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FILE NO.

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
INTRADEPARTMENTAL CORRESPONDENCE

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BY _____ DATE _____
 BY _____ DATE _____
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MEMO TO: MR. TODD HUMPHREYS
ENGINEERING TECHNICIAN DCL
TRAFFIC ENGINEERING MANAGEMENT

MR. JASON DAVIS, P.E.
MATERIALS & TESTING EVALUATION ENGINEER

MR. PHILLIP MACALUSO
TRAFFIC SERVICES CONSTRUCTION/MAINT MANAGER

FROM: MR. RICHIE CHAROENPAP, P.E. *[Signature]*
NEW PRODUCT EVALUATION COORDINATOR

DATE: FEBRUARY 11, 2015

SUBJECT: NEW PRODUCT EVALUATION
OFFER NO. 06.253
CROWN UFO'S ALL WEATHER STRIPPING SYSTEM

In accordance with EDSM V.4.1.1, the recommendation of the New Products Evaluation Committee, and with your concurrence, we have selected each of you as a Product Evaluators to evaluate the above material. The New Products Committee reviewed the product on February 10, 2015 and determined that it has potential merit.

Attached is an information sheet on the product. See Attachment. The primary use of this product is to provide extreme retroreflectivity in all weather conditions, as well as audible/vibratory warning when driven over.

RECOMMENDED FOR APPROVAL DATE

RECOMMENDED FOR APPROVAL DATE

RECOMMENDED FOR APPROVAL DATE

APPROVED DATE



CROWN TECHNOLOGY, LLC

35 INDUSTRIAL PARK DRIVE
P.O. BOX 789
WOODBURY, GA 30293
(706) 553-9500
FAX (706) 553-9501

January 5, 2015

Crown UFO's™ Reflective Pavement Marking System



Crown UFO's™ are Crown Technology, LLC's US patent pending Reflective Pavement Marking Markers designed specifically to bond to Crown Technology's TuffLine™ Pavement Marking Material. When applied properly to asphalt surfaces, Crown UFO's™ will provide extreme retro-reflectivity in all weather conditions, as well as audible/vibratory warning when driven over.

Product Advantages

- ✓ Crown UFO's™ are designed to bond to the thermoplastic road stripe without additional adhesives
- ✓ Crown UFO's™ are applied during the striping operation, no additional crews or disruptions to traffic
- ✓ Crown UFO's™ curing time is the same as regular thermoplastic applications
- ✓ Standard ribbon gun/bead dispenser can be used
- ✓ No additional traffic control required
- ✓ Application speed is comparable to that of standard thermoplastic application
- ✓ Dispenser easily attaches to most existing striping trucks with little modification

Product Specifications – Crown UFO's™

Shape: decagonal discs with sloping sides
Size: approx. 0.5" high, and approx. 2.65" in diameter
Color: white or yellow (lead free)
Spacing: Variable depending on effect desired: 2.5' - 20'

Dispenser requirements – Crown UFO's™

- 75 psi air minimum
- 12v signal from vehicle timing system
- 16" of clearance between ribbon gun and bead dispenser
- Clear path for feed tube

Application Instructions – Crown UFO's™

Standard Crown thermoplastic application instructions should be followed with the following modifications:

- Absolute minimum thermoplastic temp of 400F is recommended.
- Minimum application thickness of 0.90" above the surface is required for proper bonding. Open grade and rougher surfaces may require a thicker application of thermoplastic to provide a level foundation for the UFO to bond to the baseline. Any visible air voids around the edge of the Crown UFO's™ indicates insufficient application thickness, or inadequate surface and may cause loss.
- Crown UFO's™ dispenser must be mounted within 6 inches of the ribbon gun.

Product Expectations

Crown UFO's™ are applied with an indirect dispensing system to a thermoplastic line. As such, the spacing between Crown UFO's™ will vary as much as a few inches. However, the overall number of Crown UFO's™ per mile are not affected. Crown UFO's™ are applied behind the thermoplastic, and like the glass beads, will shift to one side of the line in curves and radiuses. In sharper radiuses, hand application may be required.

Irregular surfaces and large cracks do not provide an adequate foundation and may cause the Crown UFO's™ to fail to bond properly.

Repairs

If unacceptable amounts of the Crown UFO's™ are found to be missing, defective, or improperly installed, repairs may be made as follows:

Spot repairs: Small sections can be repaired by hand in the following manner:

- Remove defective or misapplied Crown UFO's™ with chisel until surface is level.
- Heat the area of baseline where the replacement Crown UFO's™ is to be placed with a torch until drop on beads have sunk completely, and material is bubbling or smoking. Quickly drop the Crown UFO's™ onto the line and firmly push into the molten base material with a large diameter rod such as a hammer handle, until molten material is squeezed out from underneath on all sides of the Crown UFO's™. If there is insufficient base material where the repair should be made, molten material may be added to ensure a proper bond.

Small sections: Small sections can be repaired as instructed above, or by re-applying with the striping truck. Immediately before re-applying, run out sufficient material into a tray or box, to ensure that the material is above 400F.

Large sections: Large sections will require grinding the existing marking down to a level that when .090" is added, the base material will be below required maximum line thickness standards set by local governing body. Grinding is preferred method of removal.

Crown Technology, LLC
35 Industrial Park Drive, P.O. Box 789, Woodbury, GA 30293
Ph: (706) 553-9500 Fax: (706) 553-9501



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MEMO TO: MR. TODD HUMPHREYS
ENGINEERING TECHNICIAN DCL
TRAFFIC ENGINEERING MANAGEMENT

MR. JASON DAVIS, P.E.
MATERIALS & TESTING EVALUATION ENGINEER

MR. PHILLIP MACALUSO
TRAFFIC SERVICES CONSTRUCTION/MAINT MANAGER

FROM: MR. RICHIE CHAROENPAP, P.E.
NEW PRODUCT EVALUATION COORDINATOR

DATE: JUNE 2, 2014

SUBJECT: NEW PRODUCT EVALUATION
OFFER NO. 06.247
CROWN COOKIES

In accordance with EDSM V.4.1.1, the recommendation of the New Products Evaluation Committee, and with your concurrence, we have selected each of you as a Product Evaluators to evaluate the above material. The New Products Committee reviewed the product on May 13, 2014 and determined that it has potential merit.

Attached is an information sheet on the product. See Attachment. The primary use of this product is an audible vibratory pavement marking.



35 Industrial Park Drive
P.O. Box 789,
Woodbury, GA 30293
706.553.9500 / 706.553.9501 (fax)



CROWN
TECHNOLOGY, LLC

Crown Cookies™ Audible Pavement Markers



Product Description

CrownCookies™ are Crown Technology, LLC's US patented Audible Pavement Markers designed specifically for use in Crown Technology's TuffLine™ Pavement Marking Material. When applied properly, Crown-Cookies™ will provide an audible/vibratory warning when driven over. Alternative uses, such as island accents or shoulder rumbles, on concrete will require hand application with the use of bitumen.

