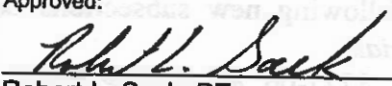


Modified by
EI 10-018
Effective
1/6/11

To:			New York State Department of Transportation ENGINEERING INSTRUCTION	EI 06-009
SUPERSEDED BY EI 11-017 EFFECTIVE <u>9/21/11</u>				
Title: REVISIONS TO STANDARD SPECIFICATIONS SECTION 727 PAVEMENT MARKING MATERIALS				
Distribution:		Approved:		
☒ Manufacturers (18)	☐ Surveyors (33)	 Robert L. Sack, PE Deputy Chief Engineer, Technical Services		
☒ Local Govt. (31)	☒ Consultants (34)			
☒ Agencies (32)	☒ Contractors (39)			
☐ _____ ()		19 APR 06 Date		

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of September 7, 2006.
- This EI does not supersede any other issuance.
- The revisions issued with this EI will be incorporated into the next update of the Standard Specifications.

PURPOSE: This EI issues a revised Section 727 *Pavement Marking Materials* of the Standard Specifications of January 2, 2002.

TECHNICAL INFORMATION:

- These revised specifications support the Department policy issued via EI 06-002 *Lead-Free Pavement Marking Materials*.
- All of the pavement marking material requirements are now described in a single section.
- All pavement marking materials now require formulations that do not contain lead-chromate-based pigments, and are VOC compliant.
- Pavement marking materials are now Approved List / Material Certification items, rather than stock-lot tested.
- Polyester pavement marking specifications will be revised and issued at a later date.

IMPLEMENTATION:

- Main Office Design Quality Assurance Bureau will insert the standard specification shelf note into the construction contract bid documents beginning with projects submitted for the letting of September 9, 2006.
- Contractors shall begin using the revised material specifications for all contracts beginning July 1, 2006.
- Engineers-in-Charge should include a copy of this EI with the first order-on-contract that uses revised force account procedures as documentation of a change in Section 727 in accordance with Contract Administration Manual (CAM) §104-03I.4.
- The cost of lead-free pavement marking materials is expected to be similar to current materials.

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- The following subsections of Section 727 *Pavement Marking Materials* have been revised:
 - §727-01 *Extruded Thermoplastic*
 - §727-02 *Removable Raised Pavement Markers*
 - §727-03 *Epoxy Paint*
 - §727-04 *Permanent Pavement Tape*
 - §727-05 *Glass Beads for Pavement Markings*
- The following new subsections have been added to Section 727 *Pavement Marking Materials*:
 - §727-06 *Removable Pavement Tape*
 - §727-07 *Removable Wet-Night Reflective Tape*
 - §727-08 *Permanent Wet-Night Reflective Tape*
 - §727-09 *Traffic Paint*
- Approved Lists for new materials will be established as soon as samples are submitted and preliminary testing is completed. Conditional approvals may subsequently be withdrawn if materials do not provide adequate performance in the field.

TRANSMITTED MATERIALS: Attached is a shelf note for Section 727 entitled *Pavement Marking Materials*.

BACKGROUND: This is the first of several steps required to update pavement marking specifications. Subsequent steps will include revision of construction specifications for pavement markings, revisions to Section 619 *Maintenance and Protection of Traffic* that contains temporary pavement marking specifications, issuance of pavement marking policy/design guidance, and issuance of construction inspection guidance.

The revisions to the material specifications were made to eliminate the requirements for lead-chromate pigments from those materials that contained them, and include a general update to references, tests and acceptance procedures. The paint industry in general is eliminating the use of lead and chromium in pigments due to associated worker safety and hazardous waste disposal issues. Nationally, most states have already moved to lead-free and chromium-free materials.

The newly issued portions of the material specifications were made to incorporate materials that are already in use, and have material requirements contained in special specifications or in Materials Bureau procedures.

Because the State is following an established national trend in policy and material requirements, significant problems with the specification and product changes are not expected. Material approved lists will be established as soon as samples are submitted by manufacturers and testing is completed. Field performance of materials other than possible slight variations in color should be similar to that currently encountered, as the carrier and binder formulations are not expected to change significantly.

CONTACT: Direct questions regarding this issuance to Patrick Galarza of the Materials Bureau via e-mail at PGalarza@dot.state.ny.us or at (518) 457-4599.

