I-95

Variable Speed Limit System

Commonwealth Transportation Board Meeting

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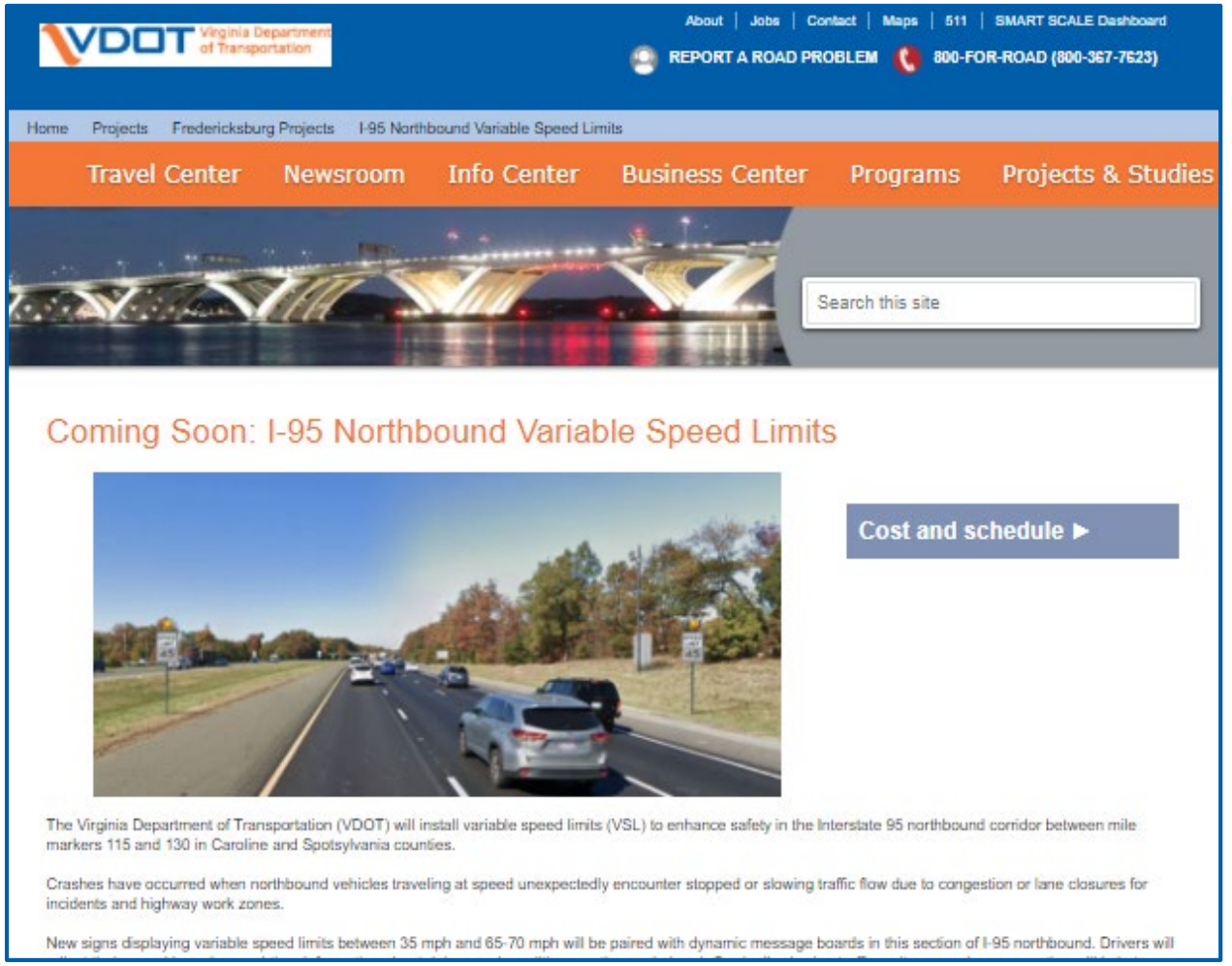
Kimley»Horn | VDOT Virginia Department of Transportation

I-95 VSL Project Presentation Overview

- Overview of Project
  - Corridor Selection
  - Project Approach & Expected Benefits
  - How the System Works
- Project Evaluation
  - Considerations
  - Driver Behavior
  - Safety
- Conclusions

JUNE 22, 2022 FULLY OPERATIONAL!!



