

**New Jersey Department of Transportation**  
***CONSTRUCTION ADVISORY***

|                                   |                                     |            |
|-----------------------------------|-------------------------------------|------------|
| <b>NUMBER:</b><br>13              | <b>Traffic Stripes, Epoxy Resin</b> | 02/12/2013 |
| <b>CATEGORY:</b><br>Miscellaneous |                                     |            |

There have been a number of projects where the quality of epoxy traffic stripes has cited as being substandard. Inspection personnel are to adhere to the attached construction inspection guidelines.

While BDC 12S-10 has made some revisions to Section 610.03.01, such as to provide certain equipment (test cards, wet film thickness gauges, LTL-X reflectometer), the guidance provided attached is valid. RE's are to enforce the requirements according to the specifications pertaining to their Contract.



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# Traffic Stripes

TRAFFIC STRIPES, EPOXY RESIN

## **Pre-Installation**

### Striping Plan

The contractor is required to submit the striping plan 20 days prior to beginning striping operations to the RE for approval. Typically, the striping plan is prepared by the striping subcontractor. The striping plan will include:

1. Schedule of operations for applying traffic stripes.
2. Number and type of equipment.
3. Manufacturer's recommendations for use of the materials, including, but not limited to, mixing ratios and application temperatures.
4. Details on the means and methods for Surface Preparation
5. Details on the means and methods for Premarking
6. Details on the proposed Test Strip

The striping plan should sufficiently detail the contractor's means and methods for: Surface Preparation; Pre-Marking; Striping Test Strip.

The striping plan only needs to be submitted once for a project. The contractor should not deviate from the striping plan when performing subsequent work on the project, unless a revised striping plan has been approved.

On projects where traffic stripes are placed on multiple, non-continuous occasions (e.g. placing stripes at the end of various stages of construction, with months in between operations, the RE may request additional test strips be performed. When applying interim/stage traffic stripes (stripes that are not placed in the final plan configuration and will be removed or covered prior to the final plan configuration), the RE should waive the requirement to perform a test strip until such time as the final striping is being performed.

The inspector should review the manufacturer's recommendations. Understand that even though the manufacturer's recommendations may permit the use of material under weather and temperature conditions prohibited by the project specifications, the inspector must enforce the project specification requirements.

## **Surface Preparation**

### Dirt and Debris

The contractor must clean the pavement surface of dirt, oil, grease, and foreign material prior to the application. Debonding of traffic stripes is most often caused by an improperly cleaned pavement surface. The cleaning should be performed just prior to the placement of epoxy traffic stripes. While dirt and dust can usually be cleaned by power sweeping or power blowers, the inspector should take care to ensure that the contractor takes additional

effort to clean any areas of oil and grease from the pavement. The contractor must decide how it will clean areas of oil and grease. Solvents which would harm the asphalt cement should not be permitted. In some circumstances, power washing or other means may need to be applied.

Dirt removed from the roadway is generally categorized as regulated waste, and needs to be disposed of in accordance with section 202.03.09.

### Existing Stripes

Epoxy traffic stripes can be applied over existing epoxy traffic stripes or existing latex traffic stripes, but if overall thickness is too great, the traffic stripes will be prone to cracking and have a reduced service life. Therefore, existing stripes must be removed where more than two applications of existing traffic stripes are on the pavement. Often existing stripes need to be removed because of stage changes in the traffic control plan.

### New HMA Pavement

There is no empirical data to indicate any problems with placing epoxy traffic stripes on new HMA pavement. While theoretically surface oils could prevent proper bonding, as a practical matter, it takes months of traffic exposure to wear away the normal surface oils on new HMA pavement. Areas of excessive oils or pavement bleeding may require remediation prior to placing epoxy traffic stripes.

### New Concrete Pavement

The existence of curing compound and laitance will prevent proper bonding of epoxy traffic stripes to the pavement. Inspectors must ensure that contractors abrade the surface to remove any curing compound and laitance from the concrete pavement where striping will be applied. The contractor must decide how it will abrade the surface to remove the curing compound and laitance. Such measures may include power sweeping or power washing, but so long as the method does not scar the deck and successfully removes the curing compound and laitance is sufficient.

