Note: The MUNI implemented in November 2021 replaces OPSS 309 COMMON, November 2013 with no technical content changes

CONSTRUCTION SPECIFICATION FOR COLD MIXED, COLD LAID, OPEN AND DENSE GRADED BITUMINOUS MIX

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309.01 SCOPE

This specification covers the requirements for production and placement of cold mixed, cold laid, open, and dense graded bituminous mix and cover aggregate.

309.01.01 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.

309.01.02 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.

309.02 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 304	Single and Double Surface Treatment
OPSS 310	Hot Mix Asphalt

Ontario Provincial Standard Specifications, Material

OPSS 1003	Aggregates - Hot Mix Asphalt
OPSS 1006	Aggregates - Surface Treatment
OPSS 1103	Emulsified Asphalt

Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-263	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
LS-265	Percent Air Voids in Compacted Dense Bituminous Pavement Mixtures
LS-266	V.M.A. in Compacted Bituminous Mixtures
LS-281	Percent Compaction of Compacted Bituminous Pavement Mixtures
LS-282	Quantitative Extraction of Asphalt Cement and Analysis of Extracted Aggregate from Bituminous Paving Mixtures
LS-301	Mix Design for Cold Mixed Dense Graded Bituminous Mixtures
LS-302	Coating Dense Graded Aggregates
LS-303	Percent Moisture Pickup in Compacted Dense Graded Bituminous Mixtures
LS-304	Coating Open Graded Aggregates
LS-305	Run Off for Open Graded Mixtures
LS-602	Sieve Analysis of Aggregates

309.03 DEFINITIONS

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

CL mix means cold mixed, cold laid, open, or dense graded bituminous mix.

Fat Spot means an area of pavement substantially blacker than the surrounding pavement.

Segregation means a condition of the pavement characterized by areas with comparatively coarser or finer texture than that of the surrounding pavement.

309.04 SUBMISSION AND DESIGN REQUIREMENTS

309.04.01 Mix Design

The CL mix design shall be the responsibility of the Contractor. The proposed mix proportions corroborated by submission of the design proposed by the Contractor as determined by the supplier of the asphalt emulsion shall be forwarded to the Contract Administrator five Business Days before the start of production.

Mix proportions shall be determined using MTO test methods LS-301, LS-302, LS-304, and LS-305.

Aggregate samples shall be representative of the materials to be used and have proven compatibility, workability, and acceptable curing time with the emulsified asphalt selected.

309.05 MATERIALS

309.05.01 Emulsified Asphalt

The emulsified asphalt shall be according to OPSS 1103. The emulsified asphalt content shall be determined by laboratory testing and shall be within the limits set out in Table 1.

309.05.02 Aggregates

Aggregates shall meet the requirements of OPSS 1003 except that the gradations of open graded aggregates shall be according to Table 2 and dense graded aggregates shall be according to Table 3.

Sufficient aggregate to complete the work shall be stockpiled at least one week prior to use.

The cover aggregate shall be Class 4 aggregate according to OPSS 1006.

309.05.03 Cold Mixed, Cold Laid, Open and Dense Graded Bituminous Mix

309.05.03.01 General

The CL mix shall show good asphalt dispersion, uniform coating, and cohesion.

309.05.03.02 Open Graded Mix

The cure time for open graded mix shall be such that the asphalt cement residue in the emulsion will not wash off the aggregate, if water is applied one hour after compaction of the mix.

309.05.03.03 Dense Graded Mix

Dense graded mix shall be according to Table 4.

309.06 EQUIPMENT

309.06.01 Production and Placement

Mobile or stationary mixing plants shall be capable of producing a uniform thoroughly blended CL mix consisting of aggregate and emulsified asphalt. The aggregate feed system to the mixing unit shall be equipped with a means of determining the mass of material being deposited into the mixing unit prior to the addition of the emulsified asphalt. The mixing unit shall be capable of continuously maintaining the amount of emulsified asphalt added within $\pm$ 0.2% of the aggregate by weight. All measuring devices shall be calibrated according to the manufacturer's specifications at the start of the Contract and whenever deemed necessary by the Contract Administrator. The emulsified asphalt supply system shall be equipped with a flow meter and a total delivery meter.

A Midland Mix Paver or a central mixing plant, according to the Cold Mix Plants subsection, will be considered acceptable equivalents for the production of CL mixes.

Production equipment shall be properly equipped and adjusted to provide a CL mix according to this specification.

Mechanical pavers may be used to place CL mixes produced in a central mix plant and shall be according to the Paving Equipment clause of OPSS 310.

309.06.02 Cold Mix Plants

309.06.02.01 General Requirements

The equipment shall be such that the CL mix produced meets this specification and shall demonstrate adequate control and documentation of the CL mix materials for monitoring and production purposes.

