

**Speed Data:
“... new twists compliments
of technology”**

Speed Data Summit
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University of Maryland
June 16, 2010

Scope

- NCHRP 20-7 – Guide to Benchmarking Operations Performance Measures
 - “A Few Good Measures” by NTOC
- I95 Corridor Coalition Vehicle Probe Project
 - Vehicle Probe Traffic Monitoring System
 - Commercial Data Provider
 - Validated data accuracy
- Bluetooth Traffic Monitoring
 - Travel time based on re-identification of a portion of vehicles

“A Few Good Measures” identified by NTOC

- Customer Satisfaction
- Extent of Congestion
- Delay
 - Non-Recurring
 - Recurring
- Incident Duration
- Speed
- Throughput
 - Person
 - Vehicle
- Travel Time
 - Link
 - Reliability
 - Trip

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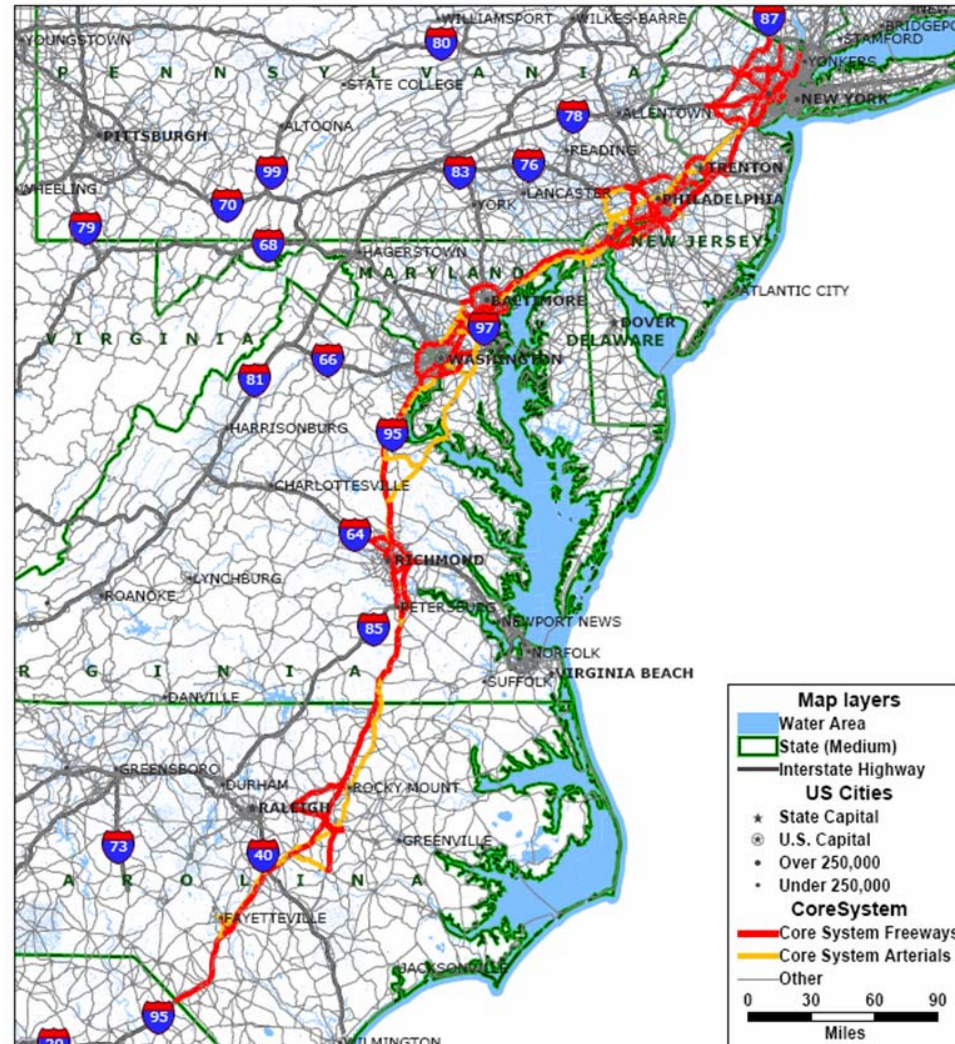
I95 Vehicle Probe Project

Initial Coverage in July 2008

- 1500 Freeway miles
- 1000 Arterial miles
- New Jersey to North Carolina

Expansions

- All NJ Freeways (500miles)
- All NC Interstates (1000 miles)
- All SC Freeways (1000 miles)
- Florida (500 miles)



Key Program Features

- **Content**

- Speed & travel time updates every minute

- Expected speed, free flow speed, and confidence values

- **Access and Use**

- 24/7/365 Web based data feed

- Full archive available

- Project portal for graphical display

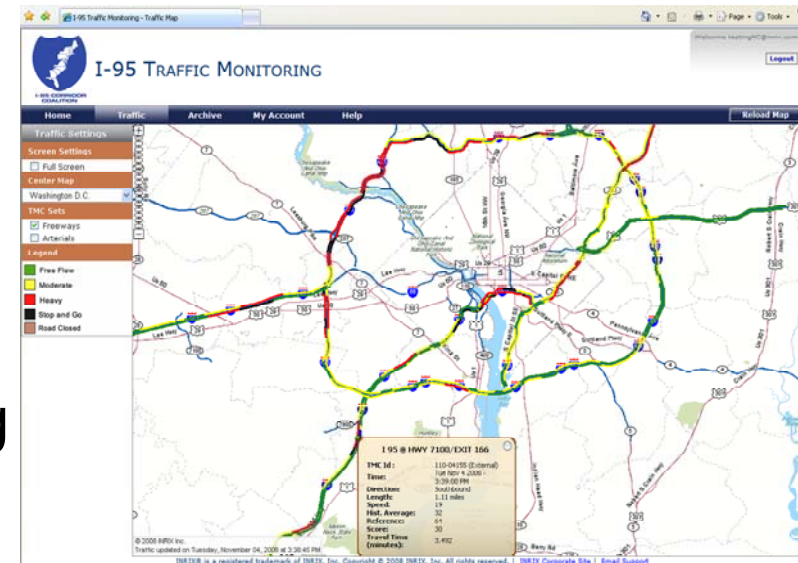
- Map overlays

- **Uses**

- 511, Traveler Information,

- Performance measures, Planning

- **Validated Accuracy**



How do they do that?



Largest GPS Probe Network in the World with ~1 Million Vehicles

- Taxis, limos, airport shuttles
- Service delivery vehicles
- Long haul trucks and Less than Truckload (LTL) vehicles



90% of Available Sensors in the US

- Loop sensors
- Radar detectors



Other Traffic Flow Sources

- Cellular probe data
- Toll tags

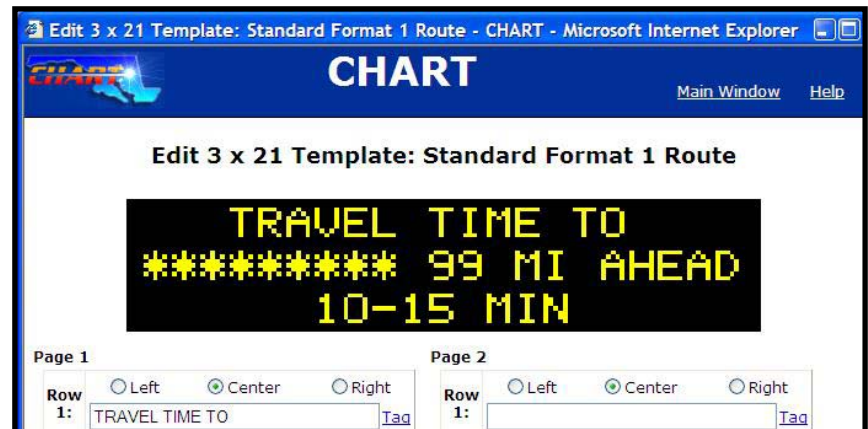
Benefits

- Coverage
- Data Accuracy

- Primary data source are GPS equipped fleets
- Other sources include:
 - Public sensor data
 - Crowd sourced data

Maryland SHA – Travel Time on Changeable Message Signs

- Planned for 2012
- Implemented January of 2010
 - 18 Months ahead of schedule!
- No need for state funds to support extended sensor network.



