TENDER DOCUMENTS

SUBSECTION 6.91
MANUAL AND MECHANICAL PATCHING WITH HOT-MIX ASPHALT

TABLE OF CONTENTS

PAGE

SUBSECTION 6.91 MANUAL AND MECHANICAL PATCHING WITH HOT-MIX ASPHALT

6.91.1 GENERAL

6.91.1.1 This subsection describes the requirements relating to manual and mechanical patching with hot-mix asphalt in order to correct minor defects in the roadway on the existing pavement surface under this Contract.

6.91.1.2 Any specific requirements pertaining to manual and mechanical patching with hot-mix asphalt covered by this Contract are indicated on the drawings and in Section 4 *Special Technical Conditions*.

6.91.2 MEASUREMENT UNITS

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

Measurement Unit	Designation	Symbol
length	meter	m
length	millimeter	mm
area	square meter	m^2
area	square centimeter	cm^2
volume	cubic centimeter	cm^3
volume	liter	L
mass	gram	g
mass	kilogram	kg
temperature	Celsius degree	°C

6.91.3 REFERENCE STANDARDS

6.91.3.1 The **Contractor** shall carry out all patching work in accordance with the requirement of the following standards and documents, to which the provisions of this Contract are added:

6.91.3.1.1 (ASTM) ASTM International:

- ASTM D995-95b (2002) *Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.*

6.91.3.1.2 (BNQ) Bureau de normalisation du Québec:

- NQ2560-114 *Travaux de génie civil – Granulats* Partie II *Matériaux pour fondation, sous-fondation, couche de roulement et accotement.*

6.91.3.1.3 (MTQ) Ministère des Transports du Québec:

- MTQ – *Cahier des charges et devis généraux* (CCDG);
- MTQ – *Normes – Ouvrages routiers* – Tome VI *Entretien*, Norme 2502 *Rapiéçage manuel des chaussées avec un enrobé posé à chaud*;
- MTQ – *Normes – Ouvrages routiers* – Tome VI *Entretien*, Norme 2503 *Rapiéçage mécanisé des chaussées avec un enrobé*;
- MTQ – *Normes – Ouvrages routiers* – Tome VII *Matériaux*, Chapitre 4 *Liants et enrobés bitumineux*:
  - Norme 4101 *Bitumes*;
  - Norme 4105 *Émulsions de bitume*;
  - Norme 4201 *Enrobés à chaud formulés selon le principe de la méthode Marshall*.
- (LC) Laboratoire des chaussées du MTQ:
  - LC 21-040 *Analyse granulométrique;*
  - LC 21-065 *Détermination de la densité et de l'absorption du granulat fin;*
  - LC 21-066 *Détermination de la densité et de l'absorption du granulat fin de classe granulaire d/D;*
  - LC 21-067 *Détermination de la densité et de l'absorption du gros granulat;*
  - LC 26-001 *Tenue à l'eau (par trempage)*;
  - LC 26-003 *Détermination de l'aptitude au compactage des enrobés à chaud à la presse à cisaillement giratoire;*
  - LC 26-004 *Formulation des enrobés à l'aide de la presse à cisaillement giratoire selon la méthode du Laboratoire des chaussées;*
  - LC 26-005 *Échantillonnage;*
  - LC 26-040 *Détermination de la densité brute et de la masse volumique des enrobés à chaud compactés;*
  - LC 26-045 *Détermination de la densité maximale*;
  - LC 26-060 *Méthode Marshall de détermination de la résistance à la déformation d'éprouvettes;*
  - LC 26-100 *Détermination de la teneur en bitume;*
  - LC 26-110 *Détermination de la masse du filler dans le produit de l'extraction;*
  - LC 26-150 *Détermination du facteur de correction à utiliser pour le calcul de la teneur en bitume;*
  - LC 26-510 *Détermination de la masse volumique in situ des enrobés à l'aide d'un nucléodensimètre;*
  - LC 26-900 *Détermination de caractéristiques par calcul de divers facteurs.*

6.91.4 INTERVENTION THRESHOLD

6.91.4.1 The manual and mechanical patching with hot-mix asphalt intervention shall be planned after one of the following situations is observed:

6.91.4.1.1 the presence of depressions retaining water or bumps posing a danger to users on the roadway or on the bridge deck;

6.91.4.1.2 the presence of significant cracks (opening larger than 25 mm);

6.91.4.1.3 the presence of potholes larger than 150 mm in diameter or deeper than 50 mm;

6.91.4.1.4 the presence of rutting on the roadway of the bridge affecting the ride quality at the joint shoulder;

6.91.4.1.5 the presence of a significant deformation of the wearing surface due to the creep of the pavement on the bridge deck slabs.

