A SPATIAL ANALYSIS OF BUS DELAYS FROM GIS, GTFS & GPS DATA

Md Matiur Rahman, PhD candidate
S.C. (Chan) Wirasinghe, Professor
Lina Kattan, Associate Professor
Department of Civil Engineering, Schulich School of Engineering, University of Calgary, Canada
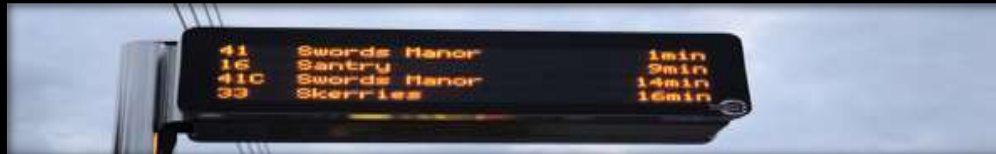
Deviation from static bus schedule...

➢ Increased perceived cost for a bus trip

✓ *Real-time bus information..*

...the philosophy behind providing dynamic bus information is to get more out of what we have.

but, what type and quality of information?

*

✓ **future bus arrival time at a stop**
✓ **its accuracy**

"...to be useful travelers must trust the information being provided to them."

* Rahman, M.M., Wirasinghe, S.C. and Kattan, L. (2013) "Users' Views on Current and Future Real-Time Bus Information Systems", Journal of Advanced Transportation, Volume 47, Issue 3, pages 336–354, DOI: 10.1002/atr.1206

✓ *Real-time bus information..*

Some basic requirements to produce real-time bus arrival information:

schedule data
- where and when the agency plans for each bus to be

real-time bus locations
- where the bus is right now

prediction algorithms
- use various data types and prediction techniques

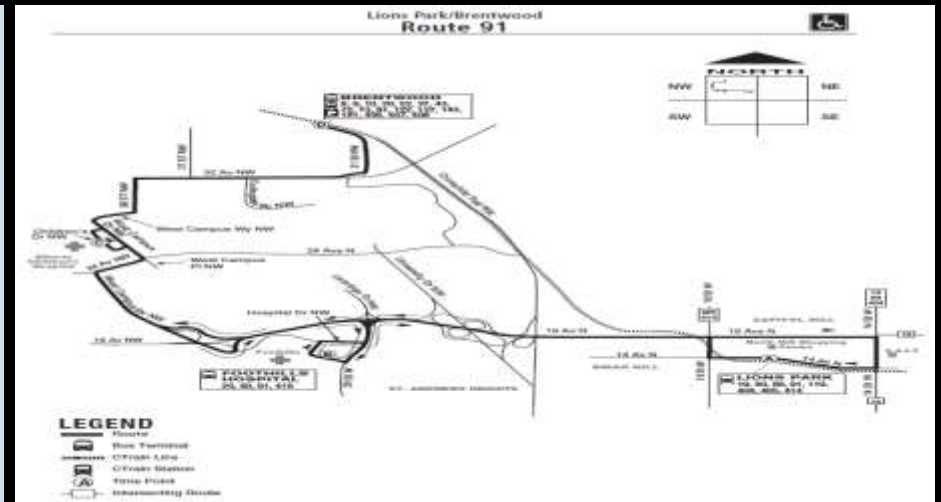**But, sometimes, a real-time system also tells you lies……**

It might report a bus is

➢ ***early*** when it's on time or even late
➢ ***late*** when it's on time or even early

… mainly due to the lack of our understanding about the dynamics of bus delays in a route!

Objectives:

… well, primarily, the analysis of bus delays

Case study route

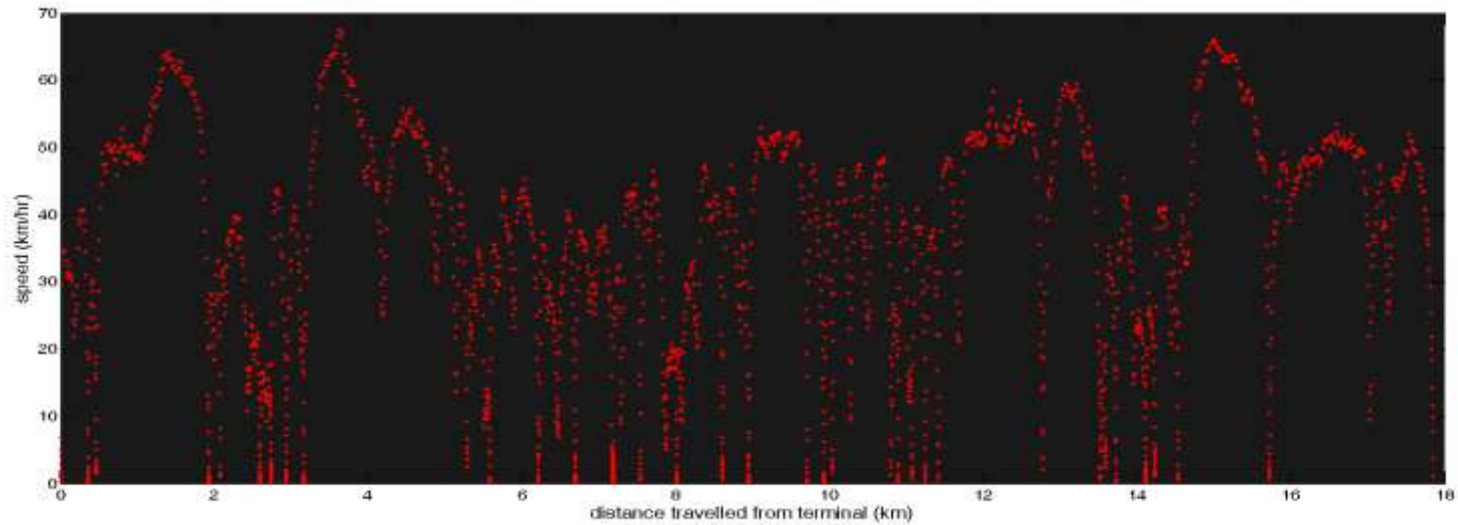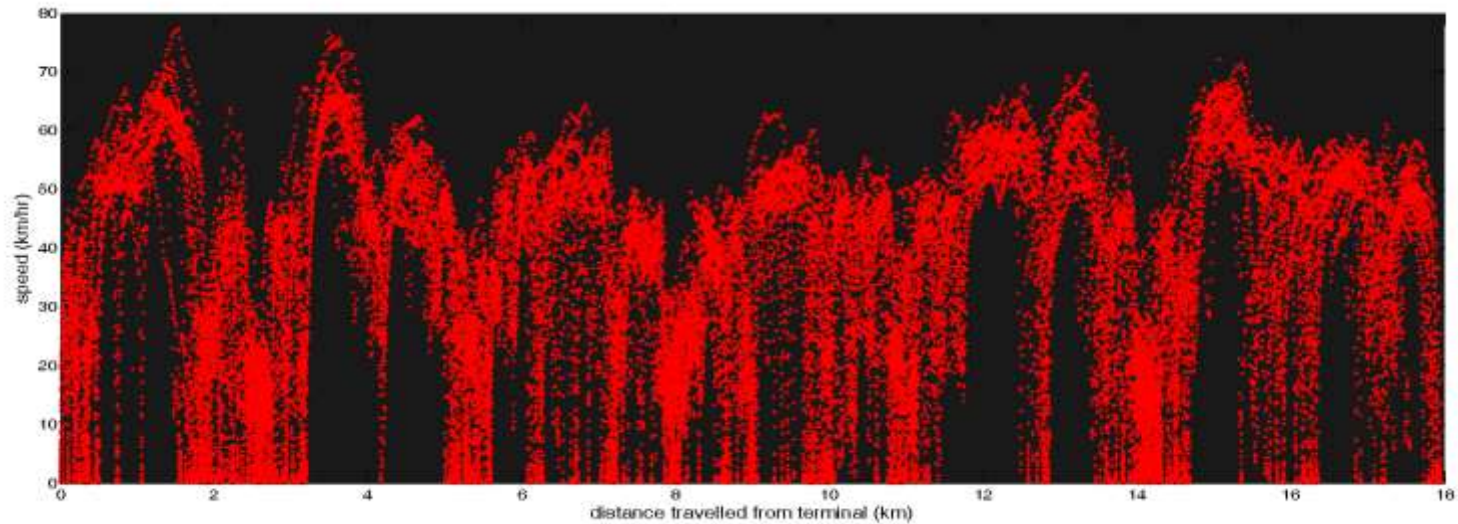

