Corporation of the Township of Brock

Staff Report to the Mayor and Members of Council

From: Paul Lagrandeur
Position: Director of Public Works
Title / Subject: Road Rehabilitation - Repair
Date of Report: November 25, 2022
Date of Meeting: December 12, 2022
Report No: 2022-CO-026

1.0 Issue / Origin

The rural roads in Brock Township over the past ten years have had an aggressive treatment plan that has had some success and some failures. The intentions of the plan were to hard top surface treat as many rural roads as possible in a cost-efficient manner. Our failed roads have become a safety concern as well as a maintenance issue within operating. A plan was asked for to correct the failed sections of roads.

2.0 Background

Our Capital projects over those past ten years have been driven to that particular goal of hard topping. Staff have continued to put Granular A in its yearly capital over those ten years and has proven to be successful in building a surface with continued strength. Also, in our Capital method over those years we have had an aggressive push to Double Surface Treat (DST) our roads. This application acts as our hard topping the surface. As mentioned in previous reports, our success rate with DST is not at a level that staff can feel confident enough with continuing at the same pace. This is where our Road Rehabilitation/Repair Capital Item is being created from. Staff will need to ensure that our identified poor sections of our roads, be corrected and repaired not only in surface but into the base of the road as well.

3.0 Analysis Methods of repair;

1) Remove and stockpile 6” to 12” or 150 mm to 300 mm of top material. Conditions of the base will be examined at that time to determine if the base is suitable or if extra excavation

is required. Place a 270R filter cloth layer with a TBX-3000 geo grid. Replace stockpiled gravel, grade and compact and add 4” or 100 mm of new granular A, grade and compact.

2) As a provisional or done in house; in low lying wet areas with positive drainage to ditches, a trench 30” to 36” or 780 mm to 900 mm in depth with 3/4'” clear stone added for base and a 4” or 100 mm sub drain added with ¾” clear stone around the pipe be added. Backfilled with suitable material and graded and compacted. Sub drain will outlet to ditch with a solid 4” or 100 mm outlet pipe with rodent trap attachment. Marked with 1” x 1” tube marker.

   Number 2 can be included with number 1 if needed but are not inclusive together.

Staff have identified areas in which the methods mentioned above may be used. A map of the roads has been attached to identify the areas. More details will be added for identifying exact locations and measurements when creating a tender for Road Rehabilitation/Repair.

TOWNSHIP MAP – Attachment 1

4.0 Related Policies / Procedures Below, we have added MTO specifications for our Granular A program as well as Statistical Analysis Report and Quality Test Report from our suppliers at CBM Votorantim and Miller Group.

OPSS/Material Specification for Aggregates – Attachment 2

CBM Votorantim Statistical Analysis Report – Attachment 3

CBM Votorantim Quality Test Report – Attachment 4

Miller report – Physical Properties – Attachment 5

Miller Report – Compliance Report – Attachment 6

Miller Report – Proctor Report – Attachment 7

5.0 Financial / Budget Assessment

Our Capital Budget for the last few seasons have included: HL-2, Granular A, Double Surface Treatment (DST) and Slurry Seal for road and street construction that are directly involved with our plans for Road Rehabilitation/Repair. As we have been adding our HL-2 program consistently over the past few years we are nearing being caught up to potential candidate streets for this application. In 2022 we had a Capital budget of $350,000 for HL-2 and we are looking at $275,000 for 2023. We would like to stay consistent with our Granular A program and leave it at $375,000 like 2022. A saving would be our DST Capital Budget. $200,000 in 2022 to be eliminated for 2023. Our Slurry Seal can also be reduced from $360,000 to $180,000. See chart on the next page.

Capital Forecast	2022 Approved	2023	2024	2025	2026	2027
HL-2 ultra thin resurfacing	$350,000	$275,000	$275,000	$200,000	-	-
Granular A	$375,000	$375,000	$375,000	$375,000	$375,000	$375,000
DST	$200,000	-	-	$250,000	$250,000	$250,000
Slurry Seal	$360,000	$180,000	-	-	$300,000	$300,000
Road Rehabilitation/ Repair	-	$450,000	$450,000	$450,000	$450,000	$450,000
Total Capital Program	**$1,285,000**	**$1,280,000**	**$1,100,000**	**$1,275,000**	**$1,375,000**	**$1,375,000**

Road Rehabilitation / Repair Cost Assumptions

Early cost estimates for Road Rehabilitation/Repairs include earth excavation to stockpile, placement of filter cloth and geo grid, replacing material from stockpile to road, adding new gravel with grading and compaction:

- EXCAVATION to stockpile: approximately $14.00/m
- PLACEMENT of geo grid and cloth (to be done with TWP staff): approximately $20.00/m
- REPLACE excavated material from stockpile back to road: approximately $15.00/m
- ADD new gravel to area: approximately $28.50/m

With these early cost estimates we can expect Method #1 with excavation, filter cloth and geo grid, replace materials, add new materials to cost $77.50/m or $77,500/km. The proposed $450,000 annual program would provide for 5.8 km.

The addition of sub drain to areas determined by staff will be done by staff within our operating budget to road improvements.

6.0 Climate Change Impacts

With the improvements to our rural roads we anticipate that the roads will be of better drainage and less sitting water. Roads will tend to be less “muddy” and should help on the dust control during the dry season.

7.0 Communications

Staff have had discussions with City of Kawartha Lakes in regard to road rehabilitation methods as they (CKL) have had a program in place for a few years regarding the breakdown of some of their DST surface roads. Their methods are similar to those provided above. CKL claim to have had great success with this approach.

