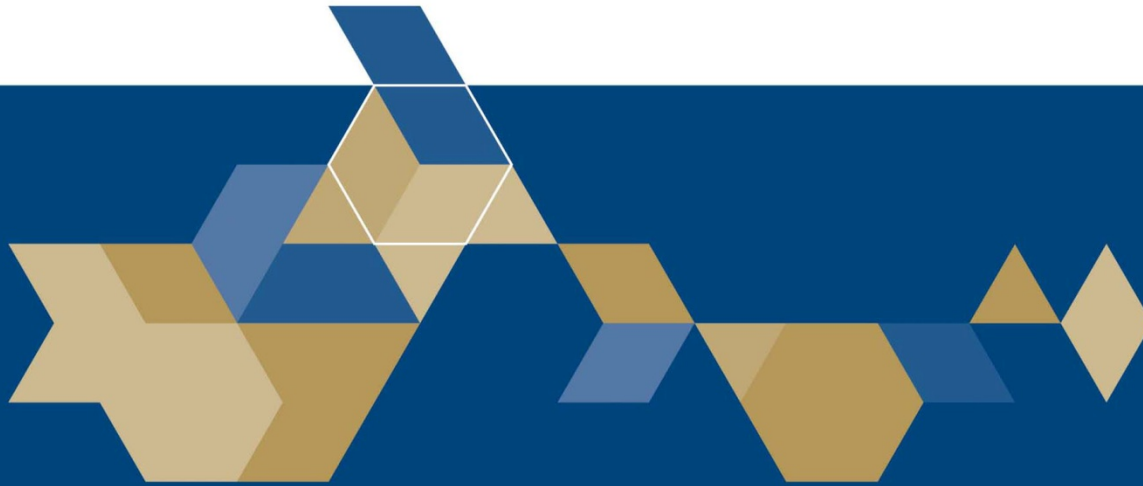


**TURKISH
AVIATION
ACADEMY**



İTÜ



Performance Metrics
Prof. Hamsa Balakrishnan

Istanbul Technical University

Air Transportation Systems and Infrastructure

Air Transportation Management

Strategic Planning

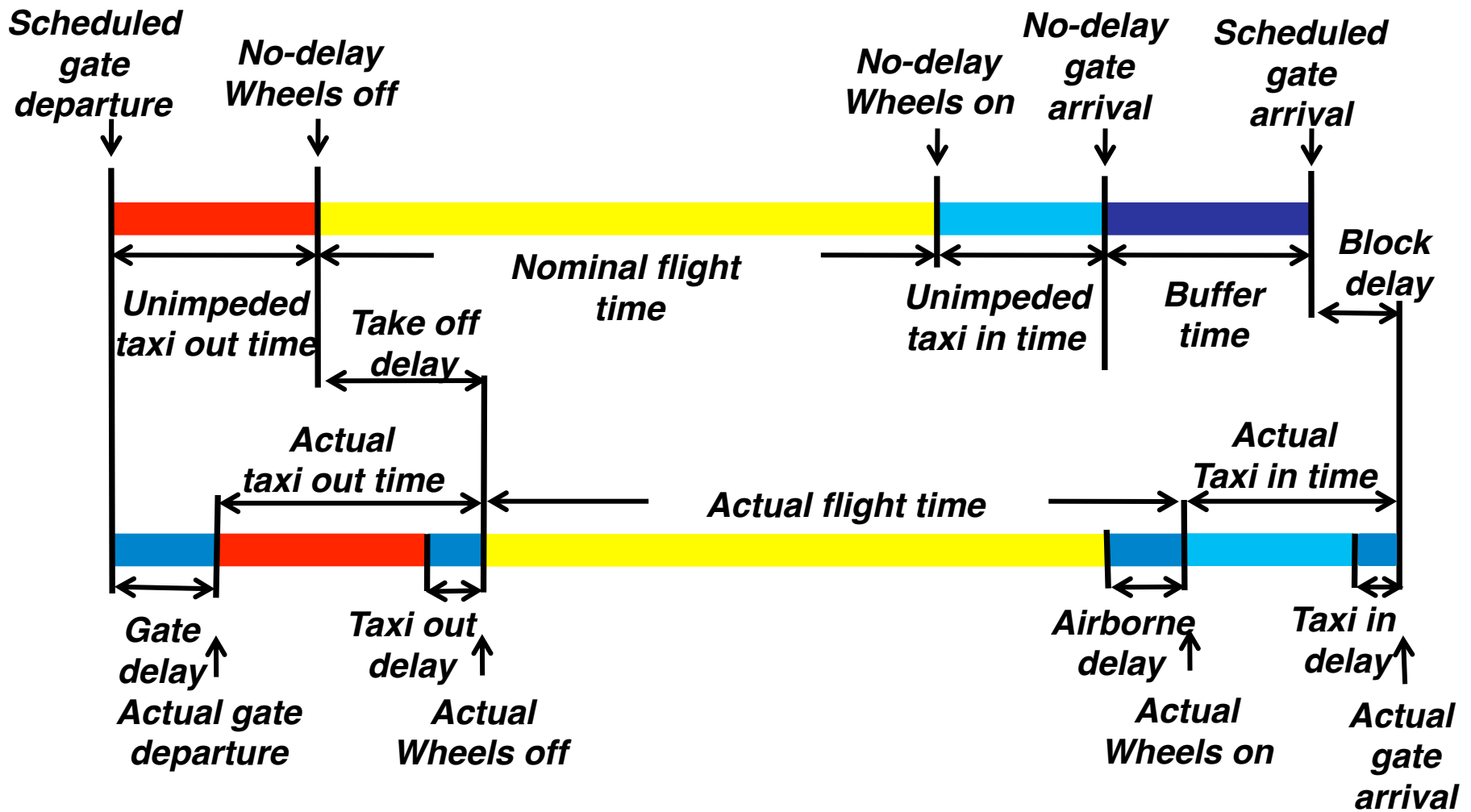
M.Sc. Program

Module 21: 29 May 2015

Flight delay metrics

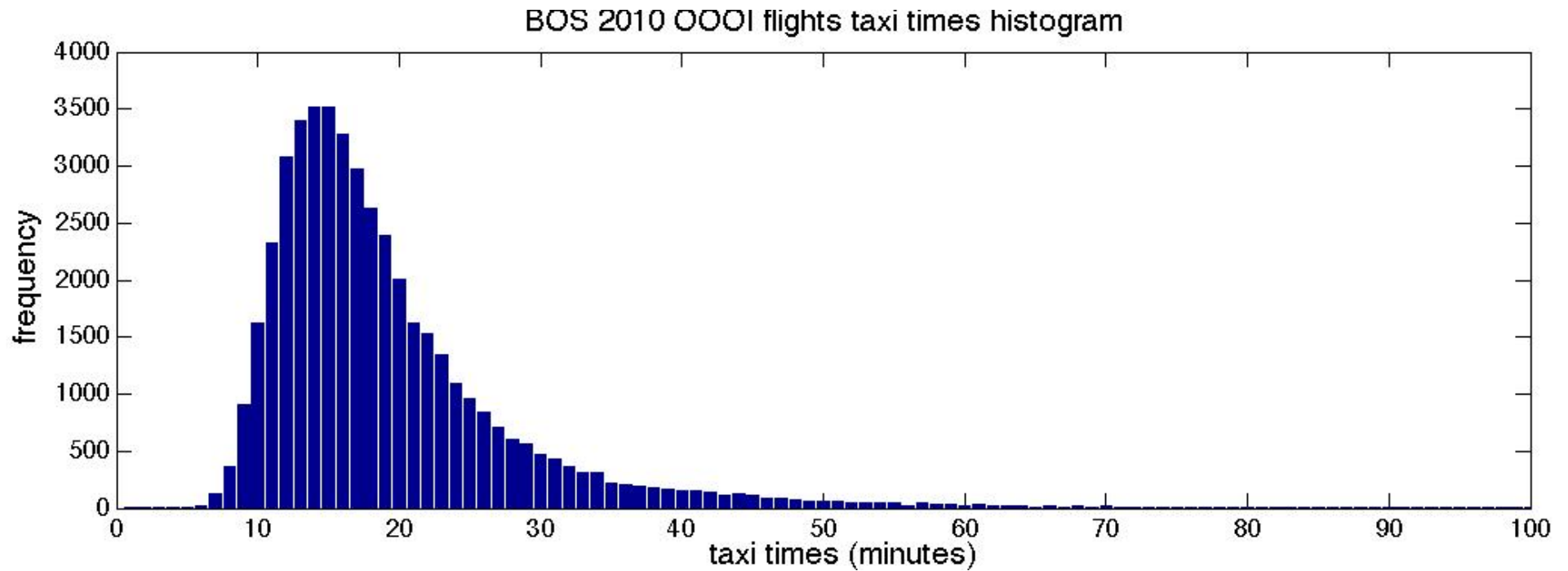
- **Airborne:** Difference between actual flight time and the planned flight time
- **Gate:** Difference between actual gate departure and scheduled gate departure
- **Unimpeded taxi-out time:** Estimated taxi-out time for an aircraft under optimal operating conditions when neither congestion, weather nor other factors delay it during its movement from gate to takeoff
- **Taxi-out delay:** Difference between actual taxi-out time and unimpeded taxi-out time by airport, carrier and season
- **Taxi-in delay:** Difference between actual taxi-in time and unimpeded taxi-in time by airport, carrier and season