Route 91:
Calgary, Alberta, Canada

Spatial analysis

- Data sources
  - GPS
  - GTFS
  - GIS

❖ BUS SPEEDS…
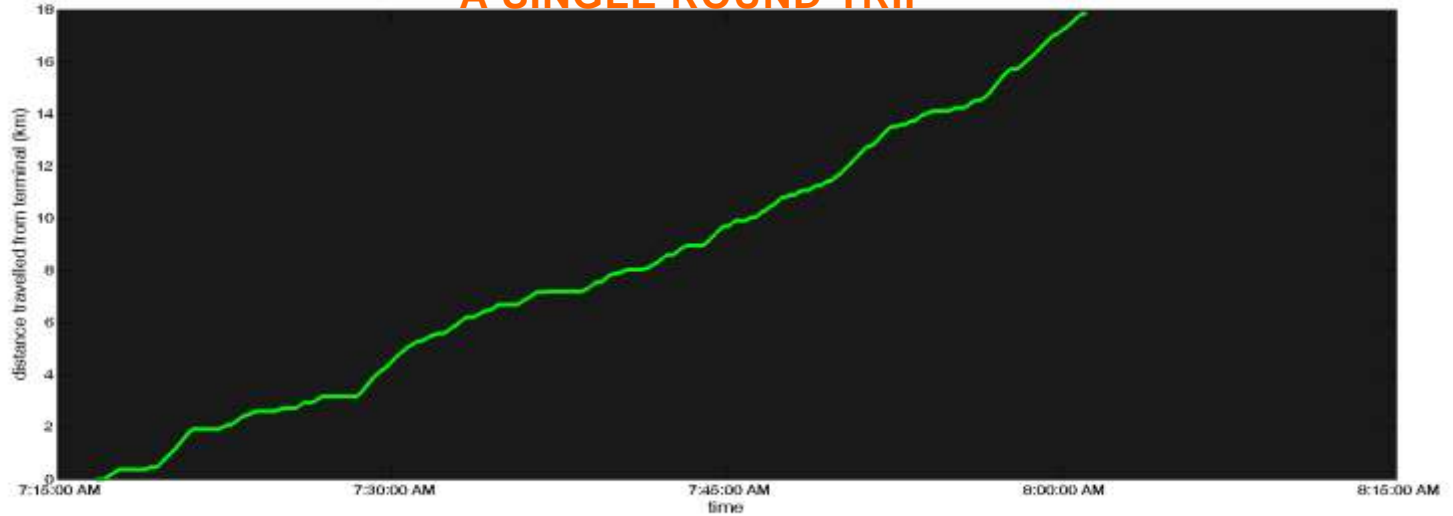
