Division of Transportation System Development
DOT Briefing Paper
Work Zone Speed Limit, I-39/90 expansion project

Red text is additional 2018 work zone speed limit documentation. The original document is from October, 2016. Speed limits tell driver the reasonable speed for a road section under ideal conditions. Wisconsin law states the motorists are required to drive at a speed that allows them to stop safely.

Issue:

The I-39/90 corridor team is planning to keep the posted speed limit through work zones at 70 m.p.h. during construction. Some industry members have voiced concerns related to the speed limit and have asked for a reduced speed limit. *WisDOT's guidance recognizes that work zone safety is important to construction workers and motorists. Work zones adjacent to 70 m.p.h. traffic that do not provide positive protection is the single case that allows a 15 m.p.h. speed reduction.*

History:

- Each project has used the Transportation Management Plan (TMP) process during design to determine the appropriate traffic control and staging. The design teams, Bureau of Project Development, Bureau of Traffic Operations, and FHWA are all involved with the process and the final plans. Speed limits and traffic control devices are thoroughly discussed through the TMP process.

- The I-39/90 team has had discussions with the WisDOT Bureau of Traffic Operations and the bureau agrees that the work zone should be signed with the speed limit that the motorists feel comfortable driving. If the speed limit is posted lower than the comfortable driving speed, it will create more differential speeds among the vehicles and increase the potential for incidents (rear-end crashes, increased weaving movements for passing, etc).

- With the numerous non-continuous work zones that exist concurrently in different locations along the 45-mile corridor, differing speed limits (reduced in work zones, not reduced outside of work zones) has the potential to negatively affect driver expectations and cause issues related to differential speeds.

- In discussions with State Patrol, they have stated that it will not be possible to enforce a reduced speed limit in the work zones due to the limited space for troopers to safely pull over motorists. Without the ability to enforce the reduced speed limit, there is increased potential for the differential speeds that are mentioned above.

    - *National work zone data indicates that when enforcement is present, speeds decrease by approximately 5 mph. I-39/90 data confirms that slower speeds also occur at approximately the same magnitude. Attachment 1 shows the resulting speed data with a patrol vehicle monitoring speed near the Rock River on November 1, 2017. Attachment 2 shows the resulting speed data when DSP ran an enforcement detail on May 21 on northbound I-39/90 between Illinois and I-43.*
    - *DSP speeding citations have decreased each year since 2015. See Exhibit 1.*

- Speed limits are adjusted on a case-by-case basis through the I-39/90 corridor work zones. An example is the Rock River bridge work zone over the winter of 2016-17, which will be signed for 55 m.p.h. due to narrow lanes and temporary barrier on the structure. Other locations on future projects may have reduced speeds due to geometric design limitations. These areas may include: crossovers, interchange ramps, or narrow mainline lanes.

    - *Prior to increasing the in posted speed on I-39/90 to 7- m.p.h. in June, 2015, corridor projects on I-39/90 reduced the speed limit to 55 mph on a case-by-by basis. The The first counter-directional work zone*

occurred in 2014 during the project that constructed the SB bridge over Sigglekow Road. The work zone from crossover to crossover was approximately 1mile. During that project, the inside (left) lane traveled at an average of 65 mph and the outside lane traveled at an average of 60 mph.

- The I-39/90 management team has had discussions with prime contractors related to the speed limit on current construction projects along the corridor. They have stated that there were concerns as the early projects were starting, but as time has passed those concerns have dissipated.

Going Forward:

- The I-39/90 corridor team will continue to actively monitor the traffic operations within the work zones, and make revisions to the posted speed as necessary.

- Communication with State Patrol will continue to be ongoing with regards to the cause of crashes, to determine if the posted speed limit is contributing to incidents.

- Most future construction projects will have barrier wall separating traffic from the work zone, so workers will be protected from traffic incidents that occur within the travel lanes.

Data-Driven Work Zone Speed Management

The I-39/90 corridor management team has been actively collecting and analyzing work zone data related to traffic speed, volumes, capacity, crashes, trucks, OSOW, and lane utilization and other data since the beginning of the project.

The 85th percentile speed and the 10 m.p.h. pace are two metrics in speed data that are accepted standards for establishing speed limits.

2017

The 85th percentile speed is the speed at or below which 85 percent of the vehicles are traveling. Since July, 2017, the 85th percentile has been analyzed. The posted speed limit was not demonstrated to affect a change in individual vehicle speeds.

2017 speed data was collected in July at the Rock River bridge work zone. Northbound was posted at 60 m.p.h. and southbound was posted at 70 m.p.h. Monday through Thursday, the 85th percentile speed was 70 m.p.h. in both directions. The 85th percentile speeds in August and October in 65 and 70 m.p.h. work zones were consistently 5 m.ph. faster than the July speeds in 60 and 70 m.p.h. work zones.

Speed data was also collected about 5 miles north of the Rock River site. Northbound was posted at 65 m.p.h. and southbound was posted at 70 m.p.h. Northbound 85th percentile speed was usually 1 m.p.h. slower than the southbound 85th percentile speed. The higher speed southbound is due to the open outside shoulder. The northbound outside shoulder has a 4 foot shoulder to the concrete barrier. See Attachment 3 for additional details.

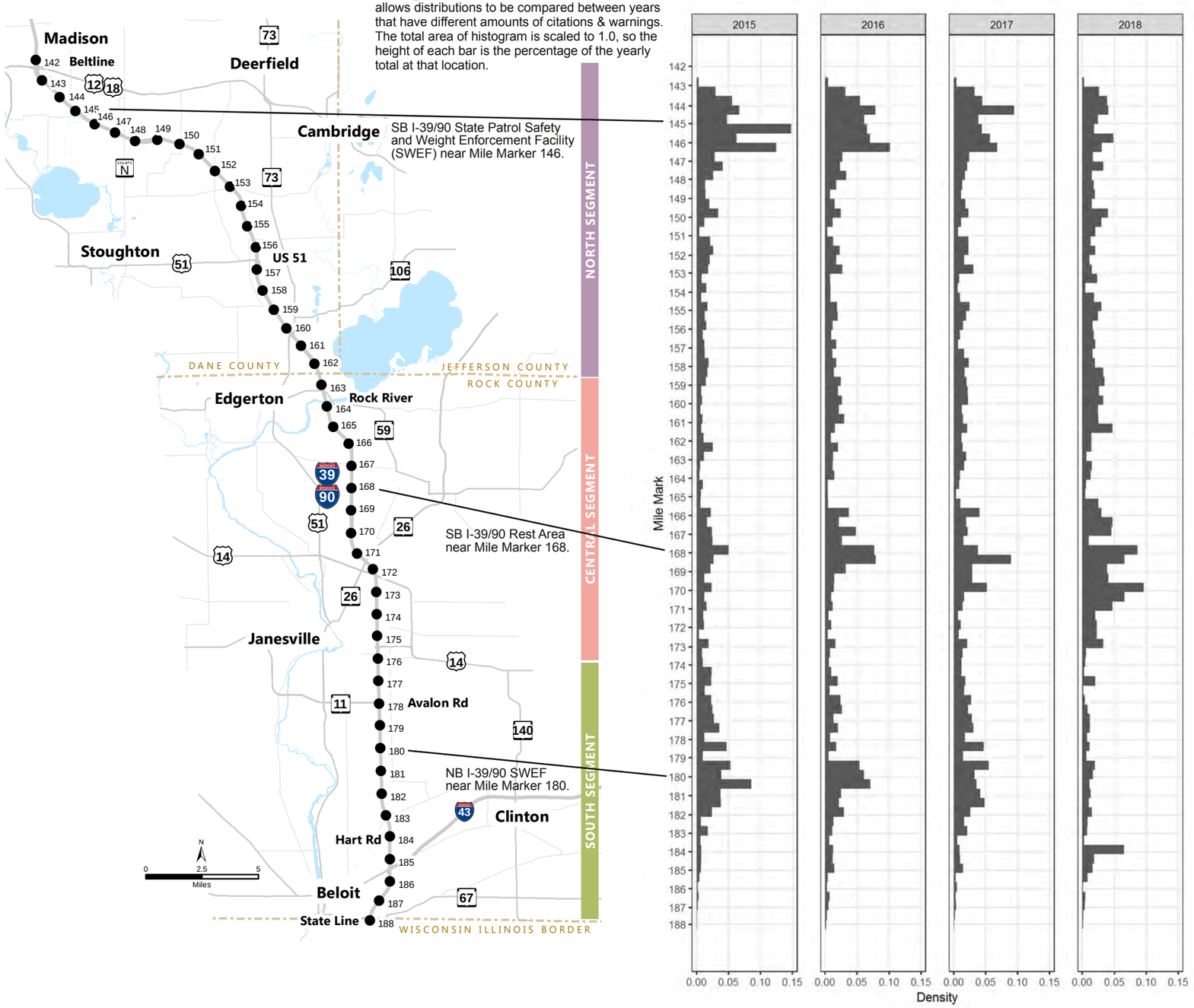
2018

2018 speed data was collected in January through March at Mount Zion Avenue and in April at Woodman Road. The posted speed at both locations was 70 m.p.h. Monday through Thursday, the 85th percentile speed is 74 to 75 mph southbound and 71 to 73 northbound. The southbound outside shoulder in open, thus the higher speed. See Attachment 4 for additional details.

The pace is the 10 m.p.h. increment that the majority for the vehicles travel. That would equate to the 25th percentile speed to the 75th percentile speed. The majority of the vehicles are always within the 10 m.p.h pace.

Spatial Distribution of All Citations & Warnings By Year

Each histogram shows the density of citations & warnings (NB & SB I-39/90 are combined). This allows distributions to be compared between years that have different amounts of citations & warnings. The total area of histogram is scaled to 1.0, so the height of each bar is the percentage of the yearly total at that location.



Number of Citations & Warnings

2018 Year-to-Date is from 1/1/2018 through 6/7/2018.
"Per Month" values divide the year total by 12. For 2018, YTD is divided by 5.2 months.

Total Citations & Warnings by Category

Category	2015 Total	2015 Per Mo.	2016 Total	2016 Per Mo.	2017 Total	2017 Per Mo.	2018 YTD	2018 Per Mo.	Grand Total (1/1/2015 - 6/7/18)
Other	5,987	499	4,059	338	2,748	229	829	160	13,623
Speed	5,076	423	3,451	288	2,799	233	930	179	12,256
Inattentive	987	82	747	62	589	49	197	38	2,520
Headway	313	26	223	19	216	18	75	14	827
Reckless	184	15	140	12	137	11	50	10	511
Influenced	112	9	127	11	139	12	69	13	447
Total	12,659	1,055	8,747	729	6,628	552	2,150	414	30,184

- "Other" relates to insurance, license, registration, vehicle equipment, commercial weight limits, etc.
- "Speed" relates to anything involving going over the speed limit.
- "Inattentive" relates to any distractions (phones, etc)
- "Influenced" relates to the driver being intoxicated or drugged.
- "Headway" relates to following too close, etc.
- "Reckless" relates to unsafe lane changing or passing behavior.