PAVEMENT MARKING MATERIALS

Make the following changes to Volume 3 of 3 of the Standard Specifications of January 2, 2002:
Delete Section 727 Page 7-257, line 1 to Page 7-266, line 18 and **Replace** it with the following:

SECTION 727 - PAVEMENT MARKING MATERIALS

727-01 EXTRUDED THERMOPLASTIC

SCOPE. This specification covers thermoplastic reflectorized pavement striping material that is extruded, in a molten state, onto the pavement surface. Following a surface application of reflective beads and upon cooling to normal pavement temperatures, the resultant marking is an adherent reflectorized stripe that is capable of resisting deformation by traffic.

MATERIAL REQUIREMENTS. Unless otherwise noted, all samples are to be prepared and tested at an ambient temperature of $23^{\circ} \pm 2^{\circ}\text{C}$.

General.

- Formulated for application at temperatures greater than 205°C .
- Show no significant breakdown or deterioration at 245°C .
- Pigment, beads and filler uniformly dispersed in the binder resin.
- Be free from all skins, dirt and foreign objects.
- Comply with the following requirements:

TABLE 727-01-1 MATERIAL PROPERTIES		
Component	% by Weight	
	White	Yellow
Binder	17.0 min	17.0 min.
Titanium Dioxide	10.0 min	---
Reflective Beads	30-40	30-40
Calcium Carbonate & Inert Fillers	43.0 max	*
Yellow Pigments	---	*
* Amount and type of yellow pigment, calcium carbonate and inert fillers at the option of the manufacturer, providing the other composition requirements of this specification are met and the yellow pigment is lead chromate free.		

Physical Properties.

A. Color. (ASTM D1535) When viewed under North Standard Daylight:

White: Approximate visual color match to Munsell Book Notation N 9.5/0.
Yellow: Approximate visual match to Munsell Book Notation 10YR8/14.

B. Yellowness Index. (ASTM D1925 at 2° Observer angle and C Illuminate)

White thermoplastic: 0.12 maximum

C. Softening Point. (ASTM E28) Softening point: 90°C minimum.

D. Specific Gravity. Between 1.8 and 2.2 as determined by a water displacement method at 25°C .

PAVEMENT MARKING MATERIALS

E. Field Drying Time. At 21°C, and thickness between 3 mm and 5 mm: Completely solid and showing no damaging effect from traffic after ten (10) minutes.

Thermoplastic Primer.

- Specifically designed to enhance the bond of thermoplastic pavement markings to HMA and/or PCC pavements.
- Be either a one-component or two-component, cold- or hot-applied material of the type recommended by the manufacturer.
- Conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. EPA, and the NYSDEC.

PACKAGING AND SHIPPING. Shipped to the job site in strong, substantial containers, clearly marked with the following and including:

- Manufacturer's Name
- Name of Product
- Material Specification Number
- Lot/Batch Number
- Manufacture Date
- Expiration Date
- Quantity
- Two-component primer containers clearly identified as "Part A" and "Part B"
- Primers accompanied with written instructions for use

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by samples of each color (white and yellow) of the product and applicable glass beads as per §727-05 *Glass Beads For Pavement Markings*, independent lab test results in accordance to this specification or in conjunction with the National Transportation Product Evaluation Program (NTPEP), and a certification that the product conforms to this specification.

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Extruded Thermoplastic will be accepted on the basis of the product appearing on the Approved List and a material certification that the product is the same as the one appearing on the Approved List and that it conforms to this specification.

727-02 REMOVABLE RAISED PAVEMENT MARKERS

SCOPE. This specification covers removable raised pavement markers.

MATERIAL REQUIREMENTS

General. Raised pavement markers shall be:

- Designed as single units consisting of an acrylic plastic or another type of durable casing, containing one or two reflective faces.
- Approximately square in shape.
- Provide daytime delineation.
- Adhered to HMA or PCC surfaces using adhesives and/or methods recommended by the manufacturer.
- Removable from HMA and PCC pavements, intact or in substantially large pieces, either manually or by the use of a mechanical roll-up device, and without the use of heat, solvents, grinding or blasting. After removal, permanent marks, scars or damage to the pavement surface shall be minimal.
- Free from dirt or any other contaminants.

PAVEMENT MARKING MATERIALS

Physical Properties.

A. Color. (ASTM D1535) When viewed under North Standard Daylight:

White: Approximate visual color match to Munsell Book Notation N 9.5/0

Yellow: Approximate visual color match to Munsell Book Notation 10YR8/14

B. Size.

1. **Casing.** Minimum: 100 mm x 100 mm x 19 mm.

2. **Reflective Lens.** Minimum area of the reflective lens: 245 mm².

C. Reflectance. Initial average reflectance values, when measured with incident light parallel to the base of the marker, at an observation angle of 0.2°.