A SINGLE ROUND TRIP

MULTIPLE TRIPS

❖ TIME SPACE DIAGRAM…
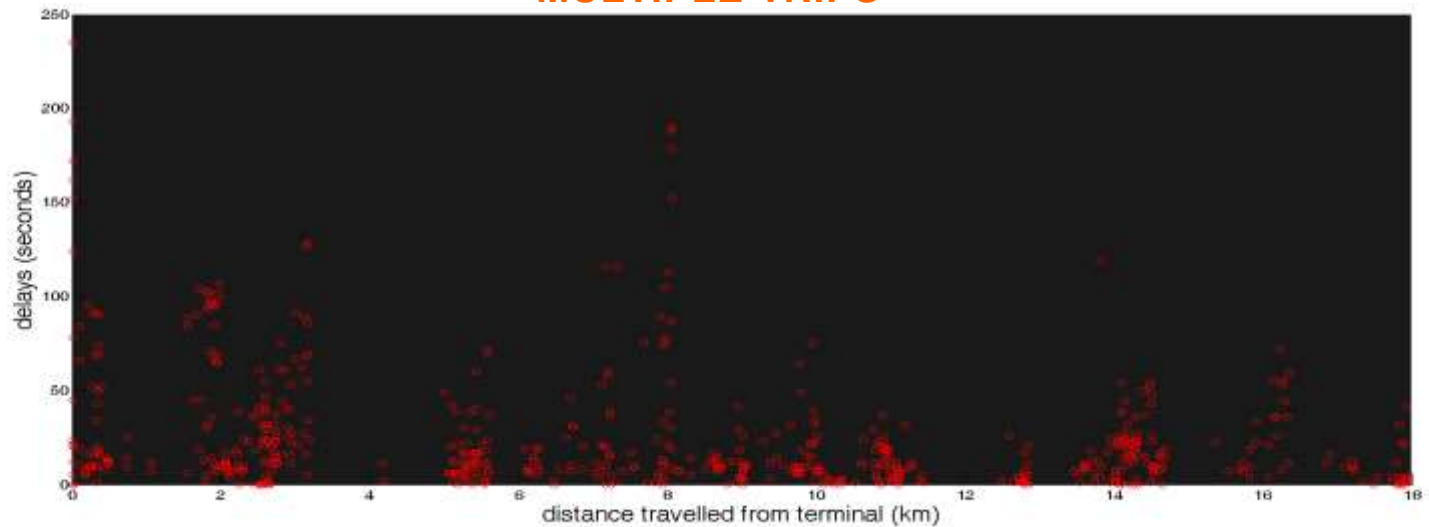