

New Jersey Turnpike Authority

P.O. Box 5042, Woodbridge, NJ 07095



June 19, 2025

Document Change Announcement

2016 Standard Supplementary Specifications

Pavement Markings Update

DCA2025SS-06

Subject: Revisions to

Section 516 Pavement Stripes and Markings, Subsection 516.01 Description

Subsection 516.02 Materials, Subsection 516.03 Equipment, Subsection 516.04 Methods of Construction

Subsection 516.05 Measurement, Subsection 516.06 Payment

Section 530 Raised Pavement Markers, Subsection 530.01 Description

Section 534 Trenchless Installation of Underground Facilities, Subsection 534.04 Methods Of Construction

Section 913 Paints and Coatings, Subsection 913.04 Traffic Paint and Marking.

Section 923 Miscellaneous, Subsection 923.46 Raised Pavement Markers and Adhesive

Section 923 Miscellaneous, Subsection 923.47 High Early Strength Patch Mix

Description of Change:

This DCA revises the pavement marking standards for Turnpike and Parkway roadways to enhance pavement marking visibility and durability, and for conformance with the latest pavement marking provisions of the current Manual on Uniform Traffic Control Devices (MUTCD). DCAs to the Standard Drawings, Design Manual, and Standard Supplementary Specifications are released concurrently to address this. A summary of changes is appended to this announcement.

Notice to New Jersey Turnpike Authority Staff and Design Consultants

Contact your New Jersey Turnpike Authority Project Manager for applicability. Effective immediately, all applicable contracts currently in the design phase shall incorporate the revisions herein. For advertised contracts awaiting the opening of bids, this revision shall be incorporated via addendum.

The revisions may be accessed on the Authority's webpage: <https://www.njta.com/doing-business/professional-services>

Recommended By:

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DCA2025SD-01 Standard Drawings							
Published Standard Drawing	Prior Title	Prior Date	Prior Version	New Title	New Date	New Version	Summary of individual sheet changes
PM-1	ENTRANCE RAMP MARKINGS	9/2022	1	PAVEMENT MARKINGS	6/2025	0 (Re-issued)	Previously part of PM-5, Striping Details. Chevron, Rumble Strip, Contrast Striping details moved to new PM-10.
PM-2	MULTILANE ENTRANCE RAMP MARKINGS	9/2022	1	ENTRANCE RAMP MARKINGS	6/2025	0 (Re-issued)	Previously PM-1. RPM notes and broken line dimension table removed.
PM-3	EXIT RAMP MARKINGS	8/2015	0	MULTILANE ENTRANCE RAMP MARKINGS	6/2025	0 (Re-issued)	Previously PM-2. RPM notes and broken line dimension table removed.
PM-4	EXIT RAMP LANE DROP MARKINGS	8/2015	0	EXIT RAMP MARKINGS	6/2025	0 (Re-issued)	Previously PM-3. RPM notes and broken line dimension table removed.
PM-5	STRIPING DETAILS	8/2015	0	CONTINUOUS AUXILIARY LANE AND LANE DROP AT EXIT RAMP MARKINGS	6/2025	0 (Re-issued)	Previously PM-4, Exit Ramp Drop Markings. 1 mile advance guide sign added. RPM notes and broken line dimension table removed.
PM-6	TOLL PLAZA STRIPING	8/2015	0	PAVEMENT MARKING SYMBOLS AND CROSSWALKS	6/2025	0 (Re-issued)	New drawing.
PM-7	(NOT USED)	—	—	PAVEMENT MARKINGS FOR EXCLUSIVE TURN LANES	6/2025	0 (Re-issued)	New drawing.
PM-8	(NOT USED)	—	—	PAVEMENT WORD MARKINGS	6/2025	0 (Re-issued)	New drawing.
PM-9	(NOT USED)	—	—	PAVEMENT LOT MARKINGS	6/2025	0 (Re-issued)	New drawing.
PM-10	(NOT USED)	—	—	MISCELLANEOUS PAVEMENT MARKING DETAILS	6/2025	0 (Re-issued)	Chevron, Rumble Strip, Contrast Striping details moved from prior PM-5.
PM-11	(NOT USED)	—	—	TOLL PLAZA STRIPING	6/2025	0 (Re-issued)	Previously PM-6. "E-Z PASS ONLY" moved to PM-08. All notes removed and replaced with two (2) new notes.

Summary of Changes to Standard Drawings

- 1. PM-1 through PM-6 are replaced entirely with new drawings PM-1 through PM-11.
- 2. Standard striping materials and procedures are updated to align with the specification changes noted below.
- 3. Marking layouts are updated to align with current MUTCD guidance.
- 4. The 25 ft stripe / 25 ft gap broken white line (BWL) standard is eliminated on the Turnpike and reset at 10 ft stripe / 30 ft gap dimensions to match the Parkway.
- 5. New details are added for miscellaneous parking layouts, crosswalks, turning lanes, traffic lines, and word markings.

DCA2025SS-06 2016 Standard Supplementary Specifications

Summary of Changes to 2016 Standard Supplementary Specifications

- 1. Restructured Section 516 and Paragraph 913.04 for better flow and clarity.
- 2. Updated pavement marking definitions and requirements within Subsection 516.01.
- 3. Updated materials and application for all permanent and temporary pavement marking types throughout to align with latest industry standards.
- 4. Added requirements and guidance for diamond grinding of recessed pavement markings.
- 5. Established minimum levels of retroreflectivity for pavement markings.
- 6. Added new material section for wet reflective optics and updated glass beads standards.
- 7. Directed that all permanent traffic stripes shall be recessed.
- 8. Directed that solid white and yellow edge lines (SWL / SYL) shall be thermoplastic on asphalt surfaces and permanent tape on concrete surfaces.
- 9. Directed that broken white lines (BWL) and dotted white lines (DWL) on all surfaces shall be permanent tape.
- 10. Directed that all permanent miscellaneous traffic lines (including diagonal and channelizing gore lines) and symbols shall be surface applied thermoplastic (on asphalt surfaces) or epoxy resin (on concrete surfaces).
- 11. Updated pay item descriptions to better align with new specifications.
- 12. Deleted Section 530 and Subsection 923.46 to remove Raised Pavement Markers (RPMs) from the Authority’s standards.
- 13. Revised Subsection 534.04 for deletion of Subsection 923.46.
- 14. Revised Subsection 923.47 for deletion of Section 530.

DCA2025DM-03 Design Manual

Summary of Changes to Design Manual

- 1. Section 7.7 is updated to eliminate the different broken white line (BWL) standards noted for the Turnpike and Parkway roadways.
- 2. Reference to the MUTCD is added for any design items not adequately addressed by the Authority’s standard documents.

NOTE: The following text REPLACES the respective Sections and Subsections of the latest version of the 2016 Standard Supplementary Specifications.

SECTION 516 - PAVEMENT MARKINGS

Delete this Section in its entirety and replace it with the following:

516.01 Description.

This work shall consist of marking bituminous surfaced roadways and concrete bridge decks and surfaces with a pavement marking system comprised of a binder material with retroreflective components. Pavement marking binders are broadly classified into two categories: extruded/sprayed and preformed. Extruded/sprayed materials encompass any pavement marking product that is applied in liquid form. Preformed materials are solid products that come to the site already formed to the width or shape that will be placed. Retroreflective components consist of glass beads and wet reflective optics. Pavement marking systems shall be surfaced applied or recessed into the roadway surface as required by the contract documents.

Pavement markings shall be used as indicated on the contract documents for marking of stripes, lines, and symbols as defined as follows:

- **"Traffic Stripes"** are the various widths and colors of lines (solid, broken, and dotted) used to designate lanes and shoulders on roadways.
- **"Traffic Lines"** are the various types and materials for diagonal and channelizing gore lines, crosswalks, stop lines, or other pavement lines not covered under "traffic stripes."
- **"Traffic Symbols"** are the various types and materials for words, arrows, or other pavement symbols.
- **"Temporary Pavement Striping"** is a pavement marking system for use in temporary traffic conditions during staged construction or in final traffic conditions on existing bituminous surfaced roadways and concrete bridge decks and surfaces as required by the contract documents. Binder materials for temporary pavement striping may be latex paint, thermoplastic, epoxy resin, or removable wet reflective pavement marking tape as required by the Contract documents or as directed by the Engineer. Temporary pavement stripes shall be surface applied (not recessed) with glass beads as applicable. Temporary pavement stripes do not require wet reflective optics unless otherwise directed.
- **"Durable Pavement Marking"** is a pavement marking system for use in final traffic conditions on newly resurfaced or constructed bituminous surfaced roadways and concrete bridge decks and surfaces. Binder materials for durable pavement markings may be permanent tape, thermoplastic, and epoxy resin as required by the Contract documents or as directed by the Engineer. All durable pavement marking systems shall include both glass beads and wet reflective optics to optimize dry and wet reflectivity.

