Amend **Section 629 - Pavement Markings** to read as follows:

"**SECTION 629 - PAVEMENT MARKINGS**

629.01 Description. This work includes installing and removing pavement markings according to the contract.

629.02 Materials. Materials shall conform to the following requirements:

White and Yellow Traffic Paint	708.06
Pavement Markers	712.40
Adhesives for Pavement Markers	712.41
Preformed Pavement Marking Tape	712.53
Reflective Thermoplastic Compound Pavement Markings	712.55

Materials installed shall be new, best of their respective grades and as specified below.

629.03 Construction Requirements.

(A) General. Pavement markings shall conform to the latest edition of:

(1) FHWA publication, "Manual on Uniform Traffic Control Devices for Streets and Highways" (MUTCD), and

(2) Traffic Standard Manual for City and County of Honolulu or governing counties.

Apply the pavement markings according to the contract. Pavement markings shall be clean cut, uniform, and neat. Correct the pavement markings according to the contract and at no cost to the State that:

(1) fail the requirements specified or

(2) the traffic damages or

(3) other causes.

Establish control points throughout the project for the layout of pavement markings. Do the layout and the Engineer will accept the layout before installing the work.

Longitudinal pavement markings shall not deviate more than 1 inch from the intended alignment on tangents and curves with radii greater than 5,000 feet. On curves with radii of 5,000 feet or less, the longitudinal pavement markings shall not deviate more than 2 inches from the intended alignment. Immediately correct misalignments when specified by the Engineer. Remove and reinstall the misaligned portion(s) plus an additional 25 feet segment from each end according to the contract.

Before applying the pavement markings, the surface shall be free of moisture and foreign or other material that may adversely affect bonding. Thoroughly blast clean the existing surfaces. Clean, newly placed surfaces need not be blast clean. Clean a prepared surface that becomes contaminated with moisture, dust, or other foreign matter before installing the pavement markings.

The Contractor may place pavement marking tape and pavement markers installed with bituminous adhesive immediately after completion of asphalt concrete pavement or within 14 days hence. Apply other pavement markings between 7 days and 14 days after completion of the pavement.

(B) Temporary Pavement Markings. Immediately install temporary pavement markings according to Table 629-I when:

(1) the Contractor does not install permanent pavement markings after completion of each day's final paving;

(2) the Contractor needs to open the roadway to public traffic for guidance through the area and as ordered by the Engineer; or

(3) the Engineer needs the temporary pavement markings for special traffic patterns.

Install flexible delineator posts with Reflector Markers or Type I Barricades spaced at 80-foot intervals or temporary solid 4 inch pavement marking tapes on the edge of the travelway for newly paved surfaces, scarified, or cold planed surfaces, reconstructed areas, and unmarked areas for guidance of motorists.

Maintain and replace temporary pavement markings, flexible delineators and barricades and as specified by the Engineer.

Remove temporary markings before installing permanent pavement markings.

Permanently installed PASS WITH CARE, DO NOT PASS, NO PASSING ZONE, or other signs designated by the Engineer are to be covered or temporarily removed unless they are in agreement with the temporary striping.

When failing to install pavement markings according to the contract herein immediately after completion of the construction operations for each day, the Engineer will suspend the work and progress payment according to Subsection 105.01 - Authority of the Engineer.

TABLE 629-I TEMPORARY PAVEMENT MARKING

TYPE	PAVEMENT MARKING
Passing Permitted - Both Sides	Single 4-inch yellow stripe 5 feet in length spaced 20 feet on centers with Type D markers spaced 40 feet on centers and located on the center of the 5 foot length of stripe.
Passing Prohibited - Both Sides	Double solid 4-inch yellows stripe with Type D markers placed 20 feet on centers on one of the 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 the stripe 20 feet on centers on the no-passing side and single 4-inch yellow stripes 5 feet in length spaced 20 feet on centers on the passing side
Lane Lines - Lane Changing Permitted	Single 4-inch yellow or white stripe 5 feet in length spaced 20 feet on centers with Type C or Type D markers spaced 40 feet on centers
Lane Lines - Lane Changing Prohibited	Double solid 4-inch white stripes with Type C markers placed 20 feet on centers on one of the 4-inch white stripes selected by the Engineer
Crosswalk	Two 4-inch white traverse lines spaced 8 feet on centers or as specified by the Engineer
Stop Line	Single 4-inch white traverse line

