



ACTIVE TRAFFIC & SAFETY MANAGEMENT SYSTEM FOR INTERSTATE 77 IN VIRGINIA

Mike McPherson, PE, PTOE

Regional Traffic Signal and Freeway Operation Engineer

Virginia Department of Transportation – Southwest Regional Operations

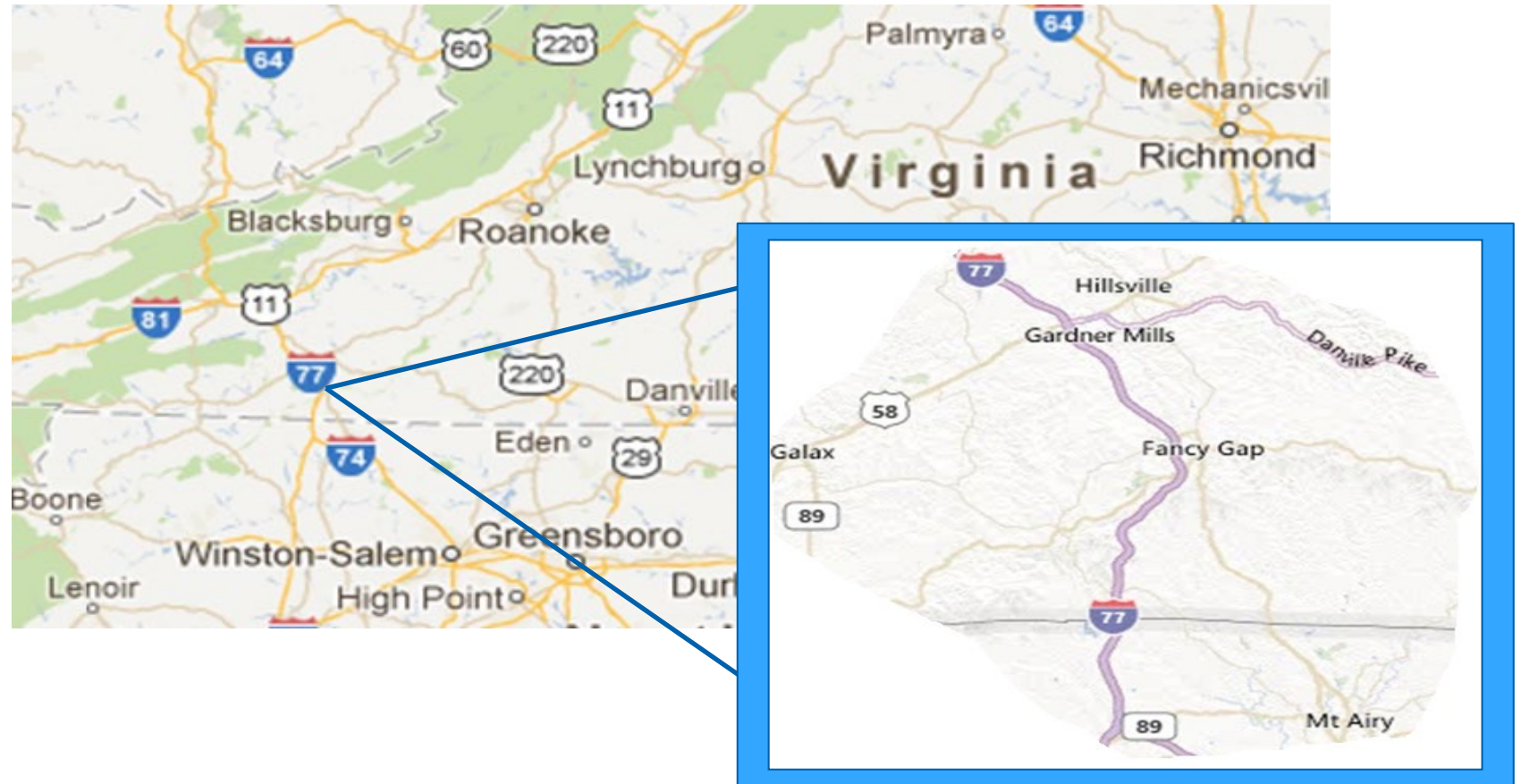


June 25th, 2019

NOCoe Road Weather Management Peer Exchange

I-77 at Fancy Gap Mountain

- Speed Limit of 65 MPH
- 1,000 feet of elevation drop
- Over 11 horizontal curves
- Area subject to dense fog and severe cross winds
- Traffic Volume 35,000 AADT



Problem Statement



Motorists transition from Sunny Skies...

To Thickening Fog...



MM 1.9, Visibility 2000 ft



MM 4.3, Visibility 430 ft



MM 5.3, Visibility 197 ft

Resulting in Rear-end Crashes



Visibility ???

I-77 at Fancy Gap Mountain Significant Fog Incidents

Date of Crash	Vehicles	Fatalities	Injured	Direction
