



**CBD – Airport rail access: institutional arrangements and decision making**

**Freida Scott**  
*State Rail Authority*

**John Black**  
*School of Civil &  
Environmental Engineering  
University of New South Wales*

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**Abstract:**

An on-going research study into the communication strategies adopted by airport management, as part of an international benchmarking study undertaken for Sydney (Kingsford Smith) Airport, has identified noise, air pollution and ground access as the “big three” issues. Transport to and from the airport is an essential component of air travel, but until recently rail planning has been viewed somewhat independently of strategies for hub airports and airport expansion more generally. Rail has not been integrated with air transport into a “seamless”, multi-modal transport system.

This paper reports on the results of a survey of railway operators and airport authorities. Fifty-nine airport-CBD links have been identified worldwide and a two-stage, mail-out questionnaire survey has been piloted and implemented. The characteristics of rail operations linking airports with their urban hinterlands are described. Connectivity, interchange, accessibility, market potential and the existence of competing modes are critical success factors. Institutional arrangements and decision making frameworks for new airport rail infrastructure are examined in the context of external factors, such as globalisation, corporatisation, competitive privatisation and sustainable transport systems.

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**Contact author:**

Prof John Black  
Professor of Transport Engineering  
School of Civil & Environmental Engineering  
University of New South Wales  
SYDNEY NSW 2052

Telephone: (02) 9385 5018

Fax: (02) 9385 6139

Email: [j.black@unsw.edu.au](mailto:j.black@unsw.edu.au)

## Introduction

Globalisation of economies is one factor forcing major cities to be more internationally competitive. Air traffic congestion and difficulties accessing airports have therefore prompted interest in ground access, especially the role of rail systems. Ground access to airports, together with aircraft noise and emissions, this has become one of the major issues surrounding airport expansion (Bellomo-McGee Inc 1996 pp 15-18). More people travel by air, and travel further. However, airport ground access is provided "piecemeal" (Nijkamp, Vleugel, Maggi, Masser 1994 p 71): historically, each transport access mode has been viewed somewhat independently by transport planners. Surface transport systems that serve the airports are not necessarily keeping up with the projected demands for air passenger travel (Ellis 1993). Furthermore, some governments, national and local, are questioning the sustainability of unconstrained road building and are instead promoting public transport (for example).

This trade-off between economic, social and environmental costs of providing more airport facilities and fast railway transport and other ground access modes is becoming of increasing interest, particularly in Europe, but also in other parts of the world. Rail transport, in addition to its competitive role with air transport up to distances of about 350 km (Nijkamp *et al* p 71), is also seen as part of a complementary multi-modal "seamless" transport network, by linking cities and air terminals. Rail has the potential to augment existing road and air transport networks, offering congestion relief on established links.

Surprisingly, little systematic information is available on planning and decision making associated with airport rail links. A research study was designed to identify and survey rail and airport operators in cities where there is a CBD - airport rail link with particular reference to investment decisions. This paper first outlines the literature on the topic of CBD - airport rail links before describing the changing institutional arrangements from the modal "insularity" approach to more integrate approaches, such as that promoted in the USA under the ISTEA Act. The research reported here aims to provide a description of CBD - airport rail characteristics, based on a survey instrument administered to over 100 airport and railway operators worldwide. Critical success factors are discussed and key decision making criteria are presented, based on the institutional interests of airport managers and rail operators.

## Literature on CBD - Airport Railway Links

The identification of systems with air and rail inter-modal facilities is problematic. City centre (CBD) - airport rail links are defined as those links which have airport rail stations within a reasonable walking distance (800 metres or less) or the airport terminal buildings or a rail station which is connected by free shuttle bus services operating at regular intervals. There is no authoritative source on CBD - airport railway links. *Jane's Urban Transport Systems* (Bushell 1994) is probably the best reference. A useful book is the irregular editions produced for travellers on how to get to and from airports of the world (Crampton 1989). Definitions of what constitutes a CBD - airport rail link

are ambiguous. Whilst rail can be identified from *Jane's Urban Transport Systems* (Bushell 1994) the distance from the rail station to the airport terminal varies from stations located in the airport terminal building to 24 kilometres away (New York - Westchester County Airport near White Plains). Bus services operate to/from the airport from the rail station at 12 out of 59 of these systems, ranging from free, frequent, shuttle buses covering a short distance, to less frequent buses over longer distances with an additional fare. For example, San Francisco International Airport is currently linked to the nearest BART railway station at Colma by a bus taking about a half an hour ride with a single, directional fare of \$US1 00 (in 1996 prices).

Given the potential of rail as an access mode, it is surprising that no comprehensive comparative survey of CBD - airport rail links has been published. The Airport Regions Conference - a Pan-European network of regional councils founded in November 1995 - recognise this issue and are currently studying access transport characteristics at 17 member airports (de Ryck and Jones 1998). Results from their surveys reports are anticipated later this year. Research by Netty (1995) aimed to identify ground transport problems at US airports and the viability of integrating multi modal surface transport with air transport. Field surveys of airport patronage were conducted in August 1993 at Houston International Airport, Dallas - Fort Worth International Airport, William P Hobby Airport (Houston) and New Orleans International Airport. A total of 784 useable questionnaire forms were completed by respondents. The majority were airline passengers (75 per cent). A question was included to determine if patrons would use mass transit services if they were available at the four airports. Indicative modal diversions (which appear to us to be high) from existing modes to a mass transit system are: 73 per cent at Dallas - Fort Worth; 62 per cent at William P Dobby; Houston' and 19 per cent at Houston International.