Multi-State Performance Measures

- NC Performance Measures – Pilot 2010
 - Statewide assessment
 - Based on Vehicle Probe data
 - Processed and delivered by UMD RITIS
- Benefits
 - Common data, formats, reporting
 - No additional in-house resources
- Replicated to all participating states

Unintended Benefits / Consequences

- Emergence of Industry Standards
 - XML based data feed
 - Integration with Internet tools
 - Traffic Message Channel as preferred geographic reference system
 - Common data formats across states, technologies, departments, and industry
- “ Silos are coming down ”***

Is the data any good?

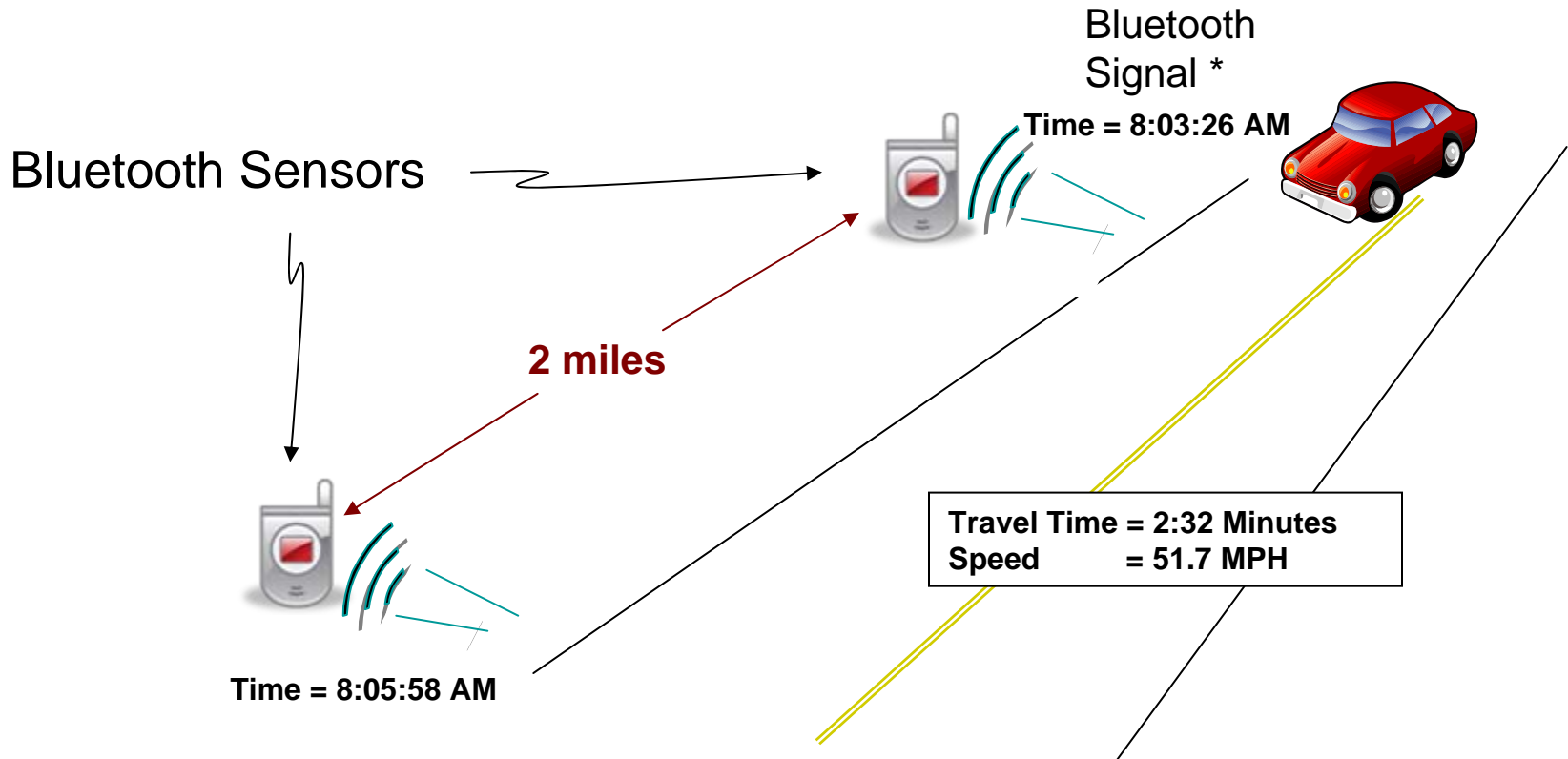
THE CHALLENGE

- Validate the accuracy of the Inrix data feed
- Perform a three year validation for approximately 1,500 freeway miles
- Adjust contractor payments to reflect data quality

Data Quality

- Travel Time / Speed Data
 - Max average absolute speed error 10 MPH
 - Maximum speed error bias +/- 5 MPH Max
- Specifications applied in four flow regimes
 - 0 - 30 MPH 30 - 45 MPH
 - 45-60 MPH > 60 MPH
- **Space mean speed specified**
- Applied flows > 500 vehicles/hour
- Maximum data lag of 8 minutes

