

## 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. \*|

The Contractor shall apply the pavement markings according to the contract. Pavement markings shall be clean cut, uniform and neat. The Contractor shall 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. \*|

The Contractor shall establish control points throughout the project for the layout of pavement markings. The Contractor shall do the layout and the Engineer will accept the layout before the Contractor installs the work. \*|

Longitudinal pavement markings shall not deviate more than one (1) inch from the intended alignment on tangents and curves with radii greater than five thousand (5,000) feet. On curves with radii of five thousand (5,000) feet or less, the longitudinal pavement markings shall not deviate more than two (2) inches from the intended alignment. The Contractor shall immediately correct misalignments when ordered by the Engineer. The Contractor shall remove and reinstall the misaligned portion(s) plus an additional twenty-five (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. The Contractor shall thoroughly blast clean the existing surfaces. Clean, newly placed surfaces need not be blast clean. The Contractor shall 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 fourteen (14) days hence. The Contractor shall apply other pavement markings after seven (7) days or before fourteen (14) days after completion of the pavement.

**(B) Temporary Pavement Markings.** The Contractor shall install temporary pavement markings immediately according to Table 629-I if:

(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 directed by the Engineer; or

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

The Contractor shall install:

(1) flexible delineator posts with Reflector Markers or Type I Barricades spaced at eighty (80) foot intervals or

(2) temporary solid four (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.

The Contractor shall maintain and replace temporary pavement markings, flexible delineators and barricades and as ordered by the Engineer.

The Contractor shall remove temporary markings before installing permanent pavement markings.

TABLE 629-I - TEMPORARY PAVEMENT MARKINGS		
MARKINGS	TAPE/PAINT*	MARKERS
<b>LONGITUDINAL</b>		
1. Passing Permitted	a	e
2. Passing Prohibited	b	-
3. Lane Lines	a	e
<b>CROSSWALK</b>	c	-
<b>STOP LINE</b>	d	-
<p>*The Contractor may use paint for temporary markings in areas where the Contractor has not completed final paving.</p> <p>a. Single 4-inch yellow or white 5 feet lengths spaced 20 feet on centers.</p> <p>b. Double 4-inch solid yellow or white line.</p> <p>c. Two 4-inch white transverse lines spaced 8 feet on centers or as ordered by the Engineer.</p> <p>d. Single 4-inch white transverse line.</p> <p>e. Type C or D markers spaced 40 feet on centers.</p>		

For fourteen (14) calendar days or less and on two (2) or three (3) \*|  
lane, two (2) way roadways, the Contractor may identify no-passing zones \*|  
by using: \*|

- (1) temporary preformed marking tape of: \*|
  - (a) single four (4) inch yellow, \*|
  - (b) four (4) feet lengths, \*|
  - (c) spaced ten (10) feet on centers and \*|
- (2) temporary Type D raised pavement markers \*|
  - (a) spaced twenty (20) feet on centers and \*|

- (3) signs: \*|
- (a) For no-passing zone facing traffic, \*|
  - 1. Beginning of no-passing zone: \*|
    - a. one (1) R4-1, "DO NOT PASS" sign right side of roadway \*|
    - b. one (1) W14-3, "NO PASSING ZONE" left side of roadway \*|

If the length of the no-passing zone exceeds the maximum sign spacing as tabulated below with respect to posted speed limit, the Contractor shall place additional W14-3 signs on the left side of the roadway facing traffic, at intervals not to exceed the maximum tabulated sign spacing. \*|
  - 2. End of no-passing zone: \*|
    - a. one (1) R4-2, "PASS WITH CARE" right side of roadway. \*|

Maximum Sign Spacing Through No-Passing Zones During Construction	
Posted Speed	Spacing
Below 45 MPH	300 feet
45 - 50 MPH	400 feet
55 MPH and over	500 feet

If the Contractor fails to install pavement markings according to the contract herein immediately after completion of the construction operations for each day, the Engineer shall suspend the work and progress payment according to Subsection 105.01 - Authority of 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. \*|

