

Recommend Approval: <u><i>Dominic DeBenedictis</i></u> 7/31/13 Team Leader Date <u><i>[Signature]</i></u> 7-31-13 Division Chief Date	Maryland Department of Transportation State Highway Administration Office of Materials Technology MARYLAND STANDARD METHOD OF TESTS
Approved: <u><i>Jim Smith</i></u> 08/02/13 Director Date	FIELD EVALUATION OF PAVEMENT MARKING MATERIALS MSMT 729

SCOPE:

This procedure is used to determine the acceptability of pavement marking materials by outlining test procedures for evaluating distribution, placement and bonding of beads, thickness, reflectivity, and adherence of pavement striping and surface applied tapes.

**BEAD ANALYSIS
Paint, Thermoplastic, Epoxy**

MATERIALS AND EQUIPMENT:

1. Magnifying lens, 10X minimum.
2. 2400 mL capacity container, 50 mL graduations.
3. Stop watch.
4. Bead Calibration Chart.

TEST PROCEDURES:

1. Determine the amount beads being applied by securing the container under the bead gun and dispensing the beads for a predetermined time. Determine the application rate needed by using the "Glass Bead Application Rate Tables". The application rate is determined in conjunction with the speed of the striping vehicle and the width of the material, (e.g. 5 in. wide striping at 8 mph needs to yield 531 mL in 5 seconds to achieve 8 lb/100 ft²). Compare the amount of collected beads to the required rate and adjust the amount of beads and/or speed to ensure the proper amount of beads are being applied to the pavement marking surface
2. After bead rate determination, apply the pavement marking and evaluate the distribution, placement, and bonding of the beads using the magnifying lens.
 - a. The beads shall be uniformly distributed over the entire width of the marking material.
 - b. The beads shall be embedded into the marking medium 55 to 60 percent.

REPORT:

Report the results of the bead analysis as satisfactory if they are uniformly distributed in the quantity specified and properly embedded.

THICKNESS
Paint, Thermoplastic, and Epoxy

MATERIALS AND EQUIPMENT:

1. Two identical shims of known uniform thickness, each greater than the thickness of the marking material to be measured.
2. Straightedge, 12 in. minimum length.
3. Taper Gauge calibrated in mils ranging from 10 to 250 or an approved equal.
4. Rigid metal test panel. A 6 in. x 12 in. x 1/16 in. metal panel has been found to be suitable.
5. Wet film thickness gauge calibrated in mils.
6. Duct Tape.

TEST PROCEDURE:

WET FILM THICKNESS
Paint and Epoxy

1. Place the metal test panel on the pavement and in the path of the marking equipment.
2. Apply the marking material without beads.
3. Immediately after the marking has been applied to the test panel, determine its thickness using the wet film thickness gauge.

DRY FILM THICKNESS - Method A
Thermoplastic

1. Place a shim on each side of the applied marking.
2. Place the straightedge on top of the shims leaving a small space between the marking and the straightedge.
3. Measure the space between the straightedge and the marking material using the taper gauge, or other equipment approved by the Engineer.
4. Determine the thickness of the marking by subtracting the space measured with the taper gauge from the shim thickness.
5. Perform Steps 1 through 4 at a minimum rate of two sites per mile in each direction, for each color and line type (edge, centers, skip, etc.). For projects less than three

miles in length, perform Steps 1 through 4 at a minimum rate of five sites per project for each color and line type (edge, centers, skip, etc.). Select test site locations per D3665.

DRY FILM THICKNESS - Method B Thermoplastic

1. Apply the duct tape to the pavement perpendicular to and in the path of the pavement marking equipment.
2. Apply the marking material across the tape.
3. When the marking has dried, remove the duct tape.
4. Place a shim in the void left by the duct tape.
5. Place the straightedge on top of the shims leaving a small space between the marking and the straightedge.
6. Measure the space between the straightedge and the marking material using the taper gauge or other approved equipment.
7. Determine the thickness of the marking by subtracting the space measured with the taper gauge from the shim thickness.
8. Perform Steps 1 through 7 at a minimum rate of two sites per mile in each direction, for each color and line type (edge, centers, skip, etc.). For projects less than three miles in length, perform Steps 1 through 4 at a minimum rate of five sites per project for each color and line type (edge, centers, skip, etc.). Select test site locations per D3665.

CALCULATIONS:

Average the thickness measurements separately by line type, (edge, skip, center, etc.) color and direction.

REPORT:

Report the thickness of the marking material, wet or dry, to the nearest mil.

ADHERENCE OF PAVEMENT STRIPING TAPE ASPHALT Inlaid Tape

MATERIALS AND EQUIPMENT:

1. Paint scraper or other approved tool.

TEST PROCEDURE:

1. Scrape the material lightly. There should be no dislodging of the tape.
2. Perform Step 1 at a minimum rate of two sites per mile in each direction, for each color and line type (edge, centers, skip, etc.). For projects less than three miles in length, perform Step 1 at a minimum rate of five sites per project for each color and line type (edge, centers, skip, etc.). Select test site locations per D3665.

