

JOINT TRANSPORTATION RESEARCH PROGRAM

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Installation and Maintenance of Raised Pavement Markers at State Transportation Agencies: Synthesis of Current Practices

Introduction

A raised pavement marker (RPM) is classified as a delineation device that is often used to provide guidance for drivers about lane discipline and curvature day and night and in good and poor weather. Although raised pavement markers have been widely applied by the Indiana Department of Transportation (INDOT), there have been multiple cases where snowplowing activities have damaged both the pavements and the raised pavement markers on INDOT's roadway assets. Dislodged raised pavement markers could reduce the design life of pavements because they leave openings for water and debris to infiltrate through pavement section. Interviews with INDOT personnel indicated that the proper installation of the markers and careful attention to the tooling of the center line of the concrete pavements could alleviate this problem. To explore issues related to the proper installation of RPMs, this study (SPR-4318) was launched by the Indiana Department of Transportation (INDOT) and the Joint Transportation Program (JTRP) to develop a synthesis of current practices at State Transportation Agencies (STAs) in the U.S. on installation and maintenance of raised pavement markers on concrete pavements. This study was conducted using a qualitative exploratory approach focusing on the review of current practices in installation and maintenance of raised pavement markers among STAs. Survey analysis and focused interviews with personnel from STAs, along with reviews of documents provided by STAs were the avenues used for data collection in this project.

Findings

This study focused on the following 10 themes for the assessment of installation and performance of raised pavement makers: (1) STA practices related to application of raised pavement markers, (2) application of

beveled and longitudinal joints/tooled longitudinal joints during installation of raised pavement markers, (3) installation and removal of raised pavement markers, (4) quality control parameters regarding preparation for the installation of raised pavement markers, (5) manuals/specifications regarding preparation of pavements for installation of raised pavement markers, (6) assessment of damages to the pavement/joints caused by raised pavement markers, (7) snowplowing activities on roadway assets, (8) inspection and maintenance of raised pavement markers, (9) assessment of damages to raised pavement markers, and (10) criteria for measuring "satisfaction" of using raised pavement markers. Key findings are summarized below.

- Typically, STAs follow the *Manual on Uniform Traffic Control Devices* (MUTCD) regarding the preparation of pavements for the installation of raised pavement markers. The MUTCD focuses on providing guidelines on the spacing requirements of RPMs and the replacement of RPMs based on their retroreflective aspect, but *it does not specifically address installation practices that could enhance the initial and long-term condition of the pavement-RPM assembly.*
- Some STAs including Delaware, New Jersey, Utah, and Louisiana have additional state-specific standards for the installation of raised pavement markers.
- There was *no common installation practice* of RPMs on concrete pavement across STAs. For instance, Delaware DOT has banned the installation of RPMS on PCC pavement joints. While Illinois DOT installs RPMs at least 2 inches away from the longitudinal joint in concrete pavement.
- STAs recognize that factors such as ambient temperature, pavement surface temperature, epoxy hardness, depth of groove, and pavement cleanliness are classified as quality control parameters for the installation of raised pavement markers.

- The majority of the STAs have routine inspection program for raised pavement markers; however, the frequency of inspection varies among agencies. For instance, Utah DOT inspects their raised pavement marker assets once a year; however, Illinois DOT conducts inspections every four years.
- Alaska, Idaho, Wyoming, Kentucky, and Kansas DOTs do not use raised pavement markers mainly because raised pavement markers are not resistant to snowplows and result in damages to the pavement, injury, and accidents when they are dislodged.

Based on the literature review and interviews with STAs, the research team suggests that INDOT further explore the following RPM installation practices on PCC pavements:

- *Criteria from Delaware DOT:* (1) If possible, do not install on a PCC pavement joint and (2) If RPMs are needed, install them a minimum of 2 inches away from longitudinal joints.
- *Criterion from Illinois DOT:* The closest edge of the RPM is installed at least 2 inches away from the longitudinal joint.
- *Criterion from North Carolina DOT:* Install markers to avoid placement at or on a longitudinal joint or surface defect.

Implementation

Based on the analysis of survey responses, interviews with STA personnel, and discussions with the Study Advisory Committee (SAC) of this project, the following suggestions are presented for further investigation by INDOT.

- Conduct a follow-up interview with the Iowa Department of Transportation to determine their prior experience with (1) their current standard specification regarding the use of a joint-forming device (Bobsled) with the slipform paver, (2) their RPM installation criteria, and (3) the condition of longitudinal joints in concrete pavements that are installed using the Bobsled.
- Conduct a follow-up interview with the Kentucky Transportation Cabinet and Dynatech Company

regarding Inlaid Pavement Marker (IPM) or Banana-Cut Marker to (1) obtain more data about construction and maintenance procedures for installation of these markers, and (2) plan a site-visit to review the performance of installed Inlaid Pavement Markers.

- Conduct a follow-up interview with the Delaware DOT regarding RPM installation practices on PCC pavements. The criteria from Delaware DOT is to (1) if possible, do not install on a PCC pavement joint, and (2) if RPMs are needed, install them a minimum of 2 inches away from longitudinal joints.
- Conduct a follow-up interview with the Illinois DOT regarding RPM installation practices on PCC pavements. The criterion from Illinois DOT is that the closest edge of the RPM be installed at least 2 inches away from the longitudinal joint.
- Conduct a follow-up interview with the North Carolina DOT regarding RPM installation practices on PCC pavements. Criterion from North Carolina DOT is to install markers to avoid placement at or on a longitudinal joint or surface defect.
- Conduct a pilot study to evaluate the effectiveness of slotted pavement markers on concrete pavements and their impact of the installation and maintenance activities of these RPMs on the condition of concrete pavements as well as on the condition and performance of the RPMs.

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