Speed Related Citations & Warnings by County

County	2015 Total	2015 Per Mo.	2016 Total	2016 Per Mo.	2017 Total	2017 Per Mo.	2018 YTD	2018 Per Mo.
Dane	**2667**	**222**	**1736**	**145**	**1019**	**85**	**364**	**70**
Warning	1970	164	1127	94	677	56	201	39
Citation	697	58	609	51	342	29	163	31
Rock	**2409**	**201**	**1715**	**143**	**1780**	**148**	**566**	**109**
Warning	1482	124	978	82	796	66	259	50
Citation	927	77	737	61	984	82	307	59
Total	**5076**	**423**	**3451**	**288**	**2799**	**233**	**930**	**179**

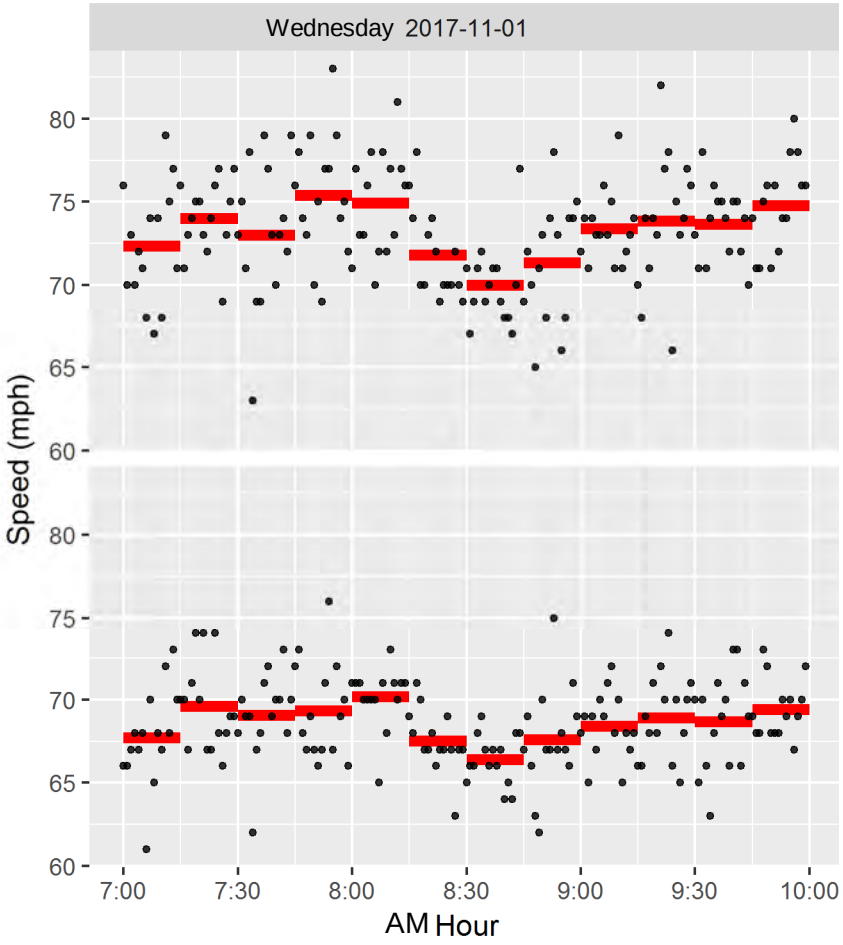
Top Citations & Warning Reasons

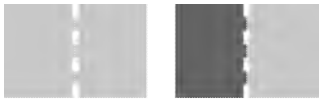
Citation or Warning	2015 Tot.	2015 Per Mo.	2016 Tot.	2016 Per Mo.	2017 Tot.	2017 Per Mo.	2018 YTD	2018 Per Mo.
Speeding on freeway (1-10 mph)	2523	210	1478	123	791	66	211	41
Speeding on freeway (11-15 mph)	1219	102	1137	95	1044	87	307	59
Operate motor vehicle w/o proof of insurance	1106	92	614	51	383	32	111	21
Speeding on freeway (16-19 mph)	445	37	411	34	490	41	135	26
Non-registration of auto, etc	330	28	252	21	190	16	70	13
Automobile following too closely	303	25	206	17	196	16	66	13
Deviation from designated lane	261	22	223	19	195	16	60	12
Operation w/o required lamps lighted	330	28	220	18	145	12	31	6
Speeding on freeway (20-24 mph)	226	19	144	12	188	16	60	12
Operating after suspension	199	17	168	14	172	14	51	10
Inattentive driving	242	20	143	12	85	7	42	8
Improperly attached license plates	292	24	115	10	85	7	15	3
Violate class a hwy weight limits	209	17	203	17	77	6	7	1
Operate w/o valid license	186	16	133	11	119	10	40	8
Operate motor vehicle w/o insurance	174	15	125	10	103	9	42	8
Fail/display vehicle license plates	209	17	130	11	60	5	13	3
Fail/yield to stop for emergency vehicle	188	16	121	10	66	6	15	3
No tail lamp/defective tail lamp-night	153	13	94	8	80	7	32	6
Unsafe lane deviation	113	9	91	8	89	7	27	5
Vehicle operator fail/wear seat belt	125	10	99	8	70	6	24	5

Speeds with Division of State Patrol on Scene

39/90 IMPROVING a gateway to Wisconsin

Average speeds drop about 5 mph when the DSP was monitoring speeds on NB I-39/90 near the Rock River at ~8:30 AM





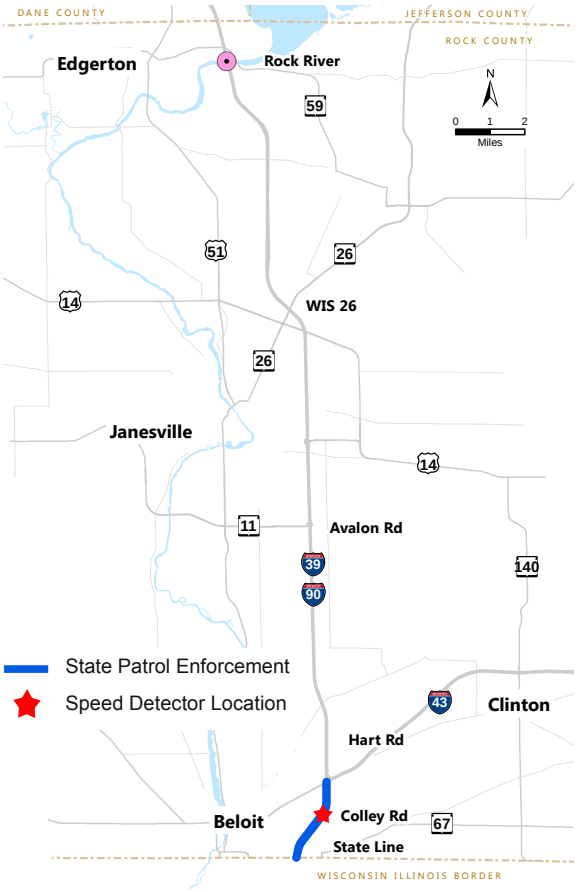
- Each dot is an average 1-minute speed

- Red line is the average of 15-minutes

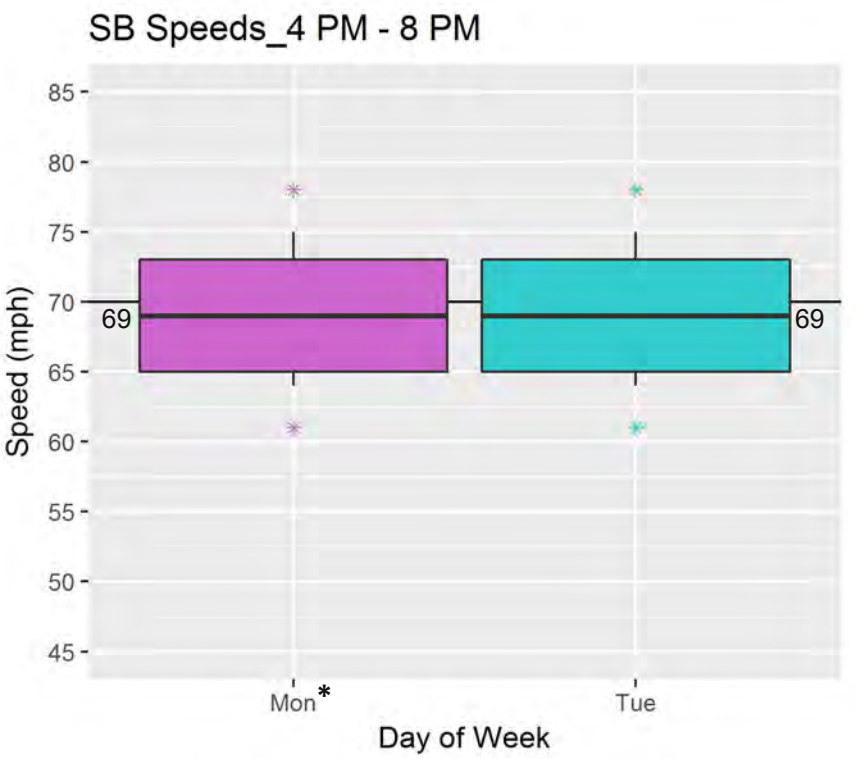
Attachment 1

U.S. Department of Transportation
Federal Highway Administration

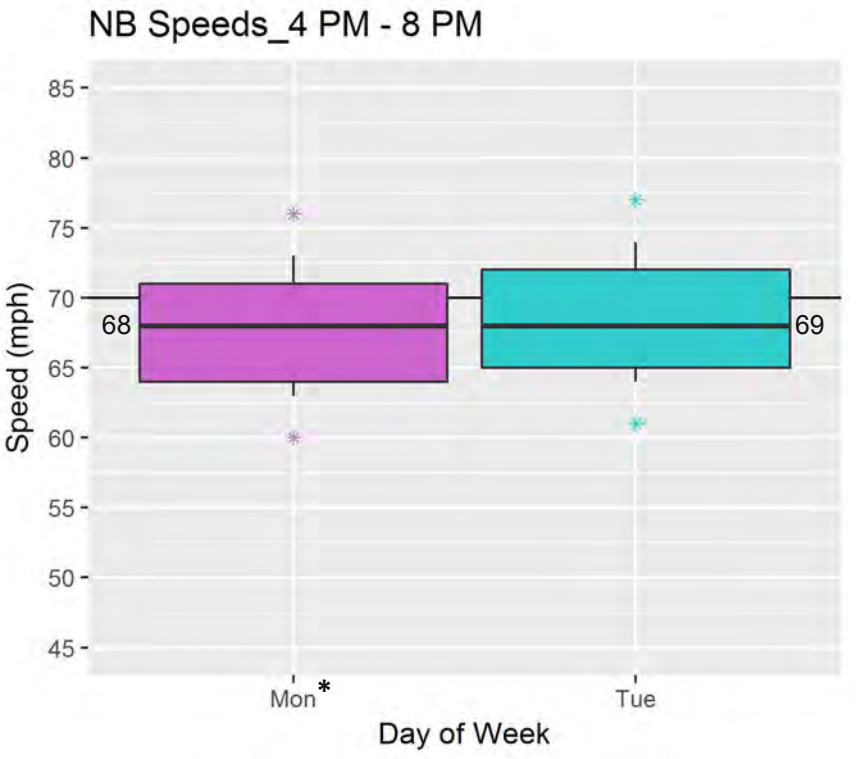
I-39/90 Speed Comparison_State Patrol Enforcement



