MATERIAL SPECIFICATION FOR
AGGREGATES - MISCELLANEOUS

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1004.01  SCOPE

This specification covers material requirements for aggregates for use as granular sheeting, rip-rap, rock protection, gabion stone, clear stone, graded stone, truck arrester bed aggregate, mortar sand, winter sand, and granular fill applications. Quality control (QC) and quality assurance (QA) procedures and referee testing protocol are incorporated.

1004.01.01  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.
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.

REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

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

Ontario Provincial Standard Specifications, Material

OPSS 1001 Aggregates - General

Ontario Ministry of Transportation Publications

MTO Laboratory Testing Manual:
LS-601 Materials 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-607 Percent Crushed Particles in Processed Coarse Aggregate
LS-608 Percent Flat and Elongated Particles in Coarse Aggregate
LS-610 Organic Impurities in Concrete Sands
LS-614 Freezing and Thawing of Coarse Aggregate
LS-616 Petrographic Analysis of Fine 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 Use of Control Charts for Construction Aggregates
LS-625 Sampling of Granular Materials
LS-703/704 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
LS-709 Determination of Permeability of Granular Soils
1004.03 DEFINITIONS

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

**Clear Stone** means a graded aggregate intended for use in drainage, backfill, bedding, and other applications.

**Gabion Stone** means a graded fractured rock aggregate intended for use in gabion baskets and gabion mats.

**Granular C and Granular D** means an aggregate intended for use as granular fill.

**Granular Sheeting** means a graded granular aggregate material intended for use as a protective surface layer on erodible soil slopes.

**Mortar Sand** means a fine aggregate intended for application in Portland cement based mortars.

**Nominal Maximum Size** means the largest sieve in the applicable specification upon which material is permitted to be retained.

**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.

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

**Quality Assurance (QA)** means a system or series of activities carried out by the Owner 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 Owner meet the specified requirements.

**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.

**Rip-Rap** means a well graded, fractured rock or crushed reclaimed concrete intended for use as slope protection in hydraulic channels.

**Rock Protection** means a well graded, fractured rock or crushed reclaimed concrete intended for use as general slope protection.

**Spheroidal Particle** means when the ratio of the greatest dimension in the longitudinal axis compared to the least dimension in a plane perpendicular to the longitudinal axis is less than 2:1.

**Truck Arrester Bed Aggregate** means a single-sized aggregate used in runaway truck lanes to slow and stop the progress of vehicles.

**Winter Sand** means a fine aggregate intended for application to roadways during winter conditions to improve frictional properties of the pavement surface.
1004.04 DESIGN AND SUBMISSION REQUIREMENTS

1004.04.01 Submission Requirements

1004.04.01.01 Test Data

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 may be submitted by either the stockpile 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.

1004.05 MATERIALS

1004.05.01 General

The requirements of OPSS 1001 shall apply to this specification. Material shall be according to this specification when tested according to the MTO Laboratory Testing Manual. Aggregates shall be according to this specification, when tested according to the methods given in this specification.

All aggregate source materials shall be clean, hard, durable particles free of earth, humus, clay coatings, and clay lumps. Aggregates may be sands, gravels, cobbles, boulders, or quarried rock. Reclaimed asphalt pavement, reclaimed Portland cement concrete, glass, other reclaimed materials, and slag materials shall not be used. When reclaimed materials are permitted by this specification or specified in the Contract Documents, they shall be homogeneously blended. When reclaimed Portland cement concrete is permitted, it shall not contain loose reinforcing material and shall be free of protruding metal.

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

1004.05.02 Clear Stone

Clear stone may be 53.0 mm, 19.0 mm Type I, 19.0 mm Type II, 16.0 mm, 13.2 mm, or 9.5 mm and shall meet the physical property requirements shown in Table 1 and the gradation requirements shown in Table 2.

1004.05.03 Granular C and Granular D

Granular C and Granular D shall meet the physical property requirements shown in Table 3 and the gradation requirements shown in Table 4.

1004.05.04 Granular Sheeting

Granular sheeting shall meet the physical property requirements shown in Table 3 and the gradation requirements shown in Table 4.