TABLE 727-02-1 REFLECTIVE MARKER LENSES REFLECTANCE

Color	White		Yellow	
Entrance Angle	0°	20°	0°	20°
Specific Intensity (mcd/lx)	93	37	56	22

NOTES:

1. Observation Angle: The angle at the reflector between the observer's line of sight and the direction of light incident on the reflector.

2. Entrance Angle: The angle in the horizontal plane between the direction of incident light and the normal to the leading edge of reflective marker.

3. Specific Intensity: The luminous intensity (candelas) of returned light at the chosen observation and entrance angles for each lux of illumination at the reflector on a plane perpendicular to the incident light.

4. Photometric Test Procedure: The reflective marker to be tested shall be located with the center of the reflective lens at a distance of 1.5 m from a uniformly bright light source, having an effective diameter of 5.1 mm. The return of light shall be measured using an annular ring photocell (9.4 mm I.D. x 11.9 mm O.D.). The photocell shall be shielded to eliminate stray light. The distance from the light source center to the photocell center shall be 5.3 mm. If a test distance of other than 1.5 m is used, the source and receiver shall be modified in the same proportion as the test distance.

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by samples of each color (white and yellow) of the product, independent lab test results in accordance to this specification or in conjunction with the National Transportation Product Evaluation Program (NTPEP), and certification that the product conforms to this specification. Additional field tests will be carried out in accordance to Materials Bureau Directives.

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Removable Raised Pavement Markers will be accepted on the basis of the product appearing on the Approved List and a material certification that the product is the same material that appears on the Approved List and that it conforms to this specification.

727-03 EPOXY PAINT

SCOPE. This specification covers durable epoxy pavement marking material that is sprayed onto the pavement. Following a surface application of reflective beads and upon drying, the resultant marking is a reflectorized stripe of specified thickness and width.

PAVEMENT MARKING MATERIALS

MATERIAL REQUIREMENTS

General.

- Formulated for use as a pavement marking material and for hot-spray application at elevated temperatures.
- Be two-component (Part A and Part B), 100% solids type system formulated and designed to provide a simple volumetric mixing ratio (e.g., two volumes of Part A to one volume of Part B).
- Be VOC compliant and lead chromate free.
- Yellow paints shall use organic yellow pigments, Color Index Pigment Yellow 65 (C.I. 11740) and/or 74 (C.I. 11741).
- Have a consistent target value of epoxy in Part A, based on ASTM D1652. Tested on a pigment free basis and calculated as the weight per epoxy equivalent (WPE).
- Have a consistent total amine value of Part B based on ASTM D2074. The manufacturer may specify an alternate test method for determining the amine value subject to the approval of the Director, Materials Bureau.
- Display no bleeding on the surface upon which the paint is applied.
- Conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. EPA and the NYSDEC.

Physical Properties.

A. % Pigment - Part A. (ASTM D2371)

Yellow: 23% minimum
White: 18% minimum

% TiO₂ (100% Purity) (NYS Test Method 727-20C)

White: 16.5% minimum

B. % Resin - Part A. (ASTM D2371)

Yellow: 70% - 77%
White: 75% - 82%

C. Color. (ASTM D1535) When viewed under North Standard Daylight, at a 0.38 ± 0.02 mm wet film thickness with no glass beads applied:

White: Approximate visual color match to Munsell Book Notation N 9.5/0

Yellow: Reasonable visual color match to Munsell Book Notation 10YR8/14
and

Be within the following chromaticity coordinate limits when tested under ASTM E1347.

TABLE 727-03-1 CHROMATICITY COORDINATES				
Coordinate	1	2	3	4
x	0.485	0.526	0.504	0.468
y	0.426	0.472	0.481	0.450

C. Directional Reflectance. (ASTM E1347)

White: 84% minimum
Yellow: 54% minimum

D. Yellowness Index. (ASTM D1925 at 2° Observer angle and C Illuminate)

White Epoxy Paint: 0.12 maximum

E. Drying Time - Laboratory. (ASTM D711) Dry to no-pick-up time in 30 minutes maximum. Application rate of 0.38 ± 0.02 mm wet-film thickness and glass-sphere application rate of 3kg/l.

F. Hardness. (ASTM D2240)

Samples cured for 72 to 96 hours prior to testing.
Shore D Hardness: 75 - 100.

PAVEMENT MARKING MATERIALS

G. Infrared Spectrophotometer Analysis. (ASTM D2621) The spectrum of each component will be analyzed and maintained as a base record. Any subsequent samples taken from a Department contract must be a reasonable match to the original formulation spectrum accepted by the Materials Bureau for the Approved List of Materials.

