Configuration of Airport Passenger Buildings

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Outline

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  - **Motivation**
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- **Range of Configurations**
- **Process of Evaluation**
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  - **Method of Analysis**
  - **Differences in Traffic Loads on Buildings**
- **Performance of Configurations**
- **Recommendation**
  - **"Hybrid" design responsive to future traffic**

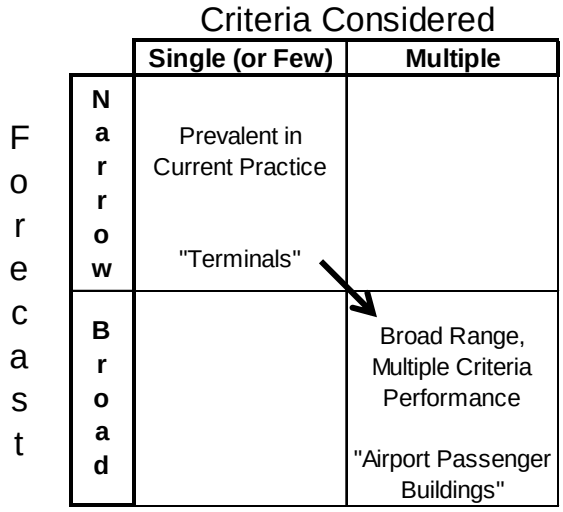
Motivation

- **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 => NY Air => 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**

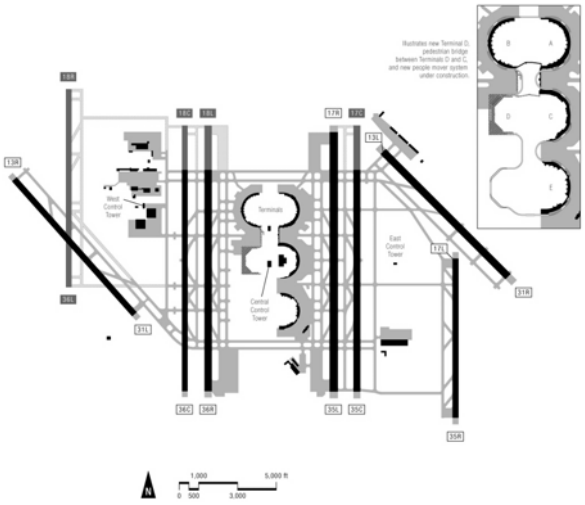
Change to View of Airport as "Passenger Buildings"



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

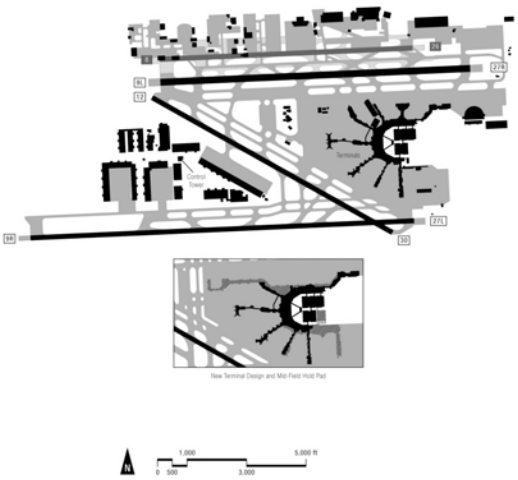


Source: FAA Office of System Capacity

Aviation Capacity Enhancement Plan

Airport Systems Planning & Design / RdN

Finger Pier: Miami/International



Source: FAA Office of System Capacity

Aviation Capacity Enhancement Plan

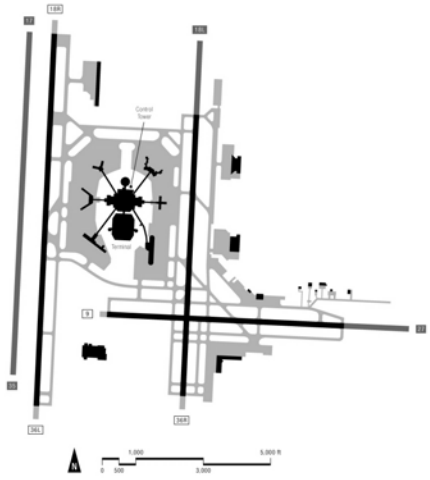
Airport Systems Planning & Design / RdN

Satellites (New York/Newark)

