Providing insight into the impacts of connectivity

Large transport projects can have a significant impact on regional economies. Traditional transport appraisal methods provide a reasonable estimate of the quantum of benefits but do not indicate how and where these benefits arise in the local economies. Research has developed two models that can be used alongside more established methods of transport appraisal, to shed light on these distributional issues, as well as indicate where benefits may also be otherwise under-estimated.

The research, conducted by a diverse-membered research team (drawing from local consultants Anthony Byett, Adolf Stroombergen and Richard Paling and James Laird from the Institute for Transport Studies at the University of Leeds) focused on the connectivity aspects of large projects.

What was the research question?

In particular, the team was interested to explore how improved connectivity between regions could lead to benefits beyond the traditionally measured user benefits and how the combined effects of reduced travel time and increased accessibility and connectivity would alter the spatial distribution, especially within a scenario of population growth (p7).

The research question arose from recognition that measuring and predicting the welfare benefits of large transport projects at a regional level can be challenging. The transport appraisal methods in the Transport Agency's *Economic evaluation manual* focus on welfare benefits to transport users, to which some widely accepted non-use benefits are currently added. This focus provides an elegant and widely accepted means to estimate the magnitude of total net benefits but it does not describe the many interactions and choices people then make, and thus does not describe the spatial gross domestic product (GDP) effects. It also risks under-estimating subsequent welfare gains from spatial reallocations of activity.

The study incorporated two models: the gross value added (GVA) model (a macro-economic model that measures growth in the total economy) and a spatial general equilibrium model which is more effective at identifying flows within the economy. Both models are intended to feed information into the Transport Cost-Benefit Analysis framework.

The GVA model largely deals with productivity improvements from improved inter-city access, as well as currently measured intra-city productivity gain. (Note that 'city' in this context encompasses villages, towns, cities, districts and regions.) The model measures productivity in terms of GDP and identifies the industry and location where the productivity improvement, but not necessarily the employment gain, is to be expected.

If a spatial dimension is added, as per a general equilibrium model, a link is made between improving connectivity between the centre and the fringe and between production sites and outlets and increasing total wealth in a district or regional community. To this end a 'spatial computable general equilibrium' model was developed to test the land use change-related benefits of improved connectivity.

Each model was built using assumptions derived from previous local and international research as to why the various effects might occur. Both models were applied in a case study region, representing the combined areas around Auckland, Hamilton and Tauranga cities. The case study involved hypothetical changes to the road network connecting these areas, with associated theoretical reductions in travel times.

What were the results?

The research confirmed that productivity effects vary by industry. In the case study they were concentrated amongst the manufacturing, consumer services, business services and community services sectors. Approximately half this productivity gain was estimated to be the result of better access to airports, although it is possible this effect was due to the proximity of the industries to large cities (which tend to have airports) in general rather than international airports per se.

It also concluded that further increasing monetarised GDP benefits required an additional investment of other factors such as labour, capital and the cost of land development, therefore estimated gains should have costs deducted to ensure estimated benefits were not inflated.

The spatial model represented a 'major innovation', as this was the first time a model of this type, which balanced out prices, productivity and preferences, had been built for New Zealand. The model was built using eight spatial zones, all proximate to Auckland city and airport. It enabled the research team to estimate the spatial and employment effects of transport projects to

improve connectivity – both the direct time savings achieved through the road improvement and the subsequent productivity improvement derived from the GVA model.

At a more general level, the project confirmed transport changes can interact with land use changes to provide benefits that exceed the user benefits represented in standard transport appraisal approaches, even when the wider economic benefit add-ons in the Economic evaluation manual are included. This means there is high potential for the welfare benefits of transport projects that improve connectivity within the regions to be unreported, especially when they occur in the context of growing populations and economies.

When would the models add value?

The research project concluded the two models can be usefully applied to major transport projects. While they are unlikely to shift the current emphasis in transport appraisal away from transport user benefits, they can complement the standard analysis in five ways.

1. The models provide relatively accessible ways to test the likely effects of major projects without the need for extensive traffic modelling. This will be useful in the early stages of business case preparation.
2. The models provide a means of validating the current derived benefit estimates used in transport appraisals, and may lead to an iterative process of improving traffic demand assumptions.
3. The models provide a means of quantifying the benefits associated with land use change.
4. The models estimate the land use and spatial effects from major transport improvement projects. These estimates are unlikely to provide a definitive measure of what will occur, as they are sensitive to the assumptions in the model, but the process of testing within the model will lead to more probing into and understanding of the dynamic effects.
5. The models provide measures of effects that are more likely to be readily understood by stakeholders, such as effects in terms of GDP and jobs.