TENDER DOCUMENTS

SUBSECTION 6.64

DECK WATERPROOFING MEMBRANE

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SUBSECTION 6.64 DECK WATERPROOFING MEMBRANE

6.64.1 GENERAL

6.64.1.1 This subsection sets out the requirements related to the placement of bridge deck waterproofing seals under this Contract.

6.64.1.2 Any specific requirements related to the placement of bridge deck waterproofing seals under this Contract are set out in Section 4 *Special Technical Conditions*.

6.64.1.3 The requirements related to paving work are set out in subsection 6.82 *Hot-mix Paving*.

6.64.2 REFERENCE STANDARDS

6.64.2.1 The **Contractor** shall perform all work related to the placement of waterproofing membrane in accordance with the requirements of the following standards and documents to which the provisions of the Contract are added:

6.64.2.2 (CGSB) Canadian General Standards Board

- CAN/CGSB 37.50-M *Hot-Applied Rubberized Asphalt for Roofing and Waterproofing;*
- CGSB 37-GP-9MA *Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.*

6.64.2.3 (ASTM) ASTM International

- ASTM D6506-01 *Standard Specification for Asphalt Based Protection for Below-Grade Waterproofing*.

6.64.2.4 (MTQ) Ministère des transports du Québec

- MTQ – *Cahier des charges et devis généraux* (CCDG);
- MTQ – *Normes – Ouvrages routiers* – Tome VII *Matériaux*, Chapitre 3. *Bétons de ciment et produits connexes,* Norme 3701 *Membrane d'étanchéité*.

6.64.3 MATERIALS

6.64.3.1 RUBBERIZED ASPHALT MEMBRANE

6.64.3.1.1 Primer

6.64.3.1.1.1 The primer applied to the concrete deck shall be a modified polymer bituminous emulsion with a minimum 6% SBS (styrene-butadiene-styrene) by volume in accordance with standard CGSB 37-GP-9MA.

6.64.3.1.2 Rubberized asphalt

6.64.3.1.2.1 The rubberized asphalt waterproofing membrane shall be made with hot-applied rubberized asphalt delivered to the site in blocks ready to be melted and spread, in original containers labelled and sealed by the manufacturer.

6.64.3.1.2.2 Subject to the requirements set out in this subsection, the composition, general properties, preparation, delivery, sampling and testing of the waterproofing membrane shall conform to standard CAN/CGSB 37.50-M. Test results on the rubberized asphalt shall be within the values shown in the following table:

Test	**Value**
Cone penetration at 25°C	110 mm maximum
Cone penetration at 50°C	200 mm maximum
Flow at 60°C	3 mm maximum
Low-temperature flexibility at -25°C	Pass (see 6.64.3.1.2.3)
Low-temperature flexibility after curing in an air proofer at -25°C	Pass (see 6.64.3.1.2.3)
Hardness	5.5 J minimum
Hardness to peak load ratio	0.040 minimum

6.64.3.1.2.3 The word “Pass” means that the membrane shows no signs of delamination, loss of adhesion or cracking after undergoing the test.

6.64.3.1.3 Reinforcement

6.64.3.1.3.1 The membrane interlayer reinforcement shall be performed using a sheet of Reemay 2014 bound non-woven polyester as manufactured by Les Membranes Hydrotech Corp. or equivalent product approved by the Engineer.

6.64.3.1.4 Asphalt protective panels

6.64.3.1.4.1 Asphalt protective panels shall be 3 mm thick and shall meet the requirements for Type 2, Class B panels set out in standard ASTM D6506.

6.64.3.1.4.2 Asphalt protective panels shall be prefabricated panels comprising a mineral-filled high-melt-point asphalt core between non-woven glass fibre mats as manufactured by Bakor or a better product approved by the Engineer.

