Hydrophast®

Fast Dry Waterborne Traffic Paint

Product Data
Version 2.0

Product Type:	**Standard Fast Dry Waterborne**	
Product Codes:	**2036**	**2037**
Product Colors:	**White**	**Yellow**
Fed-STD-595:	**37925**	**33538**

Product Description:

Lead free, fast drying, 100% acrylic waterborne traffic paint. Conforms to performance specifications referenced in Federal Specification TT-P-1952E Type I & II, Federal Specification TT-P-1952F Type I & II, & many other state & federal specifications.

Product Advantages:

- Low VOC- below 100 g/L
- Fast dry for easy traffic control
- For use on both concrete & asphalt
- Works well over various sealcoat applications
- Excellent bead retention (can be used without)
- Great for symbols, legends, & lane marking
- Approved for use in CT, ME, MA, NH, NY, RI, VT
- Methanol free

Surface Conditions:

Surfaces should be cured, clean, dry, sound, and free from oil, grease, antifreeze, sand, and other debris and/or chemicals. Loose & lifting paint should be removed prior to application. Existing coatings or sealers may interfere with paint adhesion. New concrete & asphalt should be completely cured before applying (30 days for concrete, 14 days for asphalt is recommended). Check with Franklin Paint technical for more information. *If surface condition cannot be determined, a test stripe should be applied in an inconspicuous location.*

Application:

Formulated for use with airless or conventional air atomized spray equipment. For best results, apply when air and surface temperatures are above 50°F and relative humidity is below 85%. Cold paint may be heated to 110°F for desired flow properties. Heating waterborne paint *will not* accelerate dry time.

Physical Properties:

Coverage/Gal (15 mils wet, 4" line)	320'
Dry Time (ASTM D-711)	<9 mins
No Track Time (15 mils wet, 77°F, 45-55% Relative Humidity, 9 lbs. glass beads/gallon)	<75 seconds
Dry Opacity (Hiding, contrast ratio)	>0.97
Viscosity (Krebs units)	85-90
Density (lbs./gal)	13.8-14.2
Directional Reflectance (Cap Y)	>90 (white) >54 (yellow)
VOC g/L	<100
% Total Solids by Weight (Non-Volatiles)	77.5 minimum
% Total Pigment by Weight	60.0-62.0
% Vehicle Solids by Weight	43.0 minimum

Cleaning:

Wet paint may be cleaned with water. Dried paint is very difficult to remove.

Storage & Shelf Life:

Store in a cool dry area, indoors, and out of direct sunlight, ideally at 60-70°F. Minimum 12 months shelf life when stored unopened, at these conditions. **KEEP FROM FREEZING!**

Limitations:

- Never mix waterborne paint with any other paint products.
- Not recommended for use over silicone sealers.
- Do not apply when rain is in forecast.
- Do not apply when temperatures are expected to fall below 32°F within 6 hours of application.
- Low temperatures & high humidity can slow dry.

Franklin Paint™

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EF Series

PAVEMARK® Hydrocarbon Thermoplastic

PRODUCT DATA

Product Type:	Extrude Hydrocarbon Thermoplastic	
Product Code:	884415	884665
Product Color:	White	Lead Free Yellow
Description:	TM WHT HYD EXTRD	
	TM LF YEL HYD EXTRD	
Specification:	MA M7.01	
Effective Date:	August 15, 2016	

Product Description:
Ennis-Flint's Pavemark brand Hydrocarbon Extrude Thermoplastic Pavement Marking Material is a 100% solids material blend of binder, pigments and glass beads that must be melted to a temperature of approximately 400˚F (204˚C), mixed well and applied in a molten/liquid state to the pavement. The material temperature when it meets the road surface needs to be a minimum of 380˚F. Surface temperature at the time of application should be 50˚F (10˚C) and rising. Upon cooling to normal pavement temperature, thermoplastic provides a very durable marking material.

Product Advantages:

- Non-flammable and below 150 VOC
- Demonstrates excellent bead retention and abrasion resistance
- Fast set up keeps traffic control to a minimum when striping
- Can be used for symbols, legends and lane marking
- A low cost per useful life durable form of delineation

Packaging:
Thermoplastic is sold in one ton increments (2000 pounds). The ton is divided into 40 heat degradable bags each weighing approximately 50 pounds.

Storage:
The shelf life of the product is one year from date of manufacture with proper storage. Proper storage includes inside or covered to prevent from moisture, and below 120F. Outside storage for short intervals is acceptable as long as the material is kept dry. The older the material, more agitation and dwell time is required to fully melt and mix the granular ingredients.

Conditions for Application:
All surfaces must be clean, dry and free from oil, grease, antifreeze, loose sand, aggregate and chipping/peeling existing striping. Any curing compounds used on new concrete must be mechanically abraded off prior to striping and use of a primer is strongly suggested. Concrete should be allowed to cure 14 days. When in doubt, always test adhesion. While thermoplastic may be installed behind the paver once the mat cools, new asphalt should be allowed to cure for a minimum of 14 days to maximize adhesion and durability.

Coverage:
One tons yields approximately 6000 feet of 4" stripe @ 90 mils – surface texture will decrease the yield.

Physical Characteristics:

% Binder	**22% minimum**
% Glass:	**30 - 40%**
% TiO2 in the white:	**10% minimum**
Reflectance, white:	**75 minimum**
Reflectance, yellow:	**45 minimum**
Softening Point:	**200-230°F**
Specific gravity:	**2.15 maximum**
Yellowness index, white:	**0.12 maximum**

Dry Time: With drop on glass beads applied, the thermoplastic material shall be sufficiently tack-free to carry traffic in not more than 2 minutes when pavement surface temperature is at 50˚F, and not more than 10 minutes when pavement surface temperature is 130ºF.

Limitations: Applying a test strip to determine if surface is dry enough if there has been rain in the last 24 hours.

- Do not apply if hot material shows moisture bubbles.
- Do not heat thermoplastic above 450°F.
- Do no apply if the material at the gun is below 380°F.
- Do not apply when road and ambient temperatures are below 50°F.
- Do not apply when temperatures are near or below the dew point.
- Material at application is hot – please wear personal protective equipment as described in MSDS

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EPOPLEX

LS50

PRODUCT DATA

PRODUCT DESCRIPTION

Epoplex LS50 is a two-component, 100% solids epoxy coating material designed as a rapid setting highway marking coating that provides durability and corrosion and abrasion resistance. Epoplex LS50 is formulated to provide a simple volumetric mixing ratio of two volumes of Component A to one volume of Component B.