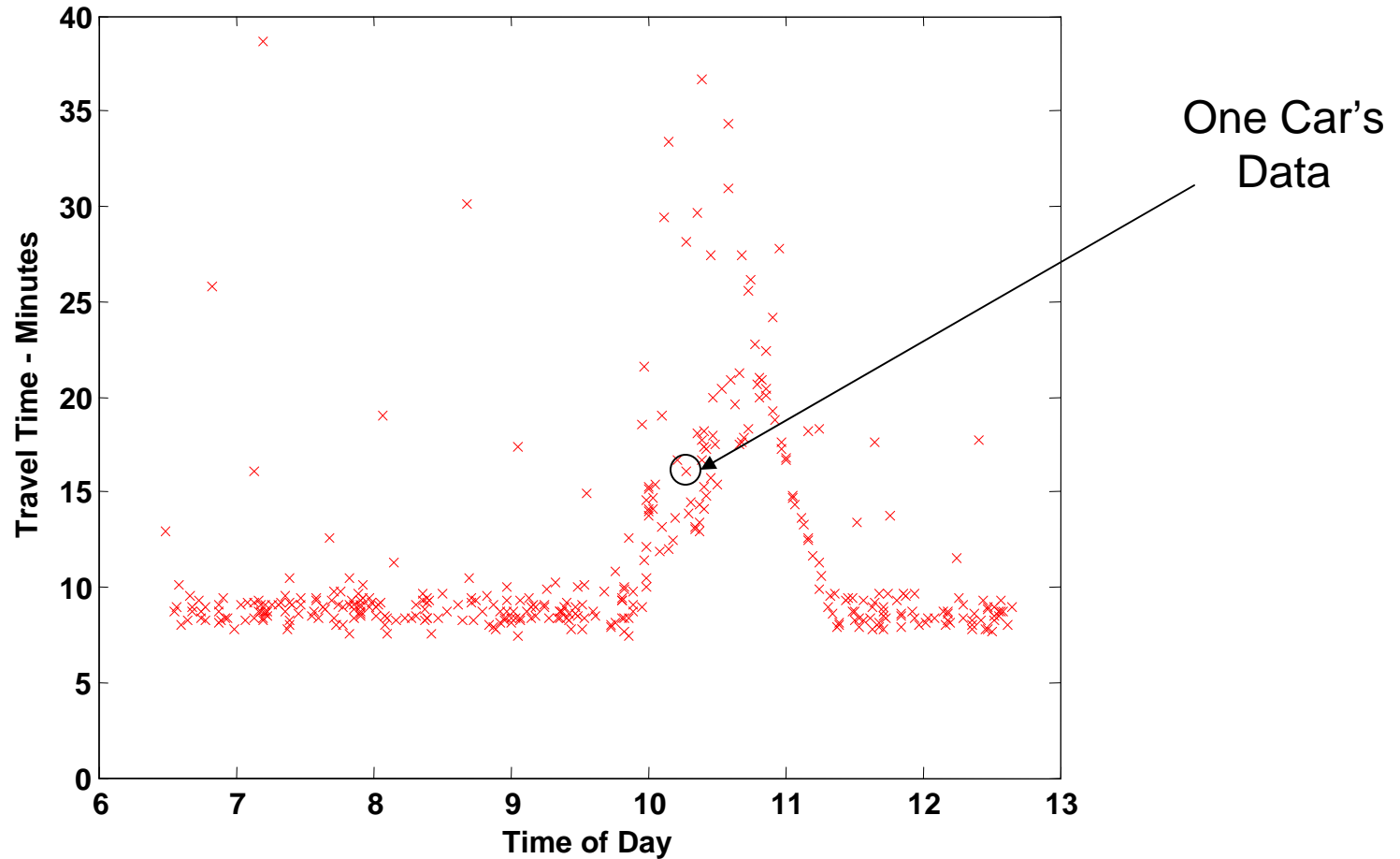
Bluetooth Traffic Monitoring



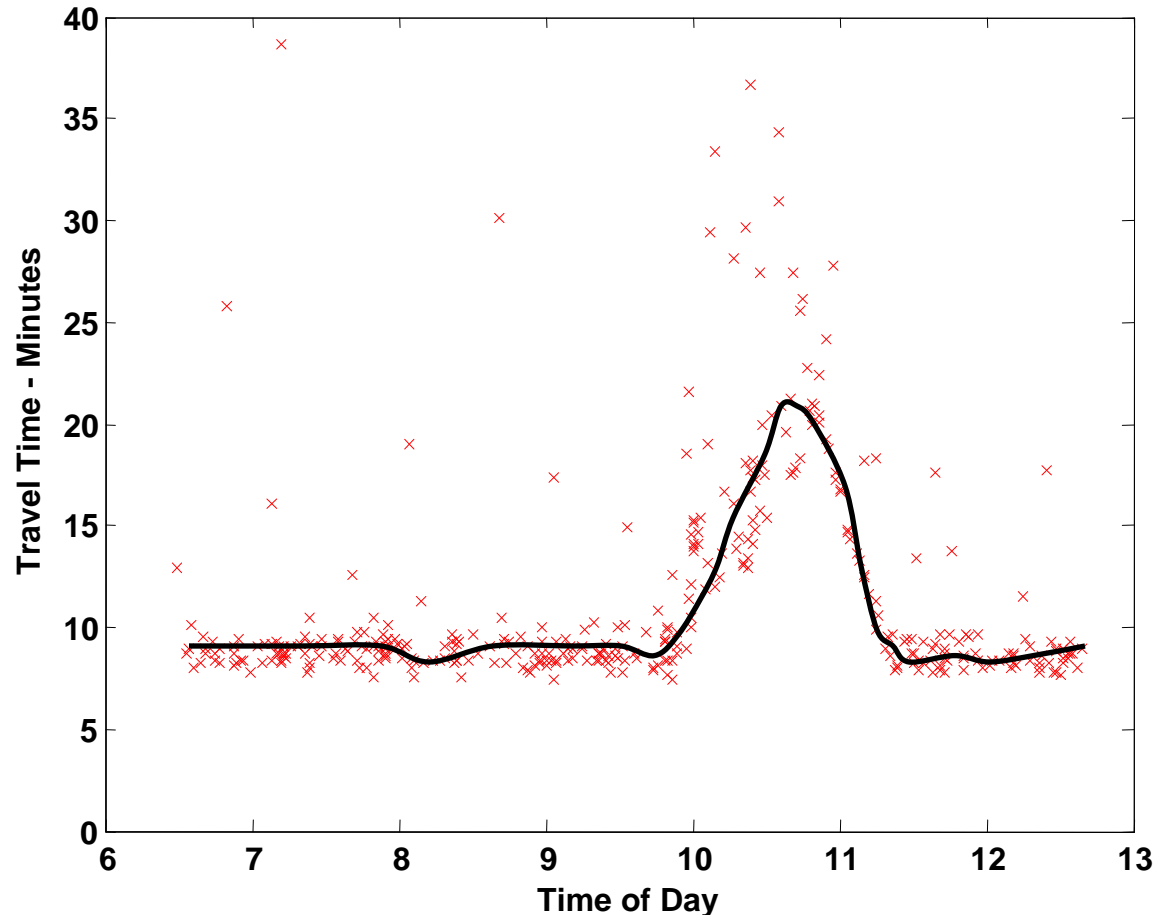
* Bluetooth signals come from cell phones, PDAs, laptops, GPS, car radios...

** Provisional patent received

Data from many cars ...



Data from many cars ...



