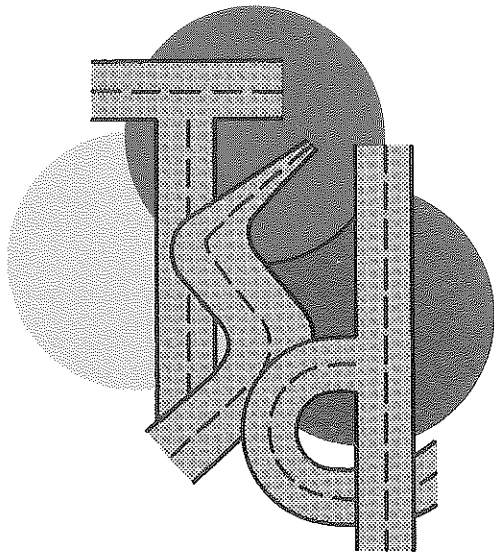


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STUDY OF FREEWAY WEIGH STATION SIGNING

TSD-TR-111-69



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STATE OF MICHIGAN**

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

STUDY OF FREEWAY WEIGH STATION SIGNING

TSD-TR-111-69

By

Charles L. Richard

Conducted by

Traffic Research Section
Traffic & Safety Division

March 1969

NOTE: At the time of data collection, the Weighmaster Section was under the Michigan Department of State Highways Weighmaster Section. The responsibility for operations of the Weigh Stations has since been transferred to the Department of Commerce, Michigan Public Service Commission.

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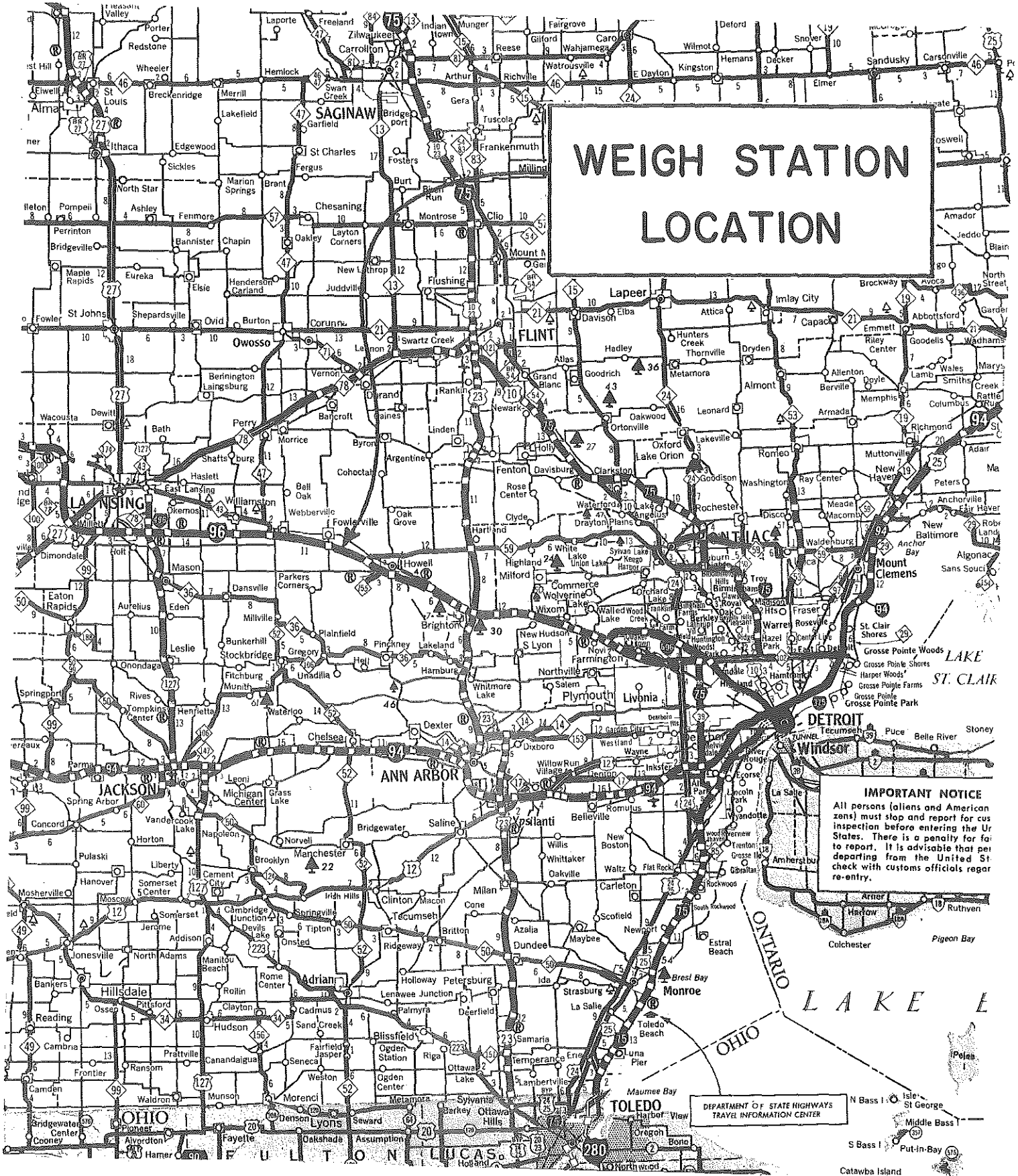
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Chief, Bureau of Operations. G. J. McCarthy
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**WEIGH STATION
LOCATION**

