NTPEP Committee Work Plan for

Field Evaluation Of Pavement Marking Materials

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National Transportation Product Evaluation Program
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NTPEP Committee Work Plan for

Field Evaluation Of Pavement Marking Materials

FIELD TESTING AND EVALUATION PROCEDURES FOR:
PERMANENT PAVEMENT MARKING MATERIALS

1. SCOPE

1.1 This work plan describes the requirements and testing criteria for the National Transportation Product Evaluation Program (NTPEP) serving the member departments of the American Association of State Highway and Transportation Officials (AASHTO). The document is divided into two sections: Field Testing Procedures (Permanent and Temporary materials), Reference to the “NTPEP Best Practices Manual” (BPM) will be noted throughout various sections of the field testing procedures.

2. REFERENCED DOCUMENTS

AASHTO Standards:
M 247 Glass Beads used in Traffic Paints
R 11 Standard Recommended Practice for Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values

ASTM Standards:
D 713 Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials
D 2177 Wet Recovery Test
D 6628 Specification for Color of Pavement Marking Materials
E 1710 Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN Geometry using a Portable Retroreflectometer
E 1349 Standard Test Method for Reflectance Factor and Color by Spectrophotometry Using Bi-directional Geometry

CEN Standards:
CEN 1436 Road Marking Materials-Road Marking Performance for Road Users

3. SIGNIFICANCE AND USE

3.1 This work plan will utilize several test sites throughout the country to evaluate the degradation of traffic marking materials under varying climatic conditions. Sites will consist of varying geographical locations throughout the United States.
country that best fit climatic conditions desired for evaluation.

3.2 Evaluation data will be compiled and made available to all participating states and testing companies through the AASHTO/NTPEP DataMine. This report will include data only. No judgment as to a product’s acceptability will be made in this report. End user participants will establish individual criteria for product acceptability.

3.3 In addition to field testing, each product will be sampled and submitted to a participating state and/or private laboratory for “fingerprint” testing in accordance with Project Work Plan for Laboratory Evaluation of Pavement Marking Materials. This information will be used to assist in future comparisons of tested materials to purchased materials. (BPM - Manufacturer’s Responsibilities - General)

3.4 All data shall be rounded and reported according to the procedures found in AASHTO R 11. Pavement Marking Material (PMM) numbers that are assigned to a Manufacturer’s product will not change for the life of the test. The Product Name that the manufacturer gives the product at the time of application will be allowed to change until the first monthly report is issued to the vendors for review. Once this report is submitted to the vendor for review no changes to the product name will be allowed.

3.5 If a manufacturer decides to make a product name change it will be the manufacturer’s responsibility to notify AASHTO and the lead state of such request. AASHTO or the lead state will make the required record changes and also notify the lab(s) of the product name change.

4. TYPE AND LOCATION OF THE TEST SITE

4.1 Test decks will be located on both concrete and asphalt surfaces.

4.2 Sites shall be selected where traffic is heavy (minimum ADT 5,000); free rolling with no or slight grades, no or slight curves, no intersections or access points near enough to cause excessive braking or turning movements, and where wear is fairly uniform and has full exposure to the sun. Selected surfaces shall be representative of the pavements upon which the materials will later be placed for actual use. Tests sections shall be applied to surfaces that have been open to traffic for a minimum of two (2) years. (BPM - Site Location)

4.3 Sites should be at least ½ mile in length of the same pavement (asphalt or concrete mix) to accommodate a typical number of products.

4.4 Some locations, in particular those on interstates, may require Environmental Certification. Consult your Department’s Environmental Management office.

4.5 Refer to the Best Practices Manual for detailed guidance on test deck location selection.

5. PRODUCT CRITERIA AND RESTRICTIONS

5.1 Materials may be either liquid or solid form and may include tapes, pre-formed thermoplastics, durable paints (> 15 mil thickness), epoxies, methacrylates, polyesters, polymeric films, thermoplastics and paints. Profiled materials that cannot be measured correctly for Retroreflectivity as described in section 10.3 of this procedure will not be allowed.