USES, APPLICATIONS

Epoplex LS50 may be applied to both cementitious and asphalt highway surfaces as a long-lasting striping material for both edging and center line markings.

PRODUCT ADVANTAGES

- 100% solids chemistry
- Low viscosity suitable for spray application
- Long-term abrasion and corrosion resistance
- Excellent bond strength assures good adhesion to a variety of substrates
- Protection against moisture penetration
- Special formulation chemistry for rapid set at a wide range of temperatures
- High ultraviolet light stability
- High reflective qualities

PACKAGING

Component A: Base Resin and Pigmentation
Component B: Activator/Curing Agent

Both components are available in 55 gallon drums and 250 gallon returnable totes.

PHYSICAL CHARACTERISTICS

Percent Solids	100%
Epoxy Equivalent Weight (ASTM D-1652, Method B)	300 +/- 50
Total Amine Value (ERF-25-68)	475 +/- 50
Track Free Time @ 77°F/25°C (ASTM D-711)	10 min. or less (with glass beads)
Adhesion (ASTM D-7234 formerly ASTM D-4541)	> 300 psi (100% concrete failure)
Hardness (ASTM D-2240, Shore D)	Min. 80
Abrasion Resistance (ASTM D-4060, formerly ASTM C-501)	< 80 mg weight loss
Tensile Strength (ASTM D-638)	6,000 psi
Compressive Strength (ASTM D-695)	12,000 psi
Theoretical Coverage	122 sq. ft. per gallon @ 15 mils
Mixing Ratio	2 Parts A to 1 Part B, by volume
Chromaticity (Color) (ASTM D-6628)	within coordinates
Yellowness Indexing (ASTM E-313)	Max. before QUV 8 Max. after QUV 20
Titanium Dioxide (White) (ASTM D-476, Type II)	18-25% (Composition by weight)
Non-Lead Organic Yellow	5-10% (Composition by weight)

STORAGE CONDITIONS

Store both components of Epoplex LS50 in a dry area. Avoid excessive heat and do not freeze. The shelf life is two years in the original, unopened container.

COLOR

Epoplex LS50 is available in highway white, non-lead yellow, and black. Custom colors are available upon request.

IMPORTANT:
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8/11
Rev. 8/11

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EPOPLEX

LS50

General Application Specification - Epoxy Pavement Markings

A. EPOXY PAINT MATERIALS

1. Shipment of Materials

The material shall be shipped to the job site in containers that are substantial and shall be plainly marked with the manufacturer's name and address, the color of the material, date of manufacture and batch number.

2. Certification of Compliance

The material manufacturer shall furnish a notarized certification that the material complies with the provisions of this specification. It shall not be inferred that the provisions of a certification of compliance waives state inspection, sampling or testing.

3. Infrared Spectra

A copy of the infrared spectra of each component shall be supplied by the Contractor along with the certification papers.

4. Glass Beads

The Contractor shall furnish certifications which shall include or have attached specific results of tests performed for roundness, refractive index, flow characteristics and gradation. The certifications shall show the quantity and lot number.

B. EPOXY PAINT STRIPING MATERIALS

1. Formulation

The epoxy paint marking material shall consist of a 100% solid, two-part system formulated and designed to provide a simple volumetric mixing ratio of the two components (e.g., two volumes of Part A to one volume of Part B).

2. Composition

The Component A composition shall be within the following limits:

	WHITE	NON-LEAD YELLOW
Pigments		
Titanium Dioxide (ASTM D-476 Type II & III)	18-25%	5-10 %
Organic Yellow		5-10%
Binder		
Epoxy Resin	75-82%	73-77%

3. Epoxide Number

The WPE of the epoxy resin (Compoionent A) shall be 300 +/- 50 as determined by ASTM D-1652 Method B and 250 +/- 50 on a pigment free basis.

4. Amine Number

The amine number of the curing agent (Component B) shall be 475 +/- 50 as determined by ERF-25-68.

5. Toxicity

Upon heating to application temperature, the material shall not exude fumes which are toxic or injurious to persons or property.

6. Viscosity

Formulations of each component shall be such that the viscosity of both components shall coincide (within 10%) at a recommended spray temperature.

7. Track Free Time

The epoxy paint pavement marking material, when mixed in the proper ratio and applied at 15 mils +/- 0.5 mil wet film thickness at 75°F +/- 2°F and with the proper saturation of glass spheres, shall exhibit no tracking time of 10 minutes or less when tested according to ASTM D-711.

8. **Curing**

The epoxy paint materials shall be capable of fully curing under a constant surface temperature of 40°F or above.

9. **Color**

The initial color for white and lead-free yellow shall fall within the following color box coordinates before and after performing ASTM G-53.

	x	y	x	y	x	y	x	y
White	.355	.355	.305	.305	.285	.325	.335	.375
Yellow	.560	.440	.490	.510	.420	.440	.460	.400

Note: Daytime Chromaticity, 45/0 (0/45) geometry, CIE Illuminant D65 and 2 degree standard observer.

10. **Yellowness Index (ASTM E-313)**

- Cure 72 hours after sample preparation
- Take yellow index reading, XYZ C/2°, following 72 hour cure and preceding QUV
- Maximum index before QUV: 8
- Place sample in QUV for 72 hours
- Maximum index after QUV: 20

11. **Directional Reflectance (ASTM D-6628, replaces ASTM E-97)**

Directional Reflectance after QUV using XYZ Scale D65/2°.

White	Yellow
Minimum: 80	Minimum: 40

12. **Adhesion to Concrete**

The catalyzed epoxy paint pavement marking materials, when tested according to ASTM D-7234 (formerly ASTM D-4541), shall have such a higher degree of adhesion to the specified concrete (4,000 psi minimum) surface that there shall be a 100% concrete failure in the performance of this test. The prepared specimens shall be conditioned at room temperature (75°F +/- 2°F) for a minimum of 24 hours and a maximum of 72 hours prior to the performance of the indicated test.

13. **Hardness**

The epoxy paint pavement marking materials, when tested according to ASTM D-2240, shall have a Shore D Hardness greater than 80. Samples shall be allowed to cure at room temperature (75°F +/- 2°F) for a minimum of 24 hours and a maximum of 72 hours prior to performing the indicated test.

