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EVALUATION OF EXPERIMENTAL SIGNS



MICHIGAN DEPARTMENT OF STATE HIGHWAYS

EVALUATION OF EXPERIMENTAL SIGNS

M. H. Janson

Research Laboratory Section  
Testing and Research Division  
Research Project 68 G-166  
Research Report No. R-695

State of Michigan  
Department of State Highways  
Lansing, March 1969

# OFFICE MEMORANDUM

March 5, 1969



MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS

To: H. H. Cooper  
Engineer of Traffic and Safety

From: L. T. Oehler

Subject: Evaluation of Experimental Signs. Research Project 68 G-166.  
Research Report No. R-695.

In response to a November 5, 1968 request by H. H. Cooper materials measurements have been made and a procedure prepared for field measurements for evaluating five experimental signs erected on Farm Lane at MSU.

In previous unreported work, laboratory measurements of reflective sign materials have been correlated with field measurements of brightness. Since this had been done, and since visibility--or in this case legibility--is dependent on ratios of values (contrast) representing brightness of the materials, ratios could be determined from laboratory data. Simply, the method of obtaining data or the magnitude of the data values are not important because we are interested in ratios.

Specific intensities were determined at four different viewing angles and three different sign orientation angles, for each of the 3M reflectorized sign materials below:

Parkway Silver, 3M, No. 3270 (currently used for Cut-out legend)<sup>1</sup>

Green, 3M, No. 3277 (currently used for backgrounds)<sup>2</sup>

High-Intensity Reflectorized Silver, 3M, No. 3870

High-Intensity Reflectorized Green, 3M, No. 3877

Legend-to-background brightness ratios were calculated at all angles from the specific intensities for each experimental sign. The ratios are given in Table 1 and the specific intensities are shown in Figure 1. Only the three useful combinations of reflectorized materials for the experimental signs are shown. In Table 2 the material associated with each experimental sign is given as well as the averaged ratios. The sign numbers correspond to

<sup>1</sup> Sampled from stock of 3M production run No. UN05 at Midwest Bridge Co., Williamston, August 21, 1968.

<sup>2</sup> Sampled at MDSH Sign Shop, November 28, 1968.

the numbers listed on the attached work order issued to P. DeCamp, Traffic Field Services Engineer on September 12, 1968.

Table 2 shows that the brightness contrast ratio varies from approximately 3:1 for a combination of silver and green High-Intensity sheeting to 13:1 for a combination of High-Intensity silver and regular reflectorized green material.

Observer determinations of sign legibility for Series "E" letters have shown that for a contrast ratio of 13:1 (sign Nos. 1 and 5) there would be a negligible loss of legibility distance.

For a contrast ratio of 3:1 (sign Nos. 2 and 4) a loss of legibility distance exceeding 12 percent of the maximum legibility distance for High-Intensity legend material might be expected. The maximum legibility distance occurs on signs with black or non-reflective backgrounds.

The high-intensity reflectorized silver is roughly three times brighter than regular reflectorized silver and could result in an approximate 20-percent greater legibility distance for a given legend size under most environmental lighting conditions, including dark rural and bright urban situations.

A study by T. W. Forbes at Michigan State University concerning sign recognition value and visibility has shown that a sign with poor contrast against its background has to be twice as large to produce a visibility equivalent to a sign having good contrast with its background. Signs without reflectorized backgrounds, for example, have an average reduction of approximately 50 percent in effectiveness due to the decreased contrast between the sign and its background of grass, trees, buildings or snow.

Thus, a sign with a high-intensity reflectorized silver legend (No. 3870) and a regular reflectorized green background (No. 3277) should have the greatest legibility distance due to the bright legend and high contrast between legend and background and should also have good visibility due to the reflectorized background.

Field evaluation of the experimental signs can be done instrumentally and brightness values can be obtained.

The procedure involves the following:

1. Equipment

- a. Vehicle: Passenger car, 4 door, automatic transmission

- b. Vehicle Headlamps:

1. Selected on the basis of candlepower distribution and uniformity, reference SAE requirements.

2. Aimed in accordance with SAE standards, vehicle loaded.

c. Alternate - spotlight: Mounted in a fixed position with respect to the brightness meter (candlepower distribution previously determined).

d. Pritchard Brightness Meter: Mounted at driver's eye position or in driver's line of sight inside or outside the vehicle.

e. Reference panel:

1. size: at least 6 inches by 6 inches.