8.0 Conclusion

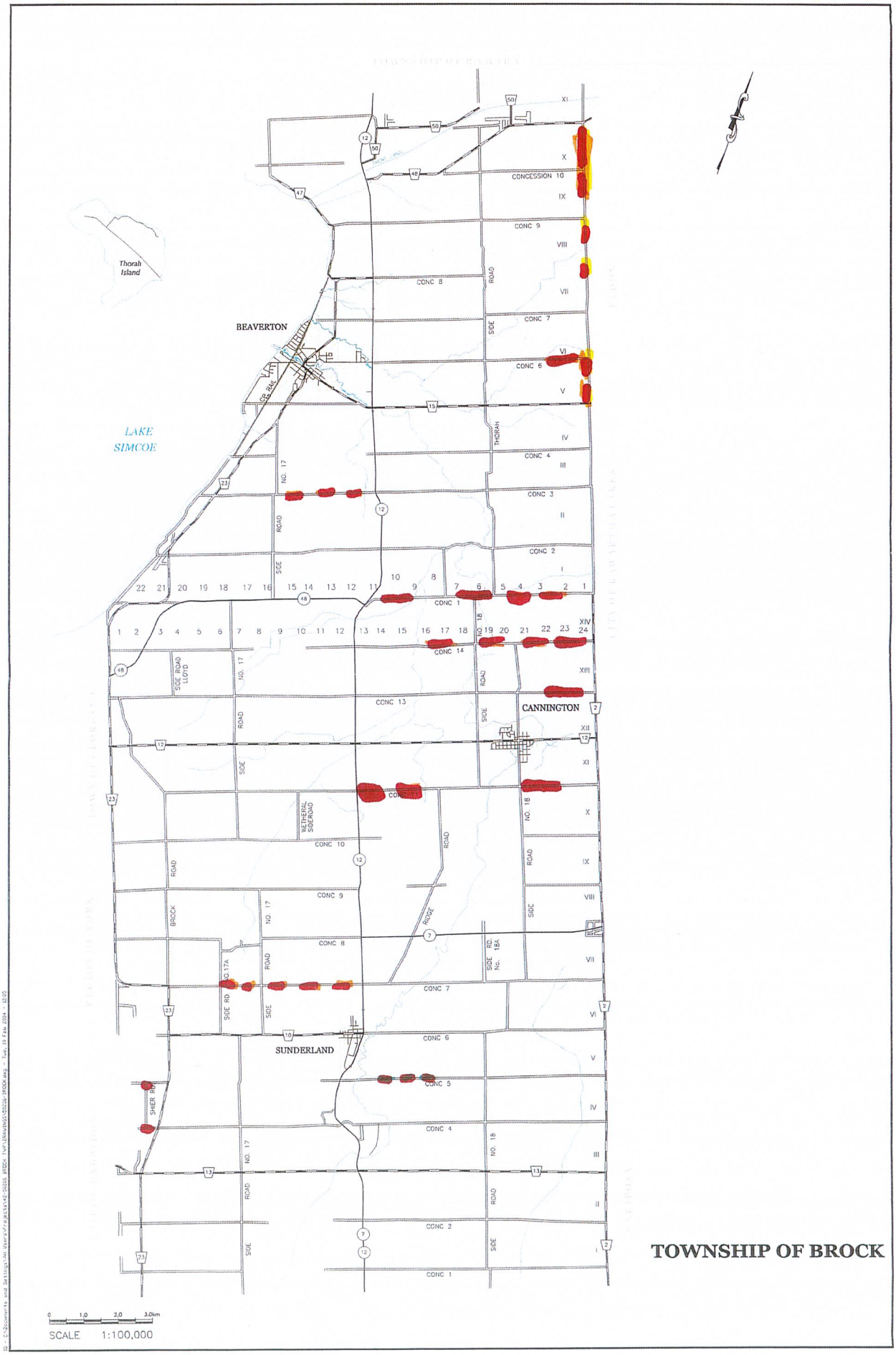
The Road Rehabilitation/Repair program is needed at this time and Staff are confident with the method above. Staff would also like to inquire further with pricing from CBM Votorantim as well as Miller Group and would like to entertain using Miller product in the North end of the Township as a trial if the costs are manageable. Concerns have been brought forward in the past regarding materials used for our gravel program. Staff are confident in both products.

9.0 Recommendation

On the basis of the foregoing review; it is recommended:

THAT BE IT RESOLVED THAT Report 2022-CO-026, Road Rehabilitation – Repair be received; and

THAT staff propose a Road Rehabilitation program for Council's consideration as part of the 2023 Budget process


Thorah Island
BEAVERTON
LAKE SIMCOE
CANNINGTON
SUNDERLAND
CONCESSION 10
CONC 9
CONC 8
CONC 7
CONC 6
CONC 5
CONC 4
CONC 3
CONC 2
CONC 1
CONC 14
CONC 13
CONC 12
CONC 11
CONC 10
SIDE ROAD LLOYD
WETHERAL SIDEROAD
SHIER RD
SCALE 1:100,000
TOWNSHIP OF BROCK

ONTARIO PROVINCIAL STANDARD SPECIFICATION

METRIC
OPS.PROV 1010
APRIL 2013

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 - Not Used
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

1010.01 SCOPE

This specification covers the requirements for granular aggregate materials for use in subgrade, subbase, base, gravel surface course, shouldering and bedding and backfill to sewers, culverts, and other structures.

1010.01.01 Specification Significance and Use

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.

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

Laboratory Testing Manual:

LS-601	Material Finer than 75 μm Sieve in Mineral Aggregates by Washing
LS-602	Sieve Analysis of Aggregates
LS-607	Percent Crushed Particles in Processed Coarse Aggregate
LS-614	Freezing and Thawing of Coarse Aggregate
LS-617	Percent Particles with Two or More Crushed Faces and Uncrushed Particles in Processed Coarse Aggregate
LS-618	Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
LS-619	Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
LS-621	Determination of Amount of Asphalt Coated Particles in Coarse Aggregate
LS-625	Guidelines for Sampling of Granular Materials
LS-630	Determination of Amount of Contamination of Coarse Aggregates
LS-631	Qualitative Determination of Presence of Plastic Fines in Aggregates
LS-709	Determination of Permeability of Granular Soils

MTO Forms:

PH-D-1A	Granular A Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1B	Granular B Types I, II & III Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1M	Granular M Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1O	Granular O Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-1SSM	SSM Gradation Computation Acceptance & Payment Adjustment Sheet
PH-D-10	Aggregate Sample Data Sheet

1010.03 DEFINITIONS

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

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

Delivery Sample means a random sample taken at the point of loading or discharge from delivery vehicles.

Duplicate Samples means two samples taken at the same time and location, one to be used for quality assurance testing and the other for referee testing.

Fines means material passing the 75 μm sieve when tested according to LS-601 or LS-602.

Gradation Test means a test used to determine the particle size distribution of an aggregate or soil material by sieving.

Lot means a specific quantity of material from a single source or a specified amount of construction assumed to be produced by the same process.

Mean means the arithmetic average of a set of data.

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. Physical properties are generally not affected by production.

Production Property means an attribute or feature of an aggregate or soil material, including gradation, that is introduced through the manufacturing process (i.e., crushing, screening, blending etc.). Tests are carried out to measure the affects of the process on the material.

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 requirements specified in the Contract Documents.

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

Random Sample means a sample based on random numbers so that any portion of a lot or sublot has an equal opportunity of being selected.

Range means the difference between the largest and the smallest measurements in a set of data.

Road Sample means a random sample taken from road construction after placement and spreading of the material in the work, but prior to compaction.

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

1010.05 MATERIALS

1010.05.01 General

Aggregates for Granular A, O, B, M and SSM shall be according to OPSS 1001, unless otherwise specified in this specification, and shall conform to the requirements of Table 2 and Table 3 when tested according to the test methods identified herein.

