Amend **Section 629 – PAVEMENT MARKINGS** to read as follows:

"SECTION 629 - PAVEMENT MARKINGS

629.01 Description. This section describes furnishing, installing, and removing pavement markings.

629.02 Materials.

White and Yellow Traffic Paint	755.01
Pavement Markers	755.02
Adhesives for Pavement Markers	755.03
Preformed Pavement Marking Tape	755.04
Retroreflective Thermoplastic Compound Pavement Markings	755.05

Pavement markers shall be of uniform composition, free from surface irregularities, and free from other physical damage or defects that affect appearance or performance, or both.

629.03 Construction.

(A) General. Pavement markings shall conform to most recent edition of MUTCD, and as amended; and shall be applied as indicated in the contract documents.

Establish control points and layout pavement markings.

Remove surface moisture and other materials that may adversely affect bonding before applying pavement markings.

If bituminous adhesive is used, apply pavement markers not less than 7 days after completing pavement. If epoxy adhesive is used, apply markers not less than 14 days after completing pavement.

Do not allow more than 1-inch deviation from intended alignment of longitudinal pavement markings on tangents and curves with radii greater than 5,000 feet. Do not allow more than 2-inch deviation from intended alignment of longitudinal pavement markings on curves with radii of 5,000 feet or less. Correct misalignments by removing and reinstalling misaligned portion(s), plus an additional 25-foot segment from each end, within one working day after notification of misalignment by the Engineer.

(B) Temporary Pavement Markings. Install temporary pavement

markings by end of work day in accordance with Table 629.03-1 - Temporary Pavement Markings when the following conditions exist:

(1) Permanent pavement markings are not installed after completion of each day's final paving.

(2) Additional guidance through area is required.

(3) Markings for special traffic patterns are warranted.

Install temporary, solid, 4-inch pavement marking tapes on edges of traveled way for newly paved, scarified, or cold-planed surfaces, reconstructed areas, and unmarked areas. Where curbs are present at edges of traveled way, 4-inch pavement marking tapes may be eliminated.

Maintain and replace temporary pavement markings, flexible delineators, and barricades.

Remove temporary markings before installing permanent pavement markings.

Cover or temporarily remove signs that conflict with temporary pavement markings.

When pavement markings are not installed by the completion of construction operations for each day, the Engineer will suspend work and progress payment in accordance with Subsection 105.01(A) - Authority of the Engineer.

TABLE 629.03-1 TEMPORARY PAVEMENT MARKINGS

TYPE	PAVEMENT MARKINGS
Passing Permitted - Both Sides	Single 4-inch yellow stripe 5 feet in length spaced 20 feet on center with Type D markers spaced 40 feet on center and located on center of 5-foot length of stripe.
Passing Prohibited - Both Sides	Double solid 4-inch yellow stripes with Type D markers placed 20 feet on center on one of 4-inch yellow stripes selected by the Engineer.
Passing Permitted - One Side Only	Single continuous 4-inch yellow stripe with Type D markers placed on stripe 20 feet on center on no-passing side and single 4-inch yellow stripes 5 feet in length spaced 20 feet on center on passing side.

Lane Lines - Lane Changing Permitted	Single 4-inch yellow or white stripe 5 feet in length spaced 20 feet on center with Type C or Type D markers spaced 40 feet on center.
Lane Lines - Lane Changing Prohibited	Double solid 4-inch white stripes with Type C markers placed 20 feet on center on one of the 4-inch white stripes selected by the Engineer.
Crosswalk	Two 12-inch white transverse lines spaced 8 feet on center or as ordered by the Engineer.
Stop Line	Single 12-inch white transverse line.
Note: Paint may be used for temporary markings in areas where final paving is not complete."	

(C) Permanent Pavement Markings.

(1) Permanent Pavement Markers. Provide pavement markers conforming to shapes, dimensions, tolerances, types, uses, and layout as indicated in the contract documents.

Submit samples of pavement markers and adhesives for testing and acceptance 10 days before usage. The Engineer will sample and test pavement markers in accordance with Subsection 755.02 – Pavement Markers.

Use bituminous adhesive or standard set type epoxy adhesive to bond pavement markers to pavement.

Heat and dispense bituminous adhesive from equipment that can maintain required temperature.

When using epoxy adhesive, mix components by employing two-component type automatic mixing and extruding apparatus. Automatic mixing equipment shall use positive displacement pumps and shall properly meter components in ratio of 1:1, $\pm$ 5 percent by volume. Check ratio in presence of the Engineer at beginning of each day or as ordered by the Engineer.

Mix only standard set type adhesive manually, and do not mix more than 1 quart.

