



• **Ferma Aggregates Inc.**

Processed Aggregate Review

Type of Document

Final Report

Project Name

Processed Aggregate Review
Ferma's Carden Quarry, Kirkfield, Ontario

Project Number

BAR-0008977-D0

Prepared By: Leigh Knecht, P. Eng.

Reviewed By: Robert Ferguson, CET

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Date Submitted

March 24, 2017

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Legal Notification

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2 Background

Ferma Aggregates Inc. owns a quarry development on Lots 7, 8, 9, and Part of Lots 6 and 10, Concession IX, Carden Township in Victoria County. The Class "A" quarry license encompasses the entire 427.2 hectare property, of which extraction is to occur in two segments totaling 205 hectares to an average depth of 32 metres (elevation 235 m.a.s.l.).

PHYSIOGRAPHY

The topography and surficial geology of Carden Township are a result of glacial activity during the Late Wisconsinan Substage of the Pleistocene Epoch, insignificantly impacted by postglacial erosion and deposition. The landscape varies from gradually sloping with gentle ridges and plateaus, infrequent knolls, and sinks represented by poorly drained swamp areas.

Fractured limestone bedrock is exposed at the ground surface over 10% of the Ferma site. A thin veneer of topsoil and glacial till of less than 0.3 metres depth over fractured limestone bedrock supporting alvar habitat (open range) and forest, covers approximately 77% of the site. The remainder of the site consists of 5% swamp, and 8% hay fields where overburden/topsoil depths are greater than 0.3 metres.

The site is split into southerly and northerly sections by a tributary stream of the Talbot River which flows from east to west. The east side of the southerly section has gently rolling topography, while the wet side hosts a poorly drained wooded swamp, a wooded rock knoll, and gently sloping open range.

North of the tributary stream, there is an upper plateau to the northwest and lower plateau to the northeast. The smaller upper plateau is separated from the lower plateau by a three to four metre high gradually sloping ridge. The ridge runs diagonally across the site intersecting the westerly and northerly boundaries at respective mid points.

GEOLOGY

SURFICIAL GEOLOGY

Overburden soils are generally thin and comprised of unsorted sand, stones, silt, and clay till. Total overburden thickness of 0.3 metres or less is found on approximately 87% of the site. The overburden is thickest in the southeast corner of the site where it varies between two and five metres in depth. Where overburden exists over the remainder of the site, it is generally between 0.15 to 0.3 metres deep.

BEDROCK GEOLOGY

GENERAL DESCRIPTION

The site is underlain at depth by Precambrian aged granite which in turn is overlain respectively by: Ordovician aged shales and sandstones of the Shadow Lake Formation, limestone and dolomitic limestone with interbedded shale of the Gull River Formation, and limestone with interbedded shale of the Bobcaygeon Formation (Ontario Geological Survey – MNR, 1981).

Quarry development will involve extraction and removal of the Ordovician aged limestone of both the Gull River and Bobcaygeon Formations.

BEDROCK LITHOLOGY

Based on previous exploration borehole advanced at the site, the general bedrock lithology is summarized as follows.

PRE-CAMBRIAN BEDROCK

Pre-cambrian rock was intersected in some of the boreholes at between 223.5 and 229.5 m.a.s.l. The pre-cambrian rock was identified as granite in borehole logs.

SHADOW LAKE FORMATION

The Shadow Lake Formation is between two and four metres thick, and deposited unconformably upon Precambrian rock. It consists of quartz sandstone (lower member), and dolomitic limestone with shale partings (upper member).

GULL RIVER FORMATION

Above the Shadow Lake Formation is the Gull River Formation consisting of the following three sub-members:

Lower Member

Lying directly on top of the Shadow Lake Formation, the lower member of the Gull River Formation is between eight to ten metres thick consisting of calcitic dolostone, dolomitic limestone, and shale partings with less than 1% shale/mudstone. Proposed extraction will penetrate to this formation.

Middle Member

The middle member of the Gull River Formation is one metre thick and was only documented at one of the borehole locations. It consists of a fine grained limestone with shale/mudstone beds.

Upper Member

The upper member of the Gull River Formation is between four and six metres thick, consisting of fine to medium grained limestone with interbeds of shale/mudstone representing 2% to 4% content.

BOBCAYGEON FORMATION

The Bobcaygeon Formation, the uppermost bedrock formation on site, has been subdivided into the following sub-members.

Lower Member

The base of the Bobcaygeon Formation is found at depths of from 20 to 25 metres below ground surface. The lower member of this formation is divided into "lower (lower)" and "lower (upper)" sections. The lower (lower) member consists of three metres of light grey to brownish grey limestone. Above this is the lower (upper) member consisting of nine metres of medium to fine grained, medium grey limestone, and is described as fossiliferous. Both members have interbeds of dark grey undulating shale/mudstone partings representing 4 to 6 % content.

Middle Member

The middle member of the Bobcaygeon Formation is six to seven metres thick consisting of medium grey to medium dark grey, fine to medium grained fossiliferous limestone with minor highly calcareous limestone zones, and shale/limestone beds having an estimated content of 3%.

Upper Member

The upper member of the Bobcaygeon is three metres thick and is at, or close to the ground surface. It consists of medium dark to medium light grey, medium to fine grained, fossiliferous friable limestone with interbeds of shale representing less than 1% content.

3 Laboratory Testing

Samples from piles 1, 2, 5, 6, 8 & 9 were obtained and returned to exp's laboratories for testing. The tests were selected to allow for comparison to the various physical properties requirements for the different aggregates specified in the Ontario Provincial Standard Specifications (OPSS). These aggregates include concrete, asphalt, surface treatment, granular materials and miscellaneous aggregates.

Grain size analysis testing was also undertaken on each sample. Since the purpose of this investigation is to assess the potential products that can be produced from this source and not specifically the suitability of the existing stockpiles, no specifications were used when plotting the gradation results for each pile. This information was used to allow for the description of the various piles based on grain size distribution.

The following table details the various tests that each sample was analysed using.

Test Method	Pile 1	Pile 2	Pile 5	Pile 6	Pile 8	Pile 9
LS-400 – Loose Density of Coarse Aggregate		X			X	X
LS-601 – % Finer than 75 µm	X	X			X	X
LS-602 – Grain Size Analysis	X	X	X	X	X	X
LS-604 – Absorption and Relative Density	X	X			X	X
LS-606 – Magnesium Sulphate Soundness	X	X			X	X
LS-607 – % Crushed	X	X			X	X
LS-608 – Flat and Elongated	X	X			X	X
LS-609 – Petrographic Number	X	X			X	X
LS-610 – Organic Impurities			X	X		
LS-613 – Acid Insoluble Residue	X	X			X	X
LS-614 – Freeze/Thaw	X	X			X	X
LS-617 – Two Faces Crushed	X	X			X	X
LS-618 – Micro Deval	X	X	X	X	X	X
LS-620 – Accelerated Mortar Bar	X	X	X	X	X	X
LS-631 – Plastic Fines			X			
CSA A23.2 – 14A – Potential Expansivity of Aggregates	X	X	X		X	X
CSA A23.2 – 26A – Alkali-Carbonate Reactivity	X	X	X	X	X	X

The results for the above noted testing are presented in table form in Appendix B. Each table presents the test results for each pile that was tested and compares the results to the OPSS requirements for various materials. Individual test reports are presented in Appendix C.

The loose density of the materials was determined to provide an estimate of the volume to mass ratio for the processed stone. The following table presents the results of this testing, along with the relative density which is determined as part of the testing for LS-604.

Pile #	Loose Density (LS-400) [tonne/m ³]	Relative Density (LS-604) [tonne/m ³]
1		2.666
2	1.548	2.683
8	1.545	2.676
9	1.521	2.670

The test results from the above testing program were compared to the results obtained from core samples extracted from two boreholes (BH1 and BH2) which were advanced in 2011 at the site by MTE. The depth of the tested portion of the cores reported below corresponds to the depth of excavation at the site. The testing reported by MTE was undertaken by **exp's** Brampton laboratory, the same facility which provided all the testing shown above. The following table shows the results of the testing from the cores, as well as a comparison to the test results from this investigation.

Test Method	Test Name	BH1-11 (3-31')	BH2-11 (9-39'2")	Piles 1, 2, 8, 9
LS-601	Wash Pass 75 µm	2.4	2.2	0.8 - 2.1
LS-604	Absorption	1.48	0.85	0.68 - 1.11
LS-607	Crushed Particles	100	100	100
LS-608	Flat and Elongated	9.5	13.6	5.9 - 12.1
LS-609	Petrographic Number	111	110	114-129
LS-614	Unconfined Freeze/Thaw	22.4	16.6	6.1 - 21.7
LS-617	Two Faces Crushed	100	100	100
LS-618	Micro-Deval Abrasion	17.7	17.1	16.7 - 19.6
LS-606	Magnesium Sulphate Soundness	6.7	12.7	5.2 - 13.2

As seen in the table above, the results of the testing carried out on the core samples is very similar to the test results obtained during this investigation.

4 Comparison to OPSS Standards

The test results were compared to the requirements detailed in various Ontario Provincial Standard Specifications (OPSS) Division 10 (aggregates) Indexes. Specifically, this reports looks at the following aggregate uses: Concrete Coarse Aggregate, Hot Laid and Super-Pave Coarse Aggregates, Granular Aggregates, Surface Treatment Aggregate, Clear Stone, and Rip-Rap/Gabion/Rock Protection Aggregate. These are the most likely uses of the aggregates that would be produced from this source given the location of the quarry and the stone being removed from it. This report looks at the requirements for both the provincial and municipal versions of the specifications and details any items that are different between the two.

OPSS 1002 – Concrete Coarse Aggregate

The physical property requirements for concrete coarse aggregate are the same for both the municipal and provincial versions of the standard. The following table details the requirements for various properties, as well as the findings of the testing completed for this assignment.

Test Method	Test Name	Specification	Test Results
LS-601	Wash Pass 75 µm	2.0 % (max)	0.8 - 2.1
LS-604	Absorption	2.0 % (max)	0.68 - 1.11
LS-608	Flat and Elongated	20 % (max)	5.9 - 12.1
LS-609	Petrographic Number	140 [125*] (max)	114 - 129
LS-614	Unconfined Freeze/Thaw	6 (max)**	6.1 - 21.7
LS-618	Micro-Deval Abrasion	17 [14*]	16.7 - 19.6
LS-620	Accelerated Mortar Bar	0.150 % (max)	0.121 - 0.154
CSA A23.2-14A	Concrete Prism Expansion	0.040 % (max at 1 year)	Testing still underway
CSA A23.2-26A	Potential Alkali-Carbonate Reactivity	Must plot as Non-expansive	Non-expansive
LS-606	Magnesium Sulphate Soundness	12 % (max)	5.2 - 13.2

[*] = requirement for concrete pavements

** - can be waived if sample meets optional test LS-606 requirements

As the above table indicates, concrete coarse aggregate can be manufactured from this site as there are test results that are acceptable for every test excluding LS-614, which can be waived if the sample meets the requirements for LS-606, which some of the samples do. The stone in piles 8 and 9 meet the above requirements.

OPSS 1003 – Asphalt – Surface Course - Coarse Aggregate

The physical property requirements for asphalt surface course coarse aggregate are the same for both the municipal and provincial versions of the standard for Superpave mixes. The municipal version also includes the requirements for Marshall (HL) mixes. The following table details the requirements for various properties, as well as the findings of the testing completed for this assignment.

Test Method	Test Name	Specification	Test Results
LS-601	Wash Pass 75 µm	1.0 to 1.3 % (max)*	0.8 - 2.1
LS-604	Absorption	1.0 to 2.0 % (max)*	0.68 - 1.11
LS-607	Crushed Particles	60 %**	100
LS-608	Flat and Elongated	15 to 20 % (max)*	5.9 - 12.1
LS-609	Petrographic Number‡	120 to 145 (max)*	114 - 129
LS-613	Insoluble Residue	45% (min)*,***	4.7-6.1
LS-614	Unconfined Freeze/Thaw	6 to 7 (max)*,****	6.1 - 21.7
LS-617	Two Faces Crushed	80 (HL1[Muni] only)	100
LS-618	Micro-Deval Abrasion	10 to 17*	16.7 - 19.6
LS-606	Magnesium Sulphate Soundness	12 % (max)*	5.2 - 13.2

* - depending on the mix

** - For municipal spec and HL3/HL4 mixes only

*** - For provincial spec, may be waived if RAP is used in mix and testing is done on combined gravel

**** - can be waived if sample meets optional test LS-606 requirements for some mixes

‡ - For northern projects, blending with a non-carbonate rock will be required to meet the spec for SP4.75, 9.5, 12.5 and HL3/HL4 mixes

As the above table indicates, coarse aggregate for surface course asphalt will be difficult to product for northern projects (the boundary line is just north of the site, passing through Washago and Norland in the vicinity of the site, as well as Highway 35 in the immediate area of the site). Piles 8 and 9 meet the specifications for SP12.5 and HL3/HL4 mixes that are south of the specified boundary.

OPSS 1003 – Asphalt – Base Course - Coarse Aggregate

The physical property requirements for asphalt base course coarse aggregate are the same for both the municipal and provincial versions of the standard for Superpave mixes. The municipal version also includes the requirements for Marshall (HL) mixes. The following table details the requirements for various properties, as well as the findings of the testing completed for this assignment.

Test Method	Test Name	Specification	Test Results
LS-601	Wash Pass 75 µm	2.0 % (max)	0.8 - 2.1
LS-604	Absorption	2.0 % (max)	0.68 - 1.11
LS-607	Crushed Particles	60 to 95 %**	100
LS-608	Flat and Elongated	15 to 20 % (max)*	5.9 - 12.1
LS-614	Unconfined Freeze/Thaw	15 (max)***	6.1 - 21.7
LS-617	Two Faces Crushed	80 to 95 %(min) (Muni. only)*	100
LS-618	Micro-Deval Abrasion	21 % (max)	16.7 - 19.6
LS-606	Magnesium Sulphate Soundness	15 % (max)	5.2 - 13.2

* - depending on the mix

** - For municipal spec and HL4/HL8 (60%) and MDBC (95%) mixes only

*** - can be waived if sample meets optional test LS-606 requirements

As the above table indicates, coarse aggregate for base course asphalt can easily be manufactured from the stone at this quarry. Piles 8 and 9 meet the specifications for base asphalt coarse aggregates. Pile 2 would also be acceptable if it were washed, reducing the % finer than 75 µm value.

OPSS 1004 – Miscellaneous Aggregates – Clear Stone/ Gabion/Rip-Rap/Rock Protection

The physical property requirements for miscellaneous aggregates are the same for both the municipal and provincial versions of the standards. The following table details the requirements for various properties, as well as the findings of the testing completed for this assignment.

Test Method	Test Name	Specification	Test Results
LS-601	Wash Pass 75 µm	2.0 % (max)*	0.8 - 2.1
LS-604	Absorption	2.0 % (max)**	0.68 - 1.11
LS-607	Crushed Particles	50 to 60 %*	100
LS-608	Flat and Elongated	15 % (max)**	5.9 - 12.1
LS-618	Micro-Deval Abrasion	25*,**	16.7 - 19.6

* - clear stone

** - gabion stone/rip-rap/rock protection

As the above table indicates, clear stone, gabion stone, rip-rap and rock protection can easily be manufactured from this source. Some additional washing may be required to ensure that the % passing the 75 µm sieve meets the specification on 2.0%.

OPSS 1006 – Surface Treatment - Coarse Aggregate

The physical property requirements for surface treatment aggregate are the same for both the municipal and provincial versions of the standards. The following table details the requirements for various properties, as well as the findings of the testing completed for this assignment.

