GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

April 18, 2008
Project 071810

Mr. William H. Wolfe
Senior Engineer
Norlite Corporation
628 South Saratoga Street
Cohoes, New York 12047

Dear Mr. Wolfe:

Re: **Geotechnical Testing for Norlite Lightweight Aggregate**
Norlite Corporation
Cohoes, New York

This letter report presents the results of the laboratory and field testing program performed by GEI Consultants, Inc. on ¾-inch Norlite lightweight aggregate. The lightweight aggregate is an expanded shale material manufactured by the Norlite Corporation. Material for the laboratory testing program was supplied by Norlite in early June 2007. Field testing was performed at the Norlite facility in Cohoes, New York on June 29, 2007.

The testing program was performed to evaluate geotechnical properties of Norlite's current production of ¾-inch lightweight aggregate.

Mr. William Wolfe of Norlite Corporation authorized our work by signed copy of GEI proposal 614618 (Rev. 1) dated August 21, 2006, and subsequent proposal revisions.

Scope of Work

Our scope included the following laboratory and field tests:

1. Grain size analyses

2. Density tests
   - Maximum-minimum density
   - Compaction

3. Permeability tests

4. Triaxial compression tests

GEI Consultants, Inc.
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5. Electrical and chemical properties tests
   - Chloride content
   - Sulfate content
   - Laboratory and Field Resistivity
   - pH
   - Organic content

6. Durability tests
   - LA abrasion
   - Soundness

7. California bearing ratio (CBR) tests

Index, density, triaxial, pH, and organic content tests were performed by GEI at our Woburn, Massachusetts location. Permeability, LA abrasion, soundness, and CBR tests were performed by GeoTesting Express of Boxborough, Massachusetts. Sulfate and chloride content tests were performed by Alternative Testing Laboratories, Inc. of Lamont Furnace, Pennsylvania. The laboratory resistivity test was performed by Navarro & Wright Consulting Engineers, Inc. of New Cumberland, Pennsylvania.

GEI performed field electrical resistivity measurements of lightweight aggregate stockpiles at Norlite's facility in Cohoes, New York.

General

Norlite lightweight aggregate is manufactured at the Norlite facility in Cohoes by expanding and vitrifying shale in a rotary kiln at temperatures of about 2,000°F. At this temperature, gases forming inside the shale particles cause expansion of the shale particles, and result in small cavities. The lightweight material formed in this manner is then crushed and sorted into various gradations.

The dry density of this material, as defined in this report, is the oven-dried sample weight divided by the total sample volume. The total sample volume includes the volume of the entrapped air within the aggregate particles and the void spaces between aggregate particles.

Grain Size Analyses

We performed four grain size analyses in general accordance with ASTM C136, "Standard Test Method for Sieve Analyses of Fine and Coarse Aggregates." Two of the grain size analyses were performed on lightweight aggregate at the "as-delivered" condition. The third analysis was performed on the sample used for triaxial test S6 prior to performing the test. The fourth test was performed on the same material following completion of the triaxial test.

A plot of the three grain size curves performed prior to any testing is shown in Figure A1. Plots of the grain size analyses performed on the sample prior to and following completion of triaxial test S6 are shown in Figure A2. Individual grain size curves are presented in Figures A3 to A6.

Grain size analyses results from the three as-delivered samples indicate consistent gradation of the lightweight aggregate. Examination of the grain size analyses in Figure A2 suggests some breakage of the lightweight aggregate during preparation and triaxial testing.

Density Tests

Maximum-Minimum Density Tests

We performed maximum and minimum density tests in general accordance with ASTM procedures D4253 and D4254, respectively. The results of the tests are presented in Appendix B1.

The maximum density test was performed using an eccentric weight, vertically vibrating table to densify aggregate placed in a mold. One maximum density was measured using oven-dried aggregate (Method 2A) and one using wet aggregate (Method 2B). Both tests were conducted using a 0.5 cubic foot mold.

The minimum density test was performed by pouring dry aggregate loosely into a 0.5 cubic foot mold using Method A.

The maximum dry density of the lightweight aggregate was 43.2 lb/ft^3 using the wet method and 43.5 lb/ft^3 using the dry method. The minimum dry density was 42.5 lb/ft^3.

Compaction Tests

To measure the compacted density, we performed one Standard Proctor in general accordance with ASTM D698, Method C and one test at a reduced compaction energy. The results of the Standard Proctor tests are shown in Appendix B2.

The Standard Proctor test was performed using six trial points and water contents varying between 1.4 and 10.4 percent. The compacted dry density was determined to be about 53 lb/ft^3 as shown in Table B2. As shown in Figure B2, the compacted density of the lightweight aggregate does not appear to be sensitive to its moisture content. The Standard Proctor compaction test caused visible grain breakage of the aggregate. The higher measured densities relative to the maximum density test densities are likely caused by grain breakage causing the void spaces to become partially filled with broken aggregate.

A second compaction test was performed at a reduced energy to help evaluate the effects of grain breakage. The second test was performed using 25 blows per lift instead of 56 blows per lift. As shown in Table B2, the maximum compacted dry density of this test was 52.2 lb/ft^3, with an average compacted density of 49 lb/ft^3. The maximum dry densities determined by the modified Standard Proctor test are still higher than the maximum index density of the material. The higher densities at lower water contents shown in Figure B1 may be a result of greater grain breakage of the drier materials. The natural "as-delivered" moisture content of the lightweight aggregate is approximately 7.5 percent. Table B1 shows a compacted density of approximately 48 lb/ft^3 at that water content.

The minimum index density of 42.5 lb/ft^3 is very close to the average maximum index density of 43.4 lb/ft^3 obtained using the ASTM D-4253 procedure. Therefore, it appears that a relatively compact material can be achieved without much compactive effort.

We anticipate, however, that regardless of the method of placement of the lightweight aggregate, some breakage will occur. Therefore, we performed the remaining tests on either "loose" material, at approximate dry densities of 42.5 lb/ft^3 or lower, or "dense" material with approximate dry densities of 47 lb/ft^3. The density of 47 lb/ft^3 was chosen as approximately the average between the maximum index density (ASTM D4253) and the densities obtained from the modified Standard

Proctor test (ASTM D698). This density appears to be representative of the density of placed and lightly compacted lightweight aggregate in the field, the "as-placed" density.

Permeability Tests

GeoTesting Express performed two constant head permeability tests in a 10-inch diameter permeameter, in general accordance with ASTM D2434, "Standard Test Method for Permeability of Granular Soils (Constant Head)". The results of the constant head permeability tests are shown in Appendix C.

The first test was performed in material loosely placed in the permeameter, resulting in a measured dry density of 40.1 lb/ft^3. The second test was performed on material lightly compacted in the permeameter in lifts, resulting in a dry density of 47.0 lb/ft^3. To allow water to saturate the porous lightweight aggregate, both samples were soaked for 48 hours in de-aired water prior to testing. The tests were performed at gradients varying between 0.33 to 0.44 and 0.26 to 0.38 for the loose and dense samples respectively.

The results of these tests are presented in Table C1. The average permeability of the loose sample was 2.5 cm/sec. The average permeability of the dry sample was 1.1 cm/sec.

Triaxial Compression Tests

We performed two sets of consolidated-drained triaxial compression (CIDC) tests on loose and dense specimens of lightweight aggregate. The samples were prepared using different methods to compact the samples to achieve loose and dense samples. Three consolidation stresses were used for each set of tests. Due to the size of the aggregate, the tests were performed on specimens approximately 6 inches in diameter and 12 inches in height. Results of the triaxial tests are summarized in Table D1 and shown in Figures D1 through D6 of Appendix D. Photos of the testing are shown on the last page of Appendix D.

Aggregate used for triaxial testing was soaked in de-aired water for 48 hours prior to testing. Loose specimens were prepared by loosely placing the aggregate in a membrane lined split mold, centered over the bottom pedestal of the triaxial test frame. Achieved dry densities varied between 41.5 and 43 lb/ft^3. Dense specimens were placed in the mold in one inch thicknesses and each lightly tamped. This method of placement resulted in densities ranging between 45.9 and 46.3 lb/ft^3.

The specimens were subjected to a vacuum through the top and bottom platens to allow removal of the split mold, leaving the specimen intact. The compression chamber was then assembled and the cell was filled with water. All the specimens were back-pressure saturated to fill the voids between the aggregate particles with water. The loose samples were then consolidated to 0.74, 2.2 and 4.1 kips/ft^3. The dense samples were consolidated to 0.41, 2.1 and 4.2 kips/ft^3. Once consolidated, the samples were loaded in compression and sheared with the drain lines open.

Figures D1 through D6 show that the friction angle decreased with increasing confining stress in both sets of tests. It varied from 42.1 to 37.5 degrees for the loose specimen and from 55.7 to 42.6 degrees for the dense specimen. Both loose and dense specimens dilated during shearing under the lower confining stresses, and became increasingly contractive with increasing confining stress.

The membrane of test S2 developed a leak at the end of the test. The membrane of test S3 ruptured at 11.5 percent strain. Therefore, subsequent tests were performed using a double membrane.

Electrical and Chemical Properties Tests

pH

We performed a total of three pH tests on the lightweight aggregate in general accordance with AASHTO T289, "Standard Method of Test for Determining pH of Soil for Use in Corrosion Testing." The tests were performed on crushed material passing the No. 10 sieve. The average pH of the material was 6.76. Test results are summarized in Table E1.

Chloride Content

Alternative Testing Laboratories performed one test for water soluble chloride ion content in soil. The test was performed in accordance with AASHTO T290, "Determining Water-Soluble Chloride Ion Content in Soil," Method A, except the material was tested in its "as-delivered" condition. The AASHTO procedure calls for pulverizing the material and testing the portion that passes the No. 10 sieve. The material was tested "as-delivered," because this condition would more accurately represent the placed condition of the lightweight aggregate. Placement of the material and light compaction of the material in the field would not result in pulverized material.

The water soluble chloride content of the "as-delivered" lightweight aggregate was 24 ppm. The chloride test results are included in Appendix E1.

Sulfate Content

Similarly, Alternative Testing Laboratories performed one test for water soluble sulfate ion content in soil. The test was performed in accordance with AASHTO T291, "Determining Water-Soluble Sulfate Ion Content in Soil," Method B, except the material was tested "as-delivered". This AASHTO procedure also calls for pulverizing the material and testing the portion that passes the No. 10 sieve. The material was tested "as-delivered," because this condition would more accurately represent the placed condition of the lightweight aggregate. Placement of the material and light compaction of the material in the field would not result in pulverized material

The water soluble sulfate content of the "as-delivered" lightweight aggregate was 74 ppm. The sulfate test results are included in Appendix E1.

Organic Content

We performed one organic content test on crushed material passing the No. 10 sieve in accordance with AASHTO T267, "Standard Method of Test for Determination of Organic Content in Soils by Loss of Ignition". The organic content was determined to be 0.04 percent. The results are tabulated in Table E1.

Resistivity Tests

To measure the resisitivity properties of the lightweight aggregate we performed two types of tests: a laboratory procedure in general accordance with AASHTO T288, "Determining Minimum Laboratory Resistivity" and a field resistivity test in general accordance with ASTM G57, "Field Measurement of Soil Resistivity using the Wenner Four-Electrode Method."

- Laboratory Resistivity Test

Navarro & Wright performed the laboratory resistivity test. In accordance with AASHTO T288, the test was performed on pulverized material passing the No. 10 sieve. Due to the limiting size of the test apparatus, "as-delivered" lightweight aggregate could not be tested.

The minimum resistivity measured was 18,172 ohms-cm. Test data are included in Appendix E2.

- Field Resistivity Test

GEI performed electrical resistivity tests on a stockpile of ¾-inch lightweight aggregate at Norlite's Cohoes facility on July 29, 2007.

The tested stockpile was about 12 feet high and contained about 300 tons of lightweight aggregate. The stockpiled aggregate was placed in the stockpile without compaction. A sketch of the stockpile layout and its dimensions are shown in Figure E2-1. Free water was not observed between aggregate particles at the top of the stockpile. The material was observed to be moist 6 inches below the top of the stockpile. The average water content, as measured by Norlite, was 7.5 percent.

The resistivity tests were performed using a Megger DET5/4 digital earth tester with a range of 0.01ohms to 20,000 ohms, and in general accordance with ASTM G-57, "Standard Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method." To determine the influence of the stockpile shape and base materials on the resistivity measurements, the probe spacing and the orientation of the test arrays were varied as shown on Figure E2-1. Arrays 1a, 2a, and 3a were oriented south to north in the center of the stockpile, whereas arrays 1aa, 2aa, and 3aa were oriented north to south in the center of the stockpile.

The results indicate values above 300,000 ohm-cm in all tests performed. Because of the limited size of the stockpile, it was difficult to achieve the requirement that the probe depth be less than 5 percent of the probe spacing. This requirement was achieved for tests 1c, 1d, 1cc, and 1dd of arrays 1a and 1aa. These test results are summarized in Table E1. The electrical resistivities of these tests ranged from 381,500 ohm-cm to 564,200 ohm-cm.

The above reported electrical resistivity values represent measurements of surface-dry Norlite lightweight aggregate. These resistivity values should not be used for aggregate placed below the groundwater. Because water is highly conductive, it will cause a large decrease in the electrical resistivity of the submerged aggregate.

Durability Tests

LA Abrasion Test

GeoTesting Express performed two LA Abrasion tests in general accordance with ASTM C131, "Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine," (B grading). The test was modified in accordance with FM 1 T-096 – Florida Method of Test to reduce both the weight of lightweight aggregate and the weight of the abrasive charge in the test cylinder. This modification was intended to maintain a volume of lightweight aggregate and abrasive charge in the Los Angeles machine cylinder equivalent to the volume used for normal weight aggregates.

LA abrasion values for the two tests were 24.3 and 24.5 percent loss. Test data are presented in Appendix F.

Soundness Test

GeoTesting Express performed one soundness test on the lightweight aggregate in general accordance with AASHTO C-88, "Standard Test method for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate". This method tests aggregates to estimate their soundness when subjected to weathering action. Five-cycles of the test were performed using the magnesium sulfate solution. The weighted percent loss was 3.41. Test data are presented in Appendix F.

California Bearing Ratio (CBR) Tests

GeoTesting Express performed three CBR tests in general accordance with ASTM D1883, "Standard Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils." Two of the tests were performed on unsoaked material at a target water content of 8.0 percent, the approximate "as-delivered" water content of the material. The remaining test was performed on lightweight aggregate that was soaked in de-aired water for 48 hours. All tests were prepared to achieve a target density of 47 lb/ft^3. The material was placed in five approximately 1-inch-thick lifts and tamped with a proctor hammer. The densities, water contents, and results of the CBR tests are shown in Appendix G.

The results of the first unsoaked test resulted in a CBR value of 13% at a penetration of 0.2 inches. The second CBR test on unsoaked material was performed to confirm the results of the first test. The second test resulted in a CBR of 18% at the same penetration. We believe that the difference in CBRs measured by the two tests may have resulted from the orientation of lightweight aggregate particles below the 3-square-inch-diameter piston prior to load application. Depending on their orientation, shifting of the particles or crushing of the angular edges of the particles under load may have resulted in the different penetrations and CBRs.

The results for the soaked material at a penetration of 0.2 inches was 14 percent, consistent with the first unsoaked test.

Limitations

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no warranty, express or implied, is made.

We appreciate the opportunity to be of service to you on this project. Please call if you have any questions.

Sincerely,

GEI CONSULTANTS, INC.

Anastasia Papadopoulos, P.E.
Senior Project Manager

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Enclosures:

Appendix A – Grain Size Analyses
Appendix B – Density Tests
Appendix C – Permeability Tests
Appendix D – Triaxial Compression Tests
Appendix E – Electrochemical Property Tests
Appendix F – Durability Tests
Appendix G – California Bearing Ratio (CBR) Tests

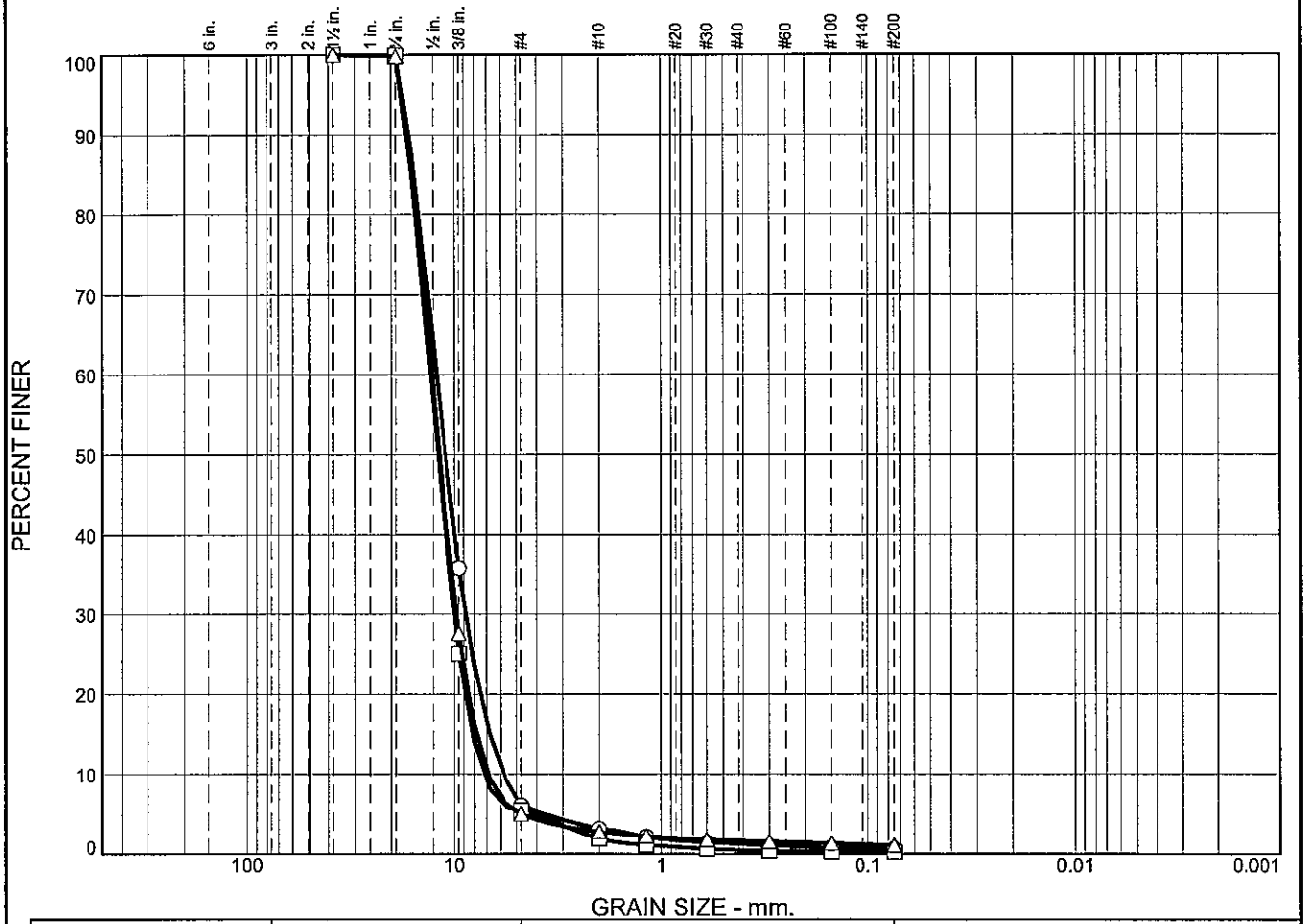
Appendix A – Grain Size Analyses

TABLE A1 - SUMMARY OF INDEX TESTS
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Grain Size Analysis [1]		
Gravel **(%)**	***Sand*** **(%)**	***Fines*** **(%)**
94.9	4.0	1.1
93.9	5.4	0.7
94.6 [2]	5.2 [2]	0.2 [2]
87.1 [3]	12.2 [3]	0.7 [3]

Notes:
1. Grain-size analysis performed on four separate samples in general accordance with ASTM C136
2. Test performed on sample S6 prior to triaxial test
3. Test performed on sample S6 following triaxial test

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.1	93.8	2.9	1.9	0.6	0.7
□	0.0	0.1	94.5	3.5	1.4	0.3	0.2
△	0.0	0.2	94.7	2.3	1.1	0.6	1.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			15.6221	12.2071	11.0851	8.8488	6.7507	5.7946	1.11	2.11
□			16.1244	13.0526	12.0339	10.0529	8.1993	7.2493	1.07	1.80
△	--		16.0298	12.8697	11.8253	9.7861	7.8530	6.8812	1.08	1.87

Material Description	USCS	AASHTO
○ Narrowly graded GRAVEL	GP	A-1-a
□ Narrowly graded GRAVEL	GP	A-1-a
△ Narrowly graded GRAVEL	GP	A-1-a

Project No. 071810 **Client:** Norlite Corp.

Project: Norlite Lightweight Aggregate Testing

Date: ○ 2/28/2008 □ 10/31/07 △ 8/10/07

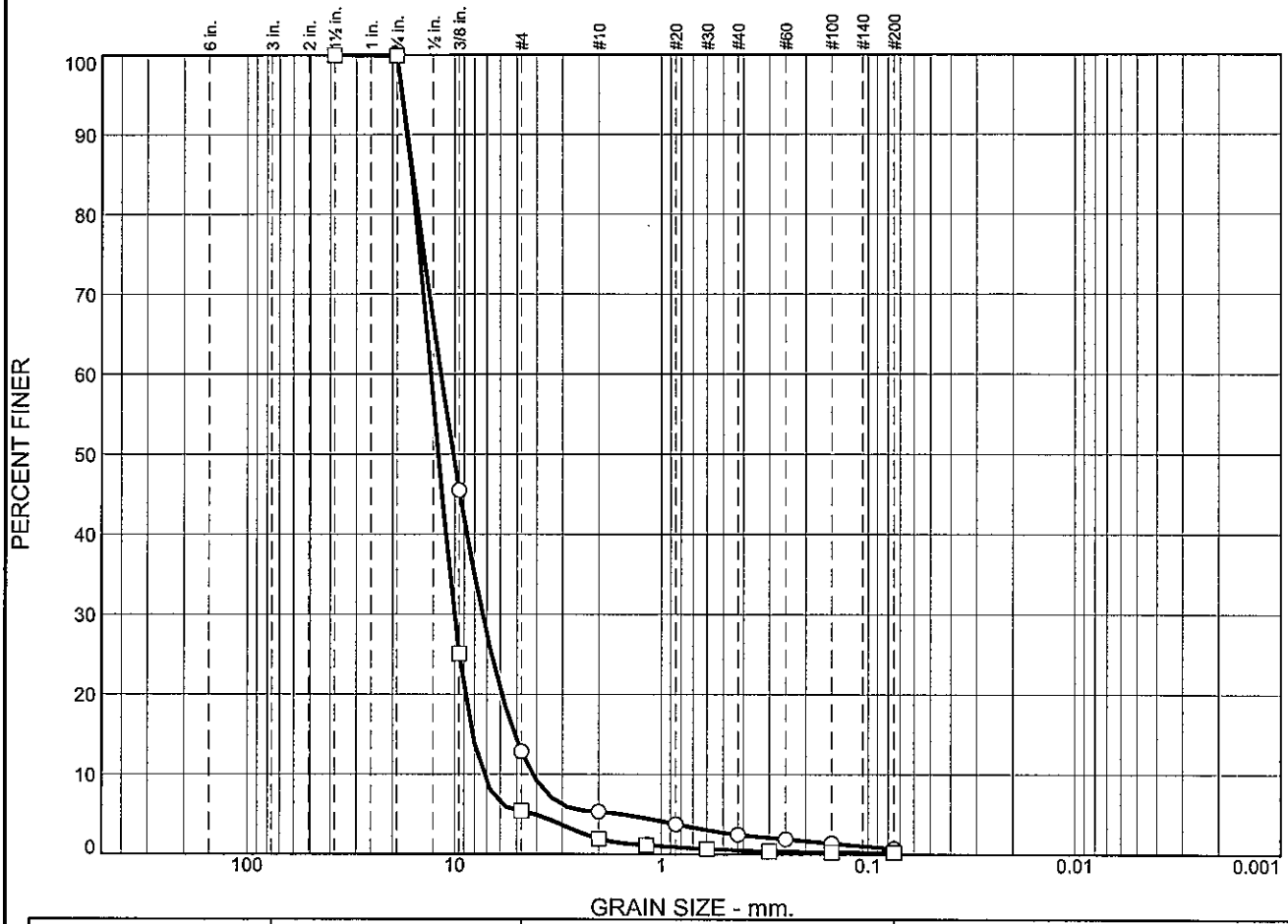
Remarks:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure A1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	87.1	7.6	2.8	1.8	0.7
□	0.0	0.1	94.5	3.5	1.4	0.3	0.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			15.9448	11.6724	10.1738	7.3350	5.1178	4.1796	1.10	2.79
□			16.1244	13.0526	12.0339	10.0529	8.1993	7.2493	1.07	1.80

	Material Description	USCS	AASHTO
○	Narrowly graded GRAVEL	GP	A-1-a
□	Narrowly graded GRAVEL	GP	A-1-a

Project No. 071810 **Client:** Norlite Corp.

