CONSTRUCTION SPECIFICATION FOR TACK COATING AND JOINT PAINTING

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308.01 SCOPE

This specification covers the requirements for the placement and acceptance of tack coating, and joint painting.

308.02 REFERENCES

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

Ontario Provincial Standard Specifications, Construction

OPSS 313 Hot Mix Asphalt - End Result
OPSS 914 Waterproofing Bridge Decks with Hot Applied Asphalt Membrane

Ontario Provincial Standard Specifications, Material

OPSS 1103 Emulsified Asphalt

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:
LS-100 Rounding-Off of Test Data and Other Numbers
LS-325 Field Verification of Tack Coat Application Rate

MTO Forms:

PH-CC-139 Bituminous Mix and Core Sample Identification
PH-CC-325 Method B: Field Verification of Tack Coat Application Rate
PH-CC-326 Method C: Field Verification of Tack Coat Application Rate by Tack Coat Distributor's Display

ASTM International

D5/D5M-20 Test Method for Penetration of Bituminous Materials
D2995-23 Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors
D6997-12(2020) Test Method for Distillation of Emulsified Asphalt

American Association of State Highway and Transportation Officials (AASHTO)

R 66-16 (2020) Standard Practice for Sampling Asphalt Materials
T 407-23 Standard Method of Test for Determining the Interlayer Shear Strength (ISS) of Asphalt Pavement Layers

308.03 DEFINITIONS

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

Binder Course means as defined in OPSS 313.

Emulsified Asphalt means as defined in OPSS 1103.

Hot Mix Asphalt (HMA) means as defined in OPSS 313.

Joint means as defined in OPSS 313.

Lot means as defined in OPSS 313.

Protection Board means as defined in OPSS 914.

Surface Course means as defined in OPSS 313.

Tack Coat Break means when the water separates enough from the emulsified asphalt for the colour to change from brown to black.

Tack Coat Set means when all the water from the emulsified asphalt has evaporated, leaving only the residual asphalt cement.

308.04 DESIGN AND SUBMISSION REQUIREMENTS

308.04.01 Submission Requirements

308.04.01.01 Tack Coat and Joint Painting Material

At least 5 Business Days prior to the first use of tack coat and/or joint painting material, the following documentation shall be submitted to the Contract Administrator:

a) Type and grade of emulsified asphalt to be used as tack coat and joint painting material;

b) Supplier and applicator of the material;

c) Safety data sheet and any other information for the safe handling, transportation, and storage of the material;

d) Typical test results; and

e) Minimum residue, minimum application rates, and residual application rates.

Proposals for the use of alternative tack coat and joint painting material, shall be submitted in writing to the Contract Administrator at least 10 Business Days prior to the intended use of the alternate material. The Contract Administrator shall respond in writing within 5 Business Days of receiving the proposal. The alternate material shall not be used until the Contract Administrator has granted permission in writing.

The proposal shall include the following:

a) The reason for the use of the alternate material;

b) Type and grade of emulsified asphalt to be used as alternate tack coat and joint painting material;

c) Safety data sheet and any other information for the safe handling, transportation, and storage of the material;

d) Testing protocols to be used in confirming the properties of the material;

e) Typical test results; and

f) Minimum residue, minimum application rates, and residual application rates.

308.05 MATERIALS

308.05.01 Tack Coat and Joint Painting Material

Tack coat and joint painting material shall consist of SS-1, SS-1H, or SS-1HH emulsified asphalt diluted up to a maximum of 50% with water (maximum dilution 1:1). Diluted tack coat materials shall meet the requirements specified in Table 1.

Tack coat and joint painting material shall be homogenous after mixing and maintain their physical and engineering properties for at least 24 Days from the Day of delivery of the tack coat to the paving site. The undiluted material shall be according to OPSS 1103.

308.06 EQUIPMENT

308.06.01 Joint Painting Distributors

A hand-held pressure applicator may be used for joint painting.

308.06.02 Tack Coat Distributors

For main lane paving, tack coat shall be applied using self-propelled or tow-along pressure distributors capable of applying the material at the specified application rate and in a continuous and uniform manner both longitudinally and transversely for the full lane width. The distributors shall be equipped with a volume-metering system of sufficient sensitivity to measure the quantity of tack coat dispensed. The distributors shall be equipped, maintained, and operated to provide uniform heating and application rates as specified.

