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MICHIGAN DEPARTMENT OF STATE HIGHWAYS

STUDY OF FREEWAY WEIGH STATION SIGNING

By

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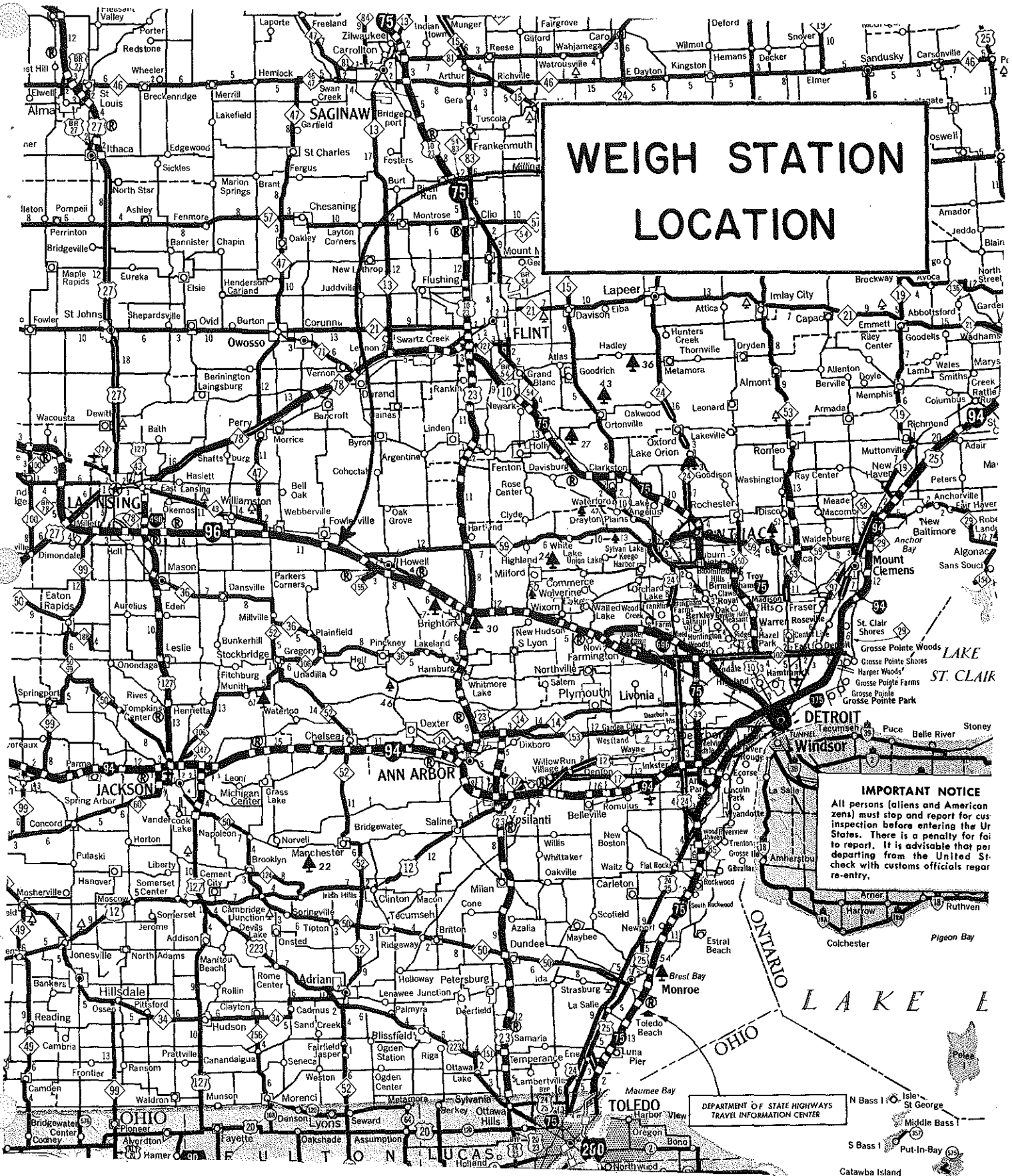
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WEIGH STATION LOCATION



IMPORTANT NOTICE
All persons (aliens and American
zens) must stop and report for cus
inspection before entering the U
States. There is a penalty for fai
to report. It is advisable that per
departing from the United St
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WEIGH STATION STUDY

INTRODUCTION

The installation of truck weigh stations on Interstate freeway systems created problems not existing on older-type, two-way roads, demanding the development of new, remote controlled changeable message blankout signs to communicate weigh station status to truck drivers.

