FLORIDA DEPARTMENT OF TRANSPORTATION
State Materials Office
5007 NE 39th Avenue
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Florida Method of Test
for
Field Evaluation of Pavement Marking Materials

Designation: FM 5-541

Part A – Project Based Testing of Pavement Marking Materials

1. SCOPE

This method delineates field testing for evaluating the following pavement marking materials (PMM): Hot-Applied Standard Thermoplastic, Hot-Applied Refurbishment Thermoplastic, Profiled Thermoplastic, Preformed Thermoplastic, Standard Paint, Durable Paint, Removable Tape, Permanent Tape, Two Reactive Components, and Hot Spray Thermoplastic.

2. APPARATUS

2.1. 30-Meter CEN-Prescribed Geometry Portable Retroreflectometer meeting the requirements of **ASTM E1710**.

2.2. Pavement marking thickness gauge with indicator with 0.01 mm accuracy as described in **Appendix A**. Thickness gauges may be purchased or fabricated.

2.3. Caliper or Micrometer with 0.01 mm accuracy.

2.4. Taper gauge.

2.5. Wet film thickness gauge.

2.6. Aluminum Panel.

2.7. Duct Tape.

3. TEST PROCEDURE

3.1. Dry Retroreflectivity Test

Dry retroreflectivity tests are required for all PMM. Initial retroreflectivity measurements should be taken immediately following installation for preformed thermoplastic, within 14 days of installation for standard or durable paint, and within 28 days of installation for all other PPM. Calibrate the retroreflectometer at the beginning of each day of use per the manufacturer's instructions. Perform additional calibrations if testing conditions change (i.e., substantial change in

ambient temperature or irregular readings).

3.1.1. Longitudinal Lines

Perform a minimum of nine retroreflectivity measurements, three at the beginning, middle, and end of each one-mile section. The measurements taken shall be representative of the entire one-mile section. Use the average of the measurements for acceptance. Retroreflectivity measurements shall be taken in the direction of travel. Take measurements at the beginning, middle, and end of each one-mile section per pay item or line type (i.e., solid, skip, and color).

3.1.2. Markings Other Than Longitudinal Lines

Perform at a minimum, one retroreflectivity measurement at one message, one symbol, and one transverse line, per intersection. Take one measurement, per mile for locations other than intersections (i.e., school messages, railroad messages, bike symbols, diagonal markings, etc.).

3.2. Thickness Test

Thickness tests are required for the following PMM

3.2.1. Hot-Applied Standard Thermoplastic, Profiled Thermoplastic, or Recapping Thermoplastic (Longitudinal Lines)

Measure the thickness using a pavement marking thickness gauge (see **Appendix A**). Center the thickness gauge over the marking material attempting to avoid irregular surface areas and read the values of all three dial indicators. When measuring the marking on a pavement joint, take the measurement in a location where the joint is even. The location thickness measurement is the average of the three dial indicators. Take a minimum of three location thickness measurements, one at the beginning, middle, and end of each one-mile section per pay item or line type (i.e., solid, broken/skip, and color). The measurements taken shall be representative of the entire one-mile section. The average of the location measurements shall be used for acceptance of each one-mile section per pay item or line type.

3.2.2. Hot-Applied Refurbishment Thermoplastic and Hot Spray Thermoplastic (Longitudinal Lines)

Use duct tape or aluminum panels to acquire samples of the PMM. Measure the thickness of the PMM with a micrometer or caliper. Make sure to subtract the thickness of the duct tape or aluminum panel from the total measurement to obtain the actual thickness of the PMM. Take a minimum of three location thickness measurements, one at the beginning, middle, and end of each one-mile section per pay item or line type (i.e., solid, broken/skip, and color). The measurements taken shall be representative of the entire one-mile section. The average of the location measurements shall be used for acceptance of each one-mile section per pay item or line type.

3.2.3. Two Reactive Components (Longitudinal Lines)

Use an aluminum panel to acquire samples of the PMM. Measure the thickness of the PMM using a micrometer or caliper. Make sure to subtract the thickness of the aluminum panel from the total measurement to obtain the actual thickness of the PMM. Take a minimum of three location thickness measurements (on aluminum panels), one at the beginning, middle, and end of each one-mile section per pay item or line type (i.e., solid, broken/skip, and color). The measurements taken shall be representative of the entire one-mile section. The average of the location measurements shall be used for acceptance of each one-mile section per pay item or line type.