## **Weather Conditions**

### Surface Moisture

If there is too much surface moisture, the epoxy traffic stripe will not properly bond to the pavement. Whenever conditions are questionable, the inspector should test the surface moisture using the following method:

1. On HMA or concrete surfaces, place a 12" x 12" square piece of plastic wrap (e.g. Saran Wrap) on the pavement surface and place duct tape completely around the perimeter to affix the plastic to the pavement.
2. After 15 minutes, if moisture bubbles on the plastic are larger than the diameter of a pencil eraser, then the pavement contains too much moisture, and striping should be postponed until the pavement is dry.

### Ambient Temperature and Pavement Temperature

The specifications require that ambient temperature be at least 45°F and the pavement temperature be at least 50 °F. Under lower temperatures, epoxy paint will cure more slowly and have a longer tracking time. Under no circumstances should epoxy paint be applied when

the ambient temperature is below 35 degrees. When the temperature is near the restriction limit, inspectors should also consider if temperatures are rising or falling.

## **Pre-Marking**

Except when applying traffic stripes over existing stripes, the contractor must mark out the locations where traffic stripes will be applied to guide the striping equipment. This is usually done by making small paint marks with spray paint. The inspector should review the pre-marking layout and ensure it conforms to the plans.

HMA longitudinal joints should have been constructed so that the joint is off-set from the lane lines by 6 inches into either lane. If the layout for permanent patterns (rather than staged or temporary traffic patterns) indicates that traffic stripes are on the longitudinal joint, the inspector should inform the RE.

The layout of traffic stripes should always have smooth lines and transitions. It should not look “wavy”. If the pre-marking layout conforms to the plans, but appears disjointed or simply does not “look right”, the inspector should seek guidance from the RE. Even small changes to the approved Striping Plans should only be made by the RE in conformance with the MUTCD. Larger changes should only be made with the concurrence of Traffic Engineering.

## **Application**

### Equipment

Usually, traffic striping is performed by one of a few regular subcontractors that specialize in this type of work, and they have the equipment that meets the requirements of Section 1007.01. Inspectors should observe that the pressure and temperature gages are in working order. Equipment problems can lead to poor striping quality and Table 1 provides some guidance as to possible causes, including equipment malfunction.

**Table 1**

| <b>Problems</b>                  | <b>Suggested Troubleshooting</b>   |
|----------------------------------|--|
| Thick Center                     | <ul style="list-style-type: none"><li>- Replace/clean application tip</li><li>- Decrease application tip size</li><li>- Increase atomizing pressure</li><li>- Decrease pump pressure</li></ul> |
| Thin Center                      | <ul style="list-style-type: none"><li>- Clean paint screen</li><li>- Decrease atomizing pressure</li><li>- Replace/clean application tip</li><li>- Increase tip size</li></ul>                 |
| Surging Pattern                  | <ul style="list-style-type: none"><li>- Leak or restriction in supply hose</li><li>- Check hydraulics</li></ul>  |
| Thin one side/<br>Thick on other | <ul style="list-style-type: none"><li>- Clean or Replace application tip</li></ul>   |
| Too Wide                         | <ul style="list-style-type: none"><li>- Lower application gun</li><li>- Select proper application tip size</li><li>- Adjust application tip angle</li></ul>                                    |
| Too Narrow                       | <ul style="list-style-type: none"><li>- Raise application gun</li><li>- Select proper application tip size</li><li>- Adjust application tip angle</li></ul>                                    |
| Too Thin                         | <ul style="list-style-type: none"><li>- Slow down vehicle</li><li>- Increase Pump Pressure</li></ul>   |
| Too Thick                        | <ul style="list-style-type: none"><li>- Speed up vehicle</li><li>- Decrease Pump Pressure</li></ul>  |

### Material

Inspectors should check that an approved DC-2891 is on file for the proposed material, and that the material being proposed is coming from the approved source. The epoxy paint manufacturer/supplier is supposed to provide a sample to the Bureau of Materials for testing prior to use by the contractor. The Inspector should check that a testing analysis report has been received from the Bureau of Materials for the project. Epoxy paint materials are accepted as meeting the material requirements of the contract, based on testing performed by the Bureau of Materials. RE's should not accept a materials certification for epoxy paint without receiving approval from the Bureau of Materials that the material will be accepted on

the basis of a certification rather than by testing.

