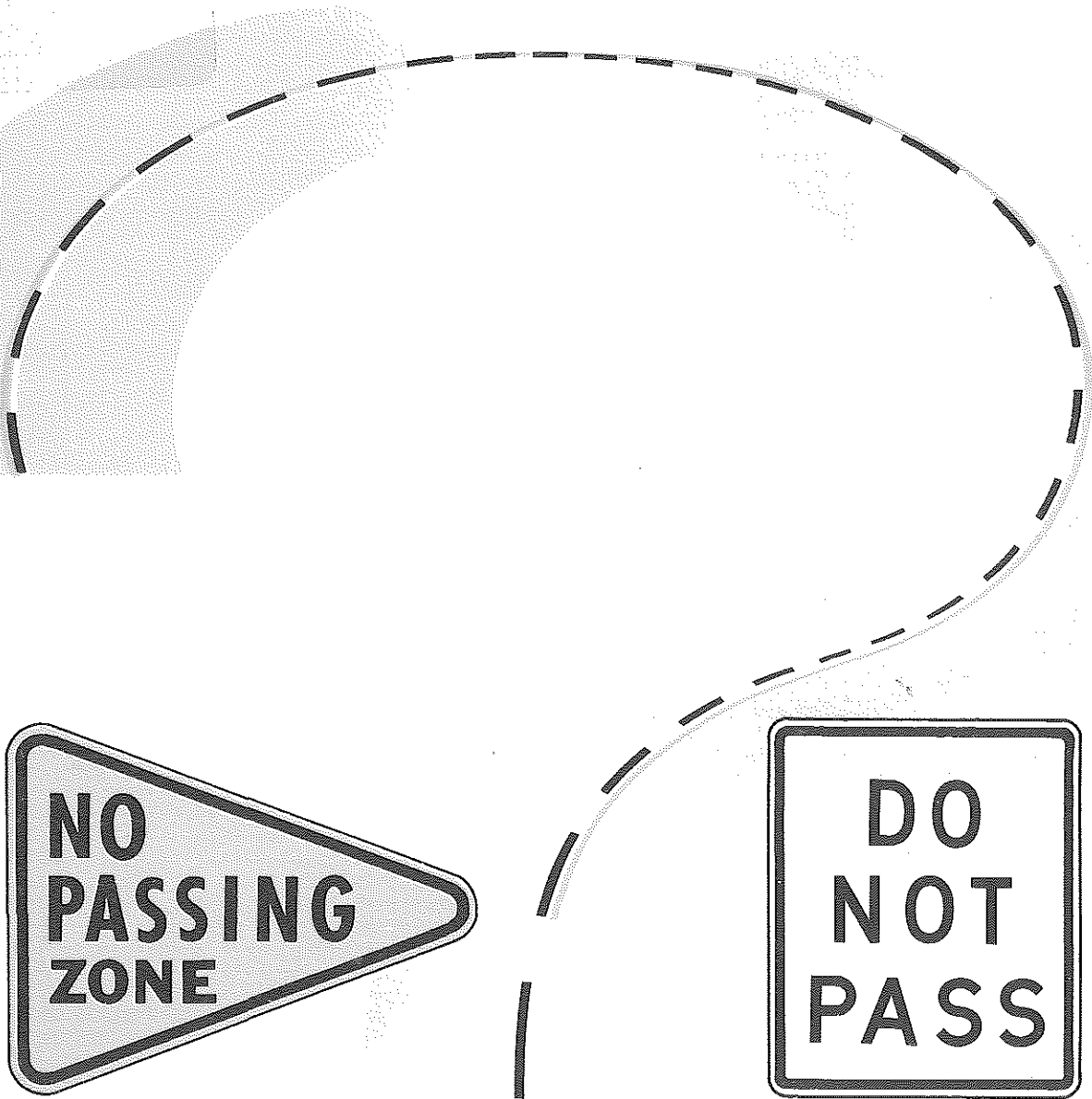


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# *Study of* **NO PASSING ZONE SIGNING**



**MICHIGAN STATE HIGHWAY DEPARTMENT**

MICHIGAN STATE HIGHWAY DEPARTMENT

A STUDY OF NO-PASSING ZONE SIGNING

Conducted by the

Traffic Research Section  
Traffic Division

in cooperation with

The Bureau of Public Roads  
U. S. Department of Commerce

May 1965

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AGENCY TITLE CHANGE

Since the original publication  
of this report, the title of the  
agency has been changed from -

Michigan State Highway Department

to

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

MICHIGAN STATE HIGHWAY DEPARTMENT

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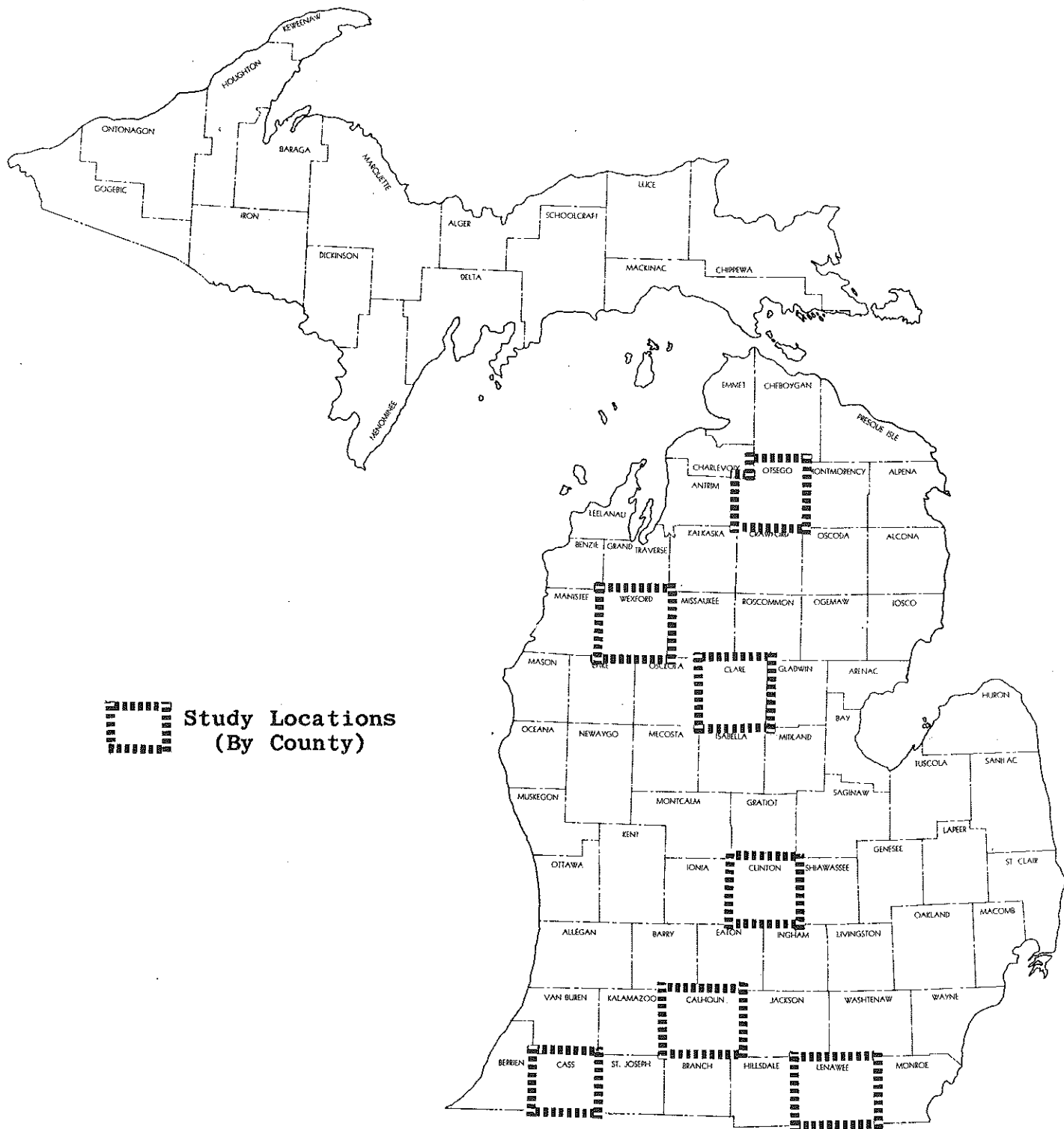
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# A STUDY OF NO-PASSING ZONE SIGNING



 Study Locations  
(By County)

## SYNOPSIS

The purpose of this study was to investigate the need for improved signing at the beginning of no-passing zones. This investigation was concerned with the use of the standard white, rectangular "DO NOT PASS" sign and the yellow, pennant shaped "NO PASSING ZONE" sign. Each sign was evaluated on both sides of the roadway.

Both signs were tested for visibility and effect on driver behavior. Films, driver interviews, and personal observations were used for this purpose. The results indicated that the sign on the left side of the roadway provided increased visibility over the one on the right.



CHAPTER I  
INTRODUCTION

Many factors exert an influence over passing maneuvers on two lane highways. Notable among them are the queuing of vehicles, the motorists' desire to pass, and the presence or absence of an oncoming vehicle. Perhaps the most important factor, however, is whether or not a safe passing area is available.

A majority of drivers will not pass another vehicle if it appears at all unsafe to do so. Regardless of their desire, the appearance of a steep hill or a curve around which they do not have unobstructed vision will usually dissuade them from completing a pass attempt. Nevertheless, most motorists want and, in fact, require notification of an area unsuitable for passing.

Generally, in Michigan, sections of highway where it is unsafe to pass are delineated by a yellow barrier line and related roadside signs. The barrier striping is placed to the right of the pavement center line and is carried throughout the length of the no-passing zone. The signs used are "DO NOT PASS" at the beginning of a zone and "PASS WITH CARE" at the end of the zone. Both are placed along the right shoulder of the roadway. The authority to mark no-passing zones is covered in the Michigan Vehicle Code as follows:

## NO-PASSING ZONES, MARKING

Sec. 640. (a) The state highway commissioner and county road commissions, with respect to highways under their jurisdiction, are hereby authorized to determine those portions of any highway under their jurisdiction where overtaking and passing or driving to the left of the roadway would be especially hazardous, and shall by appropriate signs or markings on the roadway indicate the beginning and end of such zones and such signs or markings shall be positioned in such a manner that an ordinary observant driver of a vehicle will be able to observe the directions thereof and obey the same. Within 300 feet of such positioned signs or markers, there shall be placed upon the surface of the highways painted signs of a design agreed upon by the commissioner and commissions to indicate that a no-passing zone lies ahead.

(b) The no-passing zones provided for by this section shall be based upon a traffic survey and engineering study and all such traffic-control devices installed pursuant to this section shall conform to the state manual and specifications as provided for by section 608 of this chapter.