Aggregates shall be clean, hard, durable particles and shall be produced from material free of earth, humus, clay coatings, and clay lumps or fragments of any size or shape. When tested according to LS-630, the total amount of wood shall not exceed 0.1% by mass, and the total amount of clay brick, gypsum, gypsum plaster wallboard and other contaminants shall not exceed a combined total of 1.0% by mass.

When reclaimed asphalt pavement (RAP), post-consumer glass or ceramic material is used, it shall be homogeneously blended in a manner acceptable to the Contract Administrator.

Steel slag shall not be used.

1010.05.02 Granular O

Aggregates for Granular O shall be produced from a quarry or from boulders, cobbles or gravel retained on the 50 mm sieve. Recycled or reclaimed materials, including hydraulic cement concrete, RAP, slag, glass, and ceramic are not permitted.

1010.05.03 Granular A and M

Aggregates for Granular A and M shall be produced from one or a blend of the following:

a) Boulders, cobbles, gravel, sand, and fines from naturally formed deposits.

b) A quarry or talus.

c) Reclaimed hydraulic cement concrete.

d) Iron blast furnace slag or nickel slag.

Granular A and M aggregates may include up to 30% by mass of asphalt coated particles derived from RAP, and not more than a combined total of 15% by mass of glass or ceramic material or both, unless specified elsewhere in the Contract Documents.

Granular A or M produced with RAP containing steel slag aggregates is acceptable for unpaved shouldering purposes only. Such materials shall be stockpiled separately.

1010.05.04 Granular B

Granular B may be of Type I, Type II, or Type III.

Aggregates for Granular B shall be aggregates produced from one or a blend of the following, subject to the following restrictions:

a) Boulders, cobbles, gravel, sand, and fines from naturally formed deposits.

b) A quarry or talus.

c) Reclaimed hydraulic cement concrete.

d) Iron blast furnace slag or nickel slag.

Aggregates for Granular B Type I and Type III may include up to 30% by mass of asphalt coated particles derived from RAP, and not more than a combined total of 15% by mass of glass or ceramic material or both. RAP containing steel slag aggregates shall not be permitted.

Aggregates for Granular B Type II shall only be produced from a quarry or from talus, iron blast furnace slag, or nickel slag. Recycled materials shall not be permitted.

1010.05.05 Select Subgrade Material (SSM)

Aggregates for select subgrade material shall be produced only from natural deposits of non-plastic silt, sand, and gravel material. Recycled or reclaimed materials of any type shall not be permitted.

1010.08 QUALITY ASSURANCE

1010.08.01 General

The laboratory designated by the Owner shall carry out QA testing for purposes of ensuring that aggregates used in the Work conform to the physical and production requirements of this specification. Individual test results shall be forwarded to the Contractor, as they become available.

The Owner shall be responsible for all costs associated with testing for QA purposes, unless otherwise specified in this specification.

QA testing for physical properties may be waived by the Contract Administrator when the delivered quantity of Granular A, O, B, M, or SSM is less than 5,000 tonnes.

1010.08.01.01 Sampling

QA samples shall be taken according to the Contract Documents and LS-625 and shall be road samples or delivery samples obtained from the Work at a location determined by the Contract Administrator. When required, the Contractor shall provide a front-end loader to obtain material for QA samples.

When it is not possible to take road or delivery samples, samples of compacted material taken with the permission of the Owner shall be used for QA acceptance purposes.

In the event that the Contractor is unavailable to take a sample, no further materials shall be placed in the Work until the required QA samples have been taken.

QA sampling and testing shall be based on lots that are established for each aggregate type; Granular A, O, B, M, and SSM. When more than one aggregate source is used, separate lots shall also be established for each source. When aggregates are produced from materials that are extracted from within the right-of way, each area within a 1,000 m segment of the right-of-way or within a radius of 500 m of the extraction operation located within the right-of-way shall be considered equivalent to a single aggregate source for QA acceptance purposes. When aggregates are produced with blended or reclaimed materials or both, QA testing shall be performed on the final product.

The Contractor shall provide new or clean sample bags or containers that are constructed to prevent the loss of any part of the material or contamination or damage to the contents during shipment. Metal or cardboard containers are unacceptable. QA samples shall be identified both inside and outside of the sample container. Data to be included with QA samples shall be according to MTO form PH-D-10.

The Contractor shall deliver all samples to the appropriate laboratory in a condition that is suitable for testing.

All QA samples shall be duplicate samples. One of the samples shall be randomly selected for testing by the QA laboratory and the remaining sample shall be retained by the QA laboratory for possible referee testing.

1010.08.01.02 Sample Size

The mass of the each QA sample shall meet the requirements shown in Table 4. When more than 30 kg of material is required, the total sample shall be recombined prior to testing.

1010.08.02 Physical Properties

At least one set of duplicate QA samples of each aggregate to be used in the Work shall be randomly sampled from lots of 25,000 tonnes or part thereof for physical properties. All materials delivered to the Work shall be included within a lot.

1010.08.02.01 Testing of Physical Properties

The QA laboratory shall carry out testing for each physical property requirement shown in Table 2, as applicable for each QA sample.

1010.08.02.02 Acceptance of Physical Properties

The acceptability of a lot for physical properties may result in payment at full price, payment at a reduced price, or rejection.

A lot shall be deemed to be acceptable for physical properties if all of the test results for the samples of aggregates representing that lot meet the requirements shown in Table 2.

If a tested sample of aggregates representing a lot does not meet all of the requirements shown in Table 2, then a reduced price payment of 20% of the tender price shall be given for that lot for physical properties, as long as the lot is not rejectable and the applicable test results for that sample:

a) do not exceed the requirement for LS-614 by more than 25% of the specified value.

b) do not exceed the requirement for LS-618 by more than 10% of the specified value.

c) do not identify plastic fines within the material, when determined according to LS-631 and acceptance test results for LS-602 are not subject to a payment adjustment on the 75µm sieve.

d) meet all other physical property requirements of this specification.

Should the test results for any sample of aggregates representing a lot not meet the requirements listed above, then all of the aggregates within that lot shall be considered rejectable and any of those aggregates used in the Work shall be removed at no cost to the Owner.

The reduced price payment for the lot given above shall be in addition to any payment reduction determined according to the Acceptance Based on LS-602 and LS-607 clause for production properties.

Irrespective of the negotiation of a reduced price payment, the warranty provisions of the Contract Documents shall apply.

1010.08.03 Production Properties

All lots for production properties shall be divided into four sublots of approximately equal tonnage and one duplicate QA sample shall be randomly obtained from each sublot.

For each tender item, the Contract Administrator shall estimate the quantities of granular materials obtained from each different source or process. Then, for each of those individual sources or processes, the Contract Administrator shall identify the number and size of each lot to be sampled and tested using the lot schedule shown in Table 1.