Durable pavement markings shall generally be applied for the limits of pavement removal and resurfacing projects and new full depth pavement construction within Authority jurisdiction as follows:

Table 516-01 - Pavement Marking Summary			
Surface	Marking	Material	Recessed
Asphalt (Bituminous)	Solid (Edge Line)	Thermoplastic	Yes
	Broken or Dotted	Permanent Tape	Yes
	Lines or Symbols	Thermoplastic	No
Concrete	Solid (Edge Line)	Permanent Contrast Tape	Yes
	Broken or Dotted	Permanent Contrast Tape	Yes
	Lines or Symbols	Epoxy Resin	No

Diamond grinding shall be performed to install recesses in bituminous surfaced roadways and concrete bridge decks and surfaces for recessed durable pavement markings in accordance with the Contract documents.

In addition, this work includes the removal of existing traffic markings from bituminous surfaced roadways and concrete bridge decks and surfaces. Removal shall be via mechanical means (grinding or sandblasting) or hydro milling, in accordance with the Contract documents. The work shall also consist of any required placing

of removable black line mask or black paint (only if specifically permitted) to cover existing markings to be temporarily obliterated.

Pavement markings on non-Authority facilities shall follow guidance of the jurisdictional agency.

516.02 Materials.

Materials shall conform to the following Subsections:

LATEX PAINT	913.04(A)
EPOXY RESIN	913.04(B)
THERMOPLASTIC	913.04(C)
GLASS BEADS.....	913.04(D)
BLACK PAINT.....	913.04(F)
PERMANENT TAPE.....	913.04(G)
WET REFLECTIVE OPTICS	913.04(H)
REMOVABLE WET REFLECTIVE PAVEMENT MARKING TAPE.....	920.10
REMOVABLE BLACK LINE MASK	920.14

The Contractor shall warrant for the first year that a minimum 95% of marking installations shall remain intact and serviceable. The installed material shall show no fading, lifting, shrinking, tearing, rollback, distortion or chipping due to vehicular traffic or normal maintenance activities including snow plowing. All markings shall retain a minimum retroreflective value of 150 mcd/m²/lx one year after installation. The Contractor shall replace, entirely at the Contractor's expense, such amount of markings, if any, required to meet the minimum stated percentage. The Engineer will indicate the markings to be replaced to meet the minimum stated percentages. The Contractor shall also replace those markings that fail the minimum value for retroreflectivity. Replacement under either situation shall include all materials, equipment, labor and work incidental thereto.

The Contractor shall provide to the Authority, at no extra cost, any manufacturer's warranties or guarantees that exceed the minimum requirements stated previously, that are normally provided by the manufacturer.

Permanent tape shall be warrantied in writing for a period of four years from the date of installation.

516.03 Equipment.

Pavement marking materials shall be applied by equipment as recommended by the manufacturer. The equipment shall be designed to apply lines, stripes, and symbols of uniform cross sections, clear-cut edges, and even and uniform film thickness of binder material.

The equipment for dispensing the glass beads and wet reflective optics shall mechanically and automatically distribute the beads and wet reflective optics in a uniform pattern and quantity per square foot of pavement marking, regardless of variation in speed of travel of the distributing equipment. The dispensing equipment may be an integral part of the pavement marking machine, or may be a self-contained unit suitably designed for attachment to the pavement marking machines used by the Contractor, so that the glass beads and wet reflective optics will be applied immediately following the application of the extruded/sprayed binder material.

Pavement marking equipment shall be cleaned at the end of each day's work, or more often if necessary, to insure the application of pavement markings of the specified quality and physical requirements.

(A) EPOXY RESIN PAVEMENT MARKING EQUIPMENT.

The epoxy pavement marking unit shall be so designed, equipped, maintained, and operated that the material is properly applied in variable widths at a consistent temperature. The epoxy pavement marking unit shall include a tachometer and a pressure gauge and calibrated holding vessel for each component. The holding vessels for the epoxy pigments and the hardener shall have thermometers for measuring the temperature of the vessel contents. The striping unit shall be equipped with a separate power unit for the pumps used in the mixing and distribution of the components. The following shall be furnished with each epoxy striping unit:

- (1) A calibration sheet that shows the number of the truck body, the capacity thereof, and an outage table in increments of not over ½ inch. This calibration sheet must be certified by the manufacturer or testing agency.

- (2) A metal rod for each holding vessel, with accurate divisions marked and consecutively numbered starting at the bottom. The rod shall be not less than 1 foot longer than the depth of the vessel.
- (3) Slip-proof steps with handrail to reach ground level.
- (4) Slip-proof catwalk with handrail, running along the top of the vessel.
- (5) Fire extinguisher in working order.

(B) THERMOPLASTIC PAVEMENT MARKING EQUIPMENT.

The equipment for applying thermoplastic binder material shall be capable of providing continuous mixing and agitation of the material. The parts of the equipment conveying the material between the main reservoir and the shaping die shall be so constructed to prevent accumulation and clogging. The mixing and conveying parts and the shaping dies or spray gun shall be capable of maintaining the material at optimum thermoplastic temperature. The equipment shall be so constructed to ensure continuous uniformity in the dimensions of the entire stripe or marking. The kettle provided for the melting and heating of the thermoplastic material shall be equipped with an automatic thermostat control device and heated by a controlled heat-transfer liquid rather than by a direct flame. The heating kettle and applicator shall be equipped and arranged to meet the National Board of Fire Underwriters and State and Federal regulations. The parts of the equipment that come in contact with the material shall be easily accessible for cleaning and maintenance.

(C) DIAMOND GRINDING EQUIPMENT.

Equipment shall include a free-floating cutting or grinding head to provide a consistent recess depth over irregular pavement surfaces. The type and configuration of the cutting head used to grind the recess shall produce the appropriate surface profile for the pavement marking material to be applied. Any ridges in the bottom of the recess must have a maximum height of 0.015 inches.

The diamond grinding equipment must be capable of installing a recess 6 inches away from any vertical or horizontal obstruction.

Shrouds and a vacuum apparatus shall be included as part of the diamond grinder to remove larger pieces of pavement that are ground out.

(D) GENERAL.

All equipment for applying markings shall be equipped with dispensers of a type that will mechanically and automatically dispense beads and wet reflective optics uniformly on sprayed/extruded markings at the rates specified.

Equipment for removing the various types of pavement markings shall be designed with a vacuum system to remove all millings from the pavement surface and prevent airborne residue from escaping into the atmosphere.

516.04 Methods of Construction.

Work shall be done in accordance with the following:

(A) DURABLE PAVEMENT MARKINGS.

All durable pavement markings shall conform to the location, alignment, width, length, size, color and spacing shown on the Plans. All pavement markings are to be positioned a minimum of 4 inches from the respective pavement joint or as otherwise indicated, measured from the nearest edge of the pavement marking binder (surface applied) or diamond grinding (recessed). The layout for such pavement markings shall be the responsibility of the Contractor based on guide markers and directions of the Engineer.

At the intersections of white and yellow traffic stripes, the yellow stripe shall be applied first and after the binder material has dried, the white stripe applied over the yellow.

The glass beads and wet reflective optics shall be applied separately onto the markings, following the application of the binder material to the roadway surface. The binder material shall bind the glass beads and wet reflective optics in such a manner that it will produce maximum adhesion, refraction, and reflection. For recessed traffic stripes, use a double-drop of wet reflective optics and glass beads, or approved alternative.

Surfaces upon which pavement marking materials are to be applied shall be free of moisture, both external and internal. Sufficient time, in accordance with the manufacturer's recommendations, shall elapse after

rain, sleet, snow, ice, dew, or frost to permit the surface to become thoroughly dry prior to applying pavement marking materials. Newly placed asphalt shall be allowed to cure for a minimum of 24 hours prior to placement of durable pavement markings.

The Contractor shall remove, immediately prior to applying pavement marking material to the pavement surface, all dirt, oil, grease, existing types of pavement markings, and other foreign material, including curing compound on new portland cement concrete. The surface shall be cleaned one inch beyond the perimeter of where the pavement marking is to be placed.

The Contractor shall apply a primer-sealer conforming to NJDEP volatile organic content (VOC) requirements to the areas of bituminous concrete surfaces, when recommended by the manufacturer, and to the areas of portland cement concrete surfaces where durable permanent pavement markings are to be placed.

Pavement marking materials shall be placed only upon surfaces which are dry and free from all dirt, foreign materials, scale, unbonded concrete, or mortar and shall be cleaned to the extent necessary. Pavement markings shall not be applied to any surface until such surface has been inspected by the Engineer and approved as being satisfactory for the application of striping materials. Unsatisfactory pavement markings, resulting from the presence of dirt, scale, or moisture, shall be thoroughly removed by an acceptable method and replaced by the Contractor at his own expense. Pavement markings shall not be applied when the air or surface temperature is below 35°F, and in accordance with the manufacturer's recommendation.

Pavement markings erroneously applied, spilled or dripped on the roadway surface or other Authority property in unauthorized places, shall be removed by the Contractor at his own expense and to the satisfaction of the Engineer. The Contractor will be liable for all damages resulting from the spattering of marking material on passing vehicles.

Unless permission is specifically given by the Engineer, glass beads and wet reflective optics shall not be applied under a strong wind. When such permission is granted, however, the height of the dispenser above the roadway shall be decreased to ensure proper distribution and minimize possible loss of material and, if so directed, the application rates shall also be increased to counteract such loss.

