

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 describes the requirements relating to the road marking work covered by this Contract using short-, medium- and long-performance paint.

6.73.1.2 Any specific requirements pertaining to the road marking work covered by this Contract are set out on the plans and in Section 4 *Special Technical Conditions*.

6.73.2 MEASUREMENT UNITS

6.73.2.1 The measurement units and respective symbols thereof used in this subsection are described as follows:

Measurement unit	Designation	Symbol
area	square meter	m ²
illuminance	lux	lx
stress, pressure	megapascal	MPa
length	meter	m
length	centimeter	cm
length	millimeter	mm
time	second	s
temperature	Celsius degree	°C
viscosity	megapascal-second	MPa-s
volume	liter	L

6.73.3 REFERENCE STANDARDS

6.73.3.1 The Contractor shall perform all road marking work in accordance with the requirement of following standards and documents to which the provisions of this Contract are added:

6.73.3.1.1 (ASTM) ASTM International:

- ASTM D562 *Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer;*
- ASTM D711 *Standard Test Method for No-Pick-Up Time of Traffic Paint;*
- ASTM D868 *Standard Practice for Determination of Degree of Bleeding of Traffic Paint;*
- ASTM D1210 *Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage;*
- ASTM D1475 *Standard Test Method for Density of Liquid Coatings, Inks, and Related Products;*

- ASTM D2244 *Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates*;
- ASTM D2369 *Standard Test Method for Volatile Content of Coatings*;
- ASTM D2371 *Standard Test Method for Pigment Content of Solvent-Reducible Paints*;
- ASTM D4017 *Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method*;
- ASTM E1347 *Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry*.

6.73.3.1.2 (MTQ) Ministère des Transports du Québec:

- MTQ – *Cahier des charges et devis généraux (CCDG) – Construction et réparation*;
- MTQ – *Normes – Ouvrages routiers – Tome V Signalisation routière*;
- 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*.
- (LC) Laboratoire des chaussées du MTQ:
 - 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*.

6.73.3.1.3 (FED-STD) Federal Standard:

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

6.73.4 MATERIALS

6.73.4.1 GENERAL

- 6.73.4.1.1 The Contractor shall ensure that the product used is suitable for its intended use considering, notably, the type of pavement (asphalt or cement concrete), the texture of the pavement and other conditions of the surface.
- 6.73.4.1.2 The colours used for the various short-, medium- and long-performance marking products shall comply with U.S. standard FED-STD-595C.
- 6.73.4.1.3 The white color standard of the marking product shall conform to that of standard No 37875, the yellow shall conform to that of standard No 33538 and the black shall conform to that of standard No 37038.
- 6.73.4.1.4 No marking products shall contain lead chromate (PbCrO₄).
- 6.73.4.1.5 No paint or marking products may be thinned.

6.73.4.2 SHORT-PERFORMANCE MARKING PRODUCTS

- 6.73.4.2.1 Only the marking products that comply with MTQ standard 10201 and are registered on the MTQ's list of approved products at the time of the call for tenders may be used for short-performance marking.

6.73.4.3 MEDIUM-PERFORMANCE MARKING PRODUCTS

- 6.73.4.3.1 Only the marking products that comply with MTQ standard 10202 and are registered on the MTQ's list of approved products at the time of the call for tenders may be used for medium-performance marking.
- 6.73.4.3.2 The medium-performance marking products shall not show any discoloration or come off as a result of exposure to UV radiation for a period of two (2) years, as indicated in Appendix 6.73-I – Retroreflection and *Durability Requirements for Medium-Performance Marking* of this subsection.

6.73.4.4 LONG-PERFORMANCE MARKING PRODUCTS

- 6.73.4.4.1 Only the marking products that comply with MTQ standard 10203 and are registered on the MTQ's list of approved products at the time of the call for tenders may be used for long-performance marking.
- 6.73.4.4.2 The long-performance marking products shall not show any discoloration or come off as a result of exposure to UV radiation for a period of four (4) years, as indicated in Appendix 6.73-II Retroreflection and Durability Requirements for Long-Performance Marking of this subsection.

6.73.4.4.3 The long-performance marking products shall not deteriorate when they come into contact with sodium chloride or other chemicals agents used to deice the roadway surface, with the oil contained in the different paving materials or with motor oil.