3.2.4. Hot-Applied Standard Thermoplastic (Markings Other Than Longitudinal Lines)

Use a taper gauge to measure the thickness of the PMM. Perform at a minimum, one thickness measurement at one message, one symbol, and one transverse line per intersection. Take one measurement per mile for locations other than intersections (i.e., school messages, railroad messages, bike symbols, diagonal markings, etc.).

3.2.5. Preformed Thermoplastic

Measure the thickness, prior to application, using a micrometer or caliper.

3.2.6. Permanent Tape

Measure the thickness of each batch number, prior to application, using a micrometer or caliper.

3.2.7. Durable Paint

Use a wet film thickness gauge to measure the thickness of the PMM. Take a minimum of three location thickness measurements, one at the beginning, middle, and end of each one-mile section per pay item or line type (i.e., solid, broken/skip, and color). The measurements taken shall be representative of the entire one-mile section. The average of the location measurements shall be used for acceptance of each one-mile section per pay item or line type. Perform at a minimum, one thickness measurement at one message, one symbol, and one transverse line per intersection. Take one measurement per mile for locations other than intersections (i.e., school messages, railroad messages, bike symbols, diagonal markings, etc.).

4. REPORT

Use **Form Number 700-050-70**, Traffic Marking Certification, to record and certify retroreflectivity and thickness measurements.

PART B – Approved Products List (APL)
Testing of Pavement Marking Materials

1. SCOPE

This section describes the evaluation procedure of materials using field evaluation data either from the AASHTO Product Evaluation & Audit Solutions Pavement Marking Material (PMM) or the APL Testing Procedures. For AASHTO Product Evaluation & Audit Solutions materials use the most current PMM workplan.

Pavement Marking Materials using AASHTO Product Evaluation & Audit Solutions PMM field evaluation data are Two Reactive Components, Standard Paint, Durable Paint, Permanent Tape, and Removable Tape.

Pavement Marking Materials using APL field evaluation data are Hot-Applied Standard Thermoplastic, Profiled Thermoplastic, and Hot Spray Thermoplastic.

2. APPARATUS

2.1. 30-Meter CEN-Prescribed Geometry Handheld Retroreflectometer meeting the requirements of **ASTM E1710** shall be used to measure dry retroreflectivity of all PMM.

Note: Mobile Retroreflectometer Unit (MRU) may be used to measure intermittent readings for Hot Spray Thermoplastic, Hot-Applied Standard Thermoplastic, and Profiled Thermoplastic.

2.2. 30-Meter CEN Handheld Retroreflectometer meeting the requirements of ASTM E2367 shall be used to measure nighttime chromaticity of all yellow PMM.

2.3. Spectrophotometer- This apparatus is standardized in accordance with **ASTM E1349**, “Standard Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45º:0º or 0º:45º) Geometry”.

2.4. Pavement marking thickness gauge with indicator with 0.01 mm accuracy as described in **Appendix A**. Thickness gauges may be purchased or fabricated.

2.5. Caliper or Micrometer with 0.01 mm accuracy.

2.6. One-quart sample containers with airtight lids.

2.7. Aluminum Panels (4 inches wide x 8 inches long).

3. SITE SELECTION

For Pavement Marking Materials using APL field evaluation data, select a test site with Annual Average Daily Traffic Count (AADT) greater than 5000 vehicles per lane.

4. INSTALLATION

For Pavement Marking Materials using APL field evaluation data, apply materials as white skip lines and yellow edge lines at an APL test site per the installation plan shown in **Appendix B**.

5. SAMPLING

For Pavement Marking Materials using APL field evaluation data, sample all materials during installation. Collect one intact bag of all thermoplastic materials, glass beads, and/or retroreflective elements. Collect one quart can of glass beads and/or retroreflective elements from the application nozzles. For Hot Spray Thermoplastic, also collect sample on an aluminum plate for thickness measurement (**Section 6.1.3**).

6. TEST PROCEDURES

6.1. Thickness Test

Make sure materials have hardened before taking thickness measurements.

