TO: Kerry Wilcoxon
FROM: TSMO – SAFETY GROUP
PREPARER: Sumera Kayani
CC: Saroja Devarakonda
DATE: 1/22/21
Project Name: Safety Corridor Analysis

Purpose

Four safety corridors have been in place on Arizona freeways since early 2017. The original intent of the Safety Corridor Project was to reduce fatal and serious injury crashes due to speed, impairment and other behavioral factors through driver education using both static and dynamic (driver speed feedback) signs. This memo provides an update on the effectiveness of the corridors in reducing crashes of all severities and vehicle speeds. The memo concludes with a recommendation for the future deployment and use of the safety corridors.

Overview and Recommendations
Across all four safety corridors, fatal and serious crashes have decreased while total, speed, and behavior related crashes have increased. Some of increase in crashes may be attributed to increases in volumes in the valley in recent years however this memo did not look at volume changes. Average speeds and 85% percentile from speed feedback signs were within 3- 8 mph in all segments. There is no comparable data for speeds on the corridors prior to installation of speed feedback signs. While overall crashes have increased and there does not appear to be a demonstrable effect on speeds, the corridors do seem to have fulfilled their primary task of reducing fatal and serious injury crashes. With this being said the effectiveness and the utility of the corridors including both the static and dynamic signs have likely diminished as the signs have faded into the normal driving background. Based on this and the fact that removing the signs is costly, we recommend the following:

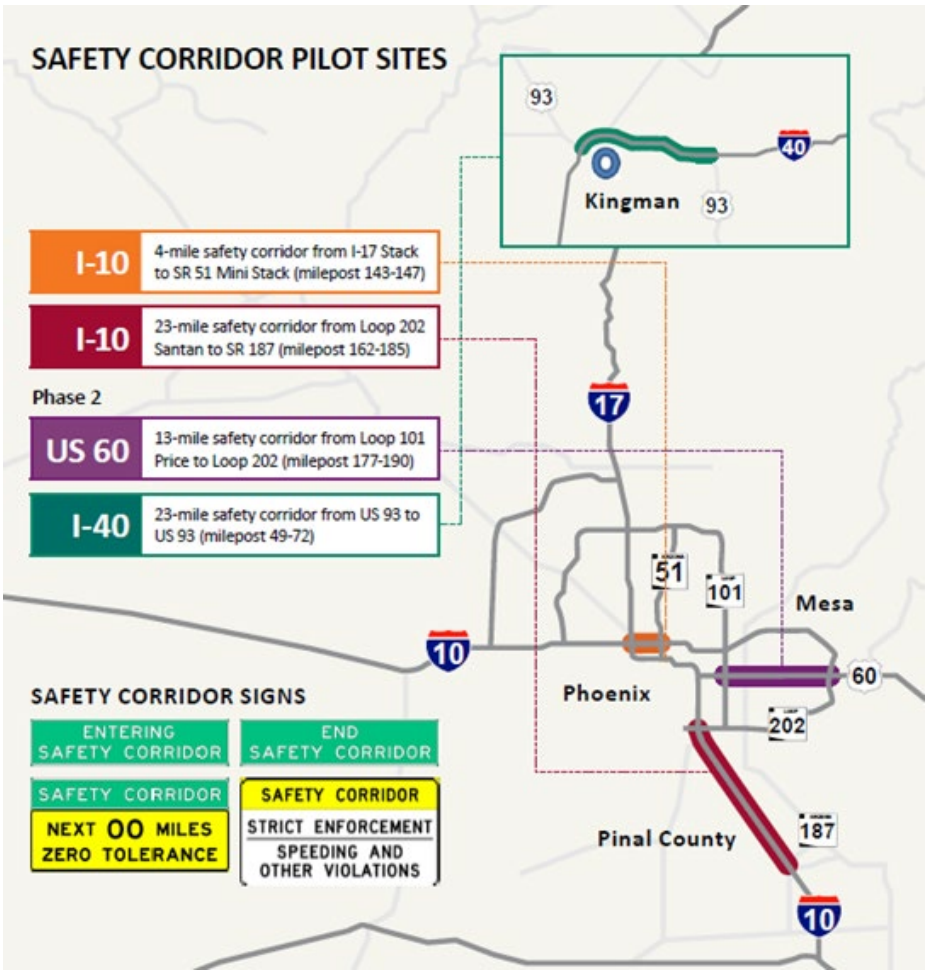
1. Static Signs – remove over time as they are knocked down or until the next major road project on each of the four corridors
2. Driver Speed Feedback Signs – signs were paid for using HSIP funds and should be left in place through the end of life cycle or until knockdown.