Flight delays



Source: Gerasimos Skaltsas, MIT

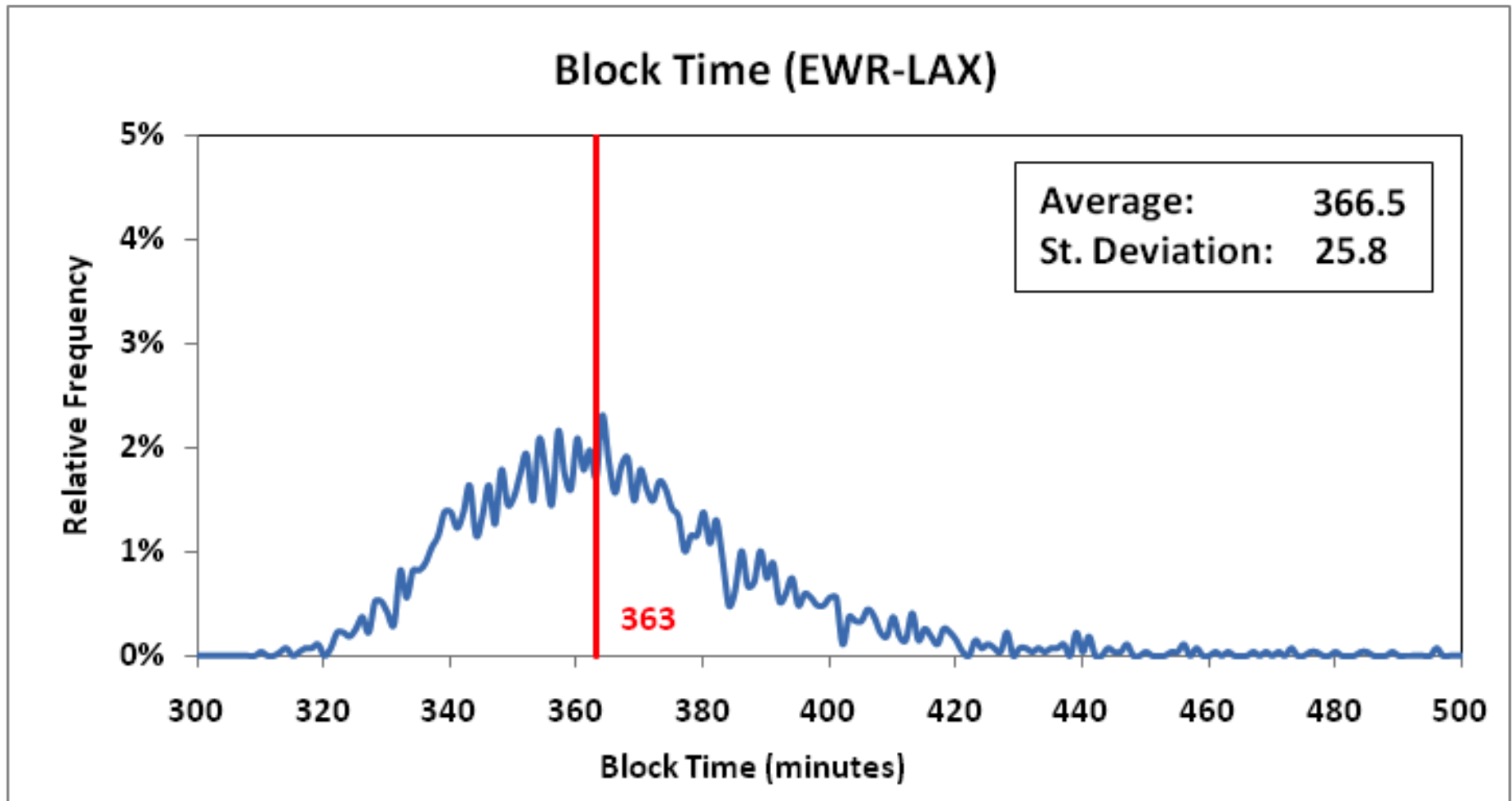
Boston Logan Intl. Airport taxi-out times (Jan-June 2010)



Flight-level performance metrics

- **Block time:** The difference in the actual gate to gate time computed from the OOOI data and the scheduled gate to gate time
- **Arrival delay:** The difference in the actual arrival time and the scheduled arrival time
- **Airport delay:** The difference in the actual wheels-off and the scheduled gate out plus the unimpeded taxi out time