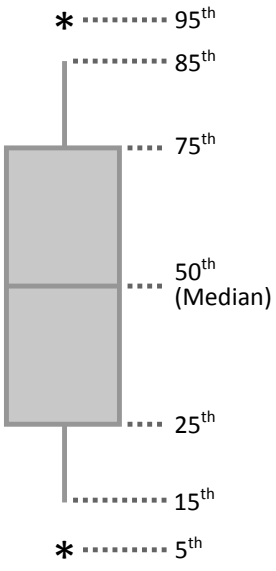
SB I-39/90



NB I-39/90



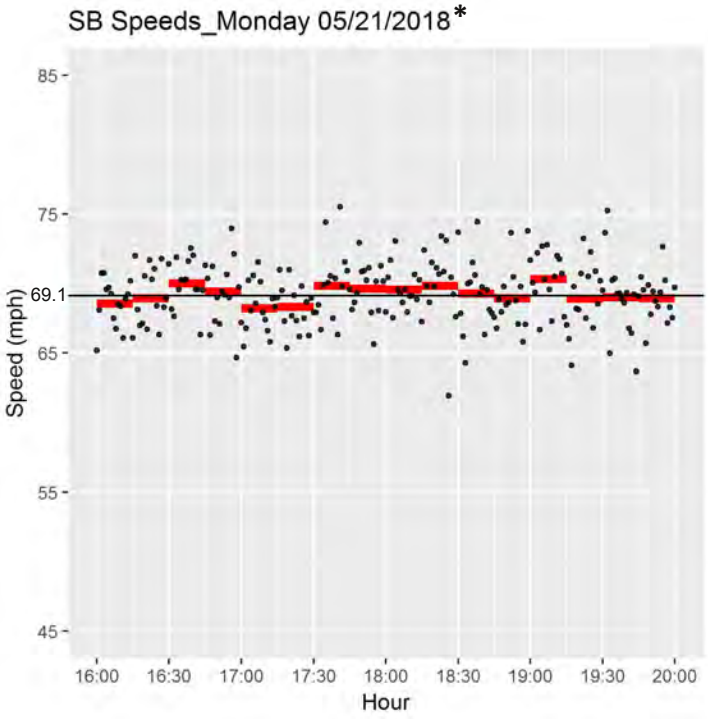
Percentile Speeds

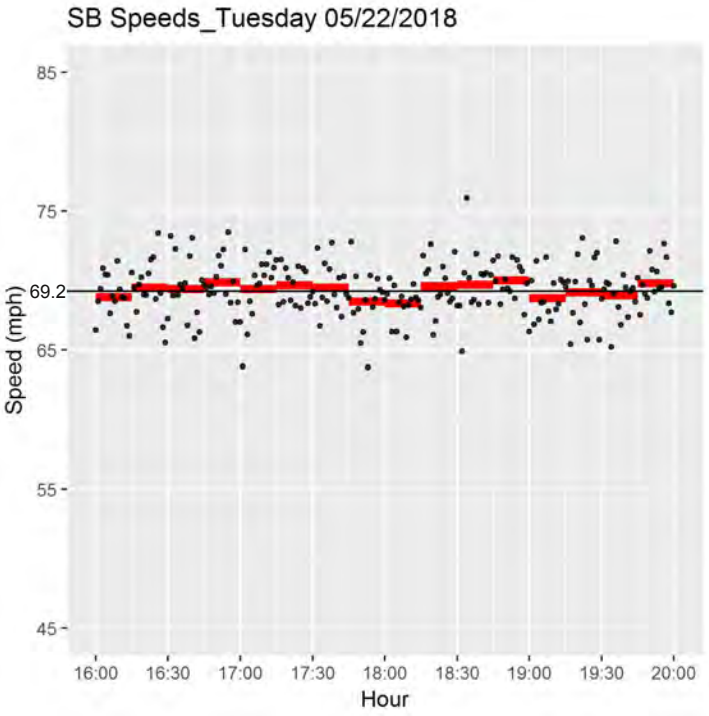


*** State Patrol ran an enforcement patrol for four hours (4PM - 8PM)**

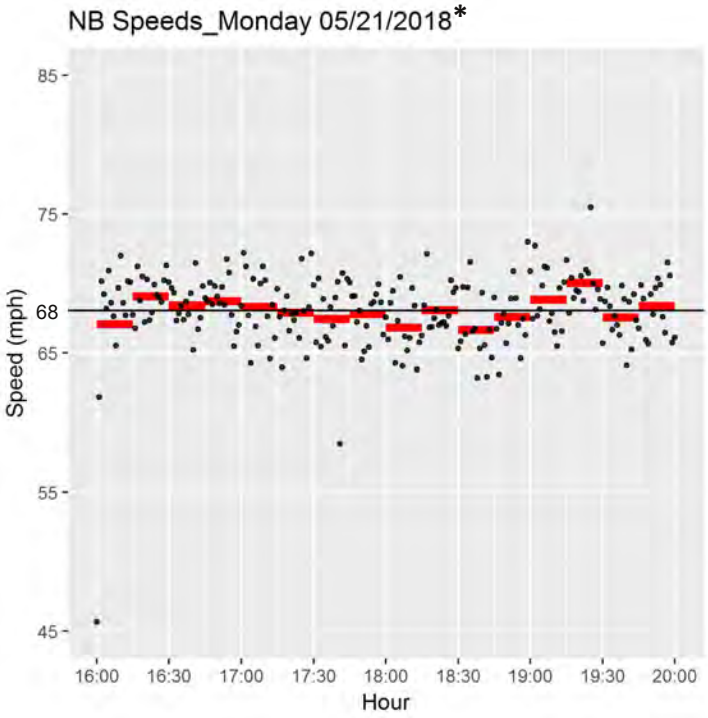
I-39/90 Speed Comparison_State Patrol Enforcement

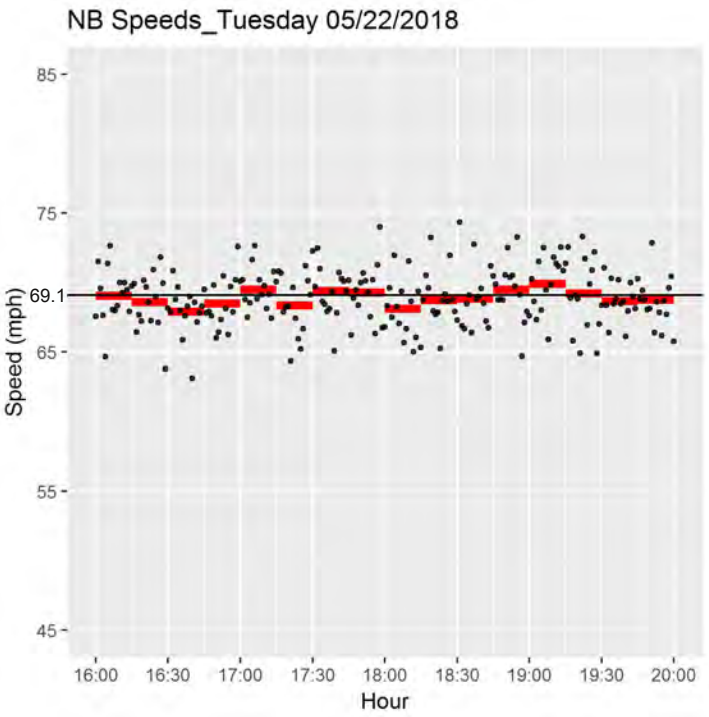
SB I-39/90





NB I-39/90





* **State Patrol ran an enforcement patrol for four hours (4PM - 8PM)**

- Each dot is the average of 1-minute speeds
- Each red line is the average of 15-minute speeds