The distributor's metering system shall be accompanied by documentation confirming that it is calibrated within the past 12 months by the manufacturer, or its authorized representative, and such documentation shall be submitted to the Contract Administrator.

The use of a hand-held pressure applicator is acceptable for tack coating protection board and small irregularly shaped areas such as tapers.

308.07 CONSTRUCTION

308.07.01 Operational Constraints

Surfaces to be tack coated and joint painted shall be free of all water and contamination, such as dirt, mud, loose aggregate, or debris. Protection board shall be dry and clean prior to the application of the tack coat.

Tack coating and joint painting shall be placed sufficiently ahead of the paving operation to allow for the tack coat set to occur prior to paving. Application of tack coating and joint painting shall only be applied to areas scheduled for HMA paving operations for that day or night.

Paving and construction equipment shall not be permitted onto the tack coated surfaces until after tack coat break and set has occurred. HMA shall not be placed on tack coated areas until tack coat set has occurred. Traffic shall be prevented from travelling upon the tack coated areas.

Construction traffic shall be limited from travelling upon the tack coated areas and construction trucks shall not be lined up on the tack coated areas. All other traffic shall be prevented from travelling upon the tack coated areas.

308.07.02 Tack Coat Application

Tack coat shall be applied to the following:

a) Protection board;

b) New and existing pavement surfaces including, but not limited to, HMA and Portland cement concrete;

c) Milled pavement surfaces;

d) Expanded asphalt surfaces;

e) Cold in-place recycled surfaces;

f) Hot in-place recycled surfaces;

g) The surfaces of all new and existing binder courses;

h) The surfaces of padding and levelling courses; and

i) Other areas specified in the Contract Documents.

308.07.03 Tack Coat Application Rates

The tack coat shall be applied at the application rate specified in Table 2. When a proposal to use an alternative tack coat material has been accepted, the application rates shall be as specified in the accepted proposal.

308.07.04 Joint Painting

Joint faces shall be painted with a thin, uniform, and continuous coating of joint painting material to the satisfaction of the Contract Administrator. The joint between echelon paved lanes is not required to be painted. The joint between pavement lanes paved with an infrared joint heater shall not be painted.

308.07.05 Material Sampling and Testing

308.07.05.01 General

Sampling frequency and sample size shall be according to Table 3.

308.07.05.02 Tack Coat

Tack coat samples for testing shall be representative of the material being used on site and shall be obtained at the paving site according to AASHTO R 66 in the presence of the Contract Administrator. A set of two samples shall be taken from each sublot. One of these samples shall be for quality assurance (QA) testing and the other shall be for referee testing. All required samples for acceptance and referee purposes shall be acquired at the same time and location as selected by the Contract Administrator.

The minimum quantity of each of the QA and referee samples shall be 1 litre. Only new containers shall be used for sampling purposes. Sample containers shall be triple tight 1 litre cans or suitable plastic containers of similar capacity that can be closed to prevent any leakage.

Samples shall be taken from a sampling spigot on the transfer line or, if one is not available, from the end of the transfer line. Each sample shall be taken after sufficient material has been drawn from the distributor truck tank to purge the transfer line. Sample containers shall be supplied and filled, leaving sufficient space to allow for expansion.

308.07.05.03 Pavement Core Samples for Interlayer Shear Strength Testing

The Contract Administrator shall submit in writing the random surface core sample locations. One core shall be obtained from the pavement surface from each lot no later than the next Business Day after the completion of paving. The cores shall be taken in the presence of the Contract Administrator for information purposes. Each core shall meet the following requirements:

a) The pavement cores shall be approximately 150 mm in diameter (145 mm to 150 mm) with the entire surface of the perimeter perpendicular to the top surface of the core within 6 mm;

b) Pavement cores shall be taken full depth, where possible, so that no prying action is needed to extract the cores from the pavement. As a minimum, the pavement core shall consist of two asphalt layers (i.e., full top layer and one underlying layer);

c) For composite pavements, the core shall be extracted only from the asphalt layers and shall not go into the concrete base; and

d) If a pavement core debonds at the interface during the coring operation, an additional pavement core shall be taken, and a note of the occurrence shall be added to the MTO form PH-CC-139, Bituminous Mix and Core Sample Identification.

