



**MATERIAL SPECIFICATION FOR
AGGREGATES - GENERAL**

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1001.01 SCOPE

This specification covers the source, processing, and testing requirements for aggregates and provides for the use of reclaimed asphalt pavement and reclaimed concrete material.

1001.01.01 Specification Significance and Use

This specification has been developed for use in municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

1001.01.02 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.

1001.02 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 Ministry of Transportation Publications

MTO Laboratory Testing Manual:

LS-602	Sieve Analysis of Aggregates
LS-609	Petrographic Analysis of Coarse Aggregate
LS-616	Petrographic Analysis of Fine Aggregate

ASTM International

D5744 - 18	Standard Test Method for Laboratory Weathering of Solid Materials Using a Humidity Cell from SAI Global
E11 - 20	Woven Wire Test Sieve Cloth and Test Sieves

Canadian General Standards Board

8.1-88	Sieves, Testing, Woven Wire, Inch Series
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Others

ADTI-WP2 Leaching Column Method for Overburden Analysis and Prediction of Weather Rates, Hornberger, Roger J., et al., 2004.

DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia, British Columbia Ministry of Employment and Investment, Energy and Minerals Division; Smithers, BC; Price, W.A., April 1997.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Toxicity Characteristic Leaching Procedure, Method 1311; United States Environmental Protection Agency, Publication SW-846, July 1992.

1001.03 DEFINITIONS

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

Aggregate means natural mineral materials such as sand, gravel, and crushed bedrock. Reclaimed materials may substitute for aggregates when allowed by the appropriate specification.

Boulder means a detached rock mass with a diameter greater than 200 mm.

Clay means a fine-grained soil with particles smaller than 2 µm that exhibit plasticity over a range of water contents.

Coarse Aggregate means that portion of aggregate material retained on the 4.75 mm sieve when tested according to LS-602.

Cobble means a rounded or semi-rounded rock fragment with an average dimension between 75 mm and 200 mm.

Crushed Material means aggregate particles having at least one well-defined face resulting from fracture and could also be materials other than aggregates (e.g., iron blast-furnace slag or nickel slag, crushed concrete). Particles with smooth faces and rounded edges or with only small chips removed are not considered crushed.

Deleterious Material means materials that include, but not limited to, the following: wood, clay brick, clay tile, plastic, gypsum, gypsum plaster, wallboard, roots, and all other organic matter.

Fine Aggregate means that portion of aggregate passing the 4.75 mm sieve when tested according to LS-602.

Flat and Elongated Particles means aggregate particles whose greatest mean dimension in the longitudinal axis compared to the least mean dimension in a plane perpendicular to the longitudinal axis exceeds a ratio of 4:1.

Granular means any processed or natural aggregate material with less than 35% by mass passing the 75 µm sieve.

Gravel means rounded, water-worn rock fragments retained on the 4.75 mm sieve and passing through the 75 mm sieve.

Iron Blast-Furnace Slag means the material resulting from solidification of molten blast-furnace slag under atmospheric conditions. Subsequent cooling may be accelerated by application of water to the solidified surface.

Manufactured Sand means sand produced by the crushing and further processing, i.e., washing, grading, classifying of quarried rock, boulders, cobbles, or gravel from which the natural fine aggregate has been removed. Natural sand may be added to optimize properties.

Mine By-Product Rock means rock which is removed during an ore mining process and has not been subjected to any sort of chemical processing.

Natural Sand means naturally formed sand found in unconsolidated deposits.

Nickel Slag means the non-metallic product resulting from the production of nickel.

Reclaimed Asphalt Pavement (RAP) means the processed hot mix asphalt material that is recovered by partial or full depth removal.

Reclaimed Concrete Material (RCM) means removed or processed hardened Portland cement concrete.

Sand means fine aggregate passing the 4.75 mm sieve and retained on a 75 µm sieve resulting from natural disintegration of rock or from crushing.

Screenings means the fine aggregate produced by the crushing of quarried rock, boulders, cobbles, or gravel.

