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Phase I (Laboratory): Investigation of Soil Stabilization Alternatives –Texas SH 130

December 2008

Final Report

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16. Abstract

Portland cement, hydrated lime, slag, class C and F fly ash, and a few nontraditional chemical stabilizers were evaluated in the laboratory for their effectiveness in improving strength and reducing swell potential of high-plasticity clay materials sampled at the proposed SH 130 project site in Texas. In addition to high plasticity index values, soils in the proposed construction area reportedly contain variable amounts of sulfate content that may lead to deleterious expansion due to secondary mineral growth. Over 900 test specimens from the project site were prepared and tested.

The goal of the laboratory phase of this project was to provide recommendations for conducting field test strip evaluations of the select portland cement stabilizers or combinations of Portland cement and other stabilizers. Unconfined compressive strength, volume change, pH, soil classification, X-ray analysis, and scanning electron microscopy methods were used in this analysis. An unconfined compressive strength of 100 psi, a maximum volume change of 2%, and a decrease in the plasticity index were used as evaluation criteria for determining suitable stabilizers for field trials.

The following cement-based stabilization mixtures would meet the laboratory-established criteria: 6% Cement Type I/II or Type V, 4% Cement Type I/II + 4% Fly ash Class C, 4% Cement Type I/II + 4% Fly ash Class F, and 3% Cement Type I/II + 3% Fly ash Class C or F. Further evaluation by field testing, with several months of evaluation including in-situ testing, sampling, and in-ground instrumentation monitoring, is recommended for Phase II. A testing plan for evaluation is presented in this report. The outcome of the field investigation would be conclusive performance results for the recommended stabilizers in terms of strength, stiffness, and volume change. It is further recommended that the stabilization construction methods be evaluated as part of the field evaluation. This would specifically include variable mixing rates and use of intelligent compaction technology with GPS mapping capabilities.

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Final Report
December 2008

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INTRODUCTION

This report summarizes the results of a laboratory study to evaluate the effectiveness of portland cement, hydrated lime, slag, class C and F fly ash, and other nontraditional chemical stabilizers for improving strength and reducing swell potential in high-plasticity clay materials sampled from the proposed SH 130 project site between Austin and San Antonio, Texas. Soils in this project area are generally characterized by high plasticity index values and high clay contents, as well as variable and isolated high concentrations of soluble sulfate.

The laboratory study was performed on materials received in September 2007. Unconfined compressive strength, volume change, pH, soil classification, X-ray analysis, and scanning electron microscopy (SEM) methods were used in this analysis. A target unconfined compressive strength of 100 psi and a maximum volume change of about 2% were selected as evaluation criteria to determine suitable stabilizers.

The goal of the laboratory phase of this project was to provide recommendations for conducting field test strip evaluations of the portland cement stabilizers or combinations of the portland cement stabilizers. Most of the stabilizer combination analysis focused on the performance of cement types I/II and V by themselves and in combination with other stabilizers. Findings suggest that the following cement-based stabilization mixtures would meet the laboratory-established criteria are recommended for field trials:

- 6% Cement Type I/II or Type V
- 4% Cement Type I/II + 4% Fly ash Class C
- 4% Cement Type I/II + 4% Fly ash Class F
- 3% Cement Type I/II + 3% Fly ash Class C or F

For these mixtures, the plasticity index (PI) values are substantially reduced, ranging initially from 31 to 49 for the untreated soil to 8 to 23 for the treated soils.

To move forward with evaluating these stabilization alternatives, it is recommended that field test sections be constructed, tested, and evaluated for a period of several months. For soils that contain high soluble sulfate content, these treatments may not be adequate and may require progressive retreatment or simple removal and replacement with other materials. Other stabilization mixtures, not listed above, also meet the laboratory criteria, but are not suggested for field trial unless needed as a benchmark. For the four mixture types listed above, the field test sections would provide conclusive information to verify the laboratory results. If the field trials confirm the laboratory results, a cement-fly ash based stabilization mixture would provide an alternative to traditional methods and has the advantage of potentially reducing costs for some applications. Recommendations for stabilizers and the field test strips are provided in this report.

TEST METHODS

This research used several methods to evaluate the soil stabilizers' effect on the mechanical and chemical properties of the soil. Based on the nearest city from the soil sample location, as well as measured engineering properties, materials are designated herein as soil groups "S", (Sequin) and "L" (Lockhart). It should be noted, the "S" group was determined to be from the Wilcox formation, while the "L" was determined to be from the Navarro formation.

Atterberg Limits

The untreated soils and combinations of soil and stabilizer were tested for liquid limit (LL), plastic limit (PL), and plasticity index (PI) according to ASTM D4318. Untreated and treated soils were mellowed for 24 hours prior to testing. Treated soils were tested following a 28 day cure period at ambient conditions. Some tests were performed at cure periods up to a few days longer than 28 days due to schedule challenges. It is not expected that the additional cure periods had a significant impact on results.

Particle Size Analysis

Soils particle size analysis was conducted in accordance with ASTM D422. Clay size was set at 0.002 mm. Appendix A provides the particle size analysis results.

Moisture Density Relationship

Optimum moisture contents were used in the mix designs as a reference for the moisture conditions of the materials. Generally, the materials were batched at moisture contents above optimum to ensure stabilizer hydration and reduce swell potential. All as-received soils were processed through a No. 4 sieve, moisture-conditioned and mellowed for 24 hours, and compacted into specimens using the Iowa State University 2x2 apparatus (O'Flaherty 1968), which simulates standard Proctor compaction energy as defined in ASTM D698. The untreated samples used for defining the moisture-density relationship were also tested for swell and unconfined compressive strength. The advantage of the 2x2 apparatus is that it facilitates efficient sample production, which can be advantageous for testing many combinations of stabilizers.

Soluble Sulfate Determination

Soils were tested for soluble sulfate content according to Tex-145-E, Determining Sulfate Content in Soils Using Colorimetric Method, and Tex-146-E, Conductivity Test for Field Detection of Sulfates in Soil. Tex-145-E testing was performed using an Orion AQUAfast II Turbidity Colorimeter. Samples containing high concentrations of sulfate were diluted to lower concentrations than those specified to provide measurements within the readability concentration of the measuring equipment. Tex- 146-E testing was conducted using an Accumet XL20 meter with a glass body, four-cell/ATC conductivity probe with a nominal cell constant of 1.0 cm^{-1}.

While this method can be considered a field test for determining sulfate, previous lab testing has resulted in quantitative correlations between conductivity and sulfate concentration (Harris et al. 2002). These correlations were used in this analysis.

pH Determinations

The pH values for the soil materials were analyzed using a LaMotte pHPlus meter calibrated with standard solutions of pH 7, 10, and 12. A 1:1 ratio technique described in "Recommended Chemical Soil Test Procedures for the North Central Region" was performed on natural, as-received materials (Watson and Brown 1998). Additional pH tests were performed during the planning of batch proportions and on 90 day ambient cured samples using the 1:1 ratio technique. The method of pH testing involved adding 25 g of distilled water to 25 g of testing material, hand mixing for 1 minute, allowing the material to stand undisturbed for 15 minutes, and measuring the pH. For the batch design, additional stabilizing agents were added in established proportions to see variations in pH values based upon changes in constituent concentration.

2x2 Sample Preparation

Material proportions for producing 2 inch x 2 inch specimens were measured gravimetrically and mixed thoroughly, mellowed for 15 minutes (for compaction delay), and then compacted using the Iowa State University 2x2 apparatus. Over 900 specimens were produced. A total of 24 specimens were prepared for each batch. Six specimens each were tested at 7 days (ambient temperature), 7 days (38°C), 28 days (ambient temperature), and 90 days (ambient temperature). Ambient temperature was approximately 21°C. Three of these samples were tested for strength, and three specimens were subjected to volumetric swell and subsequent strength tests. Due to the low amount of material containing a high sulfate content, four samples were prepared for select stabilizers, and one each was tested at 7 day ambient temperature, 7 plus 3 day ambient temperature swell, 28 plus 3 day ambient temperature swell, and 90 plus 3 day ambient temperature swell. All batch specimen measurements are included in Appendix B. The averages of triplicate test samples are summarized later in this report.

Unconfined Compressive Strength

Strength tests were performed in general accordance with ASTM D2166-00 using an ELE Versa-Loader load frame with digital displacement and load display. The loading rate was 0.05 in. per minute.

Volumetric Swell Determination

Volumetric swell measurements were recorded for each group of three 2x2 samples using methods based on ASTM D559. Samples were placed on porous stones and protected from direct water contact in a 100% relative humidity room for three days to allow expansion/swelling. Height and diameter measurements were taken with digital calipers, and average values were recorded. The final values for all three samples were combined for the final reported results.

X-Ray Analysis

X-ray analysis of the soil and stabilizing materials was conducted at the Material Analysis and Research Laboratory (MARL) at Iowa State University (ISU). X-ray fluorescence (XRF) measurements were taken using a Philips PW 2404 X-ray spectrometer using Rh X-ray tubes operated at 3,600 watts. Fused disk standards from the National Institute of Standards and technology (NIST) were used. Materials were analyzed in vacuum mode. The sulfur content of the soil was analyzed on loose powders in helium mode using calcium sulfate–based standards from the American Chemical Society (ACS). X-ray diffraction (XRD) analysis was performed using a Siemens D 500 X-ray diffractometer with Cu X-ray tube source operated at 50 kV and 27 mA using medium-resolution slits.

The cement and fly ash samples were ignited to a constant mass and then fused into glass disks for XRF analysis. The lime and slag samples were pressed into pellets for XRF analysis. All stabilizing samples were ground in an agate mortar and pestle prior to XRD analysis. Soil materials were oven-dried and ground for two minutes in a SPEX shatter box to produce a fine powder for XRD analysis. XRD specimens were back-packed to avoid preferred orientation. Selected samples were equilibrated with water vapor (100% relative humidity, 24 hour treatment) at room temperature (23±2°C) in an attempt to rehydrate the oven-dry soils. Then the samples were allowed to sit at ambient temperature and humidity (23±2°C, 25% to 35% relative humidity) for about two hours prior to XRD analysis. A companion sample was treated with ethylene glycol to check for expansive clay minerals. The glycol-treated specimens (and a single water-treated specimen) were smeared into the XRD holder, which tended to cause preferred orientation of the basal planes of the clay minerals.

Thermal Analysis

The lime sample was subjected to thermogravimetric analysis (TGA) to determine loss-on-ignition (LOI) and to estimate the calcium hydroxide and calcium carbonate contents. The material was ground in an agate mortar prior to testing. A TA Instruments TGA, model number 2950, was used at a temperature range of 25 to 1,000°C, with a 40°C increase per minute. The resolution was 5°C, and the sample size was 25 mg.

Scanning Electron Microscopy

Additional testing was conducted in the MARL facility to obtain SEM images of soils and soil/cement mixtures to look for sulfate-rich material morphology as well as to perform spatial elemental analysis. A Hitachi S-2460N variable pressure SEM equipped with secondary electron and backscattered electron detectors, a motorized stage, and an Oxford Instruments ISIS system with energy-dispersive spectrometers (EDS) for quantitative elemental analysis was used for SEM analysis. Backscatter and secondary electron images were acquired.

Cation Concentration Organic Content and Total Carbon Content

Cation concentration, organic matter, and total carbon content measurements were conducted at the Iowa State University Soil and Plant Analysis Laboratory using "Recommended Chemical Soil Test Procedures for the North Central Region" (Warncke and Brown 1998).

MATERIALS

Soils

Soils from three locations were received for investigation. Soils were grouped based on similar physical and chemical properties. Table 1 provides the material inventory.

Table 1. Materials received

Group	Material Description	Sample #
S	Segment 6.2 (Wilcox Formation) Light Brown/Orange Grey Mottled	1
L	Segment 5 (Navarro Formation) Depth 1 of 5 feet Black/Trace Brown	1
		2
		3
		4
		5
	Segment 5 (Navarro Formation) Depth 1 to 7 feet Black/Trace Brown	6
	Segment 5 (Navarro Formation) Depth 1 to 5 feet Black/Trace Brown	7
		8
	Segment 5 (Navarro Formation) Depth 1 to 7 feet Black/Trace Brown	9
L Sulfate	Segment 5 (Navarro Formation) Black/Trace Brown	1

There were two groupings of soils based on the testing performed and only one container of material (35 lbs at in situ moisture content) that contained high sulfate content. Table 2 summarizes the two soil types investigated, as well as the properties of the single sample that had high sulfate content.

Table 2. Properties of soil materials tested

Soil Designation	S	L	L (high sulfate)
PI	31	49	45
LL	51	74	73
Dry Unit Weight (pcf)	111.0	92.5	100.0
Optimum Moisture Content (%)	17.5	28.0	25.8
Clay Content (0.002 mm) %	40	58	—
Volumetric Swell (%)	18	12	14
Initial Moisture Content (%)	16.8	28.3	27.0
Final Moisture Content (%)	27.5	39.2	43.8
ppm K	185	434	328
ppm Ca	3010	10088	26285
ppm Mg	670	147	653
ppm Na	396	38	715
pH	5.7	8.7	7.8
% Carbon	0.4	2.5	0.8
%Organic Matter	0.7	4.5	1.4
Sulfate TX 145-E (ppm)	< 100 (low)	< 100 (low)	30320 (high)*
Sulfate TX-146-E (ppm)	< 100 (low)**	700 (low)**	31300 (high)**

* Sample diluted to 1:200, a dilution outside of standard used to obtain quantifiable amount in equipment measurement range; ** determined from correlation Harris (2002)

X-ray analysis was conducted on soil samples for SO_3 content (actually bulk sulfur content, expressed as $\%SO_3$). The bulk sulfur values, shown in Table 3, were generally low (less than 0.1% for the majority of samples). The samples denoted as MM were analyzed in triplicate to estimate the precision of the determinations. The bias in the method could not be determined due to a lack of appropriate standard reference materials. Calibration standards were typically only accurate to two decimal places, so the precision of the method greatly exceeded its accuracy. The sample denoted as RR (highest sulfur content) was also analyzed using the fused disk technique to provide a better estimate of its bulk chemical composition (see Table 4).

Table 3. Summary of XRF assays performed

MARL Designation	Sample Desc.	Data type	S peak	S bg1	S net kcps	C SO3, %	kcps/%	Rough est. SO3 calculated	Regression. SO3 calculated
STD B-670+FILM	—	Raw kcps	162.6269	0.6014	162.53	5.63	28.87	**5.63**	5.64
STD B-243+FILM		Raw kcps	78.1532	0.3466	78.05	3.43	22.76	**3.45**	3.45
STD B-15-16+FILM		Raw kcps	77.3196	0.3436	77.22	3.43	22.51	**3.42**	3.42
AA	S1	Raw kcps	0.7165	0.1002	0.62	—	—	**0.027**	0.033
BB		Raw kcps	0.601	0.0941	0.50	—	—	**0.022**	0.026
CC		Raw kcps	0.4863	0.0917	0.39	—	—	**0.017**	0.020
DD	L1	Raw kcps	1.733	0.0996	1.63	—	—	**0.072**	0.086
EE		Raw kcps	9.3689	0.1268	9.27	—	—	**0.410**	0.481
FF	L2	Raw kcps	0.9258	0.0987	0.83	—	—	**0.037**	0.044
GG		Raw kcps	1.0327	0.0991	0.93	—	—	**0.041**	0.049
HH	L3	Raw kcps	0.6838	0.0991	0.58	—	—	**0.026**	0.031
II		Raw kcps	0.9012	0.0976	0.80	—	—	**0.035**	0.042
JJ	L4	Raw kcps	2.882	0.109	2.78	—	—	**0.123**	0.146
KK		Raw kcps	0.6401	0.0983	0.54	—	—	**0.024**	0.029
LL	L5	Raw kcps	2.847	0.0997	2.75	—	—	**0.122**	0.144
MM		Raw kcps	0.5726	0.0963	0.47	—	—	**0.021**	0.025
NN	L6	Raw kcps	3.0763	0.1046	2.98	—	—	**0.132**	0.156
OO		Raw kcps	0.7043	0.098	0.60	—	—	**0.027**	0.032
PP	L7	Raw kcps	5.1306	0.1137	5.03	—	—	**0.223**	0.263
QQ	L8	Raw kcps	1.47	0.105	1.37	—	—	**0.061**	0.072
RR	L Sulfate	Raw kcps	220.4742	0.7025	220.37	—	—	**7.63**	6.22
SS	L9	Raw kcps	0.6129	0.0996	0.51	—	—	**0.023**	0.027
TT		Raw kcps	0.7135	0.0955	0.61	—	—	**0.027**	0.032
UU		Raw kcps	0.576	0.0992	0.48	—	—	**0.021**	0.025

Table 4. XRF Analysis of RR, high sulfur soil, fused disk preparation

Oxide or constituent	Mass%
Na_2O	0.66
MgO	1.48
Al_2O_3	11.39
SiO_2	51.77
P_2O_5	0.08
SO_3	10.94
K_2O	1.24
CaO	10.64
TiO_2	0.60
Fe_2O_3	3.92
SrO	0.04
Mn_2O_3	0.05
BaO	0.01
Moisture content (at 110° C)	0.35
Loss-on-ignition (at 950 ° C)	6.05

Sample RR (L Sulfate 1) and six other samples, were subjected to XRD analysis before and after selected treatments, as shown in Figure 1. The clay mineral, with a d-spacing of about 15 to 16 angstroms from the air-dry soil samples, tended to expand to about 18 angstroms when treated with ethylene glycol, as shown in Figure 2. This expansion indicated the presence of a swelling clay mineral. The overlays in the figure show the glycolated treatment for expansive mineral investigation, which indicates the presence of swelling clays. Sample RR was treated with water. This caused the clay basal plane to expand to 20 angstroms and caused the bassanite to hydrate to gypsum. Complete soil diffractogram results are provided in Appendix C.

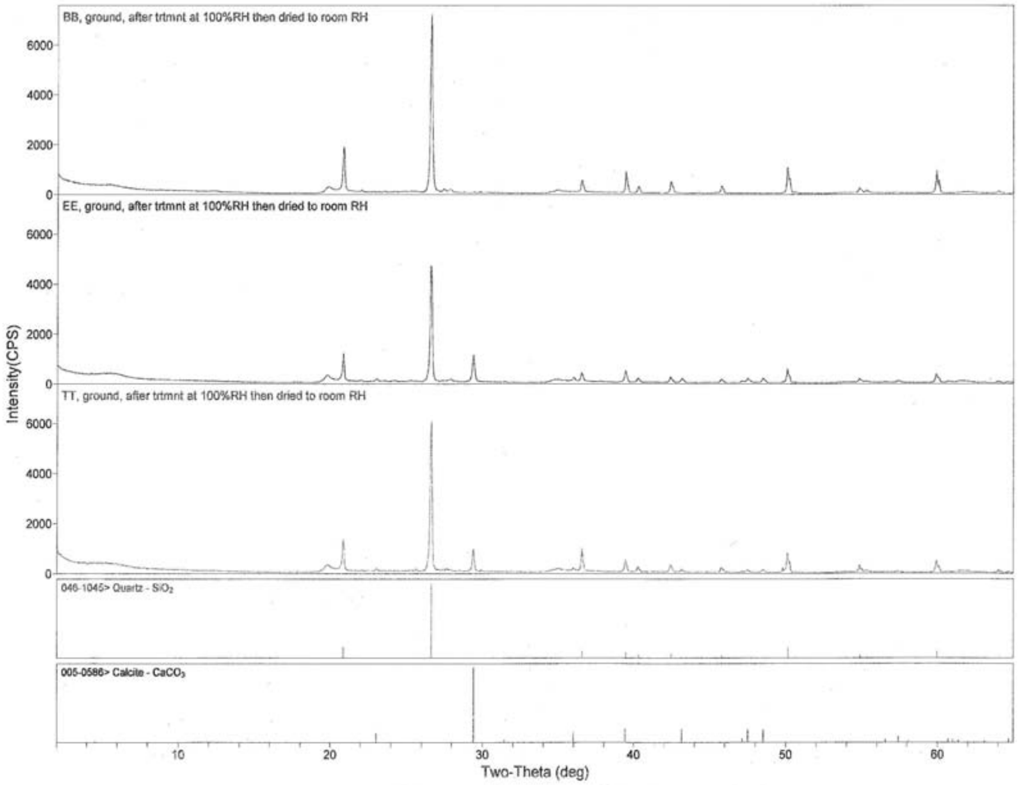


Figure 1. Diffractograms of received soils (“BB” is S soil type, “EE” and “TT” are L soil type)

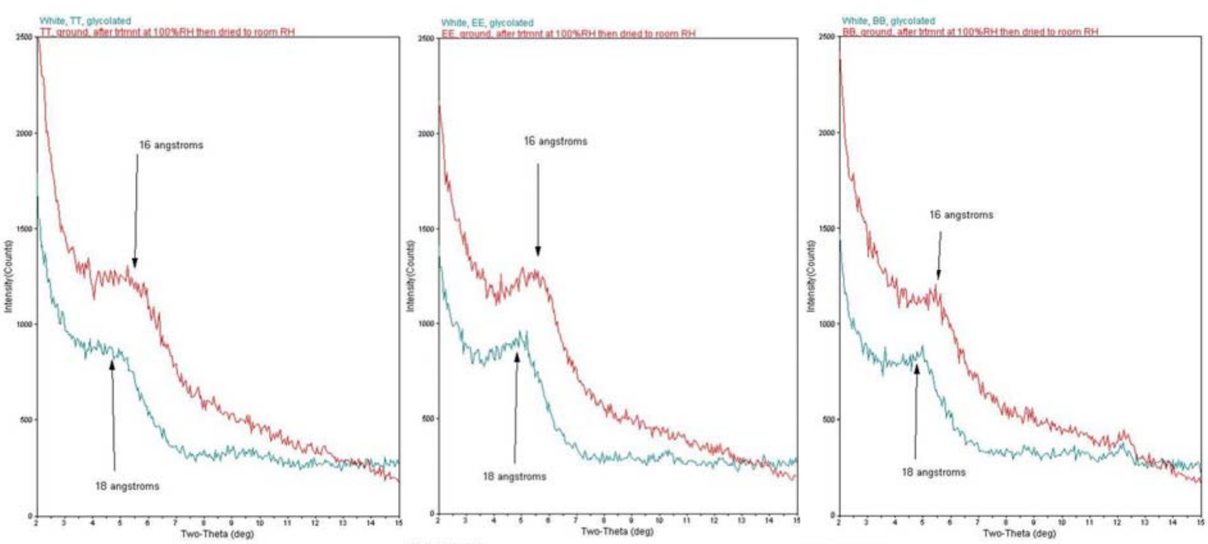


Figure 2. Diffractograms of received soils, glycolated (“BB” is S soil type, “EE” and “TT” are L soil type)

SEM Summary of Soils Received

The as-received materials in the identified testing groups were investigated using SEM techniques. The images provide particle shape, texture, and morphology, while the X-ray analysis provided elemental composition. Because many of the minerals are clays, a high concentration of silicon and aluminum was recorded. The presence of gypsum was noted and mapped using EDS in the high sulfate soil (Figure 3). In the figure, sulfur (SKa, 21) and calcium (CaKa, 22) show the presence of gypsum, and light areas indicate spatial regions of high intensity for the noted element. Figure 4 validates the high concentration of calcium, sulfur, and oxygen in the assumed $CaSO_4$ particle, showing a high intensity of counts for these elements. The inset image in Figure 4 shows the area of analysis. Appendix D contains the SEM images acquired.

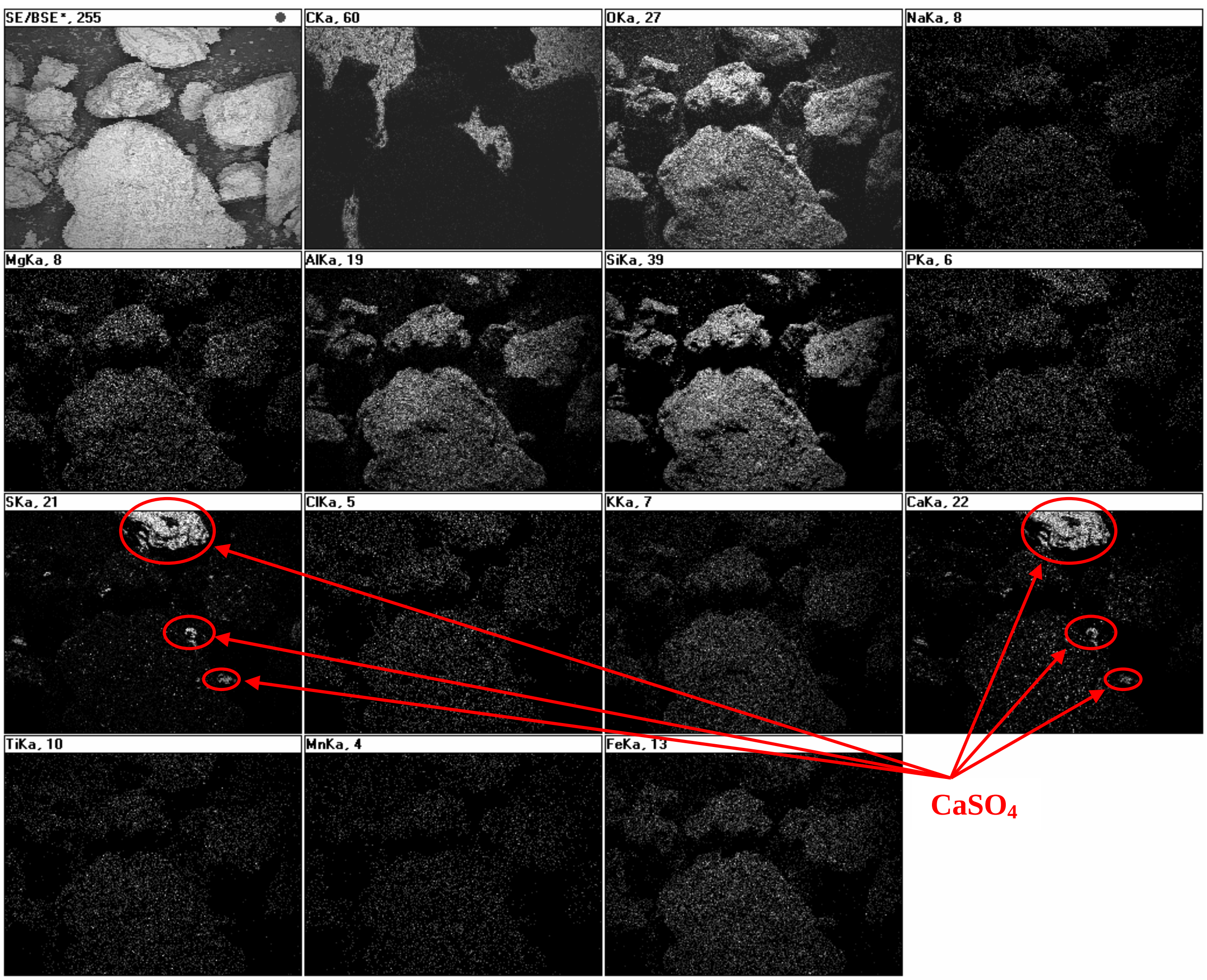


Figure 3. X-ray EDS maps of high sulfate content soil

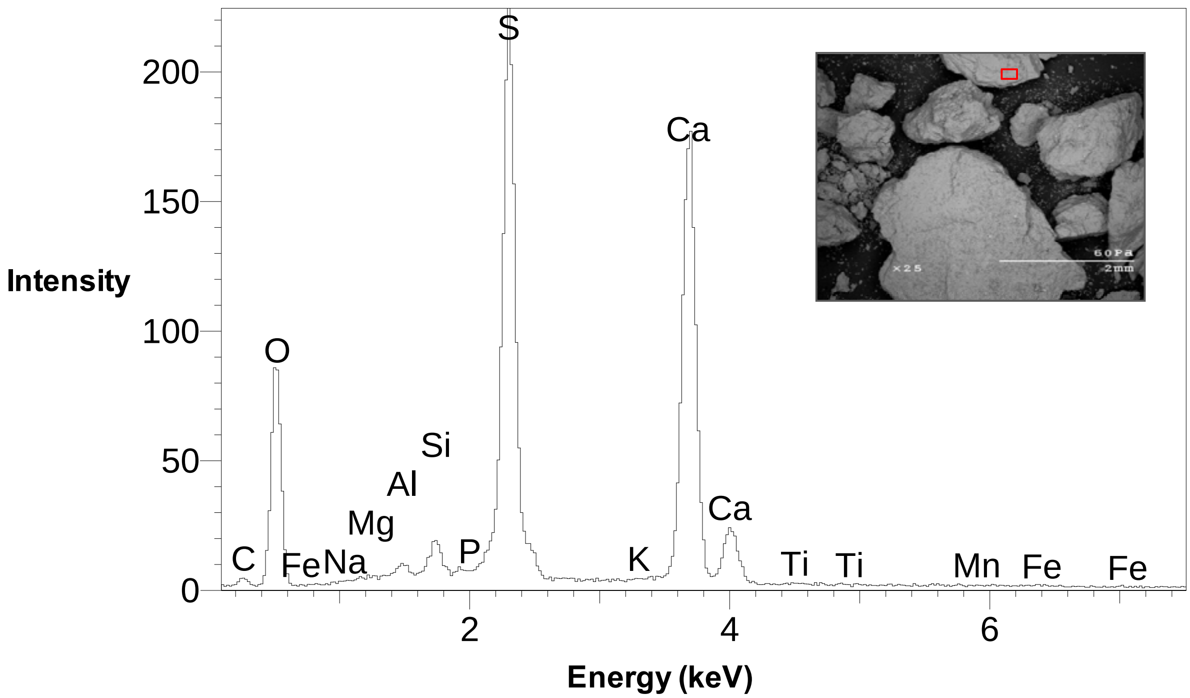


Figure 4. EDS intensity counts, showing high concentrations of oxygen, sulfur, and calcium

Stabilizers

Six stabilization materials were provided for batching, as summarized and described in Table 5. The results of chemical assays show reasonable values for the corresponding materials, as summarized in Tables 6 and 7. In Table 6, the fly ash assays are expressed on a dry basis; the samples were ignited at 750°C prior to analysis. The cement assays in the table are expressed on an as-received basis; the samples were ignited at 950°C prior to analysis. In Table 7, the slag and lime assays are expressed on an as-received basis, and the CaO content of the lime was calculated by difference from 100%. Additionally, XRF and XRD analyses were performed on the stabilizers. Diffractograms were in general agreement with the chemical assays that were acquired. Appendix E contains the complete set of stabilizer diffractogram data.

Table 5. Summary of stabilizers received

Material Type	Description
Cement Type I/II	Cemex, New Braunfels, TX
Cement Type V	Cemex Type V, Odessa, TX
Fly Ash Class C	Mineral Resource Technologies, Inc.
Fly Ash Class F	Mineral Resource Technologies, Inc. Petersburg, IN.
Lime (Hydrated)	Chemical Lime Company Fort Worth, TX
Slag	CEMEX

Table 6. Summary of fly ash and cement assays

Oxide or constituent, mass%	MRT F ASH	MRT C ASH	Cement New Braunfels-Type I/II	Cement Odessa-Type V
Na_2O	0.49	1.64	0.19	0.33
MgO	0.85	4.9	1.09	0.72
Al_2O_3	22.7	19.5	4.49	4.16
SiO_2	46.1	36.1	20.1	21.3
P_2O_5	0.21	1.10	0.07	0.06
SO_3	0.32	1.46	2.90	3.91
K_2O	2.41	0.47	0.59	0.22
CaO	1.84	26.2	64.4	63.3
TiO_2	1.03	1.65	0.21	0.17
Fe_2O_3	20.8	5.74	3.37	4.39
SrO	0.05	0.42	0.05	0.07
Mn_2O_3	0.03	0.03	0.04	0.05
BaO	0.06	0.8	not measured	not measured
LOI	1.88	0.19	2.52	1.03
Calculated via ASTM C 150				
C3S	not applicable	not applicable	66	51
C2S	not applicable	not applicable	8	23
C3A	not applicable	not applicable	6	4
C4AF	not applicable	not applicable	10	13

Table 7. Summary of slag and lime assays

Mass%	CEMEX Slag	Lime-Chemical Lime
Na_2O	0.34	<0.01
MgO	7.48	0.2
Al_2O_3	10.4	0.078
SiO_2	35.1	0.41
P_2O_5	0.02	0.008
S	0.88	0.055
K2O	0.27	<0.01
CaO	41.2	74
TiO_2	0.43	<0.01
Fe_2O_3	0.74	0.034
SrO	0.08	0.014
Mn_2O_3	0.31	<0.01
LOI	not measured	25
$Ca(OH)_2$	not measured	86.4
$CaCO_3$	not measured	6.6

Thermal Analysis

TGA determinations indicated water (1.09%), calcium hydroxide (20.99%), and calcium carbonate (2.92%) gravimetric contents in the sample of lime. The temperature and gravimetric loss profile for this sample is given in Figure 5.

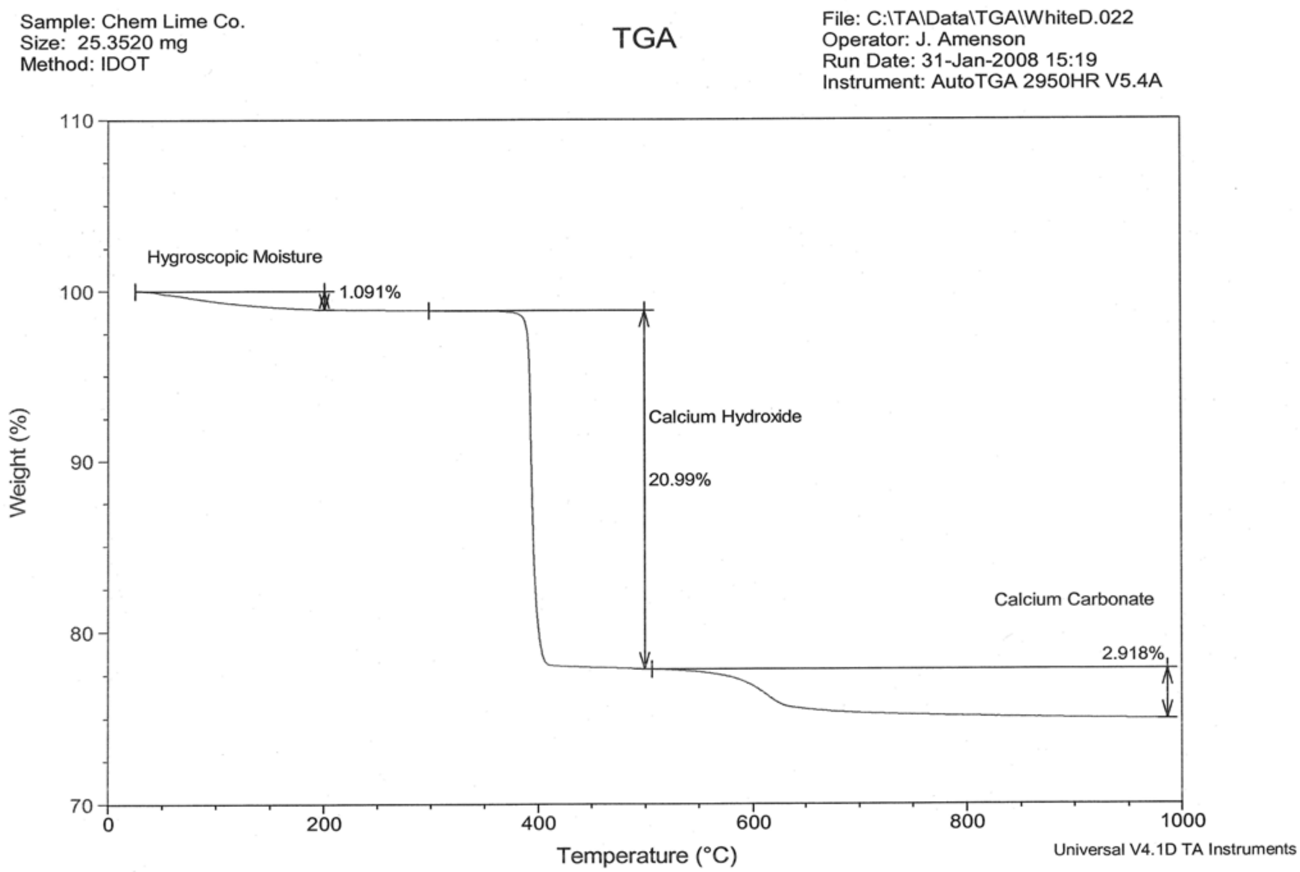


Figure 5. Thermal curve for the sample of lime (Chemical Lime Co.)

Soil Stabilization Test Results

To evaluate the effects of the different stabilizers, a total of 47 soil batches were prepared. A summary of batches and properties can be found in Table 8, and the test results are described below. The amount and type of stabilizer was varied between batches, and some batches were treated with a combination of stabilizing materials. Batches are described in Appendix B.

Table 8. Summary of average specimen data

Soil	Stabilizer	Addition Rate (based on dry weight of soil)	Moisture Content (%)	Sample #	Date Prepared	Unconfined Compressive Strength psi (Volume Change Measurements %): 7-Day 100˚F (3)	7-Day Ambient (3)	28-Day Ambient (3)	90-Day Ambient (3)	3-Day Soak: 7-Day 100˚F (3)	7-Day Ambient (3)	28-Day Ambient (3)	90-Day Ambient (3)	Liquid Limit / Plasticity Index (PI)	Initial pH Mixture 1:1 Soil/Stabililzer: Water	pH (90-Day Ambient - 1 specimen from each batch)	# Specimens
L (4800 g wet soil) ~ 198g specimen LL= 74, PI = 49, high organic/total carbon content, maximum dry unit weight = 92.5 pcf @ 28.0% moisture content. Swell potential @ optimum moisture content = 12%;	Cement I/II	8	32	L-CI/II-32-(8)	20-Feb-08	165	157	181	196	152 (0.2%)	141 (0.0%)	157 (0.0%)	164(-0.6%)	43 (1)	12.12	11.85	24
		12	32	L-CI/II-32-12	20-Feb-08	189	154	184	**205**	176 (0.9%)	154 (0.6%)	175 (-0.4%)	182 (-0.7%)	43 (2)	12.03	12.1	24
		16	32	L-CI/II-32-16	20-Feb-08	**219**	199	171	**208**	183 (1.1%)	164 (0.2%)	177 (-0.4%)	181 (0.0%)	41 (8)	12.13	12.26	24
	Fly Ash "C"	10	32	L-FC-32-10	23-Feb-08	95	92	105	118	86 (0.4%)	59 (0.3%)	94 (0.1%)	82 (-0.1%)	53 (31)		10.82	24
		15	32	L-FC-32-15	23-Feb-08	136	118	120	123	118 (0.7%)	90 (0.2%)	77 (-0.2%)	84(-0.4%)	56 (18)		9.96	24
		20	32	L-FC-32-20	23-Feb-08	129	104	128	125	106 (0.9%)	88 (0.7%)	89 (-0.3%)	91 (-0.5%)	50 (16)		11.18	24
	Fly Ash "C" + Cement I/II	8 + 8	32	L-CI/II+FC-32-8/8	23-Feb-08	172	146	173	175	160 (0.2%)	144 (0.5%)	169 (-1.1%)	167 (-0.8%)	55 (8)	12.02	11.77	24
		4 + 4	32	L-CI/II+FC-32-4/4	24-Apr-08	121	118	149	197	121 (-0.4%)	128 (-0.1%)	134 (-0.1%)	154 (0.5%)	62 (23)	11.71	11.48	24
		3+3	32	L-CI/II+FC-32-3/3	16-May-08	125	100	130	142	120 (0.1%)	112 (0.0%)	118 (-0.2%)	124 (-0.4%)	55 (23)		11.24	24
	Fly Ash "F" + Cement I/II	8 + 8	32	L-CI/II+FF-32-8/8	24-Feb-08	187	157	185	196	**203 (0.0%)**	160 (0.1%)	173 (-0.4%)	136 (-0.3%)	47 (6)		11.12	24
		4 + 4	32	L-CI/II+FF-32-4/4	24-Apr-08	125	110	114	154	112 (0.8%)	110 (-0.3%)	139 (0.1%)	128 (0.2%)	51 (17)		11.39	24
	Slag + Cement I/II	8 + 8	36	L-CI/II+S-36-8/8	23-Feb-08	**256**	175	**212**	**222**	199 (0.4%)	179 (0.7%)	**204 (-0.3%)**	177 (-0.8%)	52 (9)	12.04	11.83	24
		4+4	32	L-CI/II+S-36-4/4	9-May-08	118	113	139	163	121 (-0.2%)	124 (0.1%)	132 (-0.5%)	133 (0.3%)	47 (13)	11.76	11.83	24
	Lime + Cement I/II	4 + 8	36	L-CI/II+L-36-8/4	24-Feb-08	**315**	**273**	**358**	**376**	**335 (0.0%)**	**264 (0.3%)**	**242 (-0.4%)**	**292 (-0.2%)**	52 (NP)		11.96	24
	Cement V	8	32	L-CV-32-(8)	12-Mar-08	118	120	168	175	133 (-0.1%)	128 (0.3%)	152 (-0.4%)	166 (0.0%)	39 (1)	11.46	11.83	24
		12	32	L-CV-32-12	12-Mar-08	**202**	149	**212**	**216**	156 (0.0%)	156 (-0.2%)	180 (-0.4%)	**217 (-0.3%)**	42 (5)	11.71	10.82	24
		16	32	L-CV-32-16	12-Mar-08	173	171	**203**	**255**	165 (-0.1%)	149 (0.5%)	170 (-0.5%)	**211 (0.5%)**	43 (1)	11.86	12.3	24
	Lime	4	33	L-L-33-4	24-Apr-08	142	131	**204**	**240**	185 (0.5%)	160 (0.4%)	**217 (0.1%)**	**200 (0.9%)**	48 (8)	12.55	11.53	24
		6	33	L-L-33-6	9-May-08	**225**	140	216	**245**	**229 (0.2%)**	155 (0.6%)	**236 (0.4%)**	**234 (0.5%)**	42 (6)	12.58	11.94	24
		8	34	L-L-34-8	9-May-08	**228**	146	234	**313**	**249 (0.3%)**	164 (-0.1%)	**252 (0.4%)**	**294 (0.4%)**	42 (3)	12.59	12.19	24
S (5200 g Wet Soil) ~218g sample, LL = 51, PI = 31, moderate to low organic/total carbon content, maximum dry unit weight = 111.0 pcf @ 17.5% moisture content. Swell potential @ optimum moisture content = 18%;	Cement I/II	6	23	S-CI/II-23-6	27-Feb-08	133	115	136	143	119 (0.6%)	110 (0.2%)	107 (0.1%)	101 (-0.3%)	37 (5)		11.79	24
		10	24	S-CI/II-24-10	28-Feb-08	196	176	**202**	179	169 (-0.4%)	155 (0.4%)	150 (0.0%)	133 (-0.4%)	40 (5)	12.08	12.25	24
		16	25	S-CI/II-25-16	3-Mar-08	164	198	179	181	140 (-0.2%)	143 (0.0%)	161 (0.2%)	140 (0.1%)	40 (12)	12.17	12.35	24
	Fly Ash "C"	10	23	S-FC-23-10	3-Mar-08	116	100	115	124	15 (6.7%)	10 (8.9%)	22 (5.1%)	30 (3%)	44 (21)		10.45	24
		15	23	S-FC-23-15	3-Mar-08	112	103	96	127	23 (5.0%)	17 (7.6%)	29 (4.5%)	48 (1.2%)	37 (6)		11.41	24
		20	23	S-FC-23-20	3-Mar-08	77	78	121	115	64 (0.8%)	33 (1.5%)	54 (1.3%)	65 (0.4%)	43 (23)		11.36	24
	Fly Ash "C" + Cement I/II	8 + 8	25	S-CI/II+FC-25-8/8	6-Mar-08	132	113	158	178	90 (0.2%)	107 (0.0%)	121 (0.2%)	122 (0.5%)	32 (6)	12.07	11.94	24
		4 + 4	23	S-CI/II+FC-23-4/4	8-May-08	103	111	140	173	103 (1.0%)	112 (1.2%)	132 (0.4%)	161 (0.3%)	38 (17)	11.78	12.07	24
		3+3	23	S-CI/II+FC-23-3/3	16-May-08	100	95	121	139	73 (0.7%)	91 (0.9%)	112 (0.4%)	126 (0.3%)	39 (20)		11.67	24
	Fly Ash "F" + Cement I/II	8 + 8	23	S-CI/II+FF-23-8/8	6-Mar-08	111	119	142	173	98 (0.7%)	111 (1.1%)	132 (-0.1%)	118 (0.0%)	40 (13)	12.1	12.06	24
		4 + 4	23	S-CI/II+FF-32-4/4	8-May-08	117	111	128	144	81 (0.4%)	91 (0.4%)	112 (0.6%)	128 (0.5%)	43 (13)	11.76	10.63	24
	Slag + Cement I/II	8 + 8	23	S-CI/II+S-23-8/8	6-Mar-08	134	119	153	**207**	119 (0.1%)	121 (0.4%)	132 (-0.2%)	193 (-0.2%)	36 (5)	11.81	12.09	24
		4+4	23	S-CI/II+S-23-4/4	9-May-08	86	105	124	177	77 (0.3%)	80 (0.7%)	104 (0.3%)	178 (0.5%)	46 (20)	11.9	12.03	24
	Lime + Cement I/II	4 + 8	23	S-CI/II+L-23-8/4	6-Mar-08	**277**	**229**	**308**	**388**	**239 (0.1%)**	**222 (0.0%)**	**295 (0.2%)**	**345 (0.1%)**	37 (NP)		12.48	24
	Lime	3	23	S-L-23-3	6-Mar-08	183	119	155	**203**	121 (0.7%)	109 (0.6%)	150 (0.7%)	173 (0.5%)	42 (9)		12.04	24
		5	25	S-L-25-5	7-Mar-08	175	115	179	**267**	169 (0.8%)	111 (0.3%)	179 (-0.1%)	191 (0.2%)	41 (5)		12.4	24
		7	23	S-L-23-7	7-Mar-08	153	113	176	**343**	154 (0.3%)	110 (0.2%)	**207 (0.1%)**	**264 (0.2%)**	36 (NP)		12.54	24
	Cement V	6	23	S-CV-23-6	7-Mar-08	149	128	161	165	126 (0.5%)	87 (1.0%)	118 (0.1%)	113 (0.4%)	36 (8)		12.09	24
		10	23	S-CV-23-10	7-Mar-08	141	145	170	192	150 (0.6%)	134 (0.3%)	168 (0.1%)	168 (0.1%)	35 (7)	12.23	12.18	24
		14	23	S-CV-23-14	7-Mar-08	137	142	141	**232**	128 (0.9%)	139 (0.5%)	136 (0.3%)	**201 (0.2%)**	38 (5)	12.32	11.95	24
"?" Only 4 Speciemns for each mixture UCS @ 7day, and7, 28, 90 days soaked 90 days, LL = 73, PI = 45, moderate to low organic /total carbon content, maximum dry unit weight = 100.0 pcf @ 26.0% moisture content. Swell potential @ optimum moisture content = 20%; high sulfate content	Cement I/II	10	34	?-CI/II-34-10	1-Apr-08	—	101	-	-	—	33 (7.2%)	43 (7.0%)	63 (5.4%)	—	12.28	11.06	4
	Lime	5	34	?-L-34-5	1-Apr-08	—	95	-	-	—	35 (13.8%)	38 (13.6%)	82 (9.1%)	—		10.7	4
	Lime + Cement I II	8 + 8	34	?-L + CI/II-34-4/8	1-Apr-08	—	140	-	-	—	54 (9.5%)	67 (11.9%)	72 (14.2%)	—	12.32	11.31	4
	Fly Ash C	15	34	?-FC-34-15	1-Apr-08	—	66	-	-	—	19 (3.8%)	29 (1.7%)	52 (0.9%)	—		9.73	4
	Slag + Cement I/II	8 + 8	34	?-S+ CI/II-34-8/8	8-Apr-08	—	119	-	-	—	48 (6.6%)	39 (6.2%)	64 (2.98%)	—		10.6	4
	Fly Ash "C" + Cement I/II	8 + 8	34	?-FC+ CI/II-34-8/8	8-Apr-08	—	126	-	-	—	36 (8.8%)	39 (5.7%)	51 (4.2%)	—	11.99	10.31	4
	Fly Ash "F" + Cement I/II	8 + 8	34	?-FF+ CI/II-34-8/8	8-Apr-08	—	90	-	-	—	38 (5.0%)	56 (4.1%)	58 (2.92%)	—	12.17	10.32	4
	Clay Crete	5%	34	?-2C-34-x	21-May-08	—	-	-	-	—	—	—	—	56 (32)			
	Soil Tac	TBD	34	?-ST-34-x	-	—	-	-	-	—	—	—	—	—			
	Soil Cement*	5%	34	?-SC-34-x	20-May-08	—	-	-	-	—	—	—	—	64 (44)			
	Dust Lock	5%	34	?-DL-34-x	20-May-08	—	-	-	-	—	—	—	—	62 (47)			

*NP indicates material is non-plastic, **Bold** values are greater than 200 psi *pH Results*

Adding calcium-based stabilizers to soil generally results in a proportional increase in the pH value, up to the maximum pH value as shown in Figure 6. Generally, the maximum pH value can be used as an indicator of the target stabilizer addition rate. Clay minerals can be broken down in a high pH environment and can be irreversibly rendered non-expansive. Most of the stabilizers increased the pH of the soil-stabilizer mixtures, with the exception of the class F fly ash, which caused a slight decrease (< 0.4) in pH values. The greatest increases in pH occurred in lime, cement, and lime/cement blends, with pH values greater than 12. Appendix F contains the pH values of all soils tested.

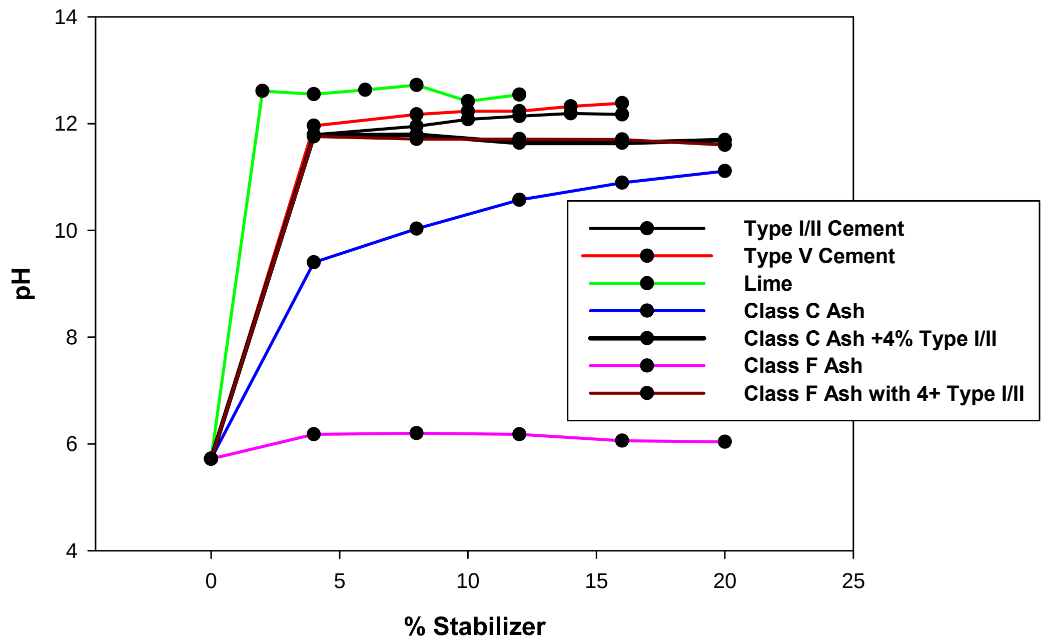
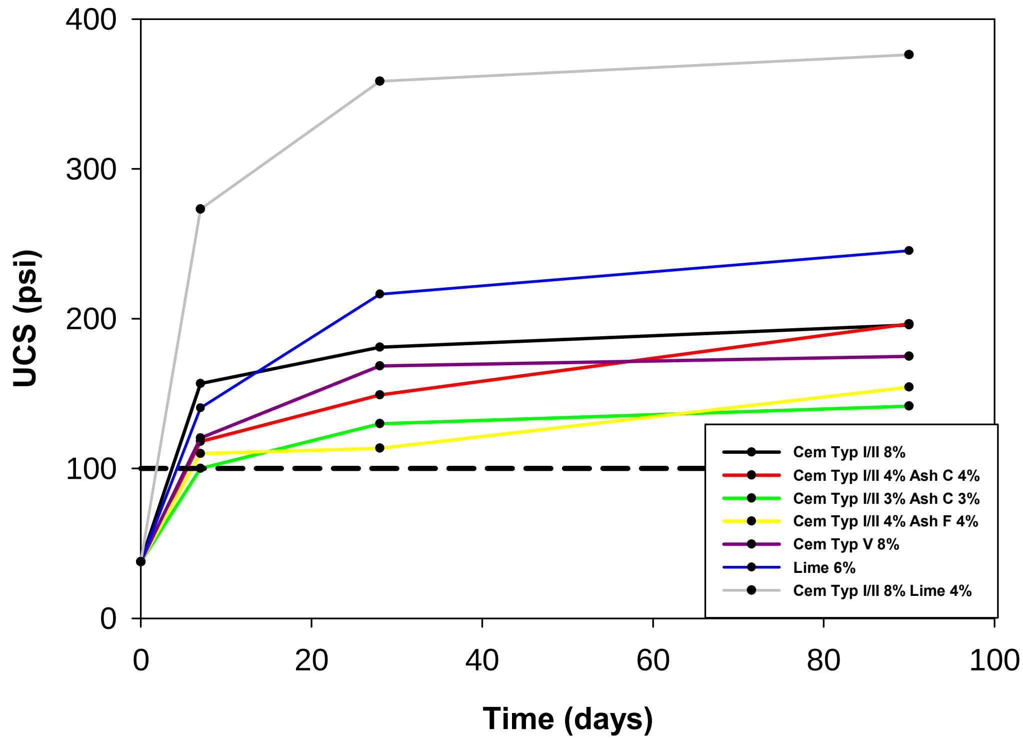


Figure 6. S soil pH measurement for various stabilizers

Unconfined Compressive Strength

Adding stabilizing materials resulted in a strength increase for most mixtures in the range of 100 to 300 psi, and recommended mixtures are summarized in Figure 7. For comparison, unstabilized soil samples produced unconfined compressive strength of 6 to 37 psi. Strength curves for the tests are presented in Appendix G. Maximum values over 300 psi were obtained in lime and cement/lime blended batches as early as 28 days in some specimens. Limes plus cement produced the highest strengths. Strengths over 200 psi were also measured in materials treated with Type I/II and Type V cement, slag/cement blends, and class F fly ash/cement blends. The values of 7 day 100° F conditioned samples generally predicted the 28 day ambient strength value. Figure 8 shows a sample after breaking, including the stabilizer-soil matrix structure. The area of high visual concentration of the stabilizer indicated how the stabilizer surrounds particles during the mixing process.