Airport managers have commissioned numerous consultancy studies of airport ground access. The study by Negrette and Brittle (1974) for the Metropolitan Transportation Commission of airport accessibility in the San Francisco Bay Area is one early example; the recent ground access study by Sinclair Knight Merz for Sydney (Kingsford Smith) Airport is another. Such applied studies typically include mathematical modelling of mode choice using revealed preference or stated preference techniques; see, for example, Yai, Morichi and Iwakura (1993) for a nested logit model applied to ground access in the Tokyo metropolitan region and the general review of patronage techniques by Lunsford and Gosling (1994). Several case studies of initiatives to increase rail patronage to airports are available - for example, the fly/rail baggage service operated by the Swiss Federal Railways and Swissair (Jud 1994) or the development of promotional programs (Foote, LaBelle and Stuart 1997) for rail in Chicago serving O'Hare Airport (Blue Line) and Midway Airport (Orange Line).

The literature offers little guidance to decision makers on the reliability of estimates of modal diversion to new rail systems. Comparative data are available for selected European airports (Table 1), although this is not based on a published source. Comparative data on rail modal split at airports with a connecting service to the city centre is only of limited value. The information dates rapidly. Passenger survey techniques and sampling procedures differ. However, the proportions of passengers

using rail - from a low of 12 per cent at London Stanstead Airport to a high of 35 per cent of passengers at Geneva Airport - provide indicative modal shares for a range of rail operating environments in Europe. The report by de Ryck and Jones (1998 p 8) on London Heathrow, London Gatwick, Amsterdam Schiphol, Paris CDG and Paris Orly point out these airports with rail links "still only achieve shares of 9% to 25% rail usage".

**Table 1** Passenger modal split (percentages) at selected European airports, 1992-1993

Airport	Private Cars %	Taxi %	Coach/Bus %	Rail %	Other %
Amsterdam	53.7	11.8	5.2	25.2	4.0
Frankfurt	57.0	14.0	4.0	23.0	2.0
Geneva	35.0	20.5	9.5	35.0	1.0
Gatwick	51.6	9.3	11.7	24.2	3.2
Heathrow	42.1	19.9	13.4	20.2	4.3
Munich	45.4	8.0	11.0	30.2	5.4
Paris CDG	34.0	40.0	13.0	13.0	0.0

(Source: Steve Kanowski, pers. com.)

Given the heavy capital and operational expenditures associated with rail transport as a means of accessing major airports, analytical tools and data resources are required to perform the various studies - air passenger surveys, groundside transport system operational data, access mode choice models and simulation and traffic flow and parking models. Gosling (1997 p 17) concludes that airport ground access planning has received relatively little attention from transport research funding agencies. Following a workshop sponsored by the US Federal Aviation Administration, a research agenda was formulated with programs that varied from documents to explain the importance of effective multi-modal planning, to the relationship between the stakeholders involved in developing analytical techniques. The need to provide policy guidance at different institutional levels was a recurrent theme in several research programs.

### **Institutional Arrangements**

The provision of transport access to major land uses has traditionally been regarded as the responsibility of the government. Road, rail, bus and tram services have been provided by government departments pursuing their own long-term capital development planning. Despite attempts at "comprehensive" land use and transport planning in major cities of the world from the 1950's onwards, institutional arrangements in most cities, including those in Australia, were best described in terms of "modal insularity". The transport planning relationships between the airport and its surrounding urban region have historically been weak. For example, progress with the findings of transport studies conducted in US cities confirms that ground access to airports was not seen as a special issue. *Transportation and Parking for Tomorrow's Cities* (Wilbur Smith and

Associates 1966) is an in-depth study of more than 200 US metropolitan regions focussing on the changing metropolis and its multi-modal transport requirements. Airport parking amounts to two pages in a report whose main body consists of 283 pages

It took another thirty years for the Federal Highway Administration to combine forces with the Federal Aviation Administration to produce a planning guide on inter-modal ground access to airports (Bellomo-McGee 1996). The study was prompted by the 50 per cent growth projection in total passenger airport enplanements between 1995 and 2005 and the increased problems for groundside facilities - off-airport access roadway congestion at passenger terminal buildings. Importantly for the arguments of this paper, the planning guide identifies institutional roles and responsibilities with its main purpose "...to aid practitioners in building partnerships between on- and off-airport planning and activities" (Bellomo-McGee 1996 p 19).

Globalisation of economies has stimulated a demand for passenger and freight through major airports. Hub-and-spoke airline networks, and their associated implications for the growth of major airport hubs, have concentrated traffic at selected locations. Airport management - once the preserve of government departments - has become more commercial. There has been a clear pattern of development with the corporatisation and the privatisation of airports. Correspondingly, the private sector is increasingly involved in building, operating and owning major urban transport infrastructure. To secure better working relations between airport management and ground access, the International Air Rail Organisation was formed recently as an industry lobby group. Membership benefits include access to best practice and access to task forces working on key problem areas. Thus, after a long period of stability, the institutions responsible for airport rail access are in a state of flux, and our survey has been conducted during this period of transformation.

