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Using Private Sector Probe Data to Examine Work Zone Performance: The Virginia DOT Experience

Mike Fontaine, Ph.D., P.E.

Motivation

- FHWA Work Zone Self Assessment Questions:
 - Has the agency established measures to track work zone congestion and delay?
 - Has the agency established work zone performance guidance on maximum queue lengths, maximum traveler delay, etc.?
- VDOT had allowable work hours, but no established program to track performance



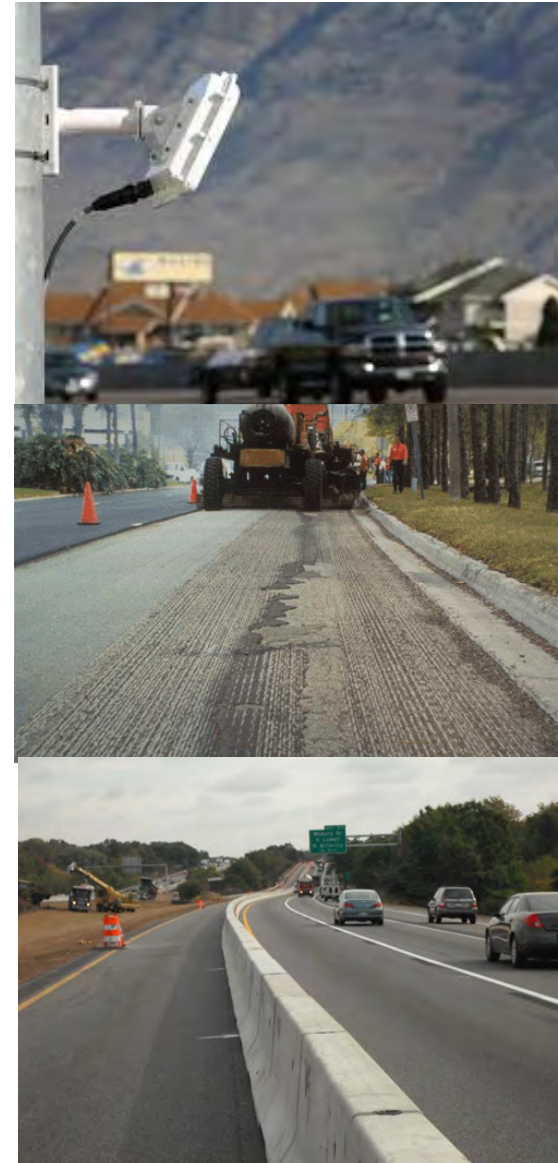
Approach

- Work zone safety coordinators met to discuss “ideal” measures
- Desired measures:
 - Queue length
 - Speed/delay/travel time
 - Reliability
- Finishing research project to examine measures and define data sources and management tools



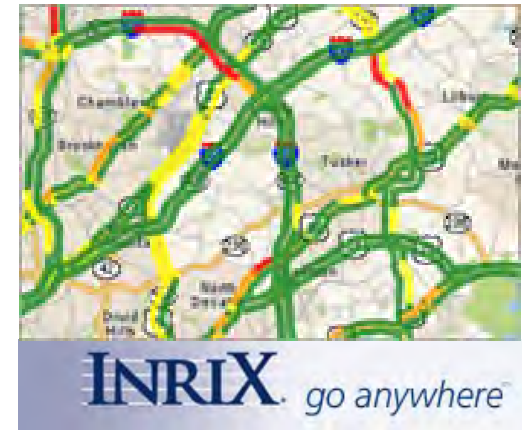
Constraints

- Manpower/cost
- Data availability
 - Are sensors available?
 - Are they functional?
- Project duration
 - Monitoring short term projects
- Project phasing impacts
 - Need to reposition sensors



Private Sector Sources of Travel Time Data: INRIX

- INRIX derives travel times from a variety of sources, including fleet and passenger vehicle probes
- Sells travel time data, does not install sensors
- Speed and travel time only, no volume



