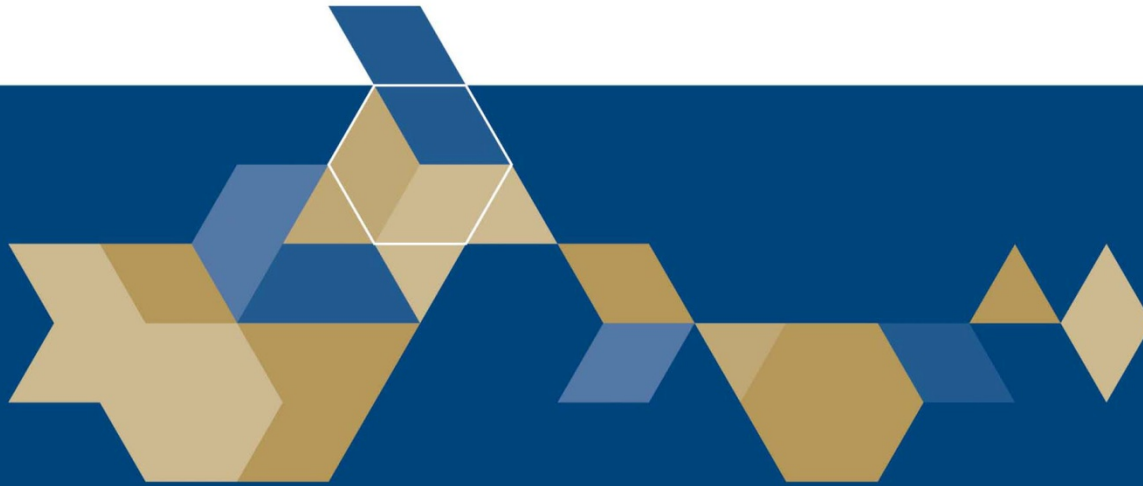


**TURKISH  
AVIATION  
ACADEMY**



**İTÜ**



***Performance Metrics***  
***Prof. Hamsa Balakrishnan***

**Istanbul Technical University**

**Air Transportation