Work Zone Configuration

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July

Study Dates: July 11th – 17th

August - October

Study Dates: Aug 25th – Sep 3th, Oct 18th – Nov 1st

- Different Speed Limits
- Same lane widths
- Same speed detector locations

U.S. Department of Transportation Federal Highway Administration

Attachment 3-1

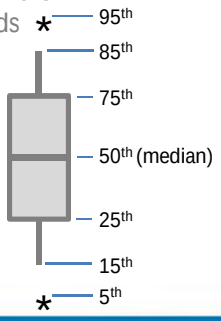
SB – Rock River – Speeds by Day of Week

39/90 IMPROVING a gateway to Wisconsin

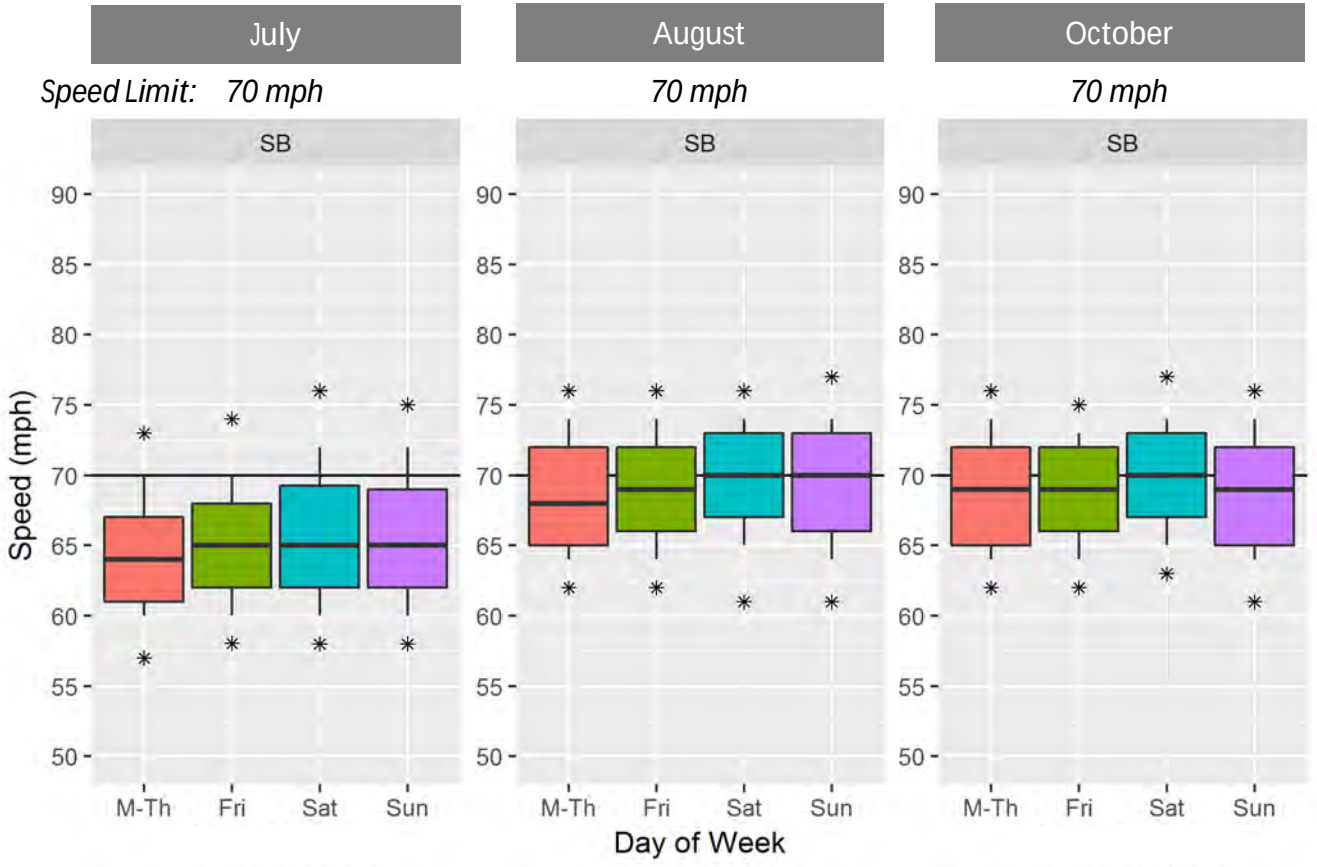
Cross Section

Data includes:
- All days during ~1 week
- Hours 6 am – 6 pm
- Speed recorded in 1-minute bins
- Uncongested times

Percentile Speeds



- Speeds about 5 mph slower in July



	July				August				October			
	M-Th	Fri	Sat	Sun	M-Th	Fri	Sat	Sun	M-Th	Fri	Sat	Sun
50th Percentile	64	65	65	65	68	69	70	70	69	69	70	69

U.S. Department of Transportation Federal Highway Administration

Attachment 3-2

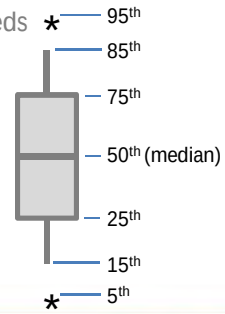
NB – Rock River – Speeds by Day of Week

39/90 IMPROVING a gateway to Wisconsin

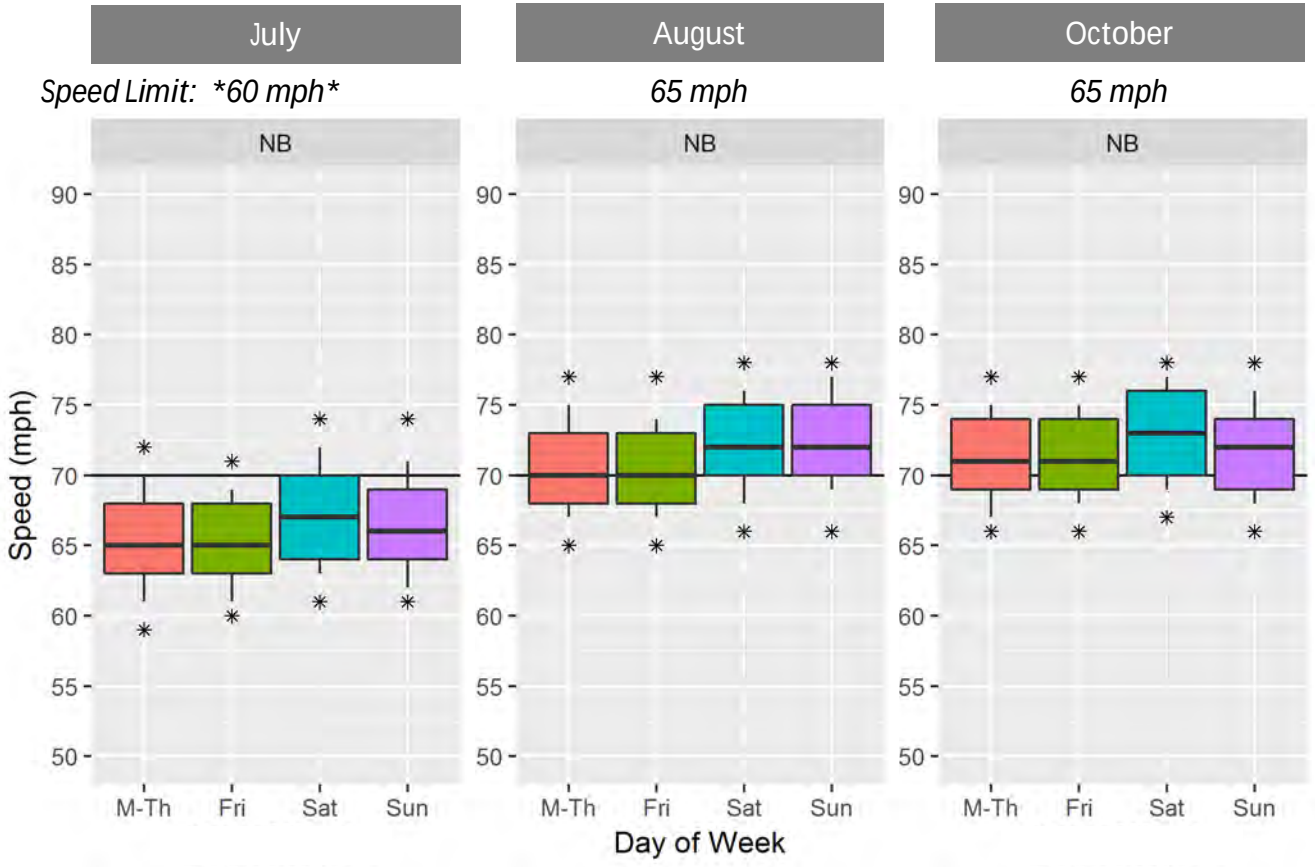
Cross Section

Data includes:
- All days during ~1 week
- Hours 6 am – 6 pm
- Speed recorded in 1-minute bins
- Uncongested times

Percentile Speeds



- Speeds about 5 mph slower in July



	July				August				October			
	M-Th	Fri	Sat	Sun	M-Th	Fri	Sat	Sun	M-Th	Fri	Sat	Sun
50th Percentile	65	65	67	66	70	70	72	72	71	71	73	72

U.S. Department of Transportation Federal Highway Administration

Attachment 3-3

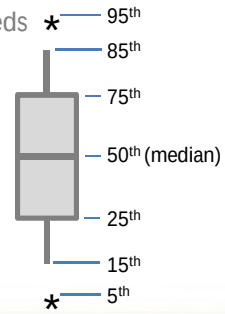
SB – Saunders Creek – Speeds by Day of Week

39/90 IMPROVING a gateway to Wisconsin

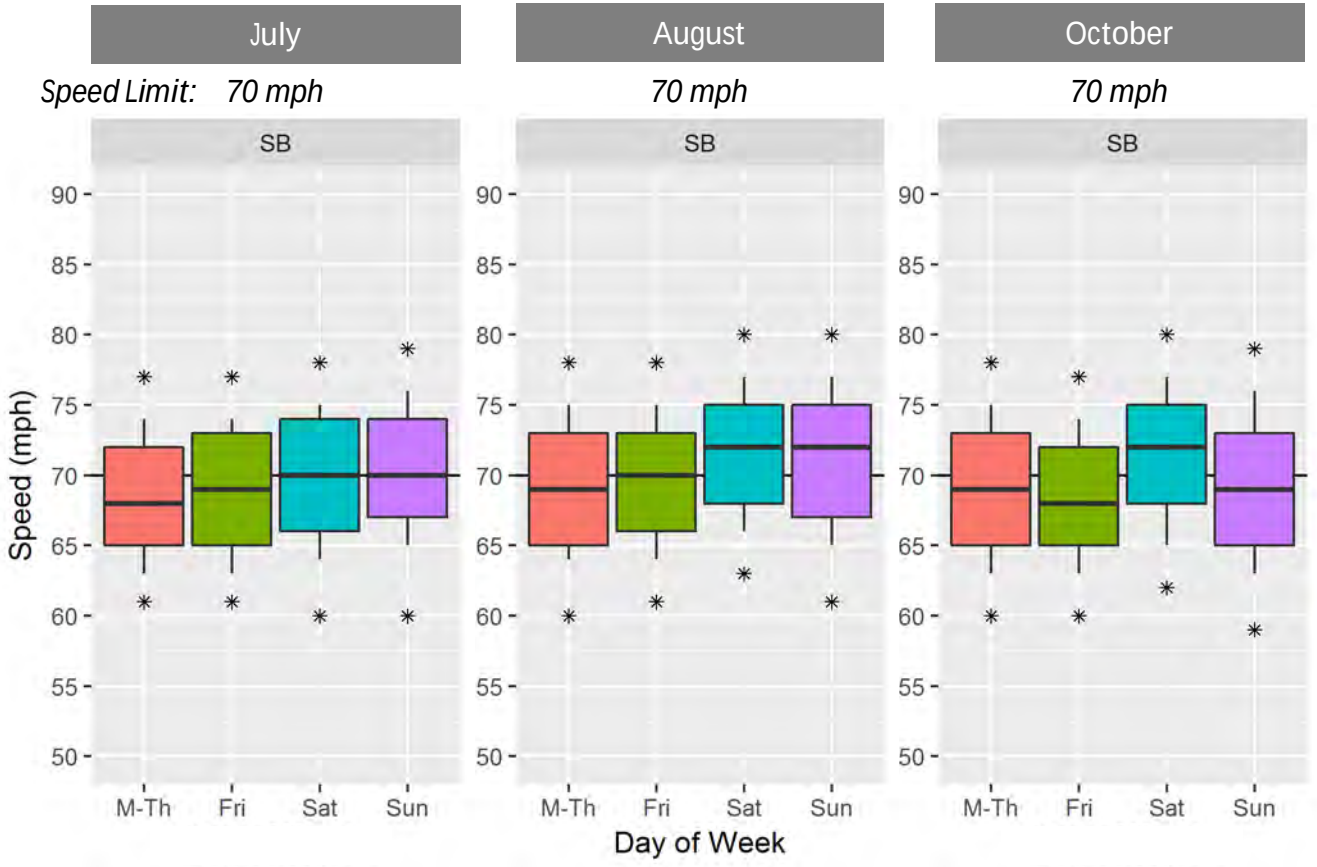
Cross Section

Data includes:
- All days during ~1 week
- Hours 6 am – 6 pm
- Speed recorded by individual vehicles
- Uncongested times

