**ITEM NO. 1210110A—4” (WHITE) TYPE I EPOXY RESIN PAVEMENT MARKINGS**

**ITEM NO. 1210111A—4” (YELLOW) TYPE I EPOXY RESIN PAVEMENT MARKINGS**

**ITEM NO. 1210112A—12” (WHITE) TYPE I EPOXY RESIN PAVEMENT MARKINGS**

**ITEM NO. 1210113A—6” (WHITE) TYPE I EPOXY RESIN PAVEMENT MARKINGS**

**ITEM NO. 1210114A—6” (YELLOW) TYPE I EPOXY RESIN PAVEMENT MARKINGS**

**ITEM NO. 1210115A—8” (WHITE) TYPE I EPOXY RESIN PAVEMENT MARKINGS**

**ITEM NO. 1210116A—8” (YELLOW) TYPE I EPOXY RESIN PAVEMENT MARKINGS**

**Section 12.10** *is supplemented and amended as follows:*

**Article 12.10.01—Description:**

 *Replace the entire Article with the following:*

 This item shall consist of furnishing and installing retroreflective Yellow and White Type I Epoxy Resin Pavement Markings of the width and color specified at the locations indicated on the plans, in conformance with the plans, this specification, and as directed by the Engineer.

 Type I Epoxy Resin Pavement Markings include center lines, lane lines, and shoulder lines.

 Type I Epoxy Resin Pavement Markings shall be installed in a pavement marking groove. Pavement marking grooves are specified elsewhere in the Contract.

**Article 12.10.02—Materials:**

 *Replace the entire Article with the following:*

 Type I Epoxy Resin Pavement Markings shall meet the requirements of **Article M.07.22 – Epoxy Resin Pavement Markings** amended as follows:

*Delete the last sentence and add the following:*

 (j) Type I Epoxy Resin Pavement Markings shall consist of one of the following mixes of retroreflective beads, or approved equal:

* Potter’s VISIMAX glass bead and a clear glass bead that meets the requirements of AASHTO M 247, Type 4.
* Potter’s VISIULTRA glass bead and a clear glass bead that meets the requirements of AASHTO M 247, Type 1.
* 3M’s tinted microcrystalline ceramic bead with minimum indexes of refraction of 1.89 (dry) and 2.4 (wet) when tested using the ASTM E1967 method and a clear glass bead that meets the requirements of AASHTO M 247, Type 4. Yellow tinted beads shall be installed on yellow pavement markings and white tinted beads shall be installed on white pavement markings.

**Article 12.10.03—Construction Methods:**

*In* Subarticle **1. Equipment**, *delete paragraph 1 and add the following:*

Equipment furnished shall include an applicator truck of adequate size and power, together with:

1. remote application equipment designed to apply an epoxy resin material in a continuous pattern, and
2. portable retroreflective bead applicators, one for each size bead, designed to provide uniform and complete coverage of the epoxy binder by a controlled free-fall method. Pressurized retroreflective bead application shall not be used.

*In* Subarticle **2. Procedures**, *delete paragraphs 3, 7, and 8 and add the following:*

All surfaces that are power washed shall be allowed to dry sufficiently prior to the application of the epoxy markings. The areas to be marked shall be broom cleaned immediately prior to the application of the epoxy markings. Retroreflective beads shall be applied immediately after application of the epoxy resin marking to provide an immediate no-track system.

The epoxy for Type I Epoxy Resin Pavement Markings shall be uniformly applied to the surface to be marked to ensure a wet film thickness, without retroreflective beads, of 20 mils ± 1 mil.

 For Potter’s VISIMAX glass bead Type I Epoxy Resin Pavement Markings, a first drop consisting of Potter’s VISIMAX glass beads shall be applied at the rate of 8 lb./gal. of epoxy pavement marking material, immediately followed by a second drop consisting of glass beads meeting the requirements of AASHTO M 247, Type 4 at the rate of 8 lb./gal. of epoxy pavement marking material. Traffic cones or other acceptable methods shall be used to protect the Type I Epoxy Resin Pavement Markings until cured.

 For Potter’s VISIULTRA glass bead Type I Epoxy Resin Pavement Markings, a first drop consisting of Potter’s VISIULTRA glass beads shall be applied at the rate of 10 lb./gal. of epoxy pavement marking material, immediately followed by a second drop consisting of glass beads meeting the requirements of AASHTO M 247, Type 1 at the rate of 5 lb./gal. of epoxy pavement marking material. Traffic cones or other acceptable methods shall be used to protect the Type I Epoxy Resin Pavement Markings until cured.

 For 3M’s tinted microcrystalline ceramic bead Type I Epoxy Resin Pavement Markings, a first drop consisting of tinted microcrystalline ceramic beads shall be applied at the rate of 5 lbs./gal. of epoxy pavement marking material, immediately followed by a second drop consisting of glass beads meeting the requirements of AASHTO M 247, Type 4 at the rate of 10 lbs./gal. of epoxy pavement marking material. Traffic cones or other acceptable methods shall be used to protect the Type I Epoxy Resin Pavement Markings until cured.