309.06.02.02 Emulsified Asphalt Storage

A suitable holding tank, which has been thoroughly cleaned of any other material, shall be used.

309.06.02.03 Aggregate Feed System

A separate tapered cold feed bin with a minimum capacity of 6.0 m^3 shall be provided for each size, type, or gradation of aggregate. Partitions of sufficient height to eliminate intermingling of the aggregate shall be provided between adjoining bins. Bins shall be a minimum of 0.5 m wider than the width of the loading buckets.

A permanent scalping screen shall cover the top of each bin to remove any oversize aggregate.

Vibratory pan feeders shall not be acceptable for proportioning aggregates.

A calibrated and manually adjustable feed gate shall regulate the flow of aggregate from each bin to a conveyor feeding the pugmill. The conveyor shall be equipped with a scale indicating tonnes per minute of production and total tonnes.

309.06.02.04 Pugmill

The pugmill shall be an approved twin shaft type with a minimum capacity of 0.6 m^3 and capable of producing a uniform mix. The clearance of the blades from the inner surfaces of the pugmill shall not exceed 20 mm. The paddles shall be of a type adjustable for angular position and reversible to retard the flow of the mix if required.

The mixing time or cycle shall be adjustable.

309.06.02.05 Emulsified Asphalt Pump

The pump shall be a variable speed positive displacement pump that feeds an adjustable spray bar located at the charging end of the pugmill. The pump may also be a positive displacement pump mechanically interlocked to the aggregate feed rate mechanism, in which case, the pump must be equipped with a variable speed control.

The pump shall be equipped with a totalizing type meter with manual reset and shall indicate the flow of emulsion being pumped in litres per minute.

There shall be a satisfactory means of positive control between the flow of aggregate from the hopper and emulsion from the pump. The pump shall be interlocked, either mechanically, electrically, or hydraulically, to the aggregate feed rate control mechanism so that a constant volumetric ratio of emulsion to aggregate is fed to the pugmill.

The system shall be interlocked through a master control switch.

309.06.02.06 Discharge Holding Hopper

The plant shall be equipped with a discharge holding hopper with a minimum capacity of 1.0 tonne. It shall be operated by a control switch on the control station panel.

309.06.03 Rollers

Rollers shall be according to OPSS 310, except that three-wheel rollers will not be allowed.

309.06.04 Cover Aggregate Spreaders

Spreaders shall be according to OPSS 304 or shall be an acceptable tailgate type spreader capable of uniform application without displacement of the CL mix.

Spinner type spreaders are not allowed.

309.07 CONSTRUCTION

309.07.01 Emulsified Asphalt

Emulsified asphalt shall be thoroughly mixed with the aggregate.

309.07.02 Cold Mixed, Cold Laid, Open and Dense Graded Bituminous Mixes

309.07.02.01 Operational Constraints

Traffic shall not be permitted on the CL mix until final rolling is completed and the mix can support traffic loading without deformation.

CL mixes shall not be produced prior to May 15th or when rain is imminent. Except by special permission from the Contract Administrator, dense graded mix shall not be produced after September 15th, and open graded mix shall not be produced after September 30th. In no case shall CL mixes be produced unless the ambient temperature is at least 10 °C and rising.

309.07.02.02 Preparation of the Foundation

309.07.02.02.01 Granular Base

The granular base on which the CL mix is to be placed shall be smooth, true to grade, and free of surface float.

309.07.02.02.02 Pavement

Paved surfaces on which the CL mix is to be placed shall be free of dirt, sand, foreign matter, and loose material.

309.07.02.03 Production and Placement

CL mix of the type specified in the Contract Documents shall be produced and placed in accordance with the requirements of this specification.

When a second course is specified in the Contract Documents, any loose cover aggregate shall be swept from the surface. The previously laid course shall be adequately cured prior to placing the second or surface course.

309.07.02.04 Compaction

309.07.02.04.01 General

Initial rolling shall commence once initial breaking of the asphalt emulsion has occurred and the mix can support the roller without shoving.

Final rolling shall be done using a steel tandem roller after the cover aggregate has been applied.

309.07.02.04.02 Open Graded Mix

Each completed course of open graded mix shall have the following percent air voids in the compacted CL mix as determined by LS-265:

CL2 and CL3 - 15-20% Air Voids
CL4 and CL8 - 20-30% Air Voids

309.07.02.04.03 Dense Graded Mix

Each completed course of dense graded mix shall be compacted to at least 94% of laboratory density as determined LS-281.

309.07.02.05 Trial Application

At the start of the Contract, a trial area, 200 m in length and one traffic lane wide, shall be constructed to demonstrate that equipment, personnel, and methods of operation to be used are capable of producing an acceptable CL mix.

If deficiencies are evident during construction of the trial area, work shall be stopped until the deficiencies are corrected.

