



**CONSTRUCTION SPECIFICATION FOR
MICRO-SURFACING**

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336.01 SCOPE

This specification covers the requirements for micro-surfacing and includes all surface preparation, material application, tack coating, handwork, joints, protection while curing, clean up, and trial area.

336.01.01 Specification Significance and Use

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be as specified in the Contract Documents.

336.01.02 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.

336.02 REFERENCES

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

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

Ontario Provincial Standard Specifications, Construction

OPSS 710 Pavement Marking

Ontario Provincial Standard Specifications, Material

OPSS 1001 Aggregates - General
OPSS 1003 Aggregates - Hot Mixed Asphalt
OPSS 1103 Emulsified Asphalt
OPSS 1301 Cementing Materials

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-200 Penetration of Bituminous Materials
LS-202 Kinematic Viscosity of Asphalt
LS-216 Determination of Residue by Distillation of Emulsified Asphalts
LS-601 Materials Finer than 75 µm Sieve in Mineral Aggregates by Washing
LS-602 Sieve Analysis of Aggregates
LS-609 Petrographic Analysis of Coarse Aggregate
LS-625 Guidelines for Sampling of Granular Materials

Ontario Traffic Manual (OTM):
Book 7 - Temporary Conditions

SP-024 Manual for Condition Rating of Flexible Pavements

MTO Forms:

- PH-CC-449a Aggregate Test Data - Hot Mix Asphalt - Physical Properties, Fine Aggregate
- PH-CC-449b Aggregate Test Data - Hot Mix Asphalt - Physical Properties, Coarse Aggregate
- PH-CC-449c Aggregate Test Data - Hot Mix Asphalt - Superpave Consensus Properties

ASTM International

D 36-95 (2000)e1 Softening Point of Bitumen - Ring and Ball Apparatus

International Slurry Surfacing Association (ISSA)

- TB-100-90 Test Method for Wet Track Abrasion of Slurry Surfaces
- TB-109-90 Test Method for Measurement of Excess Asphalt in Bituminous Mixtures by Use of a Loaded Wheel Tester and Sand Adhesion
- TB-113-90 Trial Mix Procedure for Slurry Seal Design
- TB-114-90 Wet Stripping Test for Cured Slurry Seal Mix
- TB-139-90 Test Method to Classify Emulsified Asphalt/Aggregate Mixture Systems by Modified Cohesion Tester Measurement of Set and Cure Characteristics
- TB-144-90 Test Method for Classification of Aggregate Filler - Bitumen Compatibility by Schulze-Breuer and Ruck Procedures
- TB-147-90 Test Methods for Measurement of Stability and Resistance to Compaction, Vertical and Lateral Displacement of Multi-layered Fine Aggregate Cold Mixes - Method A

336.03 DEFINITIONS

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

Appurtenances mean maintenance holes, catch basins, valve chambers, and water valve covers and similar Utility access covers located within the paved portion of the roadway.

Micro-Surfacing means a pavement surfacing composed of polymer-modified asphalt emulsion, high quality aggregate, mineral filler, and water.

Rut Filling means a layer of micro-surfacing placed on the existing pavement using a rut box on the longitudinal wheel path rut.

Scratch Coat means a layer of micro-surfacing placed on the existing pavement prior to placing a surface coat.

Siliceous Aggregates means rock particles containing or composed of silica (SiO₂) or minerals with silica in the crystal structure as silicate (SiO₄).

Surface Coat means a layer of micro-surfacing laid on a scratch coat or directly on the existing pavement.

336.04 DESIGN AND SUBMISSION REQUIREMENTS

336.04.01 Design Requirements

336.04.01.01 Mix Design

A laboratory equipped and staffed to carry out micro-surfacing mix designs shall designate the mix proportions and prepare the job mix formula.

The compatibility of the aggregate and the polymer modified emulsified asphalt shall be confirmed by the laboratory designing the mix.

All component materials used in the mix design shall be representative of the material to be used on the Contract.

Micro-surfacing material shall only be placed after the Contract Administrator has issued confirmation in writing within 5 Business Days that the mix design has been reviewed and meets the specified requirements.

The mix design proportions shall be within the following limits.

Residual Asphalt:

6.0 to 11.5% by dry mass of aggregate

Mineral Filler:

0 to 3.0% by dry mass of aggregate

The micro-surfacing material shall be designed to carry traffic within one hour of placement.

336.04.02 Submission Requirements

336.04.02.01 Mix Design

Two weeks prior to the start of micro-surfacing, the mix design shall be submitted in writing to the Contract Administrator together with the results of the tests listed in Table 1.