### **Questionnaire Development, Administration and Response**

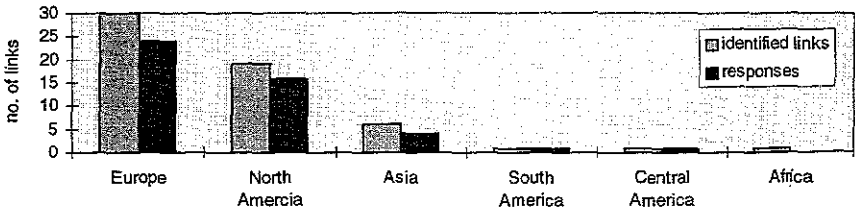
The two-stage questionnaire was formulated following a pilot survey of the draft instrument. A list of questions about CBD - airport rail access was prepared and discussed with a panel of consultants, academics and railway operators in Sydney. The majority of panel members had a direct involvement in the development of the New Southern Railway - a link from the Sydney CBD to Sydney (Kingsford Smith) Airport, now under construction, and due to commence operations in the year 2000. Four broad topics were included for comments by the expert panel: (a) factors considered in the decision to provide rail access from the city to the airport; (b) sources of funds for construction; (c) information on CBD - airport operations; and (d) critical success factors for CBD - airport rail links. From those discussions, an overall strategy for gathering primary data for empirical CBD - airport rail links was developed.

This strategy included a two-stage questionnaire addressed to railway operators and to airport authorities. The first stage concentrated on CBD - airport rail link characteristics (fares, frequencies, travel times, route distances and so on). The second stage explored how the investment decision was made, sources of funds for construction and operation,

and the factors considered important for a link to be successful. The first-stage questionnaire was posted to railway and airport operators for 59 central business district (CBD) to airport rail links. These links were identified from *Jane's World Railways* (Abbott 1993), *Jane's Urban Transport Systems* (Bushell 1994), and a book for travellers on how to get from the airport to the city (Crampton 1989). Only those links identified as existing or under construction were included in the survey. Railway operators and airport operators received slightly different questionnaires as appropriate for their institutional responsibilities. The total number of questionnaires mailed out was 118.

Of the 118 questionnaires sent out 59 responses were received (a 50 per cent response rate). Additional construction (under way or proposed) on the Dusseldorf, London - Heathrow, New York - JFK and Zurich links were identified. Four railway operators indicated that no CBD - airport link existed in their city.

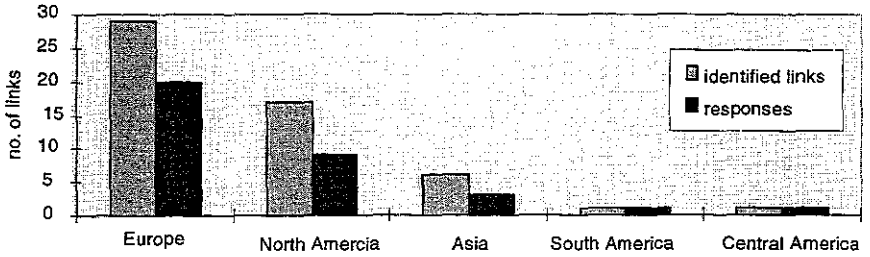
The locations of the city to airport rail links, either operating or under construction, are shown in Figure 1. 24 (52 per cent) of responses are from Europe; 16 (35 per cent) from North America; 1 (2 per cent) from Asia; 1 (2 per cent) from South America; and 1 (2 per cent) from Central America. The question arises whether respondents have different characteristics than those who did not respond to the survey. If non respondents are similar to survey respondents, non-response bias should be minimal. We examined the question in terms of two criteria: the geographical location of respondents, and the distance from the CBD to the airport. No obvious bias on these two criteria were detected.



**Figure 1** Response to first-stage survey of CBD - airport rail links by region

The second survey of airport and rail operators involved 54 systems. The mailing list was prepared from the links identified from the first stage, and altered as appropriate to add one system (Zurich) and to delete six systems (Calgary - Calgary International, Moscow - Domodedovo, Moscow - Sheremetyevo, St Petersburg - Leningrad Pulkovo, Toronto - Lester B Pearson International, and Tunis - Cherguin II). Of 108 survey forms mailed, 40 responses were received - a 37 per cent response rate. Of the responses to the second survey, airport and railway operators responded equally. Of these, seven indicated that the information requested was not known, one indicated that airport passengers were not significant on the CBD to airport railway link, and one indicated that the service does not presently operate. 58 per cent of the responses were from

European links, 26 per cent from North America, 10 per cent from Asia. The remaining responses were 1 from Central America and 1 from South America (Figure 2).