Product Advantages

- ✓ One Pass System
- ✓ CrownCookies™ are the correct size and shape from the factory, no field adjustments required
- ✓ Since CrownCookies™ are preformed, curing time is the same as regular thermoplastic applications
- ✓ Standard ribbon gun/bead dispenser can be used
- ✓ No additional traffic control required
- ✓ Application speed is comparable to that of standard thermoplastic application
- ✓ Cookie Dispenser™ easily attaches to most existing striping trucks with little modification

Product Specification

- Shape:** round discs with sloping sides
- Size:** approx. 0.45" high, and approx. 2.75" in dia.
- Color:** white or yellow (lead free)
- Spacing:** 22-36" for maximum audible/vibratory effect, can vary Audible: Typical 80dBA @55mph /28" spacing

Dispenser Requirements

- 75 psi air minimum
- 12v signal from vehicle timing system
- 16" of clearance between ribbon gun and bead dispenser
- Clear path for feed tube





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MEMO TO: MR. TODD HUMPHREYS
ENGINEERING TECHNICIAN DCL
TRAFFIC ENGINEERING MANAGEMENT

MR. JASON DAVIS, P.E.
MATERIALS & TESTING EVALUATION ENGINEER

MR. PHILLIP MACALUSO
TRAFFIC SERVICES CONSTRUCTION/MAINT MANAGER

FROM: MR. RICHIE CHAROENPAP, P.E.
NEW PRODUCT EVALUATION COORDINATOR

DATE: NOVEMBER 18, 2013

SUBJECT: NEW PRODUCT EVALUATION
06.240 VIBRALINE WHITE – PROFILED THERMPOLASTIC
06.241 VIBRALINE YELLOW – PROFILED THERMOPLASTIC
06.242 VIBRALINE WHITE II – PROFILED THERMPOLASTIC
06.243 VIBRALINE YELLOW II – PROFILED THERMOPLASTIC

In accordance with EDSM V.4.1.1, the recommendation of the New Products Evaluation Committee, and with your concurrence, we have selected each of you as a Product Evaluators to evaluate the above material. The New Products Committee reviewed the product on November 12, 2013 and determined that it has potential merit.

Attached is an information sheet on the product. See Attachment. The primary use of this product is most every marine coating need.

As evaluator, your responsibility is to:

RECOMMENDED FOR APPROVAL _____ DATE _____

RECOMMENDED FOR APPROVAL _____ DATE _____

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APPROVED _____ DATE _____

OFFER NO. 6-242

REV. 8/00

Confirmed Receipt _____

MEETING: 11/13

(FOR DOTD USE ONLY)

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT NEW
PRODUCT EVALUATION COMMITTEE (NPE) FORM INFORMATION FOR
EVALUATION PURPOSES

Trade name: Vibraline II White Profiled Thermoplastic Road Marking Material (Bumps and base installed in 2 passes)

Manufacturer (company name): Ennis-Flint

Manufacturer contact person: Dennis Evangelista

Address: 115 Todd Court, Thomasville, NC 27360
Street/P. O. Box City State Zip code

Phone: (336) 475-6600 Fax: (336) 475-7900

E-mail Address: qpladmin@ennistraffic.com Web Address: www.ennisflint.com

Manufacturer's representative (company name): _____
(If different than manufacturer)

Contact person: Howard Rife

Address: _____
Street/P. O. Box City State Zip code

Phone: (817) 975-4387 Fax: () _____

E-mail Address: hrife@ennistraffic.com Web Address: _____

Is product patented?: NO Applied for: NO

Recommended or primary use: Edge, center and skip striping on asphaltic and concrete roadways

Alternate or secondary use: Vibraline profiles give the driver an audible and mechanical alert of lane departure

Material composition (generic description): A white alkyd thermoplastic much like LA DOT 1015.10

Alternate or comparable to what existing materials or product: A raised bump profile version of 1015.10

Meets requirements of following specifications: AASHTO M249 and LA 1015.10

Is availability seasonal?: NO

Approximate delivery days after receipt of order: 15 days Are quantities limited: NO

New on market: NO Estimated cost of material per unit: \$1400 per ton

Will special equipment be required to install product: NO* if yes, will manufacturer/supplier furnish the special equipment and install the material: NO* any thermo truck can be used to install with slight adjustment

Are educational courses or films available: NO Has this proposal been made previously: NO

Additional information: Bump profile thermo has been used for years by NC, SC and FL DOT on both new and maintenance striping - Vibraline II is patterned after the SC specification and meets the audible specs of NC. Since it is applied in two passes, the bump portion can be retrofit on an existing intact thermoplastic line to boost retroreflection and to reduce lane departure accidents.

Field test sites in the following locations (state, contact person, telephone number): _____

Manufacturer/supplier shall attach twelve (12) copies of the form in addition to twelve (12) copies the following information in order to substantiate, verify or clarify its contents: specifications, drawings, sketches, pictures, warranty, installation instructions, material safety data sheet, product/material literature, test data sheets, certification, and test results.

OFFER NO. 6-243

REV. 8/00

Confirmed Receipt _____

(FOR DOTD USE ONLY)

MEETING: 11/13

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
NEW PRODUCT EVALUATION COMMITTEE (NPE) FORM
INFORMATION FOR EVALUATION PURPOSES

Trade name: Vibraline II Yellow Profiled Thermoplastic Road Marking Material (Bumps and base installed in 2 passes)

Manufacturer (company name): Ennis-Flint

Manufacturer contact person: Dennis Evangelista

Address: 115 Todd Court, Thomasville, NC 27360
Street/P. O. Box City State Zip code

Phone: (336) 475-6600 Fax: (336) 475-7900

E-mail Address: qpladmin@ennistraffic.com Web Address: www.ennisflint.com

Manufacturer's representative (company name): _____
(If different than manufacturer)

Contact person: Howard Rife

Address: _____
Street/P. O. Box City State Zip code

Phone: (817) 975-4387 Fax: () _____

E-mail Address: hrife@ennistraffic.com Web Address: _____

Is product patented?: NO Applied for: NO

Recommended or primary use: Edge, center and skip striping on asphaltic and concrete roadways

Alternate or secondary use: Vibraline profiles give the driver an audible and mechanical alert of lane departure

Material composition (generic description): A lead free yellow alkyd thermoplastic much like LA DOT 1015.10

Alternate or comparable to what existing materials or product: A raised bump profile version of 1015.10

Meets requirements of following specifications: AASHTO M249 and LA 1015.10

Is availability seasonal?: NO

Approximate delivery days after receipt of order: 15 days Are quantities limited: NO

New on market: NO Estimated cost of material per unit: \$1400 per ton

Will special equipment be required to install product: NO if yes, will manufacturer/supplier furnish the special equipment and install the material: NO* *any thermo truck can be used to install with slight adjustment

Are educational courses or films available: NO Has this proposal been made previously: NO

Additional information: Bump profile thermo has been used for years by NC, SC and FL DOT on both new and maintenance striping - Vibraline II is patterned after the SC specification and meets the audible specs of NC. Since it is applied in two passes, the bump portion can be retrofit on an existing intact thermoplastic line to boost retroreflection and to reduce lane departure accidents.

