WORK ZONE PAVEMENT MARKINGS.

(REV 6-18-97) (7-02)

SUBARTICLE 102-3.3 (Pages 108-111) is deleted and the following substituted:

102-3.3 Work Zone Pavement Markings:

102-3.3.1 Description: Furnish and install Work Zone Pavement Markings for maintenance of traffic in construction areas and in close conformity with the lines and details shown on the plans. Measure the reflectivity of white and yellow stripes using a Mirolux 12 retroreflectometer or equal approved by the State Materials Office. Reflectivity shall be at least 250 mcd/lx·m^2 for yellow and 300 mcd/lx·m^2 for white when installed. Re-stripe anytime the reflectivity falls below 150 mcd/lx·m^2. Compensation for re-striping will be at the Contract unit price for the appropriate material when the material used appears on the Qualified Products List (QPL) and is properly installed. The pavement marking materials shall not contain any lead or chromium compounds. Manufacturers seeking product approval shall furnish certified test reports showing the Work Zone Pavement Marking material meets the requirements of this Section.

Centerlines, lane lines, edgelines, stop bars and turn arrows in work zones will be required in accordance with the MUTCD with the following additions:

(a) Install edgelines when a paved shoulder 4 feet [1.2 m] or greater in width exists along the edge of a lane.

(b) Place edgelines on all detours where vehicle paths are altered from normal operations and where a lane is narrowed from its normal width for any reason.

(c) Apply Work Zone Pavement Markings, including arrows and messages determined by the Engineer to be required for safe operation of the facility, prior to the end of the day if the highway is open to traffic. Channelizing devices may be used to direct traffic during the day prior to placing the Work Zone Pavement Markings.

(d) Work Zone Pavement Markings will be designated in the plans or by the Engineer as removable or non-removable.

Work Zone Raised Pavement Markers (WZRPM's) may be used in lieu of Temporary Tape or Paint in accordance with 102-3.3.2.4.

Removable Work Zone Pavement Markings consists of materials that can be taken up by hand. An example of this category of markings is plastic film (Tape), or Work Zone Raised Pavement Markers (WZRPM's).

Non-Removable Work Zone Pavement Markings consists of markings that are not classified as removable.

Use of Removable or Non-Removable Work Zone Pavement Markings shall be as follows:

Application	Category
Finish Pavement*	
All stripes representing final pavement	Non-Removable

Application	Category
markings	
All stripes in an area where the traffic pattern will be altered prior to project acceptance	Removable
Intermediate Pavement Course	
All stripes in pavement areas that will be covered with a subsequent course of pavement prior to altering of the traffic pattern within such area.	Non-Removable
All stripes where the traffic pattern will be altered prior to placing of the subsequent paving course within such area.	Removable
Existing Pavement	
All stripes that will be removed or overlaid with new pavement prior to altering the traffic pattern within such area.	Non-Removable
All stripes where the traffic pattern will be altered prior to removal or overlaying of such area.	Removable
*Place striping representing final markings in the permanent location unless excepted in writing by the Engineer.	

Removable Pavement Markings may be substituted for Non-Removable Pavement Markings. When substitution is made, payment will be made under the Bid Item, Non-Removable Pavement Marking.

102-3.3.2 Materials:

102-3.3.2.1 Paint and Glass Beads: Meet the application requirements of Section 710, and the material requirements of Section 971.

102-3.3.2.2 Preformed Non-removable Pavement Marking Film (Tape): Conform to the application requirements of Section 713, and the material requirements of 971-18.

102-3.3.2.3 Preformed Removable Pavement Marking Film (Tape): Meet the following requirements:

(1) Composition: Use a mixture consisting of polymeric materials, pigments, glass beads, and a retro-reflective layer of glass beads firmly bonded to the top surface.

(2) Adhesive: Precoat removable preformed plastic pavement marking film with a pressure sensitive adhesive capable of being affixed to asphaltic concrete and portland cement concrete pavement surfaces without the use of heat, solvents, and other additional adhesives or activators. Use an adhesive that exhibits excellent sheer characteristics and minimal tensile characteristics. Ensure that the adhesive does not require a protective liner when the preformed plastic pavement marking film is in rolled form for shipment. Ensure that the adhesive is capable of temporarily bonding to the roadway pavement at temperatures of 50°F [10°C] and the above without pick-up distortion by vehicular traffic.

(3) Pigmentation: Thoroughly blend color pigments to provide a plastic marking film that maintains uniform color under daylight and night lighting conditions

throughout the expected life of the film. White pavement marking film shall meet Federal Standard Color No. 595-17886. Yellow pavement marking film shall be similar to Federal Standard Color No. 595-13538.