Project: Norlite Lightweight Aggregate Testing

○ **Source of Sample:** Post Triax. Test Sample

□ **Source of Sample:** Pre Triax. Test Sample

Date: ○ 11/19/07 □ 10/31/07

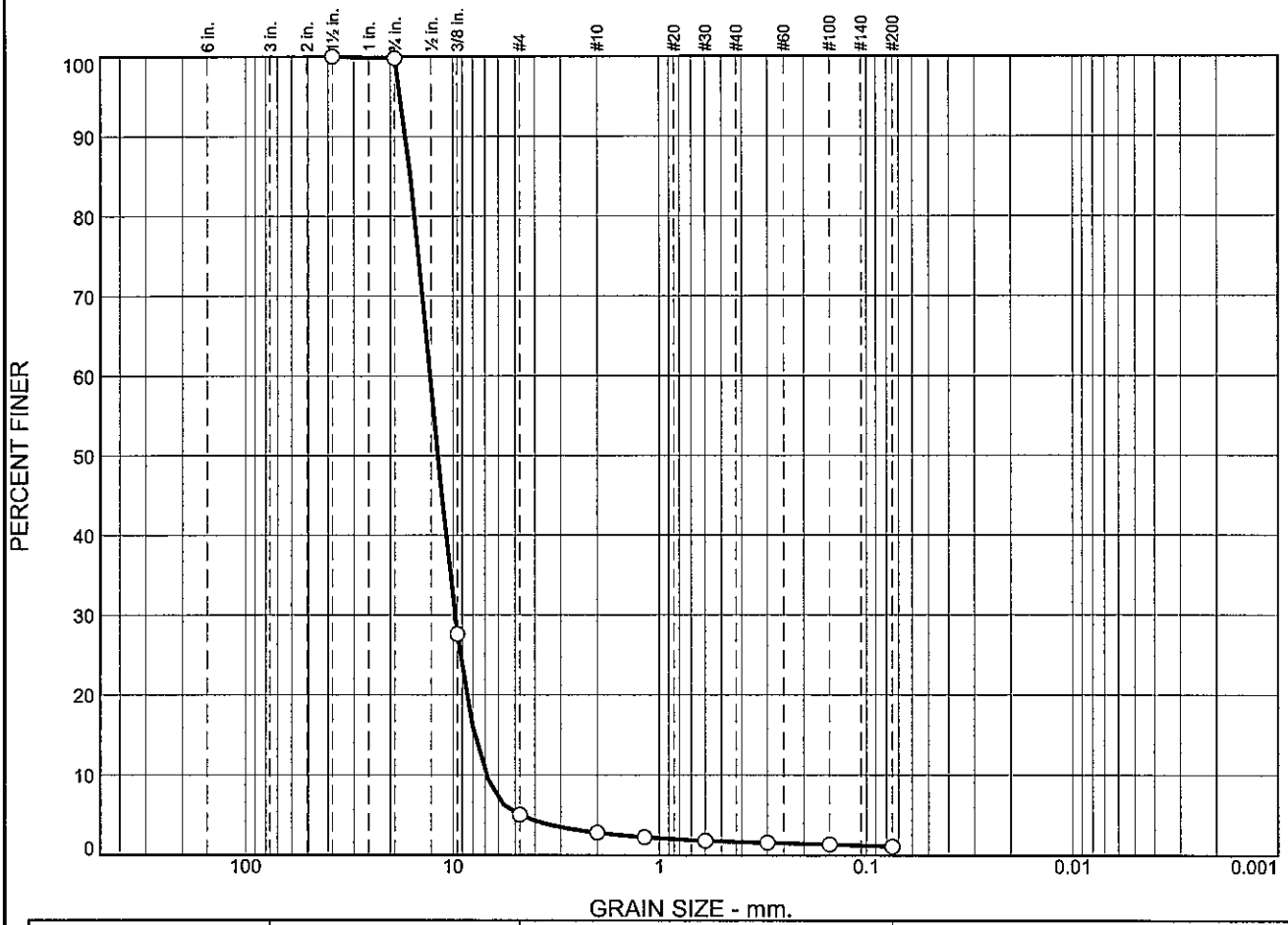
Remarks:

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure A2

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.2	94.7	2.3	1.1	0.6	1.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--		16.0298	12.8697	11.8253	9.7861	7.8530	6.8812	1.08	1.87

Material Description	USCS	AASHTO
○ Narrowly graded GRAVEL	GP	A-1-a

Project No. 071810 **Client:** Norlite Corp.

Project: Norlite Lightweight Aggregate Testing

○

Date: ○ 8/10/07

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Remarks:

○ Test performed in general accordance with ASTM C136

Figure A3

GRAIN SIZE DISTRIBUTION TEST DATA

4/16/2008

Client: Norlite
Project: Norlite Aggregate
Project Number: 071810
Material Description: Narrowly graded GRAVEL
Sample Date: 8/10/07 **Liquid Limit:** --
USCS Classification: GP **AASHTO Classification:** A-1-a
Testing Remarks: Test performed in general accordance with ASTM C136
Tested by: F. Trejo **Checked by:** B. Sawa
Sieve opening list: (Default opening sizes)

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
9532.00	0.00	435.00	1.5	435.00	100.0
			.75	455.00	99.8
			.375	7334.00	27.6
			#4	9484.00	5.1
386.40	0.00	187.70	#10	357.74	2.8
			#16	400.36	2.3
			#30	433.83	1.8
			#50	452.24	1.6
			#100	468.81	1.4
			#200	489.28	1.1

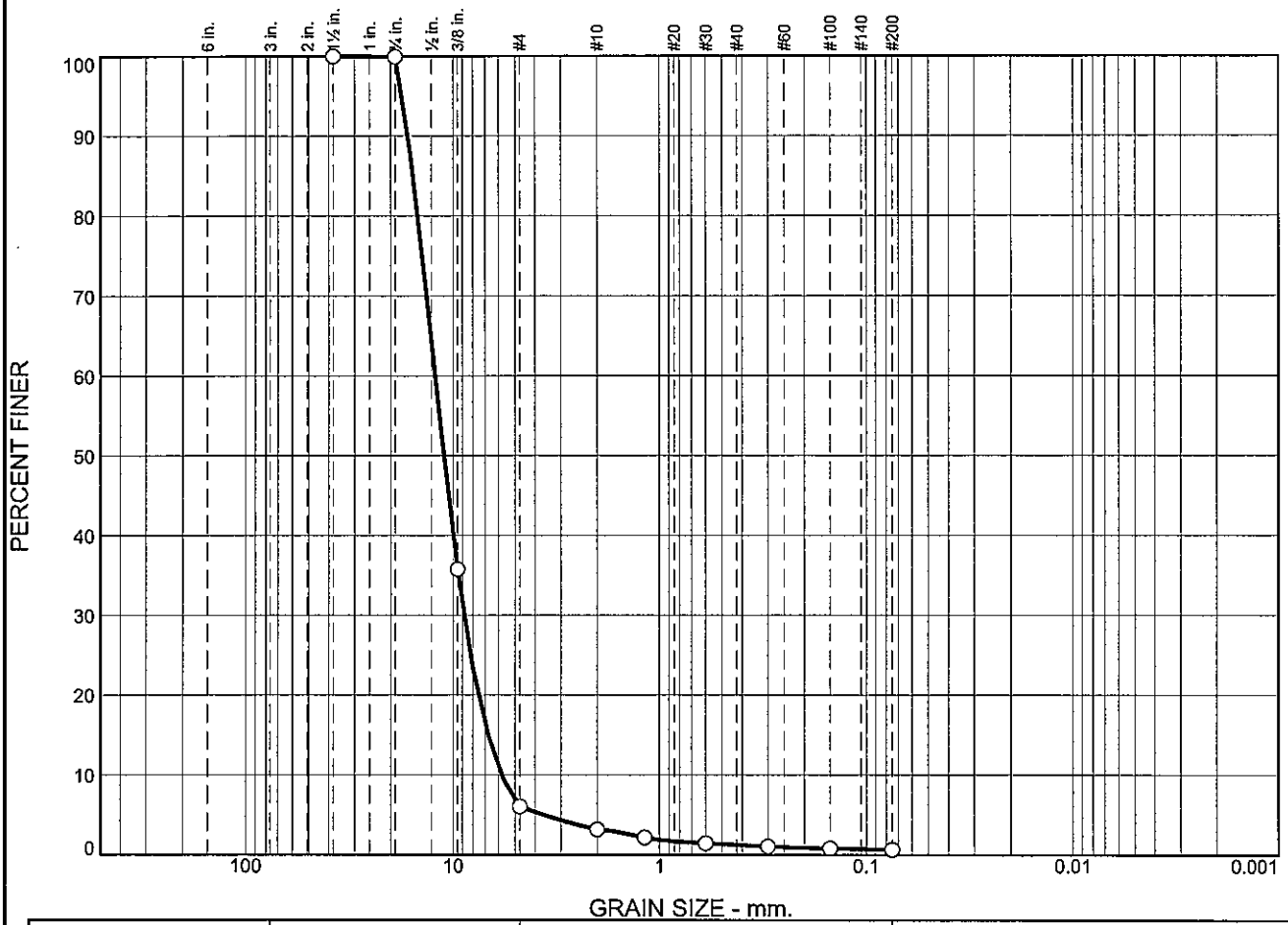
Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.2	94.7	94.9	2.3	1.1	0.6	4.0	1.1

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
6.8812	7.8530	8.5934	9.7861	11.8253	12.8697	15.2916	16.0298	16.8652	17.8511

Fineness Modulus	C_u	C_c
6.57	1.87	1.08

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.1	93.8	2.9	1.9	0.6	0.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			15.6221	12.2071	11.0851	8.8488	6.7507	5.7946	1.11	2.11

Material Description	USCS	AASHTO
○ Narrowly graded GRAVEL	GP	A-1-a

Project No. 071810 **Client:** Norlite Corp.

Project: Norlite Lightweight Aggregate Testing

○

Date: ○ 2/28/2008

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Remarks:

○ Test performed in general accordance with ASTM C136

Figure A4

GRAIN SIZE DISTRIBUTION TEST DATA

4/16/2008

Client: Norlite
Project: Norlite Aggregate
Project Number: 071810
Material Description: Narrowly graded GRAVEL
Sample Date: 2/28/2008
USCS Classification: GP **AASHTO Classification:** A-1-a
Testing Remarks: Test performed in general accordance with ASTM C136
Tested by: A. Cummings **Checked by:** B. Sawa
Sieve opening list: (Default opening sizes)

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
15378.00	0.00	836.00	1.5	836.00	100.0
			0.75	844.00	99.9
			0.375	10712.00	35.8
			#4	15281.00	6.1
348.99	0.00	355.28	#10	519.54	3.2
			#16	577.99	2.2
			#30	619.39	1.5
			#50	642.46	1.1
			#100	656.75	0.8
			#200	664.55	0.7

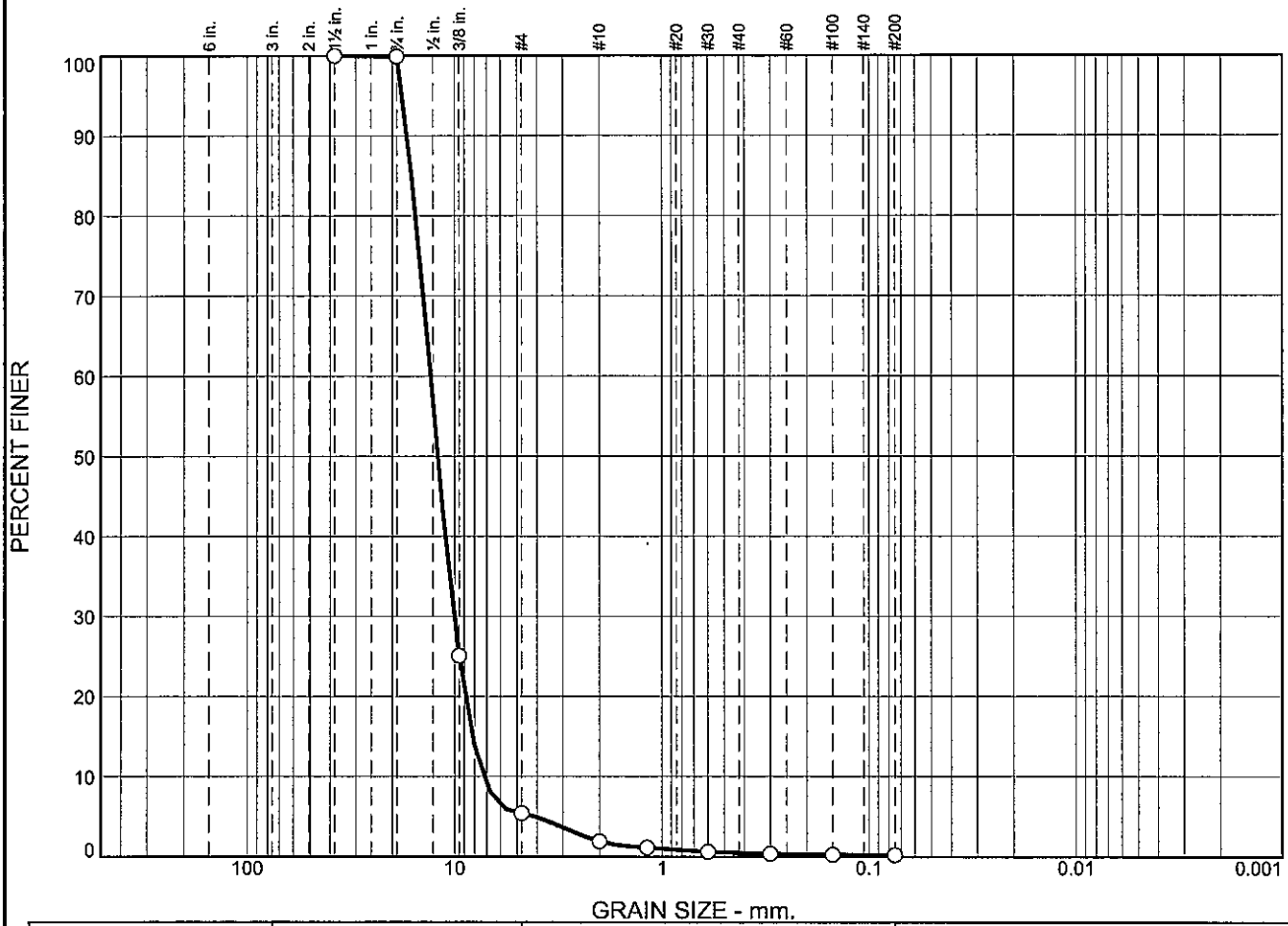
Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.1	93.8	93.9	2.9	1.9	0.6	5.4	0.7

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
5.7946	6.7507	7.5320	8.8488	11.0851	12.2071	14.8183	15.6221	16.5387	17.6335

Fineness Modulus	C_u	C_c
6.49	2.11	1.11

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
O	0.0	0.1	94.5	3.5	1.4	0.3	0.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O			16.1244	13.0526	12.0339	10.0529	8.1993	7.2493	1.07	1.80

Material Description	USCS	AASHTO
O Narrowly graded GRAVEL	GP	A-1-a

Project No. 071810 **Client:** Norlite Corp.

Project: Norlite Lightweight Aggregate Testing

O

Date: O 10/31/07

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Remarks:

O Test performed in general accordance with ASTM C136 Test performed on pre-triaxial test sample (S6)

Figure A5

GRAIN SIZE DISTRIBUTION TEST DATA

4/16/2008

Client: Norlite
Project: Norlite Aggregate
Project Number: 071810
Material Description: Narrowly graded GRAVEL
Sample Date: 10/31/07
USCS Classification: GP **AASHTO Classification:** A-1-a
Testing Remarks: Test performed in general accordance with ASTM C136
Test performed on pre-triaxial test sample (S6)
Tested by: B. Sawa **Checked by:** F. Trejo
Sieve opening list: (Default opening sizes)

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
4192.00	0.00	885.00	1.5	885.00	100.0
			0.75	889.00	99.9
			0.375	4025.00	25.1
247.24	0.00	187.70	#4	381.33	5.4
			#10	415.81	1.9
			#16	423.46	1.2
			#30	428.38	0.7
			#50	430.82	0.4
			#100	432.02	0.3
			#200	432.55	0.2

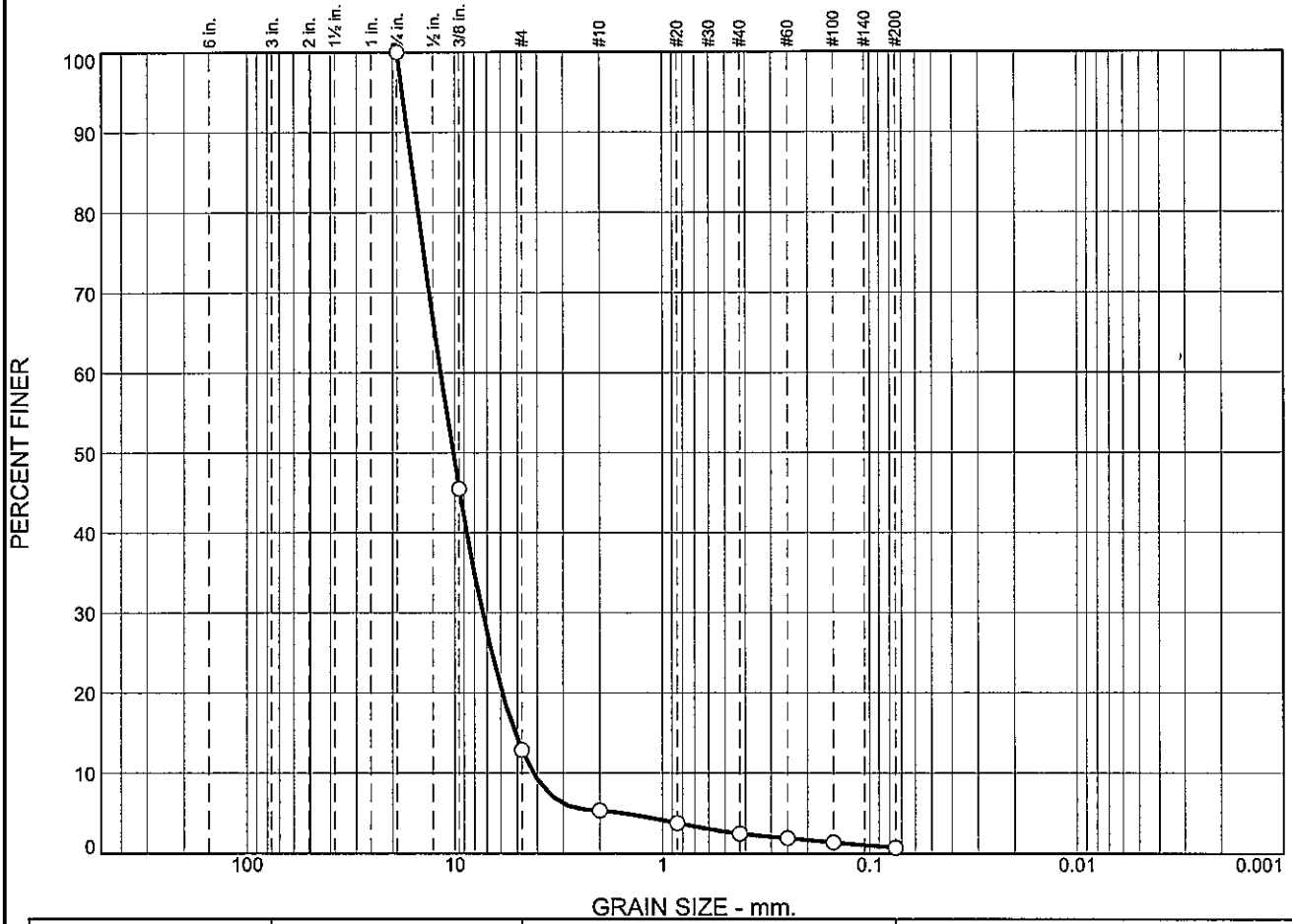
Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.1	94.5	94.6	3.5	1.4	0.3	5.2	0.2

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
7.2493	8.1993	8.9120	10.0529	12.0339	13.0526	15.4092	16.1244	16.9311	17.8781

Fineness Modulus	C_u	C_c
6.64	1.80	1.07

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	87.1	7.6	2.8	1.8	0.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			15.9448	11.6724	10.1738	7.3350	5.1178	4.1796	1.10	2.79

Material Description	USCS	AASHTO
○ Narrowly graded GRAVEL	GP	A-1-a

Project No. 071810 **Client:** Norlite Corp.

Project: Norlite Lightweight Aggregate Testing

○

Date: ○ 11/19/07

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Remarks:

○ Test performed in general accordance with ASTM C136
Test performed on post-triaxial test sample (S6)

Figure A6

GRAIN SIZE DISTRIBUTION TEST DATA

4/16/2008

Client: Norlite
Project: Norlite Aggregate
Project Number: 071810
Location: Post Triax. Test Sample
Material Description: Narrowly graded GRAVEL
Sample Date: 11/19/07
USCS Classification: GP **AASHTO Classification:** A-1-a
Testing Remarks: Test performed in general accordance with ASTM C136
Test performed on post-triaxial test sample (S6)
Tested by: F. Trejo **Checked by:** B. Sawa
Sieve opening list: (Default opening sizes)

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
3944.00	0.00	494.00	0.75	494.00	100.0
			0.375	2643.00	45.5
251.72	0.00	196.24	#4	376.78	12.9
			#10	418.39	5.3
			#20	427.01	3.8
			#40	434.20	2.5
			#60	437.34	1.9
			#100	440.20	1.4
			#200	443.88	0.7

Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.0	87.1	87.1	7.6	2.8	1.8	12.2	0.7

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
4.1796	5.1178	5.8986	7.3350	10.1738	11.6724	15.0131	15.9448	16.9244	17.9575

Fineness Modulus	C_u	C_c
6.25	2.79	1.10

Appendix B – Density Tests

Appendix B – Density Tests

B1 Maximum-Minimum Density Tests

TABLE B1 - SUMMARY OF MAXIMUM-MINIMUM DENSITY TESTS
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Method for Maximum Density [1]	Maximum Index Density [2] (lb/ft^3)	Minimum Index Density [3] (lb/ft^3)
Dry	43.5	42.5
Wet	43.2	--

Notes:
1. Dry Method - Aggregate was placed in 0.5 cubic foot mold in an oven-dry state
   Wet Method - Aggregate was submerged in water for at least 24 hours and placed in 0.5 cubic foot mold in a saturated state
2. Maximum density test performed using oven-dried and saturated material in general accordance with ASTM D4253, Method 2A (dry), Method 2B (wet)
3. Minimum density test performed using oven-dried material in general accordance with ASTM D4254, Method A

TABLE B1 - SUMMARY OF MAXIMUM-MINIMUM DENSITY TESTS
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Method for Maximum Density [1]	Maximum Index Density [2] (lb/ft^3)	Minimum Index Density [3] (lb/ft^3)
Dry	43.5	42.5
Wet	43.2	--

Notes:
1. Dry Method - Aggregate was placed in 0.5 cubic foot mold in an oven-dry state
   Wet Method - Aggregate was submerged in water for at least 24 hours and placed in 0.5 cubic foot mold in a saturated state
2. Maximum density test performed using oven-dried and saturated material in accordance with ASTM D4253, Method 2A (dry), Method 2B (wet)
3. Minimum density test performed using oven-dried material in accordance with ASTM D4254, Method A

GEI Consultants

Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table - ASTM D4253

Client:	Norlite Corporation	Date:	9/25/2007	By:	BRS
Project Name:	Geotechnical Testing of Norlite Aggregate	Checked:	4/14/2008	By:	ANC
Project Number:	07181				
Sample:	Bag Sample				
Description:	Narrowly graded GRAVEL				

From Calibration:

Calibrated volume of mold, Vc =	14308.32	cm^3 =
Cross sectional area of mold, Ac =	620.24	cm^2 =
Surcharge Plate Thickness, Tp =	1.2954	cm
Mold Height, H =	23.069	cm

Measurements:

Rheostat Setting: 85 Corresponding: Peak to Peak Displacement = -0.0131 in.

Frequency = 60.24 Hz.

	Trial 1		Trial 2		Trial 3		
Micrometer Readings:	1.45923	1.31826	1.36144	1.58496	1.43383	1.58623	cm
	1.82499		1.73101		1.50495		cm
							cm
Avg. Micrometer Readings =	1.53		1.56		1.51		cm
Mass of Empty Mold =	8731.653		8731.65		8731.65		g
Mass of Mold and Soil =	17485.99		17472.38		17463.31		g
Mass of Soil, Ms =	8754.33		8740.72		8731.65		g
Height of Tested Sample =	20.24		20.21		20.27		cm
Volume of Tested Dry Soil, V =	12553.3		12537.8		12569.3		cm^3
Maximum Index Density, ρ_{dmax} (Ms/V) =	0.697		0.697		0.695		(g/cm^3)
Maximum Index Unit Weight, γ_{dmax} =	**43.5**		**43.5**		**43.4**		(lb/ft^3)

$\gamma_{dmax} = 62.428 * \rho_{dmax}$ (lb/ft^3)

Average 43.5 lb/ft^3

Remarks:

1. Test performed on oven-dried material.

GEI Consultants

Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table - ASTM D4253

Client:	Norlite Corporation	Date:	9/26/2007	By:	BRS
Project Name:	Geotechnical Testing of Norlite Aggregate	Checked:	4/14/2008	By:	AMC
Project Number:	07181				
Sample:	Bag Sample				
Description:	Narrowly graded GRAVEL				

From Calibration:

Calibrated volume of mold, Vc =	14308.32	cm^3 =
Cross sectional area of mold, Ac =	620.4	cm^2 =
Surcharge Plate Thickness, Tp =	1.277	cm
Mold Height, H =	23.069	cm

Measurements:

Rheostat Setting: 85

Corresponding:

Peak to Peak Displacement = -0.0131 in.

Frequency = 60.24 Hz.