Place pavement markers within 60 seconds after mixing and extruding adhesive. No further movement of placed marker will be allowed. Use completely each mixed batch of adhesive within 5 minutes after start of mixing. Place adhesive on pavement surface or

on bottom of marker, covering entire area of contact, without voids and with uniform thickness, to produce slight excess after pressing marker in place. Place marker in position and apply pressure with slight twisting motion until firm contact is made with pavement. If adhesive cannot be readily extruded from under marker when pressure is applied, discard remaining batch of adhesive. Immediately remove excess adhesive around edge of marker, on surrounding pavement, and on exposed surfaces of markers.

Remove adhesive from exposed faces of markers, using soft rags moistened with mineral spirits conforming to MIL-PRF-680A(1) or kerosene. Other solvents will not be allowed.

Where bituminous adhesive is used, protect marker against impact until adhesive has hardened to the degree designated by the Engineer. Where epoxy adhesive is used, protect pavement markers against impact until adhesive has hardened in accordance with Table 629.03-2 – Adhesive Set Time For Epoxy Pavement Markers:

TABLE 629.03-2 - ADHESIVE SET TIME FOR EPOXY PAVEMENT MARKERS

Temperature* (Degrees F)	Standard Set Type (Hours)	Rapid Set Type (Minutes)
100	1.5	15
90	2	20
80	3	25
70	4	30
60	5	35
50	7	45
40	No application below 50 degrees F	65
30		85
20		No application below 30 degrees F
10		

*Either pavement surface temperature or ambient air temperature, whichever is lower.

Do not use hardness of epoxy rim around marker as an indication of degree of cure.

Remove and replace pavement markers that do not meet set time requirements indicated in Table 629.03-2 - Adhesive Set Time For Epoxy Pavement Markers.

Do not install pavement markers when relative humidity is greater than 80 percent, or when pavement surface is not dry.

When using Type A and J pavement markers for delineating 10-foot lane stripes, install markers in sets of four, with no fractional sets allowed. Adjust lengths of each 10-foot stripe and each 30-foot gap for skip striping $\pm$ 1 foot, to present uniform and balanced pattern.

Do not install pavement markers over longitudinal or transverse joints of pavement surface, pavement marking tape, and thermoplastic extrusion markings.

(2) Traffic Paint. Use wheeled, manually or motor-propelled applicator machine to apply traffic paint at nominal thickness of 0.015 inch or at rate of 300 linear feet of single 4-inch stripe for 1-gallon paint. Use applicator having appropriate shields around nozzles to permit sharp stripe definition, and separate nozzle to direct air stream immediately ahead of paint application for clearing debris, dust, and other foreign matter. Immediately remove misted, dripped, and spattered paint from pavements.

Protect freshly painted pavement markings from traffic until paint will not transfer to tires or other devices.

Repair or correct pavement markings damaged by traffic and paint marks on pavement caused by traffic crossing wet paint.

(3) Thermoplastic Extrusion Pavement Marking.

(a) Equipment. Apply material to pavement by extrusion method. One side of shaping die shall be pavement surface and other three sides shall be contained by, or shall be part of equipment for heating and controlling flow of material.

Equipment shall provide continuous mixing and agitation of material. Conveying parts of equipment shall be constructed

to prevent accumulation and clogging.

Mixing and conveying parts, including shaping die, shall maintain material at plastic temperature.

Equipment shall produce continuously uniform stripe dimensions.

Applicator shall cleanly and squarely cut off stripe ends. Pans, aprons, or similar appliances that the die overruns will not be allowed.

Apply beads to entire surface of completed stripe by automatic bead dispenser attached to liner.

Equip bead dispenser with automatic cutoff control synchronized with cutoff of thermoplastic material.

Use equipment that provides for varying die widths to produce varying widths of traffic markings.

Provide kettle for melting and heating composition. Equip kettle with automatic thermoplastic control device so that heating can be done by controlled heat transfer liquid rather than direct flame.

Equip and arrange applicator and kettle in accordance with National Fire Underwriters requirements.

Use mobile and maneuverable applicator that is capable of following straight lines and making curves in true arcs.

Use applicator capable of containing minimum of 125 pounds of molten material.

(b) Application. Clean off dirt, blaze, paint, tape, and grease and any material deleterious to the bonding of the thermoplastic extrusion pavement markings. Apply thermoplastic extrusion pavement marking only when pavement surface is dry.

Use equipment that can apply material in variable widths from 2 inches to 12 inches. Apply material for full width of stripe in one application or pass.

On concrete pavements, on HMA pavements more than seven days old, and on HMA pavements paved within seven

days containing less than 6 percent bituminous asphalt, pre-stripe application area with binder material, primer, or prime seal coat or other pre-stripe material recommended by pavement marker manufacturer and accepted by Engineer. Elimination of the pre-stripe application shall not be an option.

Line thickness, as viewed from lateral cross section, shall measure not less than 90 mils at edges, and not less than 125 mils in center.