Systems and Infrastructure**

**Air Transportation Management**

**Strategic Planning**

**M.Sc. Program**

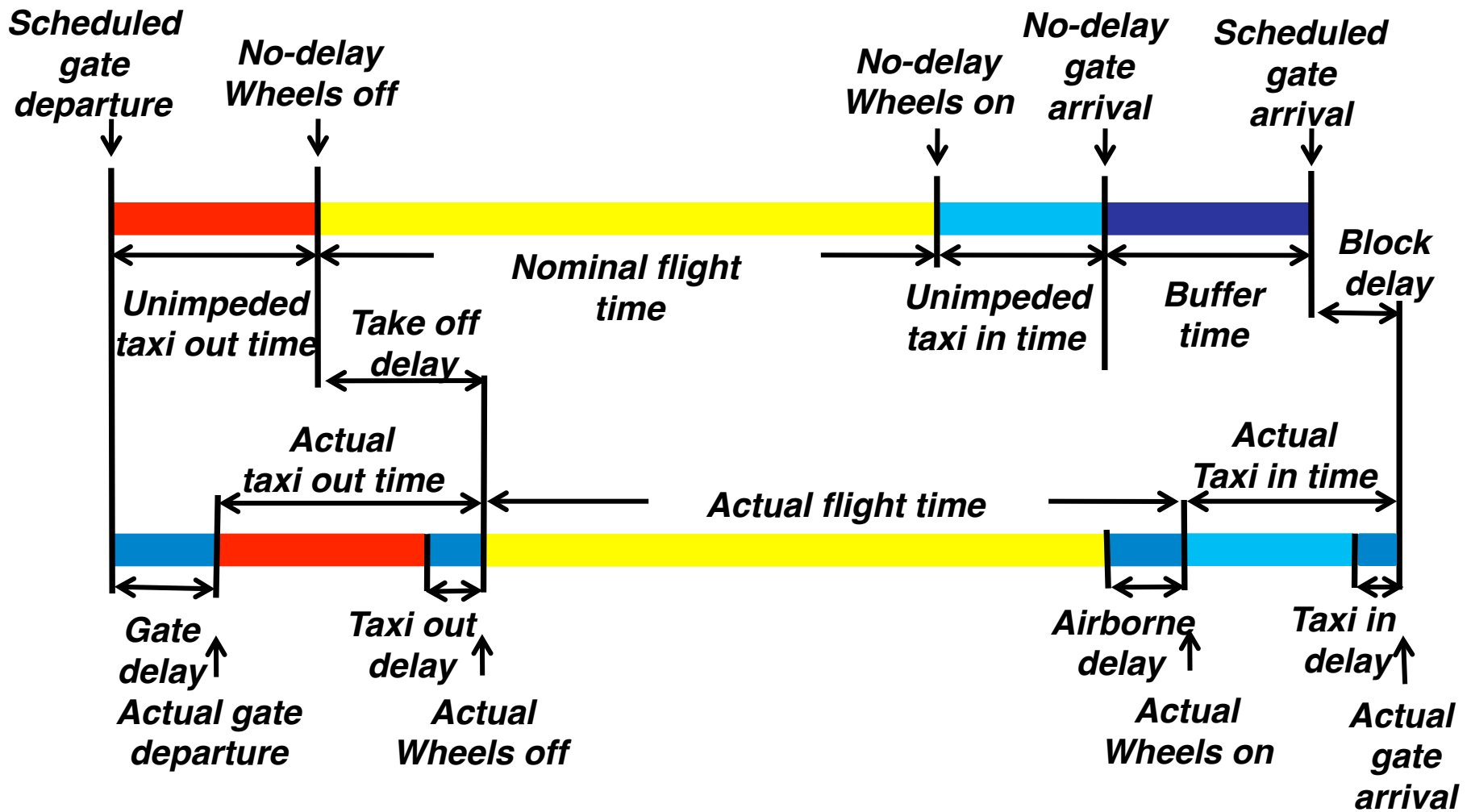
**Module 20: 1 May 2014**

## *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