Notes:
a. The Contractor may use paint for temporary markings in areas where the Contractor has not completed final paving.
b. The temporary striping schedule shall be designated by the Engineer

(C) Permanent Pavement Markings

(1) Pavement Markers. Pavement Markers shall be:

(a) of uniform composition,

(b) free from surface irregularities and

(c) free from other physical damage or defects that affect appearance and/or performance.

The shape, dimensions, tolerances, types, uses, and layout shall be according to the contract.

Submit samples of the pavement markers and bituminous adhesives and/or epoxy adhesives to the Engineer for testing and acceptance before 10 days before usage. Sampling and testing of the pavement markers shall be according to Subsection 712.40.

Use Bituminous Adhesive for Pavement Markers according to Subsection 712.41 to cement markers to the pavement. When accepted by the Engineer, the Contractor may use Standard Set epoxy adhesive according to Subsection 712.41 at no additional cost to the State.

Heat and dispense the bituminous adhesive from an acceptable equipment that can maintain the required temperature. Placement of markers using bituminous adhesive shall be similar to placement of markers using epoxy adhesive.

When using epoxy adhesive, mix the components by a two-component type automatic mixing and extruding apparatus for use on the project. Automatic mixing equipment shall use positive displacement pumps and shall properly meter the components in the ratio of one to one ± 5 percent by volume. Check the ratio in the presence of the Engineer at the beginning of each day or as ordered.

The Contractor may mix only Standard Set Type adhesive manually and shall not mix more than one quart by volume.

When using two component adhesives, carry out the work quickly and efficiently due to the short pot life of the adhesive. Place the pavement markers within 60 seconds after mixing and extruding the adhesive. The Engineer will not allow further movement of the marker. Use up each mixed batch of adhesive within five minutes completely after the start of mixing. Place the adhesive on the pavement surface or on the bottom of the marker in complete coverage of the area of contact, without voids and with a uniform and adequate thickness to produce a slight excess after pressing the marker in place. Place the marker in position and apply pressure with a slight twisting motion until making firm contact with the pavement. If the Contractor cannot extrude the adhesive from under the marker applying pressure, discard the remaining batch of adhesive. Immediately remove the excess adhesive:

(a) around the edge of the marker,

(b) on the pavement, and

(c) on the exposed surfaces of the markers.

The Contractor may use soft rags moisten with mineral spirits conforming to Federal Specification TT-T-291 or kerosene to remove adhesive from the exposed faces of the markers. Do not use other solvents.

Protect the pavement markers against impact until the adhesive has hardened sufficiently. The Contractor may use the following table as a guide for the determination of sufficient hardening:

Temperature* (degrees F)	Standard Set Type (Hours)	Rapid Set Type (Minutes)
100	1-1/2	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		

*The temperature is either pavement surfaces or air temperature whichever is lower.

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

Immediately reset the pavement markers implanted with improperly mixed adhesives requiring unusually long curing time as specified by the Engineer.

Do not install pavement markers when:

(a) the relative humidity is greater than 80% or

(b) the pavement surface is not dry.

Install the pavement markers according to contract as specified by the Engineer. When using Types A and J pavement markers for delineating 10-foot lane stripes, install them in sets of four with no fractional sets allowed. The Contractor may adjust the lengths of each 10-foot stripe and each 30-foot gap for skip striping ± one foot to present a uniform and balanced arrangement.