6.1.1. For all Pavement Marking Materials using AASHTO Product Evaluation & Audit Solutions PMM field evaluation data, verify that thickness application meets FDOT Specifications.

6.1.2. For all Pavement Marking Materials using APL field evaluation data (Hot Spray Thermoplastic, Hot-Applied Standard Thermoplastic, Profiled Thermoplastic) measure the thickness using a pavement marking thickness gauge (see **Appendix A**) starting at the 20th skip line. Measure the location thickness of PMM above the pavement surface. Center the thickness gauge over the marking material attempting to avoid irregular surface areas and read the values of all three indicators. Take three location thickness measurements at the beginning, middle, and end sections of the installation according to

Appendix C. The location thickness is the average of the value in the three indicators. The grand average of the nine location thickness measurements will be used for evaluation.

6.1.3. For Hot Spray Thermoplastic, also measure material thickness using an aluminum panel to acquire samples of the PMM. Place a 4" by 8" panel in the path of the application on the pavement surface. The manufacturer shall place the longitudinal marking across the panel. Take six (6) thickness measurements of the PMM using a micrometer or caliper. Make sure to subtract the thickness of the aluminum panel from the total measurement to obtain the actual thickness of the PMM. Report the average of the six measurements.

6.1.4. For Profiled Thermoplastic, also take thickness and dimensional measurements of the profiled "bumps" at the beginning, middle, and end of the installation according to **Appendix C** utilizing only the reading of the center dial. Take dimensional readings of the bumps using a caliper.

Note: Thickness and dimensional readings of the profiled "bumps" are to be taken at initial installation and at the end of the test period.

6.2. Dry Retroreflectivity Test

Calibrate the retroreflectometer at the beginning of each day, and ensure all measurements and calibrations are performed in accordance with the written instructions of the instrument manufacturer. Verify the retroreflectometer as needed. Measurements shall be taken in the direction in which the material was installed.

6.2.1. For Pavement Marking Materials using AASHTO Product Evaluation & Audit Solutions PMM field evaluation data, use the average reading from the skip line for evaluation.

6.2.2. For Pavement Marking Materials using APL field evaluation data, all evaluations are to be performed on dry pavement. Failure of any portion of the test requirements shall constitute failure of the product.

For skip lines, start taking measurements at the 20th skip line. Take two measurements on five consecutive skip lines as shown in **Appendix D**. Dismiss the next two skip lines and take two measurements on the next five skip lines. Repeat the procedure to achieve a total of 30 measurements.

For edge line markings, use the skip line for reference to identify edge line measurement locations. A total of 30 retroreflectivity measurements are required.

The average of the 30 measurements shall be used to evaluate the test section in skip and edge line.

Evaluation interval for Dry Retroreflectivity of Pavement Marking Materials using APL field evaluation data will be performed as per **Table 1**.

Table 1: Evaluation Frequency for Dry Retroreflectivity of PMM

Type of Material	Initial	Intermittent	Final	Location Reading	Application Length
Hot Spray Thermoplastic	Within 28 days	Every 6 months	1 year.	White – Skip line/Yellow-Edge line	½ mile
Hot-Applied Standard Thermoplastic	Within 28 days	Every 6 months	3 years.	White – Skip line/Yellow-Edge line	½ mile
Profiled Thermoplastic	Within 28 days	Every 6 months	3 years.	White – Edge line/Yellow-Edge line	½ mile

6.3. Color Property Test

Calibrate the retroreflectometer and spectrophotometer at the beginning of each day, and ensure all measurements and calibrations are performed in accordance with the written instructions of the instrument manufacturer. Verify instrument performance as needed.

6.3.1. For Pavement Marking Materials using AASHTO Product Evaluation & Audit Solutions PMM field evaluation data, verify that color results meet FDOT Specifications.

6.3.2. For Pavement Marking Materials using APL field evaluation data (Hot-Applied Standard Thermoplastic, Hot Spray Thermoplastic, and Profiled Thermoplastic) measure initial daytime chromaticity (x and y) using a spectrophotometer. Take color measurements at the beginning, middle, and end of the installation according to **Appendix E**. The average of nine color measurements will be used for evaluation.

6.3.3. For yellow pavement markings also measure nighttime chromaticity (x and y) using a retroreflectometer capable of measuring nighttime retroreflected color.