IMPORTANT NOTICE
All persons (aliens and American citizens) must stop and report for customs inspection before entering the United States. There is a penalty for failure to report. It is advisable that persons departing from the United States check with customs officials regarding re-entry.

DEPARTMENT OF STATE HIGHWAYS
TRAVEL INFORMATION CENTER

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Middle Bass I
S Bass I
Put-In-Bay
Catawba Island

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WEIGH STATION STUDY

INTRODUCTION

The installation of truck weigh stations on Interstate freeway systems created problems not existing on free access type roads, requiring 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 weigh station. 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 onto the freeway before Weigh Station personnel could change the manual message.
- (5) The manually-operated "OPEN-CLOSED" reflective sign required Weigh Station personnel to make a U-Turn on the freeway and stop on the shoulder to change messages.

This procedure is dangerous to personnel and the motoring public.

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

SIGN DEVELOPMENT

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

To be effective, this special sign had to be legible 600 feet - 1000 feet in advance of the Weigh Station entrances.

NEON SIGN

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

The legend "SCALES" was illuminated at all times with 800 m. fluorescent lamps. The legend was formed with 12 inch letters, cut out of black lettering film and overlaid on yellow acrylic plexiglas. (Photograph #1)

The "OPEN" "CLOSED" message was formed with green tubing pumped with red neon gas to provide 15 inch 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.

