686.01010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT STRIPES
686.02010011 – YELLOW POLYUREA REFLECTORIZED PAVEMENT STRIPES
686.03010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT LETTERS
686.04010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT SYMBOLS

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

MATERIALS.

Polyurea. Polyurea shall be capable of application on new and existing asphalt and portland cement concrete surfaces, and shall:

- Be a two-component (Part A and Part B), 100% solids type system formulated and designed to provide a simple volumetric mixing ratio (e.g., two volumes of Part A to one volume of Part B).
- Be VOC compliant and lead chromate free.
- Not contain 0.1% or more of any chemical listed by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), or regulated by the US Occupational Safety and Health Administration (OSHA) as a carcinogen.
- Conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC).
- Be packaged in suitable, well-sealed in their original unopened containers. Shipping documents and containers shall have identification numbers or batch dates for confirmation of when products were manufactured, clearly labeled as to the type material and the ratio of the components to be mixed by volume as well as showing resin or hardener components, brand name, name of manufacturer, lot or batch number, temperature range for storage, expiration date and the quantity contained. Include any special instructions regarding mixing and Material Safety Data Sheets. This information shall be made available for inspection at any time.
- Be stored in accordance with the manufacturer's instructions and manufacturers' requirements for shelf life and storage conditions.
- Be clearly labeled and in a dry and clean condition prior to use.
- Provide a surface friction level equivalent or better than existing pavement.
- Be colored yellow or white in conformance with the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD) as specified on provided Work Orders or Plans.

Reflective Elements. A combination of glass beads and wet-night reflective elements compatible with polyurea shall be injected into the polyurea. Glass beads shall be applied at rate specified by manufacturer. Glass beads for pavement markings shall meet the requirements of AASHTO M247 and shall be:

- Composed of glass that is highly resistant to traffic wear and to the effects of weathering.
- Minimum refractive index: 1.50 when tested by the liquid immersion method at 77°F.
- Show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps.
- Flow freely from the dispensing equipment at any time when surface and atmospheric conditions are satisfactory for painting.

A. Gradation (ASTM D1214).

- Standard Glass Beads – 85% of beads by weight with the following size distribution:

Sieve Size	#20	#30	#50	#80
Percent Passing by Weight	100	80-95	9-42	0-10

B. Coating.

Marking Type	Coating Type
Standard Glass Beads	Moisture-resistant or dual purpose type coating with adherence compatible with Polyurea.

C. Moisture Resistance. AASHTO M 247 Section 5.3.

D. Wet-Night Reflective Elements:

The Wet-Night Reflective Elements shall be composed of microcrystalline ceramic beads and designed to be applied to polyurea pavement marking paint. The ceramic elements shall have a minimum index of refraction of 2.30 when tested using the liquid oil immersion method. The ceramic beads shall be either clear or yellow tinted as required. For white markings, 3M Series 70P ceramic beads or approved equal shall be used. For yellow markings, 3M Series 71P ceramic beads or approved equal shall be used. Application rate of the Wet-Night Reflective Elements shall be based on the manufacturer's recommendation.

E. Packaging and Shipping. Reflective Elements shall:

- Be packaged in suitable, well-sealed in their original unopened containers. Shipping documents and containers shall have identification numbers or batch dates for confirmation of when products were manufactured, clearly labeled as to the type material, brand name, name of manufacturer, lot or batch number, temperature range for storage, expiration date and the quantity contained. This information shall be made available for inspection at any time.
- Be stored in accordance with the manufacturer's instructions and manufacturers' requirements for shelf life and storage conditions.
- Be clearly labeled and in a dry and clean condition prior to use.

APPROVED POLYUREA MATERIALS. Products appearing on the list below with a Manufacturer's certification that the product meets the requirements of this specification, or a Product approved equal as determined by the Engineer, are deemed acceptable for use:

HPS-5
Ennis-Flint
115 Todd Court, Thomasville, NC 27360
336-475-6600 www.ennisflint.com

5000 SERIES
3M TRAFFIC SAFETY SYSTEMS DIVISION

686.01010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT STRIPES
686.02010011 – YELLOW POLYUREA REFLECTORIZED PAVEMENT STRIPES
686.03010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT LETTERS
686.04010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT SYMBOLS

30 Greentree Court, Northport, NY, 11768
631- 896-9020 www.3M.com/TSS

LS -90
Epoplex
One Park Avenue, Maple Shade, NJ 08052
800-822-6920 www.epoplex.com

CONSTRUCTION DETAILS.