14. **Abrasion Resistance**

The epoxy paint pavement marking material, when tested according to ASTM D-4060 (formerly ASTM C-501) using a Taber Abrader, CS-17 wheels, at 1,000g for 1,000 cycles, shall not have more than 80 mg weight loss. The test shall be run on samples applied at 15 +/- mils to S-16 stainless steel plates, without glass spheres and cured at 75°F +/- 2°F for between 24 and 72 hours.

15. **Tensile Strength**

When tested according to ASTM D-638, the epoxy paint pavement marking materials shall have an average tensile strength of not less than 6,000 pounds per square inch. The Type IV Specimens shall be pulled at a rate of 1/4 inch per minute by a suitable dynamic testing machine. The samples shall be allowed to cure at room temperature (75°F +/- 2°F) for a minimum of 24 hours and a maximum of 72 hours prior to performing the indicated tests.

16. **Compressive Strength**

When tested according to ASTM D-695, the catalyzed epoxy paint pavement marking materials shall have an average compressive strength of not less than 12,000 pounds per square inch. The cast sample shall be conditioned at room temperature (75°F +/- 2°F) for a minimum of 72 hours before performing the indicated tests. The rate of compression of these samples shall be no more than 1/4 inch per minute.

C. GLASS BEADS

1. Glass Spheres

Spherical glass beads shall be used as reflective media in LS50. The glass spheres shall be colorless, clean, transparent and free of excessive air bubbles. The surface of the spheres shall not exhibit any scarring or scratching. The refractive index of the glass spheres shall be a minimum of 1.50 as determined by the liquid immersion method at 75°F/24°C. The silica content of the glass spheres shall be a minimum of 60% by weight.

2. Gradation of Glass Spheres

There shall be two gradation types used in the LS50 epoxy pavement marking material. The large glass spheres shall conform to the Type 4 gradation described in the Standard Specification for Construction of Roads and Bridges on Federal Projects FP-96, Section 718.19. The small glass spheres shall conform to the AASHTO M-247 Type 1 Specification.

D. APPLICATION

Equipment

Epoplex shall approve the equipment used for the application of LS50. The equipment shall be capable of spraying both white and yellow epoxy according to Epoplex's recommended proportions and be of sufficient size and stability with adequate hydraulic and air power supplies to produce lines of uniform dimensions. The equipment shall have a high-pressure air blast cleaning system capable of cleaning the pavement immediately prior to applying the markings.

The equipment shall be specifically designed to apply two-component liquid materials through airless static tube or impingement mixing guns in a continuous and/or skip-line pattern. The guns must accommodate plural component material systems with a volumetric ratio of two to one.

The equipment shall be mobile, truck mounted and self-contained. The equipment shall be maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. Truck mounted application units shall be equipped with accessories to allow for the application of legends, symbols, crosswalks and other special markings.

The agency engineer and material manufacturer together may approve the use of a portable applicator in lieu of truck mounted accessories for the application of special markings provided such equipment can demonstrate satisfactory application of reflectorized markings in accordance with these specifications.

E. SURFACE PREPARATION

1. Temperature

LS50 epoxy must be applied only when atmospheric and surface temperatures are 40°F/5°C or higher.

2. Moisture

Pavement surfaces must be clean and dry prior to the application of LS50 epoxy.

3. Miscellaneous Debris

The pavement surface must be free of oil, grease, dirt and dust prior to the application of LS50 epoxy. A grinder or shot blaster is recommended for removal of such surface contaminants prior to material application.

4. New Portland Cement Concrete

The curing compounds must be completely removed from Portland cement surfaces prior to the application of LS50 epoxy. High pressure water-blasting, sandblasting and/or shot blasting are the recommended methods for removing curing compounds.

5. New Asphalt

LS50 epoxy can be applied directly to new asphalt surfaces as soon as the asphalt has cooled and can support the weight of application equipment. The asphalt surface must be free of excess asphalt emulsions and oils to ensure proper adhesion of the markings.

6. Chip and Slurry Seal Coated Surfaces

Slurry seal coats must be completely cured prior to the application of LS50 epoxy. Chip seal surfaces must be free of loose aggregate. A reasonable waiting period to allow vehicles to wear off loose aggregate is recommended.

7. **Removal of Existing Pavement Markings**

Existing pavement markings must be removed prior to the application of LS50 epoxy. The roadway surface should be water-blasted, sandblasted and/or shot blasted until a minimum of 80% of the pavement surface is exposed. Oil based paints and epoxies used as temporary markings must be removed prior to application of LS50 epoxy.

LS50 epoxy may be applied over latex water-based paint applied as a temporary marking, provided these markings were applied at a mil thickness of 10 mils or less. If these water based paint markings were applied over Portland Cement prior to removal of the curing compound, these markings must be removed prior to application of LS50 epoxy.

F. APPLICATION

1. **Film Thickness**

The material film thickness shall vary depending on the condition and type of pavement surface being marked. The applied film thickness, calculated without drop-on glass spheres, shall conform to the following:

Surface Type	LS50 Application Rate (1 inch = 1,000 mils)
Smooth Asphalt or Concrete Surface	20 ± 2 mils
New Smooth Concrete Surface	20 ± 2 mils
New Grooved Concrete Surface	25 ± 2 mils
New Asphalt Surface (Standard Mix)	20 ± 2 mils
Open Grade Friction Course or Stone Matrix Asphalt (SMA)	25 ± 2 mils
Rough Asphalt or Concrete	22 ± 2 mils
Smooth Asphalt or Concrete After Removal of Existing Markings	22 ± 2 mils
Chip Seal	20 ± 2 mils
Slurry Seal	20 ± 2 mils

Applied markings shall have uniform mil thickness and glass bead distribution across the width of the line. The markings shall have crisp distinct edges and clean cutoff at the end of each line.

2. **Drop-On Glass Sphere Application**

Type 1 and Type 4 glass spheres, as described in sections C1 and C2 above, shall be applied to the LS50 epoxy in a double drop operation. Type 4 spheres shall be applied first from the bead dispenser directly behind the epoxy application gun followed immediately by the application of Type 1 beads from a second bead dispenser. The application rates of each of the glass spheres shall conform to the following:

3. **Protection of Newly Installed Markings**

All applied markings shall be protected from traffic and potential tracking while the LS50 epoxy cures. Markings may be saturated with glass spheres to help prevent tracking.