**Figure 2 Response to second-stage survey of CBD - airport rail links by region**

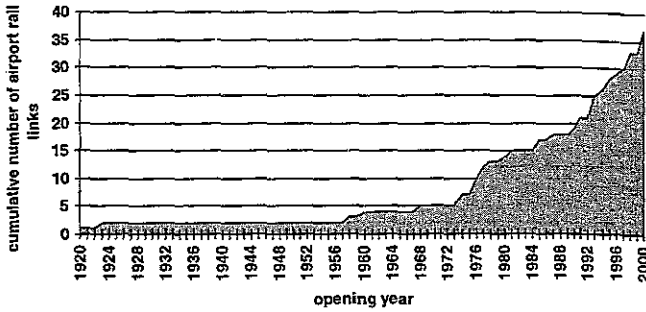
In this second stage, airport operator and railway operator questionnaires were worded differently. Table 2 shows the broad elements of each survey. Airport operators were asked about ground access by transport mode. Railway operators were asked about train service characteristics. Both were asked about sources of funds for construction and operations, the factors which were considered in the decision to construct such a link, and which factors they consider critical to the decision.

**Table 2 Second-stage survey of CBD - airport rail links: information sought from airport and railway operators**

Type of information	airport operator	railway operator
Airport ground access mode split	y	
Rail patronage from city to airport		y
Characteristics of rail station in city		y
Characteristics of rolling stock		y
Funds for construction	y	y
Funds for operation	y	y
Decision making factors	y	y
Critical success factors	y	y

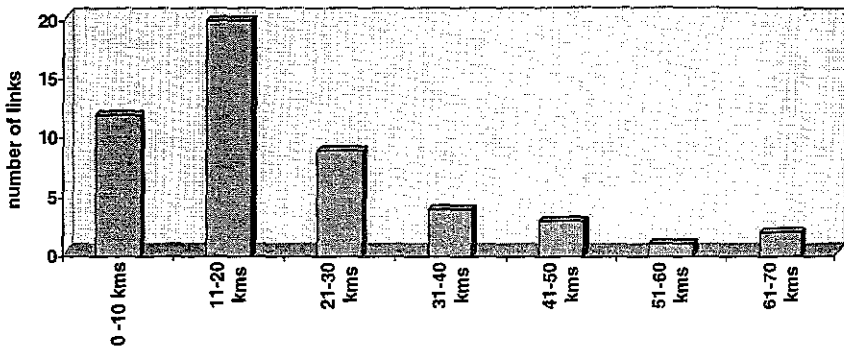
**General Characteristics of CBD - Airport Rail Links**

Information on existing CBD to airport rail links can be used to draw some conclusions about the general characteristics of these transport links and on which factors are important for a link of this type to be successful. Figure 3 plots the cumulative number of links by year of opening. The type of rail technology does not appear to be associated with the year when operations commenced. A combination of heavy or light rail modes is used by 12.5 per cent of rail operator respondents. Three quarters of the respondents use heavy rail. The remaining 12.5 per cent of rail operators use light rail systems. Rail systems have expanded primarily during the last twenty-five years.



**Figure 3** Cumulative number of CBD - airport rail links by year of opening

Distance from the city centre to the airport varies from 3 kilometres for Boston - Logan International to 68 kilometres for Tokyo - Narita. The majority of systems (almost 70 per cent) cover distances of less than 20 kilometres (Figure 4).



**Figure 4** Number of CBD - airport rail links by length (km)

Several cities with CBD to airport rail links have multiple airport and city centre connections by rail transport. Baltimore, Washington DC, Berlin, Chicago, London, Paris, New York (JFK, La Guardia, Newark, Westchester County), San Francisco (Oakland) and Tokyo (Haneda, Narita) fall into this category. Most airport rail links are part of a larger metropolitan rail network. Of systems responding to this question, 69 per cent do not use special purpose rolling stock. The links that do, or plan to, use special purpose rolling stock commenced operations no earlier than 1991 (Paris - Orly).

The connection between number of passengers through the airport and the presence of a rail link is not clear. There is a wide range of passenger numbers for responding airports. All airports handle international flights except Westchester County Airport. It is reasonable to hypothesise that international air passenger traffic is a positive indicator for a rail transport link. International passengers include a higher proportion of tourists,



who may be more likely to use rail transport. Domestic terminals, on the other hand, would handle more local business people, who would tend to use taxis or their own private or company cars for ground access.

### Critical Success Factors and Decision Making

The second questionnaire probed success factors and decision making processes. Desirability of a CBD - airport *rail* link, however, can be gauged by a comparison of mode-specific factors. Some of the factors that are thought to contribute to the success of CBD to airport rail transport have been outlined in Niblett (1995), Sproule and Mandalapu (1992), Mandle (1994), and de Neufville (1976) and can be summarised under four broad headings: (a) transport market potential; (b) existence of options; (c) service characteristics; and (d) interchange and accessibility.

Our survey asked respondents to choose the five most important factors contributing to the success of a rail link, from a list of potential factors based on previous research. Of the four broad headings for critical success factors, transport market potential, existence of options, and interchange and accessibility are the leading factors chosen by respondents. Notwithstanding access conditions at any airport being somewhat unique, the following factors are likely to contribute to the success of a CBD - airport rail link:

- high population densities and well developed metropolitan transit network;
- airport located relatively far from city;
- rail line can be used by commuters, airport workers, as well as other non airport travellers; and
- airport rail station is easily accessible - ideally in the airport terminal.

