

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

ASTM C 136 / C 117



MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
Suite 310 - 1500 Woolridge St
Coquitlam, BC, V3K 0B8

April 7, 2016
Project Number: 14-1417-0009-3130

ATTENTION: Mr. Terence Lai, M.Sc

PROJECT: Raven Pit, Vancouver Island District

Sample:	TH 16-10, Bag 905, SA1
Source:	Raven Pit

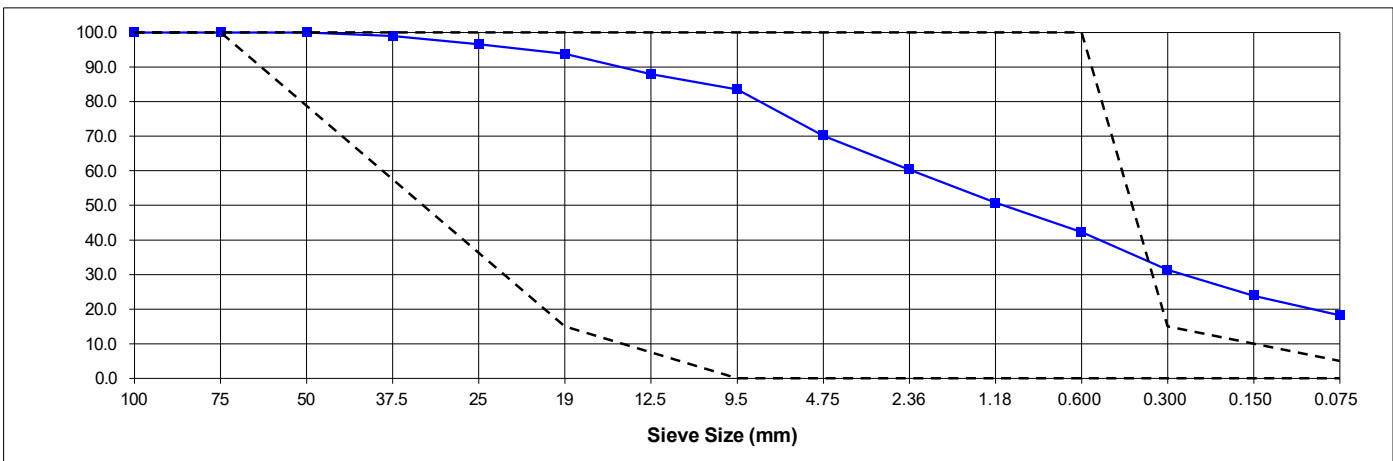
DATE RECEIVED: March 30, 2016

SAMPLED BY: Client

DATE TESTED: April 5, 2016

TESTED BY: JP/VN

SIEVE ANALYSIS						MATERIAL SPECIFICATION: BC MOTI, SELECT GRANULAR SUB-BASE	
Sieve Size (mm)	Mass Ret. (g)	% Retained	% Passing	Individual % Retained (Split values)			
				+ 4.75	- 4.75		
100	0	0.0	100.0	0.0		100	100
75	0	0.0	100.0	0.0		100	100
50	0	0.0	100.0	0.0			
37.5	127	1.0	99.0	3.5			
25	295	2.4	96.6	8.0			
19	339	2.8	93.8	9.2		15	100
12.5	720	5.9	87.9	19.6			
9.5	536	4.4	83.6	14.6		0	100
4.75	1651	13.5	70.1	45.0			
2.36	46.5	9.7	60.4		13.9		
1.18	45.9	9.6	50.7		13.7		
0.600	40.3	8.4	42.3		12.0	0	100
0.300	52.2	10.9	31.4		15.6	0	15
0.150	35.8	7.5	23.9		10.7	0	15
0.075	27.1	5.7	18.2		8.1	0	5
PAN	86.9	18.2	0		26.0		
Total		100.0		100.0	100.0		





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April 7, 2016
Project Number: 14-1417-0009-3130

