

Identifying Number: MPC-306
Continuation, Year 23, Third Year

Project Title:

Optimization of Pavement Marking Performance-Year 3

University:

South Dakota State University

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Description of Research Problem:

Clearly visible pavement markings are essential to the safety of travelers. Because drivers rely on markings for continuous direction without having to shift their attention away from the roadway, markings must provide adequate visibility and reflectivity on all pavement surfaces, in all weather conditions, day and night, in all seasons. As pavement markings deteriorate over time, roadway safety is compromised and costly replacement becomes necessary. The ideal pavement marking would provide retroreflectivity in all weather conditions and be durable enough to survive several years before replacement is warranted.

The current pavement marking for asphalt concrete (AC) pavements, which constitute a majority of South Dakota's highway network, is waterborne paint applied directly to the roadway surface. Waterborne paint typically requires repainting of the centerline every year and the shoulder line every year or two, depending on snowplow damage. Pavement markings must perform on a variety of new asphalt surfaces, including Class S mats, and in conjunction with maintenance treatments, including chip seals, fog seals,

sand seals, and crack seals. Durable, long lasting pavement markings may be covered by a surface treatment before the markings' actual operational life is reached. Surface preparation can also affect markings' initial visibility and long-term retention.

In addition, a major issue with concrete pavements is winter road maintenance. To avoid plow blade damage to markings applied on the roadway surface, markings are inlaid into the pavement. Epoxy materials and preformed tape are typically used in inlaid applications, but other less expensive alternatives may be feasible, if their period of performance warrants their substitution. Surface preparation—such as diamond grinding or carbide milling—may also play a direct role in determining the longevity of inlaid pavement markings.

Research is needed to explore the feasibility of extending the performance period of pavement markings on asphalt pavements by attempting to minimize or eliminate the impacts of surface treatments, especially chip seals, on pavement marking life and effectiveness. Developing new strategies for applying pavement markings optimally in conjunction with our standard maintenance practices will allow the use of other more durable marking materials on asphalt concrete pavements as well as extending the life of the normal waterborne systems. The exploration of combining inlay procedures with less expensive durable and waterborne markings may also result in significant savings without any reduction in pavement marking performance for Portland Cement Concrete (PCC) pavements.

Research Objectives:

1. Evaluate the constructability, durability, and visibility of alternative pavement marking materials and application practices to standard waterborne paint on asphalt pavement surfaces, in consideration of SDDOT's pavement construction and maintenance practices.
2. Compare the constructability, durability, and visibility of alternative pavement marking materials to epoxy materials in inlaid applications to concrete pavements.
3. Assess the cost-effectiveness of pavement marking alternatives for use on concrete and asphalt pavements.

Research Approach/Methods: The project will include the following tasks:

- 1) Meet with the technical panel to review project scope and work plan.
- 2) Review current literature with respect to cost and performance of currently and newly available pavement markings, including

waterborne, durable, HD21, VOC-compliant soy-based paints, and any other suitable candidates.

- 3) Interview traffic engineers, maintenance personnel, and other knowledgeable individuals within SDDOT to gather information on current practices, suggestions for improvement, and locations where evaluations of existing projects could be done.
- 4) Invite technical representatives of suppliers of specific materials of interest to SDDOT to present their products for possible inclusion in this project.
- 5) Prepare and present for the review and approval of the project's technical panel an updated experimental plan for installation and multi-year evaluation of promising pavement marking materials and methods on asphalt pavement surfaces and inlaid concrete pavements.
- 6) Monitor the installation and evaluate the long-term performance of selected inlaid pavement markings and application methods on concrete pavement at appropriate locations distributed throughout the state.
- 7) Monitor the installation and evaluate the long-term performance of selected pavement marking materials and application methods on asphalt pavement surfaces using modifications to current AC maintenance practices or strategies to apply inlay techniques to AC to insure long term performance.
- 8) On the basis of material and installation costs and observed performance, determine the cost-effectiveness of the experimental pavement marking materials and application methods.
- 9) Develop recommendations and guidelines including a decision matrix for best practices for AC and inlaid PCC pavements based on the constructability, performance, and cost-effectiveness of paving marking materials and application methods.
- 10) Prepare a final report and executive summary of the research methodology, findings, conclusions, and recommendations.
- 11) Make an executive presentation to the SDDOT Research Review Board at the conclusion of the project.

MPC Critical Issues Addressed:

- #5 Low-Cost Safety Improvement
- #15 Improved Infrastructure Design
- #16 Infrastructure Longevity

Contributions/Potential Applications of Research:

The results of this research could provide a decision matrix for extending pavement marking performance on asphalt concrete pavements while decreasing the costs associated with an annual application cycle. In addition,

the combination of an inlay approach with less expensive pavement marking materials could result in a significant reduction in application costs for PCC pavements.

Potential Technology Transfer Benefits: At the end of the study, a comprehensive report will be published to document the research procedures and results. Technical presentations will be offered to DOT engineers and technicians in Region 8 to transfer the knowledge learnt from the research. Graduate and undergraduate students also will be trained to conduct research and apply newly learnt knowledge in pavement design and safety.

Time Duration:

July 1, 2010 - June 30, 2011.

Total Project Cost:

\$32,408

MPC Funds Requested During Year 3:

\$17,157

Source of Matching Funds During Year 3:

SDDOT and SDSU: \$15,251

TRB Keywords:

Pavement Marking, Retroreflectivity, Waterborn Material, Epoxy Marking, Inlaid Marking.