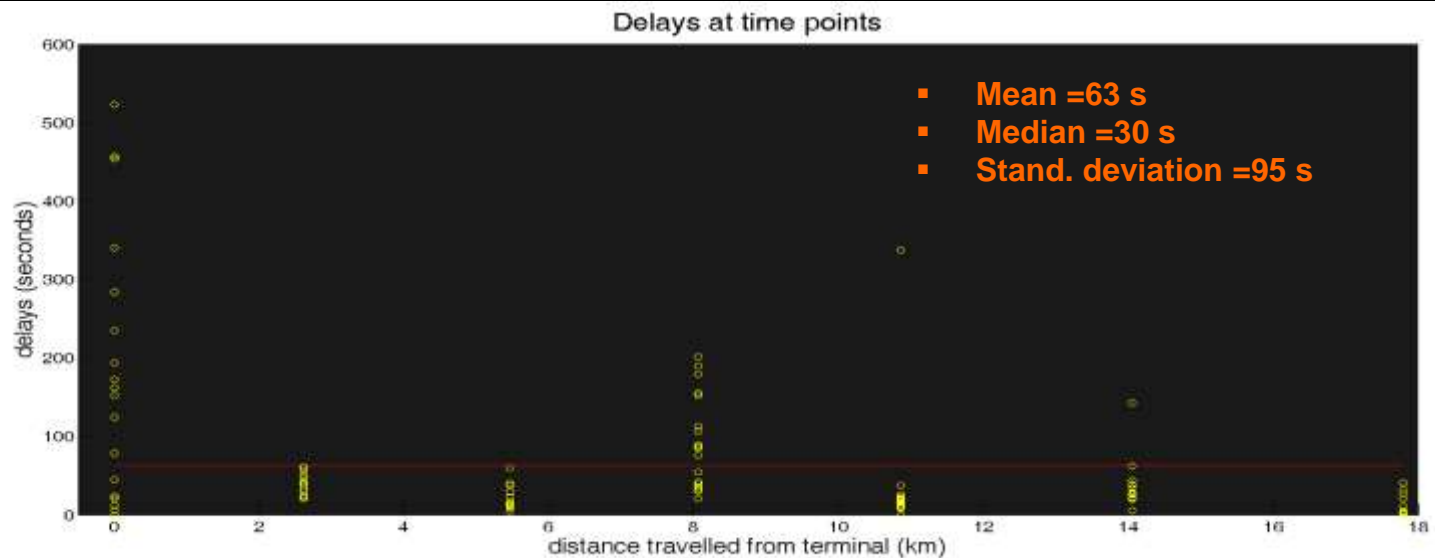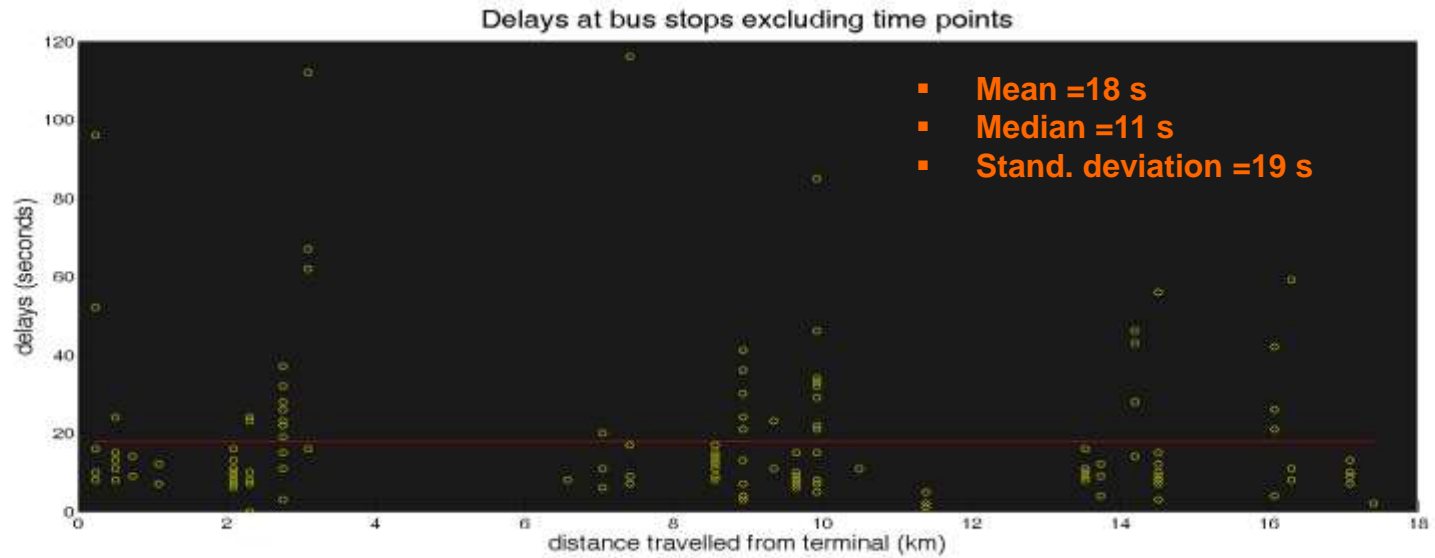
A SINGLE ROUND TRIP
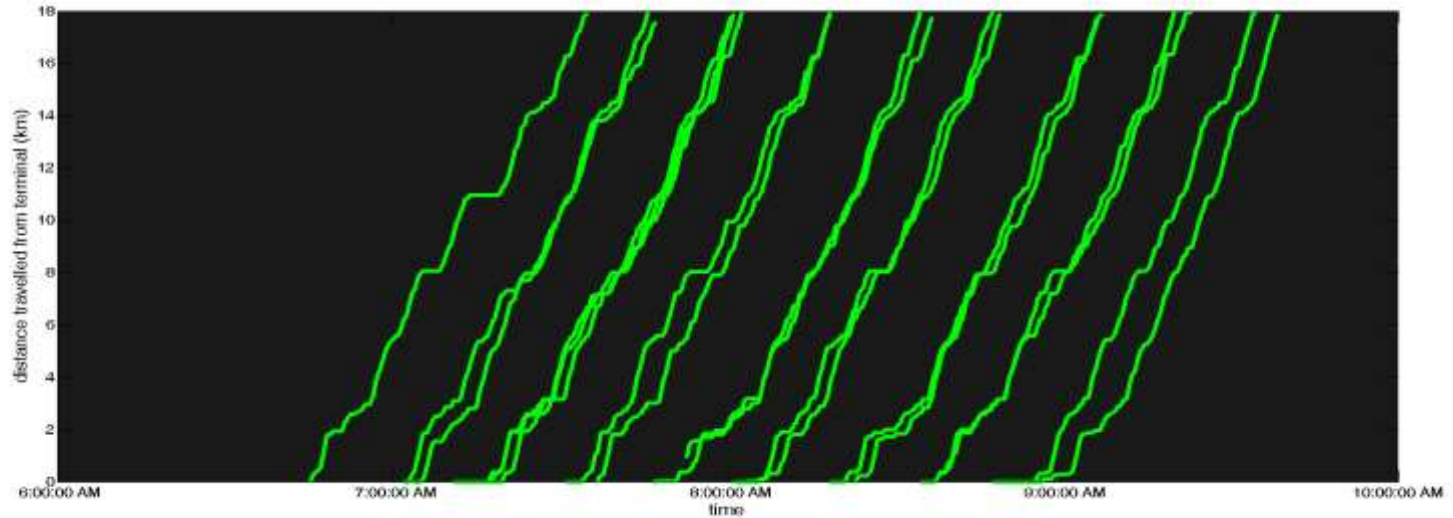
MULTIPLE TRIPS

