Note: The PROV implemented in July 2023 replaces OPSS 1713 COMMON, February 1991 with no technical content changes.

MATERIAL SPECIFICATION FOR THERMOPLASTIC PAVEMENT MARKING MATERIALS

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1713.01 SCOPE

This specification covers the requirements for reflectorized thermoplastic pavement marking material that is suitable for application onto bituminous and concrete pavements.

1713.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Material

OPSS 1750 Traffic Paint Reflectorizing Glass Beads

Canadian General Standards Board

CGSB 1-GP-12C-1983 Standard Paint Colours

American Society for Testing and Materials

ASTM D256-1988 Impact Resistance of Plastics and Electrical Insulating Materials
ASTM D570-81 (1988) Water Absorption of Plastics

ASTM D713-87	Conducting Road Service Tests on Traffic Paint
ASTM D1415-88	Rubber Property - International Hardness
ASTM D2240-86	Rubber Property - Durometer Hardness
ASTM D2244-85	Calculation of Colour Differences from Instrumentally Measured Colour Coordinates
ASTM E28-67(1982)	Softening Point by Ring and Ball Apparatus
ASTM E97-82(1987)	Test Method for 45-deg., 0-deg. Directional Reflectance Factor of Opaque Specimens by Broad-Band Filter
ASTM E303-83	Measuring Surface Frictional Properties Using the British Pendulum Tester

British Standards Institution

BS 3262-1987 Hot-Applied Thermoplastic Road Marking Materials
Part 1, Specification for Constituent Materials and Mixtures
Part 2, Specification for Road Performance
Part 3, Specification for Application of Material to Road Surfaces

United States Federal Standard

U.S. FED-STD-595B, Dec. 15, 1989 Colours Used in Government Procurement

International Commission on Illumination

CIE 1976 L^*,a^*,b^* Uniform Colour Space and Colour Difference Equation

1713.03 DEFINITIONS

For the purpose of this specification, the following definitions shall apply:

Compliance Certification means the procedure and requirements for establishing an approved source for materials.

Fingerprinting means the testing of thermoplastic pavement marking materials by gas chromatographic and infrared spectorscopic techniques for verification purposes.

Hot Applied Thermoplastic Pavement Marking Material means a thermoplastic material that is specifically formulated for hot spray or screed application onto bituminous or concrete pavements to delineate the vehicle operating limits.

No Tracking Time means the time required for a newly applied pavement marking line to show no visible deposition of the material to the pavement surface outside the line when viewed from a distance of 15 metres, as determined by passing over the applied line at 60 km per hour in a simulated passing maneuver with a passenger car.

Pavement Marking Material means a material formulated for application onto bituminous or concrete pavement in order to delineate vehicle operating limits.

Reflectorization means a material, treatment, or process to enable incident light to be returned in high proportions in the general direction of the light source.

Service Test means the evaluation of pavement marking materials on a test deck and performance rating prior to compliance certification.

Thermoplastics means a polymeric plastic material which softens, melts, and flows at elevated temperatures, but forms into a solid material at lower temperatures. This thermal behaviour being reversible is retained on repeated heating and cooling cycles.

1713.05 MATERIALS

1713.05.01 General

The thermoplastic pavement marking material shall not undergo any significant breakdown or deterioration when held at 170 °C for four hours or during four one-hour reheatings to the plastic temperature. The softening point and viscosity characteristics of the plastic material shall remain constant through four reheatings and should be the same from batch to batch.

There shall be no significant change in the colour of the material as the result of up to four reheatings of one hour each, up to a temperature of 170 °C. The material shall be environmentally safe during heating and application. The material shall not deteriorate by contact with sodium chloride, calcium chloride, or any other chemical used for ice control, or because of oil content of pavement materials or oil droppings from the traffic.

The ingredients used in the production of thermoplastic pavement marking materials shall be of high quality and consistency so that the appearance will not change in service to impair the colour or the visibility of the delineation.

1713.05.02 Colour

Thermoplastic pavement marking materials shall be according to the following colour requirements:

White Thermoplastic Pavement Marking Material - CGSB 1-GP-12C white 513-301

Yellow Thermoplastic Pavement marking Material shall match either the yellow colour chip of the Ministry of Transportation, Ontario or U.S. Federal 595B, Yellow 33538

The tolerance in colour allowed is as follows in the CIE L^*,a^*,b^* Uniform Colour Space and Colour Difference Equation when calculated from instrumentally measured colour differences according to ASTM D2244.

