

AMENDMENT TO OPSS 1002, APRIL 2018 - Concrete Aggregates

Special Provision No. 110S17

November 2022

1002.01 SCOPE

Section 1002.01 of OPSS 1002 is deleted in its entirety and replaced with the following:

This specification covers material requirements for aggregates for use in concrete.

1002.02 REFERENCES

Section 1002.02 of OPSS 1002 is amended by the addition of the following:

Ontario Provincial Standard Specifications, Construction

OPSS 366 Construction Specification for Repairing Concrete Pavement and Concrete Base

Ontario Ministry of Transportation Publications

MTO Forms:

PH-CC-447 Concrete Aggregate Gradation Acceptance Sheets

1002.03 DEFINITIONS

Section 1002.03 of OPSS 1002 is amended by the addition of the following:

Full Depth Repair means as defined in OPSS 366.

Lot means a specified amount of construction assumed to be produced by the same process.

Mean means the arithmetic average of a set of data.

Partial Depth Repair means as defined in OPSS 366.

Unacceptable Material means materials that include, but not limited to, the following: steel slag, air-blast furnace slag, glass, wood, clay brick, clay tile, plastic, gypsum plaster, wallboard, roots, and all other organic matter.

1002.05 MATERIALS

1002.05.01 General

Clause 1002.05.01 of OPSS 1002 is deleted in its entirety and replaced with the following:

Aggregates shall be according to OPSS 1001 and shall conform to the requirements of this specification.

Except as noted below or as specified in the Contract Documents, aggregates shall be sands, gravel, or quarried rock; provided the source is of such nature and extent to ensure acceptable processed aggregates of a consistent

grading and quality. When any change in the character of the aggregate occurs or when the performance of aggregate meeting the requirements of this specification is found to be unsatisfactory, use of the aggregate shall be discontinued until a reappraisal by the Contractor, with the approval of the Contract Administrator, proves the source to be satisfactory.

Steel slag or air-cooled blast furnace slag shall be prohibited for use as aggregate in concrete.

Use of aggregate in concrete shall not be permitted unless the aggregate is from a source on the current Ontario Ministry of Transportation Structural Concrete Aggregate Sources List or the Concrete Aggregate Sources List for Concrete Base/Pavement Coarse Aggregates.

Irrespective of compliance with all the physical property requirements stated in this specification, at the discretion of the Owner, aggregates may be accepted or rejected for use based on demonstrated past field performance in concrete.

The field performance of a concrete structure or concrete pavement/base using aggregates accepted based on demonstrated past field performance, shall be evaluated according to CSA A23.2-27A, Attachment A2, Guidelines for Evaluating the Field Performance of Aggregates: Field and Laboratory Testing, with the exception that the structure or concrete pavement/base shall be at least 15 years old. In addition, the concrete being evaluated to determine the field performance of an aggregate shall:

- a) Have been used for equivalent or more severe applications;
- b) Have been subjected to equivalent or more severe exposure conditions;
- c) Not contain supplementary cementing materials that may have mitigated or improved performance such as: freeze/thaw durability, scaling resistance or alkali-aggregate reactivity of aggregates in concrete.

The Owner may reject the use of any concrete aggregate based on past field performance in any structure or pavement of any age.

1002.05.02 Fine Aggregate

1002.05.02.01 General

Clause 1002.05.02.01 of OPSS 1002 is deleted in its entirety and replaced with the following:

Fine aggregates shall not be accepted for use in concrete pavement, concrete base, full depth repair, partial depth repair, exposed concrete bridge deck driving surfaces unless the acid insoluble residue ($IR_{R75\mu m}$) as determined by LS-613 is greater than 60%.

1002.05.02.02 Grading Requirements

Clause 1002.05.02.02 of OPSS 1002 is deleted in its entirety and replaced with the following:

Unless the Contract Administrator has agreed to allow a special grading, the fine aggregates shall be according to the requirements specified in Table 2.

1002.05.03 Coarse Aggregate

1002.05.03.01 Grading Requirements

Clauses 1002.05.03.01.02, 1002.05.03.01.03 and 1002.05.03.01.04 of OPSS 1002 are deleted in their entirety and replaced with the following:

1002.05.03.01.02 Concrete Structures, Sidewalks, Curb and Gutter, and Other Concrete Tender Items of More Than 100 mm in Thickness

A single coarse aggregate, with a nominal maximum aggregate size of 19.0 mm and meeting the grading requirements shown in Table 4 shall be used, unless specified elsewhere in the Contract Documents. Stockpiling aggregates in individual size fractions and blending them to meet the grading requirements, shown in Table 4, for a 19.0 mm nominal maximum size aggregate, shall be permitted. If individual stockpiles are used, the combined gradation of all coarse fractions shall be according to the requirements specified in Table 4.

