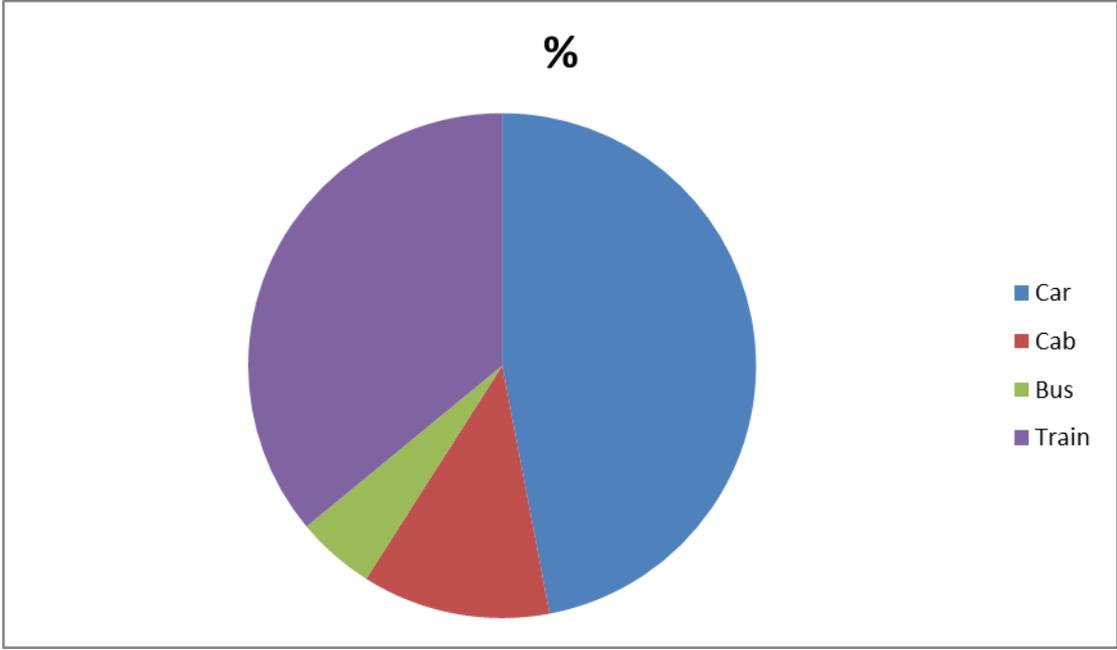




IARO report 14.10

What happens to mode share when trains start running to airports?

Second edition 2015



IARO Report 14.10: What happens to mode share when trains start running to airports?

Editor: Andrew Sharp, with grateful thanks to those members and friends of IARO who contributed to this report.

Published by

International Air Rail Organisation

Suite 3, Charter House,

26 Claremont Road,

Surbiton KT6 4QZ

Great Britain

Telephone +44 (0)20 8390 0000

Fax +44 (0)870 762 0434

Website www.iaro.com

email enquiries@iaro.com

ISBN 1 903108 12 8

Second edition 2015

© International Air Rail Organisation 2015

£250 to non-members

Our mission is to spread world class best practice and good practical ideas among airport rail links world-wide.

Contents

Introduction	4
Abbreviations and acronyms	5
Airport access mode share statistics	7
Birmingham International	10
Düsseldorf	12
Frankfurt	14
Hamburg	16
Liverpool	18
London City	19
London Heathrow	21
London Stansted	24
Manchester	27
The major New York airports	29
Portland (Oregon)	32
San Francisco	33
Stockholm Arlanda	35
Vancouver	37
Vienna (Wien)	38
What's the answer?	41
The impact on the airport	44
Conclusions	48
IARO's Air/Rail conferences and workshops	50

Introduction

What happens to airport access mode share figures when a new train service is introduced?

This is a very difficult question to answer. Airport access statistics are thin on the ground and are sometimes inconsistent. What do they actually mean?

This report tries to present a reasonable answer, but no great accuracy is claimed for the end product.

Finding reliable consistent statistics is not easy: finding them for a change which occurred more than about 10 years ago is even more difficult – there are things which are not available on the web!

Of the 50-odd airports which received a rail link in the last 15 years, some – like Hong Kong, Oslo and Kuala Lumpur - were completely new so no comparison is possible. Some (like Friedrichshafen and Kobe) are quite small, and some of these just do not have the statistics. Some, especially those in the Far East, are difficult to establish contact with.

That said, it would no doubt be possible to find statistics from some of the airports not mentioned in this report for a further edition, and if readers can help, this would be appreciated.

The report was first published in 2010: it was updated in late 2014 with new information.

As usual with these reports, comments, feedback and updates are welcome.

Andrew Sharp
Policy Adviser

Abbreviations and acronyms

ACI	Airports Council International
ACRP	Airports Cooperative Research Program, part of the TRB
ARC	Airport Regions Conference
BART	Bay Area Rapid Transit (San Francisco)
CAA	Civil Aviation Authority (UK)
CAT	City Airport Train or City Air Terminal, Vienna
CC	County Council
DC	District of Columbia
DLR	Docklands Light Railway
FS	Ferrovie dello Stato - Italian State Railways
Hbf	Hauptbahnhof - main station
IARO	International Air Rail Organisation
ICE	InterCity Express - German high speed train
JFK	New York John F. Kennedy International Airport
Km/h	kilometres/hour
m	million
MAX	Metropolitan Area Express (Portland, Oregon)
n/a	not available
ÖBB	Österreichischen Bundesbahnen (Austrian Railways)
PATH	Port Authority Trans Hudson – subway service in the New York/New Jersey region
S-Bahn	Stadtschnellbahn - City fast train (German speaking countries). Suburban railway.
SJ	Statens Järnvägar (Swedish Railways)
TCRP	Transit Co-Operative Research Program, part of the TRB
TRB	Transportation Research Board
U-Bahn	untergrundtbahn (German underground railway)

UK	United Kingdom
US or USA	United States of America
WSCC	West Sussex County Council

Note that UK conventions are used for dates (day/month/year) and numbers (in 9,999.99 the comma , separates thousands: the full stop . is a decimal point). A billion is a thousand million, following US conventions.

There are occasions when the abbreviation UK (United Kingdom) is used for simplicity when the term Great Britain (the UK excluding Northern Ireland) would be more accurate.

Airport access mode share statistics

Introduction

Airport access mode share statistics are difficult to find, and once found can be difficult to interpret.

Ideally the market share of each mode of transport serving an airport is the number of air passengers using it expressed as a percentage of the number of terminating air passengers (those whose air journey starts or finishes at the airport, and who are neither interlining¹ nor in direct transit² there).

The numerator

The numerator – the number of passengers using each mode of transport - can come from the local transport authorities, the airport, or an independent body. These bodies include regulatory agencies, like the Civil Aviation Authority (CAA) in the UK, and researchers (commercial or academic).

Figures can come from a continuous questionnaire survey (the CAA method), from a survey on one or more representative days, from manual counts or from data generated by automated counting equipment at (for example) a fare-gate or ticket barrier.

Each provider has different motives, different needs, and is therefore likely to ask different questions (if the survey is by questionnaire). Sometimes there is just a simple manual or fare-gate count: if these figures are given, are they for passengers entering the station, leaving it, or both?

Each has a different willingness to release the statistics. This willingness also varies with geography. In some places, public agencies in particular see themselves as bound to put data into the public domain; whereas in others, releasing it raises issues of commercial confidentiality. The same applies in the commercial sector: market research is expensive, and consultants can be very unwilling to release the detail of their findings.

The total number of passengers using an airport station can vary quite significantly from the number of air passengers using it.

Some airports are major bus-rail interchanges, so not all passengers are using the train at the airport as part of an air journey.

At some airports – notably Osaka Kansai – the percentage of airport-based employees using the airport railway is significant. Business partners – meeters and greeters, people going to the airport for a meeting, or sightseers – can also form sizeable contingents.

¹ Changing between one aircraft and another

² Arriving and departing on the same aircraft

Some airport railways argue that the total number of terminating air passengers is irrelevant. What matters is those whose journeys start or end within the catchment area of the railway. Hence Arlanda Express prefers to use just the number of passengers starting or ending their journey in the Stockholm downtown area.

Sometimes the mode data can be misleading, depending on how the question is asked, as can be seen from the following examples.

No-one can arrive by train at London Luton Airport: the nearest station, Luton Airport Parkway, is connected to the airport by a shuttle bus. If the question is “By what mode did you arrive at the airport?” or “What was your final mode of transport?”, the rail mode will be zero. If asked what the main travel mode was, rail will score higher.

