



**CONSTRUCTION SPECIFICATION FOR  
WATERPROOFING BRIDGE DECKS  
WITH HOT APPLIED ASPHALT MEMBRANE**

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**914.01 SCOPE**

This specification covers the requirements for waterproofing of new and existing concrete bridge decks with hot applied asphalt membrane.

**914.01.01 Specification Significance and Use**

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

## **914.01.02 Appendices Significance and Use**

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

## **914.02 REFERENCES**

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

### **Ontario Provincial Standards Specifications, Material**

OPSS 1212	Hot-Poured Rubberized Asphalt Joint Sealing Compound
OPSS 1213	Hot Applied Rubberized Asphalt Waterproofing Membrane
OPSS 1215	Protection Board

### **Ontario Ministry of Transportation Publications**

MTO Field Guide, for the Acceptance of Hot Mix and Bridge Deck Waterproofing

### **Canadian General Standards Board (CGSB)**

37-GP-9MA (1983)	Primer, Asphalt, Unfilled for Asphalt Roofing, Damproofing and Waterproofing
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### **ASTM International**

D 4285-83 (2012)	Test Method for Indicating Oil or Water in Compressed Air
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## **914.03 DEFINITIONS**

For the purpose of this specification, the following definitions apply:

**Deck** means the upper concrete surface of a structure to which waterproofing membrane shall be applied.

**Protection Board** means a durable panel specifically designed to provide an interface protection barrier between the asphalt and the waterproofing membrane.

**Random Location** means a location determined by the Contract Administrator based on random numbers or, if protection boards are used, it means the exposed corner of a protection board closest to that location.

**914.05 MATERIALS**

**914.05.01 Waterproofing Membrane**

The waterproofing membrane shall be hot applied rubberized asphalt according to OPSS 1213 and shall be supplied to the job site in cakes in the manufacturer's sealed and labelled containers ready for melting and application.

**914.05.02 Waterproofing Membrane Reinforcement**

Waterproofing membrane reinforcement shall be spun bonded sheet structure composed of 100% continuous filament polyester fibres bonded together at their crossover points and shall be acceptable to the Owner. The membrane shall be supplied in minimum widths of 450 mm. The material shall be unaffected by the heat generated by the waterproofing membrane and the hot mix.

**914.05.03 Hot-Poured Rubberized Asphalt Joint Sealing Compound**

The hot-poured rubberized asphalt joint sealing compound shall be according to OPSS 1212.

**914.05.04 Protection Board**

Protection board shall be according to OPSS 1215.

**914.05.05 Tack Coat**

The tack coat used in conjunction with the waterproofing membrane shall be primer cut back with a product recommended by the tack coat manufacturer. The primer shall be according to CGSB-37-GP-9MA

**914.06 EQUIPMENT**

**914.06.01 Heating and Mixing Kettle for Waterproofing Membrane and Hot-Poured Rubberized Asphalt Joint Sealing Compound**

Heating and mixing kettles shall be used for the waterproofing membrane and the hot-poured rubberized asphalt joint sealing compound.

The kettles shall be of the double boiler oil heat transfer type with a built-in agitator and equipped with 2 functional permanently installed dial type thermometers with an accuracy of  $\pm 2$  °C to measure the temperature of the melted compound and the oil. Heating shall be controlled by a thermostat to maintain the temperature of the product used within the range required by the manufacturer.

**914.06.02 Thermometer**

A separate calibrated thermometer with an accuracy of  $\pm 2$  °C for verification of the material temperature shall be available on the job site.

**914.06.03 Air Compressor**

The compressor shall provide oil and water free compressed air. The compressed air shall be tested according to ASTM D 4285.

