

TENDER DOCUMENTS

SUBSECTION 6.82 HOT-MIX PAVING

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SUBSECTION 6.82 HOT-MIX PAVING

6.82.1 GENERAL

- 6.82.1.1 This subsection sets out the requirements related to hot-mix paving for the construction of new roadway infrastructures or the reconditioning of existing roadway infrastructures under this Contract.
- 6.82.1.2 Any specific requirements related to hot-mix paving work carried out under this Contract are set out in Section 4 *Special Technical Conditions*.
- 6.82.1.3 The requirements related to demolition work are set out in subsection 6.21 *Demolition and Removal*.
- 6.82.1.4 The requirements related to road marking are set out in subsection 6.73 *Road Marking*.

6.82.2 REFERENCE STANDARDS

- 6.82.2.1 The **Contractor** shall perform all hot-mix paving work in conformity with the following standards and documents to which the provisions of the Contract are added:
- 6.82.2.1.1 (AFNOR) Association Française de Normalisation [French standards association]
- NF EN 12697-22+A1 September 2007 *Mélanges bitumineux – Méthodes d’essai pour mélange hydrocarboné à chaud –Partie 22: essai d’orniérage;*
 - NF EN 12697-33+A1 September 2007 *Mélanges bitumineux – Méthodes d’essai pour mélange hydrocarboné à chaud – Partie 33: confection d’éprouvettes au compacteur de plaque.*
- 6.82.2.1.2 (ASTM) ASTM International
- ASTM D995-95b(2002) *Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures;*
 - ASTM D242-04 *Standard Specification for Mineral Filler for Bituminous Paving Mixtures;*
 - ASTM D5329-07 *Standard Test Methods for Sealant and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements;*
 - ASTM D5167-03 *Standard Practice for Melting of Hot-Applied Joint and Crack Sealant and Filler for Evaluation.*
- 6.82.2.1.3 (BNQ) Bureau de normalisation du Québec
- BNQ 2560-114/2007 *Travaux de génie civil – Granulats – Partie IV : Béton de masse volumique normale.*

6.82.2.1.4 (ISO) International Organization for Standardization

- ISO 9001:2000 *Quality Management System – Requirements*

6.82.2.1.5 (MTQ) Ministère des Transports du Québec

- MTQ – *Cahier des charges et devis généraux (CCDG)*;
- MTQ – *Normes – Ouvrages routiers – Tome VII Matériaux, Chapitre 4 Liants et enrobés bitumineux :*
 - Norme 4101 *Bitumes*;
 - Norme 4104 *Bitumes fluidifiés*;
 - Norme 4105 *Émulsions de bitume*;
 - Norme 4201 *Enrobés à chaud formulés selon le principe de la méthode Marshall*;
 - Norme 4202 *Enrobés à chaud formulés selon la méthode de formulation du Laboratoire des chaussées*.

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

- 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 26-320 *Détermination du pourcentage de vides et de la compacité dans les enrobés à chaud compactés;*
- LC 26-350 *Analyse granulométrique des granulats;*
- 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 le calcul de divers facteurs.*

6.82.2.1.7 (CGSB) Canadian General Standards Board

- CAN/CGSB-37.50-M *Hot Applied, Rubberized Asphalt for Roofing and Waterproofing*

6.82.3 MATERIALS

6.82.3.1 ASPHALT

6.82.3.1.1 Asphalt used in the pavement mix shall conform to the requirements of this subsection and MTQ standard 4101.

6.82.3.1.2 The asphalt used shall be produced by a manufacturer whose plant holds a registration certificate confirming that the quality system meets the requirements of standard ISO 9001:2000.

6.82.3.1.3 The performance grade of the asphalt used for mixes shall be as prescribed in the *Special Technical Conditions*.

6.82.3.2 AGGREGATE

6.82.3.2.1 Aggregate used in the pavement mix shall conform to the requirements of this subsection, the *Special Technical Conditions* and MTQ standard 4201 or 4202 and shall make it possible to carry out on the asphalt all the tests indicated in the tables in Appendix 6.82-I *Hot-mix asphalt made using the Marshall method* or Appendix 6.82-II *Hot-mix asphalt made using the "Laboratoire des chaussées" method*.

6.82.3.2.2 The **Contractor** shall prepare a reserve of each given aggregate grade for a minimum of three production days except where it obtains its supply from commercial quarries that carry out production monitoring.

6.82.3.2.3 Aggregate of different grades shall be stored in separate reserves. The reserves shall be located on sites that have been levelled, drained and cleaned of any contaminants.

6.82.3.2.4 Unless otherwise indicated in the *Special Technical Conditions*, the use of asphalt aggregate is strictly prohibited under this Contract.