#### Transport market potential

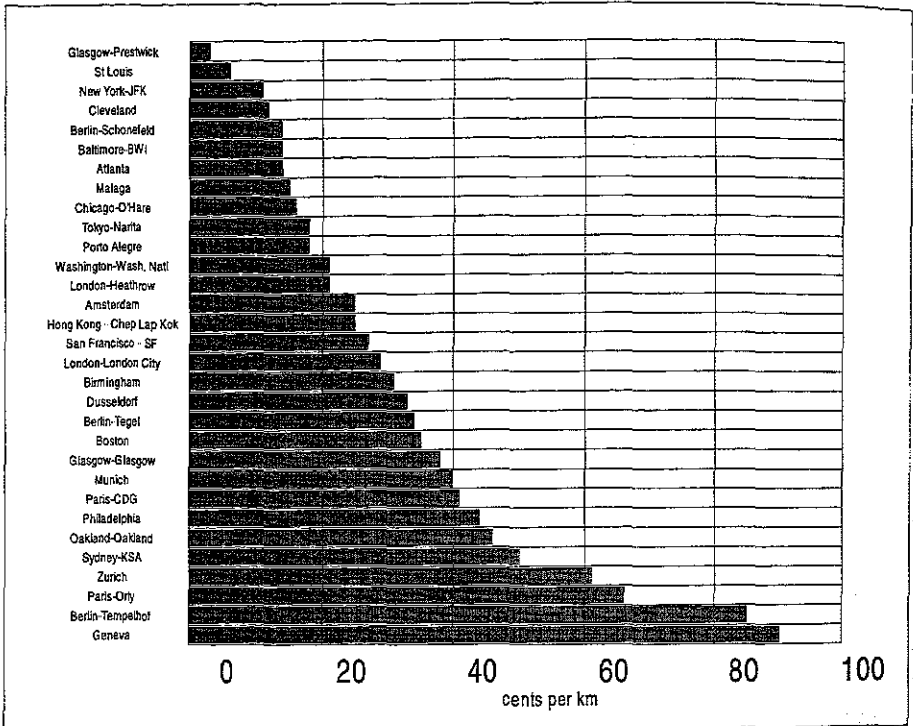
"Existing passenger demand for ground transport from the city centre to the airport" was one of the top critical success factors chosen by respondents. Greater land use activity means greater transport activity and larger transport networks. A threshold population level is probably needed to create the conditions which will make a CBD to airport link commercially viable. The potential market, measured by the regional population, must be large enough to warrant such a transport link. Of the metropolitan area populations of the regions which were identified as having CBD - airport rail links, 75 per cent have populations of 1 million or more. In addition to an assessment of the existing passenger demand for ground transport from city to airport, potential growth in the overall air transport market should also be considered.

#### Travel options

"The cost of alternative ground transport, including fares, travel and waiting time, parking fees and so on" was among the top success factors chosen by respondents. Success of a CBD - airport rail link depends in part on alternative ground transport. Some factors which favour private vehicle use are in congested city to airport road

conditions; ample parking in both the city centre and the airport, which is provided at relatively low cost. Road based public transport modes other than private vehicles would be favoured if roads are uncongested, but there are restrictions (in terms of availability or cost) on private vehicles parking at either the CBD or the airport.

Fares are often given importance in the success of a transport link, and are a component of the generalised costs of travel on which travellers base mode choice decisions. Expressing fares on a cents (in Australian currency) per kilometre basis for CBD - airport links, our survey revealed a wide range from 2.7 cents/km (Glasgow) to 85 cents/km (Geneva), with a median value of about 30 cents/km (Figure 5).



**Figure 5 CBD - airport rail fares in Australian cents per kilometre**

Faster rail travel time over other ground access modes is also an indicator of success. "Rail travel time to the city centre, when compared with other transport modes" was also chosen as a critical success factor by respondents. The slowest trip for identified CBD - airport links which are operating or under construction is Berlin CBD to Tempelhof Airport; the fastest is the proposed Kowloon to Chep Lap Kok Airport in Hong Kong. The majority of European and Asian links offer faster ground access via rail. On the other hand, relative speeds on the North American links do not clearly show rail as the faster ground access mode, where four out of nine North American links offer faster ground access via road.

Interchange and accessibility

Survey respondents also nominated interchange opportunities and accessibility as critical for success. Measures for this include the location of the rail station at the city centre and the airport, the number of rail stations passengers can reach without changing trains, and the number of stops between the city centre and the airport.

Other factors which enhance passenger accessibility, and possibly the eventual success of the CBD - airport link, are the provision of directional signs and the provision of information about the city transport system. Rail stations which are incorporated into air terminals will be more accessible and more highly patronised than those located at greater distances. Airport shuttle bus services would overcome part of the increased difficulty of changing from train to air mode, but the additional mode change is likely to inhibit patronage.

How many passengers will take the rail trip from the airport to the city also depends on origin and destination choices. Not every traveller will wish to go to the centre of the city. However, passengers may wish to connect with rail services to the city if they are available. The number of stops between the CBD and the airport is a rough guide to how many interchange possibilities there are for prospective passengers. Examples of links and the number of possible rail interchange points are shown in Table 3. On the other hand, frequent stops mean longer journey times. The Tokyo - Narita link offers express services, although other services are available. Express services are a refinement of services with more frequent stops, and can be taken as an indicator that passenger demand is sufficient to allow segmentation of services.