2. material: silver and green similar to reflectorized materials used on the signs.

3. calibration: previously photometered in the laboratory.

4. use: attach temporarily to experimental sign during brightness measurement.

## 2. Method

a. Vehicle location:

1. distance from sign, measured 200 feet or greater depending on brightness meter apertures.

2. orientation, right wheels aligned with right edge of sign, headlights horizontal.

b. Light: Measure legend and background brightness with high and low beam headlights or the spotlight.

c. Reference: Measure brightness of the reference panel after each sign brightness reading.

d. Sign orientation:

1. determine height of sign.

2. estimate or measure sign orientation angle with respect to the brightness meter or light source.

## 3. Results

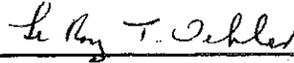
a. Adjust all sign brightness readings to compare with one reference panel value for each material and color.

b. Compare field data with laboratory data.

March 5, 1969

We can expect field brightness values to vary from laboratory values principally because of the inability to determine sign orientation with respect to headlamp beams. This along with other factors also means that similar signs in another location or the same signs viewed from another vehicle or even viewed from the same vehicle but from a slightly different vehicle position could have a different brightness.

TESTING AND RESEARCH DIVISION



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Director - Research Laboratory

LTO:MHJ:sjt

cc: R. L. Greenman  
D. Orne

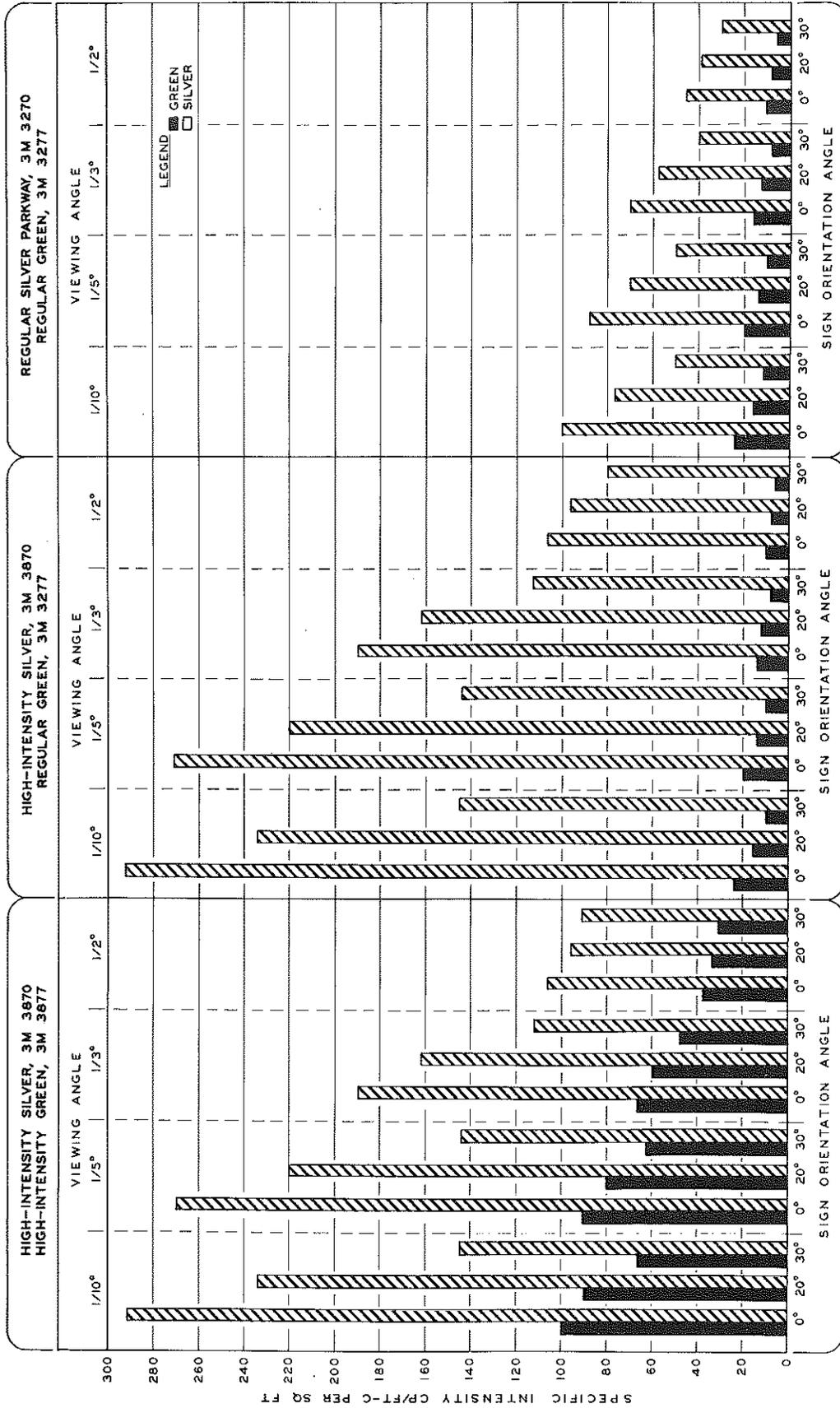


Figure 1. Specific intensities of sign materials.

TABLE 1  
CONTRAST RATIOS OF SIGN MATERIALS

SIGN MATERIAL		CONTRAST RATIO*															
		SIGN ORIENTATION ANGLE															
		0°	20°	30°	0°	20°	30°	0°	20°	30°	0°	20°	30°	0°	20°	30°	AVERAGE
