# ORIGINATION FORM

**THE INFORMATION BELOW IS TO BE PROVIDED BY THE ORIGINATOR**
(The person who receives or originates the issue and needs to forward the issue for action.)

☒ Modify Specification _____711_____.
Section/File number

☐ New Section _____.
Section number

**Subject:** Thermoplastic Traffic Stripes and Markings - Retroreflectivity

**Origination date:** July 8, 2003

**Originator:** Chester Henson
**Office/Phone:** Roadway Design/ 414-4117
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**Problem statement:** Industry standard method of measurement of retroreflectivity has changed from 15 meter geometry to 30 meter geometry.

**Information source:** Input was provided from materials lab, construction and maintenance.

**Background data:** Materials Lab, construction and maintenance currently have the equipment to measure retroreflectivity using the new 30 meter geometry.

**Recommended usage uote:**

**Desired implementation date:** **Beginning with the July 2005 letting.**

Florida Department of Transportation

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JOSÉ ABREU
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# M E M O R A N D U M

**DATE:** May 27, 2005

**TO:** Specification Review Distribution List

**FROM:** Duane F. Brautigam, P.E., State Specifications Engineer

**SUBJECT:** **Proposed Specifications Change: 7110000 – Thermoplastic Traffic Stripes and Markings**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change to Section 711.

This change was proposed by Chester Henson of the State Roadway Design Office to update Section 711 to meet current requirements.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or to my attention via e-mail at SP965DB or duane.brautigam@dot.state.fl.us. Comments received after June 24, 2005 may not be considered. Your input is encouraged.

DFB/jf

Attachment

COMMENTS:

Submitted by: Phone #:

**THERMOPLASTIC TRAFFIC STRIPES AND MARKINGS.**
**(REV 5-2-05)**

SECTION 711 (Pages 753-758) is deleted and the following substituted:

## SECTION 711
## THERMOPLASTIC TRAFFIC STRIPES AND MARKINGS

### 711-1 Description.

Apply *new* 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~~*Thermoplastic*:** Use only thermoplastic materials listed on the Qualified Products List (QPL). *The Engineer will take random samples of all material in accordance with the Department's Sampling, Testing and Reporting Guide schedule.*~~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~~

***711-2.1.1 Initial or Recapped Stripes and Markings:*** *Use materials meeting the requirements of 971-1 and 971-5.*

***711-2.1.2 Refurbishing Existing Stripes and Markings:*** *Use materials meeting the requirements of 971-1 and 971-5, or 971-6 when specifically indicated in the Contract Documents.*

***711-2.1.3 Preformed Stripes and Markings:*** *Use Materials meeting the requirements of 971-1 and 971-7.*

**711-2.2 Glass ~~s~~*S*pheres ~~(for reflective traffic stripes and markings)~~:** Use only glass spheres *listed on the Qualified Products List (QPL),* meeting the requirements of 971-1 and 971-~~14~~*2*. 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.

***711-2.3 Sand:*** *Use materials meeting the requirements of 971-5.4.*

### 711-3 Equipment.

Use equipment *capable of* ~~to install hot applied thermoplastic material constructed to~~ provid~~e~~*eing* continuous uniform heating *of striping materials* to temperatures exceeding 390ºF [200ºC], mixing and agitation of the material reservoir *to provide a homogeneous mixture without segregation. Use equipment that will maintain the striping material in a plastic state, in all mixing and conveying parts, including the line dispensing device until applied.*~~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~~*can produce* varying *width* traffic stripes ~~and marking application widths~~ and *which* meet*s* 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~~*striping* material and ~~maneuverable to the extent that~~*capable of following* straight lines ~~can be followed~~ and *making* 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.~~

*(b) is capable of applying glass spheres to the surface of the completed stripe by a double drop application for initial traffic striping and marking and a single drop application for recapping and refurbishing. The bead dispenser for the first bead drop shall be attached to the striping machine in such a manner that the beads are dispensed closely behind with the thermoplastic material. The second bead dispenser bead shall be attached to the striping machine in such a manner that the beads are dispensed immediately after the first bead drop application. Glass spheres dispensers shall be 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.*

(c) equipped with a special kettle for uniformly melting and heating the ~~thermoplastic~~*striping* 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~~*Remove* 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. *Payment for marking removal will be in accordance with 102-5.9.*

~~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.~~*Before applying traffic stripes and markings, remove any material by a method approved by the Engineer that would adversely affect the bond of the traffic stripes. Before applying traffic stripes to any Portland cement concrete surface, apply a two-part epoxy primer sealer recommended by the manufacturer. Offset longitudinal lines at least 2 inches [50 mm] from any longitudinal joints of Portland cement concrete pavement.*

Apply traffic stripes or markings only to dry surfaces, and when the ambient air and surface temperature is at least ~~55~~*50*ºF [~~13~~*10*°C] and rising *for asphalt surfaces and 60°F [16°C] and rising for concrete surfaces*~~. 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 striping to the same tolerances in dimensions and in alignment specified in 710-5. When applying traffic stripes and markings over existing markings, not more than 2 inches [50 mm] on either end and not more than 1 inch [25 mm] on either side of the existing line shall be visible.*

*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.*

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~~*2* Thickness:**

**711-4.~~3~~*2*.1 Initial ~~Traffic Striping and Markings or Recapping per 971-17~~*Recapped Stripes and Markings*:** Apply or recap traffic stripes or markings such that,

~~after~~*before* 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 0.0~~7~~*9* to 0.1~~0~~*2* inch [~~1.8~~*2.3* to ~~2.5~~*3.0* mm] when measured above the pavement surface at the edge of the traffic stripe or marking.