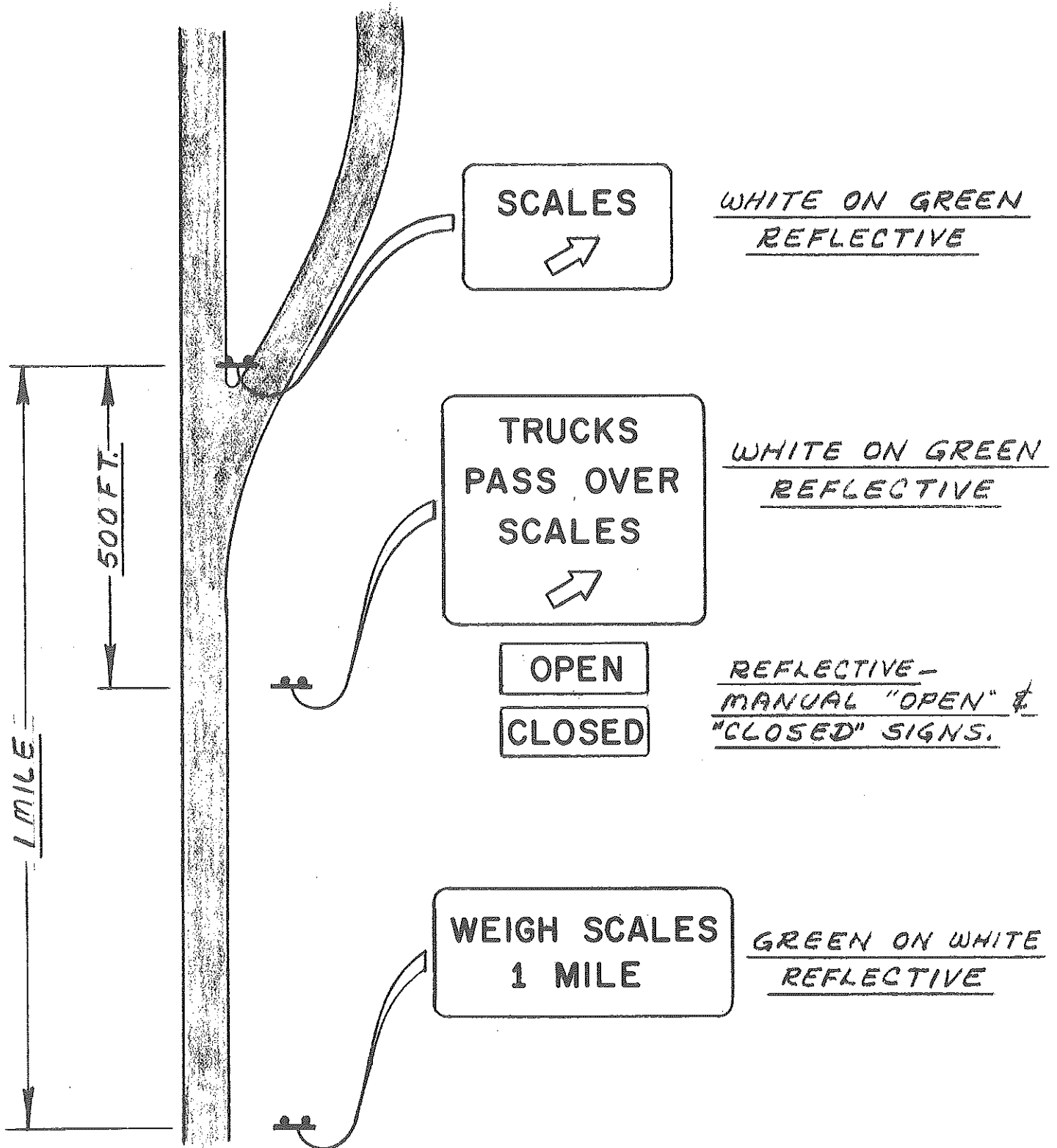
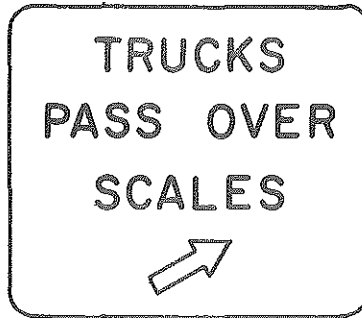


FIGURE #1

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



Although the experimental sign was accepted by Weigh Station personnel and the trucking industries, problems existed requiring changes in the design of:

- (1) Direct sunlight on the face of the neon section reduced readability considerably.
- (2) 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, due to vandalism, etc.

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. (Photograph #2)

The incandescent lamps solved the problems of the neon message sign, but produced a new problem of their own. Electrical power consumption was approximately \$40 per sign per month which is an excessive 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 better communications to the trucker as to status of the Weigh Station.