(c) Failure to obey such traffic-control devices installed pursuant to this section shall constitute prima facie evidence of a violation hereof and shall be punishable as a misdemeanor.<sup>1</sup>

The motoring public in general, by its comments and reactions, had indicated a desire for better notification of the beginning of no-passing zones. The most frequently offered suggestion concerned the placement of an additional sign on the left side of the roadway to indicate that a no-passing zone is present. A study, using the "DO NOT PASS" sign, was conducted by the Michigan State Highway Department in 1956. This study showed that the additional sign had little effect on two lane roadways but did show some benefit on three lane roadways.

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<sup>1</sup> Michigan Vehicle Code and Related Laws Concerning the Ownership and Use of Vehicles on the Streets and Highways, (Lansing, Mich., 1961), Sec. 640, p.104.

About five years ago, the State of Iowa, which had not used any sign to mark no-passing zones, adopted the use of a left-side sign which was yellow in color, pennant shaped, and had a black "NO PASSING ZONE" legend. This sign, however, had not been sufficiently tested to warrant its adoption elsewhere.

The purpose of this study, therefore, was the evaluation of the relative effectiveness of the "DO NOT PASS" and the "NO PASSING ZONE" signs. Each sign had been evaluated for two traits, (1), visibility and (2), the effect on driver behavior, based upon its location on either side of the roadway and its ability to attract driver attention.

## CHAPTER II

### VISIBILITY

Several colors were considered for a new no-passing zone sign and yellow was found to be most suitable since peak human eye response by day is to a yellowish-green color. Green did not have sufficient contrast to a background of trees and other foliage; yellow, however, did overcome this disadvantage. At night, the reflective powers of yellow were second only to two off-shades of white. This, plus the fact that a yellow sign had already been used successfully for this purpose elsewhere, led to the conclusion that only the yellow-colored sign needed to be tested further. Therefore, this evaluation was limited to the pennant-shaped "NO PASSING ZONE" sign and the standard "DO NOT PASS" sign. (The respective sign details are shown in Figures 1 & 2 in Appendix I.) The actual field study to evaluate the visibility of the "DO NOT PASS" and "NO PASSING ZONE" signs was conducted, based upon location, shape, and color. Tests were conducted during the day and at night to compare the effects of the signs under both conditions.

#### Color and Shape

Color and shape visibility comparisons were conducted for both daytime and nighttime. The daytime test was performed at a no-passing zone on Highway M-21 west of St. Johns where each sign was placed, in turn, on either side of the roadway. Colored

movies of each sign, in place, were taken between 2:00 and 4:00 p.m. on two consecutive days. The camera was in a test car which was driven through the test area for each signing condition as follows: once behind a truck, once behind another automobile, and once with an unobstructed view. These films were then viewed to obtain comparisons of the relative visibility of the two signs as to color, shape, and location. Precautions were taken to insure similar weather conditions on the days the filming was performed. The distances were obtained by counting the painted skip lines on the center line of the roadway while viewing the films. These distances, approximate though they may be, provided sufficient comparisons of visibility to determine the definite advantage of the left-side location.

Table I shows a comparison of the visibility distances for the two signs. These were based on several viewings of the film where the "DO NOT PASS" sign was compared to the "NO PASSING ZONE" sign. From an unobstructed view, the distance advantage of the "DO NOT PASS" sign was an average of only 60 feet. When following a vehicle, the average visibility distance for the "NO PASSING ZONE" sign on the left was greater by an average of more than 800 feet.

It is admitted that viewing a film is not necessarily a good simulation of actual driving conditions. Nevertheless, it is believed that some indication of the relative merits of the two types of signs and of the two locations was obtained.

STUDY OF NO-PASSING ZONE SIGNING

TABLE I

VISIBILITY DISTANCES TAKEN FROM FILMS

M-21 West of St. Johns, Michigan

<u>Signing Condition</u>	<u>Behind Truck *</u>	<u>Behind Auto *</u>	<u>Unobstructed View</u>
<u>MICHIGAN "DO NOT PASS"</u>			
Right	150-250	500	1500
Left	1500 +	1000 ++	1300
<u>IOWA "NO PASSING ZONE"</u>			
Right	Not Tested	450	1250
Left	1250	1250	1250

\* Vehicles were traveling at approximately 60 m.p.h. and were kept 100 feet apart.

+ Shadows increased visibility over other conditions.

++ Auto being followed rode pavement center line.

A test was performed to observe the relative visibility of the two signs under nighttime driving. This test was conducted on a 13 mile section of Highway US-12 in Lenawee County. At the time of the test, both the "DO NOT PASS" and the "NO PASSING ZONE" signs were in place at each of several no-passing zones in the study area. Each "DO NOT PASS" sign was in its standard position on the right and each "NO PASSING ZONE" sign was placed on the left, directly opposite. The reflective material applied to both types of signs was identical except for color. The drive through the area was made at speeds varying from 45 to 60 m.p.h. and where possible, the signs were viewed with upper and lower headlight beams. Generally, vision of the signs was unobstructed. Although a quantitative measure of the visibility of the signs was not obtained, the test did allow a somewhat subjective comparison of their relative nighttime visibility.

In the nighttime test, it was found that the white reflective "DO NOT PASS" sign became visible shortly before the yellow reflective "NO PASSING ZONE" sign. However, the "NO PASSING ZONE" sign was easily distinguishable as a no-passing sign because of its shape, while the "DO NOT PASS" sign did not become distinguishable as this type sign until it could be read. Both signs were readable at 150 to 200 feet; however, because of its rectangular shape, the "DO NOT PASS" sign could have been confused with a speed sign at distances beyond this range.

Driver interviews were conducted as a further means of determining the effect of color and shape on comparative visibility of these

signs and their relative effectiveness in obtaining the attention of the motorist. Signs of both types were erected in various positions at several no-passing zones on former US-27 both north and south of Gaylord. (The signing arrangement for the interviews is shown in Figures 2 & 3 in Appendix II.) About 10 days later, drivers were interviewed with regard to the signs and their location along the roadway.

When the interview questions were formulated, every attempt was made to word the questions such that they did not lead the motorist to a particular answer. However, when the interviews were begun, it was quickly realized from the reactions and answers given that some of the questions were apparently leading questions. Consequently, for the remainder of the interviewing, the first question regarding the "DO NOT PASS" sign was reworded omitting the words "Michigan," "left," and "right." And the first question on the "NO PASSING ZONE" sign was also reworded omitting the words "yellow," "Iowa," and "left." If the interviewee's answer indicated he had seen the "NO PASSING ZONE" sign and he made no mention of which side of the road it was on, he was then asked whether it was on the right or left. (This interview form is presented as Figure 1 in Appendix II.)

A total of 2113 interviews were taken over a two-day period. Of these, 540 were declared invalid and omitted from the study because of the above error in questioning during the first two hours of interviewing. The remaining 1573 interviews were made up of 204 local drivers, 315 out-of-state drivers, and 1054 from other



parts of Michigan. Of these 1573, 205 were eliminated because the drivers had not driven through the entire survey area, which left a net total of 1368 interviews for analysis.

As might be expected, the percentage of local drivers who had noticed the difference in signing was greater than the percentage of local drivers who had not. Seventy-five percent of the local drivers noticed the "NO PASSING ZONE" signs on the left, whereas only 42 percent of these had noticed the "DO NOT PASS" signs on the left. The smallness of this 42 percent became more apparent when it was realized that the "DO NOT PASS" signs in this area had been on the left side of the roadway for approximately one year before the interviews were taken.

Table II shows a summary of the 1368 interviews. Perhaps the most outstanding factor in this table is that 21 percent noticed the "DO NOT PASS" sign on the left while a total of 44 percent noticed the "NO PASSING ZONE" sign on the left (23 percent left only and 21 percent both sides). A total of 78 percent reported seeing the "NO PASSING ZONE" sign on the left, right, or both sides, which could have been due to the fact that drivers had passed the four "NO PASSING ZONE" signs more recently than the "DO NOT PASS" signs. However, the two "NO PASSING ZONE" signs on the left, north of Gaylord, were passed after the two "NO PASSING ZONE" signs on the right and yet, a total of 64 percent reported seeing the ones on the right compared to 44 percent who reported seeing the ones on the left. Also, south of Gaylord where the last two "NO PASSING ZONE" signs were on the right, the percentages were nearly equal for the drivers reporting observance on the right

STUDY OF NO-PASSING ZONE SIGNING

TABLE II

SUMMARY OF DRIVER INTERVIEWS

Direction From Gaylord	Number of Interviews	Noticed "DO NOT PASS" Sign on Left	Noticed "NO PASSING ZONE" Sign			Totals
			On Left	On Right	On Both Sides	
<u>AUGUST 10, 1961, 2-5 PM</u>						
South	308	83	96	92	34	222
North	384	78	75	144	101	320
Totals	<u>692</u>	<u>161</u>	<u>171</u>	<u>236</u>	<u>135</u>	<u>542</u>
<u>PERCENTAGES</u>						
South	100	26.9	31.2	29.9	11.0	72.1
North	<u>100</u>	<u>20.3</u>	<u>19.5</u>	<u>37.5</u>	<u>26.3</u>	<u>83.3</u>
Totals	100	23.3	24.7	34.1	19.5	78.3
<u>AUGUST 11, 1961, 2-5 PM</u>						
South	291	81	76	76	60	212
North	<u>385</u>	<u>45</u>	<u>67</u>	<u>154</u>	<u>95</u>	<u>316</u>
Totals	<u>676</u>	<u>126</u>	<u>143</u>	<u>230</u>	<u>155</u>	<u>528</u>
<u>PERCENTAGES</u>						
South	100	27.8	26.1	26.1	20.6	72.8
North	<u>100</u>	<u>11.7</u>	<u>17.4</u>	<u>40.0</u>	<u>24.7</u>	<u>82.1</u>
Totals	100	18.6	21.2	34.0	22.9	78.1
<u>TWO-DAY TOTALS</u>						
South	599	164	172	168	94	434
North	<u>769</u>	<u>123</u>	<u>142</u>	<u>298</u>	<u>196</u>	<u>636</u>
Totals	<u>1368</u>	<u>287</u>	<u>314</u>	<u>466</u>	<u>290</u>	<u>1070</u>
<u>PERCENTAGES</u>						
South	100	27.4	28.7	28.1	15.7	72.5
North	<u>100</u>	<u>16.0</u>	<u>18.5</u>	<u>38.7</u>	<u>25.5</u>	<u>82.7</u>
Totals	100	21.0	22.9	34.1	21.2	78.2

and left. From this, it appears that recency of observation has little bearing on the matter. If the data in Table II appears slightly inconsistent, the fact remains that the difference between the 44 percent who reported observing the "NO PASSING ZONE" sign on the left and the 21 percent who reported seeing the "DO NOT PASS" sign on the left is statistically significant. These observations were made with three "DO NOT PASS" signs on the left as compared to two of the "NO PASSING ZONE" signs, which adds to its importance.

