Rail Links and Sydney’s Airports
Key Success Factors

by

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Presentation for CIVL4815
• What type of rail link(s) does WSA need to be successful – as an airport?
• Is the existing rail link at Sydney airport a good model for WSA?
• What proportion of passengers can be or should be expected to use rail?
• To what markets – or centres of population or economic activity should a WSA airport rail link?
• What service parameters are needed to create a successful airport rail?
• Are current proposals the answer?
Sydney’s Airports and Land Transport System (3)

• Major transport corridor for road and rail into the terminal precinct and continues in tunnel across site for rail
• Provision for 2 pairs of railway tracks in the rail corridor
• Possibility of two stations – one to serve the passenger terminal and one to serve the internal business park precinct.

Source: WSA-EIS-Volume-1-Chapter-5-Stage-1-Western-Sydney-Airport.pdf
Sydney Airport Rail Link

- Sydney Airport Stations - International and Domestic
- Western Sydney Airport

[Links]
- Sydney Airport Rail Link: https://www.airportlink.com.au/trip-information/locations/
Graph shows % of total rail passengers passing through Airport Stations by rail travel time.
• **Africa** - OR Tambo;

• **Australia** - Brisbane; Sydney

• **Asia** - Seoul; Bangkok; Singapore; Shanghai Maglev; Beijing; Delhi; Kuala Lumpur; Hong Kong; Shanghai Metro; Tokyo Narita; Tokyo Haneda; Osaka Kansai;

• **Europe** - Manchester; Rome; Paris Orly; Brussels; London Luton; Dusseldorf; Moscow; Birmingham; Stockholm Arlanda; London Heathrow; London Stansted; London Southend; Hamburg; Frankfurt; Paris CDG; Vienna; Munich; Oslo; Amsterdam Schiphol; London Gatwick; Zurich; London City; Copenhagen;

• **North America** - Dallas Fort Worth; Baltimore -Washington; Philadelphia; Chicago O'Hare; Minneapolis; Boston; Chicago Midway; Portland; San Francisco; New York JFK; Atlanta; Washington Reagan; Vancouver
Key Points

- Source: IARO (IARO Report 18.13) and others;
- Why is the airport rail mode share of ground access so different around the world?
- What makes Copenhagen so different from Dallas Worth?
- What factors bear on mode choice?
- Can it be reliably predicted from those factors?
- What models work? And how well?
- Issues – getting up to date mode share data; excluding transit passengers from those requiring ground access; comparing like with like (parity pricing); getting consistent data on travel times and costs; multi-airport cities; multiple rail links to one airport (e.g. Heathrow);
Rail Links and Sydney’s Airports

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Mode Share to Rail for 51 Airport Rail links on 5 Continents (8)

Sources Transportation Associates analysis based on data originally assembled by IARO (IARO Report 18.13: Forecasting Air-Rail Author: Paul Le Blond), GARA and internet research.
Multi-Factor Linear Regression Factors

Selected as likely to be influential and data available:

- Road distance to Common Downtown location (kms);
- Best Road Time to Common Downtown Location (mins);
- Worst Road Time to Common Downtown Location (mins);
- Rail Time to a Common Downtown location (mins);
- Rail Headway (mins);
- Taxi Fare - Parity Price in 2014 USD;
- Airport Parking (best available price for parking for 24 hours short stay at airport) in USD 2014 parity currency;
- Rail Fare - Parity Cost in 2014 USD.
### Key Points
- All factors highly variable in all continents;
- US airports closer to downtown on average than European or Asian;
- US Airport Rail links competitive on average with Global Averages for Rail Time and Service Headway.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Road Distance (kms)</th>
<th>Best road time (mins)</th>
<th>Rail Time (Mins)</th>
<th>Rail Service Headway (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>24.3</td>
<td>35.0</td>
<td>15.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Australia Average</td>
<td>16.5</td>
<td>19.0</td>
<td>26.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Asia Average</td>
<td>40.7</td>
<td>36.5</td>
<td>39.3</td>
<td>11.9</td>
</tr>
<tr>
<td>Europe Average</td>
<td>28.3</td>
<td>31.2</td>
<td>25.0</td>
<td>14.1</td>
</tr>
<tr>
<td>Nth America Average</td>
<td>19.4</td>
<td>21.8</td>
<td>28.1</td>
<td>15.8</td>
</tr>
<tr>
<td>Global average</td>
<td>28.4</td>
<td>29.6</td>
<td>29.0</td>
<td>13.9</td>
</tr>
</tbody>
</table>

