

Pavement Markings





Introductions

- Chester A. Henson, P.E.
State Traffic Standards Engineer
(850) 414-4117



Florida's Customer Focus Survey

- During the day, visibility of roadway striping and markings is good.
- At night, visibility of roadway striping and marking is good.



Florida's Customer Focus Survey

Year	Florida Residents	Commercial Drivers	Well Elders	Visitors
2000	63	71	59	81
2002	63		64	
2004	65	68	58	
2006	63			
2008	64	74	51	78
2010	66	77	63	83



General Issues to All Markings

- Color



Color

- White

1. Specify Amount of TiO_2 in Formulation

- Yellow

1. Daytime Yellow – Custom Color Box
2. Nighttime Color – ASTM D 6628

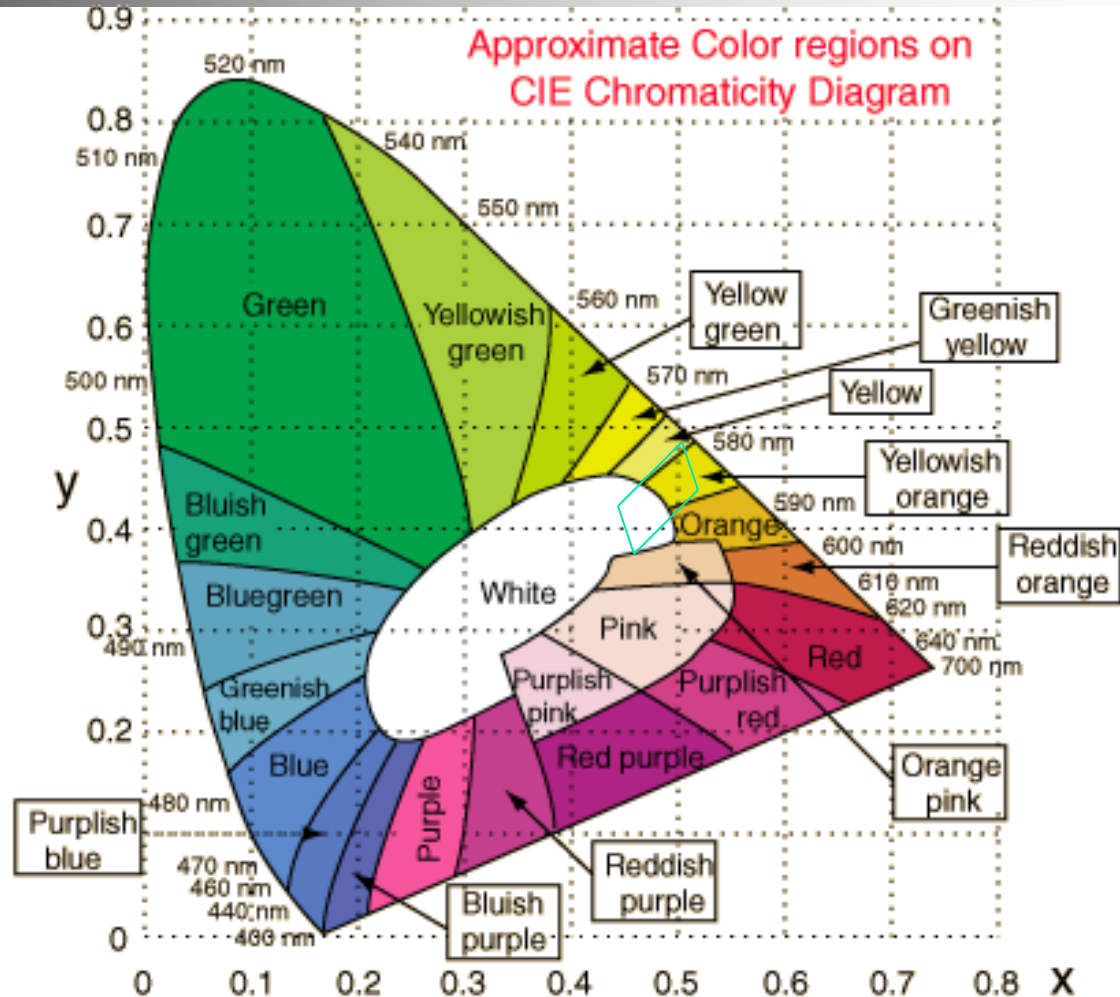
Federal Color No. 13538

FS 13538

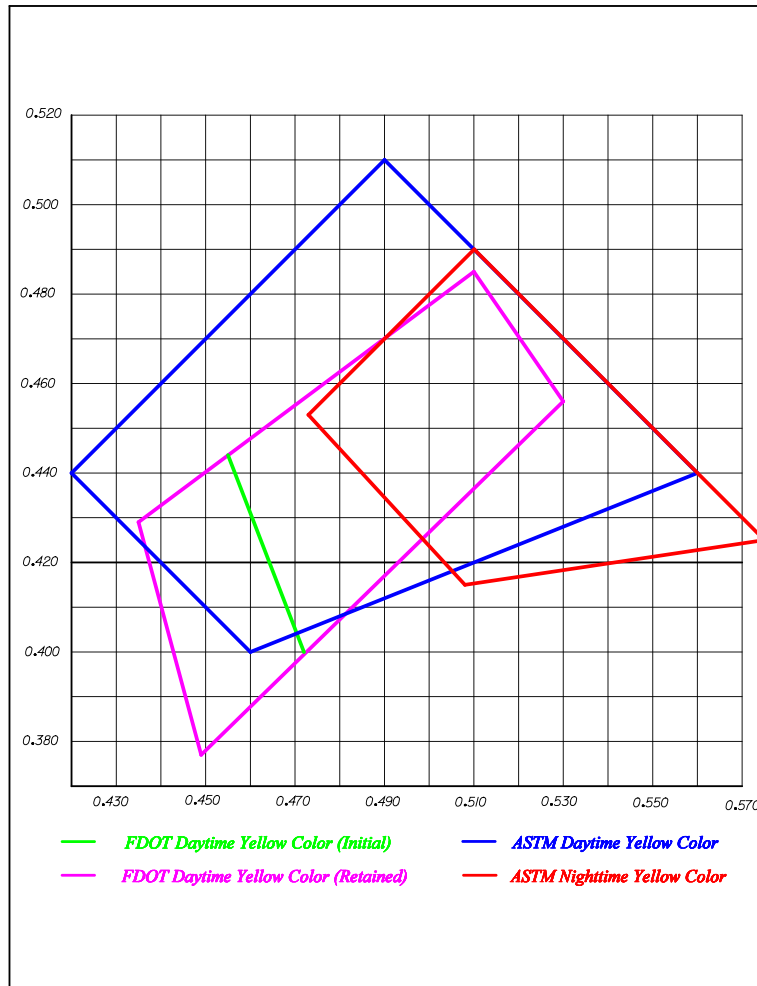


1931 CIE Chromaticity Diagram

x=.530, y=.456
x=.510, y=.485
x=.435, y=.429
x=.449, y=.377



Fl. Yellow Color Coordinates



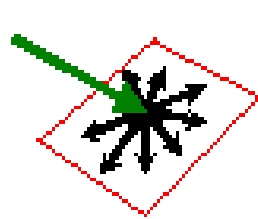


General Issues to All Markings

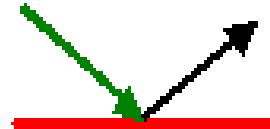
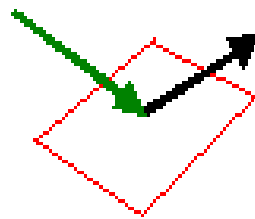
- Color
- Retroreflectivity



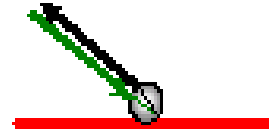
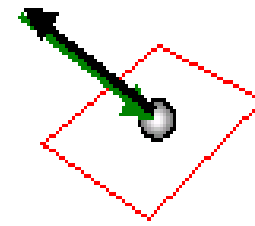
Types of Reflectors



**Diffuse
reflector**



**Specular
reflector**



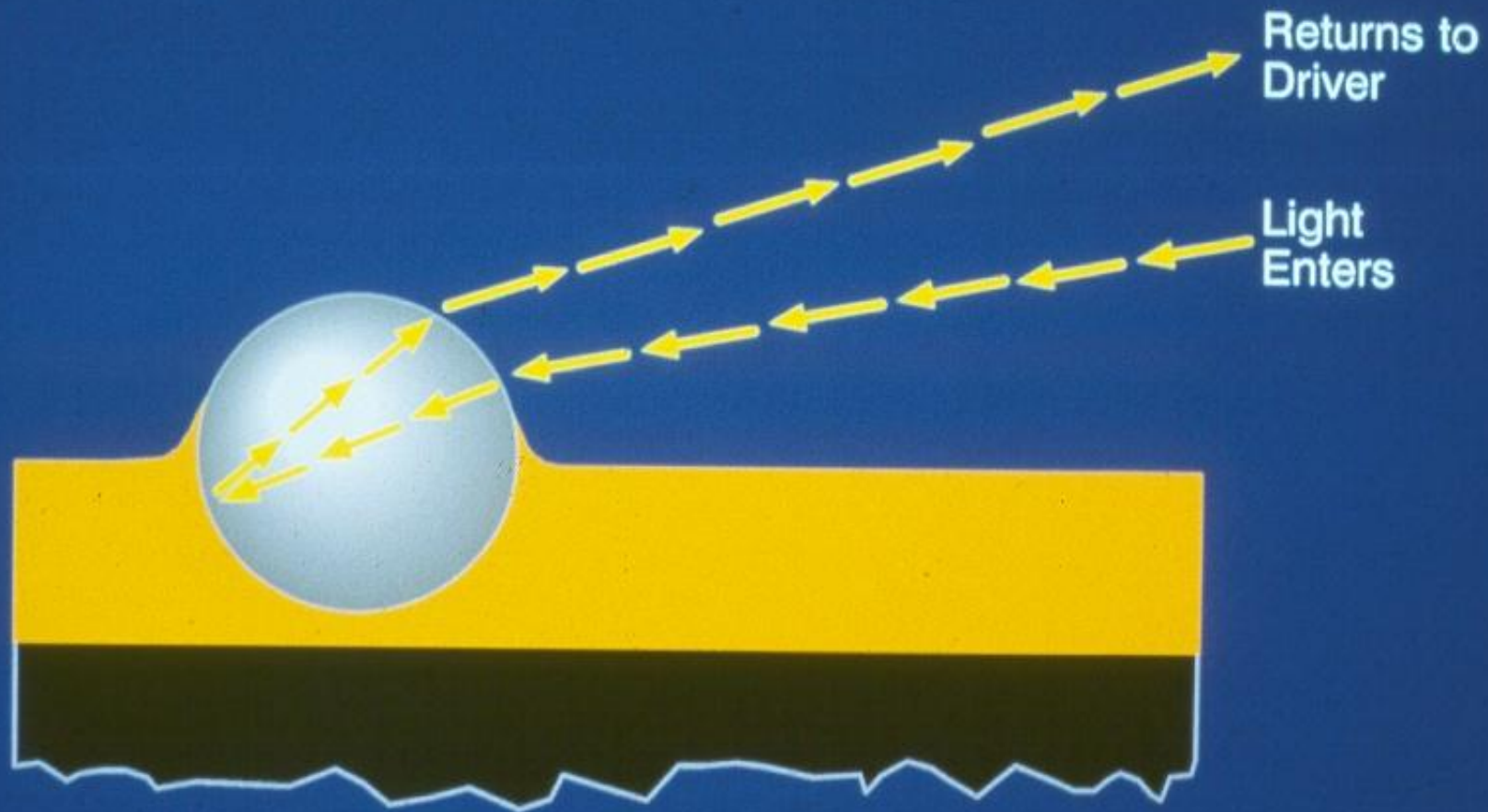
**Retro-
reflector**



What Is Retroreflectivity?