Placement Properties. The material shall be placed using standard epoxy-pavement-marking equipment and have a maximum Field No Track Time of 30 minutes when installed at 25°C.

PACKAGING AND SHIPPING. Shipped to the job site in strong, substantial containers, clearly marked with the following information:

- Manufacturer's Name
- Name of Product
- Material Specification Number
- Lot/Batch Number
- Date of Manufacture
- Expiration Date
- The Statement (as appropriate): "Part A Contains Pigment and Epoxy Resin," or "Part B Contains Catalyst"
- Quantity

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by two (2) 0.25 liter samples of each color (white and yellow) of Part A and one (1) 0.25 liter of Part B for each color, independent lab test results in accordance to this specification or in conjunction with the National Transportation Product Evaluation Program (NTPEP), and certification that the product conforms to this specification. Additional field tests will be carried out in accordance to Materials Bureau Directives.

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Epoxy Paint will be accepted on the basis of the product appearing on the Approved List and a material certification that the product is the same material that appears on the Approved List and that it conforms to this specification.

727-04 PERMANENT PAVEMENT TAPE

SCOPE. This specification covers preformed pavement marking tape that is applied to the pavement, resulting in a durable marking that is capable of resisting deformation by traffic.

GENERAL.

- Designed to provide immediate and continuous retroreflection.
- Meet all the requirements of ASTM D4505.
- Composed of a mixture of plastics or polymeric materials, resins, pigments, and reflective beads that are uniformly distributed throughout the thickness of the material.
- Have a layer of reflective beads bonded to, or embedded in the top surface.
- Be pre-coated, on its bottom side, with a pressure-sensitive adhesive for adherence to HMA or PCC surfaces.
- Be of the specified dimension and shape with clean-cut, well-defined edges, of good appearance, and free of cracks or other defects.
- Be weather resistant and through normal traffic wear shall show no appreciable fading, lifting or shrinkage.
- Be capable of molding itself to the contours, breaks and faults of HMA or PCC surfaces.
- Show no significant tearing, rollback, lifting or other signs of poor adhesion.
- Be free from dirt and any other contaminants.

PAVEMENT MARKING MATERIALS

MATERIAL REQUIREMENTS. Unless otherwise noted, all samples are to be prepared and tested at an ambient temperature of $23^{\circ} \pm 2^{\circ}\text{C}$.

A. Color. (ASTM D1535) When viewed under North Standard Daylight:

White: Approximate visual color match to Munsell Book Notation N 9.5/0

Yellow: Approximate visual color match to Munsell Book Notation 10YR8/14

B. Thickness. Preformed pavement marking tape shall be:

Uniform Cross Section: 1.5 mm minimum thickness

Patterned (Variable Cross Section): 0.5 mm minimum thickness at the thinnest portions

1.5 mm minimum thickness at the thickest portions

The patterned top surface shall have approximately 50% of the surface area raised, and its design shall provide immediate and continuing retroreflection.

C. Tensile Strength. (ASTM D638M) 275 kPa minimum

Test specimens shall be Type II prepared by die cutting with Die C as specified in ASTM D412, Test Method A. The testing machine shall operate at a speed of 5 mm per minute. For calculating the tensile strength of patterned type material, the thickness measurements shall be taken in the thinnest portions of the cross sectional area.

D. Elongation. (ASTM D638M) When tested in accordance with the conditions as specified for Tensile Strength: 15% minimum elongation

Primer.

- Be recommended by the manufacturer of the permanent tape and be compatible with the marking and surface the marking is being applied to.
- Specifically designed to enhance the bond of the permanent tape to HMA and/or PCC pavements.
- Conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. EPA and the NYSDEC.

PACKAGING AND SHIPPING. Shipped to the job site in strong, substantial containers, clearly marked with the following and including:

- Manufacturer's Name
- Name of Product
- Material Specification Number
- Lot/Batch Number
- Manufacture Date
- Quantity
- Primers accompanied with written instructions for use
- Expiration Date

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by samples of each color (white and yellow) of the product, independent lab test results in accordance to this specification or in conjunction with the National Transportation Product Evaluation Program (NTPEP), and certification that the product conforms to this specification. Additional laboratory analysis and field tests will be carried out in accordance to Materials Bureau Directives.

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Permanent Tape and primer will be accepted on the basis of the products appearing on the Approved List and a material certification that the product is the same as the one appearing on the Approved List and that it conforms to this specification.

PAVEMENT MARKING MATERIALS

727-05 GLASS BEADS FOR PAVEMENT MARKINGS

SCOPE. This specification covers reflectorized beads for application to pavement marking materials for the production of a reflective surface.

