MATERIAL SPECIFICATIONS FOR WATER-BORNE TRAFFIC PAINT

TABLE OF CONTENTS

1716.01 SCOPE

1716.02 REFERENCES

1716.03 DEFINITIONS

1716.05 MATERIALS

1716.05.01 General

1716.05.02 Colour

1716.05.03 Chemical Composition

1716.05.04 Reflectorization

1716.05.05 Physical Property Requirements

1716.05.06 Service Test

1716.07 PRODUCTION

1716.07.01 Plant Inspection

1716.07.02 Quality Control

1716.08 QUALITY ASSURANCE

1716.08.01 Acceptance Criteria

1716.08.02 Quality Control of Production Batches

1716.08.03 Storage

1716.09 AUTHORITY PURCHASE OF MATERIAL BY PURCHASE ORDER

1716.09.01 Trial Batch Application

1716.09.02 Certificate of Compliance

1716.09.03 Delivery and Packaging of Water-Borne Traffic Paint

1716.09.04 Measurement and Payment

1716.10 DESIGNATED SOURCES REQUIREMENTS

1716.01 SCOPE

This specification covers the requirements for water-borne traffic paint which is suitable for application onto concrete and bituminous pavements.
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
CGSB-1-GP-71-1983 - Testing Paints and Pigments:

**California Department of Transportation:**
8010-61G-30 - Water Borne Traffic Paint

**American Society for Testing and Materials:**
ASTM D185-84 - Coarse Particles in Pigments, Pastes and Paints
ASTM D711-84 - No Pick-Up Time of Traffic Paint
ASTM D713-87 - Conducting Road Service Tests on Traffic Paint
ASTM D869-85 - Evaluating Degree of Settling of Traffic Paint
ASTM D2205-85 - Traffic Paints
ASTM D2243-82(1987) - Freeze-Thaw Resistance of Water-Borne Paints
ASTM D2244-85 - Calculation of Colour Differences from Instrumentally Measured Colour Coordinates
ASTM D2369-87 - Volatile Content of Coatings
ASTM D3168-85 - Practice for Qualitative Identification of Polymers in Emulsion Paints
ASTM D3960-87 - Determining Volatile Organic Content (VOC) of Paints and Related Coatings
ASTM E70-77(1986) - Test Method for pH of Aqueous Solutions With the Glass Electrode
ASTM E303-83 - Measuring Surface Frictional Properties Using the British Pendulum Tester

**United States Federal Standard:**
International Commission on Illumination:


1716.03 DEFINITIONS

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

Compliance Certification: refers to the procedure and requirements for establishing an approved source for materials.

Fingerprinting: refers to testing of water-borne by gas chromatographic and infrared spectroscopic techniques for verification purposes.

No Tracking Time: refers to 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 manoeuvre with a passenger car.

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

Reflectorization: refers to 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: refers to the evaluation of pavement marking materials on a test deck and performance rating prior to compliance certification.

Traffic Paint: refers to a paint specifically formulated for use as a pavement marking to delineate vehicle operating limits.

Water-Borne Traffic Paint: refers to traffic paint whose components are carried in water either as an emulsion or a dispersion and will form a solid paint film on deposition and evaporation of water and volatiles after application.

1716.05 MATERIALS

1716.05.01 General

Water-borne traffic paint shall be homogeneous, and shall be well ground to a uniform smooth consistency. It shall be free from skin, dirt and other foreign particles, and shall be capable of being sprayed at the temperature intended for the paint. The water-borne traffic paint shall flow evenly and smoothly and cover solidly when applied to pavements.

The materials used in the manufacture of the water-borne traffic paint shall be of high quality and consistency such that the appearance will not change in service to impair the colour or visibility of the delineation. The water-borne traffic paint film shall be flat in finish, and the white and yellow markings shall be visible under daylight and artificial light after the addition of the overlay glass beads.