High Intensity, Silver 3M 3870 (Legend)	High Intensity, Green 3M 3877 (Background)	1:2.93	1:2.61	1:2.18	1:2.98	1:2.71	1:2.32	1:2.86	1:2.69	1:2.35	1:2.83	1:2.88	1:2.63				1:2.66
High Intensity, Silver 3M 3870 (Legend)	Regular Green, 3M 3277 (Background)	1:12.3	1:13.5	1:12.5	1:13.2	1:14.5	1:13.8	1:12.3	1:13.6	1:13.3	1:9.80	1:11.3	1:12.5				1:12.7
Regular Silver Parkway, 3M 3270 (Legend)	Regular Green, 3M 3277 (Background)	1:4.18	1:4.42	1:4.41	1:4.30	1:4.59	1:4.78	1:4.55	1:4.83	1:4.88	1:4.31	1:4.56	1:4.85				1:4.56
* Legend : Background Background : Background		1/10°			1/5°			1/3°			1/2°						
		VIEWING ANGLE															

TABLE 2

Sign No.	Legend Material	Background Material	Brightness Ratio $\frac{\text{Legend}}{\text{Background}} : \frac{\text{Background}}{\text{Background}}$
1	High-Intensity Silver, No. 3870	Regular Green No. 3277	12.7:1
2	High-Intensity Silver, No. 3870	High-Intensity Green No. 3877	2.7:1
3	Regular Silver No. 3270 Parkway	Regular Green No. 3277	4.6:1
4	High-Intensity Silver No. 3870	High-Intensity Green No. 3877	2.7:1
5	High-Intensity Silver No. 3870	Regular Green No. 3277	12.7:1
For reference only	Regular Silver No. 3270 Parkway	High-Intensity Green No. 3877	1:1

WHITE - Lansing Office File  
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STATE OF MICHIGAN  
 DEPARTMENT OF STATE HIGHWAYS  
 TRAFFIC AND SAFETY DIVISION

Order No. 1-107-8  
 Date September 12 1968  
 Completion Date ASAP 19  
 Sheet 1 of 2  
 Control Section 99993

**LANSING OFFICE WORK ORDER**

Issued to Peter DeCamp, Traffic Field Services Engineer

Trunkline No. - Dist. No. 8 City East Lansing County Ingham

Location Farm Lane sign test area south of East Lansing

Type of Work Traffic Signing File Ref. No. \_\_\_\_\_

Fabricate and erect the experimental sign shown below on the existing truss on Farm Lane.