1001.04 DESIGN AND SUBMISSION REQUIREMENTS

1001.04.01 Submission Requirements

1001.04.01.01 General

The Contract Administrator shall be advised in writing of each intended aggregate source, prior to its use in the Work.

All test results shall be provided in either individual or mean values, which demonstrate conformance of the material with the requirements of the appropriate specification.

Test results shall be made available at the Contract Administrator's request.

1001.04.01.02 Report for Aggregates Produced from Mine By-Product Rock

If an aggregate produced from a mine by-product rock is proposed for use, a Mine By-Product Rock Aggregate Assessment Report (MRAAR), shall be submitted to the Contract Administrator at least 20 Business Days prior to its intended use. The MRAAR shall be signed by an Engineer or a licensed Professional Geoscientist (P. Geo.).

Prior to beginning the Work, the Engineer or licensed Professional Geoscientist (P. Geo.), shall have a minimum of 3 years experience in Acid Base Accounting, NAG testing, metal leachate testing, physical property, and any other related testing and analysis, acceptable to the Owner. Relevant qualifications and examples of past projects carried out within the past 5 years by the Engineer or licenced Professional Geoscientist (P. Geo) shall be submitted.

The MRAAR shall include, but not be limited to, the following:

- a) Petrographic test results according to LS-609, Part A and LS-616, Part A carried out by a licensed Professional Geoscientist (P.Geo.). When sulphur minerals or non-iron bearing sulphides are found, sulphur mineral speciation and associated reactivity shall be determined using X-Ray Diffraction or Scanning Electron Microscopy or both.
- b) An Acid Rock Drainage (ARD) investigation, carried out by a licensed Professional Geoscientist (P.Geo.) including, but not limited to, the following:
 - i. Acid Base Accounting and Net Acid-Generating (NAG) tests. If either the neutralization potential ratio or the NAG tests indicate that the tested material is respectively not shown to be “Non-Acid Generating” or “Non-Acid Forming” according to the “DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia”, then kinetic testing shall also be carried out using either humidity cells according to ASTM D5744 or columns according to ADTI-WP2 Leaching Column Method for Overburden Analysis and Prediction of Weather Rates.
 - ii. pH testing and any other chemical analyses considered necessary by the licensed Professional Geoscientist (P.Geo.).
 - iii. An assessment of all the test results and an identification of any potential impacts of the use of acid-generating materials on surface and groundwater, any proximate aquatic ecosystems as well as any other environmentally sensitive areas. When potential impacts are found, recommendations to eliminate or reduce those impacts to acceptable levels including an acceptable monitoring plan shall be included in the assessment.
- c) Metal leachate testing using Shake Flask Extraction, as described in “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Toxicity Characteristic Leaching Procedure” or any other method acceptable to the Owner;
- d) An assessment of the suitability of the aggregate for its intended use, by assuring that the aggregate:
 - i. meets all applicable safety regulations, guidelines, and procedures;
 - ii. meets all applicable environmental regulations, guidelines and procedures, and shall not cause any adverse environmental effects;
 - iii. meets all current physical and production property requirements required for that aggregate;
 - iv. does not cause undue discolouration of the pavement or structure in which the aggregates shall be used; and
 - v. otherwise provides long term field performance at least as well as any other aggregates that are currently acceptable for the same application.
- e) Specified minimum sampling and testing rates, the location where the samples shall be taken and the recommended tests to be carried out, as well as any special recommendations outlining the handling and placement of aggregates produced from mine by-product rock during construction to ensure that all of the requirements specified in the Contract Documents shall continue to be met for the duration of the Contract.

The sampling, testing, and analyses required for parts a) to d) of the MRAAR of crushed mine by-product rock that is intended for use on the Contract shall be based on a minimum of 3 samples for up to 10,000

tonnes and a minimum of 5 additional samples between 10,000 and 100,000 tonnes. Quantities greater than 100,000 tonnes shall be 1 additional sample per 15,000 tonnes of material. All samples used for testing and assessment purposes required for parts a) to d) shall be obtained from stockpiles of at least 1000 tonnes of the crushed mine by-product rock which is intended for use in the Work. The details regarding the sampling and testing carried during construction shall be as specified in the MRAAR, according to part e) listed above.

