Configuration of Airport Passenger Buildings

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Outline

• Introduction
  → Motivation
  → Important Ideas

• Range of Configurations

• Process of Evaluation
  → Criteria of Selection
  → Method of Analysis
  → Differences in Traffic Loads on Buildings

• Performance of Configurations

• Recommendation
  → “Hybrid” design responsive to future traffic
Motivation

• No Agreement in Industry about good configuration
  → NACO -- X-shaped satellites in parallel rows: Bangkok/2nd Airport; Kuala Lumpur /International
  → “Atlanta” -- Midfield lines: Denver/International
  → Aeroports de Paris -- Triangles onto spine roads Paris/ de Gaulle

• Many Errors -- Many Choices have been inadequate for eventual traffic
  → Dallas/Ft Worth -- linear building bad for transfers
  → Boston/Logan -- International Building => domestic hub

Important Ideas

• “Airport Passenger Building”
  → NOT A TERMINAL, many passengers do not end their air trips there
  → Many passengers “transfer” between
    • Airlines ; Buildings ; Aircraft of an Airline

• “Correct Choice”
  → NOT THE OPTIMUM, for assumed conditions
  → RIGHT RESPONSE, over range of conditions
Change to View of Airport as “Passenger Buildings”

<table>
<thead>
<tr>
<th>Criteria Considered</th>
<th>Single (or Few)</th>
<th>Multiple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow</td>
<td>Prevalent in Current Practice</td>
<td>“Terminals”</td>
</tr>
<tr>
<td>Broad</td>
<td>Broad Range, Multiple Criteria Performance</td>
<td>“Airport Passenger Buildings”</td>
</tr>
</tbody>
</table>

Range of Conditions

- “Pure” Concepts
  - Linear or Gate Arrival
  - Pier; Satellite
  - Midfield
  - Transporter

- “Hybrid” Concepts
  - Combinations of Pure Elements

- Centralized and Decentralized

- Rail Access
  - Automated People Movers
  - Metropolitan
Linear: Dallas/Forth Worth

Source: FAA Office of System Capacity
Aviation Capacity Enhancement Plan

Finger Pier: Miami/International

Source: FAA Office of System Capacity
Aviation Capacity Enhancement Plan
Satellites (New York/Newark)

Satellites: Tampa

Source: FAA Office of System Capacity
Aviation Capacity Enhancement Plan
Midfield, Linear: Denver/Intl

Source: FAA Office of System Capacity Aviation Capacity Enhancement Plan

Midfield: London/Stansted
Midfield, X-shaped: Pittsburgh

Source: FAA Office of System Capacity
Aviation Capacity Enhancement Plan

Transporter: Washington/Dulles

Configuration as it has been

Source: FAA Office of System Capacity
www.asc.faa.gov
Midfield: Washington/Dulles

Configuration as planned

Source: FAA Office of System Capacity
Aviation Capacity Enhancement Plan

Hybrid: New York/LaGuardia

Source: FAA Office of System Capacity
Aviation Capacity Enhancement Plan
Hybrid: Chicago/O’Hare

Note: new trends in layouts

- Common Rental Car Facilities, often linked by people mover
  - Increasing popular
  - Eliminates circulating vans
  - New York/Newark, San Francisco, etc

- Low-cost buildings for low-cost carriers
  - Outside US, where Govt. has built buildings this is novelty – In US airlines pay and define
  - Paris/de Gaulle, Singapore (06), Marseille (06)
Process of Evaluation

- Criteria of Selection
  - Multiple Criteria
  - Broad Forecasts

- Methods of Analysis
  - Rapid, Computerized

- Differences in Traffic Loads on Buildings
  - Percent Transfers
  - Variability of Traffic
  - Need for Services

- Performance of Buildings

Criteria of Selection

- Multiple
  - Walking Distances
    - Average, Extremes
    - Terminating, Transfers
  - Aircraft Delays
  - Costs

- Under Range of Conditions
  - High, Low Traffic
  - High, Low Transfer Rates
Methods of Analysis

- Manuals (IATA, ICAO, etc.)
  - Limited Perspective
  - Unsuitable for Major Projects
- Analytic Formulas
  - Unrealistic
- Detailed Simulations
  - Difficult to Set Up
  - Too Slow for Planning
- Need: General, Computer Analysis

