

TECHNICAL MEMORANDUM

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Date: May 1, 2015

Subject: Cellular Concrete Laboratory Testing Program
Laboratory Testing Observations and Results
Fall & Winter of 2014-2015

GENERAL

This technical memorandum (TM) summarizes laboratory testing of cellular concrete samples provided to us by Cell-Crete Corporation. Two phases of laboratory testing were completed and are described in two proposals authorized by Cell-Crete on December 15, 2014 and March 2, 2015. Objectives of the laboratory testing were to characterize cellular concrete properties for its use as a fill material substitute. Two different cellular concrete materials were tested. These materials were identified as Class II cellular concrete and a lighter weight cellular concrete (special mix design) with break strengths comparable to Class IV cellular concrete identified as Class IV (low density). Samples were provided to us from castings in July 2014, November 2014, and February 2015. Samples were tested following curing period of at least 28 days. Laboratory testing included:

- Triaxial test – Isotropically consolidated sheared drained (CID),
 - Triaxial test – Isotropically consolidated sheared undrained (CIU),
 - Unconfined compression (UCS),
 - K_0 consolidated triaxial test using strain controlled axial loading and automated lateral pressure adjustment,
 - One-dimensional (1D) consolidation test,
 - Hydraulic conductivity test (backpressure saturated using flexible wall permeameter),
 - Infiltration rate of pervious concrete test,
 - Slake durability of shales and similar weak rocks.
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SAMPLE COLLECTION AND PREPARATION

The samples were prepared, collected, cured on-site, and shipped by Cell-Crete to the Gerhart Cole laboratory. The samples were delivered in Styrofoam molds each containing four 3-inch diameter by 6-inch long samples. After arriving on-site the samples continued curing up to 7 days from casting in a temperature controlled environment before being stripped from the molds. Mold stripping followed instructions provided by Elastizell, the mold manufacturer. Once stripped samples were stored in a moisture and temperature controlled environment until testing. In order to account for potential sample losses and/or cracking during shipping additional samples, beyond what we needed for testing, were shipped.

A specific gravity of 3.15 for the cellular concrete was used in phase calculations. This specific gravity was based on mix designs and was provided to us by Cell Crete. Saturation (Skempton B-value) is reported as part of individual test summaries. We note, however, the range of these B-values did vary between samples tested (from 0.64 to 0.94). Given the vesicular nature (not connected and separated by relatively impermeable material) of cellular concrete, the final B-values were selected by recording backpressure sample volume changes with pressure and time. Once sample volume changes stabilized the samples were considered saturated. Samples were initially setup with a small gradient across the sample, typically 1 psi or less, and de-aired water was allowed to percolate from the bottom of the sample which facilitated the saturation processes.

The consolidation of samples occurred quickly and the results have been provided as appropriate for specific testing. During testing of class II samples, cast 07/14, sample crushing was observed for higher consolidation stresses. The sample crushing was confirmed visually after difficulty was observed in increasing the effective stress in the sample beyond approximately 35 to 55 psi. This observed crushing relationship relative to UCS testing results for the batch resulted in the testing of sample 213-59 at 20 psi (highest load for CIU testing) rather than the 30 psi load of CID.

MATERIAL UNIT WEIGHTS

Cured unit weights were measured as part of testing and a summary of these results is summarized in Table 1. Moisture contents were calculated after testing using moist mass prior to testing and oven-dried mass after testing. Final moisture contents are reported for many of the tests completed. Please note these values, although reported, were difficult to obtain as moisture was easily expelled from samples during disassembly and therefore should not be considered representative.

Table 1 - Summary of Cellular Concrete Measured Unit Weights

| Cellular Concrete Class | Moist/Cured Unit Weight Average (pcf) | Moist/Cured Unit Weight Standard Deviation (pcf) |
|-------------------------|---------------------------------------|--|
| II | 26.6 | 2.1 |
| IV | 32.9 | 0.8 |

SHEAR STRENGTH TESTING (CID, CIU, AND UCS TESTING)

Shear strength testing was performed on Class II and Class IV (low density) cellular concrete to characterize drained and undrained strength behavior. UCS testing is considered part of cellular concrete production quality control and these tests were run as a reference point to typical values observed in the field. Typically the stress-strain information is not reported with cellular concrete UCS testing, our testing included both stress-strain curves in addition to strain at peak strength information.

UCS Test Results

UCS tests performed in the fall of 2014 exceeded the manufacturer's suggested values for the Class II material (Elastizell 2000). The samples provided in the winter of 2015 did not exceed the manufacturer's recommended minimum compressive strengths as noted in Table 2. Also included in Table 2 is a summary of the strain at the interpreted peak strength. We understand that the mixing location and setup was different than typical production for the winter 2015 samples and that mix design for Class IV is specific to the project and may not meet the typical mix design criteria identified for Class IV cellular concrete. A summary of all shear strength testing results has been included in Appendix A (Class II) and Appendix B (Class IV low density).

Table 2 Summary of Cellular Concrete UCS Testing

| Cellular Concrete Class | Minimum UCS (psi) ^a | Cast Date (MM/YR) | UCS (psi) | Unit Weight (pcf) | Strain at Peak Strength (%) |
|-------------------------|--------------------------------|-------------------|--------------|-------------------|-----------------------------|
| II | 40 | 11/14 | 65.5 | 24.3 | 8.3 |
| | | 11/14 | 62.4 | 23.9 | 7.3 |
| | | 02/15 | 23.4 | 28 | 5.8 |
| | | 02/15 | 25.9 | 27.5 | 5.8 |
| | | 02/15 | 30.5 | 29.1 | 3.5 |
| IV (low-density) | 120 | 02/15 | <i>81.8</i> | 32.1 | 0.9 |
| | | 02/15 | <i>105.6</i> | 33.5 | 1.9 |
| | | 02/15 | <i>111.7</i> | 33.2 | 2.9 |
| | | 02/15 | 96 | 34 | 2.1 |
| | | 02/15 | <i>118.6</i> | 32.7 | 1.4 |
| | | 02/15 | <i>108.5</i> | 31.3 | 1.9 |

^a Value suggested by Elastizell (2000)

^b UCS values not meeting minimum in italics.

CID Test Results

A summary of CID test results for the Class II cellular concrete are included in the attached Figures 1a to 1d. Class IV (low density) results are similarly summarized in the attached Figures 2a to 2d. Test results have been plotted with interpreted peak values summarized in Figures 1b and 2b. Given the vesicular nature of the samples no filter paper was used in sample preparation. Double membranes were used in testing and appropriate corrections applied to testing results.

Engineering judgement specific to stress ranges, loading rate, material strength, and application should be used in design parameter selection as the strength of the cellular concrete appears to be sensitive to confining stress approaching the UCS. In general, the higher confining stresses resulted in lower principal and deviator stress transitions near the transition from linear to higher deformation (plastic) loadings.

CIU Test Results

A summary of CIU test results for Class II (low density) cellular concrete are included in the attached Figures 3a to 3e. Class IV (low density) results are summarized as well in the attached Figures 4a to 4e.

Measuring of the pore water pressures within the deformation of the cellular matrix in the undrained condition resulted in variability of the principal stress ratios as sudden pore water pressures increases occurred as sample resistance from loading transferred from the concrete skeleton to hydrostatic fluid pressures during failure. Visual observation of the samples after testing support recorded data as crushed cells or section of the samples were observed (see photos included with samples after testing for each test). Engineering judgement specific to loading ranges, loading rate, and application should be used in design parameter selection (e.g., cohesion and effective friction angle) as the linear loading range of the materials appear to be sensitive to confining stresses or the maximum combined stresses.

Given the vesicular nature of the samples no filter paper was used in sample preparation. Double membranes were used in testing and appropriate corrections applied to testing results. The ASTM standard for CID and CIU testing allows for the use of either a Method A or Method B approach to estimating the effective area of consolidated samples. Method A was selected in testing as the porous nature of the samples resulted in the immediate loss of water from the sample upon removal of the membrane precluding an accurate measurement of final moisture contents.

AT-REST LATERAL EARTH PRESSURE (K_0 TRIAXIAL)

At rest lateral earth pressure testing was performed to measure Poisson's ratio and At-Rest or K_0 pressures developed through consolidation while lateral stresses were adjusted to maintain no radial volume change. Sample loading consisted of axial loading applied by the triaxial piston with an automated program adjusting the cell pressure to match the horizontal pressure transfer from sample consolidation. The balancing cell pressure provides a direct measurement of the At Rest horizontal pressure of the sample. A summary of the measured K_0 for both the Class II and Class IV (low density) samples are provided in Figure 5. These plotted test results provide a comparison of the measured K_0 pressures for the two cellular concrete classes.

A summary of measured Poisson's ratio's relative to axial load (including cell pressure), s'_1 , and axial strain is provided in Figure 6 for both Class II and Class IV (low density) samples. The test results show a horizontal pressure is exerted from the sample under axial loading and that the ratio of lateral transfer varies based on loading conditions. The samples At-rest pressure and Poisson's ratio appear to quickly converge to a

minimum value, which increases and become more variable as loading and strain increase.

The one-dimensional consolidation data has been plotted in Figure 7 (Class II) and 8 (Class IV) to compare the consolidation curves developed from triaxial loading to that of one-dimensional loading. As can be seen from the curves a reasonable agreement between the K_0 consolidation and 1-D consolidation was achieved under lower loads; but diverged at higher loadings. The range over which data appears to match between the two tests indicates that under lower loading pressures and strains/deformation, K_0 pressures are more consistent, however, at higher strains increasing variability in may occur.

A summary of all K_0 testing results has been included in Appendix A (Class II) and Appendix B (Class IV low density).

CONSOLIDATION/SETTLEMENT TESTING (1-D CONSOLIDATION)

One-dimensional consolidation testing was performed to measure sensitivity of sample yielding and settlement versus axial loading. A summary of the consolidation results for the Class II and Class IV (low density) materials is included in Figure 9 for comparison. The test results indicate a notable difference in the elastic behavior of the two classes of cellular concrete. Class IV (low density) concrete yielded at a higher pressure with a lower deformation under higher loads. During testing, sample yielding was audible as the sample consolidated at transitions from smaller deformations to higher deformations. The audible sounds were most apparent as the sample transitioned at the first major large deformation load.

The samples were inundated at the beginning of the 100 psf loading with no swell pressures recorded. Unloading deformations of the samples were not recorded as they were observed to be minimal in initial testing.

A summary of each 1-D consolidation test has been included in Appendix A (Class II) and Appendix B (Class IV low density).

HYDRAULIC CONDUCTIVITY AND INFILTRATION

Hydraulic conductivity testing was performed using a flexible wall (i.e., membrane) and a triaxial cell. The back pressure testing included double membranes on the sample. The same class II samples were tested at multiple confining stresses (i.e., 5 and 12.5 psi) to compare conductivity values for the same samples. The intent of this staged testing was to ascertain if seepage around the porous/vesicular sides of the sample influenced measured results. We did not observe an appreciable change in measured conductivity as a result of different confining stresses. As a result, the additional confining stresses were not included in the Class IV (low density) testing. The change in conductivity did not appear to change with the number of pore volumes of water tested through the sample.

Table 3 - Summary of Cellular Concrete Hydraulic Conductivity Testing (Back Pressure, Flexible Wall)

| Cellular Concrete Class | Cast Date (MM/YR) | Sample ID | Hydraulic Conductivity $K_{average}^a$ (cm/sec) | Moist Unit Weight (pcf) | Confining Stress (psi) |
|-------------------------|-------------------|-----------|---|-------------------------|------------------------|
| II | 07/14 | 13 | 1.9E-4 | 29.2 | 5 |
| | 07/14 | 13 | 1.7E-4 | 29.2 | 12.5 |
| | 07/14 | 19 | 7.7E-4 | 27.1 | 5 |
| | 07/14 | 19 | 7.2E-4 | 27.1 | 12.5 |
| IV (low density) | 02/15 | 213-31 | 1.2E-3 | 31.2 | 5 |
| | 02/15 | 213-21 | 9.5E-4 | 33.5 | 12.5 |

^a Corrected to 20° C

In comparing the class II and class IV (low density) cellular concrete it is notable that the even with the higher initial unit weights (i.e., denser) the hydraulic conductivity was slightly higher.

No direct standard exists for measuring the infiltration rate of cast cellular concrete samples in a laboratory. Currently ASTM C1701 provides guidance on testing for the infiltration rate of in-place pervious concrete in the field. This standard was used as a reference in developing an approach for infiltration testing of cast samples in the laboratory. The cast samples were prepared using a triaxial base and membranes with O-rings to isolate the samples. Double O-rings at the top of the sample were used to isolate the water from moving along the sides of the membrane. The sample port to drain the base of the sample was left open to allow for transport of standing water from the top of the sample. The height of standing water was measured relative to time to calculate the infiltration rate of the water into the exposed top of sample. The ability to control the area of the drainage and directly measure the water level in the lab eliminated the need to quantify water losses by mass as outlined in ASTM C1701.

A summary of hydraulic conductivity and infiltration testing has been included in Appendix A (Class II) and Appendix B (Class IV low density).

SLAKE DURABILITY TESTING

The purpose of slake durability testing is to estimate the resistance of rock samples to weakening or disintegration from drying, wetting, and exposure in a service environment. Slake durability testing was run on molded cellular concrete samples that were broken into smaller fragments prior to testing. Additional performance information related to the application of slake durability results is available for specific designs and functions and is not included here. Observations made during testing indicate that air drying of the samples, rather than oven drying, may be more appropriate for cellular concrete. The cellular concrete, particularly Class II, became brittle after oven drying in

cycles and this exposure to higher heat may not be appropriate for all applications or climates. A summary of test results is provided in Table 3 with specific test summaries provided in Appendices A and B.

Table 4 Summary of Cellular Concrete Slake Durability Testing

| Cellular Concrete Class | Cast Date (MM/YR) | Slake Durability Index After 2 nd Cycle (%) | Natural Moisture Content (%) |
|-------------------------|-------------------|--|------------------------------|
| II | 02/15 | 63.5 | 39.8 |
| | 02/15 | 68.1 | 40.6 |
| IV (low density) | 02/15 | 93.2 | 41.0 |
| | 02/15 | 93.2 | 40.3 |

A summary of slake durability testing has been included in Appendix A (Class II) and Appendix B (Class IV low density).

OTHER CONSIDERATIONS

The testing results indicate that adequate quality control testing in mixture preparation yields relatively homogenous samples within batches. The difference in strengths between batches based on mixing methods was apparent in our testing program and made notable differences in the triaxial testing and interpretation.

Cellular concrete is a porous material and one of the sources of variability in the use of cellular concrete is the potential increase in moisture (i.e., wicking of water into the pores) and unit weight from absorption of subgrade and ambient moisture over time. Additional consideration should be applied to site specific and in-place testing of cellular concrete samples. Additional laboratory testing should be performed during construction to confirm that design assumptions critical to the project are being satisfied by production methods.

LIMITATIONS

The assessments and recommendations presented in this document are based on field studies and laboratory testing, as well as our understanding of the project's design and manner of construction at the time of writing. If the project's design or manner of construction changes, or if conditions are found later that are different from those described, we should be notified immediately so that we can make revisions, as necessary.

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APPENDICES

Appendix A: Laboratory Testing Class II Cellular Concrete

Appendix B: Laboratory Testing Class IV (Low Density) Cellular Concrete

REFERENCES

Elastizell Specification Section 0223 – Engineered Fill (EF) (2000).

<http://elastizell.com/fillspec.html> (accessed April 13, 2015).

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)

No: 14GCI498

Date cast: 07-Nov-14

Date: 09-Dec-14

Tested by: zmg

Reduced by: zmg

Checked by: rbm/rtc

Cellular concrete type: Class II

Sample: --

Sample description: Cell Crete

USCS classification: not requested

Sample type: cast (11/07/2014)

| | Test Number | S19 | 2.5 psi | S12 | 5 psi | S6 | 12.5 psi | S7 | 30 psi |
|------------------------|-------------------------------------|-----------------------|--------------------------------|---------|--------------------------------|---------|--------------------------------|---------|--------------------------------|
| | | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d |
| Unit weight data | 0° | 5.682 | | 5.786 | | 5.673 | | 5.726 | |
| | Sample ht., H (in) | 120° 5.667 | | 5.766 | | 5.694 | | 5.739 | |
| | | 240° 5.682 | | 5.782 | | 5.659 | | 5.712 | |
| | Avg. height, Havg (in) | 5.677 | 5.677 | 5.778 | 5.778 | 5.675 | 5.676 | 5.726 | 5.726 |
| | Avg. height, Havg (cm) | 14.420 | 14.420 | 14.676 | 14.676 | 14.415 | 14.416 | 14.543 | 14.543 |
| | ΔVs (cm ³) ^b | | 0.000 | | 0.000 | | 0.000 | | 0.000 |
| | ΔVc (cm ³) ^b | | -1.439 | | -1.335 | | -5.110 | | -10.175 |
| | Ht. change, ΔHc (in) | | 0.000 | | 0.000 | | 0.000 | | 0.000 |
| | Sample dia., D (in) | top 2.959 | | 2.947 | | 2.986 | | 2.971 | |
| | | mid 2.922 | | 2.906 | | 2.925 | | 2.907 | |
| | | bot 2.873 | | 2.877 | | 2.867 | | 2.899 | |
| | Avg. dia., Davg (in) | 2.919 | 2.916 | 2.909 | 2.906 | 2.926 | 2.914 | 2.921 | 2.897 |
| | Avg. dia., Davg (cm) | 7.414 | 7.406 | 7.389 | 7.381 | 7.431 | 7.401 | 7.419 | 7.359 |
| | Avg. area, Aavg (in ²) | 6.692 | 6.677 | 6.646 | 6.632 | 6.723 | 6.668 | 6.701 | 6.593 |
| | Avg. area, Aavg (cm ²) | 43.174 | 43.074 | 42.879 | 42.788 | 43.374 | 43.018 | 43.234 | 42.534 |
| | Wt. rings + wet soil (g) | 234.57 | | 239.45 | | 237.49 | | 236.81 | |
| | Wt. rings (g) | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| | Volume, Vo (in ³) | 38.0 | 37.9 | 38.4 | 38.3 | 38.2 | 37.8 | 38.4 | 37.7 |
| | Vo (cm ³) | 622.6 | 621.1 | 629.3 | 628.0 | 625.3 | 620.1 | 628.8 | 618.6 |
| | | Vo (ft ³) | 0.0220 | 0.0219 | 0.0222 | 0.0222 | 0.0221 | 0.0219 | 0.0222 |
| Moisture | Wet soil + tare (g) | 234.57 | | 239.45 | | 237.49 | | 236.81 | |
| | Dry soil + tare (g) | 147.78 | | 153.07 | | 152.43 | | 155.72 | |
| | Tare (g) | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| | Moisture content, w (%) | 58.7 | | 56.4 | | 55.8 | | 52.1 | |
| Phase Relationships | Gs, from mix design | 3.15 | | 3.15 | | 3.15 | | 3.15 | |
| | Mass total (g) | 234.6 | | 239.5 | | 237.5 | | 236.8 | |
| | Mass of solids (g) | 147.8 | | 153.1 | | 152.4 | | 155.7 | |
| | Volume (cm ³) | 622.6 | | 629.3 | | 625.3 | | 628.8 | |
| | Volume of water (cm ³) | 86.8 | | 86.4 | | 85.1 | | 81.1 | |
| | Volume of solids (cm ³) | 46.9 | | 48.6 | | 48.4 | | 49.4 | |
| | Volume of voids (cm ³) | 575.6 | | 580.7 | | 576.9 | | 579.3 | |
| | Volume of air (cm ³) | 488.9 | | 494.3 | | 491.8 | | 498.2 | |
| | Void ratio, e | 12.270 | | 11.950 | | 11.921 | | 11.719 | |
| | Porosity, n | 0.925 | | 0.923 | | 0.923 | | 0.921 | |
| | Volumetric moisture, T | 0.139 | | 0.137 | | 0.136 | | 0.129 | |
| | Saturation, S (%) ^c | 15.08 | | 14.88 | | 14.75 | | 14.00 | |
| | Dry density (gm/cm ³) | 0.237 | | 0.243 | | 0.244 | | 0.248 | |
| | Wet unit wt., gm (pcf) | 23.5 | | 23.8 | | 23.7 | | 23.5 | |
| Dry unit wt., gd (pcf) | 14.8 | | 15.2 | | 15.2 | | 15.5 | | |

Notes:

^a ΔHsc (in) = change in height during saturation and consolidation

^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation

^c Saturation before shear set to 100% for phase calculations

^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

FIGURE 1a

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 14GCI498

Sample: --

Date cast: 07-Nov-14

Sample description: Cell Crete

Date: 09-Dec-14

USCS classification: not requested

Tested by: zmg

Sample type: cast (11/07/2014)

J:\PROJECTS\Cell-Crete\14GCI498 Cell Crete Lab Testing\Analyses\Triaxial\TX_CD4pts_ClassII-v01.xlsx\SUM

| Test Number | S19 at 2.5 psi | S12 at 5 psi | S6 at 12.5 psi | S7 at 30 psi | |
|--|---|-----------------|-----------------|-----------------|-----------------|
| Test information | Total backpressure (psi) | 70.0 | 70.0 | 70.0 | 70.0 |
| | Skempton B | 0.83 | 0.81 | 0.76 | 0.68 |
| | t-90 (min) | 1.6 | 1.1 | 1.1 | 2.1 |
| | t-100 (min) | | | | |
| | t-50 (min) | 0.4 | 0.3 | 0.3 | 0.5 |
| | Strain rate (%/hr) | 6.00 | 6.00 | 6.00 | 6.00 |
| | Strain rate (%/min) | 0.10 | 0.10 | 0.10 | 0.10 |
| | Membrane correction | yes | yes | yes | yes |
| | Filter paper correction | No filter paper | No filter paper | No filter paper | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 10.1 | 17.3 | 11.0 | 10.5 |
| | Time to failure, tf (min) | 100.6 | 173.1 | 109.9 | 104.6 |
| | Confining stress, s'3 (psi) | 2.5 | 5.0 | 12.5 | 30.0 |
| | Deviator stress, s1-s3 (psi) | 57.8 | 53.0 | 53.9 | 40.4 |
| | Obliquity, s'1/s'3 | 25.1 | 12.3 | 5.3 | 2.3 |
| | Vol. strain at failure, ev (%) | -8.5 | -14.1 | -9.8 | -9.4 |
| | q = q' = (s1-s3)/2 (psi) | 28.9 | 26.5 | 27.0 | 20.2 |
| | p' = (s'1+s'3)/2 (psi) | 31.3 | 31.2 | 39.4 | 52.3 |
| | Effective major principal stress, s'1 (psi) | 60.2 | 57.7 | 66.4 | 72.4 |
| Effective minor principal stress, s'3 (psi) | 2.4 | 4.7 | 12.4 | 32.1 | |

Comments:

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 14GCI498

Sample: --

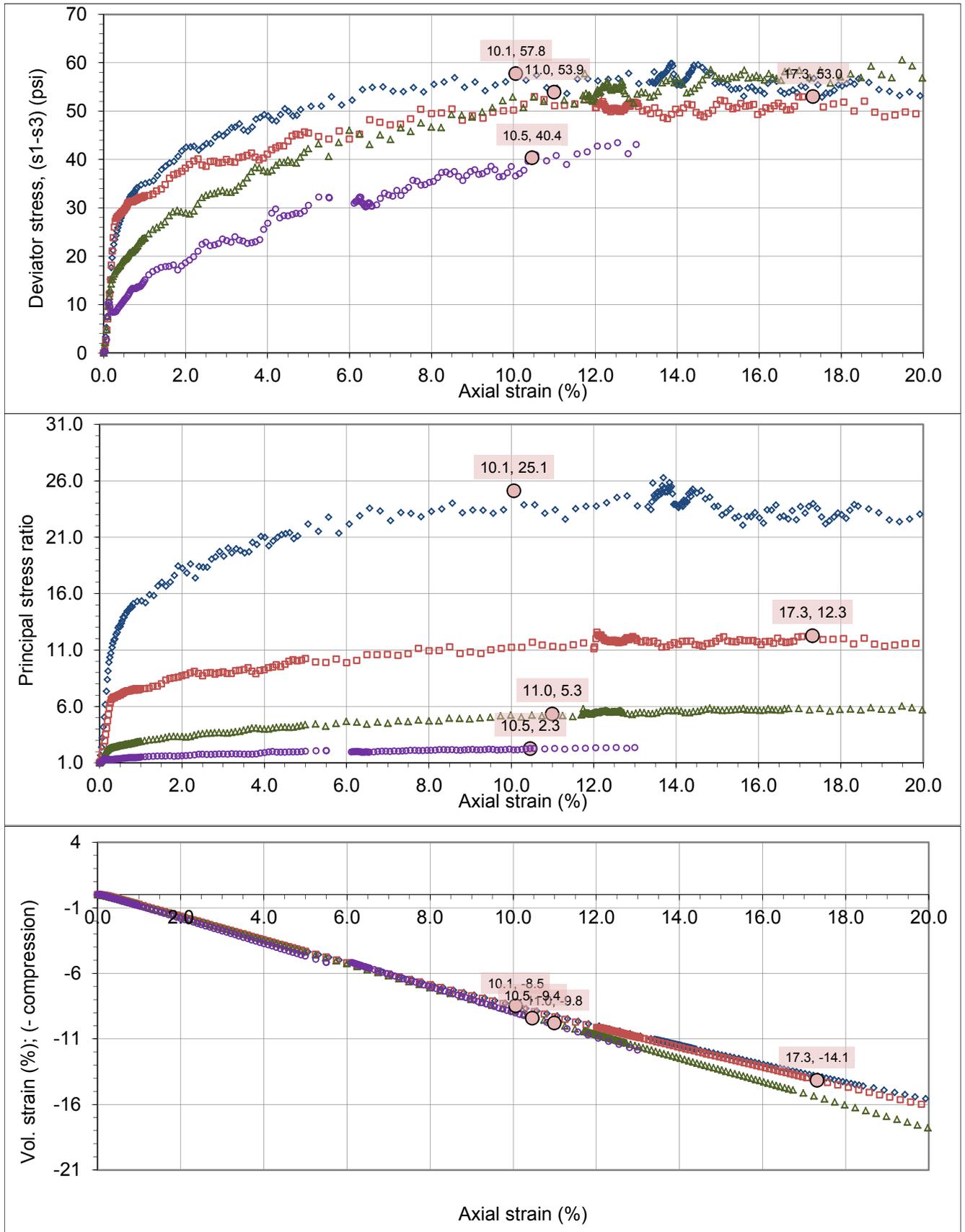


FIGURE 1c

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



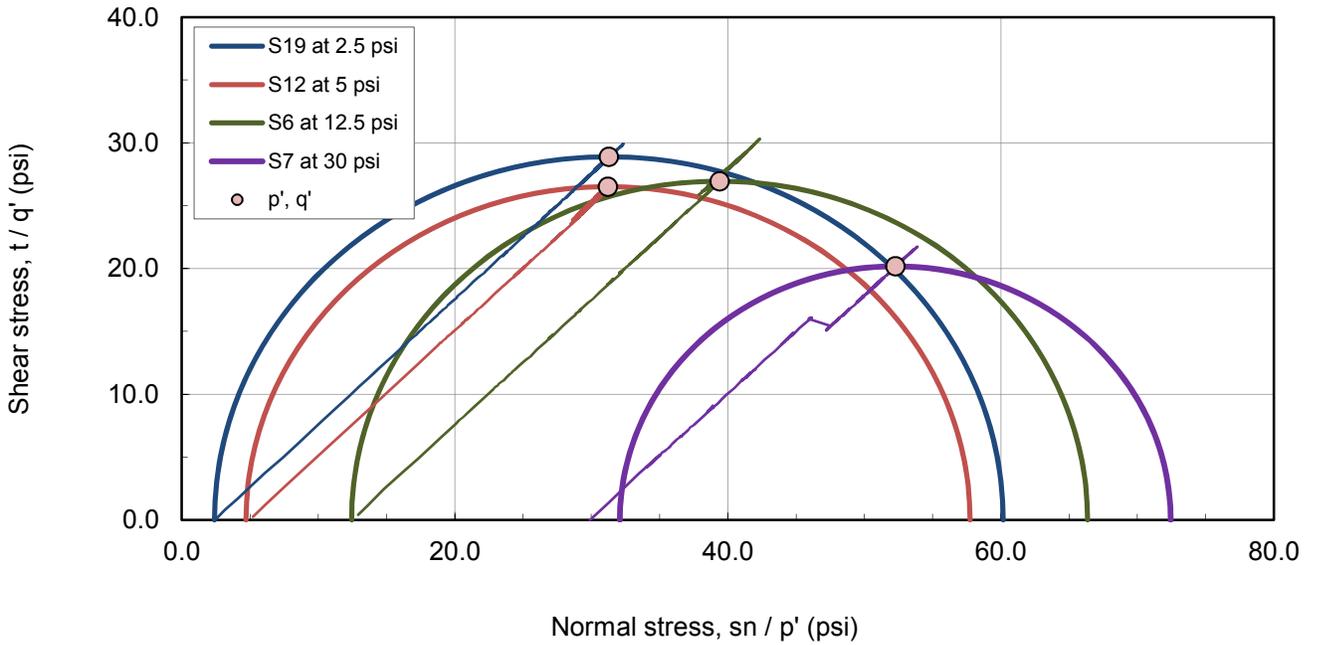
Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 14GCI498

Sample: --

Effective stress results



Peak deviator stress (s1-s3), failure criteria Mohr and p' - q' space plots

FIGURE 1d

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)



After ASTM 7181 and USBR 5755

Project: Cell-Crete
No: 14GCI498

Date cast: 13-Feb-15
 Date: 31-Mar-15

Tested by: zmg
 Reduced by: zmg
 Checked by: rbm/rtc

Cellular concrete type: Class IV (low density)

Sample: --

Sample description: Cell Crete
 USCS classification: not requested
 Sample type: Cell Crete

| | Test Number | S213-20 | | 2.5 psi | | S213-40 | | 5 psi | | S213-27 | | 12.5 psi | | S213-26 | | 30 psi | | |
|------------------------|-------------------------------------|------------|--------------------------------|---------|--------------------------------|---------|--------------------------------|---------|--------------------------------|---------|--------------------------------|----------|--------------------------------|---------|--------------------------------|--------|--|--|
| | | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d | Initial | Bef. Shr. MethodA ^d | | | |
| Unit weight data | Sample ht., H (in) | 0° 5.784 | | 5.753 | | 5.835 | | 5.764 | | 5.836 | | 5.751 | | 5.744 | | | | |
| | | 120° 5.775 | | 5.766 | | 5.836 | | 5.753 | | 5.836 | | 5.751 | | 5.744 | | | | |
| | | 240° 5.751 | | 5.752 | | 5.836 | | 5.753 | | 5.836 | | 5.751 | | 5.744 | | | | |
| | Avg. height, Havg (in) | 5.770 | 5.770 | 5.757 | 5.757 | 5.836 | 5.836 | 5.753 | 5.753 | 5.836 | 5.836 | 5.753 | 5.753 | 5.753 | 5.753 | | | |
| | Avg. height, Havg (cm) | 14.656 | 14.656 | 14.623 | 14.623 | 14.823 | 14.823 | 14.613 | 14.613 | 14.823 | 14.823 | 14.613 | 14.613 | 14.613 | 14.613 | | | |
| | ΔVs (cm ³) ^b | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | | |
| | ΔVc (cm ³) ^b | | | -1.257 | | -0.553 | | -2.362 | | -2.362 | | -2.362 | | -4.787 | | | | |
| | Ht. change, ΔHc (in) | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | | |
| | Sample dia., D (in) | top | 2.995 | | 2.981 | | 2.983 | | 2.980 | | 2.983 | | 2.980 | | 2.917 | | | |
| | | mid | 2.953 | | 2.953 | | 2.952 | | 2.938 | | 2.952 | | 2.938 | | 2.917 | | | |
| | | bot | 2.914 | | 2.913 | | 2.924 | | 2.917 | | 2.924 | | 2.917 | | 2.917 | | | |
| | Avg. dia., Davg (in) | | 2.954 | 2.951 | 2.950 | 2.949 | 2.953 | 2.947 | 2.943 | 2.943 | 2.947 | 2.943 | 2.943 | 2.943 | 2.932 | | | |
| | Avg. dia., Davg (cm) | | 7.503 | 7.495 | 7.493 | 7.490 | 7.500 | 7.486 | 7.476 | 7.476 | 7.486 | 7.476 | 7.476 | 7.476 | 7.448 | | | |
| | Avg. area, Aavg (in ²) | | 6.852 | 6.839 | 6.835 | 6.829 | 6.848 | 6.823 | 6.804 | 6.804 | 6.823 | 6.804 | 6.804 | 6.753 | | | | |
| | Avg. area, Aavg (cm ²) | | 44.208 | 44.123 | 44.096 | 44.058 | 44.178 | 44.018 | 43.895 | 43.895 | 44.018 | 43.895 | 43.895 | 43.566 | | | | |
| | Wt. rings + wet soil (g) | | 350.99 | | 325.41 | | 349.38 | | 335.48 | | 349.38 | | 335.48 | | | | | |
| | Wt. rings (g) | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | | | | |
| | Volume, Vo (in ³) | | 39.5 | 39.5 | 39.3 | 39.3 | 40.0 | 39.8 | 39.1 | 39.1 | 40.0 | 39.8 | 39.1 | 38.8 | | | | |
| Vo (cm ³) | | 647.9 | 646.7 | 644.8 | 644.3 | 654.8 | 652.5 | 641.4 | 641.4 | 654.8 | 652.5 | 641.4 | 636.6 | | | | | |
| Vo (ft ³) | | 0.0229 | 0.0228 | 0.0228 | 0.0228 | 0.0231 | 0.0230 | 0.0227 | 0.0227 | 0.0231 | 0.0230 | 0.0227 | 0.0225 | | | | | |
| Moisture | Wet soil + tare (g) | 350.99 | | 325.41 | | 349.38 | | 335.48 | | 349.38 | | 335.48 | | | | | | |
| | Dry soil + tare (g) | 246.37 | | 221.86 | | 237.08 | | 225.78 | | 237.08 | | 225.78 | | | | | | |
| | Tare (g) | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | | | | | |
| | Moisture content, w (%) | 42.5 | | 46.7 | | 47.4 | | 48.6 | | 47.4 | | 48.6 | | | | | | |
| Phase Relationships | Gs, from mix design | 3.15 | | 3.15 | | 3.15 | | 3.15 | | 3.15 | | 3.15 | | | | | | |
| | Mass total (g) | 351.0 | | 325.4 | | 349.4 | | 335.5 | | 349.4 | | 335.5 | | | | | | |
| | Mass of solids (g) | 246.4 | | 221.9 | | 237.1 | | 225.8 | | 237.1 | | 225.8 | | | | | | |
| | Volume (cm ³) | 647.9 | | 644.8 | | 654.8 | | 641.4 | | 654.8 | | 641.4 | | | | | | |
| | Volume of water (cm ³) | 104.6 | | 103.6 | | 112.3 | | 109.7 | | 112.3 | | 109.7 | | | | | | |
| | Volume of solids (cm ³) | 78.2 | | 70.4 | | 75.3 | | 71.7 | | 75.3 | | 71.7 | | | | | | |
| | Volume of voids (cm ³) | 569.7 | | 574.4 | | 579.6 | | 569.7 | | 579.6 | | 569.7 | | | | | | |
| | Volume of air (cm ³) | 465.1 | | 470.8 | | 467.3 | | 460.0 | | 467.3 | | 460.0 | | | | | | |
| | Void ratio, e | 7.284 | | 8.155 | | 7.701 | | 7.949 | | 7.701 | | 7.949 | | | | | | |
| | Porosity, n | 0.879 | | 0.891 | | 0.885 | | 0.888 | | 0.885 | | 0.888 | | | | | | |
| | Volumetric moisture, T | 0.161 | | 0.161 | | 0.171 | | 0.171 | | 0.171 | | 0.171 | | | | | | |
| | Saturation, S (%) ^c | 18.36 | | 18.03 | | 19.38 | | 19.25 | | 19.38 | | 19.25 | | | | | | |
| | Dry density (gm/cm ³) | 0.380 | | 0.344 | | 0.362 | | 0.352 | | 0.362 | | 0.352 | | | | | | |
| | Wet unit wt., gm (pcf) | 33.8 | | 31.5 | | 33.3 | | 32.7 | | 33.3 | | 32.7 | | | | | | |
| Dry unit wt., gd (pcf) | 23.7 | | 21.5 | | 22.6 | | 22.0 | | 22.6 | | 22.0 | | | | | | | |

Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

FIGURE 2a

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete

Cellular concrete type: Class IV (low density)

No: 14GCI498

Sample: --

Date cast: 13-Feb-15

Sample description: Cell Crete

Date: 31-Mar-15

USCS classification: not requested

Tested by: zmg

Sample type: Cell Crete

J:\PROJECTS\Cell-Crete\14GCI498 Cell Crete Lab Testing\Analyses\Triaxial\TX_CD4pts_ClassIV-v01.xlsx\SUM

| Test Number | S213-20 at 2.5 psi | S213-40 at 5 psi | S213-27 at 12.5 psi | S213-26 at 30 psi | |
|--|---|------------------|---------------------|-------------------|-----------------|
| Test information | Total backpressure (psi) | 80.0 | 85.0 | 85.0 | 85.0 |
| | Skempton B | 0.83 | 0.64 | 0.79 | 0.68 |
| | t-90 (min) | 1.1 | 0.6 | 0.7 | 1.1 |
| | t-100 (min) | | | | |
| | t-50 (min) | 0.3 | 0.1 | 0.2 | 0.3 |
| | Strain rate (%/hr) | 6.00 | 6.00 | 6.00 | 6.00 |
| | Strain rate (%/min) | 0.10 | 0.10 | 0.10 | 0.10 |
| | Membrane correction | yes | yes | yes | yes |
| | Filter paper correction | No filter paper | No filter paper | No filter paper | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 4.8 | 1.2 | 6.0 | 4.4 |
| | Time to failure, tf (min) | 47.7 | 11.8 | 59.7 | 43.8 |
| | Confining stress, s'3 (psi) | 2.5 | 5.0 | 12.5 | 30.0 |
| | Deviator stress, s1-s3 (psi) | 98.9 | 81.8 | 101.6 | 95.7 |
| | Obliquity, s'1/s'3 | 39.3 | 17.5 | 9.1 | 4.2 |
| | Vol. strain at failure, ev (%) | -3.3 | -0.7 | -4.7 | -3.9 |
| | q = q' = (s1-s3)/2 (psi) | 49.4 | 40.9 | 50.8 | 47.9 |
| | p' = (s'1+s'3)/2 (psi) | 52.0 | 45.8 | 63.3 | 77.6 |
| | Effective major principal stress, s'1 (psi) | 101.5 | 86.7 | 114.1 | 125.4 |
| | Effective minor principal stress, s'3 (psi) | 2.6 | 4.9 | 12.5 | 29.7 |

Comments:

FIGURE 2b

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete
No: 14GCI498

Cellular concrete type: Class IV (low density)
Sample: --

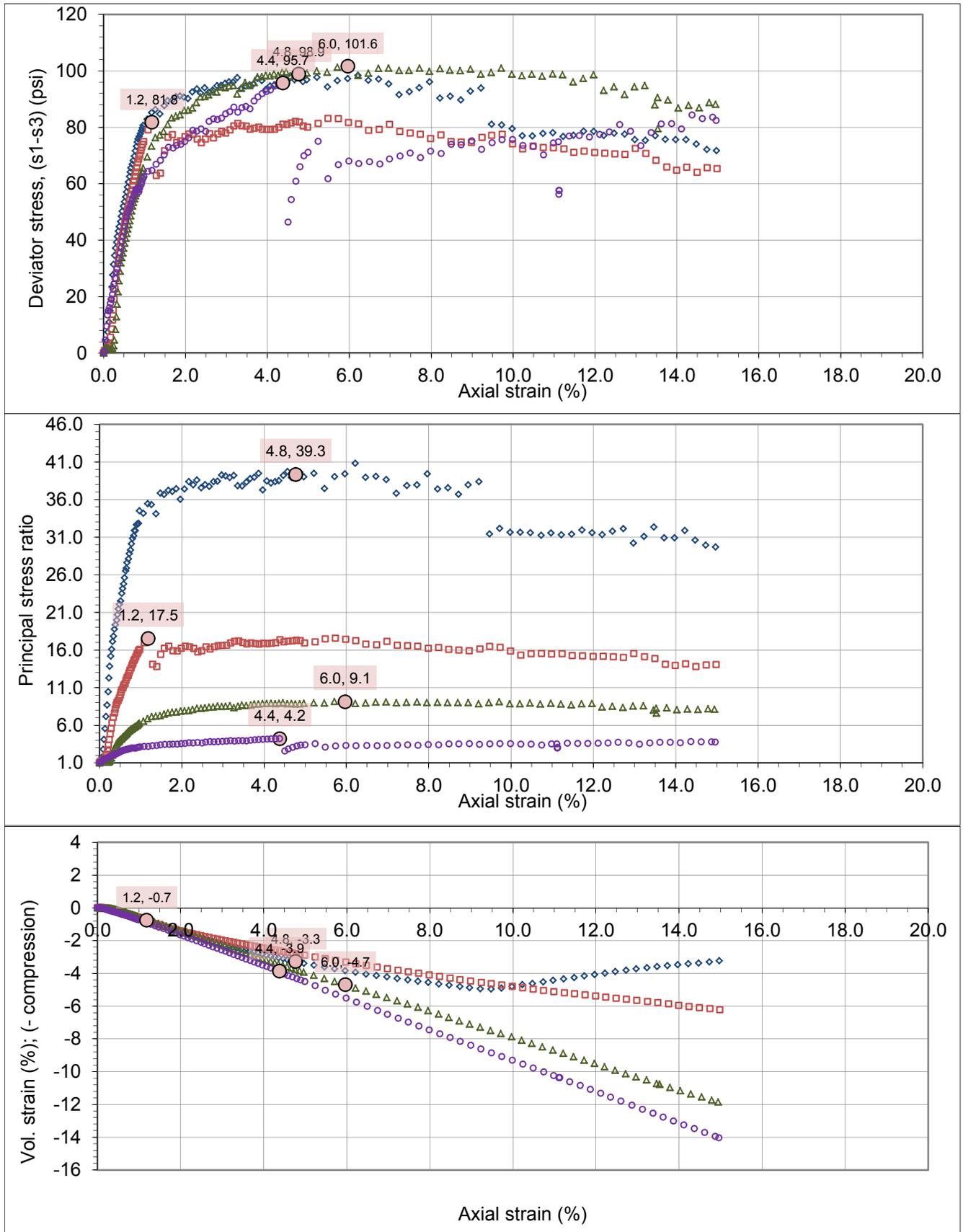


FIGURE 2c

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



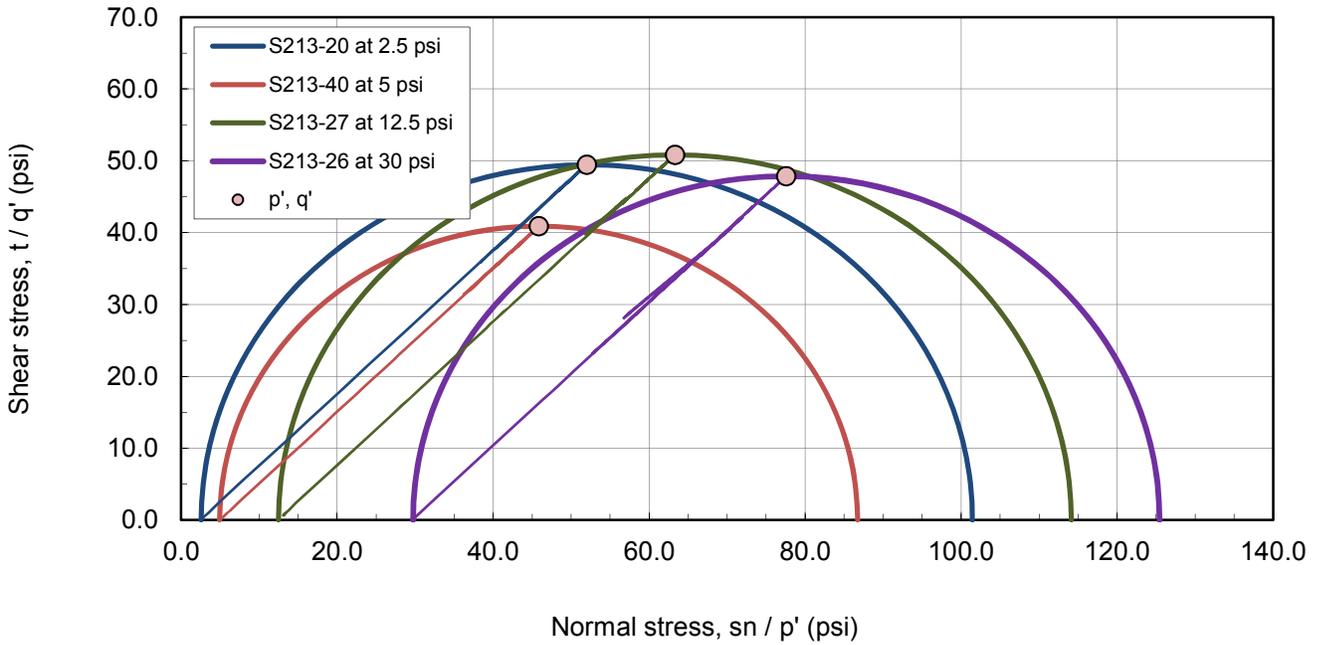
Project: Cell-Crete

Cellular concrete type: Class IV (low density)

No: 14GCI498

Sample: --

Effective stress results



Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

FIGURE 2d

Triaxial Test - Isotropic Consolidated Sheared Undrained



Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: --

Date cast: 13-Feb-15
Date: 02-Apr-15

Sample description: Cellular concrete cast 2/13/15
USCS classification: not applicable

Tested by: zmg
Reduced by: zmg
Checked by: rbm/rtc

Sample type: cast

| | Test Number | S213-54 | | 2.5 psi | | S213-48 | | 5 psi | | S213-47 | | 12.5 psi | | S213-59 | | 20 psi | | |
|-------------------------------------|-------------------------------------|------------|-----------|----------------------|---------|-----------|----------------------|---------|-----------|----------------------|---------|-----------|----------------------|---------|-----------|----------------------|---------|-----------|
| | | Initial | Bef. Shr. | MethodA ^d | Initial | Bef. Shr. | MethodA ^d | Initial | Bef. Shr. | MethodA ^d | Initial | Bef. Shr. | MethodA ^d | Initial | Bef. Shr. | MethodA ^d | Initial | Bef. Shr. |
| Unit weight data | Sample ht., H (in) | 0° 5.770 | | | 5.926 | | | 5.753 | | | 5.824 | | | 5.824 | | | | |
| | | 120° 5.766 | | | 5.939 | | | 5.748 | | | 5.844 | | | 5.844 | | | | |
| | | 240° 5.760 | | | 5.925 | | | 5.752 | | | 5.798 | | | 5.798 | | | | |
| | Avg. height, Havg (in) | 5.765 | 5.765 | | 5.930 | 5.930 | | 5.751 | 5.751 | | 5.822 | 5.822 | | 5.822 | 5.822 | | | |
| | Avg. height, Havg (cm) | 14.644 | 14.644 | | 15.062 | 15.062 | | 14.608 | 14.608 | | 14.788 | 14.788 | | 14.788 | 14.788 | | | |
| | ΔHsc (in) ^a | | 0.00 | | | 0.00 | | | 0.00 | | | 0.00 | | | 0.00 | | | |
| | Sample dia., D (in) | top 2.988 | | | 2.963 | | | 2.977 | | | 2.969 | | | 2.969 | | | | |
| | | mid 2.956 | | | 2.946 | | | 2.930 | | | 2.927 | | | 2.927 | | | | |
| | | bot 2.915 | | | 2.888 | | | 2.898 | | | 2.887 | | | 2.887 | | | | |
| | Avg. dia., Davg (in) | 2.954 | 2.957 | | 2.936 | 2.944 | | 2.934 | 2.944 | | 2.928 | 2.942 | | 2.942 | 2.942 | | | |
| | Avg. dia., Davg (cm) | 7.503 | 7.510 | | 7.457 | 7.477 | | 7.452 | 7.477 | | 7.436 | 7.472 | | 7.472 | 7.472 | | | |
| | Avg. area, Aavg (in ²) | 6.852 | 6.866 | | 6.769 | 6.806 | | 6.760 | 6.806 | | 6.731 | 6.796 | | 6.796 | 6.796 | | | |
| | Avg. area, Aavg (cm ²) | 44.208 | 44.296 | | 43.671 | 43.910 | | 43.612 | 43.911 | | 43.426 | 43.846 | | 43.846 | 43.846 | | | |
| | Wt. rings + wet soil (g) | 284.90 | 611.33 | | 296.88 | 600.14 | | 284.90 | 568.74 | | 290.84 | 582.45 | | 582.45 | 582.45 | | | |
| | Wt. rings (g) | 0.00 | 30.42 | | 0.00 | 33.75 | | 0.00 | 33.75 | | 0.00 | 30.42 | | 30.42 | 30.42 | | | |
| Volume, Vo (in ³) | 39.5 | 39.6 | | 40.1 | 40.4 | | 38.9 | 39.1 | | 39.2 | 39.6 | | 39.6 | 39.6 | | | | |
| Vo (cm ³) | 647.4 | 648.7 | | 657.8 | 661.4 | | 637.1 | 641.4 | | 642.2 | 648.4 | | 648.4 | 648.4 | | | | |
| Vo (ft ³) | 0.0229 | 0.0229 | | 0.0232 | 0.0234 | | 0.0225 | 0.0227 | | 0.0227 | 0.0229 | | 0.0229 | 0.0229 | | | | |
| ΔVs (cm ³) ^b | | 0.00 | | | 0.00 | | | 0.00 | | | 0.00 | | | 0.00 | | | | |
| ΔVc (cm ³) ^b | | -1.29 | | | -3.59 | | | -4.38 | | | -6.20 | | | -6.20 | | | | |
| Moisture | Wet soil + tare (g) | 284.90 | 697.34 | | 296.88 | 685.73 | | 284.90 | 644.07 | | 290.84 | 654.17 | | 654.17 | 654.17 | | | |
| | Dry soil + tare (g) | 189.26 | 334.10 | | 197.65 | 342.74 | | 189.83 | 334.69 | | 193.88 | 313.00 | | 313.00 | 313.00 | | | |
| | Tare (g) | 0.00 | 144.84 | | 0.00 | 145.09 | | 0.00 | 144.86 | | 0.00 | 119.12 | | 119.12 | 119.12 | | | |
| | Moisture content, w (%) | 50.5 | 191.9 | | 50.2 | 173.5 | | 50.1 | 163.0 | | 50.0 | 176.0 | | 176.0 | 176.0 | | | |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 | | 3.15 | 3.15 | | 3.15 | 3.15 | | 3.15 | 3.15 | | 3.15 | 3.15 | | | |
| | Mass total (g) | 284.9 | 777.9 | | 296.9 | 796.3 | | 284.9 | 771.0 | | 290.8 | 780.7 | | 780.7 | 780.7 | | | |
| | Mass of solids (g) | 189.3 | 189.3 | | 197.7 | 197.7 | | 189.8 | 189.8 | | 193.9 | 193.9 | | 193.9 | 193.9 | | | |
| | Volume (cm ³) | 647.4 | 648.7 | | 657.8 | 661.4 | | 637.1 | 641.4 | | 642.2 | 648.4 | | 648.4 | 648.4 | | | |
| | Volume of water (cm ³) | 95.6 | 588.6 | | 99.2 | 598.6 | | 95.1 | 581.2 | | 97.0 | 586.8 | | 586.8 | 586.8 | | | |
| | Volume of solids (cm ³) | 60.1 | 60.1 | | 62.7 | 62.7 | | 60.3 | 60.3 | | 61.5 | 61.5 | | 61.5 | 61.5 | | | |
| | Volume of voids (cm ³) | 587.3 | 588.6 | | 595.0 | 598.6 | | 576.8 | 581.2 | | 580.6 | 586.8 | | 586.8 | 586.8 | | | |
| | Volume of air (cm ³) | 491.7 | 0.0 | | 495.8 | 0.0 | | 481.7 | 0.0 | | 483.7 | 0.0 | | 483.7 | 483.7 | | | |
| | Void ratio, e | 9.775 | 9.796 | | 9.483 | 9.541 | | 9.571 | 9.644 | | 9.434 | 9.534 | | 9.534 | 9.534 | | | |
| | Porosity, n | 0.907 | 0.907 | | 0.905 | 0.905 | | 0.905 | 0.906 | | 0.904 | 0.905 | | 0.905 | 0.905 | | | |
| | Volumetric moisture, T | 0.148 | 0.907 | | 0.151 | 0.905 | | 0.149 | 0.906 | | 0.151 | 0.905 | | 0.905 | 0.905 | | | |
| | Saturation, S (%) ^c | 16.28 | 100.00 | | 16.68 | 100.00 | | 16.48 | 100.00 | | 16.70 | 100.00 | | 100.00 | 100.00 | | | |
| | Dry density (gm/cm ³) | 0.292 | 0.292 | | 0.300 | 0.299 | | 0.298 | 0.296 | | 0.302 | 0.299 | | 0.299 | 0.299 | | | |
| | Wet unit wt., gm (pcf) | 27.5 | 53.2 | | 28.2 | 51.0 | | 27.9 | 48.6 | | 28.3 | 51.5 | | 51.5 | 51.5 | | | |
| Dry unit wt., gd (pcf) | 18.3 | 18.2 | | 18.8 | 18.7 | | 18.6 | 18.5 | | 18.8 | 18.7 | | 18.7 | 18.7 | | | | |

Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

FIGURE 3a

Triaxial Test - Isotropic Consolidated Sheared Undrained



Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: Cell Crete

Cellular concrete type: Class II

No: 14GCI498

Sample: --

Date cast: 13-Feb-15

Sample description: Cellular concrete cast 2/13/15

Date: 02-Apr-15

USCS classification: not applicable

Tested by: zmg

Sample type: cast

J:\PROJECTS\Cell-Crete\14GCI498 Cell Crete Lab Testing\Analyses\Triaxial\TX_CU4pts_ClassII-v01.xlsx\SUM

| Test Number | S213-54 at 2.5 psi | S213-48 at 5 psi | S213-47 at 12.5 psi | S213-59 at 20 psi | |
|--|---|------------------|---------------------|-------------------|-----------------|
| Test information | Total backpressure (psi) | 85.0 | 75.0 | 85.0 | 85.0 |
| | Skempton B | 0.94 | 0.92 | 0.87 | 0.84 |
| | t-90 (min) | 1.2 | 1.5 | 1.2 | 1.2 |
| | t-100 (min) | | | | |
| | t-50 (min) | 0.3 | 0.4 | 0.3 | 0.3 |
| | Strain rate (%/hr) | 6.00 | 6.00 | 6.00 | 6.00 |
| | Strain rate (%/min) | 0.10 | 0.10 | 0.10 | 0.10 |
| | Membrane correction | Yes | Yes | Yes | Yes |
| | Filter paper correction | No filter paper | No filter paper | No filter paper | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 3.80 | 3.48 | 5.49 | 5.51 |
| | Time to failure, tf (min) | 38.0 | 34.8 | 54.9 | 55.1 |
| | Obliquity, s'1/s'3 | 9122.5 | 18540.2 | 195.0 | 58.5 |
| | Excess pore pressure, u (psi) | 2.5 | 5.0 | 12.4 | 19.6 |
| | q = q' = (s1-s3)/2 (psi) | 18.7 | 18.4 | 12.9 | 11.2 |
| | p' = (s'1+s'3)/2 (psi) | 18.7 | 18.4 | 13.0 | 11.6 |
| | p = (s1+s3)/2 (psi) | 21.2 | 23.4 | 25.4 | 31.2 |
| | Effective major principal stress, s'1 (psi) | 37.4 | 36.9 | 25.9 | 22.7 |
| | Effective minor principal stress, s'3 (psi) | 0.00 | 0.00 | 0.13 | 0.39 |
| | Total major pincipal stress, s1 (psi) | 39.9 | 41.9 | 38.3 | 42.3 |
| | Total minor pincipal stress, s3 (psi) | 2.5 | 5.0 | 12.5 | 20.0 |
| Skempton A at failure, Af | 0.07 | 0.14 | 0.48 | 0.88 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 4.1 | 3.5 | 5.2 | 2.3 |
| | Time to failure, tf (min) | 41.0 | 34.8 | 52.4 | 23.0 |
| | Deviator stress, s1-s3 (psi) | 38.9 | 36.9 | 25.9 | 26.4 |
| | Excess pore pressure, u (psi) | 2.5 | 5.0 | 12.4 | 18.5 |
| | q = q' = (s1-s3)/2 (psi) | 19.5 | 18.4 | 12.9 | 13.2 |
| | p' = (s'1+s'3)/2 (psi) | 19.5 | 18.4 | 13.1 | 14.7 |
| | p = (s1+s3)/2 (psi) | 22.0 | 23.4 | 25.4 | 33.2 |
| | Effective major principal stress, s'1 (psi) | 38.9 | 36.9 | 26.0 | 27.9 |
| | Effective minor principal stress, s'3 (psi) | 0.02 | 0.00 | 0.15 | 1.48 |
| | Total major pincipal stress, s1 (psi) | 41.4 | 41.9 | 38.4 | 46.4 |
| | Total minor pincipal stress, s3 (psi) | 2.5 | 5.0 | 12.5 | 20.0 |
| Skempton A at failure, Af | 0.06 | 0.14 | 0.48 | 0.70 | |

Comments:

FIGURE 3b

Project: Cell Crete
 No: 14GCI498

Cellular concrete type: Class II
 Sample: --

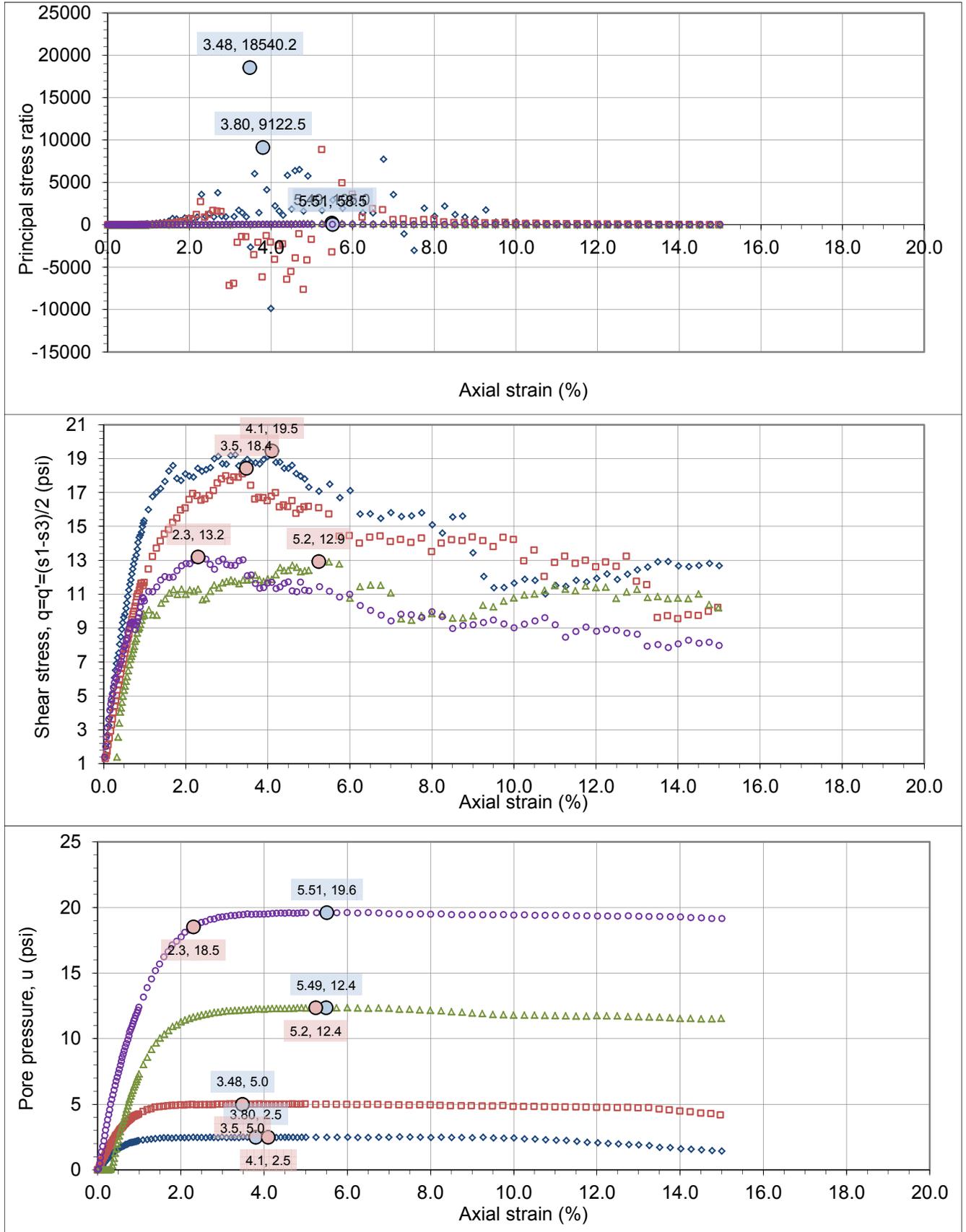
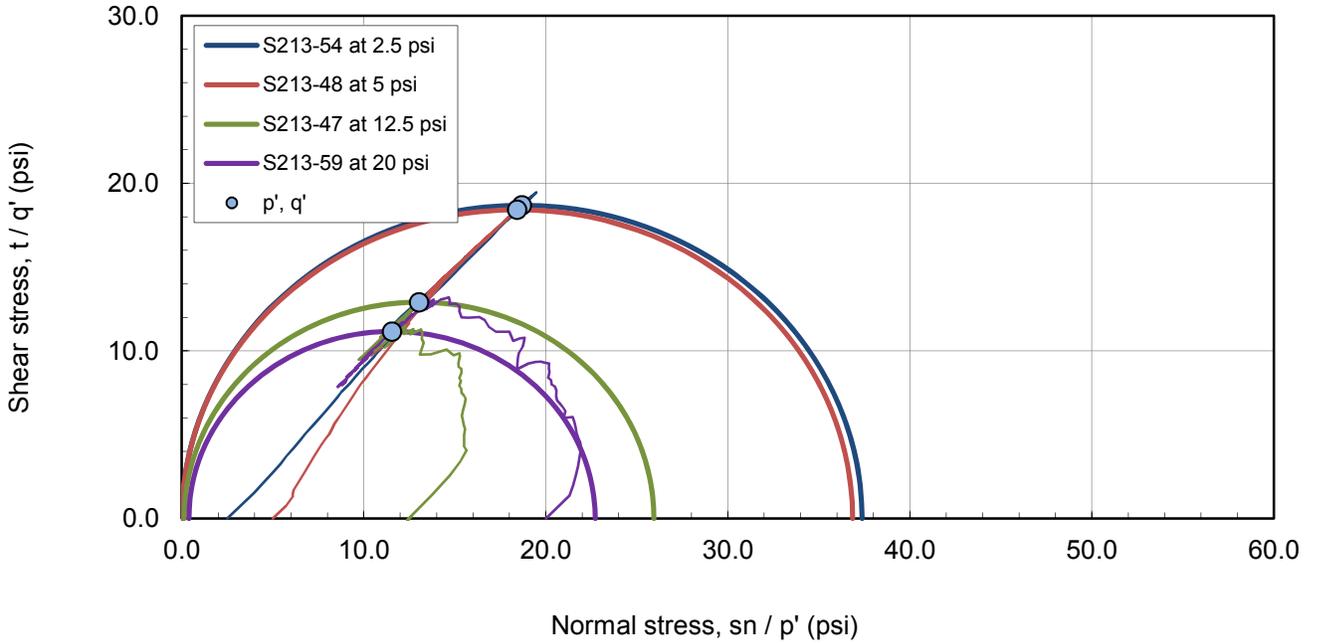


FIGURE 3c

Project: Cell Crete
 No: 14GCI498

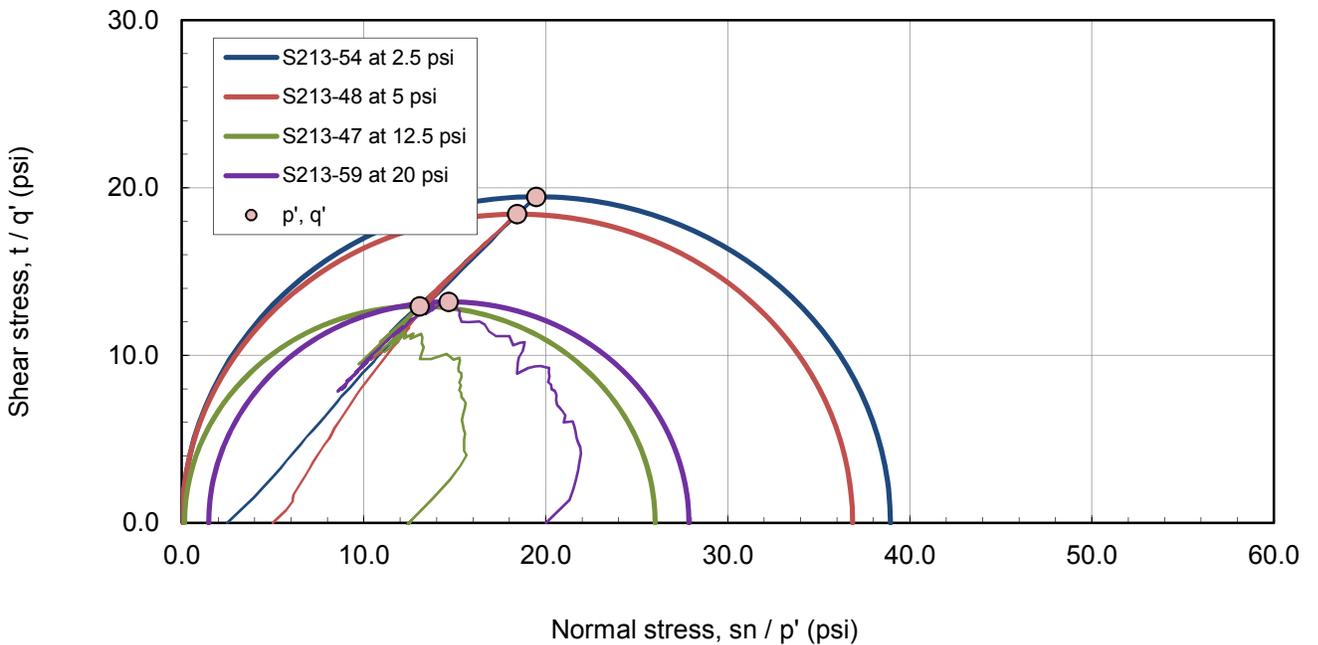
Cellular concrete type: Class II
 Sample: --

Effective stress results



Max principal stress ratio (s'_1/s'_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results



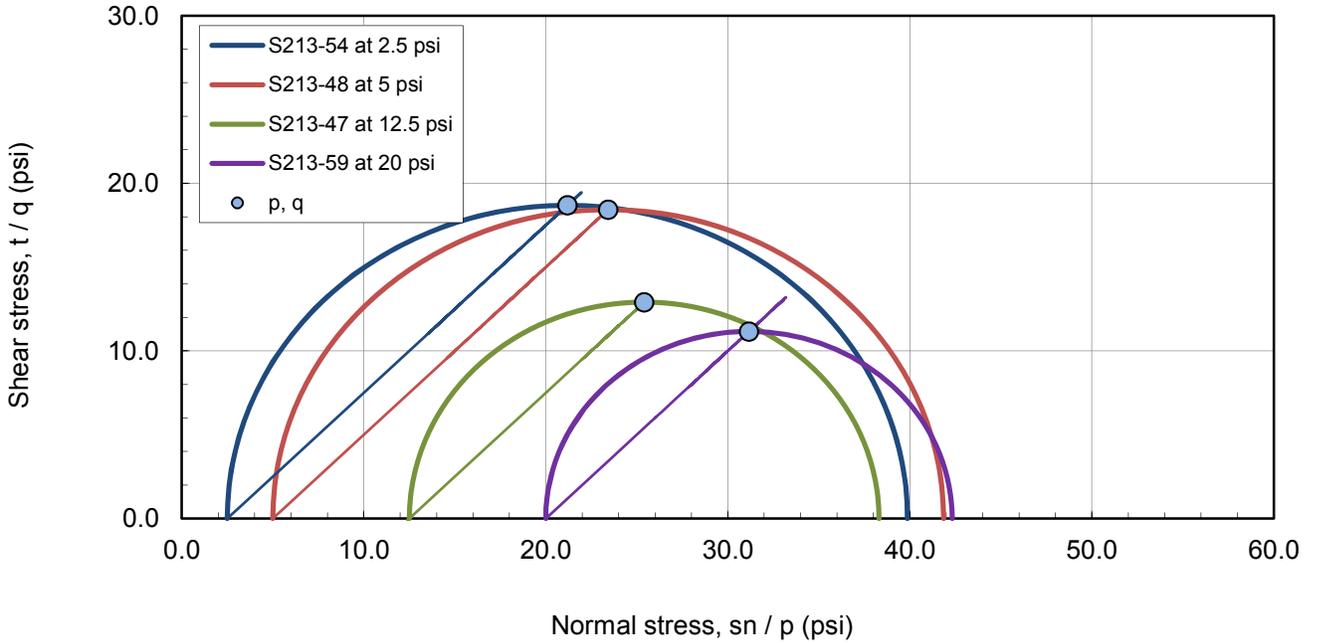
Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

FIGURE 3d

Project: Cell Crete
 No: 14GCI498

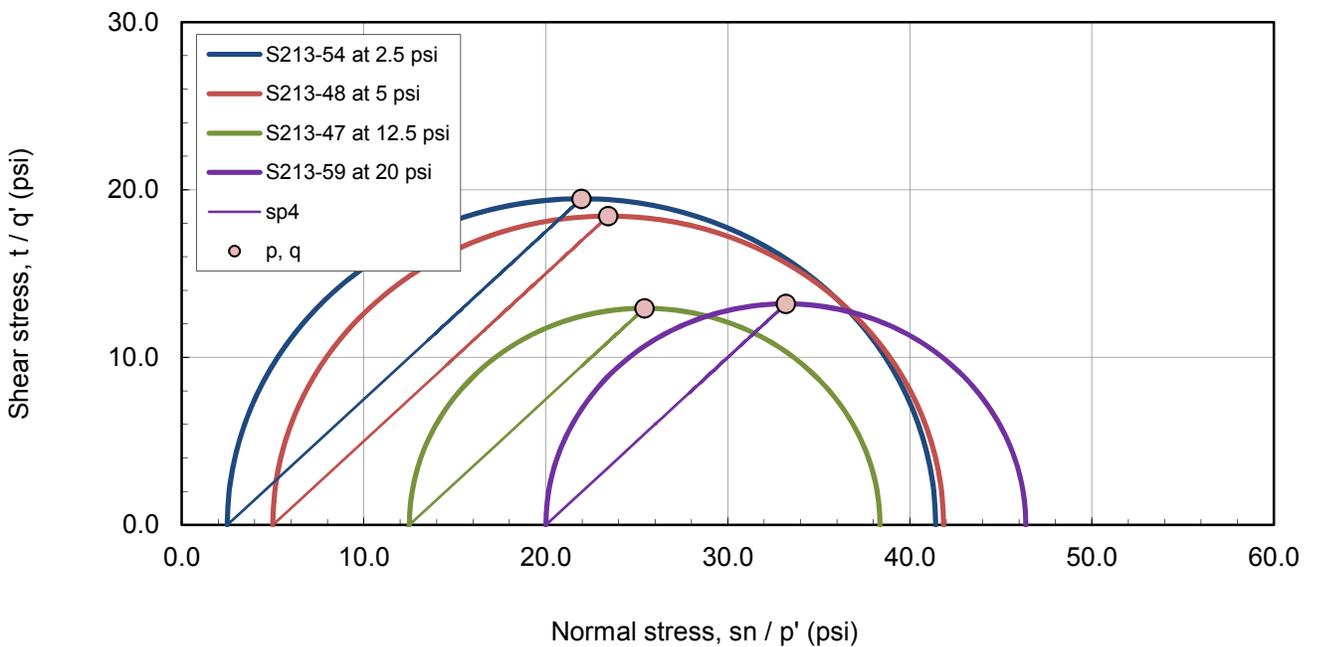
Cellular concrete type: Class II
 Sample: --

