

**STATE**

**OF**

**TENNESSEE**

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March 3, 1995

**Supplemental Specifications - Section 900**  
**of the**  
**Standard Specifications for Road and Bridge Construction**  
**March 1, 1995**

**Subsection 901.01**, replace the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> paragraphs with the following:

**901.01 Hydraulic cement.** Hydraulic cement shall conform to the requirements of the following cited specifications for the kind and type specified or permitted and be from an approved source.

Kind	Specification
Portland Cement	AASHTO M-85
Slag-modified Portland Cement Type I-SM	AASHTO M-240

Type I or Type I-SM cement shall be used unless otherwise specified. Different types of cement shall not be mixed.

**Subsection 903.03**, add the following to the last sentence of the second paragraph:

or a size no. 467, manufactured within the specified limits of Subsection 903-22.

**Subsection 903.06 (a)**, 1<sup>st</sup> paragraph, 2<sup>nd</sup> sentence, remove the words “**on limestone**”.

**Subsection 903.06 (b)**, 1<sup>st</sup> paragraph, add the following words:

Fine aggregate or screenings containing Calcium Sulfate(CaSO<sub>4</sub>/gypsum) will not be allowed if more than 5% of the material passing the #8 sieve is chemically composed of Sulfur Trioxide(SO<sub>3</sub>)

**Subsection 903.06 (c)**-Revise the “HOT MIX LEVELING COURSE MIXTURE DESIGN RANGE OF GRADATIONS” table as follows:

**HOT PLANT MIX LEVELING COURSE  
MIXTURE DESIGN RANGE OF GRADATIONS**

Total Per Cent Passing, by Weight

Sieve Size	Grading B-M	Grading B-M2*	Grading C	Grading C-W	Grading C-S
31.75mm (1-1/4")	-	100	-	-	-
25 mm (1")	100	-	-	-	-
19 mm (3/4")	85-100	81-93	100	100	-
9.5 mm (3/8")	59-79	57-73	70-90	75-100	100
4.75 mm (No. 4)	42-61	40-56	39-66	-	89-94
2.36 mm (No. 8)	29-47	28-43	23-47	43-67	53-77
600 µm (No. 30)	13-27	13-25	10-27	23-47	23-42
300 µm (No. 50)	7-20	9-19	8-15	-	-
150 µm (No. 100)	4-10	6-10	4-8	4-10	9-18
75 µm (No. 200)	0-6.5	2.5-6.5	2.5-6.5	2.5-6.5	6-13.5

\*When natural sand is used as fine aggregate, it shall be limited to a maximum amount of twenty percent(20%) by weight of the mineral aggregate.

**Subsection 903.11(a) (1)**, revise the sentence to read:

- (1) All aggregate shall have a sodium sulfate soundness loss not exceeding nine percent.

**Subsection 903.11(a) (3)**, revise the first sentence to read:

Crushed aggregate shall consist of siliceous particles processed from washed material, of which at least seventy per cent by count, of the material retained on the 4.75 millimeter (No. 4) sieve shall have a minimum of two fractured faces, one of which must be fractured for the approximate average diameter or thickness of the particle.

...and the last sentence of that same paragraph to read:

The absorption of the crushed combined aggregate retained on the 4.75 millimeter (No. 4) sieve shall not exceed five per cent when tested in accordance with AASHTO T 85.

**Subsection 903.11 (b)**, 1<sup>st</sup> paragraph, add the following words:

Fine aggregate or screenings containing Calcium Sulfate(CaSO<sub>4</sub>/gypsum) will not be allowed if more than 5% of the material passing the #8 sieve is chemically composed of Sulfur Trioxide(SO<sub>3</sub>)

**Subsection 903.11(c) (1)** for Type 1 aggregate: lower the Silica Dioxide content minimum from 50% to 40%, and in paragraph 2 of this same subsection, change the minimum British Pendulum (Tester) number from 33 to 30.

Revise the heading of number (3) under Grading D of **Subsection 903.11(c)** to read as follows:

(3) Type III (for roads with current ADT of 15,000 or less excluding interstates).

Delete the following paragraph at the end of **Subsection 903.11(c)**:

In **Subsection 903.11** under Grading D mixes, for Type 1, 2, and 3, reword the first paragraph under each mix to read as follows:

The coarse aggregate shall contain a minimum of 50% by weight of acid insolubles that are coarser than the 150 μm (No. 100) mesh sieve when tested in accordance with ASTM D 3042.

