From: Sarah Reeves <sreeves@cswd.net>
Sent: Friday, April 27, 2018 2:54 PM
To: Jamieson, Cathy; Schwendtner, Barb
Cc: Jen Holliday; JOSH TYLER; Josh Estey; Paul Stabler; Thomas Melloni; Brian Wright
Subject: CSWD Response to NOAV
Attachments: CSWD Response_NOAV_20180427.pdf; CSWD_ANR NOAV response Attachments.pdf

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Cathy and Barb,

Please find attached Chittenden Solid Waste District's response to your Notice of Alleged Violation, dated April 12, 2018 and received by the District on April 13, 2018. A hard copy has been mailed to Cathy as the signatory on the NOAV.

We look forward to your response and remain committed to resolving the issue quickly.

Best Regards,
Sarah

Sarah Reeves
General Manager
(802) 872-8100 x209

CSWD
Chittenden Solid Waste District

ADMINISTRATIVE OFFICE
1021 Redmond Rd
Williston, VT 05495
www.cswd.net

Facebook / Twitter / Instagram

Chittenden Solid Waste District

ADMINISTRATIVE OFFICE
1021 Redmond Road
Williston, VT 05495

EMAIL info@cswd.net
TEL (802) 872-8100

www.cswd.net

April 27, 2018

Ms. Cathy Jamieson, Solid Waste Program Manager
Vermont Department of Environmental Conservation
Waste Management & Prevention Division
1 National Life Drive, Davis 1
Montpelier, VT 05620-33704

RE: Chittenden Solid Waste District – Notice of Alleged Violation ("NOAV") Response

Dear Ms. Jamieson:

The Chittenden Solid Waste District ("CSWD" or the "District") received a Notice of Alleged Violation ("NOAV"), April 13, 2018, from The Vermont Department of Environmental Conservation ("VT DEC"). The NOAV identified the following alleged violations:

1. Vermont Solid Waste Management Rules 6-302(d) – Disposal outside a certified facility
2. Vermont Solid Waste Management Rules 6-1208(a) – Failure to accurately report on the destination of waste.

The following description provided support details regarding the NOAV:

A. Agency staff observed fill areas containing thousands of cubic yards of discarded crushed glass at two locations.
   i. Adjacent to the closed landfill
   ii. The compost facility
B. District staff stated that the glass was non-marketable recycled glass from the District MRF
C. Department records indicate that no approvals have been issued for the storage or disposal of glass at the two locations
D. Review of quarterly records indicate that the destination of the glass was incorrectly reported as "local projects"

The validity of each alleged violation is subject to the glass material described as solid waste.
CSWD disagrees with your assertion that glass material is a solid waste and that it was used in a manner that would elicit a NOAV. The District, in good faith, is and has been managing the glass generated from the CSWD Materials Recovery Facility ("MRF") as a Processed Glass Aggregate (PGA) according to the VT DEC Acceptable Uses for Processed Glass Aggregate, revised: January 2002 ("Acceptable Uses document"). Under the definition of PGA in this document (included as Attachment 1), the following criteria shall be met:

- *China dishes, ceramics, or plate glass shall be limited to 5 percent by mass of glass cullet.*
- *Screw tops, plastic rings, paper, labels and other deleterious materials shall be limited to 1 percent by mass of the PGA.*
- *95 percent shall pass a 25.0 mm screen.*
- *Not more than 3 percent of the material passing a 4.75 mm sieve shall pass a 75-micron sieve.*

In order to determine the technical suitability of the material (as directed by the Acceptable Uses document), the District engaged the services of Knight Consulting Engineers, Inc, Williston, Vermont, August 2004 to perform an engineering analysis on the PGA generated at the MRF (analysis is provided as Attachment 2). The results of the analysis indicate that District PGA met all physical gradation requirements per the VT DEC specification and that the PGA contained between 0.5 and 1.0 percent organic material observed as remnants of bottling labels, satisfying the requirement in the Acceptable Uses document that the user of the material determine its technical suitability as PGA. The District has maintained a ban on cathode ray tubes and fluorescent light bulbs from the MRF which in conjunction with the results provided by Knight Consulting Engineers, Inc., satisfies the specification required to define PGA.

It is the District's understanding that the PGA generated from the MRF can be used for acceptable applications without prior authorization from the Solid Waste Management Program. As described in the Agency's PGA document (cited above, page 1), *"PGA is exempt from the provisions of the Solid Waste Management Rules under Section 6-301(b)(4), and will not be considered solid waste when used for the following applications:*

1. *Roadway, trail, parking lot, sidewalk applications*
    a. *Base Course: layer(s) of specified material supporting surface course*
    b. *Subbase: layer(s) of specified material placed on a subgrade to support a base or surface course.*
    c. *Embankments: a portion of a fill section situated between the existing ground and the subgrade."*

The District used PGA generated from the MRF at its compost facility in the south field as a subbase layer placed on a subgrade and covered with backfill, and on the landfill as an embankment to stabilize a northwestern slope, which will be covered with soil and seeded with grass. Both applications fall within the acceptable uses of PGA.

The District also disagrees with the description providing support details regarding the NOAV. The material observed at the landfill is not discarded crushed glass as it is acceptable PGA meeting the requirements of the 2002, VT DEC, PGA acceptance documentation. We dispute the statement contained in the NOAV that District staff stated that the material used at the landfill and the compost facility south field was non-marketable. No approvals were needed for the placement of the material

because the material is PGA used in accordance with VT DEC requirements. The quarterly reporting destination of the MRF PGA is accurate as both locations were local projects.
The District met with VT DEC staff, April 24, 2018, to discuss the NOAV regarding clarification of the general nature of the alleged violations The Districted informed VT DEC that in calendar year 2017 the District developed an internal protocol for the sampling and analysis of PGA. The repeatability of the protocol has provided the District the ability to prove process control and meet the specifications for aggregate subbase.

The District proposes to use the glass analysis protocol developed in 2017 to test the PGA placed as an embankment for slope stabilization at the landfill. The results of analysis and verification of the material qualifying as PGA will be presented to the VT DEC upon completion, as outlined in Attachment 3. The District does not propose sampling the PGA placed as subbase at the compost facility, south field, as it is buried at varying depths and locations and a representative sample of PGA would be compromised by excavation. Once the analysis confirms the material is PGA, the District proposes to cover and seed the area.

The District is no longer placing PGA at the landfill as we have worked out an agreement with a local quarry to take the material and use it in their aggregate mix for subbase material.

This response to the April 13, 2018 NOAV falls within the 14-day response requirement and the District will in good faith work with the VT DEC to resolve these alleged violations in a timely manner.

Regards,

Sarah Reeves

Sarah Reeves, General Manager

Cc: Barb Schwendtner, Solid Waste Compliance Chief, VT DEC
Paul Stabler, Chair, CSWD
Thomas Melloni, Esq.

Attachment 1

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
RELAY SERVICE FOR THE HEARING IMPAIRED
1-800-253-0191 TDD>Voice
1-800-253-0195 Voice>TDD

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation

Waste Management Division
103 South Main Street/West Building
Waterbury, VT 05671-0404
(802) 241-3888
Fax: (802) 241-3296

Acceptable Uses for Processed Glass Aggregate

Original: August 1994,
Revised: July 1996
Revised: January 2002

Introduction:

Glass collected through community recycling programs consists primarily of clear, green, and brown food or beverage containers. Color-sorted glass has the highest resale value in glass container markets, however some glass is broken during transportation or sorting, resulting in a lower value mixed glass cullet. Further, the market price for recycled glass as cullet has decreased in recent years, a trend that is not expected to reverse in the foreseeable future. The Agency of Natural Resources encourages safe and credible alternative uses of recycled glass.

This acceptable use paper, issued by the Solid Waste Management Program, outlines the requirements for the acceptable use of uncontaminated, mixed color, processed glass aggregate (PGA) as a replacement for other natural aggregate materials (gravel, crushed gravel, or crushed stone). Public and private entities can use PGA for the applications listed below without prior authorization from the Solid Waste Management Program.

Definition of Processed Glass Aggregate (PGA):

For the purpose of this document, PGA is mixed glass cullet produced from crushed and screened clean food and beverage containers. China dishes, ceramics, or plate glass shall be limited to 5 percent by mass of glass cullet. Screw tops, plastic rings, paper, labels and other deleterious materials shall be limited to less than 1 percent by mass of the PGA. Cathode ray tubes and flourescent light bulbs are not allowed as feedstock for PGA. The PGA shall contain no hazardous waste. PGA must be crushed and screened such that 95 percent of the material passes a 25.0 mm screen and not more than three percent of the material passing the 4.75 mm sieve passes the 75 μm sieve.

Allowable Applications:

PGA is exempt from the provisions of the Solid Waste Management Rules under Section 6-301(b)(4), and will not be considered solid waste when used for the following applications:

1. Roadway, Trail, Parking Lot, Sidewalk Applications:

    a. Base course: layer(s) of specified material supporting a surface course

    b. Subbase: layer(s) of specified material placed on a subgrade to support a base or surface course.

    c. Embankments: a portion of a fill section situated between the existing ground and the subgrade.

2. Utility Trench Bedding and Backfill Applications:

    a. Backfill material for underground utilities: sewer and water pipes, electrical conduit, and fiber optic line

3. Drainage Applications:

    a. Free draining backfill behind retaining walls.

    b. Foundations drains, drainage blankets, French drains.

4. Filter media for wastewater treatment systems.

5. Landfill cover. (Requires Solid Waste Management Program pre-approval.)

6. Bulking agent for compost. (For certified facilities, this requires Solid Waste Management Program pre-approval.)

The technical suitability of PGA in the listed applications must be determined by the user. Conformance with this policy does not provide authorization of any activity in lieu other state or local laws or specifications which may also govern.

For a resource list of PGA-related publications that include specifications, contact a staff person in the Recycling Section. For authorization for other applications not listed in this document contact a staff person in the Solid Waste Management Program. Both can be reached at (802) 241-3444.

2/1/2002

P. Howard Flanders, Director, Waste Management Division — Date

Attachment 2

KNIGHT CONSULTING ENGINEERS, INC.
P.O. BOX 29
WILLISTON, VERMONT 05495
Tel: 802-879-6343 Fax: 802-879-6376

STEPHEN C. KNIGHT, JR., P.E.
MARTIN W. HAIN, P.E.
ERIC H. GODDARD, P.E.
ROBERT A. LOVGREN, P.E.

CIVIL ENGINEERING
STRUCTURAL ENGINEERING
GEOTECHNICAL ENGINEERING
HYDRAULIC ENGINEERING
CONSTRUCTION INSPECTION
CONSTRUCTION TESTING

CSWD
JUN 13 2005
RECEIVED

June 9, 2005

CSWD
Attn: Mr. Tony Barbagallo
1021 Redmond Road
Williston, VT 05495

Re: Laboratory Testing of 3/8"-Minus and 3/16"-Minus Crushed Glass (08/2004).

Dear Mr. Barbagallo:

This is a report of laboratory testing perfomed on (2) samples of crushed glass (3/8"-Minus and 3/16"-Minus) taken from stockpiles at your facility on Avenue "C" in Williston, Vermont. Our calculated internal friction angles for the glass samples were based upon field and laboratory slope (Angle of Repose) measurements combined with theoretical formulas based upon soil particle characteristics. The 33 to 34 degrees determined is right in the range for quartz-based soils. Regarding compaction issues, the 3/8"-Minus material behaves like a clean stone in that its compaction is not dependent upon water content, whereas, the 3/16"-Minus material behaves more like a conventional soil. It should be noted that between 0.5% and 1% organics content was found in the crushed glass materials due to remnants of bottling labels.

No attempt was made by Knight Consulting Engineers to investigate for the presence, extent or nature of hazardous or toxic substances.

We appreciate the opportunity to conduct this materials testing.

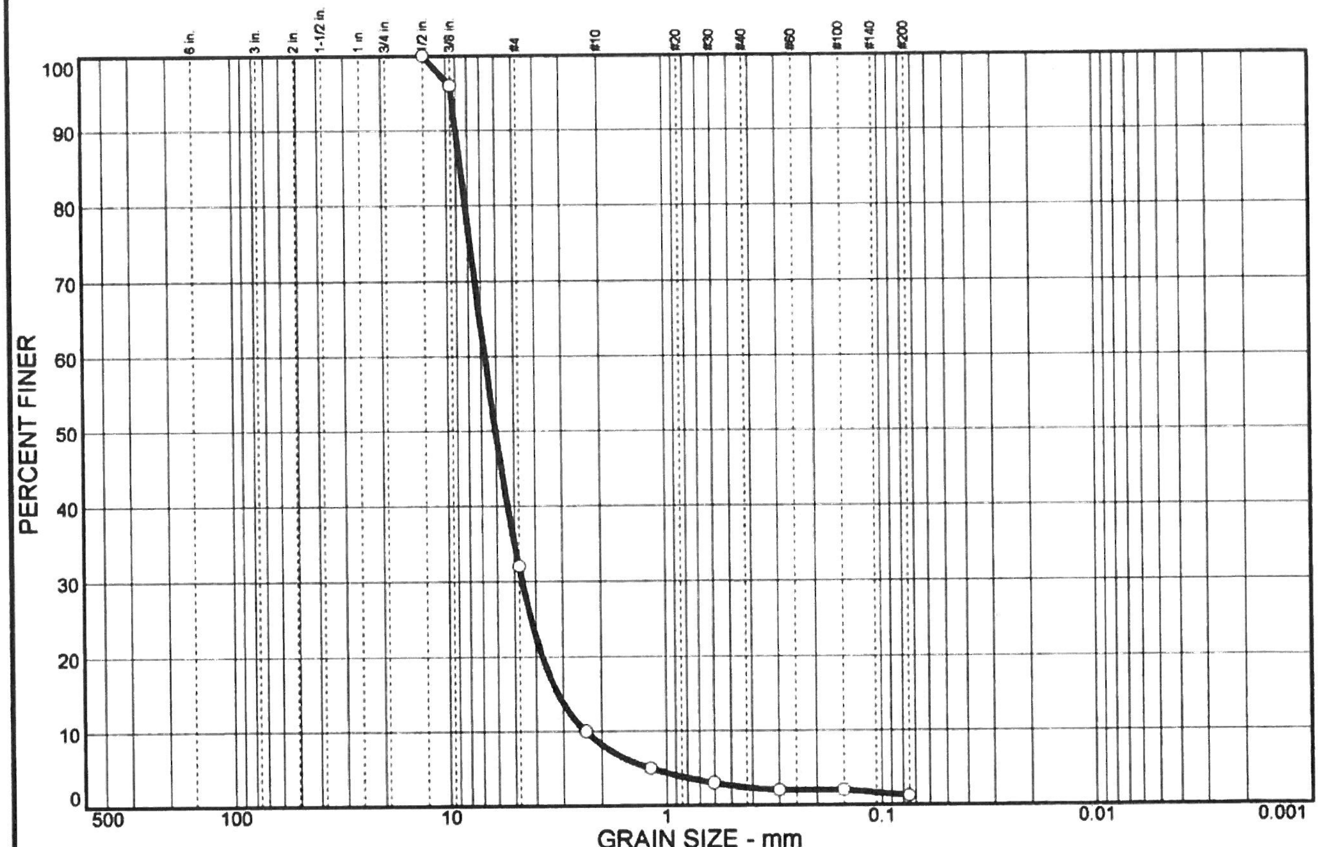
Sincerely,

Eric Goddard

Eric Goddard, P.E.
Senior Vice President
S:\04439\Word\Report2.doc

STATE OF VERMONT
ERICH GODDARD
No. 6035
REGISTERED
PROFESSIONAL ENGINEER

Grain Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0	0	68	24	6	1	1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2 in.	100		
3/8 in.	96		
#4	32		
#8	10		
#16	5		
#30	3		
#50	2		
#100	2		
#200	1.2		

