DESCRIPTION OF WORK

1. The work shall consist of furnishing and placing plowable raised pavement markers (hereafter referred to as RPMs) in accordance with the lines, symbols, and dimensions shown on the plans or as described herein on highway sections where the RPM's have never been installed to date.

2. The replacement of damaged or missing RPM's within existing marker installations in accordance with the lines, symbols and dimensions shown on the plans or as described herein. This work includes furnishing replacement RPM's.

3. The replacement of damaged or missing prismatic retro-reflectors on highway sections with existing marker installations where casting remains intact in accordance with the lines, symbols and dimensions shown on the plans or as described herein. This work includes furnishing replacement prismatic retro-reflectors.

The Contractor shall furnish all material, services, labor and equipment necessary for the required pavement preparation and pavement marker placement for each item described herein.

MATERIALS

The RPM shall consist of two components. One component is a casting; the other component is a prismatic retro-reflector. Both components of the RPM used for this project shall be Stimsonite Model 96 as manufactured by the Amerace Corporation, Niles, Illinois, or an approved functional equivalent. The RPM casting is an iron casting, snow plowable in two opposing directions, designed to be equipped with a replaceable prismatic retro-reflector. Prismatic retro-reflectors shall retro-reflect in one direction only (one way) or in two opposing directions (two-way).

The adhesive used to bond the RPM to the pavement shall be a two-component standard set epoxy available from Poly-Carb, Inc. or General Adhesives and Chemical Company or an approved functional equivalent made with the following formulation.

Component A	Parts by Weight
Epoxy Resin (Epon 828 or equal)	100.00
Titanium Dioxide	7.68
#13 Talc U	36.64

Component B	Parts by Weight
N-Aminoethyl piperazine (Jefferson or equal)	25.10
Nonyl Phenol	50.03
Talc (Fiberine C-400, Sierra or equal)	69.28
Molacco Black	0.23

The adhesive used by the Contractor to bond the prismatic retro-reflector to castings shall be MACCO, LN-602 (Liquid Nails), a waterproof synthetic rubber and resin based adhesive, manufactured by SCM Glidden-Durkee, Division of SCM Corporation, Macco Adhesives Group, Wickliffe, Ohio 44092 or an approved functional equivalent.

TESTING AND CERTIFICATION

RPMs and prismatic retro-reflectors shall be furnished and placed by the Contractor. The Contractor shall furnish to the Engineer, certified Test Data of the material's physical characteristics and Certification that the materials were manufactured and assembled in accordance with applicable State specifications. The results of all factory quality control inspection of the prismatic retro-reflector to casting bond shall be included in the physical characteristics data.

The epoxy adhesive shall be furnished by the Contractor. The Contractor shall furnish to the Engineer a Certificate of Analysis containing the Certified Formulation and Certified Test Data to be obtained in the following manner:

The Certified Formulation shall be, for each of the Component Parts, the actual percent by weight, the name of the producer and brand name of the material, and the producer's code number. A certified formulation will be required annuallu for each Component Part A and B. Certified Test Data for the properties of the Component Parts, Components A (Epoxy) and B (Hardener), and the Cured System shall be obtained in accordance with the Methods of Test of AASHTO M237-73. The respective properties of the Component Parts to be tested are noted in Sections 2.3.1 to 2.3.3 and 2.3.5 to 2.3.7. The properties of both Components A and B to be tested are noted in Section 3.1. The properties of the Cured System to be tested are listed in Table 7. Certified Test Data for the Component Parts may be obtained by the respective manufacturers. Certified Test Data for Components A and B and the Cured System may be obtained by either the Epoxy Adhesive producer or an independent test laboratory.

For sampling purposes a batch shall consist of a single charge of all Components into a mixing chamber.

A certified formulation will be required for each batch of Component Parts A and B. Certified Test Data will be required for each 1,000 gallons or fraction thereof of material. Batches of less than 1,000 gallons shall be combined in proportion to their size in order to form a composite sample representative of no more than 1,250 gallons. This composite sample shall be thoroughly mixed and shall serve to represent the material to be tested. The Contractor shall also furnish the Engineer a 1 pint sample of each Component Part from the initial batch of epoxy adhesive to be used on the project and from any subsequent batches when required by the Engineer.