336.04.02.02 Submission of Test Data

The Contractor shall provide Quality Control (QC) test results of all aggregates and filler used in the Work from a laboratory meeting the requirements of the Laboratory Requirements clause. Test results showing complete conformance with the physical property requirements of this specification shall be provided to the Contract Administrator at the time of submission of the mix design.

QC test results shall be submitted using MTO forms PH-CC-449a, PH-CC-449b, or PH-CC-449c as applicable. Test data forms must be legible and signed by the testing laboratory representative. Electronic copies are acceptable providing the original is submitted to the Contract Administrator within 5 Business Days following receipt of the copy.

Only aggregate sample test data obtained from stockpiled material to be used in the Work and tested within the past 14 months shall be submitted.

336.04.02.03 Laboratory Requirements

An acceptable laboratory conducting tests for physical properties or consensus properties shall be one that holds a certificate from the Canadian Council of Independent Laboratories (CCIL) as Type D for the applicable test methods and also participates in the annual MTO Proficiency Sample Testing Program.

An acceptable laboratory conducting tests for LS-601 and LS-602 shall be one that holds a valid certificate from CCIL as Type C. Testing for LS-601 and LS-602 shall be conducted by qualified laboratory staff who hold a valid certificate from CCIL in aggregate testing. Testing for LS-609 shall be conducted by a person holding a valid certificate from CCIL showing them qualified in petrographic examination.

Equivalent alternate laboratory and technician certifications or laboratory proficiency sample testing programs may be used to demonstrate similar requirements, provided they are acceptable to the Owner.

336.05 MATERIALS

336.05.01 Polymer Modified Emulsified Asphalt

The emulsified asphalt shall be CSS-1H emulsion according to OPSS 1103 with a quick set polymer modifier and meeting the requirements of Table 2.

The polymer modifier shall be a minimum of 3% polymer solids by mass of asphalt cement residue in the emulsion.

The emulsion shall be homogeneous after mixing. To facilitate sampling and testing, the emulsion shall be stable for 14 Days after delivery to the job site. The polymer material shall be milled or blended into the asphalt cement or blended into the emulsifier solution prior to the emulsification process. The addition of polymers or other additives after the manufacture of the polymer modified emulsified asphalt is not permitted.

336.05.02 Aggregates

Aggregates shall be according to OPSS 1001.

Aggregates shall meet the requirements of Table 3. Aggregates for micro-surfacing Type II shall meet the requirements for a high traffic volume application.

Aggregates shall meet the gradation requirements of Table 4.

336.05.03 Mineral Filler

Mineral filler shall be Portland cement, Type GU, GL, according to OPSS 1301.

336.05.04 Water

The water shall be free of harmful salts and contaminants.

336.05.05 Mix Additives

Additives shall be compatible with the other components of the micro-surfacing mix.

336.05.06 Tack Coat

Tack coat shall be the same polymer modified emulsified asphalt used in the micro-surfacing mix and diluted to 1 part emulsion to 3 parts water by volume.

336.06 EQUIPMENT

336.06.01 Rotary Power Brooms

Rotary power brooms shall be capable of cleaning gravel, sand, dirt, and other debris from the roadway surfaces.

336.06.02 Mixing Equipment

The mixing equipment shall be specifically designed and manufactured to mix and place micro-surfacing material. Materials shall be mixed by an automatic sequenced, self-propelled, continuous flow micro-surfacing mixing machine. The mixing unit shall be capable of accurately delivering and proportioning the aggregate, emulsified asphalt, mineral filler, additives, and water to a revolving multi-blade double shaft mixer and discharging the mixed product in a continuous flow. The mixing equipment shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, additives, and water to maintain an adequate supply to meet mix design proportions.

336.06.03 Proportioning Devices

Individual volume or weight controls for proportioning aggregate, mineral filler, emulsified asphalt, additives, and water to be added to the mix shall be provided and properly marked.

336.06.04 Spreading Equipment

The mix shall be spread uniformly by means of a conventional augured surfacing spreader box attached to the mixing machine and equipped with paddles to agitate and spread the mix evenly throughout the box. A front seal shall be provided to ensure no loss of the mix at the pavement contact point. The rear seal shall act as final strike-off and shall be adjustable. The spreader box and rear strike off shall be designed to ensure that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall be equipped with a suitable means to adjust the box to compensate for variations in the pavement geometry. Rut filling spreader boxes shall be specifically designed for rut filling applications.