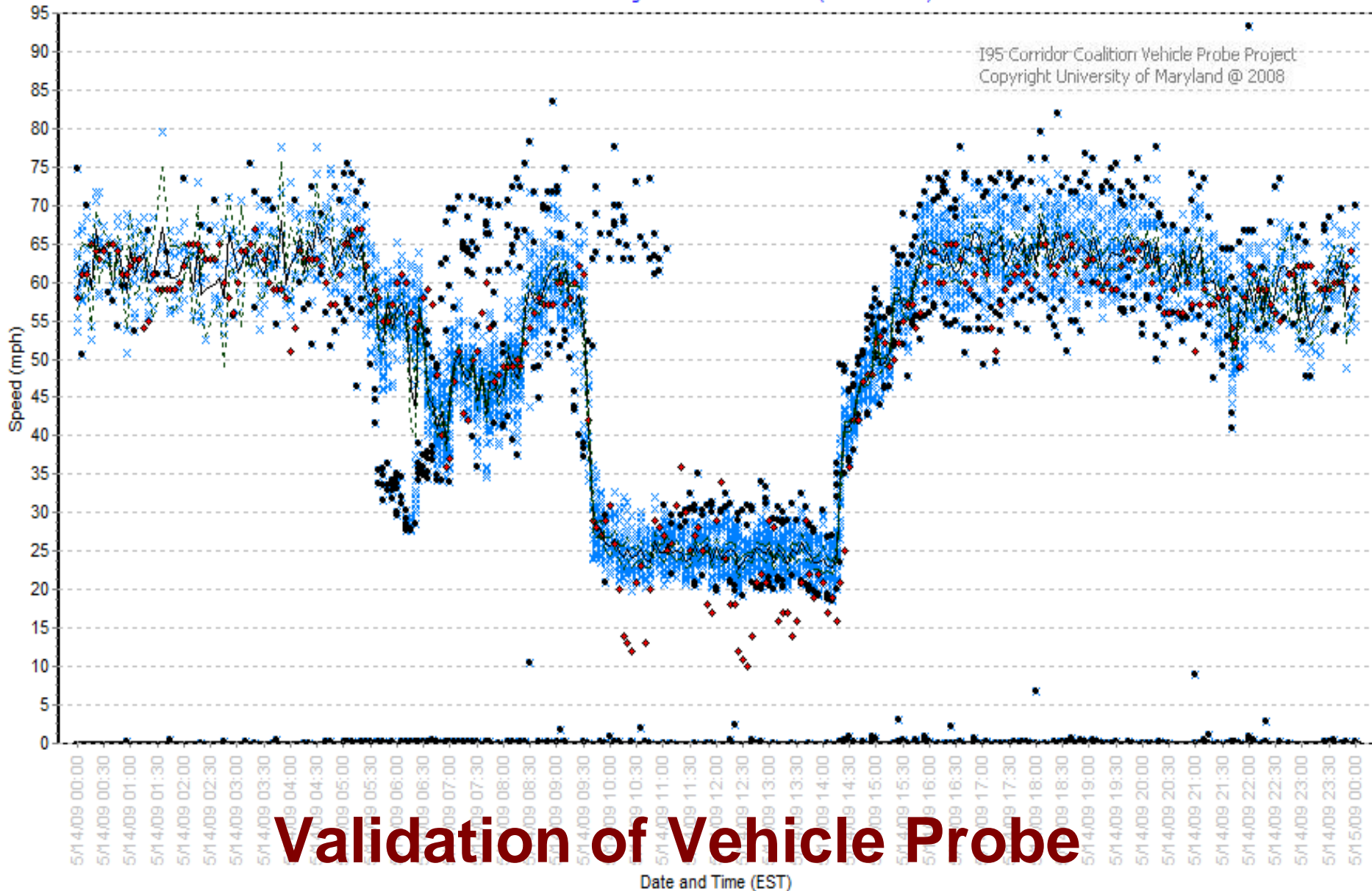
Typical Deployment



TMC:110+04155

I 95 NORTHBOUND ending at HWY 7100/EXIT 166 (2.43924 miles)

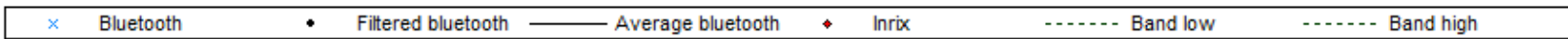
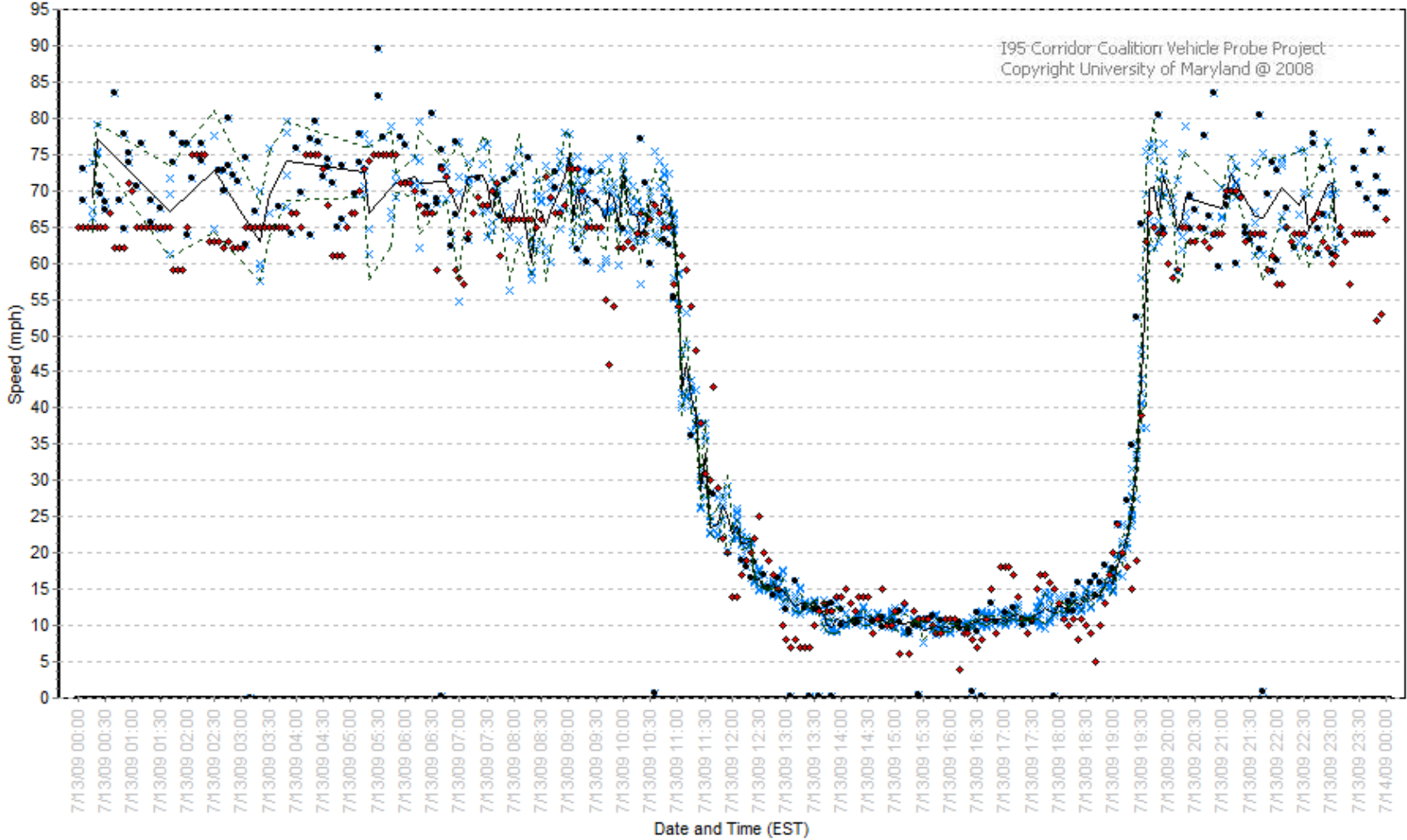
I95 Corridor Coalition Vehicle Probe Project
Copyright University of Maryland @ 2008



× Bluetooth • Filtered bluetooth — Average bluetooth ♦ Inrix - - - - - Band low Band high

