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 _____971_____.
Section/File number

☐ New Section _____.
Section number

Subject: Thermoplastic Pavement Markings

Origination date: July 8, 2003

Originator: Chester Henson
Office/Phone: Roadway Design/ 414-4117
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Problem statement: Specification was expanded to include the Type 3 and Type 4 as well as the Type 1 glass spheres. Thermoplastic materials were limited to alkyd based materials and hydrocarbon based materials will no longer be allowed.

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

Background data: Alkyd based materials have always performed better but were originally more expensive than hydrocarbon based materials. Contractors are successfully bidding and using alkyd materials on existing projects, so cost is no longer an issue.

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

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

M E M O R A N D U M

DATE: December 6, 2004

TO: Specification Review Distribution List

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

SUBJECT: **Proposed Specifications Change: 9711234 – Coatings and Traffic Marking Materials**

There have been additional changes proposed by Chester Henson of the Roadway Design Office, since the original posting of this revision on September 24, 2004. Therefore; in accordance with Specification Development Procedures, we are sending you a copy of a proposed Specification changes to In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change to Coatings and Traffic Marking Materials.

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 January 3, 2005 may not be considered. Your input is encouraged.

DFB/jho

Attachment

COATINGS AND TRAFFIC MARKING MATERIALS.
(REV ~~9-20-04~~*12-6-04*)

SUBARTICLE 971-12.6 (Page 894), is expanded by the following Subarticle:

971-12.6.4 Retroreflectivity: *The white and yellow pavement markings shall attain an initial retroreflectance of not less than ~~300~~450 mcd/lx·m^2 and not less than ~~250~~350 mcd/lx·m^2, respectively. The retroreflectance of the white and yellow pavement markings at the end of the one year service life shall not be less than 150 mcd/lx·m^2.*

SUBARTICLE 971-14.1 (Page 896), the second paragraph is deleted and the following substituted:

The glass spheres shall conform to the requirements of AASHTO M 247~~, Type I with moisture resistant coating. or a formulation specified by the traffic striping material manufacture and be one of the gradation, index of refraction and formulations included on the Qualified Products List (QPL)~~.

SUBARTICLE 971-14.2 (Page 896), is deleted and the following substituted:

971-14.2 Specific Properties: The glass spheres shall have a~~n adhesion~~ coating that will promote adhesion and proper embedment in the binder for optimum retroreflective performance. The general requirements of AASHTO M 247 ~~Part 2~~ and the following physical requirements apply:

Property	Test Method	Specification
Gradation	ASTM D 1214	AASHTO M 247~~, Type I~~
Roundness	ASTM D 1155	Min: 70% true spheres by weight per sieve size
Refractive Index	Becke Line Method (25 +/- 5 C)	1.5 minimum

Sieve Size	*Percent by Mass Passing Designated Sieve (ASTM D 1214)*		
	Grading Designation		
	Type 1	*Type 3 (FP 96)*	*Type 4 (FP 96)*
No. 8			
No. 10			*100*
No. 12		*100*	*95 – 100*
No. 14		*95 – 100*	*80 – 95*
No. 16		*80 – 95*	*10 – 40*
No. 18		*10 – 40*	*0 – 5*
No. 20	*100*	*0 – 5*	*0 – 2*
No. 25		*0 – 2*	
No. 30	*75 – 95*		
No. 40			
No. 50	*15 – 35*		
No. 80			
N0. 100	*0 – 5*		

Provide the Engineer Certified test reports from the manufacturer confirming that all glass spheres conform to the requirements of AASHTO M 247 and this Section.

SUBARTICLE 971-17.1 (Page 901) is deleted and the following substituted:

971-17.1 General: Upon cooling to normal pavement temperature, these materials shall produce an adherent, reflective pavement marking capable of resisting deformation by traffic. The manufacturer shall *utilize alkyd based materials only and* ~~*shall*~~ ~~have~~*has* the option of formulating the material according to his own specifications. However, the requirements delineated in this Specification, Section 711, and FM 5-541 ~~shall~~ apply regardless of the type of formulation used. The pigment, glass spheres, and filler shall be well dispersed in the resin. The material shall be free from all skins, dirt and foreign objects.

