Quantifying Bus Performance
A Comparison Between GPS Bus Trajectories and Schedule Data in NYC

presented to
UTRC Transportation Technology Symposium

presented by
Cambridge Systematics, Inc.
Michalis Xyntarakis, Nikhil Puri & Markos Kladeftiras

11/19/2015
Impetus Behind This Effort

- Availability of MTA BusTime and GPS Data
- The need to establish a casual relationship between Bus speeds and congestion or other factors
- Fascination with visualization
- The potential of Data Analytics/Data Mining/Machine Learning
The Data

- MTA’s General Transit Speed Specification (GTFS)
- MTA’s BusTime archived data for three months – 8/1/2014 to 10/31/2014
- Every day 5 million bus location points
- Data size: 800 MB/day

Source: http://blog.openplans.org/2012/08/the-openplans-guide-to-gtfs-data/
Bus Trajectories
On-Time Performance

Weeknights (9PM to 12AM)

Early mornings (12AM to 5AM)
Mean of scheduled headways

Headway Variability

M14D Lower East Side - Chelsea Piers via 14th St Crosstown
LOWER E. SIDE DELANCY-FDR CROSSTOWN

Mean of observed headways

Median
Standard Deviation
Trajectory Visuals Summary

- Bus motion is 100% described
  - Position, speed
  - Dwell time? (probably not)

- Timetable adherence is also evident

- Additional observations
  - Bus bunching
  - Congestion
Two Dimensional Frequency Plot
GTFS vs BusTime Speeds

BusTime (mph)

GTFS Speed (mph)
Bus On-Time Performance
Stop On-Time Performance (All days, all routes, all times)
When does On-Time Performance matter?
Number of buses dispatched
Weekday schedule
Next Steps

- We have produced descriptive statistics
- We are missing causality. Why things happen?
- We need to integrate other data sources
- Can we locate outliers?
- Can we apply predictive analytics? In real-time?
Summary of Insights

- Bus Speeds are 1 mph lower than scheduled speeds in fall 2014
- There is a ~50% chance a bus starts its trip less than 5 minutes late
- There is a 35% chance a bus ends its trip less than 5 minutes late
- Stop delays don’t differ significantly between weekdays and weekends
- Buses are slightly more punctual in early morning
- There is 20% chance a bus arrives early at a stop
Thank You!

mxyntarakis@camsys.com