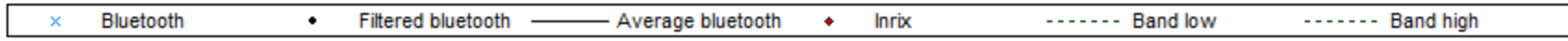
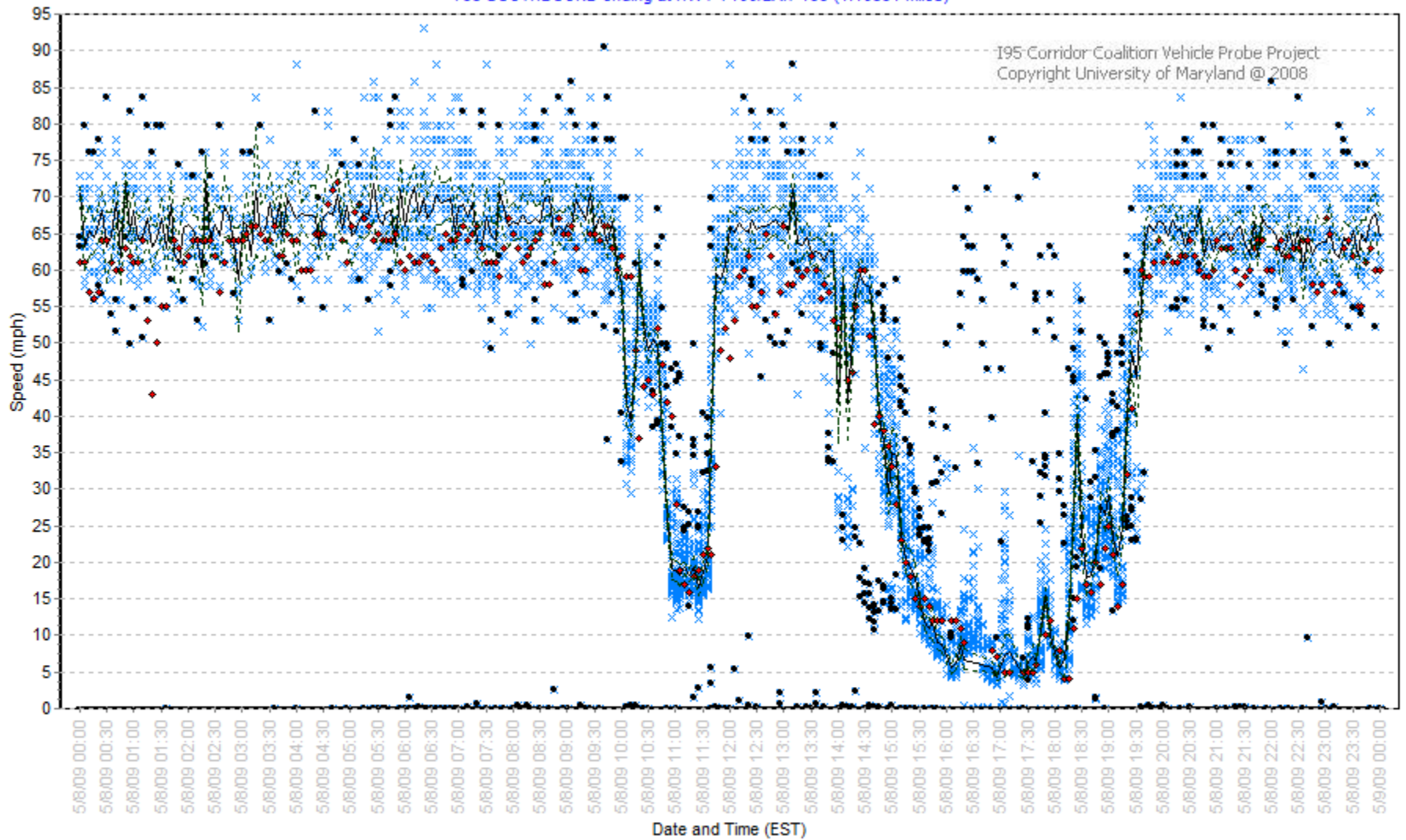
TMC:125+05269

I95 NORTHBOUND ending at HWY 903/EXIT 168 (6.76493 miles)



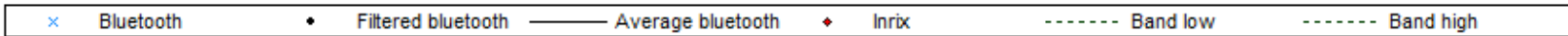
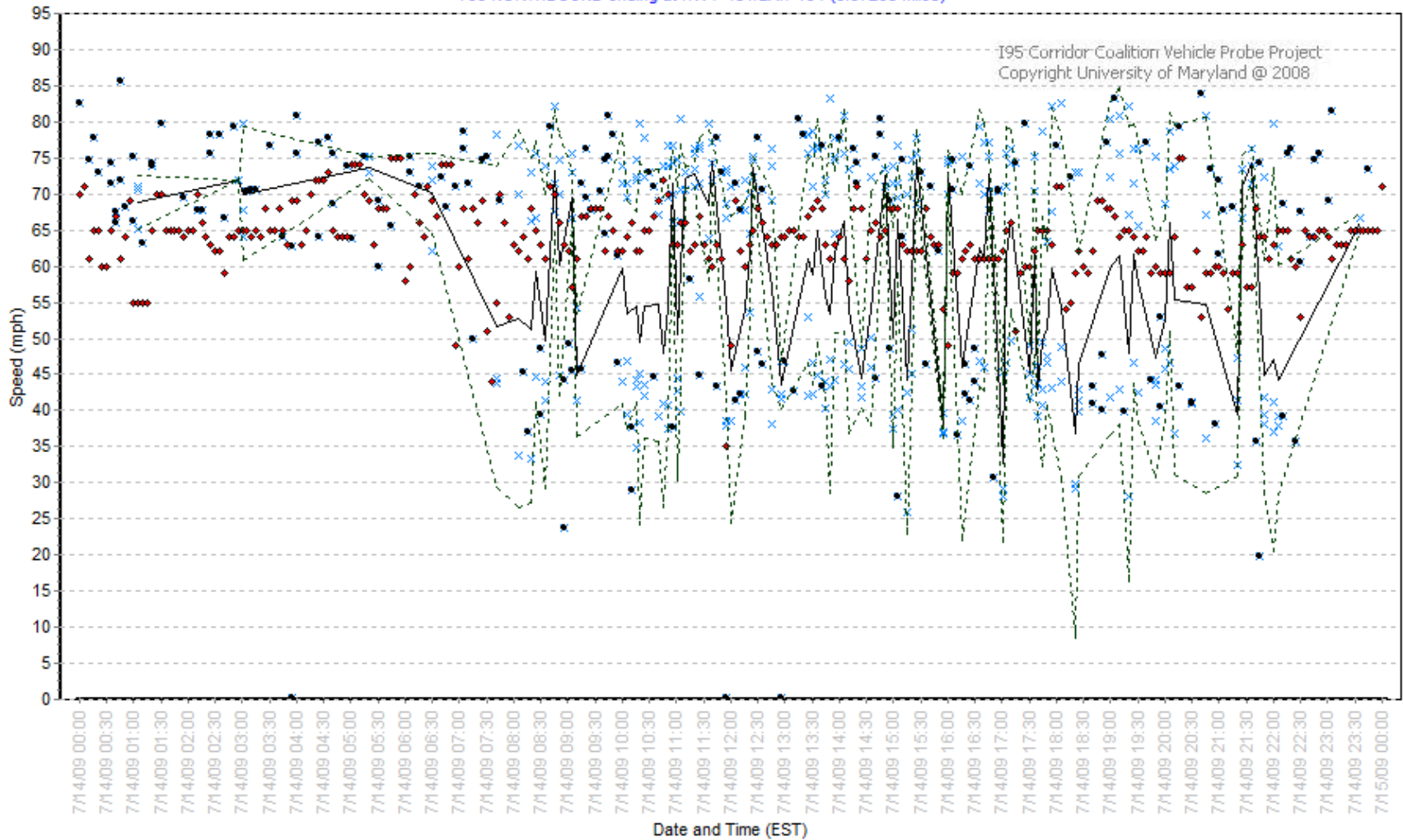
TMC:110-04155
I95 SOUTHBOUND ending at HWY 7100/EXIT 166 (1.10591 miles)

I95 Corridor Coalition Vehicle Probe Project
Copyright University of Maryland @ 2008



TMC:125+05267
 I 95 NORTHBOUND ending at HWY 481/EXIT 154 (3.57268 miles)

