

MICROFILMED
APR 2 0 1984

GENERAL NOTES

FHWA REGION	STATE	PROJECT	
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LAKE COUNTY
LAK - 84-14.48

ITEM 847- PAVEMENT MARKINGS, 847.10, AS PER PLAN

MATERIALS

THE CONTRACTOR SHALL PROVIDE STORAGE FOR ALL MATERIALS AND SHALL TRANSPORT MATERIALS TO THE SITE WHERE USED. GLASS BEADS SHALL BE KEPT DRY DURING STORAGE AND PRIOR TO USE.

PAVEMENT PREPARATION

SURFACE PREPARATION FOR PREFORMED PLASTIC MATERIAL SHALL BE AS PER 847.15 AND, IN ADDITION, THE PAVEMENT SURFACE SHALL BE CLEANED BY A JET OF COMPRESSED AIR PRIOR TO MATERIAL APPLICATION.

PAVEMENT FOR PAVEMENT PREPARATION SHALL BE INCIDENTAL TO THE APPLICATION OF AUXILIARY MARKINGS.

PREFORMED PLASTIC MATERIAL AND APPLICATION

PREFORMED PLASTIC MARKING MATERIAL SHALL BE OF THE FOLLOWING TYPE. THE MARKINGS SHALL BE PREFABRICATED PLASTIC CONSISTING OF WHITE OR YELLOW PIGMENTED PLASTIC WITH REFLECTIVE GLASS SPHERES UNIFORMLY DISTRIBUTED THROUGHOUT THEIR ENTIRE CROSS-SECTIONAL AREA AND WHICH ARE CAPABLE OF BEING AFFIXED TO BITUMINOUS PAVEMENTS BY A PRESSURE SENSITIVE PRECOATED ADHESIVE. THE MARKINGS SHALL BE PROVIDED COMPLETE IN A FORM THAT WILL FACILITATE RAPID APPLICATION AND PROTECTION OF THE MARKINGS DURING SHIPMENT AND STORAGE. SOLVENTS AND/OR ADHESIVES TO BE APPLIED AT THE TIME OF APPLICATION, ALL EQUIPMENT NECESSARY FOR PROPER APPLICATION, AND RECOMMENDATIONS FOR APPLICATION THAT WILL ASSURE AN EFFECTIVE PERFORMANCE LIFE SHALL BE IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. THE MARKINGS SHALL BE MANUFACTURED AND PACKAGED IN SUCH A MANNER TO PERMIT STORAGE AT NORMAL SHELF TEMPERATURES FOR PERIODS OF UP TO ONE YEAR AFTER PURCHASE. THE MARKING MATERIAL SHALL MOLD ITSELF TO PAVEMENT CONTOURS, BREAKS, FAULTS, AND THE LINE, BY ACTION OF TRAFFIC AT NORMAL PAVEMENT TEMPERATURES. THE PLASTIC SHALL HAVE RESEALING CHARACTERISTICS SO THAT IT WILL FUSE WITH ITSELF AND WITH PREVIOUSLY APPLIED MARKING MATERIALS OF THE SAME COMPOSITION UNDER NORMAL CONDITIONS OF USE.

TYPE 1 - 60 MIL RETROREFLECTIVE PLIANT POLYMER

TYPE 2 - 60 OR 90 MIL PREFORMED PLASTIC

TYPE 1 - 60 MIL RETROREFLECTIVE PLIANT POLYMER:

THE MARKING FILM SHALL BE RETROREFLECTIVE PLIANT POLYMER FILM OF TWO CLASSES FOR VARIOUS APPLICATIONS AS SPECIFIED:

CLASS 2 - FILM WITH PRECOATED PRESSURE SENSITIVE ADHESIVE, WITHOUT PROTECTION LINER, FOR LINE TYPE MARKINGS.

CLASS 3 - FILM WITH OR WITHOUT PRECOATED PRESSURE SENSITIVE ADHESIVE PROTECTED BY EASILY REMOVABLE LINER, FOR SYMBOL AND LEGEND MARKINGS.

A. COMPOSITION: THE RETROREFLECTIVE PLIANT POLYMER PAVEMENT MARKING FILM SHALL CONSIST OF A MIXTURE OF HIGH QUALITY POLYMERIC MATERIALS, PIGMENTS, 1.5 INDEX GLASS BEADS UNIFORMLY DISTRIBUTED THROUGHOUT ITS BASE CROSS-SECTIONAL AREA AND WITH A REFLECTIVE LAYER OF BEADS BONDED TO THE TOP SURFACE. THE FILM SHALL BE COMPOSED OF THE FOLLOWING MATERIALS:

MATERIAL	MINIMUM PERCENT BY WEIGHT
RESINS & PLASTICIZERS	20
PIGMENTS	30
GRADED GLASS BEADS	33

THIS FILM SHALL BE CAPABLE OF BEING FABRICATED INTO PAVEMENT MARKINGS OF SPECIFIED DIMENSIONS AND OF BEING ADHERED TO ASPHALT BY MEANS OF A PRESSURE SENSITIVE PRECOATED ADHESIVE, OR A LIQUID CONTACT CEMENT WHICH IS APPLIED AT THE TIME OF INSTALLATION.

