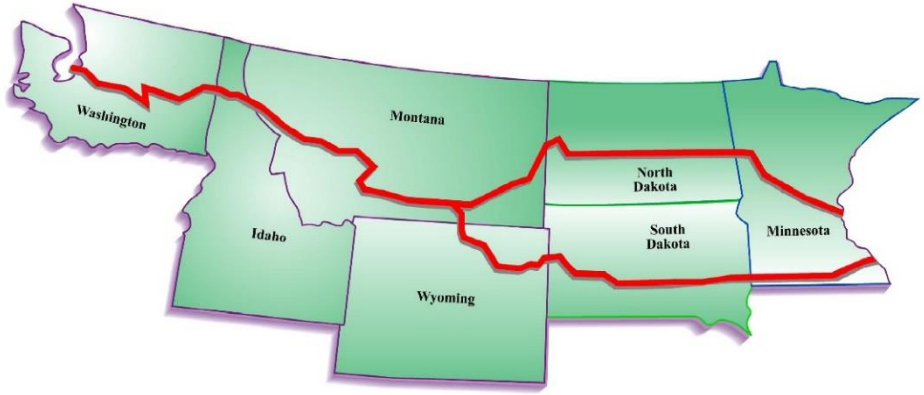
Variable Speed Limits (VSL) in Work Zones



Webinar

June 19, 2019

This webinar will be recorded.

Agenda

- VSL in Work Zones: DOT Experiences
  - Ohio DOT – Emily Willis, Maintenance of Traffic Engineer
  - Utah DOT – Josh Van Jura, State Construction Engineer
- Other NWP Related Experiences
- Questions and Answers
- Closing

VARIABLE SPEED LIMITS IN WORK ZONES













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OHIO DOT
WORK ZONE SPEED ZONES

Emily Willis

PREVIOUS WORK ZONE SPEED ZONE POLICIES

HISTORY OF PREVIOUS WZSZ POLICY

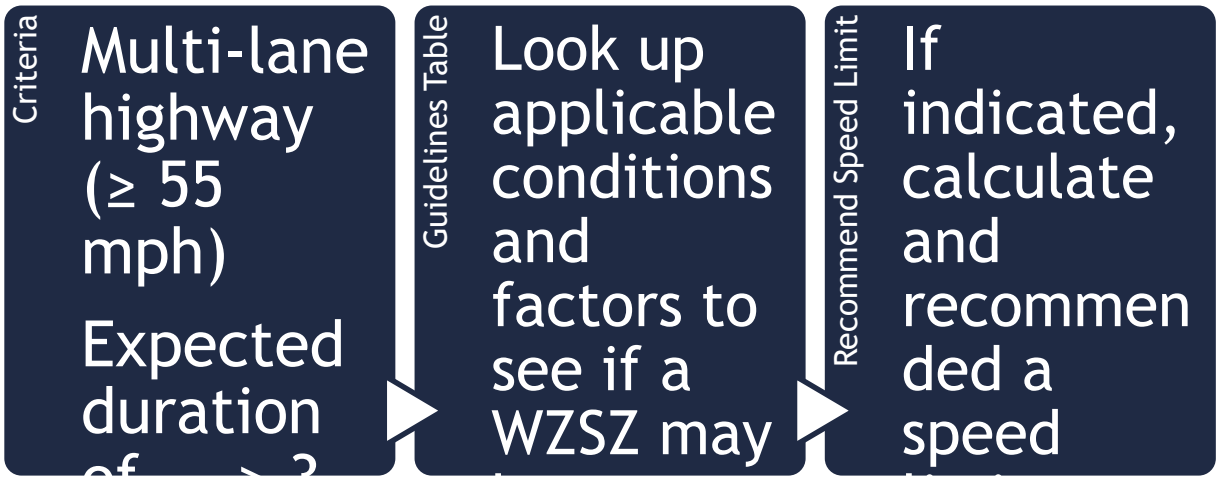
PRIOR TO 2011

- Limited to long-term construction projects
- Compliance was difficult to achieve
  - 24/7 speed limit reductions

HISTORY OF PREVIOUS WZSZ POLICY

IN 2011 (2011 to 2015)

- Changed expected duration; Removed minimum length
- Opened to all construction and maintenance that meets



- Compliance still difficult to achieve

DEVELOPING NEW WORK ZONE SPEED ZONE POLICY

OHIO LAW – 4511.98

"The director of transportation may establish speed limits within construction zones that vary based on the type of work being conducted, the time of day, or any other criteria the director may consider appropriate."

DEVELOPMENT OF NEW WZSZ POLICY

- Research conducted by Texas A&M Transportation Institute, Cleveland State University, Ohio University
- Determine effectiveness of ODOT processes for establishing work zone speed zones and variable work zone speed zones

DEVELOPMENT OF NEW WZSZ POLICY

- Simply putting up speed limit signs does not slow drivers down
- Drivers only reduce their speeds through the work zone when they perceive a need to do so, based on conditions in the work zone or the perception of enforcement activities

DEVELOPMENT OF NEW WZSZ POLICY

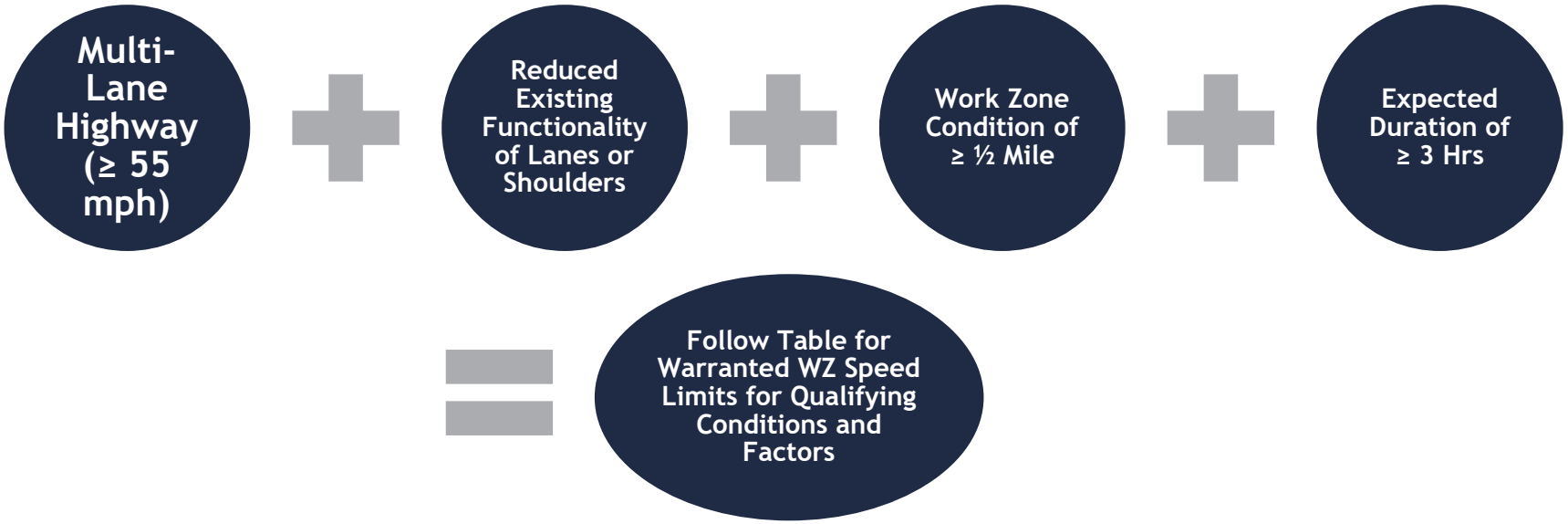
- Worked with Ohio Contractor's Association and Ohio State Highway Patrol to develop new process and new signage options
- Focus on worker presence as "the need" for drivers to slow down