6.82.3.3 FILLER

6.82.3.3.1 Filler shall conform to standard ASTM D242. However, 80 µm, 315 µm and 630 µm sieves shall be used instead of the 75 µm, 300 µm and 600 µm sieves prescribed in that standard.

6.82.3.4 TACK COAT OR PRIME

6.82.3.4.1 Unless otherwise indicated in the *Special Technical Conditions*, primes shall be slow-setting, low-viscosity asphalt emulsions conforming to MTQ standard 4105. After October 1 and before May 1, the **Contractor** may, with authorization from the Engineer, use a cutback asphalt conforming to MTQ standard 4104.

6.82.3.4.2 Unless otherwise indicated in the *Special Technical Conditions*, tack coats shall be asphalt emulsions conforming to MTQ standard 4105. After October 1 and before May 1, the **Contractor** may, with authorization from the Engineer, use a cutback asphalt conforming to MTQ standard 4104.

6.82.3.5 HOT MIX

6.82.3.5.1 The type of hot mix to be used shall be as prescribed in the *Special Technical Conditions*.

6.82.3.5.2 The hot mix shall conform to the requirements of this subsection and MTQ standard 4201 or 4202.

6.82.3.5.2.1 Hot mixes made using the Marshall method shall have the properties described in MTQ Table 4201-1 (see Appendix 6.82-I).

6.82.3.5.2.2 Hot mixes made using the "Laboratoire des chaussées" method shall have the properties described in MTQ Table 4202-1 (see Appendix 6.82-II).

6.82.4 EQUIPMENT AND TOOLS

6.82.4.1 ASPHALT PLANT

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

6.82.4.1.2 The plant shall be equipped with a dust collection system conforming to the requirements of the Quebec *Environment Quality Act* (R.S.Q., c. Q-2).

6.82.4.1.3 The hot mix produced by the plant shall conform to the final formula approved by the Engineer.

6.82.4.1.4 The pipes connecting the tank to the mixing system's asphalt incorporating device shall have a faucet allowing samples to be taken at any time.

6.82.4.2 TACK COAT SPREADER

6.82.4.2.1 The tack coat spreader shall be equipped with a flow meter to control the rate of application.

6.82.4.3 FINISHERS

6.82.4.3.1 Unless otherwise indicated in the *Special Technical Conditions*, asphalt shall be spread mechanically using automatic finishers capable of placing the asphalt according to the alignment, slope and camber specified on the drawings.

6.82.4.3.2 The finishers shall be equipped with hoppers and screw dispensers so that the asphalt is placed evenly in front of the adjustable regulators.

6.82.4.3.3 The finishers shall be capable of spreading asphalt over thicknesses ranging from 15 mm to the thickness stipulated on the drawings or in the *Special Technical Conditions* without risk of separation or tearing.

6.82.4.3.4 The term “regulator” also includes any screeding device which levels the asphalt by cutting or packing at placement temperature without causing tears, unevenness or grooves and produces a surface the properties of which meet the requirements.

6.82.4.3.5 Variable-width finishers are acceptable for extra-wide areas and longitudinal joints provided the compactor extension vibrates and heats and produces a surface that has all the required properties.

6.82.4.4 COMPACTING ROLLERS

6.82.4.4.1 Compacting rollers shall make it possible to achieve the compaction and surface properties required by this subsection or the *Special Technical Conditions*.

6.82.4.4.2 The following three types of compacting rollers may be used, subject to the restrictions indicated in article 6.82.5.8.4 *Compacting*:

- static steel cylinder roller;
- vibrating steel cylinder roller;
- tire roller.

6.82.4.5 TRUCK

6.82.4.5.1 The bed of any truck used to transport asphalt shall be sealed and equipped with a metal bottom. It must be free of dust, stones, petroleum-based hydrocarbons and any other material that may cause the asphalt to deteriorate.

- 6.82.4.5.2 The use of petroleum-based hydrocarbons as a release agent is prohibited.
- 6.82.4.5.3 The bed shall be equipped with a tarpaulin large enough to fully cover the asphalt, slow the cooling process and protect the material from the elements.
- 6.82.4.6 HAND TOOLS
- 6.82.4.6.1 The tampers used to pack asphalt in areas the rollers cannot reach shall weigh at least 10 kg and have a surface area not larger than 300 cm².
- 6.82.4.6.2 Mechanical compactors (vibrating plates) may be used instead of tampers with prior authorization from the Engineer.
- 6.82.4.6.3 Hand tools shall be cleaned away from the surface to be paved and the freshly laid pavement.
- 6.82.4.7 GAUGE
- 6.82.4.7.1 The **Contractor** shall provide and make available to the Engineer throughout the work period a gauge in the form of a straightedge at least 3 metres long fitted with a level.