Variability in actual block times

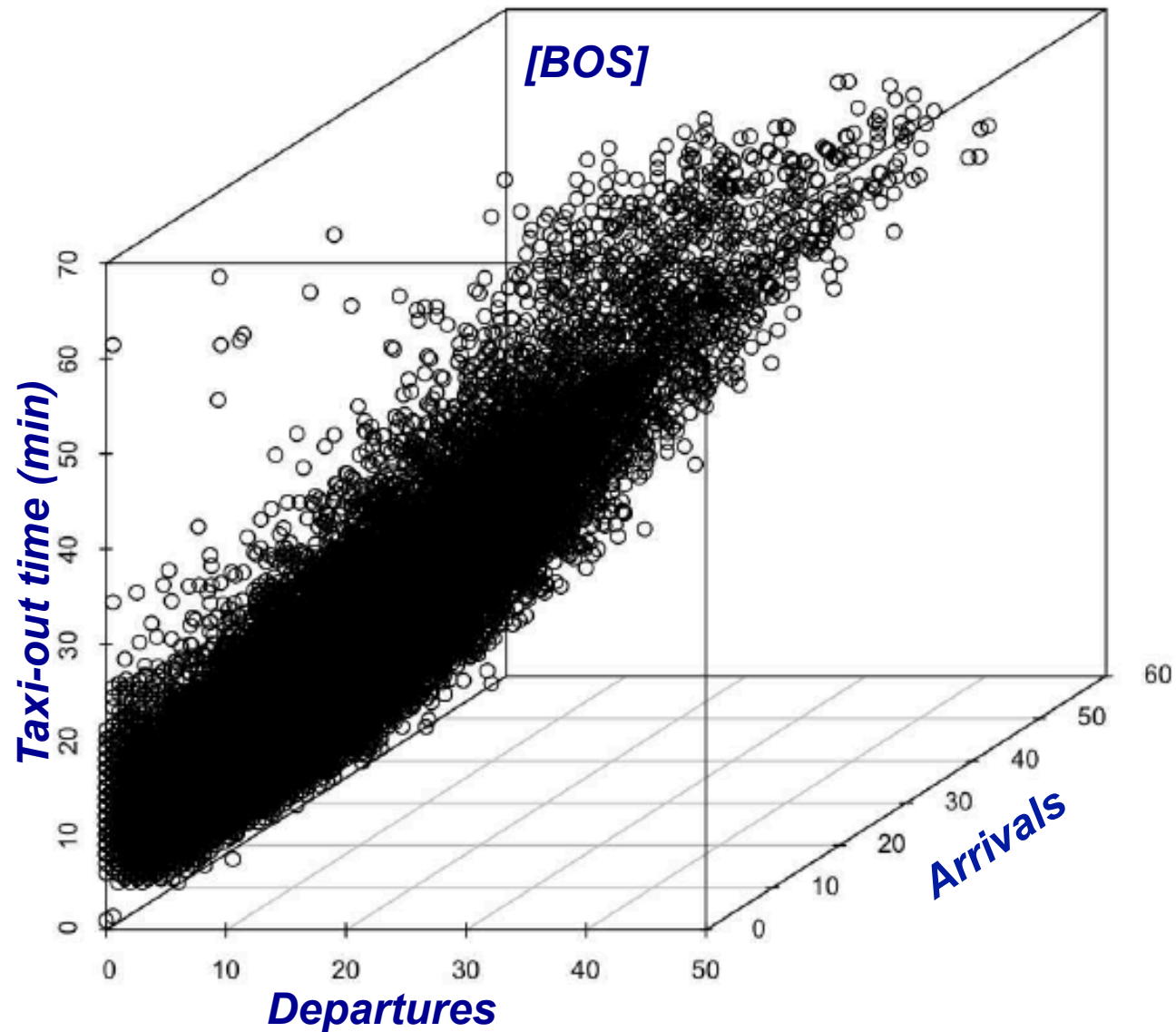


Schedule padding/ schedule creep

Determination of unimpeded taxi times

- **Estimated using lengths of arrival and departure queues**
- **Regression model in two variables**
- **Some issues:**
 - Model accuracy
 - Highest 25 percent of values excluded from regression to remove influence of extremely high taxi-out times
 - Different configurations are typically not evaluated
 - Flights for which data are available are a subset of actual operations

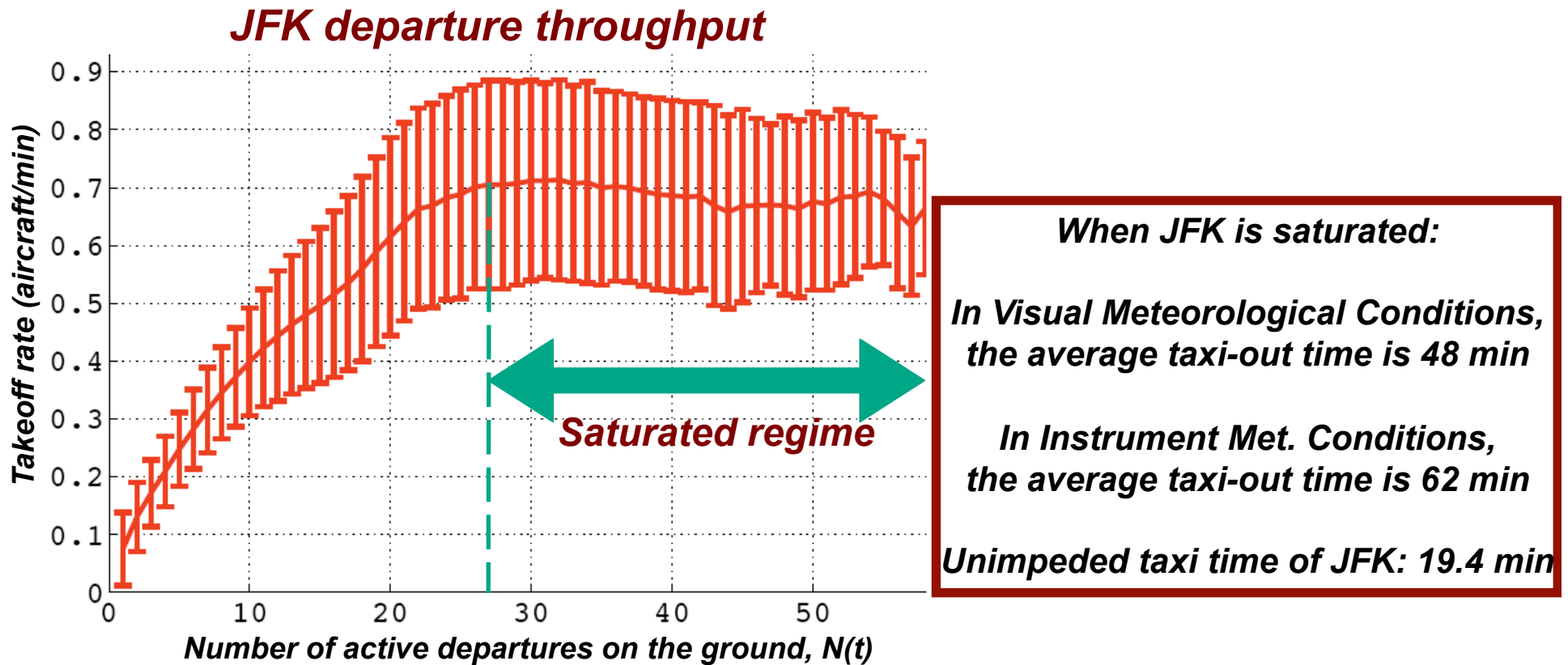
Taxi-out times as a function of arrivals and departures