The spreading equipment shall be capable of being re-supplied with the micro-surfacing materials within the working lane to continuously place micro-surfacing for a minimum 2-lane-km distance. The machine shall be equipped to allow the operator to have full control of the forward and reverse speeds during application of the micro-surfacing.

336.06.05 Pilot Vehicle

The pilot vehicle shall be according to the requirements of the OTM, Book 7.

336.07 CONSTRUCTION

336.07.01 Operational Constraints

Micro-surfacing shall be placed only when the atmospheric temperature is at least 10 °C and rising and the weather is free of fog or rain and there is no forecast of temperatures below 0 °C within 24 hours from the time of application. The mix proportions shall be adjusted when weather conditions prolong opening to traffic beyond one hour.

Micro-surfacing shall commence no earlier than May 15 and shall be completed no later than September 30.

Traffic, including construction traffic, shall be kept off the freshly placed mixture to prevent damage to the surface and vehicles.

The Contractor shall delineate the centreline with short term pavement markings at the end of each Day of micro-surfacing placement. Short term pavement markings shall be according to OPSS 710.

336.07.02 Trial Area

A trial area 100 m in length and one lane wide shall be placed at the commencement of the micro-surfacing operation to demonstrate the ability to produce micro-surfacing in conformance with this specification. Within 1 hour of placement, the Contract Administrator shall inspect the micro-surfacing for conformance. The trial areas shall be repeated until the micro-surfacing meets the requirements of this specification. The location of the trial area shall be approved by the Contract Administrator.

336.07.03 Surface Preparation

The area to be surfaced shall be thoroughly cleaned using a rotary power broom to remove all sand, dirt, and other debris. Areas inaccessible to a rotary power broom shall be manually cleaned.

Existing crack sealing material shall be removed.

Existing durable pavement markings shall be removed.

Existing pavement surfaces to receive micro-surfacing shall be tack coated. Surfaces to be tack coated shall be free of standing water and contamination, such as mud, loose aggregate, and debris. Tack coat shall be applied at a rate of 0.25 to 0.40 kg/m² as determined by the Contractor based on the condition of the existing pavement surface. Tack coating shall be allowed to cure sufficiently before application of micro-surfacing.

Tack coat shall not be applied to existing pavement surfaces specified in the Contract Documents. Where tack coating is not required, water shall be applied to the pavement surface immediately ahead of the spreader to dampen the pavement surface without allowing any free-standing or free-flowing water.

All roadway appurtenances within the area of micro-surfacing shall be properly covered and protected immediately prior to placement of the micro-surfacing.

336.07.04 Mix Application

Micro-surfacing shall be placed as a scratch and surface coat or a surface coat only, as specified in the Contract Documents.

Additives may be added to the micro-surfacing mix during construction to provide control of the quick-set properties and to increase adhesion.

A sufficient amount of the mixture shall be carried in all parts of the spreader box at all times so that complete coverage is obtained. Water used to spray the spreader box to facilitate spreading shall not harm the mix. Lumping, balling, or unmixed aggregate shall not be permitted in the finished surface. Any oversized aggregate or foreign materials shall be screened from the aggregate prior to delivery to the mixing equipment.

The application rates for individual coats of micro-surfacing shall meet the requirements of Table 5.

Wheel track ruts of 13 mm or greater in depth shall be filled independently with micro-surfacing using a rut-filling spreader box prior to the application of other micro-surfacing. Ruts greater than 25 mm shall be filled with micro-surfacing applied with two passes of the rut filling spreader box. All rut-filling material shall cure under traffic for at least a 24-hour period before additional material is applied. The minimum width of a rut filling micro-surfacing application shall be 1.5 metres.

When specified, micro-surfacing shall be applied as a scratch coat to fill ruts less than 13 mm in depth, cracks and shallow potholes to leave a uniform surface.

336.07.04.01 Handwork

In restricted areas where hand spreading is necessary, adjustments to the mix formula may be made to retard the setting time. The mixture shall be placed along one edge of the surface to be covered and spread uniformly with squeegees or other suitable Hand Tools.

336.07.04.02 Appearance

Following placement, the micro-surfacing shall have a uniform texture free from excessive scratch marks, tears, indentations, or other surface irregularities. Tear marks or other surface irregularities in any 12 m² area per lane are considered excessive if there are:

- a) four or more marks ≥ 12 mm wide and ≥ 100 mm long.
- b) any marks ≥ 25 mm wide and ≥ 25 mm long.

There shall be no transverse ripples or longitudinal streaks of 6 mm or greater in depth when measured by placing a 3 m straight edge over the finished surface in any direction.