Test Method	Test Name	Specification	Test Results
LS-601	Wash Pass 75 µm	2.0 % (max)*	0.8 - 2.1
LS-604	Absorption	1.75 to 2.0 % (max)*	0.68 - 1.11
LS-607	Crushed Particles	60 % (min)*	100
LS-608	Flat and Elongated	20 % (max)*	5.9 - 12.1
LS-609	Petrographic Number‡	60% non-carbonate (min)*	Carbonate Rock
LS-613	Insoluble Residue	60% (min)*	4.7-6.1
LS-614	Unconfined Freeze/Thaw	6 to 15 (max)*,**	6.1 - 21.7
LS-618	Micro-Deval Abrasion	25 to 30*	16.7 - 19.6
LS-606	Magnesium Sulphate Soundness	12 to 15 % (max)*	5.2 - 13.2
LS-703/704	Plasticity Index	0 (max)*	0 (non-plastic)

* - depending on the class

** - can be waived if sample meets optional test LS-606 requirements

‡ - For northern projects, blending with a non-carbonate rock will be required to meet the spec for Classes 1, 2, 3, 5 & 6

As the above table indicates, surface treatment aggregate will be difficult to produce for northern projects (the boundary line is just north of the site, passing through Washago and Norland in the vicinity of the site, as well as Highway 35 in the immediate area of the site). Piles 1 meets Class 2 requirements and Piles 8 and 9 meet the specifications for all classes for projects south of the specified boundary.

OPSS 1010 – Base, Subbase, SSM and Backfill - Coarse Aggregate

The physical property requirements for base, subbase, select subgrade material and backfill material aggregate are the same for both the municipal and provincial versions of the standards. The following table details the requirements for various properties, as well as the findings of the testing completed for this assignment.

Test Method	Test Name	Specification	Test Results
LS-607	Crushed Particles	50 to 100 % (min)*	100
LS-614	Unconfined Freeze/Thaw	15 (max)**	6.1 - 21.7
LS-617	2 or More Crushed Faces	85 % (min)**	100
LS-618	Micro-Deval Abrasion (Coarse Aggregate)	21 to 30*	16.7 - 19.6
LS-619	Micro-Deval Abrasion (Fine Aggregate)	25 to 35*	28.7
LS-621	Asphalt Coated Particles	0 to 30 % (max)*	0
LS-703/704	Plasticity Index	Non-Plastic	Non-Plastic

* - depending on the class

** - Granular O only

As the above table indicates, Granular A, B (Types I, II & III), M, S and SSM can be produced from this source. Granular O will be difficult due to the LS-614 requirement, as only one sample meet the specifications.

5 Conclusions

This review of the physical properties of the processed stone produced at Ferma's Carden Quarry demonstrates that a wide variety of aggregate products should be able to be produced from this source. This includes OPSS coarse aggregates for concrete, surface and binder course asphalts and surface treatment as well as other products such as gabion/rip/rap/rock protection, clear stone and construction aggregates such as Granular "A" (19 mm crusher-run) and Type II Granular "B".

The test results from this investigation are generally in agreement with the test results obtained from core samples as reported by MTE in November 2011. The most significant variation between the two sets of results is the Petrographic Number (PN). The aggregate piles showed a much larger range of values and this variation was all on the higher side of the range. Since higher PN's are associated with poorer quality stone, this finding may have an impact on how the stone should be processed. The larger diameter stone fractions (greater than 13.2 mm) had PN values that were very similar to the cores. All the higher PN's were associated with the smaller diameter fractions. Based on this, if an aggregate with a lower PN is required, it may be possible to take the coarse fraction of stone produced during the initial processing and re-process it to produce the final product. Since the PN is based solely on the type of rock present in the sample, once the poorer quality stone has been removed, further crushing of the better aggregate should not result in a significant change in the PN value.

6 Closure

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to contact our office.

Yours truly,

exp. Services Inc.



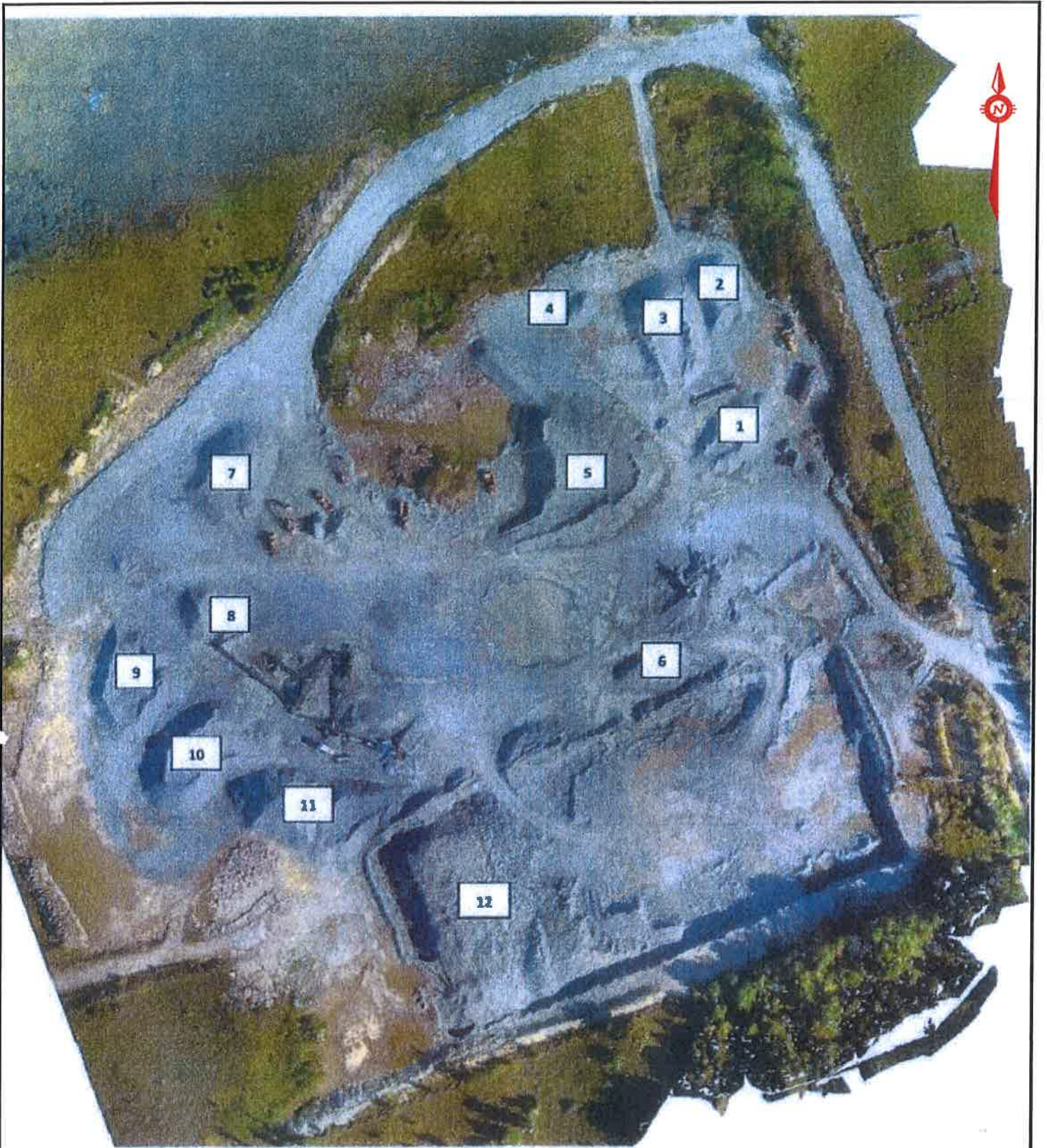
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Appendix A – Figure



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NOTES:
 - PLAN PROVIDED BY FERMA GROUP

SCALE NTS	TITLE: Stockpile Identification Plan	FIGURE 1
DATE: MARCH 2017	PROJECT: Carden Quarry - Lab Testing Carden, ON	PROJECT NO. BAR-00008977-D0
DRAWN: JF		



Stockpile #: 1
General Description of Stockpile Material: 1/4" to 3/8" Stone

Test	Method	Result	Potential Products							
			OPSS 1002 Concrete Coarse Aggregate	OPSS (MUNI) 1003 Base Asphalt - Coarse Aggregate	OPSS (MUNI) 1003 Surface Asphalt - Coarse Aggregate	OPSS (PROV) 1003 Base Asphalt - Coarse Aggregate	OPSS (PROV) 1003 - Surface Asphalt - Coarse Aggregate	OPSS 1004 Clear Stone	OPSS 1004 Rip-Rap/Gabion/Rock Protection	OPSS 1006 Surface Treatment Class 2
% Finer than 75 um	LS-601	1.9	Pass	Pass	Pass	Fail	Fail	Pass		
Absorption	LS-604	1.11	Pass	Pass	Pass (3)	Pass	Pass (7)		Pass	
Magnesium Sulphate Soundness (%)	LS-606	13.2	Fail	Pass	Fail	Pass	Fail			Pass
% Crushed	LS-607	100			Pass			Pass		Pass
Flat and Elongated	LS-608	9	Pass	Pass	Pass	Pass	Pass		Pass	
Petrographic Number	LS-609	129	Pass (1)		Pass (4)(6)		Pass(8)			
Organic Impurities	LS-610									
Acid Insoluble Residue	LS-613	6.1			Note (5)		Note (5)		Note (5)	
Freeze/Thaw	LS-614	20.8	Fail	Fail (2)	Fail	Fail (2)	Fail			Fail (2)
2 Faces Crushed	LS-617	100			Pass					
Micro-Deval	LS-618	18.8	Fail	Pass	Fail	Pass	Fail	Pass	Pass	Pass
Accelerated Mortar Bar	LS-620	0.154	Fail							
Alkali-Carbonate Reactivity	CSA-A23.2-26A	Non-Expansive	Pass							

Notes:

- (1) - Does Not Meet Specification for Concrete Pavement
- (2) - Does Not Meet Specification for Freeze/Thaw - See Test Method LS-606 Results for Pass/Fail
- (3) - Meets Specifications for SP 4.75, 9.5, 12.5, HL3, HL3F, HL3HS, HL4, HL4F
- (4) - For SP4.75, SP9.5 & SP12.5 and For Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Test Is Greater Than 60%
- (5) - For Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Is Greater Than 60%
- (6) - For HL1, DFc, SMA 9.5 and 12.5, SP 12.5 FC1 and SP12.5FC2. For HL3, HL3F, HL3HS, HL4 and HL4F see Note (5)
- (7) - For SP9.5 and SP12.5 Only
- (8) - For SP 9.5 & SP12.5 on Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Is Greater Than 60%

Stockpile #: 2
General Description of Stockpile Material: 3/8" to 1" Stone

Test	Method	Result	Potential Products - Coarse Aggregate							
			OPSS 1002 Concrete Coarse Aggregate	OPSS (MUNI) 1003 Base Asphalt - Coarse Aggregate	OPSS (MUNI) 1003 Surface Asphalt - Coarse Aggregate	OPSS (PROV) 1003 Base Asphalt - Coarse Aggregate	OPSS (PROV) 1003 - Surface Asphalt - Coarse Aggregate	OPSS 1004 Clear Stone	OPSS 1004 Rip-Rap/Gabion/Rock Protection	OPSS 1006 Surface Treatment Class 2
% Finer than 75 um	LS-601	2.1	Fail	Fail	Fail	Fail	Fail	Fail		
Absorption	LS-604	0.68	Pass	Pass	Pass	Pass	Pass		Pass	
Magnesium Sulphate Soundness (%)	LS-606	5.2	Pass	Pass	Pass (3)	Pass	Pass			Pass
% Crushed	LS-607	100			Pass			Pass		Pass
Flat and Elongated	LS-608	12.1	Pass	Pass	Pass	Pass	Pass		Pass	Pass
Petrographic Number	LS-609	114	Pass		Pass(4)		Pass(8)			
Organic Impurities	LS-610									
Acid Insoluble Residue	LS-613	5.4			Note (5)		Note (5)		Note (5)	
Freeze/Thaw	LS-614	6.1	Fail	Fail (2)	Fail (2)	Fail (2)	Fail (2)			Pass
2 Faces Crushed	LS-617	100			Pass					
Micro-Deval	LS-618	19.6	Fail	Pass	Fail	Pass	Fail	Pass	Pass	Pass
Accelerated Mortar Bar	LS-620	0.129	Pass							
Alkali-Carbonate Reactivity	CSA-A23.2-26A	Non-Expansive	Pass							

Notes:

- (1) - Does Not Meet Specification for Concrete Pavement
- (2) - Does Not Meet Specification for Freeze/Thaw - See Test Method LS-606 Results for Pass/Fail
- (3) - Meets Specifications for SP 4.75, 9.5, 12.5, HL3, HL3F, HL3HS, HL4, HL4F
- (4) - For SP4.75, SP9.5 & SP12.5 and For Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Test Is Greater Than 60%
- (5) - For Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Is Greater Than 60%
- (6) - For HL1, DFC, SMA 9.5 and 12.5, SP 12.5 FC1 and SP12.5FC2. For HL3, HL3F, HL3HS, HL4 and HL4F see Note (5)
- (7) - For SP9.5 and SP12.5 Only
- (8) - For SP 9.5 & SP12.5 on Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Is Greater Than 60%



Client: Ferma Group
Project Name: Carden Quarry - Lab Testing
Project Number: BAR-00008977-D0
Date: March 14, 2017

Stockpile #: 5
General Description of Stockpile Material: Screenings

Test	Method	Result
Organic Impurities	LS-610	<1
Micro-Deval	LS-618	28.7
Accelerated Mortar Bar	LS-620	0.102
Plastic Fines	LS-631	Non-Plastic
Potential Expansivity of Aggregates	CSA-A23.2-14A	Not Complete(1)
Alkali-Carbonate Reactivity	CSA-A23.2-26A	Non-Expansive

Notes:

(1) - Test takes 1 year to complete



Stockpile # :

General Description of Stockpile Material:

6

3/32 - 1/4" Stone

Test	Method	Result
Organic Impurities	LS-610	<1
Micro-Deval	LS-618	23.0
Accelerated Mortar Bar	LS-620	0.156
Potential Expansivity of Aggregates	CSA-A23.2-14A	Not Complete(1)
Alkali-Carbonate Reactivity	CSA-A23.2-26A	Non-Expansive

Notes:

(1) - Test takes 1 year to complete

Client: Ferma Group

Project Name: Carden Quarry - Lab Testing

Project Number: BAR-00008977-D0

Date: March 14, 2017

14 Cedar Pointe Dr., Unit 1510

Barrie, Ontario

L4N 5R7

t: 1.705.719.1100 | f: 1.705.719.1109

www.exp.com

Stockpile #: 8
General Description of Stockpile Material: 1/4" to 5/8" Stone

			Potential Products - Coarse Aggregate								
Test	Method	Result	OPSS 1002 Concrete Coarse Aggregate	OPSS (MUNI) 1003 Base Asphalt - Coarse Aggregate	OPSS (MUNI) 1003 Surface Asphalt - Coarse Aggregate	OPSS (PROV) 1003 Base Asphalt - Coarse Aggregate	OPSS (PROV) 1003 - Surface Asphalt - Coarse Aggregate	OPSS 1004 Clear Stone	OPSS 1004 Rip-Rap/Gabion/Rock Protection	OPSS 1006 Surface Treatment Class 2	OPSS 1010 Aggregates (Granular "A", Granular "B-2")
% Finer than 75 um	LS-601	0.8	Pass	Pass	Pass	Pass	Pass	Pass			
Absorption	LS-604	0.88	Pass	Pass	Pass	Pass	Pass		Pass		
Magnesium Sulphate Soundness (%)	LS-606	8	Pass	Pass	Pass (3)	Pass	Pass			Pass	
% Crushed	LS-607	100		Pass	Pass			Pass		Pass	Pass
Flat and Elongated	LS-608	10.6	Pass	Pass	Pass	Pass	Pass		Pass	Pass	
Petrographic Number	LS-609	122	Pass (1)		Pass (4)(6)		Pass (8)				
Organic Impurities	LS-610										
Acid Insoluble Residue	LS-613	4.7			Note (5)		Note (5)			Note (5)	
Freeze/Thaw	LS-614	19.6	Fail	Fail (2)	Fail (2)	Fail (2)	Fail (2)			Fail (2)	
2 Faces Crushed	LS-617	100			Pass						
Micro-Deval	LS-618	16.8	Pass (1)	Pass	Pass (3)	Pass	Pass (7)	Pass	Pass	Pass	Pass
Accelerated Mortar Bar	LS-620	0.121	Pass								
Alkali-Carbonate Reactivity	CSA-A23.2-26A	Non-Expansive	Pass								

