



Pavement Markings Practices in Minnesota

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3/18/21



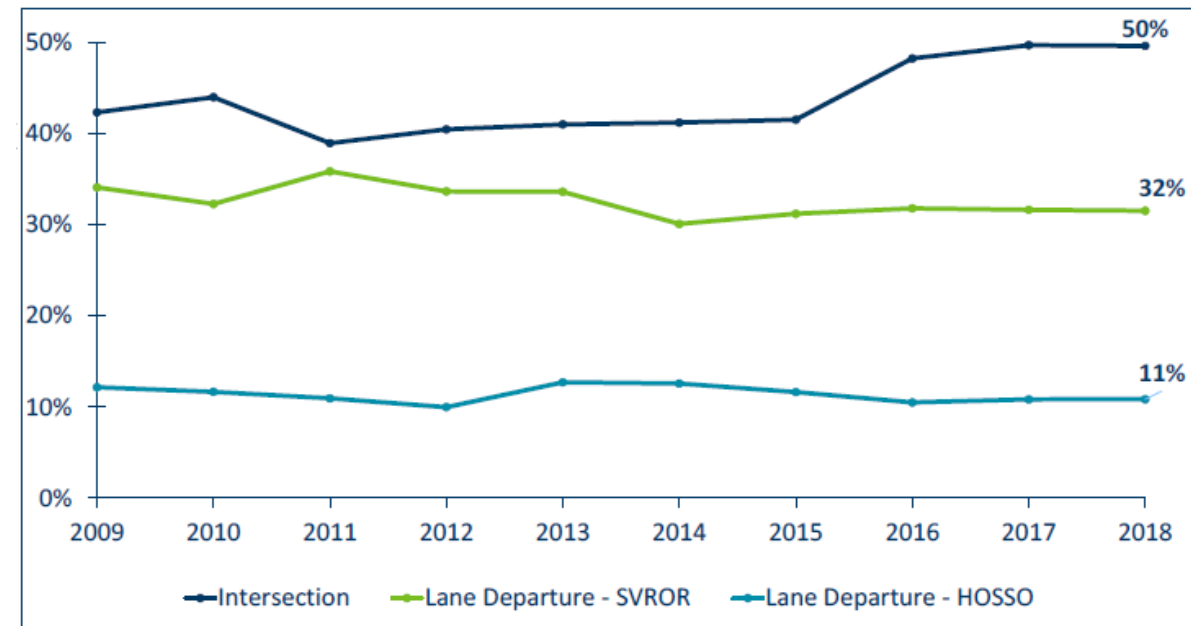
mndot.gov



Importance

- Single vehicle road departures are nearly 30% of all Minnesota fatalities
 - These crashes were widely distributed across the entire state and local network, with horizontal curves making up a disproportionate amount.
 - When looking at how low the crash density (~0.01 severe road departure/mile/year) is, pavement markings are extremely cost effective to cover an entire system.
 - Road departures are especially prevalent on rural county highways, which is why MnDOT has been an advocate for local safety planning and providing HSIP money for locals.
 - It's not the road departure that's the main concern, it's what happens afterwards!

Figure 1: Engineering Focus Areas, Percent of Statewide Death and Serious Injury Crashes (2009-2018)



Note:

- SVROR = single vehicle run off the road
- HOSSO = head-on and sideswipe opposing

MnDOT's PM Goal

- “Provide an appropriate pavement marking on all highways, 365 days per year.”
- An appropriate pavement marking is one that meets or exceeds the standards defined in the MN MUTCD. During winter weather events, pavement markings should provide presence after pavement is clear of snow and ice.