309.07.02.06 Surface Tolerance

Each course, after final compaction, shall be smooth and true to the established crown and grade and the surface of each course shall be free from deviations exceeding 6 mm as measured in any direction with a 3 m straight edge.

309.07.02.07 Surface Appearance

Each course, after final compaction, shall be of uniform texture and shall be free of segregation, fat spots, oil spills, or any other defect. Defective areas shall be removed and replaced with acceptable mix of the same type and compacted to the satisfaction of the Contract Administrator.

309.07.02.08 Sampling

Samples of the actual CL mix shall be taken by the Contractor at least twice a day and provided to the Contract Administrator. Each sample shall fill a four-litre pail.

Additional samples shall be provided when requested by the Contract Administrator.

309.07.02.09 Tolerances

The mix samples shall be according to the following tolerances:

Residual asphalt content: $\pm$ 0.3%

Aggregate retained on the 4.75 mm sieve:

For open graded mix $\pm$ 2.0%
For dense graded mix $\pm$ 6.0%

309.07.03 Cover Aggregate

After the initial rolling has taken place, cover aggregate shall be spread uniformly at a rate of 5 $\pm$ 1.5 kg/m^2 over the surface of all open graded mixes and then rolled into the CL mix.

309.07.04 Management of Excess Material

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

309.08 QUALITY ASSURANCE

309.08.01 Testing

The Owner may test any samples required by this specification for conformance to specified requirements.

309.09 MEASUREMENT FOR PAYMENT

309.01.01 Actual Measurement

309.09.01.01 Emulsified Asphalt

Measurement shall be by mass in kilograms according to the requirements of the Contract Documents, except that portable and conveyor scales will not be acceptable for use.

309.09.01.02 **Open Graded CL 2**
Open Graded CL 3
Open Graded CL 4
Open Graded CL 8
Dense Graded CL
Cover Aggregate

Measurement shall be by mass in tonnes according to the requirements of the Contract Documents.

309.10 BASIS OF PAYMENT

309.10.01 **Emulsified Asphalt - Item**
Open Graded CL 2 - Item
Open Graded CL 3 - Item
Open Graded CL 4 - Item
Open Graded CL 8 - Item
Dense Graded CL - Item
Cover Aggregate - 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.

Defective areas shall be removed, replaced with acceptable mix of the same type, and compacted to the satisfaction of the Contract Administrator at no extra cost to the Owner.

TABLE 1
Emulsified Asphalt and Residual Asphalt Content

Type of Mix	Emulsified Asphalt Content kg/t	Residual Asphalt Content by Mass (Note 1)
CL 2 Open Graded, Surface or Levelling Course	69-122	4.5 - 8.0%
CL3 Open Graded, Surface or Levelling Course	65-115	4.2 - 7.5%
CL4 Open Graded, Binder or Levelling Course	61-107	4.0 - 7.0%
CL8 Open Graded, Binder or Levelling Course	55-77	3.5 - 5.0%
Dense Graded	61-107	4.0 - 7.0%

Note:

1. As determined by test LS-282.

TABLE 2
Gradation Requirements for Open Graded Aggregates, LS-602

Sieve Designation	% Passing			
	CL 2	CL 3	CL 4	CL 8
26.5 mm				100
19.0 mm			100	95-100
16.0 mm		100	96-100	65-90
13.2 mm	100	96-100	67-86	-
9.5 mm	75-100	50-73	29-52	20-55
6.7 mm	0-40	-	-	-
4.75 mm	0-10	0-10	0-10	0-10
2.36 mm	0-5	0-5	0-5	0-5
75 μm (Note 1)	0-2	0-2	0-2	0-2

Note:

1. Open graded mix aggregates with more than 2.0% passing the 75 μm sieve will be rejected.

TABLE 3
Gradation Requirements for Dense Graded Aggregates, LS-602

Sieve Designation	% Passing
16.0 mm	100
13.2 mm	75-95
9.5 mm	50-80
4.75 mm	25-50
1.18 mm	10-40
300 μm	2-20
150 μm	0-10
75 μm (Note 1)	0-5

Note:

1. Dense graded mix aggregates can have a maximum variability of 2.0% for material passing the 75 μm sieve.

TABLE 4
Physical Requirements for Cold Mixed Dense Graded Bituminous Mix

Property of Laboratory Compacted Mixtures	Air Cured	Water Cured	MTO Test Method
Marshall Stability, N	4500 Min.	3300 Min.	LS-263
Marshall Flow Units of 0.25 mm	10 Min.	8 Min.	LS-263
% Air Voids	4-12	-	LS-265
% VMA Pass 4.75 mm by Mass			LS-266
25%	12.0	-	
37.5%	13.25	-	
50%	14.5	-	
% by Mass Moisture Pick-up	-	2 Max.	LS-303

Appendix 309-A, November 2021
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:

- Type of CL mix. (309.07.02.03)

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

- Second course of CL mix. (309.07.02.03)

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.