A bus can be a local service bus, a long-distance coach, a hotel shuttle, a car park shuttle or (especially in North America) the Super Shuttle style of pre-booked door to door van or minibus.

A car can be a hire-car, a taxi (cab) or a personal vehicle. If the latter, it can be parked at the airport (park and ride) or driven away (kiss and ride).

There is a suspicion in at least one case that private car and taxi have not been properly differentiated: this is noted in the text.

Where separate figures are given in the source documentation for private car and hire car, they are usually added together in this report: the latter is usually a small figure.

The denominator

The denominator – the number of terminating air passengers – can also be difficult to find. The most frequently published numbers are

- Total passengers excluding those in direct transit or
- Total enplaned passengers³.

The first statistic includes those who are interlining – who are just changing planes at the airport – and are therefore not likely to be able to use the local public transport system⁴. This number can be significant. Atlanta Hartsfield airport sees around 90 million passengers a year – but only 13 million start or end their journey in the Atlanta area: the rest are just changing planes. The airport is of course a major hub for Delta and used to be one for AirTran (now part of Southwest). Both carriers have significant interlining traffic.

³ Those who board an aircraft at the airport

⁴ However, in some places, interlining passengers with a long layover are offered city tours and therefore may make some limited use of the local public transport system

The second figure excludes inbound passengers. One could double the enplaned passenger number, on the assumption that the same number of passengers comes in as goes out⁵ – but this assumes that the statistics actually say what they are in the first place.

And for the purposes of establishing what happens when a train service is introduced, it is necessary to have a consistent time series covering the transition from ‘before’ to ‘after’.

In the next sections are data and a commentary for those airports where good statistics have been found. Sources are given, as is information about the statistics – in particular whether they relate to air passengers or all passengers. Consistency would have been better, but this has been constrained by data availability.

The report ends with a summary of the results and some conclusions, including a discussion of the impact of a new rail service on parking at airports. It is hoped that this will be useful to transport authorities and airports involved in air rail projects.

⁵ Not necessarily true, but probably near enough

Birmingham International

Introduction

In 1976, a new station opened to serve Birmingham International Airport and the nearby National Exhibition Centre.

The airport was connected to the station by an automated driverless magnetically-levitated (maglev) train system – the first such system in the world. This was taken out of service after nearly 20 years, because of major difficulties with availability of spare parts. Initially it was replaced by a shuttle bus service, but in 2002 a cable-powered system, taking 90 seconds to travel between station and airport, was opened.

A wide range of train services calls at the station. It is on the London – Birmingham InterCity main line, which continues through the West Midlands to serve North Wales and the north and north-west of England. Regional trains between north and south of the country and into Wales, stopping trains serving intermediate points on the West Coast Main Line, and local trains to Birmingham itself, complete the picture.

Data

Year	Car	Taxi	Bus	Rail	Other
1971	72	16	11		1
1975	81	12	5		1
1992/3	76	15	3	6	1
1999	70	17	3	10	1
2001	68	21	3	7	1
2003	62	20	9	8	1
2004	58	22	10	9	1
2005	58	21	11	9	1
2006	57	21	9	12	1
2007	58	21	9	11	1
2012	50	18	9	23	0

Figures (which, like most in these tables throughout the report, are in percentages) relate to air passengers only.

Sources are

"Passengers at Birmingham, Gatwick, Heathrow, London City, Luton, Manchester and Stansted airports in 1996", CAP 677, Civil Aviation Authority November 1997, for 1971, 1975 and 1992/3;

"Surface access mode share monitoring", Report to Birmingham Airport Consultative Committee 23 January 2002, for 1999 and 2001;

"Moving together - Birmingham airport surface access strategy 2006-2012" for 2004 – 2006;

Birmingham Airport surface access strategy web-page for 2007; and

“Birmingham airport. Helping Birmingham airport become more accessible by rail from across Britain” Birmingham airport May 2013 for 2012.

Comment

Between 1971 and 1975, the bus percentage dropped and the car percentage grew. The construction of the station and the introduction of the train service in 1976 resulted in a continued decline in bus use as well as a slow decline in car use. Bus use grew in 2003 to around 10%: car use dropped significantly between 2007 and 2012 as rail use doubled.

It needs to be borne in mind that at this airport passengers using rail have to make an additional change of mode – between train and automated people mover – at the airport station.

Düsseldorf

Introduction

In 1975, Düsseldorf airport got its first rail connection – line S7 of the S-Bahn, to the city centre. It was extended to Solingen in 1978.

This was followed in 1990 by Line S1, connecting the airport to the Ruhr cities of Duisburg, Mülheim, Essen, Bochum and Dortmund. Both lines use the same terminal station under the airport.

A second station, the InterCity station, opened in May 2000, and is used by S-Bahn, regional and InterCity services. From 2002, it was connected to the terminal by an elevated people mover, the SkyTrain. Today this station is served by some 314 trains a day, and 54 use the original underground station.

So some passengers have a one-seat ride between city and airport: others have to change between train and automated people mover.

In the mid 1990s, train service reliability, especially on line S7, declined. The SkyTrain suffered from a bad media image, and there were certainly extended periods when it had to be taken out of service and replaced by a bus shuttle (in July/August 2002 and January – September 2006, for example). Regional train services were sometimes very crowded.

The station is about 5 km from the city, so taxi or kiss and ride are popular and easy to use.

The airport has recently gained more inter-continental services. Their passengers tend to originate further from the airport, which probably tends to increase the rail mode share.

Data

Year	Car	Taxi	Bus	S7 train	S1 train	IC, ICE, regional train	Total rail	Other
1987	64.3	18.7	2.4	14.6			14.6	
1995	60.3	18.5	2.8	18.3			18.3	0.1
1998	57.3	21.1	3.7	17.8			17.8	0.1
2002	59.6	19.1	2.9	5.4	3.7	9.0	18.1	0.3
2008	58.5	21.9	2.0	4.0	2.2	10.8	17.0	0.6
2009 ⁶	56.8	22.1	1.8	3.8	2.2	12.2	18.2	1.1

The figures are percentages of departing air passengers, and exclude transit and interlining passengers. S-Bahn figures are only available for the two lines combined before 2000.

⁶ January - June

The source is the regular passenger poll carried out by the airport⁷.

Comment

Between 1987 and 1995, the car + taxi share dropped from 83% to around 78%: it has remained there ever since. Apart from a brief period, the bus share has remained below 3%. In 1987, with just one S-Bahn, rail share was 14.6%: this grew to 17%-18% in the late 1990s with the addition of more services.

The subsequent drop in the mode share of the S-Bahn to around 6% is interesting.

The overall rail percentage is virtually unchanged between 1995 and 2009 despite the major change in quality. There has not been a major increase in the rail mode share as a result of the introduction of long distance trains in 2000. This implies a reasonably static overall base of rail passengers. Those who, before 2000, needed to use long distance trains, will have used the S-Bahn to the Hauptbahnhof and changed trains there: when the airport's InterCity station (itself some distance from the terminals) opened, they used that instead.

The attraction of a direct service, rather than one needing a change of train, was clearly demonstrated by the cases of Solingen and Mülheim/Ruhr. Both cities are the same distance from the airport: journey time was two minutes more to Solingen, and the fare and train frequency were the same. Rail had a 54% share of Solingen traffic but only a 5% share of passengers from Mülheim/Ruhr - because a two-minute cross-platform interchange was needed⁸.

This is borne out by a similar phenomenon at London City Airport (see page 20).

The airport's 2013 annual report commented that the percentage of passengers accessing the airport by rail had increased from 19.6% in 2012 to 20.8% in 2013, an increase of 51,500 people. The share of motorised passengers had decreased from 54.2% to 53.6%, a decrease of 110,600 people. It also noted that the number of cars parked in the long-term car park had gone down by 1.3% to 14,100, the numbers being driven to the airport and dropped off had gone down by 4% (99,200) and the numbers using short-term parking had increased 1.1% to 2,800.

⁷ The help and cooperation of Dr. Edmund Krieger, former Vice President Marketing and Strategy at the airport, is gratefully acknowledged

⁸ "Airport rail access: the Düsseldorf experience". Presentation by Dr. Edmund Krieger, then Head of Marketing and Strategy, Düsseldorf International Airport, at the Air//Rail conference at Frankfurt Airport, September 25 2003

Frankfurt

Introduction

Regional and S-Bahn services started to serve Frankfurt airport in 1972, with a station directly under Terminal 1.

In May 1999, the new AIRail station opened adjacent to Terminal 1, to which it was connected by a covered overhead walkway. This station was built specifically for long-distance and high speed ICE services, and with it came a significant increase in both the number of trains and range of places served.