1004.05.05 Rip-Rap, Rock Protection, and Gabion Stone

1004.05.05.01 General

Rip-rap, rock protection, and gabion stone shall be produced from crushed or fractured bedrock fragments with 100% fractured faces or crushed from cobbles or boulders greater than 300 mm diameter and shall not deteriorate when exposed to air and water and shall be resistant to deterioration by cycles of wetting, drying, freezing, and thawing.
Reclaimed Portland cement concrete may be used in non-watercourse applications.

1004.05.02 Rip-Rap and Gabion Stone

Rip-rap R-10 and R-50 classifications and gabion stone G-3 and G-10 classifications shall meet the gradation requirements shown in Table 5.

1004.05.03 Rock Protection

Rock protection shall be well graded with a maximum particle diameter of 500 mm with no more than 10% by mass of the material passing the 106 mm sieve. Rock protection shall have a maximum of 15% by mass of flat and elongated particles when tested according to LS-608.

1004.05.06 Truck Arrester Bed Aggregate

Truck arrester bed aggregate shall be pit-run material meeting the gradation requirements shown in Table 6 and the physical requirements shown in Table 7. In addition, truck arrester bed aggregate shall meet the following shape requirements:

a) Rounded particles shall be a minimum of 30% by mass. Rounded particles shall be determined by the procedure given in LS-607, reporting the percentage of rounded particles instead of crushed particles. The test specimen size shall be a minimum of 3,000 g passing the 26.5 mm sieve and retained on the 19 mm sieve.

b) Spheroidal particles shall be a minimum of 50% by mass. Spheroidal particles shall be determined by the procedure given in LS-608, using a figure-eight calliper in which the ratio of the opening at one end to that at the other end is 2:1 instead of 4:1. The test specimen size shall be a minimum of 3,000 g passing the 26.5 mm sieve and retained on the 19 mm sieve.

1004.05.07 Mortar Sand

1004.05.07.01 General

Mortar sand shall consist of natural sand, or subject to the approval of the Contract Administrator other inert materials with similar characteristics, or combinations thereof, having hard, strong, durable particles. The sand shall be free from a coating of any deleterious material and free from other deleterious substances.

1004.05.07.02 Gradation Requirements

Mortar sand shall meet the gradation requirements of Table 8.

1004.05.07.03 Test for Organic Impurities

The fine aggregate, when subjected to the sodium hydroxide colorimetric test according to LS-610, shall not produce a colour darker than the standard solution or organic plate number 3. A fine aggregate failing this test may be approved if it meets the requirements of the mortar strength test according to ASTM C 87.

1004.05.07.04 Test for Strength

When subjected to the mortar strength test according to ASTM C 87, mortar specimens containing the fine aggregate shall develop a compressive strength at the age of 7 Days when using Portland cement, of not less than 90% of the strength developed by a mortar prepared in the same manner with the same cement and graded Ottawa sand having a fineness modulus of 2.40 ± 0.10.
Winter sand shall meet the gradation requirements shown in Table 9. When obtained from sources from St. Joseph Island, Manitoulin Island, or areas of Ontario south and west of a boundary delineated by the Severn River, Provincial Highway 12 and Provincial Highway 7 east of Highway 12, winter sand shall have a maximum fine aggregate Micro-Deval abrasion loss of 25%, when tested according to LS-619.

Aggregates separated during processing shall be placed in individual stockpiles. Processed aggregates secured from different sources and aggregates from the same source but of different gradations shall be placed in individual stockpiles. Materials shall be retained in stockpiles until all required QC testing has been completed.

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 source material occurs or when the performance of material that meets the requirements of this specification is found to be unsatisfactory, use of the material shall be discontinued until a reappraisal by the Contractor and approved by the Contract Administrator, proves the source to be satisfactory.

Once a stockpile has been produced, sampled, and tested, no further material may be added to the stockpile. Stockpiles produced, sampled, and tested under the procedure for control chart method may continue to have material added, provided that sampling and testing show that the material in the stockpile is in accordance to this specification and that the process remains in statistical control.

The Contractor shall be responsible for all QC sampling and testing to show complete conformance of the aggregates with this specification. These records shall be made available to the Contract Administrator upon request.

When the stockpile 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.

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 Type D certificate from Canadian Council of Independent Laboratories (CCIL) for the applicable test methods and also participates in the Annual MTO Proficiency Sample Testing Program for the specified tests, when applicable.
An acceptable laboratory conducting tests for materials finer than 75 μm by washing according to LS-601, gradation according to LS-602, and percent crushed particles according to LS-607 shall be one that holds a current Type C certificate from CCIL.

