TENDER DOCUMENTS

SUBSECTION 6.83
CEMENT CONCRETE PAVEMENT

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SUBSECTION 6.83 CEMENT CONCRETE PAVEMENT

6.83.1 GENERAL

6.83.1.1 This subsection describes the requirements relating to the cement concrete pavement work covered by this Contract.

6.83.1.2 This subsection specifies the requirements relating to the surface preparation for the construction of the cement concrete pavement, the construction of the pavement, the sealing of the joints as well as the repair of a cement concrete pavement.

6.83.1.3 Any specific requirements, if needed, pertaining to the cement concrete pavement work covered by this Contract are set out on the drawings and in Section 4 *Special Technical Conditions*.

6.83.1.4 The requirements relating to demolition work are set out in subsection 6.21 *Demolition and Removal.*

6.83.1.5 The requirements relating to reinforcing steel for concrete are set out in subsection 6.31 *Reinforcing Steel for Concrete*.

6.83.1.6 The requirements relating to formwork are set out in subsection 6.32 *Formwork*.

6.83.1.7 The requirements relating to concrete work are set out in subsection 6.33 *Cast-in-Place Concrete*.

6.83.1.8 The requirements relating to base and sub-base work are set out in subsection 6.81 *Base and Sub-Base*.

6.83.2 MEASUREMENT UNITS

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

Measurement Unit	Designation	Symbol
length	metrer	m
length	millimeter	mm
area	square meter	m^2
volume	cubic meter	m^3
volume	liter	L
volume	milliliter	mL
mass	kilogram	kg
angle plan	degree	°
stress, pressure	kilopascal	kPa
stress, pressure	megapascal	MPa
temperature	Celsius degree	°C
time	minute	min

6.83.3 REFERENCE STANDARDS

6.83.3.1 The **Contractor** shall carry out all cement concrete pavement work in accordance with the requirements of the following standards and documents, to which the provisions of this Contract are added:

6.83.3.1.1 (AASHTO) American Association of State Highway and Transportation Officials:

- AASHTO M254 *Standard Specification for Corrosion-Resistant Coated Dowel Bars*;
- AASHTO T253 *Standard Method of Test for Coated Dowel Bars*.

6.83.3.1.2 (ACNOR(CSA)) Canadian Standards Association :

- CAN/CSA-A23.1/A23.2 *Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete:*
    - A23.2-1C *Sampling of Plastic Concrete*;
    - A23.2-3C *Manufacture and Curing of Concrete Specimens for Compression and Bending Tests;*
    - A23.2-4C *Determination of the Air Content of Plastic Concrete by the Air Pressure Method;*
    - A23.2-5C *Concrete Subsidence;*
    - A23.2-8C *Determination of the Bending Strength of Concrete (by means of a single beam load to the third);*
    - A23.2-9C *Determination of the Compressive Strength of Cylindrical Concrete Specimens;*
    - A23.2-17C *Determination of the Temperature of Fresh Hydraulic Cement Concrete.*

6.83.3.1.3 (ASTM) ASTM International:

- ASTM C174/C174M *Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores*;
- ASTM D2628 *Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements;*
- ASTM D2835 *Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavement;*
- ASTM D5249 *Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints;*

- ASTM D5329 *Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.*

6.83.3.1.4 (BNQ) Bureau de normalisation du Québec:

- BNQ 2560-114 *Travaux de génie civil – Granulats* – Partie II; *Fondation, sous-fondation, couche de roulement et accotement (granulats utilisés pour les chaussées);*
- BNQ 2621-905 *Béton prêt à l'emploi – Programme de certification.*

6.83.3.1.5 (MTQ) Ministère des Transports du Québec:

- MTQ – *Cahier des charges et devis généraux* (CCDG);
- MTQ – *Ouvrages routiers* – Tome VII *Matériaux* :
    - Norme 3101 – *Béton de ciment de masse volumique normale*;
    - Norme 3501 – *Matériaux de cure;*
    - Norme 3901 – *Coulis cimentaire*;
    - Norme 4202 – *Enrobés à chaud formulés selon le principe de la méthode Marshall*;
    - Norme 4401 – *Produits de colmatage de fissures et de joints*;
    - Norme 5101 – *Armatures pour les ouvrages en béton*;
    - Norme 6101 – *Aciers de construction*.

6.83.4 MATERIALS

6.83.4.1 GRANULAR MATERIAL FOR THE CORRECTION OF THE BASE

6.83.4.1.1 The granular material for the correction of the base shall be MG 20 Type.

6.83.4.1.2 The granular material shall comply with indications on the drawings and of standard BNQ 2560-114 *Partie II* after implementation of the materials.

6.83.4.2 DOWEL

6.83.4.2.1 The dowel shall be a 300W grade smooth bar, compliant with MTQ standard 6101, excluding the Charpy test method.

6.83.4.2.2 The dowel shall be coated with epoxy in accordance with standard AASHTO M254.

6.83.4.2.3 The dowel shall be coated with a bond breaker agent in accordance with standard AASHTO M254.

6.83.4.2.4 The dowel shall be free of burrs, distortions and wrinkles preventing it from sliding easily into hard concrete.

6.83.4.3 TIE ROD

6.83.4.3.1 The tie rod shall be a grade 400W ribbed-surface bar and comply with subsection 6.31 *Reinforcing Steel for Concrete*.

6.83.4.3.2 Unless otherwise indicated on the drawings, the tie rod shall be 15 mm in diameter and 750 mm long.

6.83.4.3.3 The tie rod anchoring product shall comply with Article 6.31.4.7 *Anchor Adhesive* or Article 6.31.4.8 *Cementitious Capsules*, as applicable.

6.83.4.4 REINFORCING STEEL

6.83.4.4.1 Unless otherwise indicated on the drawings, the reinforcing steel shall be 400W grade and comply with subsection 6.31 *Reinforcing Steel for Concrete*.

6.83.4.5 WIRE MESH

6.83.4.5.1 The wire mesh shall comply with subsection 6.31 *Reinforcing Steel for Concrete*.

6.83.4.5.2 The wire mesh shall be 152 mm x 152 mm MW 25.8 x MW 25.8.

6.83.4.6 CONCRETE

6.83.4.6.1 The concrete implemented by means of a slipform paver equipment shall have the mix properties indicated on the drawings and comply with subsection 6.33 *Cast-in-Place Concrete*.

6.83.4.6.2 The concrete placed by means of a vibrating screed or manually shall have the mix properties indicated on the drawings and comply with subsection 6.33 *Cast-in-Place Concrete*.

6.83.4.7 HOT-APPLIED SEALING PRODUCT

6.83.4.7.1 The sealing product for joints shall comply with MTQ standard 4401.

6.83.4.8 BACKER ROD

6.83.4.8.1 The backer rod shall consist of closed cell polyethylene foam and comply with Type 1 of standard ASTM D5249.

6.83.4.8.2 The backer rod diameter shall be equal to 1.25 times the sealing tank width.

6.83.4.9 PREFORMED PRODUCT

6.83.4.9.1 The preformed product shall comply with standard ASTM D2628, excluding the requirement relating to mass loss in oil.

6.83.4.10 LUBRICANT

6.83.4.10.1 The lubricant for inserting the preformed product shall be recommended by the preformed product manufacturer and comply with standard ASTM D2835.

6.83.5 EQUIPMENT AND TOOLS

6.83.5.1 CONSTRUCTION OF THE CONCRETE PAVEMENT

6.83.5.1.1 Gauge

6.83.5.1.1.1 A rigid gauge in the form of a straightedge at least 3 m long, light and fitted with a brace, shall be made available to the Engineer by the **Contractor** throughout the duration of the work.

6.83.5.1.2 Fixed formwork

6.83.5.1.2.1 The formwork surface shall be straight, smooth and present no depressions greater than 3 mm under the 3 m straightedge. No bending or deformations under the vertical or lateral loads shall exceed 6 mm under a 3 m gauge.