Field test sites in the following locations (state, contact person, telephone number): _____

Manufacturer/supplier shall attach twelve (12) copies of the form in addition to twelve (12) copies the following information in order to substantiate, verify or clarify its contents: specifications, drawings, sketches, pictures, warranty, installation instructions, material safety data sheet, product/material literature, test data sheets, certification, and test results.



ENNIS
TRAFFIC SAFETY SOLUTIONS

VIBRALINE®

VIBRALINE®

VIBRALINE®

Vibraline Thermoplastic

Ennis Traffic Safety Solutions is committed to furnishing a range of products to meet all road marking applications. Road markings have been proven to be an effective counter measure against traffic related accidents and fatalities.

Ennis Traffic Safety Solutions' Vibraline® is a specialized thermoplastic road marking material, which can be applied as a profiled edge line or centerline marking to enhance wet night visibility and to provide a "rumble strip" sensory and auditory impulse to the motorist. Vibraline offers safety benefits in poor weather and additional sensory perception at all times.

Lane departure and road departure accidents can result from driver distraction or driver fatigue. Vibraline "rumble strips" provide an easily applied solution with no need for expensive milling or rolling equipment.

Product Features and Benefits

- Vibraline can be applied with standard thermo equipment with a simple modified "shoe"
- Unlike other rumble strip methods, the Vibraline system produces minimum environmental sound while providing a vibratory alert to the driver
- Vibraline generates the most vibration of any other rumble strip method
- Vibraline can be applied on shoulders less than 5' wide
- Vibraline provides both dry and wet weather retro-reflectivity



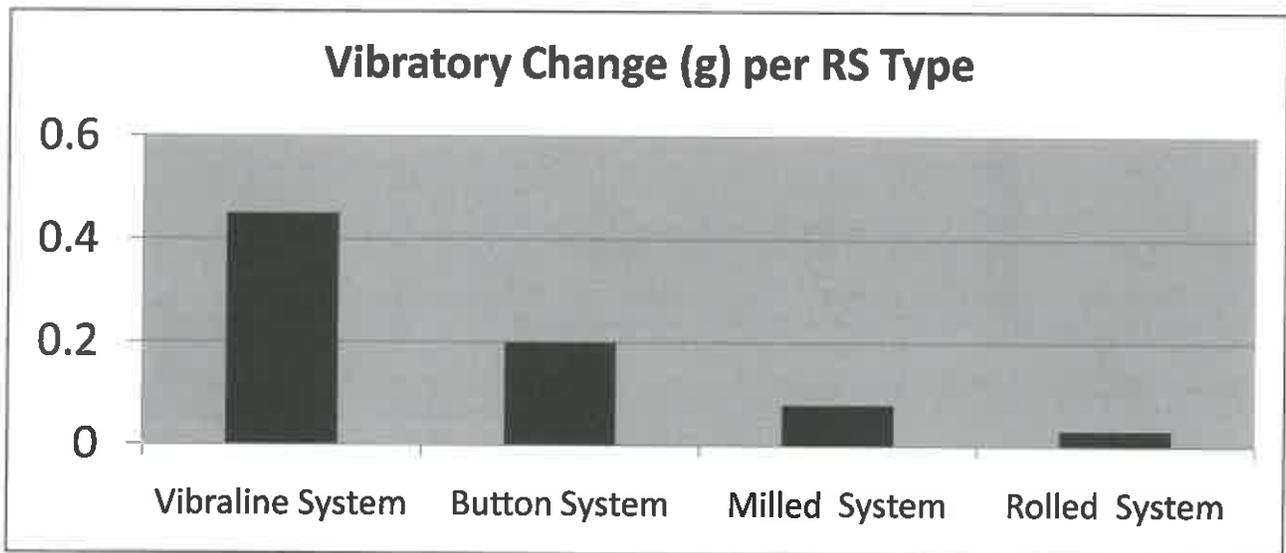
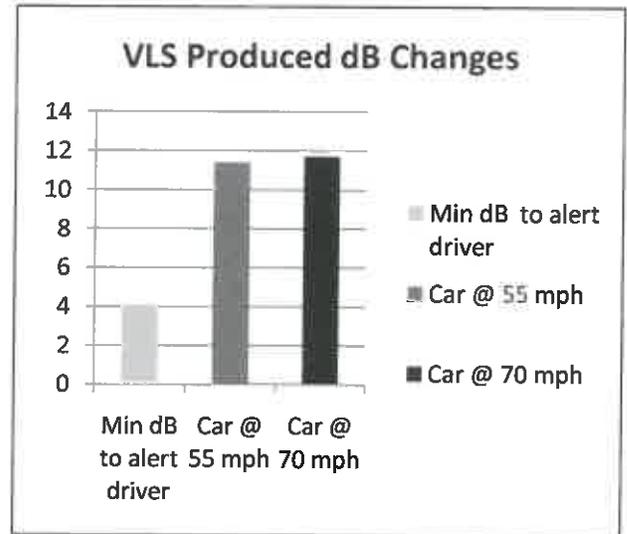


Vibraline Thermoplastic

Studies have shown that a minimum auditory change of 4 dB is needed to alert motorists who may be in danger of running off the road. The Vibraline system (VLS) has shown to provide 11dB's (see graph), a strong auditory change, but still below the 15dB level which could scare the motorist.

Unlike other rumble strip types, VLS produces the least environmental noise of any system, buttoned, rolled or milled.

The Vibraline system has proven to generate the most vibration among all rumble strip types, (rolled, milled, or buttoned) thus providing more than adequate vibratory warning.



- An automobile traveling at 70 mph experiences the above vibrations per Rumble Strip Type.
- The Vibraline Profile System produces twice the vibration as any other Rumble Strip Type.
- Vibraline proves to be a superior Rumble Strip system



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MEMO TO: MR. TODD HUMPHREYS
ENGINEERING TECHNICIAN DCL
TRAFFIC ENGINEERING MANAGEMENT

MR. JASON DAVIS, P.E.
MATERIALS & TESTING EVALUATION ENGINEER

MR. PHILLIP MACALUSO
TRAFFIC SERVICES CONSTRUCTION/MAINT MANAGER

FROM: MR. RICHIE CHAROENPAP, P.E.
NEW PRODUCT EVALUATION COORDINATOR 

DATE: NOVEMBER 18, 2013

SUBJECT: NEW PRODUCT EVALUATION
06.239 - SWARCOTHERM PROFILE THERMOPLASTIC
PAVEMENT MARKING COMPOUND WHITE AND YELLOW

In accordance with EDSM V.4.1.1, the recommendation of the New Products Evaluation Committee, and with your concurrence, we have selected each of you as a Product Evaluators to evaluate the above material. The New Products Committee reviewed the product on November 12, 2013 and determined that it has potential merit.

