

INDEX FOR  
CONSTRUCTION SPECIFICATIONS FOR EMULSIFIED ASPHALT CHIP SEALS

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CONSTRUCTION SPECIFICATIONS FOR EMULSIFIED ASPHALT CHIP SEALS

## 823. 1 SCOPE

These Specifications cover all operations necessary for and pertaining to the application of chip seals.

## 1.1 Pre-Construction Meeting

The Contractor shall attend a pre-construction meeting with the Contract Administrator, at a mutually agreed upon date, prior to aggregate production and another prior to chip seal operations. The meeting shall be initiated by the Contractor and be held a minimum of 15 business days in advance of commencing field operations.

Topics to be discussed will include the type and quantity of equipment, sequence of work and detailed work schedule, traffic control, quality management plan, calibration of equipment, sampling procedures, aggregate, mix acceptance and other pertinent topics.

## 823. 2 DEFINITIONS

Chip Seal: Surface treatment that consists of an application of emulsified asphalt covered with an application of aggregate.

Graded Chip Seal: Chip Seal construction using a single application of HF-150P emulsion followed by a single application of Type I aggregate.

Single Chip Seal: Chip Seal constructed using a single application of CRS-2P emulsion followed by a single application of Type II aggregate.

Double Chip Seal: Chip Seal constructed using two applications of CRS-2P emulsion and two layers of aggregate. The first application of emulsion is applied followed by a layer of Type II aggregate. The second application of emulsion is applied followed by a second layer of smaller aggregate.

Appeals: Request from Contractor for retesting of material property or attribute for the purpose of resolving disagreement on acceptance test results.

Bleeding/Flushing: Distinguished by a condition whereby asphalt binder rises above the surface of the chip seal or is flush with the aggregates resulting in tracking and/or loss of texture. Often associated with a shiny appearance.

Deleterious Material: Material that can affect the performance and/or cause degradation of the product.

Quality Assurance: Testing and inspection performed by the Contract Administrator for materials and placement quality acceptance.

Quality Control: Testing and inspection performed by the Contractor to monitor the material properties, quality of placement and workmanship of the Work.

Lot: Portion of work that is being considered for acceptance and for the determination of pay adjustments for aggregate.

Lot Mean: The arithmetic average of test results within a Lot.

Lot Size: Chip seal placement of approximately 10 to 15 lane-km. The Contract Administrator shall establish the Lot size at the start of each contract section. Smaller contract sections will be considered one Lot for the purpose of acceptance unless otherwise agreed upon.

Raveling: Loss of aggregate from the chip seal surface when the bond between the aggregate and binder fails.

Reject: Unacceptable material, quality of placement or workmanship.

Streaking: Formation of alternating lean and heavy lines in the chip seal that result from uneven application of binder across the surface.

823. 3 MATERIALS

3.1 Aggregates

Aggregates shall meet the requirements specified in the Contract.

Aggregate and supplementary granular materials shall consist of sound and durable particles of crushed rock, gravel, stone, sand and fines free from injurious quantities of sod, roots, clay lumps and friable particles, organics or other deleterious material.

3.1.1 Aggregate Requirements

Table 3.1 Combined Aggregate Gradation Requirements

Sieve Size		Type I		Type II	
Metric, mm	Imperial	Lower Limit	Upper Limit	Lower Limit	Upper Limit
12.5	1/2"	100	100	100	100
9.5	3/8"	75	100	90	100
4.75	#4	5	30	0	30
0.600	#30	-	-	0	2
0.425	#40	1	10	-	-
0.075	#200	1	4	0	1

Notes:

- Gradation requirements are based on percent by weight passing the sieve.
- Type II aggregate shall be washed.
- A maximum of five percent (5%) oversize particles will be allowed provided that the maximum dimension of the oversize particles does not exceed 3mm from the specified maximum size.

Table 3.2 Physical Properties Requirements

Physical Properties	Type I	Type II
Fractured Faces Content, Min. %	50	85
Lightweight Particles Content, Max. %	3	1
Ironstone Content, Max. %	11	11
L.A. Abrasion, Max. %	30	30
Flakiness Index Value, Max. %	-	30

Table 3.3 Aggregate Properties Test Methods

Test	Standard
Gradation	ASTM C136 ASTM C117
Fractured Face Content (Note 1)	ASTM D5821
Lightweight Particles Content (Note 2)	ASTM C123
Ironstone Content (Note 3)	MEB C221
L.A Abrasion, Grading type "C"	ASTM C131

Note 1: The fractured face content will be determined based on two or more fractured faces.

Note 2: The lightweight particle content will be determined by weight of all particles retained on 4.75mm sieve.

Note 3: The ironstone content is the percentage of ironstone particles by weight of all particles retained on 4.75mm sieve.