**914.07 CONSTRUCTION**

**914.07.01 General**

**914.07.01.01 Bridge Deck Waterproofing**

Bridge deck waterproofing shall consist of:

- a) Deck surface preparation.
- b) Application of the tack coat.
- c) Application of the waterproofing membrane.
- d) Application of the waterproofing membrane reinforcement.
- e) Application of the protection board.
- f) Forming and filling of grooves where there are no separate tender items for this work.
- g) If applicable, repair of rejectable or marginal lots.

**914.07.01.02 Traffic Restrictions**

After abrasive blast cleaning operations have commenced, traffic shall not be allowed on the abrasive blast cleaned area until after the hot mix binder course has been placed and cooled to ambient temperature.

The traffic restrictions apply to all traffic other than the construction equipment directly associated with the waterproofing operations and the paving operations that follow.

**914.07.01.03 Procedure**

Waterproofing operations shall only be carried out when the air and concrete surface temperature are 5 °C or higher.

Waterproofing membrane reinforcement and protection board shall be stored at the manufacturer's recommended temperature range.

The waterproofing operations shall be performed sequentially with no delay between operations other than delays that may be required by this specification.

Drainage holes through the deck shall not be plugged or covered by either waterproofing membrane or protection boards.

**914.07.01.04 Notice of Commencement of Waterproofing Operations**

At least 48 hours prior to the commencement of any waterproofing operations, the Contract Administrator shall be informed, in writing, of the date and time the Contractor intends to commence the work.

Waterproofing shall not commence until permission is given by the Contract Administrator.

**914.07.01.05 Existing Asphalt Covered Decks**

When an asphalt riding surface is to be stripped from the existing concrete structure deck, at least 7 Days prior to the commencement of the asphalt stripping operation, the Contract Administrator shall be informed, in writing, of the date and time the Contractor intends to commence the work.

**914.07.01.06 Applicators**

Waterproofing membrane applicators shall be from the Owner's list of applicators approved by the waterproofing membrane manufacturer.

**914.07.02 Deck Surface Preparation**

**914.07.02.01 Treatment of Grout Tubes on Deck Surfaces**

The grout tubes shall be cut flush with the deck surface prior to sand blasting and shall be recut flush with the concrete surface if sandblasting results in the tube projecting from above the concrete. A 450 x 450 mm piece of membrane reinforcement, centred on the tube, shall be installed as specified herein.

**914.07.02.02 New Concrete Bridge Decks and Concrete Deck Overlays**

The surface of the concrete shall be completely treated by abrasive blast cleaning to expose sound, laitance-free concrete. Curing compound used on the concrete surface shall be completely removed. All dirt and debris shall be removed from the bridge deck. Immediately prior to the application of the tack coat, the concrete surface shall be cleaned with a jet of oil-free compressed air to remove all dust and other foreign material.

**914.07.02.03 Existing Deck Surface Preparation**

All areas of the concrete deck that have a textured surface, not including sawcut grooves, shall be bush hammered, ground down, or scabbled to reduce the depth of texture to 2 mm or less prior to the abrasive blast cleaning operation for waterproofing.

Prior to waterproofing, all existing waterproofing material shall be removed and all concrete surfaces prepared according to the New Concrete Bridge Decks and Concrete Deck Overlays clause.

**914.07.02.04 Modification of Deck Joint Assemblies of Existing Bridge Decks**

Modifications to the expansion joint assemblies involving welding or other means of attachment to existing armouring shall be carried out prior to waterproofing.

**914.07.02.05 Modification of Deck Drains**

Modification of deck drains shall be as specified in the Contract Documents. The modifications shall be made prior to waterproofing the deck.

### **914.07.03 Tack Coating**

A tack coat shall be applied wherever waterproofing membrane is to be applied. The tack coat shall terminate in the chase or, where there is no chase, be extended up the face of the curbs, barrier walls, expansion joints, and deck drains to the level of the top of the proposed hot mix base course. The tack coat material shall be uniformly applied at a rate of 0.25 l/m<sup>2</sup> or as required by the manufacturer using equipment approved by the manufacturer of the tack coat material. The tack coat shall be applied when the concrete is surface dry and clean. Waterproofing equipment shall not be permitted upon the tack coat until it has fully cured.