* (no specification provided)

Soil Description

3/8" Minus Crushed Glass Before Proctor

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 8.59 D_{60}= 6.71 D_{50}= 6.02
D_{30}= 4.60 D_{15}= 3.15 D_{10}= 2.36
C_u= 2.84 C_c= 1.33

Classification

USCS= AASHTO=

Remarks

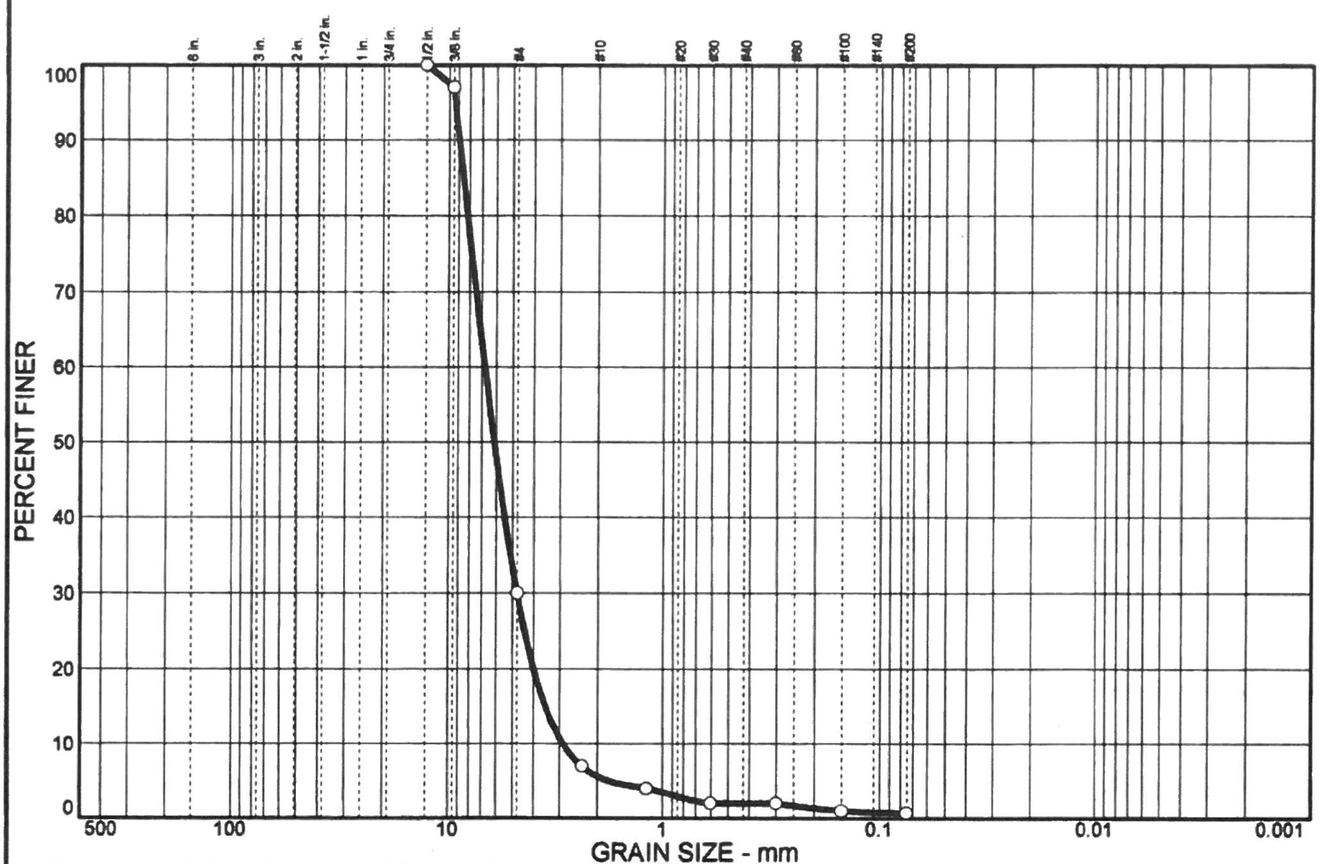
Sampled and Delivered by KCE 8-26-04
Tested by A.Davis 8-30-04
F.M.=5.50

Sample No.: 1 **Source of Sample:** Stock Pile **Date:** 8-30-04
Location: **Elev./Depth:**

Knight Consulting Engineers, Inc.

Client: CSWD
Project: Crushed Glass Consult
Project No: 04439 **Page** 1-4

Grain Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0	0	70	24	4	1	1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2 in.	100		
3/8 in.	97		
#4	30		
#8	7		
#16	4		
#30	2		
#50	2		
#100	1		
#200	0.7		

* (no specification provided)

Soil Description

3/8" Minus Crushed Glass After Proctor

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 8.55 D_{60}= 6.75 D_{50}= 6.09
D_{30}= 4.75 D_{15}= 3.50 D_{10}= 2.89
C_u= 2.34 C_c= 1.16

Classification

USCS= AASHTO=

Remarks

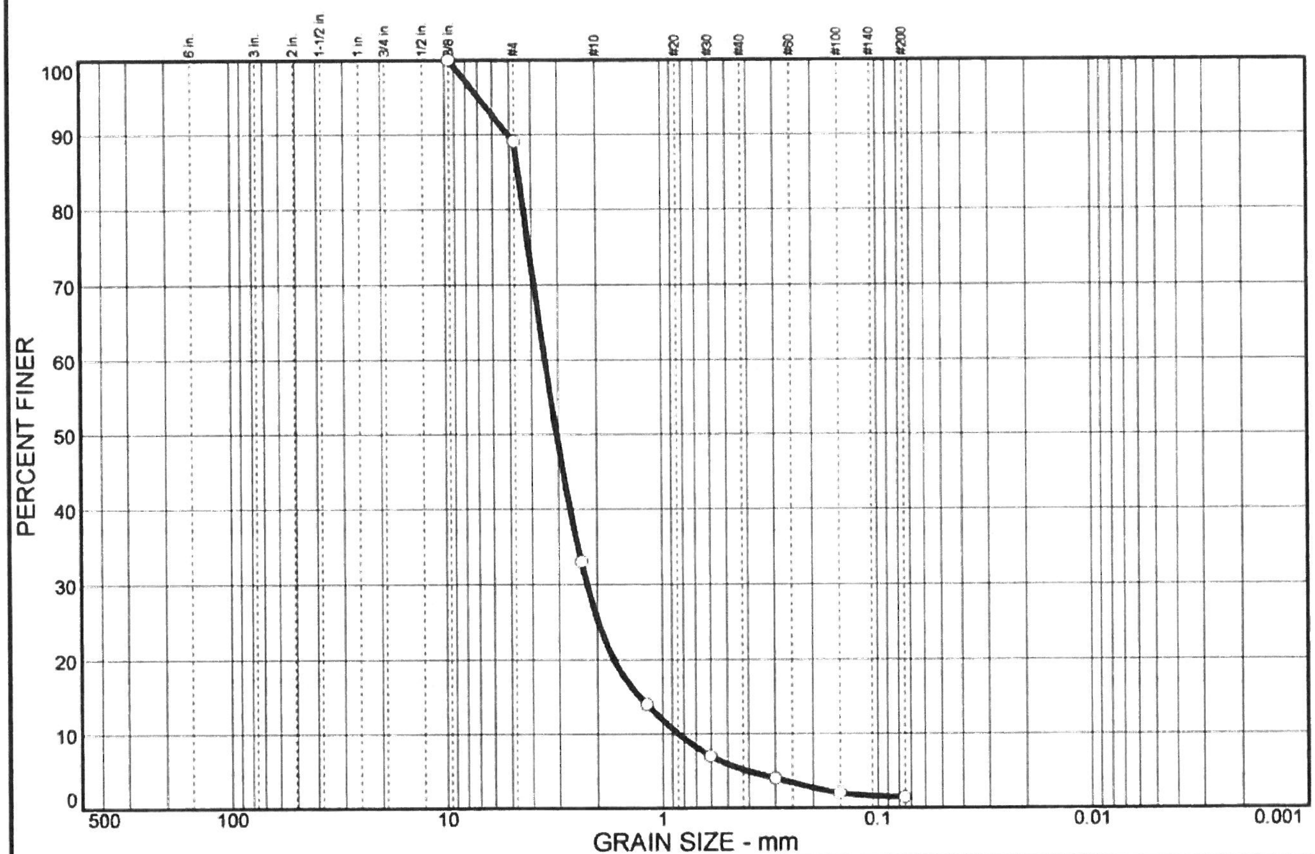
Sampled and Delivered by KCE 8-26-04
Tested by A. Davis 8-30-04
F.M.=5.57

Sample No.: 1 **Source of Sample:** Stock Pile **Date:** 8-30-04
Location: **Elev./Depth:**

Knight Consulting Engineers, Inc.

Client: CSWD
Project: Crushed Glass Consult
Project No: 04439

Grain Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0	0	11	64	20	4	1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100		
#4	89		
#8	33		
#16	14		
#30	7		
#50	4		
#100	2		
#200	1.4		

* (no specification provided)

Soil Description

3/16" Minus Crushed Glass Before Proctor

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 4.55 D_{60}= 3.45 D_{50}= 3.05
D_{30}= 2.22 D_{15}= 1.27 D_{10}= 0.843
C_u= 4.09 C_c= 1.70

Classification

USCS= AASHTO=

Remarks

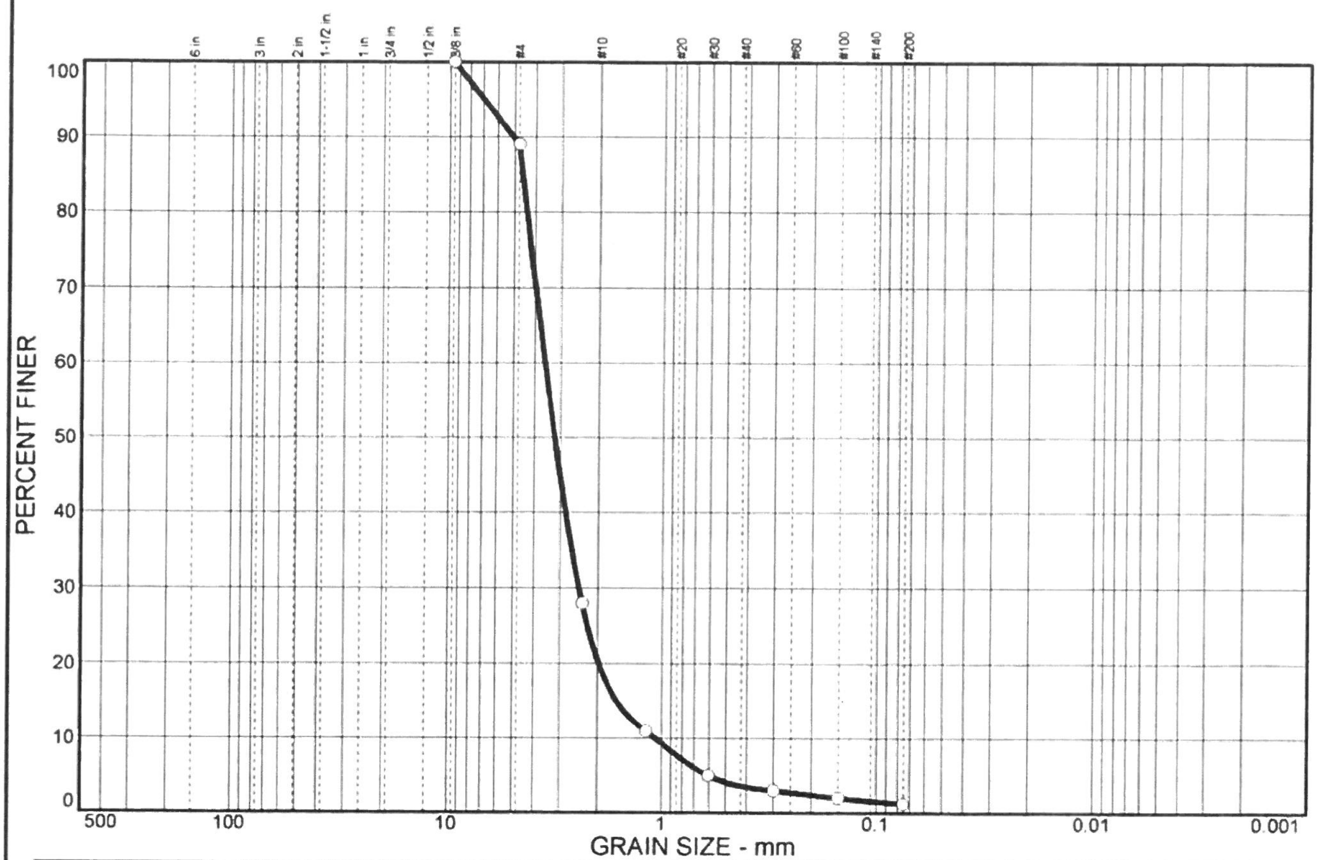
Sampled and Delivered by KCE 8-26-04
Tested by A. Davis 8-31-04
F.M.=4.51

Sample No.: 2 **Source of Sample:** Stock Pile **Date:** 8-31-04
Location: **Elev./Depth:**

Knight Consulting Engineers, Inc.