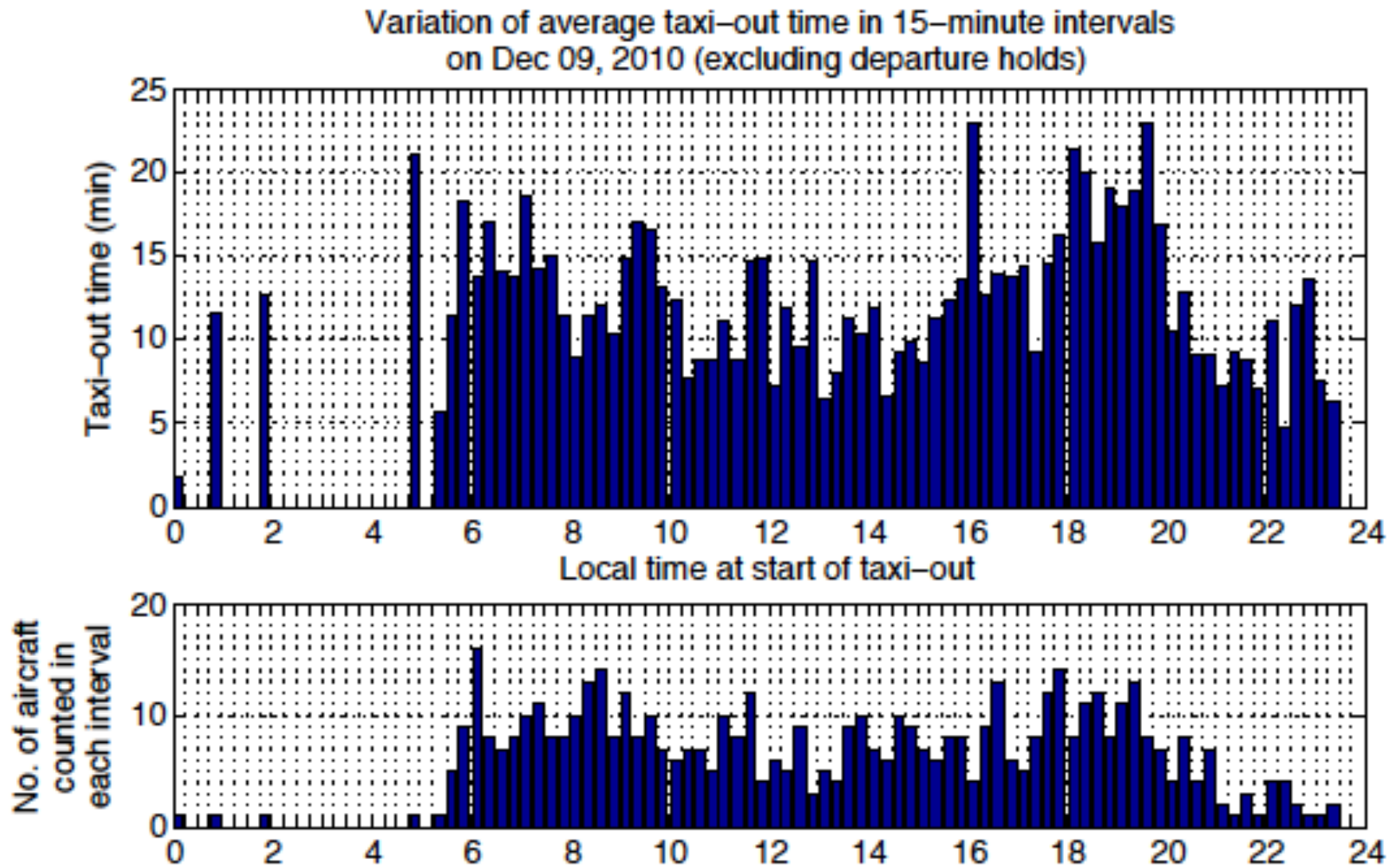
Airport performance metrics

- **Arrival and departure rates:** Information on runway configuration, scheduled demand, arrival and departure rates and actual traffic counts per quarter hour
- **Weather:** Current weather data from NOAA (ceiling, visibility, temperature, wind angle and wind speed)
- Average taxi times
- Airport capacity envelopes
- Departure throughput curves
- Runway separation times

