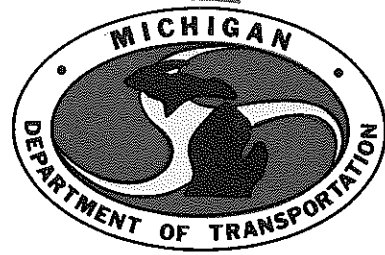


FIELD EVALUATION OF 3M AND AMERICAN  
DECAL REFLECTIVE SIGNING MATERIALS



**TESTING AND RESEARCH DIVISION  
RESEARCH LABORATORY SECTION**

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DECAL REFLECTIVE SIGNING MATERIALS**

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## Summary

This report presents the results of a field evaluation of two different brands of Type 2 engineering grade reflective sheeting (Adcolite and 3M). Measurements were first taken soon after installation in 1972 and the signs have been under observation since that time. Six years of weathering resulted in little significant effect on luminance for either material, and a casual observer would probably notice little difference after dark. Significant peeling was noted on the 3M material, which rendered its daytime appearance poorer than the Adcolite. No further investigation is planned since the signs were replaced in 1980.

## Introduction

The purpose of this evaluation was to compare the field performance of reflective sheeting from two manufacturers. The two overhead signs that were installed in December 1971 on eastbound I 96 at Exit 117A near Williamston were compared. One sign face was fabricated from 3M Co. reflective sheeting, and the other from American Decal (Adcolite) reflective sheeting. The reflective sheeting was Type 2 engineering grade. The sign face luminance and general appearance were evaluated soon after installation in 1972 and again in 1978.

The results of this study showed that six years of weathering at the I 96 location had a minor significant effect on luminance for either 3M or Adcolite reflective sheeting, but did cause extensive peeling of the 3M reflective sheeting which, in time, would have resulted in a greater loss of luminance. Replacement of the signs by overlays in 1980 cancelled any further investigation.

As shown in Figure 1, the two signs were located next to an experimental louvered sign on a truss over the exit and through lanes. The DANSVILLE sign located over the exit lane and shoulder had 3M white sheeting legend on green sheeting background, while the WILLIAMSTON EXIT sign, located over the traffic lane, had Adcolite white sheeting legend on green sheeting background.

## Procedure

Luminance, in foot-Lamberts (ft-L), was measured by means of a telephotometer at distances of 100, 200, and 500 ft along the shoulder in front of the sign faces. The telephotometer was positioned at a typical driver's eye position. Sign illumination was provided by vehicle headlamps, both high and low beams, which had been previously aimed according to the