White	L^* = +2 and -1.5 max
	a^* = +1.5 and -1 max
	b^* = +4 and -4 max
Yellow - MTO	L^* = +2 and -1.5 max
	a^* = +3 and -1.5 max
	b^* = +7 and -1.5 max
Yellow - U.S.	L^* = -2 and +4 max
	a^* = -6 and +4 max
	b^* = -9 and +10 max

1713.05.03 Chemical Composition

The chemical composition of the thermoplastic material shall be at the discretion of the manufacturer and shall be certified by the Owner.

1713.05.04 Reflectorization

Thermoplastic material for screed application and preformed thermoplastic pavement marking material shall contain premixed glass beads. Overlay glass beads shall also be applied at a rate recommended by the manufacturer for reflectorization. Thermoplastic materials recommended for spray application shall be used with overlay glass beads for reflectorization. These materials shall provide proper anchorage for the glass beads according to OPSS 1750, with the exception of the requirement of silicone coating.

Test samples of glass beads according to the above requirements may be obtained from the Owner upon request.

1713.05.05 Physical Property Requirements

Physical properties of thermoplastic pavement marking material submitted for compliance certification shall be according to Table 1.

Samples are required by the Owner for laboratory testing. The supplier shall submit with each test sample, complete data on physical properties, application procedure, and material safety for the thermoplastic pavement marking material.

1713.05.06 Service Test

Thermoplastic pavement marking material according to the qualifications of section 1713.05 and Table 1, shall be supplied for service test when requested by the Owner.

Thermoplastic pavement marking material shall be service tested according to the following:

a) Test deck location and time for application shall be determined by the Owner.

b) The test stripes shall be 10 cm in width and applied transversely across the lanes of the road. Thermoplastics shall be applied at a rate which results in a uniform thickness of 1.90 mm $\pm$ 0.40 mm measured dry. The application shall be made by the supplier/manufacturer or their approved agent, using the pieces of equipment recommended by the manufacturer of thermoplastic pavement marking material.

c) Application of test stripes of hot applied or preformed thermoplastic pavement marking material on a bituminous or concrete pavement with about 20,000 AADT.

d) Ease of application and quality and nature of the stripes, shape of the edges, and uniformity in thickness will be evaluated.

e) Thermoplastic pavement marking will be inspected periodically and its service performance will be rated by the Owner as specified in Table 2.

f) Susceptibility to snow plow damage and chipping will be assessed.

g) Approval will be given after two years of service rating, providing the material conforms to Table 2 and meets the conditions of subsection 1713.05.05.

1713.07 PRODUCTION

1713.07.01 General

In order to qualify as a supplier, a manufacturer must satisfy the following minimum requirements:

a) Adequate production facilities.

b) A laboratory sufficiently equipped and staffed to provide a quality control program which will ensure compliance with this specification.

c) Properly documented production, sampling, and testing procedures and methods.

1713.07.02 Quality Control

A manufacturer shall be responsible for carrying out a quality control program to ensure that the thermoplastic pavement marking materials conform to this specification.

1713.08 QUALITY ASSURANCE

1713.08.01 Acceptance Criteria

The Owner may request samples to be taken from the shipments at any time for quality assurance testing. Samples shall be taken from each batch produced for delivery to the Owner. Criteria for acceptance shall include the following requirements and manufacturing tolerances:

a) Composition shall not vary by more than ± 5%, based on fingerprinting and other tests of the values established for the reference sample.

b) Softening point shall be within ± 3 °C from the value established for the reference sample.

c) Colour difference 'ΔE' shall be less than ± 1.5 provided the colour conforms to this specification.

d) Directional reflectance with:

   i. Minimum value of 70% white.
   ii. Minimum value of 45% yellow.

1713.08.02 Quality Control of Production Batches

A 500 g sample of hot applied thermoplastic pavement marking material or one section of the preformed thermoplastic pavement marking material from each production batch along with test results on softening point, hardness, and material composition shall be supplied to the Owner for laboratory testing.

Delivery records shall be kept by the supplier of the number of containers of each batch shipped to each delivery point and a list of such shipments shall be given to the Owner.

1713.08.03 Storage

Thermoplastic pavement marking materials shall conform to this specification after storage.

1713.09 OWNER PURCHASE OF MATERIAL

1713.09.01 Certificate of Compliance

The manufacturer shall submit a certificate of compliance with tenders indicating that the physical properties, material composition, and installation characteristics of all of the manufacturer's production batches of thermoplastic pavement marking materials for the Owner shall conform to this specification and shall not deviate from the allowable tolerances, unless approved by the Owner.

1713.09.02 Delivery and Packaging of Thermoplastic Pavement Marking Material

The delivery schedule, delivery location, colour, type, and quantity shall be as specified by the Owner. Thermoplastic pavement marking material supplied shall be packaged to commercially acceptable standards. Each package shall have a label or marking with the following information:

a) Manufacturer's name and address.

b) Type and colour of thermoplastic pavement marking material.

c) Manufacturer's code and batch numbers.

d) Net weight in kilograms or in metres for preformed material.

e) Date of manufacture.