ATTENTION: Mr. Terence Lai, M.Sc

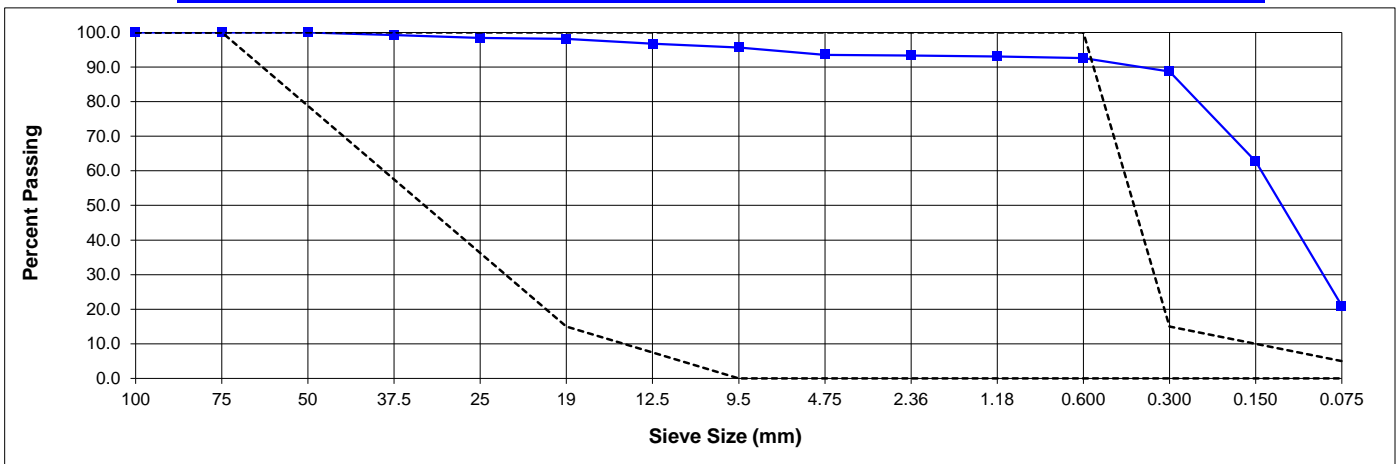
PROJECT: Raven Pit, Vancouver Island District

Sample:	TH 16-10, Bag 906, SA2
Source:	Raven Pit

DATE RECEIVED: March 30, 2016
DATE TESTED: April 1, 2016

SAMPLED BY: Client
TESTED BY: JP/DC

SIEVE ANALYSIS						MATERIAL SPECIFICATION: BC MOTI, SELECT GRANULAR SUB-BASE	
Sieve Size (mm)	Mass Ret. (g)	% Retained	% Passing	Individual % Retained (Split values)			
				+ 4.75	- 4.75		
100	0	0.0	100.0	0.0		100	100
75	0	0.0	100.0	0.0		100	100
50	0	0.0	100.0	0.0			
37.5	70	0.7	99.3	11.4			
25	83	0.9	98.4	13.5			
19	24	0.3	98.1	3.9		15	100
12.5	136	1.4	96.7	22.1			
9.5	104	1.1	95.6	16.9		0	100
4.75	197	2.1	93.6	32.1			
2.36	0.5	0.2	93.3		0.2		
1.18	0.5	0.2	93.1		0.2		
0.600	1.1	0.5	92.6		0.5	0	100
0.300	8.4	3.9	88.7		4.1	0	15
0.150	56.7	26.0	62.8		27.8		
0.075	91.1	41.8	21.0		44.6	0	5
PAN	45.8	21.0	0		22.4		
Total		100.0		100.0	100.0		



Note: Tested sample represents entirety of sample provided by client.

Total mass + 4.75mm:	614 g	Mass before wash:	204.1 g
Total mass - 4.75mm:	8909 g	Mass after wash:	165.8 g
Total mass of sample:	9523 g	Wash loss fines:	38.3 g
		Fines from pan:	7.5 g

Reported by:
S. John, ASCT

Reviewed by:
L. Hu, M. Sc. E., P.Eng.



Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other zones/depths. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

Note: Tested sample represents entirety of sample provided by client.



Total mass + 4.75mm:	3668 g	Mass before wash:	334.7
g Total mass - 4.75mm:	8595 g	Mass after wash:	252.0
g Total mass of sample:	12263 g	Wash loss fines:	82.7
g		Fines from pan:	4.2 g

Reported by: _____

Reviewed by: _____

S. John, ASCT

L. Hu, M. Sc. E., P.Eng.



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GOLDER ASSOCIATES LIMITED, 300 - 3811 North Fraser Way, Burnaby, BC Canada V5J 5J2 Tel: 604-412-6899 Fax: 604-412-6816



**RESISTANCE OF COARSE AGGREGATE
TO DEGRADATION BY ABRASION IN
THE MICRO-DEVAL APPARATUS
ASTM D 6928**

April 7, 2016
Project Number: 14-1417-0009-3130

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
Suite 310 - 1500 Woolridge St.
Coquitlam, BC
V3K 0B8

ATTENTION: Mr. Terence Lai, M.Sc.

