CONSTRUCTION SPECIFICATION FOR SLURRY SEAL

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337.01 SCOPE

This specification covers the requirements for slurry seal and includes all surface preparation, material application, handwork, joints, protection while curing, clean up, and provision for a trial area.

337.01.01 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 according to the Contract Documents.

337.01.02 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.

337.02 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, Material

OPSS 1001	Aggregates - General
OPSS 1003	Aggregates - Hot Mix Asphalt
OPSS 1103	Emulsified Asphalt
OPSS 1301	Cementing Materials
OPSS 1302	Water

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:
LS 602 - Sieve Analysis of Aggregates

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

ASTM International

D 3910-15 Standard Practices for Design, Testing and Construction of Slurry Seal

International Slurry Surfacing Association (ISSA)

TB 106-90 Measurement of Slurry Seal Consistency
TB 109-2005 Test Method for Measurement of Excess Asphalt in Bituminous Mixtures by Use of a Loaded Wheel Tester and Sand Adhesion
TB 114-90 Wet Stripping Test for Cured Slurry Seal Mix
TB 115-90 Determination of Slurry System Compatibility
TB 139-90 Test Method to Classify Emulsified Asphalt/Aggregate Mixture Systems by Modified Cohesion Tester Measurement of Set and Cure Characteristics

337.03 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.

Slurry Seal means a homogeneous mixture of emulsified asphalt, fine aggregates, water, mineral filler, and, if required, additive. This mixture is applied in a cold fluid state on a prepared bituminous surface.

337.04 DESIGN AND SUBMISSION REQUIREMENTS

337.04.01 Design Requirements

A laboratory that is equipped and staffed to carry out slurry seal mix designs with, as a minimum, a current CCIL Type C Certification or an equivalent laboratory shall designate the mix proportions and prepare the job mix formula.

The compatibility of the aggregate and the 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.

Slurry seal shall only be placed after the Contract Administrator has issued confirmation in writing that the mix design has been reviewed and meets the specified requirements.

The mix design proportions shall be within the following limits:

Residual Asphalt:

Slurry Seal - Type I	10 to 16% by dry mass of aggregate
Slurry Seal - Type II	7.5 to 13.5% by dry mass of aggregate
Slurry Seal - Type III	6.5 to 12% by dry mass of aggregate

Mineral Filler:

0.5 to 2.0% by dry mass of aggregate

The slurry seal material shall be designed to carry traffic within 4 hours of placement.

337.04.02 Submission Requirements

337.04.02.01 Mix Design

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

337.05 MATERIALS

337.05.01 Emulsified Asphalt

The emulsified asphalt shall be specially designed for slurry seal work and shall meet the requirements of OPSS 1103.

337.05.02 Aggregates

The aggregates shall be according to Table 2 and OPSS 1001. The aggregate shall meet the physical requirements of Superpave 12.5 mix for the traffic category specified in the Contract Documents according to OPSS 1003, except that the maximum absorption for coarse aggregate shall not be more than 1.75%.

337.05.03 Mineral Filler

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

337.05.04 Water

The water shall be free of harmful salts and contaminants, according to OPSS 1302.

337.05.05 Mix Additives

Additives may be added to the slurry seal mix during construction to provide control of the quick-set properties and to increase adhesion. Additives shall be compatible with the other components of the slurry seal mix.

337.05.06 Tack Coat

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

337.06 EQUIPMENT

337.06.01 Rotary Power Brooms

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

337.06.02 Mixing and Spreading Equipment

Mixing equipment shall be specifically designed and manufactured to mix slurry seal material.

Spreading equipment shall be designed to apply a fine mist of water on the road surface immediately prior to placement of slurry seal.

The spreading equipment shall also have a spreader box and rear strike-off and be designed and operated to ensure that a uniform consistency is achieved and 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. The spreader box shall be capable of spreading slurry in one pass at varying widths up to 3.75 m.

337.06.03 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.

337.06.04 Pilot Vehicle

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

337.07 CONSTRUCTION

337.07.01 Operational Constraints

Slurry seal 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.

Slurry seal 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.

337.07.02 Trial Area

A trial area 100 m in length and one lane wide shall be placed at the commencement of the slurry seal operation, to demonstrate the ability to produce slurry seal according to this specification. Within 4 hours of placement, the Contract Administrator shall inspect the slurry seal for conformance. The trial area shall be repeated until the slurry sealing meets the requirements of this specification. The location of the trial area shall be approved by the Contract Administrator.

337.07.03 Surface Preparation

The area to be surfaced shall be thoroughly cleaned using a rotary power broom. Areas inaccessible to the rotary power broom shall be cleaned manually.

Existing durable pavement markings shall be removed.

When specified in the Contract Documents, all existing pavement surfaces to receive slurry seal 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/m^2 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 slurry seal.

All roadway appurtenances within the area to receive slurry seal shall be properly covered and protected immediately prior to the placement of the slurry seal.

337.07.04 Mixture Application

Slurry seal shall be placed according to the application rates specified in Table 3.