### 3.2 Emulsified Asphalt Materials

The Contractor shall supply emulsified asphalt cement type for the chip seals as follows:

- Graded Chip Seal: HF-150P with antistrip
- Single Chip Seal: CRS-2P
- **Fog Seal: CSS-1 diluted at the suppliers asphalt plant with potable water to 50 percent. The residue by distillation shall not be less than 28 percent by weight of the total mixture.**

All asphaltic materials shall be supplied from pre-approved Suppliers and meet current Manitoba specifications as outlined in the *Grading and Surfacing Approved Products List* at <http://www.gov.mb.ca/mit/mateng/product.html>.

When the emulsified asphalt is transported to the job site storage by means of tank trucks, the Contractor shall provide a copy of the bill of lading with the following information:

- Delivery company and Load ID
- Quantity of each load expressed in Litres (L),

- Percentage of antistripping
- Specific gravity, at 70° C and
- Details of the previous load contained in the delivery tanker.

### 3.3 Chip Seal Design

The Contractor shall submit a Chip Seal Design ~~sealed by a professional engineer~~ meeting the Contract requirements **seven (7) days prior to construction.**

The Chip Seal Design shall be prepared in accordance with either the *Minnesota Seal Coat Handbook (2021~~2006~~)*, *Mcleod Method* or *AASHTO R105 ~~PP82-16~~ Emulsified Asphalt Chip Seal Design*.

For design purposes, Manitoba traffic counts can be found at the following website:

- <https://www.gov.mb.ca/mit/traffic/counts.html>

The Contractor shall submit 70kg of representative aggregates for chip seal design verification purposes to the Contract Administrator. The Quality Assurance laboratory will require ten (10) days, from the time of receipt, to test the aggregate properties.

The Contract Administrator will endeavor to verify and accept aggregate properties and proposed application rates within 48 hours of receiving quality assurance test results.

The Contractor shall not commence operations prior to receiving the Contract Administrators written notice that the design has been accepted.

A new design shall be required if there is a change to the nature or source of the aggregate, supplier or source of emulsified asphalt cement.

#### 3.3.1 Submission Requirements

The Chip Seal Design submission shall include the following:

- Type of emulsified asphalt including the name and location of supplier
- Type and source of aggregate (including legal description)
- Recommended application rates of the representative materials
  - Emulsified asphalt, L/m<sup>2</sup>
  - Aggregate, Kg/m<sup>2</sup>
- Design calculations
- Summary of quality control results meeting the aggregate requirements in Table 3.1 and Table 3.2.
- Anti-strip, % (if required)

## 823. 4 EQUIPMENT

### 4.1 General

Equipment shall be in satisfactory working condition and maintained for the duration of the Work.

Equipment shall be on site and available for inspection and acceptance before the Work commences.

Equipment deemed un-satisfactory by the Manitoba representative shall be removed from the work site and work will halt until equipment is replaced or repaired. Stoppage of work will be at the Contractors' expense and no compensation will be made to the Contractor.

#### 4.2 Asphalt Distributor

The Asphalt distributor is required and shall be capable of applying emulsion continuously at a specified rate.

The Asphalt distributor shall be equipped with the following:

- Pressure gauge.
- Spray bar adjustable to a minimum length of 2.44 to 4.88 metres.
- Positive displacement asphalt pump with separate power unit.
- Heating coils and burner capable of applying even heat to the asphalt material.
- Thermometer for measuring temperature of tank contents in degree Celsius.
- Volume measuring device.
- Computer controlling on/off of each spray bar section and application rates. System must report distance travelled (m), total spray area (m<sup>2</sup>) and total spray volume (L). Computer must be capable to capture and calculate above data regardless of changes in application rates or spray bar widths during application.

The Contractor shall ensure that the distributor meets the following adjustments and requirements:

- All spray bar nozzles are of the same manufacture, type and size.
- Clogged nozzles are removed and cleaned with solvent.
- All nozzles are set an angle of between 15 to 30 degrees from the horizontal of the spray bar as per Figure 1.
- Nozzle size meets manufacturer recommendation for the application rate.
- All nozzles spray a full fan except for the right and left edge nozzles. The right and left edge nozzles shall be adjusted to a half fan spray such that the spray stays to the inside of the spray bar.
- The spray bar is adjusted to the correct height to produce a uniform double or triple lap application fan spray.
- Shutoff is instantaneous with no dripping.
- The spray system is free from air leaks.

#### 4.3 Aggregate Spreader

The aggregate spreader is required and shall be a self-propelled mechanical type with a computerized spread control capable of distributing the aggregate uniformly at the designed rate.

The equipment must have the capability of distributing aggregate to a width of 4.90 m with the ability to apply aggregate at 3.00 m by shutting off sections individually when required.

The rear of the hopper shall have a rubber flashing or control device to prevent seepage of aggregate onto the road surface when trucks are loading the spreader unit.

#### 4.4 Sweeper

Motorized **rotary** broom with a positive means of controlling vertical pressure shall be used to clean the road surface prior to spraying emulsified asphalt and to remove loose aggregate after rolling.

Broom bristles deemed damaging to the chip seal surface due to insufficient length shall be replaced. The replacement of bristles will be considered incidental to the contract.

