

## SECTION 711 THERMOPLASTIC TRAFFIC STRIPES AND MARKINGS

### 711-1 Description.

Apply thermoplastic traffic stripes and markings, or refurbish existing thermoplastic traffic stripes and markings, in accordance with the Contract Documents and remove traffic stripes and markings as required. For preformed materials, see Section 713.

### 711-2 Materials.

**711-2.1 General:** Use only thermoplastic materials listed on the Qualified Products List (QPL). Use materials meeting the requirements of 971-1 and 971-17 for initial traffic striping and markings or recapping. Use materials for refurbishing existing thermoplastic traffic stripes and markings meeting the requirements of 971-1 and 971-20 (or 971-17 when specifically indicated in the Contract Documents). The Engineer will take random samples of all thermoplastic material in accordance with the Department's Sampling, Testing and Reporting Guide schedule.

**711-2.2 Glass spheres (for reflective traffic stripes and markings):** Use only glass spheres meeting the requirements of 971-1 and 971-14. The Engineer will take random samples of all glass spheres in accordance with ASTM D1155 and the Department's Sampling, Testing and Reporting Guide schedule.

### 711-3 Equipment.

Use equipment to install hot applied thermoplastic material constructed to provide continuous uniform heating to temperatures exceeding 390°F [200°C], mixing and agitation of the material reservoir and the line dispensing devices to prevent accumulation and clogging. All parts of the equipment which contact the material are to be constructed for easy accessibility and exposure for cleaning and maintenance. Use equipment that will maintain the thermoplastic material at a plastic temperature, to all mixing and conveying parts, including the line dispensing device. Do not use pans, aprons or similar appliances which the dispenser overruns. Use equipment which will provide for varying traffic stripes and marking application widths and meet the following requirements:

(a) mobile and capable of traveling at a uniform, predetermined rate of speed, both uphill and downhill, in order to produce a uniform application of thermoplastic material and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

(b) capable of applying glass spheres to the surface of the completed stripe by an automatic sphere dispenser attached to the striping machine such that the glass spheres are dispensed closely behind the installed line. Use a glass spheres dispenser equipped with an automatic cut-off control synchronized with the cut-off of the thermoplastic material and applies the glass spheres in a manner such that the spheres appear uniform on the entire traffic stripes and markings surface with, 50 to 60% embedment. Provide each nozzle with suitable line guides, either metallic shrouds or air blasts.

(c) equipped with a special kettle for uniformly melting and heating the thermoplastic material. The kettle must be equipped with an automatic temperature control device and material thermometer for positive temperature control and to prevent overheating or scorching of the thermoplastic material.

(d) meet the requirements of the National Fire Protection Association, state, and local authorities.

### 711-4 Application.

**711-4.1 General:** Apply thermoplastic material to the pavement either by spray, extrusion or other means approved by the Engineer. The Engineer will conduct field tests in accordance with FM 5-

541. Remove and replace traffic stripes and markings not meeting the requirements of this Section at no additional cost to the Department.

Ensure that existing pavement markings are removed, such that scars or traces of removed markings will not conflict with new stripes and markings by a method approved by the Engineer.

Prior to applying pavement stripes and markings, remove any material that would adversely affect the bond of the pavement stripes and markings by a method approved by the Engineer.

Apply traffic stripes or markings only to dry surfaces, and when the ambient air and surface temperature is at least 55°F [13°C] and rising. Follow the manufacturer's recommendations for application temperature. Do not apply pavement markings when winds are sufficient to cause spray dust.

Offset longitudinal lines at least 2 inches [50 mm] from construction joints of portland cement concrete pavement.

Prior to installation of the thermoplastic material, apply a two-part epoxy primer sealer recommended by the manufacturer, on all portland cement concrete surfaces.

Apply traffic stripes or markings, having well defined edges, over existing pavement markings such that not more than 2 inches [50 mm] on either end and not more than 1 inch [25 mm] on either side is visible.

Apply all final pavement markings prior to opening the road to traffic.

Apply striping to the same tolerances in dimensions and in alignment specified in 710-5.