Take measurements as average throughout 36-inch sections of line. Two thousand pounds of thermoplastic materials supplied in granular or block form shall yield approximately 6,600 feet of 4-inch striping with 90-mil thickness.

Where required by the contract documents to apply new markings over existing markings, bond new line over old line so that no splitting or separation takes place during its useful life.

Provide finished lines with well-defined edges, free of waviness.

(c) Profiled Pavement Marking. Profiled thermoplastic marking shall be produced in one continuous integral process consisting of an extruded base line with raised audible bumps positioned at regular and predetermined intervals. The product shall be available in standard widths and standard colors of white and yellow.

The thermoplastic material used shall be a maleic-modified glycerol ester resin (Alkyd-based) compound formulated for profiled pavement marking. The pigment, beads, resin and fillers shall be a uniform blend material that must be melted to a temperature of approximately 400 degrees F. Maintains a minimum of 380 degrees F when material meets roadway surface.

The amount of glass beads, yellow pigment and calcium carbonate filler contained in the product shall be at manufacturer's option, provided that all other material properties shall comply with requirements of Subsection 755.05 – Retroreflective Thermoplastic Compound Pavement Markings.

The profiled stripe base line shall consist of thermoplastic materials extruded to a thickness of not less than 100 mils nor more than 125 mils. The width of the line shall be in accordance with the plans. The edges of the lines shall be well

defined and free from waviness.

The raised audible bumps shall stand a minimum of 365 mils above the pavement surface. The raised bumps shall be approximately rectangular in shape and positioned at 36-inch intervals when measure center to center. The longitudinal length of the raised bump shall be a minimum of 2-1/2 inches when measured along the crown.

(4) Preformed Pavement Marking Tape. Apply temporary or permanent preformed pavement marking tape manually or with tape applicators, in accordance with tape manufacturer's recommendations and the contract documents. Install preformed pavement marking tape only when pavement surface is dry.

Do not apply preformed pavement marking tape over other markings. Remove existing pavement markings and prepare surface for tape application in accordance with Subsection 629.03(A) - General.

Apply preformed pavement marking tape only when ambient air temperature is at least 60 degrees F and rising, and roadway surface temperature is at least 70 degrees F and rising. Application of preformed pavement marking tape will not be allowed when roadway surface temperature exceeds 150 degrees F.

Before applying preformed pavement marking tape, prime existing roadway surfaces with primer in accordance with tape manufacturer's recommendations.

Use tapes of specified width or use tapes of different widths to form specified stripe width. The Engineer will pay for specified width of stripe when different tape widths are used to form specified width.

Use butt splices only. Tape material shall not be overlapped.

Areas marked with preformed pavement marking tape shall be ready for traffic immediately after application.

(5) Thermoplastic Hot Spray Pavement Marking.

(a) Equipment. Use equipment constructed for preparation and application of thermoplastic hot spray pavement marking.

Equipment shall provide continuous mixing and agitation of material. Conveying parts of equipment shall be constructed to prevent accumulation and clogging.

Use applicator capable of containing minimum of 125 pounds of molten material.

Provide kettle for melting and heating composition. Equip kettle with automatic thermostat control device so that heating can be done by controlled heat transfer liquid rather than direct flame.

Equip and arrange applicator and kettle in accordance with National Fire Underwriters requirements.

Mixing and conveying parts, including the spray gun, shall maintain material at molten temperature.

Apply beads to entire surface of completed stripe by automatic bead dispenser attached to hot spray applicator.

Equip bead dispenser with automatic cutoff control synchronized with cutoff of thermoplastic material.

Use equipment that provides for varying spray widths to produce varying widths of traffic markings.

Use mobile and maneuverable applicator that is capable of following straight lines and making curves in true arcs.

(b) Application. Clean off dirt, debris, blaze, paint, tape, and grease. Apply thermoplastic hot spray pavement marking only when pavement surface is dry.

Use equipment that can apply material in variable widths from 2 inches to 12 inches. Apply material for full width of stripe in one application or pass.

On concrete pavements, on HMA pavements more than seven days old, and on HMA pavements paved within seven days containing less than 6 percent bituminous asphalt, pre-stripe application area with binder material, primer, or prime seal coat recommended by pavement marker manufacturer.

Line thickness, as viewed from lateral cross section, shall measure not less than 90 mils at edges, and not less than 125 mils in center.

Where required by the contract documents to apply new markings over existing markings, bond new line over old line so that no splitting or separation takes place during its useful life.

Provide finished lines with well-defined edges, free of waviness.