5.2 As a standard, paints, epoxies, thermoplastics, etc. will be top dressed with AASHTO M 247, Type 1 moisture-proof beads at the rate of six (6) pounds per gallon. Type 1 beads will be furnished at the test site by the host state. The host state shall provide testing reports for the beads provided. Other beads and rates may be applied providing the manufacturer provides written instructions specifying the type and rate at which the beads will be applied with their original submittal. Products utilizing beads or rates other than the standard will be considered systems rather than
individual products and will be noted in the report. Non-standard beads will be furnished by the producer, who must also furnish to the host state one (1) intact fifty (50) pound bag of these beads along with a certified test report, as a laboratory test sample. To accommodate samples in less than fifty-pound bag increments, host state personnel at the test site will provide a sample splitter. (BPM – Field Testing and Evaluation Protocols, Material Criteria) Paints will be restricted to the following:

5.2.1 Three colors – White, Lead Based Yellow, Non-Lead Based (Organic) Yellow

5.2.1.2 Two binder systems – VOC-compliant solvent-borne, water-borne

5.2.1.3 Three No-Track times – sixty (60) Seconds, ninety (90) Seconds, two (2) Minutes or as specified by the manufacturer.

5.2.1.4 Film thickness of $15 \pm 1$ mil and $4 \pm \frac{1}{2}$ inches in width. Paints applied at different film thicknesses or widths shall be noted in the original submittal and reported by the lead state.

5.2.1.5 Length of Evaluation – two (2) years or three (3) years

5.2.2 Thermoplastics will be restricted to the following:

5.2.2.1 Three colors – White, Lead Based Yellow, Non-Lead Based Yellow or others as specified by the manufacturer.

5.2.2.2 Wet film thickness of $125 \pm 5$ mils and $6 \pm \frac{1}{2}$ inches in width or as manufacturer specified. For systems designed for applications at different film thicknesses or widths shall be noted in the original submittal by the manufacturer and reported by the lead state.

5.2.2.3 Length of Evaluation – three (3) years

5.2.3 Perform Thermoplastics will be restricted to the following:

5.2.3.1 Three colors – White, Lead Based Yellow, Non-Lead Based Yellow or others as specified by the manufacturer.

5.2.3.2 Film thickness of $125 \pm 5$ mils and $6 \pm \frac{1}{2}$ inches width or as manufacturer specified. For systems designed for applications at different film thicknesses or widths shall be noted in the original submittal by the manufacturer and reported by the lead state.

5.2.3.3 Length of Evaluation – three (3) years

5.2.4 Tapes will be restricted to the following:

5.2.4.1 Four colors – White, Lead Based Yellow, Non-Lead Based Yellow, Black

5.2.4.2 4 – 6 inches width

5.2.4.3 Length of Evaluation – three (3) years

5.2.5 Multiple Component Materials will be restricted to the following:
5.2.5.1 Four colors – White, Lead Based Yellow, Non-Lead Based Yellow, Black

5.2.5.2 Film thicknesses 20 + 5 mils and 4 + ½ inches width or as manufacturer specified. For systems designed for applications at different film thicknesses or widths shall be noted in the original submittal by the manufacturer and reported by the lead state.

5.2.5.3 Length of Evaluation – three (3) years

5.2.6 Experimental Materials will be restricted to the following:

5.2.6.1 Products comprised of submissions from either the categories above or materials which are unique to any previously established categories. These products due to marketing, development or research purposes are not intended to be marketed based on the data from this evaluation. As such, field test observations will be reported for informational purposes only. Sampling and subsequent lab testing are not performed on these materials.

5.2.6.2 Length of Evaluation – two (2) years or three (3) years

5.2.7 Each producer will be limited to twenty (20) samples per product type with a maximum of sixty (60) samples overall based on the limitations of both field and laboratory sites. Experimental materials, which are being developed by manufacturers, may be installed as part of the field test. These materials will be limited to five (5) per manufacturer and will be considered as a portion of the total of sixty (60) materials that may be submitted by any one manufacturer. The formulation of such products must accompany the submittal. This information will be kept in confidence by NTPEP unless otherwise directed by the manufacturer.