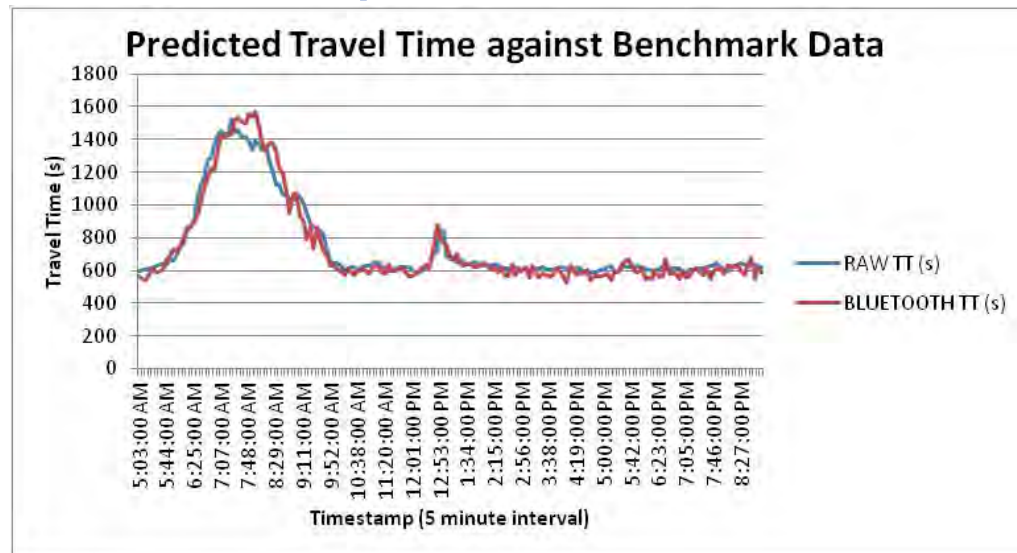
INRIX Use by VDOT

- VDOT has statewide real time data from INRIX
- Feeds real time traveler information (VMSs in DC, SE Virginia, soon in Richmond; 511 app)
- Very well received by public



INRIX Data Quality

- VDOT has conducted internal validation using Bluetooth benchmark on over 340 miles of freeway
 - 95% within 10 mph
 - 75% within 5 mph



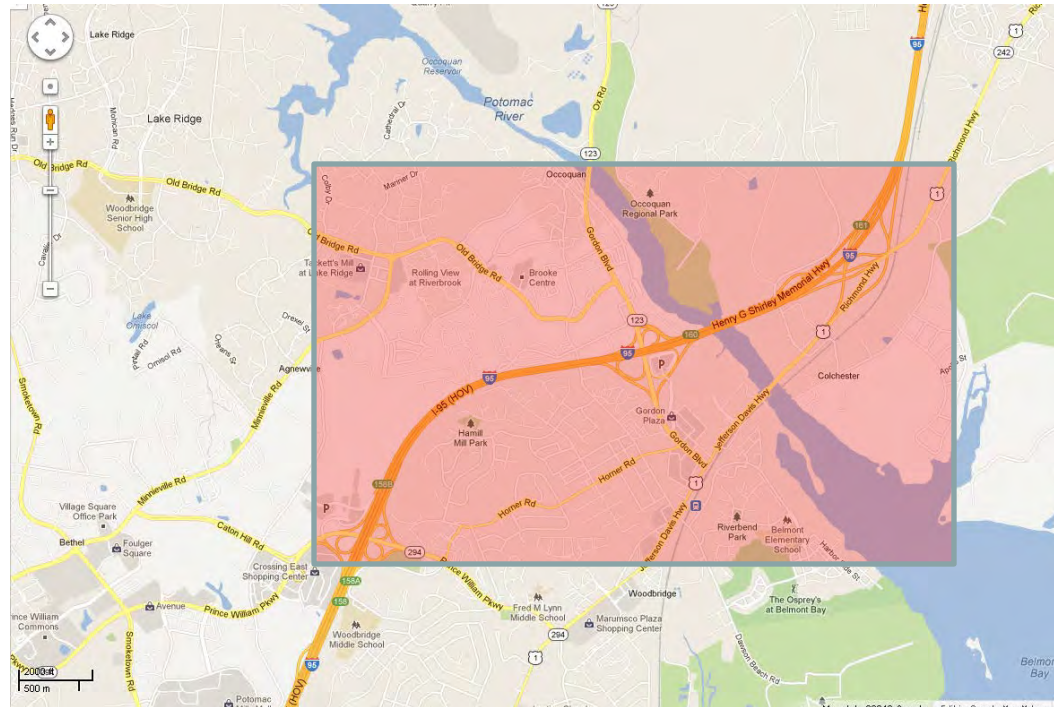
Work Zone Metrics Being Examined Using INRIX Data

