

**Amendment to OPSS.MUNI 1010 (Apr 2013) –
Material Specification for
Aggregates – Base, Subbase, Select Subgrade, and Backfill Material**

OPSS 1010.03 DEFINITIONS

Section 1010.03 of OPSS.MUNI 1010 is amended by the addition of the following:

Granular A means a set of requirements for dense graded aggregates intended for use as granular base within the pavement structure, granular shouldering and backfill. Granular A is also intended for use as embedment material for flexible pipes, bedding material and cover material for rigid pipes, and backfill material for rigid and flexible pipes.

Granular A RCM means a set of requirements for dense graded recycled concrete material intended for use as bedding, embedment material and trench backfill around underground infrastructure.

Granular A RAP means a set of requirements for dense graded recycled asphaltic material intended for use as granular base within the pavement structure and/or related work within the road allowance.

50 mm Crushed Aggregate means a set of requirements for dense graded recycled material intended for use as granular base within the pavement structure.

OPSS 1010.04 SUBMISSION AND DESIGN REQUIREMENTS

OPSS 1010.04.01 Submission of Test Data

Subsection 1010.04.01 of OPSS.MUNI 1010 is amended by deleting the first paragraph in its entirety and replacing it with the following:

The Contractor shall have test results available for the aggregates to be used in the work. The QC testing records shall be made available to Contract Administrator at least five Working Days before the delivery of the material. Test results shall be submitted by either the stockpile/pit-run method or control chart method. All test data forms shall be legible.

OPSS.MUNI 1010 is amended by the addition of the following subsection:

OPSS 1010.04.02 Submission of RCM Test Data

The Quality Control plan shall form part of the submission requirements to the City, along with test results for recent and current production confirming that the production process is according to LS-624 providing consistent RCM material meeting specification requirements. Physical properties shall be confirmed by an independent, CCIL Type C (Aggregate Quality Control) and Type D (Aggregate Physical Property Laboratory) certified laboratory.

OPSS 1010.05 MATERIALS

OPSS 1010.05.02 Granular A, Granular M, and Granular S

Subsection 1010.05.02 of OPSS.MUNI 1010 is amended by deleting the entire section and replacing with the following:

Granular A shall meet the specifications of Granular A RCM, Granular A RAP or shall be produced by crushing one or more of the following:

- 1) Quarried bedrock.
- 2) Naturally formed deposits of sand, gravel and cobbles.

Subsection 1010.05.02 of OPSS.MUNI 1010 is amended by the addition of the following clause:

OPSS 1010.05.02.01 Granular A RCM

Granular A RCM produced from reclaimed concrete material and intended primarily for pipe bedding shall:

- 1) contain up to 100 per cent by mass of crushed RCM only;
- 2) not contain glass or ceramic material; and
- 3) not contain more than a combined total of 0.5 per cent by mass of deleterious material. Gypsum, gypsum plaster and wall board mix shall not be allowed in the mix.

Subsection 1010.05.02 of OPSS.MUNI 1010 is amended by the addition of the following clause:

OPSS 1010.05.02.02 Granular A RAP

Granular A RAP produced from reclaimed asphalt pavement material:

- 1) may contain up to 100 per cent by mass of crushed RCM but shall not contain more than 30 per cent of RAP by mass;

-
-
- 2) shall not contain glass or ceramic material; and
 - 3) shall not contain more than a combined total of 0.5 per cent by mass of deleterious material. Gypsum, gypsum plaster and wall board mix shall not be allowed in the mix.

Subsection 1010.05.03 of OPSS.MUNI 1010 is amended by the addition of the following clause:

OPSS 1010.05.03.06 50 mm Crushed Aggregate

50 mm crushed aggregate:

- 1) may contain up to 100 per cent by mass of crushed RCM but shall not contain more than 30 per cent of RAP by mass;
- 2) shall not contain glass or ceramic material; and
- 3) shall not contain more than a combined total of 0.5 per cent by mass of deleterious material. Gypsum, gypsum plaster and wall board mix shall not be allowed in the mix.

50 mm crushed aggregate shall meet the physical requirements shown in Table 1 and gradation requirements shown in Table 2.

OPSS 1010.07 PRODUCTION

OPSS 1010.07.02.01 General

Clause 1010.07.02.01 of OPSS.MUNI 1010 is amended by the addition of the following paragraphs:

All Contractors or suppliers producing RCM for City construction projects shall provide a detailed Quality Control plan covering RCM production and placement as part of their materials submissions. The QC plan shall describe the Contractor's or suppliers processes for the control, acceptance and documentation of sources of old concrete and identify how the sources of old concrete are controlled during delivery to ensure they are from a suitable source.

Describe the production and physical properties testing (tests and frequency) that are conducted by the Contractor or supplier to ensure that the RCM meets the City's requirements; including the absence of gypsum, gypsum plaster and wall board mix; and including a process to control excessive fine particles, RAP and building demolition wastes.

