Technical Memorandum

To: **Electronic Distribution Recipients**

From: **Mark A. Gieseke, P.E.** Electronic signature on file
Assistant Commissioner, Engineering Services

Subject: MnDOT Provisions for Pavement Marking Operations

Expiration

This Technical Memorandum shall remain in effect until January 5, 2027 unless superseded prior to that date or incorporated into MnDOT manuals. This technical memorandum supersedes the provisions contained in Technical Memorandum 19-05-T-02, dated December 18, 2019.

Implementation

This technical memorandum shall be implemented immediately.

Introduction

The FHWA is continuing their efforts for developing minimum retroreflectivity criteria for pavement markings. When this process is completed, striping operations across the state will be responsible for assuring that pavement markings meet or exceed these minimum level criteria. Because of Minnesota's climatic extremes, a systematic approach to pavement markings (District and Statewide striping plans) has been developed and implemented in order to attain MnDOT's mission.

Over the past several years, MnDOT has put emphasis on the efforts to increase the performance of pavement markings throughout the State. These efforts have focused on improving equipment, streamlining maintenance operations, evaluating new materials, retrofitting materials on existing surfaces, and recessing markings to better deliver MnDOT's goal to:

> Provide an appropriate pavement marking on all state trunk highways, 365 days per year.

Purpose

The purpose of this technical memorandum is to provide a consistent statewide approach for pavement marking operations on state trunk highways. This includes guidance on material usage for final pavement markings including both longitudinal lines and pavement messages (i.e. crosswalks, messages, roundabout markings, etc.). The guidance contained in this technical memorandum applies to the pavement marking operations on all pavements that fall under the jurisdiction of the Minnesota Department of Transportation.

Definitions

An appropriate pavement marking is one that meets or exceeds the standards defined in the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD). During winter weather events, pavement markings should provide presence after pavement is clear of snow and ice.

Performance

Research has shown that the threshold between an acceptable and an unacceptable pavement marking based on driver visibility needs is between 80 and 120 MCD/m^2/lux. MnDOT has adopted the minimum performance of 100 MCD/m^2/lux for a white line and yellow line. These minimum performance values are used to schedule maintenance or replacement of all pavement marking installations and used to determine when pavement marking materials can be left beyond expected service life. If retroreflectivity data is not available, Districts may use expected life of pavement markings from tables below and a visual inspection to determine whether maintenance or replacement is necessary.

Pavement markings are an important road asset that needs to be managed effectively and performance measures for pavement markings need to be developed to assess the health of the system. The Office of Traffic Engineering, through the Traffic Engineering Organization, will develop these performance measures for pavement markings.

Pavement Marking Life Expectancy

Experience has shown that traffic volumes and snow & ice operations have the greatest impact on the longevity of pavement markings. The following chart outlines the life expectancy of various surface applied materials based on traffic volumes and the minimum retroreflective performance value (100 MCD/m^2/lux).

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

Research has shown that recessing pavement marking materials below the pavement surface can significantly increase the life expectancy of the marking. Examples of recessing techniques include grooving, inlaying, installing in a sinusoidal rumble strip, and slightly raising the traveled lanes (while leaving the marking area recessed). The following chart outlines the life expectancy of various materials that have been recessed based on traffic volumes.

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

Wet Reflectivity

Wet-night visibility is an increasingly important pavement marking issue. Wet reflective products and processes have been shown to improve the visibility of markings in these adverse conditions. The MnDOT sponsored Texas A&M Transportation Institute study, Pavement Markings-Wet Retroreflectivity Standards, has shown that 50 MCD/m2/lux wet-continuous retroreflectivity is the minimum for an emergency maneuver at 55 mph. Therefore, to be considered to be wet-reflective, a minimum wet-continuous performance of 50 MCD/m2/lux needs to be achieved. During restriping efforts, markings in recesses will be refreshed with wet-reflective products.

All wet reflective materials shall be recessed to insure continued wet weather performance after snow plowing operations. To ensure performance these materials should be installed as recommended by the manufacturer.