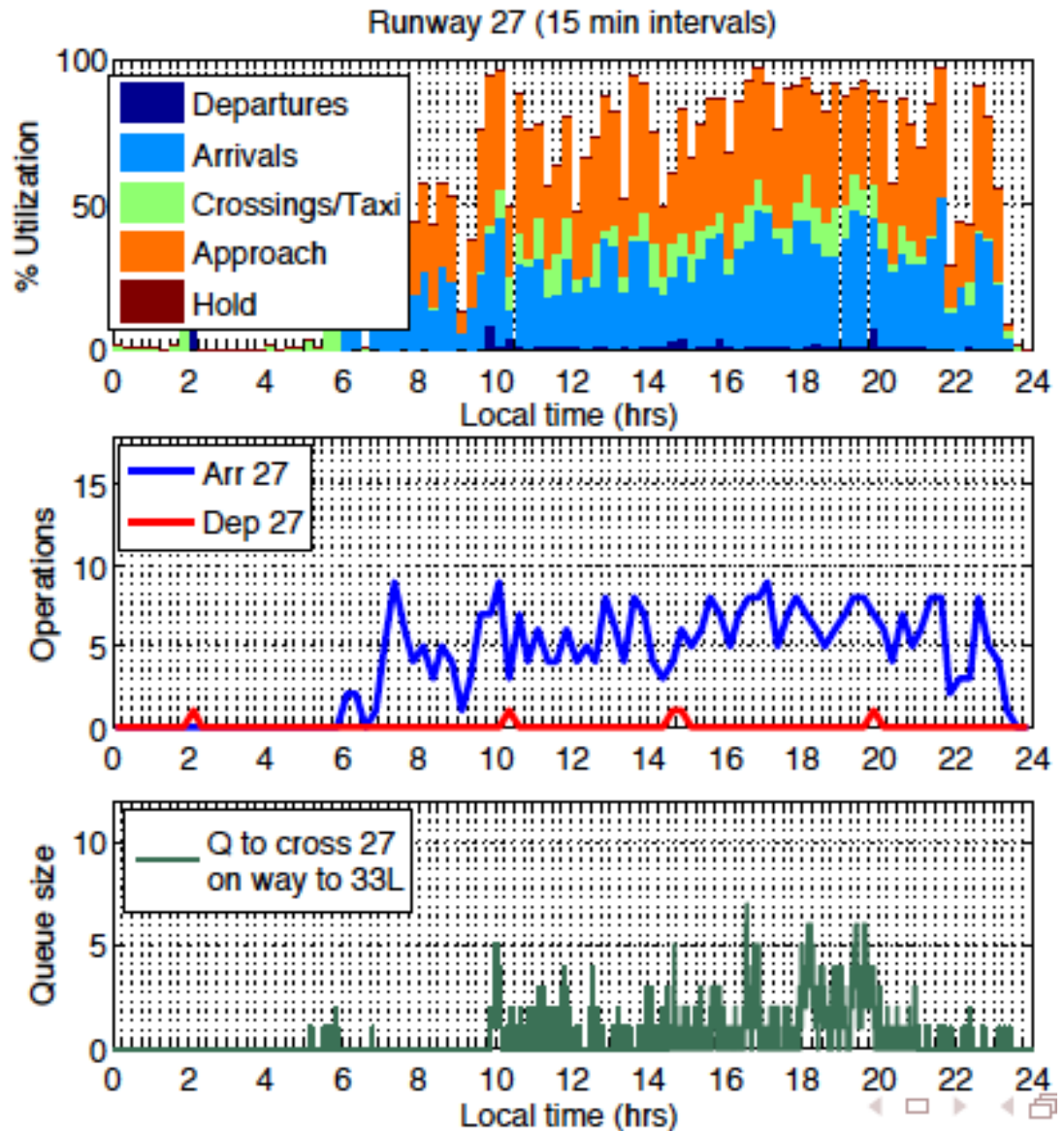
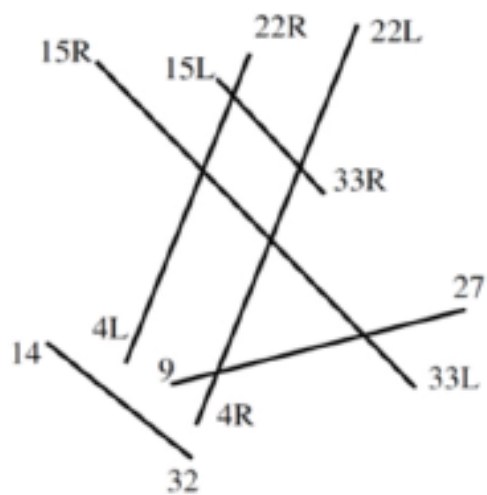
Airport departure throughput example



