Materials Testing & Consulting, Inc.

Geotechnical Engineering ● Special Inspection ● Materials Testing ● Environmental Consulting

Aggregate Durability Index

(WSDOT 113)

Project:	Jefferson County Mine Site Exploration	Client:	McLucas & Associates, Inc.
Project #:	14K026	Sampled By:	BK
Lab #:	K14-173	Date Received:	July 21, 2014
Location/Source:	Jefferson County Mine Site	Tested By:	CL
Description:	Red/ Brown Gravel w/ Sand	Date Tested:	July 25, 2014
Equipment Used:			

Data

	Run #1	Run #2
Test Sample Height (H):	31.1	13.2
Durability Index Value (D):	5	5
Average Durability Index:	5	
Required Durability Index:		Pass ☐ Fail ☐

$D = (15-H) / (15+1.75H) * 100$

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Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine ASTM C-131

Project:	Jefferson County Mine Site Exploration	Client:	McLucas & Associates, Inc.
Project #:	14K026	Sampled by:	BK
Lab #:	K14-173	Date Received:	July 21, 2014
Location/Source:	Jefferson County Mine Site	Tested by:	CL
Description:	Red/Brown Gravel / Sand	Date Tested:	July 25, 2014
Equipment Used:			

Grading Designation	A	
# of Revolutions	500	
Mass of Sample Before Test	5002.2 g	
Mass of Sample After Test	4243.8 g	
Percentage of Loss	15.16 %	
Specification	%	Pass ☐ Fail ☐

Remarks: _____

Reviewed by: _____

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Client:	McLucas & Associates, Inc.	**Date:**	July 21, 2014
Address:	US 101 & Pete Back RD	**Project:**	Jefferson County Mine Site Exploration
	Quilcene	**Project #:**	14K026
Attn:	Stephen Taylor	**Sample #:**	K14-174

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
☑	Sieve Analysis	FAIL	☐	Sulfate Soundness	
☐	Proctor		☐	Unit Weight	
☐	Sand Equivalent		☑	WSDOT Degradation	4
☐	Fracture Count		☑	LA Abrasion	16.10%
☐	Moisture Content		☐		
☐	Specific Gravity, Coarse		☐		
☐	Specific Gravity, Fine		☐		
☐	Hydrometer Analysis		☐		
☐	Atterberg Limits		☐		
☐	Asphalt Extraction/Gradation		☐		
☐	Rice Density		☐		

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Samuel Hyatt
WABO Supervising Laboratory Technician

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Sieve Report

Project: Jefferson County Mine Site Exploration
Project #: 14K026
Client: McLucas & Associates, Inc.
Source: Jefferson County Mine Site
Sample#: K14-174

Date Received: 21-Jul-14
Sampled By: BK
Date Tested: 25-Jul-14
Tested By: CL

ASTM D-2487 Unified Soils Classification System
GW-GC, Well-graded Gravel with Silty Clay and Sand
Sample Color:
Red/Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

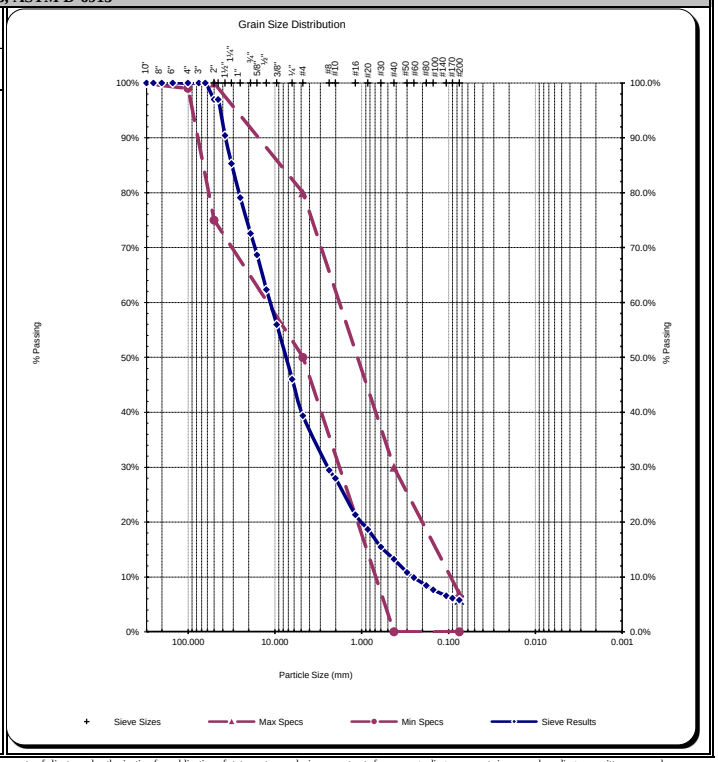
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
2012 WSDOT 9-03.14(1) Gravel Borrow
Sample Meets Specs ? No