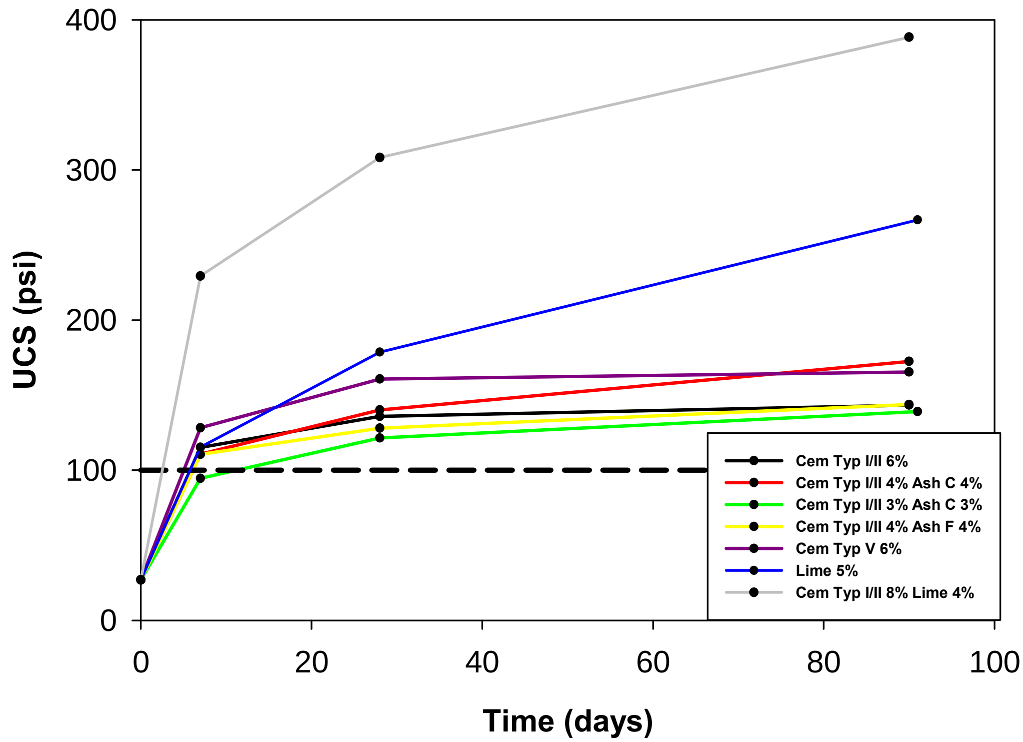


Figure 7. Unconfined compressive strength comparison for L soil (top) and S soil (bottom)

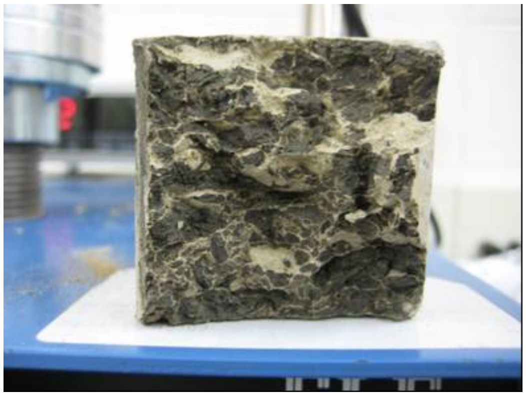


Figure 8. Soil with class C fly ash failure surface after strength testing

Atterberg Limits

Adding stabilizing agents resulted in a decrease of PI and LL in all materials. Figures 9 and 10 show plasticity charts for L and S soils. In these figures, samples are nominal 28+ day ambient temperature curing condition. Type I/II and V cement, lime, and cement/lime blends resulted in the greatest decreases in PI and LL among all the batches. Blended cement/lime stabilized batches resulted in material being rendered non-plastic. Table 9 summarizes the PI and LL values.

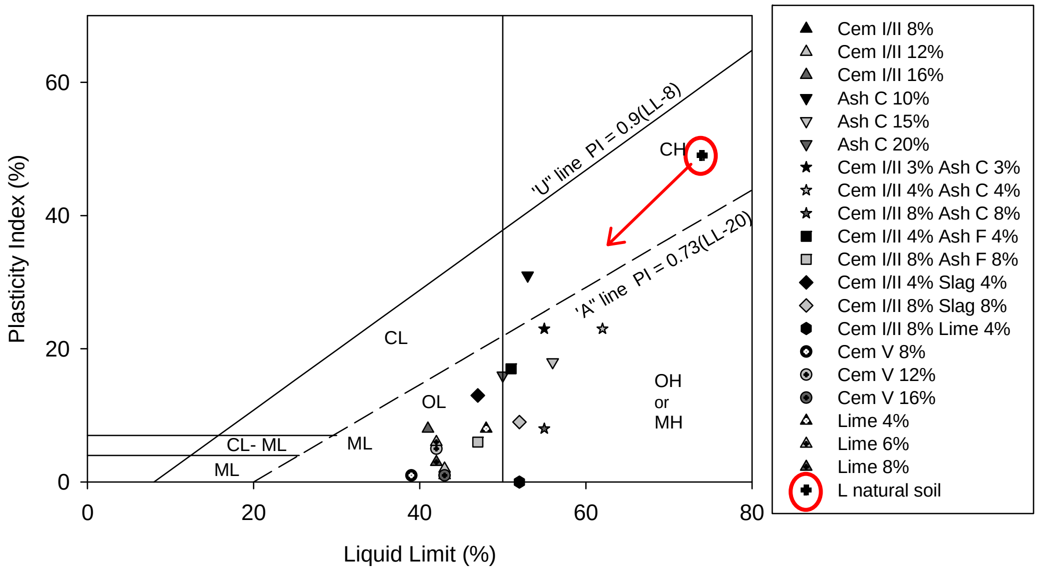


Figure 9. Plasticity chart for soil L batches

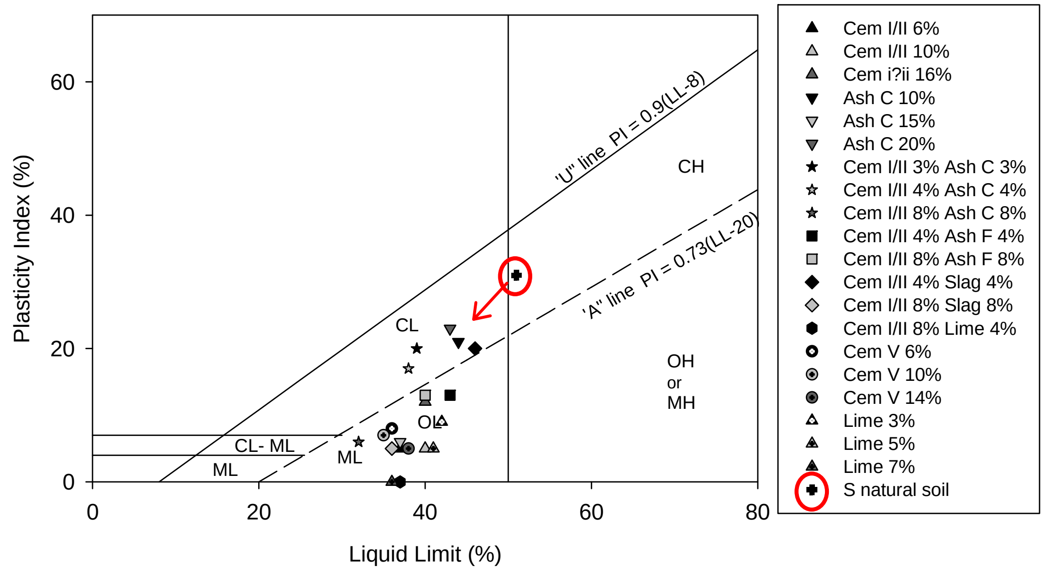


Figure 10. Plasticity chart for soil S batches

Table 9. Summary chart of liquid limit and plastic index of stabilized soils

Sample #	Liquid Limit (Plastic Index)	Sample #	Liquid Limit (Plastic Index)
L Soil Group		**S Soil Group**	
Natural Soil	74(49)	Natural Soil	51(31)
Cem I/II 8%	43 (1)	Cem I/II 6%	37 (5)
Cem I/II 12%	43 (2)	Cem I/II 10%	40 (5)
Cem I/II 16%	41 (8)	Cem I/II 16%	40 (12)
Ash C 10%	53 (31)	Ash C 10%	44 (21)
Ash C 15%	56 (18)	Ash C 15%	37 (6)
Ash C 20%	50 (16)	Ash C 20%	43 (23)
Cem I/II 8% Ash C 8%	55 (8)	Cem I/II 8% Ash C 8%	32 (6)
Cem I/II 4% Ash C 4%	62 (23)	Cem I/II 4% Ash C 4%	38 (17)
Cem I/II 3% Ash C 3%	55 (23)	Cem I/II 3% Ash C 3%	39 (20)
Cem I/II 8% Ash F 8%	47 (6)	Cem I/II 8% Ash F 8%	40 (13)
Cem I/II 4% Ash F 4%	51 (17)	Cem I/II 4% Ash F 4%	43 (13)
Cem I/II 8% Slag 8%	52 (9)	Cem I/II 8% Slag 8%	36 (5)
Cem I/II 4% Slag 4%	47 (13)	Cem I/II 4% Slag 4%	46 (20)
Cem I/II 8% Lime 4%	52 (NP)	Cem I/II 8% Lime 4%	37 (NP)
Cem V 8%	39 (1)	Cem V 6%	36 (8)
Cem V 12%	42 (5)	Cem V 10%	35 (7)
Cem V 16%	43 (1)	Cem V 14%	38 (5)
Lime 4%	48 (8)	Lime 3%	42 (9)
Lime 6%	42 (6)	Lime 5%	41 (5)
Lime 8%	42 (3)	Lime 7%	36 (NP)

* highlighted values are recommend mixtures

Volumetric Change

Untreated soil materials had volumetric swell potential percentages that ranged from 12%–20%. Adding stabilizers resulted in a decrease in the swell potential of the soil materials to less than 1%. Class C fly ash did not decrease the swell potential for the S soil. Negative volumetric swell values can be attributed to chemical changes in the stabilizing materials over time, e.g., hydration in cements, and slight variations in laboratory measurements. The high sulfate soil, while showing a decrease from the untreated 20% swell potential, had relatively higher swell values than the lower sulfate materials.

SEM Analysis

SEM examination of the batches did not show the formation of ettringite in samples containing high sulfate contents. A variety of samples were examined, ranging among all soil types and stabilizers. Figures 11 and 12 show SEM images of the recommended mixtures that display some elemental analysis and soil/stabilizer matrix. Additional SEM images and maps can be found in Appendix D.

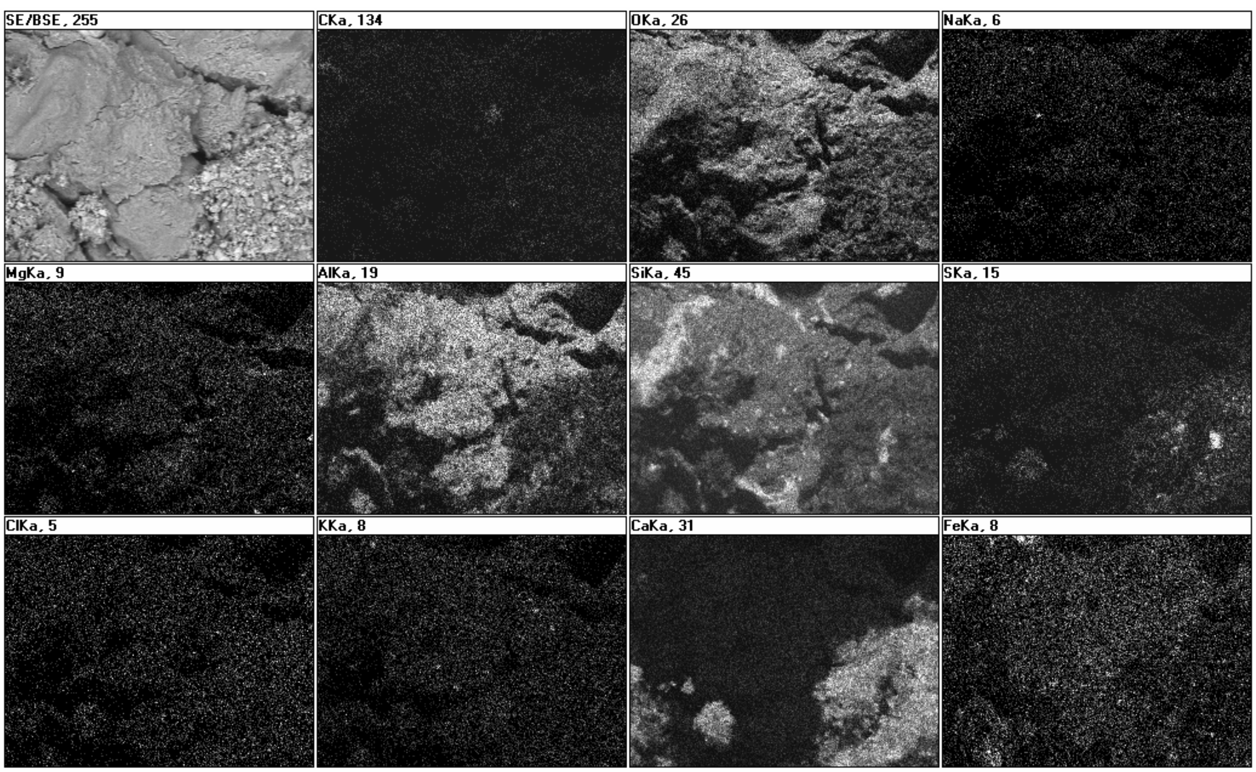


Figure 11. EDS map of soil s with type V cement

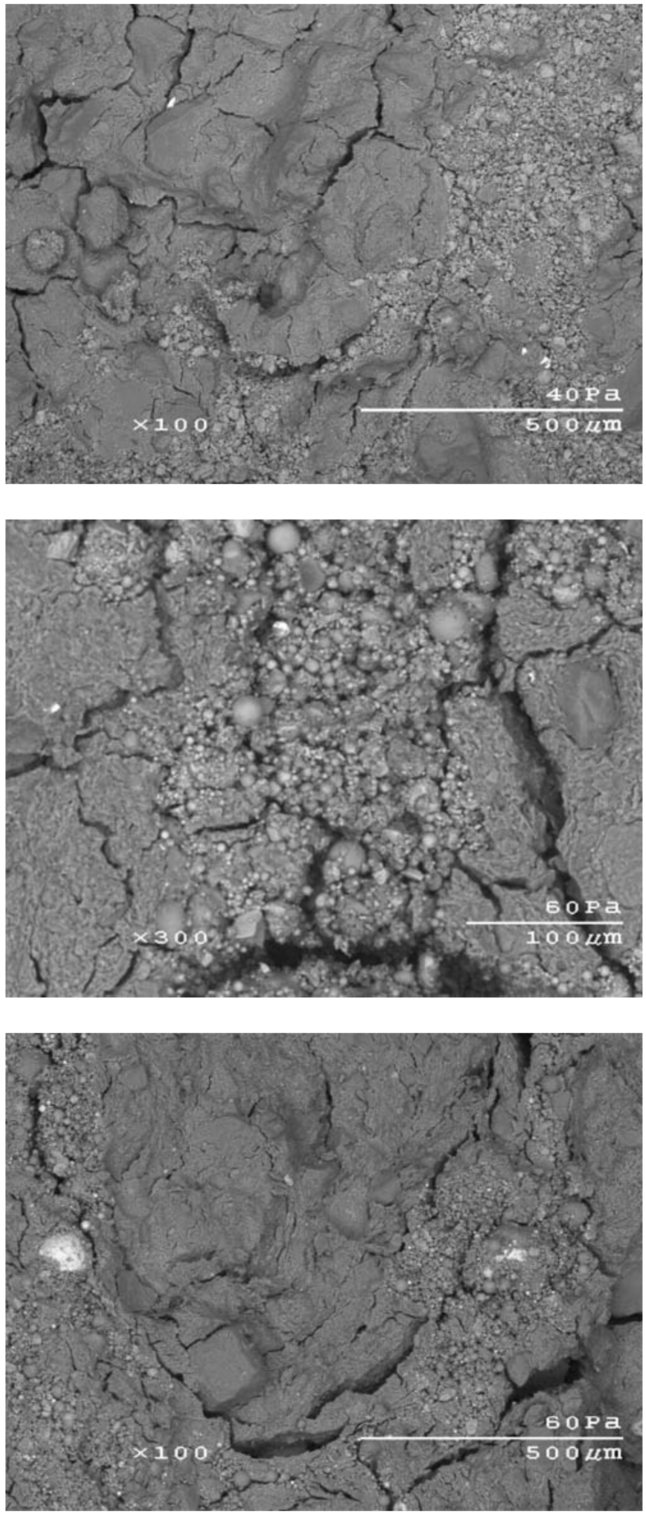


Figure 12. From top, soil S with type I/II cement, soil L with class C ash and type I/II cement, soil L with class F ash and type I/II cement

CONCLUSIONS

The preliminary conclusions from the Phase I lab study are as follows:

- Use of portland cement Type I/II and Type V alone and in combination with other stabilizers produces unconfined compressive strengths greater than 100 psi.
- Portland cement in combination with lime produced the highest strength values.
- Use of portland cement Type I/II and Type V alone and in combination with other stabilizers increases the pH values of stabilized soils mixtures.
- Use of portland cement Type I/II and Type V alone and in combination with other stabilizers reduces the PI values of high PI soils.
- Use of portland cement Type I/II and Type V alone and in combination with other stabilizers reduces the volumetric swell potential of soils with expansive properties.

RECOMMENDATIONS FOR FIELD TRIALS

Based on the results, several material combinations meet the laboratory criteria of 100 psi unconfined compressive strength and less than 2% volume change. The stabilization mixtures proposed for field trials are as follows:

- 6% Cement Type I/II or Type V
- 4% Cement Type I/II + 4% Fly ash Class C
- 4% Cement Type I/II + 4% Fly ash Class F
- 3% Cement Type I/II + 3% Fly ash Class C or F

For each stabilization mixture, three test beds should be constructed that are about 8 ft wide, 150 ft long and 1 ft deep. In addition, six test sections (also 8 ft x 150 ft x 1 ft) should be prepared with no stabilizer to optimize the reclaiming and compaction processes. In total, 18 test beds should be constructed: 12 stabilized test beds and 6 non-stabilized test beds. Table 10 presents a proposed matrix that identifies the details for each test section, each test bed number, and all stabilization quantities. Initial estimates for total material quantities are as follows:

- 35 tons of cement type I/II
- 15 tons of fly ash class C
- 15 tons of fly ash class F
- 12,000 gallons water (depends on natural w% to be verified in the field)

From a research standpoint, alternate test sections could include blends of cement and slag and blends of cement and lime (e.g. 3% Cement Type I/II + 3% Lime).

If the soils selected for the test sections contain high sulfate content, those areas will be considered for a second treatment at a later date. However, the second treatment would depend on field performance monitoring (e.g., evidence of swelling and morphology analysis in the laboratory). After compaction, the test sections should be covered with 2 in. of cover material for curing (well-graded base rock is preferred). For all 18 test beds, a total of about 250 tons of crushed rock would be needed.

Equipment requirements for this work are anticipated to include the following:

- Terex reclaimer (and trained operator) capable of mixing to 12 in. and equipped to inject water though the mixing drum
- Sufficiently large water truck to provide continuous support to the stabilization process
- Suitable mixing water free of soluble sulfates
- Padfoot and smooth drum vibratory rollers with intelligent compaction feedback control and global positioning system (GPS) mapping capability
- Motor grader to pre-rip stabilization areas as needed and to create windrows that contain dry stabilization materials
- Haul truck with spreader bar to distribute the stabilization agents in dry form

As part of this ongoing research effort, the researchers will be onsite for the construction phase to supervise the construction operations and operate the intelligent compaction rollers. The field team, with the ISU Geotechnical Mobile Lab (Figure 13) will help conduct in situ compaction measurements. A tentative schedule for this work is as follows:

Figure 13. Iowa State University Geotechnical Mobile Laboratory

- **Day 1.** Mobilize to site and set up intelligent compaction machines and layout test beds.
- **Day 2.** Evaluate mixing efficiency and speed for Terex, conduct compaction study for non-stabilized test strips (6) at target moisture contents and using two different rollers.
- **Day 3.** Distribute, mix, and compact mix test sections 4 and 5. Conduct baseline in situ test measurements.
- **Day 4.** Distribute, mix, and compact mix test sections 2 and 3. Conduct baseline in situ test measurements.
- **Day 5.** Follow up with baseline in situ test measurements.
- **Day 30.** Conduct follow up in situ tests and determine if any retreatment is necessary.
- **Day 90.** Follow up with baseline in situ test measurements.

Table 10. Summary of proposed field test sections

Test Section	Test Bed #	Details*	Material Quantities Based on L Soil	Material Quantities Based on S Soil
1	1	Terex reclaimer and high speed. Padfoot roller at high vibration amplitude	**No Stabilizer.** Anticipate needing to add about to 600 gallons of water to each test section, but depends on initial soil moisture content. Target moisture content is 32%.	**No Stabilizer.** Anticipate needing to add about 600 gallons of water to each test section, but depends on initial soil moisture content. Target moisture content is 23%.
	2	Terex reclaimer at low speed. Padfoot roller at low vibration amplitude		
	3	Terex reclaimer at optimized speed. Smooth drum roller at high amplitude		
	4	Terex reclaimer at optimized speed. Smooth drum roller at low amplitude		
	5	Terex reclaimer at optimized speed. Padfoot roller at high amplitude for initial 4 passes + 4 passes smooth drum at high amplitude		
	6	Terex reclaimer at optimized speed. Optimized compaction TBD based on roller measurements		
2	7 8 9	4% Cement Type I/II + 4% Fly ash Class C. Variable construction operations to optimize process	About **2.5 tons of Cement** + **2.5 tons F.A.** + **600 gallons of water** for each test bed	About **2.8 tons of Cement** + **2.8 tons F.A**. + **600 gallons of water** for each test bed
3	10 11 12	4% Cement Type I/II + 4% Fly ash Class F. Variable construction operations to optimize process		
4	13 14 15	6% Cement Type I/II or Type V. Variable construction operations to optimize process	About **3.5 tons of Cement** + **600 gallons of water** for each test bed	About **4.1 tons of Cement** + **600 gallons of water** for each test bed
5	16 17 18	3% Cement Type I/II + 3% Fly ash Class C or F	About **2 tons of Cement** + **2 tons F.A.** + **500 gallons of water** for each test bed	About **2.1 tons of Cement** + **2.1 tons F.A**. + **500 gallons of water** for each test bed

* Blends of cement and slag and blends of cement and lime (e.g. 3% Cement Type I/II + 3% Lime) could also be included as additional test beds.

Field Testing

The following testing procedure will be conducted in the ISU Geotechnical Mobile Lab. The purpose is to give baseline data for optimizing the construction process at the field site. These measurements will be performed as soon as possible after arrival on site:

- Standard and modified moisture-density relationship determination
- Atterberg limits determination

- Field determination of sulfate content by colorimetric and conductivity methods

Further onsite lab testing will include

- Particle size analysis
- 2x2 sample preparation of proposed mix proportions of onsite soils and stabilization materials for maturity development
- Resilient modulus samples prepared and tested as maturity develops

Field in situ testing methods will be performed at the time of construction and at follow up testing times. All measurements will be located with real time kinematic GPS to allow for detailed follow up measurements as well as correlation with intelligent compaction (IC) roller measurements. Field in situ testing methods include the following:

- Nuclear density/moisture
- Light Weight deflectometer LWD
- Dynamic cone penetrometer (full depth as needed)
- Plate load tests
- IC roller evaluation

Instrumentation for Performance Monitoring

Installation of in-ground instrumentation would also be beneficial for monitoring the performance and response of stabilized materials. Measurements of in-ground stress and strain will be measured to monitor the long-term volumetric change in the system. Installation, as shown in Figure 14, will allow measurements to be taken in different soil types determined by geological investigations as well as by field investigations to compare soils with differing concentrations of sulfate. Stress and strain measurements at the boundaries of materials may indicate the contribution of different foundation layers to system performance. If the test sections are subsequently paved and jointed pavements are used, measurements at the joints and at mid-panel will indicate variation in the system and the possible effects on pavement faulting. The final number of instrumented locations would depend on the variation in the construction testing area. A minimum of three locations is suggested, with an evaluation period of a minimum of six months.

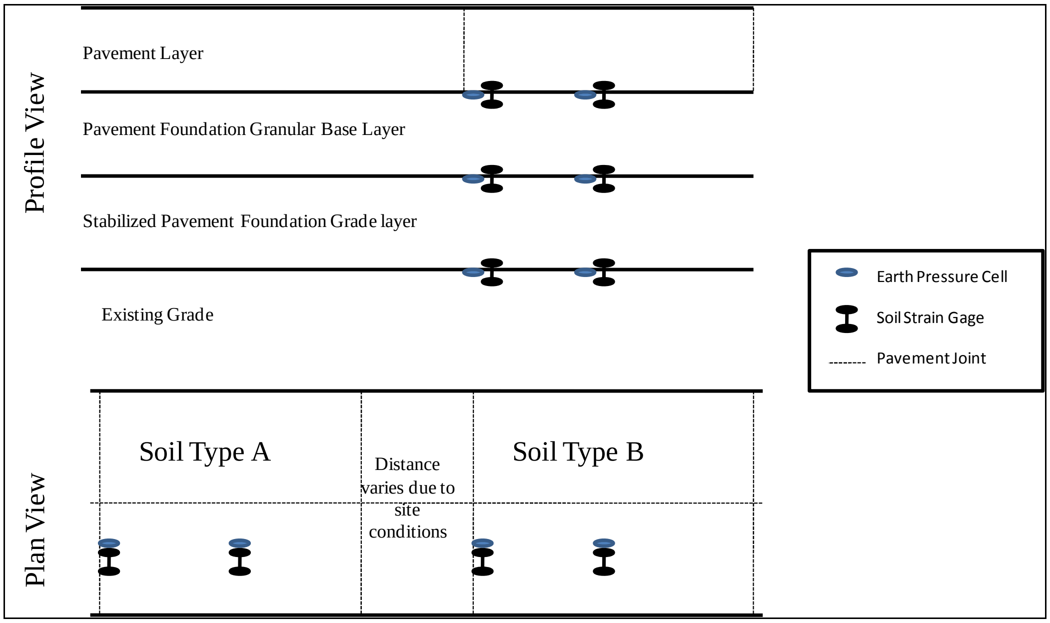


Figure 14. Schematic of in-ground instrumentation installation (similar to Pillappa 2005)

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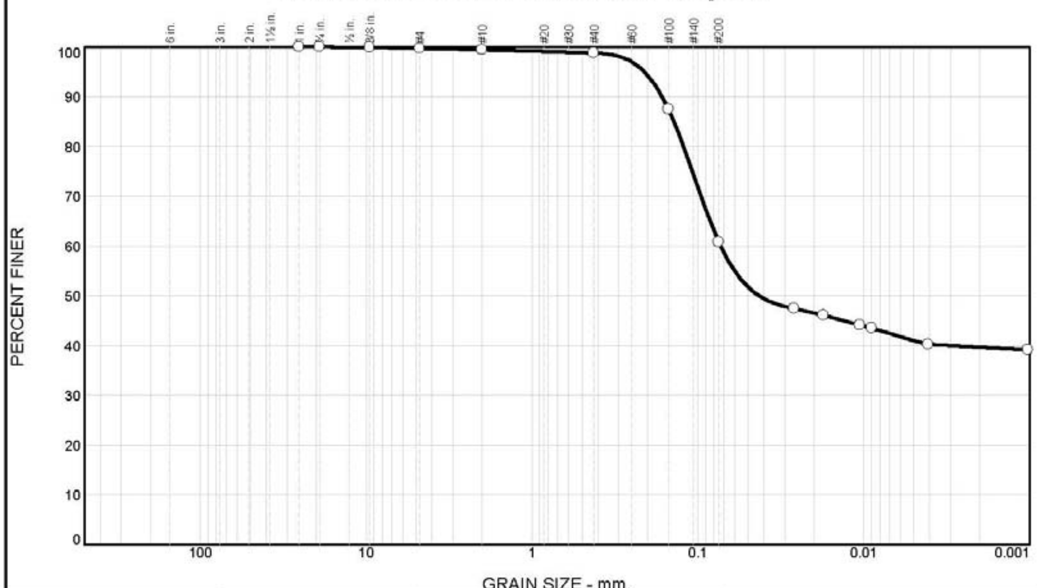
APPENDIX A. PARTICLE SIZE ANALYSIS OF S AND L SOILS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.3	0.6	38.0	21.1	39.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	100.0		
.375	99.9		
#4	99.7		
#10	99.4		
#40	98.8		
#100	87.5		
#200	60.8		

* (no specification provided)

Material Description

Soil S

Atterberg Limits (ASTM D 4318)

PL= 20 LL= 51 PI= 31

Classification

USCS= CH AASHTO= A-7-6(16)

Coefficients

D_{85}= 0.1392 D_{60}= 0.0731 D_{50}= 0.0432

D_{30}= D_{15}= D_{10}=

C_u= C_c=

Date Tested: **Tested By:**

Remarks

Sample No.: **Source of Sample:** **Date Sampled:**

Location: TEXAS- Sequin **Elev./Depth:**

Checked By: **Title:**

Iowa State University
Civil, Construction and Environmental Engineering Department

Client: CEMEX
Project: INVESTIGATION OF SOIL STABILIZATION ALTERNATIVES - TEXAS SH 130 PHASE I
Project No: **Figure**

Tested By: HG

GRAIN SIZE DISTRIBUTION TEST DATA

9/22/2008

Client: CEMEX
Project: INVESTIGATION OF SOIL STABILIZATION ALTERNATIVES - TEXAS SH 130 PHASE I
Location: TEXAS- Sequin
Material Description: Soil S
PL: 20 **LL:** 51 **PI:** 31
USCS Classification: CH **AASHTO Classification:** A-7-6(16)

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 2920.30
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
2920.30	0.00	1	0.00	0.00	100.0
		.75	0.00	0.00	100.0
		.375	2.75	0.00	99.9
		#4	5.63	0.00	99.7
		#10	8.06	0.00	99.4
72.89	0.00	#40	0.49	0.00	98.8
		#100	8.27	0.00	87.5
		#200	19.56	0.00	60.8

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 99.4
Weight of hydrometer sample =72.86
Hygroscopic moisture correction:
Moist weight and tare = 149.68
Dry weight and tare = 144.57
Tare weight = 49.70
Hygroscopic moisture = 5.4%
Table of composite correction values:

Temp., deg. C:	18.3	21.1	25.9
Comp. corr.:	-6.6	-5.5	-4.4

Meniscus correction only = 1.0
Specific gravity of solids = 2.70
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.50	20.7	39.0	33.3	0.0133	40.0	9.7	0.0263	47.4
5.75	20.8	38.0	32.4	0.0133	39.0	9.9	0.0175	46.1
16.00	21.1	36.5	31.0	0.0133	37.5	10.1	0.0106	44.1
22.30	21.4	36.0	30.6	0.0132	37.0	10.2	0.0089	43.5
109.00	22.3	33.5	28.3	0.0131	34.5	10.6	0.0041	40.2
1723.00	23.3	32.5	27.5	0.0129	33.5	10.8	0.0010	39.1

Iowa State University CCEED

Fractional Components

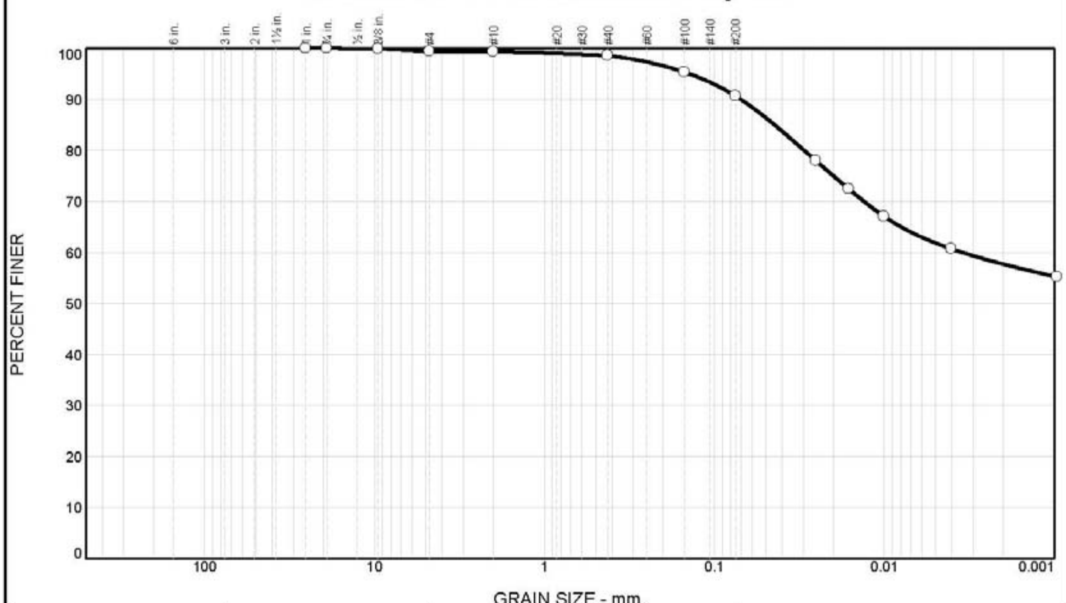
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.3	0.3	0.3	0.6	38.0	38.9	21.1	39.7	60.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0432	0.0731	0.1220	0.1392	0.1637	0.2092

Fineness Modulus
0.17

Iowa State University CCEED

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	0.1	0.7	7.9	33.0	57.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
0.75	100.0		
.375	99.9		
#4	99.4		
#10	99.3		
#40	98.6		
#100	95.3		
#200	90.7		

* (no specification provided)

Material Description

Soil L

Atterberg Limits (ASTM D 4318)

PL= 25 LL= 74 PI= 49

Classification

USCS= CH AASHTO= A-7-6(50)

Coefficients

D_{85}= 0.0443 D_{60}= 0.0035 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Date Tested: **Tested By:**

Remarks

Sample No.: **Source of Sample:** **Date Sampled:**
Location: TEXAS- Lockhart & Wilox **Elev./Depth:**
Checked By: **Title:**

Iowa State University
Civil, Construction and Environmental Engineering Department

Client: CEMEX
Project: INVESTIGATION OF SOIL STABILIZATION ALTERNATIVES - TEXAS SH 130 PHASE I
Project No: **Figure**

Tested By: HG

GRAIN SIZE DISTRIBUTION TEST DATA

9/22/2008

Client: CEMEX
Project: INVESTIGATION OF SOIL STABILIZATION ALTERNATIVES - TEXAS SH 130 PHASE I
Location: TEXAS- Sequin
Material Description: Soil S
PL: 20 **LL:** 51 **PI:** 31
USCS Classification: CH **AASHTO Classification:** A-7-6(16)

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 2920.30
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
2920.30	0.00	1	0.00	0.00	100.0
		.75	0.00	0.00	100.0
		.375	2.75	0.00	99.9
		#4	5.63	0.00	99.7
		#10	8.06	0.00	99.4
72.89	0.00	#40	0.49	0.00	98.8
		#100	8.27	0.00	87.5
		#200	19.56	0.00	60.8

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 99.4
Weight of hydrometer sample =72.86
Hygroscopic moisture correction:
Moist weight and tare = 149.68
Dry weight and tare = 144.57
Tare weight = 49.70
Hygroscopic moisture = 5.4%
Table of composite correction values:

Temp., deg. C:	18.3	21.1	25.9
Comp. corr.:	-6.6	-5.5	-4.4

Meniscus correction only = 1.0
Specific gravity of solids = 2.70
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.50	20.7	39.0	33.3	0.0133	40.0	9.7	0.0263	47.4
5.75	20.8	38.0	32.4	0.0133	39.0	9.9	0.0175	46.1
16.00	21.1	36.5	31.0	0.0133	37.5	10.1	0.0106	44.1
22.30	21.4	36.0	30.6	0.0132	37.0	10.2	0.0089	43.5
109.00	22.3	33.5	28.3	0.0131	34.5	10.6	0.0041	40.2
1723.00	23.3	32.5	27.5	0.0129	33.5	10.8	0.0010	39.1

Iowa State University CCEED

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.3	0.3	0.3	0.6	38.0	38.9	21.1	39.7	60.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0432	0.0731	0.1220	0.1392	0.1637	0.2092

Fineness Modulus
0.17

Iowa State University CCEED

APPENDIX B. BATCH SPECIMEN MEASURMENTS

Prep Date 2/19/2008

Description
Soil L no cementious material

Condition As mixed — Initial — Date

Samples	Weight (g)	Height (in)	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
21.80%	176.41	2.05	176.41	2.05	2.005	245	74.2	0.00%	0.00%	0.00%	0.00%	21.8%	85.07
25.00%	186.06	2.012	186.06	2.012	2.005	235	73.9	0.00%	0.00%	0.00%	0.00%	25.0%	91.42
27.90%	196.97	2.05	196.97	2.05	2.005	181	54.8	0.00%	0.00%	0.00%	0.00%	27.9%	94.98
31.30%	195.2	2.012	195.2	2.012	2.005	120	37.7	0.00%	0.00%	0.00%	0.00%	31.3%	88.97
34.10%	190.26	2.02	190.26	2.02	2.005	72	22.5	0.00%	0.00%	0.00%	0.00%	34.1%	86.37

3 Day Soaked — Date

Target	Weight (g)	Height (in)	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
22.30%	172.96	1.976	218.28	2.242	2.202	4	1.01	13.46%	9.83%	36.85%	26.20%	51.4%	67.44
25.30%	184	1.969	215.34	2.154	2.149	8	2.20	9.40%	7.18%	25.67%	17.03%	44.1%	72.71
28.30%	194.92	1.977	214.76	2.034	2.09	18	5.54	2.88%	4.24%	11.79%	10.18%	39.2%	81.18
31.30%	199.24	2.06	205.53	2.086	2.042	54	15.80	1.26%	1.85%	5.03%	3.16%	33.6%	87.21
34.30%	189.6	2.02	197.36	2.074	2.028	33	9.77	2.67%	1.15%	5.04%	4.09%	31.1%	85.40

Prep Date 2/20/2008 10:00 PM

Description L-CI II-32-8 L soil @ 32% with 8% Type I II Cement

Condition As mixed — 7 Day 100 F — Date 2/27/2008 10:00 PM

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	PSI	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	189.5	1.92		188.45	1.935	2.005	501	170.4		0.78%	0.00%	0.78%	-0.55%		117.26		
2	191.66	1.971		191.12	1.98	2.005	570	185.1	165.3	0.46%	0.00%	0.46%	-0.28%	27.5%	116.22	0.4%	117.7
3	201.34	2.019		200.67	2.019	2.005	450	140.6		0.00%	0.00%	0.00%	-0.33%		119.67		
4	192.18	2	3 Day Soaked	192.71	1.997	2.000	425	135.7		-0.15%	-0.25%	-0.65%	0.28%		116.77		
5	198.82	2.014	3 Day Soaked	199.06	2.019	2.003	558	174.3	152.3	0.25%	-0.10%	0.05%	0.12%	27.4%	118.95	-0.2%	118.2
6	200.12	2.028	3 Day Soaked	200.3	2.031	2.005	476	146.9		0.15%	0.00%	0.15%	0.09%		118.75		

7 Day Ambient — Date 2/27/2008 10:00 PM

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	199.24	2.017		198.79	2.018	2.005	546	170.71		0.05%	0.00%	0.05%	-0.23%		118.61		
8	198.32	2.025		198.03	2.025	2.005	487	151.21	156.6	0.00%	0.00%	0.00%	-0.15%	27.8%	117.75	0.0%	117.8
9	202.11	2.076		201.81	2.077	2.005	501	147.87		0.05%	0.00%	0.05%	-0.15%		116.99		
10	195.56	1.986	3 Day Soaked	195.58	1.986	2.006	412	133.00		0.00%	0.05%	0.10%	0.01%		118.46		
11	198.95	2.021	3 Day Soaked	198.82	2.015	2.005	500	156.79	141.3	-0.30%	0.00%	-0.30%	-0.07%	27.2%	118.80	0.0%	117.9
12	200.09	2.06	3 Day Soaked	199.64	2.063	2.005	448	134.03		0.15%	0.00%	0.15%	-0.22%		116.52		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength	Avg (psi)	Swell Ht	3/19/2008	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	192.54	1.956		192.16	1.951	2.004	530	177.285		-0.26%	-0.05%	-0.36%	-0.20%		118.71		
14	202.17	2.088		201.51	2.086	2.003	520	152.155	180.9	-0.10%	-0.10%	-0.29%	-0.33%	27.4%	116.546	-0.4%	117.9
15	191.6	1.953		191.11	1.948	2.003	636	213.398		-0.26%	-0.10%	-0.45%	-0.26%		118.3612		
16	197.62	2.021	3 Day Soaked	197.95	2.01	2.005	489	154.109		-0.54%	0.00%	-0.54%	0.17%		118.5789		
17	199.04	2.077	3 Day Soaked	199.47	2.076	2.008	545	161.01	156.8	-0.05%	0.15%	0.25%	0.22%	27.5%	115.3453	-0.1%	116.6
18	196.58	2.05	3 Day Soaked	197.06	2.048	2.006	512	155.425		-0.10%	0.05%	0.00%	0.24%		115.74		

90 Day Ambient — Date 20-May-08

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	196.44	2.039		195.02	2.019	2	760	237.384		-0.98%	-0.25%	-1.47%	-0.72%		116.8853		
20	196.82	2.047		195.79	2.041	2	663	202.646	195.8	-0.29%	-0.25%	-0.79%	-0.52%	26.6%	116.0819	-1.0%	116.5
21	193.4	2.006		192.44	2	2	463	147.378		-0.30%	-0.25%	-0.80%	-0.50%		116.4347		
22	195.3	2.032	7 Day Soaked	195.37	2.021	2.005	525	163.658		-0.54%	0.00%	-0.54%	0.04%		116.3964		
23	200	2.069	7 Day Soaked	200.21	2.057	2.004	558	167.91	163.6	-0.58%	-0.05%	-0.68%	0.11%	25.2%	117.3094	-0.6%	116.5
24	194.67	2.034	7 Day Soaked	194.77	2.033	2	517	159.267		-0.05%	-0.25%	-0.55%	0.05%		115.9315		

Prep Date 2/20/2008 11.30 pm

Description
L-CI II-32-12 Soil L @ 32% with 12% Type I II Cement

Condition As mixed — 7 Day 100 F — Date 2/27/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	197.31	1.986		196.23	1.98		520	168.9		-0.30%	-100.00%	-100.00%	-0.55%		#DIV/0!		
2	196.4	1.981		195.58	1.98		669	217.3	189.2	-0.05%	-100.00%	-100.00%	-0.42%		#DIV/0!	-100.0%	#DIV/0!
3	197.71	1.995		197.04	1.995		567	181.4		0.00%	-100.00%	-100.00%	-0.34%		#DIV/0!		
4	199.5	2.009	3 Day Soaked		2.024	2.014	511	158.8		0.75%	0.45%	1.65%	-100.00%		0.00		
5	195.6	1.988	3 Day Soaked	196.97	1.985	2.014	611	197.4	175.9	-0.15%	0.45%	0.75%	0.70%	26.7%	93.47	0.9%	62.6
6	198.48	2.003	3 Day Soaked	199.18	2	2.009	539	171.6		-0.15%	0.20%	0.25%	0.35%		94.28		

7 Day Ambient — Date 2/27/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	197.07	2.025		196.82	2.01		530	167.03		0.10%	-100.00%	-100.00%	-0.13%		#DIV/0!		
8	196.54	2.009		196.25	2.004		490	155.35	153.7	#REF!	-100.00%	-100.00%	-0.15%	26.8%	#DIV/0!	-100.0%	#DIV/0!
9	196.79	2.008		196.8	2.004		438	138.86		#REF!	-100.00%	-100.00%	0.01%		#DIV/0!		
10	197.53	2.02	3 Day Soaked	197.97	2.005	2.009	505	159.95		-0.74%	0.20%	-0.35%	0.22%		118.41		
11	196.44	2.023	3 Day Soaked	197.09	2.021	2.024	478	149.01	154.3	-0.10%	0.95%	1.80%	0.33%	26.7%	115.23	0.6%	117.1
12	196.69	2.014	3 Day Soaked	197.14	2.006	2.011	487	154.09		-0.40%	0.30%	0.20%	0.23%		117.62		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	195.54	1.999		195.17	1.985	2.005	630	203.58		-0.70%	0.00%	-0.70%	-0.19%		118.3861		
14	196.43	2.006		195.59	2.006	2.001	495	156.62	183.9	0.00%	-0.20%	-0.40%	-0.43%	26.8%	117.8687	-0.6%	118.1
15	194.26	1.993		193.9	1.98	2.005	590	191.62		-0.65%	0.00%	-0.65%	-0.19%		117.9128		
16	195.17	1.988	3 Day Soaked	196.18	1.987	2.006	612	197.36		-0.05%	0.05%	0.05%	0.52%		118.7605		
17	196.51	2.011	3 Day Soaked	197.17	1.999	2.007	473	150.71	175.2	-0.60%	0.10%	-0.40%	0.34%	27.8%	118.5251	-0.4%	118.3
18	195.54	2.025	3 Day Soaked	196.28	2.008	2.005	562	177.47		-0.84%	0.00%	-0.84%	0.38%		117.6957		

90 Day Ambient — Date

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	199.02	2.067		198.01	2.038	2	696	213.3591958		-1.40%	-0.25%	-1.89%	-0.51%		117.5709		
20	197.42	2.052		196.11	2.04	2	631	193.0543136	204.6	-0.58%	-0.25%	-1.08%	-0.66%	25.6%	116.3286	-1.2%	116.9
21	195.36	2.014		194.31	2.012	2	659	207.2716704		-0.10%	-0.25%	-0.60%	-0.54%		116.8649		
22	196.69	2.05	7 Day Soaked	197.63	2.025	2.004	610	189.4044879		-1.22%	-0.05%	-1.32%	0.48%		117.6276		
23	196.36	2.045	7 Day Soaked	197.21	2.037	2.001	573	175.8259811	181.7	-0.39%	-0.20%	-0.79%	0.43%	24.8%	117.0363	-0.7%	117.0
24	196.26	2.04	7 Day Soaked	197.12	2.048	2.001	593	180.0135822		0.39%	-0.20%	-0.01%	0.44%		116.3546		

Prep Date 8/20/2008 12:30pm

Description

L-CI II-32-16 Soil L @ 32% H2O with 16% Type I II Cement

Condition — As mixed / **7 Day 100 F** — Date 2/27/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	195.17	1.974		194.08	1.97		590	193.6		-0.20%	-100.00%	-100.00%	-0.56%		#DIV/0!		
2	197.65	1.989		196.93	1.986		690	222.7	219.2	-0.15%	-100.00%	-100.00%	-0.36%	25.2%	#DIV/0!	-100.0%	#DIV/0!
3	196.12	1.984		195.29	1.972		737	241.3		-0.60%	-100.00%	-100.00%	-0.42%		#DIV/0!		
4	197.89	1.999		199.35	1.999	2.014	601	191.5		0.00%	0.45%	0.90%	0.74%		95.26		
5	197.44	2.008	3 Day Soaked	197.39	1.999	2.012	519	165.4	182.8	-0.45%	0.35%	0.25%	-0.03%	24.9%	94.51	1.1%	94.4
6	200.09	2.026		200.44	2.036	2.022	624	191.7		0.49%	0.85%	2.20%	0.17%		93.30		

7 Day Ambient — Date 2/27/2008 1:00 AM

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	198.7	2.043		198.41	2.03		677	209.17		-0.64%	-100.00%	-100.00%	-0.15%		#DIV/0!		
8	198.84	2.032		198.48	2.012		600	188.71	199.0	-0.98%	-100.00%	-100.00%	-0.18%	25.7%	#DIV/0!	-100.0%	#DIV/0!
9	198.37	2.001		198.11	1.994		622	199.18		-0.35%	-100.00%	-100.00%	-0.13%		#DIV/0!		
10	198.4	2.005		198.96	2.004	2.006	614	194.66		-0.05%	0.05%	0.05%	0.28%		119.42		
11	198.8	2.046	3 Day Soaked	199.09	2.036	2.006	496	152.35	164.0	-0.49%	0.05%	-0.39%	0.15%	25.3%	117.62	0.2%	118.2
12	198.6	2.021		199.08	2.018	2.016	464	145.07		-0.15%	0.55%	0.95%	0.24%		117.49		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	198.08	2.031		197.5	2.024	2	600	186.48		-0.34%	-0.25%	-0.84%	-0.29%		118.0792		
14	198.07	2.058		197.5	2.054	2.003	547	165.08	171.3	-0.19%	-0.10%	-0.39%	-0.29%	24.9%	116.0063	-0.6%	117.1
15	197.41	2.034		196.95	2.029	2.003	525	162.37		-0.25%	-0.10%	-0.44%	-0.23%		117.1086		
16	197.55	2.032		198.4	2.027	2.005	496	153.70		-0.25%	0.00%	-0.25%	0.43%		117.8518		
17	196.11	2.025	3 Day Soaked	197.06	2.015	2.004	517	162.13	177.0	-0.49%	-0.05%	-0.59%	0.48%	25.8%	117.8704	-0.4%	117.6
18	190.54	1.975		191.31	1.966	2.005	653	215.11		-0.46%	0.00%	-0.46%	0.40%		117.1662		

90 Day Ambient — Date 20-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	199.8	2.1		198.57	2.099	2	761	219.9228045		-0.05%	-0.25%	-0.55%	-0.62%		114.477		
20	196.09	2.033		194.64	2.028	2	651	201.5373634	207.7	-0.25%	-0.25%	-0.74%	-0.74%	24.2%	116.1398	-0.7%	115.7
21	197.71	2.049		196.37	2.04	2	659	201.6209075		-0.44%	-0.25%	-0.94%	-0.68%		116.4828		
22	199.14	2.042		200.29	2.051	2.001	580	175.5525565		0.44%	-0.20%	0.04%	0.58%		118.0528		
23	190.56	1.97	7 Day Soaked	191.68	1.976	2.001	657	214.240698	181.2	0.30%	-0.20%	-0.10%	0.59%	23.1%	117.2661	0.0%	117.6
24	195.67	2.017		196.68	2.025	2.001	495	153.6970845		0.40%	-0.20%	0.00%	0.52%		117.4135		

Prep Date 2/23/2008 1:50pm

Description

L-FC-32-10 Soil L @ 32% with 10% Class C Fly Ash

Condition — As mixed / **7 Day 100 F** — Date 3/1/2008 7:00 PM

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	195.48	1.951		194.74	1.944		344	115.9		-0.36%	-100.00%	-100.00%	-0.38%		#DIV/0!		
2	198.72	1.985		197.77	1.974		264	86.3	95.4	-0.55%	-100.00%	-100.00%	-0.48%	26.8%	#DIV/0!	-100.0%	#DIV/0!
3	195.63	2.004		194.25	2.001		264	83.9		-0.15%	-100.00%	-100.00%	-0.71%		#DIV/0!		
4	199.01	1.99		199.56	2.003	2.005	281	89.2		0.65%	0.00%	0.65%	0.28%		93.32		
5	199.3	1.998	3 Day Soaked	199.89	1.99	2.01	317	101.9	85.6	-0.40%	0.25%	0.10%	0.30%	28.5%	93.62	0.4%	92.7
6	193.92	1.998		195.28	2	2.008	206	65.6		0.10%	0.15%	0.40%	0.70%		91.19		