6.64.3.2 PREFABRICATED MEMBRANE

6.64.3.2.1 General

6.64.3.2.1.1 Prefabricated membrane shall have a tack coat and a prefabricated sheet that fuses to the concrete surface.

6.64.3.2.1.2 The materials of which the prefabricated membrane is made shall conform to MTQ standard 3701.

6.64.3.2.2 Tack coat

6.64.3.2.2.1 The tack coat shall comprise an asphalt-based coating modified by an SBS polymer with a minimum content of 8% by volume.

6.64.3.2.3 Prefabricated sheet

6.64.3.2.3.1 The prefabricated sheet shall comprise :

6.64.3.2.3.1.1 a non-woven polyester core;

6.64.3.2.3.1.2 an SBS elastomer asphalt coating on each side of the synthetic core;

6.64.3.2.3.1.3 a top protective layer made of grey mineral chips applied at a maximum rate of 1.2 kg/m^2 and embedded in the asphalt.

6.64.3.2.3.2 The minimum thickness of prefabricated sheets shall be 4.5 mm when measured in a full sheet.

6.64.3.2.4 Flashings

6.64.3.2.4.1 Flashings shall be made of plastic cement with an SBS polymer asphalt base.

6.64.3.2.4.2 Flashings shall be triangular with a minimum height of 15 mm and a minimum width of 50 mm.

6.64.4 EQUIPMENT AND TOOLS

6.64.4.1 RUBBERIZED ASPHALT KETTLE

6.64.4.1.1 The kettle used to melt the rubberized asphalt shall be an indirect-heat, double-wall, double-boiler-type kettle that uses oil with a high flash point as a heat transfer medium.

6.64.4.1.2 The kettle shall be equipped with a continuous mechanical agitator to prevent hot spots in the material.

6.64.4.1.3 Dial thermometers shall be permanently mounted on the kettle to measure the temperature of the melted material and the oil.

6.64.4.1.4 The kettle shall not contain any material when it arrives at the site.

6.64.4.2 OTHER EQUIPMENT FOR RUBBERIZED ASPHALT

6.64.4.2.1 The temperature of the asphalt shall be checked using a calibrated infrared thermometer with an accuracy of +/-2°C.

6.64.4.2.2 The rubberized asphalt shall be stretched using a hand scraper with a heat-resistant reinforced rubber blade between 450 mm and 900 mm long.

6.64.4.3 TAPE ROLLER

6.64.4.3.1 The maximum width of the tape roller shall be 300 mm, and the maximum weight shall be 20 kg.

6.64.5 INSPECTION AND STORAGE

6.64.5.1 Rubberized asphalt shall be delivered to the site in factory-sealed containers from the manufacturer.

6.64.5.2 Rolls of prefabricated membrane shall be stored upright and protected from the elements.

6.64.6 EXECUTION OF WORK

6.64.6.1 PLANNING

6.64.6.1.1 At least fourteen (14) days prior to ordering any materials or placing any components, the **Contractor** shall submit to the Engineer for review shop drawings, technical data sheets and samples for each material to be used for waterproofing membrane work under the Contract.

6.64.6.1.2 The **Contractor** may not make any changes to the materials or construction details indicated on the technical sheets or the shop drawings reviewed by the Engineer without first obtaining written authorization from the Engineer.

6.64.6.1.3 The **Contractor** shall give the Engineer at least twenty-four (24) hours' notice of the date and time of placement. The **Contractor** shall plan to perform the work at a time when no rain is forecasted during the work period.

6.64.6.1.4 The **Contractor** shall plan the work in such a way that no vehicle goes over the waterproofing membrane.

6.64.6.2 SURFACE PREPARATION

6.64.6.2.1 The concrete surfaces of the deck on which a waterproofing membrane is to be placed shall be prepared by abrasive blasting or a similar method in order to obtain clean concrete free of laitance, rust, crusting and asphalt residue.

6.64.6.2.2 Any curing products used for cast-in-place concrete shall be completely removed using abrasive blasting.

6.64.6.2.3 Once abrasive blasting is completed, the **Contractor** shall carefully check the deck for surface flaws. Pits and bumps larger than 4 mm shall be considered flaws.