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

(2) Traffic Paint. Use a wheeled applicator machine that is manually or machine propelled to apply at a nominal thickness of 0.015 inch or at a rate of 300 linear feet of single 4 inch stripe for one gallon paint. The applicator shall have appropriate shields around the nozzles to permit sharp stripe definition. The applicator shall have a separate nozzle to direct an air stream immediately ahead of paint application for clearing away debris, dust and other foreign matter. Immediately remove misted, dripped and spattered paint on pavements as specified by the Engineer.

The Contractor may manually paint pavement arrows, symbols, words, and curb markings upon acceptance by the Engineer.

Protect freshly painted pavement markings from traffic until the paint is sufficiently dry and will not transfer to tires or other devices. The Contractor may use cones or other acceptable traffic control devices for this purpose.

Repair or correct pavement markings damaged by traffic and paint marks on the pavement caused by traffic crossing wet paint according to Subsection 629.03(D).

(3) Thermoplastic Extrusion Pavement Marking.

(a) Equipment. Apply the material to the pavement by an extrusion method. One side of the shaping die is the pavement and the other three sides are part of the equipment.

The equipment shall provide continuous mixing and agitation of the material. Construct conveying parts of the equipment to prevent accumulation and clogging. Parts of the equipment that come in contact with the material shall

easily be accessible and exposable for cleaning and maintenance.

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

The equipment shall assure continuous uniformity in the dimensions of the stripe.

The applicator shall cleanly cut off square stripe ends and apply "skip" lines. The Engineer will not permit the use of pans, aprons or similar appliances that the die overruns.

Apply beads to the surface of the completed stripe over the entire surface of the stripe and by an automatic bead dispenser attached to the liner.

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

Construct the equipment to provide for varying die widths to produce varying widths of traffic markings.

Provide a special kettle for melting and heating the composition. Equip the kettle with an automatic thermoplastic control device so that the Contractor can do the heating by controlled heat transfer liquid than direct flame.

Equip and arrange the applicator and the kettle according to the Nation Fire Underwriters requirements.

The applicator shall be mobile and maneuverable so that the Contractor can follow straight lines and make normal curves in a true arc.

The applicator shall contain a minimum of 125 pounds of molten material.

(b) Application. Clean off dirt, blaze, paint, tape and grease and ordered by the Engineer.

The Contractor may apply the material in variable widths from 2 inches to 12 inches. Apply the material for

the full width of stripe in one application or pass. For example, form an 8 inch stripe with an 8 inch die.

On concrete pavements and pavements containing less than 6% bituminous asphalt, pre-stripe the application area with a binder material, primer or prime seal coat recommended by the manufacturer.

The minimum installed thickness of the line as viewed from a lateral cross section shall be:

(a) not less than 3/32 inch at the edges, and

(b) not less than 1/8 inch in the center.

Take the measurements as an average throughout 36 inch sections of the line. 2,000 pounds of thermoplastic materials supplied in granular or block form will yield approximately 6,600 feet of 4 inch striping with a 90-mil thickness.

The new line, when applied over an old line of compatible material, shall bond itself to the old line so that no splitting or separation takes place during its useful life.

The finished lines shall have well defined edges and be free of waviness.

(4) Preformed Pavement Marking Tape. The Contractor may apply the preformed pavement marking tape manually or with the tape applicators acceptable by the tape manufacturer. Apply the markings according to the tape manufacturer's recommendations and according to the contract.

Install either temporary or permanent preformed pavement marking tape according to the contract or specified by the Engineer.

Do not apply the preformed pavement marking tape over other markings. Remove the old markings and prepare the surface for tape application according to Subsection 629.03(A).

The minimum temperatures for the applications of preformed pavement marking tape shall be 60 degrees F. for air and 70 degrees F. for roadway surfaces, with both temperatures rising. The maximum temperature shall be 150 degrees F. for surfaces.

Before applying the permanent preformed pavement marking tape, prime the existing roadway surfaces with an acceptable primer as recommended by the tape manufacturer and ordered by the Engineer.

Apply the primer in one thin coat extending at least 1 inch beyond the tape edges. Allow the primer to dry until the primer feels tacky and will not lift or string.