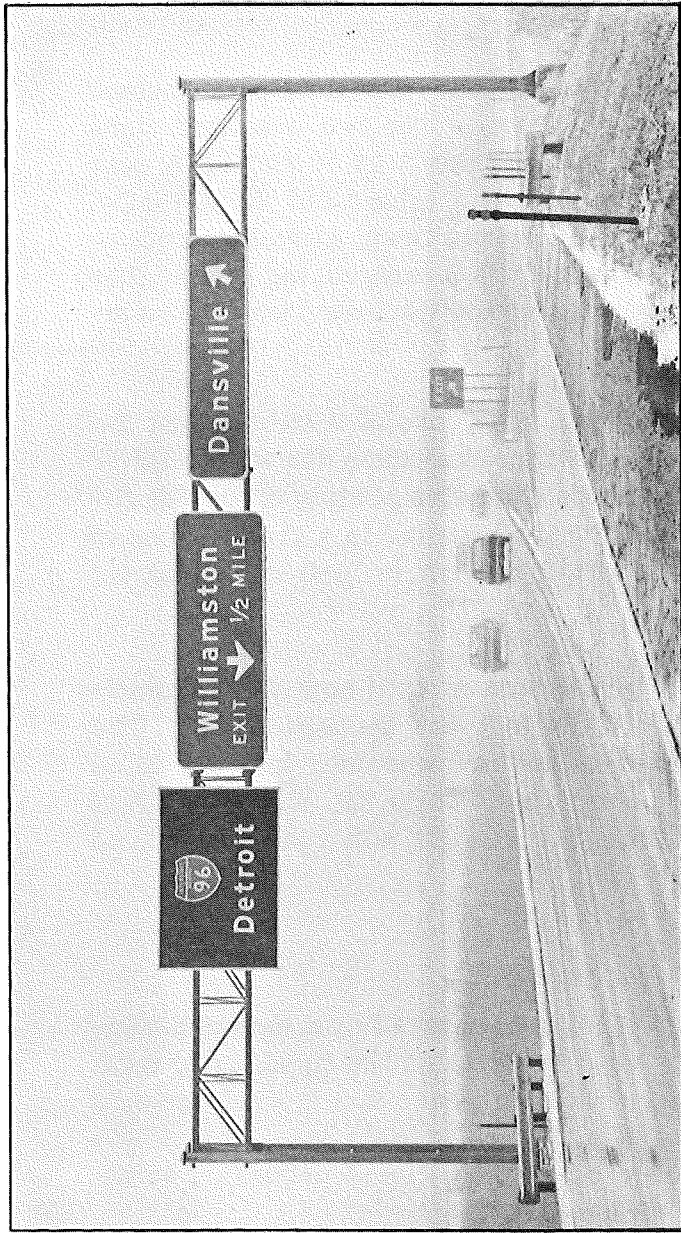


Figure 1. Subject signs as seen in daylight (experimental louvered sign on left).

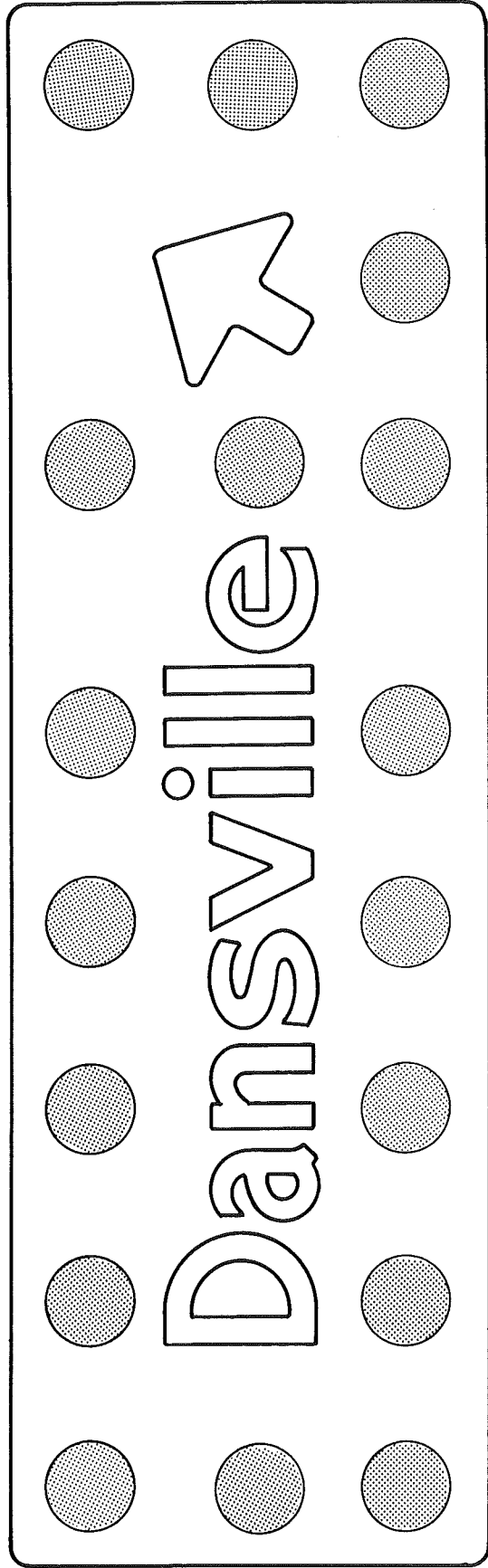


Figure 2. Green background areas sampled in measurement of luminance.

method outlined in SAE Standard 599 C, 1973. The measurement incident angles were approximately 9.1, 4.6, and 1.8 degrees below the normal to the sign face, for the 100, 200, and 500-ft distances, respectively. Luminance was measured at a minimum of 10 points each on the legend and at least 18 points on the background for each sign as shown in Figure 2.