1716.05.02 Colour

The water-borne traffic paint shall conform to the following colour requirements:
White - CGSB 1-GP-12C white 513-301

Yellow - shall match either the yellow traffic paint 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 conforming to ASTM D 2244:

White  
\[ L^* = +2 \text{ and } -1.5 \text{ max} \]
\[ a^* = +1.5 \text{ and } -1 \text{ max} \]
\[ b^* = +4 \text{ and } -4 \text{ max} \]

Yellow - MTO  
\[ L^* = +2 \text{ and } -1.5 \text{ max} \]
\[ a^{**} = +3 \text{ and } -1.5 \text{ max} \]
\[ b^* = +7 \text{ and } -1.5 \text{ max} \]

Yellow - U.S.  
\[ L^* = -2 \text{ and } +4 \text{ max} \]
\[ a^* = -6 \text{ and } +4 \text{ max} \]
\[ b^* = -9 \text{ and } +10 \text{ max} \]

1716.05.03 Chemical Composition

The chemical composition of the water-borne traffic paint shall be at the discretion of the paint manufacturer and shall be certified by the Authority.

1716.05.04 Reflectorization

The white and yellow paints shall be used with overlay glass beads which are applied uniformly after application of the paint at a rate as shown below. The white and yellow paints shall provide proper anchorage for overlay glass beads conforming to OPSS 1750.

Rate of application for overlay Glass Beads per litre of Traffic Paint

<table>
<thead>
<tr>
<th>% Volume Solids of Traffic Paint</th>
<th>Glass Beads Required in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-56</td>
<td>0.7</td>
</tr>
<tr>
<td>57-70</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Test samples of glass beads conforming to OPSS 1750 may be obtained from the Authority upon request.

1716.05.05 Physical Property Requirements

Water-borne traffic paints shall be supplied ready-mixed for use without any addition of water.

The handling and storage qualities must be acceptable with respect to degree of settling, uniform consistency, absence of skinning and thixotropic properties. The water-borne traffic paint shall be capable of being sufficiently atomized to produce an uniformly applied paint stripe without side splatter and overspray within the limitation imposed by conventional striping equipment.
The physical properties of the water-borne traffic paints submitted for compliance certification shall conform to Table 1.

Samples are required by the Authority for laboratory testing. The Supplier shall submit with each test sample, complete data on physical properties, application procedure, and material safety for the water-borne traffic paint.

**1716.05.06 Service Test**

Water-borne traffic paint, conforming to 1716.05.05 and Table 1 shall be submitted for service test when requested by the Authority.

Water-borne traffic paints will be service tested, conforming to the following:

a. Test deck location, time, and procedure of application shall be as specified by the Authority.

b. Test stripe shall be 10 cm in width and applied transversely by across the lanes of the road. Application of the traffic paint to a dry thickness of $230 \pm 25$ microns on bituminous or concrete pavement with about 20,000 AADT and application of overlay glass beads conforming to OPSS 1750, at the approved rate immediately over the white and yellow striped line.

c. The ease and uniformity of application, severity of overspray, covering properties, and drying time will be evaluated during application.

d. The applied water-borne traffic paint will be inspected periodically and its service performance will be rated by the Authority, as outlined in Table 2.

e. Approval will be given after one year of service rating, providing the material conforms to Table 2 and meets the conditions of 1716.09.02.

**1716.07 PRODUCTION**

**1716.07.01 Plant Inspection**

In order to qualify as a supplier of water-borne traffic paint(s), a manufacturer must satisfy the following minimum requirements:

a. Adequate facilities to produce minimum batches of 3000 litres;

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.

