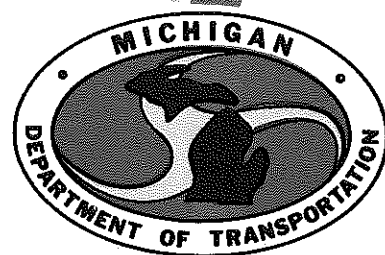


BATTERY OPERATED STROBELIGHTS



MATERIALS and TECHNOLOGY DIVISION



TK4188 .S64 1989 c. 2
Battery operated
strobelights

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Research Laboratory Section
Materials and Technology Division
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Michigan Transportation Commission
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SUMMARY AND RECOMMENDATIONS

Judging from public, contractor, and staff comments, and the lack of reported accidents at the new traffic signal installations where advanced warning strobe lights ('strokes') were employed, use of advanced warning strobes seems to be beneficial. (The above statement on lack of accidents does not imply that accidents would have occurred in the absence of strobes, but it could imply benefits, and it does imply the lack of detrimental effects due to their use.)

It is therefore recommended that the Department: 1) adopt a policy of using advance warning strobe lights for new signal installations for 30 to 90 days after installation, 2) if this policy is established, develop specifications for advanced warning strobes, and 3) incorporate strobes into the design plans for new signals.

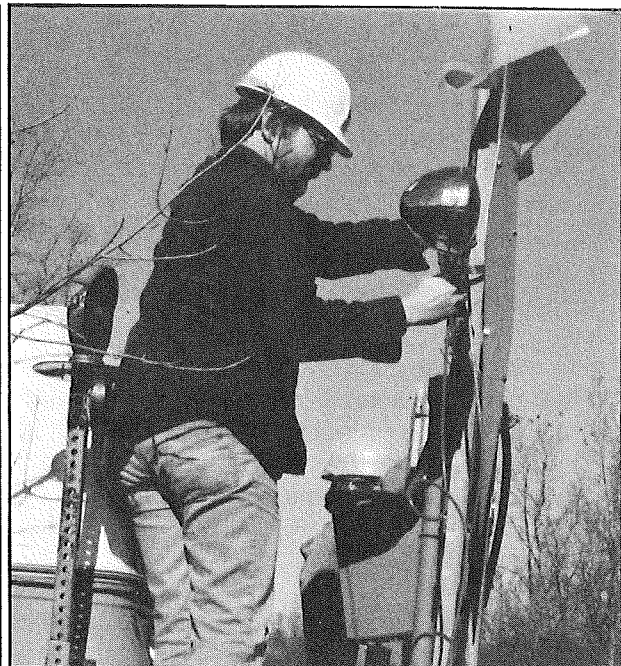
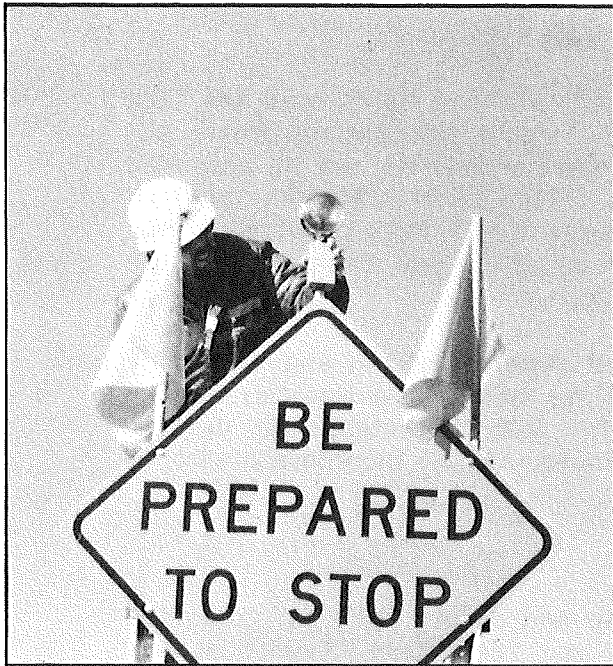
Background

The Electronic Systems Unit, Traffic and Safety Division, contacted the Photometry Group of the Materials and Technology Division in July 1986, to inquire if there were better ways of alerting motorists to new traffic signal installations. At the 12 new traffic signal installations in the previous year there were two fatalities and several accidents presumably because of motorists' unfamiliarity with the new signal. The standard method for warning drivers of new signal installation is a pair of flashing 8-in. yellow traffic signals.