#### **711-4.2 Corrections for Deficiencies:**

**711-4.2.1 Recapping Newly Applied Traffic Stripes and Markings:** Recapping applies to conditions where additional thermoplastic material is applied to new traffic stripes or markings. Recap a 1.0 mile [1.0 kilometer] LOT centered around the deficiency with additional thermoplastic material or by complete removal and reapplication at no additional cost to the Department.

If the Engineer determines that recapping will result in a thickness exceeding the maximum allowed, the traffic stripes or markings may be completely removed and reapplied, or removed to a thickness that will meet the minimum and maximum thickness criteria when recapped.

**711-4.2.2 Refurbishing of Existing Traffic Stripes and Markings:** Refurbishing applies to conditions where additional thermoplastic material is applied to existing traffic stripes or markings. Unless the Contract Documents provide otherwise, use materials meeting the requirements of 971-20. Use materials meeting the requirements of 971-17 only where specifically indicated in the Contract Documents.

If the Engineer determines that refurbishing of traffic stripes or markings will result in a thickness exceeding the maximum allowed, the existing traffic stripes or markings may be completely removed and reapplied, or removed to a thickness that will meet the minimum and maximum thickness criteria when refurbished.

#### **711-4.3 Thickness:**

**711-4.3.1 Initial Traffic Striping and Markings or Recapping per 971-17:** Apply or recap traffic stripes or markings such that, after application of drop-on glass spheres (AASHTO M 247 Type I), all lane lines, center lines, transverse markings (except pavement edge lines) and traffic stripes and markings within traffic wearing areas (such as dotted turning guide lines), will have a thickness of 0.10 to 0.15 inch [2.5 to 4.0 mm] when measured above the pavement surface at the edge of the traffic stripe or marking.

Also, all pavement edge lines, gore, island, and diagonal stripe markings, bike lane symbols and messages, wherever located, will have a thickness of 0.07 to 0.10 inch [1.8 to 2.5 mm] when measured above the pavement surface at the edge of the traffic stripe or marking.

**711-4.3.2 Refurbishing Existing Traffic Strips and Markings:** Apply thermoplastic material at a thickness greater than or equal to the minimum thickness listed on the QPL. Ensure that the combination of existing stripe and overlay after application of drop-on glass spheres (AASHTO M 247

Type I), does not exceed the maximum thickness of 0.10 inch [2.5 mm] for edge lines and 0.150 inch [4.0 mm] for lane and center lines.

**711-4.4 Glass Spheres:** Apply reflective glass spheres to all white and yellow traffic stripes or markings immediately behind the striping mechanism, at the rate of 0.10 lb/ft<sup>2</sup> [0.5 kg/m<sup>2</sup>] of thermoplastic surface, with 50 to 60% embedment.

Apply a mixture consisting of 50% glass spheres and 50% sharp silica sand to all thermoplastic transverse lines, bike lane symbols and longitudinal lines adjacent to or in a proposed bike lane, at a rate of 0.10 lb/ft<sup>2</sup> [0.5 kg/m<sup>2</sup>] thermoplastic surface.

**711-4.5 Retroreflectivity:** Apply white and yellow pavement markings that will attain an initial retroreflectance of not less than 300 mcd/lx·m<sup>2</sup> and not less than 250 mcd/lx·m<sup>2</sup>, respectively. Ensure that the intermittent and final retroreflectance of white and yellow pavement markings are not less than 150 mcd/lx·m<sup>2</sup>. This does not apply to transverse lines, bike lane symbols and longitudinal lines adjacent to or in a proposed bike lane.

**711-4.6 Color:** Use white thermoplastic material that is pure white, free from any tint and showing no deviations from magnesium oxide color standard greater than the following:

Scale Definition	Magnesium Oxide Standard	Sample
RD	100	75% minimum
Reflectance		
a. Red-Green	0	-5 to +5
b. Yellow-Blue	0	-10 to + 10

Use yellow thermoplastic material which visually matches Federal Test Standard Number 595-color 33538, and meet the following criteria for chromaticity coordinates (x,y):

x	0.455	0.510	0.472	0.530
y	0.444	0.485	0.400	0.456

**711-4.7 Durability:** Durability is the measured percent of thermoplastic material completely removed from the pavement. The thermoplastic material line loss must not exceed 5.0%.