6.83.5.1.3 Slipform paver equipment

6.83.5.1.3.1 The use of a slipform paver equipment is required for the construction of concrete pavements.

6.83.5.1.3.2 The slipform paver equipment shall be self-propelled, track-mounted and capable of spreading, consolidating and leveling fresh concrete over a minimum of two (2) traffic lanes and producing a uniform surface finish.

6.83.5.1.3.3 The slipform paver equipment shall have internal vibrators, automatic profile and directional controls and transversal power trowel.

6.83.5.1.4 Vibrator

6.83.5.1.4.1 The vibration equipment shall allow a uniform consolidation over the full slab width and thickness, without causing segregation or leaving cavities.

6.83.5.1.5 Vibrating Screed

6.83.5.1.5.1 The vibrating screed used shall be a truss equipped with vibrators allowing the uniform consolidation of concrete over the full slab width, without causing segregation or leaving cavities.

6.83.5.1.6 Self-propelled platform

6.83.5.1.6.1 A self-propelled platform shall be equipped with a device allowing the passage of an “Astroturf” type carpet over the full width of the pavement.

6.83.5.1.6.2 The self-propelled platform shall be equipped with sprinklers that spray and project the membrane-forming curing material on the concrete surface. The application rate shall be uniform and the device shall have a skirt to ensure that uniformity even in windy conditions.

6.83.5.1.7 Leveling tools

6.83.5.1.7.1 The hand and mechanical leveling tools shall be made of aluminum or magnesium alloy.

6.83.5.1.8 Concrete drills

6.83.5.1.8.1 The characteristics of the equipment used to drill holes in the slab shall not exceed:

6.83.5.1.8.1.1 8 joules of impact energy;

6.83.5.1.8.1.2 a rate of hammering of 3,000 strokes/minute;

6.83.5.1.8.1.3 a rotation speed of 300 revolutions/minute.

6.83.5.2 SEALING OF JOINTS

6.83.5.2.1 Saw

6.83.5.2.1.1 The saw shall be designed for cutting and chamfering concrete. The saw shall be self-propelled and equipped with a diamond blade. The use of an impact saw, router or percussion tool is not allowed.

6.83.5.2.2 Wet abrasive blasting cleaning equipment

6.83.5.2.2.1 The compressor shall have the following characteristics:

6.83.5.2.2.1.1 minimum pressure: 600 kPa;

6.83.5.2.2.1.2 minimum flow rate: 4 m^3/min;

6.83.5.2.2.1.3 pipe internal diameter: 19 mm.

6.83.5.2.2.2 The wet abrasive blasting cleaning equipment shall be equipped with a filter that captures oil. The filter efficiency shall be demonstrated to the Engineer before the cleaning operations.

6.83.5.2.2.3 The lance shall have a 25 mm internal diameter and be equipped with a 6 mm nozzle.

6.83.5.2.3 Air Blasting Cleaning Equipment

6.83.5.2.3.1 The compressor shall have the following characteristics:

6.83.5.2.3.1.1 minimum pressure: 600 kPa;

6.83.5.2.3.1.2 minimum flow rate: 4 m³/min;

6.83.5.2.3.1.3 pipe internal diameter: 19 mm.

6.83.5.2.3.2 The air blasting cleaning equipment shall be equipped with a filter that captures oil and moisture. The filter efficiency shall be demonstrated to the Engineer before the cleaning operations.

6.83.5.2.4 Equipment for Application of Hot-Applied Product

6.83.5.2.4.1 The boiler shall be double-walled and equipped with a mixer operational at all times. The temperature of the heat transfer fluid shall be controlled automatically so as to maintain the temperature of the sealant within the limits set by the manufacturer. Thermometers graduated in Celsius degrees shall indicate the sealant temperature. The thermometers and thermostats used shall correspond to the metrological characteristics required on the basis of the intended use. Every instrument used shall be calibrated and carry a certificate demonstrating traceability thereof while certifying its calibration compliance.

6.83.5.2.4.2 An injection nozzle shall be used to apply the product.

6.83.5.2.4.3 The use of pouring pots or spreaders mounted on wheels is prohibited.

6.83.5.3 REPAIR OF THE CONCRETE PAVEMENT

6.83.5.3.1 Unless otherwise indicated on the drawings, the material used shall be the same as that required for the construction of the concrete pavement or for the sealing of joints.

6.83.5.3.2 For surface repairs, the jackhammers used shall weigh 14 kg or less.

6.83.6 INSPECTION

6.83.6.1 INSPECTION OF SEALED JOINTS

6.83.6.1.1 Over the course of the winter that follows the sealing of joints, the Engineer and the **Contractor** shall inspect the joints. When it proves impossible to inspect the joints within the two (2) weeks that follows the extreme cold, the inspection shall be conducted as soon as possible thereafter.

6.83.7 EXECUTION OF WORK

6.83.7.1 PREPARATION OF THE SURFACE FOR CONSTRUCTION

6.83.7.1.1 The preparation of the surface to be covered shall be done by correcting the longitudinal and transversal profiles and giving the pavement the required camber and slope. The surface preparation shall be carried out over the full pavement width or as indicated on the drawings, so as to allow water to run freely towards the ditches. The surface to be covered shall extend laterally over a minimum width of 1.35 m in order to ensure a firm footing and proper leveling of the slipform paver tracks.

6.83.7.2 GRANULAR SURFACE

6.83.7.2.1 Where required, the **Contractor** shall scarify the existing granular surface to a minimum depth of 100 mm or according to the dimensions indicated on the drawings in order to loosen the surface materials and make them homogeneous, and allow preparation thereof.

6.83.7.2.2 All 80 mm or bigger pebbles that have been loosened during the scarification and all unsuitable materials shall be gathered up and disposed of.

6.83.7.2.3 Where indicated on the drawings, the **Contractor** shall spread granular material to correct the bases and construct the shoulders.

6.83.7.2.4 The granular surface shall be stable, free of foreign materials and densified according to the pavement bases indicated on the drawings and to subsection 6.81 *Base and Sub-base*.

6.83.7.2.5 Before undertaking the placement of concrete, the base shall be watered in order to obtain a wet surface without puddles.

6.83.7.2.6 A minimum of 2,500 m² of the surface to be covered shall be prepared before concreting is undertaken.

6.83.7.2.7 The Engineer has a period of four (4) hours to check the surface to be covered. Upon acceptance by the Engineer, the **Contractor** may proceed with the paving work. The **Contractor** remains responsible for any damage that may occur to the surface to be covered.

6.83.7.2.8 The final profile before the covering shall not vary from the required profile by more than 10 mm. No irregularities or depressions shall exceed 10 mm within a 3 m surface area.

6.83.7.2.9 Special attention shall be paid to bridge approaches and the intersections for a proper layout of the profiles. The expansion joints of a structure shall be constantly maintained free from granular or foreign materials.

6.83.7.3 CONSTRUCTION OF THE CONCRETE PAVEMENT

6.83.7.3.1 Dowels

6.83.7.3.1.1 Before the start of concreting work, the **Contractor** shall install the transversal joint dowels on supports fixed to the ground over a minimum distance of 100 m in front of the slipform paver.

6.83.7.3.1.2 The **Contractor** shall use a method that allows the localization of each joint directly above the dowel center with a tolerance of 6 mm.

6.83.7.3.1.3 The tolerance for the location of the dowels in the vertical plane shall be 12 mm.

6.83.7.3.1.4 In the horizontal and vertical planes, the dowel axis shall not deviate from the target orientation by more than 6 mm over the length of the dowel.

6.83.7.3.2 Tie rods

6.83.7.3.2.1 At the longitudinal joints, no tie rods shall be installed within 450 mm of a transversal joint.

6.83.7.3.2.2 When the ties rods are installed manually, the **Contractor** shall install them on supports fixed to the ground over a minimum distance of 100 m in front of the slipform paver.