Coordinate a pre-application meeting at least thirty (30) days prior to starting the installation of any pavement markings. At the pre-application meeting, provide the Engineer with the following:

- The source of supply for the pavement marking material and surface preparation adhesive, as applicable, and the manufacturer's written instructions for use. These instructions are to include, but not be limited to, the application temperatures.
- Procedures for installing traffic stripe recesses with diamond saw blades.
- Procedures for installing traffic stripes within the recesses.
- Procedures for removing existing striping and use of temporary striping, as necessary.

Provide a copy of the manufacturer's recommendations to the Engineer at least thirty (30) days prior to starting the installation of any pavement markings.

Provide a notarized copy of the manufacturer's certification including the material's date of manufacture and National Transportation Product Evaluation Program (NTPEP) code number.

The Contractor shall arrange for and have each pavement marking material manufacturer's representative on the site for the first full day of applying the pavement markings to provide technical assistance.

The Contractor shall have onsite during pavement marking installations, personnel who are certified in accordance with the pavement marking material manufacturer's certification requirements.

The Contractor shall furnish a retroreflectometer for the Engineer's use in determining the retroreflectance values of the various pavement markings. This equipment is for the sole use of the Engineer and will become the property of the Contractor after Acceptance. The retroreflective data collected for the final pavement markings shall be provided to the Authority in an approved format.

Diamond grinding shall be performed to install recesses in roadway surfaces for traffic stripes as noted on the Contract Plans. See Paragraph 516.04(B).

Pavement marking operations shall not begin until all applicable surface preparation work is completed and approved by the Engineer, and the atmospheric conditions and pavement surface temperature is within the tolerance set by the Manufacturer and is acceptable to the Engineer.

The Contractor shall demonstrate to the Engineer the application of the broken white lines for a distance of 500 feet. The Engineer shall approve the test strip before the contractor continues striping operations. See Paragraph 516.04(E).

Unless otherwise indicated, all durable pavement marking systems shall provide minimum initial retroreflectivity as specified in Table 516-01. Initial retroreflective readings shall occur no sooner than 30 days after pavement markings have been exposed to traffic. Retroreflectivity measurements are to be taken within a 400-foot evaluation section at the start/end limits and every whole milepost. Average a minimum of 20 retroreflectivity readings per line within the 400-foot evaluation section. Each average for each line will be used to determine a grand average for each line for the length of the project. The grand average of each line will be used to determine compliance. Directional data will be treated independently. See ASTM D7585 Section 920.21 for an example of how to space individual readings. For dry measurements, mobile equipment can be used as a substitute for handheld equipment.

Table 516-01 Average Initial Retroreflectivity at 30-meter Geometry in mcd/m ² /lx		
Test Method	Color	
	White	Yellow
Dry (ASTM E1710)	500	300
Wet Recovery (ASTM E2177)	250	200

Test the adhesion of the marking no sooner than 30 days after the pavement marking is installed on each line (left edge, broken and/or dotted line(s), right edge) at the start/end limits and every whole milepost using a paint scraper or other approved tool, held parallel with the highway surface. The edge of the material shall be scraped lightly and there shall be no dislodging of the material. Notify the Engineer to witness this procedure. Directional data will be treated independently.

No sooner than 30 days after the pavement markings are installed, inspect the pavement markings for adhesion, color and retroreflectivity; and inform the Engineer in writing of all pavement markings that have failed and require replacement. The adhesion and retroreflectivity testing are to be performed by an agreed upon third party. Provide testing results to the Engineer within 5 days after the measurements are taken. The pavement marking will be considered failed for any of the following conditions:

- The substrate is exposed in any section of longitudinal pavement marking line.
- Inadequate adhesion or delamination as determined by the adhesion testing results.
- Insufficient depth of the groove.
- Retroreflected luminance (R_L) levels are below minimum requirements.
- Marking is discolored based on a visual inspection. Color chips provided by the manufacturer will be used to assess discoloring.

(1) Thermoplastic Pavement Markings.

The Contractor shall apply either preformed or hot extruded/sprayed thermoplastic pavement markings, using equipment and procedures that produce pavement markings that are straight and have sharp edges; that are the specified color, width, and thickness; that have uniform retroreflectivity; and that are properly bonded to the pavement.

Diamond grinding for the applications of recessed thermoplastic traffic stripes shall be at a depth of 100 to 120 mils.

Restriping with thermoplastic may be atop of existing latex, thermoplastic, and epoxy markings when the existing marking system is firmly bonded to existing pavement surface. All other materials except those noted shall be removed prior to placement of thermoplastic markings.

Thermoplastic binder material shall be applied as follows:

a. Preformed Thermoplastic Binder.

The Contractor shall place preformed thermoplastic pavement markings on thoroughly dry surfaces and during anticipated dry weather. The preformed thermoplastic markings shall be melted, using the flame from a propane-type torch, according to the manufacturer's recommendations, to bond the pavement markings permanently in position.

The Contractor shall apply additional glass beads and wet reflective optics to the melted binder material in a uniform pattern, to attain the minimum initial retroreflectance value specified in Subparagraph 516.04(A) for thermoplastic pavement markings.

b. Extruded Thermoplastic Binder.

Thermoplastic pavement markings shall not be placed on newly constructed pavement until the pavement is a minimum of twenty-four (24) hours old. Refer to 516.04(C) for temporary striping requirements on pavement less than twenty-four (24) hours old.

The Contractor shall heat the thermoplastic binder material uniformly and apply the melted material at a temperature between 400°F and 440°F to thoroughly dry surfaces and during anticipated dry weather, when the ambient and surface temperatures are a minimum of 50°F.

The thermoplastic pavement markings shall be extruded on the bituminous surfaced roadways in a thickness of 90 mils \pm 5 mils.

Immediately after, or in conjunction with the thermoplastic application, the Contractor shall apply, by mechanical means, glass beads and wet reflective optics to the wet material in a uniform pattern. Hand throwing of the glass beads and wet reflective optics will not be allowed.

c. Sprayed Thermoplastic Binder (Restore Pavement Markings).

Sprayed application of thermoplastic binder shall be limited to restriping activities. the thermoplastic material shall be applied as recommended by the manufacturer in thickness of 35 to 45 mils.

The Contractor shall heat the thermoplastic binder material uniformly and apply the melted material at a temperature between 375°F and 425°F to thoroughly dry surfaces and during anticipated dry weather, when the ambient and surface temperatures are a minimum of 50°F.

Immediately after, or in conjunction with the thermoplastic application, the Contractor shall apply, by mechanical means, glass beads and wet reflective optics to the wet material in a uniform pattern. Hand throwing of the glass beads and wet reflective optics will not be allowed.

(2) Epoxy Resin Pavement Markings.

The Contractor shall mix epoxy resin binder material with an automatic proportioning and mixing machine, and hot-spray the compound at a temperature between 100°F and 130°F onto thoroughly dry surfaces. The material shall only be placed during anticipated dry weather when the ambient temperature is a minimum of 45°F and the surface temperature is a minimum of 50°F. The temperature of the sprayed mixture shall be adjusted as required for prevailing conditions, including the air and pavement surface temperatures, to achieve a no-track drying time of 15 minutes or less. The epoxy resin mixture shall be applied in a wet film thickness of 20 \pm 1 mil.

Immediately after, or in conjunction with the epoxy resin application, the Contractor shall apply glass beads and wet reflective optics to the binder in a uniform pattern.

Restriping with epoxy resin may be atop of existing epoxy markings when the existing marking system are firmly bonded to existing pavement surface. All other materials except those noted shall be removed prior to placement of epoxy resin markings.

Epoxy resin pavement markings shall be surface applied, not recessed.

The Contractor shall remove all epoxy resin material that has been tracked or spilled in areas outside of the intended placement areas.

(3) Permanent Tape.

Permanent tape shall consist of white or yellow films with glass and wet reflective optics incorporated to provide immediate and continuing retroreflection.

Permanent tape pavement markings shall be capable of being adhered to bituminous surfaced roadways and concrete bridge decks and surfaces by a pre-coated pressure sensitive adhesive. The Contractor shall apply a primer to precondition the roadway surface as well as any Manufacturer recommended surface adhesive regardless of seasonal waivers.

Permanent tape shall be capable of application on new bituminous wearing courses during the paving operation in accordance with the manufacturer's instruction. After application, the permanent tape shall be immediately ready for traffic.

Permanent tape shall consist of a mixture of high-quality polymeric materials, pigments and glass beads and wet reflective optics, distributed throughout its base cross-sectional area, with a reflective layer of ceramic beads bonded to a durable polyurethane topcoat surface.

Longitudinal permanent tape used for striping longer than 50' shall be scored in 50' sections.

Restriping with permanent tape pavement markings shall not be atop any existing pavement marking material.

Diamond grinding for the application of recessed permanent tape traffic stripes shall be at a depth of 150 to 170 mils.

Apply the permanent tape and surface preparation adhesive according to the manufacturer's installation instructions and as directed by the Engineer.