- Research project to examine viability of using INRIX data for WZ performance measurement:
 - Queue length
 - Use INRIX bottleneck definition
 - 60% of speed typically observed at that time of day
 - Speed/delay
 - Reliability measures (95th percentile speed, buffer index, planning time index)

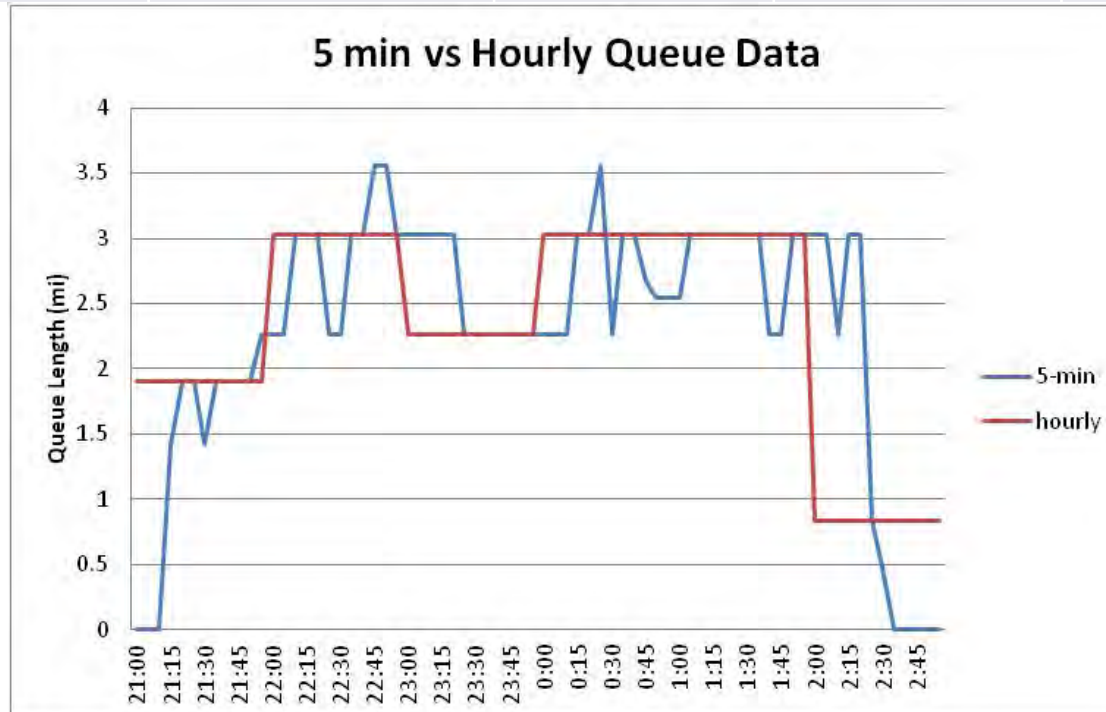


Case Study: I-95 SB, MP 158-162

- Remove cantilever sign structure at 9 PM on 2/17/12
- 2 of 3 SB lanes closed
- Impacts for about 6 hours over 3 miles