The Contractor or supplier shall provide a written certificate to the Contract Administrator expressly stating that no building demolition wastes have been used in the production of the RCM granular base and subbase. The certificate shall state that the RCM supplied contains sulphate concentrations less than or equal to 5000 µg/g. The sampling and testing frequency from the stockpile would commence with the first testing to be performed based on one test for every 1000 tonnes of production. Ten (10) samples/tests, based on one for every 1000 tonnes, are required to establish that material is considered to be under control meeting all specification requirements. The subsequent testing and sampling can be performed less frequently at one test for every 5000 tonnes.

Contractors or suppliers shall obtain and submit samples to a Canadian Association for Environmental Analytical Laboratories (CAEAL) certified third party external analytical laboratory for sulphate concentration testing as part of their ongoing QC/process control program, and submit the test results to the City as part of its approval submission.

OPSS 1010.08 QUALITY ASSURANCE

OPSS 1010.08.04 Acceptance

Subsection 1010.08.04 of OPSS.MUNI 1010 is amended by deleting the fourth paragraph in its entirety and replacing it with the following:

The Contractor shall cease using the non-complying materials and at the discretion of the Contract Administrator, remove the unacceptable materials, including the unacceptable materials that has already been placed and compacted. No payment shall be made for unacceptable materials.

OPSS 1010.08.05 Referee Testing

Subsection 1010.08.05 of OPSS.MUNI 1010 is amended by deleting the first sentence in the second paragraph in its entirety and replacing it with the following:

The Contract Administrator shall select a referee laboratory within three business days following the Contractor's notification to invoke referee testing.

TABLE 1 Physical Property Requirements

Table 1 of OPSS.MUNI 1010 is amended by the addition of column *50 mm Crushed Aggregate* as follows:

Table 1: Physical property requirements

Laboratory test	MTO test number	Granular O	Granular A	Granular S	Granular B Type I and Type II	Granular B	50 mm crushed aggregate	Select sub grade material
coarse aggregate petrographic requirement	LS-609	Note a	Note a Note b	Note a	Note a Note b	Note a Note b	Note b	Note b
freeze-thaw loss, % maximum	LS-614	15	n/a	n/a	n/a	n/a	n/a	n/a
fine aggregate petrographic requirement	LS-616 LS-709				Note c			
micro-deval abrasion coarse aggregate loss, % maximum	LS-618	21	25	25	30 ^d	25	25	30 ^d
micro-deval abrasion fine aggregate loss, % maximum	LS-619	25	30	30	35	30	30	n/a
plasticity index	LS-704	0	0	0	0	0	0	0
percent crushed, minimum	LS-607	100	50	50	n/a	50	50	n/a
2 or more crushed faces, % minimum	LS-617	85	n/a	n/a	n/a	n/a	n/a	n/a
Asphalt Coated Particles, % maximum	LS-621	n/a	30 ^f	30 ^d	Note e	30	30	n/a

-
- Note a: Granular A, B Type I, or M may contain up to 15% by mass of crushed glass and ceramic material combined.
- Note b: Granular A, B Type I, M, and S shall not contain more than 1% by mass of deleterious material. Granular O, Granular B Type II and SSM shall not contain more than 0.1% by mass of wood. Petrographic classification of rock type need not be reported. This requirement is only to be reported when such material is present.
- Note c: Test required for materials north of the French and Mattawa Rivers only. For materials with greater than 5.0% passing the 75µm sieve, the amount of mica passing the 150µm sieve and retained on the 75µm sieve, shall not exceed 10% of the material in that sieve fraction unless either testing according to LS-709 determines permeability values to be greater than 1.0×10^{-4} cm/s or field experience show satisfactory performance. Prior data demonstrating compliance with this requirement will be acceptable provided such testing has been done within the past five years and that field performance of these materials has been satisfactory.
- Note d: The coarse aggregate Micro-Deval abrasion loss test requirements will be waived if the material has more than 80% passing the 4.75 mm sieve.
- Note e: Granular B Type I may contain up to 30% asphalt coated particles. Granular B Type II shall not contain RAP or asphalt coated products.
- Note f: RAP up to 30% by mass not applicable to Granular A and Granular A RCM.