6.73.4.5 GLASS MICROBEADS

6.73.4.5.1 The glass microbeads product used shall comply with MTQ standard 14601 and be on MTQ's list of approved products at the time of the call for tenders.

6.73.4.6 PRE-MARKING PLACARDS OR DISKS

6.73.4.6.1 The pre-marking components shall be reflective, pressure adhesive, flexible and free of cracks. The self-adhesive surface shall have a removable backing that protects the adhesive.

6.73.4.6.2 The pre-marking components shall be 1.5 mm to 2 mm thick (excluding the protective backing) and 90 mm to 100 mm in diameter.

6.73.4.6.3 The basic material used to manufacture the placards shall consist of rot-proof, non-absorbent, chemically stable polymer-based prefabricated strips that are impervious to sodium chloride and calcium chloride.

6.73.5 INSPECTION AND STORAGE

6.73.5.1 The Contractor shall ensure that the Engineer is at all times able to identify the products used by the Contractor and, to this end, a product identification label shall be affixed to each container.

6.73.5.2 The label on each container shall comprise the following information:

6.73.5.2.1 the manufacturer's name and address;

6.73.5.2.2 the product name;

6.73.5.2.3 the product code number;

6.73.5.2.4 the date and place of manufacture;

6.73.5.2.5 the colour;

6.73.5.2.6 the quantity by volume and mass;

6.73.5.2.7 the batch number;

6.73.5.2.8 the workplace Hazardous Materials Information System (WHMIS) requirements.

6.73.5.3 The marking products shall be stored according to the manufacturer's recommendations.

6.73.6 EQUIPMENT AND TOOLS

6.73.6.1 The Contractor shall apply the paint or marking product by means of equipment capable of spraying both the yellow and white colours at the application rates recommended by the manufacturer.

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

6.73.6.3 The equipment shall be fitted with a device for dispensing glass microbeads on the freshly applied paint at the rate indicated on the technical data sheet.

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

6.73.6.5 The equipment shall be fitted with a quantity counting device.

6.73.6.6 The equipment shall be fitted with a linear marking device.

6.73.7 EXECUTION OF WORK

6.73.7.1 GENERAL

6.73.7.1.1 The road marking shall be carried out in accordance with this subsection and with MTQ standards, Tome V.

6.73.7.2 TECHNICAL DATA SHEETS

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

6.73.7.2.1.1 the physical and chemical characteristics of the product;

6.73.7.2.1.2 the storage conditions;

6.73.7.2.1.3 the instructions for preparing the roadway surface;

6.73.7.2.1.4 the application methods and conditions required by the manufacturer;

6.73.7.2.1.5 the drying time;

6.73.7.2.1.6 the application rate for the marking product;

6.73.7.2.1.7 the application rate for the glass microbeads;

6.73.7.2.1.8 the type of glass microbeads.

6.73.7.2.2 The Contractor shall, at the request of the Engineer, collect and submit a sample of two (2) L of each marking product for tests to be conducted by the Owner's Laboratory.

6.73.7.3 CERTIFICATE OF CONFORMITY

6.73.7.3.1 At least fourteen (14) days before ordering any materials, the Contractor shall submit to the Engineer the certificates of conformity for each product that will be used under this Contract.

6.73.7.3.2 For each production batch of marking product, the certificate of conformity shall include, without limitation, the following information:

6.73.7.3.2.1 the manufacturer's name;

6.73.7.3.2.2 the manufacturer's product code;

6.73.7.3.2.3 the date and place of manufacture;

6.73.7.3.2.4 the type of product;

6.73.7.3.2.5 the colour;

6.73.7.3.2.6 the fineness of grinding;

6.73.7.3.2.7 the reference standard;

6.73.7.3.2.8 the certification program;

6.73.7.3.2.9 the results of the following analyses and tests:

6.73.7.3.2.9.1 the consistency at 24°C;

6.73.7.3.2.9.2 the drying time;

6.73.7.3.2.9.3 the density;

6.73.7.3.2.9.4 the CIELAB unit colour;

6.73.7.3.2.9.5 the production batch number;

6.73.7.3.2.10 the temperature in °C required for 700 MPa's viscosity, for medium- and long-performance only.