Notes:

- (1) - Does Not Meet Specification for Concrete Pavement
- (2) - Does Not Meet Specification for Freeze/Thaw - See Test Method LS-606 Results for Pass/Fail
- (3) - Meets Specifications for SP 4, 7.5, 9.5, 12.5, HL3, HL3F, HL3HS, HL4, HL4F
- (4) - For SP4, 7.5, SP9.5 & SP12.5 and For Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Test Is Greater Than 60%
- (5) - For Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Is Greater Than 60%
- (6) - For HL1, DFC, SMA 9.5 and 12.5, SP 12.5 FFC1 and SP12.5 FFC2. For HL3, HL3F, HL3HS, HL4 and HL4F see Note (5)
- (7) - For SP9.5 and SP12.5 Only
- (8) - For SP 9.5 & SP12.5 on Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Is Greater Than 60%

Stockpile #: 9
General Description of Stockpile Material: 1/4" to 3/4" Stone

Test	Method	Result	Potential Products - Coarse Aggregate							
			OPSS 1002 Concrete Coarse Aggregate	OPSS (MUNI) 1003 Base Asphalt - Coarse Aggregate	OPSS (MUNI) 1003 Surface Asphalt - Coarse Aggregate	OPSS (PROV) 1003 Base Asphalt - Coarse Aggregate	OPSS (PROV) 1003 - Surface Asphalt - Coarse Aggregate	OPSS 1004 Clear Stone	OPSS 1004 Rip-Rap/Gabion/Rock Protection	OPSS 1006 Surface Treatment Class 2
% Finer than 75 um	LS-601	0.9	Pass	Pass	Pass	Pass	Pass	Pass		
Absorption	LS-604	1.02	Pass	Pass	Pass (3)	Pass	Pass (7)		Pass	
Magnesium Sulphate Soundness (%)	LS-606	8.3	Pass	Pass	Pass (3)	Pass	Pass			Pass
% Crushed	LS-607	100		Pass	Pass			Pass		Pass
Flat and Elongated	LS-608	5.9	Pass	Pass	Pass	Pass	Pass		Pass	Pass
Petrographic Number	LS-609	119	Pass		Pass (4)		Pass (8)			
Organic Impurities	LS-610									
Acid Insoluble Residue	LS-613	5.1			Note (5)		Note (5)			Note (5)
Freeze/Thaw	LS-614	21.7	Fail (2)	Fail (2)	Fail (2)	Fail (2)	Fail (2)			Fail (2)
2 Faces Crushed	LS-617	100			Pass					
Micro-Deval	LS-618	16.7	Pass (1)	Pass	Pass (3)	Pass	Pass (7)	Pass	Pass	Pass
Accelerated Mortar Bar	LS-620	0.132	Pass							
Alkali-Carbonate Reactivity	CSA-A23.2-26A	Non-Expansive	Pass							

Notes:

- (1) - Does Not Meet Specification for Concrete Pavement
- (2) - Does Not Meet Specification for Freeze/Thaw - See Test Method LS-606 Results for Pass/Fail
- (3) - Meets Specifications for SP 4.75, 9.5, 12.5, HL3, HL3F, HL3HS, HL4, HL4F
- (4) - For SP4.75, SP9.5 & SP12.5 and For Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Test Is Greater Than 60%
- (5) - For Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Is Greater Than 60%
- (6) - For HL1, DFC, SMA 9.5 and 12.5, SP 12.5 FC1 and SP12.5FC2. For HL3, HL3F, HL3HS, HL4 and HL4F see Note (5)
- (7) - For SP9.5 and SP12.5 Only
- (8) - For SP 9.5 & SP12.5 on Projects North of Washago/Norland and Highway 35, Will Need To Be Blended With Non-Carbonate Rock Such That LS-613 Is Greater Than 60%

**Appendix C –
Test Result Reports – LS-609, CSA A23.2-14A, CSA
A23.2-26A**



LS-609 (Part A) - Coarse Aggregate Petrographic Analysis (Petrographic Number, PN)

SAMPLE #: Pile #2		ANALYST: Kieran Maddock / Ashley Meagher		DATE TESTED: November 24, 2016		
TESTING LAB: exp Services Inc.		TEL: 905 793-9800		FAX: 905 793 0841		
SAMPLED BY:		DATE SAMPLED: November 3, 2016		LAB #:		
SOURCE NAME: Ferma's Kirkfield Quarry		SOURCE LOCATION: Kirkfield, ON		exp Sample #: 16-228		
AGGREGATE TYPE: HL-8		AGGREGATE PRODUCT:		exp Project #: BAR-00008977-D0		
CONTRACT:		CONTRACT LOCATION/HWY.:		LOT #:		
				SUBLOT #:		
		CONTRACTOR:				
TYPE	TYPE No.	P37.5/ R19	P19.0/ R13.2	P13.2/ R9.5	P 9.5/ R4.75	Weighted Composition (%)
		Mass (g)	% of Fraction	Mass (g)	% of Fraction	
CARBONATE (hard; silty, hard)	01	1733.7	41.7	873.7	57.8	0.0
CARBONATE (surface weathering: silty, surface weathering: medium hard; silty, medium hard)	20	615.1	14.8	215.5	14.3	0.0
CARBONATE (slightly cherty; <5% chert)	21	1495.7	36.0	329.3	21.8	0.0
TOTAL GOOD AGGREGATE		3844.5	92.5	1418.5	93.9	0.0
CARBONATE (soft; silty, soft; slightly shaley)	35	146.7	3.5	45.7	3.0	0.0
CHERT - CHERTY CARBONATE (< 20% leached chert)	26	164.6	4.0	46.9	3.1	0.0
TOTAL FAIR AGGREGATE		311.3	7.5	92.6	6.1	0.0
TOTAL POOR AGGREGATE		0.0	0.0	0.0	0.0	0.0
TOTAL DELETERIOUS AGGREGATE		0.0	0.0	0.0	0.0	0.0
TOTALS		4155.8	100.0	1511.1	100.0	0.0
Estimate % Crushed = 100						95.0
CONTAMINANTS (Not included in PN calculations)						
Totals (with contaminants)						
% GOOD		95.9 X 1 =	92.5	93.9 X 1 =	93.9	0.0 X 1 =
% FAIR		7.8 X 3 =	22.5	6.1 X 3 =	18.4	0.0 X 3 =
% POOR		0.0 X 6 =	0.0	0.0 X 6 =	0.0	0.8 X 6 =
% DELETERIOUS		0.0 X 10 =	0.0	0.0 X 10 =	0.0	0.0 X 10 =
PN =		115.0	112.3	0	0	0
COARSE AGGREGATE GRADATION OF AS-RECEIVED SAMPLE, % RETAINED						
P75.0/R53.0	P53.0 IR37.5	P37.5 IR26.5	P26.5 IR19.0	P19.0 IR13.2	P13.2 IR9.5	P 9.5 IR4.75
-	-	5.3	63.9	25.8	4.3	0.8
						114
PH-CC-343a 15-01						

Approved By:



Ashley Meagher, Geoscientist
exp Services Inc.,
1595 Clark Blvd., Brampton ON L6T 4V1

November 24, 2016
Date



LS-609 (Part A) - Coarse Aggregate Petrographic Analysis (Petrographic Number, PN)

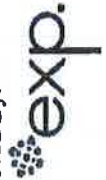
SAMPLE #: Pile #8		ANALYST: Kieran Maddock / Ashley Meagher		DATE TESTED: November 24, 2016	
TESTING LAB: exp Services Inc.		TEL: 905 793-9800		FAX: 905 793 0641	
LAB #:		DATE SAMPLED: November 3, 2016		exp Sample #: 16-230	
SAMPLED BY:		SOURCE LOCATION: Kirkfield, ON		exp Project #: BAR-0008977-D0	
SOURCE NAME: Fema's Kirkfield Quarry		AGGREGATE TYPE: HL-4		LOT #:	
AGGREGATE TYPE: HL-4		AGGREGATE PRODUCT:		SUBLOT #:	
CONTRACT:		CONTRACT LOCATION/HWY.:		CONTRACTOR:	

TYPE	TYPE No.	P26.5 / R19		P19.0 / R13.2		P13.2 / R9.5		P9.5 / R4.75		Weighted Composition (%)	
		Mass (g)	% of Fraction	Mass (g)	% of Fraction	Mass (g)	% of Fraction	Mass (g)	% of Fraction		
CARBONATE (hard; silty, hard)	01	0.0	0.0	852.3	55.2	291.0	53.9	120.0	54.9	54.4	
CARBONATE (surface weathering; silty, surface weathering; medium hard; silty, medium hard)	20	0.0	0.0	262.3	17.0	134.8	25.0	48.7	22.3	21.9	
CARBONATE (slightly cherty; <5% chert)	21	0.0	0.0	344.0	22.3	62.4	11.6	26.3	12.0	13.7	
TOTAL GOOD AGGREGATE	-	0.0	0.0	1458.6	94.5	488.2	90.4	195.0	89.2	90.0	
CARBONATE (soft; silty, soft; slightly shaley)	35	0.0	0.0	22.0	1.4	9.3	1.7	10.4	4.8	3.3	
CARBONATE (deeply weathered; silty, deeply weathered)	42	0.0	0.0	5.2	0.3	0.0	0.0	0.0	0.0	0.1	
CHERT - CHERTY CARBONATE (< 20% leached chert)	26	0.0	0.0	57.6	3.7	40.7	7.5	12.7	5.8	5.9	
TOTAL FAIR AGGREGATE	-	0.0	0.0	84.8	5.5	50.0	9.3	23.1	10.6	9.2	
CARBONATE (shaley, clayey; silty, clayey)	43	0.0	0.0	0.0	0.0	2.0	0.4	0.6	0.3	0.2	
TOTAL POOR AGGREGATE	-	0.0	0.0	0.0	0.0	2.0	0.4	0.6	0.3	0.2	
SHALE	61	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.4	0.2	
TOTAL DELETERIOUS AGGREGATE	-	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.4	0.2	
TOTALS		0.0	0.0	1543.4	100.0	540.2	100.0	218.7	100.0	100.0	
CONTAMINANTS (Not Included in PN calculations)											
Totals (with contaminants)											
Additional Information:	% GOOD	100.0 X 1 =	94.5	90.4 X 1 =	90.4	89.2 X 1 =	89.2	Weighted Average PN			
	% FAIR	0.0 X 3 =	5.5 X 3 =	16.5	9.3 X 3 =	27.8	10.6 X 3 =				31.7
	% POOR	0.0 X 6 =	0.0 X 6 =	0.0	0.6 X 6 =	2.2	0.3 X 6 =				1.6
	% DELETERIOUS	0.0 X 10 =	0.0 X 10 =	0.0	0.0 X 10 =	0.0	0.4 X 10 =				4.1
	PN =	111				120					
COARSE AGGREGATE GRADATION OF AS-RECEIVED SAMPLE, % RETAINED											
P75.0/R53.0	P37.5/R26.5	P26.5/R19.0	P19.0/R13.2	P13.2/R9.5	P9.5/R4.75	122					
-	-	0.5	18.6	27.3	53.6						

PH-CC-343a 15-01

Ashley Meagher

Approved By:



Ashley Meagher, Geoscientist
exp Services Inc.,
1595 Clark Blvd., Brampton ON L6T 4V1

November 24, 2016

Date



LS-609 (Part A) - Coarse Aggregate Petrographic Analysis (Petrographic Number, PN)

SAMPLE #: Pile #1		ANALYST: Kieran Maddock / Ashley Meagher		DATE TESTED: November 22, 2016						
TESTING LAB: exp Services Inc.		TEL: 905 793-9800		FAX: 905 793 0641						
SAMPLED BY:		DATE SAMPLED: November 3, 2016		LAB #:						
SOURCE NAME: Ferna's Kirkfield Quarry		SOURCE LOCATION: Kirkfield, ON		exp Sample #: 16-225						
AGGREGATE TYPE: 3/8" Clear Stone		AGGREGATE PRODUCT:		exp Project #: BAR-0000977-D0						
CONTRACT:		CONTRACT LOCATION/HWY.:		LOT #:						
		CONTRACTOR:		SUBLOT #:						
TYPE	TYPE No.	P26.5 / R19 Mass (g)	% of Fraction	P19.0 / R13.2 Mass (g)	% of Fraction	P13.2 / R9.5 Mass (g)	% of Fraction	P 9.5 / R4.75 Mass (g)	% of Fraction	Weighted Composition (%)
CARBONATE (hard; silty, hard)	01	0.0	0.0	0.0	0.0	331.0	62.1	134.1	64.4	63.6
CARBONATE (surface weathering; silty, surface weathering; medium hard; silty, medium hard)	20	0.0	0.0	0.0	0.0	122.8	23.0	29.0	13.9	16.8
CARBONATE (slightly cherty; <5% chert)	21	0.0	0.0	0.0	0.0	54.2	10.2	17.9	8.6	9.1
TOTAL GOOD AGGREGATE	-	0.0	0.0	0.0	0.0	508.0	95.2	181.0	86.9	89.4
CARBONATE (soft; silty, soft; slightly shaley)	35	0.0	0.0	0.0	0.0	15.8	3.0	10.7	5.1	4.4
CHERT - CHERTY CARBONATE (< 20% leached chert)	26	0.0	0.0	0.0	0.0	8.8	1.6	11.4	5.5	4.3
TOTAL FAIR AGGREGATE	-	0.0	0.0	0.0	0.0	24.6	4.6	22.1	10.6	8.7
CARBONATE (shaley, clayey, silty, clayey)	43	0.0	0.0	0.0	0.0	0.8	0.1	5.2	2.5	1.8
TOTAL POOR AGGREGATE	-	0.0	0.0	0.0	0.0	0.8	0.1	5.2	2.5	1.8
SHALE	81	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.3	0.2
TOTAL DELETERIOUS AGGREGATE	-	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.3	0.2
TOTALS		0.0	0.0	0.0	0.0	533.4	100.0	208.3	100.0	100.0
Estimate % Crushed = 100										
CONTAMINANTS (Not Included in PN calculations)										
Totals (with contaminants)										
% GOOD	100.0 X 1 =	93.9 X 1 =		95.2 X 1 =		86.9 X 1 =				
% FAIR	0.0 X 3 =	6.1 X 3 =		4.6 X 3 =		10.6 X 3 =				
% POOR	0.0 X 6 =	0.0 X 6 =		0.1 X 6 =		2.5 X 6 =				
% DELETERIOUS	0.0 X 10 =	0.0 X 10 =		0.0 X 10 =		0.3 X 10 =				
PN =										
COARSE AGGREGATE GRADATION OF AS-RECEIVED SAMPLE, % RETAINED										
P75.0/R53.0	P53.0 IR37.5	P26.5 IR19.0	P19.0 IR13.2	P13.2 IR9.5	P 9.5 IR4.75	129				
-	-	-	0.1	31.4	68.5					

PH-CC-343a 15-01

Ashley Meagher

Approved By:



Ashley Meagher, Geoscientist
exp Services Inc.,
1595 Clark Blvd., Brampton ON L6T 4V1

November 22, 2016

Date



LS-609 (Part A) - Coarse Aggregate Petrographic Analysis (Petrographic Number, PN)

