MIDWEST SMART WORK ZONE DEPLOYMENT INITIATIVE

MwSWZDI

FHWA POOLED FUND STUDY

Report Title	Report Date: 2000

Speed Monitor Display

Principle Investigator		Vendor Name and Address
Name	Maze, Tom	Speed Measurement Labs
Affiliation	Iowa State Univ	Carl Fors
Address	2901 S. Loop Drive, Suite 3100 Ames, IA 50010	2300 Harvest Glen Fort Worth, TN 76108 (817) 560-9318
Phone	515-294-9523	
Fax	515-294-0467	
Email	tmaze@iastate.edu	

Author(s) and Affiliation(s)

Supplemental Funding Agency Name and Address (if applicable)

Supplemental Notes

Abstract

SPEED MONITOR DISPLAY

Introduction

Speed displays use a radar device to detect and display the speeds of approaching vehicles. Speed monitoring displays are not generally used to enforce speed limits or issue citations; rather the assumption is that motorists will drive slower once they see their excessive speed on the display. Further, the speed measuring radar will set off the radar alarms in vehicles equipped with these devices. This will make drivers believe that enforcement personnel are located within the work zone, which may cause these speeding motorists to slow.

The speed monitor display consists of a large white box which houses a K-band radar and two 18-inch LED characters, which are visible in direct sunlight from up to 1,000 feet away. The radar detects the approaching vehicles and shows their speeds on the LED display. The display box also has an overspeed option, which flashes motorists' speeds when they exceed the speed limit. The speed threshold in this study was set to 55 mph, which was the posted regulatory speed limit of the work zone.

The speed monitor display used in this study included a solar power panel, which was mounted atop the box. This panel supplied power to the unit, and excess power was stored in a solar car-type battery housed in the box. The K-band radar used in the system broadcasts a directional radar beam over approximately one mile.

As a part of the Midwest States Smart Work Zone Deployment Initiative (MwSWZDI), on September 1999 the speed monitor display was deployed at a work zone on Interstate 35. The purpose of this field test was to evaluate the impact of the speed display on reducing vehicles' speed and increasing speed uniformity at work zones.

Test Operation

The case study work zone consisted of a left lane closure with a crossover leading into head-to-head traffic. The speed display was mounted atop a stationary pole (see Figure 2-6) located 2,250 feet upstream of the lane closure taper.

FIGURE 2-6 Speed monitor display mounted on Interstate 35.

Similar to Safety Warning System (SWS) testing operations described in a separate report, traffic data for the speed display were collected at 1,500 feet and 500 feet upstream of the taper using two traffic data collection trailers. In this case, traffic data were recorded for two days prior to and four days after the speed monitor display installation under two modes (active radar only and active radar and display) for five hours each day. The active radar mode (mode one) was used to test just the impact of the radar signal. The active radar and display mode (mode two) was used to test the impact of the radar signal combined with the reaction of drivers observing their speed shown on the display board.

The speed data initially were grouped into one before and two after data sets (i.e., modes one and two) for each data collection site (i.e., 1,500 feet and 500 feet upstream of the taper). The speed data parameters were determined for passenger cars, non-passenger cars, and all vehicles for all six data sets (i.e., before and after data (under two modes) at 1,500 feet and 500 feet upstream of the taper) resulting in 18 data sets.

Results

Data were grouped into two-mph intervals for graphical analysis. The cumulative distributions of speeds are plotted in Figures 2-7 through 2-24. The cumulative distributions have the S-shaped characteristics. Using these S-shaped curves percentile speeds, 10-mph pace, and

other speed parameters were determined. These parameters for each data set are shown in Tables 2-3 through 2-8.

These tables show that a modest decrease in mean speed was observed when the display was deployed. They also indicate increases in vehicle percentages complying with the posted speed limit (i.e., 55 mph), an increase in vehicles traveling in the 10-mph pace, and a reduction in the 10-mph speed interval. Furthermore, a moderate decrease in passenger cars' 85^{th} percentile speed was noted at the 1,500 feet data collection location (see Table 2-3). A similar speed reduction trend, however, was not detected for non-passenger cars under the second mode of operation when both radar and display were active (see Table 2-4).

The speed reduction impact of the speed monitoring display was clearly pronounced at the 500 feet location where vehicles were closer to the work zone (see Tables 2-6 to 2-8). More than 3 and 5 mph speed reductions were observed in mean and 85^{th} percentile speeds, respectively. The percentage of vehicles complying with the 55 mph speed limit increased by approximately 12 percent while the speed display was operational. A similar increase was also noted in percentage of vehicles traveling in the 10 mph pace.

In order to determine whether the difference between the mean speed before and after deployment of the speed monitor display was statistically significant, t-tests were conducted at the 0.05 level of significance. As shown in Tables 2-9 through 2-14, the differences between the mean speed of before and after the display installation (under both modes) were not found to be statistically significant for all data sets.

Conclusions

Although mean speeds were reduced after the speed monitor display installation, they were not found to be statistically significant. After the deployment of the speed monitor, the percentage of vehicles in the traffic stream complying with the speed limit increased. The number of vehicles in the 10-mph pace also increased, but the pace speed interval was lower. The reasons for the lack of statistically significant speed reductions may in part be due to the low number of vehicles equipped with radar detectors to detect K-band signals and the small size and the lack of visibility of the display. However, more qualitative measures of speed reduction were positive. The results found here are similar to those found in an evaluation of speed display monitors by McCoy, et al., (*2*) in South Dakota. In the South Dakota study the technology was found to provide only a modest reduction in the average speed (albeit a statistically significant reduction) through work zones. They did find that the devices reduced the incidents of very high speed.