Two different vehicles and two different model Pritchard telephotometers were involved in measurements. In 1972, a model 1960-PR Pritchard telephotometer was installed in a car behind the driver, but with the lens in the approximate driver's eye position. The photometer was incapable of measuring legend at 500 ft because of the small legend. In 1978, the Model 1980-A Pritchard telephotometer was installed in a vehicle. This photometer was capable of measuring the small legend.

A 12 by 12-in. panel of 3M high intensity reflective sheeting placed on the face of the 3M sign was the reference for the 1972 and 1978 luminance values. The panel had been calibrated for luminance in the laboratory. The panel provided correction factors for variations in headlamp intensity (because of voltage fluctuations) and vehicle positioning. In 1972, measurements were made with the vehicle in the traffic lane during breaks in the traffic. Similar breaks in traffic flow were not available in 1978; and therefore, both signs were measured from the right-hand shoulder. The data were corrected for the measuring displacement by means of corresponding reference panel measurements. The panel provided only approximate corrections since its value varied with location on the sign face.

## Results

Luminance - Luminance in foot-Lamberts (ft-L) is displayed on a logarithmic scale, since the human eye perception of brightness is roughly logarithmic. Figure 3 illustrates that at 100 and 200 ft for both high and low-beam headlamps, Adcolite green sheeting showed a slight increase in luminance during the six years of weathering. Weathered Adcolite sheeting was brighter than weathered 3M sheeting. Green 3M sheeting decreased in luminance with weathering, except for upper beams at 100 and 200 ft where the luminance of 3M green sheeting increased slightly.

Occasional increases in luminance of reflective sheeting have been observed in both artificial and field weathering. Theoretically, the luminance increase can be due to either experimental error, because of the different equipment used in 1978 vs. 1972, or to an alteration of the optical focus of the glass beads within the reflective sheeting through migration of the beads. The fact that the luminance changes were affected by viewing distance indicates that weathering had changed optical relationships within the Adcolite reflective sheeting.