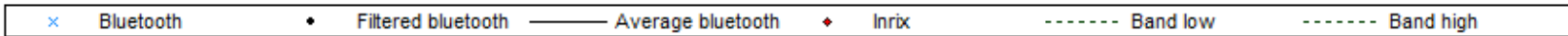
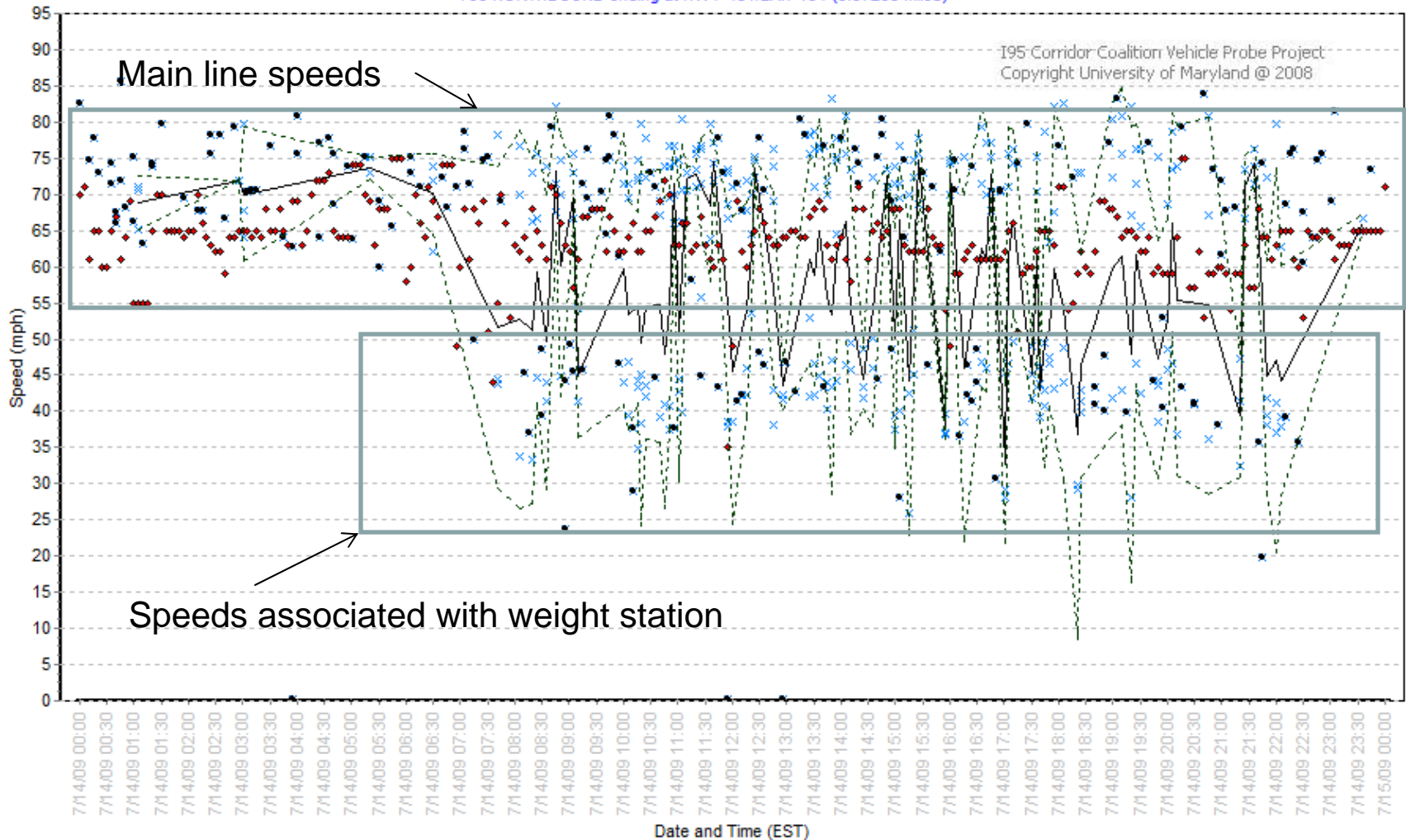
I95 Corridor Coalition Vehicle Probe Project
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TMC:125+05267

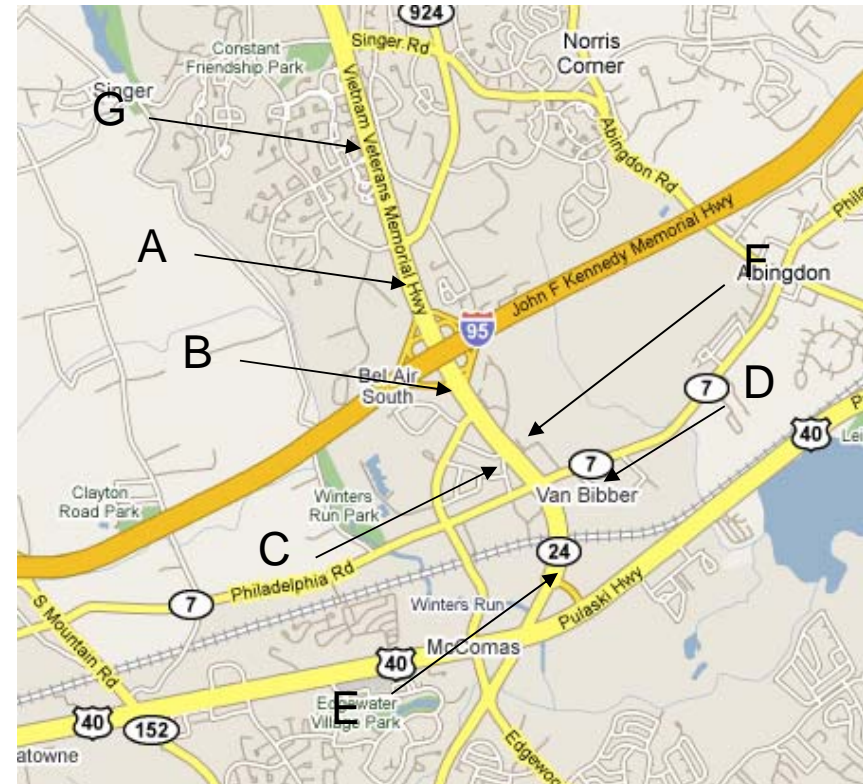
I 95 NORTHBOUND ending at HWY 481/EXIT 154 (3.57268 miles)