TABLE 2 Gradation Requirements – Percent Passing

Table 2 of OPSS.MUNI 1010 is amended by the addition of column *50 mm Crushed Aggregate* as follows:

Table 2: Gradation requirements – percent passing

MTO test number	Sieve	Granular							Select subgrade material
		O	A	S	B ^a		M	50 mm crushed aggregate	
					Type I ^b	Type II			
LS-602	150 mm	n/a	n/a	n/a	100	n/a	n/a	n/a	100
	106 mm	n/a	n/a	n/a	n/a	100	n/a	n/a	n/a
	37.5 mm	100	n/a	n/a	n/a	n/a	n/a	70-100	n/a
	26.5 mm	95-100	100	100	50-100	50-100	n/a	n/a	50-100
	19 mm	80-95	85-100 (87-100*)	90-100	n/a	n/a	100	50-80	n/a
	16 mm	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	13.2 mm	60-80	65-90 (75-95)*	75-100	n/a	n/a	75-95	n/a	n/a
	9.5 mm	50-70	50-73 (60-83)*	60-85	n/a	n/a	55-80	20-60	n/a
	4.75 mm	20-45	35-55 (40-60)*	40-60	20-100	20-55	35-55	n/a	20-100
	1.18 mm	0-15	15-40	20-40	10-100	10-40	15-40	15-40	10-100
	300 µm	n/a	5-22	11-25	2-65	5-22	5-22	n/a	5-95
	150 µm	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.0-65
75 µm	0-0.5	2.0-8.0 (2.0-10.0**)	9.0-15.0 (9.0-17.0**)	0-8.0 (0-10.0**)	0-10.0	2.0-8.0 (2.0-10.0**)	3.0-8.0	0-25.0	

Note a: Where Granular B is used for granular backfill for pipe sub drains, 100% of the material shall pass the 37.5mm sieve.

Note b: Where RAP is included in Granular B Type I, 100% of the RAP shall pass the 75mm sieve. Conditions in Note 1 supersede this requirement.

* Where the aggregate is obtained from an air-cooled blast furnace slag source.

** Where the aggregate is obtained from a quarry or an air-cooled blast furnace slag or nickel slag source.

TABLE 3 Minimum Sampling and Testing Frequency for Control Chart Use

Table 3 of OPSS.MUNI 1010 is amended by the addition of row *50 mm Crushed Aggregate* as follows:

Table 3: Minimum sampling and testing frequency for control chart use

Material	Frequency for Type 1 control chart t	Frequency for Type 2 control chart t
Granular A, M and S	2500	5000
Granular B and SSM	5000	10,000
Granular O	2000	4000
50 mm Crushed Aggregate	5000	10,000

TABLE 4 Sample Size

Table 4 of OPSS.MUNI 1010 is amended by the addition of row *50 mm Crushed Aggregate* as follows:

Table 4: Sample size

Material	Minimum mass of individual field samples kg
Granular A, S, M, and O	25
Granular B and SSM	50
Granular B and SSM 100% passing 26.5 mm sieve	25
50 mm Crushed Aggregate	50

Note: Each sample container shall hold no more than 25 kg of material.



**MATERIAL SPECIFICATION FOR
AGGREGATES - BASE, SUBBASE,
SELECT SUBGRADE, AND BACKFILL MATERIAL**

TABLE OF CONTENTS

1010.01	SCOPE
1010.02	REFERENCES
1010.03	DEFINITIONS
1010.04	DESIGN AND SUBMISSION REQUIREMENTS
1010.05	MATERIALS
1010.06	EQUIPMENT - Not Used
1010.07	PRODUCTION
1010.08	QUALITY ASSURANCE
1010.09	OWNER PURCHASE OF MATERIAL - Not Used

APPENDICES

1010-A	Commentary
1010-B	Fine Aggregate Test Data Form
1010-C	Coarse Aggregate Test Data Form

1010.01 SCOPE

This specification covers the material requirements for aggregates for use in base, subbase, select subgrade, granular surface, shouldering, and backfill material. Procedures for QC and QA and referee testing protocols are incorporated.

1010.01.01 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.

1010.01.02 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.

1010.02 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 Specification, Material

OPSS 1001 Aggregates - General

Ministry of Transportation, Ontario, Publications

MTO Laboratory Testing Manual

LS-602	Sieve Analysis of Aggregates
LS-607	Percent Crushed Particles in Processed Coarse Aggregate
LS-609	Petrographic Analysis of Coarse Aggregate
LS-614	Freezing and Thawing of Coarse Aggregate
LS-616	Petrographic Analysis of Fine Aggregate
LS-617	Percent Particles with Two or More Crushed Faces and Uncrushed Particles in Processed Coarse Aggregate
LS-618	The 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-621	Determination of Amount of Asphalt Coated Particles in Coarse Aggregate
LS-624	The Use of Control Charts for Construction Aggregates
LS-625	Sampling of Granular Materials
LS-702	Determination of Particle Size Analysis of Soils
LS-703/704	Liquid Limit, Plastic Limit and Plasticity Index of Soils
LS-709	Determination of Permeability of Granular Soils

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

Air-Cooled 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.

Bench means a ledge parallel to stratigraphic bedding that in quarries forms a single level of operation above which rock is excavated from a contiguous face.

Business Day means any Day except Saturdays, Sundays, and statutory holidays.