7 Day Ambient — Date 3/1/2008 7:00 PM

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	201.72	2.022		201.56	2.022		298	92.80		0.00%	-100.00%	-100.00%	-0.08%		#DIV/0!		
8	200.16	2.003		199.93	2.007		279	88.19	91.5	0.20%	-100.00%	-100.00%	-0.11%	27.1%	#DIV/0!	-100.0%	#DIV/0!
9	199.83	1.999		199.65	1.995		292	93.41		-0.20%	-100.00%	-100.00%	-0.09%		#DIV/0!		
10	204.08	2.04		205.61	2.038	2.012	225	68.97		-0.10%	0.35%	0.60%	0.75%		120.63		
11	200.75	2.01	3 Day Soaked	202.45	2.014	2.004	164	51.48	59.3	0.20%	-0.05%	0.10%	0.85%	29.3%	121.15	0.3%	120.8
12	200.23	2.01		201.6	2.008	2.007	182	57.47		-0.10%	0.10%	0.10%	0.68%		120.64		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	201.59	2.028		201.08	2.011	2.004	359	113.03		-0.84%	-0.05%	-0.94%	-0.25%		120.5142		
14	199.76	2.01		198.93	2.001	2.004	304	96.67	104.6	-0.45%	-0.05%	-0.55%	-0.42%	27.8%	119.8215	-0.8%	120.4
15	196.24	1.969		195.71	1.954	2.002	312	104.04		-0.76%	-0.15%	-1.06%	-0.27%		120.9587		
16	197.38	1.98		198.21	1.997	2.004	290	92.59		0.86%	-0.05%	0.76%	0.42%		119.6269		
17	200.3	2.017	3 Day Soaked	201.23	2.007	2.007	282	89.14	94.2	-0.50%	0.10%	-0.30%	0.46%	28.3%	120.4835	0.1%	120.3
18	200.18	2.008		201.11	2.001	2.006	317	100.80		-0.35%	0.05%	-0.25%	0.46%		120.8931		

94 Day Ambient — Date 5/27/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	200.07	2.01		198.87	1.995	2	375	119.9653853		-0.75%	-0.25%	-1.24%	-0.60%		120.6267		
20	198.99	1.999		197.65	1.989	1.999	350	112.6442333	117.9	-0.50%	-0.30%	-1.09%	-0.67%	24.5%	120.3686	-1.3%	120.6
21	201.88	2.027		200.56	2.012	1.998	385	121.091947		-0.74%	-0.35%	-1.43%	-0.65%		120.8655		
22	201.16	2.019		201.09	2.014	2.003	276	86.63644734		-0.25%	-0.10%	-0.45%	-0.03%		120.4609		
23	204.23	2.041	3 Day Soaked	204.18	2.042	2.003	273	83.36075838	81.9	0.05%	-0.10%	-0.15%	-0.02%	25.3%	120.6348	-0.1%	120.3
24	201.57	2.027		201.99	2.035	2.003	246	75.6339471		0.39%	-0.10%	0.19%	0.21%		119.7514		

Prep Date 2/23/2008 3:02 PM

Description

L-FC-32-15 Soil L @ 32% with 15% Class C Fly Ash

Condition — As mixed / **7 Day 100 F** — Date 3/1/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	200	1.969		199.25	1.96		494	163.7		-0.46%	-100.00%	-100.00%	-0.38%		#DIV/0!		
2	199.13	1.98		198.45	1.981		346	112.3	135.7	0.05%	-100.00%	-100.00%	-0.34%	24.8%	#DIV/0!	-100.0%	#DIV/0!
3	204.79	2.031		204.09	2.031		425	131.2		0.00%	-100.00%	-100.00%	-0.34%		#DIV/0!		
4	204.3	2.028		205.15	2.03	2.016	354	109.4		0.10%	0.55%	1.20%	0.42%		120.36		
5	200.28	1.999	3 Day Soaked	201.22	1.99	2.009	377	121.2	118.4	-0.45%	0.20%	-0.05%	0.47%	26.5%	121.26	0.7%	120.9
6	201.58	1.994		202.34	2.005	2.008	393	124.5		0.55%	0.15%	0.85%	0.38%		121.15		

7 Day Ambient — Date 3/1/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	203.33	2.031		203.18	2.026		365	113.22		-0.25%	-100.00%	-100.00%	-0.07%		#DIV/0!		
8	202.82	2.012		202.49	2.004		438	138.86	118.4	-0.40%	-100.00%	-100.00%	-0.16%	24.2%	#DIV/0!	-100.0%	#DIV/0!
9	203.55	2.036		203.4	2.027		333	103.19		-0.44%	-100.00%	-100.00%	-0.07%		#DIV/0!		
10	202.21	2.018		203.73	2.014	2.008	305	95.74		-0.20%	0.15%	0.10%	0.75%		121.44		
11	201.45	2.025	3 Day Soaked	203.33	2.017	2.007	286	89.51	89.9	-0.40%	0.10%	-0.20%	0.93%	27.2%	121.14	0.2%	121.2
12	202.3	2.019		204.17	2.029	2.007	273	84.43		0.50%	0.10%	0.70%	0.92%		120.92		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	202.5	2.019		201.54	2.005	2.001	420	133.02		-0.69%	-0.20%	-1.09%	-0.47%		121.5149		
14	203.38	2.048		202.86	2.036	2.003	332	101.97	119.5	-0.59%	-0.10%	-0.78%	-0.26%	25.6%	120.2081	-0.7%	120.7
15	202.86	2.027		202.23	2.025	2.004	398	123.58		-0.10%	-0.05%	-0.20%	-0.31%		120.3655		
16	201.01	2.009		202.19	2.004	2.004	254	80.53		-0.25%	-0.05%	-0.35%	0.59%		121.6028		
17	203.99	2.051	3 Day Soaked	205.56	2.051	2.002	254	76.88	77.4	0.00%	-0.15%	-0.30%	0.77%	27.2%	121.038	-0.2%	121.0
18	201.21	2.028		202.82	2.03	2.005	242	74.77		0.10%	0.00%	0.10%	0.80%		120.2992		

94 Day Ambient — Date 5/27/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	202.63	2.031		201.36	2.024	2	396	123.0791973		-0.34%	-0.25%	-0.84%	-0.63%		120.387		
20	204.16	2.05		202.72	2.034	2	378	116.3323197	122.9	-0.78%	-0.25%	-1.27%	-0.71%	22.8%	120.6042	-1.1%	120.5
21	202.16	2.027		200.82	2.015	2	412	129.1985384		-0.59%	-0.25%	-1.09%	-0.66%		120.6004		
22	206.7	2.082		206.43	2.072	2.002	293	86.89576354		-0.48%	-0.15%	-0.78%	-0.13%		120.3183		
23	203.16	2.038	3 Day Soaked	202.82	2.034	2.002	267	82.17124169	83.9	-0.20%	-0.15%	-0.49%	-0.17%	24.4%	120.4228	-0.4%	120.4
24	204.92	2.052		205.05	2.056	2.003	274	82.53056678		0.19%	-0.10%	0.00%	0.06%		120.3238		

Prep Date 2/23/2008 4:05pm

Description
L-FC-32-20 Soil L @ 32% with 20% Class C Fly Ash

Condition As mixed — 7 Day 100 F — Date 3/1/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	200	1.988		199.2	1.989		387	124.6		0.05%	-100.00%	-100.00%	-0.40%		#DIV/0!		
2	199.86	1.994		198.91	1.989		423	136.1	128.6	-0.25%	-100.00%	-100.00%	-0.48%	23.4%	#DIV/0!	-100.0%	#DIV/0!
3	202	2.017		201.3	2.013		398	125.1		-0.20%	-100.00%	-100.00%	-0.35%		#DIV/0!		
4	201.58	2.004		203.2	2.014	2.012	356	111.7		0.50%	0.35%	1.20%	0.80%		120.64		
5	203.15	2.039	3 Day Soaked	205.32	2.038	2.005	360	110.4	105.7	-0.05%	0.00%	-0.05%	1.07%	26.0%	121.30	0.9%	120.5
6	203.34	2.036		205.44	2.049	2.015	313	94.9		0.64%	0.50%	1.64%	1.03%		119.53		

7 Day Ambient — Date 3/1/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	203.18	2.047		202.77	2.049		323	97.96		0.10%	-100.00%	-100.00%	-0.20%		#DIV/0!		
8	204.39	2.049		204.04	2.044		333	101.48	104.0	-0.24%	-100.00%	-100.00%	-0.17%	24.6%	#DIV/0!	-100.0%	#DIV/0!
9	202.8	2.019		202.69	2.03		364	112.47		0.54%	-100.00%	-100.00%	-0.05%		#DIV/0!		
10	203.33	2.038		205.91	2.037	2.01	312	95.74		-0.05%	0.25%	0.45%	1.27%		121.11		
11	203.65	2.042	3 Day Soaked	206.37	2.045	2.015	292	88.90	87.7	0.15%	0.50%	1.15%	1.34%	27.0%	120.30	0.7%	120.7
12	203.21	2.041		205.85	2.048	2.008	258	78.32		0.34%	0.15%	0.64%	1.30%		120.66		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	202.36	2.03		201.85	2.018	2.002	431	134.76		-0.59%	-0.15%	-0.89%	-0.25%		120.7971		
14	202.42	2.034		201.9	2.03	2.004	400	123.59	128.1	-0.20%	-0.05%	-0.30%	-0.26%	24.4%	119.8731	-0.5%	120.2
15	203.4	2.045		202.8	2.038	2.004	411	125.99		-0.34%	-0.05%	-0.44%	-0.29%		119.9348		
16	202.52	2.036		204.51	2.033	2.003	281	86.56		-0.15%	-0.10%	-0.35%	0.98%		121.3646		
17	201.55	2.042	3 Day Soaked	204.05	2.036	2.005	294	90.30	88.7	-0.29%	0.00%	-0.29%	1.24%	26.0%	120.6721	-0.3%	120.8
18	199.69	2.024		201.96	2.021	2.004	286	89.15		-0.15%	-0.05%	-0.25%	1.14%		120.4427		

94 Day Ambient — Date 5/27/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	199.72	2.009		198.7	2.004	2.001	387	122.6947602		-0.25%	-0.20%	-0.65%	-0.51%		119.8624		
20	197.54	1.992		196.56	1.986	2	400	129.1254918	125.4	-0.30%	-0.25%	-0.80%	-0.50%	22.5%	119.7658	-0.8%	119.7
21	197.75	1.999		196.35	1.989	2	386	124.2304973		-0.50%	-0.25%	-1.00%	-0.71%		119.4574		
22	200.9	2.034		202.07	2.025	2.006	296	91.90775152		-0.44%	0.05%	-0.34%	0.58%		120.0306		
23	198.76	2.004	3 Day Soaked	200.1	2	2.001	297	94.53811605	91.2	-0.20%	-0.20%	-0.60%	0.67%	23.0%	120.9483	-0.5%	120.5
24	198.55	2.003		199.63	2	2.001	274	87.21698248		-0.15%	-0.20%	-0.55%	0.54%		120.6642		

Prep Date 2/23/2008 8:55pm

Description L-CI II- FC-32-8_8 Soil L @32% with 8% Type I II Cement
and 8% Class C Fly Ash

Condition As mixed — 7 Day 100 F — Date 3/1/2000

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	202.48	2.028		201.96	2.027		533	165.2		-0.05%	-100.00%	-100.00%	-0.26%		#DIV/0!		
2	202.15	2.029		201.7	2.034		515	158.5	172.1	0.25%	-100.00%	-100.00%	-0.22%	24.9%	#DIV/0!	-100.0%	#DIV/0!
3	199.26	2.003		198.63	2.002		606	192.5		-0.05%	-100.00%	-100.00%	-0.32%		#DIV/0!		
4	199.17	1.992		199.48	1.993	2.008	538	172.5		0.05%	0.15%	0.35%	0.16%		120.15		
5	200.83	2.014	3 Day Soaked	201.29	2.011	2.01	492	154.9	160.2	-0.15%	0.25%	0.35%	0.23%	25.9%	119.92	0.2%	119.8
6	199.85	2.02		200.13	2.01	2.01	486	153.2		-0.50%	0.25%	0.00%	0.14%		119.29		

7 Day Ambient — Date 3/1/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	199.71	2.025		199.6	2.02		502	156.64		-0.25%	-100.00%	#REF!	-0.06%		#DIV/0!		
8	201.04	2.046		200.83	2.04		428	130.95	146.1	-0.29%	-100.00%	#REF!	-0.10%	25.6%	#DIV/0!	#REF!	#DIV/0!
9	200.25	2.029		199.94	2.022		484	150.73		-0.34%	-100.00%	-100.00%	-0.15%		#DIV/0!		
10	199.18	2.017		199.81	2.017	2.015	425	133.01		0.00%	0.50%	1.00%	0.32%		118.10		
11	200.59	2.025	3 Day Soaked	200.86	2.018	2.003	499	156.02	144.3	-0.35%	-0.10%	-0.54%	0.13%	25.9%	120.08	0.5%	118.4
12	199.07	2.027		199.02	2.027	2.015	464	143.79		0.00%	0.50%	1.00%	-0.03%		117.05		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	199.8	2.04		199.25	2.032	2.007	530	163.43		-0.39%	0.10%	-0.19%	-0.28%		117.8302		
14	199.69	2.017		199.13	2.014	2.003	560	175.78	173.2	-0.15%	-0.10%	-0.35%	-0.28%	25.4%	119.2868	-0.3%	118.6
15	198.98	2.019		198.37	2.008	2.007	571	180.31		-0.54%	0.10%	-0.35%	-0.31%		118.712		
16	199.53	2.036		199.91	2.022	2.004	480	149.48		-0.69%	-0.05%	-0.79%	0.19%		119.1612		
17	200.35	2.039	3 Day Soaked	200.79	2.034	2.006	490	150.80	168.6	-0.25%	0.05%	-0.15%	0.22%	26.4%	118.7425	-1.1%	119.4
18	199.25	2.044		199.68	1.998	2.005	644	205.40		-2.25%	0.00%	-2.25%	0.22%		120.3337		

94 Day Ambient — Date 5/27/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	200.27	2.053		198.84	2.036	2.001	576	176.9202		-0.83%	-0.20%	-1.22%	-0.71%		118.0616		
20	199.51	2.035		198.16	2.023	2	558	173.6012783	174.8	-0.59%	-0.25%	-1.08%	-0.68%	23.2%	118.5324	-1.1%	118.3
21	197.94	2.027		196.76	2.014	2	554	173.900695		-0.64%	-0.25%	-1.14%	-0.60%		118.2209		
22	196.95	2.015		196.96	2.002	2.002	490	155.6604993		-0.65%	-0.15%	-0.94%	0.01%		118.8127		
23	197.84	2.03	3 Day Soaked	197.79	2.021	2.003	537	167.3987243	167.0	-0.44%	-0.10%	-0.64%	-0.03%	23.1%	118.0737	-0.8%	118.7
24	197.6	2.009		197.42	1.998	2.002	558	177.9728342		-0.55%	-0.15%	-0.84%	-0.09%		119.3286		

Prep Date 4/24/2008

Description L-CI II-FC-32-4_4 Soil L @32% with 152.9g type I II and
152.9g Class C ash

Condition As mixed — 7 Day 100 F — Date 5/1/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	198.95	2		198.6	2.005	2.008	393	124.5		0.25%	0.15%	0.55%	-0.18%		118.91		
2	197.59	1.993		197.19	1.986	2.004	388	125.3	121	-0.35%	-0.05%	-0.45%	-0.20%	28.5%	119.67	-0.3%	119.4
3	197.23	1.999		196.81	1.984	2.003	348	112.6		-0.75%	-0.10%	-0.95%	-0.21%		119.68		
4	198	1.993		198.46	1.991	2.005	407	130.7		-0.10%	0.00%	-0.10%	0.23%		120.02		
5	197.42	2.001	3 Day Soaked	198.15	1.988	2.005	345	111.1	121	-0.65%	0.00%	-0.65%	0.37%	28.5%	120.01	-0.4%	119.9
6	198.21	2.001		197.74	1.995	2.003	375	120.0		-0.30%	-0.10%	-0.50%	-0.24%		119.58		

7 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	197.45	1.994		197.45	1.986	2.006	340	109.8		-0.40%	0.05%	-0.30%	0.00%		119.59		
8	196.44	1.975		196.45	1.984	2.004	361	116.8	118	0.46%	-0.05%	0.36%	0.01%	29.1%	119.34	-0.1%	119.7
9	198.3	1.998		198.37	1.992	2.003	401	128.7		-0.30%	-0.10%	-0.50%	0.04%		120.14		
10	198.6	2.008		198.98	2.01	2.005	387	122.0		0.10%	0.00%	0.10%	0.19%		119.20		
11	194.14	1.958	3 Day Soaked	194.5	1.957	2.003	402	133.6	128.8	-0.05%	-0.10%	-0.25%	0.19%	29.2%	119.91	-0.1%	119.3
12	196.42	1.995		196.7	1.993	2.005	408	130.8		-0.10%	0.00%	-0.10%	0.14%		118.84		

28 Day Ambient — Date 22-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	195.82	1.978		195.5	1.985	2.007	461	148.9671087		0.35%	0.10%	0.55%	-0.16%		92.29591		
14	194.44	1.954		194	1.973	2.006	496	162.2325488	149.1	0.97%	0.05%	1.07%	-0.23%	28.2%	118.2741	0.4%	109.8
15	194.04	1.972		193.8	1.96	2.006	411	136.2197769		-0.61%	0.05%	-0.51%	-0.12%		118.9358		
16	195.15	1.974		195.41	1.977	2.005	410	133.5614126		0.15%	0.00%	0.15%	0.13%		119.0113		
17	197.07	1.99	3 Day Soaked	197.35	1.994	2.005	433	138.6590032	133.7	0.20%	0.00%	0.20%	0.14%	26.4%	119.1681	-0.1%	119.3
18	196.09	1.992		196.44	1.982	2.003	398	128.9989743		-0.50%	-0.10%	-0.70%	0.18%		119.5752		

90 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	198.3	1.995		197.51	1.995	2.003	622	198.9825857		0.00%	-0.10%	-0.20%	-0.40%		119.4431		
20	194.17	1.955		193.68	1.956	2.003	675	224.6345518	196.5	0.05%	-0.10%	-0.15%	-0.25%	26.4%	119.4623	-0.3%	119.2
21	198.42	2.018		197.72	2.013	2.002	528	165.9040004		-0.25%	-0.15%	-0.55%	-0.35%		118.6194		
22	194.35	1.96		194.51	1.975	2.006	495	161.5777233		0.77%	0.05%	0.87%	0.08%		118.465		
23	194.29	1.966	3 Day Soaked	194.39	1.968	2.006	475	156.1542853	153.8	0.10%	0.05%	0.20%	0.05%	26.4%	118.813	0.5%	118.7
24	193.58	1.955		193.78	1.962	2.005	434	143.5496735		0.36%	0.00%	0.36%	0.10%		118.9209		

Prep Date 5/16/2008

Description L-CI II-FC-32-3_3 4746g of Soil L @ 32% with 107.9g of Type I II(3%) and 107.9g of type C Fly Ash(3%)

Condition — As mixed

7 Day 100 F — Date 23-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	200.08	2.009		199.7	2.008	2.005	406	128.2		-0.05%	0.00%	-0.05%	-0.19%		93.4		
2	199.9	2.025		199.2	2.008	2.005	415	131.0	125.2	-0.84%	0.00%	-0.84%	-0.35%	28.3%	93.1	-0.4%	93.2
3	200.6	2.023		200.2	2.02	2.003	373	116.4		-0.15%	-0.10%	-0.35%	-0.20%		93.2		
4	200.4	2.024		200.81	2.03	2.006	405	125.1		0.30%	0.05%	0.40%	0.20%		119.0		
5	200.3	2.03	3 Day Soaked	200.68	2.031	2.004	344	106.2	119.4	0.05%	-0.05%	-0.05%	0.19%		119.1	0.1%	119.1
6	200.3	2.03		200.65	2.029	2.004	410	126.8		-0.05%	-0.05%	-0.15%	0.17%	26.8%	119.2		

7 Day Ambient — Date 23-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	199.9	2.021		199.4	2.02	2.01	349	108.9		-0.05%	0.25%	0.45%	-0.25%		118.3		
8	198.9	2.027		198.6	2.023	2.007	342	106.4	100.0	-0.20%	0.10%	0.00%	-0.15%	28.5%	118.0	0.2%	118.2
9	199.8	2.03		199.8	2.03	2.005	274	84.7		0.00%	0.00%	0.00%	0.00%		118.5		
10	198.7	2.025		199.08	2.027	2.006	367	113.7		0.10%	0.05%	0.20%	0.19%		118.1		
11	196.9	2.012	3 Day Soaked	197.44	2.016	2.004	367	115.0	112.3	0.20%	-0.05%	0.10%	0.27%	26.3%	118.0	0.0%	118.5
12	198.6	2.012		199.05	2.007	2.006	342	108.1		-0.25%	0.05%	-0.15%	0.23%		119.3		

28 Day Ambient — Date 13-Jun-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	197.5	2.001		197.21	1.995	2.006	391	125.1		-0.30%	0.05%	-0.20%	-0.15%		92.5		
14	198.1	2.006		197.69	1.999	2.006	360	114.7	129.9	-0.35%	0.05%	-0.25%	-0.21%	28.6%	119.0	-0.1%	110.0
15	197.8	2.004		197.38	2.001	2.007	471	149.8		-0.15%	0.10%	0.05%	-0.21%		118.5		
16	198	2.007		197.62	2.003	2.008	441	140.0		-0.20%	0.15%	0.10%	-0.19%		118.4		
17	197.7	1.999	3 Day Soaked	197.64	1.988	2.008	356	114.7	117.6	-0.55%	0.15%	-0.25%	-0.03%	25.8%	119.3	-0.2%	118.9
18	197	2.004		197.01	1.988	2.008	305	98.3		-0.80%	0.15%	-0.50%	0.01%		119.0		

90 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	198.2	2.018		197.7	2.018	2.003	400	125.1		0.00%	-0.10%	-0.20%	-0.25%		118.2		
20	198	2.015		197.39	2.011	2.003	474	149.2	141.7	-0.20%	-0.10%	-0.40%	-0.31%	28.7%	118.4	-0.4%	118.1
21	197.4	2.024		196.68	2.018	2.003	482	150.7		-0.30%	-0.10%	-0.50%	-0.36%		117.6		
22	197.7	2.016		197.86	2.018	1.999	385	120.4		0.10%	-0.30%	-0.50%	0.08%		118.8		
23	197.3	2.013	3 Day Soaked	197.32	2.008	2.003	410	129.5	123.5	-0.25%	-0.10%	-0.45%	0.01%	29.1%	118.6	-0.4%	118.7
24	197.8	2.015		198.08	2.012	2.004	384	120.8		-0.15%	-0.05%	-0.25%	0.14%		118.7		

Prep Date 2/24/2008 12:55 PM

Description L-CI II-FF-32-8_8 Soil L @32% with 8% Type I II Cement and 8% Class F Fly Ash

Condition — As mixed

7 Day 100 F — Date 3/2/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	197.53	1.978		197.06	1.974		627	204.9		-0.20%	-100.00%	-100.00%	-0.24%		#DIV/0!		
2	202	2.041		201.38	2.034		624	192.0	187.2	-0.34%	-100.00%	-100.00%	-0.31%	26.0%	#DIV/0!	-100.0%	#DIV/0!
3	201.98	2.056		201.55	2.042		539	164.6		-0.68%	-100.00%	-100.00%	-0.21%		#DIV/0!		
4	197.34	1.99		197.61	1.99	2.007	667	214.5		0.00%	0.10%	0.20%	0.14%		119.33		
5	199.78	2.018	3 Day Soaked	199.95	2.021	2.005	636	198.3	202.6	0.15%	0.00%	0.15%	0.09%	26.1%	119.13	0.0%	119.6
6	199.8	2.016		200.6	2.011	2.004	620	195.2		-0.25%	-0.05%	-0.35%	0.40%		120.23		

7 Day Ambient — Date 3/2/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	199.99	2.029		199.82	2.029		620	191.75		0.00%	-100.00%	-100.00%	-0.09%		#DIV/0!		
8	200.92	2.042		200.77	2.045		496	151.01	156.7	0.15%	-100.00%	-100.00%	-0.07%	26.7%	#DIV/0!	-100.0%	#DIV/0!
9	199.53	2.013		199.1	2.004		402	127.45		-0.45%	-100.00%	-100.00%	-0.22%		#DIV/0!		
10	199.73	2.036		200.31	2.036	2.004	492	151.12		0.00%	-0.05%	-0.10%	0.29%		118.58		
11	197.6	2.005	3 Day Soaked	197.9	2.008	2.007	528	166.73	160.2	0.15%	0.10%	0.35%	0.15%	27.1%	118.43	0.1%	118.5
12	197.77	2.015		198.4	2.015	2.005	519	162.75		0.00%	0.00%	0.00%	0.32%		118.55		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	197.17	2.018		197.5	2.009	2.005	575	181.39		-0.45%	0.00%	-0.45%	0.17%		118.3683		
14	198.7	2.021		198.21	2.02	2.003	565	176.30	184.7	-0.05%	-0.10%	-0.25%	-0.25%	26.3%	118.383	-0.4%	11828.1%
15	199.23	2.036		198.7	2.032	2.002	637	196.43		-0.20%	-0.15%	-0.49%	-0.27%		118.0927		
16	199.49	2.043		198.71	2.035	2.003	554	170.33		-0.39%	-0.10%	-0.59%	-0.39%		117.8068		
17	197.51	2.009	3 Day Soaked	196.71	2.014	2.002	563	176.73	173.1	0.25%	-0.15%	-0.05%	-0.41%	26.8%	117.9548	-0.4%	11830.6%
18	198.77	2.014		198.12	2.008	2.002	545	172.10		-0.30%	-0.15%	-0.60%	-0.33%		119.1553		

93 Day Ambient — Date 5/27/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	198.26	2.031		197.17	2.022	2.002	612	190.5897784		-0.44%	-0.15%	-0.74%	-0.55%		117.7629		
20	197.03	2.008		195.76	2.008	2	631	199.256468	196.4	0.00%	-0.25%	-0.50%	-0.64%	24.0%	117.9715	-0.7%	117.8
21	196.66	2.018		195.26	2.009	2	632	199.3736181		-0.45%	-0.25%	-0.94%	-0.71%		117.6116		
22	197.31	2.013		197.05	2.012	2	453	142.4796156		-0.05%	-0.25%	-0.55%	-0.13%		118.5128		
23	199.73	2.045	3 Day Soaked	199.44	2.041	2.004	428	130.8182229	136.1	-0.20%	-0.05%	-0.30%	-0.15%	24.6%	117.7744	-0.3%	117.8
24	198.31	2.039		197.97	2.037	2.004	440	135.014715		-0.10%	-0.05%	-0.20%	-0.17%		117.1358		

Prep Date 4/24/2008

Description L-CI II-FF-32-4_4 5045 g L @32% with 152.9g Type I II and 152.9g Class F Ash

Condition — As mixed

7 Day 100 F — Date 5/1/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	197.09	1.996		196.71	1.997	2.006	389	124.2		0.05%	0.05%	0.15%	-0.19%		118.49		
2	197.51	2.01		197.2	2.006	2.006	389	123.1	125	-0.20%	0.05%	-0.10%	-0.16%	29.3%	118.25	-0.3%	118.5
9	199.88	2.036		199.25	2.021	2.004	414	129.1		-0.74%	-0.05%	-0.84%	-0.32%		118.83		
4	198.26	2.003		198.32	2.018	2.008	317	99.1		0.75%	0.15%	1.05%	0.03%		117.98		
5	196.47	1.985	3 Day Soaked	197.48	1.988	2.005	384	123.7	111.9	0.15%	0.00%	0.15%	0.51%		119.61	0.8%	118.8
6	196.34	1.987		198.27	2.003	2.009	356	113.0		0.81%	0.20%	1.21%	0.98%	29.6%	118.71		

7 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
3	195.04	1.967		195.06	1.97	2.003	381	125.00		0.15%	-0.10%	-0.05%	0.01%		119.46		
4	198.26	2.003		198.33	2.008	2.004	280	88.42	110	0.25%	-0.05%	0.15%	0.04%	30.0%	119.04	0.2%	119.1
5	196.47	1.985		196.56	1.992	2.006	366	117.44		0.35%	0.05%	0.45%	0.05%		118.69		
10	197.96	2.017		196.83	1.991	2.007	367	117.88		-1.29%	0.10%	-1.09%	-0.57%		118.80		
11	197.32	1.995	3 Day Soaked	198.27	2.004	2.006	296	93.84	109.5	0.45%	0.05%	0.55%	0.48%	30.1%	119.01	-0.3%	119.0
12	197.97	2.019		199.36	2.01	2.006	371	116.92		-0.45%	0.05%	-0.35%	0.70%		119.30		

28 Day Ambient — Date 22-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	194.76	1.988		194.4	2.385	2.012	391	87.52063825		19.97%	0.35%	20.81%	-0.18%		75.55317		
14	195.47	1.98		195.3	1.983	2.006	406	131.459232	113.5	0.15%	0.05%	0.25%	-0.09%	29.0%	118.4662	6.9%	104.3
15	196.77	2		196.5	1.993	2.004	379	121.4884799		-0.35%	-0.05%	-0.45%	-0.14%		118.8329		
16	197.66	1.999		197.84	2.012	2.002	495	155.6896462		0.65%	-0.15%	0.35%	0.09%		118.7503		
17	196.5	1.986	3 Day Soaked	196.86	1.998	2.004	437	139.3801587	139.1	0.60%	-0.05%	0.50%	0.18%	27.1%	118.7527	0.1%	118.9
18	199.66	2.037		200.02	2.027	2.003	394	122.0953741		-0.49%	-0.10%	-0.69%	0.18%		119.0514		

90 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	197.82	2.007		197.27	2.006	2.003	508	160.735698		-0.05%	-0.10%	-0.25%	-0.28%		118.6438		
20	198.72	2.02		198.34	2.015	2.001	501	157.1079314	154.3	-0.25%	-0.20%	-0.65%	-0.19%	28.0%	118.9921	-0.3%	118.5
21	197.09	2.006		196.59	2.006	2.005	458	144.9152552		0.00%	0.00%	0.00%	-0.25%		117.9991		
22	199.36	2.033		199.32	2.032	2.004	395	121.8036139		-0.05%	-0.05%	-0.15%	-0.02%		118.2248		
23	197.37	1.997	3 Day Soaked	197.4	2.021	2.003	404	125.9387051	127.9	1.20%	-0.10%	1.00%	0.02%	27.4%	117.8408	0.2%	118.2
24	196.42	1.999		196.35	1.998	2.004	426	135.8717336		-0.05%	-0.05%	-0.15%	-0.04%		118.445		

Prep Date 2/23/2008 12.35 pm

Description
L-CI II-S-36-8_8 Soil L @ 36% with 8% Type I II cement and :

Condition As mixed

7 Day 100 F — **Date** 3/1/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	200.23	2.023		199.66	2.016		953	298.6		-0.35%	-100.00%	-100.00%	-0.28%		#DIV/0!		
2	198.91	2.009		198.29	2.009		736	232.2	255.8	0.00%	-100.00%	-100.00%	-0.31%	28.2%	#DIV/0!	-100.0%	#DIV/0!
3	199.43	2.004		198.72	2.003		746	236.7		-0.05%	-100.00%	-100.00%	-0.36%		#DIV/0!		
4	199.7	2.015	3 Day Soaked	199.61	2.013	2.011	700	219.9		-0.10%	0.30%	0.50%	-0.05%		118.7		
5	199.14	2.011		199.48	2.021	2.009	632	197.0	198.6	0.50%	0.20%	0.90%	0.17%	29.3%	118.4	0.4%	118.7
6	198.96	2.017		199.13	2.015	2.005	570	178.7		-0.10%	0.00%	-0.10%	0.09%		119.0		

7 Day Ambient — **Date** 3/1/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	200.02	2.036		199.89	2.025		597	185.4		-0.54%	-100.00%	-100.00%	-0.06%		#DIV/0!		
8	199.22	2.028		199.1	2.026		604	187.4	175.4	-0.10%	-100.00%	-100.00%	-0.06%	28.7%	#DIV/0!	-100.0%	#DIV/0!
9	197.75	2.01		197.43	2.02		492	153.5		0.50%	-100.00%	-100.00%	-0.16%		#DIV/0!		
10	201.03	2.04	3 Day Soaked	201.43	2.04	2.013	542	165.8		0.00%	0.40%	0.80%	0.20%		117.9		
11	199.54	2.02		199.8	2.023	2.015	601	187.0	179.1	0.15%	0.50%	1.15%	0.13%	29.4%	117.7	0.7%	118.3
12	198.67	2.015		199.96	2.016	2.007	589	184.5		0.05%	0.10%	0.25%	0.65%		119.2		

28 Day Ambient — **Date** 3/23/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	199.32	2.025		198.37	2.028	2.005	631	195.3		0.15%	0.00%	0.15%	-0.48%		117.8		
14	198.1	2.014		197.61	2.014	2.006	711	223.2	212.3	0.00%	0.05%	0.10%	-0.25%	28.5%	118.0	0.2%	117.8
15	200.54	2.04		199.74	2.043	2.006	716	218.4		0.15%	0.05%	0.25%	-0.40%		117.6		
16	199.52	2.03	3 Day Soaked	198.82	2.025	2.004	675	209.6		-0.25%	-0.05%	-0.35%	-0.35%		118.3		
17	199.69	2.021		198.98	2.015	2.004	651	204.1	204.2	-0.30%	-0.05%	-0.40%	-0.36%	28.7%	119.0	-0.3%	118.5
18	198.9	2.02		198.22	2.017	2.006	635	198.7		-0.15%	0.05%	-0.05%	-0.34%		118.2		

94 Day Ambient — **Date** 5/27/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	199.49	2.03		198.1	2.024	2.001	762	236.8		-0.30%	-0.20%	-0.69%	-0.70%		118.3		
20	199.67	2.035		198.54	2.027	2.001	660	204.5	222.4	-0.39%	-0.20%	-0.79%	-0.57%	25.4%	118.4	-0.6%	118.2
21	200.49	2.041		199.38	2.045	2.001	742	225.9		0.20%	-0.20%	-0.20%	-0.55%		117.9		
22	197.34	2.005	3 Day Soaked	196.97	2.006	2.004	483	152.8		0.05%	-0.05%	-0.05%	-0.19%		118.3		
23	199.33	2.033		198.96	2.003	2	591	187.6	177.0	-1.48%	-0.25%	-1.97%	-0.19%	26.3%	120.2	-0.8%	119.1
24	197.52	2.006		197.01	2.001	2.003	599	190.5		-0.25%	-0.10%	-0.45%	-0.26%		118.8		

Prep Date 5/9/2008

Description L-CI II-S-32-4_4 3863.6g dry Soil L @ 32% with 154.5g Type I II(4%) and 154.5g Slag(4%)

Condition As mixed

7 Day 100 F — **Date** 16-May-08

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	205.69	2.064		205.17	2.071	2.006	358	106.3		0.34%	0.05%	0.44%	-0.25%		94.3		
2	200.29	2.02		199.71	2.015	2.008	336	105.4	118.4	-0.25%	0.15%	0.05%	-0.29%	26.4%	94.1	-0.2%	94.5
3	200.09	2.018		199.49	1.999	2.005	451	143.7		-0.94%	0.00%	-0.94%	-0.30%		95.1		
4	202.36	2.028	3 Day Soaked	202.16	2.028	2.008	396	122.6		0.00%	0.15%	0.30%	-0.10%		119.7		
5	199.76	2.007		199.5	2.01	2.003	379	119.4	121.3	0.15%	-0.10%	-0.05%	-0.13%	25.9%	119.7	-0.2%	120.0
6	200.08	2.01		199.69	2	2.001	383	121.9		-0.50%	-0.20%	-0.89%	-0.19%		120.7		

7 Day Ambient — **Date**

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	200.96	2.016		200.8	2.018	2.002	384	120.1		0.10%	-0.15%	-0.20%	-0.08%		120.2		
8	200.18	2.012		200.2	2.015	2.004	368	115.4	113.1	0.15%	-0.05%	0.05%	0.01%	26.7%	119.7	0.1%	119.8
9	203.44	2.04		203.2	2.048	2.005	342	103.8		0.39%	0.00%	0.39%	-0.12%		119.5		
10	200.22	2.005	3 Day Soaked	199.54	2.015	2.003	411	128.9		0.50%	-0.10%	0.30%	-0.34%		119.5		
11	198.99	2		198.48	1.999	2.004	398	126.8	123.6	-0.05%	-0.05%	-0.15%	-0.26%	25.4%	119.7	0.1%	119.5
12	199.35	1.996		198.3	1.999	2.005	361	115.0		0.15%	0.00%	0.15%	-0.53%		119.4		

28 Day Ambient — **Date** 6-Jun-08

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	203	2.053		202.75	2.064	2.007	387	115.7		0.54%	0.10%	0.74%	-0.12%		93.4		
14	200.22	2.028		199.99	2.024	2.006	528	164.1	139.4	-0.20%	0.05%	-0.10%	-0.11%	26.4%	118.9	0.2%	110.6
15	199.04	2.005		198.92	2.004	2.004	437	138.5		-0.05%	-0.05%	-0.15%	-0.06%		119.6		
16	200.17	2.018	3 Day Soaked	200.49	2.018	2.005	387	121.0		0.00%	0.00%	0.00%	0.16%		119.6		
17	203.3	2.08		203.4	2.048	2.006	466	141.5	131.7	-1.54%	0.05%	-1.44%	0.05%	26.2%	119.5	-0.5%	119.4
18	202.47	2.054		202.81	2.05	2.005	438	132.7		-0.19%	0.00%	-0.19%	0.17%		119.1		

90 Day Ambient — **Date** 7-Aug-08

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	200.47	2.027		200.01	2.027	2.004	532	164.9		0.00%	-0.05%	-0.10%	-0.23%		118.9		
20	200.26	2.022		199.54	2.019	2.004	538	168.0	163.3	-0.15%	-0.05%	-0.25%	-0.36%	25.6%	119.1	-0.2%	119.1
21	200.22	2.023		199.57	2.017	2.005	502	157.1		-0.30%	0.00%	-0.30%	-0.32%		119.1		
22	199.55	2.015	3 Day Soaked	199.4	2.021	2.008	408	127.2		0.30%	0.15%	0.60%	-0.08%		118.4		
23	200.28	2.038		200.3	2.034	2.008	405	124.6	132.5	-0.20%	0.15%	0.10%	0.01%	27.4%	118.2	0.3%	118.5
24	201.87	2.04		201.9	2.038	2.008	475	145.6		-0.10%	0.15%	0.20%	0.01%		118.9273		

Prep Date 2/24/2008

Description
L-CI II-L-36-8_4 Soil L @36% with 8% Type I II cement and 4% Lime

Condition As mixed

7 Day 100 F — **Date**

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	201.12	2.052		200.62	2.052		945	285.8		0.00%	-100.00%	-100.00%	-0.25%		#DIV/0!		
2	197.66	2.003		197.05	2.015		1040	326.1	314.8	0.60%	-100.00%	-100.00%	-0.31%	28.4%	#DIV/0!	-100.0%	#DIV/0!
3	197.77	2.019		197.1	2.01		1055	332.5		-0.45%	-100.00%	-100.00%	-0.34%		#DIV/0!		
4	197.1	2.008	3 Day Soaked	197.18	2	2.006	1220	388.3		-0.40%	0.05%	-0.30%	0.04%		118.6		
5	197.5	2.018		197.63	2.019	2.008	990	309.2	335.0	0.05%	0.15%	0.35%	0.07%	29.0%	117.5	0.0%	118.0
6	197.65	2.015		197.48	2.015	2.005	980	307.3		0.00%	0.00%	0.00%	-0.09%		118.0		

7 Day Ambient — **Date**

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	197.66	2.017		197.63	2.032		949	292.6		0.74%	-100.00%	-100.00%	-0.02%		#DIV/0!		
8	198.9	2.03		198.8	2.027		904	280.1	273.1	-0.15%	-100.00%	-100.00%	-0.05%	29.2%	#DIV/0!	-100.0%	#DIV/0!
9	198.75	2.025		198.33	2.019		789	246.4		-0.30%	-100.00%	-100.00%	-0.21%		#DIV/0!		
10	197.74	2.014	3 Day Soaked	198.04	2.019	2.006	860	268.6		0.25%	0.05%	0.35%	0.15%		118.0		
11	195.59	1.988		195.79	1.999	2.005	750	239.0	264.3	0.55%	0.00%	0.55%	0.10%	29.4%	117.9	0.3%	118.0
12	196.54	2.001		196.48	2.001	2.006	897	285.2		0.00%	0.05%	0.10%	-0.03%		118.1		

28 Day Ambient — **Date**

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	196.19	1.991		195.74	1.999	2.005	1183	376.9		0.40%	0.00%	0.40%	-0.23%		117.9		
14	196.84	2.022		195.98	2.008	2.005	1070	337.9	358.5	-0.69%	0.00%	-0.69%	-0.44%	28.3%	117.5	-0.3%	117.9
15	197.53	2.015		196.91	2.006	2.004	1140	360.7		-0.45%	-0.05%	-0.55%	-0.31%		118.3		
16	194.98	1.979	3 Day Soaked	194.37	1.984	2.006	706	228.4		0.25%	0.05%	0.35%	-0.31%		117.8		
17	198.03	2.013		195.61	2.006	2.001	761	240.8	241.7	-0.35%	-0.20%	-0.74%	-1.22%	27.0%	117.9	-0.4%	117.8
18	197.34	2.016		195.42	2	2.005	804	255.9		-0.79%	0.00%	-0.79%	-0.97%		117.6		

93 Day Ambient — **Date** 5/27/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	197.25	2.025		195.88	2.023	2.003	1012	314.8		-0.10%	-0.10%	-0.30%	-0.69%		116.8		
20	196.25	2.009		195.01	2.012	2.001	1332	418.9	376.2	0.15%	-0.20%	-0.25%	-0.63%	12.4%	117.2	-0.3%	117.1
21	198.01	2.026		196.68	2.025	2.001	1272	395.0		-0.05%	-0.20%	-0.45%	-0.67%		117.4		
22	196.09	1.999	3 Day Soaked	195.56	2.003	2.002	910	288.8		0.20%	-0.15%	-0.10%	-0.27%		117.9		
23	197.96	2.026		197.67	2.034	2.004	1006	309.6	291.9	0.39%	-0.05%	0.29%	-0.15%	26.1%	117.1	-0.2%	117.5
24	197.47	2.035		197.06	2.022	2.003	890	277.2		-0.64%	-0.10%	-0.84%	-0.21%		117.6		

Prep Date 3/12/2008 11:00 AM

Description

L-CV-32-8 5119g Soil L @32% with 310.3g Type V cement(:

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
							7 Day 100 F			**Date**	3/19/2008						
1	199.09	2.039		198.74	2.029	2.004	366	113.2		-0.49%	-0.05%	-0.59%	-0.18%		93.3		
2	198.36	2.024		197.46	2.027	2.006	372	115.3	118	0.15%	0.05%	0.25%	-0.45%	26.5%	92.6	-0.3%	93.0
3	198.68	2.04		198.14	2.029	2.004	408	126.2		-0.54%	-0.05%	-0.64%	-0.27%		93.0		
4	199.22	2.036		199.85	2.034	2.004	437	134.5		-0.10%	-0.05%	-0.20%	0.32%		92.9		
5	197.02	2.009	3 Day Soaked	197.67	2.006	2.006	413	130.7	133	-0.15%	0.05%	-0.05%	0.33%	27.5%	93.0	-0.1%	92.7
6	196.92	2.026		197.6	2.021	2.006	431	134.4		-0.25%	0.05%	-0.15%	0.35%		92.3		
							7 Day Ambient			**Date**	3/19/2008						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
7	197.68	2.025		197.4	2.021	2.004	366	114.1		-0.20%	-0.05%	-0.30%	-0.14%		117.7		
8	195.77	2.01		195.51	2.009	2.005	383	120.8	120	-0.05%	0.00%	-0.05%	-0.13%	27.3%	117.2	-0.2%	117.4
9	196.14	2.021		195.95	2.015	2.004	403	126.4		-0.30%	-0.05%	-0.40%	-0.10%		117.2		
10	195.5	2.008		196.52	2.018	2.007	327	102.2		0.50%	0.10%	0.70%	0.52%		117.0		
11	193.94	1.986	3 Day Soaked	194.36	1.99	2.006	429	137.9	128	0.20%	0.05%	0.30%	0.22%	27.0%	117.5	0.3%	117.8
12	193.31	1.965		194.03	1.964	2.005	432	142.6		-0.05%	0.00%	-0.05%	0.37%		119.0		
							28 Day Ambient			**Date**	4/10/2008						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
13	190.93	1.97		191.51	1.965	2.001	564	186.0		-0.25%	-0.20%	-0.65%	0.30%		117.8		
14	192.61	1.969		192.37	1.964	2.003	526	173.6	168	-0.25%	-0.10%	-0.45%	-0.12%	26.9%	118.2	-0.7%	118.1
15	192.89	1.976		192.41	1.96	2.004	439	145.5		-0.81%	-0.05%	-0.91%	-0.25%		118.3		
16	194.44	1.989		194.82	1.987	2.003	477	153.8		-0.10%	-0.10%	-0.30%	0.20%		118.3		
17	196.22	2.008	3 Day Soaked	196.57	2.008	2	495	156.3	152	0.00%	-0.25%	-0.50%	0.18%	27.3%	118.5	-0.4%	118.2
18	193.17	1.986		193.58	1.98	2.003	450	146.1		-0.30%	-0.10%	-0.50%	0.21%		118.0		
							90 Day Ambient			**Date**	10-Jun-08						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
19	195.68	2.01		194.69	2.002	2.007	540	171.5		-0.40%	0.10%	-0.20%	-0.51%		116.9		
20	193.89	2.006		193.09	2.001	2.008	546	173.6	174.8	-0.25%	0.15%	0.05%	-0.41%	26.0%	115.8	-0.2%	116.6
21	194.29	2		193.49	1.992	2.005	559	179.4		-0.40%	0.00%	-0.40%	-0.41%		117.0		
22	193.27	2.006		192.9	2.004	2.008	502	159.2		-0.10%	0.15%	0.20%	-0.19%		115.6		
23	194.55	2.02	3 Day Soaked	194.27	2.016	2.01	492	154.1	165.9	-0.20%	0.25%	0.30%	-0.14%	25.8%	115.5	0.0%	115.9
24	194	2.007		193.44	1.999	2.004	579	184.5		-0.40%	-0.05%	-0.50%	-0.29%		116.6		

Prep Date 3/12/2008

Description

L-CV-33-12 5053g Soil L @33% with 455.9g Type V cement(12%)

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
							7 Day 100 F			**Date**							
1	195.89	1.971		195.04	1.971	2.004	614	201.2		0.00%	-0.05%	-0.10%	-0.43%		119.3		
2	195.47	1.983		194.83	1.975	2.003	580	189.3	201	-0.40%	-0.10%	-0.60%	-0.33%		119.0	-0.5%	127.2
3	195.73	1.988		235.16	1.975	2.005	655	213.8		-0.65%	0.00%	-0.65%	20.15%		143.4		
4	192.51	1.953		193.01	1.953	2.006	444	148.2		0.00%	0.05%	0.10%	0.26%		118.9		
5	194.57	1.98	3 Day Soaked	195.16	1.979	2.006	520	169.1	156	-0.05%	0.05%	0.05%	0.30%	26.6%	118.6	0.0%	118.8
6	195.95	1.994		196.73	1.991	2.005	467	150.0		-0.15%	0.00%	-0.15%	0.40%		119.0		
							7 Day Ambient			**Date**							
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
7	196.54	2.01		196.35	2.004	2.004	480	152.2		-0.30%	-0.05%	-0.40%	-0.10%		118.1		
8	199.11	2.038		198.89	2.04	2.004	494	151.1	149	0.10%	-0.05%	0.00%	-0.11%	26.2%	117.5	-0.3%	118.0
9	197.05	2.006		196.52	2	2.004	454	144.5		-0.30%	-0.05%	-0.40%	-0.27%		118.4		
10	196.24	2.028		197.14	2.024	2.006	476	147.9		-0.20%	0.05%	-0.10%	0.46%		117.2		
11	197.21	2.03	3 Day Soaked	198.08	2.023	2.004	540	168.0	156	-0.34%	-0.05%	-0.44%	0.44%	26.0%	118.0	-0.2%	117.8
12	197.71	2.025		198.54	2.016	2.008	489	153.2		-0.44%	0.15%	-0.15%	0.42%		118.2		
							28 Day Ambient			**Date**	10-Apr						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
13	195.96	2.02		195.5	2.015	2.003	669	209.8		-0.25%	-0.10%	-0.45%	-0.23%		117.1		
14	194.92	2.003		194.55	1.999	2.02	637	203.0	212	-0.20%	0.75%	1.30%	-0.19%	25.7%	115.4	0.1%	116.5
15	197.39	2.035		197.04	2.03	2.003	725	224.0		-0.25%	-0.10%	-0.44%	-0.18%		117.1		
16	198.24	2.033		198.83	2.03	2.005	509	157.3		-0.15%	0.00%	-0.15%	0.30%		117.9		
17	197.38	2.028	3 Day Soaked	198.35	2.027	2.001	489	151.5	180	-0.05%	-0.20%	-0.45%	0.49%	26.5%	118.3	-0.4%	118.2
18	197.38	2.026		197.93	2.019	2.002	740	231.1		-0.35%	-0.15%	-0.64%	0.28%		118.4		
							90 Day Ambient			**Date**	10-Jun-08	#DIV/0!					
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
19	197.98	2.02		197.31	2.017	2.009	828	259.1		-0.15%	0.20%	0.25%	-0.34%		117.3		
20	199.38	2.054		198.07	2.048	2.005	645	195.8	216.3	-0.29%	0.00%	-0.29%	-0.66%	25.0%	116.4	0.0%	116.5
21	197.03	2.035		195.94	2.032	2.007	629	194.0		-0.15%	0.10%	0.05%	-0.55%		115.9		
22	197.86	2.045		198.03	2.039	2.006	687	210.4		-0.29%	0.05%	-0.19%	0.09%		116.8		
23	195.9	2.025	3 Day Soaked	195.3	2.023	1.999	707	220.0	216.8	-0.10%	-0.30%	-0.70%	-0.31%	25.0%	116.9	-0.3%	117.0
24	195.51	2.006		195.05	1.998	2.008	690	220.1		-0.40%	0.15%	-0.10%	-0.24%		117.2		

Prep Date 3/12/2008

Description

L CV-35-16 5131g Soil L @35% with 608.1g Type V cement(:

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
							7 Day 100 F			**Date**							
1	199.85	2.02		199.25	2.016	2.007	572	179.2		-0.20%	0.10%	0.00%	-0.30%		118.8		
2	197.45	2.003		197.03	1.987	2.004	494	159.3	173	-0.80%	-0.05%	-0.90%	-0.21%	27.5%	119.5	-0.3%	119.0
3	198.07	2.004		197.63	1.996	2.008	561	179.3		-0.40%	0.15%	-0.10%	-0.22%		118.9		
4	197.05	2.001		197.7	2	2.006	507	161.4		-0.05%	0.05%	0.05%	0.33%		118.9		
5	199.45	2.022	3 Day Soaked	200.2	2.025	2.005	448	139.1	165	0.15%	0.00%	0.15%	0.38%	27.5%	119.0	-0.1%	119.2
6	196.46	1.994		197.3	1.985	2.005	600	193.9		-0.45%	0.00%	-0.45%	0.43%		119.7		
							7 Day Ambient			**Date**							
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
7	196.19	1.992		196.06	1.986	2.006	460	148.5		-0.30%	0.05%	-0.20%	-0.07%		118.7		
8	197.54	2.005		197.35	2.005	2.002	688	217.9	171	0.00%	-0.15%	-0.30%	-0.10%	27.3%	118.9	-0.4%	118.7
9	195.1	1.99		194.78	1.982	2.003	450	145.9		-0.40%	-0.10%	-0.60%	-0.16%		118.6		
10	198.83	2.023		199.09	2.024	2.008	480	149.2		0.05%	0.15%	0.35%	0.13%		118.1		
11	195.38	1.996	3 Day Soaked	197.24	2.005	2.007	450	142.5	149	0.45%	0.10%	0.65%	0.95%	28.0%	118.2	0.5%	118.2
12	200.04	2.037		200.79	2.04	2.008	508	155.4		0.15%	0.15%	0.45%	0.37%		118.2		
							28 Day Ambient			**Date**	4/10/2008						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
13	197.8	2.009		197.48	2.016	2.005	614	192.4		0.35%	0.00%	0.35%	-0.16%		117.9		
14	197.25	2.016		197.07	2.02	2.006	587	183.2	203	0.20%	0.05%	0.30%	-0.09%	27.5%	117.4	0.1%	117.7
15	194.27	1.99		194.04	1.988	2.003	727	234.2		-0.10%	-0.10%	-0.30%	-0.12%		117.8		
16	194.39	1.99		195.02	1.984	2.005	475	153.6		-0.30%	0.00%	-0.30%	0.32%		118.4		
17	196.94	2.025	3 Day Soaked	197.47	2.01	2.005	635	200.1	170	-0.74%	0.00%	-0.74%	0.27%	26.6%	118.3	-0.5%	118.2
18	197.23	2.031		197.74	2.02	2.005	500	156.0		-0.54%	0.00%	-0.54%	0.26%		117.9		
							90 Day Ambient			**Date**	10-Jun-08	#DIV/0!					
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
19	197.44	2.04		196.68	2.04	2.008	713	218.1		0.00%	0.15%	0.30%	-0.38%		115.7		
20	195.72	2.015		194.8	2.019	2.006	859	268.3	255.4	0.20%	0.05%	0.30%	-0.47%	25.6%	116.1	0.2%	115.8
21	196.86	2.035		195.75	2.032	2.008	907	279.7		-0.15%	0.15%	0.15%	-0.56%		115.6		
22	195.91	2.011		195.21	2.01	2.008	690	217.5		-0.05%	0.15%	0.25%	-0.36%		116.6		
23	199.21	2.029	3 Day Soaked	198.65	2.05	2.008	723	219.0	211.1	1.03%	0.15%	1.34%	-0.28%	25.5%	116.3	0.5%	116.5
24	198.25	2.048		198.05	2.045	2.006	646	196.7		-0.15%	0.05%	-0.05%	-0.10%		116.5		