General. All pavement markings and patterns shall be placed as shown on the Contract or Work Order documents and in accordance with the MUTCD.

Before any pavement marking work is begun, a schedule of operations shall be submitted for the approval of the Engineer and his/her authorized representative. At least five (5) days prior to starting striping, the Contractor shall provide the Engineer with the polyurea manufacturer's written instructions for use. These instructions shall include, but not be limited to, material mixing ratios and application temperatures.

When pavement markings are applied under traffic, the Contractor shall provide all necessary flags, markers, signs, etc. in accordance with the MUTCD to maintain and protect traffic, and to protect marking operations and the markings until thoroughly set.

The application of pavement markings shall be done in the general direction of traffic. Striping against the direction of traffic flow shall not be allowed.

The Contractor shall be responsible for removing, to the satisfaction of the Engineer, all tracking marks, spilled polyurea, and polyurea markings applied in unauthorized areas.

Atmospheric Conditions. Polyurea pavement markings shall only be applied during conditions of dry weather and on substantially dry pavement surfaces. At the time of installation the pavement surface temperature shall be at or above manufacturer recommendations (typically 32°F - 40°F minimum).

Surface Preparation. The Contractor shall clean the pavement and existing durable markings to the satisfaction of the Engineer. At the time of application, all pavement surfaces and existing durable markings shall be free of oil, dirt, dust, grease and similar foreign materials.

Polyurea Application Equipment. Mobile application equipment for the placement of polyurea reflectorized pavement markings shall be approved by the Engineer prior to the start of work.

In general, a mobile applicator shall be a truck mounted, self–contained pavement marking machine, specifically designed to apply polyurea resin materials and reflective glass spheres in continuous and skip-line patterns.

The application equipment shall be maneuverable to the extent that straight lines can be followed and normal curves can be made in true arc. In addition, the truck mounted unit shall be provided with accessories to allow for the marking of legends, symbols, crosswalks, and other special patterns.

At any time throughout the duration of the project, the Contractor shall provide free access to his polyurea application equipment for inspection by the Engineer or his authorized representative.

686.01010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT STRIPES
686.02010011 – YELLOW POLYUREA REFLECTORIZED PAVEMENT STRIPES
686.03010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT LETTERS
686.04010011 – WHITE POLYUREA REFLECTORIZED PAVEMENT SYMBOLS

The Engineer may approve the use of a portable applicator in lieu of mobile truck mounted accessories for use in applying special markings only, provided such equipment can demonstrate satisfactory application of reflectorized polyurea markings in accordance with these specifications. The application equipment shall include the following features:

1. Individual tanks for the storage of Part A and Part B of the polyurea resin and for the storage of reflective glass spheres.
2. Heating equipment of sufficient capacity to maintain the individual polyurea components at the manufacturer's recommended temperature for spray application.
3. Nitrogen tanks if required by the manufacturer to keep moisture out of the lines.
4. Glass bead dispensing equipment and the capacity of applying the spheres a minimum rate of 20 lbs. per gal of polyurea.
5. Metering devices or pressure gauges on the proportioning pumps, positioned to be readily visible to the Engineer.
6. All necessary spray equipment, mixers, compressors, and other appurtenances for the placement of polyurea reflectorized pavement markings in a simultaneous sequence of operations.

Application of Polyurea Reflectorized Pavement Markings. Polyurea reflectorized pavement markings shall be placed at the width, thickness, and pattern designated by the Contract Documents. Marking operations shall not begin until applicable surface preparation work is completed and approved by the Engineer, and the atmospheric conditions and pavement surface temperature are acceptable to the Engineer.