The minimum percentage mentioned in these paragraphs shall be 50% for Type I, 35% for Type II and 25% for Type III

Add the following before the last paragraph in **Subsection 903.11(c), Grading D**,

(4) Type IV (for two land roads with a current ADT of 5,000 or less:

Silica Dioxide content- minimum of 10% (test method ASTM C-25)

The British Pendulum (Tester) number BPN shall not be less than 22 when tested in accordance with AASHTO T-278 after nine hours of accelerated polishing using the British Wheel in accordance with AASHTO T-279.

The coarse aggregate must have a minimum Tennessee Terminal Textural Condition (TTTCM) value of 42.5 when tested in accordance with the method developed by the Tennessee Technological University.

In addition to the above requirements, the aggregate shall have met the pre-approval process of the Division of Materials and Tests. The aggregate must also maintain a satisfactory level of field performance to remain an approved source.

The material shall be processed and stockpiled as an independent and separate operation. Each stockpile will be sampled and tested for approval prior to use.

Replace **Section 904.01** in its entirety with the following:

**904.01-Asphalt Cements.**

*Asphalt cement used on TDOT projects shall only be from Certified Asphalt Suppliers that have an approved Quality Control Plan in accordance with TDOT Standard Operating Procedures.*

*Asphalt cement shall conform to the requirements of AASHTO M 320 and in accordance with TDOT procedures. The solubility of base asphalt cement as required in AASHTO M 320 must be reported for information every 3 months in the suppliers' quality control program. In lieu of PG 64-22 when specified, asphalt cement graded to PG 67-22 may be used. PG 67-22 shall conform to the requirements of AASHTO M 320 when all applicable tests are conducted at 67° C and -12° C, and the dynamic shear of the rolling thin film, pressure aged vessel sample shall be tested at 26.5° C.*

*Modification of the asphalt shall be accomplished by properly blending styrene butadiene (SB), styrene butadiene styrene(SBS) or styrene butadiene rubber(SBR) to a PG 64-22 or PG 67-22 base asphalt.*

*In addition to the above requirements, the PG 70-22, PG 76-22, and 82-22 shall meet the following:*

	<u>PG 70-22</u>	<u>PG 76-22</u>	<u>PG82-22</u>
Ring & Ball Softening Point, degrees F (degrees C), min.	<u>53(128)</u>	<u>57(135)</u>	<u>65(150)</u>
Elastic Recovery by means of Ductilometer, % min.	45	65	70

Test Procedures

Elastic Recovery by means of a Ductilometer

*The Elastic Recovery shall be tested in accordance with AASHTO T301 at 77° F(25°C).*

Screen Test

*The procedure shall be to pour a 1,000 gram sample heated to 275° F(135° C) through a No. 10(2.0 mm) sieve. There shall be no lumps or particles retained on the sieve.*

Viscometer Test

*In addition to the above, a rotational viscometer, meeting ASTM D4402 requirements with a thermostatically controlled cell will be required at all hot mix asphalt mix plants using modified liquid asphalt products. A minimum of 1 test per day shall be run on samples taken from the contractor's storage tank. Viscosity values shall be in the following ranges when tested at 275° F.(135° C):*

	<u>PG-70-22</u>	<u>PG 76-22</u>	<u>PG 82-22</u>
Viscosity range (cP)	650-3,000	1,000-3,000	2,000-4,000*

*\* PG82-22 must be stored at proper temperatures to maintain pumpability.*

Materials Certification

*A certification shall be furnished to the Engineer on each project stating that the asphalt cement furnished meets the Department's specification. Quality control and compliance testing shall be completed in accordance with asphalt suppliers approved quality control plan and in accordance with TDOT procedures.*

*Where blending or modification occurs after the material has left the storage tanks. A complete series of tests shall be conducted on a sample taken on the first day's production and biweekly thereafter for each grade being produced. Brookfield viscosity and DSR original tests shall be performed daily at the point of blending or modification. The DSR value  $G^*/\sin\delta$  shall be  $\geq 1.0$  kPa at the high PG grade temperature (ie. 158° F(70° C) for PG 70-22).*

*In addition, the producer shall provide a temperature-viscosity curve with a recommended mixing temperature range. In order to develop a temperature-viscosity curve, it may be necessary to run the viscosity test at a higher temperature. This temperature would be dependent on the softening point of the modified asphalt cement.*