In addition, if circumstances such as the closure of the construction season or changes in production or delivery result in a lot not being completed, then the Contractor shall notify the Contract Administrator prior to the first sample is taken within that lot, in order for the Contract Administrator to adjust the sublot sizes equally to accommodate the reduced tonnage. If such notification is not given in time, then acceptance shall be based on the number of sampled sublots that are available for the incomplete lot. All lots shall be deemed to be complete at the end of each calendar year.

1010.08.03.01 Testing of Production Properties

The QA laboratory shall conduct sieve analysis according to LS-602 and determine test results for each sieve designation shown in Table 3. The QA laboratory shall also carry out testing for percent crushed particles according to LS-607, particles with two or more crushed faces according to LS-617, and amount of asphalt coated particles according to LS-621, as applicable.

1010.08.03.02 Acceptance of Production Properties

Test results from each sublot within a lot shall be combined to determine the mean and the range of the lot for each test.

1010.08.03.02.01 Acceptance Based on LS-602 and LS-607

All lot means and ranges for test results carried out according to LS-602 and LS-607, as applicable, shall be computed to one decimal place and reported on the appropriate MTO form by the Contract Administrator, as indicated below:

Granular A	PH-D-1A
Granular O	PH-D-1O
Granular B, Types I, II or III	PH-D-1B
Granular M	PH-D-1M
SSM	PH-D-1SSM

The acceptability of a lot based on LS-602 and LS-607 may result in payment at full price, payment at a reduced price, or rejection.

A complete or incomplete lot shall be deemed to meet the applicable requirements for LS-602 and LS-607, if the mean of the test results for that lot is within the limits shown in Table 3 and the range of the test results for that lot is within the limits shown in Table 5.

Lots that are subject to a total payment adjustment factor of more than 25% in respect of lot mean and range are deemed to be rejected and shall be removed from the Work at no cost to the Owner.

When a complete or incomplete lot does not meet the requirements of LS-602 and LS-607, is not subject to removal, but the Contractor chooses to use the lot or for some reason it cannot be totally excluded from the Work, then at the request of the Contractor, an adjusted payment calculated according to the following formula shall be allowed in lieu of removal:

PAYMENT REDUCTION = lot quantity (tonnes) x item price ($/tonne) x payment adjustment factor (%)

Where:

The lot quantity shall be expressed in tonnes as determined according to Table 6, and the item price shall be according to one of the following:

a) The contract price for the items having the tender quantity in tonnes.

b) $21.50 per tonne for Granular A, O, and M; $15.50 per tonne for Granular B Type II; $15.00 per tonne for Granular B Type I and Type III; and $8.50 per tonne for SSM where bidding is not by tender quantity such as lump sum Contracts.

In addition, the payment adjustment factor, in percent, shall be equal to the sum of the adjustment points determined as follows:

a) Adjustment points shall be applied for each 0.1% that the mean gradation falls outside the gradation specification limits for each sieve, according to Table 7.

b) 0.1 adjustment points shall be applied for each 0.1% that the range exceeds the maximum acceptable range for each sieve.

c) 0.2 adjustment points shall be applied for Granular A or M for each 0.1% that the lot mean falls below the applicable limits for percent crushed.

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

1010.08.03.02.02 Acceptance Based on LS-617 or LS-621

A lot shall be deemed to meet the applicable requirements of this specification for LS-617 or LS-621, if the mean value of the test results for that lot is within the limits shown in Table 3. When the mean value of the test results for that lot does not meet these requirements, the material shall be considered deficient and managed according to the requirements specified elsewhere in the Contract Documents.

1010.08.04 Referee Testing

The Contractor may invoke referee testing for one or more attributes by submitting a written request to the Contract Administrator within 5 Business Days following notification that the lot does not meet the requirements of this specification.

Referee testing shall be carried out as specified herein and elsewhere in the Contract Documents.

The retained duplicate QA samples for all sublots shall be used for referee testing of the lot.

All referee test results shall replace the respective QA tests for acceptance of the applicable lot and shall be binding on both the Owner and the Contractor.

If a lot is not accepted at full payment based on the referee test results, then the Contractor shall be responsible for the cost of the referee testing of that lot, including the cost of transporting the samples to the referee laboratory at the rates specified elsewhere in the Contract Documents. In all other cases, the Owner shall bear the cost of the referee testing of that lot.

Table 1
Lot Schedule for Sampling and Testing

Quantity for Each Source or Process (tonnes)	Gran A, O, and M	Granular B Type I, B Type II, B Type III, and SSM
< 1,000	Sampling and testing may be waived at the discretion of the Contract Administrator	
1,000 - 5,000	One lot	One lot
> 5,000 (Note 1)	5,000 tonne lots up to 20,000 tonnes, and 10,000 tonne lots thereafter	10,000 tonne lots up to 20,000 tonnes, and 20,000 tonne lots thereafter

Note:

1. When the quantity of granular material is insufficient for a complete lot and is:
   a) less than one-half the quantity of a complete lot, that quantity shall then 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
Physical Property Requirements

Laboratory Test	MTO Test Number	Granular					Select Subgrade Material
		A	B		M	O	
			Type I / Type III	Type II			
Unconfined Freeze-Thaw, % maximum loss	LS-614	-	-	-	-	15	-
Micro-Deval Abrasion (Coarse Aggregate), % maximum loss	LS-618	25	30 (Note 1)	30	25	21	30 (Note 1)
Micro-Deval Abrasion (Fine Aggregate), % maximum loss	LS-619	30	35	35	30	25	-
Amount of Contamination	LS-630	(Note 2)					
Plastic Fines	LS-631	NP (Non-Plastic)					
Determination of Permeability, k	LS-709	(Note 3)					

Notes:

1. 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.
2. Granular A, B Type I, B Type III, or M may contain up to 15% by mass crushed glass or ceramic material or both. Granular A, O, B Type I, B Type III, and M shall not contain more than 1.0% by mass of any combination of wood, clay brick, gypsum, gypsum wall board, or plaster. Granular B Type II and SSM shall not contain more than 0.1% by mass of wood.
3. For materials north of the French/Mattawa Rivers only, the coefficient of permeability, k shall be greater than 1.0×10^{-4} cm/s or alternatively, when past field experience has demonstrated satisfactory performance. Prior data demonstrating compliance with this requirement for k shall be acceptable provided that such testing has been done within 5 years of the material being used and field performance has continually been shown to be satisfactory.

