

TENDER DOCUMENTS

SUBSECTION 6.73 ROAD MARKING

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SUBSECTION 6.73 ROAD MARKING

6.73.1 GENERAL

6.73.1.1 This subsection sets out the requirements related to road marking carried out under this Contract using short-, medium- and long-performance paint.

6.73.1.2 Any specific requirements related to road painting carried out under this Contract are set out in Section 4 *Special Technical Conditions*.

6.73.2 REFERENCE STANDARDS

6.73.2.1 The **Contractor** shall perform all road marking in accordance with the requirements of the following standards and documents to which the provisions of the Contract are added:

6.73.2.1.1 (ASTM) ASTM International

- ASTM D562-01(2005) *Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer*;
- ASTM D711-89(2004) *Standard Test Method for No-Pick-Up Time of Traffic Paint*;
- ASTM D969-85(2003)e1 *Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint*;
- ASTM D1210-05 *Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage*;
- ASTM D1475-98(2008) *Standard Test Method for Density of Liquid Coatings, Inks, and Related Products*;
- ASTM D2244-07 *Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates*;
- ASTM D2369-07 *Standard Test Method for Volatile Content of Coatings*;
- ASTM D2371-85(2005) *Standard Test Method for Pigment Content of Solvent-Reducible Paints*;
- ASTM D4017-02(2008)e1 *Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method*;
- ASTM E1347-06 *Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry*.

6.73.2.1.2 (MTQ) Ministère des Transports du Québec

- MTQ – *Cahier des charges et devis généraux (CCDG)*
- MTQ – *Normes – Ouvrages routiers - Tome VII Matériaux, Chapitre 10 Peinture et produits de marquage :*
 - ▶ *Norme 10201 Peinture alkyde pour le marquage des routes;*
 - ▶ *Norme 10202 Produits de marquage de moyenne durée;*
 - ▶ *Norme 10203 Produits de marquage de longue durée.*
- MTQ – *Normes – Ouvrages routiers - Tome VII Matériaux, Chapitre 14 Matériaux divers, Norme 14601 Microbilles de verre pour peinture servant au marquage des routes.*

6.73.2.1.3 (LC) Ministère des Transports du Québec, Laboratoire des chaussées

- LC 34-301 *Détermination du bioxyde de titane;*
- LC 34-505 *Détermination de la consistance à 5°C;*
- LC 34-506 *Détermination du degré de sédimentation – Méthode Patton;*
- LC 34-507 *Détermination de la teneur en chromate de plomb;*
- LC 34-508 *Détermination de la teneur en anhydride phtalique.*

6.73.2.1.4 WHMIS (Workplace Hazardous Materials Information System)

6.73.2.1.5 (FED-STD) Federal Standard

- FED-STD-595B *Colors Used In Government Procurement.*

6.73.3 MATERIALS

6.73.3.1 GENERAL

6.73.3.1.1 The **Contractor** shall ensure that the product used is appropriate to the application taking into account the type of surface (asphalt or cement concrete), the texture of the surface and other surface conditions.

6.73.3.1.2 The colours of the various short-, medium- and long-performance marking products used shall conform to standard FED-STD- 595B.

6.73.3.1.3 The white shall match standard 37875, the yellow shall match standard 33538 and the black shall match standard 37038.

6.73.3.1.4 No marking product shall contain lead chromate (PbCrO₄).

6.73.3.1.5 No paint or marking product may be thinned.

6.73.3.2 SHORT-PERFORMANCE MARKING PRODUCTS

6.73.3.2.1 Only marking products which conform to standard MTQ 10201 and are on the Ministère des Transports du Québec list of approved products at the time of the call for tenders may be used for short-performance marking.

6.73.3.3 MEDIUM-PERFORMANCE MARKING PRODUCTS

6.73.3.3.1 Only marking products which conform to standard MTQ 10202 and are on the Ministère des Transports du Québec list of approved products at the time of the call for tenders may be used for medium-performance marking.

6.73.3.4 LONG-PERFORMANCE MARKING PRODUCTS

6.73.3.4.1 Only marking products which conform to standard MTQ 10203 and are on the Ministère des Transports du Québec list of approved products at the time of the call for tenders may be used for long-performance marking.

6.73.3.4.2 Long-performance marking products shall not discolour or delaminate as a result of exposure to ultraviolet light for four (4) years, as required by Appendix 6.73-II *Reflectivity and Durability Requirements for Long-Performance Marking*.

6.73.3.4.3 Long-performance marking products shall not deteriorate as a result of contact with sodium chloride or other chemicals used to deice the road surface or with the oil used in paving materials or motor oil.