VSL Pilot Project Corridor

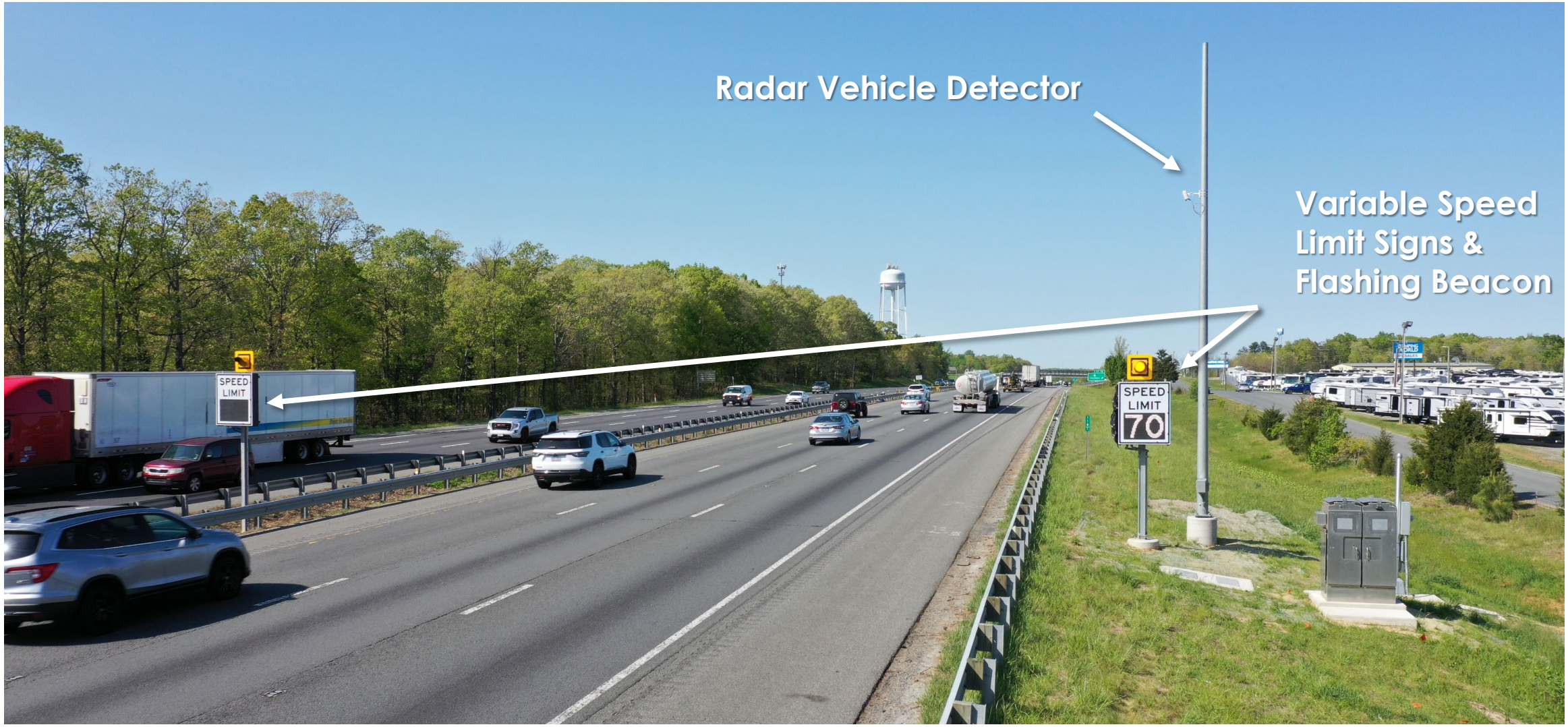
Corridor Selection

- Regular and incident-related congestion
- Hot spots with stop-and-go conditions
- High crash rates & incident delay

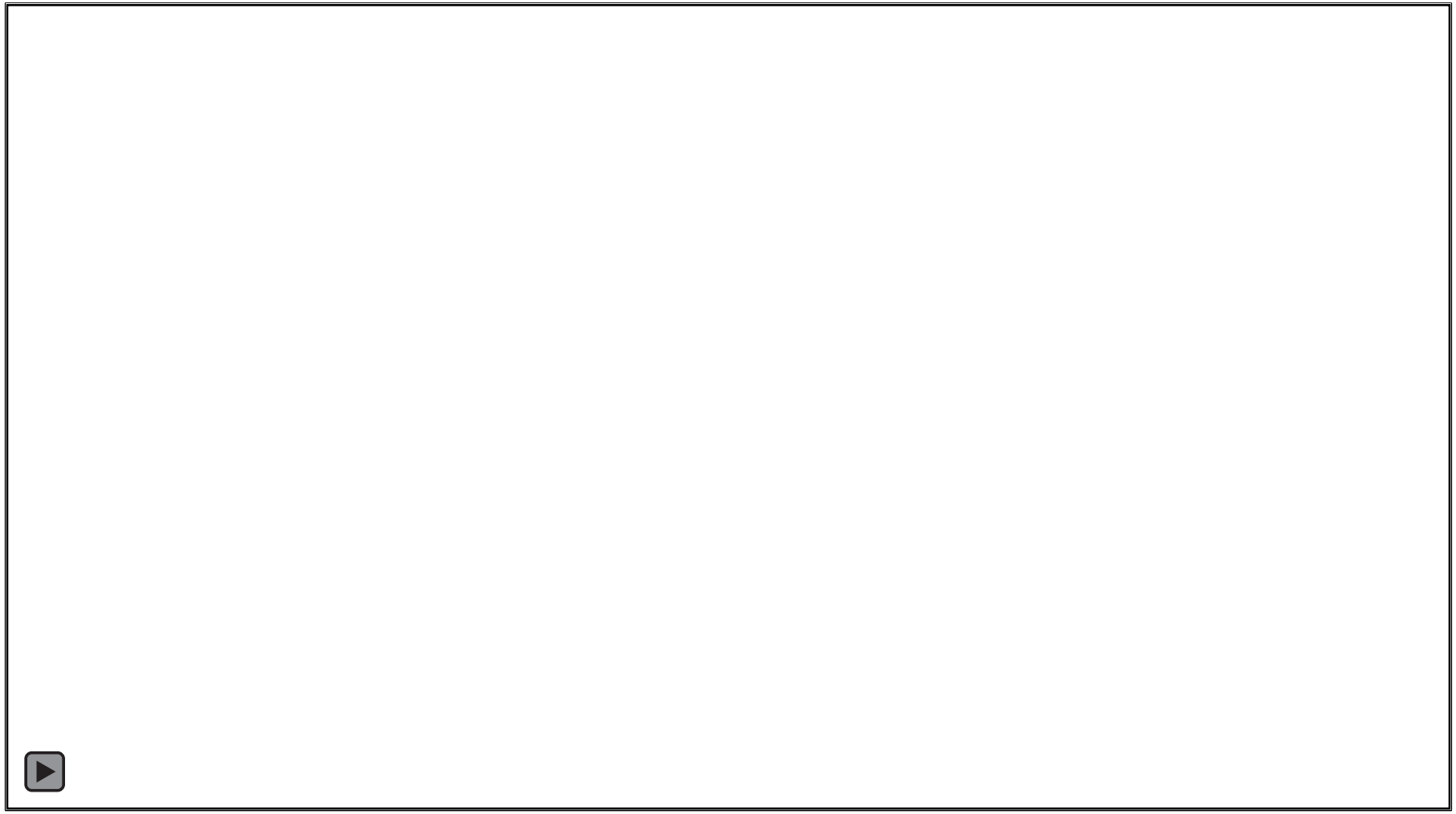
Project approach is to use VSL to harmonize traffic flow resulting in:

- Reduced crashes
- Reduced stop-and-go conditions
- Improved travel time & reliability

I-95 VSL Field Elements



Corridor Video



Public Outreach

Signs

- Safety rest area signs, indoor and outdoor
- I-95 northbound billboard at mile marker 98 (Doswell)

Social Media

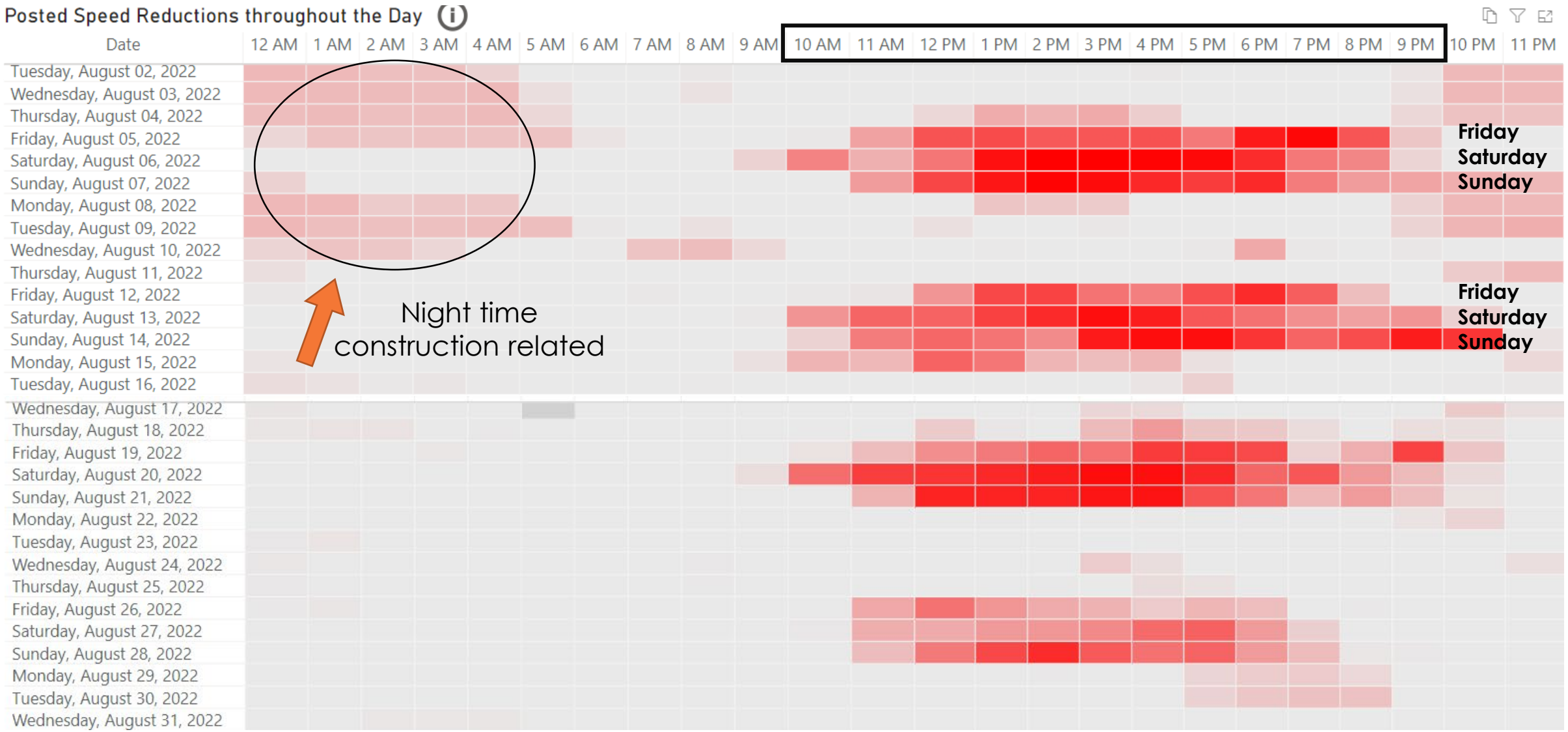
- Waze & Facebook ads
- Digital, geofenced display ads
- *900,000+ impressions (June 15-July 15)*

