



# Oregon

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## **Pavement Marking Approval Process for Permanent Pavement Markings for use on Oregon Department of Transportation (ODOT) Highways**

The purpose of this document is to outline the process required to authorize the usage of lead free permanent pavement marking materials on ODOT highways. Pavement marking binder materials used for both construction projects and in-house maintenance activities must be on the ODOT Qualified Products List (QPL). Reflective components (beads) will be determined by the product manufacturer. More information regarding the QPL is outlined on website:

<http://www.oregon.gov/ODOT/Construction/Pages/Qualified-Products.aspx>

We currently have four categories of permanent pavement markings; waterborne paint, high performance pavement markings, durable pavement markings, and pavement markers. The process for the approved use of pavement markers will not be addressed in this document. ODOT has changed the approval process for waterborne paint which will be explained later in this document. The other two categories of pavement markings require successful evaluation on an ODOT Pavement Marking Testdeck. The pavement markings are applied transverse to the highway in accordance with ASTM D713-90. Durable legend pavement markings require an eighteen month manufacturer warranty. Durable longline pavement markings require a three year manufacturer warranty for surface applied thermoplastic and four year warranty for inlaid thermoplastic and all other durable materials. High performance pavement markings require a one year manufacturer warranty. Complete warranty information can be found in 'Oregon Standard Specifications for Construction' section 00850.75. This document is also on-line on website:

[http://www.oregon.gov/ODOT/Business/Pages/Standard\\_Specifications.aspx](http://www.oregon.gov/ODOT/Business/Pages/Standard_Specifications.aspx)

### **Process for Inclusion of High Performance or Durable Products on the Test Deck**

The pavement marking material manufacturer (manufacturer) must submit all documentation required for inclusion on the QPL and the product must perform successfully on a testdeck. The documentation required for the QPL is;

- Preliminary Information for Product Evaluation Form
- Copies of test reports showing compliance with the Materials Specifications
- Copies of Brochures, including pictures
- MSDS (including primers if necessary)
- Limitations of Product or Installations
- Installation Recommendations
- Place each product on an ODOT Testdeck for evaluation
- Signed Warranty Acceptance Statement
- Copy of Contractor Certification program

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- Submit two samples of each color, and shape, approximately 8” long
- The beads and markings will be evaluated as a matched component

The manufacturer must indicate on the, ‘Preliminary Information for Product Evaluation’ form 734-5098 which application method or type they wish their product approved for. Depending on which method chosen additional testing may be required. This information can also be found on website: <http://www.oregon.gov/ODOT/Construction/Pages/Qualified-Products.aspx>

### Specification and Application Criteria

ODOT will announce future pavement marking testdecks and notify manufacturers so they will have the opportunity to participate with their products. The following specifications, test methods, and standards in effect on the opening date of the testdeck announcement form a part of the specification where referenced:

**AASHTO M247**; ASTM D93; **ASTM D713**; ASTM D913; ASTM D1210; ASTM D1729; ASTM D2621; ASTM D2697; ASTM D2805; ASTM D3335; **ASTM D3718**; **ASTM D3960**; **ASTM E2177**; ASTM E70; **EPA 3052**; EPA 6010C; **EPA 6020**; and FTMS 4053

There may be other test methods and specifications specifically described in this document. The manufacturer will submit test results from an independent laboratory indicating the materials comply with the listed specifications. *(ODOT at their discretion has limited the number of samples of similar products from one manufacturer to three formulas for each color.)*

### Independent laboratory test requirements

Provide independent laboratory tests for high performance and durable pavement markings as follows:

Volatile Organic Compound (VOC)	less than 1.2518 lbs per gallon	ASTM D3960
Chromium	No Spec	ASTM D3718
Total Lead	No Spec	EPA 6020

Color. The color of the yellow samples will be compared to the PR-1 chart. They shall meet 33538 Federal Yellow.

The beads used shall conform to the following heavy metal requirements,

Arsenic	less than 200 ppm (parts per million)	EPA 3052
Antimony	less than 200 ppm	EPA 3052
Lead	less than 200 ppm	EPA 3052

Materials for the wet weather recovery category shall conform to the following requirements,

Wet recovery white materials      350 mcd/m<sup>2</sup>/lx minimum      ASTM E2177

Wet recovery yellow materials      250 mcd/m<sup>2</sup>/lx minimum      ASTM E2177

The testdeck procedure will be in accordance with ASTM D 713-90, "Standard Practice for Conducting Road Tests on Fluid Traffic Marking Materials", except as modified herein. A panel organized by ODOT will evaluate each formulation for appearance, durability, color, and night visibility performance.