Inspectors should check that the temperature of the paint holding vessel is within the required 100°F to 130°F range.

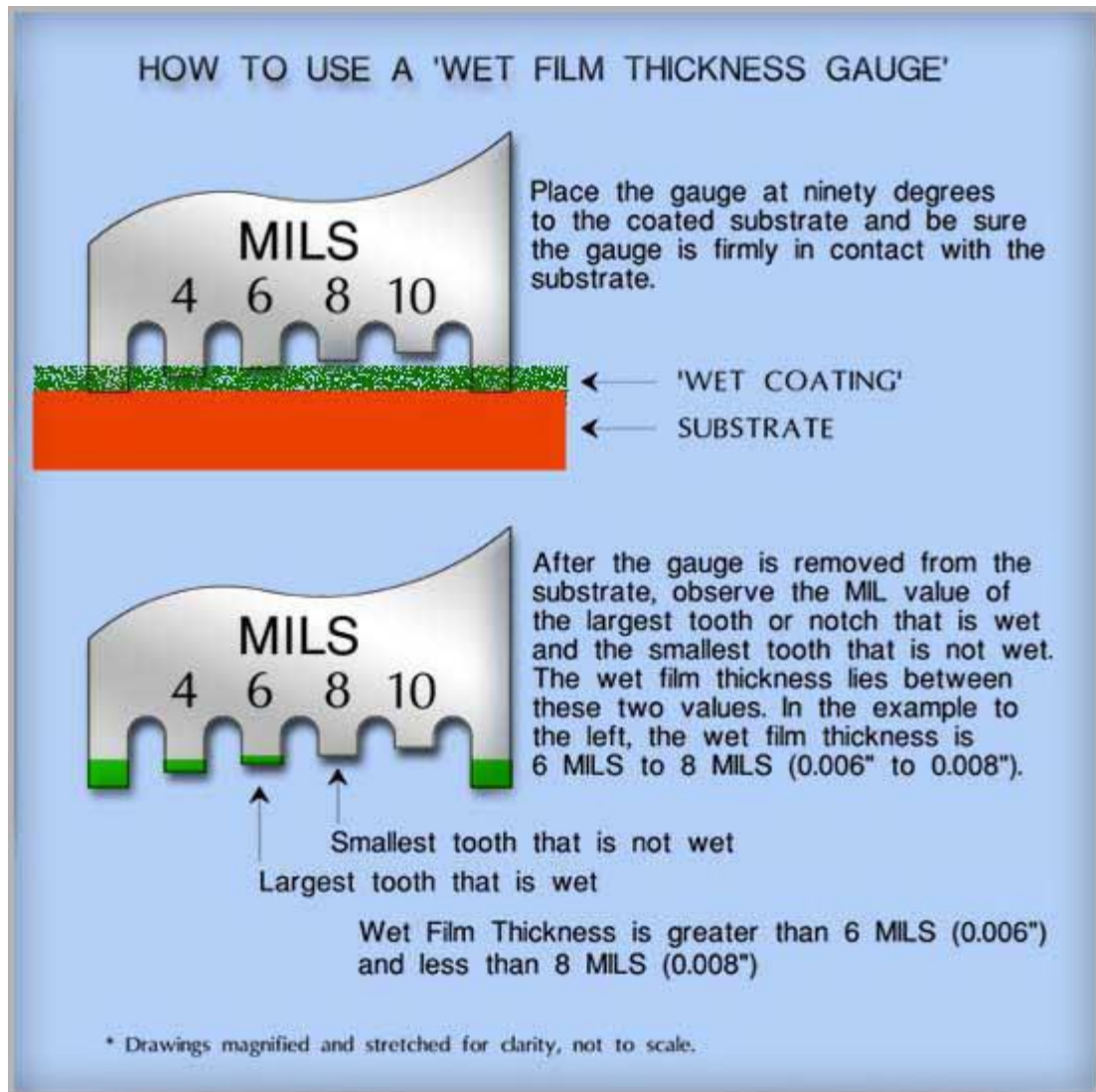
### Thickness

If traffic stripes are placed too thin, it will reduce the durability of a traffic stripe. Thus inspectors must ensure that the thickness is within the allowable range.