**Pickup type sweeper will not be permitted unless specified in the special provisions.**

#### 4.5 Pneumatic-Tire Rollers

A minimum of three (3) self-propelled pneumatic-tire rollers capable of ballast loading shall be used for rolling the aggregate. The ballast loading shall be either with water or sand to allow the weight of the machine to be varied from 7 to 9 tonnes. The alignment of the axles shall be such that the rear-axle tires, when inflated to the proper pressure, can compact the voids untouched by the front-axle tires. Roller width shall be at least 1.5 m.

#### 4.6 Steel Drum Rollers

A minimum of one (1) self-propelled double steel drum roller capable of ballast loading with water, to a weight between 8 - 12 tonnes is required. Steel drum rollers shall operate in static mode.

#### 4.7 Loader

A front end loader equipped with a calibrated scale capable of tracking the quantity of aggregate loaded per truck is required.

#### 4.8 Equipment Calibration

The Contractor shall calibrate the asphalt distributor, aggregate spreader and loader using representative materials in the presence of the Contract Administrator, before the commencement of Work. Calibration will not be permitted on statutory holidays, unless approved by the Contract Administrator.

Calibration shall be conducted no earlier than 10 days prior to chip seal operations. The contractor shall submit the results of the calibration procedure to the Contract Administrator for acceptance.

The equipment shall be recalibrated if any component that affect material proportioning is replaced or if it is determined during chip seal operations to be out of calibration. Equipment will not be allowed for use on the project until the re-calibration has been completed and accepted by the Contract Administrator.

##### 4.8.1 Asphalt Distributor

The Contractor shall empty the asphalt distributor tank and flush all nozzles.

All tank screens shall be removed and thoroughly cleaned or changed during calibration procedure.

##### Distance

**The computer read out of the asphalt distributor shall be compared to a distance of 1000m for accuracy. The distributor computer shall be calibrated within  $\pm 0.5\%$ .**

##### Volume

Volume calibration shall be determined by measuring the weight of the distributor before and after spraying a representative amount of emulsified asphalt into a secondary tank. This value shall be compared to the amount displayed on distributor computer to evaluate accuracy of the reading. If



the rate applied differs by more than 1% of the rate on the distributor computer display, the distributor computer must be recalibrated and the volume check conducted again until the rate applied is within 1% for two consecutive tests.

#### Nozzle Orientation

The Contractor shall adjust the angle of each nozzle to ensure the slots are positioned at an angle between 15 and 30 degrees (Figure 1).



Figure 1—Spray Bar Nozzle Orientation in Spray Bar

#### Spray Bar Height

~~Spray bar height shall be adjusted as per NCHRP Report 680, Chapter 7 for proper double or triple overlap.~~

**For a Triple Lap Application: To determine if the spray bar height is correct for a triple lap application, conduct the following test:**

- 1) Shut off two consecutive nozzles for each that is left open (Figure 2).
- 2) Have the distributor apply a spot binder application and examine the point where the fans hit the pavement surface. If they do not meet at the same point, the spray bar is not at the correct height.
- 3) If the fans overlap, the spray bar is too high. If they are too far apart, the spray bar is too low. Adjust the bar height as needed and repeat until the fans meet the pavement at the same point.

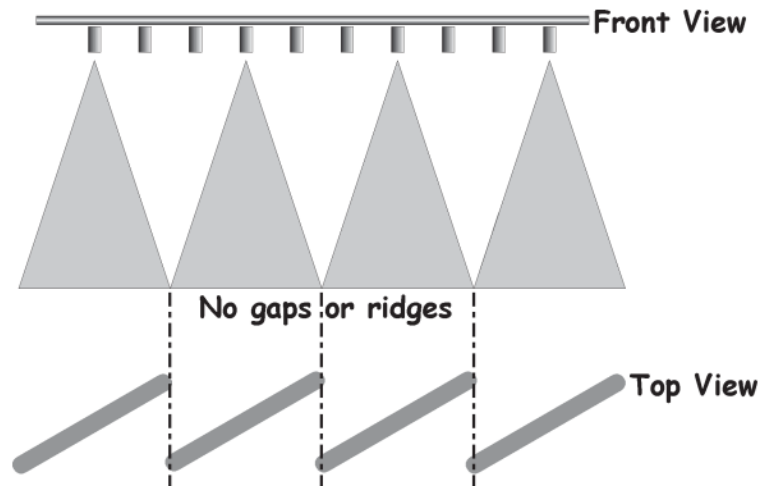


Figure 2 – Spray bar height test for triple lap (Ref: Minnesota Seal Coat Handbook 2021)

**For a Double Lap Application: To determine if the spray bar height is correct for a double lap application, conduct the following test:**

- 1) Shut off every other nozzle (Figure 3).
- 2) Have the distributor apply a spot binder application and examine the point where the fans hit the pavement surface. If they do not meet at the same point, the spray bar is not at the correct height.

- 3) If the fans overlap, the spray bar is too high. If they are too far apart, the spray bar is too low. Adjust the bar height as needed and repeat until the fans meet the pavement at the same point.