**Road Distance and Travel Time; Rail Travel Times and Headways**
Key Points

• All costs US$2014 Parity Priced)
• Highly variable on all dimensions on all continents;

<table>
<thead>
<tr>
<th>Factor</th>
<th>One way Taxi to Downtown Location</th>
<th>24 hr parking</th>
<th>One way Rail fare to Downtown Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>USD 74.4</td>
<td>USD 25.9</td>
<td>USD 24.1</td>
</tr>
<tr>
<td>Australia Average</td>
<td>USD 25.0</td>
<td>USD 49.3</td>
<td>USD 11.1</td>
</tr>
<tr>
<td>Asia Average</td>
<td>USD 59.0</td>
<td>USD 29.5</td>
<td>USD 12.4</td>
</tr>
<tr>
<td>Europe Average</td>
<td>USD 66.2</td>
<td>USD 41.1</td>
<td>USD 13.4</td>
</tr>
<tr>
<td>Nth America Average</td>
<td>USD 29.1</td>
<td>USD 27.4</td>
<td>USD 13.4</td>
</tr>
<tr>
<td>Global average</td>
<td>USD 53.6</td>
<td>USD 34.9</td>
<td>USD 10.7</td>
</tr>
</tbody>
</table>
## Predicting Rail’s Share of Airport Passenger Movements

What does make Copenhagen different to Dallas Forth Worth?

<table>
<thead>
<tr>
<th></th>
<th>Global Average</th>
<th>Copenhagen</th>
<th>Dallas Fort Worth (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rail Mode Share</strong></td>
<td>19.8%</td>
<td>55%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Road Distance (kms)</strong></td>
<td>28.4</td>
<td>13.4</td>
<td>37.9</td>
</tr>
<tr>
<td><strong>Best Road Time (Mins)</strong></td>
<td>29.7</td>
<td>28</td>
<td>24.0</td>
</tr>
<tr>
<td><strong>Worst Road Time (mins)</strong></td>
<td>51.3</td>
<td>40</td>
<td>45.0</td>
</tr>
<tr>
<td><strong>Rail Travel Time (mins)</strong></td>
<td>29.0</td>
<td>13</td>
<td>51.0</td>
</tr>
<tr>
<td><strong>Headway Mins</strong></td>
<td>13.9</td>
<td>5</td>
<td>30.0</td>
</tr>
<tr>
<td><strong>Taxi Fare (USD Parity)</strong></td>
<td>$53.70</td>
<td>$33.9</td>
<td>$43.0</td>
</tr>
<tr>
<td><strong>Parking 24 hrs (USD Parity)</strong></td>
<td>$34.93</td>
<td>$26.3</td>
<td>$22.0</td>
</tr>
<tr>
<td><strong>One Way Rail Fare (USD Parity)</strong></td>
<td>$10.81</td>
<td>$5.9</td>
<td>$4.0</td>
</tr>
</tbody>
</table>
Cumulative % of passengers passing through airport by distance from airport (difficult to estimate in two airport city and for a new airport)

% of total passengers likely to use rail by distance from airport (estimated by multifactor linear regression analysis from 51 airports data)

% of passengers likely to use rail by distance from airport (product of two above curves)

Model Predicts ~18% for Sydney airport – actual about 17% and growing;
Which way should rail link(s) point to maximum users? (10)

Model predicts: rail ridership of ~26% of total inbound and outbound passengers at WSA

% of total rail passengers inside this distance from WSA
AU$16 = global average fare

29 minutes = global average travel time
OUTCOMES REPORT Department of Infrastructure Regional Development and Cities March 2018

Source: Western Sydney Rail Needs Scoping Study

Figure 25 The Preferred Network for Western Sydney

Rail links connecting to Greater Sydney

1. Upgrades to the T1 North Shore, Northern & Western Line to increase capacity
2. Upgrades to the T8 Airport & South Line to increase capacity
3. Extending the Sydney Metro City & Southwest from Bankstown to Liverpool

Key existing or future transport interchange

Western Sydney Infrastructure Plan major road projects

Growth areas in Western Sydney

Growth areas for investigation

Rail links connecting Western Sydney and the airport

1. North-South Link via Western Sydney Airport
2. East-West Link via Western Sydney Airport

Rail links supporting growth and the airport

3. Sydney Metro West (detailed planning has commenced)
4. South West Link from Leppington to the Badgerys Creek Aerotropolis
5. Extending the Sydney Metro Northwest from Cudgegong Road to Schofields

Source: Western Sydney Rail Needs Scoping Study

PREFERRED NETWORK FOR WESTERN SYDNEY

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Western Sydney Rail Needs Scoping Study (12)
“The NSW Government will also safeguard the ability to extend Sydney Metro ........, as well as towards the west beyond Westmead – where one option could be to the new Western Sydney Aerotropolis”

https://www.sydneymetro.info/west/project-overview
“Metro rail moves more than 40,000 people an hour in each direction – significantly more than a current suburban line”

https://www.sydneymetro.info/west/project-overview

But 70% standees, so is this the right configuration for people to travel 50kms and up to 1 hour to from CBD?