Table 3
Production Requirements

Lab Test	MTO Test Number	Granular						SSM
		A	B			M	O	
	LS-602 (sieve)		Type I (Note 2)	Type II	Type III (Note 2)			
	150 mm	-	100	-	100	-	-	100
	106 mm	-	-	100	-	-	-	-
	37.5 mm	-	-	-	-	-	100	-
	26.5 mm	100	50.0-100	50.0-100	50.0-100	-	95.0-100	50.0-100
	19.0 mm	85.0-100 (87.0-100) Note 3	-	-	-	100	80.0-95.0	-
Sieve Analysis, % passing	13.2 mm	65.0-90.0 (75.0-95.0) Note 3	-	-	-	75.0-95.0	60.0-80.0	-
	9.5 mm	50.0-73.0 (60.0-83.0) Note 3	-	-	32.0-100	55.0-80.0	50.0-70.0	-
	4.75 mm	35.0-55.0 (40.0-60.0) Note 3	20.0-100	20.0-55.0	20.0-90.0	35.0-55.0	20.0-45.0	20.0-100
	1.18 mm	15.0-40.0	10.0-100	10.0-40.0	10.0-60.0	15.0-40.0	0-15.0	10.0-100
	300 μm	5.0-22.0	2.0-65.0	5.0-22.0	2.0-35.0	5.0-22.0	-	5.0-95.0
	150 μm	-	-	-	-	-	-	2.0-65.0
	75 μm	2.0-8.0 (2.0-10.0) Note 4	0-8.0 (0-10.0) Note 4	0-10.0	0-8.0 (0-10.0) Note 4	2.0-8.0 (2.0-10.0) Note 4	0-5.0	0-25.0
Percent Crushed Particles, % minimum	LS-607	60	-	100	-	60	100	-
2 or more Crushed Faces, % minimum	LS-617	-	-	-	-	-	85 Note 5	-
Asphalt Coated Particles, Coarse Aggregates,% maximum	LS-621	30	30	0	30	30	0	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 blended with Granular B Type I or Type III, 100% of the RAP shall pass the 75 mm sieve. Conditions in Note 1 supersede this requirement.
3. When the aggregate is obtained from an iron blast furnace slag source.
4. When the aggregate is obtained from a quarry or blast furnace slag or nickel slag source.
5. When Granular O is produced from boulders, cobbles, or gravel retained on the 50 mm sieve.

Table 4
Sample Size

Material	Minimum Mass of Field Samples, kg (Note 1)
Granular O, A, M; Granular B, SSM (100% passing 26.5 mm sieve)	25
Granular B, SSM	50

Notes:

1. Individual sample containers shall hold no more than 30 kg of aggregate. When more than 30 kg is required, additional sample containers shall be used.

Table 5
Range Requirements For Gradation (LS-602)

MTO Sieve	Maximum Acceptable Range						
	Granular						SSM
	A	B Type I	B Type II	B Type III	M	O	
150 mm	-	1	-	1	-	-	1
106 mm	-	-	1	-	-	-	-
37.5 mm	-	-	-	-	-	1	-
26.5 mm	1	-	30.0	-	-	5.0	-
19.0 mm	8.0	-	-	-	1	8.0	-
13.2 mm	20.0	-	-	-	16.0	17.0	-
9.5 mm	20.0	-	-	-	18.0	17.0	-
4.75 mm	18.0	-	22.0	-	18.0	18.0	-
1.18 mm	18.0	-	18.0	-	18.0	12.0	-
300 μm	12.0	50.0	12.0	25.0	12.0	-	-
75 μm	5.0	7.0	5.0	7.0	5.0	4.0	15.0

Table 6
Lot Quantity Determinations for Adjusted Payments

Item	Road or Delivery Samples
Items having the tender quantity in tonnes.	The quantity measured for payment by weighing.
All other items.	The weighed quantity when available; otherwise the theoretical quantity calculated by the Contract Administrator using a conversion factor of 2.0 tonnes per cubic metre.

Table 7
Adjustment Points

MTO Sieve Designation	Adjustment Points Per 0.1% Deviation from Specified Limit				
	Granular A	Granular B	Granular M	Granular O	Select Subgrade Material
150 mm	-	0.1 (Note 1)	-	-	0.1
106.5 mm	-	0.1 (Note 2)	-	-	
37.5 mm	-	-	-	0.1	-
26.5 mm	0.1	0.1	-	0.1	0.1
19.0 mm	0.1	-	0.1	0.1	-
13.2 mm	0.1	-	0.1	0.1	-
9.5 mm	0.1	-	0.1	0.1	-
4.75 mm	Excess Passing 0.5 / Insufficient Passing 0.2				0.1
1.18 mm	0.1	0.1	0.1	0.1	0.1
300 μm	0.1	0.1	0.1	-	0.1
150 μm	-	-	-	-	0.1
75 μm	1.0	1.0	1.0	1.0	0.5

Notes:

1. Granular B Type I and Type III only.
2. Granular B Type II only.

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

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.

Votorantim Cimentos

CBM Aggregates

Statistical Analysis Report

Plant 4809-Sunderland Pit
Product 6053170-Granular A
Specification OPSS.PROV 1010
Period 07/01/2022 - 09/30/2022

Sample Id	Date	26.5mm (%)	19mm (%)	16mm (%)	13.2mm (%)	9.5mm (%)	6.7mm (%)	4.75mm (%)	2.36mm (%)	1.18mm (%)	0.3mm (%)	75µm (%)	Pan (%)	Crushed Particles (%)	Grad Loss (%)
1543450127	07/04/2022 08:00	100.0	89.6	82.9	78.1	64.0	50.2	43.8	39.5	36.9	21.9	5.2	0.0		0.000
1036172452	07/18/2022 08:00	100.0	94.1	90.4	87.5	72.0	56.0	46.3	38.7	34.2	20.9	5.7	0.0		0.000
1036172402	07/19/2022 10:00	100.0	92.3	87.2	84.3	71.0	52.9	43.8	36.9	32.0	20.4	5.9	0.0	67.5	0.000
1036172597	07/21/2022 08:00	100.0	94.2		87.6	72.7		46.2	38.6	33.8	20.7	5.7	0.0		0.000
1036785123	08/22/2022 09:00	100.0	96.7	92.1	88.5	72.2		48.6		35.9	21.6	4.8	0.0		0.000
1776252928	08/29/2022 08:00	100.0	93.4		85.4	72.3		46.9		35.4	21.3	6.2	0.0		0.000
1265436779	09/12/2022 09:00	100.0	90.2		77.9	64.4		41.4		32.2	20.3	5.9	0.0		0.000