Retroreflectivity is where the reflected rays are preferentially returned in a direction close to the opposite of the direction of the incident rays.

RETROREFLECTIVE BEAD OPTICS

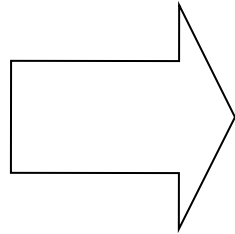


Where Does the Retroreflectivity Come From?

**Marking
Materials**

Glass Bead

**Application
Process**



Retroreflectivity



Elements Affecting Retroreflectivity

1. Pavement Marking Material - pigment

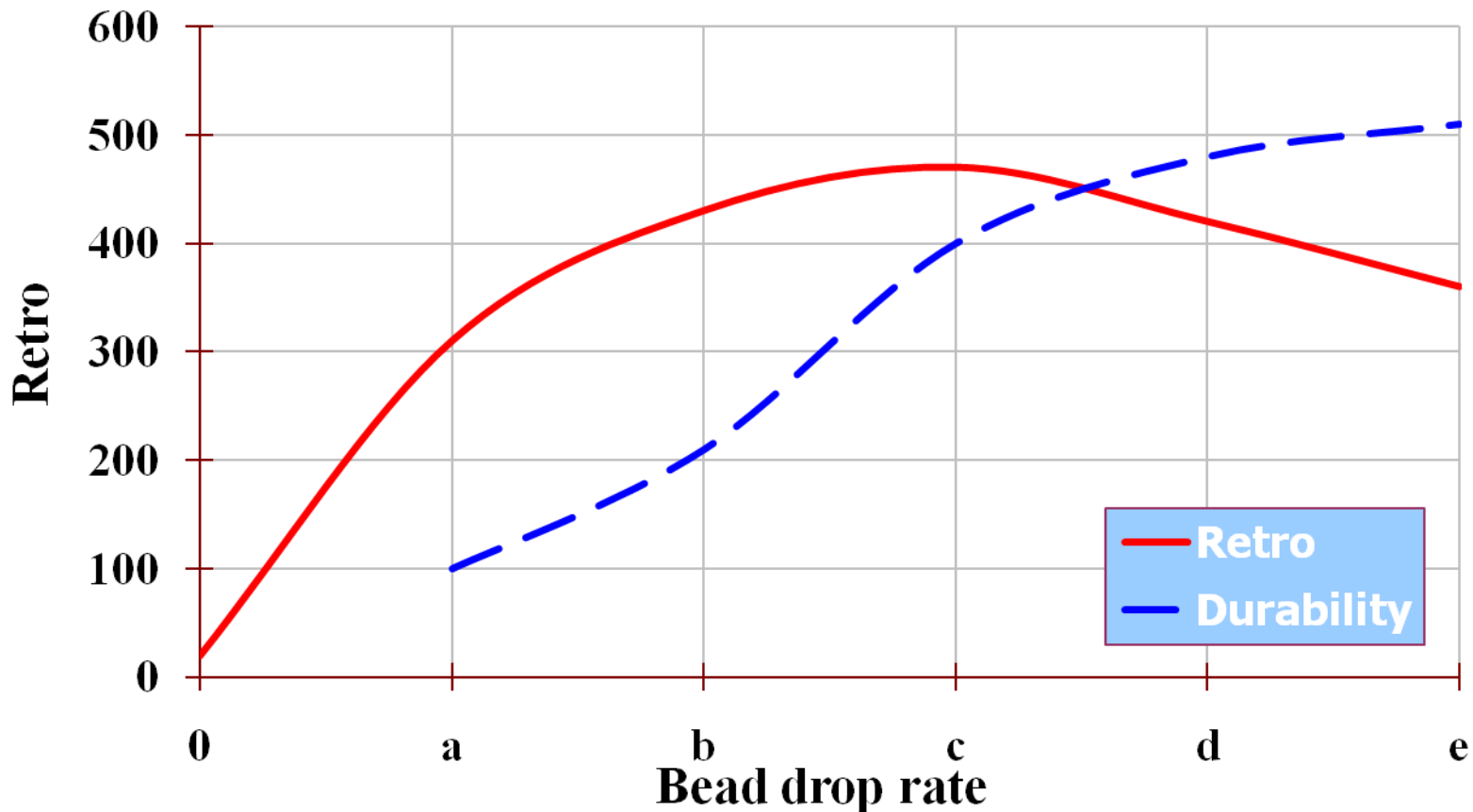
2. Glass Beads

- bead size
- bead roundness
- bead refractive index

3. Application Process

- drop on bead rate
- bead embedment control

Effect of Drop-on Bead Rate on Retroreflectivity and Durability





Specifications for Beads

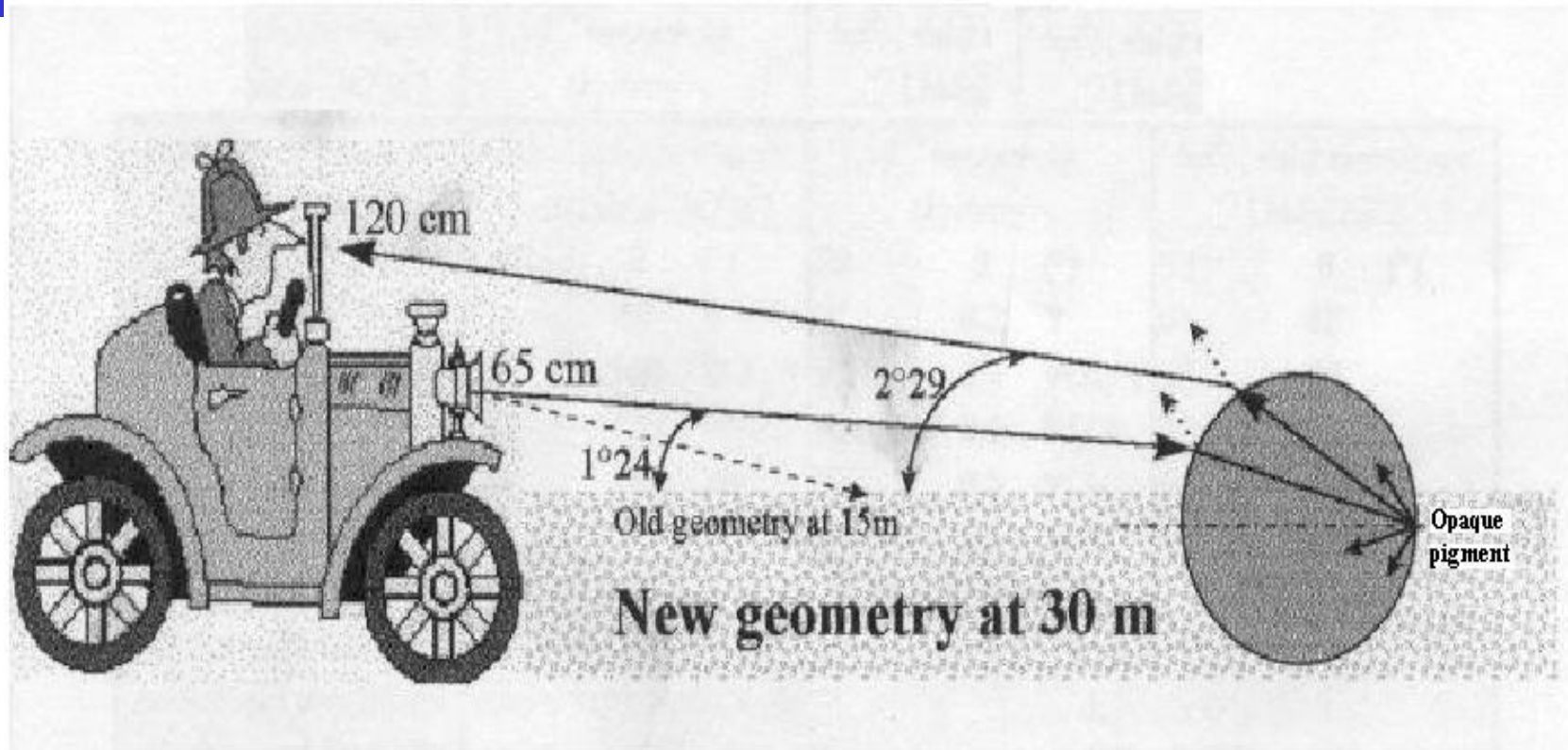
Property	Test Method	Specification
Roundness*	ASTM D 1155	Min: 70 % by weight
Roundness**	ASTM D 1155	Min: 80% by weight
Refractive Index*	Becke Line Method (25+/-5C)	1.5 minimum
Refractive Index**	Becke Line Method (25+/-5C)	1.9 minimum
*Type 1, 3, 4 and 5 beads		
**High Index beads		



Specifications for Beads

Sieve Size	Percent by Mass Passing Designated Sieve (ASTM D 1214)				
	Grading Designation				
	Type 1 (AASHTO)	Type 3 (FP 96)	Type 4 (FP 96)	Type 5 (FP 96)	High Index
No. 8				100	
No. 10			100	95 - 100	
No. 12		100	95 - 100	80 - 95	
No. 14		95 - 100	80 - 95	10 - 40	
No. 16	100	80 - 95	10 - 40	0 - 5	100
No. 18		10 - 40	0 - 5	0 - 2	95 - 100
No. 20	95 - 100	0 - 5	0 - 2		
No. 25		0 - 2			
No. 30	75 - 95				50 - 85
No. 40					20 - 45
No. 50	15 - 35				0 - 5
No. 80					
No. 100	0 - 5				

How is Retroreflectivity Measured?