PROBLEM

The problems created were:

- (1) Possible danger of slowing trucks on freeway when preparing to enter the scales area.
- (2) Reduced manpower prohibited 24-hour operation of the scales. Truckers complained about the inconvenience and delay caused by the necessity of trucks crossing scales when not in operation.
- (3) Unattended scales were being damaged by trucks crossing the scales platform too fast.
- (4) Temporary truck stalls and breakdowns on the scales platform or approaches could cause a queue of trucks on the freeway before Weighmaster personnel could change the message.
- (5) The manually operated "Open-Closed" reflective sign required Weighmaster personnel to travel on freeway, make a U-Turn and stop on the shoulder to change messages. This procedure is dangerous to Weighmaster

personnel and motoring public.

The original signing layout used on Michigan freeways to designate Weigh Scales is shown in Figure #1.

SIGN DEVELOPMENT

The original remote controlled electrical blankout signs were developed first with neon illumination and then converted to incandescent and fluorescent illumination.

NEON SIGN

To be effective, this special sign had to be legible 600' - 1000' in advance of the scales entrance.

The original sign developed was 10' long and 4' high. It was mounted with an 8' bottom height from the pavement.

The legend "SCALES" was illuminated at all times with 800 ma. fluorescent lamps. The legend was formed by 12" letters, cut out of black lettering film and overlaid on yellow acrylic plexiglas.

The "Open" "Closed" message was formed with green tubing pumped with red neon gas to provide 15" sunburst color messages. These messages were covered with a louvered screen to provide a "blankout effect" when not illuminated.

ORIGINAL WEIGH SCALES SIGNING USING
MANUAL "OPEN" & "CLOSED" SIGNS.

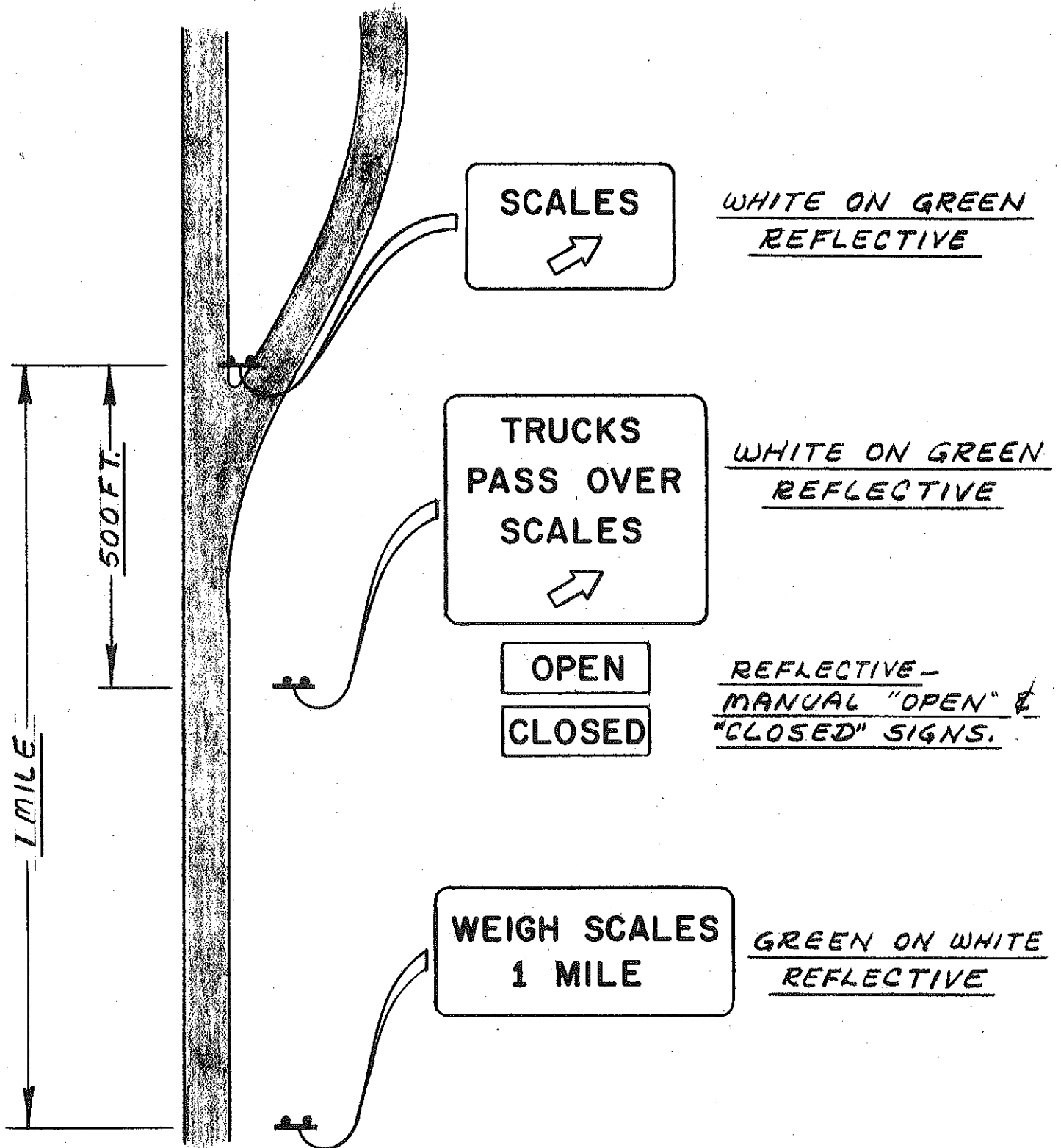
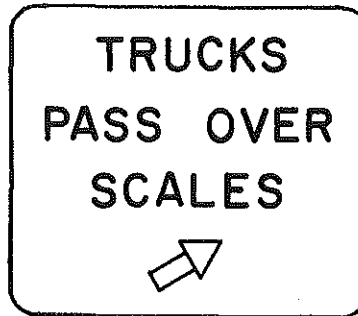