Prep Date 4/23/2008

Description
L-L-33-4 5291g L@ 33% with 159g Lime(4%)

Condition: As mixed / 7 Day 100 F — Date 5/1/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	200.1	2.059		199.6	2.078	2.007	488	143.9		0.92%	0.10%	1.12%	-0.25%		115.4		
4	198.54	2.061		198.16	2.059	2.01	440	132.1	142	-0.10%	0.25%	0.40%	-0.19%	32.0%	115.3	0.8%	115.3
7	195.71	2.025		195.23	2.035	2.008	484	148.8		0.49%	0.15%	0.79%	-0.25%		115.2		
8	194.77	2.031		194.58	2.038	2.007	572	175.3		0.34%	0.10%	0.54%	-0.10%		114.7		
10	195.92	2.042	3 Day Soaked	195.55	2.044	2.009	630	192.0	185	0.10%	0.20%	0.50%	-0.19%	31.7%	114.7	0.5%	114.8
19	194.95	2.03		194.78	2.036	2.008	608	186.7		0.30%	0.15%	0.60%	-0.09%		114.8		

7 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
2	197.2	2.045		197.25	2.042	2.005	372	113.6		-0.15%	0.00%	-0.15%	0.03%		116.3		
3	199.37	2.064		199.27	2.06	2.008	450	135.0	131	-0.19%	0.15%	0.11%	-0.05%	32.1%	116.1	0.2%	116.1
5	194.2	2.004		194.1	2.009	2.008	459	144.8		0.25%	0.15%	0.55%	-0.05%		116.0		
10	195.92	2.042		196.56	2.047	2.01	476	144.6		0.24%	0.25%	0.75%	0.33%		115.0		
11	194.01	2.03	3 Day Soaked	193.91	2.02	2.009	530	165.4	160	-0.49%	0.20%	-0.10%	-0.05%	32.0%	115.1	0.7%	114.5
19	194.95	2.03		193.95	2.049	2.01	562	170.4		0.94%	0.25%	1.44%	-0.51%		113.4		

28 Day Ambient — Date 22-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
12	195.5	2.05		195.2	2.059	2.011	611	183.5		0.44%	0.30%	1.04%	-0.15%		113.5		
13	193.41	2.02		193.1	2.025	2.008	690	214.2	204.1	0.25%	0.15%	0.55%	-0.16%	31.0%	114.5	1.2%	113.9
14	192.96	2		192.8	2.028	2.01	693	214.5		1.40%	0.25%	1.91%	-0.08%		113.9		
16	190.84	2.006		190.8	2.003	2.005	740	234.8		-0.15%	0.00%	-0.15%	-0.02%		114.7		
17	196.19	2.063	3 Day Soaked	196.17	2.065	2.007	703	209.9	217.1	0.10%	0.10%	0.30%	-0.01%	29.3%	114.2	0.1%	114.2
18	194.02	2.048		193.94	2.052	2.005	683	206.5		0.20%	0.00%	0.20%	-0.04%		113.8		

90 Day Ambient — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
15	193.26	2.014		192.81	2.015	2.007	705	221.1		0.05%	0.10%	0.25%	-0.23%		115.0		
20	191.09	2.008		190.49	2.006	2.006	751	237.6	239.9	-0.10%	0.05%	0.00%	-0.31%	29.9%	114.2	0.2%	115.1
21	185.85	1.913		185.07	1.917	2.005	753	260.9		0.21%	0.00%	0.21%	-0.42%		116.2		
22	189.66	1.976		189.21	1.994	2.007	706	226.1		0.91%	0.10%	1.11%	-0.24%		114.0		
23	192.28	1.999	3 Day Soaked	191.97	2.007	2.01	532	168.2	199.9	0.40%	0.25%	0.90%	-0.16%	29.2%	114.6	0.9%	114.4
24	192.58	2.009		192.19	2.012	2.009	653	205.4		0.15%	0.20%	0.55%	-0.20%		114.6		

Prep Date 5/9/2008

Description
L-L-33-6 5000g Soil L @ 33% with 227.3g Lime(6%) add 1% water

Condition: As mixed / 7 Day 100 F — Date 16-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	201.27	2.075		200.8	2.075	2.008	691	204.3		0.00%	0.15%	0.30%	-0.23%		116.2		
2	197.2	2.02		196.6	2.015	2.005	701	219.8	224.6	-0.25%	0.00%	-0.25%	-0.30%	28.8%	117.5	0.0%	116.9
3	194.45	1.998		193.9	1.995	2.005	780	249.5		-0.15%	0.00%	-0.15%	-0.28%		117.0		
4	197.21	2.022		196.6	2.025	2.001	686	213.0		0.15%	-0.20%	-0.25%	-0.31%		117.4		
5	196.5	2.034	3 Day Soaked	195.5	2.041	2.009	731	223.4	228.5	0.34%	0.20%	0.74%	-0.51%		114.9	0.2%	116.3
6	196.58	2.017		195.7	2.017	2.006	796	249.1		0.00%	0.05%	0.10%	-0.45%	27.6%	116.7		

7 Day Ambient — Date 16-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	198.11	2.05		197.9	2.055	2.008	424	127.8		0.24%	0.15%	0.54%	-0.11%		115.6		
8	193.08	1.983		192.8	1.978	2.006	453	147.4	140.4	-0.25%	0.05%	-0.15%	-0.15%	29.5%	117.2	0.5%	116.0
9	195.47	2.02		195.3	2.02	2.015	468	146.0		0.00%	0.50%	1.00%	-0.09%		115.3		
10	195.3	2.02		194.3	2.025	2.006	496	154.0		0.25%	0.05%	0.35%	-0.51%		115.4		
11	194.52	2.005	3 Day Soaked	193.6	2.018	2.006	501	156.6	154.9	0.65%	0.05%	0.75%	-0.47%	27.8%	115.4	0.6%	115.1
12	197.59	2.051		196.68	2.056	2.01	511	153.9		0.24%	0.25%	0.74%	-0.46%		114.6		

28 Day Ambient — Date 6-Jun-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	196.27	2.024		196	2.025	2.005	681	211.4		0.05%	0.00%	0.05%	-0.14%		90.0		
14	197.77	2.025		197.41	2.038	2.01	710	217.7	216.3	0.64%	0.25%	1.14%	-0.18%	29.4%	116.1	0.6%	107.3
15	196.29	2.024		196.07	2.029	2.01	711	219.9		0.25%	0.25%	0.75%	-0.11%		115.8		
16	194.38	2.01		194.16	2.005	2.01	719	227.7		-0.25%	0.25%	0.25%	-0.11%		116.0		
17	196.33	2.027	3 Day Soaked	196.14	2.026	2.008	805	249.7	236.1	-0.05%	0.15%	0.25%	-0.10%		116.2	0.4%	115.9
18	196.9	2.04		196.7	2.047	2.008	760	230.9		0.34%	0.15%	0.64%	-0.10%		115.4		

90 Day Ambient — Date 7-Aug-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	196.38	2.04		195.41	2.038	2.008	863	264.6		-0.10%	0.15%	0.20%	-0.49%		115.1		
20	193.67	2.002		193.15	2.007	2.007	755	238.7	245.3	0.25%	0.10%	0.45%	-0.27%	28.7%	115.6	0.3%	115.6
21	195.4	2.01		194.45	2.014	2.007	741	232.6		0.20%	0.10%	0.40%	-0.49%		116.0		
22	192.2	1.985		191.9	1.993	2.009	732	234.6		0.40%	0.20%	0.80%	-0.16%		115.5		
23	196.31	2.035	3 Day Soaked	195.87	2.029	2.009	826	255.5	234.3	-0.29%	0.20%	0.10%	-0.22%	29.4%	115.8	0.5%	115.1
24	194.44	2.04		194.01	2.041	2.009	696	212.7		0.05%	0.20%	0.45%	-0.22%		114.0		

Prep Date 5/9/2008

Description L-L-34-8 5000g of Soil L @ 34% with 303.12g Lime(8%) add 2% water(76g)

Condition: As mixed / 7 Day 100 F — Date 16-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	196.34	2.048		195.8	2.05	2.015	648	196.3		0.10%	0.50%	1.10%	-0.28%		113.9		
2	198.78	2.038		198.5	2.04	2.005	747	228.5	228.1	0.10%	0.00%	0.10%	-0.14%	28.9%	117.2	0.5%	115.6
3	191.51	1.98		191	1.98	2.009	799	259.5		0.00%	0.20%	0.40%	-0.27%		115.7		
4	191.21	1.974		190.3	1.961	2.01	769	254.6		-0.66%	0.25%	-0.16%	-0.48%		116.3		
5	191.88	1.975	3 Day Soaked	190.9	1.985	2.006	723	233.6	248.8	0.51%	0.05%	0.61%	-0.51%	27.9%	115.7	0.3%	116.1
6	193.43	1.985		192.5	1.986	2.009	800	258.3		0.05%	0.20%	0.45%	-0.48%		116.2		

7 Day Ambient — Date 16-May-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	194.94	2.018		194.8	2.005	2.008	457	144.7		-0.64%	0.15%	-0.35%	-0.07%		116.6		
8	195.92	2.02		195.7	2.025	2.01	467	145.0	146.3	0.25%	0.25%	0.75%	-0.11%	29.0%	115.8	0.1%	116.2
9	196.23	2.031		196	2.025	2.008	480	149.0		-0.30%	0.15%	0.00%	-0.12%		116.2		
10	194.67	2.01		193.71	2.005	2.005	550	174.2		-0.25%	0.00%	-0.25%	-0.49%		116.3		
11	192.34	1.998	3 Day Soaked	191.45	1.999	2.006	530	168.9	164.2	0.05%	0.05%	0.15%	-0.46%	28.1%	115.2	-0.1%	115.7
12	195.34	2.027		194.39	2.023	2.006	481	149.6		-0.20%	0.05%	-0.10%	-0.49%		115.6		

28 Day Ambient — Date 6-Jun-08

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	194.44	2.02		194.19	2.021	2.008	717	223.5		0.05%	0.15%	0.35%	-0.13%		89.1		
14	194.99	2.028		194.59	2.023	2.009	732	227.7	234.2	-0.25%	0.20%	0.15%	-0.21%	29.5%	115.4	0.1%	106.7
15	193.36	2.013		192.89	2.004	2.007	793	251.4		-0.45%	0.10%	-0.25%	-0.24%		115.7		
16	194.76	2.02		194.63	2.026	2.005	831	257.8		0.30%	0.00%	0.30%	-0.07%		115.7		
17	192.63	1.995	3 Day Soaked	192.52	2.004	2.007	808	256.2	251.5	0.45%	0.10%	0.65%	-0.06%	29.1%	115.4	0.4%	115.7
18	192.87	1.996		192.72	1.993	2.008	750	240.4		-0.15%	0.15%	0.15%	-0.08%		116.1		

90 Day Ambient — Date — #DIV/0!

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	191.68	1.984		191.05	1.986	2.008	952	307.3		0.10%	0.15%	0.40%	-0.33%		115.5		
20	195.56	2.03		194.86	2.024	2.008	1054	327.6	313.1	-0.30%	0.15%	0.00%	-0.36%	29.0%	115.6	0.4%	115.4
21	193.7	2.005		193.07	2.015	2.008	971	304.5		0.50%	0.15%	0.80%	-0.33%		115.0		
22	196.14	2.04		195.8	2.038	2.008	993	304.4		-0.10%	0.15%	0.20%	-0.17%		115.3		
23	194.71	2.029	3 Day Soaked	194.35	2.034	2.008	1116	343.5	293.7	0.25%	0.15%	0.55%	-0.18%	29.2%	114.7	0.4%	115.0
24	194.73	2.027		194.32	2.03	2.008	755	233.3		0.15%	0.15%	0.45%	-0.21%		114.9		

Prep Date 2/19/2008

Description

Soil S with no stabilizer

Condition — As mixed — Initial — Date

Samples	Weight (g)	Height (in)	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
11.6			186.1	2.046	2.005	347	105.5	#DIV/0!	0.00%	#DIV/0!	#DIV/0!	11.6%	98.1
14.10%			201.69	2.053	2.005	320	96.7	#DIV/0!	0.00%	#DIV/0!	#DIV/0!	14.1%	103.7
16.50%			209.42	1.976	2.005	240	78.3	#DIV/0!	0.00%	#DIV/0!	#DIV/0!	16.5%	109.5
19.90%			210.44	1.935	2.005	220	74.8	#DIV/0!	0.00%	#DIV/0!	#DIV/0!	19.9%	109.2
24.30%			187.96	1.834	2.005	68	25.7	#DIV/0!	0.00%	#DIV/0!	#DIV/0!	24.3%	99.3

Target — 3 Day Soaked — Date

Samples	Weight (g)	Height (in)	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
Dry	185.05	2.027	201.14	2.188	2.104	17	4.5	7.94%	4.94%	18.87%	8.69%	20.8%	83.2
13.80%	181.55	1.79	196.19	1.904	2.073	27	9.5	6.37%	3.39%	13.71%	8.06%	22.3%	94.9
16.80%	209.36	1.962	230.17	2.132	2.093	14	3.9	8.66%	4.39%	18.41%	9.94%	27.5%	93.5
19.80%	202.38	1.902	211.61	1.967	2.043	33	10.9	3.42%	1.90%	7.37%	4.56%	23.9%	100.7
24.30%	191.1	1.84	196.67	1.868	2.046	27	9.9	1.52%	2.04%	5.72%	2.91%	25.8%	96.8

Prep Date 2/27/2008

Description

S-CI II-23-6 5200g soil S @23% +254g Type I II Cement(6%

Condition — As mixed

7 Day 100 F — Date 3/5/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	216.88	2.118		216.47	2.118	2.004	404	114.7		0.00%	-0.05%	-0.10%	-0.19%		123.2		
2	206.18	2.001		205.44	2.001	2.003	432	137.4	132.7	0.00%	-0.10%	-0.20%	-0.36%	19.7%	123.9	-0.2%	123.2
3	205.89	2.02		205.36	2.014	2.006	465	146.0		-0.30%	0.05%	-0.20%	-0.26%		122.7		
4	205.76	2.017	3 Day Soaked	206.87	2.02	2.005	395	123.3		0.15%	0.00%	0.15%	0.54%		123.3		
5	205.91	2.02		207.04	2.031	2.006	379	117.0	118.9	0.54%	0.05%	0.64%	0.55%	20.4%	122.6	0.6%	122.6
6	206.14	2.022		206.92	2.036	2.008	379	116.4		0.69%	0.15%	0.99%	0.38%		122.0		

7 Day Ambient — Date 3/5/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	206.73	2.034		206.36	2.038	2.003	373	114.3		0.20%	-0.10%	0.00%	-0.18%		122.2		
8	205.31	2.025		205.17	2.03	2	382	118.0	115.2	0.25%	-0.25%	-0.25%	-0.07%	19.4%	122.3	-0.1%	122.1
9	205.68	2.035		205.56	2.031	2.006	367	113.3		-0.20%	0.05%	-0.10%	-0.06%		121.7		
10	204.62	2.038	3 Day Soaked	206.39	2.032	2.009	328	101.1		-0.29%	0.20%	0.10%	0.87%		121.8		
11	204.89	2.011		206.47	2.019	2.005	352	109.9	110.5	0.40%	0.00%	0.40%	0.77%	20.4%	123.1	0.2%	122.8
12	203.62	2.005		205.29	2.006	2.004	381	120.6		0.05%	-0.05%	-0.05%	0.82%		123.3		

28 Day Ambient — Date 3/26/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	204.33	1.988		203.4	1.977	2.004	439	143.0		-0.55%	-0.05%	-0.65%	-0.46%		124.0		
14	203.71	2.014		203.29	1.997	1.999	370	118.1	135.8	-0.84%	-0.30%	-1.44%	-0.21%	19.4%	123.3	-1.0%	123.5
15	202.97	2		202.36	1.991	1.999	455	146.1		-0.45%	-0.30%	-1.04%	-0.30%		123.1		
16	205.05	2.001	3 Day Soaked	206.29	2.009	2.006	346	109.2		0.40%	0.05%	0.50%	0.60%		123.5		
17	204.89	2.014		205.94	2.008	2.006	323	102.0	107.5	-0.30%	0.05%	-0.20%	0.51%	19.7%	123.4	0.1%	123.3
18	204.15	2.017		205.55	2.008	2.008	353	111.5		-0.45%	0.15%	-0.15%	0.69%		122.9		

90 Day Ambient — Date 5/27/2008 #DIV/0!

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	204.39	2.022		202.82	2.003	1.999	465	147.6		-0.94%	-0.30%	-1.53%	-0.77%		122.7		
20	204.62	2.015		203.32	2.009	1.997	435	137.2	143.4	-0.30%	-0.40%	-1.09%	-0.64%	11.7%	122.8	-1.0%	122.9
21	203.7	1.987		202.44	1.987	2	451	145.4		0.00%	-0.25%	-0.50%	-0.62%		123.3		
22	204.42	2.016	3 Day Soaked	204.52	2.019	2.002	316	98.7		0.15%	-0.15%	-0.15%	0.05%		122.3		
23	203.54	2		204.5	2.004	2.003	329	104.3	100.8	0.20%	-0.10%	0.00%	0.47%	18.8%	123.1	-0.3%	123.0
24	203.38	2.007		204.32	1.995	2.003	311	99.5		-0.60%	-0.10%	-0.80%	0.46%		123.6		

Prep Date 2/27/2008

Description

S-CI II-24-10 5200g soil S at 24% +423g Type I II Cement

Condition — As mixed

7 Day 100 F — Date

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	206.56	1.978		205.96	1.97	2.005	587	192.6		-0.40%	0.00%	-0.40%	-0.29%		125.9		
2	207.46	2		207.03	1.978	2.004	621	202.1	196.4	-1.10%	-0.05%	-1.20%	-0.21%	20.1%	126.2	-0.5%	125.4
3	207.34	1.999		206.59	2.005	2.004	614	194.5		0.30%	-0.05%	0.20%	-0.36%		124.2		
4	208.92	2.029	3 Day Soaked	209.7	2.017	2.003	512	160.2		-0.59%	-0.10%	-0.79%	0.37%		125.4		
5	207.05	1.991		207.79	1.997	2.002	523	167.0	169.2	0.30%	-0.15%	0.00%	0.36%	20.2%	125.7	-0.4%	126.0
6	207.47	2.001		210.13	1.99	2.006	561	180.4		-0.55%	0.05%	-0.45%	1.28%		127.0		

7 Day Ambient — Date #DIV/0!

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	207.2	2.004		206.99	1.993	2.005	503	161.2		-0.55%	0.00%	-0.55%	-0.10%		125.1		
8	207.5	2.005		207.23	2.005	2.004	562	178.0	175.8	0.00%	-0.05%	-0.10%	-0.13%	19.8%	124.6	-0.1%	124.4
9	207.84	2.016		207.77	2.025	2.005	606	188.2		0.45%	0.00%	0.45%	-0.03%		123.5		
10	206.41	1.992	3 Day Soaked	207.57	1.995	2.004	478	152.9		0.15%	-0.05%	0.05%	0.56%		125.4		
11	207.08	2.012		208.03	2.004	2.018	497	157.6	154.8	-0.40%	0.65%	0.90%	0.46%	20.5%	123.4	0.4%	124.7
12	207.12	1.989		208.04	1.991	2.008	479	153.9		0.10%	0.15%	0.40%	0.44%		125.4		

28 Day Ambient — Date

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	207.59	2.011		207.17	2.004	2.004	583	184.8		-0.35%	-0.05%	-0.45%	-0.20%		124.6		
14	207.37	2.015		206.7	2.007	2.002	620	196.0	201.8	-0.40%	-0.15%	-0.69%	-0.32%	19.9%	124.4	-0.8%	124.2
15	208.04	2.049		207.6	2.03	2.001	727	224.6		-0.93%	-0.20%	-1.32%	-0.21%		123.6		
16	207.32	2.021	3 Day Soaked	208.68	2.012	2.005	488	153.5		-0.45%	0.00%	-0.45%	0.66%		124.9		
17	206.64	2.015		207.77	2.025	2.004	464	144.1	149.9	0.50%	-0.05%	0.40%	0.55%	20.5%	123.7	0.0%	124.4
18	206.79	2.01		207.78	2.008	2.005	482	152.2		-0.10%	0.00%	-0.10%	0.48%		124.6		

90 Day Ambient — Date 5/28/2008 #DIV/0!

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	206.99	2.011		206.12	2.003	2	597	189.5		-0.40%	-0.25%	-0.89%	-0.42%		124.5		
20	207.28	2.033		206.11	2.019	2	574	179.3	178.7	-0.69%	-0.25%	-1.18%	-0.56%	32.4%	123.5	-1.1%	123.8
21	205.64	2.023		204.55	2.008	2	530	167.4		-0.74%	-0.25%	-1.24%	-0.53%		123.3		
22	206.61	2.002	3 Day Soaked	207.62	1.995	1.999	430	137.6		-0.35%	-0.30%	-0.95%	0.49%		126.1		
23	207.9	2.014		208.84	2.022	2.003	480	149.5	132.9	0.40%	-0.10%	0.20%	0.45%	19.3%	124.6	-0.4%	125.0
24	207.05	2.021		207.64	2.018	2.002	357	111.6		-0.15%	-0.15%	-0.45%	0.28%		124.3		

Prep Date 3/3/2008 8:00 AM

Description
S-CI II-25-16 5289g Soil S @ 25% with 16% Type I II Cement (677g)

Condition As mixed — **7 Day 100 F** — **Date** 3/10/2008 11:00 AM

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	209.69	2.028		209.27	2.019	2.006	544	169.9		-0.44%	0.05%	-0.34%	-0.20%		124.7		
2	208.62	2.006		207.71	2.007	2.005	502	158.7	164.1	0.05%	0.00%	0.05%	-0.44%	19.6%	124.6	-0.2%	124.7
3	208.26	2.009		207.36	2.004	2.004	516	163.6		-0.25%	-0.05%	-0.35%	-0.43%		124.7		
4	208.99	2.016		210.35	2.005	2.004	428	135.6		-0.55%	-0.05%	-0.64%	0.65%		126.4		
5	208.44	2.011	3 Day Soaked	210.12	2.008	2.005	477	150.6	140.0	-0.15%	0.00%	-0.15%	0.81%	20.1%	126.0	-0.2%	126.1
6	208.18	1.997		209.27	1.998	2.006	420	134.0		0.05%	0.05%	0.15%	0.52%		126.0		

7 Day Ambient — **Date** 3/10/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	208.08	2.017		207.84	2.02	2.003	483	150.7		0.15%	-0.10%	-0.05%	-0.12%		124.1		
8	207.8	2.007		207.67	2.001	2.003	892	283.6	197.9	-0.30%	-0.10%	-0.50%	-0.06%	19.9%	125.2	-0.4%	124.9
9	208.1	2.009		207.53	1.996	2.004	499	159.5		-0.65%	-0.05%	-0.75%	-0.27%		125.3		
10	207.4	2.016		209.99	2.028	2.005	465	144.0		0.60%	0.00%	0.60%	1.25%		124.7		
11	207.9	2.009	3 Day Soaked	209.05	2.003	2.002	420	133.3	143.3	-0.30%	-0.15%	-0.60%	0.55%	20.6%	126.0	0.0%	125.3
12	207.62	2.016		209.4	2.023	2.001	491	152.8		0.35%	-0.20%	-0.05%	0.86%		125.1		

28 Day Ambient — **Date** 3/31/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	205.71	2.002		205.36	2.006	2.008	592	187.3		0.20%	0.15%	0.50%	-0.17%		122.9		
14	205.71	2.011		205.43	2.008	2.009	559	176.5	178.8	-0.15%	0.20%	0.25%	-0.14%	19.1%	122.7	0.3%	122.9
15	204.82	1.997		204.39	2.002	2.004	543	172.5		0.25%	-0.05%	0.15%	-0.21%		123.0		
16	205.13	2.001		207.58	2.007	2.015	516	163.1		0.30%	0.50%	1.30%	1.19%		123.3		
17	204.42	1.986	4 Day Soaked	206.57	1.985	2.004	468	151.2	161.0	-0.05%	-0.05%	-0.15%	1.05%	20.7%	125.4	0.2%	124.8
18	206.08	2.003		207.77	1.995	2.003	527	168.6		-0.40%	-0.10%	-0.60%	0.82%		125.6		

91 Day Ambient — **Date** 6/2/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	206.6	2.017		205.53	2.022	2.002	600	186.9		0.25%	-0.15%	-0.05%	-0.41%		122.8		
20	206.33	2.026		205.28	2.012	2.001	571	179.6	180.9	-0.69%	-0.20%	-1.09%	0.26%	17.6%	123.3	-0.6%	123.3
21	206.37	1.999		204.1	1.988	2.004	547	176.2		-0.55%	-0.05%	-0.65%	-0.02%		123.7		
22	204.74	2.003		206.8	2.004	2.003	448	142.0		0.05%	-0.10%	-0.15%	#REF!		124.5		
23	204.15	1.998	3 Day Soaked	206.06	1.994	2.001	420	134.5	139.8	-0.20%	-0.20%	-0.60%	#REF!	20.3%	124.9	0.1%	124.5
24	204.84	2.004		208.76	2.024	2.006	460	143.0		1.00%	0.05%	1.10%	1.91%		124.1		

Prep Date 3/3/2008 10:15am

Description S-FC-23-10 5200g Soil S @23% with 10% Class C Flay ash (423g)

Condition As mixed — **7 Day 100 F** — **Date** 3/10/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	210.18	1.994		209.74	2.007	2.007	381	120.4		0.65%	0.10%	0.85%	-0.21%		125.6		
2	210.23	2.001		209.3	1.993	2.001	378	121.2	116.3	-0.40%	-0.20%	-0.80%	-0.44%	19.2%	127.0	-0.2%	126.5
3	209.25	1.989		208.26	1.981	2.003	331	107.4		-0.40%	-0.10%	-0.60%	-0.47%		126.8		
4	209.72	1.99		217.86	2.043	2.032	52	15.9		2.66%	1.35%	5.45%	3.88%		125.0		
5	209.38	2.001	3 Day Soaked	219.68	2.064	2.048	43	12.9	15.0	3.15%	2.14%	7.62%	4.92%	25.7%	122.8	6.7%	123.7
6	209.44	2.003		219.36	2.062	2.045	54	16.2		2.95%	2.00%	7.09%	4.74%		123.1		

7 Day Ambient — **Date** 3/10/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	208.89	1.999		208.64	1.996	2.003	336	107.4		-0.15%	-0.10%	-0.35%	-0.12%		126.1		
8	209.32	2		209.24	1.995	2.004	316	101.1	100.0	-0.25%	-0.05%	-0.35%	-0.04%	19.2%	126.4	-0.5%	126.2
9	210.06	2.016		209.45	2.01	2	290	91.4		-0.30%	-0.25%	-0.79%	-0.29%		126.1		
10	209.68	2.017		224.4	2.103	2.05	38	10.9		4.26%	2.24%	9.00%	7.02%		122.9		
11	209.82	2.02	3 Day Soaked	223.92	2.105	2.05	35	10.1	10.4	4.21%	2.24%	8.94%	6.72%	27.5%	122.5	8.9%	122.8
12	209.95	2.02		224.78	2.103	2.05	35	10.1		4.11%	2.24%	8.83%	7.06%		123.1		

28 Day Ambient — **Date** 3/31/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	209.66	2.02		209.22	2.008	2.003	372	117.5		-0.59%	-0.10%	-0.79%	-0.21%		125.7		
14	208.4	2.001		207.94	2.006	2.003	351	111.1	115.0	0.25%	-0.10%	0.05%	-0.22%	19.6%	125.1	-0.4%	125.6
15	207.58	1.988		206.92	1.984	2.001	360	116.4		-0.20%	-0.20%	-0.60%	-0.32%		126.1		
16	208	1.998		217.39	2.054	2.038	61	18.4		2.80%	1.65%	6.21%	4.51%		123.3		
17	207.71	2.003	4 Day Soaked	217.33	2.055	2.027	67	20.2	21.7	2.60%	1.10%	4.86%	4.63%	24.6%	124.6	5.1%	124.2
18	208.12	2		215.64	2.034	2.03	86	26.5		1.70%	1.25%	4.25%	3.61%		124.5		

91 Day Ambient — **Date** 6/2/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	207.68	1.988		206.07	1.979	1.999	369	120.0		-0.45%	-0.30%	-1.05%	-0.78%		126.1		
20	207.23	1.995		205.74	1.991	2.001	399	128.2	124.3	-0.20%	-0.20%	-0.60%	-0.72%	14.6%	124.9	-0.8%	125.6
21	207.24	1.986		206.09	1.979	2.001	384	124.8		-0.35%	-0.20%	-0.75%	-0.55%		125.9		
22	207.26	2		212.54	2.021	2.018	110	34.3		1.05%	0.65%	2.36%	2.55%		125.0		
23	207.85	2.001	3 Day Soaked	213.41	2.029	2.023	88	27.2	29.6	1.40%	0.90%	3.23%	2.68%	23.6%	124.4	3.0%	124.7
24	206.58	1.984		212.33	2.021	2.02	88	27.4		1.86%	0.75%	3.39%	2.78%		124.6		

Prep Date 3/3/2008 1:00 PM

Description S-FC-23-15 5200g Soil S @23% with 15% Class C Fly Ash (634.7g)

Condition As mixed — **7 Day 100 F** — **Date** 3/10/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	208.26	1.997		207.72	1.981	2.004	323	104.8		-0.80%	-0.05%	-0.90%	-0.26%		126.4		
2	208.22	1.987		207.82	1.986	2.004	337	108.8	111.7	-0.05%	-0.05%	-0.15%	-0.19%	19.5%	126.1	-0.2%	125.9
3	206.45	1.97		205.88	1.979	2.006	374	121.6		0.46%	0.05%	0.56%	-0.28%		125.1		
4	207.33	1.987		215.82	2.037	2.028	74	22.7		2.52%	1.15%	4.88%	4.09%		124.7		
5	205.17	1.963	3 Day Soaked	213.58	2.025	2.039	49	15.2	23.3	3.16%	1.70%	6.69%	4.10%	24.5%	122.8	5.0%	124.4
6	208.63	1.997		215.57	2.04	2.018	105	32.1		2.15%	0.65%	3.48%	3.33%		125.6		

7 Day Ambient — **Date** 3/10/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	206.95	1.977		206.44	1.97	2.003	332	108.9		-0.35%	-0.10%	-0.55%	-0.25%		126.4		
8	208.5	1.985		207.44	1.983	2.002	307	99.4	103.0	-0.10%	-0.15%	-0.40%	-0.51%	19.5%	126.3	-0.6%	126.3
9	208.81	2.012		208.69	1.998	2.002	316	100.8		-0.70%	-0.15%	-0.99%	-0.06%		126.1		
10	209.06	2.007		221.07	2.082	2.034	67	19.7		3.74%	1.45%	6.76%	5.74%		124.2		
11	207.84	2	3 Day Soaked	220.12	2.076	2.049	44	13.0	17.1	3.80%	2.19%	8.41%	5.91%	26.0%	122.2	7.6%	123.2
12	208.33	2.004		220.45	2.083	2.04	63	18.5		3.94%	1.75%	7.60%	5.82%		123.1		

28 Day Ambient — **Date** 3/31/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	207.3	2		207.57	2.005	2.008	305	96.6		0.25%	0.15%	0.55%	0.13%		124.3		
14	208.81	2.008		207.97	2.01	2.007	326	102.7	95.5	0.10%	0.10%	0.30%	-0.40%	16.7%	124.3	0.6%	124.5
15	208.27	2		209.2	2.014	2.007	278	87.3		0.70%	0.10%	0.90%	0.45%		124.8		
16	207.96	2		215.41	2.027	2.025	118	36.6		1.35%	1.00%	3.38%	3.58%		125.4		
17	208.41	2.017	4 Day Soaked	217.3	2.06	2.027	85	25.5	28.9	2.13%	1.10%	4.39%	4.27%	23.9%	124.3	4.5%	124.4
18	208.08	2.005		217.19	2.055	2.035	82	24.7		2.49%	1.50%	5.58%	4.38%		123.5		

91 Day Ambient — **Date** 6/2/2008

Samples	Weight (g)	Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	207.68	2.002		205.68	2	2.003	430	136.9		-0.10%	-0.10%	-0.30%	-0.96%		124.1		
20	208.3	2.001		207.03	1.999	2.003	383	122.0	126.9	-0.10%	-0.10%	-0.30%	-0.61%	18.6%	124.9	-0.6%	124.8
21	207.55	2.003		205.93	1.989	2	378	121.7		-0.70%	-0.25%	-1.19%	-0.78%		125.3		
22	207.37	2.018		213.59	2.032	2.015	173	53.3		0.69%	0.50%	1.70%	3.00%		125.3		
23	207.9	2.001	3 Day Soaked	213.4	2.031	2.01	147	45.4	48.1	1.50%	0.25%	2.01%	2.65%	22.0%	125.9	1.9%	125.5
24	206.64	1.994		212.04	2.015	2.015	145	45.5		1.05%	0.50%	2.06%	2.61%		125.4		

Prep Date 3/3/2008

Description S-FC-25-20 5200g S Soil @25% with 20% Class C Fly Ash (832g)

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
				7 Day 100 F						**Date**	3/10/2008						
1	208.96	2.003		208.28	2.005	2.006	222	70.3		0.10%	0.05%	0.20%	-0.33%		125.0		
2	209.83	2.001		209.11	2.003	2.007	255	80.9	76.5	0.10%	0.10%	0.30%	-0.34%	18.1%	125.5	0.4%	124.9
3	209.55	2.01		208.97	2.018	2.008	250	78.2		0.40%	0.15%	0.70%	-0.28%		124.3		
4	209.24	1.991		212	2.001	2.014	170	54.1		0.50%	0.45%	1.41%	1.32%		126.4		
5	209.58	2	3 Day Soaked	211.94	1.995	2.011	227	72.6	63.9	-0.25%	0.30%	0.35%	1.13%	19.7%	127.2	0.8%	126.9
6	209.84	2.001		212.69	2.009	2.008	206	65.0		0.40%	0.15%	0.70%	1.36%		127.1		
										Date	3/10/2008						
7	209.6	2.006		209.42	1.992	2.005	217	69.6		-0.70%	0.00%	-0.70%	-0.09%		126.6		
8	209.59	1.997		209.13	1.985	2.002	247	79.8	77.8	-0.60%	-0.15%	-0.90%	-0.22%	18.8%	127.2	-0.5%	126.5
9	209.36	2.003		209.11	2	2.007	264	84.0		-0.15%	0.10%	0.05%	-0.12%		125.6		
10	209.07	2.006		213.12	2.021	2.007	99	30.9		0.75%	0.10%	0.95%	1.94%		126.7		
11	209.27	2.017	3 Day Soaked	215.6	2.045	2.012	117	35.6	33.3	1.39%	0.35%	2.10%	3.02%	21.4%	126.1	1.5%	126.7
12	209.83	2.014		216.16	2.035	2.01	109	33.5		1.04%	0.25%	1.55%	3.02%		127.3		
				28 Day Ambient						**Date**	3/31/2008						
13	208.2	2.003		206.66	1.995	2.003	382	122.2		-0.40%	-0.10%	-0.60%	-0.74%		125.0		
14	208.38	2.017		208.04	2.004	2.004	385	122.1	121.3	-0.64%	-0.05%	-0.74%	-0.16%	18.5%	125.1	-0.6%	125.0
15	209.65	2.017		207.75	2.005	2.005	378	119.7		-0.59%	0.00%	-0.59%	-0.91%		124.8		
16	209.11	2.006		211.87	2.004	2.018	210	66.6		-0.10%	0.65%	1.20%	1.32%		125.7		
17	208.18	2.003	4 Day Soaked	211.38	2.011	2.01	167	52.6	54.1	0.40%	0.25%	0.90%	1.54%	20.5%	125.9	1.3%	125.8
18	208.57	1.998		212.69	2.021	2.012	138	43.0		1.15%	0.35%	1.86%	1.98%		125.8		
				91 Day Ambient						**Date**	6/2/2008						
19	208.73	2.005		207.67	2.005	2.006	350	110.9		0.00%	0.05%	0.10%	-0.51%		124.6		
20	209.46	2.004		208.33	2.009	2.004	406	128.1	115.0	0.25%	-0.05%	0.15%	-0.54%	16.7%	125.0	-0.1%	125.0
21	208.93	2.006		208.02	2	2.003	333	106.0		-0.30%	-0.10%	-0.50%	-0.44%		125.5		
22	208.87	2		210.89	2.002	2.007	209	66.4		0.10%	0.10%	0.30%	0.97%		126.6		
23	209.18	2.008	3 Day Soaked	211.05	2.013	2.009	213	66.9	64.9	0.25%	0.20%	0.65%	0.89%	19.7%	125.7	0.4%	126.1
24	208.85	2.003		210.37	2.004	2.008	194	61.5		0.05%	0.15%	0.35%	0.73%		126.0		

Prep Date 3/6/2008 8:30am

Description S-CI II-FC-25-8_8 5100g Soil S @25% with 326.4g Type I II(8%) and 326.4g Class C Fly Ash(8%)

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
				7 Day 100 F						**Date**							
1	209.52	2		208.8	1.99	2.007	415	133.4		-0.50%	0.10%	-0.30%	-0.34%		126.1		
2	208.9	1.998		208.01	2.005	2.01	365	115.6	131.6	0.35%	0.25%	0.85%	-0.43%	19.1%	124.3	0.2%	125.6
3	209.93	1.992		209.19	1.994	2.005	455	145.7		0.10%	0.00%	0.10%	-0.35%		126.3		
4	210.2	2.012		211.88	2.012	2.009	291	91.5		0.00%	0.20%	0.40%	0.80%		126.3		
5	209.11	1.998	3 Day Soaked	210	1.989	2.01	308	99.1	89.9	-0.45%	0.25%	0.05%	0.43%	19.8%	126.5	0.2%	126.3
6	209.6	2.005		210.15	2.001	2.008	249	79.2		-0.20%	0.15%	0.10%	0.26%		126.1		
				7 Day Ambient						**Date**		#DIV/0!					
7	209.01	1.991		208.8	1.983	2.006	334	108.1		-0.40%	0.05%	-0.30%	-0.10%		126.7		
8	210.11	2.005		209.97	2.001	2.001	377	119.9	112.6	-0.20%	-0.20%	-0.60%	-0.07%	19.2%	126.9	-0.2%	126.4
9	209.35	1.998		209.19	1.997	2.008	344	109.8		-0.05%	0.15%	0.25%	-0.08%		125.8		
10	210.36	2.02		213.93	2.007	2.01	335	105.9		-0.64%	0.25%	-0.15%	1.70%		127.7		
11	209.85	1.992	3 Day Soaked	211.49	1.99	2.008	354	113.8	106.9	-0.10%	0.15%	0.20%	0.78%	19.4%	127.6	0.0%	127.2
12	209.6	2.006		210.35	2.001	2.006	318	101.1		-0.25%	0.05%	-0.15%	0.36%		126.4		
				28 Day Ambient						**Date**							
13	209.6	2.005		209.15	2.002	2.007	500	158.8		-0.15%	0.10%	0.05%	-0.21%		125.5		
14	210.36	2.01		209.91	2.013	2.006	505	158.7	157.6	0.15%	0.05%	0.25%	-0.21%	18.3%	125.4	0.2%	125.7
15	209.04	1.982		208.5	1.984	2.008	480	155.3		0.10%	0.15%	0.40%	-0.26%		126.2		
16	210.14	2.007		211.26	2.015	2.007	387	121.4		0.40%	0.10%	0.60%	0.53%		126.0		
17	209.75	2.005	3 Day Soaked	210.5	2.001	2.006	400	127.2	121.2	-0.20%	0.05%	-0.10%	0.36%	19.6%	126.5	0.2%	126.4
18	209.68	1.994		209.88	1.993	2.007	359	115.1		-0.05%	0.10%	0.15%	0.10%		126.5		
				90 Day Ambient						**Date**	4-Jun-08						
19	209.95	2.002		208.79	2.013	2	534	167.8		0.55%	-0.25%	0.05%	-0.55%		125.5		
20	209.92	2		208.87	2.001	2.006	579	184.1	178.0	0.05%	0.05%	0.15%	-0.50%	18.2%	125.6	-0.1%	125.8
21	210.18	2.002		209	1.998	2.003	571	182.1		-0.20%	-0.10%	-0.40%	-0.56%		126.2		
22	210.43	2.01		211.91	2.011	2.01	369	116.2		0.05%	0.25%	0.55%	0.70%		126.2		
23	210.66	2.002	3 Day Soaked	211.48	2.004	2.008	422	133.8	121.8	0.10%	0.15%	0.40%	0.39%	19.0%	126.7	0.5%	126.4
24	209.97	2.002		210.98	2.002	2.01	363	115.3		0.00%	0.25%	0.50%	0.48%		126.3		

Prep Date 5/8/2008

Description S-CI II-FC-23-4_4 5000g Soil S @ 23% with 162.6g Type I II(4%) and 162.6g Class C Fly Ash(4%)

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
				7 Day 100 F						**Date**	15-May-08						
1	197.89	1.86		197.3	1.858	2.01	330	121.7		-0.11%	0.25%	0.39%	-0.30%		127.2		
2	199.37	1.893		198.75	1.89	2.01	228	81.3	103.1	-0.16%	0.25%	0.34%	-0.31%	20.2%	126.0	0.4%	124.9
3	199.76	1.888		191.41	1.89	2.008	298	106.2		0.11%	0.15%	0.41%	-4.18%		121.6		
4	202.41	1.89		203.1	1.91	2.012	263	91.8		1.06%	0.35%	1.77%	0.34%		127.1		
5	203.22	1.89	3 Day Soaked	203.4	1.886	2.016	332	118.8	102.6	-0.21%	0.55%	0.89%	0.09%		128.4	1.0%	128.0
6	203.78	1.912		204.7	1.908	2.01	278	97.2		-0.21%	0.25%	0.29%	0.45%	19.0%	128.5		
				7 Day Ambient						**Date**	15-May-08						
7	206.68	1.94		206.59	1.93	2.01	281	96.1		-0.52%	0.25%	-0.02%	-0.04%		128.2		
8	206.11	1.915		205.89	1.91	2.01	376	131.2	110.7	-0.26%	0.25%	0.24%	-0.11%	18.9%	129.1	0.2%	128.6
9	207.24	1.935		207.11	1.935	2.008	308	104.7		0.00%	0.15%	0.30%	-0.06%		128.5		
10	207.52	1.934		208.2	1.945	2.015	273	91.9		0.57%	0.50%	1.57%	0.33%		127.6		
11	207.14	1.921	3 Day Soaked	207.6	1.945	2.004	322	108.4	111.5	1.25%	-0.05%	1.15%	0.22%	19.0%	128.6	1.2%	128.5
12	208.52	1.933		208.9	1.958	2	404	134.2		1.29%	-0.25%	0.79%	0.18%		129.1		
				28 Day Ambient						**Date**	5-Jun-08						
13	208.5	1.951		208.37	1.943	2.008	400	134.9		-0.41%	0.15%	-0.11%	-0.06%		128.7		
14	210.34	1.953		210.15	1.955	2.009	452	150.6	140.2	0.10%	0.20%	0.50%	-0.09%	19.2%	128.9	0.3%	128.7
15	209.83	1.953		209.7	1.958	2.009	407	135.2		0.26%	0.20%	0.66%	-0.06%		128.4		
16	208.86	1.94		208.93	1.943	2.01	405	136.6		0.15%	0.25%	0.65%	0.03%		128.8		
17	210.42	1.963	3 Day Soaked	210.61	1.961	2.01	321	106.3	131.5	-0.10%	0.25%	0.40%	0.09%	19.9%	128.7	0.4%	129.1
18	209.98	1.95		210.19	1.942	2.01	449	151.6		-0.41%	0.25%	0.09%	0.10%		129.7		
				90 Day Ambient						**Date**	6-Aug						
19	210.23	1.948		209.78	1.945	2.006	523	176.0		-0.15%	0.05%	-0.05%	-0.21%		129.7		
20	212.11	1.966		211.55	1.976	2.006	601	196.0	172.5	0.51%	0.05%	0.61%	-0.26%	18.5%	128.8	0.2%	129.0
21	214.99	2.01		214.51	2.006	2.006	460	145.5		-0.20%	0.05%	-0.10%	-0.22%		128.6		
22	210.5	1.958		210.85	1.966	2.008	530	174.6		0.41%	0.15%	0.71%	0.17%		128.7		
23	215.68	2.005	3 Day Soaked	216.04	2.008	2.007	462	145.9	161.0	0.15%	0.10%	0.35%	0.17%	18.8%	129.3	0.3%	129.3
24	216.84	2.013		217.02	2.008	2.006	515	162.6		-0.25%	0.05%	-0.15%	0.08%		130.0		

Prep Date 5/16/2008

Description S-CI II-FC-23-3_3 4970g of Soil S @ 23% with 121.21g of Type I II(3%) and 121.21g of type C Fly Ash(3%)

Condition As mixed — **7 Day 100 F** — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	218.7	2.031		218.3	2.054	2.01	289	87.2		1.13%	0.25%	1.64%	-0.18%		127.3		
2	216.6	2.009		216.5	2.02	2.008	354	110.5	100.0	0.55%	0.15%	0.85%	-0.05%	18.9%	128.7	0.9%	128.2
3	216.3	2.012		215.7	2.016	2.006	327	102.4		0.20%	0.05%	0.30%	-0.28%		128.7		
4	216.8	2.008	3 Day Soaked	217.25	2.034	2.006	237	72.9		1.29%	0.05%	1.40%	0.21%		128.5		
5	217.2	2.017		217.41	2.027	2.006	253	78.4	73.2	0.50%	0.05%	0.60%	0.10%	19.1%	129.0	0.7%	128.9
6	216.9	2.025		217.29	2.025	2.006	220	68.3		0.00%	0.05%	0.10%	0.18%		129.1		

7 Day Ambient — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	216.3	2.009		216.3	2.018	2.012	237	74.1		0.45%	0.35%	1.15%	0.00%		128.2		
8	217.3	2.005		217.2	2.022	2.008	306	95.3	94.6	0.85%	0.15%	1.15%	-0.05%	19.9%	129.0	0.7%	129.1
9	216.1	2.001		216.1	1.993	2.007	357	114.4		-0.40%	0.10%	-0.20%	0.00%		130.3		
10	217.5	2.014	3 Day Soaked	218	2.02	2.01	327	102.0		0.30%	0.25%	0.80%	0.23%		129.3		
11	217	2.008		217.46	2.027	2.01	279	86.5	90.9	0.95%	0.25%	1.45%	0.21%	19.2%	128.5	0.9%	129.1
12	217	2.014		217.35	2.021	2.006	270	84.2		0.35%	0.05%	0.45%	0.16%		129.4		

28 Day Ambient — Date 6/13/2008

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	216.9	2.025		216.66	2.017	2.01	378	118.3		-0.40%	0.25%	0.10%	-0.11%		128.7		
14	216.4	2.014		216	2.019	2.003	332	103.7	121.4	0.25%	-0.10%	0.05%	-0.18%	19.8%	129.1	0.1%	129.1
15	217.1	2.015		216.85	2.007	2.009	450	142.2		-0.40%	0.20%	0.00%	-0.12%		129.6		
16	217.6	2.027	3 Day Soaked	217.99	2.028	2.01	383	118.6		0.05%	0.25%	0.55%	0.18%		128.8		
17	218	2.035		218.33	2.032	2.01	354	109.2	111.5	-0.15%	0.25%	0.35%	0.15%	17.6%	128.7	0.4%	128.9
18	216.7	2.018		217.1	2.013	2.01	340	106.8		-0.25%	0.25%	0.25%	0.18%		129.2		

90 Day Ambient — Date 8/11/2008

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	217.6	2.021		217.01	2.016	2.008	430	134.7		-0.25%	0.15%	0.05%	-0.27%		129.2		
20	217.9	2.028		217.31	2.018	2.008	455	142.3	138.5	-0.49%	0.15%	-0.20%	-0.27%	19.3%	129.3	-0.1%	129.2
21	218.2	2.033		218.42	2.03	2.009	436	134.7		-0.15%	0.20%	0.25%	0.10%		129.0		
22	217.9	2.021	3 Day Soaked	218.2	2.025	2.008	408	126.7	126.4	0.20%	0.15%	0.50%	0.14%	19.2%	129.4	0.3%	129.2
23	217.2	2.021		217.34	2.019	2.008	377	117.8		-0.10%	0.15%	0.20%	0.06%		129.2		

Prep Date 3/6/2008 10:00 AM

Description S-CI II-FF-25-8_8 5100g Soil S 225% with 326.4g Type I II(8%) and 326g Class F Fly Ash(8%)

Condition As mixed — **7 Day 100 F** — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	209.84	2.028		208.96	2.025	2.009	357	110.8		-0.15%	0.20%	0.25%	-0.42%		123.8		
2	209.13	2.02		208.63	2.016	2.009	351	110.0	110.8	-0.20%	0.20%	0.20%	-0.24%	19.4%	124.1	0.3%	124.0
3	207.69	2		207.16	2.003	2.008	352	111.7		0.15%	0.15%	0.45%	-0.26%		124.2		
4	208.94	2.01	3 Day Soaked	209.52	2.014	2.006	303	95.1		0.20%	0.05%	0.30%	0.28%		125.1		
5	208.49	2.005		209.3	2.01	2.011	303	95.5	98.4	0.25%	0.30%	0.85%	0.39%	19.9%	124.6	0.7%	124.8
6	209.48	2.025		211.44	2.034	2.01	340	104.6		0.44%	0.25%	0.95%	0.94%		124.5		

7 Day Ambient — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	209.22	2.023		208.9	2.017	2.008	360	112.7		-0.30%	0.15%	0.00%	-0.15%		124.3		
8	209.14	2.028		209	2.039	2.008	406	124.3	119.4	0.54%	0.15%	0.84%	-0.07%	18.0%	123.0	0.5%	123.6
9	208.16	2.011		207.71	2.018	2.008	388	121.3		0.35%	0.15%	0.65%	-0.22%		123.6		
10	209.34	2.028	3 Day Soaked	211.28	2.034	2.009	358	110.2		0.30%	0.20%	0.70%	0.93%		124.6		
11	209.26	2.028		211.62	2.039	2.009	324	99.2	111.0	0.54%	0.20%	0.94%	1.13%	19.4%	124.5	1.1%	124.2
12	209.51	2.032		211.75	2.045	2.015	406	123.6		0.64%	0.50%	1.65%	1.07%		123.4		

28 Day Ambient — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	208.93	2.025		208.37	2.025	2.01	432	134.1		0.00%	0.25%	0.50%	-0.27%		123.3		
14	209.41	2.023		208.92	2.023	2.007	460	143.1	141.7	0.00%	0.10%	0.20%	-0.23%	18.3%	124.1	0.4%	123.6
15	208.69	2.024		208.19	2.027	2.008	477	147.8		0.15%	0.15%	0.45%	-0.24%		123.3		
16	208.5	2.015	3 Day Soaked	210.15	2.007	2.007	421	133.1		-0.40%	0.10%	-0.20%	0.79%		125.8		
17	208.85	2.02		208.9	2.028	2.006	433	134.0	131.7	0.40%	0.05%	0.50%	0.02%	18.7%	123.9	-0.1%	124.9
18	208.04	2.018		208.47	2.003	2.007	403	127.9		-0.74%	0.10%	-0.55%	0.21%		125.1		

91 Day Ambient — Date 5-Jun-08

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	208.38	2.006		207.5	2.008	2.003	536	169.3		0.10%	-0.10%	-0.10%	-0.42%		124.7		
20	207.51	2		206.82	2	2.006	502	159.8	173.2	0.00%	0.05%	0.10%	-0.33%	18.9%	124.4	-0.1%	124.4
21	208.21	2.018		207.29	2.018	2.001	609	190.4		0.00%	-0.20%	-0.40%	-0.44%		124.2		
22	208.48	2.002	3 Day Soaked	209.76	2.004	2.004	354	112.2		0.10%	-0.05%	0.00%	0.61%		126.2		
23	207.81	1.99		208.81	1.987	2.005	355	114.5	118.2	-0.15%	0.00%	-0.15%	0.48%	19.4%	126.5	0.0%	126.2
24	208.52	2.01		210.74	2.014	2.005	407	127.8		0.20%	0.00%	0.20%	1.06%		126.0		

Prep Date 5/8/2008

Description S-CI II-FF-23-4_4 5000g of Soil S @ 23% with 162.6g Type I II(4%) and 162.6g Class F Ash(4%)

Condition As mixed — **7 Day 100 F** — Date 15-May-08

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	213.77	1.999		213.31	2	2.01	300	95.5		0.05%	0.25%	0.55%	-0.22%		127.8		
2	214.09	1.99		213.66	1.99	2.01	366	117.7	116.7	0.00%	0.25%	0.50%	-0.20%	17.2%	128.6	0.4%	128.5
3	216.21	2.01		215.87	2.008	2.008	434	137.0		-0.10%	0.15%	0.20%	-0.16%		129.1		
4	214.96	2.008	3 Day Soaked	215.9	2.001	2.008	230	73.1		-0.35%	0.15%	-0.05%	0.44%		129.5		
5	215.6	2.014		216.6	2.017	2.01	243	76.1	80.7	0.15%	0.25%	0.65%	0.46%		128.7	0.4%	129.0
6	215.72	2.013		216.7	2.012	2.011	295	92.8		-0.05%	0.30%	0.55%	0.45%	18.8%	128.9		