A SINGLE ROUND TRIP
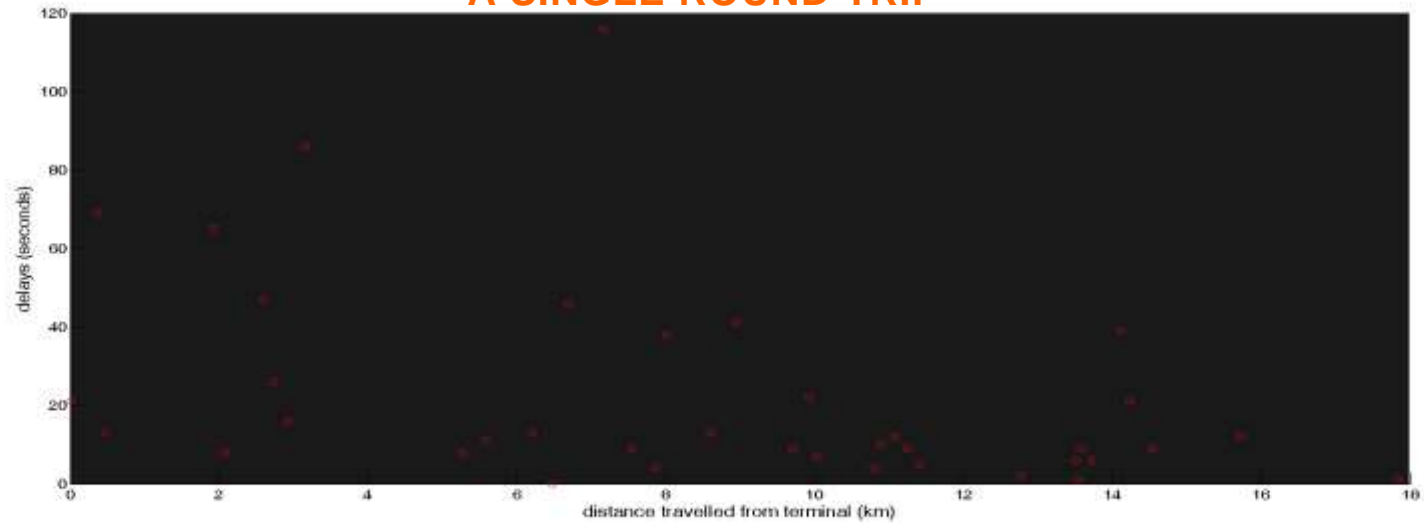
MULTIPLE TRIPS

❖ BUS DELAYS @ BUS STOPS…

Delays at bus stops excluding time points

- Mean =18 s
- Median =11 s
- Stand. deviation =19 s

Delays at time points

- Mean =63 s
- Median =30 s
- Stand. deviation =95 s

❖ BUS DELAYS @ TRAFFIC SIGNALS…

Delays at traffic signals [through]