1002.05.03.01.03 Concrete Pavement, Concrete Base, Full Depth Repair, and Partial Depth Repair

The grading bands for the individual coarse aggregate components used in concrete pavement, concrete base, full depth repair, and partial depth repair are shown in the first two columns of Table 5. Aggregates shall be stockpiled as individual size fractions and blended in the mix. The blended aggregates shall be used for concrete pavement and concrete base and shall meet the combined grading requirements specified in the last column of Table 5. The grading of coarse aggregates used in full depth repair shall be according to the requirements for 19 mm aggregate or the combined grading requirements specified in Table 5. The grading of coarse aggregates used in partial depth repair shall be according to the requirements for 19 mm aggregate grading requirements specified in Table 5.

1002.05.03.01.04 Concrete Patches, Refacing, Overlays, and Other Concrete Tender Items of 100 mm or Less in Thickness

A single coarse aggregate, with a nominal maximum aggregate size of 13.2 mm and meeting the grading requirements shown in Table 4, shall be used for concrete patches, refacing, overlays, and other concrete tender items of 100 mm or less in thickness. However, when the thickness of the repair exceeds 100 mm, a single coarse aggregate, with a nominal maximum aggregate size of 19.0 mm and meeting the grading requirements specified in Table 4, shall be used.

1002.05.04 Deleterious Expansion Other than Alkali Aggregate Reaction

Subsection 1002.05.04 of OPSS 1002 is amended by deleting the second paragraph in its entirety and replace it with the following:

Coarse and fine aggregates used in a concrete mix shall:

- individually have a total of less than 1% gypsum, anhydrite, or other sulphate minerals; and
- contain no steel slag, air-cooled blast furnace slag or glass.

Coarse and fine aggregates from a pit source used in a concrete mix shall individually have a total sulphur content of less than 0.25% as determined by a combustion infrared absorption method.

Coarse and fine aggregates from a quarry source used in a concrete mix shall individually have a total sulphur content of less than 0.6% as determined by a combustion infrared absorption method.

1002.07 PRODUCTION

Subsection 1002.07.01 of OPSS 1002 is deleted in its entirety and replaced with the following:

1002.07.01 Aggregate Processing, Handling, and Stockpiling

Stockpiles of aggregates stored in piles, bins or other temporary facilities, shall be located where those aggregates are being used to batch the concrete to be used in the work.

The processed aggregates shall be separated into fine and coarse aggregates and stockpiled separately, as follows:

- Aggregates separated during processing,
- Aggregates secured from different sources,
- Aggregates from the same source but of different gradings,
- Aggregates from a new bench in a quarry, or
- Aggregates resulting from a significant change in production that affects physical quality. .

For sampling and testing purposes, separate stockpiles shall be provided for:

- a) The fine aggregate grading, shown in Table 2, and for each different coarse aggregate grading, shown in Table 4 or 5, that will be used in the mix; and
- b) Each different aggregate component within the coarse and fine gradings referred to the respective tables above , if one or more of the individual aggregate components are derived either from a different source location or from a different lithology within the same source location.

Where a blended fine aggregate is used in the mix, one of the following shall also be provided:

- a) A single stockpile of uniformly blended fine aggregate that will be used in the mix; or
- b) The proportions of each fine aggregate component in the mix.

Where a blended coarse aggregate is used in the mix, then one of the following shall be provided:

- a) A single stockpile of uniformly blended coarse aggregate that will be used in the mix; or
- b) The proportions of each individual aggregate component in the blended coarse aggregate that will be used in the mix.

Where blended fine or coarse aggregates are to be used in the Work, the proportions shall be submitted at the same time as MTO form PH-CC-433A, Concrete Mix Design Submission Form A. If the proportions are changed, then the revised proportions and a new MTO form PH-CC-433A shall be submitted.

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 removed immediately from the stockpile.