Permanent tape application will require tamping with a vehicle tire. The vehicle must be equipped with a pointing device to aid in keeping the vehicle tire on the permanent tape. Tamp by slowly (40 feet per minute) driving over the permanent tape, making a minimum of six tamping hits all forward passing over the surface of the new permanent tape in the recess. Tire strikes from front and rear wheels when aligned with the aid of a pointing device can be completed in 3 passes. The vehicle and tire used to tamp the tape shall be recommended by the manufacturer and approved by the Engineer. Do not twist or turn the vehicle tire on the tape and make sure all edges are firmly adhered.

(4) Contrast Traffic Stripes.

Contrast traffic stripes shall be epoxy resin or permanent tape pavement markings as defined in Subparagraphs 516.04(A)(2) and 516.04(A)(3), as required by the Contract documents or as directed by the Engineer, with a 1.5-inch non-reflective black stripe installed along the perimeter of the reflectorized yellow or white traffic stripe as noted on the contract plans. If using permanent tape, the black stripe may be omitted from the front and rear sides of broken and dotted lane line traffic stripes.

Contrast striping materials and application shall conform to the manufacturer's specifications.

The markings shall have crisp distinct edges and clean cutoff at the end of each line.

(B) RECESS DIAMOND GRINDING.

The Contractor shall diamond grind bituminous surfaced roadways and concrete bridge decks and surfaces to create a recess for traffic stripes to be installed below the adjacent roadway surface as directed by the Contract documents. Transverse deck grooving on concrete bridge decks and surfaces shall be completed before the diamond grinding for the traffic stripe recess.

The recess dimensions and positioning shall be as follows:

- (1) The recess width shall exceed the width of the marking material, inclusive of the black markings for contrast traffic stripes, by 1 inch to allow a ½ inch border around the perimeter of the recessed traffic stripe.
- (2) For broken and dotted lane line traffic stripes, the leading and trailing ends of the recess shall allow a maximum tolerance of 6 inches.
- (3) The recess depth shall be as directed in 516.04(A) for the specified pavement marking system. Depth of recessing may be adjusted based on the recommendations of the manufacturers of the approved pavement marking system. Where the recessed traffic stripe is to be installed on concrete bridge decks, the tolerance for over-grinding is reduced to zero.
- (4) The edge of the recess shall be positioned a minimum of 2 inches from the edge of any concrete joints and 4 inches from any bituminous longitudinal pavement joints.

Depth shall be consistent across the full width of the recess. Depth plates shall be provided by the Contractor to the Engineer to assure that desired recess depth is achieved.

Prior to grinding for all recessed lines, the Contractor shall use a chalk line or other suitable method to layout the proposed traffic stripes on the roadway surface so that the Engineer can inspect the locations. Once the Engineer has inspected and approved the proposed traffic striping layout, diamond grinding of the recess may proceed. No recess diamond grinding shall be done without the prior approval of the Engineer.

The recess shall not be installed on bridge joints, on drainage structures, or in other areas identified by the Engineer. The recess shall not be installed continuously for intermittent traffic stripes such as broken or

dotted lane lines, but only where pavement markings are to be applied.

Recesses that are out of alignment or ground deeper or wider than the specified allowable limits shall be repaired per the direction of the Engineer at no additional cost. Recesses that are ground too shallow, too narrow, or with unacceptable rises between blade cuts shall be reground to the correct size, depth, and surface finish at no additional cost.

Recesses shall be clean, dry and free of laitance, oil, dirt, grease, paint or other foreign contaminants.

After the depth, width, length, position, and surface condition has been approved by the Engineer, an air lance shall be used to remove fine particles from the recess. Air compressors shall initially be blown out away from the application area to prevent compressor condensation build-up from entering the recess. The Contractor shall prevent traffic from traversing the recesses and re-clean recesses, as necessary, prior to application of the pavement marking system at no additional cost.

Newly placed asphalt shall be allowed to cure for a minimum of 10 days prior to installing recess. On concrete surfaces the transverse deck grooving shall be completed before installing the pavement marking recess.

All recesses must be given final approval by the Engineer prior to the placement of pavement markings.

(C) TEMPORARY PAVEMENT STRIPING.

Temporary pavement striping shall be provided by the Contractor when required per the Plans and provisions of this subparagraph when required for staged construction.

Temporary pavement striping shall be applied in construction work areas, at the locations shown on the Plans, to clean dry surfaces in accordance with the manufacturer's recommendations including use of primer as approved by the Engineer.

Prior to reopening travel lanes to final traffic conditions, pavement markings shall be reestablished with temporary pavement striping on all newly paved areas less than twenty-four (24) hours old. Temporary pavement striping must be maintained in a serviceable condition in accordance with the various provisions contained herein and subject to the satisfaction of the Engineer until such time as the durable pavement markings are constructed.

Temporary pavement striping shall be 6 inches wide for all locations where the temporary pavement stripe is applied at the same location as the recessed permanent pavement striping to follow, or where the temporary pavement striping is applied within the limits of pavement resurfacing to follow; in all other locations the temporary pavement striping shall 4 inches wide.

The following types of pavement marking systems for temporary pavement striping shall be acceptable, adhering to the below conditions:

(1) Removable Wet Reflective Pavement Marking Tape.

This shall be used for applications of four (4) days or less.

Removable wet reflective pavement marking tape, meeting the requirements of Subsection 920.10, shall be installed at designated locations under the guidance and in the presence of the manufacturer's representative, in accordance with the manufacturer's recommendations. Primers, if required, shall be used to promote tape adhesion to the wearing surface in accordance with the tape manufacturer's recommendations. The tape shall be white or yellow and shall be installed in single or double lines, as designated.

Removable wet reflective pavement marking tape shall not be overlapped. Only butt splices shall be used and continuous runs of tape shall be scored at 50-foot intervals.

Removable wet reflective pavement marking tape shall be removed when no longer required for traffic control. Removal shall be performed manually, by scraping if necessary, without the use of solvents, burning, grinding, or sand/shot blasting.

(2) Latex Paint Pavement Markings.

Latex paint may be used for pavement marking applications that will remain in place for longer than four (4) days and shall be reinstalled every thirty (30) days. Latex paint pavement markings shall have a minimum retained coefficient of dry retroreflectance value of 150 mcd/m²/lx. Latex paint shall not be used between October 15 and April 15.

The Contractor shall apply latex paint pavement markings when the ambient and surface temperatures are above 45°F and rising. The latex paint pavement markings shall be applied in a wet film thickness of 6 ± 1 mil, where markings are required for 14 days or less. The latex paint markings shall be applied in a wet film thickness of 15 ± 1 mil where markings are to be visible to traffic 15 days and beyond, or when markings are to be placed on intermediate pavement layers to be opened to traffic due to staged construction.

The application of the latex paint binder and glass beads, applied separately, including mixing and thinning of the latex paint binder, equipment pressures and operating speed of equipment, shall be in accordance with the material manufacturer's instructions and recommendations. The application of glass beads shall be uniform and shall immediately follow the application of the latex binder.

Wet reflective optics shall not be used with latex paint pavement markings unless noted otherwise in the Contract documents or directed by the Engineer. If wet reflective optics are to be used the thickness of the latex paint shall be adjusted to the appropriate depth to ensure adherence of the optics in accordance with the optic manufacturer's recommendation.

When latex paint pavement markings are required to remain visible beyond 14 days, the Contractor shall apply, before acceptance and when directed, additional applications of latex binder material and glass beads. These applications shall be applied as required by the Engineer and after any sawing or sealing of joints in the HMA overlay.

Reinstallation of latex paint pavement markings may be atop of existing latex paint, thermoplastic, and epoxy pavement markings when the existing pavement marking system(s) are firmly bonded to the existing pavement surface. All other materials except those noted shall be removed prior to placement of latex paint pavement markings.

(3) Thermoplastic Pavement Markings.

Thermoplastic pavement markings may be used for temporary traffic conditions in lieu of latex pavement markings, based on temperature constraints, as noted on the plans or as directed by the Engineer.

Temporary thermoplastic traffic stripes shall not be placed on newly constructed concrete decks until the decks are a minimum of 24 hours old.

Refer to Subparagraph 516.04(A)(1).

(4) Epoxy Resin Markings.

Epoxy resin pavement markings may be used for temporary traffic conditions in lieu of latex pavement markings, based on temperature constraints, as noted on the plans or as directed by the Engineer.

Refer to Subparagraph 516.04(A)(2).

(D) PAVEMENT MARKING REMOVAL

The Contractor shall remove all types of pavement markings as directed by methods that do not damage the integrity of the underlying pavement or adjacent pavement areas, and that do not cause gouging, or create ridges or grooves in the pavement that may result in compromising vehicular control. Obliterating markings by painting over them with black paint shall not be permitted except for areas of open grade friction course (OGFC) and where specifically called for in the contract documents or as directed by the Engineer.

Before starting removal operations, the Contractor shall demonstrate the proposed method to accomplish the removal of approximately 100 percent of the marking without the removal of more than 50 mils of pavement thickness. Removal operations will not be permitted until the method of removal has been approved.

Debris from the removal of pavement markings shall be disposed of as directed by the Engineer.

Pavement markings shall be removed before any change is made in the traffic pattern.

