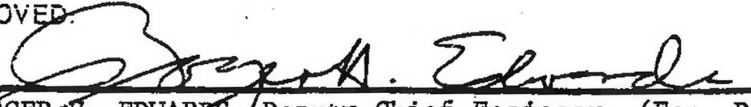


TO: SUPERSEDED BY EI 93-007 EFFECTIVE 11/18/93	<h1 style="text-align: center;">ENGINEERING INSTRUCTION</h1> <p style="text-align: center;">NEW YORK STATE DEPARTMENT OF TRANSPORTATION</p> <p style="text-align: center;">SUBJECT: PREFORMED REFLECTORIZED PAVEMENT MARKINGS</p> <p style="text-align: center;">Subject Code: 7.27-1-688</p>
Distribution: 31 Main Office 33 Regions 34 Special	Code: <u> EI 84-32 </u>
APPROVED:  <u>ROGER H. EDWARDS, Deputy Chief Engineer (Fac. Des. Div.)</u>	Date: <u> 6-11-84 </u> Supersedes: EI 82-30 (dated 5/5/82)

Attached is a revised specification for preformed reflectORIZED pavement markings.

Effective immediately, replace Item Nos. 18688.0101 through 18688.0401 with the attached new Items 18688.0102 through 18688.0402.

The major changes in the new Items include:

1. Provisions that allow the placement of preformed markings in conjunction with bituminous paving operations, and at any time during the paving operation.
2. Delayed inspection and final acceptance criteria, pending a 180 day performance evaluation.

These specifications will be inserted into proposals by the Main Office, Final Plan Review Bureau.

PREL.	FINAL
DESIGN	LANDSCAPE
RECEIVED	
FACILITIES DESIGN DIVISION	
JUN 15 1984	
CIRC.	FILE

- ITEM 18688.0102 White Preformed Reflectorized Pavement Stripes
18688.0202 Yellow Preformed Reflectorized Pavement Stripes
18688.0302 White Preformed Reflectorized Pavement Letters
18688.0402 White Preformed Reflectorized Pavement Symbols

DESCRIPTION. Under this work, the Contractor shall furnish and apply preformed reflectorized pavement markings at the location and in accordance with the patterns indicated on the plans, or as directed by the Engineer, and in accordance with these specifications.

The preformed reflectorized pavement marking shall be applied on new and existing bituminous and portland cement concrete pavement surfaces by hand and mechanical methods. The resultant marking shall be an adherent reflectorized stripe that is capable of molding itself to the contours of the pavement surface and of resisting deformation by traffic.

MATERIAL REQUIREMENTS.

A. White and Yellow Preformed Reflectorized Markings.

1. General Requirements. White and yellow preformed markings shall be composed of a mixture of plastics or polymeric materials, resins, pigments, and reflective glass spheres that are uniformly distributed throughout the thickness of the material. In addition, a reflective layer of glass spheres shall be bonded to, or embedded in the top surface.

The preformed marking shall be pre-coated, on its bottom side, with a pressure sensitive adhesive for adherence to bituminous or portland cement concrete surfaces.

The finished preformed marking material shall be of the specified dimension and shape, of good appearance, and free of cracks or other defects. The edges shall be clean cut and well defined. The material shall be weather resistant and through normal traffic wear shall show no appreciable fading, lifting or shrinkage.

When properly applied, the preformed marking shall be capable of molding itself to the contours, breaks and faults of bituminous and portland cement concrete surfaces; and shall show no significant tearing, roll-back, lifting or other signs of poor adhesion.

2. Physical Properties.

- a. Color. White preformed pavement markings, as placed, shall be white, free from dirt or tint. The color of the white marking shall be defined by the color chip in the possession of the Materials Bureau.

Yellow preformed pavement markings, as placed, shall be yellow, free from dirt or tint and shall be a reasonable visual match to Munsell Book Notation 10Yr 8/14 (ASTM D1535).

April 1, 1979
April 27, 1982 (Rev.)
April 16, 1984 (Rev.)