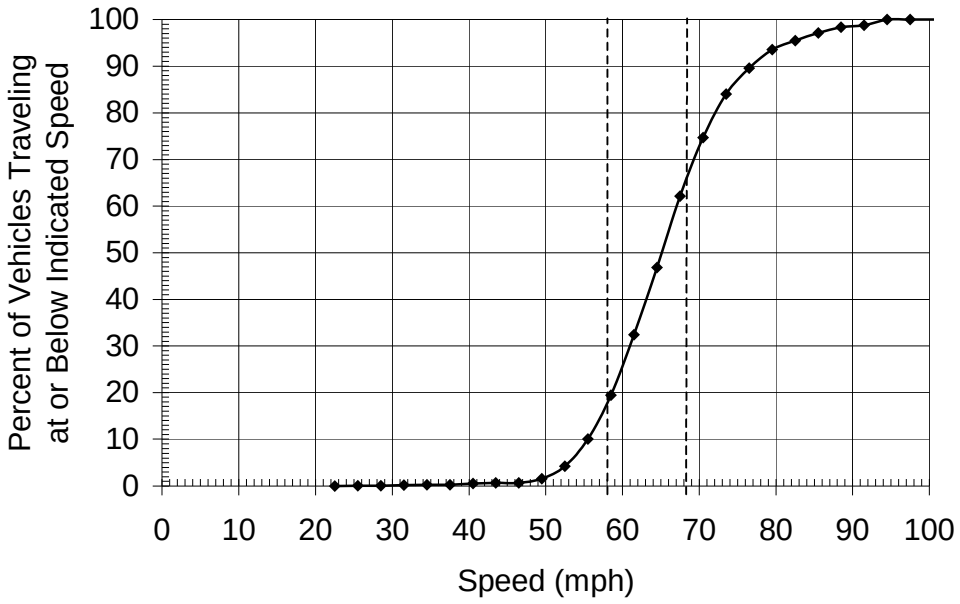

FIGURE 2-7 Before data: passenger cars – 1,500 feet upstream of taper.

It was observed that a large number of drivers did not notice the display until it was too late for them to slow down. This speed monitor display (F model) would be more suitable for use in urban areas where speeds are lower. A larger more visible speed display should be an effective tool to control speeds at work zones on interstates.

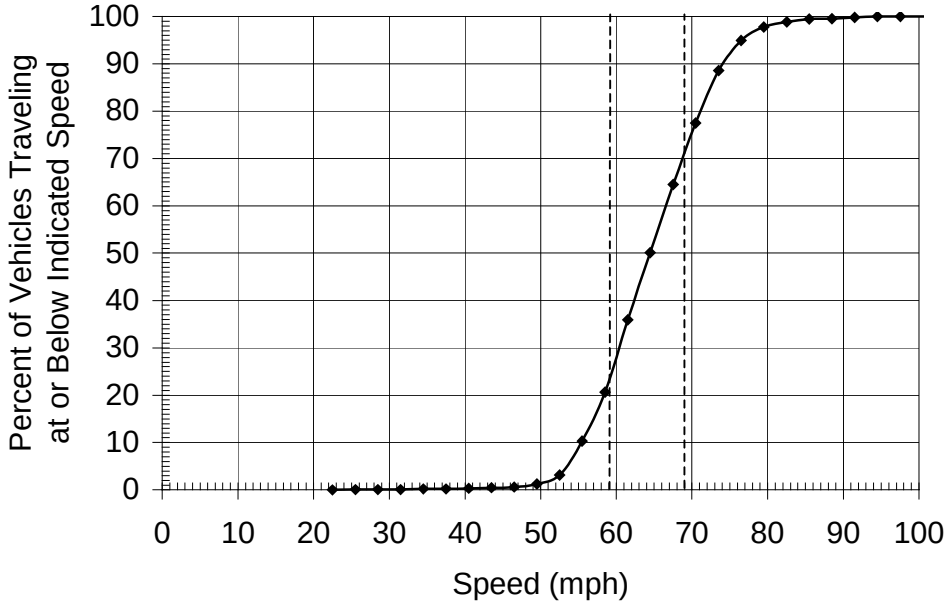

FIGURE 2-8 Speed Monitor Display Data (Mode 1): passenger cars – 1,500 feet upstream of taper.

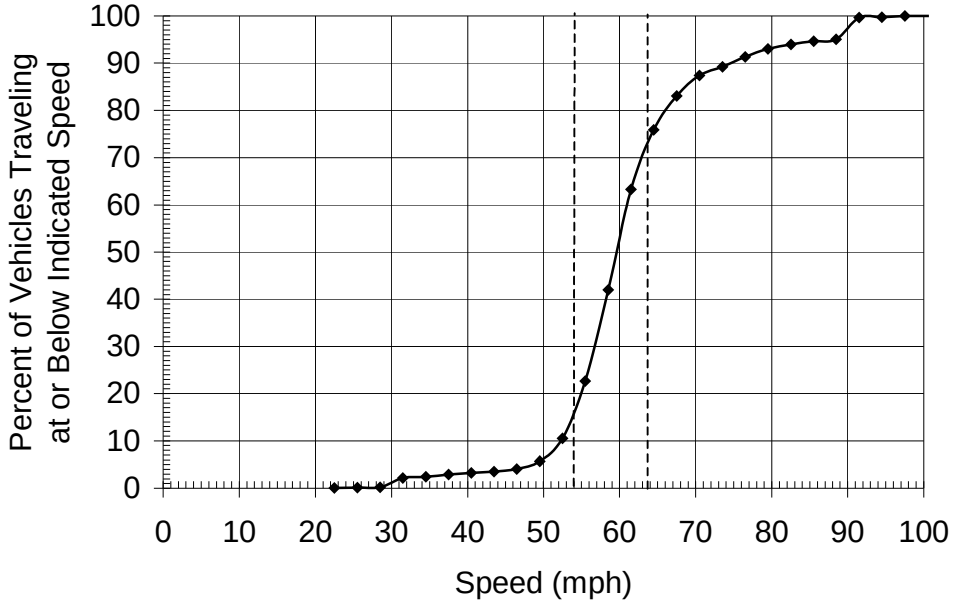

FIGURE 2-9 Speed monitor display data (Mode 2): passenger cars – 1,500 feet upstream of taper.