FIGURE #1

The sign was installed on the shoulder and replaced the standard Michigan sign:



Although the experimental sign was accepted by Weighmaster personnel and the trucking industries, some problems existed making changes necessary in the design of the sign:

- (1) Direct sunlight on the face of the neon section of the sign reduced readability considerably.
- (2) Electrical power consumption which averaged \$15 to \$20 per sign per month was not excessive, but maintenance of the neon section of the sign was very costly.

INCANDESCENT SIGN

The neon tubing was replaced by special 25 watt, yellow R-20 incandescent lamps. These lamps provide a legible message even in strong sunlight, and provided enough light output at night to require a photocell dimming device.

The incandescent lamps solved the problems of the neon message sign, but produced a new problem of their own. Electrical power consumption raised to approximately \$40 per sign per month which is excessive for operating cost.

Also, removing the standard "ALL TRUCKS PASS OVER SCALES" sign confused some non-professional truck drivers, although the law is well defined in the "Michigan Vehicle Code".

It became apparent that a color coding of the two messages would provide quicker communications to the trucker as to status of scales.

FLUORESCENT SIGN

To overcome these problems, a new sign was developed. (Figure #2). The "ALL TRUCKS" and "SCALES" messages are standard 10-inch series "D" reflectorized silver letters on reflectorized green background.

The internally illuminated "blankout" messages are illuminated by V.H.O. 1500 ma. fluorescent lamps.

The "BY PASS" message is produced by #2124 green plexiglas and the "PASS OVER" message is produced by #2451 amber plexiglas, giving a distinct color coded message to the truck driver.

The messages in the illuminated portion use 10-inch letters, using "D" series spacing with "C" series stroke to eliminate "Light spill over".

Engineering judgment gained through operational experience, observations and comments showed the acceptance of this sign far superior to preceding signs.

ORIGINAL MICHIGAN STANDARD FOR FREEWAY
WEIGH STATION SIGNING USING INTERNALLY
ILLUMINATED SIGNS.