How is Retroreflectivity Measured?



How is Retroreflectivity Measured



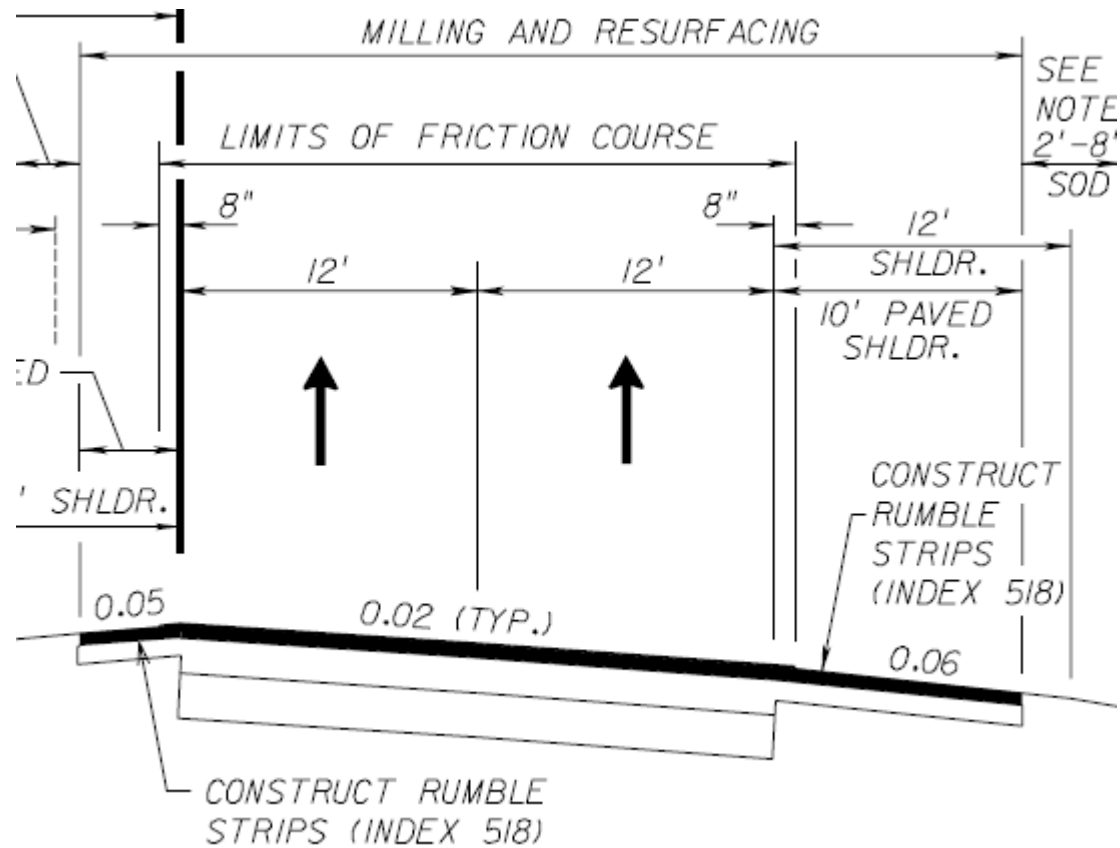
Coefficient of Retroreflected Luminance:
 R_L in ($\text{mcd}/\text{m}^2 \cdot \text{lx}$)



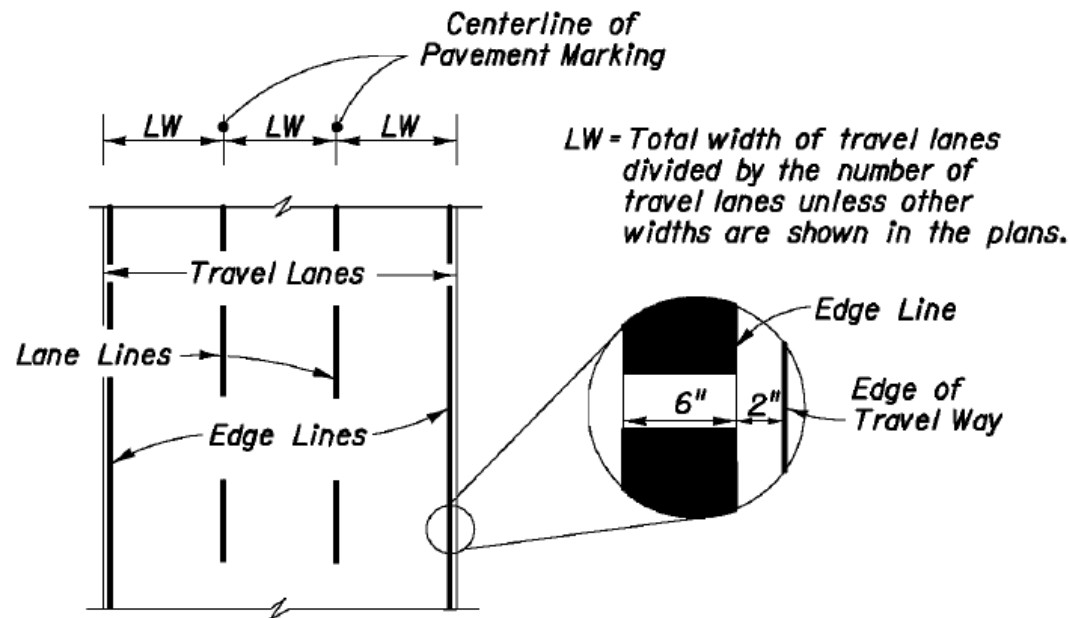
General Issues to All Markings

- Color
- Retroreflectivity
- Layout of Pavement Markings

Layout of Pavement Markings



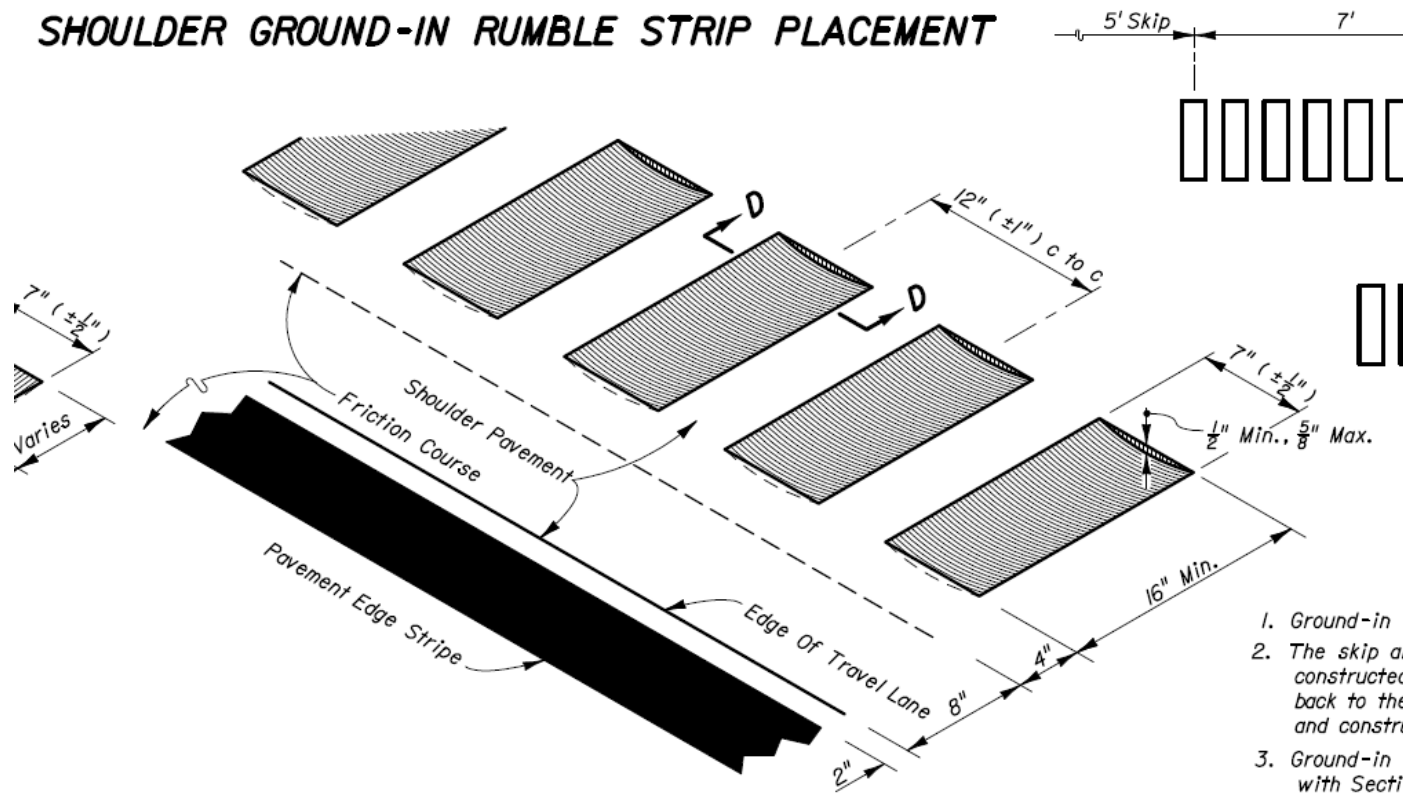
Layout of Pavement Markings



PLACEMENT OF PAVEMENT MARKINGS

Layout of Pavement Markings

SHOULDER GROUND-IN RUMBLE STRIP PLACEMENT



ISOMETRIC - LONGITUDINAL CUT

1. Ground-in
2. The skip at constructed back to the and constru
3. Ground-in with Secti
4. When frict travel lane,



Layout of Pavement Markings

- Specifications (Section 710-5)
 - Establish tack points at appropriate intervals for use in aligning stripes and set a stringline from such points to achieve accuracy.



Layout of Pavement Markings

- Specifications (Section 710-5)
 - Stripes shall not deviate more than 1" from stringline on tangents and curves one degree or less, nor more than 2" on curves greater than one degree.



Layout of Pavement Markings

- Specifications (Section 710-5)
 - Overall line tolerance of $\pm 1''$ for transverse markings, arrows and messages, when the marking cannot be completed in one pass.

Layout of Pavement Markings



Layout of Pavement Markings



Layout of Pavement Markings





Questions ??