FLUORESCENT SIGN

A new fluorescent sign was developed. (Figure #2) The "ALL TRUCKS" and "SCALES" messages uses standard 10-inch series "D" reflectorized silver letters on reflectorized green background. (Photograph #3)

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

The "BY PASS" message uses #2124 green plexiglas and the "PASS OVER" message uses #2451 amber plexiglas, giving a distinct color coded message to the truck driver before he can read the message.

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

The fluorescent lamps provide an exceptional good daytime message, readable up to 600 feet, but are overpowering at night, requiring photocell dimming.

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

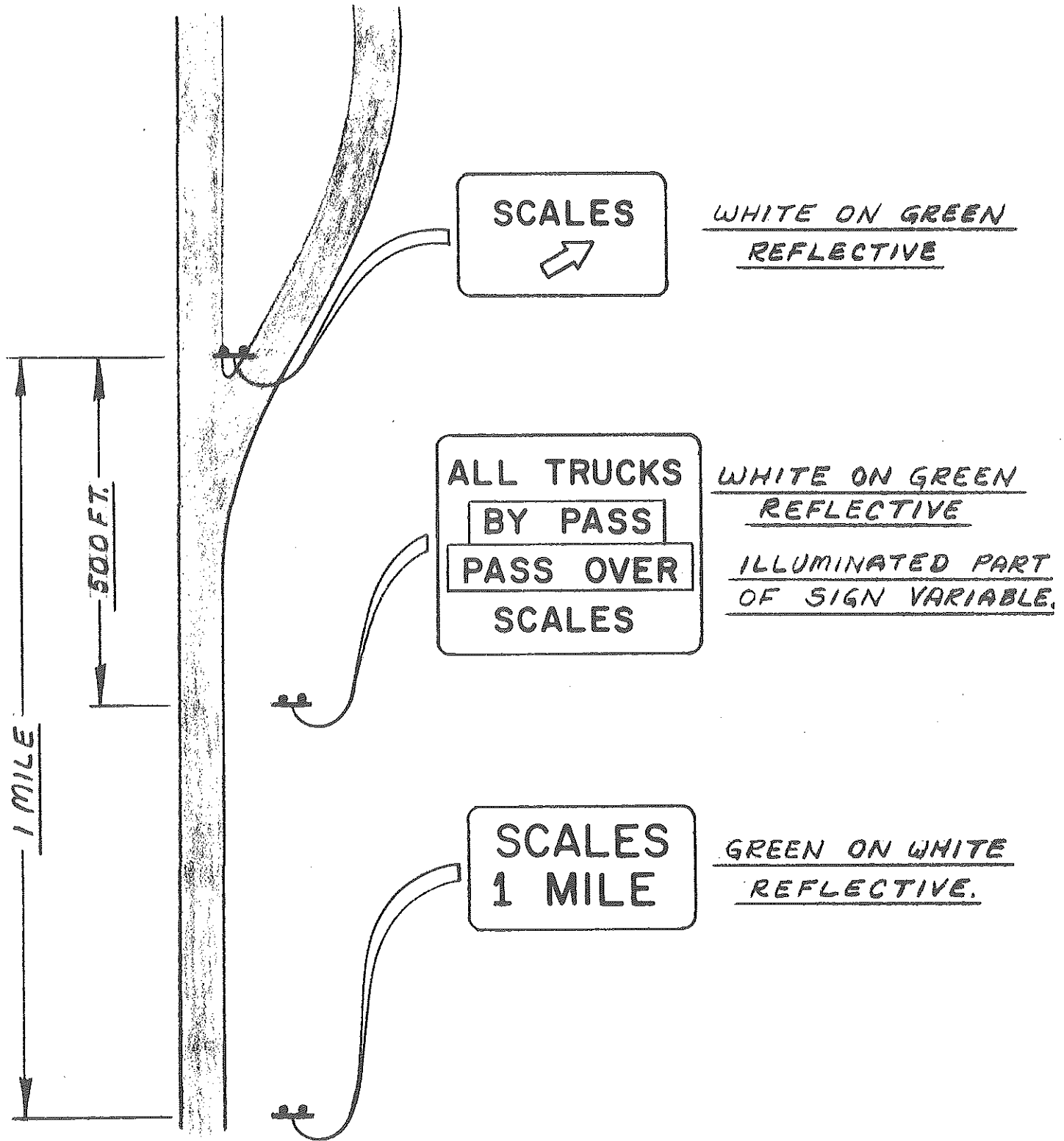


FIGURE #2

AASHO STANDARD AND MICHIGAN SIGN

At the time the Michigan sign was proposed as a state standard, the new AASHO Interpretation Memorandum No. 60-31 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, both signing systems were installed at the I-96 Fowlerville Scales as a field test study. The AASHO Standard (Photograph #4) installed in the eastbound direction, and the Michigan Standard (Photograph #3) installed in the westbound direction.

STUDY PROCEDURE

Observations of truck movements, brake lights use, 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 provide the best study procedure. The interview was taken simultaneously in both directions by interviewers.

AASHO STANDARD FOR FREEWAY
WEIGH STATION SIGNING.