PROJECT: Raven Pit, Vancouver Island District


Sample:	TH 16-11, Bag 907, SA1 (Laboratory Crushed to Passing 25 mm)
Source:	Raven Pit


Date received: March 30, 2016
Date tested: April 1, 2016

Sampled by: Client
Tested by: DC

Grading	Section 8.2 19 x 16 mm, 16 x 12.5 mm & 12.5 x 9.5 mm sieve fractions
Loss at Conclusion of Test (%)	8.2

Validation test: Drain Brothers control aggregate loss was 13.3 %, tested on April 1, 2016. Valid range is between 11.4 % and 14.8 %

Reported by: 
S. John, AScT

Reviewed by: 
L. Hu, M. Sc. E., P.Eng.



Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.



RESISTANCE OF FINE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS ASTM D 7428

April 7, 2016
Project Number: 14-1417-0009-3130

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
Suite 310 - 1500 Woolridge St.
Coquitlam, BC
V3K 0B8

ATTENTION: Mr. Terence Lai, M.Sc.

PROJECT: Raven Pit, Vancouver Island District


Sample:	TH 16-11, Bag 907, SA1
Source:	Raven Pit


Date received: March 30, 2016
Date tested: April 5, 2016

Sampled by: Client
Tested by: DC/VN

Grading	Fines 4.75 x 0.075 mm sieve fraction
Loss at Conclusion of Test (%)	10.7

Validation test: Sutherland sand control aggregate loss was 16.7 %, tested on April 5, 2016. Valid range is between 15.2 % & 18.4 %

Reported by: 
S. John, AScT

Reviewed by: 
L. Hu, M. Sc. E., P.Eng.



Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

GOLDER ASSOCIATES LTD., 300 - 3811 North Fraser Way, Burnaby, B.C. Canada V5J 5J2 Tel: 604-412-6899 Fax: 604-412-6816



RESISTANCE OF COARSE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS ASTM D 6928

April 7, 2016
Project Number: 14-1417-0009-3130

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
Suite 310 - 1500 Woolridge St.
Coquitlam, BC
V3K 0B8

ATTENTION: Mr. Terence Lai, M.Sc.

PROJECT: Raven Pit, Vancouver Island District


Sample:	TH 16-12, Bag 908, SA1 (Laboratory Crushed to Passing 25 mm)
Source:	Raven Pit


Date received: March 30, 2016
Date tested: April 1, 2016

Sampled by: Client
Tested by: DC

Grading	Section 8.2 19 x 16 mm, 16 x 12.5 mm & 12.5 x 9.5 mm sieve fractions
Loss at Conclusion of Test (%)	9.6

Validation test: Drain Brothers control aggregate loss was 13.3 %, tested on April 1, 2016. Valid range is between 11.4 % and 14.8 %

Reported by: 
S. John, AScT

Reviewed by: 
L. Hu, M. Sc. E., P.Eng.



Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.



RESISTANCE OF FINE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS ASTM D 7428

April 7, 2016
Project Number: 14-1417-0009-3130

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
Suite 310 - 1500 Woolridge St.
Coquitlam, BC
V3K 0B8

ATTENTION: Mr. Terence Lai, M.Sc.

PROJECT: Raven Pit, Vancouver Island District


Sample:	TH 16-12, Bag 908, SA1
Source:	Raven Pit


Date received: March 30, 2016
Date tested: April 5, 2016

Sampled by: Client
Tested by: DC/VN

Grading	Fines 4.75 x 0.075 mm sieve fraction
Loss at Conclusion of Test (%)	10.3

Validation test: Sutherland sand control aggregate loss was 16.7 %, tested on April 5, 2016. Valid range is between 15.2 % & 18.4 %

Reported by: 
S. John, AScT

Reviewed by: 
L. Hu, M. Sc. E., P.Eng.