MnDOT Provisions for Pavement Marking Operations

Expected Life of Surface Applied Markings

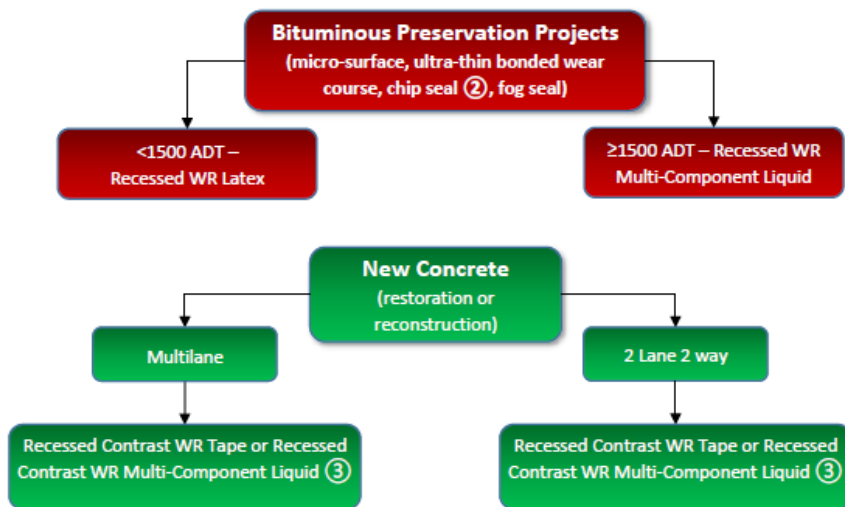
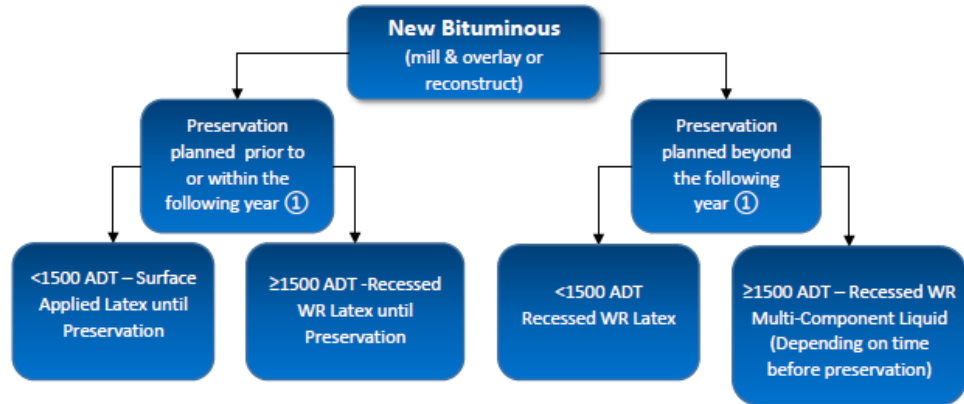
Material	ADT	
	<1,500	>1,500
Latex Paint	>1 yr.	1 yr.
Multi-Component Liquid	>5 yr.	3-5 yr.
Preformed Polymer Tape or Thermoplastic	>5 yr	>5 yr

Expected Life of Recessed Markings

Material	ADT	
	<1,500	>1,500
Latex Paint	>3 yr.	3 yr.
Multi-Component Liquid	>6 yr.	5-7 yr.
Preformed Polymer Tape or Thermoplastic	>7 yr	>7 yr

MnDOT Provisions for Pavement Marking Operations

Longitudinal Striping

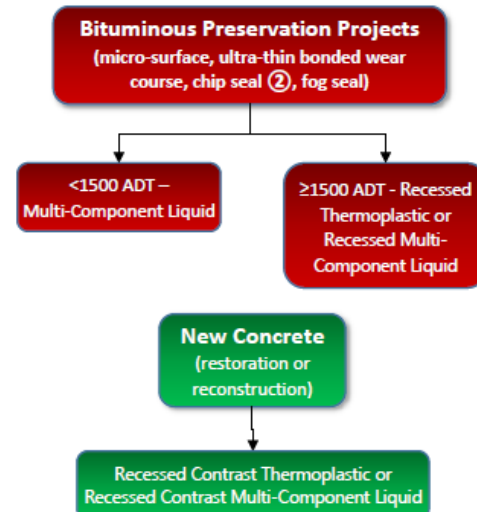
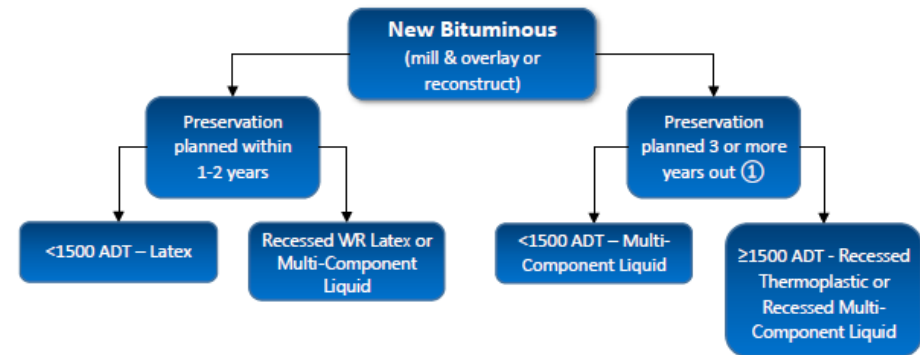


WR = Wet Reflective

- ① Based on life of material and suggested optimum time to initial preservation project.
- ② Methods for recessing markings on chip seals are still being developed.
- ③ Recommend Recessed WR Multi-Component Liquid when the adjacent shoulder is bituminous.

Pavement Messages

(Transverse, gore markings, cat tracks, and roundabouts)



- ① Based on life of material and suggested optimum time to initial preservation project.
- ② Methods for recessing markings on chip seals are still being developed.
- ③ Enhanced skid resistant materials are recommended for roundabouts and crosswalk blocks.

Retroreflectivity

- Research has shown that the threshold between an acceptable and an unacceptable pavement marking based on nighttime driver visibility needs is between 80 and 120 MCD/m² /lux.
- MnDOT is adopting a minimum performance of 100 MCD/m²/lux for both white and yellow. As markings approach this threshold they will be replaced.
- Minimum initials have been set to get the desired longevity of the pavement markings. These are tested via mobile retroreflectometer.