Client: CSWD
Project: Crushed Glass Consult
Project No: 04439 **Page** 3-4

Grain Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0	0	11	68	17	3	1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100		
#4	89		
#8	28		
#16	11		
#30	5		
#50	3		
#100	2		
#200	1.2		

* (no specification provided)

Soil Description

3/16" Minus Crushed Glass After Proctor

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 4.57 D_{60}= 3.56 D_{50}= 3.19
D_{30}= 2.44 D_{15}= 1.62 D_{10}= 1.07
C_u= 3.34 C_c= 1.57

Classification

USCS= AASHTO=

Remarks

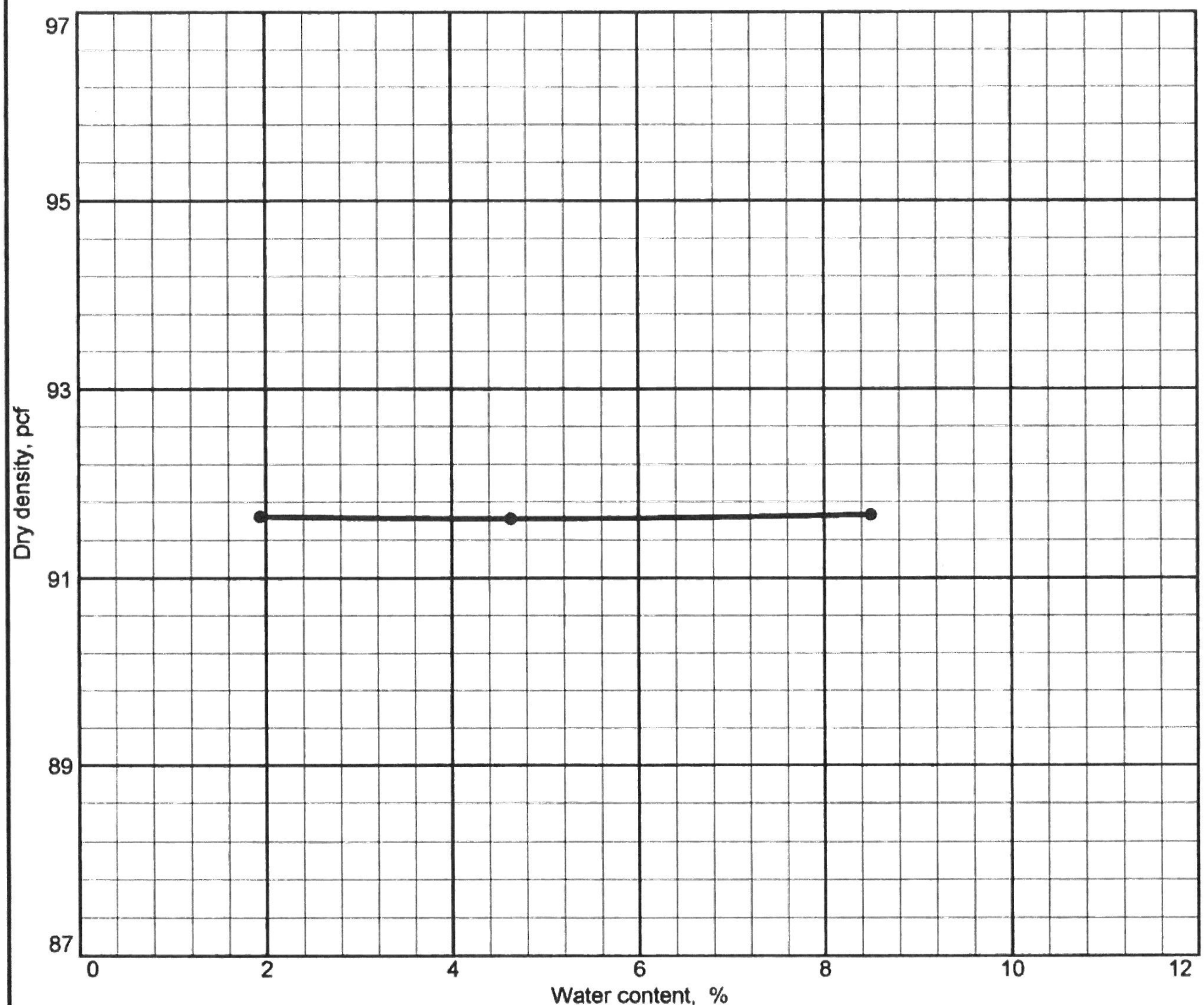
Sampled and Delivered by KCE 8-26-04
Tested by ACR 8-31-04
F.M.=4.62

Sample No.: 2 **Source of Sample:** Stock Pile **Date:** 8-31-04
Location: **Elev./Depth:**

Knight Consulting Engineers, Inc.

Client: CSWD
Project: Crushed Glass Consult
Project No: 04439 **Page** 4-4

Laboratory Compaction Report



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 91.7 pcf Optimum moisture = 8.5 %	3/8" Minus Crushed Glass

Project No. 04439 **Client:** CSWD

Project: Crushed Glass Consult

● **Source:** Stock Pile **Sample No.:** 1

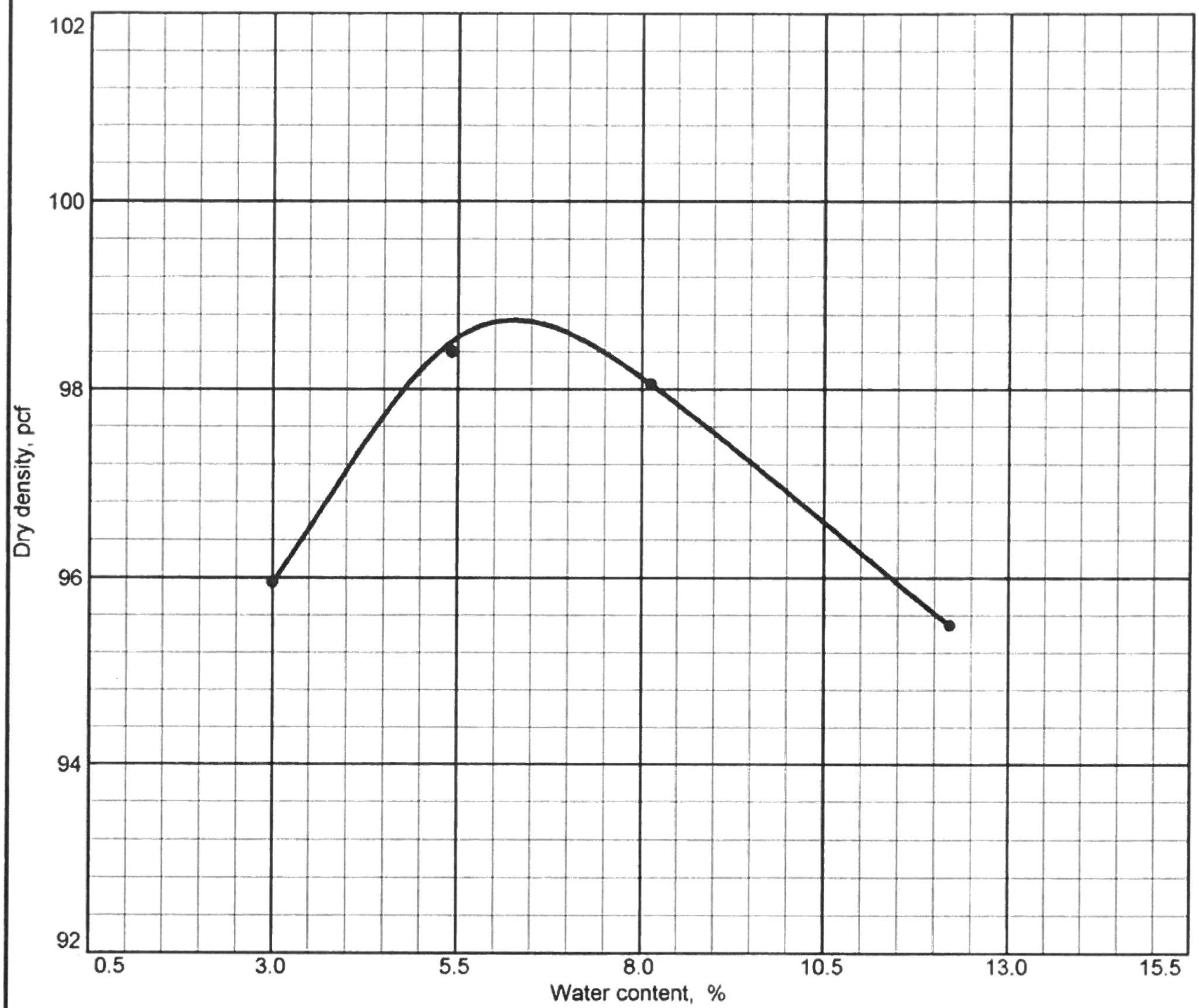
Remarks:

Sampled and Delivered by KCE 8-26-04
Tested by J.M. 8-27-04

Laboratory Compaction Report

Knight Consulting Engineers, Inc.

Laboratory Compaction Report



Test specification: ASTM D 698-78 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 98.7 pcf Optimum moisture = 6.3 %	3/16" Minus Crushed Glass

Project No. 04439 **Client:** CSWD

Project: Crushed Glass Consult

• **Source:** Stock Pile **Sample No.:** 2

Remarks:

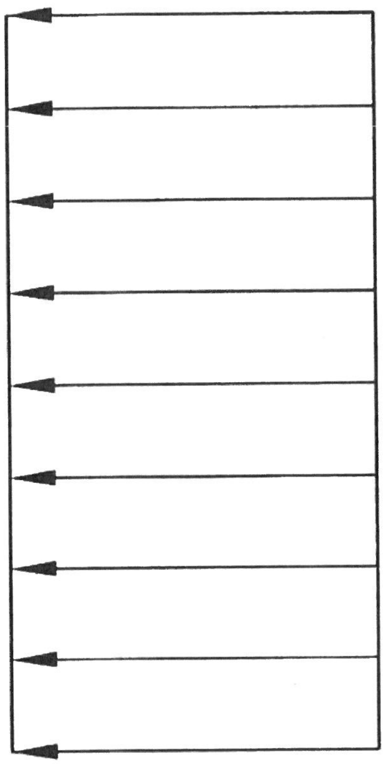
Sampled and Delivered by KCE 8-26-04
Tested by ACR 8-30-04

Laboratory Compaction Report

Knight Consulting Engineers, Inc.

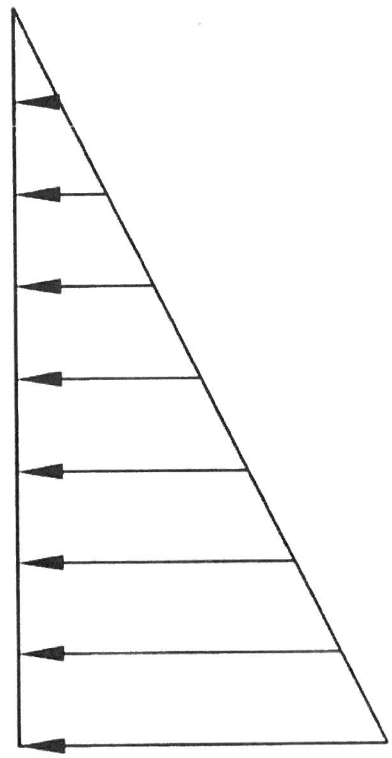
SOIL PROPERTIES (ACTIVE)

Phi = 33°
Ka = 0.295
Moist Unit Wt. = 92.6 pcf
Effective Unit Wt. = 55.0 pcf (Saturated)
Heavy Traffic Surcharge = 300 psf (if applicable)



SURCHARGE

P = 0.295 x 300 = 88.5 psf



SOIL LOADING

Lateral Unit Wt. = 0.295 x 101 = 27.3 pcf (Moist)
* Lateral Unit Wt. = 0.295 x 55.0 = 16.2 pcf (Saturated)

WATER LOADING

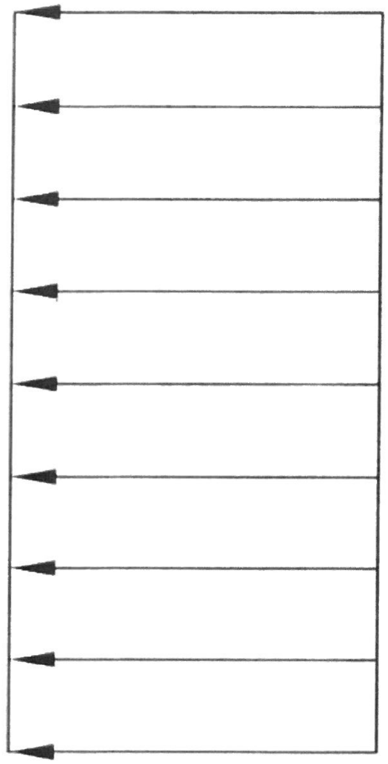
* Lateral Unit Wt. = 1 x 62.4 = 62.4 pcf (Water)

* = Must Combine Saturated Soil Loading With Water Loading To Get Total Lateral Loading.