Notice: The test data given herein pertain to the sample provided, and may not be applicable to material from other production zones/periods. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

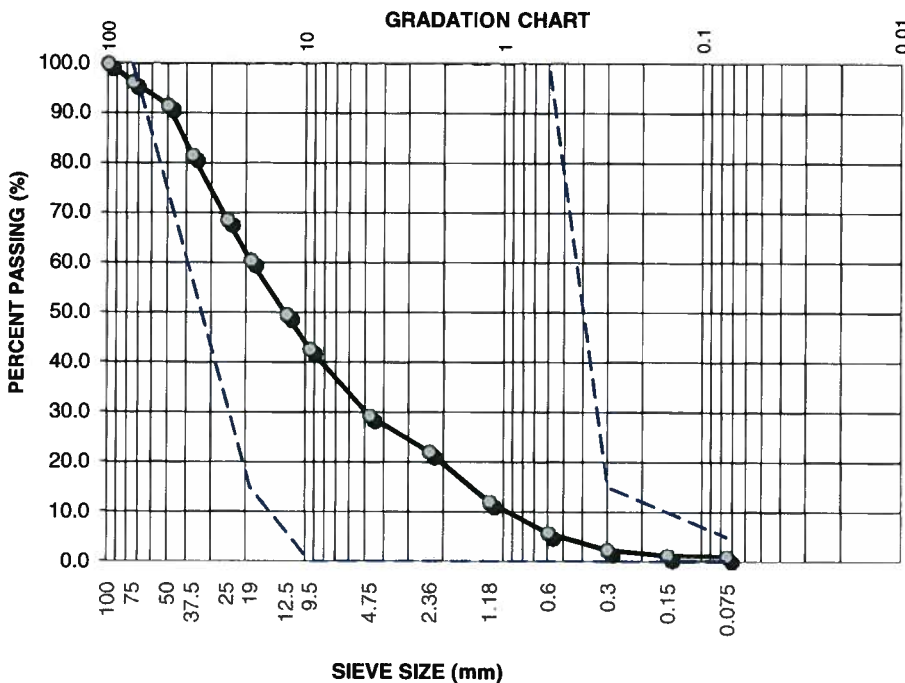


SIEVE ANALYSIS REPORT

CLIENT: Ministry of Transportation & Infrastructure
 310 - 1500 Woolridge St.
 Coquitlam, BC V3K 0B8
ATTN: Terence Lai

Project Number: VA06707-105
Date: January 2, 2014
Client P.O.: 156CS0670

PROJECT: Raven Pit - Vancouver Island District



Lab Number: L4860

Date Sampled: Sampled by MOTI
Date Received: 2-Dec-13
Date Tested: 27-Dec-13
Sampled By: MOTI
Tested By: William Mendez

TP/TH No.: TP13-14
Bag No.: 734
Material Type: Pit Run
Sample No.: 1

Gravel Sizes (mm)	Percent Passing	Gradation Limits	
		Lower	Upper
100	100	-	-
75	96	100	100
50	92	-	-
37.5	82	-	-
25	69	-	-
19	60	15	100
12.5	50	-	-
9.5	43	0	100

Sand Sizes And Fines (mm)	Percent Passing	Gradation Limits	
		Lower	Upper
4.75	29	-	-
2.36	22	-	-
1.18	12	-	-
0.6	5.7	0	100
0.3	2.3	0	15
0.15	1.2	-	-
0.075	1.0	0	5

Comments: Sieve analysis test was conducted in accordance with ASTM C136 and C117
 Plotted to Table 202-C SGSB gradation specification

