SIGN POST PAINT EVALUATION

by

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SUMMARY

After reviewing R. N. Robertson's report on "An Investigation of Streaking of Highway Traffic Signs," the Traffic Research Advisory Committee recommended that an evaluation of the Department's sign post paints be conducted. In the evaluation that was subsequently undertaken, special attention was focused on the residues formed due to chalking by the sign post paints on the sign panels, which decreases sign legibility, along with the durability and general appearance of the paints. The objective of the evaluation was to compare the Department's number 10 oil and number 11 latex paints with four latex paints provided by an independent paint company through retroreflective measurements and visual observations.

After 36 months, there have been changes in the retroreflective readings on the sign panels. Retroreflective readings and visual observations indicate that the Department's number 10 oil paint has chalked and deteriorated more rapidly than the other paints. The Department's decision to discontinue use of the number 10 oil paint is reconfirmed by the results of the evaluation. The Department's number 11 latex is performing satisfactorily; it exhibits a minimal amount of chalking while providing average appearance and durability.

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INTRODUCTION

A report on streaking of highway signs prepared by R. N. Robertson of the Research Council contained a recommendation that an evaluation of the oil base and latex paints used by the Department be conducted.[1] Upon reviewing Robertson's report, the Traffic Research Advisory Committee agreed that the performance characteristics of the Department's sign post paints should be evaluated to determine the effect of paint residues on sign panels.

PURPOSE AND SCOPE

The objective of the investigation was to evaluate through retroreflective measurements and visual observations the Department's number 10 oil and number 11 latex paints. Also the number 11 latex paint was compared with other grades of latex paint provided by an independent paint company.

METHODOLOGY

Preparation of Test Posts and Signs

Six sign posts 7-ft. (2.13 m) in length were brush painted in accordance with the Department's specifications, with three coats being applied to each post. Two of the paints (number 11 latex and number 10 oil) are presently used by the Department. Four latex paints were provided by an independent paint company and can be divided into three grades. The PL-100 is low grade, the M1-223 is medium grade, and the 2-120 and 3-100 are high grade. Also, sign panels 12 in. (30.48 cm) wide by 18 in. (45.72 cm) high were mounted 1 ft. (30.48 cm) from the top of the posts as shown in Figure 1. The sign panels were fabricated with green enclosed lens reflective sheeting

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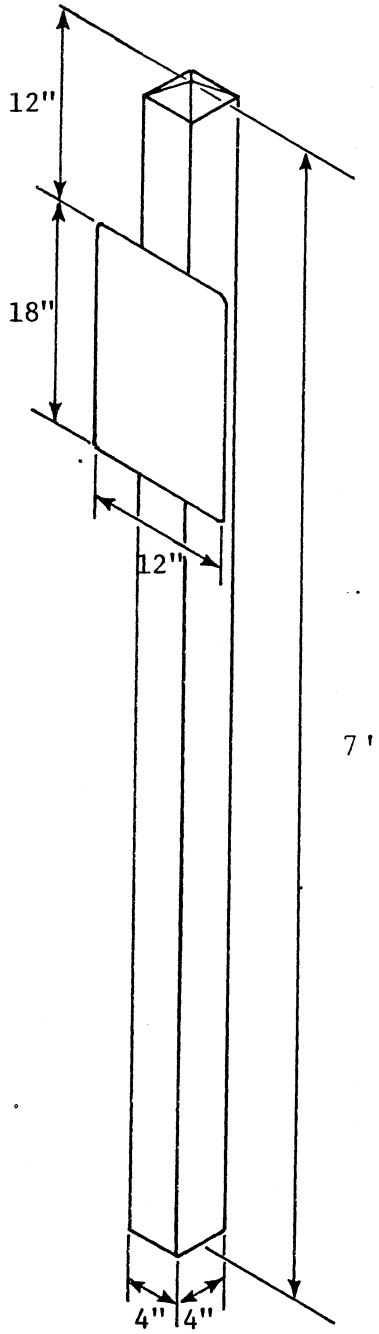
1. Robertson, R. N., An Investigation of Streaking of Highway Traffic Signs, Virginia Highway & Transportation Research Council, 1974.