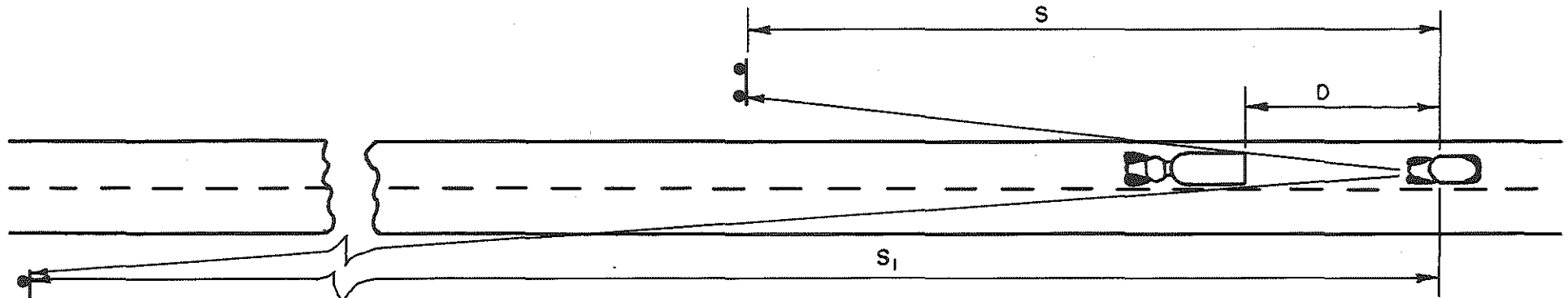
#### Location

The visibility derived from the location of signs on either the right or left for no-passing zones is a significant factor for evaluation in this study. Consideration of sign position shows the vast superiority of a left-side location as shown in Figure I which also confirms the information presented in Table I, "Visibility Distance Taken from Films." The respective visibility distances for each sign revealed that the left-side location provided more than twice the distance of visibility than that provided by the right-side location.

In a 6-1/2 foot wide car trailing an 8 foot wide truck, the driver's sight distance of a right-side sign is 155 feet when both vehicles are in the center of a 12 foot lane. With the vehicles 50 feet apart, a right-side sign can be seen only 120 feet ahead while a left-side sign allows unlimited visibility. In addition, the right-side sign can easily be obscured by a truck or other vehicle. A left-side sign, however, can be seen

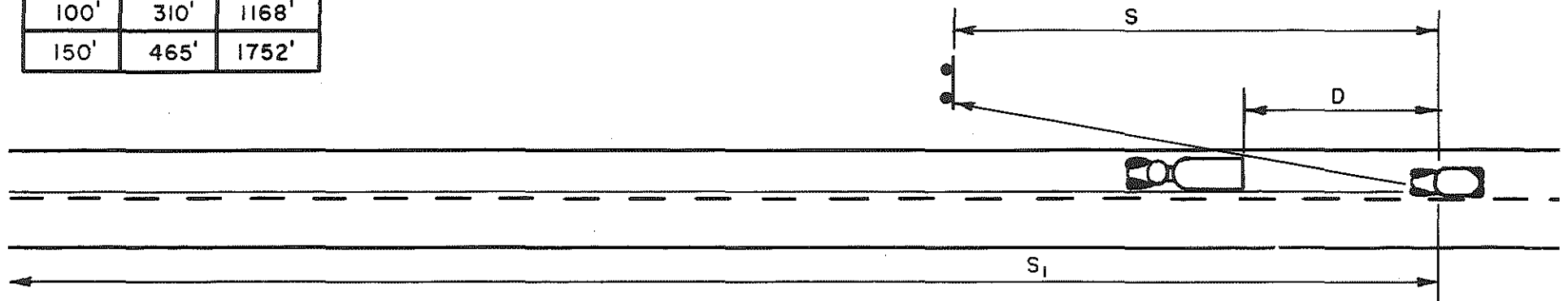
# SIGHT DISTANCES FOR NO PASSING SIGNS LEFT SIDE VS. RIGHT SIDE

TRUCK WIDTH            8'-0"  
 CAR WIDTH             6'-6"  
 STEERING COLUMN     1'-6" IN  
 SIGNS 10' FROM PAVEMENT EDGE



ASSUME TRUCK & CAR TRAVEL CENTER OF 12' LANE

D	S	S <sub>1</sub>
50'	155'	584'
100'	310'	1168'
150'	465'	1752'



ASSUME TRUCK TRAVELS CENTER OF LANE & CAR RIDES CENTER LINE

D	S	S <sub>1</sub>
50'	120'	INFINITE
100'	240'	INFINITE
150'	360'	INFINITE

FIG. 1

584 feet ahead (or nearly four times the distance for the right-side sign) since the sign is located in the line of sight of the driver attempting to pass. When the car moves to the pavement center lane, the position normally assumed prior to a pass, the difference in visibility is even more pronounced. From this factor alone, the driver is provided better visibility and advance warning of a no-passing zone.

Figures 2 thru 5 are presented here in order to provide, pictorially, the visibility advantage of the left-side location. Figure 2 presents an unobstructed view of the "NO PASSING ZONE" sign on the left and the "DO NOT PASS" sign on the right. Figures 3 thru 5 depict photographs obtained from a moving vehicle approximately 100 feet behind a truck. All of these photos present the comparison of location visibility between the signs. They were taken at distances of approximately 750 feet, 500 feet, and 150 feet respectively, in advance of the signs.

### Conclusion

The results of this phase of the study presented above led to the following conclusions concerning the comparative visibility of the two signs:

#### Color and Shape

The "NO PASSING ZONE" sign, primarily because of its color and shape, possesses features which draw heavily on the motorists' attention. It was more readily recognizable and distinguishable as a sign for demarcating a no-passing zone than was the white "DO NOT PASS" sign. This was especially