		LEGEND SIZE	LEGEND & BORDER MATERIAL	BACKGROUND MATERIAL
#1		13.3"-10"	3M High Intensity Reflectorized #3870 Silver, Embossed by Miro-Flex	Regular 3M #3277 Reflectorized Green
#2	"	13.3"-10"	"	3M High Intensity Reflectorized #3877 Green
#3	"	13.3"-10"	Regular 3M #3270 Reflectorized Park- way Silver, Direct Applied	Regular 3M #3277 Reflectorized Green
#4	"	13.3"-10"	3M High Intensity Reflectorized #3870 Silver, Direct applied	3M High Intensity Reflectorized #3877 Green
#5	"	13.3"-10"	"	Regular 3M #3277 Reflectorized Green

NOTE: Check for underground utilities.

An overrun of the estimate in excess of 10 percent must either have prior approval of the Traffic & Safety Division or must be accompanied by an explanation outlining unforeseeable difficulties encountered while performing the work which resulted in the overcharge.

Use all material necessary to complete the project in conformance with the Michigan Department of State Highways standards and specifications

Any change in this work order requires prior approval by the Traffic and Safety Division.

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STATE OF MICHIGAN  
 DEPARTMENT OF STATE HIGHWAYS  
 TRAFFIC AND SAFETY DIVISION

Order No. 1-107-8  
 Date September 12 19 68  
 Completion Date ASAP 19  
 Sheet 2 of 2  
 Control Section 99993

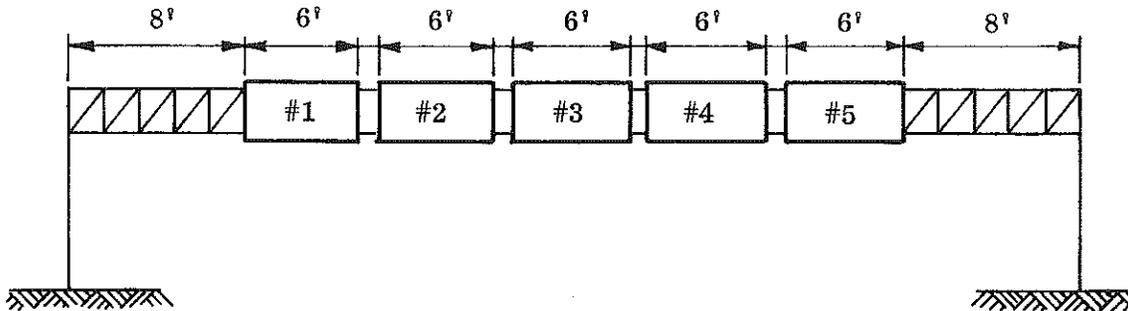
**LANSING OFFICE WORK ORDER**

Issued to Peter DeCamp, Traffic Field Services Engineer  
 Trunkline No. - Dist. No. 8 City East Lansing County Ingham  
 Location Farm Lane Sign Test Area south of East Lansing  
 Type of Work Traffic Signing File Ref. No. \_\_\_\_\_

Use a 2" border with a 6" radius on all signs.

Space letters according to standard spacing charts.

Erect the signs #1 - #5 so that they will appear as shown below when viewed from the north. Each sign spaced 1 ft apart.



NOTE: Notify Traffic Operations when signs are in place. Signs are to be removed upon notification by Traffic Operations.

NOTE: Check for underground utilities.

An overrun of the estimate in excess of 10 percent must either have prior approval of the Traffic & Safety Division or must be accompanied by an explanation outlining unforeseeable difficulties encountered while performing the work which resulted in the overcharge.

Use all material necessary to complete the project in conformance with the Michigan Department of State Highways standards and specifications

Any change in this work order requires prior approval by the Traffic and Safety Division.

Prepared <u>JLK</u>	Checked <u>WFS</u>	Date <u>9-13</u>	Estimated Cost.	\$ <u>500.00</u>
Recommended for Approval <input checked="" type="checkbox"/> <u>J. E. Hobrle</u>	Date <u>9-16-68</u>		Actual Cost.	\$ _____

Approved  Lowell J. Doyle Date 9-17-68 Authorized \_\_\_\_\_ Date \_\_\_\_\_  
 Ass't. Engineer of Traffic & Safety Maintenance Division

Trans. Code	Structure	Section Garage Equipment	Contract	Maintenance Budget Fed. Item	Authorization No. Parcel	Leave Blank	Activity	Responsibility	Operation	Account	Object	Miles Hour	Amount
		<u>99993</u>			<u>1-107-8</u>		<u>641</u>		<u>572</u>	<u>166-2200-470</u>	<u>350</u>		