March 31, 2013	96	3	25	Southbound
Nov. 16, 2011	75	2	16	Southbound
Oct. 27, 2006	30	0	10	Southbound
Sept. 25, 2005	50	0	25	Both
Jan. 21, 2005	20	0	5	Both
May 21, 2001	40-50	0	12	Southbound
Jan. 18, 2000	60	2	N/A	Southbound
Oct. 5, 1998	46	0	10	Northbound
Feb. 14, 1997	65	0	11	Southbound

16 years, 9 crashes, 482+ vehicles, 7 fatalities, 114+ injuries

March 31, 2013 Incident Summary

96

- Total Vehicles Involved

17

- Separate Crashes

15

- Vehicles on Escape Ramp

3

- Fatalities

10 hrs/
42 min

- Incident Duration

167 feet

- Shortest Visibility

>60
MPH

- Speeds



Previous Safety Improvements

Increase Frequency of Skip Lines

Diagonal striping on shoulders

Increased frequency of roadway delineators

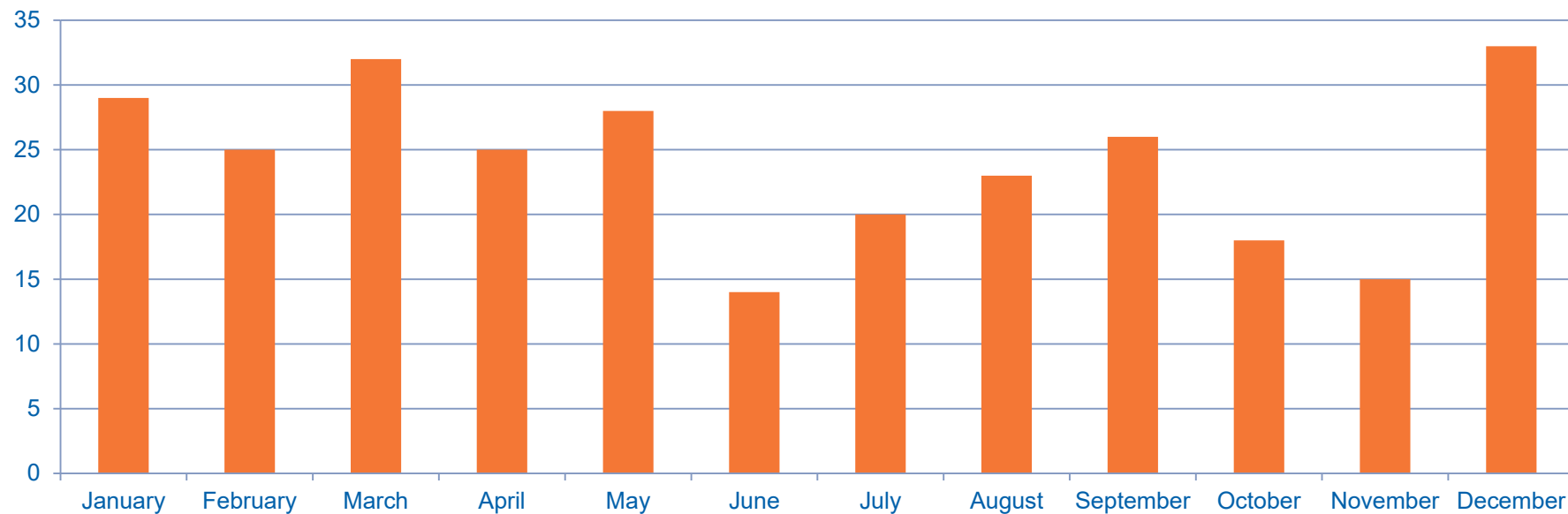
**Resulted in Minimal Safety Improvements:
These Improvements addressed Run off the
Road Crashes.**