Project Background

Focusing on special driver education and increased highway patrol enforcement, ADOT launched the Safety Corridor Program as a pilot project. As part of the program, ADOT implemented four safety corridors on state maintained highway segments in December, 2016

and January, 2017 on a pilot basis. Two of the corridors are located at urban locations (I-10 MP 143-147 and US-60 MP 177-190) and two at rural locations (I-10 MP162-185 and I-40 MP 49-72). See figure 1. Using special signs, targeted public outreach, and increased enforcement; the intent was to reduce fatal and severe injury crashes and driver behavior related crashes on these four freeway segments. The Safety Corridor Program is a joint effort by ADOT, Department of Public Safety, and the Governor's Office of Highway Safety. Segments were ranked by the number of serious crashes involving speed and aggressive driving, impaired driving, and lack of seat belt use.

Figure 1. Safety Corridor Location Map and Signs



Before and After Crash Data for Safety Corridors

Crash Period

Before: 2-years 1/1/2015 thru 12/31/2016
After: 3-years: 2/1/17 thru 1/31/20
Crash data source: Arizona crash information system (ACIS) Queries

Crash data from before and after the signs placement was compared in three categories. Total crashes, speeding crashes and impairment crashes along all corridors. The crash rate was calculated using AADT from ADOT's multimodal planning website. Table 1 and 2 respectively show before and after crash data and crash rate.

Table 1. Before and After Crash Data

CORRIDOR	2015-2016	2017-2020	BEFORE (2015,2016)	AFTER (2017-2020)	BEFORE (2015,2016)	AFTER (2017-2020)	BEFORE (2015,2016)	AFTER (2017-2020)	BEFORE (2015,2016)	AFTER(2017-2020)	BEFORE (2015,2016)	AFTER(2017-2020)
	BEFORE TOTAL CRASHES	AFTER TOTAL CRASHES	AVG. TOTAL CRASHES	AVG. TOTAL CRASHES	AVG. SPEEDING CRASHES	AVG. SPEEDING CRASHES	AVG. IMPAIRMENT CRASHES	AVG. IMPAIRMENT CRASHES	BEFORE K+A	AFTER K+A	AVG. (K+A) CRASHES	AVG. (K+A) CRASHES
I-10 EB MP 143-147	1918	2885	959	962	637	631	13	14	17	18	9	6
I-10 WB MP 143-147	1387	2342	694	781	419	460	10	13	14	10	7	3
(Before - After)	-1922		-90		-35		-4		3		7	
I-10 EB MP 162-185	328	537	164	179	92	93	5	8	13	13	7	4
I-10 WB MP 162-185	358	736	179	245	88	150	5	7	15	20	8	7
(Before - After)	-587		-81		-63		-5		-5		4	
I-40 EB MP 49-72	106	206	53	69	16	20	0	1	5	11	3	4
I-40 WB MP 49-72	120	168	60	56	31	21	1	1	8	11	4	4
(Before - After)	-148		-12		6		-1		-9		-1	
US-60 EB MP 177-190	1047	1578	524	526	339	321	11	20	24	22	12	7
US-60 WB MP 177-190	1147	1765	574	588	359	384	12	9	23	24	12	8
(Before - After)	-1149		-16		-7		-6		1		9	
All Corridors (Before - After)	-3806		-199		-99		-16		-10		19	

Table 2. Before and after Crash Rate (Crashes/MEV)