CURRENT WORK ZONE SPEED ZONE POLICY

WORK ZONE SPEED LIMIT VALUES

- All Work Zone Speed Zones (WZSZ's) are variable and will frequently fluctuate between:
  - Two approved reduced speed limits or
  - An approved reduced speed limit and the original posted speed limit

CONDITIONS WARRANTING WZ SPEED ZONE



- Does not apply to Moving/Mobile Operations
- When criteria no longer are met, the speed limit returns to the original preconstruction speed limit.

WORK ZONE SPEED LIMIT DEPENDENCIES

- Original Posted Speed Limit (Preconstruction)
- Type of temporary traffic control used
  - WITH Positive Protection: Portable Barrier or other rigid barrier
  - WITHOUT Positive Protection: Drums, cones, shadow vehicle, etc.
- Whether or not workers are present

WORK ZONE SPEED LIMIT VALUES

- Warranted Speed Limit Values (Table 1297-7)

Warranted Work Zone Speed Limits (mph) for Qualifying Conditions and Factors

Original Posted Speed Limit	WITH Positive Protection		WITHOUT Positive Protection	
	Workers Present	Workers NOT Present	Workers Present	Workers NOT Present
70	60	65	55	65
65	55	60	50	60
60	55	60	50	60
55	50	55	45	55

TWO SIGNING STRATEGIES FOR IMPLEMENTATION

Primary strategy: Digital Speed Limit (DSL) Sign Assemblies

TWO SIGNING STRATEGIES FOR IMPLEMENTATION

Secondary strategy: Traditional Temporary Flatsheet Speed Limit signs

APPROVED LIST FOR DSL

Ver-Mac

American Signal

Solar Tech

Work Area Protection

CONSIDERATIONS DURING DESIGN

DESIGN SPEEDS

- Initial approaches to the work zone based on the original preconstruction speed limit
- Remaining elements within need to accommodate whichever speed limit is in effect at that time
  - Adjust each time speeds change
  - Use the more conservative design speed for each element
    - Higher speed for tapers, buffers, clear zones, etc.
    - Lower speed for device spacing, etc.