Prepared By: Giti Ghorbanian
 Senior Materials Technologist

Reviewed By: 
 Riyadh Islam, M.A.Sc, P.Eng
 Materials Engineer

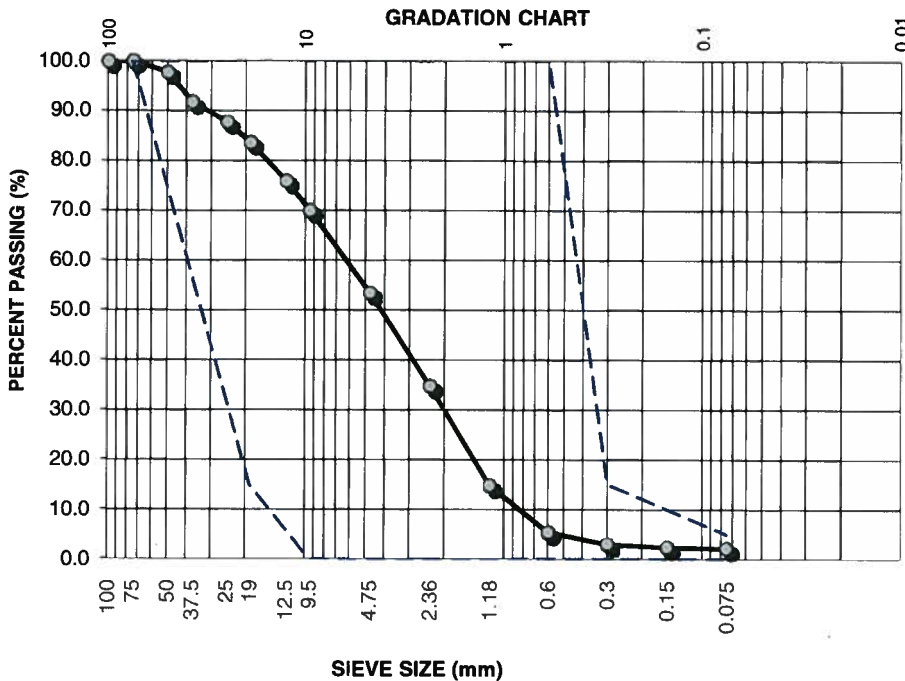


SIEVE ANALYSIS REPORT

CLIENT: Ministry of Transportation & Infrastructure
 310 - 1500 Woolridge St.
 Coquitlam, BC V3K 0B8
ATTN: Terence Lai

Project Number: VA06707-105
Date: January 2, 2014
Client P.O.: 156CS0670

PROJECT: Raven Pit - Vancouver Island District



Lab Number: L4861

Date Sampled: Sampled by MOTI
Date Received: 2-Dec-13
Date Tested: 23-Dec-13
Sampled By: MOTI
Tested By: Rodrigo Lauricio/ WM


TP/TH No.: TP13-14
Bag No.: 735
Material Type: Pit Run
Sample No.: 2

Gravel Sizes (mm)	Percent Passing	Gradation Limits	
		Lower	Upper
100	100	-	-
75	100	100	100
50	98	-	-
37.5	92	-	-
25	88	-	-
19	84	15	100
12.5	76	-	-
9.5	70	0	100

Sand Sizes And Fines (mm)	Percent Passing	Gradation Limits	
		Lower	Upper
4.75	53	-	-
2.36	35	-	-
1.18	15	-	-
0.6	5.4	0	100
0.3	3.0	0	15
0.15	2.4	-	-
0.075	2.2	0	5

Comments: Sieve analysis test was conducted in accordance with ASTM C136 and C117
 Plotted to Table 202-C SGSB gradation specification