1 foot = .3048 meter
1 inch = 2.54 centimeters

Figure 1. Sign panel and post dimensions.

Exposure Site

The painted sign posts with panels were placed on the roof of the Research Council building for exposure to weathering on February 28, 1974. In November 1975, the sign posts and panels were moved to a field test site at the Charlottesville Residency. The sign panels are facing south and are mounted in the standard vertical position as shown in Figure 2.

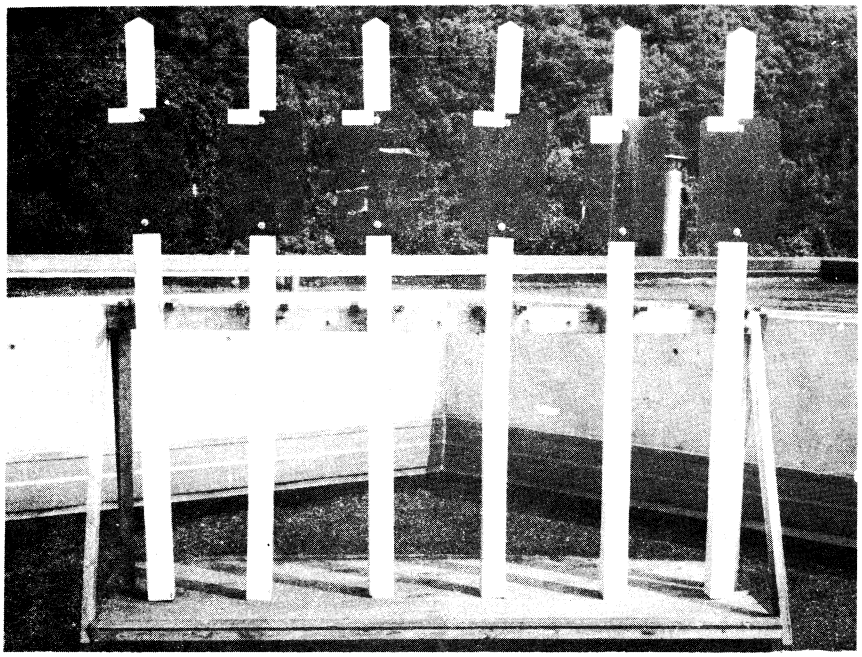


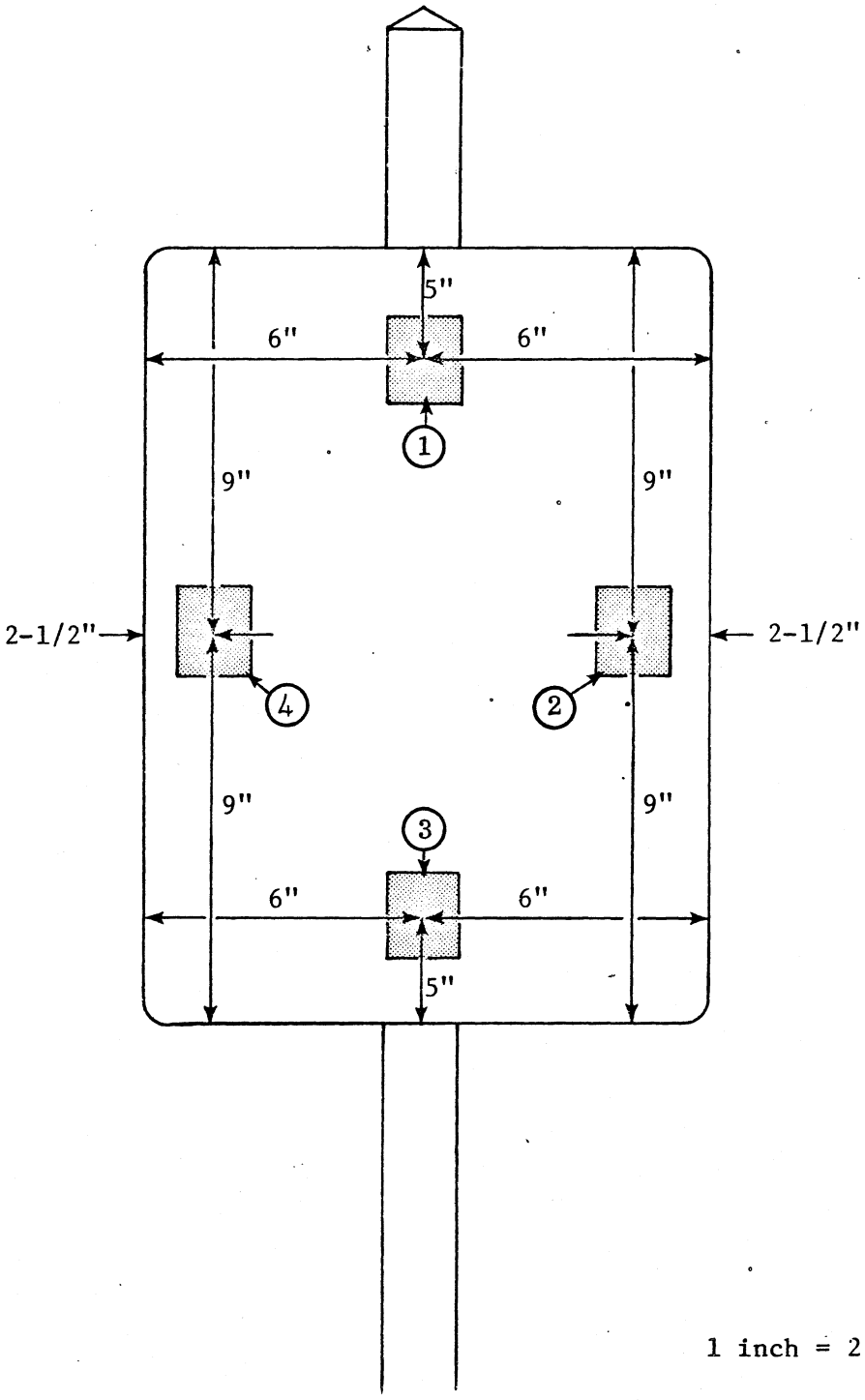
Figure 2. Test stand with six posts and panels.

Evaluation

The relative effects of paint residues on the sign surfaces caused by paint chalking were determined by measuring the loss in retroreflectivity of the sign surfaces with a reflectometer that gives the percentage of light reflected. Generally, as the paint chalks due to weathering, it streaks onto the sign panels and causes a decrease in the retroreflective readings.

Monthly retroreflective readings were taken at four locations on each test sample (see Figure 3). A template was used to ensure that the monthly readings were taken at the same locations. A modified Gardner portable reflectometer was used to take the readings.

