CHAPTER 7 POLYESTER RESIN

OBJECTIVES

1) Polyester Resin
2) Components
3) Characteristics of Polyester Resin
4) Methods of Application

POLYESTER RESIN

Polyester resin material is a three-component material. However, the manufacturer mixes the two reactive parts. At the time of application, a catalyst is added to start the reaction. Then the material is sprayed onto the roadway. Reflective beads are added using a separate gun located directly behind the paint gun.

COMPONENTS

Pigments

The material is composed of pigments that are very similar to those used in other pavement markings. The pigments are used to impart color, hiding and other desirable properties, like all other markings. However, these pigments are pre-ground prior to being blended into the resin.

Resins

The marking has polyester resin that is mixed with a reactive solvent, a styrene compound. Normally, solvents are expected to evaporate and not participate in the setting up process. In addition to acting as a solvent, the styrene participates in the polymerization process. In order for this material to begin to react, a catalyst must be added to initiate the reaction.

Additives

Driers are added to assist in the curing process.

Reflective Beads

Beads are uniformly applied across the entire width of the marking by either a gravity or pressurized bead applicator located immediately behind the polyester spray gun. Beads are generally applied at a rate of 8 lb/gal.

CHARACTERISTICS OF POLYESTER RESIN

The material has the potential to be 100 percent solid. This depends on how fast the reaction takes place. The styrene is volatile prior to the reaction. Heat is not typically added to the system except when cure time is expected to be long, such as on cool spring or fall days. The catalyst is added to drive the reaction. Usually, the catalyst is methyl ethyl ketone (MEK) or benzoyl peroxide. The polyester resin and the styrene solvent react together to crosslink, or polymerize, to form a film. The polyester resin system will not cure properly if the appropriate quantity of catalyst is not added.

Advantages

- Essentially two components in one container
- Long lasting and durable
- Does not discolor badly
- Relatively inexpensive
- Works well on concrete

Disadvantages

- Peroxide catalyst is a very reactive oxidizer
- Requires placarding as a hazardous material
- Requires commercial drivers license
- Flush solvent is flammable and a hazardous waste
- Moisture in surface a major factor and detriment
- HMA paving oils are a detriment
- Set up time depends on type of resin (usually 3-20 minutes)
- Difficult to determine whether mixed properly

METHODS OF APPLICATION

The catalyst can be added by either external or internal mixing. External mixing requires the use of two guns; one sprays the catalyst into and on the freshly applied liquid immediately prior to reflective bead application. This is the preferred method when an airless gun is used. With a conventional system, it is possible to have a set up where the catalyst is injected into a mixing chamber within the gun, by which the catalyst is added to the material stream. Atomizing the air mixes the material just prior to it being sprayed onto the roadway.

Ambient Conditions

The lower the air and road surface temperature, the longer it will take for the material to react and set up. There are two types of material: a slow dry that takes about 10 minutes at 70°F and a fast dry that takes about 3 minutes at 70°F. The minimum road and air temperature to apply polyester pavement marking is 50°F and rising.

Temperature

The material is not dependent upon heat to make it set up. However, the application of minimal heat (130°F) is helpful in the spring and fall.

Pavement Surface Considerations

Polyester cannot be applied to new HMA until the road surface oils have been removed. Concrete must have curing compounds, latency, dust, dirt, and other debris removed prior to application.

Figure 7.1 is a polyester application troubleshooting table using the conventional application method. Figure 7.2 is a polyester application troubleshooting table using the airless application method.

POLYESTER APPLICATION TROUBLESHOOTING			
CONVENTIONAL APPLICATION			
PROBLEM	**CAUSE**	**EFFECT**	**REMEDY**
Thick millage (middle of line)	• Material tank pressure too high • Control screw open too wide • Atomizing air pressure off or too low • Pump pressure too high	• Tracking or uneven wear or buried beads	• Reduce material pressure • Close control screw • Increase atomizing air pressure if material usage is OK • Lower pump pressure
Insufficient millage (center of line)	• Atomizing air pressure too high • Tank pressure too low • Pump pressure too low	• Poor quality line or short life	• Decrease atomizing air pressure • Increase tank pressure • Increase pump pressure
Wide paint line	• Paint gun height excessive	• Line does not meet standards	• Lower gun • Use or adjust shrouds if edges “fuzzy or light
Narrow paint line	• Paint gun too low • Spray nozzle slot not 90 degree angle to paint line • Paint clogging spray nozzle	• Line does not meet standards	• Raise paint gun • Adjust spray nozzle • Clean spray nozzle
Paint line “ratty” (uneven or spotty)	• Atomizing air pressure too low • Material pressure too low • Old paint (viscosity too high) • Worn fan cap • Insufficient heat	• Poor appearance	• Increase atomizing air pressure • Increase material pressure • Rotate stocks • Replace fan cap • Apply small amount of heat during application (no more than 120 °F)