**Table 3 CBD - airport rail links: rail stops (possible interchange points)**

Airport link (station names in parentheses)	Stops (number)	Length (km)
• Berlin (Friedrichstrasse) - Schonefeld	14	25
• Berlin (Friedrichstrasse) - Tegel	10	10
• Berlin (Friedrichstrasse) - Tempelhof	7	4
• Birmingham (New Street) - Birmingham International	0	13
• Chicago (Dearborn St) - O'Hare International	15	25
• Frankfurt (Hauptbahnhof) - Frankfurt am Main	0	12
• London (Picadilly Circus) - Heathrow	17	30
• London (Liverpool St) - Stanstead	8	59
• Munich (Hauptbahnhof) - Munich	8	37
• Paris (Chatelet les Halles) - Orly	13	21
• Paris (Chatelet les Halles) -Roissy CDG	11	29
• Tokyo (Hamamatsucho) - Hanada	1 (JR Express)	17
• Tokyo (Keisei Ueno) - (Narita Airport Station, Terminal)	2	68

Decision making

The second survey asked about how the decision to build the link was made. Specifically, respondents considered a range of factors: technological, financial and economic, community, land use, partnership, transport alternatives, risk, environmental and demand forecasts. The respondents ranked each consideration according to its relative importance in the decision to build the CBD to airport rail link. The results for the six most important aspects are shown separately for airport operators and for rail operators in Table 4.

**Table 4 Aspects of decision making ranked by order of importance to airport and rail operators of CBD to airport rail links**

Airport Operators	Rail Operators
<ul style="list-style-type: none"> <li>• partnerships with other organisations (other government agencies, private sector organisations, and so on)</li> </ul>	<ul style="list-style-type: none"> <li>• availability of funds for construction</li> </ul>
<ul style="list-style-type: none"> <li>• revealed preference surveys of prospective passengers</li> </ul>	<ul style="list-style-type: none"> <li>• present and future use of land adjacent to the rail link, and around railway stations</li> </ul>
<ul style="list-style-type: none"> <li>• stated preference surveys of prospective passengers</li> </ul>	<ul style="list-style-type: none"> <li>• the passenger carrying capacity of the link</li> </ul>
<ul style="list-style-type: none"> <li>• consultation with community groups (for example, local government associations, transport lobby groups, professional associations, local constituents)</li> </ul>	<ul style="list-style-type: none"> <li>• comparison of rail with other modes (private road based vehicles, bus and so on) of ground access to the airport</li> </ul>
<ul style="list-style-type: none"> <li>• transport needs of specific groups of passengers</li> </ul>	<ul style="list-style-type: none"> <li>• the railway as part of a larger plan for urban and regional development</li> </ul>
<ul style="list-style-type: none"> <li>• the railway as part of a larger plan for urban and regional development</li> </ul>	<ul style="list-style-type: none"> <li>• the railway's cost of capital</li> </ul>

When the responses of airport and railway operators are combined, the top six considerations in the decision to build the CBD to airport link are concerned with land use, the passenger carrying capabilities of rail, the availability of funds for construction and transport needs of specific passenger groups. The consideration which is common to the airport and railway operators as a group, or separately, is the railway as part of a larger plan for urban and regional development.

The responses from airport operators indicate a consideration of partnerships with other organisations is important in the development of the rail link to the airport. Obviously for an airport operator, construction of a rail link to the airport would entail a partnership with at least one other organisation - a railway. The reverse is not the case. This could indicate that the CBD to airport rail link is viewed by the *railway operator* as

more of an offshoot of the existing network, not a purpose - built link to provide ground access to the airport. Airport operators' responses focus on passenger demand and community needs when making decisions about ground access. Rail operators' responses focus on capital costs, uses of land adjacent to the railway, and passenger carrying capabilities.

From the 15 responses received to questions about capital and operating funds, public funds are used in the construction of CBD to airport rail links in 14 out of 15 cases. Only one railway operator indicated that 20 per cent of construction funds came from private sources. Funds for the operation of these links, however, can be exclusively from private sources or at least partially funded by farebox revenue. Ten responses indicated that funds for operations were exclusively from public sources. On the other hand, railways representing to Tokyo - Haneda and Tokyo - New Tokyo International (Narita) links indicated that their operations were fully funded from private sources. Three links have a combination of public and private operating funds. The airport operators surveyed also contributed to CBD to airport rail links. Nine out of the ten airport operator responses to this question indicated that the airport does contribute to provide ground access to the airport (Table 5).

**Table 5 Airport operators' contributions to CBD - airport rail links**

Contribution type	Description
money	<ul style="list-style-type: none"> <li>• contribute to rail link construction costs</li> <li>• fund traffic lights and traffic calming in airport surrounds.</li> </ul>
marketing	<ul style="list-style-type: none"> <li>• promote ground access to airport</li> <li>• provide rail link passenger information at airport</li> </ul>
facilities	<ul style="list-style-type: none"> <li>• provide facilities for bus or rail services</li> <li>• donate parking space</li> <li>• provide terminal space</li> <li>• operate shuttle bus services between rail station and terminal</li> </ul>

Rail operators indicated that the following were *not* important considerations in decision making:

- the number of years to pay back the construction costs of the link;
- partnerships with other organisations;
- an assessment of inherent risks in building the rail link, and the rail links as the lowest risk transport alternative; and
- stated preference surveys of passenger demand.