Testing shall be conducted by qualified laboratory staff holding 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.

**1004.07.02.03 Gradation**

For winter sand, a minimum of one gradation test result shall be conducted for each 1,000 tonnes of winter sand, or portion thereof, for quantities delivered to a single stockpile location. For all other materials, QC testing for gradation requirements shall be conducted at intervals chosen by the Contractor, but not less than the frequency specified in the Physical Properties clause.

When more than one source is used for supplying winter sand, each source shall be managed independently.

**1004.07.02.04 Physical Properties**

Except as noted below, test results demonstrating conformance of the aggregates with the physical property requirements of this specification shall be completed according to the following schedule on each material produced:

a) For the first 20,000 tonnes of aggregate produced.

b) For the next 20,000 tonnes of aggregate produced.

c) For each 40,000 tonnes of aggregate produced thereafter.

When required for winter sand, Micro-Deval abrasion test results obtained within the past 18 months shall be provided from each source to be used in the Work.

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.

**1004.07.02.05 Control Chart Method**

When the control chart method has been selected, a Type 1 control chart, as defined in LS-624 or similar method shall be produced for each physical property requirement. 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 given in the appropriate table 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 schedule, when the mean value of the physical property is greater than 75% of the limit given in the appropriate table or the Type 1 control chart demonstrates the process to be out of statistical control.
1004.08 QUALITY ASSURANCE

1004.08.01 General

The Contract Administrator shall be allowed access to all sampling locations and reserves the right to request a QA sample at any time from the Contractor. The Contract Administrator may elect to carry out testing of the QA sample to ensure that material used in the Work is according to the requirements of this specification. Testing shall be carried out at a laboratory designated by the Owner. The Owner shall be responsible for all costs associated with QA testing.

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

1004.08.02 Sampling

Sampling shall be according to LS-625 and taken at the time and location determined by the Contract Administrator. Samples shall be of sufficient mass to conduct the necessary gradation and physical property tests of the material. In no case shall the sample weigh less than 10 kg. For winter sands, the sample shall have a mass of not less than 5 kg.

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 delivered and stored as specified in the Contract Documents.

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

1004.08.03 Quality Assurance Laboratory Requirements

An acceptable laboratory conducting QA tests for physical properties shall be one that holds a current Type D certificate from CCIL for the applicable test methods and also participates in the Annual MTO Proficiency Sample Testing Program for the specified tests, when applicable.

An acceptable laboratory conducting QA tests for materials finer than 75 μm by washing according to LS-601, gradation according to LS-602, and percent crushed particles according to LS-607 shall be one that holds a current Type C certificate from CCIL.

Testing shall be conducted by qualified laboratory staff holding 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.

1004.08.04 Testing and Retention of Samples

When the Contract Administrator has elected to carry out QA testing, one of the duplicate samples shall be randomly selected for testing by the QA laboratory. The QA laboratory shall retain the remaining sealed sample for possible referee testing.

1004.08.04.01 Winter Sand

Following delivery, winter sand shall be subject to a visual inspection of the stockpile to determine the presence of oversize material. Oversize particles may be confirmed with a 9.5 mm sieve.
1004.08.05 Acceptance

When the Contract Administrator has elected not to test the QA sample, the material shall be deemed acceptable. Otherwise, QA test results shall be used for acceptance purposes, except when referee testing of any aggregate or a visual examination of winter sand has been carried out.

When QA test results show that the material meets the applicable gradation and physical property requirements of this specification, the material shall be accepted.

When QA test results show that the material does not meet the applicable requirements of this specification, the Contract Administrator shall notify the Contractor that material 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.

1004.08.06 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 failed 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. The Contract Administrator shall deliver referee samples to the referee laboratory. 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 shall 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. Alternatively, the Owner may consider a Contractor's request for a reduced price in lieu of removal of aggregates that fail to meet the physical requirements of this specification. Irrespective of the negotiation of a reduced price payment, the warranty provisions of the Contract Documents shall apply.