WZSZ USING DIGITAL SPEED LIMIT (DSL) SIGN ASSEMBLY

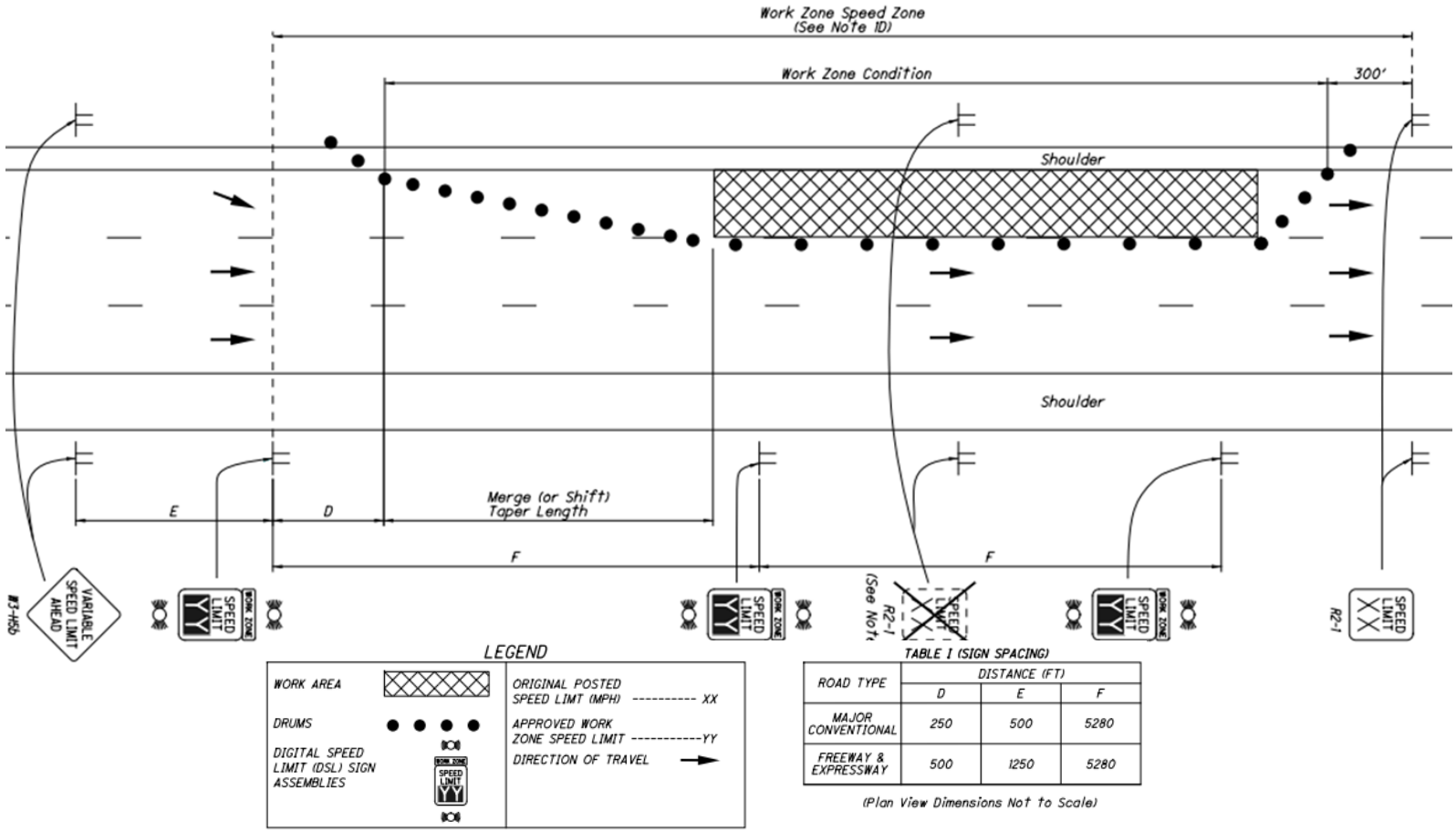
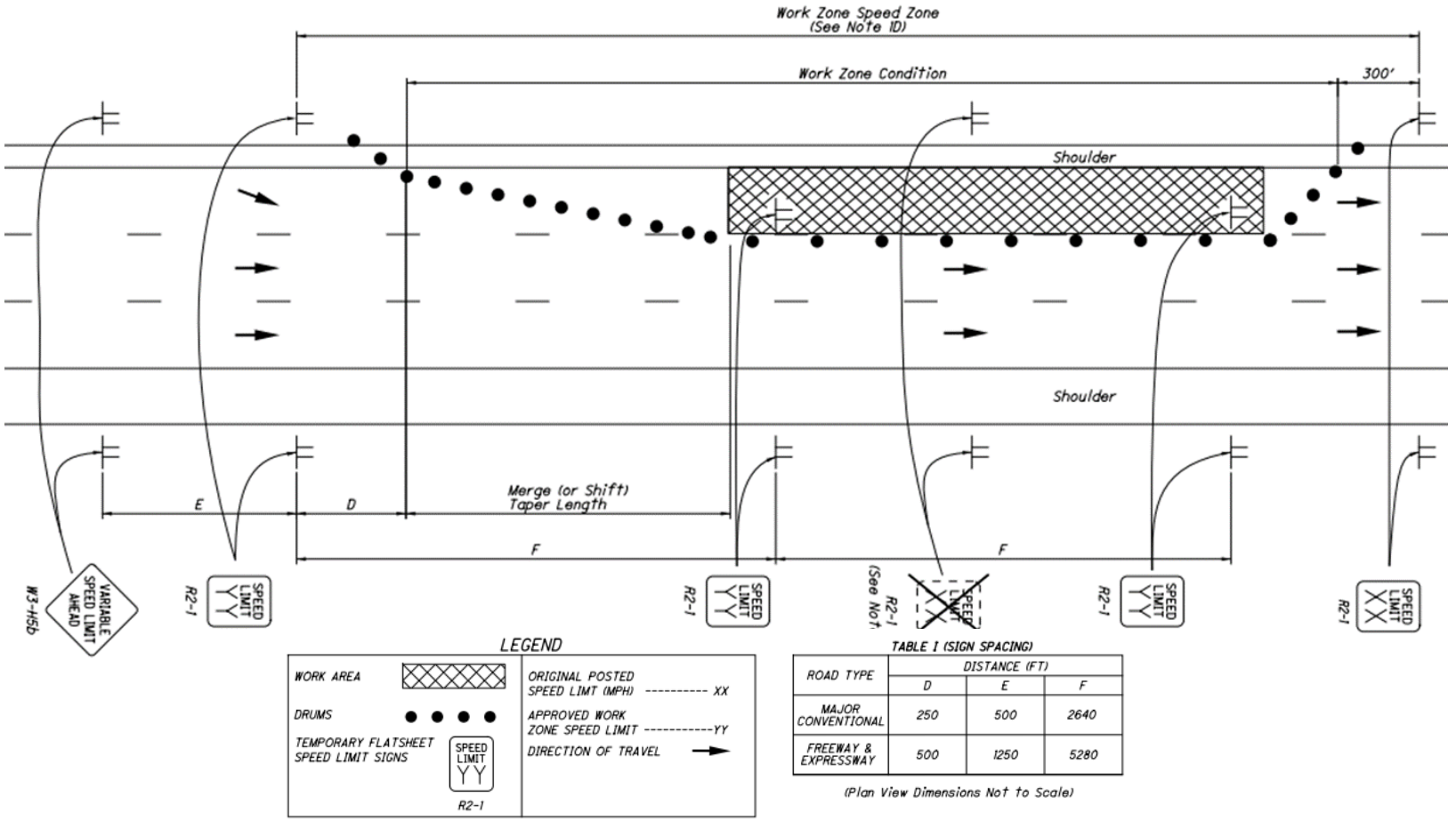


TABLE 1 (SIGN SPACING)

ROAD TYPE	DISTANCE (FT)		
	D	E	F
MAJOR CONVENTIONAL	250	500	5280
FREEWAY & EXPRESSWAY	500	1250	5280

(Plan View Dimensions Not to Scale)

WZSZ USING TEMPORARY FLATSHEET SPEED LIMIT SIGNS



LEGEND

WORK AREA	ORIGINAL POSTED SPEED LIMT (MPH) ---------- XX
DRUMS	APPROVED WORK ZONE SPEED LIMIT ----------YY
TEMPORARY FLATSHEET SPEED LIMIT SIGNS (SPEED LIMIT YY, R2-1)	DIRECTION OF TRAVEL

TABLE 1 (SIGN SPACING)

ROAD TYPE	DISTANCE (FT)		
	D	E	F
MAJOR CONVENTIONAL	250	500	2640
FREEWAY & EXPRESSWAY	500	1250	5280

(Plan View Dimensions Not to Scale)

CONSIDERATIONS DURING CONSTRUCTION

COMMUNICATION WITH LAW ENFORCEMENT

- Notify law enforcement agency
  - Prior to initial WZSZ implementation
  - Daily before enforcement begins
  - Prior to removal of WZSZ

WORK ZONE SPEED ZONE TRACKING REPORT

- Contractor to track/log all speed limit changes as they occur; Submit weekly

Ohio Department of Transportation EXAMPLE

Work Zone Speed Zone (WZSZ) Tracking Report

District:	7	Project Number:	15-0000	Project ID (PID):	012345	WZ Speed Limit Revision No:	WZ-12345
Location (County, Route & Section):		MOT-75-1.00				Original Posted Speed Limit (MPH):	65
Contractor:	Contractor X			Project Engineer/County Mgr:		Project Engineer Y	
Reporting From Date:	8/17/15	Reporting To Date:	8/18/15	Type of Signs Used (Choose One):		DSL Sign Assemblies	

Location of Each Posted Speed Limit Sign			Begin (Install)		Work Zone Speed Limit Posted (MPH)	Work Zone Speed Limit Beacon Status* (On/Off; N/A)	End (Remove)		Person Reporting (Printed Name and Signature)
Route	Log Point/ Mile Marker	Direction of Traffic	DATE (MM/DD/YY)	TIME (Example: 10:55 PM)			DATE (MM/DD/YY)	TIME (Example: 5:20 AM)	
I-75	1.56	NB	8/15/15	9:45 AM	55	On	8/15/15	2:50 PM	Pat Smith Pat Smith
I-75	2.50	NB	8/15/15	9:50 AM	55	On	8/15/15	2:55 PM	Pat Smith Pat Smith
I-75	1.56	NB	8/15/15	2:50 PM	60	Off	8/16/15	9:45 AM	Pat Smith Pat Smith
I-75	2.50	NB	8/15/15	2:55 PM	60	Off	8/16/15	9:50 AM	Pat Smith Pat Smith