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. An option for enhanced skid resistance pavement markings and colored pavements is to add an aggregate such as corundum or bauxite to the material, this helps increase friction and decrease the probability of slips for vulnerable road users. The enhanced skid resistance option is recommended for any situation where deceleration, turning movements, or pedestrian and bicyclist traffic is occurring. Examples of situations where enhanced skid resistance should be incorporated are:

- Crosswalk blocks
- Pavement messages in roundabouts
- Bike lanes that utilize colored pavement
- Railroad crossing pavement messages
- Stop lines
- Stop ahead pavement messages

Statewide Guidance

To meet the goal of providing an appropriate marking 365 days per year, flowcharts (attached) with recommendations for the application of pavement marking materials have been developed. The materials shown in the flowcharts are the minimum types recommended. Districts may choose to use materials with a longer life expectancy for specific projects or broader applications. All pavement marking materials used shall be on MnDOT's Qualified Products List (QPL). New materials to be investigated shall follow the provisional approval process of the QPL.

When markings have reached the minimum performance levels and are scheduled to be replaced by Maintenance, it is recommended that the materials used are based on remaining life of the pavement surface. The following table lists the recommendations for refreshing markings.

Refreshing Markings (Maintenance)

Remaining Pavement Surface Life[1] (years)	Surface Applied	Recessed
0-3	Latex	Latex
>3	Multi-Component Liquid[3,4]	Latex or Multi-Component Liquid[2]

1. Anticipated life of existing pavement is based on planned projects and anticipated life of surface is based on preventive maintenance plans. For the purpose of this tech memo, 3 years was chosen based on suggested optimum time until initial preservation project.
2. Avoid placing Multi-Component Liquid over Latex unless Latex presence is minimal. Multi-Component Liquid should be placed on Multi-Component Liquid if the remaining surface life is anticipated to be 6+ years.
3. If pavement joint treatment is being used, Latex may be used for lines at joints regardless of Remaining Pavement Surface Life.
4. If the surface condition of the road would require Multi-Component Liquid to be replaced within 2 years, Latex may be used.

Each year in January, the Office of Maintenance will ask the Districts to submit their annual maintenance striping request. The Districts will fulfill this request by submitting the information requested on the Request for Striping form that can be found at http://www.dot.state.mn.us/trafficeng/pavement/plansandspecialprovisions.html.

Alternative Practices and Installations

Statewide goals and plans cannot include all conditions and circumstances. To allow the Pavement Marking and Traffic Device Crashworthy Engineer to monitor alternative pavement marking practices, if a District chooses to have an alternative practice or installation that differs from the guidance in this technical memorandum, the District should provide notification to the Pavement Marking and Traffic Device Crashworthy Engineer with details and reason(s) for the change. Notification is only requested for large scale differences or district-wide practices, and need not include short segments or intersections. The Pavement Marking and Traffic Device Crashworthy Engineer will track alternate practices and installations for the purpose of using the results in future decisions on pavement marking practices and operations.

Questions

Any questions regarding the technical provisions of this Technical Memorandum can be addressed to either of the following:

- Work Zone and Pavement Marking Engineer, at **(651) 234-7386**
- Pavement Marking and Traffic Device Crashworthy Engineer at **(651) 234-7380**

Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, DesignStandards.DOT@state.mn.us. A link to all active and historical Technical Memoranda can be found at http://techmemos.dot.state.mn.us/techmemo.aspx.

