Note: The MUNI implemented in April 2023 replaces OPSS 1714 COMMON, February 1991 with no technical content changes.

MATERIAL SPECIFICATION FOR FIELD REACTED POLYMERIC PAVEMENT MARKING MATERIALS

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1714.01 SCOPE

This specification covers the requirements for field reacted, two component polymeric pavement marking materials which are suitable for application onto concrete and bituminous pavements.

1714.01.01 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.

1714.01.02 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.

1714.02 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 Specifications

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

American Society for Testing and Materials

ASTM D713-87	Conducting Road Service Tests on Traffic Paint
ASTM D868-85	Degree of Bleeding of Traffic Paint
ASTM D869-85	Degree of Settling of Traffic Paint
ASTM D1415-88	Rubber Property - International Hardness
ASTM D1644-88	Non-Volatile Content of Varnishes
ASTM D1652-88	Epoxy Content of Epoxy Resins
ASTM D2074-66 (1987)	Total, Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method
ASTM D2240-86	Rubber Property - Durometer Hardness
ASTM D2244-85	Calculation of Colour Differences from Instrumentally Measured Colour Coordinates
ASTM D4060-84	Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM E97-82 (1987)	Test for 45-deg, 0-deg, Directional Reflectance Factor of Opaque Specimens by Broad Band Filter

ASTM E298-84 Assay of Organic Peroxides
ASTM E303-83 Measuring Surface Frictional Properties Using the British Pendulum Tester

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

1714.03 DEFINITIONS

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

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

Field Reacted Polymeric Pavement Marking Material means a pavement marking material consisting of two separate components, a polymerizable component and a curing agent or a polymerization catalyst. These two components are designed to be mixed at the site and applied during the pot life of the mixture.

Fingerprinting means the testing of field reacted polymeric pavement marking materials by infrared spectroscopy and other techniques for verification purposes.

No Tracking Time means the time required for a newly installed beaded 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 pavement marking line at 60 km per hour in a simulated passing maneuver at about 60 km per hour 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.

Pot Life mean the length of time a material is usable after a curing agent or a polymerization catalyst has been mixed.

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.

1714.05 MATERIALS

1714.05.01 General

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

1714.05.02 Colour

The field reacted polymeric pavement marking material shall be according to the following colour requirements after mixing at the recommended proportions and curing:

White - CGSB 1-GP-12C white 513-301

Yellow - Shall match either the yellow colour chip of the Ministry of Transportation, Ontario or U.S. Federal 595B, Yellow 33538

Black - CGSB 1-GP-12C black 512-301

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

1714.05.03 Chemical Composition

The chemical composition of the field reacted polymeric pavement marking material shall be at the discretion of the manufacturer and shall be certified by the Owner.

1714.05.04 Reflectorization

Field reacted polymeric pavement marking material recommended for screed application shall contain premixed glass beads and overlay glass beads shall also be applied at a rate recommended by the manufacturer for reflectorization of the pavement markings. Field reacted polymeric pavement marking materials recommended for spray application shall be used with overlay glass beads for reflectorization. These materials shall provide proper anchorage for the glass beads which shall be 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.

1714.05.05 Physical Property Requirements

The physical properties of the field reacted polymeric 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 for both components and mixing ratios of the field reacted polymeric pavement marking material.

1714.05.06 Service Tests

Field reacted polymeric pavement marking materials according to the qualifications of section 1714.05 and Table 1 shall be submitted for service tests when requested by the Owner.

The field reacted polymeric 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. The application shall be made by the supplier or the manufacturer or their agent, as recommended by the manufacturer except that the thickness of screed applied material shall be 1.90 mm $\pm$ 0.40 mm.

c) Application of test stripes of the field reacted polymeric material on a bituminous or concrete pavement with about 20,000 AADT.

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

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

f) Approval will be given after two years of service rating, providing the material conforms to Table 2 and meets the conditions of subsection 1714.05.05.

1714.07 PRODUCTION

1714.07.01 General

In order to qualify as a supplier of field reacted polymeric pavement marking materials, 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.

1714.07.02 Quality Control

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

1714.08 QUALITY ASSURANCE

1714.08.01 Acceptance Criteria

The Owner may request samples to be taken from the shipments of field reacted polymeric pavement marking materials at any time for quality assurance testing. Samples shall be taken from each batch produced for delivery to the Owner. Criteria for accepting each production batch include the following requirements and manufacturing tolerances:

a) Composition shall not vary by more than ± 5% of the reference value, as determined by fingerprinting and other specific tests for the materials according to the applicable ASTM specification from ASTM D1644, ASTM D1652, ASTM D2074, and ASTM E298.

b) Pot life shall not vary by more than ± 5 minutes of the value established for the reference sample, when tested at 25 °C and 50% relative humidity.

c) Directional reflectance with:

   i) Minimum value of 70% white.

   ii) Minimum value of 45% yellow.