ACTIVE EARTH PRESSURES 3/8"-MINUS CRUSHED GLASS CSWD IN WILLISTON, VT	SHEET NO: 1	
	DWN BY: EHG	CHK BY: EHG
	PROJ. NO: 04439	
	DATE: 6/9/05	
KCE KNIGHT CONSULTING ENGINEERS, INC. P.O. BOX 29, WILLISTON VT 05495 (802) 879-6343	SCALE: 1" = 10'	
	FILE:	

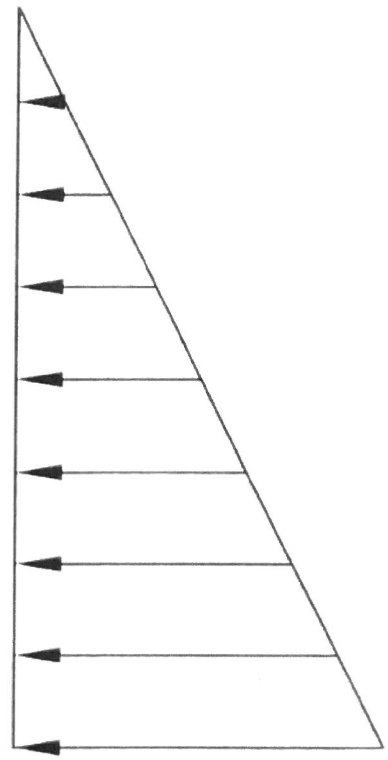
SOIL PROPERTIES (AT-REST)

Phi = 33°
Ko = 0.455
Moist Unit Wt. = 92.6 pcf
Effective Unit Wt. = 55.0 pcf (Saturated)
Heavy Traffic Surcharge = 300 psf (if applicable)



SURCHARGE

P = 0.455 x 300 = 136.5 psf



SOIL LOADING

Lateral Unit Wt. = 0.455 x 92.6 = 42.1 pcf (Moist)
* Lateral Unit Wt. = 0.455 x 55.0 = 25.0 pcf (Saturated)

WATER LOADING

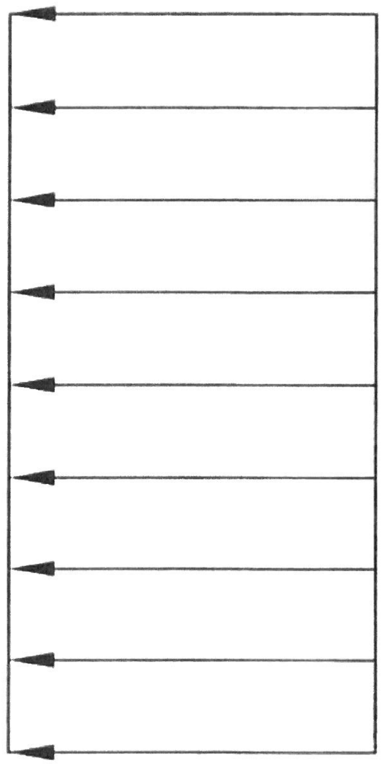
* Lateral Unit Wt. = 1 x 62.4 = 62.4 pcf (Water)

* = Must Combine Saturated Soil Loading With Water Loading To Get Total Lateral Loading.

AT-REST EARTH PRESSURES 3/8"-MINUS CRUSHED GLASS CSWD IN WILLISTON, VT	SHEET NO: 2	
	DWN BY: EHG	CHK BY: EHG
	PROJ. NO: 04439	
	DATE: 6/9/05	
KCE KNIGHT CONSULTING ENGINEERS, INC. P.O. BOX 29, WILLISTON VT 05495 (802) 879-6343	SCALE: 1" = 10'	
	FILE:	

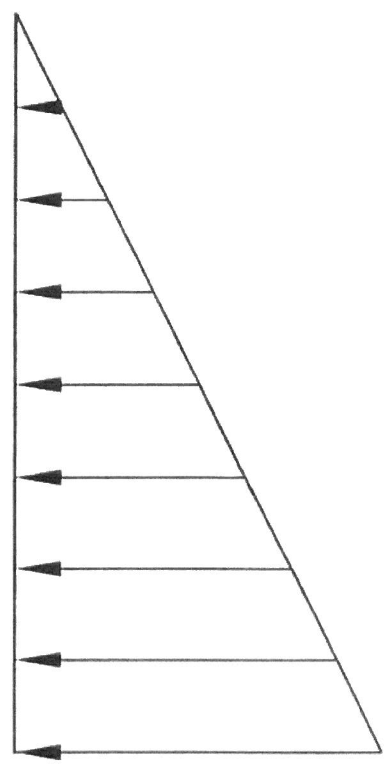
SOIL PROPERTIES (PASSIVE)

Phi = 33°
Kp = 3.392
Moist Unit Wt. = 92.6 pcf
Effective Unit Wt. = 55.0 pcf (Saturated)
Heavy Traffic Surcharge = 300 psf (if applicable)



SURCHARGE

P = 3.392 x 300 = 1018 psf



SOIL LOADING

Lateral Unit Wt. = 3.392 x 92.6 = 314.1 pcf (Moist)
* Lateral Unit Wt. = 3.392 x 55.0 = 186.6 pcf (Saturated)

WATER LOADING

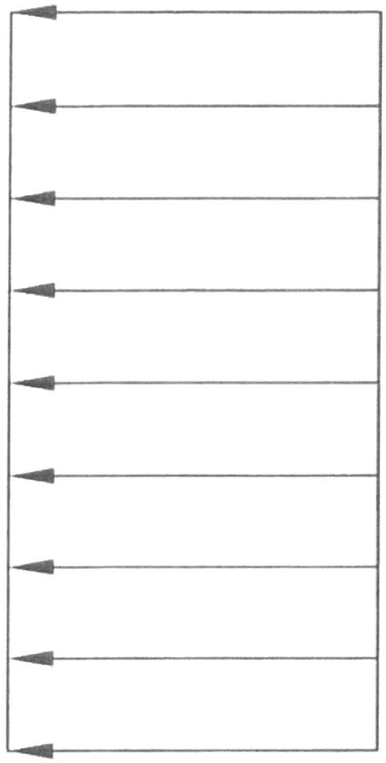
* Lateral Unit Wt. = 1 x 62.4 = 62.4 pcf (Water)

* = Must Combine Saturated Soil Loading With Water Loading To Get Total Lateral Loading.

	PASSIVE EARTH PRESSURES 3/8"-MINUS CRUSHED GLASS CSWD IN WILLISTON, VT	SHEET NO: 3
		DWN BY: EHG CHK BY: EHG
		PROJ. NO: 04439
		DATE: 6/9/05
	KCE KNIGHT CONSULTING ENGINEERS, INC. P.O. BOX 29, WILLISTON VT 05495 (802) 879-6343	SCALE: 1" = 10'
		FILE:

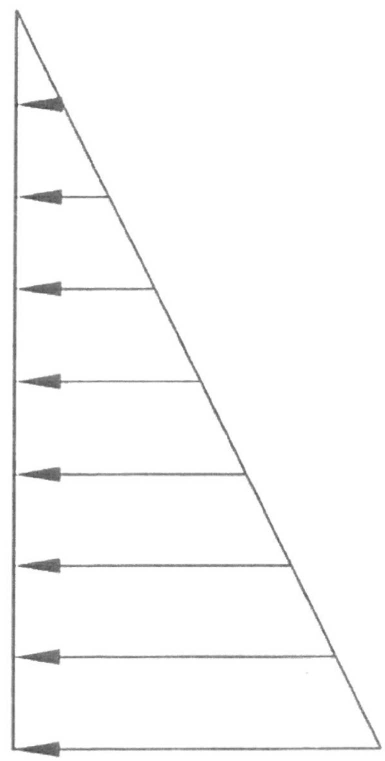
SOIL PROPERTIES (ACTIVE)

Phi = 34°
Ka = 0.283
Moist Unit Wt. = 104.9 pcf
Effective Unit Wt. = 59.2 pcf (Saturated)
Heavy Traffic Surcharge = 300 psf (if applicable)



SURCHARGE

P = 0.283 x 300 = 84.9 psf



SOIL LOADING

Lateral Unit Wt. = 0.283 x 104.9 = 25.7 pcf (Moist)
* Lateral Unit Wt. = 0.283 x 59.2 = 16.8 pcf (Saturated)

WATER LOADING

* Lateral Unit Wt. = 1 x 62.4 = 62.4 pcf (Water)

* = Must Combine Saturated Soil Loading With Water Loading To Get Total Lateral Loading.

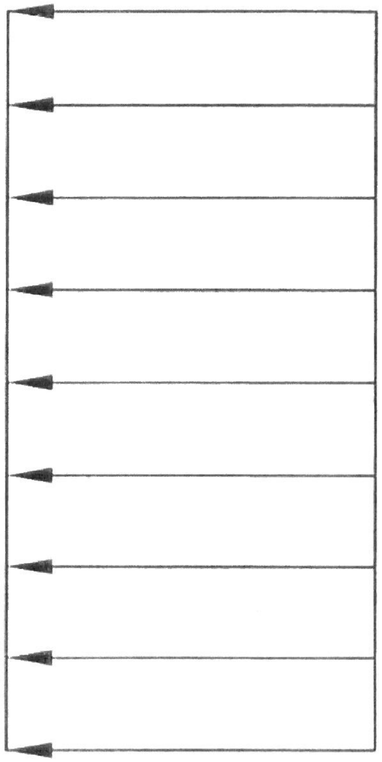
ACTIVE EARTH PRESSURES
3/16"-MINUS CRUSHED GLASS
CSWD IN WILLISTON, VT

KCE KNIGHT CONSULTING ENGINEERS, INC.
P.O. BOX 29, WILLISTON VT 05495 (802) 879-6343

SHEET NO: 1	
DWN BY: EHG	CHK BY: EHG
PROJ. NO: 04439	
DATE: 6/9/05	
SCALE: 1" = 10'	
FILE:	

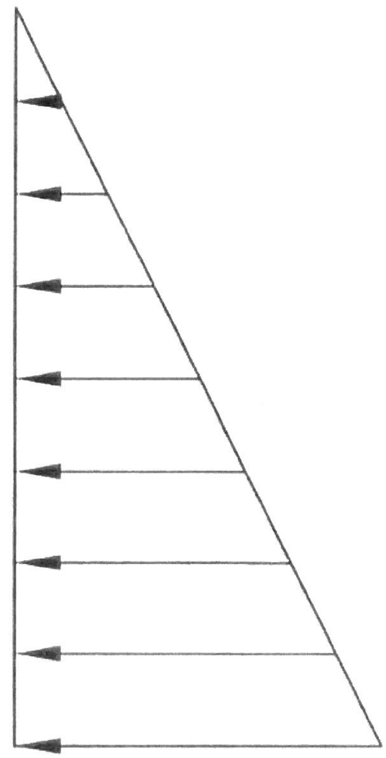
SOIL PROPERTIES (AT-REST)

Phi = 34°
Ko = 0.441
Moist Unit Wt. = 104.9 pcf
Effective Unit Wt. = 59.2 pcf (Saturated)
Heavy Traffic Surcharge = 300 psf (if applicable)



SURCHARGE

P = 0.441 x 300 = 132.2 psf



SOIL LOADING

Lateral Unit Wt. = 0.441 x 104.9 = 46.3 pcf (Moist)
* Lateral Unit Wt. = 0.441 x 59.2 = 26.1 pcf (Saturated)

WATER LOADING

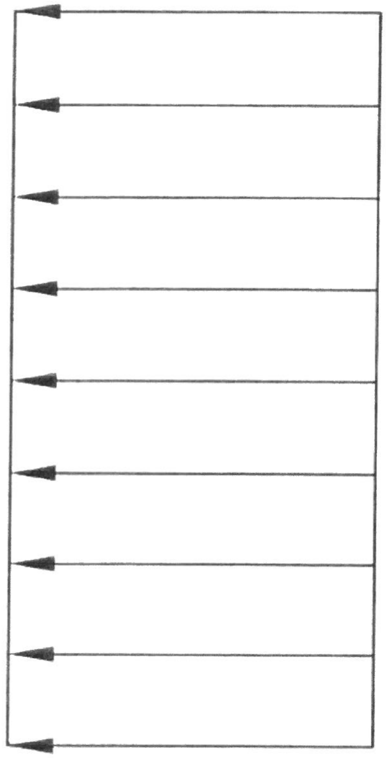
* Lateral Unit Wt. = 1 x 62.4 = 62.4 pcf (Water)

* = Must Combine Saturated Soil Loading With Water Loading To Get Total Lateral Loading.

	AT-REST EARTH PRESSURES 3/16"-MINUS CRUSHED GLASS CSWD IN WILLISTON, VT	SHEET NO: 2
		DWN BY: EHG / CHK BY: EHG
		PROJ. NO: 04439
		DATE: 6/9/05
	KCE KNIGHT CONSULTING ENGINEERS, INC. P.O. BOX 29, WILLISTON VT 05495 (802) 879-6343	SCALE: 1" = 10'
		FILE:

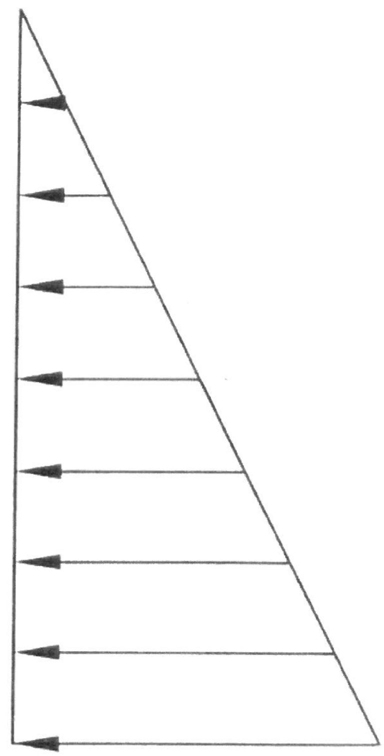
SOIL PROPERTIES (PASSIVE)

Phi = 34°
Kp = 3.537
Moist Unit Wt. = 104.9 pcf
Effective Unit Wt. = 59.2 pcf (Saturated)
Heavy Traffic Surcharge = 300 psf (if applicable)



SURCHARGE

P = 3.537 x 300 = 1061 psf



SOIL LOADING

Lateral Unit Wt. = 3.537 x 104.9 = 371.0 pcf (Moist)
* Lateral Unit Wt. = 3.537 x 59.2 = 209.4 pcf (Saturated)

WATER LOADING

* Lateral Unit Wt. = 1 x 62.4 = 62.4 pcf (Water)

* = Must Combine Saturated Soil Loading With Water Loading To Get Total Lateral Loading.