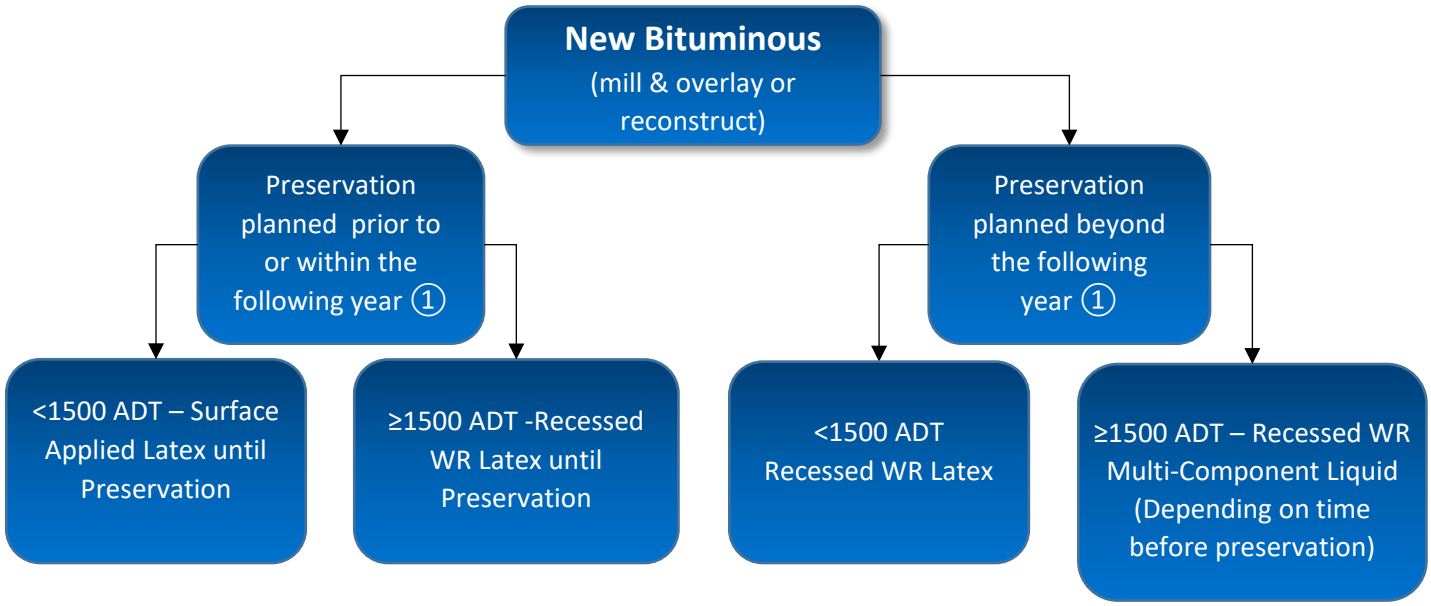
To add, remove, or change your name on the Technical Memoranda mailing list, please visit the web page http://techmemos.dot.state.mn.us/subscribe.aspx.

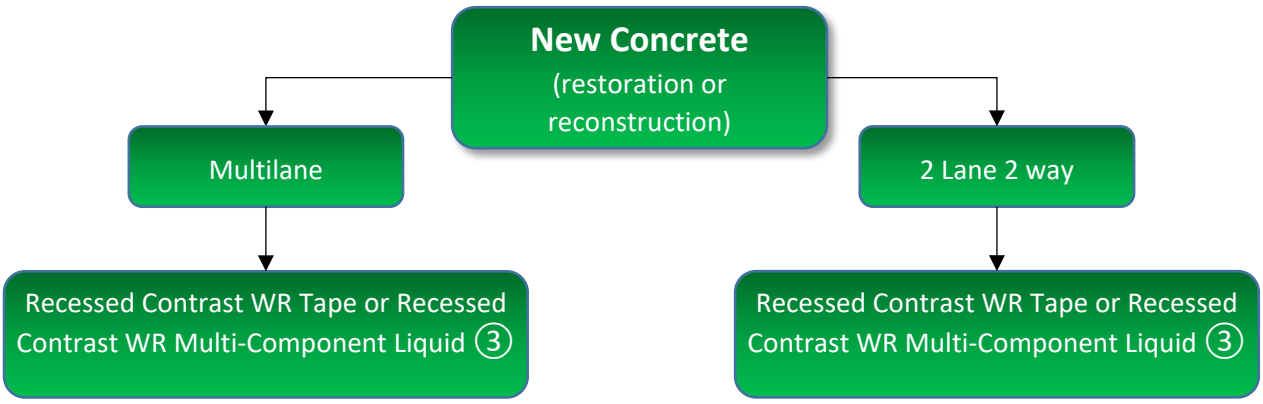
Attachments:

A: Longitudinal Striping
B: Pavement Messages

-END-

Longitudinal Striping





WR = Wet Reflective

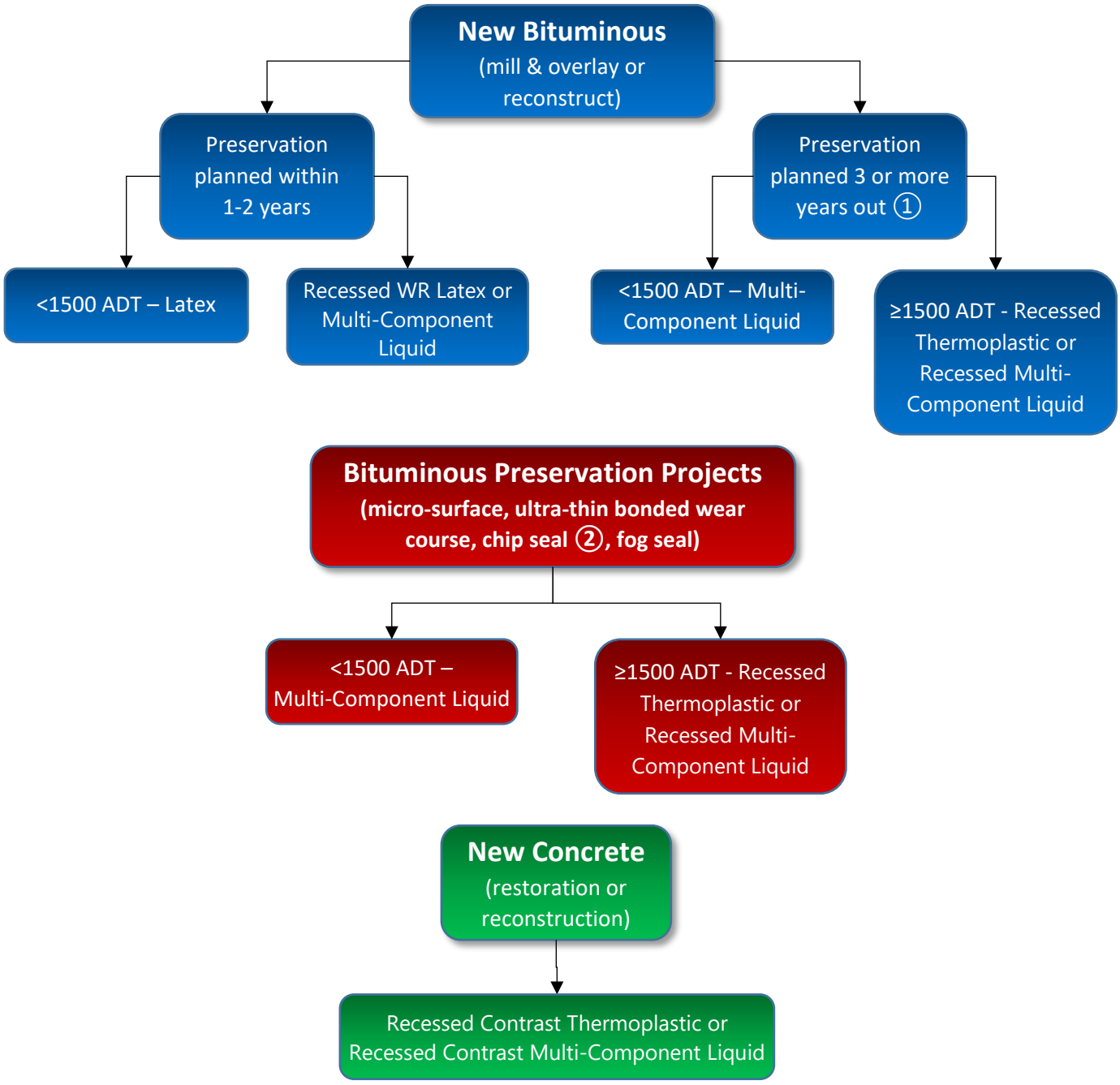
① Based on life of material and suggested optimum time to initial preservation project.

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.