*If an SBR modifier is used, the SBR shall be pre-blended with the asphalt cement or added by means of an "in-line" motionless mixer. The "in-line" mixer shall be a Komax Model No. 30715A, Ross LPD Motionless mixer, Koch Static Mixer or other approved equal. The "in-line" motionless mixing unit shall provide a homogeneity value of 0.15 or less. The mixing unit shall be equipped with a port(s) for obtaining representative samples of the blended material in accordance with AASHTO T 40. The mixer shall be oil jacketed. The mixer shall have a minimum diameter of 1/2 in. (13 mm) larger than the asphalt supply line onto which it is installed. The manufacturer shall document to the Engineer that the above specifications will be obtained with the mixer furnished.*

Add the following as the second sentence in **Subsection 904.03, A. and B.**, to read as shown below and modify the succeeding chart as shown:

Revise **Subsection 904.03** regarding Anionic Emulsified Asphalts to read as follows:

A. Anionic Emulsified Asphalts.

In general, anionic emulsified asphalts shall conform to all the requirements of AASHTO M 140, for the type and grade specified. Solubility in trichloroethylene will be required for information only every 3 months in the supplier's quality control program.

In addition to the classes provided for in AASHTO M 140, a special mixing material (AE-3), a special priming material (AE-P) or a special tack(TST-1P) may be specified. These special materials shall conform to the following requirements:

Type	Special Mixing		Special Prime		Special Tack	
Grade	AE-3		AE-P		TST-1P	
Test Requirements:	Min.	Max.	Min.	Max.	Min.	Max.
Viscosity, Saybolt-Furol, 25° C (77° F), Sec.			10	50	10	75
Viscosity, Saybolt-Furol, 50° C (122° F), Sec.	50+	&Pumpable				
Settlement, 5 days, % 24 hours		5		5		5
Sieve Test Stone Coating % coated)	90					
Distill. to 260°C						

(500° F)				
Distillate, % by weight	30	55		
Oil portion of distillate, % by vol.		6	12	
Distillation to 205°C(400°F)				
Distillate, % by weight			55	60
Tests on residue from distillation				
(a)Float Test, 60° C (140° F), Sec.	200	20		
(b)Ductility, 25° C (77° F), cm	40			
(c)Ductility, 4°C			10	35
(d)Ash, by ignition, %		2		
Demulsibility (.02 Normal/35ml)			+5	
Elastic Recovery@10°C(50°F)			25+	
Pen			75	150

The test requirement for settlement may be waived when the emulsified asphalt (special tack coat excepted) is used in less than five days' time; or the Engineer may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than five days.

The AE-3 shall be of such stability that it will remain constant and uniform while being mixed with dry or approximately dry aggregate, and shall thoroughly and uniformly coat the entire surface of each fragment while being manipulated and incorporated into the work. The emulsified asphalt after being incorporated into the work shall show no signs of re-emulsifying.

**B. Cationic Emulsified Asphalts.**

Cationic emulsified asphalts shall conform to the requirements of AASHTO M 208, for the type and grade specified. Solubility in trichloroethylene will be required for information only every 3 months in the supplier's quality control program.

When approved by the Engineer, cationic emulsions may be substituted for anionic emulsions.

Revise the second paragraph of **Subsection 907.01** as follows:

Epoxy coated reinforcing steel shall be in accordance with ASTM D 3963 and ASTM A 775.

Delete the next **three subparagraphs** regarding Sections 4.2.1, 8.2 and 11.1 in their entirety.

Add the following sentence to **Subsection 908.04 (B)2**:

Galvanized nuts shall be grade DH.

Delete any reference to ASTM A 53 in **Subsection 909.01** or **909.02** and substitute ASTM F 1083.

Delete any reference to ASTM B 241 in **Subsection 909.01** or **909.02** and substitute ASTM B 429.

Delete the second paragraph of **Subsection 909.01 (d)** and substitute the following:

At the option of the Contractor, high tensile strength wire with barb spacings as designated above, may be used. If the Contractor elects to furnish high tensile strength wire, it shall meet the requirements of ASTM A 121, chain link fence grade for the respective wire size.

In **Subsection 909.02(i)**, change the dimension of the truss rod from **9.5 millimeter(3/8 inch)** to **7.94 millimeters(5/16 inch)**.

In **subsection 910.02**, (following) under paint, characteristics, sub-paragraph 5, change the required drying time from 60 seconds to 10 minutes.

Delete **subsection 910.02** in its entirety and substitute the following:

Revise **Subsection 910.02 (d) Paint**, sub-paragraph 6 to read per the following:

**Revise Subsection 910.02 (d) Paint**, sub-paragraph 6 to read per the following, remove the section on abrasion resistance, change the range of temperatures to hold the pigment binder at under 6 – drying time and under lab testing, change the ‘dry thru time’ from 30 to 120 minutes all as shown below.