7. REPORT

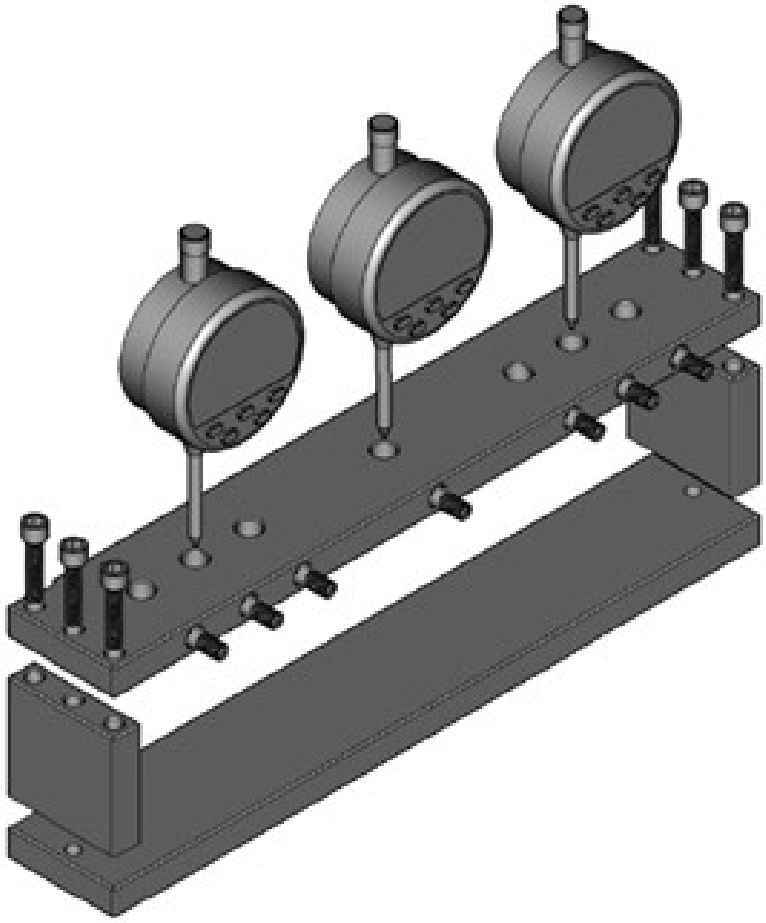
7.1. For Pavement Marking Materials using AASHTO Product Evaluation & Audit Solutions PMM field evaluation data:

After evaluation of the PMM field data, document in FDOT Product Application Tracking & History (PATH) system. Make a recommendation in PATH to approve or reject the product.

7.2. For Pavement Marking Materials using APL field evaluation data:

Report all field evaluation data (thickness, retroreflectivity, and color) as per **Section 6**. Upload initial and final field evaluation test results in PATH. Make a recommendation to approve or reject the product.