Type and Location of Pavement for Tests - The products will be applied on portland cement concrete and asphaltic cement concrete pavements. *(Location and placement of the testdeck will be regularly scheduled for mid-summers, bi-annually performed on even years. ODOT will provide traffic control during the placement and evaluations of testdecks. ODOT will prepare the pavement prior to material placement so no pavement grinding will be allowed during installation of pavement marking materials. ODOT will provide the materials to act as "control" for the evaluations. The testdeck evaluation team will consist of members from the ODOT Pavement Marking Committee and the Statewide Maintenance and Operations Branch.)*

#### Application Procedure

High Performance Pavement Markings - The material will be applied transverse to the roadway. Stripes will be 4 inches wide with a wet film thickness as submitted in writing by the manufacturer with the original bid paperwork. Two stripes of each formulation will be applied on bare pavement of both Portland cement concrete and asphalt cement concrete. The beads and bead application rate shall be those recommended by the manufacturer. The beads and material will be evaluated as a matched component. Beads shall be placed with an automatic system. The manufacturer in the presence of an ODOT official will determine the actual thickness as placed. ODOT will install a material currently on the QPL to act as "control". Performance of all submitted samples will at a minimum be expected to meet or exceed the performance of the "control". Panels of each formulation will be taken for documentation and for comparison on the appearance and color evaluations unless submitted with the bid documentation. *(Stripe width and thickness, as specified by the manufacturer, shall comply with the tolerances in the current, 'Oregon Standard Specification for Construction' section 00850.46 in effect at the time of the testdeck or the line will be rejected. The manufacturer will have the option to place another stripe to replace the rejected line)*

Durable Pavement Markings - The material will be applied transverse to the roadway. Stripes will be 4 inches wide with a wet film thickness of 120 mils. Two stripes of each formulation will be applied on bare pavement of both Portland cement concrete and asphalt cement concrete. Tape and preformed thermoplastic do not need to conform to this thickness requirement and will be the manufactured thickness. The beads and bead application rate shall be those recommended by the manufacturer. The beads and material will be evaluated as a matched component. Beads shall be placed with an automatic system. The standard ODOT thermoplastic currently on the maintenance contract will be placed on the deck and act as "control" for other thermoplastic formulas. ODOT will install other materials currently on the QPL of each different material type to act as "control". Performance of all submitted samples will at a minimum be expected to meet or exceed the performance of the "control" of that material type. Panels of each formulation will be taken for documentation and for comparison on the appearance and color evaluations unless submitted with the bid documentation. *(Stripe width and thickness, shall comply with the tolerances in the current, 'Oregon Standard Specification for Construction' section 00850.46 in effect at the time of the testdeck or the line will be rejected. The manufacturer will have the option to place another stripe to replace the rejected line)*

Evaluation criteria for pavement marking materials on the testdeck will be as follows; *(Evaluation schedule for high performance and durable pavement markings will be monthly for two years throughout the life of the testdeck or until products fail. If weather does not permit night time readings the dates can be slightly modified. During*

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*rainy times the visual evaluations may be done by the evaluation team and the retroreflectivity readings taken as soon as weather permits.)*

Appearance is the complete impression conveyed when the material surface is viewed at a distance of at least 10 feet, before any detailed inspection has been made. It takes into account changes in the color of the surface under consideration, taking into account changes due to yellowing, bleeding, darkening, fading, dirt collection, mold growth, etc. *(ODOT will provide a color sample to be used for comparison.)*

Durability is a measure of the material remaining on the pavement or substrate. The material thickness will be measured in the middle of the wheel track by one member of the evaluation team and witnessed by the other members. Failure is defined as when there is less than 50% of the material left on the pavement or substrate within the evaluation area.

Night visibility will be conducted using a Delta LTL-X hand held retroreflectometer. Five measurements will be taken between the wheel tracks of each line using a template that identifies testing locations. The average of readings from all lines for each product will be used. Failure is defined as when the measurement is less than 100 millicandellas per lux per square meter.

Color will be determined by using the PR-1 Chart, 33538 Federal Yellow. The determination will be made without preliminary washing or other modification of the surface of the test lines.