Attached is an information sheet on the product. See Attachment. The primary use of this product is most every marine coating need.

As evaluator, your responsibility is to:

RECOMMENDED FOR APPROVAL _____ DATE _____

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RECOMMENDED FOR APPROVAL _____ DATE _____

APPROVED _____ DATE _____

OFFER NO. 6-239

REV. 8/00

Confirmed Receipt _____

MEETING: 11/13

(FOR DOTD USE ONLY)

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
NEW PRODUCT EVALUATION COMMITTEE (NPE) FORM
INFORMATION FOR EVALUATION PURPOSES

Trade name: Swarcotherm Profile Thermoplastic Pavement Marking Compound—white and yellow

Manufacturer (company name): Swarco Industries, Inc.

Manufacturer contact person: Frank Coghlan

Address: 739 Talamalge Hall Drive Conroe TX 77302
Street/P. O. Box City State Zip code

Phone: (936) 697-5028 Fax: (936) 271-4078

E-mail Address: Frank.coghlan@swarco.com Web Address: www.swarco.com/americas

Manufacturer's representative (company name): n/a
(if different than manufacturer)

Contact person: n/a

Address: _____
Street/P. O. Box City State Zip code

Phone: () _____ Fax: () _____

E-mail Address: _____ Web Address: _____

Is product patented?: yes no applied for:

Recommended or primary use: Profile Applications to provide edge line audible warning, or with SWARCO

Alternate or secondary use: Bead systems to provide both audible and enhanced wet night visibility.

Material composition (generic description): A blend of resins plasticizers, glass beads, pigments & inert fillers.

Alternate or comparable to what existing materials or product: Grooved rumble strips

Meets requirements of following specifications: AASHTO ASTM Fed. Spec. Others State specifications

Is availability seasonal?: yes no

Approximate delivery days after receipt of order: 5 Are quantities limited: yes no

New on market: yes no Estimated cost of material per unit: \$1.00 per linear foot

Will special equipment be required to install product: yes no if yes, will manufacturer/supplier furnish the special equipment and install the material: yes no

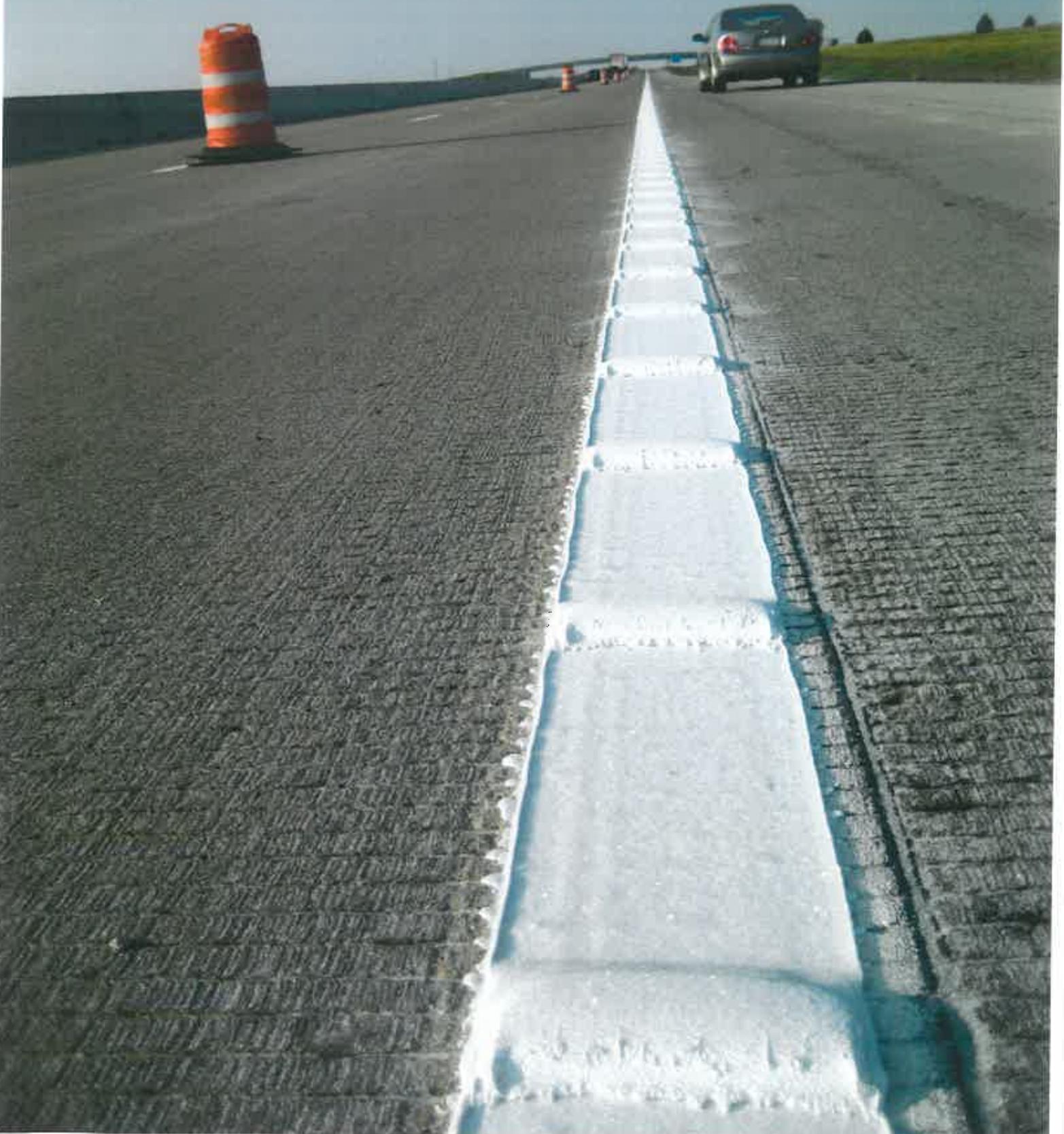
Are educational courses or films available: yes no Has this proposal been made previously: yes no

Additional information: Product is used routinely in other states (TX & SC)

Field test sites in the following locations (state, contact person, telephone number):
n/a

Manufacturer/supplier shall attach twelve (12) copies of the form in addition to twelve (12) copies the following information in order to substantiate, verify or clarify its contents: specifications, drawings, sketches, pictures, warranty, installation instructions, material safety data sheet, product/material literature, test data sheets, certification, and test results.