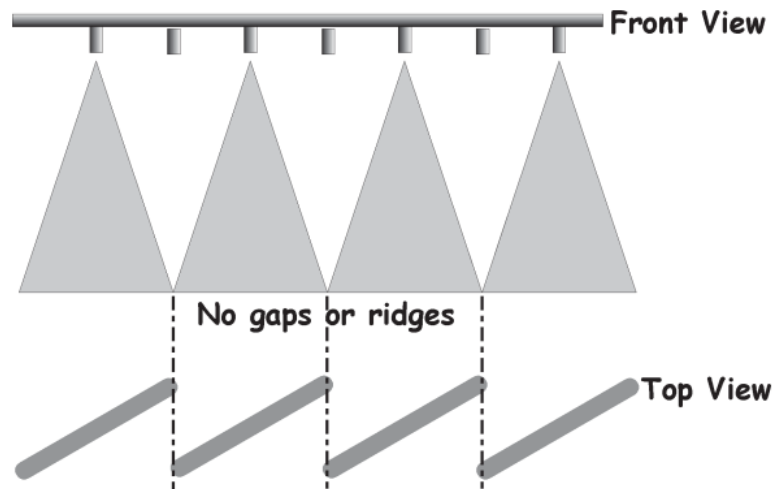


Figure 3 – Spray bar height test for double lap (Ref: Minnesota Seal Coat Handbook 2021)

#### Nozzle Flow

Flow from each nozzle in the asphalt distributor must be within  $\pm 10$  percent of the average flow of all nozzles as measured by the procedure described in *ASTM D2995 Estimating Application Rate of Bituminous Distributors - Method B*.

#### 4.8.2 Loader

Loader scale shall be calibrated as per the equipment manufacturer and verified by weighing a loaded truck at a certified permanent scale to compare the weight of the loaded material (total weight of truck plus loaded material at scale - truck's tare weight = material loaded). The loader scale shall be calibrated to within  $\pm 5$  percent of the certified permanent scale.

#### 4.8.3 Aggregate Spreader

**The contractor shall calibrate the aggregate spreader in sequence of transverse spread followed by longitudinal spread.**

#### Transverse Spread

Uniformity of the aggregate applied transverse to the pavement centerline shall be in accordance with *ASTM D5624 Standard Practice for Determining the Transverse-Aggregate Spread Rate for Surface Treatment Applications*. Tolerance for each pad tested for transverse spread rate shall be  $\pm 10$  percent of the average of the total transverse rate using representative aggregates.

#### Longitudinal Spread

Longitudinal spread rate shall be determined by spreading a known quantity of aggregates over an area. The weight of aggregates divided by the area covered will provide the spread rate. The longitudinal spread rate shall be within  $\pm 10$  percent of the design spread rate using representative aggregates.

### 5.1 Construction Limits

The Contractor shall meet with the Contract Administrator on site prior to starting each section to discuss the following construction limits:

- Start and end locations
- Width of the chip seal
- Treatment area of curves
- Treatment area of intersection(s)

### 5.2 Surface Preparation

The existing surface shall be free from dust, dirt, excessive moisture and other unacceptable material prior to the application of emulsified asphalt.

The pavement shall be swept with a motorized broom to remove loose material within one hour of seal coating. Depressions not reached by the motorized broom shall be done with a hand broom.

The Contractor shall be responsible for installing and removing protective covers on manholes, catch basins, valve chambers, expansion joints and other utility structures.

#### 5.2.1 Protective Cover Installation

The Contractor shall install protective covers in such a way that they are not displaced by the Work.

During the installation and removal of the protective covers, the Contractor shall take the necessary steps to prevent foreign material from entering the utility structure or expansion joint.

Protective covers must be removed within 24 hours of completion of the work at each job site, or before the roadway is reopened to traffic.

Where required, the Contractor shall remove protective covers during heavy rains to prevent localized flooding and replace them before starting or restarting the Work.

The supply, installation, removal and disposal of all protective covers shall be considered incidental to the Contract.

### 5.3 Test Strip

The Contractor shall construct a test strip for each contract section under similar placement conditions; temperature, and humidity expected for the duration of the project.

The test strip shall be one lane width and one lane-km in length **a minimum 500 m away from an intersection**. The Contractor shall propose the location of the test strip to the Contract Administrator for acceptance. The Contract Administrator shall be given a minimum of 48 hours' notice prior to constructing the test strip.

The Contractor shall have onsite personnel experienced in chip seals to monitor the test strip and to advise on the suitability of design rates, rolling patterns and surface finish.

Adjustments to the submitted chip seal design application rates shall be permitted provided they do not exceed  $\pm 5\%$  for emulsified asphalt and  $\pm 10\%$  for aggregates unless approved by the Contract Administrator.

The Contract Administrator will evaluate the Chip Seal based on application rates and visual assessment of the test strip. If the test strip is rejected, the Contractor shall place additional test strip(s) until the chip seal meets the requirements of the Contract.