**1716.07.02 Quality Control**

A manufacturer shall be responsible for carrying out a quality control program to ensure that the water-borne traffic paint(s) conform(s) to this specification.
1716.08 QUALITY ASSURANCE

1716.08.01 Acceptance Criteria

The Authority may request samples to be taken from the shipments of water-borne traffic paint(s) at any time for quality assurance testing. Samples shall be taken from each batch produced for delivery to the Authority. Criteria for accepting each production batch include the following requirements and manufacturing tolerances:

a. Density shall be within 0.05 kg/l of the value established on the test sample, conforming to CGSB-1-GP-71 - Method 2.1.

b. Viscosity shall be within ± 5 KU of the reference value.

c. Colour Difference ∆E shall be within ± 1.5 of the value established on the reference sample.

d. Composition shall not vary by more than ± 5%, based on fingerprinting and other tests, ASTM D3168, of the value of the reference sample.

e. Total solids shall not vary by more than ± 2% from the value of the reference sample.

f. pH of the sample shall not vary by more than one unit from that of the value established for the reference sample.

g. No pickup time of each production batch sample shall be within ± 2.5 minutes of the value established for the test sample, conforming to ASTM D-711.

h. Directional Reflectance with:
   - minimum value of 70% white
   - minimum value of 50% yellow

i. Hiding Power with minimum value of 8.4 m²/l.

1716.08.02 Quality Control of Production Batches

A one litre sample from each production batch of water-borne traffic paint along with test results on density, viscosity at 25°C, pH, total solids, and no-pickup time shall be delivered to the Authority’s laboratory within two days of manufacture of the respective batches.

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 during each calendar week shall be given to the Authority at the end of each week until the entire order is completed and shipped.

1716.08.03 Storage

The water-borne traffic paint shall conform to this specification after storage.
1716.09  AUTHORITY PURCHASE OF MATERIAL BY PURCHASE ORDER

1716.09.01  Trial Batch Application

A trial batch of water-borne traffic paint(s) conforming to this specification may be purchased by the Authority for evaluation of application properties using the Authority’s painting equipment. The trial batch shall consist of a minimum quantity of 1,000 litres of traffic paint.

No-tracking time will also be determined.

Those water-borne traffic paint(s) conforming to this specification which exhibit satisfactory loading and application properties when used with the Authority's traffic painting equipment will be considered for purchase.

1716.09.02  Certificate of Compliance

The manufacturer shall submit a certificate of compliance, with tenders, indicating that the physical properties and chemical composition of all of the manufacturer's production batches of traffic paint, for the Authority, shall conform to this specification and shall not deviate from the allowable tolerances, unless approved by the Purchaser.

1716.09.03  Delivery and Packaging of Water-Borne Traffic Paint

The delivery schedule, delivery location, colour, and quantity shall be as specified on the Authority's Purchase Order.

The water-borne traffic paint shall be furnished in returnable drums with air tight liners.

Each drum shall be clearly marked on the side and the top with weather resistant markings to show the following information:

a. manufacturer's name and address
b. type of traffic paint
c. colour
d. manufacturer's code and batch numbers date of filling the drum
e. volume of contents in litres

A small portion of the water-borne traffic paint may be required in twenty litre containers. The quantity will be specified on the Purchase Order.

1716.09.04  Measurement and Payment

The unit of measurement for water-borne traffic paint will be litres. Payment for supplying the water-borne traffic paint shall be as specified on the Authority's Purchase Order.

1716.10  DESIGNATED SOURCES REQUIREMENTS

In order for a Supplier to be considered for addition to the List of Designated Sources of the Ministry of Transportation, Ontario for water borne traffic paint, the manufacturer shall supply a production sample of the water borne traffic paint to the Ministry along with complete material data in a prescribed form PAV.M.1716 available from the Ministry, for conformance testing.
If the test samples conform to this specification and the Ministry is satisfied that the Supplier has the equipment and ability to produce the material in bulk quantities, then the Ministry, upon written request to the Manager, Purchasing and Supply Office of the Ministry of Transportation, 1201 Wilson Ave., Downsview, Ontario, M3M 1J8 will place the Supplier on the List of Designated Sources for Materials.