REPORT:

Report any dislodging of the tape.

Surface Applied Tape

MATERIALS AND EQUIPMENT:

1. Chisel or other approved tool.
2. Hammer or other approved tool.

TEST PROCEDURE:

1. Place chisel at an angle on marking.
2. Lightly tap chisel with the hammer to dislodge a section of the tape.
3. Slowly lift marking from pavement.
4. Check to determine if any asphalt adhered to the tape.
5. Perform Steps 1 through 4 at a minimum rate of two sites per mile in each direction, for each color and line type (edge, centers, skip, etc.). For projects less than three miles in length, perform Steps 1 through 4 at a minimum rate of five sites per project for each color and line type (edge, centers, skip, etc.). Select test site locations per D3665.

REPORT:

Report the results.

RETROREFLECTIVITY **Paint, Thermoplastic, Epoxy, Tape**

MATERIALS AND EQUIPMENT:

1. A 30 meter geometry Retroreflectometer.
2. Manufacturer-supplied calibration standard.

TEST PROCEDURE:

1. Prepare the equipment for use following the manufacturer's instructions.
2. Check and calibrate the equipment periodically when taking readings to assure that it is working properly.
3. Place the equipment directly on the marking to be evaluated.
4. Take five separate readings over a representative segment of the markings at each site.
5. Perform Steps 1 through 4 at a minimum rate of two sites per mile in each direction for each color and line type (edge, centers, skip, etc.). For projects less than three miles in length, perform Steps 1 through 4 at a minimum rate of five sites per project for each color and line type (edge, centers, skip, etc.). Select test sites locations in accordance with D3665.

CALCULATIONS:

Average the thickness measurements separately by line type, (edge, skip, center, etc.) color and direction. Average the five readings and express that average as the reflectance value.

REPORT:

Report the retroreflectance value to the nearest whole millicandella/lux/m².

COLOR **Paint, Thermoplastic, Epoxy, Tape**

MATERIALS AND EQUIPMENT:

Color standards will be according to construction specifications.

TEST PROCEDURE:

Place color chart or colormeter on the marking material and determine acceptability.

REPORT:

Report results as satisfactory or unsatisfactory.

WIDTH
Paint, Thermoplastic, Epoxy, Tape

MATERIALS AND EQUIPMENT:

Straightedge, 12 in. minimum length.

TEST PROCEDURE:

Measure the width of the pavement marking. Do not include edge splatter in the width measurement.

REPORT:

Report the width of the pavement marking.

TEMPERATURES
Paint, Thermoplastic, Epoxy, Tape

MATERIALS AND EQUIPMENT:

1. Surface thermometer with a range of 0-300 F; accurate to within 2 F.
2. Dial thermometer with a range of 50-550 F; accurate to within 5 F.

TEST PROCEDURE:

1. Place the surface thermometer on roadway.
2. Use the dial thermometer to obtain ambient temperature.
3. Use the dial thermometer to determine the temperature of material at the paint gun.
4. An infrared temperature gun may be used in lieu of the thermometers in Steps 1 and 3.

REPORT:

Report the temperatures to the nearest whole degree F.

SURFACE MOISTURE TEST
Paint, Thermoplastic, Epoxy, Tape

Perform this test if moisture is suspected in the pavement. If moisture is evident on the surface, delay testing until there are no visible signs.

MATERIALS AND EQUIPMENT:

1. Duct tape.
2. Thin film polyethylene approximately 18 in. square.

TEST PROCEDURE:

1. Place the polyethylene film on the pavement surface to be marked in direct sunlight.
2. Tape all edges of the film securely to the pavement.
3. Wait approximately 15 minutes.
4. Remove the film and check for moisture either on the road surface or on the film itself.
5. Delay placing pavement markings if moisture is detected. Repeat Steps 1 through 4 until there are no visible signs of moisture.

REPORT:

Report the result as satisfactory or unsatisfactory

NIGHTTIME VISIBILITY EVALUATION
(For Longitudinal Pavement Markings Only)
Paint, Thermoplastic, Epoxy, Tape, Markers

This procedure may be used for rating new and existing pavement markings under wet or dry roadway conditions.

MATERIALS AND EQUIPMENT:

1. A passenger vehicle with clean, and properly aligned headlights, and operating windshield wipers.
2. A odometer or Distance Measuring Instrument (DMI).

TEST PROCEDURES:

Perform this evaluation from the view of the driver. It may be necessary to make several passes through the evaluation area to ensure that the correct data is being recorded. Always practice established safety measures when entering or exiting traffic flow in an unusual manner. Use caution to ensure the safety of the driver, passengers, and traveling motorists.

