

EMISSIONS MEASUREMENTS - Item No.
SUPERPAVE 12.5 - WARM MIX - Item No.
SUPERPAVE 12.5 - WARM MIX - ... MM LIFT THICKNESS - Item No.
SUPERPAVE 12.5FC 1 - WARM MIX - Item No.
SUPERPAVE 12.5FC 1 - WARM MIX - ... MM LIFT THICKNESS - Item No.
SUPERPAVE 12.5FC 2 - WARM MIX - Item No.
SUPERPAVE 12.5FC 2 - WARM MIX - ... MM LIFT THICKNESS - Item No.
SUPERPAVE 19.0 - WARM MIX - Item No.
SUPERPAVE 19.0 - WARM MIX - ... MM LIFT THICKNESS - Item No.
SUPERPAVE 25.0 - WARM MIX - Item No.
SUPERPAVE 25.0 - WARM MIX - ... MM LIFT THICKNESS - Item No.

Special Provision No. BITU0029

Amendment to OPSS 313, April 2021

313.01 SCOPE

The second paragraph of Section 313.01 of OPSS 313 is deleted in its entirety and replaced by the following:

This specification also covers the requirements for the placement, compaction, and acceptance of HMA produced using warm mix asphalt (WMA) technology as well as the additional requirements including submissions, materials sampling, emissions measurements, temperature measurements, and documentation when the tender item title includes “Warm Mix”.

313.02 REFERENCES

Section 313.02 of OPSS 313 is amended by the addition of the following:

ASTM International

D7313 - 20 Standard Test Method for Determining Fracture Energy of Asphalt Mixtures Using the Disk-Shaped Compact Tension Geometry

American Association of State Highway and Transportation Officials (AASHTO)

T 324-19 Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures
TP 124-20 Standard Method of Test for Determining the Fracture Potential of Asphalt Mixtures Using the Illinois Flexibility Index Test (I-FIT)

313.03 DEFINITIONS

Section 313.03 of OPSS 313 is amended by the addition of the following:

Attribute means one of the following properties: designated large sieve (DLS), 4.75 mm sieve, 75 µm sieve, AC content, air voids, lift thickness, VMA, draindown, lane compaction, or edge compaction.

Confined Edge (CE) means a longitudinal lane edge that is paved against an existing lane edge or other existing rigid edge, excluding maintenance holes, catch basins, ditch inlets, and valves.

Control HMA means HMA surface course mix with identical mix design parameters to WMA surface course mix, except that it is produced at HMA temperature.

Edge Compaction means compaction within 250 mm of a lane edge.

Lane Compaction means compaction of a paved lane or paved shoulder, excluding 250 mm from a lane edge.

Lane Edge means confined and unconfined longitudinal edges of a paved lane or paved shoulder. When two lanes or a lane and a shoulder are paved by one piece of equipment in a single pass, no lane edge exists between the two lanes or the lane and the shoulder.

Unconfined Edge (UE) means a longitudinal lane edge that is not placed against a previously paved lane edge or other existing rigid edge excluding maintenance holes, catch basins, ditch inlets, and valves.

313.04 DESIGN AND SUBMISSION REQUIREMENTS

313.04.01 Submission Requirements

Subsection 313.04.01 of OPSS 313 is amended by the addition of the following:

The following information shall be provided in writing to the Contract Administrator no later than 14 Days prior to the start of paving WMA:

- a) The WMA technology that will be used, including the complete name and address of the supplier.
- b) The type and dosage of WMA additive and the method of incorporating the additive to produce the WMA.
- c) The WMA technology supplier's established recommendations for usage including safety data sheet and technical data sheet.
- d) Documentation from the WMA technology supplier confirming compatibility of the WMA technology with the proposed anti-stripping additive.
- e) Production temperatures for WMA and control HMA
- f) Location and type of asphalt plant, fuel type, burner make and model.

[* Designer Fill-in, See Notes to Designer]

The WMA shall not be placed until written notification has been received from the Contract Administrator confirming the receipt of all the above submissions.