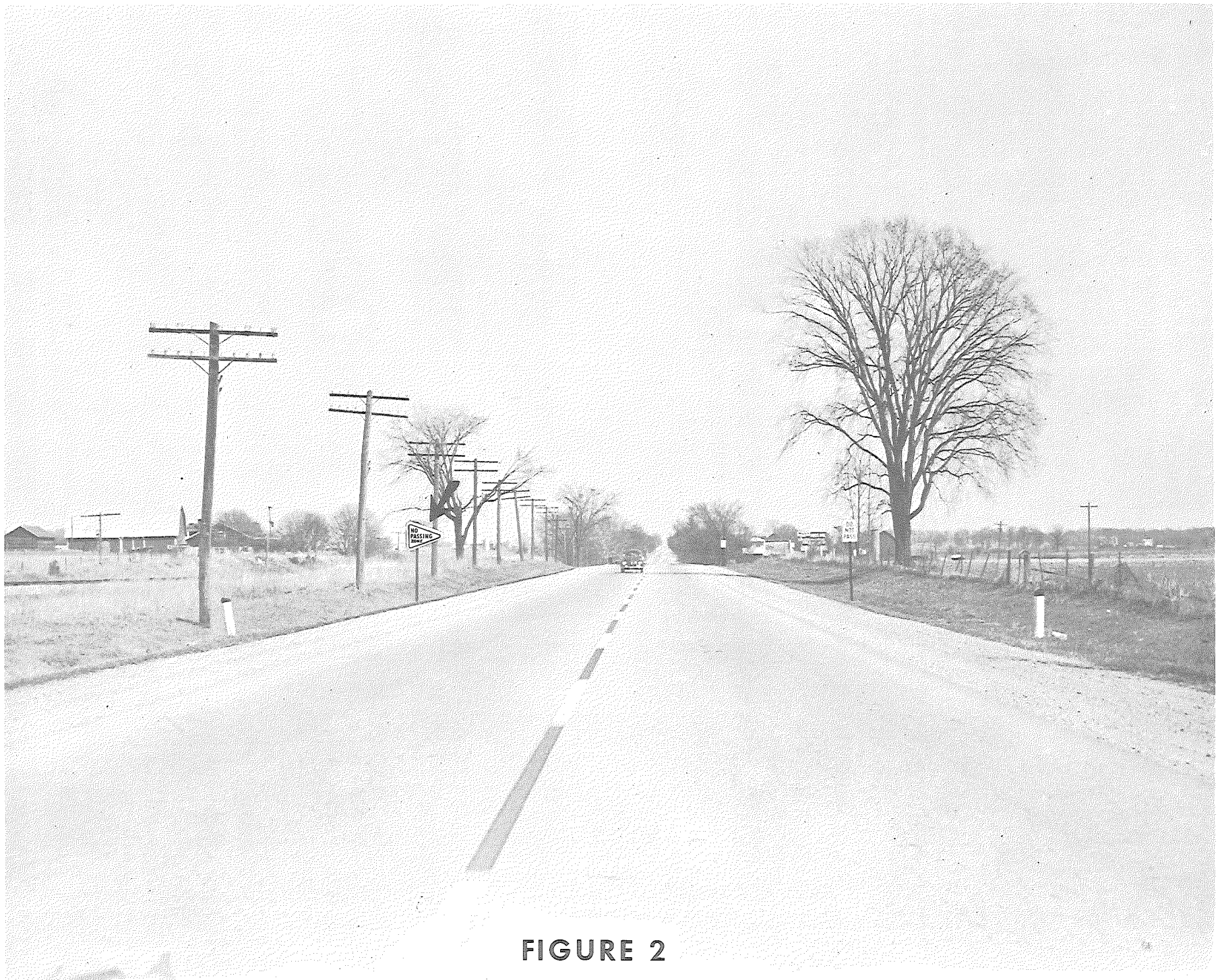


FIGURE 2

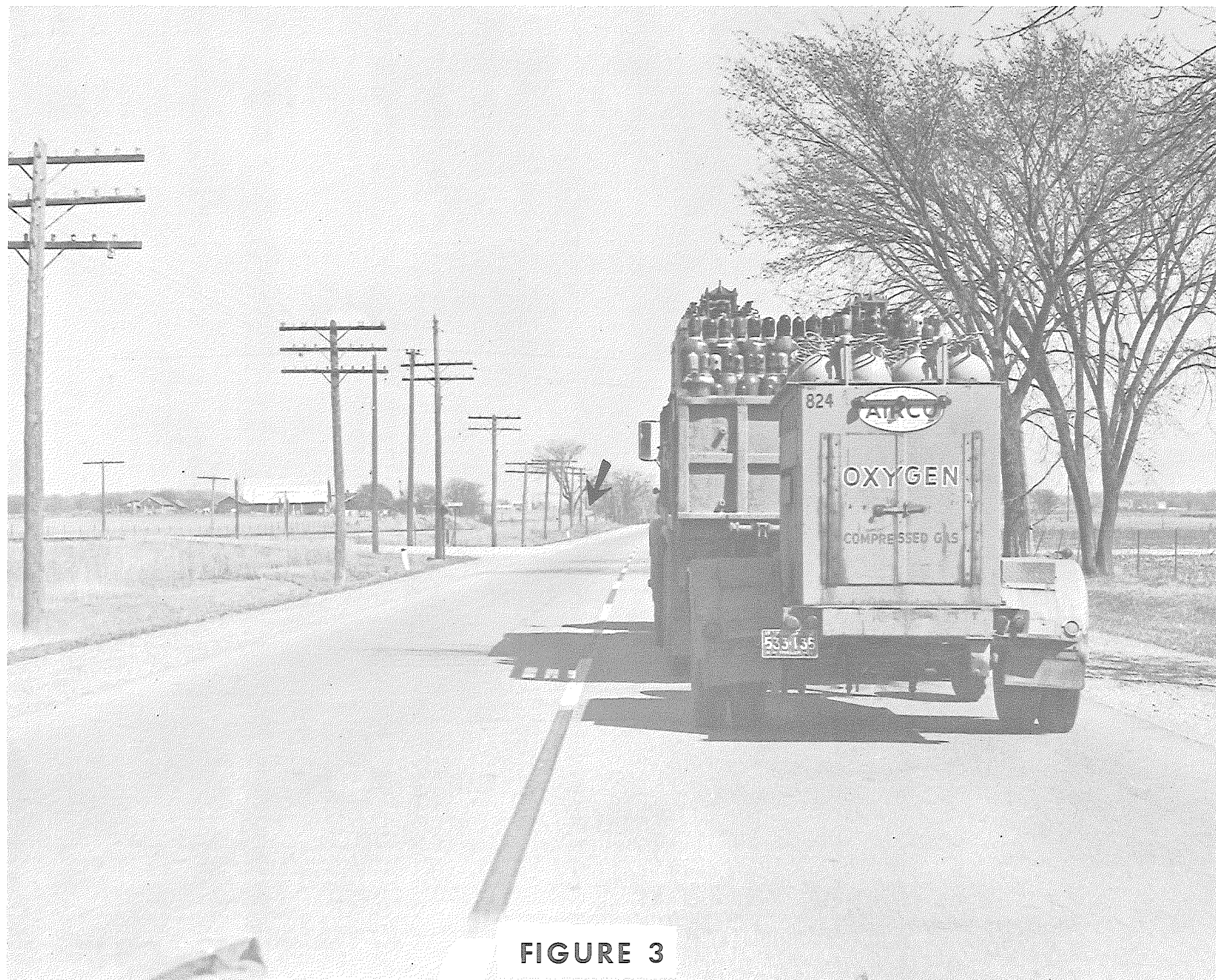


FIGURE 3





FIGURE 4





FIGURE 5

true at night and was an important point since the yellow paint line, which by day is normally visible from 500-1500 feet in advance of a zone, remained invisible at night until a motorist was practically upon it. In addition, the white rectangular "DO NOT PASS" sign could have been easily mistaken for a speed sign or for one of several other regulatory signs until the driver was within readable range (150-200 ft.).

#### Location

The left-side location had greater advantage in visibility by far over the right-side location. Visibility to a motorist attempting to pass was more than twice that provided by the right-side location.

CHAPTER III  
THE EFFECT ON DRIVER BEHAVIOR

Field Study

To evaluate the effect of the "DO NOT PASS" and "NO PASSING ZONE" sign on driver behavior, a field observation study was made at 24 no-passing zones. Both signs were placed, at various times, on either side of the roadway at each zone and distances up to 1000 feet were marked off in advance of each zone. Concealed observers noted each passing maneuver which occurred near the zones for each test day. For each maneuver, the observer noted where it began, whether or not it was completed, and if completed, where. Passing attempts not completed because of the appearance of an oncoming vehicle were excluded. An analysis was then made to correlate the results of the observations to the visibility and location of either sign.

The driver behavior field study was conducted in four parts at four locations where the signs were tested at six no-passing zones for each part, as follows:

1. Part I - Former US-27 in Otsego County
2. Part II - Former US-27 in Clare County
3. Part III - US-27 in Calhoun County
4. Part IV - US-12 in Cass County

Part I, completed in August 1961, was a study of no-passing zones at simple, vertical curves only. It revealed that the location of pass attempts should be pin-pointed more precisely in advance of the zone. This factor was included in subsequent parts of the Driver Behavior Study. However, the results of Part I are not shown in this report.

Part II, performed in October 1961, was actually a repeat of Part I except that the beginning of passing maneuvers were located by distance in advance of the yellow line.

Part III, conducted in May 1962, included the study of zones on both horizontal and vertical curves, and was identical to Part II.

Part IV, completed in September 1962, was a special study to determine the effect of the no-passing zone striping and signing. The signs were evaluated at two zones for each of three peculiar situations:

1. Zones in place, but not required
2. Zones required, but not in place
3. Zones not required, not in place, but appearing to require a restriction.

For the Driver Behavior Study, four signing conditions were tested:

1. "DO NOT PASS" on the right (Standard Condition)
2. "DO NOT PASS" on the left

3. "NO PASSING ZONE" on the right
4. "NO PASSING ZONE" on the left

At no time was there more than one sign in place at any zone.

The overall results of this field study are discussed in the following section. The intricacies and results of each individual phase are detailed in Appendix III.

### Study Results

The results of the Driver Behavior Study were based upon signing condition #1 ("DO NOT PASS" on the right) and #4 ("NO PASSING ZONE" on the left) as noted above. After studying the results of the first three parts of the field study, the data from signing conditions #2 ("DO NOT PASS" on the left) and #3 ("NO PASSING ZONE" on the right) were deemed inadequate for evaluation purposes. Therefore, the only signing conditions analyzed in the total field study were #1 and #4. Table III summarizes the results of the field study for these two conditions.

In evaluating the relative effect of the signs on driver behavior, two factors were considered. These were the percentage of pass attempts which were not completed and the percentage completed on yellow (the percentage of passes attempted which were completed by crossing the yellow line). This latter factor was calculated by dividing the number of passes completed on yellow by the total passes attempted. Although additional factors did influence passing maneuvers, they could be considered equal for both signing conditions.

It was assumed that to reveal a greater effect on traffic resulting from the proposed condition over the standard condition, the percentage of incompletd passes should increase and the percent of completed passes on yellow should decrease. As shown in Table III, these factors remained approximately the same.

Actually, there seemed to be little difference in the effect of the two signs on traffic. Overall, the difference in percentage of incompletd passes for the two conditions was only 0.6 percent and the difference in percentage for those completed on yellow was only 1.1 percent. Neither difference was statistically significant.

In Part III, with the "NO PASSING ZONE" sign, the percentage of incompletd passes increased from 24 to 30 percent, and the percentage of total pass attempts completed on yellow decreased from 16 to 11 percent. Yet, neither of these differences was statistically significant.

An attempt was made to determine whether or not the signs had any effect on the beginning of passing maneuvers as the no-passing zones were approached by a motorist. These data are presented in Table IV. Pass attempts were categorized in three parts: (1) those begun within 500 feet of a zone, (2) those begun between 500 and 1000 feet in advance of a zone, and (3) those begun over 1000 feet in advance of a zone. Only Parts II and III were conducive to this analysis.

STUDY OF NO-PASSING ZONE SIGNING

TABLE III

DRIVER BEHAVIOR STUDY

SUMMARY OF COMPARISONS\*

Study Part	Passes Attempted	Not Completed	Percent	Passes Completed		
				Before Yellow	On Yellow	% On Yellow
<u>"DO NOT PASS" - Right Only</u>						
II	611	103	16.9	428	80	13.1
III	198	47	23.7	120	31	15.7
IV	103	30	29.1	45	28	27.2
Totals	912	180	19.7	593	139	15.2
<u>"NO PASSING ZONE" - Left Only</u>						
II	397	66	16.6	267	64	16.1
III	158	48	30.4	92	18	11.4
IV	115	22	19.1	66	27	23.5
Totals	670	136	20.3	425	109	16.3
Grand Totals	1582	316	20.0	1018	248	15.7

\* This data is taken from Parts II, III, & IV of Driver Behavior Study. Part II was conducted in Clare County in October 1961; Part III was conducted in Calhoun County in May 1962; and Part IV was conducted in Cass County in September 1962.

STUDY OF NO-PASSING ZONE SIGNING

TABLE IV

DRIVER BEHAVIOR STUDY

COMPARISONS BY LOCATION OF PASS ATTEMPTS\*

Distance From Zone	Passes Attempted	Not Completed	Percent	Passes Completed		
				Before Yellow	On Yellow	% On Yellow
<u>"DO NOT PASS" - Right</u>						
0' - 500'	97	51	52.6	3	43	44.3
500' - 1000'	426	83	19.5	280	63	14.8
Over 1000'	347	29	8.4	312	6	1.7
Totals	870	163	18.7	595	112	12.9
<u>"NO PASSING ZONE" - Left</u>						
0' - 500'	52	32	61.5	1	19	36.5
500' - 1000'	293	55	18.8	187	51	17.4
Over 1000'	208	25	12.0	171	12	5.8
Totals	553	112	20.3	359	82	14.8

\* This data is taken from Parts II & III of Driver Behavior Study. Part II was conducted in Clare County in October 1961; Part III was conducted in Calhoun County in May 1962.



Table IV shows that for pass attempts begun within 500 feet of a no-passing zone, the "NO PASSING ZONE" sign showed a slightly greater advantage. It showed a greater percentage of incompleting passes, and a decrease in the total pass attempts completed on the yellow. For passes attempted at 500-1000 feet in advance of a zone, the "DO NOT PASS" sign had a slightly greater effect. For passes attempted at 1000 feet or more in advance of a zone, both the percentage of incompleting passes and total pass attempts completed on yellow increased with the "NO PASSING ZONE" sign. These differences, however, are not statistically significant. From these total data as obtained, no significant difference was apparent in the effect the signing conditions had on driver behavior.

Part IV of the Driver Behavior Study was added as a supplement to evaluate the effect of no-passing zone striping on driver behavior. Six zones were selected for this investigation and four of the six were somewhat unique. (For the details of this part, see Appendix III.) Fortunately, the non-existent no-passing zones which should exist and the existent zones which should not are rare in Michigan. The results are summarized below.

Without striping, the percentage of passes, which were assumed to have been completed on the non-existent yellow, with the "DO NOT PASS" sign on the right was 37 percent, considerably greater than the 23 percent with the "NO PASSING ZONE" sign on the left. However, the above percentages were determined to be statistically insignificant.

With the "DO NOT PASS" sign, the percentage of passes which would have been completed on the non-existent yellow was significantly greater than with striping. For the "NO PASSING ZONE" sign, the difference between striping and no striping was insignificant. With no signing present, the percentage of passes which would have been completed on the non-existent yellow was significantly greater than with actual striping. In short, striping produced an improvement when there was no signing or where there was a "DO NOT PASS" sign on the right. However, with the "NO PASSING ZONE" sign on the left, it made no significant difference. Considering passes attempted but not completed, the percentage was significantly less for no signing and no striping than with striping and no signing, again pointing up the effect of striping.

#### Conclusions

From Parts II and III of this field study, it was concluded that there was no significant difference between the two signs in their effect on the drivers' behavior. Part IV, limited though it was, clearly pointed out that in general the driver paid far more attention to the yellow no-passing stripe than to the no-passing zone signs.

