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Modelling park-and-ride

Understanding multi-modal travel

One of the key transport issues facing Europe, and indeed other parts of the world, is that of increasing congestion in urban areas, a problem exacerbated by heavy reliance on private car use. Park-and-ride has been identified by transport planners and policymakers as one of the many policies that can help alleviate this situation. A park-and-ride policy allows people to use their cars for part of a journey, while completing the rest by public transport. Thus, traffic is shifted from the critically congested urban area to the park-and-ride sites that are distributed on the periphery of the urban area.

RAND Europe's modelling team has significant expertise in modelling the park-and-ride choice as part of the mode choice decisions that people make. Our methods have contributed to the reliable assessment of the feasibility of proposed park-and-ride developments, as well as the growth in demand at existing sites. This brief presents a cross-section of our park-and-ride modelling projects of varying scope and with a range of objectives.

Park-and-ride for London 2012 Olympics

The Olympic Delivery Authority (ODA) jointly commissioned RAND Europe and Atkins to assess demand for designated park-and-ride sites for the Olympic Games in 2012. The ODA's objective is to make the Games venues entirely inaccessible by private car, with the primary modes of access to the venues being train, underground, bus/coach, walk and cycle.

Therefore, as a viable alternative, the ODA is keen to assess the relative value of bus-based park-and-ride sites situated on the periphery of the M25 (the London Orbital route). Coaches plying between these park-and-ride sites and the Games venues can thus constrain the private vehicle traffic to the region outside the M25.

RAND Europe's modelling team was responsible for the development of the park-and-ride model, which was then embedded in a Geographic Information System (GIS) tool developed by our collaborators at Atkins.

Abstract

Park-and-ride schemes can be an effective means of reducing private automobile traffic within the congested centre of an urban area. Therefore, in order to accurately assess the effects of different transport policies, travel demand models must include elements of the park-and-ride choice. RAND Europe's modelling team has significant expertise in the development of park-and-ride models, as a means to assess both the feasibility of proposed park-and-ride developments and the growth in demand at existing sites.

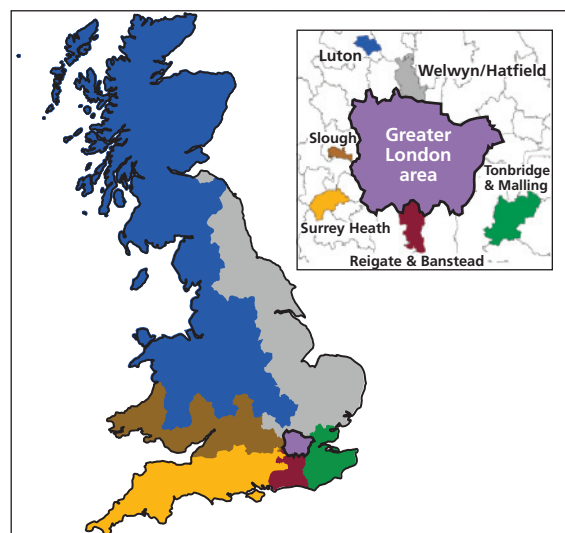


Figure 1
 GIS visualisation of demand allocation to UK park-and-ride sites (identified in inset)

The park-and-ride model is essentially a multinomial logit mode choice model that takes the following discrete alternatives: private vehicle, park-and-ride, chartered coach, tour bus, scheduled bus and rail.

The GIS tool is a spatial database that was developed by Atkins using ESRI ArcGIS technology to 'wrap' together all input data and the mode choice model. The GIS tool not only

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facilitates visualisation at a number of different levels but also enables the analysis of complex spatial interactions. For instance, Figure 1 presents the demand allocation by zone for each selected park-and-ride site.

PRISM

PRISM (Policy Responsive Integrated Strategy Mode) is a transport model developed by RAND Europe for the West Midlands region of the UK. The West Midlands region's transport problems include heavily congested motorways, congestion in the centres at peak times and a great reliance on the car (modal share more than 50%). Park-and-ride was identified by model stakeholders as a key policy issue that could alleviate some of these problems. In response to this concern, park-and-ride was explicitly modelled in PRISM via two linked choices. First, the choice of access mode to public transport was modelled, distinguishing car driver, car passenger and other access modes (including walk, cycle and other public transport modes). Second, for car access modes, the choice of access station was also modelled. The two choices were modelled jointly as illustrated in Figure 2. The structural parameter, θ , represents the relative elasticity of access mode and station choice.

