

CHAPTER 6 EPOXY RESIN

OBJECTIVES

- 1) Epoxy Resin
- 2) Components
- 3) Characteristics of Epoxy
- 4) Method of Application

EPOXY RESIN

Epoxy resin is a durable, two-component pavement marking material consisting of a pigmented resin base and a hardener. Before installation, both components are mixed at a ratio of 2 parts resin: 1 part hardener, and applied by a specialized epoxy application truck. These criteria are based on the manufacturer's specifications. This material is sprayed and combined with drop-on reflective beads to provide nighttime retroreflectivity.

COMPONENTS

Pigments

Epoxy resin pavement markings use pigments, similar to all other pavement marking materials. Pigments are ground and dispersed into the resin side of the system.

Mixture

The epoxy resin is mixed with the hardener creating a binder system that is sprayed to form a durable pavement marking. To realize all the advantages of an epoxy system, it is critical that the components are properly mixed. Each component is stored in separate tanks on the epoxy application truck and heated to temperatures in accordance with manufacturer recommendations. Proportioning pumps draw the material at a 2:1 ratio. The material is then mixed by a static mixing tube and sprayed onto the road surface at approximately 1,200 psi.

Reflective Beads

Beads are uniformly applied across the entire width of the marking by a bead gun located immediately behind the epoxy spray gun. A double drop method is typically used for the application of the beads. Large and small beads are typically applied at a rate of 11 to 13 lbs/gal for each bead size for a total of 25 lbs/gal.

CHARACTERISTICS OF EPOXY

Epoxy striping material is classified as 100 percent solids, meaning the evaporation of solvents or water is not used to cure the material. Thus, without this evaporation process, a typical application rate of 20 mils wet yields 20 mils of dry material. Epoxy striping material is cured via a thermoset chemical reaction.

Advantages

- Good wet-night visibility
- Can be applied at lower temperature
- Makes a mechanical bond with the road surface
- Good bead retention
- Low profile resists snowplow damage
- Epoxy does not contribute volatile organic compounds

Disadvantages

- Slow cure (no-track time)
- Mix proportions are critical

METHOD OF APPLICATION

The mixed epoxy material is heated and sprayed onto the road surface. The equipment performing this operation is a specially designed epoxy truck that cannot be used to apply any other liquid binder material. Because of the composition of the material, environmental temperatures will increase or decrease the no-track times.

Shelf Life

Epoxy material has a shelf life of one year. The manufacture date should be stated in the shipping documents.

How to Mix the Material

The mix ratio for epoxy resin material is typically 2:1 (2 parts resin to 1 part hardener). It is very important that components are mixed thoroughly and at the correct ratio prior to being sprayed on the road surface. The mixing operation is a function of the epoxy installation truck. It shall be performed in accordance with manufacturer's recommendations.

Temperature

Epoxy shall not be applied unless the surface and ambient temperatures are a minimum of 35°F and rising. Remember that no-track times increase as the temperature decreases and vice versa. Always check temperature minimums (air and surface) for each agency when applying epoxy.

Pavement Surface Considerations

The road surface shall be free of curing compounds, laitance, oil, grease, salt, dust, or other debris. Epoxy materials shall not be applied if moisture is present on the road surface. Epoxy material can be applied behind the HMA paving operation as long as the mat has cooled enough to support the weight of the epoxy application truck. Epoxy materials can be applied over other epoxy materials. However, this shall only be done one time. Beyond that, removing the old material is required. Figure 6.1 is an epoxy application troubleshooting guide.