Types of Marking Materials

- Paint
- Thermoplastic
- Preformed Thermoplastic
- High Performance Tapes
- Audible & Vibratory Markings
- Wet Weather Markings
- Two Component Reactive



Outline for Each Pavement Marking

- Primary Use of Marking
- Composition of Marking Materials
- Specifications
- Field Installation
- Field Inspection



Types of Marking Materials

- Paint



Painted Pavement Markings

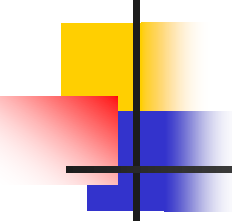
Primary Uses:

- Maintenance of Traffic Markings
- Short Term Refurbishment Marking
- Contrast Marking



What are Components in Paint ?

1. Solids
2. Pigments
3. Vehicles



What roles do the various components play in the performance of the pavement marking?

- **Solids**
 - Flexibility
 - Adhesion
 - Abrasion Resistance (durability)
- **Pigment Package**
 - Color (day and nighttime)
 - Retroreflectivity
- **Vehicle**
 - Medium for application



What role does the glass spheres play in the performance of the pavement marking?

- **Glass Spheres**
 - Retroreflectivity
 - Durability



Section 971:

Painted Pavement Markings

Material Specifications

- **Color**
 - White – 1.5 lb./gal. of TiO_2
 - Daytime Yellow – Color Box
 - Nighttime Yellow – Color Box

- **Retroreflectivity**
 - Initial (White) – 300 mcd
 - Initial (Yellow) – 250 mcd
 - End of Service Life – 150 mcd (Both)
(6 Months)

Section 710: Painted Pavement Markings Field Installation





Section 710: Painted Pavement Markings Field Installation

- **QPL Materials**
 - Paint
 - Glass Spheres

- **Initial Retroreflectivity**
 - White – 300 mcd
 - Yellow – 250 mcd

- **Contractor Responsible for Markings for Six Months**
 - White – 150 mcd
 - Yellow – 150 mcd



Section 710: Painted Pavement Markings Field Installation

- **Final Surface Paint**
 - Alignment – In accordance with Specifications and Design Indexes
 - No. of Applications – District Policy

Section 710: Painted Pavement Markings Field Installation



Section 710: Painted Pavement Markings Field Installation



Section 710: Painted Pavement Markings Field Installation



- Final paint layout should match the permanent marking dimensions



Section 710: Painted Pavement Markings Field Testing

- Contractor required to measure, record and certify on a Department approved form the retroreflectivity of white and yellow pavement markings in accordance with Florida Method FM 5-541.
- The Department reserves the right to test the markings within 3 days of receipt of the Contractor's certification.
- The test readings should be representative of the Contractor's striping performance.



Section 710: Painted Pavement Markings Field Testing

- Contractor required to measure, record and certify on a Department approved form the retroreflectivity of white and yellow pavement markings in accordance with Florida Method FM 5-541.
- Form No. 700-050-70



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of nine retroreflectivity measurements; three at beginning, middle and end of each one-mile section of line type.
 - Use the average of the measurements for acceptance.
 - Retroreflectivity measurements shall be taken in the direction of travel.



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum, one retroreflectivity measurement at one message, one symbol and one transverse line per intersection.
 - Take one measurement per mile for locations other than intersections (i.e. school messages, railroad messages, bike symbols measurements).
 - The measurements taken should be representative of the entire one-mile section.



Painted Pavement Markings

Questions ???



Types of Marking Materials

- Paint
- Thermoplastic



Thermoplastic Pavement Markings

Primary Uses:

- Longitudinal and Transverse Lines
- Messages and Symbols
- Arrows



What are Components in Thermo ?

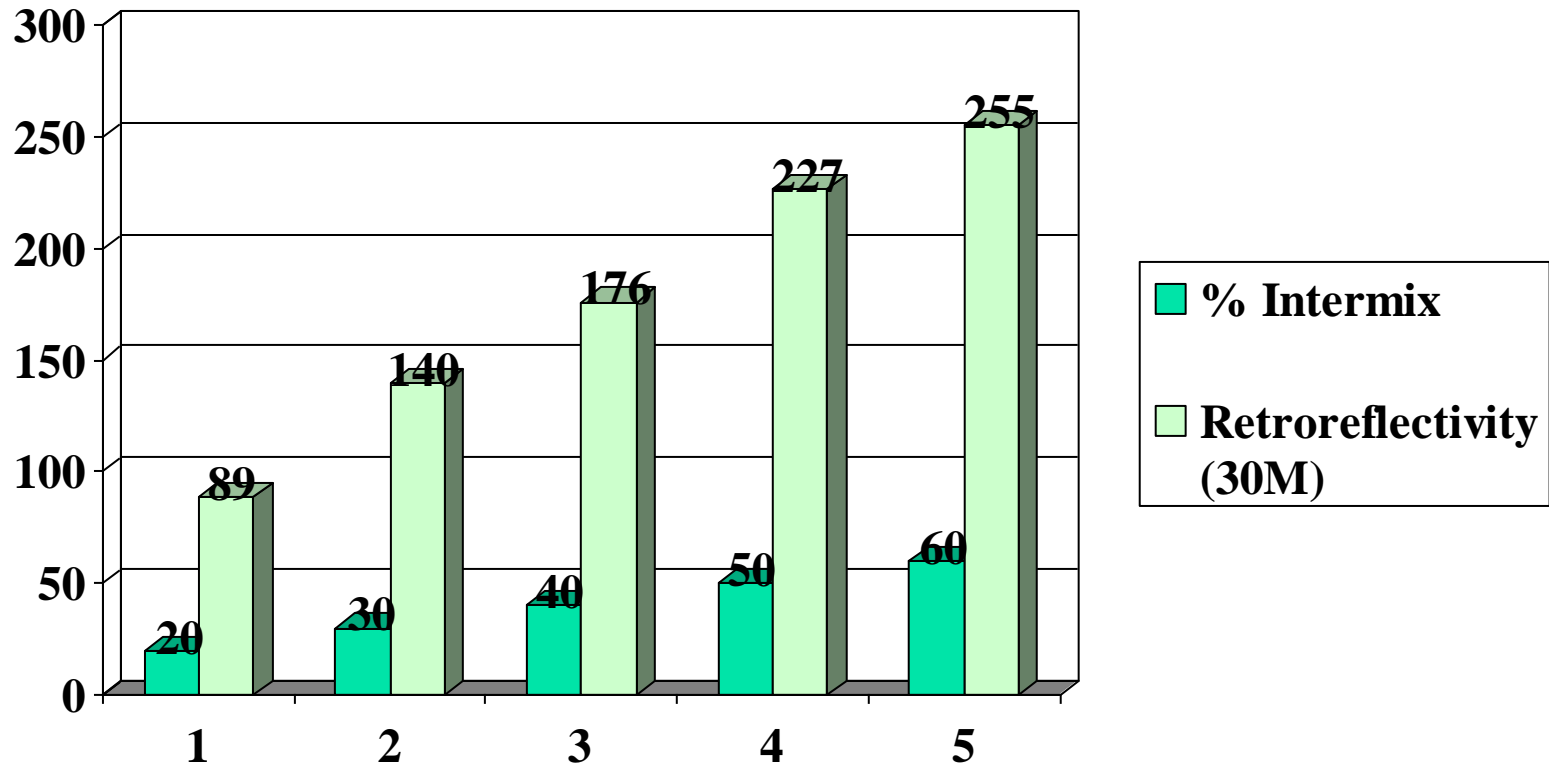
1. Binder
2. Pigments
3. Glass Spheres
4. Fillers



What roles do the thermo components play in the performance of the pavement marking?

- Binder System
 - Flexibility
 - Adhesion
 - Abrasion Resistance (durability)
- Pigment Package
 - Color (day and nighttime)
 - Retroreflectivity
- Intermix Glass Beads
 - Retroreflectivity
- Filler
 - Bulk

Study of Relationship between Percent of Intermix Beads and Retroreflectivity (Norway 1998)





Section 971: Thermoplastic Pavement Markings Material Specifications

- **Composition**
 - a. Binder Amount - 20%
 - b. Binder Type – Alkyd Only
 - c. Intermix Beads – 40%
(50% Type 1 & 50% Type 3)



Section 971: Thermoplastic Pavement Markings Material Specifications

- **Color**
 - a. White – 10% TiO₂ (Min.)
 - b. Daytime Yellow – Color Box
 - c. Nighttime Yellow – Color Box

- **Reflectivity**
 - a. Initial (White) – 450 mcd
 - b. Initial (Yellow) – 350 mcd
 - c. End of Service – 150 mcd
(3 Years)

Section 711: Thermoplastic Pavement Markings Field Installation – Ribbon Gun



Section 711: Thermoplastic Pavement Markings Field Installation – Handliner



Section 711:

Thermoplastic Pavement Markings

Field Installation

- **QPL Materials**

- Thermoplastic
- Glass Spheres

- **Initial Retroreflectivity**

- Longitudinal Lines
 - White – 450 mcd
 - Yellow – 350 mcd
- Transverse Lines, Messages and Symbols
 - White – 300 mcd
 - Yellow – 250 mcd
- Crosswalks Lines and Bike Symbols
 - White – 275 mcd



Section 711: Thermoplastic Pavement Markings Field Installation

- **Thickness**
 - Standard – 100 mils Above the Surface
(Does Not Include the Beads)
 - Refurbishment – 60 mils
(Does Not Include the Beads)
- **Layout**
 - In Accordance with Section 710-5
- **Contractor Responsible for Longitudinal Markings for 180 Days (Observation Period)**
 - White – 450 mcd
 - Yellow – 350 mcd



Critical Elements

- Application Temperature
- Line Thickness
- Bead Rate
- Bead Embedment



Thermoplastic Application Temperature

- Thermoplastic application temperature is a critical factor in material adhesion and bead embedment.
- Thermoplastic should be applied between 400F and 425F to obtain optimum bond and bead embedment without charring or discoloring.



Thermoplastic Line Thickness

- The thermoplastic line thickness is critical to the durability (longevity) of the traffic marking and can effect bead embedment.
- When testing the thickness of the thermoplastic it should be done on an unbeaded area if possible. If this is not possible, the subtraction of 20 mils from the reading to account for the drop-on beads will typically give a good estimate.



Drop-on Bead Rate

- The drop-on bead rate is an extremely critical element in optimizing the retroreflectivity and durability of the pavement marking
- Rates determined by manufacturer's recommendations

Type 4 / Type 1 Double Drop



Type 4 @ 10 lb / 100 ft²

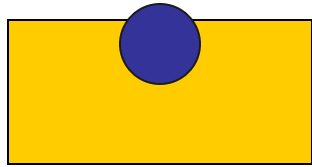
Type 1 @ 8 lb / 100 ft²



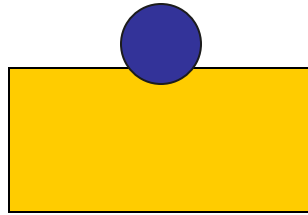
Drop-on Bead Embedment

- Drop-on bead embedment is the most critical factor in obtaining the optimum initial retroreflectivity and durability.
- The optimum bead embedment is 60%. This mean 60% of the glass bead is **below** the pavement marking surface.