Did not address Rear End Crashes



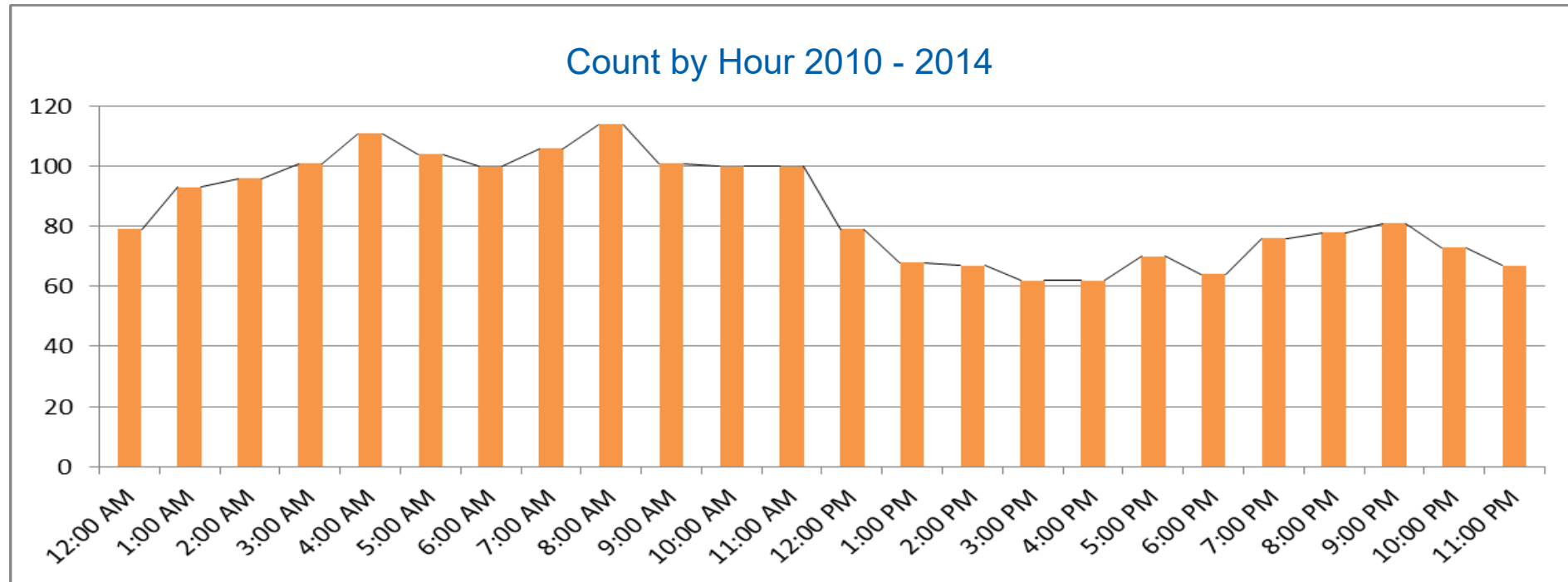
Monthly Climatology

Days with less than 300 feet of Visibility 2010-2014



Hourly Climatology

One count per every time visibility falls below 300 feet in that hour. (only one count per day per hour)



How the system works?