Satellites: Tampa

Source: FAA Office of System Capacity

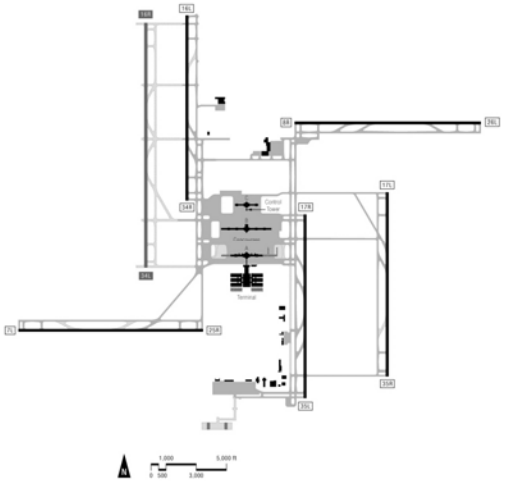
Aviation Capacity Enhancement Plan



Midfield, Linear: Denver/Intl

Source: FAA Office of System Capacity

Aviation Capacity Enhancement Plan



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Midfield: London/Stansted

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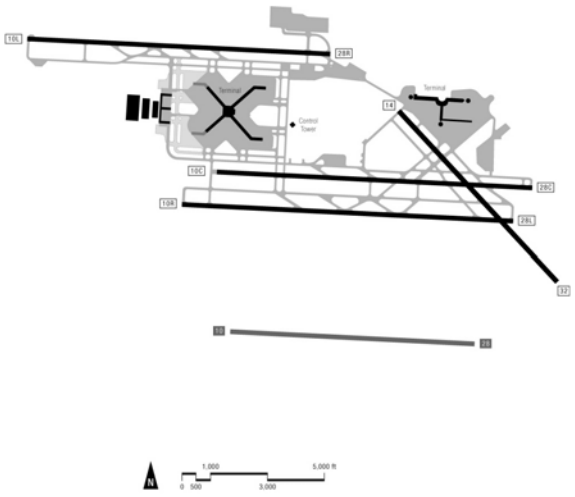
Midfield, X-shaped: Pittsburgh

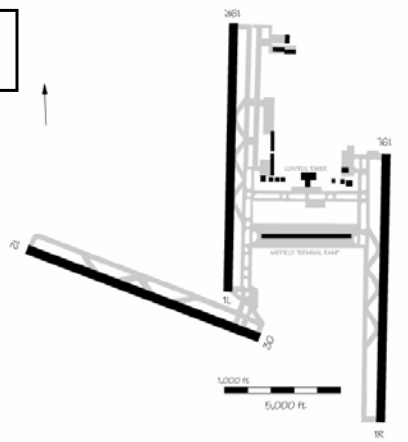


Source: FAA Office o
System Capacity

Aviation Capacity
Enhancement Plan

Transporter: Washington/Dulles

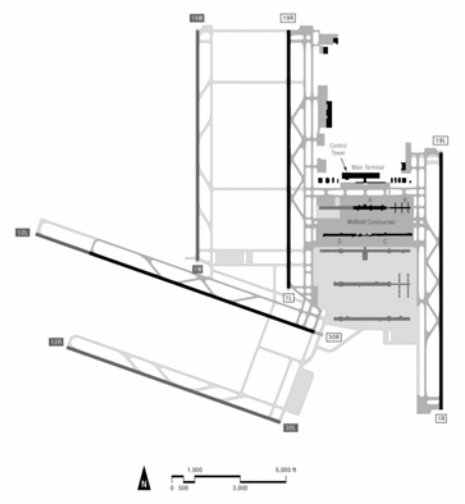
Configuration as it has been



Source: FAA Office of System Capacity
www.asc.faa.gov

Midfield: Washington/Dulles

Configuration as planned



Source: FAA Office of System Capacity

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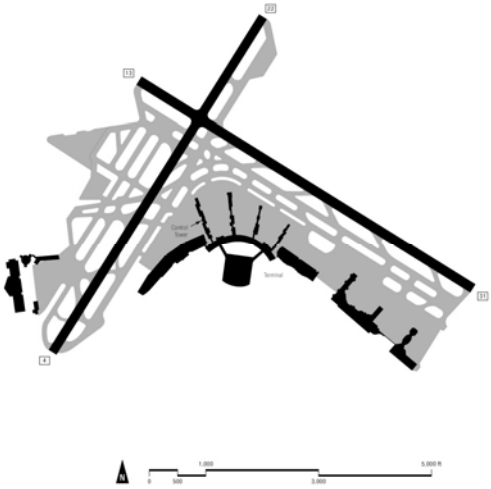
Hybrid: New York/LaGuardia