Drying of the concrete surface shall not be expedited by use of a torch or any other means.

### **914.07.04 Application of Waterproofing Membrane**

Cakes of asphalt waterproofing membrane shall be melted on the job site and shall be continuously agitated in the mechanically agitated heating and mixing kettle. The contents shall be continuously agitated until the material can be drawn free flowing and lump free from the mixing kettle at a temperature within the range recommended by the manufacturer.

Areas of the deck with sawcut grooves shall be filled with a scratch coat of waterproofing after the tack coat has cured. The waterproofing membrane shall be applied immediately after application of the scratch coat.

Waterproofing membrane shall not be applied until the tack coat has cured completely. The tack coat shall also be free of any surface moisture and dirt and it shall not be dried by torch or any other means. The waterproofing membrane shall be applied within the temperature range recommended by the manufacturer to form a uniform film having a thickness of 5 ± 1 mm. The application of the waterproofing membrane shall be continuous. If discontinuities cannot be avoided, the waterproofing membrane shall be lapped a minimum of 150 mm.

The waterproofing membrane shall terminate in the chase or, where there is no chase, be extended up the face of curbs, barrier or parapet walls, expansion joints, and deck drains to the level of the top of the proposed hot mix base course.

### **914.07.05 Membrane Reinforcement**

The membrane reinforcement shall be placed directly over the waterproofing membrane and pressed in while it is still tacky. The membrane reinforcement shall terminate in the chase or, where there is no chase, be extended up the face of the curbs, barrier walls, expansion joints, and deck drains to the level of the top of the proposed hot mix base course. The membrane reinforcement shall then be covered with an additional layer of waterproofing membrane.

### **914.07.06 Application of Protection Board**

Protection boards shall be laid on the waterproofing membrane while the surface is still tacky and shall be laid transverse to the centreline of the deck. Material shall not be applied to the waterproofing membrane surface to remove the tackiness prior to installation of the protection board. The protection boards shall be placed with all edges overlapping 12 ± 6 mm. The protection board edge shall be within 6 mm of all curbs, vertical faces of drains, and vertical faces of expansion joints. Protection boards shall be placed so that the joints lap in the direction of traffic flow and be staggered a minimum of 150 mm.

Binder course pavement shall be placed within 7 Days of waterproofing.

## **914.07.07 Form and Fill Grooves**

Where hot mix asphaltic concrete is carried directly over expansion and fixed joints and where specified in the Contract Documents, a 20 mm wide and 20 mm deep rectangular groove shall be formed. This groove shall be made either by dry sawing or routing, with vertical sides, and be located directly over the joint for the full length of the joint.

Immediately prior to placing the hot-poured asphaltic sealing compound, the groove shall be dry and clean of any dust or debris using oil-free compressed air.

Cakes of joint sealing compound shall be melted on the job site and shall be continuously agitated in the mechanically agitated heating and mixing kettle. The contents shall be continuously agitated until the material can be drawn free flowing and lump free from the mixing kettle at a temperature within the range recommended by the manufacturer.

Joint sealing compound shall be poured using hand pouring pots, mechanical methods, or any other method that gives satisfactory results.

Shields shall be provided to prevent the compound from being spilled on the concrete curb, barrier or parapet walls, expansion joints, deck drains, and on the newly placed hot mix asphalt.

Sufficient joint sealing compound shall be poured into the groove so that upon completion of the work the surface of the compound is flush with the surface of the pavement. If the compound subsides to a level below the surface of the pavement, a second pouring shall be done. When more than one pouring is required to fill the groove, succeeding pours shall be made immediately.

Damage to the joint sealing compound caused by the Contractor's operation shall be repaired.

Traffic shall not be permitted over the joint sealing compound until the compound has cooled to ambient temperature.