6.83.7.3.2.3 The tolerance for the location of the tie rods in the vertical plane shall be 12 mm.

6.83.7.3.3 Concrete

6.83.7.3.3.1 The **Contractor** shall submit to the Engineer, for review, the technical data sheets of mixes at least fourteen (14) days prior to concreting.

6.83.7.3.3.2 The **Contractor** shall also provide its slab concreting plan at least fourteen (14) days prior to the start of concreting works. This plan shall illustrate the position of the longitudinal and transversal joints as well as the tie rods and dowels.

6.83.7.3.4 Transportation of concrete

6.83.7.3.4.1 When the concrete is transported by trucks that are not equipped with an agitating device, the time period between the loading of the concrete into the hopper and unloading thereof on worksite shall be less than forty-five (45) minutes.

6.83.7.3.5 Placement

6.83.7.3.5.1 The **Contractor** shall not perform concreting work when it rains.

6.83.7.3.5.2 The concrete already in place shall be protected effectively from the effects of rain until it has sufficiently hardened.

6.83.7.3.5.3 The spreading, consolidation and finishing of concrete shall be performed using a slipform paver, unless the obstacles, limited scope of work or access prevent the use thereof. Excess concrete, produced by the slipform pavers at the base of the sides of the slab, shall be removed when the concrete is still in the plastic state.

6.83.7.3.5.4 If the placement of concrete is interrupted for a period of more than forty-five (45) minutes, a construction joint shall be executed.

6.83.7.3.5.5 The concrete shall not be placed against any material whose temperature is above 35°C or below 0°C.

6.83.7.3.6 Consolidation

6.83.7.3.6.1 The vibrators shall not touch the formwork, tie rods or dowels. The internal vibrators shall not operate when the slipform paver is stopped.

6.83.7.3.6.2 In the locations where the concrete is placed manually, the consolidation shall be performed by means of a handheld vibrator.

6.83.7.3.6.3 The use of a vibrating screed shall always be combined with the use of a handheld vibrator.

6.83.7.3.7 Finishing

6.83.7.3.7.1 The surface shall be even and compliant with the transversal and longitudinal profiles indicated on the drawings. The surface profile shall not vary from these indicated profiles by more than 6 mm. No irregularities or unevenness of the surface shall exceed 5 mm within a 3 m surface area.

6.83.7.3.7.2 If manual touch-ups are required following mechanized work, these touch-ups shall be made while the concrete is sufficiently plastic to achieve the desired result without adding water to the concrete surface.

6.83.7.3.8 Texture

6.83.7.3.8.1 The anti-slip texture of the pavement surface shall be obtained by means of an “Astroturf” type carpet dragged longitudinally in a continuous and uniform manner over the full concreted width.

6.83.7.3.9 Curing

6.83.7.3.9.1 The curing of concrete shall start immediately after having obtained the anti-slip texture, but without damaging the surface or dulling the texture.

6.83.7.3.9.2 The curing of concrete surfaces shall be performed during seven (7) consecutive days at a minimum temperature of 10°C or during the period required for the concrete to reach 70% of the compressive strength required at twenty-eight (28) days.

6.83.7.3.9.3 At least one of the following methods shall be used to cure the concrete, alone or in combination with others:

6.83.7.3.9.3.1 Absorbent fabric

6.83.7.3.9.3.1.1 The surface, including the slab edges, shall be completely covered. The fabric shall be kept damp on a continuous basis.

6.83.7.3.9.3.2 Waterproof sheet

6.83.7.3.9.3.2.1 The sheets used shall overlap over 100 mm, be well sealed to each other and completely cover the surfaces, including the slab edges.

6.83.7.3.9.3.3 Curing material

6.83.7.3.9.3.3.1 The curing material shall be applied at the rate of 0.2 L/m² over the full surface, including the slab edges, with a self-propelled platform equipped with sprinklers. The curing material shall be stirred before and during application thereof in order to obtain a homogeneous film over the full surface.

6.83.7.3.10 Cold weather protection

6.83.7.3.10.1 The concrete temperature during concreting and during the curing period shall never be below 10°C. If necessary, insulation materials, protected from water by means of a polyethylene membrane, or equivalent, shall be used to ensure that minimum temperature over the full slab surface.

6.83.7.3.10.2 At the end of the protection operation, the concrete temperature shall be gradually lowered of a maximum of 20°C per twenty-four (24) hours period.

6.83.7.3.11 Crack initiation

6.83.7.3.11.1 The crack initiation of transversal and longitudinal contraction joints shall be performed by means of a saw cut having a 3 mm width and a depth corresponding to one third of the slab thickness.

6.83.7.3.11.2 This saw cut shall be made for both types of joints as soon as it is possible to do without unsetting the aggregates or causing spalling, when the concrete has started to harden but before the tensile force produced by the shrinkage has caused irregular cracks. In the case of the longitudinal contraction joint, the saw cut shall be made no later than twenty-four (24) hours after sawing of the transversal contraction joint.

6.83.7.3.11.3 The saw cut shall be straight. It shall not deviate by more than 6 mm over a length of 3 m. The crack initiation of the transversal joint shall not vary from its theoretical location by more than 12 mm. For the longitudinal joint, the crack initiation shall not vary from its theoretical location by more than 30 mm.

6.83.7.3.11.4 Immediately after sawing, the groove produced and the slab surface shall be cleaned of any sawdust or debris, proceeding from the center of the roadway towards the shoulders.

6.83.7.3.12 Joints

6.83.7.3.12.1 The concrete pavement shall be divided into slabs by transversal and longitudinal joints. The slab dimensions and detail of joints shall meet the requirements of this Contract and a plan of the joints shall be provided by the **Contractor** to the Engineer at least fourteen (14) days prior the start of slab concreting.

6.83.7.3.12.2 Transversal contraction joints

6.83.7.3.12.2.1 Transversal contraction joints shall be fitted with dowels.

6.83.7.3.12.2.2 When the pavement is constructed in several successive longitudinal strips, the transversal joints to execute on the strips that are adjacent to the first one shall be executed in the extension of existing ones. The same requirements apply to the widening or replacement of an existing traffic lane.

6.83.7.3.12.3 Longitudinal contraction joints

6.83.7.3.12.3.1 Longitudinal contraction joints shall be fitted with tie rods.

6.83.7.3.12.3.2 Longitudinal joints shall coincide with the traffic lane divider lines. Alignment thereof shall be parallel to the pavement axis whose rectilinear or curvilinear contours they follow.

6.83.7.3.12.4 Transversal construction joints

6.83.7.3.12.4.1 Transversal construction joints shall be executed at the end of a workday or during a stoppage of concrete placement that lasts more than forty-five (45) minutes.

6.83.7.3.12.4.2 Transversal construction joints shall coincide with contraction joints. The configuration of these joints shall be similar to that of the contraction joints, except that concreting shall be stopped at the joint itself.

6.83.7.3.12.4.3 If the dowels are inserted into fresh concrete, they shall be held in place through the formwork of the joint, so as to meet the requirements relating to the position and alignment, until the concrete has hardened.

6.83.7.3.12.4.4 If the dowels are installed in hardened concrete, they shall be inserted into holes drilled in the concrete that has previously been cleaned by air blasting and then filled with an anchoring product. The **Contractor** shall comply with the anchoring product manufacturer's recommendations. The hole diameter shall exceed that of the dowels by 7 mm. The dowels shall be held in place, so as to meet the requirements relating to the position and alignment, until the anchoring product has hardened.

6.83.7.3.12.4.5 All transversal construction joints shall be identified in three (3) locations on each traffic lane. In no case shall the method to identify the joints damage the slab.