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

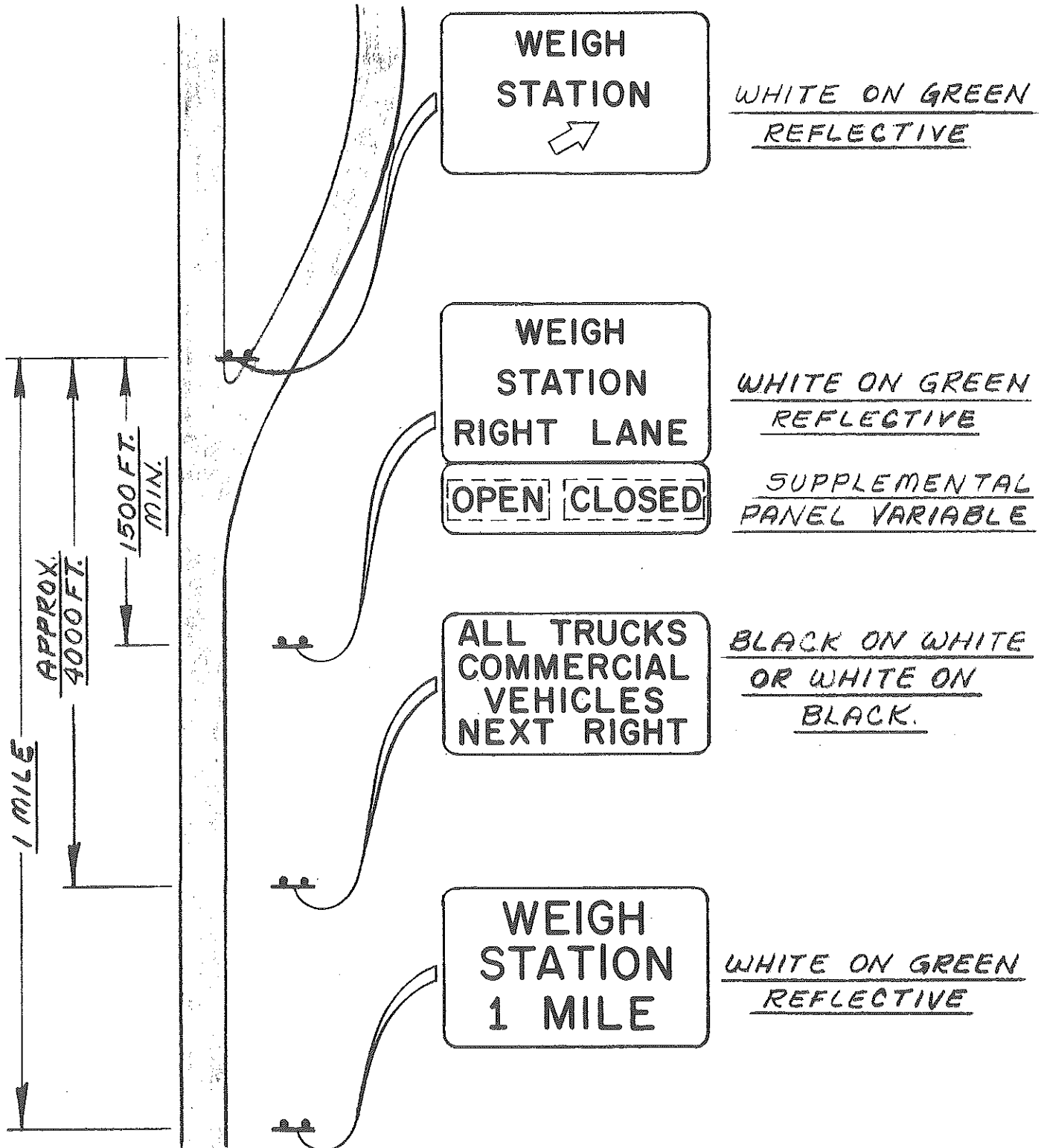


FIGURE #3

ANALYSIS

249 interviews were taken in eight hours from 2:00 PM to 11:00 PM. 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 percent preferred the Michigan signing. It was felt that unless a substantially larger percent of truck drivers preferred the Michigan sign, the national standard should be approved. Using a simple binomial model, the 95 percent confidence bounds for the grouped responses would not encompass 60 percent. 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 intervals*</u> |
|---|----------------------------------|---|---|
| Totals - Day | 164 | 0.51 | 0.57 |
| Nite | 85 | 0.54 | 0.63 |
| Drivers who identified both signs | 93 | 0.58 | 0.64 |
| Drivers who identified one sign only | 88 | 0.55 | 0.64 |
| Drivers who identified 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. There were calculated for the sample listed to the left and do not represent simultaneous 95 percent 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 percent 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 percent 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 Michigan sign. The highest preference was 58 percent (one group) for the Michigan 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 systems provide a complete means of communicating Weigh Station status to 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.