CHAPTER IV  
SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate the need for improved signing at the beginning of no-passing zones. This investigation consisted of an evaluation of the effectiveness of the "NO PASSING ZONE" sign which was yellow in color, pennant shaped, and was placed on the left side of the roadway opposite the beginning of each zone. It was anticipated that this sign would replace the presently used "DO NOT PASS" sign.

To accomplish this purpose, the study was completed in two parts, (1) a test of the relative visibility of the two signs and (2) a test of their effect on driver behavior. The results of each part are as follows:

Visibility

1. Based upon color alone, there was no appreciable difference in visibility of the two signs.
2. Based upon shape combined with color, the yellow pennant-shaped, black-legged "NO PASSING ZONE" sign was far more distinguishable and recognizable as a no-passing zone sign. This proved especially true and important at night.
3. Based upon the 1368 driver interviews used in this analysis, the "NO PASSING ZONE" sign surpassed the

"DO NOT PASS" sign in its ability to attract the motorists' attention. Only 21 percent noticed the standard sign on the left whereas 44 percent noticed the proposed sign on the left.

4. The left-side location of signing for demarcating a no-passing zone provided far greater visibility of the sign to the driver than did the right-side location. This visibility distance was doubled or tripled depending upon the lateral placement of the passing vehicle.

#### Driver Behavior

1. When the striping condition was the same for each, neither sign showed any significant difference in the effect on driver behavior.
2. There was a significant difference in driver behavior between the presence and absence of the yellow no-passing stripe.

The factor of increased sign visibility to the motorists did affect driver behavior, based upon the preponderance of favorable public comments supporting the use of the pennant sign. These comments listed the benefits of advanced notification of a no-passing zone and the advantage of being notified of an impending no-passing zone when passing a heavy truck or line of slow-moving automobiles when the "DO NOT PASS" sign is not visible.

The actual specific effect an increase in visibility would have on driver behavior was immeasurable. The field study showed that placement of the "NO PASSING ZONE" sign on the left did cause a slight increase in the percentage of pass attempts which were not completed. However, there were two other questions concerning passing maneuvers that seemed unanswered. First, how many motorists who desired to pass did not even make a noticeable attempt to do so because they were dissuaded by the increased visibility of an approaching no-passing zone? Second, how many motorists who decided to complete their passes increased their vehicular speed more than normal, in order to do so legally? That these actions or lack of actions do occur can readily be seen in one hour of observance of a no-passing zone on a moderately high-volume highway. That the total effect of the signs on traffic cannot be measured, therefore, was quite understandable. The need for further research, which would incorporate other methods and procedures for measuring driver behavior, was apparent to answer these questions.

The results of the visibility study strongly showed the desirability of a left-side no-passing zone sign. This test also showed that, for recognition of a sign as one of a no-passing zone, the pennant-shaped "NO PASSING ZONE" sign was superior to the "DO NOT PASS" sign. Motorists' favorable reaction to this sign was also an indication of its value and its increased visibility. With the results of the effect on driver behavior as they were, the only criterion for judging the effectiveness of the two signs was the comparative visibility to motorists. Here,

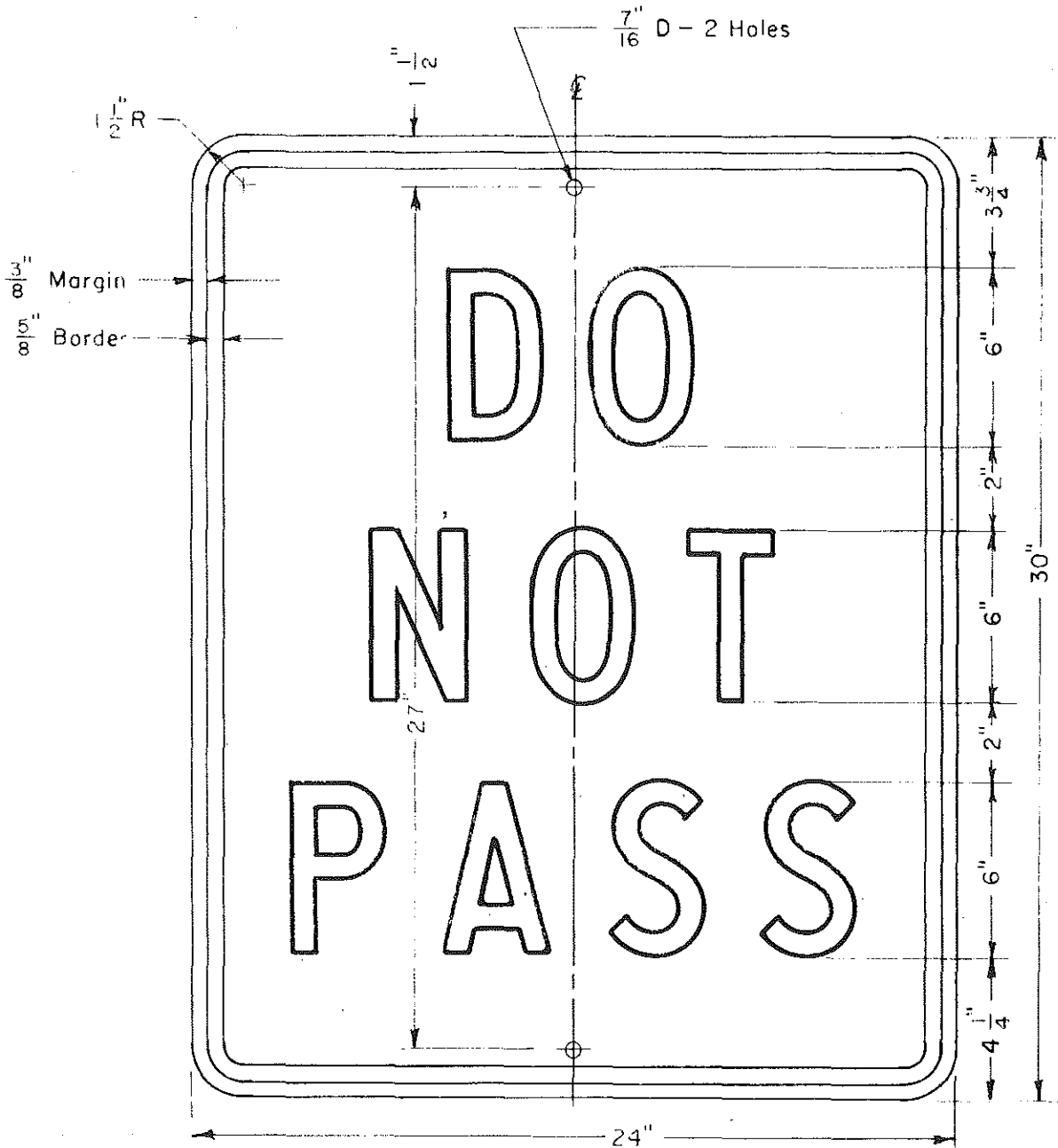
more than in any other category studied, the "NO PASSING ZONE"  
sign showed its superiority.

**APPENDIX I**

**SIGN SPECIFICATIONS**

# DO NOT PASS SIGN

FIGURE - 1



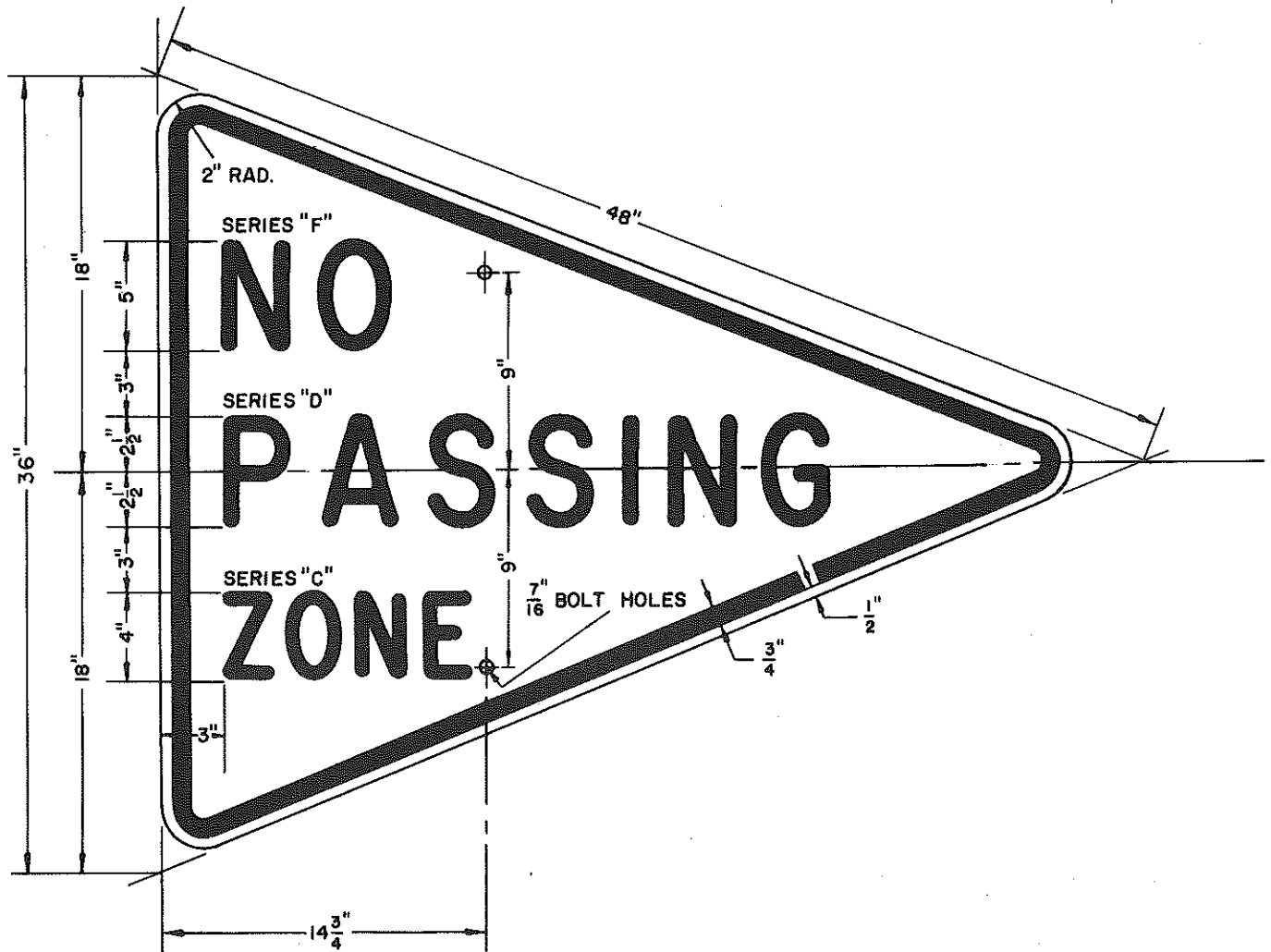
## SPECIFICATIONS

1. Sign Panel: Type III, Sheet Aluminum or approved equal.
2. Sign Face: Type B.
  - (a) Legend; 6" Series "D" (modified) letters - M.S.H.D. standard alphabet.
  - (b) Color; Black legend and border on a silver background.
  - (c) Reflectorization; Silver sheeting.