The Contractor shall submit samples of the pavement markers and bituminous adhesives and/or epoxy adhesives to the Engineer for testing and acceptance before ten (10) days before usage. Sampling and testing of the pavement markers shall be according to Subsection 712.40. \*|

For Non-Federal Aid County Projects, the Contractor may submit a Certificate of Compliance for the pavement markers and adhesives instead of samples when accepted by the Engineer. |

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

The Contractor shall 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. \*|

If the Contractor uses epoxy adhesive, the Contractor shall 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 (1) to one (1) + five (5) percent by volume. The Contractor shall 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 (1) quart by volume.

When using two (2) component adhesives, the Contractor shall carry out the work quickly and efficiently due to the short pot life of the adhesive. The Contractor shall place the pavement markers within sixty (60) seconds after the Contractor has mixed and extruded the adhesive. The Engineer will not allow further movement of the marker. The Contractor shall completely use up each mixed batch of adhesive within five (5) minutes after the start of mixing. The Contractor shall 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 the Contractor presses the marker in place. The Contractor shall place the marker in position and apply pressure with a slight twisting motion until the Contractor makes firm contact with the pavement. If the Contractor cannot extrude the adhesive from under the marker applying pressure, the Contractor shall discard the remaining batch of adhesive. The Contractor shall 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. The Contractor shall not use other solvents.

The Contractor shall 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* (°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	65
30	application	85
20	below	No application
10	50° F.	below 30° F.

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

The Contractor shall not use the hardness of the rim of epoxy around the marker as an indication of the degree of cure.

The Contractor shall immediately reset the pavement markers implanted with improperly mixed adhesives requiring unusually long curing time as ordered by the Engineer.

The Contractor shall not install pavement markers when: \*|

(a) the relative humidity is greater than eighty (80) percent or \*|  
\*|

(b) the pavement surface is not dry. \*|

The Contractor shall install the pavement markers according to the contract as ordered by the Engineer. When the Contractor uses Types A and J pavement markers for delineating ten (10) foot lane stripes, the Contractor shall install them in sets of four (4) with no fractional sets allowed. The Contractor may adjust the lengths of each ten (10) foot stripe and each thirty (30) foot gap for skip striping  $\pm$  one (1) foot to present a uniform and balanced arrangement. \*|  
\*|

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

(2) **Traffic Paint.** The Contractor shall 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 three hundred (300) linear feet of single four (4) inch stripe for one (1) 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. The Contractor shall immediately remove misted, dripped and spattered paint on pavements as ordered by the Engineer. \*|

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

The Contractor shall 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. |

The Contractor shall 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.** The Contractor shall apply the material to the pavement by an extrusion method. One side of the shaping die is the pavement and the other three (3) sides are part of the equipment. \*|  
\*|  
\*|

The equipment shall provide continuous mixing and agitation of the material. The Contractor shall 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. \*|  
\*|

The Contractor shall apply beads: \*

(a) to the surface of the completed stripe \*

(b) over the entire surface of the stripe and \*

(c) by an automatic bead dispenser attached to the liner. \*|  
\*|

The Contractor shall equip the bead dispenser with an automatic cutoff control synchronized with the cutoff of the thermoplastic material.

The Contractor shall construct the equipment to provide for varying die widths to produce varying widths of traffic markings.

The Contractor shall provide a special kettle for melting and heating the composition. The Contractor shall 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. \*



The Contractor shall 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 one hundred twenty-five (125) pounds of molten material. \*

**(b) Application.** The Contractor shall clean off dirt, blaze, paint, tape and grease and ordered by the Engineer. \*

The Contractor may apply the material in variable widths from two (2) inches to twelve (12) inches. The Contractor shall apply the material for the full width of stripe in one application or pass. For example, the Contractor shall form an eight (8) inch stripe with an eight (8) inch die. \*

On concrete pavements and pavements containing less than six (6) percent bituminous asphalt, the Contractor shall 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 three thirty-secondth ( $3/32$ ) inch at the edges, and \*

**(b)** not less than one-eighth ( $1/8$ ) inch in the center. \*

The Contractor shall take the measurements as an average throughout thirty-six (36) inch sections of the line. Two thousand (2,000) pounds of thermoplastic materials supplied in granular or block form will yield approximately six thousand six hundred (6,600) feet of four (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. The Contractor shall apply the markings according to the tape manufacturer's recommendations and according to the contract. \*|

The Contractor shall install either temporary or permanent preformed pavement marking tape according to the contract or ordered by the Engineer.