Fog on the road



Weather Station



Strategically placed weather detection station determines sight distance.

Traffic Operations Center



When sight distance falls below visibility threshold



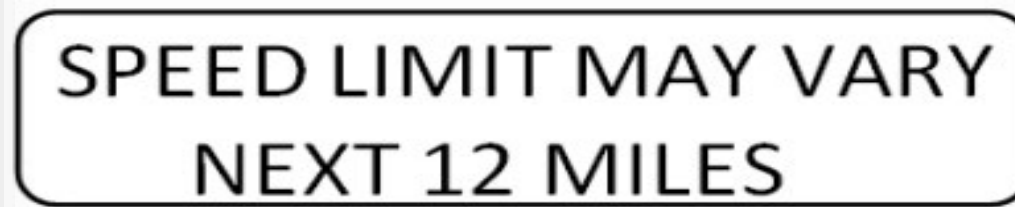
Speed limit reduced



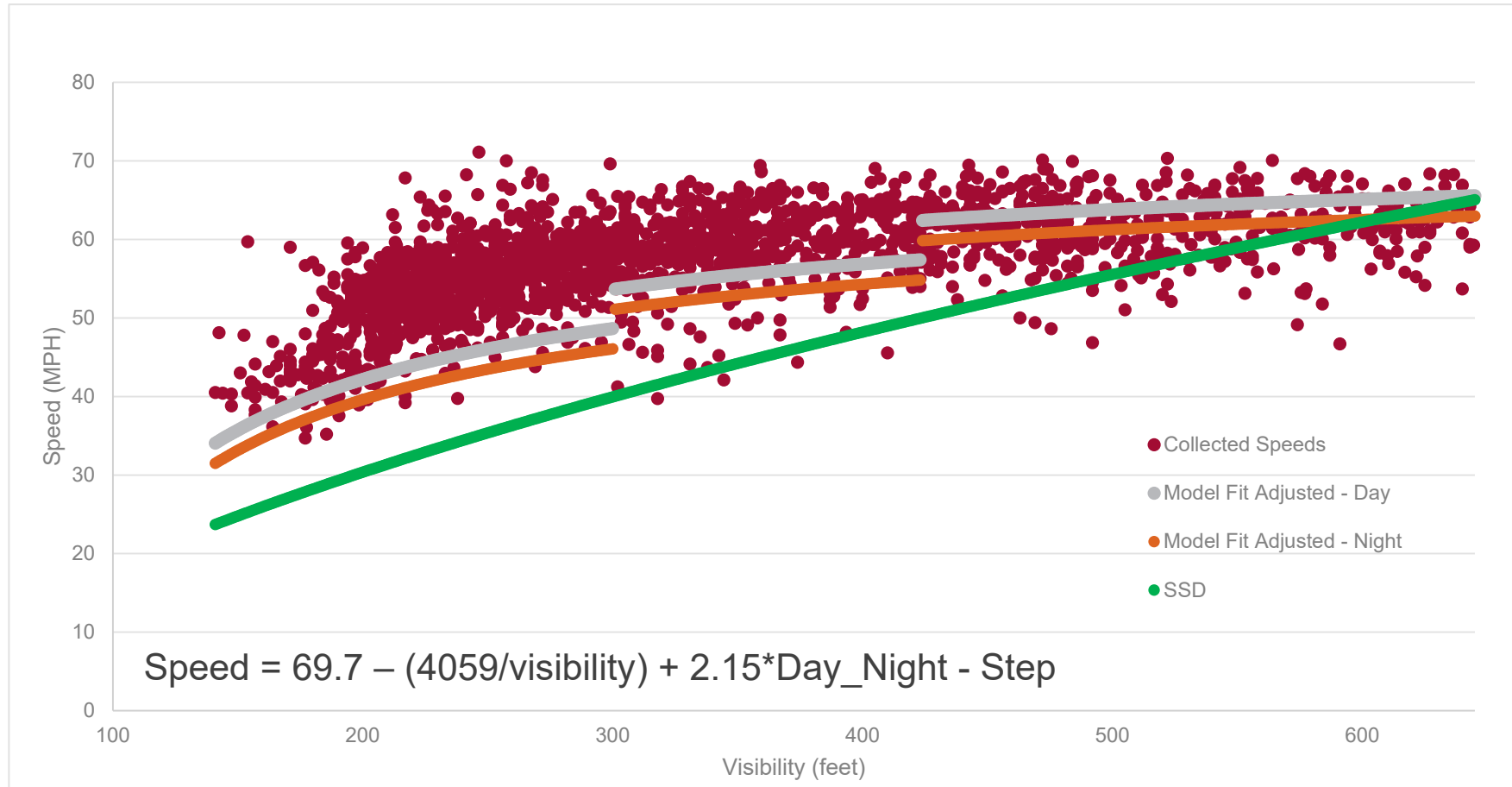
Drivers slow down

Signs

A total of 69 signs of various types (static, VMS, etc.) are in place in support of the traffic safety system.



Adjusted Step Model



I-77 VSL Visibility Module



I-77 VSL

Recommended Speed Limits

Press for Auto
Speed Limit

Incident Number:
VSL Demo

Operator Name:
MCM

Last Update:
6/19/18 4:36 PM

Countdown

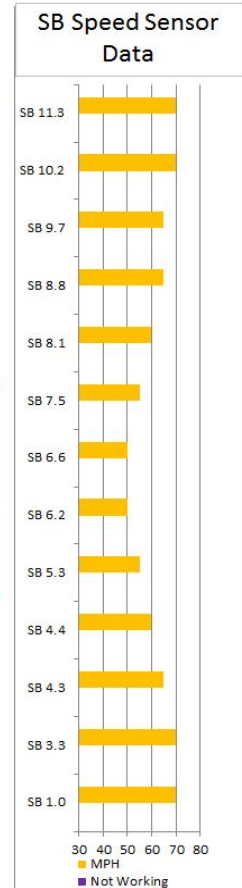
01:11

Fog Status:

Condition 2

Response Plan 2 - Beacons and
DMS Signs

Response Plan in Use:
Response Plan 2 -
Beacons and DMS
Signs



Southbound

SLCMS-177-S-00116-1
SLCMS-177-S-00116-2
SPEED LIMIT 65

SLCMS-177-S-00102-1
SLCMS-177-S-00102-2
SPEED LIMIT 65

SLCMS-177-S-00095-1
SLCMS-177-S-00095-2
SPEED LIMIT 65

SLCMS-177-S-00081-1
SLCMS-177-S-00081-2
SPEED LIMIT 50

SLCMS-177-S-00072-1
SLCMS-177-S-00072-2
SPEED LIMIT 50

SLCMS-177-S-00065-1
SLCMS-177-S-00065-2
SPEED LIMIT 50

SLCMS-177-S-00056-1
SLCMS-177-S-00056-2
SPEED LIMIT 65

SLCMS-177-S-00045-1
SLCMS-177-S-00045-2
SPEED LIMIT 65

SLCMS-177-S-00034-1
SLCMS-177-S-00034-2
SPEED LIMIT 65

SLCMS-177-S-00018-1
SLCMS-177-S-00018-2
SPEED LIMIT 65

Northbound

SLCMS-177-N-00116-1
SLCMS-177-N-00116-2
SPEED LIMIT 65

SLCMS-177-N-00102-1
SLCMS-177-N-00102-2
SPEED LIMIT 65

SLCMS-177-N-00092-1
SLCMS-177-N-00092-2
SPEED LIMIT 65

SLCMS-177-N-00081-1
SLCMS-177-N-00081-2
SPEED LIMIT 55

SLCMS-177-N-00076-1
SLCMS-177-N-00076-2
SPEED LIMIT 55

SLCMS-177-N-00065-1
SLCMS-177-N-00065-2
SPEED LIMIT 55

SLCMS-177-N-00056-1
SLCMS-177-N-00056-2
SPEED LIMIT 55

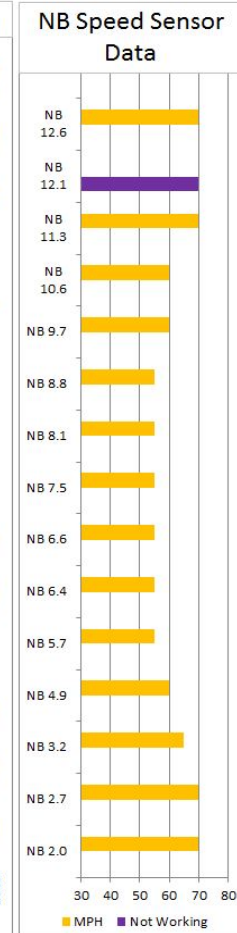
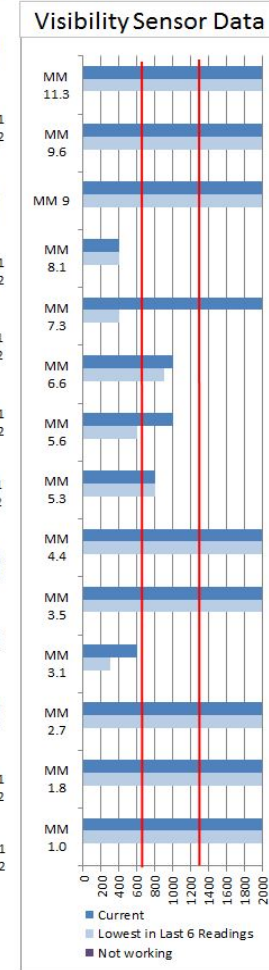
SLCMS-177-N-00046-1
SLCMS-177-N-00046-2
SPEED LIMIT 55