6.83.7.3.12.5 Longitudinal construction joints

6.83.7.3.12.5.1 The longitudinal construction joints shall be executed in cases where all lanes of a roadway are not constructed simultaneously.

6.83.7.3.12.5.2 The upper edges of a longitudinal construction joint shall be at the same level within 3 mm.

6.83.7.3.12.5.3 The longitudinal construction joints shall be fitted with tie rods anchored to the slab and installed according to either one of the following methods, in order to avoid any deformation of the concrete surface:

6.83.7.3.12.5.3.1 inserting the tie rods into fresh concrete by means of a guide in an additional section of the slipform paver;

6.83.7.3.12.5.3.2 inserting the tie rods into holes drilled in hardened concrete that have been previously cleaned by air blasting and then filled with an anchoring product.

6.83.7.3.12.5.4 The **Contractor** shall comply with the anchoring product manufacturer's recommendations. The hole diameter shall exceed that of the tie rods by 7 mm. The tie rods shall be held in place parallel to the slab surface until the anchoring product hardens.

6.83.7.3.12.5.5 Immediately after the finishing of concrete, any longitudinal construction joint located between two lanes that are not constructed simultaneously shall be identified manually and accurately at intervals of 5 m, in order for the initial sawing to coincide with the contact surface between the two (2) pours.

6.83.7.3.12.6 Uncoupling joints

6.83.7.3.12.6.1 An uncoupling joint shall be constructed wherever there may be differential movement between the concrete slab and a fixed structure (retaining wall, foundation block, etc.).

6.83.7.3.12.6.2 An uncoupling joint may be transversal, longitudinal, peripheral or at an angle, as applicable.

6.83.7.3.12.6.3 The faces of an uncoupling joint shall be flat, sawn or formed, and separated by a compressible board throughout the slab thickness.

6.83.7.3.12.7 Sealing of joints

6.83.7.3.12.7.1 All concrete pavement joints shall be sealed, including those between the cement concrete and the asphalt.

6.83.7.3.12.8 Transition

6.83.7.3.12.8.1 Transition slab between a bridge and a rigid pavement

6.83.7.3.12.8.1.1 A transition shall be performed at the junction of a bridge transition slab and a cement concrete pavement in accordance with MTQ standardized drawing DN II-2-014.

6.83.7.3.12.8.2 Longitudinal transition between a cement concrete pavement and an asphalt pavement

6.83.7.3.12.8.2.1 A transition shall be performed at the junction of a concrete pavement and an asphalt pavement in accordance with MTQ standardized drawing DN II-2-015.

6.83.7.3.12.9 Additional requirements

6.83.7.3.12.9.1 Removal of formwork

6.83.7.3.12.9.1.1 The formwork shall remain in place for at least twelve (12) hours after concrete placement, during which period the ambient temperature is above 10°C.

6.83.7.3.12.9.1.2 The equipment used to remove the formwork shall not rest on fresh concrete. If the slab's vertical surface is dimpled, the repair and curing treatment shall immediately follow.

6.83.7.3.12.9.2 Vehicular movement on the concrete slab

6.83.7.3.12.9.2.1 No vehicle heavier than 2,500 kg shall travel on the concrete before it has reached 70% of the minimum compressive strength required at twenty-eight (28) days.

6.83.7.3.12.9.2.2 The concrete surface shall be adequately protected at all times when equipment on steel tracks is used.

6.83.7.3.12.9.2.3 No steel roller or grader blade shall come into contact with the edge or top of the slab.

6.83.7.3.12.9.2.4 Placing granular materials, backfill material, crushed stones or any other material or equipment which can cause spalling or other damage on the concrete pavement is prohibited.

6.83.7.3.12.9.3 Spalling of joints

6.83.7.3.12.9.3.1 Spalling whose maximum width is less than or equal to 40 mm shall be sealed by means of a hot-applied sealant.

6.83.7.3.12.9.3.2 No spalling with a total maximum width greater than 40 mm will be accepted.

6.83.7.3.12.9.4 Repairs during construction

6.83.7.3.12.9.4.1 During the construction of a new concrete pavement, no surface repairs are permitted. All in-depth repairs shall be carried out on the width of a lane that is located between two (2) transverse joints.

6.83.7.4 SEALING OF JOINTS

6.83.7.4.1 Prerequisites

6.83.7.4.1.1 The work shall be carried out after the concrete has reached 70% of the compressive strength required at twenty-eight (28) days and after any correction by grinding.

6.83.7.4.2 Transverse joint between the concrete and the asphalt.

6.83.7.4.2.1 The joint between the concrete and the asphalt shall be sealed with a hot-applied sealant.

6.83.7.4.3 Construction of the sealing cavity

6.83.7.4.3.1 The tank shall be constructed by sawing the concrete according to the indications on the drawings. The cavity walls shall be vertical. The cavity edges shall be chamfered to 45° and to a depth of 3 mm.

6.83.7.4.3.2 The crack initiation or construction joint shall be located within the cavity limits.

6.83.7.4.3.3 The cavity shall be straight and shall not deviate by more than 6 mm over a length of 3 m.

6.83.7.4.3.4 The construction of the cavity shall not be carried out more than forty-eight (48) hours before the placement of the sealant.

6.83.7.4.4 Cleaning of the sealing cavity

6.83.7.4.4.1 After the cavity has been constructed, the **Contractor** shall completely remove the milky residues and other debris in the cavity and on the slab surface by means of water blasting. The water jet shall be applied from the center of the roadway towards the shoulders.

6.83.7.4.4.2 After cleaning by water blasting, the **Contractor** shall clean the cavity walls by means of wet abrasive blasting to obtain a slightly rough surface free of detachable debris. The wet abrasive blasting shall be applied separately on each vertical wall. It shall not be applied on the slab surface or on the chamfer.

6.83.7.4.4.3 After cleaning by wet abrasive blasting, the **Contractor** shall clean the pavement surface.

6.83.7.4.4.4 Before the installation of the backer rod, the cavity shall be cleaned by means of compressed air.

6.83.7.4.4.5 After cleaning, the cavity walls shall be dry and free of dust, grease or foreign objects.

6.83.7.4.5 Sealing with a hot-mix product

6.83.7.4.5.1 After cleaning the cavity by means of air blasting, a backer rod shall be inserted into the cavity. A second cleaning by means of air blasting is required immediately prior to the application of the hot-mix product.

6.83.7.4.5.2 The temperature of the hot-mix product shall comply at all times with the manufacturer's recommendations. Any sealant heated to a temperature exceeding the manufacturer's recommendations is rejected.

6.83.7.4.5.3 The hot-mix product shall be applied in a single layer without trapping air between the backer rod and the product.

6.83.7.4.6 Sealing with a preformed product

6.83.7.4.6.1 The transversal joints shall be sealed with a preformed product.

6.83.7.4.6.2 The placement of the preformed product shall be carried out in accordance with the manufacturer’s requirements.

6.83.7.4.7 Intersection of joints

6.83.7.4.7.1 At the intersection of joints, the **Contractor** shall place the sealants so as to ensure tightness thereof.

6.83.7.5 REPAIR OF THE CONCRETE PAVEMENT

6.83.7.5.1 Restrictions concerning surface repairs

6.83.7.5.1.1 The surface repairs shall be carried out on a minimum thickness of 75 mm without exceeding half the thickness of the pavement to repair. However, if the dimension of the surface to repair exceeds 1.5 m², the repair shall be carried out in depth.

6.83.7.5.1.2 When a surface to repair is deeper than 50% of the pavement thickness or when the top of the dowels and tie roads is visible, the repair shall be carried out in depth.

6.83.7.5.1.3 Along the joints, spalling whose total width is less than 40 mm shall be sealed with a hot-applied sealant.

6.83.7.5.2 Marking of surfaces

6.83.7.5.2.1 The Engineer will mark the location of the surfaces to repair and the type of repairs needed. These surfaces comprise a surplus of 150 mm of concrete in good condition.

