

These Digests are issued in the interest of providing an early awareness of the research results emanating from projects in the NCHRP. By making these results known as they are developed and prior to publication of the project report in the regular NCHRP series, it is hoped that the potential users of the research findings will be encouraged toward their early implementation in operating practices. Persons wanting to pursue the project subject matter in greater depth may obtain, on a loan basis, an uncorrected draft copy of the agency's report by request to: NCHRP Program Director, Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418

Current Practices in Use of Retroreflective Signing Materials

An NCHRP state-of-the-art digest derived from an interim report on NCHRP Project 3-24, "Determine the Luminous Requirements for Retroreflective Highway Signing," conducted by the Highway Safety Research Institute, University of Michigan, Ann Arbor. The principal investigator is Paul L. Olson.

THE PROBLEM AND ITS SOLUTION

Current signing practices predominantly feature use of retroreflective signing materials. Moreover, new reflective materials becoming available will provide the traffic engineer with a greater number of options in signing decisions. In addition, it is becoming increasingly apparent that sufficient information is not available concerning the effect of reflectivity on sign legibility and the range of reflectivity values that will satisfy motorist needs.

Among the basic questions that need to be answered are: What is the range of acceptable legend and/or background luminosity for effective signing? How does this range of luminosity vary as a function of sign characteristics, road geometry, environmental conditions, and so on? Can an optimum luminosity be specified for each situation? When, according to luminosity criteria, should a sign be replaced?

The aim of this research is to define the optimum relationship between sign background and legend luminance as a function of several pertinent variables. The intention is to provide traffic engineers with information on legibility distance which they require in order to make cost-effective choices for new installations, maintenance schedules, and eventual replacement of highway sign faces.

FINDINGS

NCHRP Project 3-24 is scheduled for completion in late 1976. This Research Results Digest presents the major findings from a questionnaire survey that was conducted early in the project to determine what material combinations are being used

and the basis for their selection. The following summary of survey results is based on responses from 38 state agencies and turnpike authorities.

The questionnaire requested information in the following areas:

1. Types of material currently employed in signing.
2. Practices relating to illumination.
3. Policies for use of different materials as a function of sign type and application.
4. Practices relating to inspection and maintenance.
5. Criteria and methods for refurbishing existing signs.
6. Criteria and methods for determining when sign faces have weathered to the point that they must be replaced.
7. Experience relating to the useful life of various sign face materials.

Materials Used. Table 1 summarizes responses to a question concerning material combinations used for new signs. Most agencies employed more than one technique and one employed eight of the nine combinations. However, certain practices clearly dominate. The combinations most frequently mentioned were button copy on paint or porcelain enamel and button copy on engineer-grade (enclosed lens) sheeting. Four other combinations were mentioned only about half as often as the first two. These were: button copy on high-intensity (encapsulated lens) sheeting; high-intensity copy on engineer-grade sheeting; high-intensity copy on high-intensity sheeting; and engineer-grade copy on engineer-grade sheeting. The remaining three combinations were mentioned much less frequently.

A particular material combination was defined as "major use" if it was used for 50 per cent or more of the signs employed by a given agency, or was the combination most used for particular types of highways, if such a distinction was made by the agency. Not all agencies responded to the request for an indication of the frequency with which a given material combination was used. Those that did respond mentioned only two combinations--button copy on paint or porcelain enamel and button copy on engineer-grade sheeting--more than three times.

A number of respondents described certain material combinations as experimental. Generally these references were made to high-intensity materials.

With reference to signs employing direct-applied letters, symbols, or legends, material use was almost evenly divided between engineer-grade and high-intensity sheeting. Only one agency mentioned the use of a beads-on-paint approach to this type of signing. Engineer-grade sheeting was the major use for nearly three times the number of cases as high-intensity sheeting.

Illumination. Eighty-two per cent of the responding agencies do not illuminate roadside signs, whereas 92 per cent illuminate overhead signs in at least some instances. There is appreciable variation in sign illumination policies. The most frequent response was that all overhead signs are illuminated. However, many agencies described selective policies based on the importance of the sign or the environment within which it is located.

Photometric Specifications. Ninety-five per cent of the responding agencies indicated that they have photometric specifications for signing materials (Table 2). Agencies responding to the survey provided specifications, if available.

Table 2 also indicates if the agencies use different photometric or material specifications for signs used in different applications. In general, the responses indicated that the agencies did not make such distinctions except when asked whether photometric or material specifications were altered for different classes of signs.

TABLE 1. Frequency with which Various Material Combinations are Employed for New Signing by Responding Agencies.

