

**Material Specification for
Aggregates Hot Mixed, Hot Laid Asphaltic Concrete**

Table of Contents

TS 1003.01	SCOPE	2
TS 1003.02	REFERENCES	2
TS 1003.03	DEFINITIONS	3
TS 1003.04	DESIGN AND SUBMISSION REQUIREMENTS.....	3
TS 1003.04.01	Submissions	3
TS 1003.04.02	Source(s) of Aggregates	3
TS 1003.04.03	Test Data.....	3
TS 1003.05	MATERIALS	4
TS 1003.05.01	General.....	4
TS 1003.05.02	Fine Aggregate.....	4
TS 1003.05.02.01	Gradation Requirements	4
TS 1003.05.02.02	Physical Requirements.....	5
TS 1003.05.03	Coarse Aggregate.....	5
TS 1003.05.03.01	Gradation Requirements	5
TS 1003.05.03.02	Physical Requirements.....	5
TS 1003.05.04	Filler.....	7
TS 1003.06	LABORATORY TESTING	7
TS 1003.06.01	General.....	7
TS 1003.06.02	Laboratory Requirements	7
TS 1003.07	PRODUCTION.....	9
TS 1003.07.01	Aggregate Processing, Handling and Stockpiling	9
TS 1003.07.02	Quality Control	9
TS 1003.08	QUALITY ASSURANCE.....	9
TS 1003.08.01	General.....	9
TS 1003.08.02	Sampling.....	9
TS 1003.08.03	Testing and Retention of Samples	9
TS 1003.08.04	Acceptance.....	9
TS 1003.08.05	Referee Testing	10
TS 1003.08.06	Disposition of Aggregate(s) Not Accepted.....	10
TS 1003.09	OWNER PURCHASE OF MATERIAL – Not Used.....	11

TS 1003.01 SCOPE

This specification covers the requirements for aggregates for use in hot mixed, hot laid asphaltic concrete.

TS 1003.02 REFERENCES

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

City of Toronto Standard Specifications

TS 310 Construction Specification for Hot Mixed, Hot Laid Asphaltic Concrete Paving
TS 1150 Material Specification for Hot Mixed, Hot Laid Asphaltic Concrete

Ontario Provincial Standard Specifications

OPSS 1001 Material Specification for Aggregates – General
OPSS 1003 Material Specification for Aggregates – Hot Mix Asphalt

Ontario Ministry of Transportation, Designated Sources for Materials List

DSM#3.05.25 Coarse Aggregates for HL-1, DFC and OFC and Fine Aggregates for DFC and OFC

Ontario Ministry of Transportation, Form

PH-CC-449 Aggregate Test Data – Hot Mix Asphalt

Ontario Ministry of Transportation, Laboratory Testing Manual

LS-601 Material Finer than 75 µm Sieve in Mineral Aggregates by Washing
LS-602 Sieve Analysis of Aggregates
LS-604 Relative Density and Absorption of Coarse Aggregate
LS-606 Soundness of Aggregate by Use of Magnesium Sulphate
LS-607 Percent Crushed Particles in Processed Coarse Aggregate
LS-608 Percent Flat and Elongated Particles in Coarse Aggregate
LS-609 Petrographic Analysis of Coarse Aggregate
LS-613 Determination of Insoluble Residue of Carbonate Aggregates
LS-614 Freezing and Thawing of Coarse Aggregates
LS-617 Determination of Percent Particles with Two or More Crushed Faces and Uncrushed Particles in Processed Coarse Aggregate
LS-618 Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
LS-619 Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
LS-624 Guidelines for the Use of Control Charts for Construction Aggregates
LS-625 Guidelines for Sampling of Granular Materials
LS-704 Plastic Limit and Plasticity Index of Soils

Aggregate Producers Association of Ontario

Commercial Aggregate Source Book and Membership Directory

TS 1003.03 DEFINITIONS

For the purpose of this specification, the definitions given in specification TS 310 and TS 1150, and the following definitions apply:

Advisory Clause means the information provided [Note:] to assist Contractors.

Control Chart means a graphical method used to monitor the central tendency and the variability of a material characteristic in order to control production.

Mean means the arithmetic average of a set of data.

Physical Property means an inherent attribute or feature of an aggregate material. Tests are carried out to determine a material's resistance to weathering or degradation or both. Physical properties are generally not affected by aggregate production processes.

Quality Assurance (QA) means a system or series of activities carried out by the City to ensure that materials received from the Contractor meet the specified requirements.

Quality Control (QC) means a system or series of activities carried out by the Contractor to ensure that materials supplied to the Contract meet the specified requirements.

TS 1003.04 DESIGN AND SUBMISSION REQUIREMENTS

TS 1003.04.01 Submissions

Any required submissions shall be in writing. All information and test data forms must be legible. Faxed or e-mailed copies are acceptable provided the original is submitted to the City within three Working Days following receipt of the fax or e-mail.