# NO PASSING ZONE SIGN

FIGURE - 2



N	1.41	O
4.61		5.16

P	0.62	A	0.94	S	0.94	S	1.18	I	1.18	N	1.18	G
3.36		4.19		3.36		3.36		0.78		3.36		3.36

Z	0.68	O	0.84	N	0.84	E
2.19		2.31		2.19		2.00

DESIGN SHOWS FINISHED WORK

LETTERS AND BORDER - SOLID BLACK

BACKGROUND - SMOOTH YELLOW REFLECTIVE SHEETING

SCALE - 1/8 INCH = 1 INCH

LETTER WIDTHS AND INTERLETTER SPACES SHOWN IN CHART

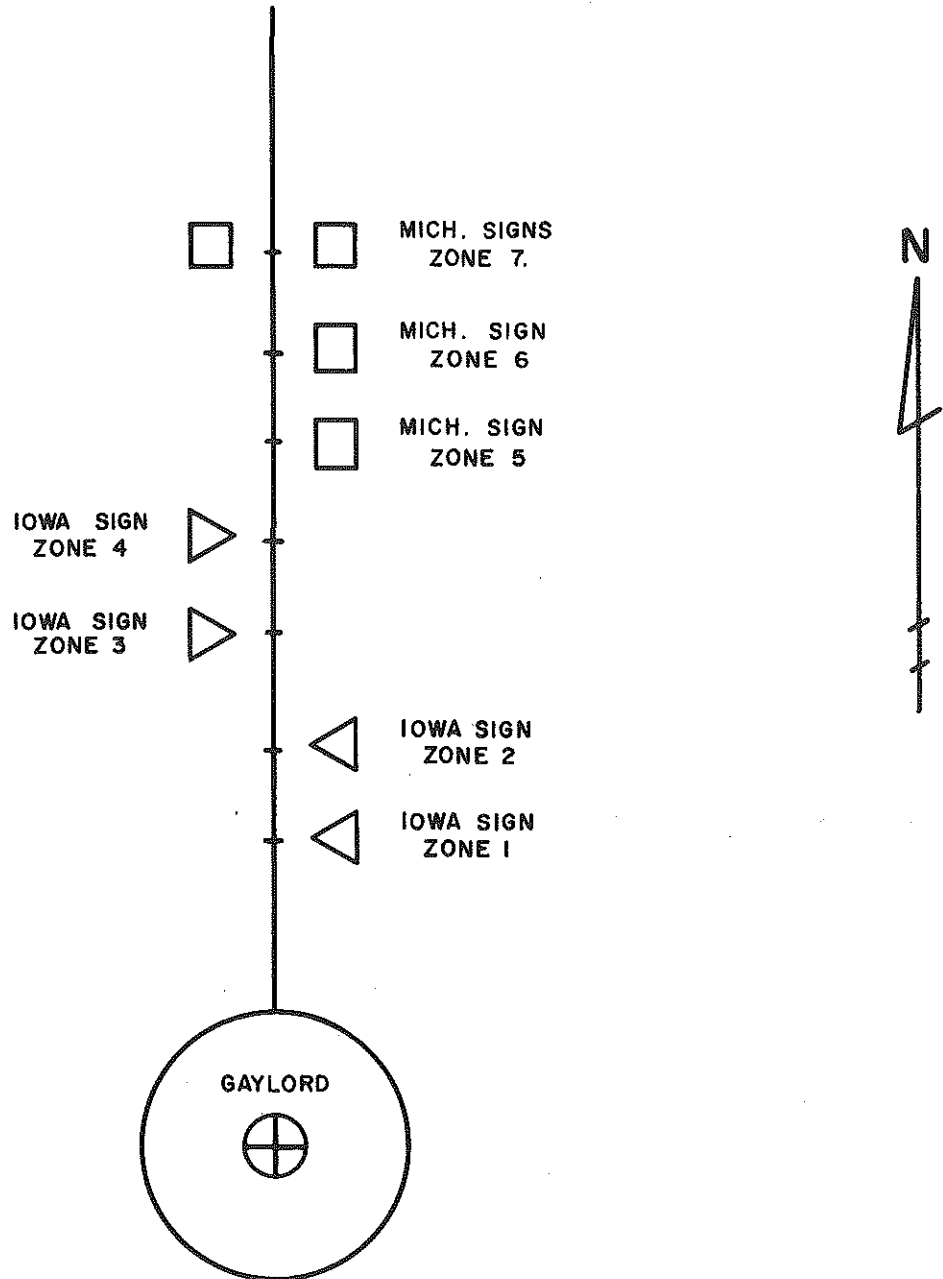
DIMENSIONS ARE IN INCHES

APPENDIX II

DRIVER INTERVIEWS



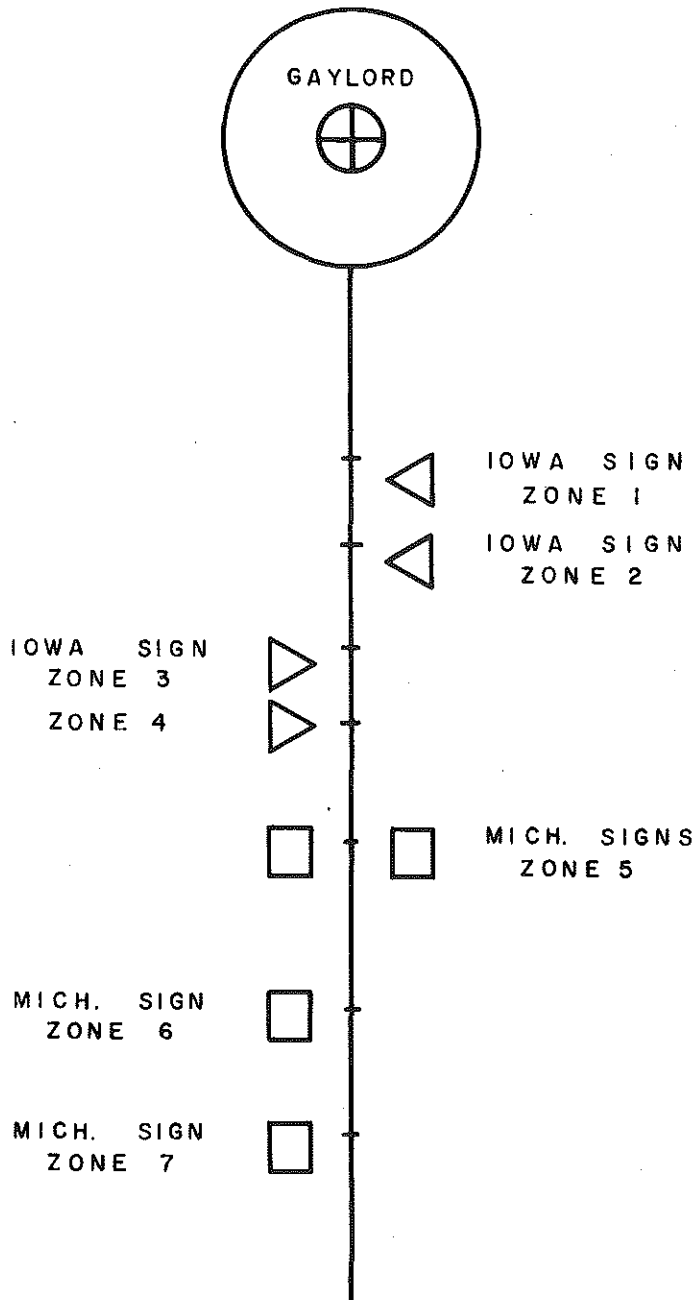
LOCATION OF NO PASSING SIGNS FOR INTERVIEWS  
NORTH STUDY AREA  
DIRECTION OF TRAVEL IS SOUTH



NOTE : NO PASSING ZONES NUMBERED CONSECUTIVELY BEGINNING AT GAYLORD IN BOTH DIRECTIONS  
NORTH AND SOUTH.

FIGURE - 2

LOCATION OF NO PASSING SIGNS FOR INTERVIEWS  
 SOUTH STUDY AREA  
 DIRECTION OF TRAVEL IS NORTH



NOTE: NO PASSING ZONES NUMBERED CONSECUTIVELY BEGINNING AT GAYLORD IN BOTH DIRECTIONS NORTH & SOUTH

FIGURE - 3

APPENDIX III  
DRIVER BEHAVIOR STUDY

- A. DRIVER BEHAVIOR STUDY - PART II\*  
Former US-27 in Clare County
- B. DRIVER BEHAVIOR STUDY - PART III  
US-27 in Calhoun County
- C. DRIVER BEHAVIOR STUDY - PART IV  
US-12 in Cass County

\* Part I is not detailed in this appendix  
since it was not conducive to this analysis.



APPENDIX III - A

DRIVER BEHAVIOR STUDY - PART II

Former US-27 in Clare County

TABLE A1

LOCATION AND DESCRIPTION  
OF  
NO-PASSING ZONES OBSERVED

<u>Zone</u>	<u>Location</u>	<u>Length of Zone</u>	<u>Type of Curve</u>
1	At Beaverton Road, 2 mi.*	555'	Vertical
2	At Dover Road, 3 mi.*	1778'	Vertical
3	At Adams Road, 4 mi.*	1928'	Double Vertical
4	7.9 mi.*	683'	Vertical
5	Just south of Mansiding Rd., 8 mi.*	653'	Vertical
6	Just north of Mansiding Rd., 8 mi.*	2109'	Double Vertical

\* North of Clare City Limits

Note: The study was made on zones in the northbound direction only.