In May 2003, the new high speed line to Köln opened, with a doubling of high speed train services at the airport.

In November 2007, all Köln-Frankfurt flights were cancelled: air passengers could use the code-share between Lufthansa and Deutsche Bahn instead⁹.

Data

Year	Car	Taxi	Bus	S-Bahn	Regional rail	High speed rail	Other
1998	55	18	5	14	7		1
1999	54	18	5	13	6	3	2
2000	48	17	7	11	7	8	2
2008	44	19	6	10	1	19	1
2012	37	19	6	14	0	22	2

Figures are percentages of originating air passengers.

The source for the 1998 – 2008 data is Frankfurt Airport’s continuing passenger survey, “FRA Monitor”. For 2012, statistics come from a presentation by Peter Pfragner, Commissioner for Intermodality for Fraport, at IARO’s Birmingham Seminar July 2013. 2013 figures for ICE (19.3%), other rail (11.2%) and bus (5.3%) are given in Fraport’s “Connecting sustainably” online report for 2013 on Fraport’s website.

Comment

Car traffic has decreased, and the bus and taxi shares have remained more or less constant.

The mode share of the local S-Bahn trains (from Frankfurt and Mainz) decreased slightly to 2008: compare this with the comments on Düsseldorf’s experience on page 13.

⁹ This codeshare had started in 2001 between Frankfurt and Stuttgart, and in 2003 was extended to the Frankfurt and Köln route: in 2013, it was extended to the Frankfurt – Düsseldorf sector, and in December 2014 to Kassel and Karlsruhe. See IARO Report 11.08, “Case studies in cooperation between air and high speed rail” for more information

Regional train traffic has dropped significantly. Part of the reason for this is the introduction of high speed trains from a wide range of cities in Germany direct to the airport station: passengers no longer have to travel to Frankfurt Hbf and change there to a regional or S-Bahn train to the airport.

Another factor may be the introduction of Lufthansa-branded bus services between the airport and nearby cities. In December 2014, for example, the long-running low-key air-rail code-share between Saarbrücken and the airport was dropped: the route is now served by a Lufthansa bus service. At the same time, the rail operator changed from DB to Netinera, a subsidiary of FS.

The elimination of the need to change trains is, of course, a great advantage: research and common sense says that air passengers in particular do not like changing trains. This is partly because of hassle and reliability issues, and partly because of the problem of transferring luggage between trains. See also the discussion of Düsseldorf on page 13 and London City Airport's experience on page 20.

Overall, the rail mode share at Frankfurt has grown considerably with the introduction of the high speed line and the increased number of places served directly by rail from the airport.

Hamburg

Introduction

Until December 2008, passengers using public transport to access the airport could take an airport bus from the city centre, or could use the S-Bahn or U-Bahn to Ohlsdorf station and then a non-stop shuttle bus from outside the station¹⁰.

The S-Bahn extension to the airport opened on 11 December 2008, and now provides a direct and very frequent service to the city centre.

Data

	2006	2009
Cab	28.8	3.37
Hire car	3.3	
Private car	46.3	72.47
Other	2.1	
Private Transport	80.5	75.8
City bus	6.8	1.55
S-Bahn	0.0	18.54
Ohlsdorf bus	8.8	0.14
Long distance bus	3.2	
Tour bus	0.2	
Public transport	19.0	20.2
Other	0.5	3.93
Total	100.0	100.0

Data come from two different sources, which is why there are inconsistencies¹¹.

Comment

The “Other” row is in the Private Transport section in the first (2006) source: percentages add up to 99.5 which is why the additional 0.5% has been put in a separate row underneath.

In the 2009 source, only cab and car are listed, with no breakdown of the car figure. Similarly no breakdown is given of the 3.93% “Other”: this is likely to include long-distance and tour buses.

However it can be concluded that in the first few months after opening of the direct S-Bahn, the use of private transport declined.

¹⁰ Although until 1974 there was a tram service to the airport – anecdotally, mainly used by sightseers

¹¹ For 2006, from Dipl.-Ing. Klaus Bokelmann, and for 2009, from Dr. Thomas Immelmann, Director Commercial (both of Hamburg Airport). Both sets of data were given in presentations at IARO’s Hamburg Air//Rail conference, 23-25 June 2009

Taxi use appears to have dropped dramatically. The car mode share increased from 50% to 72% - a strange result, unless there is some mis-reporting between car and taxi. Not enough is known about the methodology to make a definitive statement.

Assuming that the tour bus and long-distance bus figures (presumably included in "Other" in 2009) remain much the same, the city bus percentage has predictably dropped considerably.

Equally predictably, so has the share of the direct bus service from Ohlsdorf station. This route now only functions between 1:00 and 4:30 on Saturday and Sunday mornings, when the S-Bahn is not running.

Liverpool

Introduction

Liverpool John Lennon International is an interesting case study since, unlike most of the other airports reviewed, it is not directly served by rail. Instead, there is a shuttle bus from a Parkway station 5km away: this opened in June 2006.

There is a range of rail services at Liverpool South Parkway – suburban services to Liverpool provided by Merseyrail and Northern Rail, and regional services to a range of destinations across the north-west of England by London Midland, East Midlands Trains and (from December 2010) TransPennine Express.

There is a dedicated bus shuttle four times an hour, and two other bus routes operating four and five times an hour between the airport and the station. The dedicated shuttle started operations in July 2009.

Data

	Car	Taxi	Bus/coach /train	Other
1999	68	27	5	
2002	69	20	9	2
2003	69	20	10	1
2005	68	20	10	2
2007	75	10	15	
2008	62	18	17	3
2010	62	17	17	

Figures are percentages of air passengers, and are from airport surveys¹². The car and taxi figures for 2007 look odd: there could well be some misreporting here.

Comment

The percentage of car use appears to have dropped from the high 60s to the low 60s, and taxi use by ten percentage points. The bus, coach and train figure has increased by 10 percentage points: the 'Other' category is inconsistent (and rising).

¹² Airport Surface Access Strategy May 2011

London City

Introduction

London City Airport, London's downtown airport in the Docklands regeneration area, has been served by a variety of modes in its 25-year history¹³.

Silvertown station, on the North London Line looping round the eastern, northern and western London suburbs between North Woolwich, Stratford and Richmond (but not serving central London), was one way of accessing the airport by public transport for its first few years. This involved quite a devious walk - signed in the "From airport" direction by road signs showing a steam engine. It closed in December 2006. Usage by air passengers was almost certainly trivial.

Shuttle buses were provided between the airport and both Canning Town station on the Jubilee Line (which opened in December 1999) and London's Liverpool Street station.

The Docklands Light Railway (DLR) started direct services from central London (Bank station) on 2 December 2005 – which resulted in the almost-immediate withdrawal of the shuttle buses¹⁴. It was immediately successful, with 11,000 passengers/day using the line by the end of January and 13,000 by April.

At the end of the first full year of operations, the air passenger mode share had reached 49% - a share which grew slightly to 51% in 2008¹⁵.

Data

Year	Car	Taxi	Bus	Rail	Other
1996	25	53	21		
2003	23	45	31		1
2006	9	28	13	50	
2009	15	34	1	47	3

Figures are percentages of air passengers.

Data sources are as follows.

¹³ It was officially opened in November 1987

¹⁴ The Canning Town service immediately, the Liverpool Street service after four months

¹⁵ Probably the second highest rail mode share in the world, after Copenhagen Kastrup

1996 - "Passengers at Birmingham, Gatwick, Heathrow, London City, Luton, Manchester and Stansted airports in 1996", CAP 677, Civil Aviation Authority November 1997.

2003 - London City Airport Masterplan November 2006.

2006 - Discussion with airport management at London City Airport 18 March 2008. The bus figure includes limos. Of the cars, half are parked at the airport (park and ride) and half are driven away (kiss and ride).

2009 - London City Airport Travel Plan February 2011

Comment

It can be seen that all road modes lost market share to rail initially: car and taxi figures increased slightly between 2006 and 2009. Car access has always been limited at London City Airport: car parking provision is small and expensive to use on the airport's constricted site.

It is understood that many of the taxi users are travelling to or from the Canary Wharf office and commercial area. Passengers using the DLR to travel between Canary Wharf and the airport would need to change train (but not platform) at Poplar – an indication of the value placed by air passengers on a direct service.

Note that at this airport the predominant traffic is business travellers. 62.8% of passengers are travelling on business – by comparison, Heathrow's figure is just under 30%¹⁶. Most flights are short-haul – domestic or near-Europe.