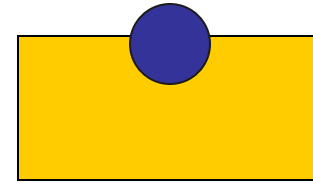
Initial Reflectivity Performance Versus Long Term Performance



Retroref. Low
Good Durability



Retroref. Good
Short Durability



Retroref. Good
Good Durability

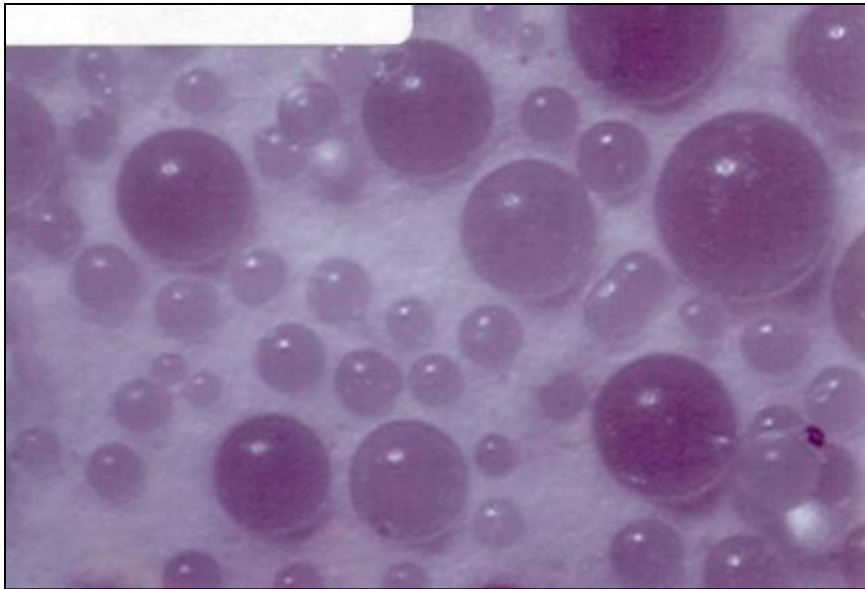


Drop-on Bead Embedment

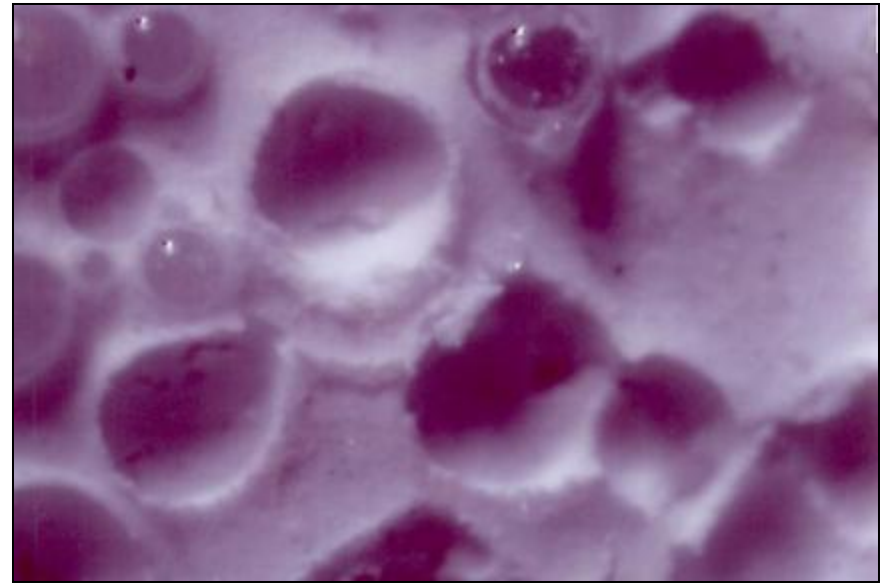






Results of Improper Bead Embedment



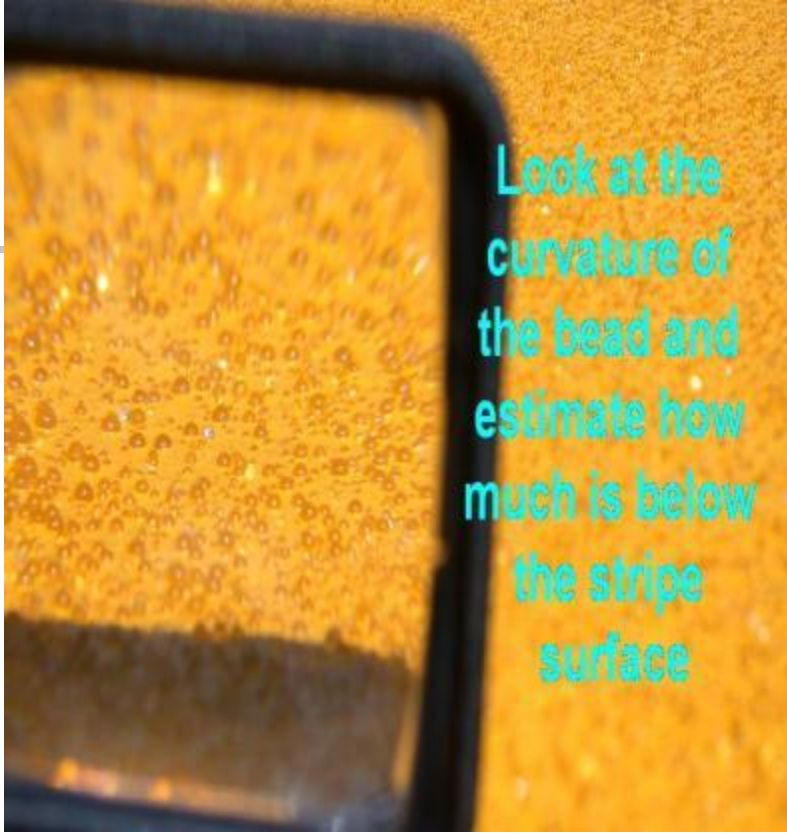
Insufficient bead embedment



**Bead loss due to lack of
embedment**



With a magnifying glass, looking at the beads at an angle is the easiest way to see the embedment.

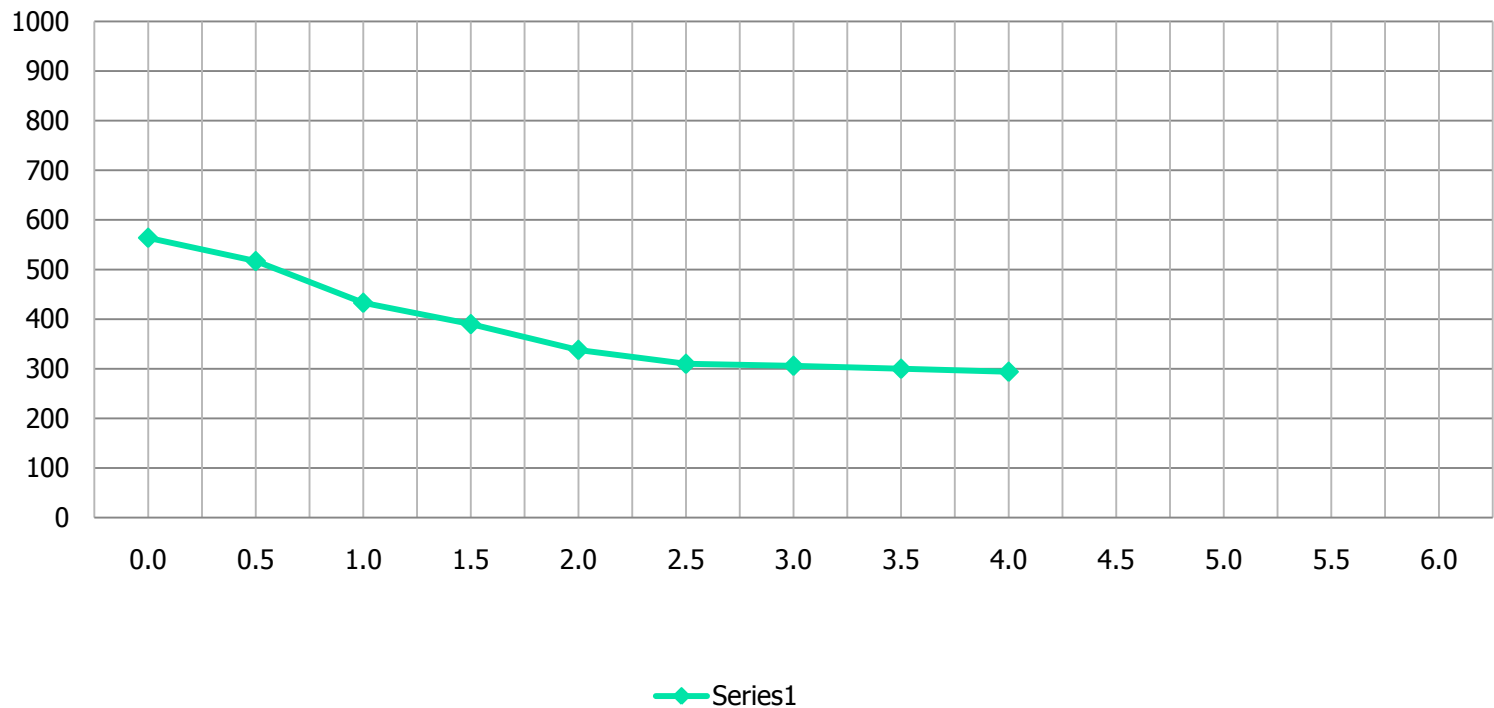


Look at the curvature of the bead and estimate how much is below the stripe surface



