Core 30 Airport Weather Impact Assessment

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Core Airport Service Analysis Research

• First study to examine forensically all weather phenomena at Core Airports (previous studies typically narrow in scope)
  – Incorporate traffic operations with weather event climatology
  – Identify how traffic and weather combine to impact terminal ops

• Objective: identify and rank weather impacts on operations at Core 30 airports for each of the following weather phenomena:
  – Thunderstorms/Heavy Rain
  – Low Ceiling and Visibility
    • IFR (CIG <1000 ft and/or VIS <3 SM)
    • MVFR (CIG 1000-3000 ft and/or VIS 3-5 SM)
  – Strong Winds (>20 kts) (includes component for crosswinds analysis)
  – Winter Weather (combination of snow, freezing rain, and ice pellets)

• Identify Shortfalls due to Weather Impact
  – By airport, phenomenon, season, etc.
  – Provides “Pool of Benefits” and input on prioritization
Why is this Study Necessary?

• Terminal weather of varying types disrupts, delays, and even prevents NextGen-enabled operations
  – Current decision support capabilities are often unable to take weather into account
    • Reduces their usefulness during operations which would benefit the most from decision support
  – Future NextGen capabilities will need to be weather-aware
    • Strategic: how will airports be affected (AAR/ADR) by different weather phenomena? How will that affect flow management and metering operations?
    • Tactical: when will wind conditions change at an airport? How can departure reservoir management be performed accurately in the face of a pending runway reconfiguration?
    • Which airports – and under what specific conditions – do targeted capabilities require enhanced weather translation for constraint identification / resolution?
Measuring Weather Impacts Relative to “No-Weather” Baseline

• ‘No Weather Baseline’:
  • Ensures weather impact analysis is isolated from delay typically present as part of “normal” daily airport operations (not associated with weather)
  • Provides a control group to perform comparative research
  • Assessed as rolling 3-hr average, computed hourly (rather than entire day or longer periods) to account for variation in airport demand, arrival vs. departure operations and peak periods, etc.

• Completed no weather baseline on a per airport per hour basis (binned in 3-hr increments) for the following metrics:
  • Arrival/Departure Counts
  • Taxi In/Taxi Out Times
  • Delay for Departures/Arrivals

*Note: Analysis can be further broken down on a seasonal, monthly, daily, hourly, etc. basis as needed and can be calculated for all operational metrics
Thunderstorms/Heavy Rain Results

Key Points:

• DFW is the most impacted airport: high Departure Delays accompanied by Departure Deficits due to early morning (09z-12z) and afternoon/evening (21z-00z) thunderstorm impact

• LGA, EWR, and PHL experience similar problems in terms of Arrival/Departure Delays due complexity and congestion of airspace as well as thunderstorm impact during high demand hours (18z-00z)

• ORD is more impacted than MDW in all metrics due to demand and timing of convection (specifically 22z-05z when thunderstorm frequency and traffic demand are both at their highest)
  - Size and complexity of airport contribute to this as well (ORD-Taxi In time)

NOTE: An in-depth analysis of these (and other) impacts is provided in the accompanying Core 30 Airport Weather Impact report
Ceiling & Visibility: MVFR Results

(CIG 1000-3000 ft and/or VIS 3-5 SM)

Key Points:

- The majority of the impacts per metric are low

- LGA, EWR, and PHL continue to exhibit similar operational impact characteristics (Arrival/Departure Delay and Arrival/Departure Deficit) due to similarities in demand and climatology
  - Seen with IFR conditions as well

- SFO, 18th for overall IFR ranking, jumped to 4th for MVFR ranking

NOTE: An in-depth analysis of these (and other) impacts is provided in the accompanying Core 30 Airport Weather Impact report
Ceiling & Visibility: IFR Results (CIG <1000 ft and/or VIS <3 SM)

Key Points:

- LGA, PHL, and EWR experience similar impacts across all metrics – all three airports have similar climatology in regards to IFR conditions and similar demand profiles (significant jump in demand after 12z)

- ORD ranks 2\textsuperscript{nd} due to Arrival/Departure Deficits

- ATL ranks 1\textsuperscript{st} in overall occurrences – most IFR conditions occur during the morning hours (06z-12z) when traffic first begins to increase, hence impacts to Arrival/Departure Delay

- LAS and PHX rank 8\textsuperscript{th} and 10\textsuperscript{th}, however small sample size (LAS 15, PHX 14) means caution required when interpreting results

NOTE: An in-depth analysis of these (and other) impacts is provided in the accompanying Core 30 Airport Weather Impact report
Winds >20 kts: Results

Key Points:

• EWR and LGA are impacted similarly across all metrics. Impact for Arrival/Departure Delays begins around 12z when wind speeds greater than 20 kts are the most prevalent (12z-18z)

• SFO experiences the highest number of crosswinds; winds >20 kts occur most often between 12z-21z (coincident with high demand)

• CLT ranks 2\textsuperscript{nd} in overall impact
  • Caution: Likely associated with limited sample size

NOTE: An in-depth analysis of these (and other) impacts is provided in the accompanying Core 30 Airport Weather Impact report
Southeast WX-Impact Classification Tree

ATL
- Arrival Operations
- Surface Operations
- Departure Operations
- Thunderstorms
- IFR - Low C&V
- MVFR - Low C&V
- Winds > 20 kts
- Winter Weather

FLL
- Arrival Operations
- Surface Operations
- Departure Operations
- Thunderstorms
- IFR - Low C&V
- MVFR - Low C&V
- Winds > 20 kts
- NA

MCO
- Arrival Operations
- Surface Operations
- Departure Operations
- Thunderstorms
- IFR - Low C&V
- MVFR - Low C&V
- Winds > 20 kts
- NA

MIA
- Arrival Operations
- Surface Operations
- Departure Operations
- Thunderstorms
- IFR - Low C&V
- MVFR - Low C&V
- Winds > 20 kts
- NA

TPA
- Arrival Operations
- Surface Operations
- Departure Operations
- Thunderstorms
- IFR - Low C&V
- MVFR - Low C&V
- Winds > 20 kts
- NA

AvMet
Results may be extended to various aspects of three key airport operations management areas including:

- **Capacity Management**
- **AAR Optimization**
- **Constraint ID / Resolution**
- **Effective Execution of Impact Mgmt Programs (e.g., GDPs / GSs)**
- **Airport ‘Node’ Viability in TBFM ‘Network’ (e.g., TMA)**

- **Surface Operations**
  - Runway Configuration Management
  - Taxi / Ramp Operations Management
  - Taxi-queue mgmt / optimization (‘surface metering’; TFDM)
  - Effective Execution of Impact mgmt Programs (e.g., GDPs / GSs)
  - Runway Treatment / Clearing
  - Deicing / anti-icing ops

- **Departure Operations**
  - Capacity Management
  - ADR Optimization; Balancing Arr / Dep Ops
  - Constraint ID / Resolution
  - Effective Execution of Impact Mgmt Programs (e.g., GDPs / GSs)
  - TBFM Departure ‘Scheduling’ for metered ops (e.g., IDAC)