6.82.5 EXECUTION OF WORK

6.82.5.1 PLANNING

- 6.82.5.1.1 The **Contractor** is responsible for proportioning the hot-mix asphalt and shall provide the Engineer, fourteen (14) days prior to spreading, with descriptive sheets showing the theoretical and final formulas, including the following information:
- 6.82.5.1.1.1 Hot-mix asphalt made using the Marshall method:
- 6.82.5.1.1.1.1 for cold aggregate, the aggregate grades, type, source, particle size, percentage used, bulk density and percentage water absorption for each aggregate grade;
- 6.82.5.1.1.1.2 the intrinsic, manufacturing and complementary properties of the combination of fine aggregate, based on the theoretical method, or of each grade of fine aggregate and each grade of coarse aggregate;
- 6.82.5.1.1.1.3 the performance grade of the asphalt;
- 6.82.5.1.1.1.4 density at 25°C in grams per cubic centimetre (g/cm³);

- 6.82.5.1.1.1.5 particle size, bulk density, percentage water absorption and total particle size distribution for the combination, the optimum asphalt content proposed to obtain a void content between 3.0% and 4.0%, and the stability, deformation and bulk and maximum density at the proposed asphalt content;
- 6.82.5.1.1.1.6 the percentage of voids, the percentage of voids between aggregate particles filled with asphalt, the percentage of voids between aggregate particles, the total specific surface and the compactability of the hot-mix asphalt, the effective asphalt percentage, and the average thickness of the effective asphalt film at the proposed asphalt content;
- 6.82.5.1.1.1.7 retained stability at the proposed asphalt content based on test method LC 26-001;
- 6.82.5.1.1.1.8 compaction, except for asphalt used for patching or repair prior to paving;
- 6.82.5.1.1.1.9 five-point physical property curves of the asphalt for the following properties:
- stability;
 - flow index;
 - density;
 - percentage of voids;
 - percentage of filled voids between aggregate particles;
 - effective asphalt film.
- 6.82.5.1.1.2 Hot-mix asphalt made using the “Laboratoire des chaussées” method
- 6.82.5.1.1.2.1 for cold aggregate, the aggregate grades, type, source, particle size, bulk density, percentage water absorption and, based on the LC 26-004 test method formula, the percentage of each aggregate grade used;
- 6.82.5.1.1.2.2 the intrinsic and complementary manufacturing properties of the combination of fine aggregate, based on the theoretical method, or of each grade of fine aggregate and each grade of coarse aggregate;
- 6.82.5.1.1.2.3 the performance grade of the asphalt;
- 6.82.5.1.1.2.4 density at 25°C in grams per cubic centimetre;

- 6.82.5.1.1.2.5 based on the mix produced using test method LC 26-004, the final particle size distribution, the effective density of the aggregate in the asphalt, the percentage water absorption of the combination, the proposed fibre content (for EGA-10 and SMA-10 asphalt), the total particle size distribution, the effective asphalt volume, the initial percentage of asphalt corresponding to the effective asphalt volume (in hundredths), the total asphalt percentage with the correction factor (in hundredths), the average percentage of voids in number of spins required corresponding to the initial percentage of asphalt (P_{ia}) and the total percentage of asphalt (P_a) (if P_a is different from P_{ia}) and the maximum density corresponding to the initial percentage of asphalt (P_{ia}) and the total percentage of asphalt (P_a) (if P_a is different from P_{ia});
- 6.82.5.1.1.2.6 retained stability at the proposed asphalt content based on test method LC 26-001;
- 6.82.5.1.1.2.7 compaction, except for asphalt used for patching or repair prior to paving.
- 6.82.5.1.2 The theoretical and final formulas for the hot-mix asphalt shall be dated and signed by the manufacturer's quality control officer.
- 6.82.5.1.3 The mix formulas shall be reviewed and approved by the **Owner's** laboratory. The Engineer reserves the right to ask for changes to the formula to ensure that it conforms to this subsection.
- 6.82.5.1.4 The **Contractor** shall provide the results of the rutting test. If a rutting test has already been done on asphalt by an MTQ laboratory but the results are more than three years old, the asphalt must be retested even if the manufacturer has not changed its formula.
- 6.82.5.2 DELIVERY OF ASPHALT
- 6.82.5.2.1 Quality system conforming to ISO standard
- 6.82.5.2.1.1 The **Contractor** shall obtain asphalt, cutback asphalt and asphalt emulsion from a manufacturer whose plant holds a registration certificate confirming that the quality system meets the requirements of standard ISO 9001:2000.
- 6.82.5.2.1.2 If the asphalt, cutback asphalt and asphalt emulsion are stored in and shipped to a place other than the manufacturer's premises, the **Contractor** shall ensure that the company responsible for storage and shipment holds a registration certificate confirming that the quality system meets the requirements of standard ISO 9001:2000.