Prepared By: Giti Ghorbanian
 Senior Materials Technologist

Reviewed By: 
 Riyadh Islam, M.A.Sc, P.Eng
 Materials Engineer

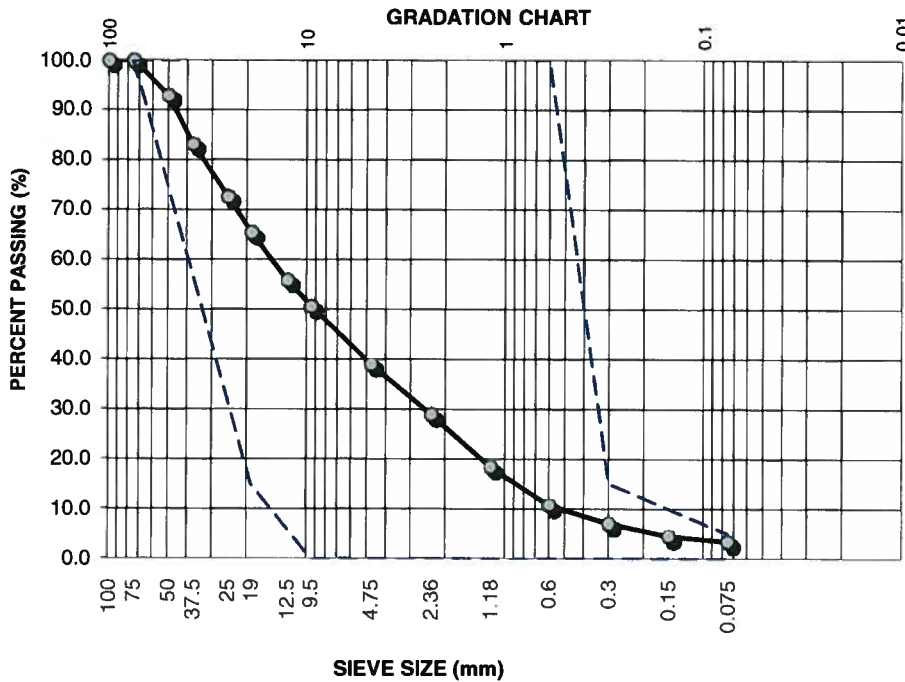


SIEVE ANALYSIS REPORT

CLIENT: Ministry of Transportation & Infrastructure
 310 - 1500 Woolridge St.
 Coquitlam, BC V3K 0B8
ATTN: Terence Lai

Project Number: VA06707-105
Date: January 2, 2014
Client P.O.: 156CS0670

PROJECT: Raven Pit - Vancouver Island District



Lab Number: L4862
Date Sampled: Sampled by MOTI
Date Received: 2-Dec-13
Date Tested: 8-Dec-13
Sampled By: MOTI
Tested By: Rodrigo Lauricio/ WM


TP/TH No.: TP13-15
Bag No.: 736
Material Type: Pit Run
Sample No.: 1

Gravel Sizes (mm)	Percent Passing	Gradation Limits	
		Lower	Upper
100	100	-	-
75	100	100	100
50	93	-	-
37.5	83	-	-
25	73	-	-
19	65	15	100
12.5	56	-	-
9.5	51	0	100

Sand Sizes And Fines (mm)	Percent Passing	Gradation Limits	
		Lower	Upper
4.75	39	-	-
2.36	29	-	-
1.18	18	-	-
0.6	11	0	100
0.3	7.0	0	15
0.15	4.5	-	-
0.075	3.4	0	5

Comments: Sieve analysis test was conducted in accordance with ASTM C136 and C117
 Plotted to Table 202-C SGSB gradation specification

Prepared By: Giti Ghorbanian
 Senior Materials Technologist

Reviewed By: 
 Riyadh Islam, M.A.Sc, P.Eng
 Materials Engineer

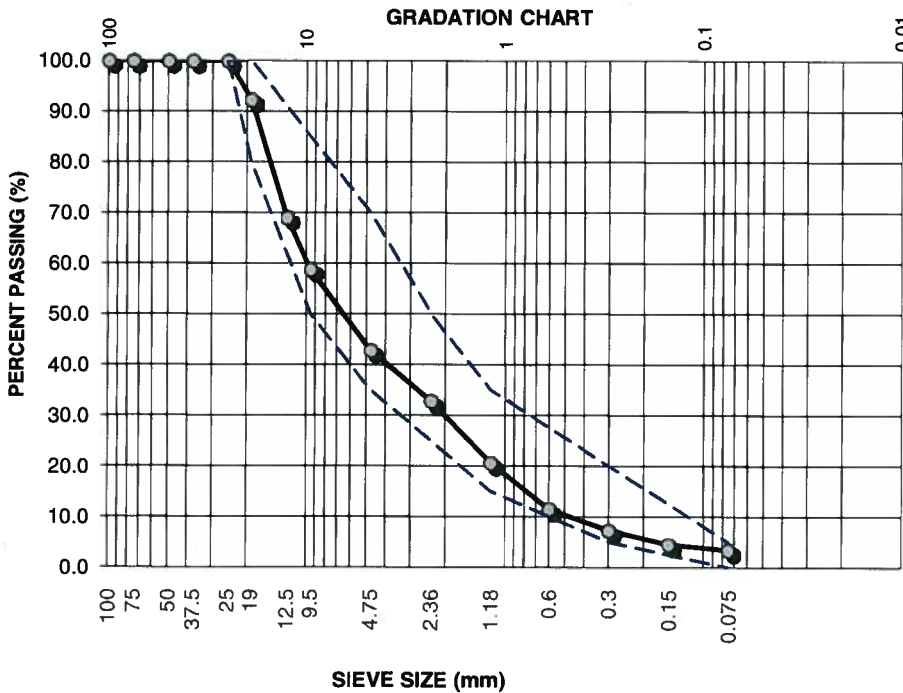


SIEVE ANALYSIS REPORT

CLIENT: Ministry of Transportation & Infrastructure
 310 - 1500 Woolridge St.
 Coquitlam, BC V3K 0B8
ATTN: Terence Lai