SAMPLE #: Pile #9		ANALYST: Kieran Maddock		DATE TESTED: November 21, 2016							
TESTING LAB: exp Services Inc.		TEL: 905 793-9800		FAX: 905 793 0841							
SAMPLED BY:		DATE SAMPLED: November 3, 2016		LAB #:							
SOURCE NAME: Ferma's Kirkfield Quarry		SOURCE LOCATION: Kirkfield, ON		exp Sample #: 16-229							
AGGREGATE TYPE: 5/8-1/4" Clear Stone		AGGREGATE PRODUCT:		exp Project #: BAR-00008977-00							
CONTRACT:		CONTRACT LOCATION/HWY.:		LOT #:							
				SUBLOT #:							
		CONTRACTOR:									
TYPE		P26.5 / R19		P19.0 / R13.2		P13.2 / R9.5		P 9.5 / R4.75		Weighted Composition (%)	
	TYPE No.	Mass (g)	% of Fraction	Mass (g)	% of Fraction	Mass (g)	% of Fraction	Mass (g)	% of Fraction	Mass (g)	% of Fraction
CARBONATE (hard; silty, hard)	01	0.0	0.0	873.7	57.8	283.1	52.7	112.9	52.5	53.5	
CARBONATE (surface weathering; silty, surface weathering; medium hard; silty, medium hard)	20	0.0	0.0	215.5	14.3	79.5	14.8	44.0	20.5	17.5	
CARBONATE (slightly cherty; <5% chert)	21	0.0	0.0	329.3	21.8	122.3	22.7	37.0	17.2	19.7	
TOTAL GOOD AGGREGATE	-	0.0	0.0	1418.5	93.9	484.9	90.2	193.9	90.2	90.8	
CARBONATE (soft; silty, soft; slightly shaley)	35	0.0	0.0	45.7	3.0	18.1	3.4	11.7	5.4	4.3	
CHERT - CHERTY CARBONATE (< 20% leached chert)	26	0.0	0.0	46.9	3.1	30.5	5.7	8.6	4.0	4.3	
TOTAL FAIR AGGREGATE	-	0.0	0.0	92.6	6.1	48.6	9.0	20.3	9.4	8.6	
CARBONATE (shaley; clayey; silty, clayey)	-	0.0	0.0	0.0	0.0	4.2	0.8	0.7	0.3	0.6	
TOTAL POOR AGGREGATE	-	0.0	0.0	0.0	0.0	4.2	0.8	0.7	0.3	0.6	
TOTAL DELETERIOUS AGGREGATE	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTALS		0.0	0.0	1511.1	100.0	537.7	100.0	214.9	100.0	100.0	
Estimate % Crushed = 100											
CONTAMINANTS (Not included in PN calculations)											
Totals (with contaminants)											
% GOOD		100.0 X 1 =		93.9	90.2 X 1 =	89.3	89.3 X 1 =	89.3			
% FAIR		0.0 X 3 =		6.1 X 3 =	18.4	9.0 X 3 =	27.1	10.4 X 3 =	28.3		
% POOR		0.0 X 6 =		0.0 X 6 =	0.0	0.8 X 6 =	4.7	0.3 X 6 =	2.0		
% DELETERIOUS		0.0 X 10 =		0.0 X 10 =	0.0	0.0 X 10 =	0.0	0.0 X 10 =	0.0		
PN =				112			122			120	
COARSE AGGREGATE GRADATION OF AS-RECEIVED SAMPLE, % RETAINED											
P75.0/R53.0	P37.5/R26.5	P26.5/R19.0	P19.0/R13.2	P13.2/R9.5	P 9.5/R4.75	119					
-	-	0.2	19.9	29.8	50.1						

PH-CC-343a 15-01

Approved By:



Ashley Mengher, Geoscientist
exp Services Inc.,
1595 Clark Blvd., Brampton ON L6T 4V1

November 21, 2016

Date



exp Services Inc.

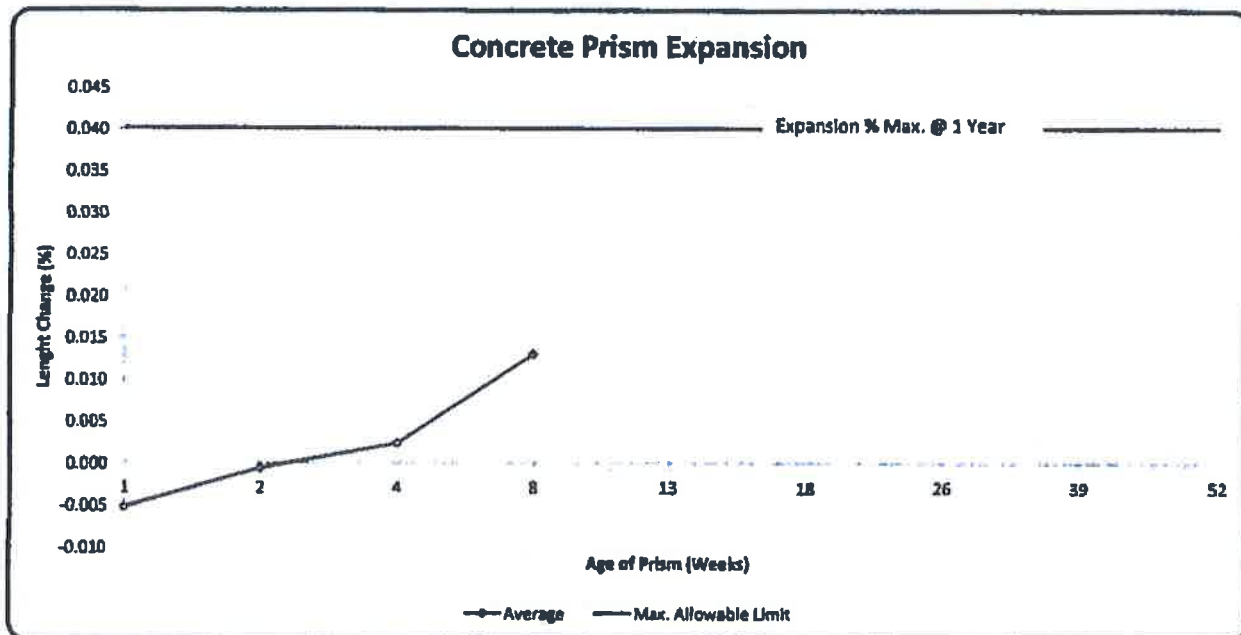
1595 Clark Boulevard, Brampton, ON L6T 4V1
Tel: (905) 793-8800; Fax: (905) 793-0841

POTENTIAL EXPANSIVITY OF AGGREGATES (Test Method: CAN/CSA A23.2-14A)

Client: Kirkfield Ferma Aggregates
Project No.: BAR-000R977-D0
Material: Pile #1
Source:
Laboratory Test Data:

Date : 9-Feb-2017
Lab No.: 18-707
Date Received: 3-Nov-2016
Date Completed: 13-Dec-2017

Elapsed Weeks:	1	2	4	8	13	18	26	39	52
Specimen ID	Expansion (%)								
A	-0.006	0.000	0.003	0.012					
B	-0.005	-0.001	0.002	0.013					
C	-0.005	-0.001	0.002	0.013					
Average	-0.005	-0.001	0.002	0.013					



Test Procedure	Test Result	Acceptance Requirements	
		Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Concrete Prism Expansion, % maximum @ 1 year CSA A23.2-14A			0.040

Approved By:

(c) *Ammanuel Yousif*
Ammanuel Yousif, C.E.T.



exp Services Inc.

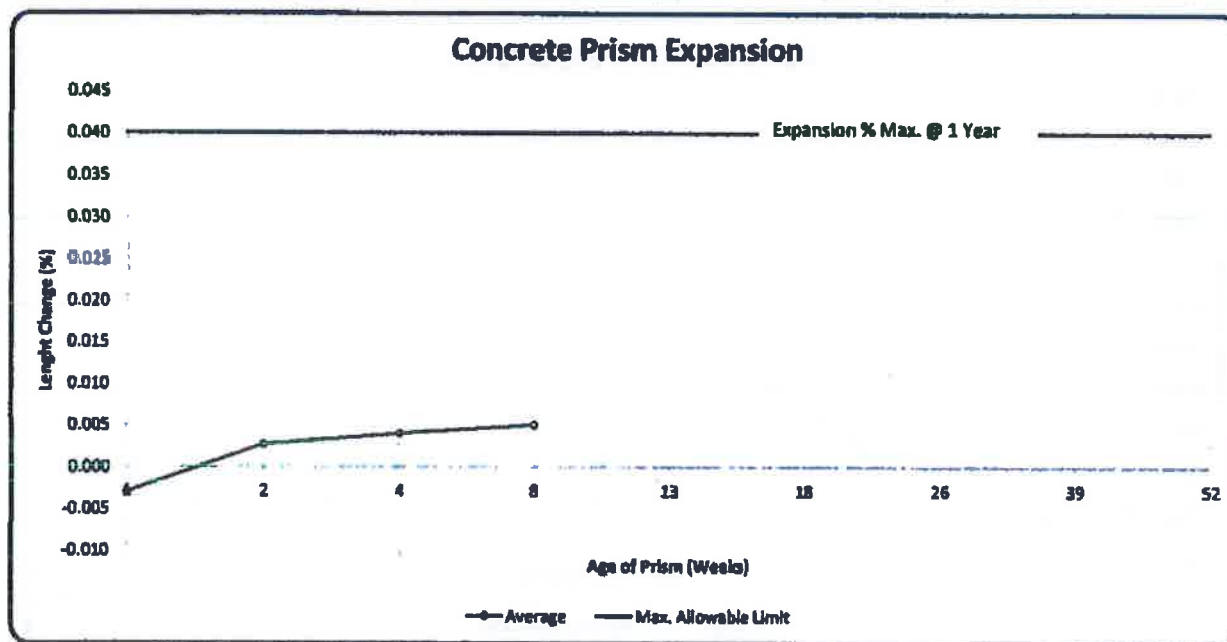
1595 Clark Boulevard, Brampton, ON L6T 4V1
Tel: (905) 783-8800; Fax: (905) 783-0641

POTENTIAL EXPANSIVITY OF AGGREGATES (Test Method: CAN/CSA A23.2-14A)

Client: Kirkfield Ferma Aggregates
Project No.: BAR-0008977-D0
Material: Pile #2
Source:
Laboratory Test Data:

Date : 9-Feb-2017
Lab No.: 16-707
Date Received: 3-Nov-2016
Date Completed: 13-Dec-2017

Elapsed Weeks:	1	2	4	8	13	18	26	39	52
Specimen ID	Expansion (%)								
A	-0.003	0.004	0.006	0.006					
B	-0.002	0.002	0.004	0.004					
C	-0.004	0.002	0.002	0.004					
Average	-0.003	0.003	0.004	0.005					



Test Procedure	Test Result	Acceptance Requirements	
		Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Concrete Prism Expansion, % maximum @ 1 year CSA A23.2-14A			0.040

Approved By:

Ammanuel Yousif
Ammanuel Yousif, C.E.T.



exp Services Inc.

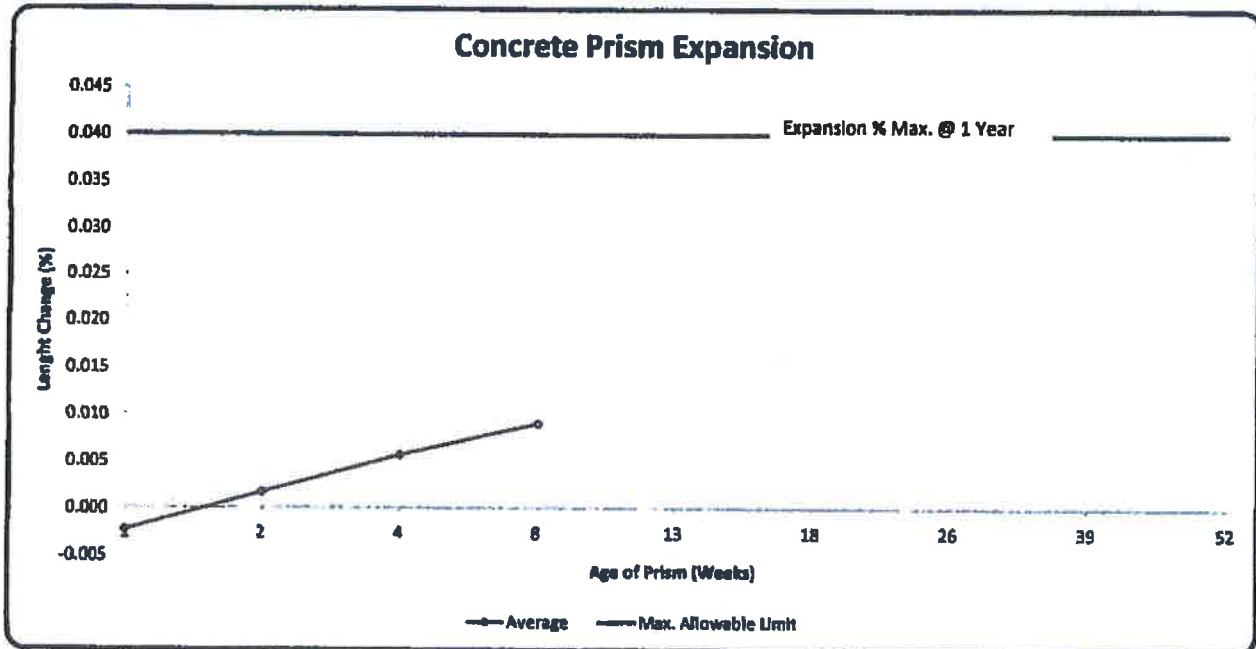
1585 Clark Boulevard, Brampton, ON L6T 4V1
Tel: (905) 793-9800; Fax: (905) 793-0641

POTENTIAL EXPANSIVITY OF AGGREGATES
(Test Method: CAN/CSA A23.2-14A)

Client: Kirkfield Ferma Aggregates
Project No.: BAR-0008977-D0
Material: Pile #5
Source:
Laboratory Test Data:

Date: 22-Feb-2017
Lab No.: 18-707
Date Received: 3-Nov-2016
Date Completed: 7-Dec-2017

Elapsed Weeks:	1	2	4	8	13	18	26	39	52
Specimen ID	Expansion (%)								
A	-0.003	0.002	0.005	0.009					
B	-0.001	0.003	0.007	0.01					
C	-0.003	0.000	0.005	0.009					
Average	-0.002	0.002	0.006	0.009					



Test Procedure	Test Result	Acceptance Requirements	
		Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Concrete Prism Expansion, % maximum @ 1 year CSA A23.2-14A			0.040

Approved By:

for Ammanuel Yousif, C.E.T.



exp Services Inc.