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results



Peak deviator stress ($s_1 - s_3$), failure criteria Mohr and $p - q$ space plots

FIGURE 3e

Triaxial Test - Isotropic Consolidated Sheared Undrained

Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: --

Date cast: 13-Feb-15
Date: 25-Mar-15

Sample description: Cellular concrete cast 2/13/15
USCS classification: not applicable

Tested by: zmg
Reduced by: zmg
Checked by: rbm/rtc

Sample type: cast

| | Test Number | S213-23 | | 2.5 psi | | S213-17 | | 5 psi | | S213-16 | | 12.5 psi | | S213-15 | | 30 psi | | |
|-------------------------------------|-------------------------------------|---------|-----------|----------------------|---------|-----------|----------------------|---------|-----------|----------------------|---------|-----------|----------------------|---------|-----------|----------------------|---------|-----------|
| | | Initial | Bef. Shr. | MethodA ^d | Initial | Bef. Shr. |
| Unit weight data | Sample ht., H (in) | 0° | 5.744 | | 5.820 | | 5.854 | | 5.884 | | 5.884 | | 5.884 | | 5.884 | | 5.884 | |
| | | 120° | 5.758 | | 5.816 | | 5.867 | | 5.888 | | 5.888 | | 5.888 | | 5.888 | | 5.888 | |
| | | 240° | 5.753 | | 5.806 | | 5.851 | | 5.872 | | 5.872 | | 5.872 | | 5.872 | | 5.872 | |
| | Avg. height, Havg (in) | | 5.752 | 5.752 | 5.814 | 5.814 | 5.857 | 5.857 | 5.881 | 5.881 | 5.881 | 5.881 | 5.881 | 5.881 | 5.881 | 5.881 | 5.881 | 5.881 |
| | Avg. height, Havg (cm) | | 14.609 | 14.609 | 14.768 | 14.768 | 14.878 | 14.878 | 14.939 | 14.939 | 14.939 | 14.939 | 14.939 | 14.939 | 14.939 | 14.939 | 14.939 | 14.939 |
| | ΔHsc (in) ^a | | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 |
| | Sample dia., D (in) | top | 2.989 | | 2.987 | | 2.986 | | 2.973 | | 2.973 | | 2.973 | | 2.973 | | 2.973 | |
| | | mid | 2.955 | | 2.960 | | 2.954 | | 2.948 | | 2.948 | | 2.948 | | 2.948 | | 2.948 | |
| | | bot | 2.927 | | 2.934 | | 2.912 | | 2.917 | | 2.917 | | 2.917 | | 2.917 | | 2.917 | |
| | Avg. dia., Davg (in) | | 2.957 | 2.960 | 2.960 | 2.966 | 2.952 | 2.956 | 2.947 | 2.956 | 2.947 | 2.956 | 2.947 | 2.956 | 2.947 | 2.956 | 2.947 | 2.956 |
| | Avg. dia., Davg (cm) | | 7.510 | 7.517 | 7.519 | 7.533 | 7.497 | 7.509 | 7.484 | 7.509 | 7.484 | 7.509 | 7.484 | 7.509 | 7.484 | 7.509 | 7.484 | 7.509 |
| | Avg. area, Aavg (in ²) | | 6.865 | 6.880 | 6.883 | 6.908 | 6.842 | 6.863 | 6.819 | 6.863 | 6.819 | 6.863 | 6.819 | 6.863 | 6.819 | 6.863 | 6.819 | 6.863 |
| | Avg. area, Aavg (cm ²) | | 44.291 | 44.384 | 44.403 | 44.566 | 44.141 | 44.280 | 43.992 | 44.280 | 43.992 | 44.280 | 43.992 | 44.280 | 43.992 | 44.280 | 43.992 | 44.280 |
| | Wt. rings + wet soil (g) | | 334.58 | 529.47 | 351.02 | 584.12 | 351.82 | 556.33 | 341.58 | 556.33 | 341.58 | 556.33 | 341.58 | 556.33 | 341.58 | 556.33 | 341.58 | 556.33 |
| | Wt. rings (g) | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Volume, Vo (in ³) | | 39.5 | 39.6 | 40.0 | 40.2 | 40.1 | 40.2 | 40.1 | 40.2 | 40.1 | 40.2 | 40.1 | 40.2 | 40.1 | 40.2 | 40.1 | 40.2 | |
| Vo (cm ³) | | 647.1 | 648.4 | 655.7 | 658.1 | 656.7 | 658.8 | 657.2 | 658.8 | 657.2 | 658.8 | 657.2 | 658.8 | 657.2 | 658.8 | 657.2 | 658.8 | |
| Vo (ft ³) | | 0.0229 | 0.0229 | 0.0232 | 0.0232 | 0.0232 | 0.0233 | 0.0232 | 0.0233 | 0.0232 | 0.0233 | 0.0232 | 0.0233 | 0.0232 | 0.0233 | 0.0232 | 0.0233 | |
| ΔVs (cm ³) ^b | | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| ΔVc (cm ³) ^b | | | -1.37 | | -2.41 | | -2.07 | | -2.07 | | -2.07 | | -2.07 | | -2.07 | | -4.18 | |
| Moisture | Wet soil + tare (g) | 334.58 | 649.35 | 351.02 | 757.40 | 351.82 | 676.43 | 341.58 | 676.43 | 341.58 | 676.43 | 341.58 | 676.43 | 341.58 | 676.43 | 341.58 | 676.43 | |
| | Dry soil + tare (g) | 228.63 | 348.51 | 232.48 | 405.76 | 234.98 | 355.08 | 221.64 | 355.08 | 221.64 | 355.08 | 221.64 | 355.08 | 221.64 | 355.08 | 221.64 | 355.08 | |
| | Tare (g) | 0.00 | 119.88 | 0.00 | 173.28 | 0.00 | 120.10 | 0.00 | 120.10 | 0.00 | 120.10 | 0.00 | 120.10 | 0.00 | 120.10 | 0.00 | 120.10 | |
| | Moisture content, w (%) | 46.3 | 131.6 | 51.0 | 151.3 | 49.7 | 136.8 | 54.1 | 136.8 | 54.1 | 136.8 | 54.1 | 136.8 | 54.1 | 136.8 | 54.1 | 136.8 | |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | |
| | Mass total (g) | 334.6 | 804.5 | 351.0 | 816.8 | 351.8 | 819.2 | 341.6 | 819.2 | 341.6 | 819.2 | 341.6 | 819.2 | 341.6 | 819.2 | 341.6 | 819.2 | |
| | Mass of solids (g) | 228.6 | 228.6 | 232.5 | 232.5 | 235.0 | 235.0 | 221.6 | 235.0 | 221.6 | 235.0 | 221.6 | 235.0 | 221.6 | 235.0 | 221.6 | 235.0 | |
| | Volume (cm ³) | 647.1 | 648.4 | 655.7 | 658.1 | 656.7 | 658.8 | 657.2 | 658.8 | 657.2 | 658.8 | 657.2 | 658.8 | 657.2 | 658.8 | 657.2 | 658.8 | |
| | Volume of water (cm ³) | 106.0 | 575.8 | 118.5 | 584.3 | 116.8 | 584.2 | 119.9 | 584.2 | 119.9 | 584.2 | 119.9 | 584.2 | 119.9 | 584.2 | 119.9 | 584.2 | |
| | Volume of solids (cm ³) | 72.6 | 72.6 | 73.8 | 73.8 | 74.6 | 74.6 | 70.4 | 74.6 | 70.4 | 74.6 | 70.4 | 74.6 | 70.4 | 74.6 | 70.4 | 74.6 | |
| | Volume of voids (cm ³) | 574.5 | 575.8 | 581.9 | 584.3 | 582.1 | 584.2 | 586.8 | 584.2 | 586.8 | 586.8 | 584.2 | 586.8 | 586.8 | 584.2 | 586.8 | 586.8 | |
| | Volume of air (cm ³) | 468.5 | 0.0 | 463.4 | 0.0 | 465.3 | 0.0 | 466.9 | 0.0 | 466.9 | 0.0 | 466.9 | 0.0 | 466.9 | 0.0 | 466.9 | 0.0 | |
| | Void ratio, e | 7.915 | 7.934 | 7.885 | 7.917 | 7.804 | 7.831 | 8.340 | 7.831 | 8.340 | 7.831 | 8.340 | 7.831 | 8.340 | 7.831 | 8.340 | 7.831 | |
| | Porosity, n | 0.888 | 0.888 | 0.887 | 0.888 | 0.886 | 0.887 | 0.893 | 0.887 | 0.893 | 0.887 | 0.893 | 0.887 | 0.893 | 0.887 | 0.893 | 0.887 | |
| | Volumetric moisture, T | 0.164 | 0.888 | 0.181 | 0.888 | 0.178 | 0.887 | 0.183 | 0.887 | 0.183 | 0.887 | 0.183 | 0.887 | 0.183 | 0.887 | 0.183 | 0.887 | |
| | Saturation, S (%) ^c | 18.44 | 100.00 | 20.37 | 100.00 | 20.07 | 100.00 | 20.44 | 100.00 | 20.44 | 100.00 | 20.44 | 100.00 | 20.44 | 100.00 | 20.44 | 100.00 | |
| | Dry density (gm/cm ³) | 0.353 | 0.353 | 0.355 | 0.353 | 0.358 | 0.357 | 0.337 | 0.357 | 0.337 | 0.357 | 0.337 | 0.357 | 0.337 | 0.357 | 0.337 | 0.357 | |
| | Wet unit wt., gm (pcf) | 32.3 | 51.0 | 33.4 | 55.4 | 33.4 | 52.7 | 32.4 | 52.7 | 32.4 | 52.7 | 32.4 | 52.7 | 32.4 | 52.7 | 32.4 | 52.7 | |
| Dry unit wt., gd (pcf) | 22.1 | 22.0 | 22.1 | 22.1 | 22.3 | 22.3 | 21.1 | 22.3 | 21.1 | 22.3 | 21.1 | 22.3 | 21.1 | 22.3 | 21.1 | 22.3 | | |

Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVC)/(Ho-DHsc)

FIGURE 4a

Triaxial Test - Isotropic Consolidated Sheared Undrained



Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 25-Mar-15
 Tested by: zmg

Cellular concrete type: Class IV (Low Density)
Sample: --
 Sample description: Cellular concrete cast 2/13/15
 USCS classification: not applicable
 Sample type: cast

J:\PROJECTS\Cell-Crete\14GCI498 Cell Crete Lab Testing\Analyses\Triaxial\TX_CU4pts_ClassIV-v01.xlsx\SUM

| Test Number | S213-23 at 2.5 psi | S213-17 at 5 psi | S213-16 at 12.5 psi | S213-15 at 30 psi | |
|--|---|------------------|---------------------|-------------------|-----------------|
| Test information | Total backpressure (psi) | 80.0 | 75.0 | 80.0 | 75.0 |
| | Skempton B | 0.78 | 0.82 | 0.65 | 0.87 |
| | t-90 (min) | 0.9 | 0.9 | 1.4 | 0.6 |
| | t-100 (min) | | | | |
| | t-50 (min) | 0.2 | 0.2 | 0.3 | 0.1 |
| | Strain rate (%/hr) | 6.0 | 6.0 | 6.0 | 6.0 |
| | Strain rate (%/min) | 0.10 | 0.10 | 0.10 | 0.10 |
| | Membrane correction | Yes | Yes | Yes | Yes |
| | Filter paper correction | No filter paper | No filter paper | No filter paper | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 8.0 | 3.5 | 4.1 | 6.5 |
| | Time to failure, tf (min) | 79.7 | 34.6 | 41.3 | 64.7 |
| | Obliquity, s'1/s'3 | 2330.7 | 87275.3 | 14527.4 | 432.5 |
| | Excess pore pressure, u (psi) | 2.5 | 5.0 | 12.5 | 29.8 |
| | $q = q' = (s1-s3)/2$ (psi) | 29.6 | 43.2 | 38.3 | 38.5 |
| | $p' = (s'1+s'3)/2$ (psi) | 29.6 | 43.2 | 38.3 | 38.7 |
| | $p = (s1+s3)/2$ (psi) | 32.1 | 48.2 | 50.8 | 68.5 |
| | Effective major principal stress, s'1 (psi) | 59.2 | 86.3 | 76.5 | 77.3 |
| | Effective minor principal stress, s'3 (psi) | 0.03 | 0.00 | 0.01 | 0.18 |
| | Total major pincipal stress, s1 (psi) | 61.7 | 91.3 | 89.0 | 107.1 |
| | Total minor pincipal stress, s3 (psi) | 2.5 | 5.0 | 12.5 | 30.0 |
| Skempton A at failure, Af | 0.04 | 0.06 | 0.16 | 0.39 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 1.7 | 1.7 | 4.7 | 6.0 |
| | Time to failure, tf (min) | 17.5 | 16.6 | 47.3 | 59.8 |
| | Deviator stress, s1-s3 (psi) | 91.1 | 90.8 | 78.6 | 79.0 |
| | Excess pore pressure, u (psi) | 2.6 | 5.0 | 12.5 | 29.8 |
| | $q = q' = (s1-s3)/2$ (psi) | 45.6 | 45.4 | 39.3 | 39.5 |
| | $p' = (s'1+s'3)/2$ (psi) | 45.5 | 45.4 | 39.3 | 39.7 |
| | $p = (s1+s3)/2$ (psi) | 48.1 | 50.4 | 51.8 | 69.5 |
| | Effective major principal stress, s'1 (psi) | 91.0 | 90.8 | 78.6 | 79.2 |
| | Effective minor principal stress, s'3 (psi) | -0.07 | 0.00 | 0.02 | 0.20 |
| | Total major pincipal stress, s1 (psi) | 93.6 | 95.8 | 91.1 | 109.0 |
| | Total minor pincipal stress, s3 (psi) | 2.5 | 5.0 | 12.5 | 30.0 |
| Skempton A at failure, Af | 0.03 | 0.06 | 0.16 | 0.38 | |

Comments:

FIGURE 4b

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: --

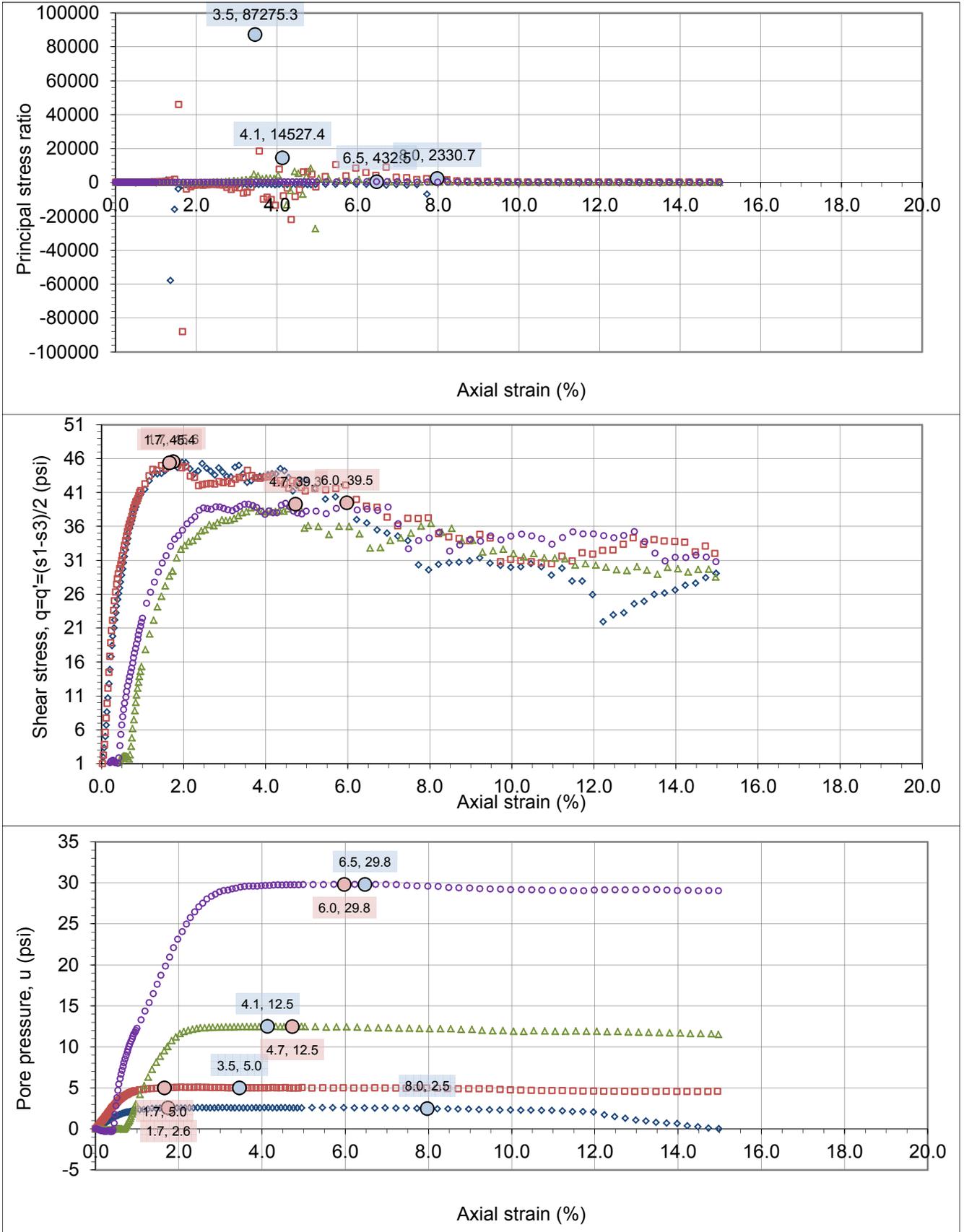
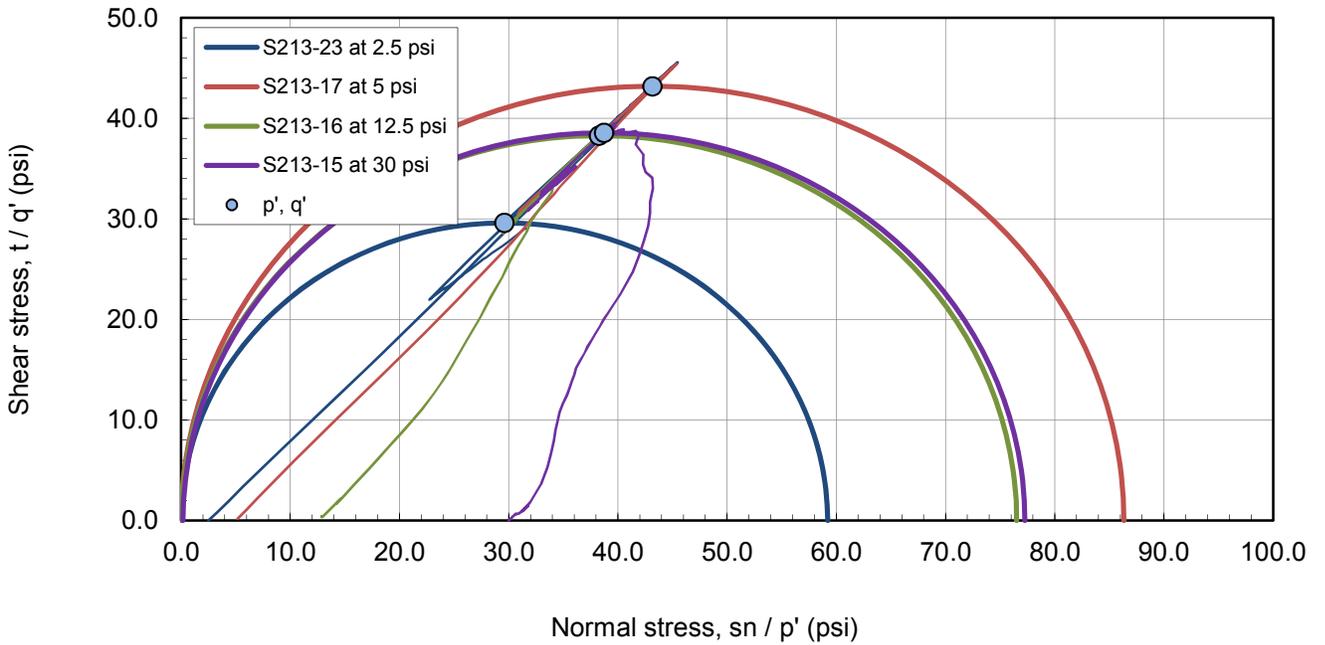


FIGURE 4c

Project: Cell Crete
 No: 14GCI498

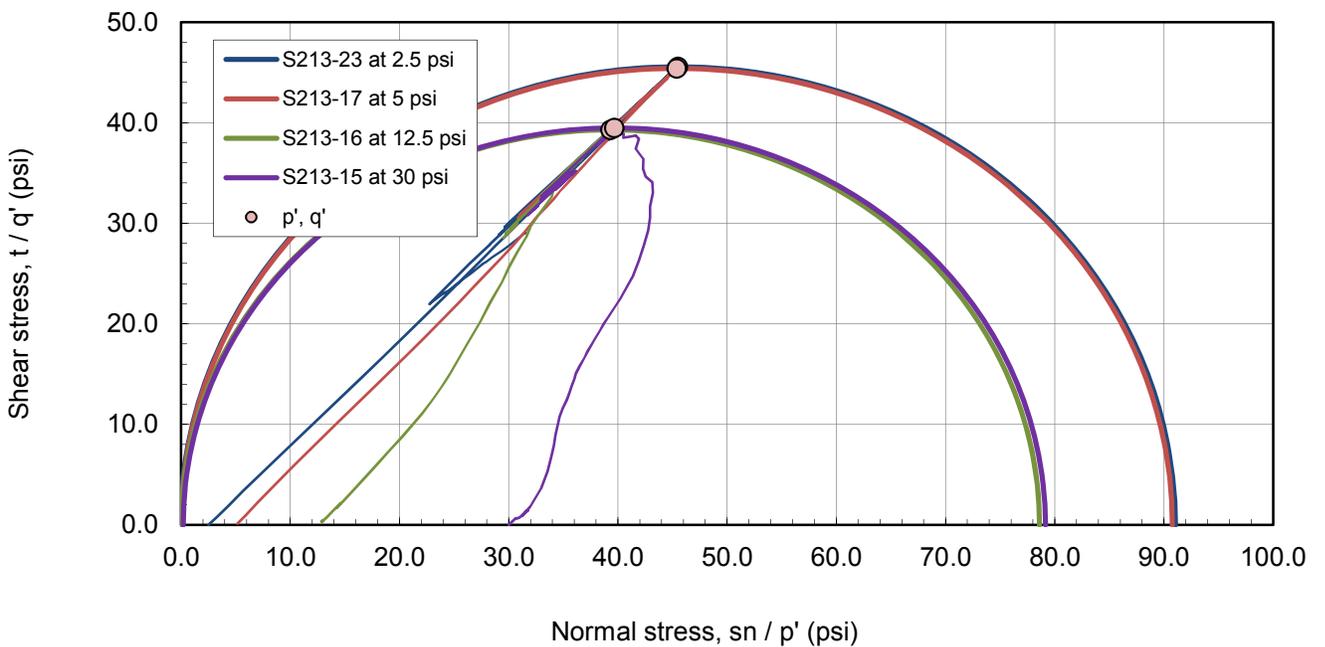
Cellular concrete type: Class IV (Low Density)
 Sample: --

Effective stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and p' - q' space plots

Effective stress results



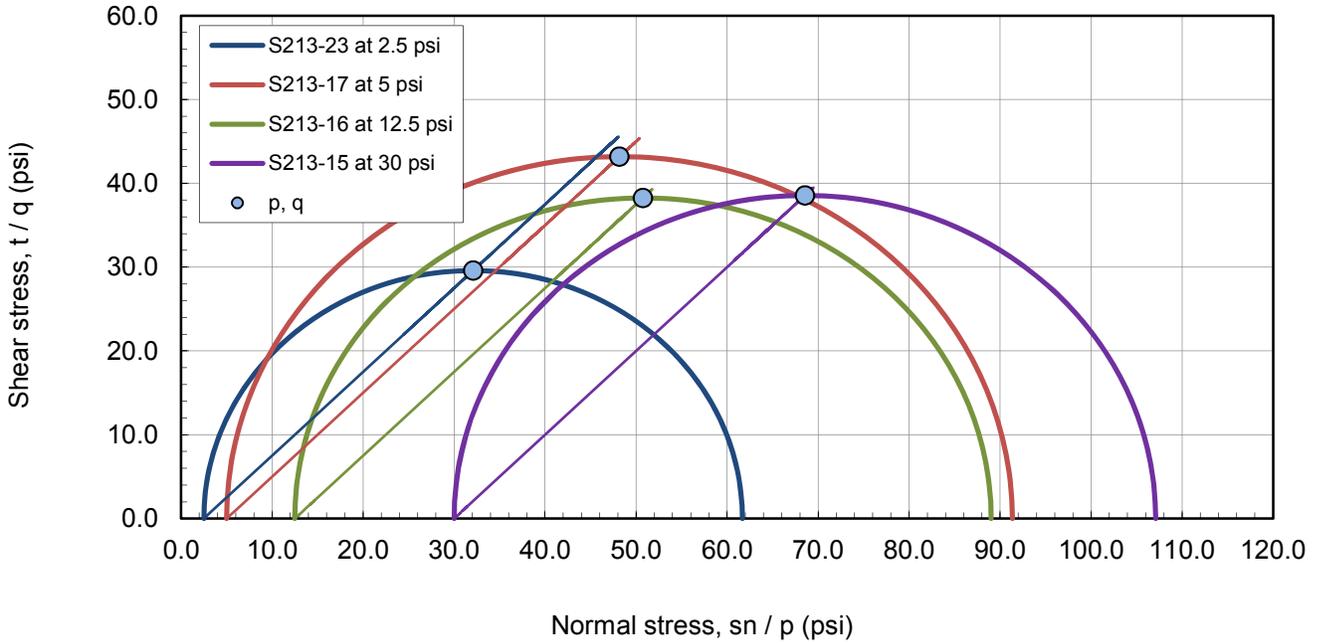
Peak deviator stress (s_1-s_3), failure criteria Mohr and p' - q' space plots

FIGURE 4d

Project: Cell Crete
 No: 14GCI498

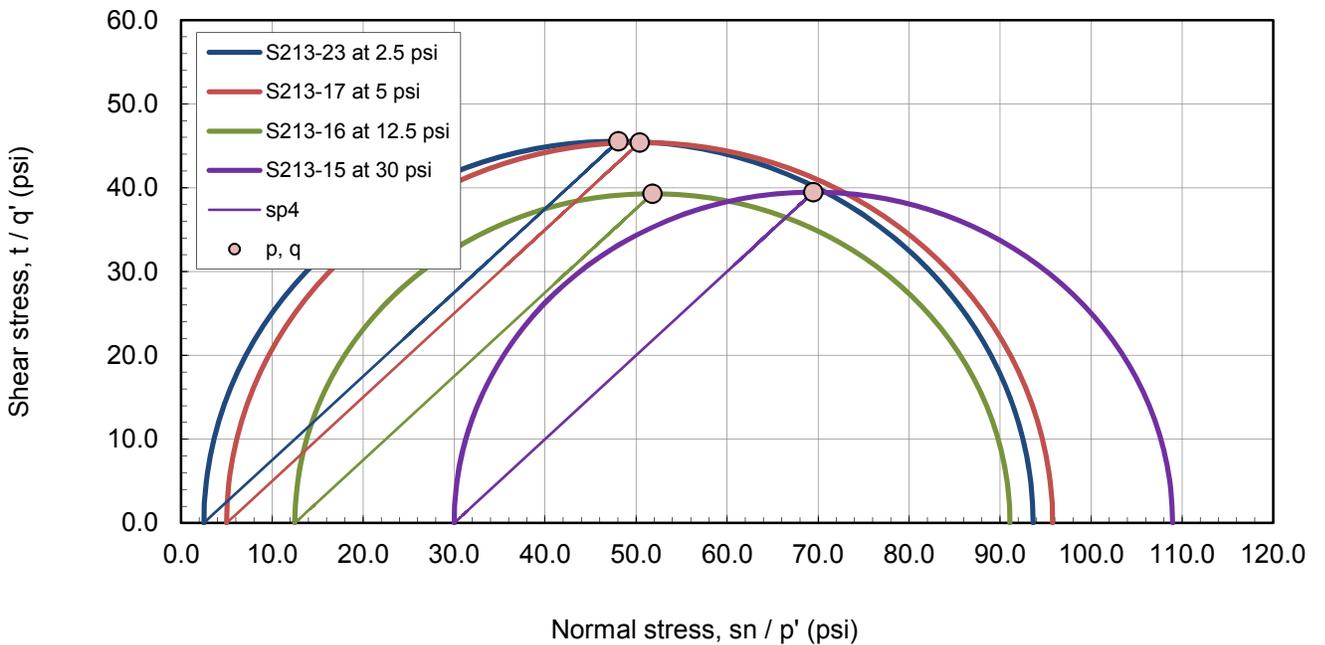
Cellular concrete type: Class IV (Low Density)
 Sample: --

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results



Peak deviator stress (s_1-s_3), failure criteria Mohr and $p - q$ space plots

FIGURE 4e

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II and Class IV (Low Density)
Sample: --

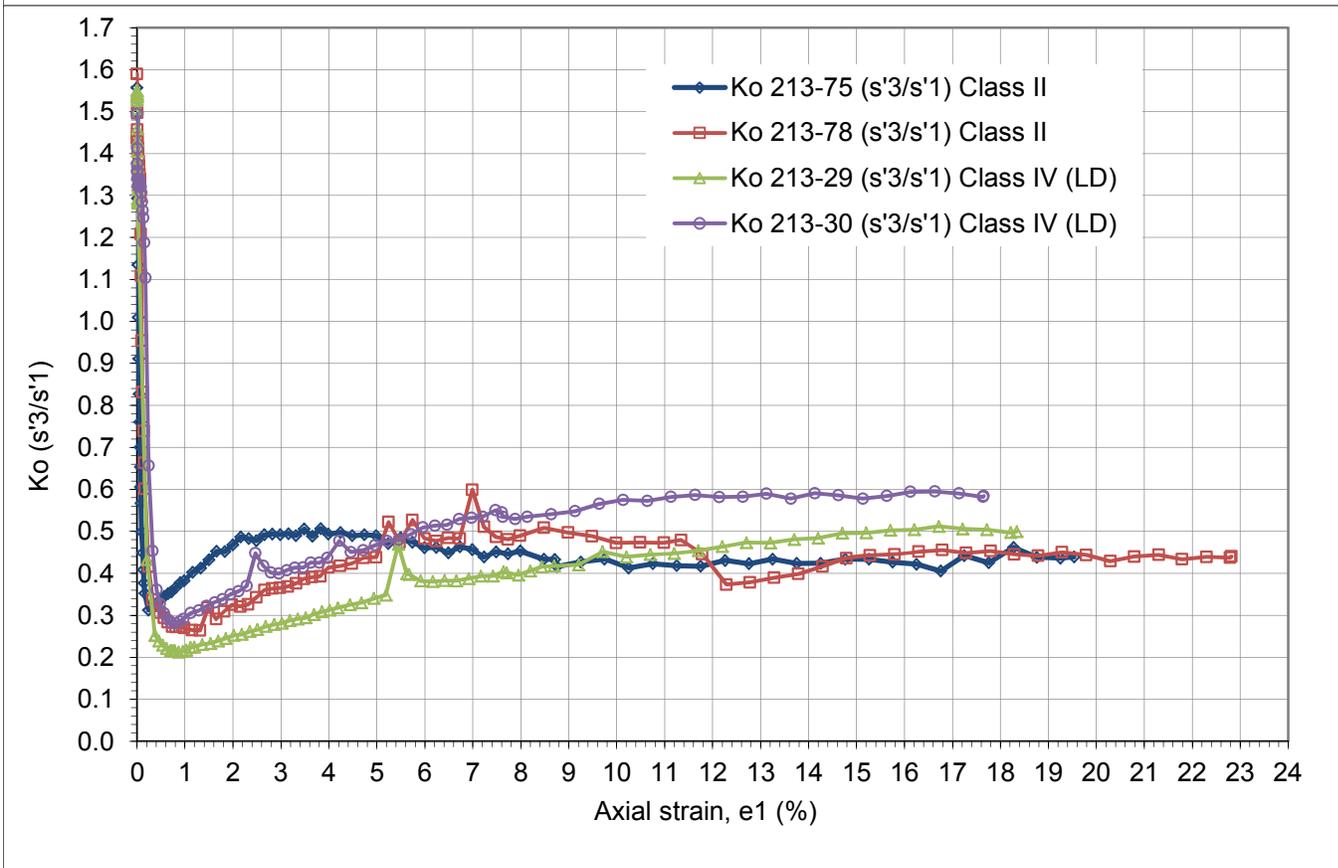
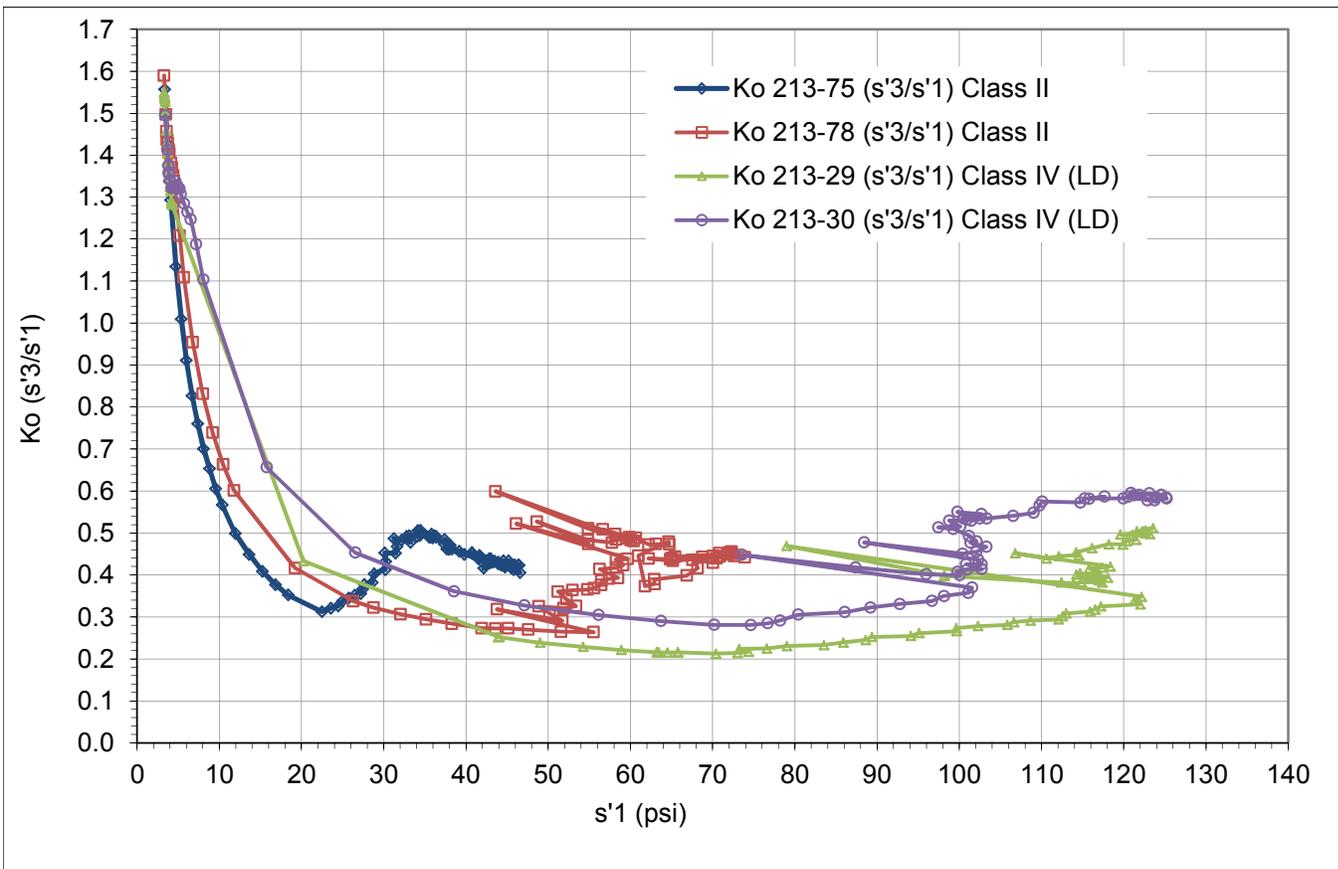


FIGURE 5

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II and Class IV (Low Density)
Sample: --

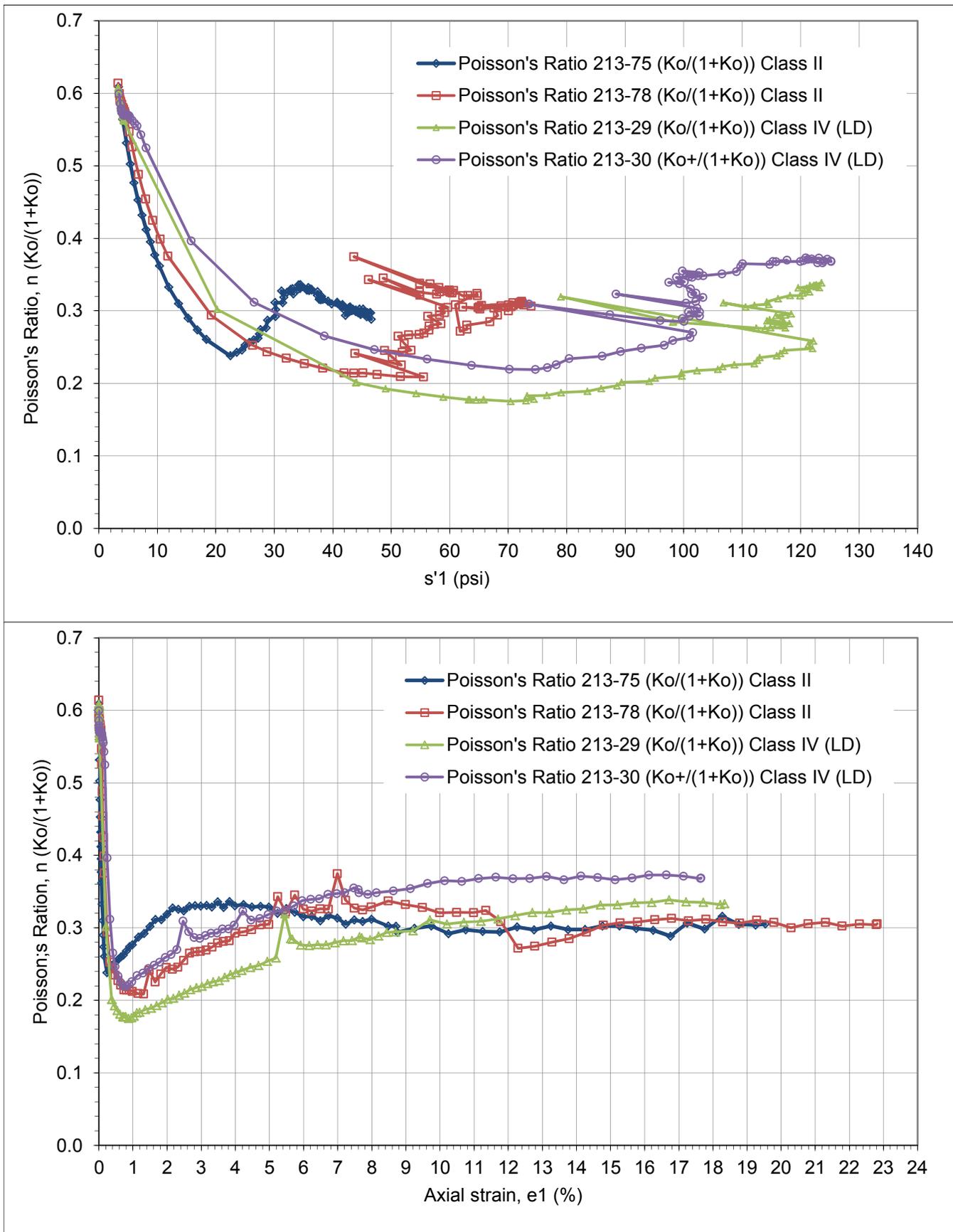


FIGURE 6

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Type II
Sample: --

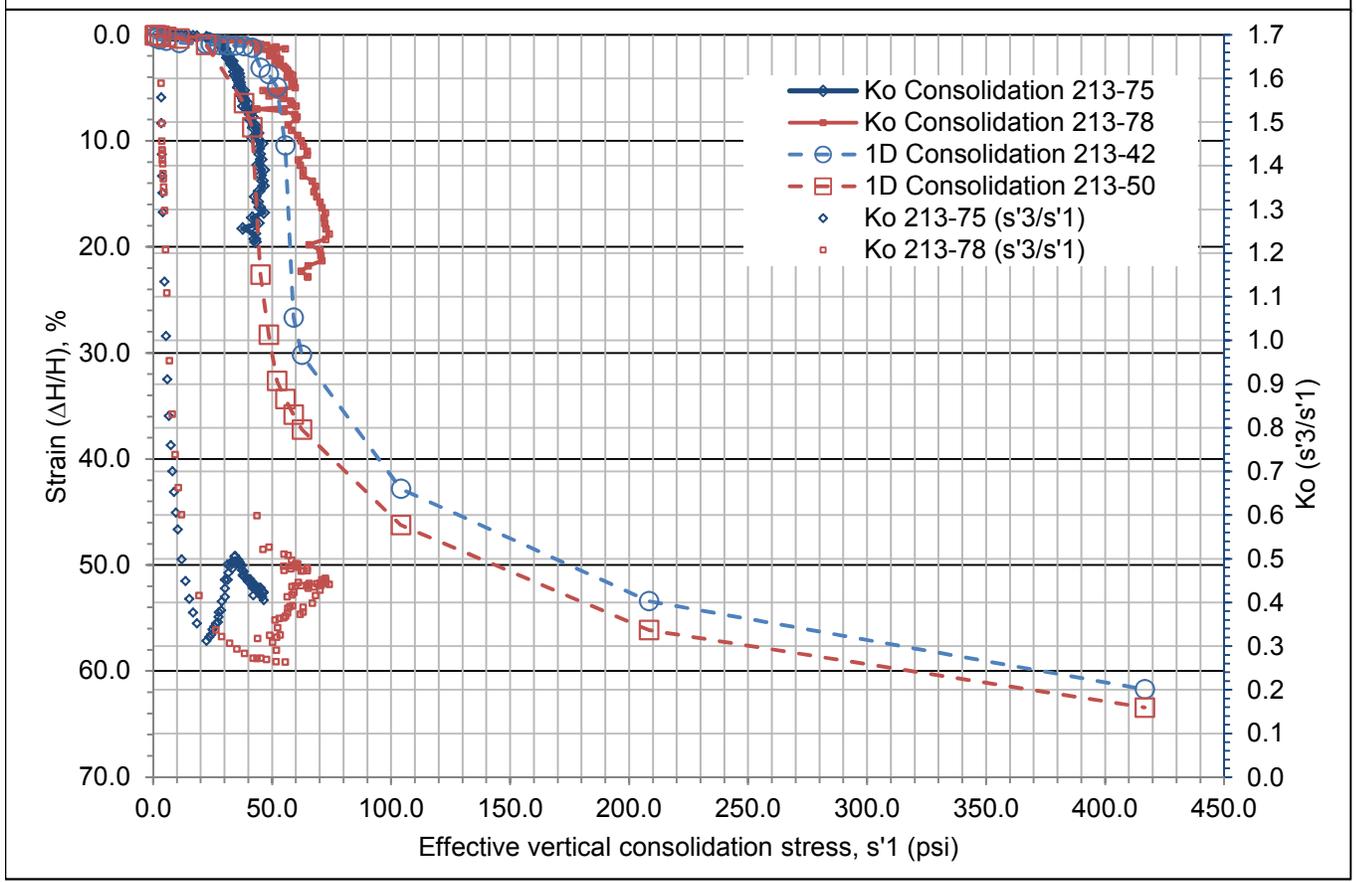
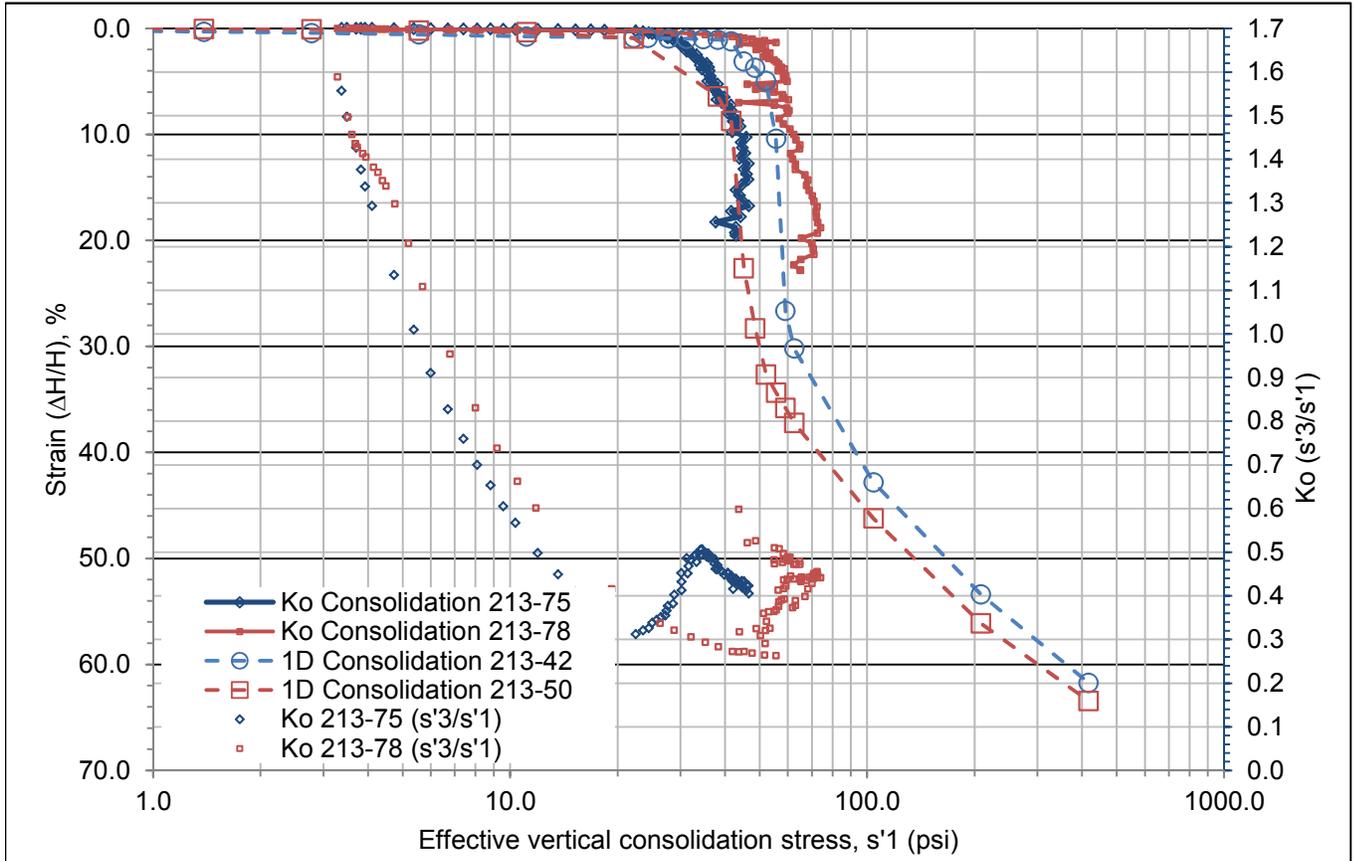


FIGURE 7

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: --

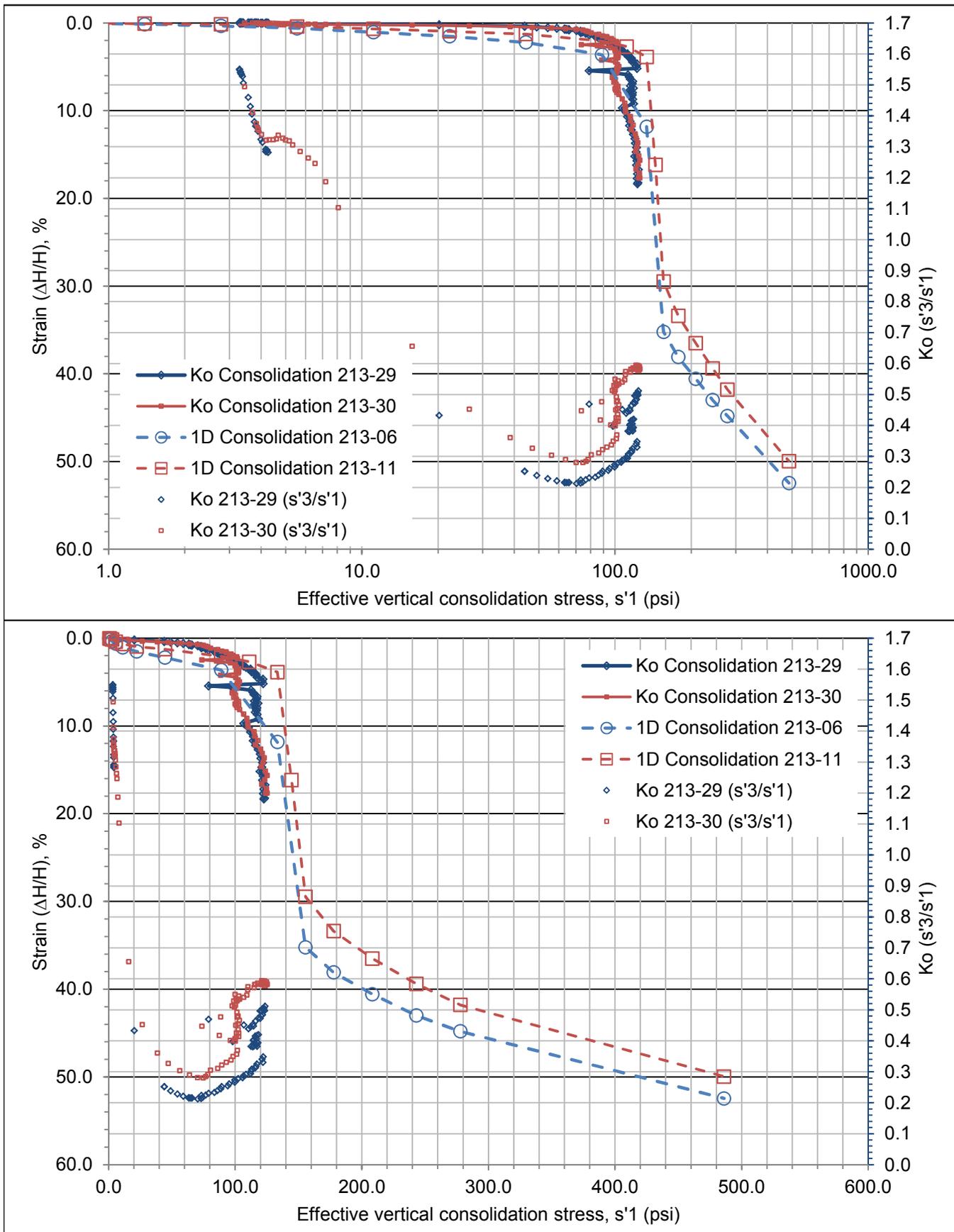


FIGURE 8

One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



Project: Cell Crete

No: 14GCI498

Cellular concrete type: Class II and Class IV (Low Density)

Sample: --

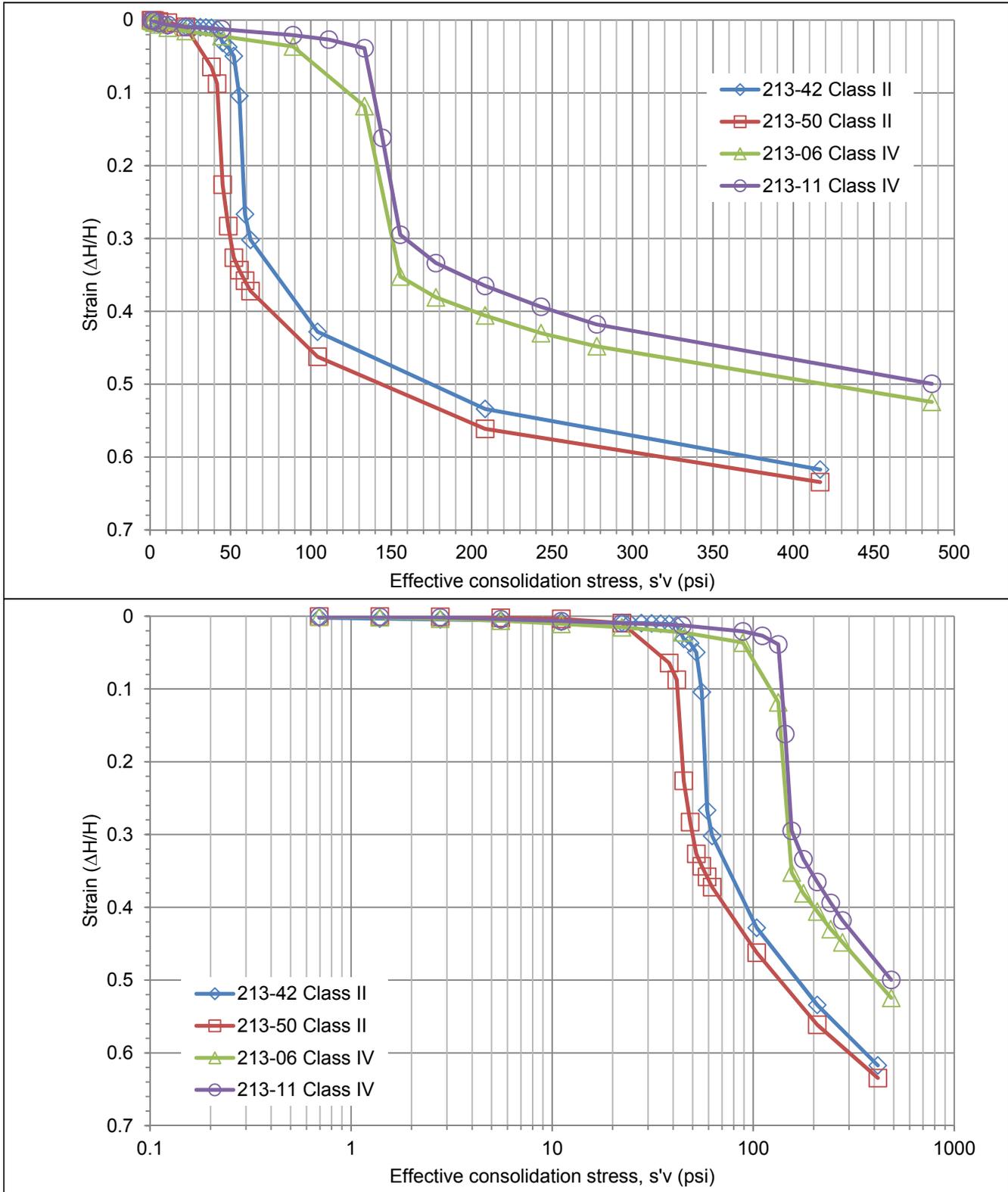


FIGURE 9

APPENDIX -A LABORATORY TESTING CLASS II CELLULAR CONCRETE

Table of Contents

| <u>Description</u> | <u>Page #'s</u> |
|---|-----------------|
| Triaxial Test - Isotropic Consolidated Sheared Drained (CID) | Class II-A01 |
| Triaxial Test - Isotropic Consolidated Sheared Undrained | |
| Measuring Pore Pressure (CIU-PP) | Class II-A17 |
| Unconfined Compression of Light Weight Material (UC)..... | Class II-A41 |
| K ₀ Consolidation Test Using Strain Controlled Axial Loading and Automated | |
| Lateral Pressure Adjustment | Class II-A46 |
| One-Dimensional Consolidation Properties of Soils | Class II-A56 |
| Hydraulic Conductivity Test - Back Pressure, Flexible Wall | Class II-A60 |
| Infiltration Rate of Pervious Concrete | Class II-A68 |
| Slake Durability of Shales and Similar Weak Rocks | Class II-A70 |

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755

Project: Cell-Crete (Cellular Concrete)

No: 0002

Date cast: 07-Nov-14

Date: 12-Dec-14

Tested by: zg

Reduced by: zg

Checked by: rbm/rtc

Cellular concrete type: Class II

Sample: Sample 19

Sample description: Cell Crete

USCS classification: not requested

Sample type: cast (11/07/2014)

Age of sample (days): 35 (at shear)

| | Test Number | S19 | | 2.5 psi | |
|------------------------|---|-----------------------------------|---------------------------------|---------|--|
| | | Initial | Bef. Shr. Method A ^d | Final | |
| Unit weight data | 0° | 5.682 | | | |
| | Sample ht., H (in) 120° | 5.667 | | | |
| | 240° | 5.682 | | | |
| | Avg. height, Havg (in) | 5.677 | 5.677 | | |
| | Avg. height, Havg (cm) | 14.420 | 14.420 | | |
| | ΔV_s (cm ³) ^b | | 0.000 | | |
| | ΔV_c (cm ³) ^b | | -1.439 | | |
| | Ht. change, ΔH_{sc} (in) ^a | | 0.000 | | |
| | Sample dia., D (in) top | 2.959 | | | |
| | mid | 2.922 | | | |
| | bot | 2.873 | | | |
| | Avg. dia., Davg (in) | 2.919 | 2.916 | | |
| | Avg. dia., Davg (cm) | 7.414 | 7.406 | | |
| | Avg. area, Aavg (in ²) | 6.692 | 6.677 | | |
| | Avg. area, Aavg (cm ²) | 43.174 | 43.074 | | |
| | Wt. rings + wet soil (g) | 234.57 | | | |
| | Wt. rings (g) | 0.00 | | | |
| | Volume, V _o (in ³) | 38.0 | 37.9 | | |
| | V _o (cm ³) | 622.6 | 621.1 | | |
| | | V _o (ft ³) | 0.0220 | 0.0219 | |
| Moisture | Wet soil + tare (g) | 234.57 | | 609.60 | |
| | Dry soil + tare (g) | 147.78 | | 321.07 | |
| | Tare (g) | 0.00 | | 173.29 | |
| | Moisture content, w (%) | 58.7 | | 195.2 | |
| Phase Relationships | G _s , from mix design | 3.15 | | | |
| | Mass total (g) | 234.6 | | | |
| | Mass of solids (g) | 147.8 | | | |
| | Volume (cm ³) | 622.6 | | | |
| | Volume of water (cm ³) | 86.8 | | | |
| | Volume of solids (cm ³) | 46.9 | | | |
| | Volume of voids (cm ³) | 575.6 | | | |
| | Volume of air (cm ³) | 488.9 | | | |
| | Void ratio, e | 12.270 | | | |
| | Porosity, n | 0.925 | | | |
| | Volumetric moisture, T | 0.139 | | | |
| | Saturation, S (%) ^c | 15.08 | | | |
| | Dry density (gm/cm ³) | 0.237 | | | |
| Wet unit wt., gm (pcf) | 23.5 | | | | |
| Dry unit wt., gd (pcf) | 14.8 | | | | |

Photo of sample after testing



Notes:

- ^a ΔH_{sc} (in) = change in height during saturation and consolidation
- ^b ΔV_s = change in volume during saturation, ΔV_c = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where A_c (Method A) = $(V_o - DV_s - DV_c) / (H_o - DH_{sc})$

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 0002

Sample: Sample 19

Date cast: 07-Nov-14

Sample description: Cell Crete

Date: 12-Dec-14

USCS classification: not requested

Tested by: zg

Sample type: cast (11/07/2014)

X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_CD1pts_TypeII_2-5psi-v01.xlsx]SUM

| Test Number | S19 at 2.5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 70.0 |
| | Skempton B | 0.83 |
| | t-90 (min) | 1.6 |
| | t-100 (min) | |
| | t-50 (min) | 0.4 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | yes |
| | Filter paper correction | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 10.06 |
| | Time to failure, tf (min) | 100.6 |
| | Confining stress, s'3 (psi) | 2.5 |
| | Deviator stress, s1-s3 (psi) | 57.8 |
| | Obliquity, s'1/s'3 | 25.11 |
| | Vol. strain at failure, ev (%) | -8.47 |
| | $q = q' = (s1-s3)/2$ (psi) | 28.9 |
| | $p' = (s'1+s'3)/2$ (psi) | 31.3 |
| | Effective major principal stress, s'1 (psi) | 60.2 |
| Effective minor principal stress, s'3 (psi) | 2.4 | |

Comments:

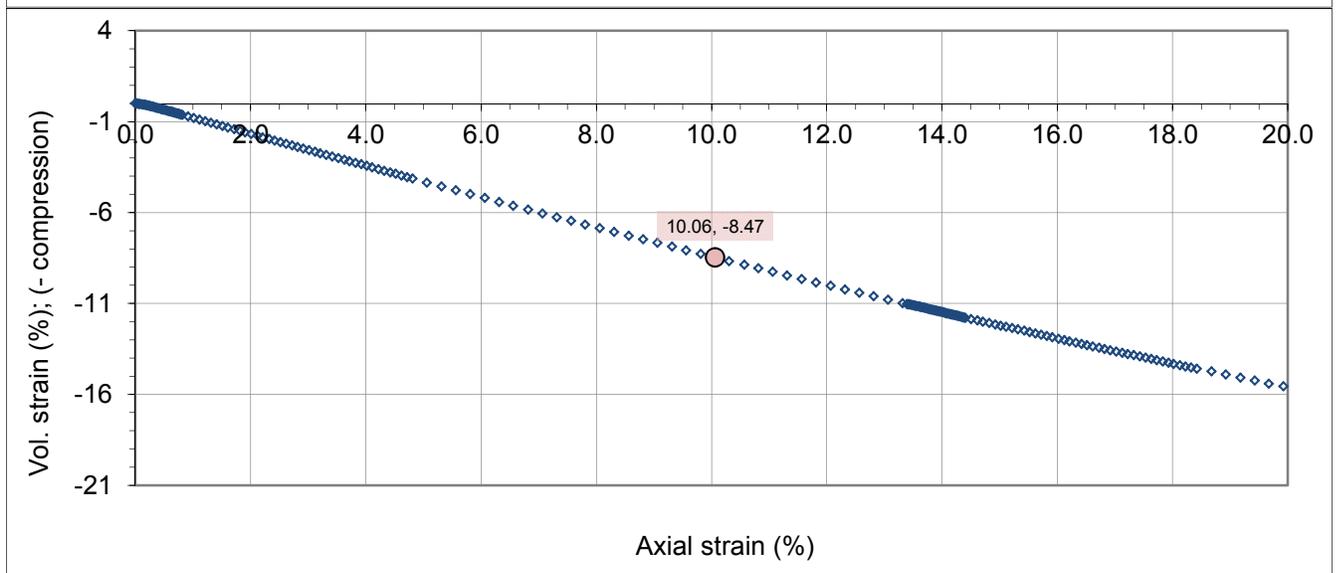
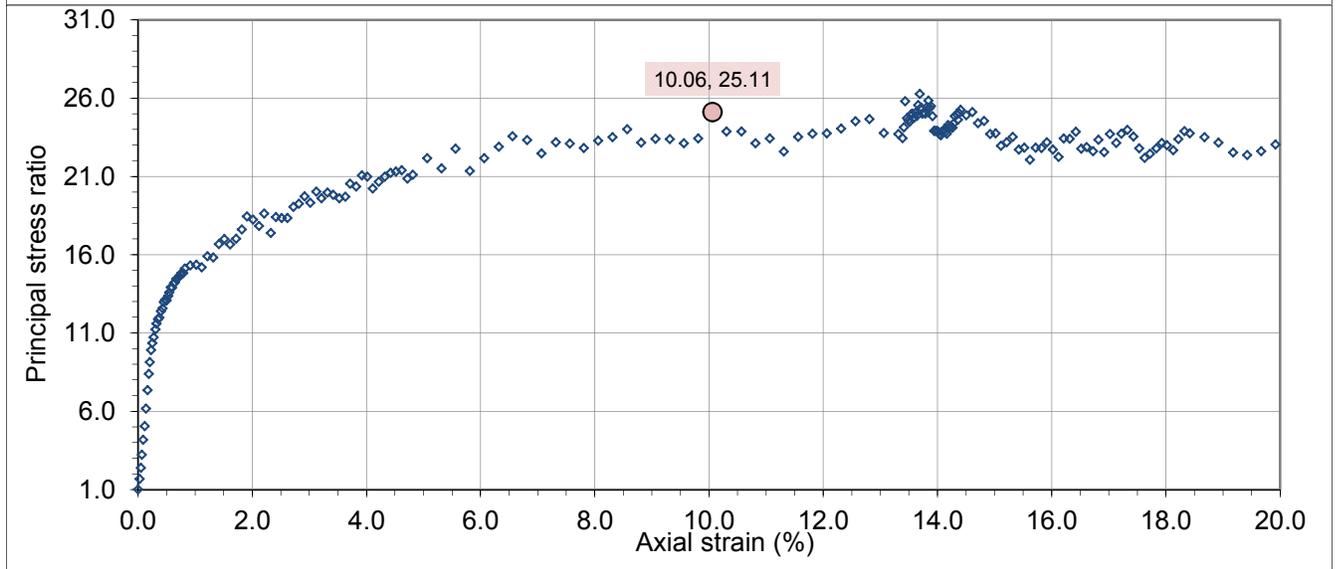
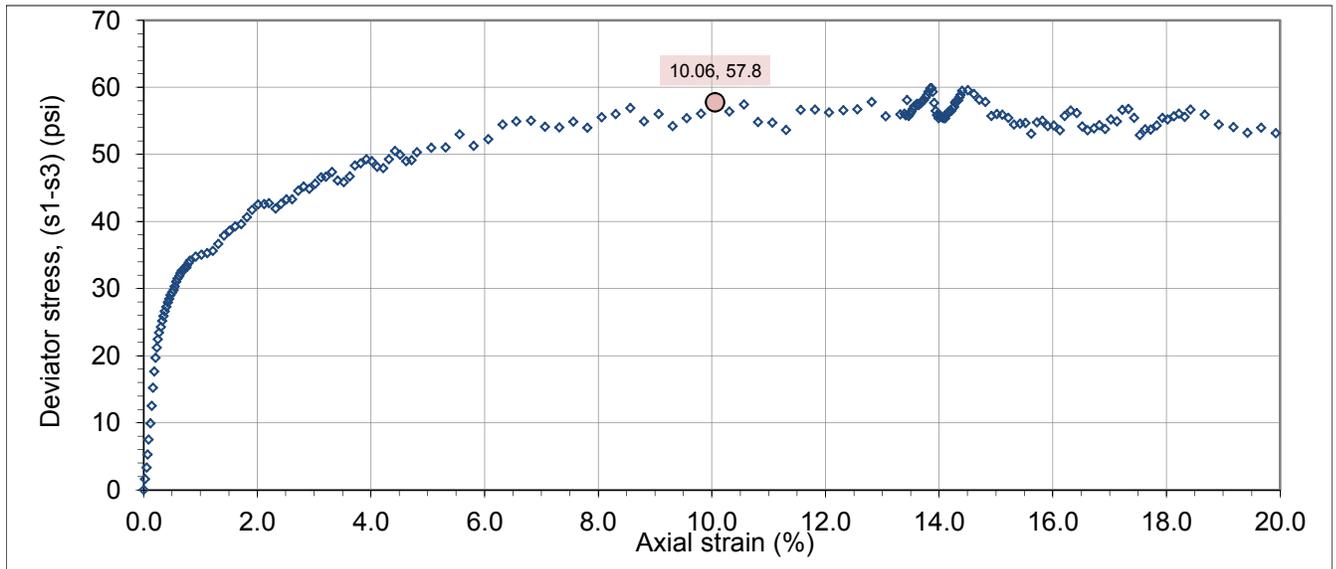
Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)
No: 0002

Cellular concrete type: Class II
Sample: Sample 19



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



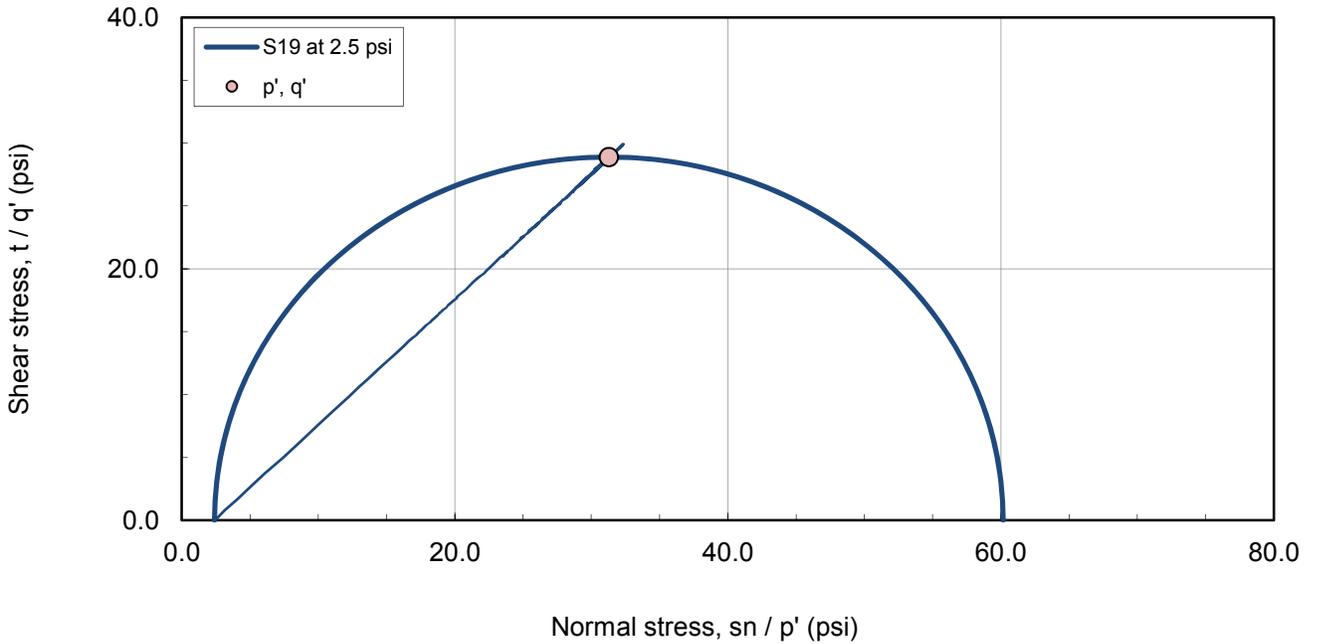
Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 0002

