



ODOT Test Deck Field Evaluation of Permanent Pavement Marking Materials

Maintenance & Operations Branch

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1. SCOPE

- 1.1. This work plan is the standard for evaluating durable longitudinal and transverse pavement marking materials for the Oregon Department of Transportation (ODOT) test deck. Submittal requirements for applications on the QPL Standard Guidelines for Product Review for each type of product [here](#). Raised pavement markers, paint, and high-performance pavement markings are not tested on the ODOT test deck.

2. REFERENCED DOCUMENTS

- 2.1. ASTM Standards:
 - 2.1.1. ASTM D 913 Standard Test Method for Evaluating Degree of Resistance to Wear of Traffic Paint
 - 2.1.2. ASTM D 6628 Specification for Color of Pavement Marking Materials
 - 2.1.3. ASTM E 1710 Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN Geometry using a Portable Retroreflectometer
 - 2.1.4. ASTM E 1349 Standard Test Method for Reflectance Factor and Color by Spectrophotometry Using Bi-directional Geometry
 - 2.1.5. ASTM 2177 Standard Test for Measuring the Coefficient of Retroreflected Luminance (RL) of Pavement Markings in a Standard Condition of Wetness

3. SIGNIFICANCE AND USE

- 3.1. This work plan may use several test sites throughout the state of Oregon to evaluate the degradation of pavement marking materials under varying conditions.
- 3.2. The ODOT Statewide Pavement Marking Committee (SWPMC) will gather and review material performance data to approve or reject materials for the ODOT Qualified Products List (QPL). This data will not be released, but will be held by the SWPMC as reference to the materials performance.
- 3.3. In addition to field testing, each product will submit the following:
 - 3.3.1. ODOT Preliminary Information for Product Evaluation Form 734-5098
 - 3.3.2. List of the specific application methods you are submitting for using the submittal form
 - 3.3.3. Include a detailed drawing of application, if submittal is for other than a flat line or standard profiled line.
 - 3.3.4. Signed Warranty Acceptance Statement
 - 3.3.5. Copy of your contractor certification program
 - 3.3.6. Copies of brochures, including pictures
 - 3.3.7. MSDS (including primers if necessary)
 - 3.3.8. Limitations of product
 - 3.3.9. Installation Recommendations
 - 3.3.10. Two samples of each color, and shape, approximately 8" long.
 - 3.3.11. Sample of the reflective elements used for any top dressing (1 pint).
 - 3.3.12. NTPEP data, or other state DOT approvals and data that allow use of studded snow tires.
 - 3.3.13. Documentation for Build America Buy America Act and implementing regulations (Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. No. 117-58, which includes the Build America, Buy America Act ("the Act"). Pub. L. No. 117-58, Sections 70901-70941).

3.3.14. Submit all documents and products required to:
Qualified Products List: QPLIST@odot.oregon.gov

Or mail to:
Oregon Department of Transportation
Product Evaluation Coordinator
800 Airport Road SE
Salem OR 97301-4792

3.3.15. Pavement Marking Material (PMM) numbers that are assigned to a Manufacturer's product will not change for the life of the test.

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 by ODOT (on the State Highway System with free-flowing traffic with a minimum ADT of 5,000 vehicles per day); on a tangent section with no or slight grades, no intersections or access points near enough to cause excessive braking or turning movements; where the pavement surface is worn fairly uniformly and is fully exposed 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
- 4.3. Sites should be at least 200' in length of the same pavement type (asphalt or concrete mix) to accommodate a typical number of products.