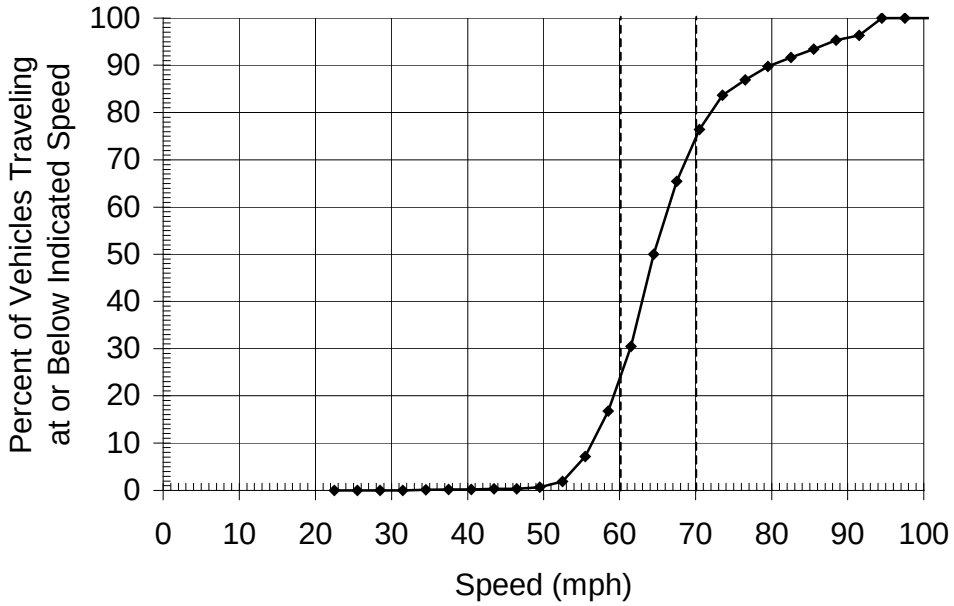

FIGURE 2-10 Before data: non-passenger cars – 1,500 feet upstream of taper.

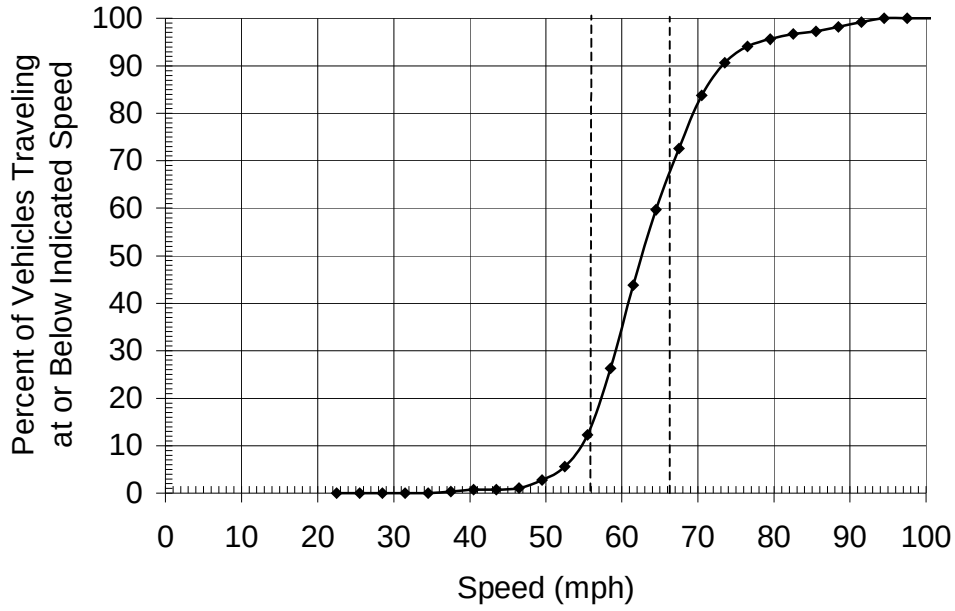

FIGURE 2-11 Speed monitor display data (Mode 1): non-passenger cars – 1,500 feet upstream of taper.

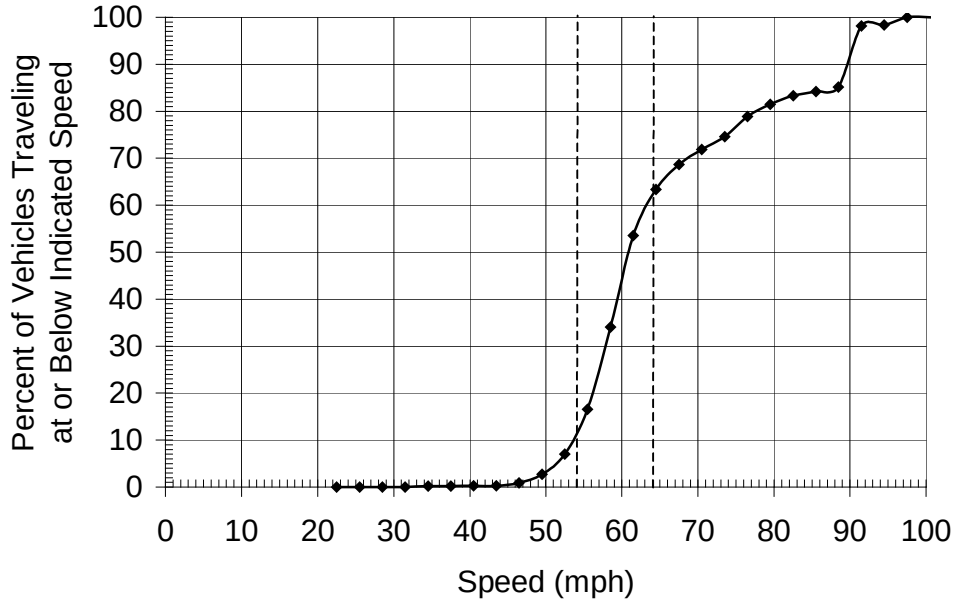

FIGURE 2-12 Speed monitor display data (Mode 2): non-passenger cars – 1,500 feet upstream of taper.