¹⁶ CAA's "Passenger survey report 2010", table 19.12

London Heathrow

Introduction

London Underground's Piccadilly Line was extended to Heathrow in 1977. Heathrow Express, a high speed dedicated non-stop Airport Express, started service in June 1998 running every 15 minutes¹⁷. Heathrow Connect, a stopping service using the same tracks as Heathrow Express but running every half hour, started in the spring of 2005.

Data

Year	Car	Taxi	Bus	Rail
1994	46	20	13	21
1999	39	26	14	21
2000	38	26	14	22
2001	39	27	13	21
2007	35	27	13	25
2008	34	26	14	26
2009	35	25	14	26
2013	34	25	14	28

Figures are percentages of all passengers travelling to and from the airport.

Sources are

For 1994, "Optimising air/rail intermodality", a presentation by Roland Niblett, of Colin Buchanan & Partners, at the "Opportunities for air and rail interaction" conference in the Dorchester Hotel, London, on 17 April 1996.

For 1999-2001, "Heathrow delivering for London and the regions", Heathrow Airport Ltd., 2002.

For 2007, "Regional Transport Statistics 2008" table 8.4, published by Transport Statistics in January 2009.

For 2008 and 2009, CAA survey data.

For 2013, Heathrow's "Taking Britain further" 2014 page 234

Comment

In 1994, the rail figure was for London Underground trains only: thereafter it was Heathrow Express and London Underground combined (and, since 2007, Heathrow Connect too). The table on the next page gives a breakdown between the main-line and underground services.

¹⁷ Although a precursor service, Fastrain, ran to a temporary station north of the airport from mid-January 1998: each train was met by buses serving the individual terminals

The car and taxi share seems to have been fairly constant initially at around 63%-66%, with a steady decline after 2001.

The bus share has been constant. The number of express bus services between city and airport dropped when Heathrow Express started up. This is likely to have been offset by increased use of local buses which received marketing and seed-funding support from Heathrow Airport's Transport Fund under the "Freeflow Heathrow" programme¹⁸. The airport, reportedly the largest bus and coach station in the UK, is a major bus-rail-air interchange.

It could be seen as disappointing that the investment of some £500m in Heathrow Express has resulted in relatively little in the way of mode shift. However, it has to be remembered that Heathrow is a major international airport whose catchment area embraces much of the UK: Heathrow Express just serves central London.

Between 1999 and 2013, there appears to have been a shift away from private car to the train – a positive result, especially since overall air traffic volumes will also have grown.

Despite the relatively long journey time, the London Underground's Piccadilly Line is attractive for a number of important destinations – in particular, the office area of Hammersmith, and the hotels of Kensington and Russell Square.

For air passengers only, the following split between London Underground and Heathrow Express is available: the source is the Heathrow Airport Interim Master Plan 2005 (1999, 2000 and 2001 figures)¹⁹, "Regional Transport Statistics 2008" table 8.4 for 2007²⁰ and the sources listed above for other years.

Year	Heathrow Express	London Underground
1999	7.1	13.9
2000	8.5	13.6
2001	8.4	13.1
2007 ²¹	10.0	15.0
2008	13	16
2009	9	17
2013	9	18

¹⁸ Funded by a levy on car parking at the airport

¹⁹ Note that these are percentages of non-transfer passengers, not total passengers

²⁰ See

<http://www.dft.gov.uk/pgr/statistics/datatablespublications/regionaldata/rts/regtr anstats2007>

²¹ includes Heathrow Connect

Initially Heathrow Express carried half as many passengers as the London Underground: this figure had increased to 75% by 2007, but now appears to have reverted back.

London Stansted

Introduction

Stansted Airport's new terminal opened in 1991 with a significantly increased air service. At the same time an Airport Express service – initially branded as the Stansted Skytrain and then rebranded as Stansted Express – was launched between the airport and London Liverpool Street.

Trains stopped intermediately at Tottenham Hale for a connection with London Underground's Victoria Line. Liverpool Street is very convenient for the City of London and the historic financial district in the east of the central business district: the Victoria Line provides a connection through King's Cross to Oxford Circus and Victoria Station in the West End.

The new railway connection was in the shape of a wye or triangle off the Liverpool Street – Cambridge main line.

A cross-country service connecting the airport to Cambridge and Birmingham also started, but this was suspended from 1993 to 1998 because of lack of patronage. In summer 2014, the Cambridge service was doubled to half hourly.

Also in 1998, a stopping service to London was introduced: this has had a somewhat chequered history, sometimes running to Stratford and sometimes being suspended – and sometimes only running out of the London commuter peaks.

The Airport Express too has had a slightly varied stopping pattern over the years. It has sometimes incorporated stops at commuter stations like Harlow and Bishop's Stortford²². Much of the time it has had dedicated rolling stock²³ – but this has not always appeared on the trains it should have. Initially 4-car trains ran four times an hour except during the evening London commuter peak, when longer trains ran twice hourly. This was because of capacity constraints on this very busy commuter railway.

There was a short-lived Colchester – Basingstoke service which served the airport. Run by Anglia Railways and branded Crosslink, it ran between May 2000 and September 2002.

Stansted airport is a major hub for new entrant carriers: Ryanair dominates, with Easyjet, Air Berlin and Norwegian next in the ranking. The airport has a very high percentage of non-UK passengers.

²² Which led to it no longer being classified as an Airport Express by IARO

²³ Initially refurbished, not new, commuter trains: a fleet of new trains entered service in 2011

Data

Year	Car	Taxi	Bus	Rail	Other
1984	41	4	55		
1987	55	5	39		1
1991	69	8	10	12	
2003	58	8	8	26	
2006	50	9	16	24	
2007	47	9	20	25	
2008	44	8	21	26	
2012	39	10	27	24	
2013	38	10	29	22	1

Figures are percentages of air passengers.

Sources are as follows

1984 – 1991 data: "Passengers at Birmingham, Gatwick, Heathrow, London City, Luton, Manchester and Stansted airports in 1996", CAP 677, Civil Aviation Authority November 1997.

2003 figures - "Ensuring easy and reliable access". Surface access strategy for Stansted March 2004.

2006 figures – "Regional Transport Statistics 2007" table 8.4, published by Transport Statistics on 13 December 2007²⁴.

For 2007, "Regional Transport Statistics 2008" table 8.4, published by Transport Statistics in January 2009.

For 2008, the source is Stansted Express: the figures are in "Airport design issues with particular reference to light rail and low cost carriers" by Professor Antonin Kazda, University of Žilina, 2009.

For 2012 and 2013, figures given by John Pope of Essex CC and Chair of Stansted's Transport Forum at the Stansted Airport Transport Forum on 19 February 2015.

Comment

Taxi traffic has never been large, presumably because of the distance from London (55 km) together with the fact that low-fare carriers predominate.

²⁴ See

<http://www.dft.gov.uk/pgr/statistics/datatablespublications/regionaldata/rts/regtranstats2007>

The rail service seems initially to have hit the bus market considerably, although car traffic also declined with the introduction of the rail service. That reduction in car traffic continued, although with market share being won back by the bus. It needs to be remembered that air passenger volumes were low before 1991, so any comparisons spanning the opening of the new terminal can be suspect.

Car parking at the airport is tightly controlled: off-airport parking is not allowed under the planning regime under which the airport operates²⁵.

The airport is now a major hub for medium-distance buses and coaches, including services to various parts of the London conurbation. In particular, there is a good service late at night and very early in the morning when the rail service is not operating. The rail operator is in discussion with the infrastructure owner to try to get a more consistent early morning service – possibly at the expense of more lightly-used late-night services to preserve the necessary track maintenance time²⁶.

²⁵ It is in a relatively affluent rural area, with sites of historic landscape significance nearby

²⁶ The first train, the 3:40, only runs on Monday mornings: the second, at 4:10, does not run on Tuesdays, Wednesdays or Thursdays. The third, at 4:40, has slightly different timings on those three days. The 4:10 is due to arrive at 4:58, giving just two hours before the first flights leaving at 7:00.

Manchester

Introduction

Manchester Airport, to the south of the city, is served by regional trains from the north and north-west of England, and from parts of Scotland (in particular, Edinburgh and Glasgow): these trains also serve central Manchester. The railway was opened in 1993 in the form of a spur from the Manchester – Crewe line. In 1996 a southern arm – the third side of the triangle - was opened, allowing trains to run directly between the airport and places to the south. Today, these trains terminate at Crewe, although in the past there have been short-lived local services to Stoke and Derby as well as long-distance services between Rochdale and London via the airport.