## **914.07.08 Sampling for Quality Assurance**

### **914.07.08.01 Material Samples**

Representative samples of the following shall be taken for quality assurance testing by the Owner:

- a) For each lot, as defined in the Quality Assurance section of this specification, a 4 litre sample of waterproofing membrane from the heating and mixing kettle, at the time directed by the Contract Administrator.
- b) For each Contract, a 1 litre sample of tack coat.
- c) For each Contract, a 300 x 300 mm piece of waterproofing membrane reinforcement.
- d) For each Contract, a 300 x 300 mm piece of protection board.
- e) For each Contract, a 1 litre sample of joint sealing compound.

The time of sampling shall be determined using the Field Guide for the Acceptance of Hot Mix and Bridge Deck Waterproofing.

The Contract Administrator shall be allowed to examine the sample containers prior to sampling to ensure they are clean and free of debris.

**914.07.08.02                      Delivery of Samples**

Samples of the waterproofing membrane, waterproofing membrane reinforcement, joint sealing compound, tack coat, and the protection board shall be delivered within 5 Business Days of the application date to:

Head, Concrete Section  
Ontario Ministry of Transportation  
Room 15, Building C  
1201 Wilson Avenue  
Downsview, Ontario, M3M 1J8

**914.07.09                      Management of Excess Material**

Management of excess material shall be according to the Contract Documents.

**914.08                      QUALITY ASSURANCE**

**914.08.01                      Lot Size**

A lot size shall be a single bridge deck or part of a bridge deck with a surface area of 800 m<sup>2</sup> or less. Decks larger than 800 m<sup>2</sup> shall be divided into the least number of equal size lots of 800 m<sup>2</sup> or less. Decks separated into segments for staged construction shall be treated as separate lots. The Contract Administrator shall determine the limits of each lot.

For measurement of membrane thickness only, a lot shall be divided into 10 equal sublots. The sampling location within the subplot shall be determined by the Contract Administrator.

**914.08.02                      Acceptance of Waterproofing Membrane Reinforcement, Joint Sealing Compound, and Tack Coat**

Waterproofing membrane reinforcement, joint sealing compound, and tack coat shall be evaluated by the Owner for compliance with the requirements of this specification.

**914.08.03                      Acceptance of Waterproofing Membrane Thickness**

**914.08.03.01                      General**

The Contract Administrator shall determine the acceptability of the waterproofing membrane thickness by measurement on a lot-by-lot basis.

**914.08.03.02                      Testing of Waterproofing Membrane Thickness**

Measurements shall be made according to the Field Guide For the Acceptance of Hot Mix and Bridge Deck Waterproofing and shall be taken after each lot has been completed, including the placement of protection board.

**914.08.03.03                      Waterproofing Membrane Thickness Acceptance Determination**

The decision to accept the waterproofing membrane thickness shall be based on the mean and standard deviation of each lot.

If the lot mean is less than 4.0 mm or greater than 6.0 mm, the entire lot is rejectable and the Contractor shall remove and replace the lot according to the Treatment of Rejectable Lots clause.



If the lot mean is greater than or equal to 4.0 mm and less than or equal to 6.0 mm, the mean and the standard deviation shall be rounded to the closest 0.1 mm and 0.05 mm, respectively, and shall then be applied to Table 1 to determine if the lot is in the acceptable, marginal, or rejectable range. If the lot is within the marginal range as shown in Table 1, the Contractor may repair the lot as outlined below or request that the Owner accept the lot as is with a payment adjustment as outlined in the Payment Adjustment Due to Membrane Thickness Deficiency clause. If the lot is within the rejectable range as shown in Table 1, the Contractor shall remove and replace the lot according to the Treatment of Rejectable Lots clause.

Where the membrane thickness is greater than 6.0 mm, the Contractor may submit a proposal in writing for an alternative to removal and replacement for rejectable waterproofing membrane thickness for the Owner's consideration.