1002.08 QUALITY ASSURANCE

1002.08.04 Sampling

Subsection 1002.08.04 of OPSS 1002 is deleted in its entirety and replaced with the following:

Sampling, shall be according to CSA A23.2-1A, LS-625 and all other requirements as specified in the Contract Documents. During the production of concrete, QA samples of aggregate representing each lot of concrete in the Work, shall be randomly taken from the aggregate stockpiles being used to batch the concrete for that lot. Such stockpiles shall meet the following requirements:

- a) Stockpile shall be of sufficient size to meet all sampling requirements, including the construction of a proper sampling pad; and
- b) Meet all other requirements to ensure that the samples taken, for each lot, will be representative of the aggregates within that lot.

New or clean sample bags or containers shall be provided for sampling. Sample bags or containers shall be constructed to prevent the loss of any part of the material or contamination or damage to the contents during shipment. Sample containers shall be securely fastened. Metal or cardboard containers are unacceptable. The sample shall be identified both inside and outside of the sample container. Data to be included with the sample shall be according to MTO form PH-D-10, Aggregate Sample Data Sheet.

For physical properties, at least one set of duplicate QA samples of each coarse and each fine aggregate component from each individual source shall be randomly sampled from lots according to the schedule specified in Table 1.

Separate sets of lots shall be developed for gradation according to the schedule specified in Table 1, for each of the following:

- a) Individual coarse aggregate component being used for structural concrete.
- b) Individual coarse aggregate component being used for concrete pavement, concrete base, full depth repair, and partial depth repair. Or, at the discretion of the Contract Administrator, -the combined coarse aggregate being used in concrete pavement, concrete base, full depth repair, and partial depth repair, if a stockpile of such aggregate has been provided.
- c) Individual fine aggregate component being used or, at the discretion of the Contract Administrator, for the combined fine aggregate, if a stockpile of such aggregate has been provided.

Each gradation lot shall be divided into two sublots of approximately equal tonnage or cubic metres, as applicable. One set of duplicate QA samples shall be randomly obtained from each subplot.

If any circumstances, such as the closure of the construction season or changes in production, result in a lot not being completed, then the Contract Administrator shall be notified prior to the first sample being taken within that lot, for the Contract Administrator to adjust the subplot sizes to accommodate the reduced quantity. If such notification is not given in time, then acceptance shall be based on the sampled subplot for the incomplete lot. All lots shall be deemed to be complete at the end of each calendar year.

If the Contractor is unavailable to take samples, no further material shall be placed in the Work until the required QA samples have been taken. The Contract Administrator shall seal each sample container at the time and place of sampling.

One of the duplicate QA samples shall be randomly selected from each subplot for testing by the QA laboratory. The QA laboratory shall retain the remaining sample for referee testing purposes.

1002.08.04.01 Sample Size

The mass of each QA sample shall meet the requirements of Table 7. When more than 30 kg is required, the total sample shall be recombined by the QA laboratory prior to testing.

1002.08.05 Acceptance

1002.08.05.01 Physical Properties

Clause 1002.08.05.01 of OPSS 1002 is deleted in its entirety and replaced with the following:

The physical property requirements of a lot for fine and coarse aggregates shall be deemed to be acceptable if all the physical property test results for the sample representing that lot are according to Tables 3 and 6, respectively.

If the tested sample of aggregates representing a lot of concrete does not meet all the physical property requirements of this specification, then a reduction in payment shall be applied if the applicable test results for that sample meet ~~any one~~ all of the following:

- a) Do not exceed the requirement for LS-614 or LS-606 if it has been accepted by the Owner as an alternative to LS-614, by more than 25% of the specified value.
- b) Do not exceed a petrographic number of 135 for concrete pavement and 150 for structural concrete when tested according to LS-609;
- c) Do not exceed the requirement for LS-618 by more than 10% of the specified value; and
- d) Meets all other physical requirements of this specification.

The reduction in payment, for the Work represented by the lot of concrete, or portion thereof, left in place, which includes the deficient aggregate that the sample represents, shall be equal to 5% of the tender item price for the associated item or items within that lot, up to a maximum of:

- a) \$25/m³, for Concrete Pavement and Base only;
- b) \$50/m³, for Curb & Gutter, Sidewalks and Approach Slabs only; and
- c) \$130/m³, for all other concrete tender items.

If the physical property test results for any sample of aggregates representing a lot of concrete not meeting all the requirements listed above, then the concrete that includes those aggregates shall be deemed rejectable, removed from the Work, and replaced.