The edges of the micro-surfacing shall be finished uniformly, with a neat appearance along the roadway centreline, lane lines, shoulder, pavement edge, and curb lines.

336.07.04.03 Documentation

A summary of the quantity and application rate of micro-surfacing placed and a list of the quantities used for each of the mix components (i.e., aggregate, emulsified asphalt, water, mineral filler, and additive) shall be submitted daily to the Contract Administrator.

A summary of the station-to-station limits, quantity, and application rate of the tack coat shall be submitted daily to the Contract Administrator.

336.07.04.04 Joints

The longitudinal and transverse joints shall be neat and uniform in appearance, with no excessive build-up. Longitudinal joints shall be placed on lane lines.

The longitudinal joints in the scratch coat shall be constructed as a butt joint.

The longitudinal joint in the surface course shall have an overlap of 50 to 100 mm.

336.07.05 Clean Up

All areas not to be micro-surfaced, such as shoulders, ditches, and gutters, shall have the micro-surfacing material removed on a daily basis.

Appurtenances shall be free of micro-surfacing and left in operable condition.

336.07.06 Traffic Convoy

The Contractor shall convoy traffic according to the OTM, Book 7.

The pilot vehicle shall guide one-way traffic through or around construction. The maximum speed of the convoy shall be 30 km/h. Convoying shall be maintained until such time as the micro-surfacing mixture is able to carry traffic without damage.

336.07.07 Repairs

All repairs to address appearance deficiencies described in the Appearance clause shall consist of an additional application of micro-surfacing for the full lane width over the length of deficiency.

The length of repair shall be sufficient to eliminate all appearance deficiencies. If the distance between repair areas is less than 3 m, then the adjacent repairs shall be treated as one repair.

336.07.08 Management of Excess Material

Management of excess material shall be as specified in the Contract Documents.

336.08 QUALITY ASSURANCE

336.08.01 Sampling and Testing

Sampling shall be conducted by the Contractor according to LS-625. Quality assurance (QA) samples shall be taken from stockpiles of aggregate to be used in the Work. Sampling locations shall be determined by the Contract Administrator.

Duplicate samples shall be obtained and sealed by the Contractor in the presence of the Contract Administrator. One of the duplicate samples shall be randomly selected for testing by the QA laboratory and the remaining sealed sample shall be retained by the QA laboratory for possible referee testing. In the event that the Contractor is unavailable to take the sample, no further material shall be placed in the Work until the QA sample has been taken. Samples shall be of sufficient mass of the material to conduct the necessary gradation and physical property tests.

All QA samples shall be delivered by the Contractor, within 24 hours of sampling, to a location specified in the Contract Documents.

Notwithstanding the requirements for QA sampling as indicated in this specification, the Owner reserves the right to obtain a QA sample at any time without notice.

336.08.02 Warranty Requirements

336.08.02.01 Warranty Period

The Warranty Period shall be 24 months.

336.08.02.02 Completion of Warranty Period

At the end of the Warranty Period, the work shall meet the provisions of the Performance Requirements clause in order for the Contractor to be released from responsibility and ensure return of the performance bond or letter of credit or certified cheque.

336.08.02.03 Distress Survey

The Owner shall complete a distress survey in accordance with the severity and density definitions provided in SP-024 after the end of 1 year and a second distress survey a minimum of 45 Days prior to the end of the Warranty Period. The results of both surveys shall be sent to the Contractor.

If the Owner determines that the distresses pose a hazard to the travelling public at any time during the Warranty Period, the Contractor shall be required to make the repairs in accordance with this specification within 2 weeks of being notified. Repairs shall be made to the approval of the Owner.

336.08.02.04 Performance Requirements

At the end of the Warranty Period, the micro-surfacing shall be free from any aggregate loss or ravelling that is slight to very severe and from flushing that is moderate to very severe. The density of flushing that is very slight to slight shall not be greater than intermittent.

If the micro-surfacing does not meet these performance requirements, the necessary repair or replacement methods shall be according to Table 6. Repairs shall be made to the approval of the Owner.

The length of repair shall be sufficient to eliminate all surficial defects as described. If the distance between repair areas is less than 3 m, then the adjacent repairs shall be treated as one repair.

336.09 MEASUREMENT FOR PAYMENT

336.09.01 Actual Measurement

**336.09.01.01 Micro-Surfacing Type II
Micro-Surfacing Type III Modified
Micro-Surfacing Type III**

Measurement of the micro-surfacing placed shall be by area in square metres.