6.91.5 MATERIALS

6.91.5.1 HOT-MIX ASPHALT

6.91.5.1.1 The mixes used by the **Contractor** shall comply with Table 4202-1 *Caractéristiques des enrobés à chaud formulés selon la méthode de formulation du Laboratoire des chaussées* of MTQ standard 4202.

6.91.5.1.2 Unless otherwise indicated on the drawings, for correction of the existing asphalt pavement whose finished thickness is less than 20 mm, the **Contractor** shall use EC-10 or EC-5 hot-mix asphalt.

6.91.5.1.3 Unless otherwise indicated on the drawings, for correction of the existing asphalt pavement whose finished thickness is equal to or greater than 20 mm, the **Contractor** shall use ESG-10 hot-mix asphalt.

6.91.5.1.4 Unless otherwise indicated on the drawings, the **Contractor** shall use performance grade PG 64-34 bitumen. The bitumen shall comply with MTQ standard 4101.

6.91.5.2 TACK COAT

6.91.5.2.1 The tack coat shall be a bitumen emulsion compatible with the base materials of the hot-mix asphalt and compliant with MTQ standard 4105.

6.91.5.2.2 The **Contractor** shall apply to all surfaces to be patched a tack coat of the type indicated on following table:

Type of tack coat[1]	**CSS-1 or SS-1**	**CRS-1 or RS-1**
Suggested application temperature[2]	Above 10°C	Above 10°C
Approximate breaking or curing time[3]	30 minutes	15 minutes
Residual bitumen rate (L/m^2)[4]	0.25 or 0.30	0.25 or 0.30

1. Any other type of tack coat deemed equivalent by the Engineer may also be used in accordance with the manufacturer's recommendations.
2. A tack coat may not be applied to a wet or frozen pavement.
3. The breaking and curing time of a tack coat varies, notably, according on the atmospheric temperature, humidity, viscosity of the wind, sunshine. The time indicated in the table is typically a minimum and corresponds to work carried out under favorable conditions.
4. On old asphalt pavement or on a smooth concrete surface, the residual bitumen rate shall be 0.25 L/m^2. On a levelled asphalt pavement or on a rough concrete surface, the residual bitumen rate shall be 0.30 L/m^2.

6.91.5.2.3 For the patching work carried out on section 6 of the Champlain Bridge, which is an orthotropic deck, the **Contractor** shall use an RC-30 type tack coat product.

6.91.6 EQUIPMENT AND TOOLS

6.91.6.1 BACKHOE

6.91.6.1.1 The **Contractor** shall use a backhoe equipped with a bucket of a maximum width of 600 mm to remove the damaged asphalt pavement surfaces and the waterproofing membrane on section 6 of the Champlain Bridge which is an orthotropic deck. The backhoe bucket shall be fitted with a blade. Buckets with teeth are prohibited.

6.91.6.2 FINISHER

6.91.6.2.1 Where so required by the size of the area to be patched, the **Contractor** shall spread the asphalt mechanically by means of a self-propelled finisher capable of placing the asphalt according to the alignment, slope and camber of the existing pavement.

6.91.6.3 COMPACTION ROLLER

6.91.6.3.1 The compaction rollers shall be such that they make it possible to achieve the compactness and surface properties that meet the requirements of this subsection.

6.91.6.3.2 The **Contractor** shall be pay special attention when using a vibrating compaction roller to avoid damaging any underlying or adjacent structures and pipes; in case of doubt, vibration is prohibited. The Engineer may prohibit the use of the vibrating compaction roller.

6.91.6.3.3 The use of a vibrating compaction roller is prohibited on bridge and viaduct decks and within 2 m of an abutment or a retaining wall.

6.91.6.4 HAND TOOLS

6.91.6.4.1 The tampers used to pack the hot-mix asphalt pavement in areas that the rollers cannot reach shall weigh at least 10 kg and have a maximum surface area of 300 cm². Mechanical compactors (vibrating plates) may, with prior authorization from the Engineer, be used instead of the tampers.

6.91.6.4.2 Hand shovels or picks may be needed to remove the damaged asphalt pavement surfaces and the waterproofing membrane on the orthotropic deck of section 6 of the Champlain Bridge.

6.91.7 EXECUTION OF WORK

6.91.7.1 GENERAL

6.91.7.1.1 The manual and mechanical patching shall be carried out according to this subsection and Tome VII *Matériaux* of MTQ.