	26.5mm (%)	19mm (%)	16mm (%)	13.2mm (%)	9.5mm (%)	6.7mm (%)	4.75mm (%)	2.36mm (%)	1.18mm (%)	0.3mm (%)	75µm (%)	Pan (%)	Crushed Particles (%)	Grad Loss (%)
Count	7	7	4	7	7	3	7	4	7	7	7	7	1	7
Min	100.0	89.6	82.9	77.9	64.0	50.2	41.4	36.9	32.0	20.3	4.8	0.0	67.5	0.000
Max	100.0	96.7	92.1	88.5	72.7	56.0	48.6	39.5	36.9	21.9	6.2	0.0	67.5	0.000
Mean	100.0	92.9	88.2	84.2	69.8	53.0	45.3	38.4	34.3	21.0	5.6	0.0	67.5	0.000
St Dev	0.00	2.46	4.05	4.46	3.86	2.90	2.41	1.09	1.85	0.61	0.48	0.00		0.0000
Lower Target	100	85		65	50		35		15	5	2			
Upper Target	100	100		90	73		50		40	22	8			
Target														
Lower Spec (LSL)	100	85		65	50		35		15	5	2			
Upper Spec (USL)	100	100		90	73		55		40	22	8			

Votorantim Cimentos

CBM Aggregates

Statistical Analysis Report

Plant 4809-Sunderland Pit
Product 6053170-Granular A
Specification OPSS.PROV 1010
Period 07/01/2022 - 09/30/2022

Sample Id	Date	Wash Loss (# 200/75um) (%)	Total Moisture (%)
1543450127	07/04/2022 08:00	4.5	2.06
1036172452	07/18/2022 08:00	5.1	2.87
1036172402	07/19/2022 10:00	5.0	1.98
1036172597	07/21/2022 08:00	5.1	2.96
1036785123	08/22/2022 09:00	4.3	3.02
1776252928	08/29/2022 08:00	5.8	3.35
1265436779	09/12/2022 09:00	5.2	3.68

	Wash Loss (# 200/75um) (%)	Total Moisture (%)
Count	7	7
Min	4.3	1.98
Max	5.8	3.68
Mean	5.0	2.85
St Dev	0.49	0.627
Lower Target		
Upper Target		
Target		
Lower Spec (LSL)		
Upper Spec (USL)		

Votorantim Cimentos

CBM Aggregates

Quality Test Report

Plant 4809-Sunderland Pit
Product 6053170-Granular A
Specification OPSS.PROV 1010

1036172452

Sample Information

Sample No 1036172452
Date Sampled 07/18/2022 08:00
Sampled By John McEachern
Type Shipping
Method Pad
Location Yard Stock
Process Load Zone
Other TWP

Split Sample ☐
Resample ☐

Test Note
22-711 Brock township

Gradation Results

Date Completed 07/18/2022 08:00

Tested By Lavish Chugh

Unit	Moist Mass	Dry Mass	Wash Mass	Moisture %	Wash Loss %	Procedure
g	14173.50	13777.70	13072.76	2.9	5.1	

Sieve	Mass Retained	Cum Mass Retained	Ind % Retained	% Retained	% Passing	Target	Specification	Comment
26.5mm	0.00	0.00	0.0	0.0	100.0	100-100	100-100	
19mm	810.00	810.00	5.9	5.9	94.1	85-100	85-100	
16mm	510.00	1320.00	3.7	9.6	90.4			
13.2mm	396.36	1716.36	2.9	12.5	87.5	65-90	65-90	
9.5mm	2145.44	3861.80	15.6	28.0	72.0	50-73	50-73	
6.7mm	2207.00	6068.80	16.0	44.0	56.0			
4.75mm	1332.30	7401.10	9.7	53.7	46.3	35-50	35-55	
2.36mm	1051.22	8452.32	7.6	61.3	38.7			
1.18mm	610.95	9063.27	4.4	65.8	34.2	15-40	15-40	
0.3mm	1837.79	10901.06	13.3	79.1	20.9	5-22	5-22	
75µm	2095.03	12996.08	15.2	94.3	5.7	2-8	2-8	
Pan	76.68	13072.76	5.7	100.0	0.0			

Other Test Results

Test Name	Date / Procedure	Result / Lab	Unit	Target	Specification / Tested By	Comment
Grad Loss	07/18/2022 08:00	0.000 Sunderland Pit	%		Lavish Chugh	
Total Moisture	07/18/2022 08:00	2.87 Sunderland Pit	%		Lavish Chugh	
Wash Loss (#200/75um)	07/18/2022 08:00	5.1 Sunderland Pit	%		Lavish Chugh	

Votorantim Cimentos

CBM Aggregates

Quality Test Report

Plant 4809-Sunderland Pit
Product 6053170-Granular A
Specification OPSS.PROV 1010

1036172402

Sample Information

Sample No 1036172402
Date Sampled 07/19/2022 10:00
Sampled By John McEachern
Type Shipping
Method Pad
Location Yard Stock
Process Load Zone
Other TWP

Split Sample ☐
Resample ☐

Test Note
22-764
Brock township

Gradation Results

Date Completed 07/19/2022 10:00

Tested By Lavish Chugh

Unit	Moist Mass	Dry Mass	Wash Mass	Moisture %	Wash Loss %	Procedure
g	15052.90	14760.50	14022.01	2.0	5.0	

Sieve	Mass Retained	Cum Mass Retained	Ind % Retained	% Retained	% Passing	Target	Specification	Comment
26.5mm	0.00	0.00	0.0	0.0	100.0	100-100	100-100	
19mm	1136.70	1136.70	7.7	7.7	92.3	85-100	85-100	
16mm	749.20	1885.90	5.1	12.8	87.2			
13.2mm	428.80	2314.70	2.9	15.7	84.3	65-90	65-90	
9.5mm	1966.40	4281.10	13.3	29.0	71.0	50-73	50-73	
6.7mm	2670.30	6951.40	18.1	47.1	52.9			
4.75mm	1337.00	8288.40	9.1	56.2	43.8	35-50	35-55	
2.36mm	1029.05	9317.45	7.0	63.1	36.9			
1.18mm	714.28	10031.73	4.8	68.0	32.0	15-40	15-40	
0.3mm	1723.96	11755.68	11.7	79.6	20.4	5-22	5-22	
75µm	2135.58	13891.26	14.5	94.1	5.9	2-8	2-8	
Pan	130.75	14022.01	5.9	100.0	0.0			

Other Test Results

Test Name	Date	Result	Unit	Target	Specification	Comment
	Procedure	Lab			Tested By	
Crushed Particles	07/19/2022 10:00	67.5	%			
	Method B				Lavish Chugh	
Grad Loss	07/19/2022 10:00	0.000	%			
		Sunderland Pit			Lavish Chugh	
Total Moisture	07/19/2022 10:00	1.98	%			
		Sunderland Pit			Lavish Chugh	
Wash Loss (#200/75um)	07/19/2022 10:00	5.0	%			
		Sunderland Pit			Lavish Chugh	

Votorantim Cimentos

CBM Aggregates

Quality Test Report

Plant 4809-Sunderland Pit
Product 6053170-Granular A
Specification OPSS.PROV 1010