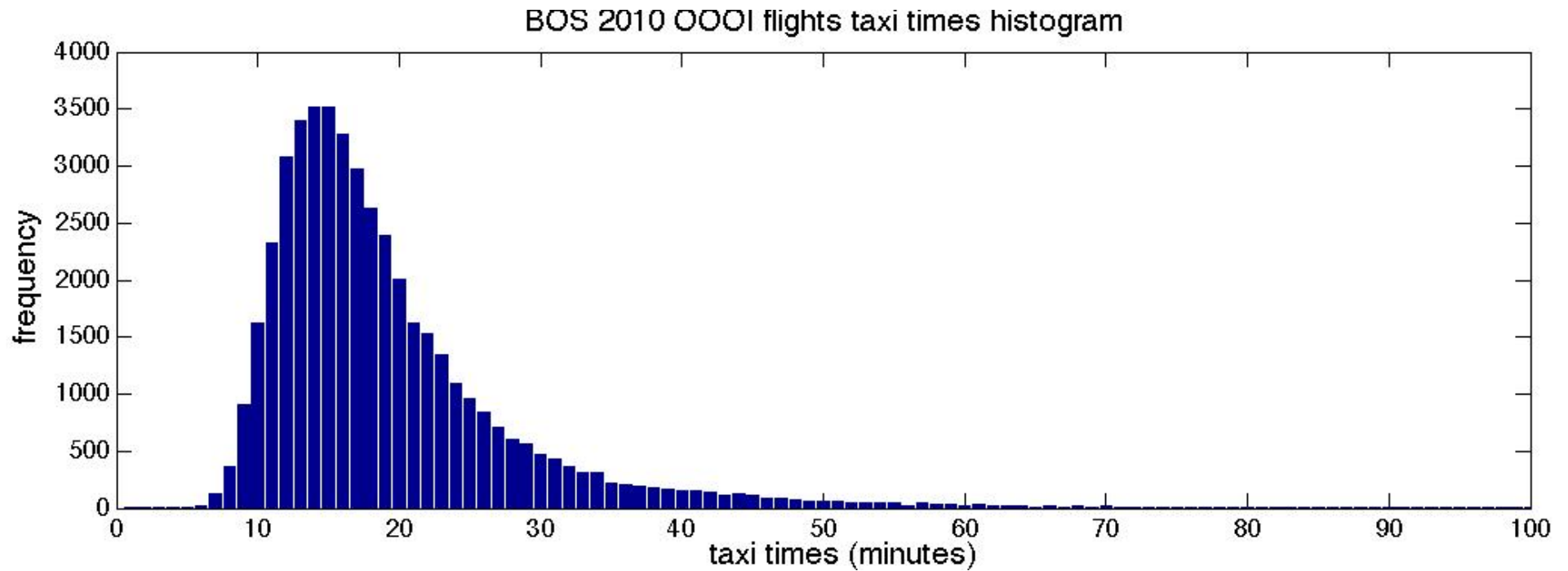
# Flight delays



Source: Gerasimos Skaltsas, MIT

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

---

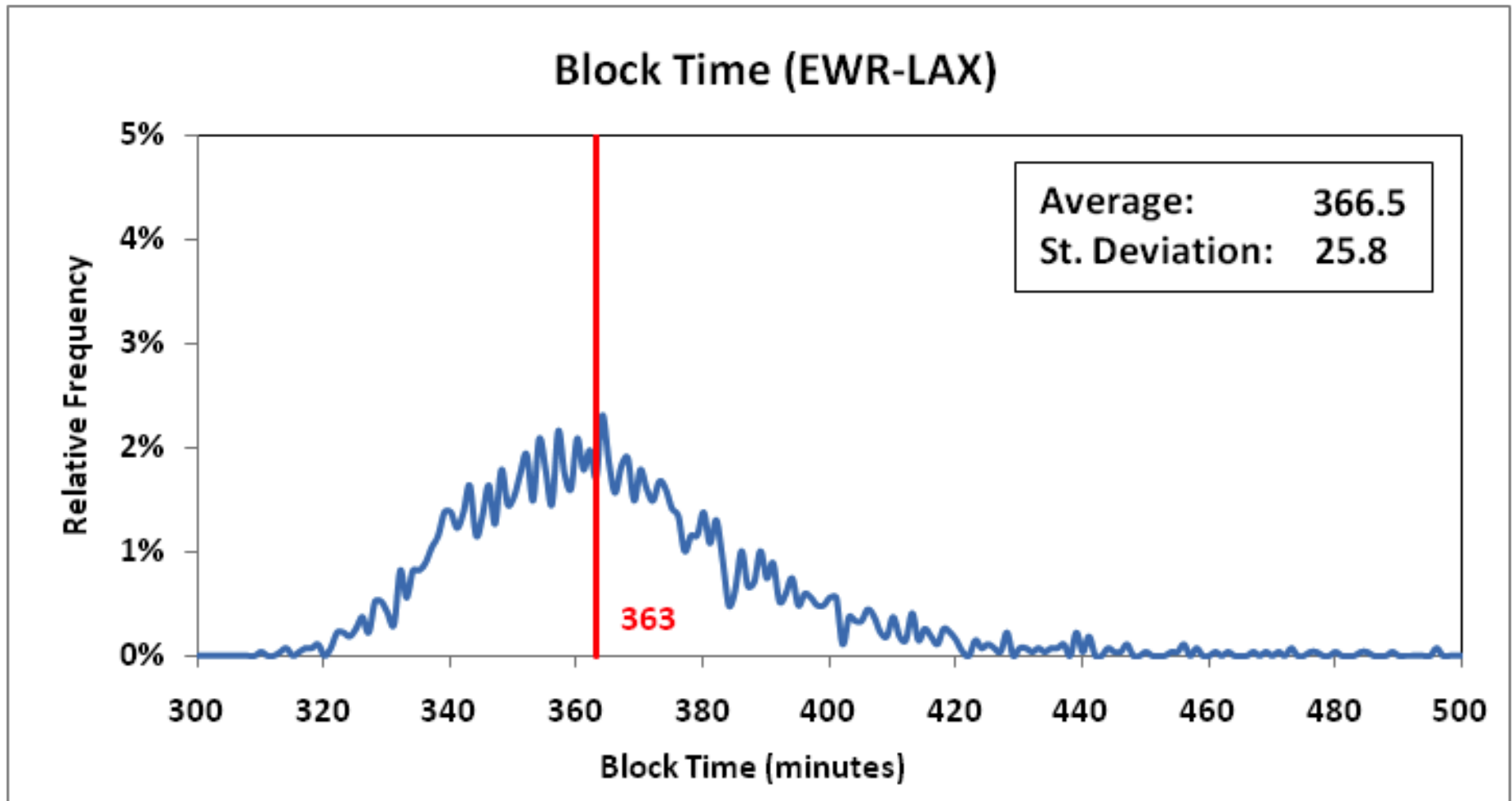