Prior to coring at the core location, the direction of travel shall be marked using a permanent marker with a straight line arrow across the diameter parallel to the traffic flow so that it can be identified once the core is removed. A MTO form PH-CC-139, Bituminous Mix and Core Sample Identification, shall be filled out in full and submitted with the core samples. Cores shall not be taken on bridge decks. Cores shall be taken a minimum of 1.0 m away from other cores.

The traffic direction, lot and sublot numbers shall be clearly marked using a permanent marker on all cores.

HMA and compaction requirements for filling the sample holes shall be the same as the adjacent undisturbed pavement. Sample holes shall be cleaned, dried, filled, and then compacted using mechanical self-powered gas-powered, electric-powered, or air-powered compactor immediately after sampling.

308.07.06 Management of Excess Material

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

308.08 QUALITY ASSURANCE

308.08.01 Acceptance Criteria for Tack Coat

Acceptance of the tack coat shall be based on the following criteria:

a) Tack coat material:

   i. Percent residue.

b) Field application:

   i. Field tack coat application rate.
   ii. Appearance/coverage.

308.08.02 Acceptance of Tack Coat Material

308.08.02.01 General

The Owner shall conduct tests, carry out calculations and provide test results according to Table 4. Test results shall be submitted to the Contractor as they become available to the Contract Administrator.

The Contract Administrator shall determine the acceptability of tack coat.

308.08.02.02 Lot and Sublot Sizes

The Contract Administrator shall determine the size and location of the lots for each tack coat application rate, after discussion with the Contractor and before HMA production. There shall be separate lot(s) for each specified application rate for tack coat material used on the Contract. The lots shall be divided into sublots. Sublot size shall be the quantity used to cover an area of 40,000 m^2, however, sublot sizes may be adjusted to ensure a minimum of three sublots per lot. A sublot may be terminated at the Contractor Administrator's option when HMA production for the work ceases for a period of 20 Business Days or more.

308.08.02.03 Basis of Acceptance

308.08.02.03.01 General

Tack coat material acceptance is based on the percent residue of the diluted material according to Table 1 for each sublot. The percent oil portion of distillate and penetration shall be reported for each sublot for information purposes only.

308.08.02.03.02 Weighted Lot Mean for the Percent Residue

The weighted lot mean for the percent residue (WM_{pro}) shall be calculated using the following equation:

$$WM_{pro} = \frac{\left((PR_1 \times A_1) + (PR_2 \times A_2) + \cdots + (PR_n \times A_n)\right)}{(A_1 + A_2 + \cdots + A_n)}$$

Where:

WM_{pro} = Weighted lot mean for the percent residue shall be calculated to one decimal place according to LS-100.
PR_n = Percent residue for sublot n
A_n = The area of sublot n in square metres
n = The number of sublots with percent residue equal to or greater than 26.5%

Sublots with percent residue equal to or greater than 26.5% shall be accepted into the work with a payment adjustment according to the Payment Adjustment for Tack Coat clause.

Sublots with percent residue less than 26.5% shall be deemed rejectable and shall not be included in the weighted lot mean for percent residue payment factor calculation.

308.08.02.03.03 Residue Penetration

One penetration test shall be performed on the residue obtained by the distillation test on the diluted material for each sublot. The penetration test results shall be reported for information purposes only.

308.08.02.03.04 Referee Testing

Referee testing for percent residue, penetration, and oil portion of distillate for a given sublot can only be invoked by the Contractor within 2 Business Days of the Contractor receiving the sublot results and if the referee sample received by the laboratory is in a condition suitable for testing.

All referee test results shall replace the respective QA test results for acceptance of the applicable sublot and shall be binding on both the Owner and the Contractor.

If the referee percent residue sublot test result is less than 27.5%, then the Contractor shall bear the cost of the referee testing at the rates specified in the Contract Documents.

308.08.03 Acceptance of Field Application

308.08.03.01 General

The Owner's acceptance of field application shall consist of the field application rate and appearance meeting the requirements of the Contract Documents.

The Contract Administrator shall determine the acceptability of tack coat and joint painting.