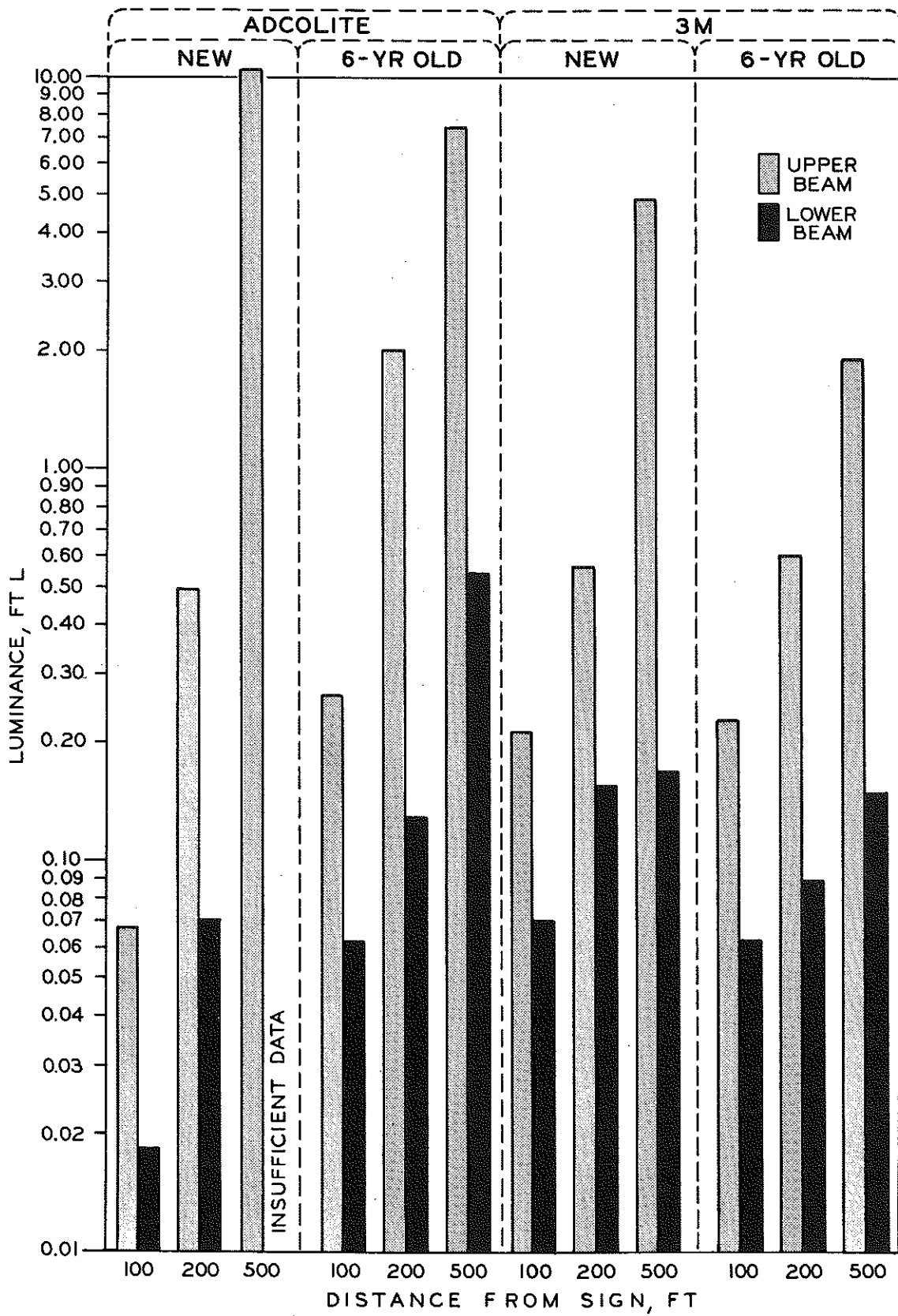


Figure 3. Luminance of green reflective (background) sheeting.

Figure 4 shows the white sheeting luminance. The luminance of the white Adcolite sheeting increased during the six years of weathering while the luminance level of the 3M white sheeting increased very slightly with high beams and decreased with low beams after weathering. The white Adcolite sheeting luminance value averaged less than 3M initially, but after weathering, the Adcolite luminance was greater than the 3M luminance value.

Appearance and Physical Condition - Physical changes in both signs appeared by 1978. Immediately after installation in 1972, vertical light and dark bands appeared in the Adcolite sign when viewed under vehicle illumination at night (Fig. 5). Several of the dark bands followed some of the seams in the sign overlay. The striping did not interfere with reading the legend; the legend itself contained no striping. There appeared to be no ready explanation for the striping. Another sign with Adcolite reflective sheeting installed at the same time as the WILLIAMSTON sign on eastbound I 496 near the Pennsylvania Ave exit showed no evidence of striping. The daytime appearance showed no striping, as shown in Figure 6.

By 1978, the 3M sign had already manifested severe peeling and crazing of the sheeting surface as shown in Figure 7.

### Conclusions

Except for the 500-ft measuring geometry, Adcolite luminance values were lower than 3M values initially, but after six years of weathering Adcolite values were higher than 3M values. In general, a nighttime observer would probably consider the signs to have about the same legend and background brightness.

Daytime appearance of the 3M sign surface was poor after six years service; the white and green sheeting had cracked and peeled. The surface condition may have caused the decrease in luminance and in less than one year, luminance would be greatly affected. The Adcolite material had a good daytime appearance and at least two more years of service was expected.

The nighttime vertical stripes in the green sheeting of the Adcolite sign had not altered their appearance in the intervening six-year period. The striping did not appear to affect night legibility.

On the basis of this comparison, American Decal's engineering grade reflective sheeting showed better service and service life than 3M's sheeting.