DRIVER BEHAVIOR STUDY - PART II

Former US-27 in Clare County

TABLE A2

SIGNING CONDITIONS AND DATES OBSERVED

<u>Sign</u>	<u>Location</u>	<u>Zone</u>	<u>Day &amp; Date</u>
"DO NOT PASS"	Right	1	(Tue) 10-17-61
		1	(Tue) 10-24-61
		2 thru 6	(Mon) 10-16-61
		Each	(Mon) 10-23-61
"DO NOT PASS"	Left	1	(Wed) 10-18-61
		1	(Wed) 10-25-61
		2 thru 6	(Tue) 10-17-61
		2 thru 6	(Tue) 10-24-61
"NO PASSING ZONE"	Right	1	(Thu) 10-19-61
		1	(Thu) 10-26-61
		2 thru 6	(Wed) 10-18-61
		2 thru 6	(Wed) 10-25-61
"NO PASSING ZONE"	Left	1	(Fri) 10-20-61
		1	(Fri) 10-27-61
		2 thru 6	(Thu) 10-19-61
		2 thru 6	(Thu) 10-26-61

DRIVER BEHAVIOR STUDY - PART II  
Former US-27 in Clare County

TABLE A3  
SUMMARY OF OBSERVATIONS - BY ZONE

Signing Condition	Passes Attempted	Not Completed	Percent	Passes Completed		
				Before Yellow	On Yellow	% On Yellow
<u>ZONE #1</u>						
#1-Right	168	38	22.6	110	20	11.9
#1-Left	116	25	21.6	74	17	14.7
#2-Right	91	25	27.5	54	12	13.2
#2-Left	123	28	22.8	69	26	21.1
Totals	498	116	23.3	307	75	15.1
<u>ZONE #2</u>						
#1-Right	88	20	22.7	55	13	14.8
#1-Left	71	16	22.5	45	10	14.1
#2-Right	72	21	29.2	46	5	6.9
#2-Left	90	19	21.1	55	16	17.8
Totals	321	76	23.7	201	44	13.7
<u>ZONE #3</u>						
#1-Right	116	12	10.3	96	8	6.9
#1-Left	64	2	3.1	53	9	14.1
#2-Right	68	3	4.4	59	6	8.8
#2-Left	58	2	3.4	54	2	3.4
Totals	306	19	6.2	262	25	8.2
<u>ZONE #4</u>						
#1-Right	74	19	25.7	46	9	12.2
#1-Left	56	9	16.1	39	8	14.3
#2-Right	52	5	9.6	39	8	15.4
#2-Left	42	9	21.4	25	8	19.0
Totals	224	42	18.8	149	33	14.7
<u>ZONE #5</u>						
#1-Right	90	10	11.1	62	18	20.0
#1-Left	62	8	12.9	40	14	22.6
#2-Right	62	7	11.3	46	9	14.5
#2-Left	46	7	15.2	29	10	21.7
Totals	260	32	12.3	177	51	19.6
<u>ZONE #6</u>						
#1-Right	75	4	5.3	59	12	16.0
#1-Left	59	1	1.7	50	8	13.6
#2-Right	52	3	5.8	45	4	7.7
#2-Left	38	1	2.6	35	2	5.3
Totals	224	9	4.0	189	26	13.8

SIGN #1 = "DO NOT PASS"

SIGN #2 = "NO PASSING ZONE"

DRIVER BEHAVIOR STUDY - PART II  
Former US-27 in Clare County

TABLE A4

SUMMARY OF OBSERVATIONS - BY SIGNING CONDITION

<u>Zone</u>	<u>Passes Attempted</u>	<u>Not Completed</u>	<u>Percent</u>	<u>Passes Completed</u>		
				<u>Before Yellow</u>	<u>On Yellow</u>	<u>% On Yellow</u>
<u>"DO NOT PASS" - Right</u>						
1	168	38	22.6	110	20	11.9
2	88	20	22.7	55	13	14.8
3	116	12	10.3	96	8	6.9
4	74	19	25.7	46	9	12.2
5	90	10	11.1	62	18	20.0
6	75	4	5.3	59	12	16.0
Totals	611	103	16.9	428	80	13.1
<u>"DO NOT PASS" - Left</u>						
1	116	25	21.6	74	17	14.7
2	71	16	22.5	45	10	14.1
3	64	2	3.1	53	9	14.1
4	56	9	16.1	39	8	14.3
5	62	8	12.9	40	14	22.6
6	59	1	1.7	50	8	13.6
Totals	428	61	14.3	301	66	15.4
<u>"NO PASSING ZONE" - Right</u>						
1	91	25	27.5	54	12	13.2
2	72	21	29.2	46	5	6.9
3	68	3	4.4	59	6	8.8
4	52	5	9.6	39	8	15.4
5	62	7	11.3	46	9	14.5
6	52	3	5.8	45	4	7.7
Totals	397	64	16.1	289	44	11.1
<u>"NO PASSING ZONE" - Left</u>						
1	123	28	22.8	69	26	21.1
2	90	19	21.1	55	16	17.8
3	58	2	3.4	54	2	3.4
4	42	9	21.4	25	8	19.0
5	46	7	15.2	29	10	21.7
6	38	1	2.6	35	2	5.3
Totals	397	66	16.6	267	64	16.1

DRIVER BEHAVIOR STUDY - PART II

Former US-27 in Clare County

TABLE A5

OVERALL COMPARISONS

	<u>Passes Attempted</u>	<u>Not Completed</u>	<u>Percent</u>	<u>Passes Completed</u>		
				<u>Before Yellow</u>	<u>On Yellow</u>	<u>% On Yellow</u>
<u>SIGN vs. SIGN</u>						
Sign #1	1039	164	15.8	729	146	14.1
Sign #2	794	130	16.4	556	108	19.4
<u>RIGHT vs. LEFT</u>						
Right	1008	167	16.6	717	124	12.3
Left	825	127	15.4	568	130	15.8
<u>OVERALL TOTALS</u>						
	1833	294	16.0	1285	254	13.9

SIGN #1 = "DO NOT PASS"

SIGN #2 = "NO PASSING ZONE"

APPENDIX III - B

DRIVER BEHAVIOR STUDY - PART III

US-27 in Calhoun County

TABLE B1

LOCATION AND DESCRIPTION  
OF  
NO-PASSING ZONES OBSERVED

<u>Zone</u>	<u>Location</u>	<u>Direction</u>	<u>Length of Zone</u>	<u>Type of Curve</u>
1	Immediately south of north county line.	Northbound Southbound	547' 504'	Vertical Horizontal
Note: Northbound striping could not be seen until almost at beginning of zone.				
2	First zone north of Interchange with I-94	Northbound Southbound	900' 850'	Vertical Double vertical
3	At 17 Mile Road and L Drive south, about 4 mi. north of M-60	Northbound Southbound	709' 758'	Horizontal Horizontal

Note: Northbound striping and sign could not be  
seen until within 350' of beginning of zone.

DRIVER BEHAVIOR STUDY - PART III

US-27 in Calhoun County

TABLE B2

SIGNING CONDITIONS AND DATES OBSERVED

<u>Sign</u>	<u>Location</u>	<u>Zone</u>	<u>Day &amp; Date</u>	
"DO NOT PASS"	Right	1 & 2	(Thu)	5-3-62
	Right	3	(Fri)	5-4-62
	Right	All	(Thu)	5-24-62
"NO PASSING ZONE"	Right	All	(Mon)	5-14-62
	Right	All	(Tue)	5-15-62
"NO PASSING ZONE"	Left	All	(Tue)	5-8-62
	Left	All	(Wed)	5-9-62

DRIVER BEHAVIOR STUDY - PART III  
US-27 in Calhoun County

TABLE B3

SUMMARY OF OBSERVATIONS - BY ZONE

<u>Signing Condition</u>	<u>Passes Attempted</u>	<u>Not Completed</u>	<u>Percent</u>	<u>Passes Completed</u>		
				<u>Before Yellow</u>	<u>On Yellow</u>	<u>% On Yellow</u>
<u>ZONE #1 - NORTHBOUND</u>						
#1-Right	24	5	20.8	13	6	25.0
#2-Right	35	11	31.4	19	5	14.3
#2-Left	<u>27</u>	<u>12</u>	<u>44.4</u>	<u>12</u>	<u>3</u>	<u>11.1</u>
Totals	86	28	32.6	44	14	16.3
<u>ZONE #1 - SOUTHBOUND</u>						
#1-Right	47	16	34.0	27	4	8.5
#2-Right	67	34	50.7	32	1	1.5
#2-Left	<u>29</u>	<u>11</u>	<u>37.9</u>	<u>17</u>	<u>1</u>	<u>3.4</u>
Totals	143	61	42.7	76	6	4.2
<u>ZONE #2 - NORTHBOUND</u>						
#1-Right	27	7	25.9	18	2	7.4
#2-Right	30	10	33.3	15	5	16.7
#2-Left	<u>30</u>	<u>9</u>	<u>30.0</u>	<u>18</u>	<u>3</u>	<u>10.0</u>
Totals	87	26	29.9	51	10	11.5
<u>ZONE #2 - SOUTHBOUND</u>						
#1-Right	44	4	9.1	37	3	6.8
#2-Right	47	2	4.3	41	4	8.5
#2-Left	<u>40</u>	<u>7</u>	<u>17.5</u>	<u>33</u>	<u>0</u>	<u>0.0</u>
Totals	131	13	9.9	111	7	5.3
<u>ZONE #3 - NORTHBOUND</u>						
#1-Right	30	14	46.7	5	11	36.7
#2-Right	27	17	63.0	5	5	18.5
#2-Left	<u>18</u>	<u>8</u>	<u>44.4</u>	<u>3</u>	<u>7</u>	<u>38.9</u>
Totals	75	39	52.0	13	23	30.7
<u>ZONE #3 - SOUTHBOUND</u>						
#1-Right	26	1	3.8	20	5	19.2
#2-Right	23	3	13.0	16	4	17.4
#2-Left	<u>14</u>	<u>1</u>	<u>7.1</u>	<u>9</u>	<u>4</u>	<u>28.6</u>
Totals	63	5	7.9	45	13	20.6

SIGN #1 = "DO NOT PASS"

SIGN #2 = "NO PASSING ZONE"

DRIVER BEHAVIOR STUDY - PART III  
US-27 in Calhoun County

TABLE B4

SUMMARY OF OBSERVANCES - BY SIGNING CONDITION

Zone	Passes Attempted	Not Completed	Percent	Passes Completed		
				Before Yellow	On Yellow	% On Yellow
<u>"DO NOT PASS" - Right</u>						
1 (NB)	24	5	20.8	13	6	25.0
(SB)	47	16	34.0	27	4	8.5
2 (NB)	27	7	25.9	18	2	7.4
(SB)	44	4	9.1	37	3	6.8
3 (NB)	30	14	46.7	5	11	36.7
(SB)	26	1	3.8	20	5	19.2
Totals	198	47	23.7	120	31	15.7
<u>"NO PASSING ZONE" - Right</u>						
1 (NB)	35	11	31.4	19	5	14.3
(SB)	67	34	50.7	32	1	1.5
2 (NB)	30	10	33.3	15	5	16.7
(SB)	47	2	4.3	41	4	8.5
3 (NB)	27	17	63.0	5	5	18.5
(SB)	23	3	13.0	16	4	17.4
Totals	229	77	33.6	128	24	10.5
<u>"NO PASSING ZONE" - Left</u>						
1 (NB)	27	12	44.4	12	3	11.1
(SB)	29	11	37.9	17	1	3.4
2 (NB)	30	9	30.0	18	3	10.0
(SB)	40	7	17.5	33	0	0.0
3 (NB)	18	8	44.4	3	7	38.9
(SB)	14	1	7.1	9	4	28.6
Totals	158	48	30.4	92	18	11.4