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- b. Thickness. Preformed pavement marking material shall have a minimum thickness of not less than 0.060 inch (60 mils). Minimum thickness shall be determined as the average of five micrometer readings, taken on a 4"x6" sample of material applied to an aluminum panel and by deducting the thickness of the aluminum panel.
- c. Reflective Glass Spheres. Glass spheres for use in the preformed marking composition and for surface application shall have a refractive index of not less than 1.50, as determined by the liquid immersion method at 25°C.
- d. Friction Resistance. The surface of the preformed marking material, with glass beads, shall provide a minimum friction resistance value of 45 BPN when tested in accordance with ASTM E303.
- e. Tensile Strength. Preformed pavement marking material shall have a minimum tensile strength of 40 pounds per square inch when tested in accordance with ASTM D638. The sample size shall be 6"x1". Tests shall be conducted at an ambient temperature of 70±5°F. The testing machine shall operate at a speed of 0.20" per minute.
- f. Elongation. Preformed pavement marking material shall have a minimum elongation of 15% when tested in accordance with ASTM D638, and under the conditions as specified for "e. Tensile Strength."
- g. Plastic Pull Test. A 6"x1" test specimen shall support a dead weight of 4 lbs. for not less than 5 minutes. Tests shall be conducted at an ambient temperature of 70±5°F.

B. Primer.

Primer or adhesive activators shall be of the type recommended by the manufacturer of the preformed marking material.

C. Packaging and Shipment.

Preformed reflectorized pavement marking and primer materials shall be shipped and packaged in accordance with commercially accepted standards. The following information shall be plainly marked on each container or on the shipping invoice: the name of the product; the name and address of the manufacturer; the quantity of material; the date of manufacture; and the date of expiration or shelf life.

BASIS OF ACCEPTANCE. White and yellow preformed reflectorized pavement marking and primer materials shall be approved by the Materials Bureau. Detailed requirements and procedures for approval are available from the Materials Bureau.

Approval of preformed markings will be based on laboratory analysis and field testing prior to their use on a Department project. If the proposed marking passes the requirements for laboratory analysis and initial field tests and it is considered acceptable by the Director, Materials Bureau, the product will be placed on the Department's "Approved List" of materials.

Project acceptance will be based on the appearance of the marking and primer material on the Department's approved list of preformed reflectorized pavement markings.

CONSTRUCTION DETAILS.

1. General. All pavement markings and patterns shall be placed as shown on the plans and in accordance with the New York State Manual of Uniform Traffic Control Devices.

Before any pavement marking work is begun, a schedule of operations shall be submitted for the approval of the Regional Director or his authorized representative.

At least five (5) days prior to the start of work, the Contractor shall provide the Engineer with the manufacturer's written instructions for the application of preformed marking and primer materials.

When pavement markings are applied under traffic, the Contractor shall supply all necessary flags, markers, signs, and other devices, to maintain traffic and to protect the markings until set.

The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of traffic flow will not be allowed without prior approval of the Engineer.

The Contractor shall be responsible for removing, to the satisfaction of the Engineer, preformed markings applied in unauthorized areas.

When required by the Engineer, the Contractor shall establish marking line points at twenty-five (25) foot intervals throughout the length of the pavement or as directed by the Engineer.

2. Application Methods. Preformed pavement markings shall be applied by the following methods. The installation of markings on the project may be performed simultaneously by more than one method.
 - a. During Bituminous Paving Operations. Preformed markings shall be applied on newly paved bituminous surfaces after finish rolling is complete.
 - b. On Completed Pavements. Preformed markings shall be applied on new and existing bituminous and portland cement concrete pavement surfaces as prescribed in § 3. Weather and Seasonal Limitations.

3. Weather and Seasonal Limitations. The Engineer shall determine as to when temperature and pavement surface conditions are such as to produce satisfactory results.

Preformed pavement markings shall be placed upon dry pavement surfaces; pavements exposed to rain or wet conditions shall be allowed to thoroughly dry before marking application.

Preformed markings applied in conjunction with § 2a. During Bituminous Paving Operations, shall only be placed within the seasonal limitations of Standard Specification § 401-3.01. The bituminous pavement surface temperature shall, at all times, be the controlling temperature at which preformed markings are placed, and shall be between 100F and 170F.

Preformed markings applied in conjunction with § 2b. On Completed Pavements, shall be applied within the seasonal limitations of Table 1, Temperature and Seasonal Requirements. The pavement surface and ambient air temperatures in Table 1 shall, in all cases, be the controlling temperatures at which preformed markings are placed. Marking application work shall be discontinued when temperatures fall below the specified requirements.