PAVEMENT PREPARATION

The Contractor shall clean and prepare the pavement to which the RPM casting is to be bonded, to the satisfaction of the Engineer, such that at the time of RPM installation the pavement shall be free of dirt, dust, oil, grease, moisture, curing compound, loose or unsound layers or any other material which would interfere with proper bonding of the RPM to the pavement. Sand blasting shall be used when directed by the Engineer.

INSTALLATION AND REPLACEMENT OF RPMs

At the time of installation, or replacement the RPM casting shall be free of dirt, dust, oil, grease, rust, moisture or any foreign matter which will impair adhesion to the pavement. It shall be the Contractor's responsibility to clean each contaminated casting by sand blasting or other acceptable procedure to remove all such foreign matter prior to installation. Before beginning RPM casting installation or replacement, the Contractor shall accurately and adequately lay out, by reference points, the location of all RPMs, to assure their proper placement.

RPMs shall not be placed on pavement surfaces that show visible evidence of cracking, checking, spalling, or failure of underlying base material.

If an RPM falls within a distance equal to ten percent of typical longitudinal spacing of a bridge enddam, the marker shall be relocated onto the approach slab.

RPMs shall not be placed on active signal detector loops and detector lead-in cables.

RPMs shall not be placed directly over pavement markings except where the markings deviate visibly from their correct alignment, and then only with the approval of the Engineer.

If during the pre-installation layout operation, it is determined that a RPM would be placed at a point with one of the aforementioned conditions or at a pavement construction joint or within an intersection of a driveway or public street as the result of typical marker spacing, the affected marker shall be relocated longitudinally a sufficient distance to a point approved by the Engineer. The distance the RPM may be relocated shall not excced 10% of the typical RPM spacing. Where it would be necessary to relocate the marker a distance greater than 10% of the typical marker spacing, the affected RPM shall not be installed.

When replacing RPM's at a location within an existing pattern of RPM's a new location shall be cut into the pavement one foot away from the damaged or missing casting. The old locations of the damaged or missing castings are not suitable for new castings.

The pavement surface temperature at the time of application shall be not less than 50°F. The ambient air temperature shall be not less than 50°F. No RPMs shall be installed if the pavement surface is not dry.

The Contractor shall keep traffic off newly installed or replaced RPMs for the minimum period specified in the following table.

Ambient Air Temperature °F	Minimum Period (Minutes) Protected from Traffic
100	15
90	20
80	25
70	30
60	35
50 (no application below 50°F)	45

During periods of high ambient relative humidity, epoxy may require slightly longer drying time than indicated above.

RPMs shall be installed by inserting the two keels on the casting into parallel slots cut into the pavement. Within 7 days after the slots are cut into the pavement, the RPM castings shall be installed.

The epoxy adhesive shall be mixed by combining Component Parts A (Epoxy) and B (Hardener) in a ratio of 1:1 by volume. The epoxy adhesive requires that the mixing operation and placing of the RPMs be done rapidly. Any mixed batch that becomes so viscous that it cannot be readily extruded from under the RPM with light pressure shall not be used. The epoxy adhesive shall be maintained at 60°F to 80°F before mixing. Any heating of the epoxy adhesive shall be by the application of indirect heat. The epoxy adhesive shall not be heated above 120°F.

Before applying the epoxy adhesive, the slots shall be brushed or blown clean of loose material and shall be dry. The cleaned slots shall be filled with epoxy adhesive. Sufficient epoxy shall be placed in and between the slots to insure that all voids beneath and around the casting are filled so as to create a watertight seal around the casting. The keels of the casting shall be hand placed into the slots in such a manner as to assure that the tips of the RPM's snowplow deflecting surfaces are below the pavement surface and that the four lugs on the keels of the casting are in contact with the pavement.

