ITEM 644 THERMOPLASTIC PAVEMENT MARKING

644.01 Description. This work consists of furnishing and applying screed extruded thermoplastic pavement markings according to Item 641, 740.01, 740.04, 740.09, and the additional requirements specified below.

644.02 Materials. Furnish materials from the City's QPL conforming to:

Thermoplastic pavement marking 740.04
Glass beads, Type C 740.09

The Engineer may obtain random samples from the application equipment. Furnish the manufacturer's identification information for the sampled liquid materials. The City will test the quality assurance sample for conformance to the manufacturer's production ranges. For samples not meeting the manufacturer's production ranges, re-apply, at no cost to the City, all markings using that sample. The City will consider all other untested batches to be not approved materials and will either require testing or re-application.

Do not apply material that has exceeded the manufacturer's shelf life. Do not use glass beads that are wet.

644.03 Equipment. Equip all thermoplastic pavement marking trucks for center line, lane line and edge line markings with a computerized Data Logging System (DLS), including a cab mounted display which shows the actual bead application rate. A DLS is not required for markings applied with hand carts. For center line, lane line and edge line markings applied with truck-mounted equipment, when the length of marking exceeds 0.5 miles (0.8 km) of continuous line equivalent, document the following with the DLS:

1. Measure and record application vehicle speed to the nearest 0.1 MPH (0.16 km/h).
2. Measure and record pavement surface temperature.
3. Measure and record air temperature.
4. Measure and record thermoplastic temperature in the kettle and at the point of application.

Record as a separate DLS report line entry the above information for each route section painted, when the length of marking exceeds 0.5 miles (0.8 km) of continuous line equivalent. A route section is defined as one direction of a contiguous section of highway (without breaks) with the same route number designation.

If the DLS equipment fails, finish that day's work only and resume when the DLS equipment is working.

Ensure that each DLS has an annual calibration of all mechanical and electrical components and its software function and output confirmed by the DLS manufacturer or

their designated representative. Provide evidence of the annual calibration by affixing a signed and dated stamp or seal to the inside of the driver's door of each striper.

Use application equipment that includes a kettle for melting the thermoplastic and maintaining it at the proper temperature. Equip the kettle with a thermostat to control the temperature of the melted thermoplastic and to prevent overheating. Use equipment that continuously mixes and agitates the molten thermoplastic. Ensure that the parts of the equipment that convey the thermoplastic from the kettle to the application point maintains it at the required temperature.

Attach an automatic bead dispenser to the equipment so that the beads are immediately and uniformly dispensed over the marking surface. Equip the bead dispenser with an automatic cut-off control synchronized with the cut-off of the thermoplastic material.

Ensure that the applicator portion of the equipment has a shoe that rides on the pavement and extrudes the thermoplastic. Ensure that the application equipment applies lines with a square end and can apply broken lines. Furnish application equipment for applying screed extruded markings that consists of dies of varying widths to produce different widths of lines. Do not use pans, aprons, or similar devices that the die overruns.

Use equipment that ensures uniformity in the thickness and width of lines. Use equipment that forms lines 12 inches (300 mm) wide or less by one application pass, and lines wider than 12 inches (300 mm) by no more than two passes. Do not allow individual passes to overlap or to be separated by a gap greater than 1/4 inch (6 mm).

644.04 Application. If applying thermoplastic to pavements that are less than six months old, ensure that both the pavement surface and the ambient air temperature at the time of application are not less than 50 °F (10 °C) and rising. However, if applying thermoplastic to pavements that are older than a year, ensure that both the pavement surface and the ambient air temperature at the time of application are not less than 60 °F (21 °C) and rising. Ensure that the temperature of thermoplastic at the point of application is at least 400 °F (204 °C) and not more than 440 °F (227 °C).

Apply thermoplastic at a thickness of 125 mils (3.2 mm). Thermoplastic for small quantities or auxiliary markings up to 100 feet (30 m) in length can be exchanged as equal in function and price with 125 mil (3.2 mm) thick heat-fused preformed thermoplastic (Item 647).