7 Day Ambient — Date 15-May-08

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	217.5	2.027		217.41	2.031	2.001	315	97.2		0.20%	-0.20%	-0.20%	-0.04%		129.4		
8	215.3	2.016		215.26	2.019	2.01	284	88.7	110.5	0.15%	0.25%	0.65%	-0.02%	18.9%	127.7	0.3%	128.5
9	217.31	2.028		217.19	2.03	2.008	471	145.5		0.10%	0.15%	0.40%	-0.06%		128.4		
10	214.51	1.998	3 Day Soaked	215.1	1.999	2.007	331	105.5		0.05%	0.10%	0.25%	0.28%		129.3		
11	216.08	2.016		216.8	2.015	2.008	296	92.8	91.0	-0.05%	0.15%	0.25%	0.33%	18.3%	129.2	0.4%	129.0
12	215.16	2.008		215.8	2.01	2.01	237	74.7		0.10%	0.25%	0.60%	0.30%		128.6		

28 Day Ambient — Date 5-Jun-08

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	214.87	2.019		214.71	2.004	2.01	336	106.5		-0.74%	0.25%	-0.25%	-0.07%		128.4		
14	215.55	2.006		215.41	1.998	2.009	397	126.6	128.0	-0.40%	0.20%	0.00%	-0.06%	18.8%	129.3	0.1%	129.0
15	215.76	1.996		215.59	1.998	2.009	473	150.9		0.10%	0.20%	0.50%	-0.08%		129.4		
16	216.6	2.018	3 Day Soaked	216.84	2.028	2.01	374	115.8		0.50%	0.25%	1.00%	0.11%		128.1		
17	214.37	2.006		214.54	2	2.009	337	107.3	111.6	-0.30%	0.20%	0.10%	0.08%	19.2%	128.6	0.6%	128.3
18	215.34	2.006		215.28	2.015	2.009	356	111.6		0.45%	0.20%	0.85%	-0.03%		128.1		

90 Day Ambient — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	215.04	2.006		214.51	1.992	2.007	467	149.8		-0.70%	0.10%	-0.50%	-0.25%		129.4		
20	218.03	2.023		217.47	2.025	2.006	453	140.7	143.7	0.10%	0.05%	0.20%	-0.26%	18.1%	129.2	-0.1%	129.1
21	214.49	1.998		213.84	1.996	2.006	440	140.6		-0.10%	0.05%	0.00%	-0.30%		128.9		
22	215.41	2.003	3 Day Soaked	215.85	2.007	2.008	413	130.5		0.20%	0.15%	0.50%	0.20%		129.1		
23	213.44	1.998		213.98	1.999	2.009	432	137.6	128.4	0.05%	0.20%	0.45%	0.25%	18.3%	128.4	0.5%	128.9
24	216.72	2.016		217.24	2.02	2.008	375	117.0		0.20%	0.15%	0.50%	0.24%		129.1		

Prep Date 3/6/2008 11:45am

Description S-CI-II-S-25-8_8 5100g Soil S225% with 326.4g Type I II(8%) and 326.4g Slag(8%)

Condition	As mixed			7 Day 100 F						Date							
Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	207.95	2.003		207.14	1.995	2.006	402	128.6		-0.40%	0.05%	-0.30%	-0.39%		124.9		
2	209.06	2.02		208.6	2.015	2.005	452	141.7	134.0	-0.25%	0.00%	-0.25%	-0.22%	17.1%	124.6	-0.1%	124.8
3	208.46	1.995		207.4	1.993	2.008	411	131.7		-0.10%	0.15%	0.20%	-0.51%		124.9		
4	207.51	1.999	3 Day Soaked	209.6	1.987	2.007	423	136.4		-0.60%	0.10%	-0.40%	1.01%		126.8		
5	208.43	1.99		210.32	1.99	2.005	330	106.1	119.4	0.00%	0.00%	0.00%	0.91%	19.5%	127.3	0.1%	126.6
6	207.64	1.995		209.97	1.998	2.01	363	115.8		0.15%	0.25%	0.65%	1.12%		125.9		
				7 Day Ambient						Date							
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	207.78	1.996		207.52	1.994	2.003	316	101.2		-0.10%	-0.10%	-0.30%	-0.13%		125.6		
8	207.94	1.998		207.79	1.991	2.005	330	106.0	118.8	-0.35%	0.00%	-0.35%	-0.07%	19.0%	125.7	-0.6%	125.5
9	207.78	2.02		207.69	1.992	2.007	465	149.2		-1.39%	0.10%	-1.19%	-0.04%		125.3		
10	208.72	2.01	3 Day Soaked	210.92	2.014	2.007	353	110.8		0.20%	0.10%	0.40%	1.05%		125.8		
11	207.74	2.006		209.69	2.01	2.007	477	150.3	121.2	0.20%	0.10%	0.40%	0.94%	18.4%	125.4	0.4%	125.8
12	209.22	2.002		210.69	2.002	2.008	323	102.6		0.00%	0.15%	0.30%	0.70%		126.3		
				31 Day Ambient						Date	4/6/2008						
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	207.91	2		207.48	2.001	2.005	476	151.4		0.05%	0.00%	0.05%	-0.21%		124.8		
14	206.67	1.98		206.04	1.97	2.007	493	161.7	153.3	-0.51%	0.10%	-0.31%	-0.30%	18.0%	125.7	-0.1%	125.3
15	208.67	1.997		208.29	1.991	2.009	457	146.8		-0.30%	0.20%	0.10%	-0.18%		125.5		
16	208.63	1.994	3 Day Soaked	210	1.991	2.003	335	107.6		-0.15%	-0.10%	-0.35%	0.66%		127.3		
17	207.99	1.995		211.33	1.996	2.007	486	155.3	132.2	0.05%	0.10%	0.25%	1.61%	19.5%	127.2	-0.2%	127.1
18	206.3	1.992		208.5	1.982	2.004	412	133.5		-0.50%	-0.05%	-0.60%	1.07%		126.8		
				91 Day Ambient						Date	5-Jun-08						
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	205.99	1.985		204.81	1.976	2.006	531	173.2		-0.45%	0.05%	-0.35%	-0.57%		124.7		
20	207.66	1.998		206.34	1.994	2.003	645	206.5	206.9	-0.20%	-0.10%	-0.40%	-0.64%	17.2%	124.8	-0.2%	125.0
21	205.04	1.955		204.27	1.957	2.006	725	241.0		0.10%	0.05%	0.20%	-0.38%		125.6		
22	208.21	1.999	3 Day Soaked	209.23	1.989	2.003	642	206.6		-0.50%	-0.10%	-0.70%	0.49%		126.9		
23	209.03	1.998		209.75	1.992	2.006	572	183.5	192.9	-0.30%	0.05%	-0.20%	0.34%	18.8%	126.7	-0.2%	126.6
24	207.39	1.977		208.13	1.982	2.006	582	188.6		0.25%	0.05%	0.35%	0.36%		126.3		

Prep Date 3/6/2008

Description S-CI II- L-25-8_4 5200g Soil S @25% with 332.8 g Type I II(8%) and 166.4g Lime (4%)

Condition	As mixed			7 Day 100 F						Date	3/13/2008						
Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	208.31	1.975		207.55	1.975	2.004	826	269.6		0.00%	-0.05%	-0.10%	-0.36%		126.7		
2	210.81	2.006		210.08	2	2.005	807	256.9	277.3	-0.30%	0.00%	-0.30%	-0.35%	20.2%	126.5	-0.3%	126.5
3	211.32	2.014		210.32	2.009	2.002	968	305.4		-0.25%	-0.15%	-0.55%	-0.47%		126.4		
4	210.62	2.002	3 Day Soaked	210.68	2.006	2.007	655	207.2		0.20%	0.10%	0.40%	0.03%		126.2		
5	209.77	2.003		209.66	1.995	2.008	774	247.6	238.6	-0.40%	0.15%	-0.10%	-0.05%	20.6%	126.2	0.1%	126.0
6	208.76	2.002		208.87	2	2.006	820	261.0		-0.10%	0.05%	0.00%	0.05%		125.6		
				7 Day Ambient						Date	3/13/2008						
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	210.54	2.005		210.37	1.997	2.005	785	250.6		-0.40%	0.00%	-0.40%	-0.08%		126.8		
8	208.54	1.997		208.22	1.987	2.007	727	234.4	229.3	-0.50%	0.10%	-0.30%	-0.15%	20.3%	125.9	-0.3%	125.9
9	209.49	2.017		209.1	2.017	2.004	648	202.8		0.00%	-0.05%	-0.10%	-0.19%		124.9		
10	209.78	2.004	3 Day Soaked	210.11	1.997	2.007	800	255.4		-0.35%	0.10%	-0.15%	0.16%		126.4		
11	209.13	2.004		209.34	2.004	2.007	590	187.1	222.0	0.00%	0.10%	0.20%	0.10%	20.7%	125.5	0.0%	126.1
12	209.07	1.994		209.16	1.983	2.01	690	223.4		-0.55%	0.25%	-0.06%	0.04%		126.4		
				31 Day Ambient						Date	4/6/2008						
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	209.13	2.004		208.7	1.993	2.004	970	310.9		-0.55%	-0.05%	-0.65%	-0.21%		126.2		
14	209.52	2.006		209.11	2.001	2.007	940	298.9	308.3	-0.25%	0.10%	-0.05%	-0.20%	19.7%	125.6	-0.2%	125.9
15	209.15	1.996		208.6	2	2.003	990	315.1		0.20%	-0.10%	0.00%	-0.26%		125.8		
16	206.19	2.001	3 Day Soaked	209.34	2.004	2.006	995	315.5		0.15%	0.05%	0.25%	1.53%		125.7		
17	208.92	1.995		208.98	1.997	2.007	851	271.7	294.6	0.10%	0.10%	0.30%	0.03%	20.7%	125.8	0.2%	125.8
18	211.17	2.019		211.28	2.019	2.005	950	296.7		0.00%	0.00%	0.00%	0.05%		126.0		
				91 Day Ambient						Date	5-Jun-08						
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	209.63	2.015		208.51	2.018	2.002	1180	368.9		0.15%	-0.15%	-0.15%	-0.53%		124.8		
20	210.83	2.021		209.75	2.028	2.001	1330	411.7	388.4	0.35%	-0.20%	-0.05%	-0.51%	19.7%	125.0	-0.2%	125.2
21	209.29	1.998		208.1	1.991	2.005	1197	384.5		-0.35%	0.00%	-0.35%	-0.57%		125.8		
22	210.1	2.007	3 Day Soaked	209.95	2.009	2.005	1049	330.9		0.10%	0.00%	0.10%	-0.07%		125.8		
23	210.24	2.012		210.21	2.011	2.006	1042	328.1	344.7	-0.05%	0.05%	0.05%	-0.01%	19.9%	125.7	0.1%	125.6
24	210.49	2.018		210.4	2.019	2.006	1201	375.1		0.05%	0.05%	0.15%	-0.04%		125.4		

Prep Date 3/6/2008 4:00 PM

Description
S-L-23-3 5174g Soil S @23% with 126.2g Lime(3%)

Condition	As mixed			7 Day 100 F						Date							
Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	209.98	2.001		209.27	1.999	2.006	602	191.8		-0.10%	0.05%	0.00%	-0.34%		125.9		
2	209.23	1.998		208.45	1.991	2.004	596	191.4	183.3	-0.35%	-0.05%	-0.45%	-0.37%	20.0%	126.2	-0.1%	126.1
3	209.76	1.99		209.04	1.99	2.008	518	166.5		0.00%	0.15%	0.30%	-0.34%		126.1		
4	209.31	1.98	3 Day Soaked	209.42	1.984	2.014	343	110.9		0.20%	0.45%	1.10%	0.05%		126.0		
5	210.15	2.011		210.12	2.008	2.01	453	143.0	121.1	-0.15%	0.25%	0.35%	-0.01%	20.9%	125.4	0.7%	126.0
6	210.22	1.99		210.52	1.99	2.01	340	109.3		0.00%	0.25%	0.50%	0.14%		126.7		
				7 Day Ambient						Date							
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	210.14	1.997		209.84	1.995	2.007	413	132.1		-0.10%	0.10%	0.10%	-0.14%		126.4		
8	209.95	1.995		209.67	1.989	2.009	310	99.8	119.1	-0.30%	0.20%	0.10%	-0.13%	21.0%	126.4	0.2%	126.1
9	209.89	2.002		209.7	2.005	2.008	396	125.4		0.15%	0.15%	0.45%	-0.09%		125.6		
10	210.61	1.998	3 Day Soaked	210.45	1.99	2.01	323	103.9		-0.40%	0.25%	0.10%	-0.08%		126.7		
11	210.16	2		210.03	2.003	2.009	387	122.8	108.8	0.15%	0.20%	0.55%	-0.06%	20.9%	125.8	0.6%	126.1
12	210.16	1.985		209.98	2.003	2.008	314	99.7		0.91%	0.15%	1.21%	-0.09%		125.8		
				29 Day Ambient					4/4/2008	Date							
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	210.01	1.998		209.76	2	2.005	452	143.9		0.10%	0.00%	0.10%	-0.12%		126.3		
14	210.86	2.013		210.4	2.028	2.006	559	173.1	154.5	0.75%	0.05%	0.85%	-0.22%	20.9%	124.8	0.6%	126.0
15	210.05	1.975		209.65	1.98	2.01	451	146.5		0.25%	0.25%	0.75%	-0.19%		126.9		
16	208.04	1.97	3 Day Soaked	207.98	1.983	2.01	396	128.2		0.66%	0.25%	1.16%	-0.03%		125.7		
17	209.48	1.979		208.7	1.983	2.006	508	164.5	150.1	0.20%	0.05%	0.30%	-0.37%	20.9%	126.6	0.7%	126.3
18	208.84	1.983		209.47	1.989	2.007	490	157.7		0.30%	0.10%	0.50%	0.30%		126.6		
				91 Day Ambient						Date	5-Jun-08	#DIV/0!					
				Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	210.52	1.997		209.43	2.005	2.005	739	234.1		0.40%	0.00%	0.40%	-0.52%		125.8		
20	212.58	2.021		211.72	2.028	2.005	506	156.6	203.1	0.35%	0.00%	0.35%	-0.40%	21.0%	125.7	0.3%	125.9
21	211.79	2.01		210.97	2.016	2.003	698	218.7		0.30%	-0.10%	0.10%	-0.39%		126.3		
22	210.63	2.008	3 Day Soaked	210.4	2.008	2.008	647	204.3		0.00%	0.15%	0.30%	-0.11%		125.8		
23	211.16	2.013		211.12	2.016	2.012	524	164.2	172.7	0.15%	0.35%	0.85%	-0.02%	20.7%	125.2	0.5%	125.6
24	210.92	2.011		210.79	2.004	2.012	472	149.6		-0.35%	0.35%	0.35%	-0.06%		125.8		

Prep Date 3/7/2008 10:30 AM

Description
S-L-24-5 5167g Soil S @24% with 208.35 g Lime (5%)

Condition / Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
							7 Day 100 F			**Date**	14-Mar						
1	209	1.987		208.3	1.989	2.007	485	156.1		0.10%	0.10%	0.30%	-0.33%		125.85		
2	210.13	2.014		208.85	2.015	2.006	551	172.8	174.5	0.05%	0.05%	0.15%	-0.61%	20.3%	124.67	0.2%	125.2
3	210.23	2.014		209.33	2.011	2.008	618	194.6		-0.15%	0.15%	0.15%	-0.43%		124.96		
4	210.17	2.009		209.45	2.03	2.009	435	134.4		1.05%	0.20%	1.45%	-0.34%		123.74		
5	209.29	2.017	3 Day Soaked	209.7	2.011	2.01	603	189.8	169.0	-0.30%	0.25%	0.20%	0.20%	20.4%	124.93	0.8%	124.2
6	209.75	2.018		209	2.025	2.008	589	182.9		0.35%	0.15%	0.65%	-0.36%		123.90		
							7 Day Ambient			**Date**		#DIV/0!					
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
7	210.74	2.029		210.43	2.029	2.006	407	125.88		0.00%	0.05%	0.10%	-0.15%		124.75		
8	209.47	2.026		208.8	2.025	2.005	377	117.06	115.4	-0.05%	0.00%	-0.05%	-0.32%	20.4%	124.15	0.0%	124.4
9	210.25	2.037		209.99	2.03	2.007	334	103.20		-0.34%	0.10%	-0.14%	-0.12%		124.30		
10	208.6	2.01		209.26	2.014	2.013	334	104.84		0.20%	0.40%	1.00%	0.32%		124.11		
11	210.23	2.065	3 Day Soaked	211.46	2.061	2.01	391	117.20	110.7	-0.19%	0.25%	0.30%	0.59%	21.3%	122.92	0.3%	124.3
12	209.43	2.025		210.8	2.024	2.002	354	110.03		-0.05%	-0.15%	-0.35%	0.65%		125.78		
							30 Day Ambient			**Date**	4/6/2008						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
13	208.74	2.025		208.31	2.03	2.006	620	191.6		0.25%	0.05%	0.35%	-0.21%		123.4324		
14	208.78	2.035		208.31	2.023	2.004	531	165.2	178.7	-0.59%	-0.05%	-0.69%	-0.23%	20.4%	124.1068	0.0%	123.9
15	208.68	2.014		208.18	2.012	2.009	570	179.3		-0.10%	0.20%	0.30%	-0.24%		124.0875		
16	208.72	1.992		208.32	1.99	2.005	599	192.6		-0.10%	0.00%	-0.10%	-0.19%		126.0451		
17	209.1	2.021	3 Day Soaked	209.12	2.021	2.006	525	163.7	178.5	0.00%	0.05%	0.10%	0.01%	20.4%	124.4642	-0.1%	124.6
18	206.98	2.026		206.93	2.019	2.005	574	179.3		-0.35%	0.00%	-0.35%	-0.02%		123.4057		
							90 Day Ambient			**Date**	5-Jun-08						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
19	205.81	1.97		204.34	1.966	2.007	734	241.7906587		-0.20%	0.10%	0.00%	-0.71%		124.897		
20	205.05	1.995		203.94	1.993	2.006	885	283.6868198	266.8	-0.10%	0.05%	0.00%	-0.54%	20.2%	123.0864	0.0%	123.6
21	206.11	2.011		205.16	2.01	2.005	872	274.8114702		-0.05%	0.00%	-0.05%	-0.46%		122.898		
22	206.99	1.995		206.67	1.985	2.008	656	211.9792263		-0.50%	0.15%	-0.20%	-0.15%		124.9875		
23	206.49	2.015	3 Day Soaked	206.1	2.019	2.008	567	177.1009564	191.0	0.20%	0.15%	0.50%	-0.19%		122.5437	0.2%	123.4
24	206.94	2.022		206.18	2.02	2.008	589	183.7904924		-0.10%	0.15%	0.20%	-0.37%		122.5306		

Prep Date 3/7/2008

Description
S-L-25-7 5268g Soil S @25% with 295g Lime (7%)

Condition / Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
							7 Day 100 F			**Date**							
1	207.46	2		206.98	2	2.007	463	147.4		0.00%	0.10%	0.20%	-0.23%		124.4		
2	208.85	2.023		208.3	2.016	2.009	534	167.3	153.4	-0.35%	0.20%	0.05%	-0.26%	21.9%	123.9	0.0%	124.3
3	208.89	2.02		208.26	2.01	2.006	462	145.6		-0.50%	0.05%	-0.40%	-0.30%		124.6		
4	208.71	2.005		208.37	2.002	2.01	403	128.0		-0.15%	0.25%	0.35%	-0.16%		124.7		
5	207.64	2.017	3 Day Soaked	207.21	2.017	2.007	450	140.8	154.3	0.00%	0.10%	0.20%	-0.21%	21.8%	123.4	0.3%	124.2
6	209.24	2.016		208.92	2.017	2.007	620	194.0		0.05%	0.10%	0.25%	-0.15%		124.5		
							7 Day Ambient			**Date**							
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
7	209.28	2.018		208.98	2.015	2.008	332	104.1		-0.15%	0.15%	0.15%	-0.14%		124.5		
8	208.52	1.999		207.49	1.999	2.007	383	122.0	113.2	0.00%	0.10%	0.20%	-0.49%	21.2%	124.7	0.1%	124.8
9	208.82	2.004		208.64	2.002	2.007	357	113.4		-0.10%	0.10%	0.10%	-0.09%		125.2		
10	209.5	2.056		210.77	2.053	2.006	334	100.9		-0.15%	0.05%	-0.05%	0.61%		123.5		
11	209.53	2.043	3 Day Soaked	210.69	2.045	2.008	394	120.0	109.7	0.10%	0.15%	0.40%	0.55%	22.5%	123.7	0.2%	124.3
12	208.25	1.998		208.9	1.999	2.006	340	108.3		0.05%	0.05%	0.15%	0.31%		125.7		
							30 Day Ambient			**Date**	4/6/2008						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
13	209.2	2.034		208.76	2.03	2.006	560	173.0		-0.20%	0.05%	-0.10%	-0.21%		123.7		
14	207.95	2.009		207.62	2.006	2.006	521	164.8	175.7	-0.15%	0.05%	-0.05%	-0.16%	22.1%	124.5	-0.1%	124.1
15	208.32	2.018		207.65	2.015	2.006	603	189.1		-0.15%	0.05%	-0.05%	-0.32%		124.0		
16	206.68	1.998		206.41	1.989	2.008	570	183.4		-0.45%	0.15%	-0.15%	-0.13%		124.6		
17	208.12	2.01	3 Day Soaked	207.8	2.006	2.012	699	221.2	207.6	-0.20%	0.35%	0.50%	-0.15%	22.0%	123.9	0.1%	124.1
18	208.28	2.024		208.04	2.024	2.005	702	218.2		0.00%	0.00%	0.00%	-0.12%		123.8		
							90 Day Ambient			**Date**	5-Jun-08						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
19	208.6	2.025		207.54	2.021	2.005	1219	380.0		-0.20%	0.00%	-0.20%	-0.51%		123.6		
20	207.31	2.012		206.19	2.009	2.007	984	310.4	343.4	-0.15%	0.10%	0.05%	-0.54%	21.2%	123.3	-0.2%	123.5
21	207.79	2.02		206.51	2.011	2.006	1079	339.7		-0.45%	0.05%	-0.35%	-0.62%		123.5		
22	208.02	2.03		207.39	2.029	2.009	804	248.7		-0.05%	0.20%	0.35%	-0.30%		122.6		
23	208.06	2.008	3 Day Soaked	207.29	2.006	2.009	1023	323.7	264.0	-0.10%	0.20%	0.30%	-0.37%	21.3%	123.9	0.2%	123.5
24	207.94	2.016		206.97	2.012	2.005	698	219.5		-0.20%	0.00%	-0.20%	-0.47%		123.9		

Prep Date 3/7/2008 2:30 PM

Description S-CV-23-6 5100g Soil S @23% with 248.8g Type V Cement(6%)

Condition / Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
							7 Day 100 F			**Date**							
1	208.45	2.002		207.84	2	2.006	460	146.4		-0.10%	0.05%	0.00%	-0.29%		125.0		
2	209.12	2.006		208.57	1.999	2.004	463	147.5	148.8	-0.35%	-0.05%	-0.45%	-0.26%	19.7%	125.8	-0.4%	125.4
3	209.66	2.023		209.2	2.012	2.002	485	152.5		-0.54%	-0.15%	-0.84%	-0.22%		125.6		
4	209.93	2.03		211.39	2.029	2.004	444	137.3		-0.05%	-0.05%	-0.15%	0.70%		125.6		
5	209.36	2.002	3 Day Soaked	210.81	2.009	2.01	386	121.8	126.1	0.35%	0.25%	0.85%	0.69%	20.6%	125.7	0.5%	125.3
6	208.55	2.015		210.15	2.019	2.01	382	119.3		0.20%	0.25%	0.70%	0.77%		124.7		
							7 Day Ambient			**Date**							
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
7	207.78	1.991		207.7	1.98	2.003	390	126.7		-0.55%	-0.10%	-0.75%	-0.04%		126.6		
8	208.07	2.001		207.81	2.003	2.006	390	123.8	128.3	0.10%	0.05%	0.20%	-0.12%	20.4%	124.8	-0.3%	125.8
9	208.99	2.002		208.6	1.994	2.004	420	134.5		-0.40%	-0.05%	-0.50%	-0.19%		126.1		
10	207.07	1.99		209.1	1.991	2.01	305	98.0		0.05%	0.25%	0.55%	0.98%		125.8		
11	208.55	1.991	3 Day Soaked	210.5	2.002	2.01	298	94.7	87.0	0.55%	0.25%	1.05%	0.94%	21.2%	126.0	1.0%	125.4
12	207.88	2.015		211.39	2.026	2.014	220	68.2		0.55%	0.45%	1.45%	1.69%		124.5		
							30 Day Ambient			**Date**	4/6/2008						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
13	209.87	2.019		209.03	2.003	2.005	529	167.9		-0.79%	0.00%	-0.79%	-0.40%		125.7		
14	209.36	1.997		208.95	1.995	2.001	534	170.8	160.7	-0.10%	-0.20%	-0.50%	-0.20%	19.7%	126.6	-0.6%	126.0
15	208.21	1.998		207.69	1.991	2.004	446	143.3		-0.35%	-0.05%	-0.45%	-0.25%		125.7		
16	208.75	2		209.73	1.998	2.005	375	119.6		-0.10%	0.00%	-0.10%	0.47%		126.4		
17	209.2	1.999	3 Day Soaked	210.19	1.999	2.005	372	118.5	117.9	0.00%	0.00%	0.00%	0.47%	21.1%	126.6	0.1%	126.4
18	208.78	1.995		209.68	2.001	2.005	363	115.4		0.30%	0.00%	0.30%	0.43%		126.2		
							90 Day Ambient			**Date**	5-Jun-08						
				Weight (g)	**Height (in)**	**Dia. (in)**	**Strength(lbs)**	**Strength (psi)**	**Avg (psi)**	**Swell Ht**	**Swell Dia**	**Vol Swell**	**Δ Weight**	**% H2O**	**Dry Dens**	**Avg Vol Swell**	**Avg Dry Dens**
19	208.93	2.03		207.97	2.021	2.003	516	160.9		-0.44%	-0.10%	-0.64%	-0.46%		124.2		
20	208.28	2.005		207.17	2	2	536	170.6	165.4	-0.25%	-0.25%	-0.75%	-0.53%	19.4%	125.3	-0.6%	124.5
21	208.2	2.018		207.45	2.018	2.002	527	164.8		0.00%	-0.15%	-0.30%	-0.36%		124.1		
22	208.41	2.015		209.2	2.018	2.008	363	113.5		0.15%	0.15%	0.45%	0.38%		124.4		
23	208.25	2.045	3 Day Soaked	209.86	2.054	2.008	364	109.9	113.0	0.44%	0.15%	0.74%	0.77%	20.2%	122.7	0.4%	123.8
24	208.37	2.022		208.79	2.019	2.006	370	115.6		-0.15%	0.05%	-0.05%	0.20%		124.4		

Prep Date 3/7/2008 3:40 PM

Description

S-CV-23-10 5200g Soil S @24% with 419.4g Type V cement

7 Day 100 F — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	208.81	1.945		208.34	1.95	2.007	464	155.4		0.26%	0.10%	0.46%	-0.23%		128.4		
2	212.54	1.99		211.87	1.975	2.01	404	131.9	141.0	-0.75%	0.25%	-0.26%	-0.32%	18.5%	128.5	0.3%	128.2
3	212.86	1.986		212.12	1.992	2.009	423	135.7		0.30%	0.20%	0.70%	-0.35%		127.7		
4	212.65	1.986		213.84	1.995	2.01	378	120.9		0.45%	0.25%	0.95%	0.56%		128.4		
5	213.2	1.991	3 Day Soaked	214.16	1.995	2.007	480	153.6	150.4	0.20%	0.10%	0.40%	0.45%	18.9%	129.0	0.6%	128.7
6	213.81	2.001		215.02	2	2.011	555	176.7		-0.05%	0.30%	0.55%	0.57%		128.7		

7 Day Ambient — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	212.41	1.985		212.32	1.997	2.008	440	140.5		0.60%	0.15%	0.91%	-0.04%		127.6		
8	213.54	1.998		213.4	2.007	2.006	441	139.4	144.7	0.45%	0.05%	0.55%	-0.07%	18.5%	127.9	0.6%	128.1
9	209.94	1.96		209.83	1.958	2.008	464	154.1		-0.10%	0.15%	0.20%	-0.05%		128.6		
10	210.84	1.981		212.14	1.982	2.008	383	124.1		0.05%	0.15%	0.35%	0.62%		128.5		
11	212.25	1.997	3 Day Soaked	213.99	1.989	2.009	451	145.2	134.1	-0.40%	0.20%	0.00%	0.82%	18.7%	129.0	0.3%	128.9
12	211.52	1.975		213.21	1.982	2.008	410	132.9		0.35%	0.15%	0.65%	0.80%		129.1		

30 Day Ambient — Date 4/6/2008

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	215.1	2.03		214.6	2.028	2.007	515	159.4		-0.10%	0.10%	0.10%	-0.23%		127.2		
14	213.27	2.012		212.8	2.01	2.007	561	176.8	170.4	-0.10%	0.10%	0.10%	-0.22%	18.5%	127.2	0.1%	127.6
15	211.86	1.98		211.4	1.98	2.007	539	175.1		0.00%	0.10%	0.20%	-0.22%		128.3		
16	212.6	1.988		213.3	1.983	2.005	550	178.1		-0.25%	0.00%	-0.25%	0.33%		129.5		
17	212.78	1.995	3 Day Soaked	212.28	1.994	2.004	491	157.2	168.3	-0.05%	-0.05%	-0.15%	-0.23%	19.1%	128.3	0.1%	128.6
18	213.41	2.001		214.14	2.009	2.007	538	169.7		0.40%	0.10%	0.60%	0.34%		128.1		

90 Day Ambient — Date 5-Jun-08 #DIV/0!

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	213.18	1.998		212.25	1.995	2.008	651	208.3		-0.15%	0.15%	0.15%	-0.44%		127.7		
20	213.36	2.001		212.43	1.999	2.009	582	185.4	191.9	-0.10%	0.20%	0.30%	-0.44%	18.1%	127.4	0.4%	127.4
21	213.03	1.998		212.07	1.997	2.012	570	182.0		-0.05%	0.35%	0.65%	-0.45%		127.0		
22	212.26	1.988		213.6	1.982	2.008	526	170.5		-0.30%	0.15%	0.00%	0.63%		129.4		
23	214.65	2.003	3 Day Soaked	215.75	2.006	2.005	497	157.3	168.4	0.15%	0.00%	0.15%	0.51%	19.2%	129.5	0.1%	129.2
24	214.75	2.024		216.75	2.021	2.008	569	177.4		-0.15%	0.15%	0.15%	0.93%		128.7		

Prep Date 3/7/2008

Description S-CV-25-14 5200g Soil S @25% with 582.4g Type V Cement (14%)

7 Day 100 F — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
1	211.3	2.01		210.37	2.019	2.002	360	112.4		0.45%	-0.15%	0.15%	-0.44%		125.8		
2	211.22	1.999		210.39	1.996	2.009	441	140.9	136.8	-0.15%	0.20%	0.25%	-0.39%	19.6%	126.4	0.1%	126.3
3	211.92	2.008		211.17	2.008	2.005	497	156.9		0.00%	0.00%	0.00%	-0.35%		126.6		
4	212.42	2.017		212.8	2.023	2.011	435	135.3		0.30%	0.30%	0.90%	0.18%		125.9		
5	211.27	2.003	3 Day Soaked	211.88	2.008	2.017	371	117.2	127.6	0.25%	0.60%	1.45%	0.29%	19.9%	125.5	0.9%	125.9
6	211.72	2.015		212.37	2.017	2.008	416	130.2		0.10%	0.15%	0.40%	0.31%		126.4		

7 Day Ambient — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
7	211.55	2.015		211.44	2.012	2.007	383	120.5		-0.15%	0.10%	0.05%	-0.05%		126.3		
8	213.5	2.021		213.31	2.02	2.013	569	177.5	141.7	-0.05%	0.40%	0.75%	-0.09%	19.4%	126.1	0.3%	126.3
9	212.49	2.016		212.36	2.015	2.008	405	127.0		-0.05%	0.15%	0.25%	-0.06%		126.5		
10	209.9	1.99		210.49	1.995	2.004	423	135.3		0.25%	-0.05%	0.15%	0.28%		127.2		
11	211.03	2.002	3 Day Soaked	211.66	2.008	2.008	423	133.6	139.2	0.30%	0.15%	0.60%	0.30%	20.7%	126.5	0.5%	127.0
12	213.05	2.008		213.74	2.012	2.01	473	148.8		0.20%	0.25%	0.70%	0.32%		127.3		

28 Day Ambient — Date

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
13	213.37	2.03		212.9	2.033	2.009	452	139.2		0.15%	0.20%	0.55%	-0.22%		125.6		
14	212.96	2.016		212.35	2.014	2.003	425	133.4	141.2	-0.10%	-0.10%	-0.30%	-0.29%	20.1%	127.2	0.1%	126.6
15	212.45	2.013		212.21	2.008	2.007	478	150.9		-0.25%	0.10%	-0.05%	-0.11%		127.0		
16	213.48	2.01		213.62	2.011	2.006	370	116.5		0.05%	0.05%	0.15%	0.07%		127.8		
17	213.02	2.015	3 Day Soaked	213.51	2.008	2.012	480	151.6	135.9	-0.35%	0.35%	0.35%	0.23%	20.1%	127.1	0.3%	127.3
18	213	2.015		213.46	2.018	2.007	447	139.8		0.15%	0.10%	0.35%	0.22%		127.1		

90 Day Ambient — Date 5-Jun-08

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Avg (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens	Avg Vol Swell	Avg Dry Dens
19	212.48	2.001		211.6	1.995	2.006	767	245.4		-0.30%	0.05%	-0.20%	-0.41%		127.6		
20	210	1.986		209.09	1.981	2.009	714	231.7	231.9	-0.25%	0.20%	0.15%	-0.43%	19.4%	126.6	0.0%	127.1
21	210.21	1.98		209.28	1.976	2.007	671	218.8		-0.20%	0.10%	0.00%	-0.44%		127.3		
22	211.33	1.985		211.59	1.985	2.008	694	224.3		0.00%	0.15%	0.30%	0.12%		128.0		
23	213.12	2.011	3 Day Soaked	213.52	2.006	2.009	584	184.8	200.8	-0.25%	0.20%	0.15%	0.19%	20.0%	127.7	0.2%	127.6
24	212.39	2.01		212.6	2.001	2.011	608	193.3		-0.45%	0.30%	0.15%	0.10%		127.2		

Prep Date 2/19/2008

Description

Soil S with no stabilizer

Condition: As mixed / Initial / Date

Samples	Weight (g)	Height (in)	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
21%	205.16	2.205	250.9	2.503	2.187	4	0.8	13.51%	8.59%	33.85%	22.29%	47.8%	68.65
24.00%	200.31	2.079	228.47	2.261	2.116	8	2.0	8.75%	5.48%	21.01%	14.06%	41.5%	73.92
27.00%	198.57	1.904	226.22	2.171	2.159	8	2.2	14.02%	7.63%	32.08%	13.92%	43.8%	73.22
30.00%	205.59	2.027	217.58	2.151	2.067	23	6.3	6.12%	3.04%	12.67%	5.83%	37.3%	83.46
33.00%	205.88	2.08	219.44	2.169	2.064	12	3.2	4.28%	2.89%	10.40%	6.59%	41.5%	83.72

Prep Date 4/1/2008

Description

?-CI II-34-10 Soil 750g at 34% WITH 56G Type I II Cement

Condition: As mixed / 7 Day Ambient / Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
1	198.01	1.982		197.93	1.99	2.006	314	101	0.40%	0.05%	0.50%	-0.04%	29.4%	88.1
2	197.99	1.978	3 Day Soaked	207.27	2.049	2.04	108	33	3.59%	1.75%	7.24%	4.69%	35.7%	86.7

28 Day Soaked — Date 5/4/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
3	197.99	1.978	3 Day Soaked	208.52	2.054	2.035	141	43	3.84%	1.50%	6.97%	5.32%	34.1%	88.5

90 Day Soaked — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
4	199.84	1.993	3 Day Soaked	205.2	2.035	2.037	205	63.0	2.11%	1.60%	5.39%	2.68%	31.5%	87.7

Prep Date 4/1/2008

Description

?-L-34-5750g ? @ 34% with 28g Lime

Condition: As mixed / 7 Day Ambient / Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
1	197.94	2.004		197.82	2.038	2.032	309	95	1.70%	1.35%	4.45%	-0.06%	32.1%	81.5
2	196.73	1.995	3 Day Soaked	209.01	2.119	2.075	123	35	6.22%	3.49%	13.76%	6.24%	39.5%	79.5

28 Day Soaked — Date 5/4/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
3	197.26	2.002	3 Day Soaked	206.72	2.12	2.077	134	38	5.89%	3.59%	13.64%	4.80%	38.3%	79.1

90 Day Soaked — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
4	176.74	1.785	3 Day Soaked	180.58	1.854	2.055	222	82.2	3.87%	2.49%	9.11%	2.17%	33.6%	80.7

Prep Date 4/1/2008

Description ?-L-CI II-34-4 8 750g ? @ 34% with 44.8g Type I II and 22.4 g Lime

Condition: As mixed / 7 Day Ambient / Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
1	198.32	1.993		198.23	2.004	2.012	439	139.2	0.55%	0.35%	1.26%	-0.05%	29.6%	91.3
2	197.6	1.996	3 Day Soaked	210.05	2.082	2.054	184	54.0	4.31%	2.44%	9.47%	6.30%	36.7%	84.6

28 Day Soaked — Date 5/4/2008

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
3	196.38	1.983	3 Day Soaked	209.61	2.095	2.063	232	67.3	5.65%	2.89%	11.85%	6.74%	35.7%	83.9

90 Day Soaked — Date

Samples	Weight (g)	Height (in)		Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
4	199.1	2.022	3 Day Soaked	213.43	2.135	2.085	259	72.3	5.59%	3.99%	14.18%	7.20%	35.8%	82.0

Prep Date 4/1/2008

Descriptio
?-FC-34-15 750g ? Soil at 34% with 84 g Class C Ash

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Test	Date	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
1	197.13	1.954		7 Day Ambient		197.04	1.95	2.006	198	66.3	-0.20%	0.05%	-0.11%	-0.05%	27.5%	92.3
2	198.3	1.964	3 Day Soaked	7 Day Ambient		204.95	2.01	2.019	61	19.2	2.34%	0.70%	3.78%	3.35%	31.7%	91.9
3	200.48	2.001	3 Day Soaked	28 Day Soaked	5/4/2008	204.55	2.015	2.015	94	29.5	0.70%	0.50%	1.71%	2.03%	32.0%	91.7
4	201.49	2.006	3 Day Soaked	90 Day Soaked		203.1	2.004	2.015	163	51.7	-0.10%	0.50%	0.90%	0.80%	29.8%	91.5

Prep Date 4/8/2005

Description ?-S-CI II-34-8 8750g ? Soil @ 34% with 44.8g Type I II and 44.8 g Slag

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Test	Date	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
1	198.55	2.003		7 Day Ambient		198.48	2.028	2.01	383	118.6	1.25%	0.25%	1.75%	-0.04%	27.2%	92.2
2	198.78	1.995	3 Day Soaked	7 Day Ambient		209.8	2.072	2.031	162	48.0	3.86%	1.30%	6.57%	5.54%	32.6%	89.6
3	198.41	1.991	3 Day Soaked	28 Day Soaked		205.67	2.032	2.025	182	56.1	2.06%	1.00%	4.11%	3.66%	32.0%	90.5
4	198.45	1.985	3 Day Soaked	90 Day Soaked		203.15	2.008	2.023	203	64.1	1.16%	0.90%	2.98%	2.37%	31.0%	90.6

Prep Date 4/8/2008

Description ?-FC-CI II-34-8 8750g ? @ 34% with 44.8g Class C Ash and 44.8g Type I II Cement

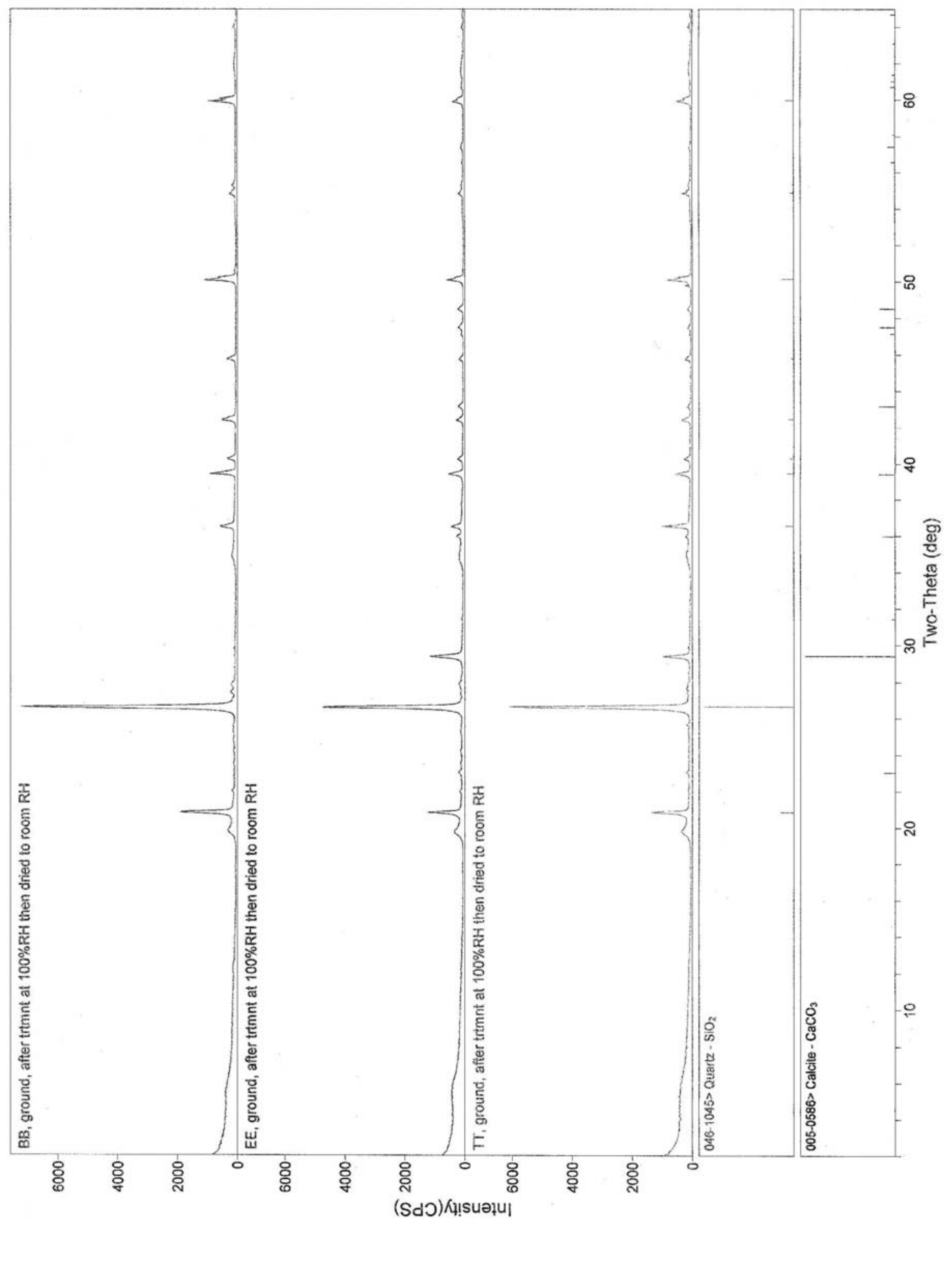
Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Test	Date	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
1	198.13	1.975		7 Day Ambient		198.03	1.978	2.009	387	126	0.15%	0.20%	0.55%	-0.05%	26.6%	90.5
2	199.94	1.996	3 Day Soaked	7 Day Ambient		208.2	2.09	2.044	125	36	4.71%	1.95%	8.82%	4.13%	32.6%	87.0
3	200.38	2.001	3 Day Soaked	28 Day Soaked	5/9/2008	207.53	2.049	2.037	128	38.8	2.40%	1.60%	5.69%	3.57%	32.5%	89.2
4	198.94	1.989	3 Day Soaked	90 Day Soaked		204.92	2.019	2.031	162	50.6	1.51%	1.30%	4.16%	3.01%	30.0%	89.9

Prep Date 4/8/2008

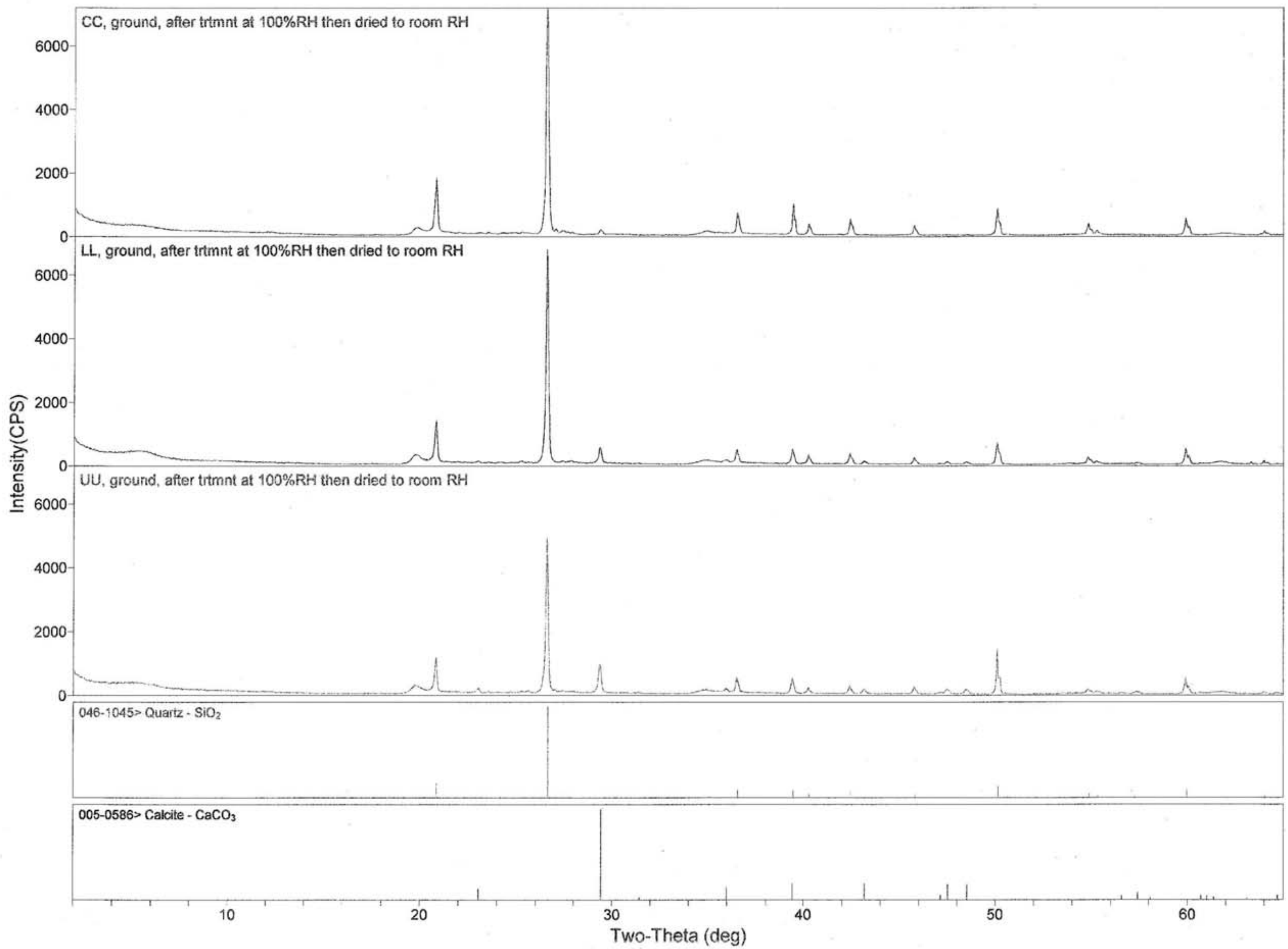
Description
?-FF-CI II- 34-8 8750g ? @ 34% with 44.8g Type I II and 44.8g

Samples	As mixed Weight (g)	As mixed Height (in)	Condition	Test	Date	Weight (g)	Height (in)	Dia. (in)	Strength(lbs)	Strength (psi)	Swell Ht	Swell Dia	Vol Swell	Δ Weight	% H2O	Dry Dens
1	194.58	1.978		7 Day Ambient		194.32	1.978	2.009	276	89.8	0.00%	0.20%	0.40%	-0.13%	28.0%	92.0
2	197.8	1.987	3 Day Soaked	7 Day Ambient		205.74	2.029	2.033	122	37.7	2.11%	1.40%	4.99%	4.01%	33.1%	89.2
3	198.89	2.01	3 Day Soaked	28 Day Soaked	5/9/2008	208	2.065	2.038	130	38.8	2.74%	1.65%	6.15%	4.58%	33.3%	88.0
4	199.08	2.01	3 Day Soaked	90 Day Soaked		203.57	2.038	2.02	189	57.9	1.39%	0.75%	2.92%	2.26%	30.1%	88.9

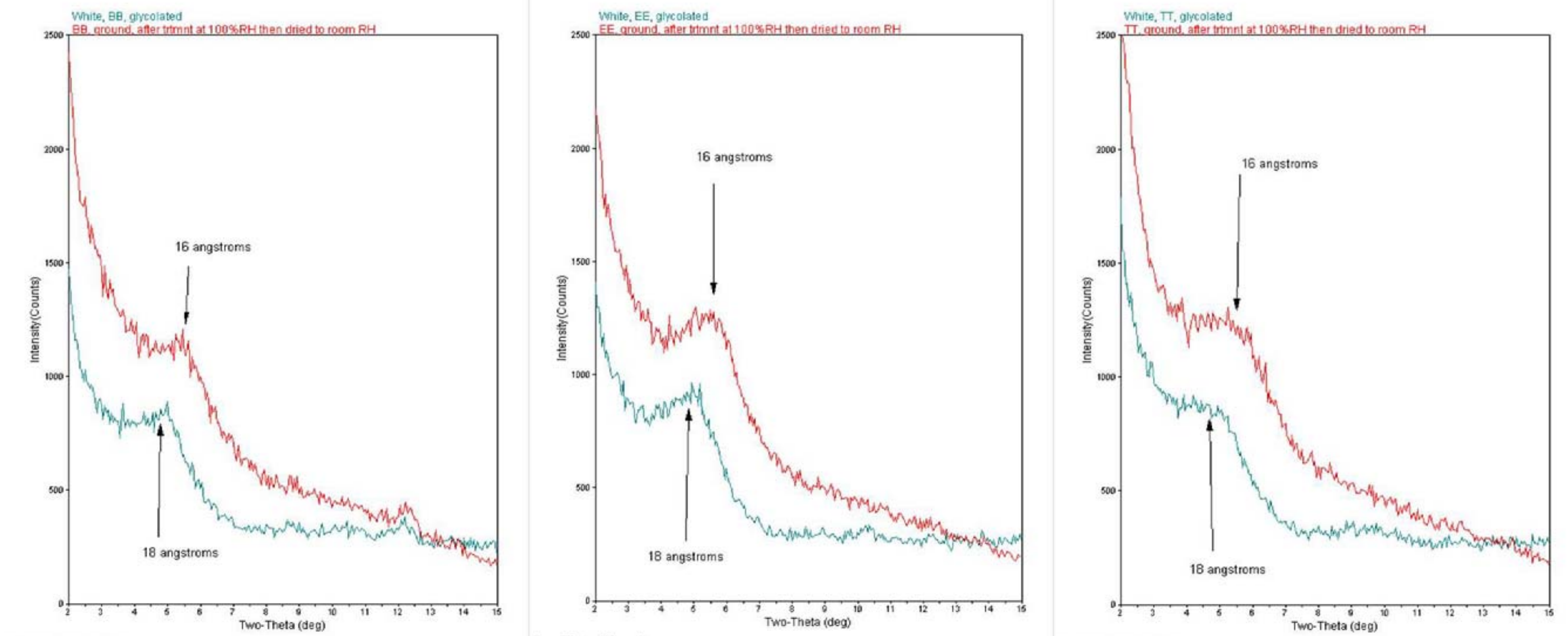
APPENDIX C. SOIL XRD DIFFRACTOGRAMS



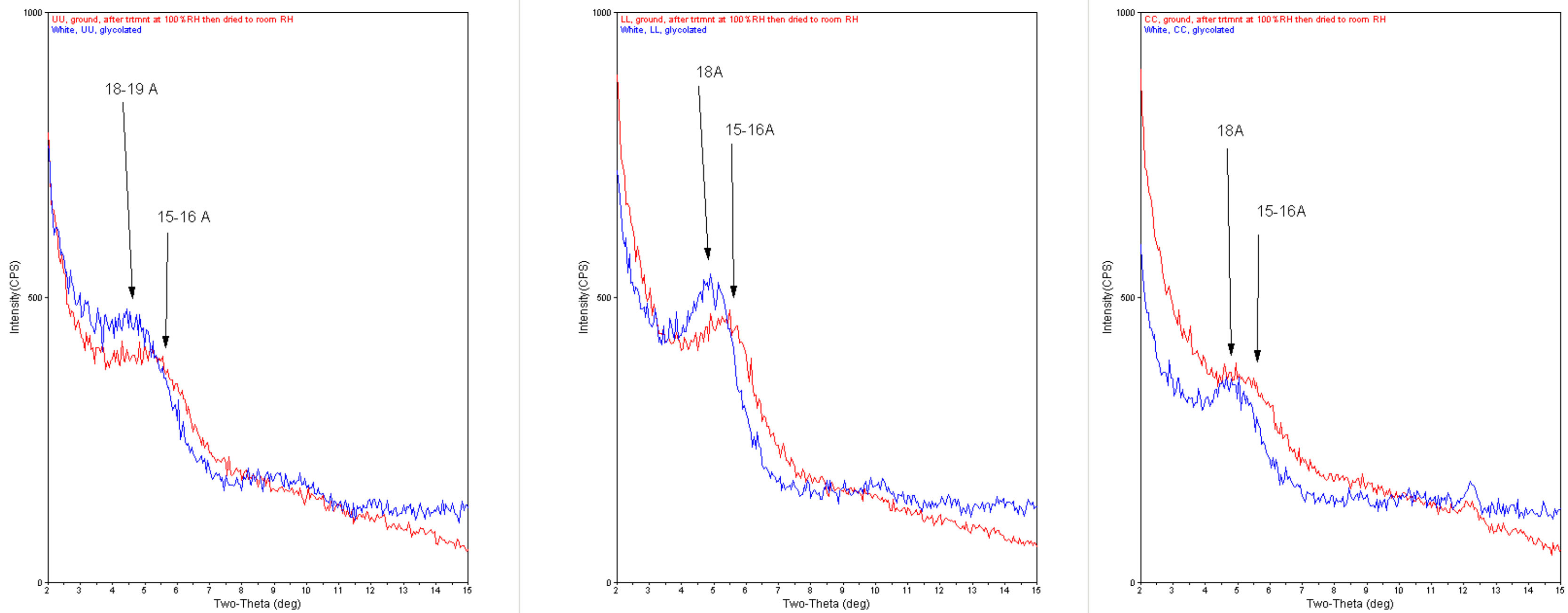
Diffractograms of received soils, BB is S soil type, EE and TT are L soil Type



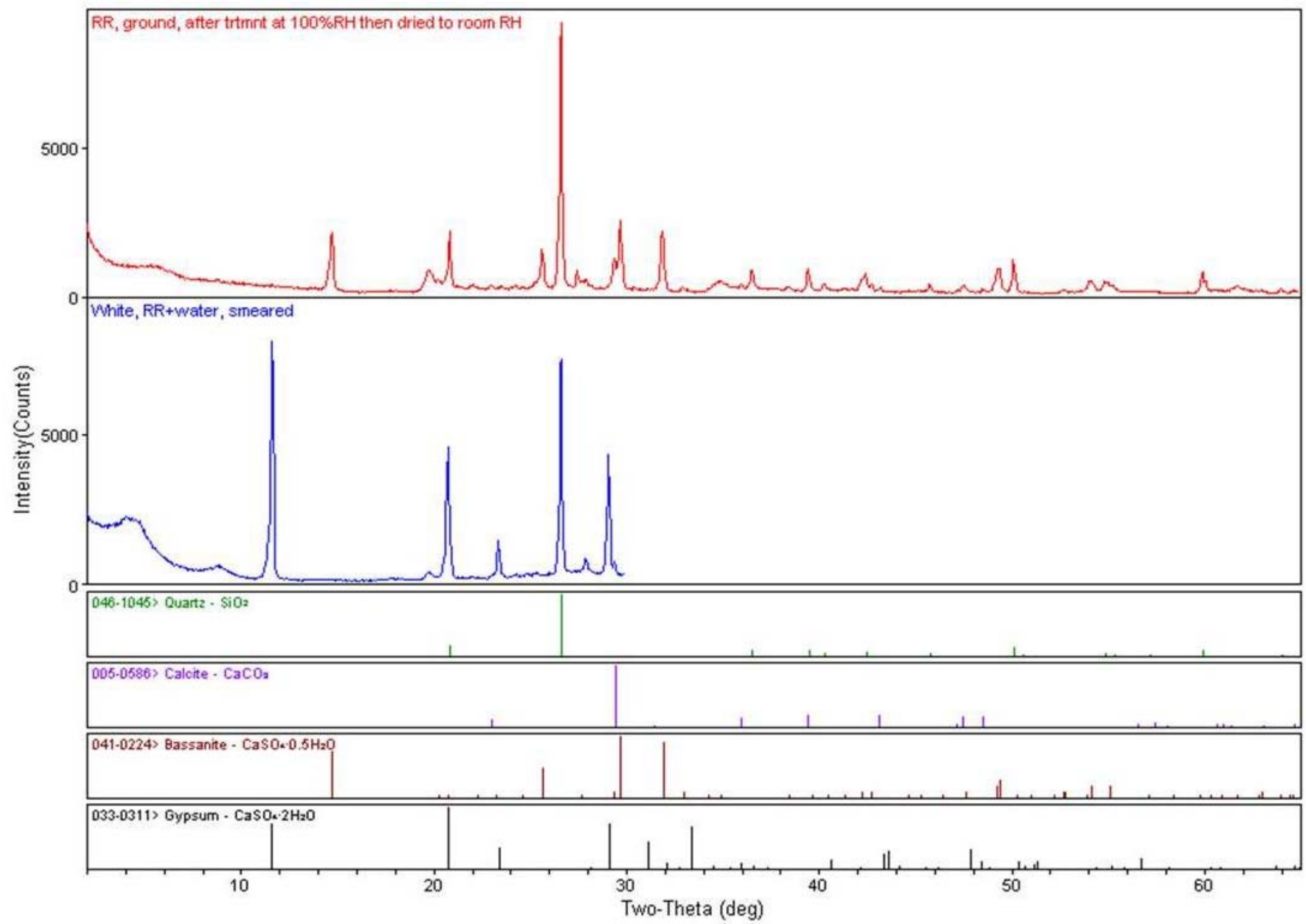
Diffractograms of received soils, CC is S soil type, LL and UU are L soil Type



Diffractograms of received soils, BB is S soil type, EE and TT are L soil type. Overlays show glycolated treatment for expansive mineral investigation. Samples display presence of swelling clays.