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

Ceramic means porcelain, china, and whiteware, e.g., sinks, toilets, and bidets made from clay and silica fired at a high temperature, excluding clay brick and tile, free of organic materials, metal, and plastic.

Deleterious Material means materials from the recycling stream other than glass, ceramic, reclaimed asphalt pavement, and reclaimed concrete materials that includes but is not limited to the following: wood, clay brick, clay tile, plastic, gypsum, gypsum plaster, and wallboard.

Free of Clay means the amount of material with a particle diameter less than 2 µm shall not be greater than 1% of the total sample when tested according to LS-702.

Glass means processed glass obtained from the recycling stream that is free of organic materials, metal, and plastic.

Granular A means a set of requirements for dense graded aggregates intended for use as granular base within the pavement structure, granular shouldering, and backfill.

Granular B means a set of requirements for well-graded aggregates intended for use as granular subbase within the pavement structure and granular backfill. Granular B may be either Type I or Type II.

Granular M means a set of requirements for dense graded aggregates intended for use on unpaved road surfaces and for the maintenance of unpaved shoulders.

Granular O means a set of requirements for open graded aggregates intended only for use as a free draining granular base within the pavement structure.

Granular S means a set of requirements for dense graded aggregates intended only for use as surface dressing of low volume unpaved roads with an AADT less than 200.

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

Physical Property means an inherent attribute or feature of an aggregate or soil material. Tests are carried out to determine a materials resistance to weathering or degradation or both.

Pit-Run Material means material excavated directly from an existing bank in a pit and delivered to the job site without further processing, e.g., crushing, screening, washing, and classifying.

Production Characteristic means an attribute or feature of an aggregate or soil material, including gradation, that is introduced into the material through the manufacturing process, e.g., crushing, screening, and, blending.

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

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

Random Numbers means numbers generated by chance and recorded in random number tables.

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

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

Referee Testing means testing by an independent laboratory selected by the Contract Administrator and acceptable to the Contractor, the results of which are used for resolving differences between QC and QA testing.

Select Subgrade Material (SSM) means a set of requirements for well-graded non-plastic aggregates used to replace poor subgrade materials and as swamp backfill.

Statistical Control means when all sources of assignable variation have been removed, that is when the variability of the process is confined to chance variation alone.

Steel Slag means the non-metallic co-product resulting from the production of steel in a basic oxygen or electric arc furnace.

1010.04 DESIGN AND SUBMISSION REQUIREMENTS

1010.04.01 Submission Requirements

1010.04.01.01 Submission of Test Data

The Contractor shall have test results available for the aggregates to be used in the work. At the request of the Contract Administrator, the Contractor shall make available or submit QC test results prior to the delivery of the material. Test results shall be submitted by either the stockpile/pit-run method or control chart method. All test data forms shall be legible.

Test data for each aggregate product shall be managed independently. When more than one source is used for supplying materials, test data from each source and product shall be managed independently.

1010.05 MATERIALS

1010.05.01 General

The requirements of OPSS 1001 shall apply to this specification. Materials shall conform to this specification when tested according to the MTO Laboratory Testing Manual.

All aggregate source materials shall be clean hard durable particles free of earth, humus, and clay, e.g., coatings, lumps, and fragments. When reclaimed materials are permitted, they shall be homogeneously blended. When RCM is permitted, RCM shall not contain loose reinforcing materials.

When air-cooled blast furnace slag, nickel slag, and RAP containing steel slag aggregates are used, site-specific notification shall be given by the Contractor to the Ontario Ministry of the Environment (MOE). Glass and ceramic material shall be processed to remove all deleterious organic materials.

One hundred percent of the processed glass and ceramic material shall pass the 13.2 mm sieve.

Steel slag shall not be used.

1010.05.02 Granular A, Granular M, and Granular S

Granular A, Granular M, and Granular S may be produced by crushing one or more of the following:

- a) Quarried bedrock.
- b) Naturally formed deposits of sand, gravel, and cobbles.
- c) RAP up to 30% by mass.
- d) RCM.
- e) Air-cooled blast-furnace slag or nickel slag.
- f) Glass or ceramic materials up to 15% by mass combined.

Granular A and Granular M may contain up to 100% RCM but shall not contain more than 30% by mass of asphalt coated particles and not more than a combined total of 15% by mass of glass and ceramic material. The combined amount of deleterious material shall not exceed a total of 1% by mass.

Granular A and Granular M containing RAP with steel slag aggregates shall be acceptable for unpaved gravel shoulders only.

1010.05.03 Granular B

1010.05.03.01 General

Granular B may be either Type I or Type II as described below.

1010.05.03.02 Granular B Type I

Granular B Type I may be produced from naturally formed deposits of sand, gravel, and cobbles or by crushing one or more of the following:

- a) Quarried bedrock.
- b) Air-cooled blast-furnace slag or nickel slag.
- c) RCM.
- d) RAP up to 30% by mass.
- e) Glass or ceramic materials up to 15% by mass combined.

