Committee on Climate Change Expert Workshop 2.6.2009

Land Use Aspects of Transport's Contribution to Climate Change

Purpose: the workshop was a tightly focused discussion with experts on land use/transport interactions on the scope for changes in travel choices that are linked to land use, including both new patterns of land use and changing origin-destination choices within existing patterns of land use, with an emphasis on evidence currently available.

Attendance

Experts: David Banister, Joyce Dargay, Phil Goodwin (Chair), Peter Headicar, David Simmonds, Philipp Thiessen, Alan Wenban-Smith
CCC: Adrian Gault, Eric Ling, Rachel Lund, Michele Pittini

Presentations

David Simmonds presented an overview of conclusions drawn from transport models which assume land use patterns (a Bristol case study) , and land-use/transport interaction models which allow for feedback effects (South Yorkshire and Edinburgh case studies). In Bristol the modeling suggested a trend of substantial growth in car use, which would need big changes in public transport and parking restraint to change much, and with only 'a few percent' reduction as a result of restricting new building to the existing built-up area, and 'a few percent more' if restricted to the central area[1].

[1] The Trend land-use scenario with Do-Minimum transport change produced in increase in person-Km by car of 51.2% over 25 years. The "Compact City" land-use scenario reduced this to 47.8%. Adding traffic restraint and major public transport investment to the Compact city reduced the growth to 44.0%. Further modifying the land-use scenario (with the traffic restraint and PT investment) to a much more radical centralisation of development reduced the growth to 36.8%. The combination of land-use and transport measures thus reduced car travel in year 25 by approximately 10% compared with the trend (136.8%/151.2%).

Consideration of feedback effects from transport policy to land use revealed some potential problems of unintended effects, if traffic restraint in urban areas led people to choose to move to less dense or more distant areas. However, increases in fuel prices would encourage centralization and more compact land use, by giving greater incentive to consumers to choose home, work and other destination locations which are closer together, and hence provide greater market advantage for developers to do the same, to the extent that planning regulation allows. This would amplify (rather than offset) the initial stimulus. 'Self-selection' effects (where some people choose more compact areas and other people choose less compact areas) makes comparison of cross-section cases difficult, and is not well understood.

He suggested that strategic land use planning makes a small contribution to reducing travel demands, the main levers being transport ones, but land uses can either undermine or reinforce the transport ones so the joint effect of both is important.

Alan Wenban-Smith considered aggregate trends in personal travel (with data from National Travel Survey and other sources) and suggested mechanisms by which they operated at the individual and urban level. His analysis suggested that over the period 1972 to 2006 (during which CO2 emissions from cars had more than doubled, from 34 to 70 mt pa); this increase can be decomposed into an increase in the overall number of trips per head by all modes, an increase in the average trip length of all trips, and a higher proportion of the total done by car at higher rates of carbon emission than public transport. While all of these make a contribution, the biggest effect was due to the 48% increase in overall trip length.

Trip length and mode change together accounted for 75% of the observed increase in CO2 emissions by cars. These factors were considered to be related to each other and to land-use changes. The increase in average trip length implied a significant change in destination choice, ie to more distant destinations, which could be decomposed into two processes: the effect of changes in transport conditions, and the effect of changes in choices of location of homes, workplaces and other centres of activity.

Consideration of the slow pace of new development (new housing adds about 1% per year to the existing stock), and the faster pace of 'churn' of choices (on average about 10% of houses change hands during any one year, plus the effects of immigration and emigration) suggests that in the short run changes in patterns of travel within the existing physical pattern of land-uses can be of the order of ten times greater than changes due to new development. This does not of itself demonstrate that the effect of policies targeting 'churn' would have ten times the effect on journey distances as policies on new development, since there are other influences than policy on both, and the scope for a more optimal matching of origins and destinations will depend on how much the previous trends in prices and services have encouraged a sub-optimal matching, but does indicate the need for a broader concept of 'spatial policy' which encompasses not just new development, but the changing pattern of occupation of existing stock and resulting changes to travel patterns throughout the *whole* stock – old and new. It is likely that the latter effects will be bigger and swifter.

Peter Headicar discussed the effects of town size, structure and orientation within a region on travel patterns, with evidence from Cornwall, Oxfordshire and a generic model of a city region., Throughout the sixty years of statutory development control planning policy had sought to retain much of the inherited pattern of discrete, medium density towns with defined centres and a mix of land use. This provides a good potential for low car use. However, at the same time increased car ownership and very substantial provision of improved inter-urban roads had resulted in spatial widening of both housing and job markets resulting in longer average car journey distances, and diverse 'many to many' location patterns favouring increased car use. As a result, movements between settlements had an increasing effect on car use, especially commuting, as compared to movements within settlements.