Under the Northern Hub scheme, services between the airport and places beyond Manchester will be increased and accelerated. The proposals will allow more places to be served directly from the airport and will increase rail capacity. The associated North West Electrification programme will both speed up services and make them more attractive.

Manchester's Metrolink light rail system was extended to the airport: construction started in late 2011 and it opened to the airport in early November 2014.

Data

Year	Car	Taxi	Bus	Rail	Other
1992	68	17	12		3
1994	66	22	4	8	
1996	53	24	14	6	
2008	60	29	3	8	
2009	62	28	3	7	

Figures are percentages of all passengers travelling to and from the airport.

Sources are

For 1994, "Optimising air/rail intermodality", a presentation by Roland Niblett, of Colin Buchanan & Partners at the "Opportunities for air and rail interaction" conference in the Dorchester Hotel, London, on 17 April 1996.

For 1992 and 1996, "Rail Air transport integration in Britain" by John Stubbs and F. Jegede in the *Journal of Transport Geography* Vol. 6 no. 1 1998.

For 2008, personal communication from Manchester Airport.

For 2009, the source is the "CAA Passenger Survey Report 2009", quoted in "Sustainable Development and Airport Surface Access: The Role of Technological Innovation and Behavioral Change" by Ryley and colleagues, *Sustainability* 2013, 5, 1617-1631; doi:10.3390/su5041617.

Comment

The balance between car and taxi at an airport can be affected by things like the size of the catchment area and airport parking charges. The airport reports a switch recently from taxi and kiss-and-ride to long-term parking, partly because of issues like this²⁷.

About 30% of Manchester Airport's passengers come from the Greater Manchester area, and are therefore within an hour's journey by car or taxi.

A taxi fare of £10 - £20 each way is seen as reasonable - especially if more than one person is travelling (and the airport has a strong leisure traffic base: leisure passengers tend to travel in larger groups than those travelling on business).

Passengers originating in the local area, especially those travelling off-peak, are likely to have access to friends or family who will give them a lift: this constrains parking charges and impacts on the shares of the different modes.

The bus usage data are odd. When the railway was opened, the dedicated airport bus running to Piccadilly Station was withdrawn: this will have accounted for an initial decline. However, today there is a good network of bus services serving the airport: the multi-modal interchange - "The Station" - is a model of its kind, showing excellence in multi-modal information provision, physical facilities and amenities for the traveller.

Overall journey time seems to be a significant factor in choice of public or private transport: to city centres, where trains are frequent, bus or rail are attractive. If a change of vehicle or mode is necessary, many will be deterred from using public transport. The problems of dealing with luggage and the additional hassle are significant, and any need to change vehicle or mode adds to concerns about reliability.

²⁷ It needs to be remembered that about half of the long-term parking for this airport is run by private operators – who control their own prices

The major New York airports

Introduction

New York City is served by three major airports – John F. Kennedy (JFK), Newark Liberty International, and LaGuardia – all operated by the Port Authority of New York and New Jersey.

LaGuardia, regarded as the city's downtown airport because of its proximity to Manhattan, does not have a rail connection²⁸. There is a scheduled express bus to Grand Central Terminal and the Port Authority Bus Terminal, as well as a network of service buses to nearby subway stations. Some of these local services have recently been enhanced with dedicated bus lanes and a reduction in the number of stops.

JFK is about 4km from Howard Beach station on the New York subway. Between 1978 and 1990, this station was served by a dedicated express service, the "Train to the Plane". It called at principal stations in Manhattan, Jay Street in Brooklyn then ran non-stop to Howard Beach (where passengers had to transfer to a bus to reach the terminals). After 1990, only the regular subway service was available²⁹: the Port Authority continued to provide a connecting shuttle bus which also served the massive parking lots between Howard Beach station and the terminals.

Then on 17 December 2003 Airtrain JFK opened. This is an innovative elevated automated transport system running on a loop around all of the terminals, with spurs off to both Howard Beach and to Jamaica station, on the Long Island Railroad and the subway. Passengers using the inter-terminal loop have a free ride: for the stations with subway and rail connections there is a \$5 fare, payable at the interchange point.

This airport too has a scheduled express bus service to Grand Central Terminal and the Port Authority Bus Terminal.

In addition there are a few regular service buses to nearby subway stations, which were particularly useful before the Airtrain service opened.

Newark Liberty International Airport has an express bus service to Bryant Park and Grand Central Terminal, which formerly served Penn Station and lower Manhattan. A second express service connects the airport with the Port Authority Bus Terminal. Until 2001, there was an express bus to downtown Newark. The airport is also served by local scheduled buses.

On 21 October 2001, Airtrain Newark opened – an automated elevated tracked transit system connecting the three terminals, the main parking lots and the new station on Amtrak's Northeast corridor (connecting Boston, New York City and Washington DC).

²⁸ Although there have been plans, most recently in January 2015

²⁹ served by an express service making 18 stops between Howard Beach and Manhattan (Penn Station)

The station is served both by New Jersey Transit commuter trains and Amtrak's Regional long-distance services. However, at the time of writing, only nine of these Regional services³⁰ stop each day. This reduces the attractiveness to air passengers relying on connections: just missing a train is more serious as frequency reduces. At times, there are 40 minute gaps between successive New Jersey Transit trains. New Jersey Transit tickets are not valid on Amtrak trains: Amtrak tickets are generally valid only on specific trains.

There are plans to extend the PATH service, a multi-stop subway serving lower Manhattan, from its current terminus at Newark Penn Station to Newark Liberty International Airport Station: air passengers would have to change to the Airtrain there. The project is under study.

The Port Authority produces a comprehensive annual "Airport traffic report": that for 2008 (published May 2009) was the latest to hand when this report was originally being written.

One of the tables in the report deals with surface access by departing air passengers. It only gives data for selected modes – essentially the express bus services to downtown New York and (for Liberty International Airport) Newark, and the rail services. It does not cover other short-distance service buses, cabs or private cars, or indeed longer distance buses, charter buses, hotel shuttles or the pre-booked van services of the Super Shuttle variety.

Data

The table below summarises the data, which have been converted to percentages of annual passengers through each airport.

Year	Newark			JFK			LaGuardia
	Bus	Train	Public transport	Bus	Train	Public transport	Bus
1995	5.74		5.74	3.00	3.79	6.79	3.00
1996	5.93		5.93	2.84	3.88	6.72	2.78
1997	5.31		5.31	2.46	5.54	8.00	2.29
1998	5.05		5.05	1.74	5.04	6.78	1.45
1999	4.75		4.75	1.96	4.20	6.16	1.58
2000	4.31		4.31	1.75	n/a		1.75
2001	3.72	0.41	4.13	1.70	n/a		1.74
2002	2.11	3.45	5.56	1.61	3.68	5.29	1.72
2003	2.09	4.00	6.09	1.68	4.02	5.70	1.72
2004	2.14	4.29	6.43	1.52	6.90	8.42	1.72
2005	1.95	4.37	6.32	1.40	8.34	9.74	1.64
2006	1.73	4.46	6.19	1.21	9.27	10.48	1.58
2007	1.74	4.93	6.67	1.05	9.21	10.26	1.53
2008	1.89	5.47	7.36	1.02	9.90	10.92	1.44

³⁰ And no Acela Expresses: these only stop here when the air service is badly disrupted

Subway numbers for JFK were not reported in 2000 and 2001.

In the 2002 “Airport traffic report” there is a note that Airtrain Newark figures include Amtrak passengers: it is assumed that this practice has continued.

Comment

A valuable component of these statistics is the inclusion of a “control” airport, LaGuardia, which has had no significant change in its public transport access arrangements between 1996 and 2008.

There, the very small public transport (bus) share has declined – initially quickly then more slowly, but overall halving over the 14-year period.

By contrast, the other two airports, each with a new rail connection, showed increases in the public transport share – 5.74% to 7.36% at Newark and 6.79% to 10.92% at JFK. These figures are not large by European standards, but they are by those of North America, where rail mode share percentages tend to be in single figures.

As with LaGuardia, bus mode share has dropped considerably – see below.

What is also obvious is that the major jump in public transport mode share occurred around the time of introduction of the Airtrain services. Inevitably there are distortions caused by the effects of the 9/11 terrorist attacks, but comparing 1999 and 2008 at Newark shows a growth in public transport mode share from 4.75% to 7.36%, and JFK 6.16% to 10.92%.

Perhaps inevitably, the express bus share has declined. Again comparing 1999 and 2008, the figures for the three airports are

	1999	2008
Newark	4.75	1.89
JFK	1.96	1.02
LaGuardia	1.58	1.44

The smaller the initial market share, the smaller the decline has been – an indication of a strong preference by a dedicated few whose needs the service meets precisely, perhaps.

