



**Note: The MUNI implemented in November 2021 replaces OPSS 1713 COMMON, February 1991 with no technical content changes.**

## **MATERIAL SPECIFICATION FOR THERMOPLASTIC PAVEMENT MARKING MATERIALS**

---

### **TABLE OF CONTENTS**

<b>1713.01</b>	<b>SCOPE</b>
<b>1713.02</b>	<b>REFERENCES</b>
<b>1713.03</b>	<b>DEFINITIONS</b>
<b>1713.04</b>	<b>DESIGN AND SUBMISSION REQUIREMENTS - Not Used</b>
<b>1713.05</b>	<b>MATERIALS</b>
<b>1713.06</b>	<b>EQUIPMENT - Not Used</b>
<b>1713.07</b>	<b>PRODUCTION</b>
<b>1713.08</b>	<b>QUALITY ASSURANCE</b>
<b>1713.09</b>	<b>OWNER PURCHASE OF MATERIAL</b>

### **APPENDICES**

<b>1713-A</b>	<b>Commentary</b>
---------------	-------------------

### **1713.01 SCOPE**

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

#### **1713.01.01 Specification Significance and Use**

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

## **1713.01.02 Appendices Significance and Use**

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

## **1713.02 REFERENCES**

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

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 spectrosopic 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  $1.90 \text{ mm} \pm 0.40 \text{ mm}$  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  $\pm 5\%$ , based on fingerprinting and other tests of the values established for the reference sample.
- b) Softening point shall be within  $\pm 3\text{ }^\circ\text{C}$  from the value established for the reference sample.
- c) Colour difference ' $\Delta E$ ' shall be less than  $\pm 1.5$  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 % White Yellow	70 45		E97
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						Test Method
	Newly Installed Thermo-Plastics	Service Life Ratings of					
		1 yr	2 yrs	3 yrs	4 yrs	5 yrs	
Directional Reflectance %							
White	≥ 70	≥ 50	≥ 50	≥ 50	≥ 50	≥ 50	ASTM E97*
Yellow	≥ 45	≥ 35	≥ 35	≥ 35	≥ 35	≥ 35	
Retroreflectance							Instrument Mirolux 12
mcd/m <sup>2</sup> /lux							
White	**	**	**	**	**	**	
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.

**Appendix 1713-A, November 2021  
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

**Note:** This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

**Designer Action/Considerations**

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

**Related Ontario Provincial Standard Drawings**

No information provided here.