1713.09.03 Measurement and Payment

Measurement of thermoplastic pavement marking material shall be by metres.

Payment at the price specified in the purchasing order shall be for the supply of thermoplastic pavement marking material.

TABLE 1
PHYSICAL PROPERTY REQUIREMENTS FOR
THERMOPLASTIC PAVEMENT MARKING MATERIAL

Test and Property	Requirements		Test Methods ASTM
	Min.	Max.	
Directional Reflectance %			E97
White	70		
Yellow	45		
Softening Point °C	80		E28
Water Absorption %		0.5	D570
Impact Resistance Izod	**		D256*
Hardness at 25 °C			
IRHD	90	98	D1415
Skid Resistance			
BPN Units	**		E303

* Material is cast into 3" x 1" x 0.9" bars for this test.

** Values to be established.

TABLE 2
PERFORMANCE REQUIREMENTS FOR SERVICE TEST AT ABOUT 20,000 AADT
FOR THERMOPLASTIC PAVEMENT MARKING MATERIAL

Property	Performance Requirements for Test Stripes						
	Newly Installed Thermo-Plastics	Service Life Ratings of					Test Method
		1 yr	2 yrs	3 yrs	4 yrs	5 yrs	
Directional Reflectance %							
White	≥ 70	≥ 50	≥ 50	≥ 50	≥ 50	≥ 50	ASTM
Yellow	≥ 45	≥ 35	≥ 35	≥ 35	≥ 35	≥ 35	E97*
Retroreflectance							Instrument
$mcd/m^2/lux$							Mirolux
White	**	**	**	**	**	**	12
Yellow	**	**	**	**	**	**	
No Tracking Time, mins.	≤ 2						MTO
Durability		≥ 95	≥90	≥ 80	≥ 75	≥ 70	MTO***
Appearance	10	≥ 8	≥ 7	≥ 6	≥ 5	≥ 5	ASTM D713 & MTO***

* These values are based on markings placed on a typical asphalt surface.

** Values to be established.

*** Durability is calculated, first by estimating the % wear from the photographs/video images of stripes taken at test sites, and then deducting the value obtained from 100.

**** Rating 1-10; Perfect score is 10.
Rating made on inspection of the markings by a panel of evaluators from the Owner.

THERMOPLASTIC PAVEMENT MARKING MATERIAL DATA FORM

A. MANUFACTURER'S NAME _____
ADDRESS _____

_____

_____

TELEPHONE NO. _____

B. SAMPLE IDENTIFICATION

Commercial Trade Name of Sample _____
Manufacturer's Code No. _____
Batch No. _____
Colour _____
Date of Manufacture _____

C. MATERIAL COMPOSITION
Resins and Conditioners wt % _____
Pigments and Fillers wt % _____
Glass Beads wt, % _____
Gradation of Beads _____

_____

_____

_____

_____

_____

_____

D. TEST DATA

Softening Point °C	ASTM E28	_____
Water Absorption %	ASTM D570	_____
Impact Resistance	ASTM D256*	_____
Hardness**, IRHD	ASTM D1415	_____
Shore A° or D°	ASTM D2240	_____

E. MATERIAL SAFETY DATA

* Material is cast into 3" x 1" x 0.9" bars for this test.

** Hardness may also be measured according to ASTM D2240.

F. PROCEDURE FOR OVERLAY AND INLAY APPLICATION

1. Pavement Surface Preparation Procedure _____

   _____

   _____

   _____

2. Pavement Temperature Range for Installation
   Minimum °C _____
   Maximum °C _____

3. Air Temperature
   Minimum °C _____

4. Humidity Maximum % _____

5. Temperature Range of Hot Thermoplastic Material for Application
   Minimum °C _____
   Maximum °C _____

6. Types of Pavement *** where the application is not recommended.

   _____
   _____
   _____

7. Equipment for Application _____
   _____
   _____
   _____

8. Application Procedure for Glass Beads _____
   _____
   _____
   _____

9. Particulars regarding suitability of application onto partly worn existing pavement marking.

   a. On solvent based traffic paint _____
   b. On water-borne traffic paint _____
   c. On thermoplastic pavement marking _____
   d. On field reacted polymeric pavement marking _____

10. Any Other Relevant Information _____
    _____
    _____
    _____

*** Refers to the age of pavement, the surface texture (e.g., OFC, DFC etc.) and whether it is asphalt or concrete pavement.

Note: This form must be completed in full and forwarded with material sample. Samples submitted without a completed data form will not be considered.