**910.02-Quick Dry Traffic Marking Paint (White and Yellow).** These specifications cover quick dry white and yellow traffic paint, also referred to as pigmented binder, for use in marking traffic lanes or barrier lines on bituminous and concrete highways.

- (a) General Requirements. The pigmented binder shall be properly formulated so as to be suitable for application by spray equipment when heated to 50°C (123°F) maximum and applied on bituminous or portland cement concrete pavements.
- (b) Other formulations for traffic stripe paints, with no more than one minute dry time, may be substituted for use subject to approval by the Division of Materials and Tests. Only those paints with a proven service performance will be considered. Documentary evidence of service performance, formulation, and a sample of the proposed paint shall be submitted to the Division of Materials and Tests for evaluation.
- (c) Drop on Glass Beads. The glass beads drop-on type, shall meet the requirements of AASHTO M 247 Type I or Type II. Beads having the following gradation and roundness requirements may be substituted for the Type I or Type II glass beads provided all other requirements of AASHTO M 247 are met.

GRADATION

<u>Sieve</u>	<u>% Passing</u>
1.180mm(No. 16)	100
0.850mm(No. 20)	75-95
0.600mm(No. 30)	65-95
0.300mm(No. 50)	15-35
0.150mm(No. 100)	0-5

ROUNDNESS

Beads retained on a 0.850 mm (No. 20) sieve shall have a minimum of 65% true spheres. Beads passing the 0.850 mm (No. 20) sieve shall have a minimum of 75% true spheres.

(d) Paint.

Characteristic requirements.

- Pigment content shall be between 58% and 65% by weight. Pigment for white paint shall contain 120 grams/L (0.99 lbs/gal.) of 94% titanium dioxide. Pigment for yellow paint shall be lead free and contain 26 grams/L (0.22 lbs/gal.) minimum of 94% titanium dioxide.
- Total non-volatile shall not be less than 76% by weight.
- Vehicle non-volatile shall not be less than 41% by weight. Vehicle shall be Rohm and Haas E-2706, DOW DT211NA or approved equal.
- Minimum weight shall not be less than 1600 grams/L(13.3 lbs./gal.).
- The paint viscosity shall be between 78 and 95 Kneb units when tested at 25°C ( $\pm$  1°C).
- Drying Time:  
 FIELD -The paint shall dry to a no-tracking condition in 3 minutes when applied at 380 plus or minus 25  $\mu$ m (15 plus or minus 1 mil.). Wet film thickness with 0.7 kilograms (6 pounds of glass spheres per liter (gallon) of binder, when the pavement temperature is between 4 and 49 degrees Centigrade (40 and 120 degrees Fahrenheit) and the relative humidity is not exceeding 80%. The pigmented binder shall be applied with specialized equipment so as to have the binder at a temperature of 35 to 55 degrees Centigrade (100 to 130 degrees Fahrenheit) at the spray gun. The no-pick-up time shall be determined by passing over the line as applied above in a simulated passing maneuver with a passenger car travelling 56 kilometers per hour (35 M.P.H.). A line showing no visual deposition when viewed from a distance of 15 meters (50 feet) shall be considered as conforming to this drying requirement.  
 LAB - The pigmented binder without glass spheres, shall dry to no-pick-up condition in 10 minutes or less when tested in accordance with ASTM D 711. The paint shall also have a dry through (early washout) requirement of the

following: 380 plus or minus 25  $\mu\text{m}$  (15 plus or minus 1 mil.) wet film of the candidate paint placed immediately in a humidity chamber maintained at 24 degrees Centigrade plus or minus 1 degree Centigrade (75 degrees Fahrenheit plus or minus 2 degrees) and 90% plus or minus 5% relative humidity shall have a dry-through time of 120 minutes maximum when tested in accordance with ASTM D 1640 except that the pressure exerted will be the minimum needed to maintain contact between the thumb and film.

7. The paint shall meet the current EPA VOC requirements or 150 grams/L whichever is lower.
8. The ph of the paint shall be a minimum of 9.6.