(4) Glass Beads: Use colorless glass beads with a minimum refraction index of 1.50 when tested using the liquid oil immersion method. Use size and quantity of beads that will maintain the retro-reflectivity of the preformed plastic film as the film wears through the surface course. Firmly adhere approximately 2% by weight of glass beads to the top of the preformed plastic film. Beads should not be easily removed when film surface is scratched firmly with a thumbnail.

(5) Application Requirements: Apply removable Pavement Marking Film (Tape) with a mechanical applicator to provide pavement lines that are neat, accurate and uniform. Equip the mechanical applicator with a film cut-off device and with measuring devices that automatically and accumulatively measure the length of each line placed within an accuracy tolerance of ±2%. Roll or tamp pavement marking films (tape) to facilitate adhesion to the road surface. Tape may be placed by hand on short sections 500 feet [150 m] or less if it is done in a neat accurate manner.

(6) Removability: Provide preformed plastic pavement marking film capable of being removed from bituminous concrete and portland cement concrete pavement intact or in substantially large strips, either manually or by a mechanical roll-up device, at temperatures above 40°F [4°C], without the use of heat, solvents, grinding or blasting. Ensure that the manufacturer shows documented reports that the retro-reflective preformed plastic pavement marking film meets this requirement after being in place for a minimum of 90 days and under an average daily traffic count per lane of at least 9,000 vehicles per day.

102-3.3.2.4 Work Zone Raised Pavement Markers: Work Zone Raised Pavement Markers (WZRPM's) are RPM's intended for use in work zones as an alternate to other line markings. Use tape or paint in all transition areas in addition to the RPM's. WZRPM's shall be referred to as class "D" or class "E" Markers. Apply all markers in accordance with Design Standards, Index No. 600.

Class A, B, and flexible E markers may be used in lieu of Class D Markers. Class E Markers will only be allowed for use in areas for five continuous days or less.

Use colorless reflectors to replace white lines and amber reflectors to replace yellow lines. Space markers at 30 inch [750 mm] centers for lane lines and 5 foot [1.5 m] centers for edgelines.

To provide contrast, place five black Work Zone Raised Pavement Markers (WZRPM's) immediately after the five colorless reflective markers on asphalt pavement five years or older and all concrete pavement. Black Work Zone Raised Pavement Markers (WZRPM's) will not be required with amber markers.

Ensure that Work Zone Raised Pavement Markers (WZRPM's),are certified as meeting the following except for Class E markers as noted below:

(1) Composition: Use markers made of plastic, ceramic or other durable materials. Markers with studs or mechanical attachments will not be allowed.

(2) Dimensions: Marker minimum and maximum surface dimensions is based on an x and y axis where the y dimension is the axis parallel to the centerline and the x axis is 90 degrees to y. Class E markers shall be 4 inch [100 mm] (W) by 2 inch [50 mm] (H) by 1 inch [25 mm] (D).

The x and y dimension of Class D markers shall be a maximum of 5 inches [125 mm]. The x dimension shall be a minimum of 4 inches [100 mm] and the minimum y dimension will be 2.25 inches [57 mm].

Ensure that the maximum installed height of Class D markers is 1 inch [25 mm]. Ensure that the maximum installed height of Class E markers is 2 inches [50 mm]. Use Class D markers having a minimum reflective face surface of 0.35 in^2 [225 mm^2]. Use Class E markers having a minimum reflective surface area of 1 in^2 [645 mm^2].

Ensure that after installation, the marker's reflective face is completely visible and above the pavement surface measured from a line even with the pavement perpendicular to the face of the marker.

(3) Optical Performance: Ensure that the specific intensity of each white reflecting surface at 0.2 degrees observation angle is at least the following when the incident light is parallel to the base of the marker:

Horizontal Entrance Angle	Specific Intensity
0 degrees	3
20 degrees	1.2

For yellow reflectors, the specific intensity shall be 60% of the value for white.

For red reflectors, the specific intensity shall be 25% of the value for white.

Reflectivity of all (WZRPM's) shall not be less than 1.0 Specific Intensity (SI) any time after installation.

(4) Strength requirements: Markers shall support a load of 5,000 pounds [20 kN]. Three markers per lot or shipment will be randomly selected for a test.

Position the marker base down between the flat parallel platens of a compression testing machine. Place on top of the marker a flat piece of 65 durometer rubber 6 by 6 by 0.375 inch [150 by 150 by 9.5 mm] centered on the marker. Apply the compressive load through the rubber to the top of the marker at a rate of 0.2 in/s [0.085 mm/s].

Either cracking or significant deformation of the marker at any load less than 5,000 pounds [20 kN] will constitute failure.

(5) Adhesion: Use bituminous or other adhesive materials recommended by the marker manufacturer for bonding the markers to the pavement. The adhesive used shall be one of the products included on the Qualified Products List

(6) Removability: Ensure that the pavement marker is removable from asphalt pavement and portland cement concrete pavement intact or in substantially large pieces, either manually or by mechanical devices at temperatures above 40°F [4°C], and without the use of heat, grinding or blasting.

