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The New Airport and its Urban Region: Evaluating Transport Linkages

Luis Ferreira, Nicholas Stevens and Doug Baker¹

Abstract

Privatized airports are emerging as significant transportation and logistics hubs competing with traditional CBDs as activity centres with significant environmental, social and economic impacts. The major implications for transportation planning and evaluation of options have been highlighted as: the difficulty in arriving at an agreed set of relative weights to be attached to each objective; the need to undertake any interface analysis at the regional scale; the need to model the complex nature of the interaction between mixed land use activities within the emerging airport precinct and the supply, pricing and regulation of the relevant transportation links; and the relevance of 'option value' concepts when evaluating transit access to airports.

Keywords: airport strategic planning; travel demand modeling; freight planning.

Introduction

International airports have globally emerged as critical transportation and logistics hubs that provide key gateways for national and regional economies. Modern airports are rapidly emerging as portals for regional and national economic growth both in Australia and abroad, with dramatic transformations of the areas around them, Abbot and Wu (2002) and Graham (2003). They have become privatised, sub-regional activity centres characterised by growing complexity in land use, infrastructure, transport and stakeholder relations, with significant environmental impacts and sustainability concerns.

These 'new airports' have the potential to become cities in which the layout, infrastructure and economy are centered on a major airport. Kasarda (2001) recognizes this urban form as the aerotropolis and argues that the airport is the next hub for development with *accessibility* being the future driver for business location and urban expansion. The successful operation of the new airport hinges on the land based access and its critical relationships with the urban or regional periphery. World trade in services, information and knowledge has redefined the role of the region, and many regions now have access to world-scaled trade because of airport transportation hubs.

¹School of Urban Development, Queensland University of Technology, PO Box 2434, Brisbane, Queensland, 4001, Australia.

As Feldhoff (2003) notes, an airport's position in the transnational airport hierarchy is not only decided by the size of the region's population but also "the combination of a city's economic functions" with the airport's infrastructural efficiency.

Airports and their surrounding commercial districts are playing an increasingly important role in shaping urban and regional growth patterns. The "airfront" is a term used to describe the wide range of commercial, industrial, and transportation facilities intrinsically tied to the airport. Blanton (2004) outlines several requirements for an effective "airfront" district including, efficient land based transport access, with the surrounding district and regional centres, provided for through comprehensive planning of land use, environmental and transportation systems. Walker and Wijnene (2006) describe the main components of a decision-support system for strategic planning of the emerging airport based on policy analysis principles. Stamatopoulos et al. (2004) deal with tools to plan airside demand and supply at the strategic planning level.

This paper is organized as followed: The next section deals with the implications of the emerging airport for transport planning. This is followed by a discussion of the ways in which land based transport access infrastructure and policy options need to be evaluated within a system-wide approach. The main issues canvassed relate to setting objectives for evaluation purposes; undertaking regional network-wide analysis and landside transportation demand analysis; the use of multi-modal evaluation methodologies; and the use of 'options' value in transit evaluation.

Implications for land based transport planning

The airport can no longer be managed in isolation from the metropolis that it serves and airport impacts now pose considerable challenges for both airport operators and the surrounding urban and regional environment. The range of impacts, interactions and conflicts between airports and their regions, concerning land based transport planning can be conceptualised as *interfaces*. Four interface domains are recognised as integral to the development and evaluation of transport linkages of the new airport, namely: economic development; land use; infrastructure and governance.

Economic Development occurs in the airport and its host region as a result of airport-centric activities. The 'region' is seen as the areas within reasonable airport access for person and freight trips. *Land Use* involves the geographical/geophysical resources of the airport and the region. Land use has both social and biophysical environmental impacts managed by the use of local; regional land use and transportation plans and airport master plans. *Infrastructure* includes those transport links which have local and regional access significance. *Governance* refers to both legislative arrangements and institutionalised processes. The fact that many players have a stake in the outcomes of transport linkages has implications for the evaluation of options.

The emerging airport is a large attractor/generator of trips, with time sensitive, high value and perishable attributes. If transport linkages allow the movement of people and goods further and faster, we are in essence increasing the airport catchments. This may have significant environmental impacts at both the local and

regional levels, including the availability and value of land. The evaluation of transport linkages will allow an understanding of these network wide impacts by all stakeholders.

Changes in the intensity of land use and infrastructure, may occur very quickly as a consequence of the external environment (eg: fuel costs, economic performance; etc.) although the planning and the provision of both happens over long time horizons. The resilience of a network to change, or impact, is an increasingly important focus of evaluation. The evaluation of the security of transport linkages is the capacity to identify, assess and respond to possible emergency, crisis, and disaster events with significant potential to disrupt the flow of goods and services. There is a need for the assurance of continuity in supply chains and generic capacities to withstand disturbance, yet remain functional. Strong evidence exists internationally that, as airport-related networks expand in size and interactive complexity, they become more vulnerable to catastrophic failure, which is often triggered by small and seemingly insignificant disturbances, Lagadec (2004).