6.73.7.3.3 For each production batch of glass microbeads, the certificates of conformity shall include, without limitation, the following information:

6.73.7.3.3.1 the manufacturer's name;

6.73.7.3.3.2 the manufacturer's product code;

6.73.7.3.3.3 the date and place of manufacture;

6.73.7.3.3.4 the type of product;

6.73.7.3.3.5 the applicable reference standard;

6.73.7.3.3.6 the production batch number;

6.73.7.3.3.7 the results of the following analyses and tests:

6.73.7.3.3.7.1 the grading;

6.73.7.3.3.7.2 the sphericity;

6.73.7.3.3.7.3 the imperfections;

6.73.7.3.3.7.4 the water-repellent properties.

6.73.7.4 PRE-MARKING ON NEW ROADWAY PAVEMENT

6.73.7.4.1 The pre-marking elements shall be used on the new asphalt pavement as an alignment mark to delineate the roadway traffic lanes before the final marking.

6.73.7.4.2 The pre-marking shall be implemented immediately prior to the final pass of the compaction equipment.

6.73.7.4.3 Unless otherwise indicated on the plans or at the request of the Engineer, the spacing of the pre-marking elements shall be 10 m in straight lines, 5 m in curved lines and on the center line between two (2) traffic lanes.

6.73.7.4.4 The accuracy of the alignment of the pre-marking elements shall be 100 mm longitudinally and 10 mm transversely to the theoretical line.

6.73.7.4.5 The Engineer will carry out an inspection of the pre-marking and the reopening of the lanes to traffic shall be subject to his approval.

6.73.7.5 SURFACE CLEANING

- 6.73.7.5.1 The surface to be marked shall be clean, dry and free of dirt or debris, including, without limitation, dust, contaminants, loose particles, foreign objects, oil or grease that could interfere with the adhesion and durability of the marking.
- 6.73.7.5.2 The surface to be marked shall be cleaned using a method such as sweeping with a rotary brush mechanical sweeper or a vacuum sweeper. If necessary, the Contractor shall complete the cleaning process by manual sweeping.

6.73.7.6 ERASING EXISTING MARKINGS

- 6.73.7.6.1 In areas indicated on the plans or identified by the Engineer, the Contractor shall erase any existing lines or markings.
- 6.73.7.6.2 The markings shall be removed by friction such as abrasive, water or shot blasting, rotary grinding with a hot planer or any other method approved by the Engineer.
- 6.73.7.6.3 Unless otherwise indicated on the plans, the use of neutralizing paint to erase markings is not authorized.
- 6.73.7.6.4 When erasing the existing markings, the Contractor shall be careful:
 - 6.73.7.6.4.1 not to remove fine particles or coarse aggregate;
 - 6.73.7.6.4.2 not to damage the asphalt binder or the joint and crack filling materials.
- 6.73.7.6.5 Where the Contractor uses a hot planer, the pavement shall not be heated to more than 120°C.
- 6.73.7.6.6 The Contractor shall dispose of milling and erasing waste in accordance with the environmental requirements of subsection 6.13 *Environmental Protection* of this Contract.

6.73.7.7 ROAD MARKING

- 6.73.7.7.1 The marking shall not be carried out in the following conditions:
 - 6.73.7.7.1.1 the roadway is damp or wet;
 - 6.73.7.7.1.2 the marking product risks being wetted by the rain before the end of the drying time recommended by the manufacturer;
 - 6.73.7.7.1.3 the air temperature or the temperature of the roadway is below 10°C;
 - 6.73.7.7.1.4 the temperature of the pavement is below the dew point + 2°C;

- 6.73.7.7.1.5 the humidity level is above 70 %;
- 6.73.7.7.1.6 the surface of the roadway to be marked is covered with earth, rocks, dust, oil, grease or any other foreign substance;
- 6.73.7.7.1.7 the product shall not be applied on longitudinal joints in the pavement or on top of joint or crack sealant;
- 6.73.7.7.1.8 the marking product must not be applied on top of existing marking products unless otherwise indicated on the plans or as directed by the Engineer.

6.73.8 QUALITY CONTROL

6.73.8.1 APPLICATION RATE

- 6.73.8.1.1 The Contractor is responsible for monitoring the application rate and, to this end, shall keep close watch on the thickness of the product film by means of the Interchemical Thickness Gauge and on the penetration of the glass microbead by collecting a control sample at the end of each shift.
- 6.73.8.1.2 The control samples of lines drawn shall be taken on transparent plates and shall clearly show the following information: date, time, lane, direction and test results.
- 6.73.8.1.3 The thickness test results shall be recorded in the site log and the plates shall be forwarded to the Engineer at the end of each shift.
- 6.73.8.1.4 The Engineer may, at any time, measure the flow from the guns used to apply a product or of the equipment used to spread the glass microbeads.