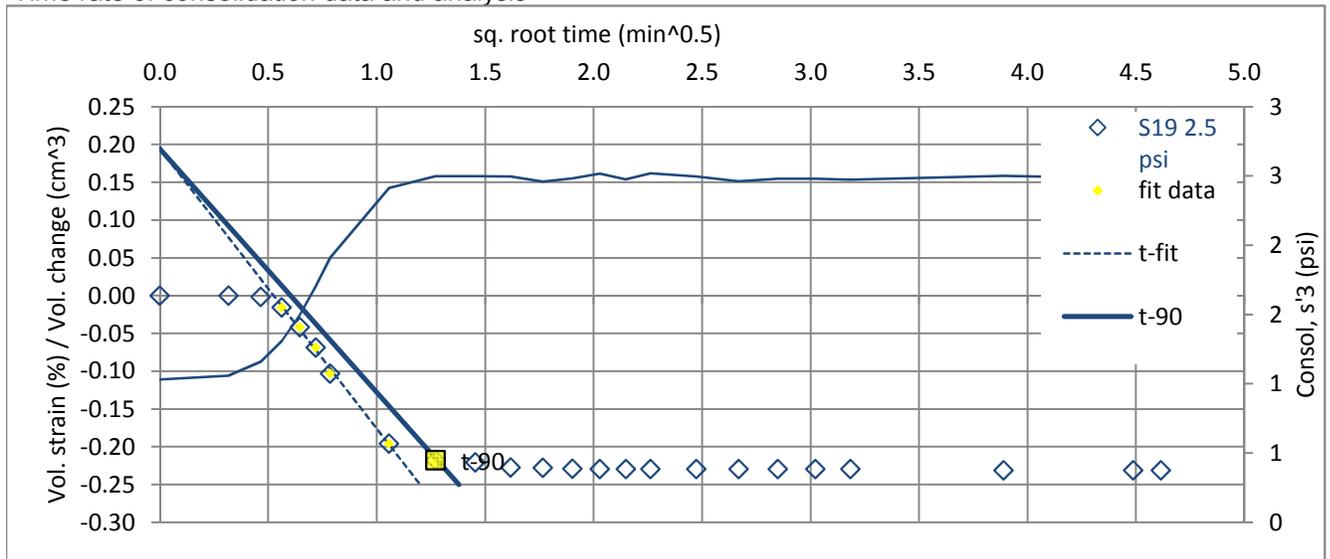
Sample: Sample 19

Effective stress results



Peak deviator stress (s1-s3), failure criteria Mohr and p' - q' space plots

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755

Project: Cell-Crete (Cellular Concrete)

No: 0002

Date cast: 07-Nov-14

Date: 09-Dec-14

Tested by: zg

Reduced by: zg

Checked by: rbm/rtc

Cellular concrete type: Class II

Sample: Sample 12

Sample description: Cell Crete

USCS classification: not requested

Sample type: cast (11/07/2014)

Age of sample (days): 32 (at shear)

| | Test Number | S12 | | 5 psi | |
|---|-------------------------------------|---------|--------------------------------|--------|--|
| | | Initial | Bef. Shr. MethodA ^d | Final | |
| | 0° | 5.786 | | | |
| Sample ht., H (in) | 120° | 5.766 | | | |
| | 240° | 5.782 | | | |
| Avg. height, Havg (in) | | 5.778 | 5.778 | | |
| Avg. height, Havg (cm) | | 14.676 | 14.676 | | |
| ΔV_s (cm ³) ^b | | | 0.000 | | |
| ΔV_c (cm ³) ^b | | | -1.335 | | |
| Ht. change, ΔH_{sc} (in) ^a | | | 0.000 | | |
| Sample dia., D (in) | top | 2.947 | | | |
| | mid | 2.906 | | | |
| | bot | 2.877 | | | |
| Avg. dia., Davg (in) | | 2.909 | 2.906 | | |
| Avg. dia., Davg (cm) | | 7.389 | 7.381 | | |
| Avg. area, Aavg (in ²) | | 6.646 | 6.632 | | |
| Avg. area, Aavg (cm ²) | | 42.879 | 42.788 | | |
| Wt. rings + wet soil (g) | | 239.45 | | | |
| Wt. rings (g) | | 0.00 | | | |
| Volume, V _o (in ³) | | 38.4 | 38.3 | | |
| V _o (cm ³) | | 629.3 | 628.0 | | |
| | V _o (ft ³) | 0.0222 | 0.0222 | | |
| Moisture | Wet soil + tare (g) | 239.45 | | 600.16 | |
| | Dry soil + tare (g) | 153.07 | | 273.11 | |
| | Tare (g) | 0.00 | | 120.04 | |
| | Moisture content, w (%) | 56.4 | | 213.7 | |
| Phase Relationships | G _s , from mix design | 3.15 | | | |
| | Mass total (g) | 239.5 | | | |
| | Mass of solids (g) | 153.1 | | | |
| | Volume (cm ³) | 629.3 | | | |
| | Volume of water (cm ³) | 86.4 | | | |
| | Volume of solids (cm ³) | 48.6 | | | |
| | Volume of voids (cm ³) | 580.7 | | | |
| | Volume of air (cm ³) | 494.3 | | | |
| | Void ratio, e | 11.950 | | | |
| | Porosity, n | 0.923 | | | |
| | Volumetric moisture, T | 0.137 | | | |
| | Saturation, S (%) ^c | 14.88 | | | |
| | Dry density (gm/cm ³) | 0.243 | | | |
| Wet unit wt., gm (pcf) | 23.8 | | | | |
| Dry unit wt., gd (pcf) | 15.2 | | | | |

Photo of sample after testing



Notes:

- ^a ΔH_{sc} (in) = change in height during saturation and consolidation
- ^b ΔV_s = change in volume during saturation, ΔV_c = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where A_c (Method A) = $(V_o - DV_s - DV_c) / (H_o - DH_{sc})$

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 0002

Sample: Sample 12

Date cast: 07-Nov-14

Sample description: Cell Crete

Date: 09-Dec-14

USCS classification: not requested

Tested by: zg

Sample type: cast (11/07/2014)

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| Test Number | S12 at 5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 70.0 |
| | Skempton B | 0.81 |
| | t-90 (min) | 1.1 |
| | t-100 (min) | |
| | t-50 (min) | 0.3 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | yes |
| | Filter paper correction | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 17.31 |
| | Time to failure, tf (min) | 173.1 |
| | Confining stress, s'3 (psi) | 5.0 |
| | Deviator stress, s1-s3 (psi) | 53.0 |
| | Obliquity, s'1/s'3 | 12.269 |
| | Vol. strain at failure, ev (%) | -14.15 |
| | $q = q' = (s1-s3)/2$ (psi) | 26.5 |
| | $p' = (s'1+s'3)/2$ (psi) | 31.2 |
| | Effective major principal stress, s'1 (psi) | 57.7 |
| Effective minor principal stress, s'3 (psi) | 4.7 | |

Comments:

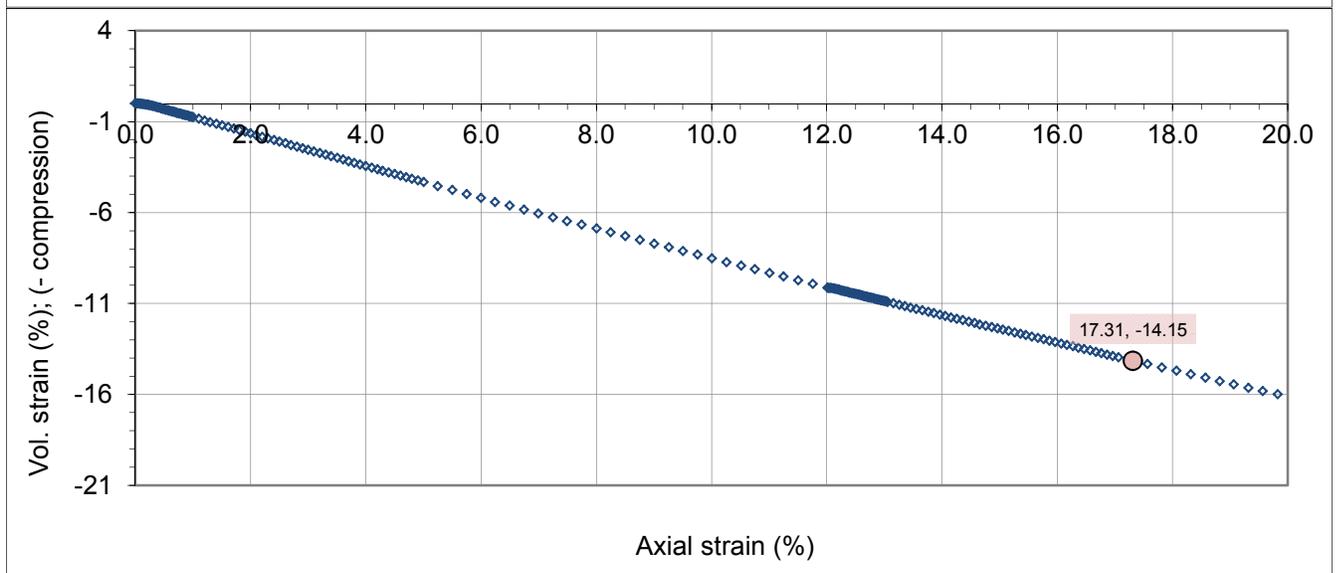
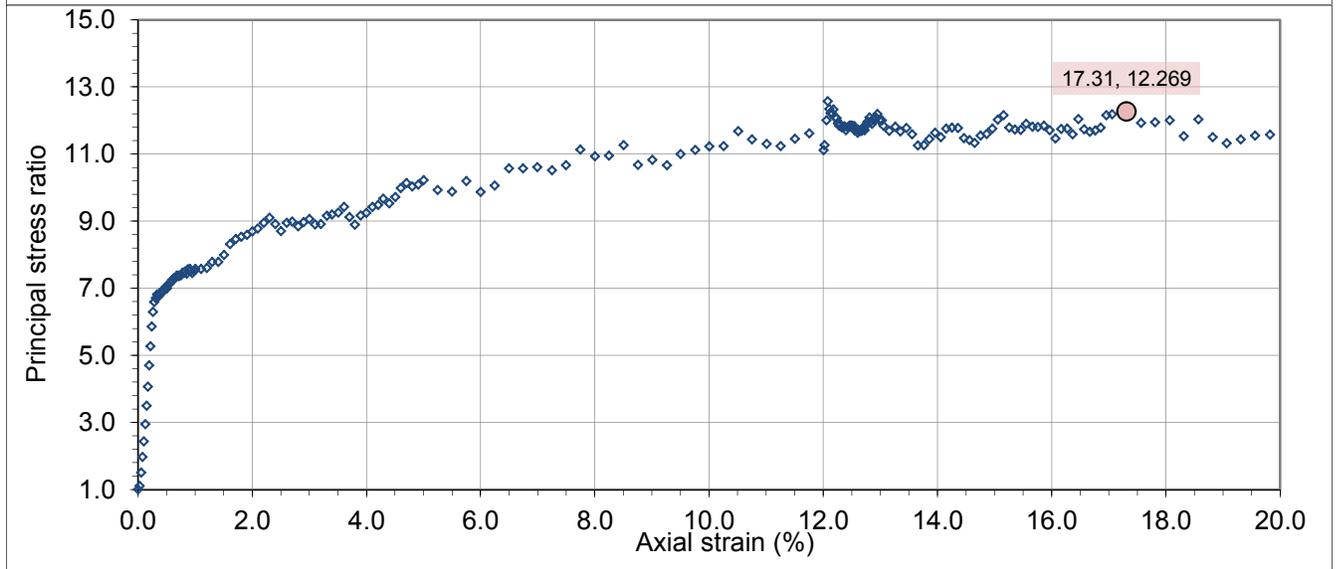
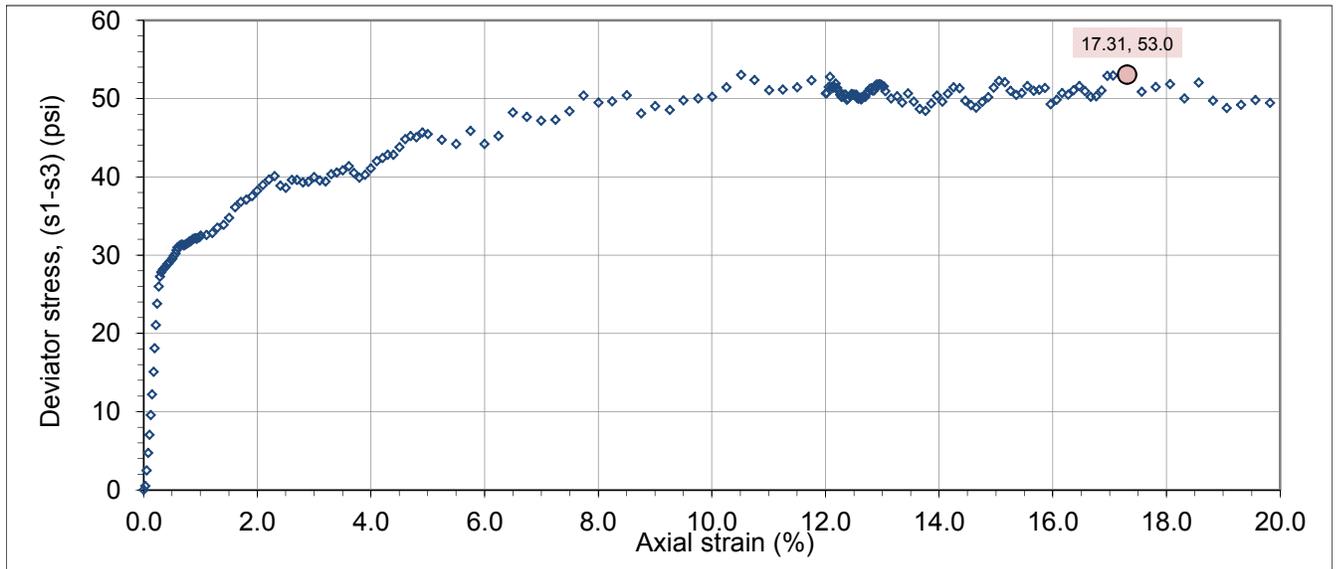
Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)
No: 0002

Cellular concrete type: Class II
Sample: Sample 12



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



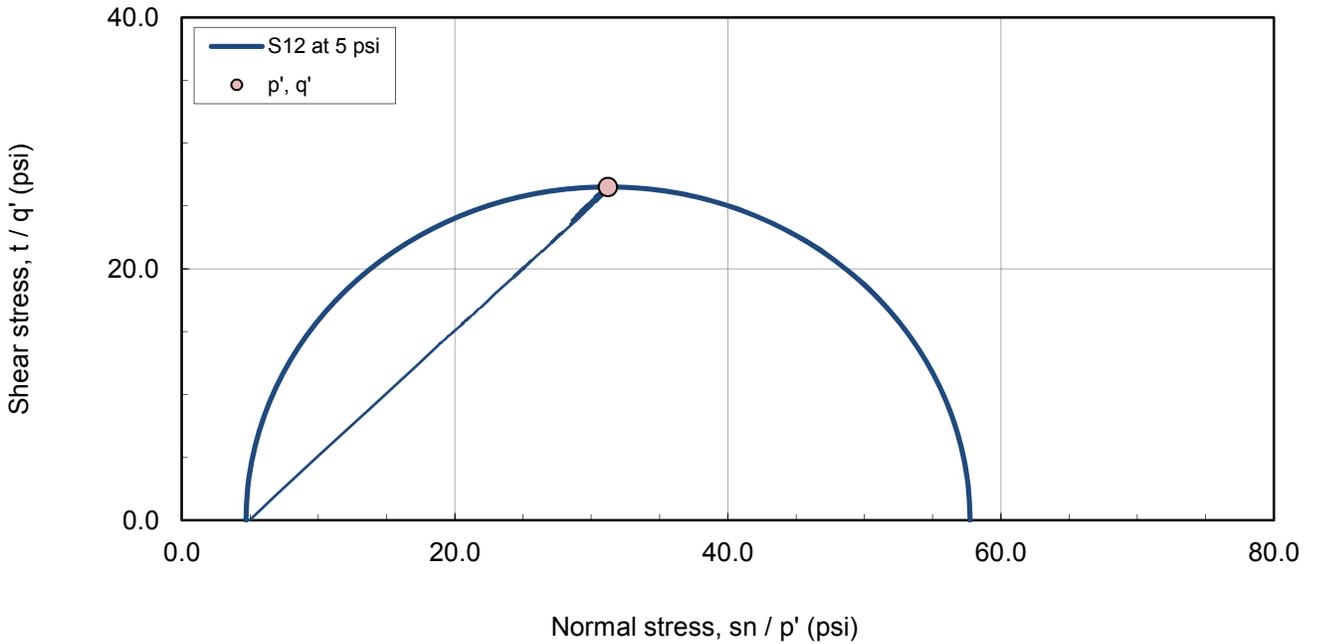
Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 0002

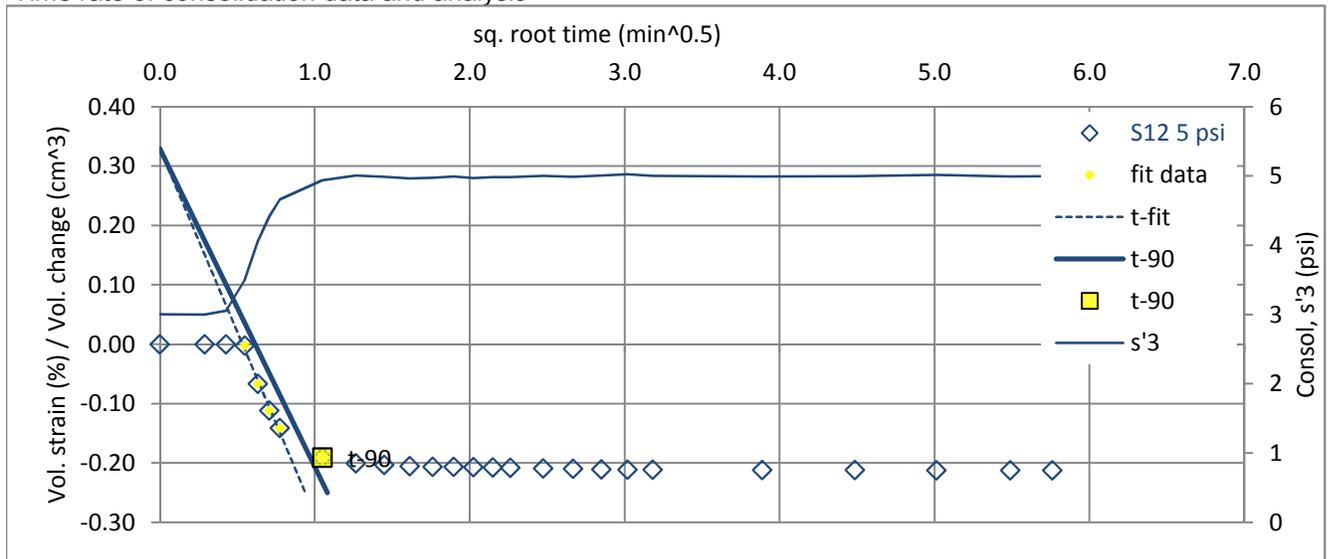
Sample: Sample 12

Effective stress results



Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755

Project: Cell-Crete (Cellular Concrete)

No: 0002

Date cast: 07-Nov-14

Date: 11-Dec-14

Tested by: zg

Reduced by: zg

Checked by: rbm/rtc

Cellular concrete type: Class II

Sample: Sample 6

Sample description: Cell Crete

USCS classification: not requested

Sample type: cast (11/07/2014)

Age of sample (days): 34 (at shear)

| | Test Number | S6 | 12.5 |
|---|---|---------|---------------------------------------|
| | | Initial | Bef. Shr. Method A ^d Final |
| Unit weight data | 0° | 5.673 | |
| | Sample ht., H (in) 120° | 5.694 | |
| | 240° | 5.659 | |
| | Avg. height, Havg (in) | 5.675 | 5.676 |
| | Avg. height, Havg (cm) | 14.415 | 14.416 |
| | ΔV_s (cm ³) ^b | | 0.000 |
| | ΔV_c (cm ³) ^b | | -5.110 |
| | Ht. change, ΔH_{sc} (in) ^a | | 0.000 |
| | Sample dia., D (in) top | 2.986 | |
| | mid | 2.925 | |
| | bot | 2.867 | |
| | Avg. dia., Davg (in) | 2.926 | 2.914 |
| | Avg. dia., Davg (cm) | 7.431 | 7.401 |
| | Avg. area, Aavg (in ²) | 6.723 | 6.668 |
| | Avg. area, Aavg (cm ²) | 43.374 | 43.018 |
| Wt. rings + wet soil (g) | 237.49 | | |
| Wt. rings (g) | 0.00 | | |
| Volume, V _o (in ³) | 38.2 | 37.8 | |
| V _o (cm ³) | 625.3 | 620.1 | |
| | V _o (ft ³) | 0.0221 | 0.0219 |
| Moisture | Wet soil + tare (g) | 237.49 | 551.40 |
| | Dry soil + tare (g) | 152.43 | 294.09 |
| | Tare (g) | 0.00 | 144.31 |
| | Moisture content, w (%) | 55.8 | 171.8 |
| Phase Relationships | G _s , from mix design | 3.15 | |
| | Mass total (g) | 237.5 | |
| | Mass of solids (g) | 152.4 | |
| | Volume (cm ³) | 625.3 | |
| | Volume of water (cm ³) | 85.1 | |
| | Volume of solids (cm ³) | 48.4 | |
| | Volume of voids (cm ³) | 576.9 | |
| | Volume of air (cm ³) | 491.8 | |
| | Void ratio, e | 11.921 | |
| | Porosity, n | 0.923 | |
| | Volumetric moisture, T | 0.136 | |
| | Saturation, S (%) ^c | 14.75 | |
| | Dry density (gm/cm ³) | 0.244 | |
| Wet unit wt., gm (pcf) | 23.7 | | |
| Dry unit wt., gd (pcf) | 15.2 | | |

Photo of sample after testing



Notes:

^a ΔH_{sc} (in) = change in height during saturation and consolidation

^b ΔV_s = change in volume during saturation, ΔV_c = change in volume during consolidation

^c Saturation before shear set to 100% for phase calculations

^d Before shear Aavg using method A; where A_c (Method A) = $(V_o - DV_s - DV_c) / (H_o - DH_{sc})$

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 0002

Sample: Sample 6

Date cast: 07-Nov-14

Sample description: Cell Crete

Date: 11-Dec-14

USCS classification: not requested

Tested by: zg

Sample type: cast (11/07/2014)

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Test Number

S6 at 12.5

| | | |
|--|---|-------|
| Test information | Total backpressure (psi) | 70.0 |
| | Skempton B | 0.76 |
| | t-90 (min) | 1.1 |
| | t-100 (min) | |
| | t-50 (min) | 0.3 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | yes |
| Filter paper correction | No filter paper | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 10.99 |
| | Time to failure, tf (min) | 109.9 |
| | Confining stress, s'3 (psi) | 12.5 |
| | Deviator stress, s1-s3 (psi) | 53.9 |
| | Obliquity, s'1/s'3 | 5.334 |
| | Vol. strain at failure, ev (%) | -9.78 |
| | $q = q' = (s1-s3)/2$ (psi) | 27.0 |
| | $p' = (s'1+s'3)/2$ (psi) | 39.4 |
| | Effective major principal stress, s'1 (psi) | 66.4 |
| Effective minor principal stress, s'3 (psi) | 12.4 | |

Comments:

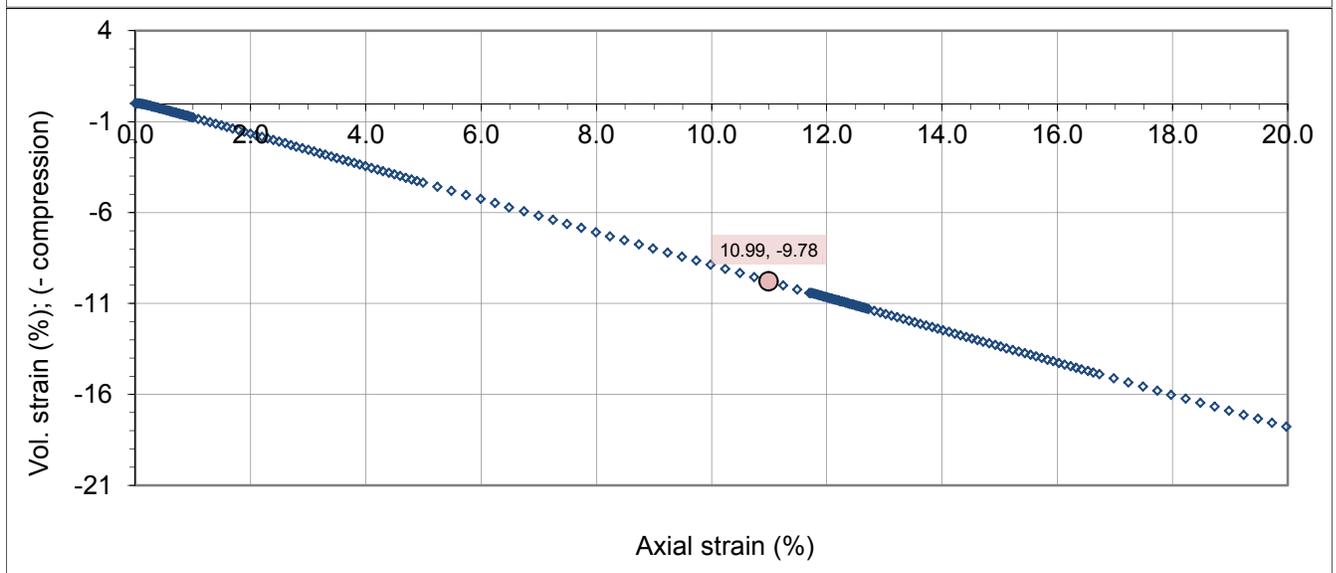
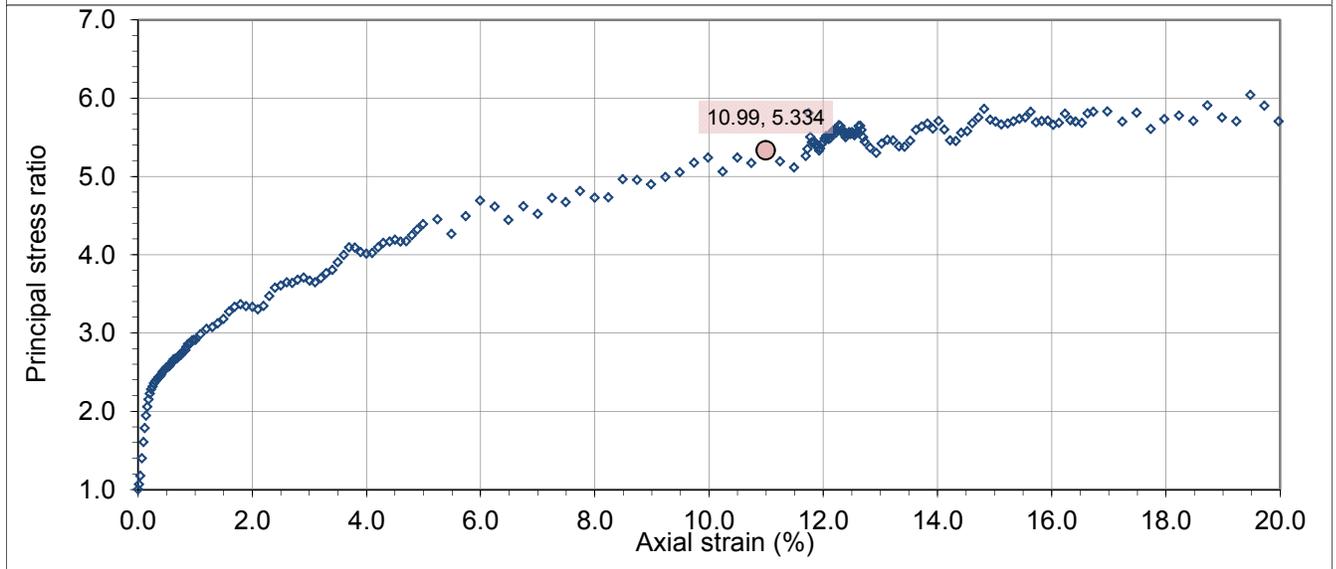
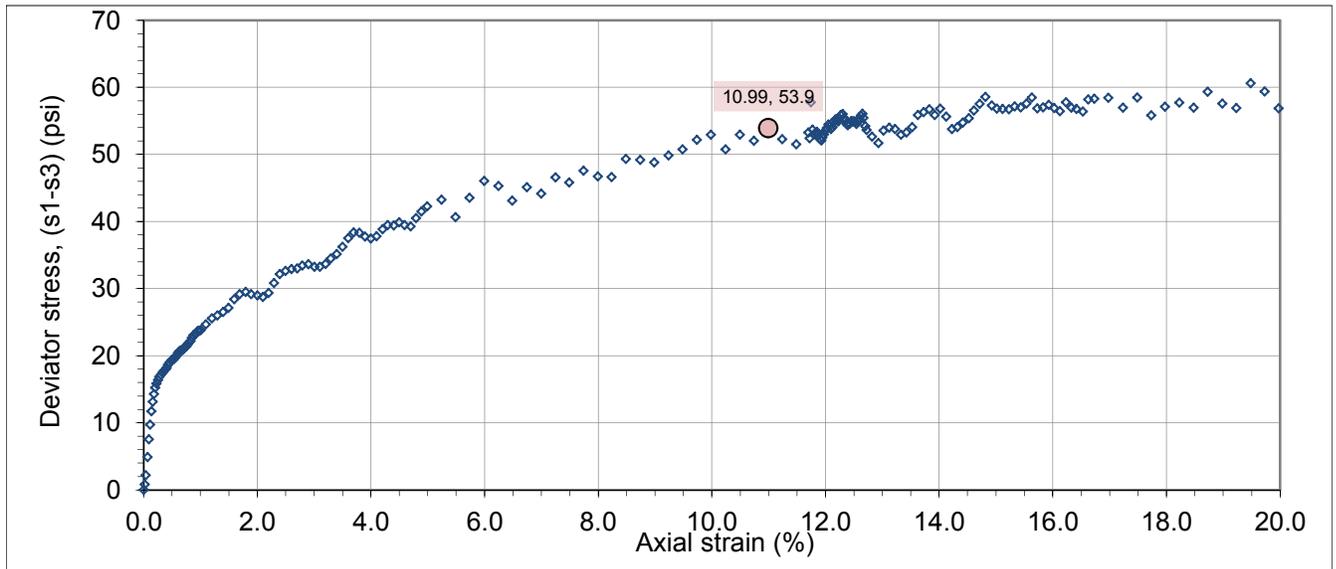
Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)
No: 0002

Cellular concrete type: Class II
Sample: Sample 6



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



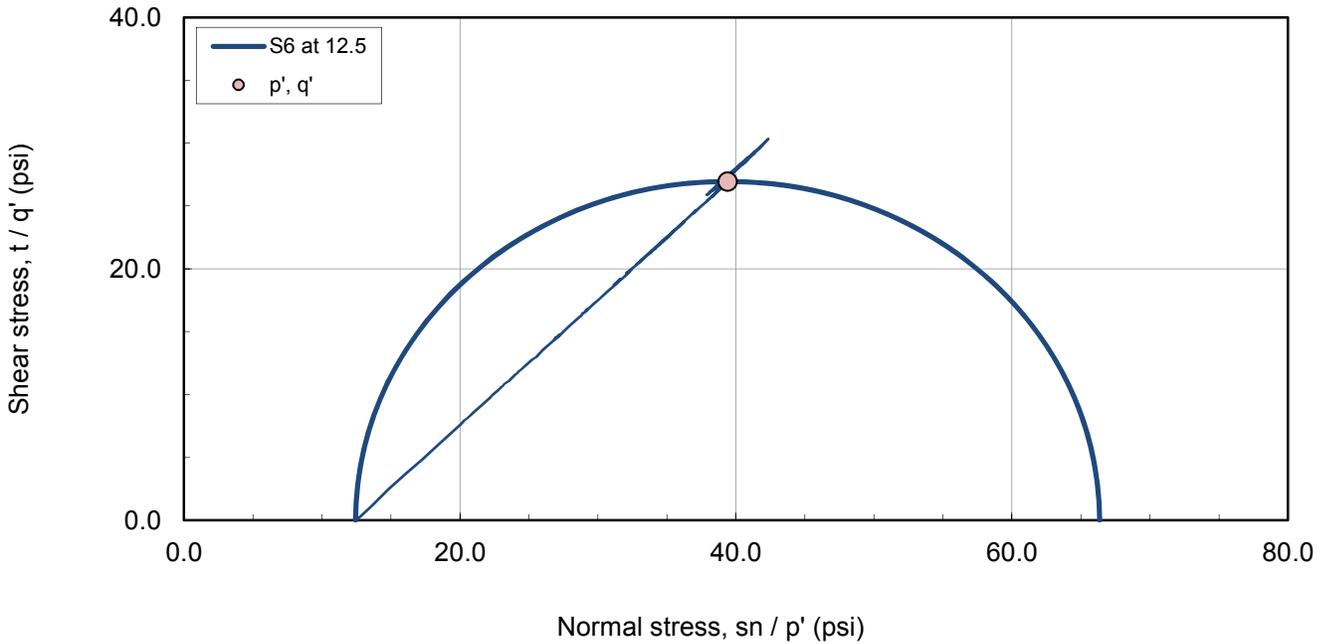
Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 0002

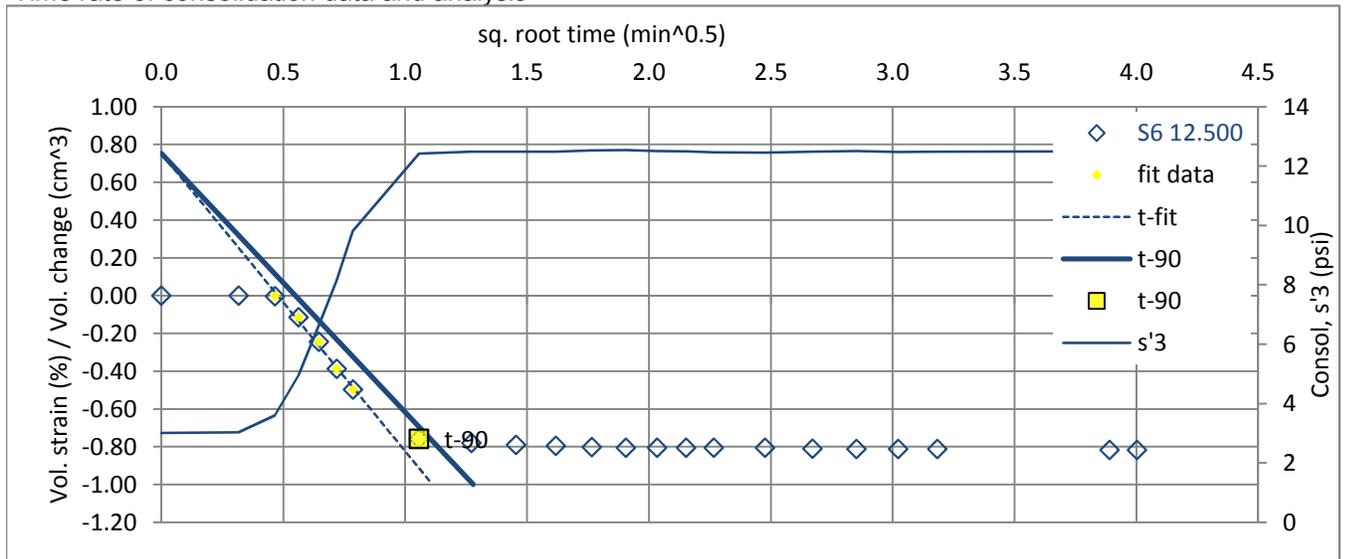
Sample: Sample 6

Effective stress results



Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755

Project: Cell-Crete (Cellular Concrete)

No: 0002

Date cast: 07-Nov-14

Date: 08-Dec-14

Tested by: zg

Reduced by: zg

Checked by: rbm/rtc

Cellular concrete type: Class II

Sample: Sample 7

Sample description: Cell Crete

USCS classification: not requested

Sample type: cast (11/07/2014)

Age of sample (days): 31 (at shear)

| | Test Number | 30 psi | |
|---|-------------------------------------|---------|---------------------------------------|
| | | S7 | |
| | | Initial | Bef. Shr. Method A ^d Final |
| | 0° | 5.726 | |
| Sample ht., H (in) | 120° | 5.739 | |
| | 240° | 5.712 | |
| | Avg. height, Havg (in) | 5.726 | 5.726 |
| Avg. height, Havg (cm) | 14.543 | 14.543 | |
| ΔV_s (cm ³) ^b | | | 0.000 |
| ΔV_c (cm ³) ^b | | | -10.175 |
| Ht. change, ΔH_{sc} (in) ^a | | | 0.000 |
| Sample dia., D (in) | top | 2.971 | |
| | mid | 2.907 | |
| | bot | 2.899 | |
| Avg. dia., Davg (in) | 2.921 | 2.897 | |
| Avg. dia., Davg (cm) | 7.419 | 7.359 | |
| Avg. area, Aavg (in ²) | 6.701 | 6.593 | |
| Avg. area, Aavg (cm ²) | 43.234 | 42.534 | |
| Wt. rings + wet soil (g) | 236.81 | | |
| Wt. rings (g) | 0.00 | | |
| Volume, V _o (in ³) | 38.4 | 37.7 | |
| V _o (cm ³) | 628.8 | 618.6 | |
| | V _o (ft ³) | 0.0222 | 0.0218 |
| Moisture | Wet soil + tare (g) | 236.81 | 568.51 |
| | Dry soil + tare (g) | 155.72 | 274.68 |
| | Tare (g) | 0.00 | 118.96 |
| | Moisture content, w (%) | 52.1 | 188.7 |
| Phase Relationships | G _s , from mix design | 3.15 | |
| | Mass total (g) | 236.8 | |
| | Mass of solids (g) | 155.7 | |
| | Volume (cm ³) | 628.8 | |
| | Volume of water (cm ³) | 81.1 | |
| | Volume of solids (cm ³) | 49.4 | |
| | Volume of voids (cm ³) | 579.3 | |
| | Volume of air (cm ³) | 498.2 | |
| | Void ratio, e | 11.719 | |
| | Porosity, n | 0.921 | |
| | Volumetric moisture, T | 0.129 | |
| | Saturation, S (%) ^c | 14.00 | |
| | Dry density (gm/cm ³) | 0.248 | |
| Wet unit wt., gm (pcf) | 23.5 | | |
| Dry unit wt., gd (pcf) | 15.5 | | |

Photo of sample after testing



Notes:

- ^a ΔH_{sc} (in) = change in height during saturation and consolidation
- ^b ΔV_s = change in volume during saturation, ΔV_c = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where A_c (Method A) = $(V_o - DV_s - DV_c) / (H_o - DH_{sc})$

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 0002

Sample: Sample 7

Date cast: 07-Nov-14

Sample description: Cell Crete

Date: 08-Dec-14

USCS classification: not requested

Tested by: zg

Sample type: cast (11/07/2014)

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Test Number

S7 at 30 psi

| | | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 70.0 |
| | Skempton B | 0.68 |
| | t-90 (min) | 2.1 |
| | t-100 (min) | |
| | t-50 (min) | 0.5 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | yes |
| | Filter paper correction | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 10.46 |
| | Time to failure, tf (min) | 104.6 |
| | Confining stress, s'3 (psi) | 30.0 |
| | Deviator stress, s1-s3 (psi) | 40.4 |
| | Obliquity, s'1/s'3 | 2.257 |
| | Vol. strain at failure, ev (%) | -9.41 |
| | $q = q' = (s1-s3)/2$ (psi) | 20.2 |
| | $p' = (s'1+s'3)/2$ (psi) | 52.3 |
| | Effective major principal stress, s'1 (psi) | 72.4 |
| Effective minor principal stress, s'3 (psi) | 32.1 | |

Comments:

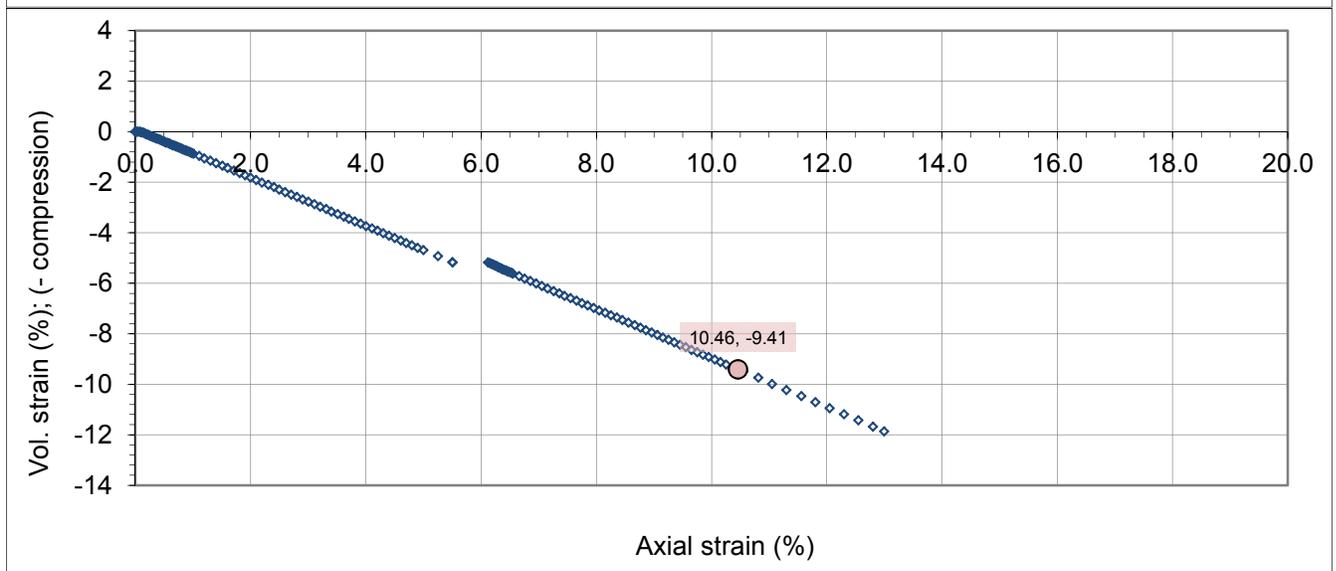
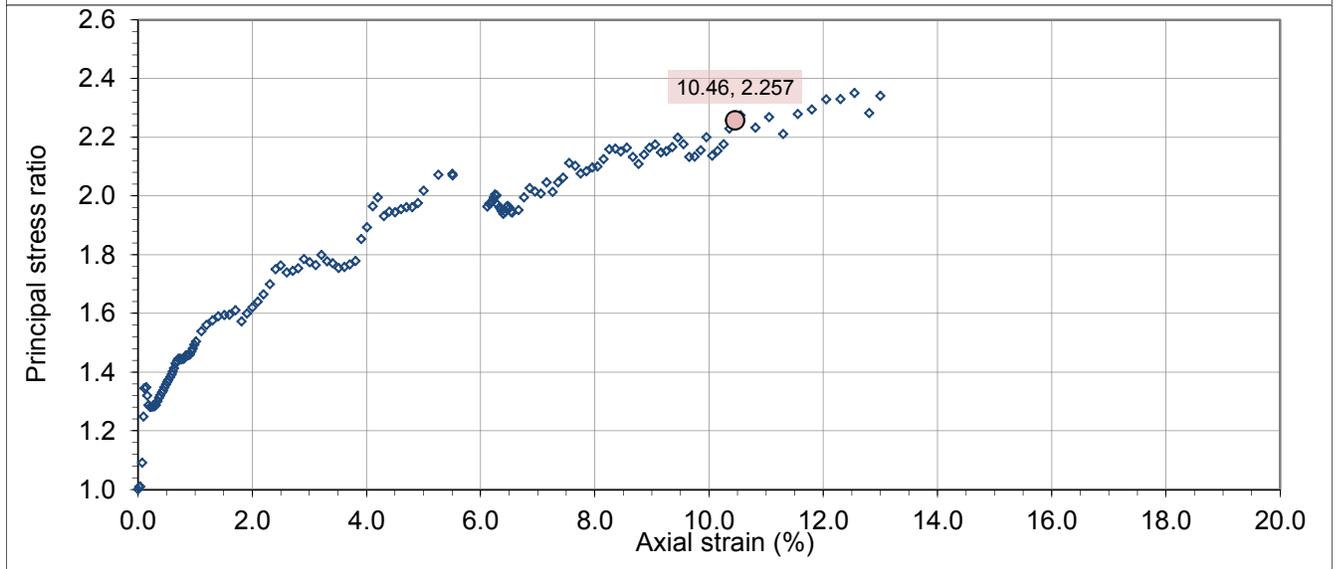
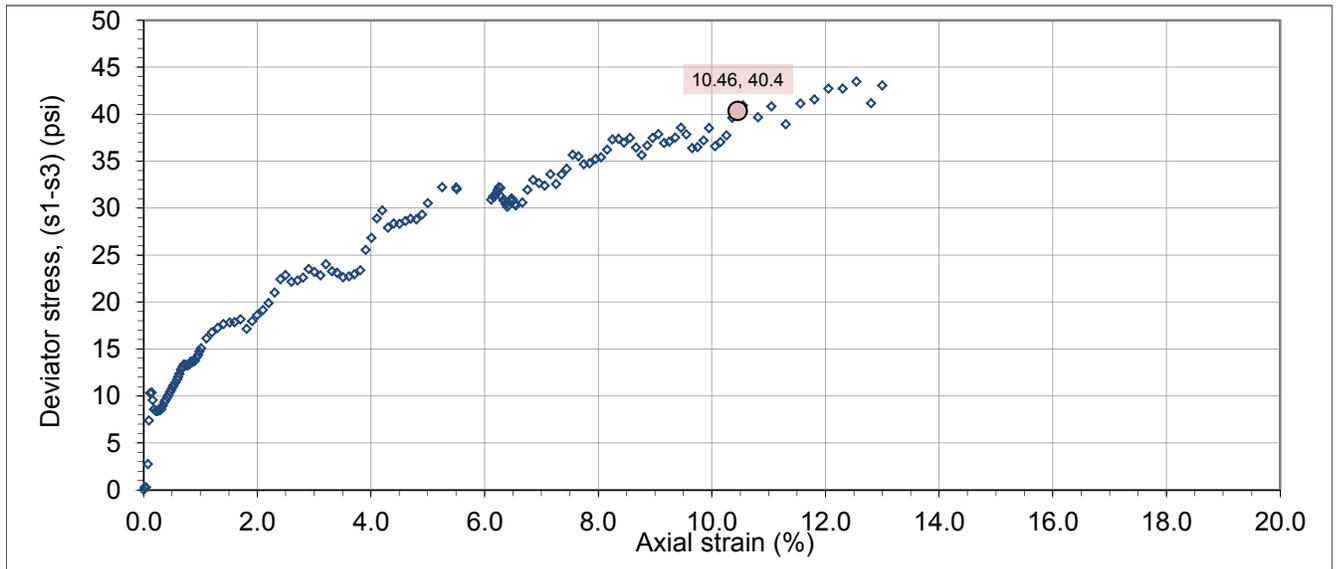
Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete (Cellular Concrete)
No: 0002

Cellular concrete type: Class II
Sample: Sample 7



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



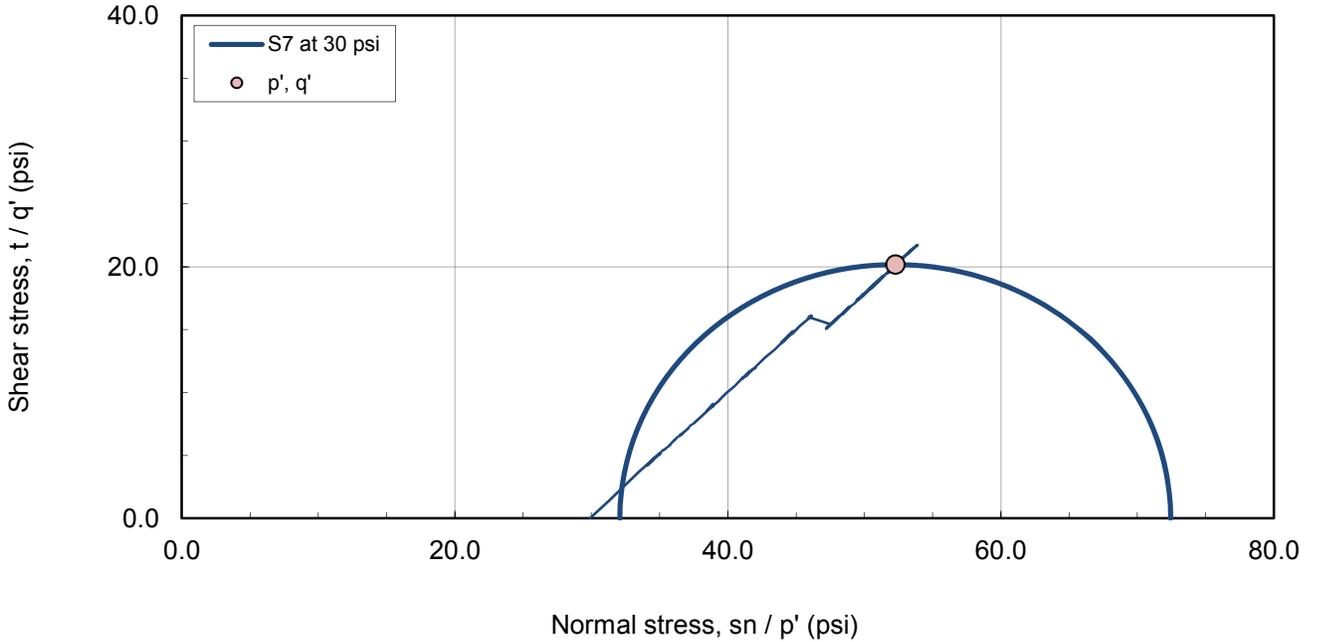
Project: Cell-Crete (Cellular Concrete)

Cellular concrete type: Class II

No: 0002

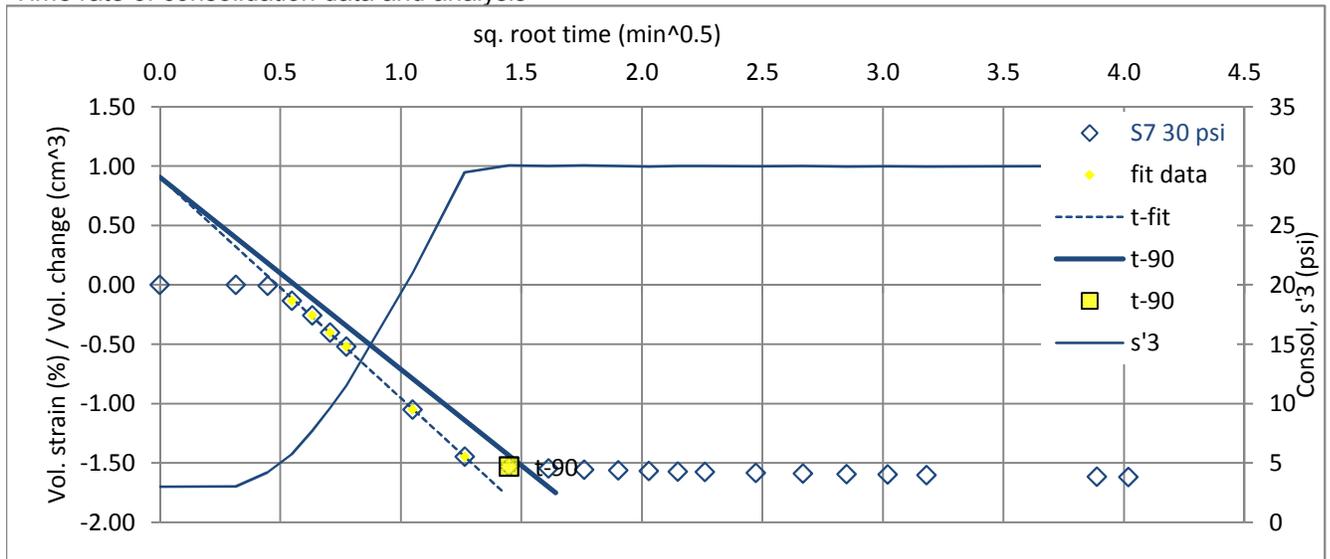
Sample: Sample 7

Effective stress results



Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: **Cell Crete** Cellular concrete type: **Class II**
 No: **14GCI498** Sample: **213-54**
 Date cast: **13-Feb-15** Sample description: **Cellular concrete cast on 2/13/15**
 Date: **04-Apr-15** USCS classification: **not applicable**
 Tested by: **zmg** Sample type: **cast**
 Reduced by: **zmg** Age of sample (days): **50** (at shear)
 Checked by: **rbm/rtc**

| | Test Number | 2.5 psi | |
|-------------------------------------|-------------------------------------|---------|--------------------------------|
| | | S1 | Bef. Shr. MethodA ^d |
| Unit weight data | Sample ht., H (in) | Initial | |
| | 0° | 5.770 | |
| | 120° | 5.766 | |
| | 240° | 5.760 | |
| | Avg. height, Havg (in) | 5.765 | 5.765 |
| | Avg. height, Havg (cm) | 14.644 | 14.644 |
| | ΔHsc (in) ^a | | 0.00 |
| | top | 2.988 | |
| | mid | 2.956 | |
| | bot | 2.915 | |
| | Avg. dia., Davg (in) | 2.954 | 2.957 |
| | Avg. dia., Davg (cm) | 7.503 | 7.510 |
| | Avg. area, Aavg (in ²) | 6.852 | 6.866 |
| | Avg. area, Aavg (cm ²) | 44.208 | 44.296 |
| | Wt. rings + wet soil (g) | 284.90 | 611.33 |
| | Wt. rings (g) | 0.00 | 30.42 |
| | Volume, Vo (in ³) | 39.5 | 39.6 |
| Vo (cm ³) | 647.4 | 648.7 | |
| Vo (ft ³) | 0.0229 | 0.0229 | |
| ΔVs (cm ³) ^b | | 0.00 | |
| ΔVc (cm ³) ^b | | -1.29 | |
| Moisture | Wet soil + tare (g) | 284.90 | 697.34 |
| | Dry soil + tare (g) | 189.26 | 334.10 |
| | Tare (g) | 0.00 | 144.84 |
| | Moisture content, w (%) | 50.5 | 191.9 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 284.9 | 777.9 |
| | Mass of solids (g) | 189.3 | 189.3 |
| | Volume (cm ³) | 647.4 | 648.7 |
| | Volume of water (cm ³) | 95.6 | 588.6 |
| | Volume of solids (cm ³) | 60.1 | 60.1 |
| | Volume of voids (cm ³) | 587.3 | 588.6 |
| | Volume of air (cm ³) | 491.7 | 0.0 |
| | Void ratio, e | 9.775 | 9.796 |
| | Porosity, n | 0.907 | 0.907 |
| | Volumetric moisture, T | 0.148 | 0.907 |
| | Saturation, S (%) ^c | 16.28 | 100.00 |
| | Dry density (gm/cm ³) | 0.292 | 0.292 |
| Wet unit wt., gm (pcf) | 27.5 | 53.2 | |
| Dry unit wt., gd (pcf) | 18.3 | 18.2 | |

Photo of sample after testing



Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 04-Apr-15
 Tested by: zmg

Cellular concrete type: Class II
Sample: 213-54
 Sample description: Cellular concrete cast on 2/13/15
 USCS classification: not applicable
 Sample type: cast

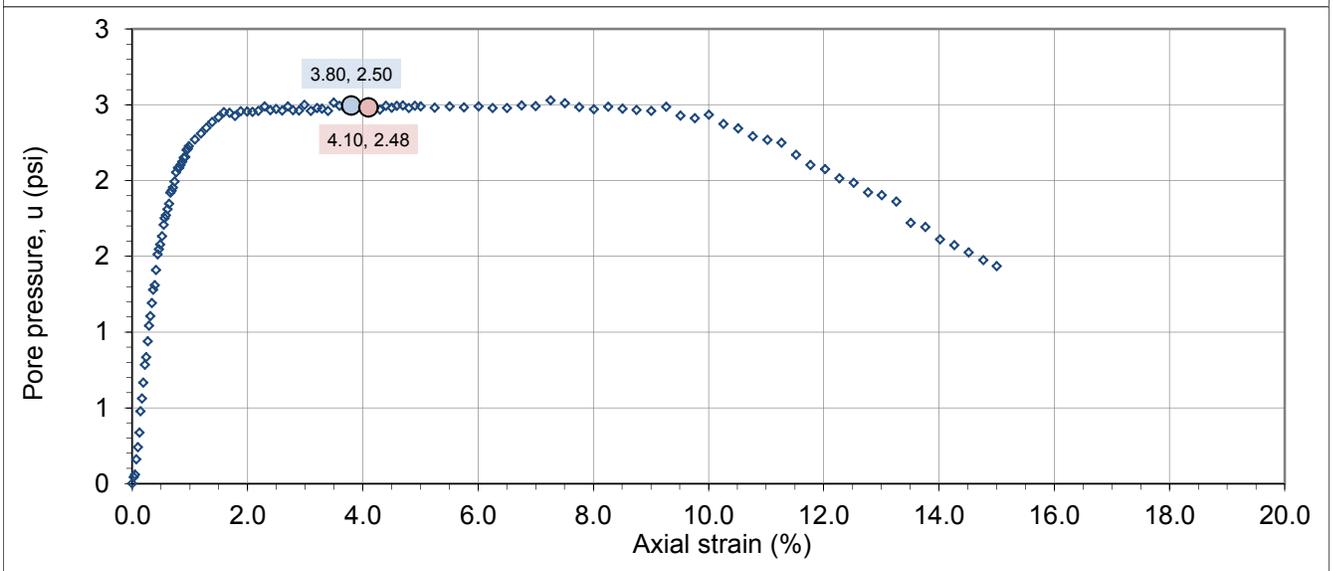
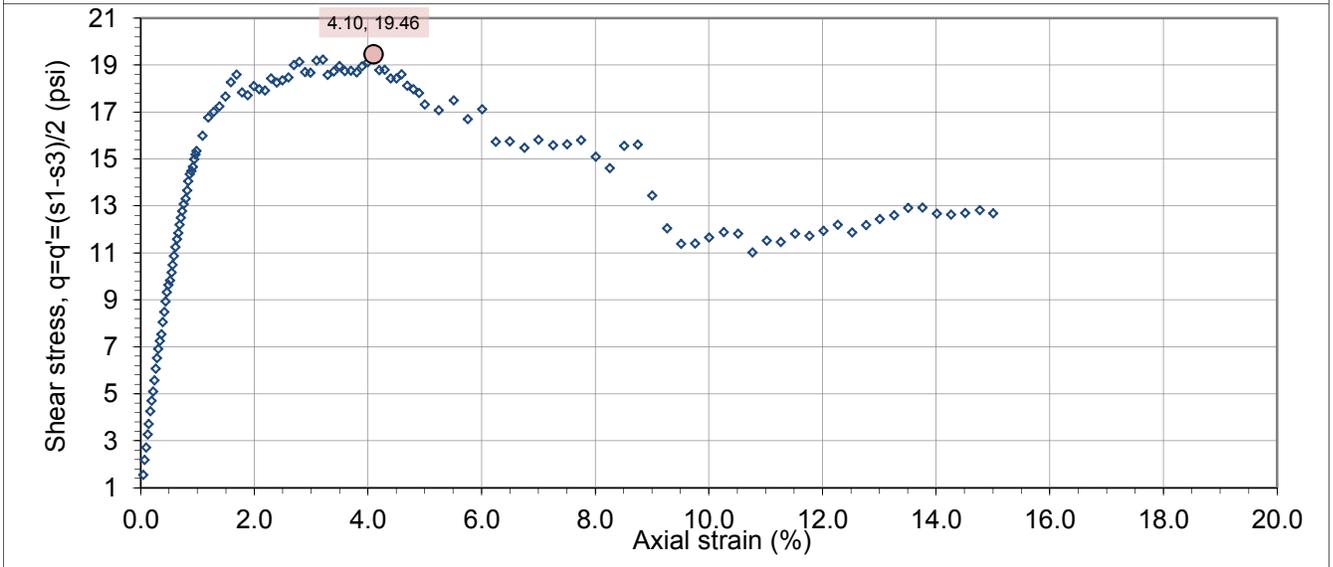
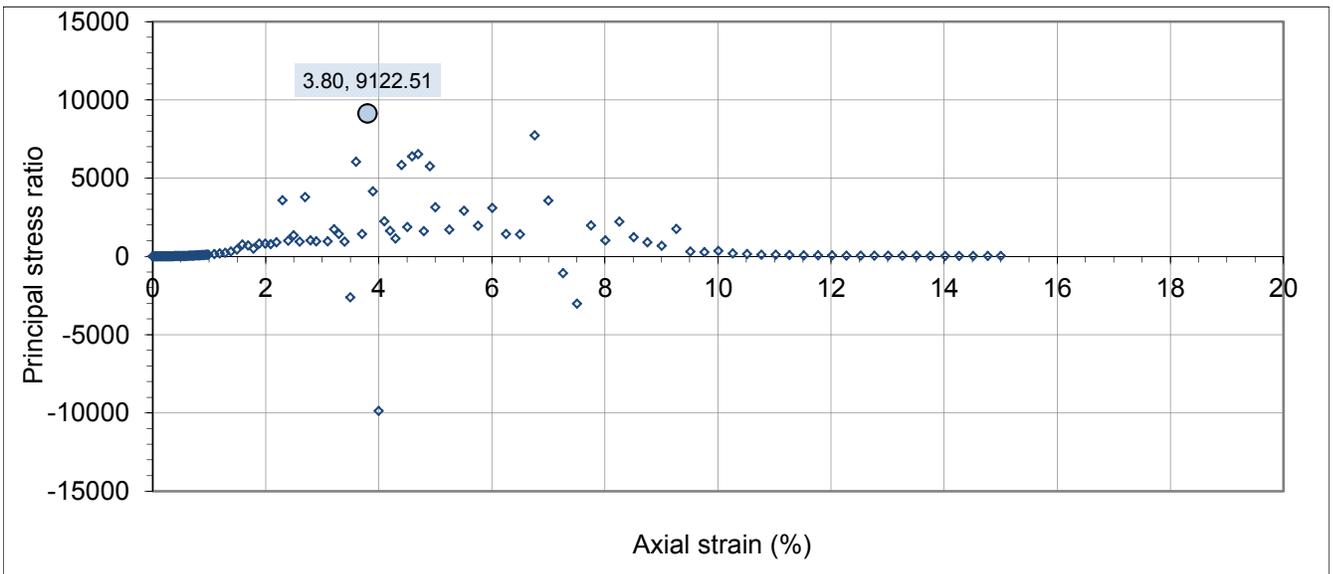
X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_CU1pts_TypeII_2-5psi-v02.xlsx]SUM

| Test Number | S1 at 2.5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 85.0 |
| | Skempton B | 0.94 |
| | t-90 (min) | 1.2 |
| | t-100 (min) | |
| | t-50 (min) | 0.3 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | Yes |
| | Filter paper correction | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 3.80 |
| | Time to failure, tf (min) | 38.0 |
| | Obliquity, s'1/s'3 | 9122.51 |
| | Excess pore pressure, u (psi) | 2.50 |
| | $q = q' = (s1-s3)/2$ (psi) | 18.69 |
| | $p' = (s'1+s'3)/2$ (psi) | 18.69 |
| | $p = (s1+s3)/2$ (psi) | 21.19 |
| | Effective major principal stress, s'1 (psi) | 37.38 |
| | Effective minor principal stress, s'3 (psi) | 0.00 |
| | Total major pincipal stress, s1 (psi) | 39.87 |
| Total minor pincipal stress, s3 (psi) | 2.50 | |
| Skempton A at failure, Af | 0.07 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 4.10 |
| | Time to failure, tf (min) | 41.0 |
| | Deviator stress, s1-s3 (psi) | 38.92 |
| | Excess pore pressure, u (psi) | 2.48 |
| | $q = q' = (s1-s3)/2$ (psi) | 19.46 |
| | $p' = (s'1+s'3)/2$ (psi) | 19.48 |
| | $p = (s1+s3)/2$ (psi) | 21.96 |
| | Effective major principal stress, s'1 (psi) | 38.94 |
| | Effective minor principal stress, s'3 (psi) | 0.02 |
| | Total major pincipal stress, s1 (psi) | 41.42 |
| Total minor pincipal stress, s3 (psi) | 2.50 | |
| Skempton A at failure, Af | 0.06 | |

Comments:

Project: Cell Crete
 No: 14GCI498

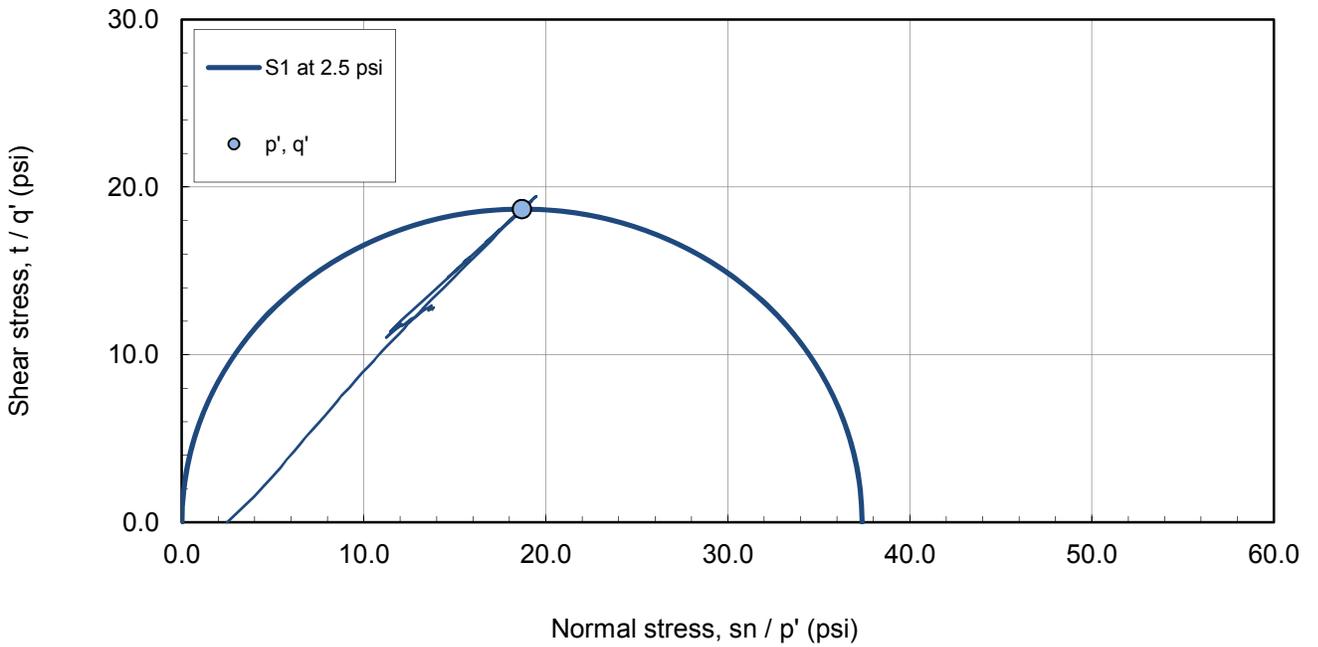
Cellular concrete type: Class II
 Sample: 213-54



Project: Cell Crete
No: 14GCI498

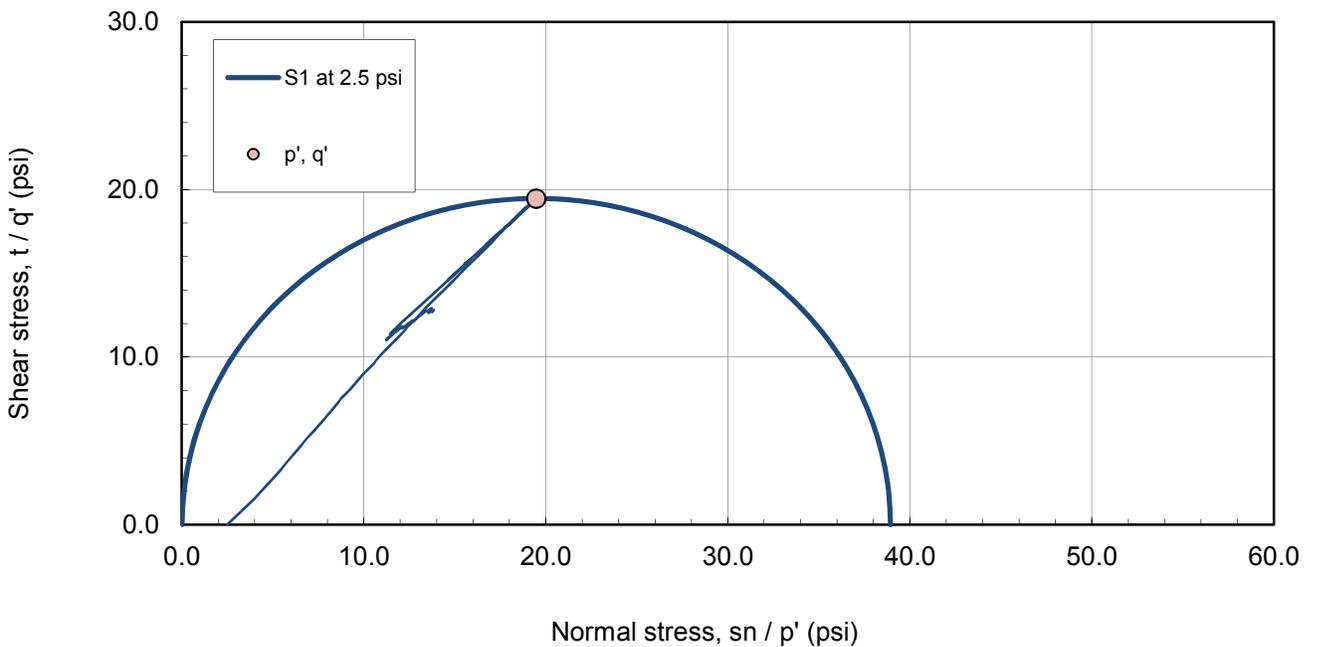
Cellular concrete type: Class II
Sample: 213-54

Effective stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results

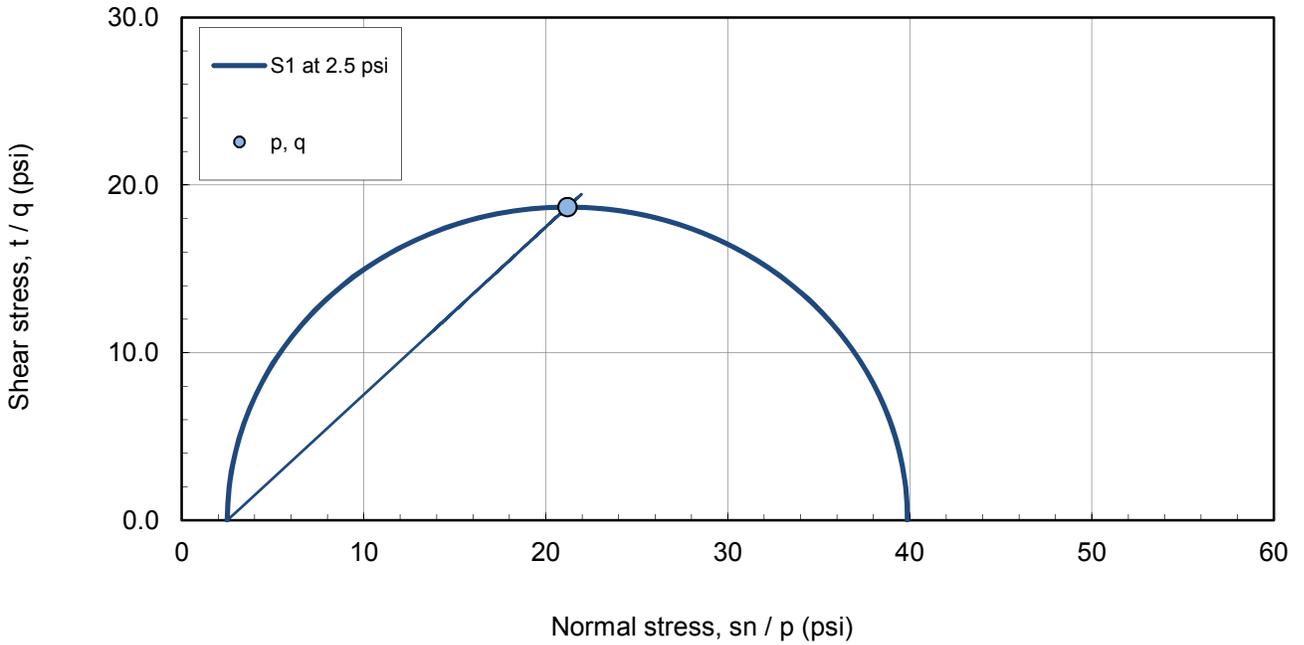


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Project: Cell Crete
No: 14GCI498