- B. APPLICABILITY TO PAVEMENT SURFACES: THE CLASS 2 AND CLASS 3 PAVEMENT MARKING FILMS SHALL BE CAPABLE OF APPLICATION TO NEW, DENSE AND OPEN GRADED ASPHALT CONCRETE WEARING COURSES DURING THE PAVING OPERATION IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. WHEN APPLIED TO STABLE EXISTING ASPHALT PAVEMENTS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, ALL CLASSES OF THE PAVEMENT MARKING FILM SHALL BE CAPABLE OF CONFORMING TO PAVEMENT CONTOURS THROUGH THE ACTION OF TRAFFIC AT NORMAL PAVEMENT TEMPERATURES.
- C. TENSILE STRENGTH: THE FILM SHALL HAVE A MINIMUM TENSILE STRENGTH OF 40 POUNDS PER SQUARE INCH OF CROSS-SECTION WHEN TESTED ACCORDING TO ASTM D638-76. A SAMPLE 6" x 1" x 0.06" SHALL BE TESTED AT A TEMPERATURE BETWEEN 70 F AND 80 F USING A JAW SPEED OF 12 INCHES PER MINUTE.
- D. ELONGATION: THE FILM SHALL HAVE A MINIMUM ELONGATION OF 75% AT BREAK WHEN TESTED ACCORDING TO ASTM D638-76 USING A JAW SPEED OF 12 INCHES PER MINUTE.
- E. PIGMENTATION: THE PIGMENTS SHALL BE SELECTED AND BLENDED TO PROVIDE A MARKING FILM WHICH IS WHITE OR YELLOW CONFORMING TO STANDARD HIGHWAY COLORS THROUGH THE EXPECTED LIFE OF THE FILM. THE WHITE MARKING FILM SHALL BE FREE FROM TINT AND HAVE A DAYLIGHT REFLECTANCE (45-0 DEGREES) NOT LESS THAN 75 PERCENT OF THAT OF MAGNESIUM OXIDE. THE YELLOW MARKING FILM SHALL CONFORM TO NO. 33538 OF FEDERAL STANDARD NO. 595, WITHIN 6.0 N.B.S. UNITS.
- F. GLASS BEADS: THE SIZE AND QUALITY OF THE BEADS WILL BE SUCH THAT PERFORMANCE REQUIREMENTS FOR THE RETROREFLECTIVE PLIANT POLYMER FILM SHALL BE MET.

THE FILM SHALL HAVE GLASS BEAD RETENTION QUALITIES SUCH THAT WHEN A 2" x 6" SAMPLE IS BENT OVER A 1/2" DIAMETER MANDREL, WITH THE 2" DIMENSION PERPENDICULAR TO THE MANDREL AXIS, MICROSCOPIC EXAMINATION OF THE AREA ON THE MANDREL SHALL SHOW NO MORE THAN 10% OF THE BEADS WITH ENTRAPMENT BY THE BINDER OF LESS THAN 40%.

THE GLASS BEAD INDEX OF REFRACTION, % ROUNDS BY COUNT AND SIEVE GRADATION, SHALL BE AS FOLLOWS:

DROP-ON GLASS

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|------------------------|----------------------|
| 1. INDEX OF REFRACTION | 1.50 MIN., 1.60 MAX. |
| 2. % ROUNDS BY COUNT | 70% MIN. |
| 3. SIEVE SIZE | |
| % PASSING 40 MESH | 80-100% |
| % PASSING 80 MESH | 0-20% |

IN-MIX GLASS:

- | | |
|---------------------------------|----------------------|
| 1. INDEX OF REFRACTION | 1.50 MIN., 1.60 MAX. |
| 2. % ROUNDS BY COUNT | 70% |
| 3. SIEVE SIZE | |
| % PASSING 30 MESH | 100% (APPROX.) |
| % PASSING 140 MESH | 25% (MAXIMUM) |
| 4. % GLASS IN FORMULA BY WEIGHT | MIN. 30% |

G. REFLECTIVITY RETENTION: TO HAVE A GOOD, EFFECTIVE PERFORMANCE LIFE, THE GLASS BEADS MUST BE STRONGLY BONDED AND NOT BE EASILY REMOVED BY TRAFFIC WEAR. THE FOLLOWING TESTS SHALL BE EMPLOYED TO MEASURE REFLECTIVITY RETENTION:

- 1. TABER ABRASER SIMULATION TEST
USING A TABER ABRASER WITH AN H-19 WHEEL AND A 125 GRAM LOAD, THE SAMPLE SHALL BE INSPECTED AT 200 CYCLES, UNDER A MICROSCOPE, TO OBSERVE THE EXTENT AND TYPE OF BEAD FAILURE. NO MORE THAN 15% OF THE BEADS SHALL BE LOST DUE TO POP-OUT AND THE PREDOMINANT MODE OF FAILURE SHALL BE "WEAR DOWN" OF THE BEADS.
- 2. QUALITATIVE TESTS
BEAD BOND STRENGTHS SHALL BE JUDGED UNDER A MICROSCOPE WITH A MAGNIFICATION OF AT LEAST 5X. THE BEADS SHALL BE DIFFICULT TO REMOVE, AND WHEN REMOVED, BEATS SHALL SHOW A PORTION OF THE POLYMERIC BEAD BOND RETAINED WITH THE BEADS RATHER THAN CLEAN REMOVAL FROM THE SOCKETS.
- H. THICKNESS: THE RETROREFLECTIVE PLIANT POLYMER FILM, WITHOUT ADHESIVE, SHALL BE SUPPLIED IN A MINIMUM THICKNESS OF 0.055 INCHES.
- I. EFFECTIVE PERFORMANCE LIFE: THE FILM, WHEN APPLIED ACCORDING TO THE RECOMMENDATIONS OF THE MANUFACTURER, SHALL PROVIDE A NEAT, DURABLE MARKING THAT WILL NOT FLOW OR DISTORT DUE TO TEMPERATURE IF THE PAVEMENT SURFACE REMAINS STABLE. ALTHOUGH REFLECTIVITY IS REDUCED BY WEAR, THE PLIANT POLYMER SHALL PROVIDE A CUSHIONED, RESILIENT SUBSTRATE THAT REDUCES BEAD CRUSHING AND LOSS. THE FILM SHALL BE WEATHER RESISTANT AND, THROUGH NORMAL TRAFFIC WEAR, SHALL SHOW NO APPRECIABLE FADING, LIFTING OR SHRINKAGE THROUGHOUT THE USEFUL LIFE OF THE MARKING, AND SHALL SHOW NO SIGNIFICANT TEARING, ROLL BACK, OR OTHER SIGNS OF POOR ADHESION.

TYPE 2 - 60 OR 90 MIL PREFORMED PLASTIC:

THE TYPE 2 PREFORMED PLASTIC MATERIAL SHALL CONFORM TO 847, EXCEPT AS PROVIDED HEREIN. IN LIEU OF THE REQUIREMENTS OF PARAGRAPHS 2 AND 5 OF 847.10, THE FOLLOWING SHALL APPLY: PREFORMED MATERIAL SHALL PROVIDE THE COLORS SPECIFIED IN 847.07 AND, WHEN WHITE, SHALL CONTAIN TITANIUM DIOXIDE CONFORMING TO ASTM D 476 TYPE IV. THE MATERIAL SHALL CONTAIN GLASS BEADS WHICH SHALL BE UNIFORMLY DISTRIBUTED THROUGHOUT AND EMBEDDED IN THE SURFACE. THE MATERIAL SHALL BE OF GOOD APPEARANCE, FREE OF CRACKS, AND WITH EDGES WHICH ARE STRAIGHT, TRUE AND UNBROKEN.

THE MATERIAL SHALL HAVE A THICKNESS OF NOT LESS THAN 60 MILS, NOT INCLUDING THE PRECOATED ADHESIVE LAYER. THE MATERIAL SHALL BE FURNISHED IN TAPE OR ROLL FORM FOR PAVEMENT LINES AND IN PRECUT SHEETS OR PIECES FOR THE VARIOUS SYMBOLS AND LETTERS. THE MATERIAL MAY BE FURNISHED IN PRECUT SMALL SHAPES SUCH AS SQUARES, DISCS, AND RECTANGLES FOR STOP AND CROSSWALK LINES, ETC.

IN ADDITION TO THE REQUIREMENTS OF 847, THE FOLLOWING REQUIREMENTS SHALL APPLY: IN TABLE 7, THE PERCENT BY WEIGHT OF THE GLASS BEAD INGREDIENT OF PREFORMED PLASTIC MATERIAL SHALL INCLUDE ALL SURFACE AND INTERNAL GLASS BEADS. NOT LESS THAN ONE (1) PERCENT NOR MORE THAN THREE (3) PERCENT OF THE MATERIAL, BY WEIGHT, SHALL BE SURFACE EMBEDDED GLASS BEADS.

IN LIEU OF PARAGRAPH 13 OF 847.10 THE RETENTION OF GLASS BEADS WILL BE DETERMINED AS FOLLOWS. A 2 BY 6-INCH SPECIMEN WILL BE PLACED ON A 1/2-INCH MANDREL, AND AT A TEMPERATURE OF 75 ± 5F, WILL BE BENT UNTIL THE SPECIMEN FORMS AN INVERTED "U" WITH PARALLEL PLANES 1/2 INCH APART. A 1/2-INCH STRIP MASKING TAPE WILL BE FIRMLY APPLIED TO THE MAXIMUM BEND AREA AND THEN PEELLED OFF. ANY SIGNIFICANT TRANSFER OF BEADS FROM THE PERFORMED MATERIAL TO THE TAPE SHALL BE CAUSE FOR REJECTION OF THE MATERIAL.