Evaluating Future Transport Options

Setting objectives. The difficulty in arriving at an agreed set of relative weights to be attached to each objective is compounded by the multiple stakeholders involved. For example: airport operators; airlines; airport precinct tenants; community; governments (at local and regional levels); transit operators; private road toll operators; and other road infrastructure managers. Some objectives are common to all players (e.g: grow the regional economy and minimise environmental impacts). However, the weights attached to each objective by individual players are likely to differ. Other objectives may be conflicting (eg: road toll operators aim to maximise revenue; local community aim to minimise road traffic at local level; private airport operator aims to maximise revenues from non-aeronautical sources such as parking fees). There is a potential to develop a multi-level, multi-actor model using new approaches such as multi-agent modeling, Henesey et al. (2003), Ho et al. (2003), and Davidson et al. (2005).

Landside Transportation Demand Analysis. Figure 1 shows the main elements present when estimating airport precinct transport demand. A land use/transport demand model needs to be built using a conventional strategic transport modelling approach adapted to suit airport-urban region transport and land use interaction. This model should comprised both passenger and freight demand as shown in Figure 1. The approach will require an innovative way to modelling the interaction between: (a) land use activities within the airport precinct; (b) the land use configuration within the surrounding region; and (c) the levels of service provided by the transportation networks linking the airport with its region. The results of trip generation surveys of land use activities within the airport precinct need to be used to calibrate appropriate trip generation models for person movements, as well as for freight related trip demand. Freight modelling continues to suffer from a lack of adequate disaggregated data on trip generation rates by activity; commodity; vehicle type and time of day, Pan (2006); Fisher and Myong (2001).

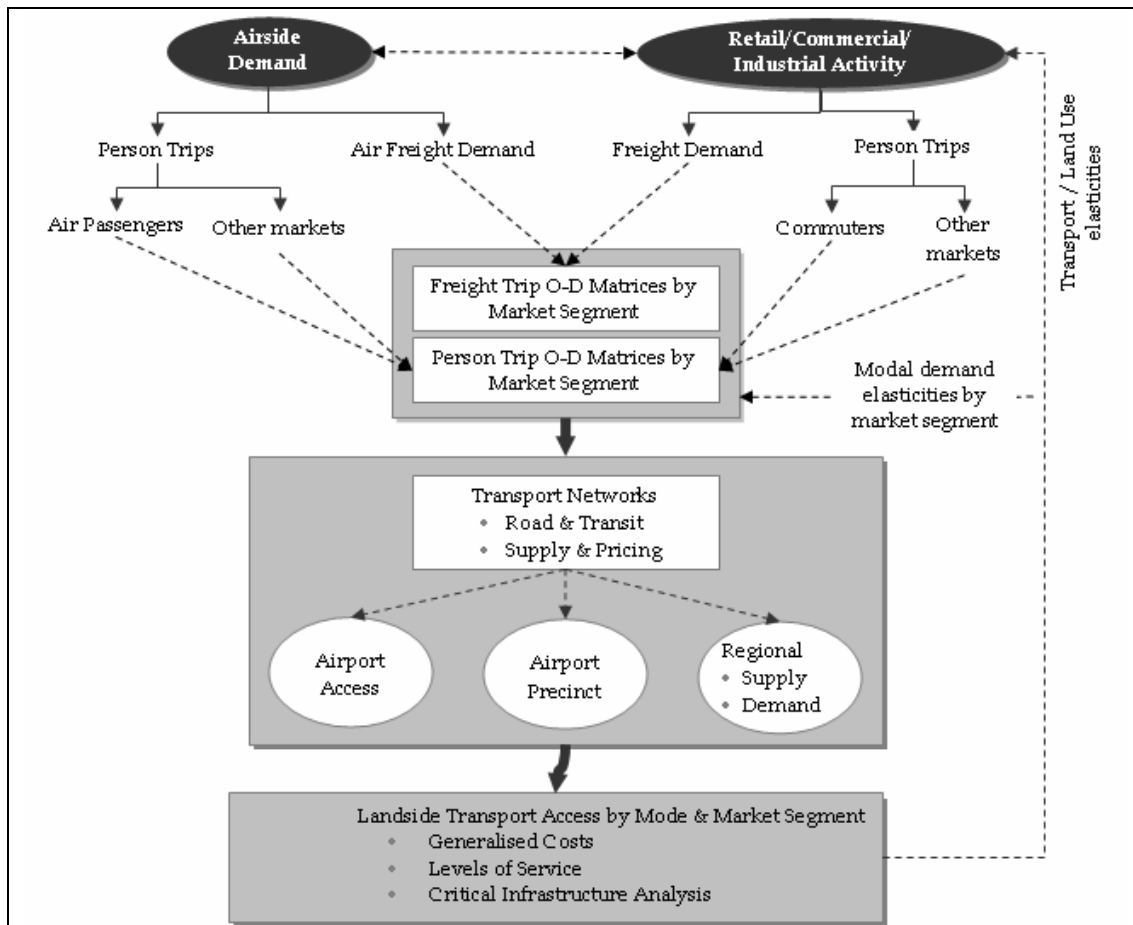


Figure 1: Modelling airport transport linkages

A critical modelling issue is:

How will changes in the attributes of transport networks influence the type of, and the rate of change in, land use activity patterns in the new airport precinct?