6.91.7.2 TECHNICAL DATA SHEETS

6.91.7.2.1 The **Contractor** is responsible for proportioning the proposed hot-mix asphalt and shall provide the Engineer, at least fourteen (14) calendar days prior to the asphalt spreading operations, with the technical data sheets on the theoretical and final formulas, notably comprising the following information:

6.91.7.2.1.1 the mix designation and number or code;

6.91.7.2.1.2 for the cold aggregate, the grade of aggregate, type, source, granularity, percentage used, bulk density and percentage of water absorption for each grade of aggregate;

6.91.7.2.1.3 the intrinsic, manufacturing and complementary properties of the fine aggregate mixture, according to the theoretical method, of each grade of fine aggregate and each grade of coarse aggregate;

6.91.7.2.1.4 the performance grade of the bitumen;

6.91.7.2.1.5 the density at 25°C expressed in g/cm^3;

6.91.7.2.1.6 the granularity, bulk density, percentage of water absorption and total aggregate grading of the mixture, optimum content in bitumen proposed to obtain a void content ranging between 3.0% and 4.0%, as well as the stability, deformation and bulk and maximum densities at the proposed bitumen content;

6.91.7.2.1.7 the percentage of voids, percentage of voids between the aggregate particles (VMA) filled with bitumen, VMA, total specific surface as well as the compactability of the hot-mix asphalt, percentage of actual bitumen and average thickness of the actual bitumen film at the proposed bitumen content;

6.91.7.2.1.8 the stability value maintained at the proposed bitumen content in accordance with test method LC 26-001;

6.91.7.2.1.9 the five-point physical property curves of the asphalt mix for each of the following properties:

6.91.7.2.1.8.1.1 the stability;

6.91.7.2.1.8.1.2 the flow index;

6.91.7.2.1.8.1.3 the density;

6.91.7.2.1.8.1.4 the percentage of voids in the asphalt;

6.91.7.2.1.8.1.5 the percentage of filled VAM;

6.91.7.2.1.8.1.6 the actual bitumen film.

6.91.7.2.2 The mix formulas shall be reviewed by the Owner's Laboratory and approved prior to the start of the work. The **Owner** reserves the right to request changes to the formula in order for it to comply with the indications on the drawings.

6.91.7.3 CERTIFICATE OF CONFORMITY

6.91.7.3.1 At least fourteen (14) days prior to ordering any materials, the **Contractor** shall submit to the Engineer the certificates of conformity for each product that will be used in the performance of the work covered by this subsection.

6.91.7.3.2 More specifically, for each delivery of bitumen, the certificates of conformity shall include, without however being limited to, the following information:

6.91.7.3.2.1 the name of the manufacturer and place of manufacturing;

6.91.7.3.2.2 the storage site at the manufacturer's and the place from which the bitumen will be shipped to the **Contractor**;

6.91.7.3.2.3 the performance grade of the bitumen;

6.91.7.3.2.4 the batch number;

6.91.7.3.2.5 the date of manufacture;

6.91.7.3.2.6 the date of characterization;

6.91.7.3.2.7 the results of the following tests:

6.91.7.3.2.7.1 the density at 25°C expressed in g/cm^3;

6.91.7.3.2.7.2 the Brookfield viscosity at 135°C and 165°C;

6.91.7.3.2.7.3 the storage stability and average softening point;

6.91.7.3.2.7.4 the elasticity recovery when required in Table 4101-1 of MTQ standard 4101;

6.91.7.3.2.7.5 the ash content;

6.91.7.3.2.7.6 the RTFOT mass change;

6.91.7.3.2.7.7 the high-temperature characterization;

6.91.7.3.2.7.8 the low-temperature characterization;

6.91.7.3.2.7.9 the modulus of rigidity and slope measured on the original bitumen;

6.91.7.3.2.7.10 the monitoring date;

6.91.7.3.2.7.11 the minimum and maximum storage temperatures;

6.91.7.3.2.7.12 the minimum and maximum mixing temperatures.

6.91.7.4 PROPORTIONING AND MANUFACTURE OF THE HOT-MIX ASPHALT

6.91.7.4.1 The **Contractor** shall obtain its supply from a manufacturer capable of certifying that the facilities, equipment and materials used in the manufacture and all operations related to the manufacturing of the hot-mix asphalt comply with standard ASTM D995.

6.91.7.4.2 The hot-mix asphalt produced by the plant shall comply with the final formula approved by the Engineer.

6.91.7.5 DELIVERY SLIP

6.91.7.5.1 Prior to spreading any hot-mix asphalt, the **Contractor** shall submit to the Engineer a delivery slip containing the following information:

6.91.7.5.1.1 the name of the hot-mix asphalt manufacturer and identification of the batch plant;

6.91.7.5.1.2 the mix designation, number or code;

6.91.7.5.1.3 the loading date and delivery slip identification number;

6.91.7.5.1.4 the **Contractor**'s name;

6.91.7.5.1.5 the name of every structure covered or **Contractor**'s Contract number;

6.91.7.5.1.6 the quantity being delivered and quantity delivered to date.