Equally are DD’s suitable as airport trains?

<table>
<thead>
<tr>
<th></th>
<th>Headway (mins)</th>
<th>seats per train</th>
<th>standees per train</th>
<th>total pax</th>
<th>Seats per hour</th>
<th>Standees per hour</th>
<th>Total Pax per hour</th>
<th>% standees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sydney Metro at Start-up</td>
<td>4.0</td>
<td>346</td>
<td>806</td>
<td>1,152</td>
<td>5,184</td>
<td>12,096</td>
<td>17,280</td>
<td>70%</td>
</tr>
<tr>
<td>Sydney Metro NW Capacity</td>
<td>2.4</td>
<td>346</td>
<td>806</td>
<td>1,152</td>
<td>8,640</td>
<td>20,160</td>
<td>28,800</td>
<td>70%</td>
</tr>
<tr>
<td>Safeguarded Capacity (12 car trains)</td>
<td>2.0</td>
<td>461</td>
<td>979</td>
<td>1,440</td>
<td>13,824</td>
<td>29,376</td>
<td>43,200</td>
<td>68%</td>
</tr>
<tr>
<td>Waratah DDs</td>
<td>4.0</td>
<td>894</td>
<td>418</td>
<td>1,312</td>
<td>13,410</td>
<td>6,270</td>
<td>19,680</td>
<td>32%</td>
</tr>
<tr>
<td>Waratah DDs – ERTMS</td>
<td>2.4</td>
<td>894</td>
<td>418</td>
<td>1,312</td>
<td>22,350</td>
<td>10,450</td>
<td>32,800</td>
<td>32%</td>
</tr>
<tr>
<td>Waratah DDs (12 car trains) &amp; ERTMS</td>
<td>2.0</td>
<td>894</td>
<td>418</td>
<td>1,312</td>
<td>26,820</td>
<td>12,540</td>
<td>39,360</td>
<td>32%</td>
</tr>
</tbody>
</table>
Comparison of Airport Rail Links to Major CBDs (15)

Sydney Metro if extended
- SD Longitudinal seating
- All stops - 45 mins
- Mixed travellers
- No dedicated CBD terminus?
- Average speed 60km/h

Stockholm Arlanda Express
- SD 2+2 seating
- No stops – 20 mins, 10 mins headway
- Airport travellers only
- Dedicated CBD Terminus
- Suburban Service as well

Oslo Gardemoen Express
- SD 2+2 seating
- One stop 19 mins, 10 mins headway
- Airport travellers
- Dedicated CBD Platform
- NSB link as well

Helsinki Airport Railway
- SD 2+2 seating
- 5-7 stops 27 mins, 10 mins headway
- Airport and suburban travellers
- Dedicated CBD Platform

Copenhagen Airport Railways
- SD 2+2 seating
- Mainline 13 mins, 10 mins h’way
- Metro 13 mins, 4 mins h’way
- International, Airport and suburban travellers
- Dedicated Mainline Platform; Metro Station in CBD

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Hong Kong Airport Rail Link – 20 years old but still one of the best (16)

Average Speed ~85 km/h

Source: Wikipedia; Veloasia; MTR;
• High passenger generation capability and growth potential locations – e.g. Parramatta and Sydney CBDs;
• A CBD to WSA time of 30-35 minutes; Competitive fares;
• Clearly identifiable CBD point of “low friction” access;
• Similarly, an airport station that is more findable than a taxi rank;
• Focus on a few key interchanging locations;
• Fully seated, not commuter standing and crowded, airport style rolling stock;
• Less than 15 minute headways;
• Future North-of-harbour link to tap into Sydney’s “Golden Arc of Employment”?
• Focus the service parameters – travel time, fares, comfort;
• North – South Link more about urban development than making airport successful per se;
• As currently presented, Sydney West Metro not suitable;
• **BUT** – there are some positives so it could become so!
• Hong Kong’s Tung Chung Line is good model – fast airport overlaid on slower stopping suburban services;
• Unique opportunity to link the three GSC designated cities;
• Keep on encouraging the Governments to plan and deliver a rail link which can help make the Airport successful.
If you are interested in the original data or analyses then go to
or

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