The Contractor shall use the same material, equipment and construction methods that were accepted on the test strip for the remainder of the chip seal operations on the Contract.

#### 5.4 Longitudinal Seams

For roadways with paved shoulders, the Contractor shall place the longitudinal seam on the centreline and 100 mm beyond the painted edge line.

For roadways without paved shoulders, the Contractor shall place the longitudinal seam on the centreline and edge of pavement.

The longitudinal centreline shall be swept prior to construction of the adjacent lane. All loose aggregate shall be removed to at least 100 mm from the proposed longitudinal seam.

#### 5.5 Application of Emulsified Asphalt

The emulsified asphalt shall be applied at the accepted test strip rate, to the width in which aggregate will be applied by the spreader in a single pass.

The rate of emulsified asphalt shall be within  $\pm 5\%$  of the accepted test strip rate.

Application of emulsified asphalt shall not be more than 100 m ahead of the application of cover aggregate.

The temperature of the emulsified asphalt at the time of application shall range between 70 – 80°C.

The Contractor shall advise the Contract Administrator when the asphalt distributor is empty in order that a percentage of error test may be performed.

#### 5.6 Application of Cover Aggregates

Within 15 seconds of applying the emulsified asphalt, cover aggregate shall be placed at the accepted test strip rate using a chip spreader.

The application rate of aggregate shall be within  $\pm 10\%$  of the accepted test strip rate.

For Single Chip Seal the application, rate should allow for emulsified asphalt to be visible between most of the aggregates but not so much that it causes pickup on pneumatic tire rollers. If emulsion cannot be seen between the aggregate the rate is too high and shall be reduced to a rate agreed to by the Contract Administrator.

#### 5.7 Transverse Joints

The asphalt distributor shall begin applying emulsified asphalt by starting the application on top of tar paper unless the Contractor can demonstrate to the Contract Administrator an acceptable joint can be obtained without tar paper.

When abutting the previously placed chip seal, the transverse paper joint shall be formed by placing a 1.0 m wide tar paper on top of the previously applied chip seal so the edge of the paper aligns with the joint. After the asphalt distributor moves forward and over the joint, the Contractor shall remove and dispose of the paper in accordance to provincial regulations.

5.8 Rolling Operations

The first roller passes shall be completed by pneumatic tire roller no longer than 1 minute after the initial spread of the chip seal aggregates.

The pneumatic tired rollers shall make a minimum of three passes over the entire area of application with rollers positioned in echelon to ensure the entire width of the pavement lane is covered in one pass of the rollers.

The steel roller shall make a minimum of one pass over the entire area of application.

Ensure rolling is completed before the emulsified asphalt breaks and no longer than 15 min after the emulsified asphalt is sprayed.

The asphalt distributor and aggregate spreader speed shall be reduced if the rolling operations cannot meet the Contract requirements.

Rollers shall proceed in a longitudinal direction at a speed less than or equal to 12.0 km/h.

The final 2 km of daily production shall receive additional rolling passes prior to work stoppage for the day. Additional rolling passes will be based on emulsion curing conditions or environmental factors as determined by the Contract Administrator. Additional rolling passes are considered incidental to the Contract.

5.9 Sweeping

The Contractor shall sweep the entire road surface including the paved shoulder to the satisfaction of the Contract Administrator.

First and second sweep shall occur in accordance with Table 5.1 and after rolling is completed. Minimum time may be shortened as approved by the Contract Administrator.

Table 5.1 Timing of Sweeping

Action	Graded Chip seal	Single Chip Seal
First Sweep	24 to 48 hours	6 to 24 hours
Second Sweep	5 to 10 days	2-3 days

**The Contractor shall notify the Department representative at least 24 hours in advance of the second sweep.**

5.9.1 Sweeping Before A Long Weekend

The Contractor shall ensure the first sweep is completed prior to any long weekend. If the Contractor fails to complete the first sweep prior to the long weekend, the Contractor shall be charged a cost of \$2000 per occurrence. This cost represents a genuine pre-estimate of the cost that Manitoba would incur to address the issue.

5.10 Protection of Motor Vehicles

The Contractor shall not pilot traffic on a graded chip seal less than three (3) hours after being applied. On other chip seal types, the contractor shall not pilot traffic on the chip seal less than one (1) hour after being applied. Minimum time may be shortened for end of day production and for short section(s) of Work as agreed to by the Contract Administrator.

The Contractor shall not allow gravel trucks to travel on the fresh chip seal during construction. Trucks required to pull onto fresh chip seal shall minimize the amount of time on the chip seal and not exceed travel speeds greater than 10 km/hour.

The Contractor shall be responsible and pay just claims from road users arising directly or indirectly for damages caused by Chip Seal construction. Damage claims include but are not limited to windshield and paint damage and cleaning emulsion off of vehicles.