336.10 BASIS OF PAYMENT

**336.10.01 Micro-Surfacing Type II - Item
Micro-Surfacing Type III Modified - Item
Micro-Surfacing Type III - 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.

All costs associated with repairing and replacing unacceptable trial areas shall be borne by the Contractor.

The accepted trial area shall be paid for at the Contract unit price for micro-surfacing.

Repair, removal, disposal, and replacement of any damaged or defective micro-surfacing shall be at no extra cost to the Owner.

Any work requirements, as determined by the distress survey for repair or replacement of micro-surfacing, shall be completed at no extra cost to the Owner.

All costs for handling and delivery of samples shall be the responsibility of the Contractor.

**TABLE 1
Mix Design Requirements**

Test Method	Description	Requirements
ISSA TB-139	Wet cohesion - @ 30 minutes min. (Set) - @ 60 minutes min. (Traffic)	12 kg-cm minimum 20 kg-cm minimum
ISSA TB-109	Excess asphalt by LWT sand adhesion	538 g/m ² maximum
ISSA TB-114	Wet stripping	90% minimum
ISSA TB-100	Wet track abrasion loss-one hour soak Loss-six day soak	538 g/m ² maximum 807 g/m ² maximum
ISSA TB-147 Method A	Lateral displacement Specific gravity after 1000 cycles of 57 kg	5% maximum 2.10 maximum
ISSA TB-144	Classification compatibility	(AAA, BAA) 11 Grade Points minimum
ISSA TB-113	Mix time @ 25 °C	Controllable to 120 seconds minimum

**TABLE 2
Tests on Residue**

Test Method	Description	Requirements
LS-216	Residue by distillation	62% by mass minimum
ASTM D 36	Softening point	57 °C minimum
LS-200	Penetration at (25 °C, 100 g, 5 s)	40 - 90
LS-202	Kinematic Viscosity @ 135 °C	650 mm ² /s minimum

**TABLE 3
Micro-Surfacing Coarse and Fine Aggregates Requirements**

Micro-Surfacing Type	Application	Physical Requirements as Specified in OPSS 1003
II	Low Traffic Volume	Superpave 12.5
II	High Traffic Volume	Superpave 12.5 FC1
III Modified	N/A	Superpave 12.5 FC1
III	N/A	Superpave 12.5 FC1

Note:

- A. Aggregates meeting the physical requirements of Superpave 12.5 aggregates shall be produced from quarried bedrock consisting of 100 % siliceous aggregate determined in accordance with LS-609.

**TABLE 4
Gradation Requirements**

Percent Passing, LS-602			
MTO Sieve Designation	Micro-Surfacing Type II	Micro-Surfacing Type III Modified	Micro-Surfacing Type III
9.5 mm	100	100	100
6.7 mm	--	95-100	--
4.75 mm	90-100	80-95	70-90
2.36 mm	65-90	50-75	45-70
1.18 mm	45-70	33-55	28-50
600 µm	30-50	25-40	19-34
300 µm	18-30	15-30	12-25
150 µm	10-21	7-20	7-18
75 µm	5-15	5-15	5-15

**TABLE 5
Micro-Surfacing Single Layer Application Rates**

Micro-Surfacing Type	Application Rate kg/m²
Type II	5 to 11
Type III and Type III Mod	8 to 16

**TABLE 6
Micro-Surfacing Repair and Replacement Methods**

Surface Defects	Severity	Density	Repair/Replacement Method
Flushing	Very slight to slight	Frequent to throughout	Resurface with one layer of micro-surfacing for a full lane width
	Moderate to very severe	Few to throughout	Removal by milling of all flushed areas for a full lane width and replace with two layers of micro-surfacing.
Aggregate Loss / Ravelling	Slight to moderate	Few to throughout	Resurface with one lift of micro-surfacing for a full lane width.
	Severe to very severe	Few to throughout	Fill in delaminations/potholes with micro-surfacing and resurface with two layers of micro-surfacing.
<p>Note:</p> <p>A. Surface defect definitions according to SP-024.</p>			

Appendix 336-A, November 2018 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

Micro-surfacing is a thin wearing course that seals the pavement surface and improves frictional resistance. Micro-surfacing does not address structural deficiencies.