SWARCO PROFILE THERMOPLASTIC





SWARCO INDUSTRIES, INC.

A large, dark-colored thermoplastic pavement marking machine is shown in operation on a road. The machine is equipped with several large red cylindrical tanks and various hoses. It is applying bright yellow stripes to the asphalt surface. The background shows a street with yellow dashed lines and a building.

SWARCOTHERM
THERMOPLASTIC PAVEMENT MARKING COMPOUND

SWARCO | First in Traffic Solutions.

SWARCO | FIRST IN TRAFFIC SOLUTIONS.

SWARCO not only offers superior thermoplastic products but an extensive line of quality road marking products:

Glass Beads

- Reflex Standard Glass Beads
- MEGALUX-BEADS® Large Glass Beads
- PLUS9BEADS® High Index Glass Beads
- PLUS9BEADS® Spots High Performance Wet Night Reflective System
- DURALUX® High Performance Glass Beads

Pavement Marking Tapes

- Director60 Permanent Pavement Marking Tape
- Director35 Intersection Grade Permanent Pavement Marking Tape
- Director2 Temporary Removable Pavement Marking Tape
- Visa-Line Engineer / Construction Grade Temporary Pavement Marking Tape
- Visa-Mark Custom Pavement Legends, Symbols & Logos
- RUMBLER® Reflective / Non-Reflective Rumble Strips

Pavement Marking Paints

- Waterborne Pavement Marking Paint
- Solventborne Pavement Marking Paint
- Epoxy
- MMA

Preformed Thermoplastic

- 90 MIL Pavement Marking Lines, Legends & Symbols
- 125 MIL Pavement Marking Lines, Legends & Symbols



SWARCO INDUSTRIES, INC.

P.O. Box 89
Columbia, TN 38402
T. +1-800-216-8781
F. +1-931-388-4039
E. office.industries@swarco.com
www.swarco.com/northamerica

Your local contact:





SWARCO is not only a leading thermoplastic manufacturer but we are the oldest U.S. operating thermoplastic producer. From standard government specifications, to custom colors and formulations, SWARCO works with professional strippers and government agencies to find a solution that meets your performance and safety requirements. Our global experience and expertise in thermoplastics, combined with our leading edge glass bead and reflective media technology, are leading the way to brighter and safer thermoplastic markings for you and the world's traveling public. Our goal is not only to deliver products but provide economical turnkey thermoplastic marking systems that out perform other durable markings.



THERMOPLASTIC

HIGH PERFORMANCE ROAD MARKINGS

Thermoplastic Pavement Marking Compounds have been used extensively in the road marking industry since the 1950's as a durable and economical pavement marking on the world's highways. It remains today the durable marking of choice due to long term performance, cost benefit and a wide range of application techniques that improve motorist safety and provide agencies a long term marking solution.

Today's formulations and application techniques have evolved to provide enhanced safety benefits to the motoring public which include improved wet-night reflective solutions, audible profile solutions and economical thin-line spray solutions. Listed below are a few samples of application systems that are possible with thermoplastic:

40-Mil Instant Dry Spray Applications with SWARCO drop on bead applications to improve reflectivity levels including wet night reflectivity enhancement. Reflectivity up to 700 mcd for white and 500mcd for yellow is achievable

90 -Mil Applications with double drop bead systems to provide enhanced dry and wet night reflectivity. Reflectivity of 600+mcd for white and 400+mcd for yellow.

Profile Applications to provide edge line audible warning, or with SWARCO bead systems to provide both audible and enhanced wet night visibility.



SWARCOTHERM

TYPES OF THERMOPLASTIC



Hydrocarbon

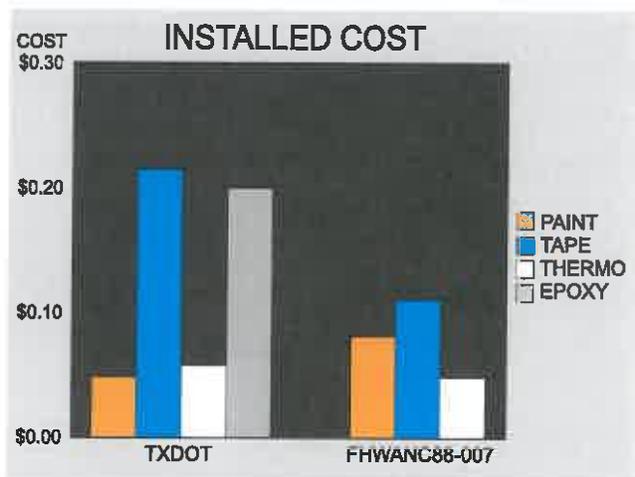
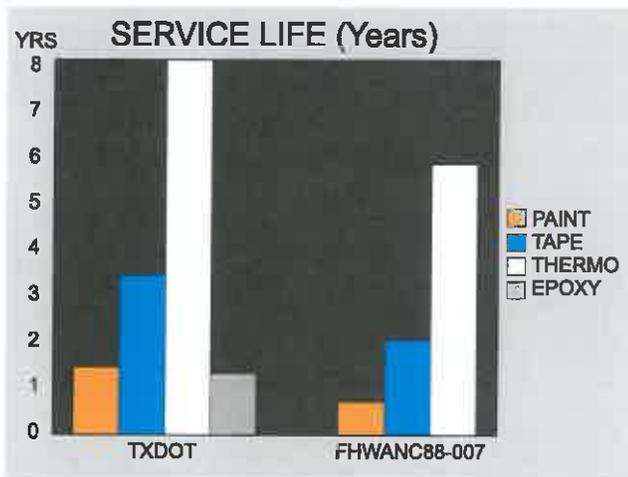
Hydrocarbon thermoplastic pavement markings are made from petroleum derived resins which provide heat stability and ideal application properties. Because hydrocarbon based materials are readily soluble in oil drippings, fuel and other petroleum based products, they are not recommended for high traffic areas where cars are stationary. Hydrocarbon based markings are ideal for any centerline, edge-line and skip-line applications with superior performance on both asphalt & concrete.



Alkyd

Alkyd thermoplastic contains a naturally occurring resin that is resistant to petroleum products making them ideal for inner city markings and other high traffic areas where oil drippings are common. Along with being a great product for intersection markings such as crosswalks, legends & symbols, Alkyd thermoplastic is also ideal for centerline, edge-line and skip-line markings.

Studies have shown that properly applied thermoplastic can provide up to 8+ years of service life at 1/3 the life cycle cost of other marking binders.



FHWA/NC/88-007: Plastic Pavement Marking Materials
 FHWA Project PMS000S (172): Evaluation of Various Pavement Marking Materials

Thermoplastic marking programs provide government agencies' marking solutions starting at the new design and construction level, that allow markings to be maintained with economical thermoplastic maintenance programs and products through out the roadway life cycle.



