33rd Annual FAA Aviation Forecast Conference

Airports/Infrastructure Panel

Multiple Airport Demand Allocation and Intermodal Issues

Airport Demand Allocation Models

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Outline

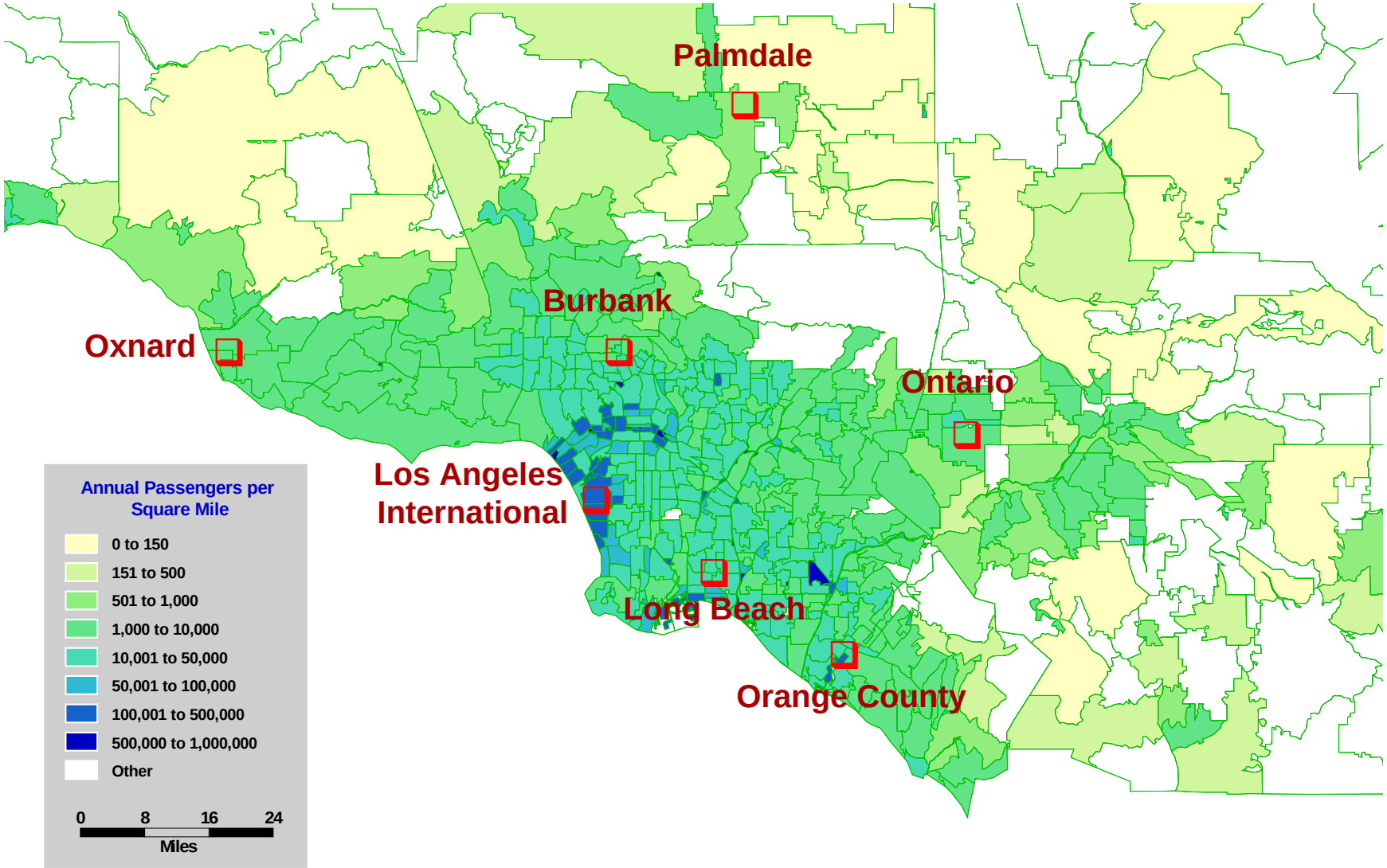
- Modeling airport demand allocation
- Principles of airport choice models
- Issues in modeling airport demand allocation
- Some recent airport choice models
- Overview of selected models
- Conclusions

Modeling Airport Demand Allocation

- Key issue in airport system planning in regions served by multiple airports
  - Large metropolitan regions
  - Statewide and multi-state planning
- Increasing role of secondary airports
  - Capacity constraints at primary airports
  - Use by low-fare airlines
- Intermodal considerations
  - Airport access, short-haul travel

Activity Allocation in Airport Systems

- Central issue in system planning
  - Increasing importance of multiple airport systems
    - Need to allocate regional demand to airports
    - Reflect market realities, not wishful thinking
  - Determines infrastructure requirements, environmental impacts and system performance
  - Typically highly politically charged
    - Need for dispassionate technical analysis