6.64.6.2.4 Flaws in concrete surfaces shall be repaired before the waterproofing membrane is placed. Pits shall be filled with mortar. The mortar shall be fully cured before placement of the membrane begins. Ripples shall be ground until they are level with the surface of the deck.

6.64.6.2.5 Unless otherwise indicated in the *Special Technical Conditions* or by the Engineer, all placed concrete, including the vertical edges of concrete barriers, curbs, sidewalks and deck joint shoulders, shall have cured for at least twenty-eight (28) days and shall be dry and clean.

6.64.6.2.6 The concrete shall be cleared of dust and debris and the dust and debris shall be removed before the tack coat is applied.

6.64.6.2.7 The concrete surface shall be cleaned immediately prior to application of the tack coat using oil-free compressed air in order to eliminate any dust or foreign bodies.

6.64.6.2.8 Application of the tack coat may not start until at least twenty-four (24) hours with no rain, the twenty-four (24) hours period beginning after all material and water have been removed from the slab.

6.64.6.2.9 A representative of the supplier of the membrane shall inspect the surface of the slab and confirm in writing that it meets the manufacturer's requirements before the **Contractor** can beginning applying the primer. The dampness of the deck slab shall be checked to ensure that is within the maximum limits prescribed in the *Special Technical Conditions*.

6.64.6.3 PLACEMENT OF RUBBERIZED ASPHALT MEMBRANE

6.64.6.3.1 Application of tack coat

6.64.6.3.1.1 The tack coat shall be applied using equipment that ensures an even coat at the prescribed rate of application.

6.64.6.3.1.2 The residual application rate shall be 0.20 l/m^2.

6.64.6.3.1.3 None of the equipment used to place the waterproofing membrane shall be left on the tack coat until the tack coat is fully cured.

6.64.6.3.2 Placement of rubberized asphalt

6.64.6.3.2.1 The membrane shall not be placed until the tack coat is fully cured and any dust or moisture is removed from the surface of the tack coat.

6.64.6.3.2.2 The **Contractor** shall heat the rubberized asphalt on site in a kettle as described in article 6.64.4.1 *Rubberized asphalt kettle*. The **Contractor** shall respect the minimum and maximum temperatures recommended by the manufacturer.

6.64.6.3.2.3 The **Contractor** shall check the temperature of the rubberized asphalt in the kettle every fifteen (15) minutes using an infrared thermometer and shall take the necessary measures to ensure that the temperature of the asphalt does not exceed the maximum temperature recommended by the manufacturer.

6.64.6.3.2.4 The rubberized asphalt shall be continuously agitated in the kettle until it is applied. The minimum heating time is thirty (30) minutes; the maximum heating time is five (5) hours.

6.64.6.3.2.5 The rubberized asphalt shall be spread in two (2) layers using a hand scraper.

6.64.6.3.2.6 Each layer of the membrane shall comprise an even film of rubberized asphalt between 1.5 mm and 2.5 mm thick.

6.64.6.3.2.7 Application shall be continuous; however, if it is impossible to avoid breaks, there shall be at least 150 mm of overlap.

6.64.6.3.2.8 The membrane shall be run up against drains, concrete barriers, curbs, sidewalks and deck joint shoulders to the height of the asphalt concrete pavement.

6.64.6.3.2.9 The total thickness of the two layers of the waterproofing membrane shall be between 3.0 mm and 5.0 mm.

6.64.6.3.3 Placement of reinforcing sheets

6.64.6.3.3.1 The interlayer reinforcement sheets of the membrane shall be placed directly on top of the first layer of the waterproofing membrane and embedded in that layer while it is still tacky.

6.64.6.3.3.2 The interlayer reinforcement sheets shall be run up against barriers, curbs, sidewalks and deck joint shoulders to the height of the asphalt concrete pavement.

6.64.6.3.3.3 The interlayer reinforcement sheets shall be placed side by side or end to end with an allowable spacing tolerance of +/-5 mm between edges and shall then be covered with a second layer of rubberized asphalt.