	PASSIVE EARTH PRESSURES 3/16"-MINUS CRUSHED GLASS CSWD IN WILLISTON, VT	SHEET NO: 3
		DWN BY: EHG / CHK BY: EHG
		PROJ. NO: 04439
		DATE: 6/9/05
	KCE KNIGHT CONSULTING ENGINEERS, INC. P.O. BOX 29, WILLISTON VT 05495 (802) 879-6343	SCALE: 1" = 10'
		FILE:

Attachment 3

Chittenden Solid Waste District

ADMINISTRATIVE OFFICE
1021 Redmond Road
Williston, VT 05495

EMAIL info@cswd.net
TEL (802) 872-8100

www.cswd.net

CSWD: Materials Recovery Facility PGA Materials Sampling Protocol

Processed Glass Aggerate (PGA) generated from the Chittenden Solid Waste District (CSWD), Materials Recovery Facility (MRF), shall meet the following state specifications to be defined as PGA per the 2002 Vermont Department of Conservation (VT DEC): Acceptable Uses for Processed Glass Aggregate Document.

PGA Specifications:

- 95% of the material shall pass a 1-inch sieve
- Not more than 3% of the material passing a No. 4 sieve shall pass a No. 200 sieve
- Material shall be less than 5% china dishes, ceramics, plate (window or mirror) glass, or other glass products
- Material shall be less than 1% screw tops, plastic cap rings or other contaminants
- Material shall not be toxic or a hazardous material*
- Process control shall be performed once per 2500 cubic yards

*Toxicity and Hazardous material analysis included with this protocol

For the purposes of VT DEC Notice of Alleged Violation received April 13, 2018 the following sampling protocol will be performed on the volume of PGA described below:

MRF Glass - PGA (tons)													
Outbound													
Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Totals
2015													0
2016		1,525	488	194	666	1,027		279	444	1,326	853		6,803
2017	500	844	304	751		1,343				1,831		234	5,806
2018	1,208		1,301										2,509
												Total	**15,118**

Tonnage data collected from MRF scale reports, outbound PGA; weight ticket numbers associated with the above tonnage will be emailed upon request. All ASSHTO and ASTM standards used in this protocol are included with this document. The district has defined the volume of the PGA placed on the closed CSWD landfill as an embankment for slope stabilization to be 11,629 cubic yards. Calculated by:

(-) 3/16" PGA bulk density 98.7 lbs./cubic foot = 1.33 tons/cubic yard
Total tonnage of 15,118 = 11,629 cubic yards

Per the Vermont Agency of Transportation Standard Specifications for Construction, Division 300, Section 301.02 Materials: process control tests shall be performed at a minimum frequency of one test per 2,000 m^3 (2,500 yd^3) of material produced by a stable process. This includes sources of PGA. Based on volume of 11,629 cubic yards the district will randomly sample 4.65 times rounded to five (5) samples to define a representative sample for the entire volume. The district will sample from five locations per AASHTO Designation: T 2-91 (2000)/ ASTM Designation: D 75-87 (1992) Sampling of aggregates, specific to fine aggregate requirements. Each of the five sample sizes will be collected at a weight of 25 pounds per AASHTO Designation: T 2-91 (2000)/ ASTM Designation: D 75-87 (1992) Sampling of aggregates, specific to fine aggregate requirements. Analysis of PGA particle distribution will be in accordance with ASTM Designation: C 136-01 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. The Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates requires that each sample to be analyzed is dried at 105° Celsius for a minimum of twelve hours. The drying process removes the moisture from all of the organics in the PGA sample which are lighter by weight than the PGA itself. When the dried sample is placed on the sieve stack and in the sieve shaker, the mechanical shaking process brings all organics, labels and lighter fraction plastics to the top of the sample and causes all of the denser PGA particulates to fall to the bottom of each sieve. This separation allows for the sampling of deleterious material. The deleterious material will be removed from each sieve in the sieve stack and placed in a pre-weighed container. Upon completion of the sieve analysis for an entire twenty-five-pound sample the removed and collected deleterious material will be weighed and the percent by weight contamination will be calculated. This protocol will be performed on all five samples collected and an average deleterious contamination percentage will be calculated to represent the entire volume of PGA being analyzed. Each twenty-five-pound sample takes a day to dry and a day to analyze, the District shall perform the analysis as continuous as possible and requests 20 business days to complete the verification of PGA at the CSWD closed Landfill. Upon the VT DEC approval of this sampling protocol and request to sample per the **Chittenden Solid Waste District – Notice of Alleged Violation ("NOAV") Response,** dated April 27, 2018, the District will notify the VT DEC in writing the start of the 20 business days required to complete the PGA verification testing.

Please contact me with any questions,

Josh Tyler, Project Manager

ENDYNE Inc.
Environmental Laboratories

Chittenden Solid Waste Dist.		PROJECT: Glass Waste Characterization
1021 Redmond Road	100701	WORK ORDER: **1706-14283**
Williston, VT 05495		DATE RECEIVED: June 29, 2017
		DATE REPORTED: July 25, 2017
Atten: Brian Wright		SAMPLER: Josh Tyler

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 07/25/2017

CLIENT: Chittenden Solid Waste Dist. WORK ORDER: **1706-14283**
PROJECT: Glass Waste Characterization DATE RECEIVED 06/29/2017

001 Site: MRF Glass Pile Date Sampled: 6/29/17 Time: 9:00

Parameter	Result	Units	Method	Analysis Date/Time		Lab/Tech	NELAC	Qual.
TCLP Extract-VOA ZHE	Completed		EPA 1311	7/10/17		W FAA	A	
TCLP Extract-SVOA/Metals	Completed		EPA 1311	7/6/17		W FAA	A	
Ignitability-Solids Package								
Ignitability	Negative		EPA 1030	7/13/17		W JSS	N	
Flashpoint	> 220	Degrees F	EPA 1010A Modified	7/13/17		W JSS	U	
pH	7.35	SU at 24.1C	EPA 9045D	7/10/17	17:33	W BDB	A	
Reactivity	Negative		SW846-React	7/3/17		SWSUB	U	SBP
Reactive Cyanide	< 5	mg/Kg, dry	SW846-React	7/3/17		SWSUB	U	SBP
Reactive Sulfide	< 20	mg/Kg, dry	SW-7.3	7/3/17		SWSUB	U	SBP
TCLP Mercury Digestion	Digested		EPA 7470A	7/11/17		W CM	A	
TCLP Metals Digestion	Digested		EPA 3015A	7/14/17		W MGT	A	
Arsenic, Total TCLP	< 0.20	mg/L	EPA 6010C	7/20/17		W MGT	A	
Barium, Total TCLP	< 0.20	mg/L	EPA 6010C	7/20/17		W MGT	A	
Cadmium, Total TCLP	< 0.020	mg/L	EPA 6010C	7/20/17		W MGT	A	
Chromium, Total TCLP	< 0.05	mg/L	EPA 6010C	7/20/17		W MGT	A	
Lead, Total TCLP	< 0.20	mg/L	EPA 6010C	7/20/17		W MGT	A	
Mercury, Total TCLP	< 0.010	mg/L	EPA 7470A	7/11/17		W CM	A	
Selenium, Total TCLP	< 0.20	mg/L	EPA 6010C	7/20/17		W MGT	N	
Silver, Total TCLP	1.5	mg/L	EPA 6010C	7/21/17		W MGT	A	CR
TCLP VOLATILES								
Vinyl chloride, TCLP	< 0.020	mg/L	EPA 8260B	7/12/17		W TEL	A	
1,1-Dichloroethene, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
2-Butanone (MEK), TCLP	< 0.10	mg/L	EPA 8260B	7/12/17		W TEL	A	
Chloroform, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
Carbon tetrachloride, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
Benzene, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
1,2-Dichloroethane, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
Trichloroethene, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
Tetrachloroethene, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
Chlorobenzene, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
1,4-Dichlorobenzene, TCLP	< 0.010	mg/L	EPA 8260B	7/12/17		W TEL	A	
Surr. 1 (Dibromofluoromethane)	96	%	EPA 8260B	7/12/17		W TEL	A	
Surr. 2 (Toluene d8)	99	%	EPA 8260B	7/12/17		W TEL	A	
Surr. 3 (4-Bromofluorobenzene)	99	%	EPA 8260B	7/12/17		W TEL	A	
TCLP PESTICIDES								
Liq/Liq Solvent Extraction	Completed		EPA 3510C	7/17/17		W AKJ	A	
Lindane, TCLP	< 0.0020	mg/L	EPA 8081A	7/24/17		W DPD	A	
Heptachlor, TCLP	< 0.0020	mg/L	EPA 8081A	7/24/17		W DPD	A	
Heptachlor Epoxide, TCLP	< 0.0020	mg/L	EPA 8081A	7/24/17		W DPD	A	
Endrin, TCLP	< 0.0020	mg/L	EPA 8081A	7/24/17		W DPD	A	
Methoxychlor, TCLP	< 0.0040	mg/L	EPA 8081A	7/24/17		W DPD	A	
Chlordane, TCLP	< 0.010	mg/L	EPA 8081A	7/24/17		W DPD	A	
Toxaphene, TCLP	< 0.010	mg/L	EPA 8081A	7/24/17		W DPD	A	
Surrogate-TCMX	62	%	EPA 8081A	7/24/17		W DPD	A	
Surrogate-DCB	84	%	EPA 8081A	7/24/17		W DPD	A	
TCLP HERBICIDES								

Laboratory Report DATE REPORTED: 07/25/2017

CLIENT: Chittenden Solid Waste Dist. WORK ORDER: **1706-14283**
PROJECT: Glass Waste Characterization DATE RECEIVED 06/29/2017

001 Site: MRF Glass Pile Date Sampled: 6/29/17 Time: 9:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Liq/Liq Solvent Extraction	Completed		SM 6640B-01	7/12/17	W AKJ	A	
2,4-D, TCLP	< 0.25	mg/L	SM-6640B-01	7/14/17	W DPD	A	
2,4,5-TP, TCLP	< 0.10	mg/L	SM 6640B-01	7/14/17	W DPD	A	
Surrogate-DCAA	84	%	sm 6640B-01	7/14/17	W DPD	A	
TCLP SEMI-VOLATILES							
Liq/Liq Solvent Extraction	Completed		EPA 3510C	7/10/17	W AKJ	A	
Pyridine, TCLP	< 0.1	mg/L	EPA 8270C	7/11/17	W EEP	A	
Hexachloroethane, TCLP	< 0.05	mg/L	EPA 8270C	7/11/17	W EEP	A	
Nitrobenzene, TCLP	< 0.05	mg/L	EPA 8270C	7/11/17	W EEP	A	
Hexachlorobutadiene, TCLP	< 0.05	mg/L	EPA 8270C	7/11/17	W EEP	A	
2,4-Dinitrotoluene, TCLP	< 0.05	mg/L	EPA 8270C	7/11/17	W EEP	A	
Hexachlorobenzene, TCLP	< 0.05	mg/L	EPA 8270C	7/11/17	W EEP	A	
Cresols, Total TCLP	< 0.1	mg/L	EPA 8270C	7/11/17	W EEP	U	
2,4,5-Trichlorophenol, TCLP	< 0.1	mg/L	EPA 8270C	7/11/17	W EEP	A	
2,4,6-Trichlorophenol, TCLP	< 0.1	mg/L	EPA 8270C	7/11/17	W EEP	A	
Pentachlorophenol, TCLP	< 0.1	mg/L	EPA 8270C	7/11/17	W EEP	A	
B/N Surr.1 Nitrobenzene-d5	58	%	EPA 8270C	7/11/17	W EEP	A	
B/N Surr.2 2-Fluorobiphenyl	53	%	EPA 8270C	7/11/17	W EEP	A	
B/N Surr.3 Terphenyl-d14	96	%	EPA 8270C	7/11/17	W EEP	A	
Acid Surr.1 2-Fluorophenol	27	%	EPA 8270C	7/11/17	W EEP	A	
Acid Surr.2 Phenol-d5	23	%	EPA 8270C	7/11/17	W EEP	A	
Acid Surr.3 Tribromophenol	75	%	EPA 8270C	7/11/17	W EEP	A	

Report Summary of Qualifiers and Notes

SBP: Analysis performed by subcontracted laboratory, Phoenix Environmental Laboratories, ELAP#11301. Results are presented here for your convenience. Refer to the complete subcontracted report, which has been appended to this report, for detailed information regarding this result.

CR: The value reported exceeded the analytical calibration range. Sample value determined by extrapolation and has a higher degree of uncertainty than a value bracketed by known standards.

PHOENIX
Environmental Laboratories, Inc.

Wednesday, July 05, 2017

Attn: Mr Mark Fausel
Endyne, Inc.
160 James Brown Dr.
Williston, VT 05495

Project ID: 1706-14283-W
Sample ID#s: BY50963

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext. 200.

Sincerely yours,

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #MA-CT-007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Telephone (860) 645-1102 Fax (860) 645-0823

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

July 05, 2017

FOR: Attn: Mr Mark Fausel
Endyne, Inc.
160 James Brown Dr.
Williston, VT 05495

Sample Information		Custody Information		Date	Time
Matrix:	SOLID	Collected by:		06/29/17	9:00
Location Code:	END-WIL	Received by:	SW	06/30/17	13:16
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:					

Laboratory Data

SDG ID: GBY50963
Phoenix ID: BY50963

Project ID: 1706-14283-W
Client ID: 001 MRF GLASS PILE

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Percent Solid	99		%		06/30/17 23:22	D	SW846-%Solid
Reactivity Cyanide	< 5	5	mg/Kg	1	07/03/17 17:41	K/B/G	SW846-ReactCyn
Reactivity Sulfide	< 20	20	mg/Kg	1	07/03/17 18:10	K/B/G	SW-7.3
Reactivity	Negative		Pos/Neg	1	07/03/17 18:10	K/B/G	SW846-React

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

The reactivity, reported above, is based only on the EPA Interim Guidance for Reactive Cyanide.This method is no longer listed in the current version of SW-846.

The reactivity, reported above, is based only on the EPA Interim Guidance for Reactive Sulfide. This method is no longer listed in the current version of SW-846.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If there are any questions regarding this data, please call Phoenix Client Services.
This report must not be reproduced except in full as defined by the attached chain of custody.