Percentile Speeds



- Speeds about the same July though Oct



	July				August				October			
	M-Th	Fri	Sat	Sun	M-Th	Fri	Sat	Sun	M-Th	Fri	Sat	Sun
50th Percentile	68	69	70	70	69	70	72	72	69	68	72	69

Attachment 3-4

NB – Saunders Creek – Speeds by Day of Week

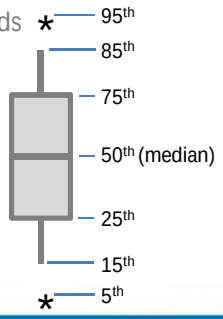
39/90 IMPROVING a gateway to Wisconsin

Location

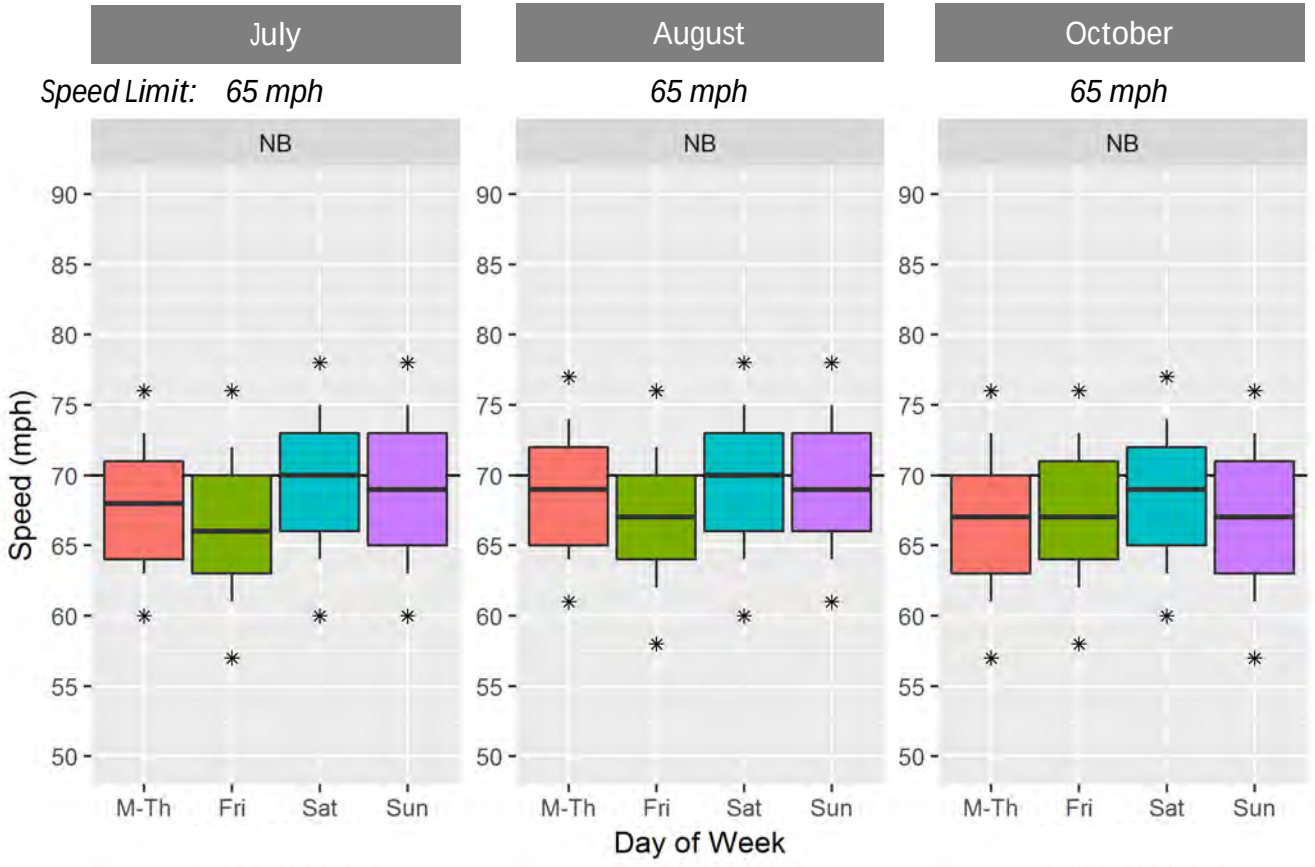
Cross Section

Data includes:
- All days during ~1 week
- Hours 6 am – 6 pm
- Speed recorded by individual vehicles
- Uncongested times

Percentile Speeds



- Speeds about the same July though Oct



	July				August				October			
	M-Th	Fri	Sat	Sun	M-Th	Fri	Sat	Sun	M-Th	Fri	Sat	Sun
50th Percentile	68	66	70	69	69	67	70	69	67	67	69	67

U.S. Department of Transportation Federal Highway Administration

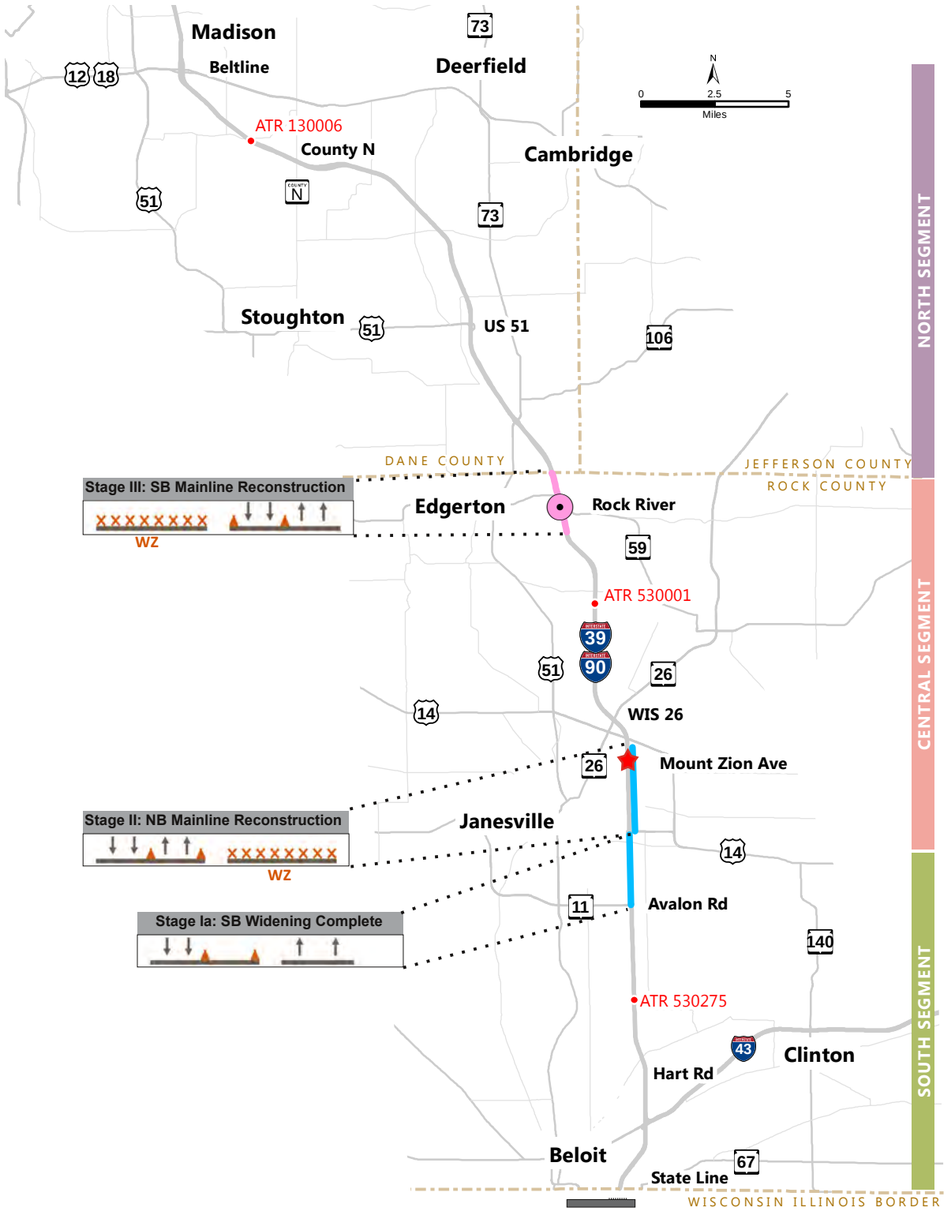
Attachment 3-5

Traffic Performance Summary

January 2018

WisDOT ID 1001-01-02

Project Work Zone Configuration



Begin Construction Year: 2016, 2017

Interchange (colored by year); Bridge (colored by year)