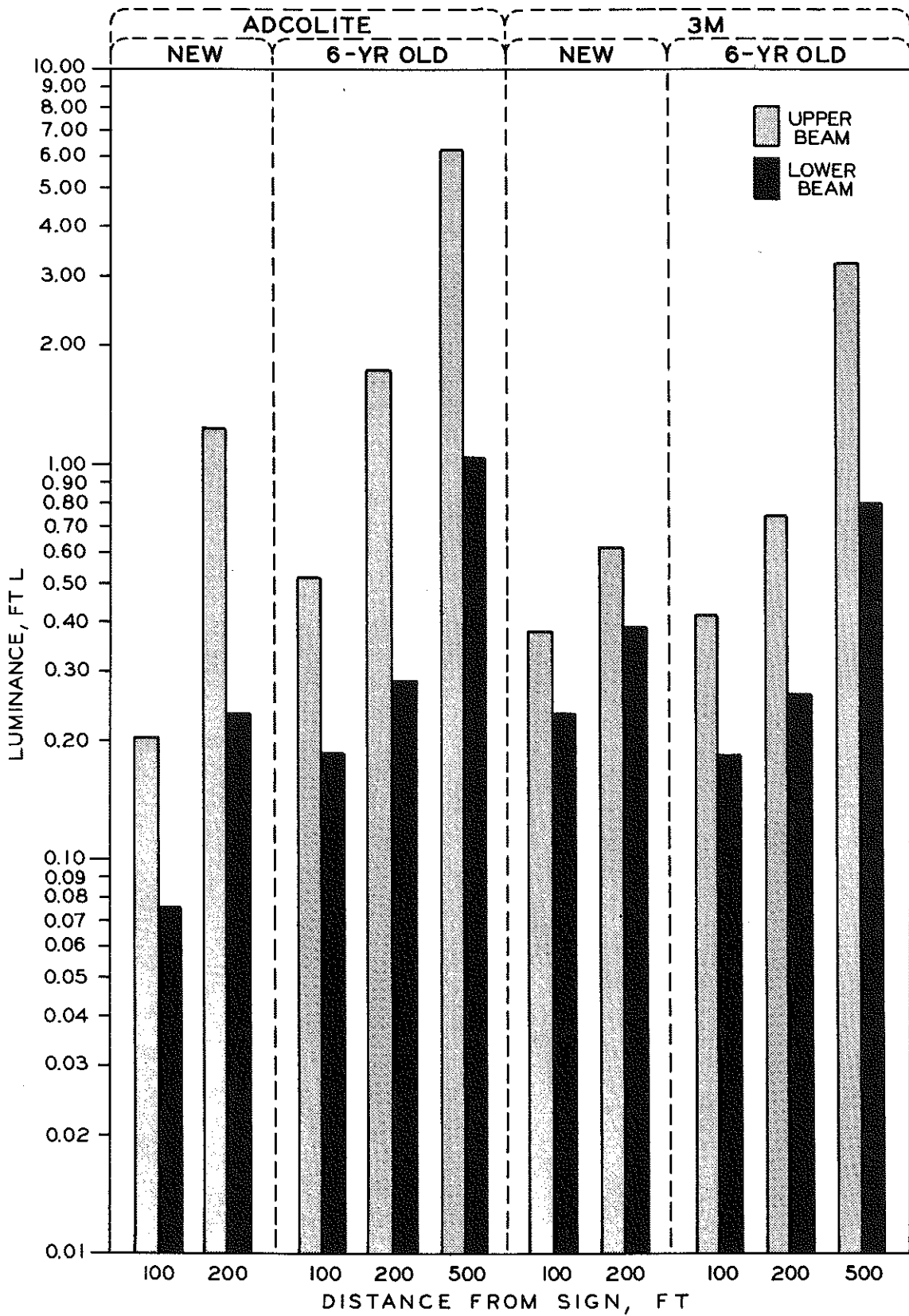


Figure 4. Luminance of white reflective (legend) sheeting.