EPOXY APPLICATION TROUBLESHOOTING			
SPRAY APPLICATION			
PROBLEM	CAUSE	EFFECT	REMEDY
Heavy centers	<ul style="list-style-type: none"> Inadequate fluid delivery 	<ul style="list-style-type: none"> Tracking Erratic wear patterns “Railroad Tracks” initially 	<ul style="list-style-type: none"> Increase fluid pressure Decrease tip size
Light centers	<ul style="list-style-type: none"> Inadequate fluid delivery 	<ul style="list-style-type: none"> Tracking from the edges Erratic wear patterns “Railroad tracking” with time 	<ul style="list-style-type: none"> Increase tip size Replace tip
Surging pattern	<ul style="list-style-type: none"> Pulsating fluid delivery 	<ul style="list-style-type: none"> Does not conform to standards Erratic wear patterns 	<ul style="list-style-type: none"> Reduce demand Remove restrictions in supply system Check supply hose for leaks
“Lop sided” millage	<ul style="list-style-type: none"> Worn tip sides Clogged tip 	<ul style="list-style-type: none"> Erratic wear patterns 	<ul style="list-style-type: none"> Replace tips Clean tips
Line too wide	<ul style="list-style-type: none"> Gun too high Too wide a fan angle on tip 	<ul style="list-style-type: none"> Does not meet standards 	<ul style="list-style-type: none"> Lower gun Adjust tip size if necessary
Line too narrow	<ul style="list-style-type: none"> Gun too low Too narrow a fan angle on tip 	<ul style="list-style-type: none"> Does not meet standards 	<ul style="list-style-type: none"> Raise gun Adjust tip size if necessary
Applied line too thin	<ul style="list-style-type: none"> Inadequate tip hole Traveling too fast for tip size Change in delivery pressure 	<ul style="list-style-type: none"> Poor durability Does not meet standards 	<ul style="list-style-type: none"> Change tip size Decrease speed of application Verify pressure settings
Applied line too thick	<ul style="list-style-type: none"> Too large a tip size Traveling too slow for tip size Change in delivery pressure 	<ul style="list-style-type: none"> Too long a cure time May cause shape problems Poor retro-reflectivity due to buried beads 	<ul style="list-style-type: none"> Change tip size Increase speed of application Verify pressure settings
Too much hardener	<ul style="list-style-type: none"> Displacement pumps not properly synchronized 	<ul style="list-style-type: none"> Dark or black lines Takes too long to cure 	<ul style="list-style-type: none"> Adjust pumps
Too little hardener	<ul style="list-style-type: none"> Displacement pumps not properly synchronized 	<ul style="list-style-type: none"> Poor durability 	<ul style="list-style-type: none"> Adjust pumps

Figure 6.1
Epoxy troubleshooting chart

VIRGINIA DOT REFERENCES

See Appendix A for the following:

VIRGINIA DOT ROAD & BRIDGE SPECIFICATIONS

Section 246.01 thru 246.02 (a)

(a) Color Requirements

Section 246.02 (e) 1. and 2.

(e) Epoxy Resin Material (Type B, Class III)

1. Composition

2. Physical Requirements

Section 704.01 thru 704.03 (a) 2. c.

704.01 thru 704.03 Description, Material Types, and Procedures

(a) Pavement Markings

2. Type B Markings

c. Epoxy Resin (Application and Bead Application)

See Appendix B for the following:

VIRGINIA DOT 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 6
Epoxy Resin
Review Questions

1. Epoxy pavement marking material:
 - a) is a two component system.
 - b) has glass beads intermixed by the manufacturer.
 - c) uses a catalyst.
 - d) all of the above

2. Epoxy pavement marking material does not contain solvent.
 - a) True
 - b) False

3. For epoxy pavement markings, the ratio of resin to hardener is:
 - a) critical.
 - b) specified by the manufacturer.
 - c) 2 parts resin to 1 part hardener
 - d) all of the above

4. The Virginia specified thickness for epoxy pavement markings is:
 - a) 15 ± 2 mils when wet
 - b) 12 ± 1 mil when set
 - c) 20 ± 1 mil when wet
 - d) 90 ± 5 mils when wet

5. The equipment used to apply epoxy resin pavement markings cannot be used to apply any other liquid binder material.
 - a) True
 - b) False

6. The minimum surface temperature for applying epoxy markings in Virginia is:
 - a) 30 °F +
 - b) 40 °F +
 - c) 50 °F +
 - d) 60 °F +

7. Glass beads should be applied to the surface of epoxy resin at the rate of:
 - a) 6 pounds per gallon
 - b) 25 pounds per gallon
 - c) depends on epoxy temperature
 - d) depends on surface temperature