6.73.3.5 GLASS MICROBEADS

6.73.3.5.1 The product used shall conform to standard MTQ 14601 and be on the Ministère des Transports du Québec list of approved products at the time of the call for tenders.

6.73.3.6 PRE-MARKING PLACARDS OR DISKS

6.73.3.6.1 Pre-marking components shall be reflective, pressure adhesive, flexible and free of cracks. The self-adhesive surface shall have a removable backing to protect the adhesive.

6.73.3.6.2 Pre-marking components shall be 1.5 mm to 2 mm thick (not including the protective backing) and 90 mm to 100 mm in diameter.

6.73.3.6.3 The basic material used to make placards shall be prefabricated strips of rot-resistant, non-absorbent, chemically stable polymer impervious to sodium chloride or calcium chloride.

6.73.4 INSPECTION AND STORAGE

6.73.4.1 The **Contractor** shall ensure that the Engineer is able to identify at all times the products used by the **Contractor**; accordingly, a product identification label shall be affixed to every container.

6.73.4.2 The label on each container shall include the following information:

- manufacturer's name and address;
- product name;
- product code number;
- date of manufacture;
- colour;
- quantity by volume and mass;
- batch number;
- WHMIS requirements.

6.73.4.3 Marking products shall be stored according to the manufacturer's recommendations.

6.73.5 EQUIPMENT AND TOOLS

6.73.5.1 The **Contractor** shall apply paint or marking products using equipment capable of spraying both yellow and white at the application rate recommended by the manufacturer.

6.73.5.2 The equipment shall be installed on a sturdy, stable vehicle with the power needed to draw even single, double, broken or unbroken lines with clean edges and no spattering or excessive dispersal of the product.

6.73.5.3 The equipment shall be fitted with a device to dispense glass microbeads on top of the fresh paint at the recommended rate.

6.73.5.4 The equipment shall be fitted with a shut-off device.

6.73.6 EXECUTION OF WORK

6.73.6.1 GENERAL

6.73.6.1.1 Road marking shall be carried out in accordance with the requirements of this subsection and Tome V *Traffic Control Devices* of the Ministère des Transports du Québec collection of road works standards entitled *Normes – Ouvrages routiers*.

6.73.6.2 TECHNICAL DATA SHEETS

6.73.6.2.1 At least fourteen (14) days before ordering any materials, the **Contractor** shall submit to the Engineer technical data sheets for each product that will be used under this Contract. The technical data sheets shall include the following information in particular :

- physical and chemical characteristics of the product;
- storage conditions;
- instructions for preparing road surface;
- application methods and conditions required by the manufacturer;
- drying time;
- application rate for marking product;
- application rate for glass microbeads;
- type of glass microbeads.

6.73.6.2.2 The fact that the documents or items referred to in this subsection are reviewed by the Engineer does not relieve the **Contractor** of its responsibility under this Contract, which includes, but is not limited to, supplying appropriate materials and equipment, adopting suitable work methods and ensuring good workmanship.

6.73.6.2.3 At the Engineer's request, the **Contractor** shall collect and submit a sample of two (2) litres of each marking product for laboratory testing by the **Owner**.

6.73.6.3 CERTIFICATION OF CONFORMITY

6.73.6.3.1 At least fourteen (14) days before ordering materials, the **Contractor** shall submit to the Engineer a certificate of conformity for each product that will be used under the Contract.

6.73.6.3.2 The certificate of conformity for each production batch of marking product shall include at least the following information:

- manufacturer's name;
- manufacturer's product code;
- date and place of manufacture;
- type of product;
- colour;

- fineness of grind;
- reference standard;
- approval program;
- results of the following analyses and tests:
 - consistency at 24°C;
 - drying time;
 - density;
 - CIELAB colour;
 - production batch number;
- temperature required for 700 cP, in °C (medium- and long-performance only).

6.73.6.3.3 The certificate of conformity for each production batch of glass microbeads shall include at least the following information:

- manufacturer's name;
- manufacturer's product code;
- date and place of manufacture;
- type product;
- applicable reference standard;
- production batch number;
- the results of the following analyses and tests:
 - particle size;
 - sphericity;
 - imperfections;
 - water-repelling properties.

6.73.6.4 PRE-MARKING ON NEW PAVEMENT

6.73.6.4.1 Pre-marking shall be used on new asphalt pavement as alignment marks indicating the location of the traffic lanes prior to final marking.

6.73.6.4.2 Pre-marking shall be done immediately prior to the final pass of the roller.

6.73.6.4.3 Unless otherwise indicated in the *Special Technical Conditions* or requested by the Engineer, the spacing of pre-marking elements shall be 10 m in straight lines and 5 m on curves and on the centre line between two (2) traffic lanes.