#### Qualitative Requirements.

The finished paint shall meet the following quality requirements:

1. Condition in container: The paint received shall show no livering, skinning, mold growth, corrosion of the container, or hard settling of the pigment. Any settling shall be readily dispersed when stirred by hand with no persistent foaming.
2. Color: The color for white after drying shall be flat white, free from tint, furnishing good opacity and visibility under both daylight and artificial light. For yellow, the color shall closely match chip 33538 of Federal Standard 595.
3. Flexibility: The paint shall show no cracking or flaking when tested on a 13 millimeter (1/2") mandrel in accordance with Federal Specification TT-P-1952B.
4. Dry Opacity: The minimum contrast ratio shall be 0.95 when drawn with a 0.005 Bird Applicator.
5. Daylight Reflectance: The daylight directional reflectance of the white paint shall be not less than 85% and not less than 50% for yellow (relative to manganese oxide) when measured in accordance with Federal Test Method No.1416.
6. Bleeding: The paint shall have a minimum bleeding ratio of 0.97 when tested in accordance with Federal Specification TT-P-1952B.
6. Scrub Resistance: The paint shall pass 300 cycles when tested in accordance with ASTM D 2486.
7. Freeze-Thaw Stability: The paint shall show no change in consistency greater than 10% when tested in accordance with Federal Specification TT-P-1952B.
8. Storage Stability: When stored at  $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$  in a three-quarter filled can for a period of thirty days, the paint shall be in a homogeneous state with no skinning, curdling, hard settling or caking that cannot be readily remixed.

#### (e) Inspection, Testing, Packaging, and Marking.

All paint furnished under this specification shall be proportioned in accordance with the respective formula set forth herein. Compounding shall be from ingredients or component materials that have been found to conform with the detail specifications as set forth herein by reference or otherwise. Prior to the manufacture of the paint, the successful bidder will submit to the Division of

Materials and Tests, for approval, a sample of each type of ingredient he proposes to use. These samples will be accompanied by the proposed formulation and shall identify the type and source of supply for each ingredient.

Manufacture may proceed upon receipt of approval of raw materials and formulation. After manufacture has begun, a 0.5 liter (pint) sample along with certified laboratory analysis for each batch shall be sent to the Division of Materials and Tests. A liter (quart) sample and a certified gradation shall be sent to the Division of Materials and Tests for each batch or lot of glass beads shipped for use on Tennessee projects.

Each shipment of paint and beads shall be accompanied by a detailed analysis for that particular batch and certification that all ingredients meet the requirements set forth in this specification.

The Department reserves the right to perform in-plant sampling of ingredients and finished product during manufacturing operations and to sample the packaged product when it is received by the Department. Acceptance of the product may be withheld until analysis of samples has been completed.

All paint shall be shipped in new containers that can be properly sealed.

All containers shall be plainly marked or labeled to show the following information: Description of paint, color, net gallons, name of manufacturer, batch number and date of manufacture (month and year).

Revise the following in subsection **910.03- Inorganic Zinc Paint System for Steel Structures**.

Under the heading **Inorganic Zinc**, revise the first sentence to read as follows:

This system shall be composed of an inorganic zinc silicate primer with an intermediate tie coat followed by a high-build aliphatic urethane finish coat.

Delete the entire section regarding, **Vehicle**.

Under the heading **Mixed Paint**, revise the last sentence of the second paragraph to read as follows:

There shall be no hard settling which cannot be easily dispersed during either the pot life or storage life periods.

And revise the **third paragraph** of that section to read as follows:

The inorganic zinc coating shall be so formulated as to produce a distinct contrast in color with the blast-cleaned metal surfaces and with subsequent coats.

Under **Packaging and Labeling**, revise the last sentence of the second paragraph to read as follows:

The manufacturer of the inorganic zinc coating shall furnish a technical representative to assist and advise the applicator in the sandblasting and application of the zinc and subsequent coats.

Revise **Section 2.** to read, **Intermediate Tie Coat.** Revise the first paragraph under this section to read as follows:

The Intermediate Tie Coat shall display compatibility with and adhesion to the cured inorganic zinc when applied directly over the inorganic zinc paint in accordance with the manufacturer's printed instructions. Delete the entire section regarding **Composition.**

Under **Section 3. High Build Aliphatic Polyurethane Finish Coat, Composition,** revise the last sentence of the first paragraph to read as follows:

It shall provide adequate hiding when applied in a single coat directly over intermediate tie coat.

Revise the **Prequalifications** heading to read,

**Qualified Products List Acceptance**

Revise the **first sentence** under this section to read as follows:

Prior to approval and use of any paint, the manufacturer shall submit in triplicate to the Department a certified test report from an approved testing laboratory showing specific test results conforming to all requirements of these specifications.