CORRIDOR	BEFORE (2015,2016)	BEFORE (2015,2016)	AFTER (2017-2020)	AFTER (2017-2020)
	CRASH RATE(CRASHES/MEV)	AVG. CRASH RATE(CRASHES/MVM) BOTH DIRECTIONS	CRASH RATE(CRASHES/MEV)	AVG. CRASH RATE(CRASHES/MVM) BOTH DIRECTIONS
I-10 EB MP 143-147	5.34	4.55	4.84	4.82
I-10 WB MP 143-147	3.76		4.80	
(Before - After)		-0.27		
I-10 EB MP 162-185	0.60	0.62	0.57	0.76
I-10 WB MP 162-185	0.64		0.95	
(Before - After)		**-0.14**		
I-40 EB MP 49-72	0.56	0.60	0.61	0.59
I-40 WB MP 49-72	0.64		0.56	
(Before - After)		**0.02**		
US-60 EB MP 177-190	1.56	1.53	0.96	1.20
US-60 WB MP 177-190	1.50		1.43	
(Before - After)		**0.34**		

Crash observations for After Period compare to Before Period

I-10 MP 143- 147 Urban

- Total crashes increased by average of 0.3% in the EB direction and 12.5% in the WB direction.
- Speeding crashes increased by an average of 0.9 in the EB direction and 9.8 in the WB direction.
- Behavioral crashes increased by an average of 7.7% in the EB direction and by 30% in the WB direction.
- Fatal and serious injury crashes decreased by average of 33.3% in the EB direction and 57.1% in the WB direction.
- Average crash rates increased from 4.55 crashes/100MAADT to 4.82 crashes/100MAADT

US 60 MP 177-190 Urban

- Total crashes increased by average of 0.4% in the EB direction and 2.4% in the WB direction.
- Speeding crashes decreased by an average of 5.3% in the EB direction and increased 7% in the WB direction.
- Behavioral crashes increased by an average of 81.8%in the EB direction and decreased by 25% in the WB direction.
- Fatal and serious injury crashes decreased by average of 41.7% in the EB direction and 33.3% in the WB direction.
- Average crash rates decreased from 1.53 crashes/100MAADT to 1.20 crashes/100MAADT

I-10 MP 162-185 Rural

- Total crashes increased by average of 9.1% in the EB direction and 36.9% in the WB direction.
- Speeding crashes increased by an average of 1.1% in the EB direction and 70.5% in the WB direction.
- Behavioral crashes increased by an average of 60% in the EB direction and by 40% in the WB direction.
- Fatal and serious injury crashes decreased by average of 42.9% in the EB direction and 12.5% in the WB direction.
- Average crash rates increased from 0.62 crashes/100MAADT to 0.76 crashes/100MAADT

I-40 MP 49-72 Rural

- Total crashes increased by average of 30.2% in the EB direction and decreased by 6.7% in the WB direction.
- Speeding crashes increased by an average of 25% in the EB direction and decreased by an average of 32.3% in the WB direction.
- Behavioral crashes increased by an average of 1 in the EB direction and no changes were observed in the WB direction.

- Fatal and serious injury crashes increased by average of 33.3% in the EB direction and average remained the same in the WB direction.
- Average crash rates decreased from 0.60 crashes/100MAADT to 0.59 crashes/100MAADT

Crash Comparison Summary:

Fatal and serious injury crashes went down in all urban and one of the rural segments and went slightly up in one of the rural segment, while total, and behavioral crashes went up in all four corridors. Speeding crashes went down in one of the rural corridor and went up in all other three corridors. We looked at the crashes on the rest of highways and it seems that trends are similar to the selected corridors. Overall the total numbers of crashes on the selected state highways have gone up while fatal and serious injury crashes have gone down which is in par with the corridors.

Speed Data

Average speed and 85th percentile was obtained from speed feedback signs along the safety corridor for the last three months is shown in the appendix. More than three months of data cannot be obtained at this time due to vendor having technical difficulties.

I-10 MP 143- 147 Urban
Posted Speed 65 mph

- The average speeds went down by an average of 2 mph than posted speed.
- The 85% percentile went up by an average of 8 mph than the posted speed.