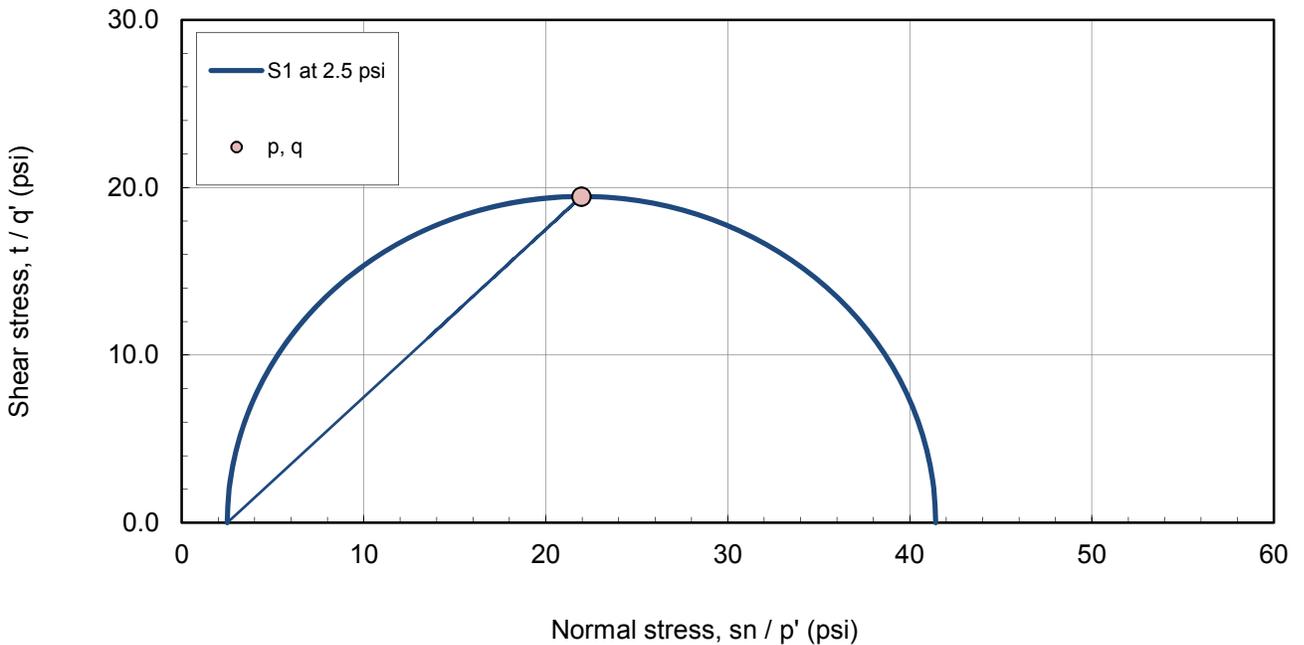
Cellular concrete type: Class II
Sample: 213-54

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results

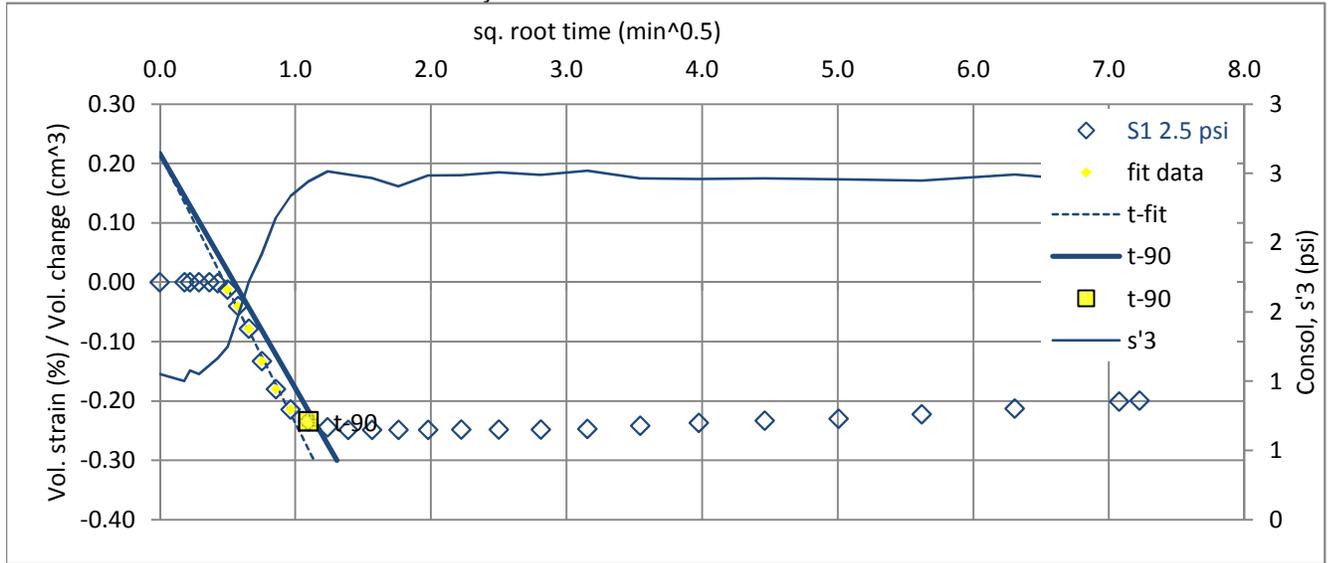


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p - q$ space plots

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-54

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: **Cell Crete** Cellular concrete type: **Class II**
 No: **14GCI498** Sample: **213-48**
 Date cast: **13-Feb-15** Sample description: **Cellular concrete cast on 2/13/15**
 Date: **02-Apr-15** USCS classification: **not applicable**
 Tested by: **zmg** Sample type: **cast**
 Reduced by: **zmg** Age of sample (days): **48** (at shear)
 Checked by: **rbm/rtc**

| | Test Number | 5 psi | |
|------------------------|-------------------------------------|--------|--------------------------------|
| | | S1 | Bef. Shr. MethodA ^d |
| | 0° | 5.926 | |
| Sample ht., H (in) | 120° | 5.939 | |
| | 240° | 5.925 | |
| | Avg. height, Havg (in) | 5.930 | 5.930 |
| | Avg. height, Havg (cm) | 15.062 | 15.062 |
| | ΔHsc (in) ^a | | 0.00 |
| Unit weight data | Sample dia., D (in) top | 2.963 | |
| | mid | 2.946 | |
| | bot | 2.888 | |
| | Avg. dia., Davg (in) | 2.936 | 2.944 |
| | Avg. dia., Davg (cm) | 7.457 | 7.477 |
| | Avg. area, Aavg (in ²) | 6.769 | 6.806 |
| | Avg. area, Aavg (cm ²) | 43.671 | 43.910 |
| | Wt. rings + wet soil (g) | 296.88 | 600.14 |
| | Wt. rings (g) | 0.00 | 33.75 |
| | Volume, Vo (in ³) | 40.1 | 40.4 |
| | Vo (cm ³) | 657.8 | 661.4 |
| | Vo (ft ³) | 0.0232 | 0.0234 |
| | ΔVs (cm ³) ^b | | 0.00 |
| | ΔVc (cm ³) ^b | | -3.59 |
| Moisture | Wet soil + tare (g) | 296.88 | 685.73 |
| | Dry soil + tare (g) | 197.65 | 342.74 |
| | Tare (g) | 0.00 | 145.09 |
| | Moisture content, w (%) | 50.2 | 173.5 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 296.9 | 796.3 |
| | Mass of solids (g) | 197.7 | 197.7 |
| | Volume (cm ³) | 657.8 | 661.4 |
| | Volume of water (cm ³) | 99.2 | 598.6 |
| | Volume of solids (cm ³) | 62.7 | 62.7 |
| | Volume of voids (cm ³) | 595.0 | 598.6 |
| | Volume of air (cm ³) | 495.8 | 0.0 |
| | Void ratio, e | 9.483 | 9.541 |
| | Porosity, n | 0.905 | 0.905 |
| | Volumetric moisture, T | 0.151 | 0.905 |
| | Saturation, S (%) ^c | 16.68 | 100.00 |
| | Dry density (gm/cm ³) | 0.300 | 0.299 |
| | Wet unit wt., gm (pcf) | 28.2 | 51.0 |
| Dry unit wt., gd (pcf) | 18.8 | 18.7 | |

Photo of sample after testing



Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 02-Apr-15
 Tested by: zmg

Cellular concrete type: Class II
Sample: 213-48
 Sample description: Cellular concrete cast on 2/13/15
 USCS classification: not applicable
 Sample type: cast

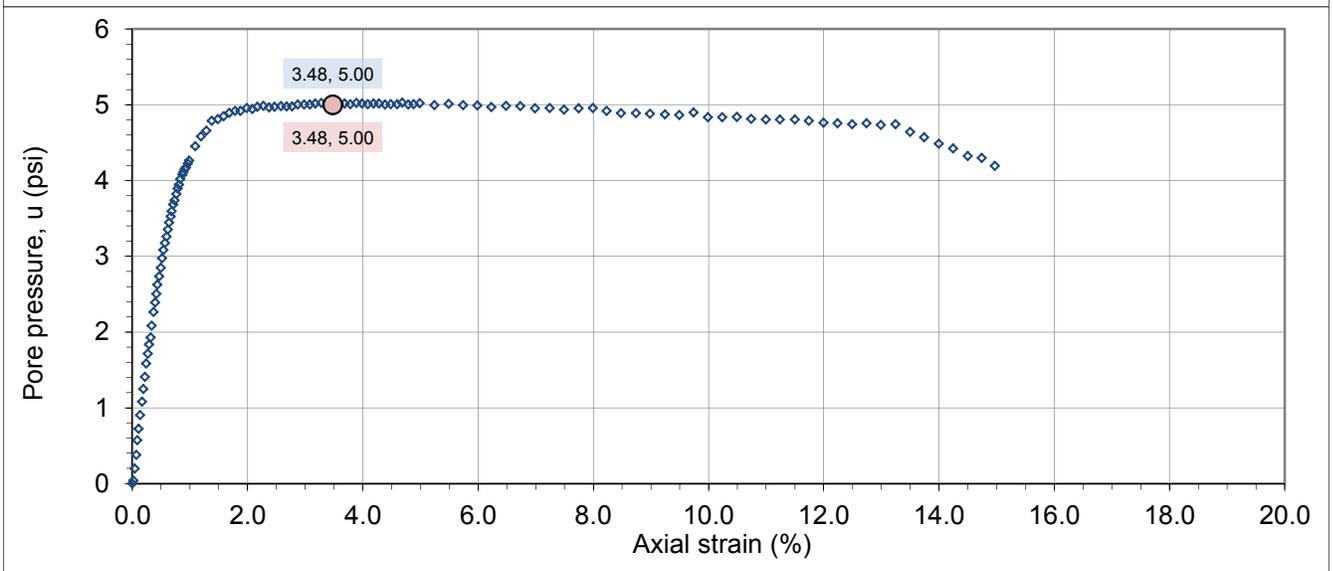
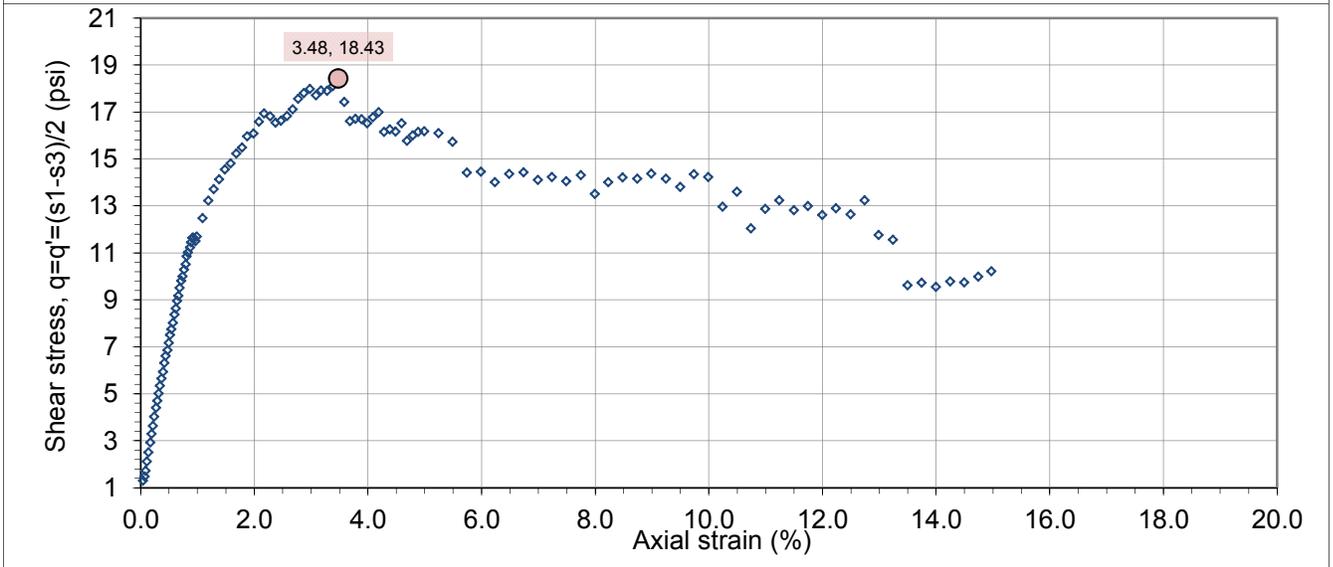
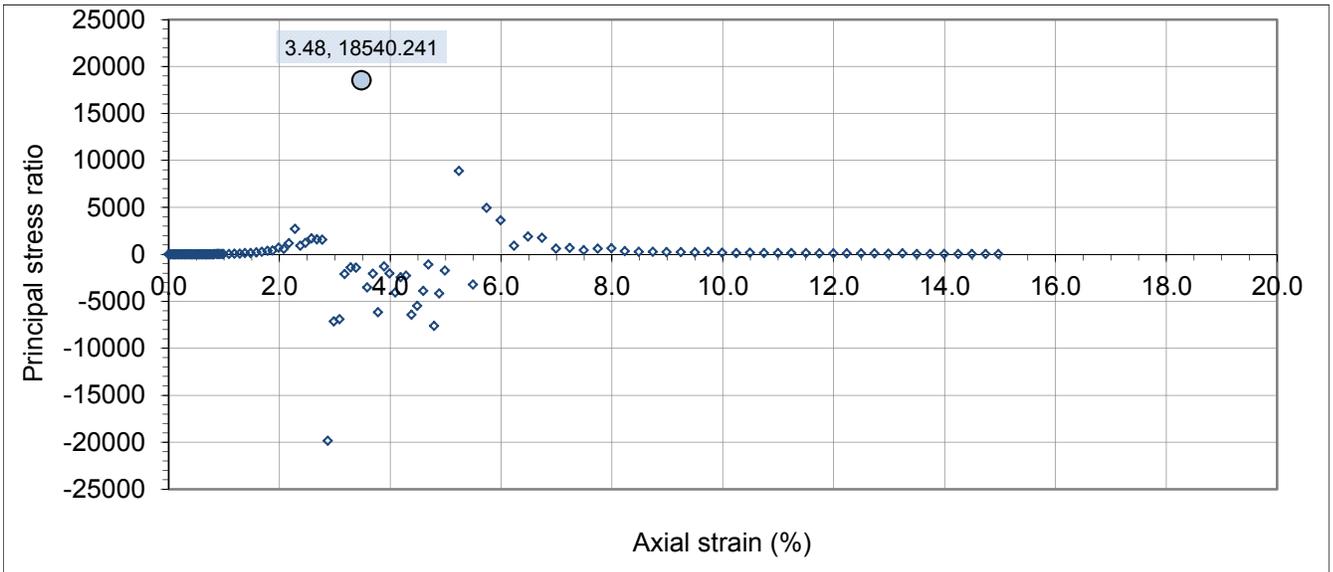
X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_CU1pts_TypeII_5psi-v02.xlsx]SUM

| Test Number | S1 at 5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 75.0 |
| | Skempton B | 0.92 |
| | t-90 (min) | 1.5 |
| | t-100 (min) | |
| | t-50 (min) | 0.4 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | Yes |
| | Filter paper correction | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 3.48 |
| | Time to failure, tf (min) | 34.8 |
| | Obliquity, s'1/s'3 | 18540.241 |
| | Excess pore pressure, u (psi) | 5.00 |
| | $q = q' = (s1-s3)/2$ (psi) | 18.43 |
| | $p' = (s'1+s'3)/2$ (psi) | 18.43 |
| | $p = (s1+s3)/2$ (psi) | 23.43 |
| | Effective major principal stress, s'1 (psi) | 36.86 |
| | Effective minor principal stress, s'3 (psi) | 0.00 |
| | Total major principal stress, s1 (psi) | 41.86 |
| | Total minor principal stress, s3 (psi) | 5.00 |
| Skempton A at failure, Af | 0.14 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 3.48 |
| | Time to failure, tf (min) | 34.8 |
| | Deviator stress, s1-s3 (psi) | 36.86 |
| | Excess pore pressure, u (psi) | 5.00 |
| | $q = q' = (s1-s3)/2$ (psi) | 18.43 |
| | $p' = (s'1+s'3)/2$ (psi) | 18.43 |
| | $p = (s1+s3)/2$ (psi) | 23.43 |
| | Effective major principal stress, s'1 (psi) | 36.86 |
| | Effective minor principal stress, s'3 (psi) | 0.00 |
| | Total major principal stress, s1 (psi) | 41.86 |
| | Total minor principal stress, s3 (psi) | 5.00 |
| Skempton A at failure, Af | 0.14 | |

Comments:

Project: Cell Crete
 No: 14GCI498

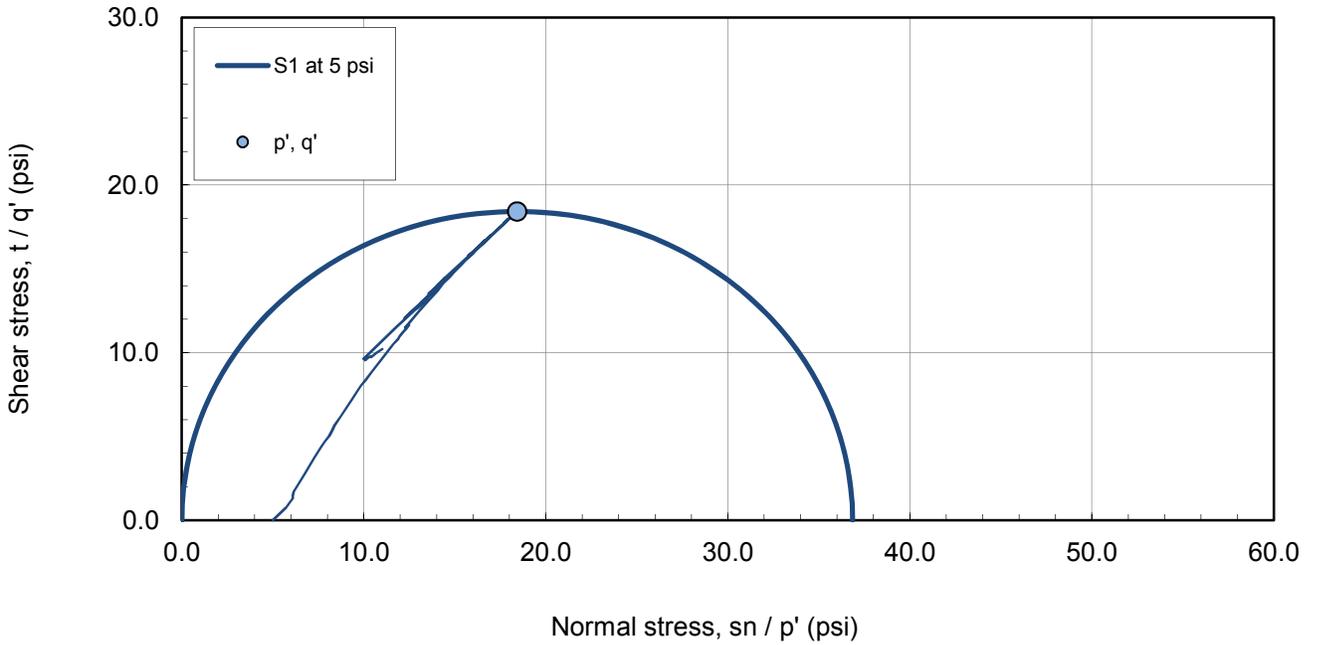
Cellular concrete type: Class II
 Sample: 213-48



Project: Cell Crete
No: 14GCI498

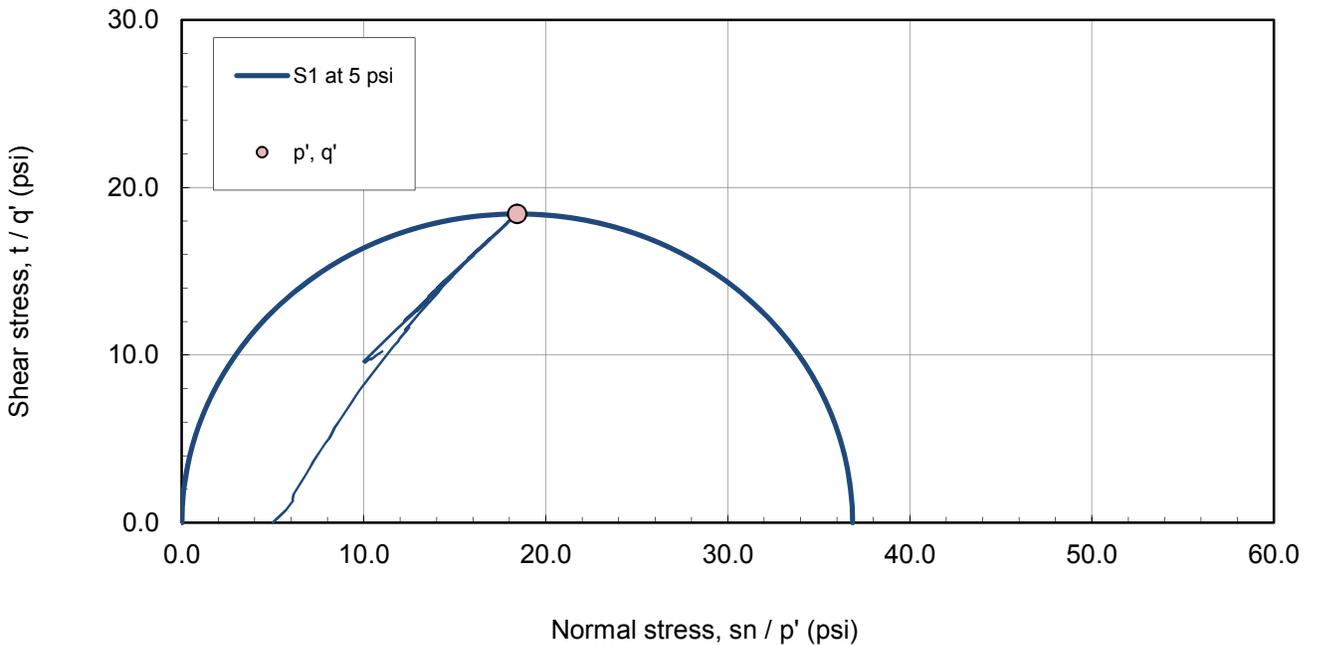
Cellular concrete type: Class II
Sample: 213-48

Effective stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results

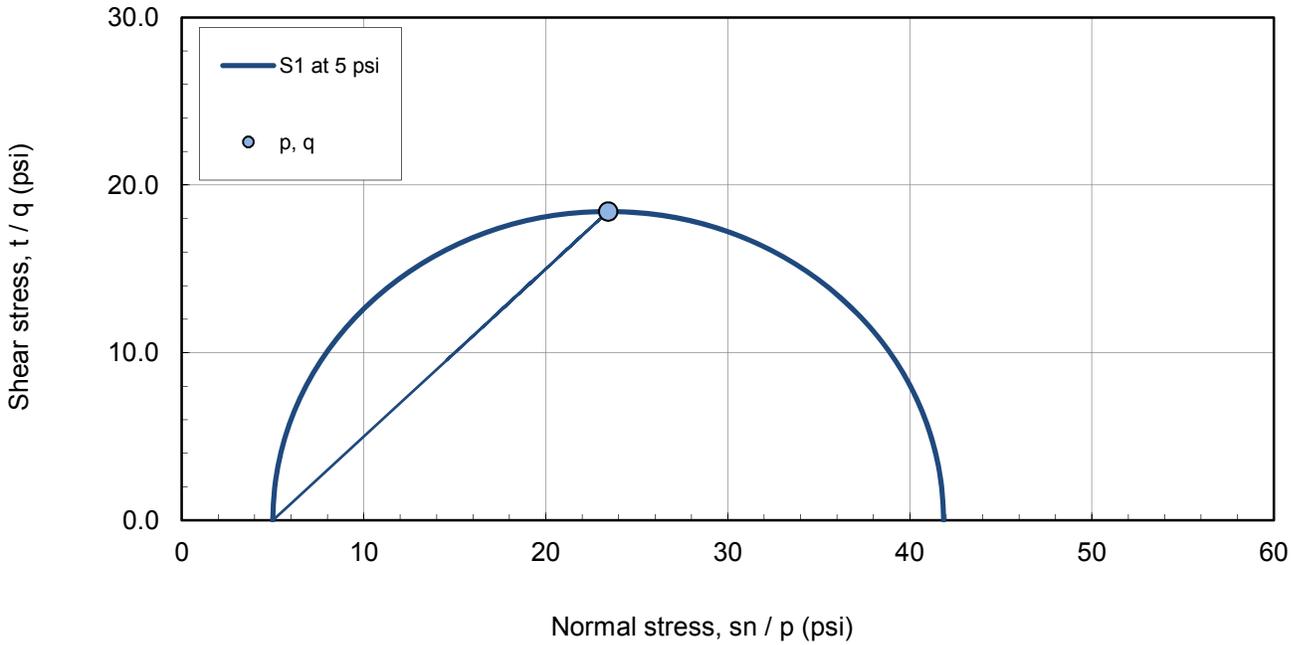


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Project: Cell Crete
No: 14GCI498

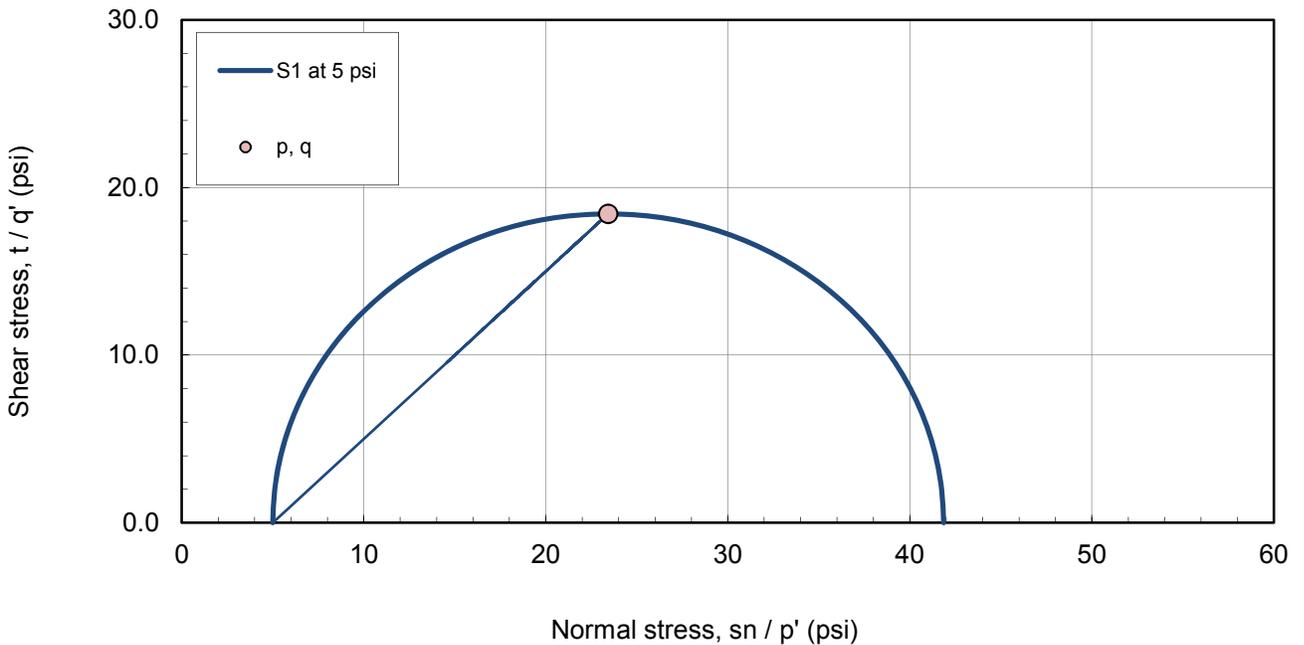
Cellular concrete type: Class II
Sample: 213-48

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results

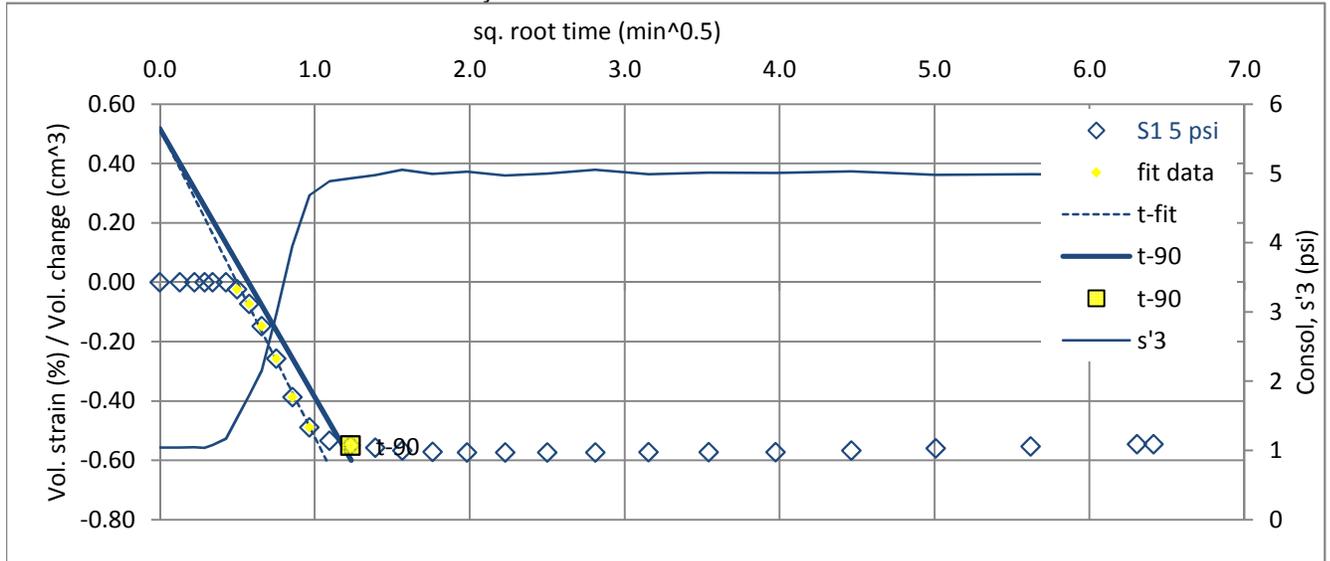


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p - q$ space plots

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-48

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: **Cell Crete** Cellular concrete type: **Class II**
 No: **14GCI498** Sample: **213-47**
 Date cast: **13-Feb-15** Sample description: **Cellular concrete cast on 2/13/15**
 Date: **01-Apr-15** USCS classification: **not applicable**
 Tested by: **zmg** Sample type: **cast**
 Reduced by: **zmg** Age of sample (days): **47** (at shear)
 Checked by: **rbm/rtc**

| | Test Number | 12.5 psi | |
|-------------------------------------|-------------------------------------|----------|--------------------------------|
| | | S1 | Bef. Shr. MethodA ^d |
| Unit weight data | 0° | 5.753 | |
| | Sample ht., H (in) 120° | 5.748 | |
| | 240° | 5.752 | |
| | Avg. height, Havg (in) | 5.751 | 5.751 |
| | Avg. height, Havg (cm) | 14.608 | 14.608 |
| | ΔHsc (in) ^a | | 0.00 |
| | top | 2.977 | |
| | Sample dia., D (in) mid | 2.930 | |
| | bot | 2.898 | |
| | Avg. dia., Davg (in) | 2.934 | 2.944 |
| | Avg. dia., Davg (cm) | 7.452 | 7.477 |
| | Avg. area, Aavg (in ²) | 6.760 | 6.806 |
| | Avg. area, Aavg (cm ²) | 43.612 | 43.911 |
| | Wt. rings + wet soil (g) | 284.90 | 568.74 |
| | Wt. rings (g) | 0.00 | 33.75 |
| | Volume, Vo (in ³) | 38.9 | 39.1 |
| | Vo (cm ³) | 637.1 | 641.4 |
| | Vo (ft ³) | 0.0225 | 0.0227 |
| ΔVs (cm ³) ^b | | 0.00 | |
| ΔVc (cm ³) ^b | | -4.38 | |
| Moisture | Wet soil + tare (g) | 284.90 | 644.07 |
| | Dry soil + tare (g) | 189.83 | 334.69 |
| | Tare (g) | 0.00 | 144.86 |
| | Moisture content, w (%) | 50.1 | 163.0 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 284.9 | 771.0 |
| | Mass of solids (g) | 189.8 | 189.8 |
| | Volume (cm ³) | 637.1 | 641.4 |
| | Volume of water (cm ³) | 95.1 | 581.2 |
| | Volume of solids (cm ³) | 60.3 | 60.3 |
| | Volume of voids (cm ³) | 576.8 | 581.2 |
| | Volume of air (cm ³) | 481.7 | 0.0 |
| | Void ratio, e | 9.571 | 9.644 |
| | Porosity, n | 0.905 | 0.906 |
| | Volumetric moisture, T | 0.149 | 0.906 |
| | Saturation, S (%) ^c | 16.48 | 100.00 |
| Dry density (gm/cm ³) | 0.298 | 0.296 | |
| Wet unit wt., gm (pcf) | 27.9 | 48.6 | |
| Dry unit wt., gd (pcf) | 18.6 | 18.5 | |

Photo of sample after testing



Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 01-Apr-15
 Tested by: zmg

Cellular concrete type: Class II
Sample: 213-47
 Sample description: Cellular concrete cast on 2/13/15
 USCS classification: not applicable
 Sample type: cast

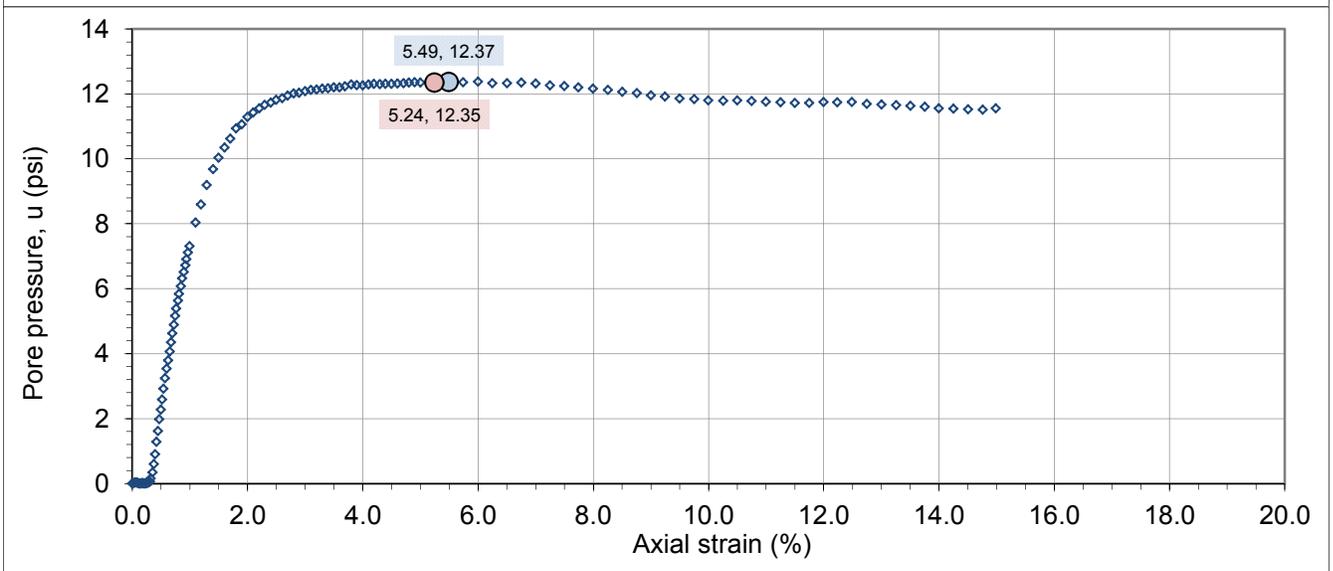
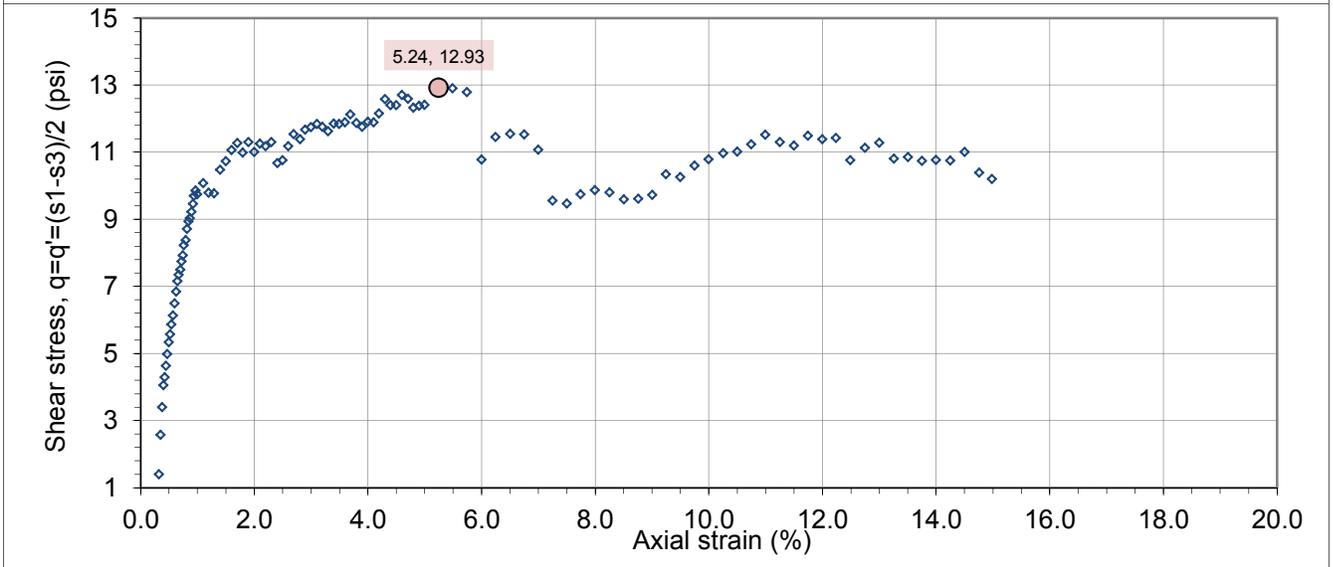
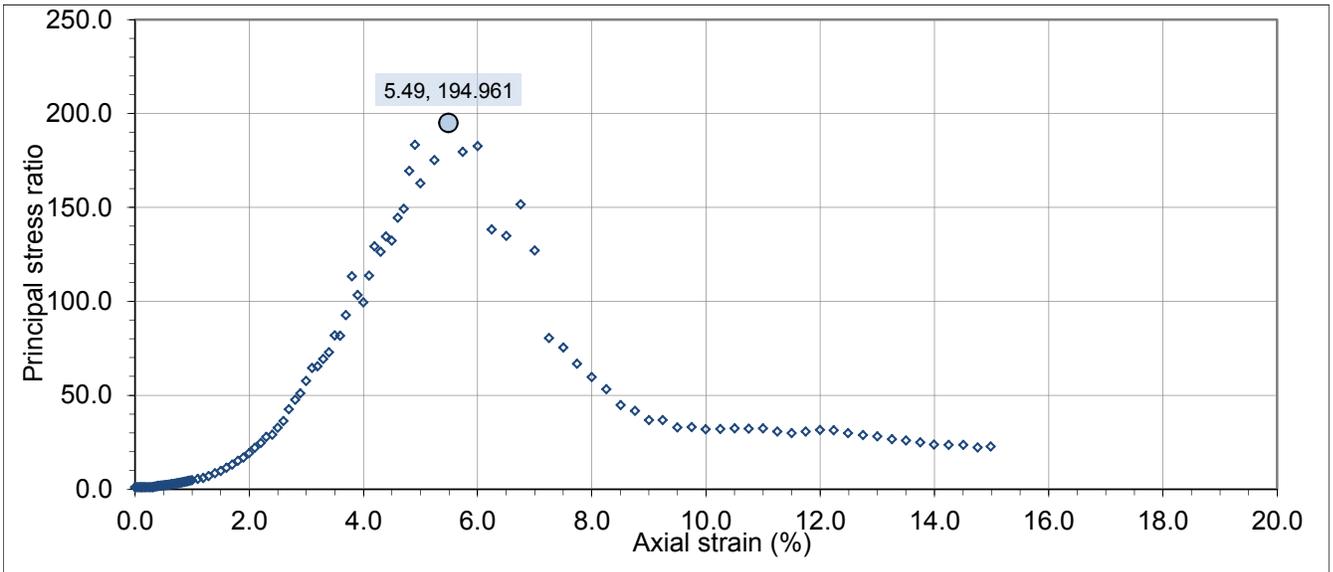
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| Test Number | S1 at 12.5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 85.0 |
| | Skempton B | 0.87 |
| | t-90 (min) | 1.2 |
| | t-100 (min) | |
| | t-50 (min) | 0.3 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | Yes |
| | Filter paper correction | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 5.49 |
| | Time to failure, tf (min) | 54.9 |
| | Obliquity, s'1/s'3 | 194.961 |
| | Excess pore pressure, u (psi) | 12.37 |
| | $q = q' = (s1-s3)/2$ (psi) | 12.91 |
| | $p' = (s'1+s'3)/2$ (psi) | 13.04 |
| | $p = (s1+s3)/2$ (psi) | 25.41 |
| | Effective major principal stress, s'1 (psi) | 25.94 |
| | Effective minor principal stress, s'3 (psi) | 0.13 |
| | Total major principal stress, s1 (psi) | 38.31 |
| | Total minor principal stress, s3 (psi) | 12.50 |
| Skempton A at failure, Af | 0.48 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 5.24 |
| | Time to failure, tf (min) | 52.4 |
| | Deviator stress, s1-s3 (psi) | 25.86 |
| | Excess pore pressure, u (psi) | 12.35 |
| | $q = q' = (s1-s3)/2$ (psi) | 12.93 |
| | $p' = (s'1+s'3)/2$ (psi) | 13.08 |
| | $p = (s1+s3)/2$ (psi) | 25.43 |
| | Effective major principal stress, s'1 (psi) | 26.00 |
| | Effective minor principal stress, s'3 (psi) | 0.15 |
| | Total major principal stress, s1 (psi) | 38.36 |
| | Total minor principal stress, s3 (psi) | 12.50 |
| Skempton A at failure, Af | 0.48 | |

Comments:

Project: Cell Crete
 No: 14GCI498

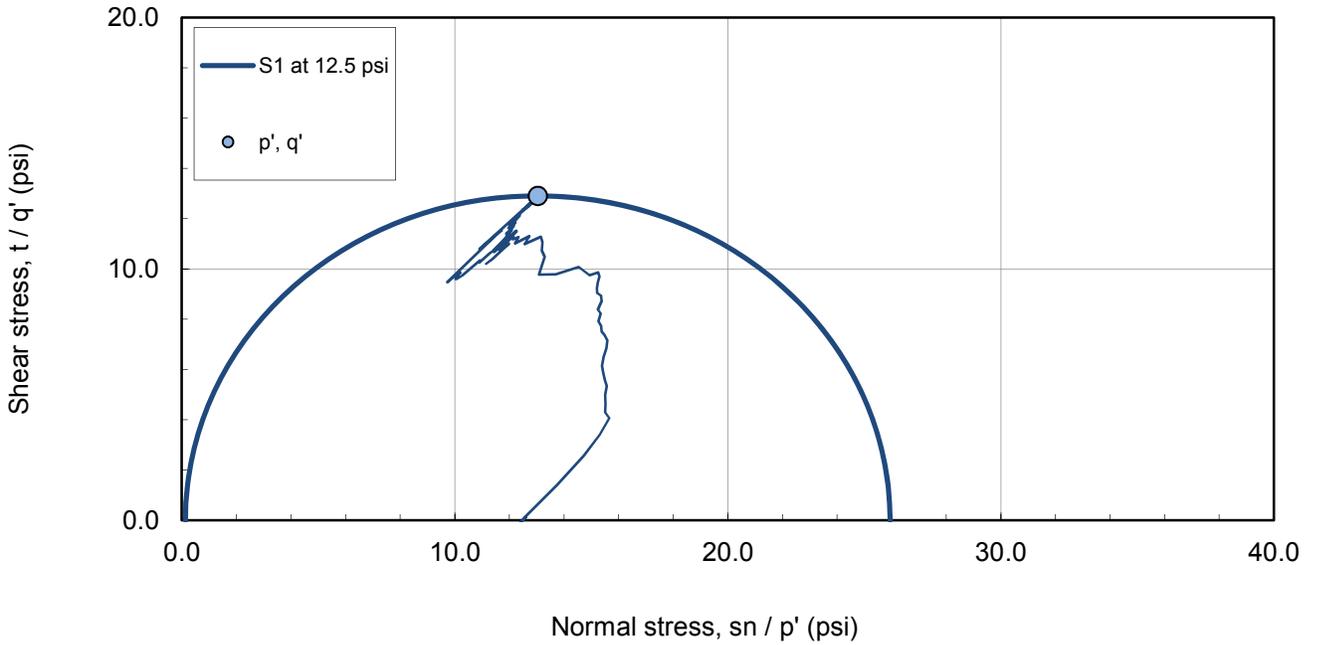
Cellular concrete type: Class II
 Sample: 213-47



Project: Cell Crete
No: 14GCI498

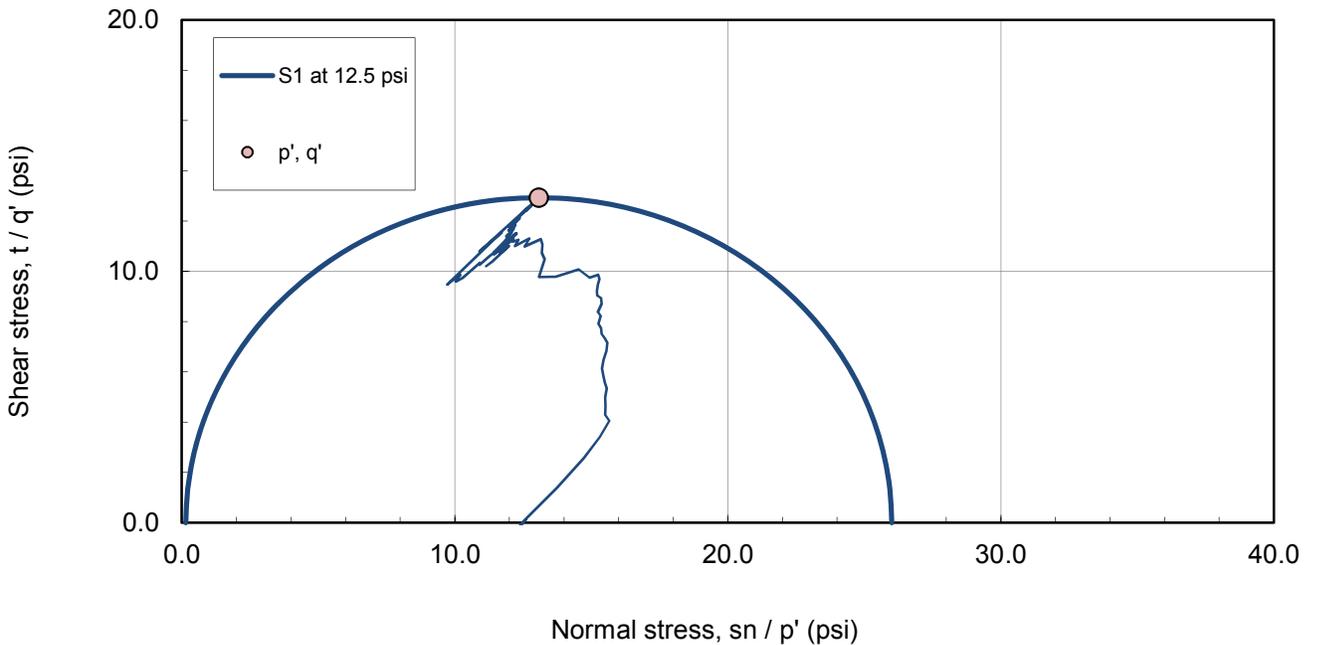
Cellular concrete type: Class II
Sample: 213-47

Effective stress results



Max principal stress ratio (s'_1/s'_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results

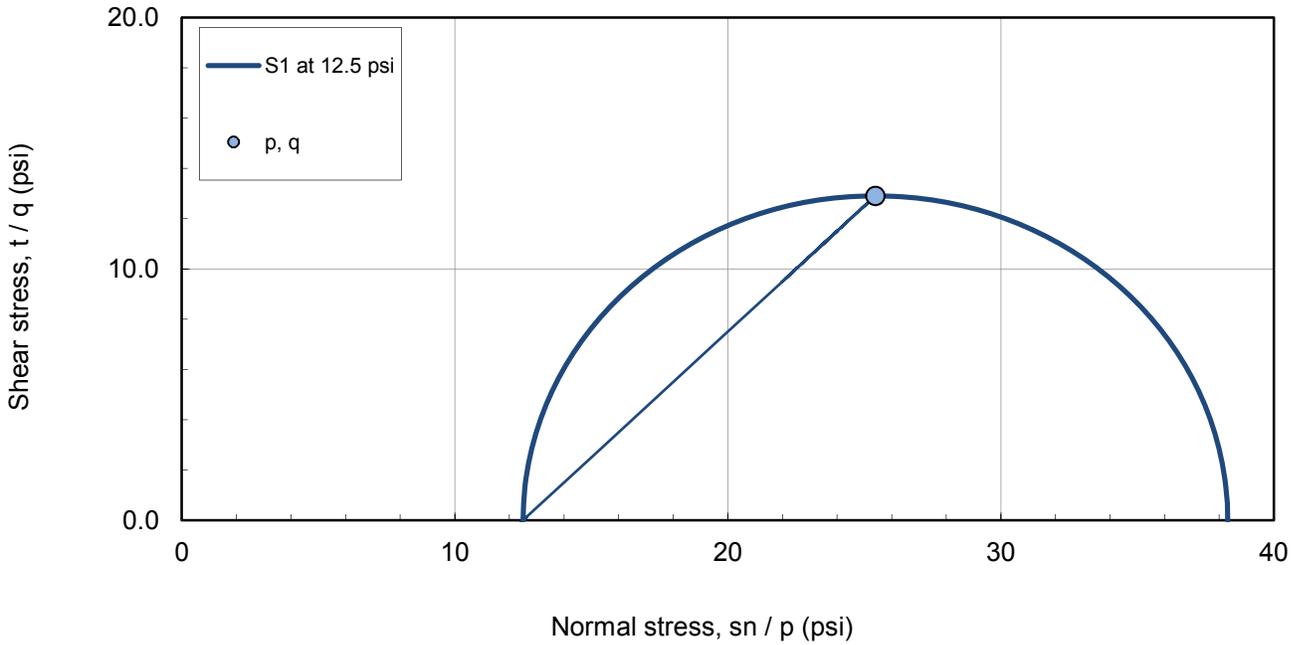


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Project: Cell Crete
No: 14GCI498

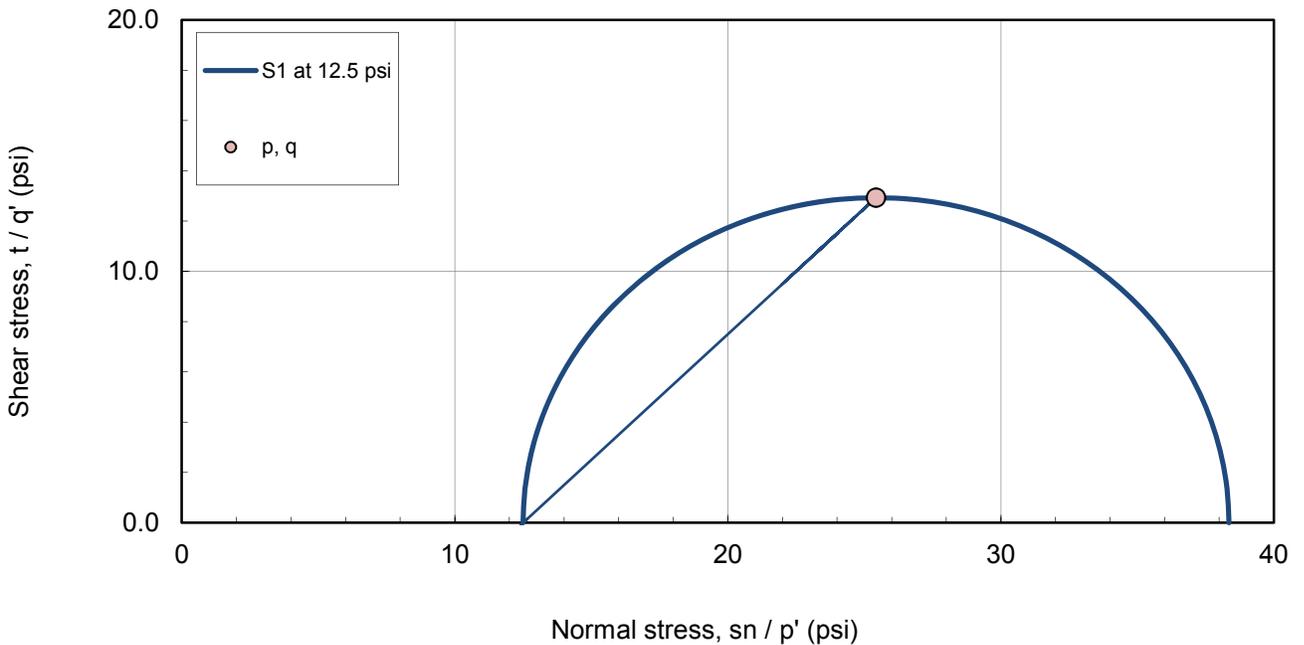
Cellular concrete type: Class II
Sample: 213-47

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results

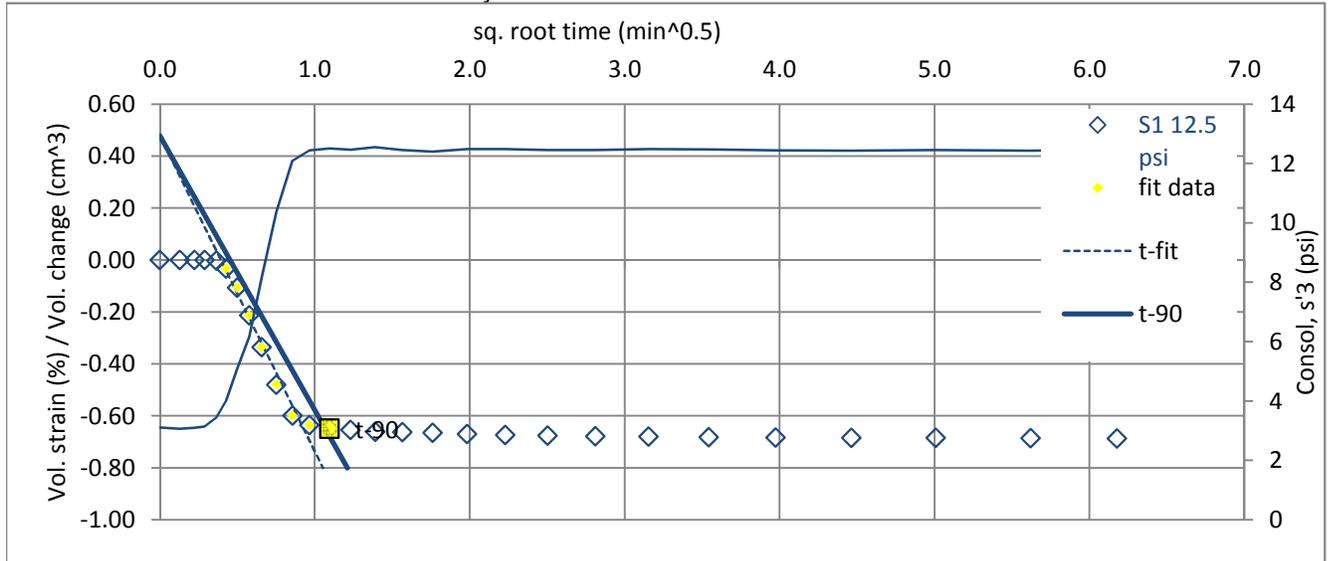


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p - q$ space plots

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-47

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: **Cell Crete** Cellular concrete type: **Class II**
 No: **14GCI498** Sample: **213-59**
 Date cast: **13-Feb-15** Sample description: **Cellular concrete cast on 2/13/15**
 Date: **06-Apr-15** USCS classification: **not applicable**
 Tested by: **zmg** Sample type: **cast**
 Reduced by: **zmg** Age of sample (days): **52** (at shear)
 Checked by: **rbm/rtc**

| | Test Number | 20 psi | |
|-------------------------------------|-------------------------------------|--------|---------------------------------|
| | | S1 | Bef. Shr. Method A ^d |
| Unit weight data | 0° | 5.824 | |
| | Sample ht., H (in) 120° | 5.844 | |
| | 240° | 5.798 | |
| | Avg. height, Havg (in) | 5.822 | 5.822 |
| | Avg. height, Havg (cm) | 14.788 | 14.788 |
| | ΔHsc (in) ^a | | 0.00 |
| | top | 2.969 | |
| | Sample dia., D (in) mid | 2.927 | |
| | bot | 2.887 | |
| | Avg. dia., Davg (in) | 2.928 | 2.942 |
| | Avg. dia., Davg (cm) | 7.436 | 7.472 |
| | Avg. area, Aavg (in ²) | 6.731 | 6.796 |
| | Avg. area, Aavg (cm ²) | 43.426 | 43.846 |
| | Wt. rings + wet soil (g) | 290.84 | 582.45 |
| | Wt. rings (g) | 0.00 | 30.42 |
| | Volume, Vo (in ³) | 39.2 | 39.6 |
| | Vo (cm ³) | 642.2 | 648.4 |
| Vo (ft ³) | 0.0227 | 0.0229 | |
| ΔVs (cm ³) ^b | | 0.00 | |
| ΔVc (cm ³) ^b | | -6.20 | |
| Moisture | Wet soil + tare (g) | 290.84 | 654.17 |
| | Dry soil + tare (g) | 193.88 | 313.00 |
| | Tare (g) | 0.00 | 119.12 |
| | Moisture content, w (%) | 50.0 | 176.0 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 290.8 | 780.7 |
| | Mass of solids (g) | 193.9 | 193.9 |
| | Volume (cm ³) | 642.2 | 648.4 |
| | Volume of water (cm ³) | 97.0 | 586.8 |
| | Volume of solids (cm ³) | 61.5 | 61.5 |
| | Volume of voids (cm ³) | 580.6 | 586.8 |
| | Volume of air (cm ³) | 483.7 | 0.0 |
| | Void ratio, e | 9.434 | 9.534 |
| | Porosity, n | 0.904 | 0.905 |
| | Volumetric moisture, T | 0.151 | 0.905 |
| | Saturation, S (%) ^c | 16.70 | 100.00 |
| | Dry density (gm/cm ³) | 0.302 | 0.299 |
| Wet unit wt., gm (pcf) | 28.3 | 51.5 | |
| Dry unit wt., gd (pcf) | 18.8 | 18.7 | |

Photo of sample after testing



Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 06-Apr-15
 Tested by: zmg

Cellular concrete type: Class II
Sample: 213-59
 Sample description: Cellular concrete cast on 2/13/15
 USCS classification: not applicable
 Sample type: cast

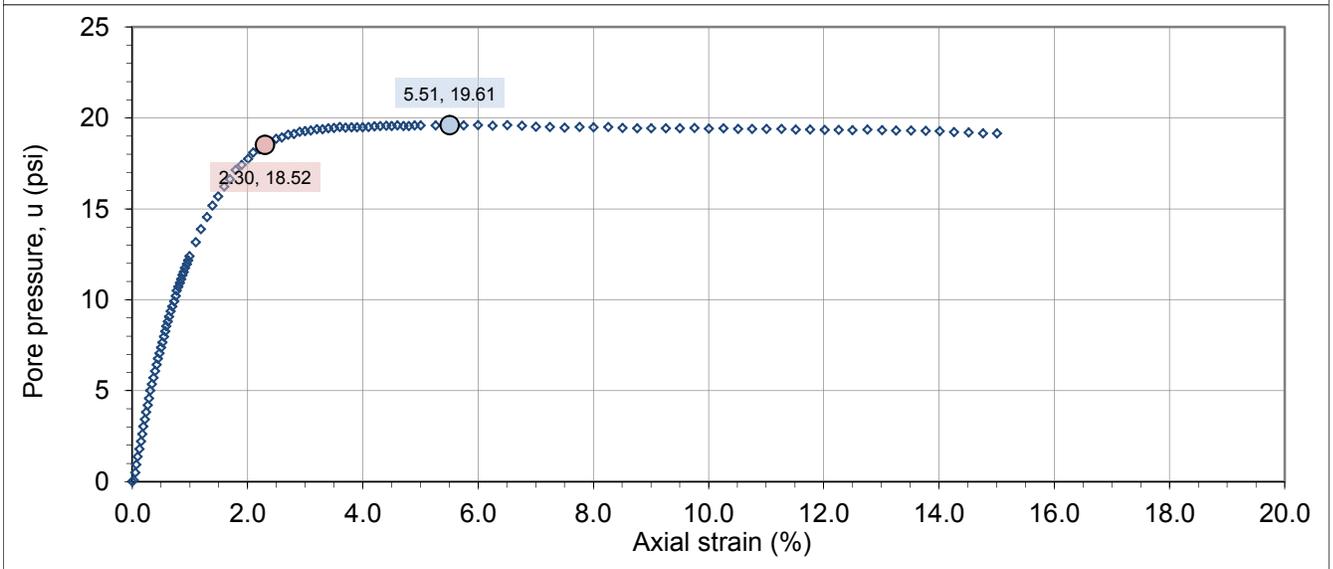
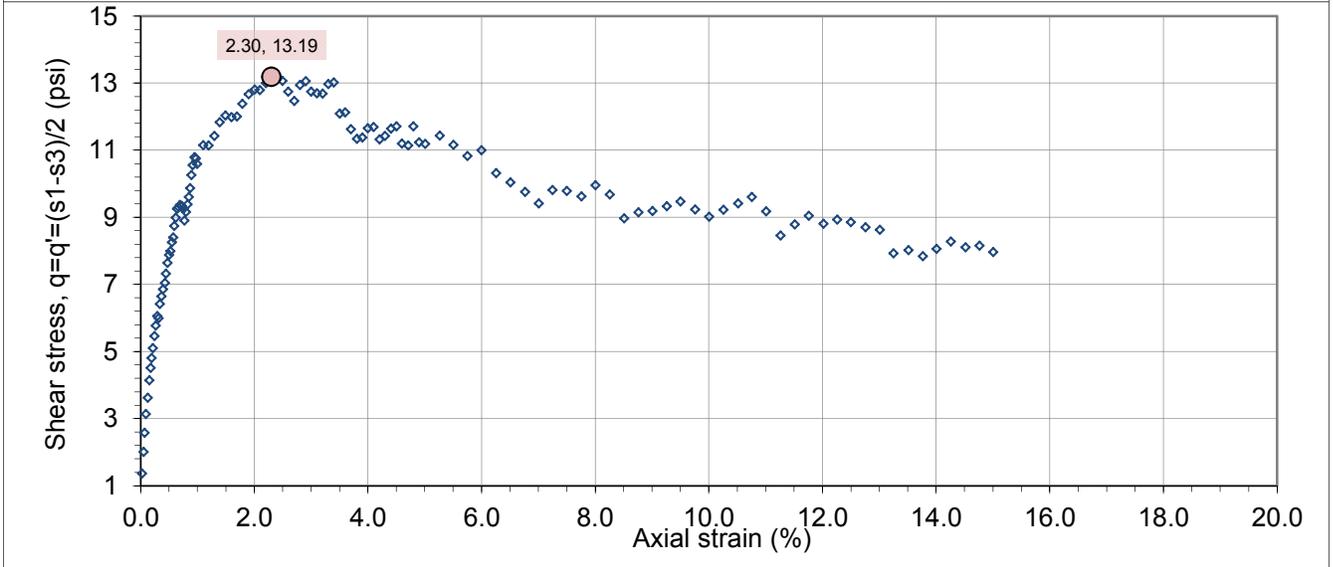
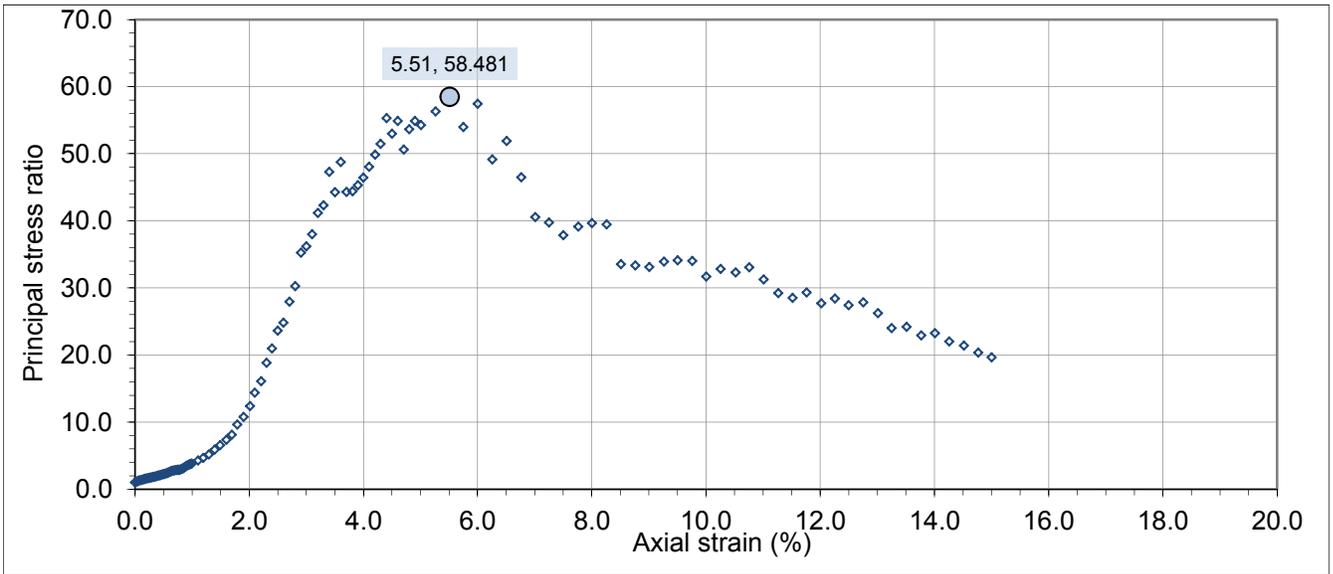
X:\PROJECTS\14GCI498 Cell Crete Lab Testing\TX_CU1pts_TypeII_20psi-v02.xlsx]SUM

| Test Number | S1 at 20 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 85.0 |
| | Skempton B | 0.84 |
| | t-90 (min) | 1.2 |
| | t-100 (min) | |
| | t-50 (min) | 0.3 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | Yes |
| | Filter paper correction | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 5.51 |
| | Time to failure, tf (min) | 55.1 |
| | Obliquity, s'1/s'3 | 58.481 |
| | Excess pore pressure, u (psi) | 19.61 |
| | $q = q' = (s1-s3)/2$ (psi) | 11.16 |
| | $p' = (s'1+s'3)/2$ (psi) | 11.55 |
| | $p = (s1+s3)/2$ (psi) | 31.16 |
| | Effective major principal stress, s'1 (psi) | 22.71 |
| | Effective minor principal stress, s'3 (psi) | 0.39 |
| | Total major principal stress, s1 (psi) | 42.33 |
| Total minor principal stress, s3 (psi) | 20.00 | |
| Skempton A at failure, Af | 0.88 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 2.30 |
| | Time to failure, tf (min) | 23.0 |
| | Deviator stress, s1-s3 (psi) | 26.38 |
| | Excess pore pressure, u (psi) | 18.52 |
| | $q = q' = (s1-s3)/2$ (psi) | 13.19 |
| | $p' = (s'1+s'3)/2$ (psi) | 14.67 |
| | $p = (s1+s3)/2$ (psi) | 33.19 |
| | Effective major principal stress, s'1 (psi) | 27.86 |
| | Effective minor principal stress, s'3 (psi) | 1.48 |
| | Total major principal stress, s1 (psi) | 46.38 |
| Total minor principal stress, s3 (psi) | 20.00 | |
| Skempton A at failure, Af | 0.70 | |

Comments:

Project: Cell Crete
 No: 14GCI498

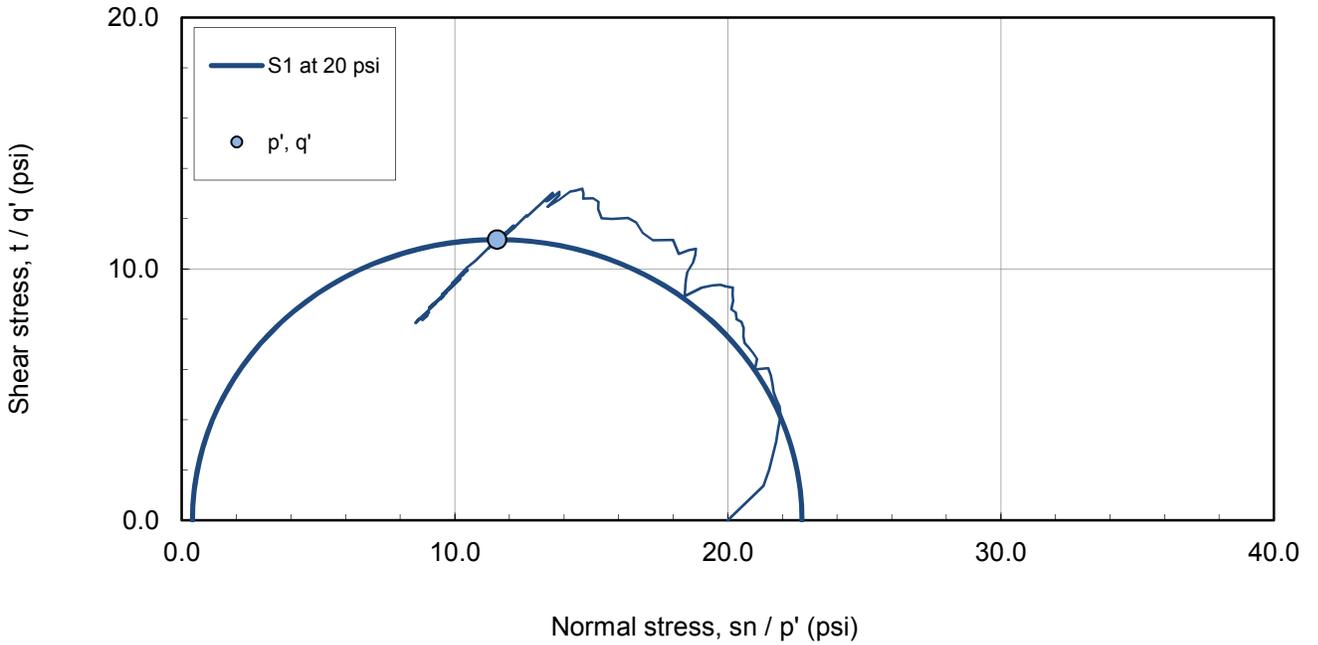
Cellular concrete type: Class II
 Sample: 213-59



Project: Cell Crete
No: 14GCI498

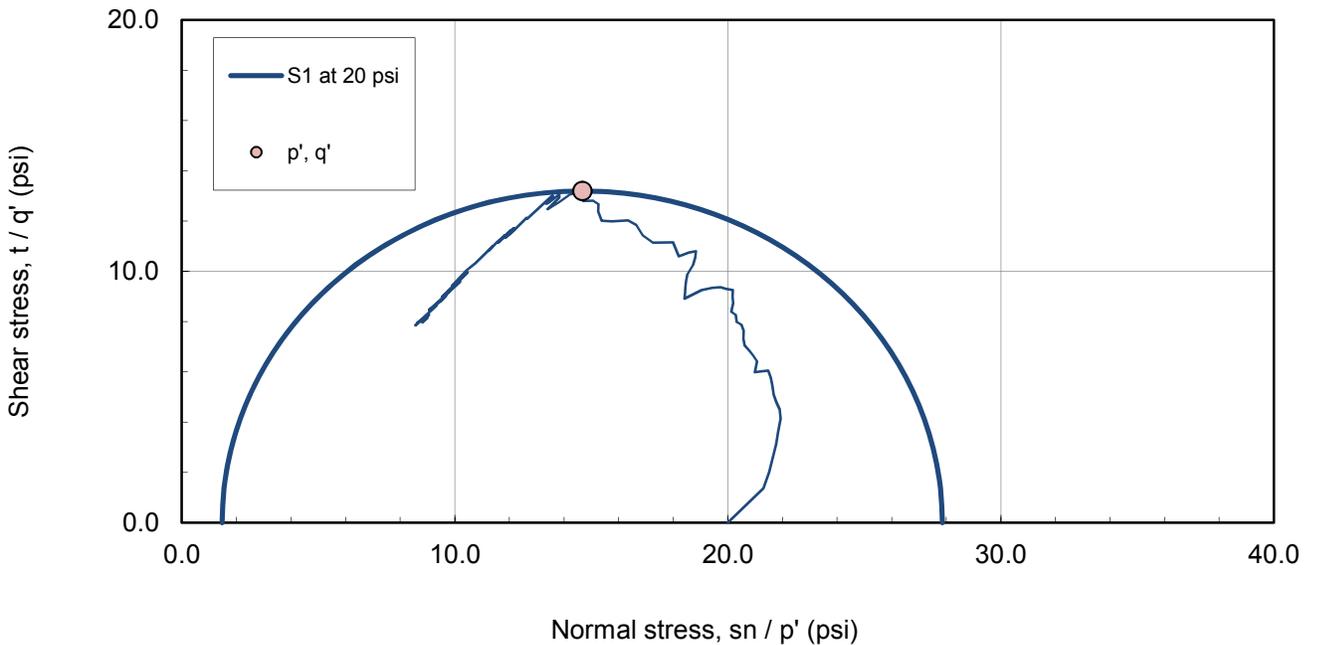
Cellular concrete type: Class II
Sample: 213-59

Effective stress results



Max principal stress ratio (s'_1/s'_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results

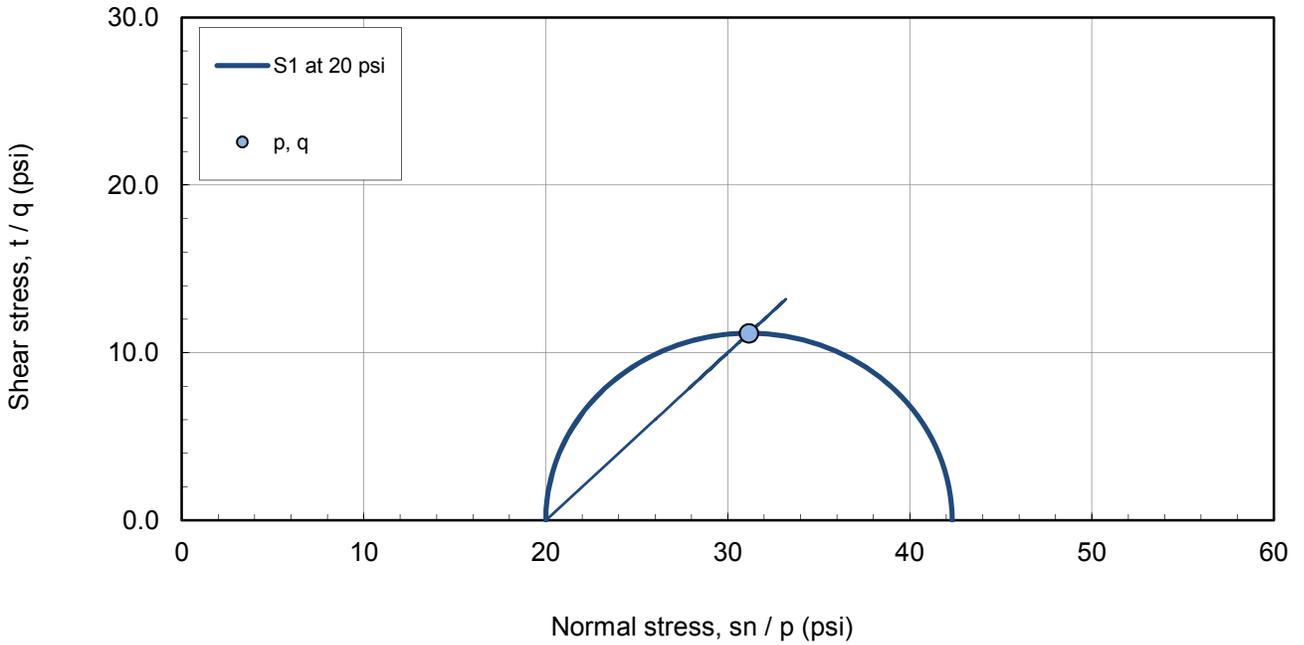


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Project: Cell Crete
No: 14GCI498

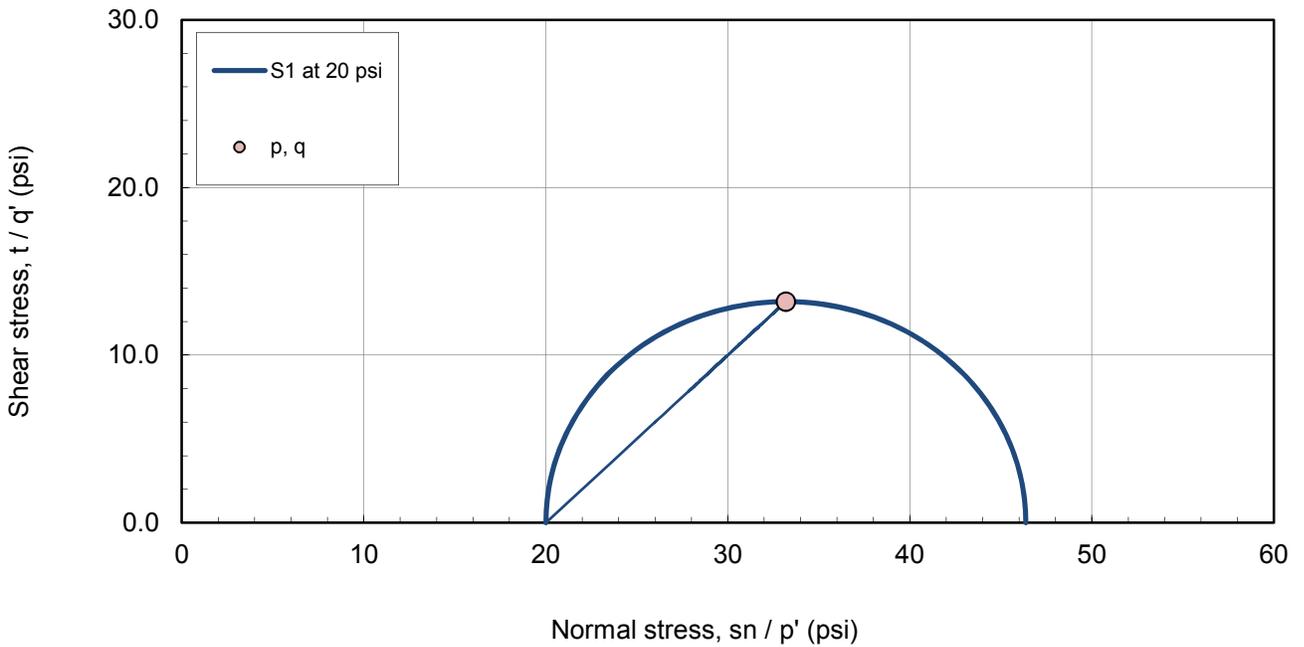
Cellular concrete type: Class II
Sample: 213-59

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results



Peak deviator stress (s_1-s_3), failure criteria Mohr and $p - q$ space plots

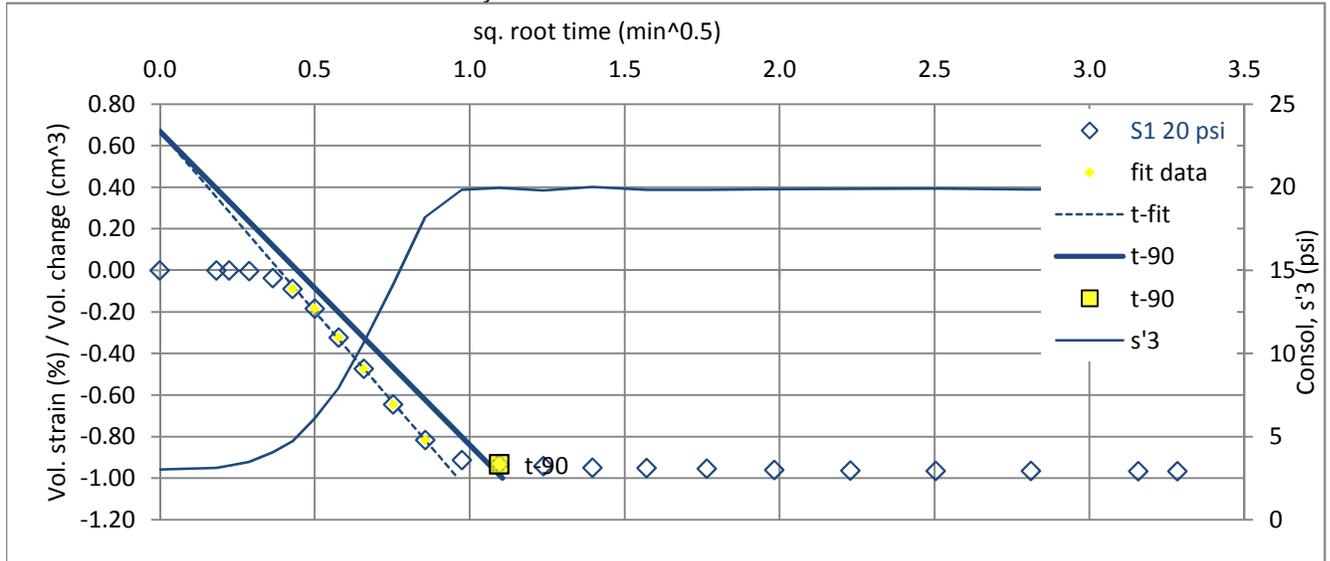
Project: Cell Crete

Cellular concrete type: Class II

No: 14GCI498

Sample: 213-59

Time rate of consolidation data and analysis



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M

Project: Cell-Crete (Cellular Concrete)

Sample: 11-05-14-01

No: 0002

Cellular concrete type: Class II

Date cast: 07-Nov-14

Location: ---

Sample description: not requested

Age of sample (days): 41

Date: 18-Dec-14

USCS classification: not requested

Tested by: zg

Sample type: Cell Crete

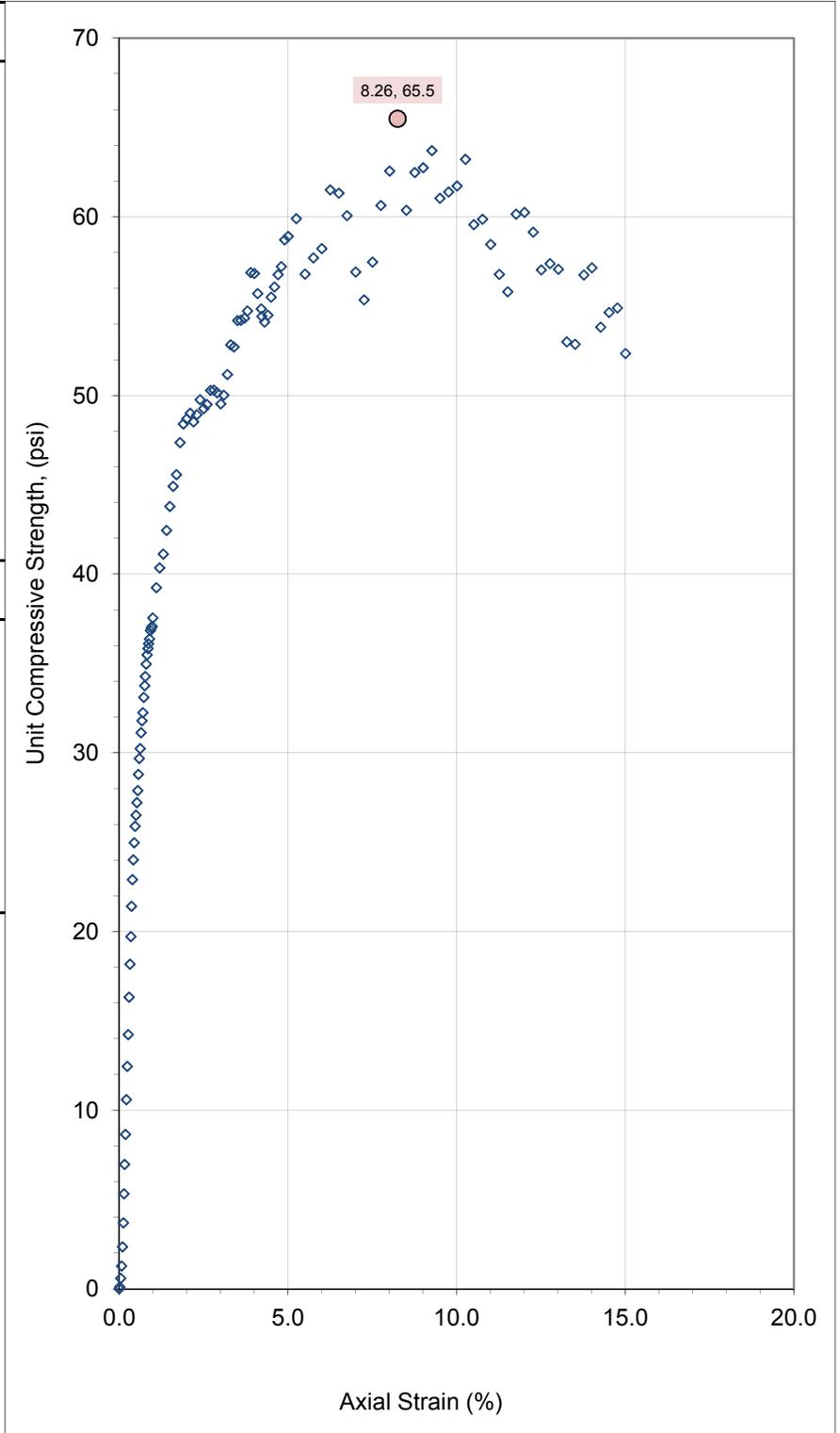
Reduced by: zg

Type of cap: no cap

Checked by: rbm

| Test Number 1 | | |
|--------------------------|--------------------------|--------|
| Unit weight data | 0° | 5.413 |
| | Sample ht., H (in) 120° | 5.392 |
| | 240° | 5.403 |
| | Avg. height, Havg (in) | 5.403 |
| | Avg. height, Havg (cm) | 13.723 |
| | top | 2.962 |
| | Sample dia., D (in) mid | 2.903 |
| | bot | 2.846 |
| | Avg. dia., Davg (in) | 2.904 |
| | Avg. dia., Davg (cm) | 7.375 |
| | Avg. area, Aavg (in^2) | 6.621 |
| | Avg. area, Aavg (cm^2) | 42.717 |
| | Wt. rings + wet soil (g) | 228.02 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in^3) | 35.8 |
| | Vo (cm^3) | 586.2 |
| | Vo (ft^3) | 0.0207 |
| Gs, from mix design | 3.14 | |
| Moist unit wt., gm (pcf) | 24.3 | |

| | | |
|----------------------------------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 8.26 |
| | Time to failure, tf (min) | 8.3 |
| | Maximum vertical load (lbs) | 433.6 |
| | Unit compressive strength, (psi) | 65.5 |
| Unit compressive strength, (psf) | 9429 | |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M

Project: Cell-Crete (Cellular Concrete)

Sample: 11-05-14-20

No: 0002

Cellular concrete type: Class II

Date cast: 07-Nov-14

Location: ---

Sample description: not requested

Age of sample (days): 41

Date: 18-Dec-14

USCS classification: not requested

Tested by: zg

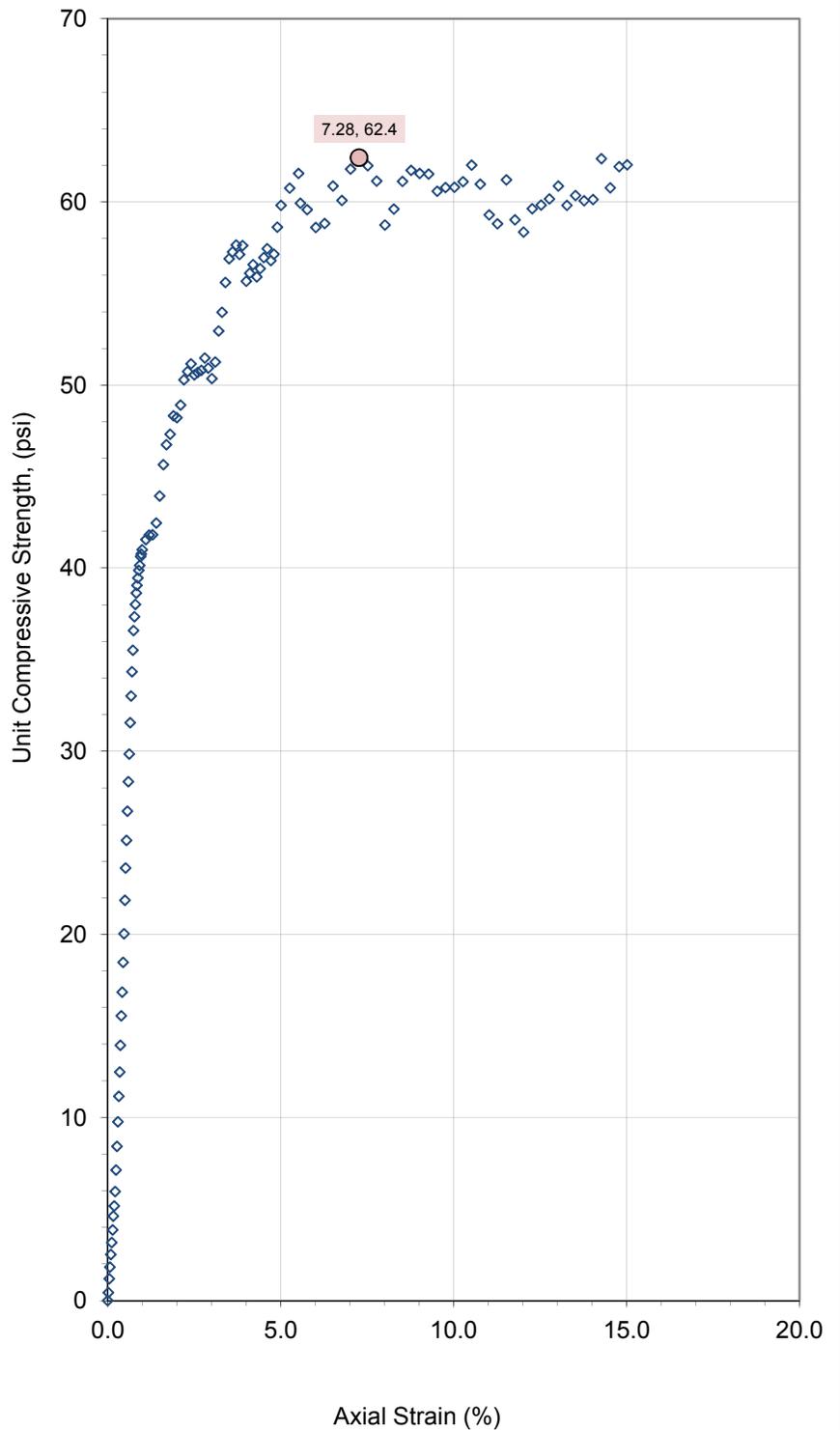
Sample type: Cell Crete

Reduced by: zg

Type of cap: no cap

Checked by: rbm

| Test Number 2 | | |
|----------------------------------|------------------------------------|--------|
| Unit weight data | 0° | 5.473 |
| | Sample ht., H (in) 120° | 5.450 |
| | 240° | 5.441 |
| | Avg. height, Havg (in) | 5.455 |
| | Avg. height, Havg (cm) | 13.855 |
| | top | 2.946 |
| | Sample dia., D (in) mid | 2.929 |
| | bot | 2.888 |
| | Avg. dia., Davg (in) | 2.923 |
| | Avg. dia., Davg (cm) | 7.424 |
| | Avg. area, Aavg (in ²) | 6.710 |
| | Avg. area, Aavg (cm ²) | 43.293 |
| | Wt. rings + wet soil (g) | 229.31 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in ³) | 36.6 |
| | Vo (cm ³) | 599.8 |
| | Vo (ft ³) | 0.0212 |
| Gs, from mix design | 3.14 | |
| Moist unit wt., gm (pcf) | 23.9 | |
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 7.28 |
| | Time to failure, tf (min) | 7.3 |
| | Maximum vertical load (lbs) | 419.4 |
| | Unit compressive strength, (psi) | 62.4 |
| Unit compressive strength, (psf) | 8987 | |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M



Project: Cell Crete
No: 14GCI498

Sample: 213-41
Cellular concrete type: Class II

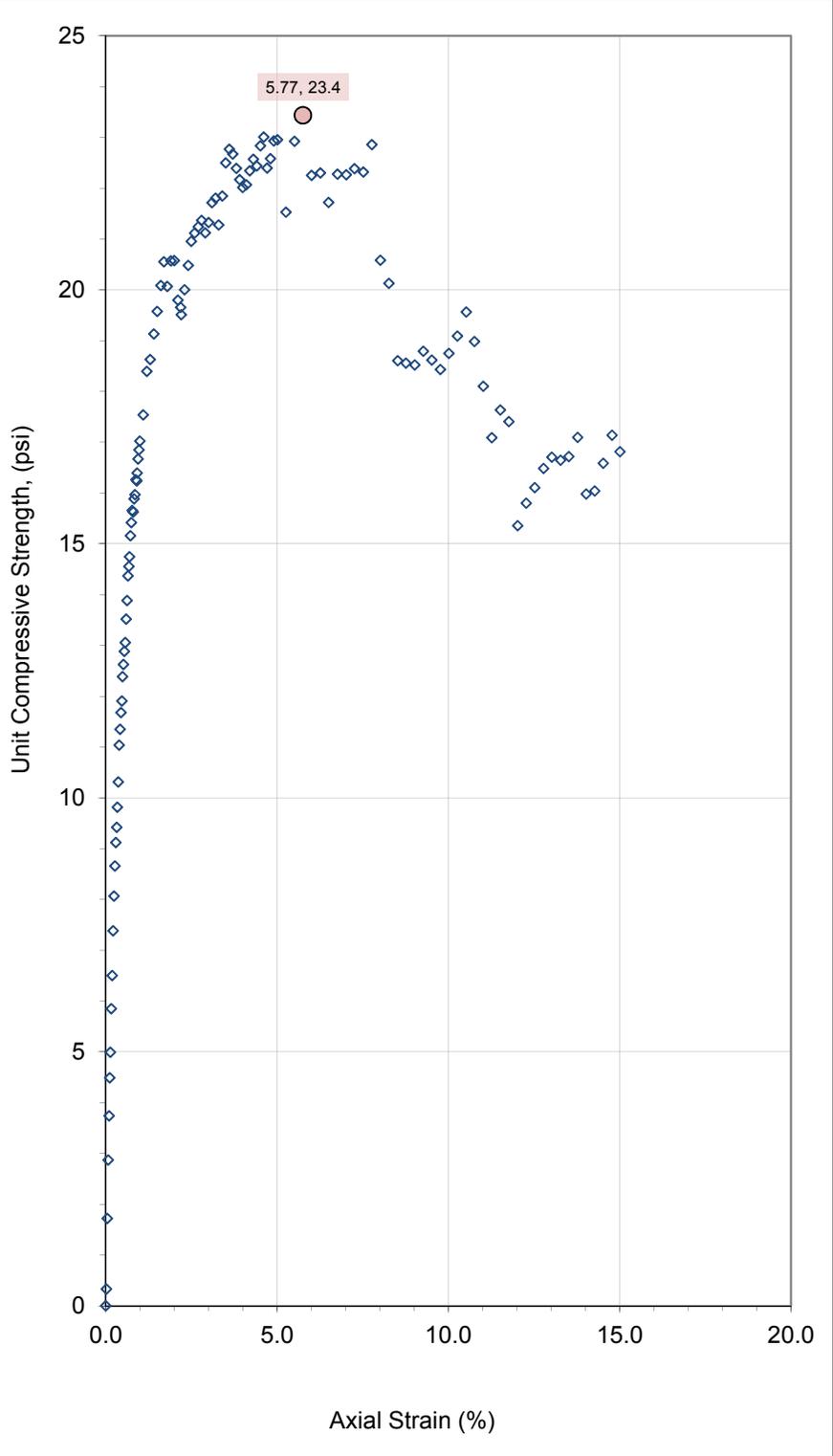
Date cast: 13-Feb-15
Age of sample (days): 29

Location: ---
Date: 14-Mar-15
Tested by: zg
Reduced by: zg
Checked by: rbm

Sample description: not requested
USCS classification: not requested
Sample type: Cell Crete
Type of cap: no cap

| Test Number 3 | | |
|--------------------------|--------------------------|------------------|
| Unit weight data | 0° | 5.761 |
| | Sample ht., H (in) | 120° 5.764 |
| | | 240° 5.756 |
| | Avg. height, Havg (in) | 5.760 |
| | Avg. height, Havg (cm) | 14.631 |
| | | top 2.970 |
| | Sample dia., D (in) | mid 2.933 |
| | | bot 2.903 |
| | Avg. dia., Davg (in) | 2.935 |
| | Avg. dia., Davg (cm) | 7.454 |
| | Avg. area, Aavg (in^2) | 6.764 |
| | Avg. area, Aavg (cm^2) | 43.641 |
| | Wt. rings + wet soil (g) | 286.04 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in^3) | 39.0 |
| | | Vo (cm^3) 638.5 |
| | | Vo (ft^3) 0.0225 |
| | Gs, from mix design | 3.15 |
| Moist unit wt., gm (pcf) | 28.0 | |

| | | |
|----------------------------------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 5.77 |
| | Time to failure, tf (min) | 5.8 |
| | Maximum vertical load (lbs) | 158.7 |
| | Unit compressive strength, (psi) | 23.4 |
| Unit compressive strength, (psf) | 3374 | |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M



Project: Cell Crete

No: 14GCI498

Location: ---

Date: 17-Mar-15

Tested by: zmg

Reduced by: zmg

Checked by: rbm

Sample: 213-45

Cellular concrete type: Class II

Sample description: not requested

USCS classification: not requested

Sample type: Cell Crete

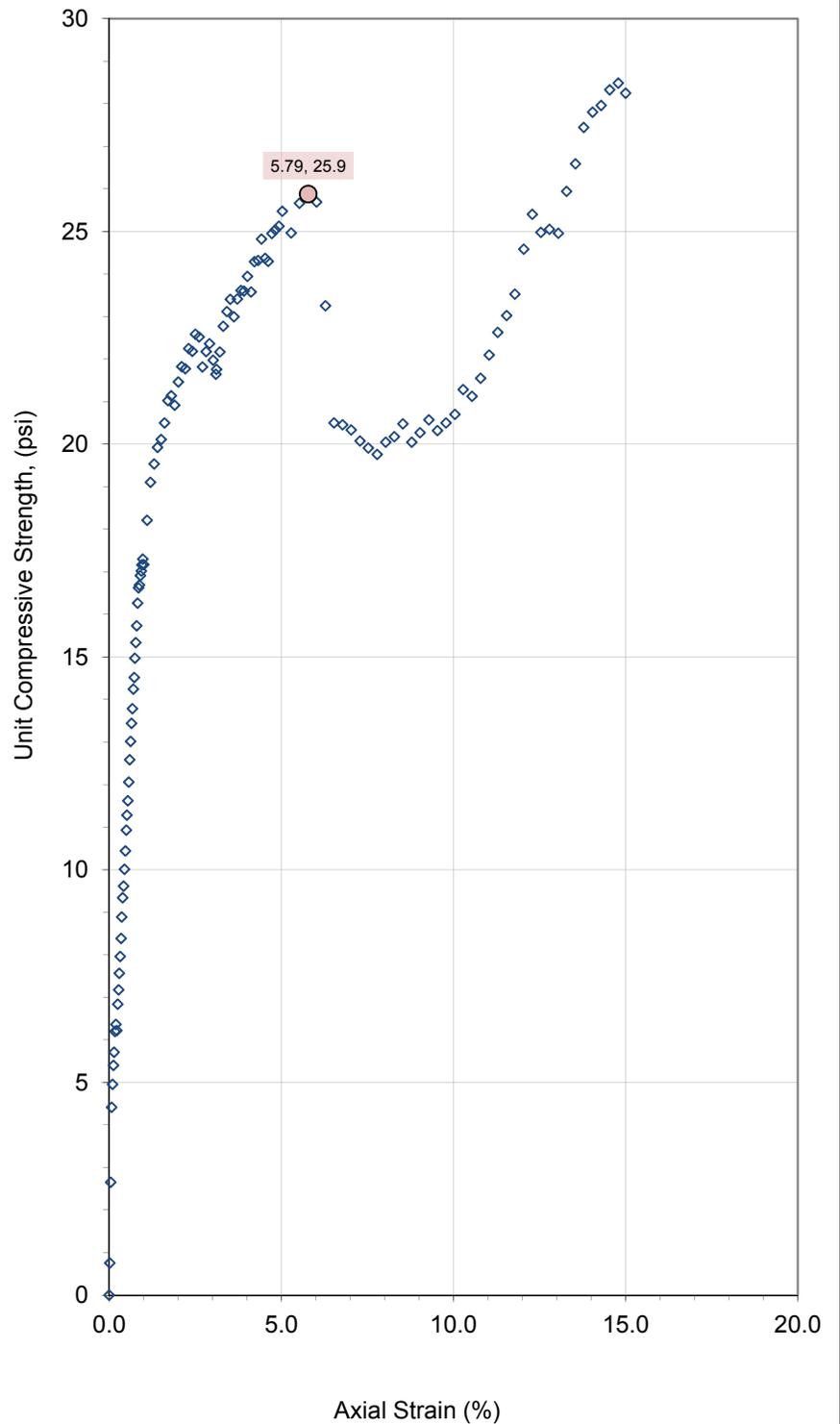
Type of cap: no cap

Date cast: 13-Feb-15

Age of sample (days): 32

| Test Number 4 | | | |
|------------------|--------------------------|-----------|--------|
| | 0° | 5.789 | |
| Unit weight data | Sample ht., H (in) | 5.795 | |
| | | 240° | 5.801 |
| | Avg. height, Havg (in) | 5.795 | |
| | Avg. height, Havg (cm) | 14.719 | |
| | | top | 2.973 |
| | Sample dia., D (in) | mid | 2.937 |
| | | bot | 2.891 |
| | Avg. dia., Davg (in) | | 2.935 |
| | Avg. dia., Davg (cm) | | 7.454 |
| | Avg. area, Aavg (in^2) | | 6.763 |
| | Avg. area, Aavg (cm^2) | | 43.634 |
| | Wt. rings + wet soil (g) | | 282.36 |
| | Wt. rings (g) | | 0.00 |
| | Volume, Vo (in^3) | | 39.2 |
| | | Vo (cm^3) | 642.3 |
| | Vo (ft^3) | 0.0227 | |
| | Gs, from mix design | 3.15 | |
| | Moist unit wt., gm (pcf) | 27.4 | |

| | | |
|-----------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 5.79 |
| | Time to failure, tf (min) | 5.8 |
| | Maximum vertical load (lbs) | 193.4 |
| | Unit compressive strength, (psi) | 25.9 |
| | Unit compressive strength, (psf) | 3726 |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M

Project: Cell Crete

No: 14GCI498

Location: ---

Date: 17-Mar-15

Tested by: zg

Reduced by: zg

Checked by: rbm

Sample: 213-55

Cellular concrete type: Class II

Sample description: not requested

USCS classification: not requested

Sample type: Cell Crete

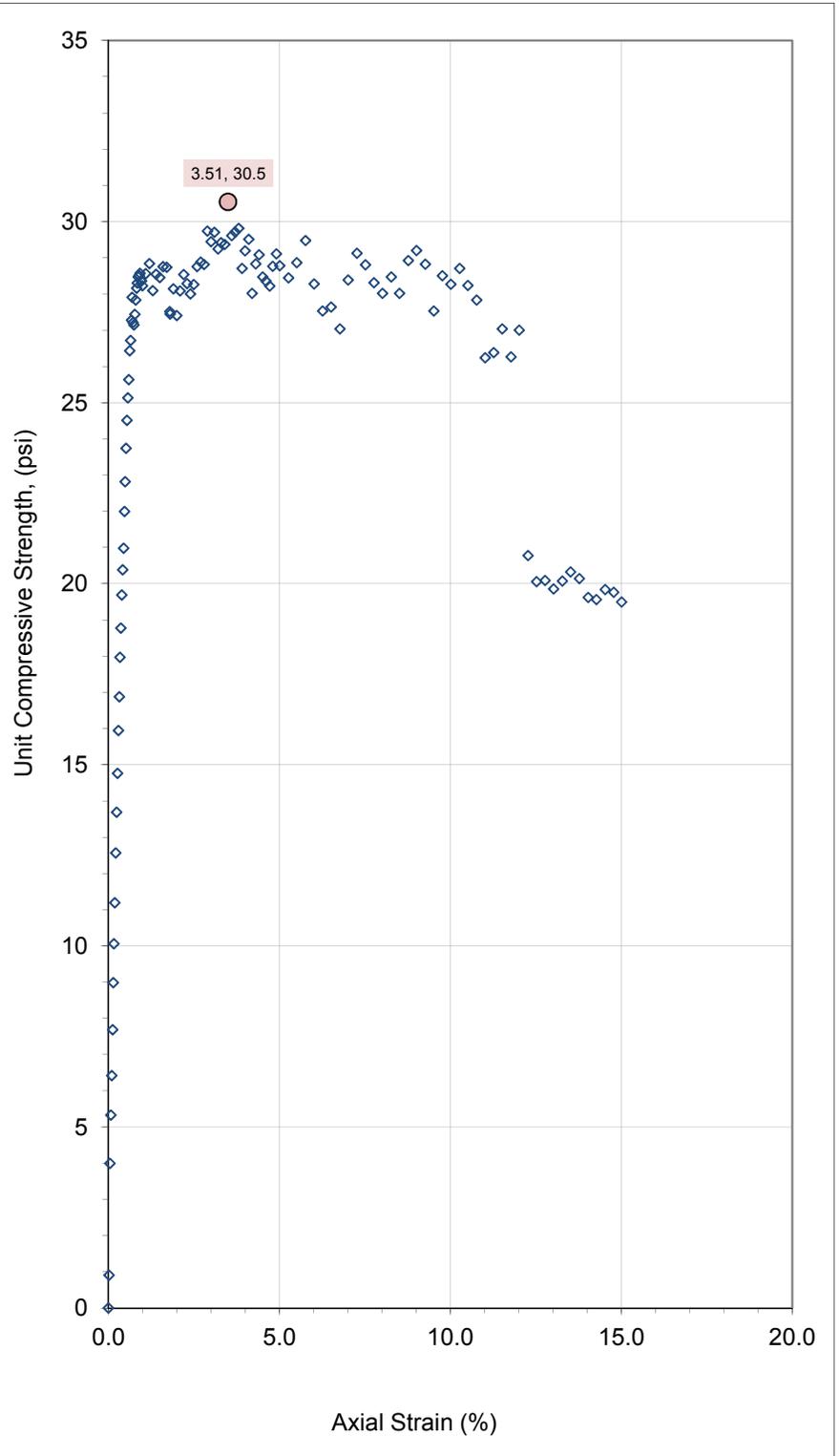
Type of cap: no cap

Date cast: 13-Feb-15

Age of sample (days): 32

| Test Number 5 | | |
|------------------|------------------------------------|-----------------------------|
| | 0° | 5.743 |
| Unit weight data | Sample ht., H (in) | 120° 5.754 |
| | | 240° 5.749 |
| | Avg. height, Havg (in) | 5.749 |
| | Avg. height, Havg (cm) | 14.602 |
| | | top 2.982 |
| | Sample dia., D (in) | mid 2.928 |
| | | bot 2.891 |
| | Avg. dia., Davg (in) | 2.932 |
| | Avg. dia., Davg (cm) | 7.448 |
| | Avg. area, Aavg (in ²) | 6.753 |
| | Avg. area, Aavg (cm ²) | 43.567 |
| | Wt. rings + wet soil (g) | 296.09 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in ³) | 38.8 |
| | | Vo (cm ³) 636.2 |
| | Vo (ft ³) 0.0225 | |
| | Gs, from mix design | 3.15 |
| | Moist unit wt., gm (pcf) | 29.1 |

| | | |
|-----------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 3.51 |
| | Time to failure, tf (min) | 3.5 |
| | Maximum vertical load (lbs) | 206.8 |
| | Unit compressive strength, (psi) | 30.5 |
| | Unit compressive strength, (psf) | 4397 |
| Comments: | | |



K₀ Consolidation Test Using Strain Controlled Axial Loading and Automated Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-75

Location: ---
Date: 20-Mar-15
Date cast: 13-Feb-15
Tested by: zmg
Reduced by: zmg
Checked by: rbm/rtc

Sample description: Cellular concrete cast on 2/13/15
USCS classification: not applicable
Sample type: cast
Age of sample (days): 35

- Comments:
1. No shearing of sample was performed after the Ko consolidation phase
 2. Initial sample moisture content was back calculated from oven dried sample
 3. Automated lateral pressure adjustment using TruePath software

| | | Sample: 213-75 | |
|-------------------------------|-------------------------------------|----------------|--------|
| | | Initial | Final |
| Unit weight data | Sample ht., H (in) | 0° 5.812 | |
| | | 120° 5.813 | |
| | | 240° 5.799 | |
| | Avg. height, Havg (in) | 5.808 | |
| | Avg. height, Havg (cm) | 14.752 | |
| | ΔHsc (in) ^a | | |
| | | top 2.957 | |
| | Sample dia., D (in) | mid 2.915 | |
| | | bot 2.884 | |
| | Avg. dia., Davg (in) | 2.918 | |
| | Avg. dia., Davg (cm) | 7.411 | |
| | Avg. area, Aavg (in ²) | 6.686 | |
| | Avg. area, Aavg (cm ²) | 43.137 | |
| | Wt. rings + wet soil (g) | 289.20 | |
| | Wt. rings (g) | 0.00 | |
| Volume, Vo (in ³) | 38.8 | | |
| | Vo (cm ³) 636.4 | | |
| | Vo (ft ³) 0.0225 | | |
| Moisture | Wet soil + tare (g) | 289.20 | 579.06 |
| | Dry soil + tare (g) | 191.00 | 335.64 |
| | Tare (g) | 0.00 | 144.64 |
| | Moisture content, w (%) | 51.4 | 127.4 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 289.2 | 434.4 |
| | Mass of solids (g) | 191.0 | 191.0 |
| | Volume (cm ³) | 636.4 | 304.1 |
| | Volume of water (cm ³) | 98.2 | 243.4 |
| | Volume of solids (cm ³) | 60.6 | 60.6 |
| | Volume of voids (cm ³) | 575.7 | 243.4 |
| | Volume of air (cm ³) | 477.5 | 0.0 |
| | Void ratio, e | 9.495 | 4.015 |
| | Porosity, n | 0.905 | 0.801 |
| | Volumetric moisture, T | 0.154 | 0.801 |
| | Saturation, S (%) | 17.06 | 100.00 |
| | Dry density (gm/cm ³) | 0.300 | 0.628 |
| | Wet unit wt., gm (pcf) | 28.4 | 89.2 |
| Dry unit wt., gd (pcf) | 18.7 | 39.2 | |

Notes:

^a ΔHsc (in) = change in height during saturation and consolidation (end of test)

K0 Consolidation Test Using Strain Controlled Axial Loading and Automated*Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89***Project: Cell Crete
No: 14GCI498****Cellular concrete type: Class II
Sample: 213-75**

Location: ---

Sample description: Cellular concrete cast on 2/13/15

Date: 20-Mar-15

USCS classification: not applicable

Tested by: zmg

Sample type: cast

Checked by: rbm/rtc

X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_K0CU1pts_TypeII_213-75-v01.xlsm]SUM

Sample 213-75

| | | |
|------------------|-----------------------------------|------|
| Test information | Total backpressure (psi) | 75.0 |
| | Skempton B | 0.78 |
| | Consolidation strain rate (%/hr) | 1.00 |
| | Consolidation strain rate (%/min) | 0.02 |
| | Unloading strain rate (%/hr) | --- |
| | Shear strain rate (%/hr) | --- |
| | Consolidation membrane correction | Yes |
| | Shear membrane correction | N/A |
| | Filter paper correction | No |

[Photo of sample after testing](#)

Comments:

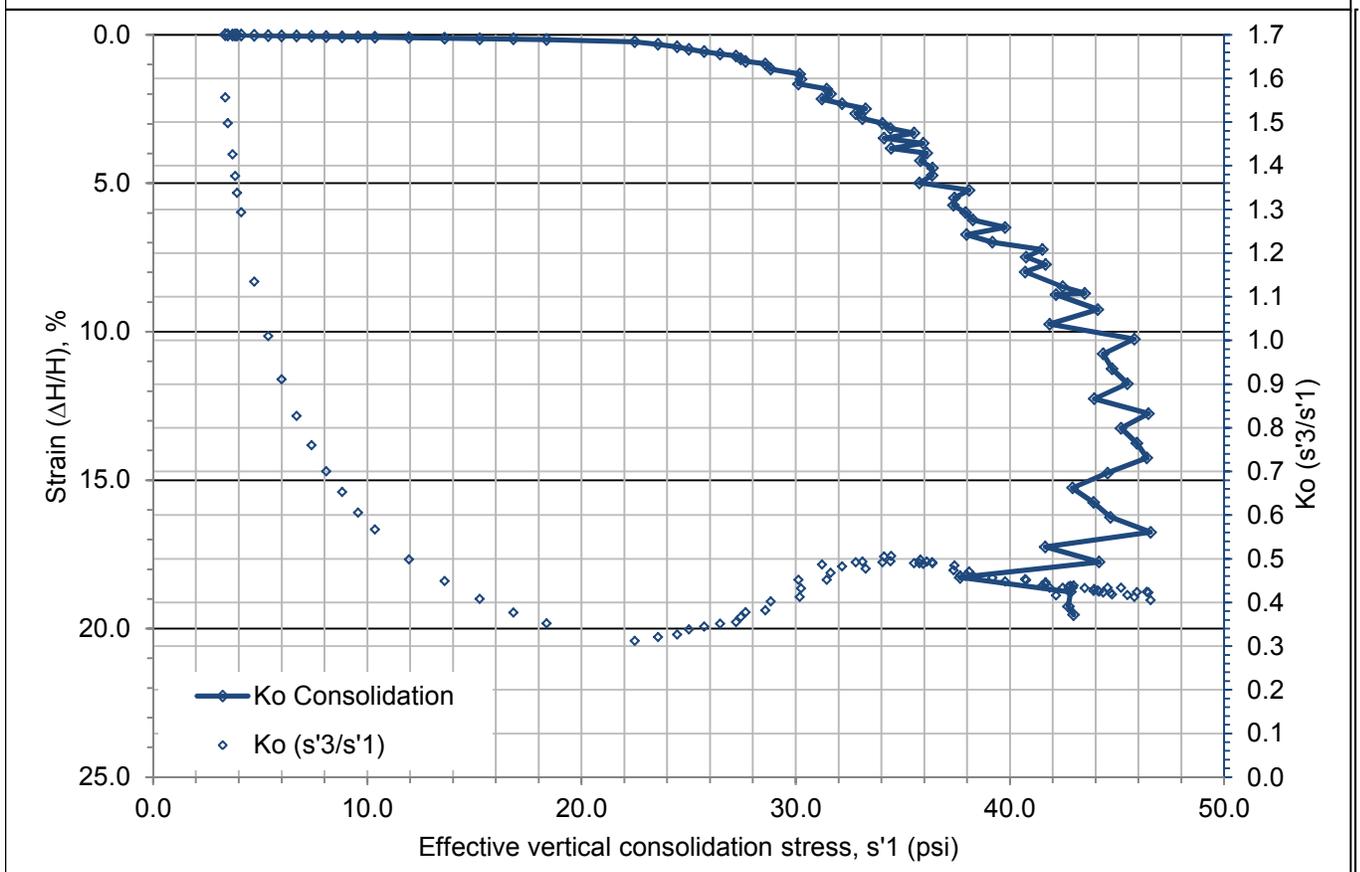
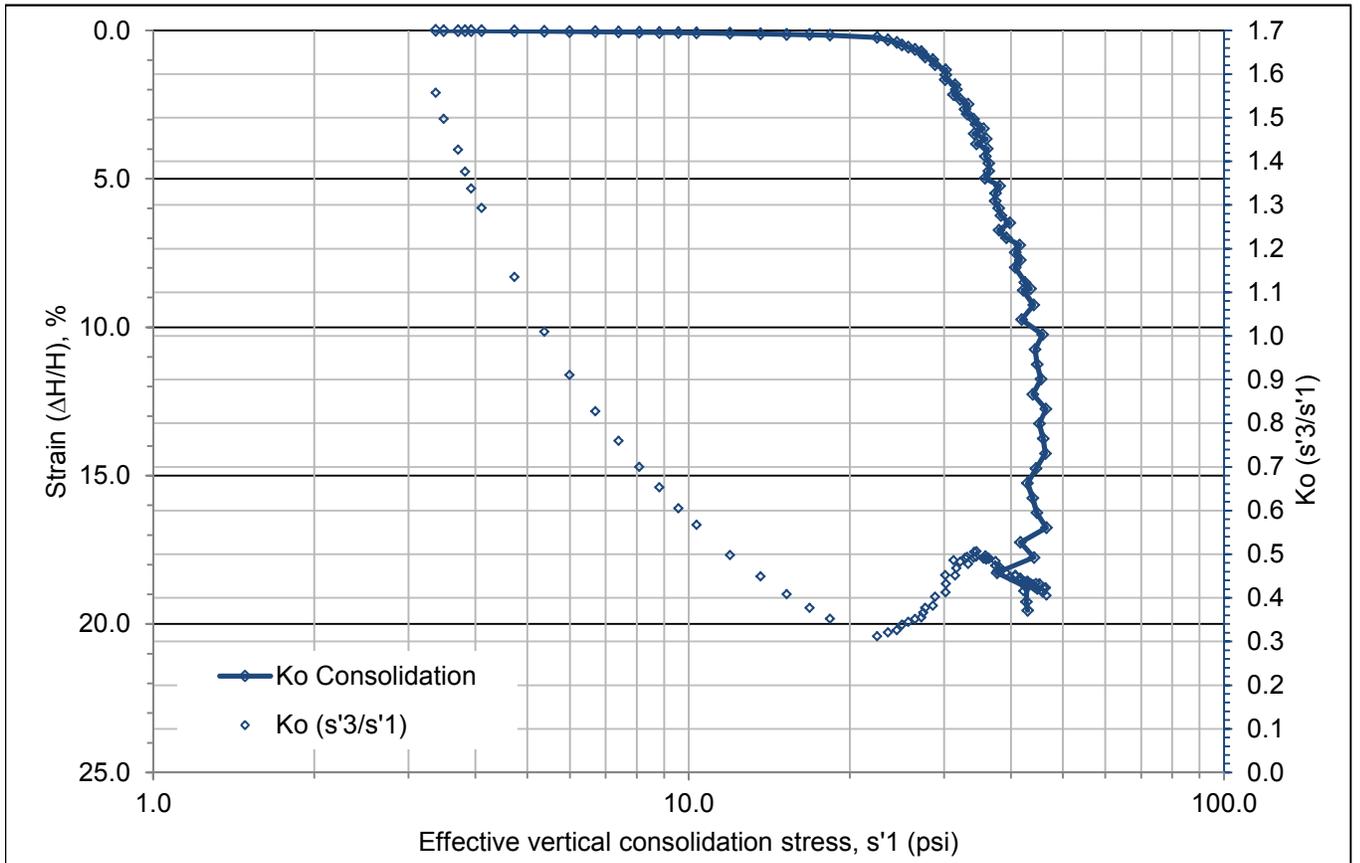
K0 Consolidation Test Using Strain Controlled Axial Loading and Automated

Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89



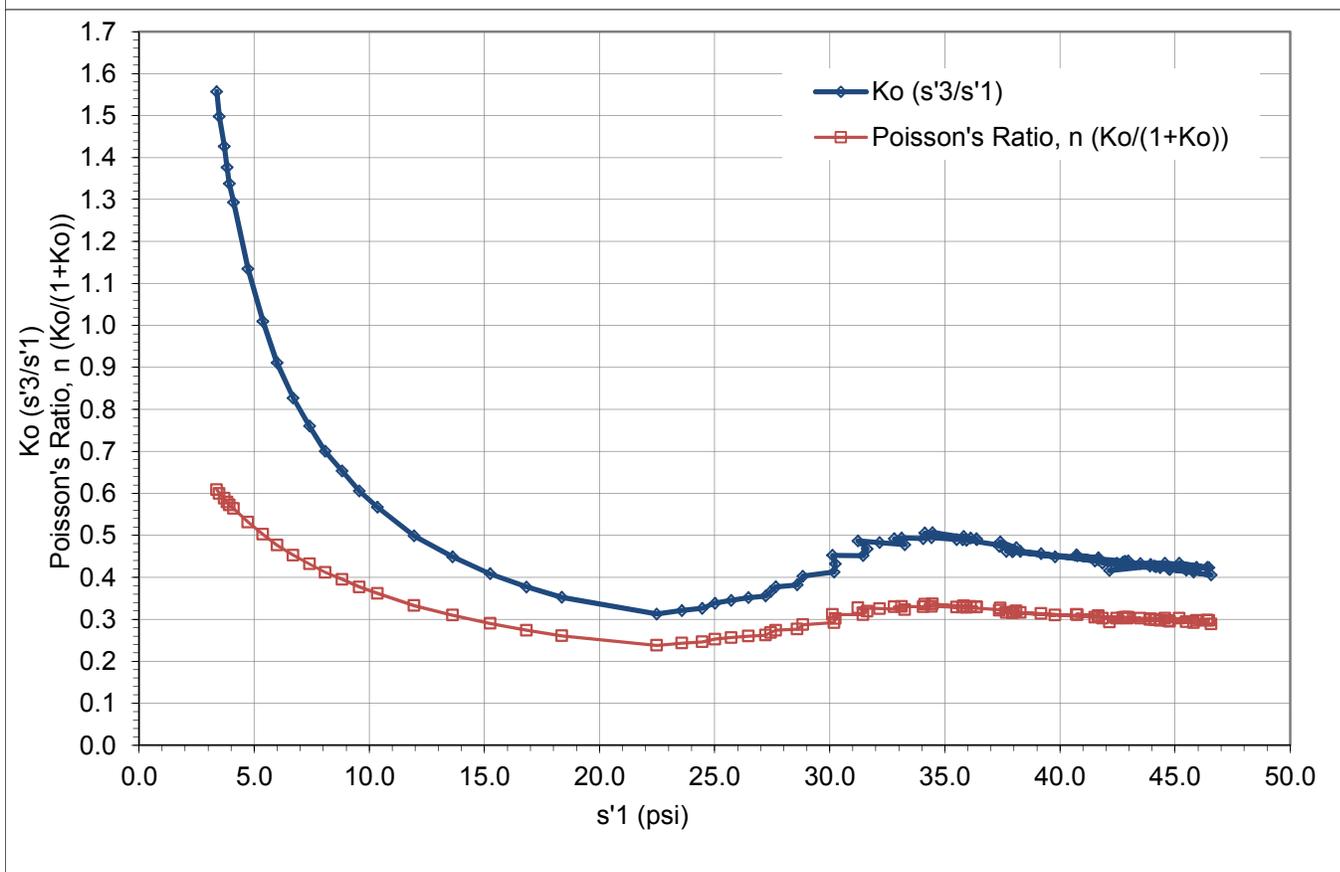
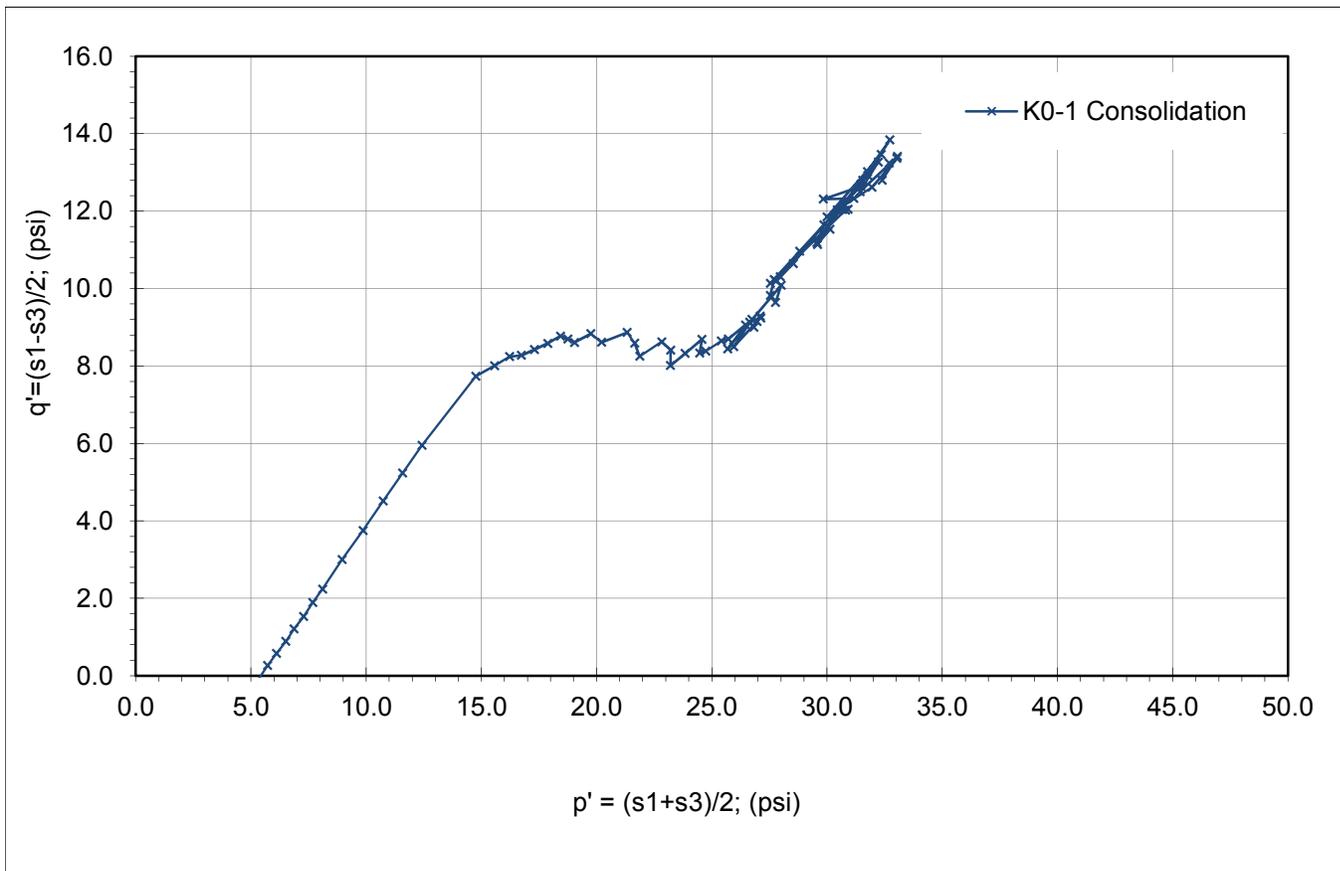
Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-75



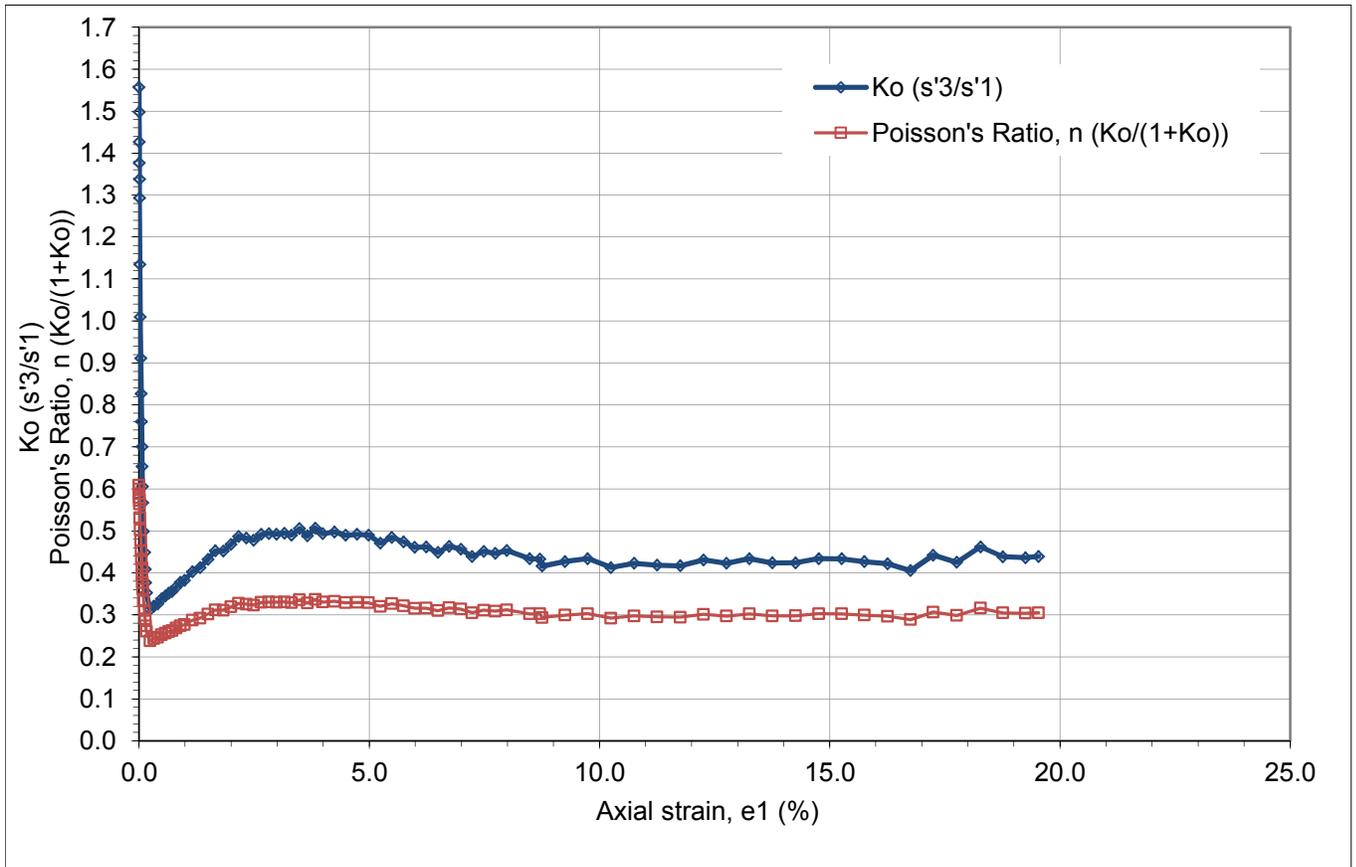
Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-75



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-75



K₀ Consolidation Test Using Strain Controlled Axial Loading and Automated Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-78

Location: ---
 Date: 21-Mar-15
 Date cast: 13-Feb-15
 Tested by: zmg
 Reduced by: zmg
 Checked by: rbm/rtc

Sample description: Cellular concrete cast on 2/13/15
 USCS classification: not applicable
 Sample type: cast
 Age of sample (days): 36

- Comments:
1. No shearing of sample was performed after the Ko consolidation phase
 2. Initial sample moisture content was back calculated from oven dried sample
 3. Automated lateral pressure adjustment using TruePath software

| | | Sample: 213-78 | |
|-------------------------------|-------------------------------------|----------------|--------|
| | | Initial | Final |
| Unit weight data | Sample ht., H (in) | 0° 5.751 | |
| | | 120° 5.783 | |
| | | 240° 5.782 | |
| | Avg. height, Havg (in) | 5.772 | |
| | Avg. height, Havg (cm) | 14.661 | |
| | ΔHsc (in) ^a | | |
| | | top 2.971 | |
| | Sample dia., D (in) | mid 2.940 | |
| | | bot 2.905 | |
| | Avg. dia., Davg (in) | 2.939 | |
| | Avg. dia., Davg (cm) | 7.465 | |
| | Avg. area, Aavg (in ²) | 6.784 | |
| | Avg. area, Aavg (cm ²) | 43.768 | |
| | Wt. rings + wet soil (g) | 288.55 | |
| | Wt. rings (g) | 0.00 | |
| Volume, Vo (in ³) | 39.2 | | |
| | Vo (cm ³) 641.7 | | |
| | Vo (ft ³) 0.0227 | | |
| Moisture | Wet soil + tare (g) | 288.55 | 605.64 |
| | Dry soil + tare (g) | 209.84 | 336.58 |
| | Tare (g) | 0.00 | 126.74 |
| | Moisture content, w (%) | 37.5 | 128.2 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 288.6 | 478.9 |
| | Mass of solids (g) | 209.8 | 209.8 |
| | Volume (cm ³) | 641.7 | 335.7 |
| | Volume of water (cm ³) | 78.7 | 269.1 |
| | Volume of solids (cm ³) | 66.6 | 66.6 |
| | Volume of voids (cm ³) | 575.1 | 269.1 |
| | Volume of air (cm ³) | 496.4 | 0.0 |
| | Void ratio, e | 8.632 | 4.039 |
| | Porosity, n | 0.896 | 0.802 |
| | Volumetric moisture, T | 0.123 | 0.802 |
| | Saturation, S (%) | 13.69 | 100.00 |
| | Dry density (gm/cm ³) | 0.327 | 0.625 |
| | Wet unit wt., gm (pcf) | 28.1 | 89.1 |
| Dry unit wt., gd (pcf) | 20.4 | 39.0 | |

Notes:

^a ΔHsc (in) = change in height during saturation and consolidation (end of test)

K0 Consolidation Test Using Strain Controlled Axial Loading and Automated*Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89***Project: Cell Crete****No: 14GCI498**

Location: ---

Date: 21-Mar-15

Tested by: zmg

Checked by:

Cellular concrete type: Class II**Sample: 213-78**

Sample description: Cellular concrete cast on 2/13/15

USCS classification: not applicable

Sample type: cast

X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_K0CU1pts_TypeII_213-78-v01.xlsm]SUM

Sample 213-78

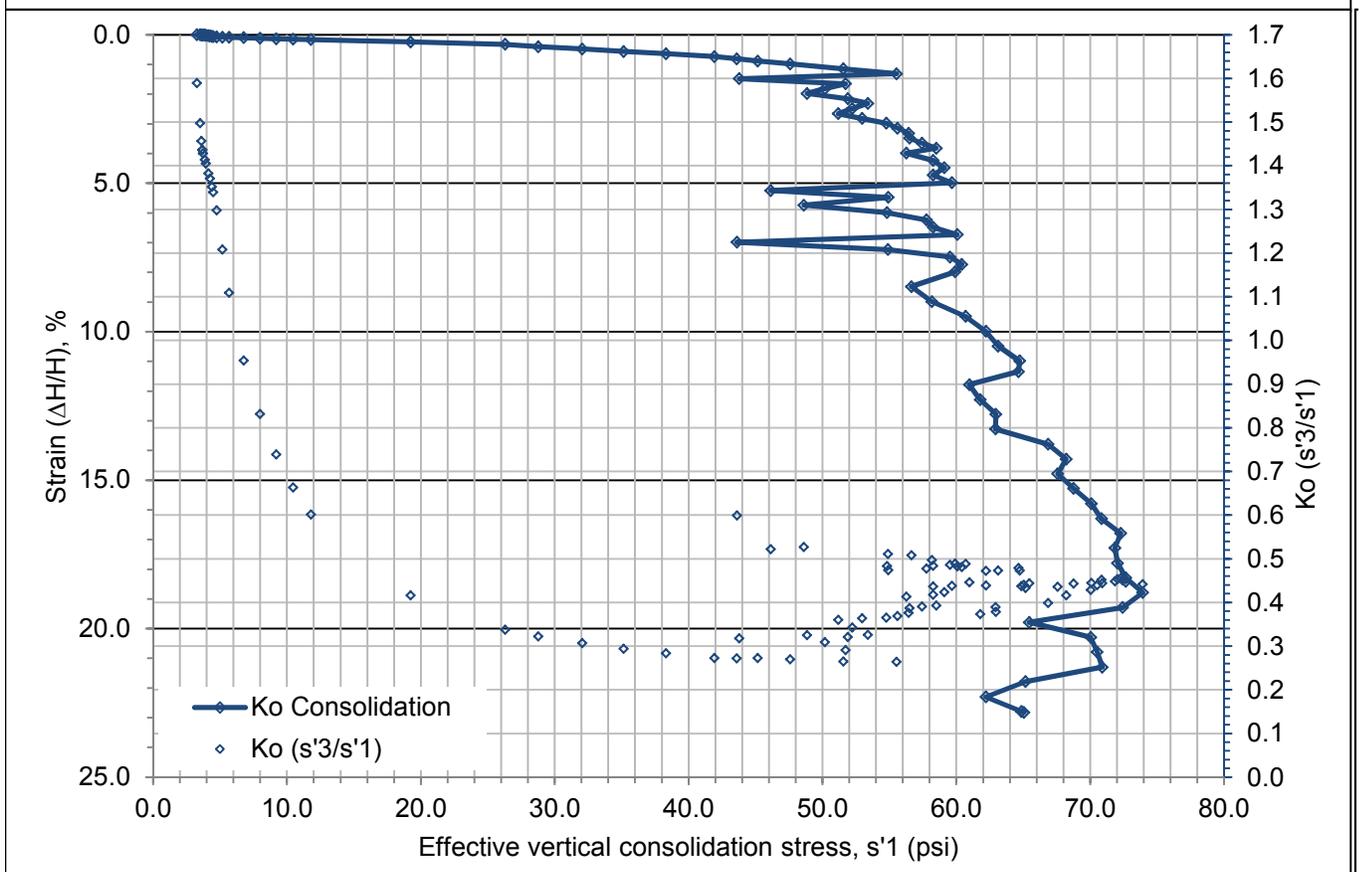
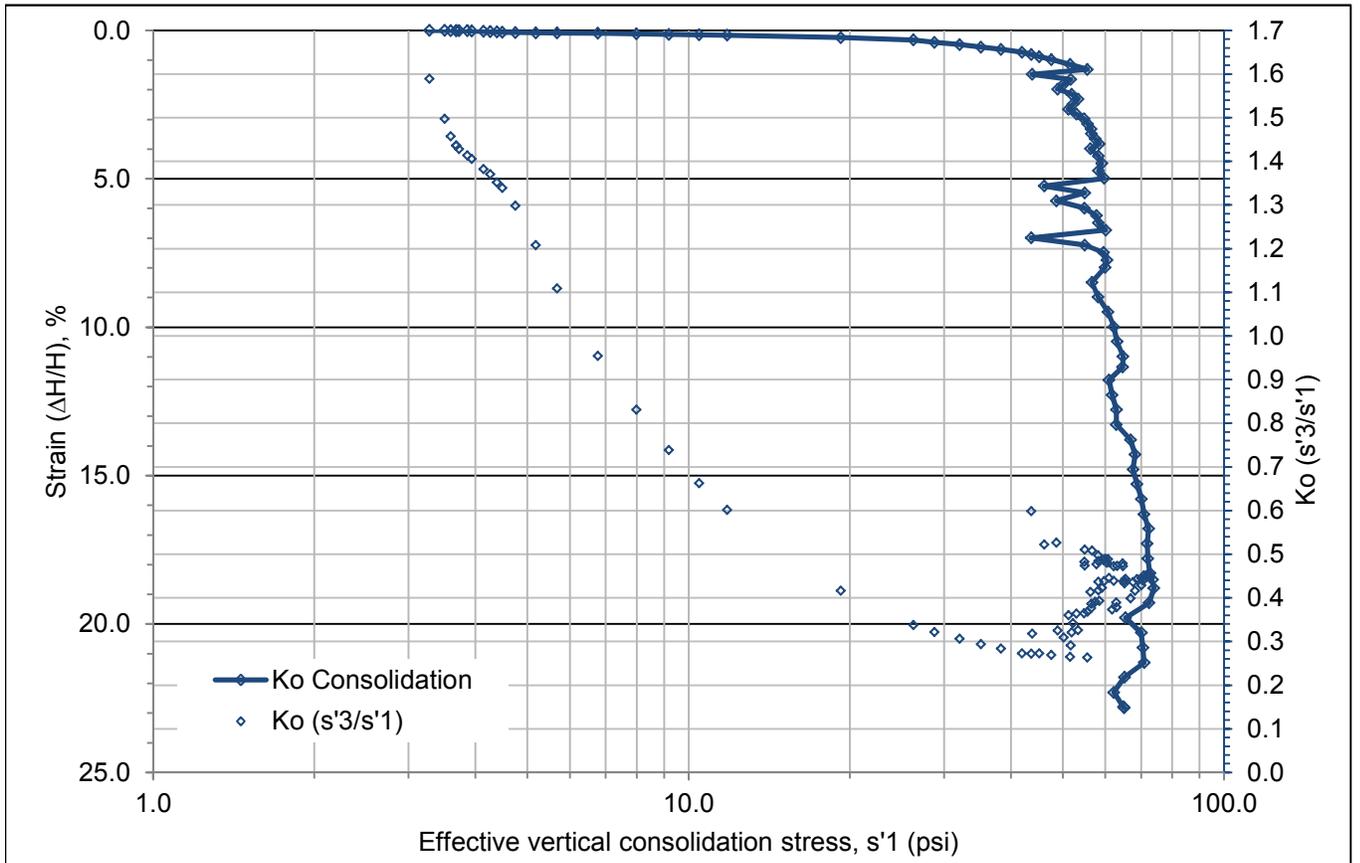
| | | | |
|------------------|---------|-----------------------------------|------|
| Test information | rbm/rtc | Total backpressure (psi) | 75.0 |
| | | Skempton B | 0.87 |
| | | Consolidation strain rate (%/hr) | 1.00 |
| | | Consolidation strain rate (%/min) | 0.02 |
| | | Unloading strain rate (%/hr) | --- |
| | | Shear strain rate (%/hr) | --- |
| | | Consolidation membrane correction | Yes |
| | | Shear membrane correction | N/A |
| | | Filter paper correction | No |