Delete the last two sentences of this section and replace with the following:

Paint meeting the above requirements will be placed on the Department's Qualified Products List. The Department will require recertification every 2 years. Certified test results shall be submitted any time the manufacturing process or the paint formulation is changed and may be required by the Department when random sampling and testing of the material offered for use indicates nonconformance to any of the requirements herein specified.

Delete the paragraph regarding **Sampling and Testing.** and substitute the following:

**Certifications.**

No paint shall be applied, either in the shop or the field, until the manufacturer of the paint has furnished the Engineer a letter of certification in triplicate stating the material supplied conforms to the requirements specified above and has the same formulation as the material listed on the Department's Qualified Products List. The Engineer reserves the right to sample and test any or all materials supplied.

Delete subsection **910.04-Miscellaneous Paints**, in it's entirety.

Delete the paragraph under "Sampling and Testing" in **Subsection 910.03** and substitute the following:

**Certifications**

No paint shall be applied, either in the shop or the field, until the manufacturer of the paint has furnished the Engineer a letter of certification in triplicate stating that the material supplied conforms to the requirements specified above for pre-qualification and has the same formulation as the pre-qualified material. The Engineer reserves the right to sample and test any or all materials supplied.

Revise **Subsection 912.02** to read as follows:

Brick shall conform to AASHTO M 91, except that brick made from concrete meeting all other requirements of this specification may be used. Unless otherwise specified or indicated the brick shall be Grade SM, size 200 mm x 92 mm x 57 mm (8 inch x 3-5/8 inch x 2-1/4 inch).

Revise the first sentence in Subsection 914.07 to read as follows:

Tubing accepted under this Specification shall conform to the requirements of AASHTO 252 or ASTM F 405 for Heavy Duty Tubing, except as noted below:

**Section 914**, add **Subsection 914.10, High Density Polyethylene Plastic Pipe**

Pipe accepted under this specification shall conform to the requirements of AASHTO M 294, Type S.

**Section 916**, revise **Subsection 916.06** starting with the third paragraph to read as follows:

Reflective Sheeting for all signs with a SILVER-WHITE, YELLOW, RED, GREEN, BROWN or BLUE background shall be Encapsulated Lens or Micro-prismatic Lens material meeting or exceeding the minimum requirements for Type III as specified by AASHTO M 268. FLOURESCENT ORANGE background material shall meet the requirements for Type IV, as specified by AASHTO M 268, with the following changes:

Minimum Retroreflection Values for  
Fluorescent Orange Sheeting

Divergence Angle (Deg.)	Incidence Angle (Deg.)	Fluorscent Orange
0.2	-4	200
0.2	+30	85

0.5	-4	80
0.5	+30	40

Daytime Color:

Color shall conform to the requirements in the table below. Daytime color and maximum spectral radiance factor (peak reflectance) of sheeting, mounted on aluminum test panels shall be determined instrumentally in accordance with ASTM E 991. The values shall be determined on an instrument meeting the requirements of ASTM E 991 which has circumferential viewing (illumination). Computations shall be done in accordance with ASTM E 308 for the 2° observer.

**Color Specification Limits \*\* (Daytime)**  
**Luminance**

Color	1		2		3		4		Factor Y(%)	
	<u>x</u>	<u>y</u>	<u>x</u>	<u>y</u>	<u>x</u>	<u>y</u>	<u>x</u>	<u>y</u>	min.	
	max.									
Orange (new)	.583	.416	.523	.397	.560	.360	.631	.369	30	
Orange (weathered)	.583	.416	.523	.397	.560	.360	.631	.369	20	45

\*\*The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 standard colorimetric system measured with standard illuminant D<sub>65</sub>.

Specular Gloss:

The retroreflective sheeting shall have a specular gloss of not less than 50 when tested in accordance with ASTM D 523 using an 85° glossmeter.

**Section 916**, add the following sentence to **Subsection 916.06**:

In addition to the above requirements, the sign sheeting material shall have met the Department’s pre-approval process.

Revise subsection **916.08-Flexible Delineator Posts**. as follows:

Revise the **fifth paragraph** to read:

The delineator post shall have been evaluated by the National Transportation Product Evaluation Program (NTPEP). Data generated by the NTPEP testing will be used to select those materials with a satisfactory performance and meeting the following test requirements for placement on a qualified products list. The delineator post shall demonstrate the ability to properly perform its intended function when subjected to the following tests:”

Under the heading, **b. Field Tests**, revise the **fourth paragraph** to read as follows:

The test vehicle shall be a standard sedan and shall have no unusually sharp hood ornaments or other appurtenances.