1002.08.05.02 Gradation

1002.08.05.02.02 Gradation for All Other Fine and Coarse Aggregates

Clause 1002.08.05.02.02 of OPSS 1002 is deleted in its entirety and replaced with the following:

Test results carried out according to LS-602 as applicable, shall be computed to one decimal place and reported on MTO form PH-CC-447, Concrete Aggregate Gradation Acceptance Sheets.

The acceptability of a lot based on fineness modulus of fine aggregate and LS-602 may result in payment at full price, payment at a reduced price, or rejection.

With the exception of a fine aggregate accepted by the Owner according to the Special Grading For Fine Aggregate subsection, a complete or incomplete lot shall be deemed to meet the applicable requirements for gradation if, for each individual sieve, the percent passing for at least one of the two test results as well as the average of both test results representing the two sublots within an aggregate lot, are within the acceptable limits shown in Table 2 for a fine aggregate and the applicable limits shown in Table 4 or 5, for the applicable coarse aggregate.

When the test results for any sample of fine aggregates representing a subplot of a concrete lot do not meet the requirement of Note 1 or 2 in Table 2, then all the aggregates within that subplot shall be rejectable. The remaining subplot of the lot shall be treated as a separate lot and shall be deemed to meet the applicable requirements for gradation if, for each individual sieve, the percent passing for the test result shall be within the acceptable limits shown in Table 2 for a fine aggregate and Table 4 or 5, for the coarse aggregate.

If the fineness modulus test result from one subplot within a lot is smaller than -0.2 from the fineness modulus shown on the accepted MTO form PH-CC-433A for the corresponding concrete tender item, and the test result from the other subplot within the lot is more than +0.2 from the fineness modulus on the accepted PH-CC-433A, then all the aggregates within that lot shall be rejectable.

For each individual sieve in Tables 2, 4 and 5, if the LS-602 result from one subplot within a lot is lower than the applicable lower specification limit and the result from the other subplot within the lot is higher than the applicable higher specification limit, then all the aggregates within that lot shall be rejectable.

When a complete or incomplete lot does not meet the requirements of Table 2, 4 or 5 or the fineness modulus, and the lot is not rejectable, then at the request of the Contractor, an adjusted payment calculated according to the following formula shall be allowed in lieu of removal. However, lots that are subject to a total payment adjustment factor of more than 15% shall be rejectable, regardless of the value of the maximum price reduction for the item or items.

PAYMENT REDUCTION

$$= \sum_{k=1}^n \text{affected quantity (m}^3\text{)}_k \times \text{item price (\$/m}^3\text{)}_k \times \text{payment adjustment factor}_k$$

Where:

The Payment reduction for the lot is equal to the sum of the payment adjustments that are calculated separately for each affected tender item or component within the lot. The individual affected quantity shall be calculated by the Contract Administrator for the corresponding tender item within the lot. The individual affected quantity, representing the whole or part of the concrete item or concrete component, shall be converted to m³ if the unit of measurement of the item or component is not by m³. The item price shall be converted to \$/m³ for each tender

item or component with unit price other than $\$/\text{m}^3$. $k=1\dots n$, n denotes the number of tender items or components within the lot.

The total payment adjustment factor, in percent unless resulting in the maximum price/ m^3 as described below, shall be equal to the sum of the adjustment points determined by applying:

- a) Adjustment points to each 0.1% that the mean gradation falls outside the gradation specification limits for each sieve, according to applicable Tables 8, 9 and 10.
- b) 0.1% adjustment points to each 0.01 that the mean fineness modulus is more than ± 0.20 from the fineness modulus shown on the PH-CC-433A accepted by the Contract Administrator for the corresponding concrete tender item.

If only one of the two sublots is not rejectable and treated as a lot, the applicable adjustment points above shall be applied to the deviation of the test results of this subplot from the applicable specification limits as stated in a) and b) above. The affected quantity shall be the whole or part of the items represented by the subplot that is treated as a lot.

In the equation above, the product of multiplying the item price by the payment adjustment factor for the corresponding concrete item or component within the lot of concrete that is not rejectable, which includes the deficient aggregates that the samples represent, shall be capped to a maximum of:

- a) $\$25/\text{m}^3$, for Concrete Pavement and Base;
- b) $\$50/\text{m}^3$, for Curb & Gutter, Sidewalks and Approach Slabs; and
- c) $\$130/\text{m}^3$, for all other concrete tender items.

The reduced price payment for the lot given above shall be in addition to any payment reduction determined according to the Acceptance for Physical Properties clause.