Mils of LS50 Applied	Application Rate of Glass Spheres
20 mils	10 lbs/gallon of Type 1 10 lbs/gallon of Type 4 (Total of 20 lbs per gallon)
22 mils	12 lbs/gallon of Type 1 12 lbs/gallon of Type 4 (Total of 24 lbs per gallon)
25 mils	15 lbs/gallon of Type 1 15 lbs/gallon of Type 4 (Total of 30 lbs per gallon)

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AASHTO M247-11 TYPE 1 GLASS BEAD MARKING SPHERES

1.0 GENERAL REQUIREMENTS

The beads shall be clear, smooth and spherically shaped and shall conform to the following specific requirements.

1.1 ***Gradation*** – The **AASHTO M247-11 TYPE 1** glass beads shall meet the gradation requirements as given below and shall be tested in accordance to ASTM D1214 and AASHTO PP-74-13.

US Sieve No.	Microns	Mass % Passing
16	1180	100
20	850	95-100
30	595	75-95
50	297	15-35
100	149	0-5

1.2 ***Roundness*** – **AASHTO M247-11 TYPE 1** safety spheres shall be at least 70% round by Computerized Optical Method (AASHTO PP-74-13) or approved equivalent in accordance with AASHTO T346-13 Section 6. %Rounds may increase to meet local specification enhancement.

1.3 ***Refractive Index*** – The **AASHTO M247-11 TYPE 1** glass beads shall have a refractive index of 1.50 to 1.55.

1.4 ***Coating*** – The **AASHTO M247-11 TYPE 1** can be ordered with coatings to meet or exceed each state or paint manufacturer specification, typically an Adherence Enhancing or Dual Coating.

2.0 APPLICATION SPECIFICATIONS

AASHTO M247-11 TYPE 1 Glass Bead Drop rates in lbs./100 sq. foot				
System	Standard 15 mil Waterborne	High build Waterborne	Epoxy	Thermoplastic
Single Drop	6-8	6-8	12-16	6-8
Double Drop with M247 Type 1		6-8 8	12-16 8	6-8 8

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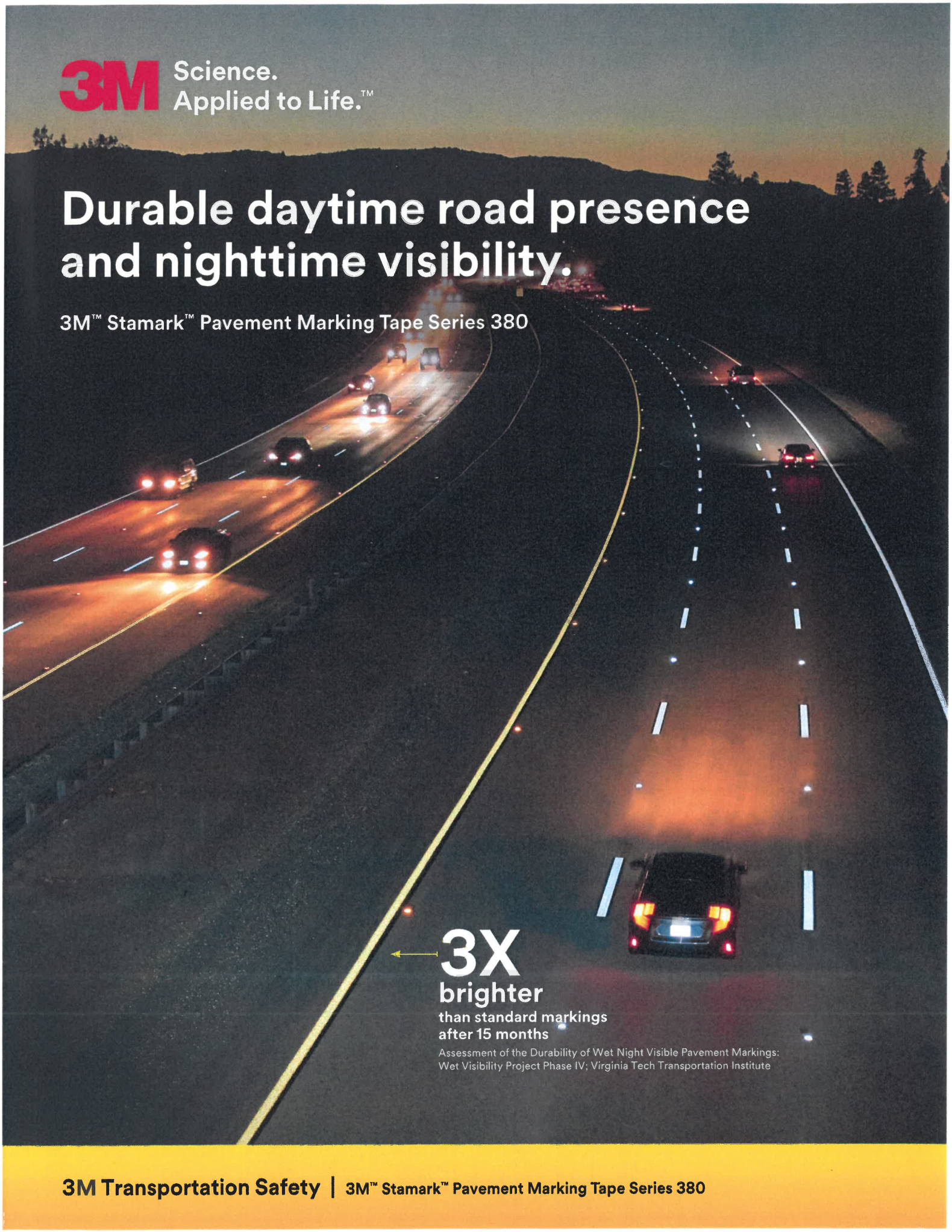

3M Science. Applied to Life.™
Durable daytime road presence and nighttime visibility.
3M™ Stamark™ Pavement Marking Tape Series 380
3X
brighter
than standard markings after 15 months
Assessment of the Durability of Wet Night Visible Pavement Markings: Wet Visibility Project Phase IV; Virginia Tech Transportation Institute
3M Transportation Safety | 3M™ Stamark™ Pavement Marking Tape Series 380

Durable by design.

