National Transportation Product Evaluation Program (NTPEP)  
Pavement Marking Materials Data Usage Guide

Introduction:

The NTPEP program has successfully tested and reported results of pavement marking material performance to AASHTO member departments (states) since the early mid 90’s. This program brings all pavement marking manufacturers to one location each year for application and testing thus eliminating the tremendous costs to individual states in performing their own field and laboratory testing. With the continued reduction in experienced personnel and staffing, of member departments the NTPEP pavement marking performance data has become an integral part of many member departments qualification process. This guide is offered as information for AASHTO member departments use in developing acceptance criteria for pavement marking products.

This guide has been developed as a consensus document within the NTPEP Pavement Marking Materials (PMM) Technical Committee (TC). State and industry representatives have collaborated on the procedures and parameters listed herein to provide information in the assessment and performance of pavement marking materials submitted for evaluation in this program.

Key Aspects of the Program:

Within the NTPEP Committee there is a Pavement Marking Materials Technical Committee. Members of this committee are representatives of member Departments of Transportation with pavement marking expertise and representatives from the markings industry. The industry representatives have input in the development of committee documents, however they are not voting members of the committee.

All performance testing is done on an asphalt concrete roadway and a Portland cement concrete roadway. These “test decks” are located and classified as a snowplow (northern state) or non-snowplow (southern state) test sites in accordance with the Administrative Guide for Pavement Marking Materials. This field evaluation includes retroreflectivity, durability, daytime color, nighttime color (for yellow materials) and wet night retroreflectivity (if requested by the manufacturer) on all temporary and permanent products. An auto-no-track time is performed for paint products, while removability and discernability testing is conducted for temporary tape products.

Temporary products are tested for six months and permanent markings are evaluated for 3 years. In addition each product is sampled for laboratory testing for properties shown in the Project Work Plan for the Laboratory Evaluation of Pavement Marking Materials. These compositional and physical evaluations are essential to departments of transportation for verification testing of products consistency when batch production materials are supplied to local projects.

All markings are installed by the manufacture or an appointed representative. Specifics of the pavement markings (mil thickness, bead type and rate applied) are recorded. Conditions during application (air temperature, surface temperature and humidity) are also recorded. Evaluations are performed by the State hosting the test deck or a contracted research partner (i.e. college or university). The laboratory testing is done by a variety of State Transportation laboratories and in rare cases private laboratories.

Manufacturers that elect to participate in the program are assessed fees that cover the cost of the testing and reporting of information. States are assessed an annual fee for all Technical Services programs provided by AASHTO.

All performance data collected through laboratory and field evaluations is reported through an online database. While most data can be accessed by the public, proprietary data is limited to the submitting manufacturer and the member departments of transportation.

While NTPEP works to make the pavement marking product evaluations process comprehensive and meet the requirements for AASHTO member departments, all test data should be carefully reviewed by the specifying agency and in the context of field experience with these products. The data gathered from the field test site provides a means to benchmark product performance under nearly the same conditions. This provides a means to rank the performance of all
products evaluated. However this data is specifically limited to the particular evaluation site chosen. Specific field conditions encountered in subsequent applications, ranging from weather severity, road surface condition, application process, equipment used, average daily traffic and locations of the marking system can affect product performance. With this in mind the review of the data produced through this evaluation program should be viewed as a tool in making reasonable judgments and selections of marking materials for projects in any specific location.

**Typical Test Deck Configuration**

![Diagram of test deck configuration]

**Performance Categories**

The categories that follow are reported performance observations made on most, if not all materials placed on a PMM test deck. Each test is explained in general terms with emphasis on the practical application of the test results in practice. When applicable suggested parameters for acceptance may be provided as a guide. It is recognized that individual agencies may elect to utilize variations of these parameters.

Following these general performance observations will be additional testing that is done to specialized products for unique applications.

**Average Retroreflectivity – Transverse Lines**

Dry retroreflectivity readings (30 meter geometry) are taken in the first 9 inches of the marking closest to the skip line of the road referred to as the “skip” reading and in the wheel path closest to the skip line of the road shown as “Wheel” in the database. Wet retroreflectivity readings are taken in accordance with ASTM 2177 wet recovery test, the readings will be taken in the nine (9) inches of line closest to the road edge line shown in the database as “Dry” and “Wet”. Wet retroreflectivity is only done when the manufacture requests this as part of the evaluation. Retroreflectivity is averaged over the number of lines that are remaining to test.