#### **914.08.03.04 Referee Testing of Waterproofing Membrane Thickness for Marginal or Rejectable Lots**

The Contractor may request retesting, prior to paving and within 2 Business Days of being advised of test results, if any or all of the 10 subplot test values are challenged. If this occurs, 10 new thickness measurements shall be taken within the lot by the Contract Administrator in the presence of the Contractor. The new test values shall then be used to determine acceptance. Acceptance shall be based on the criteria specified in the Membrane Thickness Acceptance Determination clause and shall be binding on both parties.

If the referee testing results in either a marginal or a rejectable lot, the Contractor shall bear the cost of the referee testing. If the referee testing results in the material passing thickness testing criteria and resulting in an acceptable lot, the referee testing charge shall be paid by the Owner.

#### **914.08.04 Acceptance of Waterproofing Membrane Quality**

##### **914.08.04.01 General**

Acceptance of the waterproofing membrane quality shall be on a lot-by-lot basis.

##### **914.08.04.02 Sampling and Testing of Waterproofing Membrane Quality**

The sample delivered to the Owner shall be split at the laboratory into 2 equal parts; one part shall be tested for acceptance and the other shall be retained for referee testing.

##### **914.08.04.03 Waterproofing Membrane Quality Acceptance Determination**

A lot shall be acceptable if it meets the requirements as shown in Table 2 when tested in accordance with OPSS 1213 and this specification. Marginal lots shall be subject to a payment adjustment according to this specification.

A lot is rejectable if any of the following criteria are met:

- a) The total number of adjustment points (PT), as shown in Table 2 is greater than 20.
- b) Any test result for a sample is in the rejection value range, as shown in Table 2.

A lot shall be considered marginal and subject to a payment adjustment as outlined in the Payment Adjustment Due to Membrane Quality Deficiency clause if the total number of adjustment points (PT) resulting from Table 2 is greater than zero and less than or equal to 20.

Rejectable lots shall be removed and replaced according to the Treatment of Rejectable Lots clause.

**914.08.04.04 Referee Testing of Waterproofing Membrane Quality**

The Contractor may request, in writing, retesting of any sample that results in payment adjustment or rejection of a lot; however, the request shall be made within 5 Business Days of receiving notification of payment adjustment or rejection of the lot. The results of the referee test shall be used for acceptance determination and shall be binding on both parties. If the referee testing results in either a payment adjustment or rejection of the lot, the Contractor shall bear the cost of the referee testing. If the referee testing results in the material passing all test criteria, the referee testing charge shall be paid by the Owner.

**914.08.05 Acceptance of Protection Board**

Protection board shall be acceptable if it meets the requirements of OPSS 1215 and this specification.

The Contract Administrator shall determine acceptability of protection board thickness on a lot-by-lot basis. A lot size shall be the total number protection boards required to cover the area defined in the Lot Size clause.

One protection board per lot shall be randomly selected by the Contract Administrator and the thickness shall be measured according to the Field Guide for the Acceptance of Hot Mix and Bridge Deck Waterproofing. Protection board thickness measurement shall be done on site prior to the commencement of the waterproofing operation.

Lots where the measured protection board thickness is less than 3.2 mm or greater than 4.0 mm shall be rejectable.

Rejectable protection board shall not be placed in the work. Rejectable protection board that has been placed in the work shall be removed and replaced, along with the waterproofing membrane according to the Treatment of Rejectable Lots clause.

**914.08.06 Treatment of Rejectable Lots**

Removal of membrane material shall include removal of the full membrane thickness to neat lines and removal of overlying pavement, as applicable. Deck surface preparation, placement of a new tack coat, membrane material, and membrane reinforcement over the removal area shall be completed according to this specification. New membrane material shall be lapped according to the Application of Waterproofing Membrane clause.

Any protection boards that are removed during the repairs and referee testing shall be replaced with new ones.