Granular B Type I may contain up to 100% RCM but shall not contain more than 30% by mass of asphalt coated particles. Granular B Type I may not contain more than a combined total of 15% by mass of glass and ceramic material. The combined amount of deleterious material shall not exceed 1% by mass.

RAP containing steel slag aggregates shall not be allowed.

1010.05.03.03 Granular B Type II

Granular B Type II shall only be obtained from crushing quarried bedrock, air-cooled blast furnace slag, or nickel slag. Steel slag and reclaimed materials shall not be used in the production of Granular B Type II.

1010.05.03.04 Granular O

Granular O shall only be produced by crushing quarried bedrock, or by crushing cobbles or boulders retained on the 50 mm sieve.

1010.05.03.05 Select Subgrade Material

Select subgrade material shall only be non-plastic granular or sandy type soil produced from naturally formed deposits.

1010.07 PRODUCTION

1010.07.01 Aggregate Processing, Handling, and Stockpiling

Aggregates that have become mixed with foreign matter of any description, or aggregates that have become mixed with each other shall not be used and shall be removed from the stockpile immediately. When a change in the character of the materials occurs or when the performance of materials that meet the requirements of this specification is found to be unsatisfactory, the use of the materials shall be discontinued until the Contractor, with the approval of the Contract Administrator, proves the source to be satisfactory.

Once a stockpile has been produced, sampled, and tested for QC under the procedure for stockpile/pit-run method, no further materials shall be added to the stockpile. Stockpiles produced, sampled, and tested under the procedure for control chart method may continue to have materials added provided that sampling and testing show that materials in the stockpile conform to this specification and that the process remains in statistical control.

1010.07.02 Quality Control

1010.07.02.01 General

The Contractor shall be responsible for all QC sampling and testing required to show conformance of the aggregates with this specification. Either the stockpile/pit-run method or control chart method shall be used. These records shall be made available to the Contract Administrator upon request.

When the stockpile/pit-run method has been selected, test data shall be obtained from samples taken from stockpiled or pit-run material to be used in the work.

When the control chart method has been selected, control charts shall be prepared in accordance with LS-624 or similar method. Each control chart shall contain information regarding control limits, specification limits, target values, testing frequencies, sampling locations, and time period over which the testing has taken place. Each control chart shall include individual test data of the most recent sample indicated on the chart.

1010.07.02.02 Laboratory Requirements

The Contractor shall select all QC laboratories and shall be responsible for all costs associated with the testing for QC requirements.

An acceptable laboratory conducting tests for physical properties shall be one that holds a current certificate from 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 for the specific tests, except LS-616 and LS-709.

An acceptable laboratory to conduct tests for gradation according to LS-602 and percent crushed particles according to LS-607 shall be one who holds a current certificate from CCIL as Type C.

Testing shall be conducted by qualified laboratory staff that hold a valid aggregate testing certificate from CCIL.

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

1010.07.03 Physical Properties

1010.07.03.01 Stockpile/Pit-Run Method

Testing demonstrating conformance of the aggregates shown in Table 1 shall be completed for each quantity of material produced according to the following schedule:

- a) For the first 25,000 tonnes of aggregate produced.
- b) For the next 50,000 tonnes of aggregate produced.
- c) For each 100,000 tonnes of aggregate produced thereafter.

Further testing is required whenever material is produced from a new source or a new bench in a quarry or whenever a significant change in aggregate production or material occurs that may affect the quality of material.

1010.07.03.02 Control Chart Method

The Contractor shall use a Type 1 control chart as defined in LS-624 or similar method for each physical property requirement shown in Table 1. When the control chart has been established, the minimum frequency of sampling and further testing shall be as follows:

- a) Annually, i.e., obtained within the past 12 months, when the mean value of the physical property is less than 75% of the limit shown in Table 1 and the Type 1 control chart demonstrates the process to be in statistical control; or
- b) Three times per year, spaced evenly throughout the aggregate production season, when the mean value of the physical property is greater than 75% of the limit shown in Table 1 or the Type 1 control chart demonstrates the process to be out of statistical control.

1010.07.04 Production Characteristics

1010.07.04.01 Stockpile/Pit-Run Method

Testing demonstrating conformance of the aggregates shown in Table 2 shall be completed for each 1,000 tonnes of material produced.

1010.07.04.02 Control Chart Method

A Type 1 or Type 2 control chart according to LS-624 or similar method for each applicable requirement shown in Table 2 may be used.

Type 1 control charts shall cover production of at least 20,000 tonnes of material. Type 2 control charts shall cover production of at least 80,000 tonnes of material. New or revised control charts shall be required for each successive production and delivery quantity of material, as applicable.