5.2.8 All products shall be labeled to show the NTPEP number, product name, manufacturer and type of material.

5.2.9 Manufacturer shall furnish the following minimum quantities to the test site:

- Paints (Waterborne and Solventborne) – Five (5) gallons
- Thermoplastics – 200 pounds
- Preformed Thermoplastics – 150 linear feet
- Tapes – 150 linear feet
- Multiple Component Materials – Five (5) gallons
- Experimental Materials – To be determined by lead state on submittal

5.2.10 All materials must come from the same lot or batch as will be sampled for laboratory testing. Should the producer fail to furnish enough material to fulfill sampling and installation requirements, then any lines installed for that product will be voided and not used in the field evaluation. Producers will be allowed to obtain new materials and reinstall the product provided this is done during the initial installation period. All lines and samples must be completed from a single quantity of material. The manufacturer will have until the end of the installation day to void any material that they feel is not suitable for testing. Re-installation of any material should be during the manufacturer’s designated installation period by re-arrangements made with the lead state. This reapplication will typically be permitted at the start of the next available day on that test site.

5.2.11 In the case of a product that does not fit into the work plan, the following process shall be:

5.2.11.1 After being approached by industry, the TC panel will determine if there is an interest of the member states to see such a product evaluated through NTPEP.
5.2.11.2 If member states do not indicate interest in the proposed product, there will be no further consideration of same.

5.2.11.3 If member states indicate interest in the proposed product, the following will apply:

5.2.11.3.1 TC Panel and industry determine whether the new product would necessitate a change in the work plan in order to be evaluated. If no change is needed the new product will be incorporated into the existing work plan.

5.2.11.3.2 If a change to the work plan is needed; the industry would be required to submit proposed work plan changes to address the intent of the new product. The industry would need to coordinate to submit changes to the work plan to accommodate that category of new product before submission. This would prevent the States from having to review product specific proposed work plan changes on a product specific basis for each new product.

5.2.11.3.3 Once the proposed work plan changes are received by the industry, the panel will review and comment. Proposed changes will be balloted by all member States on the TC panel.

6. SAMPLING AND TESTING

6.1 During installation all products except for experimental products must be sampled by the manufacturer in the presence of a person from the lead state.

6.2 After it has been liquefied, thermoplastic shall be sampled by the manufacturer with sampling witnessed by the testing agency.

*NOTE:* Test deck personnel will closely monitor sampling. Only samples taken in the presence of a trained NTPEP representative will be accepted. Material should be taken as the material is being poured into or out of the product reservoir and must clearly represent the material be applied on the deck.

6.3 Sample sizes for laboratory testing shall be as follows:

- Paints (Waterborne and Solventborne): Four (4), one (1) quart containers of each product
- Thermoplastic: Four (4) each 5 pound blocks formed by dumping molten plastic into 9 x 13 x 1 inch disposable aluminum baking pans or similar containers
- Preformed Thermoplastics: twenty-five (25) linear feet
- Tapes: twenty-five (25) linear feet
- Multiple Component Materials: Four (4) quarts of each base component, plus the required amount of activator for the associated base component material (1:1, 2:1, etc.)
- Experimental Materials: Shall not be sampled for laboratory testing
- Glass Beads: One (1) each intact 50 lb bag or a representative sample taken by a trained NTPEP rep. from a full 50 lb bag using a sample splitter.

6.4 Samples shall be labeled by the manufacturer with the NTPEP number; the labeling shall be witnessed lead state personnel, who will then be responsible for transporting the samples to the appropriate laboratory testing facility.

6.5 The manufacturer shall label multicomponent and primer sealers samples with the NTPEP number, the labeling shall be witnessed by lead state personnel. Mixing instructions and mixing ratios of multi-component materials shall be included with samples of materials. This information will be transmitted with the sample to the testing laboratory.
7. CONDITIONS OF TIME AND APPLICATION

7.1 Products will be installed at times to be specified by the lead state. The exact dates will be decided by the participating lead state and submitted to the manufacturer at the earliest convenience.