$D_{(5)}$ =	0.065	mm	% Gravel =	60.6%	Coeff. of Curvature, C_C =	2.13
$D_{(10)}$ =	0.256	mm	% Sand =	33.6%	Coeff. of Uniformity, C_U =	44.47
$D_{(15)}$ =	0.562	mm	% Silt & Clay =	5.8%	Fineness Modulus =	5.50
$D_{(30)}$ =	2.492	mm	Liquid Limit =	n/a	Plastic Limit =	n/a
$D_{(50)}$ =	7.578	mm	Plasticity Index =	n/a	Moisture %, as sampled =	6.1%
$D_{(60)}$ =	11.391	mm	Sand Equivalent =	n/a	Req'd Sand Equivalent =	
$D_{(90)}$ =	37.029	mm	Fracture %, 1 Face =	n/a	Req'd Fracture %, 1 Face =	
			Fracture %, 2+ Faces =	n/a	Req'd Fracture %, 2+ Faces =	

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%		
10.00"	250.00		100%		
8.00"	200.00		100%		
6.00"	150.00		100%		
4.00"	100.00	100%	100%	100.0%	99.0%
3.00"	75.00	100%	100%		
2.50"	63.00	100%	100%		
2.00"	50.00	97%	97%	100.0%	75.0%
1.75"	45.00	97%	97%		
1.50"	37.50	90%	90%		
1.25"	31.50	85%	85%		
1.00"	25.00	79%	79%		
3/4"	19.00	73%	73%		
5/8"	16.00	69%	69%		
1/2"	12.50	62%	62%		
3/8"	9.50	56%	56%		
1/4"	6.30	46%	46%		
#4	4.75	39%	39%	80.0%	50.0%
#8	2.36		29%		
#10	2.00	28%	28%		
#16	1.18		21%		
#20	0.850	19%	19%		
#30	0.600		15%		
#40	0.425	13%	13%	30.0%	0.0%
#50	0.300		11%		
#60	0.250	10%	10%		
#80	0.180	8%	8%		
#100	0.150	8%	8%		
#140	0.106		7%		
#170	0.090		6%		
#200	0.075	5.8%	5.8%	7.0%	0.0%



Comments: _____

Reviewed by: _____

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Client:	McLucas & Associates, Inc.	**Date:**	July 21, 2014
Address:	US 101 & Pete Back Rd	**Project:**	Jefferson County Mine Site Exploration
	Quilcene	**Project #:**	14K026
Attn:	Stephen Taylor	**Sample #:**	K14-175

As requested MTC, Inc. has performed the following test(s) on the sample referenced above. The testing was performed in accordance with current applicable AASHTO or ASTM standards as indicated below. The results obtained in our laboratory were as follows below or on the attached pages:

	Test(s) Performed:	Test Results		Test(s) Performed:	Test Results
☑	Sieve Analysis	FAIL	☐	Sulfate Soundness	
☐	Proctor		☐	Unit Weight	
☐	Sand Equivalent		☑	WSDOT Degradation	3
☐	Fracture Count		☑	LA Abrasion	17.10%
☐	Moisture Content		☐		
☐	Specific Gravity, Coarse		☐		
☐	Specific Gravity, Fine		☐		
☐	Hydrometer Analysis		☐		
☐	Atterberg Limits		☐		
☐	Asphalt Extraction/Gradation		☐		
☐	Rice Density		☐		

If you have any questions concerning the test results, the procedures used, or if we can be of any further assistance please call on us at the number below.

Respectfully Submitted,
Samuel Hyatt
WABO Supervising Laboratory Technician

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Sieve Report

Project: Jefferson County Mine Site Exploration
Project #: 14K026
Client: McLucas & Associates, Inc.
Source: Jefferson County Mine Site
Sample#: K14-175

Date Received: 21-Jul-14
Sampled By: BK
Date Tested: 25-Jul-14
Tested By: CL

ASTM D-2487 Unified Soils Classification System
GM, Silty Gravel with Sand
Sample Color:
Red/Brown