The Contractor shall employ mechanical (grinding or sandblasting), hydromilling, or black line mask for obliterating stripes as shown on the Plans. Striping removal operations will not be permitted until the removal method has been tested and approved by the Engineer.

Grinding or Sandblasting shall only be performed on pavement and concrete-wearing surfaces which are scheduled to be replaced.

Hydromilling shall be used in the removal of existing or temporary markings on pavement and concrete-wearing surfaces which are scheduled to remain. The hydromilling system shall be as specified in

Subsection 919.51. The area of removal includes the area of the marking plus 1 inch on all sides. Hydromilling shall not be used when the temperature is 35°F and below.

When black painting of existing pavement markings is permitted, the existing marking shall be kept obliterated for the duration of the work under that stage. Black paint used for obliteration of existing epoxy or latex paint pavement markings shall not be removed and epoxy or latex paint pavement marking will be installed over the black paint. Black paint shall not be used over existing thermoplastic or permanent tape pavement markings. If the existing marking reappear, the black paint shall be reapplied.

Pavement markings shall be removed to the fullest extent possible from the pavement by methods that do not damage the surface texture or result in undesirable variations in color. Sand or other material deposited on the pavement shall be removed as the work progresses. Accumulations of sand or other material which might interfere with drainage or might constitute a hazard to traffic will not be permitted.

Where blast cleaning is performed within 10 feet of a lane occupied by public traffic, the residue including dust shall be removed immediately after contact between the sand and the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation, or by other methods acceptable to the Engineer.

Any damage to the pavement or surfacing, caused by removal of the pavement marking, shall be repaired by the Contractor at his expense by methods acceptable to the Engineer.

For construction durations of greater than 7 days, the Contractor shall cover the existing pavement markings by placing a removable black line mask over them. The removable black line mask shall be applied and tamped in accordance with the manufacturer's recommendations and any required primer. It shall completely mask the existing pavement markings being covered and extend one inch beyond their edges. The black line mask shall provide a neat, durable masking that must be replaced if it flows, distorts, lifts or shrinks during its use, as directed by the Engineer. When directed, the black line mask shall be removed, and the travel lanes shall revert to their original alignment. Black line mask shall be used for temporary obliteration of existing pavement stripes for staged construction with durations of fifteen (15) days or less. Removable Black Line Mask shall not be overlapped. Only butt splices shall be used. Continuous runs shall be scored at 50-foot intervals.

For lane shifts or traffic detours, when a portion or all of the shoulder is to be used as a traffic lane, the Contractor shall obliterate existing pavement stripes as called for in the plans or as directed by the Engineer and place temporary pavement striping. At the deceleration and acceleration lanes when a portion or all of the shoulder is used as a traffic lane, the Contractor shall remove the pavement markings delineating the auxiliary lane. Upon completion of the work, all pavement markings shall be reinstalled in accordance with the details shown on the Standard Drawings, unless shown differently on the contract plans.

At no cost to the Authority, the Contractor shall remove all temporary pavement markings that will not be directly under durable pavement markings where such markings would be allowed to remain as per the contract documents.

(E) PAVEMENT MARKING ACCEPTANCE

(1) Determination of Acceptability.

Before starting all pavement marking operations, the Contractor shall construct one or more test strips. Each test strip shall consist of approximately 500 linear feet of pavement with white and yellow traffic stripes (lane and edge lines) or markings similar to that required for the Project. The test strips shall demonstrate the capability of the proposed materials, equipment, and procedures to produce pavement markings that comply with the Specifications, including dimensions, appearance (uniform color and crisp, well-defined edges), wet film thickness, drying time, and retroreflective components application and retention. A test strip will be required for each applicator unit used. Additional test strips may be required when major equipment repairs or adjustments are made or when the pavement markings fail to comply with the Specifications. Permission to proceed with the pavement marking operations will be given when the test strips are in compliance. Each test strip may remain in place and become part of the finished stripes subject to the requirements of Paragraph 516.04(A).

(2) Defective Markings.

The Contractor shall replace at no cost to the Authority, installed durable pavement markings determined by the Engineer to be in non-conformance with the Specifications, not placed at the locations or in the dimensions specified, to have an incorrect color, to have failed to bond to the pavement, or to have chipped or cracked.

The Contractor shall replace defective pavement markings based on the following:

- (1) The entire length of traffic stripe or traffic line shall be replaced if any portion of the stripe or line is determined to have a deficiency as defined herein unless noted otherwise.
- (2) The entire area of traffic symbol shall be replaced if any portion of the symbol is determined to have a deficiency as defined herein unless noted otherwise.
- (3) The pavement marking is determined to have a wet film thickness of less than the permissible, based upon the calculated and measured yields.
- (4) The pavement marking is determined to have improperly cured or a discoloration has occurred. Discoloration is defined as localized areas or patches of brown or grayish colored material. When improper curing or discoloration occurs intermittently in intervals of 100 feet or less throughout the traffic stripe, the entire length of traffic stripe shall be replaced from where it first occurs until where it no longer exists plus 5 feet on each end.
- (5) The pavement marking is determined to have failed to bond to the pavement or has chipped or cracked. The pavement marking shall be replaced from where it first occurs to where it no longer exists. When more than 25 spots (combined or individual) of chipping, cracking or poor bonding has occurred within a 1,000 linear foot distance, the entire 1,000 linear feet shall be replaced.
- (6) The pavement marking is determined to have deficient retroreflective component coverage or retention, based on yield determinations made during application and on visual comparisons of the production pavement markings with those of the test strips.
- (7) The entire 1-mile length of traffic stripe shall be replaced where the minimum initial retroreflectivity value of two of four readings for that 1-mile length of traffic stripe is less than required by Paragraph 516.04(A). Initial retroreflectance for determination of acceptance will be determined as follows:

- Step 1: Visual night inspections will be made to identify traffic markings which appear to be below the specified minimum value.
- Step 2: All retroreflectance measurements will be made on a clean, dry surface utilizing a portable reflectometer.
- Step 3: (a) For word traffic symbols, three random retroreflectance measurements will be made on each letter.
(b) For all other traffic symbols, nine random retroreflectance measurements will be made over the symbol.
- Step 4: All retroreflectance measurements within an area will be averaged to determine if the minimum retroreflectance requirements are met.

Remove defective pavement markings in accordance with Paragraph 516.04(D). Obliterating defective markings by black painting over them will not be permitted.

If the Authority determines that emergency repairs are necessary, the contractor shall perform the repairs within 24 hours of notification. If the contractor fails to respond within the 24-hour period, the Authority reserves the right to perform the repairs and will charge the contractor for all costs. The Authority's determination of costs incurred is final and conclusive.

Removable Wet Reflective Pavement Marking Tape that has become damaged, and is no longer serviceable, in the sole opinion of the Engineer, shall be replaced immediately. Damaged tape that is not replaced immediately may be replaced by the Authority and the costs shall be charged to the Contractor in accordance with Subsection 106.23.

At no cost to the Authority, the Contractor shall replace markings damaged due to any sawing or sealing of joints in the bituminous roadway surface.

Defective pavement markings shall be replaced with the same requirements as the original material; if it is determined that the defect was a result of the pavement system, a different pavement marking system may be used as directed by the Engineer.

Repair or replace other defects not noted above, but determined by the Engineer to need repair, as directed by and to the satisfaction of the Engineer.

(F) OPENING TO TRAFFIC.

Pavement markings shall be applied, utilizing lane and/or shoulder closings and be thoroughly dry before opening to traffic. The Contractor shall complete each application of all types of pavement markings and allow them to thoroughly dry before opening to traffic. In the event a vehicle should cross the molten pavement marking binder, such pavement markings shall be reapplied, and any tracking of the pavement markings made by the moving vehicle shall be removed at no additional cost to the Authority.

Should ambient and surface temperatures be below the minimums specified for various materials, with approval, pavement markings may be placed at temperatures as low as 35°F in order to open the traveled way to traffic. Placement of durable pavement markings may be delayed for up to seven days after paving. If the application of durable pavement markings will be delayed following the paving operation, temporary markings shall be applied, so that the paved roadway will be marked according to the pavement marking details, prior to opening the roadway to traffic. Temporary traffic markings shall be applied in accordance with Paragraph 516.04(C). The Engineer will determine when the traveled way is to be opened.

516.05 Measurement.

Traffic Stripes of the various binder material types will be measured by the linear foot of 6-inch width of yellow or white traffic stripe applied for each binder material type, regardless of color. Widths not equal to 6 inches will be converted to equivalent linear feet of 6-inch width. Gaps in traffic striping will not be measured for payment.

Contrast Traffic Stripes will be measured by the linear foot of 6-inch width of yellow or white traffic stripe applied for each binder material type, regardless of color. Widths not equal to 6 inches will be converted to equivalent linear feet of 6-inch width. The black stripe installed along the perimeter of the yellow or white traffic stripe will not be measured for payment. Gaps in traffic striping will not be measured for payment.

Traffic Lines of the various binder material types for diagonal gore lines, crosswalks, or stop lines will be measured by the linear foot per 6-inch width of traffic line applied for each binder material type, regardless of color. Widths not equal to 6 inches will be converted to equivalent linear feet of 6-inch width. Gaps between traffic lines will not be measured for payment.