MATERIAL REQUIREMENTS.

- Composed of glass that is highly resistant to traffic wear and to the effects of weathering.
- Be colorless, clean, transparent, free from milkiness or excessive air bubbles, and essentially free from surface scarring or scratching.
- Silica content (ASTM C169): 60% minimum.
- Refractive index: 1.50 when tested by the liquid immersion method at 25°C.
- Show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps.
- Flow freely from the dispensing equipment at any time when surface and atmospheric conditions are satisfactory for painting.

A. Sphericity. (ASTM D1155 Procedure A) Spherical in shape - 70% minimal, true spheres. Wet/Night Visibility Beads shall be tested for roundness according to the procedural directives of the Materials Bureau.

B. Gradation. (ASTM D1214).

TABLE 727-05-1 GLASS SPHERE GRADATION (Standard Bead)				
Percent Passing by Weight				
Marking Type	Sieve Size			
	850 µm	600 µm	300 µm	180 µm
Epoxy	100	80-95	9-42	0-10
Traffic Paint	100	80-95	9-42	0-10
Thermoplastic	100	79-95	15-60	0-15

TABLE 727-05-2 GLASS SPHERE GRADATION (Wet/Night Visibility Bead)						
Percent Passing by Weight						
Marking Type	Sieve Size					
	2.00 mm	1.70 mm	1.40 mm	1.18 mm	1.00 mm	850µm
Epoxy Wet/Night Reflective	100	95-100	75-95	10-47	0-7	0-2

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C. Coating.

TABLE 727-05-3 GLASS SPHERE COATINGS	
Marking Type	Coating Type
Epoxy (Wet/Night Visibility Bead)	Silane Type a dherence c oating designed to interact with and adhere to epoxy pavement markings. Moisture-resistant coating or a dual purpose type coating (moisture-resistant and adherence).
Epoxy (Standard Bead)	
Traffic Paint	
Thermoplastic (Drop on)	

D. Moisture Resistance. Place one kilogram of spheres in a washed cotton bag, having a thread count of approximately 8 per square centimeter (warp and woof) and immerse the bag in a container of water for 30 seconds. Remove the bag and force excess water from the sample by squeezing the bag. Suspend and allow to drain for two hours at room temperature ($23^{\circ} \pm 2^{\circ}\text{C}$). Then, mix the sample in the bag by shaking thoroughly. Transfer sample slowly to a clean, dry glass funnel having a stem 100 mm in length, with a 9.5 mm stem entrance inside diameter opening and a minimum exit opening of 6.4 mm. The entire sample shall flow freely through the funnel without stoppage. When first introduced into the funnel, if the spheres clog, it is permissible to lightly tap the funnel to initiate the flow.

PACKAGING AND SHIPPING. Shipped to the job site in waterproof plastic lined burlap or plastic lined paper bags with the following information clearly marked on the packages:

- Manufacturer's Name
- Name of Product
- Size/Type/Coating
- Material Specification Number
- Lot/Batch Number
- Manufacture Date
- Quantity/Weight of Material

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by one 30 kg bag sample of the product, independent lab test results in accordance to this specification and certification that the product conforms to this specification.

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Glass Beads for Pavement Markings will be accepted on the basis of the product appearing on the Approved List and a material certification that the product is the same as the one appearing on the Approved List and that it conforms to this specification.

727-06 REMOVABLE PAVEMENT TAPE

SCOPE. This specification covers the material and performance requirements for removable pavement marking tape and masking tape.

MATERIAL REQUIREMENTS.

General.

- Composed of a mixture of plastics or polymeric materials, resins, pigments.
- Have on its bottom side, a pre-applied, pressure-sensitive adhesive for adherence to HMA or PCC surfaces.

PAVEMENT MARKING MATERIALS

- Be of the specified dimension and shape with clean-cut, well defined-edges, of good appearance, and free of cracks or other defects.
- Be weather resistant and through normal traffic wear shall show no appreciable fading, lifting or shrinkage.
- Be capable of molding itself to the contours, breaks and faults of HMA or PCC surfaces.
- Show no significant tearing, rollback, lifting or other signs of poor adhesion.
- Be easily removable from HMA, PCC and/or existing pavement markings in substantially intact or large pieces with out damage to the underlying surface and without the use of heat, solvents, grinding or blast cleaning.
- Be free from dirt and any other contaminants.

Reflective Tape.