ACCREDITED
Certificate #: 1366.01, 1366.02

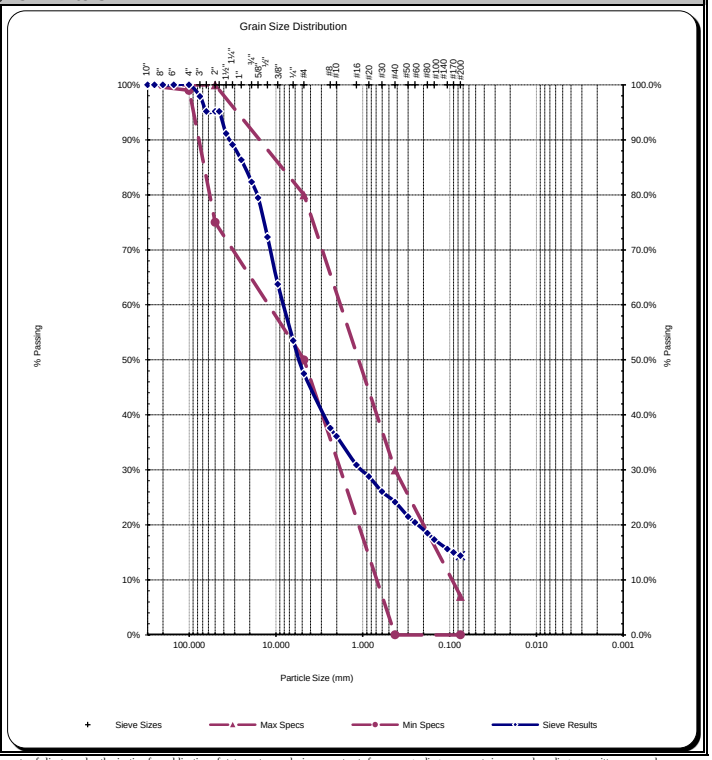
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
2012 WSDOT 9-03.14(1) Gravel Borrow
Sample Meets Specs ? No

$D_{(5)}$ =	0.026	mm	% Gravel =	52.5%	Coeff. of Curvature, C_C = 2.50
$D_{(10)}$ =	0.052	mm	% Sand =	33.1%	Coeff. of Uniformity, C_U = 159.85
$D_{(15)}$ =	0.090	mm	% Silt & Clay =	14.4%	Fineness Modulus = 4.78
$D_{(30)}$ =	1.041	mm	Liquid Limit =	n/a	Plastic Limit = n/a
$D_{(50)}$ =	5.401	mm	Plasticity Index =	n/a	Moisture %, as sampled = 9.8%
$D_{(60)}$ =	8.328	mm	Sand Equivalent =	n/a	Req'd Sand Equivalent =
$D_{(90)}$ =	34.091	mm	Fracture %, 1 Face =	n/a	Req'd Fracture %, 1 Face =
			Fracture %, 2+ Faces =	n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%		
10.00"	250.00		100%		
8.00"	200.00		100%		
6.00"	150.00		100%		
4.00"	100.00	100%	100%	100.0%	99.0%
3.00"	75.00	98%	98%		
2.50"	63.00	95%	95%		
2.00"	50.00	95%	95%	100.0%	75.0%
1.75"	45.00	95%	95%		
1.50"	37.50	91%	91%		
1.25"	31.50	89%	89%		
1.00"	25.00	86%	86%		
3/4"	19.00	82%	82%		
5/8"	16.00	79%	79%		
1/2"	12.50	72%	72%		
3/8"	9.50	64%	64%		
1/4"	6.30	53%	53%		
#4	4.75	47%	47%	80.0%	50.0%
#8	2.36		38%		
#10	2.00	36%	36%		
#16	1.18		31%		
#20	0.850	29%	29%		
#30	0.600		26%		
#40	0.425	24%	24%	30.0%	0.0%
#50	0.300		22%		
#60	0.250	20%	20%		
#80	0.180	18%	18%		
#100	0.150	17%	17%		
#140	0.106		16%		
#170	0.090		15%		
#200	0.075	14.4%	14.4%	7.0%	0.0%



Comments: _____

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Sieve Report

	Jefferson County Mine Site Exploration -		
Project:	Penny Pit	**Date Received:**	12-Aug-14
Project #:	14K026	**Sampled By:**	Client
Client:	McLucas & Associates, Inc.	**Date Tested:**	15-Aug-14
Source:	Penny Pit	**Tested By:**	C. Larabee
Sample#:	S14-363		

ASTM D-2487 Unified Soils Classification System
GW, Well-graded Gravel with Sand
Sample Color:
brown