Sample Information

Sample No 1036172597
Date Sampled 07/21/2022 08:00
Sampled By John McEachern
Type Shipping
Method Pad
Location Yard Stock
Process Load Zone
Other TWP

Split Sample ☐
Resample ☐

Test Note
22-780 Brock township

Gradation Results

Date Completed 07/21/2022 08:00

Tested By Lavish Chugh

Unit	Moist Mass	Dry Mass	Wash Mass	Moisture %	Wash Loss %	Procedure
g	14185.50	13777.70	13073.87	3.0	5.1	

Sieve	Mass Retained	Cum Mass Retained	Ind % Retained	% Retained	% Passing	Target	Specification	Comment
26.5mm	0.00	0.00	0.0	0.0	100.0	100-100	100-100	
19mm	800.80	800.80	5.8	5.8	94.2	85-100	85-100	
16mm								
13.2mm	905.80	1706.60	6.6	12.4	87.6	65-90	65-90	
9.5mm	2055.20	3761.80	14.9	27.3	72.7	50-73	50-73	
6.7mm								
4.75mm	3649.30	7411.10	26.5	53.8	46.2	35-50	35-55	
2.36mm	1049.58	8460.68	7.6	61.4	38.6			
1.18mm	659.38	9120.06	4.8	66.2	33.8	15-40	15-40	
0.3mm	1810.21	10930.26	13.1	79.3	20.7	5-22	5-22	
75µm	2067.05	12997.31	15.0	94.3	5.7	2-8	2-8	
Pan	76.56	13073.87	5.7	100.0	0.0			

Other Test Results

Test Name	Date Procedure	Result Lab	Unit	Target	Specification Tested By	Comment
Grad Loss	07/21/2022 08:00	0.000 Sunderland Pit	%		 Lavish Chugh	
Total Moisture	07/21/2022 08:00	2.96 Sunderland Pit	%		 Lavish Chugh	
Wash Loss (#200/75um)	07/21/2022 08:00	5.1 Sunderland Pit	%		 Lavish Chugh	

Votorantim Cimentos

CBM Aggregates

Quality Test Report

Plant 4809-Sunderland Pit
Product 6053170-Granular A
Specification OPSS.PROV 1010

1265436779

Sample Information

Sample No 1265436779
Date Sampled 09/12/2022 09:00
Sampled By John McEachern
Type Shipping
Method Pad
Location Yard Stock
Process Load Zone
Other TWP

Split Sample ☐
Resample ☐

Test Note
22-999
Brock Township yards

Gradation Results

Date Completed 09/12/2022 09:00

Tested By John McEachern

Unit	Moist Mass	Dry Mass	Wash Mass	Moisture %	Wash Loss %	Procedure
g	14558.90	14041.60	13314.79	3.7	5.2	

Sieve	Mass Retained	Cum Mass Retained	Ind % Retained	% Retained	% Passing	Target	Specification	Comment
26.5mm	0.00	0.00	0.0	0.0	100.0	100-100	100-100	
19mm	1373.10	1373.10	9.8	9.8	90.2	85-100	85-100	
16mm								
13.2mm	1732.40	3105.50	12.3	22.1	77.9	65-90	65-90	
9.5mm	1890.60	4996.10	13.5	35.6	64.4	50-73	50-73	
6.7mm								
4.75mm	3228.60	8224.70	23.0	58.6	41.4	35-50	35-55	
2.36mm								
1.18mm	1298.39	9523.09	9.2	67.8	32.2	15-40	15-40	
0.3mm	1670.42	11193.51	11.9	79.7	20.3	5-22	5-22	
75µm	2020.27	13213.78	14.4	94.1	5.9	2-8	2-8	
Pan	101.01	13314.79	5.9	100.0	0.0			

Other Test Results

Test Name	Date / Procedure	Result / Lab	Unit	Target	Specification / Tested By	Comment
Grad Loss	09/12/2022 09:00	0.000 Sunderland Pit	%		John McEachern	
Total Moisture	09/12/2022 09:00	3.68 Sunderland Pit	%		John McEachern	
Wash Loss (#200/75um)	09/12/2022 09:00	5.2 Sunderland Pit	%		John McEachern	

Ontario

AGGREGATE TEST DATA -- GRANULARS
Physical Properties

Ministry of Transportation

Contract No.:	Contractor: Carden Quarry	Contract Location:	
Testing Laboratory: **The Miller Group-Materials Research Laboratory**		Telephone No.: **905-726-9518**	Fax No.: **905-726-4180**
Sampled By (Print Name): **Customer**		Date Sampled: (YY/MM/DD) **22/05/10**	**Lab No.: 765953849**
Granular Type: **Granular A**		Lot No.:	Quantity (tonnes):
Source Name/Location: **Carden Quarry**		Aggregate Inventory Number (AIN):	

Laboratory Test, Test Number	Requirements						Test Results		
	Granular A	Granular B Type I, III	Granular B Type II	Granular M	Granular O	SSM	Reference Material	Sample	Meets Requirement (Y/N)
Freeze Thaw Loss, % maximum, LS-614	--	--	--	--	15	--			
Micro-Deval Loss, Coarse Aggregate, % maximum LS 618	25	30 (Note 1)	30	25	21	30 (Note 1)	**13.5**	**15.5**	**Y**
Micro-Deval Loss, Fine Aggregate, % maximum LS 619	30	35	35	30	25		**17.2**	**15.2**	**Y**
Amount of Contamination, LS-630	Note 2								
Plastic Fines, LS-631	NP (Non-Plastic)							**NP**	
Determination of Permeability, *k*, LS-709	Note 3								

Note 1: The coarse aggregate micro-Deval abrasion loss test requirement shall be waived if the material has more than 80% passing 4.75 sieve.

Note 2: Granular A, B Type I, B Type III , or M may contain upto 15 percent by mass crushed glass and/or ceramic material. Granular A, O, B Type I, B Type III, and M shall not contain more than 1 percent by mass of wood, clay brick and/or gypsum wall board or plaster. Granular B Type II and SSM shall not contain more than 0.1 percent by mass of wood.

Note 3: For materials north of the French/Mattawa Rivers only, the coefficient of permeability, *k*, shall be greater than 1.0×10^{-4} cm/s or field experience has demonstrated satisfactory performance. Prior data demonstrating compliance with this requirement for *k*, shall be acceptable provided that such testing has been done within five years of the material being used and field performance has continually been shown to be satisfactory.