All material and work shall be visually inspected by the Contract Administrator. Visually defective material and work shall be rejected or repaired to the Contract Administrator satisfaction.

308.08.03.02 Verification of Field Tack Coat Application Rate

Verification of field tack coat application rate for each sublot shall be conducted by the Contract Administrator by using one of the following options and testing frequency as determined by the Contract Administrator:

Option 1: An initial verification of field application rate on a 100 m trial section at the start of the application of tack coating the first sublot and then on every sublot thereafter by using LS-325 Method A (ASTM D2995) or B (Simplified Method).

Option 2: An initial verification of field application rate on a 100 m trial section at the start of application of tack coating the first sublot by using LS-325 Method A (ASTM D2995) or B (Simplified Method) then on every sublot thereafter by using LS-325 Method C (Tack Coat distributor's Display Method).

Option 3: An initial verification of field application rate on a 100 m trial section at the start of application of tack coating the first sublot and then on every sublot thereafter using the LS-325 Method C (Tack Coat Distributor's Display Method).

Sublots with field tack coat application rates less than the minimum application rates for tack coat specified in Table 2 shall be deemed rejectable.

308.08.03.03 Joint Painting Application Rate Acceptance

Joint painting shall provide a thin, uniform, and continuous coating to the satisfaction of the Contract Administrator.

308.08.03.04 Appearance Acceptance

The tack coat and joint painting application shall be visually uniform and shall fully cover the area specified in the Contract Documents. Areas of insufficient or non-uniform coverage shall be re-sprayed by the Contractor at no additional cost to the Owner. Where tack coating is performed using hand-held devices, the visual appearance of such areas shall be consistent with the adjacent areas of machine applied material. Tack coat and joint painting deemed by visual appearance to be non-uniform or to have uncoated surfaces or to have patches of bare material due to tracking by vehicles or dirty or does not fully cover the areas specified in the Contract Documents, shall be deemed rejectable.

308.08.04 Disposition of HMA Produced with Rejectable Tack Coat

The Owner shall review the laboratory testing and field application rate test results and determine the disposition of the HMA placed on any tack coat that is deemed rejectable.

HMA placed on tack coat for which both laboratory testing and field application results are rejectable shall be subject to repair or payment adjustment. The Owner shall determine if HMA placed on a rejectable tack coat sublot may remain in the work without repairs, with a payment adjustment accepted by the Owner. When test results indicate non-conformance with the Contract Documents, all costs to the Owner to establish the degree and extent of the non-conformance shall be the responsibility of the Contractor.

308.09 MEASUREMENT FOR PAYMENT

308.09.01 Actual Measurement

Measurement of Tack Coat shall be by area in square metres.

308.09.02 Plan Quantity Measurement

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

308.10 BASIS OF PAYMENT

308.10.01 Tack Coat - Item

308.10.01.01 General

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

a) Payment for joint painting shall be made under the appropriate hot mix tender item.

b) Payment for tack coating of concrete surfaces completed in association with bridge deck waterproofing shall be included in the bridge deck waterproofing item and payment for tack coating of the protection board shall be paid under the Tack Coat item.

c) When a payment adjustment applies according to the Payment Adjustment for Tack Coat clause.

308.10.01.02 Payment Adjustment for Tack Coat

The payment adjustment for each lot of tack coat shall be calculated using the following equation:

Payment Adjustment = A_{Total} x Price x TODRF (1.00 – PRPF)

Where:

A_{Total} = Total tack coated area in square metres of sublots included in the weighted lot mean percent residue.
TODRF = Tender opening date reduction factor according to Table 5.
Price = The price shall be the tender item price for the tack coat material or the negotiated price of the alternate material if the Owner accepted the use of that material.
PRPF = Percent residue payment factor from Table 6 using the weighted lot mean percent residue (WM_{pro}) calculated for the lot according to the Weighted Lot Mean for the Percent Residue clause.