Source: FAA Office of System Capacity

Aviation Capacity Enhancement Plan

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Hybrid: Chicago/O'Hare

Source: FAA Office of System Capacity

Aviation Capacity Enhancement Plan

Note: new trends in layouts

- **Low-cost buildings for low-cost airlines**
  - **Outside US, where Government has built buildings this is novelty – In US airlines pay and define**
  - **Jetblue facility in New York/Kennedy; Orlando/Sanford**
  - **Paris/de Gaulle, Singapore, Marseille**
- **Common Rental Car Facilities, often linked by people mover**
  - **Increasing popular, eliminates circulating vans**
  - **New York/Newark, San Francisco, Atlanta, etc**

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**

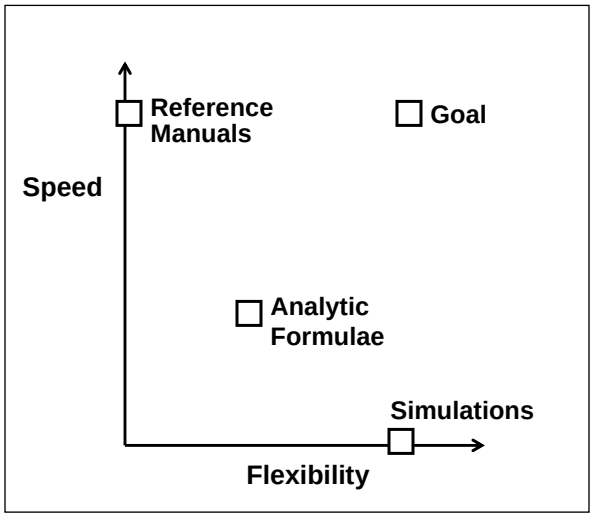
Criteria of Selection

- **Multiple**
  - **Walking Distances – effect on passengers**
    - **Average, Extremes**
    - **Terminating, Transfers**
  - **Aircraft Delays – these can be decisive (for example: 250,000 ops x 4 min x $100/min = $100Million --- this justifies about $1 billion in construction !)**
  - **Costs of construction**
- **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 with appropriate data**
  - **Too Slow for Planning most initial planning**
- **Need: General, Computer Analysis**

Problem Statement (Graphically)



Current Decision Support Is Inadequate

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

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**

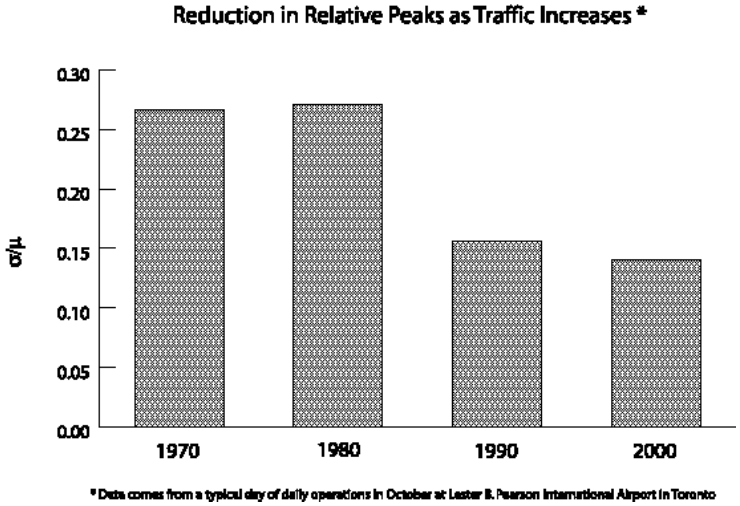
Transfer Rates

- **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/Trudeau, London/Gatwick...**

Variability of Traffic

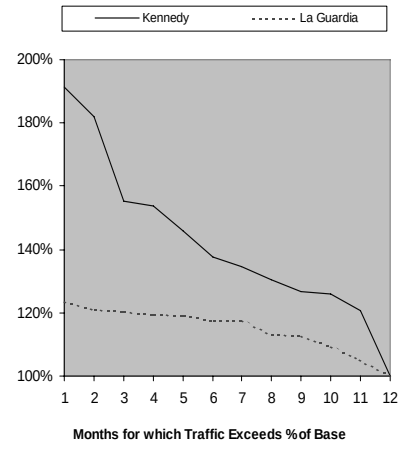
- **Steady Loads**
  - **Low Cost/Passenger for Built Facilities**
  - **Typical Case: Business Market**
  - **Example: New York/LaGuardia**
- **Variable Loads**
  - **Low Utilization for Marginal (less Attractive) Facilities**
  - **High Cost/Passenger for Built Facilities**
  - **Typical Case: Tourist, Special Event Markets**
  - **Examples: London/Gatwick; Jeddah**

