

# **“Evaluation of New Detectors for Rural High-Speed Signalized Intersections”**

Session S4: Intersection Safety Tools: Next Steps in Standards Development and the Latest in Technology Evaluations

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# Outline

- Background
- Methodology
- Results
- Remaining Activities

# Background

- TxDOT legacy systems
  - Inductive loops
  - Video detection
  - Non-intrusive detectors
- New detectors not well understood

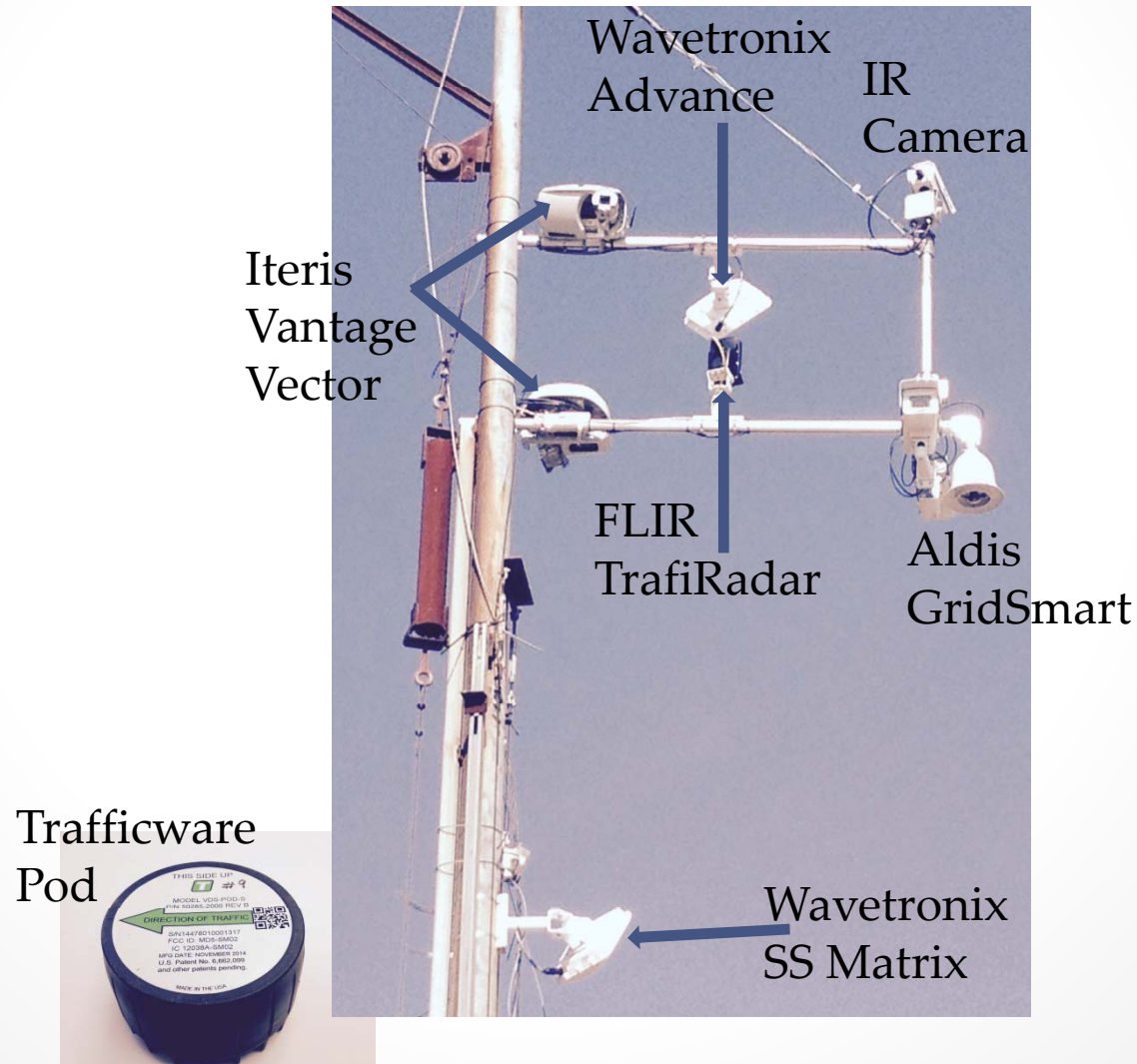
Detector/Technology	Stop Line	Indecision Zone
<b>Video Image Detection</b> <ul style="list-style-type: none"> <li>• Aldis Gridsmart</li> <li>• FLIR/Traficon IR Camera</li> </ul>	Primary Primary	N/A Secondary
<b>Radar (Doppler or Microwave)</b> <ul style="list-style-type: none"> <li>• Intersector by MS Sedco</li> <li>• Wavetronix SmartSensor Advance (SS-200E)</li> <li>• Wavetronix SmartSensor Matrix</li> </ul>	N/A N/A Primary	Primary Primary N/A
<b>Multiple Technology Detectors (Hybrid)</b> <ul style="list-style-type: none"> <li>• Iteris Vantage Vector</li> <li>• FLIR/Traficon TrafiRadar</li> </ul>	Primary Primary	Primary Primary
<b>Magnetometers</b> <ul style="list-style-type: none"> <li>• Sensys Networks</li> <li>• Trafficware Pods</li> </ul>	Primary Primary	Secondary Secondary