TABLE 1 - TEMPERATURE AND SEASONAL REQUIREMENTS
(§ 2b. ON COMPLETED PAVEMENTS)

Geographic Location	Pavement Surface Temperature (Note 1)	Ambient Air Temperature (Note 2)	Allowable Installation Dates
Regions 1,2,3,4,5,6, 7, & 9 (All Counties) Region 8 (Ulster Co. only)	70F,Min.	60F,Min.	May 15 to September 1
Regions 8 & 10 (except Ulster Co.)	70F,Min.	60F,Min.	May 15 to September 15
Region 11	70F,Min.	60F,Min.	May 1 to September 30

Notes:

- Surface temperatures shall be measured on the pavement surface where the preformed markings are to be placed. The controlling temperature shall be the average of three temperature readings taken at locations 100± feet apart.
- Ambient air temperatures shall be measured in the shade.

4. Mechanical Applying Equipment. Mechanical applying equipment for the placement of preformed pavement marking stripes shall be of the type recommended by the manufacturer of the preformed material. All applying equipment shall be approved by the Engineer prior to the start of work.
5. Rollers. Preformed markings applied in conjunction with § 2a. During Bituminous Paving Operations, shall be rolled into place with compaction equipment meeting the requirements of Standard Specification § 401-3.06. Vibratory roller models shall operate in a "static" mode.

Preformed markings applied in conjunction with § 2b. On Completed Pavements, shall be rolled into place using steel wheel or pneumatic rubber-tired roller equipment approved by the Engineer. Steel wheel rollers shall weigh a minimum 200 pounds on each axle. Pneumatic rubber-tired rollers shall exert a minimum tire compression on the pavement of 28 p.s.i. Hand rollers or rubber tired vehicles (e.g. pick-up truck) meeting the above requirements may be suitable for use.

6. Primer Requirements. When required, primer or adhesive activators shall be used for marking applications in accordance with the written recommendations of the manufacturer of the preformed marking material.

Primer materials shall be placed at the application rate and by the application methods recommended by the manufacturer.

When primer is applied, the area of application shall be at least the width or dimension, of the new preformed marking, plus one (1) inch on each side.

7. Surface Cleaning and Preparation of Pavement Surfaces. The Contractor shall be responsible for cleaning the pavement surface to the satisfaction of the Engineer.

Surface cleaning and preparation work shall be performed only in the area of the preformed markings application.

At the time of application, all pavement surfaces shall be free of oil, dirt, dust, grease and similar foreign materials. The cost of cleaning these contaminants shall be included in the bid price of this item.

In addition, concrete curing compounds on new portland cement concrete surfaces and existing pavement markings on both concrete and bituminous pavement surfaces shall be removed and paid for under separate items.

8. Application of Preformed Reflectorized Pavement Markings. Unless otherwise approved by the Engineer, all longitudinal lines shall be applied using mechanical applying equipment. Transverse and special marking patterns may be applied by hand or mechanical methods.

Preformed marking operations shall not begin until after the pavement surface has been cleaned and prepared.

Preformed stripes shall not be applied over longitudinal paving joints or over the point of transition between the pavement surface and adjoining shoulder. The placement of stripes in the area of transition shall be either on the pavement or on the shoulder, as directed by the Engineer.

No roller shall operate in excess of 3 miles per hour. One roller pass shall be defined as one movement of the roller over any point of the preformed marking, in the direction of the marking application.

- a. Application During Bituminous Paving Operations. The application of preformed markings shall not begin until finish rolling of the new bituminous pavement is complete.

At the time of marking application, the surface temperature of the new bituminous pavement shall be between 100F and 170F. The Contractor shall coordinate paving and preformed marking operations to conform with surface temperature requirements.

Immediately after finish rolling is complete, the preformed marking shall be applied on the new bituminous surface. Traces of water or other residue from finish rolling operations shall first be removed. Immediately after its placement, the preformed marking shall be adhered to the warm pavement surface by rolling. Rollers shall make a minimum one pass, and operate in the same direction that the marking was applied. Diagonal, reverse or crosswise rolling will not be allowed. The minimum one pass may be increased by the Engineer if, in his opinion, the desired adherence is not obtained.