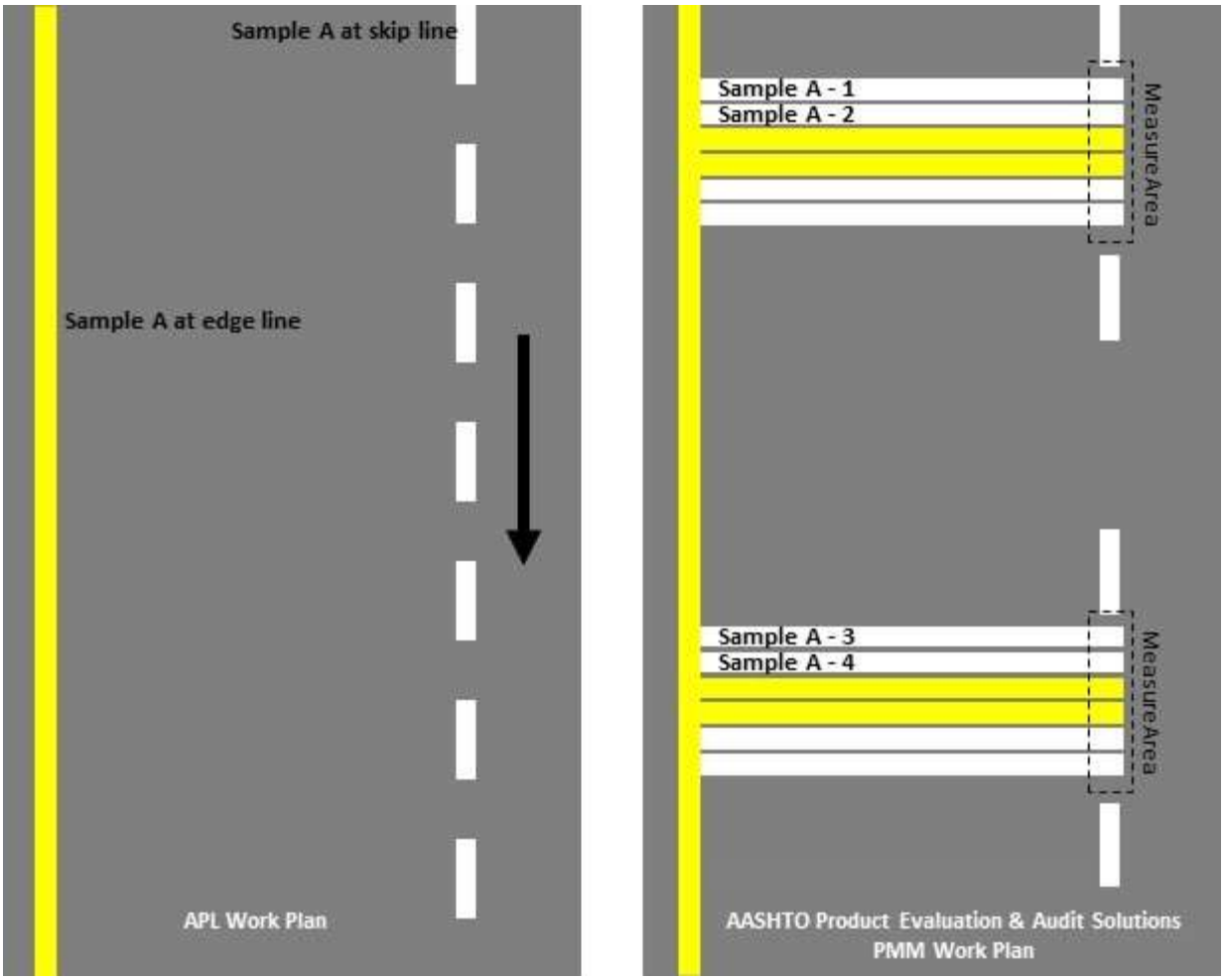
APPENDIX



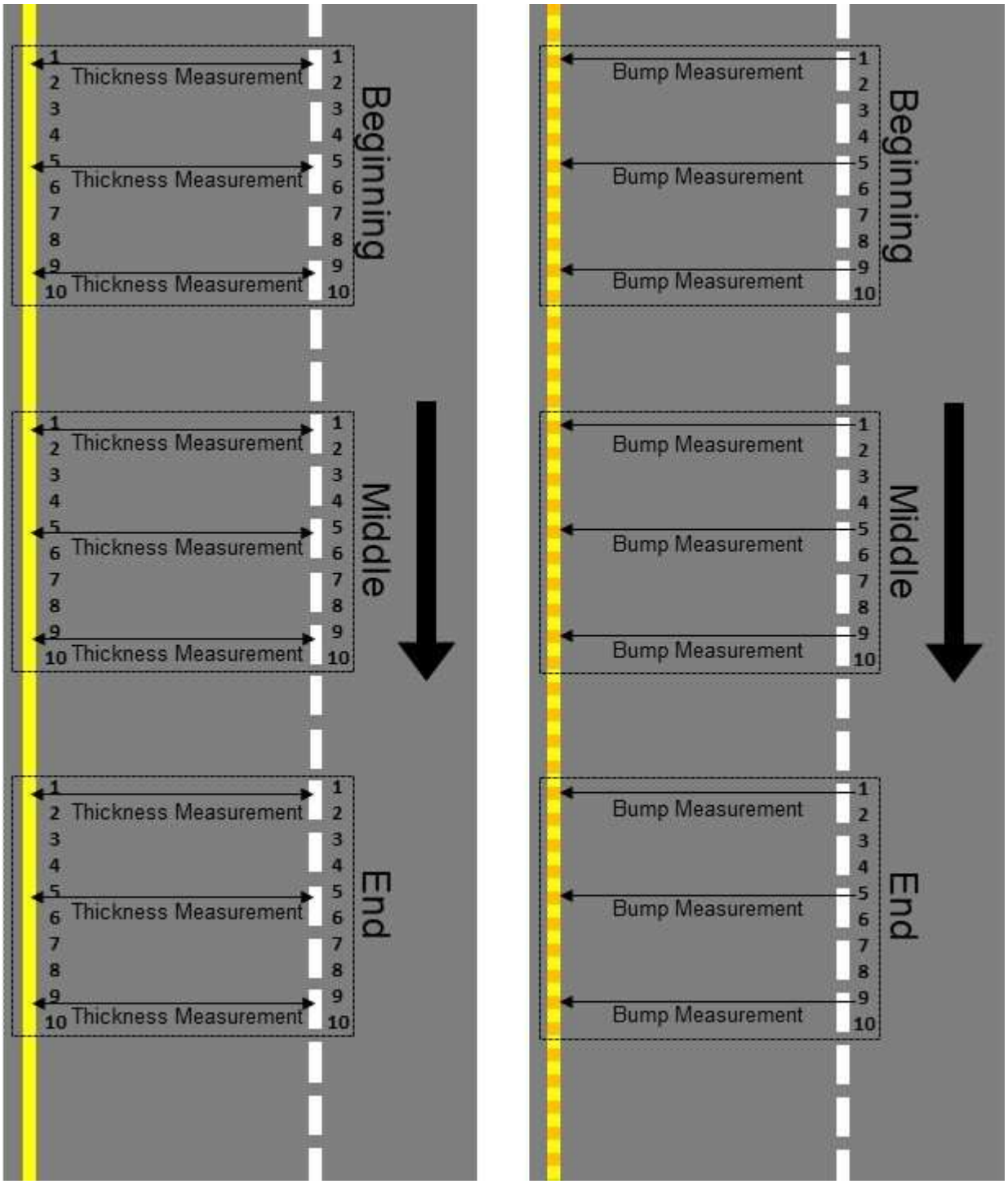
APPENDIX A: EXAMPLE OF A PAVEMENT MARKING THICKNESS GAUGE

A schematic of the Pavement Marking Thickness Gauge fabricated by the State Materials Office can be found at the following link:

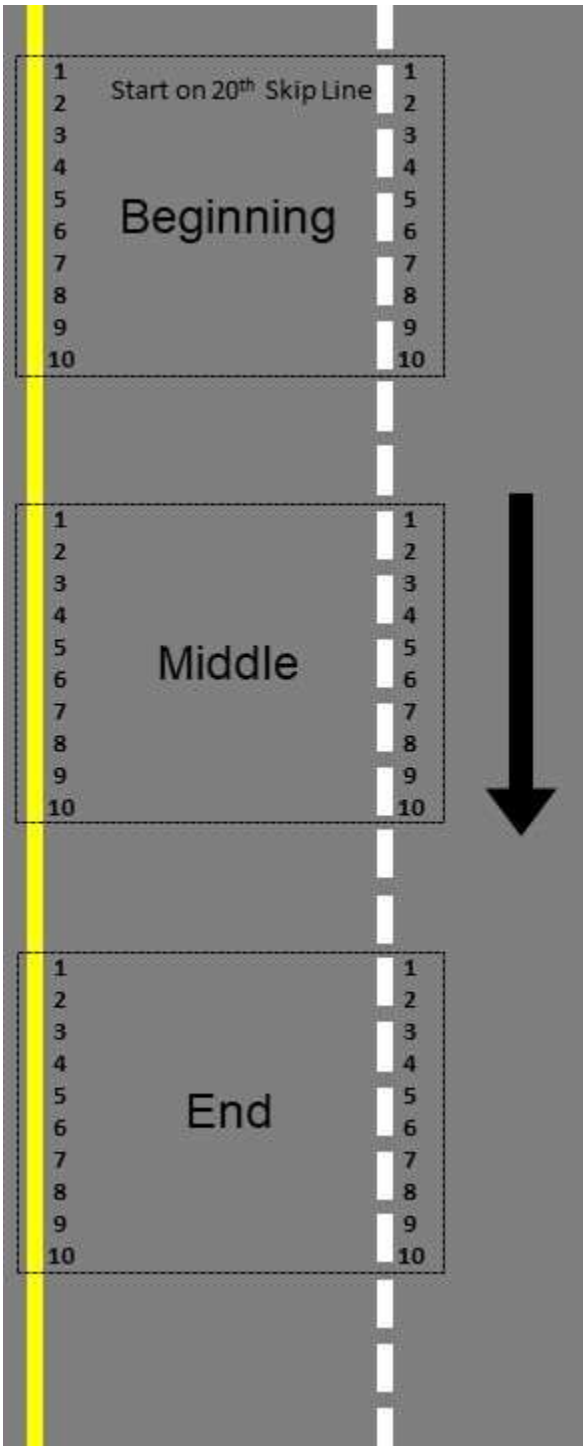
https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/materials/administration/resources/library/publications/fstm/methods/pavement-marking-gage-sheet-1-2020-12-21.pdf?sfvrsn=bef4ed30_2