Appendix 1002-A includes examples for calculation of payment reduction.

1002.08.06 Referee Testing

The third paragraph of Clause 1002.08.06 of OPSS 1002 shall be deleted and replaced with the following:

The retained duplicate QA samples for the lot and both sublots shall be used for referee testing of the lot. QA Testing of both sublots shall be completed before referee is invoked.

TABLE 1 of OPSS 1002 is deleted in its entirety and replaced with the following:

**TABLE 1
Lot Schedule for Sampling and Testing**

Total Quantity of Each Tender Item or Items With the Same Mix Design (Notes 1 and 3)		Minimum Lot Schedule (Notes 4 and 5)
Concrete Pavement and Base Tender Items (m²)	Structural and all Other Concrete Tender Items (m³) (Note 2)	
≤ 10,000	≤ 500	One lot
> 10,000	> 500	Concrete Pavement and Base: 10,000 m ² lots Structural and all Other Concrete: 500 m ³ lots

Notes:

1. For the purposes of this table only, the same mix design shall mean that all the applicable mix designs involved have:
 - a) Aggregates with the same Nominal Maximum Aggregate Size(s), comprised of the same individual aggregate component(s), produced from the same source(s), and from the same bench(es) when specific bench(es) are required in quarry source(s); AND
 - b) Where blended fine and/or coarse aggregates are also involved, all the applicable mix designs have the same relative proportions of each individual fine aggregate component within the blended fine aggregate and the same relative proportions of each individual coarse aggregate component within the blended coarse aggregate, respectively.
2. For tender items with units of measurement other than m³, the quantities shall be converted to m³, to establish the lot schedule.
3. Structural concrete items using the same mix design as defined in Note 1 for the same structure shall be combined in individual lots of up to 500m³. If the total quantity of structural concrete items for all structures in the contract is less than 150m³, structural concrete items using the same mix design as defined in Note 1 for multiple structures shall be combined in individual lots of up to 15m³.
4. At the discretion of the Contract Administrator, concrete repairs, individual sections of bridge decks or critical structural elements such as cast-in-place girders, cantilever extensions etc., can form their own lot or lots, regardless of Note 1 and Note 3 or their quantities.
5. Where the remaining quantity of the applicable tender item is insufficient to form a complete lot and is:
 - a) Less than one-half the quantity of a complete lot, then that quantity shall be added to the previous lot, or,
 - b) Greater than or equal to one-half the quantity of a complete lot, then that quantity shall form its own lot.

TABLE 2 of OPSS 1002 is amended by deleting Note 1 in its entirety and replacing it with the following:

Note:

1. Fine aggregates shall have no more than 45% passing any sieve and retained on the next consecutive sieve.
2. The fineness modulus shall be a minimum of 2.3 and a maximum of 3.1.
3. The mean fineness modulus for the lot shall not vary by more than ±0.20 from the fineness modulus shown on the PH-CC-433A accepted by the Contract Administrator for the corresponding concrete tender item.

TABLE 3 of OPSS 1002 is deleting in its entirety and replacing with the following:

TABLE 3
Physical Property Requirements for Fine Aggregate(s)

MTO Test Number, and Sulphur Content (Note 1)	Laboratory Test	Acceptance Limit (Note 2)
LS-610	Organic Impurities, Organic plate number	3 (Note 3)
LS-613	Insoluble Residue, (IR _{R75}) minimum % retained on the 75 µm sieve	60 (Note 4)
LS-616	Contamination, Sulphate Rocks and Minerals	Individual Fine aggregate component shall contain: a. No unacceptable material; and b. Less than 1.0% of gypsum, anhydrite, or other sulphate minerals.
LS-619	Micro-Deval Abrasion, % maximum loss	20
LS-620 (Note 5)	Accelerated Mortar Bar, % maximum at 14 Days	0.150
LS-635 (Note 5)	Concrete Prism Expansion, % maximum at 1 year	0.040
LS-615 (Note 5)	Potential Alkali-Carbonate Reactivity of Quarried Carbonate Rock (Note 6)	Chemical composition shall plot in the non-expansive field of Fig. 1 of test method
Sulphur Content (Note 5)	A combustion infrared absorption method	0.25% (Natural Sand) 0.60% (Manufactured Sand)

Notes:

1. LS-615, LS-619, LS-620 and LS-635 and Sulphur content shall apply to each individual fine aggregate component in the mix. LS-610 and LS-613 shall be carried out either on samples taken from a stockpile of the blended fine aggregate intended to be used in the mix or from samples taken from stockpiles of each individual fine aggregate component and later combined in the laboratory to the proportions provided with PH-CC-433A, prior to testing. All sampling and blending shall be as specified in the Aggregate Processing, Handling, and Stockpiling subsection.
2. If the fraction of a coarse aggregate passing the 4.75 mm sieve represents more than 10% of the grading of that aggregate, by mass, then that fraction of the individual coarse aggregate shall also meet these requirements.
3. Blended fine aggregate that produces a colour darker than standard colour No. 3 shall be considered to have failed this requirement. However, a failed blended fine aggregate may be used if comparative mortar specimens prepared according to ASTM C 87/C 87M meet the following requirements:
 - a) Mortar specimens prepared using unwashed fine aggregate shall have a 7-Day compressive strength that is a minimum of 95% of the strength of mortar specimens prepared using the same fine aggregate washed in a 3% sodium hydroxide solution. Type GU Hydraulic cement shall be used.
 - b) The setting time of the unwashed fine aggregate mortar specimens shall not differ from the washed fine aggregate mortar specimens by more than 10%.
4. This requirement shall apply to all fine aggregates used in concrete pavement, concrete base, full depth repair, partial depth repair, and exposed concrete bridge deck driving surfaces (parking lots are excluded). Fine aggregates not meeting the IR_{R75} requirement may be uniformly blended with other suitable fine aggregate(s), to increase the IR_{R75} to a minimum of 60%.
5. The need for data to demonstrate compliance with this test shall be waived by the Contract Administrator, if the fine aggregate component is from a source listed on the current Ontario Ministry of Transportation Structural Concrete Aggregate Sources List or the Concrete Aggregate Sources List for Concrete Base/Pavement Coarse Aggregates.
6. This requirement only applies to aggregates produced from quarried Gull River and Bobcaygeon geological Formations and their stratigraphic equivalents.

TABLE 4 of OPSS 1002 is amended by changing the title to:

TABLE 4
Grading Requirements for Coarse Aggregate, LS-602
Structural and all Other Concrete Tender Items Except Concrete Pavement, Concrete Base, Full
Depth Repair, and Partial Depth Repair

TABLE 5 of OPSS 1002 is deleted in its entirety and replaced with the following:

TABLE 5
Grading Requirements for Coarse Aggregate, LS-602
Concrete Pavement, Concrete Base, Full Depth Repair, and Partial Depth Repair

Nominal Maximum Size	37.5 mm	19.0 mm	Combined Grading (Note 1)
MTO Sieve Designation mm	Percent Passing		
53.0	100	-	100
37.5	90-100	-	95-100
26.5	20-55	100	-
19.0	0-15	85-100	35-70
9.5	0-5	20-55	10-30
4.75	-	0-10	0-5

Note:

1. The grading shown here shall be determined either from a sample of blended coarse aggregate intended for use in the mix, or from separate samples of the individual coarse aggregate components which are combined in

the laboratory according to the proportions provided along with the mix design submission, as specified in the Aggregate Processing, Handling, and Stockpiling subsection.

TABLE 6 of OPSS 1002 is deleted in its entirety and replaced with the following:

TABLE 6
Physical Property Requirements for Coarse Aggregate(s)

MTO or ASTM Test Number, and Sulphur Content (Note 1)	Laboratory Test	Acceptance Requirements (Notes 2 and 3)	
		Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
LS-412	Scaling Resistance Due to De-Icing Chemicals, maximum loss after 50 cycles of freezing and thawing. (Note 4)	0.80 kg/m ²	
LS-601 (Guideline A)	Wash Pass 75µm, % maximum - for gravel - for crushed rock	1.0 2.0	1.0 2.0
LS-604	Absorption, % maximum	2.0	2.0
LS-608	Flat and Elongated Particles, % maximum	20	20
LS-609	Petrographic Number, Concrete, maximum	125	140
	Contamination and Unacceptable Minerals	Individual coarse aggregate component shall contain: a. No unacceptable material; and b. Less than 1.0% by mass of gypsum, anhydrite, or other sulphate minerals.	
	Siliceous Aggregates Related to LS-412	Note 4	
LS-614	Unconfined Freeze-Thaw, % maximum loss (Note 5)	6	6
LS-618	Micro-Deval Abrasion, % maximum loss	14	17
LS-620	Accelerated Mortar Bar Expansion, % maximum at 14 Days (Note 6)	0.150 (Note 7)	0.150 (Note 7)
ASTM C 666/C 666M	D-Line Cracking, Average change in length of 3 tested beams, % Average Fundamental Transverse Frequency (FTF). (Note 8)	no more than ± 0.0350%, ≥ 90% of the FTF at 14 days	For Concrete Base Only: no more than ± 0.0350%, ≥ 90% of the FTF at 14 days
LS-635	Concrete Prism Expansion Test, % maximum at one year (Notes 6)	0.040	0.040
LS- 615	Potential Alkali-Carbonate Reactivity of Quarried Carbonate Rock (Notes 6 and 9)	Chemical composition shall plot in the non-expansive field of Fig. 1 of test method	
Sulphur Content (Note 6)	A combustion infrared absorption method	0.25% (Gravel) 0.60% (Quarried rock)	
Alternative Requirement for LS-614			
LS-606	Magnesium Sulphate Soundness Loss, 5 Cycles, % maximum (Note 5)	12	12