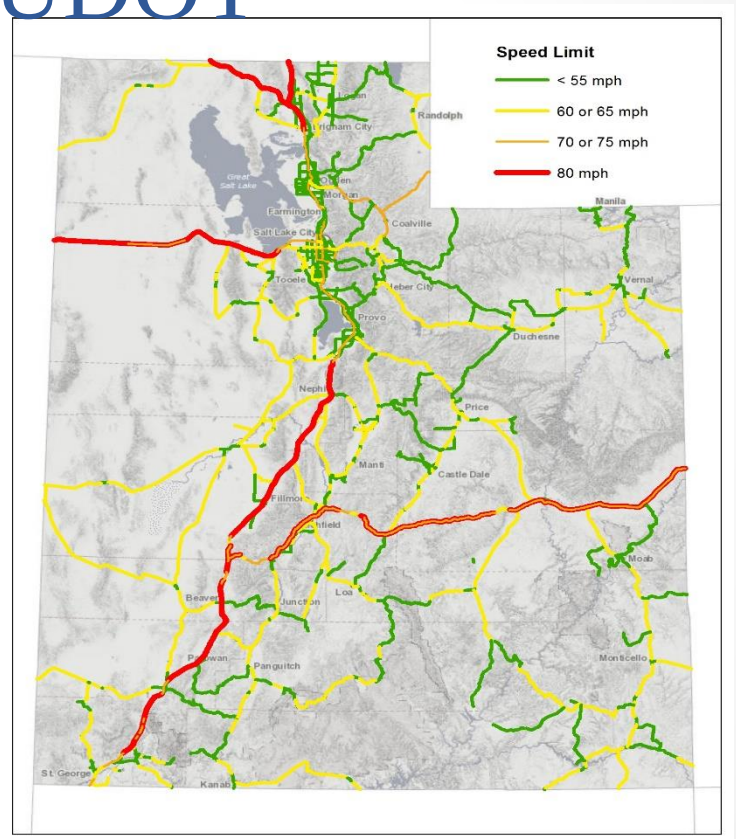
QUESTIONS

Use of Portable and Dynamic Variable Speed Limits in Construction Zones

Josh Van Jura
Utah Department of Transportation

Overview of UDOT

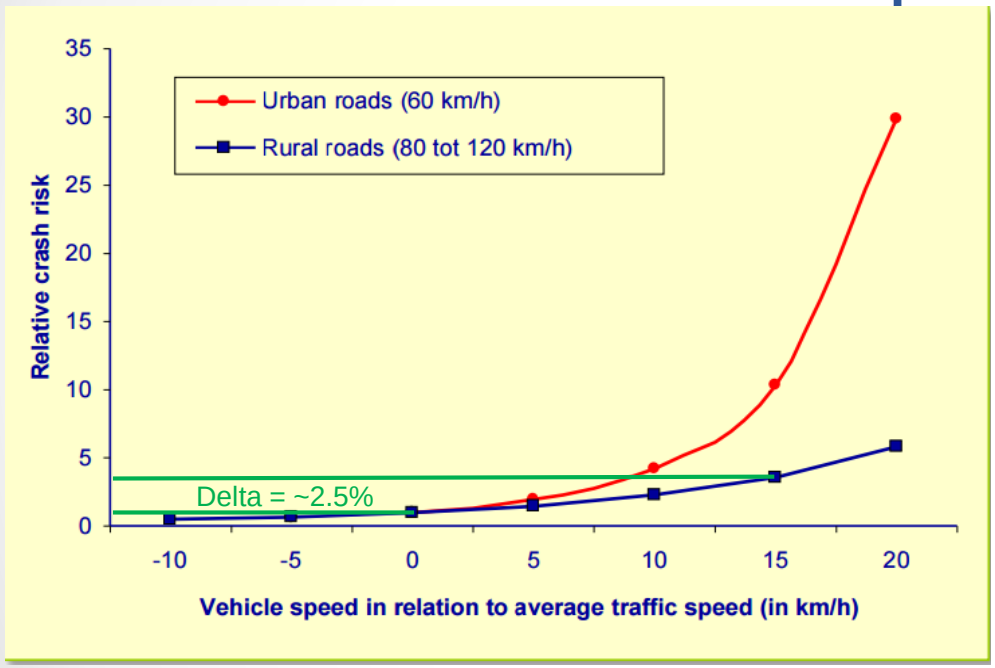
- Centerline Miles by Type
  - 935 miles of Interstate
  - 2,945 miles of Level 1 (AADT>1,000)
  - 1,985 miles of Level 2 (AADT<1,000)
  - 5,865 miles total
- Speed Limits
  - 13% @ 80 mph
  - 35% @ 70mph or higher
  - 60% @ 60mph or higher
  - 82% @ 50mph or higher



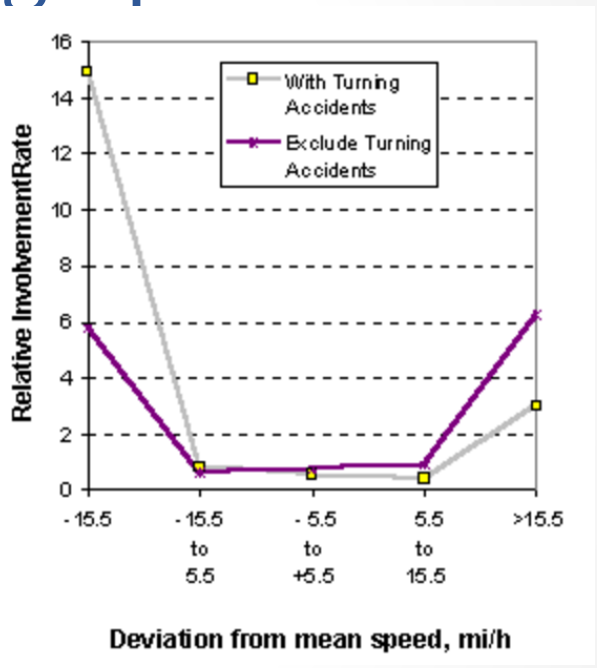
Project Goal

Goal: Improve safety within construction work zones through significant reduction in traveler speed within the boundary of Active Work Space.