[Photo of sample after testing](#)

Comments:

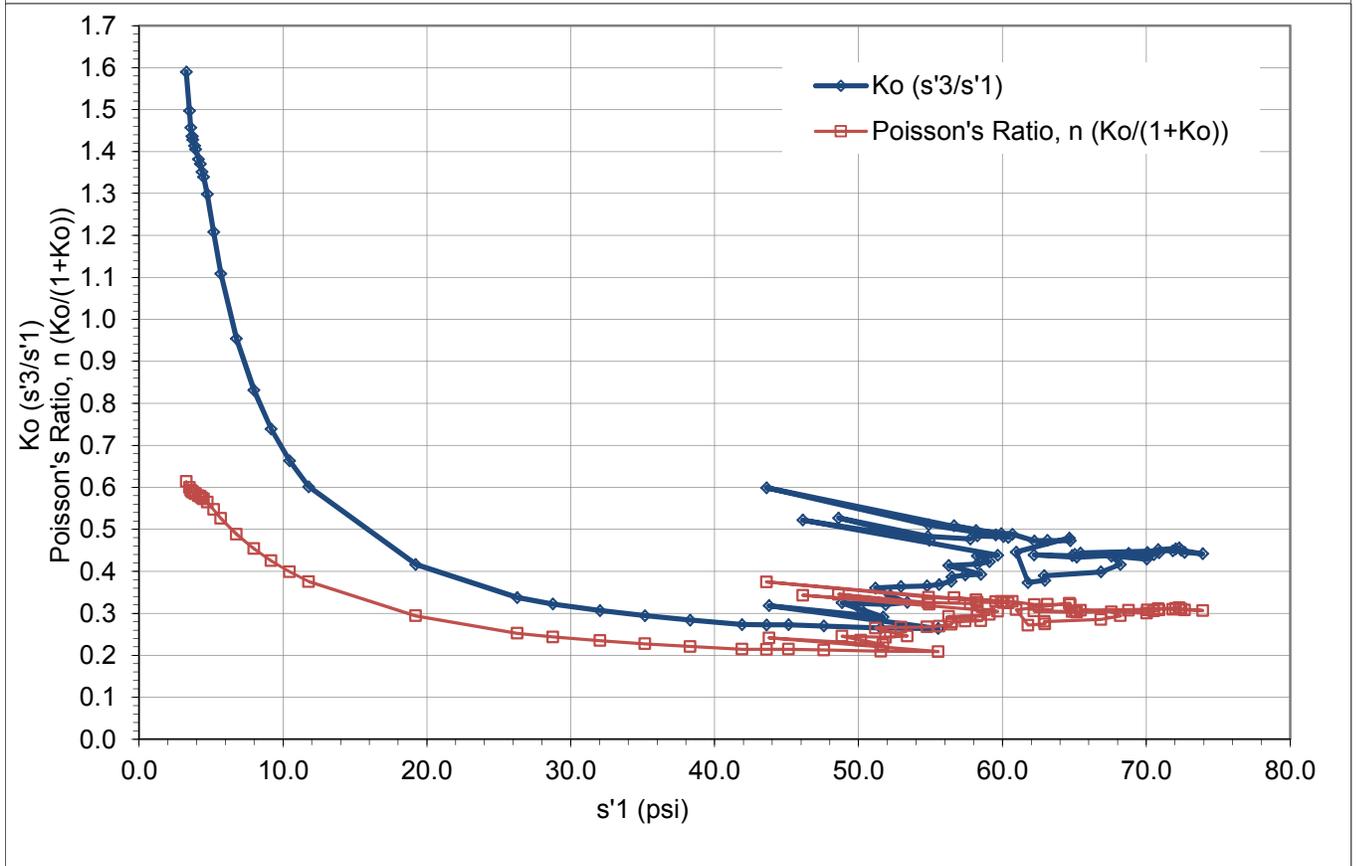
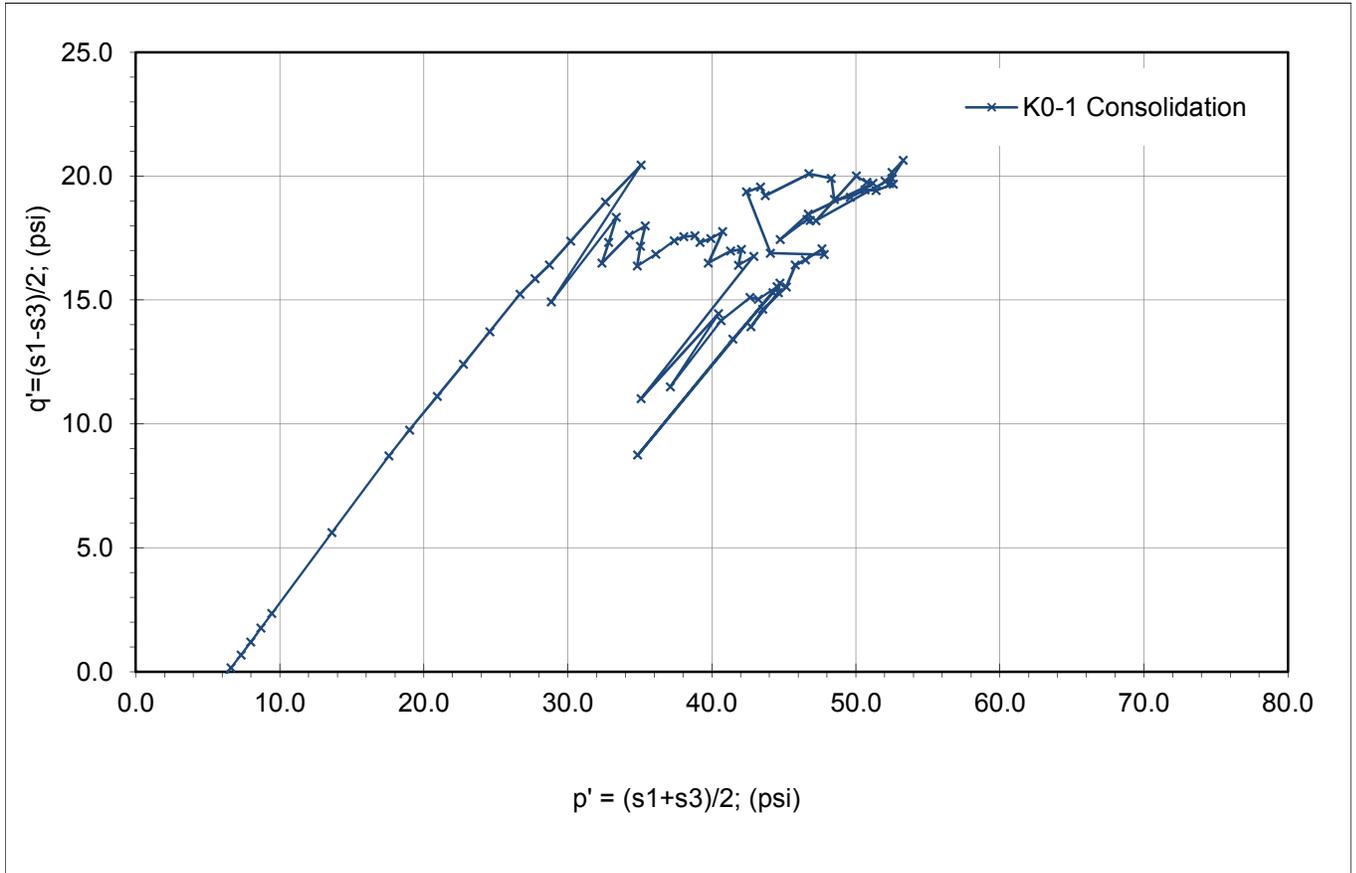
Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-78



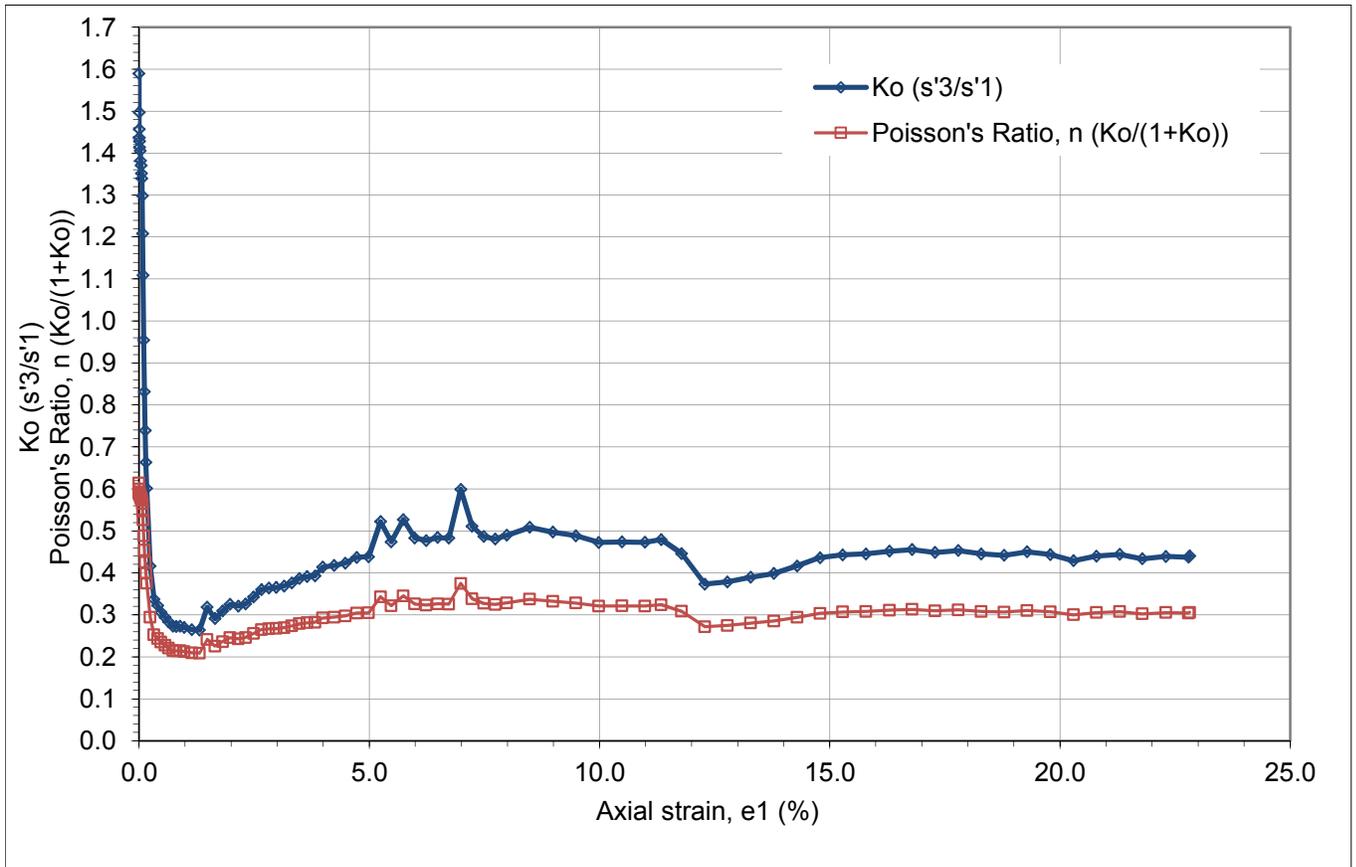
Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-78



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-78



One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



| | |
|----------------------------|---|
| Project: Cell Crete | Cellular concrete type: Class II |
| No: 14GCI498 | Sample: 213-42 |
| Location: -- | Sample description: Cellular concrete cast on 2/13/15 |
| Date: 13-Mar-15 | USCS classification: not applicable |
| Cast date: 13-Feb-15 | Sample type: cast |
| Tested by: zmg | Inundation stress (psf): 100, beginning |
| Reduced by: zmg | Swell pressure (psf): not recorded |
| Checked by: rbm/rtc | Test method: B |
| Comments: | Preparation procedure: trimmed |
| | Age of sample (days): 28 |

| Phase Relationships | | | Vertical Stress - Deformation Results | | | | | | |
|-----------------------------------|---------|--------|---------------------------------------|--------------------|-----------------------------------|----------------------|------------------|-----------|----------------------------------|
| | Initial | Final | Vert. stress (psf) | Vert. stress (psi) | Corr. Dial, dfc ^a (in) | Hc ^b (in) | Vert. strain, ev | Load (lb) | Load duration (min) ^c |
| Height, H (in) | 1.0000 | 0.3828 | Seating | Seating | 0.0000 | 1.0000 | 0.0000 | 0.9 | 0 |
| Height, H (cm) | 2.540 | 0.972 | 100 | 0.69 | 0.0021 | 0.9979 | 0.0021 | 2.3 | 8 |
| Dia., D (in) | 2.500 | 2.500 | 200 | 1.39 | 0.0032 | 0.9968 | 0.0032 | 8.9 | 4 |
| Dia., D (cm) | 6.350 | 6.350 | 400 | 2.78 | 0.0045 | 0.9955 | 0.0045 | 13.1 | 9 |
| Wt. rings + wet soil (g) | 248.56 | 253.14 | 800 | 5.56 | 0.0058 | 0.9942 | 0.0058 | 28.3 | 4 |
| Wt. rings (g) | 214.58 | 214.58 | 1,600 | 11.11 | 0.0076 | 0.9924 | 0.0076 | 55.3 | 3 |
| Wet soil + tare (g) | 185.04 | 182.82 | 3,200 | 22.22 | 0.0089 | 0.9911 | 0.0089 | 107.5 | 3 |
| Dry soil + tare (g) | 173.07 | 167.59 | 3,500 | 24.31 | 0.0091 | 0.9909 | 0.0091 | 116.9 | 3 |
| Tare (g) | 144.82 | 144.63 | 4,000 | 27.78 | 0.0094 | 0.9906 | 0.0094 | 134.7 | 3 |
| Moisture cont., w (%) | 42.4 | 61.6 | 4,500 | 31.25 | 0.0098 | 0.9902 | 0.0098 | 150.9 | 4 |
| Gs, from mix design | 3.15 | 3.15 | 5,000 | 34.72 | 0.0102 | 0.9898 | 0.0102 | 171.2 | 3 |
| Mass total (g) | 34.0 | 38.6 | 5,500 | 38.19 | 0.0107 | 0.9893 | 0.0107 | 190.4 | 3 |
| Mass of solids (g) | 23.9 | 23.9 | 6,000 | 41.67 | 0.0122 | 0.9878 | 0.0122 | 204.2 | 9 |
| Volume (cm ³) | 80.4 | 30.8 | 6,500 | 45.14 | 0.0313 | 0.9687 | 0.0313 | 220.1 | 16 |
| Vol. of water (cm ³) | 10.1 | 14.7 | 7,000 | 48.61 | 0.0371 | 0.9629 | 0.0371 | 240.3 | 10 |
| Vol. of solids (cm ³) | 7.6 | 7.6 | 7,500 | 52.08 | 0.0496 | 0.9504 | 0.0496 | 252.3 | 20 |
| Vol. of voids (cm ³) | 72.9 | 23.2 | 8,000 | 55.56 | 0.1042 | 0.8958 | 0.1042 | 274.9 | 14 |
| Vol. of air (cm ³) | 62.8 | 8.5 | 8,500 | 59.03 | 0.2666 | 0.7334 | 0.2666 | 291.0 | 30 |
| Area, A (cm ²) | 31.7 | 31.7 | 9,000 | 62.50 | 0.3019 | 0.6981 | 0.3019 | 309.1 | 28 |
| Ht. solids, Hs (cm) | 0.239 | 0.239 | 15,000 | 104.17 | 0.4281 | 0.5719 | 0.4281 | 508.1 | 17 |
| Void ratio, e | 9.617 | 3.064 | 30,000 | 208.33 | 0.5340 | 0.4660 | 0.5340 | 1015.1 | 2 |
| Porosity, n | 0.906 | 0.754 | 60,000 | 416.67 | 0.6172 | 0.3828 | 0.6172 | 2050.0 | 3 |
| Vol.moisture, T | 0.126 | 0.477 | | | | | | | |
| Saturation, S (%) | 14 | 63 | | | | | | | |
| Dry density (gm/cm ³) | 0.297 | 0.775 | | | | | | | |
| Wet unit wt., gm (pcf) | 26.4 | 78.2 | | | | | | | |
| Dry unit wt., gd (pcf) | 18.5 | 48.4 | | | | | | | |

Notes: ^a dfc = end of increment deformation corrected for machine, porous stone, and filter paper deformation
^b Hc = height at end of consolidation of each vert. stress
^c Loading advanced after the change in deformation was observed to be less than 1% of initial height

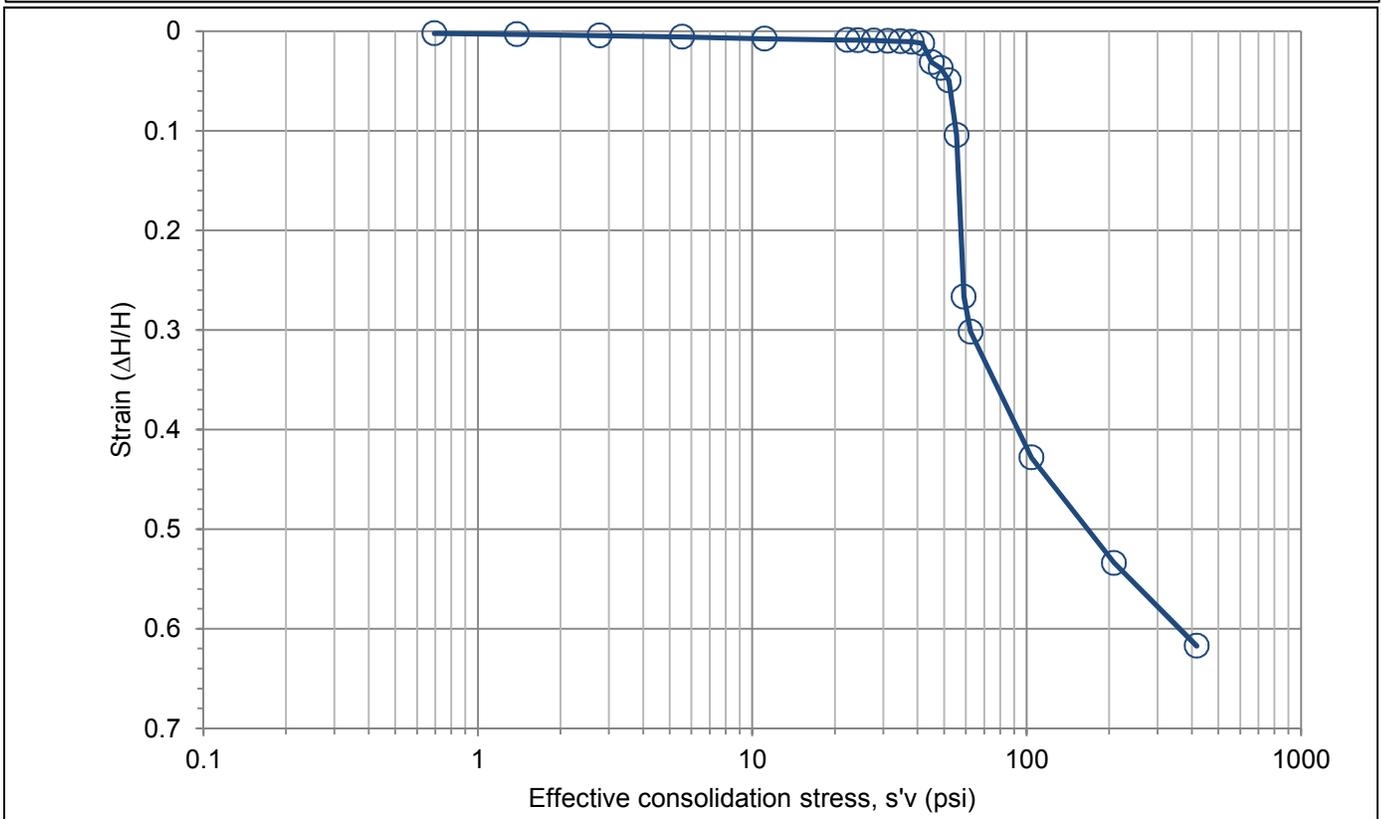
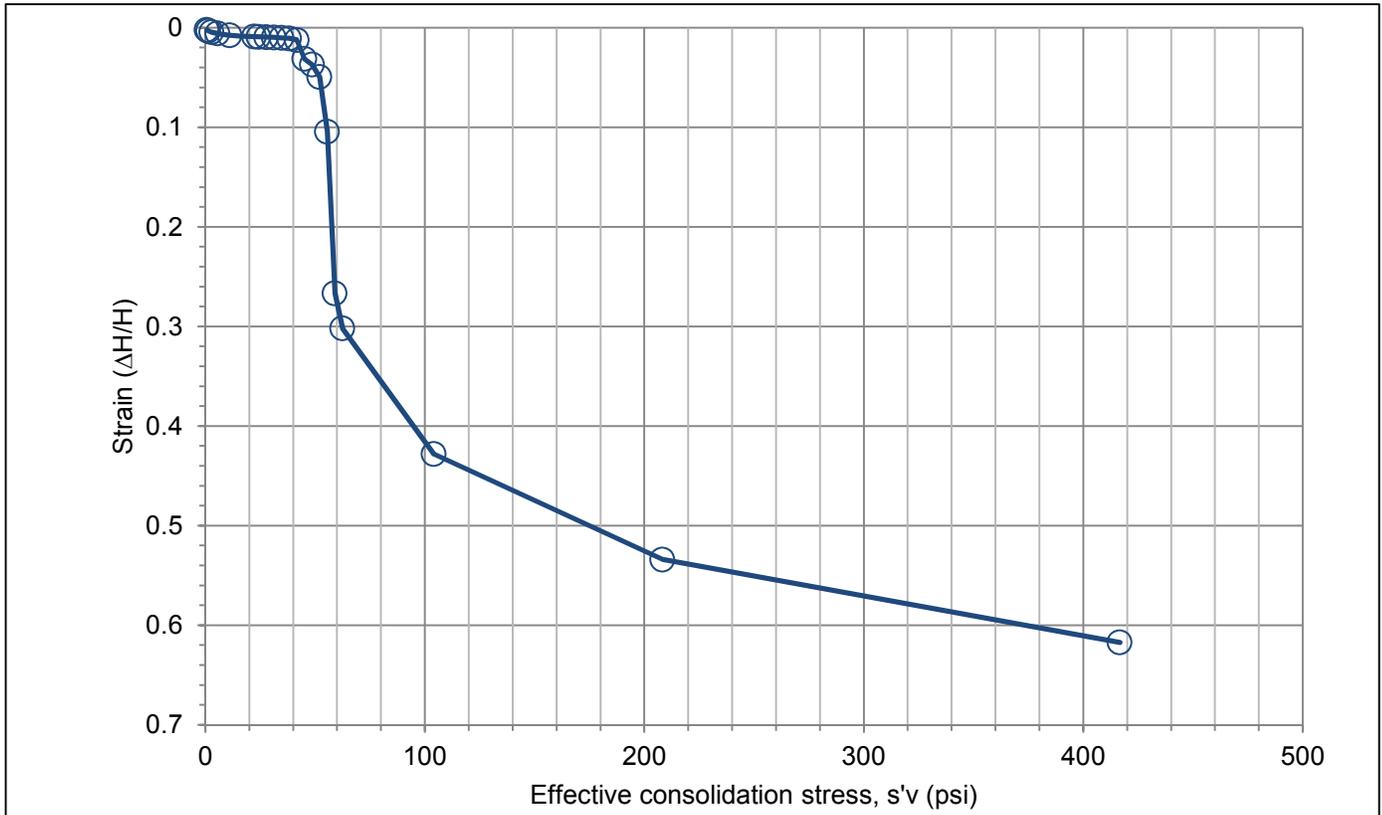
One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-42



One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



| | |
|----------------------------|---|
| Project: Cell Crete | Cellular concrete type: Class II |
| No: 14GCI498 | Sample: 213-50 |
| Location: -- | Sample description: Cellular concrete cast on 2/13/15 |
| Date: 13-Mar-15 | USCS classification: not applicable |
| Cast date: 13-Feb-15 | Sample type: cast |
| Tested by: zmg | Inundation stress (psf): 100, beginning |
| Reduced by: zmg | Swell pressure (psf): not recorded |
| Checked by: rbm/rtc | Test method: B |
| Comments: | Preparation procedure: trimmed |
| | Age of sample (days): 28 |

Phase Relationships

Vertical Stress - Deformation Results

| | Initial | Final | Vert. stress (psf) | Vert. stress (psi) | Corr. Dial, dfc ^a (in) | Hc ^b (in) | Vert. strain, ev | Load (lb) | Load duration (min) ^c |
|-----------------------------------|---------|--------|--------------------|--------------------|-----------------------------------|----------------------|------------------|-----------|----------------------------------|
| Height, H (in) | 1.0000 | 0.3656 | Seating | Seating | 0.0000 | 1.0000 | 0.0000 | 1.8 | 0 |
| Height, H (cm) | 2.540 | 0.929 | 100 | 0.69 | 0.0004 | 0.9996 | 0.0004 | 5.1 | 3 |
| Dia., D (in) | 2.500 | 2.500 | 200 | 1.39 | 0.0005 | 0.9995 | 0.0005 | 8.4 | 3 |
| Dia., D (cm) | 6.350 | 6.350 | 400 | 2.78 | 0.0008 | 0.9992 | 0.0008 | 14.7 | 2 |
| Wt. rings + wet soil (g) | 247.25 | 252.05 | 800 | 5.56 | 0.0021 | 0.9979 | 0.0021 | 27.9 | 2 |
| Wt. rings (g) | 214.58 | 214.58 | 1,600 | 11.11 | 0.0037 | 0.9963 | 0.0037 | 54.9 | 2 |
| Wet soil + tare (g) | 173.51 | 181.95 | 3,200 | 22.22 | 0.0094 | 0.9906 | 0.0094 | 110.7 | 5 |
| Dry soil + tare (g) | 160.21 | 167.50 | 5,500 | 38.19 | 0.0643 | 0.9357 | 0.0643 | 185.8 | 10 |
| Tare (g) | 126.73 | 144.84 | 6,000 | 41.67 | 0.0873 | 0.9127 | 0.0873 | 206.0 | 10 |
| Moisture cont., w (%) | 39.7 | 60.3 | 6,500 | 45.14 | 0.2261 | 0.7739 | 0.2261 | 218.9 | 10 |
| Gs, from mix design | 3.15 | 3.15 | 7,000 | 48.61 | 0.2829 | 0.7171 | 0.2829 | 240.0 | 4 |
| Mass total (g) | 32.7 | 37.5 | 7,500 | 52.08 | 0.3264 | 0.6736 | 0.3264 | 258.4 | 8 |
| Mass of solids (g) | 23.4 | 23.4 | 8,000 | 55.56 | 0.3436 | 0.6564 | 0.3436 | 271.5 | 5 |
| Volume (cm ³) | 80.4 | 29.4 | 8,500 | 59.03 | 0.3581 | 0.6419 | 0.3581 | 287.3 | 8 |
| Vol. of water (cm ³) | 9.3 | 14.1 | 9,000 | 62.50 | 0.3722 | 0.6278 | 0.3722 | 308.6 | 9 |
| Vol. of solids (cm ³) | 7.4 | 7.4 | 15,000 | 104.17 | 0.4623 | 0.5377 | 0.4623 | 511.6 | 2 |
| Vol. of voids (cm ³) | 73.0 | 22.0 | 30,000 | 208.33 | 0.5614 | 0.4386 | 0.5614 | 1021.4 | 2 |
| Vol. of air (cm ³) | 63.7 | 7.9 | 60,000 | 416.67 | 0.6344 | 0.3656 | 0.6344 | 2044.9 | 2 |
| Area, A (cm ²) | 31.7 | 31.7 | | | | | | | |
| Ht. solids, Hs (cm) | 0.234 | 0.234 | | | | | | | |
| Void ratio, e | 9.837 | 2.962 | | | | | | | |
| Porosity, n | 0.908 | 0.748 | | | | | | | |
| Vol.moisture, T | 0.115 | 0.479 | | | | | | | |
| Saturation, S (%) | 13 | 64 | | | | | | | |
| Dry density (gm/cm ³) | 0.291 | 0.795 | | | | | | | |
| Wet unit wt., gm (pcf) | 25.4 | 79.6 | | | | | | | |
| Dry unit wt., gd (pcf) | 18.1 | 49.6 | | | | | | | |

Notes: ^a dfc = end of increment deformation corrected for machine, porous stone, and filter paper deformation
^b Hc = height at end of consolidation of each vert. stress
^c Loading advanced after the change in deformation was observed to be less than 1% of initial height

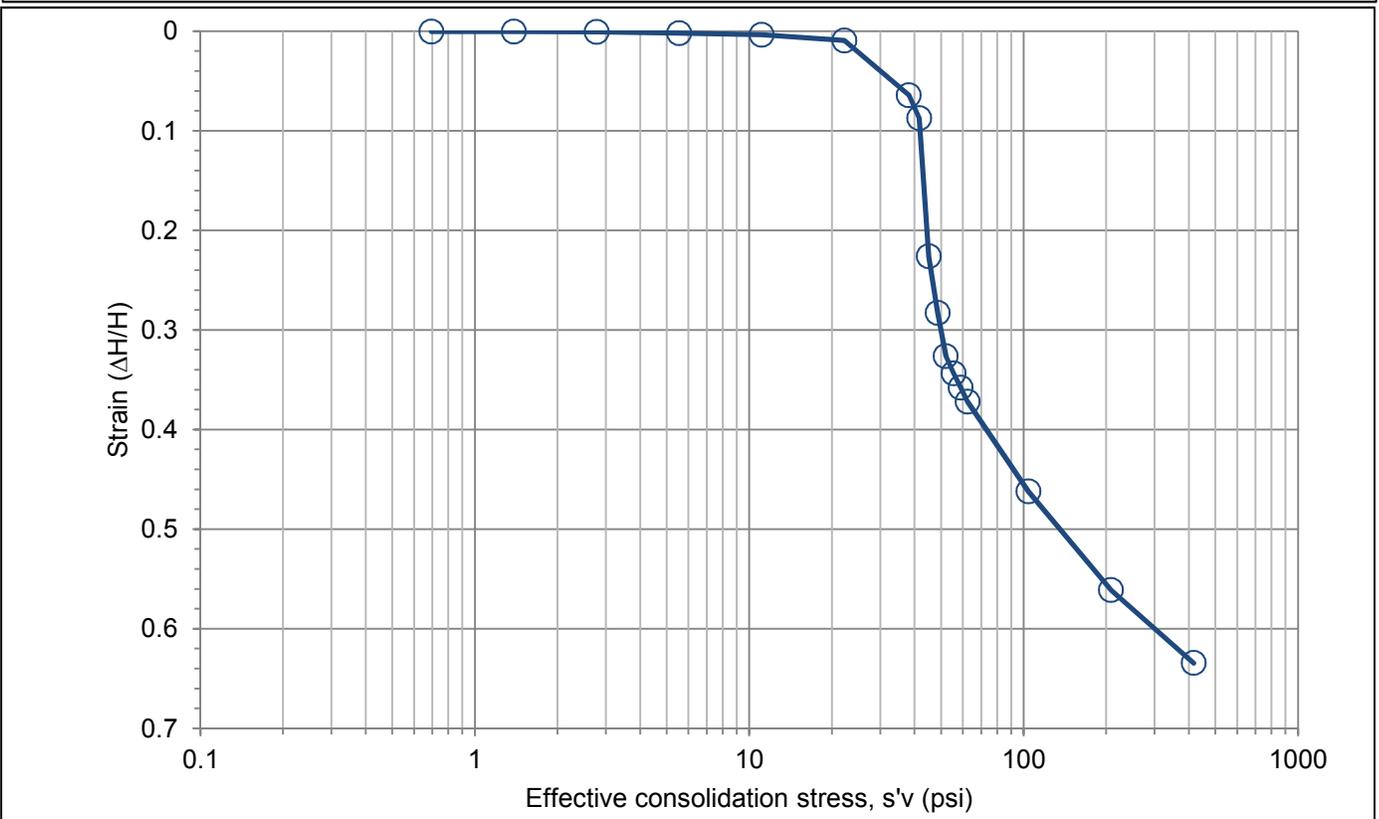
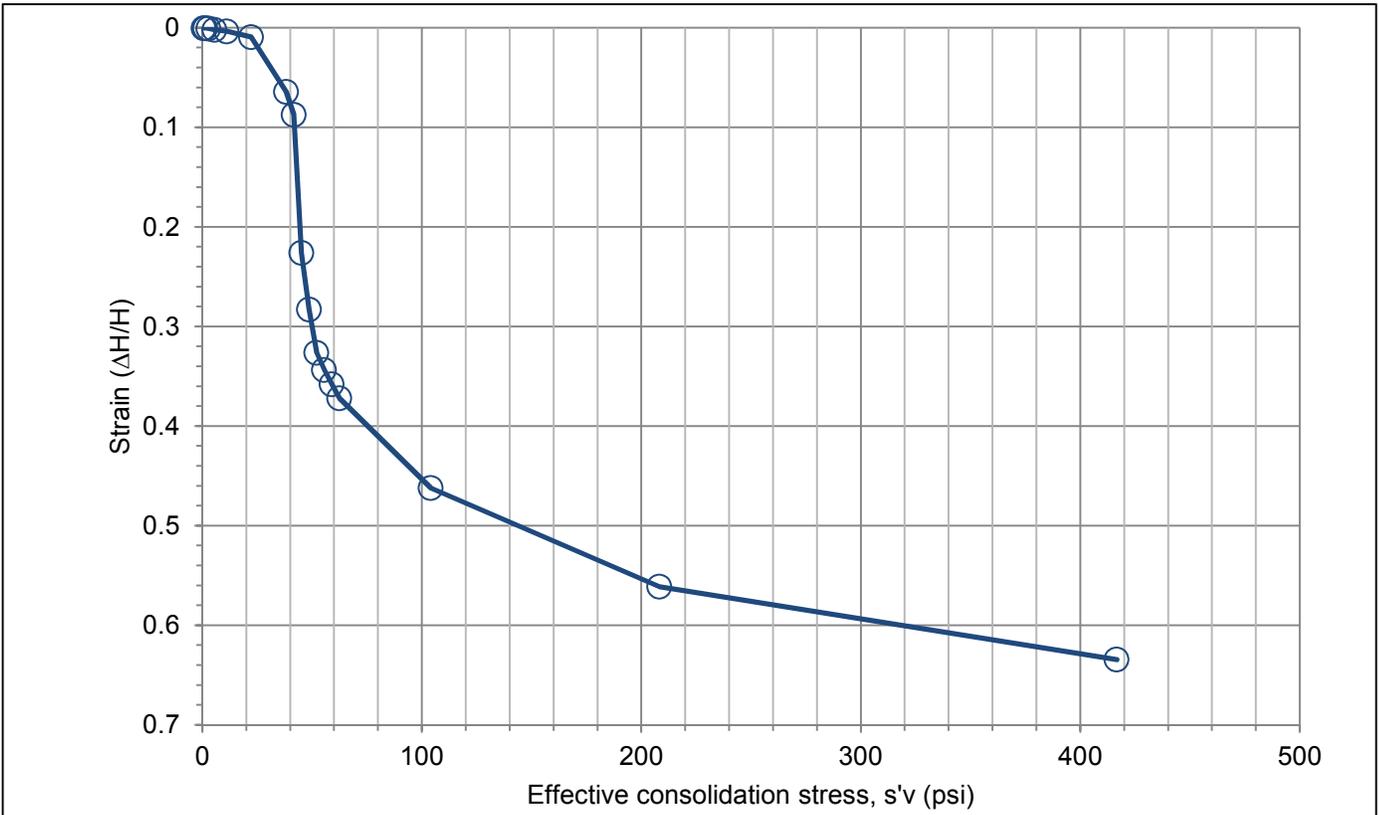
One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: 213-50



Hydraulic Conductivity Test - Back Pressure, Flexible Wall

after ASTM D5084 Method C



Project: Cell Crete

No: 14GCI498

Cast date: 17-Jul-14

Date: 4-Aug-14

Tested by: zmg

Reduced by: zmg

Reviewed by: rbm/rtc

Cellular concrete type: Class II

Sample: Sample 13

Sample description: Cellular concrete cast on 7/17/14

USCS classification: not applicable

Sample type: cast

Age of sample (days): 18

Comments:

Initial sample moisture content was back calculated from the oven dried sample after

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| Sample Height, H (in) | 2.996 | 2.996 |
| Sample Diameter, D (in) | 2.429 | 2.470 |
| Sample Length, L (cm) | 7.610 | 7.610 |
| Sample Area, A (cm ²) | 29.896 | 30.908 |
| Sample Volume, V (cm ³) | 227.50 | 235.20 |
| Wt. Rings + Wet Soil (g) | 106.45 | 240.54 |
| Wt. Rings (g) | 0.00 | 0.00 |
| Wet Soil + Tare (g) | 210.29 | 385.78 |
| Dry Soil + Tare (g) | 200.62 | 224.53 |
| Tare (g) | 125.62 | 145.24 |
| Weight of solids, Ws (g) | 94.29 | 94.29 |
| Moisture Content, w (%) | 12.89 | 203.37 |
| Wet Unit Wt., g _m (pcf) | 29.2 | 63.8 |
| Dry Unit Wt., g _d (pcf) | 25.9 | 21.0 |
| Volume solids (cm ³) | 29.93 | 29.93 |
| Volume of voids (cm ³) | 197.57 | 205.27 |
| Void ratio, e | 6.60 | 6.41 |
| Porosity, n | 0.87 | 0.86 |
| Volumetric moisture, T | 0.05 | 0.86 |
| Saturation, S (%) | 6.2 | 100.0 |
| Gs, from mix design | | 3.14 |

| Cell No. / Base No. / Top No. | A1 | A2 | A3 |
|------------------------------------|---------------|------|---------|
| pw (gm/cm ³) | | 1.00 | Assumed |
| Permeant liquid used | deaired water | | |
| Total backpressure (psi) | 79 | | |
| Effective horiz. con. stress (psi) | 5 | | |
| Effective vert. con. stress (psi) | 5 | | |

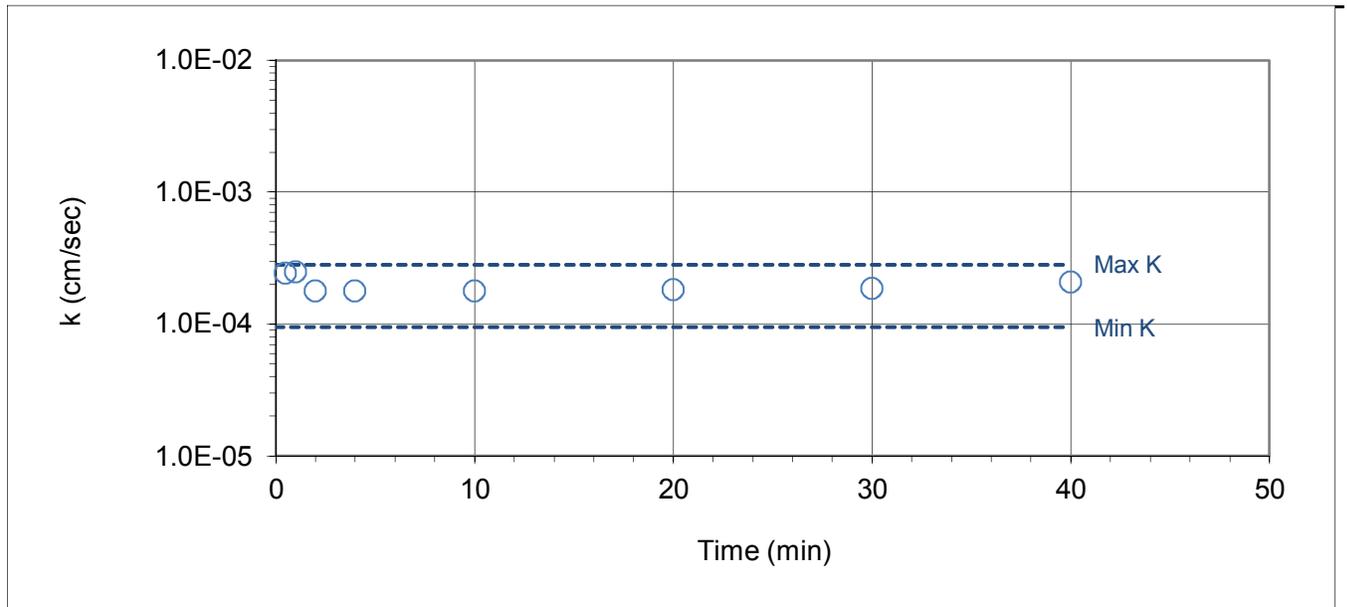
| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| B value | 0.12 | 0.54 |
| External Burette (cm ³) | 10.00 | 18.10 |
| Cell Pressure (psi) | 5.0 | 84.0 |

| | |
|--|---------------|
| System volume coefficient (cm ³ /psi) | 0.20 |
| System volume change (cm ³) | 15.80 |
| Net sample volume change (cm ³) | 7.70 |
| Base burette ground length, l _b (cm) | 69.5 |
| Top burette ground length, l _t (cm) | 69.5 |
| Pipet area, a _{pi} / a _{po} (cm ²) | 0.865 / 0.865 |
| Annulus area, a _{ai} / a _{ao} (cm ²) | 3.105 / 4.176 |
| Conversion, reading to cm head (cm/rd) | 1.156 |

^a Saturation set to 100% for phase calculations

K average last 4 values = 1.9E-04

^b K corrected to 20°C



Project: **Cell Crete**

No: **14GCI498**

Cellular concrete type: **Class II**

Sample: **Sample 13**

Cast date: **17-Jul-14**

Sample description: **Cellular concrete cast on 7/17/14**

Permeability Data

| time (min) | time (sec) | Burrett reading | | hp (psi) | $h_{(i/f)}$ (cm) | i | K (cm/sec) | Avg. Temp (°C) | Visc. Ratio Rt | Pore Vol | K^b (cm/sec) |
|---------------|---------------|-----------------|-------|-------------|---------------------|-----|---------------|----------------------|----------------------|-------------|-------------------|
| | | Base | Top | | | | | | | | |
| 0 | [Annulus] | 0.00 | 25.00 | 0.5 | 64.1 | 8.4 | | | | | |
| 0.5 | 30 | 0.60 | 24.60 | 0.5 | 62.9 | 8.3 | 2.7E-04 | 23.9 | 0.91 | 0.01 | 2.4E-04 |
| 0.5 | 30 | 1.20 | 24.20 | 0.5 | 61.7 | 8.1 | 2.7E-04 | 23.9 | 0.91 | 0.02 | 2.5E-04 |
| 1.0 | 60 | 2.00 | 23.60 | 0.5 | 60.1 | 7.9 | 1.9E-04 | 23.9 | 0.91 | 0.03 | 1.8E-04 |
| 2.0 | 120 | 3.60 | 22.50 | 0.5 | 57.0 | 7.5 | 1.9E-04 | 23.9 | 0.91 | 0.06 | 1.8E-04 |
| 6.0 | 360 | 8.00 | 19.60 | 0.5 | 48.6 | 6.4 | 2.0E-04 | 23.9 | 0.91 | 0.14 | 1.8E-04 |
| 10.0 | 600 | 14.00 | 15.60 | 0.5 | 37.0 | 4.9 | 2.0E-04 | 23.9 | 0.91 | 0.24 | 1.8E-04 |
| 10.0 | 600 | 18.70 | 12.50 | 0.5 | 28.0 | 3.7 | 2.0E-04 | 23.9 | 0.91 | 0.32 | 1.9E-04 |
| 10.0 | 600 | 22.60 | 9.90 | 0.5 | 20.5 | 2.7 | 2.3E-04 | 23.9 | 0.91 | 0.38 | 2.1E-04 |

K average last 4 values = 1.9E-04

^b *K corrected to 20°C*

Hydraulic Conductivity Test - Back Pressure, Flexible Wall

after ASTM D5084 Method C



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: Sample 13

Cast date: 17-Jul-14

Sample description: Cellular concrete cast on 7/17/14

Date: 4-Aug-14

USCS classification: not applicable

Tested by: zmg

Sample type: cast

Reduced by: zmg

Age of sample (days): 18

Reviewed by: rbm/rtc

Comments:

Initial sample moisture content was back calculated from the oven dried sample after

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| Sample Height, H (in) | 2.996 | 2.996 |
| Sample Diameter, D (in) | 2.429 | 2.478 |
| Sample Length, L (cm) | 7.610 | 7.610 |
| Sample Area, A (cm ²) | 29.896 | 31.105 |
| Sample Volume, V (cm ³) | 227.50 | 236.70 |
| Wt. Rings + Wet Soil (g) | 106.45 | 240.54 |
| Wt. Rings (g) | 0.00 | 0.00 |
| Wet Soil + Tare (g) | 210.29 | 385.78 |
| Dry Soil + Tare (g) | 200.62 | 224.53 |
| Tare (g) | 125.62 | 145.24 |
| Weight of solids, Ws (g) | 94.29 | 94.29 |
| Moisture Content, w (%) | 12.89 | 203.37 |
| Wet Unit Wt., g _m (pcf) | 29.2 | 63.4 |
| Dry Unit Wt., g _d (pcf) | 25.9 | 20.9 |
| Volume solids (cm ³) | 29.93 | 29.93 |
| Volume of voids (cm ³) | 197.57 | 206.77 |
| Void ratio, e | 6.60 | 6.41 |
| Porosity, n | 0.87 | 0.86 |
| Volumetric moisture, T | 0.05 | 0.86 |
| Saturation, S (%) | 6.2 | 100.0 |
| G _s , from mix design | | 3.14 |

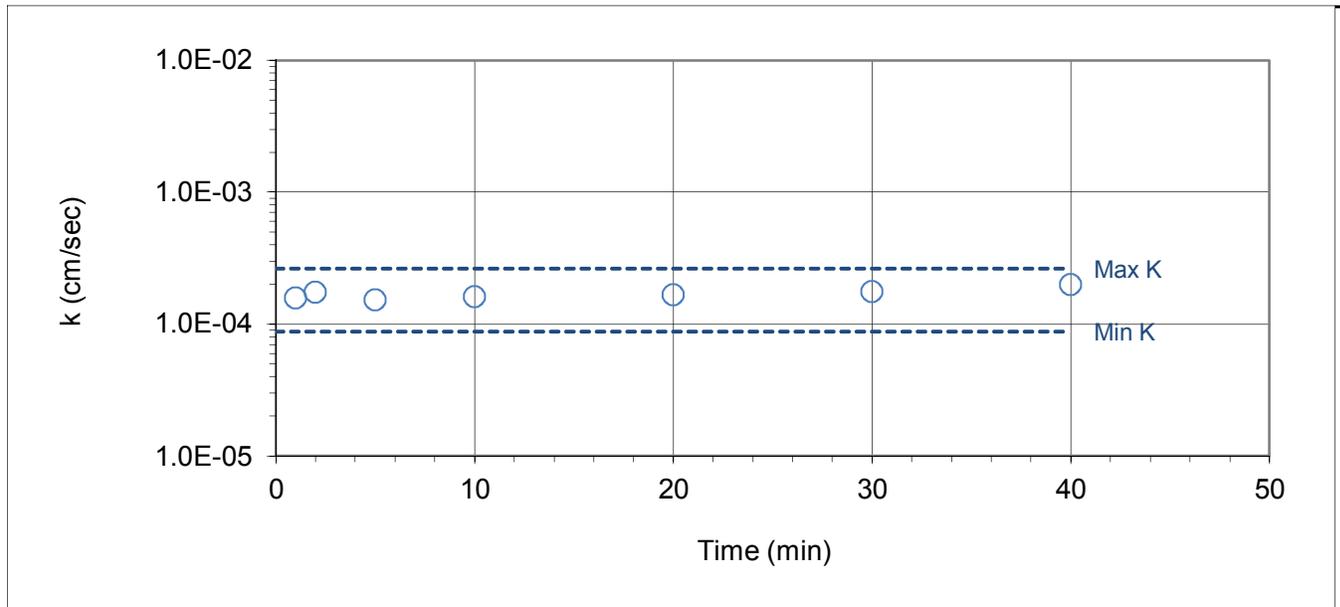
| Cell No. / Base No. / Top No. | A1 | A2 | A3 |
|-------------------------------------|---------------|-----------|---------|
| pw (gm/cm ³) | | 1.00 | Assumed |
| Permeant liquid used | deaired water | | |
| Total backpressure (psi) | 79 | | |
| Effective horiz. con. stress (psi) | 12.5 | | |
| Effective vert. con. stress (psi) | 12.5 | | |
| | Initial (o) | Final (f) | |
| B value | 0.12 | 0.54 | |
| External Burette (cm ³) | 10.00 | 18.10 | |
| Cell Pressure (psi) | 5.0 | 91.5 | |

| | |
|--|-------------|
| System volume coefficient (cm ³ /psi) | 0.20 |
| System volume change (cm ³) | 17.30 |
| Net sample volume change (cm ³) | 9.20 |
| Base burette ground length, l _b (cm) | 69.5 |
| Top burette ground length, l _t (cm) | 69.5 |
| Pipet area, a _{pi} / a _{po} (cm ²) | 0.865 0.865 |
| Annulus area, a _{ai} / a _{ao} (cm ²) | 3.105 4.176 |
| Conversion, reading to cm head (cm/rd) | 1.156 |

^a Saturation set to 100% for phase calculations

K average last 4 values = 1.7E-04

^b K corrected to 20°C



Project: **Cell Crete**

No: **14GCI498**

Cellular concrete type: **Class II**

Sample: **Sample 13**

Cast date: **17-Jul-14**

Sample description: **Cellular concrete cast on 7/17/14**

Permeability Data

| time (min) | time (sec) | Burrett reading | | hp (psi) | $h_{(i/f)}$ (cm) | i | K (cm/sec) | Avg. Temp (°C) | Visc. Ratio Rt | Pore Vol | K^b (cm/sec) |
|---------------|---------------|-----------------|-------|-------------|---------------------|-----|---------------|----------------------|----------------------|-------------|-------------------|
| | | Base | Top | | | | | | | | |
| 0 | [Annulus] | 0.00 | 25.00 | 0.5 | 64.1 | 8.4 | | | | | |
| 1.0 | 60 | 0.70 | 24.40 | 0.5 | 62.6 | 8.2 | 1.7E-04 | 23.9 | 0.91 | 0.01 | 1.6E-04 |
| 1.0 | 60 | 1.50 | 23.80 | 0.5 | 60.9 | 8.0 | 1.9E-04 | 23.9 | 0.91 | 0.03 | 1.7E-04 |
| 3.0 | 180 | 3.60 | 22.40 | 0.5 | 56.9 | 7.5 | 1.7E-04 | 23.9 | 0.91 | 0.06 | 1.5E-04 |
| 5.0 | 300 | 6.90 | 20.10 | 0.5 | 50.4 | 6.6 | 1.8E-04 | 23.9 | 0.91 | 0.12 | 1.6E-04 |
| 10.0 | 600 | 12.70 | 16.20 | 0.5 | 39.2 | 5.2 | 1.8E-04 | 23.9 | 0.91 | 0.22 | 1.7E-04 |
| 10.0 | 600 | 17.50 | 13.10 | 0.5 | 30.1 | 4.0 | 1.9E-04 | 23.9 | 0.91 | 0.30 | 1.8E-04 |
| 10.0 | 600 | 21.50 | 10.40 | 0.5 | 22.3 | 2.9 | 2.2E-04 | 23.9 | 0.91 | 0.37 | 2.0E-04 |

K average last 4 values = 1.7E-04

^b *K corrected to 20°C*

Hydraulic Conductivity Test - Back Pressure, Flexible Wall

after ASTM D5084 Method C



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: Sample 19

Cast date: 17-Jul-14

Sample description: Cellular concrete cast on 7/17/14

Date: 14-Aug-14

USCS classification: not applicable

Tested by: zmg

Sample type: cast

Reduced by: zmg

Age of sample (days): 28

Reviewed by: rbm/rtc

Comments:

Initial sample moisture content was back calculated from the oven dried sample after

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| Sample Height, H (in) | 3.237 | 3.237 |
| Sample Diameter, D (in) | 2.432 | 2.438 |
| Sample Length, L (cm) | 8.222 | 8.222 |
| Sample Area, A (cm ²) | 29.970 | 30.116 |
| Sample Volume, V (cm ³) | 246.41 | 247.61 |
| Wt. Rings + Wet Soil (g) | 107.08 | 266.52 |
| Wt. Rings (g) | 0.00 | 0.00 |
| Wet Soil + Tare (g) | 215.36 | 413.90 |
| Dry Soil + Tare (g) | 201.90 | 233.55 |
| Tare (g) | 127.23 | 147.88 |
| Weight of solids, Ws (g) | 90.73 | 90.73 |
| Moisture Content, w (%) | 18.03 | 210.52 |
| Wet Unit Wt., g _m (pcf) | 27.1 | 67.2 |
| Dry Unit Wt., g _d (pcf) | 23.0 | 21.6 |
| Volume solids (cm ³) | 28.80 | 28.80 |
| Volume of voids (cm ³) | 217.61 | 218.81 |
| Void ratio, e | 7.56 | 6.63 |
| Porosity, n | 0.88 | 0.87 |
| Volumetric moisture, T | 0.07 | 0.87 |
| Saturation, S (%) | 7.5 | 100.0 |
| Gs, from mix design | | 3.14 |

Cell No. / Base No. / Top No. A1 A2 A3
pw (gm/cm³) 1.00 Assumed
Permeant liquid used deaired water

Total backpressure (psi) 80

Effective horiz. con. stress (psi) 5

Effective vert. con. stress (psi) 5

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| B value | 0.02 | 0.62 |
| External Burette (cm ³) | 0.00 | 14.80 |
| Cell Pressure (psi) | 5.0 | 85.0 |

System volume coefficient (cm³/psi) 0.20

System volume change (cm³) 16.00

Net sample volume change (cm³) 1.20

Base burette ground length, l_b (cm) 69.5

Top burette ground length, l_t (cm) 69.5

Pipet area, a_{pi} / a_{po} (cm²) 0.865 0.865

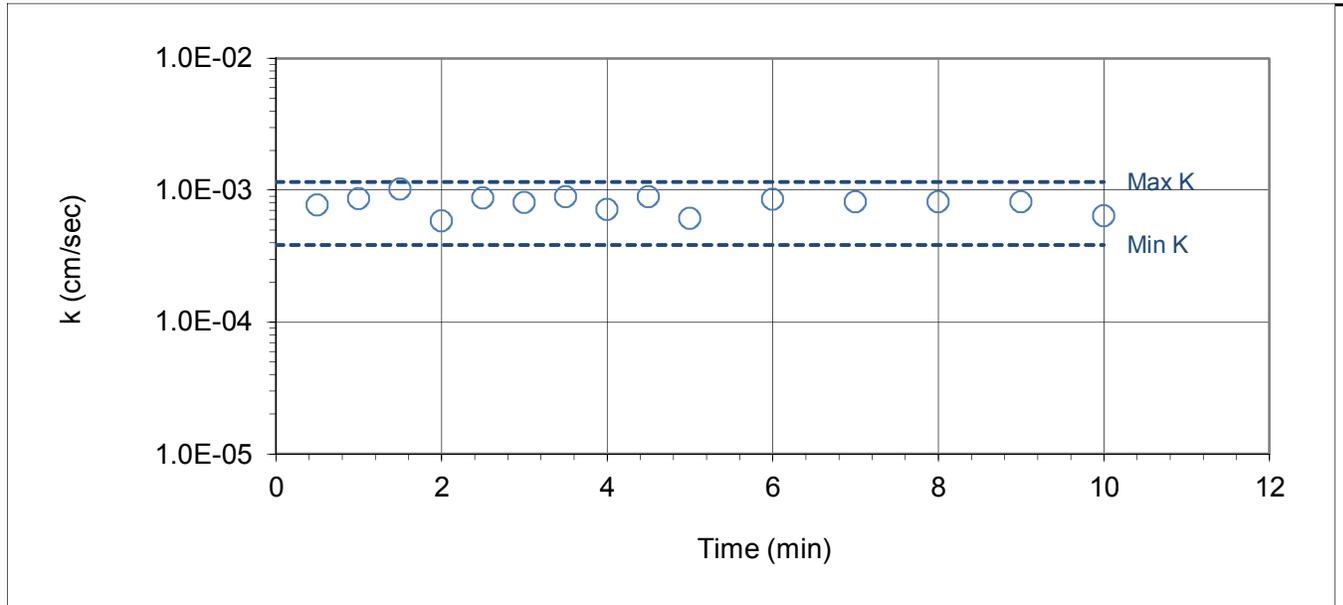
Annulus area, a_{ai} / a_{ao} (cm²) 3.105 4.176

Conversion, reading to cm head (cm/rd) 1.156

^a Saturation set to 100% for phase calculations

K average last 4 values = 7.7E-04

^b K corrected to 20°C



Project: Cell Crete

Cellular concrete type: Class II

No: 14GCI498

Sample: Sample 19

Cast date: 17-Jul-14

Sample description: Cellular concrete cast on 7/17/14

Permeability Data

| time (min) | time (sec) | Burrett reading | | hp (psi) | $h_{(i/f)}$ (cm) | i | K (cm/sec) | Avg. Temp (°C) | Visc. Ratio Rt | Pore Vol | K^b (cm/sec) |
|---------------|---------------|-----------------|-------|-------------|---------------------|-----|---------------|----------------------|----------------------|-------------|-------------------|
| | | Base | Top | | | | | | | | |
| 0 | [pipet] | 0.00 | 25.00 | 0.0 | 28.9 | 3.5 | | | | | |
| 0.5 | 30 | 2.20 | 22.40 | 0.0 | 23.4 | 2.8 | 8.4E-04 | 23.9 | 0.91 | 0.01 | 7.7E-04 |
| 0.5 | 30 | 4.60 | 20.50 | 0.0 | 18.4 | 2.2 | 9.4E-04 | 23.9 | 0.91 | 0.02 | 8.6E-04 |
| 0.5 | 30 | 6.80 | 18.80 | 0.0 | 13.9 | 1.7 | 1.1E-03 | 23.9 | 0.91 | 0.03 | 1.0E-03 |
| 0.5 | 30 | 7.50 | 17.70 | 0.0 | 11.8 | 1.4 | 6.4E-04 | 23.9 | 0.91 | 0.03 | 5.8E-04 |
| 0.5 | 30 | 8.60 | 16.60 | 0.0 | 9.2 | 1.1 | 9.6E-04 | 23.9 | 0.91 | 0.04 | 8.7E-04 |
| 0.5 | 30 | 9.40 | 15.80 | 0.0 | 7.4 | 0.9 | 8.8E-04 | 23.9 | 0.91 | 0.04 | 8.0E-04 |
| 0.5 | 30 | 10.10 | 15.10 | 0.0 | 5.8 | 0.7 | 9.7E-04 | 23.9 | 0.91 | 0.05 | 8.9E-04 |
| 0.5 | 30 | 10.60 | 14.70 | 0.0 | 4.7 | 0.6 | 7.8E-04 | 23.9 | 0.91 | 0.05 | 7.1E-04 |
| 0.5 | 30 | 11.00 | 14.20 | 0.0 | 3.7 | 0.4 | 9.8E-04 | 23.9 | 0.91 | 0.05 | 8.9E-04 |
| 0.5 | 30 | 11.30 | 14.00 | 0.0 | 3.1 | 0.4 | 6.7E-04 | 23.9 | 0.91 | 0.05 | 6.1E-04 |
| | [pipet] | 0.00 | 25.00 | 0.0 | 28.9 | 3.5 | | | | | |
| 1.0 | 60 | 4.60 | 20.20 | 0.0 | 18.0 | 2.2 | 9.3E-04 | 23.9 | 0.91 | 0.07 | 8.5E-04 |
| 1.0 | 60 | 7.50 | 17.40 | 0.0 | 11.4 | 1.4 | 8.9E-04 | 23.9 | 0.91 | 0.09 | 8.2E-04 |
| 1.0 | 60 | 9.30 | 15.60 | 0.0 | 7.3 | 0.9 | 8.9E-04 | 23.9 | 0.91 | 0.09 | 8.1E-04 |
| 1.0 | 60 | 10.50 | 14.50 | 0.0 | 4.6 | 0.6 | 8.9E-04 | 23.9 | 0.91 | 0.10 | 8.2E-04 |
| 1.0 | 60 | 11.10 | 13.90 | 0.0 | 3.2 | 0.4 | 7.0E-04 | 23.9 | 0.91 | 0.10 | 6.4E-04 |

K average last 4 values = 7.7E-04

^b K corrected to 20°C

Hydraulic Conductivity Test - Back Pressure, Flexible Wall

after ASTM D5084 Method C



Project: Cell Crete

No: 14GCI498

Cast date: 17-Jul-14

Date: 15-Aug-14

Tested by: zmg

Reduced by: zmg

Reviewed by: rbm/rtc

Cellular concrete type: Class II

Sample: Sample 19

Sample description: Cellular concrete cast on 7/17/14

USCS classification: not applicable

Sample type: cast

Age of sample (days): 29

Comments:

Initial sample moisture content was back calculated from the oven dried sample after

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| Sample Height, H (in) | 3.237 | 3.237 |
| Sample Diameter, D (in) | 2.432 | 2.432 |
| Sample Length, L (cm) | 8.222 | 8.222 |
| Sample Area, A (cm ²) | 29.970 | 29.982 |
| Sample Volume, V (cm ³) | 246.41 | 246.51 |
| Wt. Rings + Wet Soil (g) | 107.08 | 266.52 |
| Wt. Rings (g) | 0.00 | 0.00 |
| Wet Soil + Tare (g) | 215.36 | 413.90 |
| Dry Soil + Tare (g) | 201.90 | 233.55 |
| Tare (g) | 127.23 | 147.88 |
| Weight of solids, Ws (g) | 90.73 | 90.73 |
| Moisture Content, w (%) | 18.03 | 210.52 |
| Wet Unit Wt., g _m (pcf) | 27.1 | 67.5 |
| Dry Unit Wt., g _d (pcf) | 23.0 | 21.7 |
| Volume solids (cm ³) | 28.80 | 28.80 |
| Volume of voids (cm ³) | 217.61 | 217.71 |
| Void ratio, e | 7.56 | 6.63 |
| Porosity, n | 0.88 | 0.87 |
| Volumetric moisture, T | 0.07 | 0.87 |
| Saturation, S (%) | 7.5 | 100.0 |

Gs, from mix design 3.14

^a Saturation set to 100% for phase calculations

Cell No. / Base No. / Top No. A1 A2 A3
pw (gm/cm³) 1.00 Assumed

Permeant liquid used deaired water

Total backpressure (psi) 80

Effective horiz. con. stress (psi) 12.5

Effective vert. con. stress (psi) 12.5

Initial (o) Final (f)

B value 0.02 0.62

External Burette (cm³) 0.00 17.40

Cell Pressure (psi) 5.0 92.5

System volume coefficient (cm³/psi) 0.20

System volume change (cm³) 17.50

Net sample volume change (cm³) 0.10

Base burette ground length, l_b (cm) 69.5

Top burette ground length, l_t (cm) 69.5

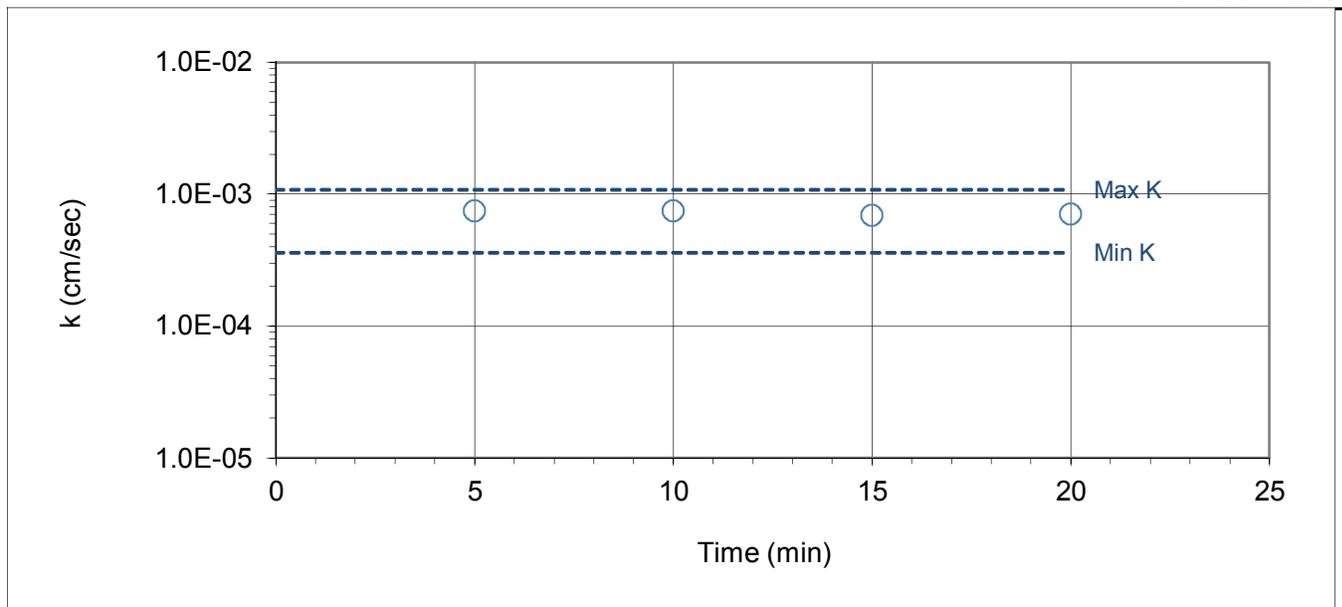
Pipet area, a_{pi} / a_{po} (cm²) 0.865 0.865

Annulus area, a_{ai} / a_{ao} (cm²) 3.105 4.176

Conversion, reading to cm head (cm/rd) 1.156

K average last 4 values = 7.2E-04

^b K corrected to 20°C



Project: **Cell Crete**

No: **14GCI498**

Cellular concrete type: **Class II**

Sample: **Sample 19**

Cast date: **17-Jul-14**

Sample description: **Cellular concrete cast on 7/17/14**

Permeability Data

| time (min) | time (sec) | Burrett reading | | hp (psi) | $h_{(i/f)}$ (cm) | i | K (cm/sec) | Avg. Temp (°C) | Visc. Ratio Rt | Pore Vol | K^b (cm/sec) |
|---------------|---------------|-----------------|-------|-------------|---------------------|-----|---------------|----------------------|----------------------|-------------|-------------------|
| 0 | [pipet] | 0.00 | 25.00 | 0.0 | 28.9 | 3.5 | | | | | |
| 5.0 | 300 | 10.70 | 14.00 | 0.0 | 3.8 | 0.5 | 8.0E-04 | 23.1 | 0.93 | 0.05 | 7.4E-04 |
| | [pipet] | 0.00 | 25.00 | 0.0 | 28.9 | 3.5 | | | | | |
| 5.0 | 300 | 10.70 | 14.00 | 0.0 | 3.8 | 0.5 | 8.0E-04 | 23.1 | 0.93 | 0.10 | 7.4E-04 |
| | [pipet] | 0.00 | 25.00 | 0.0 | 28.9 | 3.5 | | | | | |
| 5.0 | 300 | 10.60 | 14.30 | 0.0 | 4.3 | 0.5 | 7.6E-04 | 23.9 | 0.91 | 0.15 | 6.9E-04 |
| | [pipet] | 0.00 | 25.00 | 0.0 | 28.9 | 3.5 | | | | | |
| 5.0 | 300 | 10.60 | 14.30 | 0.0 | 4.3 | 0.5 | 7.6E-04 | 23.1 | 0.93 | 0.20 | 7.0E-04 |

K average last 4 values = 7.2E-04

^b *K corrected to 20°C*

Infiltration Rate of Pervious Concrete

after ASTM C1701



Project: Cell Crete
No: 14GCI498

Date cast: 17-Jul-14

Date: 4-Aug-14

Tested by: zg

Reduced by: zg

Reviewed by: rbm/rtc

Cellular concrete type: Class II

Sample: Sample 13

Sample description: Cellular concrete cast on 7/17/14

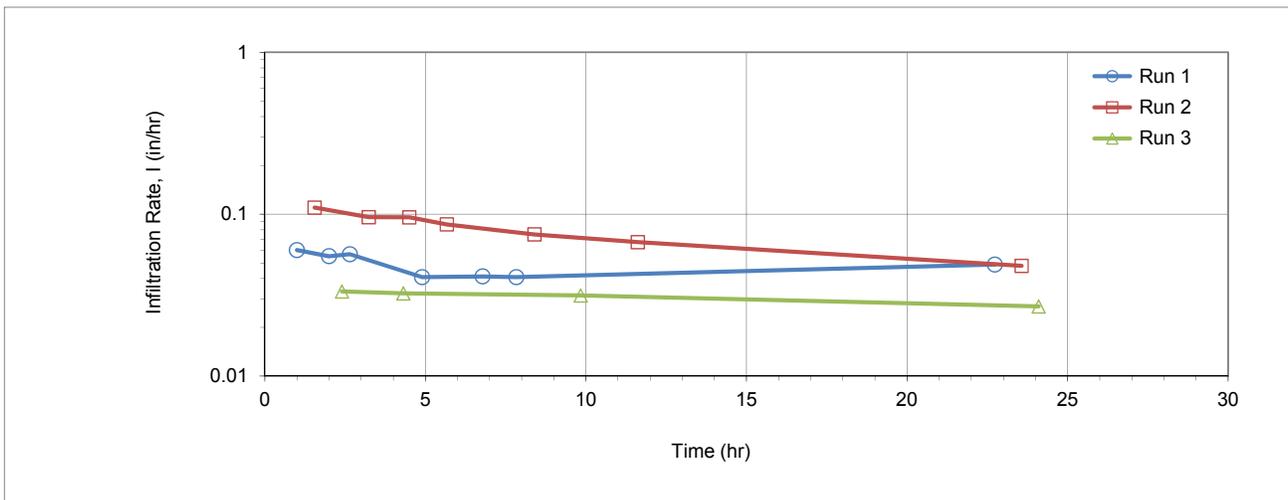
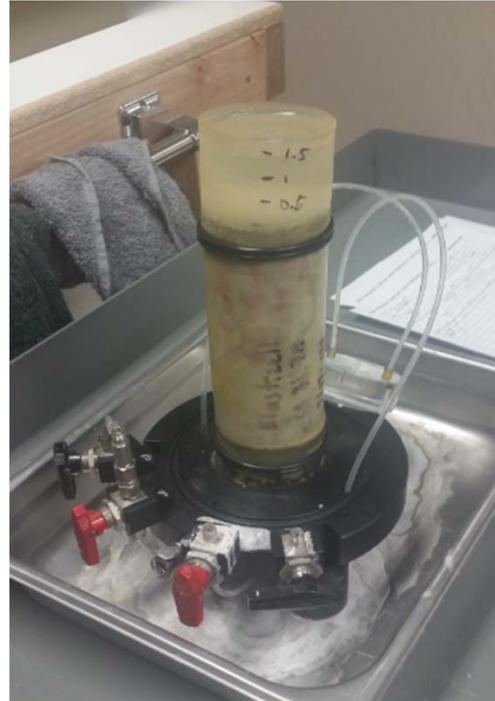
USCS classification: not applicable