TS 1003.04.02 Source(s) of Aggregates

At least 10 Working Days prior to the commencement of the asphalt paving work, the Contractor shall notify the Contract Administrator as to the commercial aggregate source(s) for the aggregates to be used in the asphalt mix types for the Work.

TS 1003.04.03 Test Data

At least 10 Working Days prior to the commencement of the asphalt paving work, the Contractor shall provide the Contract Administrator with test results, from a quality control (QC) laboratory meeting the requirements of subsection TS 1003.06.02, herein, demonstrating conformance of the aggregates with the requirements of this specification. Test results shall be submitted using MTO Form PH-CC-449 (suitably modified for the Contract) or equivalent, for either the stockpile method or control chart method as appropriate, according to OPSS 1003.

TS 1003.05 MATERIALS

TS 1003.05.01 General

The requirements of OPSS 1001 shall apply to the Contract. Materials shall be according to this specification when tested according to the MTO Laboratory Testing Manual “LS” test number identified in following subsections.

Aggregates shall only be obtained from commercial aggregate sources that comply with the OPSS 1003 requirements for aggregate processing, handling, stockpiling and quality control (stockpile and/or control chart method).

Note: Contractors should note that the APAO publishes a Commercial Aggregate Source Book and Membership Directory.

Aggregates may be gravels, quarried rock, or from reclaimed asphalt pavement (RAP), provided the source is of such a nature and extent as to ensure acceptable processed aggregates of a consistent gradation and quality. Coarse aggregates for HL-3 (HS), HL-3 Mod, HL 8 (HS) and LSBC asphalt mixes shall be either 100 per cent crushed particles produced by crushing bedrock material or shall be crushed from gravel, cobbles or boulders retained on the 50 mm sieve size (75 mm sieve size for LSBC), including washing and classification if necessary. Fine aggregates (manufactured sands) for HL-1 (100 per cent crushed component), HL-3 (HS), HL-3 Mod (100 per cent crushed component), HL-2, HL-8 (HS) and LSBC shall be either 100 per cent crushed particles produced by crushing bedrock material or shall be crushed from gravel, cobbles or boulders retained on the 9.5 mm sieve size, including washing and classification if necessary.

Note: Contractors should note that washed screenings may not meet the gradation and/or physical requirements for 100 per cent crushed fine aggregates (manufactured sand).

When reclaimed asphalt pavement is used in hot mix, it shall be processed for such use, and shall be obtained solely from removed asphalt concrete, consisting of aggregates and asphalt cement, and shall not contain any steel slag material.

Steel slags, iron blast furnace slags, nickel slags and copper slags are not acceptable for use in hot mix.

Irrespective of compliance with the physical requirements of this specification, aggregates may be accepted or rejected on the basis of field performance.

TS 1003.05.02 Fine Aggregate

TS 1003.05.02.01 *Gradation Requirements*

Fine aggregate shall be consistently graded, meeting the requirements of Table 1. The difference between the amount retained between any two consecutive sieves, excluding the 75 µm sieve, shall not be less than 5 per cent.

TS 1003.05.02.02 *Physical Requirements*

Each fine aggregate shall be composed of clean, hard, durable particles meeting the physical requirements of Table 2. DFC and SMA fine aggregates must be obtained from commercial aggregate sources listed on the MTO DSM #3.05.25 list. The DFC fine aggregate and coarse aggregate must be obtained from the same commercial aggregate source. The SMA fine aggregate and coarse aggregate must be obtained from the same commercial aggregate source.

TS 1003.05.03 *Coarse Aggregate***TS 1003.05.03.01 *Gradation Requirements***

Coarse aggregates shall be consistently graded, meeting the requirements of Table 3. The gradation shall not be subject to the extreme limits of the grading envelope specified.

TS 1003.05.03.02 *Physical Requirements*

Each coarse aggregate shall be composed of clean, hard, durable particles meeting the physical requirements of Table 4. DFC, SMA and HL-1 coarse aggregates must be obtained from commercial aggregate sources listed on the MTO DSM #3.05.25 list meeting the requirements for frictional properties.

Table 1: Gradation requirements (LS-602) for fine aggregate¹

MTO sieve designation	Per cent passing by mass				
	DFC SMA	HL-1 HL-3 HL-3 Fine HL-3 Mod	HL-2	HL-8	HL-3 (HS) HL-8 (HS) LSBC
9.5 mm	100	100	100	100	100
4.75 mm	85-100	90-100	85-100	85-100	95-100
2.36 mm	65-95	70-100	70-90	60-100	80-100
1.18 mm	48-80	50-90	50-75	34-90	50-90
600 µm	25-60	30-70	30-55	17-70	28-70
300 µm	10-35	15-40	15-35	9-40	10-40
150 µm	5-15	5-15	5-15	3-15	5-15
75 µm	0-6	0-5	3-8	0-7	0-5

Note 1: When using two or more fine aggregates, the combined gradation shall meet the requirements of this table. Each fine aggregate shall meet the physical requirements of Table 2.