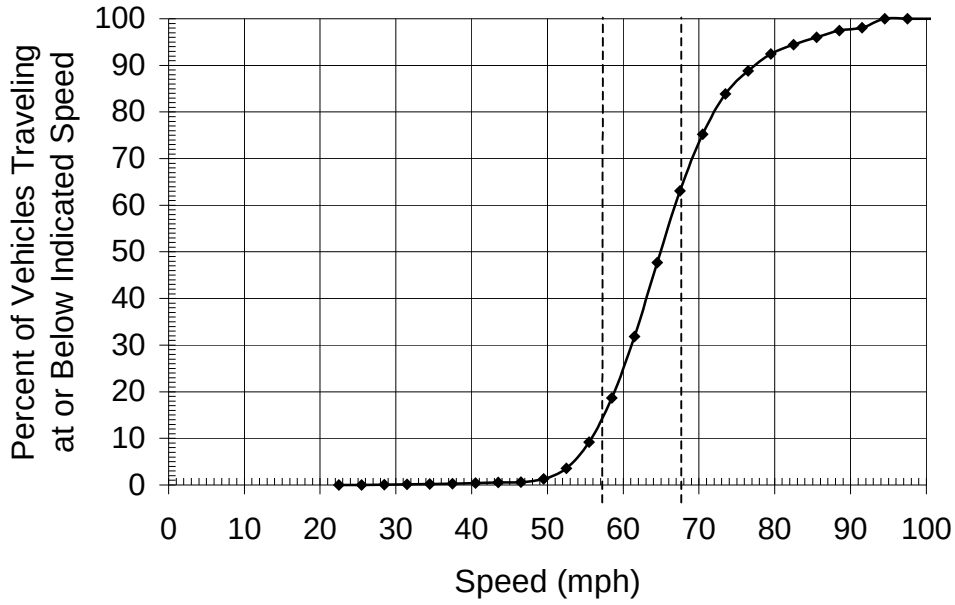

FIGURE 2-13 Before data: all vehicles – 1,500 feet upstream of taper.

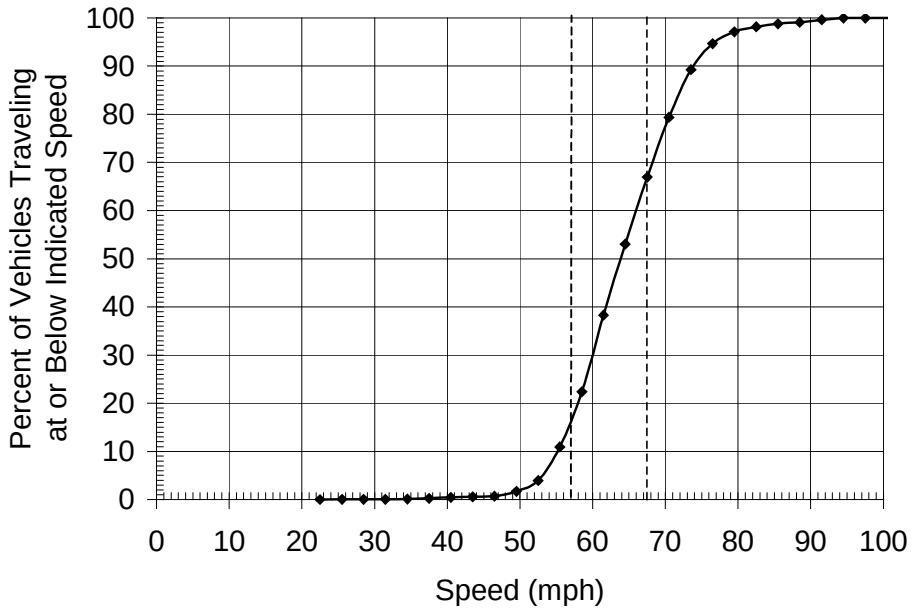

FIGURE 2-14 Speed monitor display data (Mode 1): all vehicles – 1,500 feet upstream of taper.

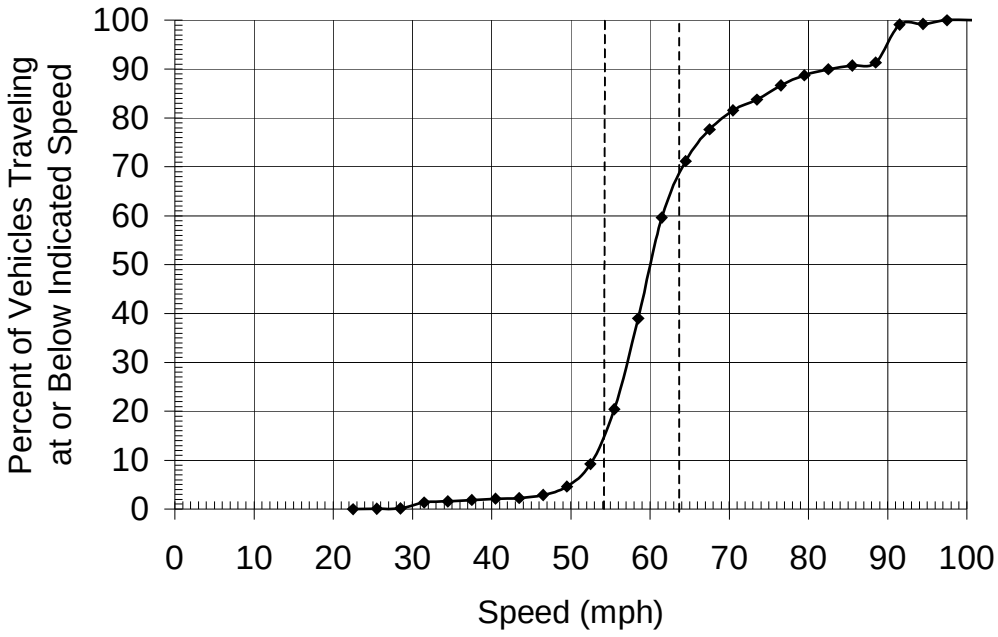

FIGURE 2-15 Speed monitor display data (Mode 2): all vehicles - 1,500 feet upstream of taper.