- Designed to provide immediate and continuous retroreflection.
- Composed of a mixture of plastics or polymeric materials, resins, pigments, and reflective beads that are uniformly distributed throughout the thickness of the material.
- Have a layer of reflective beads bonded to, or embedded in the top surface.
- Meet the following requirements:

A. Color: (ASTM D1535) When viewed under North Standard Daylight:

White: Approximate visual color match to Munsell Book Notation N 9.5/0

Yellow: Approximate visual color match to Munsell Book Notation 10YR 8/14
and

Be within the following chromaticity coordinate limits when tested under ASTM E1347.

TABLE 727-06-1 CHROMATICITY COORDINATES				
Coordinate	1	2	3	4
x	0.485	0.526	0.504	0.468
y	0.426	0.472	0.481	0.450

B. Reflectance:

TABLE 727-06-2 PREFORMED TAPE REFLECTANCE REQUIREMENTS				
Color	White		Yellow	
Observation Angle	0.2°	0.5°	0.2°	0.5°
Specific Luminance (mcd/m ² /lx)	1770	1270	1310	810

Masking Tape.

- Specifically designed for use to temporarily cover existing pavement markings.
- Consist of durable, nonreflective, pliant polymer tape on a reinforced, conformable backing, pre-coated with a pressure-sensitive adhesive
- Capable of adhering to existing pavement markings, asphalt pavement and Portland cement concrete pavement without the use of heat, solvents, additional adhesives or other means.
- Be substantially similar in color to the pavement surface with a flat matte finish and textured, skid-resistant surface.

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by samples of each color (white, yellow, black/grey) of the product, independent lab test results in accordance to this specification or in conjunction with the National Transportation Product Evaluation Program (NTPEP), and certification that the product conforms to this specification. Additional laboratory analysis and field tests will be carried out in accordance to Materials Bureau Directives.

PAVEMENT MARKING MATERIALS

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Removable Pavement Tape will be accepted on the basis of the product appearing on the Approved List and a material certification that the product is the same as the one appearing on the Approved List and that it conforms to this specification.

727-07 REMOVABLE WET-NIGHT REFLECTIVE TAPE

SCOPE. This specification covers the material and performance requirements for removable wet-night reflective pavement marking tape.

MATERIAL REQUIREMENTS.

General.

- Designed to provide immediate and continuous retroreflection in day and night as well as dry and wet conditions.
- Composed of a mixture of durable plastics or polymeric materials, resins, pigments, and reflective beads that are uniformly distributed throughout the thickness of the material.
- Be pre-coated, on its bottom side, with a pressure-sensitive adhesive.
- Capable of adhering to existing pavement markings, asphalt pavement and Portland cement concrete pavement without the use of heat, solvents, additional adhesives or other means.
- Be of the specified dimension and shape with clean-cut, well-defined edges, of good appearance, and free of cracks or other defects.
- Be weather resistant and through normal traffic wear shall show no appreciable fading, lifting or shrinkage.
- Be capable of molding itself to the contours, breaks and faults of HMA or PCC surfaces.
- Show no significant tearing, rollback, lifting or other signs of poor adhesion.
- Be easily removable from HMA, PCC and/or existing pavement markings in substantially intact or large pieces with out damage to the underlying surface and without the use of heat, solvents, grinding or blast cleaning.
- Have a layer of reflective beads bonded to, or embedded in the top surface.
- Be free from dirt and any other contaminants.
- Meet the following requirements:

Physical Properties.

A. Color: (ASTM D1535) When viewed under North Standard Daylight:

White: Approximate visual color match to Munsell Book Notation N 9.5/0
and

Be within the following daytime chromaticity coordinates (dry) when tested under
ASTM E1347.

TABLE 727-07-1 WHITE CHROMATICITY COORDINATES				
Coordinate	1	2	3	4
x	0.355	0.305	0.285	0.335
y	0.355	0.305	0.325	0.375

PAVEMENT MARKING MATERIALS

Yellow: Approximate visual color match to Munsell Book Notation 10YR 8/14
and

Be within the following daytime chromaticity coordinates (dry) when tested under
ASTM E1347.

TABLE 727-07-2 YELLOW CHROMATICITY COORDINATES				
Coordinate	1	2	3	4
x	0.560	0.460	0.420	0.490
y	0.440	0.400	0.440	0.510

B. Retroreflectivity.

Wet: ASTM E2176 and ASTM E2177

Dry: ASTM E1710

TABLE 727-07-3 MINIMUM INITIAL RETROREFLECTANCE [mcd/m ² /lx]	
White	Yellow
750	450

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by samples of each color (white and yellow) of the product, independent lab test results in accordance to this specification or in conjunction with the National Transportation Product Evaluation Program (NTPEP), and certification that the product conforms to this specification. Additional laboratory analysis and field tests will be carried out in accordance to Materials Bureau Directives.