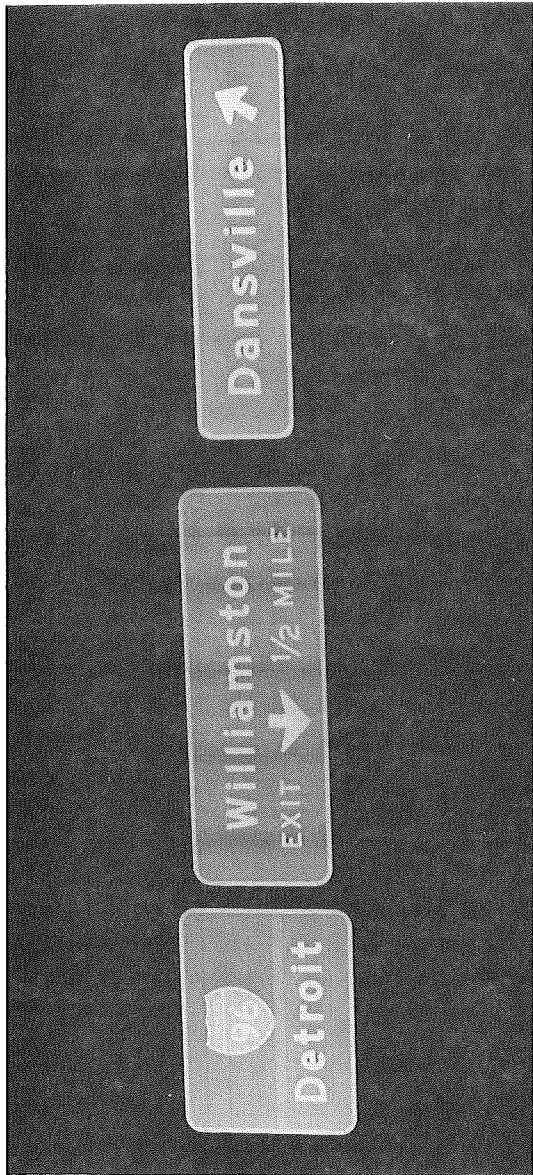


Figure 5. Subject signs as seen at night; note vertical stripes on Adcolite sign (not visible in daylight).

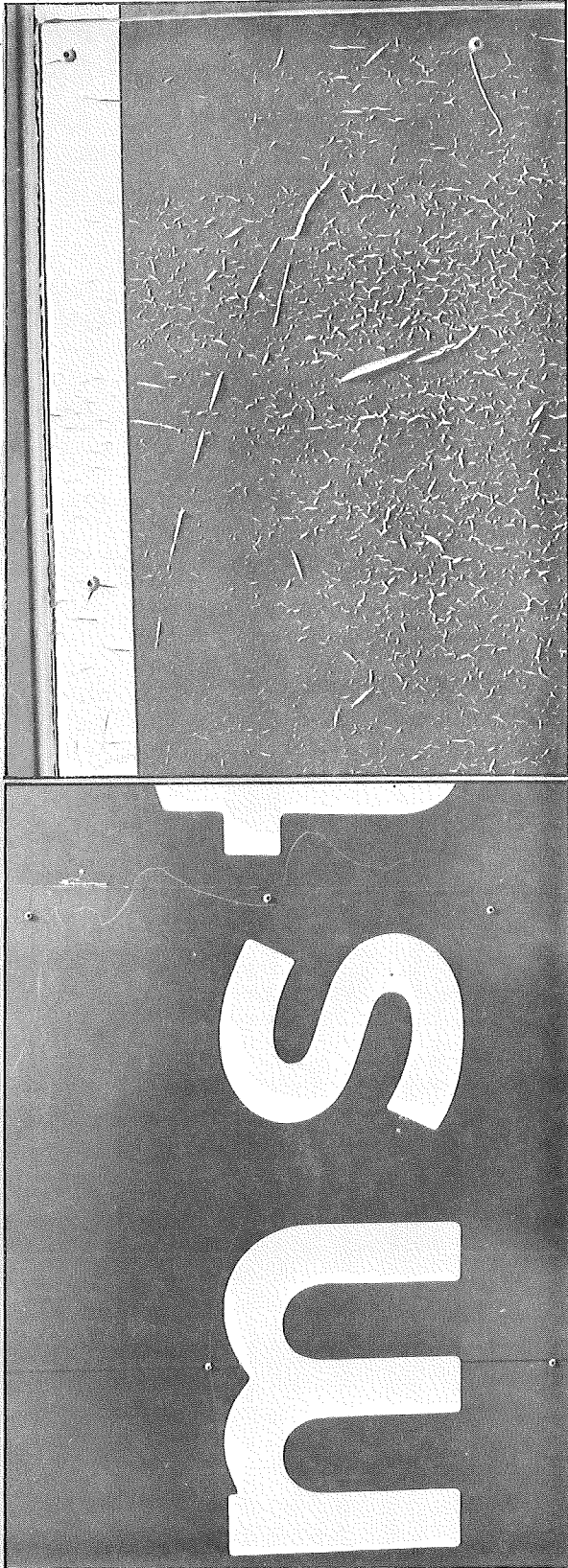


Figure 6. Close-up daytime view of Adcolite sign. The seam through the letter 'm' in the overlay appeared darker at night.



Figure 7. Daytime view of 3M sign (1978) showing severe peeling and crazing.