Designation: D713 – 12

Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials[1]

This standard is issued under the fixed designation D713; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the determination of the relative service life of fluid traffic marking materials such as paint, thermoplastic, epoxy, and polyester products under actual road conditions using transverse test lines. Materials under test are applied under prescribed conditions and periodic observations are made using prescribed performance criteria.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D711 Test Method for No-Pick-Up Time of Traffic Paint

D913 Practice for Evaluating Degree of Traffic Paint Line Wear

D6628 Specification for Color of Pavement Marking Materials

E1710 Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer

E2367 Test Method for Measurement of Nighttime Chromaticity of Pavement Marking Materials Using a Portable Retroreflection Colorimeter

3. Significance and Use

3.1 This practice is an accelerated evaluation of bead retention, retroreflectivity, daytime color, night time color, and wear characteristics of fluid traffic marking materials. It is used to determine the useful life of such markings in the field. The same procedures are applicable to evaluating longitudinal lines to determine service life.

4. Type and Location of Pavement for Tests

4.1 Select sections where traffic is moderate and free-rolling with no grades, curves, intersections, or access points near enough to cause excessive braking or turning movements, where wear is uniform with full exposure to the sun throughout daylight hours, and there is good drainage. Select surfaces that are representative of the pavements upon which the fluid traffic marking material will be used in practice. Such surfaces include portland cement concrete, sheet asphalt, bituminous concrete, rock asphalt, and bituminous surface treatment.

5. Conditions at Time of Application

5.1 Clean the test area thoroughly of all foreign material. Follow the pavement marking manufacturer's recommendation for the application of the pavement marking to be tested. This should include the recommendations for air and pavement temperature, material temperature, relative humidity, wind chill, and wind speed. Application between 10 a.m. and 3 p.m. is recommended. During application record air and pavement temperature, wind speed, and relative humidity hourly.

6. Measurement of Wet Film Thickness

6.1 To aid in obtaining the correct film thickness, a length of roofing paper placed by the side of the road can be used. Place a rigid metal test panel on the roofing paper and in the path of the test line. A 300 by 300-mm (12 by 12-in.) metal panel 1.5 mm (1⁄16 in.) in thickness is satisfactory. Immediately after the test line is applied by the motorized striper, read the wet film thickness. If the wet film thickness is not satisfactory, adjust the spray pressure and repeat until the target wet film thickness is attained. It is important that no glass beads or other interfering materials be present that would give a false wet film reading. When the wet film thickness is correct, apply a test line across a tared metal panel and weigh immediately. A balance must be immediately available and be thoroughly shielded from wind as well as be of 1500-g capacity with 0.1 g or better sensitivity. As a basis for determination of glass bead application (7.1) the

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

weight of a paint line 100 by 300 mm (4 by 12 in.) (without consideration for solvent loss) can be calculated as follows:

$$W = 0.0943 \times t \times g$$

where:

W = weight of paint line, g,
t = mil thickness, and
g = weight per gallon, lb.

6.2 Application of pavement markings by the spray process shall be by an appropriate spray applicator with traction drive and a spray nozzle similar to that used on normal marking equipment. The machine must be capable of setting and maintaining a constant speed during the application process. Standard traffic paint shall be applied at a thickness of 15 mil (+ 1 mil).

6.2.1 Application of other materials shall be accordance with the manufacturers' recommended procedures and as similar as possible to that used on their normal marking equipment. High build water bourne paints, epoxies, modified epoxies, polyurea, Methacrylate, and other exotic materials tested shall be applied at the rate recommended by the manufacturer with a 15 mil minimum. The minimum thickness for thermoplastic material tested shall be 30 mil. If the pavement markings are applied by some other method than spray, such as extrusion, it must be done with a piece of equipment that will provide consistent material thickness throughout the test marking and be able to meet the manufacturer's requirements for the application of the pavement marking.

6.3 Test line for traffic paint and thermoplastic applied at less than 60 mil in thickness shall be 4 ± ½ in. in width. Thermoplastic applied at more than 60 mil shall be 6 ± ½ in. in width. For any other materials the applied width shall be according to the manufacturers' recommendation.

6.4 If the material is sprayable and can be applied with traction drive and a spray nozzle similar to that used on normal marking equipment, thickness shall be checked by weight. For materials applied by any other means the thickness shall be checked by instrument. Thickness will be determined by use of a test panel and a micrometer or magnetic dry film thickness gauge.

7. Measurement of Glass Beads

7.1 After the completion of 6.1, apply another test line to a tared panel with the motorized striper, this time also adding the glass beads, and weigh immediately. The weight difference between this measurement and that in 6.1 gives the amount of glass beads on the panel. Prior to weighing the panel, remove excess glass beads which are not adhered to the pavement marking from the panel to ensure an accurate representation of the bead rate. The process can be repeated if an adjustment in the bead application rate is needed. The weight of applied glass beads per gallon of pavement marking material can be calculated as follows:

$$W = 1.418 \times B \times (T/15)$$

where:

W = weight of glass beads, g,
B = glass beads per gallon of paint, lb., and
T = thickness of paint being applied, mil.