Revise the **last paragraph** to read as follows:

Delineator posts meeting the above laboratory and field test requirements will be placed on the qualified list of delineators maintained by the Division of Materials and Tests. The contractor shall select material from this qualified list. The manufacturer shall certify that the materials to be supplied are formulated the same as when tested by the NTPEP and will conform to the requirements of this specification. The Department reserves the right to periodically sample and test delineator posts.

**Section 916**, add **Subsection 916.10**, Reflectors

Type I

The Type I reflector unit shall consist of a hermetically sealed acrylic plastic prismatic reflex reflector housed in embossed aluminum and provided with a single grommetted mounting hole.

The reflector shall consist of a clear and transparent plastic face with at least 4500 mm<sup>2</sup> (7 square inches) of reflective area, herein referred to as the lens, with a heat sealable plastic coated metallic foil back fused to the lens under heat and pressure around the entire perimeters of the lens and the central mounting hole to form a unit permanently sealed against dust, water and water vapor.

All requirements of Subsection 916.07 Type "B" (a), (b), (e), shall apply, except that the reflectors shall be colorless or yellow, as specified and the minimum Specific Intensity values shall be as follows:

Observation Angle Degrees	Entrance Angle Degrees	Crystal	Specific-Intensity Candelas Per LUX(Foot-Candles)	
			Yellow	Red
0.1°	0°	11.1(119)	6.6(71)	2.7(29)
0.1°	20°	4.4(47)	2.6(28)	1.0(11)

The housing shall be 0.051 cm (0.020-inch) 5052-0 aluminum formed to approximately 8.25 cm (3.25 inches) in diameter and sufficient in depth to retain the acrylic reflector. It shall have embossed circular reinforcement ribs or other suitable configuration to provide rigidity of the housing and shall be marked with the name and part number of the manufacturer.

An aluminum grommet with a 0.475 cm (0.187 inch) inside diameter shall be expanded within the reflector mounting hole.

Type II

The Type II reflector unit shall consist of a sealed optical system having a plastic face with a prismatic molded rear surface fused to a plastic back at central and peripheral edges. The complete reflector unit shall be provided with a metal grommetted central hole for mounting which will accommodate 0.475 cm(0.187 inch) metal fasteners. The reflector shall be approximately 8.25 cm(3.25 inches) in diameter.

In addition to the above requirements, the reflector units shall meet all requirements under (a), (b), and (c) for the Type "B" reflector unit described in Subsection 916.07, except that the reflector shall be either colorless or yellow, as specified, and the minimum Specific Intensity Values shall be as prescribed for the Type I reflector in Subsection 916.10 (this Subsection).

Revise the Headings for Groups D, E and F in **Subsection 918.14** to read as follows:

<b>GROUP "D"</b>	<b>GROUP "E"</b>	<b>GROUP "F"</b>
<b>Jan. 1-May 1</b>	<b>May 1-July 15</b>	<b>July 15-Jan. 1</b>
Italian Rye, 33-1/3%	*Sudan-Sorghum	Balboa Rye, 66-2/3%
Korean Lespedeza, 33-1/3%	Crosses, 100%	Italian Rye, 33-1/3%
Summer Oats, 33-1/3%	or **Starr Millet, 100%	

Revise the first paragraph of **Subsection 918.20** to read as follows:

The reflector shall consist of a shell filled with tightly adherent potting compound. The shell shall be molded of methyl methacrylate conforming to ASTM D 788, Grade 0131, or a poly-carbonate material meeting ASTM D 3935. The filler shall be a potting compound selected for strength, resilience and adhesion adequate to pass the necessary physical requirements. The shell shall contain one or two reflective faces. The reflector shall be attached with adhesive to an iron casting with an elastomeric pad.

Revise the first three paragraphs of **Subsection 918.20** to read as follows:

The reflector shall meet the following requirements:

- (a) Dimensions. Each reflector shall be 100 ± 13 millimeters (4 ± 0.5 inches) by 50 ± 13 millimeters (2.0 ± 0.25 inches) at the base. Height of the reflector shall be 10 millimeters (0.40 inch) or no higher than 13 millimeters (0.50 inch). The slope of the

reflector shall be 30° and the minimum area of the reflective surface shall be 1200 square millimeters (1.87 square inches).