Time	Historic Speed (mph)	Queue Threshold Speed (mph)	Observed Speed (mph)	Delay (min)	Queue (mi)
9-10 PM	52.6	31.6	22.1	9.7	1.90
10-11 PM	61.8	37.1	10.1	21.2	3.03
11-Mid	61.8	37.1	10.5	20.4	2.26
Mid-1AM	61.8	37.1	9.5	22.5	3.03
1-2 AM	61.8	37.1	8.5	25.1	3.03
2-3 AM	61.8	37.1	22.6	9.5	0.84



Long Term Work Zone Tracking

- 8 Freeway Work Zones:
 - Lengths: 1.97 to 11.9 miles long
 - 55 to 65 mph speed limit
 - Directional AADT between 4,800 and 25,230
 - Interchange density between 0 to 0.5 interchanges/mile
- 7 Arterial Work Zones:
 - Lengths: 1.04 to 7.2 miles long
 - 35 to 60 mph speed limits
 - Directional AADT between 1,757 and 9,005
 - Between 0 and 4.6 signals/mile



Work Zone Impacts on Mean Speed and 95th % Travel Rate

- Used entire 24 hours
- Significant degradations in both measures, especially on freeways

	Mean Speed (mph)			95 th % Travel Rate (sec/mi)		
	Base	WZ	Δ	Base	WZ	Δ
Freeway	60.08	56.58	-3.50	79.01	104.72	+25.72
Arterial	38.31	37.68	-0.63	131.16	133.19	+2.03
Combined	51.12	48.80	-2.32	100.48	116.45	+15.96

Yellow significant at $\alpha=0.05$, orange at $\alpha=0.10$



Work Zone Impacts on Buffer and Planning Time Index

- Used entire 24 hours
- Significant degradations in both measures, especially on freeways

	Buffer Index (%)			Planning Time Index		
	Base	WZ	Δ	Base	WZ	Δ
Freeway	26.00	46.33	+20.33	1.386	1.804	+0.417
Arterial	25.02	26.01	+0.99	1.527	1.545	+0.019
Combined	25.60	37.96	+12.37	1.444	1.697	+0.253