In any case, the sampling and testing rates and the types of tests specified above in parts a) to d) for the preparation of the MRAAR and in part e) to be conducted during construction, shall only be considered minimums and the actual amount of sampling, testing, and types of tests carried out anytime during the Contract shall depend on the variability of the source, the Contractor's ability to control that variability as well as any other relevant recommendations that the MRAAR provides.

All testing carried out for the preparation of the MRAAR as well as during construction shall be conducted by laboratories that are acceptable to the Owner.

Within 15 Business Days after submission of the MRAAR, the Contractor shall be notified as to whether the mine by-product rock is acceptable for use.

In addition to the MRAAR, an aggregate management plan shall also be submitted to the Contract Administrator within 20 Business Days of using aggregate produced from mine by-product rock. The aggregate management plan shall detail how aggregate production will meet the requirements of the Work for the duration of the Contract.

1001.05 MATERIALS

1001.05.01 Aggregates

1001.05.01.01 General

Aggregates shall be composed of hard, durable fragments that are clean and free of clay coatings and other deleterious material.

1001.05.01.02 Fine Aggregates

Fine aggregates shall be according to the appropriate specifications and, unless otherwise specified in the Contract Documents, shall be one or a blend of the following:

- a) Natural sand.
- b) Manufactured sand.
- c) Screenings produced during crushing.
- d) Iron blast-furnace slag or nickel slag.
- e) Reclaimed asphalt pavement.
- f) Reclaimed concrete material.

1001.05.01.03 Coarse Aggregates

Coarse aggregates shall be according to the appropriate specifications and, unless otherwise provided specified in the Contract Documents, shall be one or a blend of the following:

- a) Crushed material of consistent quality throughout produced from bedrock formations or boulders.
- b) Uncrushed material of consistent quality produced from gravel formations.
- c) Iron blast-furnace slag or nickel slag.
- d) Reclaimed asphalt pavement.
- e) Reclaimed concrete material.

1001.07 PRODUCTION

1001.07.01 Stripping of Aggregate Source

Prior to excavating materials for aggregate production, the area to be worked shall be cleared of shrubs and trees, grubbed of roots, and stripped of all unsuitable surface materials and weathered zones. The area open ahead of the quarrying or excavating operation shall be of sufficient size to prevent contamination of the aggregate source working face.

1001.07.02 Processing

1001.07.02.01 General

When necessary to conform to the type of materials specified, aggregates shall be screened, crushed, washed, classified, or otherwise processed with suitable equipment to meet specification requirements.

Washed materials or materials excavated from underwater shall be stored for at least a 24 hours or longer period to allow all free water to drain and for the materials to attain uniform water content.

1001.07.02.02 Washing

When specified in the Contract Documents, aggregates shall be washed in washing plants, or otherwise processed to meet specification requirements. Truck or mixer washing and other similar methods shall not be permitted.

Water used for washing aggregates shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

1001.07.02.03 Blending

Blending of aggregates including reclaimed materials that meet the gradation requirements of the material to be provided by the applicable specification shall be permitted. The blending shall produce a consistent and acceptable product. Except where noted elsewhere in the Contract Documents, blending to improve the physical requirements shall not be permitted, except to increase the percentage of crushed material or decrease the percentage of flat and elongated particles.

1001.07.03 Handling and Transporting

At all times, aggregates shall be handled and transported in a manner and with equipment that avoids segregation of the material, excess loss of fines, and contamination by any deleterious material.

1001.07.04 Stockpiling

Stockpile sites shall be level, well drained, free of all foreign materials, and of adequate bearing capacity to support the mass of the materials to be placed thereon. Stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

For all coarse aggregates, except when stockpiled on Portland cement concrete or asphaltic concrete foundations or on an uncontaminated durable surface, a compacted granular pad of material with a maximum particle size no larger than that of the material being stockpiled and not less than 0.3 m in depth shall be provided to prevent contamination of the piled material.

