8-22 PAVEMENT MARKING

8-22.1 Description

This Work consists of furnishing, installing, and removing pavement markings upon the Roadway surface in accordance with the Plans, Standard Plans, the FHWA publication Standard Alphabet for Highway Signs and Pavement Markings and these Specifications, at locations shown in the Contract or as ordered by the Engineer in accordance with Section 1-04.4.

Pavement Markings may be either Longitudinal (long) Line Markings or Transverse Markings. Longitudinal line markings are generally placed parallel and adjacent to the flow of traffic. Transverse markings are generally placed perpendicular and across the flow of traffic. Word and symbol markings are classified as transverse markings. Traffic letters used in word messages shall be 8-feet high with the exception of the "R" in the railroad crossing symbol which shall be as shown in the Standard Plans.

8-22.2 Materials

Material for pavement marking shall be paint or plastic as noted in the Bid item meeting the requirements of Section 9-34. Glass beads for paint shall meet the requirements of Section 9-34.4. Glass beads for plastic shall be as recommended by the material manufacturer.

8-22.3 Construction Requirements

8-22.3(1) Preliminary Spotting

The Engineer will provide necessary control points at intervals agreed upon with the Contractor to assist in preliminary spotting of the lines before marking begins. The Contractor shall be responsible for preliminary spotting of the lines to be marked. Approval by the Engineer is required before marking begins. Preliminary spotting to guide the striping machine is required for all longitudinal lines except where a clearly visible separation is present. Preliminary spotting shall be provided at a spacing of 100-feet maximum on tangents and 25-feet maximum on curves. The color of the material used for spotting shall match the color of the permanent marking.

8-22.3(2) Preparation of Roadway Surfaces

For the application of paint the pavement surface temperature and ambient temperature shall be 50°F and rising. The temperature requirement may be superseded by the material manufacturers written installation instructions. New and existing HMA pavement shall be dry, clean and free of contaminants such as surface oils. Portland cement concrete pavement shall have a minimum compressive strength of 2500-PSI and shall be dry, clean and free of contaminants. Contaminants shall be removed by approved mechanical means.

For the application of plastic pavement marking material surface temperature and ambient temperature shall be 50°F and rising. New and existing HMA pavement shall be dry, clean, and free of contaminants such as surface oils and existing pavement marking materials. Portland cement concrete pavement shall also be free of contaminants including curing agents. Contaminants shall be removed by approved mechanical means.

Pavement surfaces shall be prepared for plastic marking application in accordance with the previous paragraph and the pavement marking material manufacturer's recommendations. Manufacturers of Type D material also require a pavement cure period prior to application. Typically, Type D material applied on hot mix asphalt pavement requires a pavement cure period of 21-days. Typically, Type D material applied on portland cement concrete pavement requires a pavement cure period of 28-days. These cure periods may be reduced if the manufacturer performs a successful bond test and approves the reduction of the pavement cure period.

Existing pavement marking material shall be removed, measured, and paid for in accordance with the provisions in this section of the Standard Specifications.

8-22.3(3) Marking Application

Marking colors

Lane line and right edge line shall be white in color. Center line and left edge line shall be yellow in color. Transverse markings shall be white, except as otherwise noted in the Standard Plans.

Line Patterns

Solid line – a continuous line without gaps.

Broken line – a line consisting of solid line segments separated by gaps.

Dotted line – a broken line with noticeably shorter line segments separated by noticeably shorter gaps.

Line Surfaces

Flat Lines – Pavement marking lines with a flat surface.

Profiled Marking – A profiled pavement marking is a marking that consists of a base line thickness and a profiled thickness which is a portion of the pavement marking line that is applied at a greater thickness than the base line thickness. Profiles shall be applied using the extruded method in the same application as the base line. The profiles may be slightly rounded provided the minimum profile thickness is provided for the length of the profile. See the Standard Plans for the construction details.

Embossed Plastic Line – Embossed plastic lines consist of a flat line with transverse grooves. An embossed plastic line may also have profiles. See the Standard Plans for the construction details.

Line Applications

Surface line – a line applied directly to the pavement surface.