The designer should specify the following in the Contract Documents:

- Any existing pavement surfaces not requiring tack coat. (336.07.03)
- If the application is to be one or two coats (i.e., scratch and surface or only surface). (336.07.04)
- Location of testing laboratory for sample delivery. (336.08.01)
- Type of micro-surfacing. (336.10.01)

If verbal confirmation of the mix design review and compliance is acceptable or no mix design review is required, the designer should consider deleting the requirement for the Contract Administrator to issue confirmation in writing that the mix design has been reviewed and meets the specified requirements. (336.04.01.01)

For projects with extensive intersection and urban work, the designer should consider deleting the requirement for equipment capable of continuous placement operations and allowing for a truck mounted unit. (336.06.04)

Crack sealant is typically removed prior to micro-surfacing when the crack sealant shows signs of deterioration or debonding. Crack sealant that has been in place less than 1 year can interfere with the micro-surfacing operations. For projects with existing crack sealant, the designer should determine if the crack sealant should be left in place and if so, delete the requirement for the removal of the existing crack sealing material. (336.07.03)

If a thick scratch coat is anticipated, the designer may consider deleting the requirement for tack coat. (336.07.03)

For projects with ruts greater than 13 mm, the designer should consider specifying the locations for the use of a rut-filling spreader box, including the locations for 2 passes of the rut filling spreader box. (336.07.04) When the average rut depth is greater than 20 mm, the designer should consider requiring a coarse aggregate gradation (Type III gradation) for rut fill mix.

For projects where a traffic convoy is not feasible or desired, the designer should consider deleting the requirement for a traffic convoy. (336.07.06)

If the forms in Appendices 336-B, 336-C, or 336-D are to be used for submission purposes rather than the MTO forms, they need to be invoked by reference in the Contract Documents and a special provision should be written to delete the MTO forms from the specification.

Typically two coats (i.e., scratch and surface coats) are specified to remove severe surface defects.

This specification should not be used in areas with the prevalence of studded tires or where pavements exhibit high deflection.

Appendix 336-A

Type II micro-surfacing with Superpave 12.5 quality aggregate is used on local residential streets and low volume arterial and collectors. Type II micro-surfacing with Superpave 12.5 FC1 quality aggregate is used on higher volume arterials and collectors. Type III micro-surfacing is used on freeways and other high speed, high volume roads. Type III Modified micro-surfacing is used in lieu of Type III micro-surfacing to reduce traffic generated noise.

Micro-surfacing should be carried out in warm dry weather.

Micro-surfacing should be carried out between May 15 and September 30.

Routing and crack sealing should not be carried out prior to micro-surfacing.

Quality of micro-surfacing is critically dependent on appropriate mix design, equipment, and construction experience.

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

No information provided here.

**Appendix 336-B, November 2018
FOR USE IN MUNICIPAL CONTRACTS, WHEN REFERENCED IN THE CONTRACT DOCUMENTS**

Note: This is a non-mandatory Additional Information Appendix intended to provide supplementary requirements for the OPS specification in a municipal contract, when the appendix is invoked by the Owner. It is written in mandatory language to permit invoking it by reference in the Contract Documents. If the appendix has not been invoked by reference in the Contract Documents, it does not apply.

Hot Mix Asphalt Fine Aggregate Test Data - Physical Properties

Municipality:		Consultant:	
Contract Name:			
Contract No.:	Contractor:	Contract Location:	
Testing Laboratory:		Telephone No.:	Fax No.:
Sampled by:		Date Sampled:	___ QC
Mix Type:	Lot No.:	Quantity (tonnes):	QA: ___ Stockpile ___ Cold Feed
Source Name:			Aggregate Inventory No.:

Laboratory Test and Number	Requirement			Test Result		
	SMA, DFC, OFC, & Superpave 12.5FC2	HL1, HL3, & Superpave 12.5FC1	HL2, HL4, HL8, HD8C, MD8C, & Superpave 9.5, 12.5, 19.0, 25.0, 37.5	Reference Material	Sample	Meets Requirement (Y/N)
Micro-Deval Abrasion loss, % maximum, LS-619 (Note 1)	15	20	25			
Plasticity Index, maximum, LS-704	0	0	0			

Note:

1. For blended aggregates sampled from the cold feed, the Micro-Deval Abrasion loss of each individual fine aggregate in stockpile, prior to blending, shall not exceed 35 percent.

Issued By:

PRINT NAME	TESTING LABORATORY REPRESENTATIVE SIGNATURE	DATE

Received By:

PRINT NAME	CONTRACT ADMINISTRATOR REPRESENTATIVE SIGNATURE	DATE

Copies to: Contract Administrator Contractor Municipality

Appendix 336-C, November 2018

FOR USE IN MUNICIPAL CONTRACTS, WHEN REFERENCED IN THE CONTRACT DOCUMENTS

Note: This is a non-mandatory Additional Information Appendix intended to provide supplementary requirements for the OPS specification in a municipal contract, when the appendix is invoked by the Owner. It is written in mandatory language to permit invoking it by reference in the Contract Documents. If the appendix has not been invoked by reference in the Contract Documents, it does not apply.