The general appearance and durability of each paint were judged by visual observations of the sign panels and posts. The appearance of the paints was visually evaluated on the basis of accumulated residue, cracking, blistering, flaking, streaking, molding, spotting, and erosion. The whiteness of the paints was evaluated by rating on a scale of one to six, with one being the whitest paint.



1 inch = 2.54 centimeters

Figure 3. Retroreflective reading locations.

RESULTS

The average retroreflectivity (four locations for each panel) at the beginning of the study and after 36 months, along with the difference of averages and the percentage loss in retroreflectivity, are shown in Table 1.

Table 1

Summary of Retroreflective Readings

Panels	Averages 2-74	Averages 3-77	Difference of Averages	% Loss
PL-100	14.25	12.94	1.31	9%
2-120	13.94	13.38	0.56	4%
M1-223	13.50	13.19	0.31	2%
3-100	13.81	12.69	1.12	8%
No. 11 latex	13.25	13.00	0.25	2%
No. 10 oil	14.00	11.63	2.37	17%

As can be noted from Table 1, the number 10 oil paint panel showed the largest percentage loss of retroreflectivity. The PL-100 and the 3-100 panels had retroreflective decreases of 9% and 8%, respectively. The 2-120 panel decreased in retroreflectivity by 4%, while the Department's number 11 latex and the M1-223 had only a 2% loss.