For fine or combined aggregate stockpiles, the foundation shall be as specified above for coarse aggregates or the material may be placed on the ground provided that the bottom 0.3 m of the pile is not incorporated into the Work.

When samples are obtained for acceptance purposes from stockpiles of combined fine and coarse aggregate material for gradation testing, the stockpile shall be constructed in layers not exceeding 1 m in depth, and spilling of material over the edge of the stockpile shall not be permitted. These stockpile construction requirements shall not apply to separate stockpiles of fine and coarse aggregates, and shall not apply to stockpiles of combined fine and coarse aggregate when the gradation acceptance samples are obtained after the material has been removed from the stockpile.

1001.08 QUALITY ASSURANCE

1001.08.01 General

Irrespective of compliance or non-compliance with the gradation and physical requirements of the applicable specification, aggregates may be accepted or rejected on the basis of past field performance, as determined by the Owner.

When a change in the character of the material occurs or when the performance of the materials is found to be unsatisfactory, use of those materials shall be discontinued until it can be proven to the satisfaction of the Contract Administrator that the source remains acceptable or can be made acceptable.

1001.08.02 Sampling

Quality Assurance samples shall be obtained, handled, and stored as specified in the Contract Documents. The Contract Administrator shall be allowed to access all sampling locations and reserves the right to request quality assurance samples at any time.

Samples obtained for the purposes of mix design shall be representative of the materials to be placed in the Work.

1001.08.03 Testing

Tests on aggregates shall be as specified in the Contract Documents. The most recent published test method shall be used.

The Owner may require additional sampling and testing during construction. Such sampling and testing shall be carried out at no additional cost to the Owner.

Gradation analysis shall be based on the designated sieves shown in Table 1. As indicated, sieves complying with the alternative shown are compatible and may be used interchangeably with the MTO sieve designation shown.

TABLE 1
Laboratory Testing Sieves

MTO Sieve Designation	Alternate Sieve Standards, CAN/CGSB 8.1 and ASTM E11
150 mm	6 inch
106 mm	4.24 inch
75.0 mm	3 inch
63.0 mm	2-1/2 inch
53.0 mm	2.12 inch
37.5 mm	1-1/2 inch
26.5 mm	1.06 inch
25.0 mm	1 inch
22.4 mm	7/8 inch
19.0 mm	3/4 inch
16.0 mm	5/8 inch
13.2 mm	0.530 inch
12.5 mm	1/2 inch
9.5 mm	3/8 inch
6.7 mm	0.265 inch
4.75 mm	No. 4
2.36 mm	No. 8
1.18 mm	No. 16
600 µm	No. 30
425 µm	No. 40
300 µm	No. 50
150 µm	No. 100
75 µm	No. 200

**Appendix 1001-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 determine if the following is required and, if so, specify it in the Contract Documents:

- All requirements. (1001.04.01.02)
- Additional sampling and testing requirements during construction. (1001.04.01.02)
- Fine aggregates. (1001.05.01.02)
- Coarse aggregates. (1001.05.01.03)
- Washing of aggregates. (1001.07.02.02)
- Blending. (1001.07.02.03)
- Obtaining, handling, and shorting of samples for Quality Assurance. (1001.08.02)
- Tests on aggregates. (1001.08.03)

This specification is to be used in conjunction with OPSS 1002, OPSS 1003, OPSS 1004, OPSS 1006, and OPSS 1010.

This specification incorporates Superpave aggregates, tests, and sieves.

Assessment of Potential for Acid Rock Drainage in Highway Construction, Materials Engineering and Research (MERO) Report (Unpublished), Smith, S.J., Rogers, C.A and Senior, S.A., March 2007. Some of the applicable sections within this report may be obtained upon request from the Head of the Soils and Aggregates Section, Materials Engineering and Research Office, MTO, at the following address:

Ministry of Transportation
95 Arrow Road
Toronto, ON
M9M 2L4
Soils-Aggregates@ontario.ca

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.