I95 Corridor Coalition Vehicle Probe Project
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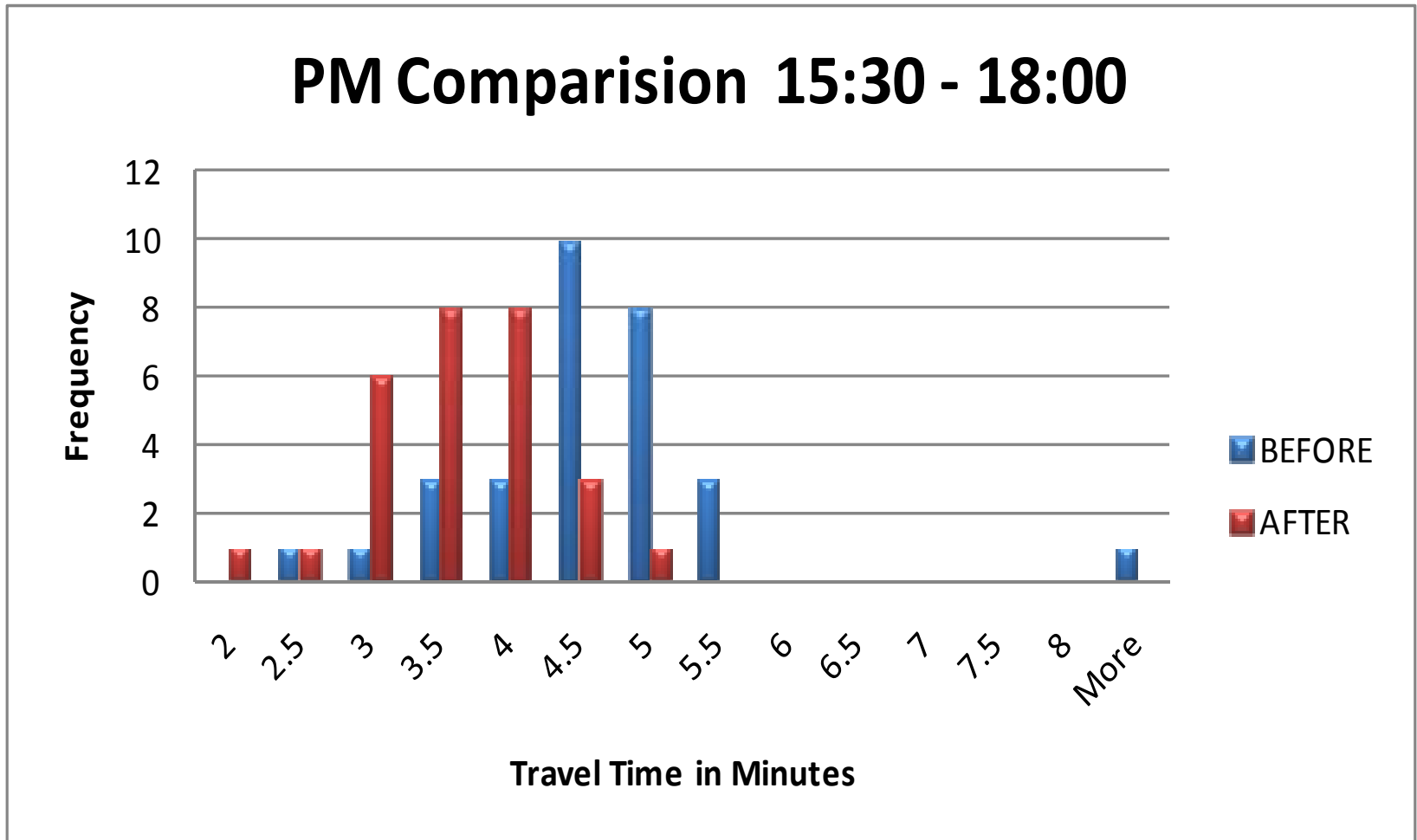


Arterial Assessment

- MD24 in Northern Baltimore
- Before/After impact of signal timing
- AM, Mid-day, and PM analysis
- February 23-27, 2009
 - New timing on 2/25/09