A summary of the whiteness ratings and observations used to subjectively evaluate the general appearance and durability of the paints is given in Table 2. Visual evaluations of the sign panels and posts provided a basis for comparing the six paints. On the basis of whiteness the 2-120 was superior for the 36-month time period with a rating of 1. It was followed by the 3-100, number 10 oil paint, number 11 latex, M1-223, and PL-100 in order of decreasing whiteness. Visual observations of the posts also indicated other items of interest. All six paints exhibited streaking, cracking, and spotting. All showed mold, except the number 10 oil paint. The number 10 oil paint was the only paint to exhibit erosion (exposure of bare wood) and it also showed the worst cracking and flaking. Considering all factors in the visual evaluation, the number 10 oil paint had the poorest appearance and the 3-100 had the best appearance.

The percentages of titanium dioxide in the paints were considered in the evaluation and the values are shown in Table 3.

Table 2

General Appearance and Durability Ratings
(X Indicates Presence)

Panels	Whiteness Ratings	Observations						
		Mold	Flaking	Streaks	Cracks	Spots	Blistering	Erosion
PL-100	6	x	x	x	x	x	x	
2-120	1	x		x	x	x	x	
M1-223	5	x	x	x	x	x	x	
3-100	2	x	x	x	x	x		
No. 11 latex	4	x	x	x	x	x		
No. 10 oil	3		x	x	x	x		x

Table 3

Titanium Dioxide Percentages

Paint	Titanium Dioxide Type	% Composition
PL-100	III	20
2-120	IV	25
M1-223	IV	18
	I	2
3-100	III	22
No. 11 latex	III	19-21
No. 10 oil	I	14-16

According to the findings in Robertson's report, titanium dioxide causes the streaking on the sign panels. It is carried down the sign face by precipitation. Robertson's study suggested that the higher titanium dioxide percentages would cause greater streaking. Perhaps, the type I titanium dioxide, which is predominately used in the number 10 oil paint, is the cause of the severe streaking and also the loss in retroreflectivity. None of the latex paints include the type I titanium dioxide, except the M1-223, which has only 2%. It and the Department's number 11 latex showed very limited streaking. A comparison of the titanium dioxide percentages with the losses of retroreflectivity of the sign panels showed no correlation.

Paint storage qualities must be considered when paint is considered in large quantities, so samples of the six paints were examined after storage at room temperature for approximately three years. All six samples readily mixed upon stirring. The number 10 oil paint can be applied and stored at temperatures as low as 32°F (0°C) without harm. Its shelf life may be as much as ten years. The latex paints evaluated must be applied at temperatures above 50°F (10°C) and they should be stored at a temperature above freezing. The shelf life of the latex paints is considerably less than ten years.

The costs of the six paints were also investigated. The paint costs as of March 1977 were approximately $3.95 for PL-100, $4.32 for the M1-223, $5.32 for 2-120 and 3-100, and $3.55 for the Department's number 11 latex. The costs may vary according to quantities purchased.

FINDINGS

After 36 months of exposure to weathering, the test signs have all undergone a loss in retroreflectivity. The Department's number 10 oil paint has the most streaked panel. The Department's number 11 latex and the average grade M1-223 have the least streaked panels.

The Department's decision to discontinue use of the number 10 oil paint is reconfirmed by the results of the evaluation. The Department's number 11 latex is performing satisfactorily; it exhibits a minimal amount of streaking while providing average appearance and durability as compared with the paints provided by the independent paint company. The 2-120 and 3-100, the higher grade paints provided by the independent paint company, have the best overall appearance with whiteness ratings of 1 and 2. Furthermore, these paints appeared to be superior in durability; however, they are considerably more expensive than the number 11 latex paint presently used by the Department.

ACKNOWLEDGEMENTS

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