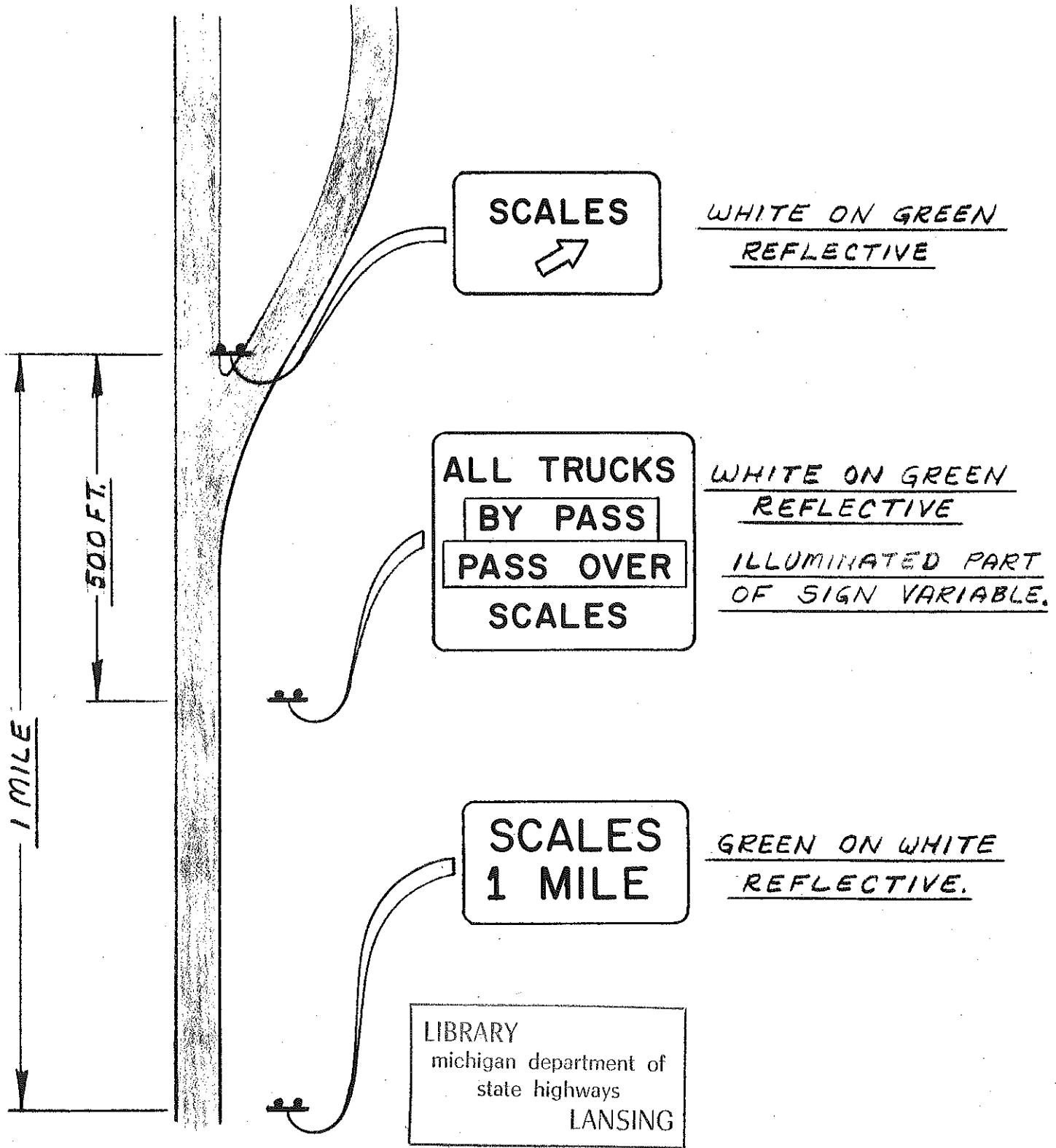


FIGURE #2

The V.H.O. fluorescent lamps provide an exceptional good day-time message, readable up to 600', but are overpowering at night. Arrangements could be made to provide a dimming device for nighttime viewing.

It was also recommended that the entire sign be illuminated since the light message overpowers the reflectorized message at night. This was never accomplished.

AASHO STANDARD AND MICHIGAN SIGN

At the time the Michigan sign was proposed as a State standard, the new AASHO Interpretation Memorandum No. 61-30 for Weigh Station Signing, dated June 11, 1965, was issued. (Figure #3). Since the two systems are quite different, Michigan requested an interpretation from the AASHO Committee as to use of the Michigan system. At the request of the AASHO Committee, it was decided to install both systems at the I-96 Fowlerville Scales as a field test study.

STUDY PROCEDURE

Observations of truck movement, brake lights, etc. at Freeway Weigh Station entrances showed reliable data could not be collected by these methods; therefore, it was decided that a survey of truck driver opinions at the Weigh Station would be the study procedure.

AASHO STANDARD FOR FREEWAY

WEIGH STATION SIGNING.

MEMORANDUM NO. 61-30 ISSUED 6-11-65.