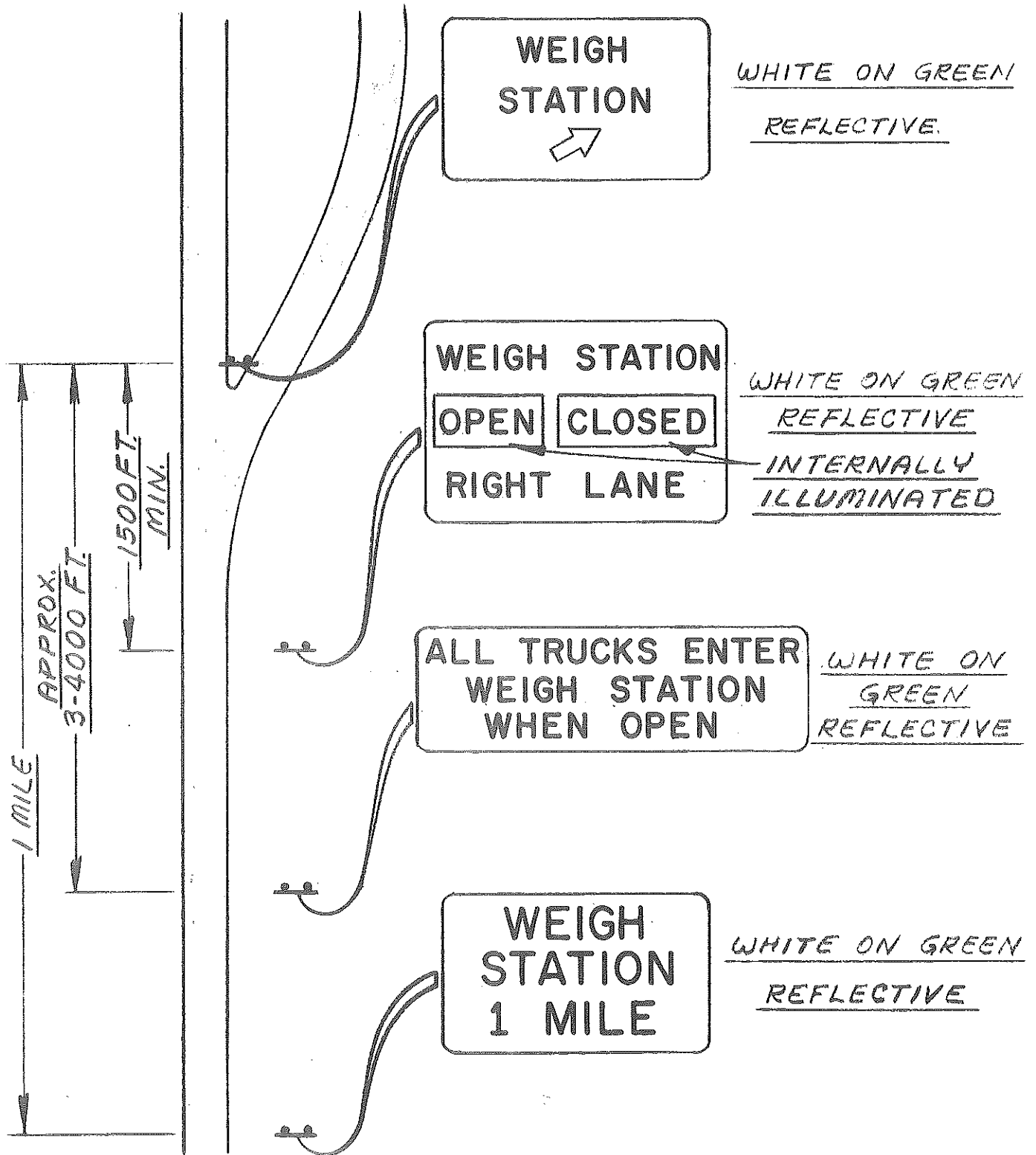


FIGURE #4

APPENDIX I

INTERVIEW PROCEDURE

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 freeway to cross over the scales. The Weigh Stations are signed to require trucks to cross over the scales at a speed of 10 miles per hour or less. This provided for easy direction of trucks into the interview lane, located beyond the scales on the roadway shoulder which provided the interviewers the greatest degree of safety.

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

Once the truck driver had been directed into the interview lane, the interviewer would approach him, and ask, "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?" All 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 answers were received by hearing the conversation between the interviewer and the truck driver over the telephone headsets.

Repeat drivers were not interviewed the second time through.

APPENDIX II

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 sign?

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 _____

APPENDIX IV