SLCMS-177-N-00035-1
SLCMS-177-N-00035-2
SPEED LIMIT 50

SLCMS-177-N-00024-1
SLCMS-177-N-00024-2
SPEED LIMIT 50

SLCMS-177-N-00018-1
SLCMS-177-N-00018-2
SPEED LIMIT 65

SLCMS-177-N-00013-1
SLCMS-177-N-00013-2
SPEED LIMIT 65



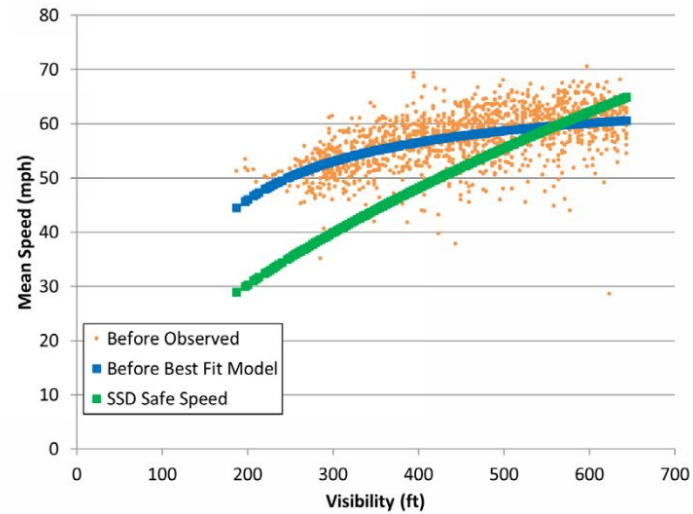
View from the Field

About 400' Visibility

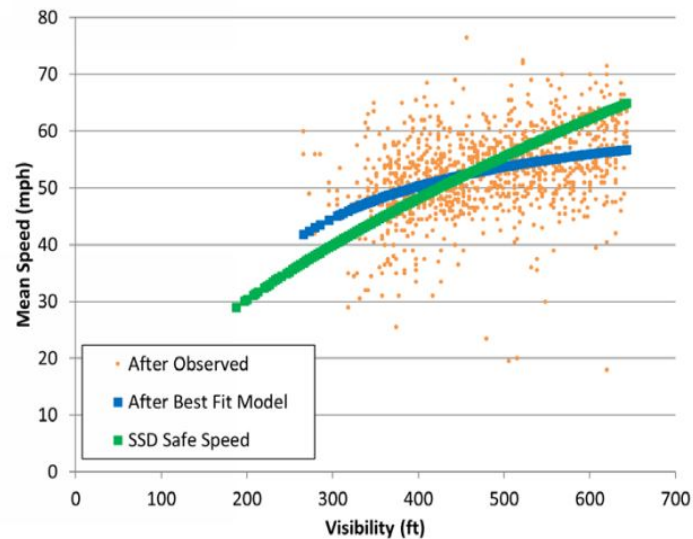


Results

Before
Project



After
Project

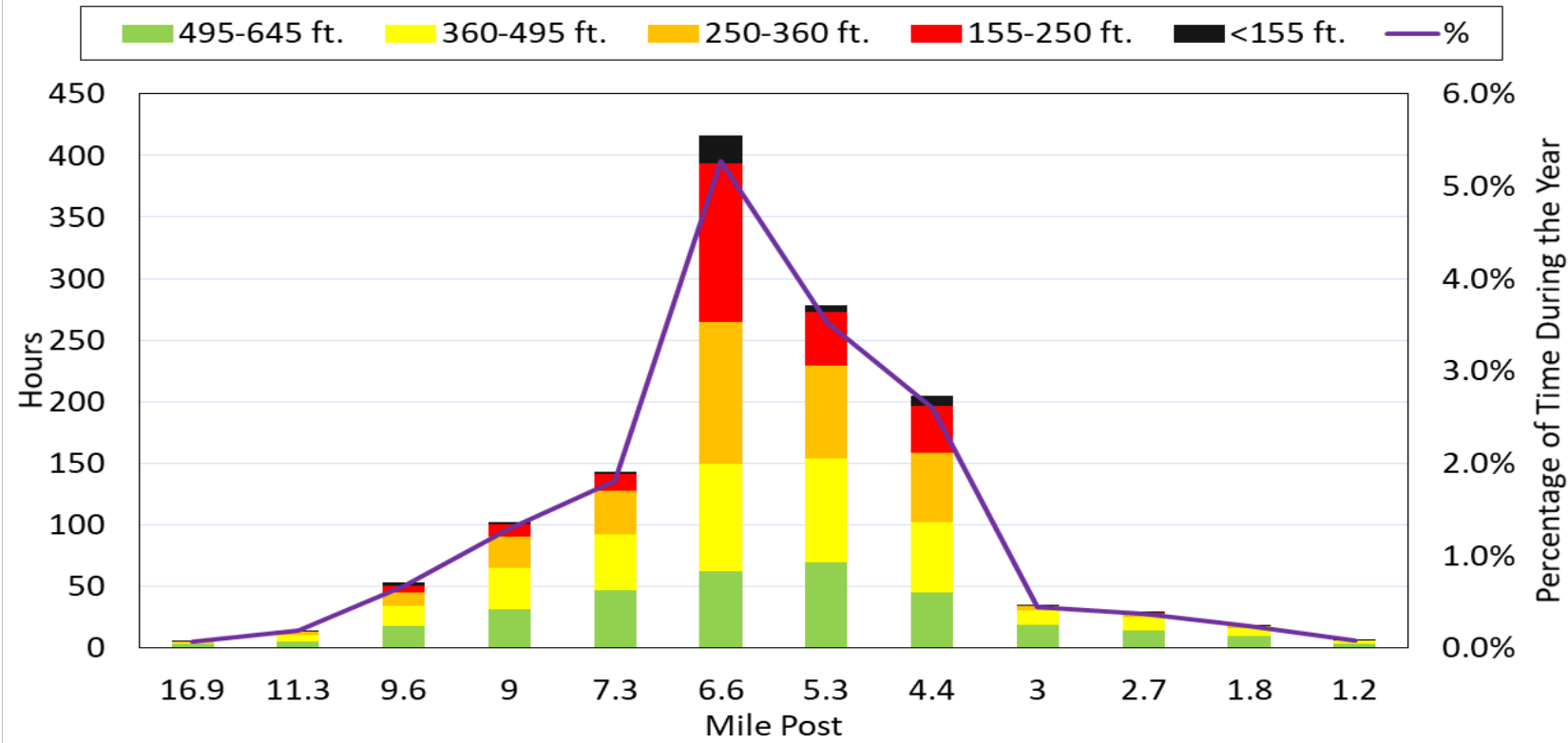


Before - After Comparison of Mean Speed at MP 4.4 SB							
Visibility Bin (ft)	SSD Safe Speed	Before			After		
		No. of Intervals (10-min intervals)	Mean Speed (mph)	Standard Deviation (mph)	No. of Intervals (5-min intervals)	Mean Speed (mph)	Standard Deviation (mph)
>645	65	69307	67.07	7.31	5158	64.34	5.41
495-645	55-65	513	59.88	8.45	526	55.12	6.33
360-494.9	45-55	524	56.63	9.03	561	51.83	5.4
250-359.9	35-45	297	52.43	8.83	73	50.49	5.04
155-249.9	25-35	22	49.75	7.96	0	-	
<155	<25	0	-	-	0	-	

Posted vs Observed Speed Differentials

Difference Between Mean Observed Speed and Posted Speed Limit SB										