7.2 Materials shall be applied during dry conditions when the air temperature is between 50° F and manufacturer’s maximum temperature. No products will be applied to wet or damp pavement. (BPM – Condition at Time of Application)

7.3 Pavement and air temperatures as well as relative humidity shall be recorded every half hour during the installation period. (BPM – Equipment Criteria)

8. APPLICATION GENERAL

8.1 No lines shall be installed without a lead state inspector present.

8.2 The application temperature of the material shall be recorded.

8.3 Four (4) beaded transverse lines will be applied per product. Two (2) lines shall be placed in one area with the other two applied in a separate area to allow for a better statistical representation of the product. No applied lines shall be placed over top of existing skip lines or into groves where raised pavement markings are installed in the surface. (BPM - Installation)

8.4 All spray applied materials such as paints (waterborne and solventborne), multiple component materials, spray thermoplastic and glass beads shall be applied in a single operation using an appropriate spray applicator with traction drive, spray nozzle and glass bead applicator similar to that used on normal marking equipment. Manually propelled equipment and spreading glass beads by hand is prohibited for application of paints (waterborne and solventborne), multiple component materials and spray thermoplastics.

8.5 The calibration procedure found in ASTM D 713 (Measurement of Wet Film Thickness and Measurement of Glass Bead) shall be used where possible to assure that paints and glass beads are applied at the prescribed rates.

8.6 Thermoplastic and beads shall be applied in a single operation using equipment suitable for such purpose.

8.7 Tapes, preformed thermoplastic, and methacrylate shall be applied according to the manufacturer’s recommendations.

8.8 Surface Preparation – Portland cement concrete surface can be roughened (on vendor request and at the discretion of the host state) by mechanical or abrasive means to lightly abrade the substrate to enhance pavement marking adhesion. Roughening which causes significant pavement damage (dislodged aggregate and/or significant concrete pieces) or roughening beyond 20 mils will not be allowed. Surface prep and type shall be noted in installation data for the record.

8.9 Pavement Preheating – If the pavement is mechanically heated before a product is installed, that pavement temperature for that product shall be noted separately from the temperature in section 7.3.

9. CALIBRATION PROCESS

9.1 Paint, multiple component materials and spray thermoplastic application equipment shall be calibrated according to the procedure found in ASTM D 713 (Measurement of Wet Film Thickness and Measurement of Glass Bead). Once calibrated, the equipment may not be adjusted again until all test stripes for the product are placed. All equipment settings for this calibration will be recorded. If adjustments to the equipment are necessary, then the equipment shall be recalibrated. (BPM -pages 35-38 and section 3.5.5 - Calibration)
9.2 Equipment for placement of other materials shall be operated according to the manufacturer’s recommendations.

9.3 Products found to be outside the prescribed width and thickness tolerances shall be voided and replaced with lines within the tolerances.

9.4 The thickness for any materials which cannot have application equipment calibrated as per ASTM D 713 (such as thermoplastic, tapes, MMA, etc.) shall be checked by placing a 2 x 10 x 1/6 inch metal plate in the path of one stripe, removing it after the equipment has passed over it, cooling and measuring with a micrometer or alternate dry film thickness measuring device.

NOTE: Spray applied thermoplastic shall be measured as ASTM D 713 (Measurement of Wet Film Thickness and Measurement of Glass Bead). (BPM - Thermoplastics)

10. FIELD TEST OBSERVATION (SEE BPM – APPENDIX 2)

10.1 Auto-No-Track time shall be conducted at the time of installation, using the procedure found in ASTM D 713 Performance Criteria – Auto-No-Track Time. The vehicle shall pass over the freshly painted line at a speed of 15 ± 2 miles per hour. Results shall be reported as track/no track for the designated dry line. While retesting at shorter dry times is prohibited, retests at greater dry times than the original test will be permitted. (BPM – Auto No Track (Paints Only))

10.2 Initial field performance tests as outlined below will be conducted within three (3) to seven (7) days after application (unless otherwise stated) on the test deck. Follow up field performance testing will be conducted on a monthly basis during the first year of testing (unless otherwise noted below) and then will move to quarterly testing for the remaining two (2) years.

NOTE: In snow-belt areas evaluations cannot be done during the winter months due to low temperatures, snow/ice and deicing residues (road salts). In these areas evaluations will cease, following the first significant snowfall (first snow event which causes anti / deicing agents to be applied to the road surface) and commence at such time as no visible salt residue remains on the road surface.