Notes:

1. LS-412, LS-618, LS-620, ASTM C 666/C 666M, LS-635, LS-615 and Sulphur Content shall apply to each individual coarse aggregate component in the mix. The remaining tests shown in this table shall be carried out either on samples taken from a stockpile of the blended coarse aggregate intended to be used in the mix or from samples taken from stockpiles of each individual coarse aggregate component and later combined in the laboratory to the proportions provided with Form A, prior to testing. All sampling and blending shall be as specified in the Aggregate Processing, Handling, and Stockpiling subsection.
2. If the fraction of any coarse aggregate component, passing the 4.75 mm sieve represents more than 10% of the grading of that aggregate, by mass, then that fraction of the individual coarse aggregate component shall also meet the fine aggregate requirements given in Table 3.
3. When a concrete surface including pavements, base, full depth repair, and partial depth repair and exposed bridge decks are subject to vehicular traffic, the physical requirements for "Pavement" shown in this table shall apply to the aggregates used in the mix.
4. LS-412 shall be conducted as specified in the Scaling Resistance clause. LS-412 will be waived if the aggregate is from the same bench/formation in a quarry which is listed on the current Ontario Ministry of Transportation Structural Concrete Aggregate Sources List or the Concrete Aggregate Sources List for Concrete Base/Pavement Coarse Aggregates, if, at the discretion of the Owner, the aggregate under consideration is still representative of the aggregate that the Owner originally approved.
5. The requirement for this test shall be waived provided that the Contractor has submitted a written request that the coarse aggregate meet the alternative requirements for LS-606, magnesium sulphate soundness, as specified in the Alternative to LS-614 clause.
6. The need to demonstrate compliance with this requirement shall be waived by the Contract Administrator, if the aggregate component is from a source on the current Ontario Ministry of Transportation Structural Concrete Aggregate Sources List or the Concrete Aggregate Sources List for Concrete Base/Pavement Coarse Aggregates.
7. If the aggregate is produced from quarried sandstone, siltstone, granite or gneiss, the expansion shall be less than 0.080% after 14 Days. If an aggregate is produced from quarried Gull River, Bobcaygeon, Verulam, Lindsay Formations, or their stratigraphic equivalents, the expansion shall be less than 0.100% after 14 Days.
8. The test shall be conducted as specified in the D-Line Cracking clause. The testing shall be waived if the aggregate is from the same bench/formation in a quarry which is listed on the current Ontario Ministry of Transportation Structural Concrete Aggregate Sources List or the Concrete Aggregate Sources List for Concrete Base/Pavement Coarse Aggregates, if, at the discretion of the Owner, the aggregate under consideration is still representative of the aggregate that the Owner originally approved.
9. This requirement only applies to aggregates produced from quarried Gull River, Bobcaygeon Formations, and their stratigraphic equivalents.