- Mean =22 s
- Median =18 s
- Stand. deviation =17 s

Delays at traffic signals [left turn]
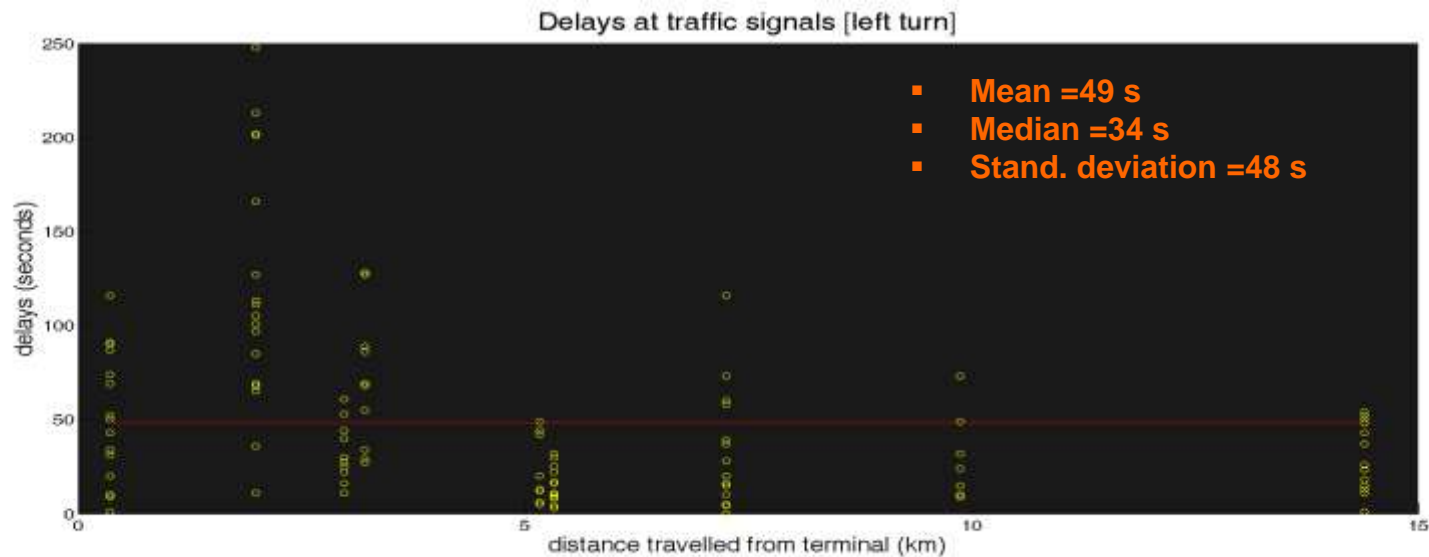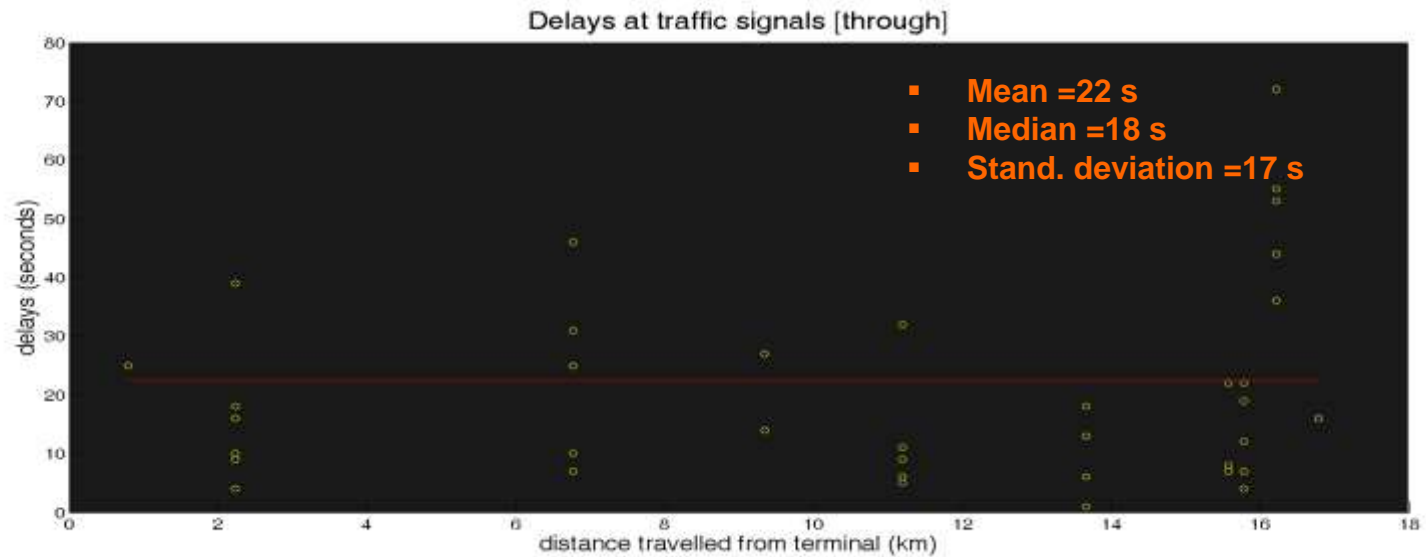
- Mean =49 s
- Median =34 s
- Stand. deviation =48 s

