Taxi Time Prediction for CDM

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Introduction

• Airline operations contribute to taxi delays
  - Hub complexes create peaks in the demand for ATC services
  - Congestion impacts surface operations
  - Significant variation in taxi time

• Taxi out time uncertainty creates uncertainty in arrival time estimates

• Results in inaccurate estimates of arrival demand
  - Unused capacity

• Need to improve taxi time estimates at congested airports
Definitions

- **scheduled pushback**
- **actual pushback**
- **pushback delay**
- **taxi-out time**
- **wheels-off**
Pushback-Taxi Time Correlation
Factor Analysis

• Approach
  - Stepwise selection

• Factors
  - Airline
  - Terminal
  - Time of day
  - Day of week
  - Fleet information
  - Departure and arrival traffic
    - 10, 30, 60 and 90 minutes time windows which can represent all traffic at, before and after the scheduled pushback time
  - Weather
    - 7 categories of weather reported in the Boston Globe
Model
Time Windows

scheduled pushback

15 min
• Airport with significant taxi out times
• Distinct configuration characteristics
• Convenient
  - Close
  - Data available
• Impacted by weather
  - Time of year effects
Case 1: July 1998; 27-22L/22L-22R

Arrival

Departure
Case 1: Key Factors

- Terminal
- Weather
- Number of airplanes scheduled to be pushed back in 10 minute time window
- Traffic at the other terminal in larger time windows
Case 2: July 1998; 4L-4R-9/4L-4R

Arrival
Departure
Case 2: Key Factors

• Airline

• Terminal

• Day of week.

• Traffic at terminal C
  - Terminal C (at the center of the primary taxiways) could create bottleneck for other terminals
  - Aircraft scheduled to be pushed back from terminal E take longer to taxi out because terminal E is the farthest terminal from the departure runways and because these aircraft must taxi past terminal C
Case 3: January 1998; 27-22L/22L-22R

Arrival

Departure
Case 3: Key Factors

- Fleet type
- Weather
- Long-term traffic demand
  - Traffic demand at terminal C is the most important
  - Traffic demand at terminal A is the least important
Comparison of Model to Actual Data
Summary

- Taxi out time uncertainty creates uncertainty in arrival time estimates
- Results in inaccurate estimates of arrival demand
- Need to improve taxi time estimates at congested airports
- Factor analysis model used to determine key factors that affect taxi out time
- Favorable comparison of model to actual data
  - 43% less than or equal to 1 min error
  - 86% less than or equal to 5 min error