## *Flight-level performance metrics*

---

- **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*

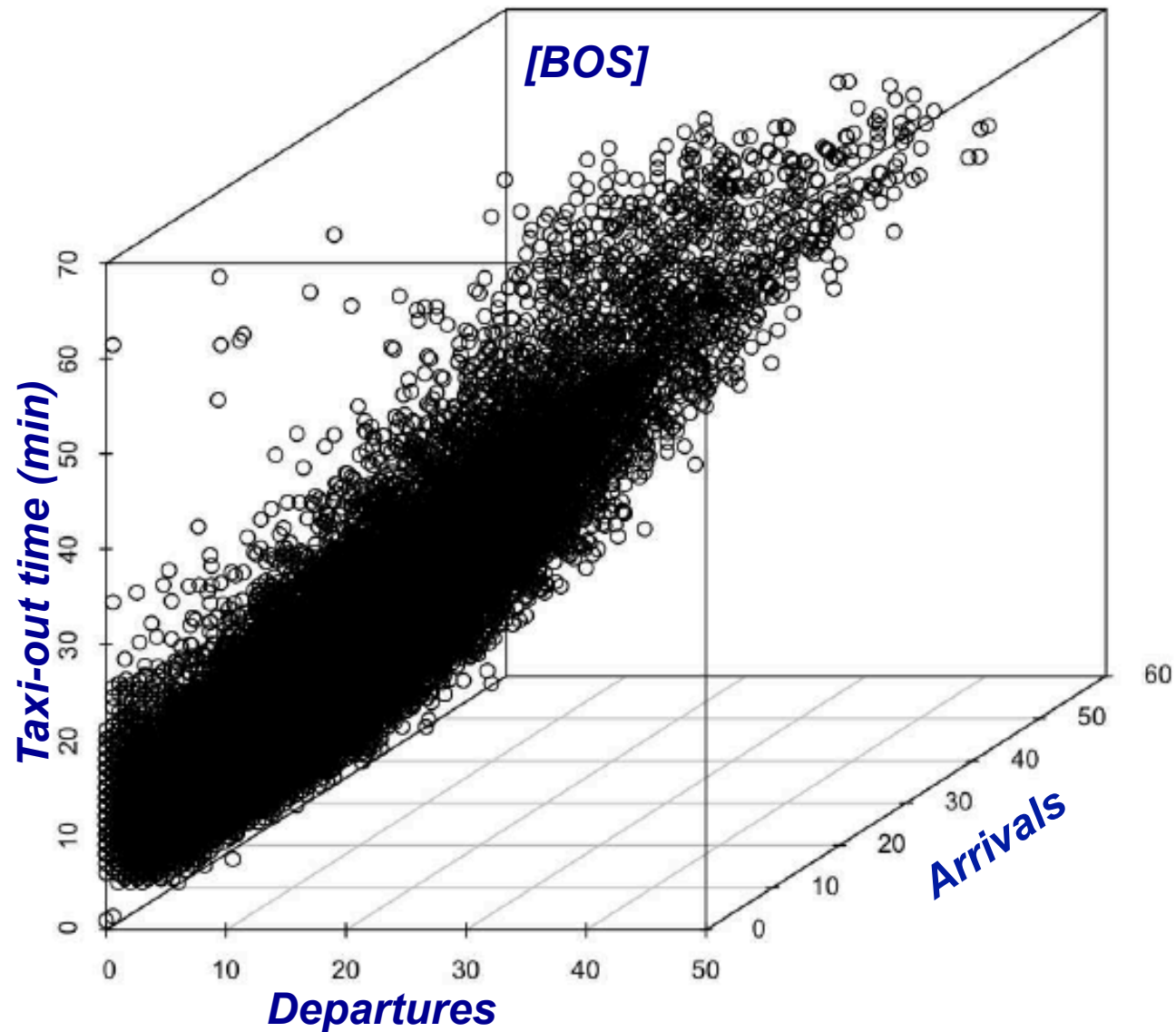
## ***Determination of unimpeded taxi times***