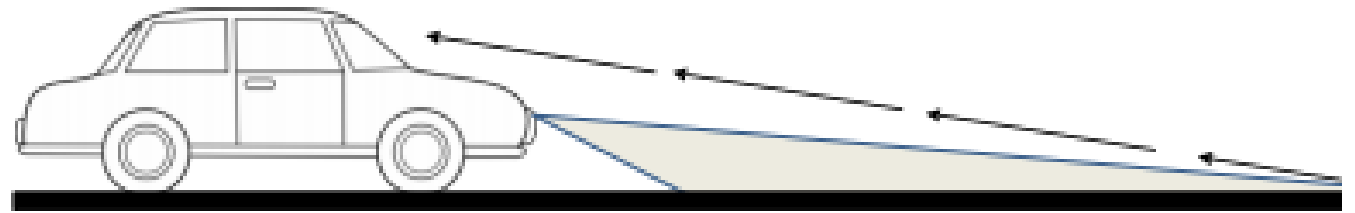


Table 2582.3-3

Minimum Initial Pavement Marking Retroreflectivity

	White	Yellow
PREF TAPE	600 mcd/ m ² /lux	500 mcd/m ² /lux
PREF THERMO	300 mcd/ m ² /lux	200 mcd/ m ² /lux
PREF THERMO, ESR (Enhanced Skid Resistance)	250 mcd/ m ² /lux	150 mcd/ m ² /lux
MULTI COMP	300 mcd/ m ² /lux	200 mcd/ m ² /lux
PAINT	275 mcd/ m ² /lux	180 mcd/ m ² /lux

Wet Retroreflectivity

- As of 2022 Wet Retroreflectivity testing will be included on many construction projects
- Measured using ASTM E 2832 Continuous Wetting method or approved equivalent
- WR pavement markings will now require Utah Blend as the supplemental drop with WR elements

Minimum Initial Pavement Marking Wet Retroreflectivity

	White	Yellow
All Materials	200 mcd/sq. m/lux	200 mcd/sq. m/lux

Enhanced Skid Resistance

- Low skid resistance of pavement messages and colored pavements can be an issue for the safety of vulnerable road users (motorcyclists, bicyclists, and pedestrians) when traversing intersections on state roadways.
- The enhanced skid resistance option (added aggregate) is recommended for any situation where deceleration, turning movements, or pedestrian and bicyclist traffic is occurring:
 - Crosswalk blocks
 - Pavement messages in roundabouts
 - Bike lanes that utilize colored pavement
 - Railroad crossing pavement messages
 - Stop lines
 - Stop ahead pavement messages



6" Pavement Markings

- MnDOT has adopted 6" Edgelines as standard
- 2022 both Construction and Maintenance will be applying 6" Edgelines
- Severe crashes can be reduced 20-40% by increasing the width of edgelines
- Research has shown that 6" edgelines provide a Benefit/Cost of ~25:1
- CAVs would also benefit from this moving into the future

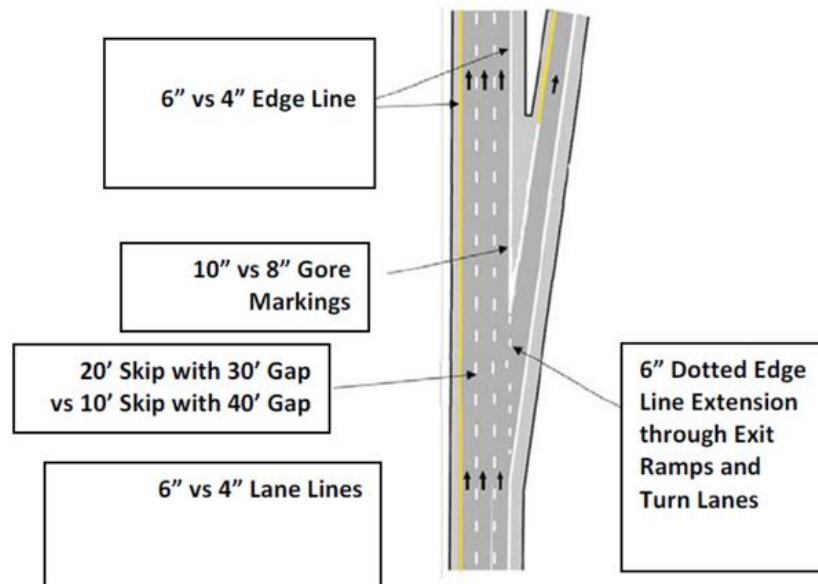
Effectiveness

10% to 35% consistent
crash decrease
reported



Studies Involving Pavement Markings

- Pavement Marking/Colored Pavement Friction Differential and Product Durability
- Pavement Marking Patterns and Widths - Human Factors Study
- Assessing Pavement Markings for Automated Vehicle Readiness
 - I-94 Monticello to Clearwater



Thank you again!

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