5. PRODUCT CRITERIA AND RESTRICTIONS

- 5.1. Materials may fit either the Specification 00865 – Longitudinal Markings – Durable or specification 00867 – Transverse Pavement Markings – Legends and Bars of the [Oregon Standard Specifications](#). Materials included in these categories are tapes, pre-formed thermoplastics, methyl methacrylates, and thermoplastics. Profiled materials must be first tested without profile and after approval to the QPL can then be demonstrated later for profile. For approval in the wet weather category products must first be approved on the QPL then submit third party wet retroreflectivity data.
 - 5.1.1. At ODOT's discretion besides the materials above, ODOT may allow experimental materials if requested.
- 5.2. As a standard, reflective elements will be used according to the manufacture's recommendations specifying the type and rate at which the beads will be applied with their original submittal. Products utilizing beads or rates will be considered systems rather than individual products and will be noted.
- 5.3. The following material will be allowed on the ODOT Test deck with their requirements noted:

5.3.1. Liquid-Applied Thermoplastics will be restricted to the following:

- 5.3.1.1. Two Colors – White and Yellow
- 5.3.1.2. Wet film thickness of 120 mils $\pm$ 1/10 the specified thickness and 4 inches in width or as manufacturer specified.
- 5.3.1.3. Length of Evaluation – two (2) years unless ODOT sees a need or reason to end the evaluation sooner.

5.3.2. Perform Thermoplastics will be restricted to the following:

- 5.3.2.1. Two colors – White and Yellow. ODOT may allow other colors on the test deck. If colors besides white and yellow are desired for approval it should be noted in the QPL submittal request.
- 5.3.2.2. Film thickness of 125 mils $\pm$ 1/10 the specified thickness and 6 inches width or as manufacturer specified. Systems designed for applications at different film thicknesses or widths shall be noted in the original submittal by the manufacturer and reported to ODOT.
- 5.3.2.3. Length of Evaluation – two (2) years unless ODOT sees a need or reason to end the evaluation.

5.3.3. Tapes will be restricted to the following:

- 5.3.3.1. Two colors – White and Yellow.
- 5.3.3.2. 6 inches width
- 5.3.3.3. Length of Evaluation – two (2) years unless ODOT sees a need or reason to end the evaluation.

5.3.4. Methyl Methacrylates will be restricted to the following:

- 5.3.4.1. Two colors – White and Yellow/ ODOT may allow other colors on the test deck. If colors besides white and yellow are desired for approval it should be noted in the QPL submittal request.
- 5.3.4.2. Wet film thickness of 120 mils $\pm$ 1/10 the specified thickness and 4 inches in width or as manufacturer specified.
- 5.3.4.3. Length of Evaluation – two (2) years unless ODOT sees a need or reason to end the evaluation.

5.4. Manufacturer shall bring enough materials to the test deck site to complete all lines necessary as well as extra for any lines that may be voided.

- 5.5. All lines 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 ODOT. This reapplication will typically be permitted once during the installation day. If the reapplication was unsuccessful, it is up to ODOT's discretion to allow another reapplication. ODOT may require removal of lines by the manufacturer of voided lines.
- 5.6. ODOT will furnish a control line to be placed with the materials being tested. The control lines will be of current approved products on the QPL so that ODOT can compare the materials being tested knowing how well the control lines have performed in the past.

6. SAMPLING AND TESTING

- 6.1. During installation, all products must be sampled by the manufacturer in the presence of ODOT personnel.
- 6.2. Samples will be taken by placing a metal sample plate towards the shoulder side of the test strip. The material will be applied over the sample plate as the test strip is placed down on the test deck.
 - 6.2.1. This sample will be used to determine each lines thickness.
 - 6.2.2. Samples will be labeled by ODOT with the appropriate number assigned to the test line.
- 6.3. The following independent lab tests are required for markings submitted to the test deck for review (for more information please see the appropriate product review guidelines for each product [here](#)):
 - 6.3.1. Volatile Organic Compound (VOC) - ASTM D3690
 - 6.3.2. Chromium – ASTM D3718
 - 6.3.3. Total Lead – EPA 6020
 - 6.3.4. Color – PR-1 Chart
 - 6.3.5. Arsenic (beads) - EPA 3052
 - 6.3.6. Antimony (beads) - EPA 3052
 - 6.3.7. Lead (beads) - EPS 3052
 - 6.3.8. Wet recovery white materials retroreflectivity – ASTM 2177. Note: only required for materials being evaluated for wet weather recovery
 - 6.3.9. Wet recovery yellow materials retroreflectivity – ASTM 2177. Note: only required for materials being evaluated for wet weather recovery