Phyllis Shiller

Phyllis Shiller, Laboratory Director
July 05, 2017
Reviewed and Released by: Deb Lawrie, Project Manager

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

QA/QC Report

July 05, 2017

QA/QC Data

SDG I.D.: GBY50963

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 392356 (mg/Kg), QC Sample No: BY49611 4.95X (BY50963)													
Reactivity Cyanide	BRL	0.05	<6	<5.8	NC	99.3						85 - 115	30

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller, Laboratory Director
July 05, 2017

Wednesday, July 05, 2017
Criteria: None
State: VT

Sample Criteria Exceedances Report

GBY50963 - END-WIL

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

Analysis Comments

July 05, 2017 SDG I.D.: GBY50963

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

23.5 ONL

Phoenix Environmental Labo
567 East Middle Turnpike
Manchester CT 6040
Ph 860-645-8726

Chain of Custody

STATE OF ORIGIN: VERMONT

The analysis requested requires that you have and maintain NELAC certification. If you do not currently have NELAC certification in the above referenced State, and specified matrix please contact Endyne immediately at(802) 879-4333 ext 301. Thank you.

Copy of Report To		Billing Information		Project Information
CUSTOMER:	Endyne, Inc.	BILL TO:	Endyne, Inc.	1706-14283-W
ADDRESS:	160 James Brown Drive	ADDRESS:	160 James Brown Drive	TURN AROUND TIME:
	Williston, VT 05495		Williston, VT 05495	SPECIAL INSTRUCTIONS:
ATTENTION:	Eileen Toomey	ATTENTION:	Reporting	
E-MAIL:	etoomey@endynelabs.com	E-MAIL:	mfausel@endynelabs.com	
PHONE:	(802) 879-4333 x 300	PHONE:	802-879-4333 x 308	

Reactivity Package

Sample Identification				Matrix	DT TM Sampled	
1706-14283	001	MRF Glass Pile	008	Solid	6/29/17	9:00

50963

Relinquished by:(Sign, Date, Time) [signature] 6/29/17 17:00 UPS

Received by: (Sign, Date, Time) [signature] 6/30/17 13:16

ENDYNE, INC.
160 James Brown Drive
Williston, Vermont 05495
(802) 879-4333

CHAIN-OF-CUSTODY-RECORD

Special Reporting Instructions/PO#: MRF Haz/Tox analysis

77665

Project Name: Glass Waste Char.	Client/Contact Name: CSWD Josh Tyler	Sampler Name: Josh Tyler
State of Origin: (VT) __ NY __ NH __ Other __	Phone #: 802-872-8100 x210	Phone #: 802-338-5304
Endyne WO #	Mailing Address: 1021 Redmond Rd Williston, VT 05495	Billing Address: 1021 Redmond Rd Williston, VT 05495

Sample Location	Matrix	GRAB	COMP	Date/Time Sampled	Sample Containers No.	Sample Containers Type/Size	Sample Preservation	Analysis Required	Remarks	Due Date
MRF Glass Pile	Glass		X	6.29.17 ~~6/13/17~~ 900 ~~1130~~	1	1 L	NA			

1706-14283
Chittenden Solid Waste Dist.
Glass Waste Char.
1706-14283

Relinquished by:	Date/Time	Received by:	Date/Time	Received by:	Date/Time
[signature]	6.29.17 ~~6.28.17~~ 9:09			B Bugbee	6/29/17 9:00

(1)	pH	6	TKN	11	Total Solids	16	Sulfate	21	1664 TPH/FOG	26	8270 PAH Only
2	Chloride	7	Total P	12	TSS	17	Coliform (Specify)	22	8015 GRO	27	8081 Pest
3	Ammonia N	8	Total Diss. P	13	TDS	18	COD	23	8015 DRO	28	8082 PCB
4	Nitrite N	9	BOD	14	Turbidity	19	VT PCF	24	8260B	29	PP13 Metals
5	Nitrate N	10	Alkalinity	15	Conductivity	20	VOC Halocarbons	25	8270 B/N or Acid	30	Total RCRA8
31	Metals (Total, Diss.) Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Sn, Tl, U, V, Zn										
(32)	(TCLP (volatiles, semi-volatiles, metals, pesticides, herbicides))					33	Other				
34	Corrosivity	(35)	Ignitability	(36)	Reactivity	37	Other				
38	Other										

LAB USE ONLY
Delivery: 24.6 Client
Temp: ~~27.1~~ 33
Comment:

(White - Laboratory / Yellow - Client)

Page ___ of ___

CSWD

Chittenden Solid Waste District
1021 Redmond Road • Williston, VT 05495-7729
802-872-8100 • Fax: 802-878-5787 • Web: www.cswd.net

There are 4 characteristics to hazardous waste determination of unknowns:

Ignitability

If the material is solid, like paper, wood, etc, then it is analyzed for **Ignitability**. Solid samples have results that are either positive or negative. If the material is a free-flowing liquid, such as water or oil, the Ignitabilty is determined by **Flashpoint**. The Flashpoint result is either a temperature at which the sample flashed (positive) or a ">158 C" (negative). Many waste haulers request a determination up to 220 Celsius

Corrosivity

In this case **Corrosivity** is really **pH**, to determine if the material will eat through metal, etc. A waste sample, even if it is aqueous,is treated as a solid. If the material is a solvent, which may harm the probe, it will be analyzed using pH paper method.

Reactivity

According to the EPA Website, **Reactivity** is a measure of how unstable the substance is under normal conditions. Reactive wastes can cause explosions, toxic fumes, etc when heated, compressed or mixed with other substances. Generally, the reactive release of **Cyanide** or **Sulfide** is the only determination of Reactivity. We do not perform this assay at our facility, but we work with a subcontracted lab to perform certified analyses.

Toxicity

Toxicity consists of testing for 44 compounds deemed by the EPA to be toxic. Toxicity of a substance is divided into 5 groups of analytes: **Metals (The RCRA 8 Group)**, **Volatile Organics**, **Pesticides**, **Herbicides**, and **Semi-VOAs**.

Toxicity analysis	
TCLP Glass Analysis	
TCLP Metals	Arsenic
	Barium
	Cadmium
	Chromium
	Lead
	Mercury
	Selenium
	Silver
TCLP Volatiles	Vinyl Chloride
	1,1-Dichloroethene
	2-Butanone (MEK)
	Chloroform
	Carbon Tetrachloride
	Benzene
	1,2-Dichloroethane
	Trichloroethene
	Tetrachloroethene
	Chlorobenzene
	1,4-Dichlorobenzene
TCLP Semi-Volatiles	Pyridine
	Hexachloroethane
	Nitrobenxene
	Hexachlorobutaadiene
	2,4-Dinitrotoluene
	Hexachlorobenzene
	Cresols, Total
	2,4,5-Trichloropehnol
	2,4,6-Trichloropehnol
	Pentachlorophenol
TCLP Herbacides	2,4-Dinitrotoluene
	2,4,5-TP
TCLP Pesticides	Lindane
	Heptachlor
	Heptachlor Epoxide
	Endrin
	Methoxychlor
	Chlordane
	Toxaphene

Standard Method of Test for

Sampling of Aggregates

AASHTO Designation: T 2-91 (2000)
ASTM Designation: D 75-87 (1992) $^{\epsilon 1}$

AASHTO T 2-91 is identical to ASTM D 75-87 (1992) $^{\epsilon 1}$ except that all references to ASTM Standard C 702 contained in ASTM D 75-87 (1992) $^{\epsilon 1}$ shall be replaced with AASHTO Standard T 248.

Designation: D 75 - 87 (Reapproved 1992) $^{\epsilon 1}$

American Association State Highway and Transportation' Officials Standard AASHTON No 12

Standard Practice for Sampling Aggregates[1]

This standard is issued under the fixed designation D 75; the number immediately following the designation indicates the year of original adoption or. in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This practice has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

$^{\epsilon 1}$ NOTE—Editorial changes were made throughout in September 1992.

1. Scope*

1.1 This practice covers sampling of coarse and fine aggregates for the following purposes:

1.1.1 Preliminary investigation of the potential source of supply,

1.1.2 Control of the product at the source of supply,

1.1.3 Control of the operations at the site of use, and

1.1.4 Acceptance or rejection of the materials.

NOTE 1—Sampling plans and acceptance and control tests vary with the type of construction in which the material is used. Attention to directed to Practices E 105 and D 3665.

1.2 The values stated in inch-pound units are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C702 Practice for Reducing Field Samples of Aggregate to Testing Size[2]

D2234 Test Method for Collection of a Gross Sample of Coal[3]

D3665 Practice for Random Sampling of Construction Materials[4]

E105 Practice for Probability Sampling of Materials[5]

E122 Practice for Choice of Sample Size to Estimate the Average Quality of a Lot or Process[5]

E 141 Practice for Acceptance of Evidence Based on the Results of Probability Sampling[5]

[1]This practice is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.30 on Methods of Sampling.

Current edition approved Oct. 30. 1987. Published December 1987. Originally published as D 75 – 20 T. Last previous edition D 75 —82.

[2]*Annual Book of ASTM Standards*, Vol 04.02.

[3]*Annua/ Book of ASTM Standards.* Vol 05.05.

Annual Book of ASTM Standards. Vol 04.03.

Annual Book of ASTM Standards, Vol 14.02.

3. Significance and Use

3.1 Sampling is equally as important as the testing, and the sampler shall use every precaution to obtain samples that will show the nature and condition of the materials which they represent.

3.2 Samples for preliminary investigation tests are obtained by the party responsible for development of the potential source (Note 2). Samples of materials for control of the production at the source or control of the work at the site of use are obtained by the manufacturer, contractor, or other parties responsible for accomplishing the work. Samples for tests to be used in acceptance or rejection decisions by the purchaser are obtained by the purchaser or his authorized representative.

NOTE 2—The preliminary investigation and sampling of potential aggregate sources and types occupies a very important place in determining the availability and suitability of the largest single constituent entering into the construction. It influences the type of construction from the standpoint of economics and governs the necessary material control to ensure durability of the resulting structure, from the aggregate standpoint. This investigation should be done only by a responsible trained and experienced person. For more comprehensive guidance, see the Appendix.

4. Securing Samples

4.1 *General*—Where practicable, samples to be tested for quality shall be obtained from the finished product. Samples from the finished product to be tested for abrasion loss shall not be subject to further crushing or manual reduction in particle size in preparation for the abrasion test unless the size of the finished product is such that it requires further reduction for testing purposes.

4.2 *Inspection*—The material shall be inspected to determine discernible variations. The seller shall provide suitable equipment needed for proper inspection and sampling.

4.3 *Procedure:*

4.3.1 *Sampling from a Flowing Aggregate Stream (Bins or Belt Discharge)*—Select units to be sampled by a random method, such as Practice D 3665, from the production. Obtain at least three approximately equal increments, selected at random from the unit being sampled, and combine to form a field sample whose mass equals or exceeds the minimum recommended in 4.4.2. Take each increment from the entire cross section of the material as it is being discharged. It is usually necessary to have a special device constructed for use at each particular plant. This device consists of a pan of sufficient size to intercept the entire cross section of the discharge stream and hold the required quantity of material without overflowing. A set of rails may be necessary to support the pan as it is passed under the discharge stream. Insofar as is possible, keep bins continuously full or nearly full to reduce segregation.

NOTE 3—Sampling the initial discharge or the final few tons from a bin or conveyor belt increases the chances of obtaining segregated material and should be avoided.

4.3.2 *Sampling from the Conveyor Belt*—Select units to be sampled by a random method, such as Practice D 3665, from the production. Obtain at least three approximately equal increments, selected at random, from the unit being sampled and combine to form a field sample whose mass equals or exceeds the minimum recommended in 4.4.2. Stop the conveyor belt while the sample increments are being obtained. Insert two templates, the shape of which conforms to the shape of the belt in the aggregate stream on the belt, and space them such that the material contained between them will yield an increment of the required weight. Carefully scoop all material between the templates into a suitable container and collect the fines on the belt with a brush and dustpan and add to the container.

4.3.3 *Sampling from Stockpiles or Transportation Units*— Avoid sampling coarse aggregate or mixed coarse and fine aggregate from stockpiles or transportation units whenever possible, particularly when the sampling is done for the purpose of determining aggregate properties that may be dependent upon the grading of the sample. If circumstances make it necessary to obtain samples from a stockpile of coarse aggregate or a stockpile of combined coarse and fine aggregate, design a sampling plan for the specific case under consideration. This approach will allow the sampling agency to use a sampling plan that will give a confidence in results obtained therefrom that is agreed upon by all parties concerned to be acceptable for the particular situation. The sampling plan shall define the number of samples necessary to represent lots and sublots of specific sizes. General principles for sampling from stockpiles are applicable to sampling from trucks, rail cars, barges or other transportation units. For general guidance in sampling from stockpiles, see the Appendix.

4.3.4 Sampling from Roadway (Bases and Subbases)— Sample units selected by a random method, such as Practice D 3665, from the construction. Obtain at least three approximately equal increments, selected at random from the unit being sampled, and combine to form a field sample whose mass equals or exceeds the minimum recommended in 4.4.2. Take all increments from the roadway for the full depth of the material, taking care to exclude any underlying material. Clearly mark the specific areas from which each increment is to be removed: a metal template placed over the area is a definite aid in securing approximately equal increment weights.

4.4 *Number and Masses of Field Samples:*

TABLE 1 Size of Samples

Maximum Nominal Size of Aggregates[A]	Approximate Minimum Mass of Field Samples, lb (kq)[B]
Fine Aggregate	
No. 8 (2.36 mm)	25 (10)
No. 4 (4.75 mm)	25 (10)
Coarse Aggregate	
3/8 in. (9.5 mm)	25 (10)
1/2 in. (12.5 mm)	35 (15)
¾ in. (19.0 mm)	55 (25)
1 in. (25.0 mm)	110 (50)
1 1/2 in. (37.5 mm)	165 (75)
2 in. (50 mm)	220 (100)
2 1/2 in. (63 mm)	275 (125)
3 in. (75 mm)	330(150)
3 1/2 in. (90 mm)	385 (175)

A For processed aggregate the nominal maximum size of particles is the largest sieve size listed in the applicable specification, upon which any material is permitted to be retained.

B For combined coarse and fine aggregates (for example, base or subbase) minimum weight shall be coarse aggregate minimum plus 25 lb (10 kg).