7.1.1 To calculate the bead rate in terms of weight per unit area use the following calculation:

$$Bead\ Rate\ (lbs/100\ ft^2) = (W/A) * 100$$

where:

W = weight of glass beads, lb and
A = area of pavement marking, ft^2.

7.2 Unless a manufacturer has requested to use a special coated bead, glass beads meeting requirements of AASHTO M247 for Type I Beads (identified at the time of application) will be applied to the pavement markings. The coating on the beads shall be specified by the purchaser and shall be noted as part of the test report. For standard traffic paint applied at 15 wet mil the glass beads shall be applied at a rate of 6 pounds per gallon (6 lbs/100 ft^2) and will be supplied by the testing agency. The testing agency will provide quality control test results for the beads provided.

7.3 Use of special beads or other retroreflective optics may be applied at the manufacturer's recommended application rate and method. If this is to be done the manufacturer shall provide the recommended application methodology, and application rate in the form of weight per unit area (such as lb/100 ft^2) for each bead or retroreflective optic that is to be used. The manufacturer shall also provide the technical information for the material being used to include such things as material description, pertinent specifications met, physical properties such as size, roundness, chemical properties, and coating characteristics. This information shall be available as part of the report.

7.4 If the bead or reflective optic application can be controlled then the actual bead application rate shall be determined and included as part of the report. If the rate cannot be consistently controlled then the beads or reflective optics should be applied in such a manner to fully saturate (flood) the marking and this should be reflected in the report.

8. Application Procedure

8.1 Apply the test stripes at the required width and transversely on the road. At the option of the purchaser, the test stripes may be applied to the pavement at an angle of 45° to the direction of the traffic, or longitudinally in each wheel path, in order to increase the area of contact with traffic. If the markings are to be applied in a longitudinal pattern then the pattern should be discussed and agreed to prior to conducting the field test.

8.2 Apply test stripes (trained personnel under the supervision of the purchaser) by using a pavement-marking machine similar to the production pavement marking equipment. Apply the test stripes to at least two sections of each road surface selected to ensure against undetected road surface problems. When more than one specimen is tested at more than one location, change the sequence of placement to minimize the effect of time of day and time period before the test deck is opened to traffic.

8.3 Apply at least two lines of each specimen in each section for better statistical reliability. A tared panel as used in the measurement of glass beads (see 7.1) should be placed between the wheel track of one line's application as a double check for material and glass bead application rates. Weights between this reading and that found in 7.1 should agree within 0.5 g. The purchaser may wish to place another smaller panel between the wheel tracks to retain for future reference. The thickness of samples shall be checked within the first three foot section of the test lines.

8.4 For standard traffic paint the road surface test lines should have a wet film thickness within ±1.0 mil of that required by the purchaser.

NOTE 1—If no wet film thickness is specified, 15.0 mil is recommended.

8.5 High build waterborne paints, epoxies, modified epoxies, polyurea, Methacrylate, and other exotic materials tested shall be applied at the rate recommended by the manufacturer with a 15 mil minimum. The minimum mil thickness for thermoplastic material tested shall be 30 mil. If the pavement markings are applied by some other method than spray, such as extrusion, it must be done with a piece of equipment that will provide consistent material thickness throughout the test marking and be able to meet the manufacturer's requirements for the application of the pavement marking.

8.6 A fluid marking material with which the purchaser has had considerable production experience is recommended to be added to the test series as a control to gauge the relative performance for materials applied under the road service test conditions for a particular test series.

8.7 For standard traffic paint that utilizes the standard glass beads (AASHTO Type 1) for drop on application, the glass beads are placed in the paint film within ±0.5 lb/gal of that required by the purchaser. The standard glass beads are supplied by the purchaser.

NOTE 2—If no bead application rate is specified, 6.0 lb/gal (6 lb/100 ft^2) of paint that is applied at 15 mil is recommended.

8.8 If special beads or other retroreflective optics are used per the manufacturer's recommendations the application shall be made according to the manufacturer's recommended application methodology, and application rate for each bead or retroreflective optic that is to be used. The application rate shall be of each type of bead or other retroreflective optic shall be included in the report.

9. Performance Criteria

9.1 Unless otherwise stated all evaluations shall be performed in one or both of the following areas; the center of the left wheel path and in the skip line area. The evaluations will be made at the eighteen (18) in. length of line centered on the left wheel track area (wheel track) and nine (9) in. from the skip line area (centerline). The centerline can further be located as the area to the left of the left wheel path in the last nine (9) in. of the line.