Although debates on urban planning and transport policy tended to focus on the form and management of individual towns from a CO2 point of view, it is car journeys in the 'middle range' of distance (say, 5-35 miles) which emit a large proportion of the carbon, and a high proportion of these are between neighboring towns, or from smaller settlements to a town or city in the same region. The way in which planned housing growth is distributed between towns

within a sub-region will have a critical effect on the extent of this 'inter-town' movement and hence on the volume of carbon. (Larger towns normally have a greater degree of self-containment, particularly in respect of journeys to work, and a higher share of travel by modes other than the car,) .

In a worked example, it is shown that spatial options could result in CO2 differences of around 40% of the increase in carbon due to population growth alone, from the least to the most favourable, or about 6% of the total in a modeled example. Although in theory some of the generated travel could be reduced by improving the jobs/housing balance in smaller towns evidence of office completions during the decade 1995-2005 shows a marked concentration in certain regional and sub-regional centres of population (essentially as a product of market forces) although not necessarily in the physical centres of the towns and cities concerned. The distribution of new housing relative to these burgeoning employment locations is of increasing significance from a travel perspective.

It is important to recognize that regional planning bodies and individual planning authorities retain considerable discretion in the selection of areas for major housing development, whilst still conforming with Government guidance to focus new development in and around existing urban areas and to utilize opportunities to develop brownfield sites. For example there is a long tradition of preventing the outward expansion of larger towns in response to public concerns about 'urban sprawl' and 'loss of countryside', often reinforced by the effect of local government boundaries. Meanwhile market preferences amongst housing developers and private households for smaller towns plus the interest of local councils in securing the additional business and public investment associated with population growth creates a coalition of interest which has the effect of exacerbating the sub-regional imbalances noted above.

Joyce Dargay reported on an econometric analysis of National Travel Survey data 1989-2001 relating household car ownership and individual mode choice to various land use and transport features of the areas where they lived, notably population density, size of urban area, proximity and frequency of public transport, and proximity to amenities such as shops and services. This

analysis does not allow account to be taken of the issue of proximity between neighboring towns, as discussed above. Substantial, systematic and significant differences are seen. Car ownership is 56% greater in the least dense than the most dense areas, and share of car in total passenger miles increases from 74% to 92%. There is also an effect of town size: the larger the town, the less car use, though this effect seems to be significant only for London. The features are somewhat correlated with each other, especially in that the supply of public transport tends to be more, and the amenities closer, in denser areas, which also tend to be in larger towns. Allowing for these interactions, higher population density is associated with less car ownership, lower car use, more public transport use and more walking. Town size is less important in influencing mode choice and car use, but there are still significant effects notably in the biggest and smaller settlements. Bus frequency is more important than proximity to bus stop. The statistical analysis suggests that proximity to local amenities has an independent effect in addition to the density variable, in encouraging walking and reducing car use. There is also an effect on car ownership, and especially on multiple car ownership: households living in areas where amenities are a long walk away are 10% more likely to have more than 1 car than those in areas where amenities are a short walk away. Thus the results suggest that policies which will influence residential density in general, the density (hence proximity) of local amenities, and the level of service of local bus services will all influence car ownership, car use, and mode shares. The differences within the current range of circumstances are very large though the marginal effects of any given policy will of course be smaller.

Philippe Thiessen described the way in which the Department for Transport national forecasting model, NTM, handled CO2 and land use considerations. It was a multi-modal aggregate model driven by socio-economic trends and transport generalized costs, with feedback effects of overcrowding and congestion. Land uses were inputs not outputs, for example the country was divided up into 2500 zones, in each of which planning data such as employment levels could be assumed, and there is a mechanism by which transport costs could influence average journey length, which can be used optionally in model runs, but this has not been examined yet for land use implications. There was some experience that NTM tended to show that traffic levels were

influenced more by changes in journey distances than mode switching. (Further work is continuing and will be reported separately).

David Banister discussed how land use considerations fitted into a wider 'sustainable mobility paradigm' in which he suggested that four elements could be distinguished, namely the number of trips (which could be substituted or not made); the journey distance (which could be reduced by closer destinations or land use planning); the mode (substituting bus, walk and cycle for car); and efficiency (load factors, fuels, vehicle efficiency and design). The most favourable conditions would be achieved by strengthening cities, supporting larger settlement sizes of 50,000 plus, with medium and high densities of over 25 dw/ha, (and preferably over 30-35 dw/ha), mixed use developments, public transport accessible corridors (with densities up to 60-80 dw/ha around rail stations, and centric and polycentric urban forms. Sustainable mobility can be 'built-in' by suitable urban form and layout.

'New urbanism' debates had supported more walking, quieter, narrower streets, strong street connectivity with vibrant local communities, and green space, as part of a movement to regenerate cities but with positive sustainability effects. In a Canadian study, calculations of the total greenhouse gas emissions involved in construction, building operations, car travel, and bus travel, meant that in total urban apartments were associated with only 40% of the emissions of suburban detached houses, the largest element of the difference being in car use.