A) Thickness Testing – Before beginning epoxy stripe operations, the contractor must construct a Striping Test Strip. During the test strip application the inspector will conduct a paint thickness test as follows:

1. Place a test card transversely across the path of the intended stripe. A test card is a card made out of heavy stock paper having an approximate size of 8" x 2". The dimensions do not need to be exact; it should be a little wider than the traffic stripe so that the test can be performed on the full width of a stripe. The exact weight of the paper is not important; it simply needs to be stiff enough to hold the sample.
2. Secure the test card to the pavement with duct tape. Ensure the contractor operates the traffic striping equipment in a uniform manner and is not slowing down in the area of a thickness test card. The inspector will record the operating pressure and the speed of the equipment. During production, inspectors should ensure that the equipment runs at the same pressure and speed as during the test strip demonstration.
3. Ensure the glass bead applicator is turned OFF while going over the test card. You will not be able to take an accurate thickness measurement if beads have been applied.
4. While the material is still wet, measure the wet film thickness using a wet film thickness gage. Take three measurements (left, center and right) across the test card. The wet film thickness must be  $20 \pm 1$  mil.
5. If any of the three wet film thickness measurements for a test are less than the minimum the work is considered unacceptable. Immediately notify the contractor and have the contractor take corrective action, and perform another test strip until an acceptable application can be applied.

When applying interim/stage traffic stripes (stripes that are not placed in the final plan configuration and will be removed or covered prior to the final plan configuration), initial retroreflectance testing is sufficient.



- B) Yield – For each day's production and striping truck, the inspector must determine the number of gallons used and calculate the theoretical yield.

Obtain the certified calibration sheet for the paint holding vessel from the contractor. The calibration sheet must be provided for each truck. Measure the amount of paint in the truck at the start and end of each day's operation with the contractor's representative. Using the calibration sheet determine the number of gallons applied.

For a 20 mil thick, 4 inch width line, one gallon of paint will yield 240 LF, and at 19 mil thick will yield 252 LF. For a 20 mil thick, 6 inch width line, one gallon of paint will yield 160 LF, and at 19 mil, will yield 168 LF.

If the actual quantity of striping placed is more than the theoretical quantity based on the volume of paint and the theoretical production at 19 mil thick, then the entire day's production has failed the thickness requirement, and the contractor must restripe the defective lines.

### Color

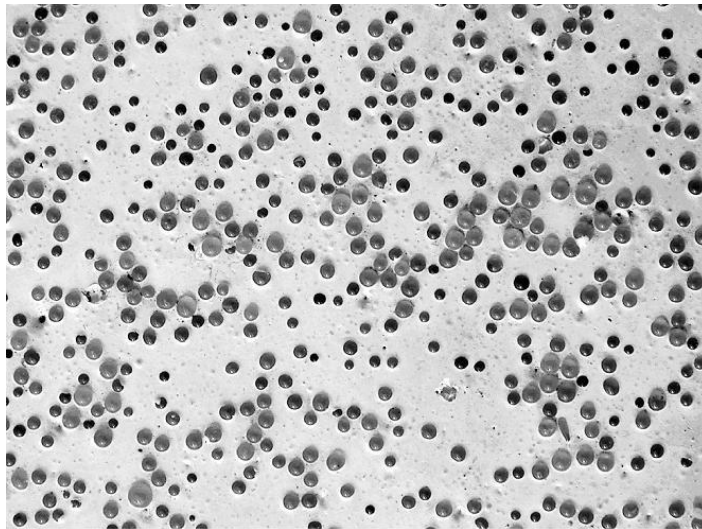
The color of traffic stripes (white and yellow) is based on national standards and is usually not a problem with epoxy traffic stripes. The color requirements are established in the Materials Section of the Standard Specification. While the color must conform to ASTM standards, if there is a problem it will be readily apparent to the inspector through casual observation. Color problems may occur when changing colors and the equipment has not been thoroughly cleaned out.

If areas of discoloration are found, have the contractor restripe the affected areas.

### Glass Bead Dispersion and Retroreflectance

Inspectors should make occasional visual inspections to observe if the glass bead coverage is uniform, which is necessary to achieve uniform retroreflectance. Figure 1 provides a picture of good glass bead dispersion.

Figure 1.