(7) Replacement Requirements: Replace markers any time after installation when more than two markers in a skip, or more than three consecutive markers on an edgeline are missing at no expense to the Department. Replace all failed markers in a timely manner as directed by the Engineer.

102-3.3.3 Certification: Furnish the Engineer certified test reports showing the work zone pavement marking material and adhesive supplied meets the applicable specification.

Each certification shall cover only one type. Due to the wide range of application of the products within some types, the certification shall state that the product is recommended for that specific project location, and specific use.

102-3.3.4 Compensation: The quantities to be paid for will be the length of skip and solid pavement markings, and the area of pavement markings placed as follows:

(a) The total transverse distance, in feet [meters], of skip pavement marking authorized and acceptably applied. The length of actual applied line will depend on the skip ratio of the material used. Measurement will be the distance from the beginning of the first painted stripe to the end of the last painted stripe with proper deductions made for unpainted intervals as determined by plan dimensions or stations, subject to 9-1.3. Unpainted intervals will not be included in pay quantity when WZRPM's are substituted for skip lines.

(b) The net length, in feet [meters], of solid pavement marking authorized and acceptably applied. When substituting WZRPM's for solid pavement marking tape, payment will be as if removable pavement markings were used.

(c) The number directional arrows or pavement messages authorized and acceptably applied.

Payment for (WZRPM's), and Removable Tape shall be made under:

Item No. 102-911- Removable Pavement Marking (White/Black) - per foot.
Item No. 2102-911- Removable Pavement Marking (White/Black) - per meter.
Item No. 102-912- Removable Pavement Marking (Yellow) - per foot.
Item No. 2102-912- Removable Pavement Marking (Yellow) - per meter.

Payment for Non-Removable Tape shall be made under:

Item No. 711- 31- Skip Traffic Stripe (White) - per gross mile.
Item No. 2711- 31- Skip Traffic Stripe (White) - per gross kilometer.
Item No. 711- 32- Skip Traffic Stripe (Yellow) - per gross mile.
Item No. 2711- 32- Skip Traffic Stripe (Yellow) - per gross kilometer.
Item No. 711- 33- Skip Traffic Stripe (White) - per foot.
Item No. 2711- 33- Skip Traffic Stripe (White) - per meter.
Item No. 711- 34- Skip Traffic Stripe (Yellow) - per foot.
Item No. 2711- 34- Skip Traffic Stripe (Yellow) - per meter.
Item No. 711- 35- Solid Traffic Stripe (White) - per foot.
Item No. 2711- 35- Solid Traffic Stripe (White) - per meter.
Item No. 711- 36- Solid Traffic Stripe (Yellow) - per foot.
Item No. 2711- 36- Solid Traffic Stripe (Yellow) - per meter.
Item No. 711- 37- Solid Traffic Stripe (White) - per net mile.
Item No. 2711- 37- Solid Traffic Stripe (White) - per net kilometer.
Item No. 711- 37- Solid Traffic Stripe (Yellow) - per net mile.
Item No. 2711- 38- Solid Traffic Stripe (Yellow) - per net kilometer.

Payment for Painted Lines shall be made under:

Item No. 710- 21- Skip Traffic Stripe (White/Black) - per gross mile.
Item No. 2710- 21- Skip Traffic Stripe (White/Black) - per gross kilometer.
Item No. 710- 22- Skip Traffic Stripe (Yellow) - per gross mile.
Item No. 2710- 22- Skip Traffic Stripe (Yellow) - per gross kilometer.
Item No. 710- 23- Solid Traffic Stripe (White/Black) - per net mile.
Item No. 2710- 23- Solid Traffic Stripe (White/Black) - per net kilometer.
Item No. 710- 24- Solid Traffic Stripe (Yellow) - per net mile.

Item No. 2710- 24- Solid Traffic Stripe (Yellow) - per net kilometer.
Item No. 710- 25- Solid Traffic Stripe (White/Black) - per foot.
Item No. 2710- 25- Solid Traffic Stripe (White/Black) - per meter.
Item No. 710- 26- Solid Traffic Stripe (Yellow) - per foot.
Item No. 2710- 26- Solid Traffic Stripe (Yellow) - per meter.

Payment for Directional Arrows and Pavement Messages shall be made under:

Item No. 710- 6- Directional Arrows, Painted - each.
Item No. 2710- 6- Directional Arrows, Painted - each.
Item No. 710- 7- Pavement Messages, Painted - each.
Item No. 2710- 7- Pavement Messages, Painted - each.

Payment for class A or B Raised Pavement Markers used to supplement line markings will be paid for under Item No. 102-78 [Item No. 2102-78], Reflective Pavement Marker. These markers shall be installed at 40 foot [12 m] spacing on tangent and 20 foot [6 m] spacing on transitions, curves and crossovers as detailed on Design Standards.