4.4.1 The number of field samples (obtained by one of the methods described in 4.3) required depends on the criticality of, and variation in, the properties to be measured. Designate each unit from which a field sample is to be obtained prior to sampling. The number of field samples from the production should be sufficient to give the desired confidence in test results.

NOTE 4—Guidance for determining the number of samples required to obtain the desired level of confidence in test results may be found in Test Method D 2234, Practice E 105, Practice E 122, and Practice E 141.

4.4.2 The field sample masses cited are tentative. The masses must be predicated on the type and number of tests to which the material is to be subjected and sufficient material obtained to provide for the proper execution of these tests. Standard acceptance and control tests are covered by ASTM standards and specify the portion of the field sample required for each specific test. Generally speaking, the amounts specified in Table 1 will provide adequate material for routine grading and quality analysis. Extract test portions from the field sample according to Practice C 702 or as required by other applicable test methods.

5. Shipping Samples

5.1 Transport aggregates in bags or other containers so constructed as to preclude loss or contamination of any part of the sample, or damage to the contents from mishandling during shipment.

5.2 Shipping containers for aggregate samples shall have suitable individual identification attached and enclosed so that field reporting, laboratory logging, and test reporting may be facilitated.

6. Keywords

6.1 aggregates, exploration of potential sources, aggregates, number and sizes needed to estimate character; aggregates, sampling

APPENDIXES

(Nonmandatory Information)

XI. SAMPLING AGGREGATE FROM STOCKPILES OR TRANSPORTATION UNITS

XI.I Scope

XI.l.l In some situations it is mandatory to sample aggregates that have been stored in stockpiles or loaded into rail cars, barges, or trucks. In such cases the procedure should ensure that segregation does not introduce a serious bias in the results.

XI .2 Sampling from Stockpiles

XI.2.l In sampling material from stockpiles it is very difficult to ensure unbiased samples, due to the segregation which often occurs when material is stockpiled, with coarser particles rolling to the outside base of the pile. For coarse or mixed coarse and fine aggregate, every effort should be made to enlist the services of power equipment to develop a separate, small sampling pile composed of materials drawn from various levels and locations in the main pile after which several increments may be combined to compose the field sample. If necessary to indicate the degree of variability existing within the main pile, separate samples should be drawn from separate areas of the pile.

XI.2.2 Where power equipment is not available, samples from stockpiles should be made up of at least three increments taken from the top third, at the mid-point, and at the bottom third of the volume of the pile. A board shoved vertically into the pile just above the sampling point aids in preventing further segregation. In sampling stockpiles of fine aggregate the outer layer, which max' have become segregated, should be removed and the sample taken from the material beneath. Sampling tubes approximately 1 ~ (30-mm) mm by 6 ft (2-m) mm in length may be inserted into the pile at random locations to extract a minimum of five increments of material to form the sample.

XI.3 Sampling from Transportation Units

XI .3.1 In sampling coarse aggregates from railroad cars or barges, effort should be made to enlist the services of power equipment capable of exposing the material at various levels and random locations. Where power equipment is not available, a common procedure requires excavation of three or more trenches across the unit at points that will, from visual appearance, give a reasonable estimate of the characteristics of the load. The trench bottom should be approximately level, at least 1 ft (0.3 m) in width and in depth below the surface. A minimum of three increments from approximately equally spaced points along each trench should be taken by pushing a shovel downward into the material. Coarse aggregate in trucks should be sampled in essentially the same manner as for rail cars or barges, except for adjusting the number of increments according to the size of the truck. For fine aggregate in transportation units, sampling tubes as described in XI.2 may be used to extract an appropriate number of increments to form the sample.

X2. EXPLORATION OF POTENTIAL AGGREGATE SOURCES

X2.I Scope

X2.1.1 Sampling for evaluation of potential aggregate sources should be performed by a responsible trained and experienced person. Because of the wide variety of conditions under which sampling may have to be done it is not possible to describe detailed procedures applicable to all circumstances. This appendix is intended to provide general guidance and list more comprehensive references.

X2.2 Sampling Stone from Quarries or Ledges

X2.2. I *Inspection*—The ledge or quarry face should be inspected to determine discernible variations or strata. Differences in color and structure should be recorded.

X2.2.2 *Sampling and Size of Sample*—Separate samples having a mass of at least 50 lb (approximately 25 kg) should be obtained from each discernible stratum. The sample should not include material weathered to such an extent that it is no longer suitable for the purpose intended. One or more pieces in each sample should be at least 6 by 6 by 4 in. (150 by 150 by 100 mm) in size with the bedding plane plainly marked, and this piece should be free of seams or fractures.

X2.2.3 *Record*—In addition to the general information accompanying all samples the following information should accompany samples taken from ledges or quarry faces:

X2.2.3.1 Approximate quantity available. (If quantity is very large this may be recorded as practically unlimited.)

X2.2.3.2 Quantity and character of overburden.

X2.2.3.3 A detailed record showing boundaries and location of material represented by each sample.

NOTE X2.1—A sketch, plan, and elevation, showing the thickness and location of the different layers is recommended for this purpose.

X2.3 Sampling Roadside or Bank Run Sand and Gravel Deposits

X2.3. I *Inspection*—Potential sources of bank run sand and gravel may include previously worked pits from which there is an exposed face or potential deposits discovered through air-photo interpretation, geophysical exploration, or other types of terrain investigation.

X2.3.2 *Sampling*—Samples should be so chosen from each different stratum in the deposit discernible to the sampler. An estimate of the quantity of the different materials should be made. If the deposit is worked as an open-face bank or pit, samples should be taken by channeling the face vertically, bottom to top, so as to represent the materials proposed for use. Overburdened or disturbed material should not be included in the sample. Test holes should be excavated or drilled at numerous locations in the deposit to determine the quality of the material and the extent of the deposit beyond the exposed face, if any. The number and depth of test holes will depend upon the quantity of the material needed, topography of the area, nature of the deposit, character of the material, and potential value of the material in the deposit. If visual inspection indicates that there is considerable variation in the material, individual samples should be selected from the material in each well-defined stratum. Each sample should be thoroughly mixed and quartered if necessary so that the field sample thus obtained will be at least *25* lb (12 kg) for sand and 75 lb (35 kg) if the deposit contains an appreciable amount of coarse aggregate.

X2.3.3 *Record*—In addition to the general information accompanying all samples the following information should accompany samples of bank run sand and gravel:

X2.3.3. I Location of supply.

X2.3.3.2 Estimate of approximate quantity available.

X2.3.3.3 Quantity and character of overburden.

X2.3.3.4 Length of haul to proposed site of work.

X2.3.3.5 Character of haul (kind of road, maximum grades, etc.)

X2.3.3.6 Details as to extent and location of material represented by each sample.

NOTE X2.2—A sketch of plans and elevations, showing the thickness and location of different layers, is recommended for this purpose.

X3. NUMBER AND SIZE OF INCREMENTS NEEDED TO ESTIMATE CHARACTER OF UNIT SAMPLED

X3.1 Scope

X3.1.1 This appendix presents the rationale used by the responsible committee in the development of this practice.

X3.2 Descriptions of Terms Specific to This Standard

X3.2. 1 *field sample*—a quantity of the material to be tested of sufficient size to provide an acceptable estimate of the average quality of a unit.

X3.2.2 *lot*—a sizable isolated quantity of bulk material from a single source, assumed to have been produced by the same process (for example, a day's production or a specific mass or volume).

X3.2.3 *test portion*—a quantity of the material of sufficient size extracted from the larger field sample by a procedure designed to ensure accurate representation of the field sample, and thus of the unit sampled.

X3.2.4 *unit*—a batch or finite subdivision of a lot of bulk material (for example, a truck load or a specific area covered).

X3.3 Test Unit, Size, and Variability

X3.3.1 The unit to be represented by a single field sample should neither be so large as to mask the effects of significant variability within the unit nor be so small as to be affected by the inherent variability between small portions of any bulk material.

X3.3.2 A unit of bulk material composed of graded aggregate or aggregate mixtures might consist of a full truckload. If it were possible, the entire load might be tested; as a practical matter, a field sample is composed of three or more increments chosen at random from the material as it is loaded or unloaded from the truck. Research has shown that such a procedure permits an acceptable estimate to be made of the average gradation that might be measured from 15 or 20 increments from the truck.

X3.3.3 Significant variability with a lot of material, where it might exist, should be indicated by statistical measures, such as the standard deviation between units selected at random from within the lot.

SUMMARY OF CHANGES

This section identifies the location of selected changes to this practice that have been incorporated since the last issue. For the convenience of the user, Committee D-4 has highlighted those changes that may impact the use of this practice. This section may also include descriptions of the changes or reasons for the changes, or both.

(1) Appendix X3 was added.

Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates[1]

This standard is issued under the fixed designation C 136; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This test method covers the determination of the particle size distribution of fine and coarse aggregates by sieving.

1.2 Some specifications for aggregates which reference this method contain grading requirements including both coarse and fine fractions. Instructions are included for sieve analysis of such aggregates.

1.3 The values stated in SI units are to be regarded as the standard. The values in parentheses are provided for information purposes only. Specification E 11 designates the size of sieve frames with inch units as standard, but in this test method the frame size is designated in SI units exactly equivalent to the inch units.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 117 Test Method for Materials Finer Than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing[2]

C 125 Terminology Relating to Concrete and Concrete Aggregates[2]

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[2]

C 702 Practice for Reducing Field Samples of Aggregate to Testing Size[2]

D 75 Practice for Sampling Aggregates[3]

E 11 Specification for Wire-Cloth and Sieves for Testing Purposes[4]

2.2 *AASHTO Standard:*

AASHTO No. T 27 Sieve Analysis of Fine and Coarse Aggregates[5]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, refer to Terminology C 125.

4. Summary of Test Method

4.1 A sample of dry aggregate of known mass is separated through a series of sieves of progressively smaller openings for determination of particle size distribution.

5. Significance and Use

5.1 This test method is used primarily to determine the grading of materials proposed for use as aggregates or being used as aggregates. The results are used to determine compliance of the particle size distribution with applicable specification requirements and to provide necessary data for control of the production of various aggregate products and mixtures containing aggregates. The data may also be useful in developing relationships concerning porosity and packing.

5.2 Accurate determination of material finer than the 75-μm (No. 200) sieve cannot be achieved by use of this method alone. Test Method C 117 for material finer than 75-μm sieve by washing should be employed.

6. Apparatus

6.1 *Balances*—Balances or scales used in testing fine and coarse aggregate shall have readability and accuracy as follows:

6.1.1 For fine aggregate, readable to 0.1 g and accurate to 0.1 g or 0.1 % of the test load, whichever is greater, at any point within the range of use.

6.1.2 For coarse aggregate, or mixtures of fine and coarse aggregate, readable and accurate to 0.5 g or 0.1 % of the test load, whichever is greater, at any point within the range of use.

6.2 *Sieves*—The sieve cloth shall be mounted on substantial frames constructed in a manner that will prevent loss of material during sieving. The sieve cloth and standard sieve

[1] This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.20 on Normal Weight Aggregates.

Current edition approved June 10, 2001. Published August 2001. Originally published as C 136 – 38 T. Last previous edition C 136 – 96a.

[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.03.

[4] *Annual Book of ASTM Standards*, Vol 14.02.

[5] Available from American Association of State Highway and Transportation Officials, 444 North Capitol St. N.W., Suite 225, Washington, DC 20001.

***A Summary of Changes section appears at the end of this standard.**

frames shall conform to the requirements of Specification E 11. Nonstandard sieve frames shall conform to the requirements of Specification E 11 as applicable.

NOTE 1—It is recommended that sieves mounted in frames larger than standard 203.2-mm (8 in.) diameter be used for testing coarse aggregate to reduce the possibility of overloading the sieves. See 8.3.

6.3 *Mechanical Sieve Shaker*—A mechanical sieving device, if used, shall create motion of the sieves to cause the particles to bounce, tumble, or otherwise turn so as to present different orientations to the sieving surface. The sieving action shall be such that the criterion for adequacy of sieving described in 8.4 is met in a reasonable time period.

NOTE 2—Use of a mechanical sieve shaker is recommended when the size of the sample is 20 kg or greater, and may be used for smaller samples, including fine aggregate. Excessive time (more than approximately 10 min) to achieve adequate sieving may result in degradation of the sample. The same mechanical sieve shaker may not be practical for all sizes of samples, since the large sieving area needed for practical sieving of a large nominal size coarse aggregate very likely could result in loss of a portion of the sample if used for a small sample of coarse aggregate or fine aggregate.

6.4 *Oven*—An oven of appropriate size capable of maintaining a uniform temperature of 110 ± 5°C (230 ± 9°F).

7. Sampling

7.1 Sample the aggregate in accordance with Practice D 75. The size of the field sample shall be the quantity shown in Practice D 75 or four times the quantity required in 7.4 and 7.5 (except as modified in 7.6), whichever is greater.

7.2 Thoroughly mix the sample and reduce it to an amount suitable for testing using the applicable procedures described in Practice C 702. The sample for test shall be approximately the quantity desired when dry and shall be the end result of the reduction. Reduction to an exact predetermined quantity shall not be permitted.

NOTE 3—Where sieve analysis, including determination of material finer than the 75-µm sieve, is the only testing proposed, the size of the sample may be reduced in the field to avoid shipping excessive quantities of extra material to the laboratory.

7.3 *Fine Aggregate*—The size of the test sample, after drying, shall be 300 g minimum.

7.4 *Coarse Aggregate*—The size of the test sample of coarse aggregate shall conform with the following:

Nominal Maximum Size, Square Openings, mm (in.)	Test Sample Size, min, kg (lb)
9.5 (⅜)	1 (2)
12.5 (½)	2 (4)
19.0 (¾)	5 (11)
25.0 (1)	10 (22)
37.5 (1½)	15 (33)
50 (2)	20 (44)
63 (2½)	35 (77)
75 (3)	60 (130)
90 (3½)	100 (220)
100 (4)	150 (330)
125 (5)	300 (660)

7.5 *Coarse and Fine Aggregate Mixtures*—The size of the test sample of coarse and fine aggregate mixtures shall be the same as for coarse aggregate in 7.4.