Yellow significant at $\alpha=0.05$, orange at $\alpha=0.10$



Lessons Learned

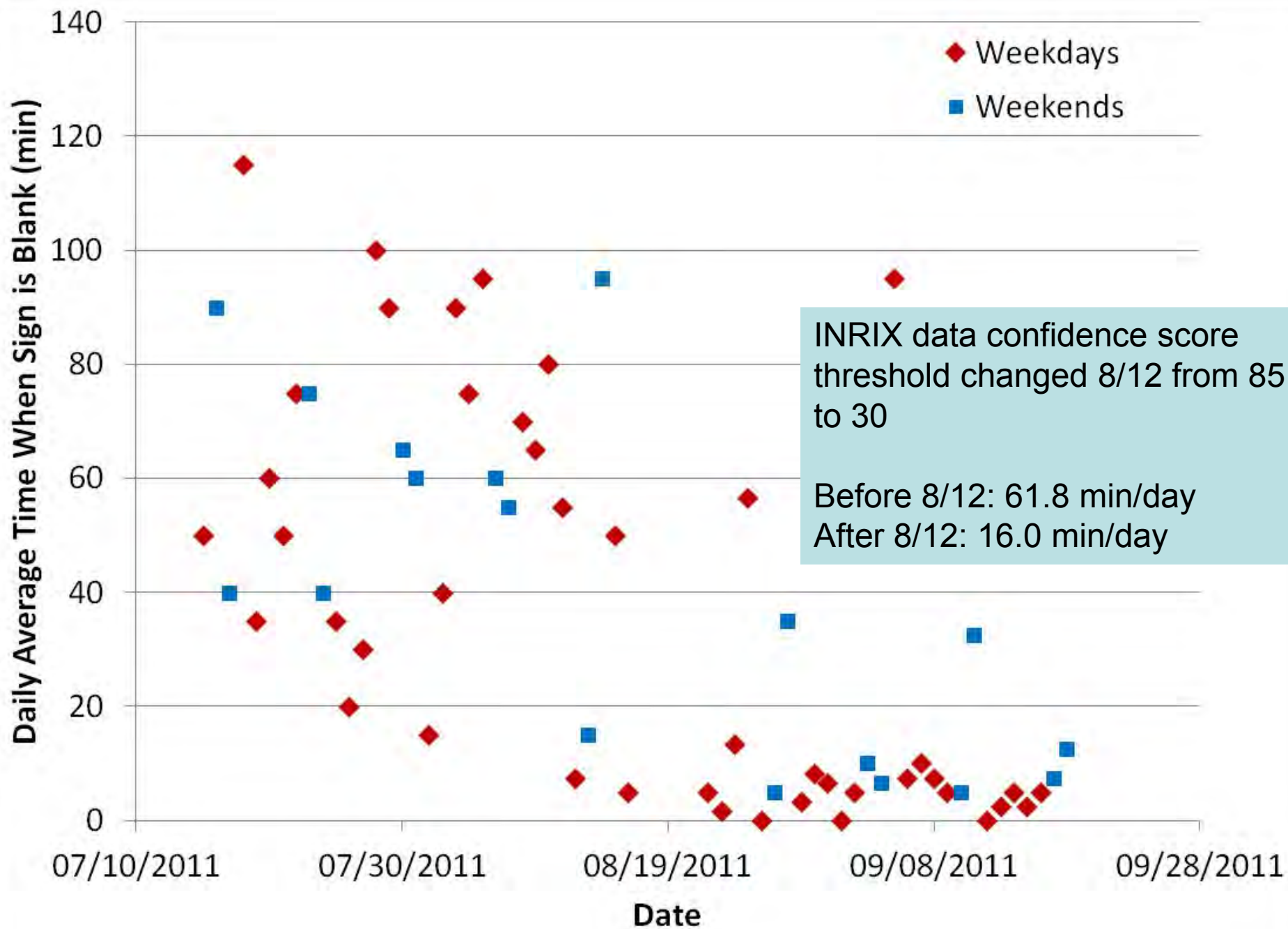
- INRIX real time confidence scores and confidence values
- Data availability
- Issues with spatial match to work zones
- Issues with temporal aggregation
- Treatment around threshold values
- Full road closures



INRIX Confidence Scores/Values

- INRIX indicates 3 levels of confidence:
 - “10” – Historic data
 - “20” – Blend of historic and real time data
 - “30” – Purely real time data
- Scores > 10 also have a confidence value from 0-100 indicating degree of agreement with past trends and recent data
- Challenge is to weigh responsiveness with accuracy