High Performance Pavement Markings - Each stripe will be evaluated for 24 months or until a failure occurs. Any pavement marking sample that fails laboratory testing or fails any of the field tests within the 24 month period may be considered a failure and disqualified from the process. All products that pass the laboratory testing, field tests, and perform at least as well as the control will be approved for placement on the QPL but the manufacturer must have both a white and yellow sample pass the testing for the products to be placed on the QPL.

Durable Pavement Marking - Each stripe will be evaluated for 24 months or until a failure occurs. Any pavement marking sample that fails laboratory testing or fails any of the field tests within the 24 month period may be considered a failure and disqualified from the process. All products that pass the laboratory testing, field tests, and perform at least as well as the control will be approved for placement on the QPL but the manufacturer must have both a white and yellow sample pass the testing for the products to be placed on the QPL. The only exception to this is for material to be used for legends because only white products are used so no yellow material is required for the legend categories.

The manufacturer will indicate in their QPL submittal which application method or type they want their product approved for. If the products are approved for placement on the QPL some additional testing may be required. If they chose a profile marking they must verify with additional testing the ability of their product to profile. ODOT will choose a location and arrange with the manufacturer a time to perform this additional testing. *(A status report will be provided to the participants when their products fail the evaluation or annually.)*

### **Conditional Approval**

Conditional approval of products for the QPL may occur for high performance and durable pavement markings. There are three options for gaining conditional approval;

1) Pavement marking products that have been evaluated for a minimum of six months on testdecks done in other states to include either state managed or National Transportation Product Evaluation Program (NTPEP) testdecks that resulted in approval by other DOT's. This documentation will be evaluated and if approved by ODOT will be granted conditional approval once the manufacturer provides all the ODOT QPL required paperwork as listed above in, **'Process for Inclusion of Products on the Test Deck.'** *(The evaluation team will consist of the five Region Pavement Marking Managers and the Statewide Pavement Marking Coordinator (SPMC) who will determine approval based off of value to the Agency and Public.)*

2) ODOT may approve a demonstration of pavement marking products if Agency determines a benefit to the State. Manufacturer will submit request to the SPMC using a New Products form included below and all the ODOT QPL required paperwork. This demonstration will be evaluated for a minimum of one year. After acceptable performance of the product conditional approval will be granted. *(The evaluation team will consist of the five Region Pavement Marking Managers and the SPMC. The team will base their decision off of the following: For longline application a minimum of 2000' of all lines will be provided by the manufacturer. The manufacturer will provide all initial testing consistent with the construction requirements for the product category and ODOT may verify these test results. The longline projects will be tested by the laserlux van approximately annually after installation. After the first year the performance levels will be at least 225 mcd for white markings and 200 mcd for yellow markings. For legend materials a minimum of five locations will be selected by ODOT. The materials will be provided by the manufacturer along with all initial testing consistent with the construction requirements for the product category and ODOT may verify the test results. The legend material when tested with a Delta LTL-X will have a minimum of 150 mcd and show little to no wear after a year from installation. Products already listed as qualified on the QPL will use the demonstration option to gain approval for different application method(s) type, or top dressing of beads. Any product(s) for any category that fail the testing will be placed on the ODOT QPL rejected list. ODOT will limit the location and amount of conditional test sites. These options may be eliminated by ODOT if deemed appropriate.*

3) For materials placed on an ODOT testdeck and after at least six months of evaluation where the material performs as well as other materials in the same category ODOT may grant conditional acceptance on the QPL based on needs of the Agency.

Beads used as part of a matched component system with pavement marking materials already listed as qualified on the QPL can expand their usage as follows;

- Beads used as drop on that are approved with a type of pavement marking material can be approved for use with other approved formulas of the same type of material. Both the bead manufacturer and pavement marking material manufacturer must agree and submit in writing to ODOT. This acceptance can be without additional testing.
- Pavement marking material listed as qualified on the QPL will require a successful six month demonstration with previously unapproved beads to have this matched component option added to the QPL.
- If the integral beads are changed in a marking material the new component marking will need to be evaluated on an ODOT testdeck.