Unfortunately taxi figures are not given. There is a flat fare of \$45 (2011) for a cab between JFK and downtown Manhattan, compared with a rail fare of one-sixth to one-third of this. A comparison of the cab mode share over time would have been interesting.

Portland (Oregon)

Introduction

The MAX light rail extension to Portland (Oregon) airport opened on 10 September 2001 – hardly the most auspicious day!

Trains – mainly low-floor – run on-street and on reserved infrastructure to and through the city centre. The city is widely known for excellence in pedestrian and public transport facilities.

Data

Year	Car	Taxi	Bus	Rail	Other
1997/98	81	4	11		4
2001	73	4	15	5	3
2003	81	4	9	6	

Figures are percentages of air passengers.

The source is the "Terminal Access Study Portland International Airport", published in March 2005 by Leigh Fisher Associates for the Port of Portland.

The bus figure relates to shuttles – either hotel shuttles or the North American Super Shuttle style of pre-booked door to door transport. "Other" is likely to be local bus.

Comment

Car traffic initially dropped but then came back to its previous level. While rail appears to have gained at the expense of bus, given the nature of the bus traffic this conclusion cannot be strongly defended.

It is very difficult to draw conclusions from any 2001 figures for the US: the events of 11 September and the aftermath (massive parking restrictions at airports, for example) distorted things so much.

San Francisco

Introduction

The extension of the BART subway system to San Francisco International Airport was opened on 21 June 2003.

The station at the airport is close to the international terminal, but for other terminals either a long walk or a ride on an internal automated people mover is necessary.

Frequent trains run between the airport and downtown San Francisco (and beyond).

Two seminal reports showed mode share statistics for public transport access to the airport. Both use percentages of enplaned passengers³¹.

TCRP report 62, “Improving public transportation access to large airports” (2000), gave mode share figures for the airport in figure S-1 on page 2. The source is quoted as “provided by airport management in December 1999”: no date for the figures is given.

ACRP Report 4, “Ground access to major airports by public transportation” (2008) gave 2004 statistics. These did not explicitly say that bus figures included shared-ride van, but it is considered likely.

Data

	TCRP report 62	ACRP report 4
	1999?	2004
Bus	9	16
Shared ride van	12	
Rail		7
Total	21	23

Figures for 2011 were extracted from the SFO Annual Survey 2011 (at <http://www.flysfo.com/media/customer-survey-data>). This shows the following:

³¹ There is a strong suspicion that the travel characteristics of outbound (enplaned) and inbound air passengers differ, although quantification is hard to come by

Mode	%
Car	45
Taxi	12
Bus	0
Shared ride van	16
Rail	8
Other	18

Only 3 respondents (of over 3800) in the survey came by service bus.

Comment

Since only public transport figures are given in the earlier reports, the impact of the introduction of the train service on individual private modes is not known. However, it is clear that the overall public transport share has not grown much.

Stockholm Arlanda

Introduction

A frequent dedicated high speed Airport Express service, Arlanda Express, between central Stockholm and the airport started on 25 November 1999: it was followed on 10 January 2000 by a regional service provided by SJ, the State Railways. This ran to several Swedish cities, including Stockholm.

A local service between the university city of Uppsala (north of the airport), Arlanda Airport, and the suburban town of Upplands Väsby (south of the airport), where passengers could connect to local trains to the city, started in 2007. A direct local service to downtown Stockholm started in 2013.

In 2004 it was reported that the reaction of the express bus service to the opening of the Airport Express had been to halve fares and double frequencies³².

Data

Year	Car	Taxi	Bus	Rail	Other
1997	37	28	32		3
2006	31	26	18	26	
2008	33	21	19	27	
2012	29	19	20	28	3
2013	29	19	19	30	3

Figures are percentages of air passengers³³.

Sources:

1997 - Luftfartverket³⁴ Environmental Report 1998.

2006 - Presentation material from Roger Jones, WSCC and ARC. The taxi figure includes hire cars.

2008 – Luftfartverket: personal communication from Gerd Englund, then Manager Airport Services Landside, Stockholm Arlanda Airport.

2012 and 2013 - Luftfartverket: personal communication from Tomas Kreij, Surface Access Director, Stockholm Arlanda Airport.

The “Other” figure in 1997 relates to passengers who caught a local bus between the airport and the nearby Märsta station to connect with a suburban train to or from Stockholm.

³² Public Transport International 2/2004

³³ and not just those originating or ending their journey in Stockholm itself – see page 7

³⁴ Swedish Airports Authority

Comment

It can be seen that the bus service was particularly badly hit by the introduction of the Airport Express. A reason behind the steep decline is probably the distance between airport and city – 40 km. Mode shares of both car (immediately) and cab (with a time-lag) dropped after the introduction of the train service.

Vancouver

Introduction

In late August 2009, the Canada Line automated light metro between Vancouver and its airport opened.

Data

Very preliminary statistics, supplied by the airport authority in its presentation³⁵ in IARO's "Successful light rail to airports" conference there on 19 October 2009, show the following.

	Car	Hire car	Limo	Train	Taxi	Hotel bus	Tour Bus	Airport – city bus	Other
Before	41	9	2	3	27	5	3	3	7
After	37	8	2	16	22	5	3		7

Comment

Figures relate to air passengers, meeters and greeters and sightseers (the latter being 6% of the total) only: they exclude employees (20% of total rail users).

The Airporter express bus between airport and city was withdrawn when Canada Line opened.

Canada Line users' previous mode of transport was car (49%), taxi (25%), Airporter bus (25%) and other (1%).

The table shows that the exclusive modes – hotel bus, tour bus and limo – have kept their market share. Car and cab shares have each gone down by about 5 percentage points.

³⁵ by John Lenahan, Director, Engineering Projects, Vancouver International Airport

Vienna (Wien)

Introduction

Vienna International Airport is not only a very interesting case study, but also one which is well documented with reasonably good statistics.

In 1977, an S-Bahn service opened with hourly stopping trains connecting two main-line stations in the city (Nord and Mitte) and the airport. It was operated by the State Railways, ÖBB, and took 35 minutes.

In 1996, ÖBB started an express bus service between city and airport, running every 20 minutes. The fare was twice that charged for the S-Bahn.

In 1997, work started on a major upgrade of the line used by the S-Bahn, which then ran on a constricted formation with some single-track sections. Speeds were limited to 50 km/h. At times during the work, trains ran infrequently and passengers were encouraged to catch the express bus. As part of the work, new freight rail infrastructure was created in the area: this allowed space to be vacated to facilitate double-tracking of the passenger line, significantly increasing capacity and reliability.

On 14 December 2003, a premium Airport Express – CAT, City Airport Train – started service. At the same time, because of the upgraded infrastructure, the S-Bahn journey time was reduced to 28 minutes and frequencies were standardised at two trains an hour.

CAT ran half-hourly: the line speed was increased to 120 km/h and trains took 16 minutes to travel non-stop between the airport and a modernised area of Mitte station with in-town check-in facilities. It is jointly owned by the airport authority (50.1%) and ÖBB (49.1%). When it started, there were initial reliability problems associated with track and traction³⁶.

The railways serving central Vienna have been upgraded, with a new central station being created. As part of this, a new connection was made so that through trains can run between the airport and other parts of the country. This opened in December 2014. Concurrently, ÖBB and Austrian Airlines started a code-share on the Vienna – Linz sector – reportedly, very successfully³⁷. It has given passengers better choice with more frequent services, and has saved Austrian Airlines significant amounts on the loss-making flights.

And there have long been plans to extend the railway towards Bratislava, in Slovakia.

³⁶ according to “Today’s Railways”, April 2004 page 61

³⁷ “Austrian Airlines Will Increasingly Rely on Rail Service between Linz and Vienna” <http://www.ttweurope.com/news/article/austrian-airlines-will-increasingly-rely-rail-service-linz-vienna-2/> 3 February 15 accessed 4 February 15

Data

Year	Car	Taxi	Bus	S-Bahn	CAT	Other
1999	49	26	15	7		3
2000	43	32	17	7		
2001	43	32	20	5		
2002	45	28	23	3		
2003	41.7	31.8	18.5	6.2		
2004	41.0	29.0	14.3	7.6	7.0	
2005	42.5	26.0	11.0	9.3	9.9	
2006	40.4	25.1	10.8	13.2	9.9	
2007	40.2	23.9	12.5	13.9	9.1	
2008	36.4	23.4	12.4	15.4	8.8	3.2
2009	36.1	23.3	12.2	14.3	11.0	3.3
2010	35.6	22.9	12.2	13.1	11.6	5.0

Figures are percentages of air passengers only.