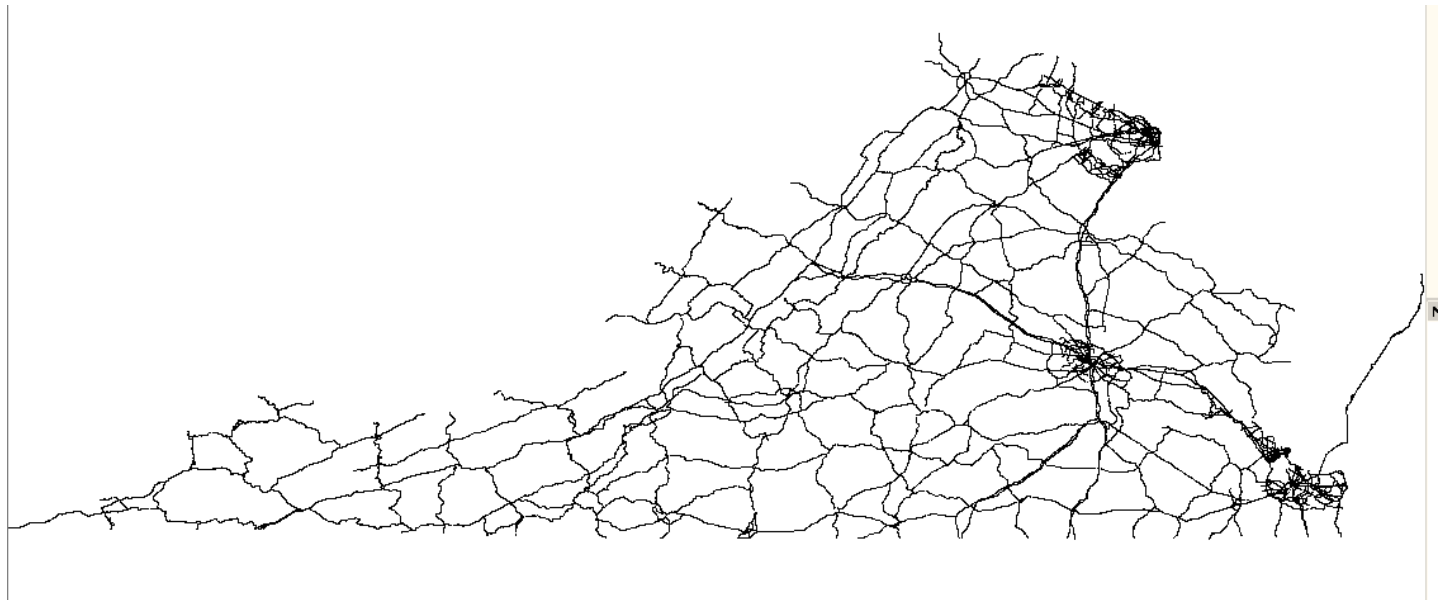
Data Availability

- Real time data availability of 98% or more during daytime periods on freeways
- Data availability sometimes suffers overnight (Midnight to 4 or 5 AM)
- Some data issues on arterial system outside of high volume NHS routes
- Data availability is moving target



Spatial Mismatch Issues

- Data is reported using Traffic Message Channel (TMC) links
- Typically located between major intersections



Matching Private Data to Work Zones

- TMC boundaries often do not precisely align with work zone boundaries/impacts (or DOT roadway inventory links)
- Differences in lengths (TMC-Work Zone, 18 work zones)
 - Freeways: Mean of +1.16 mi
 - Arterials: Mean of +2.42 mi