---

- **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*

---



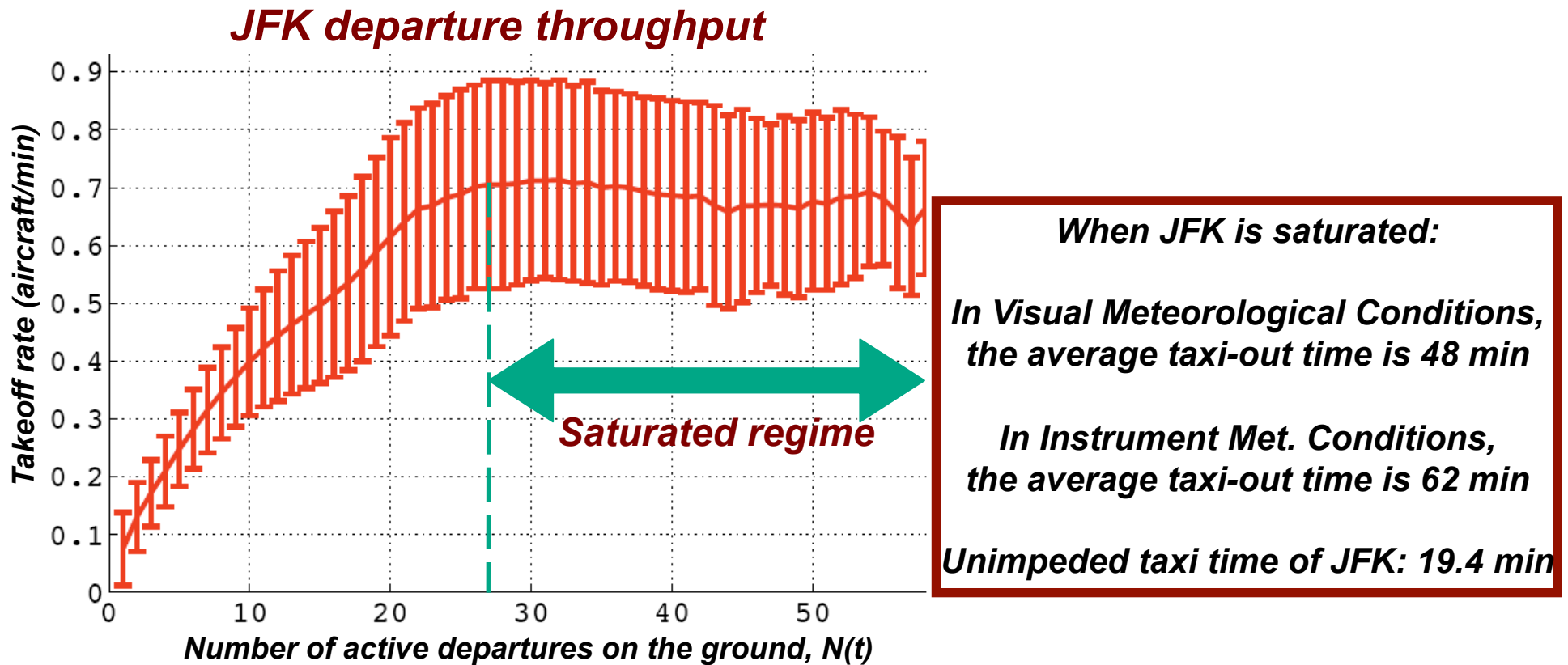


## ***Airport performance metrics***

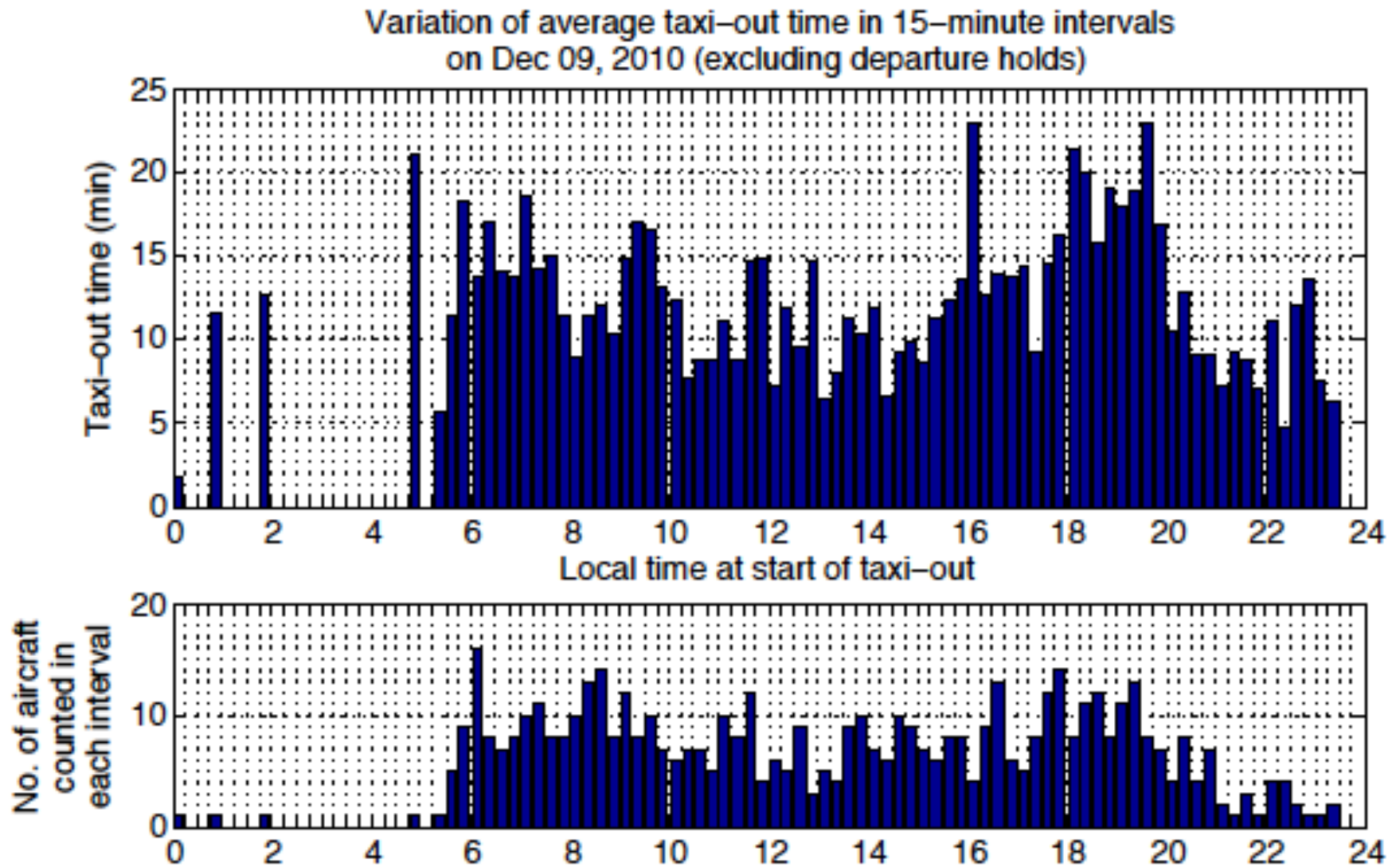