The Contractor may attach the prismatic retro-reflectors to new castings, which do not include a prismatic retro-reflector already factory attached by Amerace Corporation, at any time prior to the insertion of the casting into the pavement slots. Otherwise, the prismatic retro-reflector shall not be attached to a new casting until after the epoxy adhesive in the pavement slots has properly hardened. In either operation, the following prismatic retro-reflector attachment procedure shall be used. The RPM casting shall be free of dirt, dust, oil, grease, rust, moisture or any foreign matter (including damaged reflectors or parts thereof) which will impair adhesion of the prismatic retro-reflector to the casting. Sandblasting or another procedure acceptable to the Engineer shall be utilized to free the casting of foreign matter. The recessed attachment area shall be coated with LN-602 (Liquid Nails) adhesive. The backing paper shall then be peeled from the butyl adhesive bottom of the prismatic retro-reflector and the prismatic retro-reflector shall be inserted into the recessed attachment area and pressed into place until a small amount of adhesive will squeeze out on both sides and a firm bond has been made with the casting. The Contractor shall press the prismatic retro-reflector into place by the application of a 100 pound load or by a procedure acceptable to the Engineer. Adhesive material shall not be permitted on the reflective surface of the prismatic retro-reflector. The pavement surface temperature and the ambient air temperature shall be between 40°F and 90°F at the time of application of the prismatic retro-reflector. The Contractor shall not attach the prismatic retro-reflector to the casting when rain is imminent.

REPLACEMENT OF RETRO-REFLECTORS

Damaged or missing retro-reflectors within the existing marker installations where the casting remains intact shall be replaced with the reflector type shown on the details in the plan. Damaged reflectors include those that are loose or have been broken, chipped, cracked or have otherwise lost their retro-reflective properties as determined by the Engineer.

The location of existing RPM's that require the replacement of damaged or missing retro-reflectors shall be determined by the Engineer.

Some existing castings have remnants of the old retro-reflector or contain retro-reflectors that are not serviceable due to cracking, discoloration, etc. If the casting is specified by the Plan or Engineer to have the retro-reflector replaced, the work shall include removing the old portion of the retro-reflector. The attachment procedure of prismatic retro-reflectors that are replacing damaged or missing prismatic retro-reflectors within existing marker installations shall be performed as described in "Installation and Replacement of RPMs".

CHANNELIZING LINES

RPMs which are used in channelizing line applications shall have one-way prismatic retro-reflectors facing traffic which shall be white in color to match the channelizing line color. RPMs shall be placed so that the near edge of the marker casting is no more than 1 inch from the near edge of the channelizing line. Placement of the RPMs and RPM spacing shall be as shown on the details in this plan.

LANE LINES

RPMs which are used in lane line applications shall have two-way prismatic retro-reflectors, crystal white facing traffic and red facing the opposite direction. RPMs shall be placed between and in line with the dashes of the lane line. Placement of the RPMs and RPM spacing shall be as shown on the details in this plan.

EDGE LINES

RPMs which are used in edge line applications shall have prismatic retro-reflectors which match the edge line color (white facing traffic for right edge lines; yellow facing traffic for the left edge lines). RPMs shall be placed so that the near edge of the marker casting is no more than 1 inch from the near edge of the edge line.

The number of retro-reflective faces required, the placement of RPMs and the RPM spacing shall be as shown on the details in this plan.

CENTER LINES

RPMs which are used in centerline applications shall have two-way prismatic retro-reflectors, which shall be yellow to match the centerline color. RPMs shall be placed between the lines of double line centerline and between and in line with the dashes on single line centerline. Placement of the RPMs and RPM spacing shall be as shown on the details in this plan.

METHOD OF MEASUREMENT

The number of RPMs installed or replaced will be the actual number, furnished, complete, in place, and accepted, in the units designated, including layout, premarking, surface preparation, and the furnishing and application of all required epoxy adhesive.

The number of prismatic retro-reflectors replaced will be the actual number furnished, complete, in place, and accepted in the units designated, including existing casting preparation and application of all required adhesive.

BASIS OF PAYMENT

Payment for accepted quantities in place will be made at the contract unit price for:

ITEM	UNIT	DESCRIPTION
Special	Each	Raised Pavement Marker
Special	Each	Raised Pavement Marker Replaced
Special	Each	Prismatic Retro-reflector Replaced

Payment shall be full compensation for all materials, labor, incidentals, and equipment for placement of the RPMs and Prismatic Retro-reflectors.

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RAISED PAVEMENT MARKER NOTES