Issued by (Testing Laboratory Representative):

James Simser		May 10/22
PRINT NAME	SIGNATURE	DATE

Recieved by (Contract Administrative Representative):

PRINT NAME	SIGNATURE	DATE

Copies to: ☐ Contract Administrator ☐ Contractor ☐ Regional Quality Assurance ☐ Regional Geotechnical ☐ MERO (Soils and Aggregate)

PH-CC-450a Apr-10

DETERMINATION OF AMOUNT OF CONTAMINATION OF COARSE AGGREGATE

(LS-630, R24)

Testing Laboratory:	Telephone No.:		Fax No.:
The Miller Group-Materials Research Laboratory	**905-726-9518**		**905-726-4180**
Sampled By (Print Name):	Date Sampled: (YY/MM/DD)		
Customer	**22/05/10**		
Granular Type:	Lot No.:	Quantity (tonnes):	
Granular A			**Lab No.: 765953849**
Source Name/Location:		Aggregate Inventory Number (AIN):	
Carden Quarry			

Laboratory Sample No.	Largest Particle Size (>95% Passing Sieve)	Mass of Sample, g A	Mass of Wood, g B	Type of Contaminant	Mass of Contaminant, g C	% Wood (B*100/A)	% Contaminant (C*100/A)	
	26.5 mm			No Contamination Found	0			
	16.0 mm				0			
	13.2 mm				0			
	9.5 mm				0			
	6.7 mm				0			
	4.75 mm				0			

Remarks: _____

_____

Date: May 10/22

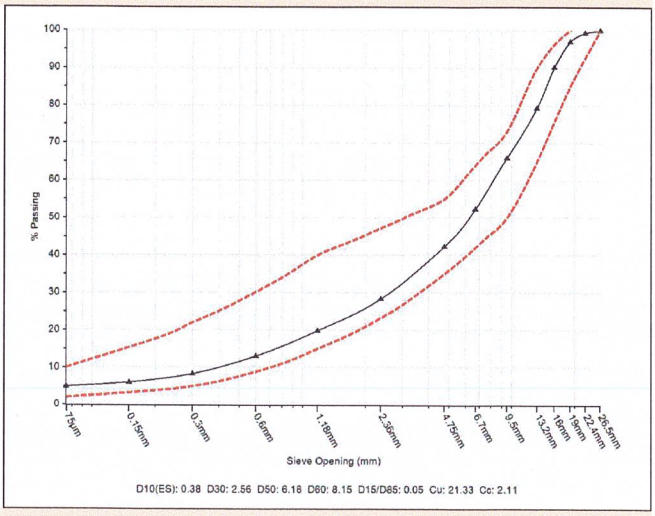
Operator: Lily

The Miller Group - Materials Research Laboratory
287 Ram Forest Road
Stouffville, ON L4A 2G8
905-726-9518

Compliance Report

Sample Information

Sample No 765953849
Product Id GRN-A
Product Name Granular A Quarry
Specification OPSS.PROV 1010 (GranA -Quarry)
Date Sampled 04/26/2022 14:01
Sampled By Vannessa Dewell
Sample Type Physicals
Sample Method Pad
Sample Location Carden Quarry
Customer A004-Miller Aggregates - Carden Quarry



Notes

Carden Quarry
Granular A
Physicals & Proctor
Apr/26/22

Gradation Results

Date Tested 05/04/2022 14:01
Tested By Lillethe Anglin

Sieve	% Passing	Tolerances
26.5mm	100.0	100-100
22.4mm	99.3	
19mm	97.0	85-100
16mm	90.2	
13.2mm	79.3	65-90
9.5mm	66.0	50-73
6.7mm	52.4	
4.75mm	42.4	35-55
2.36mm	28.3	
1.18mm	19.9	15-40
0.6mm	13.1	
0.3mm	8.3	5-22
0.15mm	6.1	
75µm	4.9	2-10

Quality Results

Test	Result	Unit	Tolerances	Method
Micro-Deval (A)	15.5	%	≤25	LS-618(CA)
Micro-Deval (Fine Agg)	15.2	%	≤30	LS-619
Other	0.0	%		LS-630
Liquid Limit	NA	%		LS631
Plastic Limit	NA	%		LS631
Plasticity Index	NP	%		LS631

The Miller Group - Materials Research Laboratory
287 Ram Forest Road
Stouffville, ON L4A 2G8
905-726-9518

Proctor Test

Plant 702-The Miller Group - Materials Research Laboratory
Product GRN-A-Granular A Quarry

765953849

Test Information

Test Number	22936737	**Sample No**	765953849
Date Started	5/18/2022 2:01:00 PM	**Date Sampled**	04/26/2022 14:01
Date Completed	05/18/2022 14:01		
Tested By	Lillethe Anglin		
Procedure	LS706		
Lab			

Test Results

Test Method	AASHTO	**Specific Gravity (Soil)**		
Proctor Type	Standard	**Specific Gravity Procedure**		
Method	A	**% Retained on 3/4" (19mm)**		
Prep Method	Dry	**Oversize Correction**	None	
Hammer Type	Manual	**Mold/Moisture Mass Units**	g	g
Mold Size	6 in	**Volume Unit**	cm3	
Mold Volume	2123.142 cm3	**Density Unit**	kg/m3	

Subsamples 5

	Subsample 1	Subsample 2	Subsample 3	Subsample 4	Subsample 5	
Mass of Mold	6406.2	6406.2	6406.2	6406.2	6406.2	g
Mass of Mold + Wet Soil	10716.8	10888.1	11003.6	11178.6	11160.3	g
Wet Mass of Soil	4310.6	4481.899	4597.399	4772.399	4754.1	g
Volume of Mold	2123.142	2123.142	2123.142	2123.142	2123.142	cm3
Wet Density	2030	2111	2165	2248	2239	kg/m3
Mass Of Pan	89.8	96.6	89.8	96.6	93.6	g
Wet Mass of Soils + Pan	605.9	599.3	644.1	610.9	604.6	g
Dry Mass of Soils + Pan	594.8	580.3	616.1	570	550.3	g
Mass of Moisture	11.1	19	28	40.9	54.3	g
% Moisture	2.2	3.9	5.3	8.6	11.9	%
Dry Density	1986.3	2031.8	2056	2070	2000.9	kg/m3

The Miller Group - Materials Research Laboratory
287 Ram Forest Road
Stouffville, ON L4A 2G8
905-726-9518

Proctor Test

Plant 702-The Miller Group - Materials Research Laboratory
Product GRN-A-Granular A Quarry

765953849

Test Information

Test Number 22936737
Date Started 5/18/2022 2:01:00 PM
Date Completed 05/18/2022 14:01
Tested By Lillethe Anglin
Procedure LS706
Lab

Sample No 765953849
Date Sampled 04/26/2022 14:01

	Results	Targets	Specifications
Opt Moisture (Proctor-Std) %	7.3		
Max Dry Density (Proctor-Std) kg/m3	2072.2		
Max Wet Density (Proctor-Std) kg/m3	2223