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

The Owner will 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 for Clear Stone

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>MTO Test Number</th>
<th>Nominal Maximum Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>53 mm 19 mm 19 mm Type I 19 mm Type II, 16 mm, 13.2 mm, and 9.5 mm</td>
</tr>
<tr>
<td>Loss by Washing, Pass 75 μm Sieve, % maximum</td>
<td>LS-601</td>
<td>2.0 2.0 2.0</td>
</tr>
<tr>
<td>Crushed particles, % minimum</td>
<td>LS-607</td>
<td>- 50 60</td>
</tr>
<tr>
<td>Micro-Deval Abrasion Loss, coarse aggregate, % maximum</td>
<td>LS-618</td>
<td>25 25 25</td>
</tr>
</tbody>
</table>

### TABLE 2
Gradation Requirements for Clear Stone

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Gradation (LS-602), Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>53 mm Type I 19 mm Type II 19 mm Type I 19 mm Type II 16 mm 13.2 mm 9.5 mm</td>
</tr>
<tr>
<td>63 mm</td>
<td>100</td>
</tr>
<tr>
<td>53 mm</td>
<td>90 - 100</td>
</tr>
<tr>
<td>26.5 mm</td>
<td>- 100 100</td>
</tr>
<tr>
<td>19.0 mm</td>
<td>0 - 15 90 - 100 90 - 100 100</td>
</tr>
<tr>
<td>16.0 mm</td>
<td>- 65 - 90 96 - 100 100</td>
</tr>
<tr>
<td>13.2 mm</td>
<td>- - 67 - 90 96 - 100 100</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>- 0 - 55 20 - 55 29 - 52 50 - 73 95 - 100</td>
</tr>
<tr>
<td>6.7 mm</td>
<td>- - - 20 - 45</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>- 0 - 10 0 - 10 0 - 10 0 - 10 0 - 10</td>
</tr>
<tr>
<td>75 μm</td>
<td>0 - 2.0 0 - 2.0 0 - 2.0 0 - 2.0 0 - 2.0 0 - 2.0</td>
</tr>
</tbody>
</table>
TABLE 3  
Physical Property Requirements for Granular C, Granular D, and Granular Sheeting

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>MTO Test Number</th>
<th>Granular D</th>
<th>Granular C</th>
<th>Granular Sheeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petrographic Requirement, fine aggregate</td>
<td>LS-616</td>
<td>(Note 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micro-Deval Abrasion Loss, coarse aggregate, % maximum (Note 2)</td>
<td>LS-618</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micro-Deval Abrasion Loss, fine aggregate, % maximum</td>
<td>LS-619</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasticity Index (PI), maximum</td>
<td>LS-704</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

1. For materials north of the French/Mattawa Rivers only: for materials with > 5.0% passing the 75 μm sieve, the amount of mica retained on the 75 μm sieve, passing the 150 μm sieve, shall not exceed 10% of the material on that sieve, unless testing according to LS-709 determines permeability values > 1.0 x 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 field performance has been satisfactory.

2. The requirement for the coarse aggregate Micro-Deval abrasion loss test shall be waived if the material has more than 80% passing the 4.75 mm sieve.

TABLE 4  
Gradation Requirements for Granular C, Granular D, and Granular Sheeting

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Gradation (LS-602), Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Granular C</td>
</tr>
<tr>
<td>150 mm</td>
<td>100</td>
</tr>
<tr>
<td>26.5 mm</td>
<td>50 - 100</td>
</tr>
<tr>
<td>13.2 mm</td>
<td>-</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>-</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>20 - 100</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>10 - 100</td>
</tr>
<tr>
<td>300 μm</td>
<td>5 - 90</td>
</tr>
<tr>
<td>150 μm</td>
<td>4 - 30</td>
</tr>
<tr>
<td>75 μm</td>
<td>0 - 10.0</td>
</tr>
</tbody>
</table>
### TABLE 5
Gradation Requirements for Gabion Stone and Rip-Rap

<table>
<thead>
<tr>
<th>Mass kg</th>
<th>Approximate Dimension Mm</th>
<th>Gradation, percent less than mass specified</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Gabion Stone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G-3</td>
</tr>
<tr>
<td>75</td>
<td>305</td>
<td>-</td>
</tr>
<tr>
<td>50</td>
<td>265</td>
<td>-</td>
</tr>
<tr>
<td>25</td>
<td>210</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>155</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>125</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>105</td>
<td>90 - 100</td>
</tr>
<tr>
<td>2.5</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>0.5</td>
<td>60</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

Notes:
A. Masses are based on approximate size of an equivalent cube with a specific gravity of 2.65 and are provided for estimating purposes only. Gradation is determined by weighing individual stone particles in the field or laboratory.