**711-4.~~3~~*2*.2 Refurbishing Existing Traffic Strips and Markings:** Apply *a minimum of 0.06 inch of* thermoplastic material ~~at a thickness greater than or equal to the minimum thickness listed on the QPL~~. Ensure that the combination of *the* existing stripe and *the* 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~~ *all* 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$^2$ [0.5 kg/m$^2$] 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$^2$ [0.5 kg/m$^2$] thermoplastic surface.~~

**711-4.~~5~~*3* Retroreflectivity:** Apply white and yellow ~~pavement~~*traffic stripes and* markings that will attain an initial ~~retroreflectance~~*retroreflectivity* of not less than ~~300~~*450* mcd/lx·m$^2$ and not less than ~~250~~*350* mcd/lx·m$^2$, respectively *for all longitudinal lines*. *All transverse lines, messages and arrows will attain an initial retroreflectivity of not less than 300 mcd/lx·m$^2$.* ~~Ensure that the intermittent and final retroreflectance of white and yellow pavement markings are not less than 150 mcd/lx·m$^2$.~~ This does not apply to ~~transverse lines~~*pedestrian crosswalks*, bike lane symbols ~~and longitudinal lines adjacent to~~ or *messages* in a proposed bike lane.

*Measure, certify on Department approved form and submit to the Engineer, no later than the next working day after the application of pavement markings, the retroreflectivity of white and yellow pavement markings in accordance with Florida Method FM-5-541.*

*If the Department retests within 3 days of initial application and reflectivity values measure below values shown above, the striping will be reapplied at the Contractor's expense. Project personnel performing any retesting should take into consideration events beyond the control of the Contractor and not due to material application failures before requiring re-striping at Contractor expense. The retest readings should be representative of the Contractor's striping performance.*

**711-4.~~6~~*4* 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:~~*meets the requirements of 971-1.*

***711-4.5 Glass Spheres:***

***711-4.5.1 Longitudinal Lines:*** *For initial traffic striping and marking, apply the first drop of Type 4 or larger glass spheres immediately followed by the second drop of Type 1 glass spheres. For refurbishing, apply a single drop of Type 3 glass spheres. Apply reflective glass spheres to all markings at the rates determined by the manufacturer's recommendations.*

*711-4.5.2 Transverse Stripes and Markings: Apply a single drop of Type 1 glass spheres. Apply reflective glass spheres to all markings at the rates determined by the manufacturer's recommendations.*

*Apply a mixture consisting of 50% glass spheres and 50% sharp silica sand to all thermoplastic pedestrian crosswalk lines and bike lane symbols at the rates determined by the manufacturer's recommendations.*

| ~~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 *striping* 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~~*Do not allow traffic onto or permit vehicles to cross newly applied pavement markings until they are sufficiently dry. Remove and replace any portion of the pavement markings damaged by passing traffic or from any other cause, at no additional cost to the Department*

***711-7 Observation Period.***

*Pavement markings are subject to a 180 day observation period under normal traffic. The observation period shall begin with the satisfactory completion and acceptance of the work.*

*The pavement markings shall show no signs of failure due to blistering, excessive cracking, chipping, discoloration, poor adhesion to the pavement, loss of reflectivity or vehicular damage. The Department reserves the right to check the color and retroreflectivity within 30 days prior to the end of the observation period.*

*Replace, at no additional expense to the Department, any pavement markings that do not perform satisfactorily under traffic during the 180 day observation period*.

***711-8 Corrections for Deficiencies.***

*Recapping applies to conditions where additional striping material is applied to new or refurbished traffic stripes or markings to correct a deficiency. Recap a 1.0 mile [1.0 kilometer] LOT centered around the deficiency with additional striping material or by complete removal and reapplication at no additional cost to the Department.*

*If recapping will result in a thickness exceeding the maximum allowed, the traffic stripes or markings will be removed and reapplied.*

**711-~~7~~*9* 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 *and~~,~~* stripes ~~and bands~~, authorized and acceptably applied.

~~(b) The number of thermoplastic pavement messages and directional arrows, authorized and acceptably applied.~~

(~~c~~*b*) The total traversed distance in gross miles [kilometers] of *10-30* 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~~*c*) 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.~~

*(d) The number of pavement messages, symbols and directional arrows, authorizd and acceptably applied.*

**711-~~8~~*10* 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. |