The Photometry staff suggested that recent research by the U. S. Coast Guard indicated that strobe lights are more conspicuous than incandescent flashers. They contacted a manufacturer of strobes, Tomar Inc., Tuscon, Arizona, for a daytime demonstration of different size strobes in the north parking lot of the laboratory building. They also examined the strobes in the laboratory's darkened photometric range. Due to this demonstration it was determined to proceed with strobes as a possible warning enhancement.

As a result, the Electronic Systems Unit of the Traffic and Safety Division requested that the Materials and Technology Division develop an appropriate strobe system for advanced warning of new signal installations. The Instrumentation and Data Systems Unit, Materials and Technology Division, was to conduct the assembly and installation of the strobes on the site. The purpose of such advance warning strobes would be to improve motorists reaction to new signal installations, and therefore reduce accidents and injury.

Laboratory and field evaluations of strobes were planned to determine the most effective ones. The laboratory study would determine the effective intensity, and hence the conspicuousness, of the strobe based on established research. The field study would verify strobe performance in actual field installations. The experimental sites selected by the Traffic



Installing the PAR 36 (left) 4-1/2-in. diameter strobe, and the PAR 56 (right) 6-1/2-in. diameter strobe units.

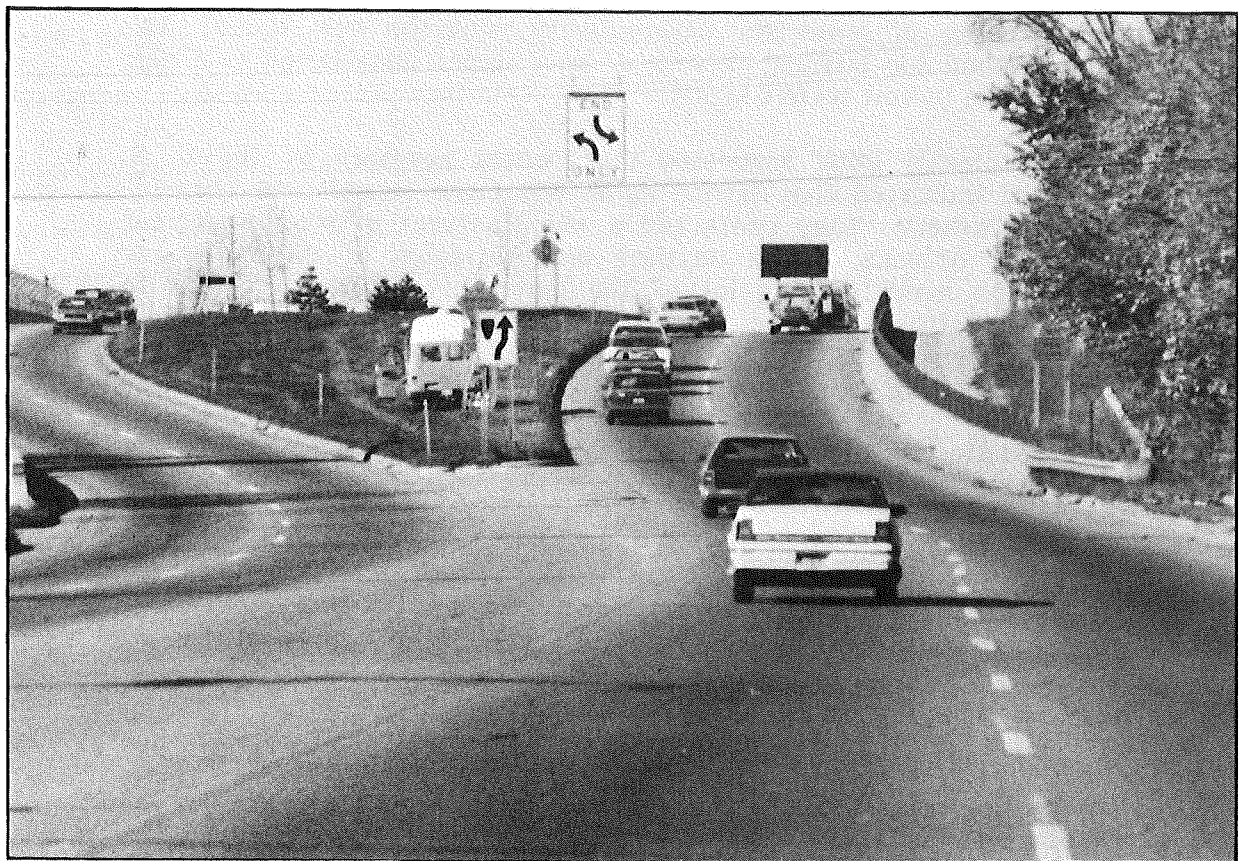


Figure 1. Looking west on Grand River Ave toward new signal installation. Smaller strobes are on top of the nearer signs (BE PREPARED TO STOP) on both sides of the road (right-hand sign partly obscured by shrubbery). The larger strobe was installed later on the distant sign at the middle left.

and Safety Division were a new signal installation at Park Lake Rd and M 43 (Grand River Ave. in Okemos), and later a second site on M 55 near Houghton Lake.

Initial constraints were that, 1) the strobes must be battery powered because the majority of installations are in rural areas without a nearby power line, and 2) the batteries must be capable of supplying at least two weeks of power before recharging or replacement.