Website

- virginiadot.org/variablespeedlimits

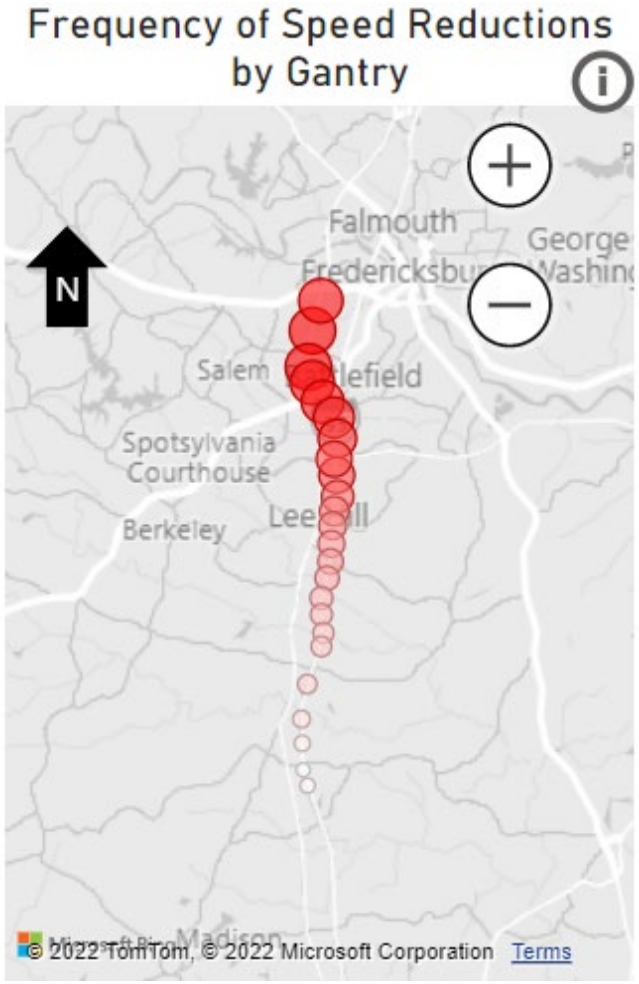
August System Activation Patterns

Intensity of RED corresponds to a lower speed limit displayed for a longer time

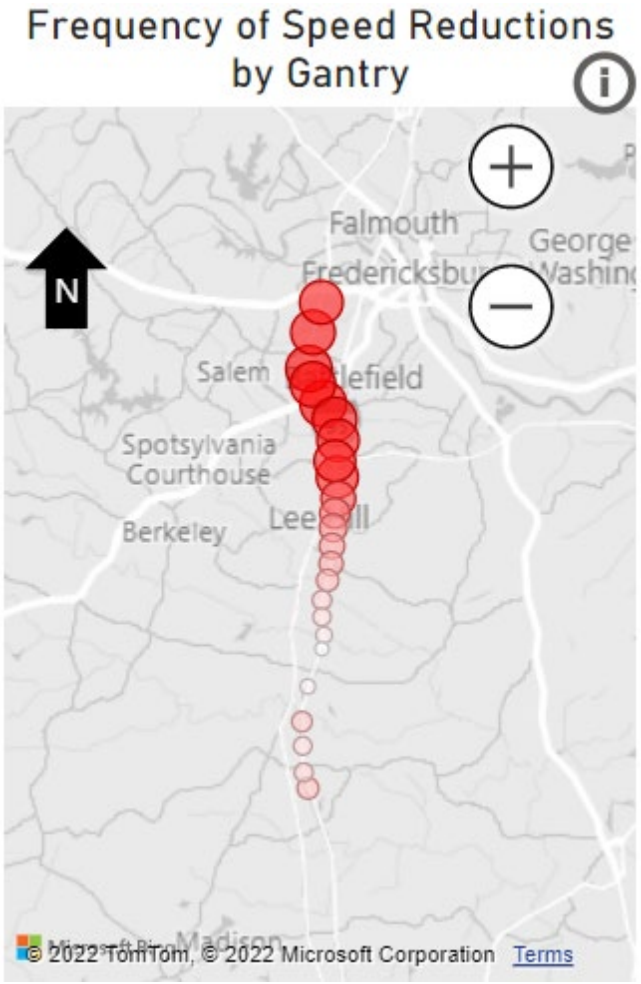