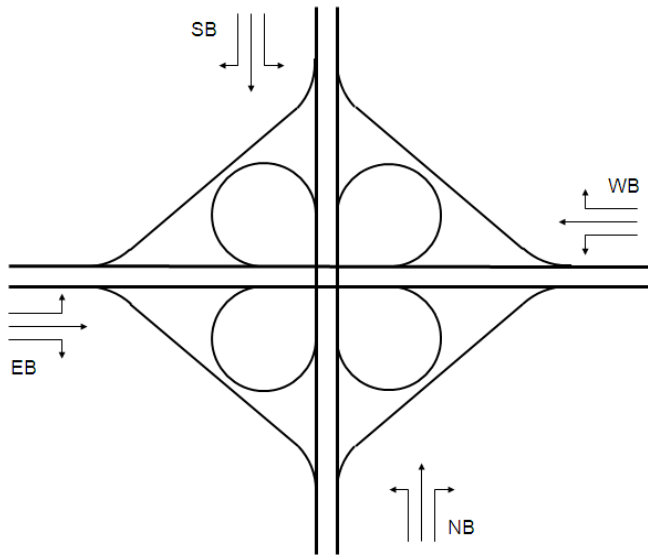


Results PM Comparison

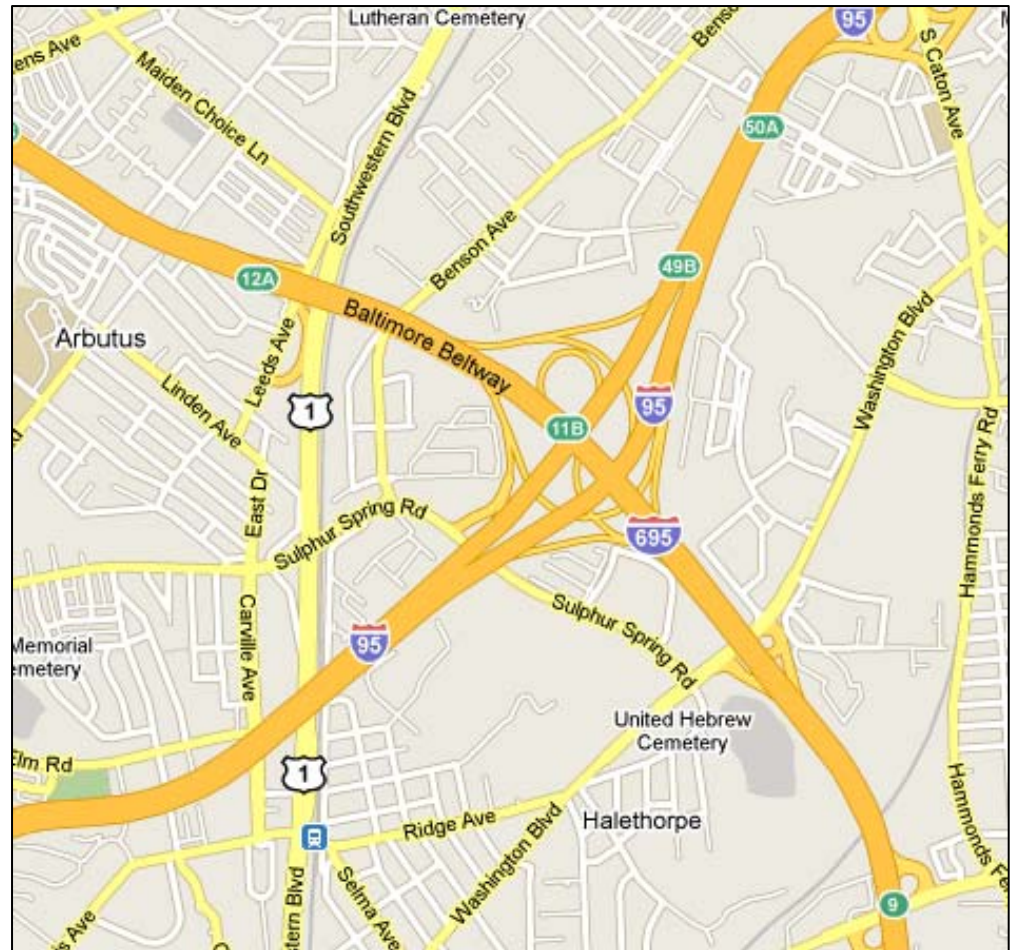


MONITORING INTERCHANGES

I-695 & I-95



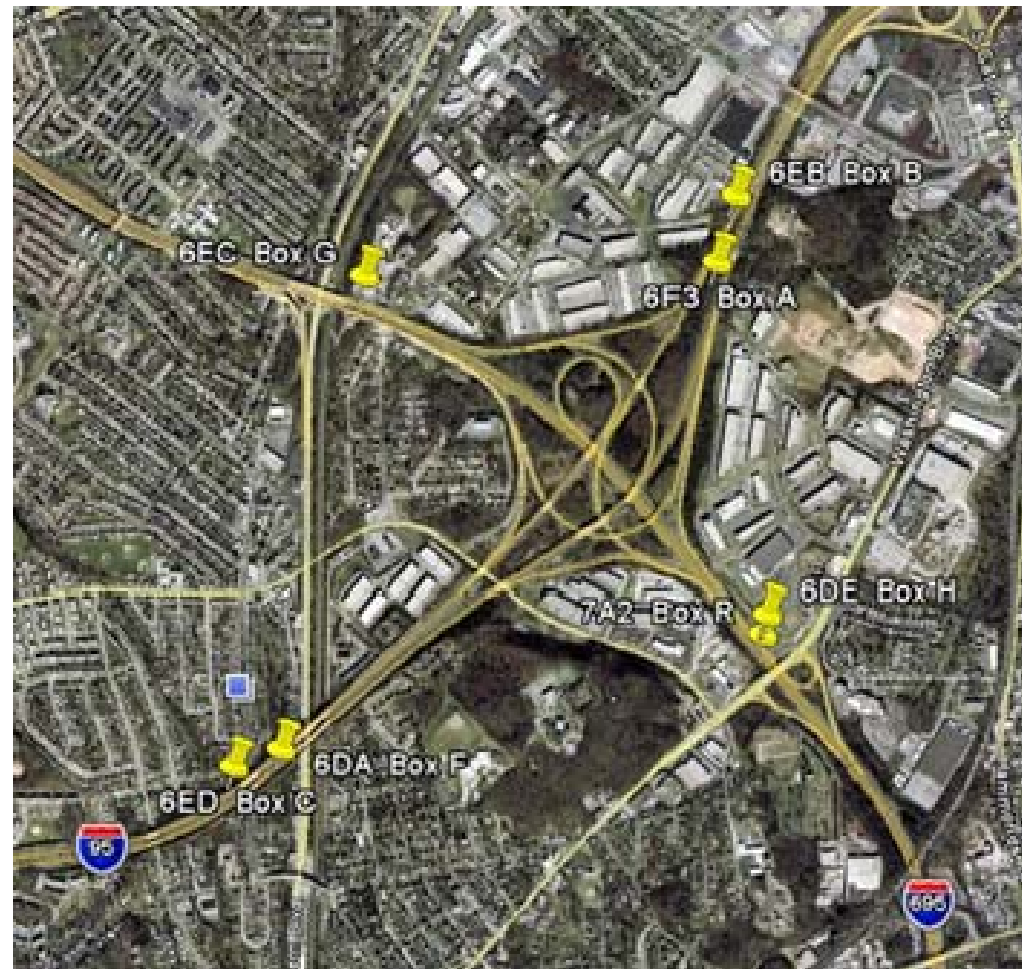
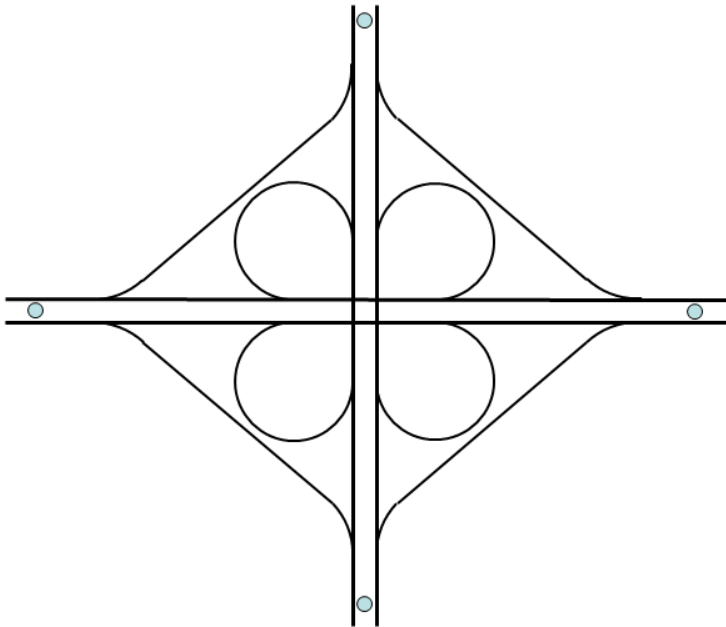
**Where do you
deploy sensors?
How many?**



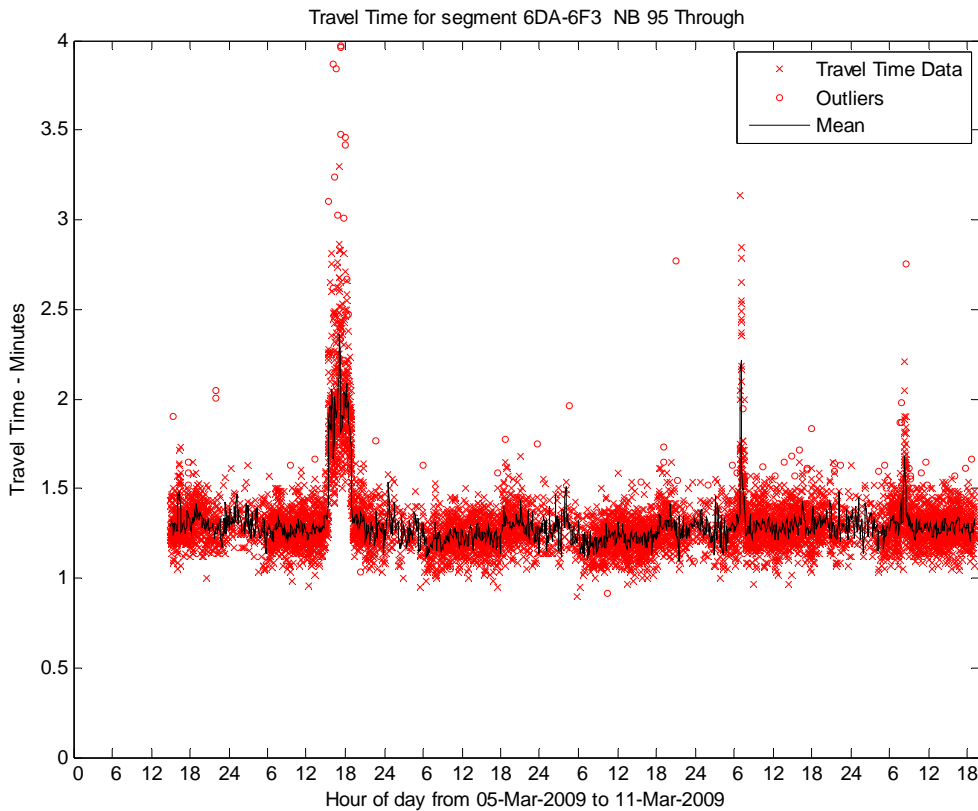
MONITORING INTERCHANGES

I-695 & I-95

BLUETOOTH INSTRUMENTATION



ALL 12 TURNING MOVEMENTS CAPTURED!!!



DETECTIONS

FROM	TO			
	I95 NB	I95 SB	I695 WB	I695 EB
I95 NB	5889		3186	520
I95 SB		8039	2895	733
I695 WB	833	543	3817	
I695 EB	836	1333		1622

Bluetooth Technology Applications

- Freeway travel time (VM)
- Arterial travel time and Performance Measures (M)
- Traffic signal studies (M)
- Pedestrian travel time (E)
 - Airports, Evacuation Modeling, Transit
- O&D studies (R&D)

Toward a National Speed Data Program

What should be measured and how?

- Define speed ...
 - Different for freeways, arterials, ramps ...
 - Spot speed vs space mean speed
- What should be measured?
 - Mean, median, percentiles (85th, 95th, IQR)
 - Reporting intervals (peak hour, 5 min, 15 min)
 - Level of precision, (confidence intervals ?)
- Spatial reporting format (consider TMCs)

Toward a National Speed Data Program

Assessing New Technology and Methods

- Commercial Data Feeds
- Bluetooth Traffic Monitoring
- Issues:
 - Accuracy, coverage and cost
 - Types of data delivered
 - How to validate
 - Guidance and case studies

Thank You