	Trial 1		Trial 2		Trial 3		
Micrometer Readings:	1.72466	1.62179	1.67767	1.669542	4.82473	4.19862	cm
	2.02184		1.82372		5.12826		cm
							cm
Avg. Micrometer Readings =	1.79		1.72		4.72		cm
Mass of Empty Mold =	8731.653		8731.65		8731.65		g
Mass of Mold and Soil =	18388.63		18873.98		17272.80		g
Mass of Soil, Ms =	9656.98		10142.33		8541.14		g
Height of Tested Sample =	20.00		20.07		17.07		cm
Volume of Tested Dry Soil, V =	12409.6		12450.4		10593.2		cm^3
Wet weight of sample=	9634		10092		8482		g
Dry weight of sample=	8336		8641		7420		g
Water Content=	15.6		16.8		14.3		%
Maximum Index Density, ρ_{dmax} (Ms/V) =	0.673		0.697		0.705		(g/cm^3)
Maximum Index Unit Weight, γ_{dmax} =	**42.0**		**43.5**		**44.0**		(lb/ft^3)

$\gamma_{dmax} = 62.428 * \rho_{dmax}$ (lb/ft^3)

Average 43.2 lb/ft^3

Remarks:

1. Test performed on saturated material.

GEI Consultants

Standard Test Methods for Minimum Index Density and Unit Weight of Soils Using a Vibratory Table - ASTM D4254 (Method A)

Client:	Norlite Corporation	Date:	9/25/2007	By:	BRS
Project Name:	Geotechnical Testing of Norlite Aggregate	Checked:	4/14/2008	By:	AMC
Project Number:	07181				
Sample:	Bag Sample				
Description:	Narrowly graded GRAVEL				

From Calibration:

Calibrated volume of mold, Vc = 14308.32 cm^3 =
Cross sectional area of mold, Ac = 620.24 cm^2 =

Measurements:

	Trial 1	Trial 2	Trial 2	
Mass of Empty Mold =	8715	8717	8717	g
Mass of Mold and Soil =	18559	18428	18374	g
Mass of Soil, Ms =	9844	9711	9657	g
Minimum Index Density, ρ_{dmin} (Ms/Vc) =	0.688	0.679	0.675	g/cm^3
Minimum Index Unit Weight, γ_{dmin} =	42.9	42.4	42.1	lb/ft^3
($\gamma_{dmin} = 62.428 * \rho_{dmin}$)				
Average	**42.5**			lb/ft^3

Remarks:

1. Material total weight upon receipt: 73.26 lbs
2. Material total weight after air drying: 65.86 lbs
3. Material split on 3/4" sieve. Weight retained on 3/4" = 6.16 lbs

Appendix B – Density Tests

B2 Compaction Tests

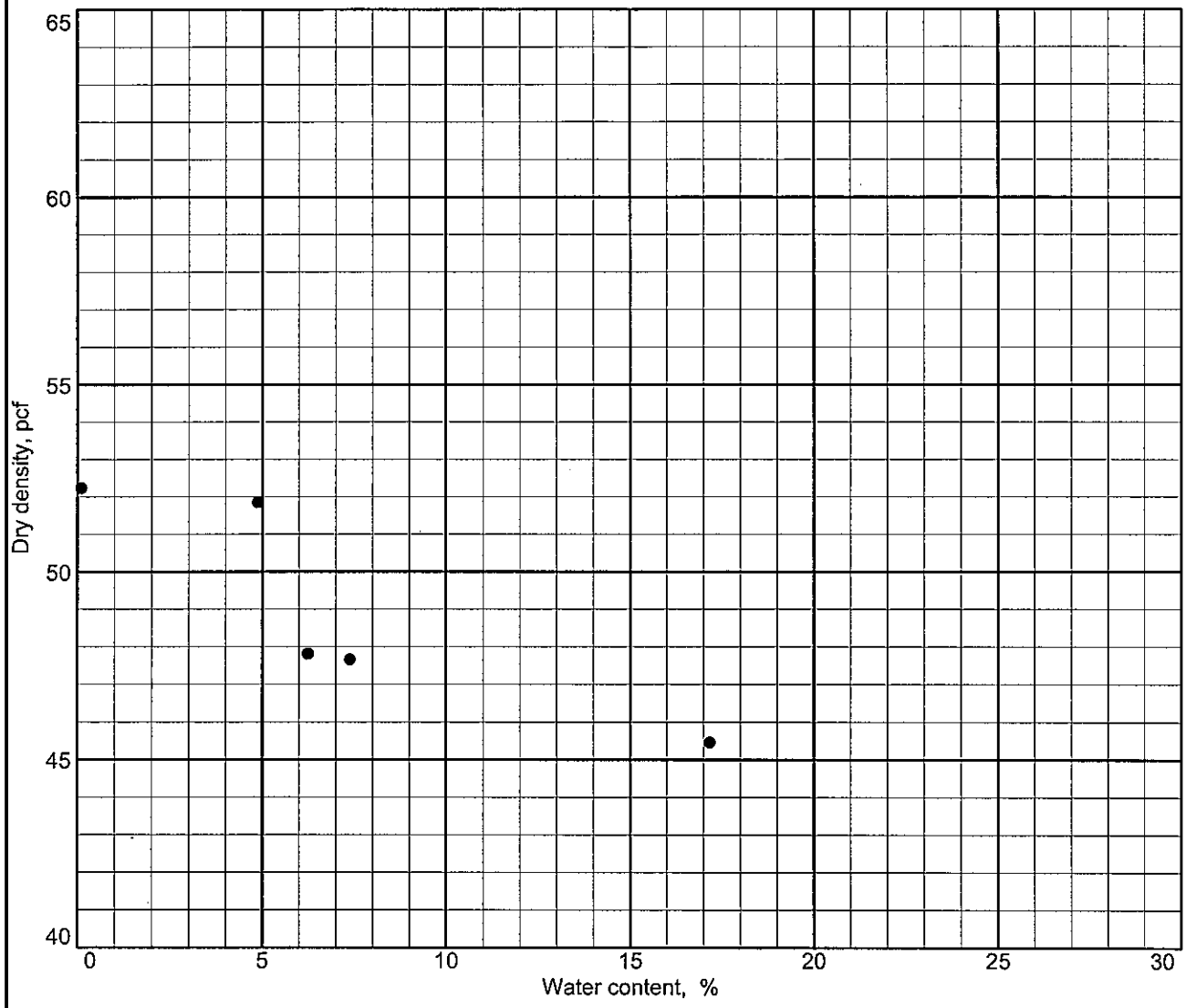
TABLE B2 - SUMMARY OF COMPACTION TESTS
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Compacted Density Reduced Compaction Energy[1]				Compacted Density Standard Proctor[2]			
Determination No.	*Water Content (%)*	*Wet Density (lb/ft^3)*	*Dry Density (lb/ft^3)*	*Determination No.*	*Water Content (%)*	*Wet Density (lb/ft^3)*	*Dry Density (lb/ft^3)*
1	0.1	52.3	52.2	1	1.5	54.7	53.9
2	4.9	54.4	51.9	2	4.2	55.1	52.9
3	6.2	50.8	47.8	3	7.5	56.5	52.6
4	7.4	51.2	47.7	4	8.7	59.9	55.1
5	17.2	53.3	45.5	5	8.5	56.0	51.6
--	--	--	--	6	10.4	58.4	52.9

Notes:

1. Test performed in accordance with ASTM D698, Procedure C except 25-blows were used for compacting each lift. Test was performed using a 5.5 pound hammer dropping 12 inches and compacted in 3 lifts with 25-blows per lift.
2. Test performed in general accordance with ASTM D698, Procedure C. Test was performed using a 5.5 pound hammer dropping 12 inches and compacted in 3 lifts with 56 blows per lift.

COMPACTION TEST REPORT



Test specification: ASTM D 698-00a Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	GP	A-1-a	--	--	--	--	0.2	1.1

TEST RESULTS	MATERIAL DESCRIPTION
	Narrowly graded GRAVEL

Project No. 071810 **Client:** Norlite Corp.
Project: Norlite Lightweight Aggregate Testing

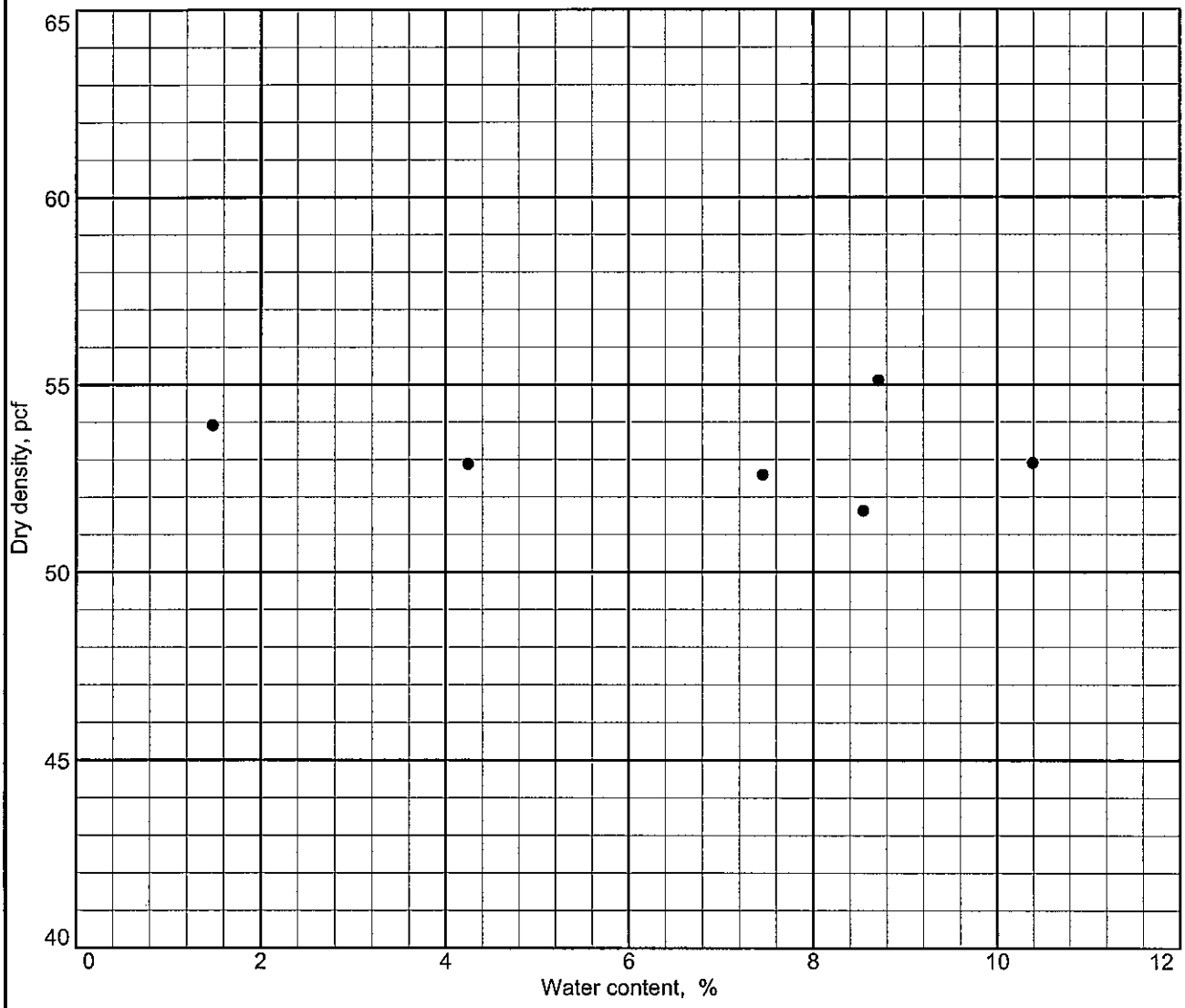
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Remarks:
Test performed using 5.5 lb hammer dropping 12 in.
Aggregate compacted in 3 lifts with 25 blows per lift.

Figure B1

Tested by: J. Stone Checked by: B. Sawa

COMPACTION TEST REPORT



Test specification: ASTM D 698-00a Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	GP	A-1-a	--	--	--	--	0.0	1.6

TEST RESULTS	MATERIAL DESCRIPTION
	Narrowly graded GRAVEL

Project No. 071810 **Client:** Norlite Corp.
Project: Norlite Lightweight Aggregate Testing

Remarks:
Aggregate compacted in 3 lifts with 56 blows per lift

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure B2

Tested by: D.Packard Checked by: B. Sawa

Appendix C – Permeability Tests

TABLE C1 - **SUMMARY OF PERMEABILITY TESTS**
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Loose Sample: Dry Density = 40.1 lb/ft^3		Dense Sample: Dry Density = 47.0 lb/ft^3	
Hydraulic Gradient	**Average Permeability (cm/sec.)**	**Hydraulic Gradient**	**Average Permeability (cm/sec.)**
0.33	2.5	0.26	1.1
0.38	2.6	0.34	1.1
0.44	2.4	0.38	1.0

Notes:

1. Aggregate soaked in water for 48 hours prior to test. Specimens were typically 12-inches in height
2. Test performed in 10" permeameter and in general accordance with ASTM D2434

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	GEI Consultants, Inc.		
Project Name:	Norlite Aggregate Testing		
Project Location:	---		
GTX #:	7744		
Start Date:	12/28/08	Tested By:	ema
End Date:	12/31/08	Checked By:	jdt
Boring #:	---		
Sample #:	Norlite Aggregate		
Depth:	---		
Visual Description:	Dry, brown gravel		

Permeability of Granular Soils (Constant Head) by ASTM D 2434

Sample Type: Remolded

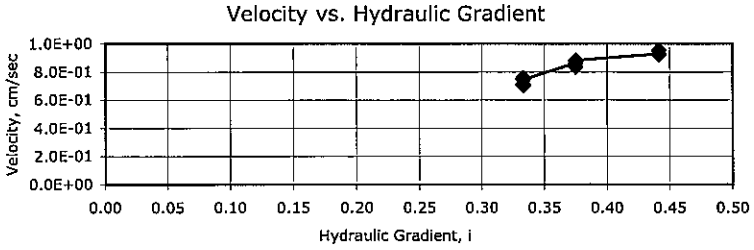
Sample Information:

Maximum Dry Density:	--- pcf
Optimum Moisture Content:	--- %
Compaction Test Method:	ASTM D 1557
Classification (ASTM D 2487):	---
Assumed Specific Gravity:	1.80

Sample Preparation / Test Setup: Material soaked in de-aired water for 48 hours and then compacted to 42.5 pcf (minimum density as determined by client) in the test apparatus.

Parameter	Initial	Final
Height, in	12.00	12.00
Diameter, in	9.55	9.55
Area, in^2	71.6	71.6
Volume, in^3	860	860
Mass, g	10,932	17,686
Bulk Density, pcf	48.4	78.4
Moisture Content, %	20.9	95.5
Dry Density, pcf	40.1	40.1
Degree of Saturation, %	---	95.4
Void Ratio, e	---	1.80

Date	Reading #	Volume of Flow, cc	Time of Flow, sec	Flow Rate, cc/sec	Gradient	Permeability, cm/sec	Temp., °C	Correction Factor	Permeability @ 20 °C, cm/sec
12/31	1	1630.47	5	326.09	0.33	2.1E+00	15.0	1.135	2.4E+00
12/31	2	1740.57	5	348.11	0.33	2.3E+00	15.0	1.135	2.6E+00
12/31	3	1721.55	5	344.31	0.33	2.2E+00	15.0	1.135	2.5E+00
12/31	4	1989.79	5	397.96	0.38	2.3E+00	15.0	1.135	2.6E+00
12/31	5	1927.74	5	385.55	0.38	2.2E+00	15.0	1.135	2.5E+00
12/31	6	2032.83	5	406.57	0.38	2.3E+00	15.0	1.135	2.7E+00
12/31	7	2140.93	5	428.19	0.44	2.1E+00	15.0	1.135	2.4E+00
12/31	8	2199.98	5	440.00	0.44	2.2E+00	15.0	1.135	2.4E+00
12/31	9	2126.92	5	425.38	0.44	2.1E+00	15.0	1.135	2.4E+00



PERMEABILITY @ 20 °C = 2.5 cm/sec

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	GEI Consultants, Inc.		
Project Name:	Norlite Aggregate Testing		
Project Location:	---		
GTX #:	7744		
Start Date:	11/26/07	Tested By:	ema
End Date:	11/27/07	Checked By:	jdt
Boring #:	---		
Sample #:	Norlite Aggregate		
Depth:	---		
Visual Description:	Dry, brown gravel		

Permeability of Granular Soils (Constant Head) by ASTM D 2434

Sample Type: Remolded

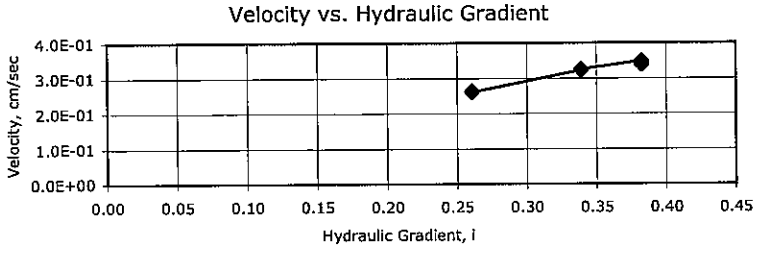
Sample Information:

Maximum Dry Density:	--- pcf
Optimum Moisture Content:	--- %
Compaction Test Method:	ASTM D 1557
Classification (ASTM D 2487):	---
Assumed Specific Gravity:	1.80

Sample Preparation / Test Setup: Material soaked in de-aired water for 48 hours and then compacted to 47 pcf in the test apparatus.

Parameter	Initial	Final
Height, in	12.00	11.50
Diameter, in	9.55	9.55
Area, in^2	71.6	71.6
Volume, in^3	860	824
Mass, g	12,518	17,664
Bulk Density, pcf	55.5	81.7
Moisture Content, %	18.1	73.6
Dry Density, pcf	47.0	47.0
Degree of Saturation, %	---	95.5
Void Ratio, e	---	1.39

Date	Reading #	Volume of Flow, cc	Time of Flow, sec	Flow Rate, cc/sec	Gradient	Permeability, cm/sec	Temp., °C	Correction Factor	Permeability @ 20 °C, cm/sec
11/26	1	3660.30	30	122.01	0.26	1.0E+00	15.0	1.135	1.1E+00
11/26	2	3604.25	30	120.14	0.26	1.0E+00	15.0	1.135	1.1E+00
11/26	3	3602.25	30	120.07	0.26	1.0E+00	15.0	1.135	1.1E+00
11/26	4	2235.01	15	149.00	0.34	9.5E-01	15.0	1.135	1.1E+00
11/26	5	2229.01	15	148.60	0.34	9.5E-01	15.0	1.135	1.1E+00
11/26	6	2252.03	15	150.14	0.34	9.6E-01	15.0	1.135	1.1E+00
11/26	7	2417.18	15	161.15	0.38	9.1E-01	15.0	1.135	1.0E+00
11/26	8	2340.11	15	156.01	0.38	8.8E-01	15.0	1.135	1.0E+00
11/26	9	2383.15	15	158.88	0.38	9.0E-01	15.0	1.135	1.0E+00



PERMEABILITY @ 20 °C = 1.1 cm/sec

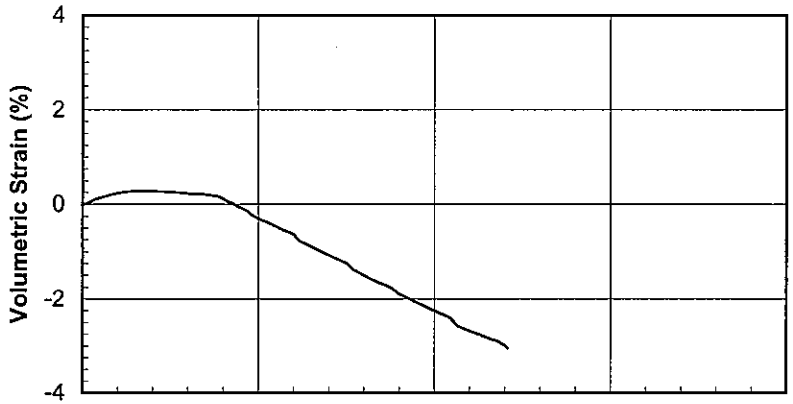
Appendix D – Triaxial Tests

- CIDC Triaxial Test Results
- Triaxial Test Photographs

TABLE D1 - SUMMARY OF TRIAXIAL STRENGTH TESTS
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Test No.	Dry Unit Weight (pcf)	Effective Confining Stress (ksf)	Peak Shear Stress, q[1] (ksf)	Effective Friction Angle, Φ (deg.)	Strain (%)
S1	41.5	0.74	1.50	42.1	3.3
S2	43.0	2.19	4.60	42.6 (2)	12.7
S3	42.8	4.10	6.39	37.5 (3)	11.2
S4	46.3	0.41	1.95	55.7	4.0
S5	45.9	2.05	5.22	45.9	10.2
S6	46.2	4.18	8.76	42.6	11.5

Notes:
1. Peak shear stress is the shear stress on the 45-degree plane (1/2 deviator stress).
2. Membrane developed leak at end of test.
3. Membrane ruptured at approximately 11.5% strain.



SAMPLE INFORMATION

Sample: Norlite Test No.: S1
Type: Recompacted sample
Description: 3/4-inch lighweight shale aggregate

SPECIMEN INFORMATION (after saturation)

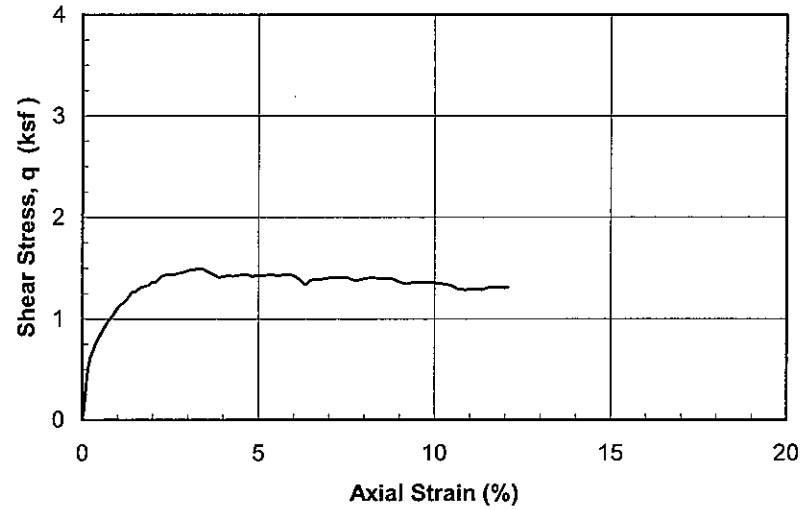
Height: 11.21 in Dia.: 6.07 in Area.: 28.96 sq. in
Water Content: 95.8% Dry Unit Weight: 41.5 pcf

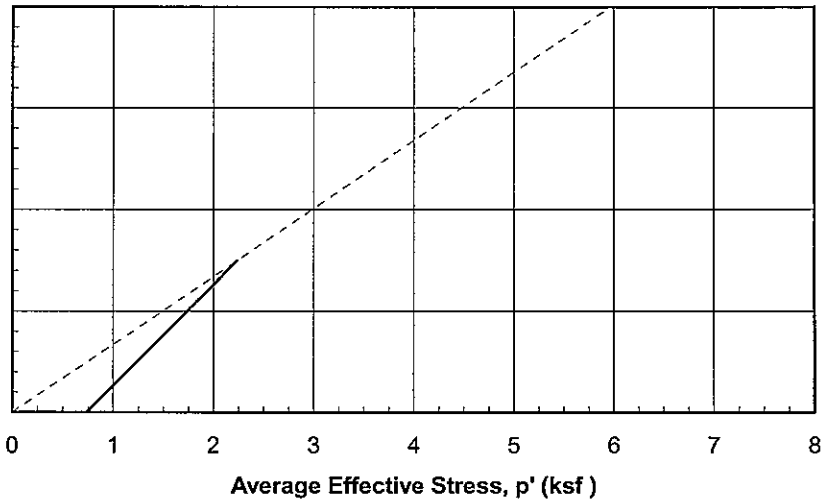
TEST SUMMARY (end of test)

Effective Confining Stress: 0.74 ksf vert., 0.74 ksf horiz.
Water Content: 95.8 % Dry Unit Weight: 41.5 pcf
B Coefficient: 0.93 Strain Rate: 0.089 %/min
Peak Shear Stress: 1.50 ksf @ 3.4 % Strain
Peak Effective Friction Angle: 42.1 deg. @ 3.3 % Strain

Failure Sketch

REMARKS: Positive volumetric strain indicates specimen contraction.





Operator: D. Aghjayan
Checked: B. Sawa
Test Date: 10-Oct-2007

4/17/2008 10:30

Geotechnical Testing of Norlite Lightweight Aggregate	GEI Consultants	CONSOLIDATED ISOTROPIC DRAINED TRIAXIAL COMPRESSION
Norlite Corporation Cohoes, New York	07181	April 2008 Figure D1

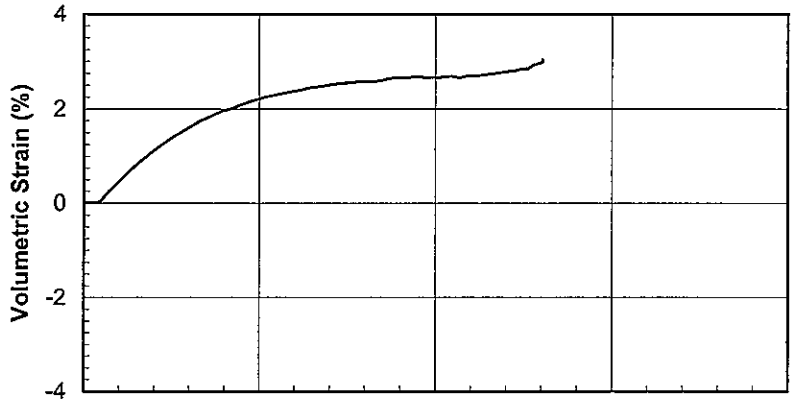
PROJECT #:	07181												
PROJECT:	Norlite Aggregate			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water	Dry	Total	Void
TEST:	S1									Content	Density	Density	Ratio
BORING:	--				(ksf)	(ksf)	(inch)	(inch)	(in²)	(%)	(pcf)	(pcf)	
SAMPLE:	Norlite			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	--			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	D. Aghjayan			In tube before extrusion	--	--	--	--	--	--	--	--	--
TEST DATE:	10/10/2007			Under vac.	-0.51	-0.51	11.214	6.072	28.959		41.5		3.017

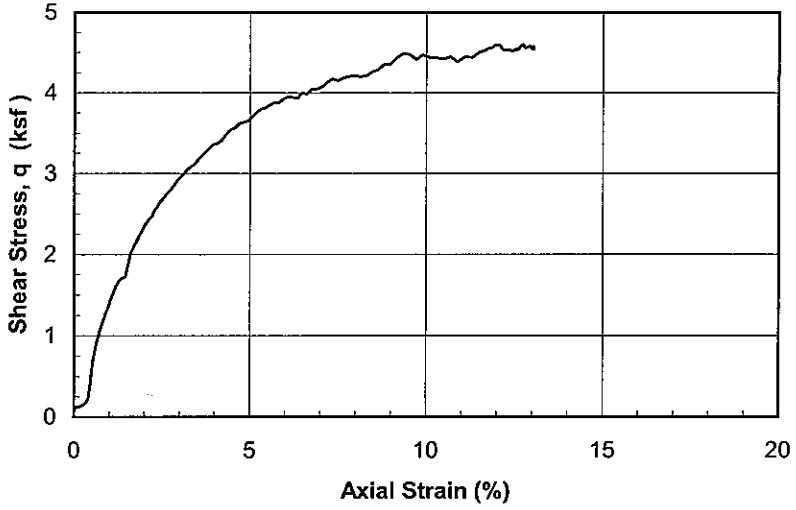
Transducer	No.	Cal. Factor	Unit	End of:							calculated from start of test		
DCDT	5733	-14.208	mm/(mV/V)	Saturation	0.74	0.74	11.21	6.07	28.96	95.84	41.5	81.3	3.017
Load Cell	60293	-149.1745	kg/(mV/V)	Consol. Stage 1	0.74	0.74	11.21	6.07	28.96	95.84	41.5	81.3	3.017
Pressure	10260	-0.7056	ksc/(mV/V)	Consol. Stage 2	0.74	0.74	11.21	6.07	28.96	95.84	41.5	81.3	3.017
Volume	DV2B	1.2097	cc/(mV/V)	Consol. Stage 3	0.74	0.74	11.21	6.07	28.96	95.84	41.5	81.3	3.017
				Consol. Stage 4	0.74	0.74	11.21	6.07	28.96	95.84	41.5	81.3	3.017
Gravity of Solids		2.67	(assumed)	Consol. Stage 5	0.74	0.74	11.21	6.07	28.96	95.84	41.5	81.3	3.017
B value start shear		0.93		Final Shear 6									
Test Stage End of#	1			This Stage Initial Values	0.74	0.74	11.21	6.07	28.96	95.84	41.5	81.3	3.017
Stage Strain rate		0.089	%/min	Kc start stage	1.00		Back Pressure		13.11 ksf				
Data Start Row	32												

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in²)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
32	2.387	26.475	-32.328	0.00	0.00	28.96	0.74	0.74	0.00	1.00	0.0
33	2.556	49.135	-32.163	0.06	0.00	28.98	0.99	0.86	0.12	1.34	8.3
34	2.699	89.959	-31.739	0.11	0.01	28.99	1.43	1.08	0.35	1.94	18.7
35	2.855	120.066	-30.937	0.16	0.03	29.00	1.76	1.25	0.51	2.39	24.2
36	3.028	138.594	-29.665	0.22	0.05	29.01	1.96	1.35	0.61	2.66	27.0
37	3.214	148.993	-28.274	0.29	0.08	29.02	2.08	1.41	0.67	2.82	28.4
38	3.426	162.435	-26.719	0.36	0.11	29.03	2.22	1.48	0.74	3.02	30.1
39	3.633	171.835	-26.130	0.44	0.12	29.05	2.33	1.53	0.79	3.15	31.2
40	3.854	181.735	-25.470	0.51	0.13	29.07	2.43	1.59	0.85	3.30	32.3
41	4.066	190.045	-24.433	0.59	0.15	29.09	2.52	1.63	0.89	3.42	33.2
42	4.269	197.674	-23.443	0.66	0.17	29.10	2.60	1.67	0.93	3.53	34.0
43	4.489	206.711	-22.736	0.74	0.18	29.12	2.70	1.72	0.98	3.66	34.8
44	4.710	212.114	-21.699	0.82	0.20	29.14	2.76	1.75	1.01	3.74	35.3
45	4.952	219.380	-20.992	0.90	0.21	29.16	2.84	1.79	1.05	3.85	36.0
46	5.177	227.463	-20.143	0.98	0.23	29.18	2.92	1.83	1.09	3.97	36.7
47	5.406	234.774	-19.483	1.06	0.24	29.20	3.00	1.87	1.13	4.07	37.3