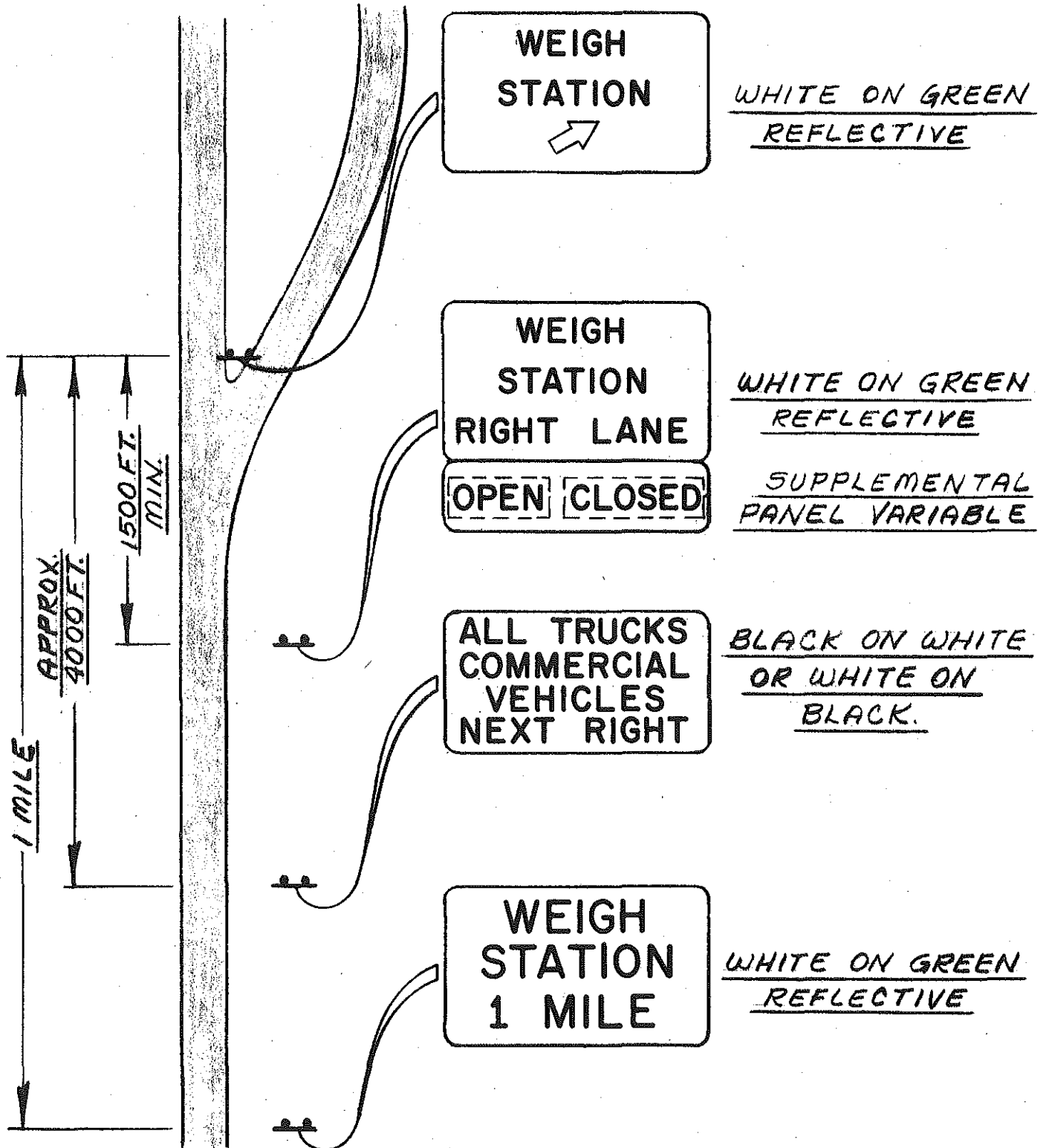


FIGURE #3

INTERVIEW PROCEDURE

Since the drivers to be interviewed were truck drivers who use the Weigh Station, the location picked for the interview was the Weigh Station on I-96 near Fowlerville. When the Weigh Station is open, all trucks are required to leave the main roadway and cross over the scales. The Weigh Stations are signed to require trucks to cross over the scales at a speed of 10 MPH or less. This provided for easy direction of trucks into the interview lane, located just beyond the scales on the shoulder of the roadway. This location of the interview station provided the greatest degree of safety for the interviewers.

Each interviewer was equipped with a battery-powered telephone headset, a plastic encased cardboard with the questions to be asked, and a notebook with colored photographs of the two sign systems under study. All answers to the interviews were recorded by a recorder located inside the scale house.

Once the truck driver had been directed into the interview lane, the interviewer would approach him, and say, "How did you know the Weigh Station was open?" The driver's answer would be recorded as "sign" or "other". The interviewer would then explain that this was a survey to determine a standardized sign to be used at all Freeway Weigh Stations in the State of Michigan. The interviewer would then ask the truck driver, "How often do you drive this part of I-96?" The driver's answer

was recorded into two categories - more than once a month or once a month or less. If the driver answered once a month or less, the interviewer would show him colored photographs of the signs under study, and ask, "Would you like to see either sign become the one used in Michigan?" If the driver answered "yes", it was recorded, and he was asked, "Which one?" The interviewer then asked the driver, "Would you recommend or suggest changes in these signs?" Any suggestions were recorded. The interviewer then asked the driver, "Could you tell from the interview which sign we are interested in?" If the driver answered "yes", he was asked, "Which one do you think it is?" and his answer was recorded. This question was asked of the driver to determine any bias of interviewers.

When the driver answered the question, "How often do you drive this part of I-96?", as "more than once a month", the interviewer asked, "What does the sign at this Weigh Station say?", and "What color is the lighted part of the sign?" Because of this driver's familiarity, he was then asked, "Could you describe the sign at the Weigh Station across the Road?" The driver's answer was recorded simply as "yes" or "no".