Variations in delays among various locations
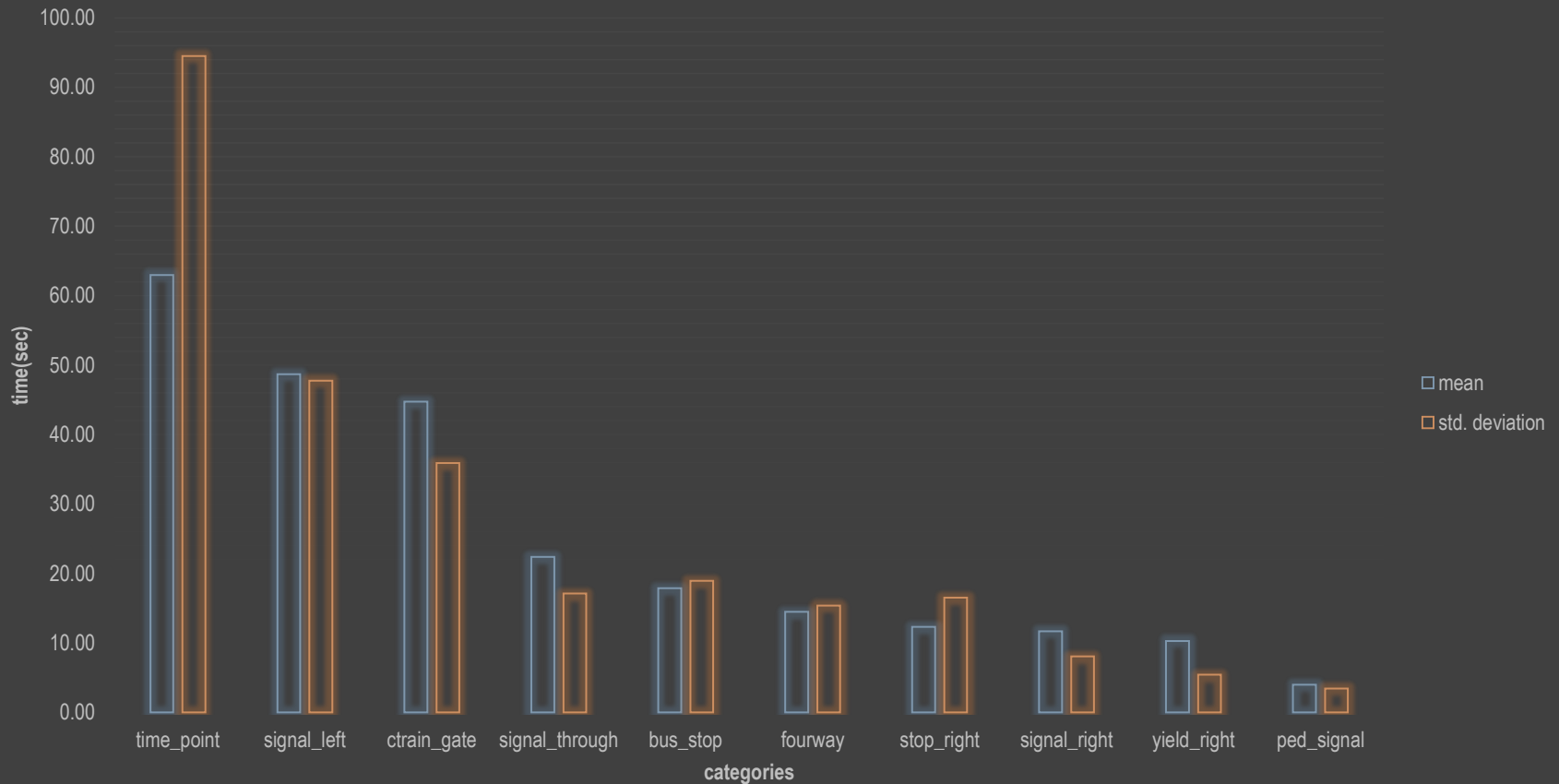
temporal analysis

- **D a t a   s o u r c e s**
  - **A P C**
  - **E n v I r o r n m e n t   c a n a d a**

❖ BUS DELAYS…

KEY FINDINGS
[TEMPORAL ANALYSIS OF ONE YEAR APC DATA FOR THE CASE STUDY ROUTE]

Running Time for a round trip

- ↑ 1 minute @ **morning peak**
- ↑ 2.5 minutes @ **afternoon peak**
- ↓ 2 minutes @ **weekends**
- ↓ 3 minutes @ **holidays**
- ↑ 1 minute @ **winter**
- ↑ 1 minute @ **snow**

Dwell Time at a bus stop

- ↓ 2 sec @ **winter**
- ↓ 1 sec @ **snow**
- ↑ 4 sec @ **one boarding passenger**
- ↑ 3 sec @ **one alighting passenger**

[significant @ 95% con. Level, multiple linear regression]

Thank you