313.05 MATERIALS

313.05.04 Warm Mix Asphalt

Subsection 313.05.04 of OPSS 313 is amended by the addition of the following:

The permitted WMA technologies are as listed below in alphabetical order:

- a) CWM

- b) Evotherm M1
- c) Rediset LQ-1200A
- d) WarmGrip N1
- e) Zycotherm SP2

313.07 CONSTRUCTION

313.07.07 Placing Hot Mix Asphalt

313.07.07.01 Operational Constraints

Clause 313.07.07.01 of OPSS 313 is amended by the addition of the following:

The limits of control HMA section are identified below.

Section	Paving Limits	Mix Type and Thickness
Control HMA	**	**

[** Designer Fill-ins, See Notes to Designer]

Clause 313.07.07.01 of OPSS 313 is amended by the addition of the following clause:

313.07.07.01.01 Maximum Production Temperature

The maximum allowable production temperature for WMA at the asphalt plant shall be:

- a) 135 °C, or
- b) At least 20 °C below the production temperature of the control HMA with identical mix design parameters to WMA and not exceeding 150 °C.
- c) During daily start-up, temporary increases of up to 15°C above the maximum allowable production temperatures stated in a) and b) are allowed for a maximum period of 1 hour.

313.07.09.05 Warm Mix Asphalt

Clause 313.07.09.05 of OPSS 313 is deleted in its entirety and replaced with the following:

313.07.09.05 Additional Samples

Additional loose mix and pavement core samples of WMA and control HMA shall be obtained from select sublots according to Table 2 for moisture sensitivity testing and mix performance testing. The sublots are to be selected randomly from the sublots identified for mix properties by the Contract Administrator.

The loose mix shall be taken from the paver and the pavement cores shall be taken within 1 Day of paving from the same location where the loose mix was collected. The pavement cores shall be taken along the mid-lane at 1 m spacing and shall consist of the top two layers of asphalt. Requirements for filling the sample holes shall be according to Compaction Clause.

These samples shall be designated for QA testing for moisture sensitivity and mix performance testing according to Table 4. A complete sample data sheet shall accompany the samples. The data sheet shall also identify corresponding mix properties lot/sublot number, GPS coordinates of sample locations, and that the samples are for moisture sensitivity and mix performance testing. Both moisture sensitivity and mix performance testing are required for information only.

Edge compaction cores shall be taken for surface course compaction according to Table 2. Transversely, one edge compaction core shall be centred 150 mm from the lane edge. The edge compaction core shall be taken within 3 m of the same longitudinal location as the lane compaction cores. For each subplot, a random number between 0 and 100 shall be used to determine if the edge compaction core is taken from the right or left lane edge, while facing the same direction as public traffic. If the subplot's random number is less than 50 the edge compaction core shall be taken from the right lane edge and if the subplot's random number is equal to or greater than 50 the edge compaction core shall be taken from the left lane edge. Edge compaction core shall include the edge type (UE or CE) on the label and UE or CE shall be clearly marked with a permanent marker on all edge compaction cores. The edge compaction testing is required for information only.

313.07.10 Identification of Warm Mix Asphalt Paving Limits

Subsection 313.07.10 of OPSS 313 is amended by the addition of the following:

In addition, GPS coordinates for the control HMA paving limits shall be submitted to the Contract Administrator no later than 7 Days after completion of control HMA paving.

Section 313.07 of OPSS 313 is amended by the addition of subsection 313.07.12

313.07.12 Measurements

313.07.12.01 Temperature Measurement

Plant production temperatures, obtained once per hour at discharge point during the entire production of WMA and control HMA, shall be provided to the Contract Administrator at the end of each Day's production.

The temperature of the WMA and control HMA shall be measured in the presence of the Contract Administrator and recorded immediately after spreading using a calibrated infrared thermometer gun or other Owner-accepted technologies such as thermal cameras. The measurements shall be conducted at wheel paths and midlane, once every 250 lane-metres during the WMA and control HMA paving. The temperature records shall be submitted to the Contract Administrator no later than 2 Business Days from the date of measurement.