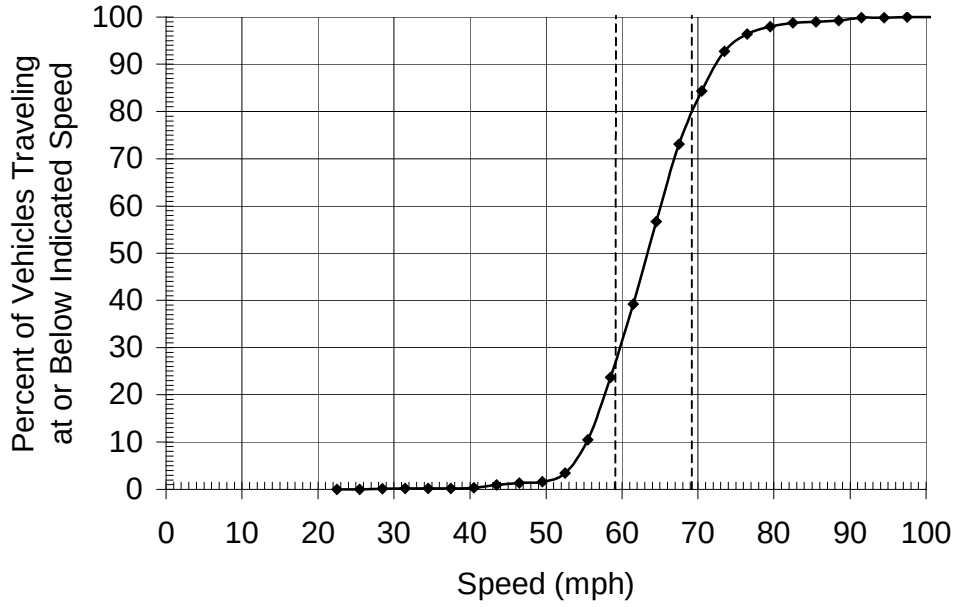

FIGURE 2-16 Before data: passenger cars – 500 feet upstream of taper.

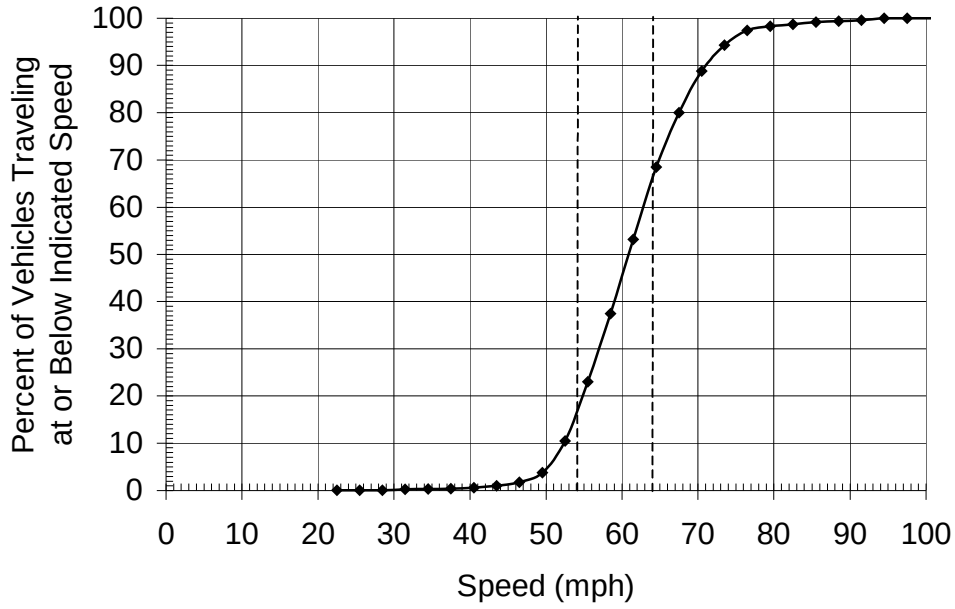

FIGURE 2-17 Speed monitor display data (Mode 1): passenger cars – 500 feet upstream of taper.

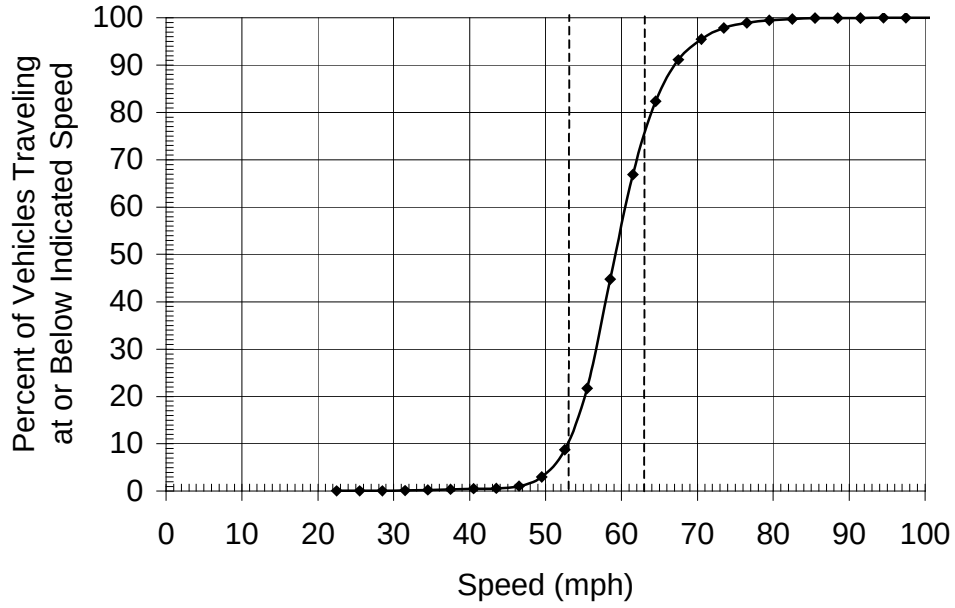

FIGURE 2-18 Speed monitor display data (Mode 2): passenger cars – 500 feet upstream of taper.