#### 5.11 Fog Seal

**If specified, fog seal shall be applied to the surface of the completed chip seal within four hours of final sweeping and before placement of permanent pavement markings.**

**The Contractor shall fog seal at an application rate of 0.65 L/m<sup>2</sup>.**

**The fog seal shall be applied to one lane width at a time. When matching, the fog seal shall not overlap by more than 100 mm at the longitudinal or traverse joint.**

**The fog seal shall be allowed to cure for at least two hours before opening to traffic. Curing time may be extended based on environmental factors as determined by the Contract Administrator.**

**The Contractor shall fog seal no sooner than 2 days and no longer than 5 days following completion of any contract section.**

#### 5.12 Weather Limitations

Construction of chip seal **and fog seal**, shall not be permitted in the following conditions:

- air temperature is below 10°C
- relative humidity greater than 85%
- road surface is damp
- visibility is less than 700 metres
- during periods of precipitation
- **for fog seal only, wind speeds in excess of 30 km/h**

Chip Seal operations shall not be permitted when weather conditions are unfavourable, or are likely to become unfavourable. Chip seal operations may be suspended by the Contract Administrator without liability or cost to Manitoba.

### 823. 6 QUALITY CONTROL

The Contractor shall meet the requirements of Manitoba's *Standard Construction Specification for Quality Control (No. 110)*.

The Contractor shall perform quality control sampling, testing and inspection to ensure the chip seal conforms to the Contract requirements.

**The Contractors shall provide an electronic document management system (DMS) accessible to the Contractor and Department. The DMS shall contain records not limited to testing, inspection, chip seal design and non-conformance reports.**

## 6.1 Testing Frequency and Methods

Recommended frequencies and test methods are listed in Table 6.1 and 6.2.

Table 6.1: Aggregate Properties

Test or Action	Minimum Frequency	Test Method
Gradation	1 per 500 tonnes	ASTM C136 ASTM C117
Fractured Faces Content, Min. %	1 per 500 tonnes	ASTM D5821
Lightweight Particles Content, Max. %	2 samples	ASTM C123
Ironstone Content, Max. %	2 samples	MEB C221
L.A. Abrasion Loss, Max. %	2 samples	ASTM C131

Table 6.2 Construction of Chip Seal

Test of Action	Frequency	Test Method
Application Rate for Emulsified Asphalt	Continual Inspection	NCHRP 680, Chapter 7
Application Rate for Aggregate	Continual Inspection	NCHRP 680, Chapter 7
Longitudinal Joint Overlap	Continual Inspection	N/A
Transverse Joints	Continual Inspection	N/A

## 6.2 Construction Documents

The Contractor shall complete construction template documents provided by the Contract Administrator.

Documents include:

- *Distributor Form* to document quantity of emulsified asphalt, distance travelled and area
- *Loader Form* to document quantity of aggregate per truck

The Contractor shall complete the documents and provide a legible copy to the Contract Administrator at the end of each day.

## 823. 7 QUALITY ASSURANCE

### 7.1 General

The Contract Administrator will conduct Quality Assurance testing and inspection of the emulsified asphalt quality, aggregate properties, application rates and deficiencies to determine its acceptability on a regular basis.

The Contract Administrator may test for any property outlined in the Contract at any time throughout the work. The Contractor will be provided with the results from the completed tests.

The Contractor shall supply bags and containers for sampling and the Contract Administrator will provide tags or labels. Quality Assurance inspection and testing will be performed at no cost to the Contract.

The inability of the Contract Administrator to provide Quality Assurance test results shall not relieve the Contractor of their obligation to remedy any defect.

#### 7.2 Emulsified Asphalt Quality

The Contractor shall be responsible for sampling the emulsified asphalt in accordance with *MEB P031 Sampling and Testing Asphalt Binder Materials* and providing all samples to the Contract Administrator for Quality Assurance testing.

Samples shall be taken from each truckload of emulsified asphalt delivered to the Contractor's storage tanks. The Contract Administrator must be present during the sampling process unless otherwise authorized by the Contract Administrator.

Unless otherwise specified, the emulsified asphalt shall conform to the latest Specifications for Emulsified Asphalt on the approved products list (APL).

#### 7.3 Aggregate Gradation

Aggregate samples will be taken from the working face of the staging area stockpile during the construction of chip seals.

The Contract Administrator will identify three (3) sample locations in each Lot for Quality Assurance Testing.

The Contractor shall obtain two (2) samples from each sample location, in the presence of the Contract Administrator, as per *MEB P047 Sampling Aggregate Materials for Laboratory Testing – Front End Loader Method*. One of the samples will be used for Quality Assurance and the other will be reserved for the prospective Appeal testing.

The Contract Administrator will test the aggregate gradation as per the Aggregate Property Test Methods listed in Table 3.3.

#### 7.4 Application Rates

The Contract Administrator will verify application rates of the emulsified asphalt and aggregate to ensure they meet the Contract requirements.

#### 7.5 Deficiencies

Each lane-km, including shoulders will be inspected for areas of deficiencies.

The Contractor shall provide 24 hours notice to request inspection of the Work in each section and arrange an on-site meeting with the Contract Administrator.