APPLICATION METHODS



Screed

Thermoplastic material is forced through a dispensing shoe that rides directly on the road surface. A continuous line is formed by a three sided die with a control gate set to a pre-determined thickness.

Advantages

- Improved temperature retention in applied material
- Improves bonding/durability when material is applied in marginal application conditions
- Allows for precise thickness control

Recommended Applications

- Centerline
- Edge-line
- Skip-line
- Legends
- Symbols
- Crosswalks



Ribbon

This method of application involves using a gun that rides just above the pavement surface. Material is forced through the die and from there it flows onto the pavement.

Advantages

- Produces sharp edges
- Easily marks rough surfaces
- Faster than screen application while still considered an extrusion process

Recommended Applications

- Centerline
- Edge-line
- Skip-line
- Legends
- Symbols
- Crosswalks



Spray

Spraying combines air and hot thermoplastic under pressure depositing it onto the pavement through a nozzle. The primary advantage is that striping can occur at higher speeds.

Advantages

- Dries quickly
- High application speed
- Great surface bond

Recommended Applications

- Centerline
- Edge-line
- Skip-line



Profile

Thermoplastic markings are constructed with an alternating elevated and recessed profile which provide nighttime retroreflectivity under wet conditions, and in cases where the profiles are large enough, a rumble effect can be felt when driving over the markings.

Advantages

- Wet Night Retroreflectivity (Audible/Inverted)
- Audible lane delineation

Recommended Applications

- Centerline
- Edge-line
- Skip-line



QUALITY

As an ISO 9001 Certified Company, SWARCO has invested the resources to assure the highest level of quality in all our products. Our Quality Management System starts with a quality assurance testing program on all incoming raw materials and continues through the entire production process. Our quality control systems and state of the art computerized batch control manufacturing facility delivers a superior product every time. Zero defects is the goal! Once our products leave the plant our commitment to quality continues in the field where we provide expert technical field support to assist our customers with their daily challenges. From raw material to the road, SWARCO is untiring in our commitment to quality.



TECHNOLOGY & INNOVATION

As a leading thermoplastic and glass bead manufacturer, SWARCO is leading the way with superior performing thermoplastic systems that provide increased visibility and driver guidance under all driving conditions. We combine our high performance reflective glass bead systems with our advanced thermoplastic formulations to deliver profiled and flat line systems that will be the performance markings of tomorrow. These systems will provide exceptional durability and wet night reflectivity. Our in-house rain tunnel and accelerated wear test equipment are a few of the tools we use daily to develop the future of thermoplastic.



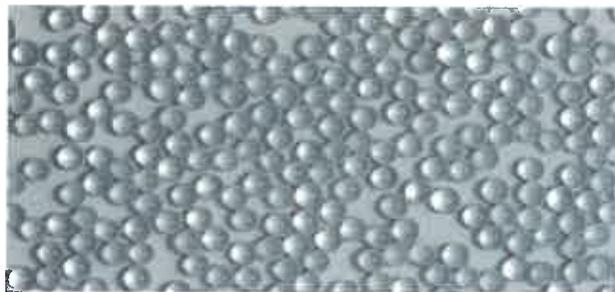


VISION

Since 1969 SWARCO has been committed to improving the vital communication link between road and driver by providing innovative, environmentally sound highway marking products and systems. This commitment requires our products to perform on highways around the world in challenging and severe traffic conditions. With thermoplastic plants in the United States, Germany and Saudi Arabia our vision continues to grow.

CUSTOMER CARE

At SWARCO our goal is 100% customer satisfaction. We believe that our success depends on the success of our valued customers. Our products, service, and partnering effort will earn your business and trust and be a major part of that success, present and future.



ENVIRONMENT

SWARCO thermoplastic products are among the most durable and environmentally safe marking products available in the world. Since they are 100% solids and emit zero volatile organic compounds they make thermoplastic the responsible choice of markings for our present and future environment. SWARCO is committed to producing environmentally friendly marking materials thereby protecting the environment, our customers and our employees.

Thermoplastic Field Guide

Thermoplastic is a pavement marking material that is a 100% solid, environmentally and user safe compound. A mixture of glass beads, pigments, binder, and filler materials, thermoplastic, as its name suggests, becomes liquid when heat is applied.

Glass beads - provide the retroreflectivity necessary for its bright night time appearance

Pigments - provide the color and opacity

Binder - a mixture of plasticizer and resins that provide toughness, flexibility, and bond strength while holding all the components together

Fillers - such as calcium carbonate, sand and/or other inert substances that provide bulk

Thermoplastic Types:

Two basic types of thermoplastic are available. The two, *hydrocarbon* and *alkyd*, take their names from their binder types. **Hydrocarbon thermoplastic** is made from petroleum-derived resins.

- Hydrocarbon tends to be more heat stable, with more predictable application properties, than alkyd
- Because it tends to break down under oil drippings and other automobile contaminants, hydrocarbon is recommended for long-line, skip lines and edge-line applications and not for high-traffic areas where cars are stationary. (Such as stop bars, crosswalks, turn arrows)

Alkyd thermoplastic is made from wood-derived resins that is resistant to petroleum products. Alkyd thermoplastic exhibits some advantages over hydrocarbon materials such as:

- higher retroreflective values
- being oil impervious
- being more durable

Alkyd is recommended for inner-city markings and other high-traffic areas where petroleum drippings are common.

Both hydrocarbon and alkyd thermoplastic are available in granular or block form, packaged in 50-pound bags or boxes. The application properties of each should have a guaranteed shelf life of one year when stored inside at a temperature less than 100° F.

Hot applied thermoplastic is prepared for road application in a melting kettle where the granular or block material is introduced and heated until it liquefies at temperatures exceeding 400° F. An agitator blends the ingredients until thermoplastic is transferred into a screed, ribbon or spray device where it is then shaped into its specified width and thickness as a line, legend or symbol. Glass beads are immediately applied to provide initial retroreflectivity.

When applied on asphaltic surfaces, thermoplastic material develops a thermal bond via heat-fusion. When applied on Portland Concrete Cement and on oxidized or aged asphaltic surfaces, and a recommended sealer is properly applied, a tenacious mechanical bond is achieved.

Providing that all necessary conditions are met concerning temperature of material and substrate, absence of moisture, road preparation and minimum thickness, you can achieve excellent performance using thermoplastic pavement marking compounds. Typical performance life ranges from 4 to 8 years depending on roadway conditions.

Correct application of thermoplastic:

Temperature is the most important factor in the proper mixing, melting and bonding of thermoplastic.

- Heated to a temperature between 400 and 440⁰ F and agitated properly, the thermoplastic compound becomes a homogenized liquid.
- Applied at this temperature, the thermoplastic melts into the upper surface of the asphalt, forming a thermal bond.
- When installed on porous surfaces, such as open-graded asphalt or tined concrete, the hot liquid thermoplastic fills all voids, creating a good mechanical lock on concrete .