10.3 Unless otherwise stated all performance tests shall be reported as the average of four (4) lines.

10.3.1 Retroreflectivity:

This data will be obtained by taking readings in both the center of the wheel path closest to the skip line area (This will be referred to the wheel reading) and also in the skip line area (this will be referred to as the skip reading). Readings will be made with a 30 meter CEN geometry portable retroreflectometer in accordance with ASTM D 1710. The readings will be taken in the eighteen (18) inch length of line centered on the wheel path (wheel reading) and nine (9) inches from the skip line area (skip reading). In both cases the retroreflectometer shall be oriented to face the direction of application when taking the reading. Results shall be reported in millicandelas per square meter per lux. Both wheel and skip readings will be reported separately. (BPM – Required Equipment (photo 3))

10.3.2 Durability:

This is a rating on a one (1) to ten (10) scale with ten (10) being the best. Durability will be obtained by taking readings in eighteen (18) inch length of line centered in the wheel path closest to the skip line area (This will be referred to the wheel reading) and also in the nine (9) inches of line in the skip line area (this will be referred to as the skip reading). 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. Photographic standards can be downloaded off of the NTPEP website to use as reference during evaluations. Both wheel and skip readings will be reported separately.
10.3.2.1 A minimum of 2 trained raters shall be used to visually obtain durability ratings on each product line (in both the wheel and skip reading areas). In the case that the 2 raters cannot come to an agreement then a third rater shall be used to make the final decision. These values are obtained for all four representative product lines. The reported value is the average of the four (4) values for both areas. For each product, each area has a separate, averaged value reported.

10.3.3 Daytime Color:

Daytime color readings will be taken in the skip line area of the transverse line, with a spectrophotometer according to ASTM D 6628. The readings shall be taken in Y, x, y CIE coordinates with a 2 degree observer using a D65 Illuminant. Readings will be taken on a quarterly basis for all three (3) years of evaluations. In snow-belt states readings will cease during the winter months. All colors will be evaluated. (BPM – Required Equipment (photo 3)

Nighttime Color:

Nighttime color readings will be taken on the skip line area of the transverse line, with a 30 meter CEN Geometry portable retroreflectometer equipped to measure nighttime color (such as an LTL 2000Y or equivalent) which converts data to RL x, y CIE coordinates. Readings will be taken on a quarterly basis for all three (3) years of evaluations. In snow-belt states readings will cease during the winter months. Only yellow colors will be evaluated.

10.3.4 Wet/Dry Retroreflectivity:

Wet/Dry retroreflectivity readings will be taken with an LTL X or other approved equal retroreflectometer (with the same basic geometric design criteria). Initial readings will be taken 30 days after application and then quarterly for the remaining three years of testing. All readings will be taken in the nine (9) inches of line closest to the road edge line. The retroreflectometer shall be oriented to face the edge line when taking the reading and results shall be reported in millicandelas per square meter per lux. The testing shall be executed using ASTM 2177 Wet Recovery Test (using a sprayer to wet the area). Only materials specifically earmarked by the manufacturer for this testing will be evaluated.

10.3.5 Pictures of all lines shall be taken during every scheduled reading for both surfaces.

10.3.6 Winter Weather Data – The following winter weather data shall be collected: date of snowfall event (such as snow, sleet, freezing rain, etc.), snowfall amount, number of plow truck passes made during snow removal, amount of salt by lbs, amount of anti-skid by lbs and amount of liquid deicer used.

11. REPORT

11.1 Data shall be generated and distributed through the AASHTO/NTPEP Data Mine 2.0. The data shall be available online within 1-2 months after installation and subsequent inspection readings shall be available 1 month after completion of the readings. Reporting will continue for the three year evaluation cycle; however this time could be less depending on the predetermined evaluation cycle for that material type.

11.2 The following minimum information shall be included:

11.2.1 Road Surface Information: This shall include surface type, average daily traffic (ADT), percentage of truck traffic, road surface age, any road surface special treatments, and if the road is tined.