6.73.6.4.4 Pre-marking shall be accurate to within 100 mm longitudinally and 10 mm transversely relative to the baseline.

6.73.6.5 SURFACE CLEANING

6.73.6.5.1 The surface to be marked shall be clean, dry and free of dirt or debris, including, but not limited to, dust, contaminants, loose particles, foreign objects, oil or grease, that could adversely affect the adhesion or durability of the marking.

6.73.6.5.2 The surface to be marked shall be cleaned using a method such as sweeping with a mechanical sweeper with rotary brushes or with a vacuum sweeper. If necessary, the **Contractor** will do the final sweep manually.

6.73.6.5.3 Abrasives or solvents used to remove paint, oil, grease or rubber residue shall be a recognized brand designed specifically for cleaning road surfaces. The products shall not damage the equipment and shall be approved by the Engineer.

6.73.6.6 ERASING EXISTING MARKINGS

6.73.6.6.1 In areas indicated on the drawings or in the *Standard Technical Conditions* or identified by the Engineer, the **Contractor** shall erase any existing lines or markings.

6.73.6.6.2 Markings shall be removed using a friction method such as abrasive, water or shot blasting, rotary grinding with a hot planer or any other method approved by the Engineer.

6.73.6.6.3 Unless otherwise indicated in the *Special Technical Conditions*, the use of neutralizing paint to erase markings is not accepted.

6.73.6.6.4 When erasing existing markings, the **Contractor** shall be careful:

- not to remove fine particles or coarse aggregate;
- not to damage the asphalt binder or joint and crack filler.

6.73.6.6.5 Where the **Contractor** uses a hot planer, the pavement shall not be heated to more than 120°C.

6.73.6.6.6 The **Contractor** shall dispose of planing and erasing waste in accordance with the environmental requirements of subsection 6.13 *Environmental Protection* and the *Special Technical Conditions* of this Contract.

6.73.6.7 MARKING

6.73.6.7.1 Marking shall not be done in the following conditions:

- the pavement is wet;

- the marking product could become wet from rain before the end of the drying time recommended by the manufacturer;
- the air temperature or the temperature of the pavement is below 10°C;
- the humidity level is above 70%;
- the surface to be marked is covered with earth, rocks, dust, oil, grease or other foreign substance;
- the product shall not be applied to longitudinal joints in the pavement or on top of joint or crack sealant;
- the marking product shall not be applied on top of existing marking products unless otherwise indicated in the *Special Technical Conditions* or directed by the Engineer.

6.73.7 QUALITY CONTROL

6.73.7.1 APPLICATION RATE

- 6.73.7.1.1 The **Contractor** is responsible for monitoring the application rate and accordingly shall keep close watch on the thickness of the film of product using an interchemical thickness gauge and the penetration of glass microbeads by taking a control sample at the end of each shift.
- 6.73.7.1.2 The control samples from lines drawn shall be taken on transparent slides and shall clearly indicate the following information: date, time, lane, direction and test results.
- 6.73.7.1.3 The thickness test results shall be recorded in the site log and the slides given to the Engineer at the end of each shift.
- 6.73.7.1.4 The Engineer may measure at any time the flow from the guns used to apply a product or equipment used to spread glass microbeads.

6.73.7.2 ALIGNMENT

- 6.73.7.2.1 The alignment must be correct to within +/-2.5 cm relative to the marking drawings or the Engineer's instructions for lines shorter than 3 m. For markings longer than 3 m, the tolerance is +/-5 cm.

6.73.7.3 SIZE OF LINES OR MARKINGS

6.73.7.3.1 Unless otherwise indicated in the *Special Technical Conditions* or on the drawings, lines or markings shall be 150 mm wide \pm 5 mm.

6.73.7.3.2 The colour and density of painted lines shall be uniform, and the edges shall be sharp.

6.73.7.4 SPACING

6.73.7.4.1 The spacing between lines and the configuration of the striped areas of approach noses shall meet the requirements shown on the drawings.

6.73.7.5 TEST METHODS

6.73.7.5.1 The Engineer may, if he deems such action necessary, conduct the following tests in order to validate the conformity of the marking products applied by the **Contractor**:

- colour difference test conforming to the requirements of test method ASTM D2244;
- lead chromate content test conforming to the requirements of test method LC 34-507;
- paint opacity test conforming to the requirements of test method ASTM E1347.

6.73.7.5.2 Material that fails to meet any of the requirements of the above mentioned test methods shall be deemed non-compliant and shall be replaced by the **Contractor** at no additional cost to the **Owner**.