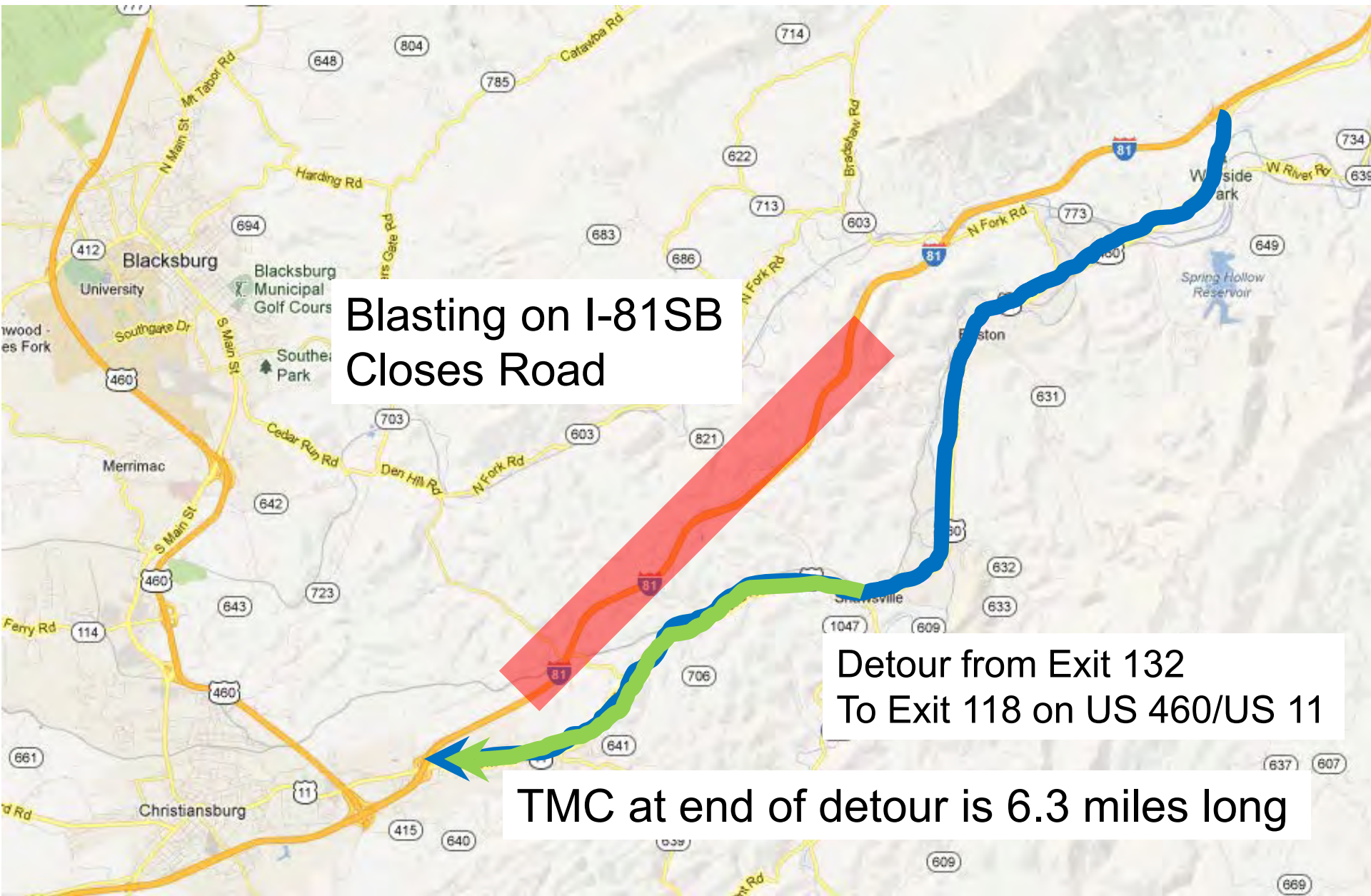


Temporal Aggregation

- Long aggregation intervals can “wash out” localized impacts
- Short time intervals require more resources to analyze
- Project level vs. programmatic tradeoffs



