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Center for Transportation Research and Education

Wet-Reflective Pavement Marking Demonstration Project

tech transfer summary

Water significantly decreases pavement marking retroreflectivity, which can make it difficult for drivers to stay in their lanes and/or on the road when traveling under wet night and low visibility conditions.

Problem Statement

Pavement markings provide critical guidance to motorists. However, seeing pavement markings under wet night conditions is problematic given that the presence of water can significantly decrease a marking's retroreflectivity. Driving under these conditions can cause both stress and fatigue to motorists, which can have an impact on operations and safety.

Objectives

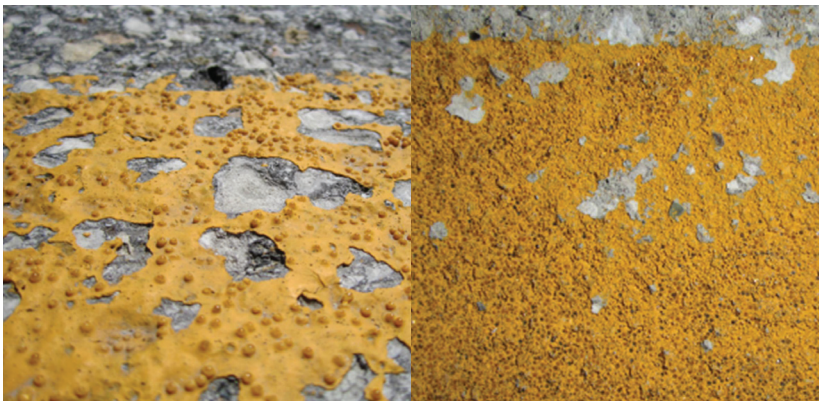
Many new pavement marking products are being introduced to address wet night visibility. This evaluation provides the Iowa Department of Transportation (DOT) with information to consider on how 16 different products performed in Iowa over a two-year evaluation period.

The test deck layout provided an opportunity to analyze the 16 products under a variety of conditions, which included installation technique (grooved or surface-applied), line type (left yellow edge line, white center skip, and white edge line), retroreflectivity (dry and wet), and cost.

Research Description and Methods

Working with the Iowa DOT Pavement Marking Task Force, the research team developed an evaluation methodology, installed wet-reflective pavement markings, and evaluated the performance of the materials and treatments over a two year period.

Performance parameters included durability, presence, and retro-reflectivity (both dry and wet). Locating the test sections within Story County allowed Iowa DOT management and staff, as well as local agencies, to drive the area and provide input on products and treatments.



Sample material loss (loss of presence) on waterborne paint products after two winters

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RESEARCH PROJECT TITLE
Wet-Reflective Pavement Marking Demonstration Project

SPONSORS
Iowa Highway Research Board (IHRB Project TR-597)
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Retroreflectometer used to obtain both dry and wet measurements (with rain box used, bottom)

Retroreflectivity was sampled using a handheld LTL-X retroreflectometer under dry conditions. For rain conditions, a rain box was built according to the specifications from ASTM WK19806 (New Test Method for Measuring the Coefficient of Retroreflected Luminance of Pavement Markings in a Standard Condition of Continuous Wetting).

Pavement marking presence was monitored for each test section through visual observation and digital photos.

Summary of Key Findings

The primary source of pavement marking damage in Iowa is due to winter maintenance practices. Accordingly, the pavement marking retroreflectivity performance is presented in the report in terms of initial values and then after one and two winters.

The white skip lines for some sections did not perform beyond the first winter. Grooved markings performed better than surface-applied markings overall through Iowa winters and snow-plowing operations. All of the paint test sections showed material loss after one and especially after two winters. After one winter, 13 of the 16 total test sections had higher values for the grooved versus surfaced-applied treatments and this was still true after the second winter.

Initial measurements of dry retroreflectivity varied considerably from a maximum value of 1,289 millicandelas (mcd) to a minimum 268 mcd. After two winters, these averages were reduced to a maximum of 512 mcd and a minimum of 131 mcd.

Wet retroreflectivity performance among the products varied considerably.

Yellow Edge Line

Initial measurements of wet retroreflectivity showed that only seven of the 16 sections measured above 100 mcd. Two sections measured roughly three to four times the average of the group. After one winter, only three sections measured above 100 mcd. After two winters only two sections measured above 100 mcd.

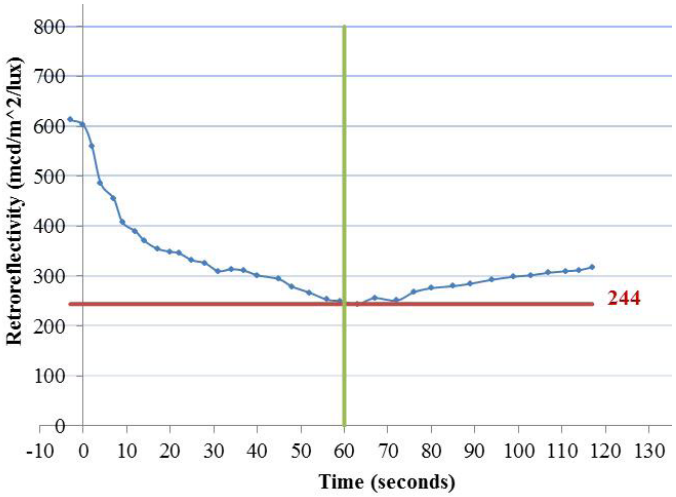
White Skip Line

Initial measurements of wet retroreflectivity show that 13 of the 16 sections measured above 100 mcd. Three sections measured well above the group average. After one winter, six sections measured above 100 mcd (and all of these were grooved). After two winters only one section measured above 100 mcd.

Because each agency has their own performance criteria for pavement marking materials, no other summary product conclusions were developed for this project.

Implementation Benefits and Readiness

This evaluation serves as a resource for the Iowa DOT Pavement Marking Task Force in assessing the utility of these types of markings in improving visibility and overall safety for the motoring public. The documented performance of the various products and treatments will assist the Iowa DOT and local agencies in determining when and where use of these products might be most effective.



Sample wet retroreflectivity measurements (shown in blue), indicating the amount of loss that the driver sees, with the initial dry readings (two) at above 600 mcd/m^2/lux and the wet readings down to less than half of that, at 244 (red line), after one minute of wetting (green line)