At this time, the driver was handed the colored photographs of the two signs under study and asked the rest of the questions in the same manner as the unfamiliar driver.

All recording was done on a prepared form by a recorder inside the Weigh Station. The recorder received the answers by hearing

the conversation between the interviewer and the truck driver over the telephone headsets.

Any repeat drivers were not interviewed the second time through.

INTERVIEW SHEET QUESTIONS

How did you know the scale was open today?

How often do you drive this part of I-96?

More than once a month

What does the sign at this Weigh Station say?

What color is the lighted part of the sign?

Could you describe the sign at the Weigh Station across
the road?

(Show pictures)

Would you like to see either sign become the one used in
Michigan?

Which one?

Would you recommend or suggest changes in the Weigh Station
Signs?

Could you tell from my interview which sign we are interested
in?

Which one do you think it is?

How often do you drive this part of I-96?

Once a month or less

(Show pictures)

Would you like to see either sign become the one used in
Michigan?

Which one?

Would you recommend or suggest changes in the signs?

Could you tell from my interview which sign we are interested
in?

Which one do you think it is?

INTERVIEW RECORDING SHEET

Interviewer _____ Interview No. _____

Hour _____

Direction of Travel _____ Bound

Professional Driver

Yes

No

What Caused You to Enter This Weigh Station? Sign Other

How often do you drive this part of I-96?

More than once a month

Once a month or less

Would you describe the signs at this weigh station?

Yes

No

Can you describe the sign at the Weigh Station on the other side

Yes

No

If no, show picture of sign on other side

This is a picture of the sign (show picture)

This is a picture of the sign on the other side (show picture)

We are attempting to improve the signing at our Weigh Stations

This is a picture of the sign you just passed (show picture)

This is a picture of the sign on the other side (show picture)

Would you like to see either sign become standard?

Yes

No

Which sign?

State

National

Would you recommend or suggest changes in these signs?

(Record any suggestions)

Can you tell which one of these signs I am interested in? Yes No

If so, which sign _____

ANALYSIS

249 interviews were taken in 8 hours from 2:00 P.M. to 11:00 P.M. Each interviewer's recordings were checked for bias before grouping. There was no apparent bias among the interviewers.

Of the 249 interviewed, 129 or 52% preferred the State sign. It was felt that unless a substantially larger percent of truck drivers preferred the State sign, the national standard should be approved. Using a simple binomial model, the 95% confidence bounds for the grouped responses would not encompass 60%. Therefore, the national standard appears acceptable.

	<u>Total No. Interviewed</u>	<u>Observation Pref. Mich. Sign</u>	<u>An upper bound for a 95% con- fidence interval*</u>
Totals - Day	164	0.51	0.57
Nite	85	0.54	0.63
Drivers who identi- fied both signs	93	0.58	0.64
Drivers who identi- fied one sign only	88	0.55	0.64
Drivers who identi- fied no signs	28	0.42	0.58
Drivers who drove the area less than once a month	40	0.35	0.48
Drove Eastbound	119	0.53	0.61
Drove Westbound	90	0.59	0.68
	<hr/>	<hr/>	<hr/>
Totals	249	0.52	0.57

* The confidence bounds are one-sided. They were calculated for the sample listed to the left and do not represent simultaneous 95% confidence bounds for all categories. The categories which seem most relevant to the reader can thus be evaluated separately. However, caution must be used in quoting several upper bounds as 95% bounds where the samples are not disjoint, e.g. "Drivers who identified both signs" and "Drove Westbound" are not disjoint.

CONCLUSION

The Michigan sign appeared to be preferred (not significant at a 5% level) as the standard sign. However, since most drivers interviewed were familiar with the area, the percent favoring the State sign would not warrant recommending changing the national sign.

For purposes of the analysis, truck drivers were separated into the following categories:

- (1) Those who used the freeway more than once a month who could
 - (a) describe both signs
 - (b) describe one sign
 - (c) describe no sign
- (2) Those who used the road less than once a month.

Drivers' preference for the State sign was related to the above classifications. The better they could describe the signs, the higher their preference was for the State sign. The highest preference was 58% (one group) for the State sign.

Driver comments showed a requirement for color coding of the "Open-Closed" message, and better readability by providing a background around the illuminated messages. Drivers also preferred the sign installed further in advance of the exit for quicker decision making.

RECOMMENDATIONS

Both type signs provide a complete means of communicating Weigh Station status to truck drivers. The Michigan Standard was not greatly preferred by truck drivers. Therefore, to provide better uniformity for the Freeway truck driver, it is recommended to use the AASHO Standard for Weigh Station Signing on Michigan Freeways, with certain minor changes as shown in Figure #4 to conform to Michigan laws.