#### Community consultation

Community consultation is one feature of sustainable development processes. Our survey asked whether the development of the CBD - airport rail link involved community consultation, and if it did, with whom. About 68 per cent (21/31) of the

responses indicated consultation with community groups. Of the stakeholder groups identified, 52 per cent (11/21) consulted with air passengers and / or workers. The stage in project development which consultation took place was at the project concept stage (52 per cent, 11/21) and during the environmental impact assessment stage (38 per cent, 8/21).

Thirteen of the 31 responses supplied information on potential partners who were considered in the decision to build the link. Several responses gave more than one potential partner. Possible partners fall into three categories:

- (a) other transport agencies / providers;
- (b) other government, non transport agencies; and
- (c) private investors or developers.

Overall, other transport agencies, or providers, are natural partners for the development of a CBD - airport rail link. The majority of possible partners indicated (9) fall into this category. Other government agencies were also well represented (6) as potential partners. Private investors or developers were mentioned (twice) infrequently.

## Conclusions

Public transport is seen as a key component in achieving more sustainable urban transport systems. The majority of the world's major passenger airports are not linked into their urban hinterlands by rail. Despite the previous lack of an inter-modal approach to planning, there is now a renewed interest in rail both as a complementary mode for ground access and as a competing mode to relatively short-haul air transport in dense passenger markets.

Surprisingly, a planning guide on inter-modal transport for ground access to airports was published only within the past two years (Bellomo-McGee 1996). Worldwide, airport managers are recognising the importance of forging better working relations with other transport authorities to solve ground access problems in the context of broader metropolitan land-use and transport policies. The survey results reported here on CBD - airport rail links represent the most extensive coverage of such systems throughout the world. Information was obtained from the different perspectives of rail operators and airport operators. The first-stage questionnaire identified general transport characteristics: the year rail operations commenced, transport technology, and distance and fares.

The second-stage questionnaire provided information in critical success factors and decision making processes. It appears that the catchment population must exceed 1 million; that private transport must be constrained either by congestion or through high airport parking charges and the rail must be fast and cheap, together with a package of other service features (for example, comfort, luggage space and security); and that traveller characteristics are of particular importance; placing an upper bound on rail choice of about 35 to 40 per cent for all accessing passengers. In terms of the most important factors in deciding upon whether a rail link is built between a CBD and the airport, there were different responses from airport operators and rail operators.

Rail operators saw (1) availability of funds (usually public) for construction, (2) land-use potential around stations, (3) passenger carrying capacity, and (4) the relative performance of all ground access modes as the four most important factors. Airport operators reported that partnerships with other transport agencies and institutions, market surveys and community consultation were most important aspects in decision making.

Such divergences reflect the more corporate approaches being adopted by some airport managers in a dynamic and rapidly growing industry. Rail managers, in contrast, are operating in a more traditional and mature industry and have different views on priorities. In building the partnerships desirable to airport management, one of the key institutional challenges may be the separate organisational cultures in rail and airport authorities. Whether private-sector involvement in infrastructure, as in Sydney, or whether competition in the provision of rail services provide the catalysts for tackling this important passenger segment of urban transport remain important research questions for further study.

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### References

- Abbott, J (ed.) (1993) *Jane's World Railways 1993 - 1994* Coulsdon Surrey: Jane's Information Group
- Bellomo-McGee Inc (1996) *International Ground Access to Airports: A Planning Guide* Washington DC: US Department of Transportation, Federal Highway Administration & Federal Aviation Administration
- Bushell, C (ed.) (1994) *Jane's Urban Transport Systems 1994 - 1995* Coulsdon Surrey: Jane's Information Group
- Coogan, M (1997) Airports are getting better connected in Europe and in the US *Mass Transit September / October, 22 - 24*
- Crampton, N (1989) *How to get from the Airport to the City* (1989 - 1990 edition) New York: M Evans & Co
- de Neufville, R (1976) *Airport Systems Planning* Cambridge: The MIT Press
- de Ryck, L and Jones, R (1998) *Planning Surface Access Provision at Major Airports* Airport Regions Conference Surface Access Working Group (mimeo)
- Ellis, G (1993) Airport ground access - the missing link!, pp. 249 - 253 of *5th Australian Aeronautical Conference 13 - 15 September 1993, Regent Hotel, Melbourne, Australia* Canberra: The Institution of Engineers, Australia