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
48	5.657	239.134	-18.894	1.15	0.25	29.22	3.05	1.89	1.16	4.13	37.6
49	5.908	244.038	-18.446	1.24	0.26	29.24	3.10	1.92	1.18	4.20	38.0
50	6.155	251.259	-18.069	1.32	0.27	29.27	3.18	1.96	1.22	4.31	38.5
51	6.406	259.569	-17.834	1.41	0.27	29.29	3.26	2.00	1.26	4.43	39.2
52	6.665	260.522	-17.669	1.50	0.28	29.32	3.27	2.00	1.27	4.44	39.2
53	6.920	265.836	-17.527	1.59	0.28	29.35	3.33	2.03	1.29	4.51	39.6
54	7.184	269.514	-17.598	1.68	0.28	29.37	3.36	2.05	1.31	4.56	39.8
55	7.457	271.149	-17.621	1.78	0.28	29.40	3.38	2.06	1.32	4.58	39.9
56	7.738	273.419	-17.598	1.88	0.28	29.43	3.40	2.07	1.33	4.61	40.1
57	8.023	278.914	-17.857	1.98	0.27	29.46	3.46	2.10	1.36	4.69	40.4
58	8.304	279.867	-17.951	2.08	0.27	29.49	3.46	2.10	1.36	4.70	40.5
59	8.585	286.725	-18.022	2.18	0.27	29.52	3.54	2.14	1.40	4.80	40.9
60	8.854	291.220	-18.140	2.27	0.27	29.55	3.58	2.16	1.42	4.86	41.2
61	9.152	293.582	-18.352	2.37	0.26	29.59	3.60	2.17	1.43	4.89	41.3
62	9.446	293.718	-18.588	2.48	0.26	29.62	3.60	2.17	1.43	4.88	41.3
63	9.749	294.581	-18.965	2.58	0.25	29.65	3.61	2.17	1.44	4.89	41.3
64	10.060	296.760	-19.224	2.69	0.25	29.69	3.63	2.18	1.45	4.92	41.5
65	10.363	299.076	-19.743	2.80	0.24	29.72	3.65	2.19	1.46	4.95	41.6
66	10.696	301.074	-19.955	2.92	0.23	29.76	3.67	2.20	1.46	4.97	41.7
67	11.020	304.389	-20.709	3.03	0.22	29.80	3.70	2.22	1.48	5.02	41.9
68	11.358	304.753	-21.110	3.15	0.21	29.84	3.70	2.22	1.48	5.02	41.9
69	11.691	307.886	-20.827	3.27	0.22	29.87	3.73	2.23	1.50	5.06	42.0
70	12.037	308.340	-20.992	3.39	0.21	29.91	3.73	2.23	1.50	5.06	42.1
71	13.455	292.991	-24.056	3.89	0.16	30.08	3.55	2.14	1.41	4.81	41.0
72	13.810	295.489	-26.695	4.01	0.11	30.14	3.57	2.15	1.42	4.84	41.1
73	14.169	297.986	-29.264	4.14	0.06	30.19	3.59	2.16	1.43	4.87	41.3
74	14.554	297.124	-31.739	4.27	0.01	30.25	3.58	2.16	1.42	4.85	41.2
75	14.930	299.440	-34.614	4.40	-0.04	30.31	3.60	2.17	1.43	4.88	41.3
76	15.324	300.757	-37.065	4.54	-0.09	30.36	3.61	2.17	1.43	4.89	41.3
77	15.709	301.801	-39.587	4.68	-0.14	30.42	3.61	2.17	1.44	4.90	41.4
78	16.115	298.350	-44.230	4.82	-0.22	30.49	3.57	2.15	1.42	4.84	41.1
79	16.500	301.392	-47.246	4.95	-0.28	30.55	3.59	2.17	1.43	4.87	41.3
80	16.924	301.029	-49.980	5.10	-0.33	30.62	3.58	2.16	1.42	4.86	41.2
81	17.357	303.663	-52.337	5.26	-0.38	30.68	3.61	2.17	1.43	4.89	41.3
82	17.746	304.344	-55.000	5.39	-0.43	30.74	3.61	2.17	1.43	4.89	41.3
83	18.161	302.936	-57.829	5.54	-0.48	30.80	3.59	2.16	1.42	4.86	41.2

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
84	18.568	304.980	-60.845	5.68	-0.54	30.87	3.60	2.17	1.43	4.88	41.3
85	19.009	306.796	-63.367	5.84	-0.58	30.93	3.61	2.18	1.44	4.90	41.4
86	19.454	304.707	-65.912	5.99	-0.63	31.00	3.59	2.16	1.42	4.86	41.2
87	19.909	298.895	-73.407	6.15	-0.77	31.10	3.52	2.13	1.39	4.77	40.8
88	20.376	288.359	-76.353	6.32	-0.83	31.17	3.40	2.07	1.33	4.62	40.1
89	20.830	297.578	-79.228	6.47	-0.88	31.24	3.49	2.12	1.38	4.74	40.6
90	21.297	300.802	-82.504	6.64	-0.94	31.31	3.52	2.13	1.39	4.77	40.8
91	21.768	301.846	-85.733	6.80	-1.00	31.39	3.52	2.13	1.39	4.78	40.8
92	22.240	304.117	-88.844	6.97	-1.06	31.46	3.54	2.14	1.40	4.80	40.9
93	22.720	306.887	-91.979	7.14	-1.12	31.53	3.56	2.15	1.41	4.83	41.1
94	23.226	305.797	-95.255	7.32	-1.18	31.61	3.54	2.14	1.40	4.80	41.0
95	23.758	307.341	-98.507	7.50	-1.24	31.70	3.55	2.14	1.41	4.82	41.0
96	24.255	303.118	-105.648	7.68	-1.38	31.80	3.50	2.12	1.38	4.75	40.7
97	24.744	303.935	-109.466	7.85	-1.45	31.88	3.50	2.12	1.38	4.75	40.7
98	25.263	307.704	-113.166	8.03	-1.52	31.97	3.53	2.13	1.40	4.79	40.9
99	25.799	310.520	-116.772	8.22	-1.59	32.05	3.55	2.14	1.41	4.82	41.0
100	26.344	309.702	-120.142	8.41	-1.65	32.14	3.53	2.14	1.40	4.79	40.9
101	26.898	310.520	-122.806	8.61	-1.70	32.22	3.54	2.14	1.40	4.80	40.9
102	27.443	310.520	-126.482	8.80	-1.77	32.31	3.53	2.13	1.40	4.78	40.9
103	28.018	304.571	-133.105	9.00	-1.89	32.43	3.46	2.10	1.36	4.69	40.4
104	28.554	302.028	-136.734	9.19	-1.96	32.51	3.43	2.08	1.35	4.65	40.2
105	29.091	305.298	-140.599	9.38	-2.03	32.60	3.45	2.09	1.36	4.68	40.4
106	29.714	306.297	-144.653	9.59	-2.11	32.71	3.45	2.10	1.36	4.68	40.4
107	30.315	307.341	-148.589	9.80	-2.18	32.81	3.46	2.10	1.36	4.69	40.4
108	30.899	306.887	-152.407	10.01	-2.26	32.91	3.44	2.09	1.35	4.67	40.3
109	31.509	305.933	-156.131	10.22	-2.33	33.01	3.43	2.08	1.34	4.65	40.2
110	32.149	303.890	-159.949	10.45	-2.40	33.11	3.40	2.07	1.33	4.61	40.0
111	32.741	297.214	-169.494	10.66	-2.58	33.25	3.32	2.03	1.29	4.51	39.6
112	33.355	296.533	-172.982	10.87	-2.64	33.35	3.31	2.02	1.29	4.49	39.5
113	34.017	299.576	-176.847	11.10	-2.72	33.46	3.33	2.03	1.30	4.51	39.6
114	34.653	298.622	-179.958	11.33	-2.77	33.56	3.31	2.02	1.29	4.49	39.5
115	35.289	304.208	-183.753	11.55	-2.85	33.67	3.36	2.05	1.31	4.55	39.8
116	35.946	306.478	-186.463	11.78	-2.90	33.78	3.37	2.05	1.32	4.57	39.9
117	36.482	305.388	-190.587	11.97	-2.97	33.87	3.35	2.04	1.31	4.55	39.7
118	36.802	306.978	-194.476	12.08	-3.05	33.94	3.36	2.05	1.31	4.56	39.8





SAMPLE INFORMATION

Sample: Norlite Test No.: S2
Type: Recompacted sample
Description: 3/4-inch lighweight shale aggregate

SPECIMEN INFORMATION (after saturation)

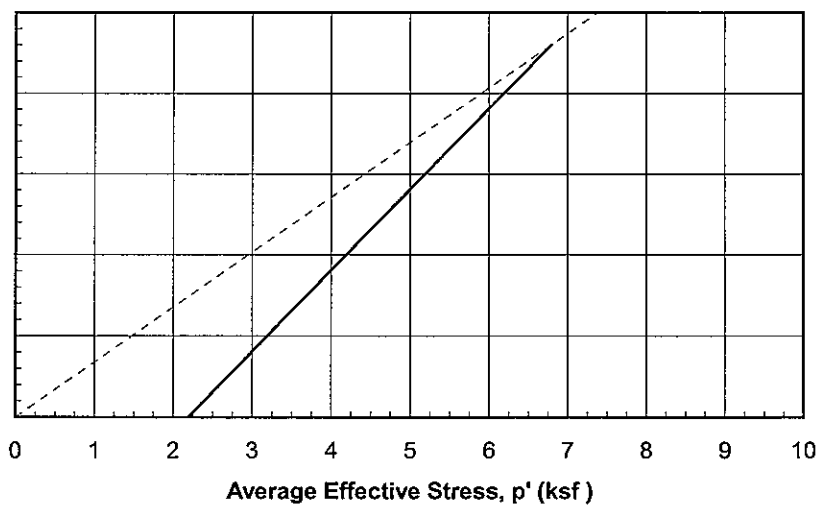
Height: 11.44 in Dia.: 6.00 in Area.: 28.30 sq. in
Water Content: 90.0% Dry Unit Weight: 43.0 pcf

TEST SUMMARY (end of test)

Effective Confining Stress: 2.19 ksf vert., 2.19 ksf horiz.
Water Content: 90.0 % Dry Unit Weight: 43.0 pcf
B Coefficient: 0.9 Strain Rate: 0.087 %/min
Peak Shear Stress: 4.60 ksf @ 12.7 % Strain
Peak Effective Friction Angle: 42.6 deg. @ 12.7 % Strain

Failure Sketch

REMARKS: Positive volumetric strain indicates specimen contraction.
Specimen membrane developed leak at end of test.



Operator: D. Aghjayan
Checked: B. Sawa
Test Date: 15-Oct-2007

4/17/2008 10:30

Geotechnical Testing of Norlite Lightweight Aggregate	GEI Consultants	CONSOLIDATED ISOTROPIC DRAINED TRIAXIAL COMPRESSION
Norlite Corporation Cohoes, New York	07181	April 2008 Figure D2

PROJECT #:	7223													
PROJECT:	Norlite Aggregate			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water	Dry	Total	Void	
TEST:	S2									Content	Density	Density	Ratio	
BORING:	--				(ksf)	(ksf)	(inch)	(inch)	(in²)	(%)	(pcf)	(pcf)		
SAMPLE:	Norlite			In situ	--	--	--	--	--	--	--	--	--	
DEPTH (ft):	--			After Sampling	--	--	--	--	--	--	--	--	--	
OPER.:	D. Aghjayan			In tube before extrusion	--	--	--	--	--	--	--	--	--	
TEST DATE:	10/15/2007			Under vac.	-0.51	-0.51	11.445	6.003	28.303		43.0		2.881	
Transducer	No.	Cal. Factor	Unit	End of:							calculated from start of test			
DCDT	5733	-14.208	mm/(mV/V)	Saturation	2.19	2.19	11.44	6.00	28.30	90.03	43.0	81.6	2.881	
Load Cell	60293	-149.1745	kg/(mV/V)	Consol. Stage 1	2.19	2.19	11.44	6.00	28.30	90.03	43.0	81.6	2.881	
Pressure	10260	-0.7056	ksc/(mV/V)	Consol. Stage 2	2.19	2.19	11.44	6.00	28.30	90.03	43.0	81.6	2.881	
Volume	DV2B	1.2097	cc/(mV/V)	Consol. Stage 3	2.19	2.19	11.44	6.00	28.30	90.03	43.0	81.6	2.881	
				Consol. Stage 4	2.19	2.19	11.44	6.00	28.30	90.03	43.0	81.6	2.881	
Gravity of Solids		2.67	(assumed)	Consol. Stage 5	2.19	2.19	11.44	6.00	28.30	90.03	43.0	81.6	2.881	
B value start shear		0.90		Final Shear 6										
Test Stage End of#	1			This Stage Initial Values	2.19	2.19	11.44	6.00	28.30	90.03	43.0	81.6	2.881	
Stage Strain rate		0.087	%/min	Kc start stage	1.00		Back Pressure		14.21 ksf					
Data Start Row	33													

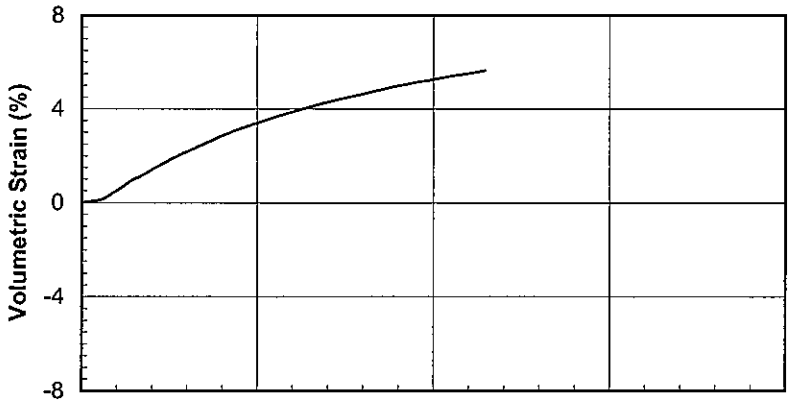
	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in²)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
33	-0.502	0.636	-14.393	0.00	0.00	28.30	2.19	2.19	0.00	1.00	0.0
34	-0.489	15.031	-13.733	0.00	0.01	28.30	2.35	2.27	0.08	1.07	2.0
35	-0.307	22.751	-13.521	0.07	0.02	28.32	2.44	2.32	0.12	1.11	3.1
36	-0.095	22.388	-13.426	0.14	0.02	28.34	2.44	2.31	0.12	1.11	3.0
37	0.164	25.657	-13.474	0.23	0.02	28.36	2.47	2.33	0.14	1.13	3.4
38	0.445	30.289	-13.426	0.33	0.02	28.39	2.52	2.36	0.17	1.15	4.0
39	0.662	38.463	-13.261	0.40	0.02	28.41	2.61	2.40	0.21	1.19	5.0
40	0.861	74.883	-12.107	0.47	0.04	28.42	3.02	2.61	0.41	1.38	9.2
41	1.021	117.115	-9.561	0.52	0.09	28.43	3.49	2.84	0.65	1.59	13.2
42	1.207	143.090	-6.592	0.59	0.15	28.43	3.78	2.99	0.80	1.73	15.4
43	1.401	166.840	-3.646	0.65	0.20	28.43	4.05	3.12	0.93	1.85	17.3
44	1.618	189.318	-0.440	0.73	0.26	28.44	4.30	3.24	1.05	1.96	18.9
45	1.838	206.756	2.482	0.80	0.32	28.44	4.49	3.34	1.15	2.05	20.1
46	2.059	223.195	5.640	0.88	0.38	28.45	4.68	3.43	1.24	2.13	21.2
47	2.163	231.959	7.007	0.92	0.40	28.45	4.77	3.48	1.29	2.18	21.8
48	2.279	239.406	8.398	0.96	0.43	28.45	4.86	3.52	1.33	2.22	22.2

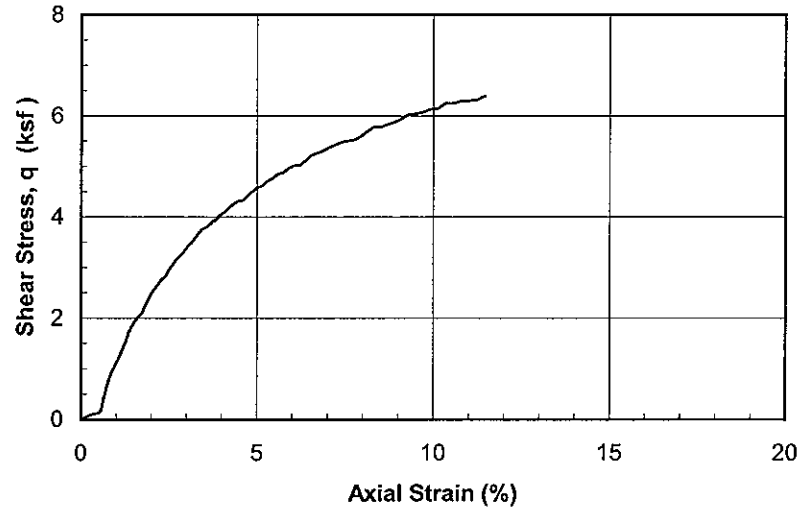
	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
49	2.496	257.298	11.532	1.03	0.49	28.46	5.05	3.62	1.43	2.31	23.3
50	2.725	273.782	14.690	1.11	0.55	28.46	5.24	3.71	1.52	2.39	24.2
51	2.958	289.313	18.013	1.19	0.61	28.47	5.41	3.80	1.61	2.47	25.1
52	3.214	300.121	21.549	1.28	0.68	28.47	5.53	3.86	1.67	2.52	25.6
53	3.469	306.615	24.612	1.37	0.73	28.48	5.60	3.90	1.71	2.56	26.0
54	3.737	310.293	27.535	1.46	0.79	28.49	5.64	3.92	1.73	2.57	26.1
55	4.169	362.470	32.720	1.61	0.89	28.51	6.22	4.21	2.01	2.84	28.6
56	4.351	371.189	34.817	1.67	0.93	28.52	6.32	4.25	2.06	2.88	29.0
57	4.533	381.361	36.891	1.73	0.97	28.52	6.43	4.31	2.12	2.93	29.4
58	4.727	391.533	38.918	1.80	1.00	28.53	6.54	4.37	2.17	2.98	29.9
59	4.918	402.795	41.110	1.86	1.05	28.54	6.67	4.43	2.24	3.04	30.3
60	5.121	411.877	43.420	1.93	1.09	28.55	6.77	4.48	2.29	3.09	30.7
61	5.320	424.229	45.164	2.00	1.12	28.56	6.90	4.55	2.35	3.15	31.2
62	5.540	432.948	47.308	2.08	1.16	28.57	7.00	4.59	2.40	3.19	31.5
63	5.744	440.213	49.430	2.15	1.20	28.58	7.08	4.63	2.44	3.23	31.8
64	5.960	447.479	51.551	2.22	1.24	28.59	7.15	4.67	2.48	3.26	32.1
65	6.172	461.284	53.554	2.30	1.28	28.60	7.31	4.75	2.56	3.33	32.6
66	6.388	466.733	55.652	2.37	1.32	28.61	7.36	4.78	2.59	3.36	32.8
67	6.604	477.995	57.773	2.44	1.36	28.62	7.49	4.84	2.65	3.42	33.2
68	6.834	485.261	59.823	2.52	1.40	28.63	7.57	4.88	2.69	3.45	33.4
69	7.063	493.980	61.803	2.60	1.44	28.64	7.66	4.93	2.73	3.50	33.7
70	7.331	503.062	63.783	2.69	1.47	28.66	7.76	4.97	2.78	3.54	34.0
71	7.591	510.328	65.904	2.78	1.51	28.67	7.83	5.01	2.82	3.58	34.3
72	7.854	520.500	67.836	2.87	1.55	28.69	7.94	5.07	2.88	3.63	34.6
73	8.084	529.219	69.698	2.95	1.58	28.70	8.04	5.11	2.92	3.67	34.9
74	8.317	536.121	71.631	3.03	1.62	28.72	8.11	5.15	2.96	3.70	35.1
75	8.559	542.297	73.516	3.12	1.66	28.73	8.18	5.18	2.99	3.73	35.3
76	8.815	551.016	75.543	3.20	1.69	28.74	8.27	5.23	3.04	3.77	35.5
77	9.065	557.555	77.476	3.29	1.73	28.76	8.34	5.27	3.07	3.81	35.7
78	9.342	563.005	79.125	3.39	1.76	28.78	8.40	5.29	3.10	3.83	35.9
79	9.619	570.997	80.869	3.48	1.79	28.80	8.48	5.34	3.14	3.87	36.1
80	9.922	581.532	82.590	3.59	1.83	28.82	8.59	5.39	3.20	3.92	36.4
81	10.181	588.798	84.310	3.67	1.86	28.84	8.67	5.43	3.24	3.95	36.6
82	10.450	595.700	86.031	3.77	1.89	28.85	8.74	5.47	3.27	3.99	36.8
83	10.731	603.693	87.445	3.86	1.92	28.88	8.82	5.51	3.32	4.03	37.0
84	10.990	612.412	88.977	3.95	1.95	28.89	8.91	5.55	3.36	4.07	37.3

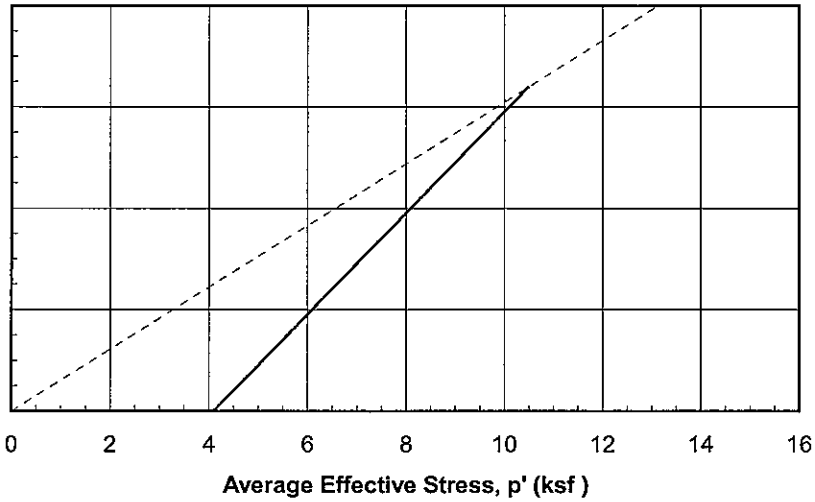
	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
85	11.289	614.228	90.249	4.06	1.97	28.92	8.93	5.56	3.37	4.07	37.3
86	11.630	620.767	91.475	4.17	1.99	28.95	8.99	5.59	3.40	4.10	37.5
87	11.907	631.303	92.818	4.27	2.02	28.97	9.10	5.65	3.46	4.15	37.7
88	12.201	642.565	94.609	4.37	2.05	28.99	9.22	5.71	3.52	4.21	38.0
89	12.504	648.740	96.165	4.47	2.08	29.01	9.28	5.74	3.55	4.24	38.2
90	12.837	653.463	97.815	4.59	2.11	29.04	9.33	5.76	3.57	4.26	38.3
91	13.174	664.362	99.653	4.70	2.15	29.06	9.44	5.82	3.63	4.31	38.6
92	13.520	666.541	101.185	4.82	2.18	29.09	9.46	5.83	3.63	4.32	38.6
93	13.884	670.901	102.434	4.95	2.20	29.12	9.50	5.85	3.65	4.33	38.7
94	14.199	680.710	103.707	5.06	2.22	29.15	9.60	5.90	3.70	4.38	38.9
95	14.537	690.518	104.932	5.17	2.25	29.18	9.70	5.94	3.75	4.43	39.2
96	14.878	699.237	106.087	5.29	2.27	29.21	9.79	5.99	3.80	4.47	39.3
97	15.246	702.507	107.077	5.42	2.29	29.24	9.81	6.00	3.81	4.48	39.4
98	15.631	709.773	108.114	5.55	2.31	29.27	9.88	6.04	3.85	4.51	39.6
99	16.016	716.675	109.269	5.68	2.33	29.31	9.95	6.07	3.88	4.54	39.7
100	16.397	716.675	110.494	5.81	2.35	29.34	9.94	6.07	3.87	4.54	39.7
101	16.773	727.574	111.484	5.94	2.37	29.38	10.05	6.12	3.93	4.58	39.9
102	17.149	733.386	112.309	6.07	2.39	29.41	10.10	6.15	3.95	4.61	40.0
103	17.547	733.023	113.440	6.21	2.41	29.45	10.09	6.14	3.95	4.60	40.0
104	17.945	731.207	114.713	6.35	2.43	29.49	10.06	6.12	3.93	4.59	40.0
105	18.339	745.375	116.009	6.48	2.46	29.52	10.20	6.20	4.00	4.65	40.3
106	18.715	742.105	116.504	6.61	2.47	29.56	10.16	6.17	3.98	4.63	40.2
107	19.130	755.184	117.117	6.75	2.48	29.60	10.28	6.24	4.05	4.69	40.4
108	19.563	757.000	118.201	6.90	2.50	29.64	10.29	6.24	4.05	4.70	40.5
109	19.982	763.176	119.073	7.05	2.51	29.68	10.35	6.27	4.08	4.72	40.6
110	20.402	774.075	119.874	7.19	2.53	29.72	10.45	6.32	4.13	4.77	40.8
111	20.830	783.520	120.487	7.34	2.54	29.77	10.54	6.37	4.17	4.81	41.0
112	21.280	780.250	121.029	7.49	2.55	29.81	10.49	6.34	4.15	4.79	40.9
113	21.729	788.243	121.571	7.65	2.56	29.86	10.56	6.38	4.19	4.82	41.0
114	22.201	793.692	122.161	7.81	2.57	29.91	10.61	6.40	4.21	4.84	41.1
115	22.664	796.598	122.585	7.97	2.58	29.96	10.63	6.41	4.22	4.85	41.2
116	23.148	795.508	122.490	8.14	2.58	30.01	10.60	6.40	4.20	4.84	41.1
117	23.624	798.778	122.962	8.30	2.59	30.07	10.62	6.41	4.21	4.85	41.1
118	24.100	809.677	123.645	8.46	2.60	30.12	10.72	6.46	4.26	4.89	41.3
119	24.584	816.216	125.460	8.63	2.63	30.16	10.78	6.48	4.29	4.92	41.5
120	25.081	829.294	126.497	8.80	2.65	30.21	10.90	6.55	4.35	4.97	41.7