### TABLE 6
Physical Property Requirements for Truck Arrester Bed Aggregate

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>MTO Test Number</th>
<th>Truck Arrester Bed Aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss by Washing, Pass 75 μm Sieve, % maximum</td>
<td>LS-601</td>
<td>1.0</td>
</tr>
<tr>
<td>Absorption, % maximum</td>
<td>LS-604</td>
<td>2.0</td>
</tr>
<tr>
<td>Freeze-Thaw Loss, % maximum</td>
<td>LS-614</td>
<td>6</td>
</tr>
<tr>
<td>Micro-Deval Abrasion Loss, coarse aggregate, % maximum</td>
<td>LS-618</td>
<td>21</td>
</tr>
</tbody>
</table>
### TABLE 7
Gradation Requirements for Truck Arrester Bed Aggregate

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Gradation (LS-602), Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>26.5 mm</td>
<td>90 - 100</td>
</tr>
<tr>
<td>19.0 mm</td>
<td>0 - 10</td>
</tr>
</tbody>
</table>

### TABLE 8
Gradation Requirements for Mortar Sand

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Gradation (LS-602), Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75 mm</td>
<td>100.0</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>95 - 100</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>60 - 100</td>
</tr>
<tr>
<td>600 μm</td>
<td>35 - 80</td>
</tr>
<tr>
<td>300 μm</td>
<td>15 - 50</td>
</tr>
<tr>
<td>150 μm</td>
<td>2 - 15</td>
</tr>
<tr>
<td>75 μm</td>
<td>0 - 5.0</td>
</tr>
</tbody>
</table>
## TABLE 9
Gradation Requirements for Winter Sand

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Gradation (LS-602), Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5 mm</td>
<td>100.0 (Note 1)</td>
</tr>
<tr>
<td>6.7 mm</td>
<td>97 - 100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>90 - 100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>50 - 95</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>20 - 90</td>
</tr>
<tr>
<td>600 μm</td>
<td>0 - 70</td>
</tr>
<tr>
<td>300 μm</td>
<td>0 - 35</td>
</tr>
<tr>
<td>150 μm</td>
<td>0 - 15</td>
</tr>
<tr>
<td>75 μm</td>
<td>0 - 5.0</td>
</tr>
</tbody>
</table>

Notes:

1. In addition to LS-602, to be confirmed by visual inspection of the stockpile.

A. The minimum size of the test sample shall be 5 kg. Following oven drying, the sample shall be sieved on the 9.5 mm, 6.7 mm, and 4.75 mm sieves. Material passing the 4.75 mm sieve shall be split to an appropriate size according to LS-602 for subsequent washing and fine sieving. The final grading shall be calculated according to LS-602 as the percentage of material passing each sieve based on the total mass of the oven dried sample.
Appendix 1004-A, November 2012
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 be aware that OPSS 1004 includes the introduction of new physical test methods, introduction of laboratory qualification requirements, minimum quality control (QC) requirements, and referee testing.

The designer should be aware that quality assurance (QA) testing for purposes of ensuring material used in the Work meets the requirements of OPSS 1004 is not mandatory, unless specifically included in the Contract Documents. The decision to conduct QA testing should be based on the size, complexity, and desired service life of the Work. The designer should specify the frequency of QA testing. In the event that the Contract Administrator elects not to carry out QA testing, QC test data may be used for acceptance purposes at the risk of the Owner. In this case, the minimum frequency of QC sampling and testing should be specified.

QC test data is typically obtained from samples taken from stockpiled material to be used in the Work. At the discretion of the Contract Administrator and when the quantities or dollar value of aggregate warrant, aggregate test data obtained within the past 18 months from the same location within the source that is to be used in the Work may be provided.

The designer should specify any additional referee testing laboratory requirements, including time lines, selection criteria or roster for referee laboratories, and the cost for referee testing.

The designer may consider the use of reclaimed materials as an alternate aggregate source material. If so, the designer should specify this requirement in the Contract Documents. (1004.05.01)

For the approval of rip-rap, rock protection, and gabion stone material, the designer should investigate the durability of available material for the intended use. (1004.05.01)

The designer should ensure that the need for stability of 53 mm clear stone is considered. When required, the minimum percent crushed requirement should be added. (Table 1)

The designer should specify the storage and delivery requirements for QA samples. (1004.08.02)

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.