Project Number: VA06707-105
Date: 2-Jan-2014
Client P.O.: 156CS0670

PROJECT: Raven Pit - Vancouver Island District



Lab Number: L4862

Date Sampled: Sampled by MOTI
Date Received: 2-Dec-13
Date Tested: 13-Dec-13
Sampled By: MOTI
Tested By: Alexie Mirochnikov


TP/TH No.: TP13-15
Bag No.: 736
Material Type: Crushed
Sample No.: 1

Gravel Sizes (mm)	Percent Passing	Gradation Limits	
		Lower	Upper
100	100	-	-
75	100	-	-
50	100	-	-
37.5	100	-	-
25	100	100	100
19	92	80	100
12.5	69	-	-
9.5	59	50	85

Sand Sizes And Fines (mm)	Percent Passing	Gradation Limits	
		Lower	Upper
4.75	43	35	70
2.36	33	25	50
1.18	21	15	35
0.6	11	-	-
0.3	7.3	5	20
0.15	4.5	-	-
0.075	3.4	0	5

Comments: Sieve analysis test was conducted in accordance with ASTM C136 and C117
 Plotted to Table 202-C WGB gradation specification

Prepared By: Giti Ghorbanian
 Senior Materials Technologist

Reviewed By: 
 Riyadh Islam, M.A.Sc, P.Eng
 Materials Engineer

AMEC Environment &
Infrastructure
#110 - 18568 - 96th Avenue
Surrey British Columbia
Canada, V4N 3P9
Tel: 604-295-8657
Fax: 604-295-8658

FRACTURE COUNT FOR COARSE AGGREGATE (BCH 1-13)



CLIENT: Ministry of Transportation & Infrastructure
310 - 1500 Woolridge St.
Coquitlam, BC V3K 0B8
ATTN: Terence Lai

Project Number: VA06707-105
Date: January 7, 2014
Client P.O.: 156CS0670

PROJECT: Raven Pit - Vancouver Island District

Sample Source & ID: TP13-15 Bag #736- SA #1 - Crushed
Lab No.: L4862

Sieve Size (mm)	Original Weight (g)	Fractured Particles (g)	Non- Fractured Particles (g)	% Fracture
50 to 37.5				
37.5 to 25.0				
25.0 to 19.0	1023.5	799.6	223.9	
19.0 to 13.2	1283.6	989.9	293.7	
13.2 to 9.5	1267.3	1012.3	255.0	
Totals	3574.4	2801.8	772.6	78

Comments: Fracture Particles in Coarse Aggregate tests were conducted in accordance with BCH 1-13 Method B

Prepared By: _____
Giti Ghorbanian
Senior Materials Technologist

Reviewed By: _____
Riyad Islam, M.A.Sc, P.Eng
Materials Engineer

Test Results for Resistance of Aggregate to Degradation by Abrasion in the Micro-Deval



CLIENT: Ministry of Transportation & Infrastructure
310 - 1500 Woolridge St.
Coquitlam, BC V3K 0B8
ATTN: Terence Lai

Project Number: VA06707-105
Date: January 7, 2014
Client P.O.: 156CS0670

PROJECT: Raven Pit - Vancouver Island District

Sample Source & ID: TP13-15 Bag # 736 SA #1 - Pit Run
Lab No.: L4862

Coarse and Fine Aggregate

Grading	Initial Mass (g)	Final Mass (g)	Loss of Mass (g)	% Loss
	A	B	A - B	(A-B)*100/A
Coarse	1497.8	1322.5	175.3	11.7
Fine	500.3	435.2	65.1	13.0

Comments:

Maximum size of aggregate is 50.0 mm.

Resistance of materials to Degradation by Abrasion in the Micro-Deval Apparatus was conducted in accordance with ASTM D6928 for Coarse aggregate and ASTM D7428 for Fine aggregate

Grading for coarse aggregate used for test is: 19-16 mm, 16-12.5 mm, 12.5-9.5 mm

Drain Brothers- Stony Lake Quarry was used as calibration coarse materials and percent loss is 15.0%. Southerland Sand was used as calibration fine materials and percent loss is 17.7%.

MOTI Standard:

Maximum acceptable value of any base material is 25 or less

Maximum acceptable value of any Sub-base material is 30 or less

Prepared By: _____
Giti Ghorbanian
Senior Materials Technologist

Reviewed By: _____
Riyad Islam, M.A.Sc, P.Eng
Materials Engineer