- Foote, P J LaBelle, S J and Stuart D G (1997) Increasing rail transit access to airports in Chicago *Transportation Research Board 76th Annual Meeting January 12 - 16, 1997* Washington DC (paper no. 97 0199)
- Gosling, G D (1997) Airport ground access and intermodal interface *Transportation Research Board 76th Annual Meeting January 12 - 16, 1997* Washington DC (paper no. 97 1016)
- Higgins, I J (1994) California airports: ground access vehicle trips, emissions and emission reduction strategies, pp 102 -126 of Sproule, W J (ed.) *Aviation Crossroads - Challenges in a Changing World: Proceedings of the 23rd Air Transport Conference* New York: American Society of Civil Engineers
- Jud, E H (1994) Switzerland: rail access to airports and the fly - luggage system, pp. 159 - 161 of Sproule, W J (ed.) *Aviation Crossroads - Challenges in a Changing World: Proceedings of the 23rd Air Transport Conference* New York: American Society of Civil Engineers
- Kanuk, L and Berenson, C (1975) Mail surveys and response rates: a literature review *Journal of Marketing Research* 12, 440 - 453
- Lunsford, M E and Gosling, G D (1994) *Airport Choice and Ground Access Mode Choice Models: A Review and Analysis of Selected Literature* Institute of Transportation Studies, University of California Berkeley ITS-WP-94-5
- Mandle, P B (1994) Rail service to airports, pp 140 - 149 of Sproule, W J (ed.) *Aviation Crossroads - Challenges in a Changing World* New York: American Society of Civil Engineers
- Negrette, A J and Brittle, C (1974) *Airport Accessibility in the San Francisco Bay Area - A Study of its Function and Role in the Regional Transportation Plan, volume I* Washington DC: Federal Highway Administration and Urban Mass Transportation Administration
- Niblett, R (1995) Keys to success in airport rail links *Railway Gazette International* December 1995, 863 - 867
- Nijkamp, P Vleugel, J Maggi, R Masser, I (1994) *Missing Transport Networks in Europe* Aldershot: Avebury
- Rand McNally (1994) *Deluxe Road Atlas and Travel Guide* Chicago: Rand McNally
- Wilbur Smith and Associates (1966) *Transportation and Parking for Tomorrow's Cities* New Haven Connecticut: Wilbur Smith and Associates



**Appendix A List of Airports and Railway Operators Responding to the Survey**

<p><b>EUROPE</b></p> <ul style="list-style-type: none"> <li>• Amsterdam - Schipohl<sup>1</sup></li> <li>• Barcelona - Prat<sup>2</sup></li> <li>• Berlin - Tegel<sup>1</sup></li> <li>• Berlin - Tempelhof<sup>1</sup></li> <li>• Berlin - Schonefeld*</li> <li>• Birmingham - Birmingham International*</li> <li>• Bremen - Bremen Neuenland*</li> <li>• Brussels - Brussels National</li> <li>• Dusseldorf - Dusseldorf*</li> <li>• Frankfurt - Frankfurt Main</li> <li>• Geneva - Cointrin*</li> <li>• Glasgow - Prestwick<sup>1</sup></li> <li>• London - Beckton</li> <li>• London - Gatwick<sup>2</sup></li> <li>• London - Heathrow*</li> <li>• London - London City*</li> <li>• London - Southend</li> <li>• London - Stanstead*</li> <li>• Malaga - Pablo Picasso</li> <li>• Manchester - Manchester*</li> <li>• Milan - Malpensa International*</li> <li>• Munich - Munich International*</li> <li>• Newcastle Upon Tyne - Newcastle*</li> <li>• Paris - Roissy CDG<sup>1</sup></li> <li>• Paris - Orly*</li> <li>• Rome - Fiumicino International<sup>1</sup></li> <li>• Valencia - Manises</li> <li>• Vienna - Schwechat*</li> <li>• Zurich - Zurich*</li> </ul>	<p><b>NORTH AMERICA</b></p> <ul style="list-style-type: none"> <li>• Atlanta - Atlanta International*</li> <li>• Baltimore - Baltimore Washington Int<sup>1</sup></li> <li>• Boston - Logan International<sup>1</sup></li> <li>• Calgary - Calgary International<sup>1</sup></li> <li>• Chicago - Midway<sup>2</sup></li> <li>• Chicago - O'Hare International*</li> <li>• Cleveland - Cleveland Hopkins Int<sup>1</sup>*</li> <li>• Newark - Newark International<sup>1</sup></li> <li>• New York - J F Kennedy International*</li> <li>• New York - Westchester County<sup>1</sup></li> <li>• Oakland - Oakland International<sup>1</sup></li> <li>• Philadelphia - Philadelphia International*</li> <li>• San Francisco - Oakland International</li> <li>• San Francisco - San Francisco Int<sup>1</sup>*</li> <li>• St Louis - Lambert St Louis Int<sup>1</sup></li> <li>• Washington - Dulles<sup>2</sup></li> <li>• Washington - Washington National<sup>1</sup></li> </ul>
<p><b>SOUTH AMERICA</b></p> <ul style="list-style-type: none"> <li>• Porto Alegre - Porto Alegre*</li> </ul>	<p><b>CENTRAL AMERICA</b></p> <ul style="list-style-type: none"> <li>• Mexico City - Benito Juarez*</li> </ul> <p><b>ASIA</b></p> <ul style="list-style-type: none"> <li>• Bangkok - Don Muang<sup>1</sup></li> <li>• Hong Kong - Chep Lap Kok*</li> <li>• Seoul - Kimpo International*</li> <li>• Taipei - Chang Kai Shek International</li> <li>• Tokyo - Haneda<sup>2</sup></li> <li>• Tokyo - New Tokyo International*</li> </ul>

\* Received response to both surveys  
<sup>1</sup> Received response to first survey only  
<sup>2</sup> Received response to second survey only