Speed Detector Location

Traffic Operations and Crashes

Traffic Volume Data

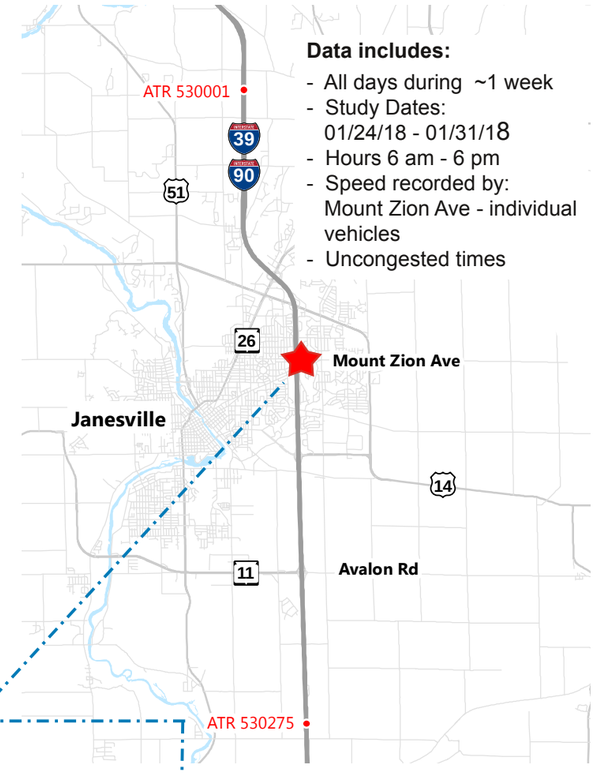
ATR	Average Daily Volume	Maximum Daily Volume	Maximum Hourly Volume
January 2018			
130006	46,364	56,110	4,711
530001	38,513	49,911	4,462
530275	44,459	53,610	4,507
January 2017			
130006	-	-	-
530001	41,087	51,203	4,380
530275	-	-	-
-No January 2017 Data			

Crash Data

Location	# of Crashes	Crash Severity K	A	B	C	PDO	Collision Type Rear	Ice/ Snow/ Wet
January 2018								
I-39/90 Corridor	50	1	---	6	9	34	5	28
I-39/90 Work-Zone Only	15	---	---	3	3	9	2	8
January 2017								
I-39/90 Corridor	81	1	---	13	14	53	13	41
I-39/90 Work-Zone Only	18	---	---	3	5	10	2	9

Speed Profiles

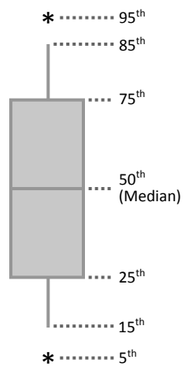
Box plots demonstrate speed percentiles along I-39/90 at Mount Zion Avenue in each direction. 50% of the data is within the box, and is a good indicator of the spread of data.



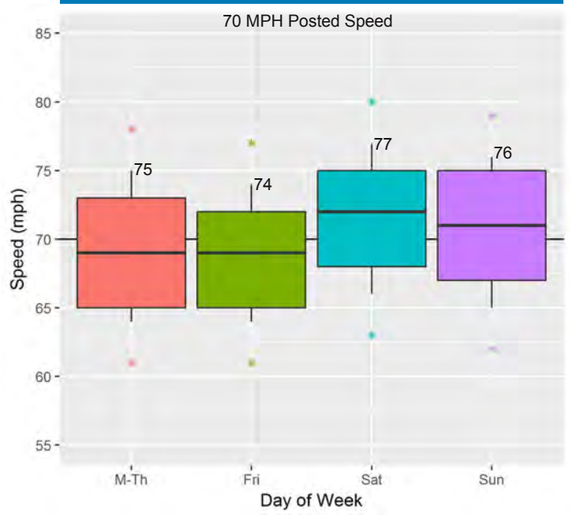
Data includes:

- All days during ~1 week
- Study Dates: 01/24/18 - 01/31/18
- Hours 6 am - 6 pm
- Speed recorded by: Mount Zion Ave - individual vehicles
- Uncongested times

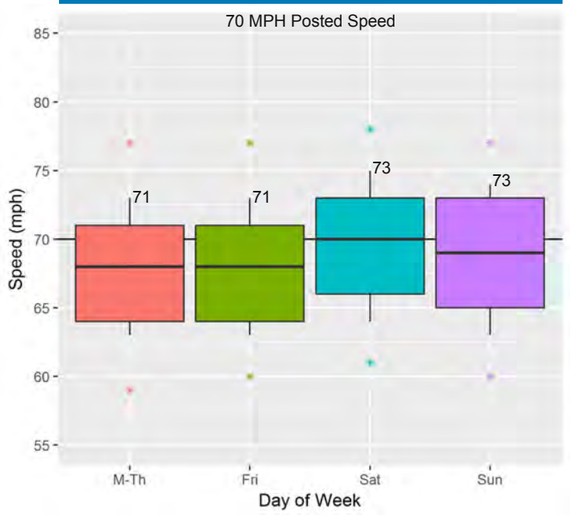
Percentile Speeds



Mount Zion Ave - SB



Mount Zion Ave - NB

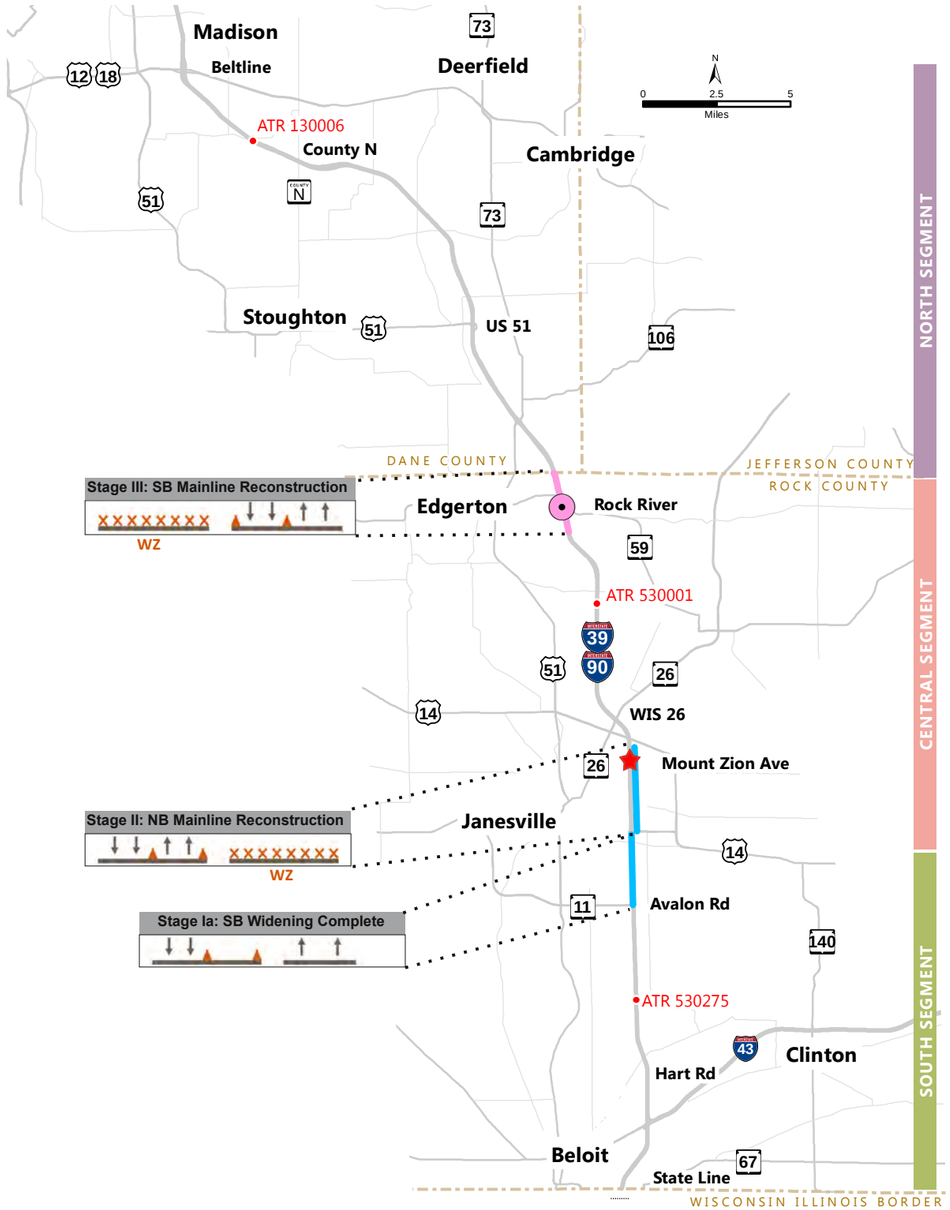


Attachment 4-1

Traffic Performance Summary

February 2018
WisDOT ID 1001-01-02

Project Work Zone Configuration



Begin Construction Year: 2016, 2017
Interchange (colored by year)
Bridge (colored by year)
Speed Detector Location

Traffic Operations and Crashes

Traffic Volume Data

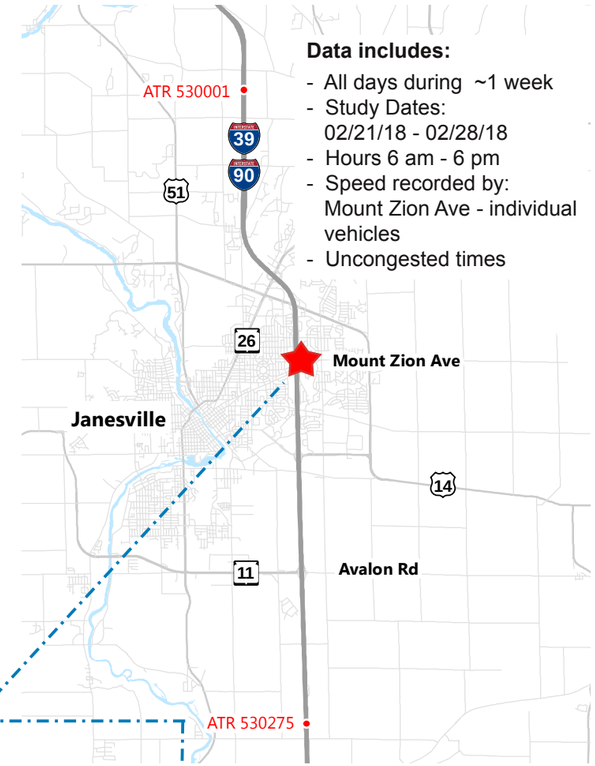
ATR	Average Daily Volume	Maximum Daily Volume	Maximum Hourly Volume
February 2018			
130006	47,643	63,884	5,302
530001	42,149	56,912	4,602
530275	45,180	60,374	4,908
January 2018			
130006	46,364	56,110	4,711
530001	38,513	49,911	4,462
530275	44,459	53,610	4,507

Crash Data

Location	# of Crashes	Crash Severity K	A	B	C	PDO	Collision Type Rear	Ice/ Snow/ Wet
February 2018								
I-39/90 Corridor	80	---	1	10	7	62	19	49
I-39/90 Work-Zone Only	32	---	1	5	2	24	5	18
January 2018								
I-39/90 Corridor	50	1	---	6	9	34	5	28
I-39/90 Work-Zone Only	15	---	---	3	3	9	2	8

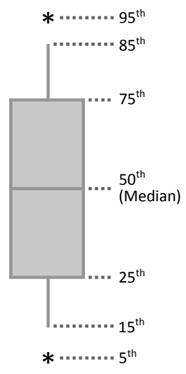
Speed Profiles

Box plots demonstrate speed percentiles along I-39/90 at Mount Zion Avenue in each direction. 50% of the data is within the box, and is a good indicator of the spread of data.