ACCREDITED Certificate # 1366.01, 1366.02

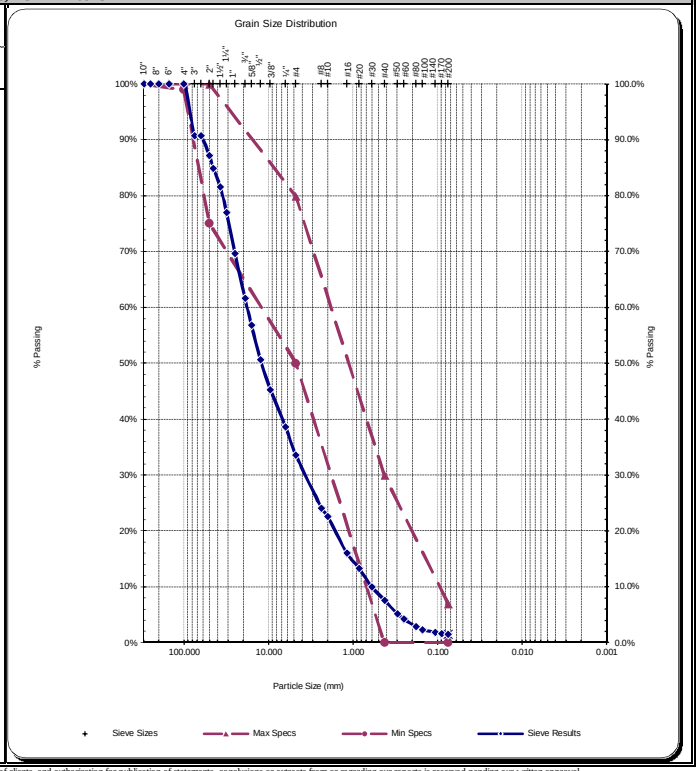
ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
2014 WSDOT 9-03.14(1) Gravel Borrow
Sample Meets Specs ? No

$D_{(5)}$ = 0.291 mm	% Gravel = 66.4%	Coeff. of Curvature, C_C = 1.37
$D_{(10)}$ = 0.602 mm	% Sand = 32.1%	Coeff. of Uniformity, C_U = 29.89
$D_{(15)}$ = 1.056 mm	% Silt & Clay = 1.5%	Fineness Modulus = 6.15
$D_{(30)}$ = 3.846 mm	Liquid Limit = n/a	Plastic Limit = n/a
$D_{(50)}$ = 12.163 mm	Plasticity Index = n/a	Moisture %, as sampled = n/a
$D_{(60)}$ = 17.991 mm	Sand Equivalent = n/a	Req'd Sand Equivalent =
$D_{(90)}$ = 60.473 mm	Fracture %, 1 Face = n/a	Req'd Fracture %, 1 Face =
	Fracture %, 2+ Faces = n/a	Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%		
10.00"	250.00		100%		
8.00"	200.00		100%		
6.00"	150.00		100%		
4.00"	100.00	100%	100%	100.0%	99.0%
3.00"	75.00	91%	91%		
2.50"	63.00	91%	91%		
2.00"	50.00	87%	87%	100.0%	75.0%
1.75"	45.00		85%		
1.50"	37.50	82%	82%		
1.25"	31.50	77%	77%		
1.00"	25.00	70%	70%		
3/4"	19.00	62%	62%		
5/8"	16.00	57%	57%		
1/2"	12.50	51%	51%		
3/8"	9.50	45%	45%		
1/4"	6.30	39%	39%		
#4	4.75	34%	34%	80.0%	50.0%
#8	2.36		24%		
#10	2.00	23%	23%		
#16	1.18		16%		
#20	0.850	13%	13%		
#30	0.600		10%		
#40	0.425	8%	8%	30.0%	0.0%
#50	0.300		5%		
#60	0.250	4%	4%		
#80	0.180	3%	3%		
#100	0.150	2%	2%		
#140	0.106		2%		
#170	0.090		2%		
#200	0.075	1.5%	1.5%	7.0%	0.0%



Comments: _____

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Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine ASTM C-131

Project:	Jefferson County Mine Site - Penny Pit	Client:	McLucas & Associates, Inc.
Project #:	14K026	Sampled by:	Client
Lab #:	S14-362	Date Received:	August 12, 2014
Location/Source:	Penny Pit	Tested by:	C. Larabee
Description:	brown gravel w/ sand	Date Tested:	August 16, 2014
Equipment Used:	SW068, LA Abrasion Machine		

Grading Designation	A	
# of Revolutions	500	
Mass of Sample Before Test	5009.6 g	
Mass of Sample After Test	4321.9 g	
Percentage of Loss	13.7 %	
Specification	Max. 35 %	Pass ☒ Fail ☐

Remarks: _____

Reviewed by: _____

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Aggregate Durability Index

(WSDOT 113)

Project:	Jefferson County Mine Site - Penny Pit	Client:	McLucas & Associates, Inc.
Project #:	14K026	Sampled By:	Client
Lab #:	S14-363	Date Received:	August 12, 2014
Location/Source:	Penny Pit	Tested By:	C. Larabee
Description:	brown gravel w/ sand	Date Tested:	August 22, 2014
Equipment Used:	SW063, SW016, SW022		

Data

	Run #1	Run #2
Test Sample Height (H):	2.0	1.9
Durability Index Value (D):	70	71
Average Durability Index:	70.5	
Required Durability Index:	Min 15	Pass ☒ Fail ☐

$D = (15-H) / (15+1.75H) * 100$

Reviewed by: _____

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