

Airport and Airline Access

Dr. Richard de Neufville

Professor of Engineering Systems and
Civil and Environmental Engineering
Massachusetts Institute of Technology

Airport Systems Planning & Design / RdN

Airport and Airline Access

- **Objective: To identify key issues, provide guidelines, and present current situation**
- **Airport Access**
 - **User Needs vs Standard Notions**
 - **Cost Effectiveness Analysis**
 - **Policy Conclusions and Guidelines**
 - **Worldwide deployment**
- **On Airport People movers**
 - **Catalyst of Major Changes in Airport Form**

Airport Systems Planning & Design / RdN

User Needs (I)

- As a general rule...
- Most airport traffic is to suburbs
 - Travelers, employees, and others each comprise about 1/3 of airport traffic
 - Employees mostly in suburbs
 - Suppliers mostly in suburbs
 - Travelers: about half to suburbs, half to city center
- Conclusion: Only about 1/6 of airport access traffic to city center

Airport Systems Planning & Design / RdN

User Needs (II)

- Traffic to city center alone is not enough to justify mass transit economically
- Example analysis
 - 25 million total passengers airport with 20 % transfers
 - => 10,000,000 enplanement airport
 - About 30,000 pax/day => ~ 15,000 pax/day to city center
 - If mass transit mode split is 50% (which would be excellent), this gives it 7,500 passengers per day
 - Since capacity of rail line is about 7,500 pax/hour
 - Airport traffic to city unlikely to justify mass transit
- Justification is in being part of city network

Airport Systems Planning & Design / RdN

User Needs (III)

- **Travelers' priority: reliability of travel time**
 - Making the flight is most important
 - Direct travel, without changing modes, is an important part of travelers' confidence in reliability of access
- **Travelers do not put priority on speed of travel to airport**
 - Travelers typically arrive early
 - "50% arrive an hour early"

Airport Systems Planning & Design / RdN

A Standard Concept of Airport Access

- **Travel to/from airport is too slow**
 - Crawling in traffic is absurd compared to speed of aircraft
- **Solution: High speed link between airport and city center**
- **Examples**
 - Paris -- RER
 - London -- Paddington/Heathrow express

Airport Systems Planning & Design / RdN

Rail Access often “over sold”

- **Heathrow Express: “you can be in the centre of London... in just 15 minutes”**
 - Actually, schedule is 23 min from Terminal 4
 - To Paddington, 20 to 30 minutes from “center”
 - Need to buy tix, wait for train – it’s an hour trip
- **New York AirTrain 2006: “Airport to downtown in “less than 45 minutes”**
 - If you happen to want to be in Penn Station!!!
 - After 2007 brochure more correctly gave travel times of 60 min to PSta.; 75 to Canal St; 85 to 125th.

Airport Systems Planning & Design / RdN

Rail often not cost competitive

- **Heathrow Express, 2009: about \$30 1-way adult (1/2 for child) (in station costs more)**
 - Price for family of three, including taxi to station between \$90 – 110; about same as direct taxi
- **AirTrain, 2009: \$5/person + \$2.50 subway**
 - Compare to \$45 flat taxi fee (plus tolls) from Airport
 - Ok but generally much longer
 - Note: Employees get subsidized fare -- \$1/ride
 - Note: AirTrain subsidized by Airport Passenger facility charge: ~\$100 million/yr or \$25/rider in 2007 (latest)

Airport Systems Planning & Design / RdN

A Standard Objection to High Speed Airport Access

- **An issue of social justice:**
 - Why should air travelers get special treatment, compared to commuters?
 - Air travelers a fraction of urban congestion
 - Air travelers also only a fraction of rush hour traffic to/from airport
 - Balance are airport employees, etc.
 - Example: 20% at San Francisco
- **Examples of these objections**
 - New York -- Newark and Kennedy to downtown