- b. Application on Completed Pavements. The application of preformed markings shall only be performed within the limitations of § 3. Weather and Seasonal Limitations.

If required by the manufacturer, primer and adhesive activators shall be applied and allowed to dry in accordance with the instructions of the manufacturer of the preformed material.

The preformed marking shall be placed on the pavement surface and adhered by rolling. Rollers shall make a minimum one pass, and operate in the same direction that the marking was applied. Diagonal, reverse or crosswise rolling will not be allowed. The minimum one pass may be increased by the Engineer if, in his opinion, the desired adherence is not obtained.

METHOD OF MEASUREMENT. Pavement striping will be measured by linear feet along the centerline of the pavement stripe and will be based on a 4-inch wide stripe.

The preformed pavement markings will be inspected during and following installation to determine conformance with this specification. In addition, they will be inspected following a performance period that will extend for 180 calendar days following both their installation and opening of the roadway to traffic.

Within 15 consecutive calendar days after the end of the 180 day performance period, a final performance inspection will be made by the Engineer. If this inspection discloses any work, in whole or in part, as not being visibly intact and serviceable to the following extent, the Contractor shall completely repair or replace such work:

- A. Broken line: 90 percent measured longitudinally of the total length of all broken lines in any 500 foot long pavement section.
- B. Dotted line: 50 percent measured longitudinally of the total length of all dotted lines in any 100 foot long pavement section.
- C. Solid line and edge line: 90 percent measured longitudinally of the total length of solid line or edge line in any 500 foot long pavement section.
- D. Channelizing line, stop line, crosswalk lines, clearance line and crossbars, hatch lines, letters and symbols: 90 percent by area of any individual line, letter or symbol.

When required all repair or replacement work shall be performed in accordance with this specification and completed within 60 calendar days of the earliest allowable installation date as specified in Table 1, for that location.

Upon completion of the final performance inspection, or after satisfactory completion of any necessary corrections, the Engineer will, within 10 calendar days, notify the Contractor in writing, of the date of such final performance inspection and release him from further performance responsibility.

This delay in performance inspection and performance acceptance of preformed markings shall not delay acceptance of the entire project and final payment due if the Contractor provides the Department with a "Faithful Performance Bond", and a "Labor and Material Bond" in the full amount of all preformed pavement marking items. These bonds shall conform to the requirements of § 103-04 and shall be in full force and effect until final performance inspection and performance acceptance of the pavement markings. In addition the Contractor shall keep in force the various types of insurance as required by § 107-06.

Pavement striping on on-going projects will be measured as the total of the striping applied, if after the final 180 day performance period, damage to the striping is not in excess of that specified (e.g. If 95% of the edgeline striping is intact in a 500 foot pavement section, the edgeline will be measured as the full 500 foot of applied marking. No deduction will be made for the damaged 5% (25') of striping).

Measurement for striping with a plan width greater or less than the basic 4 inches as shown on the plans or as directed by the Engineer, will be made by the following method:

$$\frac{\text{Plan Width of Striping (inches) X Linear Feet}}{4(\text{inches})}$$

No payment will be made for the number of linear feet of gaps between broken or dotted line segments.

Letters and symbols will be measured by each unit applied. A unit will consist of one letter or one symbol. Example: "SCHOOL" would be measured as six units.

BASIS OF PAYMENT. The accepted quantities of markings will be paid for at the contract unit price, which shall include the cost of furnishing all labor, materials and equipment to satisfactorily complete the work. The cost of cleaning pavement surfaces of oil, dirt, dust, grease and similar foreign materials shall be included in the price bid. The cost of removal of concrete curing compounds and existing pavement markings will be paid under separate items and are not included in this item.

Payment will be made under:

<u>ITEM NO.</u>	<u>ITEM</u>	<u>PAY UNIT</u>
18688.0102	White Preformed Reflectorized Pavement Stripes	Linear Foot
18688.0202	Yellow Preformed Reflectorized Pavement Stripes	Linear Foot
18688.0302	White Preformed Reflectorized Pavement Letters	Each
18688.0402	White Preformed Reflectorized Pavement Symbols	Each