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RESEARCH UPDATE U 2002-1

ALL SIGN® POLYCARBONATE SIGN
(Final Report)

REFERENCES

Work Plan 2000-R-8

INTRODUCTION

In April 2000, four ALL SIGN® stop signs were erected in the towns of Morristown (Village of Morrisville), Marshfield, Middlesex, and Barre. The sign locations were selected to best test the elements that degrade the retroreflectance of the product. These elements may include weathering, sun (ultraviolet radiation), repeated freezing and thawing, abrasion cause by blowing dust and sand, and vandalism.

The most commonly used reflective sign sheeting used by the state of Vermont is ASTM standard Type III (high intensity). In accordance with ASTM D4956-95, the a minimum coefficient of retroreflection (R_A) of this type of sign sheeting is 250 $(cd)(lux^{-1})(m^{-2})$ for white and 45 $(cd)(lux^{-1})(m^{-2})$ and for red at a measurement geometry of 0.2° observation angle and a -4° entrance angle. The proposed specification for the polycarbonate sign is a minimum R_A of 600 $(cd)(lux^{-1})(m^{-2})$ for white and 150 $(cd)(lux^{-1})(m^{-2})$ for red at the same geometry.

PRODUCT DESCRIPTION

The ALL SIGN® stop sign is made completely of plastic. Manufactured using an injected mold process which creates a sign face cube corner technology, the sign is designed to provide high retroreflective properties. The polycarbonate resin provides color throughout and incorporates ultraviolet stabilized pigments that provide protection from the sun's rays. In addition, the face of the sign is coated with a transparent film made of Tedlar, manufactured by DuPont, which is designed to add protection from chemicals and graffiti. The sign is also available without this film at a lower cost but without the graffiti and fade warranties.

The geometric design of the sign incorporates a sloping crown, which is intended to reduce specular glare coming off the sign. The sign conforms to the requirements of the Manual of Uniform Traffic Control Devices (MUTCD) for color and physical dimension for an R1-1 (30"x30") stop sign and AASHTO (ASTM D4956) for the maximum requirements for weathering both actual and accelerated. This product has been evaluated by the Highway Innovative Technology Evaluation Center (HITEC), report 98-04, #40308, product 29.

COST

In April 2000, the cost of the ALL SIGN® stop sign was $80 per sign with the Tedlar protective coating. In February, the price of the same product is $85 per sign, but may be less when ordered in large quantities. For comparison, the cost of an R1-1 (30" x 30") stop sign with Type III (high intensity) sheeting cost $64 per sign based on Vermont's Maintenance Division's current contract price.

INSTALLATION

Four ALL SIGN® stop signs were installed by Vermont Agency of Transportation, Maintenance District 6, in April 2000. The signs, designed with a reinforced mounting area on the backside, are attached with two, 5/16-inch stainless steel nuts. The design of the signs allows for mounting from the back, with no fasteners visible on the sign face.

The signs were placed in the following locations (Figures 1-4):
Barre – Miller Road at junction with VT Route 63,
Marshfield – VT Route 232 at junction with US Route 2,
Middlesex – Middlesex Center Road at junction with US Route 2, and
Morristown – Northgate Ave (Village of Morrisville) at the junction with VT Route 100.

Figure 1. Barre – Miller Road at junction with VT Route 63 (left sign).

Figure 2. Marshfield – VT Route 232 at junction with US Route 2.

Figure 3. Middlesex – Middlesex Center Road at junction with US Route 2.

Figure 4. Morristown – Northgate Ave at junction with VT Route 100.

PERFORMANCE

Graffiti Testing

To test the protective coating, Tedlar, manufactured by DuPont, a sign was graffiti tested in the laboratory. The sign was marked with permanent marker and painted with traffic marking paint (Figure 5). After setting for 24 hours, the sign was completely cleaned using acetone (Figure 6).

Figure 5. Graffiti Testing – Before.

Figure 6. Graffiti Testing – After.

In addition, during its placement in the field, the sign located in Marshfield had been faced with paint. The Maintenance District removed the sign and cleaned it. Although no significant damage resulted, minor scratches had occurred on the sign face (Figure 7).

Figure 7. Marshfield – Scratches on sign face.

Retroreflectivity

Due to the product's unique design, standard retroreflectivity measuring devices were not available to us for field testing purposes. Proposed specification values for the white and red material, as well as a comparison of new and weathered white and red test samples is available in HITEC report 98-04, #40308, product 29. Based on values presented in this report, this material exceeds the AASHTO (ASTM D4956) specification for Type III reflective sheeting.

Color Performance

As documented in HITEC report 98-04, #40308, product 29, the ALL SIGN® stop sign has been tested in accordance with the CIE standardized measurement procedure (ASTM E-308) for new and weathered material, as well as after exposure to graffiti. Values for both the white and red material fell within the FHWA defined zones for their respective colors.

Luminance

The ALL SIGN® stop sign's design creates a product with a translucent effect. Test data presented in HITEC report 98-04, #40308, product 29, indicate that this feature creates luminance values higher then those of a metal sign under ambient daylight conditions.

Visual Observations

A comprehensive subjective evaluation of driver's response to the ALL SIGN® product is presented in HITEC report 98-04, #40308, product 29. This evaluation incorporated the comparison of the product with Type I, Type III, Type IV, and microprismatic signs. The evaluation provides a statistical comparison indicating that the ALL SIGN® product was more than or equal in sign recognition at 750 feet and at a 250 feet its recognition was the least preferred of all the materials.

Visual observations of the signs placed at the four test sites indicate a product with high retroreflectivity, but perhaps with some legibility problems and glare.

Durability

After nearly two years of service, the ALL SIGN® stop sign has remained intact at two of the four test sites. The sign at the Barre site was removed and replaced with a standard Type III sign in February 2001. The removal of this sign was not by agency forces and its whereabouts is unknown. The sign at the Marshfield site was discovered in February 2002, to have had the front "STOP" portion of the sign gone. An inspection of the back of the sign remaining showed no indication of prying or tampering. No pieces were found during a visual observation of the post. The sign face may be buried in snow pack adjacent. Further investigation planned for the Spring 2002 may reveal the failure mechanism.

Figure 8. **Marshfield – After 22 months of service.**

Figure 9. **Morristown – After 22 months of service.**

Figure 10. Middlesex – After 22 months of service.

SUMMARY

After 22 months of service, two of four of the All Sign® products continue to perform satisfactory. The design of the sign appears to give a visual enhancement over our traditionally used Type III reflective sign sheeting, making recognition more rapid from greater distances on most road geometric configurations. Because of the translucent sign back the product may prove to be more illuminated in areas typically shaded or dark. But, this feature may also be a disadvantage in areas with a lot of artificial lighting.

Legibility of the sign may also appear to some driver's as "blurred" and hard to distinguish the lettering, but the geometry and color of the sign is distinguishable only to the function of a stop sign by which the message is conveyed.

Based on data presented in HITEC report 98-04, #40308, product 29, and supporting field observations, the All Sign® polycarbonate sign may be a suitable substitute for the ASTM standard Type III (high intensity) reflective sheeting. Determination of the product's effectiveness and suitability to a specific site should be considered, based on such things as road geometry and lighting conditions for a 'best fit' sign.

Reference:

Highway Innovative Technology Evaluation Center (HITEC), Evaluation Findings of the All Sign® Products, Inc. Polycarbonate Stop Sign, Civil Engineering Research Foundation (CERF), CERF REPORT: HITEC 98-04 #40308, Product 29, copyright 1998.