Table 2: Physical requirements for fine aggregate

Laboratory test	MTO test number	DFC SMA	HL-1	HL-3 (HS)		
				HL-3 HL-3 Fine HL-3 Mod	HL-2 HL-8 LSBC	HL-8 (HS)
micro-deval abrasion loss, % maximum	LS-619	15	20	20	25	25
plasticity index	LS-704	0	0	0	0	0
flat and elongated particles, % maximum	Note 1	10	10	---	---	15

Note 1: Weighted average, 4 to 1 aspect ratio, LS-608; +4.75 mm, -4.75 mm/+2.36 mm and - 2.36 mm/+1.18 mm size fractions.

Table 3: Gradation requirements (LS-602) for coarse aggregate¹

MTO sieve designation	Per cent passing by mass			
	DFC	SMA	HL-8 (HS)	LSBC
	HL-1 HL-3 (HS) HL-3	HL-3 Mod HL-3 Fine	HL-8	
37.5 mm	---	---	---	100
26.5 mm	---	---	100	55-80
19.0 mm	---	---	90-100	40-65
16.0 mm	100	---	65-90	---
13.2 mm	96-100	100	---	20-50
9.5 mm	50-73	50-75	20-55	10-30
4.75 mm	0-10	0-10	0-10	0-10

Note 1: When using two or more coarse aggregates, the combined gradation shall meet the requirements of this table. Each coarse aggregate shall meet the physical requirements of Table 4.

Note: Contractors should note that practical experience indicates meta-arkose aggregates and gneiss aggregates are brittle and subject to breakdown, so that care is required with their handling.

TS 1003.05.04 Filler

Filler shall consist of baghouse dust, mineral filler, fly ash, hydrated lime, Portland cement or other fine material as designated and currently approved by the City for use in hot mix. Mineral filler shall consist of thoroughly dry dust produced from rock sources acceptable for coarse aggregates meeting the physical requirements listed in Table 4, and shall meet the following gradation requirements:

- Passing 600 μm sieve size 100%, and
- Passing 75 μm sieve size not less than 80%.

TS 1003.06 LABORATORY TESTING

TS 1003.06.01 General

The Contractor shall be responsible for all aggregates quality control (QC) testing and associated costs. The City will designate an aggregate quality assurance (QA) laboratory and will be responsible for all costs associated with quality assurance testing.

TS 1003.06.02 Laboratory Requirements

The aggregates QC and QA testing laboratories shall hold CCIL/APAO, Type C or Type D certification for the applicable test methods.

Table 4: Physical requirements for coarse aggregate

Laboratory test	MTO test number	DFC HL-1 and SMA									
		Material type						Gneiss (DFC and HL- 1 only)	HL-3 (HS)	HL-3	HL-8
		Gravel (HL-1 only)	Ande- site (HL- 1) only	Dolo- mitic sand stone	Trap- rock dia- base	Meta- arkose	HL-3 HL-3 Mod		HL-3 Fine	HL-8 (HS) LSBC	HL-8
loss by washing, pass 75µm sieve, % maximum	LS-601	1.0 ^a	1.0 ^a	1.0 ^a	1.0 ^a	1.0 ^a	1.0 ^a	1.3 ^b	1.3 ^b	1.3 ^b	1.3 ^b
absorption by mass, % maximum	LS-604	1.0	1.0	1.0	1.0	1.0	1.0	1.75	1.75	2.0	2.0
magnesium sulphate soundness, % maximum loss ^c	LS-606	---	---	---	---	---	---	12	12	15	15
percent crushed particles, % minimum	LS-607	---	100	100	100	100	100	100	80	100	80
particles with 2 faces crushed, % minimum	LS-617	80	---	---	---	---	---	95 ^d	---	95 ^d	---
flat and elongated particles, % maximum	LS-608	15	15	15	15	15	15	20	20	15	20
Petrographic Number (HL), maximum	LS-609	120	120	145	120	145	145	---	---	---	---
insoluble residue, retained 75µm sieve, % minimum	LS-613	---	---	45	---	---	---	---	---	---	---
freezing and thawing, % loss maximum	LS-614	6	6	6	6	6	6	6 ^e	6 ^e	15 ^e	15 ^e
micro-deval abrasion Loss, % maximum	LS-618	5	10	15	10	15	15	17	17	21	21

Note a: When control charts (LS-624, 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%.