### 823. 8 APPEALS

The Contractor may Appeal the results of Quality Assurance testing for any aggregate properties.

Appeals will be considered by the Contract Administrator if the Contractor can demonstrate that the Quality Assurance test results are different from the Quality Control test results.



Quality Control test results for the aggregate stockpile which are provided to the Contract Administrator subsequent to the Contractor's receipt of the Quality Assurance test results will not be considered for an Appeal.

The Contractor shall serve Notice of Appeal to the Contract Administrator, in writing, within five (5) days of receipt of the applicable Quality Assurance test results. Samples collected and retained for Appeal testing will be discarded if notice of Appeal is not received within the allotted time period.

The Contractor shall bear all costs of Appeal testing unless the new test results indicate an improvement to the unit price. The cost for Appeal testing will be based on the cost that Manitoba pays its Service Provider for the Appeal test in question (including tax) plus 10% for administration. Manitoba will select the Appeal testing Service Provider on the basis of competitively tendered lowest qualified price that does not pose a conflict of interest with the Contractor or Manitoba.

Appeal testing will be done by a 3rd party laboratory retained by the Contract Administrator.

The Appeal test results shall replace the appealed Quality Assurance test result and be used for acceptance.

Manitoba will not be responsible for any delays including but not limited to Contractor's downtime, or other costs as a results of the Appeal.

## 823. 9 ACCEPTANCE CRITERIA

### 9.1 General

The acceptance of materials, segregation and surface defects shall be based on the following criteria from the Quality Assurance test results:

- Emulsified Asphalt Quality
- Aggregate Properties
- Application Rates
- Deficiencies

If the results fall in rejection, corrective action shall be performed as per Section 11.

### 9.2 Emulsified Asphalt Quality

Emulsified asphalt with test results failing to meet the specification will be subjected to pay adjustment depending on the extent of the problem.

The Contract Administrator will notify the Contractor of out-of-specification test results.

### 9.3 Aggregate Properties

The Acceptance of the aggregates will be based on the material characteristics from the Quality Assurance test results.

Pay adjustment will apply if the gradation from the representative Lot do not meet all the requirements.

The Contract Administrator will accept the material into the Work at a reduced payment to the Unit Price unless the pay adjustment is equal to or greater than 20%.

#### 9.3.1 Pay Adjustment for Gradation

Price adjustment is based on the deviation of the Lot Mean from the specification limits in Table 3.1.

Table 9.1 Pay Adjustments for Gradation

Sieve Size	Mean Deviation from Specification Limit (Dsl)		Unit Price Adjustment, Percent Reduction per Square metre, %
	Type I	Type II	
12.5 mm	≤3	≤3	= 1 x Dsl
	>3	>3	Reject
9.5 mm and 4.75 mm	1 to 15	1 to 15	= 1 x Dsl
	>15	>15	Reject
0.600 mm	-	1 to 2	= 1.5 x Dsl
	-	>2	Reject
0.425 mm	1 to 10	-	= 1 x Dsl
	>10	-	Reject
0.075 mm	1 to 3	0.1 to 1.2	= 1.5 x Dsl (Type I) = 15 x (Dsl <sup>1.7</sup> ) (Type II)
	>3	>1.2	Reject

The pay adjustment for each Lot will be the sum of the pay adjustment for each sieve.

$$\text{PayReduction per SQ.m} = \text{PRSQ} \times (\text{Sum of Percent Reduction in Table 9.1})$$

Where:

$$\text{PRSQ} = \text{Price per Sq. m of chip seal}$$

If the Sum of Percent Reduction in Table 9.1 exceeds 20%, the representative Lot will be rejected and corrective actions may apply.

#### 9.4 Application Rates

The Contractor shall correct application rates if they are outside the application rate tolerances.

Where the application rate of emulsified asphalt is 5% below the accepted test strip rate, the Contract Administrator will calculate a pay reduction on the quantity of Chip Seal constructed outside the accepted test strip rate. The Contract Administrator will take into consideration changes in existing surface and environmental conditions when assessing the application rate pay adjustment.

##### 9.4.1 Pay Adjustment for Application Rate of Emulsified Asphalt

Pay adjustment for application rate of emulsified asphalt will be calculated using Table 9.2.

The deviation will be calculated using the following formula:

$$Dar = \frac{\text{accepted application rate} - \text{actual application rate}}{\text{accepted application rate}} * 100$$

Where:

*Dar = Deviation of application rate*

Table 9.2 Pay Adjustment for Application Rate of Emulsified Asphalt

Deviation of Application Rate (Dar)	Unit Price Adjustment, Percent Reduction per square metre
0 to 5%	No reduction
> 5%	=(Dar - 5)*3

$$\text{PayReduction per Sq. m} = \text{PRSQ} \times (\text{Percent Reduction in Table 9.2})$$

Where:

*PRSQ = Price per Sq. m of Chip Seal*

9.5 Deficiencies

Deficiencies include but are not limited to the following:

- Chip coverage less than 99% (single bare area greater than 0.01m<sup>2</sup> per one square metre)
- Streaking
- Raveling/stone loss
- Bleeding/flushing
- Uneven texture
- Non uniform surface
- Wheel tracks with excess bleeding
- Loose chips
- Transverse joint overlap
- Excessive longitudinal joint overlap

All identified Segregation and surface defects shall be rejected and are subject to corrective action.