Contrast Traffic Lines of the various binder material types for diagonal gore lines, crosswalks, or stop lines will be measured by the linear foot per 6-inch width of traffic line applied for each binder material type, regardless of color. Widths not equal to 6 inches will be converted to equivalent linear feet of 6-inch width. The black stripe installed along the perimeter of the traffic stripe will not be measured for payment. Gaps between traffic lines will not be measured for payment.

Traffic Symbols of the various binder material types will be measured by the square foot for each binder material type, regardless of color. Gaps between, or voids within, traffic symbols will not be measured for payment.

Contrast Traffic Symbols of the various binder material types will be measured by the square foot for each binder material type, regardless of color. The black background installed under the symbol will not be measured for payment. Gaps between, or voids within, traffic symbols will not be measured for payment.

Diamond Grinding will be measured by the linear foot, based on 6-inch width, of recessed traffic stripes installed. Gaps in traffic striping that are not ground will not be measured for payment. Traffic Stripes of widths not equal to 6 inches will be converted to equivalent linear feet of 6-inch width. The additional width of grinding beyond the width of the traffic stripe will not be measured for payment.

Temporary Pavement Stripes will be measured by the linear foot of Latex Paint applied, regardless of the color and width. Temporary Traffic Stripes which are replaced because of damage or excessive wear, as determined by the Engineer, will be measured for payment. Gaps in temporary traffic stripes will not be measured for payment. Durable pavement marking systems used for temporary pavement striping will be measured for payment as Traffic Stripes as defined above.

Removable Wet Reflective Pavement Marking Tape will be measured by the linear foot per 6-inch width of traffic line applied, regardless of color. Widths not equal to 6 inches will be converted to equivalent linear feet of 6-inch width. Gaps in tape will not be measured for payment.

Removable black line mask of the width specified will be measured by the linear foot applied, based on 6-inch width of the existing marking being obscured. Removable black line mask, which is replaced because of damage through no fault of the Contractor, as determined by the Engineer, will be measured for payment. Any Contractor damaged striping or black line mask materials shall be replaced at Contractor expense. The additional width of removable black line mask beyond the width of the existing traffic marking being obscured will not be measured for payment.

Striping and Marking Removal, Hydromilling will be measured by the linear foot of pavement marking removed by hydromilling. Gaps in pavement markings not requiring removal will not be measured for payment.

Striping and Marking Removal, Mechanical will be measured by the linear foot of pavement marking removed by mechanical means (grinding or sandblasting). Gaps in pavement markings not requiring removal will not be measured for payment.

Striping and Marking Removal, Painting will be measured by the linear foot, based on 6-inch width of the marking to be obscured. Widths not equal to 6 inches will be converted to equivalent linear feet of 6-inch width. The amount of paint extending beyond the pavement marking to be obscured will not be measured for payment. Gaps between pavement markings will not be measured for payment.

Restore Traffic Stripes, Thermoplastic; Restore Traffic Lines, Thermoplastic; and, Restore Traffic Symbols, Thermoplastic will be measured as noted for Traffic Stripes, Thermoplastic; Traffic Lines, Thermoplastic; and, Traffic Symbols, Thermoplastic respectively.

516.06 Payment.

Payment will be made under:

<i>PAY ITEM.....</i>	<i>PAY UNIT</i>
TRAFFIC STRIPES, EPOXY RESIN	LINEAR FOOT
TRAFFIC STRIPES, THERMOPLASTIC	LINEAR FOOT
TRAFFIC STRIPES, PERMANENT TAPE.....	LINEAR FOOT
CONTRAST TRAFFIC STRIPES, EPOXY RESIN.....	LINEAR FOOT
CONTRAST TRAFFIC STRIPES, PERMANENT TAPE	LINEAR FOOT
TRAFFIC LINES, EPOXY RESIN	LINEAR FOOT
CONTRAST TRAFFIC LINES, EPOXY RESIN.....	LINEAR FOOT
TRAFFIC LINES, THERMOPLASTIC	LINEAR FOOT
TRAFFIC SYMBOLS, EPOXY RESIN	SQUARE FOOT
CONTRAST TRAFFIC SYMBOLS, EPOXY RESIN	SQUARE FOOT
TRAFFIC SYMBOLS, THERMOPLASTIC.....	SQUARE FOOT
DIAMOND GRINDING	LINEAR FOOT
TEMPORARY PAVEMENT STRIPING	LINEAR FOOT
RESTORE TRAFFIC STRIPES, THERMOPLASTIC	LINEAR FOOT
RESTORE TRAFFIC LINES, THERMOPLASTIC	LINEAR FOOT
RESTORE TRAFFIC SYMBOLS, THERMOPLASTIC.....	SQUARE FOOT
REMOVABLE WET REFLECTIVE PAVEMENT MARKING TAPE.....	LINEAR FOOT
REMOVABLE BLACK LINE MASK	LINEAR FOOT
STRIPING AND MARKING REMOVAL, HYDROMILLING	LINEAR FOOT
STRIPING AND MARKING REMOVAL, MECHANICAL.....	LINEAR FOOT
STRIPING AND MARKING REMOVAL, PAINTING.....	LINEAR FOOT

Furnishing and installation of glass beads or wet reflective optics will not be measured for payment but shall be considered incidental to the pavement marking and the costs thereof shall be included in the respective pavement marking pay items for application.

Permanent Tape that has become damaged and is no longer serviceable shall be replaced immediately without additional compensation and will not be measured for payment. Permanent Tape that is damaged by construction operations shall also be replaced immediately without additional compensation and will not be measured for payment.

Traffic control for the adhesion and retroreflectivity testing to be performed by an agreed upon third party shall be provided by the Contractor and shall be paid for under the item Furnishing Traffic Control Devices.

No separate payment will be made for black traffic paint used to temporarily obliterate traffic stripes, but the costs thereof shall be included in the pay item(s) for the removal of striping.

Temporary pavement striping constructed on new pavement less than twenty-four (24) hours old, necessary to re-open a staged work area to traffic, will not be measured for payment but shall be considered incidental to the placement of pavement.

No separate payment will be made for the removal of Removable Wet Reflective Pavement Marking Tape or Removable Black Line Mask, but the costs thereof shall be included in their respective pay items for application.

Removable Wet Reflective Pavement Marking Tape that has become damaged and is no longer serviceable shall be replaced immediately without additional compensation and will not be measured for payment. Tape that is damaged by construction operations shall also be replaced immediately without additional compensation and will not be measured for payment. Damaged tape, not replaced immediately, may be replaced by the Authority and the costs shall be charged to the Contractor in accordance with Subsection 106.23.

SECTION 530 - RAISED PAVEMENT MARKERS

Delete this Section in its entirety.

NOTE: The following text is ADDED to the latest version of the 2016 Standard Supplementary Specifications.

SECTION 534 – TRENCHLESS INSTALLATION OF UNDERGROUND FACILITIES

534.04 Methods of Construction

(R) CONNECTIONS

Delete the fourth paragraph in its entirety and replace with:

All other connections shall satisfy the requirements of Subsection 923.08 and be performed in accordance with the certified SSWP.

NOTE: The following text REPLACES the respective Sections and Subsections of the latest version of the 2016 Standard Supplementary Specifications.

SECTION 913 – PAINTS AND COATINGS

913.04 Pavement Markings.

Delete this Subsection in its entirety and replace it with the following:

(A) LATEX PAINT

Latex paints shall be as specified herein and shall be suitable for application by spray equipment and shall be capable of receiving and securely holding glass beads when applied by the drop-on method for producing reflectorized traffic markings on hard surface pavement of all types.

The pigment and vehicle shall be so prepared and blended that the resulting paint shall be uniform in composition and of the required consistency. The paint at the time of use shall comply with all the provisions specified herein.

In addition to the methods of tests and inspection set forth below, the Engineer reserves the right to make any and all additional tests he may deem necessary to determine compliance with these Specifications and the suitability of the paint for its intended use. The Engineer further reserves the right to require the manufacturer of the paint to certify to the use of specific materials and components in the quantities specified herein where such materials or components are not readily identifiable in the finished paint.

All paint furnished must be shipped in strong, substantial containers, plainly marked with the name, weight and volume of the content, together with the color, formula and name and address of the manufacturer.

Latex traffic paint for traffic stripes or traffic markings shall be a white or a yellow ready-mixed pigmented binder that is emulsified in water and capable of anchoring reflective glass beads that are separately applied. In addition, the paint shall not contain any of the materials listed in the EPA Code of Regulations (CFR) 40, Section 261.24, Table 1.

Manufacturers of latex paint shall have produced, to the satisfaction of the Authority, a fast-drying traffic paint that meets the following requirements:

(1) Composition.

The exact composition of the latex paint shall be left to the discretion of the manufacturer, provided that the finished product meets the requirements as stipulated hereinafter.

(2) Pigment.

The pigment portion shall be a combination of prime and extender pigments as required to produce either a white or yellow traffic paint meeting the color and other requirements of the finished product for white or yellow, as specified elsewhere in this specification.