# Methodology

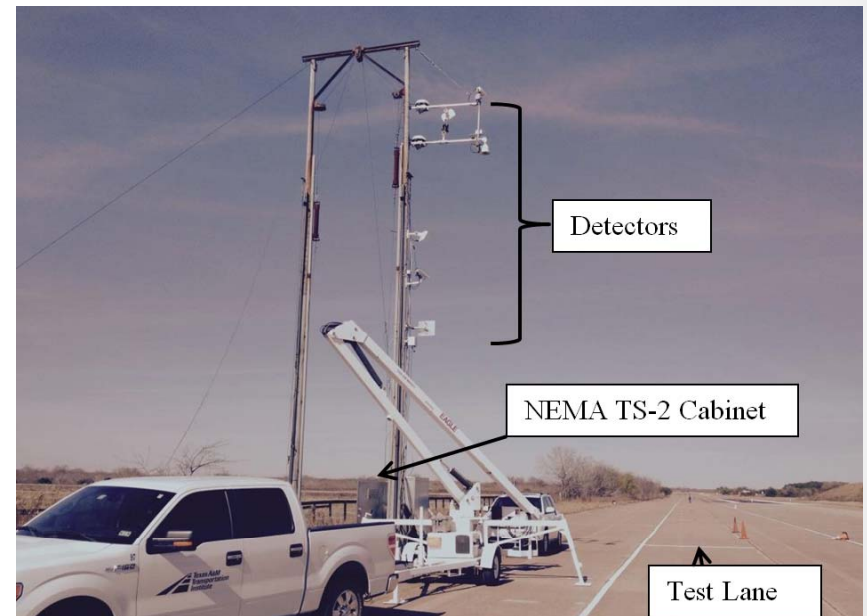
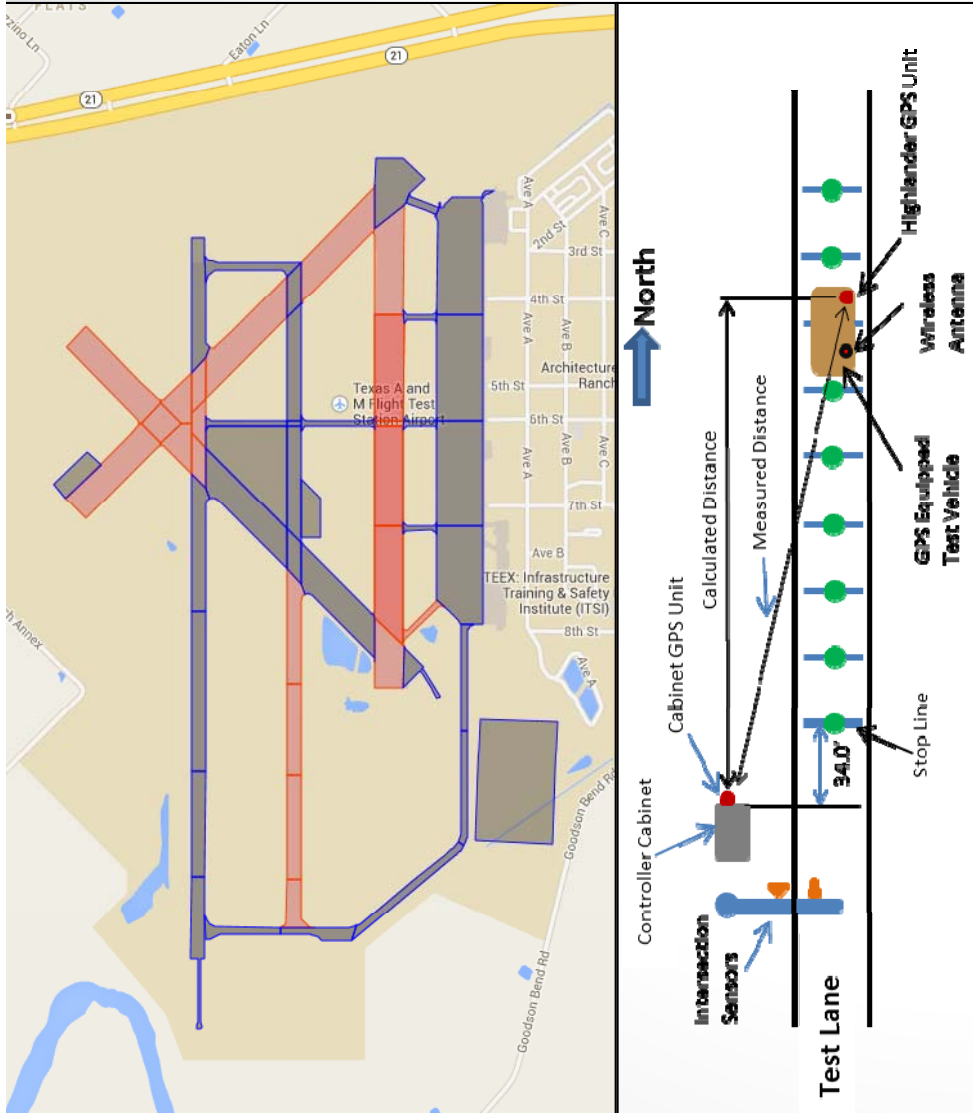
- Develop Test Plan
- Test in controlled environment
  - Speeds 50 and 70 mph
  - Variety of vehicle types
  - Weather and light
- Rural or suburban intersections
  - Geometry
  - Speed limit
  - Controller type
  - Detection installed
  - District support