Palmdale
Burbank
Oxnard
Ontario
Los Angeles International
Long Beach
Orange County
Annual Passengers per Square Mile
0 to 150
151 to 500
501 to 1,000
1,000 to 10,000
10,001 to 50,000
50,001 to 100,000
100,001 to 500,000
500,000 to 1,000,000
Other
0
8
16
24
Miles

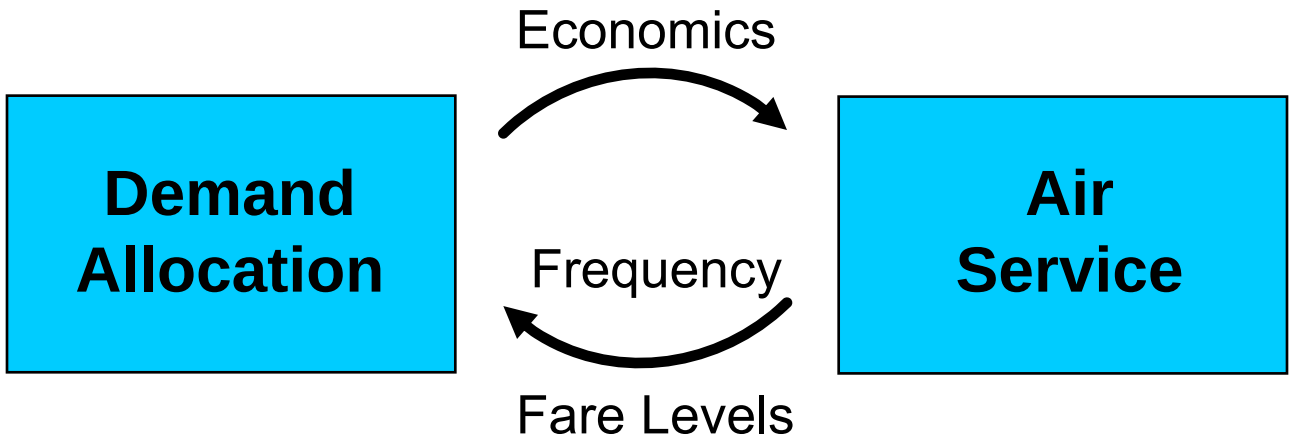
Source: SH&E

Activity Allocation in Airport Systems

- Distribution of activity only indirectly influenced by planning decisions
  - Result of interplay of market forces
  - "Build it, but will they come?"
  - Need to identify and analyze policy levers
    - Model the market response to different policy decisions and actions

Positive Feedback Effect

- Airline decisions depend on traveler choice
- Traveler behavior depends on air service



Principles of Airport Choice Models

- Disaggregate behavioral models
  - Choice depends on traveler characteristics
    - Ground origin, travel destination, trip purpose
- Factors affecting airport choice
  - Air service at alternative airports
    - Air fare, flight frequency, nonstop/connecting, airline preference
  - Accessibility of alternative airports
    - Access times, parking rates
    - Role of public transportation

Current State of Practice

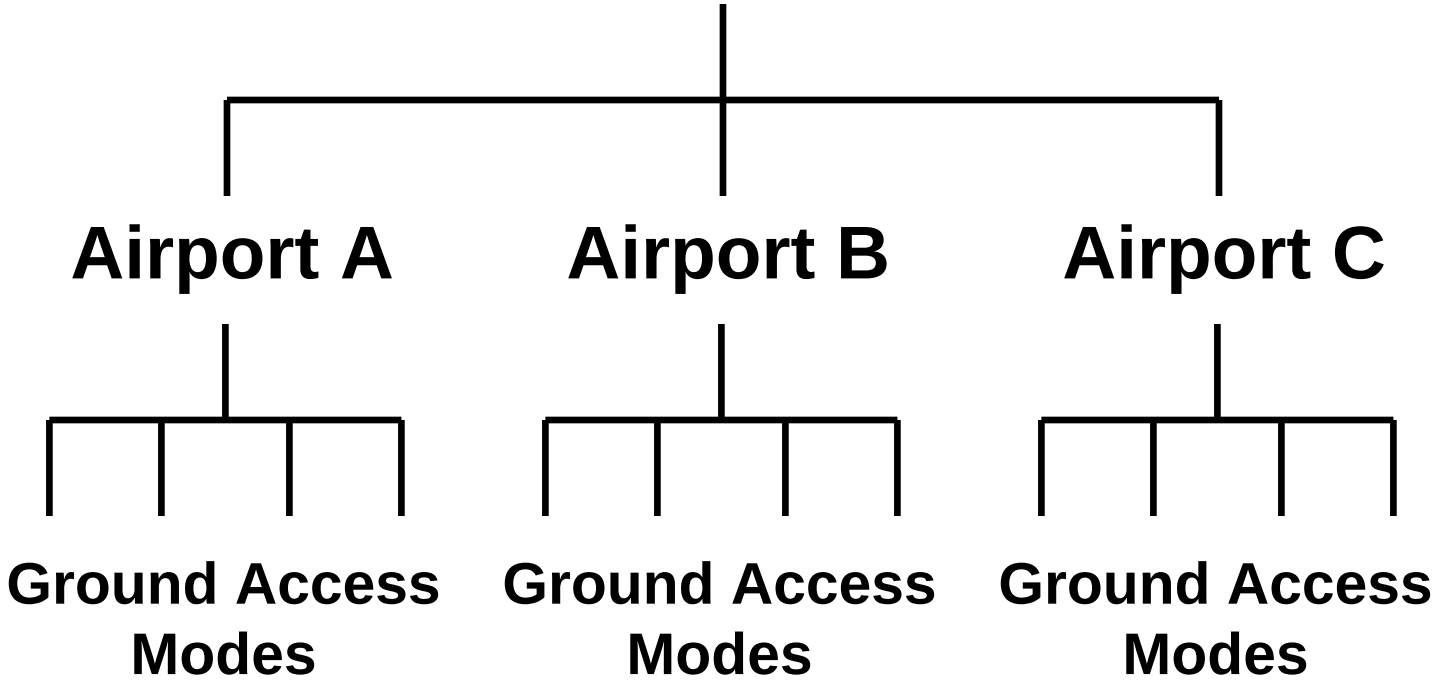
- Multinomial logit choice models
  - Disaggregate behavioral choice

