

Pavement Markings on Challenging Surfaces

What is the issue?

Seal coating and micro surfacing present a challenge for the performance and maintenance of pavement markings. Seal coating is a widely used pavement resurfacing technique that consists of applying a thin layer of liquid asphalt, followed by a cover layer of stone chips. Micro surface treatments involve a machine laid combination of crushed aggregate, asphalt emulsion, mineral filler (such as Portland cement), and water that is spread as a relatively thin layer over an existing pavement surface. Seal coats and micro surfaces provide excellent traction for drivers, even under wet pavement conditions. However, both treatments produce a coarse pavement surface with relatively large gaps between the aggregate which provides a way for paint to sink below the surface where it is not visible to motorists. This problem is magnified during adverse conditions, such as low light and wet pavement. Even when the lane markings are new, they are seen as faded or non-existent.



Typical Seal Coat (Chip Seal)



Typical Micro Surface

What are potential solutions?

The two most common materials for marking edge and center lines in Minnesota include latex paint and epoxy.² There is a long history of agencies using latex paint because it is inexpensive, can be easily painted over, and provides reasonable levels of retro-reflectivity on roadways that have traditional, smoother surfaces. Pavement markings wear out due to the volume of roadway traffic, harsh weather, and loss of material from winter maintenance activities. These conditions result in a typical service life of 1 to 2 years for latex paint. Epoxy has a slightly longer service life, usually 3 to 5 years, but lower unit costs and ease of application result in most agencies opting to continue using latex paint.

In response to these issues, research was conducted that focused on identifying the performance of a variety of potential solutions, including: latex paint, latex over a primer coat, epoxy, and a combination of a layer of latex applied immediately following the chip seal followed by epoxy the next year.¹

How effective are these solutions?

For chip seals, the research¹ found:

- A thick layer (high-build) of either latex or epoxy performed well.
- The combination of striping with latex over the seal coat immediately after resurfacing followed by applying epoxy the following year performed very well, with observed service lives of 2 to 3 years.

The research concluded that the most cost-effective and easy to implement solution was the combination of applying a thin coat of latex immediately after the chip seal followed by a layer of epoxy the following year. In contrast to applying thick layers of paint, using standard layers of latex and epoxy is consistent with MnDOT guidelines for all road surfaces². The material can be ordered using MnDOT's materials specification, requires no installation adjustments and performed well on the research test deck.

For micro surfaces, the research¹ found:

- Thin layers of latex markings by themselves, with and without primer coatings, performed poorly and needed repainting less than 1 year after installation.
- Thin layers of epoxy performed well, even after 2 years.

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What are the possible locations for implementation?¹

The suggested combination of epoxy over latex can be expected to provide the highest possible levels of retroreflectivity on chip seals. On micro surface overlays, the use of a single layer of epoxy provided good performance after two winters.

Photos illustrate the degradation of a thin epoxy on a micro surface. Between 50% and 70% of the paint remains even after two winters. The research concluded that this would still exceed the expected performance measure for retro-reflectivity.

12 mil Urethane Modified Epoxy	12 mil Polyacrylate Two-Component Epoxy
 Initial (2013)	 After 2 winters (2016)
 Initial (2013)	 After 2 winters (2016)

Cost

- Per Linear Foot
- Latex: \$0.08
- Epoxy: \$0.24
- Combined: \$0.32

Service Life: 2-3 Years when combined as suggested on chip seals or with a single layer of latex on micro surfaces.

Additional considerations?

The Federal Highway Administration has initiated a rulemaking process that would require agencies that provide center and edge lines along segments exceeding specific speeds (35 mph) and volumes (6,000 vpd) to manage them to an adopted retroreflectivity threshold.^{2,3} If an agency puts these lines down, they must maintain them according to the levels mandated by the Federal Highway Administration on the higher speed and volume segments. This impending requirement places a greater emphasis on dealing with challenging surfaces as the use of these resurfacing treatments becomes more common. **END**

References

- 1 Hawkins, N., Smadi, O., and Knickerbocker, S. 2016. *Evaluation of Pavement Markings on Challenging Surfaces*. MnDOT Report 2016-0.8 <http://www.dot.state.mn.us/research/TS/2016/201608.pdf>. Accessed June 2017.
- 2 Minnesota Department of Transportation (MnDOT). 2014. *MnDOT Provisions for Pavement Marking Operations*. Technical Memorandum No. 14-11-T-02. <http://dotapp7.dot.state.mn.us/edms/download?docId=1520674>. Accessed June 2017.
- 3 Federal Highway Administration (FHWA). 2017. *Nighttime Visibility Pavement Markings – Regulations/Standards*. https://safety.fhwa.dot.gov/roadway_dept/night_visib/pavementreg.cfm. Accessed June 2017.