6.82.5.2.2 Certification of conformity

6.82.5.2.2.1 At least fourteen (14) days prior to ordering any materials, the **Contractor** shall submit to the Engineer certificates of conformity for each of the products that will be used in performing work under this subsection.

6.82.5.2.2.2 More specifically, for each shipment of asphalt, the certificates of conformity shall include the following information:

- the name of the manufacturer and the place of fabrication;
- the manufacturer's storage site and the place from which the asphalt is shipped to the **Contractor**;
- the performance grade of the asphalt;
- the batch number;
- the date of manufacture;
- the date of determination of properties;
- the following test results:
 - density at 25°C in g/cm³;
 - Brookfield viscosity at 135°C and 165°C;
 - storage stability and average softening point;
 - the elasticity recovery required in Table 4101-1 of standard 4101;
 - ash content;
 - RTFOT mass variation;
 - high characterization temperature;
 - low characterization temperature;
 - stiffness modulus and slope measured on initial asphalt;
 - monitoring date;
 - minimum and maximum storage temperatures;
 - minimum and maximum mixing temperatures.

6.82.5.2.3 Delivery control

6.82.5.2.3.1 The **Owner's** laboratory will conduct delivery control of the tack coat and prime. The procedure consists in drawing 1 litre of binder from the spreader sampling tap. The laboratory will allow 1 litre of binder to run before collecting the sample in a metal container with an enamel interior or a plastic container.

- 6.82.5.2.3.2 The **Contractor** shall randomly take one sample of asphalt for every 3,000 tonnes of asphalt manufactured (minimum of one sample).
- 6.82.5.2.3.3 Sampling is done at the sampling tap. The **Contractor** collects in a metal container with an enamel interior a representative sample of the product in the asphalt plant's tank.
- 6.82.5.2.3.4 A sample is comprised of two (2) one litre taking. One (1) litre is used for the asphalt tests carried out by the **Owner's** laboratory, while the other is retained by the **Owner** as a control sample.
- 6.82.5.2.3.5 The following information must appear on the label on each asphalt sample:
- the contract number;
 - the number of the certificate of conformity;
 - identification of the asphalt plant;
 - the tank number at the plant;
 - the name of the person taking the sample;
 - the sampling date;
 - the temperature of the asphalt at the time of sampling.
- 6.82.5.3 MANUFACTURE OF HOT-MIX ASPHALT
- 6.82.5.3.1 Hot-mix asphalt shall be manufactured by a company that operates an asphalt plant holding a registration certificate confirming that the quality system meets the requirements of standard ISO 9001:2000.
- 6.82.5.3.2 The **Contractor** shall submit to the Engineer at least fourteen (14) days prior to the start of asphalt manufacture a copy of the plant's registration and a quality plan conforming to MTQ standard 4201 or 4202.
- 6.82.5.3.3 The **Owner's** laboratory will determine the conformity of the asphalt based on the results provided by the **Contractor**. However, if the **Owner's** laboratory validates the test results and the various factors calculated by the **Contractor**, the provisions of clause 13.3.2.2.5 of CCDG will apply.
- 6.82.5.3.4 At the plant, the asphalt shall be mixed at the temperature indicated on the certificate of conformity of the asphalt used.
- 6.82.5.3.5 Hot-mix asphalt shall be stored in a silo protected from the elements so as to prevent separation, compacting, contamination and cooling to a temperature below the temperature recommended for the type of asphalt used.

6.82.5.4 DELIVERY SLIP

6.82.5.4.1 Before spreading the hot-mix asphalt, the **Contractor** shall present the Engineer with a delivery slip containing the following information:

6.82.5.4.1.1 the name of the hot-mix asphalt manufacturer and the name of the asphalt plant;

6.82.5.4.1.2 the formula number and type of hot-mix asphalt;

6.82.5.4.1.3 the loading date and the delivery slip identification number;

6.82.5.4.1.4 the **Contractor's** name;

6.82.5.4.1.5 the name of each roadway infrastructure or the number of the **Contractor's** contract;

6.82.5.4.1.6 the quantity being delivered and the quantity delivered to date.

6.82.5.5 SURFACE PREPARATION

6.82.5.5.1 Granular surface

6.82.5.5.1.1 Placement of granular material shall conform to standard NQ 2560-114, Part II: *Fondation, sous-fondation, couche de roulement et accotement* and shall be approved by the Engineer prior to the start of paving work.

6.82.5.5.1.2 Preparation of the surface to be paved entails correcting the longitudinal and transverse profiles and giving the surface the required camber and slope. Surface preparation shall be carried out over the full width of the roadway or as required by the drawings and this subsection so as to allow water to run freely to the ditches or drainage systems.

6.82.5.5.1.3 The **Contractor** shall always scarify the granular surface to a minimum depth of 25 mm in order to facilitate penetration of the prime binder.