11.2.2 Product Information: This shall include submittal year, NTPEP number, manufacturer name, product name, type and
11.2.3 Installation Information: This shall include date of installation, sub-deck and line locations, air temperature, road temperature, humidity, dry no track time, material temperature, applied thickness, bead type, bead rate, bead coatings, primer, vehicle, binder, and pigment.

11.2.4 Inspection Data: This shall include retroreflectivity (both wheel and skip), durability (both wheel and skip), daytime color, nighttime color, wet/dry retroreflectivity and photos of each line.

11.2.5 Winter Weather Data: This shall include date of snowfall event (such as snow, sleet, freezing rain, etc.), snowfall amount, number of plow truck passes made during snow removal, amount of salt by lbs, amount of anti-skid by lbs and amount of liquid deicer used.

FIELD TESTING AND EVALUATION PROCEDURES FOR: TEMPORARY PAVEMENT MARKING TAPE

12. SCOPE

12.1 The purpose of this work plan is to define field procedures for sampling, installing, and evaluating temporary pavement marking materials (removable and non-removable) with the exception of raised and recessed markers. Permanent pavement markings will not be considered in the procedure but will be evaluated according to “FIELD TESTING AND EVALUATION PROCEDURES FOR PERMANENT PAVEMENT MARKING MATERIALS”. This procedure shall serve as the standard for the National Transportation Product Evaluation Program (NTPEP) serving the AASHTO states.

13. REFERENCED DOCUMENTS

AASHTO Standards:

R 11 Standard Recommended Practice for Indicating Which Places of Figures Are To Be Considered Significant in Specified Limiting Values

ASTM Standards:

D 6628 Specification for Color of Pavement Marking Materials

E 1710 Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable thirty (30) degree Retro-reflect-o-meter

E 1349 Standard Test Method for Reflectance Factor and Color by Spectrophotometry Using Bi-directional Geometry

CEN Standards

CEN 1436 Road Marking Materials – Road Marking Performance for Road Users

14. SIGNIFICANCE AND USE

14.1 This work plan will utilize several test sites throughout the country to evaluate the degradation of traffic marking materials under varying climatic conditions. Sites will consist of varying geographical locations throughout the country that best fit climatic conditions desired for evaluation.

14.2 Evaluation data will be compiled and made available to all participating states and testing companies through the
14.3 All data shall be rounded and reported according to the procedures found in AASHTO R 11.

15. **TYPE AND LOCATION OF TEST SITE**

15.1 Test decks will be located on both concrete and asphalt surfaces.

15.2 Sites shall be selected where traffic is heavy (minimum ADT 5,000), free rolling with no or a slight grade, no curves, no intersections or access points near enough to cause excessive braking or turning movements, and where wear is fairly uniform and has full exposure to the sun.

15.3 Selected surfaces shall be representative of the pavements upon which the materials will later be placed for actual use. Test sections shall be applied to surfaces that have been open to traffic for a minimum of two (2) years. (BPM - Site Selection)

16. **PRODUCT CRITERIA AND RESTRICTIONS**

16.1 Each producer will be limited to a maximum of twenty (20) products per product type of material with a maximum of forty (40) total based on the limitations of the testing site.

16.2 All products shall be labeled to show the NTPEP number, product name, manufacturer, and type of material.

16.3 Manufacturers shall furnish the following minimum quantities to the test site:

16.3.1 Removable Tape – 350 linear feet

16.3.2 Non-Removable Tape – 350 linear feet

16.4 All materials must come from the same lot or batch as will be sampled for laboratory testing. Should the producer fail to furnish enough material to fulfill sampling and installation requirements, then any lines installed for that product will be voided and not used in the field evaluation. Producers will be allowed to obtain new materials and reinstall the product provided this is done during the initial installation period.

16.5 All lines and samples must be completed from a single quantity of material.

17. **SAMPLING AND TESTING**

17.1 Tapes shall be sampled by the manufacturer and witnessed by the lead state personnel during the installation.

17.1.1 Removable Tapes – 25 linear feet

17.1.2 Non-Removable Tapes – 25 linear feet

*NOTE:* Lead state personnel will closely monitor sampling. Only samples taken in the presence of a trained NTPEP representative will be accepted.