[*** Designer Option, See Notes to Designer]

313.08 QUALITY ASSURANCE

313.08.01 Acceptance Criteria

313.08.01.02 Mix Properties and Compaction

313.08.01.02.03 Basis of Acceptance

Clause 313.08.01.02.03 of OPSS 313 is amended by the addition of clause:

313.08.01.02.03.01 Acceptance of WMA

When the maximum allowable production temperature is not according to the Maximum Production Temperature clause, the mix shall be considered non-conforming. Non-conforming WMA shall be accepted into the work according to the Payment Adjustment for WMA clause.

313.10 BASIS OF PAYMENT

313.10.01 Hot Mix

Subsection 313.10.01 of OPSS 313 is amended by the addition of the following clause:

313.10.01.08 Payment Adjustment for WMA

A payment adjustment shall be applied for non-conforming WMA accepted into the work. The payment adjustment for non-conforming WMA shall be calculated using the following formula:

$$\text{WMA Payment Adjustment} = -3\% \times \text{price} \times \text{quantity of non-conforming WMA} \quad (\text{Formula 17})$$

Where:

price = the Contract price of the WMA tender item
quantity of non-conforming WMA = quantity of (t, m²) UOM of non-conforming WMA

Section 313.10 of OPSS 313 is amended by the addition of the following subsection:

313.10.07 Emissions Measurements - 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 2 of OPSS 313 is deleted in its entirety and replaced with the following:

TABLE 2
Sample Size and Frequency

Material	Sample Size	Frequency of Sampling
SMA mixes, Superpave 9.5, 12.5, 12.5FC 1, 12.5FC 2, and 19.0 (Note 1)	20 to 30 kg or 30 to 40 kg (Note 2)	Every subplot
Superpave 25.0 and 37.5 (Note 1)	25 to 35 kg or 35 to 45 kg (Note 2)	Every subplot
HMA Compaction Cores	150 to 200 mm diameter	Every mix properties subplot
Additional Compaction Core at lane edge (surface course only)	150 to 200 mm diameter	Every mix properties subplot
HMA Thickness Cores	50 mm diameter	Every thickness subplot
HMA Aggregates for Density Testing	Coarse aggregate 10 kg Fine aggregate, RAP 5 kg	First sample to be taken at least 10 Days prior to producing first HMA lot; second sample at 15,000 tonnes; thereafter every 20,000 tonnes or when new samples requested
SMA mixes for draindown testing	3 to 5 kg	Once per lot
Additional WMA samples for moisture sensitivity testing and mix performance testing - for information (Note 1) Additional WMA pavement cores (at the same location as the above loose samples) for mix performance testing – for information	120 kg per subplot 12 cores of 150 mm diameter per subplot	Three sublots per mix type, randomly selected by the Contract Administrator
Additional control HMA samples for moisture sensitivity testing and mix performance testing - for information (Note 1) Additional HMA pavement cores (at the same location as the above loose samples) for mix performance testing – for information	120 kg per subplot 12 cores of 150 mm diameter per subplot	One subplot per mix type, randomly selected by the Contract Administrator
<p>Notes:</p> <ol style="list-style-type: none"> 1. Each material sample receptacle shall have a maximum mass of 30 kg. For ease of handling, especially when the larger sample size is required, splitting of material at the paving site is permitted such that a sample is contained in a maximum of two receptacles whose total mass does not exceed the maximum specified above. Once delivered to testing laboratories, combining of the material from the two receptacles is only mandatory if a single receptacle contains insufficient material to carry out the full suite of tests required. 2. The larger sample size shall be applicable when samples are designated for testing to the maximum number of gyrations. The frequency of the larger samples shall be one per lot, as designated by the Contract Administrator. 		