7.6 *Samples of Large Size Coarse Aggregate*—The size of sample required for aggregate with 50-mm nominal maximum size or larger is such as to preclude convenient sample reduction and testing as a unit except with large mechanical splitters and sieve shakers. As an option when such equipment is not available, instead of combining and mixing sample increments and then reducing the field sample to testing size, conduct the sieve analysis on a number of approximately equal sample increments such that the total mass tested conforms to the requirement of 7.4.

7.7 In the event that the amount of material finer than the 75-µm (No. 200) sieve is to be determined by Test Method C 117, proceed as follows:

7.7.1 For aggregates with a nominal maximum size of 12.5 mm (1/2 in.) or less, use the same test sample for testing by Test Method C 117 and this method. First test the sample in accordance with Test Method C 117 through the final drying operation, then dry sieve the sample as stipulated in 8.2-8.7 of this method.

7.7.2 For aggregates with a nominal maximum size greater than 12.5 mm (½ in.), a single test sample may be used as described in 7.7.1, or separate test samples may be used for Test Method C 117 and this method.

7.7.3 Where the specifications require determination of the total amount of material finer than the 75-µm sieve by washing and dry sieving, use the procedure described in 7.7.1.

8. Procedure

8.1 Dry the sample to constant mass at a temperature of 110 ± 5°C (230 ± 9°F).

NOTE 4—For control purposes, particularly where rapid results are desired, it is generally not necessary to dry coarse aggregate for the sieve analysis test. The results are little affected by the moisture content unless: (*1*) the nominal maximum size is smaller than about 12.5 mm (½ in.); (*2*) the coarse aggregate contains appreciable material finer than 4.75 mm (No. 4); or (*3*) the coarse aggregate is highly absorptive (a lightweight aggregate, for example). Also, samples may be dried at the higher temperatures associated with the use of hot plates without affecting results, provided steam escapes without generating pressures sufficient to fracture the particles, and temperatures are not so great as to cause chemical breakdown of the aggregate.

8.2 Select sieves with suitable openings to furnish the information required by the specifications covering the material to be tested. Use additional sieves as desired or necessary to provide other information, such as fineness modulus, or to regulate the amount of material on a sieve. Nest the sieves in order of decreasing size of opening from top to bottom and place the sample on the top sieve. Agitate the sieves by hand or by mechanical apparatus for a sufficient period, established by trial or checked by measurement on the actual test sample, to meet the criterion for adequacy or sieving described in 8.4.

8.3 Limit the quantity of material on a given sieve so that all particles have opportunity to reach sieve openings a number of times during the sieving operation. For sieves with openings smaller than 4.75-mm (No. 4), the quantity retained on any sieve at the completion of the sieving operation shall not exceed 7 kg/m^2 of sieving surface area (Note 5). For sieves with openings 4.75 mm (No. 4) and larger, the quantity retained in kg shall not exceed the product of 2.5 × (sieve opening, mm × (effective sieving area, m^2)). This quantity is shown in Table 1 for five sieve-frame dimensions in common

TABLE 1 Maximum Allowable Quantity of Material Retained on a Sieve, kg

Sieve Opening Size, mm	Nominal Dimensions of Sieve[A]				
	203.2-mm dia[B]	254-mm dia[B]	304.8-mm dia[B]	350 by 350 mm	372 by 580 mm
	Sieving Area, m^2				
	0.0285	0.0457	0.0670	0.1225	0.2158
125	C	C	C	C	67.4
100	C	C	C	30.6	53.9
90	C	C	15.1	27.6	48.5
75	C	8.6	12.6	23.0	40.5
63	C	7.2	10.6	19.3	34.0
50	3.6	5.7	8.4	15.3	27.0
37.5	2.7	4.3	6.3	11.5	20.2
25.0	1.8	2.9	4.2	7.7	13.5
19.0	1.4	2.2	3.2	5.8	10.2
12.5	0.89	1.4	2.1	3.8	6.7
9.5	0.67	1.1	1.6	2.9	5.1
4.75	0.33	0.54	0.80	1.5	2.6

[A] Sieve frame dimensions in inch units: 8.0-in. diameter; 10.0-in. diameter, 12.0-in. diameter; 13.8 by 13.8 in. (14 by 14 in. nominal); 14.6 by 22.8 in. (16 by 24 in. nominal).

[B] The sieve area for round sieve frames is based on an effective diameter 12.7 mm (½ in.) less than the nominal frame diameter, because Specification E 11 permits the sealer between the sieve cloth and the frame to extend 6.35 mm (¼ in.) over the sieve cloth. Thus the effective sieving diameter for a 203.2-mm (8.0-in.) diameter sieve frame is 190.5 mm (7.5 in.). Some manufacturers of sieves may not infringe on the sieve cloth by the full 6.35 mm (¼ in.).

[C] Sieves indicated have less than five full openings and should not be used for sieve testing except as provided in 8.6.

use. In no case shall the quantity retained be so great as to cause permanent deformation of the sieve cloth.

8.3.1 Prevent an overload of material on an individual sieve by one of the following methods:

8.3.1.1 Insert an additional sieve with opening size intermediate between the sieve that may be overloaded and the sieve immediately above that sieve in the original set of sieves.

8.3.1.2 Split the sample into two or more portions, sieving each portion individually. Combine the masses of the several portions retained on a specific sieve before calculating the percentage of the sample on the sieve.

8.3.1.3 Use sieves having a larger frame size and providing greater sieving area.

NOTE 5—The 7 kg/m^2 amounts to 200 g for the usual 203.2-mm (8-in.) diameter sieve (with effective sieving surface diameter of 190.5 mm (7.5 in.)).

8.4 Continue sieving for a sufficient period and in such manner that, after completion, not more than 1 % by mass of the material retained on any individual sieve will pass that sieve during 1 min of continuous hand sieving performed as follows: Hold the individual sieve, provided with a snug-fitting pan and cover, in a slightly inclined position in one hand. Strike the side of the sieve sharply and with an upward motion against the heel of the other hand at the rate of about 150 times per minute, turn the sieve about one sixth of a revolution at intervals of about 25 strokes. In determining sufficiency of sieving for sizes larger than the 4.75-mm (No. 4) sieve, limit the material on the sieve to a single layer of particles. If the size of the mounted testing sieves makes the described sieving motion impractical, use 203-mm (8 in.) diameter sieves to verify the sufficiency of sieving.

8.5 In the case of coarse and fine aggregate mixtures, the portion of the sample finer than the 4.75-mm (No. 4) sieve may be distributed among two or more sets of sieves to prevent overloading of individual sieves.

8.5.1 Alternatively, the portion finer than the 4.75-mm (No. 4) sieve may be reduced in size using a mechanical splitter according to Practice C 702. If this procedure is followed, compute the mass of each size increment of the original sample as follows:

$$A = \frac{W_1}{W_2} \times B \quad (1)$$

where:

A = mass of size increment on total sample basis,
W_1 = mass of fraction finer than 4.75-mm (No. 4) sieve in total sample,
W_2 = mass of reduced portion of material finer than 4.75-mm (No. 4) sieve actually sieved, and
B = mass of size increment in reduced portion sieved.

8.6 Unless a mechanical sieve shaker is used, hand sieve particles larger than 75 mm (3 in.) by determining the smallest sieve opening through which each particle will pass. Start the test on the smallest sieve to be used. Rotate the particles, if necessary, in order to determine whether they will pass through a particular opening; however, do not force particles to pass through an opening.

8.7 Determine the mass of each size increment on a scale or balance conforming to the requirements specified in 5.1 to the nearest 0.1 % of the total original dry sample mass. The total mass of the material after sieving should check closely with original mass of sample placed on the sieves. If the amounts differ by more than 0.3 %, based on the original dry sample mass, the results should not be used for acceptance purposes.

8.8 If the sample has previously been tested by Test Method C 117, add the mass finer than the 75-µm (No. 200) sieve determined by that method to the mass passing the 75-µm (No. 200) sieve by dry sieving of the same sample in this method.

9. Calculation

9.1 Calculate percentages passing, total percentages retained, or percentages in various size fractions to the nearest 0.1 % on the basis of the total mass of the initial dry sample. If the same test sample was first tested by Test Method C 117, include the mass of material finer than the 75-µm (No. 200) size by washing in the sieve analysis calculation; and use the total dry sample mass prior to washing in Test Method C 117 as the basis for calculating all the percentages.

9.1.1 When sample increments are tested as provided in 7.6, total the masses of the portion of the increments retained on each sieve, and use these masses to calculate the percentages as in 9.1.

9.2 Calculate the fineness modulus, when required, by adding the total percentages of material in the sample that is coarser than each of the following sieves (cumulative percentages retained), and dividing the sum by 100: 150-µm (No. 100), 300-µm (No. 50), 600-µm (No. 30), 1.18-mm (No. 16), 2.36-mm (No. 8), 4.75-mm (No. 4), 9.5-mm (⅜-in.), 19.0-mm (¾-in.), 37.5-mm (1½-in.), and larger, increasing in the ratio of 2 to 1.

10. Report

10.1 Depending upon the form of the specifications for use of the material under test, the report shall include the following:

10.1.1 Total percentage of material passing each sieve, or

10.1.2 Total percentage of material retained on each sieve, or

10.1.3 Percentage of material retained between consecutive sieves.

10.2 Report percentages to the nearest whole number, except if the percentage passing the 75-μm (No. 200) sieve is less than 10 %, it shall be reported to the nearest 0.1 %.

10.3 Report the fineness modulus, when required, to the nearest 0.01.

11. Precision and Bias

11.1 *Precision*—The estimates of precision for this test method are listed in Table 2. The estimates are based on the results from the AASHTO Materials Reference Laboratory Proficiency Sample Program, with testing conducted by Test Method C 136 and AASHTO Test Method T 27. The data are based on the analyses of the test results from 65 to 233 laboratories that tested 18 pairs of coarse aggregate proficiency test samples and test results from 74 to 222 laboratories that tested 17 pairs of fine aggregate proficiency test samples (Samples No. 21 through 90). The values in the table are given for different ranges of total percentage of aggregate passing a sieve.

11.1.1 The precision values for fine aggregate in Table 2 are based on nominal 500-g test samples. Revision of this test method in 1994 permits the fine aggregate test sample size to be 300 g minimum. Analysis of results of testing of 300-g and 500-g test samples from Aggregate Proficiency Test Samples 99 and 100 (Samples 99 and 100 were essentially identical) produced the precision values in Table 3, which indicate only minor differences due to test sample size.

NOTE 6—The values for fine aggregate in Table 2 will be revised to reflect the 300-g test sample size when a sufficient number of Aggregate Proficiency Tests have been conducted using that sample size to provide reliable data.

TABLE 2 Precision

	Total Percentage of Material Passing		Standard Deviation (1s), %[A]	Acceptable Range of Two Results (d2s), %[A]
Coarse Aggregate:[B]				
Single-operator precision	<100	≥95	0.32	0.9
	<95	≥85	0.81	2.3
	<85	≥80	1.34	3.8
	<80	≥60	2.25	6.4
	<60	≥20	1.32	3.7
	<20	≥15	0.96	2.7
	<15	≥10	1.00	2.8
	<10	≥5	0.75	2.1
	<5	≥2	0.53	1.5
	<2	>0	0.27	0.8
Multilaboratory precision	<100	≥95	0.35	1.0
	<95	≥85	1.37	3.9
	<85	≥80	1.92	5.4
	<80	≥60	2.82	8.0
	<60	≥20	1.97	5.6
	<20	≥15	1.60	4.5
	<15	≥10	1.48	4.2
	<10	≥5	1.22	3.4
	<5	≥2	1.04	3.0
	<2	>0	0.45	1.3
Fine Aggregate:				
Single-operator precision	<100	≥95	0.26	0.7
	<95	≥60	0.55	1.6
	<60	≥20	0.83	2.4
	<20	≥15	0.54	1.5
	<15	≥10	0.36	1.0
	<10	≥2	0.37	1.1
	<2	>0	0.14	0.4
Multilaboratory precision	<100	≥95	0.23	0.6
	<95	≥60	0.77	2.2
	<60	≥20	1.41	4.0
	<20	≥15	1.10	3.1
	<15	≥10	0.73	2.1
	<10	≥2	0.65	1.8
	<2	>0	0.31	0.9

[A] These numbers represent, respectively, the (1s) and (d2s) limits described in Practice C 670.

[B] The precision estimates are based on aggregates with nominal maximum size of 19.0 mm (¾ in.).

11.2 *Bias*—Since there is no accepted reference material suitable for determining the bias in this test method, no statement on bias is made.

12. Keywords

12.1 aggregate; coarse aggregate; fine aggregate; gradation; grading; sieve analysis; size analysis

TABLE 3 Precision Data for 300-g and 500-g Test Samples

Fine Aggregate Proficiency Sample				Within Laboratory		Between Laboratory	
Test Result	Sample Size	Number Labs	Average	1s	d2s	1s	d2s
ASTM C136/AASHTO T27							
Total material passing the No. 4 sieve (%)	500 g	285	99.992	0.027	0.066	0.037	0.104
	300 g	276	99.990	0.021	0.060	0.042	0.117
Total material passing the No. 8 sieve (%)	500 g	281	84.10	0.43	1.21	0.63	1.76
	300 g	274	84.32	0.39	1.09	0.69	1.92
Total material passing the No. 16 sieve (%)	500 g	286	70.11	0.53	1.49	0.75	2.10
	300 g	272	70.00	0.62	1.74	0.76	2.12
Total material passing the No. 30 sieve (%)	500 g	287	48.54	0.75	2.10	1.33	3.73
	300 g	276	48.44	0.87	2.44	1.36	3.79
Total material passing the No. 50 sieve (%)	500 g	286	13.52	0.42	1.17	0.98	2.73
	300 g	275	13.51	0.45	1.25	0.99	2.76
Total material passing the No. 100 sieve (%)	500 g	287	2.55	0.15	0.42	0.37	1.03
	300 g	270	2.52	0.18	0.52	0.32	0.89
Total Material passing the No. 200 sieve (%)	500 g	278	1.32	0.11	0.32	0.31	0.85
	300 g	266	1.30	0.14	0.39	0.31	0.85

SUMMARY OF CHANGES

This section identifies the location of changes to this test method that have been incorporatedsince the last issue.

(1) Paragraph 8.4 was revised.