The prime pigment for white paint shall be titanium dioxide conforming to ASTM D 476, Type IV, with a minimum titanium dioxide content of 94 percent and shall be used at a minimum rate of 1 pound per gallon.

The prime pigment for yellow paint shall be a non-toxic organic pigment yellow, No. 75 or equal pre-approved by the Authority laboratory, with excellent exterior and color permanence. The prime pigment shall also contain a minimum 0.2 pounds per gallon of titanium dioxide conforming to ASTM D 476, Type IV, 94 percent purity.

The percent pigment by weight of the finished product shall not be less than 60 nor more than 62 percent.

(3) Vehicle.

The non-volatile vehicle shall not be less than 42 percent by weight, and shall be pre-approved by the Authority Laboratory and meet the dry through (early washout) requirements specified hereinafter.

(4) Physical Properties.

(a) Color.

The color shall match FED-STD-595B, No. 33538 for yellow, No. 37886 for white, and No. 37038 for black

(b) Organic Volatiles.

The volatile organic content (VOC) of the finished paint shall contain less than 2 pounds per gallon of volatile organic matter of total non-volatile paint material as required by NJSA 7:27-23.

(c) Volume of Solids.

The finished paint shall not be less than 61 percent solids by volume.

(d) Total Solids.

The finished paint shall not be less than 77.5 percent total non-volatiles by weight, when tested according to ASTM D 2369.

(e) Weight.

The weight of the finished paint shall be 14 ± 0.2 pounds per gallon for each color.

(f) Grind.

The grind shall not be less than 2 Hegman when tested in accordance with ASTM D 1210.

(g) Field No-Tracking Time.

The paint shall dry to a no-tracking condition under traffic in 120 seconds maximum when the ambient temperature is 77 °F, and when applied in a wet film thickness of 15 ± 1 mil, at 140 °F, and with glass beads at the rates specified in Paragraph 913.04(F) for latex traffic paint.

(h) Viscosity.

The consistency of the paint shall be not less than 70 nor more than 95 Krebs Units at 77 °F, when tested according to ASTM D 562.

(i) Flexibility.

The paint shall show no cracking or flaking when tested according to ASTM D 522.

(j) Dry Opacity.

The minimum contrast ratio shall be 0.95 when tested according to ASTM D 2805.

(k) Daylight Reflectance.

The daylight directional reflectance shall not be less than 85 percent for the white paint and not less than 54 percent for the yellow (relative to magnesium oxide), when tested according to ASTM E 1347.

(l) Abrasion Resistance.

The abrasion resistance shall be such that no less than 55 gallons of sand shall be required for removal of the paint film when tested according to ASTM D 968.

(m) Dilution Test.

The paint shall be capable of dilution with water at all levels without curdling or precipitation such that the wet paint can be readily cleaned up with only water.

(n) Dry Through (Early Washout).

The "dry through" time of a 15-mil wet film placed immediately in a humidity chamber maintained at 72.5 ± 2.5 °F and 90 ± 5 percent relative humidity shall be less than or equal to the Authority Laboratory reference film when tested according to ASTM D 1640, except that the pressure exerted shall be the minimum needed to maintain contact with the thumb and film.

(o) Shelf Life.

All paint furnished shall have a minimum shelf life of nine months at temperatures above 35 °F. When tested, the paint shall conform to the physical requirements specified herein. In addition,

the paint shall show no skinning, gelling or hardening on the surface, nor hard settling upon storage in the sealed containers, that will affect the performance of the product.

(p) Packaging.

The paint shall be delivered in containers as recommended by the manufacturer. The containers shall be free of pin holes, scratches, or other defects that may allow contamination of the paint from corrosion of the container.

Each container shall be clearly marked to indicate the color of the material, process batch number or similar manufacturer's identification, manufacturer's name, address of the plant, and date of manufacture. All containers shall be labeled according to the current code of Federal Regulations and shall contain all information necessary to comply with NJSA 34:5A-1, NJ Worker and Community Right to Know Act.

(5) Inspection and Testing.

The manufacturer shall provide access for the representative of the Authority's independent testing laboratory to obtain two one-quart production samples of the paint for each production batch. Each sample shall be accompanied by an analysis report showing compliance with specification requirements for the following physical tests:

(a) Viscosity.

(b) Weight per gallon.

(c) Grind.

Testing shall be performed on production batches by the manufacturer and witnessed by the representative of the laboratory or Authority. Compliance with the above requirements must be met before batches are sampled for testing by the Authority Laboratory.

The Authority also reserves the right to randomly sample raw materials during the manufacturing process.

Only Authority approved material conforming to all the requirements of this specification shall be shipped. Any specification deviation will result in rejection of the entire batch. Paint not approved, but shipped, shall be picked up entirely at the manufacturer's expense.

(B) EPOXY RESIN

Epoxy resin compound shall be specifically formulated for use as a durable pavement marking for hot-spray application at elevated temperatures. The types and amounts of epoxy resins and curing agents shall be at the discretion of the manufacturer, provided that the physical properties and composition specified in this Subsection are satisfied.

(1) Physical Properties of the Mixed Compound.

(a) Samples.

All samples shall be mixed at the ratio specified by the manufacturer and tested at an ambient temperature of 73 ± 5 °F unless otherwise specified.

(b) Color.

The white and yellow epoxy resin compound, when applied in a wet film thickness of 20 ± 1 mil and allowed to cure, shall meet the following initial color requirements as depicted in Table 913-01.

Table 913-01 Initial Color Requirements										
Color	1		2		3		4		Reflectance Limits Y (%)	
	x	y	x	y	x	y	x	y	Min.	Max.
White	0.302	0.344	0.325	0.344	0.302	0.320	0.325	0.320	80.0	100.0
Yellow	0.5425	0.4718	0.4752	0.4718	0.5425	0.4245	0.4752	0.4245	50.0	60.0

The black epoxy resin compound, when applied in a wet film thickness of 20 ± 1 mils and allowed to cure, shall match color chip No. 37038 of FED-STD-595B.

The blue epoxy resin compound, when applied in a wet film thickness of 20 ± 1 mils and allowed to cure, shall match color chip No. 35180 of FED-STD-595B.

(c) Yellowness Index.

When tested according to ASTM D 1925-95 (with glass beads), the white epoxy resin should exhibit the following color stability:

Maximum Yellowness Index before QUV: 10.00

Maximum Yellowness Index after 72 hours QUV: 20.00

(d) Directional Reflectance.

The white epoxy resin compound (without glass beads) shall have a daylight directional reflectance of not less than 80 percent relative to a magnesium oxide standard when tested according to ASTM E 1347.

The yellow epoxy resin compound (without glass beads) shall have a daylight directional reflectance of not less than 50 percent relative to a magnesium oxide standard when tested according to ASTM E 1347.

(e) Drying Time.

The epoxy resin compounds, when mixed in the proper ratio and applied according to the thickness requirements specified above and immediately dressed with glass beads and wet reflective optics at the rates specified in Paragraphs 913.04(F) and 913.04(G), shall exhibit a no-track drying time of 15 minutes or less when tested according to ASTM D 711.

(f) Abrasion Resistance.

When the epoxy resin material is tested according to ASTM C 501 with a CS-17 wheel under a load of 1,000 grams for 1,000 cycles, the abrasive wear index shall be no greater than 80. The abrasive wear index is the weight in milligrams that is abraded from the sample under the specified test conditions.

(g) Hardness.

After the epoxy resin material has cured for not less than 72 hours and not more than 96 hours at 70 °F, Shore D hardness of the material shall be not less than 75 nor more than 100 when tested according to ASTM D 2240.

(2) Epoxy Composition.

Black epoxy resin is to be applied with black aggregate to remove any sheen. Use a black aggregate as recommended by the epoxy resin manufacturer.

The epoxy resin material shall be a two-component (Component A and Component B), 100 percent solids type system formulated and designed to provide a simple volumetric mixing ratio (e.g., two volumes of Component A to one volume of Component B) according to Table 913-02:

Table 913-02 Epoxy Composition		
Pigment Composition	Percent By Weight	
	Minimum	Maximum
White:		
Titanium Dioxide Rustile (94% minimum purity) (ASTM D 476, Type III)	18.0	25.0
Epoxy Resin	75.0	82.0
Yellow:		
Organic Non-Lead Yellow	7.0	8.0
Epoxy Resin	77.0	79.0
Titanium Dioxide (ASTM D 476, Type III)	14.0	17.0
Black:		
Epoxy Resin	79%	
Black Pigment	21%	
Blue:		
Epoxy Resin	79%	
Blue Pigment	21%	

The entire pigment composition shall consist of titanium dioxide. No extender pigments shall be permitted, except in non-lead formula.

The epoxy resin shall be as follows:

(a) Epoxy Content (Component A).

The epoxy content of the epoxy resin shall be tested according to ASTM D 1652 and calculated as the weight per epoxy equivalent (WPE). The epoxy content shall be determined on a pigment free basis and shall meet the target value provided by the manufacturer's certification and approved by the Authority. A tolerance of plus or minus 50 will be applied to the target value to establish the acceptance range.

(b) Amine Value (Component B).