17.2 The manufacturer shall label all samples with the NTPEP number, labeling shall be witnessed by the lead state, which will then be responsible for transporting the samples to the appropriate testing facility.
The manufacturer shall label any primer/sealers/adhesive samples with the NTPEP number; the labeling shall be witnessed by the lead state. These samples will be transported with the sample to the testing laboratory.

18. CONDITIONS AT TIME OF APPLICATION

18.1 Products will be installed at times to be specified by the lead state. The exact dates will be decided by the participating lead state and submitted to the manufacturer at the earliest convenience.

18.2 Due to the short duration nature of these materials, all products will be applied (by all vendors) on the same day of application to the same surface.

18.3 Materials shall be applied during dry conditions when the temperature is between 50° F and the manufacturer’s recommended maximum temperature.

18.4 Temporary tape materials typically require dry pavement conditions both 24 hours prior and post installation. Applications which do not meet these conditions have the potential to void an installation leading to a reapplication of materials. Reapplication will only take place with the unanimous consent of all vendors with the final decision to be made by the lead state and AASHTO.

18.5 Pavement and air temperatures as well as relative humidity shall be recorded every half hour during the installation period.

18.6 Failure of materials beyond the 24-hour post-application will not be immediate grounds for re-application.

18.7 Manufacturers shall present in writing concerns to the subcommittee and the AASHTO/NTPEP coordinator for consideration. This group will then determine if the facts warrant reinstallation consideration. Complete reinstallation will normally only be allowed if >80% of all applied temporary materials have lost adhesion and/or been completely destroyed.

19. APPLICATION GENERAL

19.1 No lines shall be installed without lead state personnel present.

19.2 Removable tapes will be placed six (6) lines transverse to the flow of traffic and six (6) lines in skip fashion longitudinal to the traffic lanes and two (2) inches to the right of existing skip lines. (BPM – section 3.5.10)

19.3 Non-Removable (Temporary) Tapes shall be placed four (4) lines in the transverse direction only. Tapes shall be applied according to the manufacturer’s recommendations.

20. FIELD TEST OBSERVATION

20.1 Field performance test as outlined below will be conducted within three (3) to seven (7) days after installation of materials on the test deck, and at approximately thirty (30) day intervals for six (6) months (unless noted otherwise).

Note: In snow-belt areas monthly evaluations cannot be done during the winter months due to low temperatures, snow/ice and deicing residues (road salts). Temporary tape materials should generally only be removed if the road surface temperature is above 50 degrees Fahrenheit. However if 50 degrees Fahrenheit is not able to be reached then the tapes can still be removed at the discretion of the lead state personnel making sure that the road surface temperature is noted on the report. In these areas evaluations will cease proceeding the first significant winter weather event. This can effectively mean that not all six sets of lines will be removed within the six-month period.
20.2 **Retroreflectivity:**

This data will be obtained by taking readings in the center of the wheel path closest to the skip line area (This will be referred to the wheel reading) and in the skip line area (this will be referred to as the skip reading) for all transverse lines and in the center of the line of all longitudinal lines. Readings will be made with a 30 meter CEN geometry portable retroreflectometer in accordance with ASTM D 1710. The wheel readings will be taken in the center of the wheel path closest to the skip line area. The skip readings will be taken by aligning the retroreflectometer with the road surface skip lines. The longitudinal lines shall be read by placing the retroreflectometer in the center of the line. Results shall be reported in millicandelas per square meter per lux. The wheel and skip readings for transverse lines as well as the center of line readings for longitudinal lines will be reported separately as averages. (BPM – Required Equipment)

20.3 **Daytime Color:**

Daytime color readings will be taken on all six transverse lines in the skip line area and in the center of the line of all six longitudinal lines with a spectrophotometer according to ASTM D 6628. The readings shall be taken in Y, x, y CIE coordinates with a 2-degree observer using a D65 Illuminant. Readings will be taken each month. All colors will be evaluated. The readings for the transverse and longitudinal lines for each month shall be averaged separately. (BPM – Required Equipment)

20.4 **Nighttime color:**

Readings will be taken on all six transverse lines in the skip line area and in the center of the line of all six longitudinal lines with a 30 meter CEN Geometry portable retroreflectometer equipped to measure nighttime color (such as an LTL 2000Y or equivalent) which converts data to RL x, y CIE coordinates. Readings will be taken each month. Only yellow colors will be evaluated. The readings for the transverse and longitudinal lines for each month shall be averaged separately.