Apply thermoplastic at the following rates:

125 Mil Thickness	Line Width (inch)				
	4	5	10	20	24
	Pounds per Mile of Line				
Solid Line	2340	2925	5850	11700	14040
Broken Line	585	731	1462	2925	3510
Dotted Line	585	731	1462	2925	3510
Areas, Symbols, Words	133 pounds per 100 square feet				

3.2 mm Thickness	Line Width (mm)				
	100	127	254	508	600
	Kilograms per Kilometer of Line				
Solid Line	650	813	1626	3252	3900
Broken Line	165	203	406	812	975
Dotted Line	165	203	406	812	975
Areas, Symbols, Words	6.5 kg/m²				

Mechanically apply glass beads to the wet thermoplastic surface so that the beads are embedded and retained and provide uniform retroreflectivity in the surface. Do not place beads by hand, except to symbols and words, and to complete the ends of lines. Apply beads at a minimum rate of 12 pounds per 100 square feet (6 kg per 10 m²) of thermoplastic surface area.

When placing Item 644 on concrete pavement or concrete bridge decks, furnish primer, and apply it according to the manufacturer's recommendations. Include primer cost in the unit price. Use primer except on new asphalt pavement..For each route section on the DLS report, the Engineer will compute the amount of thermoplastic marking material and glass beads applied. The City will reduce the contract price in direct proportion to the percent of deficiency of thermoplastic marking material or glass beads as specified in 644.04, up to 20 percent for each material deficiency. The City will only use the greater deficiency of marking material or glass beads to compute the deduction.

If the deficiency of thermoplastic marking material or glass beads is 20 percent or more, the City will consider the work unsatisfactory. In addition, the Engineer will consider as unsatisfactory materials applied outside the temperature or application requirements in 644.04 without written approval of the Engineer. Replace thermoplastic markings and glass beads in all sections determined to be unsatisfactory by entirely removing the unsatisfactory thermoplastic material by grinding according to 641.10 and then reapplying at the full thickness specified in 644.04. Do not apply a layer of sprayed thermoplastic to sections determined to be unsatisfactory to achieve the required thickness.

Furnish the Engineer daily, biweekly and final DLS reports conforming to 644.03, and additional reports indicating material type and quantities in pounds (kilograms) of thermoplastic materials used, according to 641.04.

644.05 Layout and Premarking. In addition to the requirements specified in 641.06, only place auxiliary markings on new pavement. The Contractor may place initial thermoplastic markings over work zone traffic paint markings.

644.06 Basis of Payment. The City will not pay for any thermoplastic lines that do not meet the required thickness. The City will pay for accepted quantities at the contract prices, or prices adjusted according to 644.04, measured according to 641.12, with the provisions specified in 641.13, and as follows:

Item	Unit	Description
644	Mile (Kilometer)	Edge Line
644	Mile (Kilometer)	Lane Line
644	Mile (Kilometer)	Center Line
644	Foot (Meter)	Channelizing Line
644	Foot (Meter)	Stop Line
644	Foot (Meter)	Crosswalk Line
644	Foot (Meter)	Transverse/Diagonal Line
644	Each	Handicap Symbol Marking
644	Each	Railroad Symbol Marking, __ inch (__ mm)
644	Each	School Symbol Marking, __ inch (__ mm)
644	Foot (Meter)	Parking Lot Stall Marking
644	Each	Lane Arrow
644	Each	Lane Drop Arrow
644	Each	Word on Pavement, ___ inch (___ mm)
644	Foot (Meter)	Dotted Line, ___ inch (___ mm)
644	Each	Bike Marking
644	Each	Speed Hump Marking, Type
644	Foot or Square Foot (Meter or Square Meter), or Each	Removal of Pavement Marking
644	Lump Sum	Two-Way Radio Equipment