Posted vs. Operating Speed



Kloeden et al., 1997, 2002



West and Dunn 1971

Reduction of Operating Speed

- Portable, Intelligent and Dynamic
- Regulatory
- Multiple Devices (PVSL, Detectors, PVMS)
  - Integrated as one system
  - Dynamically posting speed limits
  - Traveler information messages
  - Operated by Contractor and UDOT Field Crews (No TOC)

PVSL System: How we are getting there

- **FHWA AID Grant**
  - Awarded December 2014
- **System Planning & Design**
  - NTP June 2015
  - Kimley»Horn and avenue CONSULTANTS
- **Turn-key Solution Provider**
  - NTP May 2016
  - VER-MAC and INTERSTATE BARRICADES

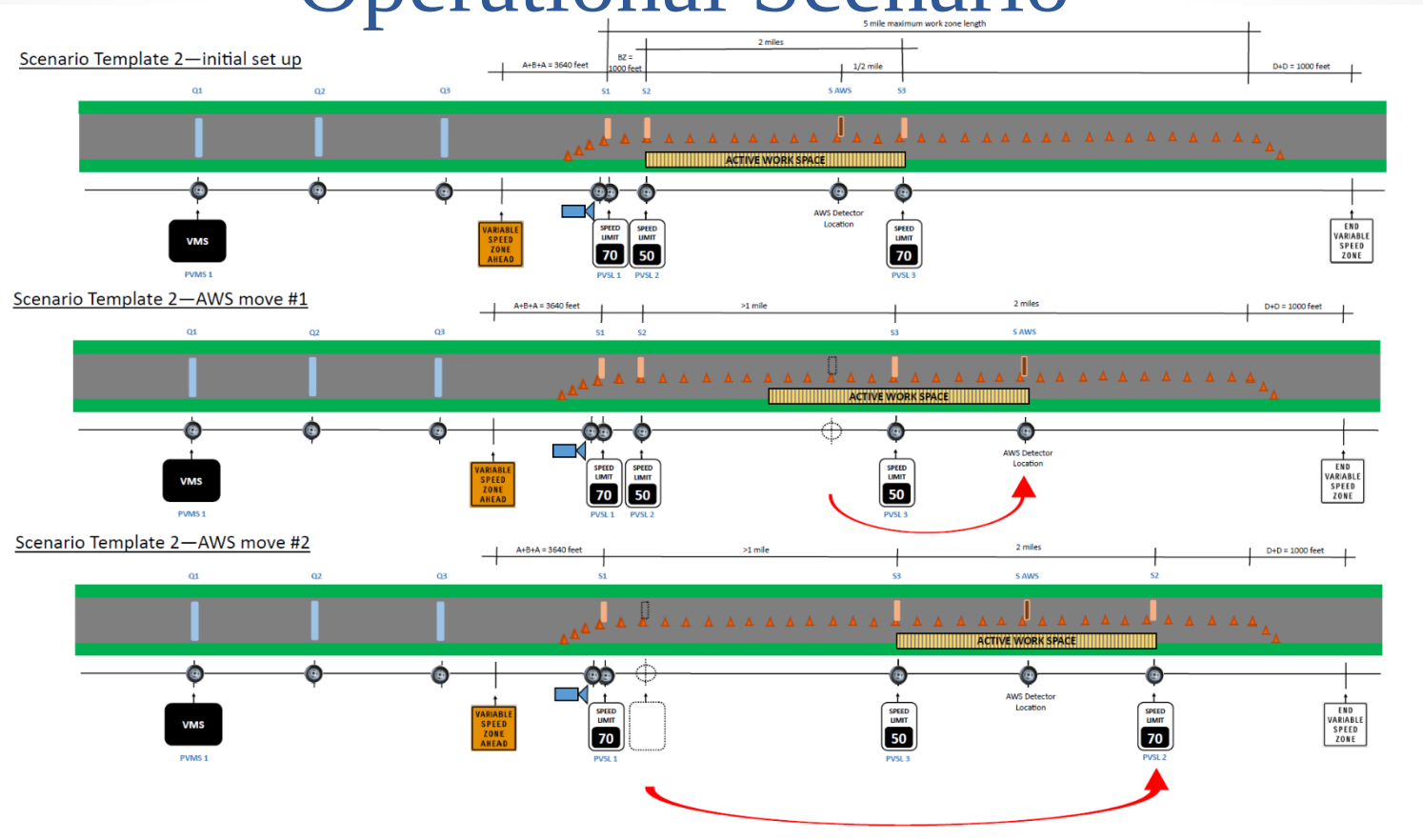
System Components 1

- **Portable Variable Speed Limit Signs (PVSL)**
  - White LEDs on black background (Regulatory)
- **Speed Detection Trailers**
  - K-Band Doppler Speed Radar
- **Portable variable message sign (PVMS)**

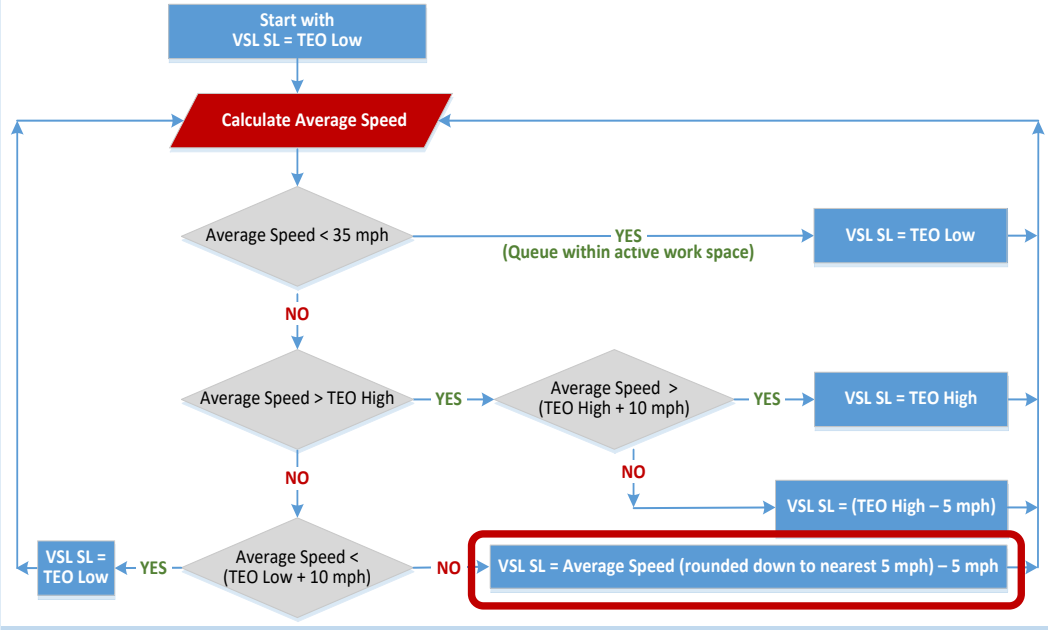
System Components 2

- **Portable Operator Control Device**
  - Laptop / Tablet / Cell Phone
  - Cell Service Req'd
- **Communications**
  - Internet via cell phone network
- **Power**
  - Solar system with 7-day batteries