PROPOSED MICHIGAN STANDARD FOR FREEWAY
WEIGH STATION SIGNING.

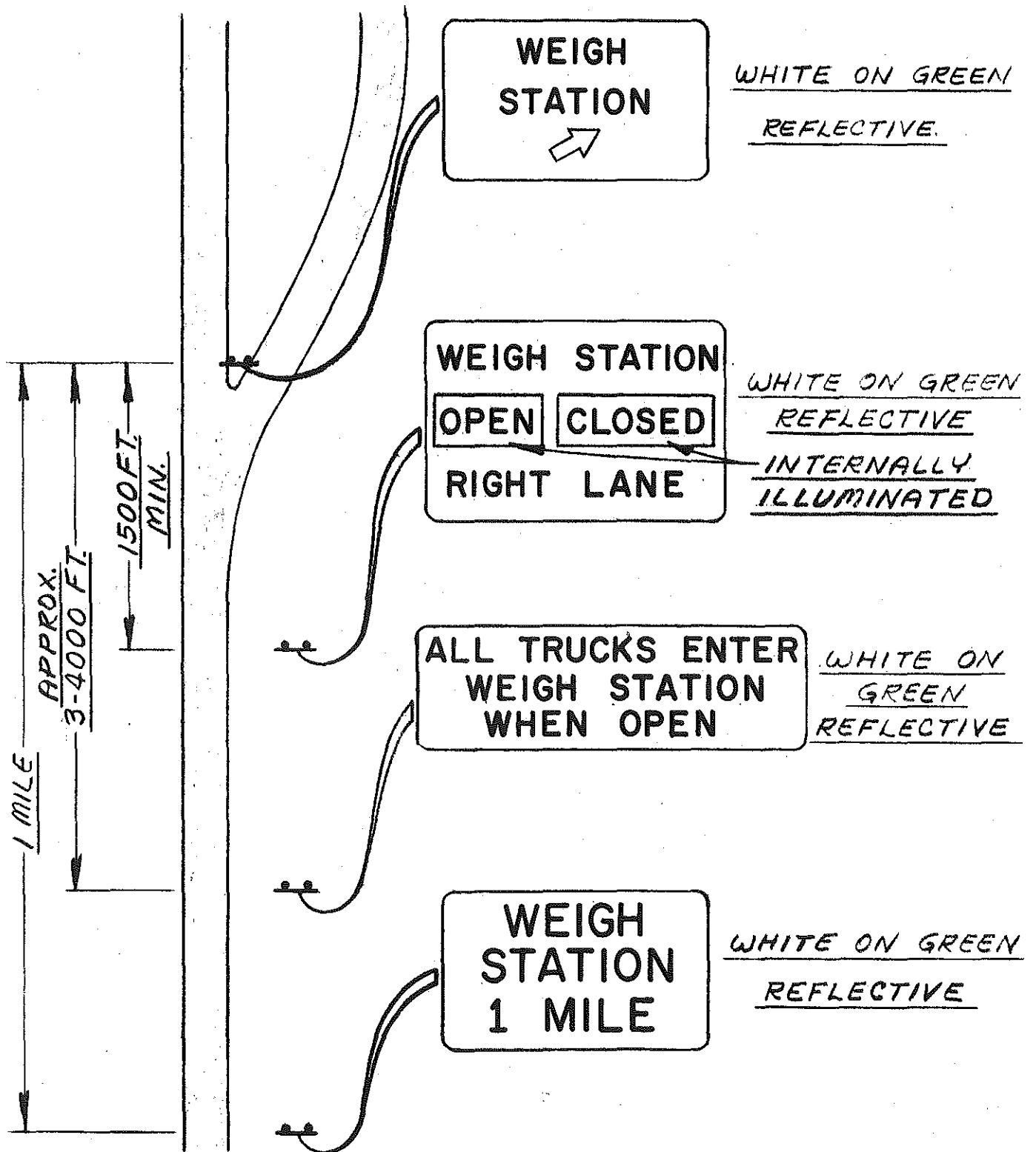


FIGURE #4

	Day Westbound				Nite Eastbound				Day Eastbound				Nite Westbound				Totals
Interviewers	1				2				3				4				
Total Drivers Interviewed																	
Day	34				36				38				56				164
Nite	23				27				16				19				85
Described Both Signs	Preferred				Preferred				Preferred				Preferred				
	State	AASHO	None	Sub-Total	State	AASHO	None	Sub-Total	State	AASHO	None	Sub-Total	State	AASHO	None	Sub-Total	
Day	7	4	0	11	7	3	1	11	5	2	2	9	12	10	2	24	55
Nite	8	3	1	12	7	1	0	8	4	7	0	11	4	2	1	7	38
Described One Sign																	
	Day	9	5	1	15	8	3	3	14	6	7	1	14	8	4	3	
Nite	5	1	0	6	7	4	1	12	2	2	0	4	3	5	0	8	30
No Signs Described																	
	Day	1	0	1	2	4	0	0	4	2	3	1	6	2	4	1	
Nite	1	1	1	3	0	2	1	3	0	0	0	0	2	1	0	3	9
Those Who Used Road More Than Once A Month																	
	Day	17	9	2	28	19	6	4	29	13	12	4	29	22	18	6	