More durable pavement markings reduce the need for frequent costly lane closures associated with replacing markings. 3M™ Stamark™ Pavement Marking Tape Series 380 is ideal for permanent long line applications on high-traffic roadways.

Get the durability, wet reflectivity and high-contrast visibility you need to help make roads easier and safer to navigate. These pre-formed reflective tapes are for permanent-type applications such as lane and center lines, edge lines, gore markings, crosswalks, stop bars, symbols and legends.

Built for the long haul.

The unique microcrystalline ceramic beads used in Stamark Series 380 are far tougher, harder and more resistant to harsh conditions than conventional glass beads—retaining their visibility long after other beads become ineffective.

Long-lasting day and nighttime visibility.

Dirt and abrasion resistance is an integral part of Stamark Series 380—from the microcrystalline ceramic beads to the brilliant white and yellow topcoats.

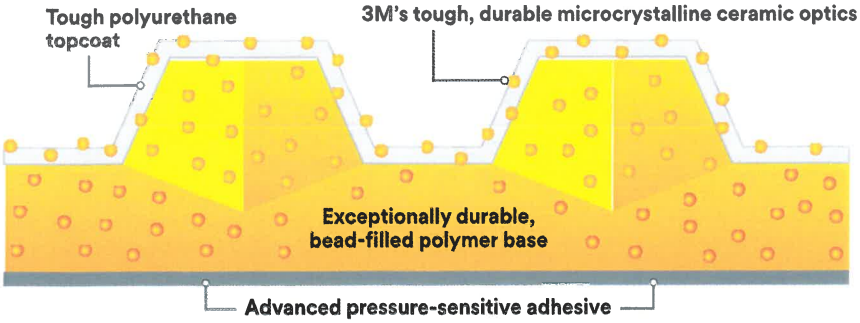
Easy application.

Pre-formed tape is easy to apply—just unwind, apply and tamp. For an extended season, series 380IES can be applied early and late season, at temperatures down to 40°F (4°C) with use of our Surface Preparation Adhesive.

Pre-formed and ready from the box.

No installation variability—Stamark Series 380 is manufactured in the USA to the high quality standards you expect from 3M.

How it works.



A cross-section of 3M™ Stamark™ Pavement Marking Tape Series 380 shows 3M's advanced technologies in every aspect of construction, inside and out.

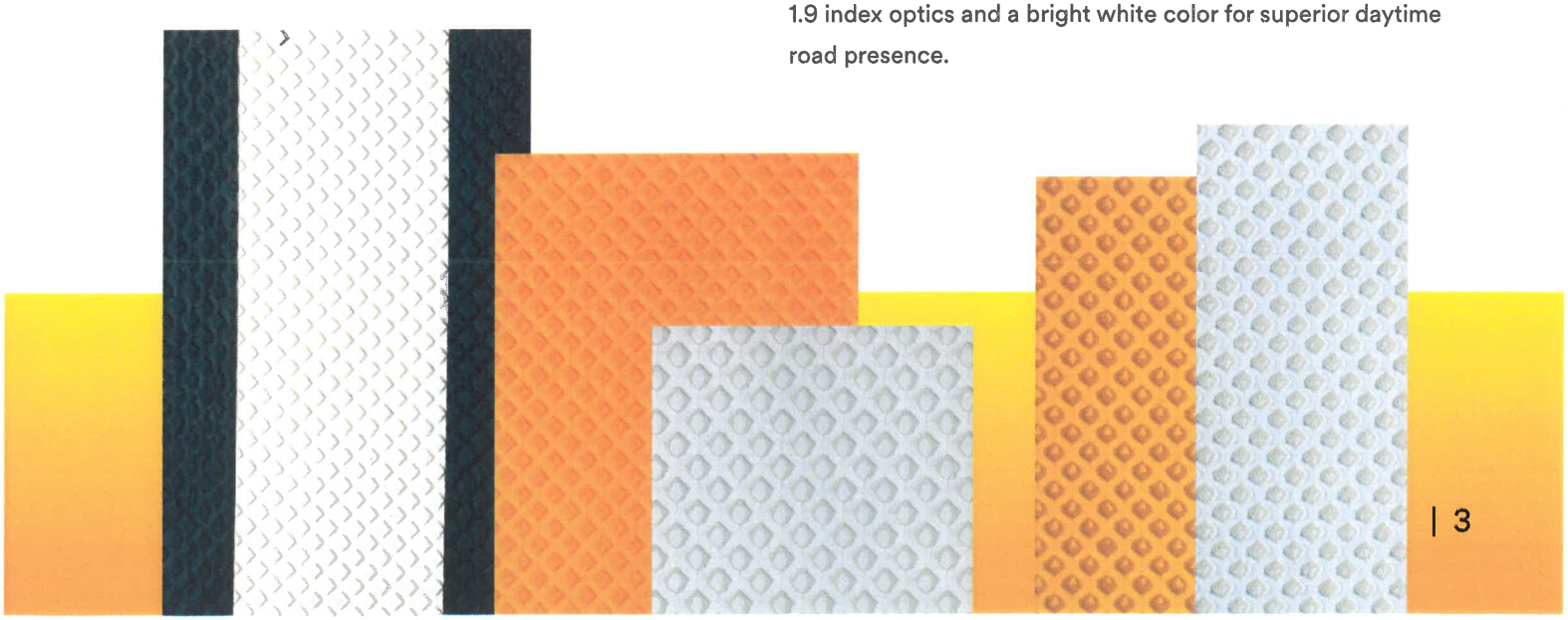
59%
of fatal crashes
happen during dark or poor light conditions.
Source: Federal Highway Administration

70% **of weather related vehicle crashes**
occur on wet pavement or when it's raining.
Source: https://ops.fhwa.dot.gov/weather/q1_roadimpact.htm
https://www-fars.nhtsa.dot.gov/Crashes/CrashesTime.aspx
https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/810637

Our high-performance pavement marking tapes are ideal for interstates, dark rural roads and urban streets where nighttime reflectivity is critical. These tapes are built to last with abrasion-resistant microcrystalline ceramic beads bonded in a highly durable polyurethane topcoat.

3M™ Stamark™ All Weather Tape Series 380AW
Provides excellent retroreflectivity in both dry and rainy conditions, with a combination of 3M's 2.4 and 1.9 index optics, providing you all weather performance. The high-profile diamond pattern aids in water dispersion, helping to improve wet recovery.