Lots that have been repaired or replaced shall be subject to Quality Assurance acceptance requirements of this section.

The Contractor shall be responsible for all costs associated with removing and replacing rejectable lots.

**914.09 MEASUREMENT FOR PAYMENT**

**914.09.01 Actual Measurement**

**914.09.01.01 Membrane Reinforcement**

Measurement of membrane reinforcement shall be by length in metres. Allowance shall not be made in the measurement for the turn-up at vertical faces or for any overlap.

**914.09.01.02 Form and Fill Grooves**

Measurement of forming and filling grooves shall be by length in metres.

**914.09.01.03 Modification of Deck Drains**

For measurement purposes, a count shall be made of the number of deck drains modified, regardless of type and size.

**914.09.01.04 Deck Surface Preparation**

Measurement of deck surface preparation shall be by area in square metres.

**914.09.02 Plan Quantity Measurement**

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

**914.10 BASIS OF PAYMENT**

**914.10.01 Bridge Deck Waterproofing - Item  
Membrane Reinforcement - Item  
Form and Fill Grooves - Item  
Deck Surface Preparation - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

When the Contract does not contain separate tender items for the work required by this specification, payment at the Contract price for the tender item Bridge Deck Waterproofing shall be full compensation for all labour, Equipment, and Material to do the work.

When repairs or remedial work to the concrete deck is required prior to abrasive blast cleaning and the work is not specified in the Contract Documents, payment for the cost of such work shall be administered as Extra Work.

Repairs to damaged grooves shall be made at the Contractor's expense at no additional cost to the Owner.

**914.10.01.01 Payment Adjustment Due to Membrane Thickness Deficiency**

When a lot is within the acceptable range as shown in Table 1, a thickness adjustment factor of 1.00 shall be applied to the Contract price for the lot.

When a lot is within the marginal range as shown in Table 1 and the Contractor requests that the Owner accept the lot as is, the thickness adjustment factor as shown in Table 1 shall be applied. Where a lot with mean thickness greater than 6.0 mm has been deemed acceptable and the Contractor requests that the Owner accept the lot as is, a payment adjustment factor of 0.60 shall be applied due to membrane thickness deficiency.

**914.10.01.02 Payment Adjustment Due to Membrane Quality Deficiency**

Quality adjustment factors are calculated as follows:

If any individual test result is inside the rejection value range, the lot is rejectable.

If the sample test results are in the marginal range for one or more tests, the adjustment points as shown in Table 2 for each borderline test result shall be totalled. If the total exceeds 20, the lot is rejectable. If the total is less than or equal to 20, the Contract Administrator shall assign a payment adjustment factor which shall be 100 minus the total of all the adjustment points (PT) and the result divided by 100.

If the sample test results meet all specification limits as shown in Table 2, the Contract Administrator shall assign a payment adjustment factor of 1.00.

**914.10.01.03                      Calculation for Total Adjustment Payment**

The total adjusted payment for the lot shall be based on the thickness and on the quality for the waterproofing membrane and is calculated as follows:

The Contract price for the lot shall be multiplied by the thickness adjustment factor and the results shall then be multiplied by the quality adjustment factor.

**914.10.02                      Modification of Deck Drains - Item**

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the work.

**TABLE 1**  
**Acceptance Determination and Payment Adjustment Factors Membrane Thickness**

		Lot Mean															
		4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1			5.2	
<b>Lot Standard Deviation</b>	0.0															0.0	<b>Lot Standard Deviation</b>
	.05															.05	
	.10															.10	
	.15															.15	
	.20															.20	
	.25															.25	
	.30															.30	
	.35															.35	
	.40															.40	
	.45	Acc														.45	
	.50	.99	Acc													.50	
	.55	.94	.99	Acc												.55	
	.60	.83	.95	.99	Acc											.60	
	.65	Rej	.86	.95	.99	Acc										.65	
	.70	Rej	.59	.87	.96	.99	Acc									.70	
	.75		Rej	.71	.89	.96	.99	Acc								.75	
	.80			Rej	.76	.91	.96	.99	Acc							.80	
	.85				Rej	.81	.91	.96	.99	Acc	Acc					.85	
	.90					Rej	.83	.92	.97	.99	.99	Acc				.90	
	.95					Rej	.64	.84	.93	.97	.99	.99	Acc			.95	
1.00						Rej	.71	.87	.93	.97	.99	.99	Acc		1.00		