Subsequent changes in formulations, the inability to maintain quality production or to meet commitments, or failure to conform to this specification shall be cause for cancellation of approval and shall necessitate application for reapproval.
## TABLE 1
PHYSICAL PROPERTY REQUIREMENTS FOR WATER-BORNE TRAFFIC PAINT

<table>
<thead>
<tr>
<th>TEST AND PROPERTY</th>
<th>REQUIREMENTS</th>
<th>TEST METHODS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>Volatile Organic Content %</td>
<td></td>
<td>8.5</td>
</tr>
<tr>
<td>Settling 6 months</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>Hiding Power m²/l</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>Skinning 48 hours</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td>Viscosity KU @ 7°C</td>
<td>85</td>
<td>135.0</td>
</tr>
<tr>
<td>Viscosity KU @ 25°C</td>
<td>85</td>
<td>110.0</td>
</tr>
<tr>
<td>Viscosity Change after Heat-Shear Stability Test at 25°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeze-Thaw Stability</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td>Coarse Particles # 60 sieve - 250 µm</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td>Coarse Particles #100 sieve - 150 µm</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>No Pickup Time, mins.</td>
<td>8.0*</td>
<td></td>
</tr>
<tr>
<td>Directional Reflectance %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Paint</td>
<td>70.0</td>
<td></td>
</tr>
<tr>
<td>Yellow Paint</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>Black Paint</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Skid Resistance</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>BPN Units</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* For coning type of traffic paints, this value can be higher.

** Values to be established.
**TABLE 2**

PERFORMANCE REQUIREMENTS FOR SERVICE TEST
AT ABOUT 20,000 AADT FOR WATER-BORNE TRAFFIC PAINT

<table>
<thead>
<tr>
<th>Property</th>
<th>Performance Requirements</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Newly Installed Paints</td>
<td>Service Life Ratings of Paints</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 mths</td>
</tr>
<tr>
<td>Directional Reflectance %</td>
<td>White</td>
<td>≥ 70</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>≥ 50</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>≤ 12</td>
</tr>
<tr>
<td>Retroreflectance mcd/m²/lux</td>
<td>White</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>**</td>
</tr>
<tr>
<td>No Tracking Time, mins.</td>
<td></td>
<td>≤ 2</td>
</tr>
<tr>
<td>Durability</td>
<td>White and Yellow</td>
<td>≥ 90</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>≥ 90</td>
</tr>
<tr>
<td>Appearance</td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

* These values were obtained 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 Authority.
WATER-BORNE TRAFFIC PAINT DATA FORM

A. MANUFACTURER’S NAME _____________________________________________
   ADDRESS ____________________________________________
   ________________________________________________________
   TELEPHONE NO. __________________________________________

B. SAMPLE IDENTIFICATION
   Manufacturer’s Code No. ______________________ Paint Batch No. ______________________
   Colour of Paint ______________________________ Sample Date ______________________

C. TEST DATA
   Density, kg/l 1-GP-71 M2.1 ___________________________________
   Volatile Organic Content % ASTM D 3960 ______________________
   No Pickup Time, minutes ASTM D711 ________________________
   Hiding Power, m²/l Pfund Cryptometer OPSS 1716, Table 1
   pH ASTM E70 ____________________________________________
   Total Solids ASTM D2369 __________________________________
   Freeze-Thaw Stability ASTM D2243 _________________________
   Viscosity Change after Heat-Shear Stability OPSS 1716, Table 1

D. COMPOSITION OF PAINT % by Mass % by Volume
   Pigment and Fillers ____________________________________________
   Binder _____________________________________________________
   Water ______________________________________________________

Composition of Pigment and Fillers % by Mass

1 ____________________________________________________________
2 ____________________________________________________________
3 ____________________________________________________________
4 ____________________________________________________________
5 ____________________________________________________________
6 ____________________________________________________________
7 ____________________________________________________________
8 ____________________________________________________________

Type of Binder ______________________________________________

VOC individual components mg/litre

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
E. MATERIAL SAFETY DATA

F. APPLICATION PROCEDURE
   Surface Preparation ________________________________________________________________
   Minimum Pavement Temperature ____________________________________________________
   Paint Temperature ___________ min °C ___________ max °C
   Mode of Application ______________________________________________________________
   Air Temperature ___________ min °C  Humidity ___________ max %

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