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
121	25.613	832.564	127.016	8.98	2.66	30.27	10.92	6.55	4.36	4.98	41.7
122	26.128	849.638	126.285	9.16	2.65	30.33	11.08	6.63	4.44	5.05	42.0
123	26.656	859.084	127.534	9.34	2.67	30.38	11.16	6.68	4.48	5.09	42.2
124	27.179	859.810	127.393	9.52	2.67	30.45	11.15	6.67	4.48	5.09	42.2
125	27.724	850.002	127.039	9.71	2.66	30.51	11.03	6.61	4.42	5.03	41.9
126	28.260	862.353	127.275	9.89	2.67	30.57	11.14	6.67	4.47	5.08	42.2
127	28.827	857.631	126.733	10.09	2.66	30.64	11.07	6.63	4.44	5.05	42.0
128	29.394	858.721	127.746	10.28	2.68	30.70	11.06	6.63	4.44	5.05	42.0
129	29.960	857.994	128.170	10.48	2.69	30.77	11.04	6.61	4.42	5.04	42.0
130	30.548	865.623	126.356	10.68	2.65	30.85	11.09	6.64	4.45	5.06	42.1
131	31.132	854.724	128.477	10.88	2.69	30.90	10.97	6.58	4.39	5.00	41.8
132	31.716	868.529	128.783	11.08	2.70	30.97	11.09	6.64	4.45	5.06	42.1
133	32.335	868.893	129.514	11.30	2.71	31.04	11.07	6.63	4.44	5.05	42.0
134	32.914	883.061	130.386	11.49	2.73	31.11	11.20	6.69	4.50	5.11	42.3
135	33.355	888.510	131.211	11.65	2.74	31.15	11.24	6.72	4.52	5.13	42.3
136	33.546	892.143	131.658	11.71	2.75	31.18	11.27	6.73	4.54	5.14	42.4
137	33.749	896.866	131.823	11.78	2.75	31.20	11.31	6.75	4.56	5.16	42.5
138	33.952	897.956	132.130	11.85	2.76	31.22	11.32	6.75	4.56	5.16	42.5
139	34.164	904.858	132.908	11.92	2.77	31.24	11.38	6.79	4.59	5.19	42.6
140	34.380	903.768	132.931	12.00	2.78	31.27	11.36	6.78	4.58	5.18	42.6
141	34.597	906.674	133.520	12.07	2.79	31.29	11.38	6.79	4.60	5.19	42.6
142	34.822	896.139	134.110	12.15	2.80	31.32	11.27	6.73	4.54	5.14	42.4
143	35.051	894.323	134.110	12.23	2.80	31.34	11.24	6.72	4.53	5.13	42.4
144	35.280	897.229	135.076	12.31	2.82	31.37	11.27	6.73	4.54	5.14	42.4
145	35.518	895.049	135.830	12.39	2.83	31.39	11.24	6.71	4.52	5.13	42.3
146	35.756	896.139	136.042	12.47	2.83	31.42	11.24	6.72	4.52	5.13	42.4
147	35.920	900.862	136.466	12.53	2.84	31.44	11.28	6.74	4.55	5.15	42.4
148	36.041	898.319	137.032	12.57	2.85	31.45	11.25	6.72	4.53	5.14	42.4
149	36.149	901.225	136.396	12.61	2.84	31.47	11.28	6.73	4.54	5.15	42.4
150	36.275	906.674	137.150	12.65	2.85	31.48	11.33	6.76	4.57	5.17	42.5
151	36.405	910.307	138.776	12.70	2.89	31.48	11.36	6.78	4.59	5.19	42.6
152	36.534	913.940	139.672	12.74	2.90	31.49	11.40	6.79	4.60	5.20	42.6
153	36.664	904.495	141.274	12.78	2.93	31.50	11.30	6.75	4.55	5.16	42.5
154	36.794	906.311	141.062	12.83	2.93	31.52	11.31	6.75	4.56	5.16	42.5
155	37.079	911.760	142.806	12.93	2.96	31.54	11.36	6.78	4.59	5.18	42.6
156	37.218	903.768	142.924	12.98	2.96	31.56	11.28	6.73	4.54	5.15	42.4

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
157	37.352	906.311	143.914	13.02	2.98	31.57	11.30	6.75	4.55	5.16	42.5
158	37.378	903.768	143.325	13.03	2.97	31.58	11.27	6.73	4.54	5.14	42.4
159	37.378	911.034	145.917	13.03	3.02	31.56	11.35	6.77	4.58	5.18	42.6
160	37.378	907.764	146.718	13.03	3.04	31.56	11.32	6.75	4.56	5.16	42.5







SAMPLE INFORMATION

Sample: Norlite Test No.: S3
Type: Recompacted sample
Description: 3/4-inch lighweight shale aggregate

SPECIMEN INFORMATION (after saturation)

Height: 11.19 in Dia.: 5.99 in Area.: 28.19 sq. in
Water Content: 71.3% Dry Unit Weight: 42.8 pcf

TEST SUMMARY (end of test)

Effective Confining Stress: 4.10 ksf vert., 4.10 ksf horiz.
Water Content: 71.3 % Dry Unit Weight: 42.8 pcf
B Coefficient: 0.9 Strain Rate: 0.089 %/min
Peak Shear Stress: 6.39 ksf @ 11.5 % Strain
Peak Effective Friction Angle: 37.5 deg. @ 11.2 % Strain

Failure Sketch

REMARKS: Positive volumetric strain indicates specimen contraction.
Specimen membrane ruptured at about 11.5% strain.

Operator: D. Aghjayan
Checked: B. Sawa
Test Date: 19-Oct-2007

4/17/2008 10:30

Geotechnical Testing of Norlite Lightweight Aggregate

Norlite Corporation
Cohoes, New York

GEI Consultants

07181

CONSOLIDATED ISOTROPIC DRAINED TRIAXIAL COMPRESSION

April 2008 Figure D3

PROJECT #:	07181
PROJECT:	Norlite Aggregate
TEST:	S3
BORING:	--
SAMPLE:	Norlite
DEPTH (ft):	--
OPER.:	D. Aghjayan
TEST DATE:	10/19/2007

Stage	SIGMAv' (ksf)	SIGMAh' (ksf)	Height (inch)	Diameter (inch)	Area (in²)	Water Content (%)	Dry Density (pcf)	Total Density (pcf)	Void Ratio
In situ	--	--	--	--	--	--	--	--	--
After Sampling	--	--	--	--	--	--	--	--	--
In tube before extrusion	--	--	--	--	--	--	--	--	--
Under vac.	1.02	1.02	11.192	5.991	28.190		42.8		2.896

Transducer	No.	Cal. Factor	Unit
DCDT	5733	-14.208	mm/(mV/V)
Load Cell	60293	-149.1745	kg/(mV/V)
Pressure	10260	-0.7056	ksc/(mV/V)
Volume	DV2B	1.2097	cc/(mV/V)
Gravity of Solids		2.67	(assumed)
B value start shear		0.90	
Test Stage End of#	1		
Stage Strain rate		0.089	%/min
Data Start Row	33		

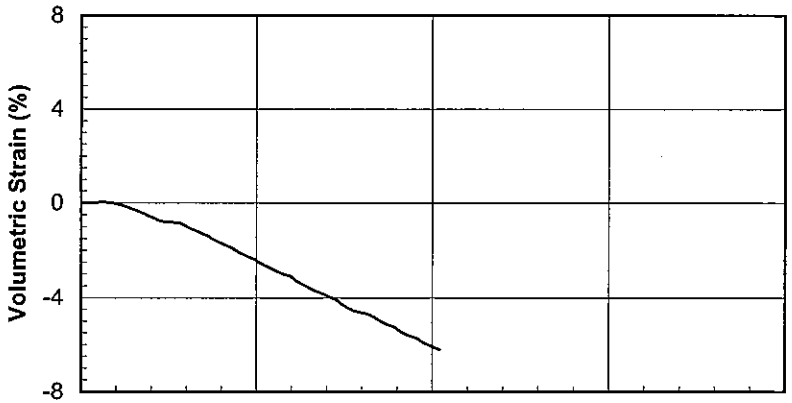
End of:								calculated from start of test		
Saturation	1.04	1.04	11.19	5.99	28.19	71.30	42.8	73.3	2.896
Consol. Stage 1	4.10	4.10	11.19	5.99	28.19	71.30	42.8	73.3	2.896
Consol. Stage 2	4.10	4.10	11.19	5.99	28.19	71.30	42.8	73.3	2.896
Consol. Stage 3	4.10	4.10	11.19	5.99	28.19	71.30	42.8	73.3	2.896
Consol. Stage 4	4.10	4.10	11.19	5.99	28.19	71.30	42.8	73.3	2.896
Consol. Stage 5	4.10	4.10	11.19	5.99	28.19	71.30	42.8	73.3	2.896
Final Shear 6									
This Stage Initial Values	4.10	4.10	11.19	5.99	28.19	71.30	42.8	73.3	2.896
Kc start stage 1.00			Back Pressure		11.26 ksf				

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in²)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
33	0.532	22.161	-20.355	0.00	0.00	28.19	4.10	4.10	0.00	1.00	0.0
34	0.809	29.426	-19.625	0.10	0.01	28.21	4.18	4.14	0.04	1.02	0.6
35	1.068	33.786	-18.871	0.19	0.03	28.24	4.23	4.16	0.07	1.03	0.9
36	1.298	37.419	-17.504	0.27	0.06	28.25	4.27	4.18	0.09	1.04	1.2
37	1.535	41.051	-16.655	0.35	0.07	28.27	4.31	4.20	0.11	1.05	1.4
38	1.752	42.868	-15.736	0.43	0.09	28.29	4.33	4.21	0.12	1.06	1.6
39	1.955	44.684	-14.864	0.50	0.11	28.30	4.35	4.22	0.13	1.06	1.7
40	2.171	53.767	-13.780	0.58	0.13	28.32	4.45	4.27	0.18	1.09	2.4
41	2.362	93.002	-11.282	0.64	0.18	28.32	4.89	4.49	0.40	1.19	5.1
42	2.569	128.604	-7.794	0.72	0.24	28.32	5.29	4.69	0.60	1.29	7.3
43	2.785	163.116	-4.188	0.79	0.31	28.33	5.68	4.89	0.79	1.39	9.3
44	3.010	188.546	-0.275	0.87	0.39	28.33	5.96	5.03	0.93	1.46	10.7
45	3.270	209.254	3.684	0.96	0.46	28.33	6.19	5.14	1.05	1.51	11.8
46	3.516	231.777	8.633	1.05	0.56	28.33	6.45	5.27	1.17	1.57	12.9
47	3.750	254.301	12.876	1.13	0.64	28.33	6.70	5.40	1.30	1.64	13.9
48	3.979	278.278	17.047	1.21	0.72	28.33	6.97	5.53	1.44	1.70	15.0

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in²)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
49	4.174	300.802	21.124	1.28	0.80	28.33	7.22	5.66	1.56	1.76	16.0
50	4.373	325.506	25.155	1.35	0.88	28.33	7.50	5.80	1.70	1.83	17.1
51	4.624	347.666	29.255	1.44	0.96	28.33	7.74	5.92	1.82	1.89	17.9
52	4.887	367.284	33.238	1.53	1.04	28.33	7.96	6.03	1.93	1.94	18.7
53	4.931	369.100	33.780	1.55	1.05	28.33	7.98	6.04	1.94	1.95	18.8
54	5.177	383.995	36.043	1.63	1.09	28.35	8.15	6.12	2.03	1.99	19.3
55	5.484	397.800	40.050	1.74	1.17	28.36	8.30	6.20	2.10	2.03	19.8
56	5.739	422.140	43.868	1.83	1.24	28.36	8.57	6.34	2.24	2.09	20.7
57	5.960	443.211	47.992	1.91	1.32	28.36	8.81	6.45	2.36	2.15	21.4
58	6.202	463.555	52.116	1.99	1.40	28.36	9.04	6.57	2.47	2.21	22.1
59	6.470	480.629	56.311	2.09	1.48	28.37	9.23	6.66	2.57	2.25	22.7
60	6.730	496.251	59.635	2.18	1.55	28.37	9.40	6.75	2.65	2.29	23.1
61	7.050	515.505	65.055	2.29	1.65	28.38	9.62	6.86	2.76	2.35	23.7
62	7.353	525.314	69.132	2.40	1.73	28.38	9.72	6.91	2.81	2.37	24.0
63	7.612	547.837	73.163	2.49	1.81	28.39	9.98	7.04	2.94	2.44	24.7
64	7.872	563.095	77.428	2.58	1.89	28.39	10.15	7.12	3.02	2.48	25.1
65	8.157	581.260	81.388	2.68	1.97	28.40	10.35	7.22	3.13	2.53	25.6
66	8.451	595.428	85.229	2.79	2.04	28.41	10.50	7.30	3.20	2.56	26.0
67	8.776	609.959	89.330	2.90	2.12	28.42	10.66	7.38	3.28	2.60	26.4
68	8.992	624.128	92.041	2.98	2.17	28.42	10.82	7.46	3.36	2.64	26.8
69	9.091	630.667	92.323	3.01	2.18	28.43	10.89	7.49	3.40	2.66	27.0
70	9.407	643.382	96.424	3.12	2.26	28.44	11.03	7.56	3.47	2.69	27.3
71	9.727	660.820	100.384	3.23	2.34	28.45	11.22	7.66	3.56	2.74	27.7
72	10.017	679.711	104.249	3.34	2.41	28.46	11.43	7.76	3.67	2.79	28.2
73	10.337	696.422	107.973	3.45	2.48	28.47	11.61	7.86	3.76	2.84	28.6
74	10.666	704.051	111.979	3.56	2.56	28.48	11.70	7.90	3.80	2.86	28.8
75	11.007	715.676	116.174	3.69	2.64	28.50	11.82	7.96	3.86	2.89	29.0
76	11.297	728.754	119.497	3.79	2.71	28.51	11.97	8.03	3.93	2.92	29.3
77	11.362	725.485	120.817	3.81	2.73	28.51	11.93	8.01	3.92	2.91	29.3
78	11.717	745.466	125.107	3.93	2.81	28.52	12.15	8.12	4.03	2.97	29.7
79	12.089	757.091	129.137	4.07	2.89	28.54	12.27	8.18	4.09	3.00	30.0
80	12.448	772.349	132.955	4.19	2.97	28.55	12.44	8.27	4.17	3.04	30.3
81	12.824	787.970	137.550	4.32	3.05	28.56	12.61	8.35	4.26	3.08	30.6
82	13.218	798.506	141.062	4.46	3.12	28.59	12.72	8.41	4.31	3.10	30.8
83	13.603	802.502	145.139	4.60	3.20	28.60	12.76	8.43	4.33	3.11	30.9
84	13.979	819.213	148.604	4.73	3.27	28.62	12.94	8.52	4.42	3.16	31.3

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
85	14.359	834.471	152.092	4.86	3.34	28.64	13.10	8.60	4.50	3.20	31.6
86	14.485	838.104	153.247	4.91	3.36	28.65	13.14	8.62	4.52	3.21	31.6
87	14.770	848.639	155.509	5.01	3.40	28.67	13.25	8.67	4.58	3.23	31.8
88	15.177	856.268	159.374	5.15	3.48	28.69	13.33	8.71	4.62	3.25	32.0
89	15.588	874.433	163.051	5.30	3.55	28.71	13.52	8.81	4.71	3.30	32.3
90	16.007	884.968	166.775	5.44	3.62	28.73	13.63	8.86	4.77	3.33	32.5
91	16.427	901.316	170.216	5.59	3.69	28.76	13.80	8.95	4.85	3.37	32.8
92	16.877	906.402	173.987	5.75	3.76	28.79	13.85	8.97	4.88	3.38	32.9
93	17.305	923.113	177.569	5.90	3.83	28.81	14.02	9.06	4.96	3.42	33.2
94	17.746	933.285	181.010	6.06	3.89	28.84	14.13	9.11	5.02	3.45	33.4
95	18.200	935.465	184.592	6.22	3.96	28.87	14.14	9.12	5.02	3.45	33.4
96	18.667	953.266	188.033	6.38	4.03	28.90	14.33	9.21	5.11	3.50	33.7
97	18.801	958.715	189.353	6.43	4.06	28.90	14.38	9.24	5.14	3.51	33.8
98	19.121	972.520	191.616	6.54	4.10	28.93	14.53	9.31	5.22	3.55	34.1
99	19.597	981.602	195.198	6.71	4.17	28.96	14.62	9.36	5.26	3.57	34.2
100	20.047	991.411	198.592	6.87	4.23	28.99	14.71	9.40	5.31	3.59	34.4
101	20.527	1003.763	201.773	7.03	4.30	29.02	14.83	9.47	5.37	3.62	34.6
102	21.020	1013.935	205.120	7.21	4.36	29.06	14.93	9.51	5.42	3.65	34.7
103	21.539	1025.560	208.207	7.39	4.42	29.09	15.05	9.57	5.47	3.67	34.9
104	22.045	1032.099	211.460	7.57	4.48	29.13	15.10	9.60	5.50	3.69	35.0
105	22.577	1037.185	214.642	7.76	4.55	29.17	15.14	9.62	5.52	3.70	35.0
106	23.066	1049.537	217.917	7.93	4.61	29.21	15.26	9.68	5.58	3.73	35.2
107	23.602	1069.881	221.382	8.12	4.68	29.25	15.47	9.78	5.69	3.78	35.5
108	24.126	1087.319	224.917	8.30	4.74	29.28	15.64	9.87	5.77	3.82	35.8
109	24.679	1089.499	228.335	8.49	4.81	29.33	15.65	9.87	5.78	3.82	35.8
110	25.246	1100.034	232.223	8.69	4.89	29.37	15.75	9.92	5.83	3.84	36.0
111	25.808	1109.843	235.358	8.89	4.95	29.41	15.84	9.97	5.87	3.87	36.1
112	26.344	1122.558	238.375	9.08	5.00	29.45	15.96	10.03	5.93	3.90	36.3
113	26.920	1141.449	241.438	9.28	5.06	29.50	16.14	10.12	6.02	3.94	36.5
114	27.508	1146.898	244.408	9.49	5.12	29.55	16.18	10.14	6.04	3.95	36.6
115	28.113	1155.254	247.236	9.70	5.18	29.60	16.25	10.17	6.08	3.97	36.7
116	28.334	1159.250	248.108	9.78	5.19	29.62	16.28	10.19	6.09	3.97	36.7
117	28.723	1167.606	249.876	9.92	5.23	29.66	16.36	10.23	6.13	3.99	36.8
118	29.324	1171.965	252.940	10.13	5.29	29.71	16.38	10.24	6.14	4.00	36.9
119	29.917	1193.399	255.886	10.34	5.34	29.76	16.59	10.34	6.25	4.05	37.2
120	30.548	1194.852	259.397	10.56	5.41	29.81	16.58	10.34	6.24	4.05	37.1

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
121	31.197	1205.751	261.943	10.79	5.46	29.87	16.67	10.39	6.29	4.07	37.3
122	31.842	1209.020	264.582	11.01	5.51	29.93	16.68	10.39	6.29	4.07	37.3
123	32.473	1215.560	267.245	11.24	5.56	29.99	16.73	10.41	6.32	4.08	37.3
124	33.126	1231.544	270.639	11.47	5.63	30.05	16.87	10.48	6.39	4.12	37.5



SAMPLE INFORMATION

Sample: Norlite Test No.: S4
Type: Recompacted sample
Description: 3/4-inch lighweight shale aggregate

SPECIMEN INFORMATION (after saturation)

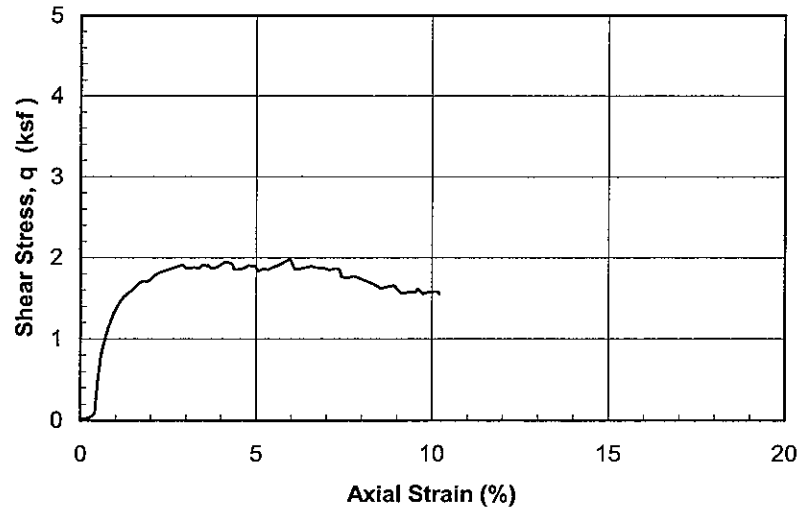
Height: 11.93 in Dia.: 5.99 in Area.: 28.14 sq. in
Water Content: Not measured Dry Unit Weight: 46.3 pcf

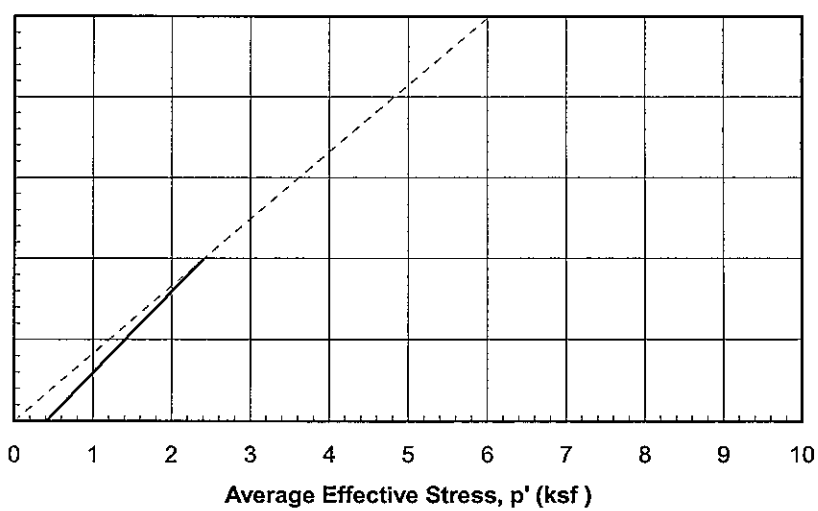
TEST SUMMARY (end of test)

Effective Confining Stress: 0.41 ksf vert., 0.41 ksf horiz.
Water Content: Not measured Dry Unit Weight: 46.3 pcf
B Coefficient: Not measured Strain Rate: 0.084 %/min
Peak Shear Stress: 1.95 ksf @ 4.1 % Strain
Peak Effective Friction Angle: 55.7 deg. @ 4.0 % Strain

Failure Sketch

REMARKS: Positive volumetric strain indicates specimen contraction.





Operator: D. Aghjayan
Checked: B. Sawa
Test Date: 25-Oct-2007

4/17/2008 10:30

Geotechnical Testing of Norlite Lightweight Aggregate	GEI Consultants	CONSOLIDATED ISOTROPIC DRAINED TRIAXIAL COMPRESSION
Norlite Corporation Cohoes, New York	07181	April 2008 Figure D4

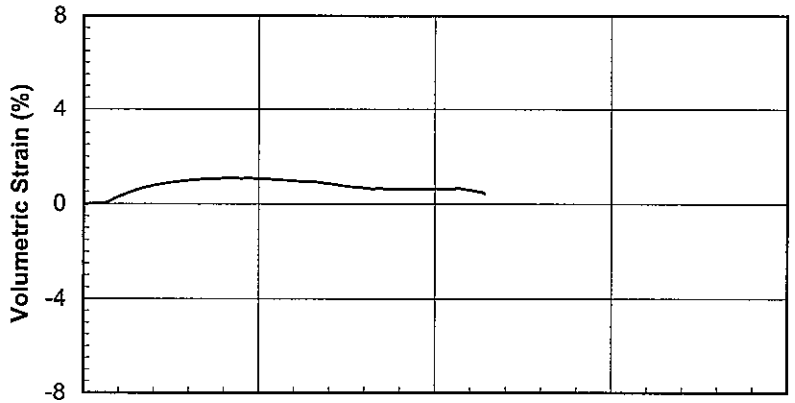
PROJECT #:	07181												
PROJECT:	Norlite Aggregate			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water	Dry	Total	Void
TEST:	S4									Content	Density	Density	Ratio
BORING:	--				(ksf)	(ksf)	(inch)	(inch)	(in²)	(%)	(pcf)	(pcf)	
SAMPLE:	Norlite			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	--			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	D. Aghjayan			In tube before extrusion	--	--	--	--	--	--	--	--	--
TEST DATE:	10/25/2007			Under vac.	1.02	1.02	11.925	5.986	28.143		46.3		--

Transducer	No.	Cal. Factor	Unit	End of:							calculated from start of test		
DCDT	5733	-14.208	mm/(mV/V)	Saturation	0.41	0.41	11.93	5.99	28.14	--	46.3	--	--
Load Cell	60293	-149.1745	kg/(mV/V)	Consol. Stage 1	0.41	0.41	11.93	5.99	28.14	--	46.3	--	--
Pressure	10260	-0.7056	ksc/(mV/V)	Consol. Stage 2	0.41	0.41	11.93	5.99	28.14	--	46.3	--	--
Volume	DV2B	1.2097	cc/(mV/V)	Consol. Stage 3	0.41	0.41	11.93	5.99	28.14	--	46.3	--	--
				Consol. Stage 4	0.41	0.41	11.93	5.99	28.14	--	46.3	--	--
Gravity of Solids		2.67	(assumed)	Consol. Stage 5	0.41	0.41	11.93	5.99	28.14	--	46.3	--	--
B value start shear		0.90		Final Shear 6						--			
Test Stage End of#	1			This Stage Initial Values	0.41	0.41	11.93	5.99	28.14	--	46.3	--	--
Stage Strain rate		0.084	%/min	Kc start stage	1.00		Back Pressure		10.86 ksf				
Data Start Row	34												

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in²)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
34	0.303	13.078	-25.228	0.00	0.00	28.14	0.41	0.41	0.00	1.00	0.0
35	0.476	16.711	-25.269	0.06	0.00	28.16	0.45	0.43	0.02	1.10	2.7
36	0.705	17.438	-25.352	0.13	0.00	28.18	0.46	0.43	0.02	1.12	3.2
37	0.926	18.891	-25.095	0.21	0.00	28.20	0.48	0.44	0.03	1.16	4.2
38	1.138	21.071	-25.225	0.28	0.00	28.22	0.50	0.45	0.04	1.22	5.7
39	1.323	23.250	-25.440	0.34	0.00	28.24	0.52	0.47	0.06	1.28	7.0
40	1.527	29.063	-25.699	0.40	-0.01	28.26	0.59	0.50	0.09	1.44	10.4
41	1.700	72.657	-24.922	0.46	0.01	28.27	1.08	0.74	0.33	2.63	26.7
42	1.886	118.432	-24.076	0.52	0.02	28.28	1.59	1.00	0.59	3.89	36.2
43	2.089	154.760	-23.749	0.59	0.03	28.30	2.00	1.20	0.79	4.88	41.3
44	2.292	178.737	-23.814	0.66	0.03	28.32	2.27	1.34	0.93	5.53	43.9
45	2.500	199.081	-24.123	0.73	0.02	28.34	2.49	1.45	1.04	6.09	45.9
46	2.729	218.699	-24.630	0.80	0.01	28.37	2.71	1.56	1.15	6.62	47.5
47	2.950	232.504	-25.564	0.87	-0.01	28.39	2.86	1.64	1.23	6.99	48.6
48	3.162	246.309	-26.663	0.94	-0.03	28.42	3.02	1.71	1.30	7.36	49.5
49	3.361	257.934	-27.959	1.01	-0.05	28.44	3.14	1.78	1.37	7.67	50.3