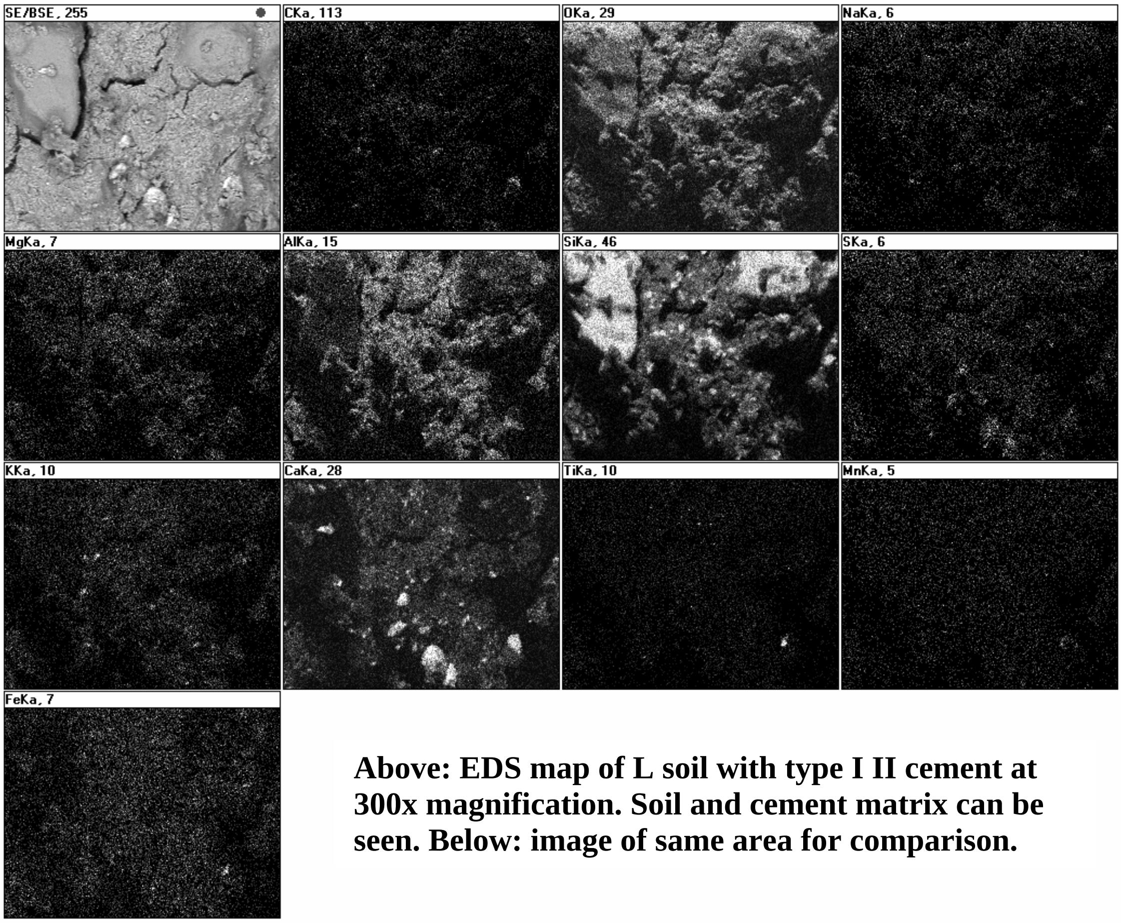


Diffractograms of received soils, CC is S soil type, LL and UU are L soil type. Overlays show glycolated treatment for expansive mineral investigation. Samples display presence of swelling clays

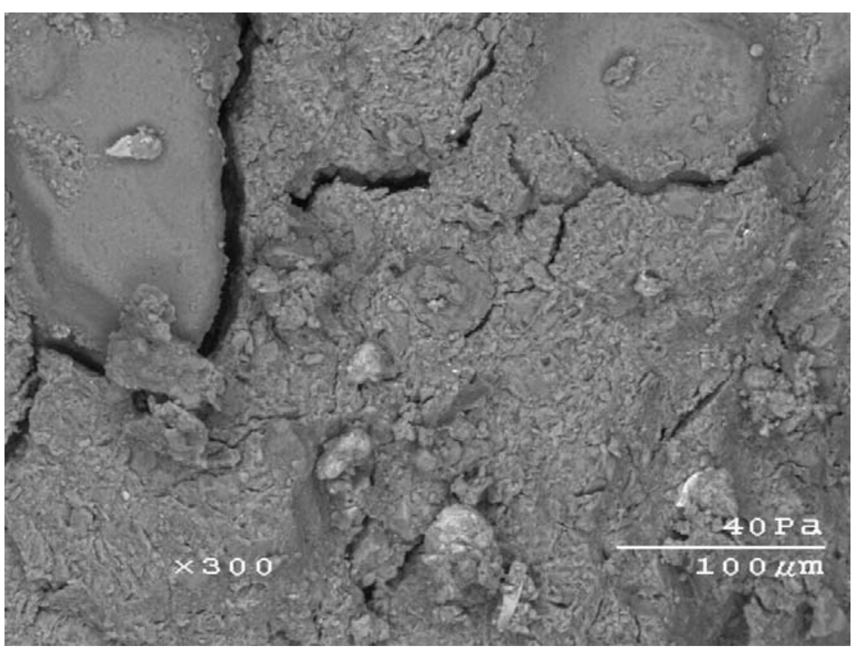


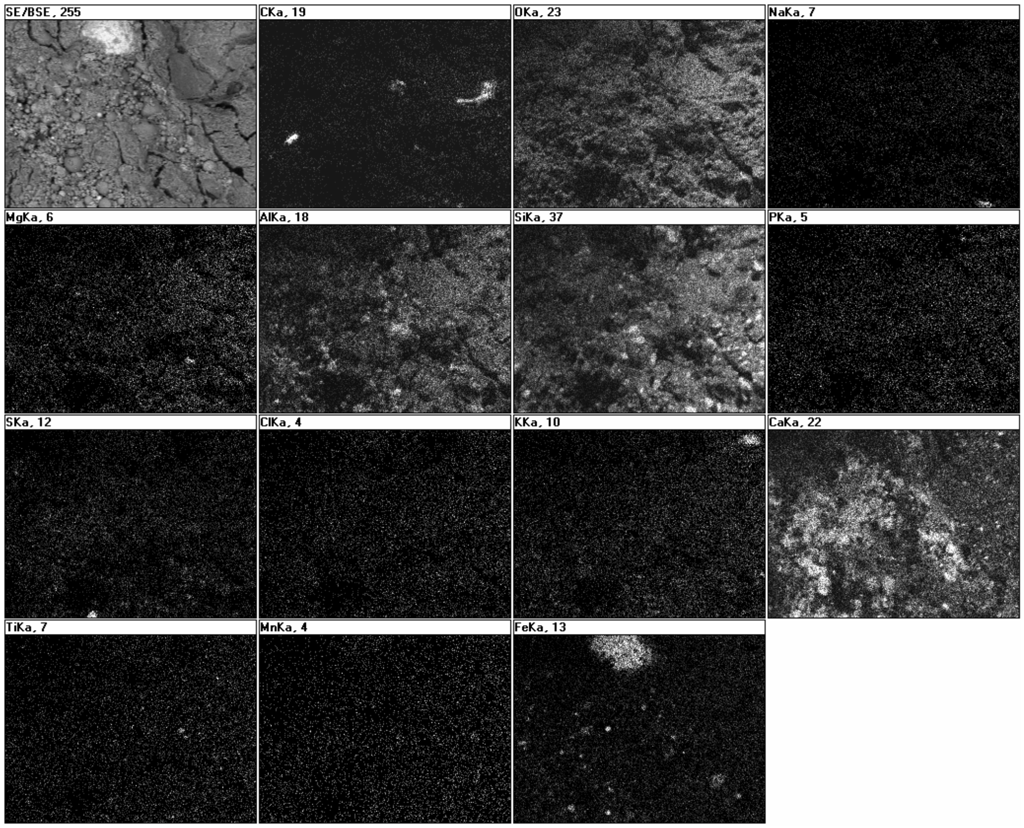
Diffractograms of RR soil containing high sulfate content. Samples treated at 100% Rh and water treatment. Water treated sample was smeared onto slide causing some orientation of clay minerals. Water treatment resulted in hydration of bassanite to gypsum and expansion of clay basal plane to 20 angstroms.

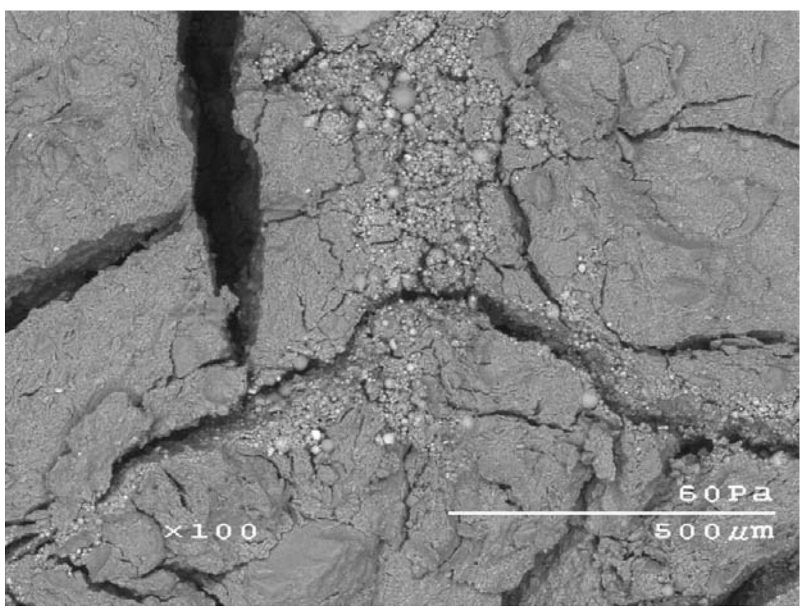
APPENDIX D. SEM IMAGES



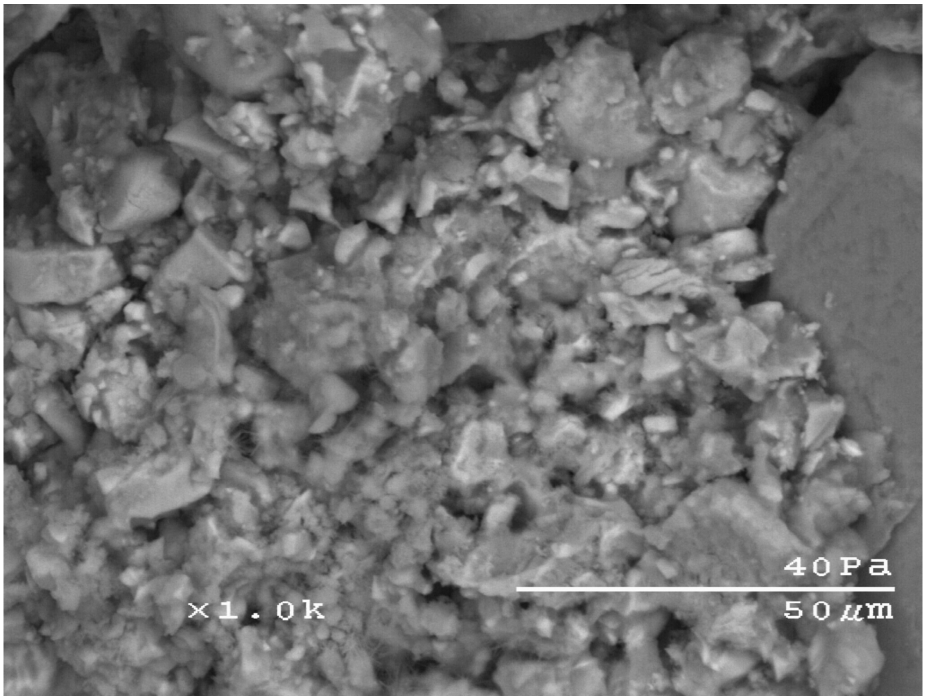
Above: EDS map of L soil with type I II cement at 300x magnification. Soil and cement matrix can be seen. Below: image of same area for comparison.



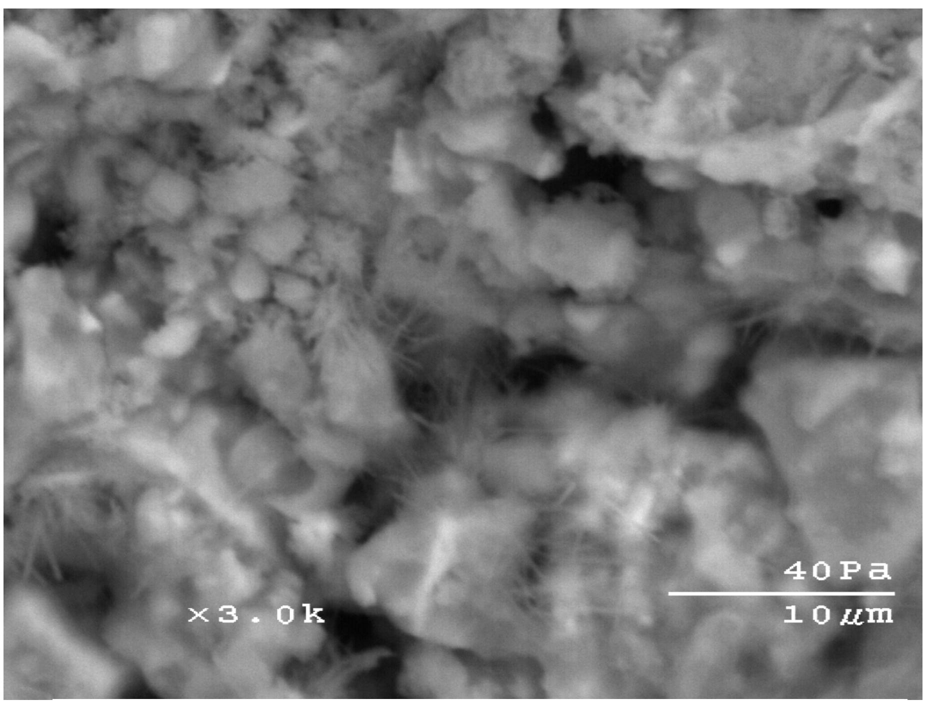




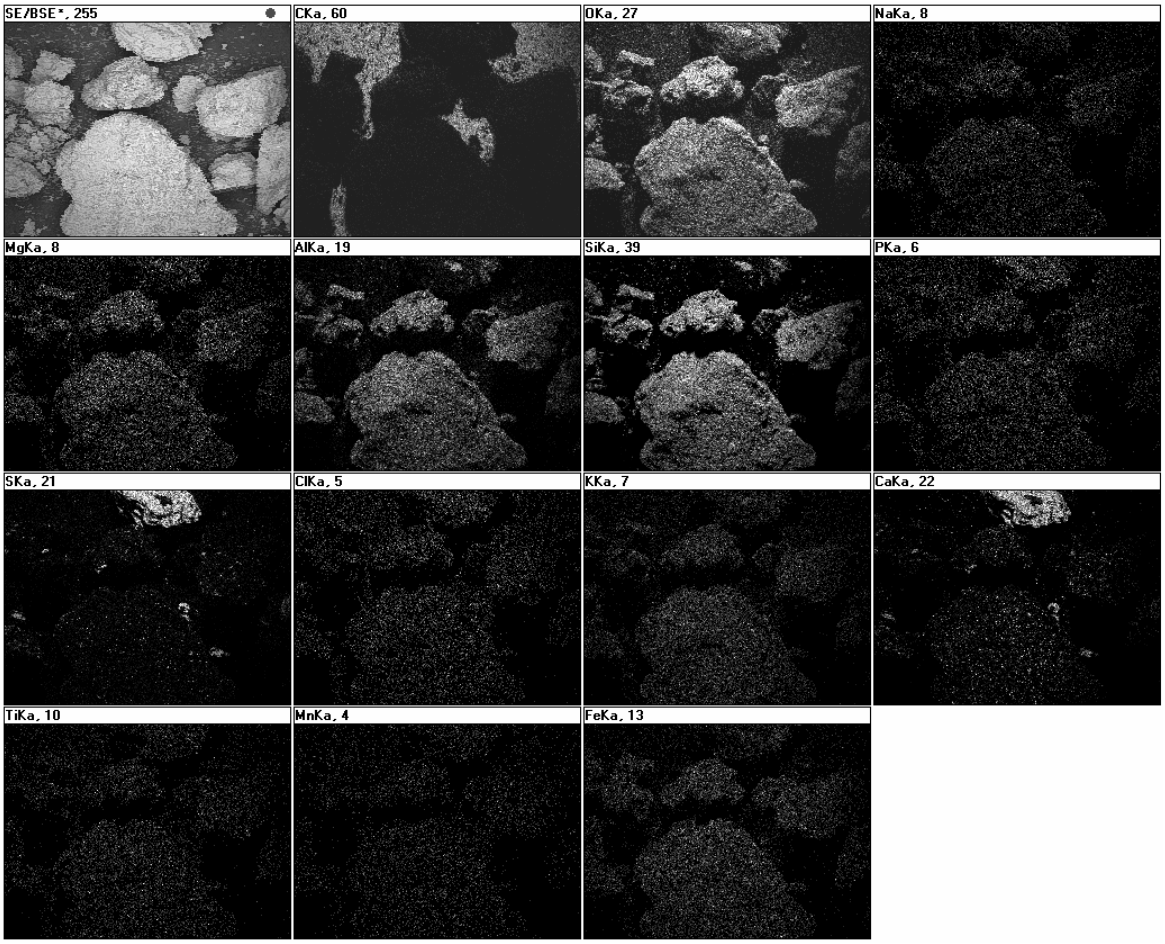
Top: EDS map of L soil with type I II cement and class F fly ash at 300x magnification. Bottom: L with type I II cement and class C fly ash at 100x magnification. Soil and cement matrix can be seen.

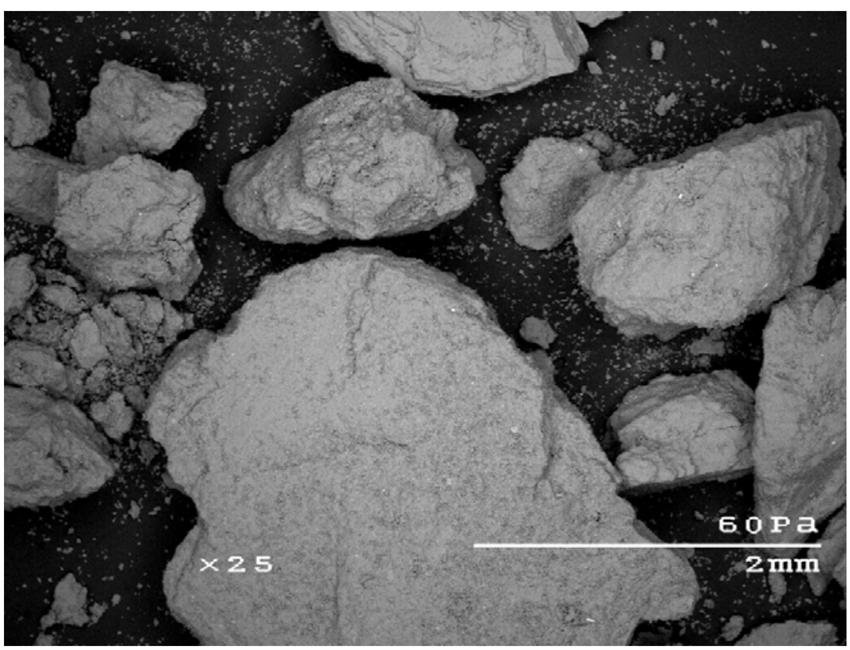


Soil L with lime and type I II cement, magnified 1000x

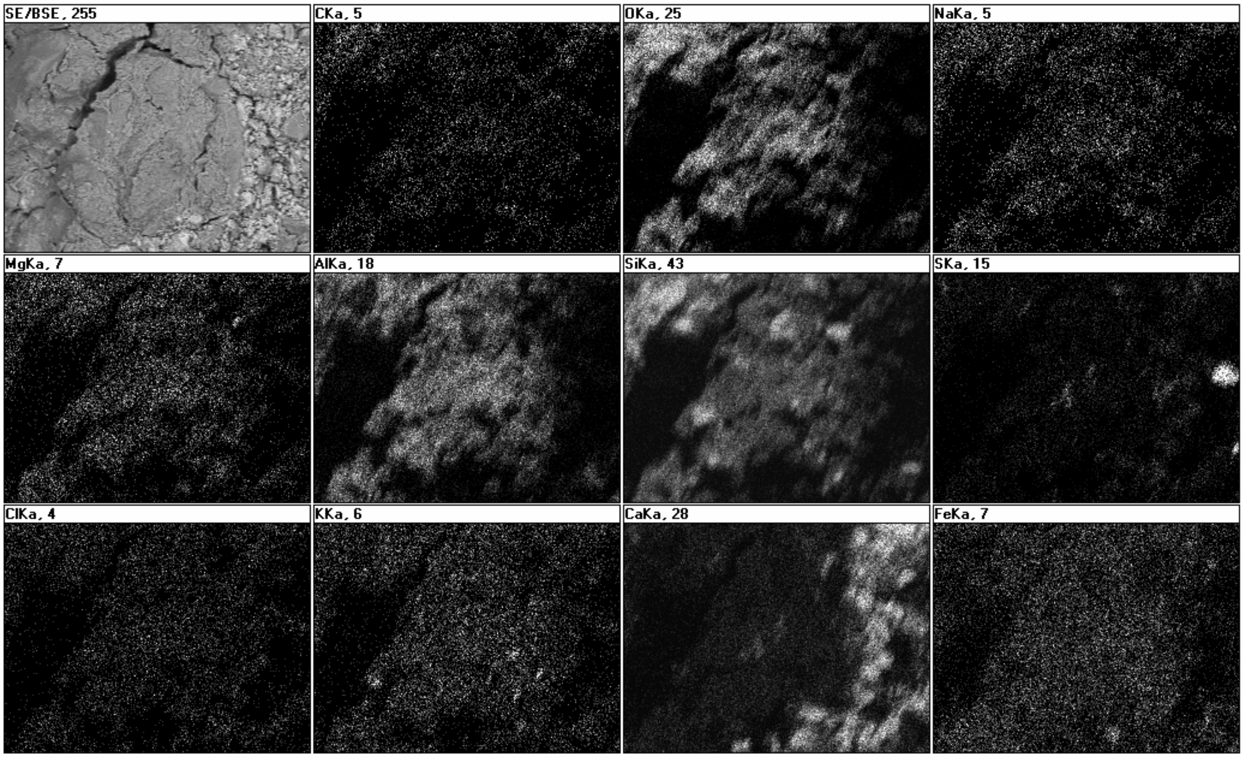


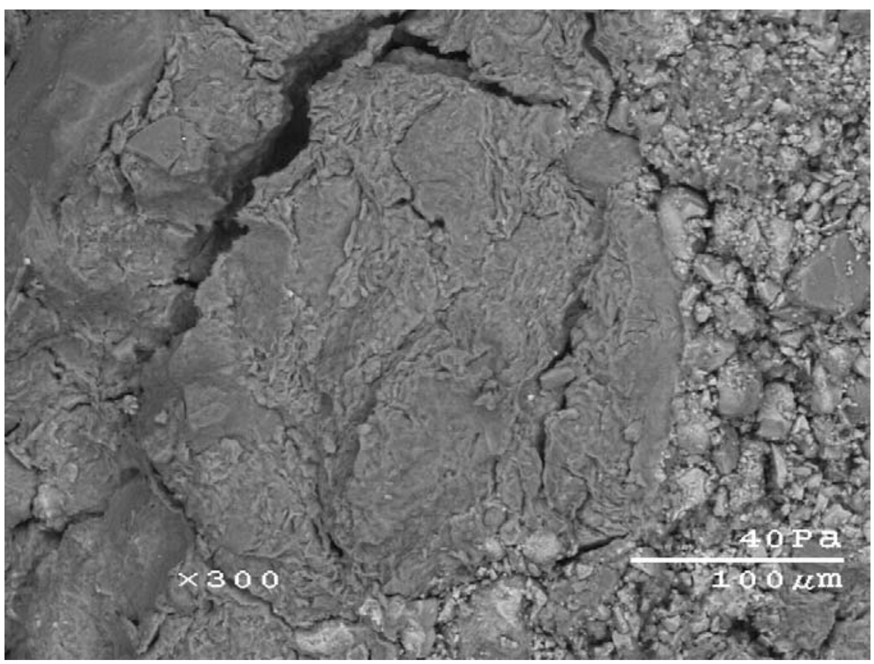
Soil L with lime and type I II cement, magnified 3000x





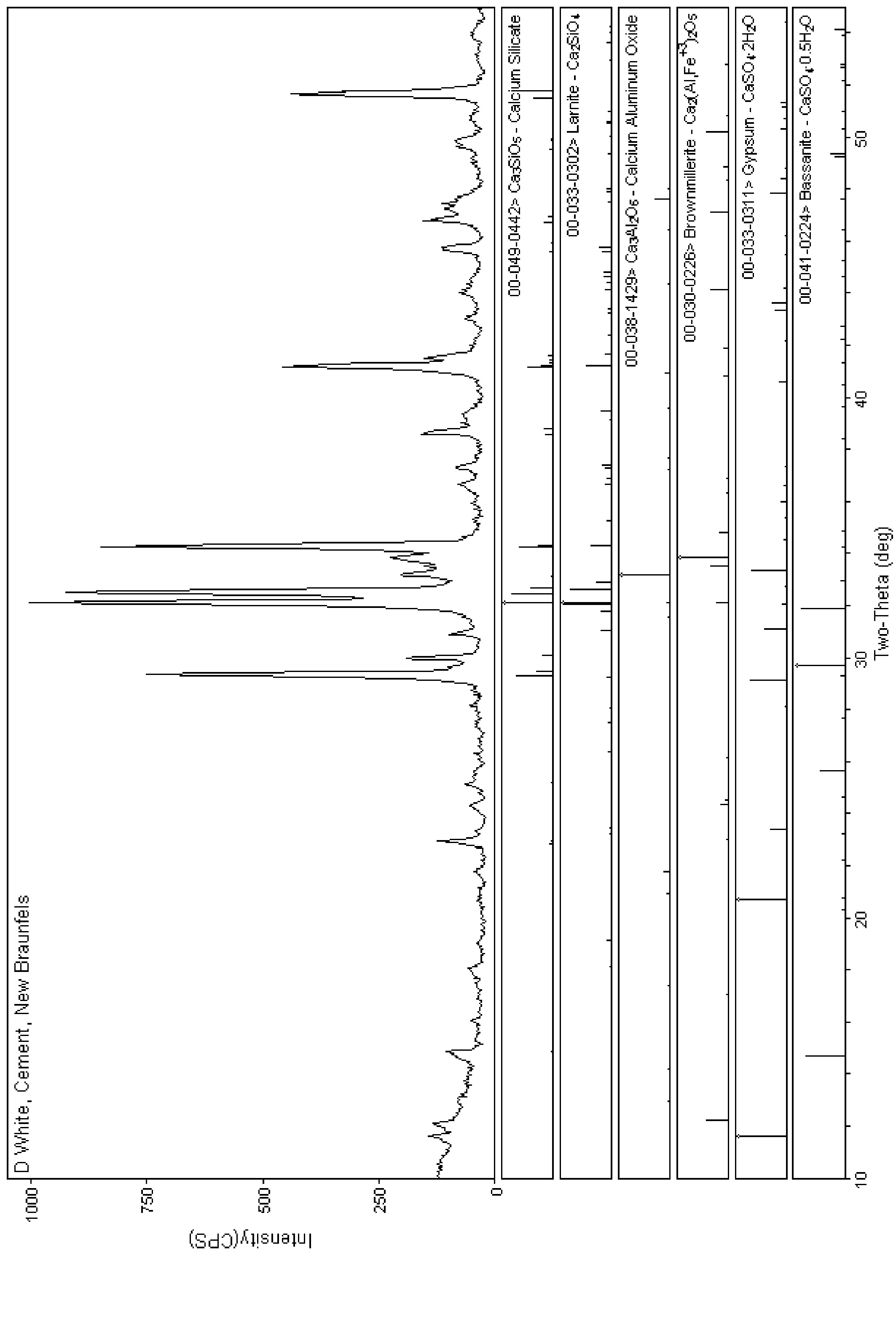
Top: EDS map of high sulfate soil. Bottom: SEM image of sample mapped at 25x magnification



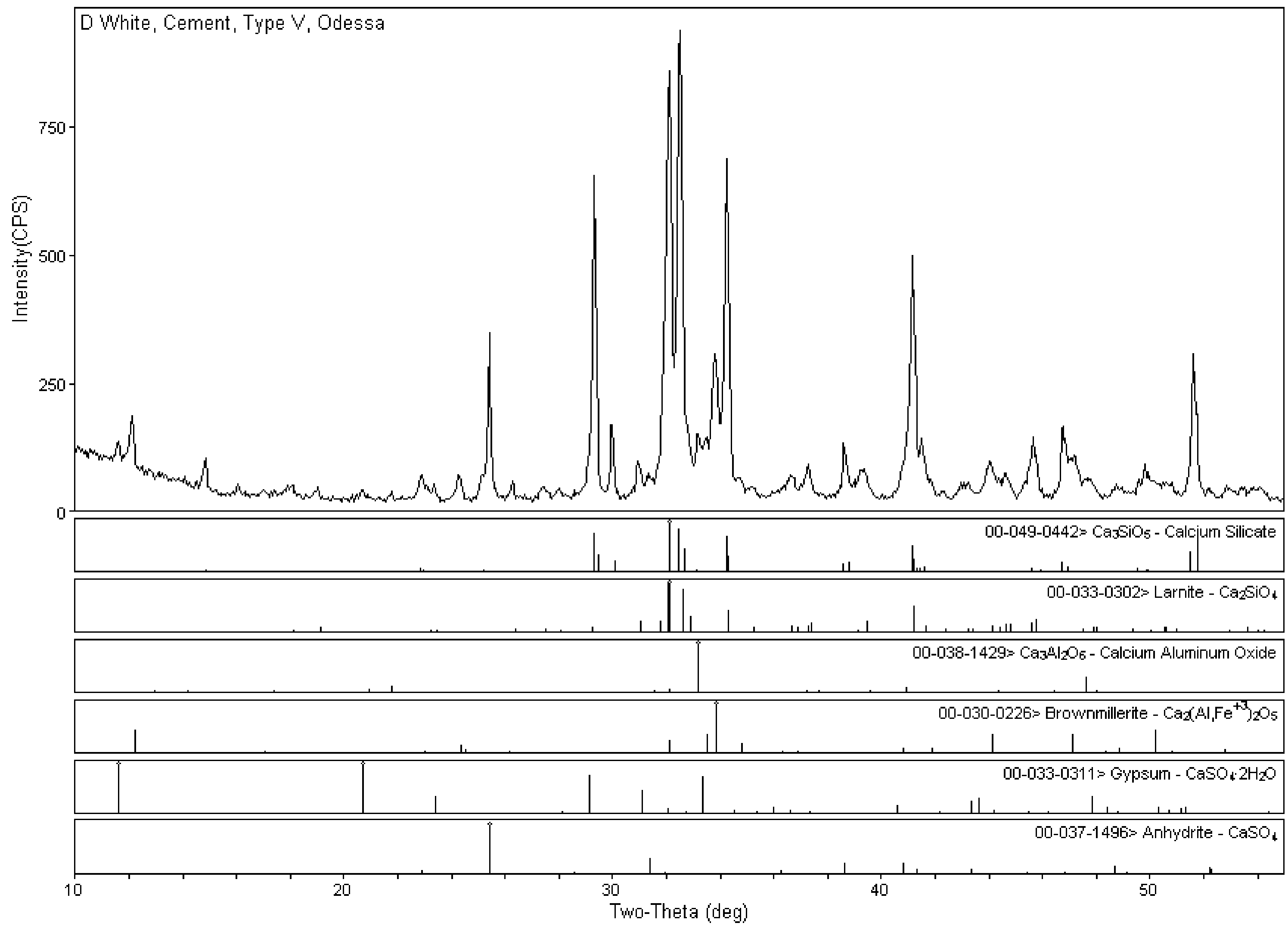


Above: EDS map of S soil type V cement batch. Below: SEM image S soil and type V cement at 300x magnification.

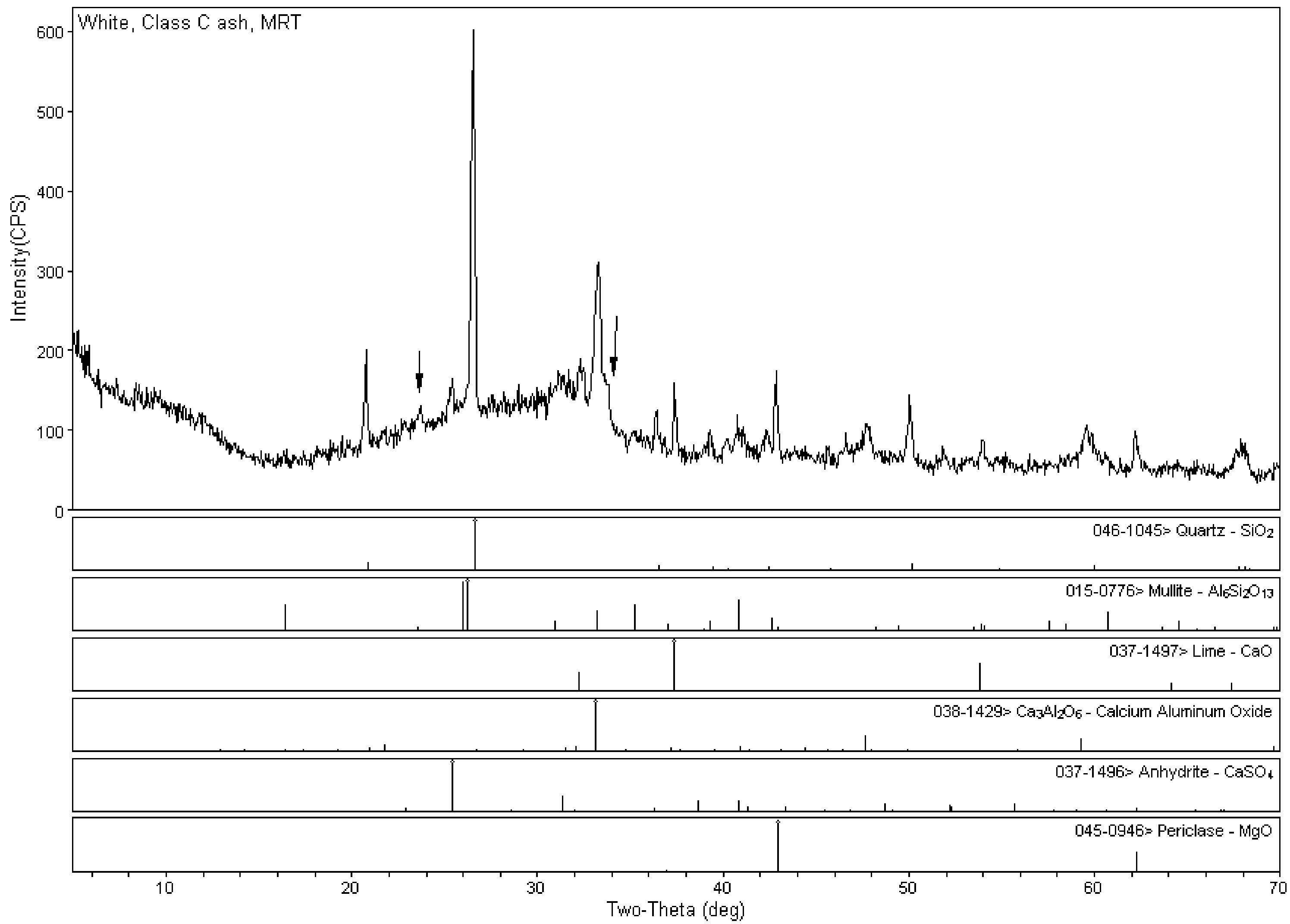
APPENDIX E. STABILIZER XRD DIFFRACTOGRAMS



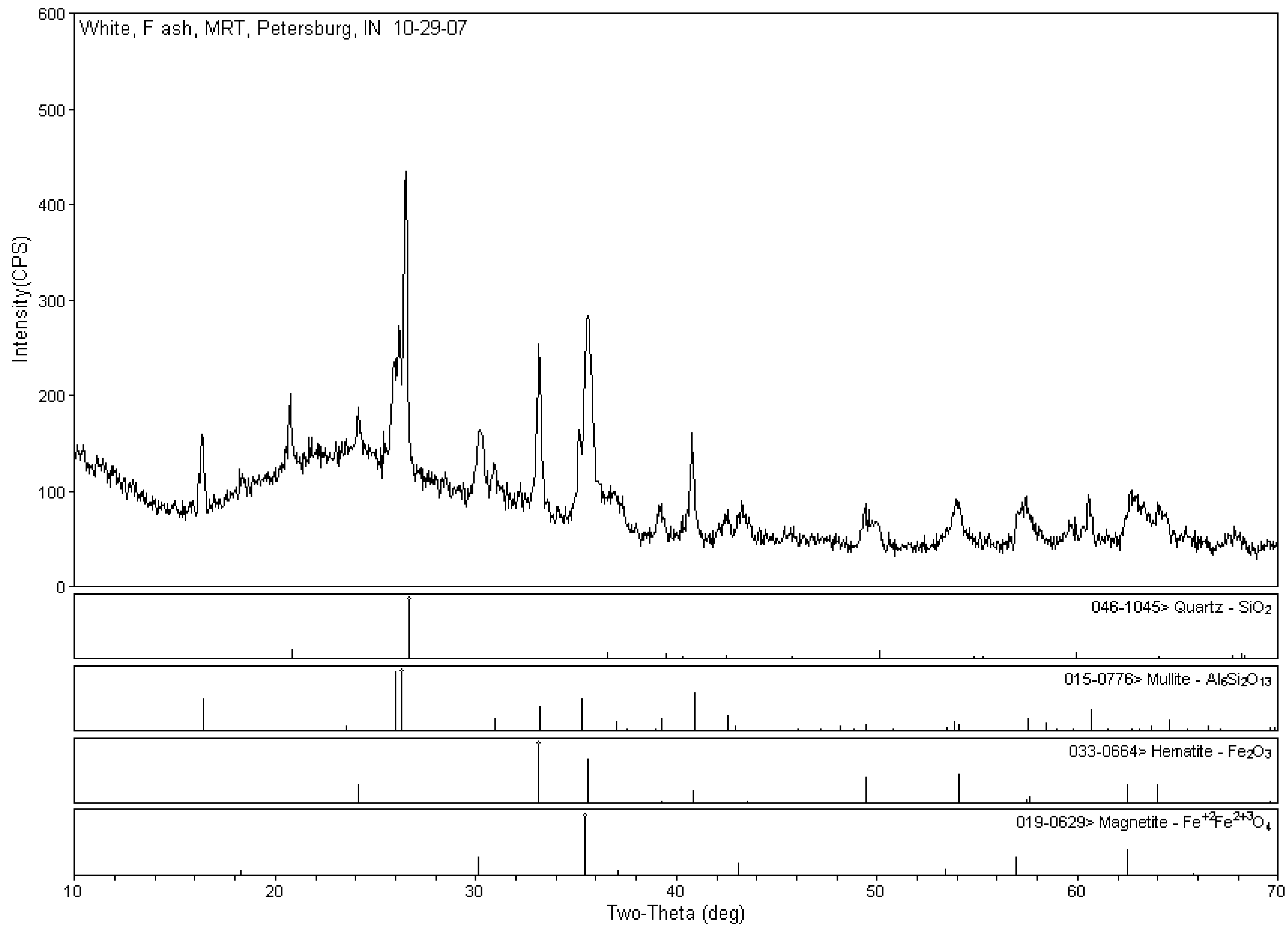
X-ray diffractogram of New Braunfels Type I II cement



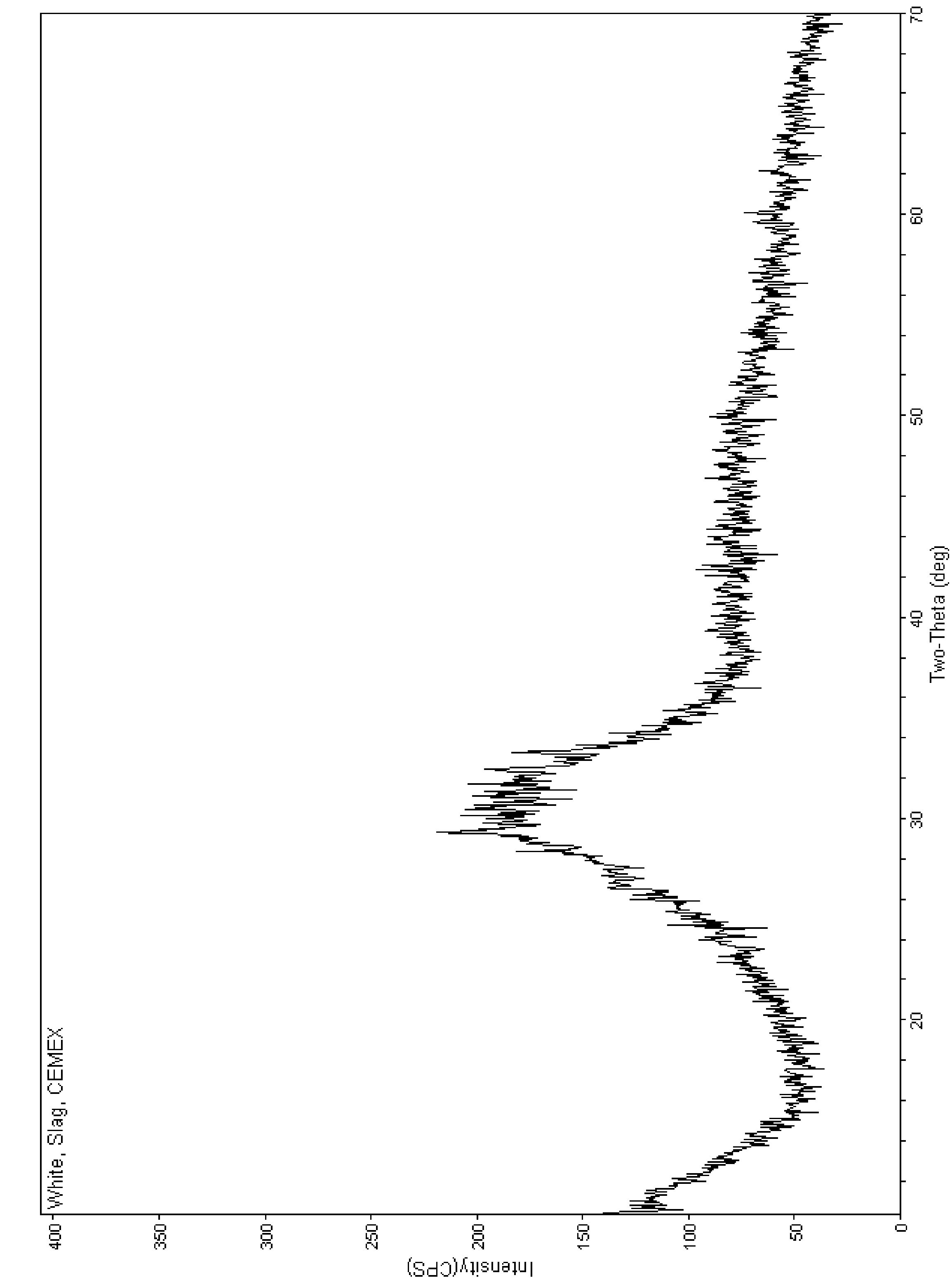
X-ray diffractogram of Odess type V cement