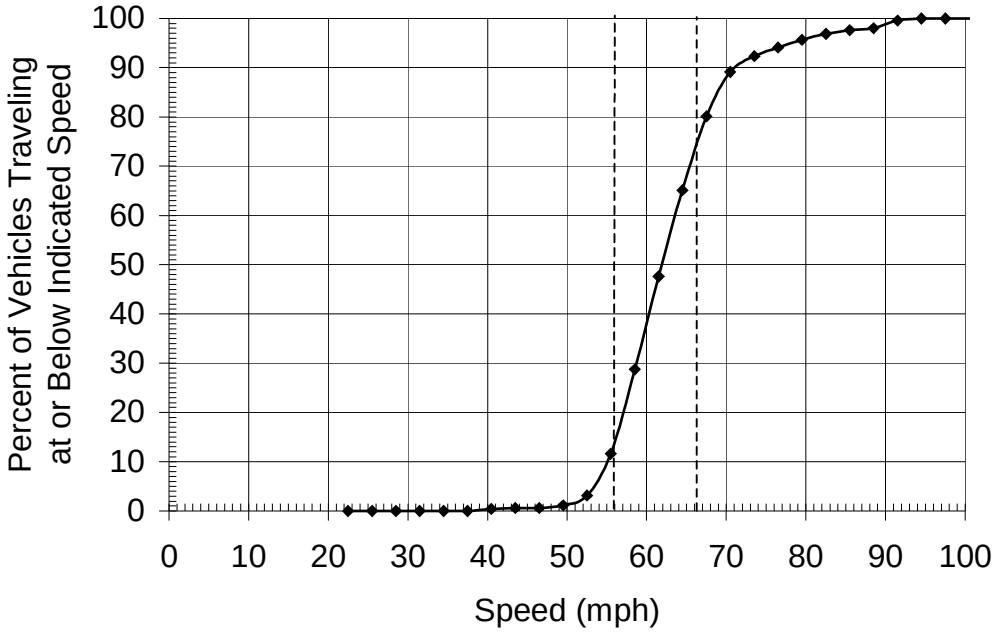

FIGURE 2-19 Before data: non-passenger cars – 500 feet upstream of taper.

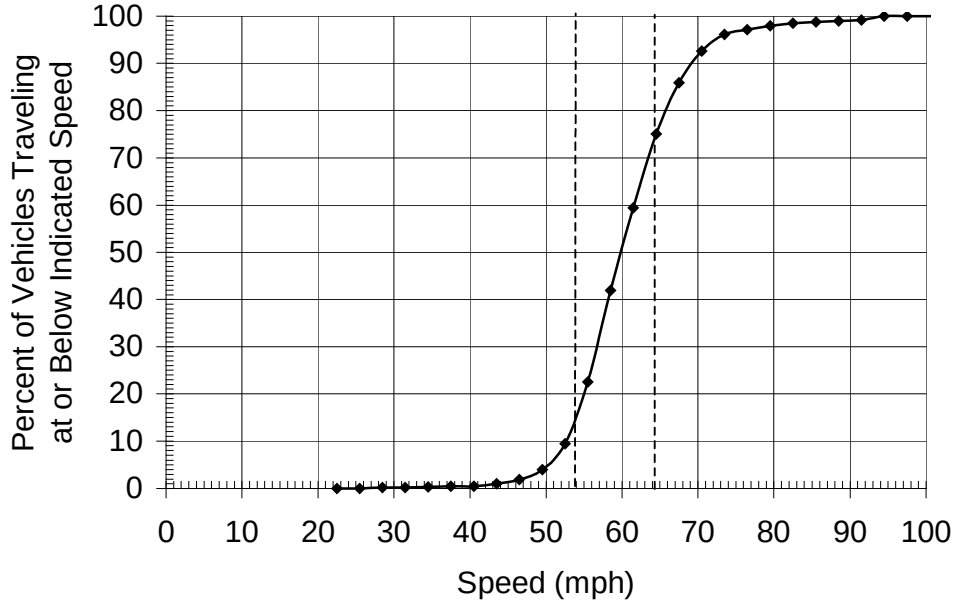

FIGURE 2-20 Speed monitor display data (Mode 1): non-passenger cars – 500 feet upstream of taper.