For example, major road projects in Brisbane in next 5 years close to \$A5B have the potential to impact directly on airport landside accessibility in terms of travel times and reliability of arrival times. The projects, which are currently in the planning stages, are already having an impact on location decisions of firms. The area in the vicinity of the airport has one of the fastest growing industrial activity nodes in the region. Past attempts at modelling the interaction between land use and transportation networks have produced rather data intensive models Wadell et al. (2006); Badoe and Miller (2000). Such models are less likely to be used when a scenario testing of broad strategic options is being considered. In such cases, the feed-back between transportation networks and land use activities may be modelled through the use of a transportation demand modelling approach used iteratively with appropriate elasticity factors land use inputs.

It will be necessary to model the choice of mode for passenger trips, as well as the choice of vehicle type and hours of operation for freight flows to/from the airport precinct.

As transportation options to reduce existing reliance on private car trips to access the airport precinct will need to be evaluated, it will be necessary to model the elasticities of demand for the different market segments, with respect to public transport levels of service including cost and frequency, Gosling (2006) and Mandl et al. (2000).

Regional Network-wide impacts. In the presence of a wide area for airport transport access ‘footprint’, it is important that activity/transport scenario evaluation is undertaken at the regional scale. For example, in the case of the Brisbane airport, the weighted average rail passenger distances vary from 18 kms to the CBD to almost 90 kms to the outer Gold Coast area; with an average distance in the suburban area of 35 kms., Ferreira and Charles (2006). Those authors report on the road network impacts of Brisbane airport rail passenger operations. The likely avoided CO₂ emissions and road crashes in South East Queensland were quantified.

In terms of the potential impact of airport land use/transport options on the wider urban transport networks, it is important to undertake the analysis by time of day, if congestion effects are to be captured. As seen in Figure 2, the daily peak periods rail passenger access to/from Brisbane airport coincides with the general peak period for the urban road and transit networks. Therefore, the use of transit as an alternative to car based person-trips, has the potential to reduce demand for road space on the wider urban network during those times when volume/capacity ratios are approaching or exceed saturation levels.

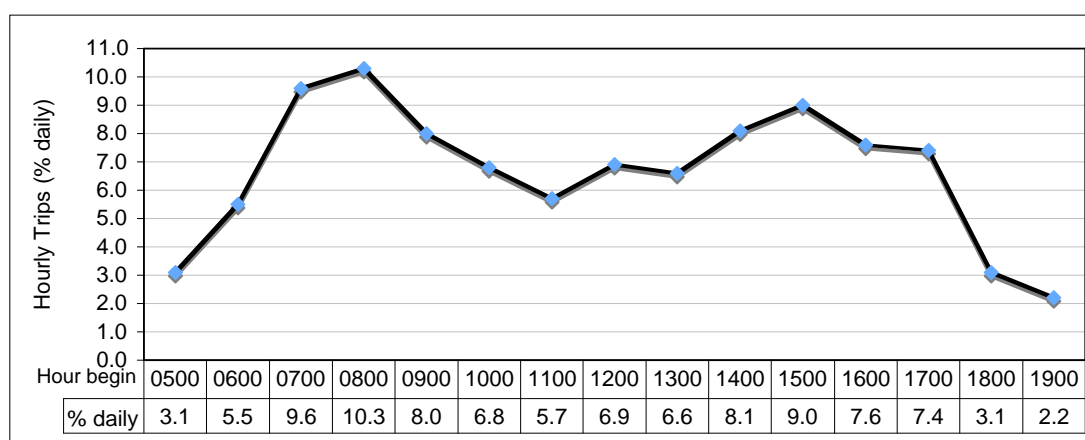


Figure 2: Hourly Distribution of Rail passenger Trips – Brisbane Airport

Multi-modal approach to evaluation of transport options. Most transport options to improve access to airport focus on the road network. However, transit related options to achieve environmental sustainability and other objectives, need to be assessed as part of overall scenario testing. The issue of interrelated benefits from transit and road network projects is of particular relevance when evaluating transport options. It is possible to arrive at a set of road network measures which may negate some of the benefits from transit initiatives. Given the cross-elasticities of demand for urban trips between modes, we cannot easily isolate components of an overall transport strategy and evaluate them separately. For example, in the case of Brisbane airport access by

rail, the recent growth in passengers carried shown in Figure 3, may not be sustainable if proposed new major road projects are able to significantly alter the relative perceived generalised cost for competing person trip markets.