Case Study: I-81 and US 460/11

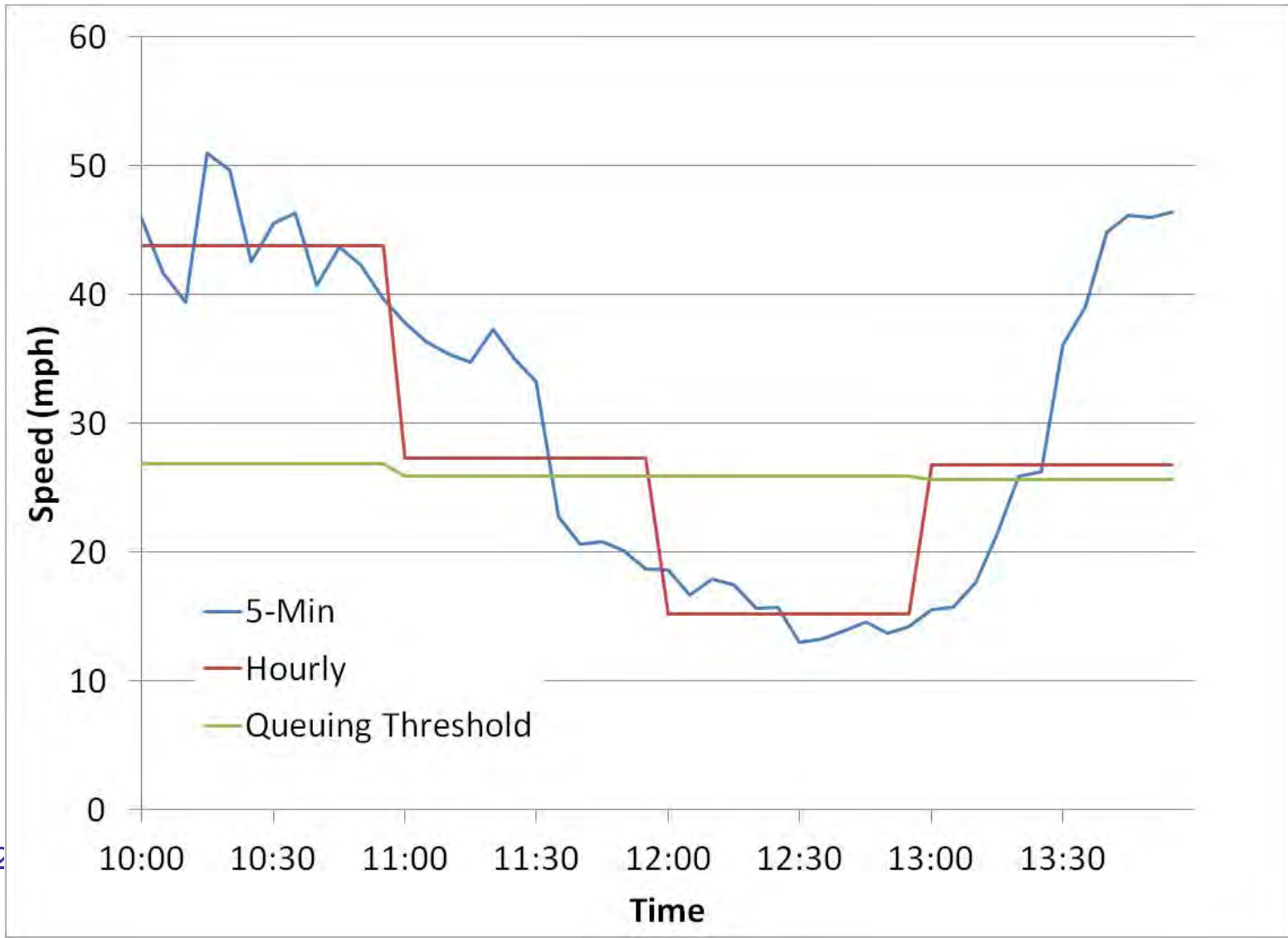


Blasting on I-81SB
Closes Road

Detour from Exit 132
To Exit 118 on US 460/US 11

TMC at end of detour is 6.3 miles long

Speeds and Queuing Threshold



5-min vs Hourly Queue Data



Full Road Closures

- If there is a full road closure, INRIX will report scores of “10” since they have no data unless they have been notified
- Need to account for this in performance measure calculations



Summary

Private Sector Probe Data

- Advantages:
 - No infrastructure to install/maintain
 - Good data quality on freeways
 - Large coverage area
 - Useful for many other purposes
- Limitations:
 - Spatial granularity
 - Arterial coverage
 - Overnight coverage
 - Does not directly measure queuing



Next Steps

- TMC granularity
 - INRIX indicates improvements are coming to overcome long TMC lengths in rural areas
- VDOT is reviewing data now to try to determine where to set performance threshold values
- Parallel effort to develop system that integrates probe data with detector data in user friendly archive



Questions?

- Mike Fontaine, P.E., Ph.D.
- 434-293-1980
- Michael.Fontaine@VDOT.Virginia.Gov