6.83.7.5.2.2 For slabs larger than 6 m, the minimum dimensions of an in-depth repair shall be 1.8 m long on the full width or half-width of a lane. That length is extended to 3.6 m when the repair is on either side of a transverse joint. In the case of slabs smaller than 6 m, the dimensions of the repair shall be of half of a lane from one transverse joint to the other, or 1.8 m long on a full lane width. When there is a longitudinal joint located inside a repair, the repair shall be carried out on a minimum of half the width of a lane on each side. The contraction joints of the repair shall be executed in the extension of those of neighboring slabs.

6.83.7.5.2.3 The sides of the surface to repair shall be parallel to the longitudinal and to the transversal joints. No saw cuts shall overlap adjacent surfaces by more than 35 mm.

6.83.7.5.2.4 The saw cut shall be straight and shall not deviate by more than 10 mm measured on 3 m. For greater variations, the **Contractor** shall resume the saw cut at its expense and assume the cost of the additional surface to repair, at no additional cost to the **Owner**.

6.83.7.5.2.5 In case of a spalling within the first 35 mm from the pavement surface, the **Contractor** shall redo, at its expense, a new saw cut and remove that part, at no additional cost to the **Owner**.

6.83.7.5.3 Removal of concrete

6.83.7.5.3.1 The **Contractor** shall make 50 mm deep saw cuts on the perimeter of the surface to repair. It shall demolish and remove the concrete to a minimum depth of 75 mm without exceeding half the pavement thickness at the location where it is damaged. The bottom of the repair shall be flat and horizontal relative to the vertical walls.

6.83.7.5.4 In-depth repair

6.83.7.5.4.1 The **Contractor** shall saw, over the full slab thickness, the perimeter of the surface to repair. The cut portion of the concrete shall be removed by jacking. All debris shall be removed down to the base.

6.83.7.5.4.2 During the sawing work, the **Contractor** shall take care not to damage the vertical wall. When work is resumed due to breakage or spalling in the concrete, the expenses incurred shall be borne by the **Contractor.**

6.83.7.5.5 Repair of the base

6.83.7.5.5.1 For the in-depth repair of the slab, the **Contractor** shall remove the debris and soiled materials. It shall compact the base using a manual compactor. After compaction, the **Contractor** shall restore the base profile with cement concrete of the same quality as that of the concrete used for the repair.

6.83.7.5.6 Drilling of holes and installation of dowels and tie rods

6.83.7.5.6.1 The center of the holes shall be located at the slab mid-thickness with a vertical tolerance of ± 12 mm. The hole diameter shall exceed that of the tie rods and dowels by 7 mm. The **Contractor** shall comply with the anchoring product manufacturer's recommendations. The tie rods and dowels shall be held in place parallel to the surface until the anchoring product hardens. In the horizontal and vertical planes, the dowel axis shall not deviate from the target orientation by more than 6 mm over the length of the dowel.

6.83.7.5.7 Wire mesh

6.83.7.5.7.1 In slabs larger than 6 m, the wire mesh shall be installed at the pavement mid-thickness, but it shall be installed above the tie rods and dowels. The wire mesh shall be maintained at the correct height by placing the necessary number of supports. The wire mesh shall stop at 75 mm from the sides of the surface to repair and from the joints.

6.83.7.5.8 Cleaning and priming of the surface area to repair

6.83.7.5.8.1 The surfaces where new concrete comes into contact with the existing concrete shall be cleaned by abrasive blasting. The cleaning shall remove the chunks of concrete that no longer adhere perfectly, in order to obtain a rough surface. Immediately before pouring the concrete, the **Contractor** shall clean all surrounding surfaces, the prepared surface and the excavation walls by compressed air.

6.83.7.5.8.2 On all surfaces where the new concrete must adhere to the existing concrete, a bonding primer shall be applied. If the bonding primer dries before concreting, application thereof shall be resumed.

6.83.7.5.9 Compressive board

6.83.7.5.9.1 In order to maintain the space required for the free movement of the pavement slab during the concreting of a surface repair, the **Contractor** shall install a compressible board in the existing joints. The compressible board shall meet the requirements for the construction of the concrete pavement as indicated on the drawings. The compressible board shall be 13 mm thick. The board shall exceed the dimensions of the surface to repair by 75 mm on each side and by 25 mm in the bottom.

6.83.7.5.10 Longitudinal joints for in-depth repair

6.83.7.5.10.1 The longitudinal contraction and construction joints shall be fitted with tie rods.

6.83.7.5.11 Transversal joints for in-depth repair

6.83.7.5.11.1 Construction joints

6.83.7.5.11.1.1 The transversal construction joints shall be fitted with tie rods.

6.83.7.5.11.2 Contraction joints

6.83.7.5.11.2.1 The transversal contraction joints shall be fitted with dowels.

6.83.7.5.11.3 Expansion joints

6.83.7.5.11.3.1 In slabs larger than 6 m, the expansion joints shall have 38 mm diameter dowels by 450 mm x 300 mm from centre to centre (c/c) with an 85 mm ± 10 mm expansion cap. The joints shall have a 19 mm compressible board and their location is determined by the Engineer. The joints shall coincide with the joints of adjacent slabs.

6.83.7.5.12 Uncoupling joint

6.83.7.5.12.1 The uncoupling joint shall meet the requirements for the construction of the concrete pavement as indicated on the drawings.

6.83.7.5.13 Concreting

6.83.7.5.13.1 The **Contractor** shall proceed from the center of the surface to repair towards the edges, for the concrete placement. A vibrating screed shall be used for the surfaces to repair that have a width of one lane over more than 10 m in length or a total surface area of 100 m² and more.

6.83.7.5.13.2 The concrete shall be consolidated using immersion vibrators. For surface repairs, the immersion vibrator shall have a maximum diameter of 25 mm. The vibrators shall be inserted at 300 mm on center over the full repair surface. Manual floating and smoothing are prohibited. The surface texture shall comply with Article 6.83.7.3 *Construction of the concrete pavement*.

6.83.7.5.14 Curing

6.83.7.5.14.1 The concrete curing shall be carried out with a membrane-forming curing material applied at the rate of 0.2 L/m² over the full concrete surface, including the slab edges. The curing material shall be stirred before and during application thereof in order to obtain a homogeneous film over the full surface.

6.83.7.5.15 Crack initiation

6.83.7.5.15.1 The crack initiation shall comply with article 6.83.7.3 *Construction of the concrete pavement*.

6.83.7.5.16 Vehicular movement on the concrete slab

6.83.7.5.16.1 The **Contractor** shall comply with article 6.83.7.3 *Construction of the concrete pavement*.

6.83.7.5.17 Finishing

6.83.7.5.17.1 The level of the repaired surface shall be the same as that of the adjacent existing pavement. Any variation of more than 5 mm, measured over 3 m in length, shall be corrected by the **Contractor**. If this Contract provides for grinding after the repairs have been carried out, the **Contractor** shall ensure to obtain grinding on 100% of the repaired surface.

6.83.7.5.18 Sealing of joints

6.83.7.5.18.1 All joints of the concrete pavement shall be sealed, including the joints between the concrete and the asphalt.

6.83.8 QUALITY CONTROL

6.83.8.1 CONSTRUCTION OF THE CONCRETE PAVEMENT

6.83.8.1.1 Concrete

6.83.8.1.1.1 No later than fourteen (14) days before beginning the construction of the concrete pavement, the **Contractor** shall provide a quantity of 2 m³ of concrete of each of the proposed mix so that the Engineer may check the properties thereof.

6.83.8.1.1.2 Certification

6.83.8.1.1.2.1 Normal-density concrete shall be manufactured and delivered by a manufacturer whose plant holds a compliance certificate issued by the BNQ in accordance with certification protocol BNQ 2621-905.