Hot Mix Asphalt Coarse Aggregate Test Data - Physical Properties

Municipality:		Consultant:	
Contract Name:			
Contract No.:	Contractor:	Contract Location:	
Testing Laboratory:		Telephone No.:	Fax No.:
Sampled by:		Date Sampled:	___QC
Mix Type:	Lot No.:	Quantity (tonnes):	QA: ___Stockpile ___Cold Feed
Source Name:			Aggregate Inventory No.:

Requirement: HL1, SMA, DFC, OFC, and Superpave 12.5FC1, 12.5FC2						Test Result		
Laboratory Test and Number	Gravel	Quarry Rock				Reference Material	Sample	Meets Requirements (Y/N)
	HL1 & 12.5FC1 only	Dolomitic Sandstone (D)	Traprock, Diabase & Andesite (T)	Meta-Arkose & Gneiss (M)	Rock Type (Note 1)			
Wash Pass 75 µm Sieve, % maximum, LS-601 (Note 2)	1.0	1.0	1.0	1.0				
Absorption by mass, % maximum, LS-604	1.0	1.0	1.0	1.0				
Flat and Elongated Particles (4:1), % maximum, LS-608	15	15	15	15				
Petrographic Number (HL), maximum, LS-609	120	145	120	145				
Insoluble Residue, retained 75 µm Sieve, % minimum, LS-613	-	45	-	-				
Unconfined Freeze Thaw Loss, % maximum, LS-614	6	7	6	6				
2 Faces Crushed Particles, % minimum, LS-617 (HL1 only)	80	-	-	-				
Micro-Deval Abrasion Loss, % maximum, LS-618	5	15	10	15				

Appendix 336-C

Requirement: HL3, HL3HS, HL4, HL8, HDDB, MDBD, and Superpave 9.5, 12.5, 19.0, 25.0, 37.5						Test Result		
Laboratory Test and Number	HL3 & HL3HS	HL4 Surface & 12.5 (Note 3)	HL4 Binder, HL8, & 9.5, 19.0, 25.0, 37.5	HDDB	MDBD	Reference Material	Sample	Meets Requirements (Y/N)
Wash Pass 75 µm Sieve, % maximum, LS-601 (Note 4)	1.3/2.0	1.3/2.0	1.3/2.0	1.3/2.0	1.3/2.0			
Absorption by mass, % maximum, LS-604	1.75	2.0	2.0	2.0	2.0			
Percent Crushed Particles, % minimum, LS-607 (Note 5)	60 / 80	60 / 80	60 / 80	-	-			
Flat and Elongated Particles (4:1), % maximum, LS-608 (Note 6)	20	20	20	15	15			
Petrographic Examination, % non-carbonate ret 4.75 mm, LS-609	(Note 7)		-	-	-			
Unconfined Freeze-Thaw loss, % maximum, LS-614	6	6	15	15	15			
2 Faces Crushed Particles, % minimum, LS-617 (Note 8)	-	-	-	95	80			
Micro-Deval Abrasion loss, % maximum, LS-618	17	17	21	21	21			
MgSo ₄ Soundness loss, % maximum, LS-606 (Note 9)	12	12	15	15	15			

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Notes:

- Enter the type of rock or material used in the mix as follows:
 D - dolomitic sandstone
 T - traprock, diabase, andesite
 M - meta-arkose, gneiss
- HL1, SMA, DFC, OFC and Superpave 12.5FC1, 12.5FC2 only: When control charts (n>20) are used for LS-601, the average value shall not exceed the specification maximum (1.0%) with no single value greater than 1.4%.
- These physical requirements for HL4 apply where the asphaltic concrete forms the surface upon which vehicular traffic will directly travel, otherwise, the physical requirements for HL4 Binder apply.
- HL3, HL4, HL8, HDDB, MDBD and Superpave 9.5, 12.5, 19.0, 25.0, 37.5 only: When control charts (n>20) are used for LS-601, the average value shall not exceed 1.3% with no single value greater than 1.7%. When quarried rock is used, a maximum of 2.0% passing the 75 µm sieve is permitted. When control charts (n>20) are used for LS-601 for quarried rock, the average value shall not exceed 2.0%, with no single value greater than 2.4%.
- HL3, HL4, HL8, HDDB, MDBD only: For hot mix aggregates used on 400 series highways and Highways 3, 6, 7, 10, 11, 12, 17, 26, 28, 35, 61, 69, 102, and 115, the minimum percent crushed particles is 80%.
- For Superpave 9.5, 19.0, 25.0, and 37.5 only: Where HDDB and MDBD mixes have historically been used, this requirement is reduced to 15%. Check Contract Documents for this requirement.