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Tel (905) 793-9800 Fax (905) 793-0841

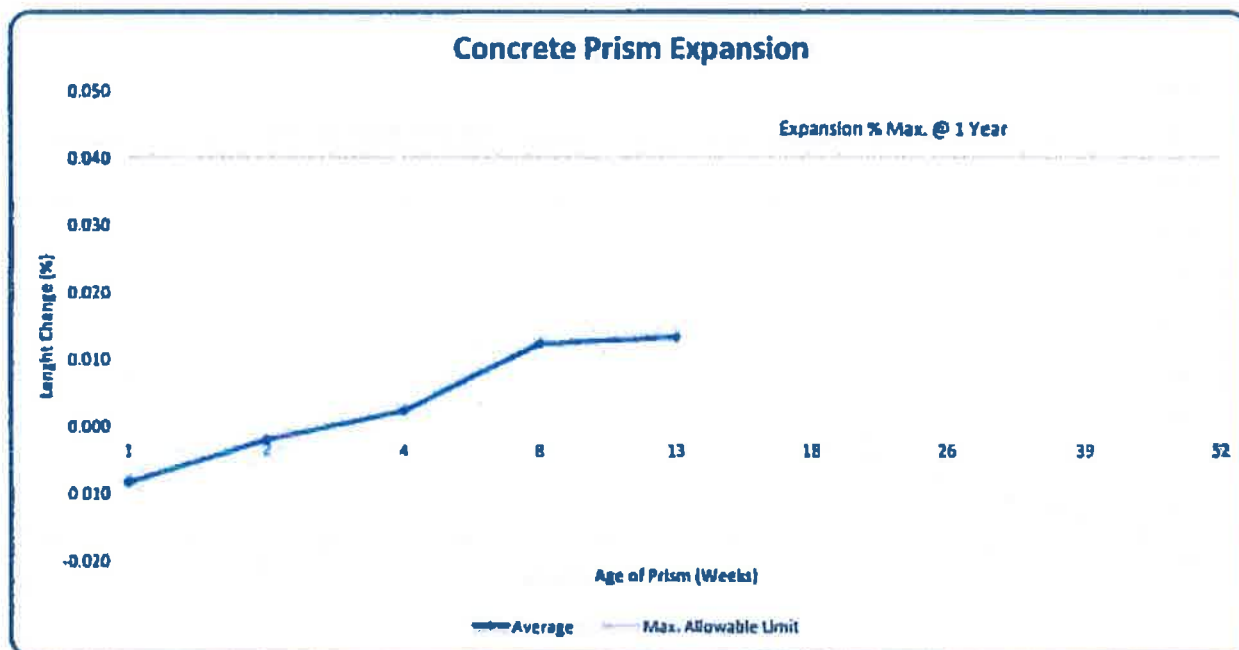
POTENTIAL EXPANSIVITY OF AGGREGATES

(Test Method: CAN/CSA A23.2-14A)

Client: Kirkfield Ferma Aggregates
Project No.: BAR-0008977-D0
Material: Pile #8 (HL4)
Source:
Laboratory Test Data:

Date : 9-Mar-2017
Lab No.: 16-707
Date Received: 3-Nov-2016
Date Completed: 13-Dec-2017

Elapsed Weeks:	1	2	4	8	13	18	26	39	52
Specimen ID	Expansion (%)								
A	-0.009	-0.003	0.002	0.012	0.013				
B	-0.009	-0.002	0.002	0.011	0.014				
C	-0.008	-0.002	0.002	0.012	0.012				
Average	-0.009	-0.002	0.002	0.012	0.013	.	.	.	.



Test Procedure	Test Result	Acceptance Requirements	
		Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Concrete Prism Expansion % maximum @ 1 year CSA A23.2-14A			0.040

Approved By:

Ammanuel Yousif, C.E.T.



exp Services Inc.

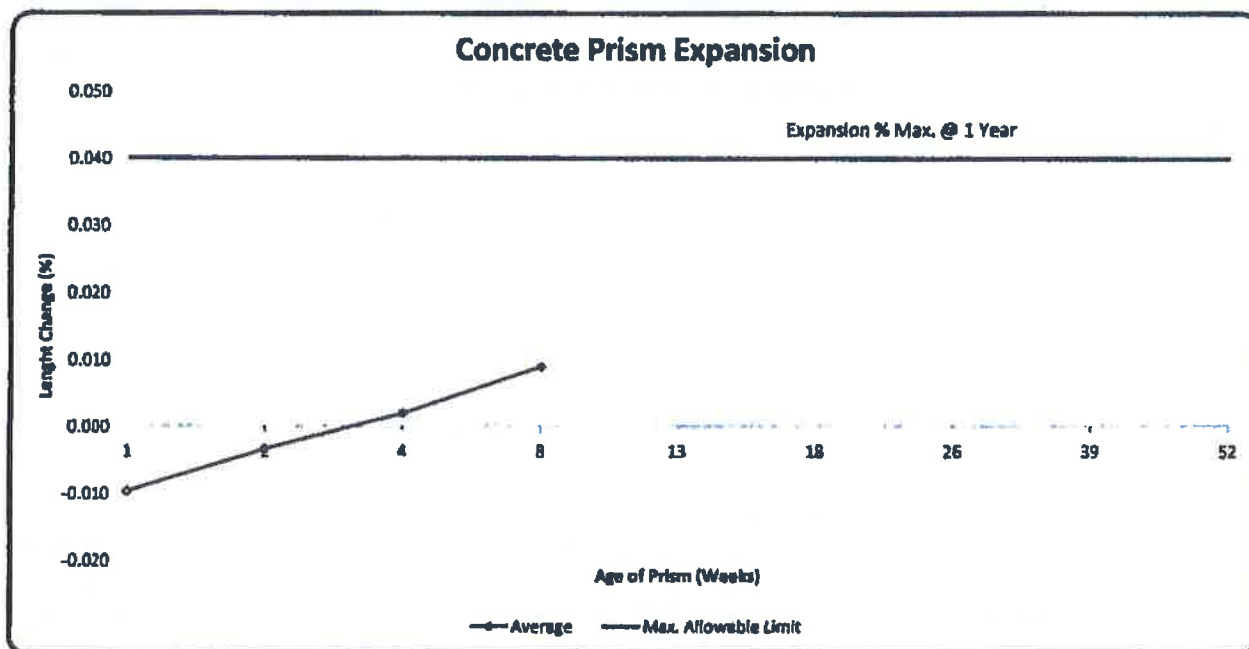
1595 Clark Boulevard, Brampton, ON L6T 4V1
Tel: (905) 793-9800; Fax: (905) 793-0641

POTENTIAL EXPANSIVITY OF AGGREGATES
(Test Method: CAN/CSA A23.2-14A)

Client: Kirkfield Ferma Aggregates
Project No.: BAR-0008977-D0
Material: Pile #9
Source:
Laboratory Test Data:

Date: 22-Feb-2017
Lab No.: 16-707
Date Received: 3-Nov-2016
Date Completed: 7-Dec-2017

Elapsed Weeks:	1	2	4	8	13	18	26	39	52
Specimen ID	Expansion (%)								
A	-0.010	-0.003	0.000	0.008					
B	-0.009	-0.002	0.004	0.01					
C	-0.010	-0.005	0.002	0.01					
Average	-0.010	-0.003	0.002	0.009					



Test Procedure	Test Result	Acceptance Requirements	
		Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Concrete Prism Expansion, % maximum @ 1 year CSA A23.2-14A			0.040

Approved By:

Ammanuel Yousif, C.E.T.



exp Services Inc.

Brampton Laboratory
1595 Clark Boulevard, Brampton ON L6T 4V1
Tel: (905) 783-9800; Fax: (905) 793-0841

ACCELERATED MORTAR BAR EXPANSION

(Test Method: LS-620 Or CSA A23.2-25A)

Client: exp Barrie

Reported: December 16, 2016

Sampled:

Received: November 3, 2016

Project No.: BAR-00008977-D0 BAR-100 (Kirkfield Ferma Aggregate)

Type of Curing: 80°C NaOH

Initial Reading: 2-Dec-16

Material: Pile #1

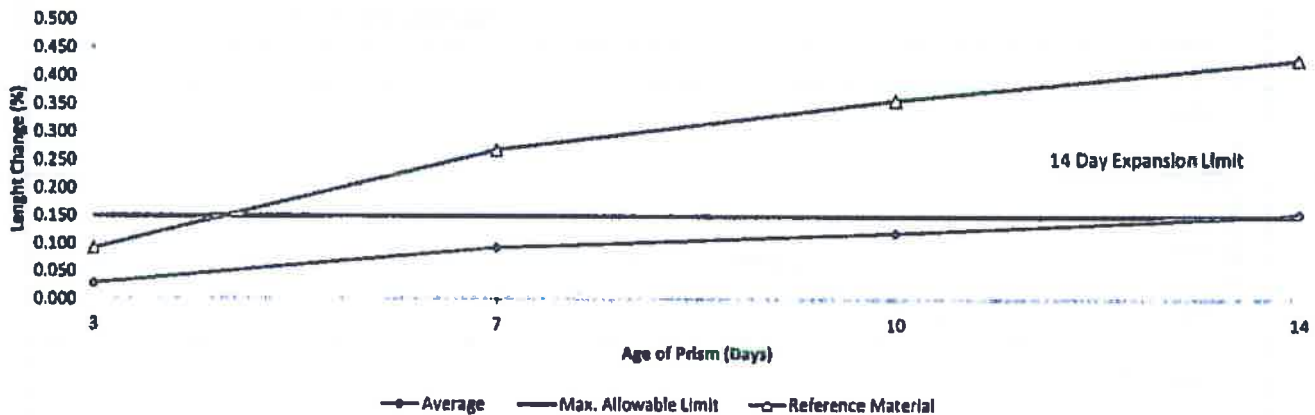
Source: Kirkfield Ferma Aggregate

Laboratory Test Data:

exp ID:

Elapsed Days:	0	0	3			7			10			14			Significant Remarks
Reading Date:	Dec. 1/16	2-Dec-16	5-Dec-16			9-Dec-16			12-Dec-16			16-Dec-16			
Specimen ID	Effective Gauge Lenth	Initial Reading	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	
A	257	3.153	3.226	0.073	0.028	3.394	0.241	0.094	3.464	0.311	0.121	3.554	0.401	0.154	
B	257	2.886	2.956	0.070	0.027	3.119	0.233	0.091	3.185	0.299	0.116	3.275	0.389	0.151	
C	257	2.714	2.791	0.077	0.03	2.959	0.245	0.095	3.028	0.314	0.122	3.112	0.398	0.155	
Average					0.028			0.093			0.12			0.154	

Accelerated Mortar Bar Expansion



Test Procedure	Test Number	Test Result	Acceptance Requirements	
			Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Accelerated Mortar Bars, % Expansion at 14 days (Sample ID:)	LS-620	0.154	0.150 Max	0.150 Max
Accelerated Mortar Bars, % Expansion at 14 days Reference Material	LS-620	0.429		

Approved By:

Ammanuel Yousif



exp Services Inc.
 Brampton Laboratory
 1595 Clark Boulevard, Brampton ON L6T 4V1
 Tel: (905) 793-8800; Fax: (905) 793-0841

ACCELERATED MORTAR BAR EXPANSION

(Test Method: LS-620 Or CSA A23.2-25A)

Client: exp Barrie

Reported: December 16, 2016

Sampled:

Received: November 3, 2016

Project No.: BAR-00008977-D0 BAR-100 (Kirkfield Ferma Aggregate)

Type of Curing: 80°C NaOH

Initial Reading: 2-Dec-16

Material: Pile #8

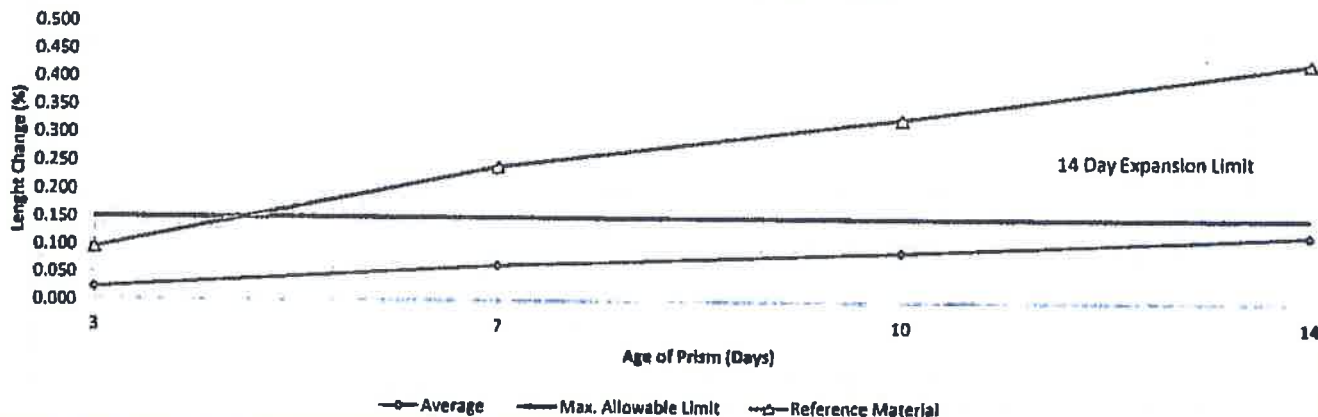
Source: Kirkfield Ferma Aggregate

Laboratory Test Data:

exp ID:

Elapsed Days:	0	0	3			7			10			14			Significant Remarks
Reading Date:	2-Dec-16	2-Dec-16	5-Dec-16			9-Dec-16			12-Dec-16			16-Dec-16			
Specimen ID	Effective Gauge Lenth	Initial Reading	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	
A	256	1.67	1.736	0.066	0.026	1.84	0.17	0.066	1.904	0.234	0.091	1.985	0.315	0.123	
B	255	0.769	0.826	0.057	0.022	0.933	0.164	0.064	0.998	0.229	0.09	1.078	0.309	0.121	
C	254	-0.482	-0.429	0.053	0.021	-0.326	0.156	0.061	-0.257	0.225	0.089	-0.176	0.306	0.12	
Average					0.023			0.064			0.09			0.121	

Accelerated Mortar Bar Expansion



Test Procedure	Test Number	Test Result	Acceptance Requirements	
			Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Accelerated Mortar Bars, % Expansion at 14 days (Sample ID:)	LS-620	0.121	0.150 Max	0.150 Max
Accelerated Mortar Bars, % Expansion at 14 days Reference Material	LS-620	0.429		

Approved By:

Ammanuel Yousif



exp Services Inc.

Brampton Laboratory
1595 Clark Boulevard, Brampton ON L6T 4V1
Tel: (905) 783-9800; Fax: (905) 793-0641

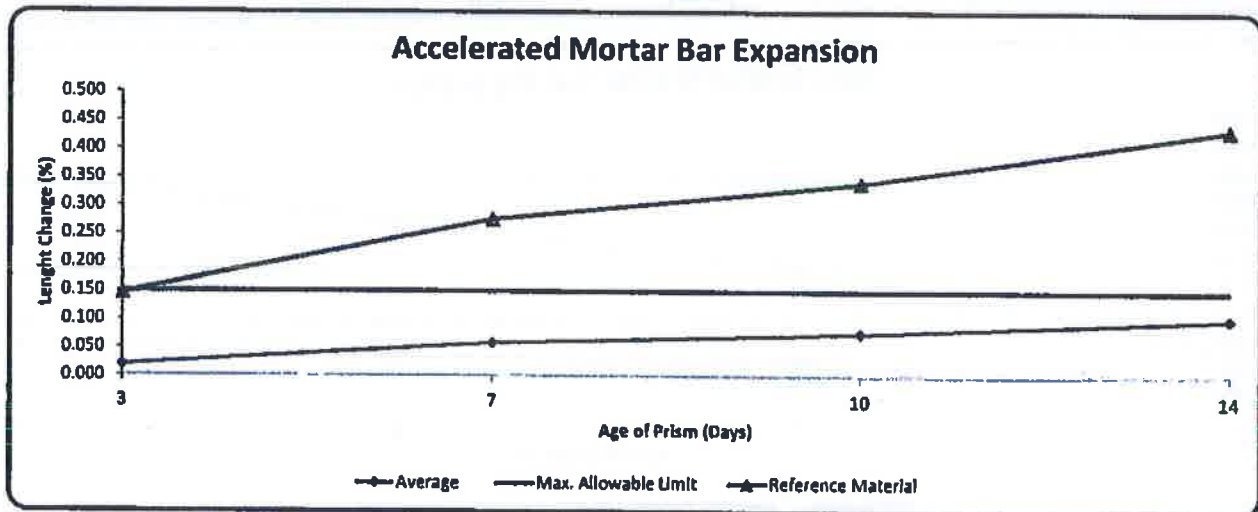
ACCELERATED MORTAR BAR EXPANSION
(Test Method: LS-620 Or CSA A23.2-25A)

Client: exp Barrie
Project No.: BAR-00008977-D0 BAR-100 (Kirkfield Ferma Aggregate)
Date Cast: Nov. 9, 2016 **Material:** Pile #5 - Fine

Date: November 28, 2016
Type of Curing: 80°C NaOH
Source: Kirkfield Ferma Aggregate

Laboratory Test Data:

Elapsed Days:	0	3	7	10	14	Significant Remarks									
Reading Date:															
Specimen ID	Effective Gauge Length	Initial Reading	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	
A	257	2.635	2.685	0.050	0.019	2.789	0.154	0.060	2.832	0.197	0.077	2.901	0.266	0.104	
B	257	0.133	0.181	0.048	0.019	0.281	0.148	0.058	0.324	0.191	0.075	0.387	0.254	0.100	
C	257	2.957	3.007	0.050	0.019	3.107	0.150	0.058	3.153	0.196	0.076	3.220	0.263	0.102	
Average					0.019			0.059			0.076			0.102	



Test Procedure	Test Number	Test Result	Acceptance Requirements	
			Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Accelerated Mortar Bars, % Expansion at 14 days (Sample ID:)	LS-620	0.102	0.150 Max	0.150 Max
Accelerated Mortar Bars, % Expansion at 14 days Reference Material	LS-620	0.434		

Testing Laboratory Representative Signature
Ammanuel Yousef, C.E.T.