6.83.8.1.1.2.2 In the case where the concrete is manufactured using a mobile concrete mixer, a calibration certificate less than one (1) year old for each mobile concrete mixer and for each mix to be manufactured shall be submitted to the Engineer in addition to a copy of the compliance certificate issued by the BNQ.

6.83.8.1.1.2.3 The calibration certificate shall be signed by an engineer who is a member of the *Ordre des ingénieurs du Québec (OIQ)*, reporting to the person in charge of the manufacturer's quality control. In case of changes in the sources of supply or in the properties of the cement concrete materials, a new calibration certificate shall be produced.

6.83.8.1.1.2.4 The calibration certificates of the water meters and outlet openings shall be available to control and determine the quantities of ingredients used. These devices shall allow for the production of the concrete according to the quantities provided on the technical data sheet of the mix.

6.83.8.1.1.3 Delivery control of concrete

6.83.8.1.1.3.1 The **Contractor** shall establish the concrete mix proportions according to indications on the drawings and produce the rheological properties suitable to the placement mode and maintaining of the physical properties of the concrete.

6.83.8.1.1.3.2 The **Contractor** shall retain the services of a laboratory member of the *Association des firmes de génie-conseil - Québec (AFG)* of its choice, to conduct tests on the plastic concrete (temperature, slump, air content, moulding, storage on worksite and transportation of test specimens to the laboratory designated by the **Contractor**) as indicated on the drawings and to the satisfaction of the Engineer.

6.83.8.1.1.3.3 Sampling method of cement concrete in the plastic state

6.83.8.1.1.3.3.1 The sampling method shall comply with standard CAN/CSA-A23.2-1C.

6.83.8.1.1.3.4 Air content, temperature and slump of plastic concrete

6.83.8.1.1.3.4.1 The method for determining the air content of the concrete shall comply with standard CAN/CSA-A23.2-4C, supplemented by the manufacturer's recommendations for calibration and method of use of the equipment.

6.83.8.1.1.3.4.2 The method for determining the slump of plastic concrete shall comply with standard CAN/CSA-A23.2-5C.

6.83.8.1.1.3.4.3 The temperature measurement of plastic concrete shall be performed according to standard CAN/CSA-A23.2-17C.

6.83.8.1.1.3.4.4 The **Contractor** shall, during the sampling and conduct of the control tests on fresh concrete, signal, on the spot, any comments on a method it deems incorrect.

6.83.8.1.1.3.4.5 The verification testing of air content, temperature and slump shall also be conducted during the preparation of the test specimens intended for testing the compressive strength.

6.83.8.1.1.3.4.6 During these tests on plastic concrete, the **Contractor** shall await the results before continuing unloading the truck.

6.83.8.1.1.3.4.7 Any load which does not meet the requirements for air content, slump or temperature will be refused and not paid.

6.83.8.1.1.3.5 Verification rate

6.83.8.1.1.3.5.1 For verification testing of the slump, air content and temperature of plastic concrete, the first two (2) loads shall be verified and, if the concrete meets the requirements, a verification shall be carried out every three (3) loads, or according to a rhythm determined by the Engineer at a worksite meeting prior to concreting, without ever exceeding 75 m^3. If one (1) load proves to be non-compliant, the next load shall be verified and so on until there are two (2) consecutive loads that comply.

6.83.8.1.1.3.6 Concrete strength

6.83.8.1.1.3.6.1 Sampling rate

6.83.8.1.1.3.6.1.1 The samples for testing the compressive strength shall be collected randomly on the basis of the quantities used on worksite, or on the basis of the batch formation decided at a worksite meeting prior to concreting work.

6.83.8.1.1.3.6.1.2 When the concrete plant is dedicated to the exclusive use of the worksite, the concrete intended for the slab and placed by means of the slipform paver shall be sampled every 225 m^3 and at least once a day. In this case, a batch represents 900 m^3 or less of this cement concrete.

6.83.8.1.1.3.6.1.3 All other types of concrete from a plant, whether or not dedicated to the exclusive use of the worksite, shall be sampled at the rate of one (1) sample per 75 m^3 of concrete. A batch represents 450 m^3 or less of the same type of concrete supplied during a period of thirty (30) days.

6.83.8.1.1.3.6.1.4 A test specimen intended for testing the flexural strength shall be prepared for each production day in order to validate the flexural strength value submitted at the time of acceptance of the mix.

6.83.8.1.1.3.6.1.5 In addition to the two (2) test specimens required according to standard BNQ 2621-905, a third test specimen is required for testing the compressive strength at seven (7) days.

6.83.8.1.1.3.6.2 Preparation of the test specimens for testing the compressive and the flexural strengths

6.83.8.1.1.3.6.2.1 Test specimens shall be prepared and cured according to standard CAN/CSA-A23.2-3C.

6.83.8.1.1.3.6.2.2 The molds used for collecting the concrete test specimens intended for testing the compressive strength shall be reusable and made of polyurethane-based plastic. The minimum wall thickness is 5 mm for the 150 mm × 300 mm molds and 3.4 mm for the 100 mm × 200 mm molds. The use of ABS plastic molds is prohibited.

6.83.8.1.1.3.6.2.3 The choice of dimension of the mold used to control the compressive strength shall be subject to prior agreement between the **Contractor** and the Engineer. However, the use of the 100 mm × 200 mm mold is prohibited when the maximum aggregate size is equal to or greater than 28 mm.

6.83.8.1.1.3.6.3 Verification of the compressive and flexural strengths

6.83.8.1.1.3.6.3.1 The compressive strength tests shall be conducted according to the requirements of standard CAN/CSA-A23.2-9C. The flexural strength tests shall be conducted according to standard CAN/CSA-A23.2-8C.

6.83.8.1.1.3.6.4 Evaluation of the cement concrete based on the compressive strength

6.83.8.1.1.3.6.4.1 The batches shall be formed by concrete type, cement type and by manufacturer. A cement type consists in a grouping for which the requirements relating to the concrete properties are identical. These requirements are set out in *tableau* 3101-1 of MTQ standard 3101.

6.83.8.1.1.3.6.4.2 The concrete shall be evaluated on the basis of the average strength at twenty-eight (28) days of the samples constituting the batch, according to the criteria to evaluate the compliance of the concrete strength.

6.83.8.1.1.3.7 Concrete pavement thickness

6.83.8.1.1.3.7.1 The Engineer shall check the concrete pavement thickness by means of the samples collected by core sampling.

6.83.8.1.1.3.7.2 Rate

6.83.8.1.1.3.7.2.1 The batch unit for acceptance of the concrete pavement thickness consists of 3,000 m². A concrete core sample is collected every 600 m², at a location determined randomly. Any remaining surface area of less than 3,000 m² is considered as a batch unit.

6.83.8.1.1.3.7.3 Sampling and testing methods

6.83.8.1.1.3.7.3.1 The concrete core samples shall be collected and measured according to standard ASTM C174M. The core sample diameter shall be 100 mm ± 5 mm. No core sample shall be collected within 500 mm of a joint.

6.83.8.1.1.3.7.4 Filling of the holes left by the core sampling

6.83.8.1.1.3.7.4.1 The **Contractor** shall fill the holes left by the core sampling within a maximum period of five (5) days after the core sampling. Prior to filling, the hole wall shall be cleaned and coated with a bonding agent. The hole shall be filled with fresh concrete so that the thickness, quality of the filling material and texture are the same as those of the neighboring slab.

6.83.8.1.1.4 Criteria to evaluate the compliance of the concrete compressive strength

6.83.8.1.1.4.1 Upper strength limit

6.83.8.1.1.4.1.1 To calculate the concrete strength of a batch unit, the concrete test specimens with strength greater than 150% of the required strength will be considered as having strength equal to 150% of the required strength.