While acceptance is based on the stripe's retroreflectance, inspectors should visually check to see that an even distribution is being achieved, and alert the contractor when problems are observed.

The inspector should periodically test the initial retroreflectance levels using a reflectometer (soon after the epoxy traffic stripe has cured). The inspector should brush away beads that are simply lying on the surface. This initial testing will likely yield higher retroreflectance results than the acceptance testing, but it can provide an early indication of a problem that the contractor can address. When applying interim/stage traffic stripes (stripes that are not placed in the final plan configuration and will be removed or covered prior to the final plan configuration), a testing of the initial retroreflectance is sufficient.

Once the roadway is opened to traffic, traffic will wear away some of the beads that lay on the surface and this will reduce the retroreflectance level. After being exposed to traffic for



two weeks, enough of the surface beads will have worn off to allow for reliable retroreflectance testing.

Inspectors must perform retroreflectance testing using an LTL-X reflectometer provided by the contractor. The inspector should check that the reflectometer has been certified as being properly calibrated within the last two years. Retroreflectance testing should be performed at least two weeks after the roadway has been opened to traffic. While the specifications require a retroreflectance level be maintained for the first 60 days, testing should be performed within 30 days after the application of traffic stripes.

The contractor will need to provide traffic control to safely take measurements. Since traffic lines by definition are on the edge of a lane, a lane closure will need to encroach on the adjoining lane to provide room to conduct the test. Even so, the testing will often be near active traffic, and caution must be taken at all times.

The RE will measure the retroreflectance according to the following schedule:

### **Interim/ Stage Traffic Lines**

Test for initial retroreflectance – 2 tests every 10,000 LF with a minimum of 4 tests

### **Final Configuration Traffic Lines**

| Quantity              | Frequency               |
|-----------------------|-------------------------|
| First 10,000 LF       | 2 tests every 1,000 LF  |
| Next 15,000 LF        | 2 tests every 5,000 LF  |
| After first 25,000 LF | 2 tests every 10,000 LF |

Testing should be performed at randomly distributed locations and should include both white and yellow stripes. Reflectometer testing may be performed in day or night conditions; however it is often easier to visually spot retroreflectance defects under night conditions.

The minimum retroreflectance values for epoxy traffic stripes are:

|        |  |
|--------|--|
| White  | 375 millicandelas per square meter per lux |
| Yellow | 250 millicandelas per square meter per lux |

If any test indicates a retroreflectance value less than the required minimum values, the inspector will conduct additional testing to determine the limits of defective retroreflectance. The contractor will be required to re-stripe 50 LF before and after the limits of any defective retroreflectance for solid lines, and the entire stripe for a skip line. Additionally, if any area of defective retroreflectance is determined, the inspector will take an additional 10 tests at random locations.

The inspector may take additional tests at any location that appears defective.

### General Performance

After epoxy traffic stripes have been completed, they should be inspected to ensure that work is in generally good condition, and holding up to traffic wear. Normally, epoxy traffic stripes will last 3+ years under heavy traffic conditions. Minor fading, chipping, cracking will not warrant corrective action, but if more than 25 spots of defects occur within a 1,000 LF, the entire length of the defective area must be replaced.

## **Reports**

Inspection daily work reports should contain the following:

- How the surface has been prepared, noting in particular the efforts on concrete surfaces
- The ambient and surface temperatures
- The pavement's moisture conditions and results of any moisture testing performed
- How the pre-marking was performed, and how the layout was checked
- If the striping was applied on existing striping (including Temporary Striping)
- That the paint is from an approved source
- The measurement of the paint holding vessel at the start of work, and the end of the day's production
- How and where the test strip was performed
- The vehicle operating speed, tank pressure, and paint temperature
- The results of the thickness test
- Location of striping, including start and end stations, sketches and pictures
- Measured quantity of striping
- Theoretical yield compared to measured quantity
- Pictures detailing work quality and progress
- Pictures of equipment used
- Initial retroreflectance testing
- Direction or other communications to the contractor.
- If any defects (including any tracking) observed, and their location
- Traffic Control used

For retroreflectance testing the daily work report should contain the following:

- Weather conditions
- Total number of tests performed and the quantity of traffic stripes represented
- Locations of the tests and the retroreflectance level measured
- Color of the stripe
- If any defects determined, the limits of defective retroreflectance