*Continues on Next Page*

**TABLE 1 (Cont'd)**  
**Acceptance Determination and Payment Adjustment Factors Membrane**

		Lot Mean																	
		4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0			
<b>Lot Standard Deviation</b>	1.05	Rej	.76	.87	.94	.97	.99	.99	Acc								1.05	<b>Lot Standard Deviation</b>	
	1.10		Rej	.79	.89	.94	.97	.99	.99	Acc							1.10		
	1.15		Rej	.59	.81	.90	.95	.97	.99	.99	Acc						1.15		
	1.20			Rej	.64	.83	.91	.95	.97	.99	.99	Acc					1.20		
	1.25				Rej	.71	.84	.91	.95	.97	.99	.99	Acc				1.25		
	1.30					Rej	.76	.86	.92	.95	.97	.99	.99	Acc			1.30		
	1.35						Rej	.77	.87	.92	.95	.98	.99	.99	Acc		1.35		
	1.40						Rej	.59	.79	.87	.93	.96	.98	.99	.99	Acc	1.40		
	1.45							Rej	.68	.82	.88	.93	.96	.98	.99	.99	1.45		
	1.50								Rej	.71	.83	.89	.93	.96	.98	.99	1.50		
	1.55									Rej	.74	.84	.90	.94	.96	.98	1.55		
	1.60										Rej	.78	.86	.91	.94	.96	1.60		
	1.65										Rej	.64	.79	.87	.91	.94	1.65		
	1.70											Rej	.68	.81	.87	.91	1.70		
	1.75												Rej	.71	.82	.87	1.75		
	1.80													Rej	.74	.83	1.80		
	1.85														Rej	.59	.76		1.85
	1.90															Rej	.64		1.90
1.95																Rej	1.95		
2.00																Rej	2.00		

**Notes:**

- A. Cells containing the Payment Adjustment Factors form the marginal range.
- B. "Acc" means acceptable.
- C. "Rej" means rejectable.

**TABLE 2**  
**Acceptance Determination and Payment Adjustment Factors Membrane Quality**

<b>Test</b>	<b>Specification Limits</b>	<b>Marginal Range (B)</b>	<b>Adjustment Points</b>	<b>Rejection Value</b>
Low Temperature Flexibility at -25 °C	Pass	N/A	N/A	Fail
Cone Penetration at 25 °C (0.1 mm)	Max. 110	111 to 130	$P1 = 0.4*(B-110)$	> 130
Cone Penetration at 50 °C (0.1 mm)	Max. 160	161 to 180	$P2 = 0.4*(B-160)$	> 180
Flow at 60 °C (mm)	Max. 3 mm	3.1 to 5.0	$P3 = 4*(B-3)$	> 5
Toughness (joules)	Min. 5.5	5.4 to 4.0	$P4 = 5*(5.5-B)$	< 4.0
Toughness/Peak Load (joules/newton)	Min. 0.040	0.039 to 0.030	$P5 = 500*(0.040-B)$	< 0.030
PT = P1 + P2 + P3 + P4 + P5				
<p>Note:</p> <p>A. B is an observed test result within the marginal range to be used for calculation of adjustment points.</p>				

**Appendix 914-A, November 2014  
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

**Note:** This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

**Designer Action/Considerations**

No information provided here.

**Related Ontario Provincial Standard Drawings**

No information provided here.