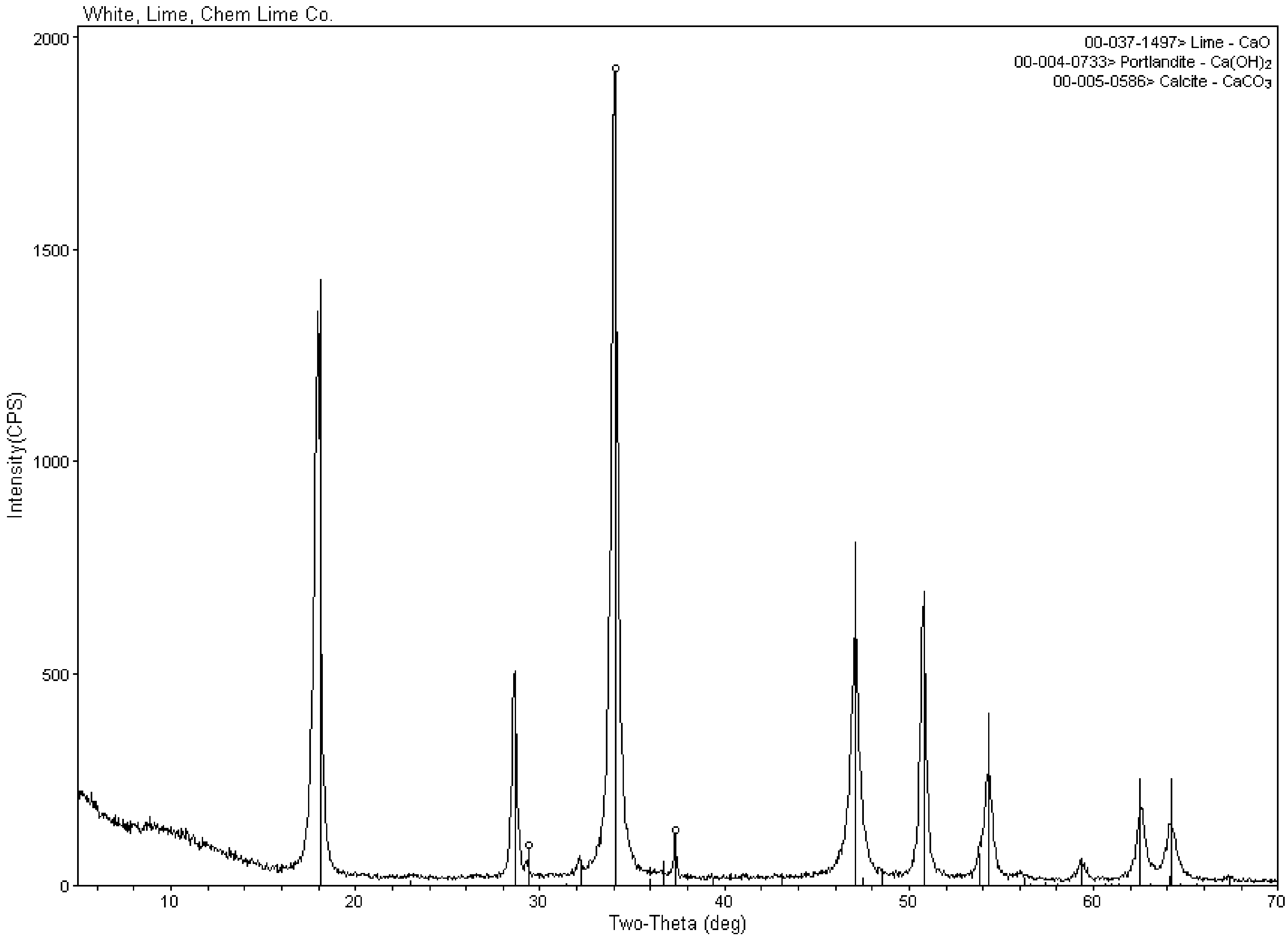
X-ray diffractogram of. Class C fly ash



X-ray diffractogram of. Class F fly ash



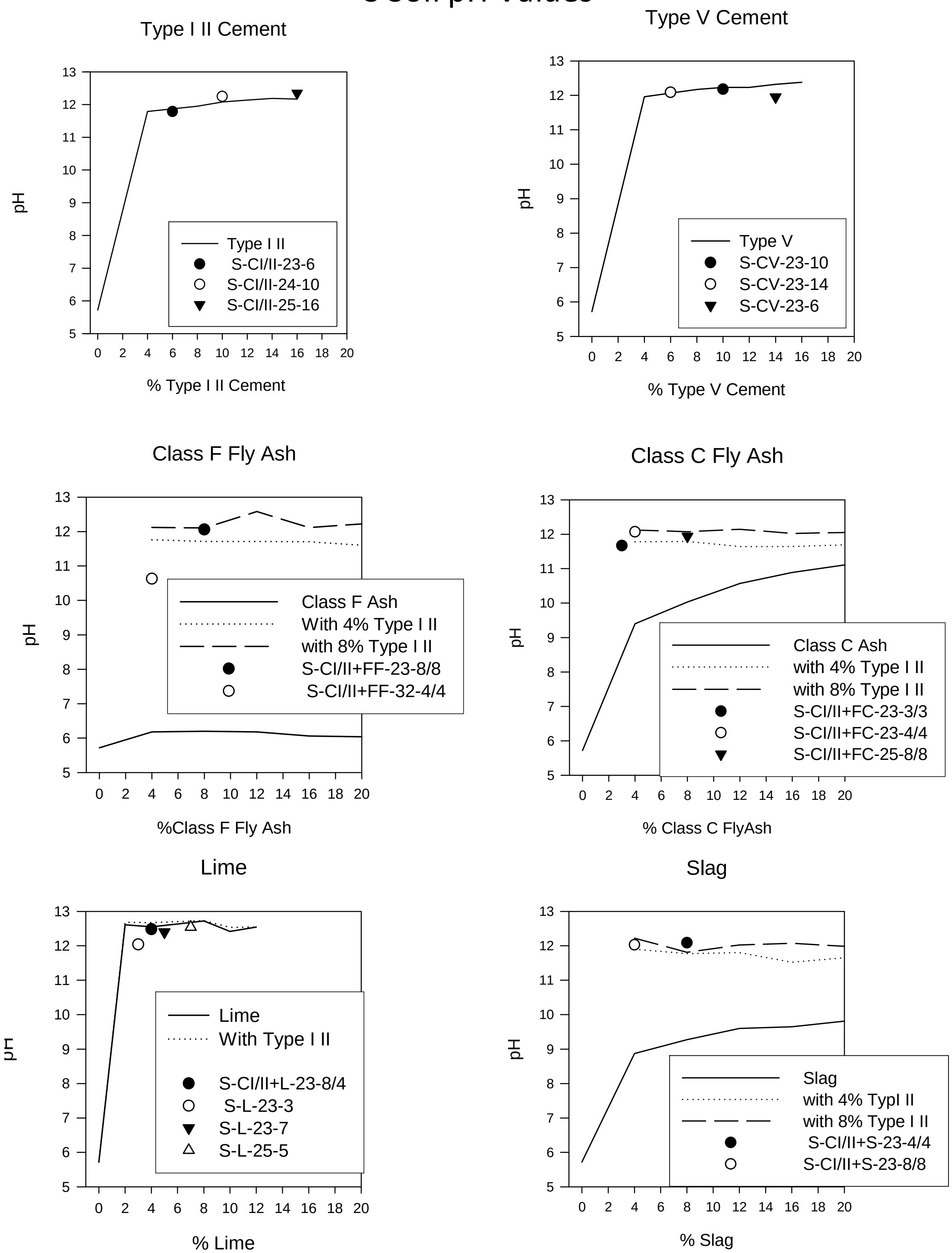
X-ray diffractogram of slag



X-ray diffractogram of. slag

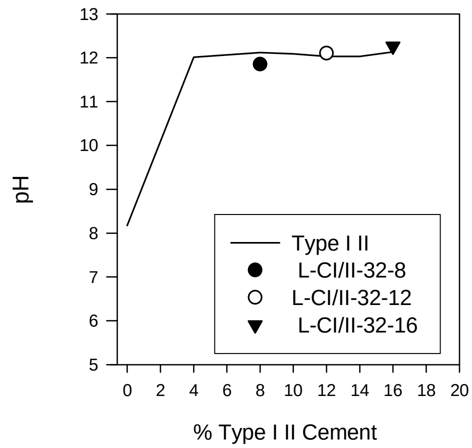
APPENDIX F. pH MEASUREMENTS

S Soil pH Values

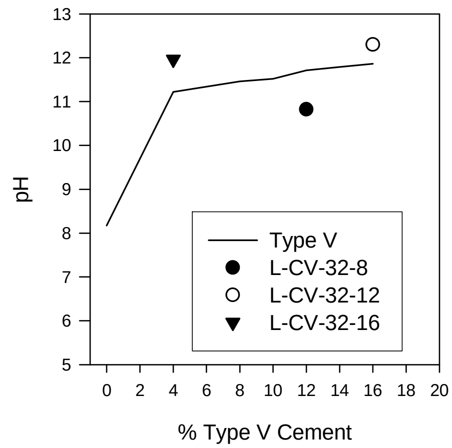


L Soil ph Values

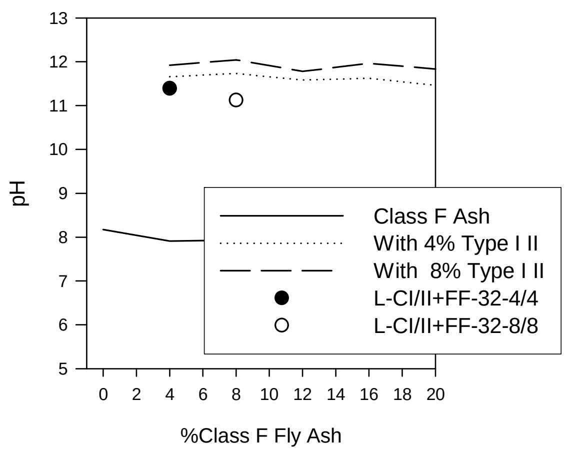
Type I II Cement



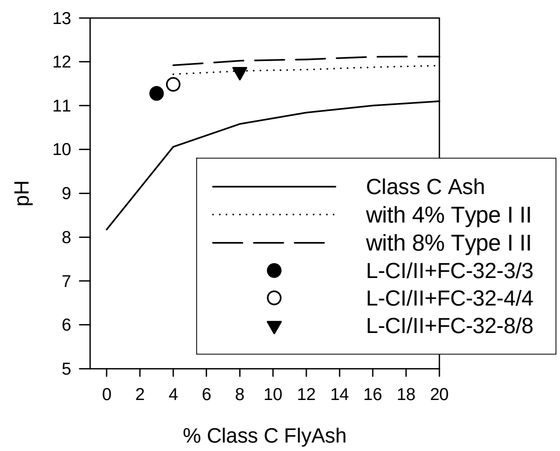
Type V Cement



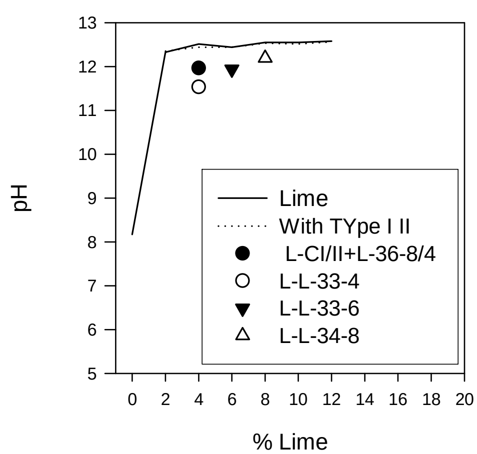
Class F Fly Ash



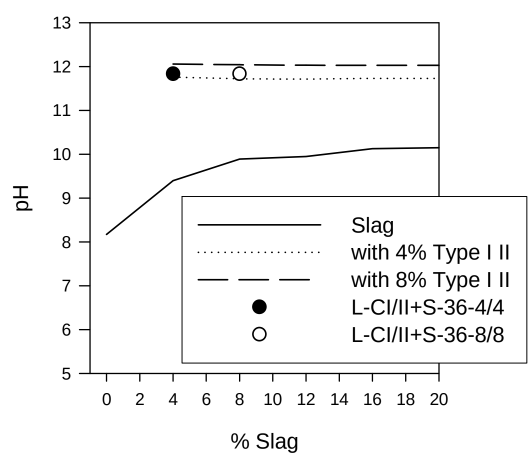
Class C Fly Ash



Lime

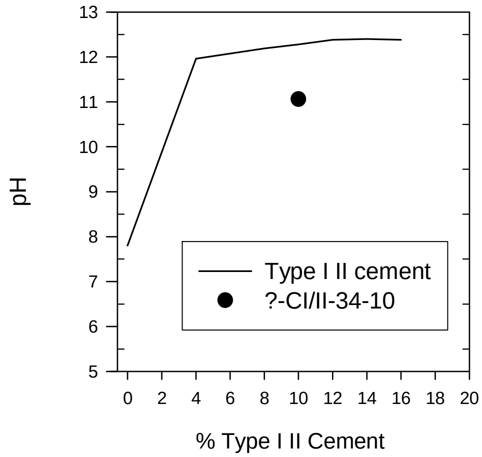


Slag

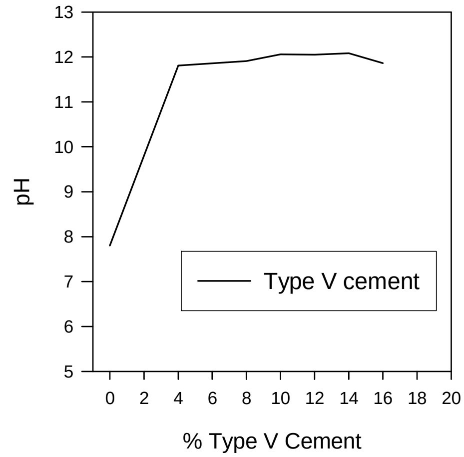


? Soil pH Values

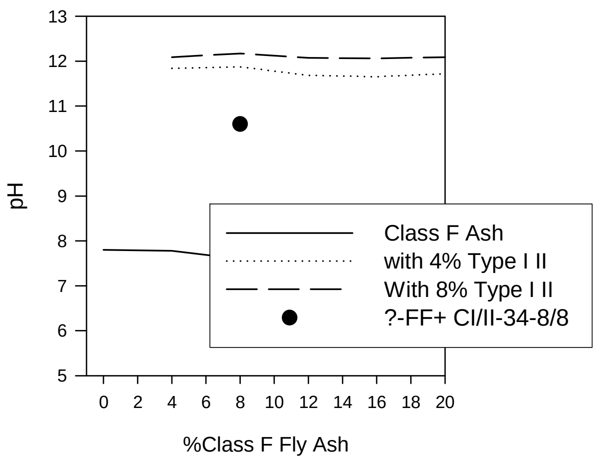
Type I II Cement



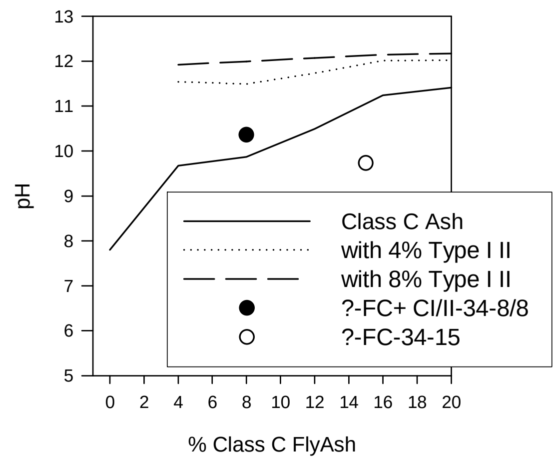
Type V Cement



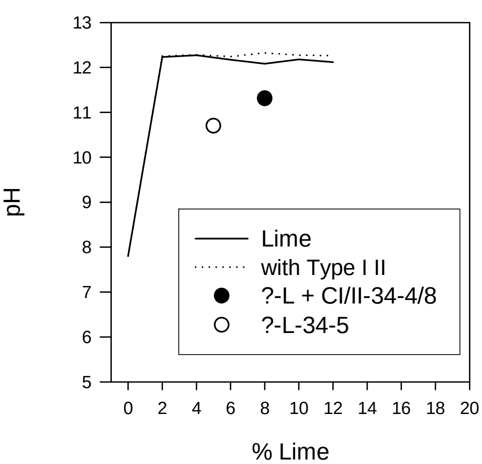
Class F Fly Ash



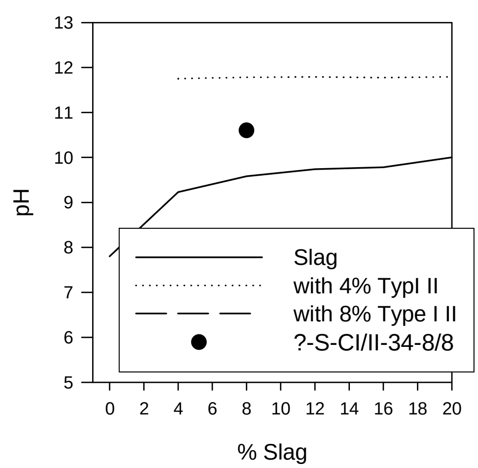
Class C Fly Ash



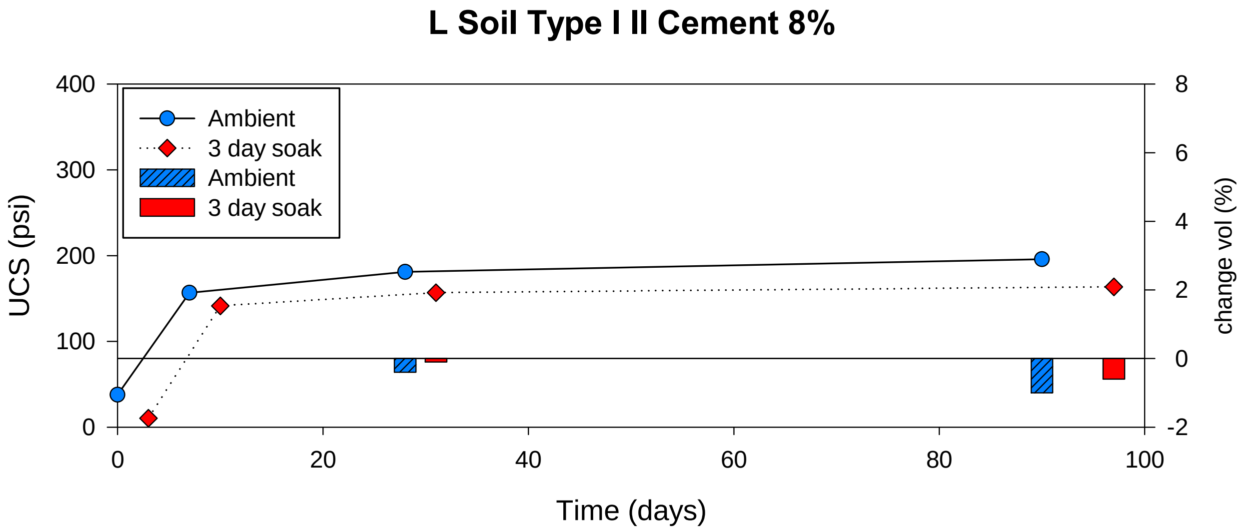
Lime

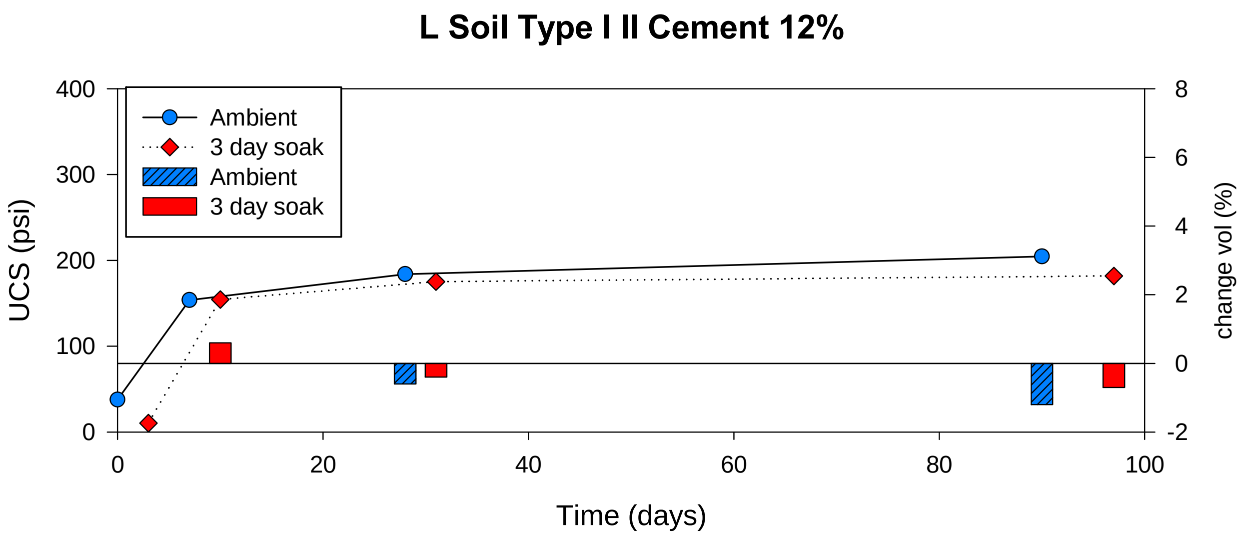


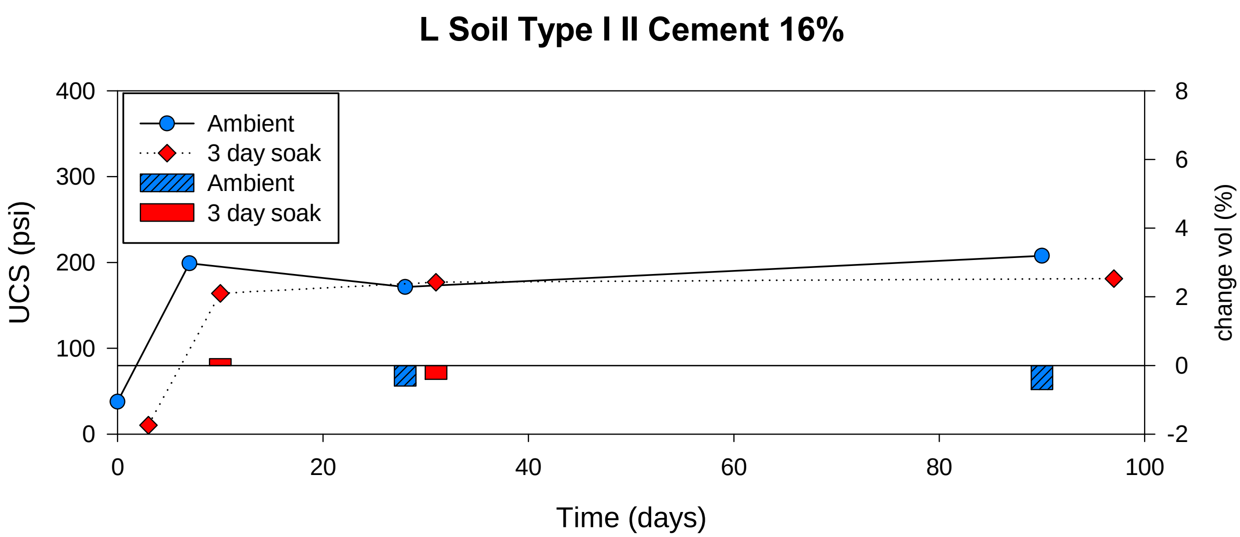
Slag



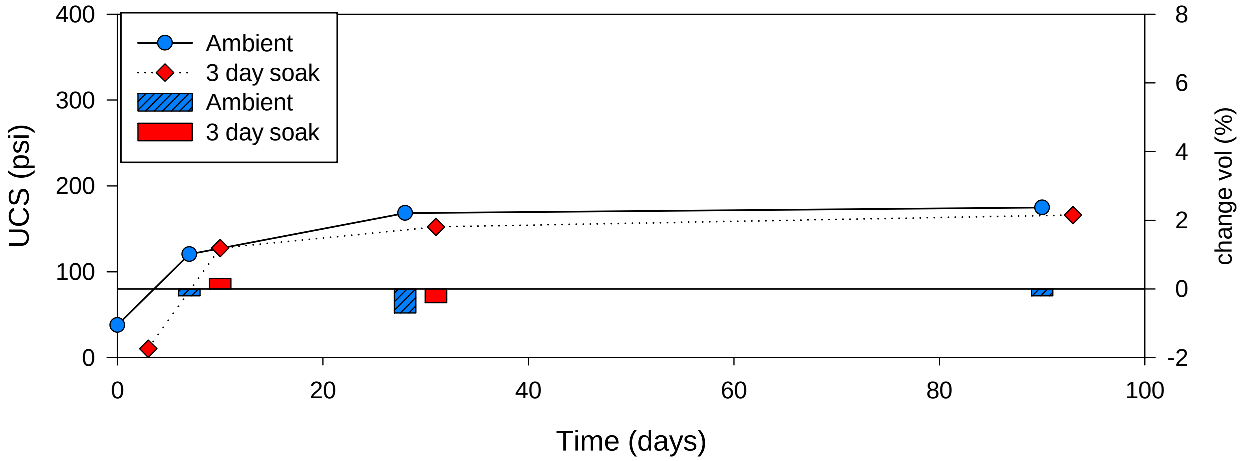
APPENDIX G. STRENGTH CURVES WITH VOLUMETRIC SWELL



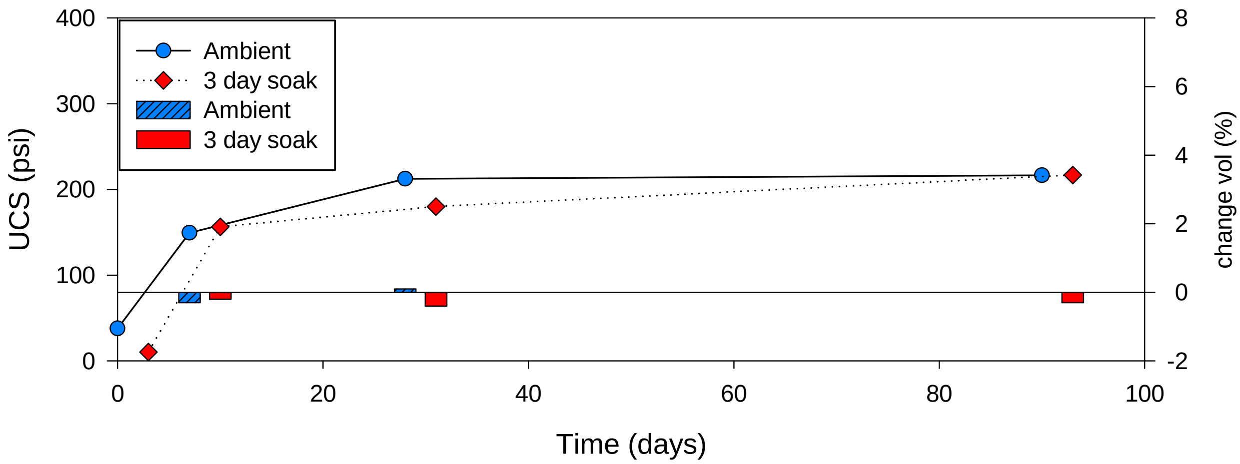




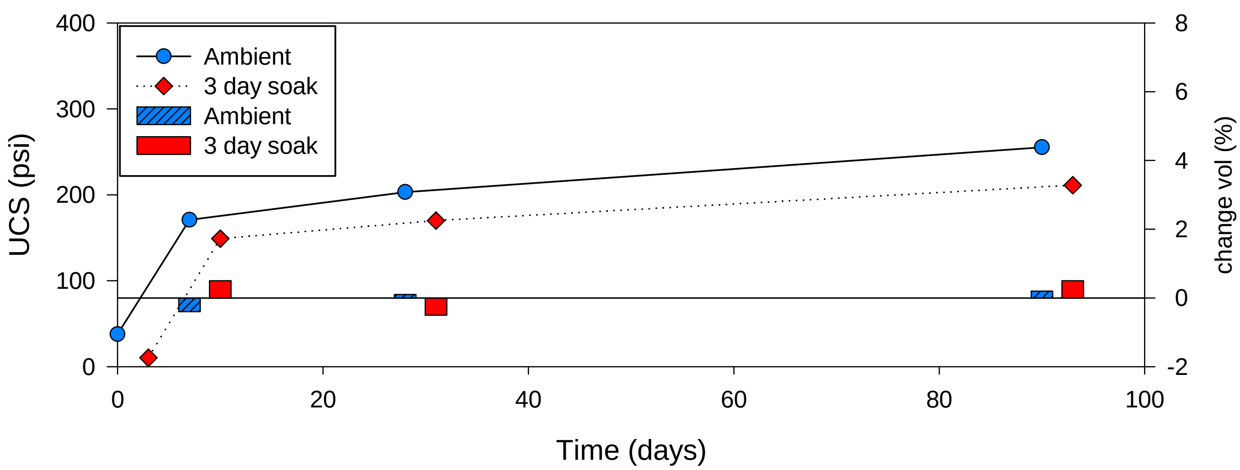
L Soil Type V Cement 8%



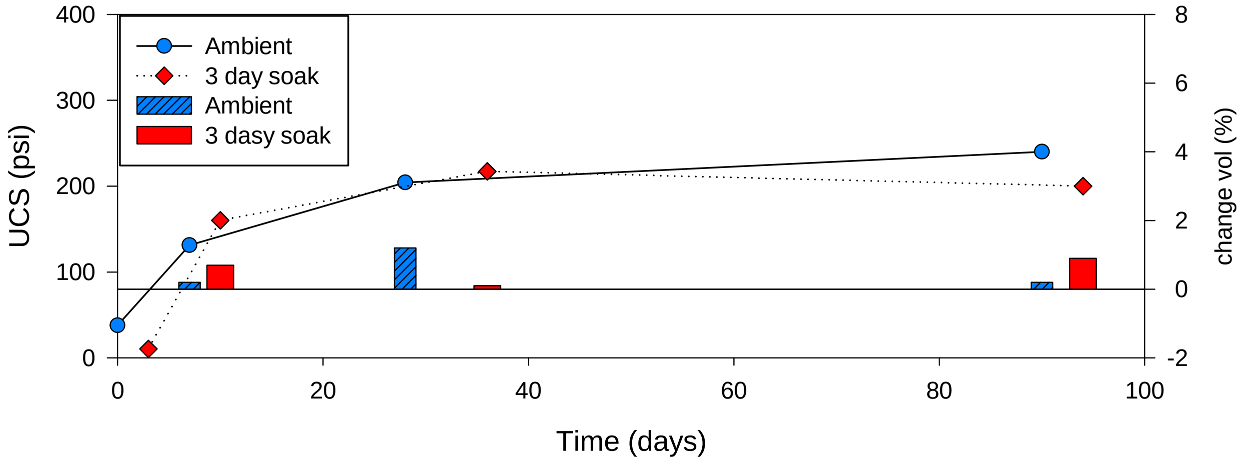
L Soil Type V Cement 12%



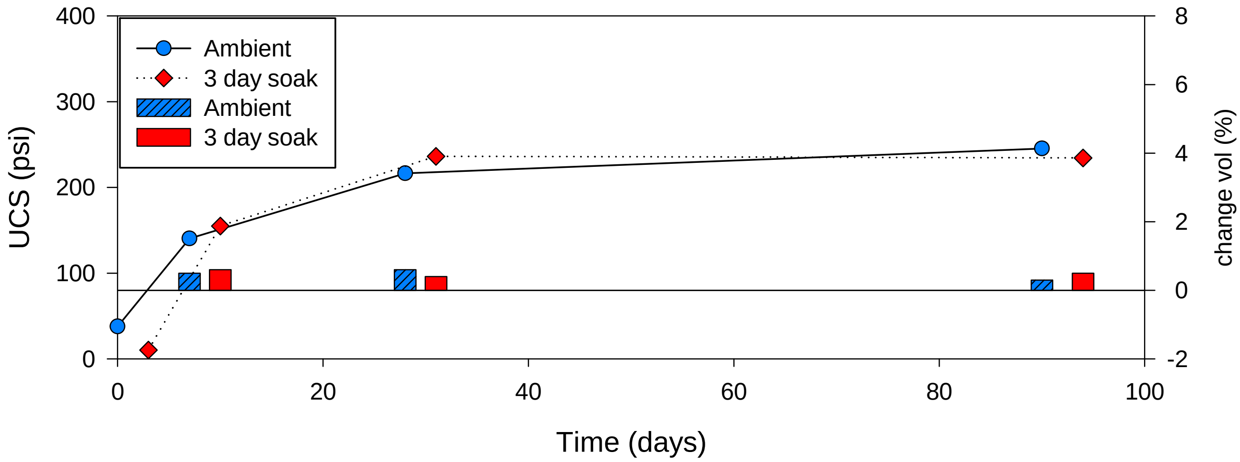
L Soil Type V Cement 16%



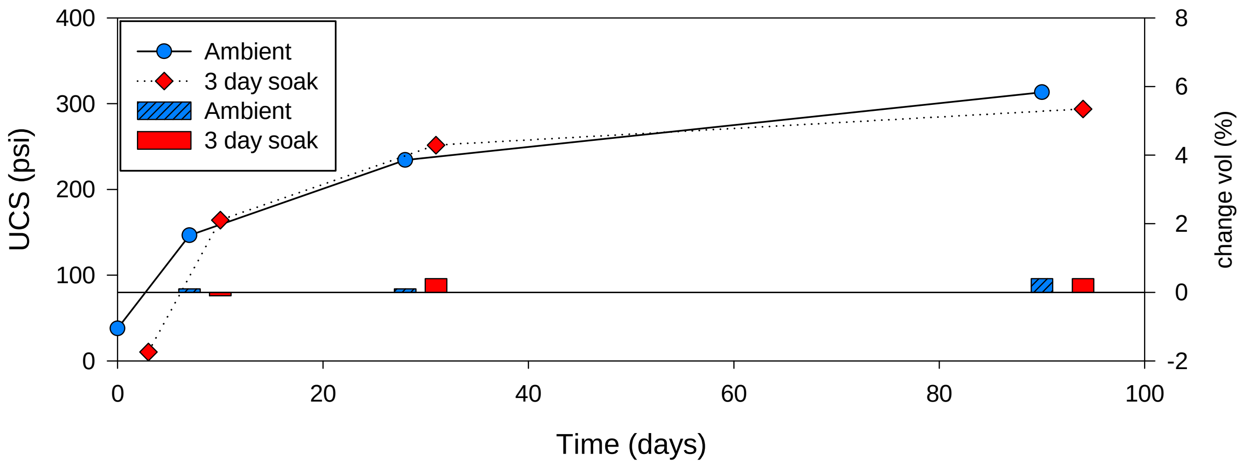
L Soil Lime 4%

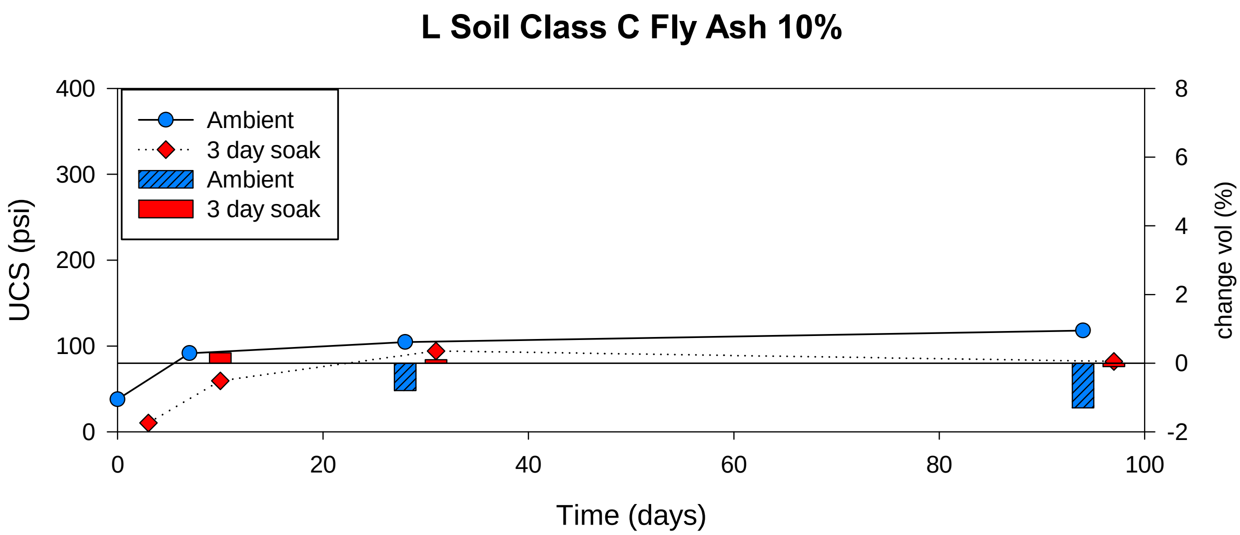


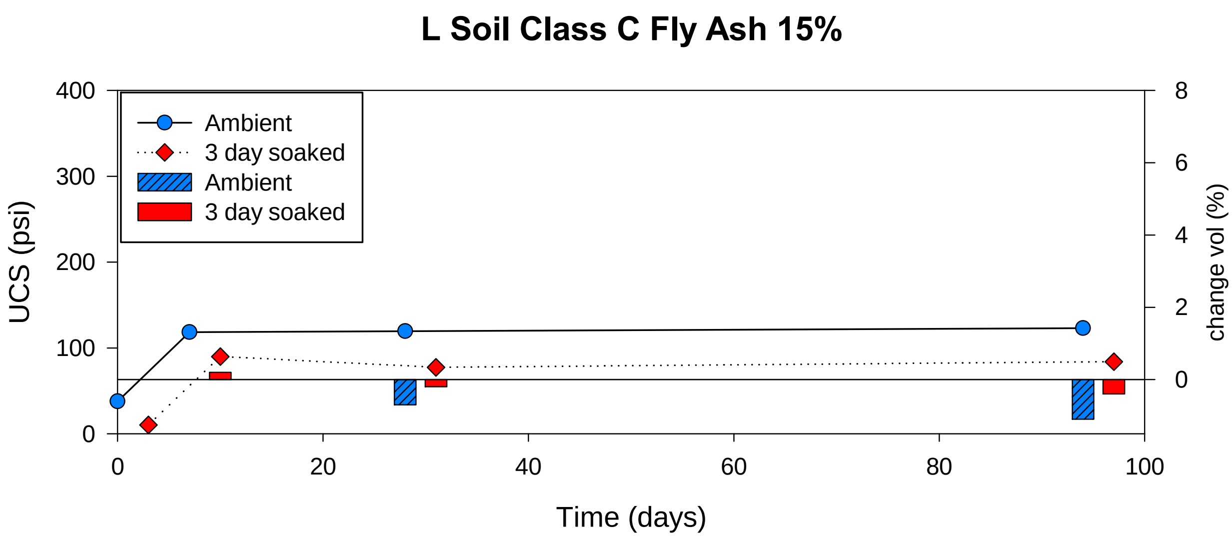
L Soil Lime 6%

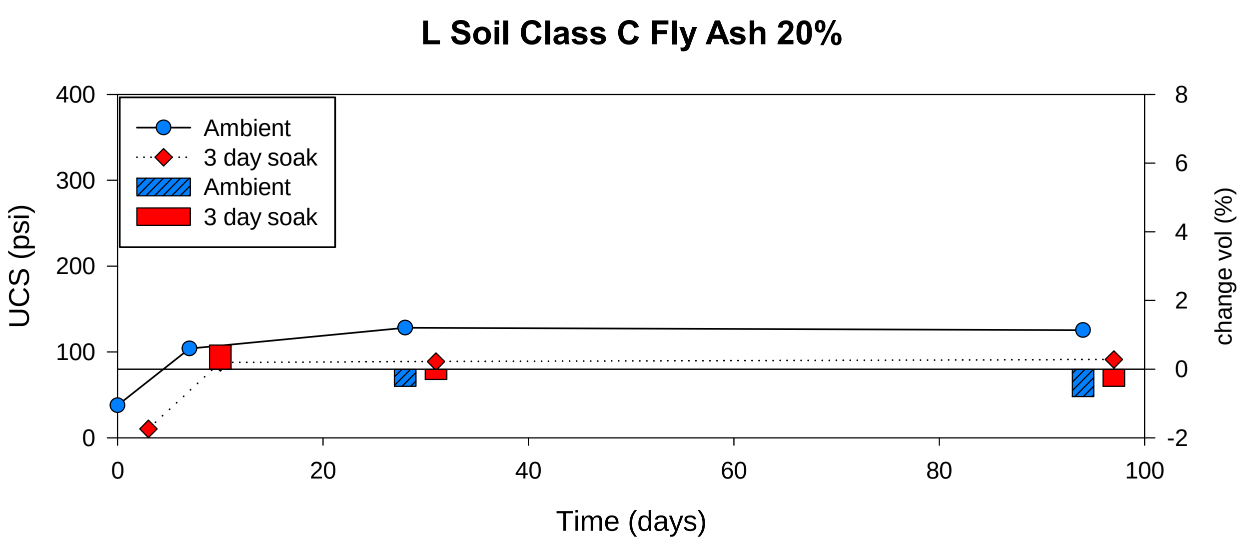


L Soil Lime 8%

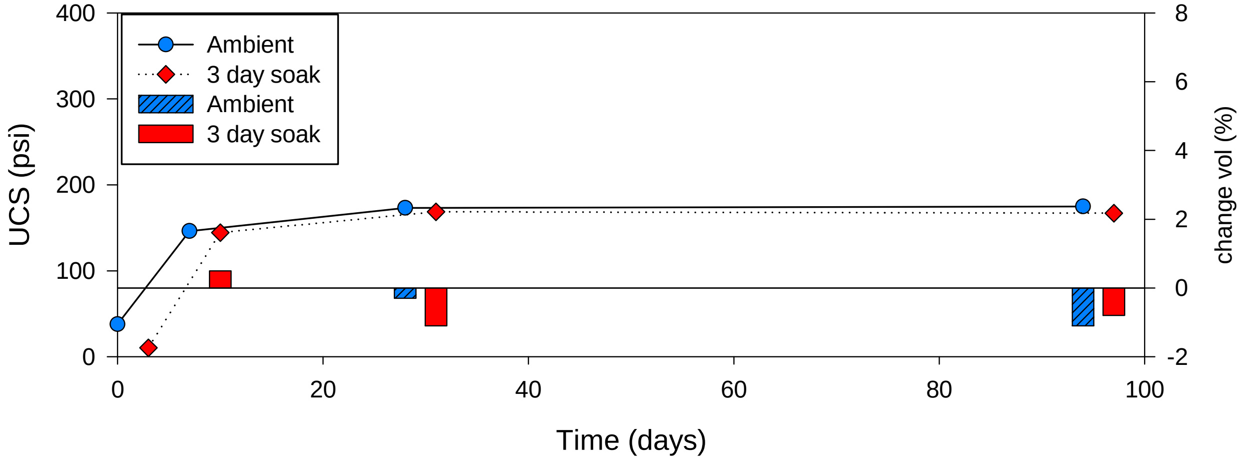



L Soil Class C Fly Ash 10%
Ambient
3 day soak
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
0
100
200
300
400
0
20
40
60
80
100
8
6
4
2
0
-2

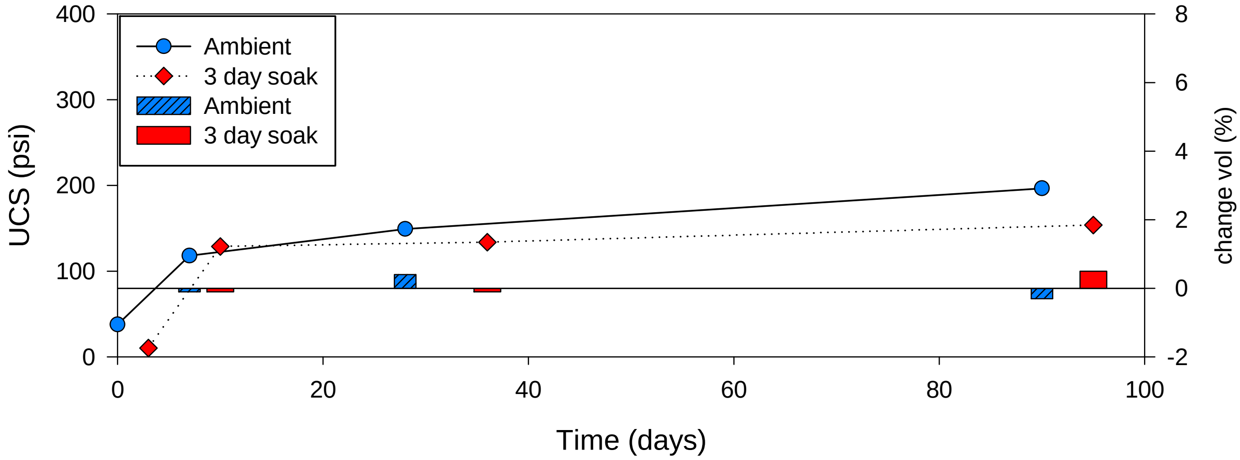

L Soil Class C Fly Ash 15%
Ambient
3 day soaked
Ambient
3 day soaked
UCS (psi)
change vol (%)
Time (days)
0
100
200
300
400
0
20
40
60
80
100
8
6
4
2
0


L Soil Class C Fly Ash 20%
Ambient
3 day soak
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
0
100
200
300
400
0
20
40
60
80
100
8
6
4
2
0
-2