6.64.6.3.4 Placement of asphalt protective panels

6.64.6.3.4.1 The asphalt protective panels shall be placed directly on the second layer of rubberized asphalt and embedded in that layer while it is still tacky. The **Contractor** shall take such measures as are needed to ensure that no air bubbles are trapped under the asphalt protective panels.

6.64.6.3.4.2 The asphalt protective panels of the membrane shall be placed in such a manner that the joints are staggered by at least 150 mm and overlap is limited to between 10 mm and 25 mm.

6.64.6.4 PLACEMENT OF PREFABRICATED MEMBRANE

6.64.6.4.1 Placement of tack coat

6.64.6.4.1.1 The first tack coat shall be applied using equipment that will ensure an even coat of the binding agent at a rate of application of 0.15 l/m^2 and as specified by the prefabricated membrane manufacturer.

6.64.6.4.1.2 The **Contractor** shall use tarps or other appropriate equipment to protect sidewalks, curbs, barriers, guardrails, drains and deck joints from splatters. A roller shall be used to apply the tack coat to all areas located within a distance inferior to 600 mm of those components. Any soiled surfaces shall be cleaned by the **Contractor** to the Engineer's satisfaction.

6.64.6.4.2 Placement of prefabricated membrane

6.64.6.4.2.1 The prefabricated membrane shall be placed at least twelve (12) hours but not more than twenty-four (24) hours after the tack coat has been applied.

6.64.6.4.2.2 The membrane shall be placed using mechanical equipment or a propane torch as described or required in the *Special Technical Conditions*.

6.64.6.4.2.3 The welding parameters shall be adjusted to accommodate the profile of the surfaces to be covered and the weather conditions in order to obtain a melted asphalt net at least 20 mm wide in front of the membrane roll and an overlap of asphalt along the joints.

6.64.6.4.2.4 The membrane shall be placed from the low spots of the surfaces to be covered to the high point of the cross profile. The cross joints shall be staggered so as to ensure that there are no more than three thicknesses of membrane at any point. Preferably, the strips should be unrolled in the direction of traffic.

6.64.6.4.2.5 The width of the overlaps shall be 75 mm for lengthwise joints and 150 mm for sideways joints. The granular surface shall be removed from membrane over a width of 150 mm in order to make the sideways joints.

6.64.6.4.2.6 The maximum distance between the membrane and such components as curbs, sidewalks, barriers, drains and deck joint shoulders shall be 15 mm.

6.64.6.4.2.7 After the membrane is placed, a flashing shall be installed along curbs, sidewalks, barriers and deck joint shoulders, taking care not to block drainage holes near the deck drains.

6.64.6.4.2.8 The minimum temperature of the plastic cement of the flashing at the time of placement shall be 20°C.

6.64.6.4.2.9 Flashings shall be triangular with a minimum height of 15 mm and a minimum width of 50 mm.

6.64.7 QUALITY CONTROL

6.64.7.1 THICKNESS OF RUBBERIZED ASPHALT MEMBRANE

6.64.7.1.1 The deck to be covered with a rubberized asphalt membrane shall be divided into multiple lots. Each lot shall not exceed a surface area of 300 m^2 and the membrane thickness shall be checked on each lot.

6.64.7.1.2 Each lot shall be subdivided into ten (10) equal parcels.

6.64.7.1.3 On each parcel, three (3) membrane thickness measurements shall be taken for test purposes: one at each corner of an imaginary triangle centred around a randomly selected test site.

6.64.7.1.4 The test sites will be determined by the Engineer in the presence of the **Contractor**, who shall then accept them.

6.64.7.1.5 The imaginary triangle shall measure approximately 100 mm on each side. The average of the three measurements taken on each parcel of a lot shall be calculated and rounded to the nearest millimetre and recorded as the test result.

6.64.7.1.6 The average and the standard deviation for the ten (10) test results obtained for each lot shall be calculated.