System Activation by Location

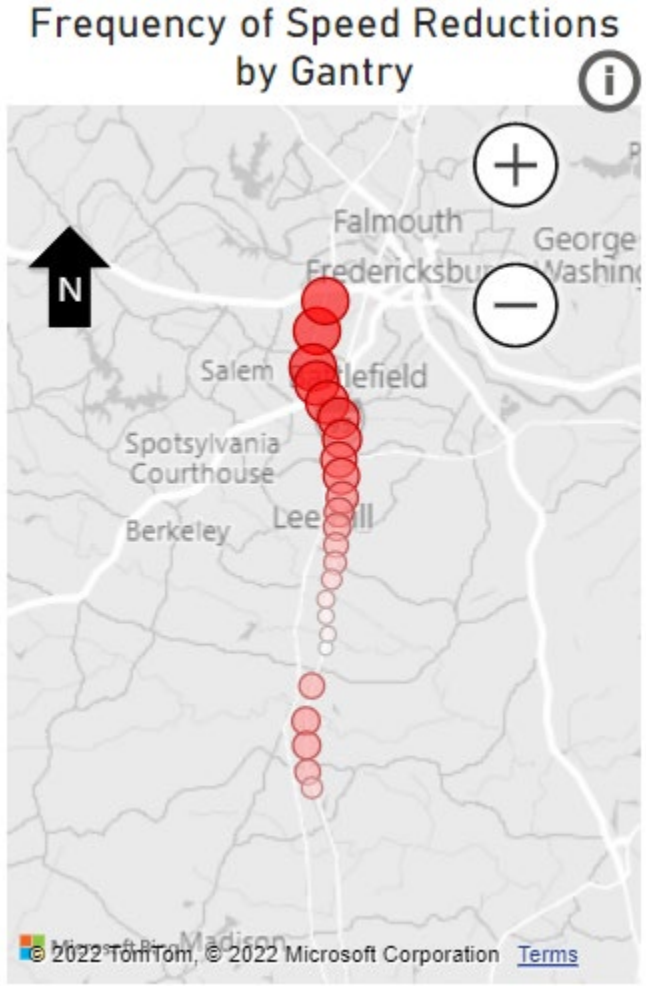
June 2022



July 2022



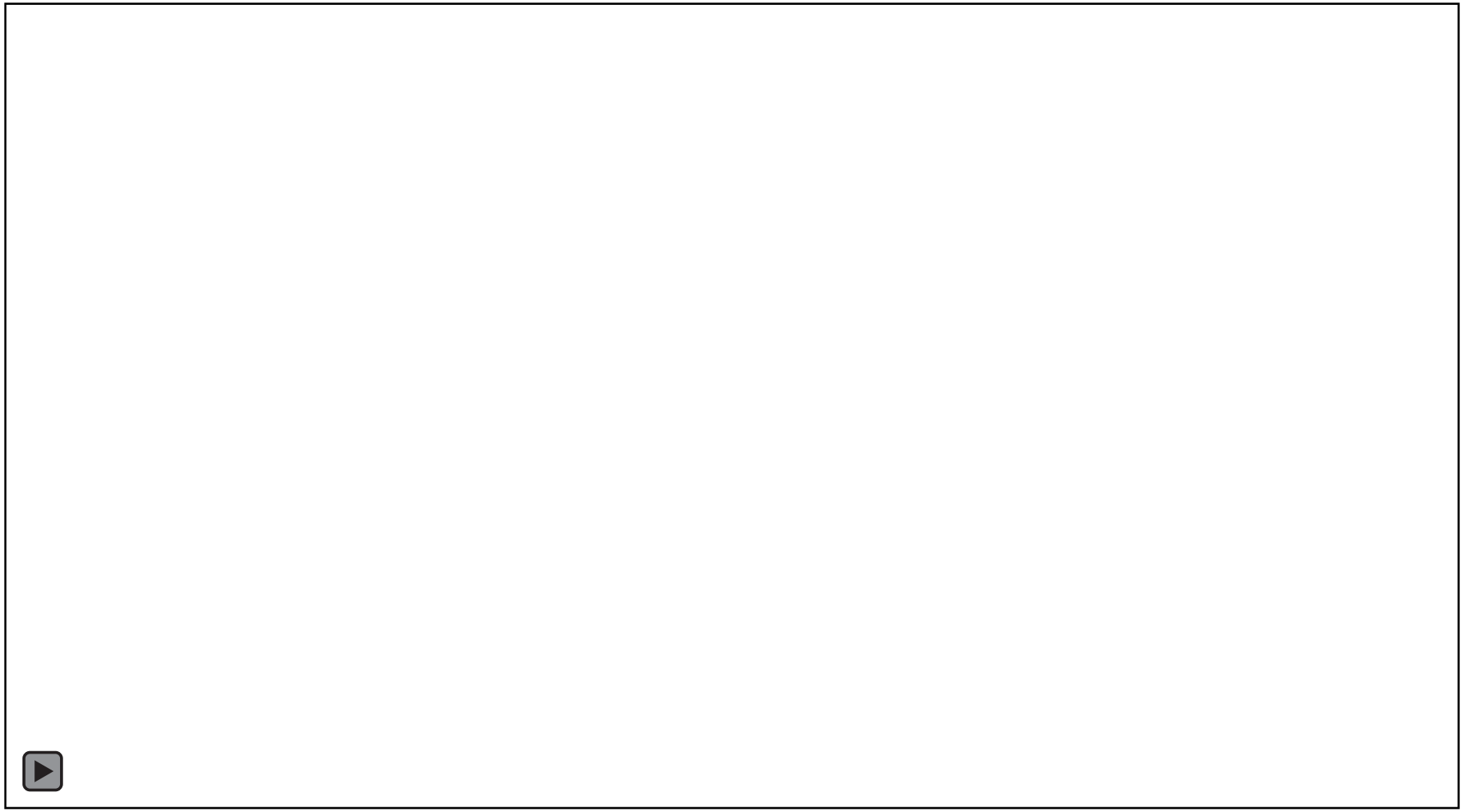
August 2022



Intensity of RED corresponds to a lower speed limit; size of circle corresponds to more frequent activation