6.82.5.5.1.4 Where required, the **Contractor** shall scarify the existing surface to a minimum depth of 100 mm or as prescribed in the *Special Technical Conditions* in order to loosen the surface and get it ready for paving.

6.82.5.5.1.5 The scarifying equipment used shall produce an even surface with a uniform texture and grooves with a relative depth of less than 8 mm. Provision shall be made for an automatic profile controller with a tolerance of ± 3 mm.

6.82.5.5.1.6 Any stones, 80 mm or bigger, loosened during scarification and all unclean material shall be collected and disposed of.

- 6.82.5.5.1.7 Base aggregate shall be spread and compacted in accordance with the requirements for laying roadbed materials, except that the thickness of the correction layer can vary depending on the work to be done and the extent to which the profile has to be corrected.
- 6.82.5.5.2 Asphalt or concrete surfaces
- 6.82.5.5.2.1 Correction using hot-mix asphalt
- 6.82.5.5.2.1.1 The surface to be re-covered shall be cleaned to remove any mud, debris or deleterious material.
- 6.82.5.5.2.1.2 The **Contractor** shall apply a tack coat at the rate stipulated in the *Special Technical Conditions* over the entire pavement or concrete surface to be re-covered.
- 6.82.5.5.2.1.3 If required by the *Special Technical Conditions* or requested by the Engineer, rough and irregular surfaces shall be corrected using hot-mix correction asphalt.
- 6.82.5.5.2.1.4 If compacting is not done using a tire roller, the next layer cannot be laid until twelve (12) hours after the correction layer is placed.
- 6.82.5.5.2.2 Planing
- 6.82.5.5.2.2.1 If required by the *Special Technical Conditions* or requested by the Engineer, surfaces shall be corrected to restore the longitudinal and transverse profiles by planing the existing surfaces and removing any visible imperfections.
- 6.82.5.5.2.2.2 Unless otherwise indicated in the *Special Technical Conditions*, in places where the surface layer is not fully adhered to the layer beneath, the planing depth shall be increased until the surface layer is completely removed.
- 6.82.5.5.2.2.3 In straight sections, the planing planes shall intersect at the line between driving lanes. The 2% slope shall be restored in each lane with an accuracy of $\pm 0.2\%$. On curves, the slopes shall be restored by means of a uniform rectilinear planing plane.
- 6.82.5.5.2.2.4 Planing shall be done without interruption from the edge of one shoulder to the other. Planing of a single lane shall be done from the middle of the road out.
- 6.82.5.5.2.2.5 At the end of each work period, the sideways temporary joint shall be made perpendicular to the road.

- 6.82.5.5.2.2.6 The **Contractor** shall ensure that the edges, hatch covers, grates and deck joint shoulders are not damaged during planing. The **Contractor** is liable for damage caused during these procedures and shall make any necessary repairs at no additional cost to the **Owner**.
- 6.82.5.5.2.2.7 The surface shall be mechanically swept to remove any dust using equipment specifically designed for sweeping, cleaning and collecting debris. Hand sweeping shall be done in addition to mechanical sweeping in areas that are more heavily soiled. The **Contractor** is responsible for the disposal of asphalt aggregate as required by subsection 6.13 *Environment Protection*.
- 6.82.5.6 APPLICATION OF TACK COAT OR PRIME
- 6.82.5.6.1 Unless otherwise indicated on the drawings or in the *Special Technical Conditions*, the **Contractor** shall spread a prime coat on any granular surfaces and a tack coat on any asphalt or concrete surfaces that are to be re-covered and between each layer of hot-mix asphalt.
- 6.82.5.6.2 The **Contractor** shall apply the tack coat or prime evenly using a pressurized distributor at the following rates (tolerance $\pm 10\%$) :
- at the residual asphalt rate of 1.2 L/m² for prime on a scarified granular surface;
 - at the residual asphalt rate of 0.15 L/m² for a tack coat on a waterproofing membrane placed on a bridge deck;
 - at the residual asphalt rate of 0.20 L/m² for a tack coat on new pavement;
 - at the residual asphalt rate of 0.25 L/m² for a tack coat on worn pavement or a smooth concrete surface;
 - at the residual asphalt rate of 0.30 L/m² for a tack coat on planed asphalt or a rough concrete surface.
- 6.82.5.6.3 The application rate and evenness shall be measured and checked by the **Contractor** using a method submitted to the Engineer fourteen (14) days prior to the start of binder spreading.
- 6.82.5.6.4 All surfaces that come into contact with the hot-mix asphalt, such as the vertical surfaces of curbs, sidewalks, construction joints and other structures shall be covered with a thin even coat of bituminous binder in order to make a permanent waterproof joint.
- 6.82.5.6.5 Circulation of vehicles over the binder is prohibited at all times.
- 6.82.5.6.6 It is strictly forbidden to apply a tack coat when it is raining, on a wet or frozen surface, or when the air temperature is below the temperature recommended by the manufacturer.