Operational Scenario



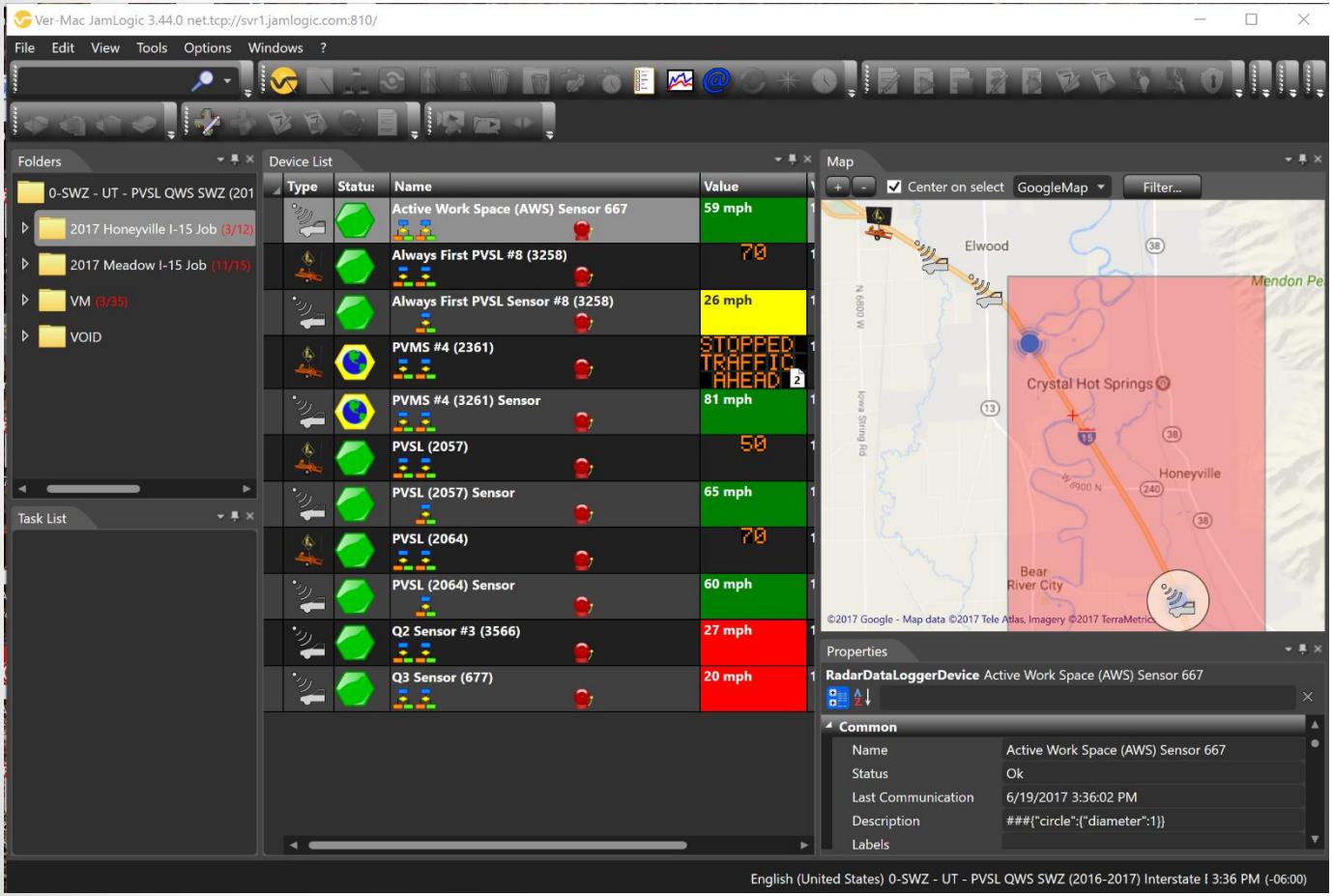
VSL Subsystem Algorithm



Legend:

Average Speed = Calculated Average Speed based on rolling 5 minutes of speed measurements in active work space .
VSL SL = Speed limit posted on VSL sign.
TEO High = Maximum speed allowed by TEO, typically “Original Posted Speed” or “Original Posted Speed – 10 mph”.
TEO Low = The lowest speed limit allowed by TEO.
Frequency of Speed Limit Change = Minimum of 15 minutes between speed limit changes
Bad or No Data Received => VSL SL = Last known VSL SL

PVSL Trailers

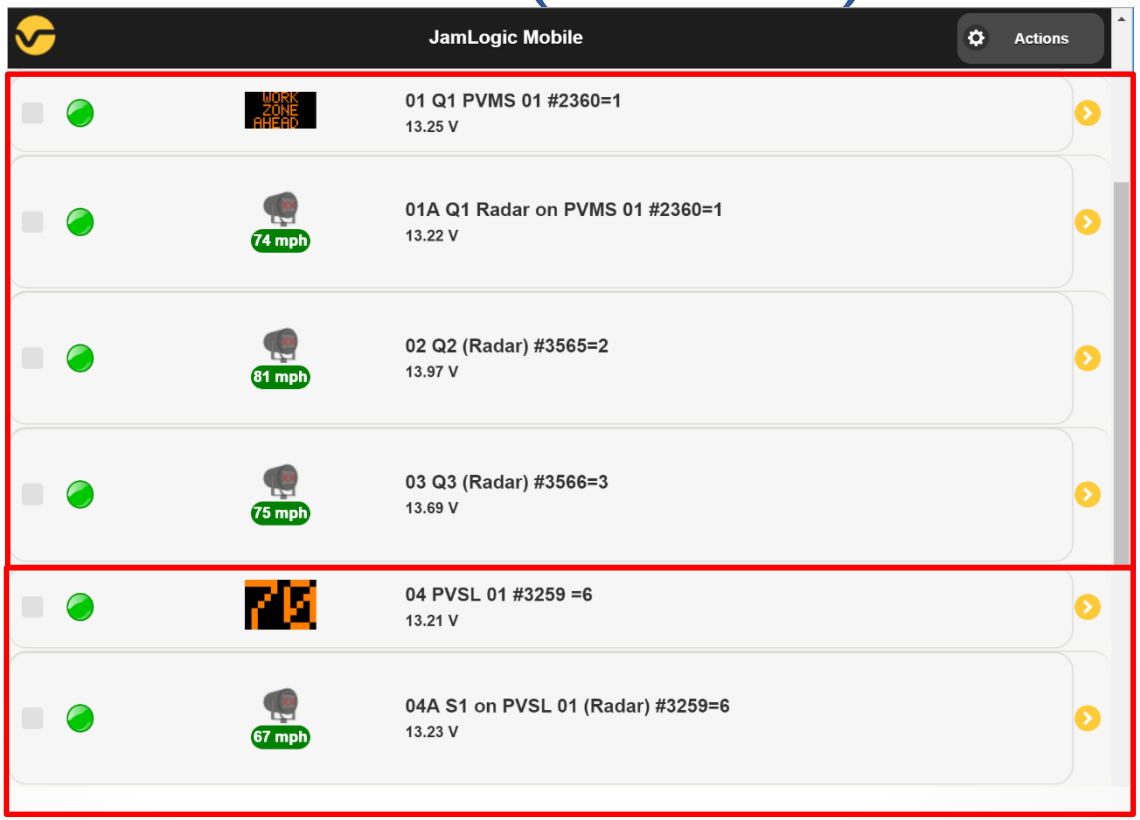


Software (Desktop)