Thickness of the applied thermoplastic should be as specified. A minimum thickness of 90 mils is important to the material's ability to hold the heat necessary for good bonding. The thermal bonding that occurs when application is at the proper thickness ensures the thermoplastic's durability and long-term retroreflectivity. A minimum thickness of 30 mils is required to hold the heat necessary for proper bonding when recapping a line because of poor reflectivity or inadequate thickness.

Being raised above the road surface, combined with the retroreflectivity produced by the glass beads, makes thermoplastic more visible from a distance and at night. The thickness also contributes to improved retroreflective performance in wet conditions and the exceptional durability of the product.

The amount of glass beads, both mixed in with the compound and dropped on the installed line, must be correct.

- Drop-on beads must be applied evenly and adhered to a depth of 50 to 60%.
- Apply at 8 to 10 lbs / 100 ft².
- Proper application thickness, temperature and formulation, in conjunction with correct bead coatings, ensure that bead depth is accurate.
- Intermix beads shall be mixed in the thermoplastic in accordance with agency's specification.

Equipment:

Application equipment should meet the criteria of the specification. The engineer may be responsible for approving such equipment, whether it be mobile or portable, prior to the start of work.

Melting Kettle(s) must be capable of :

- Heating thermoplastic material to its application temperature evenly, without scorching.
- Maintaining temperatures above 400⁰ F. The heating mechanism of the kettle should employ a heat transfer medium consisting of oil or hot air.
- A temperature gauge must be visible on the outside of the kettle to indicate the temperature of the thermoplastic material. The material gauge must not be confused with the heat transfer medium (oil temperature) gauge.

- Material temperatures should be monitored frequently with an external, calibrated thermometer. **Proper application temperatures should always be checked at the point of application.**

Mixing and Agitating Equipment - Melting kettles and portable applicators:

- Must be equipped with material agitators.
- Must be capable of thoroughly mixing the material at a rate which will ensure even disbursement and uniform temperatures throughout the material mass.

Priming Equipment

On pavement surfaces that are to be primed before the application of the thermoplastic material, the primer material shall be sprayed on the surface at the specified rates recommended by the manufacturer of the primer/sealer material. All of the priming equipment should be inspected and checked to ensure that it is completely operational and capable of disbursing the primer/sealer at the rate prescribed by the manufacturer.

Glass Bead Dispenser

Both mobile and portable thermoplastic application equipment are required to be equipped with a drop-on or a pressure-type bead dispenser. The glass beads are to be evenly dropped-on to the hot thermoplastic stripe immediately after its application, embedding and anchoring at a depth of 50 to 60%. The purpose of the glass beads is to provide initial night time retroreflectivity of the pavement marking which, without them, would be barely visible to the motorist. The bead dispenser shall be inspected frequently to ensure proper operation and to ensure uniform rates of each application over the entire marking surface.

Dispensing Devices

There are various devices used to screed/extrude thermoplastic material onto the pavement. The device should be positioned such to protect it from the wind.

- ***Ribbon Dispensers*** are heated and suspended above the road surface, applying a forced-extrusion, well-defined thermoplastic line.
- ***Spray Dispensing Devices*** - Thermoplastic spray pattern shall result in a uniformly thick, well-defined and securely-bonded stripe as specified. Compressed air must be dry when mixing with the molten thermoplastic.
- ***Screed Extrusion Devices*** - The dispensing shoe rides directly on the road surface and a continuous line is formed by a three sided die with a control gate set to a pre-determined thickness.

Successful Performance:

Because bond failures are application related, they can be minimized by proper application controls. This can be accomplished through correct and frequent inspection at the project site. The following guidelines are intended to assure successful installation performance.

Marking Location - To minimize damage from snowplow blades and from substrate failure, thermoplastic markings must be:

- placed directly on the lane, preferably 2 inches from the shoulder and construction joints.
- Do not apply edgeline markings directly over the joint formed between the roadway and the adjoining shoulder.
- Do not apply skip line markings over the longitudinal joint between travel lanes.

Equipment - A daily inspection of equipment should be made to ensure that is operable and within the specification requirements. Breakdowns of equipment during the day may cause thermoplastic materials or primers to be subsequently held too long or heated improperly. This can result in parts of the job failing to meet the overall specifications and longevity requirements of the road marking material. Intermittent malfunctions of equipment can also cause inconsistent performance of small sections of lane lines within a limited area. Continuous uniform operation of all equipment used to make thermoplastic applications is of extreme importance. Keep equipment clean and free of material residue buildup.

Materials - Material specifications should be reviewed completely. It is the function of the government testing laboratory to determine whether or not the material meets the requirements of the material specifications. Field samples of material may be retained by the project engineer for quality verification.

Material packaging shall have accurate batch number designations. The material type and formulation should be distinctively shown on the container: 1) Alkyd or Hydrocarbon and 2) Extrude or Spray.

Although alkyd and hydrocarbon materials will fuse to one another on the road, they are incompatible in a melting kettle. Failure to completely clean out kettles during material change-overs can cause severe equipment problems. DO NOT MIX ALKYD AND HYDROCARBON MATERIALS!!!

Pavement Surface - Pavement surfaces must be clean, dust free and dry. Remove poorly adhering, existing markings and curing compounds. Air and surface temperatures shall be at least 50⁰ F and rising during applications.

Heavy deposits of existing painted pavement markings, polymer traffic tapes, and built-up roadside accumulations of dirt, etc., will all require removal. In some cases, an air blast or manual or mechanical brooming will be sufficient to clean the surface. In others, more effort or different methods such as abrasive-blasting, water blasting or mechanical removal will be needed.

New thermoplastic applications should successfully bond to worn existing thermoplastic lines or preform thermoplastic markings. Do not apply thermoplastic over existing tape markings.

All pavement should be more than visibly dry. Moisture is the most detrimental factor in bonding. Subsurface moisture can be present in amounts sufficient to affect proper bonding. Early morning dew and fog conditions will usually cause dampness. If excess pavement moisture exists, it will usually result in blistering the hot-applied marking. Blisters will form as surface bubbles which may or may not have burst open. They are easily spotted, and if the condition occurs, marking operations should be stopped until the pavement dries. The only way to be certain whether moisture is present is to conduct a test. There are numerous ways to test for moisture.

- Tape a 12 inch square sheet of thin plastic to the road surface, being careful to seal all edges. After 15 minutes, examine the bottom of the sheet and the road surface. If more than a sparse amount of moisture is present, do not apply thermoplastic.
- Place an 18 inch piece of tar paper on pavement and apply thermoplastic heated to 420⁰ F on top. Wait two minutes and lift tar paper. Check underside. If moisture is present, do not apply.