- 6.82.5.6.7 Not less than 30 minutes after the binder has been applied, the granular surface shall be compacted to a minimum of 98.0% of the maximum dry density prescribed for on-site compaction of roadbed material.
- 6.82.5.6.8 The **Contractor** shall wait for the binder to cure fully before proceeding to place the asphalt.
- 6.82.5.6.9 In all cases, the **Contractor** shall take the necessary precautions to ensure that the tack coat or prime is not spread onto adjacent surfaces that have already been or do not have to be re-covered.
- 6.82.5.7 TRANSPORT OF HOT-MIX ASPHALT
- 6.82.5.7.1 Asphalt shall not be overheated to compensate for cooling during transport, regardless of the travel time. The drop in the temperature of the asphalt between mixing and placement on site shall not exceed 15°C.
- 6.82.5.8 PLACEMENT OF ASPHALT
- 6.82.5.8.1 General
- 6.82.5.8.1.1 Any surveying needed to locate the elevation points for the final profile of the asphalt shall be carried out by the **Contractor**, at its own expense, and the **Contractor** shall bear full responsibility for the accuracy of the work.
- 6.82.5.8.1.2 Work may not be performed when the surface to be re-covered is frozen, wet or covered with puddles of water or mud.
- 6.82.5.8.1.3 The air temperature shall remain above 10°C at all times during placement of asphalt the thickness of which after compacting is less than 50 mm. For thicknesses of 50 mm or more, the air temperature shall be above 2°C and rising.
- 6.82.5.8.1.4 Air temperature shall be measured using a thermometer accurate to 1°C. The reading shall be taken at a height of 1.5 m above the ground and more than 5 m from site equipment or other sources of heat.
- 6.82.5.8.2 Mechanical spreading
- 6.82.5.8.2.1 The advance speed of the finisher shall make it possible to place pavement the density and properties of which conform to the requirements on the drawings and in the *Special Technical Conditions*.
- 6.82.5.8.2.2 Immediately after one layer is placed and before compacting begins, the **Contractor** shall check the surface and correct any flaws. Any accumulation of material shall be removed and indentations of any kind shall be levelled and filled with hot-mix asphalt.
- 6.82.5.8.3 Hand spreading

- 6.82.5.8.3.1 Asphalt shall be spread by hand in areas the finisher cannot reach. The **Contractor** shall divide the asphalt evenly and spread an even layer of uniform density, taking care to ensure that the mix does not separate. Prior to compacting, the **Contractor** shall check the surface with a straightedge and correct any flaws. Asphalt shall not be broadcast over a surface in such a way that the aggregate fans out.
- 6.82.5.8.4 Compacting
- 6.82.5.8.4.1 The following requirements apply to all layers of pavement:
- 6.82.5.8.4.1.1 except where the work is done at night, compacting shall be completed before sunset; the Engineer may agree to waive this requirement if he feels the precautions taken by the **Contractor** are satisfactory;
- 6.82.5.8.4.1.2 the **Contractor** shall be especially careful when using vibrating rollers so as not to damage any underlying or adjacent structures or pipes; where there is any doubt, vibrating is prohibited;
- 6.82.5.8.4.1.3 the compacting sequence shall produce a driving surface and compaction conforming to the requirements (see tables in appendices based on type of asphalt).
- 6.82.5.8.4.2 Each layer shall be even with a uniform texture and no separation or bleeding and shall conform to the transverse and longitudinal profiles indicated on the drawings. The Engineer may, if he considers such action warranted, prohibit the use of a vibrating roller.
- 6.82.5.8.4.3 Use of a vibrating roller is strictly prohibited on bridge and viaduct decks and within 2 m of an abutment or retaining wall.
- 6.82.5.8.4.4 Any layer of asphalt applied directly to the existing concrete of slabs on grade shall be compacted using a pneumatic compactor.
- 6.82.5.8.4.5 The on-site density of the compacted mix shall be between 93% and 98% of the theoretical "Rice" density of the mix.
- 6.82.5.8.4.6 The compaction of the asphalt will be checked as prescribed in article 6.82.6 *Quality control* of this subsection.
- 6.82.5.9 JOINTS IN ASPHALT PAVEMENT
- 6.82.5.9.1 Longitudinal joints shall be parallel to the edges of the road and shall not overlap.