TABLE 1
Tack Coat Material
Requirements (Maximum Dilution 1:1)

Emulsified Asphalt Type/Grade	Test Method	SS-1	SS-1H	SS-1HH
Minimum Residue by Distillation, % by Mass	ASTM D6997	27.5	27.5	27.5
Maximum Percent Oil Distillation	ASTM D6997	1.5	1.5	1.5
Penetration on Residue (at 25 °C, 100 g, 5 s), 0.1 mm	ASTM D5	100-200	40-100	20-55

TABLE 2
Application Rate Requirements for Tack Coat Material

Surface Type	Minimum Residual Application Rate, kg/m²	Minimum Application Rate for Undiluted Tack Coat, kg/m² (Note 2)	Minimum Application Rate for Diluted Tack Coat, kg/m² (Note 4)	Range of Application Rate for Diluted Tack Coat, kg/m² (Note 5)
Existing pavement surfaces, milled pavement surfaces, full-depth reclamation with expanded asphalt stabilization surfaces (Note 1) and any binder course surface that has been left open to traffic over at least one winter.	0.10 kg/m²	0.18 kg/m² (Note 3)	0.35 kg/m²	0.35 - 0.45 kg/m²
Cold in-place recycled surfaces, cold in-place recycled expanded asphalt mix surfaces, hot in-place recycled surfaces, and new surfaces that have been paved in the same calendar year.	0.07 kg/m²	0.13 kg/m² (Note 3)	0.25 kg/m²	0.25 - 0.35 kg/m²
Protection board.	0.14 kg/m²	0.25 kg/m²	0.50 kg/m²	0.50 - 0.60 kg/m²

Notes:

1. SS-1H and SS-1HH tack coat not permitted on full depth reclamation with expanded asphalt stabilization surfaces.
2. Undiluted tack coat with a minimum residue of 55%.
3. If undiluted tack coat is used, consult with the tack coat distributor's manufacturer or equipment supplier for any equipment limitations.
4. Diluted tack coat with a minimum residue of 27.5%.
5. Range of application rate is provided for equipment variability.

A. kg/m² can be interchangeable to l/m² considering specific gravity of 1.00.

TABLE 3
Sampling Frequency and Sample Size for Tack Coat Material

Sample Type	Frequency	Minimum Sample Quantity	Labelling
QA and Referee	Every Sublot	One Litre Each	• Tack Coat Material Type • Supplier
Pavement Core Sample for Interlayer Shear Strength (ISS) Test by QA Laboratory	Every Lot	One Core Every Lot	• Attach completed MTO form PH-CC-139, Bituminous Mix and Core Sample Identification • ISS Testing • Traffic direction marked with an arrow on ISS core • Tack Coat Material Type • Field Application Rate • Surface Type on which tack coat was applied • Supplier • Mix Type

TABLE 4
Testing Requirements for Tack Coat Material

Properties and Attributes	Testing Method	Calculations, Values, and Results Required
Test on Emulsified Asphalt		
Residue by Distillation, % by Mass	ASTM D6997	• % Residue to 0.1%, • Weighted Lot Mean to 0.1%
Percent Oil Distillation	ASTM D6997	% Oil Distillate to 0.1% (For information purposes only)
Test on Residue		
Penetration (at 25 °C, 100 g, 5 s)	ASTM D5	Penetration Units to 1 dmm (For information purposes only)
Assessment of Field Application		
Verification of Field Tack Coat Application Rate	LS-325	• Application Rate of Tack Coat in the Field • Complete and submit MTO form PH-CC-325, Field Verification of Tack Coat Application Rate (LS-325-Method B-Using Simplified Procedure) and MTO form PH-CC-326, Field Verification of Tack Coat Application Rate (LS-325-Method C-Using Tack Coat Distributor's Display), as applicable
Appearance	Visual Assessment	Visual assessment of uniformity and coverage
Test on Pavement Cores - Interlayer Shear Strength (ISS) Test		
Interlayer Shear Strength (ISS) test on Pavement Cores (Bond Strength Test)	AASHTO T 407. This test to be conducted on field pavement cores. No normal load is required during testing.	ISS, Ultimate Applied Load (For information purposes only)

TABLE 5
Tender Opening Date Reduction Factor for Tack Coat Payment Factor

Year of Tender Opening	Tender Opening Date Reduction Factor (TODRF)
2023 and 2024	0.75
2025 and beyond	1.00

TABLE 6
Payment Factors for Weighted Lot Mean Percent Residue

% Residue - Weighted Lot Mean (WM_{pro})	Percent Residue Payment Factor (PRPF)
$\geq$ 27.5	1.00
26.5 - 27.4	0.75