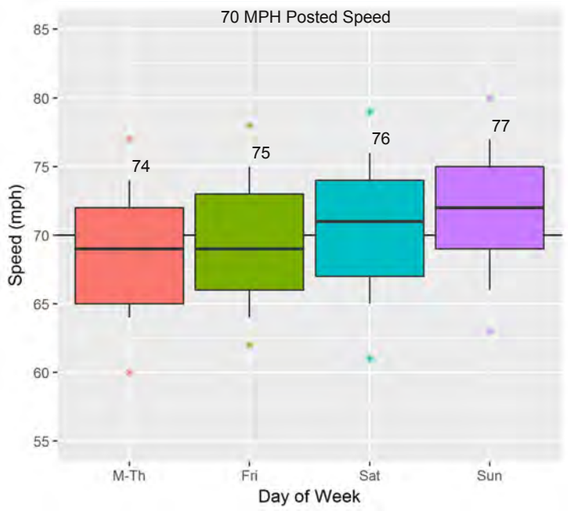


Data includes:
- All days during ~1 week
- Study Dates: 02/21/18 - 02/28/18
- Hours 6 am - 6 pm
- Speed recorded by: Mount Zion Ave - individual vehicles
- Uncongested times

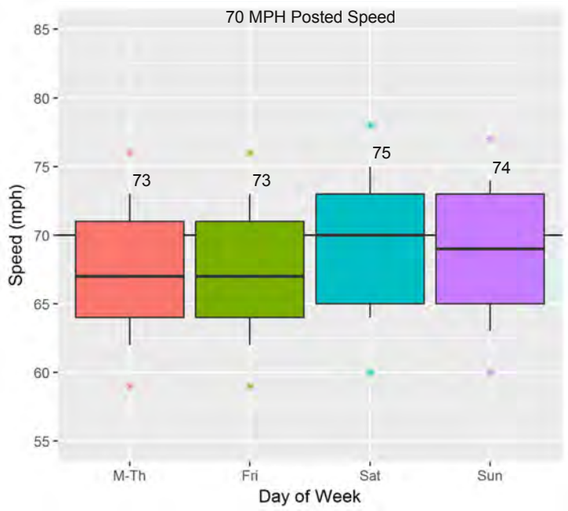
Percentile Speeds



Mount Zion Ave - SB



Mount Zion Ave - NB

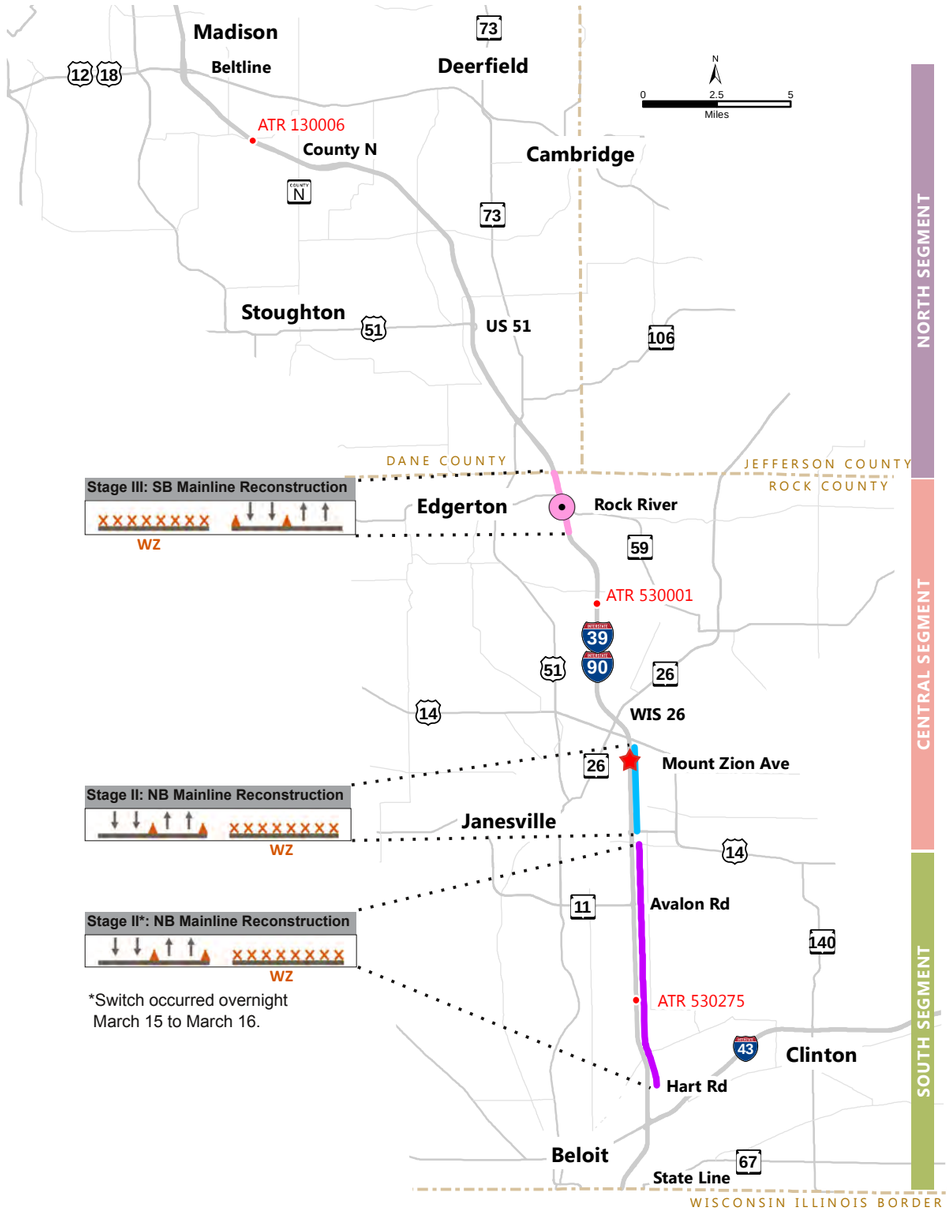


Attachment 4-2

Traffic Performance Summary

March 2018
WisDOT ID 1001-01-02

Project Work Zone Configuration



Traffic Operations and Crashes

Traffic Volume Data

ATR	Average Daily Volume	Maximum Daily Volume	Maximum Hourly Volume
March 2018			
130006	54,401	70,453	5,618
530001	47,881	61,374	4,943
530275	51,384	64,561	4,779
February 2018			
130006	47,643	63,884	5,302
530001	42,149	56,912	4,602
530275	45,180	60,374	4,908

Crash Data

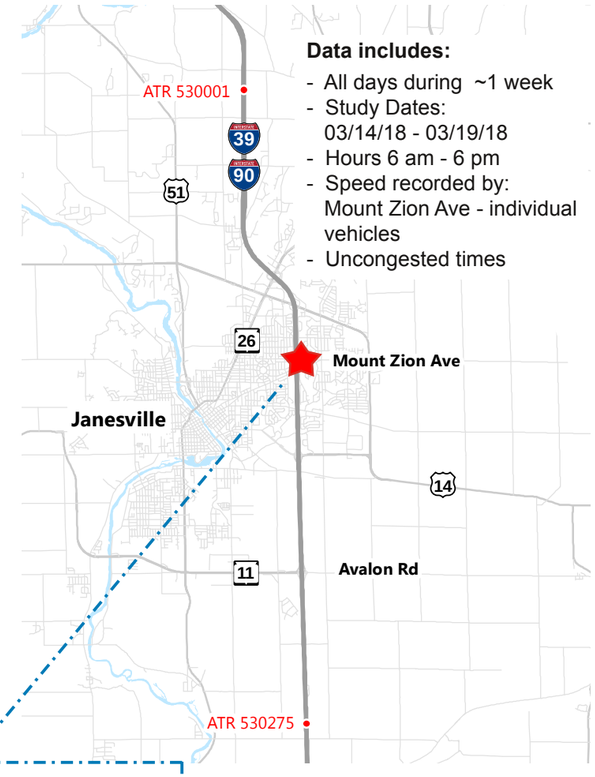
Location	# of Crashes	Crash Severity K	A	B	C	PDO	Collision Type Rear	Ice/ Snow/ Wet
March 2018								
I-39/90 Corridor	26	---	---	2	3	21	7	3
I-39/90 Work-Zone Only	18	---	---	2	2	14	6	1
February 2018								
I-39/90 Corridor	80	---	1	10	7	62	19	49
I-39/90 Work-Zone Only	32	---	1	5	2	24	5	18

Diversion Data

Date	Direction	Route	Volume	Cause
March 16	NB	CTH G	100	Ramp closure
March 23	SB	CTH G	125	Crash

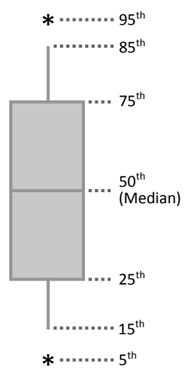
Speed Profiles

Box plots demonstrate speed percentiles along I-39/90 at Mount Zion Avenue in each direction. 50% of the data is within the box, and is a good indicator of the spread of data.