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Removable Wet-Night Reflective Tape will be accepted on the basis of the product appearing on the Approved List and a material certification that the product is the same as the one appearing on the Approved List and that it conforms to this specification.

727-08 PERMANENT WET-NIGHT REFLECTIVE TAPE

SCOPE. This specification covers the material and performance requirements for permanent wet-night pavement marking tape.

MATERIAL REQUIREMENTS. Unless otherwise noted, all samples are to be prepared and tested at an ambient temperature of $23^{\circ} \pm 2^{\circ}\text{C}$.

General.

- Designed to provide immediate and continuous retroreflection in day and night as well as dry and wet conditions.
- Composed of a mixture of plastics or polymeric materials, resins, pigments, and reflective beads that are uniformly distributed throughout the thickness of the material.
- Have a layer of reflective beads bonded to, or embedded in the top surface.
- Be pre-coated, on its bottom side, with a pressure-sensitive adhesive for adherence to HMA or PCC surfaces.
- Be of the specified dimension and shape with clean-cut, well-defined edges, of good appearance, and free of cracks or other defects.
- Be weather resistant and through normal traffic wear shall show no appreciable fading, lifting or shrinkage.
- Be capable of molding itself to the contours, breaks and faults of HMA or PCC surfaces.

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- Show no significant tearing, rollback, lifting or other signs of poor adhesion.
- Be free from dirt and any other contaminants.

Physical Properties.

A. Color: (ASTM D1535) When viewed under North Standard Daylight:

White: Approximate visual color match to Munsell Book Notation N 9.5/0
and

Be within the following daytime chromaticity coordinates (dry) when tested under
ASTM E1347.

TABLE 727-08-1 WHITE CHROMATICITY COORDINATES				
Coordinate	1	2	3	4
x	0.355	0.305	0.285	0.335
y	0.355	0.305	0.325	0.375

Yellow: Approximate visual color match to Munsell Book Notation 10YR 8/14
and

Be within the following daytime chromaticity coordinates (dry) when tested under
ASTM E1347.

TABLE 727-08-2 YELLOW CHROMATICITY COORDINATES				
Coordinate	1	2	3	4
x	0.560	0.460	0.420	0.490
y	0.440	0.400	0.440	0.510

B. Retroreflectivity. Wet: ASTM E2176 and ASTM E2177
Dry: ASTM E1710

TABLE 727-08-3 MINIMUM INITIAL RETROREFLECTANCE [mcd/m ² /lx]	
White	Yellow
750	450

C. Thickness. Preformed pavement marking tape shall be a

Uniform Cross Section: 1.5 mm minimum thickness

Patterned (Variable Cross Section): 0.5 mm minimum thickness at the thinnest portions
1.5 mm minimum thickness at the thickest portions

The patterned top surface shall have approximately 50% of the surface area raised, and its design shall provide immediate and continuing retroreflection.

D. Friction Resistance. (ASTM E303) Friction resistance: 45 BPN minimum

E. Tensile Strength. (ASTM D638M) Tensile strength: 275 kPa minimum

Test specimens shall be Type MII prepared by die cutting with Die C as specified in ASTM D412, Test Method A. The testing machine shall operate at a speed of 5 mm per minute. For calculating the tensile strength of patterned type material, the thickness measurements shall be taken in the thinnest portions of the cross sectional area.

F. Elongation. (ASTM D638M) 15% minimum elongation when tested in accordance with the conditions as specified for Tensile Strength.

PAVEMENT MARKING MATERIALS

Primer.

- Be recommended by the manufacturer of the preformed pavement marking and be compatible with the marking and surface the marking is being applied to.
- Specifically designed to enhance the bond of the preformed pavement markings to HMA and/or PCC pavements.
- Conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. EPA and the NYSDEC.

PACKAGING AND SHIPPING. Shipped to the job site in strong, substantial containers, clearly marked with the following and including:

- Manufacturer's Name
- Name of Product
- Material Specification Number
- Lot/Batch Number
- Manufacture Date
- Quantity
- Primers accompanied with written instructions for use
- Expiration Date

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by samples of each color (white and yellow) of the product, independent lab test results in accordance to this specification or in conjunction with the National Transportation Product Evaluation Program (NTPEP), and certification that the product conforms to this specification. Additional laboratory analysis and field tests will be carried out in accordance to Materials Bureau Directives.

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Permanent Wet Night Reflective Tape and primer will be accepted on the basis of the product appearing on the Approved List and a material certification that the product is the same as the one appearing on the Approved List and that it conforms to this specification.