US 60 MP 177-190 Urban
Posted Speed 65 mph

- The average speeds went up by an average of 3 mph than posted speed.
- The 85% percentile went up by an average of 9 mph than posted speed.

I-10 MP 162-185 Rural
Posted Speed 65-75 mph

- The average speeds went down by an average of 3 mph than the posted speed.
- The 85% percentile went up by an average of 4 mph than posted speed.

I-40 MP 49-72 Rural
Posted Speed 75 mph

- The average speeds went down by an average of 3 mph than posted speed.
- The 85% percentile speed went up by an average of 4 mph than the posted speed.

Speed Data Summary:

Based on the three month speed data the average speeds went down in all corridors except one of the urban corridor compare to posted speeds. Meanwhile the 85% percentile speeds went up in all urban and rural corridors.

Moving Forward:
Assuming no additional enforcement resources can be deployed to possibly improve the effectiveness of the Safety Corridor Program; there are four possible options for moving forward with the corridors.

Option 1 – Status Quo – Under this option, the corridors including static and driver speed feedback signs would remain in place where they are today. As signs are damaged or destroyed, they are repaired or replaced. This effort continues indefinitely. There is limited cost to this option however, the signs have likely lost their effectiveness and will be less so over time. Permanent signs will add to the freeway visual clutter and the effectiveness of messaging here and elsewhere along the state highway system may decrease since there is no additional active enforcement.

Option 2 – Status Quo with Gradual Removal - Under this option, the corridors including static and driver speed feedback signs would remain in place but not be replaced when damaged or knocked down and eventually removed altogether during the next scheduled major freeway work on individual corridors. Since the dynamic signs were paid for using HSIP funds, these signs would need to remain in place until end of life. There is limited cost to this option as well and although the same effectiveness arguments apply, they would eventually be phased out.

Option 3 – Remove Static Signs - Under this option, the static signs would be removed by ADOT forces and not moved to new locations. As with options 1 and 2, the dynamic speed feedback signs would be left in place until end of life. The cost for removal of the static signs was estimated at $13,280 in July 2020.

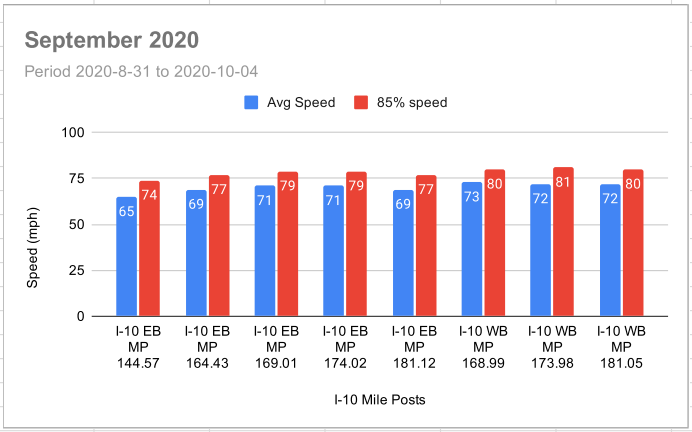
Option 4 – Remove Static Signs and Move to New Locations – Under this option, the static signs would be removed from the existing four locations and installed across three new corridors. Due to the HSIP funding source, special permission would be needed from FHWA to move the dynamic speed feedback signs. This option was originally requested by DPS in October 2019 with the understanding that enforcement would be easier on these new corridors that on the existing locations. The cost for removing and relocating the signs would be $91,533 however, no additional enforcement resources are being committed and it is unlikely that moving the corridors to the new locations would change the long-term outcome. There is limited cost to this option however, the signs have likely lost their effectiveness and will be less so over time. Permanent signs will add to the freeway visual clutter and the effectiveness of messaging here and elsewhere along the state highway system may decrease since there is no additional active enforcement.