Appendix 336-C

7. This requirement is applicable to surface course aggregates in the area to the north and west of a boundary defined as follows: the north shore of Lake Superior, the north shore of the St. Mary's River, the south shore of St. Joseph Island, the north shore of Lake Huron easterly to the north and east shore of Georgian Bay (excluding Manitoulin Island), along the Severn River to Washago and a line easterly passing through Norland, Burnt River, Burleigh Falls, Madoc, and hence easterly along Highway 7 to Perth and northerly to Calabogie and easterly to Arnprior and the Ottawa River.
 - a. When the coarse aggregate for surface course mix is obtained from a gravel pit or quarry containing more than 40% limestone and dolostone in the retained 4.75 mm portion of the coarse aggregate, then blending with aggregate of non-carbonate rock type shall be required. The blend shall be such as to increase the non-carbonate rock type content of the coarse aggregate to 60% minimum of the retained 4.75 mm portion, as determined by petrographic examination (LS-609). The method of blending shall be such as to produce uniform blending and shall be subject to approval by the Owner. In cases of dispute, the acid insoluble residue test shall be used (LS-613) with a minimum acid insoluble residue of 60%.
 - b. When the coarse aggregate for surface course mix is obtained from a non-carbonate source, blending with carbonate rocks (Limestone and dolostone) shall not be permitted.
8. This only applies to HDBC and MDBC coarse aggregate crushed from gravel sources. Maximum allowable amount of uncrushed particles is 5% (MDBC only).
9. Compliance with this requirement is waived if the aggregate meets the alternative unconfined freeze-thaw requirement (LS-614).

Appendix 336-D, November 2018

FOR USE IN MUNICIPAL CONTRACTS, WHEN REFERENCED IN THE CONTRACT DOCUMENTS

Note: This is a non-mandatory Additional Information Appendix intended to provide supplementary requirements for the OPS specification in a municipal contract, when the appendix is invoked by the Owner. It is written in mandatory language to permit invoking it by reference in the Contract Documents. If the appendix has not been invoked by reference in the Contract Documents, it does not apply.

Hot Mix Asphalt Superpave Aggregate Test Data - Consensus Properties

Municipality:		Consultant:	
Contract Name:			
Contract No.:	Contractor:	Contract Location:	
Testing Laboratory:		Telephone No.:	Fax No.:
Sampled by:		Date Sampled:	___QC
Mix Type:	Lot No.:	Quantity (tonnes):	QA: ___Stockpile ___Cold Feed
Source Name:			Aggregate Inventory No.:

FINE AGGREGATE								
Source Name/Location:						Aggregate Inventory Number (AIN):		
Laboratory Test and Number		Requirement					Test Result	
		Traffic Level Category					Sample	Meets Requirements (Y/N)
		A	B	C	D	E		
Uncompacted Voids, % minimum, AASHTO T304	≤100 mm (Note 1)	-	40	45	45	45		
	>100 mm (Note 1)	-	40	40	40	100/100		
Sand Equivalent, % minimum, AASHTO T176 (Notes 2, 3)		-	40	40	40	45		

COARSE AGGREGATE								
Source Name/Location:						Aggregate Inventory Number (AIN):		
Laboratory Test and Number		Requirement					Test Result	
		Traffic Level Category					Sample	Meets Requirements (Y/N)
		A	B	C	D	E		
Fractured Particles, % minimum, ASTM D 5821 (Note 3)	≤100 mm (Note 1)	55/-	75/-	85/80	95/90	100/100		
	>100 mm (Note 1)	-	50/-	60/-	80/75	100/100		
Flat and Elongated particles (5:1), % minimum, ASTM D 4791		-	10					

Appendix 336-D

Notes:

1. Denotes the depth of the top of lift below final pavement surface. If less than 25% of a layer is within 100 mm of the surface, the layer may be considered to be below 100 mm.
2. This requirement is waived for total fine aggregate containing RAP.
3. A minimum uncompacted void content of 43% is acceptable provided that the selected mix satisfies the mix volumetrics specified elsewhere in the Contract Documents.
4. 85/80 denotes that 85% of the coarse aggregate has one fractured face and 80% has two or more fractured faces.

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