Problem Statement (Graphically)
Current Decision Support Is Inadequate

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Selection Of Initial Configuration and Geometry</th>
<th>Reference Manuals/Texts</th>
<th>Analytic Formulae</th>
<th>Computer-Based</th>
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<tbody>
<tr>
<td></td>
<td>LATA, ICAO, FAA, TRB, Parsons, Transport Canada, Ashford, Blow, Hart, Blankenship, Horonjeff and McKelvey</td>
<td>Bandara, Robuste, Vandebona, Wirasinghe</td>
<td>Need</td>
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<tr>
<th>Step 2</th>
<th>Detailed Layout of Floor Plan</th>
<th>Reference Manuals/Texts</th>
<th>Analytic Formulae</th>
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<td>Impractical</td>
<td>Dunlay, Pararas, BAA, FAA, Transport Canada, Private Industry</td>
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Difference in Loads

- “Total Number of Passengers” does not properly define loads on Buildings
- Effective Loads depend on Passenger Needs
- Key Load Characteristics:
  - Transfer Rates (%)
    - passengers changing aircraft, buildings or airlines
  - Variability of Traffic
    - Daily, Seasonal Patterns
  - Need for Services
    - International controls; Meals and accommodations
  - Industry Structure
  - Aircraft Types
Transfer Rates

- **Transfer passengers require:**
  - Easy Internal Flow; No Airport Access

- **Hub-and-Spoke Airports**
  - have very high transfer rates, more than 50%
  - common worldwide (fewer in US, more in Europe and Asia)

- **Examples:**
  - High Rates: Chicago/O'Hare, Minneapolis/St.Paul, Denver/Intl, Dallas/Fort Worth, Detroit/Metro, Salt Lake City...
    Hong Kong/CLK, Tokyo/Narita (Northwest), London/Heathrow, Amsterdam/Schiphol...
  - Low Rates: Boston/Logan, San Francisco/Intl, Montreal/Dorval, London/Gatwick...

Variability of Traffic

- **Steady Loads**
  - Low Cost/Passenger for Built Facilities
  - Typical Case: Business Market
  - Example: New York/LaGuardia

- **Variable Loads**
  - Low Utilization for Marginal (less Attractive) Facilities
  - High Cost/Passenger for Built Facilities
  - Typical Case: Tourist, Special Event Markets
  - Examples: London/Gatwick; Jeddah
Variability decrease with traffic


Source: Port Authority of NY/NJ, 1995
Source: ICAO Digest of Statistics, 1995
Variations in Traffic at New York and London Airports (c.1975)

Example of Daily Traffic Fluctuations
Performance

• Linear
• Centralized
• Satellite
• Midfield
• Transporter
• Sensitivity to
  → Transfer Rates
  → Industry Structure

Performance: Linear

• Cost
  → High
  → Only one side of “fingers” used by aircraft

• Access
  → Mixed
  → Passengers: OK for locals, Terrible for Transfers
  → Aircraft: Good

• Services:
  → Poor
  → Excessive Staff/Passenger
  → Low Traffic for Concessions
Performance: Centralized

- **Cost**
  - Relatively Low
  - High per Passenger if Variability is high and expensive building often under used

- **Access**
  - OK in General
  - Especially good for transfers
  - Not so good for aircraft

- **Services**
  - Good
  - Efficient use of Personnel
  - High traffic for concessions

Performance: Satellite

- Efficient Use of Waiting Areas
- Efficient for Transfers
- Designs Sensitive to Transfer Rates
Performance: Midfield

- **Big Differences between**
  - Linear buildings (Atlanta, London/Heathrow T5)
  - X-Shaped (Pittsburgh, Kuala Lumpur)
- **Linear**
  - Space Needed/Aircraft Stand: Excellent
  - Delays to Aircraft: Minimal
  - Practical When distances between runways large
- **X-Shaped**
  - Suitable for Narrow Airfields
  - Space Needed/Aircraft Stand: Poor
  - Delays to Aircraft: Large

Performance: Transporter

- **Cost**
  - Mixed
  - Variability high: Good -- costs are reduced when service not needed
  - Low Variability: High Costs
- **Access**
  - Good Overall
  - Passengers: generally good... delays on short flights
  - Aircraft: Great
- **Services**
  - Good
Recommendation: “Hybrid” Designs Best

- Hybrid designs best because:
  - Meet Variety of Existing Needs
  - Adapt Easily to Future Needs
  - Cost-Effective
  - Maximize quality of service to
    - Passengers
    - Airlines
    - Airport Owners
- Example:
  - Paris / Charles de Gaulle (Air France)

Conclusion

- Configurations
  - Cannot be best for all conditions
  - ... only for some limited conditions
- Since Conditions Vary
  - For Airport Users:
    - Business Shuttles, Holiday Traffic
  - Over Time
    - With Traffic Levels and Types
    - Changes in Industry Structure
- Do not apply single configuration!