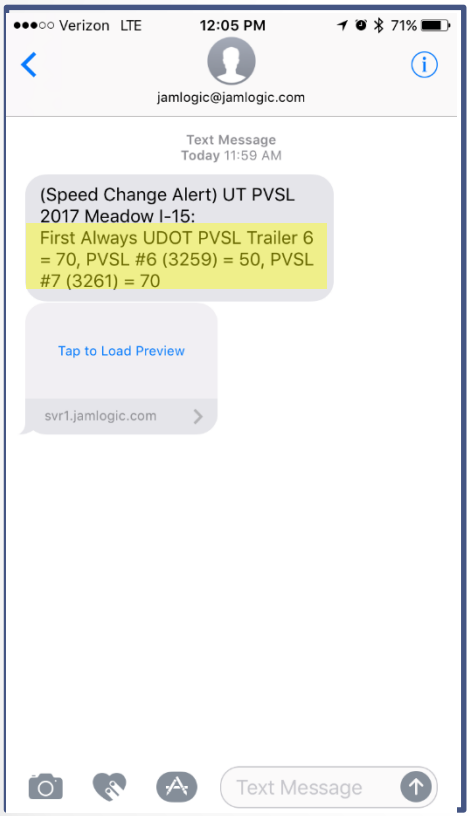
Software (Mobile)