White Thermoplastic Performance

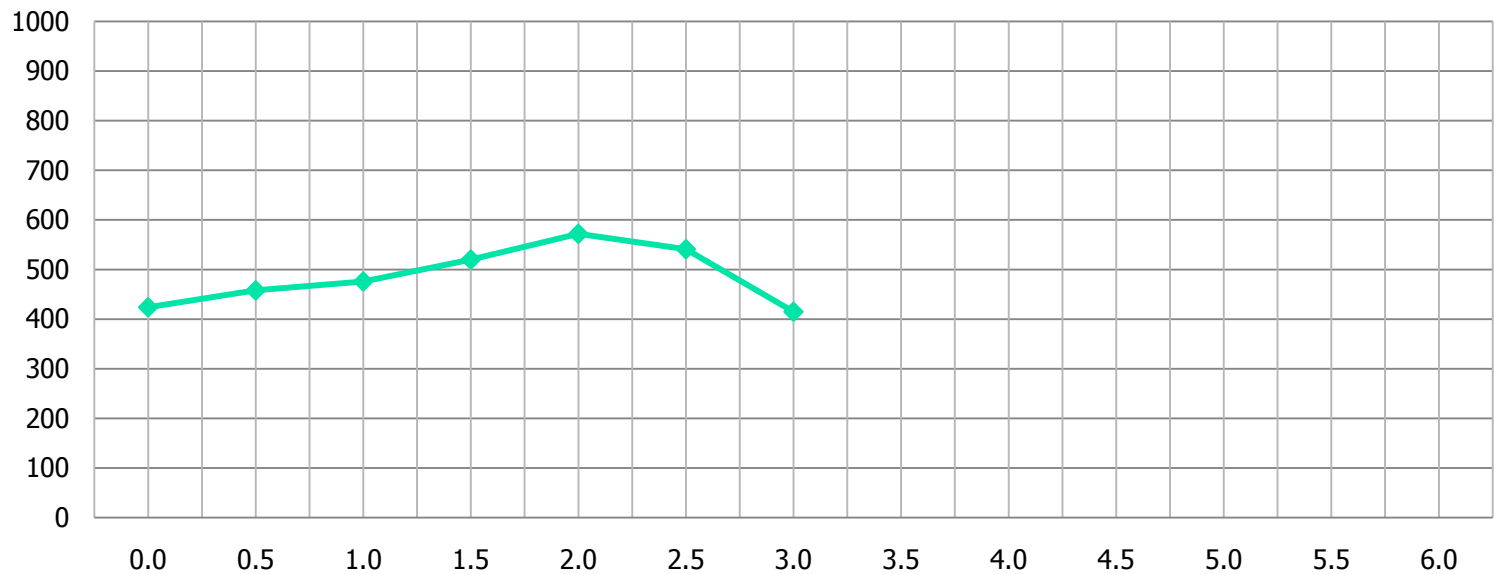
White Retroreflectivity





Yellow Thermoplastic Performance

Yellow Retroreflectivity



Series 1

Section 711:

Thermoplastic Pavement Markings

Field Installation - Concrete

- Before applying markings on concrete surface, apply a primer, sealer or surface preparation adhesive of the type recommended by the manufacturer.
- Apply markings only to dry surfaces.

Section 711:

Thermoplastic Pavement Markings

Improper Field Installation _Too Thin



Section 711:

Thermoplastic Pavement Markings

Improper Field Installation – Moisture in Concrete



Section 711:

Thermoplastic Pavement Markings

Improper Field Installation – Moisture in Concrete



Section 711:

Thermoplastic Pavement Markings

Improper Field Installation – Refurbishment Thermo



Section 711:

Thermoplastic Pavement Markings

Improper Field Installation – Refurbishment Thermo



Section 711: Thermoplastic Pavement Markings Improper Field Installation – Symbols





Section 711: Thermoplastic Pavement Markings Field Testing

- Contractor required to measure, record and certify on a Department approved form the retroreflectivity of white and yellow pavement markings and the thickness in accordance with Florida Method FM 5-541.
- The test readings should be representative of the Contractor's striping performance.
- Form No. 700-050-70



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of nine retroreflectivity measurements; three at beginning, middle and end of each one-mile section of line type.
 - Use the average of the measurements for acceptance.
 - Retroreflectivity measurements shall be taken in the direction of travel.



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum, one retroreflectivity measurement at one message, one symbol and one transverse line per intersection.
 - Take one measurement per mile for locations other than intersections (i.e. school messages, railroad messages, bike symbols measurements).
 - The measurements taken should be representative of the entire one-mile section.



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of one thickness measurement; one at beginning, middle and end of each one-mile section of longitudinal line type. Measurements for standard thermoplastic shall be performed using a three dial gauge.
 - Use the average of the measurements for acceptance.

FM 5-541





Thermoplastic Pavement Markings

Questions ???



Types of Marking Materials

- Paint
- Thermoplastic
- **Preformed Thermoplastic**



Preformed Thermoplastic Pavement Markings

Primary Uses:

- Exit Ramp Numbers
- Crosswalk Pavement Markings
- Bicycle Symbols
- Pavement Messages
- Horizontal Pavement Signing

Preformed Thermoplastic Markings



Preformed Thermoplastic Markings



Preformed Thermoplastic Markings



Preformed Thermoplastic Markings



Section 711: Preformed Thermoplastic Markings Field Installation





What are Components in Thermo?

1. Binder
2. Pigments
3. Glass Spheres
4. Fillers



Section 971: Preformed Thermoplastic Markings Material Specifications

- **Color**
 - a. Initial Cap Y - 55
 - b. End of Service Cap Y - 35
- **Reflectivity**
 - a. Initial (White) – 300 mcd
 - b. End of Service – 150 mcd (3 Years)
- **Skid Resistance**
 - a. Normal – 35 BPN
 - b. Pedestrians & Bicycle – 55 BPN



Section 711: Preformed Thermoplastic Markings Field Installation

- **QPL Materials**
- **Initial Retroreflectivity**
 - Standard White – 300 mcd
 - Pedestrian & Bicycle – 275 mcd
- **Layout**
 - In Accordance with Section 710-5
- **Surface**
 - Clean & Dry
 - Preheating (Some Products)



Critical Elements

- Surface Preparation
- Uniform Heat Application
- Sufficient Heat for Adhesion

Section 711: Preformed Thermoplastic Markings Field Installation



Section 711: Preformed Thermoplastic Markings Field Installation





Section 711: Preformed Thermoplastic Markings Field Testing

- Contractor required to measure, record and certify on a Department approved form the retroreflectivity of white pavement markings in accordance with Florida Method FM 5-541.
- Form No. 700-050-70



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum, one retroreflectivity measurement at one message, one symbol and one transverse line per intersection.
 - Take one measurement per mile for locations other than intersections (i.e. school messages, railroad messages, bike symbols measurements).
 - The measurements taken should be representative of the entire one-mile section.



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of one thickness measurement per batch of material.



Preformed Thermoplastic Markings

Questions ???



Types of Marking Materials

- Paint
- Thermoplastic
- Preformed Thermoplastic
- **Permanent Tapes**



Tape Pavement Markings

Primary Uses of High Performance:

- Longitudinal Lines on Concrete

Primary Uses of Standard Performance

- Transverse Lines on Concrete
- Messages and Symbols

High Performance Tape Markings





What are Components in Tapes?

1. Resins
2. Pigments
3. Glass Spheres or Reflective Elements
4. Fillers



Section 971:

High Performance Tape Markings

Material Specifications

- **Color**
 - a. Daytime Yellow – Color Box
 - b. Nighttime Yellow – Color Box

- **Reflectivity**
 - a. Initial (White) – 450 mcd
 - b. Initial (Yellow) – 350 mcd
 - c. Two Years (White) – 300 mcd
 - d. Two Years (Yellow) – 250 mcd
 - e. End of Service – 150 mcd (5 Years)



Section 971: Standard Performance Tape Markings Material Specifications

- **Color**
 - a. Daytime Yellow – Color Box
 - b. Nighttime Yellow – Color Box

- **Reflectivity**
 - a. Initial (White) – 300 mcd
 - b. Initial (Yellow) – 250 mcd
 - c. End of Service – 150 mcd (3 Years)



Section 971: Tape Pavement Markings Material Specifications

- **Skid Resistance**
 - a. Normal – 35 BPN
 - b. Pedestrians & Bicycle – 55 BPN



Section 713: Tape Pavement Markings Field Installation

- **QPL Materials**
- **High Performance Retroreflectivity**
 - White – 450 mcd
 - Yellow – 350 mcd
- **Standard Retroreflectivity**
 - White – 300 mcd
 - Yellow – 250 mcd
- **Layout**
 - In Accordance with Section 710-5
- **Surface**
 - Clean & Dry



Section 713: Tape Pavement Markings Field Installation

- **Surface**
 - Clean & Dry



Critical Elements

- Clean the Surface
(Removal of Existing Marking)
- No Moisture
- Application of Adhesion
- Tamping of Tape

Section 713: Tape Pavement Markings Field Installation



Section 713: Tape Pavement Markings Field Installation



Section 713: Tape Pavement Markings Field Installation



Section 713: High Performance Tape Markings Field Installation - Mobile



Section 713: Tape Pavement Markings Field Installation





Section 713: Tape Pavement Markings Field Testing

- Contractor required to measure, record and certify on a Department approved form the retroreflectivity of white and yellow pavement markings and the thickness in accordance with Florida Method FM 5-541.
- Form No. 700-050-70



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of nine retroreflectivity measurements; three at beginning, middle and end of each one-mile section of line type.
 - Use the average of the measurements for acceptance.
 - Retroreflectivity measurements shall be taken in the direction of travel.



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of one thickness measurement per batch of material.



Tape Pavement Markings

Questions ???



Types of Marking Materials

- Paint
- Thermoplastic
- Preformed Thermoplastic
- High Performance Tapes
- Audible & Vibratory Markings



All Crashes
1,578,550 (2002-2006)

Lane Departure
733,482
46.47%

Other
845,068
53.53%

State Highway System
290,612
39.62%

Off-System
442,870
60.38%



Fatality Statistics

Year	Total Fatalities	SHS Lane Departure Fatalities
2002	3,142	1,220
2003	3,185	1,224
2004	3,260	1,262
2005	3,533	1,378
2006	3,365	1,282



Audible & Vibratory Policy

- Edge lines on all two-lane and multi-lane flush shoulder rural roads with posted speed of 50 mph or greater.
- Only on centerlines of two-lane rural roads with history of centerline cross over crashes.



Audible & Vibratory Pavement Markings

Primary Use:

- Longitudinal Edge Lines

Audible & Vibratory Markings

Ennis Product



Audible & Vibratory Markings

Crown Product



Audible & Vibratory Markings

Ground-in Rumble Stripe





Components in Audible & Vibratory Markings?