| | 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 | | | | | | | | | | | | | | | | | |
| | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | |
| Day | 9 | 5 | 1 | 15 | 8 | 3 | 3 | 14 | 6 | 7 | 1 | 14 | 8 | 4 | 3 | 15 | 58 |
| Nite | 5 | 1 | 0 | 6 | 7 | 4 | 1 | 12 | 2 | 2 | 0 | 4 | 3 | 5 | 0 | 8 | 30 |
| No Signs Described | | | | | | | | | | | | | | | | | |
| | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | |
| Day | 1 | 0 | 1 | 2 | 4 | 0 | 0 | 4 | 2 | 3 | 1 | 6 | 2 | 4 | 1 | 7 | 19 |
| 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 | | | | | | | | | | | | | | | | | |
| | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | |
| Day | 17 | 9 | 2 | 28 | 19 | 6 | 4 | 29 | 13 | 12 | 4 | 29 | 22 | 18 | 6 | 46 | 132 |
| 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 | | | | | | | | | | | | | | | | | |
| | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | State | AASHO | None | Sub-Total | |
| Day | 1 | 3 | 2 | 6 | 4 | 1 | 2 | 7 | 2 | 7 | 0 | 9 | 5 | 4 | 1 | 10 | 22 |
| Nite | 1 | 1 | 0 | 2 | 2 | 2 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 8 |

| | 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**