50 in Houston

# Methodology — Controlled Environment



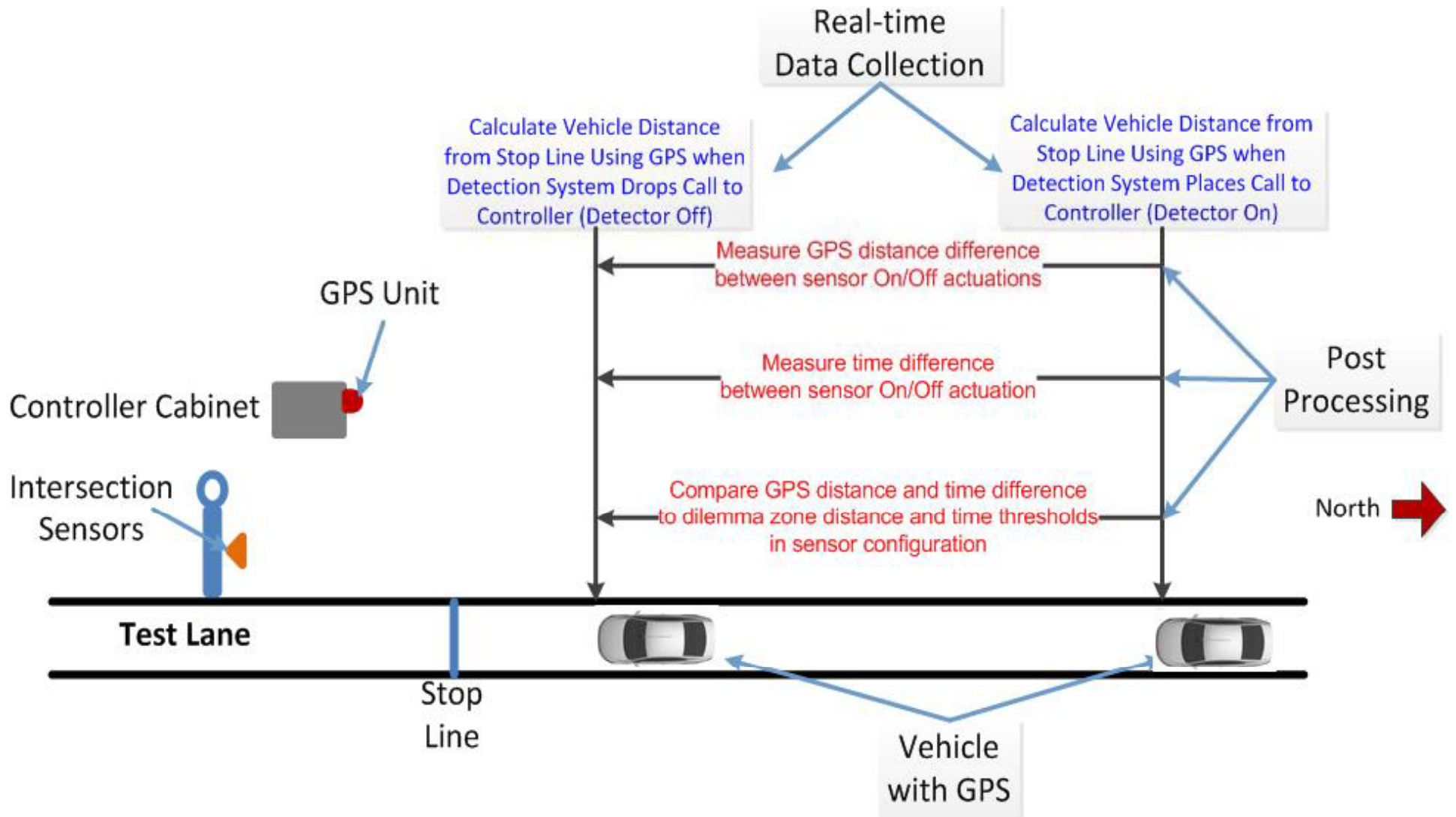
# Methodology — Controlled Environment



# Methodology

Detector Type	Examples	Tests
Point detectors	Loops, Magnetometers, Video	On, Off, Presence time False calls Missed calls Stuck-on calls Dropped calls
Tracking detectors	Iteris Vantage Vector FLIR TraqiRadar Wavetronix Advance (SS-200E)	Time/distance "on" Time/distance "off" Range "on" to "off" Speed accuracy

# Methodology



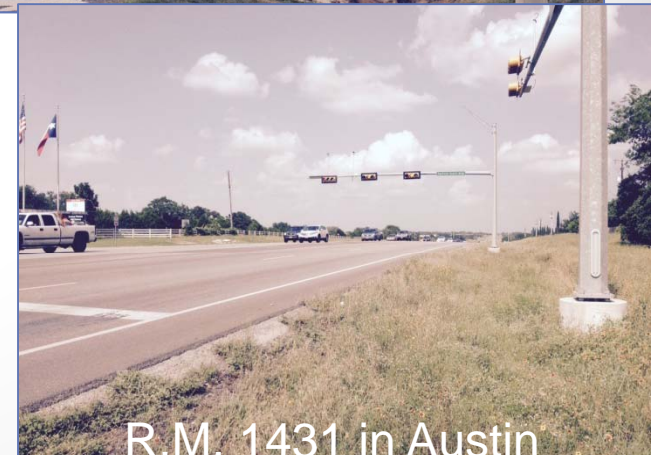


# Methodology

- All detectors communicate with controller
- Simple data collection design
  - One vehicle in detection zone
  - Constant speed
- Develop list of conditions for field sites
  - Speeds: 50 mph, 70 mph
  - Vehicle types: MC, sedan, pick-up, Class 8 truck tractor
  - Weather/light: day/dry, day/wet, night/dry, transition/dry
- Store data in standard format
- Initial filtering to remove undesirable data
- Develop macros in MS Excel
- Tabulate and plot results
- Statistical analysis