3M™ Stamark™ High Performance Tape Series 380IES
Provides excellent nighttime retroreflectivity with our durable 1.9 index optics and a bright white color for superior daytime road presence.



Product Specifications

Application	Series	Product	Color	Available Marking Width (Inches)	Available Contrast Width (Inches)	Optics
Long Line	A380IES	A380IES	White	4, 5, 6, 8, 10, 12, 18, 24		Dry
		A381IES	Yellow	4, 5, 6, 8, 12, 24		Dry
		A385ES	Black	2, 4, 5, 6		None
	A380IES Contrast	A380I-SES	White	4, 5, 6, 8	1.5, 2*	Dry
		A381I-SES	Yellow	4, 5, 6	1.5, 2*	Dry
	380AW	A380AW	White	4, 5, 6, 8, 10, 12, 24		All Weather
		A381AW	Yellow	4, 5, 6, 8, 12, 24		All Weather
		A385AW	Black	2, 4, 5, 6		None
	380AW Contrast	A380AW-5	White	4, 5, 6, 8	1.5, 2*	All Weather
		A381AW-5	Yellow	4, 5, 6, 8	1.5, 2*	All Weather
Symbols & Legends	380IES	SMS-L380IES	White	Standard MUTCD Configurations	1.5	Dry
	380AW	SMS-L380AW	White		1.5	All Weather

*2 inch available only with 6 inch tape.

We're here to help.

3M offers 24/7 support to help ensure your success in the planning and installation of our pavement markings. Our engineers understand the conditions and challenges you face during installation and are here to help your project be a success and ensure you're happy with the results.

Contact an application specialist at 1-800-553-1380.

Find technical specifications and application information documents in the Resource Library:

Product Bulletin:
Stamark™ High Performance All Weather Tape Series 380AW

Product Bulletin:
3M™ Stamark™ High Performance Tape Series 380IES

Application Folder 5.7:
Stamark™ Surface Preparation and Application Techniques

Keep moving forward at 3M.com/PavementMarkings.

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Specification for Durable, All Weather, Preformed, Patterned Pavement Markings

3M™ Stamark™ High Performance All Weather Tape Series 380AW

March 2016

(SP380AW)

Market Test Specification For Durable, All Weather, Preformed, Patterned Pavement Markings

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March 2016

I. Description

This work shall consist of furnishing and installing retroreflective preformed patterned pavement markings in accordance with this provision and in reasonably close conformance to the dimensions and lines shown on the plans or established by the engineer.

II. Materials - General

The preformed patterned markings shall consist of white or yellow films with clear microcrystalline ceramic beads incorporated to provide immediate and continuing retroreflection during both wet and dry conditions. This film shall be manufactured without any intentional use of lead chromate pigments or other similar, lead-containing chemicals.

Preformed words and symbols shall conform to the applicable shapes and sizes as outlined in the "Manual on Uniform Traffic Control Devices for Streets and Highways."

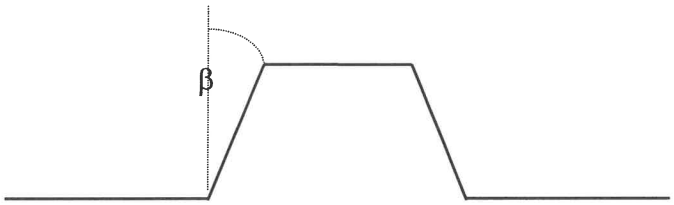
The preformed markings shall have a pre-coated pressure sensitive adhesive, and shall be capable of being adhered to properly prepared asphalt cement concrete and Portland cement concrete, when installed according to the manufacturer's application requirements. The preformed markings shall conform to pavement contours by the action of traffic. The pavement markings shall be capable of application on new, asphalt cement concrete wearing courses during the paving operation in accordance with the manufacturer's instructions. After application, the markings shall be immediately ready for traffic. The bidder shall identify proper surface preparation adhesives (where necessary) to be applied at the time of application, all equipment necessary for proper application, and requirements for application that help assure effective product performance. The preformed markings shall be suitable for use for one year after the date of receipt when stored in accordance with the manufacturer's requirements.

III. Classification

The markings shall be highly durable and retroreflective pliant polymer materials designed for longitudinal and word/symbol markings subjected to high traffic volumes and severe wear conditions such as shear action from crossover or encroachment on typical longitudinal configurations such as edge lines and lane lines. The markings shall be capable of providing retroreflection during both wet and dry conditions.

IV. Requirements

Composition: The retroreflective pliant polymer pavement markings shall consist of a mixture of high-quality polymeric materials, pigments and glass beads distributed throughout its base cross-sectional area, with a reflective layer of microcrystalline ceramic beads bonded to a durable polyurethane topcoat surface. The patterned surface shall have approximately 40% ± 15% of the surface area raised, or 40% +/- 10% of the total pavement marking volume raised, and presenting a near vertical face (ß angle of 0° to 60°) to traffic from any direction (see diagram below). The channels between the raised areas shall be substantially free of exposed beads or particles.



Retroreflectance: The white and yellow markings shall have the initial expected retroreflectance values as shown in Table 1 under dry, wet, and rainy conditions. The photometric quantity to be measured shall be coefficient of retroreflected luminance (R_L) and shall be expressed as millicandelas per square foot per foot-candle [mcd/ft^2/fc]. The metric equivalent shall be expressed as millicandelas per square meter per lux [mcd/m^2/lx].

Retroreflectance values shall be measured under dry conditions in accordance with the testing procedures of ASTM E1710.

Initial retroreflectance values shall be measured under wet conditions in accordance with ASTM E2832-12 or ASTM E2177 prior to installation. Wet retroreflectance values measured under a "condition of continuous wetting" (simulated rain) shall be in accordance with ASTM E2832-12. Wet retroreflectance values measured under a "condition of wetness" (wet recovery) shall be in accordance with ASTM E2177. To reduce variability between measurements, the test method shall be performed in a controlled laboratory environment while the marking is positioned with a 3 to 5 degree lateral slope. A wetting agent shall be used to improve wetting of the pavement marking by the water. It is required that a 0.1% by volume liquid soap solution be used.

Measurements shall be reported as an average for each roll tested, in a minimum of three locations.