Grooved Line – A line constructed by grinding or saw cutting a groove into the pavement surface and spraying, extruding or gluing pavement marking material into the groove. The groove depth is dependent upon the material used, the pavement surface and location. See the project Plans and Special Provisions.

Two applications of paint will be required to complete all paint markings. The second application of paint shall be squarely on top of the first pass. The time period between paint applications will vary depending on the type of pavement and paint (low VOC waterborne, high VOC solvent, or low VOC solvent) as follows:

Pavement Type	Paint Type	Time Period
Bituminous Surface Treatment	Low VOC Waterborne	4-hours min., 48-hours max.
Hot Mix Asphalt Pavement	Low VOC Waterborne	4-hours min., 30-days max.
Cement Concrete Pavement	Low VOC Waterborne	4-hours min., 30-days max.
Bituminous Surface Treatment	High and Low VOC Solvent	40 min. min., 48 hrs. max.
Hot Mix Asphalt Pavement	High and Low VOC Solvent	40 min. min., 30-days max.
Cement Concrete Pavement	High and Low VOC Solvent	40 min. min., 30-days max.

Centerlines on 2 lane Highways with broken line patterns, paint or plastic, shall be applied in the increasing mile post direction so they are in cycle with existing broken line patterns at the beginning of the project. Broken line patterns applied to multi-lane or divided Roadways shall be applied in cycle in the direction of travel.

Where paint is applied on centerline on two-way roads with bituminous surface treatment or centerline rumble strips, the second paint application shall be applied in the opposite (decreasing mile post) direction as the first application (increasing mile post) direction. This will require minor broken line pattern corrections for curves on the second application.

Application Thickness

Pavement markings shall be applied at the following base line thickness measured above the pavement surface or above the groove bottom for grooved markings in thousandths of an inch (mils):

Marking Material Application		HMA	PCC	BST
Paint-first coat	spray	10	10	10
Paint- second coat	spray	15	15	15
Type A - flat/transverse & symbols	extruded	125	125	125
Type A - flat/long line & symbols	spray	90	90	120
Type A - with profiles	extruded	90	90	120
Type A - embossed	extruded	160	160	160
Type A - embossed with profiles	extruded	160	160	160
Type A – grooved/flat/long line	extruded	230	230	230
Type B - flat/transverse & symbols	heat fused	125	125	125
Type C-2 - flat/transverse & symbols	adhesive	90	90	NA
Type C-1 & 2 - flat/long line	adhesive	60	60	NA
Type C-1 - grooved/flat/long line	adhesive	60	60	NA
Type D - flat/transverse & symbols	spray	120	120	120
Type D - flat/transverse & symbols	extruded	120	120	120

Type D - flat/long line	spray	90	90	120
Type D - flat/long line	extruded	90	90	120
Type D - profiled/long line	extruded	90	90	120
Type D – grooved/flat/long line	extruded	230	230	230

Liquid pavement marking material yield per gallon depending on thickness shall not exceed the following:

Mils thickness	Feet of 4” line/gallon	Square feet/gallon
10	483	161
15	322	108
30	161	54
40	125	42
45	107	36
60	81	27
90	54	18
90 with profiles	30	10
120	40	13
120 with profiles	26	9
230	21	7

Solid pavement marking material (Type A) yield per 50-pound bag shall not exceed the following:

Mils thickness	Feet of 4” line/50# bag	Square feet/50# bag
30 - flat	358	120
45 - flat	240	80
60 - flat	179	60
90 - flat	120	40
90 - flat with profiles	67	23
120 - flat	90	30
120 - flat with profiles	58	20
125 - embossed	86	29
125 - embossed with		
profiles	58	20
230- flat grooved	47	15

All grooved plastic lines shall be applied into a groove cut or ground into the pavement. For Type A or D material the groove shall be cut or ground with equipment to produce a smooth square groove 4-inches wide. For Type C-1 material the groove shall be cut with equipment to produce a smooth bottom square groove with a width in accordance with the material manufacturer's recommendation. The groove depth for Type C-1 material shall be 100-mils, plus or minus 10-mils. The groove depth for Type A or D material shall be as shown in the Plans. After grinding, clean the groove by a method approved by Engineer. Immediately before placing the marking material clean the groove with high pressure air.