337.07.05 Handwork

Areas which cannot be reached with the slurry seal spreading equipment shall be surfaced using hand squeegees to provide complete and uniform slurry seal coverage. The area to be hand worked shall be lightly dampened prior to slurry seal placement and the slurry seal applied concurrent with adjacent machine applied slurry seal.

337.07.06 Appearance

Following placement the slurry seal shall have a uniform texture, free from excessive scratch marks, tears, indentations, or other surface irregularities. Tear marks in any 12 m^2 area per lane are considered excessive if there are:

a) Four or more marks $\geq$ 12 mm wide and $\geq$ 100 mm long

b) Any marks $\geq$ 25 mm wide and $\geq$ 25 mm long

There shall be no longitudinal ripples, raking, wash-boarding, chatter, or other irregularities that affect the ride quality.

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

337.07.07 Documentation

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

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

337.07.09 Clean Up

All areas not to be slurry sealed, such as shoulders, ditches, and gutters, shall have the slurry seal material removed on a daily basis. Appurtenances shall be free of slurry seal and left in operable condition.

337.07.10 Repairs

Damaged slurry sealed surfaces shall be repaired.

Repairs to address appearance deficiencies described in the Appearance subsection shall consist of an additional application of slurry seal 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, these repair areas shall be treated as one continuous repair.

337.07.11 Traffic Convoy

When specified in the Contract Documents, traffic shall be convoyed 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 slurry seal is able to carry traffic without damage.

337.07.12 Management of Excess Material

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

337.08 QUALITY ASSURANCE

337.08.01 Sampling

The aggregate shall be stockpiled 2 weeks prior to construction for sampling and testing. Samples for gradation testing shall be taken from the stockpile as determined by the Contract Administrator.

337.09 MEASUREMENT FOR PAYMENT

337.09.01 Actual Measurement

337.09.01.01 Slurry Seal - Type I
Slurry Seal - Type II
Slurry Seal - Type III

Measurement of the slurry seal placed shall be by area in square metres with no deductions for appurtenances.

337.09.01.02 Plan Quantity Measurement

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

337.10 BASIS OF PAYMENT

337.10.01 Slurry Seal - Type I - Item
Slurry Seal - Type II - Item
Slurry Seal - 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.

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

The accepted trial area shall be paid for at the tender unit price for slurry seal. All costs associated with unacceptable trial areas shall be borne by the Contractor at no extra cost to the Owner.

TABLE 1
Mix Design Requirements

Test Method	Description		Requirements	
			Minimum	Maximum
ISSA TB-106	Slurry Seal Consistency, cm		2	3
ISSA TB-109	Excess Asphalt, g/m^2		550	750
ISSA TB-114	Wet Stripping, % Retained Coating		90	100
ISSA TB-115	Compatibility		Pass Tests (Note 1)	
ASTM D 3910	Wet Track Abrasion, g/m^2		---	800
ISSA TB-139	Set and Cure Characteristics			
	Set Time	12 kg-cm minimum @ 30 minutes		
	Traffic Time	20 kg-cm minimum @ 240 minutes		

Note:

1. Mixing tests must pass at the maximum expected air temperature.

TABLE 2
Slurry Seal Aggregate Gradation Requirements, LS-602

MTO Sieve Designation	Type I Percent Passing	Type II Percent Passing	Type III Percent Passing
9.5 mm	100	100	100
4.75 mm	100	90 - 100	70 - 100
2.36 mm	90 - 100	65 - 90	45 - 70
1.18 mm	65 - 90	45 - 70	28 - 50
600 μm	40 - 65	30 - 50	19 - 34
300 μm	25 - 42	18 - 30	12 - 25
150 μm	15 - 30	10 - 21	7 - 18
75 μm	10 - 20	5 - 15	5 - 15

TABLE 3
Slurry Seal Application Rates

Slurry Seal Type	Application Rate kg/m^2
Type I	4.3 to 6.5
Type II	5.4 to 9.8
Type III	8.1 to 12.0

Appendix 337-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

The designer should specify the following in the Contract Documents:

- Traffic category. (337.05.02)

The designer should determine if the following is required and, if so, specify it in the Contract Documents:

- Tack coat. (337.07.03)

- Traffic convoy. (337.07.11)

Slurry seal is specified to seal the surface, prevent ravelling, and improve frictional characteristics. It is not intended to increase the structural strength of pavement. Pavements that are structurally deficient or exhibiting severe distress should be sealed and distortions repaired prior to slurry seal application. A detailed pavement condition investigation should be carried out to determine the appropriateness of specifying slurry seal.

The three generally accepted types of slurry seal are:

Type I - is a fine gradation mix for sealing low volume residential road surfaces.

Type II - is a medium gradation mix used for sealing road surfaces on moderate volume residential road surfaces.

Type III - is a coarse gradation mix used to improve skid resistance on moderate volume municipal road surfaces.

Selection of slurry seal type is dependent on traffic volumes and surface friction requirements.

Where slurry seal is considered for higher volume roadways, the use of a premium aggregate or micro-surfacing is recommended.

Normally, tack coat is not required unless the surface to be covered is extremely dry and ravelled or it is concrete or brick.

Traffic should be prohibited from the finished surface for a period of up to four hours to permit the slurry seal to cure. This may necessitate a separate pay item for traffic control.

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.