Air Temperature - Thermoplastic should only be applied if the air temperature is 50 F and rising. Be sure to account for wind chill factors. If the temperature falls below 50 F, then striping operation should be halted.

Primer Application - Use the thermoplastic manufacturer's recommended primer:

- on all Portland concrete
- on asphalt surfaces that are more than two years old, oxidized and/or have aggregate exposed

If specified prior to the thermoplastic application, the primer must be applied to all pavement surfaces at manufacturer's recommended application rates. It must set for the specified cure or evaporation time prior to thermoplastic being applied.

Primed pavement surfaces must be striped within the specified set time or within the same working day. If the primed surfaces are not striped within these time limits, they must be reprimed prior to the thermoplastic application at the prescribed rate denoted by the manufacturer. If an approved epoxy primer is used, proportional mixing must be checked and thermoplastic application must occur before epoxy has cured.

Improper primer/sealer application will cause bond failure between the thermoplastic and substrate. Improper application may also result in physical degradation of the thermoplastic material by excessive pinholing and blistering of the line. This degradation may occur through extraction of the binder by the solvent system contained in the primer/sealer promoted by improper drying time and application rates.

Thermoplastic Application - The thermoplastic striping material must be applied onto the pavement surface at a material temperature range between 400⁰ F to 440⁰ F depending on ambient weather conditions. Material temperature is measured preferably at the point of road contact.

Drop-on glass beads must be immediately mechanically deposited after applying the thermoplastic line. If the glass beads are not adhering to the thermoplastic line, all operations should immediately be suspended until the problem can be corrected. Drop-on beads anchor and reflect best at 50-60% embedment

Applying thermoplastic at proper application temperature (400⁰ F+) is the most critical factor affecting the bond to the substrate. If the road temperature is 50⁰ F, then the recommended application temperature for the thermoplastic striping is 440⁰ F. If the road temperature is at 77⁰ F, the thermoplastic material may be applied at a lower temperature.

Applications on Portland cement surfaces should always exceed 425⁰ F in order to maximize penetration and bond strength.

The thermoplastic material temperature in the kettles, applicators, or exiting dispensing device, can be verified with a noncontact infrared thermometer.

Discrepancies of 10⁰ F may be tolerated, but in no case should a 10⁰ F discrepancy be tolerated if this shows as 10⁰ F below the minimum recommended application temperature.

Preheater/melter operation

- Calibrate material temperature gauges periodically (weekly is suggested) by using a reference thermometer
- Fill melter to 30% capacity. When thermoplastic is liquefied, add remaining material gradually to fill melter to capacity.
- Transfer thermoplastic 30 minutes after its temperature reaches 400⁰ F. During transfer, thermoplastic should pass through a one-quarter inch mesh screen.

- Add more thermoplastic when two-thirds of the liquefied material has been used. The material is ready again for transfer 30 minutes after reaching 400⁰ F.
- Cease agitation during cool-down after the thermoplastic's temperature cools to 300⁰ F.

Important preheater/melter considerations

- Maximum holding time: Do not hold thermoplastic above 400⁰ F for more than six hours.
- Maximum temperature: The thermoplastic should not exceed 450⁰ F.
- Maximum reheats: Reheat granular thermoplastic a maximum of three times; block, two times.
- **Color change** indicates the material is overheated and beginning to scorch: White thermoplastic turns beige or creamy; yellow develops a brown or greenish tint.
- Cleaning: Schedule the melter for cleaning if charred or burned particles remain on the screen during transfer. Completely flush the system when changing from alkyd to hydrocarbon or vice versa.
- Operating tip: Do not completely drain kettle during overnight shutdown unless material must be replaced. Keep kettle closed to protect against moisture and other contaminants.
- Precautions: Guard against temperature loss during transfer.
- Safety tip: Keep a bucket of ice water on site during application. In case of accidental contact with hot thermoplastic, use the ice water to cool affected areas immediately. Follow instructions on Materials Safety Data Sheet or call physician immediately.

Thickness

The specified alkyd or hydrocarbon thermoplastic thickness may vary from 30 to 125 mils. The service life of a thermoplastic marking is directly related to its thickness. A thin line will wear out much faster than a thicker line. To ensure that the proper thickness is being applied, both the wet and the dry line thickness of the line may be routinely checked.

The most accurate determination thickness can be accomplished by laying a metal panel or black duct tape in the dispensing device path. After the application is made on the panel, it is removed and total material thickness and panel can be measured with a micrometer. Subtract the panel thickness measured to calculate the true thickness of the thermoplastic line applied.

The thermoplastic thickness should be uniform and consistent throughout the total length of the job. Overall discrepancies in the application rate and the total thermoplastic thickness will affect the durability and performance of the line.

Appearance

The applied thermoplastic markings should be inspected continually for overall workmanship. Markings should be of the specified width, with clean cut edges. White, yellow, red, black and other colors should appear distinct. The drop-on glass bead application should appear uniform on the entire marking surface. Over saturation with glass beads can cause excessive live embrittlement and premature abrasion. The hardened thermoplastic should resist deformation, dirt pick up, etc. by traffic within 2 to 10 minutes of application.

The marking should be firmly bonded to the pavement surface. If the thermoplastic marking can be easily removed from the pavement with the use of a putty knife, and little or no bituminous substrate is on the back of the marking, then it can be assumed there is not a sufficient bond to the substrate. There must be fusion with the bituminous pavement to ensure maximum mechanical bond strength. Concrete bond strength can be checked by attempting to force separation with a stiff putty knife.

SUCCESSFUL APPLICATION BASICS

Road Surface

- The surface is clean and dry.
- Deteriorated existing markings or curing compound have been removed. (Note: Do not apply thermoplastic over existing tape products.)
- If existing line is well-beaded, the line should be roughed, especially if beads were coated with silicone.
- If premark was dressed with drop-on beads, it should be roughed to promote a good bond with the thermoplastic.
- Portland cement or asphalt that is more than two years old, that is oxidized and/or has exposed aggregate has been primed according to the thermoplastic manufacturer's recommendations.

Temperature

- Surface 50⁰ F and rising
- The air and surface temperatures are at least 50⁰ F and rising.
- The thermoplastic has heated to at least 400⁰ F and no higher than 450⁰ F, for no longer than six hours.

Materials/equipment

- Verify material certification (thermoplastic, glass beads, and primer/sealer, where required). Take material samples according to your agency's sample and testing procedures. Check contractor's equipment against contract requirements.

During application, check:

Drop-on bead application

- Beads are adhered to a depth of 50 to 60% of bead circumference.
- Bead application is by machine except where technically impossible.
- Material is properly bonded

Workmanship

- Markings are uniform
- Straightness conforms to specifications.
- Cut-off is clean. There should be no excessive overspray, and any excessive dribble should be removed.