---

- **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

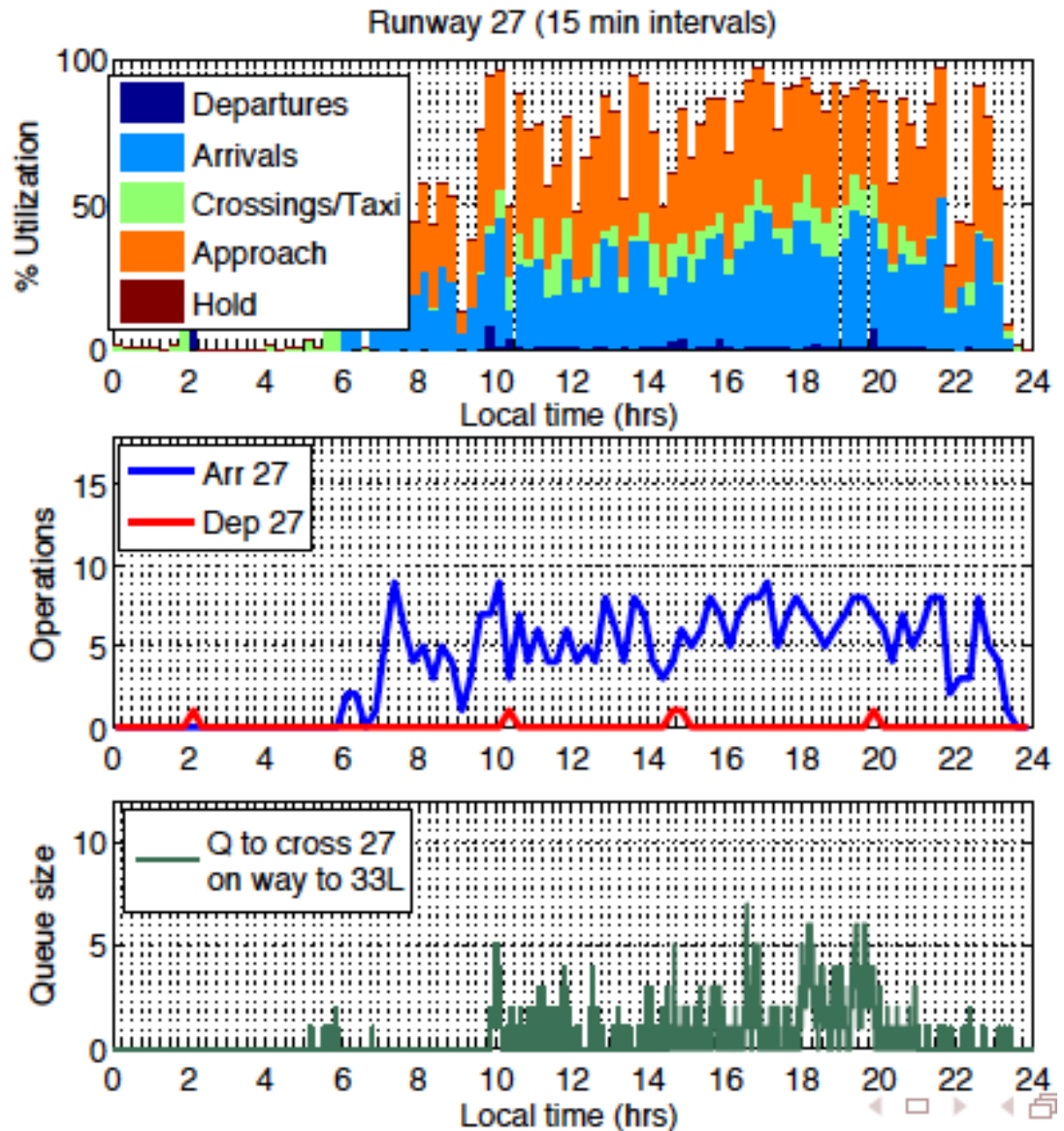
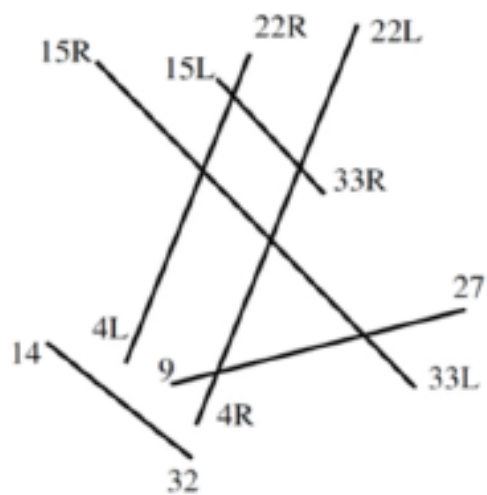
# Airport departure throughput example