# Methodology— Intersections

- Develop Test Plan
- Test in controlled environment
  - Speeds 50 and 70 mph
  - Variety of vehicle types
  - Weather and light
- Rural or suburban intersections
  - Geometry
  - Speed limit
  - Controller type
  - Detection installed
  - District support



# Results

- Issues
  - Radar interference
  - Support movement
- Metrics
  - Detection rates
  - Box plots—travel time
  - Box plots—Distance
  - Valid advance detection rates
  - Time to stop line (on-off events)
  - Presence time

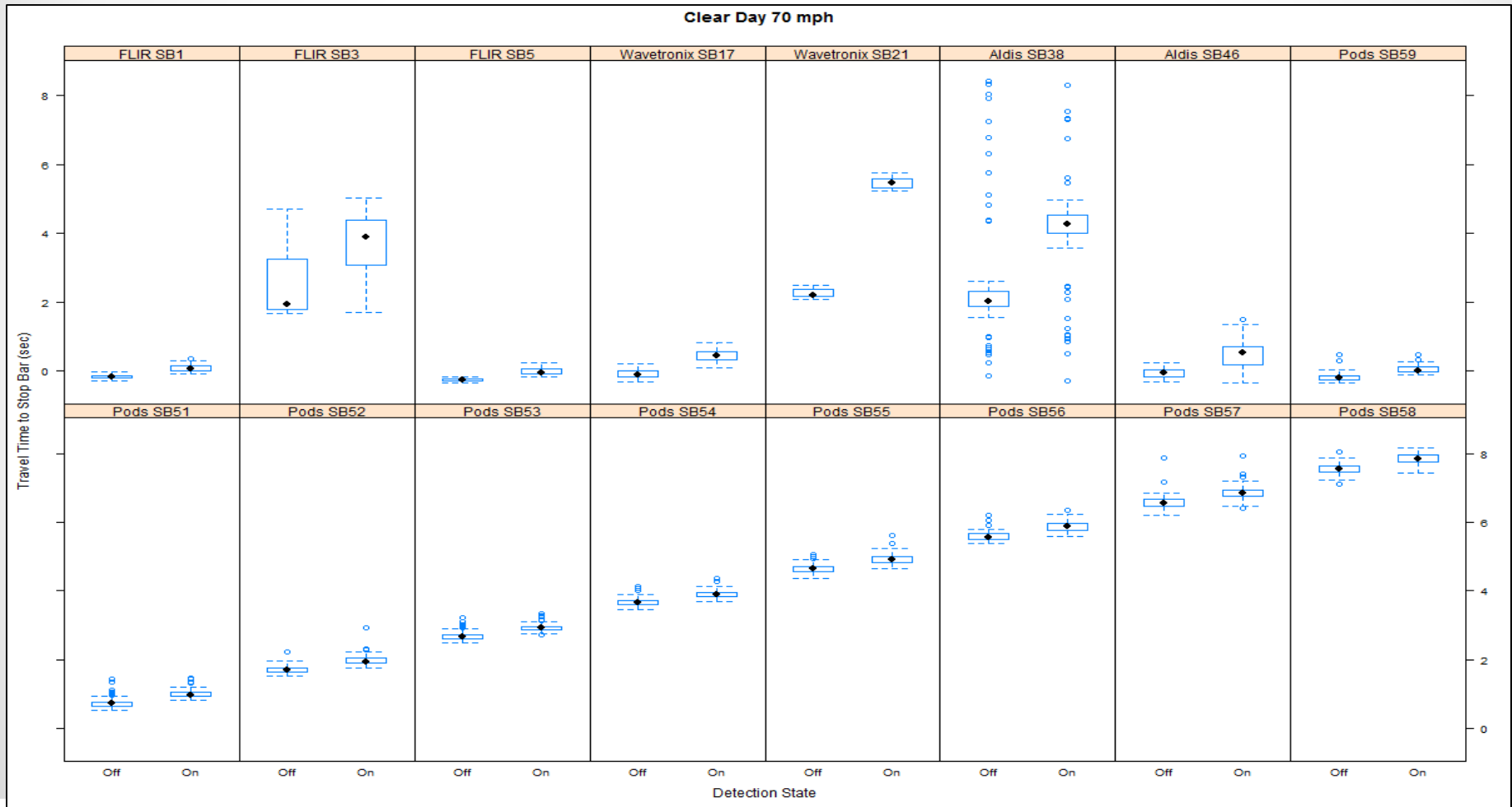
# Results-Detection Rates

Detector Channel	Description	50 mph			70 mph		
		Clear Day	Clear Night	Rain Day	Clear Day	Clear Night	Rain Day
FLIR SB5	FLIR VIP Stop Line	1.00	1.00	0.98	1.00	1.00	0.93
Iteris SB13	Stop Line	0.99	0.98	0.90	0.97	1.00	#N/A
Iteris SB15	Trip Line at 485 ft	1.00	0.98	0.96	1.00	1.00	1.00
Iteris SB16	Trip Line at 566 ft	#N/A	#N/A	#N/A	1.00	#N/A	1.00
Wavetronix SB17	Matrix	1.01	#N/A	1.00	1.00	1.00	1.00
Wavetronix SB21	Advance	1.00	#N/A	1.00	1.00	1.00	1.00
Aldis SB38	Southbound upstream	1.31	0.94	1.17	1.36	0.99	0.96
Aldis SB46	Southbound Stop Line	0.88	1.00	1.00	0.92	0.89	0.96