Tables 8 through 10 are added as follows:

TABLE 8
Adjustment Points for Fine Aggregate Gradation in Table 2

MTO Sieve Designation	Adjustment Points Per 0.1% Deviation from Specified Limit in Table 2
9.5 mm	0.1
4.75 mm	0.1
2.36 mm	0.1
1.18 mm	0.1
600 µm	0.1
300 µm	0.1
150 µm	0.1
75 µm	0.1

TABLE 9
Adjustment Points for Coarse Aggregate Gradation in Table 4

Nominal Maximum Size	19.0 mm	16.0 mm	13.2 mm	9.5 mm	6.7 mm
MTO Sieve Designation, mm	Adjustment Points Per 0.1% Deviation from Specified Limit in Table 4				
26.5	0.1	-	-	-	-
19.0	0.1	0.1	0.1	-	-
16.0	Excess Passing 0.2 / Insufficient Passing 0.1	0.1	-	-	-
13.2	-	Excess Passing 0.2 / Insufficient Passing 0.1	0.1	0.1	0.1
9.5	0.1	0.1	Excess Passing 0.2 / Insufficient Passing 0.1	0.1	-
6.7	-	-	-	-	0.1
4.75	0.1	0.1	0.1	Excess Passing 0.2 / Insufficie nt Passing 0.1	0.1
2.36	-	-	-	0.1	0.1

TABLE 10
Adjustment Points for Grading Requirements for Coarse Aggregate Gradation in Table 5

MTO Sieve Designation mm	19.0 mm	Combined Grading
		Adjustment Points Per 0.1% Deviation from Specified Limit in Table 5
53.0	-	0.1
37.5	-	0.1
26.5	0.1	-
19.0	0.1	Excess Passing 0.2 / Insufficient Passing 0.1
9.5	0.1	0.1
4.75	0.1	0.1

Appendix 1002-A, November 2021

FOR USE AS A REFERENCE FOR CALCULATION OF PAYMENT REDUCTION

Note: This is a non-mandatory Commentary Appendix intended to provide an example for the purpose of calculating payment reduction under 1002.08.05.02. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's decisions and methodology.

Example 1: Calculation of payment reduction for a gradation lot with 2 sublots

Assume that the tender item price for a bridge item is \$200,000 lump sum for a total of 125 m³. The aggregate used in Lot 1 of the concrete does not meet the requirements of LS-602 and meets all other requirements in the specification. Adjustment points are determined as 5% because the mean gradation of the 2 sublots falls outside the gradation specification limits by a total 5.0%. Affected quantity of aggregate in Lot 1 is calculated to be 18.051m³ for approach slabs and 50.885m³ for all other concrete.

Payment reduction should be calculated as follows:

1. $5.0\% \times \$200,000/125 \text{ m}^3 = \$80/\text{m}^3$
2. As $\$80/\text{m}^3 >$ the max of $\$50/\text{m}^3$ for approach slabs, but $<$ the max of $\$130/\text{m}^3$ for all other concrete items, the adjustment will be based on $\$50/\text{m}^3$ for approach slabs and $\$80/\text{m}^3$ for all other concrete.
3. Price reduction = $18.051\text{m}^3 \times 50/\text{m}^3 + 50.885\text{m}^3 \times 80/\text{m}^3 = \4973.35 .

This Payment reduction is in addition to applicable cost of referee testing.

Example 2: Calculation of payment reduction for an incomplete gradation lot with one subplot that is treated as a lot

Assume that Lot 1 of concrete includes concrete patches formed surface and Form & Pump. The tender item price is $\$40,000/\text{m}^3$ for formed surface and $\$80,000/\text{m}^3$ for Form & Pump. The aggregate used in Sublot 1 of Lot 1 of the concrete does not meet the requirements of LS-602 and meets all other requirements in the specification. A certain circumstance results in Sublot 1 being treated as a lot and the acceptance being based on Sublot 1 only. Adjustment points are determined as 2% because the gradation of Sublot 1 falls outside the gradation specification limits by a total 2.0%. Affected quantity of aggregate in Sublot 1 is calculated to be 2.230m³ for formed surface and 3.500m³ for Form & Pump.

Payment reduction should be calculated as follows:

1. $2.0\% \times \$40,000/\text{m}^3 = \$800/\text{m}^3$
2. $2.0\% \times \$80,000/\text{m}^3 = \$1,600/\text{m}^3$
3. As both $\$800/\text{m}^3$ and $\$1,600/\text{m}^3$ are larger than the max of $\$130/\text{m}^3$ for all other concrete items, the adjustment will be based on $\$130/\text{m}^3$.
4. Price reduction = $2.230\text{m}^3 \times 130/\text{m}^3 + 3.500\text{m}^3 \times 130/\text{m}^3 = \744.9 .

This Payment reduction is in addition to applicable cost of referee testing.

WARRANT: Always with OPSS 1002, Material Specification for Concrete Aggregates.