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
50	3.573	267.379	-29.335	1.08	-0.07	28.47	3.25	1.83	1.42	7.92	50.9
51	3.793	276.098	-30.861	1.15	-0.10	28.50	3.34	1.87	1.46	8.15	51.4
52	4.022	285.544	-32.575	1.23	-0.13	28.53	3.44	1.93	1.52	8.40	51.9
53	4.182	289.177	-33.845	1.28	-0.16	28.55	3.48	1.94	1.53	8.49	52.1
54	4.265	292.083	-34.549	1.31	-0.17	28.56	3.51	1.96	1.55	8.57	52.3
55	4.515	297.169	-37.902	1.39	-0.23	28.61	3.56	1.99	1.58	8.70	52.5
56	4.771	301.529	-40.144	1.48	-0.27	28.64	3.61	2.01	1.60	8.81	52.8
57	4.996	308.068	-42.577	1.55	-0.32	28.68	3.68	2.04	1.63	8.97	53.1
58	5.242	314.607	-45.040	1.63	-0.36	28.71	3.74	2.08	1.67	9.14	53.4
59	5.480	320.419	-47.500	1.71	-0.40	28.75	3.80	2.11	1.70	9.29	53.7
60	5.744	323.689	-49.957	1.80	-0.45	28.79	3.84	2.12	1.71	9.36	53.8
61	5.744	323.689	-49.972	1.80	-0.45	28.79	3.84	2.12	1.71	9.36	53.8
62	6.034	322.418	-54.538	1.89	-0.53	28.84	3.82	2.11	1.70	9.31	53.7
63	6.332	326.414	-57.814	1.99	-0.59	28.88	3.85	2.13	1.72	9.41	53.9
64	6.613	335.314	-60.786	2.08	-0.65	28.93	3.95	2.18	1.77	9.63	54.3
65	6.894	341.490	-64.106	2.18	-0.71	28.97	4.01	2.21	1.80	9.79	54.5
66	7.184	345.850	-67.329	2.27	-0.77	29.02	4.05	2.23	1.82	9.89	54.7
67	8.793	361.108	-70.806	2.80	-0.83	29.19	4.19	2.30	1.89	10.24	55.3
68	9.130	364.741	-74.756	2.91	-0.90	29.25	4.23	2.32	1.91	10.32	55.4
69	9.463	357.111	-80.262	3.02	-1.00	29.31	4.14	2.27	1.86	10.10	55.1
70	9.805	359.654	-84.584	3.14	-1.08	29.37	4.16	2.28	1.87	10.15	55.1
71	10.160	361.108	-88.597	3.25	-1.15	29.42	4.16	2.29	1.88	10.17	55.2
72	10.523	360.018	-92.647	3.37	-1.23	29.48	4.15	2.28	1.87	10.12	55.1
73	10.856	369.463	-97.473	3.48	-1.31	29.54	4.24	2.32	1.91	10.35	55.5
74	11.241	366.557	-101.636	3.61	-1.39	29.60	4.20	2.31	1.90	10.25	55.3
75	11.293	369.100	-102.192	3.63	-1.40	29.61	4.23	2.32	1.91	10.32	55.4
76	11.604	361.108	-108.809	3.73	-1.52	29.68	4.13	2.27	1.86	10.09	55.0
77	11.959	364.377	-113.484	3.85	-1.60	29.74	4.16	2.28	1.88	10.16	55.2
78	12.353	370.916	-118.228	3.98	-1.69	29.80	4.22	2.32	1.91	10.31	55.4
79	12.750	379.635	-122.873	4.11	-1.78	29.87	4.31	2.36	1.95	10.51	55.7
80	13.153	377.456	-127.390	4.24	-1.86	29.94	4.27	2.34	1.93	10.43	55.6
81	13.412	375.276	-130.333	4.33	-1.91	29.98	4.25	2.33	1.92	10.36	55.5
82	13.555	363.651	-133.656	4.38	-1.97	30.01	4.12	2.26	1.85	10.05	55.0
83	13.944	364.741	-139.860	4.50	-2.08	30.08	4.12	2.27	1.86	10.06	55.0
84	14.364	367.647	-144.971	4.64	-2.18	30.16	4.14	2.28	1.87	10.11	55.1
85	14.775	375.276	-149.985	4.78	-2.27	30.23	4.21	2.31	1.90	10.29	55.4

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
86	15.216	374.549	-154.973	4.92	-2.36	30.30	4.20	2.30	1.89	10.25	55.3
87	15.359	374.913	-156.596	4.97	-2.39	30.32	4.20	2.30	1.89	10.25	55.3
88	15.631	364.014	-163.198	5.06	-2.51	30.39	4.08	2.24	1.83	9.95	54.8
89	16.051	369.463	-169.246	5.20	-2.62	30.46	4.12	2.27	1.86	10.07	55.0
90	16.509	369.463	-174.994	5.35	-2.72	30.54	4.11	2.26	1.85	10.04	55.0
91	16.954	376.002	-180.612	5.50	-2.83	30.62	4.17	2.29	1.88	10.19	55.2
92	17.387	381.452	-186.012	5.64	-2.92	30.70	4.22	2.31	1.90	10.30	55.4
93	17.845	389.081	-191.341	5.79	-3.02	30.78	4.29	2.35	1.94	10.47	55.7
94	18.313	398.163	-194.346	5.95	-3.08	30.84	4.37	2.39	1.98	10.68	56.0
95	18.356	399.979	-194.346	5.96	-3.08	30.85	4.39	2.40	1.99	10.72	56.0
96	18.788	374.913	-204.937	6.10	-3.27	30.95	4.12	2.27	1.86	10.06	55.0
97	19.264	377.456	-211.940	6.26	-3.40	31.04	4.14	2.27	1.86	10.10	55.1
98	19.753	381.088	-218.816	6.42	-3.52	31.13	4.16	2.29	1.88	10.16	55.2
99	20.224	385.811	-225.512	6.58	-3.64	31.22	4.20	2.30	1.90	10.25	55.3
100	20.454	382.542	-227.975	6.65	-3.69	31.26	4.16	2.29	1.88	10.16	55.2
101	21.241	382.542	-236.242	6.91	-3.84	31.39	4.15	2.28	1.87	10.12	55.1
102	21.764	379.635	-243.503	7.09	-3.97	31.49	4.11	2.26	1.85	10.02	54.9
103	22.279	384.358	-249.546	7.26	-4.08	31.58	4.14	2.28	1.87	10.11	55.1
104	22.625	382.905	-256.286	7.37	-4.20	31.66	4.12	2.26	1.85	10.05	55.0
105	22.828	364.377	-261.489	7.44	-4.30	31.71	3.93	2.17	1.76	9.59	54.2
106	23.347	364.377	-269.496	7.61	-4.44	31.81	3.92	2.16	1.75	9.56	54.2
107	23.883	368.737	-276.398	7.79	-4.57	31.91	3.95	2.18	1.77	9.64	54.3
108	25.021	357.475	-283.431	8.16	-4.69	32.08	3.82	2.11	1.70	9.32	53.7
109	25.609	352.389	-290.648	8.35	-4.83	32.19	3.76	2.08	1.67	9.17	53.4
110	26.197	342.217	-301.560	8.55	-5.02	32.32	3.64	2.03	1.62	8.89	52.9
111	26.725	348.393	-308.201	8.72	-5.15	32.42	3.69	2.05	1.64	9.02	53.2
112	27.322	352.389	-314.113	8.92	-5.25	32.52	3.72	2.07	1.66	9.09	53.3
113	27.932	333.498	-325.927	9.12	-5.47	32.66	3.52	1.97	1.56	8.60	52.3
114	28.529	337.494	-333.339	9.32	-5.60	32.77	3.55	1.98	1.57	8.67	52.5
115	29.160	338.584	-339.953	9.53	-5.72	32.89	3.55	1.98	1.57	8.67	52.5
116	29.368	347.666	-341.847	9.60	-5.76	32.92	3.64	2.02	1.61	8.88	52.9
117	29.791	336.041	-349.887	9.74	-5.90	33.02	3.51	1.96	1.55	8.58	52.3
118	30.440	342.580	-357.982	9.95	-6.05	33.14	3.57	1.99	1.58	8.71	52.6
119	31.076	344.396	-365.120	10.16	-6.18	33.26	3.57	1.99	1.58	8.72	52.6
120	31.236	338.584	-366.782	10.21	-6.21	33.29	3.51	1.96	1.55	8.58	52.3



SAMPLE INFORMATION

Sample: Norlite Test No.: S5
Type: Recompacted sample
Description: 3/4-inch lighweight shale aggregate

SPECIMEN INFORMATION (after saturation)

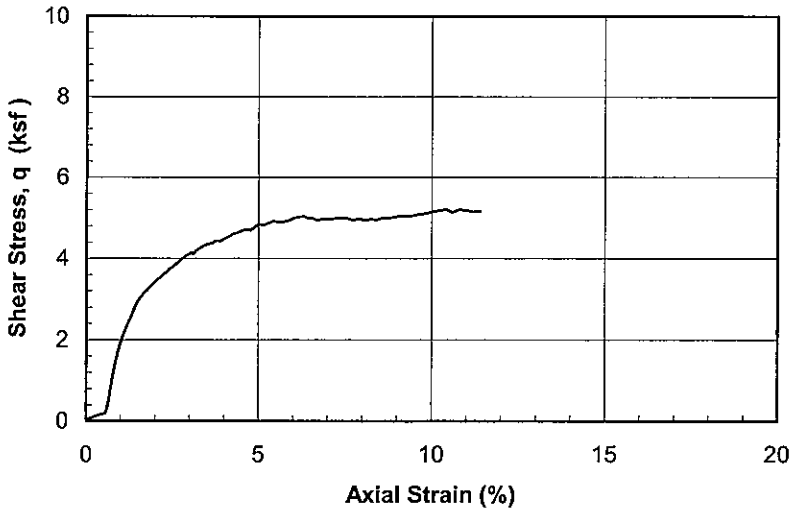
Height: 11.98 in Dia.: 5.98 in Area.: 28.05 sq. in
Water Content: Not measured Dry Unit Weight: 45.9 pcf

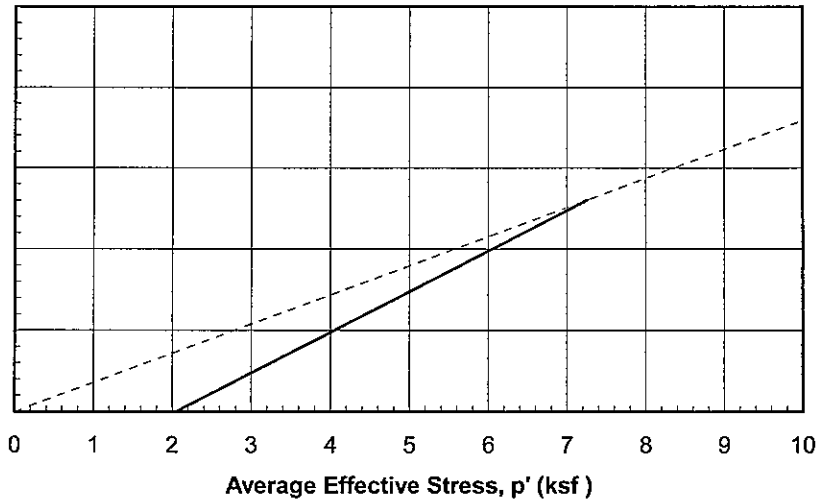
TEST SUMMARY (end of test)

Effective Confining Stress: 2.05 ksf vert., 2.05 ksf horiz.
Water Content: Not measured Dry Unit Weight: 45.9 pcf
B Coefficient: Not measured Strain Rate: 0.083 %/min
Peak Shear Stress: 5.22 ksf @ 10.4 % Strain
Peak Effective Friction Angle: 45.9 deg. @ 10.2 % Strain

Failure Sketch

REMARKS: Positive volumetric strain indicates specimen contraction.





Operator: B.Sawa
Checked: D. Aghjayan
Test Date: 30-Oct-2007

4/17/2008 10:30

Geotechnical Testing of Norlite Lightweight Aggregate	GEI Consultants	CONSOLIDATED ISOTROPIC DRAINED TRIAXIAL COMPRESSION
Norlite Corporation Cohoes, New York	07181	April 2008 Figure D5

PROJECT #:	07181												
PROJECT:	Norlite Testing			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water	Dry	Total	Void
TEST:	S5									Content	Density	Density	Ratio
BORING:	--				(ksf)	(ksf)	(inch)	(inch)	(in²)	(%)	(pcf)	(pcf)	
SAMPLE:	Norlite			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	--			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	B.Sawa			In tube before extrusion	--	--	--	--	--	--	--	--	--
TEST DATE:	10/30/2007			Under vac.	1.02	1.02	11.979	5.976	28.047		45.9		--

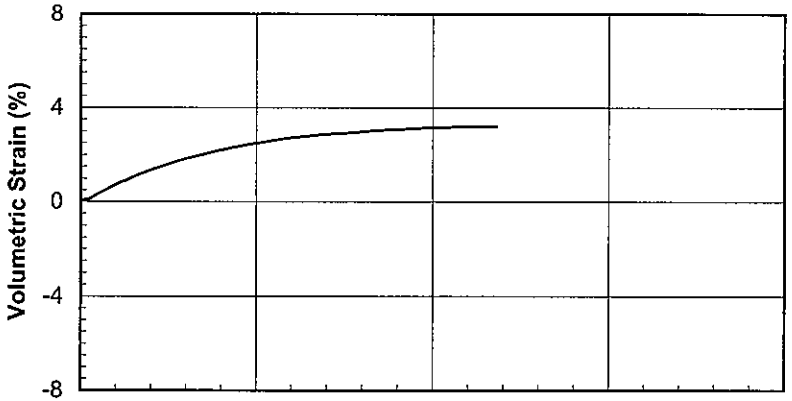
Transducer	No.	Cal. Factor	Unit	End of:							calculated from start of test		
DCDT	5733	-14.208	mm/(mV/V)	Saturation	2.05	2.05	11.98	5.98	28.05	--	45.9	--	--
Load Cell	60293	-149.1745	kg/(mV/V)	Consol. Stage 1	2.05	2.05	11.98	5.98	28.05	--	45.9	--	--
Pressure	10260	-0.7056	ksc/(mV/V)	Consol. Stage 2	2.05	2.05	11.98	5.98	28.05	--	45.9	--	--
Volume	DV2B	1	cc/(mV/V)	Consol. Stage 3	2.05	2.05	11.98	5.98	28.05	--	45.9	--	--
				Consol. Stage 4	2.05	2.05	11.98	5.98	28.05	--	45.9	--	--
Gravity of Solids		2.67	(assumed)	Consol. Stage 5	2.05	2.05	11.98	5.98	28.05	--	45.9	--	--
B value start shear		0.90		Final Shear 6						--			
Test Stage End of#	1			This Stage Initial Values	2.05	2.05	11.98	5.98	28.05	--	45.9	--	--
Stage Strain rate		0.083	%/min	Kc start stage	1.00		Back Pressure		11.10 ksf				
Data Start Row	34												

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in²)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
34	0.406	17.773	-11.130	0.00	0.00	28.05	2.05	2.05	0.00	1.00	0.0
35	0.695	29.380	-10.786	0.10	0.01	28.07	2.18	2.11	0.07	1.06	1.8
36	0.993	34.459	-10.721	0.19	0.01	28.10	2.24	2.14	0.09	1.09	2.5
37	1.283	39.537	-10.674	0.29	0.01	28.13	2.29	2.17	0.12	1.12	3.2
38	1.542	43.889	-10.289	0.37	0.02	28.15	2.34	2.20	0.15	1.14	3.8
39	1.805	46.791	-10.351	0.46	0.01	28.17	2.38	2.21	0.16	1.16	4.2
40	2.077	51.869	-10.036	0.55	0.02	28.20	2.43	2.24	0.19	1.19	4.9
41	2.319	87.416	-9.015	0.63	0.04	28.21	2.83	2.44	0.39	1.38	9.2
42	2.535	156.333	-6.339	0.70	0.09	28.22	3.61	2.83	0.78	1.76	16.0
43	2.751	220.172	-3.453	0.77	0.14	28.23	4.32	3.19	1.14	2.11	20.9
44	2.975	277.482	-0.524	0.84	0.19	28.23	4.97	3.51	1.46	2.43	24.6
45	3.200	325.362	2.271	0.92	0.24	28.24	5.51	3.78	1.73	2.69	27.2
46	3.459	367.437	5.268	1.00	0.30	28.25	5.98	4.01	1.96	2.92	29.3
47	3.519	374.692	5.912	1.02	0.31	28.25	6.06	4.05	2.01	2.96	29.7
48	3.727	400.808	7.812	1.09	0.34	28.26	6.35	4.20	2.15	3.10	30.8
49	3.986	436.355	10.727	1.18	0.40	28.27	6.75	4.40	2.35	3.30	32.3

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
50	4.267	466.098	13.522	1.27	0.45	28.28	7.08	4.56	2.52	3.46	33.5
51	4.530	496.566	16.328	1.36	0.50	28.29	7.42	4.73	2.69	3.62	34.6
52	4.768	523.408	18.599	1.43	0.54	28.30	7.72	4.88	2.84	3.77	35.5
53	5.001	547.348	20.643	1.51	0.58	28.31	7.99	5.02	2.97	3.90	36.3
54	5.273	564.758	22.658	1.60	0.61	28.33	8.18	5.11	3.06	3.99	36.8
55	5.562	583.620	24.714	1.69	0.65	28.35	8.39	5.22	3.17	4.09	37.4
56	5.864	598.854	27.014	1.79	0.69	28.36	8.55	5.30	3.25	4.18	37.8
57	6.171	614.814	28.914	1.89	0.73	28.38	8.73	5.39	3.34	4.26	38.3
58	6.244	617.716	29.391	1.92	0.74	28.39	8.76	5.40	3.35	4.28	38.4
59	6.469	632.224	30.767	1.99	0.76	28.40	8.92	5.48	3.43	4.35	38.8
60	6.767	644.557	32.497	2.09	0.79	28.42	9.05	5.55	3.50	4.42	39.1
61	7.069	659.066	34.082	2.19	0.82	28.44	9.21	5.63	3.58	4.50	39.5
62	7.384	670.673	35.806	2.29	0.85	28.46	9.33	5.69	3.64	4.56	39.8
63	7.726	688.809	37.250	2.41	0.88	28.49	9.53	5.79	3.74	4.65	40.2
64	8.058	699.691	38.427	2.52	0.90	28.51	9.64	5.84	3.80	4.71	40.5
65	8.382	714.925	39.689	2.62	0.92	28.54	9.80	5.93	3.88	4.79	40.9
66	8.702	727.983	40.642	2.73	0.94	28.56	9.94	6.00	3.95	4.85	41.2
67	9.017	743.943	41.556	2.83	0.96	28.59	10.11	6.08	4.03	4.94	41.5
68	9.345	754.824	42.492	2.94	0.97	28.61	10.23	6.14	4.09	4.99	41.8
69	9.686	767.157	43.604	3.05	0.99	28.64	10.35	6.20	4.15	5.06	42.0
70	9.794	757.726	43.877	3.09	1.00	28.65	10.25	6.15	4.10	5.00	41.8
71	10.058	774.411	44.689	3.17	1.01	28.67	10.43	6.24	4.19	5.09	42.2
72	10.425	786.744	45.533	3.29	1.03	28.70	10.55	6.30	4.25	5.15	42.4
73	10.779	799.077	45.889	3.41	1.04	28.74	10.68	6.36	4.32	5.21	42.7
74	11.129	806.331	46.333	3.52	1.04	28.77	10.75	6.40	4.35	5.25	42.8
75	11.487	810.684	46.801	3.64	1.05	28.80	10.79	6.42	4.37	5.27	42.9
76	11.858	823.742	47.101	3.76	1.06	28.84	10.92	6.48	4.44	5.33	43.2
77	12.238	823.742	47.525	3.89	1.07	28.87	10.91	6.48	4.43	5.33	43.1
78	12.627	835.349	47.980	4.02	1.07	28.91	11.03	6.54	4.49	5.38	43.4
79	12.985	846.230	48.342	4.13	1.08	28.94	11.14	6.59	4.54	5.44	43.6
80	13.340	857.838	48.604	4.25	1.08	28.97	11.25	6.65	4.60	5.49	43.8
81	13.728	865.092	48.033	4.38	1.07	29.02	11.32	6.68	4.64	5.53	43.9
82	14.121	874.523	47.866	4.51	1.07	29.06	11.41	6.73	4.68	5.57	44.1
83	14.540	883.228	48.133	4.65	1.08	29.10	11.49	6.77	4.72	5.61	44.2
84	14.890	878.150	48.098	4.76	1.08	29.13	11.42	6.74	4.69	5.58	44.1
85	15.261	897.011	47.619	4.88	1.07	29.17	11.62	6.83	4.78	5.67	44.4

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
86	15.671	909.344	46.924	5.02	1.05	29.22	11.74	6.89	4.84	5.73	44.7
87	16.112	907.893	46.280	5.16	1.04	29.27	11.70	6.88	4.83	5.71	44.6
88	16.522	918.775	45.801	5.30	1.03	29.31	11.81	6.93	4.88	5.76	44.8
89	16.945	927.480	45.210	5.44	1.02	29.36	11.89	6.97	4.92	5.80	44.9
90	17.390	923.853	44.733	5.58	1.01	29.40	11.83	6.94	4.89	5.78	44.8
91	17.835	928.206	44.007	5.73	1.00	29.45	11.86	6.95	4.91	5.79	44.9
92	18.275	934.735	43.012	5.87	0.98	29.50	11.91	6.98	4.93	5.82	45.0
93	18.716	948.518	41.951	6.02	0.96	29.56	12.05	7.05	5.00	5.88	45.2
94	19.148	954.322	40.777	6.16	0.94	29.61	12.09	7.07	5.02	5.90	45.3
95	19.588	958.674	40.392	6.30	0.94	29.65	12.12	7.08	5.04	5.92	45.3
96	20.055	950.694	40.392	6.46	0.94	29.70	12.02	7.03	4.99	5.87	45.1
97	20.370	955.047	40.392	6.56	0.94	29.74	12.05	7.05	5.00	5.89	45.2
98	20.525	947.067	39.874	6.61	0.93	29.76	11.96	7.01	4.96	5.84	45.0
99	20.987	949.969	37.980	6.76	0.89	29.81	11.97	7.01	4.96	5.85	45.1
100	21.454	955.047	36.332	6.92	0.86	29.87	12.01	7.03	4.98	5.86	45.1
101	21.942	956.498	34.444	7.08	0.83	29.93	12.00	7.03	4.98	5.86	45.1
102	22.447	961.576	32.356	7.24	0.79	30.00	12.04	7.04	4.99	5.88	45.2
103	22.926	965.203	30.447	7.40	0.76	30.06	12.05	7.05	5.00	5.89	45.2
104	23.419	964.478	28.779	7.56	0.72	30.12	12.03	7.04	4.99	5.87	45.1
105	23.933	958.674	27.358	7.73	0.70	30.19	11.94	7.00	4.95	5.83	45.0
106	24.455	968.105	26.308	7.90	0.68	30.25	12.02	7.04	4.99	5.87	45.1
107	24.623	965.203	25.820	7.96	0.67	30.27	11.99	7.02	4.97	5.85	45.1
108	24.960	960.851	24.517	8.07	0.65	30.31	11.93	6.99	4.94	5.82	45.0
109	25.461	970.281	23.855	8.23	0.64	30.37	12.01	7.03	4.98	5.86	45.1
110	25.997	967.380	23.914	8.41	0.64	30.43	11.96	7.00	4.95	5.84	45.0
111	26.537	978.261	23.343	8.59	0.63	30.49	12.05	7.05	5.00	5.88	45.2
112	27.076	979.712	23.734	8.77	0.63	30.55	12.05	7.05	5.00	5.88	45.2
113	27.599	986.241	23.708	8.94	0.63	30.61	12.09	7.07	5.02	5.90	45.3
114	28.130	994.946	23.528	9.11	0.63	30.67	12.16	7.11	5.06	5.94	45.4
115	28.687	993.496	23.484	9.30	0.63	30.73	12.13	7.09	5.04	5.92	45.3
116	29.240	999.299	23.411	9.48	0.63	30.79	12.17	7.11	5.06	5.94	45.4
117	29.806	1008.730	23.061	9.66	0.62	30.85	12.24	7.15	5.10	5.98	45.5
118	30.376	1013.808	23.078	9.85	0.62	30.92	12.28	7.16	5.11	5.99	45.6
119	30.933	1023.964	23.337	10.03	0.63	30.98	12.36	7.20	5.16	6.03	45.7
120	31.503	1031.219	23.364	10.22	0.63	31.04	12.41	7.23	5.18	6.06	45.8
121	32.081	1039.924	23.296	10.41	0.63	31.11	12.48	7.26	5.22	6.09	45.9

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
122	32.673	1026.866	23.220	10.61	0.62	31.18	12.32	7.19	5.14	6.02	45.6
123	32.716	1029.042	25.661	10.62	0.67	31.17	12.35	7.20	5.15	6.03	45.7
124	33.252	1042.100	22.831	10.80	0.62	31.25	12.46	7.25	5.20	6.08	45.9
125	33.843	1042.826	20.178	10.99	0.57	31.33	12.43	7.24	5.19	6.07	45.8
126	34.444	1037.748	17.534	11.19	0.52	31.42	12.36	7.20	5.15	6.03	45.7
127	34.957	1042.826	14.860	11.36	0.47	31.49	12.38	7.22	5.17	6.05	45.7
128	35.074	1042.100	11.957	11.39	0.42	31.52	12.36	7.21	5.16	6.04	45.7



SAMPLE INFORMATION

Sample: Norlite Test No.: S6
Type: Recompacted sample
Description: 3/4-inch lighweight shale aggregate

SPECIMEN INFORMATION (after saturation)

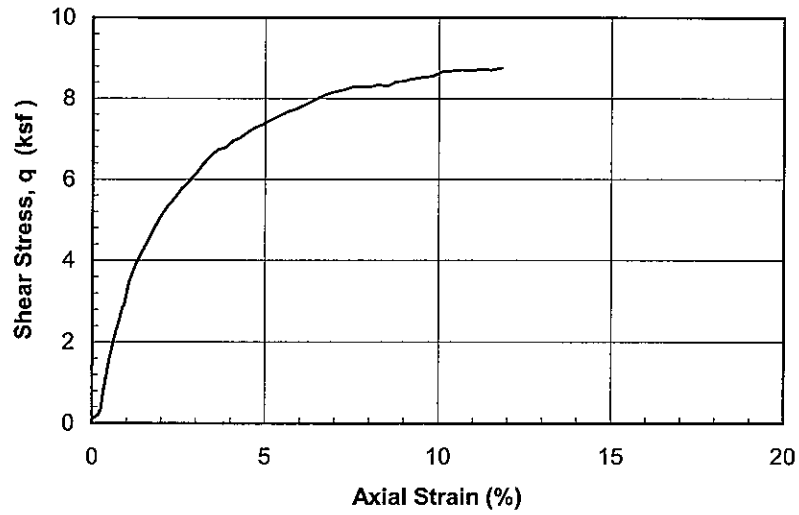
Height: 11.78 in Dia.: 6.01 in Area.: 28.34 sq. in
Water Content: Not measured Dry Unit Weight: 46.2 pcf

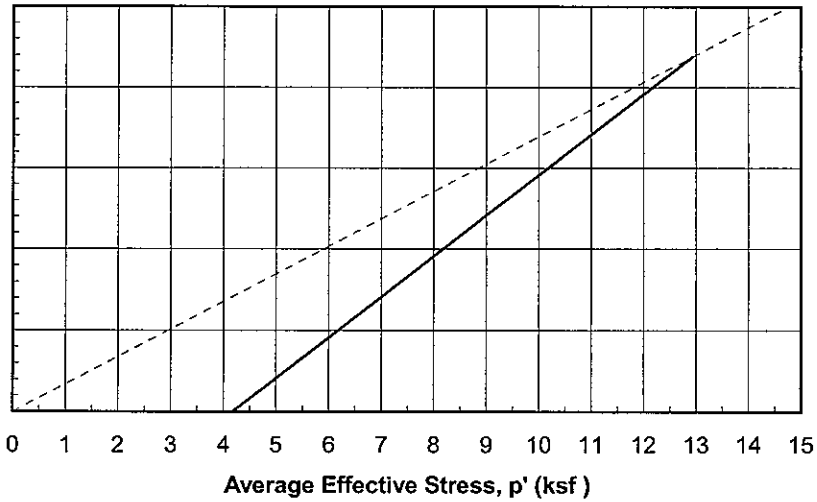
TEST SUMMARY (end of test)

Effective Confining Stress: 4.18 ksf vert., 4.18 ksf horiz.
Water Content: Not measured Dry Unit Weight: 46.2 pcf
B Coefficient: Not measured Strain Rate: 0.085 %/min
Peak Shear Stress: 8.76 ksf @ 11.8 % Strain
Peak Effective Friction Angle: 42.6 deg. @ 11.5 % Strain

Failure Sketch

REMARKS: Positive volumetric strain indicates specimen contraction.