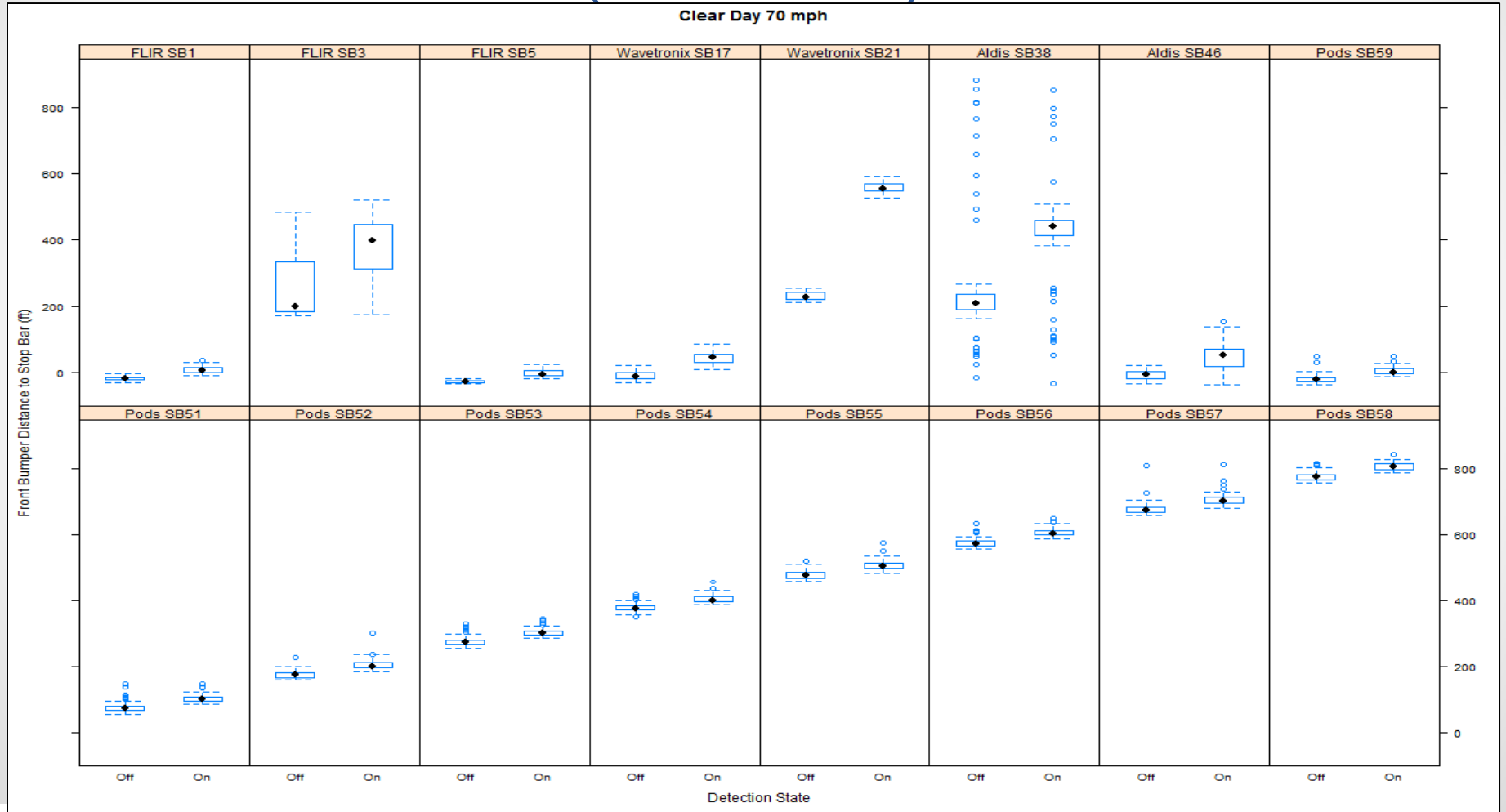
# Results-Detection Rates

Detector Channel	Description	50 mph			70 mph		
		Clear Day	Clear Night	Rain Day	Clear Day	Clear Night	Rain Day
Pod SB59	At Stop Line	1.00	0.99	1.00	1.00	1.00	1.00
Pod SB51	100 ft from stop line	1.00	1.00	1.00	0.99	1.00	1.00
Pod SB52	200 ft from stop line	1.00	1.00	1.00	1.00	1.00	1.00
Pod SB53	300 ft from stop line	1.00	1.00	1.00	1.00	1.00	1.00
Pod SB54	400 ft from stop line	0.99	0.99	1.00	0.98	1.00	1.00
Pod SB55	500 ft from stop line	0.99	1.00	1.00	0.99	1.00	1.00
Pod SB56	600 ft from stop line	1.00	1.00	1.00	1.00	1.00	1.00
Pod SB57	700 ft from stop line	0.99	0.97	1.00	1.00	0.99	0.98
Pod SB58	800 ft from stop line	0.99	0.95	1.00	1.00	0.99	1.00

# Results — Box Plots (Travel Time)



# Results—Box Plots (Distance)



# Results – Upstream

## (Valid Detection Rate)

Detector	ValidCount	TotalCount	PctValid
Aldis	259	330	78.5%
Iteris	109	110	99.1%