6.64.7.1.7 The thickness of the membrane shall then be assessed as follows :

6.64.7.1.7.1 Scenario 1 – Average membrane thickness for lot is less than 3.0 mm

6.64.7.1.7.1.1 If the average for a lot is less than 3.0 mm, the entire lot will be rejected and the entire lot shall be corrected as prescribed in article 6.64.7.1.8 *Correction of unacceptable lots* below.

6.64.7.1.7.2 Scenario 2 - Average membrane thickness for lot is between 3.0 mm and 5.0 mm

6.64.7.1.7.2.1 If the average for a lot is between 3.0 mm and 5.0 mm, the average and standard deviation shall be rounded to the nearest 0.1 mm and 0.05 mm respectively. The lot will be accepted or rejected after comparison with the data in the table in Appendix 6.64-I *Decision-making grid for acceptance by lot of rubberized asphalt membrane*.

6.64.7.1.7.3 Scenario 3 – Average membrane thickness for lot is more than 5.0 mm

6.64.7.1.7.3.1 If the average for a lot is more than 5.0 mm, the entire lot will be rejected, regardless of the standard deviation, and the entire lot shall be corrected as prescribed in article 6.64.7.1.8 *Correction of unacceptable lots*.

6.64.7.1.8 Correction of unacceptable lots

6.64.7.1.8.1 The **Contractor** shall propose a repair method and shall make all the necessary corrections to the satisfaction of the Engineer. Once the corrections are made, the entire lot shall be retested.

6.64.7.2 PREFABRICATED MEMBRANE

6.64.7.2.1 Once it has been placed, the prefabricated membrane shall be inspected visually by the Engineer to ensure that it adheres fully to the entire surface of the slab.

6.64.7.2.2 The **Contractor** shall correct any flaws identified by the Engineer. Air pockets and wrinkles shall be dug out and covered with a piece of membrane extending at least 100 mm beyond the perimeter of the area to be repaired. Poorly welded joints in the membrane shall be welded again.

6.64.8 WARRANTY

6.64.8.1 Notwithstanding, the provisions of Section 8 *General Conditions* of the Contract, the **Contractor** shall, in addition to the warranty referred to in clause GC32 *Warranty and Rectification of Defects in Work*, provide the **Owner** with a written warranty certifying that the membrane will remain waterproof for a minimum of five (5) years from the date the Interim Certificate of Completion is issued.

END OF SUBSECTION

APPENDIX 6.64-I

DECISION-MAKING GRID FOR ACCEPTANCE BY LOT OF RUBBERIZED ASPHALT MEMBRANE

DECISION-MAKING GRID FOR ACCEPTANCE BY LOT
OF RUBBERIZED ASPHALT MEMBRANE

AVERAGE FOR LOT

STANDARD DEVIATION FOR LOT

	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	
0.00																						0.00
0.05																						0.05
0.10																						0.10
0.15																						0.15
0.20																						0.20
0.25																						0.25
0.30																						0.30
0.35											ACCEPTABLE											0.35
0.40																						0.40
0.45																						0.45
0.50																						0.50
0.55	X																					0.55
0.60		X																				0.60
0.65			X																			0.65
0.70				X																		0.70
0.75					X																	0.75
0.80						X																0.80
0.85																						0.85
0.90							X															0.90
0.95								X														0.95
1.00									X													1.00
1.05										X												1.05
1.10											X											1.10
1.15												X										1.15
1.20													X									1.20
1.25														X								1.25
1.30															X							1.30
1.35																X						1.35
1.40																	X					1.40
1.45																		X				1.45
1.50																						1.50
1.55																			X			1.55
1.60					UNACCEPTABLE															X		1.60
1.65																					X	1.65
1.70																						1.70
1.75																						1.75
1.80																						1.80
1.85																						1.85
1.90																						1.90
1.95																						1.95
2.00																						2.00

Lots for which the results fall in the “unacceptable” range of the table shall be corrected in accordance with article 6.64.7.1.8 *Correction of Unacceptable Lots*. Lots for which the results fall in a box marked with an “X” in the table will be deemed unacceptable.