System Management

- Detailed Algorithm Performance Review



System Management

- Real-time System Monitoring at TOC
  - Monitoring hardware and communication status
  - Monitoring active congestion and algorithm speed recommendations

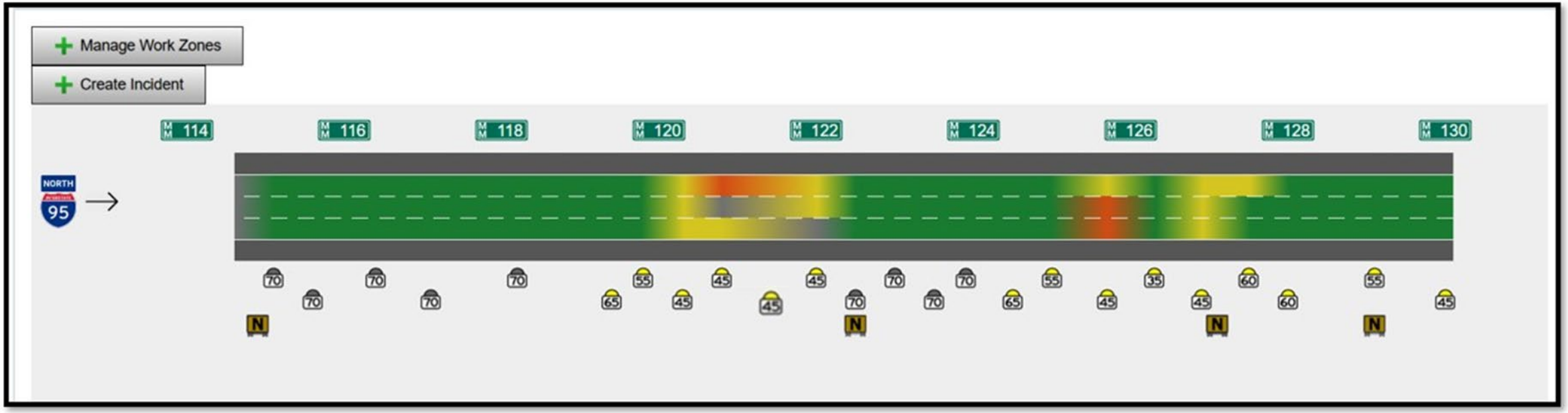
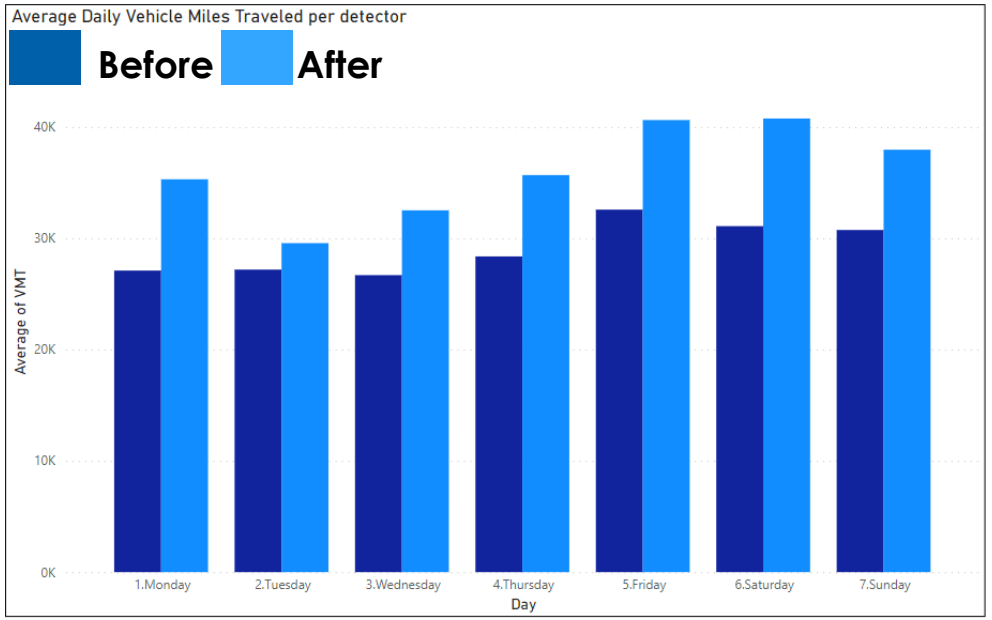


Image captured on June 9, 2022 prior to go-live

System Evaluation Considerations

- A before/after evaluation was conducted in the corridor.
  Before: 1/1/22 – 3/26/22 **After**: 6/22/22 – 8/31/22
- Volume and event types changed significantly between the periods.
- The analysis attempts to address this to the extent possible.