Wavetronix	95	98	96.9%



# Results – Upstream

## (Time to Stop Line at On/Off Events)

Detector	Mean Off	SD Off	SD/Mean	<i>t</i> -value <sup>a</sup>	Mean On	SD On	SD/Mean	<i>t</i> -value <sup>b</sup>
Aldis	2.91	0.75	0.26	8.77	5.98	1.61	0.27	4.84
Iteris	1.97	0.86	0.44	-6.46	5.81	0.62	0.11	5.24
Wavetrenix	2.24	0.22	0.10	-11.20	5.41	0.30	0.06	-3.00

<sup>a</sup> Tested against 2.5 seconds.

<sup>b</sup> Tested against 5.5 seconds.

# Results – Upstream (On Time)

Detector	Mean On Time	SD On Time	SD/Mean	<i>t</i> -value <sup>a</sup>
Aldis	3.08	0.98	0.32	1.28
Iteris	3.84	0.40	0.10	21.95
Wavetronix	3.16	0.30	0.09	5.35

<sup>a</sup> Tested against 3.0 seconds (5.5 s minus 2.5 s)

# Remaining Activities

- Collect data at signalized intersections
- Complete analysis of all data
- Complete deliverables
  - Methodology
  - Findings
  - Guidelines

# Contact Information

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