Sources are as follows.

1999 - "From airport to airport city". Airport Regions Conference January 2001.

2000-2003 – “Umwelt-Aktuell 2004” from the web-site of Vienna International Airport. The 2003 report is the oldest accessible on the web-site, so it is unfortunately not easy to go back further.

2004-2006 – “Umwelt-Aktuell 2006” published by Vienna International Airport.

2007 – “Umwelt-Aktuell 2008” from the web-site of Vienna International Airport.

2008, 2009 and 2010 - “Umwelt-Aktuell 2010” from the web-site of Vienna International Airport.

Comment

The “Umwelt-Aktuell” series of publications, available on the web-site of Vienna International Airport³⁸, has been a valuable source of data. Each annual report gives three years of mode share figures – although occasionally there are minor discrepancies between figures for the same year in different issues (discrepancies too minor to affect any conclusions drawn here). There are also discrepancies between these figures and those quoted by CAT, presumably because the latter include people who are not air passengers. Figures in the table above are given to the accuracy with which they were quoted in the original publication.

The figure for car plus taxi remains constant in the early years at around 75%: it then drops steadily each year from 2004 – the first full year of CAT – to just over 64% in 2007 and 58.5% in 2010.

It took four years until 2008 for the car mode share to drop significantly, from over 40% to around 36%. The taxi mode share, by contrast, dropped almost immediately (31.8% in 2003 to 26% in 2005) and has stayed reasonably constant at around 23% since 2007. This is an interesting contrast with Stockholm Arlanda (see page 36).

The bus mode share climbed steadily in the early years as the S-Bahn figure declined, presumably with the impact of the major engineering work on the line. It then dropped away again with a slight upturn in 2007. The S-Bahn share then climbed again, and stayed at or above the Airport Express figure³⁹.

The 35% rail mode share forecast by ÖBB⁴⁰ has yet to be attained.

³⁸ <http://www.vie-umwelt.at/jart/prj3/umwelt/umwelt.jart?rel=de&content-id=1174475986790&reserve-mode=active>

³⁹ compare with the Heathrow situation, page 19

⁴⁰ in International Railway Journal, June 1999 page 36, “Rebuilding the airport line” and a Vienna Airport Press Release issued on 12 March 2002

What's the answer?

It needs to be emphasised that the statistical basis of this report is not particularly robust. However, the following conclusions are offered.

Individual modes

What happens to mode share figures when a train service is introduced?

In the following table, an increase is shown by a + symbol, and a decrease by a - sign. An = sign means no change.

Airport	All (A) or passengers (P)	Car	Taxi	Bus
Birmingham	P	-	=	=
Düsseldorf	P	-	+	=
Frankfurt	P	-	=	=
Hamburg	?	+	-	-
Liverpool	P	-	-	+
London City	P	-	-	-
Heathrow	A	-	+	=
Stansted	P	-	+	-
Manchester	A	-	+	?
New York City	P	Not available		-
Portland (Oregon)	P	=	=	=
San Francisco	P	Not available		-
Stockholm Arlanda	P	-	-	-
Vancouver	P	-	-	-
Vienna	P	-	-	-

It can certainly be concluded that bus share declines – this has been true for nine of the fifteen airports (including Newark and JFK, excluding LaGuardia).

At Düsseldorf, Frankfurt, Heathrow and Portland, bus share remained much the same (although it was always very small in Düsseldorf). In Vienna, there has been a decline but this may have been arrested. Figures for Manchester are difficult to interpret. The Liverpool figure is a combined figure for bus, coach and train because public transport data are for the bus service to the nearby railway station. Birmingham shows much fluctuation – from 11% to 3% to 11% to 9%. The share of bus at Stansted, having been as low as 8%, is now up at 30%.

The private car mode share is also likely to decline – it has done so in eleven cases, although it has grown in Hamburg (possibly because of an anomaly in the figures) and remained much the same in Birmingham. No figures are available for the New York City airports or San Francisco. At Stansted, there has been a perceptible drop in car mode share (69% to 38%) between 1991 (opening of the new terminal and expansion of air service) and 2013.

Taxis show anomalous results. Their mode share has dropped in six of the cases, increased in four and remained the same in three.

Taxi mode share has unambiguously increased at Düsseldorf (3½ percentage points), Heathrow (5 percentage points) and Manchester (11 percentage points); and after an initial decrease has climbed back to just above the original level at Birmingham. At Frankfurt and Stansted, the market share has grown by a very small extent. At Portland (Oregon) it has remained steady at a low level. In Liverpool, Stockholm Arlanda, Vancouver, and Vienna, there has been a decline: at London City Airport, the taxi mode share virtually halved, although the latest figures show an increase on that low point. In Hamburg there has been a significant decrease, but there may be problems with the accuracy of the figures (see page 17).

Overall public transport mode share

The overall public transport mode share has unambiguously increased in all cases except Manchester (where the decline – 12% to 10% - is trivial and probably within the limits of statistical accuracy). There have been significant increases at Frankfurt (16 percentage points), Liverpool (12 percentage points), London City Airport (21% to 48%), Stansted (22% in 1991 to 52% in 2013), Stockholm Arlanda (17 percentage points), Vancouver (10 percentage points) and Vienna (15 percentage points).

Stansted is a bit difficult to interpret: figures for 1991 may be based on a low throughput, before completion of the terminal and the relaunch of the airport.

There appears to be no correlation with factors like journey time, distance, airport size or airport function (hub or point-to-point, or whether the predominant traffic is business or leisure, origin or destination).

As with all good research, one can only conclude by emphasising the need for more. The sample size is very small.

The bigger picture

Manchester Airport commented that mode share figures in a time of generally growing demand do not tell the whole story.

In 1992, the last full year before the rail link opened, they handled 11.7m non-transfer passengers: in 2008 the figure was around 21m. It is unlikely that a wholly road based system could have handled the 10m (nearly 80%) increase, even given the improvements to the highway network over 15 years.

In 2008, rail was carrying some 2.5m passengers – a quarter of the increase, but many of these are medium to long distance passengers. People from places like Leeds, York and Newcastle are attracted to Manchester Airport (and away from closer smaller airports) in part by the good regional rail service to a good regional airport with a wide range of flights, destinations and carriers. Rail is the fourth largest carrier at the airport.

The airport's firm view is that the benefits of a good rail link are really felt when terminating passenger numbers exceed around 10m a year.

The impact on the airport

Introduction

This section, the major piece of new work in the second edition, was prompted by a question from Metrolinx in Toronto, planning their airport railway which is to open in 2015. The airport authority is levying an access fee of around C\$2/passenger to compensate for the loss of parking revenue assumed to be caused by the start-up of the rail service – a proposal thought at the time by IARO to be unique⁴¹.

The basic assumption was that parking revenue would be lost as passengers would ride the train instead of parking at the airport.

However if it was true, as air passenger numbers increased – as they tend to, over time – parking revenue would increase too and would ultimately be back where it was before the opening of the train.

Can it be proven?

A possible answer is given by the figures from Manchester Airport on page 42. In 1992, before the railway line opened, 8 million people - 68% of the airport's 11.7m non-transfer passengers – accessed the airport by car. In 2008, the percentage had dropped to 60% - but because passenger throughput had risen (to 21 million), numbers arriving by car had increased to 12.6m. This is more than 50% above the 1992 figure.

The assumption that people parking at the airport would transfer to rail if there was a train is one which is difficult to prove. The only airport with published data on the previously used mode is Vancouver, where 49% of the 16% who now use train formerly used a car (see page 37). No doubt this includes a mix of kiss-and-fly and park-and-fly. Car mode share has gone down by just four percentage points, from 41% to 37%.

Another method might be to look at the percentage of air passengers parking at the airport before and after the train service started. This statistic too is unreliable – people change between park and fly and kiss and fly (and indeed other modes) for all sorts of reasons⁴². The cost of parking and levels of household car ownership are obvious factors.

A change in the type of traffic between originating and terminating passengers would also be a factor. People flying in from a home elsewhere would not have a car available: those living near the airport and starting their journey there would.

⁴¹ Although apparently it has been discussed at Denver too

⁴² In 2010, parking revenue at ACI member airports went down 3.5% compared with the previous year, according to ACI's Airport Economics Survey: 2010 was not a year in which large numbers of airport railways opened

Many of the statistics needed are not easily available. For some airports (like Stockholm Arlanda) data for car park usage are not separately published: Swedish aviation authority Luftfartsverket publishes results as a group. For other airports, data spanning the introduction of the rail link are not available on their web-site.