- 6.82.5.9.2 Longitudinal joints in the wearing course or the top layer shall not be made in the normal wheel path.
- 6.82.5.9.3 Work shall be planned so as to ensure that the placement of asphalt late in the day does not leave a longitudinal joint to be completed the next day.
- 6.82.5.9.4 Any transverse or longitudinal joint the temperature of which is below 85°C shall be covered with an even tack coat. Every joint shall have the surface properties required for layers of pavement.
- 6.82.5.9.5 The **Contractor** shall make transverse joints at expansion joints only.
- 6.82.5.9.6 New pavement shall be packed tight against the vertical face of the existing pavement.
- 6.82.5.9.7 The **Contractor** shall push any asphalt overlapping the existing pavement onto the new section over a width 75 to 100 mm from the joint.
- 6.82.5.9.8 The **Contractor** shall run the roller over the existing pavement overlapping the new section of pavement 75 to 100 mm.
- 6.82.5.9.9 The roller shall make at least two (2) passes in this manner so as to ensure complete compaction of the narrow strip beside the joint and obtain a joint flush with the existing pavement.

6.82.6 QUALITY CONTROL

6.82.6.1 VERIFICATION OF COMPACTION

- 6.82.6.1.1 In addition to the quality control carried out by the **Contractor**, inspections and tests of the asphalts and its ingredients will be done by a test laboratory retained by the **Owner**. Under no circumstances shall such inspections and tests reduce or alter the **Contractor's** obligations under this Contract.
- 6.82.6.1.2 At least twenty-four (24) hours before the start of each paving job, the **Contractor** shall give written notice of the work to the Engineer so that he can notify the **Owner's** laboratory. The **Contractor** shall ensure that a representative from the laboratory is present when the asphalt is laid, failing which the Engineer will not allow paving to proceed.
- 6.82.6.1.3 After the final compacting of each layer, the Engineer will check the edges and the slopes. The profile of each layer shall not vary more than 6 mm from the profile indicated on the drawings and in the *Special Technical Conditions*. Irregularities or depressions shall not exceed 5 mm in 3 m for the top layer or 6 mm in 3 m for the other layers. The thickness of each layer shall not vary more than 6 mm from the average thickness stipulated by the application rate per square metre. That rate is converted to thickness using the average bulk density determined when compaction is measured.

- 6.82.6.1.4 Irregularities are checked by the Engineer using a straightedge supplied by the **Contractor**.
- 6.82.6.1.5 The **Contractor** is responsible for ensuring that the work produces a profile that meets the requirements on the drawings. If the work does not comply, the **Contractor** shall place and resurface at its expense any portion of lane affected by the non-compliance.
- 6.82.6.1.6 The percentage compaction is determined using test method LC 26-510.
- 6.82.6.1.7 For purposes of acceptance, a lot is the quantity of asphalt placed during the day for each hot-mix asphalt formula.
- 6.82.6.1.8 A lot is accepted when the average of the six (6) compaction results for the day is between 93.0% and 98.0%. If the average compaction for the day is below the requirement of 93.0%, the Engineer shall notify the **Contractor** in writing and indicate that the core sampling will be done to re-evaluate the compaction.
- 6.82.6.1.9 Compaction is re-evaluated by means of six (6) core samples covering the area of asphalt laid during the day, the locations of which are determined by the Engineer randomly. Sampling shall be done within twenty (20) days after the notice is sent to the **Contractor**.
- 6.82.6.1.10 The percentage compaction of the pavement is the ratio of the bulk density of the core taken from the road and the average maximum density for the day recorded in the delivery log multiplied by 100.
- 6.82.6.1.11 Bulk density tests will be done in the **Owner's** laboratory using test method LC 26-040.
- 6.82.6.1.12 If the average of the six (6) measures of compaction using core samples is below the required minimum compaction of 93.0%, the asphalt laid during the day is deemed non-compliant.
- 6.82.6.1.13 The holes made by core sampling shall be filled by the **Contractor** at its expense immediately after sampling. The **Contractor** is responsible for the cost of ensuring signage and traffic control.
- 6.82.6.1.14 The **Contractor** shall designate a person to observe sampling and testing. Any comments about a procedure the observer deems improper shall be reported on the spot, and the Engineer shall be notified in writing of any discrepancy.
- 6.82.6.1.15 Work deemed non-compliant with regard to compaction and thickness will not be accepted, and the **Contractor** will have to redo the work at its own expense and still meet the deadlines set out in this Contract.