Investigation

On August 11, 1986, members of the Traffic and Safety Division, a representative of Maxi-Signal Products Co., supplier for Tomar, and the Photometry staff discussed different types and sizes of strobes. A daylight viewing of different strobes and their combination with various sizes of power supplies was conducted, and a PAR 36 (4-1/2-in. diameter lens) with a Tomar Model 670 power supply built into the strobe head was selected as the light source. This combination produced the most intense strobe output and still maintained a two-week charge on the largest deep-cycle batteries available.

Laboratory Study

The strobe intensity distribution was evaluated in the 100-ft photometric range at the Department's Research Laboratory according to the Illuminating Engineering Society "Guide for Calculating the Effective Intensity of Flashing Signal Lights." The illuminance meter used to make intensity measurements was the International Light Model 710A with a special photoreceptor head and calibration.

The laboratory results showed that the PAR 36 Model 670 strobe with internal power supply produced an expected 274-ft daylight viewing distance. Thus, the typical driver should detect the strobe from over 250 ft on a day with average sunlight around noon. At night the detection distance would be about 2,500 ft. These day and night viewing distances seemed adequate. The PAR 36 strobe was evaluated for battery life at slightly over two weeks.

A weatherproof locked wooden shed housed the two 12-v, parallel-connected batteries. Every two weeks two fresh batteries would replace the two depleted batteries, which would then be recharged.

First Site Installation

On October 30, 1986, the PAR 36 strobe was installed on top of the "Be Prepared to Stop, New Signal" signs on each side of the westbound Grand River Ave. (Fig. 1). The sign was approximately 500 ft before the new signal at Park Lake Rd. Day and night assessments by the Instrumentation and Photometry Group showed that the strobes had inadequate conspicuity. The great amount of commercial and background lighting

overwhelmed the effect of the strobe. It did not have the intensity to overpower the background light and demand the attention of passing drivers.