1. Locate and identify the area to be evaluated (perform reconnaissance drive-through, if necessary).
2. Review the nighttime pavement marking rating guidelines as specified in the “Guidelines for Nighttime Pavement Marking Ratings”
3. Record the current roadway and weather conditions.
4. Drive through the evaluation area and rate the pavement markings according to the nighttime guidelines. Use low beams only.
5. Stop at a safe location then record the ratings.

CALCULATIONS:

Average the recorded values of pavement markings by the different raters. Separate the averages into separate groups according to line type (edge, skip, center, etc...), color and direction.

REPORT:

Record the information required on the Nighttime Drive-through Visual Evaluation Worksheet.

GUIDELINES FOR NIGHTTIME PAVEMENT MARKING RATINGS

**PERFORM RATINGS AT THE POSTED SPEED LIMIT OR
AT A SAFER REDUCED SPEED AS THE WEATHER DICTATES**

LINE CONDITION	NUMERIC RATING	CONDITION DESCRIPTION	
		Lines	Markers
EXCELLENT	9 - 10	Very bright lines, very little concentration needed to follow pavement marking pattern. Retro-reflectance is uniform across marking. More than 4 skip lines can be seen in advance for N spacing.	Very bright markers, very little concentration needed to follow pavement marking pattern. Retro-reflectance is uniform across markers. More than 4 markers can be seen in advance for N spacing. No missing or damaged markers.
GOOD	7 - 8	Bright lines that are clear and the pavement marking pattern is easy to follow. 4 skip lines can be seen in advance.	Bright markers that are clear and the pavement marking pattern is easy to follow. 4 markers can be seen in advance at N spacing. No missing or damaged markers
FAIR	5 - 6	Lines are visible, but some concentration is required to follow the pavement marking pattern. 3 or more skip lines can be seen.	Markers are visible, but require some concentration to follow the pavement marking pattern. 3 markers at N spacing can be seen with a few random missing markers or damaged markers.
POOR	3-4	Pavement marking pattern is hard to see. Lines are barely visible. Less than 3 skip lines are visible	Markers are hard to see with missing or damaged markers. Markers are barely visible. Less than 3 markers are visible at N spacing.
INADEQUATE	1-2	Lane delineation is not visible. Pavement marking pattern is obliterated, not visible, etc.	Lane delineation is not visible. Markers pattern is obliterated, not visible, etc. Markers are only visible randomly.

**MARYLAND STATE HIGHWAY ADMINISTRATION
STRUCTURAL MATERIALS AND PAVEMENT MARKINGS DIVISION
FIELD QUALITY ASSURANCE TEAM
NIGHTTIME DRIVE-THROUGH VISUAL EVALUATION WORKSHEET**

EFP# _____

RATER(S) NAME: _____ DATE/TIME: _____

CONTRACT NO. /FMIS NO. NO.: _____

LOCATION(COUNTY/ROUTE/MP): _____

TYPE OF PAVEMENT MARKING: _____

APPLICATION DATE: _____

WEATHER CONDITIONS: DRY WET RAIN FOG OTHER _____

WEATHER SEVERITY: LIGHT (DRIZZLE) MODERATE (STEADY) HEAVY

ROAD CONDITIONS: DRY WET PUDDLING OTHER

APPROVED WORKPLAN # _____ DATE OF APPROVAL _____ NAME OF PI _____

(RATING - refer to the "Guidelines For Nighttime Pavement Markings Ratings")

Mile Point	Direction	Color	Line Type	Rating

REMARKS: _____

**GLASS BEAD APPLICATION RATE
EQUIVALENT VOLUME IN MILLILITERS PER 5 SECONDS PER 100 FT²**

TABLE 1 (5 INCH STRIPE)										
SPEED mph	WEIGHT OF BEADS, lb									
	6	8	10	12	14	16	18	20	22	24
10	500	688	844	1000	1168	1325	1500	1668	1831	2000
9	438	594	750	875	1035	1162	1312	1462	1600	1750
8	400	531	687	800	938	1068	1200	1338	1468	1600
7	344	462	575	688	800	919	1031	1150	1273	1375
6	300	400	500	593	694	793	900	1000	1100	1187
5	250	325	412	500	587	662	750	825	912	1000
4	200	262	325	400	462	400	600	662	725	800
3	156	200	250	313	362	412	468	518	556	625
2	100	125	162	200	231	262	300	331	362	400

TABLE 2 (6 INCH STRIPE)										
SPEED mph	WEIGHT OF BEADS, lb									
	6	8	10	12	14	16	18	20	22	24
10	600	825	1012	1200	1402	1590	1800	2003	2198	2400
9	525	712	900	1050	1230	1395	1575	1755	1920	2100
8	480	638	825	960	1126	1282	1440	1605	1762	1920
7	412	555	690	825	960	1103	1238	1380	1528	1650
6	360	480	600	712	825	952	1080	1200	1320	1425
5	300	390	445	600	705	795	900	990	1095	1200
4	240	315	390	480	555	480	720	795	870	960
3	187	240	300	375	435	495	562	622	668	750
2	120	150	195	240	278	315	360	398	435	480