- a) When a Type 1 chart is used, the minimum number of test results shall be twenty ($n=20$). When this control chart has been established, the frequency of sampling and further testing shall be as follows:
 - i. When the mean value ($n=20$) of the test results is within the limit and the process is shown to be in statistical control, the frequency of sampling and testing may be decreased to meet the quantities shown in Table 3; otherwise,
 - ii. The minimum frequency shall be every 1,000 tonnes of material produced.

- b) When a Type 2 chart is used, the minimum number of subgroups shall be twenty ($k=20$). When this control chart has been established, the frequency of sampling and further testing shall be as follows:
- i. When the process is shown to be in statistical control, frequency of sampling and testing may be decreased to meet the quantities shown in Table 3; otherwise,
 - ii. The minimum frequency shall be every 1,000 tonnes of material produced.

1010.08 QUALITY ASSURANCE

1010.08.01 General

The Contract Administrator shall be allowed access to all sampling locations and reserves the right to take a QA sample at any time with notice to the Contractor. The Contract Administrator may elect to carry out testing at the QA laboratory to ensure that materials used in the work conform to the requirements of this specification.

Test data for each aggregate type shall be managed independently. When more than one source is used for supplying materials, test data from each source, and product shall be managed independently.

1010.08.02 Sampling

Sampling shall be according to LS-625 taken at a time and location determined by the Contract Administrator.

Duplicate samples shall be obtained and sealed by the Contractor in the presence of the Contract Administrator. In the event that the Contractor is unavailable to take the sample, no further materials 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.

Each QA sample shall meet the requirements shown in Table 4 and shall be clearly identified both inside and outside of the container.

When materials contain blended or reclaimed aggregates or both, QA sampling shall be performed on the final blended product.

1010.08.03 QA Laboratory Requirements

The Owner shall designate the QA laboratories and shall be responsible for all costs associated with QA testing.

An acceptable laboratory conducting tests for physical properties shall be one that holds a current certificate from CCIL as Type D for the applicable test methods and also participates in the Annual MTO Proficiency Sample Testing Program for the specific tests, except for LS-616 and LS-709.

An acceptable laboratory to conduct tests for gradation according to LS-602 and percent crushed particles according to LS-607 shall be one that holds a current certificate from CCIL as Type C.

Testing shall be conducted by qualified laboratory staff that holds a valid aggregate testing certificate from CCIL.

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

1010.08.04 Acceptance

When QA testing has not been carried out, the material shall be deemed acceptable. Otherwise, QA test results or referee test results shall be used for acceptance purposes as indicated below.

When QA test results show that the materials meet the applicable requirements shown in Table 1 and Table 2, the material shall be accepted.

When QA test results show that the material does not meet the applicable requirements shown in Table 1 and Table 2, the Contract Administrator shall notify the Contractor that materials represented by the test results shall not be accepted. This notification shall take place in writing within 3 business days of receipt of the non-conforming data.

At the discretion of the Contract Administrator, irrespective of non-compliance with the requirements shown in Table 1 and Table 2, aggregates may be accepted on the basis of satisfactory field performance.

1010.08.05 Referee Testing

When QA test results do not meet the requirements of this specification, the Contractor has the option of invoking referee testing of the test result that fails to meet the requirements. The Contractor shall notify the Contract Administrator of the selected option within 2 business days following notification of unacceptable material.

The Contract Administrator shall select a referee laboratory acceptable to the Contractor within 3 business days following the Contractor's notification to invoke referee testing. Referee samples shall be delivered to the referee laboratory from the QA laboratory by the Contract Administrator. The sealed sample shall be opened in the presence of the Contractor and the Contract Administrator. If referee materials are not available, the Contractor shall be responsible for obtaining and submitting new samples to the referee laboratory from a location to be decided by the Contract Administrator. The Contract Administrator shall be present to witness the sampling.

Referee testing shall be carried out in the presence of the Contract Administrator. When applicable, the referee laboratory shall also test a control aggregate sample for each test method required. The Contractor may observe the testing at no cost to the Owner. Comments on the nonconformity of the test methods must be made and corrected at the time of testing. If the testing cannot be corrected or if agreement on the procedure cannot be reached, the testing shall be postponed until the procedure is corrected or agreement between the parties is reached. Referee test results shall be binding on both the Owner and the Contractor.

When a referee test result shows that the aggregates do not meet the requirements of this specification, the material represented by the test result, including materials in existing stockpiles or in the work shall not be accepted. The Contractor shall remove the material from the work at no cost to the Owner.

When a referee test result shows that the aggregates are in complete conformance with the requirements of this specification, the material represented by the sample shall be accepted.

The Owner shall be responsible for the cost of referee testing provided that the referee test results show that the aggregates meet the applicable specifications. Otherwise, the Contractor shall be responsible for the costs.

