

LEGIBILITY DISTANCE OF I 69 REFLECTOR
BUTTON LEGEND SIGNS



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MICHIGAN DEPARTMENT OF STATE HIGHWAYS

LEGIBILITY DISTANCE OF I 69 REFLECTOR
BUTTON LEGEND SIGNS

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John P. Woodford, Director
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As a result of driver complaints and newspaper accounts that the experimental reflector button legend signs on I 69 between Charlotte and Marshall caused excessive glare, could not easily be read, and were hazardous, the Research Laboratory investigated the legibility of the signs.

The nighttime legibility distances of the I 69 reflector button legend signs were measured December 5 and 6, 1973 with four observers: K. A. Allemeier, and D. M. Malott, Testing and Research; W. L. Borton and N. Enustun, Traffic and Safety Divisions. The daytime legibility distances of the signs were measured using one observer, M. E. Scarlata of the Research Laboratory.

Thirty-four button signs were tested and, for comparison purposes, twenty-eight reflective sheeting (engineering grade) signs were also measured. Lower headlight beams were used throughout, except for five of the reflector button signs which were evaluated using upper beams. In addition, three externally illuminated signs (overhead) were included in the observations.

During the observations, an observer drove the vehicle while another observer sat in the center of the front seat. The vehicle was a 1971 Ambassador sedan (AMC). The headlights were aimed according to the Society of Automotive Engineers Standard J599c, 1973.

A fifth wheel attached to the center of the rear bumper measured vehicle distance traveled. A microswitch on the rim of the fifth wheel advanced counters held by the experimenters in the rear seat of the vehicle. Each counter advance was equivalent to 5.2 ft travel of the fifth wheel and vehicle. There were two counters and a two-position pushbutton switch for each observer. The observers were instructed to indicate by means of the handheld pushbuttons both the point where they first read the sign and the point where they could no longer read the sign. The counters automatically registered the distance in feet from each point to the sign.

Table 1 lists the legibility distances of all signs in feet and Table 2 lists the legibility distances of the signs in feet per inch of legend height. Table 2 permits comparison of the legibility of various sign types unaffected by legend height.

In general the tables show that: 1) Reflector button legend signs with legend heights of 6, 8, 12, 13.3, and 16 in. were legible at greater distances at night than were engineering grade reflective sheeting signs with legend heights of 6, 9, 10, 12, 13.3, and 16 in. 2) Daytime legibility distances for sheeting signs were greater than for reflector button legend signs. 3) Daytime legibility distances for both types of legends were greater than nighttime legibility distances for both the reflector button and sheeting legend signs, with the exception of a "REST AREA" sign which had a white legend on a blue background. The "REST AREA" sign was read an average

of 130 ft farther at night than in the daytime. 4) Upper beams increased legibility distance for 16-in. reflector button legend signs while decreasing the legibility distance for 8-in. legend height signs. Upper beams seemed to produce a great deal of glare and halation, relative to that resulting from lower beams, around the letters of the 8-in. legends. 5) Three reflective sheeting signs on I 96 which were more than five years old were found to have an average legibility distance (545 ft) of about 65 percent of the distance (840 ft) of similar signs less than two years old (Table 1, footnote 4). 6) The only sign (a route marker) with high intensity legend (Table 1, footnote 3) could not be read as far away as could an identical sign with reflector button legend. The legibility distance of the high intensity sheeting sign was comparable to the legibility distance of engineering grade sheeting signs. 7) Externally illuminated (fluorescent fixtured) signs exhibited legibility distances for 16-in. legend heights of nearly that of upper beam illuminated reflector button signs. 8) Reflector button signs with white legend on a blue background fared better than white on green reflector button signs. The greater legibility of blue signs may not be due to the greater color contrast of blue and white signs, but may be the consequence of blue signs having upper case legend and the green signs having lower case legend with the exception of the initial letters in each word ("EXIT" words were not read because of their greater familiarity). Perhaps a more important cause may be the reduction in legend-to-background brightness contrast of a green sign caused by the relatively greater brightness of its high intensity reflective sheeting background as compared to the brightness contrast of a blue sign which has an engineering grade reflective sheeting background. The hypothesis that lowered legibility distances are a result of brighter sign backgrounds should be investigated by further studies employing observers.