Location (Milepost)			Posted Speed							
VSL	RWIS Station	Downstream Speed Sensor	65	60	55	50	45	40	35	30
11.6	11.3	11.3	0	4.8	2	9	12.4	-	-	-
10.2	9.7	9.7	2.6	2.5	8.5	9.4	-	-	-	-
9.5	8.8	8.8	3	4.7	4.2	7.9	4.5	-	-	-
8.1	7.5	7.5	0.7	2.4	5.7	6.4	11.3	10.3	-	12.1
7.2	6.6	6.6	4.1	7.2	7.6	12.2	13.6	17.5	22.3	22.9
5.6	5.3	5.3	1	5.5	4.8	10.2	10.8	15.3	17.2	21.3
4.5	4.4	4.4	0.1	2.7	3.5	5.6	4.9	8.1	6.4	-
4.5	4.3	4.3	0.5	3.3	3.5	5.1	3.8	5.8	5.3	-
3.4	3.3	3.3	2.9	4.8	3.5	7.1	5.6	9.6	-	-
1.8	1	1	3.4	4.7	-	-	-	-	-	-

Fog Distribution



Crash Data

Preliminary Results:
Reduction in Rear End and overall
number of Crashes
Reduction in Crash Severity

	2010 - 2015		Oct 2016 - May 2019	
	Total	Per Year	Total	Per Year
Low Visibility Crashes	62	10.3	13	4.9
Rear End Crashes	39	6.5	9	3.4
Fix Object Off Road	3	0.5	2	0.7
Other	20	3.3	2	0.7



Summary of Results

- **Speeds still above Posted Speed Limit but closer to SSD Safe Speeds**
- **Speed Reductions lag until drivers encounter fog**
- **Continuing analysis on compliance**



Questions?