November 28, 2016
Date



exp Services Inc.

Brampton Laboratory

1595 Clark Boulevard, Brampton ON L6T 4V1

Tel:(905) 793-9800; Fax:(905) 793-0641

ACCELERATED MORTAR BAR EXPANSION

(Test Method: LS-620 Or CSA A23.2-25A)

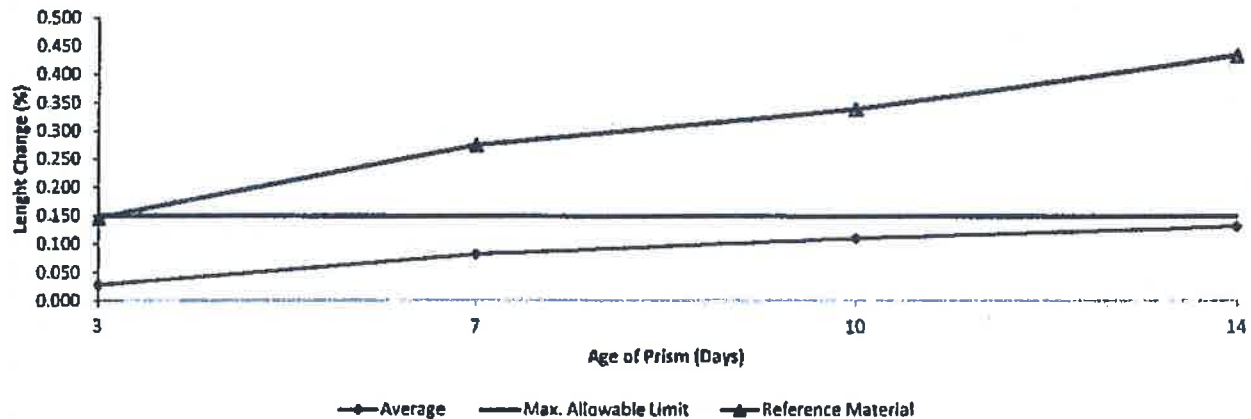
Client: exp Barrie
Project No.: BAR-00008977-D0 BAR-100 (Kirkfield Ferma Aggregate)
Date Cast: Nov. 23, 2016 Material: Pile #9

Date: December 12, 2016
Type of Curing: 80°C NaOH
Source: Kirkfield Ferma Aggregate

Laboratory Test Data:

Elapsed Days:	0	0	3			7			10			14			Significant Remarks
Reading Date:															
Specimen ID	Effective Guage Lenth	Initial Reading	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	
A	254	0.636	0.566	0.070	0.028	0.427	0.209	0.082	0.362	0.274	0.108	0.311	0.325	0.128	
B	253	0.781	0.708	0.073	0.029	0.567	0.214	0.085	0.496	0.285	0.113	0.444	0.337	0.133	
C	255	0.371	0.441	0.070	0.027	0.582	0.211	0.083	0.656	0.285	0.112	0.714	0.343	0.135	
Average					0.028			0.083			0.111			0.132	

Accelerated Mortar Bar Expansion



Test Procedure	Test Number	Test Result	Acceptance Requirements	
			Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Accelerated Mortar Bars, % Expansion at 14 days (Sample ID:)	LS-620	0.132	0.150 Max	0.150 Max
Accelerated Mortar Bars, % Expansion at 14 days Reference Material	LS-620	0.434		


Testing Laboratory Representative Signature
Ammanuel Yousif, C.E.T.

December 12, 2016

Date



exp Services Inc.

Brampton Laboratory
1595 Clark Boulevard, Brampton ON L6T 4V1
Tel: (905) 793-9800; Fax: (905) 793-0641

ACCELERATED MORTAR BAR EXPANSION

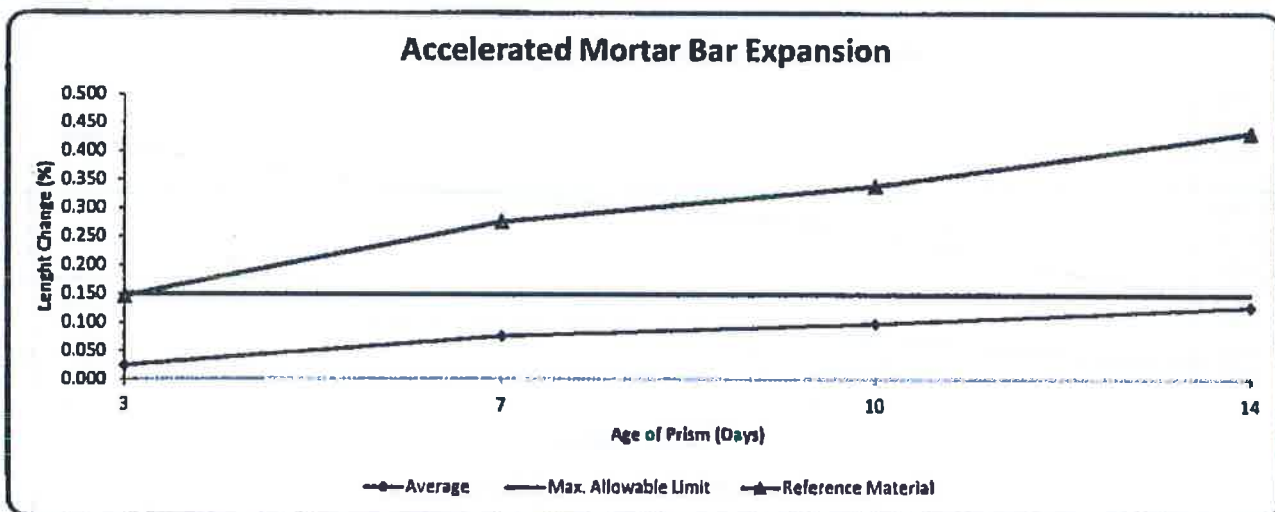
(Test Method: LS-620 Or CSA A23.2-25A)

Client: exp Barrie
Project No.: BAR-00008977-D0 BAR-100 (Kirkfield Ferma Aggregate)
Date Cast: Nov. 23, 2016 Material: Pile #2

Date: December 12, 2016
Type of Curing: 80°C NaOH
Source: Kirkfield Ferma Aggregate

Laboratory Test Data:

Elapsed Days:	0	0	3			7			10			14			Significant Remarks
Reading Date:															
Specimen ID	Effective Guage Lenth	Initial Reading	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	Reading	Difference	% Expansion	
A	257	2.462	2.525	0.063	0.025	2.660	0.198	0.077	2.717	0.255	0.099	2.793	0.331	0.129	
B	256	1.576	1.642	0.066	0.026	1.770	0.194	0.076	1.833	0.257	0.100	1.905	0.329	0.129	
C	256	2.343	2.401	0.058	0.023	2.546	0.203	0.079	2.600	0.257	0.100	2.674	0.331	0.129	
Average					0.025			0.077			0.100			0.129	



Test Procedure	Test Number	Test Result	Acceptance Requirements	
			Pavement	Structures, Sidewalk, Curb and Gutter, and Concrete Base
Accelerated Mortar Bars, % Expansion at 14 days (Sample ID:)	LS-620	0.129	0.150 Max	0.150 Max
Accelerated Mortar Bars, % Expansion at 14 days Reference Material	LS-620	0.434		

Ammanuel Yousif, C.E.T.

Testing Laboratory Representative Signature
Ammanuel Yousif, C.E.T.

December 12, 2016
Date



exp Services Inc.
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Potential Alkali-Carbonate Reactivity of Carbonate Rocks Test Report

CA32

Sample Test No.: 262544-66

Report No.: 1

Date Reported: 06/12/2016

Client Sample ID:

Project No.: BAR-00008977-D0

Date Sampled:

Date Received: 03/11/2016

Sample Location:

Sampled By: Client

Sample Description: Pile # 1

Sample Remark:

Aggregate Type:

Normal Size/Type:

Aggregate Source: Kirkfield Ferma

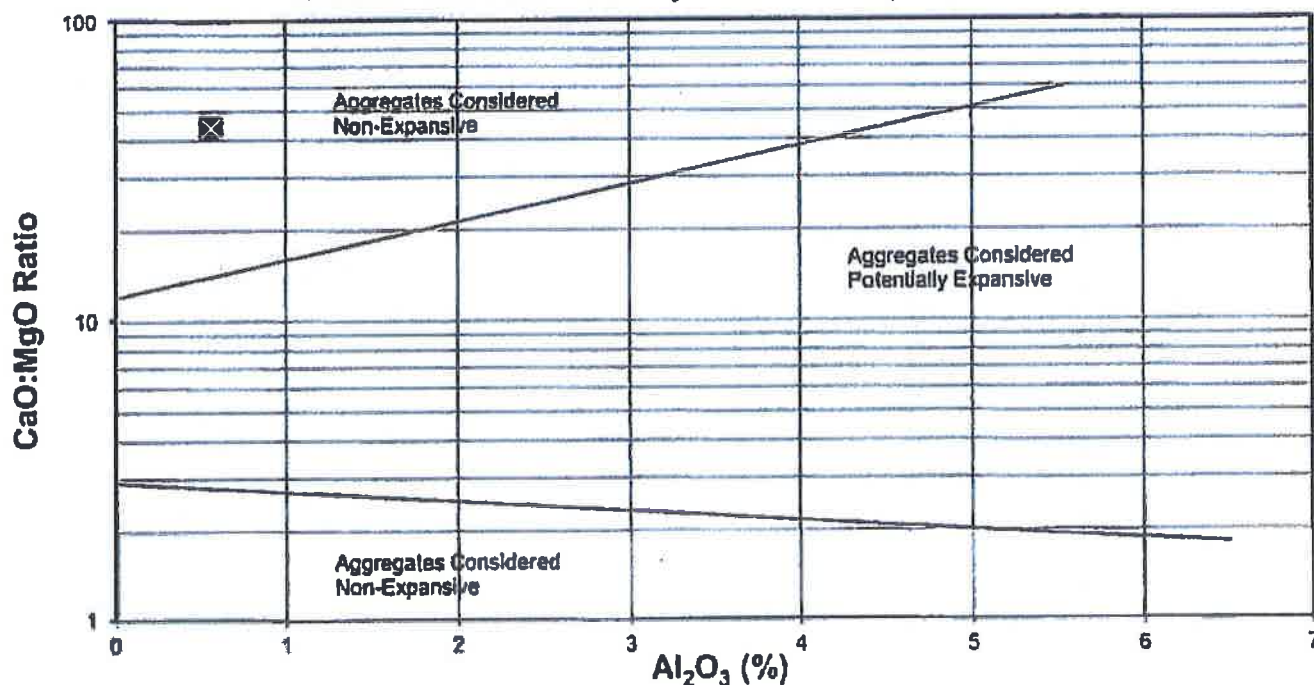
Source Code:

Method of Analysis:

Results of Analysis:

CaO (%)	MgO (%)	CaO:MgO Ratio	Al ₂ O ₃ (%)
50.29	1.14	44.11	0.56

Determination of Potential Alkali-Carbonate Reactivity of
Quarried Carbonate Rocks by Chemical Composition



Remark: We hereby certify the testing procedure in accordance with CAN/CSA A23.2-26A

Project Manager: Leigh Kneigt

Approved By:

Date Approved: 06/12/2016

Ammanuel Yousif



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Potential Alkali-Carbonate Reactivity of Carbonate Rocks Test Report

CA32

Sample Test No.: 262544-42

Report No.: 2

Date Reported: 06/12/2016

Client Sample ID:

Project No.: BAR-00008977-D0

Date Sampled:

Date Received: 03/11/2016

Sample Location:

Sampled By: Client

Sample Description: Pile # 2

Sample Remark:

Aggregate Type:

Aggregate Source: Kirkfield Ferma

Method of Analysis:

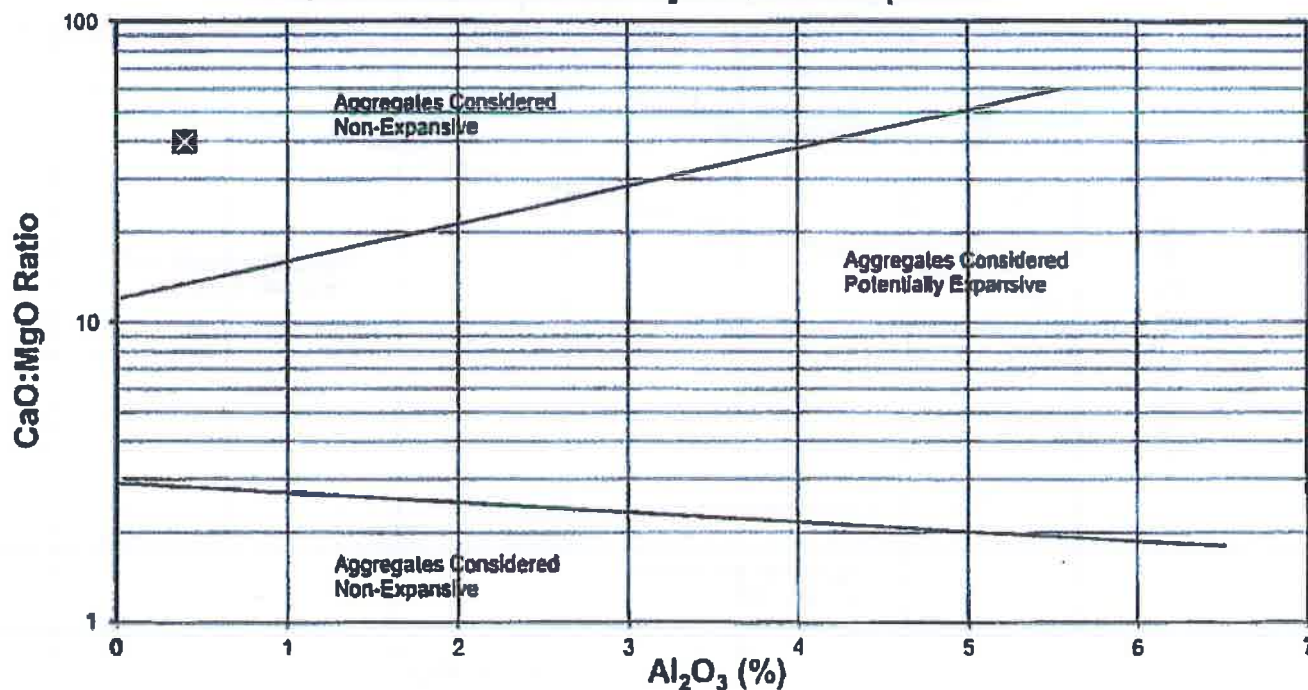
Normal Size/Type:

Source Code:

Results of Analysis:

CaO (%)	MgO (%)	CaO:MgO Ratio	Al ₂ O ₃ (%)
51.06	1.28	39.89	0.40

Determination of Potential Alkali-Carbonate Reactivity of
Quarried Carbonate Rocks by Chemical Composition