1. Binder
2. Pigments
3. Glass Spheres
4. Fillers



Section 971: Audible & Vibratory Markings Material Specifications

- **Color**
 - a. Daytime Yellow – Color Box
 - b. Nighttime Yellow – Color Box

- **Reflectivity**
 - a. Initial (White) – 300 mcd
 - b. Initial (Yellow) – 250 mcd
 - c. End of Service – 150 mcd (3 Years)



Section 971: Audible & Vibratory Markings Material Specifications

- **Bump Height**
 - a. 0.45 inches

- **Reflectivity**
 - a. Initial (White) – 300 mcd
 - b. Initial (Yellow) – 250 mcd
 - c. End of Service – 150 mcd (3 Years)



Section 701: Audible & Vibratory Markings Field Installation

- **QPL Materials**
- **Initial Retroreflectivity**
 - White – 300 mcd
 - Yellow – 250 mcd
- **Layout**
 - In Accordance with Section 710-5
- **Thickness**
 - 100 mils
 - 50 mils Max. (Baseline of Profiled Products)
 - 110 mils Avg. (Top of Profiles of Profiled Products)



Section 701: Audible & Vibratory Markings Field Installation

- **Bump**
 - 450 mils Above Surface
- **Bump Spacing**
 - 30"
- **Front or Rear Slope of Bump**
- **Bump Loss**
 - 1% in First 45 Days



Critical Elements

- Thickness of Baseline (Crown Product)
- Height of Bump (Ennis Product)

Section 701: Audible & Vibratory Markings Field Installation - Ennis Product



Section 701: Audible & Vibratory Markings Field Installation - Ennis Product



Section 701: Audible & Vibratory Markings Field Installation - Ennis Product



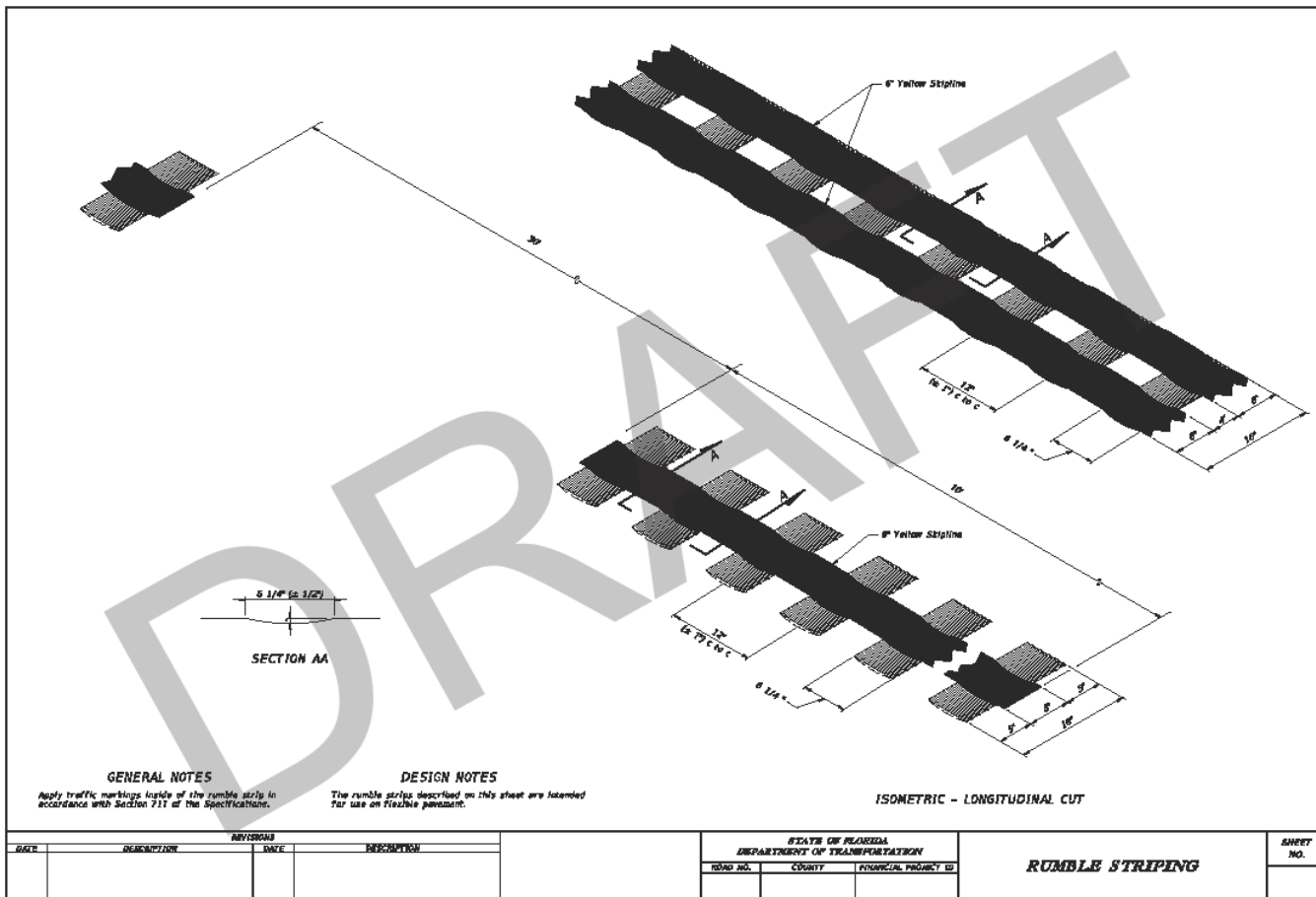
Section 701: Audible & Vibratory Markings Field Installation - Crown Product



Section 701: Audible & Vibratory Markings Field Installation - Crown Product



Section 701: Audible & Vibratory Markings Field Installation - Ground-in Rumble Stripe



Section 701: Audible & Vibratory Markings

Field Installation - Ground-in Rumble Stripe



Section 701: Audible & Vibratory Markings

Field Installation - Ground-in Rumble Stripe



Section 701: Audible & Vibratory Markings

Field Installation - Ground-in Rumble Stripe



Section 701: Audible & Vibratory Markings

Field Installation - Ground-in Rumble Stripe



Section 701: Audible & Vibratory Markings

Field Installation - Ground-in Rumble Stripe





Section 701: Audible & Vibratory Markings Field Testing

- Contractor required to measure, record and certify on a Department approved form the retroreflectivity of white and yellow pavement markings and the thickness in accordance with Florida Method FM 5-541.
- Contractor required to measure, record and certify on a Department approved form the loss after – days.
- Form No. 700-050-70



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of nine retroreflectivity measurements; three at beginning, middle and end of each one-mile section of line type.
 - Use the average of the measurements for acceptance.
 - Retroreflectivity measurements shall be taken in the direction of travel.



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of three thickness measurement per mile.



Audible & Vibratory Markings

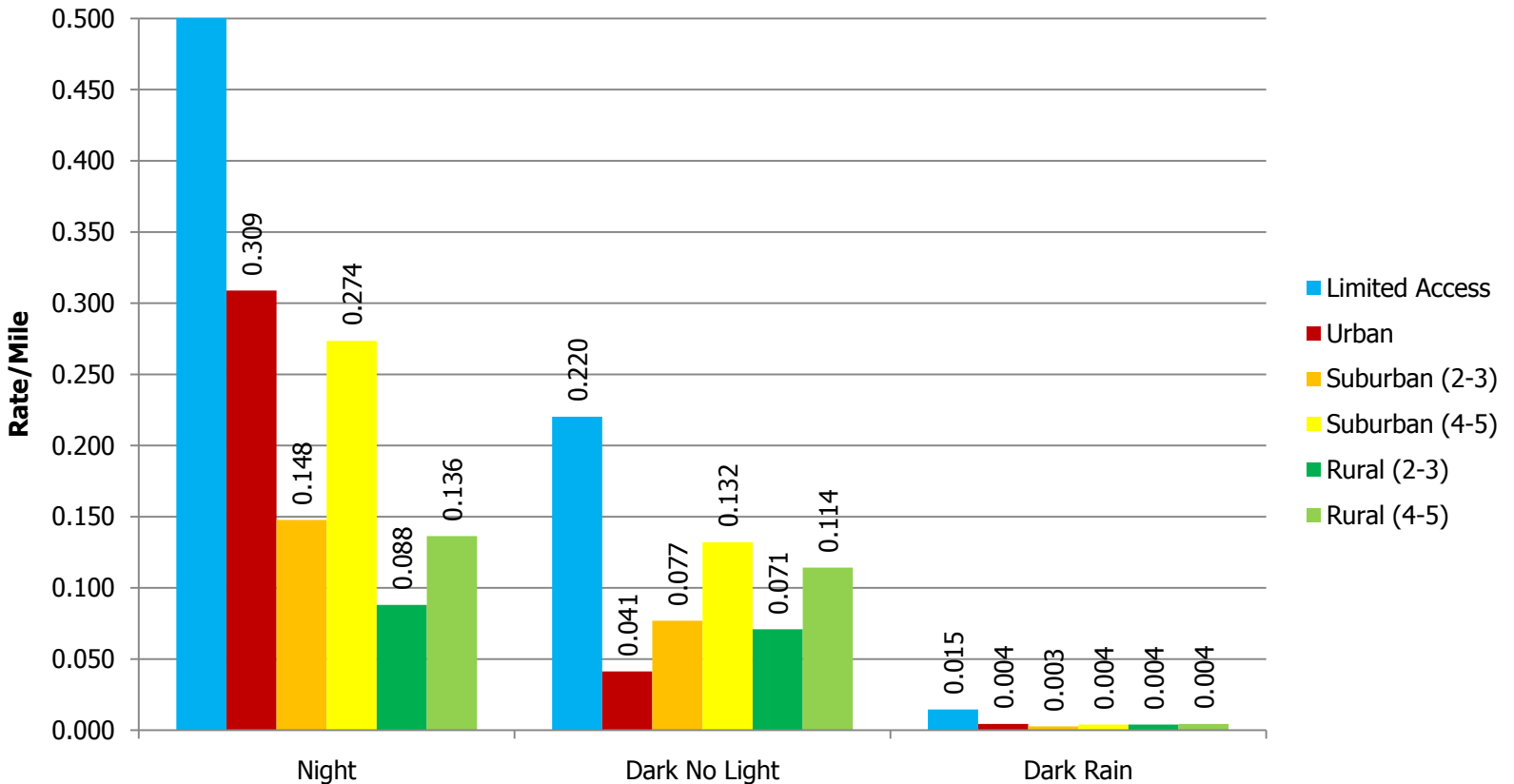
Questions ???