Average taxi-out times (from ASDE-X)

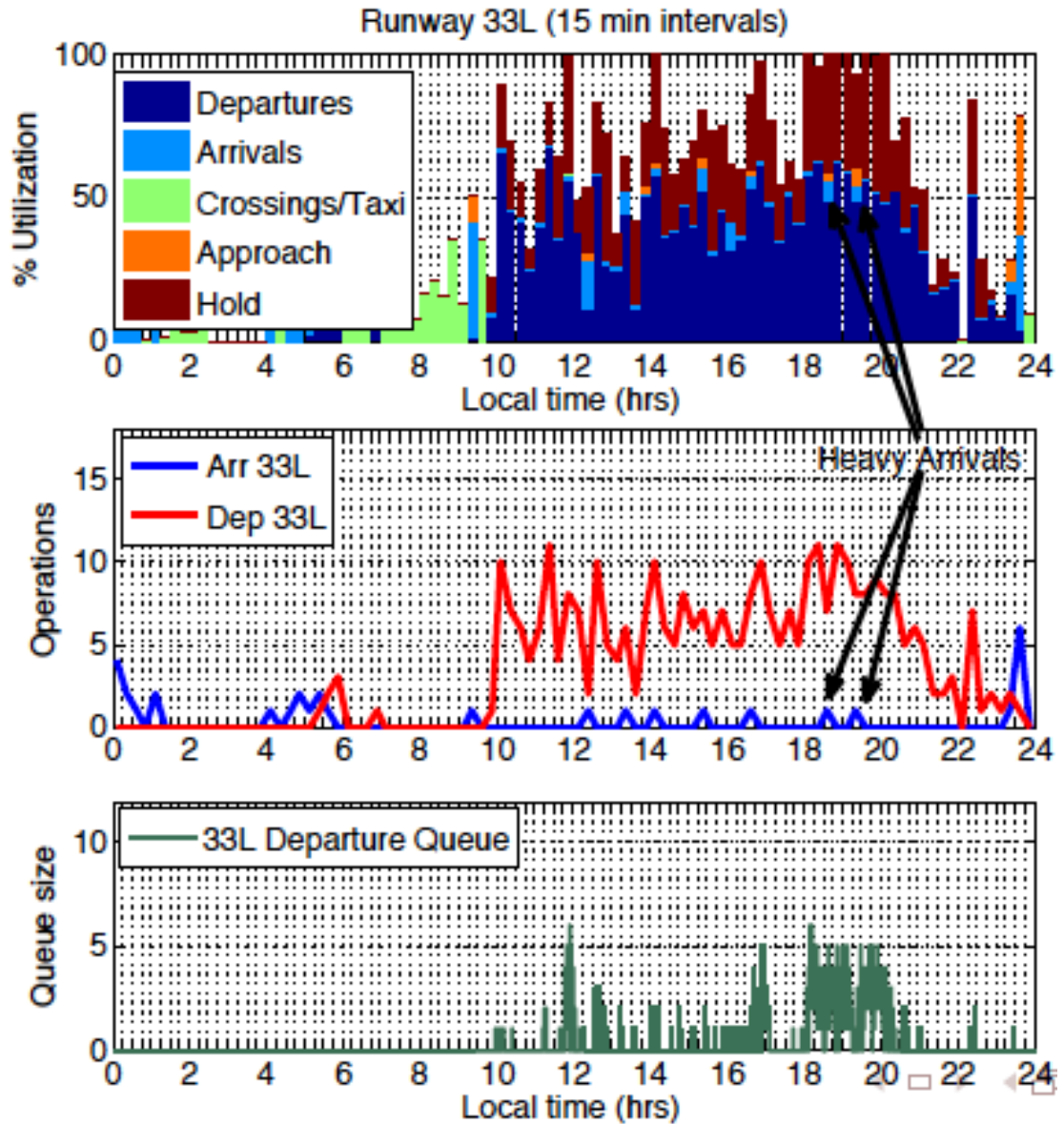
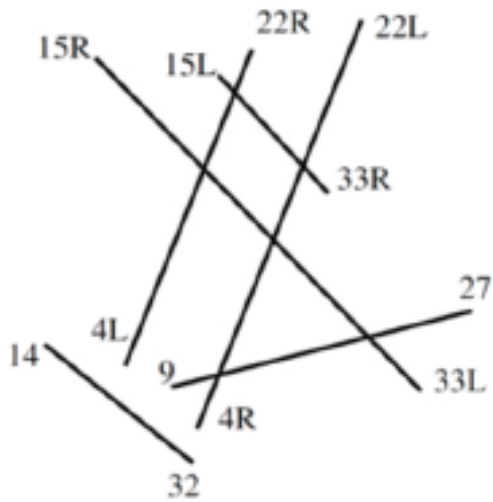


Runway utilization (from ASDE-X)