Remark: We hereby certify the testing procedure in accordance with CAN/CSA A23.2-26A

Project Manager: Leigh Knegt

Approved By:

Ammanuel Yousif

Date Approved: 06/12/2016



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Potential Alkali-Carbonate Reactivity of Carbonate Rocks Test Report

CA32

Sample Test No.: 262544-43

Report No.: 3

Date Reported: 06/12/2016

Client Sample ID:

Project No.: BAR-00008977-D0

Date Sampled:

Date Received: 03/11/2016

Sample Location:

Sampled By: Client

Sample Description: Pile # 5

Sample Remark:

Aggregate Type:

Norminal Size/Type:

Aggregate Source: Kirkfield Ferma

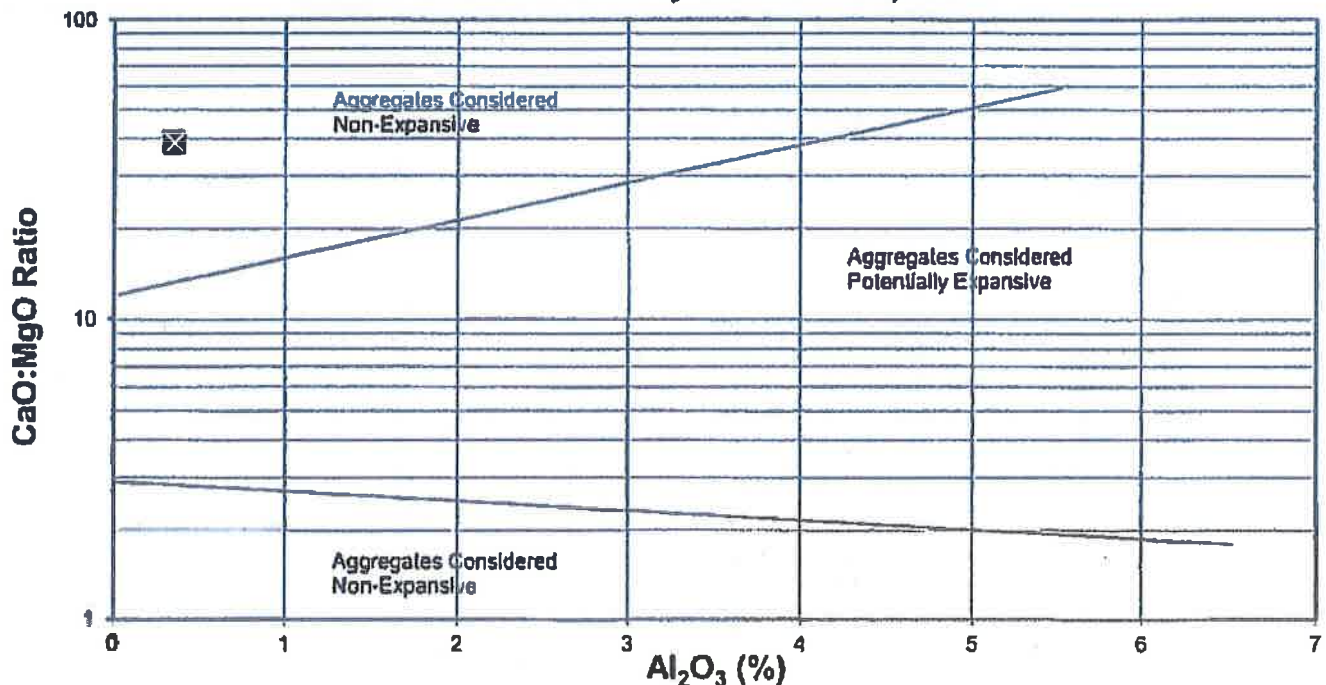
Source Code:

Method of Analysis:

Results of Analysis:

CaO (%)	MgO (%)	CaO:MgO Ratio	Al ₂ O ₃ (%)
52.96	1.37	38.66	0.35

Determination of Potential Alkali-Carbonate Reactivity of Quarried Carbonate Rocks by Chemical Composition



Remark: We hereby certify the testing procedure in accordance with CAN/CSA A23.2-26A

Project Manager: Leigh Kneigt

Approved By:

Ammanuel Yousif

Date Approved: 06/12/2016



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Potential Alkali-Carbonate Reactivity of Carbonate Rocks Test Report

CA32

Sample Test No.: 262544-44

Report No.: 4

Date Reported: 06/12/2016

Client Sample ID:

Project No.: BAR-00008977-D0

Date Sampled:

Date Received: 03/11/2016

Sample Location:

Sampled By: Client

Sample Description: Pile # 6

Sample Remark:

Aggregate Type:

Aggregate Source: Kirkfield Ferma

Method of Analysis:

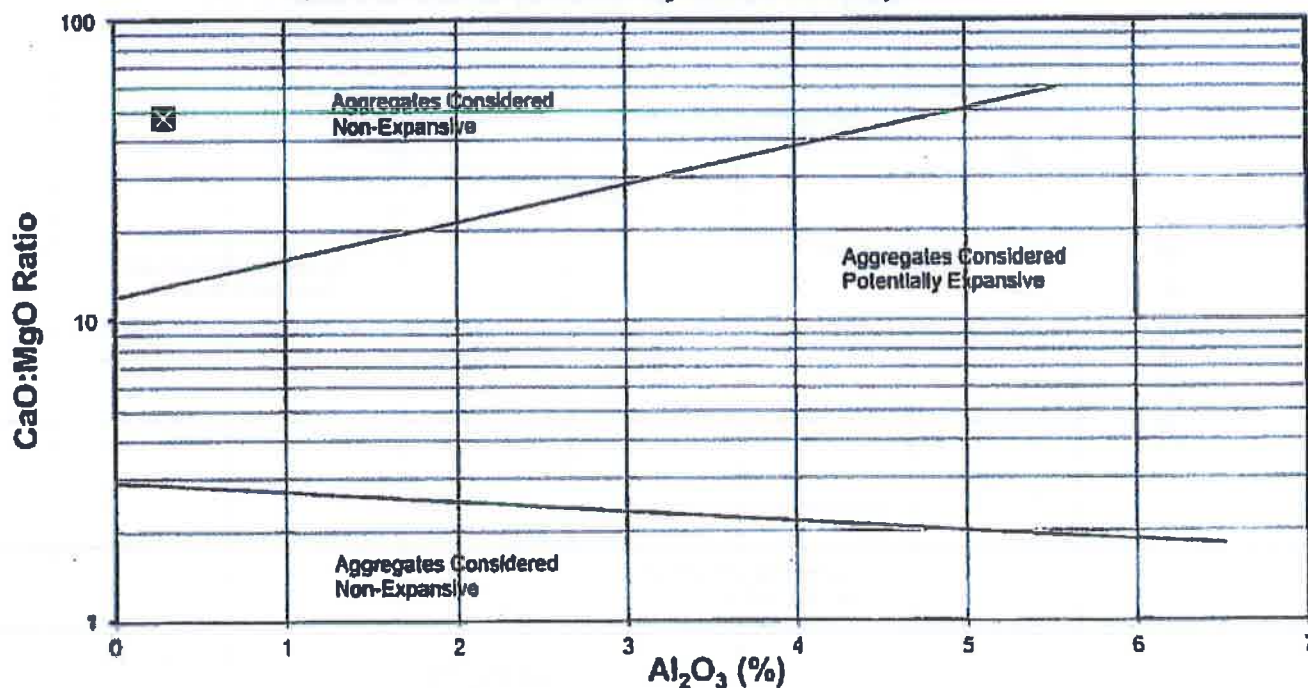
Normalinal Size/Type:

Source Code:

Results of Analysis:

CaO (%)	MgO (%)	CaO:MgO Ratio	Al ₂ O ₃ (%)
49.29	1.03	47.85	0.29

Determination of Potential Alkali-Carbonate Reactivity of
Quarried Carbonate Rocks by Chemical Composition



Remark: We hereby certify the testing procedure in accordance with CAN/CSA A23.2-26A

Project Manager: Leigh Kneigt

Approved By:

Ammanuel Yousif

Date Approved: 06/12/2016



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Potential Alkali-Carbonate Reactivity of Carbonate Rocks Test Report

CA32

Sample Test No.: 262544-45

Report No.: 5

Date Reported: 06/12/2016

Client Sample ID:

Project No.: BAR-00008977-D0

Date Sampled:

Date Received: 03/11/2016

Sample Location:

Sampled By: Client

Sample Description: Pile # 8

Sample Remark:

Aggregate Type:

Norminal Size/Type:

Aggregate Source: Kirkfield Ferma

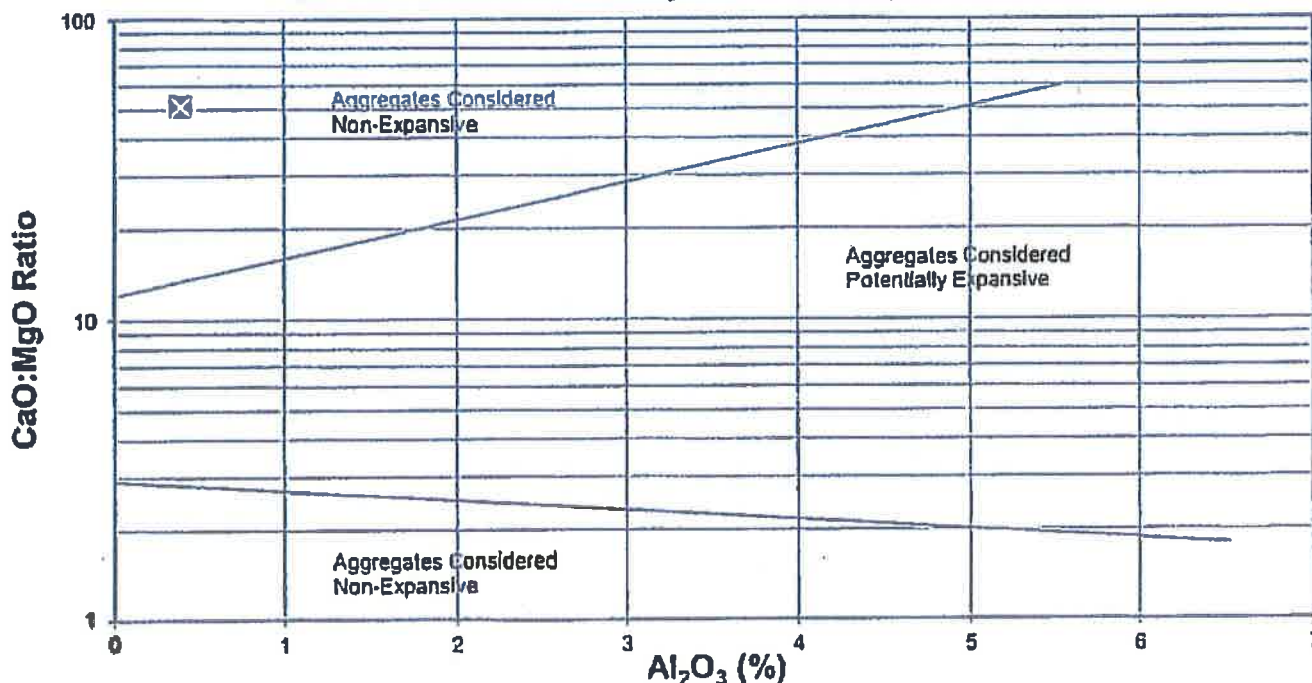
Source Code:

Method of Analysis:

Results of Analysis:

CaO (%)	MgO (%)	CaO:MgO Ratio	Al ₂ O ₃ (%)
49.72	0.97	51.26	0.40

Determination of Potential Alkali-Carbonate Reactivity of
Quarried Carbonate Rocks by Chemical Composition



Remark: We hereby certify the testing procedure in accordance with CAN/CSA A23.2-26A

Project Manager: Leigh Kneigt

Approved By:

Date Approved: 06/12/2016

Ammanuel Yousif



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Ontario, Canada, L6T 4V1
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Potential Alkali-Carbonate Reactivity of Carbonate Rocks Test Report

CA32

Sample Test No.: 262544-46

Report No.: 6

Date Reported: 06/12/2016

Client Sample ID:

Project No.: BAR-00008977-D0

Date Sampled:

Date Received: 03/11/2016

Sample Location:

Sampled By:

Client

Sample Description:

Pile # 9

Sample Remark:

Aggregate Type:

Aggregate Source:

Kirkfield Ferma

Normalinal Size/Type:

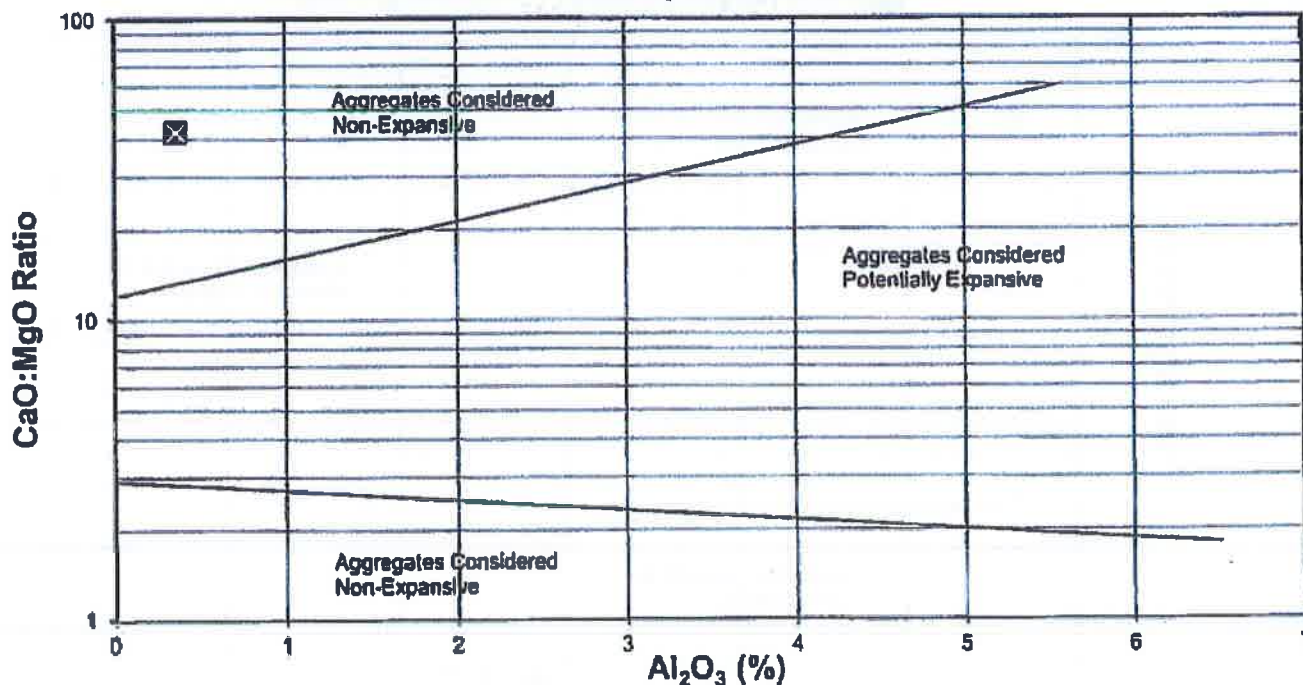
Source Code:

Method of Analysis:

Results of Analysis:

CaO (%)	MgO (%)	CaO:MgO Ratio	Al ₂ O ₃ (%)
45.11	1.07	42.16	0.36

Determination of Potential Alkali-Carbonate Reactivity of
Quarried Carbonate Rocks by Chemical Composition



Remark: We hereby certify the testing procedure in accordance with CAN/CSA A23.2-26A

Project Manager: Leigh Knegt

Approved By:

Ammanuel Yousif

Date Approved: 06/12/2016



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f: 1.705.719.1109
14 Cedar Pointe Dr., Unit 1510
Barrie, Ontario
L4N 5R7
www.exp.com