Operator: B.Sawa
Checked: D. Aghjayan
Test Date: 2-Nov-2007

4/17/2008 10:30

Geotechnical Testing of Norlite Lightweight Aggregate	GEI Consultants	CONSOLIDATED ISOTROPIC DRAINED TRIAXIAL COMPRESSION
Norlite Corporation Cohoes, New York	07181	April 2008 Figure D6

PROJECT #:	07181
PROJECT:	Norlite Testing
TEST:	S6
BORING:	--
SAMPLE:	Norlite
DEPTH (ft):	--
OPER.:	B.Sawa
TEST DATE:	11/2/2007

Stage	SIGMAv' (ksf)	SIGMAh' (ksf)	Height (inch)	Diameter (inch)	Area (in²)	Water Content (%)	Dry Density (pcf)	Total Density (pcf)	Void Ratio
In situ	--	--	--	--	--	--	--	--	--
After Sampling	--	--	--	--	--	--	--	--	--
In tube before extrusion	--	--	--	--	--	--	--	--	--
Under vac.	1.02	1.02	11.776	6.007	28.342		46.2		--
End of:							calculated from start of test		
Saturation	4.18	4.18	11.78	6.01	28.34	--	46.2	--	--
Consol. Stage 1	4.18	4.18	11.78	6.01	28.34	--	46.2	--	--
Consol. Stage 2	4.18	4.18	11.78	6.01	28.34	--	46.2	--	--
Consol. Stage 3	4.18	4.18	11.78	6.01	28.34	--	46.2	--	--
Consol. Stage 4	4.18	4.18	11.78	6.01	28.34	--	46.2	--	--
Consol. Stage 5	4.18	4.18	11.78	6.01	28.34	--	46.2	--	--
Final Shear 6						--			
This Stage Initial Values	4.18	4.18	11.78	6.01	28.34	--	46.2	--	--

Transducer	No.	Cal. Factor	Unit
DCDT	5733	-14.208	mm/(mV/V)
Load Cell	60293	-149.1745	kg/(mV/V)
Pressure	10260	-0.7056	ksc/(mV/V)
Volume	DV2B	1	cc/(mV/V)
Gravity of Solids		2.67	(assumed)
B value start shear		0.90	
Test Stage End of#	1		
Stage Strain rate		0.085	%/min
Data Start Row	34		

Kc start stage	1.00	Back Pressure	11.18 ksf

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in²)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
34	-0.851	8.343	-20.402	0.00	0.00	28.34	4.18	4.18	0.00	1.00	0.0
35	-0.941	20.675	-19.752	-0.03	0.01	28.33	4.32	4.25	0.07	1.03	0.9
36	-0.916	22.126	-19.149	-0.02	0.02	28.33	4.33	4.26	0.08	1.04	1.0
37	-0.890	22.126	-18.790	-0.01	0.03	28.33	4.33	4.26	0.08	1.04	1.0
38	-0.864	23.577	-18.446	0.00	0.04	28.33	4.35	4.26	0.09	1.04	1.1
39	-0.833	25.028	-17.984	0.01	0.04	28.33	4.37	4.27	0.09	1.04	1.3
40	-0.808	27.204	-17.725	0.01	0.05	28.33	4.39	4.28	0.11	1.05	1.4
41	-0.777	28.655	-17.531	0.02	0.05	28.33	4.41	4.29	0.11	1.05	1.5
42	-0.747	30.831	-17.231	0.03	0.06	28.34	4.43	4.30	0.13	1.06	1.7
43	-0.721	32.282	-16.860	0.04	0.06	28.34	4.45	4.31	0.13	1.06	1.8
44	-0.691	33.008	-16.728	0.05	0.07	28.34	4.45	4.32	0.14	1.07	1.8
45	-0.665	33.733	-16.531	0.06	0.07	28.34	4.46	4.32	0.14	1.07	1.9
46	-0.635	33.733	-16.404	0.07	0.07	28.34	4.46	4.32	0.14	1.07	1.9
47	-0.600	35.184	-16.169	0.08	0.08	28.34	4.48	4.33	0.15	1.07	2.0
48	-0.574	35.909	-16.095	0.09	0.08	28.35	4.49	4.33	0.15	1.07	2.0
49	-0.548	36.635	-15.993	0.10	0.08	28.35	4.50	4.34	0.16	1.08	2.1

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
50	-0.518	37.360	-15.769	0.11	0.08	28.35	4.50	4.34	0.16	1.08	2.1
51	-0.488	38.811	-15.681	0.12	0.09	28.35	4.52	4.35	0.17	1.08	2.2
52	-0.458	40.262	-15.525	0.13	0.09	28.35	4.54	4.36	0.18	1.09	2.4
53	-0.428	40.988	-15.095	0.14	0.10	28.35	4.54	4.36	0.18	1.09	2.4
54	-0.402	42.438	-14.954	0.15	0.10	28.36	4.56	4.37	0.19	1.09	2.5
55	-0.367	43.164	-14.731	0.16	0.10	28.36	4.57	4.37	0.19	1.09	2.6
56	-0.337	43.889	-14.689	0.17	0.10	28.36	4.58	4.38	0.20	1.10	2.6
57	-0.307	46.066	-14.672	0.18	0.10	28.36	4.60	4.39	0.21	1.10	2.8
58	-0.276	50.418	-14.654	0.19	0.11	28.37	4.65	4.41	0.24	1.11	3.1
59	-0.242	55.496	-14.607	0.20	0.11	28.37	4.71	4.44	0.26	1.13	3.4
60	-0.216	61.300	-14.410	0.21	0.11	28.37	4.77	4.47	0.30	1.14	3.8
61	-0.181	59.849	-14.378	0.22	0.11	28.37	4.75	4.47	0.29	1.14	3.7
62	-0.147	62.751	-14.342	0.24	0.11	28.38	4.79	4.48	0.30	1.15	3.9
63	-0.121	67.104	-14.357	0.24	0.11	28.38	4.84	4.51	0.33	1.16	4.2
64	-0.086	72.182	-14.289	0.26	0.11	28.38	4.89	4.54	0.36	1.17	4.5
65	-0.056	83.789	-14.028	0.27	0.12	28.38	5.02	4.60	0.42	1.20	5.3
66	-0.030	93.945	-13.548	0.27	0.13	28.38	5.14	4.66	0.48	1.23	5.9
67	0.000	104.827	-13.083	0.28	0.13	28.38	5.26	4.72	0.54	1.26	6.6
68	0.030	116.434	-12.551	0.29	0.14	28.38	5.39	4.78	0.60	1.29	7.3
69	0.060	127.315	-11.813	0.30	0.16	28.38	5.51	4.84	0.67	1.32	7.9
70	0.086	137.472	-11.254	0.31	0.17	28.38	5.62	4.90	0.72	1.35	8.5
71	0.121	146.177	-10.692	0.32	0.18	28.38	5.72	4.95	0.77	1.37	9.0
72	0.151	154.157	-10.174	0.33	0.19	28.38	5.81	4.99	0.82	1.39	9.4
73	0.181	165.039	-9.592	0.35	0.20	28.38	5.93	5.05	0.88	1.42	10.0
74	0.216	174.469	-9.089	0.36	0.21	28.38	6.04	5.11	0.93	1.44	10.5
75	0.246	184.626	-8.457	0.37	0.22	28.38	6.15	5.16	0.99	1.47	11.0
76	0.281	196.233	-8.001	0.38	0.23	28.38	6.28	5.23	1.05	1.50	11.6
77	0.315	204.938	-7.224	0.39	0.24	28.38	6.38	5.28	1.10	1.53	12.0
78	0.350	213.643	-6.556	0.40	0.25	28.38	6.47	5.33	1.15	1.55	12.4
79	0.384	223.799	-6.168	0.41	0.26	28.39	6.59	5.38	1.20	1.58	12.9
80	0.423	233.230	-5.477	0.43	0.27	28.39	6.69	5.44	1.26	1.60	13.4
81	0.458	243.386	-4.812	0.44	0.29	28.39	6.81	5.49	1.31	1.63	13.8
82	0.492	253.543	-4.153	0.45	0.30	28.38	6.92	5.55	1.37	1.66	14.3
83	0.527	264.424	-3.644	0.46	0.31	28.39	7.04	5.61	1.43	1.69	14.8
84	0.561	272.404	-3.088	0.47	0.32	28.39	7.13	5.65	1.48	1.71	15.1
85	0.600	283.286	-2.568	0.49	0.33	28.39	7.25	5.72	1.54	1.74	15.6

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
86	0.635	294.168	-1.994	0.50	0.34	28.39	7.37	5.78	1.60	1.77	16.1
87	0.674	303.598	-1.418	0.51	0.35	28.39	7.48	5.83	1.65	1.79	16.5
88	0.713	310.127	-0.727	0.52	0.36	28.39	7.55	5.87	1.69	1.81	16.7
89	0.756	320.284	-0.385	0.54	0.37	28.39	7.67	5.92	1.74	1.83	17.1
90	0.795	329.714	0.185	0.55	0.38	28.39	7.77	5.98	1.80	1.86	17.5
91	0.838	338.420	0.821	0.56	0.39	28.39	7.87	6.02	1.85	1.88	17.8
92	0.881	345.674	1.491	0.58	0.40	28.39	7.95	6.06	1.89	1.90	18.1
93	0.920	355.105	2.147	0.59	0.41	28.39	8.06	6.12	1.94	1.93	18.5
94	0.963	365.261	2.850	0.61	0.43	28.39	8.17	6.17	2.00	1.96	18.9
95	1.006	371.065	3.433	0.62	0.44	28.39	8.23	6.21	2.03	1.97	19.1
96	1.049	381.946	3.974	0.64	0.45	28.40	8.36	6.27	2.09	2.00	19.5
97	1.049	382.672	4.159	0.64	0.45	28.39	8.36	6.27	2.09	2.00	19.5
98	1.093	390.652	4.762	0.65	0.46	28.40	8.45	6.32	2.14	2.02	19.8
99	1.136	400.082	5.503	0.66	0.47	28.40	8.56	6.37	2.19	2.05	20.1
100	1.183	407.337	5.921	0.68	0.48	28.40	8.64	6.41	2.23	2.07	20.4
101	1.226	416.768	6.718	0.69	0.50	28.40	8.74	6.46	2.28	2.09	20.7
102	1.274	426.924	7.383	0.71	0.51	28.40	8.86	6.52	2.34	2.12	21.0
103	1.321	431.276	8.101	0.73	0.52	28.40	8.91	6.54	2.36	2.13	21.2
104	1.369	442.158	8.745	0.74	0.53	28.40	9.03	6.60	2.42	2.16	21.5
105	1.416	450.138	9.515	0.76	0.55	28.40	9.12	6.65	2.47	2.18	21.8
106	1.468	458.118	10.257	0.78	0.56	28.40	9.21	6.69	2.51	2.20	22.1
107	1.511	466.823	11.063	0.79	0.58	28.40	9.30	6.74	2.56	2.23	22.3
108	1.559	478.430	11.783	0.81	0.59	28.40	9.43	6.81	2.63	2.26	22.7
109	1.602	488.587	12.533	0.82	0.60	28.40	9.55	6.86	2.68	2.28	23.0
110	1.650	499.468	13.260	0.84	0.62	28.40	9.67	6.92	2.74	2.31	23.4
111	1.701	506.723	14.039	0.85	0.63	28.41	9.75	6.96	2.79	2.33	23.6
112	1.753	512.526	14.863	0.87	0.64	28.41	9.81	7.00	2.82	2.35	23.7
113	1.801	521.231	15.710	0.89	0.66	28.41	9.91	7.04	2.87	2.37	24.0
114	1.857	526.310	16.619	0.91	0.68	28.41	9.97	7.07	2.89	2.39	24.2
115	1.900	527.760	17.319	0.92	0.69	28.41	9.98	7.08	2.90	2.39	24.2
116	2.345	633.675	22.996	1.07	0.79	28.42	11.16	7.67	3.49	2.67	27.1
117	2.634	670.673	26.555	1.17	0.86	28.43	11.57	7.88	3.70	2.77	28.0
118	2.893	705.494	28.423	1.25	0.89	28.44	11.96	8.07	3.89	2.86	28.8
119	3.450	762.079	35.397	1.44	1.02	28.46	12.59	8.38	4.20	3.01	30.1
120	4.020	818.664	42.065	1.63	1.14	28.48	13.21	8.69	4.52	3.16	31.3
121	4.590	874.523	48.080	1.82	1.25	28.51	13.83	9.00	4.82	3.31	32.4

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
122	5.165	929.656	54.099	2.01	1.36	28.53	14.43	9.30	5.13	3.45	33.4
123	5.748	973.909	59.743	2.21	1.47	28.56	14.91	9.55	5.37	3.57	34.2
124	5.847	978.261	60.637	2.24	1.48	28.56	14.96	9.57	5.39	3.58	34.3
125	6.348	1010.181	64.882	2.41	1.56	28.59	15.30	9.74	5.56	3.66	34.8
126	6.940	1051.531	70.391	2.60	1.66	28.62	15.75	9.96	5.79	3.77	35.5
127	7.531	1084.176	75.330	2.80	1.75	28.65	16.10	10.14	5.96	3.85	36.0
128	8.144	1118.272	80.351	3.01	1.84	28.68	16.46	10.32	6.14	3.94	36.5
129	8.775	1164.700	84.660	3.22	1.92	28.72	16.96	10.57	6.39	4.06	37.2
130	9.056	1178.484	86.575	3.31	1.96	28.74	17.10	10.64	6.46	4.09	37.4
131	9.405	1202.423	88.969	3.43	2.00	28.76	17.36	10.77	6.59	4.15	37.7
132	10.045	1229.990	93.455	3.64	2.08	28.80	17.64	10.91	6.73	4.22	38.1
133	10.692	1241.597	97.429	3.86	2.15	28.84	17.75	10.97	6.79	4.25	38.2
134	11.336	1273.517	101.235	4.07	2.22	28.89	18.08	11.13	6.95	4.33	38.7
135	11.958	1288.751	105.015	4.28	2.29	28.93	18.23	11.20	7.03	4.36	38.8
136	12.571	1315.593	108.447	4.49	2.36	28.97	18.50	11.34	7.16	4.43	39.2
137	13.240	1339.532	111.756	4.71	2.42	29.02	18.74	11.46	7.28	4.48	39.4
138	13.918	1356.218	114.754	4.94	2.47	29.08	18.89	11.54	7.36	4.52	39.6
139	14.082	1362.021	115.560	4.99	2.49	29.09	18.95	11.57	7.39	4.54	39.7
140	14.570	1377.981	117.542	5.16	2.52	29.13	19.11	11.64	7.46	4.57	39.9
141	15.274	1399.019	120.636	5.39	2.58	29.18	19.31	11.74	7.56	4.62	40.1
142	15.965	1420.057	123.687	5.62	2.63	29.24	19.51	11.84	7.66	4.67	40.3
143	16.647	1433.115	126.593	5.85	2.69	29.29	19.62	11.90	7.72	4.70	40.5
144	17.338	1454.152	128.875	6.08	2.73	29.35	19.82	12.00	7.82	4.74	40.7
145	18.068	1476.641	130.599	6.33	2.76	29.42	20.02	12.10	7.92	4.79	40.9
146	18.750	1497.679	133.096	6.55	2.81	29.48	20.22	12.20	8.02	4.84	41.1
147	19.493	1518.717	135.296	6.80	2.85	29.54	20.41	12.29	8.11	4.88	41.3
148	20.227	1532.500	136.667	7.05	2.87	29.61	20.52	12.35	8.17	4.91	41.4
149	20.936	1544.833	137.917	7.28	2.89	29.68	20.61	12.39	8.22	4.93	41.5
150	21.687	1562.244	139.120	7.54	2.92	29.76	20.76	12.47	8.29	4.97	41.7
151	22.378	1565.871	140.676	7.77	2.95	29.82	20.76	12.47	8.29	4.97	41.7
152	23.086	1568.773	142.224	8.00	2.97	29.89	20.75	12.46	8.29	4.97	41.7
153	23.859	1584.007	143.885	8.26	3.00	29.97	20.87	12.52	8.35	5.00	41.8
154	24.598	1578.929	145.297	8.51	3.03	30.04	20.78	12.48	8.30	4.97	41.7
155	25.358	1605.045	146.674	8.76	3.05	30.11	21.01	12.59	8.42	5.03	41.9
156	26.161	1613.025	147.883	9.03	3.08	30.20	21.05	12.61	8.44	5.04	42.0
157	26.489	1621.730	148.174	9.14	3.08	30.23	21.12	12.65	8.47	5.05	42.0

	Axial DCDT (mm)	Load Cell (kg)	Volume Change (cc)	Axial Strain (%)	Volumetric Strain (%)	Area (in^2)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)
158	26.869	1627.534	148.998	9.27	3.10	30.27	21.16	12.67	8.49	5.06	42.1
159	27.698	1639.141	150.209	9.54	3.12	30.35	21.23	12.71	8.53	5.08	42.2
160	28.510	1648.571	151.007	9.82	3.13	30.44	21.28	12.73	8.55	5.09	42.2
161	29.339	1675.413	151.966	10.09	3.15	30.53	21.51	12.85	8.67	5.15	42.4
162	30.190	1684.844	152.569	10.38	3.16	30.62	21.56	12.87	8.69	5.16	42.5
163	30.989	1692.824	153.410	10.65	3.18	30.71	21.59	12.89	8.71	5.17	42.5
164	31.861	1696.451	154.098	10.94	3.19	30.81	21.57	12.88	8.70	5.16	42.5
165	32.695	1707.332	154.048	11.22	3.19	30.90	21.63	12.91	8.73	5.18	42.5
166	33.563	1709.509	154.830	11.51	3.20	31.00	21.60	12.89	8.71	5.17	42.5
167	34.465	1724.743	154.210	11.81	3.19	31.11	21.69	12.94	8.76	5.19	42.6

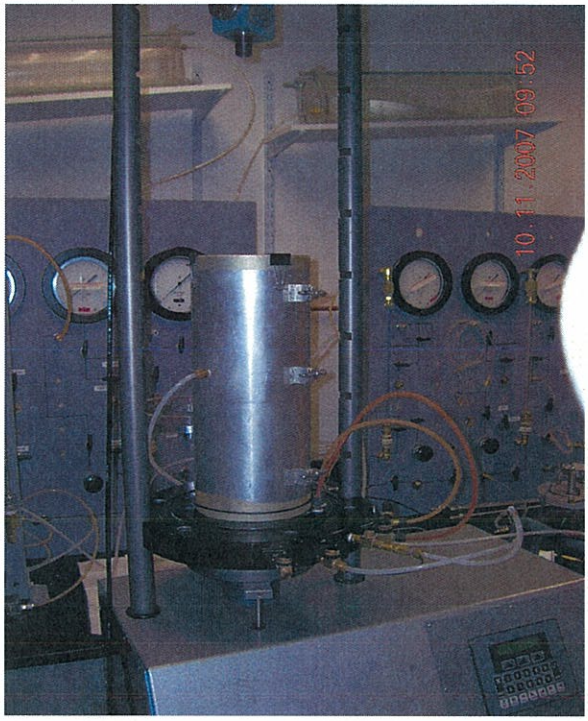


Photo 1 - Mold and membrane for preparing the lightweight aggregate test specimen

Photo 2 - Prepared lightweight aggregate test specimen under vaccuum

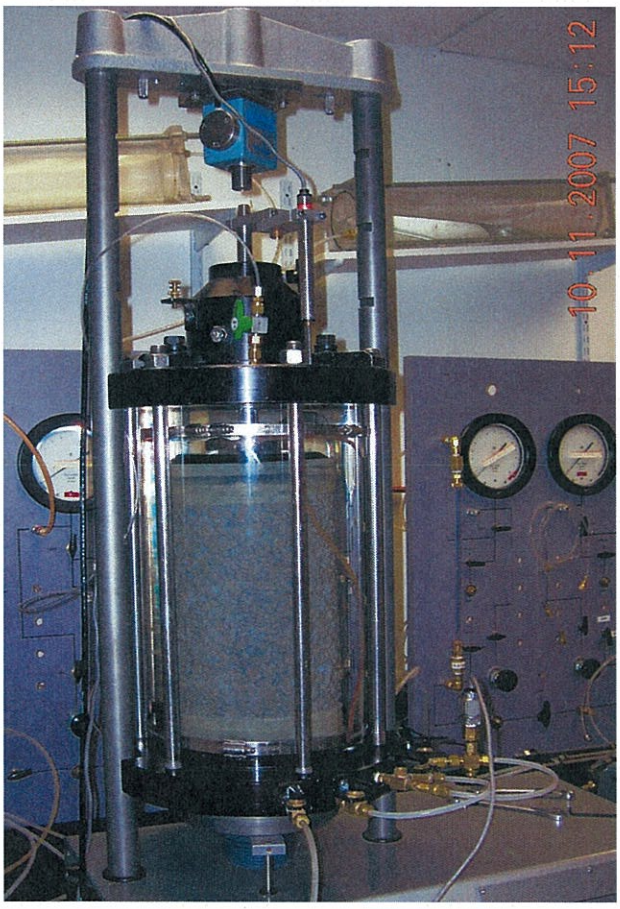


Photo 3 - Specimen in triaxial test cell apparatus prior to testing

Photographs depicting equipment and sample preparation for consolidated-drained triaxial tests

Appendix E – Electrochemical Properties Tests

E1 Summary of pH, Chloride, Sulfate, Organic Content Tests and Resistivity Tests

E2 Resistivity Tests

- Laboratory Test
- Field Test

Appendix E – Electrochemical Properties Tests

E1 Summary of pH, Chloride, Sulfate, Organic Content Tests and Resistivity Tests

TABLE E1 - SUMMARY OF ELECTROCHEMICAL PROPERTIES TESTS
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Resistivity				pH [3]	Chloride Content [4]	Sulfate Content [5]	Organic Content [6]
Lab[1]	Field [2]						
Minimum Resistivity ohm - cm	Test No.	Spacing feet	Minimum Resistivity ohm - cm		ppm		(%)
18,172	1c	6	443,541	6.91	24	74	0.04
	1d	8	458,095	6.70			
	1cc	6	564,193	6.67			
	1dd	8	381,491				

Notes:
1. Test performed on crushed material passing the No. 10 sieve in general accordance with AASHTO T288
2. See Figure E2-1 for locations of test lines on stockpiles
3. Average pH of three of tests = 6.76. Test performed on crushed material passing the No. 10 sieve in general accordance with AASHTO T289
4. Test performed in accordance with AASHTO T291, Method B on "as-received" lightweight aggregate
5. Test performed in accordance with AASHTO T290, Method A on "'as-received" lightweight aggregate
6. Test performed on crushed material passing the No. 10 sieve in general accordance with AASHTO T267

Alternative Testing Laboratories, Inc.
2252 University Drive - Suite 300
Lemont Furnace, PA 15456
Phone: 724-437-6514 Fax: 724-437-6517

ANALYSIS REPORT

TO: GEI CONSULTANTS
ATTN: ANASTASIA PAPADOPOULOS
400 UNICORN PARK DRIVE
WOBURN, MA 01801

DATE 11-12-07
JOB NO. 07-2267
P.O. NO. 15371
ENVIRONMENTAL LAB ID #26-00852

LAB NO.	DESCRIPTION	ANALYSIS REQUIRED	ANALYTICAL RESULTS	METHOD OF ANALYSIS
		GEI CONSULTANTS PROJECT NO 07181-0		
622-53418	NORLITE LIGHTWEIGHT AGGREGATE 1.2 kg 10-2007	AS RECEIVED		
		WATER SOLUBLE SULFATE	74 ppm	AASHTO T290A
		WATER SOLUBLE CHLORIDE	24 ppm	AASHTO T291B

SCOTT J. GRAY – PRESIDENT

Appendix E – Electrochemical Properties Tests

E2 Resistivity Tests

- Laboratory Test

Boring No.	Sample No.	Sample Depth (ft)	pH	Chloride Content (ppm)	Sulfate Content (ppm)	Minimum Resistivity (kohms x cm) AASHTO T 288	* Soil Classification
N/A	Norlite Agg.	-	-	-	-	18.172	-

* Uppercase denotes laboratory classification, lowercase denotes visual classification.

Project: GEI Consultants
Project #: SL003
Test Date: 11/2/2007
Tested By: JDP
Checked By: BBB

NAVARRO & WRIGHT CONSULTING ENGINEERS

AAP AASHTO R18

CHEMICAL TESTING SUMMARY
pH - ASTM D 4972 or AASHTO T289
Resistivity AASHTO T288
Chloride - CalDOT 422, Sulfate - CalDOT 417

American Association of State Highway and Transportation Officials

AASHTO Accreditation Program - Certificate of Accreditation

This is to signify that

Navarro & Wright Consulting Engineers, Inc.

