out. This is particularly important in a monetary climate that is moving away from the direct subsidy of services, as it is in the UK. Therefore, whilst current modelling techniques and the indicators that were identified through this project may be a long way from accurately representing the social impacts of transport decisions, they at least put the issue of social sustainability on the table. This allows the social outcomes of transport projects to be evaluated on an equal footing with considerations of their economic viability and environmental sustainability.

Clearly, far more research is needed in this respect, not only to secure better data with which to model the impact of transport on social welfare but also to develop models that more accurately reflect the travel patterns of different population sectors. Our interviews with key stakeholders suggest that whatever advances can be made in this respect will be welcomed by decision-makers. We would, however, like to conclude this paper by stressing the importance of understanding the realities of people's travel experiences and not just modelled versions of those realities. To this end direct engagement with people from a variety of different social sectors and circumstances is still the key tool in advancing our understanding of the impacts of transport on social sustainability.

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APPENDIX

Table 1: Social indicators presented to key stakeholders

Area of Progress	Indicator of Progress	Disaggregation	Direction of change	Changes made after consultation
Poverty (Source: Family Expenditure Survey)	Total household expenditure on travel	Households below 60% of contemporary median household income vs. all households	Not increasing overall and not exceeding 15% for households below 60% of contemporary median household income	Dropped on recommendation of UK Office of national Statistics due to lack of disaggregated data
Accessibility (Source: Modeled data)	Weighted journey times to: • key centres of employment; • primary, secondary & further educational facilities; • primary health care provider[1] & general hospital[2]; • key food shops	By car and public transport[3]	Reduced ratio between car-based and public transport options	Include a measure of cost of trips to assess affordability to compensate for loss of poverty indicator above. Use a continuous measure of weighted journey times over opportunity contours in the absence of data on acceptable travel thresholds for different journey purposes.
Safety (Source: National Statistics)	Number of child pedestrian casualties per 1,000 children in population	Social Class I - V	Reduce number injured by 50% by 2010 compared with the average for 1994-98 plus reduced disparity between social groups	It was decided to include all accidents under the social pillar and disaggregate the indicator by index of deprivation, teenage deaths by driving and child pedestrian deaths.
	Recorded incidences of crime on public transport	None	Down overall and improved perceptions of safety	No changes recommended
Quality of Life (Source: Local Transport Plans)	Percentage of residents living within 1000m or 15-minute 'safe walk'[4] to key destinations	Can be disaggregated by particular relevant groups (e.g. primary school by	Up	No changes recommended

[1] Doctor's surgery, health centre, NHS walk-in centre
[2] Hospital offering A&E and other key services
[3] Can also be disaggregated by particular relevant groups (e.g. health care facility by % of people suffering Chronic Heart Disease; primary school by % of children under 11 years; etc.) and also by housing tenure (the latter may be particularly in rural areas where low-income households are more likely to have higher levels of car ownership).
[4] Determined by an official safe route. A safe cycle route to these destinations could also be included

	(e.g. health, educational, leisure and cultural facilities, food shops, post office, etc.)	% of children under 11 years).		
Housing	Lowest 10% value of house prices within x minutes (based on average local journey times to employment) of: • the town centre and • key centres of employment	By public transport and car	Reduced ratio between car-based and public transport options	Indicator added because of concerns about this issue even though it was recognised that this proxy may not be a perfect measure. There may be issues with operationalising this indicator at the modelling stage.

Table 2: Accessibility thresholds showing % population within journey time threshold of a facility

Access to	Threshold	2006 Base Year	Scenarios 2 and 3
Employment	% 0 to 20 MINS	84	85
	% 0 to 40 MINS	99	99
Supermarket	% 0 to 15 MINS	84	83[5]
	% 0 to 30 MINS	99	99
General Practitioner	% 0 to 15 MINS	96	96
	% 0 to 30 MINS	100	100
Primary School	% 0 to 15 MINS	99	98[1]
	% 0 to 30 MINS	100	100
Secondary School	% 0 to 20 MINS	96	97
	% 0 to 40 MINS	99	100
Further education	% 0 to 30 MINS	96	97
	% 0 to 60 MINS	99	100

Table 3: Summary of KSI accident analysis

	Scenario 1	Scenario 2	Scenario 3
Current KSI	1080		
Current Flow (veh.km/day)	31.7m		
Target 2021 KSI	681		
2021 Flow (veh.km/day)	34.8m	33.3m	32.3m
Accident rate change current - 2021	-46%	-43.5%	-41%

[5] The apparent increase here is due to rounding differences in the calculations.

Figure 1: Access to major employment – 2006

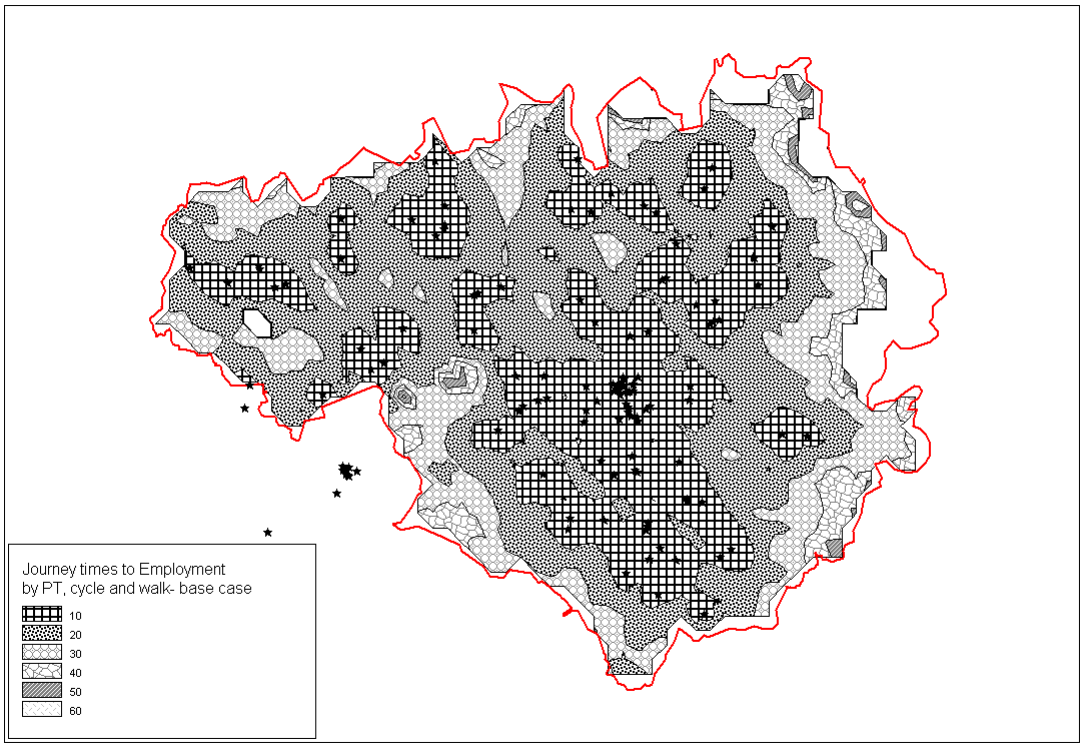

Figure 2: Access to major employment – 2021 Scenarios 2 and 3