The Contractor shall not apply the preformed pavement marking tape over other markings. The Contractor shall 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 sixty (60) degrees Fahrenheit for air and seventy (70) degrees Fahrenheit for roadway surfaces, with both temperatures rising. The maximum temperature shall be one hundred fifty (150) degrees Fahrenheit for surfaces.

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

The Contractor shall apply the primer in one (1) thin coat extending at least one (1) inch beyond the tape edges. The Contractor shall 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 (2) \*| four (4) inch wide tapes to form an eight (8) inch wide stripe). The \*| Engineer will make payment for the specified stripe width according \*| to the contract. \*|

The Contractor shall use butt splices only and shall not overlap the tape material.

The Contractor shall tamp the markings thoroughly with an acceptable mechanical tampers. Also, the Contractor shall 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.** The Contractor shall remove the existing pavement markings according to the contract and/or ordered by the Engineer. The Contractor shall resolve the conflicts between existing and new markings by removing the existing as ordered by the Engineer and according to the following:

- (1) The Contractor shall remove the existing pavement markings before applying the traffic paint, thermoplastic extrusion or preformed pavement marking tape;
- (2) The Contractor shall remove the existing markings so that the Contractor can make a smooth transition between existing and new markings; and
- (3) The Contractor shall remove the unnecessary markings before making changes in the traffic pattern.

The Contractor shall use removal methods that will cause the least possible damage to the pavement and its surface. The Contractor shall not cause impressions of old markings to remain after the removal operations. The Contractor shall repair the damage to the pavement or its surface caused by removal operations including impressions of old markings at no cost to the State. The Contractor shall make the reparations as ordered 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. The Contractor shall not burn nor ground off the preformed pavement marking tape. The Contractor shall 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. The Contractor shall remove the sand or other material deposited on the pavement due to removal operations as work progresses. The Engineer will not permit accumulation. The Contractor shall immediately remove excess sand or other material deemed hazardous to traffic when ordered by the Engineer.

#### **629.04 Method of Measurement.**

**(A) Thermoplastic Extrusion and Preformed Pavement Marking Tape.** The Engineer will measure the longitudinal pavement markings by the 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, per lane, or per each according to the contract. \*|

The Engineer will not measure the crosswalk markings when contracted on a lump sum basis.

The Engineer will not measure the thermoplastic extrusion and pavement marking tape when contracted on a lump sum basis.

The Engineer will not measure 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.

The Engineer will measure the temporary pavement markings and temporary signs installed as ordered by the Engineer for special temporary traffic patterns on a force account basis, if the contract specifies payment in the proposal. \*|  
\*|

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. If the contract stipulates that the Engineer will make payment for the removal of pavement markings, the Engineer will measure the removal of pavement markings. \*|

**(B) Pavement Markers.** The Engineer will measure the pavement markers per each for the types shown in the proposal. \*|

The Engineer will not measure the pavement markers when contracted on a lump sum basis.

**(C) Traffic Paint.** 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 not measure the painted pavement striping including curb markings when contracted on a lump sum basis.

The Engineer will measure the longitudinal pavement markings by the linear foot or per gallon 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, per lane, per each or per gallon according to the contract. \*

The Engineer will not measure the crosswalk markings when contracted on a lump sum basis.