Revise the Specific Intensity (f) of **Subsection 918.20** on page 806 to read as follows:

- (f) Specific Intensity. The specific intensity (0.2° observation angle) of an abraded lens, conditioned as described below, shall be as follows:

	Clear	Yellow	Red
0 Degree Incidence Angle-	3.0	1.8	0.75
20 Degree Incidence Angle-	1.2	0.7	0.3

Abrasion Procedure: Form a 25 millimeter (1 inch) diameter flat pad using #3 coarse steel wool per Federal Specification FF-W-1825. Place the steel wool pad on the reflector lens, apply a load of 22.7 kilograms (50 pounds) and rub the entire lens 100 times. (Note: On two color units, the red lens may not be glass covered and if so should not be abraded.)

Revise the General casting requirements (a) of **Subsection 918.20** on page 806 to read as follows:

- (a) General. The casting shall be 250 ± 13 millimeters (10 ± 0.5 inches) long by 140 ± 13 millimeters (5.5 ± 0.5 inches) wide. The maximum projection of the casting above the roadway shall not exceed 13 millimeters (0.5 inch). The casting shall be designed so that snowplow blades will ride over it without contacting the reflective marker.

Revise the first paragraph of **Subsection 918.23** to read as follows:

This material shall conform to AASHTO M 249. Drop on glass beads shall meet the requirements as specified in Subsection 910.02 (c).  
Preformed thermoplastic material shall meet the same requirements as above.

In **Subsection 918.28**, remove in its entirety, the section on Erosion Control Blanket(Type I).

Also, reword the second paragraph of Erosion Control Blanket(Type II) to read as follows:

Excelsior  
A machine produced blanket of 100% curled wood excelsior of which 80 percent has 150 millimeters (six inch) or longer fiber length, with consistent thickness and the fiber evenly distributed over the entire area of the blanket. The blanket shall be smolder resistant and shall be marked in a suitable manner to clearly show which side is the top. The netting on top and bottom side of each blanket shall be covered with a photodegradable plastic having a mesh size of 25 mm x 25 mm (1 X 1 inch) (plus or minus 6 mm (1/4 inch)). The blanket shall be at least 1.2 meters (48 inches) wide with a minimum thickness of 13 millimeters (1/2 inch) and a minimum dry weight of 0.55 kilograms per square meter (1.0 pounds per square yard).

Also, in **Subsection 918.28**, section regarding Erosion Control Blanket(Type III), remove the paragraph regarding Excelsior.

Revise the paragraphs in **Subsection 918.28** regarding Bonded Fiber Matrix and Synthetic Polypropylene Mesh to read as follows:

**Bonded Fiber Matrix (Type V)**

A hydraulically applied, biodegradable blanket of wood fibers, natural binders and organic and/or mineral activators or non-asphaltic tackifiers, and may include polyacrylamide copolymers. The composition of the fiber matrix shall be a) 90 percent wood fibers, 9 percent natural binder and 1 percent organic and mineral activators (percentages by weight) or b) 95% wood fiber mulch, 3.8% organic and fiber stabilizers, and 1.2% copolymers. The applied matrix shall have 100 percent ground coverage with no holes greater than 1 mm in size and shall have a surface coverage thickness of 3 to 5 mm (1/8 to 3/16 inch) after drying. The fiber matrix shall be applied at 35-45 kg per 100 square meters (3000-4000 lbs per acre). A dye shall be added to the mixture to delineate coverage. This dye shall be a color that will stand out from the surroundings, will be non destructive to the environment and water soluble so as to be short lived. The fiber matrix shall be listed on the Department's Qualified Products List.

In **Subsection 918.28**, remove the following paragraph regarding Synthetic Polypropylene Mesh (Type VI).

Add the following to the first paragraph in Subsection **918.29**:

The panels shall be fabricated in a plant certified by the Precast/Prestressed Concrete Institute(PCI) category B-3.

Revise the preceding paragraph B of **Subsection 918.30** to read as follows:

- B. Material shall be subjected to a five-thousand hour exposure test conforming to ASTM G 153, operating enclosed carbon arc light apparatus for exposure for non-metallic materials. At the end of said exposure test, the exposed sample must not show any chipping, flaking or peeling.

Delete **Subsection 918.31** and replace with the following:

**918.31 – Fly Ash.** The fly ash shall meet the requirements of AASHTO M-295, Class “F” or Class “C”, for the class specified. Fly ash of different classes or sources used as a partial cement replacement in Type I, Portland cement concrete will not be permitted on the same project.

Replace **Subsection 918.32** with the following:

**918.32 – Ground Granulated Blast Furnace Slag.** Ground granulated Blast Furnace Slag shall meet the requirements of AASHTO M 302, Grade 100 or Grade 120. Ground granulated blast furnace slag of different grades or sources used as a partial cement replacement in Type I Portland cement concrete will not be permitted on the same project.