Table 4 of OPSS 313 is deleted in its entirety and replaced with the following:

**TABLE 4
Testing Requirements**

Properties and Attributes	Testing Method	Calculations, Values, and Results Required
Mix Properties		
AC Content and Aggregate Gradation for mix samples	LS-282 or LS-292	% AC, % passing DLS sieve, 4.75 mm sieve, 75 µm sieve
Volumetric Properties		
Laboratory Compaction to: i. Design number of gyrations (N_{des}) ii. Maximum number of gyrations (N_{max}) Maximum Theoretical Specific Gravity (G_{mm})	AASHTO T 166 using the same laboratory compaction protocol as was used in mix design. (Note 1) AASHTO T 312, LS-264 Superpave Mixes only: in addition to compacting all samples to the design number of gyrations, one sample from each lot of HMA shall be compacted to the maximum number of gyrations. Bulk Relative Density for mix samples, BRD_m	BRD_m BRD at N_{des} BRD at N_{ini} BRD at N_{max} G_{mm} % G_{mm} @ N_{ini} % G_{mm} @ N_{des} % G_{mm} @ N_{max}
Voids in Mineral Aggregate (VMA)	LS-604, LS-605, LS-266 (Note 2) G_{sb} = combined bulk relative density of blended coarse and blended fine aggregates	G_{sb} VMA
Voids Filled with Asphalt (VFA)	AASHTO R 35	VFA
Air voids for mix (V_a)	LS-265	V_a
Dust to Binder Ratio (D_p) for Superpave mixes	AASHTO R 35	D_p
Compaction		
Compaction and Thickness of Cores	BRD_c = Bulk Relative Density for core samples, LS-262 (Note 1) MRD_m = G_{mm} (Maximum Relative Density for loose mix samples, LS-264) % Compaction = $(100 \times BRD_c / MRD_m)$	Thickness of Core % Compaction
Lift Thickness		
Thickness of Cores	LS-294	Lift Thickness
SMA Mix Properties		
Draindown for mix	LS-310	% Draindown
Moisture Sensitivity (for Information Only)		
Moisture Sensitivity	AASHTO T 283 including Table 1	TSR Visual Stripping Rating

Mix Performance Tests (for Information Only)		
Flexibility Index (FI)	AASHTO TP 124	As per REPORT section of AASHTO TP 124
Disk-Shaped Compact Tension (DCT)	ASTM D7313	As per Report section of ASTM D7313
Hamburg Wheel-Track (HWT)	AASHTO T 324	As per REPORT section of AASHTO T 324
<p>Notes:</p> <ol style="list-style-type: none"> 1. For all gyratory-compacted specimens and cores of SMA mixes and Superpave mixes, if the per cent water absorbed by the specimen is found to exceed 2% by volume, as described in AASHTO T 166, then the bulk relative density shall be determined using either LS-306 or ASTM D6752. 2. Calculate to two decimal places for each subplot using the BRD_m for the subplot, and the G_{sb} of the most recent QA sample, as specified in the Contract Documents, to provide a lot mean VMA to two decimal places. 3. The rounding-off procedure, for all values, shall be according to LS-100. 		

NOTES TO DESIGNER:

*** Designer Fill-In**

Insert the following when Emissions Measurement clause (Designer Option) is included, as recommended by the Bituminous Section and Regional Geotechnical Section:

- a) A proposal from an environmental consultant detailing emissions measurements procedures and methodologies.

**** Designer Fill-Ins**

- Insert paving limits for control HMA section as determined by the Regional Geotechnical Section.
- Insert Superpave mix type and thickness for the control HMA as determined by the Regional Geotechnical Section.

The quantity for the control HMA section should be about one day's production or equivalent to 1,500 to 2,000 tonnes.

Traffic category, PGAC grade, and AC_{BID} information for the control HMA should be provided in the SSP111F06.