In-service wet retroreflectance values measured under a standard condition of continuous wetting shall be in accordance with ASTM E2832-12, and the test may be performed with the marking installed on the road. Measurements in the field shall not be made where both the cross slope and grade are less than 0.5 percent, or where the water submerges the test specimen. Newly installed markings shall be tested using a wetting agent, as previously described.

Table 1. Minimum Retroreflectivity Values

Color	White		Yellow	
Condition/Test	Dry ASTM E1710	Wet & Rainy ASTM E2832-12 or ASTM E2177	Dry ASTM E1710	Wet & Rainy ASTM E2832-12 or ASTM E2177
Entrance Angle[1]	88.76°	88.76°	88.76°	88.76°
Observation Angle[1]	1.05°	1.05°	1.05°	1.05°
Coefficient of Retroreflected Luminance [mcd/m²/lux]	500	250	300	200

Notes: *Coefficients of retroreflected luminance when measured under ASTM E2177 will be higher than when measured under ASTM E2832-12. Stated minimum values shall be met using either test method.*

English R_L: Millicandelas per square foot per foot-candle [(mcd/ft²)/fc]

Metric R_L: Millicandelas per square meter per lux [(mcd/m²)/lx]

Beads: Index of Refraction: All "dry-performing" microcrystalline ceramic beads bonded to the polyurethane-coated, patterned surface of the material shall have a minimum index of refraction of 1.70 when tested using the liquid oil immersion method. All "wet-performing" microcrystalline ceramic beads bonded to the polyurethane-coated, patterned surface of the material shall have a minimum index of refraction of 2.30 when tested using the liquid oil immersion method. The glass beads mixed into the pliant polymer shall have a minimum index of refraction of 1.5 when tested by the liquid oil immersion method.

Testing Procedure for Refractive Index of Beads By Liquid Immersion

Equipment Required:

1. Microscope (minimum 100X magnification)
2. Light source - preferably sodium light or other monochromatic source, but not absolutely essential
3. Refractive index liquids*
4. Microscope slide and slide cover
5. Mortar and pestle

*Available from R.P. Cargille Laboratories, Inc., Cedar Grove, NJ.

[1] Entrance Angle 88.76° and Observation Angle 1.05° represent a simulated driver viewing geometry at a 30 meter distance.

Procedure:

1. Using the mortar and pestle, crush a few representative beads and place a few of these crushed particles on a microscope slide.

2. Place a drop of a refractive index liquid, with an index as close to that of the glass as can be estimated, on the particles.

3. Cover the slide with a microscope slide cover and view the crushed particles by transmitted light normal to the slide surface (illuminated from the bottom).

4. Adjust the microscope mirror to allow a minimum light intensity for viewing. This is particularly important if sodium light is not used.

5 Bring a relatively flat and transparent particle into focus.

6. By slightly raising and lowering the objective (microscope tube), look for one or both of the following:

    a. Becke Line - This light line will appear to move either into the particle or away from it. In general, if the objective is raised, the line will move toward the material of higher refractive index; if the objective is lowered, the line will move toward the material of lower index.

    b. Variation in Particle Brightness - When raising the object from a sharp focus, the particle will appear to get brighter or darker than the surrounding field. If it becomes brighter, the glass has a higher refractive index than the liquid. If it becomes darker, the glass has a lower refractive index than the liquid. In both cases, the opposite will be true if the object is lowered.

7. This test can be used to confirm that the beads are above or below a specified index. It can also be used to give an accurate determination of the index (± 0.001). This is done by using several refractive index liquids until a match or near match of indices occurs. The index of the glass will equal that of the liquid when no Becke line and no variation in bead brightness can be observed.

The size and quality of the beads shall be such that the performance requirements for the retroreflective pliant polymer shall be met.

Acid Resistance: The beads shall show resistance to corrosion of their surface after exposure to a 1% solution (by weight) of sulfuric acid. The 1% acid solution shall be made by adding 5.7cc of concentrated acid into 1000cc of distilled water. CAUTION: Always add the concentrated acid into the water, not the reverse. The test shall be performed as follows:

Take a 1-inch x 2-inch sample, adhere it to the bottom of a glass tray and place just enough acid solution to completely immerse the sample. Cover the tray with a piece of glass to prevent evaporation and allow the sample to be exposed for 24 hours under these conditions. Then decant the acid solution (do not rinse, touch or otherwise disturb the bead surfaces) and dry the sample while adhered to the glass tray in a 150° F. (66° C.) oven for approximately 15 minutes.

Microscopic examination (20X) shall show no more than 15% of the beads having a formation of a very distinct opaque white (corroded) layer on their entire surface.

Color: The preformed markings shall consist of white and yellow films with pigments selected and blended to conform to standard highway colors.

Skid Resistance: The patterned surface of the retroreflective pliant polymer shall provide an initial average skid resistance value of 45 BPN when tested according to ASTM E303 except values shall be taken in one direction and then at a 45° angle from that direction. These two values shall then be averaged to find the skid resistance of the patterned surface.

Thickness: The patterned material without adhesive shall have a minimum caliper of 0.085 inches (2.159mm) at the thickest portion of the patterned cross-section and a minimum caliper of 0.020 inches (.508mm) at the thinnest portion of the cross-section.

V. Warranty

The manufacturer shall warrant that white and yellow pavement marking material sold for this application in the United States and Canada will remain effective for its intended use under normal traffic conditions and meet the minimum retained coefficient of dry retroreflection value of 100 millicandelas per foot squared per foot-candle (in accordance with ASTM E1710), subject to the following provisions:

Table 2
Warranty Periods

Application*	Dry Retroreflectivity Warranty Period
Longitudinal Markings	4 years
Symbols and Legends	2 years

*Applications in mountainous, heavy snowfall areas above 5,000 ft. (1,500m) are not covered by this warranty.

If the pavement markings are applied in accordance with all the manufacturer's application requirements and fail during the warranty period, fail to adhere to the roadway, or fail due to complete wear-through during the warranty period shown above (from the date of installation), the manufacturer's sole responsibility and purchaser's and user's exclusive remedy shall be:

Manufacturer will provide the replacement materials that will restore the pavement marking retroreflectivity values to warranty levels or greater.

Conditions

Such failure must be solely the result of design or manufacturing defects in the pavement marking material and not of outside causes such as improper installation or substrate failure. Failure to follow required application procedures will void this warranty.

Damage to pavement markings caused by snow removal equipment is not covered under this warranty.