Recommendations:

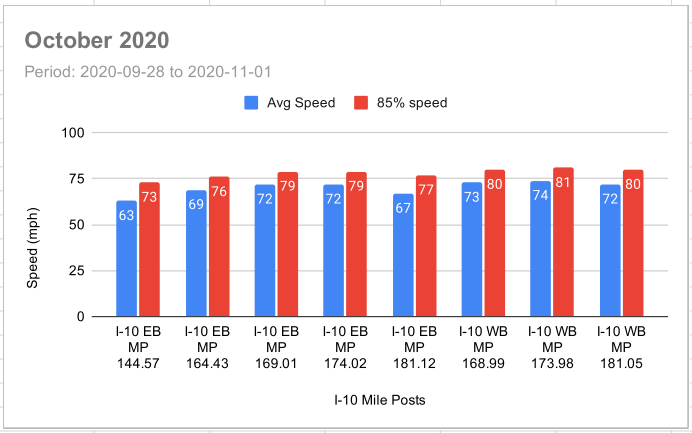
In general, the results of the Safety Corridor have not been overwhelmingly successful, crashes have increased but fatal and serious injury crashes have decreased slightly. Based on this and the cost of moving or removing the signs, we recommend pursuing Option 2, leaving the signs in place and gradually removing them as circumstances allow.

Appendix: Speed Data from Speedfeed Back Signs

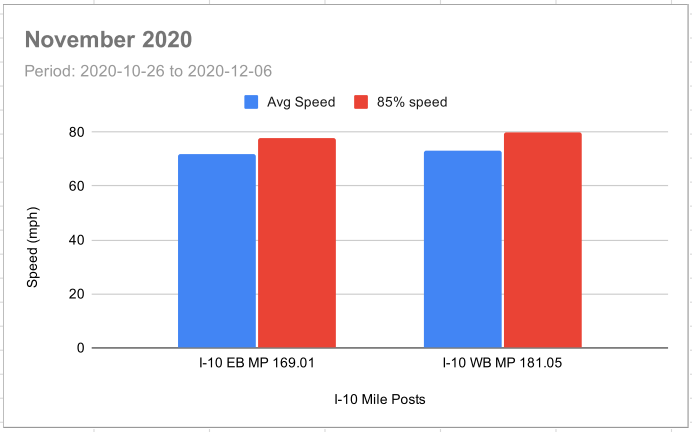
I-10 Monthly Avg	September		
	period: 2020-08-31 to 2020-10-04		
	I-10 Mile Posts	**Avg Speed**	**85% speed**
	I-10 EB MP 144.57	65	74
	I-10 EB MP 164.43	69	77
	I-10 EB MP 169.01	71	79
	I-10 EB MP 174.02	71	79
	I-10 EB MP 181.12	69	77
	I-10 WB MP 168.99	73	80
	I-10 WB MP 173.98	72	81
	I-10 WB MP 181.05	72	80
	I-10 WB MP 145.53	N/A	N/A
	I-10 WB MP 164.48	N/A	N/A



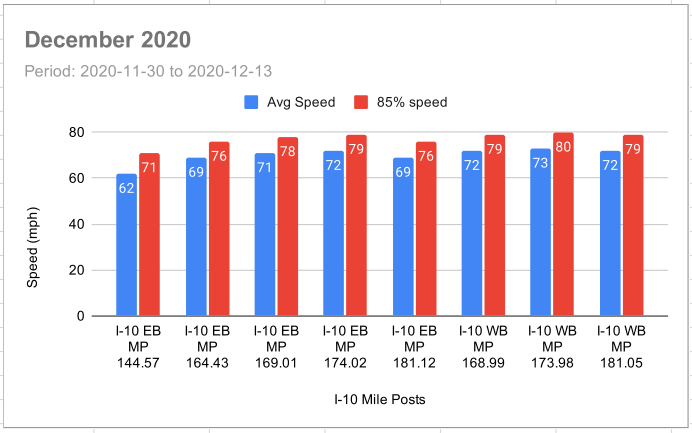
	October		
	Period: 2020-09-28 to 2020-11-01		
	I-10 Mile Posts	**Avg Speed**	**85% speed**
	I-10 EB MP 144.57	63	73
	I-10 EB MP 164.43	69	76
	I-10 EB MP 169.01	72	79
	I-10 EB MP 174.02	72	79
	I-10 EB MP 181.12	67	77
	I-10 WB MP 168.99	73	80
	I-10 WB MP 173.98	74	81
	I-10 WB MP 181.05	72	80
	I-10 WB MP 145.53	N/A	N/A
	I-10 WB MP 164.48	N/A	N/A