6.83.8.1.1.4.2 Rejection of concrete

6.83.8.1.1.4.2.1 When the measurements indicate that the strength of a sample is lower than 76% of the required strength, the concrete represented by this sample will be deemed non-compliant and will not be paid. The portion of the structure constructed with that concrete is considered as defective and shall be redone according to the drawings and at the **Contractor**'s expense.

6.83.8.1.1.4.2.2 In the case where a certain quantity of concrete in a batch is rejected, the measured average strength and the tolerable average strength of the remaining batch shall be calculated excluding the samples representing the rejected concrete. The tolerable average strength is that set by the number of samples, as defined in Article 6.83.8.1.1.4.4 *Acceptance of a Batch*.

6.83.8.1.1.4.3 Concrete with compressive strength greater that the required strength

6.83.8.1.1.4.3.1 No premium will be paid to the **Contractor** for concrete which, per batch unit, has a compressive strength greater than that required.

6.83.8.1.1.4.4 Acceptance of a batch

6.83.8.1.1.4.4.1 A batch is accepted when the measured average strength is equal to or greater than the tolerable average strength (R_t) obtained using the following formula:

$$R_t = f'_c + (k \cdot d/100)$$

f'_c: required strength;
k: acceptance factor based on the number of batch samples;
d: dispersion index of batch samples established as follows:

$$d = \sqrt{\frac{\sum_{i=1}^{n}(R_i - R)^2}{n - 1}}$$

R_i: strength of each batch sample;
R: measured average strength of the batch;
n: number of batch samples.

The values of the acceptance factor (k) based on the number of batch samples (n) are shown in the following table:

Number of samples (n)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Acceptance factor (k)	-88	-9	10	19	26	31	34	38	41	43	45	47	49	50	52	53	54	55	56	57	58	59	60

6.83.8.1.1.4.5 Rejection of a batch

6.83.8.1.1.4.5.1 If the measured average strength (R) of a batch is lower than the critical strength, or 80% of the required strength (f'_c), the concrete is deemed non-compliant and is not be paid. The structure is considered as defective and shall be redone according to the drawings, at no additional cost to the **Owner**.

6.83.8.1.1.4.6 Variation between the results of two (2) test specimens

6.83.8.1.1.4.6.1 If the variation of a concrete sample made of two (2) test specimens is more than 5 MPa, the sample is deemed defective and its value is rejected.

6.83.8.1.1.5 Criteria to evaluate the compliance of the concrete pavement thickness

6.83.8.1.1.5.1 Upper thickness limit

6.83.8.1.1.5.1.1 For the purposes of calculating the average thickness (T) of the concrete slab of a batch unit, the core samples whose concrete has a thickness greater than the specified nominal thickness (T_s) by 40 mm or more are considered as having the specified nominal thickness (T_s), plus 40 mm.

6.83.8.1.1.5.2 Lower thickness limit

6.83.8.1.1.5.2.1 If the result of the measurement of one (1) core sample indicates that the concrete thickness is lower than the specified nominal thickness (T_s) by 15 mm or more, the **Contractor** shall randomly collect four (4) additional core samples in the 600 m² surface area represented by this core sample.

6.83.8.1.1.5.2.2 If the average thickness of the five (5) core samples collected in the 600 m² surface area is equal to or greater than the critical thickness (T_c), or T – 10 mm, this average value shall be used in the calculation of the average thickness (T) of the batch unit.

6.83.8.1.1.5.2.3 If the average thickness of the five (5) core samples collected in the 600 m² surface area is lower than the critical thickness (T_c), the quantity of concrete represented by that surface area shall be removed and replaced. In that case, the average thickness (T) of the batch unit shall be calculated excluding the samples representing the rejected concrete.

6.83.8.1.1.5.3 Acceptance of a batch

6.83.8.1.1.5.3.1 A batch unit of concrete slabs is accepted with respect to thickness when the average thickness (T) of the batch unit is equal to or greater than the tolerable average thickness (T_t) or T_s – 3 mm.

6.83.8.1.1.5.4 Rejection of a batch

6.83.8.1.1.5.4.1 If the average thickness (T) of a batch unit of concrete slabs is lower than the critical thickness (T_c), or T_s – 10 mm, the slab shall be removed and replaced by the **Contractor**'s expense, by a slab having the required thickness.

6.83.8.1.1.5.5 Contractor's appeal

6.83.8.1.1.5.5.1 If the average thickness (T) of the batch unit is lower than the tolerable average thickness (T_t), the **Contractor** may request that a laboratory member of AFG, randomly collects five (5) additional core samples according to the established procedure. This request for additional core sampling shall be submitted to the Engineer within a period of fourteen (14) days following the reception of the results by the **Contractor**.

6.83.8.1.1.5.5.2 The additional core sampling and testing shall be performed in the presence of the Engineer, and the additional core samples shall be returned to the Engineer when testing is complete.

6.83.8.1.1.5.5.3 For the purposes of acceptance or rejection of a batch or to calculate the revised unit price in the case of non-compliant concrete pavement thickness, the measured average thickness (T) of the batch unit shall be calculated based on the ten (10) core samples (5 initial core samples and five (5) additional ones), and the tolerable average thickness corresponds to the specified nominal thickness (T_s).

6.83.8.1.1.5.5.4 The cost of the additional core sampling and measurements shall be borne by the **Contractor**, unless the average (T) of the batch unit becomes greater than or equal to the tolerable average thickness ($T_t = T_s$) following the **Contractor**'s appeal.

6.83.8.1.1.5.6 Concrete slabs with a thickness greater than that specified

6.83.8.1.1.5.6.1 The **Contractor** is not entitled to extra payment for slabs which, per batch unit, have an average thickness greater than that stipulated.

6.83.8.1.2 Dowels

6.83.8.1.2.1 The **Contractor** shall provide shop drawings for the dowel baskets. These drawings shall indicate the details of the supports and materials, as well as the method of manufacturing and fixing to the ground.

6.83.8.1.2.2 Certificate of conformity

6.83.8.1.2.2.1 Steel

6.83.8.1.2.2.1.1 For each delivery of dowels, the **Contractor** shall provide the Engineer with a certificate of conformity containing the following information for each production batch:

6.83.8.1.2.2.1.1.1 the name of steel bar manufacturer;

6.83.8.1.2.2.1.1.2 the grade;

6.83.8.1.2.2.1.1.3 the size;

6.83.8.1.2.2.1.1.4 the CSA designation;

6.83.8.1.2.2.1.1.5 the chemical composition;

6.83.8.1.2.2.1.1.6 the yield strength;

6.83.8.1.2.2.1.1.7 the ultimate tensile strength;

6.83.8.1.2.2.1.1.8 the elongation at break;

6.83.8.1.2.2.1.1.9 the production batch number.

6.83.8.1.2.2.1.2 A production batch corresponds to one (1) cast of steel from the steel mill.

6.83.8.1.2.2.1.3 The production batch number shall be easily identifiable on the delivery order.

6.83.8.1.2.2.2 Anti-corrosion Coating

6.83.8.1.2.2.2.1 For each delivery of anti-corrosion coating, the **Contractor** shall provide the Engineer with a certificate of conformity issued by the coating applicator and containing the following information for each production batch:

6.83.8.1.2.2.2.1.1 the name of the coating applicator;

6.83.8.1.2.2.2.1.2 the mass and thickness of the coating;

6.83.8.1.2.2.2.1.3 the results of the tests defined in standard AASHTO T 253;

6.83.8.1.2.2.2.1.4 the production batch number.

6.83.8.1.2.2.2.2 A production batch consists of dowels that have undergone the same sequence of application, with the same material and at the same applicator.

6.83.8.1.2.3 Delivery control

6.83.8.1.2.3.1 A delivery control performed by the Engineer consists in the sample collecting of two (2) coated dowels per production batch.