POLYESTER APPLICATION TROUBLESHOOTING –continued			
CONVENTIONAL APPLICATION			
PROBLEM	**CAUSE**	**EFFECT**	**REMEDY**
Thick wet millage	• Control screw open too wide • Material pressure too high • Atomizing air pressure too high • Truck traveling too slow	• Tracking and/or buried beads	• Close control screw • Reduce tank pressure • Adjust atomizing air pressure • Increase truck speed
"Railroad tracking"	• Atomizing air pressure too high • Bead pressure too high • Catalyst not spraying evenly	• Tracking only on the edges • Tracking in sections of the line	• Adjust atomizing air pressure • Adjust bead pressure • Clean catalyst gun tip
Heavy millage on one side	• Clogged tip • Clogged shroud	• Tracking • Buried beads	• Clean tip • Clean shroud
Too long a cure time	• Not enough catalyst • Catalyst not spraying evenly (in a gun system)	• Tracking • Loss of durability	• Adjust amount of catalyst • Adjust angle of catalyst gun if applied separately
Line darkens noticeably overnight	• Too much catalyst • Darkening due to dirt pickup	• Poor appearance • Loss of durability	• Reduce amount of catalyst • Check line for after tack

Figure 7.1
Polyester application troubleshooting for conventional application

POLYESTER APPLICATION TROUBLESHOOTING			
AIRLESS APPLICATION			
PROBLEM	**CAUSE**	**EFFECT**	**REMEDY**
Heavy centers	• Inadequate fluid delivery	• Tracking • Erratic wear patterns • "Railroad tracks" initially	• Increase fluid pressure • Decrease tip size
Light centers	• Inadequate fluid delivery	• Tracking from the edges • Erratic wear patterns • "Railroad tracking" with time	• Increase tip size • Replace tip
Surging pattern	• Pulsating fluid delivery	• Does not conform to standards • Erratic wear patterns	• Reduce demand • Remove restrictions in supply system • Check supply hose for leaks
"Lop sided" millage	• Worn tip sides • Clogged tip	• Erratic wear patterns	• Replace tips • Clean tips • Lower gun
Line too wide	• Gun too high • Too wide a fan angle on tip	• Does not meet standards	• Lower gun • Adjust tip size if necessary
Line too narrow	• Gun too low • Too narrow a fan angle on tip	• Does not meet standards	• Raise gun • Adjust tip size if necessary
Applied line too thin	• Inadequate tip hole • Traveling too fast for tip size • Change in delivery pressure	• Poor durability • Does not meet standards	• Change tip size • Decrease speed of application • Verify pressure settings
Applied line too thick	• Too large a tip size • Traveling too slow for tip size • Change in delivery pressure	• Too long a cure time • May cause shape problems • Poor retro-reflectivity due to buried beads	• Change tip size • Increase speed of application • Verify pressure settings

Figure 7.2
Polyester application troubleshooting for airless application

VIRGINIA DOT REFERENCES

See Appendix A for the following:

VIRGINIA DOT ROAD & BRIDGE SPECIFICATION BOOK

Section 246.01 thru 246.02 (a)
(a) Color Requirements

Section 246.02 (d) 1. and 2.
(d) Polyester Resin (Type B, Class II)
1. Composition
2. Physical Requirements

Section 704.01 thru 704.03 (a) 2. b.
704.01 thru 704.03 Description, Material Types, and Procedures
(a) Pavement Markings
2. Type B Markings
b. Polyester Resin (Class II) Application and Bead Application

See Appendix B for the following:

VIRGINIA MANUAL OF INSTRUCTIONS

Section 204.30 (a) (1) and (2)
(1) Sampling, Testing, and Approval
(2) Acceptance (Requires Cert. I)

See Appendix C for the following:

VIRGINIA TEST METHOD

VTM-94 Quality Control Testing of Pavement Markings

Chapter 7
Polyester Resin
Review Questions

1. What is one advantage for using polyester pavement marking materials ?

   a) The peroxide catalyst is a very reactive oxide.
   b) It is a relatively inexpensive material.
   c) Asphalt paving oils used are a detriment.
   d) This material's use requires placarding.

2. The Virginia specified thickness for polyester pavement markings is

   a) 20 ± 2 mils when wet
   b) 12 ± 1 mils when wet
   c) 15 ± 1 mils when wet
   d) 90 ± 5 mils when wet

3. Polyester resin will not cure properly if the appropriate amount of catalyst is not added .

   a) True
   b) False

4. Polyester pavement marking material may be applied over any existing type of marking.

   a) True
   b) False

5. The minimum road and air temperature required to apply polyester pavement marking is:

   a) 30°F +
   b) 40°F +
   c) 50°F +

6. Polyester resin is dependent upon heat to make it set up.

   a) True
   b) False