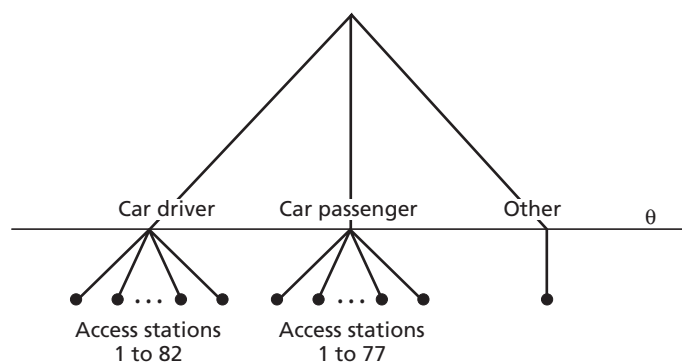


Figure 2
Joint access mode and station choice

By summing the predictions of the park-and-ride models across journey purposes, it is possible to obtain forecasts of demand for each park-and-ride site. In the process of developing this model, RAND Europe researchers also undertook analyses of several dedicated park-and-ride surveys that provide useful insight into the characteristics of park-and-ride users.

ProMiSe

ProMiSe (Prognosemodel voor Middellange termijn Studies) is a forecasting model system for train travel developed for Netherlands Railways (NS). The core of the model system consists of linked main mode choice and train access and egress mode choice models (see Figure 3), together with choice of train services. The access and egress models include the following alternatives: car driver (i.e., rail park-and-ride), car passenger (i.e., kiss-and-ride), taxi, train-taxi (a special service operated in cooperation with NS), bus/tram/metro (BTM) and the slow modes, e.g., walk, cycle and mopeds. Rail park-and-ride choice was modelled as the choice of access mode to the train station.

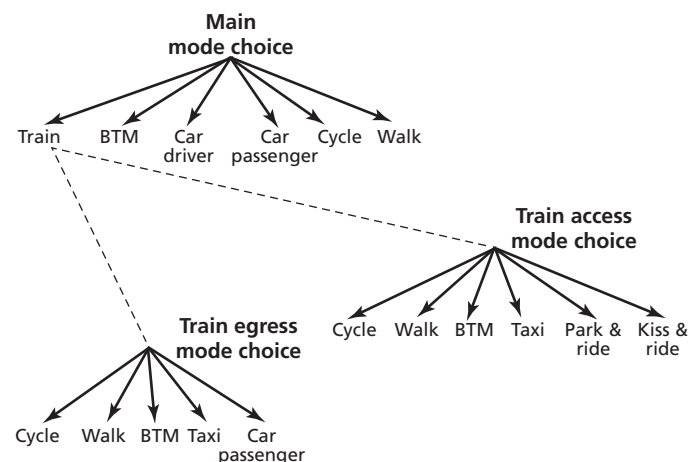


Figure 3
Park-and-ride as a means of train access

In addition to the projects described here, RAND Europe's modelling team has estimated many other such multi-modal models, including a model for Union Railways Limited giving detailed consideration to access to the stations to predict international travel demand for Eurostar trains on the proposed Channel Tunnel rail link.

As evidenced by these projects, as well as the successful park-and-ride schemes currently implemented across the UK in cities such as Cambridge, Coventry, Oxford, Bristol and York, park-and-ride is a key policy issue of interest to planners and policymakers. Clearly, the development of reliable park-and-ride choice models is an important step towards the successful planning and implementation of park-and-ride policies. ■

Further reading:

Cohn, N., A. Daly, C. Rohr, A. F. Dam, W. Oosterwijk, and T. van der Star (1996) 'ProMiSe: Policy Sensitive Rail Passenger Forecasting for the Netherlands Railways', PTRC European Transport Forum.

Fox, J. (2005) 'Modelling Park-and-Ride in the West Midlands Region', European Transport Conference, Strasbourg.

Sivakumar, A. (2007) 'Park-and-Ride Model for London 2012', report prepared for the Olympic Delivery Authority.



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