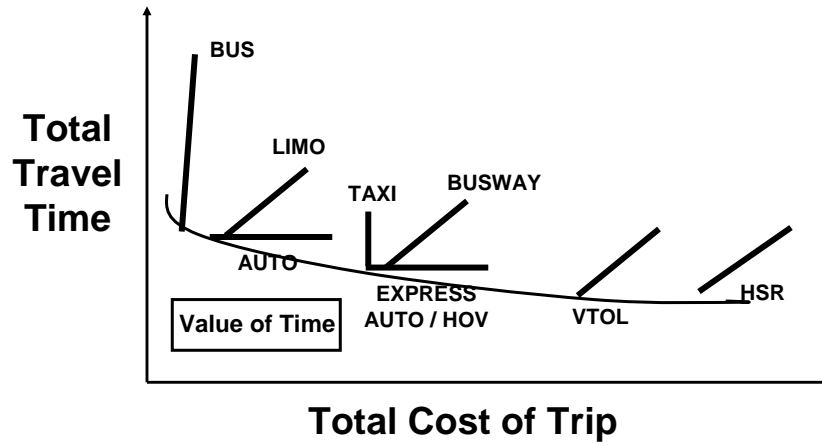
Airport Systems Planning & Design / RdN

Cost-Effectiveness Analysis of Airport Access

- **For a Range of Conditions**
 - Size of Airport, Distance from city center
- **Looked at Cost & Speed of Many Modes**
 - Taxi, Car, Bus, Bus on own right-of-way
 - Rail, High-Speed Rail, Helicopter
- **Can determine most attractive mode for various values of time**

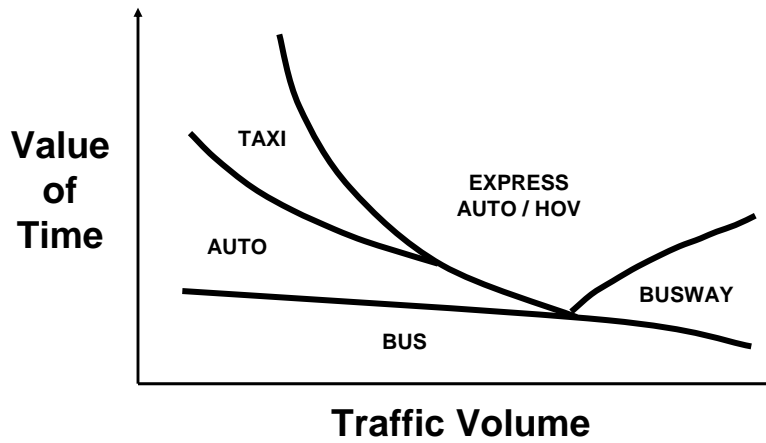
Airport Systems Planning & Design / RdN

Airport Access Cost vs. Time Tradeoffs



Airport Systems Planning & Design / RdN

Preferred Access Mode Depends on Traffic, Value of Time



Airport Systems Planning & Design / RdN

Results of Cost-Effectiveness Analysis

- **Customers prefer Rubber-tired access**
 - Such as Boston Silver line, direct to terminals
- **These offer better service to most customers because they are:**
 - **Faster: direct service (no need to go to station) that eliminates schedule delay**
 - **Cheaper: Less Capital intensive (at margin: people own cars)**
 - **Also (not included in analysis) these vehicles can distribute traffic around city, not just to central city, this is most important to employees**

Airport Systems Planning & Design / RdN

When is rail access effective?

- **A metropolitan rail net exists, so that:**
- **....cost of extension to airport is relatively small**
- **Highway access difficult (example: to airport islands or congested areas)**
- **As a pollution control measure**

- **Thus: Many rail systems exist and many being developed**

Airport Systems Planning & Design / RdN

Rail Access To Airports (Europe, part 1)

Country	City	Airport	High Speed	Intercity	Metropolitan
Austria	Vienna				yes
Belgium	Brussels				yes
Denmark	Copenhagen			yes	
France	Lyon		yes	yes	
	Paris	de Gaulle	yes	yes	yes
		Orly			yes
Germany	Berlin	Schonefield	planned		yes
	Dresden				yes
	Duesseldorf		yes	yes	yes
	Frankfurt		yes	yes	yes
	Hamburg				yes
	Hannover			u. c.	yes
	Koeln-Bonn		yes		yes
	Leipzig-Halle		yes	yes	yes
	Munich				yes
Stuttgart				yes	

Airport Systems Planning & Design / RdN

Rail Access To Airports (Europe, part 2)

Greece	Athens				yes
Italy	Milan	Malpensa		yes	
	Rome	Fuimicino		yes	
Netherlands	Amsterdam			yes	yes
Norway	Oslo			yes	
Poland	Warsaw				u.c. 2011
Portugal	Porto				yes
Russia	Moscow	Domodedovo			yes
		Sheremetyevo			yes
Spain	Barcelona				yes
	Madrid				yes
Sweden	Arlanda				yes
Switzerland	Geneva			yes	yes
	Zuerich			yes	yes
Turkey	Istambul				yes
United Kingdom	Birmingham			yes	
	Glasgow				scrapped
		Gatwick		yes	
	London	Heathrow		yes	yes
		Stansted			
	Manchester				yes
Newcastle					yes

Airport Systems Planning & Design / RdN

Rail Access To Airports (Asia and Australia)