The following figures have been found, however.

Copenhagen

The 2009 annual report of Copenhagen Airport states that, “Primarily due to the intensified competition from the new Metro line to the airport, which opened in September 2007, revenue from the parking concession fell by 3.8%.”

Minneapolis – St. Paul (MSP)

An MSP official is quoted in a 2013 report⁴³ as saying that a very small number of passengers park elsewhere and come on the light rail, although some employees do. The impact on parking revenue was trivial – between 1% and 2%.

New York data

Useful data for the New York airports are available. These are particularly valuable since, as discussed in the section on the major New York airports (see section starting on page 29), while Newark Liberty International Airport and JFK Airport have both received an enhancement to their accessibility (the Airtrain), LaGuardia Airport has not.

The Port Authority’s Airport Traffic Report⁴⁴ shows in table 2.2.1 the number of passengers and in table 4.2.1 the number of paid parked cars each year. From this it is possible to calculate the average number of paid parked cars/passenger (or the percentage of passengers who pay to park a car at the airport).

Between 2000 and 2010 this has changed as follows.

⁴³ Airport World August/September 2013 p84, “On a roll” by Ian Putzger

⁴⁴ <http://www.panynj.gov/airports/general-information.html?tabnum=2>

Airport		2000	2010	2010 as a percentage of 2000
JFK	Passengers (m)	32.828	46.514	
	Paid parked cars (m)	4.727	4.166	
	Parked cars/passenger	.144	.090	58.5
Newark	Passengers (m)	34.189	33.110	
	Paid parked cars (m)	5.921	3.106	
	Parked cars/passenger	.173	.094	54.2
LaGuardia	Passengers (m)	25.36	23.983	
	Paid parked cars (m)	2.943	1.531	
	Parked cars/passenger	.116	.064	55.0

The final column shows virtually no difference in the percentage drop in the number of cars parked/passenger across the three airports, even though only two of them have had a rail connection added.

This is strong evidence for suggesting that a new rail connection does not result in a decline in the number of people parking at an airport. The decrease may be due to the growth in private off-airport parking.

Vancouver data

In Vancouver, the parking revenue/passenger⁴⁵ has decreased over the time Canada Line opened. In 2008 it was C\$1.80: in 2010 it was C\$1.68⁴⁶. This could be because of diversion from park-and-fly to public transport or to kiss-and-fly.

Vienna (Wien) data

In the section on Vienna above, key before and after years were 2003 and 2005. City Airport Train (CAT) opened on 14 December 2003. Statistics for terminating passengers and parking revenue for those years and for 2010 have been extracted from the annual reports of the airport.

⁴⁵ Parking revenue divided by the total number of passengers through the airport

⁴⁶ Source is the airport authority's published annual reports, available on its web-site

	2003	2005	2006	2010
Terminating passengers (m)	12.7	15.8	16.9	13.8
Parking revenue (€m)	20.9	22.5	22.8	37.2
Parking revenue/terminating passenger (€)	1.64	1.42	2.03	2.70

So parking revenue/passenger dropped by €0.22 (about 12½%) between 2003 and 2005 – but by 2006 it had significantly increased, by €0.39 (around 25%) above pre-CAT levels. The trend appears to have continued.

As noted on page 40, it is the taxi share rather than the private car share which has declined.

Conclusions

General

When a new rail service starts running to an airport, bus and car mode share are likely to decline.

The overall public transport mode share is likely to increase.

There may be a short term impact on airport parking, but not necessarily – and not necessarily caused by the start-up of the railway.

From the small sample size available, these effects appear to have no correlation with factors like journey time, distance, airport size or airport function.

The figures given in this report are mode share percentages – either of all airport users or of air passengers only.

What does this hide?

To a degree, this conceals some important factors –

- the absolute number of passengers,
- the split between originating and terminating passengers⁴⁷
- the usage of car parks (a major earner at airports), which can be affected by airport pricing policy and off-airport competition and
- the magnitude of the usage of the transport network (in terms of, for example, passenger kilometres) – an important factor in transport planning.

This is highlighted by the comments of Manchester Airport reported on page 42. In 1992, 68% of Manchester's passengers – some 8m people – accessed the airport by private car. In 2008, the percentage had gone down to 60, but because of the growth in passenger numbers, this still meant that 12.6m people were using a car. That is an increase of nearly 60%. Those airports who fear that a new train service will decimate their parking revenue could ponder on these figures.

Specific lessons

One important point, brought out by consideration of views from both Düsseldorf and London City Airport, is the value of through services.

Air passengers do not like changing trains, however easy it is (and in both of these cases it is exceptionally easy).

⁴⁷ Originating passengers are those living near the airport and starting their journey there, as opposed to terminating passengers who are living elsewhere and are flying in

This in turn argues for a variety of services at an airport – for example a dedicated Airport Express for high speed downtown connections, and a local transit service for employees and for people with destinations other than the central business district. Choice increases public transport mode share.

A bus shuttle (as at Liverpool) and a people mover (Birmingham) both work.

Airport access statistics are of variable quality, and need to be used with extreme care. Because of this, so does this report.

Local factors always need consideration: the individual circumstances at individual airports influence mode share over time.

Some airports – Düsseldorf, Frankfurt and Manchester in particular – are finding that the proportion of long distance passengers arriving by rail is high. This has a disproportionate effect on road traffic, of course, as the passenger-kilometres for each trip are greater than with shorter trips. The overall effect is difficult to quantify without significantly more data, but it is nonetheless important.

Long-distance trains at airports are popular, even if there is no code-share arrangement with airlines. This is demonstrated at Düsseldorf (12.2% mode share by long distance train) and Frankfurt (19%). The figure for Paris Charles de Gaulle is 4% of total air passengers (including those interlining – changing planes): this is despite a high speed train service which, with few exceptions, has relatively infrequent connections to major cities.

The future

We hope to continue to expand this report and keep it updated. Feedback from readers and data for more airports would be welcome.

IARO's Air/Rail conferences and workshops

Copies of the published reports of the earlier workshops and other research reports are available price £250 (free to IARO members). See www.iaro.com/publications.htm. Papers presented at more recent workshops are available on CD-ROM at the same price.

Workshops are very focused, dealing in detail with a restricted number of key issues, and complement the regular Air Rail Conferences. Workshops and conferences (with site visits) have been held as follows.

1993 - Zürich

1994 - Paris

1996 - London (Heathrow Express, Stansted Express)

1997 - Oslo (Airport Express Train)

1998 - Hong Kong (Airport Express Line)

- Frankfurt (with the AIRail station and the Cargo Sprinter)

1999 - Workshop 1: Berlin (the Schönefeld link)

- Copenhagen (the Øresund Link)

2000 - Workshop 2: Milan (Malpensa Express)

- Paris (plans for CDG Express)

- Washington (Baltimore-Washington International Airport)

2001 - Zürich airport: Air rail links - improving the partnership

- Workshop 3: Madrid (and its airport rail links)

- London Heathrow (Heathrow Express)

2002 - Workshop 4: Amsterdam, for railways serving airports but not as their main job - "Help - there's an airport on my railway".

- New York (the Airtrain projects)

2003 - Workshop 5: Barcelona. Today's design and funding issues for airport railways

- Frankfurt (The AIRail project)

- Workshop 6: Newark. Practical air rail intermodality

2004 - Workshop 7: Oslo. Leisure passengers - a market for airport railways.

2004 - Brussels (Thalys:Air France code-share)

2005 - Chicago (Chicago's future in an era of successful air-rail intermodality)

- Shanghai study tour

- Workshop 8: Edinburgh. Security on airport railways.

- 2006 – Workshop 9: Baltimore (BWI). Security on airport railways.
 - Regional meeting 1: Stockholm
 - Workshop 10: Marketing and ticketing innovations (e-air-rail) Düsseldorf
 - Regional meeting 2: Kuala Lumpur
- 2007 - Los Angeles: Air/Rail East/West
 - Baltimore: The seamless journey
 - Vienna (Wien): Communications
- 2008 - October - London Gatwick. One-day conference on ticketing
- 2009 - June - Hamburg, with site visit to the new S-Bahn
 - October – Vancouver: light rail to airports
- 2010 - October – Lyon, with a site visit to the LesLYS express tram to the city
 - November/December – Far East study tour (with AREMA)
- 2011 - October – Venice
- 2012 - September – Berlin
- 2013 - July – Birmingham
 - September – Gatwick
- 2014 - April - Dallas
 - September - Stockholm
 - November - Heathrow



Details are available from IARO, or on www.iaro.com: you can sign up for details of future events in different parts of the world on www.iaro.com/events.htm