20.5 **Wet/Dry Retroreflectivity:**

Wet/Dry retroreflectivity readings will be taken with an LTL X or other approved equal retroreflectometer (with the same basic geometric design criteria). Initial readings will be taken 30 days after application and then monthly for the remaining readings. All readings will be taken in the nine (9) inches of line closest to the road edge line. The retroreflectometer shall be oriented to face the edge line when taking the reading the results shall be reported in millicandelas per square meter per lux. The reported data shall be executed using ASTM 2177 Wet Recovery Test (using a sprayer to wet the area). Only materials specifically earmarked by the manufacturer for this testing will be evaluated. Readings of all existing lines (prior to monthly removal) will be averaged.

20.6 **Removability:**

This test will begin thirty (30) days after installation and at thirty (30) day intervals thereafter. One (1) longitudinal installed line and one (1) transverse installed line shall be removed from the pavement. Reported values represent individual lines. Transverse lines and longitudinal lines will be reported separately. If the temperature requirements for removal as specified by the manufacturer are not met, the lines shall not be removed until the temperature is in the specified limits. Non-removable tapes are not subject to this test. Each line shall be rated on a scale of one (1) to ten (10) for the following:

20.6.1 **Internal Tape Strength: How many pieces had to be removed for complete removal**

<table>
<thead>
<tr>
<th>Internal Tape Strength (Rating)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Tape removed intact, in one piece</td>
<td></td>
</tr>
<tr>
<td>3 = Tape removed in three to four pieces</td>
<td></td>
</tr>
<tr>
<td>5 = Tape removed in five pieces</td>
<td></td>
</tr>
<tr>
<td>7 = Tape removed in seven pieces</td>
<td></td>
</tr>
</tbody>
</table>
10 = Tape only removed in very small fragments

20.6.2 Adhesive Bond: How much effort was required to remove tape

Adhesive Bond (Rating)
1 = Tape removed easy (potentially by one hand)
3 = Tape removed with moderate, two-handed effort
5 = Tape removed significant, two-handed effort, requiring multiple pulls
9 = Tape removed only by exhausting, two-handed effort
10 = Tape could not be removed from surface

20.6.3 Discernability after Removal: A discernible marking is any marking, stain, or discoloration that can be detected on the pavement after the line has been removed. These ratings shall be taken at a distance of twenty (20) feet away with the sun at your back. Each line shall be rated 30 minutes after removal to allow time for any residual moisture to evaporate and then approximately thirty (30) days after removal under the following.

Discernible Markings after Removal (Rating)
1 = No discernable marking on road surface
5 = 50% of marking (adhesive outline) left on road surface
10 = 100% of marking left on road surface

20.6.3.1 A discernable marking should be rated of the same scale as durability of all permanent products, on a scale of 0 to 10.

21. REPORTS

21.1 Subsequent reports Data shall be uploaded at monthly intervals for review and public use on the AASHTO/NTPEP Data Mine 2.0.

21.2 The following minimum information shall be included:

21.2.1 Road Surface Information: This shall include surface type, average daily traffic (ADT), percentage of truck traffic, road surface age, any road surface special treatments, and if the road is tined.

21.2.2 Product Information: This shall include submittal year, NTPEP number, manufacturer name, product name, type and color.

21.2.3 Installation Information: This shall include date of installation, sub-deck and line locations, air temperature, road temperature, humidity, applied thickness, bead types, bead application rates, bead coatings, primer, binder, and pigment.

21.2.4 Inspection Data: This shall include retroreflectivity (wheel, skip and center of line), daytime color, nighttime color, wet/dry retroreflectivity, removability (Internal Tape Strength, Adhesive Bond, Discernability after Removal, and Discernability 30 days After Removal) and photos of each line.