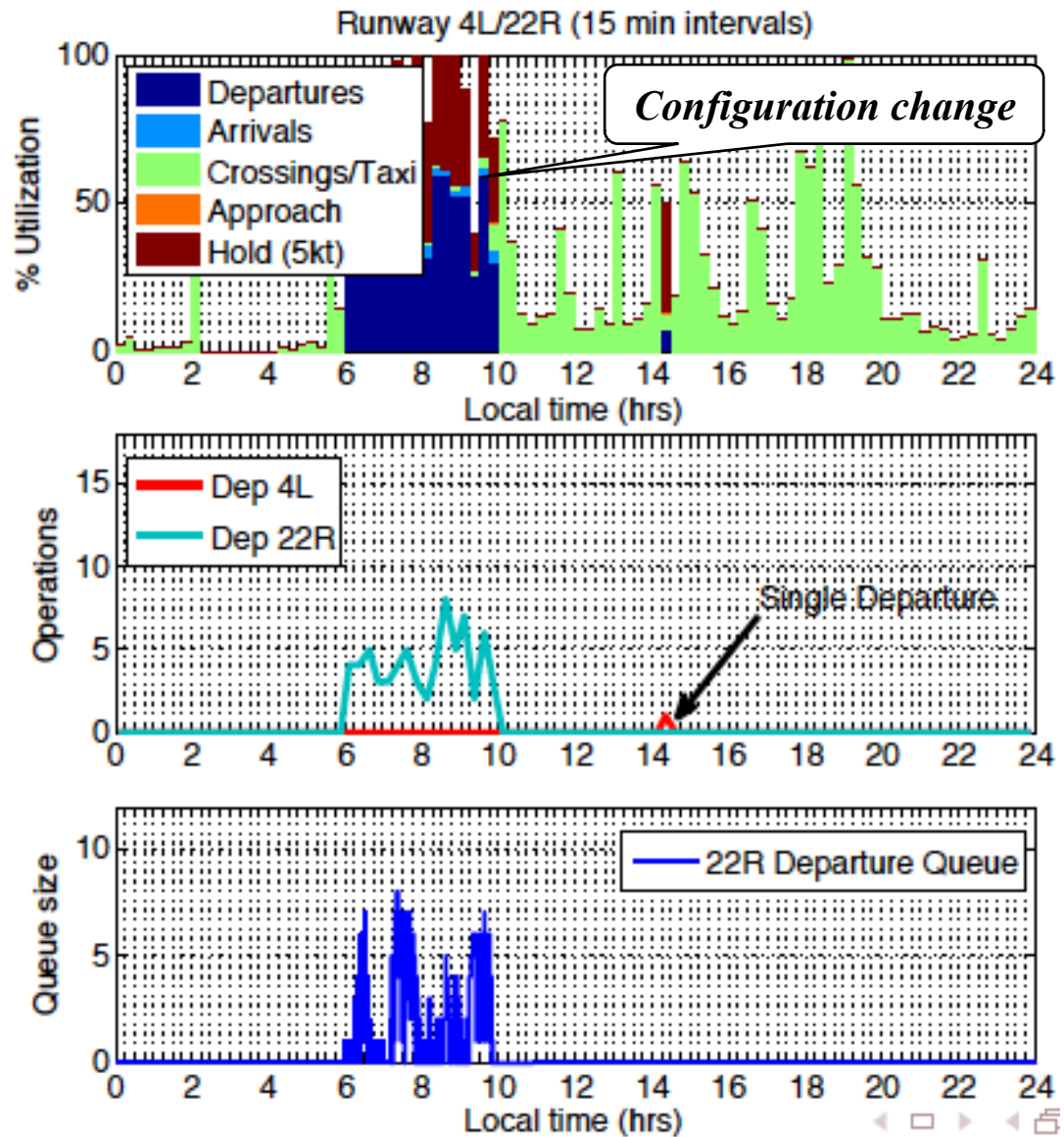
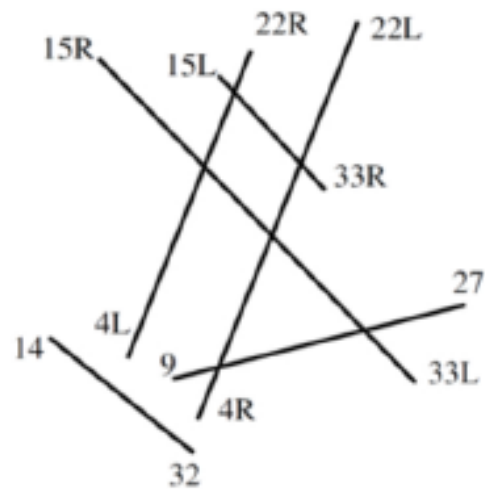
[Khadilkar et al. 2011]

Runway utilization (from ASDE-X)



[Khadilkar et al. 2011]

Runway utilization (from ASDE-X)



Departure spacing efficiency (from ASDE-X)

- Dashboard with efficiency, demand and departures
- Demand is function of queue size and no. of operations
- Accounts for arrival crossings