6.73.7.6 CORRECTION OF IRREGULARITIES

6.73.7.6.1 Within forty-eight (48) hours, the **Contractor** shall correct at its own expense any marking irregularities brought to its attention by the Engineer. The lines or markings shall be erased by friction only. Neutralizing paints may not be used to correct irregularities.

6.73.7.7 TEMPORARY PROTECTION OF MARKING

6.73.7.7.1 The **Contractor** shall protect the marking until the paint is dry. However, cones or other signal devices shall not be left in place for more than two (2) hours after the paint is applied unless authorized by the Engineer to ensure the quality of the marking.

6.73.8 WARRANTY

6.73.8.1 WARRANTY ON MEDIUM-PERFORMANCE MARKING PRODUCTS

6.73.8.1.1 Without limiting the scope of Section 8 *General Conditions* of the Contract, the **Contractor** shall, in addition to the warranty prescribed in clause GC32 *Warranty and Rectification of Defects in Work*, provide a written warranty issued in the **Owner's** name guaranteeing the reflective properties and durability of the medium-performance marking product according to the requirements of Appendix 6.73-I *Reflectivity and Durability Requirements for Medium-Performance Marking* for a period of two (2) years from the date on which the Interim Certificate of Completion for the work in question is issued.

6.73.8.2 WARRANTY ON LONG-PERFORMANCE MARKING PRODUCTS

6.73.8.2.1 Without limiting the scope of Section 8 *General Conditions* of the Contract, the **Contractor** shall, in addition to the warranty prescribed in clause GC32 *Warranty and Rectification of Defects in Work*, provide a written warranty issued in the **Owner's** name guaranteeing the reflective properties and durability of the long-performance marking product according to the requirements of Appendix 6.73-II *Reflectivity and Durability Requirements for Long-Performance Marking* for a period of four (4) years from the date on which the Interim Certificate of Completion for the work in question is issued.

END OF SUBSECTION

APPENDIX 6.73-I

**REFLECTIVITY AND DURABILITY REQUIREMENTS
FOR MEDIUM-PERFORMANCE MARKING
(1 PAGE)**

REFLECTIVITY REQUIREMENTS

For a period of two (2) years from the date on which the Interim Certificate of Completion is issued, medium-performance marking products shall meet the following performance requirements:

	LANE MARKINGS		APPROACH NOSE, ARROW, CROSSING, STOP LINE
	Yellow	White	Yellow
At time of application	≥ 175	≥ 300	≥ 175
After one (1) year	≥ 100	≥ 120	≥ 100
After two (2) years	≥ 75	≥ 85	≥ 75

These values are determined using an Ecolux retroreflectometer. The unit of measurement is the MCD (md/lx/m^2).

DURABILITY REQUIREMENTS

Separation of marking products shall be minimal. The percentage of markings visible on the road surface shall be equal to or greater than the following values:

	LANE MARKINGS		APPROACH NOSE, ARROW, CROSSING, STOP LINE
At time of application	100%		100%
After one (1) year	95%		90%
After two (2) years	85%		75%

The percentage of markings visible on the road surface is calculated using photographs with the percentage visible at the time the product is applied (100%) used as a point of reference. A visual method approved by the Engineer may also be used.

APPENDIX 6.73-II

**REFLECTIVITY AND DURABILITY REQUIREMENTS
FOR LONG-PERFORMANCE MARKING
(1 PAGE)**

REFLECTIVITY REQUIREMENTS

For a period of four (4) years from the date on which the Interim Certificate of Completion is issued, long-performance marking products shall meet the following performance requirements:

	LANE MARKINGS		APPROACH NOSE, ARROW, CROSSING, STOP LINE
	Yellow	White	Yellow
At time of application	≥ 175	≥ 300	≥ 175
After one (1) year	≥ 110	≥ 140	≥ 100
After two (2) years	≥ 100	≥ 120	≥ 75
After three (3) years	≥ 90	≥ 100	-
After four (4) years	≥ 75	≥ 85	-

These values are determined using an Ecolux retroreflectometer. The unit of measurement is the MCD (md/lx/m^2).

DURABILITY REQUIREMENTS

Separation of marking products shall be minimal. The percentage of markings visible on the road surface shall be equal to or greater than the following values:

	LANE MARKINGS	APPROACH NOSE, ARROW, CROSSING, STOP LINE
At time of application	100%	100%
After one (1) year	95%	90%
After two (2) years	85%	75%
After three (3) years	80%	-
After four (4) years	75%	-

The percentage of markings visible on the road surface is calculated using photographs with the percentage visible at the time the product is applied (100%) used as a point of reference. A visual method approved by the Engineer may also be used.