## Average taxi-out times (from ASDE-X)

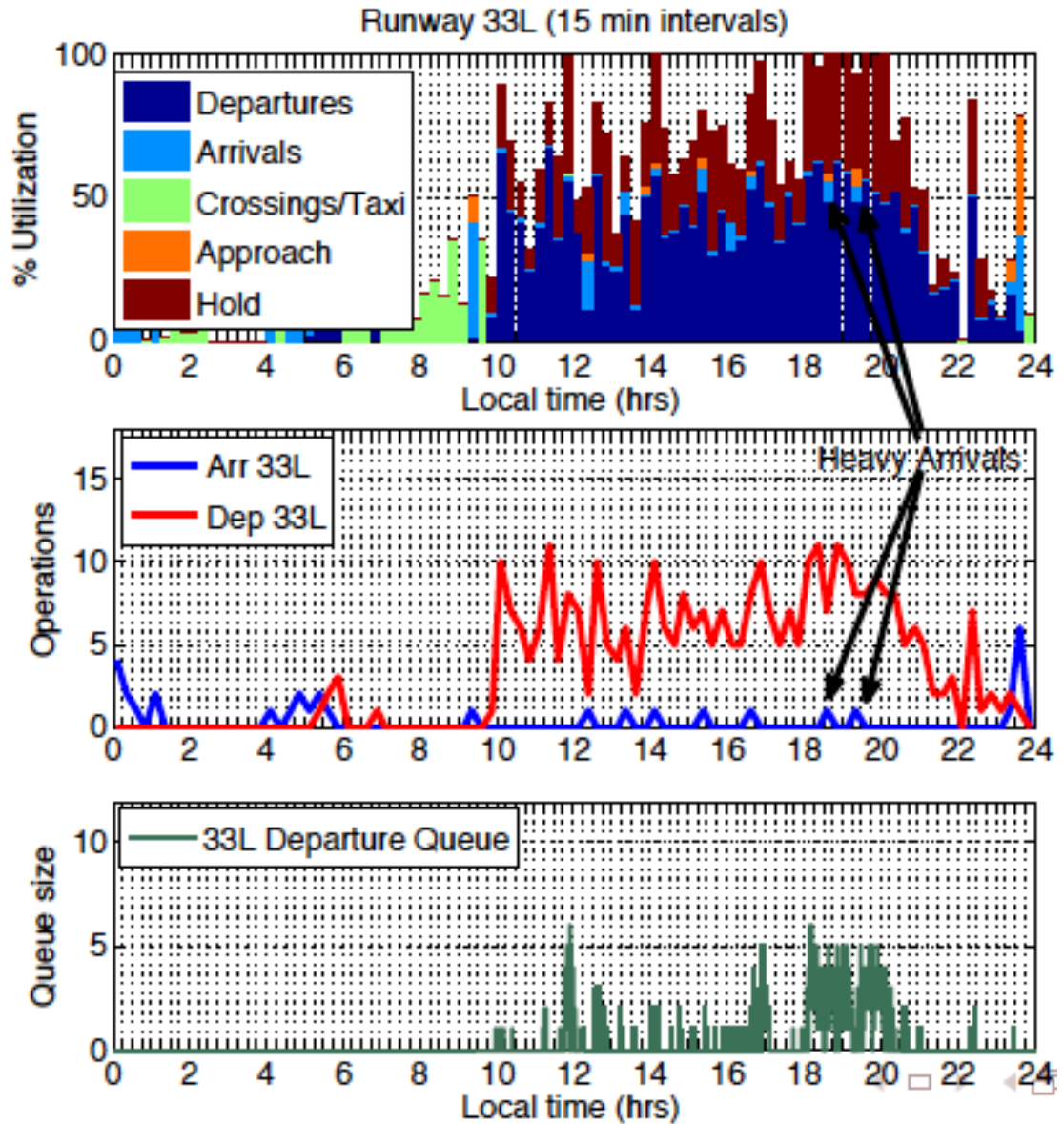
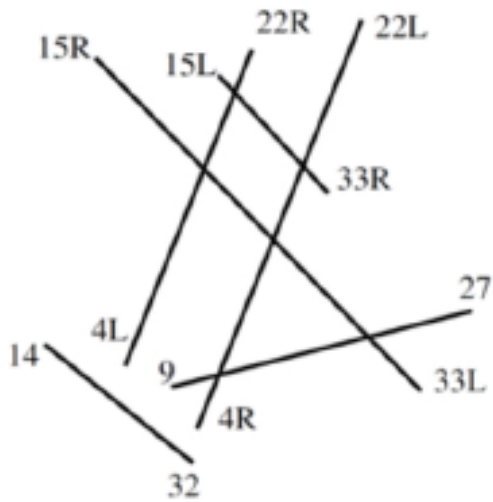