Country	City	Airport	Intercity	Metropolitan
Australia	Sydney			yes
China	Beijing			yes
	Shanghai	Pudong		yes
	Hong Kong	Chep Lak Kok		yes
India	Delhi			uc 2010?
Israel	Tel Aviv			yes
Japan	Nagoya			yes
	Osaka	Shin Kansai		yes
	Sapporo	Shin Chitose	yes	
	Tokyo	Haneda		yes
Narita			yes	
Korea	Seoul	Gimpo		yes
		Incheon		yes
Malaysia	Kuala Lumpur	Sepang	yes	
Philippines	Manila			planned
Singapore	Singapore	Changi		yes
Thailand	Don Muang		yes	
	Suvarnabhumi			Dec 5 2009

Airport Systems Planning & Design / RdN

Rail Access To Airports (United States)

City	Airport	Intercity	Metropolitan
Atlanta			yes
Baltimore			yes
Boston	Logan		yes
Chicago	Midway		yes
Chicago	O'Hare		yes
	Midway		yes
Cleveland			yes
New York	Kennedy		yes
	Newark Liberty	yes	
Minneapolis/St.P			yes
Philadelphia			yes
Portland (Oregon)			yes
Providence		u.c. 2010?	
San Francisco	International		yes
	Oakland		2013?
St. Louis			yes
Toronto CANADA			planned
Vancouver CANADA			yes, 2009
Washington	Baltimore		yes
	Dulles		planned
	Reagan		yes

Airport Systems Planning & Design / RdN

Effect of Low-Cost Airlines?

- **Low-cost airlines are transforming industry – effect on airport access?**
- **Let's examine possibilities...**
- **'Planning Airport Access in an Era of Low-Cost Airlines,' J. of Am. Planning Assn, Summer 2006, 72(3), pp 347-356. R. de Neufville**

Airport Systems Planning & Design / RdN

Possible Logical Chain

- **Low-cost airlines associated with**
 - **Secondary airports – often remote**
 - **Inexpensive facilities**
 - **Cost-conscious passengers**
- **This is not a market favorable to expensive rail projects**

Airport Systems Planning & Design / RdN

Rubber-tired Alternatives

- **Alternatives are coaches, vans**
 - “Super Shuttle” – US consortium of shared-ride operators, 22 cities and 8 million pax in 2007
<http://www.supershuttle.com>
 - “Airport Shuttle” 100 airports in US, Canada, Mexico, France, Italy, Scotland, England
<http://www.goairportshuttle.com>
 - Boston: Logan Express 4 routes to suburbs
 - BRT – Bus Rapid Transit – Silver Line in Boston
- **Many Regulatory issues to be solved...**

Airport Systems Planning & Design / RdN

Another form of access

PEOPLE MOVERS

Airport Systems Planning & Design / RdN

Role of People Movers

- People movers are “trains” that cover short distances -- “horizontal elevators”
- They constitute major innovation in design of passenger buildings
- They resolve tension between
 - Desire to concentrate passengers
 - Need to space aircraft widely
- They link landside and airside buildings or landside and remote parking, stations...
 - A way to reduce curb congestion and pollution

Airport Systems Planning & Design / RdN

Airport People Movers: North America

Region	Country	City	Airport	Landside	Midfield	
America	Canada	Toronto	Pearson	yes		
	Mexico	Mexico		yes		
	U.S.A.	Atlanta			Nov 10 2009	yes
		Chicago	O'Hare		yes	yes
		Cincinnati				yes
		Dallas/Ft.Worth	Dallas/Ft.Worth		yes	
		Denver	International			yes
		Detroit	Wayne County			yes
		Houston	Bush		yes	
		LasVegas				yes
		Miami	International		2010, 2011	yes
		Minneapolis/St.P	International		yes	yes
		New York	Newark		yes	
		Orlando	International			yes
		Pittsburgh				yes
		Sacramento				2011
		San Francisco	International		yes	
		Seattle-Tacoma				yes
Tampa				yes		
Washington	Dulles			2010?		

Airport Systems Planning & Design / RdN

Airport People Movers: Europe & Asia

Region	Country	City	Airport	Landside	Midfield	
Europe	France	Paris	de Gaulle	yes		
			Orly	yes		
	Germany		Frankfurt		yes	
			Dusseldorf		yes	
	United Kingdom	London	Birmingham		yes	
			Gatwick	yes	yes	
			Heathrow		yes	
			Stansted		yes	
	Italy	Rome			yes	
	Spain	Madrid		yes		
Switzerland	Zurich			yes		
Asia	China		Chep Lak Kok	yes	yes	
			Beijing		yes	
	Dubai	Dubai			yes	
	Japan		Osaka	Shin Kansai	yes	
			Tokyo	Narita		yes
	Korea	Seoul	Incheon		yes	
	Malaysia	Kuala Lumpur	Sepang		yes	
	Singapore	Singapore	Changi	yes		
	Taiwan	Taipei		yes		
	Thailand	Bangkok	Suvarnabhumi		planned	