TABLE 1
Physical Property Requirements

Laboratory Test	MTO Test Number	Granular O	Granular A	Granular S	Granular B Type I and Type II	Granular M	Select Subgrade Material
Coarse Aggregate Petrographic Requirement	LS-609	(Note 2)	(Note 1) (Note 2)	(Note 2)	(Note 1) (Note 2)	(Note 1) (Note 2)	(Note 2)
Freeze-Thaw Loss, % maximum	LS-614	15	N/A	N/A	N/A	N/A	N/A
Fine Aggregate Petrographic Requirement	LS-616 LS-709	(Note 3)					
Micro-Deval Abrasion Coarse Aggregate loss, % maximum	LS-618	21	25	25	30 (Note 4)	25	30 (Note 4)
Micro-Deval Abrasion Fine Aggregate loss, % maximum	LS-619	25	30	30	35	30	N/A
Plasticity Index	LS-704	0	0	0	0	0	0
Percent crushed, minimum	LS-607	100	50	50	N/A	50	N/A
2 or more crushed faces, % minimum	LS-617	85	N/A	N/A	N/A	N/A	N/A
Asphalt Coated Particles, % maximum	LS-621	N/A	30	30	(Note 5)	30	N/A

Notes:

- Granular A, B Type I, or M may contain up to 15% by mass of crushed glass and ceramic material combined.
- Granular A, B Type I, M, and S shall not contain more than 1% by mass of deleterious material. Granular O, Granular B Type II, and SSM shall not contain more than 0.1% by mass of wood. Petrographic classification of rock type need not be reported. This requirement is only to be reported when such material is present.
- Test required for materials north of the French and Mattawa Rivers only. For materials with greater than 5.0% passing the 75 µm sieve, the amount of mica passing the 150 µm sieve and retained on the 75 µm sieve, shall not exceed 10% of the material in that sieve fraction unless either testing according to LS-709 determines permeability values to be greater than 1.0×10^{-4} cm/s or field experience show satisfactory performance. Prior data demonstrating compliance with this requirement shall be acceptable provided such testing has been done within the past five years and that field performance of these materials has been satisfactory.
- The coarse aggregate Micro-Deval abrasion loss test requirements shall be waived if the material has more than 80% passing the 4.75 mm sieve.
- Granular B Type I may contain up to 30% asphalt coated particles. Granular B Type II shall not contain RAP or asphalt coated products.

TABLE 2
Gradation Requirements - Percent Passing

MTO Test Number	Sieve	Granular					Select Subgrade Material	
		O	A	S	B (Note 1)			M
					Type I (Note 2)	Type II		
LS-602	150 mm	N/A	N/A	N/A	100	N/A	N/A	100
	106 mm	N/A	N/A	N/A	N/A	100	N/A	N/A
	37.5 mm	100	N/A	N/A	N/A	N/A	N/A	N/A
	26.5 mm	95-100	100	100	50-100	50-100	N/A	50-100
	19.0 mm	80-95	85-100 (87-100*)	90-100	N/A	N/A	100	N/A
	13.2 mm	60-80	65-90 (75-95*)	75-100	N/A	N/A	75-95	N/A
	9.5 mm	50-70	50-73 (60-83*)	60-85	N/A	N/A	55-80	N/A
	4.75 mm	20-45	35-55 (40-60*)	40-60	20-100	20-55	35-55	20-100
	1.18 mm	0-15	15-40	20-40	10-100	10-40	15-40	10-100
	300 µm	N/A	5-22	11-25	2-65	5-22	5-22	5-95
	150 µm	N/A	N/A	N/A	N/A	N/A	N/A	2.0-65.0
	75 µm	0-5.0	2.0-8.0 (2.0-10.0**)	9.0-15.0 (9.0-17.0**)	0-8.0 (0-10.0**)	0-10.0	2.0-8.0 (2.0-10.0**)	0-25.0

Notes:

1. When Granular B is used for granular backfill for pipe subdrains, 100% of the material shall pass the 37.5 mm sieve.
2. When RAP is included in Granular B Type I, 100% of the RAP shall pass the 75 mm sieve. Conditions in Note 1 supersede this requirement.

* When the aggregate is obtained from an air-cooled blast furnace slag source.

** When the aggregate is obtained from a quarry or an air-cooled blast furnace slag or nickel slag source.

TABLE 3
Minimum Sampling and Testing Frequency for Control Chart Use

Material	Frequency for Type 1 Control Chart t	Frequency for Type 2 Control Chart t
Granular A, M, and S	2,500	5,000
Granular B and SSM	5,000	10,000
Granular O	2,000	4,000

TABLE 4
Sample Size

Material	Minimum Mass of Individual Field Samples kg
Granular A, S, M, and O	25
Granular B and SSM	50
Granular B and SSM 100% passing 26.5 mm sieve	25
Note: Each sample container shall hold no more than 25 kg of material.	