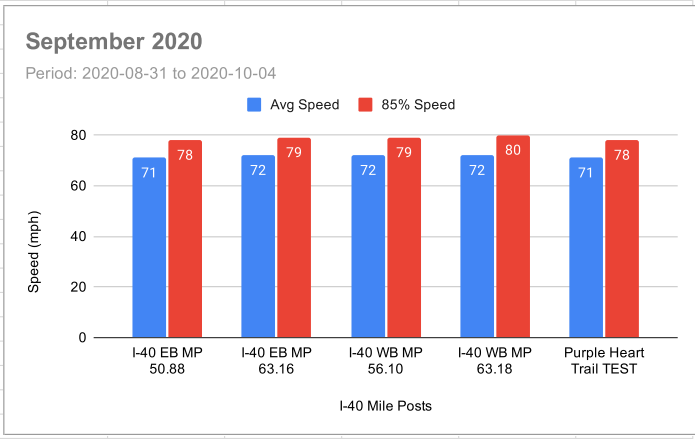
	November		
	Period: 2020-10-26 to 2020-12-06		
	I-10 Mile Posts	**Avg Speed**	**85% speed**
	I-10 EB MP 169.01	72	78
	I-10 WB MP 181.05	73	80
	I-10 EB MP 144.57	N/A	N/A
	I-10 EB MP 164.43	N/A	N/A
	I-10 EB MP 181.12	N/A	N/A
	I-10 WB MP 168.99	N/A	N/A
	I-10 WB MP 173.98	N/A	N/A
	I-10 EB MP 174.02	N/A	N/A
	I-10 WB MP 145.53	N/A	N/A
	I-10 WB MP 164.48	N/A	N/A



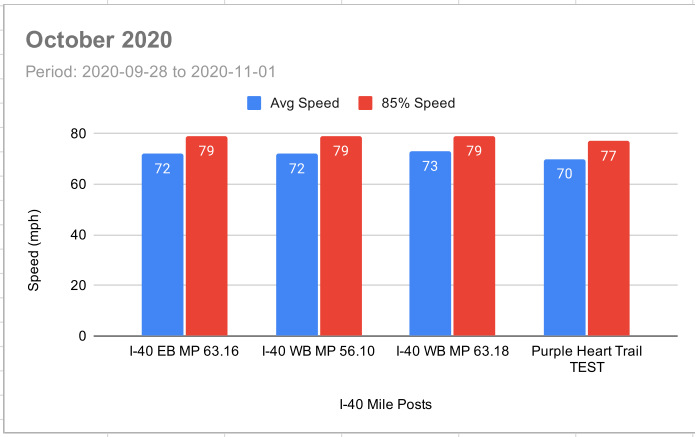
	December		
	Period: 2020-11-30 to 2020-12-13		
	I-10 Mile Posts	**Avg Speed**	**85% speed**
	I-10 EB MP 144.57	62	71
	I-10 EB MP 164.43	69	76
	I-10 EB MP 169.01	71	78
	I-10 EB MP 174.02	72	79
	I-10 EB MP 181.12	69	76
	I-10 WB MP 168.99	72	79
	I-10 WB MP 173.98	73	80
	I-10 WB MP 181.05	72	79
	I-10 WB MP 145.53	N/A	N/A
	I-10 WB MP 164.48	N/A	N/A