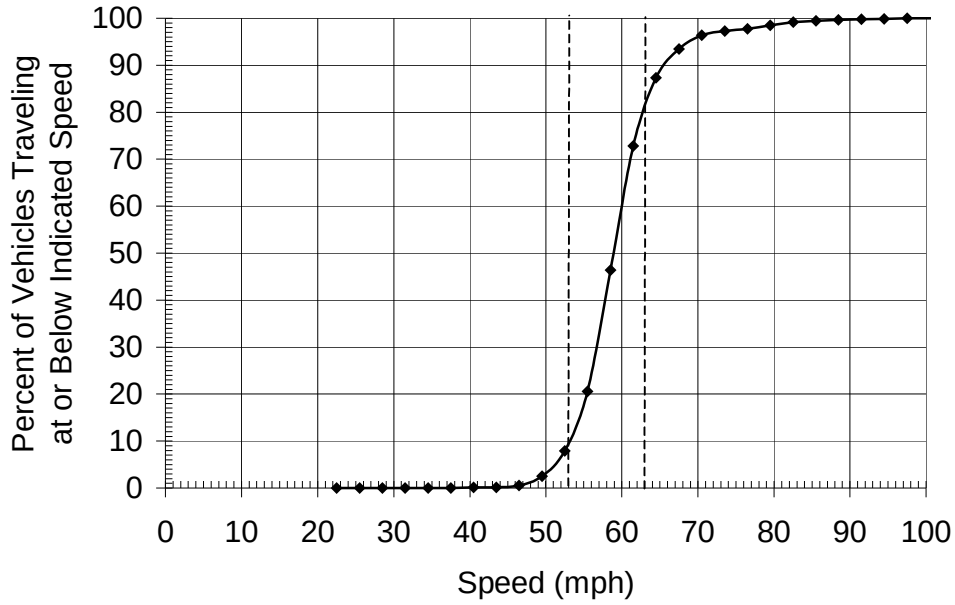

FIGURE 2-21 Speed monitor display data (Mode 2): non-passenger cars – 500 feet upstream of taper.

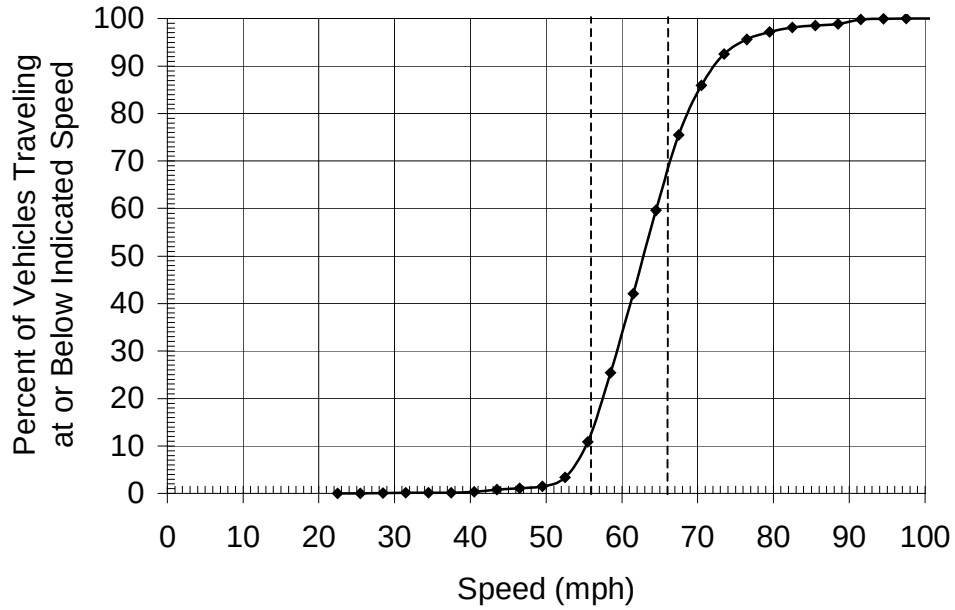

FIGURE 2-22 Before data: all vehicles – 500 feet upstream of taper.

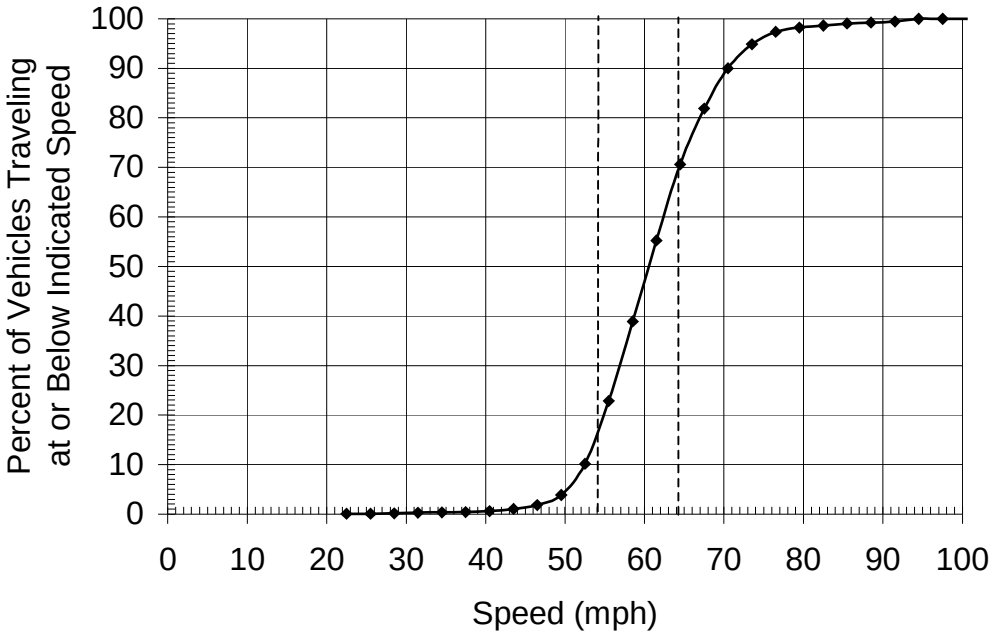

FIGURE 2-23 Speed monitor display data (Mode 1): all vehicles – 500 feet upstream of taper.