New Cumberland, Pennsylvania

has demonstrated proficiency for the testing of construction materials
and has met the minimum requirements in AASHTO R18
set forth by the AASHTO Highway Subcommittee on Materials.

The scope of accreditation can be obtained by viewing
the AAP Directories of Accredited Laboratories (www.amrl.net)
or by contacting AMRL.

Executive Director

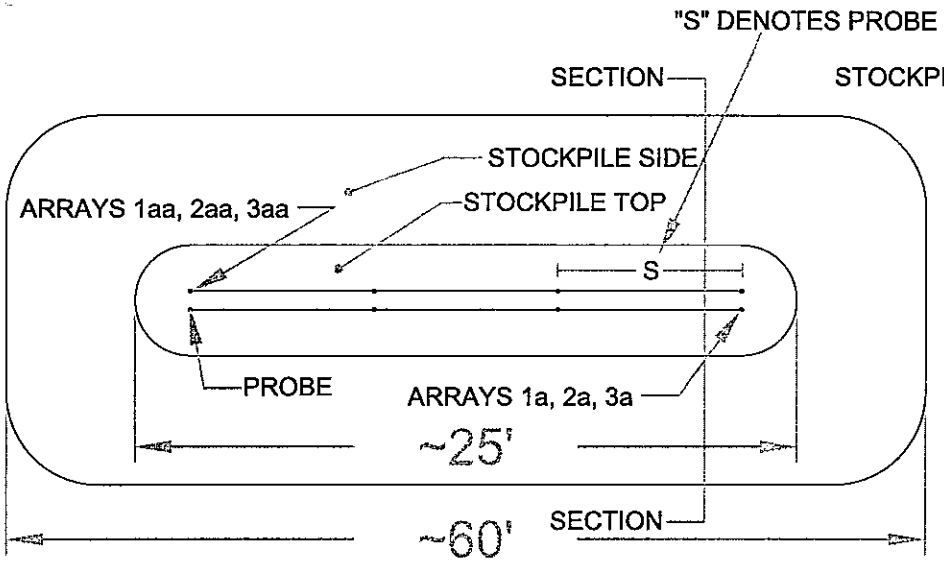
Chair, AASHTO Highway
Subcommittee on Materials

AAP®
AASHTO R18

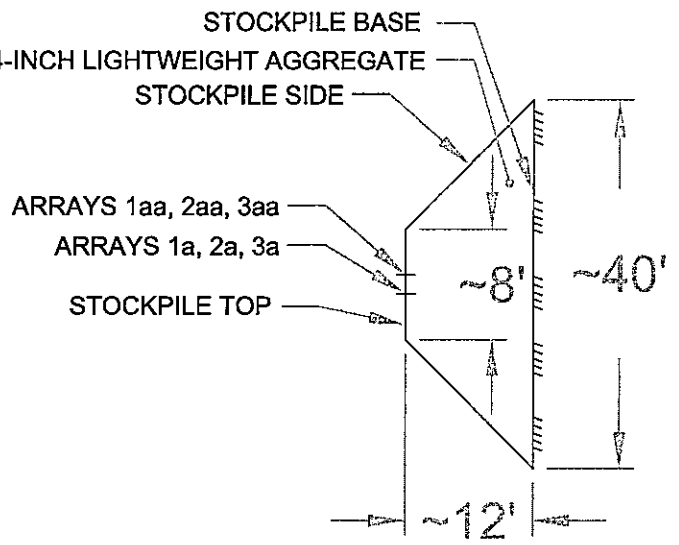
Appendix E – Electrochemical Properties Tests

E2 Resistivity Tests

- Field Test



PLAN VIEW



SECTION VIEW

NOTES:

1. SKETCH NOT TO SCALE.
2. PROBE SPACING RANGED FROM 2 to 8 FEET.
3. PROBE SPACING SHOWN AT 8 FEET.
4. ARRAYS 1A, 2A, AND 3A ORIENTATED SOUTH TO NORTH. ARRAYS 1AA, 2AA, AND 3AA ORIENTATED NORTH TO SOUTH.

FIELD RESISTIVITY TESTING
$\frac{3}{4}$-INCH LIGHTWEIGHT AGGREGATE
COHOES, NEW YORK

NORLITE
COHOES, NEW YORK

GEI Consultants

Project 07181

APPROXIMATE STOCKPILE PLAN AND PROFILE FOR FIELD RESISTIVITY TEST

APRIL 2008

Figure E2-1

Table E2-1 - Summary of Field Resistivity Test Results

Project Norlite, Cohoes New York Facility
Date 29-Jul-07
Temperature ~75F, mostly sunny
Location Cohoes, New York
Topography Top of Aggreate Stockpile
Drainage Not applicable
Soil type Norlite 3/4-inch

Test Number	Probe Depth (inches)	a Probe Spacing (feet)	R Electrical Resistance (ohms)	ρ Electrical Resistivity (ohm-cm)
1a	4	2	1,521	582,578
1b	4	4	532	407,536
1c	4	6	386	443,541
1d	4	8	299	458,095
1aa	4	2	1,283	491,418
1bb	4	4	567	434,348
1cc	4	6	491	564,193
1dd	4	8	249	381,491

Test Number	Probe Depth (inches)	a Probe Spacing (feet)	R Electrical Resistance (ohms)	ρ Electrical Resistivity (ohm-cm)
2a	9	2	1,446	553,851
2b	9	4	454	347,785
2c	9	6	321	368,851
2d	9	8	260	398,344
2aa	9	2	1,219	466,905
2bb	9	4	488	373,830
2cc	9	6	358	411,367
2dd	9	8	242	370,766

Test Number	Probe Depth (inches)	a Probe Spacing (feet)	R Electrical Resistance (ohms)	ρ Electrical Resistivity (ohm-cm)
3a	18	2	1,090	417,495
3b	18	4	428	327,868
3	18	6	301	345,870
3d	18	8	241	369,234
3aa	18	2	993	380,342
3bb	18	4	447	342,423
3cc	18	6	354	406,770
3dd	18	8	229	350,849

Notes:

1. Stockpile volume = 300 tons
2. Probe length = 20 inches
3. Tested stockpiled aggregate using Megger 5/4R digital earth meter

Table 1b - Average and Minimum Resistivity for each Probe Spacing

Probe Spacing (feet)	Average Electrical Resistivity (ohm-cm)	Minimum Electrical Resistivity (ohm-cm)
2	536,998	491,418
4	420,942	407,536
6	503,867	443,541
8	419,793	381,491

Probe Spacing (feet)	Average Electrical Resistivity (ohm-cm)	Minimum Electrical Resistivity (ohm-cm)
2	510,378	466,905
4	360,808	347,785
6	390,109	368,851
8	384,555	370,766

Probe Spacing (feet)	Average Electrical Resistivity (ohm-cm)	Minimum Electrical Resistivity (ohm-cm)
2	398,918	380,342
4	335,145	327,868
6	376,320	345,870
8	360,042	350,849

Appendix F – Durability Tests

- **LA Abrasion and Soundness Tests**

TABLE F1 - SUMMARY OF DURABILITY TESTS
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Soundness [1] (% Loss)	LA Abrasion [2] (% Loss)
3.41	24.3
--	24.5

Notes:
1. Test performed in general accordance with ASTM C88 (5 cycles using Magnesium Sulfate).
2. Test performed in accordance with ASTM C131 (B grading) modified in accordance with Florida Method FM1 T-096.

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Client:	GEI Consultants, Inc.
Project Name:	Norlite Aggregate Testing
Project Location:	---
GTX:	7744
Date:	1/15/2008
Tested By:	rmt
Checked By:	jdt
Sample ID:	Norlite Aggregate
Sample Description:	Dry, brown gravel

Resistance to Abrasion of Small-Size Coarse Aggregate by Use of the Los Angeles Machine FM 1 T-096

Sieve Size		Weight of indicated size, g			
		Grading			
Passing	Retained on	A	B	C	D
1 1/2	1	---	---	---	---
1	3/4	---	---	---	---
3/4	1/2	---	1194 ± 10	---	---
1/2	3/8	---	1194 ± 10	---	---
3/8	1/4	---	---	---	---
1/2	#4	---	---	---	---
#4	#8	---	---	---	---
Total		---	2388 ± 10	---	---

Grading:	B
Dry Weight of Sample before test, g (a)	2388
Dry Weight of Sample after test, g (b)	1807
Weight loss, g (a-b) (c)	581
Percent Loss (c/a)	**24.3%**

Notes: Required test specimen mass reduced in accordance with FM 1 T-096

Required abrasive charge of 5 steel spheres used (reduced in accordance with FM 1 T-096

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Client:	GEI Consultants, Inc.
Project Name:	Norlite Aggregate Testing
Project Location:	---
GTX:	7744
Date:	1/17/2008
Tested By:	rmt
Checked By:	jdt
Sample ID:	Norlite Aggregate
Sample Description:	Dry, brown gravel

Resistance to Abrasion of Small-Size Coarse Aggregate by Use of the Los Angeles Machine FM 1 T-096

Sieve Size		Weight of indicated size, g			
		Grading			
Passing	Retained on	A	B	C	D
1 1/2	1	---	---	---	---
1	3/4	---	---	---	---
3/4	1/2	---	1194 ± 10	---	---
1/2	3/8	---	1194 ± 10	---	---
3/8	1/4	---	---	---	---
1/2	#4	---	---	---	---
#4	#8	---	---	---	---
Total		---	2388 ± 10	---	---

Grading:	B
Dry Weight of Sample before test, g (a)	2388
Dry Weight of Sample after test, g (b)	1804
Weight loss, g (a-b) (c)	584
Percent Loss (c/a)	**24.5%**

Notes: Required test specimen mass reduced in accordance with FM 1 T-096

Required abrasive charge of 5 steel spheres used (reduced in accordance with FM 1 T-096

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	GEI Consultants, Inc.
Project:	Norlite Aggregate Testing
Location:	---
GTX No.:	7744
Tested By:	rmt
Checked By:	jdt
Date:	11/2/2007
Sample ID:	Norlite Aggregate
Sample Description:	Dry, brown gravel

Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate ASTM C 88

Sample Type:	---	Date Solution Prepared:	10/29/2007
Salt Solution:	Magnesium Sulfate	No. of Cycles Required:	5

Quantitative Examination - Coarse Aggregate Soundness

Sieve Size	Grading of Original Sample (T27), %	Initial Mass of Individual Fractions, grams	Initial Mass of Combined Fractions, grams	Final Mass of Individual Fractions, grams	Final Mass of Combined Fractions, grams	Percent Passing Designated Sieve after Test, %	Weighted Percent Loss, %
2.5 - 1.5 inch	---	---	---	---	---	---	---
2.5 - 2.0 inch	---	---	---	---	---	---	---
2.0 - 1.5 inch	---	---	---	---	---	---	---
1.5 - 3/4 inch	---	---	---	---	---	---	---
1.5 - 1.0 inch	---	---	---	---	---	---	---
1.0 - 3/4 inch	---	---	---	---	---	---	---
3/4 - 3/8 inch	100	---	1000.3	---	970.27	3.00	3.00
3/4 - 1/2 inch	---	670.2	---	654.12	---	---	---
1/2 - 3/8 inch	---	330.1	---	316.15	---	---	---
3/8 - No.4	100	300.0	300.0	298.78	298.78	0.41	0.41
Total							3.41

Notes:

Appendix G - California Bearing Ratio (CBR) Tests

TABLE G1 - SUMMARY OF CALIFORNIA BEARING RATIO TESTS
Norlite Lightweight Aggregate
Norlite Corporation
Cohoes, New York

Dry Density	Average Water Content	Penetration	California Bearing Ratio
(lb/ft^3)	*(%)*	*(inches)*	
46.4	8.0	0.1	10 (1)
		0.2	13 (1)
46.3	7.1	0.1	18 (1)
		0.2	21 (1)
46.3	22.0	0.1	10 (2)
		0.2	14 (2)

Notes:
1. Test performed on unsoaked material in general accordance with ASTM D1883.
2. Test performed on soaked material in general accordance with ASTM D1883.

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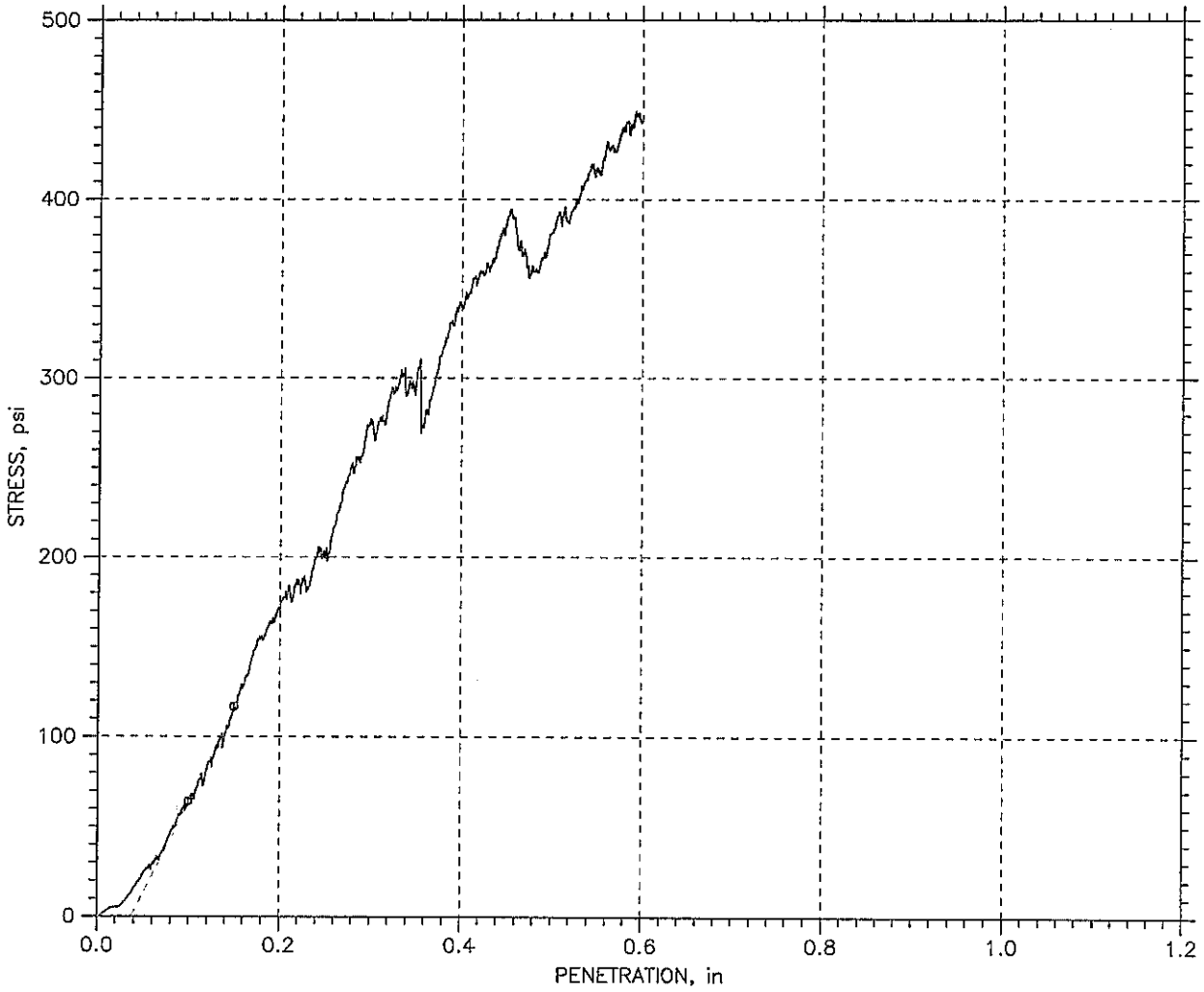
CALIFORNIA BEARING RATIO TEST REPORT



Sample Height: 4.65 in	California Bearing Ratio		
Sample Area: 28.274 in^2	at 0.1 in: 10	at 0.3 in: 16	at 0.5 in: 16
Sample Volume: 0.076085 ft^3	at 0.2 in: 13	at 0.4 in: 16	
Sample Mass: 1734.4 gm			

Sample Condition: Unsoaked	Water Content	Before	Top	Average
Swell: 0.00 %	Tare ID	EL	M&M	JKTOLL
Surcharge: 4535 gm	Tare Mass, gm	8.11	8.6	8.04
Void Ratio: 1.42	Mass Tare + Wet Soil, gm	271.98	98.49	208.49
Wet Unit Weight: 50.255 pcf	Mass Tare + Dry Soil, gm	251.95	92.14	193.61
Dry Unit Weight: 46.44 pcf	Water Content, %	8.21	7.60	8.02

Project: Norlite Aggregate	Location: ---	Project No.: GTX-7744
Boring No.: ---	Tested By: jdt	Checked By: njh
Sample No.: Norlite Agg	Test Date: 01/15/08	Depth:
Test No.: cbr3	Sample Type: remolded	Elevation:
Description: Dry, brown gravel		
Remarks: Target Compaction = 47 pcf. UNSOAKED.		

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Figure G1

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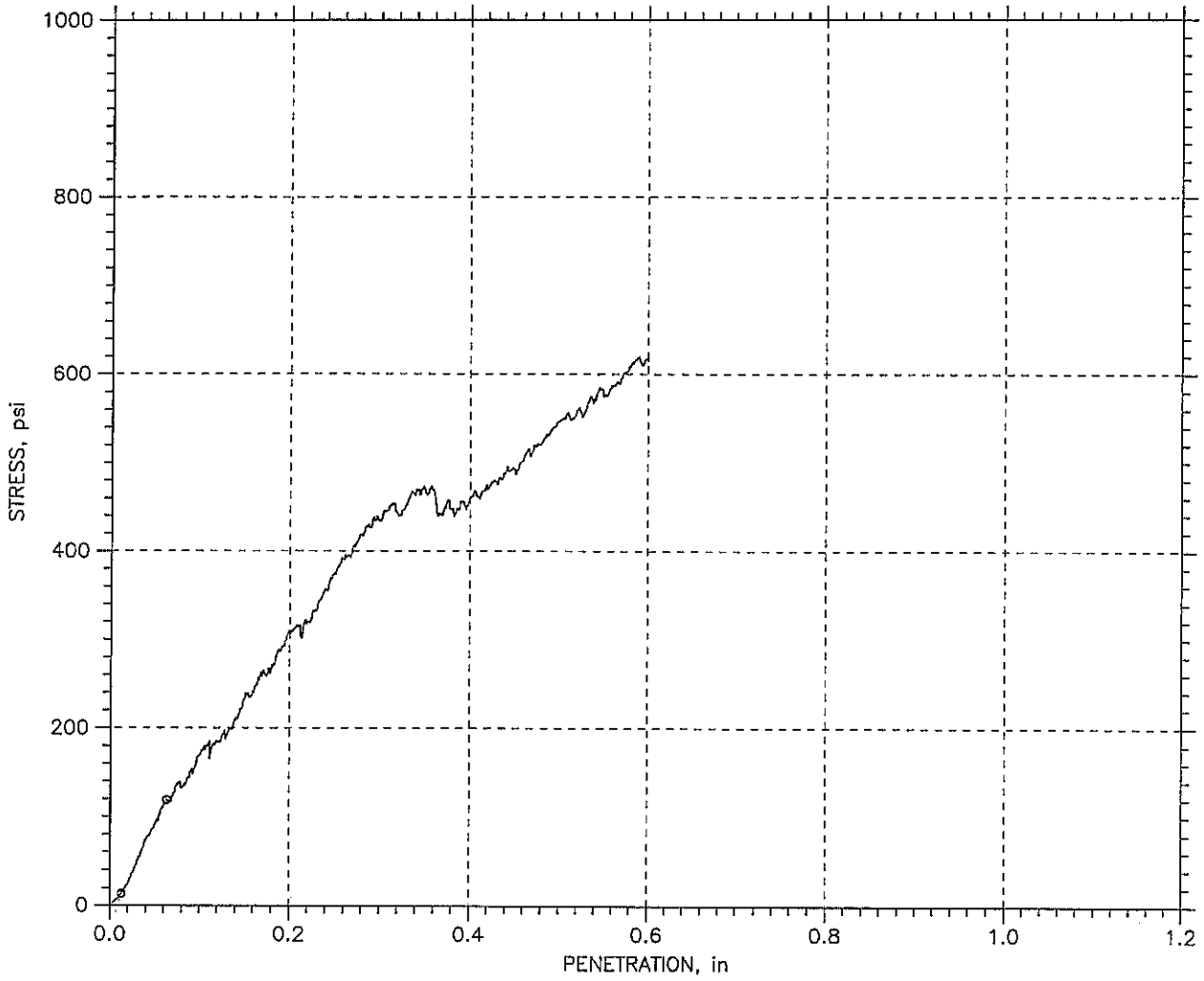
CALIFORNIA BEARING RATIO TEST REPORT



Sample Height: 4.68 in	California Bearing Ratio		
Sample Area: 28.274 in^2	at 0.1 in: 18	at 0.3 in: 23	at 0.5 in: 21
Sample Volume: 0.076576 ft^3	at 0.2 in: 21	at 0.4 in: 20	
Sample Mass: 1737.6 gm			

Sample Condition: Soaked	Water Content	Before	Top	Average
Swell: 0.00 %	Tare ID	P-52	otis8	what
Surcharge: 4535 gm	Tare Mass, gm	118.77	8.4	8.12
Void Ratio: 1.43	Mass Tare + Wet Soil, gm	370.53	172.9	240.81
Wet Unit Weight: 50.025 pcf	Mass Tare + Dry Soil, gm	351.6	161.44	225.39
Dry Unit Weight: 46.264 pcf	Water Content, %	8.13	7.49	7.10

Project: Norlite Aggregate	Location: ---	Project No.: GTX-7744
Boring No.: ---	Tested By: jdt	Checked By: njh
Sample No.: Norlite Agg	Test Date: 01/17/08	Depth: ---
Test No.: CBR-4	Sample Type: remolded	Elevation: ---
Description: Dry, brown gravel		
Remarks: Target Compaction = 47 pcf. UNSOAKED.		

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Figure G2

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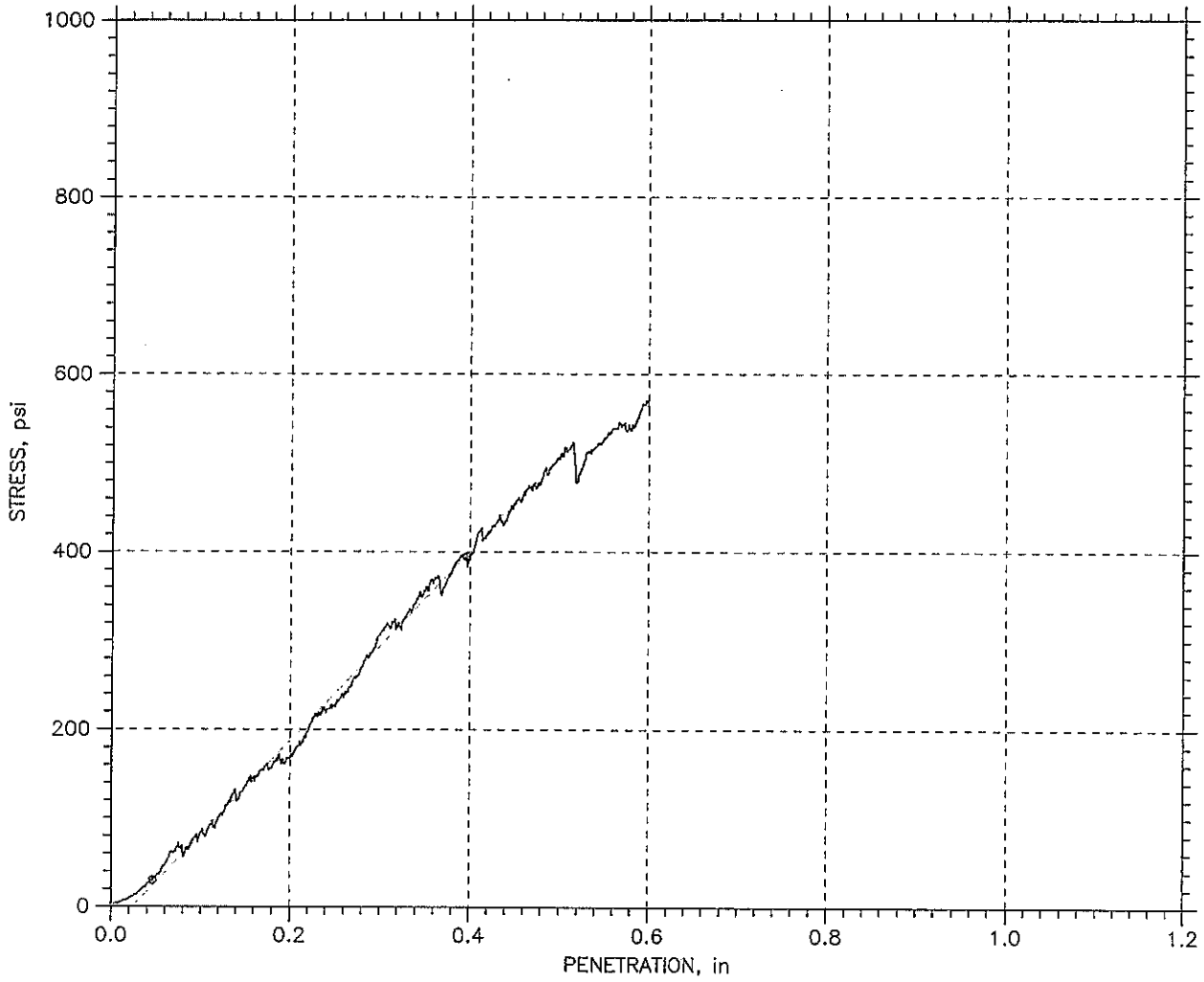
CALIFORNIA BEARING RATIO TEST REPORT



Sample Height: 4.65 in	California Bearing Ratio		
Sample Area: 28.274 in^2	at 0.1 in: 10	at 0.3 in: 17	at 0.5 in: 19
Sample Volume: 0.076085 ft^3	at 0.2 in: 14	at 0.4 in: 19	
Sample Mass: 1925.9 gm			

Sample Condition: Soaked	Water Content	Before	Top	Average
Swell: 0.00 %	Tare ID	5	fred	bogus
Surcharge: 4540 gm	Tare Mass, gm	8.11	8.66	8.14
Void Ratio: 1.42	Mass Tare + Wet Soil, gm	264.61	126.64	216.86
Wet Unit Weight: 55.804 pcf	Mass Tare + Dry Soil, gm	221.15	104.92	179.15
Dry Unit Weight: 46.349 pcf	Water Content, %	20.40	22.56	22.05

Project: Norlite Aggregate	Location: ---	Project No.: GTX-7744
Boring No.: ---	Tested By: jdt	Checked By: jdt
Sample No.: Norlite Agg	Test Date: 2/4/8	Depth: ---
Test No.: CBR-5	Sample Type: remolded	Elevation: ---
Description: Dry, brown gravel		
Remarks: Target Compaction = 47 pcf. SOAKED.		

Tue, 05-FEB-2008 12:04:24

Figure G3