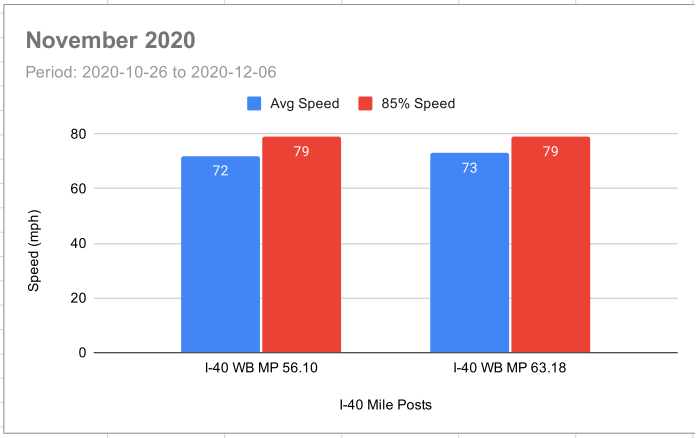
I-40 Monthly Avg	September		
	Period: 2020-08-31 to 2020-10-04		
	I-40 Mile Posts	**Avg Speed**	**85% Speed**
	I-40 EB MP 50.88	71	78
	I-40 EB MP 63.16	72	79
	I-40 WB MP 56.10	72	79
	I-40 WB MP 63.18	72	80
	Purple Heart Trail TEST	71	78
	I-40 WB MP 49.91	N/A	N/A
	I-40 EB MP 56.10	N/A	N/A



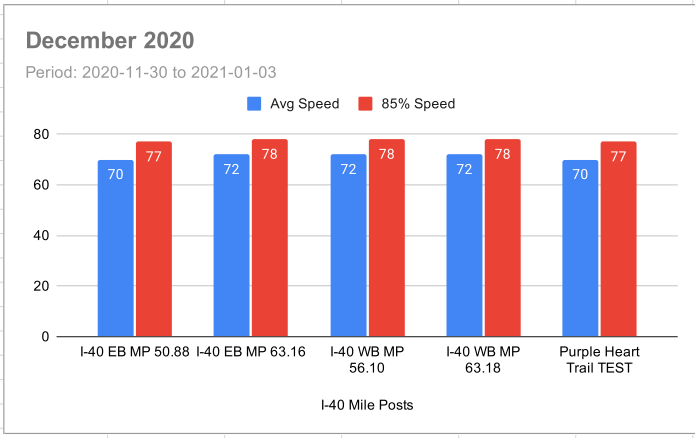
	October		
	Period: 2020-09-28 to 2020-11-01		
	I-40 Mile Posts	**Avg Speed**	**85% Speed**
	I-40 EB MP 63.16	72	79
	I-40 WB MP 56.10	72	79
	I-40 WB MP 63.18	73	79
	Purple Heart Trail TEST	70	77
	I-40 WB MP 49.91	N/A	N/A
	I-40 EB MP 56.10	N/A	N/A
	I-40 EB MP 50.88	N/A	N/A



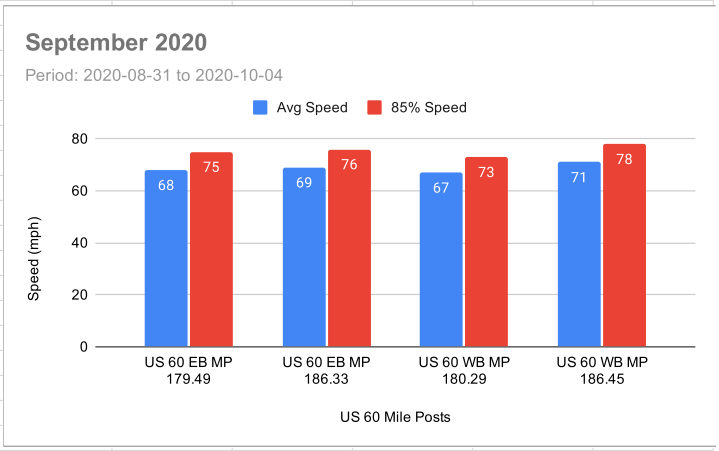
	November		
	Period: 2020-10-26 to 2020-12-06		
	I-40 Mile Posts	**Avg Speed**	**85% Speed**
	I-40 WB MP 56.10	72	79
	I-40 WB MP 63.18	73	79
	Purple Heart Trail TEST	N/A	N/A
	I-40 WB MP 49.91	N/A	N.A
	I-40 EB MP 56.10	N/A	N/A
	I-40 EB MP 50.88	N/A	N/A
	I-40 EB MP 63.16	N/A	N/A