One motorist complaint was that, as the driver approached a readable reflector button legend sign, the sign became illegible before the driver reached the sign. With the second counter for each observer recording the distance to the sign from the point where the observer could no longer read the sign, the results showed that all four observers experienced the phenomenon of being unable to read some of the signs just before they passed by them. This phenomenon occurred for an average of 7 of the 34 reflector button signs, and for 2 of the 28 reflective sheeting signs for each observer. The average distance from the sign at which the blackout occurred was 25 ft for reflector button legend signs and 24 ft for the reflective sheeting signs. For reflector button 6-in. legend height signs (milemarkers) the average distance was 66 ft.

In a meeting on December 10, 1973, with M. N. Clyde and other members of the Traffic and Safety Division, wherein Tables 1 and 2 in this report were discussed, it was agreed that further observer data for 6 and 8-in. legends were needed.

Accordingly, the Photometry Group of the Research Laboratory will conduct a more controlled study of observer legibility distances of small legend signs, using various combinations of legend and background materials, such as reflector buttons, and high and low intensity reflective sheeting.

TABLE 1
LEGIBILITY DISTANCE (ft)

Legend Height, in.	Sign Type	Color of Sign Background	Legibility Distance, ft							
			Daytime ¹		Nighttime ²				Externally Illuminated	
			Reflector Button Legend	Reflective Sheeting Legend	Lower Beams Buttons	Lower Beams Sheeting	Upper Beams Buttons	Upper Beams Sheeting		
6	Milemarker	Green	405	335	253	205	---	---	---	
8	Road Name Distance	Green	595	---	465	---	450	---	---	
9	Guide: "East-Follow I 69 North"	Green	---	515	---	370	---	---	---	
10	Information Accommodations	Blue	---	795	---	655	---	---	---	
12	Guide: Route Marker ³ ; Rest Area	Blue	870	---	1,000	615 ³	---	---	---	
13.3	Guide	Green	885	1,130	785	690	---	---	---	
16	Guide	Green	1,160	1,200	905	840 ⁴	1,133	---	1,065	
20	Guide	Green	1,475	---	1,240	---	---	---	---	

¹ one observer (Scarлата)

² four observers: (Enustun, Borton, Malott, and Allemeier)

³ high intensity reflective sheeting

⁴ Average value obtained on approximately 2-year old signs. An average value of 545 ft was obtained on three signs greater than 5-years old.

TABLE 2
LEGIBILITY DISTANCE (ft./in. of Legend Height)

Legend Height, in.	Sign Type	Color of Sign Background	Legibility Distance, ft								Externally Illuminated
			Daytime ¹		Nighttime ²						
			Reflector Button Legend	Reflective Sheeting Legend	Lower Beams Buttons	Lower Beams Sheeting	Upper Beams Buttons	Upper Beams Sheeting			
6	Milemarker	Green	67.8	55.8	42.4	34.3	---	---	---	---	---
8	Road Name Distance	Green	74.6	---	58.0	---	56.4	---	---	---	---
9	Guide	Green	---	57.1	---	41.1	---	---	---	---	---
10	Information Accommodations	Blue	---	79.7	---	65.3	---	---	---	---	---
12	Guide: Route Marker ³ Rest Area	Blue	72.5	---	83.5	51.4 ³	---	---	---	---	---
13.3	Guide	Green	66.6	85.1	59.2	51.9	---	---	---	---	---
16	Guide	Green	72.6	75.2	56.6	52.6 ⁴	70.8	---	---	---	66.6
20	Guide	Green	73.8	---	61.9	---	---	---	---	---	---
Avg. of 13.3 + 16		Green	69.6	80.2	57.9	52.2	70.8	---	---	---	66.6
Avg. of 10 + 12		Blue	72.5	79.7	83.5	58.4	---	---	---	---	---

¹ one observer (Scarlatia)

² four observers: (Emustun, Borton, Malott, and Allemeier)

³ high intensity reflective sheeting

⁴ 34.0 ft per in. for old signs on I 96 (eastbound between US 27 and Logan)