***** Designer Option**

Insert the following when recommended by the Bituminous Section and Regional Geotechnical Section:

313.02 REFERENCES

Section 313.02 of OPSS 313 is amended by the addition of the following:

ASTM International

- D7313 - 20 Standard Test Method for Determining Fracture Energy of Asphalt Mixtures Using the Disk-Shaped Compact Tension Geometry

American Association of State Highway and Transportation Officials (AASHTO)

T 324-19 Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Asphalt Mixtures
TP 124-20 Standard Method of Test for Determining the Fracture Potential of Asphalt Mixtures Using the Illinois Flexibility Index Test (I-FIT)

Ontario Ministry of the Environment, Conservation and Parks (MECP):

PIBS 1310e03 Ontario Source Testing Code (OSTC)

Unites States Environmental Protection Agency (U.S. EPA):

Test Methods 2, 3A, 4, 6C, 7E, 10, 25A, as applicable

National Institute for Occupational Safety and Health

Method 5042 Benzene-Soluble Fraction and Total Particulate (Asphalt Fume)

Subsection 313.07.12 of OPSS 313 is amended by the addition of clause 313.07.12.02

Others

Environmental Protection Act, Ontario Regulation 419/05, Air Pollution-Local Air Quality - R.S.O. 1990

313.07.12.02 Emissions Measurement

313.07.12.02.01 General

An environmental consultant shall be retained for sampling and preparation of emission reports.

313.07.12.02.01.01 Asphalt Fume Sampling

Asphalt fume sampling shall be conducted for 3 Days of construction of WMA and 1 Day of construction of control HMA in accordance with the National Institute for Occupational Safety and Health Method 5042. The fume sampling dates shall be identified by the Contract Administrator so that all sampling occurs within 7 Business Days.

Air samples shall be collected to determine the degree to which paving crew members are exposed to fumes during paving operations for both the WMA and the HMA. Air sampling pumps shall be placed within the breathing zone of the asphalt crew. A minimum of two air sampling pumps are to be used. One unit shall be attached to the employee working at the rear of the paving vehicle, and the other to be attached to the operator of the paving vehicle. Fumes shall be analyzed for total particulate matter and benzene soluble matter.

313.07.12.02.01.02 Stack Sampling

Readings shall be obtained of all stack emissions produced at the asphalt plant for 1 Day's production of WMA and 1 Day's production of HMA for the same Superpave mix identified by the Contract Administrator.

The dates for the stack emissions measurements shall be identified by the Contract Administrator so that all measurements occur within 3 Business Days. Emissions measured shall include carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides (NO_x), sulphur oxides (SO_x), oxygen (O₂), volatile organic compounds and total particulate matter. Stack emissions testing methods shall be in accordance with either OSTC or U.S. EPA.

313.07.12.02.02 Emission Reports

313.07.12.02.02.01 Asphalt Fume Emission

Within 60 Days of field fume sampling, an emission report shall be submitted to the Contract Administrator and the Regional Head of Quality Assurance documenting the results of emissions surrounding lay down operations of WMA and HMA as well as the following additional data:

- a) Executive summary, methodologies, findings, interpretation of findings, appendixes including field data.
- b) Visual observations of emissions from the hopper of the asphalt paver, according to Ontario Regulation 419/05,
- c) Weather data including ambient temperature (at least three times during paving period), wind speed and direction, humidity, precipitation,
- d) Diagrams and photographs documenting activities and sampling locations.

313.07.12.02.02.02 Stack Emission

Within 60 Days of emissions measurement, an emission report shall be submitted to the Contract Administrator documenting the stack emission results as well as the following additional data:

- a) Executive summary, methodologies, findings, interpretation of findings, appendixes including field data.
- b) Asphalt production rate in tonnes/hr for each mix during the time period when the emissions measurements were made.
- c) Plant fuel usage for the days when the emissions measurements were conducted.
- d) Stack gas volumetric flow rates, temperature, and moisture content during the time period when the emissions measurements were made.
- e) Typical photographs of instrument set up and emission fumes.

WARRANT: Always with these tender items, as recommended by the Regional Geotechnical Section in Contracts with a minimum WMA quantity of 40,000 square metres or its tonnage equivalent.

CUSTODIAN: Gelu Vasiliu, EMO – Bituminous Section