### 711-5 Contractor’s Responsibility for Notification.

Notify the Engineer prior to the placement of the thermoplastic materials. Furnish the Engineer with the manufacturer’s name and LOT numbers of the thermoplastic materials and glass spheres to be used. Ensure that the approved LOT numbers appear on the thermoplastic materials and glass spheres packages. Submit a certified test report to the Engineer indicating that the materials meet all requirements specified.

### 711-6 Protection of Newly Applied Traffic Stripes And Markings.

Do not allow traffic onto newly applied traffic stripes and markings until they are sufficiently dry to permit vehicles to cross them without damage. Remove and replace any portion of the traffic stripes and markings damaged by passing traffic or from any other cause, at no additional cost to the Department.

### 711-7 Method of Measurement.

The quantities to be paid for under this Section will be as follows:

- (a) The net length, in feet [meters], of each of the various types of thermoplastic lines, stripes and bands, authorized and acceptably applied.
- (b) The number of thermoplastic pavement messages and directional arrows, authorized and acceptably applied.

(c) The total traversed distance in gross miles [kilometers] of skip line. The actual applied line is 25% of the traverse distance for a 1:3 ratio. This equates to 1,320 feet [250 m] of marking per mile [kilometer] of single line.

(d) The area, in square feet [square meters], of Remove Existing Markings (Thermoplastic), acceptably removed.

(e) The length, in net miles [net kilometers], of Solid Traffic Stripe, authorized and acceptably applied.

(f) The length, in gross miles [gross kilometers], of Alternating Skip Traffic Stripe, authorized and acceptably applied.

### **711-8 Basis of Payment.**

Prices and payments will be full compensation for all work specified in this Section, including, all cleaning and preparing of surfaces, furnishing of all materials, application, curing and protection of all items, protection of traffic, furnishing of all tools, machines and equipment, and all incidentals necessary to complete the work. Final payment will be withheld until all deficiencies are corrected.

Payment will be made under:

Item No. 711- 3- Pavement Messages, Thermoplastic - each.

Item No. 2711- 3- Pavement Messages, Thermoplastic - each.

Item No. 711- 4- Directional Arrows, Thermoplastic - each.

Item No. 2711- 4- Directional Arrows, Thermoplastic - each.

Item No. 711- 5- Guide Lines, Thermoplastic (Dotted) - per foot.

Item No. 2711- 5- Guide Lines, Thermoplastic (Dotted) - per meter.

Item No. 711- 7- Remove Existing Pavement Markings- (Thermoplastic) - per square foot.

Item No. 2711- 7- Remove Existing Pavement Markings- (Thermoplastic) - per square meter.

Item No. 711- 31- Skip Traffic Stripe, Thermoplastic (White)- per gross mile.

Item No. 2711- 31- Skip Traffic Stripe, Thermoplastic (White)- per gross kilometer.

Item No. 711- 32- Skip Traffic Stripe, Thermoplastic (Yellow)- per gross mile.

Item No. 2711- 32- Skip Traffic Stripe, Thermoplastic (Yellow)- per gross kilometer.

Item No. 711- 33- Skip Traffic Stripe, Thermoplastic (White) - per foot.

Item No. 2711- 33- Skip Traffic Stripe, Thermoplastic (White) - per meter.

Item No. 711- 34- Skip Traffic Stripe, Thermoplastic (Yellow) - per foot.

Item No. 2711- 34- Skip Traffic Stripe, Thermoplastic (Yellow) - per meter.

Item No. 711- 35- Solid Traffic Stripe, Thermoplastic (White) - per foot.

Item No. 2711- 35- Solid Traffic Stripe, Thermoplastic (White) - per meter.

Item No. 711- 36- Solid Traffic Stripe, Thermoplastic (Yellow) - per foot.

Item No. 2711- 36- Solid Traffic Stripe, Thermoplastic (Yellow) - per meter.

Item No. 711- 37- Solid Traffic Stripe, Thermoplastic (White) - per net mile.

Item No. 2711- 37- Solid Traffic Stripe, Thermoplastic (White) - per net kilometer.

Item No. 711- 38- Solid Traffic Stripe, Thermoplastic (Yellow) - per net mile.

Item No. 2711- 38- Solid Traffic Stripe, Thermoplastic (Yellow) - per net kilometer.