Nite	14	5	2	21	14	7	2	23	6	9	0	15	9	8	1	18	77
Those Who Used Road Less Than Once A Month																	
	Day	1	3	2	6	4	1	2	7	2	7	0	9	5	4	1	
Nite	1	1	0	2	2	2	0	4	0	1	0	1	0	1	0	1	8

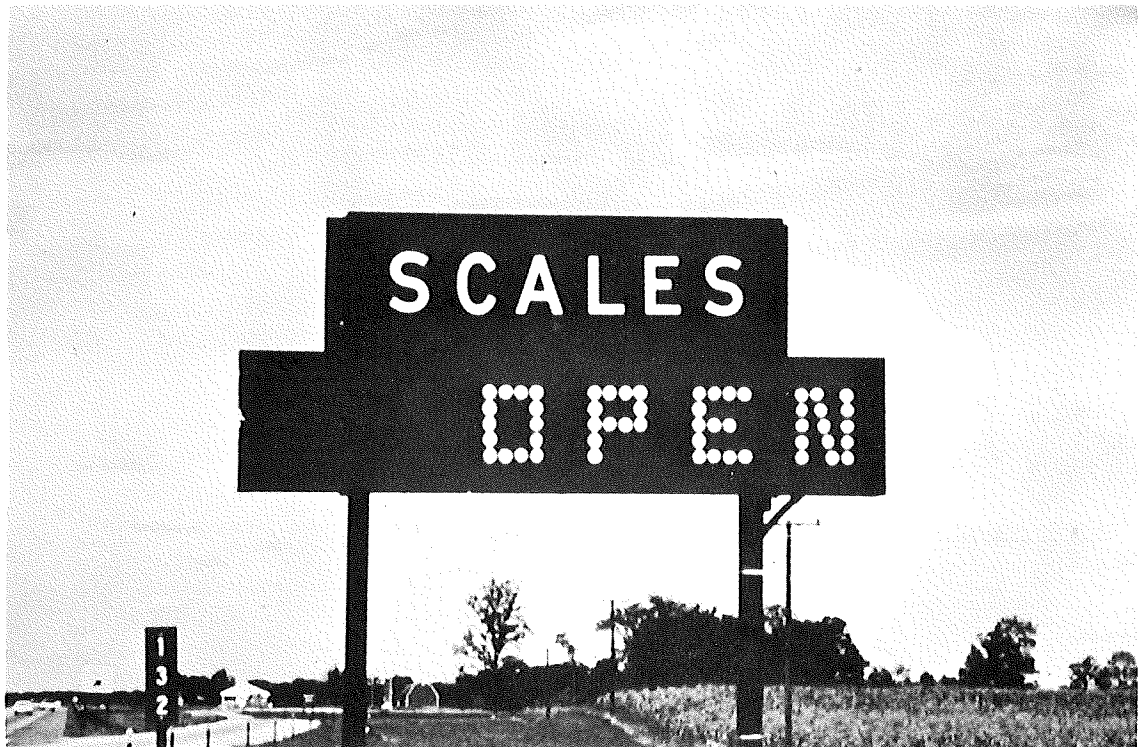
SUMMARY OF DATA

	Day Westbound			Nite Eastbound			Day Eastbound			Nite Westbound			Totals
Interviewers	1			2			3			4			
Reason for Entering Scale Area	Sign	Other	AASHO	Sign	Other	AASHO	Sign	Other	AASHO	Sign	Other	AASHO	
Day	22	5	7	26	4	6	35	3	0	47	9	0	164
Nite	18	5	0	24	3	0	12	4	0	16	3	0	85
Reply to "Can you tell what sign I am interested in?"													
Day	11	6	17	15	5	16	9	13	16	18	21	17	125
Nite	4	6	13	2	14	11	4	3	9	5	6	8	85

SUMMARY OF DATA



PHOTOGRAPH #1 - NEON TYPE SIGN



PHOTOGRAPH #2 - INCANDESCENT TYPE SIGN



PHOTOGRAPH #3 - FLUORESCENT TYPE SIGN
AS USED IN FIELD STUDY



**PHOTOGRAPH #4 - FLUORESCENT TYPE SIGN
TO AASHO REQUIREMENTS AS USED IN
FIELD STUDY**