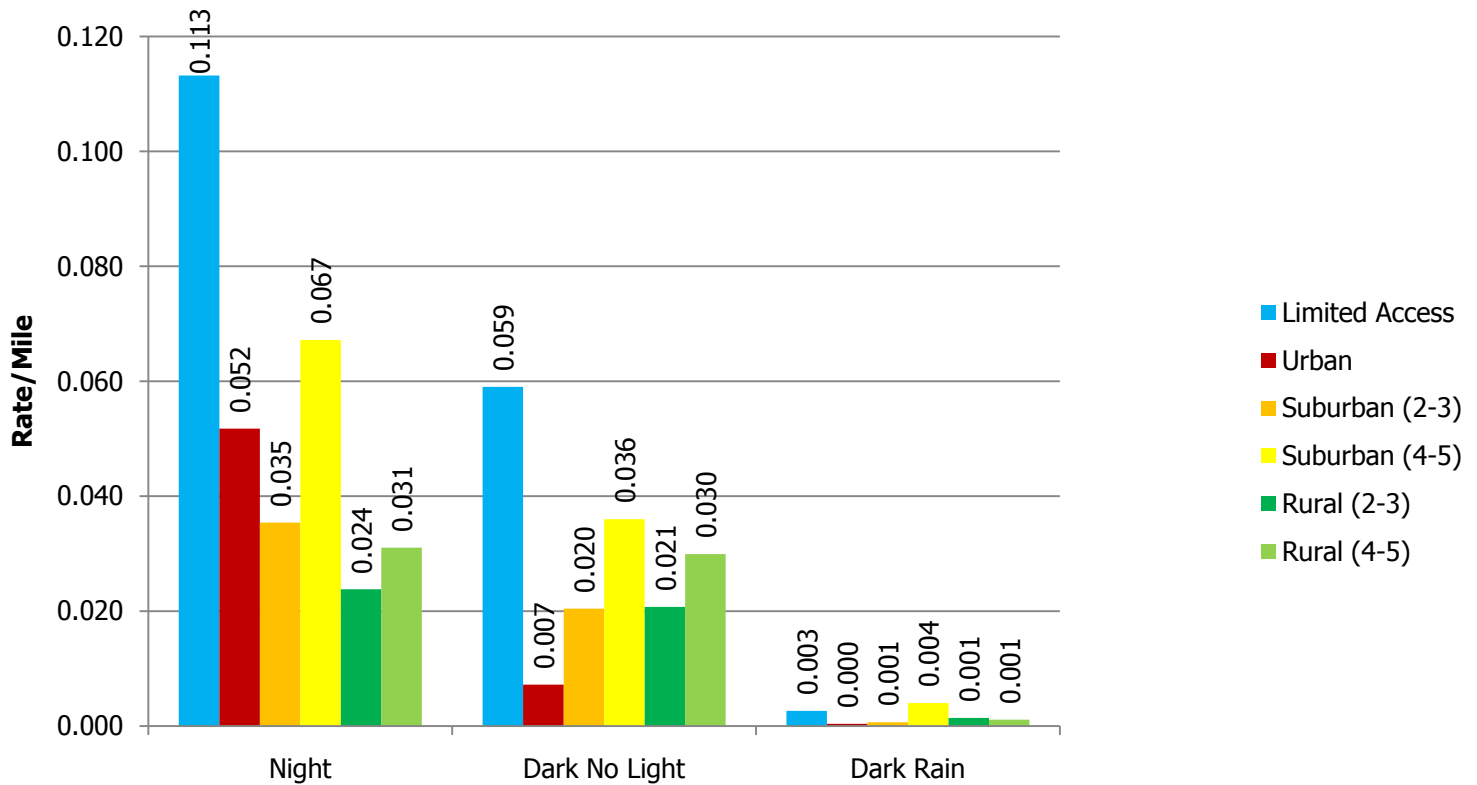
Types of Marking Materials

- Paint
- Thermoplastic
- Preformed Thermoplastic
- High Performance Tapes
- Audible & Vibratory Markings
- **Wet Weather Markings**

Serious Injury Rates/Mile



Fatality Rates/Mile





Wet Weather Policy

- Only on rural roads with history of nighttime wet weather crashes where no lighting is installed.



Wet Weather Pavement Markings

Primary Use:

- Longitudinal Lines

Wet Weather Markings

3M Product





Components in Wet Weather Markings?

1. Binder
2. Pigments
3. Glass Spheres and/or Reflective Elements
4. Fillers



Section 971: Wet Weather Markings Material Specifications

- **Color**

- a. Daytime Yellow – Color Box
- b. Nighttime Yellow – Color Box

- **Reflectivity**

- a. Initial Dry (White) – 300 mcd
- b. Initial Dry (Yellow) – 250 mcd
- c. Initial Wet Recovery (White) – 150 mcd
- d. Initial Wet Recovery (Yellow) – 125 mcd



Section 971: Wet Weather Markings Material Specifications

- **Reflectivity**
 - e. End of Service (Dry) – 150 mcd (3 Years)
 - f. End of Service Wet Recovery – 75 mcd (3 Years)



Section 702: Wet Weather Markings Field Installation

- **QPL Materials**
- **Initial Dry Retroreflectivity**
 - White – 300 mcd
 - Yellow – 250 mcd
- **Initial Wet Recovery Retroreflectivity**
 - White – 150 mcd
 - Yellow – 125 mcd
- **Layout**
 - In Accordance with Section 710-5



Section 702: Wet Weather Markings Field Installation

- **Thickness**
 - 100 mils
 - 50 mils Max. (Baseline of Profiled Products)
 - 110 mils Avg. (Top of Profile for Profiled Products)
- **Bump Height**
 - 450 mils
- **Bump Loss**
 - 1% in First 45 Days
- **Layout**
 - In Accordance with Section 710-5



Critical Elements

- Thickness of Baseline (Crown Product)
- Height of Bump (Ennis Product)



Section 702: Wet Weather Markings Field Testing

- Contractor required to measure, record and certify on a Department approved form the dry and wet retroreflectivity of white and yellow pavement markings and the thickness in accordance with Florida Method FM 5-541.
- Contractor required to measure, record and certify on a Department approved form the loss after 45 days.
- Form No. 700-050-70



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of nine dry retroreflectivity measurements; three at beginning, middle and end of each one-mile section of line type.
 - Perform a minimum of nine wet retroreflectivity measurements; three at beginning, middle and end of each one-mile section of line type. Use ASTM E 2177 (Bucket Method).
 - Use the average of the measurements for acceptance.



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Retroreflectivity measurements shall be taken in the direction of travel.
 - Perform a minimum of three thickness measurement per mile.



Wet Markings

Questions ???



Types of Marking Materials

- Paint
- Thermoplastic
- Preformed Thermoplastic
- High Performance Tapes
- Audible & Vibratory Markings
- Wet Weather Markings
- **Two Component Reactive**



Types of Two Component Reactive Pavement Markings

- Epoxies
- Polyureas
- Modified Urethanes
- Methyl Methacrylates



Characteristics of Various Two Component Markings

- Epoxy's
 - Great Durability
 - Good Adhesion
 - Not UV Resistant
 - Long Cure Times



Characteristics of Various Two Component Markings

- Modified Urethane's
 - Good Durability
 - Good Adhesion
 - UV Resistant
 - 2–5 min. Set to Bare
 - Excellent Wicking



Characteristics of Various Two Component Markings

- Polyurea's
 - Good Durability
 - Good Adhesion
 - UV Resistant
 - 2–5 min. Set to Bare (Varies By Product)
 - Surface Preparation (Concrete)



Characteristics of Various Two Component Markings

- Methyl Methacrylate's
 - Outstanding Durability
 - Great Adhesion
 - UV Resistant
 - Flat or Structured Line
 - 15 min. Set to Bare

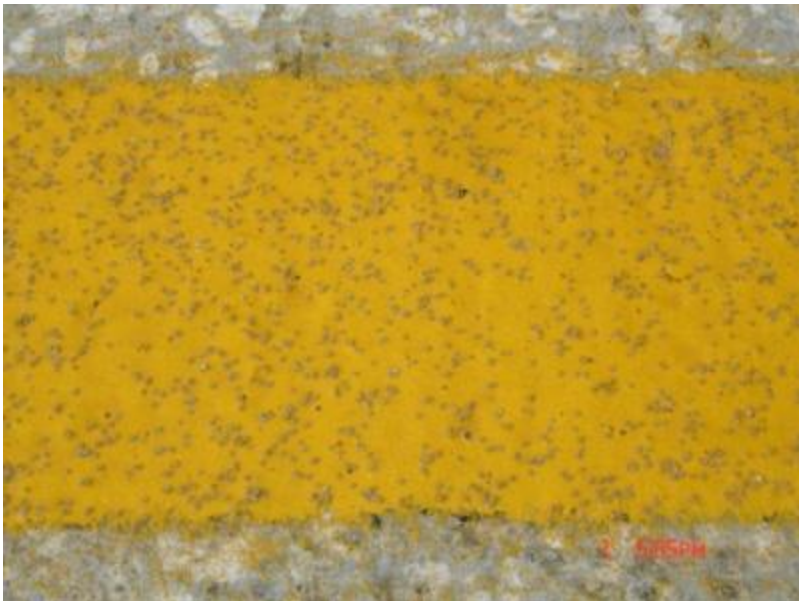


Two Component Reactive Pavement Markings

Primary Use:

- Longitudinal Lines

Two Component Reactive Markings On Concrete



Two Component Reactive Markings On Asphalt





Components in Two Component Reactive Markings?

1. Active Resin
2. Catalyst or Hardener
3. Pigments
4. Glass Spheres and/or Reflective Elements

Section 971:

Two Component Reactive Markings Material Specifications

- **Color**

- a. Daytime Yellow – Color Box
- b. Nighttime Yellow – Color Box

- **Reflectivity**

- a. Initial Dry (White) – 450 mcd
- b. Initial Dry (Yellow) – 350 mcd
- c. End of Service (Dry) – 150 mcd (3 Years) .



Section 709:

Two Component Reactive Markings

Field Installation

- **QPL Materials**
- **Initial Dry Retroreflectivity**
 - White – 450 mcd
 - Yellow – 350 mcd
- **Layout**
 - In Accordance with Section 710-5

Section 709: Two Component Reactive Markings Field Installation





Critical Elements

- Surface Preparation (Concrete)
- Protection Until Cured

Section 709:

Two Component Reactive Markings

Field Testing

- Contractor required to measure, record and certify on a Department approved form the retroreflectivity of white and yellow pavement markings in accordance with Florida Method FM 5-541.
- Form No. 700-050-70



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Perform a minimum of nine dry retroreflectivity measurements; three at beginning, middle and end of each one-mile section of line type.
 - Perform a minimum of nine dry retroreflectivity measurements; three at beginning, middle and end of each one-mile section of line type.
 - Use the average of the measurements for acceptance.



FM 5-541

- Field Evaluation of Traffic Marking Materials
 - Part A – Project Based Testing
 - Retroreflectivity measurements shall be taken in the direction of travel.
 - Perform a minimum of three thickness measurement per mile.



Two Component Reactive Markings

Questions ???