Traffic Volume
(Daily Vehicle Miles of Travel by Day of Week)



Event Types
(Traffic Impacting Events)

Event Type	Average Hours/Day	
	Before	After
Crash	0.65	0.26
Weather	0.72	0.07
Work Zone	0.18	2.51
Disabled Vehicle	0.04	0.09

System Evaluation - Driver Behavior

- Drivers are responding to new posted speed limits.
- Speeds were 3-4 mph slower during transitional periods (55 or 45 mph speed limits).
- Pre-activation data was processed using the VSL algorithm to determine what would have been posted in the "before" period if the system had been active.

VSL Algorithm Recommended Speed (mph)	Before (Static Speed Signs, Algorithm On)			After (VSLs Active)		
	% of Posted Speeds	Avg. Speed (mph)	Difference from VSL (mph)	% of Posted Speeds	Avg. Speed (mph)	Difference from VSL (mph)
65, 70	96.5%	72	+7	89.7%	71	+6
60	0.0%	63	+3	0.1%	62	+2
55	**0.8%**	**62**	**+7**	**1.5%**	**59**	**+4**
45	**0.6%**	**52**	**+7**	**1.4%**	**48**	**+3**
35	2.1%	28	-7	7.3%	29	-6

Transitional Speeds

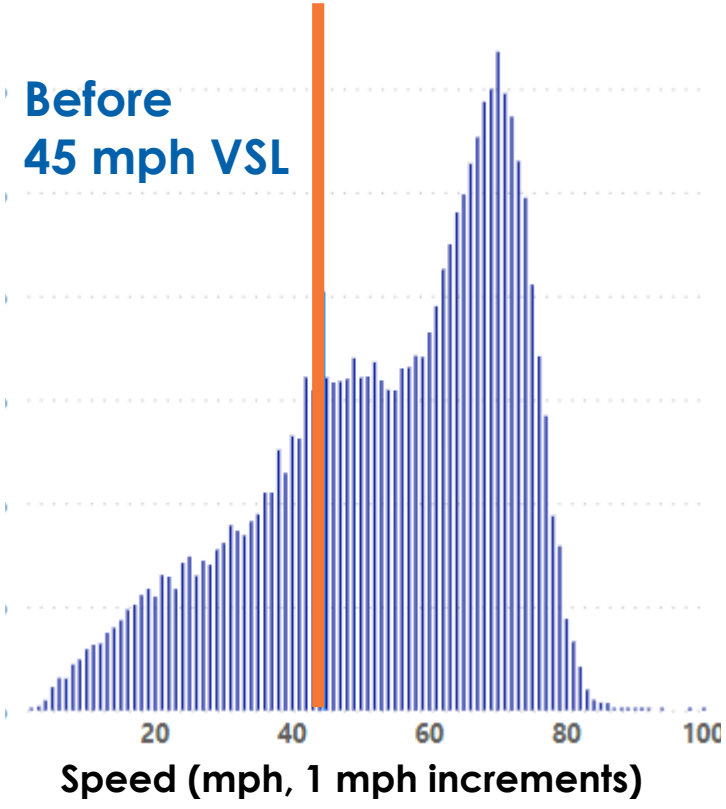
System Evaluation – Driver Behavior

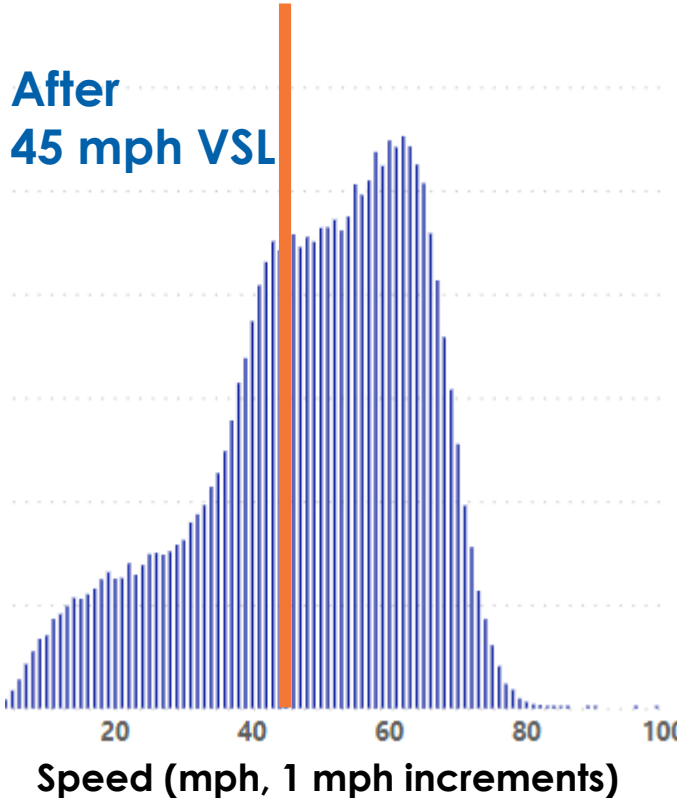
- Drivers did respond to the VSLs during transitional flow, indicating that the VSL was providing benefits in smoothing flow into congestion.
- Further improvements in driver compliance with VSLs could be beneficial.