Note b: When control charts (LS-624, n>20) are used for LS-601, the average value shall not exceed the specification maximum (1.3%), with no single value greater than 1.7%. When quarried rock is used as a source of coarse aggregate, a maximum of 2.0 percent passing the 75µm sieve shall be permitted. When control charts (n>20) are used for LS-601 for quarried rock, the average value shall not exceed the specification maximum (2.0%), with no single value greater than 2.4%.

Note c: The requirements will be waived by the City when the aggregate meets the alternative unconfined freeze-thaw requirements, LS-614, of this Table.

Note d: This only applies to HL-3 (HS), HL-3 Mod, HL-8 (HS) and LSBC coarse aggregate crushed from gravel sources.

Note e: Alternative requirements to Magnesium Sulphate Soundness, LS-604.

TS 1003.07 PRODUCTION

TS 1003.07.01 Aggregate Processing, Handling and Stockpiling

The commercial aggregate source(s) shall be according to the aggregate processing, handling and stockpiling requirements of OPSS 1003.

TS 1003.07.02 Quality Control

The commercial aggregate source(s) shall be according to the quality control requirements of OPSS 1003.

TS 1003.08 QUALITY ASSURANCE

TS 1003.08.01 General

Quality assurance testing may be carried out by the City for purpose of ensuring that the aggregates used in the Contract asphalt mix type(s) conform with the gradation or physical requirements or both of this specification.

TS 1003.08.02 Sampling

Aggregate samples for QA will be taken by the City at the asphalt plant, or in the absence of a stockpile(s) at the asphalt plant, from a stockpile(s) at the commercial aggregate source(s). The Contractor shall assist the City, at no extra cost to the City, in obtaining the QA aggregate samples.

TS 1003.08.03 Testing and Retention of Samples

Aggregate testing will be carried out at the City's QA laboratory to ensure that the aggregates conform to the requirements of this specification. Following the preparation of the test samples, the QA laboratory shall retain all remaining aggregates for possible referee testing.

TS 1003.08.04 Acceptance

The Contractor's submission of test data, subsection TS 1003.04.03, herein, will be used to accept aggregates in the work, except where aggregates QA testing or referee testing has been carried out.

When QA test results show that the aggregate(s) meets the requirements of this specification, the aggregate(s) shall be accepted.

When QA test results show that the aggregate(s) does not meet the requirements of this specification, the Contract Administrator will notify the Contractor that material(s) from the commercial aggregate source(s), including material(s) in existing stockpiles or in the work, shall not be accepted. The Contractor then has the option of either removing the material(s) from the Work or requesting referee testing as outlined in subsection TS 1003.08.05, herein.

TS 1003.08.05 Referee Testing

When aggregate samples tested by the City do not meet the requirements of this specification, the Contractor has the option of selecting a new commercial Aggregate source(s) or invoking referee testing. The Contractor shall notify the Contract Administrator of the selected option within two Working Days following notification.

When referee testing is selected, the City will select a referee laboratory, meeting the requirements of subsection TS 1003.06.02, herein, within three Working Days following notification of the intent to use a referee. Retained referee materials shall be delivered to the referee laboratory from the QA laboratory by the Contract Administrator. If referee materials are not available, the City will be responsible for obtaining (LS-625) and submitting new aggregate samples to the referee laboratory, from a location to be decided by the Contract Administrator. The Contractor shall be present to witness the sampling.

Referee testing will be carried out in the presence of the Contract Administrator. Where applicable, the referee laboratory will also test a control aggregate sample for each test method required. The Contractor may observe the testing at no extra cost to the City. Comments on any nonconformity in the test methods must be made and corrected at the time of referee testing. Referee test results will be binding on both the City and the Contractor.

TS 1003.08.06 Disposition of Aggregate(s) Not Accepted

When referee test results show that the aggregate(s) meets the requirements of this specification, the material will be accepted.

When the referee test results show that the aggregate(s) does not meet the requirements of this specification, the material from the commercial Aggregate Source(s), including materials in existing stockpiles or in the Work, shall not be accepted. The Contractor shall remove the material from the Work at no extra cost to the City.

At the City's option, the Contractor may negotiate a reduced price payment in lieu of removal provided that: the referee test values do not exceed the requirement for Magnesium Sulphate Soundness (LS-606) or Unconfined Freeze-Thaw (LS-614) value by more than 25 per cent of the specified value; or exceed the requirement for the Micro-Deval Abrasion (LS-618) value by more than 10 per cent of the specified value. For example, where the magnesium sulphate requirement value is 12, a reduced payment may be negotiated provided the referee test value does not exceed 15. The minimum price reduction will be 10 per cent of the Contract Price for the applicable asphalt mix type(s) in the Pricing Form. This price reduction will be assessed independently of any other price adjustment provisions for the Contract.

The cost of referee testing shall be borne by the Contractor unless the testing confirms aggregate(s) conformance with this specification, in which case the costs will be borne by the City.