7. CONDITIONS OF TIME AND APPLICATION

- 7.1. Products will be installed at times to be specified by ODOT. ODOT will send exact dates 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.
- 7.3. Pavement temperature, air temperatures, and relative humidity shall be recorded by ODOT approximately every half hour during the installation period.
- 7.4. ODOT will notify manufacturers of the current scheduled test deck installation closing time at the beginning of the installation day. Based on this information, manufacturers should schedule the installation of their final product of the day so that the materials will be adequately cured for traffic prior to opening the test deck area to traffic. Manufacturers may request a cure time of up to one hour after a line is installed before the test deck area is opened to traffic. ODOT will consider workload, site conditions, availability of ODT staff, traffic patterns, traffic control and test deck scheduling (present/future) when finalizing the lane closure schedule.

8. APPLICATION GENERAL

- 8.1. Tapes, preformed thermoplastic, and methacrylate shall be applied according to the manufacturer's recommendations.
- 8.2. No lines shall be installed without approval from ODOT personnel to install.
- 8.3. The application temperature of the material shall be recorded by ODOT.
- 8.4. Four (4) beaded transverse lines will be applied per product. Two (2) lines shall be placed in one area with asphalt pavement the other two (2) will be applied in an area with concrete pavement to allow for better evaluation of the product. No applied lines shall be placed over top of existing pavement markings or into groves where raised pavement markings are installed in the surface.
- 8.5. All spray applied materials 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.
- 8.6. Wet Film Thickness will be measured with a gauge where possible to assure that materials are applied at the prescribed rates.
- 8.7. Thermoplastic and beads shall be applied in a single operation using equipment suitable for such purpose.

- 8.8. All materials shall be installed in the same direction going from the shoulder toward the open traffic lane. Installing all the same direction will increase safety for installation crew as well as increase consistency on material application and review.

9. CALIBRATION PROCESS

- 9.1. Equipment for placement of materials shall be operated according to the manufacturer's recommendations.
- 9.2. Products found to be outside the prescribed width and thickness tolerances shall be voided and replaced with lines within the tolerances

10. FIELD TEST OBSERVATION

- 10.1. A minimum of two (2) trained raters within ODOT shall be used to obtain field test observation data on each product line (in both the wheel and skip reading areas). Data will be averaged between raters. These values are obtained for all four representative product lines. For each product, each area has a separate, averaged value.
- 10.2. Initial field performance tests for permanent materials as outlined below will be conducted within seven (7) days after application (unless otherwise stated) on the test deck. Follow up field performance testing will be conducted approximately every two (2) months after installation during the first six (6) months of testing (unless otherwise noted below). Following the sixth (6th) month field performance testing, evaluation frequency will move to approximately quarterly testing for the remainder of the 2-year test deck. Testing may be delayed due to winter weather. The following tests and data collection will be completed at each field performance testing visit, but ODOT reserves the right to collect any of this data using newer technologies (e.g. lidar scanning) in addition to the methods below and may compare data collected from each method.:
- 10.2.1. Retroreflectivity: This data will be obtained by taking readings in both the center of the wheel path closest to the skip line area (the "wheel reading") and in the skip line area (the "skip reading"). For both locations on each line five (5) readings will be taken. 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 recorded in millicandelas per square meter per lux. Both wheel and skip readings will be reported separately.

- 10.2.2. 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 (the “wheel reading”) and in the nine (9) inches of line in the skip line area (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.
- 10.2.3. Daytime Color: Daytime color must meet ASTM D 6628. Daytime color values will be taken using spectrophotometry according to ASTM E 1349
- 10.2.4. Pictures of all lines shall be taken during every scheduled reading for both surfaces.
- 10.2.5. 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. This data will be collected after events with approximate data for the location.

11. DATA COMPILATION

- 11.1. Data will be recorded by ODOT and will not be shared or reported out.
- 11.2. The following minimum information shall be recorded:
 - 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, ODOT product number, manufacturer name, product name, type and color.
 - 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, 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.