Grain Size Analysis Report

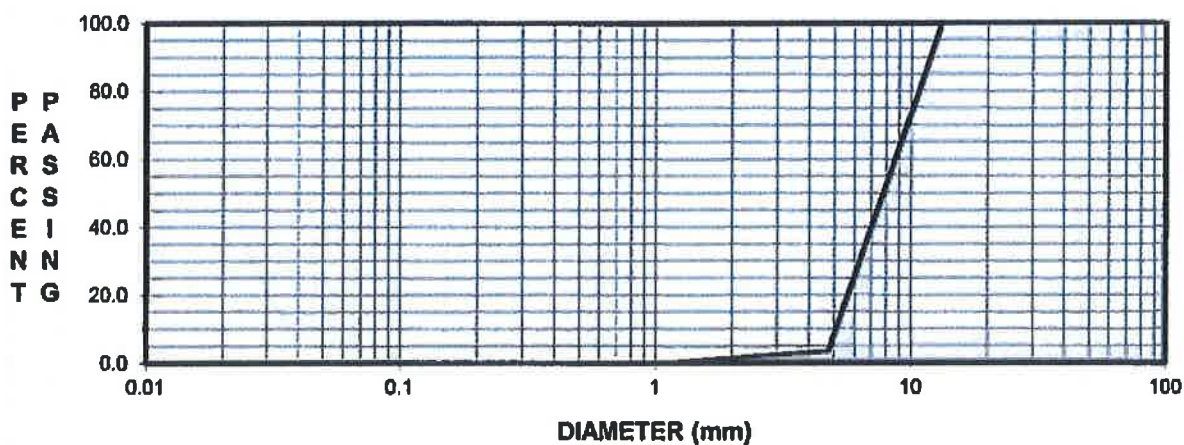
Project Name: Carden Quarry- Lab Testing
Project No.: BAR-00008977-D0
Material: 1/4" to 3/8" Stone
Sample Location: Carden Quarry- Pile #1

Client: Ferma Group
Dated Tested: October 18, 2016
Date Sampled: October 12, 2016
Supplier: Carden Quarry

SAMPLE DATA

Sieve Diameter (mm)	Percent Retained (%)	Percent Passing (%)	Spec (%)
150			
75			
53			
37.5			
26.5			
19			
13.2			
9.5	31.5	68.5	
4.75	96.6	3.4	
2.36	98.3	1.7	
1.18			
0.6			
0.3			
0.15			
0.075			

GRAIN SIZE DISTRIBUTION



Distribution:
Ferma Group

Prepared By:

Scott Fraser
Mr. Scott Fraser, C.E.T.

Checked By:

Leigh Knecht
Leigh Knecht P. Eng.

Report No. _____



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f: 1.705.719.1109
14 Cedar Pointe Dr., Unit 1510
Barrie, Ontario
L4N 5R7
www.exp.com

Grain Size Analysis Report

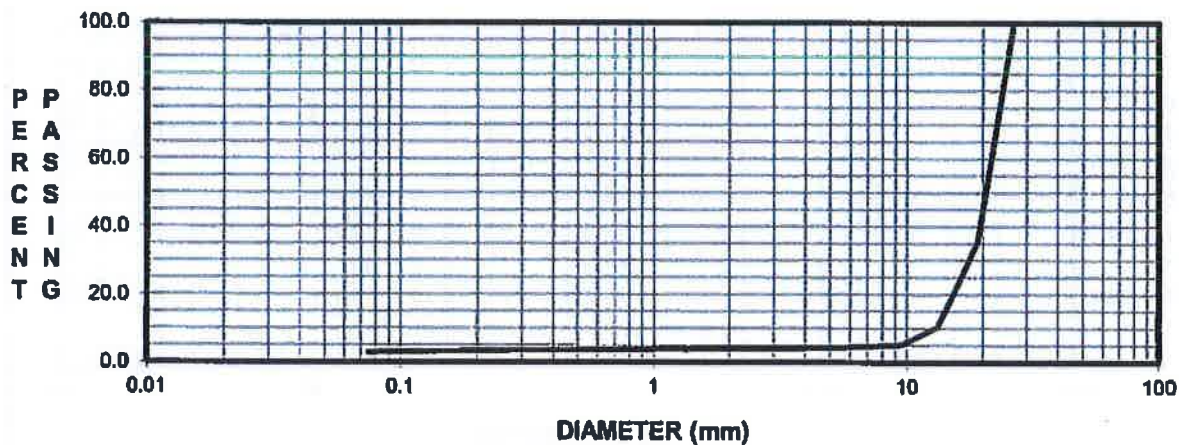
Project Name: Carden Quarry- Lab Testing
Project No.: BAR-00008977-D0
Material: 3/8" to 1" Stone
Sample Location: Carden Quarry- Pile # 2

Client: Ferma Group
Dated Tested: Oct 19 2016
Date Sampled: Oct 12 2016
Supplier: Carden Quarry

SAMPLE DATA

Sieve Diameter (mm)	Percent Retained (%)	Percent Passing (%)	Spec (%)
150			
75			
53			
37.5			
26.5	1.4	98.6	
19	64.9	35.1	
13.2	89.7	10.3	
9.5	94.8	5.2	
4.75	95.8	4.2	
2.36	96.0	4.0	
1.18	96.1	3.9	
0.6	96.3	3.7	
0.3	96.5	3.5	
0.15	96.8	3.2	
0.075	97.2	2.8	

GRAIN SIZE DISTRIBUTION



Distribution:
Ferma Group

Prepared By:

for Scott Fraser, C.E.T.

Checked By:

Leigh Knight P. Eng.

Report No. _____



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f: 1.705.719.1109
14 Cedar Pointe Dr., Unit 1510
Barrie, Ontario
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Grain Size Analysis Report

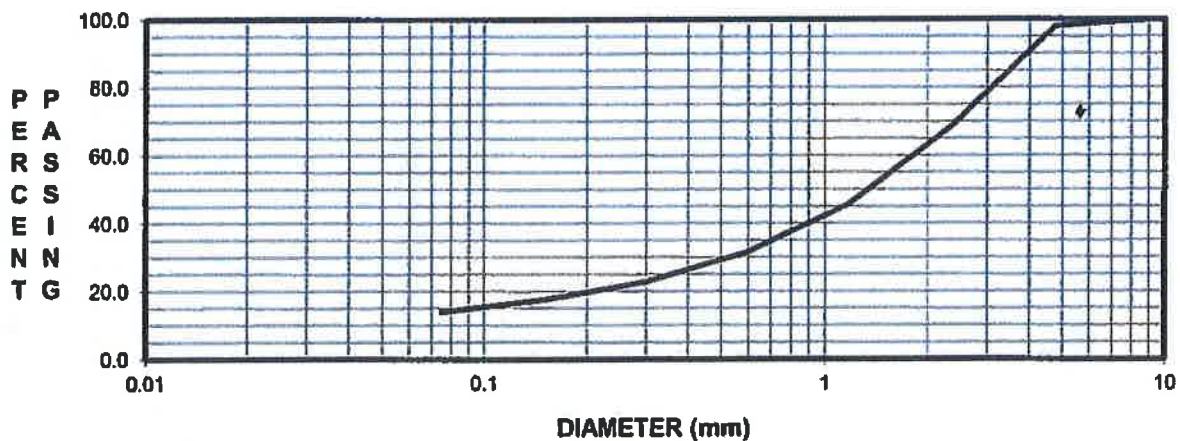
Project Name: Carden Quarry- Lab Testing
Project No.: BAR-00008977-D0
Material: Screenings
Sample Location: Carden Quarry- Pile #5

Client: Ferma Group
Dated Tested: October 20, 2016
Date Sampled: October 12, 2016
Supplier: Carden Quarry

SAMPLE DATA

Sieve Diameter (mm)	Percent Retained (%)	Percent Passing (%)	Spec (%)
150			
75			
53			
37.5			
26.5			
19			
13.2			
9.5			
4.75	2.1	97.9	
2.36	31.4	68.6	
1.18	54.3	45.7	
0.6	68.5	31.5	
0.3	77.3	22.7	
0.15	82.5	17.5	
0.075	86.1	13.9	

GRAIN SIZE DISTRIBUTION



Distribution:
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Prepared By:

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Grain Size Analysis Report

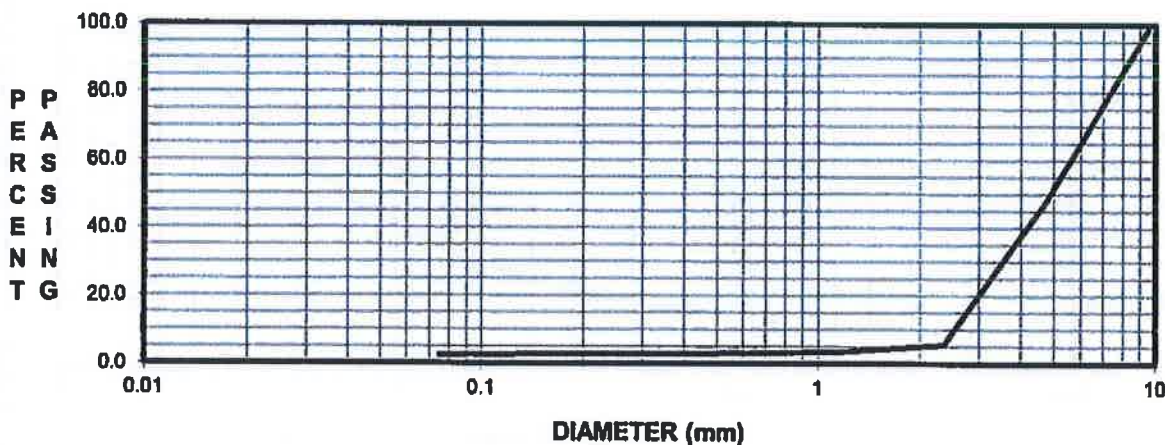
Project Name: Carden Quarry- Lab Testing
Project No.: BAR-00008977-D0
Material: 3/32" - 1/4" Stone
Sample Location: Carden Quarry- Pile #6

Client: Ferma Group
Dated Tested: October 20, 2016
Date Sampled: October 12, 2016
Supplier: Carden Quarry

SAMPLE DATA

Sieve Diameter (mm)	Percent Retained (%)	Percent Passing (%)	Spec (%)
75			
53			
37.5			
26.5			
19			
13.2			
9.5			
6.7	1.4	98.6	
4.75	52.0	48.0	
2.36	94.5	5.5	
1.18	96.4	3.6	
0.6	97.0	3.0	
0.3	97.2	2.8	
0.15	97.4	2.6	
0.075	97.6	2.4	

GRAIN SIZE DISTRIBUTION



Distribution:
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Grain Size Analysis Report

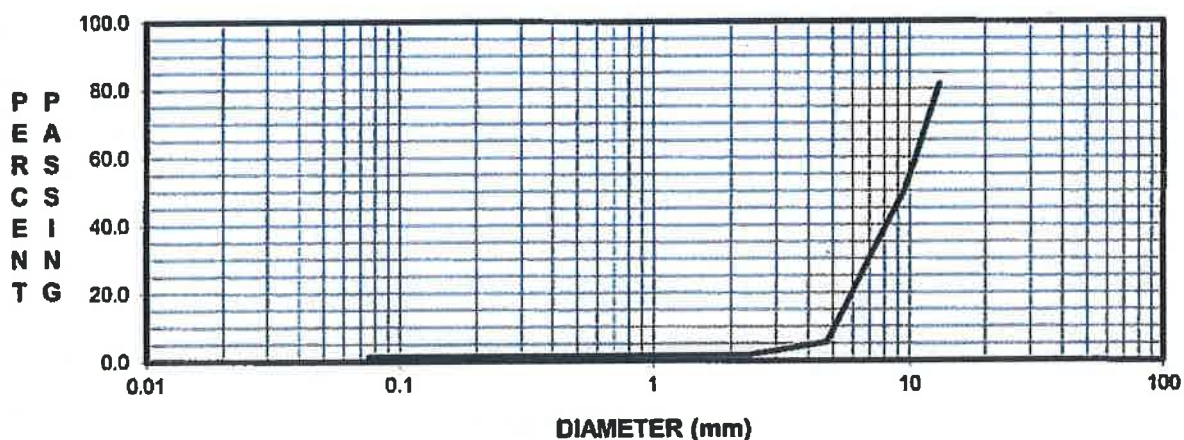
Project Name: Carden Quarry- Lab Testing
Project No.: BAR-00008977-D0
Material: 1/4" to 5/8" Stone
Sample Location: Carden Quarry- Pile #8

Client: Ferma Group
Dated Tested: October 17, 2016
Date Sampled: October 12, 2016
Supplier: Carden Quarry

SAMPLE DATA

Sieve Diameter (mm)	Percent Retained (%)	Percent Passing (%)	Spec (%)
150			
75			
53			
37.5			
26.5			
19			
13.2	18.6	81.4	
9.5	50.3	49.7	
4.75	94.6	5.4	
2.36	98.3	1.7	
1.18	98.5	1.5	
0.6	98.5	1.5	
0.3	98.6	1.4	
0.15	98.7	1.3	
0.075	98.8	1.2	

GRAIN SIZE DISTRIBUTION



Distribution:
Ferma Group

Prepared By:

for Scott Fraser, C.E.T.

Checked By:

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Grain Size Analysis Report

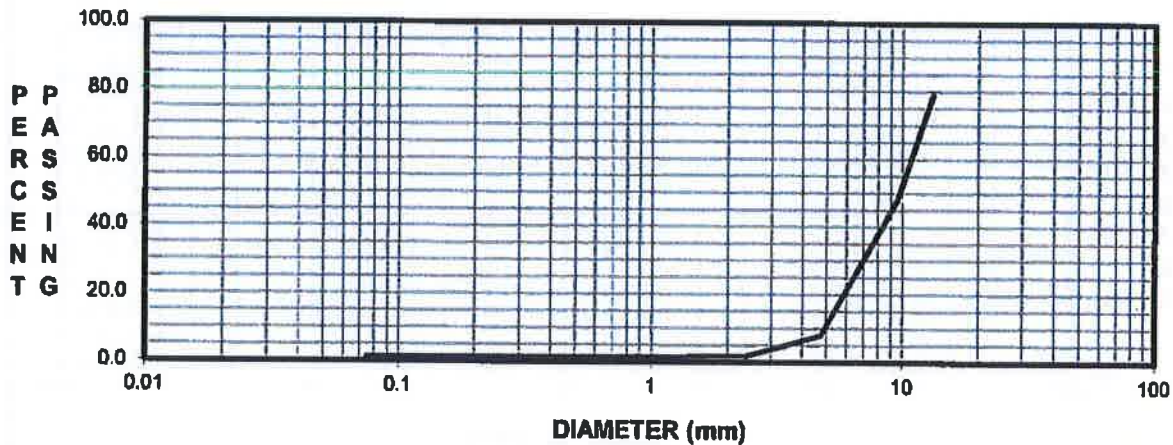
Project Name: Carden Quarry- Lab Testing
Project No.: BAR-00008977-D0
Material: 1/4" - 3/4" Stone
Sample Location: Carden Quarry- Pile #9

Client: Ferma Group
Dated Tested: October 17, 2016
Date Sampled: October 12, 2016
Supplier: Carden Quarry

SAMPLE DATA

Sieve Diameter (mm)	Percent Retained (%)	Percent Passing (%)	Spec (%)
150			
75			
53			
37.5			
26.5			
19			
13.2	21.0	79.0	
9.5	52.5	47.5	
4.75	92.1	7.9	
2.36	98.3	1.7	
1.18	98.5	1.5	
0.6	98.6	1.4	
0.3	98.6	1.4	
0.15	98.7	1.3	
0.075	98.8	1.2	

GRAIN SIZE DISTRIBUTION



Distribution:
Ferma Group

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for Scott Fraser, C.E.T.

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