Sample type: cast

Age of sample (days): 18

Comments:

| | Initial | Final |
|--------------------------------------|---------|---------|
| | 0° | 5.948 |
| Sample ht., H (in) | 120° | 5.943 |
| | 240° | 5.969 |
| Avg. sample height, Havg (in) | | 5.953 |
| Avg. sample height, Havg (cm) | | 15.121 |
| | top | 2.414 |
| Sample dia., D (in) | mid | 2.418 |
| | bot | 2.414 |
| Avg. sample dia., Davg (in) | | 2.416 |
| Avg. sample dia., Davg (cm) | | 6.137 |
| Avg. area, Aavg (in^2) | | 4.584 |
| Avg. area, Aavg (cm^2) | | 29.577 |
| Wt. rings + wet soil (g) | | 206.78 |
| Wt. rings (g) | | 0.00 |
| Wet Soil + Tare (g) | | 206.78 |
| Dry Soil + Tare (g) | | 171.03 |
| Tare (g) | | 0.00 |
| Moisture Content, w (%) | | 20.90 |
| Volume, Vo (in^3) | | 27.293 |
| Vo (cm^3) | | 447.245 |
| Vo (ft^3) | | 0.0158 |
| diameter of undeformed membrane (in) | | 2.5 |
| diameter of undeformed membrane (cm) | | 6.35 |
| area of undeformed membrane (in^2) | | 4.909 |
| area of undeformedmemb. (cm^2) | | 31.669 |
| Wet unit wt., gm (pcf) | | 28.9 |
| Dry unit wt., gd (pcf) | | 23.9 |
| Gs, from mix design | | 3.15 |



Infiltration Rate of Pervious Concrete

after ASTM C1701



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class II
Sample: Sample 13

| Run Number | Incremental time (min) | Time (min) | Time (hr) | Height from base to meniscus (in) | Head (in) | Infiltration (inch/hr) |
|------------|------------------------|------------|--------------|-----------------------------------|-----------|------------------------|
| Run 1 | | | [start test] | 8.89 | 2.94 | |
| | 60.0 | 60.0 | 1.0 | 8.83 | 2.88 | 0.06 |
| | 60.0 | 120.0 | 2.0 | 8.78 | 2.83 | 0.05 |
| | 39.0 | 159.0 | 2.6 | 8.74 | 2.79 | 0.06 |
| | 135.0 | 294.0 | 4.9 | 8.69 | 2.74 | 0.04 |
| | 113.0 | 407.0 | 6.8 | 8.61 | 2.66 | 0.04 |
| | 63.0 | 470.0 | 7.8 | 8.57 | 2.62 | 0.04 |
| | 894.0 | 1364.0 | 22.7 | 7.78 | 1.83 | 0.05 |
| Run 2 | | | [reset] | 8.95 | 3.00 | |
| | 93.0 | 93.0 | 1.5 | 8.78 | 2.83 | 0.11 |
| | 101.0 | 194.0 | 3.2 | 8.64 | 2.69 | 0.10 |
| | 76.0 | 270.0 | 4.5 | 8.52 | 2.57 | 0.10 |
| | 70.0 | 340.0 | 5.7 | 8.46 | 2.51 | 0.09 |
| | 164.0 | 504.0 | 8.4 | 8.32 | 2.37 | 0.08 |
| | 193.0 | 697.0 | 11.6 | 8.17 | 2.22 | 0.07 |
| | 717.0 | 1414.0 | 23.6 | 7.82 | 1.87 | 0.05 |
| Run 3 | | | [reset] | 8.88 | 2.93 | |
| | 144.0 | 144.0 | 2.4 | 8.80 | 2.85 | 0.03 |
| | 115.0 | 259.0 | 4.3 | 8.74 | 2.79 | 0.03 |
| | 331.0 | 590.0 | 9.8 | 8.57 | 2.62 | 0.03 |
| | 856.0 | 1446.0 | 24.1 | 8.23 | 2.28 | 0.03 |

Slake Durability of Shales and Similar Weak Rocks

After ASTM D 4644



Project: Cell Crete

Cellular concrete type: Class II

No: 14GCI498

Sample: 213-62

Date: 08-Apr-15

Date cast: 13-Feb-15

Tested by: zmg

Description: Cell Crete

Reduced by: zmg

Fluid: Distilled water

Reviewed by: rbm

Age of sample (days): 54

| | | |
|--------------|--|---------|
| Moisture | Wet sample + drum (g) | 1499.82 |
| | Dry sample + drum (g) | 1432.14 |
| | Mass of drum (g) | 1262.14 |
| | Natural moisture content (%) | 39.8 |
| Test Data | Water temperature before 1st cycle (°C) | 26 |
| | Water temperature after 1st cycle (°C) | 26 |
| | Average water temperature 1st cycle (°C) | 26 |
| | Dry sample + drum after 1st cycle (g) | 1405.60 |
| | Water temperature before 2nd cycle (°C) | 26 |
| | Water temperature after 2nd cycle (°C) | 26 |
| | Average water temperature 2nd cycle (°C) | 26 |
| | Dry sample + drum after 2nd cycle (g) | 1370.38 |
| Test Results | Slake durability index; 2nd cycle (%) | 63.7 |
| | Standard verbal description | II |

Photo of Sample Before Test



Photo of Sample After 2nd Cycle



Slake Durability of Shales and Similar Weak Rocks

After ASTM D 4644



Project: Cell Crete

Cellular concrete type: Class II

No: 14GCI498

Sample: 213-63

Date: 08-Apr-15

Date cast: 13-Feb-15

Tested by: zmg

Description: Cell Crete

Reduced by: zmg

Fluid: Distilled water

Reviewed by: rbm

Age of sample (days): 54

| | | |
|--------------|--|---------|
| Moisture | Wet sample + drum (g) | 1505.62 |
| | Dry sample + drum (g) | 1434.81 |
| | Mass of drum (g) | 1260.44 |
| | Natural moisture content (%) | 40.6 |
| Test Data | Water temperature before 1st cycle (°C) | 26 |
| | Water temperature after 1st cycle (°C) | 26 |
| | Average water temperature 1st cycle (°C) | 26 |
| | Dry sample + drum after 1st cycle (g) | 1412.22 |
| | Water temperature before 2nd cycle (°C) | 26 |
| | Water temperature after 2nd cycle (°C) | 26 |
| | Average water temperature 2nd cycle (°C) | 26 |
| | Dry sample + drum after 2nd cycle (g) | 1379.27 |
| Test Results | Slake durability index; 2nd cycle (%) | 68.1 |
| | Standard verbal description | II |

Photo of Sample Before Test



Photo of Sample After 2nd Cycle



APPENDIX -B

LABORATORY TESTING

CLASS IV (LOW DENSITY)

CELLULAR CONCRETE

Table of Contents

| <u>Description</u> | <u>Page #'s</u> |
|---|------------------|
| Triaxial Test - Isotropic Consolidated Sheared Drained (CID) | Class IV(LD)-B01 |
| Triaxial Test - Isotropic Consolidated Sheared Undrained | |
| Measuring Pore Pressure (CIU-PP) | Class IV(LD)-B17 |
| Unconfined Compression of Light Weight Material (UC)..... | Class IV(LD)-B41 |
| K ₀ Consolidation Test Using Strain Controlled Axial Loading and Automated | |
| Lateral Pressure Adjustment | Class IV(LD)-B47 |
| One-Dimensional Consolidation Properties of Soils | Class IV(LD)-B57 |
| Hydraulic Conductivity Test - Back Pressure, Flexible Wall | Class IV(LD)-B61 |
| Infiltration Rate of Pervious Concrete | Class IV(LD)-B65 |
| Slake Durability of Shales and Similar Weak Rocks | Class IV(LD)-B67 |

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755

Project: Cell-Crete

No: 14GCI498

Date cast: 13-Feb-15

Date: 31-Mar-15

Tested by: zmg

Reduced by: zmg

Checked by: rbm/rtc

Cellular concrete type: Class IV (low density)

Sample: 213-20

Sample description: Cell Crete

USCS classification: not requested

Sample type: Cell Crete

Age of sample (days): 46 (at shear)

| Test Number | | S1 | 2.5 psi | |
|------------------------|---|------------|--------------------------------------|--|
| | | Initial | Bef. Shr. MethodA ^d Final | |
| Unit weight data | Sample ht., H (in) | 0° 5.784 | | |
| | | 120° 5.775 | | |
| | | 240° 5.751 | | |
| | Avg. height, Havg (in) | 5.770 | 5.770 | |
| | Avg. height, Havg (cm) | 14.656 | 14.656 | |
| | ΔV_s (cm ³) ^b | | 0.000 | |
| | ΔV_c (cm ³) ^b | | -1.257 | |
| | Ht. change, ΔH_{sc} (in) ^a | | 0.000 | |
| | Sample dia., D (in) | top | 2.995 | |
| | | mid | 2.953 | |
| | | bot | 2.914 | |
| | Avg. dia., Davg (in) | 2.954 | 2.951 | |
| | Avg. dia., Davg (cm) | 7.503 | 7.495 | |
| | Avg. area, Aavg (in ²) | 6.852 | 6.839 | |
| | Avg. area, Aavg (cm ²) | 44.208 | 44.123 | |
| | Wt. rings + wet soil (g) | 350.99 | | |
| | Wt. rings (g) | 0.00 | | |
| | Volume, V _o (in ³) | 39.5 | 39.5 | |
| | V _o (cm ³) | 647.9 | 646.7 | |
| | V _o (ft ³) | 0.0229 | 0.0228 | |
| Moisture | Wet soil + tare (g) | 350.99 | 700.55 | |
| | Dry soil + tare (g) | 246.37 | 390.81 | |
| | Tare (g) | 0.00 | 144.44 | |
| | Moisture content, w (%) | 42.5 | 125.7 | |
| Phase Relationships | G _s , from mix design | 3.15 | | |
| | Mass total (g) | 351.0 | | |
| | Mass of solids (g) | 246.4 | | |
| | Volume (cm ³) | 647.9 | | |
| | Volume of water (cm ³) | 104.6 | | |
| | Volume of solids (cm ³) | 78.2 | | |
| | Volume of voids (cm ³) | 569.7 | | |
| | Volume of air (cm ³) | 465.1 | | |
| | Void ratio, e | 7.284 | | |
| | Porosity, n | 0.879 | | |
| | Volumetric moisture, T | 0.161 | | |
| | Saturation, S (%) ^c | 18.36 | | |
| | Dry density (gm/cm ³) | 0.380 | | |
| Wet unit wt., gm (pcf) | 33.8 | | | |
| Dry unit wt., gd (pcf) | 23.7 | | | |

Photo of sample after testing



Notes:

- ^a ΔH_{sc} (in) = change in height during saturation and consolidation
- ^b ΔV_s = change in volume during saturation, ΔV_c = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where A_c (Method A) = $(V_o - DV_s - DV_c) / (H_o - DH_{sc})$

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete

Cellular concrete type: Class IV (low density)

No: 14GCI498

Sample: 213-20

Date cast: 13-Feb-15

Sample description: Cell Crete

Date: 31-Mar-15

USCS classification: not requested

Tested by: zmg

Sample type: Cell Crete

X:\PROJECTS\14GCI498 Cell Crete Lab Testing\TX_CD1pts_TypeIV_2-5psi-v01.xlsx]SUM

| Test Number | S1 at 2.5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 80.0 |
| | Skempton B | 0.83 |
| | t-90 (min) | 1.1 |
| | t-100 (min) | |
| | t-50 (min) | 0.3 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | yes |
| | Filter paper correction | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 4.77 |
| | Time to failure, tf (min) | 47.7 |
| | Confining stress, s'3 (psi) | 2.5 |
| | Deviator stress, s1-s3 (psi) | 98.9 |
| | Obliquity, s'1/s'3 | 39.335 |
| | Vol. strain at failure, ev (%) | -3.27 |
| | $q = q' = (s1-s3)/2$ (psi) | 49.4 |
| | $p' = (s'1+s'3)/2$ (psi) | 52.0 |
| | Effective major principal stress, s'1 (psi) | 101.5 |
| Effective minor principal stress, s'3 (psi) | 2.6 | |

Comments:

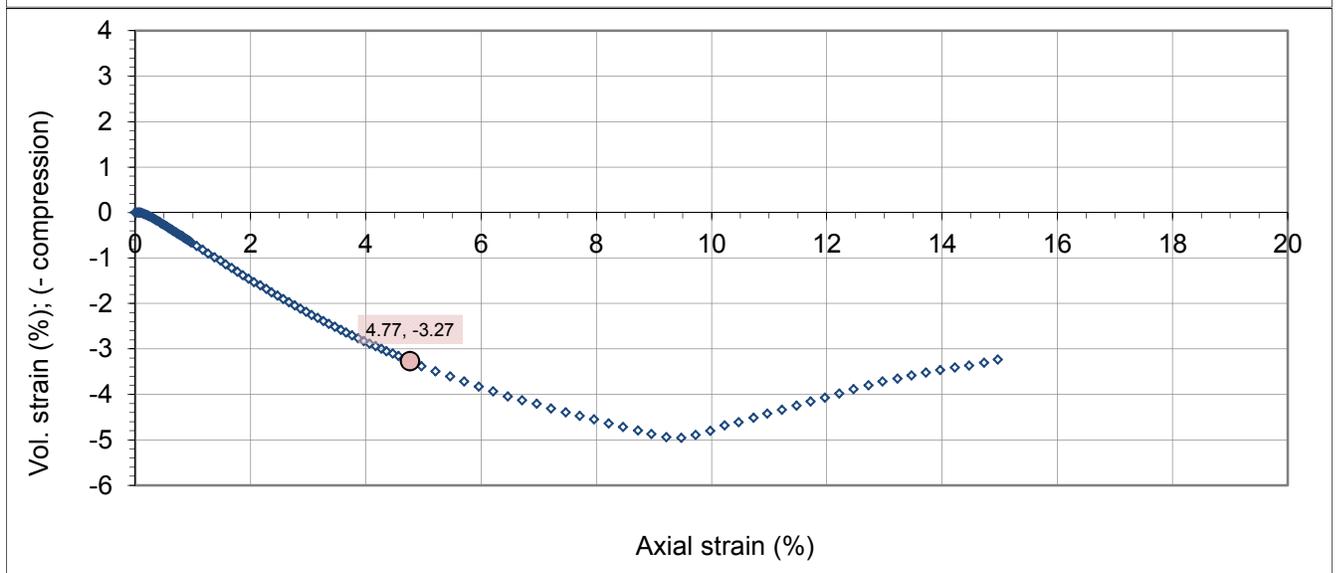
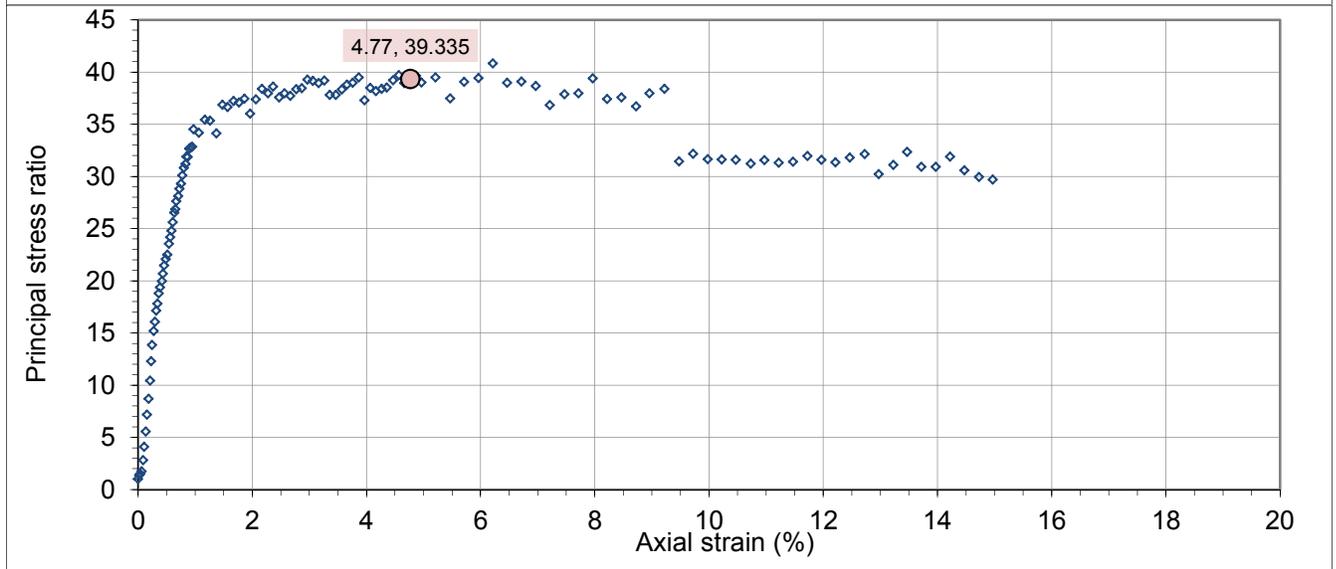
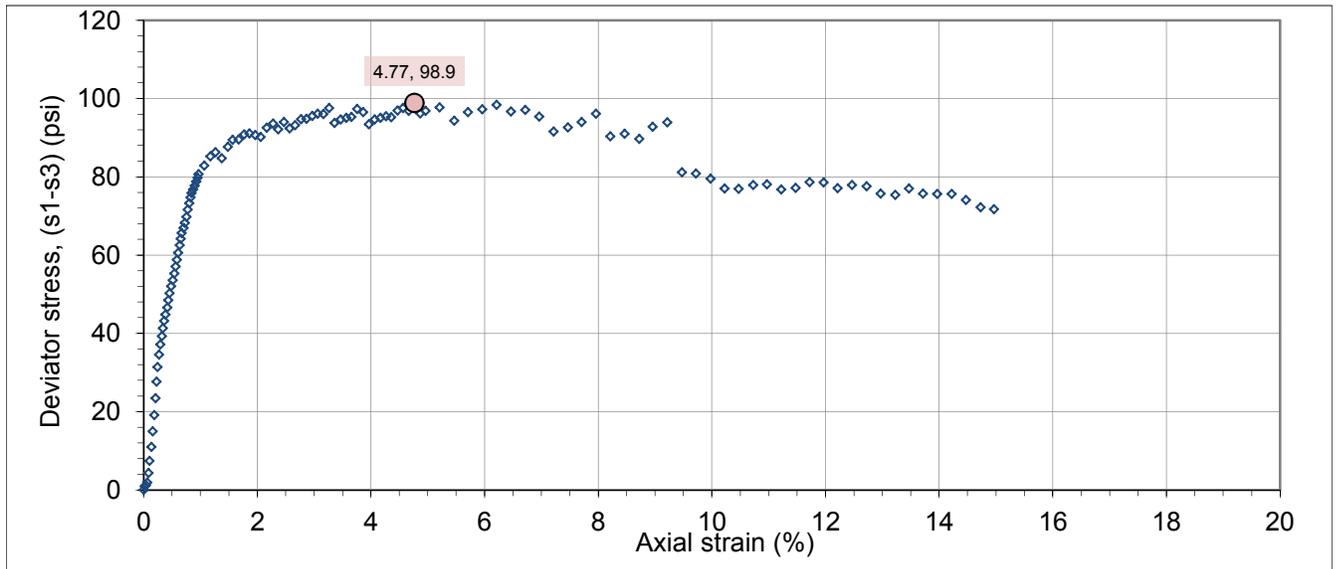
Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete
No: 14GCI498

Cellular concrete type: Class IV (low density)
Sample: 213-20



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



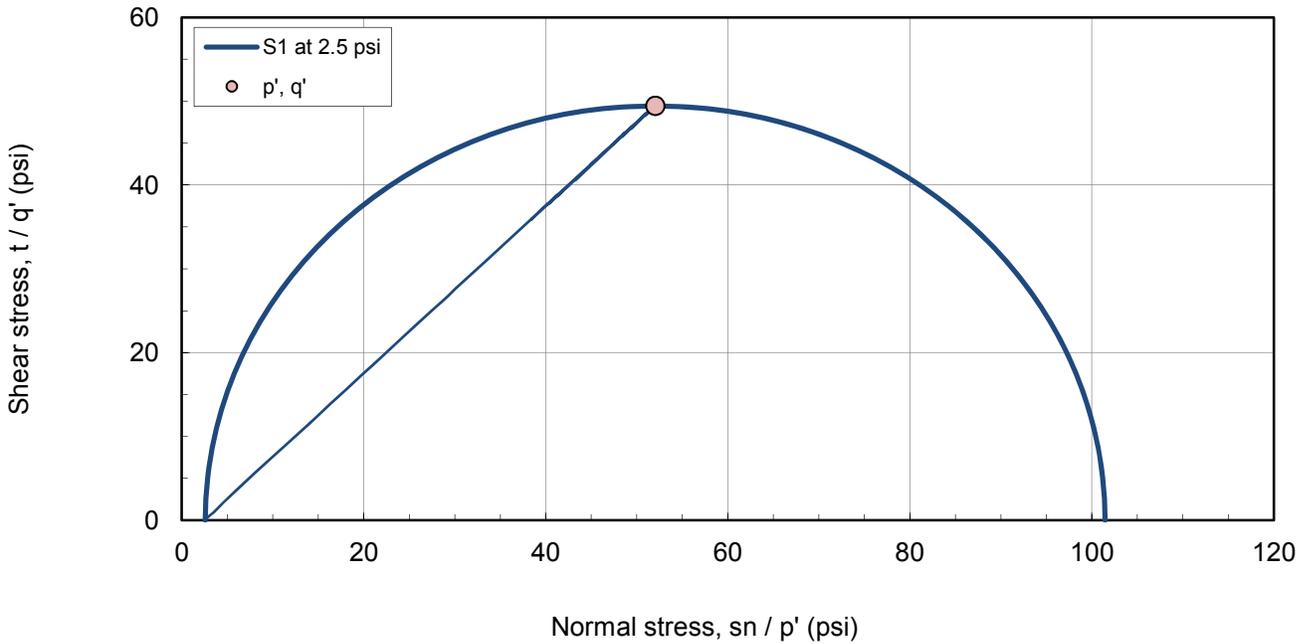
Project: Cell-Crete

Cellular concrete type: Class IV (low density)

No: 14GCI498

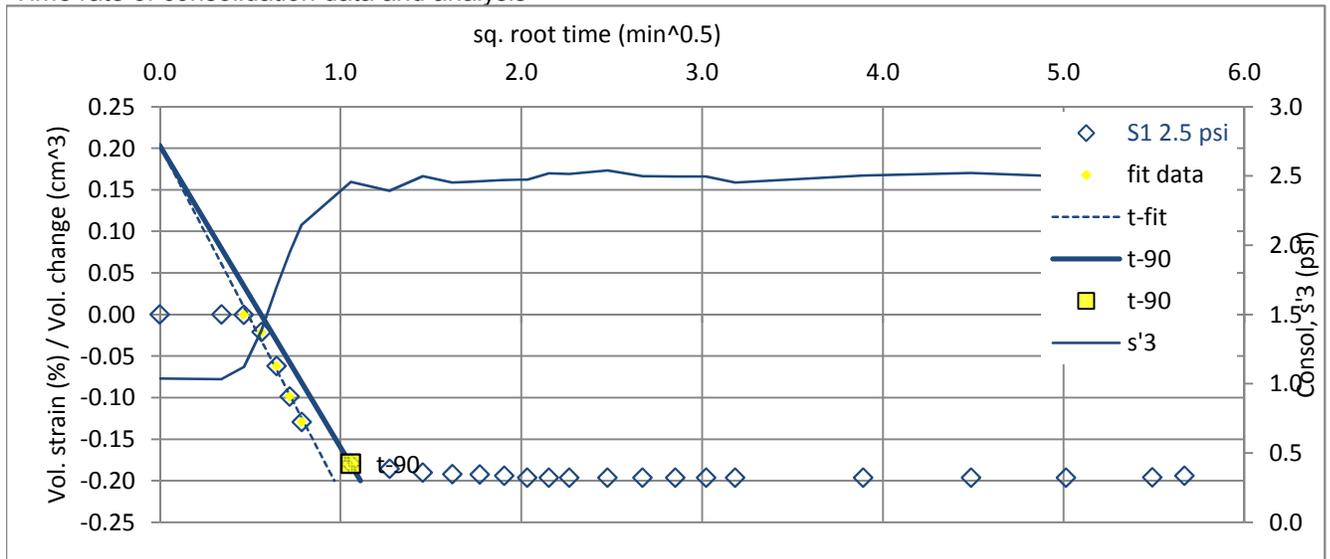
Sample: 213-20

Effective stress results



Peak deviator stress (s1-s3), failure criteria Mohr and p' - q' space plots

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755

Project: **Cell-Crete**

No: **14GCI498**

Date cast: **13-Feb-15**

Date: **27-Mar-15**

Tested by: **zmg**

Reduced by: **zmg**

Checked by: **rbm/rtc**

Cellular concrete type: **Class IV (low density)**

Sample: **213-40**

Sample description: **Cell Crete**

USCS classification: **not requested**

Sample type: **Cell Crete**

Age of sample (days): **42** (at shear)

| | Test Number | S1 | | 5 psi | |
|------------------------|---|-----------------------------------|---------------------------------|--------|--|
| | | Initial | Bef. Shr. Method A ^d | Final | |
| Unit weight data | 0° | 5.753 | | | |
| | Sample ht., H (in) 120° | 5.766 | | | |
| | 240° | 5.752 | | | |
| | Avg. height, Havg (in) | 5.757 | 5.757 | | |
| | Avg. height, Havg (cm) | 14.623 | 14.623 | | |
| | ΔV_s (cm ³) ^b | | 0.000 | | |
| | ΔV_c (cm ³) ^b | | -0.553 | | |
| | Ht. change, ΔH_{sc} (in) ^a | | 0.000 | | |
| | Sample dia., D (in) top | 2.981 | | | |
| | mid | 2.953 | | | |
| | bot | 2.913 | | | |
| | Avg. dia., Davg (in) | 2.950 | 2.949 | | |
| | Avg. dia., Davg (cm) | 7.493 | 7.490 | | |
| | Avg. area, Aavg (in ²) | 6.835 | 6.829 | | |
| | Avg. area, Aavg (cm ²) | 44.096 | 44.058 | | |
| | Wt. rings + wet soil (g) | 325.41 | | | |
| | Wt. rings (g) | 0.00 | | | |
| | Volume, V _o (in ³) | 39.3 | 39.3 | | |
| | V _o (cm ³) | 644.8 | 644.3 | | |
| | | V _o (ft ³) | 0.0228 | 0.0228 | |
| Moisture | Wet soil + tare (g) | 325.41 | | 703.01 | |
| | Dry soil + tare (g) | 221.86 | | 394.92 | |
| | Tare (g) | 0.00 | | 173.06 | |
| | Moisture content, w (%) | 46.7 | | 138.9 | |
| Phase Relationships | G _s , from mix design | 3.15 | | | |
| | Mass total (g) | 325.4 | | | |
| | Mass of solids (g) | 221.9 | | | |
| | Volume (cm ³) | 644.8 | | | |
| | Volume of water (cm ³) | 103.6 | | | |
| | Volume of solids (cm ³) | 70.4 | | | |
| | Volume of voids (cm ³) | 574.4 | | | |
| | Volume of air (cm ³) | 470.8 | | | |
| | Void ratio, e | 8.155 | | | |
| | Porosity, n | 0.891 | | | |
| | Volumetric moisture, T | 0.161 | | | |
| | Saturation, S (%) ^c | 18.03 | | | |
| | Dry density (gm/cm ³) | 0.344 | | | |
| Wet unit wt., gm (pcf) | 31.5 | | | | |
| Dry unit wt., gd (pcf) | 21.5 | | | | |

Photo of sample after testing



Notes:

^a ΔH_{sc} (in) = change in height during saturation and consolidation

^b ΔV_s = change in volume during saturation, ΔV_c = change in volume during consolidation

^c Saturation before shear set to 100% for phase calculations

^d Before shear Aavg using method A; where A_c (Method A) = $(V_o - DV_s - DV_c) / (H_o - DH_{sc})$

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete

Cellular concrete type: Class IV (low density)

No: 14GCI498

Sample: 213-40

Date cast: 13-Feb-15

Sample description: Cell Crete

Date: 27-Mar-15

USCS classification: not requested

Tested by: zmg

Sample type: Cell Crete

X:\PROJECTS\14GCI498 Cell Crete Lab Testing\TX_CD1pts_TypeIV_5psi-v01.xlsx]SUM

| Test Number | S1 at 5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 85.0 |
| | Skempton B | 0.64 |
| | t-90 (min) | 0.6 |
| | t-100 (min) | |
| | t-50 (min) | 0.1 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | yes |
| | Filter paper correction | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 1.18 |
| | Time to failure, tf (min) | 11.8 |
| | Confining stress, s'3 (psi) | 5.0 |
| | Deviator stress, s1-s3 (psi) | 81.8 |
| | Obliquity, s'1/s'3 | 17.533 |
| | Vol. strain at failure, ev (%) | -0.75 |
| | $q = q' = (s1-s3)/2$ (psi) | 40.9 |
| | $p' = (s'1+s'3)/2$ (psi) | 45.8 |
| | Effective major principal stress, s'1 (psi) | 86.7 |
| Effective minor principal stress, s'3 (psi) | 4.9 | |

Comments:

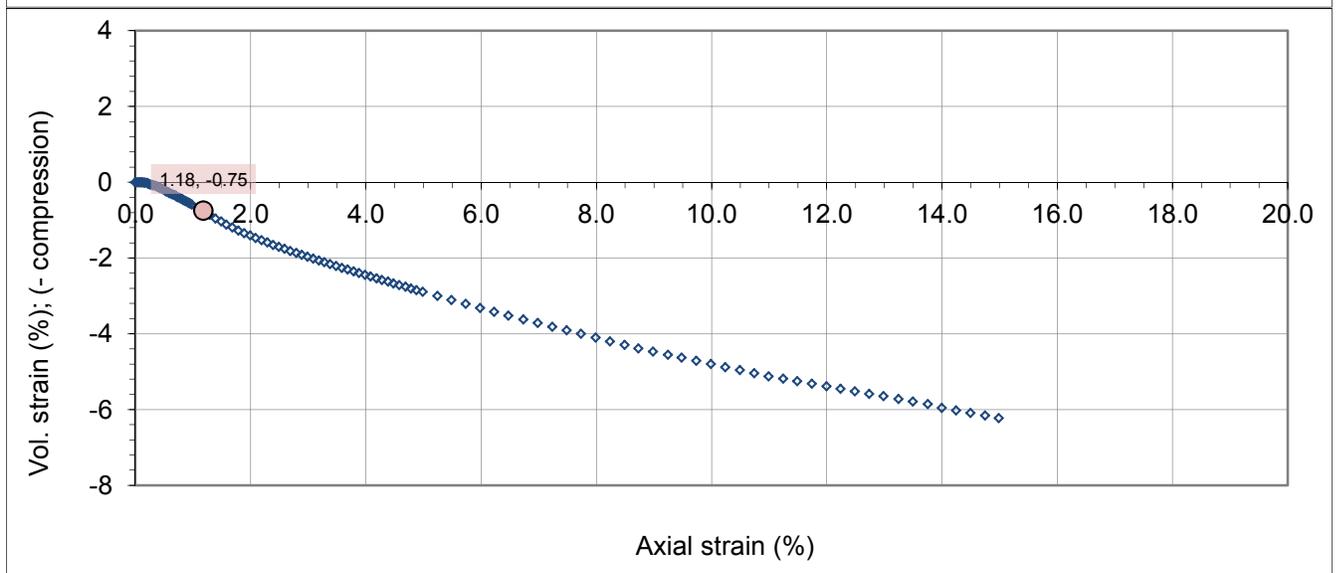
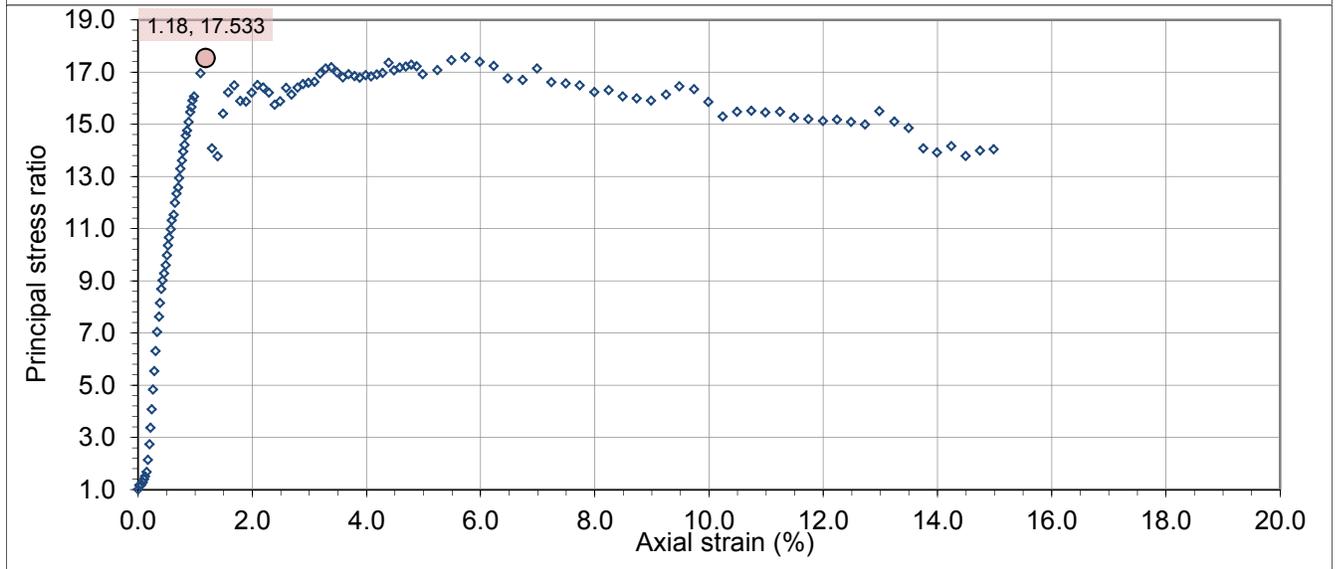
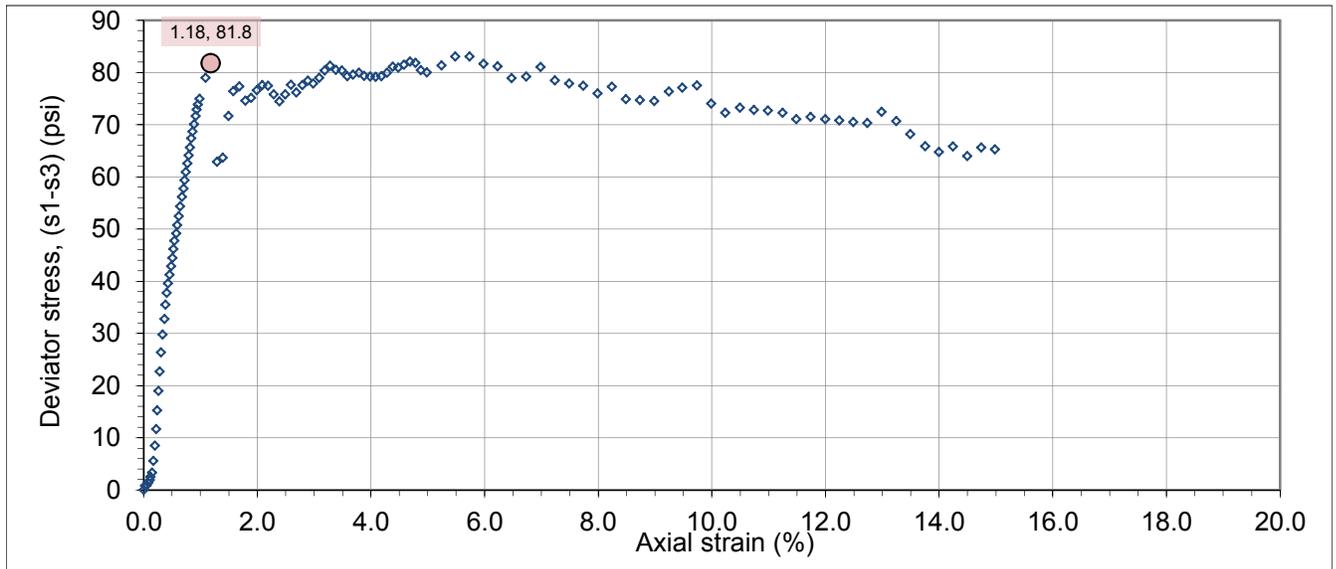
Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete
No: 14GCI498

Cellular concrete type: Class IV (low density)
Sample: 213-40



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



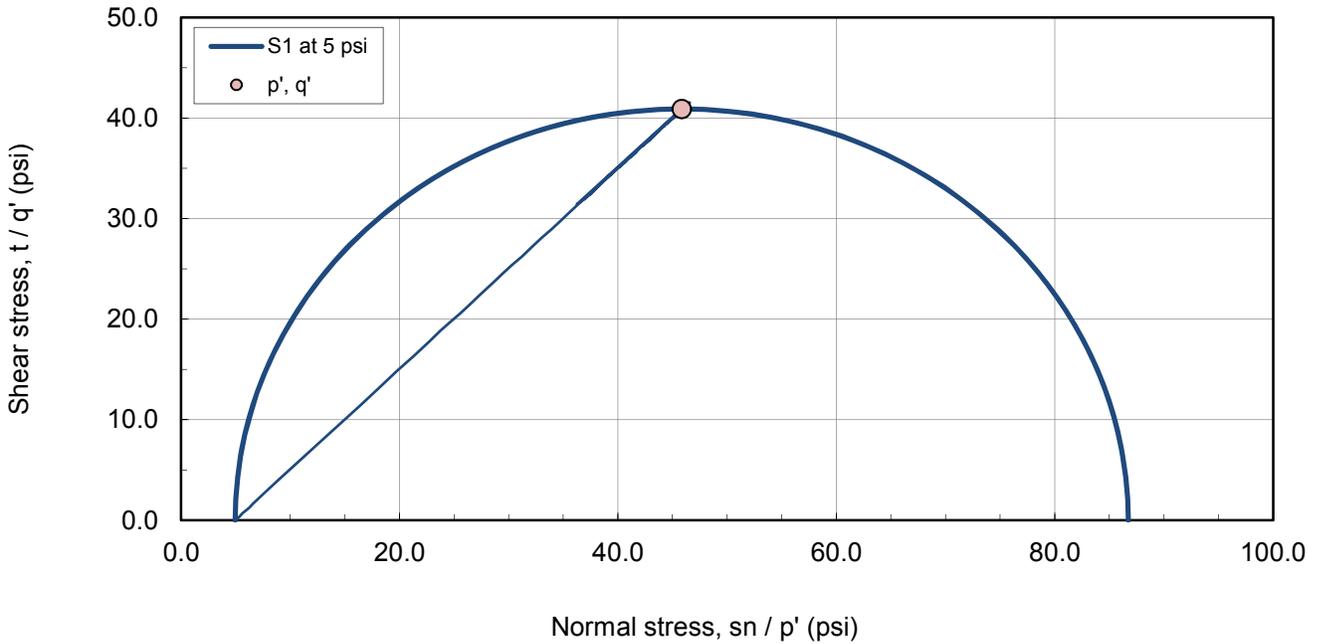
Project: Cell-Crete

Cellular concrete type: Class IV (low density)

No: 14GCI498

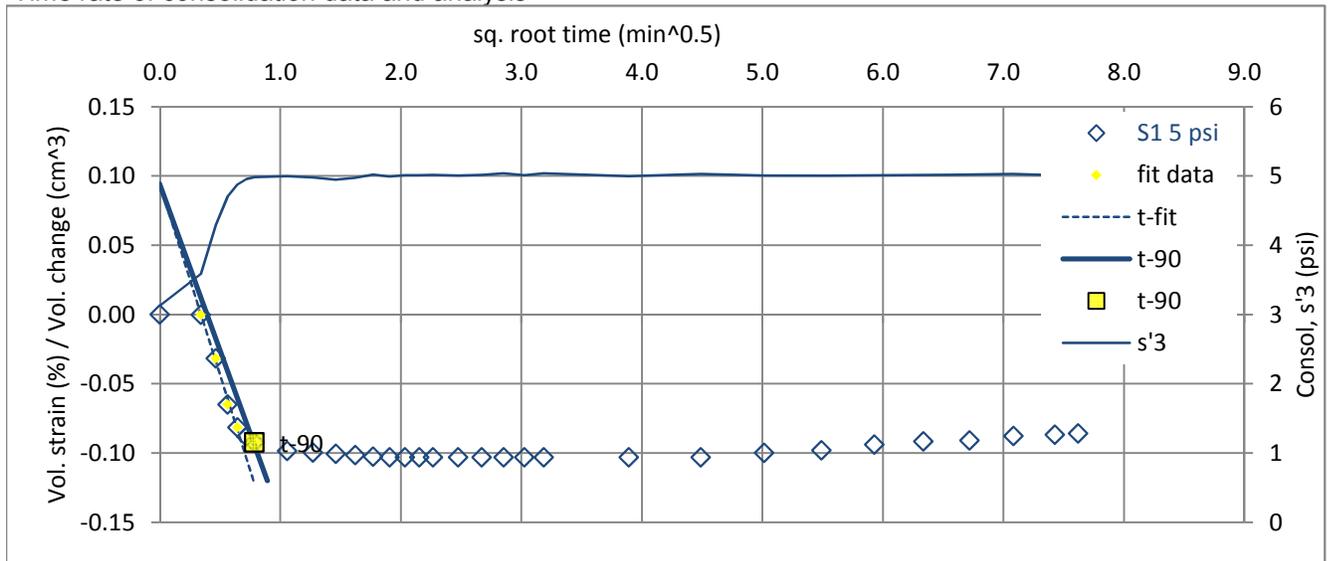
Sample: 213-40

Effective stress results



Peak deviator stress (s1-s3), failure criteria Mohr and p' - q' space plots

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755

Project: Cell-Crete

No: 14GCI498

Date cast: 13-Feb-15

Date: 30-Mar-15

Tested by: zmg

Reduced by: zmg

Checked by: rbm/rtc

Cellular concrete type: Class IV (low density)

Sample: 213-27

Sample description: Cell Crete

USCS classification: not requested

Sample type: Cell Crete

Age of sample (days): 45 (at shear)

| | Test Number | S1 | | 12.5 psi | |
|-----------------------------------|---|---------|--------------------------------|----------|--|
| | | Initial | Bef. Shr. MethodA ^d | Final | |
| Unit weight data | 0° | 5.835 | | | |
| | Sample ht., H (in) 120° | 5.836 | | | |
| | 240° | 5.836 | | | |
| | Avg. height, Havg (in) | 5.836 | 5.836 | | |
| | Avg. height, Havg (cm) | 14.823 | 14.823 | | |
| | ΔV_s (cm ³) ^b | | 0.000 | | |
| | ΔV_c (cm ³) ^b | | -2.362 | | |
| | Ht. change, ΔH_{sc} (in) ^a | | 0.000 | | |
| | Sample dia., D (in) top | 2.983 | | | |
| | mid | 2.952 | | | |
| | bot | 2.924 | | | |
| | Avg. dia., Davg (in) | 2.953 | 2.947 | | |
| | Avg. dia., Davg (cm) | 7.500 | 7.486 | | |
| | Avg. area, Aavg (in ²) | 6.848 | 6.823 | | |
| | Avg. area, Aavg (cm ²) | 44.178 | 44.018 | | |
| | Wt. rings + wet soil (g) | 349.38 | | | |
| | Wt. rings (g) | 0.00 | | | |
| | Volume, V _o (in ³) | 40.0 | 39.8 | | |
| V _o (cm ³) | 654.8 | 652.5 | | | |
| | V _o (ft ³) | 0.0231 | 0.0230 | | |
| Moisture | Wet soil + tare (g) | 349.38 | | 707.24 | |
| | Dry soil + tare (g) | 237.08 | | 382.20 | |
| | Tare (g) | 0.00 | | 145.12 | |
| | Moisture content, w (%) | 47.4 | | 137.1 | |
| Phase Relationships | G _s , from mix design | 3.15 | | | |
| | Mass total (g) | 349.4 | | | |
| | Mass of solids (g) | 237.1 | | | |
| | Volume (cm ³) | 654.8 | | | |
| | Volume of water (cm ³) | 112.3 | | | |
| | Volume of solids (cm ³) | 75.3 | | | |
| | Volume of voids (cm ³) | 579.6 | | | |
| | Volume of air (cm ³) | 467.3 | | | |
| | Void ratio, e | 7.701 | | | |
| | Porosity, n | 0.885 | | | |
| | Volumetric moisture, T | 0.171 | | | |
| | Saturation, S (%) ^c | 19.38 | | | |
| | Dry density (gm/cm ³) | 0.362 | | | |
| Wet unit wt., gm (pcf) | 33.3 | | | | |
| Dry unit wt., gd (pcf) | 22.6 | | | | |

Photo of sample after testing



Notes:

^a ΔH_{sc} (in) = change in height during saturation and consolidation

^b ΔV_s = change in volume during saturation, ΔV_c = change in volume during consolidation

^c Saturation before shear set to 100% for phase calculations

^d Before shear Aavg using method A; where A_c (Method A) = $(V_o - DV_s - DV_c) / (H_o - DH_{sc})$

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete
No: 14GCI498

Cellular concrete type: Class IV (low density)
Sample: 213-27

Date cast: 13-Feb-15
Date: 30-Mar-15
Tested by: zmg

Sample description: Cell Crete
USCS classification: not requested
Sample type: Cell Crete

X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_CD1pts_TypeIV_12-5psi-v01.xlsx]SUM

| Test Number | S1 at 12.5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 85.0 |
| | Skempton B | 0.79 |
| | t-90 (min) | 0.7 |
| | t-100 (min) | |
| | t-50 (min) | 0.2 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | yes |
| | Filter paper correction | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 5.97 |
| | Time to failure, tf (min) | 59.7 |
| | Confining stress, s'3 (psi) | 12.5 |
| | Deviator stress, s1-s3 (psi) | 101.6 |
| | Obliquity, s'1/s'3 | 9.129 |
| | Vol. strain at failure, ev (%) | -4.69 |
| | $q = q' = (s1-s3)/2$ (psi) | 50.8 |
| | $p' = (s'1+s'3)/2$ (psi) | 63.3 |
| | Effective major principal stress, s'1 (psi) | 114.1 |
| Effective minor principal stress, s'3 (psi) | 12.5 | |

Comments:

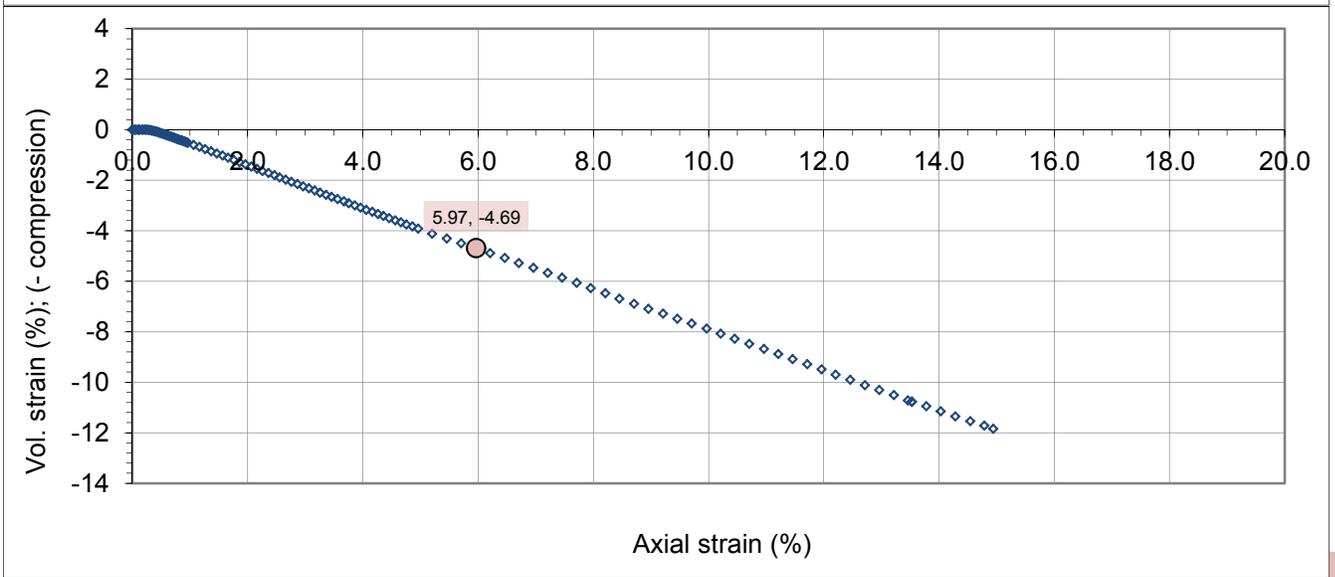
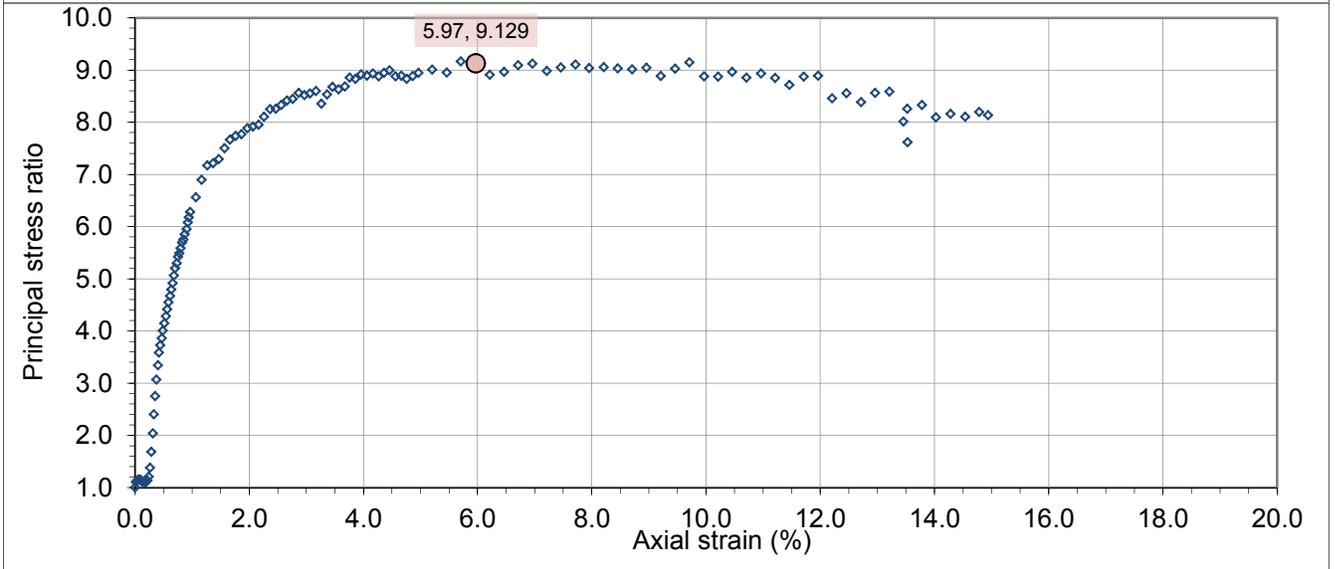
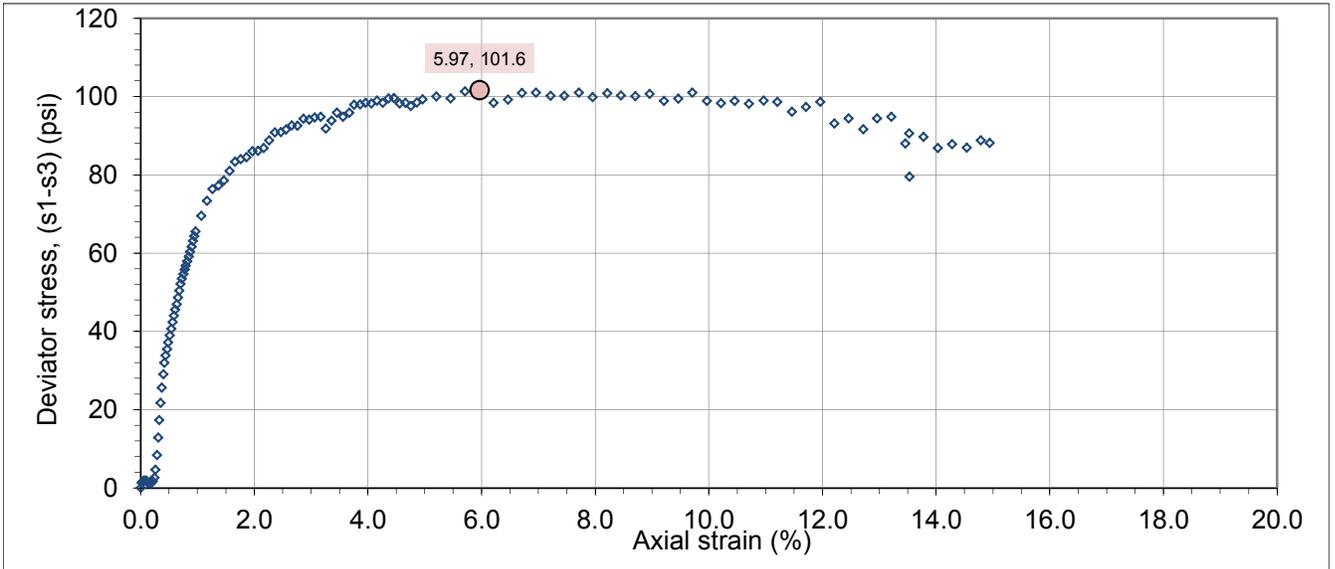
Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete
No: 14GCI498

Cellular concrete type: Class IV (low density)
Sample: 213-27



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



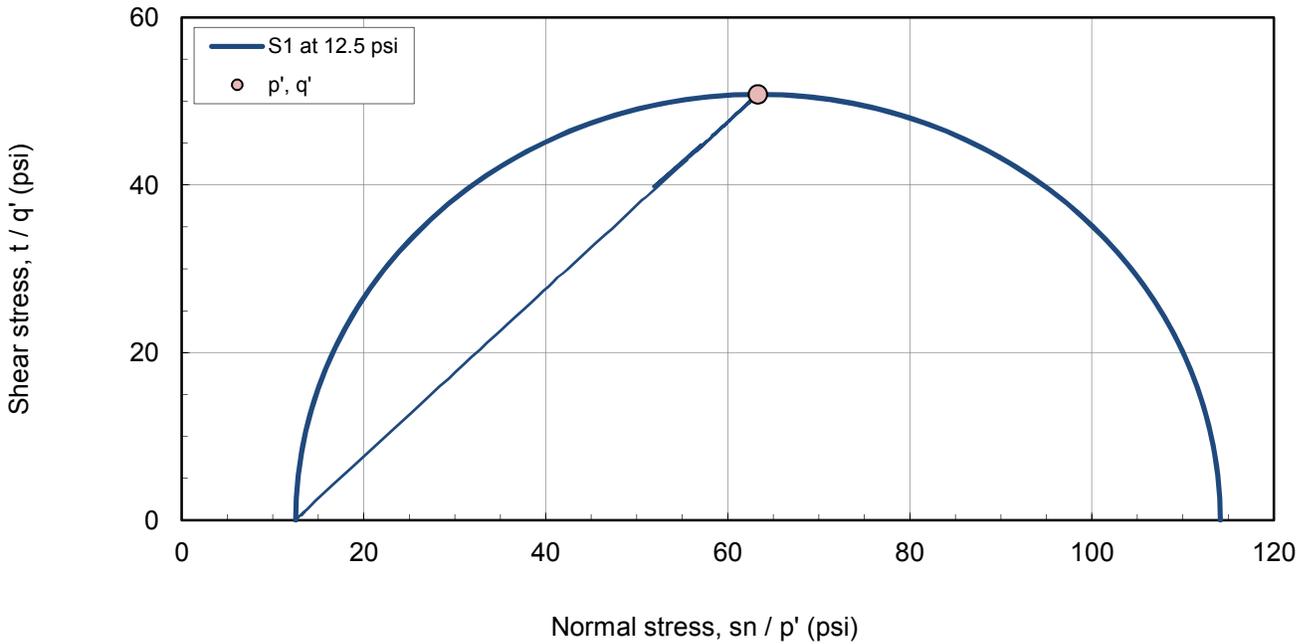
Project: Cell-Crete

Cellular concrete type: Class IV (low density)

No: 14GCI498

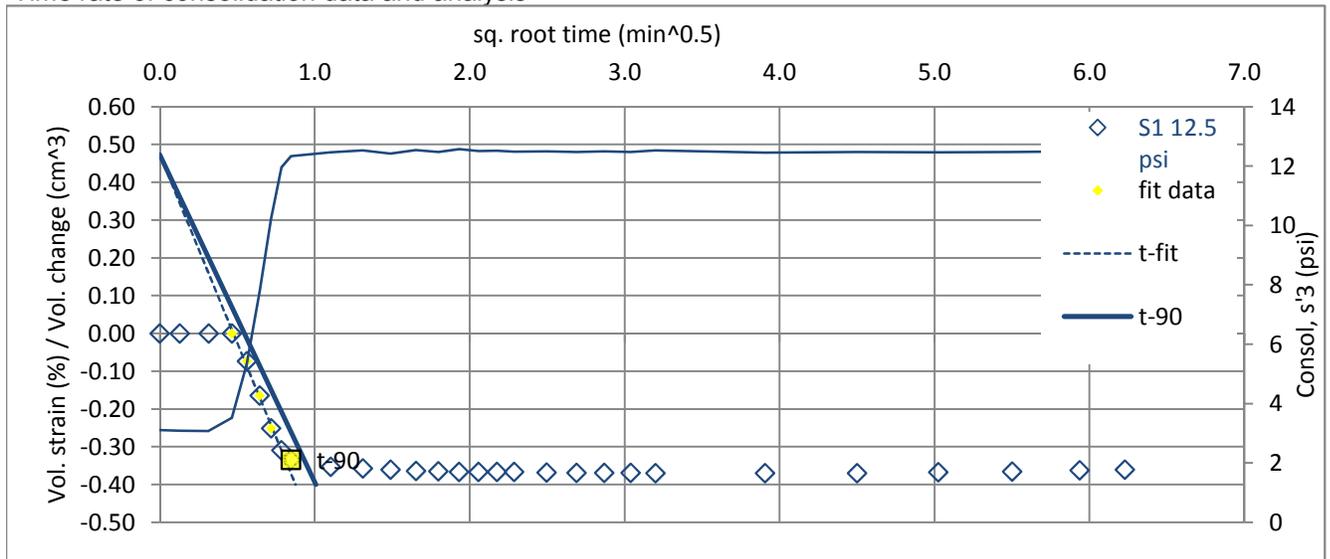
Sample: 213-27

Effective stress results



Peak deviator stress (s1-s3), failure criteria Mohr and p' - q' space plots

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755

Project: **Cell-Crete**

No: **14GCI498**

Date cast: **13-Feb-15**

Date: **27-Mar-15**

Tested by: **zmg**

Reduced by: **zmg**

Checked by: **rbm/rtc**

Cellular concrete type: **Class IV (low density)**

Sample: **213-26**

Sample description: **Cell Crete**

USCS classification: **not requested**

Sample type: **Cell Crete**

Age of sample (days): **42** (at shear)

| | Test Number | 30 psi | |
|---|-------------------------------------|---------|--------------------------------------|
| | | S1 | Bef. Shr. MethodA ^d Final |
| | | Initial | Final |
| | 0° | 5.764 | |
| Sample ht., H (in) | 120° | 5.751 | |
| | 240° | 5.744 | |
| | Avg. height, Havg (in) | 5.753 | 5.753 |
| Avg. height, Havg (cm) | 14.613 | 14.613 | |
| ΔV_s (cm ³) ^b | | 0.000 | |
| ΔV_c (cm ³) ^b | | -4.787 | |
| Ht. change, ΔH_{sc} (in) ^a | | 0.000 | |
| Sample dia., D (in) | top | 2.980 | |
| | mid | 2.938 | |
| | bot | 2.917 | |
| Avg. dia., Davg (in) | 2.943 | 2.932 | |
| Avg. dia., Davg (cm) | 7.476 | 7.448 | |
| Avg. area, Aavg (in ²) | 6.804 | 6.753 | |
| Avg. area, Aavg (cm ²) | 43.895 | 43.566 | |
| Wt. rings + wet soil (g) | 335.48 | | |
| Wt. rings (g) | 0.00 | | |
| Volume, V _o (in ³) | 39.1 | 38.8 | |
| V _o (cm ³) | 641.4 | 636.6 | |
| V _o (ft ³) | 0.0227 | 0.0225 | |
| Moisture | Wet soil + tare (g) | 335.48 | 611.49 |
| | Dry soil + tare (g) | 225.78 | 352.52 |
| | Tare (g) | 0.00 | 126.74 |
| | Moisture content, w (%) | 48.6 | 114.7 |
| Phase Relationships | G _s , from mix design | 3.15 | |
| | Mass total (g) | 335.5 | |
| | Mass of solids (g) | 225.8 | |
| | Volume (cm ³) | 641.4 | |
| | Volume of water (cm ³) | 109.7 | |
| | Volume of solids (cm ³) | 71.7 | |
| | Volume of voids (cm ³) | 569.7 | |
| | Volume of air (cm ³) | 460.0 | |
| | Void ratio, e | 7.949 | |
| | Porosity, n | 0.888 | |
| | Volumetric moisture, T | 0.171 | |
| | Saturation, S (%) ^c | 19.25 | |
| | Dry density (gm/cm ³) | 0.352 | |
| Wet unit wt., gm (pcf) | 32.7 | | |
| Dry unit wt., gd (pcf) | 22.0 | | |

Photo of sample after testing



Notes:

- ^a ΔH_{sc} (in) = change in height during saturation and consolidation
- ^b ΔV_s = change in volume during saturation, ΔV_c = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where A_c (Method A) = $(V_o - DV_s - DV_c) / (H_o - DH_{sc})$

Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete
No: 14GCI498

Cellular concrete type: Class IV (low density)
Sample: 213-26

Date cast: 13-Feb-15
Date: 27-Mar-15
Tested by: zmg

Sample description: Cell Crete
USCS classification: not requested
Sample type: Cell Crete

X:\PROJECTS\14GCI498 Cell Crete Lab Testing[TX_CD1pts_TypeIV_30psi-v01.xlsx]SUM

| Test Number | S1 at 30 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 85.0 |
| | Skempton B | 0.68 |
| | t-90 (min) | 1.1 |
| | t-100 (min) | |
| | t-50 (min) | 0.3 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | yes |
| | Filter paper correction | No filter paper |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 4.38 |
| | Time to failure, tf (min) | 43.8 |
| | Confining stress, s'3 (psi) | 30.0 |
| | Deviator stress, s1-s3 (psi) | 95.7 |
| | Obliquity, s'1/s'3 | 4.219 |
| | Vol. strain at failure, ev (%) | -3.86 |
| | $q = q' = (s1-s3)/2$ (psi) | 47.9 |
| | $p' = (s'1+s'3)/2$ (psi) | 77.6 |
| | Effective major principal stress, s'1 (psi) | 125.4 |
| Effective minor principal stress, s'3 (psi) | 29.7 | |

Comments:

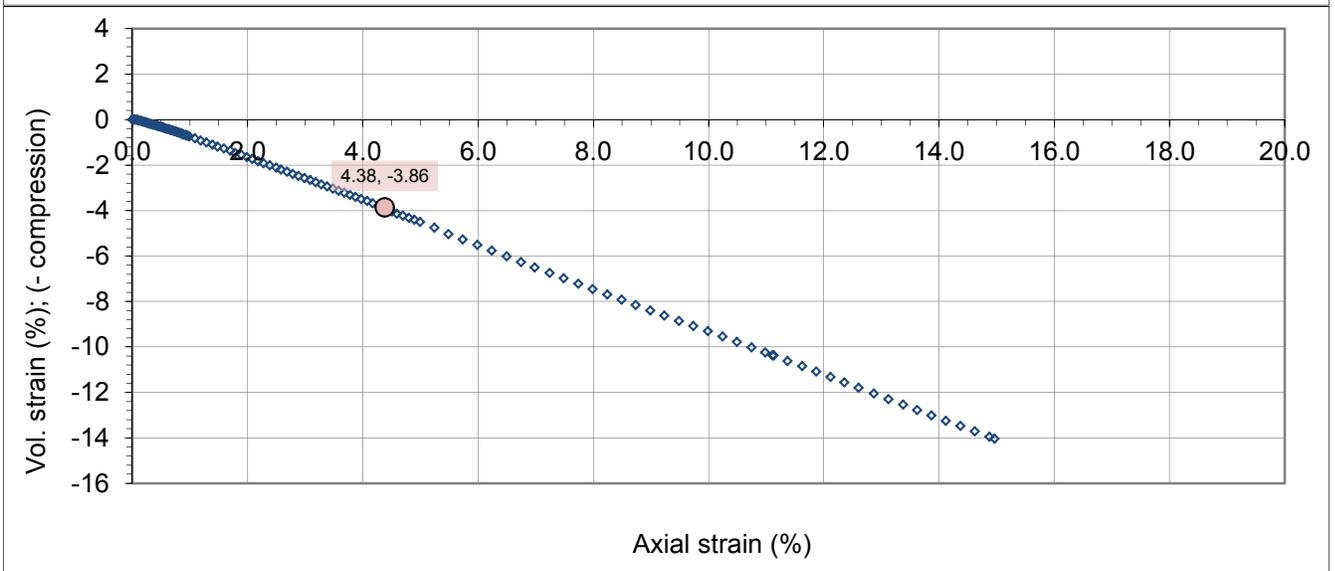
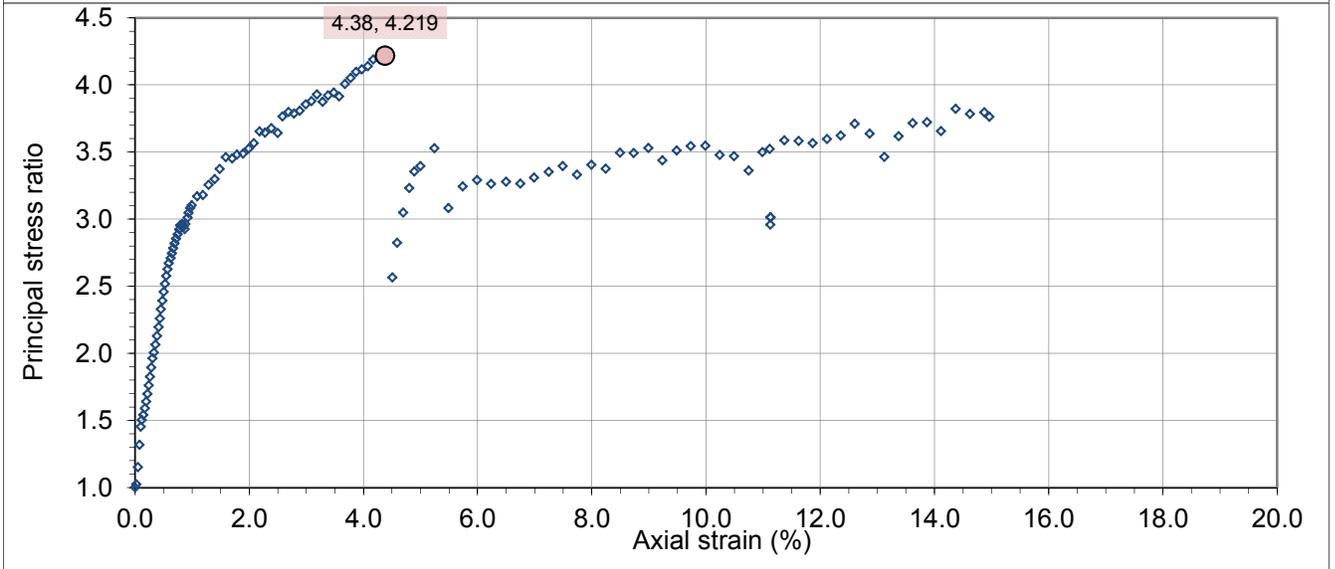
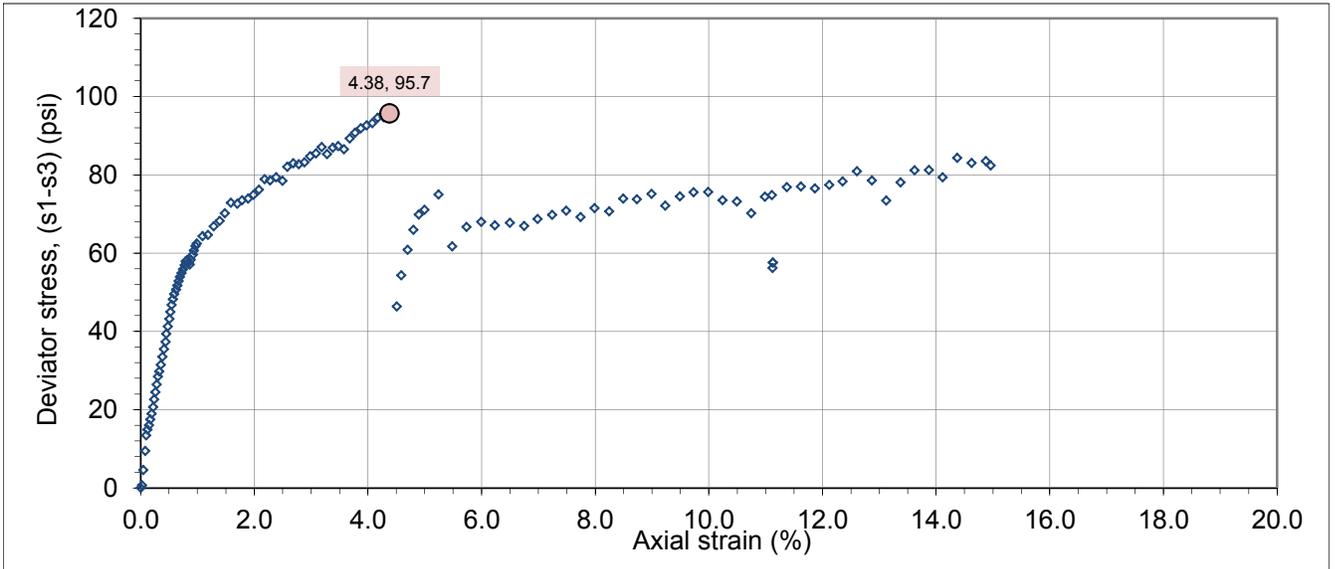
Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