END OF SUBSECTION

APPENDIX 6.82-I

HOT-MIX ASPHALT MADE USING THE MARSHALL METHOD

(1 PAGE)

HOT-MIX ASPHALT MADE USING THE MARSHALL METHOD

Type of Asphalt	EB-20	EB-14	EB-10S	EB-10C	EB-5	CH-10
Uses	Base layer	Single layer, top layer or base layer	Top layer	Top layer or correction layer	Hand patching or correction layer	Waterproofing
Minimum number of separate aggregate grades to be used	3	3	2	2	1	2
Sieve	(% passing)					
28 mm	100					
20 mm	95-100	100				
14 mm	65-88	95-100	100	100		100
10 mm	48-78	75-90	92-100	94-100	100	96-100
5 mm	34-55	50-65	50-65	66-78	85-100	75-85
2.5 mm	24-45	29-47	27-50	45-65	65-90	57-75
1.25 mm	16-39	20-40	18-42	30-50	-	-
630 µm	9-31	14-34	12-35	20-40	26-65	25-50
315 µm	6-23	10-26	8-26	14-29	18-48	15-40
160 µm	4-15	5-17	5-17	7-18	8-30	7-25
80 µm	3.0-8.0	3.0-8.0	4.0-10.0	4.0-10.0	4.0-12.0	4.0-13.0
Binder (% min)	4.2	4.7	4.8	5.2	6	5.5
Flow (mm)	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.5	2.0-4.0
Stability (N)(min)	9000	9000	9000	9000	7000	9000
Voids (%)	2.0-5.0	2.0-5.0	2.0-5.0	2.0-5.0	2.0-5.0	2.0-5.0
Filled voids between particles (% max)	85	85	85	85	85	85
Compaction (% min)	93	93	93	93	93	93
Rutting resistance on 100 mm plates at 60°C at 30,000 cycles (% max deformation)	10.0	10.0	-	-	-	-
Rutting resistance on 50 mm plates at 60°C						
at 1,000 cycles	-	-	10.0	10.0	-	-
at 3,000 cycles (% max deformation)	-	-	20.0	20.0	-	-
Water content (% min)	70	70	70	70		

APPENDIX 6.82-II

**HOT-MIX ASPHALT FORMULATED USING THE
“LABORATOIRE DES CHAUSSÉES” METHOD**

(1 PAGE)

HOT-MIX ASPHALT FORMULATED USING THE "LABORATOIRE DES CHAUSSÉES" METHOD

Type of Asphalt	GB-20	ESG-14	ESG-10	EG-10	EGA-10	SMA-10	ESG-5
Uses	Base layer	Single layer, top layer or base layer	Top layer	Top layer	Top layer	Top layer	Anti-cracking layer
Minimum number of separate aggregate grades to be used	3	3	2	2	2	2	2
Sieve	(% passing)						
Particle size range	28 mm	100					
	20 mm	95-100	100				
	14 mm	67-90	95-100	100	100	100	100
	10 mm	52-75	70-90	92-100	90-100	90-100	90-100
	5 mm	35-50	40-60	52-65	40-48	40-50	25-35
	2.5 mm	-	39.2	46.1	46.1	46.1	18-28
	1.25 mm	-	25.7-31.7	30.7-36.7	30.7-36.7	30.7-36.7	-
	630 µm	-	19.1-23.1	22.8-26.8	22.8-26.8	22.8-26.8	-
	315 µm	-	15.4	18.1	18.1	18.1	-
	160 µm	-	-	-	-	-	-
Restriction zone (8)	80 µm	4.0-8.0	3.0-8.0	4.0-10.0	4.0-10.0	4.0-10.0	8.0-11.0
	2.5 mm	-	39.2	46.1	46.1	46.1	-
	1.25 mm	-	25.7-31.7	30.7-36.7	30.7-36.7	30.7-36.7	-
	630 µm	-	19.1-23.1	22.8-26.8	22.8-26.8	22.8-26.8	-
	315 µm	-	15.4	18.1	18.1	18.1	-
	Percentage fibres (%)					1.3	1.0
	Vibration (%)	10.2	11.4	12.2	12.4	14.6	14.8
	Voids at 10 turns (%)	≥ 11.0	≥ 11.0	≥ 11.0	≥ 11.0	≥ 11.0	≥ 11.0
	Voids at 80 turns (%)		-	4.0-7.0	4.0-7.0	4.0-7.0	(60g) 4.0-7.0
	Voids at 100 turns (%)		4.0-7.0	-	-	-	(50g) 4.0-7.0
Voids at 120 turns (%)	4,0-7,0						
Voids at 200 turns (%)	≥ 2,0	≥ 2,0	≥ 2,0	≥ 2,0	≥ 2,0	≥ 2,0	
Compaction (% min)	93,0	93,0	93,0	93,0	93,0	93,0	
Rutting resistance on 100 mm plates at 60°C at 30,000 cycles (% max deformation)	10,0	10,0	-	-	-	-	
Rutting resistance on 50 mm plates at 60°C at 1,000 cycles	-	-	10,0	10,0	10,0	-	
Rutting resistance on 50 mm plates at 60°C at 3,000 cycles (% max deformation)	-	-	20,0	20,0	20,0	10,0	
Water content (% min)	70	70	70	-	70	70	