# Runway utilization (from ASDE-X)



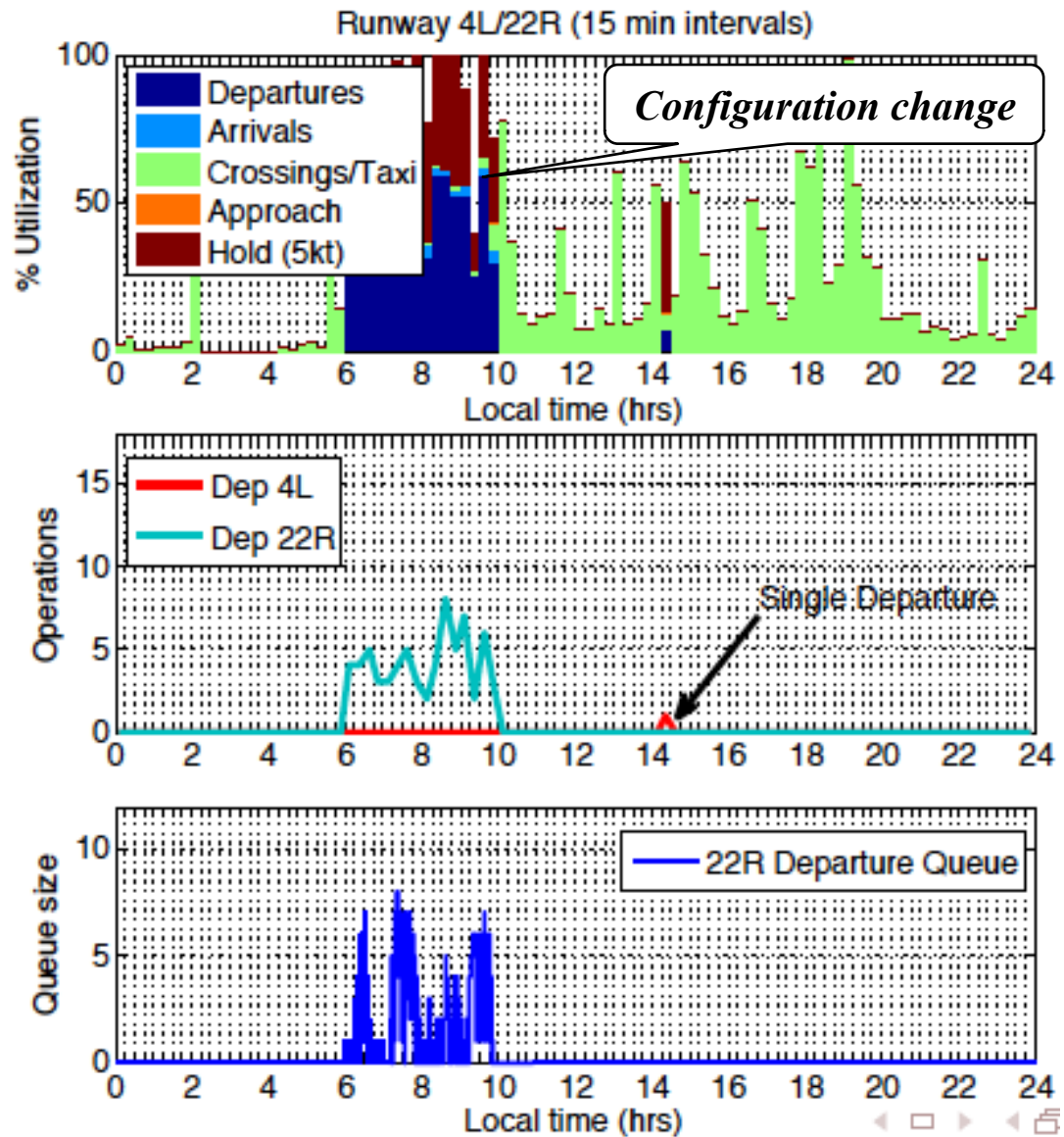
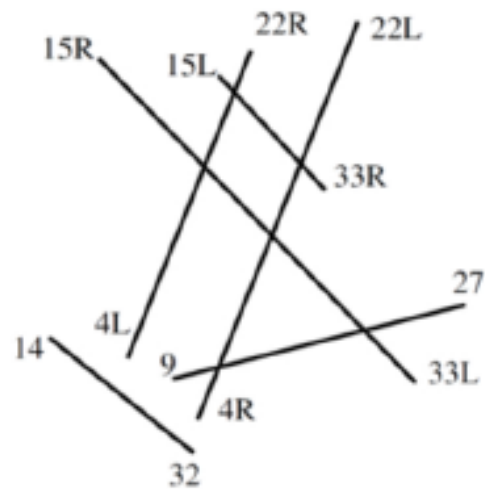
[Khadilkar et al. 2011]

# 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