6.83.8.1.3 Tie rods and reinforcing steel

6.83.8.1.3.1 Certificate of conformity

6.83.8.1.3.1.1 For each delivery, the **Contractor** shall provide the Engineer with a certificate of conformity for the steel in accordance with the drawings and subsection 6.31 *Reinforcing Steel for Concrete*.

6.83.8.1.3.2 Delivery control

6.83.8.1.3.2.1 A delivery control performed by the Engineer consists in the sample collecting of two (2) tie rods and two (2) 800 millimeters-long reinforcing bars per production batch.

6.83.8.1.3.3 Anchoring product for dowels and tie rods

6.83.8.1.3.3.1 At least Fourteen (14) days before the start of the work under this Contract, the **Contractor** shall submit to the Engineer, in writing, the trade name of the product it intends to use. At the request of the Engineer, the **Contractor** shall, for the purposes of verification of the quality of the product, submit a representative sample of the material.

6.83.8.1.4 Start-Stop Basket

6.83.8.1.4.1 Where the **Contractor** uses pre-assembled baskets of empty sleeves for inserting free dowels, also called “start-stop baskets”, the sleeves shall be made of steel. Any sleeves made of another material will be deemed unacceptable and shall not be used for this purpose. Moreover, when inserting free dowels, the sleeves shall have been previously injected with a cementitious or epoxy binder, in order to ensure that all voids and unevenness between each sleeve-dowel assembly is filled.

6.83.8.1.5 Curing material

6.83.8.1.5.1 Certificate of conformity

6.83.8.1.5.1.1 For each delivery of curing material, the **Contractor** shall provide the Engineer with a certificate of conformity containing the following information for each production batch:

6.83.8.1.5.1.1.1 the class of the product;

6.83.8.1.5.1.1.2 the production batch number;

6.83.8.1.5.1.1.3 the application rate (L/m²);

6.83.8.1.5.1.1.4 the water loss (kg/m²) at seventy-two (72) hours.

6.83.8.1.5.1.2 A production batch corresponds to a specific quantity of curing material with the same physico-chemical characteristics, manufactured according to the same recipe, from the same source of supply, during an uninterrupted period of production.

6.83.8.1.5.2 Delivery control

6.83.8.1.5.2.1 A delivery control performed by the Engineer consists in the sample collecting of 1 L of membrane-forming curing material per production batch, poured in an airtight container whose content has been previously homogenized.

6.83.8.2 SEALING OF JOINTS

6.83.8.2.1 Certificate of conformity of the sealant

6.83.8.2.1.1 For each delivery of sealant, the **Contractor** shall provide the Engineer with a certificate of conformity containing the following information for each production batch:

6.83.8.2.1.1.1 the identification of the manufacturer;

6.83.8.2.1.1.2 the product trade name;

6.83.8.2.1.1.3 the date of manufacture;

6.83.8.2.1.1.4 the production batch number;

6.83.8.2.1.1.5 the minimum placement temperature.

6.83.8.2.1.2 For hot-applied sealant, the **Contractor** shall also provide the Engineer with the following:

6.83.8.2.1.2.1 the test results, namely: penetration, resilience and flow at ambient temperature conducted according to standard ASTM D5329;

6.83.8.2.1.2.2 the maximum heating temperature.

6.83.8.2.1.3 A production batch of sealant corresponds to a specific quantity of sealant with the same physico-chemical characteristics, manufactured according to the same process, from the same ingredients and same source of supply, during an uninterrupted period of production.

6.83.8.2.2 Certificate of conformity of the backer rod

6.83.8.2.2.1 For each delivery of backer rods, the **Contractor** shall provide the Engineer with a certificate of conformity containing the following information for each production batch:

6.83.8.2.2.1.1 the identification of the manufacturer;

6.83.8.2.2.1.2 the product trade name;

6.83.8.2.2.1.3 the date of manufacture;

6.83.8.2.2.1.4 the production batch number;

6.83.8.2.2.1.5 the results of the tests conducted according to standard ASTM D5249.

6.83.8.2.2.2 A production batch of backer rods corresponds to 5,000 m of product.

6.83.8.2.3 Evaluation of the hot-applied sealant product before the start of work

6.83.8.2.3.1 Before the hot sealing of joints begins, the **Contractor** shall submit to the Engineer a 10 kg sample of unheated sealant, collected in a box randomly selected and representative of the batch of sealant to be used, at the rate of one (1) sample per batch.

6.83.8.2.3.2 The **Contractor** shall provide for a period of fourteen (14) days from the date of the reception of the sample by the Engineer for the conduct of the evaluation tests if the sealant has already been evaluated for another project of the **Owner** during the current calendar year and found to comply with *tableau* 4401-1 of MTQ standard 4401. For a sealant that has not been evaluated or has not been found to comply with *tableau* 4401-1 of MTQ standard 4401 during the current calendar year, the **Contractor** shall provide for a period of twenty-one (21) days for the conduct of all evaluation tests specified in *tableau* 4401-1 of MTQ standard 4401 on the sample submitted.

6.83.8.2.3.3 When the results of the evaluation tests for a batch of sealant comply with *tableau* 4401-1 of MTQ standard 4401, this batch of sealant may be used. Otherwise, the batch shall be rejected and may not be used, and the evaluation process shall be resumed on another batch. If two (2) consecutive batches are found to be non-compliant, the evaluation process shall be resumed on a third batch and so on until the results of the evaluation tests of the last batch evaluated meets the requirements. All evaluation tests beyond those conducted on the two (2) first batches shall be borne by the **Contractor**, at no additional cost to the **Owner**.

6.83.8.2.4 Delivery control of the hot-applied sealant after heating

6.83.8.2.4.1 The quality of the sealant after heating shall be evaluated every workday from a sample consisting of four (4) specimens collected by the Engineer during the workday. The sealant shall be collected at the outlet of the injection nozzle and poured into 177 ml laboratory containers filled to 75% capacity. Two (2) containers shall be used for the first control tests (penetration and resilience), another for a resumption (penetration or resilience) and the last one is kept in the laboratory in case the results are challenged by the **Contractor**.

6.83.8.2.4.2 If each test result complies with *tableau* 4401-2 of MTQ standard 4401, the product is accepted. If a test result does not comply with *tableau* 4401-2 of MTQ standard 4401, a new penetration or resilience test shall be conducted on another container. If the new result meets the requirements, the product is accepted. If one of the results does not comply with *tableau* 4401-2 of MTQ standard 4401, the product shall be rejected, as well as the portion of the work corresponding to the workday sampling.

6.83.8.2.4.3 The **Contractor** has five (5) days after the reception of the test results conducted by the laboratory designated by the Engineer to challenge them and request the resumption of the test on the last container. The retesting is performed in the presence of both parties, at the laboratory designated by the Engineer or in a laboratory member of AFG, selected by the **Contractor** and accepted by the Engineer, and whose scope of accreditation relates to the testing of hot-applied sealant. The cost of these tests shall be borne by the **Owner** if the results comply with *tableau* 4401-2 of MTQ standard 4401, and by the **Contractor** when they are non-compliant. If all results comply with *tableau* 4401-2 of MTQ standard 4401, the product is accepted. If one of the results is non-compliant, the product shall be rejected, as well as the portion of the work corresponding to the workday sampling.

6.83.8.2.4.4 When the product is deemed non-compliant, as well as the portion of the work corresponding to the workday sampling, the Engineer requests the resumption of the portion of the work concerned at the expense of the **Contractor**. The **Contractor** shall then submit to the Engineer a proposal to describe the method it intends to follow to resume the work. The new control tests shall also be conducted at the expense of the **Contractor**.

6.83.8.3 REPAIR OF THE CONCRETE PAVEMENT

6.83.8.3.1.1 The quality assurance of the materials shall be performed according to the requirements for the construction of the concrete pavement, except for requirements relating to the testing of the flexural strength, pavement thickness and surface roughness.

END OF SUBSECTION