9.2 *Auto-No-Track Time*—The auto no-track time is determined by passing over the freshly applied line in a simulated passing maneuver with a standard size passenger car with regular treads (no snow treads). A line showing no visual pick-up and redeposition of the materials onto the pavement surface when viewed from a distance of 15 m (50 ft) in the highway direction is considered as showing no pick-up and conforming to the drying time requirements.

9.2.1 The test line is applied at the same temperature, the same wet film thickness, and the same rate of glass beads as will be specified by the purchaser in production application.

9.2.2 The no-track maximum time is measured when the pavement temperature is from 15 to 50°C (60 to 120°F) and under local humidity conditions, providing that the pavement is dry.

9.3 *Appearance*—The impression of the observer of the general condition of the test lines when viewed without any detailed inspection, from a distance of at least 10 ft. It is a measure of satisfactory or unsatisfactory appeal to the observer. It includes a comparison of the color of the surface under consideration with the original color, taking into account changes due to yellowing, bleeding, darkening, fading, dirt collection, mold growth, etc. This determination is made in both the left wheel path and in the skip line area as defined in 9.1. The appearance is rated either acceptable or unacceptable.

9.4 *Durability*—The durability is equal to one tenth of the percentages of material remaining on the pavement (when examined by the unaided eye). This determination is made in both the left wheel path and in the skip line area as defined in 9.1. The percent of pavement marking remaining on the pavement is considered as the percent of the prescribed area of test stripe in which the substrate is not exposed. Make the evaluations in accordance with Test Method D913.

NOTE 3—In the absence of a specification by the purchaser, failure shall be a rating less than 4 (less than 40 % material remaining on the pavement).

9.5 *Night Visibility (Retroreflectivity)*—This data will be obtained by taking readings with a handheld device in the center of the left wheel path and in the skip line area. Readings will be made with a 30 meter CEN geometry portable retroreflectometer in accordance with Test Method E1710. 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 track and centerline values will be reported separately.

9.6 *Daytime Color*—Readings will be taken on the skip line area of the transverse line, with a spectrophotometer in accordance with Specification D6628. The readings shall be taken in Y, x, y CIE coordinates with a 2 degree observer using a D65 Illuminant.

9.7 *Night Time Color*—Readings will be taken on the skip line area of the transverse line, with a portable reflection colorimeter in accordance with Test Method E2367. The readings shall be taken in x, y CIE coordinates.

9.8 *Length of Useful Life*—The length of useful life is determined by the number of days of duration between the date

the sample was applied to the road surface and the date any one of the designated measurements falls below the specified minimum rating.

10. Evaluation Procedure

10.1 Field performance evaluations shall be conducted within three (3) to seven (7) days after application (unless otherwise agreed upon) on the test deck, and at approximately thirty (30) day intervals for the first year, and at approximately one hundred twenty (120) day intervals for the periods longer than one year.

NOTE 4—In snowbelt areas monthly 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.

10.2 Make periodic inspections of the test sections in accordance with 9.3, 9.4, 9.5, 9.6, and 9.7. Record at each inspection the subjective rating or the measured value of criteria being evaluated for each line in each section. Also average the values or ratings in each section by material and calculate an overall average for each criteria.

10.3 Inspect the test lines at regular monthly intervals. As the test lines approach failure, they should be evaluated every two weeks (weather permitting). The test lines must be evaluated until failure. Different types of traffic paint and markings do not wear out in a linear manner. Hence, it is not possible to extrapolate to failure some intermediate data. The winter season is also a must when evaluating test lines.

10.4 *Weather Data*—This shall include monthly totals for rainfall and snowfall and average high and low temperatures. Additional data as to use of snowplows, used on the test deck to include type of snowblade used (that is, grader, wingblade, loader bucket blade), number of passes made during snow removal, amount of salt, amount of anti-skid, and salt/anti-skid by the ton, used on the test deck.

10.5 A photo log of all lines in all sections may be maintained for future visual reference.

11. Report

11.1 Interim and final reports shall be available according to an agreed upon schedule. The following minimum information shall be included:

11.1.1 Site location, including ADT, type, age and special treatment of pavement surface material.

11.1.2 Company information, including name, code, class of material, color, primer (if needed), indication if material contains lead or other heavy metals.

11.1.3 Application information, thickness, relative humidity, air temperature, pavement temperature, material temperature at time of application.

11.1.4 Auto no track reported from data obtained during installation of the test deck for applicable materials according to testing criteria agreed upon by the purchaser and the manufacturer.

11.1.5 Retroreflectance by data table.

11.1.6 Color (daytime and night time) in Y, x, y chromaticity value format by data table.

11.1.7 Durability rating by data table.

11.1.8 Appearance rating by data table.

11.1.9 Monthly photo log of all lines from both site surfaces.

12. Keywords

12.1 pavement markings; road tests; traffic paint