6.91.7.6 SURFACE PREPARATION

6.91.7.6.1 The **Contractor** shall make saw cuts around the areas identified by the Engineer. The depth of the saw cuts shall be validated and authorized by the Engineer before sawing begins.

6.91.7.6.2 The **Contractor** shall remove the deteriorated asphalt and/or cement concrete carefully in order to avoid widening the area identified by the Engineer. The surfaces demolished beyond the areas identified by the Engineer shall be repaired at no additional cost to the **Owner**.

6.91.7.6.3 The **Contractor** shall take measures to avoid damaging the existing waterproofing membranes on the bridge and viaduct decks. However, during the work on the orthotropic deck of section 6 of the Champlain Bridge, the **Contractor** shall remove the existing waterproofing membrane.

6.91.7.6.4 The **Contractor** shall ensure that the method used to saw and remove the existing asphalt on section 6 of the Champlain Bridge does not damage the steel of the orthotropic deck. The **Contractor** shall note the following characteristics of the orthotropic deck:

6.91.7.6.4.1 the existing pavement on the Champlain Bridge orthotropic deck consists in a base layer made of an epoxy tack coat impregnated with aggregate and a top coat of asphalt with polymer.

6.91.7.6.4.2 the base layer thickness varies from 5 mm to 10 mm including the aggregate. The total pavement thickness is approximately 50 mm.

6.91.7.6.5 The surface to be paved shall be dried and any loose asphalt mix, hardened mud, dust and other matter that could prevent the asphalt from adhering shall be removed using compressed air.

6.91.7.6.6 The **Contractor** shall apply a tack coat on all surfaces to be patched, including the vertical walls of the surface, the concrete curbs, manholes, catch basins and any other surfaces that will come into contact with the new asphalt.

6.91.7.6.7 Where repairs are being made on granular materials, the **Contractor** shall apply the tack coat on the walls only.

6.91.7.6.8 The tack coat shall be applied at the rate indicated in the table of paragraph 6.91.5.2.2 for the type used, application temperature and type of support.

6.91.7.6.9 The **Contractor** shall not place the hot-mix asphalt until the tack coat is fully cured or broken.

6.91.7.7 MONITORING OF THE MIX TEMPERATURE

6.91.7.7.1 The mix temperature shall not exceed 165°C at any time during the production process.

6.91.7.7.2 It is forbidden to overheat the asphalt mix to compensate for the cooling caused by transportation, regardless of the travel time. The drop in the asphalt temperature between mixing and placement on worksite shall not exceed 15°C.

6.91.7.7.3 In no case shall the temperature be below 135°C immediately after spreading and before the first pass of the compaction roller.

6.91.7.7.4 The minimum ambient air temperature shall remain above 10°C at all times during the placement of asphalt whose thickness after compaction is less than 50 mm. For the placement of asphalt whose thickness is 50 mm or more, the ambient air temperature shall be above 2°C.

6.91.7.8 ASPHALT MIX PLACEMENT

6.91.7.8.1 The **Contractor** shall spread the hot-mix asphalt manually or mechanically, according to the size of the area to be repaired, in uniform layers, taking care to avoid the segregation of the materials.

6.91.7.8.2 The **Contractor** shall compact the hot-mix asphalt as soon as possible after spreading, starting with the pavement joints and edges and from the bottom of the slopes to the top thereof. This operation shall continue until the asphalt is compacted to the satisfaction of the Engineer.

6.91.7.8.3 The **Contractor** shall compact the hot-mix asphalt without vibration where the mix thickness is less than 25 mm.

6.91.7.8.4 The **Contractor** shall clear, to the satisfaction of the Engineer, any work debris from the patched area before removing the temporary signage. The debris shall be transported to an authorized disposal site in accordance with subsection 6.13 *Environmental Protection*.

6.91.8 QUALITY CONTROL

6.91.8.1 For the acceptance of the patching work, the Engineer shall make the following checks, without however being limited thereto:

6.91.8.1.1 the continuity of the profile (±5 mm on the 3 m straightedge);

6.91.8.1.2 the perfect, continuous and waterproof bonding of the joints;

6.91.8.1.3 the uniform surface texture with no segregation or bleeding;

6.91.8.1.4 the pavement edges being straight and clearly defined, avoiding jagged edges;

6.91.8.1.5 the improved international roughness index (IRI).

END OF SUBSECTION