The amine value of the curing agent shall be determined according to ASTM D 2074. The total amine value shall meet a target value provided by the manufacturer and approved by the Authority. A tolerance of plus or minus 50 will be applied to the target value to establish the acceptance range. If the manufacturer specifies an alternate test method for determining the amine value, the alternate shall be subject to approval by the Authority's Bureau of Materials.

(c) Toxicity.

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

(3) Sampling and Certified Analysis.

The epoxy manufacturer shall furnish certified test results that each batch of epoxy resin material used on the Project complies with these specifications. In addition, all epoxy components shall be pre-approved for use on the Project. Samples of the epoxy components shall be submitted to the Authority Laboratory at least 30 days before the needed approval date.

To verify that the epoxy resin material subsequently used on the Project is of an identical formulation as those pre-approved, epoxy components shall be sampled at the Project and submitted to the Authority Laboratory. These sample components shall match their respective infrared spectrums in the pre-approved file in the Authority Laboratory.

(4) Containers and Shipment.

The epoxy resin material shall be shipped in appropriate containers supplied by the Contractor and shall be plainly marked with the following information:

Manufacturer's Name and Address.

- (a) Name of Product.
- (b) Lot/Batch Number.
- (c) Color.
- (d) Net Weight and Volume of Contents.
- (e) Date of Manufacture.
- (f) Date of Expiration.
- (g) Statement of Contents (As Appropriate):
 - Component A - Pigment and Epoxy Resin.
 - Component B - Catalyst.
- (h) Mixing Proportions and Instructions.
- (i) Safety Information.

(C) THERMOPLASTIC

Thermoplastic for durable pavement markings shall be of either preformed or hot extruded material. The thermoplastic, including pre-mix glass beads, shall conform to the requirements of AASHTO M 249, except as follows:

- (1) Preformed material shall be 90 mils thick (± 5 mils) and conform to only those portions of AASHTO M 249 not associated with material in a liquid state.
- (2) For white, the composition of the mixture shall be according to Table 913-03.

Table 913-03 Thermoplastic Composition (White)	
Component	Percent by weight
Resin/Binder	22-26 percent minimum
Glass Beads (pre-mix)	30 percent minimum
White Pigment	10 percent minimum
Calcium Carbonate and Inert Fillers (shall not contain silica other than as glass beads)	34-38 percent maximum

- (3) For yellow non-lead formulas, the composition of the mixture shall be according to Table 913-04.

Table 913-04 Thermoplastic Composition (Yellow)	
Component	Percent by weight
Resin/Binder	22-26 percent minimum
Glass Beads (pre-mix)	30 percent minimum
Yellow Pigment	2 percent minimum
Calcium Carbonate and Inert Fillers (shall not contain silica other than as glass beads)	42-46 percent maximum

The yellow material's combined totals of lead, cadmium, mercury, and hexavalent chromium shall not exceed 100 parts per million.

Other colors shall be as per table 913-04 with the pigment coinciding with the color of the thermoplastic. Blue shall match color chip No. 35180 of FED-STD-595B.

The thermoplastic manufacturer shall certify, according to Subsection 105.04, that the material will meet the requirements specified.

(D) GLASS BEADS

Glass beads shall meet AASHTO M-247 requirements except as modified and shall be from an approved supplier as listed on the QPL. Drop rates shall be a minimum of 10 pounds per 100 square feet of marking and as directed by the manufacturer.

Glass beads shall be a minimum 40 percent molten kiln direct melt virgin glass.

All glass beads shall be transparent, clean, colorless glass which are smooth and spherically shaped and free of milkiness, pits, or air bubbles. All glass beads shall conform to the following when tested according to Subsection 990.10 and with other appropriate methods:

(1) Spherical Particles (Rounds).

Glass beads shall contain a minimum of 80 percent rounds per screen for the two highest sieve quantities. There shall be no more than 3 percent sharp angular particles per screen. The remaining sieve fractions shall contain not less than 75 percent rounds.

(a) Gradation.

The beads shall meet the specified grading requirements for marking materials when tested according to ASTM D 1214.

Table 913-06 Bead Gradation		
US Mesh	Micron	Percent Retained by weight
No. 18	1000	20-35
No. 30	600	50-70
No. 50	300	95-100

(b) Coating.

The beads shall be coated with a silane adherence coating meeting the requirements of Subsection 990.06, except that pre-mix beads for thermoplastic shall be uncoated and conform to AASHTO M247, Type 1.

Glass beads used with waterborne marking material require a moisture resistant coating.

Additional coatings on glass beads shall be in accordance with the manufacturer's recommendations.

(c) Index of Refraction.

Glass beads, when tested by the liquid immersion method, shall show a minimum refractive index of 1.5.

(d) Chemical Stability.

Glass beads that show any tendency toward decomposition, including surface etching, when exposed to atmospheric conditions, moisture, dilute acids or alkalines, or paint film constituents, shall be rejected.

(e) Packaging.

The glass beads shall be packaged in moisture-resistant containers conforming to the packaging and marking requirements of AASHTO M 247 and as recommended by the manufacturer.

Each container shall be clearly marked to indicate the material, process batch number or similar manufacturer's identification, manufacturer's name, address of the plant, and date of manufacture. All containers shall be labeled according to the current code of Federal Regulations and shall contain all information necessary to comply with NJSA 34:5A-1, NJ Worker and Community Right to Know Act.

(E) PLIANT, POLYMER RUBBER MARKING MATERIALS

Delete this Paragraph in its entirety.

(F) BLACK PAINT

Black Paint for obscuring striping shall be from an approved supplier as listed on the QPL and shall be non-reflective and abrasion and weather resistant.

See Paragraph 913.04(A).

(G) PERMANENT TAPE

Permanent tape shall be a pliant polymer preformed marking material. Permanent tape shall consist of white or yellow preformed patterned markings with white (clear) or yellow retroreflective beads incorporated. When contrast is required for traffic stripes, the material must be pre-formed and retroreflective, consisting of a white or yellow film with retroreflective beads and a contrasting black film border. The contrasting black border must be a nonreflective film bonded on each side of the white or yellow film to form a continuous roll.

The permanent tape shall be affixed to pavement using a pressure sensitive adhesive and following manufacturer's recommendations and shall be ready for traffic immediately after application. The manufacturer shall have a documented certification program for Contractor credentialing to demonstrate the Contractor's understanding and adherence to the Manufacturer's installation recommendations.

Permanent tape shall be as listed in the QPL, or an approved equal shall conform to the following properties in this subsection.

Permanent tape shall be durable and consist of white or yellow films that meet minimum retroreflective luminance values, measured at an Entrance Angle of 88.76° and an Observation Angle of 1.05° which simulate the viewing geometry of a driver at a distance of 100 feet. Minimum retroreflective luminance values are depicted in Table 913-05.

Table 913-05 Average Initial Retroreflectivity at 30-meter Geometry in mcd/m²/lx		
Test Method	Color	
	White	Yellow
Dry (ASTM E1710)	500	300
Wet Recovery (ASTM E2177)	250	200

Permanent tape shall integrate a mixture of reflective optics with refractive indices of 2.4 and 1.9.

Permanent tape shall be capable of installation within a recess or on new asphalt as an inlay. Color (daytime and nighttime) shall conform to ASTM D6628

When installed in accordance with the manufacturer's application recommendations the permanent tape shall be guaranteed to not fade, lift, shrink, or chip for a period of four years from the date of installation. During the warranty period tape shall be guaranteed to:

- (1) Maintain retroreflectance values above the minimum retained coefficient of dry retroreflection
- (2) Remain completely adhered to the roadway.
- (3) Retain sufficient thickness to avoid failure due to complete wear-through.

Provide a written warranty that includes the method of making a warranty claim. in a form acceptable to the Authority.

(H) WET REFLECTIVE OPTICS

When combined with standard glass beads, select wet reflective optics shall be from an approved supplier as listed on the QPL. The combined system of glass bead and wet optics shall meet or exceed the retroreflectivity requirements in Table 913-07.

Table 913-07 General Wet Reflective Optic Requirements: Average Initial Retroreflectivity at 30-meter Geometry in mcd/m²/lx		
Test Method	Color	
	White	Yellow
Dry (ASTM E1710)	500	300
Wet Recovery (ASTM E2177)	250	200

Wet reflective optics meeting the above retroreflectivity requirements may be elements or glass beads and should have an index of refraction that is 1.65 or greater.

Prior to application, submit certification from the wet reflective optics manufacturer that when applied according to the manufacturer's application recommendations, the wet reflective optics meet the requirements of above table.

The type, gradation, and application rates for wet reflective optics used must meet the optics manufacturer's recommendation based on the binder material.

SECTION 923 - MISCELLANEOUS

923.46 Raised Pavement Markers and Adhesive

Delete this Section in its entirety.

NOTE: The following text is ADDED to the latest version of the 2016 Standard Supplementary Specifications.

SECTION 923 – MISCELLANEOUS

923.47 High Early Strength Patch Mix

Delete this Subsection in its entirety and replace with:

High early strength patch mix for use in emergency and routine roadway and bridge repairs shall be from an approved supplier as listed on the QPL and in accordance with the specifications as set forth in Section 417 Bridge Deck Rehabilitation.