8-22.3(3)A Glass beads

Top dress glass beads shall be applied to all spray and extruded pavement marking material. Glass beads shall be applied by a bead dispenser immediately following the pavement marking material application. Glass bead dispensers shall apply the glass beads in a manner such that the beads appear uniform on the entire pavement marking surface with 50 to 60-percent embedment. Hand casting of beads will not be allowed.

Glass beads shall be applied to 10 or 15 mil thick paint at a minimum application rate of 7-pounds per gallon of paint. For plastic pavement markings, glass beads shall be applied at the rate recommended by the marking material manufacturer.

When 2 or more spray applications are required to meet thickness requirements for Type A and Type D materials, top dressing with glass beads is only allowed on the last application. The cure period between successive applications shall be in accordance with the manufacturer's recommendations. Any loose beads, dirt or other debris shall be swept or blown off the line prior to application of each successive application. Successive applications shall be applied squarely on top of the preceding application.

8-22.3(4) Tolerances for Lines

Allowable tolerances for lines are as follows:

Length of Line: The longitudinal accumulative error within a 40-foot length of skip line shall not exceed plus or minus 1-inch.

Width of Line: The width of line shall not vary more than plus or minus ¼-inch.

Lane Width: The lane width, which is defined as the lateral width from the edge of pavement to the center of the lane line or between the centers of successive lane lines, shall not vary from the widths shown in the Contract by more than plus or minus 4-inches.

Thickness: A thickness tolerance not exceeding plus 10-percent will be allowed for thickness or yield in paint and plastic material application.

Parallel Lines: The gap tolerance between parallel lines is 0.5-inches.

8-22.3(5) Plastic Installation Instructions

Installation instructions for plastic markings shall be provided for the Engineer. All materials including glass beads shall be installed according to the manufacturer's recommendations. A manufacturer's technical representative shall be present at the initial installation of plastic material to approve the installation procedure or the material manufacturer shall certify that the Contractor will install the plastic material in accordance with their recommended procedure.

8-22.3(6) Removal of Pavement Markings

Pavement markings to be removed shall be obliterated until blemishes caused by the pavement marking removal conform to the coloration of the adjacent pavement. If, in the opinion of the Engineer, the pavement is materially damaged by pavement marking removal, such damage shall be repaired by the Contractor in accordance with Section 1-07.13(1). Sand or other material deposited on the pavement as a result of removing lines and markings shall be removed as the Work progresses to avoid hazardous conditions. Accumulation of sand or other material which might interfere with drainage will not be permitted.

8-22.4 Measurement

Center line, center line with no pass line, double center line, double lane line, edge line, solid lane line, dotted extension line, lane line, reversible lane line, and two-way left turn center line will be measured by the completed linear foot as "Paint Line", "Plastic Line", "Embossed Plastic Line", "Profiled Plastic Line", "Profiled Embossed Plastic Line" or Grooved Plastic Line".

The measurement for "Paint Line" will be based on a marking system capable of simultaneous application of three 4-inch lines with two 4-inch spaces. No deduction will be made for the unmarked area when the marking includes a broken line such as center line, dotted extension line, center line with no-pass line, lane line, reversible lane line, or two-way left turn center line. No additional measurement will be made when more than 1 line can be installed on a single pass such as center line with no-pass line, double center line, double lane line, reversible lane line, or two-way left turn center line.

The measurement for "Plastic Line", "Embossed Plastic Line", "Profiled Plastic Line", "Profiled Embossed Plastic Line" or "Grooved Plastic Line" will be based on the total length of each 4-inch wide plastic line installed. No deduction will be made for the unmarked area when the marking includes a broken line such as, center line, dotted extension line, center line with no-pass line, lane line, reversible lane line, or two-way left turn center line.

The measurement for "Painted Wide Lane Line", "Plastic Wide Lane Line", "Profiled Plastic Wide Lane Line", "Painted Wide Line", "Plastic Wide Line", "Painted Barrier Center Line", "Plastic Barrier Center Line", "Painted Stop Line", or "Plastic Stop Line", will be based on the total length of each painted, plastic or profiled plastic line installed. No deduction will be made for the unmarked area when the marking includes a broken line such as, wide broken lane line, drop lane line, or wide dotted lane line. The measurement for double wide lane line will be based on the total length of each wide lane line installed.