### **Usage of Conditionally Approved Products**

Once a pavement marking has been granted conditional approval by one of the above three options the material **may be used on construction projects**. Products that are conditionally qualified on the QPL are only available for contractors to use for the categories and application methods they are approved. To use a conditionally approved product the manufacturer will make a request to the construction Project Manager for the product to be used on a specific construction project. This request will be made a minimum of one week prior to the scheduled application and accepted on a case by case basis in proactive collaboration with the Region Pavement Marking

Manager. ODOT will consider many factors to help with this decision. The factors include, but are not limited to, the size of the project, traffic volume, location, type of highway, climatic area, and what type of pavement markings are on the adjacent sections. ODOT will track the usage of conditional products and evaluate the performance of these pavement markings for those projects. These reviews are used as additional information along with the mandatory ODOT testdeck information to make the decision on product acceptance. Products that do not perform acceptably, for the required time, on the testdeck and/or in field applications will be removed from the Conditional List. The list will be reviewed and updated on a yearly basis. The manufacturer will be notified of any changes to a products status by the end of June so they can prepare for the upcoming season.

Conditionally approved pavement marking products must successfully pass the evaluation on an ODOT pavement marking testdeck to become qualified on the QPL. Conditional usage is not required but used along with the mandatory testdeck data to assist with the decision. Products that perform successfully on an ODOT pavement marking testdeck and have successful reviews from conditional projects will be approved for the QPL. Once approved by ODOT and the manufacturer has submitted the QPL documentation the product will have qualified status on the QPL.

### **Approval Process for Waterborne Paint**

The following specifications, test methods, and standards currently in effect form a part of the specification where referenced:

AASHTO M247; ASTM D93; ASTM D713; ASTM D913; ASTM D1210; ASTM D1729; ASTM D2621; ASTM D2697; ASTM D2805; ASTM D3335; ASTM D3718; ASTM D3960; ASTM E70; EPA 3052; EPA 6010C; EPA 6020; and FTMS 4053

There may be other test methods and specifications specifically described in this document. The manufacturer will submit test results from an independent laboratory indicating the materials comply with the listed specifications.

#### **Independent laboratory test requirements**

Independent laboratory test requirements for waterborne paint are as follows:

Viscosity at 25°C	100 KU max.	ASTM D562
Fineness of Grind, Hegman	3 min.	ASTM D1210
Laboratory dry to no pickup time @ 380 µm wet film thickness (no beads) @ 50% humidity	10 minutes max.	ASTM D711
Flash Point, °C min	37 min.	ASTM D93
Pigment content, % by weight	68% max.	ASTM D3723

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Non volatile vehicle, % by weight	36% min.	FTMS 4053
Total solids by volume	60% min.	ASTM D2697
Directional Reflectance @ 380 µm wet film thickness White	88% min.	ASTM D2805
Contrast Ratio @ 380 µm wet film thickness White	98% min.	ASTM D2805
Yellow	96% min.	ASTM D2805
Freeze Thaw	5 cycles min.	ASTM D2243
Volatile Organic Compound (VOC)	less than 150 g per liter	ASTM D3960
pH	9.5 min.	ASTM E70
Chromium	shall be negative	ASTM D3718

The binder shall be 100% acrylic when tested in accordance with ASTM D2621.

Color. Paint draw-downs shall be prepared in accordance with ASTM E97. The color of the yellow samples will be compared to the PR-1 chart. They shall meet 33538 Federal Yellow.

Scrub Resistance. The paint shall pass a minimum of 500 cycles when tested in accordance with ASTM D2486.

Static Heat Stability. Put 450 mL of paint in a 473 mL (one pint) lined container, close the container, seal it with tape, and put in an oven maintained at 135°F ± 1°F for 7 days. Equilibrate the paint at standard conditions and mix thoroughly with gentle stirring. Examine paint for livering and hard settling and determine viscosity. The paint shall show no increase in viscosity greater than 10 KU over the viscosity at 77°F nor any coagulation, lumps, or coarse particles.

No-Track Time. The paint shall dry to a no-track condition in no more than 90 seconds when applied at 15 mils wet film thickness on dry pavement temperature of 50°F to 100°F and maximum 85% relative humidity, with 5-6 pounds of glass beads per gallon of paint. "No-Track" shall be the time required for the line to withstand the running of a standard automobile over the line at a speed of approximately 40 mph simulating a passing procedure, without tracking of the reflectorized line when viewed from a distance of 50 feet downstream.

Performance data from a National Transportation Product Evaluation Program (NTPEP) testdeck will be evaluated.

Formulations of waterborne paint that conform to the independent laboratory tests and perform well on a NTPEP testdeck will be included on the ODOT QPL.

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