1714.08.02 Quality Control of Production Batches

A 500 g sample of the prepolymer or polymerizable component and an equivalent amount of curing agent or catalyst samples shall be supplied to the Owner for laboratory testing.

1714.08.03 Storage

The field reacted polymeric pavement marking materials shall be according to this specification after storage.

1714.09 OWNER PURCHASE OF MATERIAL

1714.09.01 Certificate of Compliance

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

1714.09.02 Delivery and Packaging of the Field Reacted Polymeric Pavement Marking Material

The delivery schedule, delivery location, colour, type, and quantity shall be as specified by the Owner. Both components of the field reacted polymeric 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 the field reacted polymeric pavement marking material.

c) Manufacturer's code and batch numbers.

d) Net weight in kilograms.

e) Date of manufacture.

1714.09.03 Measurement and Payment

Measurement of field reacted polymeric pavement marking material shall be by kilograms.

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

TABLE 1

PHYSICAL PROPERTY REQUIREMENTS FOR FIELD REACTED POLYMERIC PAVEMENT MARKING MATERIALS

Test and Property	Requirements		Test Methods	
	Min.	Max.	ASTM	Other
Settling, 6 months			D869	
Component A	6			
Component B	6			
Pot Life min. at 25 °C		20		MTO
Bleeding	5		D868	
Directional Reflectance %			E97	
White Paint	70			
Yellow Paint	45			
Black		12		
Hardness IRHD	90	98	D1415	
Abrasion Resistance 1000 cycles/g	*		D4060 CS-17	
Skid Resistance BPN Units	*		E303	

* Values to be established.

TABLE 2

PERFORMANCE REQUIREMENTS FOR SERVICE TEST AT ABOUT 20,000 AADT FOR FIELD REACTED POLYMERIC PAVEMENT MARKING MATERIALS

Property	Performance Requirements							
	Newly Installed Marking	Service Life Ratings of						Test Method
		3 mths	1 yr	2 yr	3 yrs	4 yrs	5 yrs	
Directional Reflectance %								
White	≥ 70		≥ 50	≥ 50	≥ 50	≥ 50	≥ 50	ASTM E97*
Yellow	≥ 45		≥ 35	≥ 35	≥ 35	≥ 35	≥ 35	
Black	≤ 12	≤ 12						
Retroreflectance mcd/m²/lux								Instrument Mirolux
White	**		**	**	**	**	**	
Yellow	**		**	**	**	**	**	
Black	**	**						
No Tracking Time, mins.	≤ 15							
Durability								
White & Yellow			≥ 95	≥ 90	≥ 80	≥ 75	≥ 70	MTO***
Black		≥ 90						
Appearance	10	≥ 9	≥ 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.

FIELD REACTED POLYMERIC PAVEMENT MARKING MATERIAL DATA FORM

A. MANUFACTURER'S NAME _____
ADDRESS _____
_____
_____
TELEPHONE NO. _____

B. SAMPLE IDENTIFICATION	COMPONENT A	COMPONENT B
Commercial, Trade Name of Sample	_____	_____
Manufacturer's Code No.	_____	_____
Batch No.	_____	_____
Colour	_____	_____
Date of Manufacture	_____	_____

C. MATERIAL COMPOSITION	COMPONENT A	COMPONENT B
Resins and Conditions, wt %	_____	_____
Pigments and Fillers, wt %	_____	_____
% Active Polymerization Catalyst, Curing Agent	_____	_____
Glass Beads, wt %	_____	_____
Gradation of Glass Beads	_____	_____
	_____	_____
	_____	_____

D. TEST DATA

Settling, 6 months	ASTM D869	
Component A		_____
Component B		_____
Bleeding, mixed material	ASTM D868	_____
Pot Life at 25°C min.	MTO	
		_____

Hardness*, IRHD	ASTM D1415	_____
Shore A° or D°	ASTM D2240	_____

Abrasion Resistance	ASTM D4060	
1000 cycles/g	CS-17	_____

E. MATERIAL SAFETY DATA FOR BOTH COMPONENTS

F. PROCEDURE FOR OVERLAY AND INLAY APPLICATION

1. Pavement Surface Preparation Procedure
_____
_____
_____

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

3. Air Temperature
Minimum °C _____
Maximum °C _____

4. Humidity Maximum % _____

5. Mix Ratio of Component A & B _____
Mixing Procedure Quantities _____
Pot Life min. at 25 °C _____

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

7. Equipment for Application _____
_____
_____
_____

8. Application Procedure for Glass Beads Overlay _____
_____
_____
_____

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 _____
_____
_____
_____

* Hardness may also be measured according to ASTM D2240.

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

NOTE: This form must be completed in full and forwarded with test sample. Samples submitted without a completed Data Form will not be considered.

Appendix 1714-A, April 2023
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.