727-09 TRAFFIC PAINT

SCOPE. This specification covers waterborne and solventborne paints that are sprayed onto the pavement. Following a surface application of glass beads and upon drying, the resultant marking is a reflectorized stripe of specified thickness and width.

MATERIAL REQUIREMENTS.

General.

- Formulated for use as a pavement marking material.
- Be VOC compliant and lead chromate free.
- Yellow paints must use organic yellow pigments Color Index Pigment Yellow 65 (C.I. 11740) and/or 74 (C.I. 11741).
- Display no bleeding on the surface upon which the paint is applied.
- Conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. EPA, and the NYSDEC.

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Physical Properties.

A. Composition.

% Pigment. (ASTM D3723)	58.0% – 62.0%
% Total Solids. (ASTM D3723)	76.0 % minimum
% Vehicle Non-Volatile. (ASTM D3723)	43.0 % minimum

The manufacturers certified organic yellow pigment content shall be used to determine the final laboratory test results for: total pigment (%), and for nonvolatile vehicle (%). The Department reserves the right to validate the manufacturers "certified" organic yellow pigment content through outside, independent laboratory testing.

B. Color. (ASTM D1535) When viewed under North Standard Daylight at a 0.38 ± 0.03 mm wet film thickness with no glass beads applied:

White: Approximate visual color match to Munsell Book Notation N 9.5/0.
Yellow: Approximate visual color match to Munsell Book Notation 10YR 8/14.
and

Be within the following chromaticity coordinate limits when tested under ASTM E1347.

TABLE 727-09-1 CHROMATICITY COORDINATES				
Coordinate	1	2	3	4
x	0.485	0.517	0.492	0.468
y	0.426	0.462	0.471	0.450

C. Directional Reflectance (ASTM E1347) White: 84% minimum
Yellow: 54% minimum

D. Yellowness Index. (ASTM D1925 at 2° Observer angle and C Illuminate)
White Traffic Paint: 0.12 maximum.

E. Drying Time (Laboratory) (ASTM D711) Dry to no-pick-up time in 3 minutes maximum.
Application rate of 0.38 ± 0.02 mm wet-film thickness and glass-sphere application rate of 0.75 kg/l.

F. Viscosity. (ASTM D562 Procedures B) 75 – 95 Kneb Units at 25°C

G. Dry Opacity. (ASTM D2805) 0.95 minimum contrast ratio
Application at 90 mm wide, wet-film thickness of 0.13 mm to white and black contrast panels matching Lenta Form 5C or equivalent. Dry time of 1 hour minimum.

H. Abrasion Resistance. (ASTM D4060) Average weight loss: 50 milligrams, maximum

I. Flexibility. (Federal Specification TT-P-858, Section 4.4.5) No cracking or flaking visible.

J. Freeze-Thaw Stability. (Federal Specification TT-P-1952b, Section 4.5.7)
No coagulation or change in consistency greater than 15 Kneb Units.

K. Heat Stability. (Federal Specification TT-P-1952b, Section 4.5.8) Waterborne only.
No coagulation, discoloration or change in consistency greater than 15 Kneb Units when tested in an oven at $49^\circ \pm 1^\circ\text{C}$.

L. Infrared Spectrophotometer Analysis. Waterborne: (ASTM D3168)
Solventborne: (ASTM D2621)

PAVEMENT MARKING MATERIALS

The spectrum of the paint will be analyzed and maintained as a base record. Any subsequent samples taken from a Department contract must be a reasonable match to the original formulation spectrum accepted by the Materials Bureau for the Approved List.

Placement Properties.

The material shall be placed using standard traffic paint application equipment and have a maximum Field No Track Time of 3 minutes when installed at 25°C.

PACKAGING AND SHIPPING. Shipped to the job site in strong, substantial containers. Individual containers plainly marked with the following information:

- Manufacturer's Name
- Name of Product
- Material Specification Number
- Lot/Batch Number
- Test Number
- Manufacture Date
- Expiration Date
- Quantity

BASIS OF APPROVAL. Application for approval shall be submitted to the Materials Bureau by the manufacturer, accompanied by eight (8) 0.5 liter samples of each color (white and yellow) of the product, independent lab test results in accordance to this specification or in conjunction with the National Transportation Product Evaluation Program (NTPEP), and certification that the product conforms to this specification. Additional field tests will be carried out in accordance to Materials Bureau Directives.

Upon approval by the Materials Bureau, the product will be placed on the Approved List.

BASIS OF ACCEPTANCE. Traffic Paint will be accepted on the basis of the product appearing on the Approved List and a material certification that the product is the same as the one appearing on the Approved List and that it conforms to this specification.