No additional measurement for payment will be made for the required second application of paint. No additional measurement for payment will be made for additional applications required to meet thickness requirements for plastic markings.

Diagonal and chevron-shaped lines used to delineate medians, gore areas, and parking stalls are constructed of painted or plastic 4-inch or 8-inch lines in the color and pattern shown in the Standard Plans. These lines will be measured as "Painted Line", "Plastic Line", "Painted Wide Line" or "Plastic Wide Line" by the linear foot of line installed. Crosswalk line will be measured by the square foot of marking installed.

Traffic arrows, traffic letters, access parking space symbols, HOV symbols, railroad crossing symbols, drainage markings, bicycle lane symbols, aerial surveillance full, and ½ markers, yield line symbols, yield ahead symbols, and speed bump symbols will be

measured per each. Type 1 through 6 traffic arrows will be measured as 1 unit each, regardless of the number of arrow heads.

Removal of lines, 4-inches, 8-inches, 18-inches and 20-inches in width will be measured by the linear foot, with no deduction being made for the unmarked area when the marking includes a gap.

Removal of traffic arrows, traffic letters, access parking space symbol, HOV lane symbol, railroad crossing symbol, bicycle lane symbols, drainage markings, aerial surveillance full and ½ markers, yield line symbol, yield ahead symbol, and speed bump symbol will be measured per each. Removal of crosswalk lines will be measured by the square foot of lines removed.

8-22.5 Payment

Payment will be made in accordance with Section 1-04.1, for each of the following Bid items that are included in the Proposal:

"Paint Line", per linear foot.

"Plastic Line", per linear foot.

"Embossed Plastic Line", per linear foot.

"Profiled Plastic Line", per linear foot.

"Profiled Embossed Plastic Line", per linear foot.

"Grooved Plastic Line", per linear foot.

"Painted Wide Lane Line", per linear foot.

"Plastic Wide Lane Line", per linear foot.

"Profiled Plastic Wide Lane Line", per linear foot.

"Painted Wide Line", per linear foot.

"Plastic Wide Line", per linear foot.

"Painted Barrier Center Line", per linear foot.

"Plastic Barrier Center Line", per linear foot.

"Painted Stop Line", per linear foot.

"Plastic Stop Line", per linear foot.

"Painted Crosswalk Line", per square foot.

"Plastic Crosswalk Line", per square foot.

"Painted Traffic Arrow", per each.

"Plastic Traffic Arrow", per each.

"Painted Traffic Letter", per each.

"Plastic Traffic Letter", per each.

"Painted Access Parking Space Symbol", per each.

"Plastic Access Parking Space Symbol", per each.

"Painted Railroad Crossing Symbol", per each.

"Plastic Railroad Crossing Symbol", per each.

"Painted Bicycle Lane Symbol", per each.

"Plastic Bicycle Lane Symbol", per each.

"Painted Drainage Marking", per each.

"Plastic Drainage Marking", per each.

"Painted Aerial Surveillance Full Marker", per each.
"Plastic Aerial Surveillance Full Marker", per each.
"Painted Aerial Surveillance ½ Marker", per each.
"Plastic Aerial Surveillance ½ Marker", per each.
"Painted Access Parking Space Symbol with Background", per each.
"Plastic Access Parking Space Symbol with Background", per each.
"Painted HOV Lane Symbol", per each.
"Plastic HOV Lane Symbol", per each.
"Painted Yield Line Symbol", per each.
"Plastic Yield Line Symbol", per each.
"Painted Yield Ahead Symbol", per each.
"Plastic Yield Ahead Symbol", per each.
"Painted Speed Bump Symbol", per each.
"Plastic Speed Bump Symbol", per each.
"Removing Paint Line", per linear foot.
"Removing Plastic Line", per linear foot.
"Removing Painted Crosswalk Line", per square foot.
"Removing Plastic Crosswalk Line", per square foot.
"Removing Painted Traffic Marking", per each.
"Removing Plastic Traffic Marking", per each.