DRIVER BEHAVIOR STUDY - PART III

US-27 in Calhoun County

TABLE B5

OVERALL COMPARISONS

	<u>Passes Attempted</u>	<u>Not Completed</u>	<u>Percent</u>	<u>Passes Completed</u>		
				<u>Before Yellow</u>	<u>On Yellow</u>	<u>% On Yellow</u>
<u>SIGN vs. SIGN</u>						
Sign #1	198	47	23.7	120	31	15.7
Sign #2	387	125	32.3	220	42	10.9
<u>RIGHT vs. LEFT</u>						
Right	427	124	29.0	248	55	12.9
Left	158	48	30.4	92	18	11.4
<u>OVERALL TOTALS</u>						
	585	172	29.4	340	73	12.5

SIGN #1 = "DO NOT PASS"

SIGN #2 = "NO PASSING ZONE"

APPENDIX III - C

DRIVER BEHAVIOR STUDY - PART IV

US-12 in Cass County

TABLE C1

LOCATION AND DESCRIPTION  
OF  
NO-PASSING ZONES OBSERVED

<u>Zone</u>	<u>Location</u>	<u>Direction</u>	<u>Length of Zone</u>	<u>Type of Curve</u>
A	First simple vertical curve on US-12 east of Village of Edwardsburg	Eastbound Westbound	400' 465'	Simple vertical
B	Only no-passing zone on M-60BR east of City of Niles	Eastbound Westbound	450' 1050'	Simple vertical
C	First simple vertical curve on US-12 east of Community of Union	Eastbound Westbound	400' 400'	Simple Vertical

A = Zone required, not in place

B = Zone not required, but in place

C = Zone not required, not in place

DRIVER BEHAVIOR STUDY - PART IV

US-12 in Cass County

TABLE C2

SIGNING CONDITIONS AND DATES OBSERVED

<u>Zone</u>	<u>Condition</u>	<u>Day &amp; Date</u>
A	1. No Stripe & No Sign	(Fri) 9-21-62
	2. No Stripe & "DO NOT PASS"	(Mon) 9-24-62
	3. No Stripe & "NO PASSING ZONE"	(Tue) 9-25-62
	4. Stripe & No Sign	(Wed) 9-26-62
	5. Stripe & "NO PASSING ZONE"	(Thu) 9-27-62
	6. Stripe & "DO NOT PASS"	(Fri) 9-28-62
B	1. Stripe & No Sign	(Fri) 9-21-62
	2. Stripe & "NO PASSING ZONE"	(Mon) 9-24-62
	3. Stripe & "DO NOT PASS"	(Tue) 9-25-62
C	1. No Stripe & "DO NOT PASS"	(Wed) 9-26-62
	2. No Stripe & "NO PASSING ZONE"	(Thu) 9-27-62
	3. No Stripe & No Sign	(Fri) 9-28-62

DRIVER BEHAVIOR STUDY - PART IV  
US-12 in Cass County

TABLE C3

SUMMARY OF OBSERVATIONS - BY ZONE

Condition Stripe Sign	Passes Attempted	Not Completed	Percent	Passes Completed		
				Before Yellow	On Yellow	% On Yellow
<u>ZONE A - EASTBOUND</u>						
No No	18	0	0.0	8	10 + 3*	55.6
No #1	8	1	12.5	3	4 + 2*	50.0
No #2	13	0	0.0	10	3	23.1
Yes No	13	0	0.0	11	2	15.4
Yes #1	7	0	0.0	3	4	57.1
Yes #2	14	0	0.0	10	4 + 1*	28.6
Totals	73	1	1.4	45	27 + 6*	37.0
<u>ZONE A - WESTBOUND</u>						
No No	24	6	25.0	6	12 + 14*	50.0
No #1	21	6	28.6	4	11 + 8*	52.4
No #2	18	3	16.7	10	5 + 4*	27.8
Yes No	17	5	29.4	8	4 + 1*	23.5
Yes #1	16	7	43.8	8	1 + 2*	6.2
Yes #2	13	3	23.1	9	1	7.7
Totals	109	30	27.5	45	34 + 29*	31.2
<u>ZONE B - EASTBOUND</u>						
Yes No	37	14	37.8	18	5 + 5*	13.5
Yes #1	17	6	35.3	8	3 + 1*	17.6
Yes #2	27	8	29.6	11	8	29.6
Totals	81	28	34.6	37	16 + 6*	19.8
<u>ZONE B - WESTBOUND</u>						
Yes No	23	10	43.5	9	4 + 2*	17.4
Yes #1	12	1	8.3	10	1 + 1*	8.3
Yes #2	8	1	12.5	5	2	25.0
Totals	43	12	27.9	24	7 + 3*	16.3
<u>ZONE C - EASTBOUND</u>						
No No	6	3	50.0	3	0	0.0
No #1	8	2	25.0	6	0	0.0
No #2	7	3	42.9	3	1 + 1*	14.3
Totals	21	8	38.1	12	1 + 1*	4.8
<u>ZONE C - WESTBOUND</u>						
No No	17	1	5.9	9	7 + 1*	41.2
No #1	14	7	50.0	3	4 + 1*	28.6
No #2	15	4	26.7	8	3 + 1*	20.0
Totals	46	12	26.1	20	14 + 3*	30.4

\* Incompleted pass begun in violation zone.

SIGN #1 = "DO NOT PASS"

SIGN #2 = "NO PASSING ZONE"

Note: Under the Condition, Stripe-No, Passes Completed-On Yellow means the passes were completed at points where there would have been a yellow stripe to the right of the center line had a no-passing zone been demarcated.

DRIVER BEHAVIOR STUDY - PART IV

US-12 in Cass County

TABLE C4

SUMMARY OF OBSERVATIONS  
BY  
SIGNING AND STRIPING CONDITION

<u>Condition</u> <u>Stripe</u> <u>Sign</u>	<u>Passes</u> <u>Attempted</u>	<u>Not</u> <u>Completed</u>	<u>Percent</u>	<u>Passes Completed</u>		
				<u>Before</u> <u>Yellow</u>	<u>On</u> <u>Yellow</u>	<u>% On</u> <u>Yellow</u>
No No	65	10	15.4	26	29	44.6
No #1	51	16	31.4	16	19	37.3
No #2	53	10	18.9	31	12	22.6
Yes No	90	29	32.2	46	15	16.7
Yes #1	52	14	26.9	29	9	17.3
Yes #2	62	12	19.4	35	15	24.2

SIGN #1 = "DO NOT PASS"

SIGN #2 = "NO PASSING ZONE"

DRIVER BEHAVIOR STUDY - PART IV

US-12 in Cass County

TABLE C5

EFFECT OF STRIPING - "A" ZONES ONLY

<u>Zone</u>	<u>Passes Attempted</u>	<u>Not Completed</u>	<u>Percent</u>	<u>Passes Completed</u>		
				<u>Before Yellow</u>	<u>On Yellow</u>	<u>% On Yellow</u>
<u>NO STRIPING</u>						
A (EB)	39	1	2.6	21	17 + 5*	43.6
(WB)	63	15	23.8	20	28 + 26*	44.4
Totals	102	16	15.7	41	45 + 31*	44.1
<u>STRIPING</u>						
A (EB)	34	0	0.0	24	10 + 1*	29.4
(WB)	46	15	32.6	25	6 + 3*	13.0
Totals	80	15	18.8	49	16 + 4*	20.0

\* Incompleted pass attempted in violation zone.

DRIVER BEHAVIOR STUDY - PART IV

US-12 in Cass County

TABLE C 6

EFFECT OF SIGNS WITH STRIPING

ZONES A & B

Zone	Passes Attempted	Not Completed	Percent	Passes Completed		Violation Percentage
				Before Yellow	On Yellow	
<u>"DO NOT PASS"</u>						
A (EB)	7	0	0.0	3	4	57.2
(WB)	16	7	43.7	8	1 + 2*	6.2
B (EB)	17	6	35.3	8	3 + 1*	17.6
(WB)	12	1	8.3	10	1 + 1*	8.3
Totals	52	14	26.9	29	9 + 4*	17.3
<u>"NO PASSING ZONE"</u>						
A (EB)	14	0	0.0	10	4 + 1*	28.6
(WB)	13	3	23.1	9	1	7.7
B (EB)	27	8	29.6	11	8	29.6
(WB)	8	1	12.5	5	2	25.0
Totals	62	12	19.4	35	15 + 1*	24.2
<u>NO SIGN</u>						
A (EB)	13	0	0.0	11	2	15.4
(WB)	17	5	29.4	8	4 + 1*	23.5
B (EB)	37	14	37.9	18	5 + 5*	13.5
(WB)	23	10	43.4	9	4 + 2*	17.4
Totals	90	29	32.3	46	15 + 8*	16.7

\* Incompleted passes attempted in violation zone.

DRIVER BEHAVIOR STUDY - PART IV

US-12 in Cass County

TABLE C 7

EFFECT OF SIGNS WITHOUT STRIPING

ZONES A & C

Zone	Passes Attempted	Not Completed	Percent	Passes Completed		Percentage
				Before Yellow	On Yellow	
<u>"DO NOT PASS"</u>						
A (EB)	8	1	12.5	3	4 + 2*	50.0
(WB)	21	6	28.6	4	11 + 8*	52.4
C (EB)	8	2	25.0	6	0	0.0
(WB)	14	7	50.0	3	4 + 1*	28.6
Totals	51	16	31.4	16	19 + 11*	37.3
<u>"NO PASSING ZONE"</u>						
A (EB)	13	0	0.0	10	3	23.1
(WB)	18	3	16.7	10	5 + 4*	27.8
C (EB)	7	3	42.8	3	1 + 1*	14.3
(WB)	15	4	26.7	8	3 + 1*	20.0
Totals	53	10	18.9	31	12 + 6*	22.6
<u>NO SIGN</u>						
A (EB)	18	0	0.0	8	10 + 3*	55.5
(WB)	24	6	25.0	6	12 + 14*	50.0
C (EB)	6	3	50.0	3	0	0.0
(WB)	17	1	5.9	9	7 + 1*	41.2
Totals	65	10	15.4	26	29 + 18*	44.7

\* Incompleted passes attempted in violation zone.



DRIVER BEHAVIOR STUDY - PART IV

US-12 in Cass County

TABLE C 8

OVERALL COMPARISONS

SIGN vs. SIGN

	<u>Passes Attempted</u>	<u>Not Completed</u>	<u>Percent</u>	<u>Passes Completed</u>		<u>Violation Percentage</u>
				<u>Before Yellow</u>	<u>On Yellow</u>	
No Sign	155	39	25.2	72	44 + 26*	28.4
Sign #1	103	30	29.1	45	28 + 15*	28.2
Sign #2	115	22	19.1	66	27 + 7*	23.5
Totals	373	91	24.4	183	99 + 48*	26.6

\* Incompleted passes attempted in violation zone.

SIGN #1 = "DO NOT PASS"

SIGN #2 = "NO PASSING ZONE"