



INDOT Research

TECHNICAL *Summary*

Technology Transfer and Project Implementation Information

TRB Subject Code: 51-6 Compatibility of Standards
Publication No.: FHWA/IN/JTRP-2002/22, SPR-2482

December 2002
Final Report

Sign Retroreflectivity Study

Introduction

Signing is a big yearly cost to state DOT's in sign maintenance and replacement costs. In 2001 the Indiana Department of Transportation (INDOT) replaced 14,930 signs at a cost of \$1,067,931 and did maintenance work on 34,084 signs at a cost of \$2,136,076. These values include the cost of the material used for making the sign, equipment use, and labor costs. Replacement is defined as a sign being replaced because it is ten years of age or older. Maintenance is defined as signs needing to be cleaned or replaced due to knockdowns or vandalism. Currently the replacement of interstate and highway signs, which are ten years or older, is about one-third of the entire cost of the INDOT sign maintenance and replacement program.

Recently, guidelines have been proposed by the Federal Highway Administration (FHWA) for minimum retroreflectivity of traffic signs for state, county, and city roads in the United States. The purpose of this study was to evaluate if the majority of the signs currently by INDOT will meet the new minimum requirements proposed by the FHWA. In addition, this study provides quantitative data to assess the effectiveness of the current sign replacement program used by the Indiana Department of Transportation (INDOT) and determine if the current ten year replacement schedule is adequate to keep the State of Indiana in compliance with the new guidelines or if adjustments need to be made. This study was limited to ASTM Type III sheeting.

Findings

Given the data analysis performed on the data collected from the field the vast majority of the signs are expected to meet the proposed retroreflectivity minimums with no change in the current 10 year replacement policy. Only a very small percentage of the sample taken violated the most conservative minimums for each of the color categories. Over 98% of the signs in the field under normal circumstances should not only meet but exceed the proposed retroreflectivity minimums for any speed or size sign (Table 1).

Currently, the proposed minimums are different requirements for different size and speeds for each color group. We have found that this needlessly complicates field inspection because the majority of the signs pass the most conservative minimums for each of the color groups.

The majority of the signs with red backgrounds and white legends will meet the proposed white to red ratio requirement because the performance of the white ASTM Type III sheeting is so good that for the most part the retroreflectivity does not change as the sign ages.

Currently INDOT districts replace traffic signs in a ten year cycle. This is typically done using one of two methods. The first is done by replacing signs as sections of highways and interstates are repaved. The other is done based on inspection of the signs age. From the literature review done for this study, we recommend adding a third replacement procedure based upon an annual or bi-annual night observation technique. This allows trained personnel to travel at night time when the signs are most needed and make sure that they are adequate for use in the field. Unlike using a retroreflectometer at night one can see the how

the entire face of the sign performs and be able to catch dead spots on the sign face. Also unlike using a retroreflector this method is not as cost and labor intensive as doing night inspections.

Based upon our experience with the retroreflectometers, we found that the values obtained varied somewhat depending upon which instrument was used. This raises some concern

with regards to state liability. Perhaps the proposed FHWA minimums should be augmented with a tolerance value. This current values would be interpreted as a minimum safe values, and some slightly higher values would be used a guidelines for replacement. Such a procedure would have negligible impact on the amount of signs replaced, but would provide consistency among agencies on sign replacement.

Table 1: Data Set Compliance with Proposed Retroreflectivity Minimums

| Sample Compliance With Proposed Retroreflectivity Minimums | | | | |
|--|-----------------|-------------------|---|--------------------------|
| Color | Number of Signs | Minimum Reference | Highest Retroreflectivity Minimum (cd/lx/m ²) | % of Signs Below Minimum |
| Red | 415 | FHWA 2001 | 8 | 1.0% |
| | | FHWA 2002 | | |
| | | Carlson 2003 | 7 | 0.7% |
| White | 683 | FHWA 2001 | 70 | 0.0% |
| | | FHWA 2002 | 88 | 0.0% |
| | | Carlson 2003 | 50 | 0.0% |
| Yellow | 243 | FHWA 2001 | 55 | 1.2% |
| | | FHWA 2002 | 84 | 2.1% |
| | | Carlson 2003 | 75 | 1.6% |

Implementation

From the analyses done it is recommended that the life cycle of traffic signs with white and yellow backgrounds can be safely extended for at least two years to 12 years, providing there are is no apparent damage or defects. Red, however, should not be left out in the field for longer than 10 years because the red coloring at that point has faded too much. Such a policy could save INDOT up to \$27,000 per year in material costs.

Currently, the dominant vendor of ASTM Type III sheeting to INDOT is 3M. That was the material exclusively evaluated in this study. However, additional vendors are beginning to introduce their material into the state. It is proposed that INDOT construct an outdoor test stand in one of their districts, and annually

randomly select several samples to hang of each sheeting vendors color palette for long term monitoring. It is very important these samples be randomly selected from INDOT stock (but different lots), independent of the vendor. Details regarding the product vendor, manufacture date, installation date, and lot number would be recorded on the back of the sample. Annual monitoring of this test stand would provide an early warning to INDOT of impending problems with a particular vendor's Type III sheeting. Such an outdoor test stand could be constructed very economically because the size the samples would probably be constructed from small scraps of material too small to use on an ordinary sign.

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