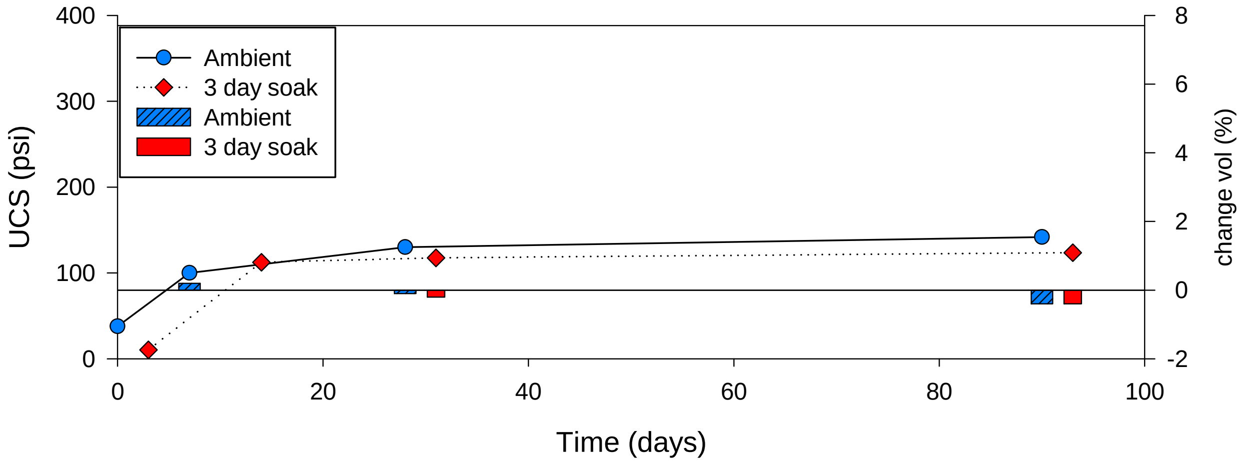
L Soil Cement 8% with Fly Ash C 8%



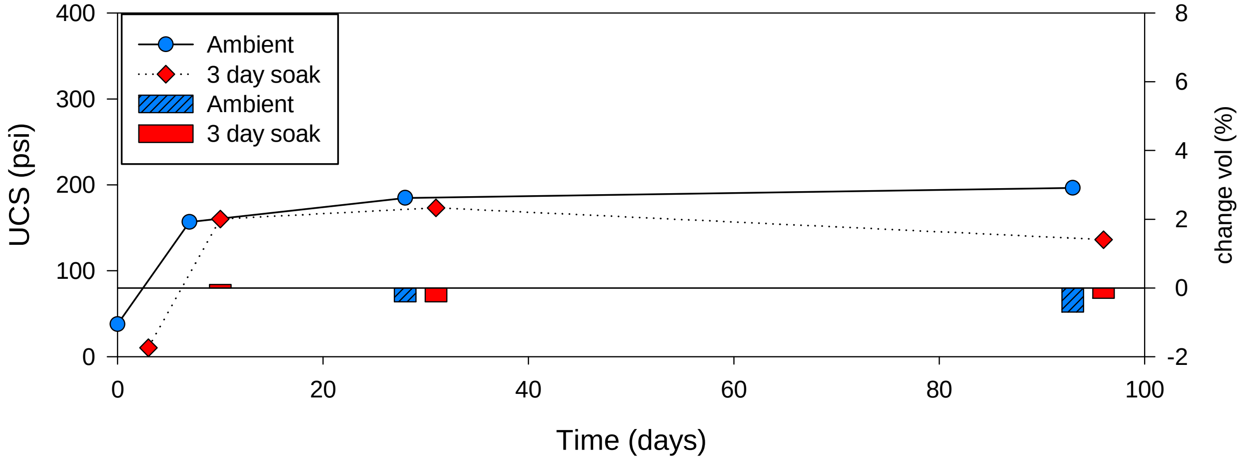
L Soil Cement 4% with Fly Ash C 4%



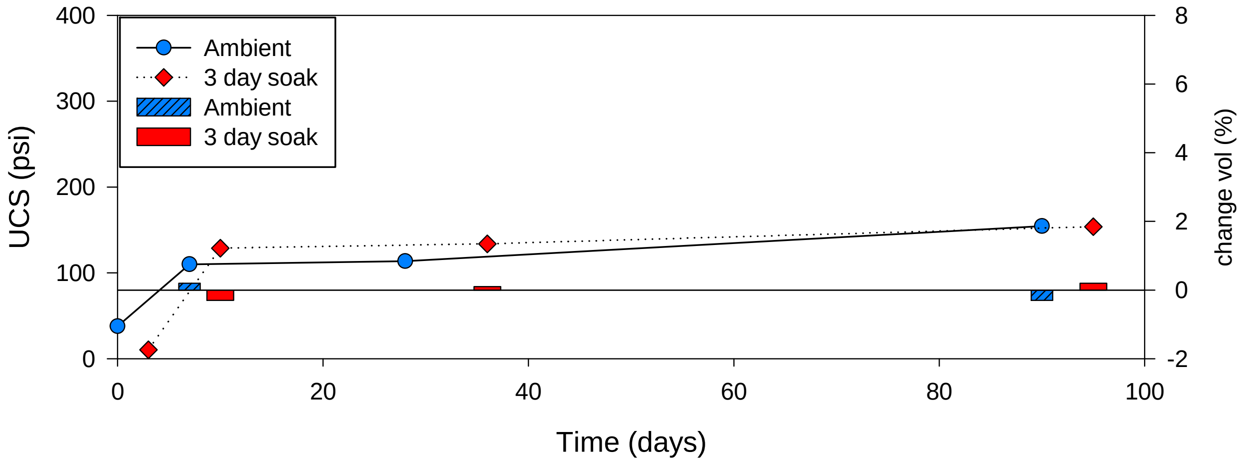
L Soil Cement 3% with Fly Ash C 3%



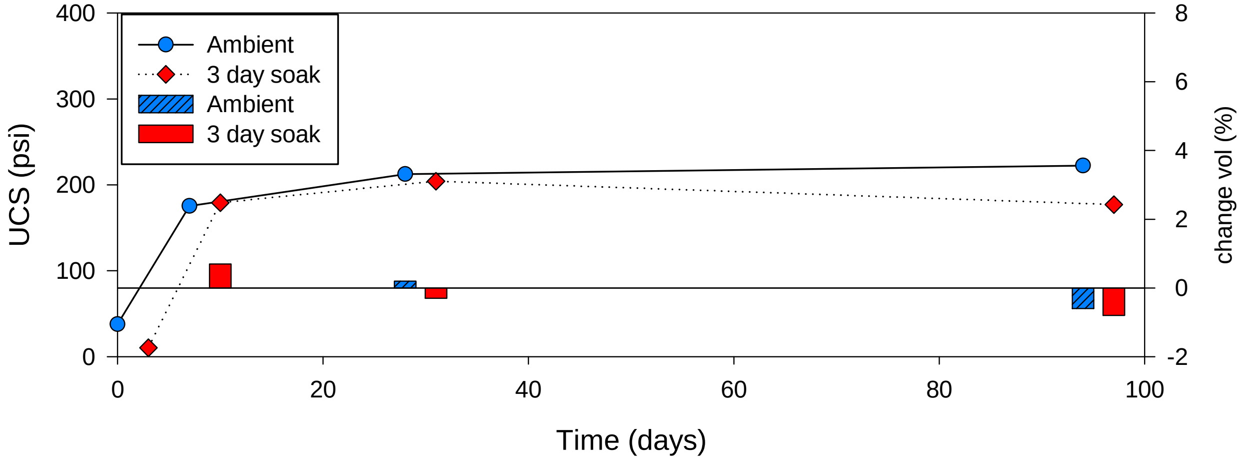
L Soil Cement 8% with Fly Ash F 8%



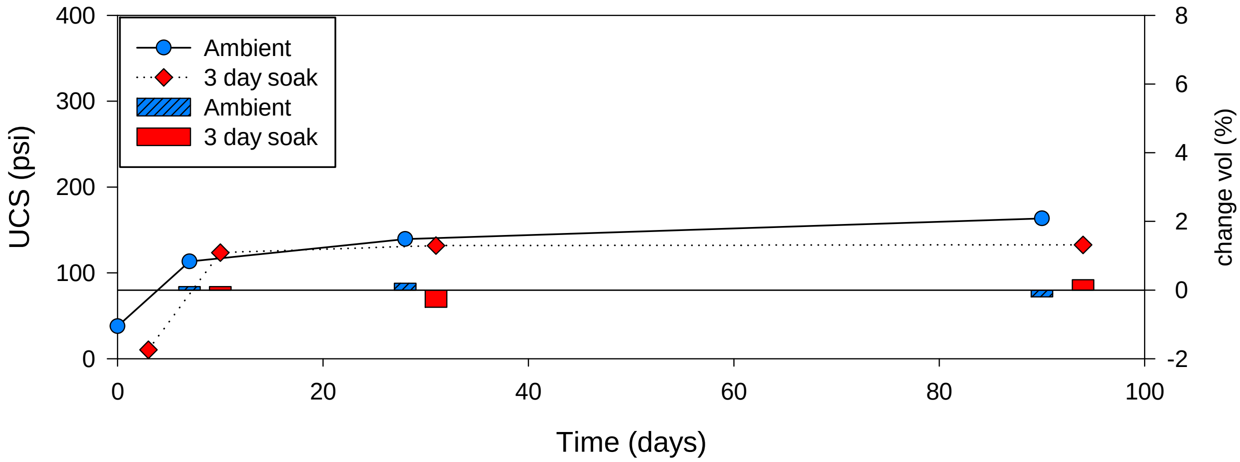
L Soil Cement 4% with Fly Ash F 4%



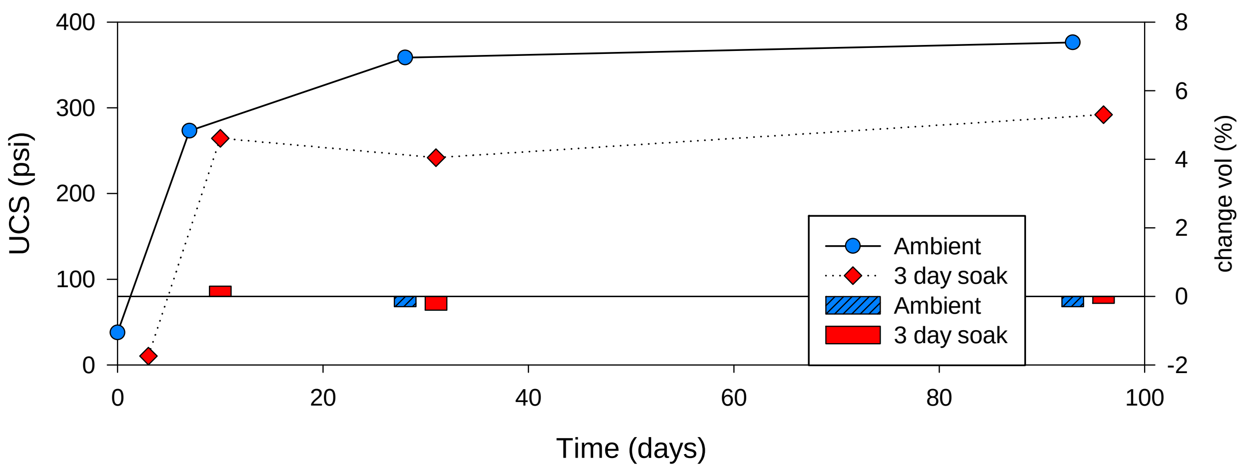
L Soil Cement 8% with Slag 8%



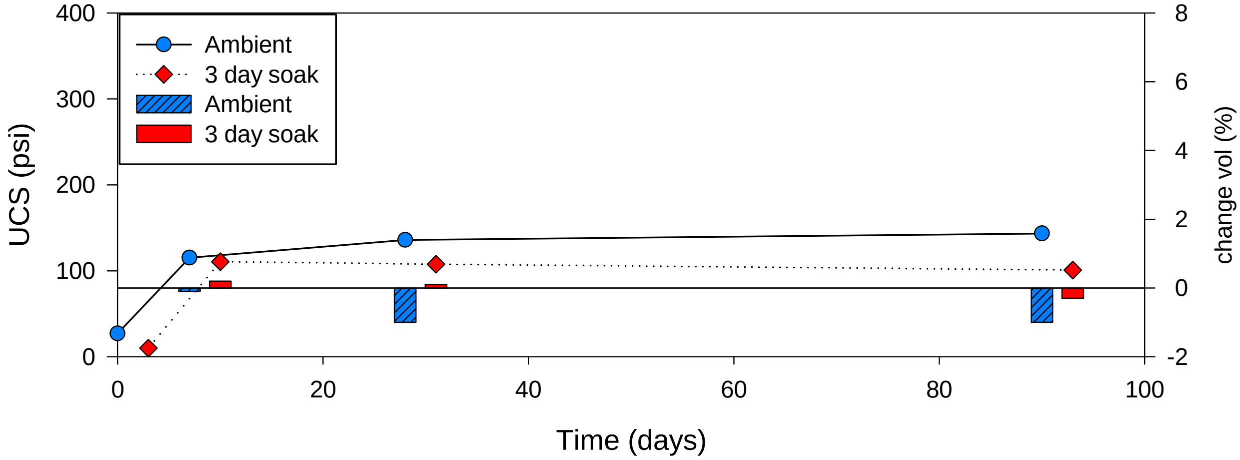
L Soil Cement 4% with Slag 4%



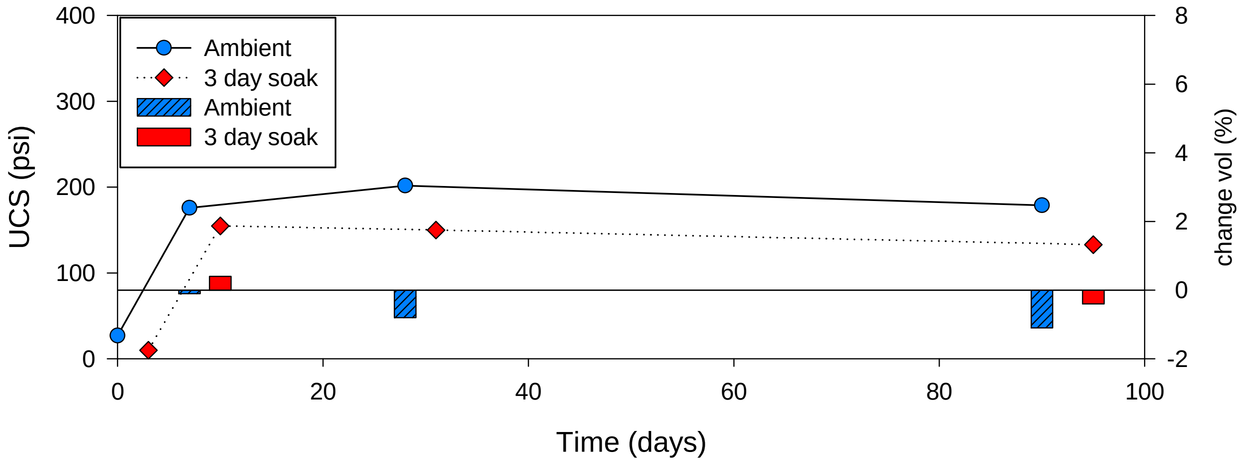
L Soil Cement 8% with Lime 4%



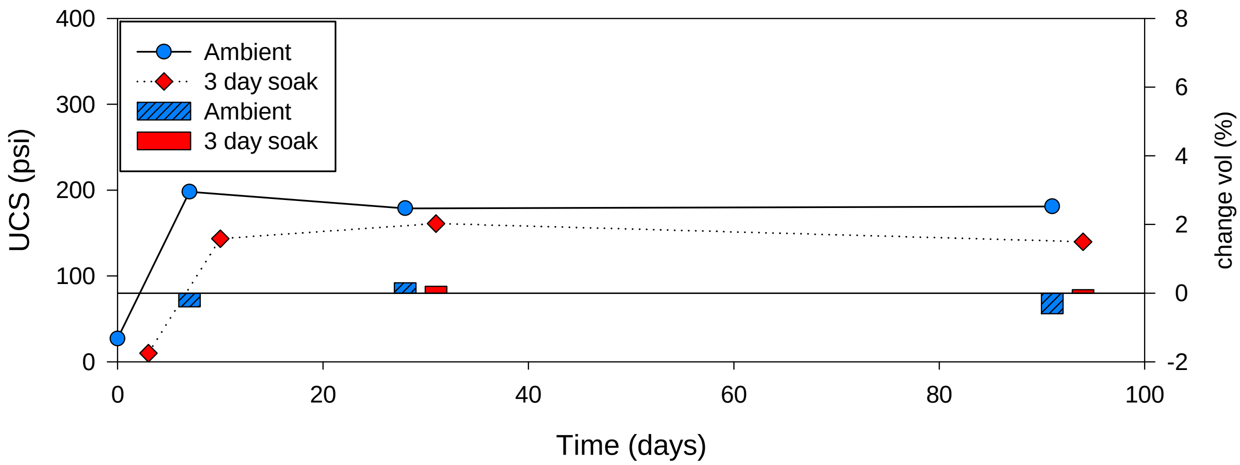
S Soil Type I II Cement 6%



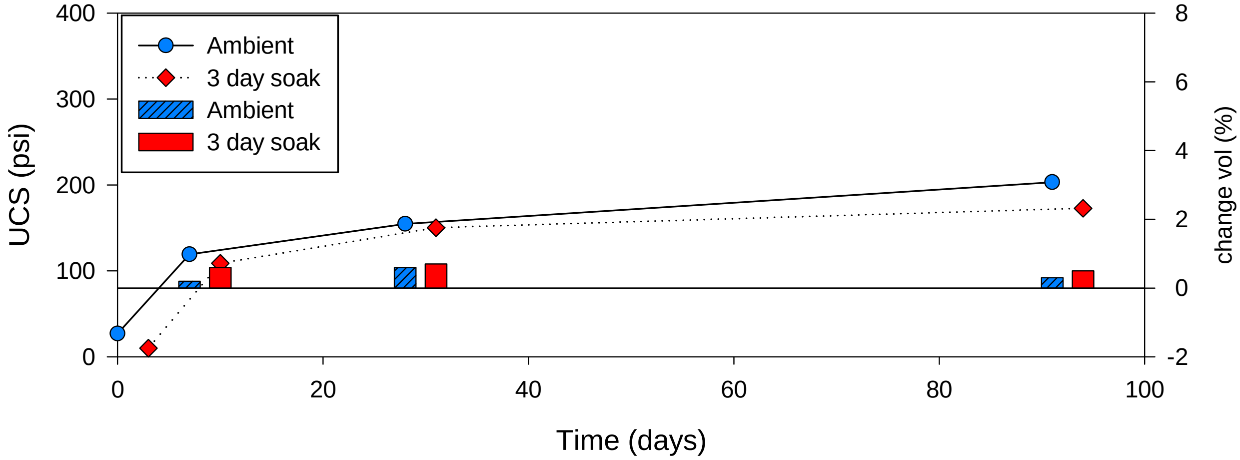
S Soil Type I II Cement 10%



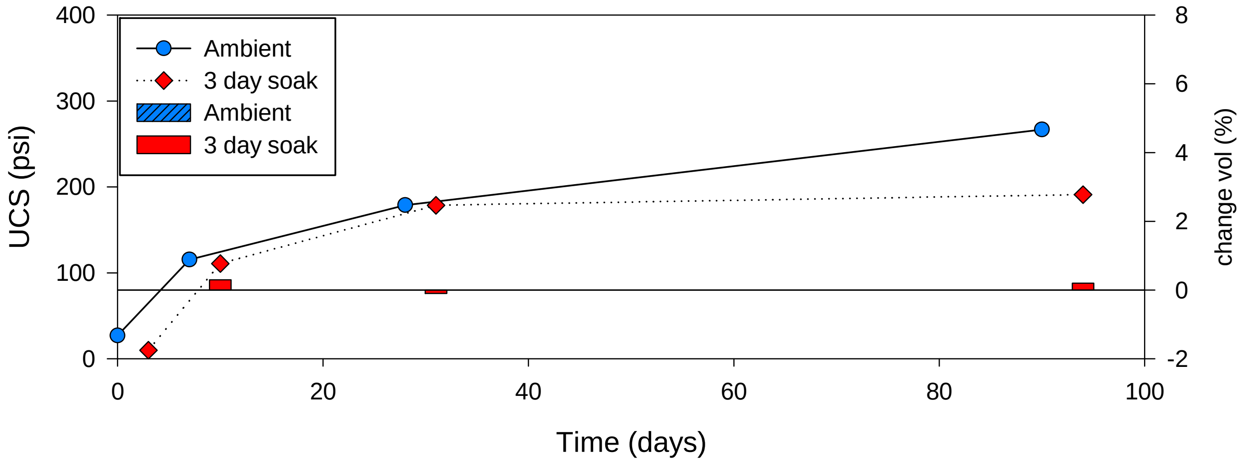
S Soil Type I II Cement 16%



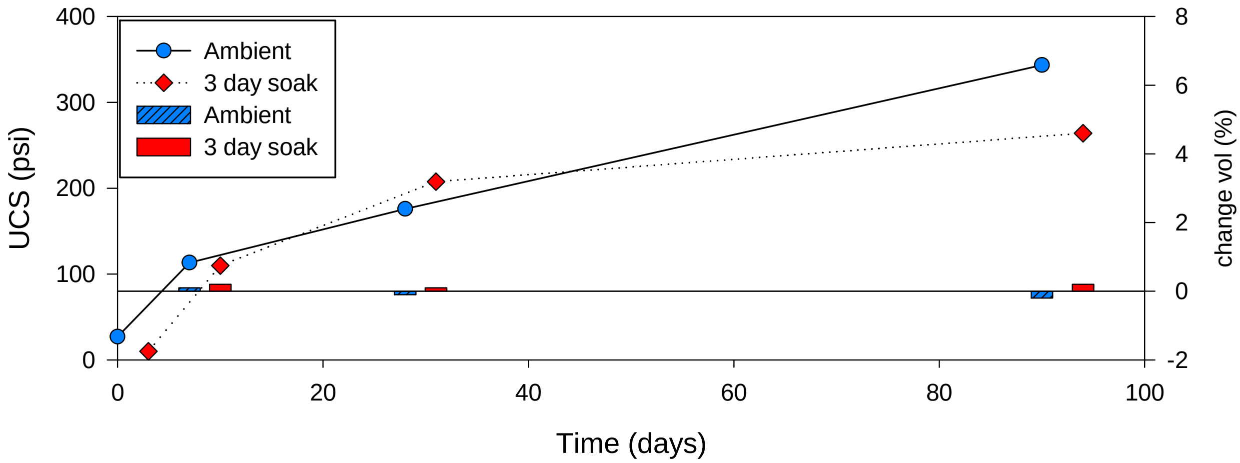
S Soil Lime 3%



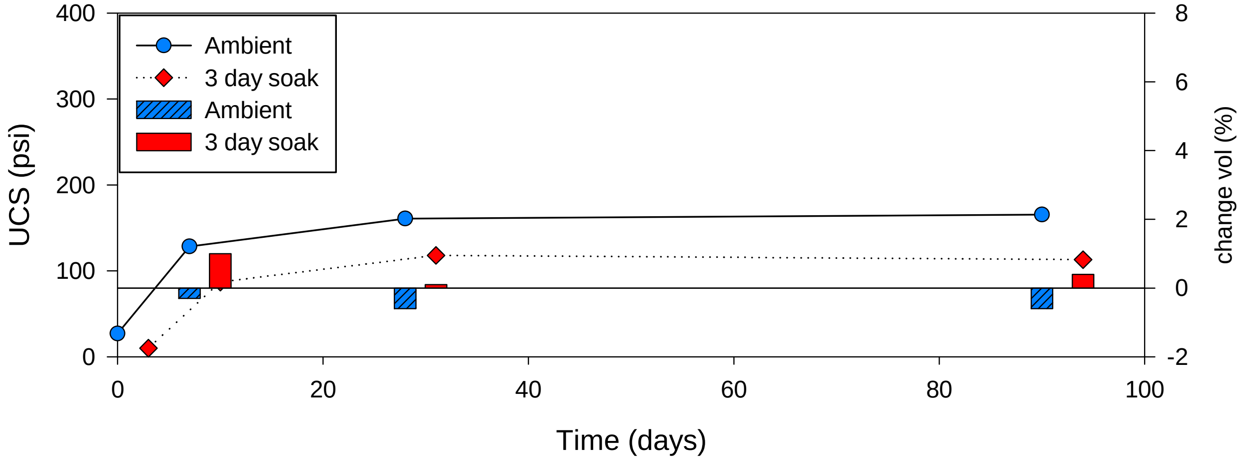
S Soil Lime 5%



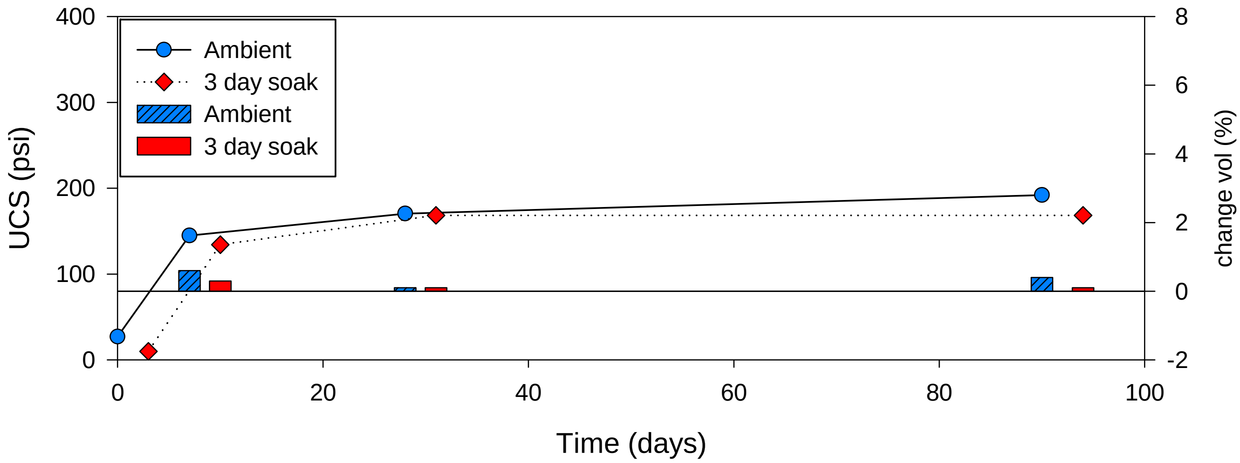
S Soil Lime 7%



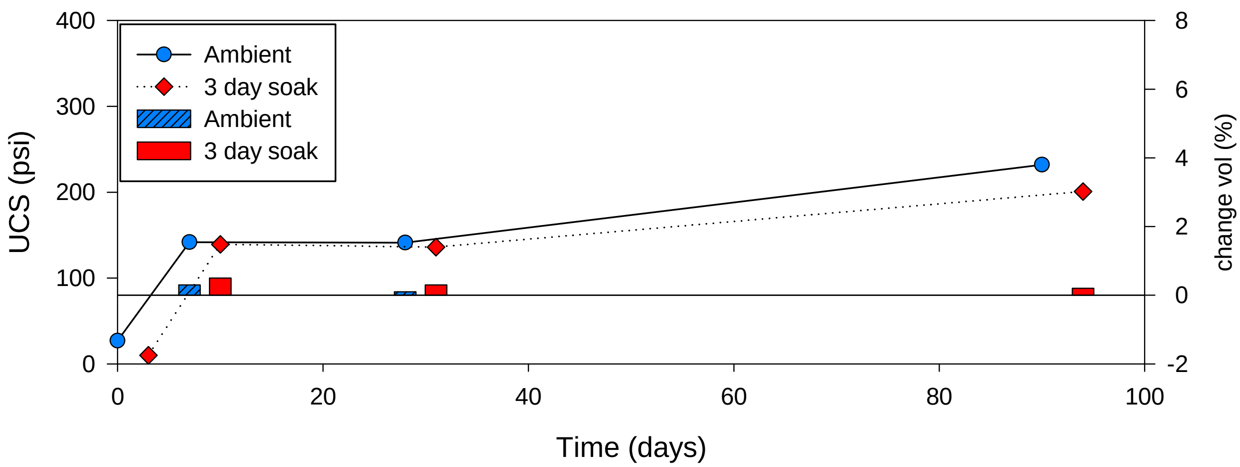
S Soil Type V Cement 6%

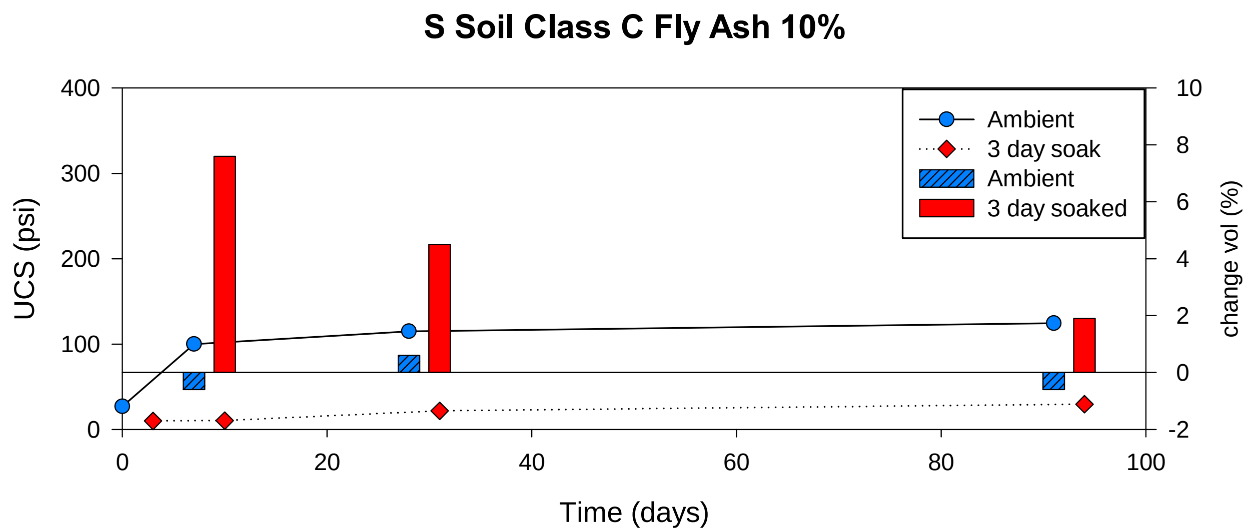


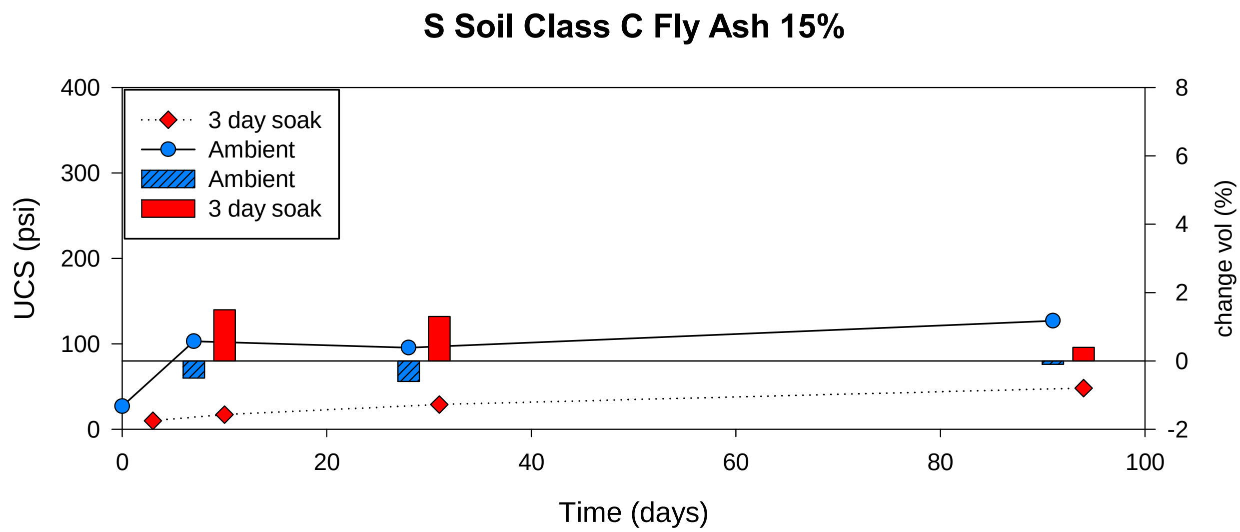
S Soil Type V Cement 10%

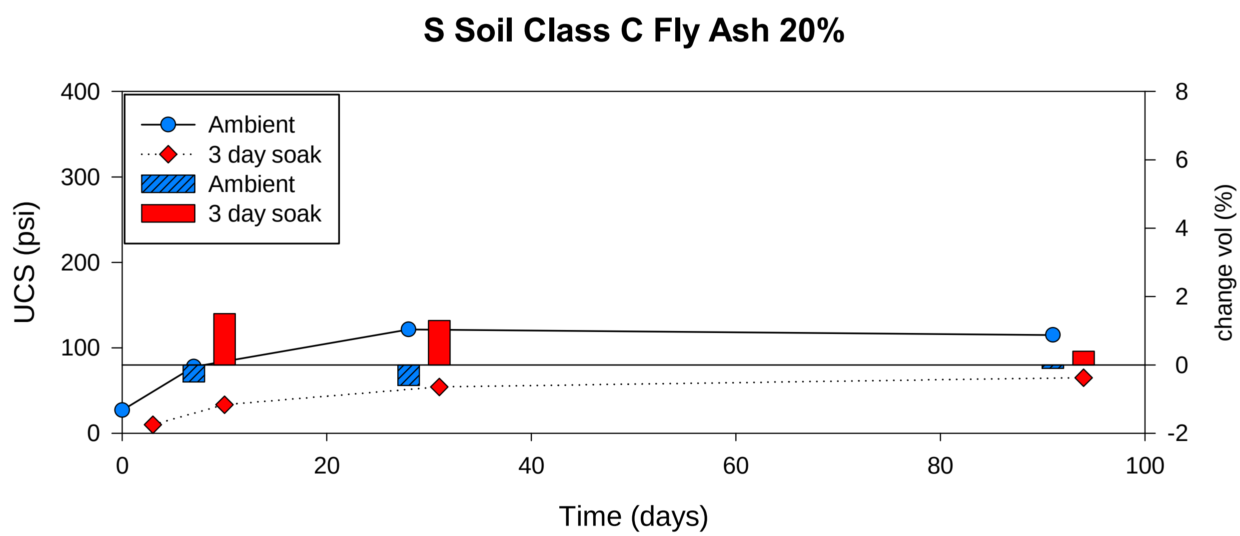


S Soil Type V Cement 14%

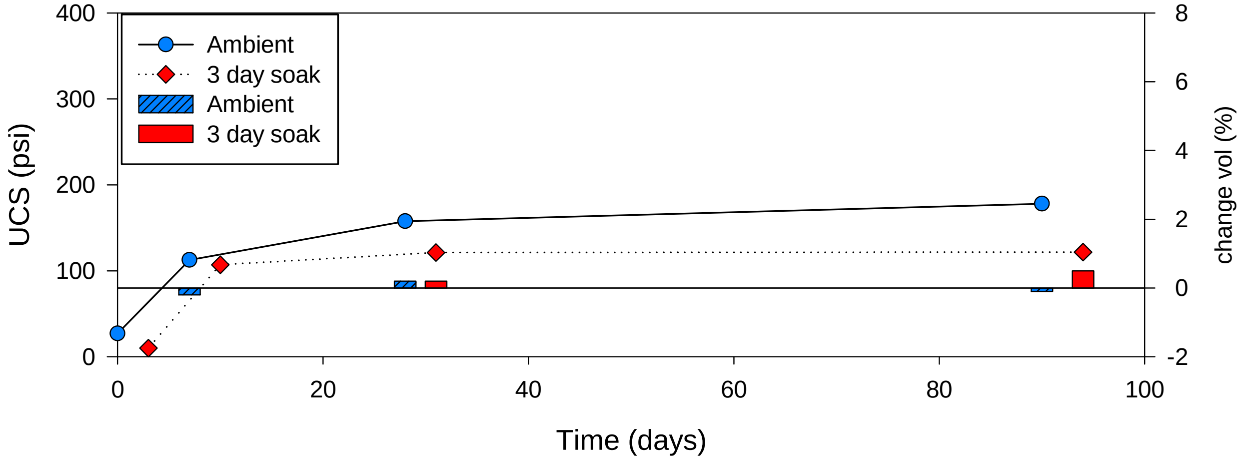



S Soil Class C Fly Ash 10%
Ambient
3 day soak
Ambient
3 day soaked
UCS (psi)
change vol (%)
Time (days)
0
100
200
300
400
20
40
60
80
10
8
6
4
2
-2

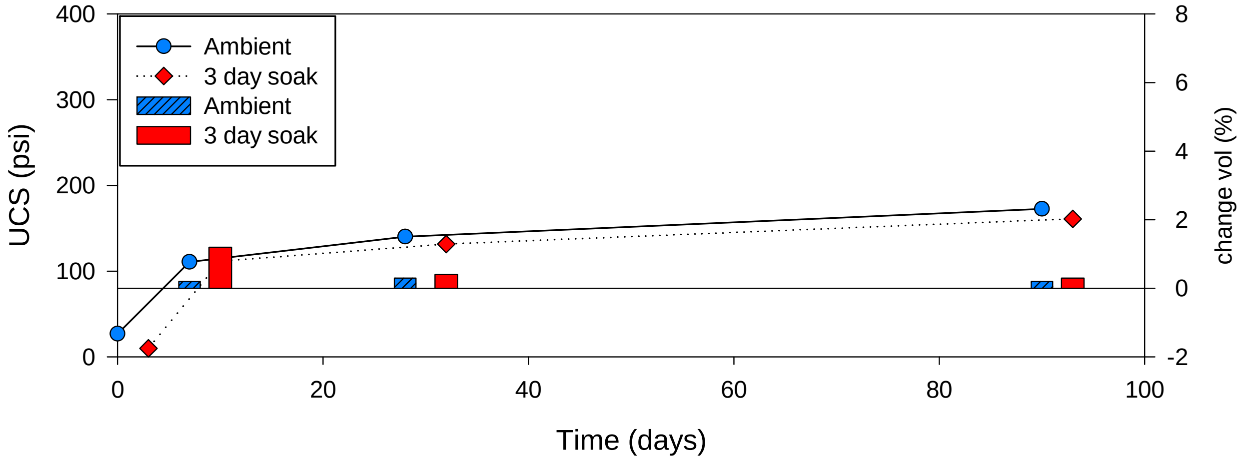

S Soil Class C Fly Ash 15%
3 day soak
Ambient
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
0
100
200
300
400
20
40
60
80
8
6
4
2
-2


S Soil Class C Fly Ash 20%
Ambient
3 day soak
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
0
100
200
300
400
20
40
60
80
8
6
4
2
-2

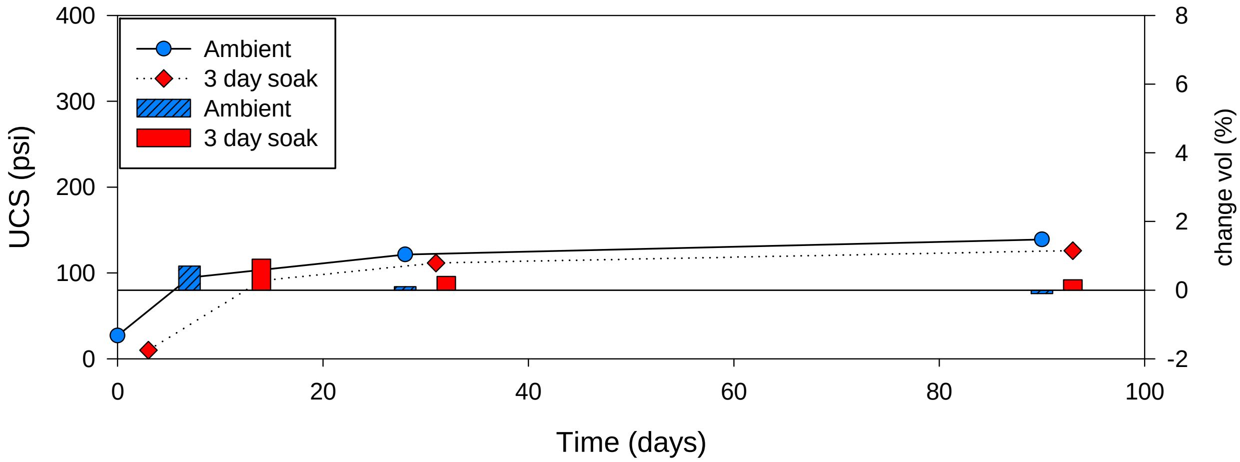
S Soil Cement 8% with Fly Ash C 8%

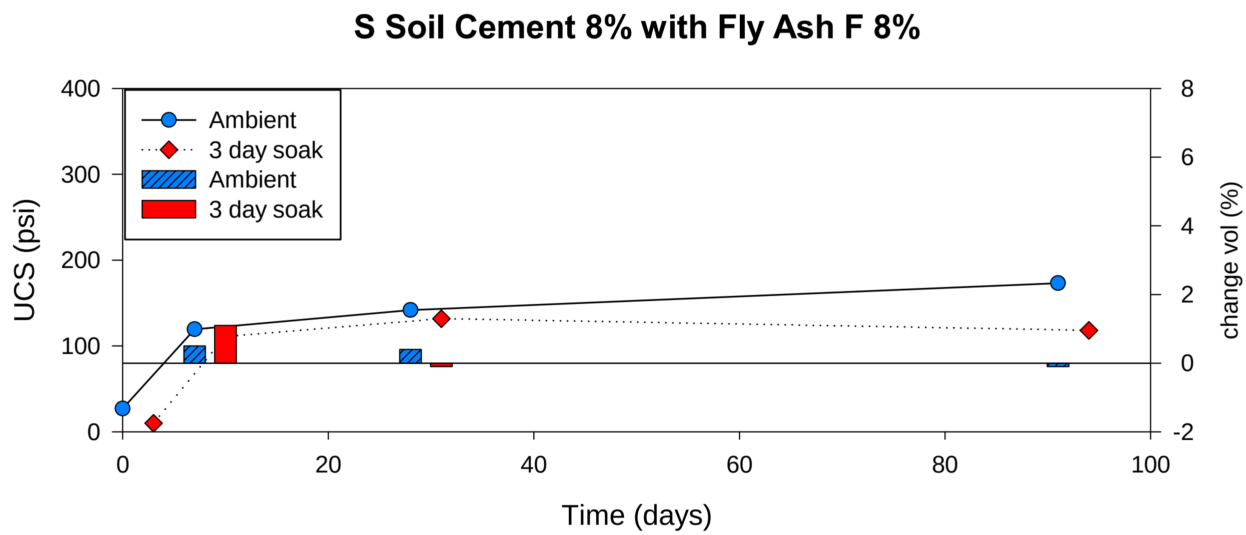


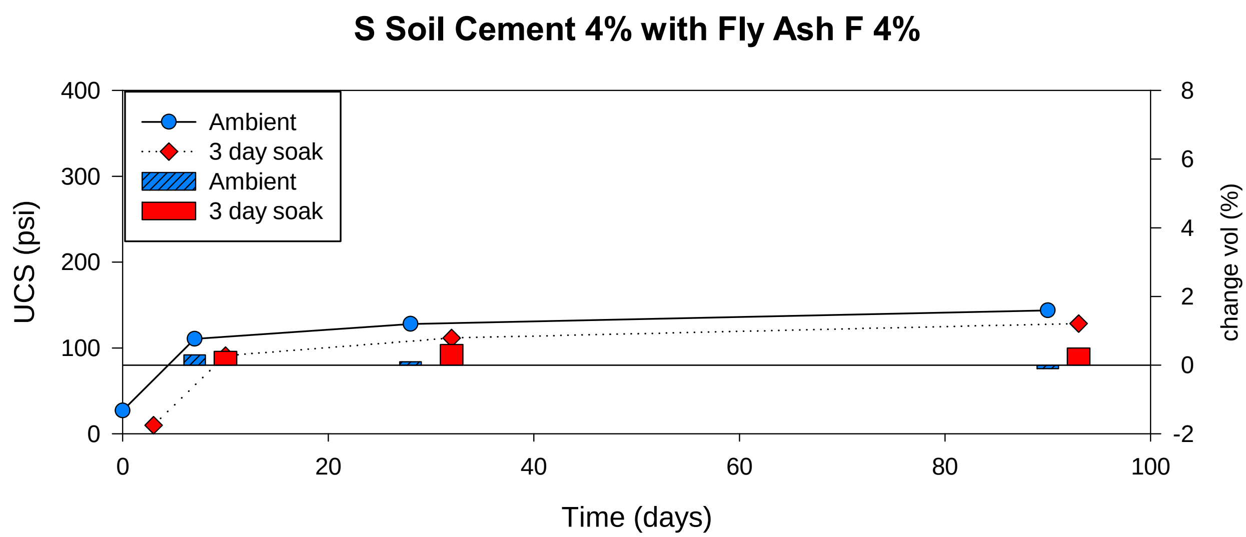
S Soil Cement 4% with Fly Ash C 4%

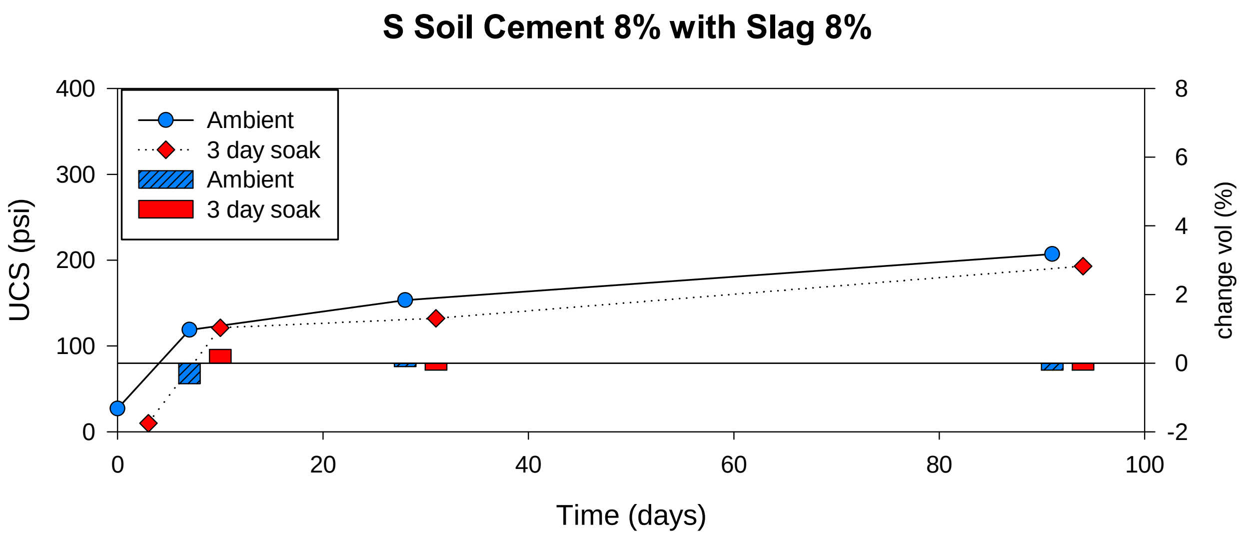


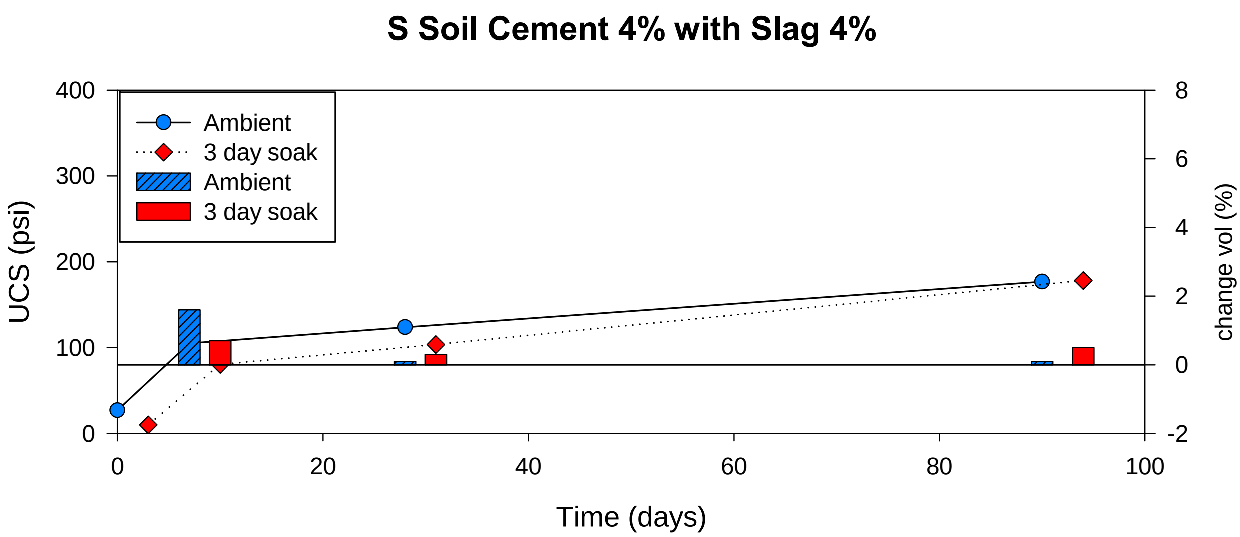
S Soil Cement 3% with Fly Ash C 3%

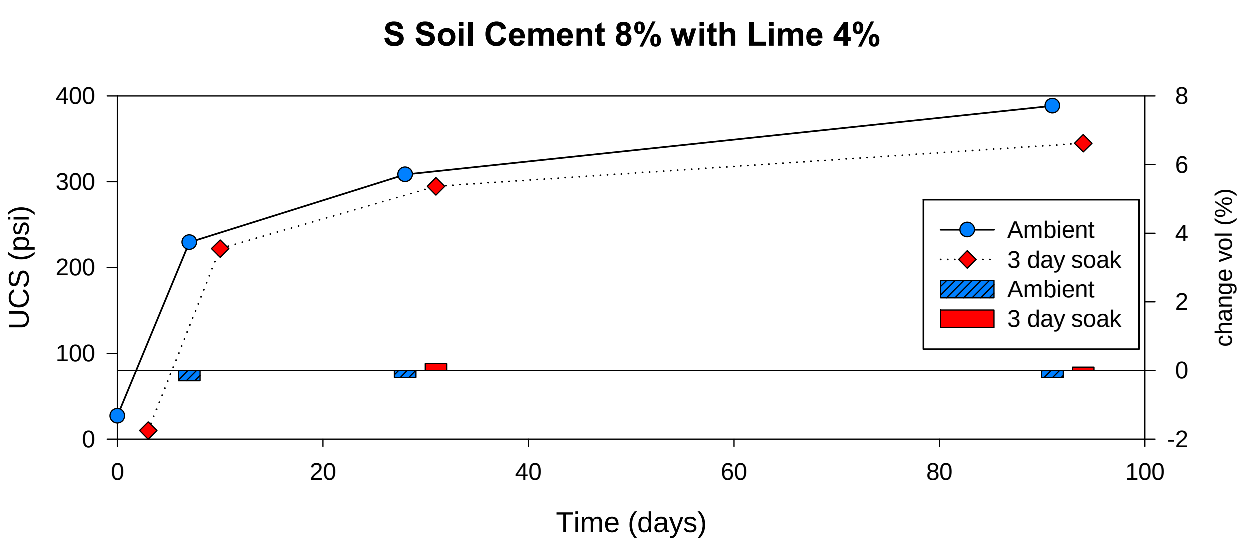



S Soil Cement 8% with Fly Ash F 8%
Ambient
3 day soak
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
0
100
200
300
400
-2
0
2
4
6
8
0
20
40
60
80
100

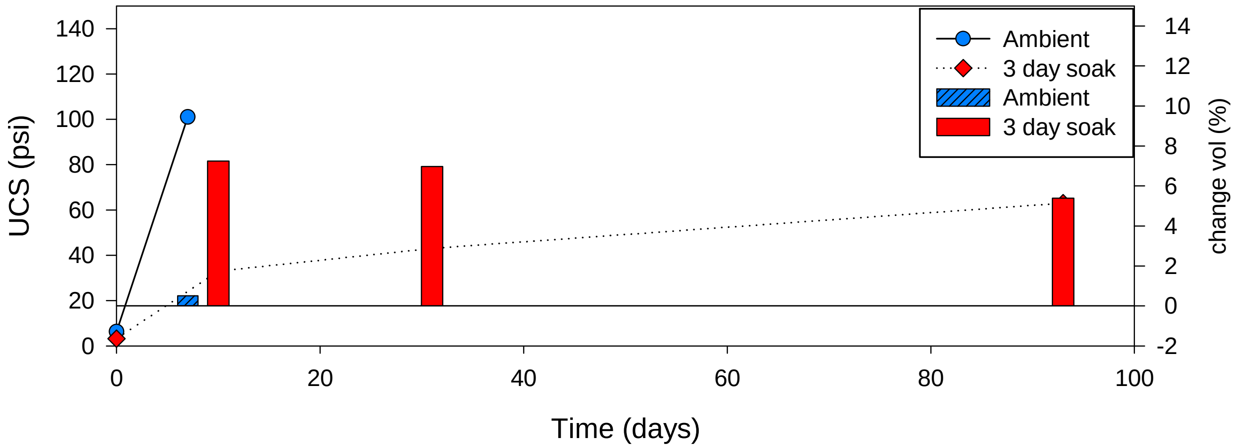

S Soil Cement 4% with Fly Ash F 4%
Ambient
3 day soak
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
0
100
200
300
400
-2
0
2
4
6
8
0
20
40
60
80
100


S Soil Cement 8% with Slag 8%
Ambient
3 day soak
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
400
300
200
100
0
8
6
4
2
0
-2
0
20
40
60
80
100

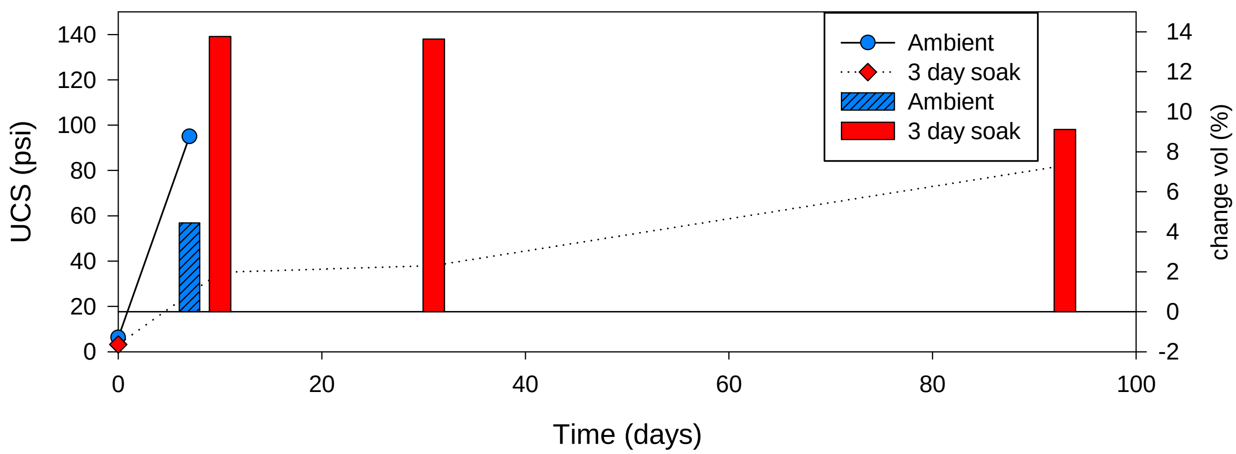

S Soil Cement 4% with Slag 4%
Ambient
3 day soak
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
400
300
200
100
0
8
6
4
2
0
-2
0
20
40
60
80
100


S Soil Cement 8% with Lime 4%
Ambient
3 day soak
Ambient
3 day soak
UCS (psi)
change vol (%)
Time (days)
400
300
200
100
0
8
6
4
2
0
-2
0
20
40
60
80
100

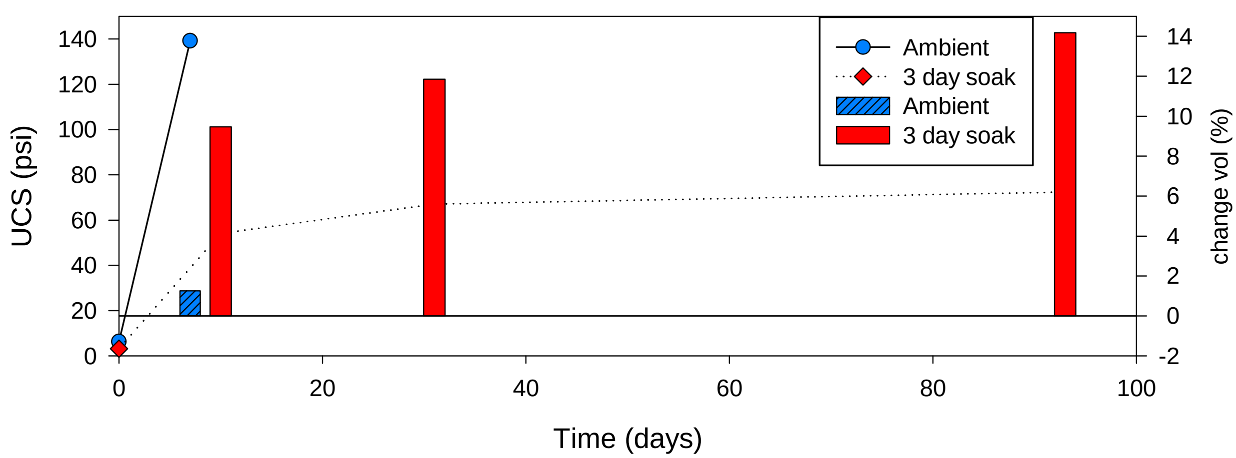
? Soil Type I II Cement 10%



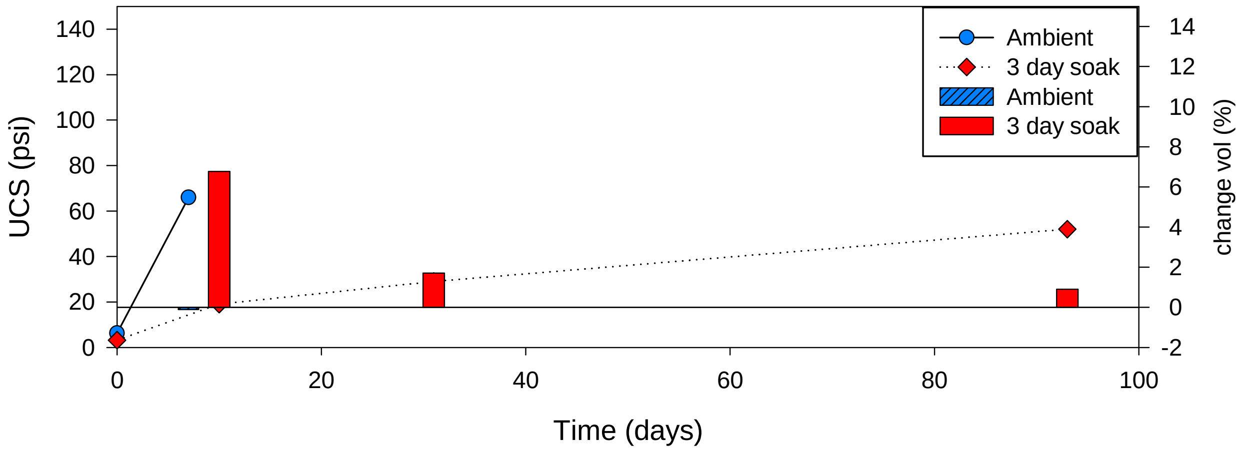
? Soil Lime 5%



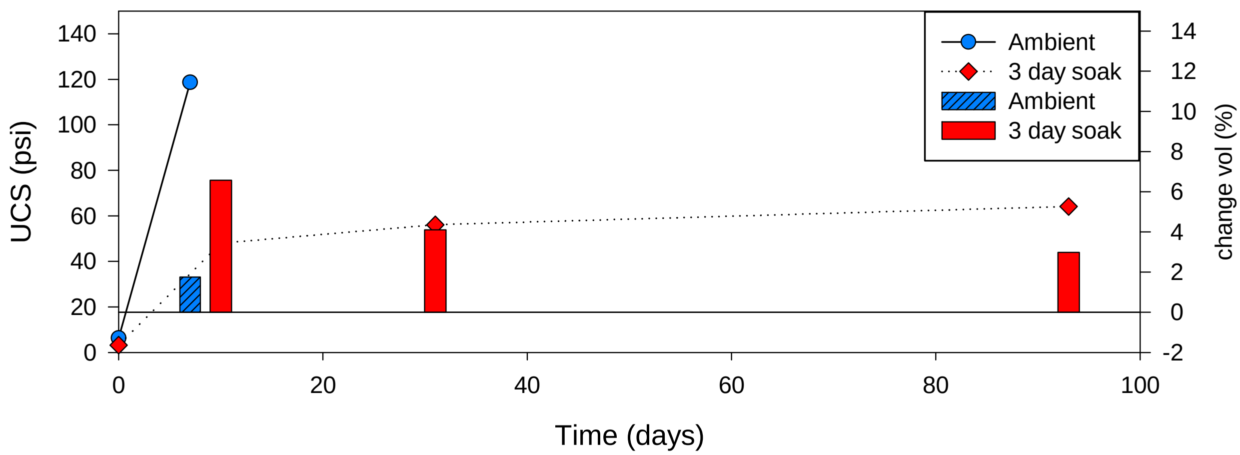
? Soil Cement 8% with Lime 4%



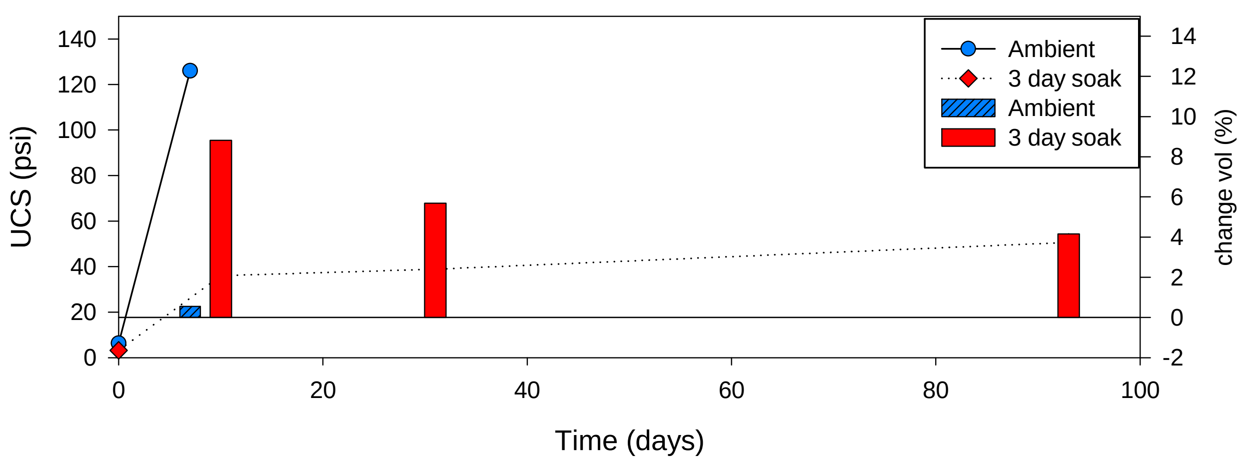
? Soil Class C Fly Ash 15%

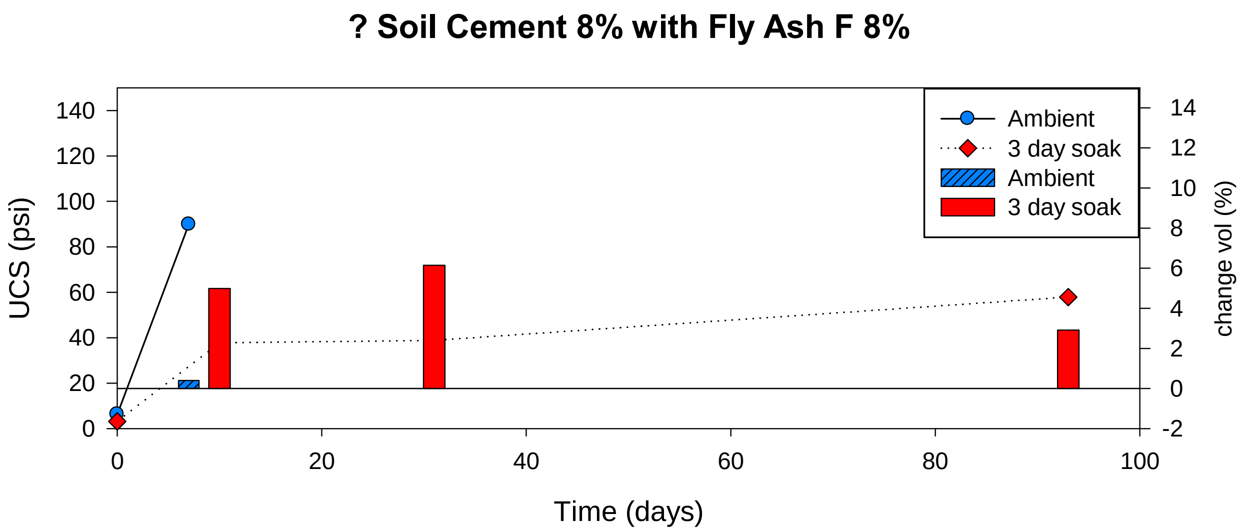


? Soil Cement 8% with Slag 8%



? Soil Cement 8% with Fly Ash C 8%




? Soil Cement 8% with Fly Ash F 8%
UCS (psi)
change vol (%)
Time (days)
Ambient
3 day soak
Ambient
3 day soak
0
20
40
60
80
100
120
140
-2
0
2
4
6
8
10
12
14
0
20
40
60
80
100