We therefore decided to install a much larger strobe between the existing strobes and the new signal installation on a sign with a picture of a traffic signal. After reviewing the manufacturer's data, we decided that a PAR 56 with a Tomar Model 750-12 power supply would provide the necessary intensity to alert motorists. The power consumption of the larger strobe, however, was too great for batteries, so it required a 120-v power line from the controller box at Park Lake Rd.

Second Laboratory Study

The PAR 56 strobe was tested at the Department's Research Laboratory. The results indicated detection distances of 1,580 ft daytime and 7-1/2 miles at night. The PAR 56 strobe exhibited an extremely high intensity which could be debilitating to the motorist's vision if the flash were prolonged, but was judged not to produce disabling glare because of the very short flash duration (50 milliseconds or less).

Second Field Study

The PAR 56 strobe was installed in November 1986, at a distance of about 200 ft from the new signal (Fig. 1). Night observations showed that the strobe was attention-getting nearly to the Marsh Rd intersection with Grand River in Okemos, one mile away. Viewing from greater distances was blocked by buildings and trees. Daytime detection was available to Okemos Rd and Grand River, over 1/2 mile distant.

Materials

- 1) Four Wonch Model 8T27 105 amp-hour, deep-cycle batteries. Cost \$216.60 (Wonch Battery, 1521 Keystone, Lansing, Michigan 48911).
- 2) Two Tomar PAR 36 strobe lights with unbreakable amber lens, chrome shell. Cost - \$179.52 (Maxi-Signal Co., 5 East 49th St, LaGrange, Illinois 60525 (312) 354-4730).
- 3) One Tomar Model 56-S PAR 56 lamp head assembly with amber unbreakable Lexan lens. Cost - \$113.68. One Tomar Model 750-12 strobe single head power supply (double flash). Cost - \$221.10. One Tomar Model 20-C cable connector. Cost - \$22.50. One Tomar Model JIC water-proof NEMA 4 junction box. Cost \$40.
- 4) Power cable (underground) from the controller box as required, 400 ft. Cost - \$650 (est.) Total Cost - \$1,442.88.

5) Strobes can be reused many times at different locations. The flash tubes are rated at 10,000-hr continuous use and can easily be replaced.

All strobes were removed from the site in March 1987.

Second Site

The Traffic and Safety Division selected another site for installation of a new traffic signal, a predominantly rural area on M 55, approximately 1/2-mile east of US 27, at Lockesley Rd, near Houghton Lake.

Because this site had a lighting environment that was very dark compared to the Okemos installation, it was judged that the smaller strobes would yield adequate conspicuity at this site. Consequently, District 4 personnel installed one PAR 36 strobe on each side of the road about 1/4 mile in advance of the new traffic signal installation. A sequence of three warning signs, beginning with a "Signal Ahead" sign at the strobe, were installed. The strobes were in place about four months.

Over the past 1-1/2 years District 4 has installed strobes at new signal locations at a bridge reconstruction on US 23, south of Tawas City, M 31 in Petoskey, M 18 in Prudenville, and at a site on M 32.

CONCLUSIONS

Informal conversations conducted with motorists regularly driving through the Okemos site indicated that the strobes were strongly attention-getting, but not annoying even with repeated exposure.

Telephone conversations in January 1989, with Wayne Gunderman, District 4 Traffic and Safety Engineer, elicited the following comments about the effectiveness of strobes in alerting drivers:

1) According to project engineers, contractors, and motorists the strobes were "highly conspicuous," but not "overpowering" to the extent that roadway hazards were obscured.

2) No reports of accidents caused by drivers ignoring the new signals, although it is unknown whether any accidents would have occurred without the advanced warning strobes.

3) No complaints reported regarding the strobes.

RECOMMENDATIONS

1) The Department should incorporate the use of advanced warning strobes into existing policies and procedures for new traffic signal installations.

2) For urban or brightly lit areas, the brighter PAR 56 or equivalent strobes should be used, possibly in conjunction with PAR 36 strobes.

3) For dark rural areas, PAR 36 strobes should be used.

NOTE: The Photometry Group will proceed with development of specifications for advanced warning strobelights.