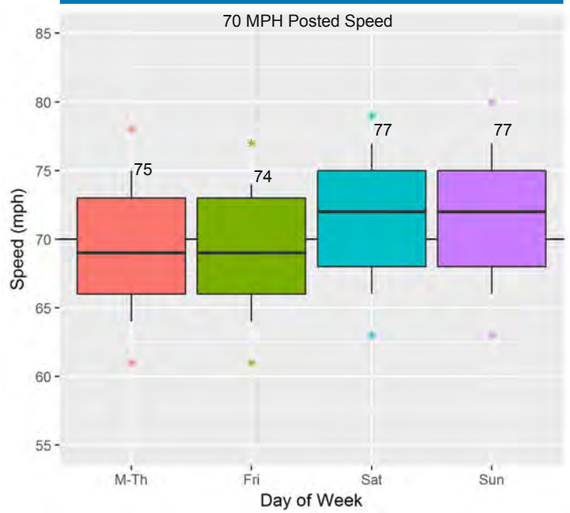


Data includes:
- All days during ~1 week
- Study Dates: 03/14/18 - 03/19/18
- Hours 6 am - 6 pm
- Speed recorded by: Mount Zion Ave - individual vehicles
- Uncongested times

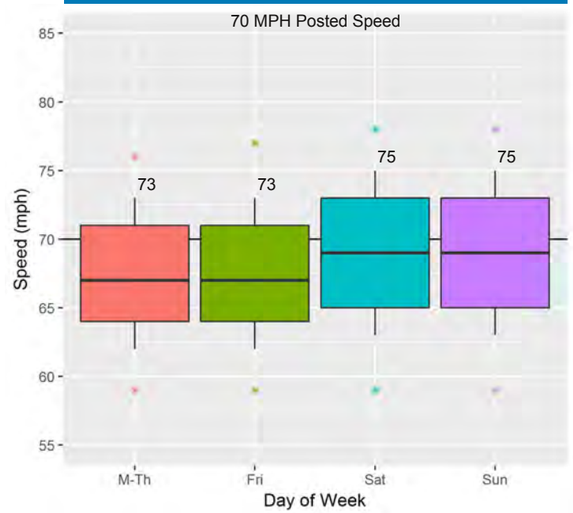
Percentile Speeds



Mount Zion Ave - SB



Mount Zion Ave - NB

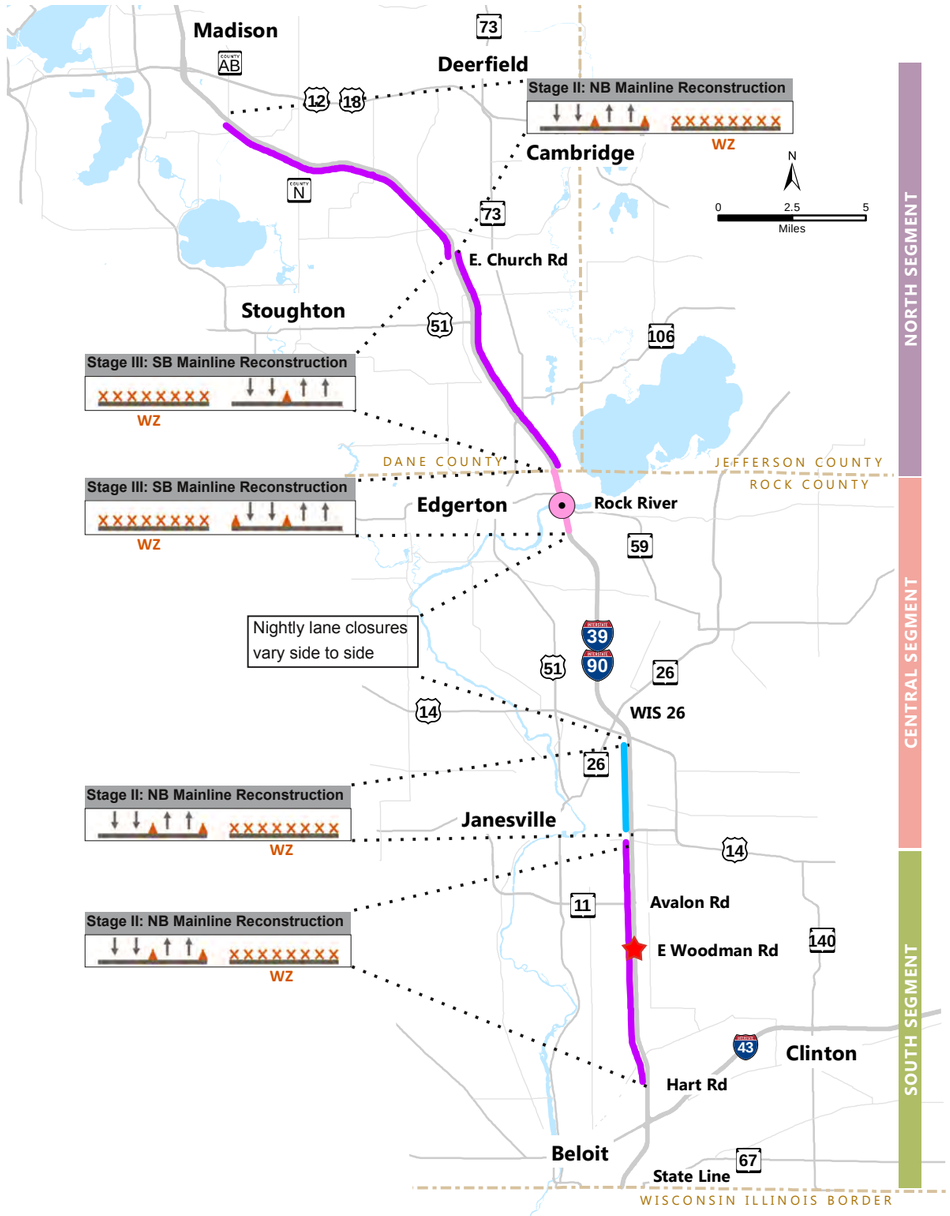


Attachment 4-3

Traffic Performance Summary

April 2018
WisDOT ID 1001-01-02

Project Work Zone Configuration



Traffic Operations and Crashes

Traffic Volume Data

ATR	Average Daily Volume	Maximum Daily Volume	Maximum Hourly Volume
April2018			
130006	54,842	68,812	5,342
530001	53,408	75,171	5,053
530275*	52,758	64,091	4,890
March2018			
130006	54,401	70,453	5,618
530001	47,881	61,374	4,943
530275	51,384	64,561	4,779

*Two weeks of data missing due to ATR vs Armadillo test

Crash Data

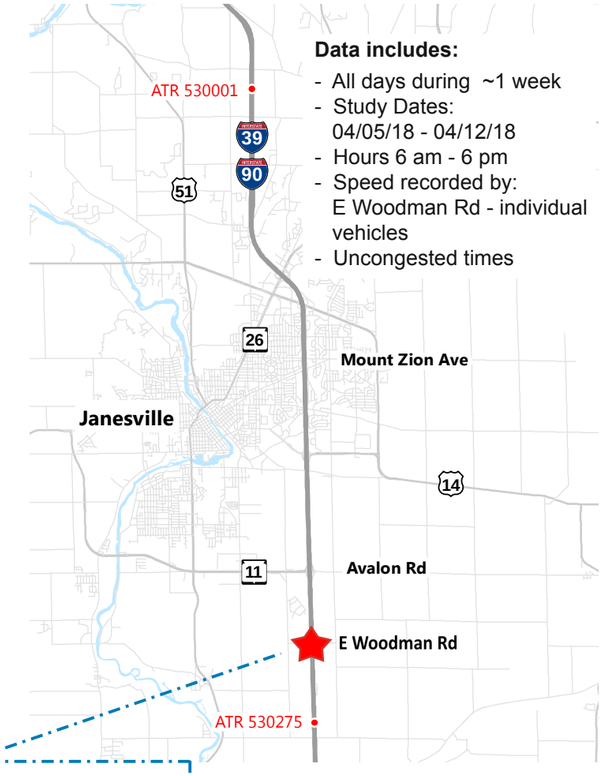
Location	# of Crashes	Crash Severity K	A	B	C	PDO	Collision Type Rear	Ice/ Snow/ Wet
April 2018								
I-39/90 Corridor	63	---	1	6	10	46	17	18
I-39/90 Work-Zone Only	41	---	---	2	8	31	13	12
March2018								
I-39/90 Corridor	26	---	---	2	3	21	7	3
I-39/90 Work-Zone Only	18	---	---	2	2	14	6	1
February 2018								
I-39/90 Corridor	80	---	1	10	7	62	19	49
I-39/90 Work-Zone Only	32	---	1	5	2	24	5	18

Diversion Data

Date	Direction	Route	Volume	Cause
April 12	NB	CTH G	750	Crash –over 4 hrs of diversion
April 13	SB	STH 73	250	Crash
April 23	NB	STH 73	150	Crash

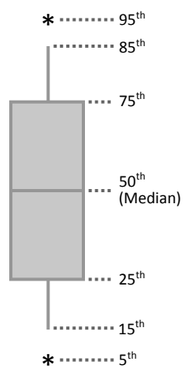
Speed Profiles

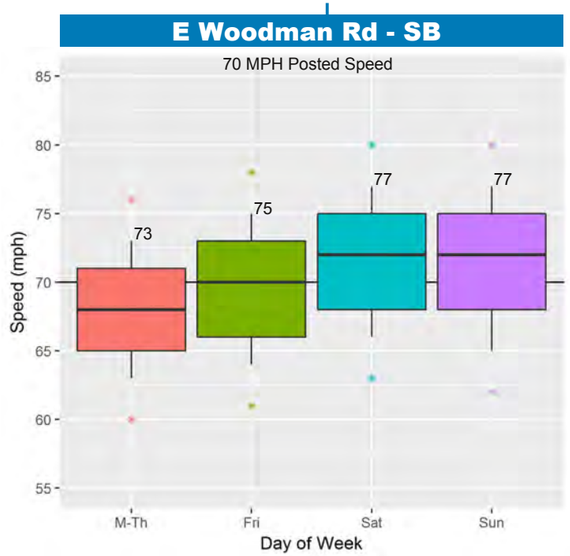
Box plots demonstrate speed percentiles along I-39/90 at E Woodman Road in each direction. 50% of the data is within the box, and is a good indicator of the spread of data.

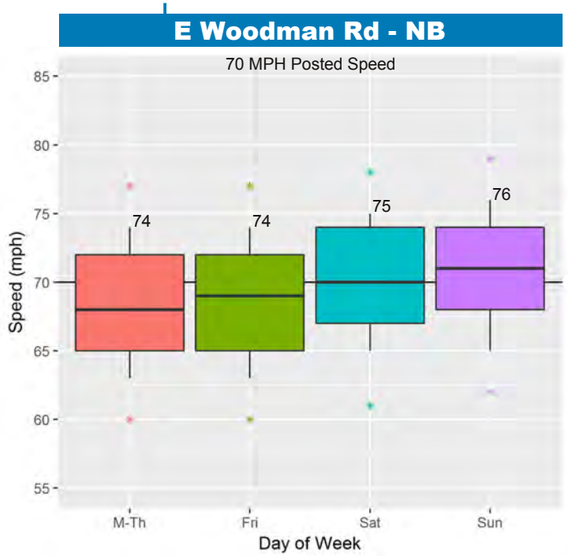


Data includes:
- All days during ~1 week
- Study Dates: 04/05/18 - 04/12/18
- Hours 6 am - 6 pm
- Speed recorded by: E Woodman Rd - individual vehicles
- Uncongested times

Percentile Speeds







Attachment 4-4