A visual night inspection must be made with a manufacturer's representative and a customer representative present to identify areas of the installation which appear to be below the minimum dry retained reflectance values of 100 millicandelas per foot squared per foot-candle. Areas which appear to be below the minimum retained reflectance value shall be identified as "zones of measurement." To qualify for material replacement, follow the steps below:

Sampling and Testing Procedure for Determining Initial and Retained Coefficients of Retroreflected Luminance for Manufacturer's Warranty Purposes

Step 1: A visual night inspection must be made with a Manufacturer's representative and a customer representative present to identify areas of interest which appear to be below the specified minimum retained reflectance values. Areas of interest which appear to be below the minimum retained reflectance value shall be identified as potential zones of investigation

("Zone of Investigation"). To qualify for a warranty claim, a Zone of Investigation must be at least 360 feet (108 meters) in road length, and shall consist of either edge lines, center lines or lane lines, but not in combination.

Step 2: Within each Zone of Investigation, reflectance measurements must be taken at specified measurement sections. The measurement procedure varies based on the total length of the Zone of Investigation, as described below.

a. Zone of Investigation Measuring 360 Feet (108 m) to 1,080 Feet (324 m) in Length

For continuous lines, reflectance measurements must be made at approximately 20 ft. (6 m) intervals throughout the Zone of Investigation. For skip lines, two measurements must be taken at two random locations on each skip throughout the Zone of Investigation.

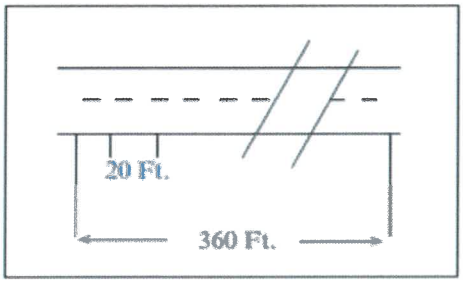


Figure 1

b. Zone of Investigation Measuring 1,080 Feet (324 m) to 6 Miles (9.6 km) in Road Length

A minimum of three measurement sections must be specified within the Zone of Investigation. Each measurement section must be at least 360ft in road length. The start point, the midpoint and the end point of the Zone of Investigation must be included in a measurement section, as shown in Figure 2. A minimum of 18 measurements must be made at each measurement section. For continuous lines, reflectance measurements must be made at 20-foot (6 m) intervals throughout each measurement section. For skip lines, two measurements must be taken at two random locations on each skip in the measurement sections.

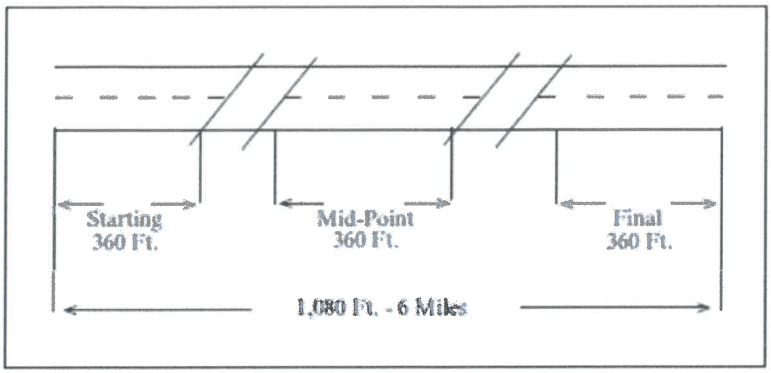


Figure 2: Measure every 20 ft. on continuous lines or 2 measurements per skip for each measurement section.

c. Zone of Investigation Greater than 6 Miles in Road Length

Each 3-mile (4.8 kilometers) interval throughout the Zone of Investigation must include at least one measurement section. In each measurement section, a minimum of 18 measurements must be made. The start point and the end point of the Zone of Investigation must be a part of a measurement section. For continuous lines, reflectance measurements must be made at 20-foot (6 m) intervals throughout each measurement section. For skip lines, two measurements must be taken at two random locations on each skip in the measurement sections.

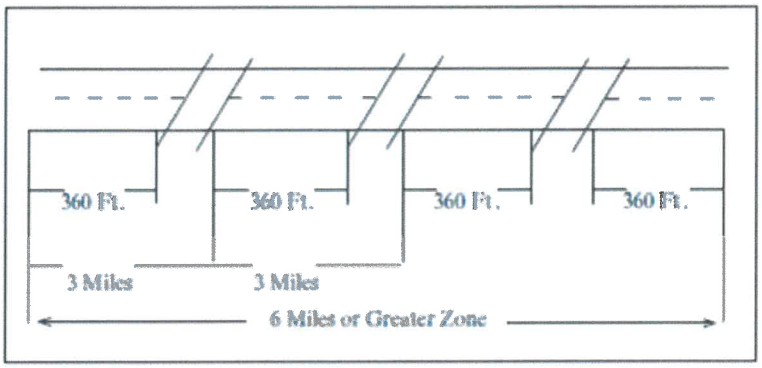


Figure 3: Measure every 20 ft. on continuous lines or 2 measurements per skip for each measurement section.

Step 3: All reflectance measurements made at the checkpoints shall be made on a clean, dry surface at a minimum temperature of 40° F (4° C). The test instrument shall use an Entrance Angle of 88.76° and an Observation Angle 1.05° which represent a simulated driver viewing geometry at a 30 meter distance.

Step 4: All reflectance measurements within the Zone of Investigation must be averaged to determine if the minimum retained retroreflectance values have been met.

VI. Installation

The markings shall be applied in accordance with the manufacturer's installation instructions. Marking configurations shall be in accordance with the "Manual on Uniform Traffic Control Devices."

In snow removal states, the markings should preferably be inlaid in the fresh surface during final rolling of the mat, or grooved into existing pavement surfaces in accordance with the manufacturer's installation instructions. These markings can also be overlaid on new or existing pavement surfaces in accordance with the manufacturer's installation instructions.

VII. Contract Units and Basis For Payment

Linear pavement markings will be measured in linear feet complete-in-place for the width specified.

Retroreflective preformed pavement markings will be paid for at the contract unit price, which shall be full compensation for cleaning and preparing the pavement surface, for furnishing and placing all materials, and for all materials, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Preformed Pavement Marking, Linear (width)	Linear Foot
Preformed Pavement Marking, Words/Symbols	Each