(D) Removal of Existing Pavement Markings. Completely remove existing pavement markings and dispose of it off the project site before performing the following activities: applying temporary or permanent traffic paint, thermoplastic extrusion pavement marking, or preformed pavement marking tape; and making changes in traffic pattern. Dispose of material in accordance with Subsection 201.03(F) - Removal and Disposal of Material. Use one of the following removal methods:

(1) Grinding. Feather edges of grinding to make smooth transition to existing roadway surface. Limit feathering to 3 inches beyond edge of existing striping to be removed. Vary feathered edges to differentiate them from traffic stripes. Coat ground asphalt pavement with rapid-setting slurry.

(2) Burning. Burn off existing painted pavement markings using excess oxygen method.

(3) Sandblasting. As work progresses, immediately remove sand and other material deposited on pavement.

(4) Hydro-demolition. Use stripe-removing hydro-demolition machine that has an integrated vacuum to collect water and debris (e.g., Hog Technologies' Stripe Hog series or equal).

(5) Other. Remove preformed pavement marking tape by methods recommended by manufacturers. Eradication of existing markings by painting over them will not be allowed.

Damaged pavement due to pavement marking removal shall be repaired. Submit remedial repair method to the Engineer for review and acceptance. Repair damaged pavement at no increase in contract price or contract time.

629.04 Measurement.

(A) The Engineer will measure thermoplastic and preformed pavement marking tape per linear foot in accordance with the contract documents. The longitudinal pavement markings, including profiled lane markings, will be measured per linear foot as a single stripe for the width specified in the contract and in the proposal. The Engineer will include the longitudinal gaps for skip striping, up to thirty (30) feet long, in the measurement.

The Engineer will measure the transverse markings by the linear foot according to the contract.

The Engineer will not measure temporary pavement markings including flexible delineator posts with reflector makers or Type I Barricades and temporary signs installed for the longitudinal guidance of public traffic over reconstructed areas, cold planed surfaces, newly paved surfaces or other unmarked or scarified areas for payment.

The Contractor shall consider the work required for the removal of pavement markings incidental to the various contract items, except as provided in the proposal or elsewhere in the contract.

The Engineer will measure crosswalk markings per lane of traffic marked according to the contract.

The Engineer will measure pavement arrows (single and multiple heads), symbols, and words per each according to the contract.

(B) The Engineer will measure the pavement markers per each for the types shown in the proposal.

(C) The Engineer will measure the painted stripes that are twelve (12) inches wide or less as a single stripe. The Engineer will measure the painted stripes over twelve (12) inches wide as two (2) stripes. The Engineer will measure the double stripes that are twelve (12) inches or less in total width including the transverse space between the stripes as a single stripe.

The Engineer will measure the longitudinal pavement markings by the linear foot according to the contract. Longitudinal gaps for skip striping that are 30 feet or less will be included in the measurement.

The Engineer will measure the transverse markings by the linear foot according to the contract.

The Engineer will measure crosswalk markings per lane of traffic marked according to the contract.

The Engineer will measure pavement arrows (single and multiple heads), symbols, and words per each according to the contract.

The Engineer will measure the painted curb markings by the linear foot according to the contract.

629.05 Payment.

(A) The Engineer will pay for thermoplastic and preformed pavement marking tape at the contract price per linear foot according to the contract, complete in place, including primers.

The Engineer will pay for double four (4) inch striping with a four (4) inch space between stripes at the contract price per linear foot according to the contract.

The Engineer will pay for crosswalk markings at the contract price per lane of traffic marked according to the contract.

The Engineer will pay for pavement arrows (single and multiple heads), symbols, and words at the contract price per each according to the contract.

The contract unit price paid shall be full compensation for furnishing labors, materials, tools, equipment and incidentals and for doing the work involved in furnishing and installing pavement markings complete in place according to the contract.

The Engineer will not pay for the temporary pavement markings including flexible delineator posts with reflector markers or Type I Barricades and temporary signs installed for the longitudinal guidance of public traffic over reconstructed areas, cold planed surfaces, newly paved surfaces or other unmarked or scarified areas for payment if not shown in the proposal separately. The Engineer will consider them incidental to the various contract items.

(B) The Engineer will pay for the various types of pavement markers at the contract price per each according to the contract, complete in place, including adhesives.

(C) The Engineer will pay for painted pavement striping at the contract price per linear foot according to the contract.

The Engineer will pay for crosswalk markings at the contract price per lane of traffic marked according to the contract.

The Engineer will pay for pavement arrows (single or multiple arrow heads), symbols, and words at the contract price per each according to the contract.

The Engineer will pay for the accepted quantities of curb markings at the contract price per linear foot according to the contract.

The Engineer will pay for the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
_____ - Inch Pavement Striping (Thermoplastic Extrusion)	Linear Foot
Pavement Arrow (Thermoplastic Extrusion)	Each
Type A Pavement Marker (Rumble Strip)	Each
Type ____ Pavement Marker	Each”

END OF SECTION 629