823. 10 CORRECTIVE ACTION

Each identified unacceptable chip seal or warranty area is subject to corrective actions.

All corrective actions shall be performed at the Contractor’s expense.

The Contractor shall submit a proposal to the Contractor Administrator to remedy all required corrective actions in accordance to this specification.

The Contractor shall not undertake any correction on any defective work prior to receiving acceptance of the proposal from the Contract Administrator.

823. 11 WARRANTY

11.1 Warranty Period

The warranty period shall be 12 months after acceptance of the Work in the Contract. If warranty repairs are required, the warranty period shall be extended for an additional 12 months after corrective actions are completed.

11.2 Warranty Repairs

The Contract Administrator will inform the Contractor of necessary warranty repairs in writing during the warranty period.

The warranty work shall be completed between May 16th and August 15st inclusive.

Warranty repair is required within 60 days of the notification.

Damage caused by winter maintenance activities or areas directly damaged within an intersection caused by vehicles turning are not be subject to warranty repair.

Warranty repairs shall be in accordance with *Section 10 Corrective action* and Table 11.1 unless otherwise accepted by the Contract Administrator.

Table 11.1 Warranty Repairs

Deficiency	Severity	Description	Corrective Actions
Ravelling/Aggregate loss	Slight	10% or less aggregate loss in a 200 m segment.	No Action Required
	Moderate	10 to 20% aggregate loss in a 200 m segment.	Re-seal the affected area by machine or manual method.
	Severe	20% or more aggregate loss in a 200 m segment.	1. Remove and replace seal coat in affected area. 2. Re-seal the affected area.
Bonding		Chip seal has separated from the underlying surface.	Remove and replace seal coat in affected area. (Note 1)

Flushing/Bleeding	Slight	Chip seal surface presents uneven discoloration due to excess Binder. Aggregates are not obscured by excess binder.	No Action Required
	Severe	Chip seal surface presents uneven discoloration due to excess Binder. Aggregates are obscured by excess Binder and tire marks may be evident in warm weather.	1. Remove and replace seal coat in affected area. (Note 1) 2. Re-seal the affected area.

Note 1: Area of the repair shall not be less than one lane width by 10 m in length. If there is less than 10 m between two sections in the lane designated for repair or replacement, the repair or replacement shall be continuous.

823. 12 METHOD OF MEASUREMENT

"Graded Aggregate Chip Seal", "Single Chip Seal" and "**Fog Seal**" will be measured for payment by the square metre based on measurements taken by the Contract Administrator.

823. 13 BASIS OF PAYMENT

The unit price per square metre for "Graded Aggregate Chip Seal", "Single Chip Seal" and "**Fog Seal**" will be payment in full for all labour, equipment, material and associated activities necessary to complete the Work in accordance to this specification.

Overspray, repair, changes in application rates or warranty work will be considered incidental to the Contract.

Where pay adjustments are made, deductions will be made as a lump sum separately from the Unit Price.

13.1 Emulsified Asphalt Cement Cost Adjustment

Manitoba will adjust payment to the Contractor based on the Departments Asphalt Cement price index. The price index will be used to calculate the cost adjustment per tonne of emulsified asphalt accepted into the Work.

The price index is based on the price, excluding taxes, of asphalt cement grade PG 58-28. The price index for each month reflects the average of the same month's prices and will be circulated on the last day of the month. The price index established for the month will apply to quantity of Work accepted in the same month.

The emulsified asphalt cement (EAC) cost adjustment per tonne is calculated based on the residual asphalt cement content using the following formula:

$$EAC\ Cost\ Adjustment = (Index_m - Index_{tc}) * (EACQuantity_m * \frac{AC_{res}}{100})$$

Where,

- Index<sub>m</sub>*= Manitoba Index for the month in which paving occurs, \$
- Index<sub>tc</sub>*= Manitoba Index for the month prior to tender closing, \$
- EACQuantity<sub>m</sub>*= Quantity of EAC placed for the month, Tonnes
- AC<sub>res</sub>*= Minimum residual asphalt cement content required as per specification requirements

The quantity of emulsified asphalt cement placed for the month will be calculated using the following formula:

$$EACQuantity_m = \frac{EAC_{app} * SQMQuantity_m * SG_{eac}}{1000}$$

Where,

$EAC_{app}$  = Application rate of emulsified asphalt cement required as per accepted rate, L/m<sup>2</sup>

$SQMQuantity_m$  = Monthly quantity of Chip Seal accepted in the work, m<sup>2</sup>

$SG_{eac}$  = Specific Gravity of the emulsified asphalt cement

EAC cost adjustments will be made as a lump sum separately from the Unit Price on progress payments.