The Engineer will measure the curb markings by the linear foot or per gallon according to the contract. \*

#### 629.05 Basis of Payment.

**(A) Thermoplastic Extrusion and Preformed Pavement Marking Tape.** The Engineer will pay for the accepted quantities of pavement striping at the contract unit price per linear foot or on a lump sum basis according to the contract, complete in place, including primers. \*

The Engineer will pay for the accepted quantities of double four (4) inch striping with a four (4) inch space between stripes at the contract unit price per linear foot or on a lump sum basis according to the contract. \*

The Engineer will pay for the accepted quantities of crosswalk markings at the contract unit price per lane of traffic marked, per each or on a lump sum basis according to the contract complete in place. \*

The Engineer will pay for the accepted quantities of pavement arrows (single and multiple heads), symbols, and words at the contract unit price per each according to the contract complete in place. \*

The contract unit prices 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 and ordered by the Engineer.

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.

If the contract specifies payment for temporary pavement markings installed as ordered by the Engineer for special temporary traffic patterns, the Engineer will pay from an allowance for "Temporary Construction Zone Markings".

The Engineer will compute the actual amount paid to the Contractor for force account work according to Subsection 109.04 - Extra or Force Account Work. \*

If the contract specifies payment for removal of pavement markings under unit price pay items, the Engineer will pay for the accepted quantities at the contract unit prices bid. The prices shall be full compensation for removing such items according to the contract. \*

**(B) Pavement Markers.** The Engineer will pay for the accepted quantities of the various types of pavement markers at the contract unit price per each or on a lump sum basis according to the contract, complete in place, including adhesives. \*

**(C) Traffic Paint.** The Engineer will pay for the accepted quantities of painted pavement striping at the contract unit price per linear foot or on a lump sum basis according to the contract complete in place. \*

The Engineer will pay for the accepted quantities of crosswalk marking at the contract unit price per lane of traffic marked, per each or on a lump sum basis according to the contract complete in place. \*

The Engineer will pay for the accepted quantities of pavement arrows (single or multiple arrow heads), symbols, and words will paid for at the contract unit price per each according to the contract, complete in place. \*

The Engineer will pay for the accepted quantities of curb markings at the contract unit price per linear foot or on a lump sum basis.

The Engineer will make payment under:

Pay Item	Pay Unit
Pavement Striping (Paint)	Linear Foot
Pavement Striping (Paint)	Gallon
Pavement Striping (Paint) (___ L.F.)	Lump Sum
___-Inch Pavement Striping (Type ___ Tape or Thermoplastic Extrusion)	Linear Foot
___-Inch Pavement Striping (Type ___ Tape or Thermoplastic Extrusion) (___ L.F.)	Lump Sum
___-Inch Detour Pavement Striping (Temporary Tape or Thermoplastic Extrusion) (___ L.F.)	Lump Sum

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Crosswalk Marking (Tape, Type III or Thermoplastic Extrusion)	Lane
Crosswalk Marking (Tape, Type III or Thermoplastic Extrusion)	Each
Crosswalk Marking (Tape, Type III or Thermoplastic Extrusion)	Lump Sum
Pavement Arrow (Paint, Type I Tape, or Thermoplastic Extrusion)	Each
Pavement Arrow (Paint, Type I Tape, or Thermoplastic Extrusion)	Arrow Head
Pavement Word (Paint, Tape, Type I Tape or Thermoplastic Extrusion)	Each
Pavement Symbol (Paint, Tape, Type I Tape or Thermoplastic Extrusion)	Each
Type ____ Pavement Marker	Each
Type ____ Pavement Marker (____ Each)	Lump Sum
Temporary Construction Zone Markings	Force Account
Curb, Type ____ Markings (Paint)	Linear Foot
Curb, Type ____ Markings (Paint) (____ L.F.)	Lump Sum
Removal of _____	Each
Removal of _____	Lane
Removal of _____	Linear Foot
Removal of _____ (____ ____)	Lump Sum

**SECTION 630 - (Reserved)**

**SECTION 631 - (Reserved)**

**SECTION 632 - (Reserved)**

**SECTION 633 - (Reserved)**