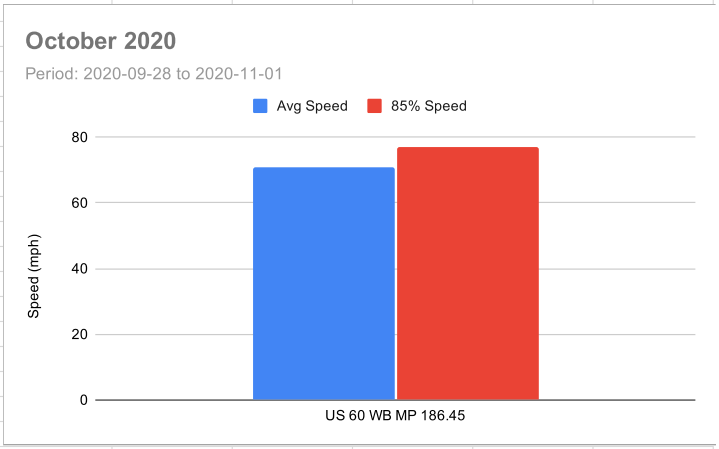
	December		
	Period: 2020-11-30 to 2020-12-11		
	I-40 Mile Posts	**Avg Speed**	**85% Speed**
	I-40 EB MP 50.88	70	77
	I-40 EB MP 63.16	72	78
	I-40 WB MP 56.10	72	78
	I-40 WB MP 63.18	72	78
	Purple Heart Trail TEST	70	77
	I-40 WB MP 49.91	N/A	N/A
	I-40 EB MP 56.10	N/A	N/A



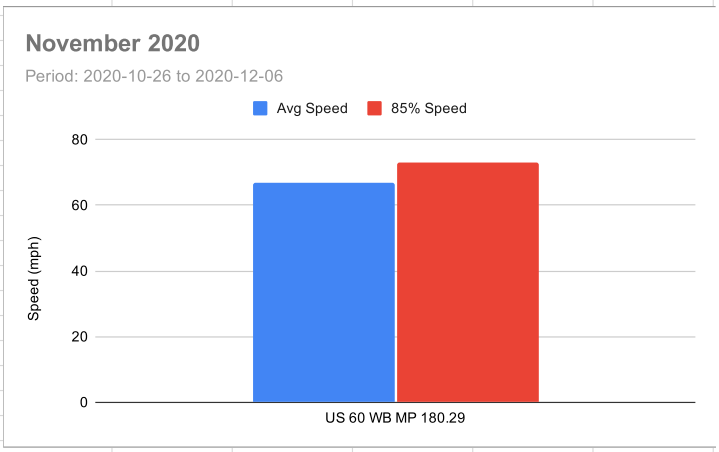
US 60 Monthly Avg	September		
	Period: 2020-08-31 to 2020-10-04		
	US 60 Mile Posts	**Avg Speed**	**85% Speed**
	US 60 EB MP 179.49	68	75
	US 60 EB MP 186.33	69	76
	US 60 WB MP 180.29	67	73
	US 60 WB MP 186.45	71	78



	October		
	Period: 2020-09-28 to 2020-11-01		
	US 60 Mile Posts	**Avg Speed**	**85% Speed**
	US 60 WB MP 186.45	71	77
	US 60 EB MP 179.49	N/A	N/A
	US 60 EB MP 186.33	N/A	N/A
	US 60 WB MP 180.29	N/A	N/A



	November		
	Period: 2020-10-26 to 2020-12-06		
	US 60 Mile Posts	**Avg Speed**	**85% Speed**
	US 60 WB MP 180.29	67	73
	US 60 EB MP 179.49	N/A	N/A
	US 60 EB MP 186.33	N/A	N/A
	US 60 WB MP 186.45	N/A	N/A



	December		
	Period: 2020-11-30 to 2020-12-11		
	US 60 Mile Posts	**Avg Speed**	**85% Speed**
	US 60 EB MP 179.49	66	73
	US 60 EB MP 186.33	68	75
	US 60 WB MP 180.29	66	72
	US 60 WB MP 186.45	70	77