Airport Systems Planning & Design / RdN

Types of People Movers

- **Two general types**
 - Self-propelled (motor on board)
 - Cable-driven (lighter, shorter distances)
- **Can be rubber-tired or steel-wheeled**
- **Many, many manufacturers**
 - However, a couple are beginning to dominate:
 - **Bombardier (Ex Adtranz and Westinghouse) -- rubber-tired, self-propelled, longer distances**
 - **Poma/Otis -- cable driven, short distances**

Airport Systems Planning & Design / RdN

Examples of People Movers

Following 10 slides from presentation by
Harley Moore, Chairman, Lea + Elliott

Drawn from their extensive, world-leading
practice in the design and
implementation of people-movers

Airport Systems Planning & Design / RdN

POMA-Otis

- **DTW – NW
Midfield Terminal**
- **Cable Propelled**
- **Air Levitated**
- **On Mezzanine
Level inside
Airside Building**
- **Source: NW
Airlines**



Airport Systems Planning & Design / RdN

Siemens

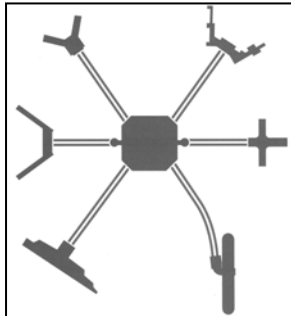
- Dusseldorf Airport
- Suspended Monorail
- Source: Siemens



Airport Systems Planning & Design / RdN

ADtranz (now Bombardier)

- Tampa Airport
- Original Shuttle
- New CX-100 Shuttle



GT
n z



Airport Systems Planning & Design / RdN

ADtranz (now Bombardier)

- Frankfurt
- CX-100
- Rubber-tired AGT
- Pinched-Loop System
- Source: ADtranz



Airport Systems Planning & Design / RdN

ADtranz (now Bombardier)

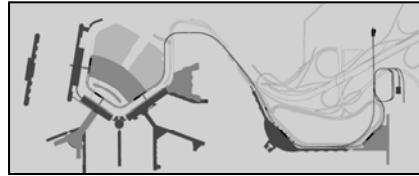
- Rome-Fiumicino
- CX-100
- Rubber-tired AGT
- Source: ADtranz



Airport Systems Planning & Design / RdN

Matra

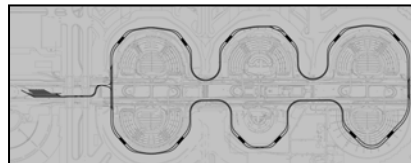
- Chicago-O'Hare
- Now Siemens-Matra
- Rubber-tired AGT
- Source: Matra



Airport Systems Planning & Design / RdN

ADtranz (Bombardier) Innovia

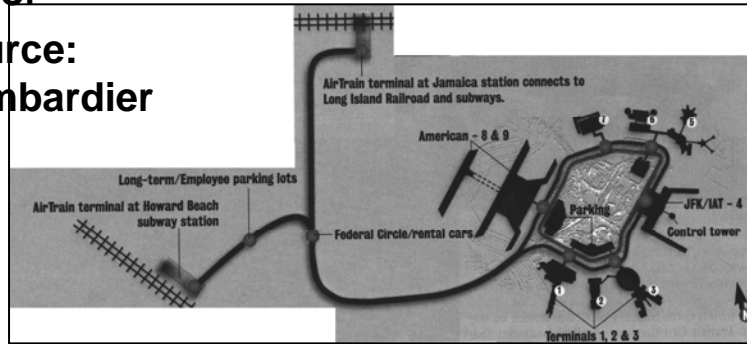
- D/FW Airport
- Rubber-Tired AGT
- Source:
 - Map: Lea+Elliott
 - Picture: Lea+Elliott



Airport Systems Planning & Design / RdN

Bombardier

- JFK – Air Train
- Steel Wheel / Rail
- Linear Induction Motor
- Source: Bombardier



D/FW Airport - AirTrain



Otis

- **Narita Airport – Terminal 2**
- **Cable Propelled**
- **Air Levitated**
- **Bypass Shuttle**



Airport Systems Planning & Design / RdN

Summary

- **Rail Transportation now a common feature at major airports worldwide**
- **Role as much for employees as for passengers – speed not critical factor**
- **On-airport “rail” allows designers to spread out passenger facilities and provide good service for big airports**

Airport Systems Planning & Design / RdN