	Used	Major use	Experimental
Signs with demountable letters, symbols or legends:			
<u>Button copy on:</u>			
Paint or porcelain enamel (non-reflective)	22	6	
Engineer grade sheeting	24	9	
High intensity sheeting	11	1	2
<u>High intensity sheeting copy on:</u>			
Paint or porcelain enamel	6		1
Engineer grade sheeting	13	3	2
High intensity sheeting	13	3	2
<u>Engineer grade sheeting copy on:</u>			
Paint or porcelain enamel	4		
Engineer grade sheeting	14	1	1
High intensity sheeting	9		
Signs with direct applied letters, symbols or legends:			
<u>Beads on paint</u>	1		
<u>Engineer grade sheeting</u>	31	28	
<u>High intensity sheeting</u>	28	10	1

The practices regarding use of different materials for various applications or classes of signs are quite varied, but the most prominent trend is for use of encapsulated lens material for functions such as construction and red background signs.

Quality Control. Sixty-three per cent of the agencies indicated that they did not have photometric facilities available. Of those that did, 71 per cent ran photometric checks on materials prior to use and 44 per cent ran checks on materials that either were in use or had been retired from use.

About one-half the responding agencies indicated that they had sign shops remote from their central office; of those, 95 per cent said that these individual shops were responsible for their own quality control.

Inspection. Responses to a question concerning the frequency with which signs are inspected were quite varied. Fifteen per cent of the agencies said they conducted monthly inspections, 5 per cent said every three months, 20 per cent every six months, 33 per cent every 12 months, and 27 per cent checked the "other" category.

It would seem desirable that nighttime inspections be conducted to properly assess the performance of retroreflective materials. In response to a question concerning the frequency of nighttime inspections, 9 per cent of the agencies stated that they conducted no nighttime inspections, 53 per cent said that one-fourth of sign inspections were carried out at night, 12 per cent said one-half of sign inspections were conducted at night, and 26 per cent said all sign inspections were carried out at night.

In responding to a question concerning the utility of police reports and citizens' complaints as a means of identifying worn out signs, about 70 per cent of the agencies indicated that they did not find either of these sources to be of help.

There are available special devices to aid in the inspection of signs. Of the responding agencies, however, only three (8 per cent) indicated that they make use of any kind of objective reference in sign inspections.

Maintenance. Seventy-three per cent of the responding agencies indicated that they have a sign cleaning program. Four per cent of the agencies indicated that they clean signs as often as once every three months, 16 per cent said once every six months, 32 per cent indicated that they clean signs at least annually, 48 per cent said they clean signs "as required." In general, those agencies that checked the "as required" box indicated that cleaning was based on reports from inspection.

TABLE 2. Responses to Inquiry Concerning Photometric Specifications.

	Yes	No
Do you have photometric specifications for signing materials?	95%	5%
Do you have different photometric or material specifications for:		
Overhead as compared with roadside sign installations?	24%	76%
Signs placed in brightly lit surroundings as compared with those placed in dark surroundings?	5%	95%
Signs placed on different classes of highway or where different traffic volumes are encountered?	19%	81%
Different classes of signs (guide, warning and regulatory)? Color differences aside, do you use different materials (e.g. high intensity sheeting) on some classes of sign and not others?	57%	43%

Refurbishing processes are available which are intended to prolong the life of sign materials. Fifty-eight per cent of the responding agencies indicated that they used some kind of refurbishing process on at least some signs. This is generally based on visual inspection (68 per cent of the responses). The only other response checked was "manufacturer's recommendations." A number of agencies checked both of these categories.

Replacement. One of the most important benefits that may flow from the present research program is to provide an objective basis for determining when signing materials have worn to the point where they must be replaced. The responses to a question on how signs are judged ready for replacement at present are summarized in Table 3. Many of the agencies checked more than one response to this question.

The techniques employed in replacing sign faces are extremely varied. Most of the agencies responding checked more than one option, usually depending on the size and location of the sign or the extent to which it was worn. These responses are summarized in Table 4.

Information was requested on the effective life of various signing materials. Responses to this question were quite varied with regard to some materials and quite uniform for others. For example, useful life reported for engineer-grade sheeting varied from 3 to 10 years, although the time most frequently mentioned was 7 years. In comparison, the combination of buttons on porcelain enamel was generally checked as lasting 15 or more years. Similarly, button copy was reported to last for 15 or more years by most of the agencies responding. Where high-intensity sheeting was mentioned, it was usually stated that the agency had not had enough experience to evaluate its effective life.

TABLE 3. Means by which Responding Agencies Determine When Signs Require Replacement.

Photometric performance	0%
Visual inspection using reflectivity standards	6%
Visual inspection and best judgment	73%
Age	19%
Other	2%

TABLE 4. Means Employed to Replace Sign Faces.

Complete replacement	42%
Overlay with sheet aluminum and new sign film	29%
Strip sign film and re-apply	24%
Other	5%

APPLICATIONS

The responses to this survey have indicated a substantial diversity of materials, applications, and philosophies. It is apparent that highway agencies are sincerely concerned with the problem of sign legibility and how best to achieve it; however, there is no general agreement as to the best ways to bring about optimum legibility.

Because the final report on this project is not currently available, the statement in blue at the head of this Digest concerning loans of uncorrected draft copies of the report does not apply. A list of individual responses to specific questions contained in the questionnaire may be requested from: Program Director, NCHRP, Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, DC 20418.

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National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

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