$$P(i) = exp(U_i) / \Sigma_j exp(U_j)$$

where $U_j = f(access, air\ service)$

- Nested logit models
  - Two or more levels of decisions
    - Ground access mode choice
    - Airline choice

Nested Logit Model



More Advanced Models

- Cross-nested logit models
  - Accounts for correlation between airline, access mode and airport choice
- Mixed logit models
  - Variable error terms (taste variation)
- Other techniques
  - Box-Cox logit
  - Neural networks

Issues in Modeling Demand Allocation

- Viability of air service at secondary airports
  - Introduction of service
  - Airline competition
- Accounting for fare differences
  - Yield management affects fare availability
  - Survey data vs. prediction
- Policy instruments to encourage use of secondary airports
  - Ground access, support for new air service

Some Recent Airport Choice Models

- Airport system planning studies
  - Southern California (RADAM)
  - New England Regional Airport System Plan
  - UK SERAS (London Region) Study
- Academic studies
  - Pels, Nijkamp & Rietveld (SF Bay Area)
  - Hess & Polak (SF Bay Area; London Region)
  - Pathomsiri,Mahmassani & Haghani (Baltimore-Washington Region)

Overview of Selected Models

Study	Model	Region
Harvey, 1988	NL	SF Bay Area
Furuichi & Koppelman, 1994	NL	Japan
Windle & Dresner, 1995	MNL	Washington/Baltimore
Bondzio,1996	NL	Southern Germany
Pels, Nijkamp & Rietveld, 1998	NL	SF Bay Area
Mandel, 1999	BCL	Western Germany
Halcrow Group Ltd., 2002	MNL	Southeast England
Pathomsiri, *et al.* , 2004	MNL	Washington/Baltimore
Hess & Polak, 2004	NL	SF Bay Area

MNL = Multinomial Logit NL = Nested Logit BCL = Box-Cox Logit

Overview of Selected Models (cont.)

Study	Air Service Variables
Harvey, 1988	Frequency
Furuichi & Koppelman, 1994	Relative Frequency; Flight time; Fare
Windle & Dresner, 1995	Frequency
Bondzio,1996	Frequency
Pels, Nijkamp & Rietveld, 1998	Frequency; Average Fare
Mandel, 1999	Frequency; Travel time; Trip cost; Stops
Halcrow Group Ltd., 2002	Flight time; Frequency; Fare premium
Pathomsiri *et al.* , 2004	Frequency; Fare
Hess & Polak, 2004	Frequency; Use of turboprop

Overview of Selected Models (cont.)

Study	Ground Access Variables
Harvey, 1988	Travel time; Waiting time; Cost + 7 others
Furuichi & Koppelman, 1994	Travel time; Cost
Windle & Dresner, 1995	Highway travel time
Bondzio,1996	Travel time; Cost; Income; Luggage
Pels, Nijkamp & Rietveld, 1998	Travel time
Mandel, 1999	Distance; Logsum: Travel time; Cost; others
Halcrow Group Ltd., 2002	Logsum: Travel time; Cost; Interchanges
Pathomsiri, *et al.* , 2004	Total access time; Prior use of airports
Hess & Polak, 2004	In-vehicle time; Out-of-vehicle time; Cost

Conclusions

- Airport demand allocation models form a key component of airport system planning
  - However, models are technically complex
- Many critical aspects not well understood
  - Need for more research into issues
- Lack of readily available and accepted modeling tools
  - Some proprietary models (e.g. RADAM)
  - Many models custom-built for specific studies