VSL Algorithm Recommended Speed (mph)	Before (Static Speed Signs, Algorithm On)			After (VSLs Active)		
	> VSL Speed	> VSL Speed +5 mph	> VSL Speed +10 mph	> VSL Speed	> VSL Speed +5 mph	> VSL Speed +10 mph
65,70	65%	29%	5%	60%	24%	4%
60	74%	52%	25%	66%	35%	8%
55	**81%**	**74%**	**62%**	**78%**	**65%**	**44%**
45	**69%**	**61%**	**53%**	**62%**	**51%**	**39%**
35	29%	21%	14%	32%	21%	12%

System Evaluation – Driver Behavior

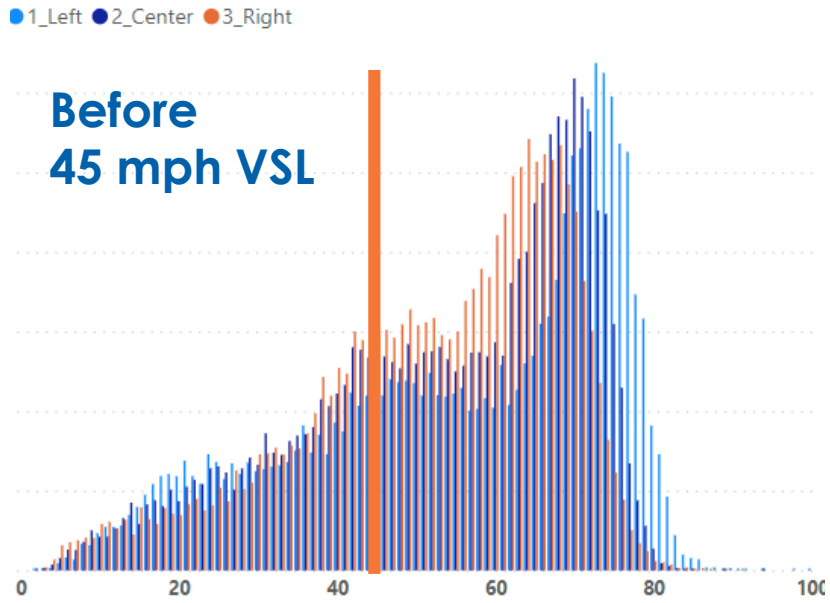
- Drivers reacted to VSLs by traveling closer to the recommended speed

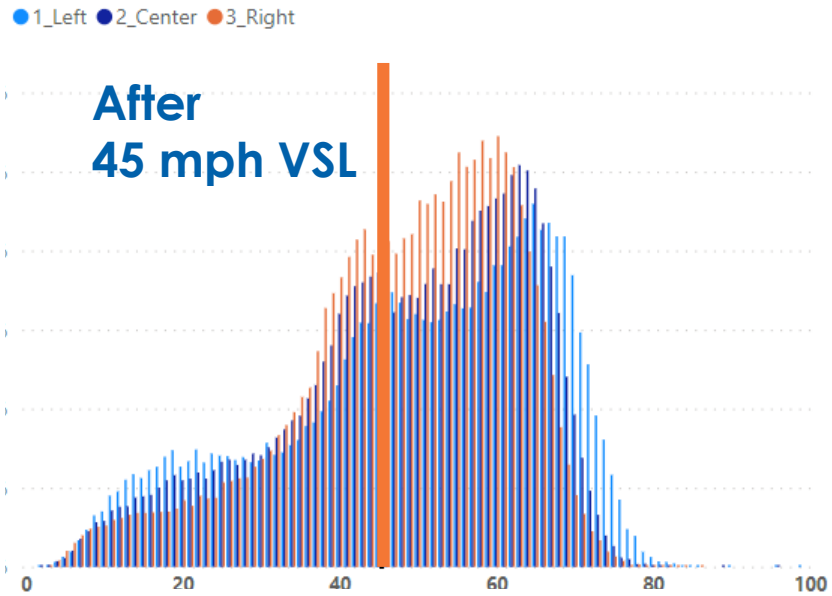




Speed Harmonization Improvement

- Speed differentials between lanes have decreased since VSL activation





Period	Speed Differential (mph)	
	Left-Center	Center-Right
Before	2.4	1.4
After	**1.0**	**0.3**

System Evaluation – Safety

- Crashes were compared between milepost 115 and 130 from system activation through July 31 (most recent finalized data).
- **Crashes are rare and random events. Trends from 5 weeks of VSL activation data are a small sample and should be viewed with caution.**

Year	Crash Counts			
	January 1 - June 21	% Change from Previous Year	June 22 - July 31	% Change from Previous Year
2019	78	-21%	34	-29%
2020	Omitted due to pandemic effects on traffic			
2021	99	+27%	42	+24%
2022	**137**	**+38%**	**35**	**-17%**

Conclusions

- Based on initial results, the system is working as designed.
- Drivers are reacting to the VSLs.
  - Average speeds have decreased 3-4 mph when the transitional 45 and 55 mph speed limits are posted.
  - Speed differentials have declined between lanes. Speed harmonization is occurring.
  - Early crash results show positive trends.
- Safety and operational results will continue to be monitored. Updated results will be reported to the Board at a future meeting.