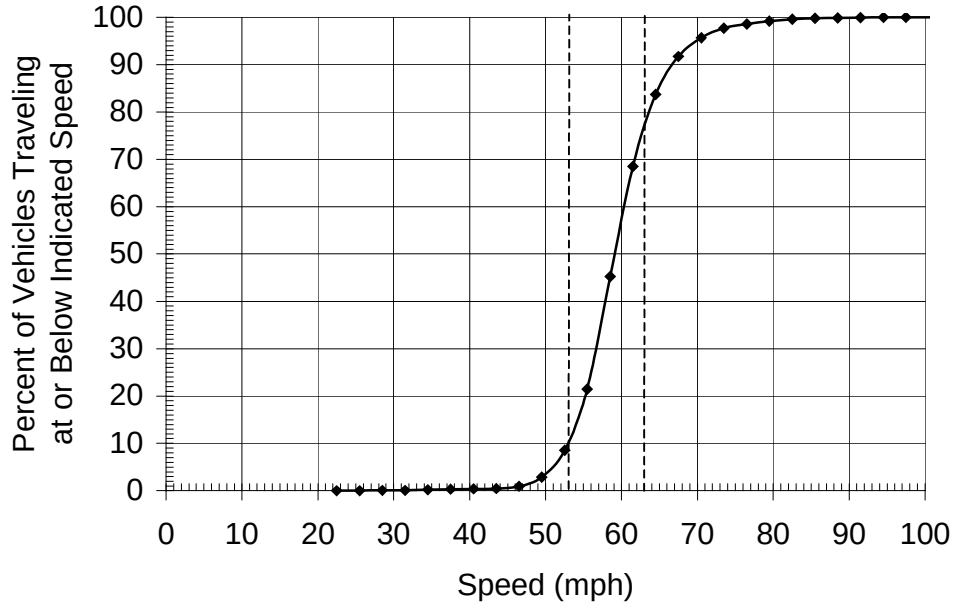

FIGURE 2-24 Speed monitor display data (Mode 2): all vehicles – 500 feet upstream of taper.

Table 2-3 Traffic data: passenger cars - 1,500 feet upstream of taper.

SMD	Mean Speed	85th Percentile	10-mph Pace	Percent in Pace	Standard Deviation	% Comply w/SL	Mean of Highest 15%
Before	65.7	74	59-69	43.5	8.8	10	80
After-1	65	72	59-69	44	7.5	10	64.7
After-2	61	69	54-64	56	10.8	22.7	81.2

Table 2-4 Traffic data: non-passenger cars - 1,500 feet upstream of taper.

SMD	Mean Speed	85th Percentile	10-mph Pace	Percent in Pace	Standard Deviation	% Comply w/SL	Mean of Highest 15%
Before	66.4	74	60-70	48.7	9.5	7	83.5
After-1	63.7	71	56-66	48.3	8.4	12.3	78
After-2	66	88	54-64	48.2	13	16.6	90.7

Table 2-5 Traffic data: all vehicles - 1,500 feet upstream of taper.

SMD	Mean Speed	85th Percentile	10-mph Pace	Percent in Pace	Standard Deviation	% Comply w/SL	Mean of Highest 15%
Before	65.9	74	59-69	45	9	9.3	81
After-1	64.4	72	57-67	44.8	7.8	11	77.3
After-2	63	75	54-64	52.8	11.9	20.4	86.3

Table 2-6 Traffic data: passenger cars - 500 feet upstream of taper.

SMD	Mean Speed	85th Percentile	10-mph Pace	Percent in Pace	Standard Deviation	% Comply w/SL	Mean of Highest 15%
Before	63.5	71	59-69	50.8	7.5	10.6	63.3
After-1	61.3	68	54-64	47.2	7.9	23	73.4
After-2	59.6	65	53-63	62	6.1	22.5	69.7

Table 2-7 Traffic data: non-passenger cars - 500 feet upstream of taper.

SMD	Mean Speed	85th Percentile	10-mph Pace	Percent in Pace	Standard Deviation	% Comply w/SL	Mean of Highest 15%
Before	62.9	69	56-66	58.3	7.7	11.6	77.5
After-1	60.5	67	54-64	52.8	7.6	22.5	73.2
After-2	59.3	64	53-63	68.2	5.9	20.6	70.2

Table 2-8 Traffic data: all vehicles - 500 feet upstream of taper.

SMD	Mean Speed	85th Percentile	10-mph Pace	Percent in Pace	Standard Deviation	% Comply w/SL	Mean of Highest 15%
Before	63.3	70	56-66	53	7.6	10.9	76
After-1	61	68	54-64	50	7.8	22.8	72.7
After-2	59.5	65	53-63	63.7	6	21.4	70

Table 2-9 Before and after data: passenger cars - 1,500 feet upstream of taper.

SMD	Mean Speed	Confidence Intervals	Standard Deviation	Data Points	Statistically Significant?
Before	65.7	0.36	8.8	2,267	No
After-1	65	0.34	7.5	1,911	No
After-2	61	0.48	10.8	1,904	No

Table 2-10 Before and after data: non-passenger cars - 1,500 feet upstream of taper.

SMD	Mean Speed	Confidence Intervals	Standard Deviation	Data Points	Statistically Significant?
Before	66.4	0.62	9.5	900	No
After-1	63.7	0.57	8.4	838	No
After-2	66	0.75	13	1,140	No

Table 2-11 Before and after data: all vehicles - 1,500 feet upstream of taper.

SMD	Mean Speed	Confidence Intervals	Standard Deviation	Data Points	Statistically Significant?
Before	65.9	0.31	9	3167	No
After-1	64.4	0.29	7.8	2,749	No
After-2	63	0.42	11.9	3,044	No

Table 2-12 Before and after data: passenger cars - 500 feet upstream of taper.

SMD	Mean Speed	Confidence Intervals	Standard Deviation	Data Points	Statistically Significant?
Before	63.5	0.47	7.5	976	No
After-1	61.3	0.37	7.9	1,862	No
After-2	59.6	0.25	6.1	2,368	No

Table 2-13 Before and after data: non-passenger cars - 500 feet upstream of taper.

SMD	Mean Speed	Confidence Intervals	Standard Deviation	Data Points	Statistically Significant?
Before	62.9	0.67	7.7	508	No
After-1	60.5	0.50	7.6	880	No
After-2	59.3	0.39	5.9	884	No

Table 2-14 Before and after data: all vehicles - 500 feet upstream of taper.

SMD	Mean Speed	Confidence Intervals	Standard Deviation	Data Points	Statistically Significant?
Before	63.3	0.38	7.6	1,484	No
After-1	61	0.29	7.8	2,742	No
After-2	59.5	0.21	6	3,252	No