The retroreflectivity of multiple products can be compared to one another within datamine using the graphing function. This can be useful when comparing similar products from different manufactures. Retro reflectivity from the ‘skip area’ should be considered to represent long line retroreflectivity performance. ‘Wheel track’ data can be considered for lines being used in a longitudinal fashion, stop bars, cross walks, legends and area of excessive wear due to braking, stopping and turning movements. The wheel track can also be used as means of determining future retroreflectivity values under accelerated wear conditions.

Wet retroreflectivity is a measure of a marking’s ability to ‘recover’ following a rain event. The retroreflectivity is measured after a timed interval following a period of ‘wetting down’ by a portable garden sprayer.
**Day and Night Color**

Daytime color, nighttime color and Cap Y readings are taken on both transverse and longitudinal markings. Recorded CIE Chromaticity (color) values of x and y are taken and plotted against an allowable chromaticity box. Cap Y- luminance factors, are a measure of lightness of markings and is also recorded. ASTM D 6628 Standard Specification for Color of Pavement Marking Materials provides chromaticity (corner points) for daytime color, nighttime color and Cap Y luminance factors.

These color coordinates and luminance measurements can be compared to the ASTM specification within datamine using the graphing function. This application will quickly show where the data points fall with respect to the specification chosen. This data can be evaluated for initial color compliance as well as long-term, weathering related to color fastness, fading, etc.

**Durability**

This is a rating on a one (1) to ten (10) scale with ten (10) being the best. Durability is obtained by examining an eighteen (18) inch length of line centered on the wheel track area, reported as “wheel” in the database and the nine (9) inches of skip line area, reported as “skip” in the database. A percentage of the marking material remaining in this area is translated to a one (1) to ten (10) scale. Durability is conducted according to ASTM D 913. The reported value is the average of the four (4) values for both areas. This data can be used to determine the ‘toughness’ of a pavement marking binder under log-term field conditions and weathering. It judges only the amount of binder retained on the evaluation surface. Retention of beads to this binder is NOT implied. Durability can be used in conjunction with retro reflectivity to provide an overall snapshot of the performance of a marking material at various points during service life.

![Durability Ratings](image)

A complete set of photographs depicting durability ratings from 1 to 10 can be found online of the PMM TC page of the AASHTO NTPEP website.

**Paints**

**No Track**

Auto-No-Track time is conducted at the time of installation, using the procedure found in Section 9.1 of ASTM D 713. A vehicle is driven over a freshly painted line at a speed of 15 mph (+- 2 mph) at the desired auto-no-track time. A host state representative stands 50 feet away from where the test line was placed and looks to see if any paint was deposited by the vehicle tires on the pavement. If there is no visible paint deposited on the pavement than that paint passes for that auto-no-track time.

The values can range between 30 and 300 seconds. This property is useful when evaluating products and the potential for them to be tracked depending of the method of application, volume of traffic and climate the product is being applied. While this data demonstrates no track performance in one specific set of conditions, this value should be considered carefully and related to your historic application experience. It can more reliably be used as a relative comparison to other products on the same test deck.
Temporary Removable Pavement Marking Tape

For removable tapes six transverse lines and six longitudinal lines are installed. For non-removable tapes four transverse lines are installed. The evaluation period for temporary tapes is six months at thirty-day intervals.

Average Retroreflectivity – Longitudinal Lines

Retroreflectivity readings (30 meter geometry) are taken at the mid point of the marking, referred to as the “Center of Line” reading for the longitudinal line. Retroreflectivity is averaged over the number of lines that are remaining to test.

ASTM D 4592 Standard Specification for Preformed Plastic Pavement Marking Tape for Limited Service Life recommends minimum dry retroreflective values of 500 mcd/m²/lux and 300 mcd/m²/lux for white and yellow respectively independent of orientation.

Removability

Removability is measured by rating two properties, the internal tape strength and adhesive bond. Internal tape strength and adhesive bond are rated on a scale of 1 to 10. Internal Tape Strength is a measure of how many pieces the tape was removed in when removed. This provides a means to determine whether the material is removed intact as one piece or fragments into multiple pieces upon removal. The fewer pieces removed is important when removing large amounts of tape. Adhesive Bond Rating is a measure of how much effort it takes to remove the tape. This is important from a time to remove standpoint. It measures (subjectively) the physical effort involved in removing the tape from the road surface. Ideally a moderate effort would be needed to remove tape (rating between 1 and 5) and it should come up in one to four pieces (rating of 1 to 3).

Discernability

This is a measure of what is visible on the pavement surface once the tape has been removed. This is important to agencies to eliminate motorists from following a phantom line that is left after removal. This is rated similar to durability, with the residual being visually measured to determine how much of the surface has still been affected after removal. This property can be affected by ambient lighting, distance and the amount of time after line removal. Ideally there is no evidence a line existed once removed. This corresponds to a rating of one (1) or zero (0).