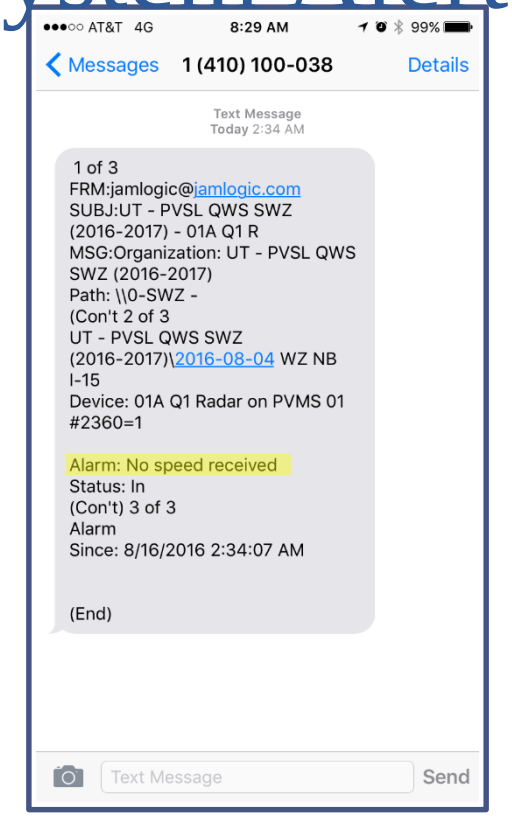
Queue Warning

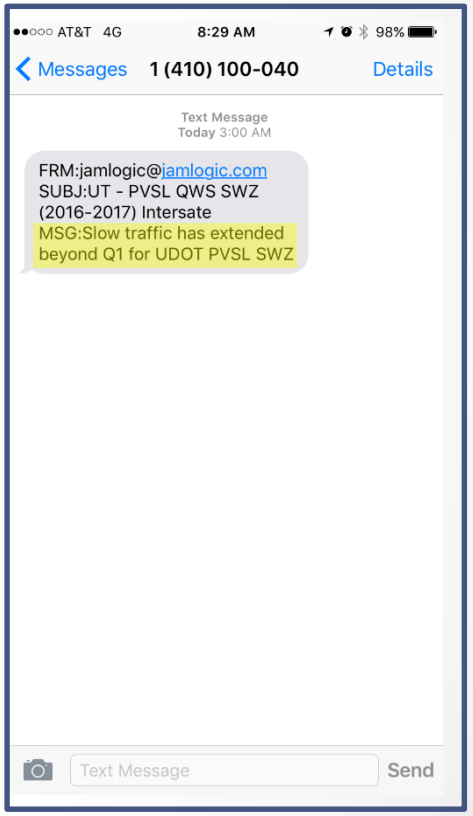
PVSL



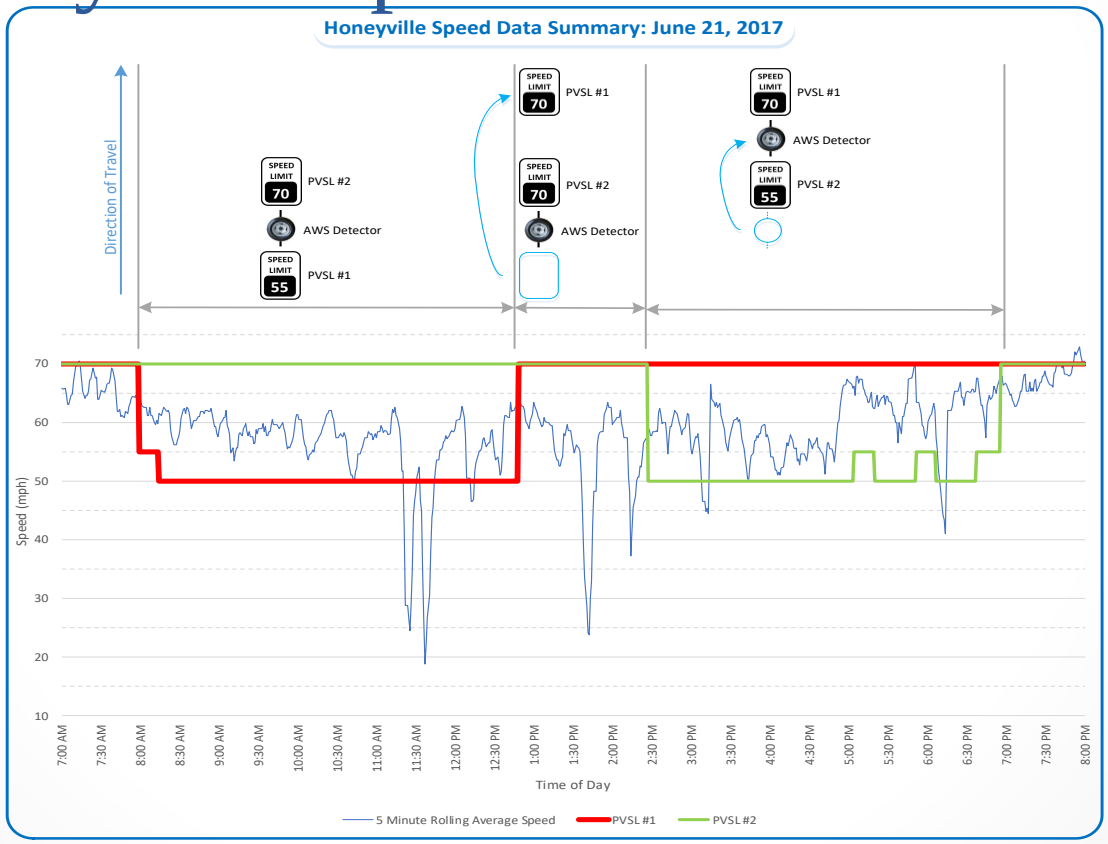
System Alerts



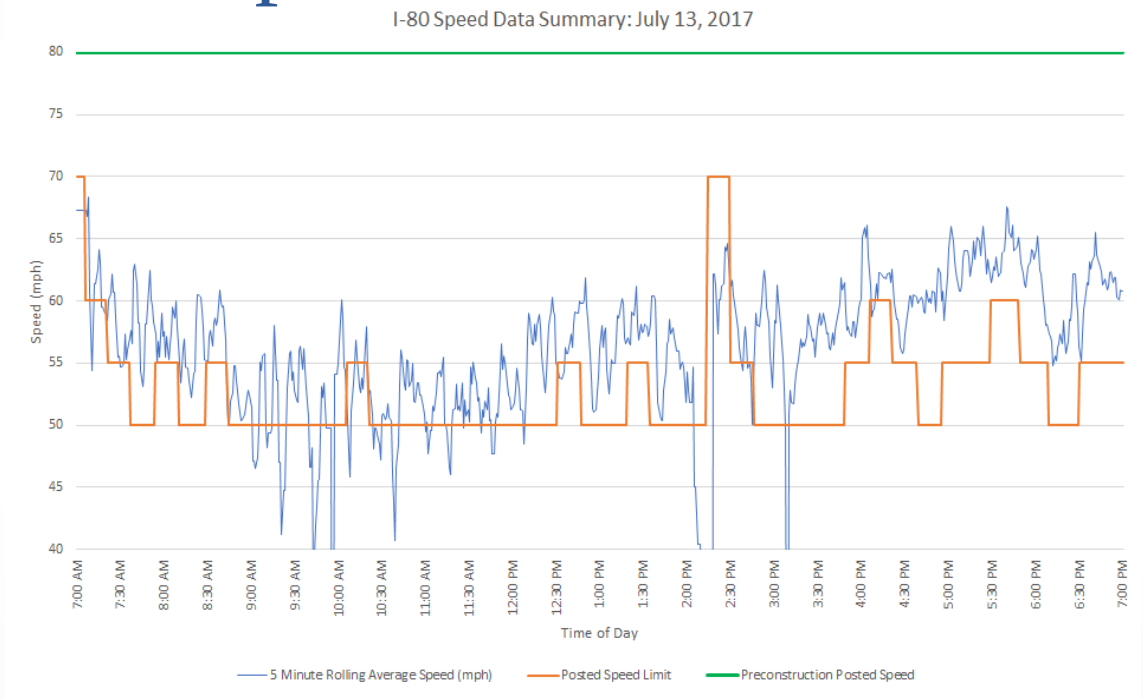




Honeyville Speed Data -6.21.2017



I-80 Speed Data – 7.13.2017

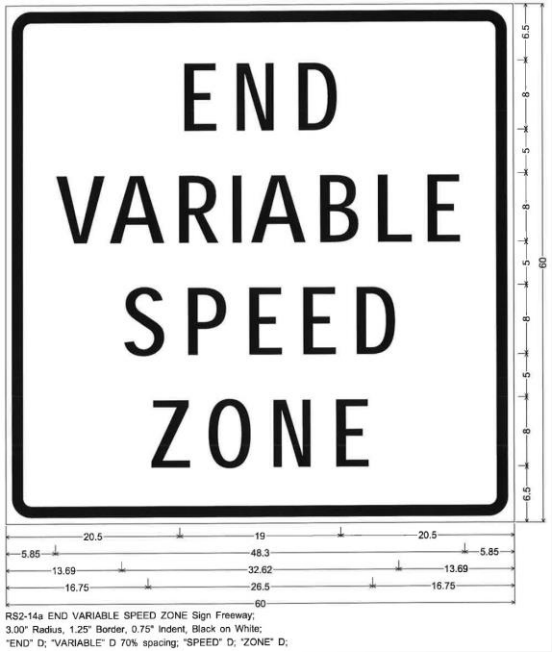


Speed Compliance

Project	Speeds < 10mph Over Posted Speed		10mph < Speeds < 15mph		Speeds >=15mph Over Posted Speed	
	Baseline	PVSL	Baseline	PVSL	Baseline	PVSL
Y1P1, Tremonton	23%	37%	10%	15%	67%	48%
Y2P1, Meadows	88%	58%	9%	29%	3%	13%
Y2P2, Honeyville	N/A	60%	N/A	29%	N/A	10%
Y2P3, I-80	43%	81%	42%	14%	15%	6%

Other Important Factors

- Public Information
  - Communicate impact and duration
  - 1.5 miles = 52 seconds
  - Real time messages
- Challenges
  - Comfort w/ automation
  - Supporting Legislation
  - Just because you can doesn't mean you should



RS2-14a END VARIABLE SPEED ZONE Sign Freeway; 3.00" Radius, 1.25" Border, 0.75" Indent, Black on White; "END" D; "VARIABLE" D 70% spacing; "SPEED" D; "ZONE" D;

Contact Information

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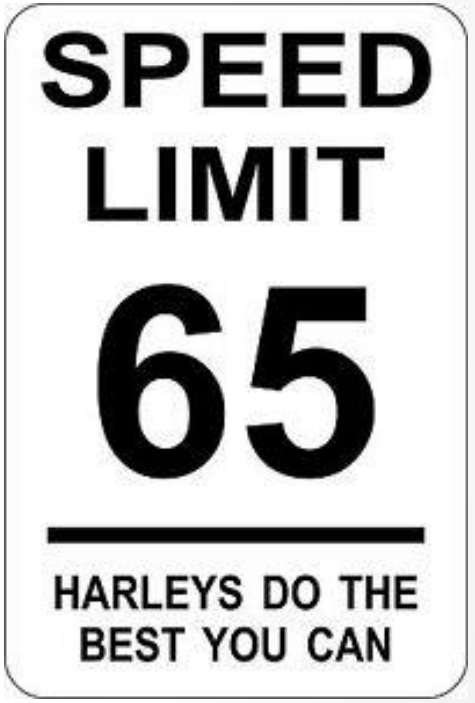

Questions/Other Experiences

Closing

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