Pavement markings shall be applied by the following simultaneous operation:

1. The pavement surface is air-blasted to remove dirt and residues.
2. The polyurea resin, mixed and heated in accordance with the manufacturer's recommendations, is uniformly hot-sprayed onto the pavement surface at the required thickness.
3. Reflective glass beads are injected into, or dropped onto, the liquid polyurea marking at manufacturer’s recommended rate.. The Wet-Night Reflective Elements are applied at the manufacturer’s recommended rate.

It is preferred the impingement-mixing spray gun use a mechanical or air purge method to prevent clogging. If solvent purge is deemed necessary by the contractor, special care shall be used to ensure solvents are contained and disposed in conformance with all federal, state and local health, safety, and environmental regulations.

The applied film thickness, calculated without drop-on reflective beads, shall be 22 +/- 2 mils. Applied markings shall have uniform thickness and reflective bead distribution across the width of the line. The markings shall have crisp, distinct edges and a clean cutoff at the end of each line.

Defective Polyurea Pavement Markings. Polyurea reflectorized pavement markings, which after application and curing are determined by the Engineer to be defective and not in conformance with this specification, shall be repaired. Repair of defective markings shall be the responsibility of the Contractor and shall be performed to the satisfaction of the Engineer as follows:

1. Insufficient film thickness and line width and/or insufficient glass bead coverage or inadequate glass bead retention.

   Repair Method. Prepare the surface of the defective polyurea marking to the satisfaction of the Engineer, to the extent that a substantial amount of the reflective glass spheres are removed and a roughened polyurea marking surface remains. Repair shall be made by restriping over the cleaned surface in accordance with the requirements of this specification and at the full thickness.

2. Uncured or discolored polyurea and/or insufficient bond (to pavement surface or existing durable marking).

   Repair Method. The defective polyurea marking shall be completely removed and cleaned to the underlying pavement surface to the satisfaction of the Engineer. The extent of removal shall be the defective area plus any adjacent polyurea pavement marking material extending three feet in any direction.

   After surface preparation work is complete, repair shall be made by reapplying polyurea over the cleaned pavement surface in accordance with the requirements of this specification.

Other defects not noted above, but determined by the Engineer to need repair, shall be repaired or replaced as directed by and to the satisfaction of the Engineer.

All work in conjunction with the repair or replacement of defective polyurea reflectorized pavement markings shall be performed at the Contractor's expense.

Personal Protective Equipment. Follow all exposure, respiratory and personal protective equipment controls, handling and safety precautions and spill and disposal procedures as identified by safety data sheets (SDS), labels and other manufacturer's recommendations for the products used.

WORK ZONE TRAFFIC CONTROL (WZTC). The Contractor is responsible for ensuring appropriate WZTC in compliance with the MUTCD appropriate for the dry time of the selected material applied. The Contractor is responsible to ensure adequate WZTC to prevent those walking, skating, bicycling, and driving from coming into contact with applied material that is still capable of being tracked. The Contractor shall be liable for such tracking and property damage should it occur.

METHOD OF MEASUREMENT. Pavement striping will be measured by linear foot along the centerline of the pavement stripe, and will be based on a 4 inch wide stripe. Measurement for striping with a plan width greater or less than the basic 4 inch as shown on the plans or as directed by the Engineer will be made by the following method:

$$\frac{\text{Plan Width of Striping (inches)} \times \text{Plan Length of Striping (feet)}}{\text{4 inches}}$$

No payment will be made for the number of feet of skips in the dashed line.

Letters and symbols will be measured by each unit applied. A unit will consist of one letter or symbol. Example: "SCHOOL" would be measured as six units. Double and triple headed arrows will be measured as a single unit, but the "X" in railroad grade crossing markings (MUTCD Figure 8B-6) will be measured

by feet of 4 inch stripe. Stencils used for bicycle lane symbols shall include the arrow or "sergeant stripes" and will be measured as a single unit.

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 for maintaining and protecting traffic during the marking operations 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:

Item No.	Item	Pay Unit
686.01010011	White Polyurea Reflectorized Pavement Stripes	Feet
686.02010011	Yellow Polyurea Reflectorized Pavement Stripes	Feet
686.03010011	White Polyurea Reflectorized Pavement Letters	Each
686.04010011	White Polyurea Reflectorized Pavement Symbols	Each