6.73.8.2 ALIGNMENT

- 6.73.8.2.1 For lines shorter than 3 m, the alignment shall be respected with an accuracy of ± 2.5 cm relative to the marking plans or the instructions of the Engineer. For markings longer than 3 m, the accuracy is ± 5 cm.

6.73.8.3 SIZE OF LINES OR MARKINGS

- 6.73.8.3.1 Unless otherwise indicated on the plans, the lines or markings shall be 150 mm ± 5 mm wide.
- 6.73.8.3.2 The painted lines shall have a uniform colour and density and the demarcations shall be clean.
- 6.73.8.3.3 The length of a marking shall not deviate from the required length by more than 25 mm.

6.73.8.4 SPACING

6.73.8.4.1 The spacing between the lines and the configuration of the hatched areas of the gores shall be as indicated on the plans.

6.73.8.5 TEST METHODS

6.73.8.5.1 The Engineer may, if he deems it necessary, request the Owner's Laboratory to conduct the following tests in order to validate the conformity of the marking products applied by the Contractor:

6.73.8.5.1.1 the colour difference test in accordance with test method ASTM D2244;

6.73.8.5.1.2 the lead chromate content test in accordance with test method LC 34-507;

6.73.8.5.1.3 the paint opacity test in accordance with test method ASTM E1347.

6.73.8.5.2 Any materials that fail to meet any of the requirements of the test methods described above will be deemed non-compliant and shall be replaced by the Contractor at no additional cost to the Owner.

6.73.8.6 CORRECTION OF IRREGULARITIES

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

6.73.8.7 TEMPORARY PROTECTION OF THE MARKING

6.73.8.7.1 The Contractor shall protect the marking until the paint is dry. However, the cones or other signage 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.

6.73.9 WARRANTY

6.73.9.1 WARRANTY ON MEDIUM-PERFORMANCE MARKING PRODUCTS

6.73.9.1.1 Without limiting the scope of Section 8 *General Conditions* of the Contract, the Contractor shall, in addition to the warranty provided for in 8.32 *Rectification of Defects in Work*, provide a written warranty, issued in the Owner's name, guaranteeing the retroreflection and durability of the medium-performance marking product in accordance with Appendix 6.73-1 *Retroreflection and Durability Requirements for Medium-Performance Marking* for a period of two (2) years from the date of issuance of the Interim Certificate of Completion for the contemplated work.

6.73.9.2 WARRANTY ON LONG-PERFORMANCE MARKING PRODUCTS

6.73.9.2.1 Without limiting the scope of Section 8 *General Conditions* of the Contract, the Contractor shall, in addition to the warranty provided for in 8.32 *Rectification of Defects in Work*, provide a written warranty, issued in the Owner's name, guaranteeing the retroreflection and durability of the long-performance marking product in accordance with Appendix 6.73-II *Retroreflection and Durability Requirements for Long-Performance Marking* for a period of four (4) years from the date of issuance of the Interim Certificate of Completion for the contemplated work.

END OF SUBSECTION

APPENDIX 6.73-I

**RETROREFLECTION AND DURABILITY REQUIREMENTS
FOR MEDIUM-PERFORMANCE MARKING**

(1 PAGE)

1 RETROREFLECTION REQUIREMENTS

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

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

1.2 These values are determined using the Ecolux retroreflectometer. The measurement unit is the MCD (md/lx/m²).

2 DURABILITY REQUIREMENTS

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

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

2.2 The percentage of markings visible on the roadway surface is calculated using photographic images, 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

**RETROREFLECTION AND DURABILITY REQUIREMENTS
FOR LONG-PERFORMANCE MARKING**

(1 PAGE)

1 RETROREFLECTION REQUIREMENTS

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

	LANE MARKINGS		GORE, ARROW, CROSSING, STOP LINE
	Yellow	White	Yellow
At the 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	-

1.2 These values are determined using the Ecolux retroreflectometer. The measurement unit is the MCD (md/lx/m²).

2 DURABILITY REQUIREMENTS

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

	LANE MARKINGS	GORE, ARROW, CROSSING, STOP LINE
At the 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%	-

2.2 The percentage of markings visible on the roadway surface is calculated using photographic images, 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.