The Contractor may use tapes of different widths to form a specified stripe width. For example, the Contractor may use two 4-inch wide tapes to form an 8-inch wide stripe). The Engineer will make payment for the specified stripe width according to the contract.

Use butt splices only and shall not overlap the tape material.

Tamp the markings thoroughly with an acceptable mechanical tampers. Also, slowly drive a truck on the newly applied markings several times.

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

(D) Removal of Existing Pavement Markings. Remove the existing pavement markings according to the contract and as specified by the Engineer. Resolve the conflicts between existing and new markings by removing the existing as specified by the Engineer and according to the following:

(1) remove the existing pavement markings before applying the traffic paint, thermoplastic extrusion or preformed pavement marking tape;

(2) remove the existing markings so that the Contractor can make a smooth transition between existing and new markings; and

(3) remove the unnecessary markings before making changes in the traffic pattern.

Use removal methods that will cause the least possible damage to the pavement and its surface. Do not cause impressions of old markings to remain after the removal operations. Repair the damage to the pavement or its surface caused by removal operations including impressions of old markings at no cost to the State. Make the reparations as specified and accepted by the Engineer.

The Engineer will not permit eradication of existing markings by painting over them. The Engineer will permit burning off existing paint markings provided the Contractor uses an acceptable method using excess oxygen. Do not burn nor ground off the preformed pavement marking tape. Remove the preformed pavement marking tape and thermoplastic extrusion markings by methods recommended by the manufacturer and acceptable by the Engineer.

The Engineer will permit sandblasting for paint removal. Remove the sand or other material deposited on the pavement due to removal operations as work progresses. The Engineer will not permit accumulation. Immediately remove excess sand or other material deemed hazardous to traffic when specified by the Engineer.

629.04 Method of Measurement. The Engineer will not measure for furnishing and installing pavement striping, pavement markers, detour pavement striping, curb markings, temporary pavement markings, flexible delineators posts with reflector markers, Type I Barricades, and temporary signs and removing pavement markings for payment.

The Engineer will measure the crosswalk marking per lane.

The Engineer will measure the pavement arrow and pavement symbol per each.

The Engineer will measure the parallel parking stall marking per each.

629.05 Basis of Payment. The Engineer will pay for the accepted pavement striping at the contract lump sum price complete in place. The price includes full compensation for establishing control points, laying out, cleaning the existing surface, furnishing and applying the pavement stripings, and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the accepted crosswalk marking at the contract unit price per lane. The price includes full compensation for establishing control points, laying out, cleaning the existing surface, furnishing and applying the crosswalk markings, and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the accepted pavement arrow and pavement symbol at the contract unit price per each. The price includes full compensation for establishing control points; laying out; cleaning the existing surface; furnishing and applying the pavement arrow and pavement symbol; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the accepted parallel parking stall markings at the contract lump sum price. The price includes full compensation for establishing control points; laying out; cleaning the existing surface; furnishing and applying the parallel parking stall markings; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the pavement markers including adhesives at the contract lump sum price. The price includes full compensation for submitting samples; applying adhesives; furnishing, installing, and protecting the pavement markers; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will not pay for the accepted removal of existing pavement markings, temporary pavement markings, flexible delineators posts with reflector markers, Type I Barricades, and temporary signs. The Engineer will consider the price for them included in the bid price of the various contract items. The price includes full compensation for maintaining, replacing, and eventually removing the temporary pavement markings, flexible delineators and barricades; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay under:

Pay Item	**Pay Unit**
_____-Inch Pavement Striping (Tape, Type _____ or Thermoplastic Extrusion)	Lump Sum
Crosswalk Marking (Tape, Type III or Thermoplastic Extrusion)	Lane
Pavement Arrow (Tape, Type III or Thermoplastic Extrusion)	Each
Pavement Symbol (_____) (Tape, Type III or Thermoplastic Extrusion)	Each
Parallel Parking Stall Marking – Three Stall (Tape, Type III or Thermoplastic Extrusion)	Each
Type _____ Pavement Marker	Lump Sum"

END OF SECTION