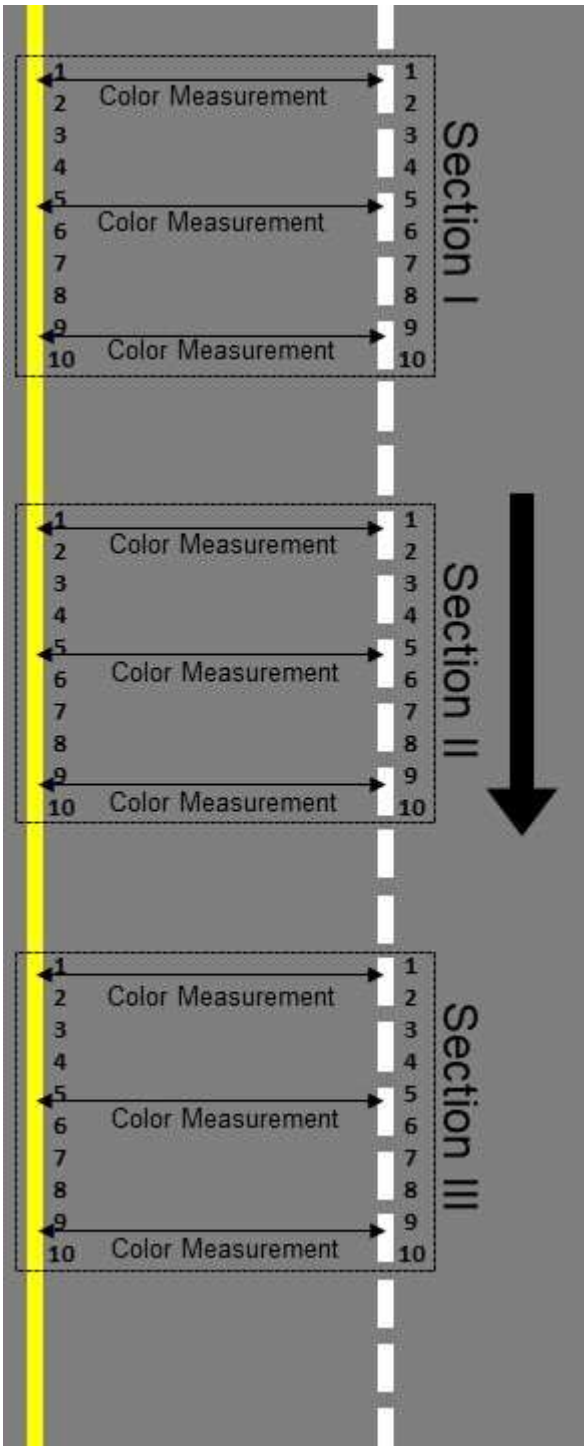
APPENDIX B: INSTALLATION PLAN



APPENDIX C: THICKNESS AND BUMP MEASUREMENT LOCATIONS



APPENDIX D: DRY RETROREFLECTIVITY MEASUREMENT LOCATIONS



APPENDIX E: COLOR MEASUREMENT LOCATIONS