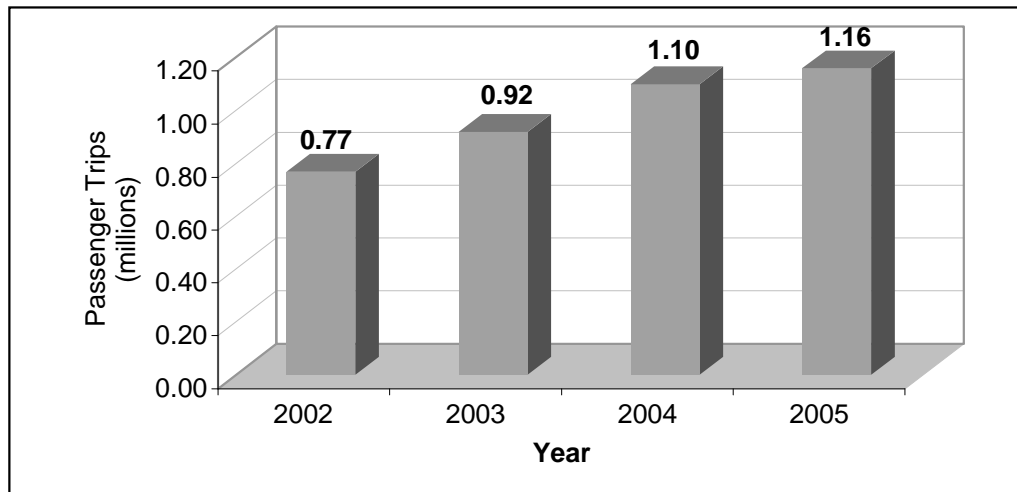


Figure 3: Airtrain Annual Passenger Trips [source: Ferreira and Charles (2006)]

The use of ‘option value’ concepts in transit evaluation. Airports are particularly vulnerable to disruptions to movement on the major access transport links (complete closure or major delays for extended periods). Major traffic incidents result in a loss of network capacity, which restricts mobility and access, and causes congestion, Charles and Ferreira (2006) and Ferreira et al. (2006). With limited access points to the airport by road, traffic incidents on key connecting roads can have a dramatic impact on access to the airport for air passengers.

Reliability of travel is a critical factor in selecting the mode of transport, hence the cost and reliability of freight and passenger transport. There is evidence that unexpected delay should be valued significantly different from average travel time valuations (eg: values of between 2.5 and 5 times in-vehicle travel time has been used, Ferreira (2005)).

The so called ‘option value’ may be relevant if a transit service provides potential users with the option of using it if they choose to do so. Such a benefit is associated with the unexpected use of the system and it has been measured through the willingness to pay to have the option of using the new system. UK research in the early 1990’s has found non-users of the systems to have significantly lower option values than regular users, Bristow et al. (1991) and Crocket (1992); guidance on quantifying option values can be found in TAG (2004). More recently, methodological and empirical evidence has been provided by Humphreys (2004) and Geurs et al. (2006). In the case of airport passenger rail operations, the option of being able to use the service in an emergency (eg: when a major incident on the critical airport access road links), is likely to have significant value for those currently using car as the main mode for airport access trips.

Conclusions

The paper has identified the characteristics of a rapidly emerging trend for airports to become significant transportation and logistics hubs that provide key gateways for national and regional economies. Privatized airports are competing with traditional CBDs as sub-regional activity centres with significant environmental impacts and sustainability concerns.

The major implications for transportation planning and evaluation of options to manage the interface between the airport and its urban region, have been highlighted as:

- The difficulty in arriving at an agreed set of relative weights to be attached to each objective given the multiplicity of stakeholders involved;
- The need to undertake any interface analysis at the regional scale given the presence of a wide area of influence for the airport transport access 'footprint'.
- In terms of the potential impact of airport land use/transport options on the wider urban transport networks, it is important to undertake the analysis by time of day, if congestion effects are to be captured.
- The need to model the complex nature of the interaction between mixed land use activities within the emerging airport precinct and the supply, pricing and regulation of the relevant transportation links;
- The lack of research into the freight trip generation and attraction components of demand, in relation to the types of mixed use development at airports;
- The need for multi-modal approach to option generation and evaluation. Transit related options to achieve environmental sustainability and other objectives, need to be assessed having regard to the interrelated benefits from transit and road network projects;
- The relevance of 'option value' concepts when evaluating transit access to airports with their vulnerability to disruptions to movement on the major access transport links (complete closure or major delays for extended periods).

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