**Appendix 1010-A, April 2013
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 forms in Appendices 1010-B and 1010-C are to be used for submission purposes. If so, they need to be invoked by reference in the Contract Documents.

The use of steel slag aggregate is prohibited.

The designer should be aware that air-cooled blast furnace slag, nickel slag, and RAP containing steel slag aggregates may require specific placement guidelines based on local municipal and MOE requirements.

Prior to tendering, when Owner supplied or specified air-cooled blast furnace slag, nickel slag, or RAP containing steel slag aggregates are to be used, the designer should obtain site notification from MOE and ensure all environmental guidelines and requirements are met.

RAP content is determined by LS-623, percent Asphalt Coated Particles. However, this test is limited to identifying RAP content in the coarse aggregate portion only. When RAP in fine aggregate is a concern a Petrographic Examination of the material passing the 4.75 mm sieve is recommended. (1010.05.02)

The Contract Documents should specify the QA testing to be performed in the Contract. If QA testing is not specified, the material shall be deemed acceptable.

The designer may specify a higher percent crushed requirement to improve performance in higher traffic areas.

Related Ontario Provincial Standard Drawings

No information provided here.

Appendix 1010-B, Additional Information for OPSS.MUNI 1010, April 2013

Note: This appendix is not a mandatory part of the standard specification. However, it is written in mandatory language to permit invoking it by reference in the Contract Documents.

**OPSS 1010 - FINE AGGREGATE TEST DATA
Granular A, B, M, O, S, and Select Subgrade Material (SSM)**

Contract No:	Contractor:	Contract Location:
Name of Testing Laboratory:		
Telephone No:	Fax No:	Date Tested:

Material Type (check one)						
Granular						[] SSM
[] A	[] B Type I	[] B Type II	[] M	[] O	[] S	
Date Sampled (YY/MM/DD):		Sampled by (Print Name):			Material Source:	

Laboratory Test Number	Acceptance Requirements							Test Results	
	Granular						SSM	Reference Material	Sample
	A	B Type I	B Type II	M	O	S			
Petrographic Requirement, LS-616	For materials north of the French and Mattawa Rivers: maximum 10% mica (retained on the 75 μm sieve).							N/A	
Micro-Deval Abrasion Loss, % maximum, LS-619	30	35	35	30	25	30	N/A		
Plasticity Index, % maximum, LS-704	0	0	0	0	0	0	0	N/A	

Issued by Testing Laboratory Representative:

PRINT NAME	SIGNATURE	DATE
------------	-----------	------

Received By Contract Administrator Representative:

PRINT NAME	SIGNATURE	DATE
------------	-----------	------

Appendix 1010-C, Additional Information for OPSS.MUNI 1010, April 2013

Note: This appendix is not a mandatory part of the standard specification. However, it is written in mandatory language to permit invoking it by reference in the Contract Documents.

**OPSS 1010 - COARSE AGGREGATE TEST DATA
Granular A, B, M, O, S, and Select Subgrade Material (SSM)**

Contract No:	Contractor:	Contract Location:
Name of Testing Laboratory:		
Telephone No:	Fax No:	Date Tested:

Material Type (check one)						
Granular						[] SSM
[] A	[] B Type I	[] B Type II	[] M	[] O	[] S	
Date Sampled (YY/MM/DD):		Sampled By (Print Name):			Material Source:	

Laboratory Test Number	Acceptance Requirements							Test Results	
	Granular						SSM	Reference Material	Sample
	A	B Type I	B Type II	M	O	S			
Crushed Particles, % minimum, LS-607	50	N/A	100	50	100	50	N/A	N/A	
Petrographic Requirement, LS-609	(Note 1)	N/A	(Note 1)	(Note 1)	N/A	(Note 1)	N/A	N/A	
Freeze-Thaw Loss, % maximum, LS-614	N/A	N/A	N/A	N/A	15	N/A	N/A		
2 Faces Crushed, % minimum, LS-617	N/A	N/A	N/A	N/A	85	N/A	N/A	N/A	
Micro-Deval Abrasion Loss, % maximum, LS-618	25	30 (Note 2)	30	25	21	25	30 (Note 2)		
Asphalt Coated Particles, % maximum, LS-621	30	30	N/A	30	N/A	30	N/A	N/A	

Notes:

- Maximum of 15% by mass of crushed glass or ceramic material or both, and maximum of 1% by mass of deleterious materials (wood, clay brick, clay tile, gypsum, gypsum plaster, and wallboard).
- The coarse aggregate Micro-Deval abrasion loss test requirement shall be waived if the material has more than 80% passing the 4.75 mm sieve.

Issued by Testing Laboratory Representative:

PRINT NAME	SIGNATURE	DATE
------------	-----------	------

Received by Contract Administrator Representative:

PRINT NAME	SIGNATURE	DATE
------------	-----------	------