Variability decrease with traffic

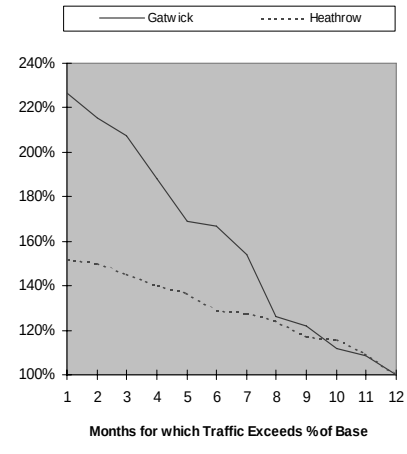


* Data comes from a typical day of daily operations in October at Lester B. Pearson International Airport in Toronto

Variations in Traffic at New York and London Airports (1995)

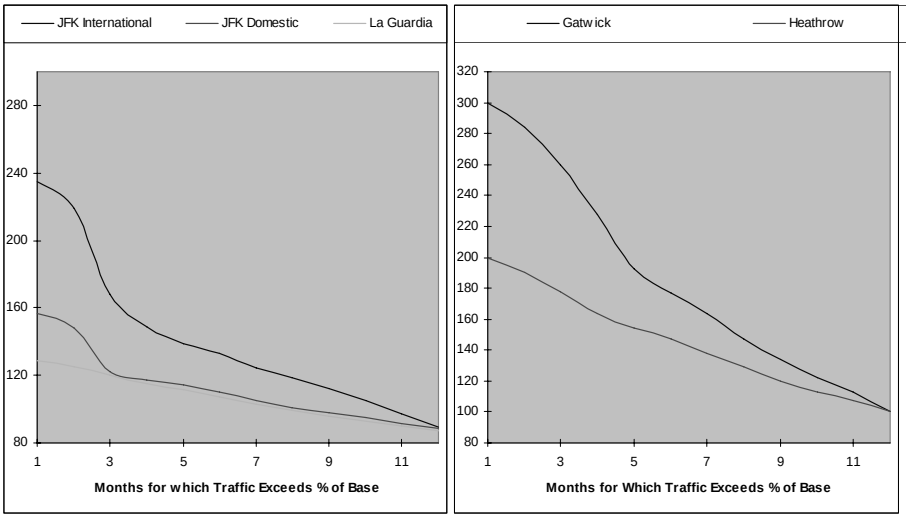


Source: Port Authority of NY/NJ, 1995

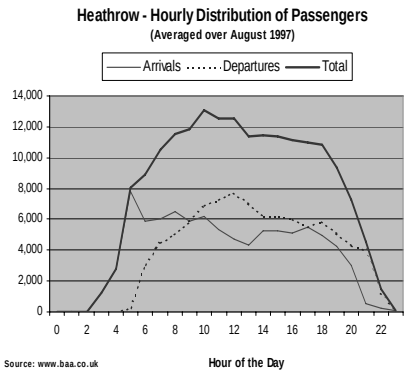


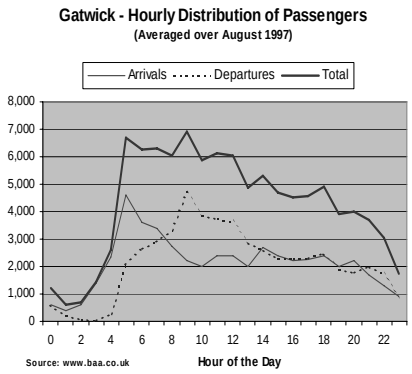
Source: ICAO Digest of Statistics, 1995

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 (in terms of relative cost/gate)
  - Only one side of “fingers” used by aircraft
- Access
  - Mixed
  - Passengers: OK for locals, Terrible for Transfers
  - Aircraft: Good
- Services:
  - Poor (examples: Kansas City; Munich 1)
  - 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**
  - Because waiting areas can be shared by many flights
- **Efficient for Transfers**
  - If volume not too high
- **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 (busses parked…)**
  - **Low Variability: High Costs**
- **Access**
  - **Good Overall**
  - **Passengers: generally good... delays on short flights**
  - **Aircraft: Great (can be parked for easy operation)**
- **Services**
  - **Good (because can be concentrated)**

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!**