 *Replace* Subarticle **3. Initial Performance** *with the following:*

 The retroreflectivity of the markings applied shall be measured by the Contractor using the procedure and equipment detailed below for the Initial Test Period, Review Period, and Observation Period.

 Test Lots: The following test lots will be randomly selected by the Engineer to represent the line markings applied:

**Table 12.10.03-3.1: Line Test Lots**

|  |  |  |
| --- | --- | --- |
| Length of line | Number of Lots | Length of Test Lot |
| < 1000 feet | 1 | Length of Line |
| < 1.0 mile  | 1 | 1000 feet  |
| ≥ 1.0 mile  | 1 per 1.0 mile  | 1000 feet  |

 Measurement Equipment and Procedure: Retroreflectometer equipment shall be calibrated using the instructions from the instrument manufacturer within 24 hours prior to use.

 Skip line measurement shall be obtained for every other stripe, taking no more than 2 readings per stripe with readings no closer than 20 inches from either end of the marking.

 Solid line test lots shall be divided into 10 sub-lots of 100 foot length and measurements obtained at 1 randomly select location within each sub-lot.

 The Contractor shall perform retroreflectivity readings on the Type I Epoxy Resin Pavement Markings between 30 and 37 days after installation per the measurement and sampling procedures contained in ASTM D7585 (*Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments*). Portable Retroreflectometer and Mobile Retroreflectometer testing is allowed using the following methods.

* ASTM E1710 *(Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer)*;
* ASTM E2177 *(Standard Test Method for Measuring the Coefficient of Retroreflected Luminance (RL) of Pavement Markings in a Standard Condition of Wetness).*

 Additional Contents of Certified Test Report (CTR): The CTR shall also list:

* Project, Route number, and Route direction.
* Geographical location of the test site(s), including distance from the nearest reference point.
* Manufacturer and model of retroreflectometer used.
* Most recent calibration date for equipment used.
* Time of Day the readings are taken.

 Recordings shall be certified by the Contractor, reviewed by the Engineer, and provided to the CTDOT Division of Traffic Engineering.

 A CTR, in accordance with 1.06.07 or 1.20-1.06.07, shall be submitted to the Engineer no later than 10 days after the measurements are taken.

 The Materials Certificates (MC) shall also list:

* Liquid binder application rate.
* Retroreflective bead type(s) and drop rate.

 Recordings shall be certified by the Contractor, reviewed by the Engineer, and provided to the CTDOT Division of Traffic Engineering.

 The MC, in accordance with 1.06.07 or 1.20-1.06.07, shall be submitted to the Engineer no later than 10 days after the measurements are taken.

 Initial Test Period: The minimum initial retroreflectivity readings shall meet or exceed the following minimum values using an observation angle of 1.05 degrees and an entrance angle of 88.8 degrees:

|  |  |  |
| --- | --- | --- |
|  | \*Type I White Markings | \*Type I Yellow Markings |
| ASTM E1710 (Dry) | 350 mcd/lux/m2 | 225 mcd/lux/m2 |
| ASTM E2177 (Wet Recovery) | 300 mcd/lux/m2 | 200 mcd/lux/m2 |

 Review Period: A 90-day Review Period shall be implemented for Type I Epoxy Resin Pavement Markings. The Contractor shall be responsible for any defects in materials and workmanship of the Type I Epoxy Resin Pavement Markings for a period of 90 days from the date the Type I Epoxy Resin Pavement Markings are installed and subjected to live traffic conditions.

 At the end of the Review Period, the Engineer will inspect the Type I Epoxy Resin Pavement Markings for durability, color, and retroreflectivity, and inform the Contractor of all rejected pavement markings that require replacement. The Type I Epoxy Resin Pavement Markings will be rejected for any of the following conditions:

* Insufficient thickness or line width, uneven cross-section.
* Poor adhesion or delamination.
* Insufficient groove depth.

 The Contractor shall be responsible for replacing all rejected Type I Epoxy Resin Pavement Markings at no cost to the State. All rejected Type I Epoxy Resin Pavement Markings shall be replaced within 14 days of notification to the Contractor of the failed Review Period test. All Type I Epoxy Resin Pavement Markings installed as the result of a failed Review Period test shall meet all testing requirements of the initial performance testing procedures, and shall be subject to an additional Review Period.

**Article 12.10.04—Method of Measurement:**

 *Replace the entire Article with the following:*

 Type I Epoxy Resin Pavement Markings will be measured for payment by the actual number of linear feet of Type I Epoxy Resin Pavement Markings installed on the pavement and accepted by the Engineer.

 The cost of all measuring and testing of the retroreflectivity of the Type I Epoxy Resin Pavement Markings by the Contractor will be considered incidental to the cost of the item.

**Article 12.10.05—Basis of Payment:**

 *Replace the entire Article with the following:*

 This work will be paid for at the Contract unit price per linear foot for “Type I Epoxy Resin Pavement Markings” of the width and color specified, installed on the pavement and accepted. These prices shall be for all the work required by this Section and all materials, equipment, tools and labor incidental thereto. Payment will not be made for pavement markings affected by Contractor error and ordered removed.

 Pay Item Pay Unit

 (Width) (Color) Type I Epoxy Resin Pavement Markings l.f.