SUBARTICLE 971-17.2 (Page 902) is deleted and the following substituted:

971-17.2 Composition:

~~Component~~	~~Test Method~~	~~White~~	~~Yellow~~
~~Binder~~		~~18.0% minimum~~	~~18.0% minimum~~
~~TiO_2, Type II Ructile~~	~~ASTM D 476~~	~~10.0% minimum~~	~~-~~
~~Glass Spheres~~	~~AASHTO T 250~~	~~40.0% minimum~~	~~40.0% minimum~~
~~Yellow Pigment~~		~~-~~	~~% minimum per manufacturer~~
~~Calcium Carbonate and Inert Filler (-200 mesh [-75 µm] sieve)~~		~~32.0% maximum~~	~~39.5% maximum~~
~~Percentages are by weight.~~			

Component	*Test Method*	*White*	*Yellow*
Binder		*20.0% minimum*	*20.0% minimum*
TiO_2, Type II Ructile	*ASTM D 476*	*10.0% minimum*	-
Glass Spheres	*AASHTO T 250*	*40.0% minimum*	*40.0% minimum*
Yellow Pigment		-	*% minimum per manufacturer*
Calcium Carbonate and Inert Filler (-200 mesh [-75 µm] sieve)		*30.0% maximum*	*37.5% maximum*
Percentages are by weight.			

The alkyd/maleic binder must consist of a mixture of synthetic resins (at least one synthetic resin must be solid at room temperature) and high boiling point plasticizers. At least one-half of the binder composition must be 100% maelic-modified glycerol of rosin and be no less than 15% by weight of the entire material formulation.

SUBARTICLE 971-17.3 (Page 902) is deleted and the following substituted:

971-17.3 Glass Spheres: Glass spheres *shall consist of 50% Type 1 and 50% Type 3. Glass spheres* ~~shall~~*and* meet the requirements of 971-14.

SUBARTICLE 971-17.5 (Pages 902-903), is expanded by the following Subarticles:

971-17.5.3 Retroreflectivity: *The white and yellow pavement markings shall attain an initial retroreflectance of not less than ~~300~~450 mcd/lx·m^2 and not less than ~~250~~350 mcd/lx·m^2, respectively. The retroreflectance of the white and yellow pavement markings at the end of the ~~three~~five year service life shall not be less than 150 mcd/lx·m^2.*

971-17.5.4 Durability: *Durability is the measured percent of thermoplastic material completely removed from the pavement. The thermoplastic material line loss must not exceed 5.0%.*

SUBARTICLE 971-18.1 (Page 903) is deleted and the following substituted:

971-18.1 General: The preformed materials for pavement stripes and markings shall consist of white or yellow weather-resistant reflective film as specified herein. *The markings ~~shall be~~are divided into two classes: Standard and High Performance. The classes are differentiated by their durability and retroreflectivity.* The pigment, glass spheres, and filler shall be well dispersed in the resin. However, the requirements delineated in this specification, Section ~~709~~ *713*, and FM 5-541 shall apply. The material shall be free from all skins, dirt and foreign objects.

SUBARTICLE 971-18.5 (Page 904) is deleted and the following substituted:

971-18.5 Thickness: ~~The preformed materials shall range in thickness from 20 to 90 mils [0.508 to 2.286 mm].~~ The Qualified Products List will list the specified thickness of each approved product.

SUBARTICLE 971-18.6 (Page 904) is deleted and the following substituted:

971-18.6 Durability and Wear Resistance: When properly applied, the preformed material shall provide neat, durable stripes and markings. *Durability is the measured percent of pavement marking material completely removed from the pavement. The pavement marking material line loss must not exceed 5.0% of surface area.* ~~The preformed materials shall provide a cushioned resilient substrate that reduces sphere crushing and loss. The film shall be weather resistant and, through normal wear, shall show no significant tearing, rollback or other signs of poor adhesion.~~

SUBARTICLE 971-18.13 (Page 905) is expanded by the following Subarticle:

971-18.13 Standard Markings: *The preformed materials for pavement stripes and markings shall have a service life of three year. The materials shall attain an initial retroreflectance of not less than 300 mcd/lx·m^2 and not less than 250 mcd/lx·m^2, respectively. The retroreflectance of the white, yellow and contrast pavement markings at the end of the three year service life shall not be less than 150 mcd/lx·m^2.*

SUBARTICLE 971-18.14 (Page 905) is expanded by the following Subarticle:

971-18.14 High Performance Markings: *The preformed materials for pavement stripes and markings shall have a service life of five years. The materials shall attain an initial retroreflectance of not less than 600 mcd/lx·m^2 for white and contrast markings and not less than 450 mcd/lx·m^2 for yellow markings. The pavement stripes and markings shall retain a minimum retroreflectance for two years of not less than 300 mcd/lx·m^2 for white and contrast markings and not less than 250 mcd/lx·m^2 for yellow markings. The retroreflectance of the white, yellow and contrast pavement markings at the end of the five year service life shall not be less than 150 mcd/lx·m^2.*

SUBARTICLE 971-20.4 (Pages 908-909) is deleted and the following substituted:

971-20.4 Physical Requirements: Sample specimens shall be prepared in accordance with ASTM D 4960~~, 8. Procedure shall~~ *and* meet the following requirements:

Property	*Test Method*	*Minimum*	*Maximum*
Water Absorption	*ASTM D 570*	*-*	*0.5%*
Softening Point	*ASTM D 36*	*195ºF [90ºC]*	*-*
Low Temperature Stress Resistance	*AASHTO T 250*	*Pass*	*-*
Specific Gravity	*Water displacement*		*1.87*
Indentation Resistance	*ASTM D 2240* Shore Durometer, A2*	*5*	*30*
Impact Resistance	*ASTM D 256, Method A*	*1.0 N·m*	*-*
Flash Point	*ASTM D 92*	*475ºF [245ºC]*	*-*
**The durometer and panel shall be at 110ºF [45ºC] with a 4.4 lb [2.0 kg] load applied. Instrument measurement shall be taken after 15 seconds.*			

~~(a)~~***971-20.4.1*** **Color:** The white thermoplastic material shall be pure white and free from any tint. Using a ~~colorimeter, such as a Gardner Color Difference Meter~~ *Hunter tristimulus colorimeter or approved equivalent in accordance with ASTM D 4960*, the material shall not show 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

The initial color of the yellow thermoplastic material shall fall within the following limits:

Reflectance ..... 43% minimum

Chromaticity Coordinates (x,y)*:

X	0.455	0.51	0.472	0.53
Y	0.444	0.485	0.4	0.456
*Chromaticity shall fall in an area bordered by these coordinates for an initial beaded yellow line when measured with a BYK Gardner Catalog No. 9200 Handy-Color Colorimeter or approved equal by the State Materials Office.				

The retained color of the yellow thermoplastic line chromaticity coordinates, shall fall within the following limits:

Chromaticity Coordinates (x,y)**

X	0.435	0.51	0.449	0.53
Y	0.429	0.485	0.377	0.456

**Chromaticity shall fall in an area bordered by these coordinates of beaded yellow line (for the life of the reflectivity performance when measured in accordance with Florida Test Method FM 5-541) when measured with a BYK Gardner Catalog No. 9200 Handy-Color Colorimeter or approved equal by the State Materials Office in accordance with Florida Test Method FM 5-541.

~~(b) Water Absorption: When tested in accordance with ASTM D 570, the thermoplastic material shall contain no more than 0.5% by weight of retained water.~~

~~(c) Softening Point: When tested in accordance with ASTM D 36, the material shall have a softening point of not less than 190ºF [90ºC].~~

~~(d) Low temperature Stress Resistance: A test sample shall not crack or fail to adhere to a concrete substrate when tested in accordance with AASHTO T 250.~~

~~(e) Safety: The thermoplastic binder shall not emit fumes which are toxic or otherwise injurious to persons when heated at the manufacturer's recommended application temperature.~~

~~(f) Specific Gravity: The specific gravity of the material, measured by water displacement, shall be 1.87 maximum.~~

~~(g) Set To Bear Traffic Time: When applied at the temperatures and thickness specified by Section 711, the thermoplastic shall set to bear traffic in not more than two minutes.~~

~~(h) Indentation Resistance: The hardness shall be measured by a Shore Durometer, Type A2, as described in ASTM D 2240. The durometer and the panel shall be at 110ºF [45ºC] with a 4 lb [2 kg] load applied, the reading shall be between 30 and 5 units after 15 seconds.~~

~~(i) Impact Resistance: When tested in accordance with Method A, ASTM D 256, the average impact resistance of four separate samples shall not be less than 10 inch pound [1 N·m].~~

~~(j) Flash Point: The thermoplastic material shall have a flash point not less than 475ºF [245ºC] when tested in accordance with ASTM D 92.~~

971-20.4.2 Set To Bear Traffic Time: *Meet the requirements of 971-17.*

971-20.4.3 Retroreflectivity: *The white and yellow pavement markings shall attain an initial retroreflectance of not less than 300 mcd/lx·m^2 and not less than 250 mcd/lx·m^2, respectively. The retroreflectance of the white and yellow pavement markings at the end of the one year service life shall not be less than 150 mcd/lx·m^2.*

SUBARTICLE 971-21.4.1 (Page 911) is deleted and the following substituted:

971-21.4.1 Set To Bear Traffic Time: When applied at the ~~temperatures and~~ thickness specified by Section ~~711~~*701*, the thermoplastic shall set to bear traffic in not more than 15 minutes.

SUBARTICLE 971-21.4 (Pages 911-912) is expanded by the following:

971-21.4.3 Durability and Retroreflectivity: *Meet the requirements of 971-17.*

SUBARTICLE 971-23.4.2 (Page 915) is deleted and the following substituted:

971-23.4.2 Color, Retroreflectivity and Durability: Meet the requirements of 971-17.