Discussion and Conclusions

Phil Goodwin suggested outline summary and conclusions, which were then discussed, circulated and amended. The following represents a broad consensus of key points among the participants, though not on every point (as will be indicated).

All presentations, and the discussions around them, tended to support broadly the same narrative explanation for the dominant trends over a long period (30 years discussed with evidence, and over a century qualitatively). This was that there had been a long term move towards patterns of land use which were associated with more travel overall, greater car use in particular, a more

diverse pattern of trips, and lower densities. At least some of these trends had been (and still were) actively assisted by policy decisions, notably about the location of large distant developments over a wide area in preference to smaller local developments within existing walk and public transport catchment distances, and the contrasting pricing regimes for private and public surface travel.

Land use policy and development control decisions which would be most favorable to CO2 reduction would be those tending to favour higher densities, active and attractive local communities with amenities and activities within walking distance and/or oriented in directions well served by public transport (especially with strong centrality). There would be a presumption of favouring urban brown field development over ex-urban green field development. Because of the importance of existing stock to locational choices and travel patterns, urban renewal can be seen to be an important component of a broader spatial policy framework for reducing the amount and carbon-intensity of travel demand (and can be supported for reasons other than greenhouse gas emissions). Thus there is emergence of an intellectually coherent and broadly consistent view of development and regeneration within urban areas, though it is less well advanced when considering movement between urban areas which is both important and less well analysed

All these land use policies would be either undermined by, or reinforced by, decisions about pricing of car use (lower costs tending to encourage longer distance car journeys, which in turn provides market incentives for new developments in more distant sites where land costs are less, less constrained parking, and a resulting land use pattern with greater emissions in total.

There was considerable discussion about the significance of changes in journey distance, because (a) it had been a very large part of the trend of increasing emissions and therefore was likely to be important in determining future emissions); (b) there were very clearly land use effects on journey distance; and (c) journey distance was also likely to be affected by travel decisions other than those connected with land-use changes. For these reasons, a judgment of the size of contribution which can be made by land use policy in part depends on the interpretation of how much of the observed journey distance changes were land-use effects, and how much were more conventional travel choice effects.

The balance of view in the discussion was that the effects of transport policy on journey distance within a given existing land use were bigger than the effects of policy about the location of new development on journey distance – very much so in any given year, though with an increasing buildup of the effects of new development decisions over periods of decades. Although new developments will be small in number in the short run, their characteristics can vary very substantially as between (say) inner city high density regeneration projects with high densities, low provision for car ownership, and an existing pattern of public transport and local amenities at the one extreme, and low density distant suburban developments with high parking provision, good road access, poor public transport facilities, and almost no local facilities at the other extreme, and the journey patterns which follow from each will continue to influence emissions for a very long period into the future.

However, **Alan Wenban-Smith** noted that the indirect influence on patterns of travel of land-use policy for new development may well be more important these small direct effects. A focus on large greenfield developments (such as eco-towns) diverts investment, attention and resources for infrastructure, services and environmental improvement from urban regeneration. Such diversions tend to reduce the relative attractiveness of urban locational choices to those households and businesses that can choose, leading to a more diffuse and polarised pattern of economic activity and settlement within the total stock (existing and new). Such locational choices would increase social polarisation, increase travel demand and reduce the proportion by low carbon modes; this in turn would limit the areal extent and skills depth of the available labour market and thus the realisation of agglomeration advantages – as well as increasing CO2 emissions.

There are complex system and behavioural interactions between land-use and transport policies, some but not all of which are understood (though more are understood than are used in much policy-making). It is likely that low carbon using land use and transport policies which were consistent with each other would result in a synergy or positive feedback, as has been observed in the opposite direction for most of the last century. This would build up to bigger impacts over time. It is almost certain that land-use and transport policies which were inconsistent with each other would be deeply undermined, and with very much reduced effectiveness.

There is a general view of discontent with the quality and salience of the evidence base on this question, partly due to the lack of an overview of very many local experiences which have not been brought together and properly assessed. However, the direction of policy intervention which would be helpful is rather clear. Done well, the view of participants is that the direct land-use effects of 'pure' new development is likely to be rather small, though potentially significantly more in the longer run, but the travel effects of policies favouring more compact travel use patterns of the inherited land uses[2] would be many times larger, and quicker.

Report prepared by Phil Goodwin

[2] Such an approach to planning would also be more consistent with the move from simple 'land-use' to broader 'spatial policy' since 2003: "The Government's policy on spatial planning goes beyond traditional land use planning tobring together and integrate policies for the development and use of land with other policies and programmes which influence the nature of places and how they function." (Planning Policy Statement 11: Regional Planning (2003))