After ASTM 7181 and USBR 5755



Project: Cell-Crete
No: 14GCI498

Cellular concrete type: Class IV (low density)
Sample: 213-26



Triaxial Test - Isotropic Consolidated Sheared Drained (CID)

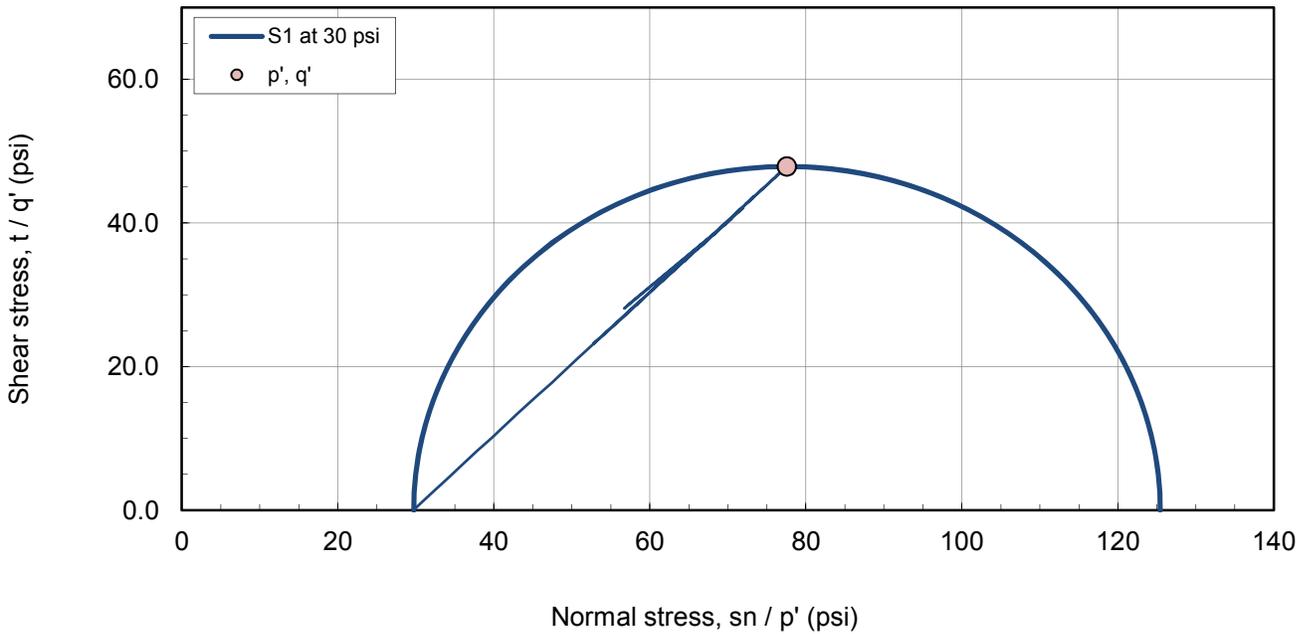
After ASTM 7181 and USBR 5755



Project: Cell-Crete
No: 14GCI498

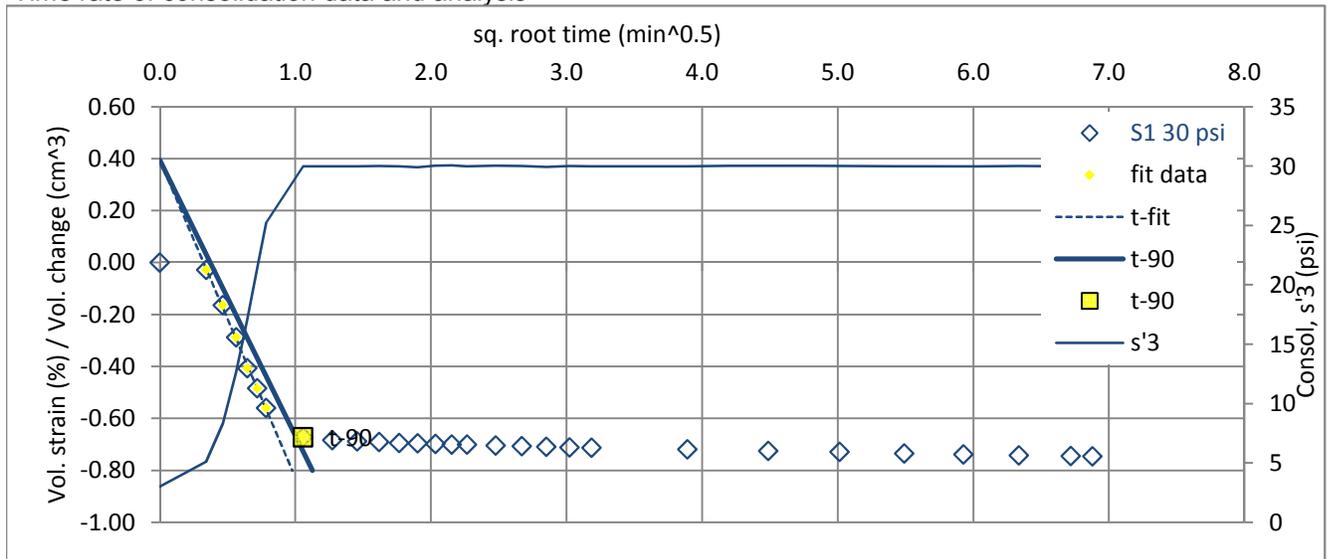
Cellular concrete type: Class IV (low density)
Sample: 213-26

Effective stress results



Peak deviator stress (s1-s3), failure criteria Mohr and p' - q' space plots

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: **Cell Crete** Cellular concrete type: **Class IV (Low Density)**
 No: **14GCI498** Sample: **213-23**
 Date cast: **13-Feb-15** Sample description: **Cellular concrete cast on 2/13/15**
 Date: **26-Mar-15** USCS classification: **not applicable**
 Tested by: **zmg** Sample type: **cast**
 Reduced by: **zmg** Age of sample (days): **41** (at shear)
 Checked by: **rbm/rtc**

| | Test Number | 2.5 psi | |
|------------------------|-------------------------------------|---------|--------------------------------|
| | | S1 | Bef. Shr. MethodA ^d |
| | | Initial | |
| | 0° | 5.744 | |
| Sample ht., H (in) | 120° | 5.758 | |
| | 240° | 5.753 | |
| | Avg. height, Havg (in) | 5.752 | 5.752 |
| | Avg. height, Havg (cm) | 14.609 | 14.609 |
| | ΔHsc (in) ^a | | 0.00 |
| Sample dia., D (in) | top | 2.989 | |
| | mid | 2.955 | |
| | bot | 2.927 | |
| | Avg. dia., Davg (in) | 2.957 | 2.960 |
| | Avg. dia., Davg (cm) | 7.510 | 7.517 |
| | Avg. area, Aavg (in ²) | 6.865 | 6.880 |
| | Avg. area, Aavg (cm ²) | 44.291 | 44.384 |
| | Wt. rings + wet soil (g) | 334.58 | |
| | Wt. rings (g) | 0.00 | |
| | Volume, Vo (in ³) | 39.5 | 39.6 |
| | Vo (cm ³) | 647.1 | 648.4 |
| | Vo (ft ³) | 0.0229 | 0.0229 |
| | ΔVs (cm ³) ^b | | 0.00 |
| | ΔVc (cm ³) ^b | | -1.37 |
| Moisture | Wet soil + tare (g) | 334.58 | 649.35 |
| | Dry soil + tare (g) | 228.63 | 348.51 |
| | Tare (g) | 0.00 | 119.88 |
| | Moisture content, w (%) | 46.3 | 131.6 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 334.6 | 804.5 |
| | Mass of solids (g) | 228.6 | 228.6 |
| | Volume (cm ³) | 647.1 | 648.4 |
| | Volume of water (cm ³) | 106.0 | 575.8 |
| | Volume of solids (cm ³) | 72.6 | 72.6 |
| | Volume of voids (cm ³) | 574.5 | 575.8 |
| | Volume of air (cm ³) | 468.5 | 0.0 |
| | Void ratio, e | 7.915 | 7.934 |
| | Porosity, n | 0.888 | 0.888 |
| | Volumetric moisture, T | 0.164 | 0.888 |
| | Saturation, S (%) ^c | 18.44 | 100.00 |
| | Dry density (gm/cm ³) | 0.353 | 0.353 |
| Wet unit wt., gm (pcf) | 32.3 | 51.0 | |
| Dry unit wt., gd (pcf) | 22.1 | 22.0 | |

Photo of sample after testing



Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 26-Mar-15
 Tested by: zmg

Cellular concrete type: Class IV (Low Density)
Sample: 213-23
 Sample description: Cellular concrete cast on 2/13/15
 USCS classification: not applicable
 Sample type: cast

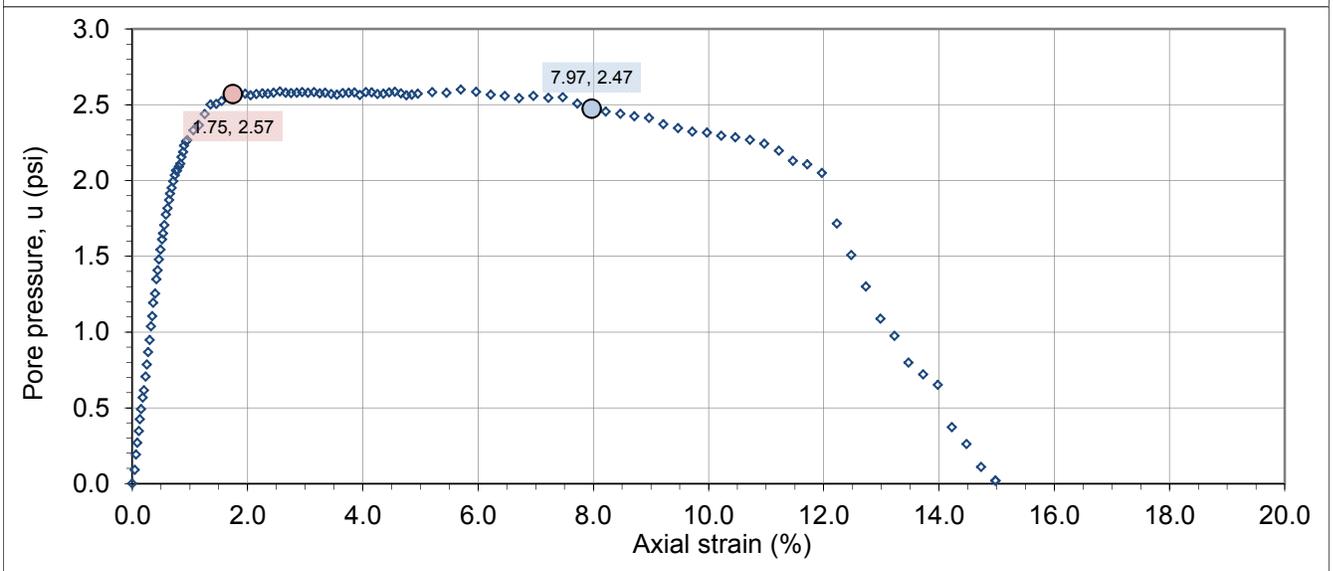
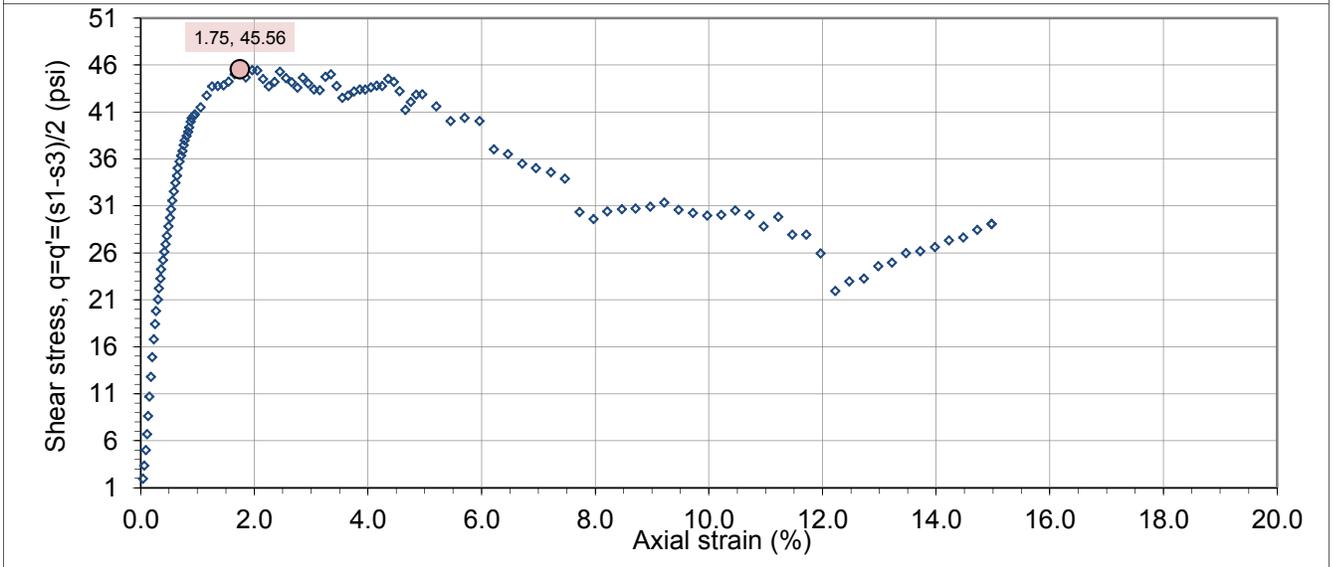
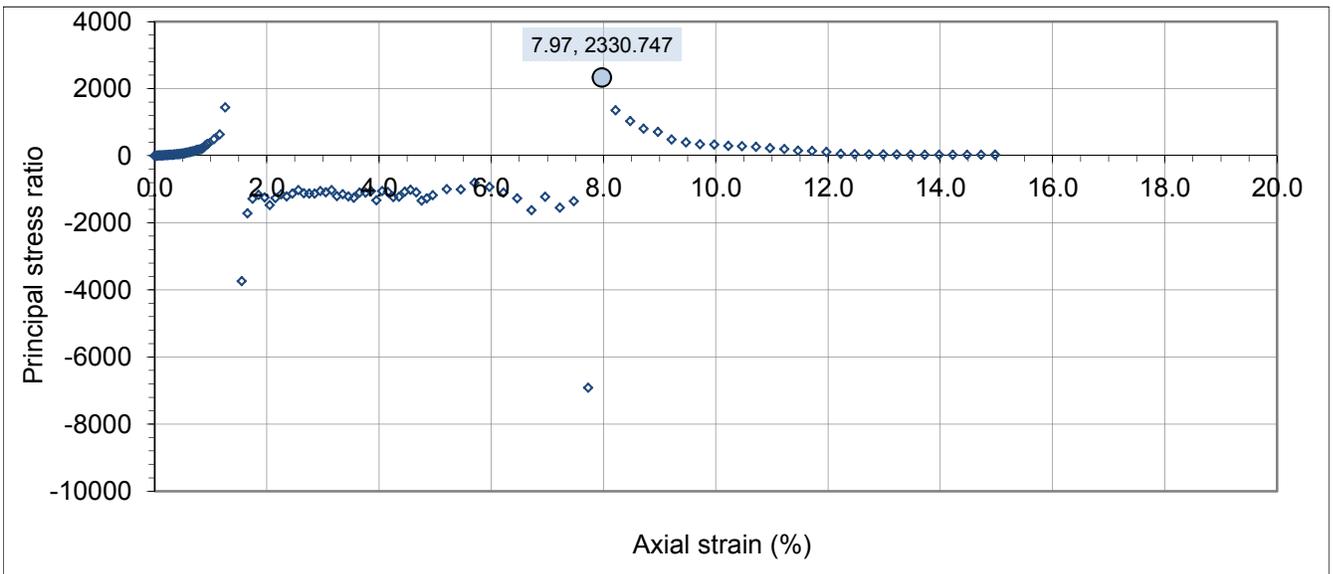
X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_CU1pts_TypeIV_2-5psi-v02.xlsx]SUM

| Test Number | S1 at 2.5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 80.0 |
| | Skempton B | 0.78 |
| | t-90 (min) | 0.9 |
| | t-100 (min) | |
| | t-50 (min) | 0.2 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | Yes |
| | Filter paper correction | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 7.97 |
| | Time to failure, tf (min) | 79.7 |
| | Obliquity, s'1/s'3 | 2330.747 |
| | Excess pore pressure, u (psi) | 2.47 |
| | $q = q' = (s1-s3)/2$ (psi) | 29.59 |
| | $p' = (s'1+s'3)/2$ (psi) | 29.62 |
| | $p = (s1+s3)/2$ (psi) | 32.09 |
| | Effective major principal stress, s'1 (psi) | 59.21 |
| | Effective minor principal stress, s'3 (psi) | 0.03 |
| | Total major principal stress, s1 (psi) | 61.68 |
| Total minor principal stress, s3 (psi) | 2.50 | |
| Skempton A at failure, Af | 0.04 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 1.75 |
| | Time to failure, tf (min) | 17.5 |
| | Deviator stress, s1-s3 (psi) | 91.12 |
| | Excess pore pressure, u (psi) | 2.57 |
| | $q = q' = (s1+s3)/2$ (psi) | 45.56 |
| | $p' = (s'1+s'3)/2$ (psi) | 45.49 |
| | $p = (s1+s3)/2$ (psi) | 48.06 |
| | Effective major principal stress, s'1 (psi) | 91.05 |
| | Effective minor principal stress, s'3 (psi) | -0.07 |
| | Total major principal stress, s1 (psi) | 93.62 |
| Total minor principal stress, s3 (psi) | 2.50 | |
| Skempton A at failure, Af | 0.03 | |

Comments:

Project: Cell Crete
 No: 14GCI498

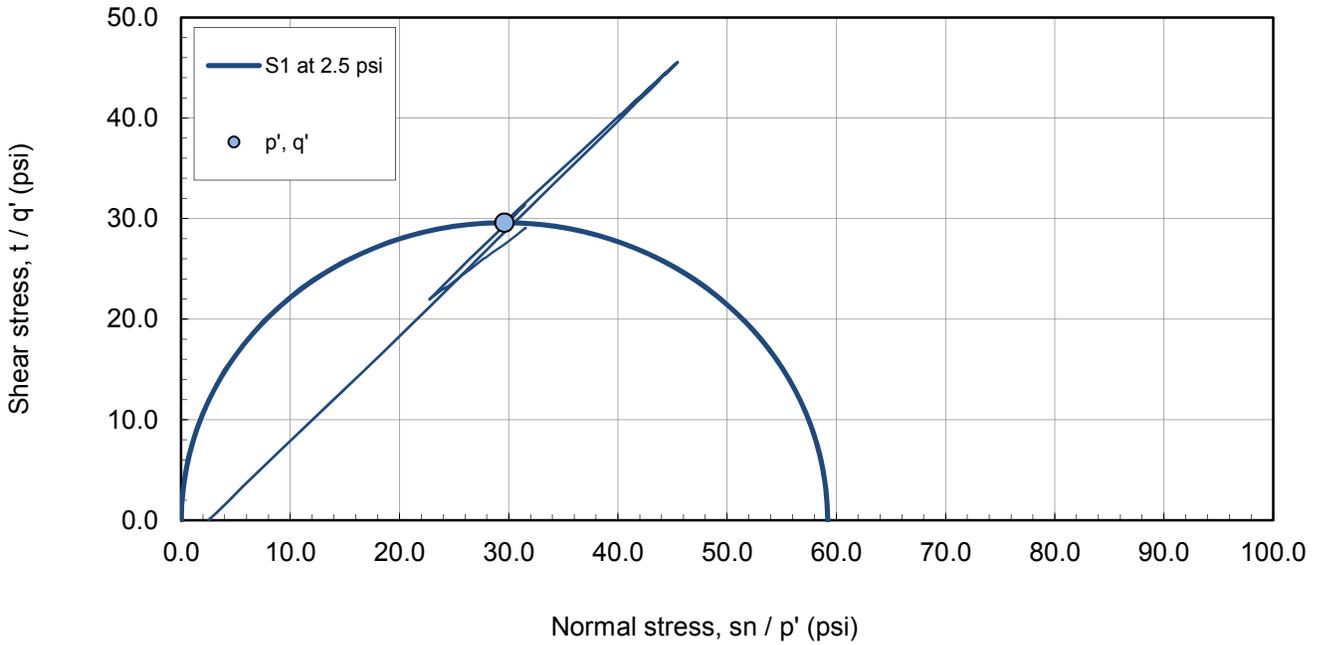
Cellular concrete type: Class IV (Low Density)
 Sample: 213-23



Project: Cell Crete
No: 14GCI498

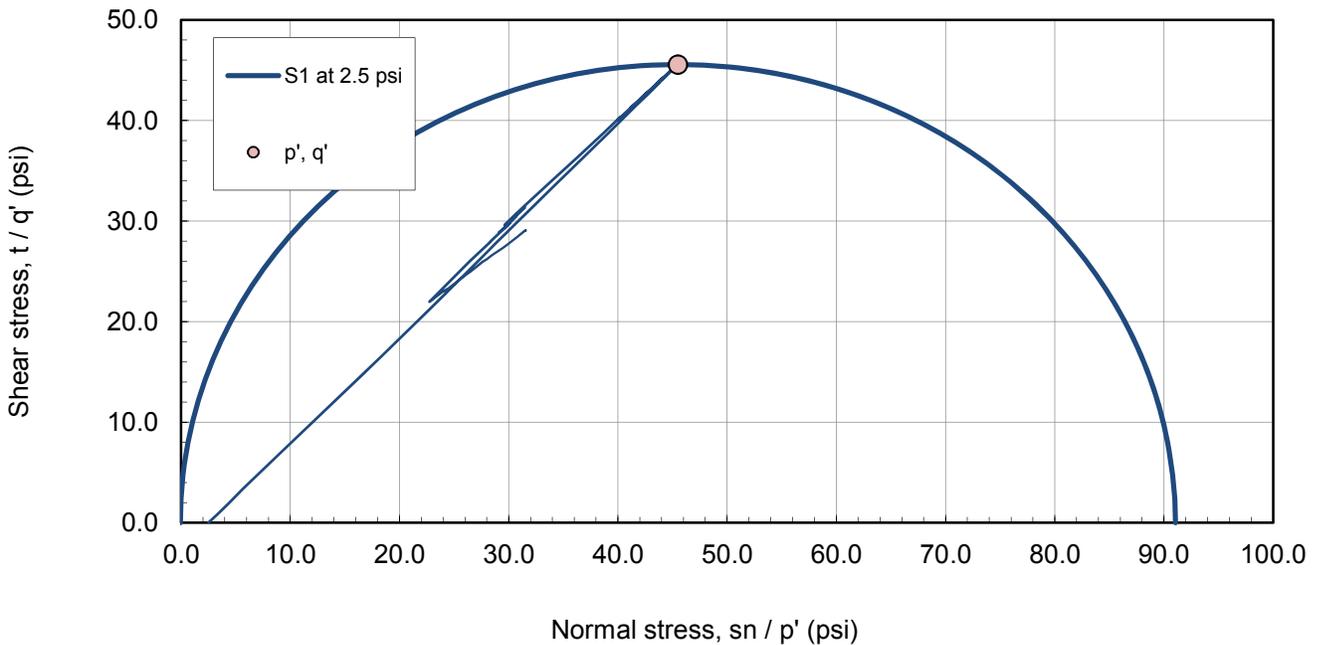
Cellular concrete type: Class IV (Low Density)
Sample: 213-23

Effective stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results

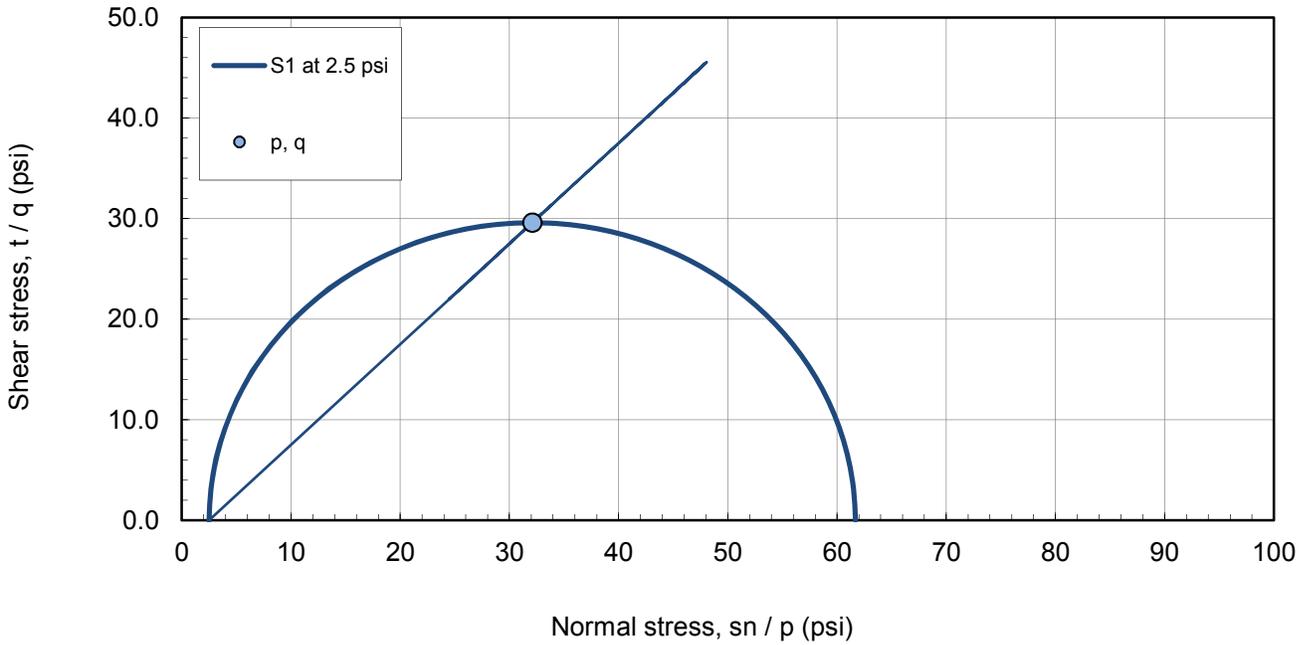


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Project: Cell Crete
 No: 14GCI498

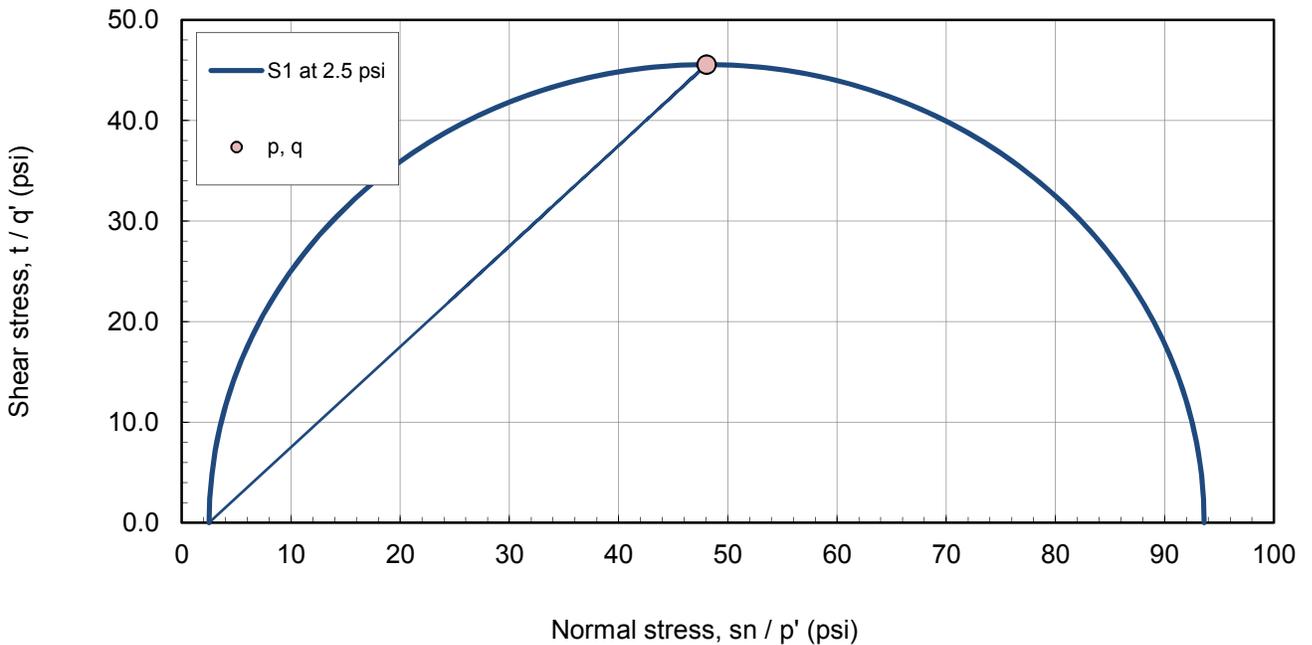
Cellular concrete type: Class IV (Low Density)
 Sample: 213-23

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results

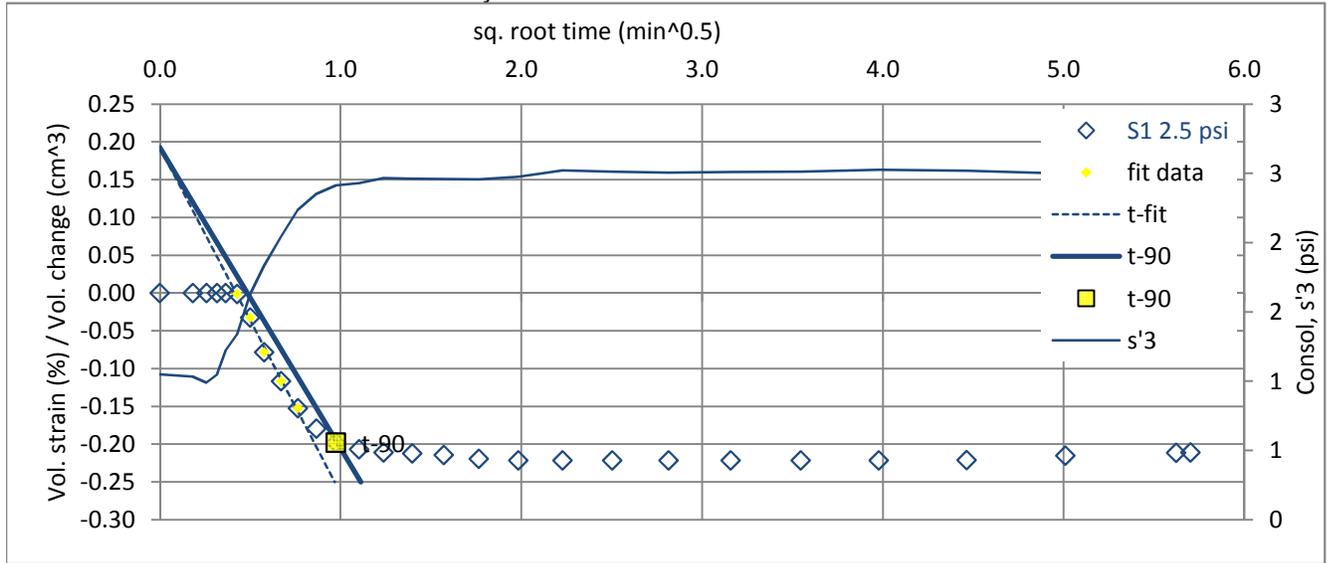


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p - q$ space plots

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-23

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: **Cell Crete** Cellular concrete type: **Class IV (Low Density)**
 No: **14GCI498** Sample: **213-17**
 Date cast: **13-Feb-15** Sample description: **Cellular concrete cast on 2/13/15**
 Date: **25-Mar-15** USCS classification: **not applicable**
 Tested by: **zmg** Sample type: **cast**
 Reduced by: **zmg** Age of sample (days): **40**
 Checked by: **rbm/rtc**

| | Test Number | 5 psi | |
|-------------------------------------|-------------------------------------|---------|--------------------------------|
| | | S1 | Bef. Shr. MethodA ^d |
| | | Initial | |
| | 0° | 5.820 | |
| Sample ht., H (in) | 120° | 5.816 | |
| | 240° | 5.806 | |
| Avg. height, Havg (in) | | 5.814 | 5.814 |
| Avg. height, Havg (cm) | | 14.768 | 14.768 |
| ΔHsc (in) ^a | | | 0.00 |
| | top | 2.987 | |
| Sample dia., D (in) | mid | 2.960 | |
| | bot | 2.934 | |
| | Avg. dia., Davg (in) | 2.960 | 2.966 |
| Avg. dia., Davg (cm) | | 7.519 | 7.533 |
| Avg. area, Aavg (in ²) | | 6.883 | 6.908 |
| Avg. area, Aavg (cm ²) | | 44.403 | 44.566 |
| Wt. rings + wet soil (g) | | 351.02 | 584.12 |
| Wt. rings (g) | | 0.00 | 0.00 |
| Volume, Vo (in ³) | | 40.0 | 40.2 |
| Vo (cm ³) | | 655.7 | 658.1 |
| Vo (ft ³) | | 0.0232 | 0.0232 |
| ΔVs (cm ³) ^b | | | 0.00 |
| ΔVc (cm ³) ^b | | | -2.41 |
| Moisture | Wet soil + tare (g) | 351.02 | 757.40 |
| | Dry soil + tare (g) | 232.48 | 405.76 |
| | Tare (g) | 0.00 | 173.28 |
| | Moisture content, w (%) | 51.0 | 151.3 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 351.0 | 816.8 |
| | Mass of solids (g) | 232.5 | 232.5 |
| | Volume (cm ³) | 655.7 | 658.1 |
| | Volume of water (cm ³) | 118.5 | 584.3 |
| | Volume of solids (cm ³) | 73.8 | 73.8 |
| | Volume of voids (cm ³) | 581.9 | 584.3 |
| | Volume of air (cm ³) | 463.4 | 0.0 |
| | Void ratio, e | 7.885 | 7.917 |
| | Porosity, n | 0.887 | 0.888 |
| | Volumetric moisture, T | 0.181 | 0.888 |
| | Saturation, S (%) ^c | 20.37 | 100.00 |
| | Dry density (gm/cm ³) | 0.355 | 0.353 |
| Wet unit wt., gm (pcf) | 33.4 | 55.4 | |
| Dry unit wt., gd (pcf) | 22.1 | 22.1 | |

Photo of sample after testing



Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 25-Mar-15
 Tested by: zmg

Cellular concrete type: Class IV (Low Density)
Sample: 213-17
 Sample description: Cellular concrete cast on 2/13/1
 USCS classification: not applicable
 Sample type: cast

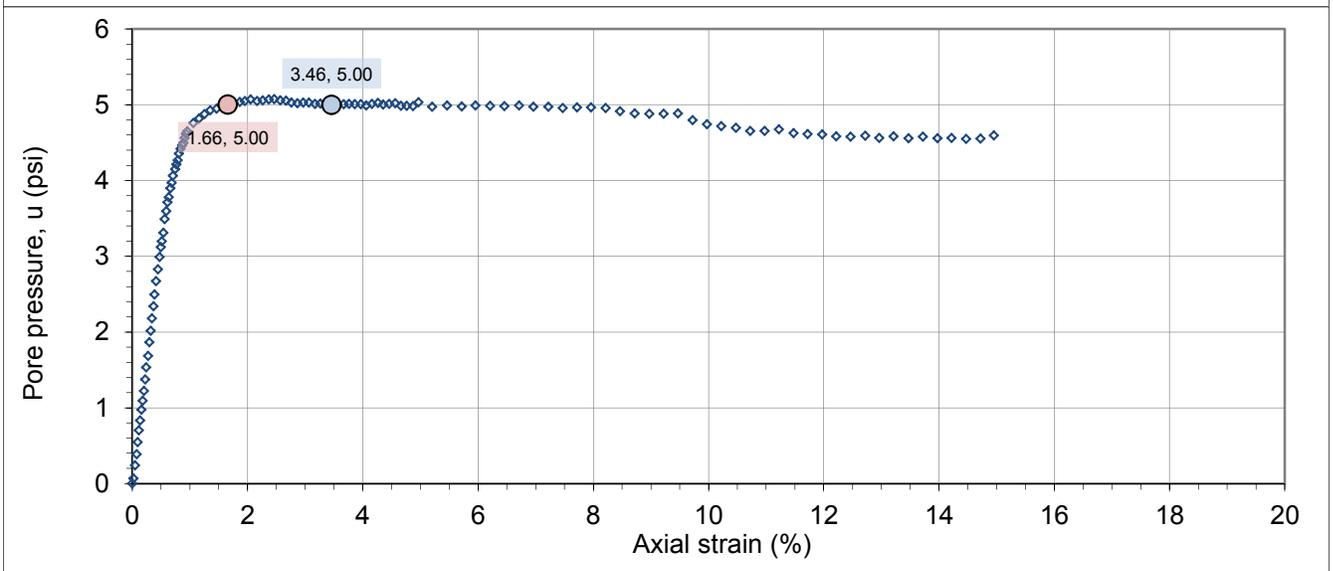
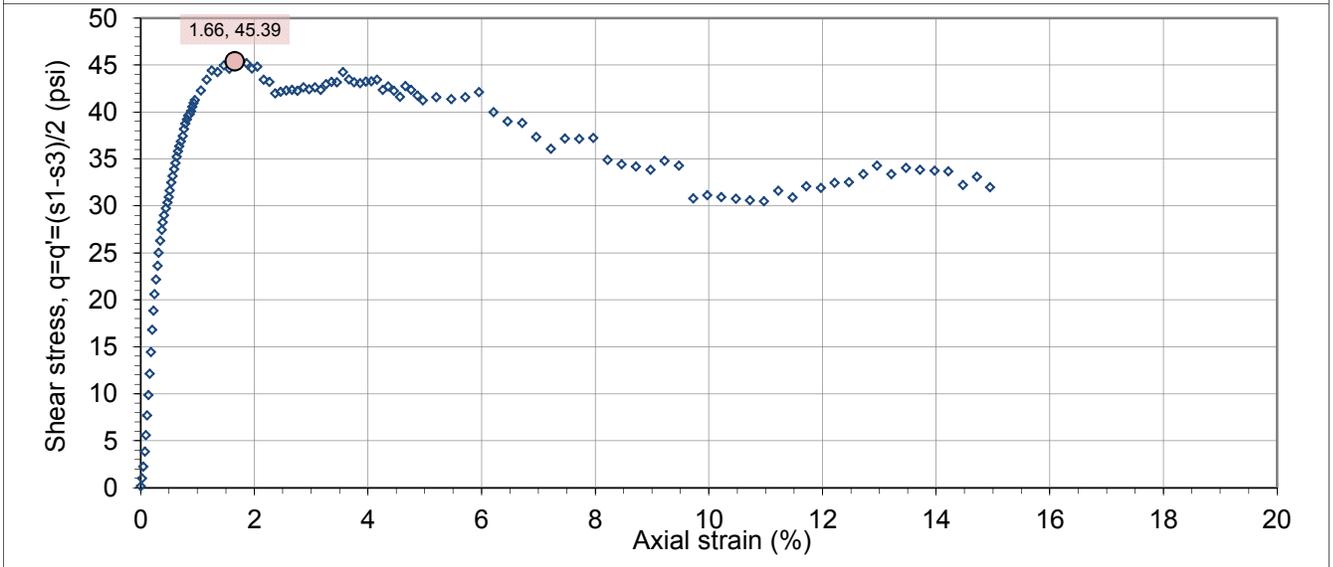
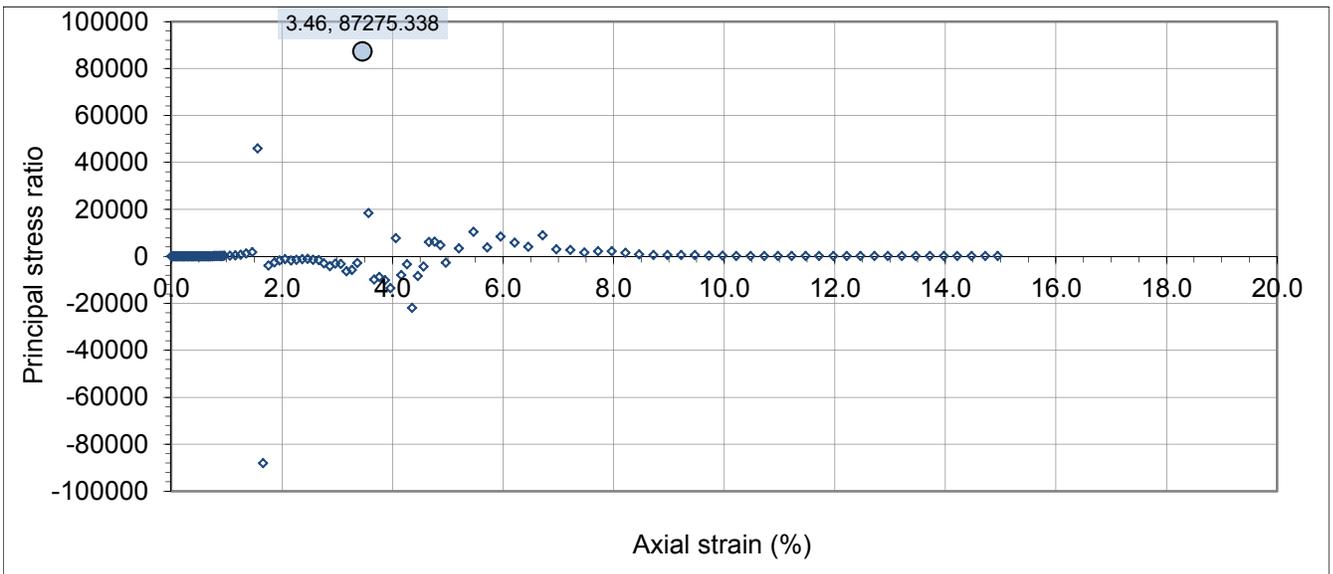
X:\PROJECTS\14GCI498 Cell Crete Lab Testing\TX_CU1pts_TypeIV_5psi-v02.xlsx]SUM

| Test Number | S1 at 5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 75.0 |
| | Skempton B | 0.82 |
| | t-90 (min) | 0.9 |
| | t-100 (min) | |
| | t-50 (min) | 0.2 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | Yes |
| | Filter paper correction | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 3.46 |
| | Time to failure, tf (min) | 34.6 |
| | Obliquity, s'1/s'3 | 87275.338 |
| | Excess pore pressure, u (psi) | 5.00 |
| | $q = q' = (s1-s3)/2$ (psi) | 43.17 |
| | $p' = (s'1+s'3)/2$ (psi) | 43.17 |
| | $p = (s1+s3)/2$ (psi) | 48.17 |
| | Effective major principal stress, s'1 (psi) | 86.35 |
| | Effective minor principal stress, s'3 (psi) | 0.00 |
| | Total major principal stress, s1 (psi) | 91.35 |
| | Total minor principal stress, s3 (psi) | 5.00 |
| Skempton A at failure, Af | 0.06 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 1.66 |
| | Time to failure, tf (min) | 16.6 |
| | Deviator stress, s1-s3 (psi) | 90.78 |
| | Excess pore pressure, u (psi) | 5.00 |
| | $q = q' = (s1-s3)/2$ (psi) | 45.39 |
| | $p' = (s'1+s'3)/2$ (psi) | 45.39 |
| | $p = (s1+s3)/2$ (psi) | 50.39 |
| | Effective major principal stress, s'1 (psi) | 90.78 |
| | Effective minor principal stress, s'3 (psi) | 0.00 |
| | Total major principal stress, s1 (psi) | 95.78 |
| | Total minor principal stress, s3 (psi) | 5.00 |
| Skempton A at failure, Af | 0.06 | |

Comments:

Project: Cell Crete
 No: 14GCI498

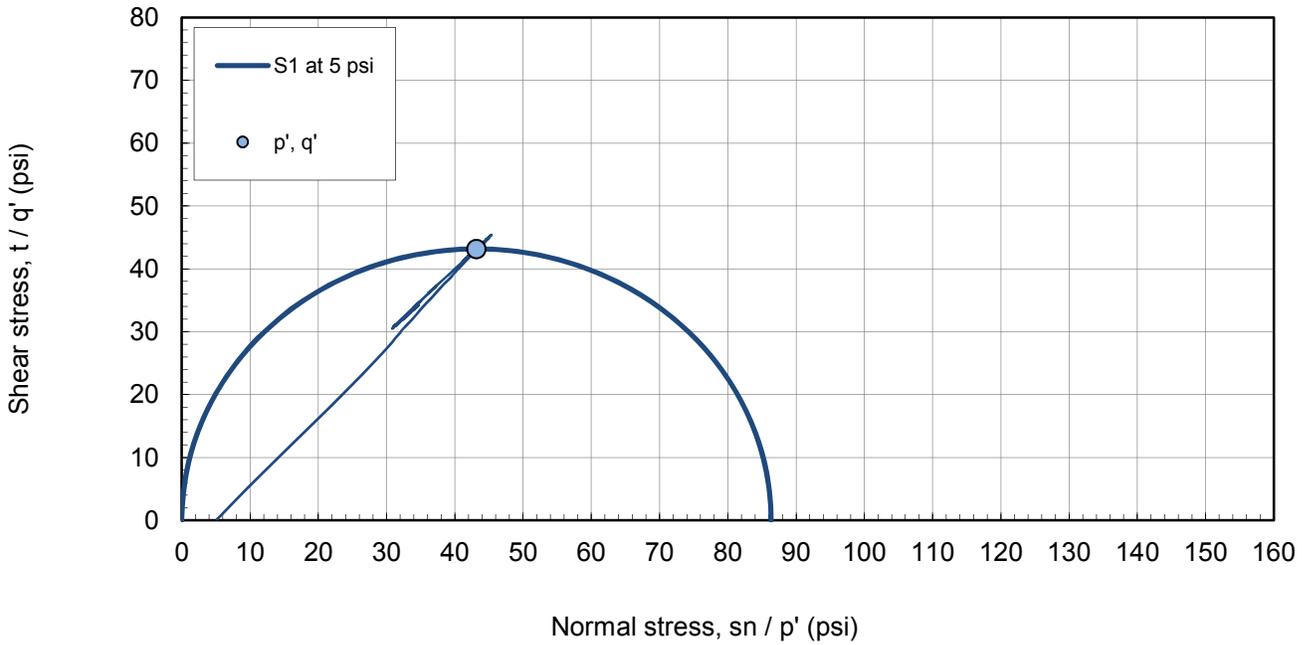
Cellular concrete type: Class IV (Low Density)
 Sample: 213-17



Project: Cell Crete
No: 14GCI498

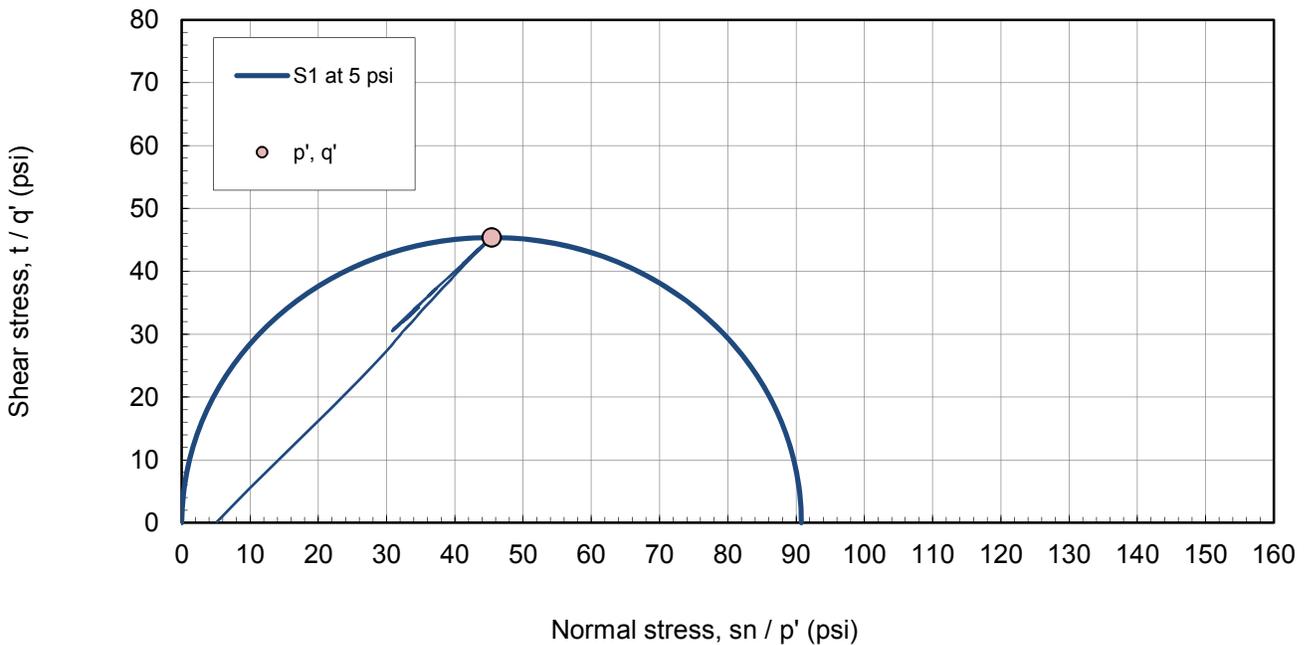
Cellular concrete type: Class IV (Low Density)
Sample: 213-17

Effective stress results



Max principal stress ratio (s'_1/s'_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results

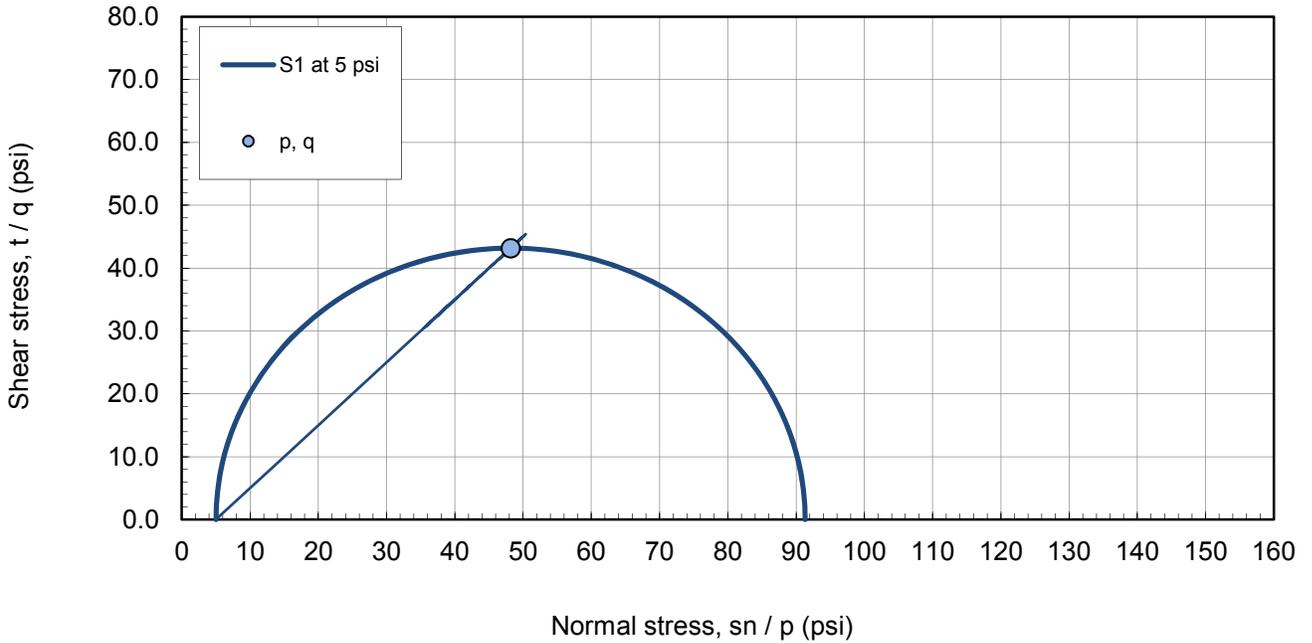


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Project: Cell Crete
 No: 14GCI498

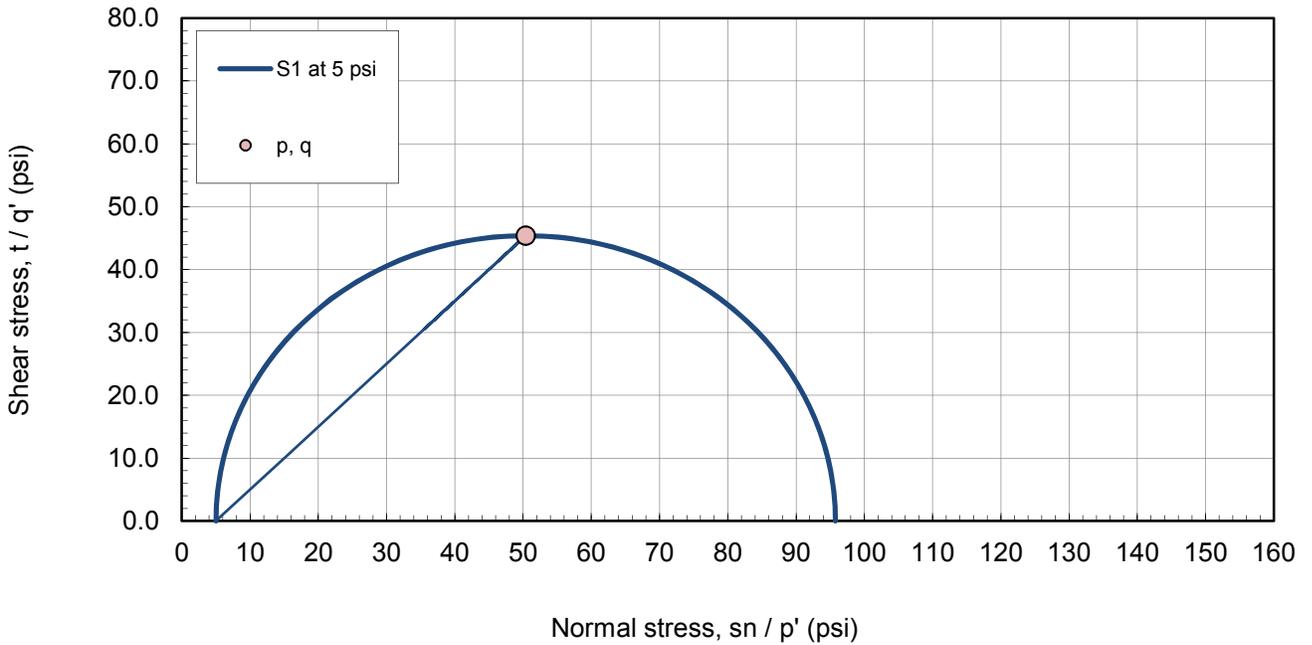
Cellular concrete type: Class IV (Low Density)
 Sample: 213-17

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results

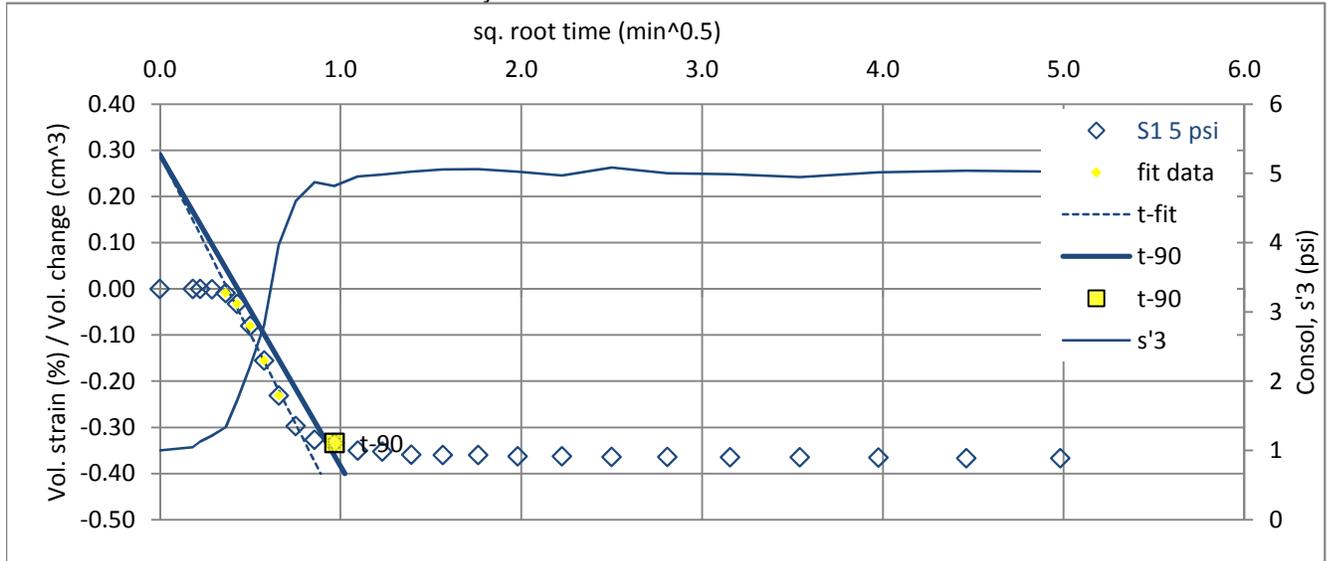


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p - q$ space plots

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-17

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: **Cell Crete** Cellular concrete type: **Class IV (Low Density)**
 No: **14GCI498** Sample: **213-16**
 Date cast: **13-Feb-15** Sample description: **Cellular concrete cast on 2/13/15**
 Date: **25-Mar-15** USCS classification: **not applicable**
 Tested by: **zmg** Sample type: **cast**
 Reduced by: **zmg** Age of sample (days): **40**
 Checked by: **rbm/rtc**

| | Test Number | S1 | 12.5 psi |
|-------------------------------------|-------------------------------------|---------------------|--------------------------------|
| | | Initial | Bef. Shr. MethodA ^d |
| Unit weight data | 0° | 5.854 | |
| | Sample ht., H (in) 120° | 5.867 | |
| | 240° | 5.851 | |
| | Avg. height, Havg (in) | 5.857 | 5.857 |
| | Avg. height, Havg (cm) | 14.878 | 14.878 |
| | ΔHsc (in) ^a | | 0.00 |
| | top | 2.986 | |
| | Sample dia., D (in) mid | 2.954 | |
| | bot | 2.912 | |
| | Avg. dia., Davg (in) | 2.952 | 2.956 |
| | Avg. dia., Davg (cm) | 7.497 | 7.509 |
| | Avg. area, Aavg (in ²) | 6.842 | 6.863 |
| | Avg. area, Aavg (cm ²) | 44.141 | 44.280 |
| | Wt. rings + wet soil (g) | 351.82 | 556.33 |
| | Wt. rings (g) | 0.00 | 0.00 |
| Moisture | Volume, Vo (in ³) | 40.1 | 40.2 |
| | Vo (cm ³) | 656.7 | 658.8 |
| | Vo (ft ³) | 0.0232 | 0.0233 |
| | ΔVs (cm ³) ^b | | 0.00 |
| | ΔVc (cm ³) ^b | | -2.07 |
| | Wet soil + tare (g) | 351.82 | 676.43 |
| | Dry soil + tare (g) | 234.98 | 355.08 |
| | Tare (g) | 0.00 | 120.10 |
| | Moisture content, w (%) | 49.7 | 136.8 |
| | Phase Relationships | Gs, from mix design | 3.15 |
| Mass total (g) | | 351.8 | 819.2 |
| Mass of solids (g) | | 235.0 | 235.0 |
| Volume (cm ³) | | 656.7 | 658.8 |
| Volume of water (cm ³) | | 116.8 | 584.2 |
| Volume of solids (cm ³) | | 74.6 | 74.6 |
| Volume of voids (cm ³) | | 582.1 | 584.2 |
| Volume of air (cm ³) | | 465.3 | 0.0 |
| Void ratio, e | | 7.804 | 7.831 |
| Porosity, n | | 0.886 | 0.887 |
| Volumetric moisture, T | | 0.178 | 0.887 |
| Saturation, S (%) ^c | | 20.07 | 100.00 |
| Dry density (gm/cm ³) | | 0.358 | 0.357 |
| Wet unit wt., gm (pcf) | 33.4 | 52.7 | |
| Dry unit wt., gd (pcf) | 22.3 | 22.3 | |

Photo of sample after testing



Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 25-Mar-15
 Tested by: zmg

Cellular concrete type: Class IV (Low Density)
Sample: 213-16
 Sample description: Cellular concrete cast on 2/13/1
 USCS classification: not applicable
 Sample type: cast

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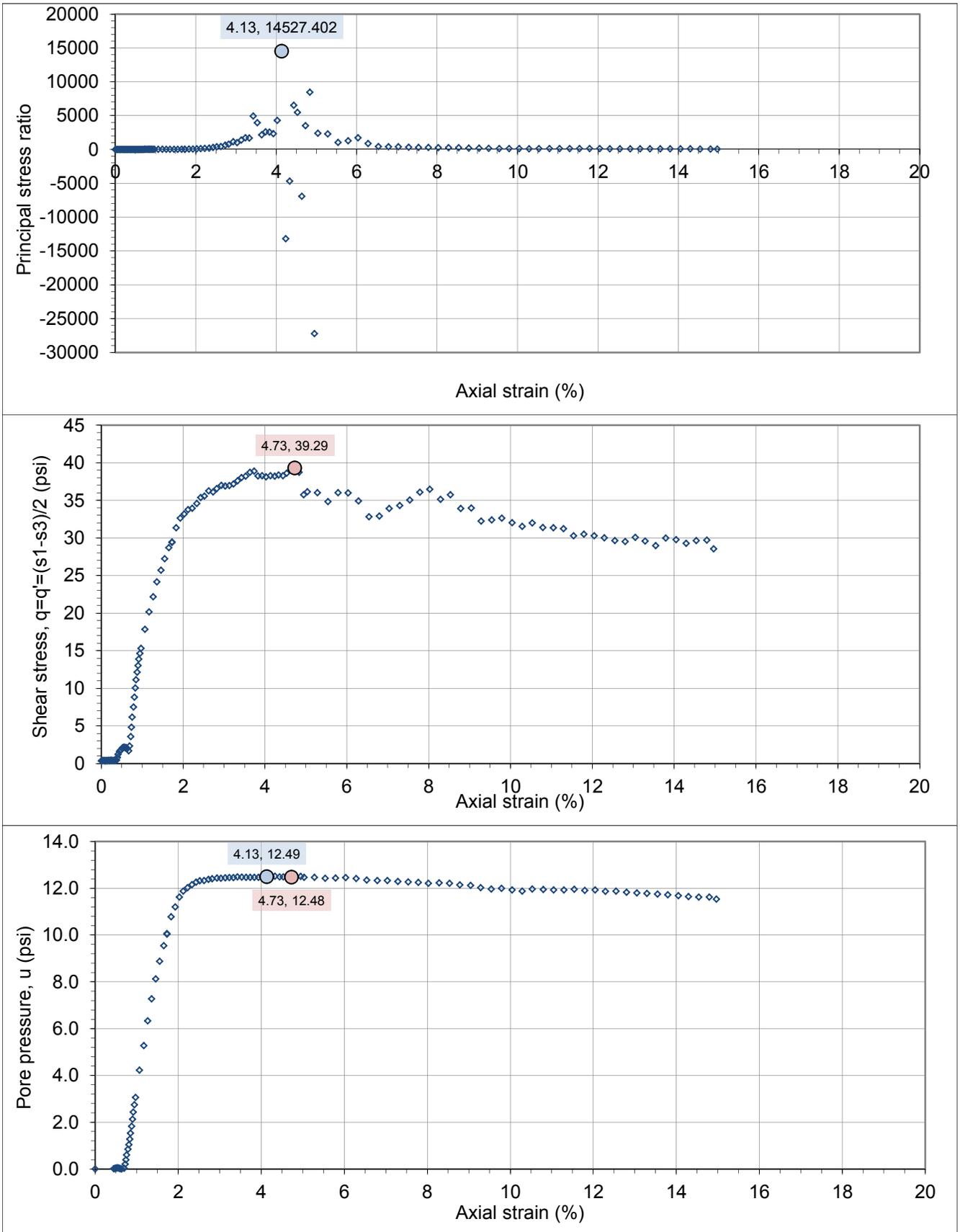
| Test Number | S1 at 12.5 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 80.0 |
| | Skempton B | 0.65 |
| | t-90 (min) | 1.4 |
| | t-100 (min) | |
| | t-50 (min) | 0.3 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | Yes |
| | Filter paper correction | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 4.13 |
| | Time to failure, tf (min) | 41.3 |
| | Obliquity, s'1/s'3 | 14527.402 |
| | Excess pore pressure, u (psi) | 12.49 |
| | $q = q' = (s1-s3)/2$ (psi) | 38.26 |
| | $p' = (s'1+s'3)/2$ (psi) | 38.26 |
| | $p = (s1+s3)/2$ (psi) | 50.76 |
| | Effective major principal stress, s'1 (psi) | 76.52 |
| | Effective minor principal stress, s'3 (psi) | 0.01 |
| | Total major principal stress, s1 (psi) | 89.02 |
| Total minor principal stress, s3 (psi) | 12.50 | |
| Skempton A at failure, Af | 0.16 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 4.73 |
| | Time to failure, tf (min) | 47.3 |
| | Deviator stress, s1-s3 (psi) | 78.59 |
| | Excess pore pressure, u (psi) | 12.48 |
| | $q = q' = (s1-s3)/2$ (psi) | 39.29 |
| | $p' = (s'1+s'3)/2$ (psi) | 39.31 |
| | $p = (s1+s3)/2$ (psi) | 51.79 |
| | Effective major principal stress, s'1 (psi) | 78.61 |
| | Effective minor principal stress, s'3 (psi) | 0.02 |
| | Total major principal stress, s1 (psi) | 91.09 |
| Total minor principal stress, s3 (psi) | 12.50 | |
| Skempton A at failure, Af | 0.16 | |

Comments:

Initial sample moisture content was back calculated from oven dried sample after test

Project: Cell Crete
 No: 14GCI498

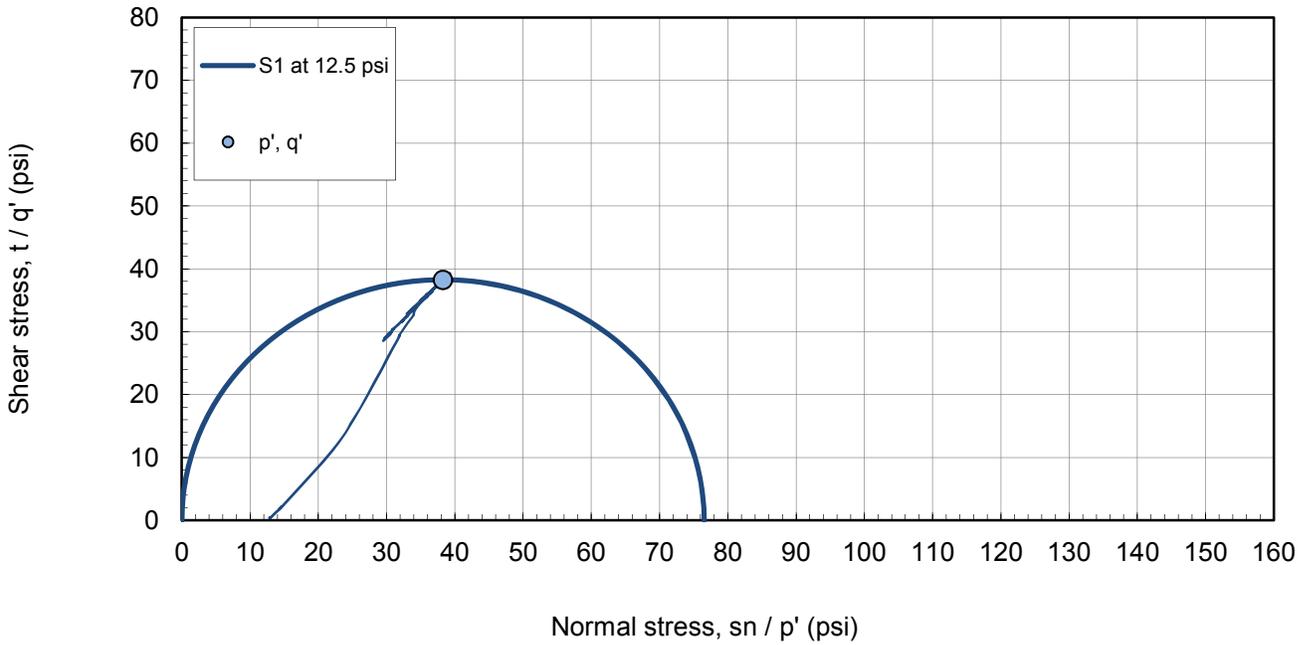
Cellular concrete type: Class IV (Low Density)
 Sample: 213-16



Project: Cell Crete
No: 14GCI498

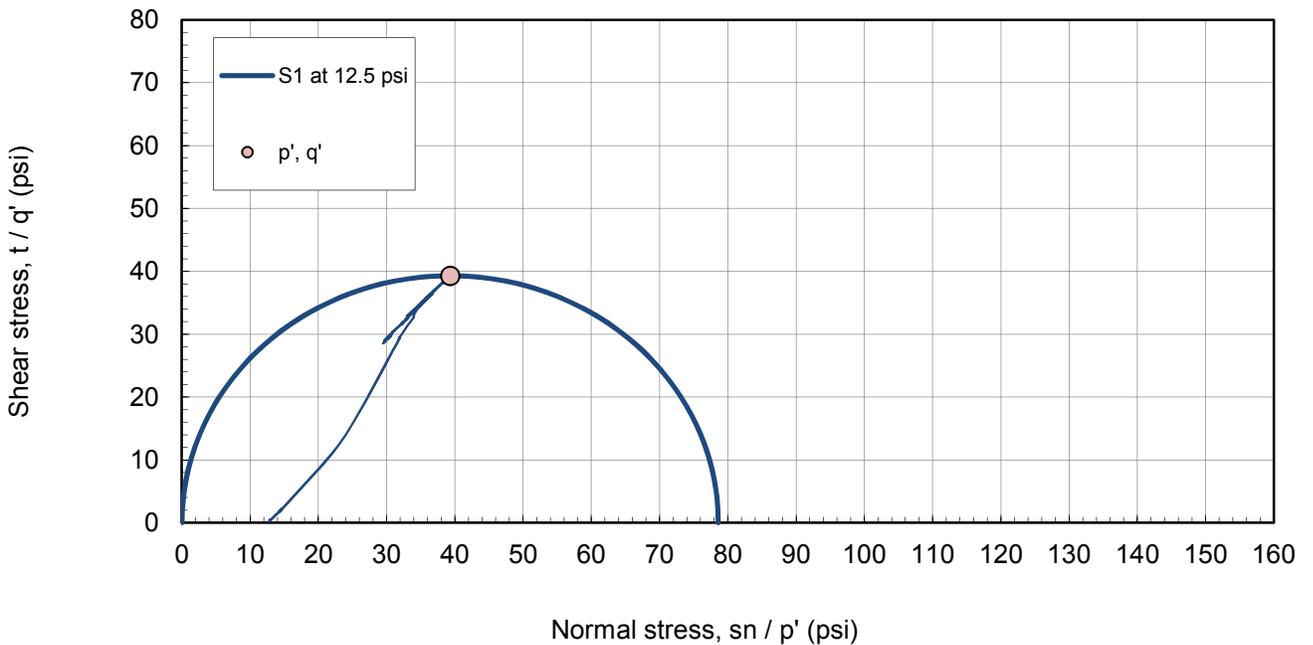
Cellular concrete type: Class IV (Low Density)
Sample: 213-16

Effective stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results

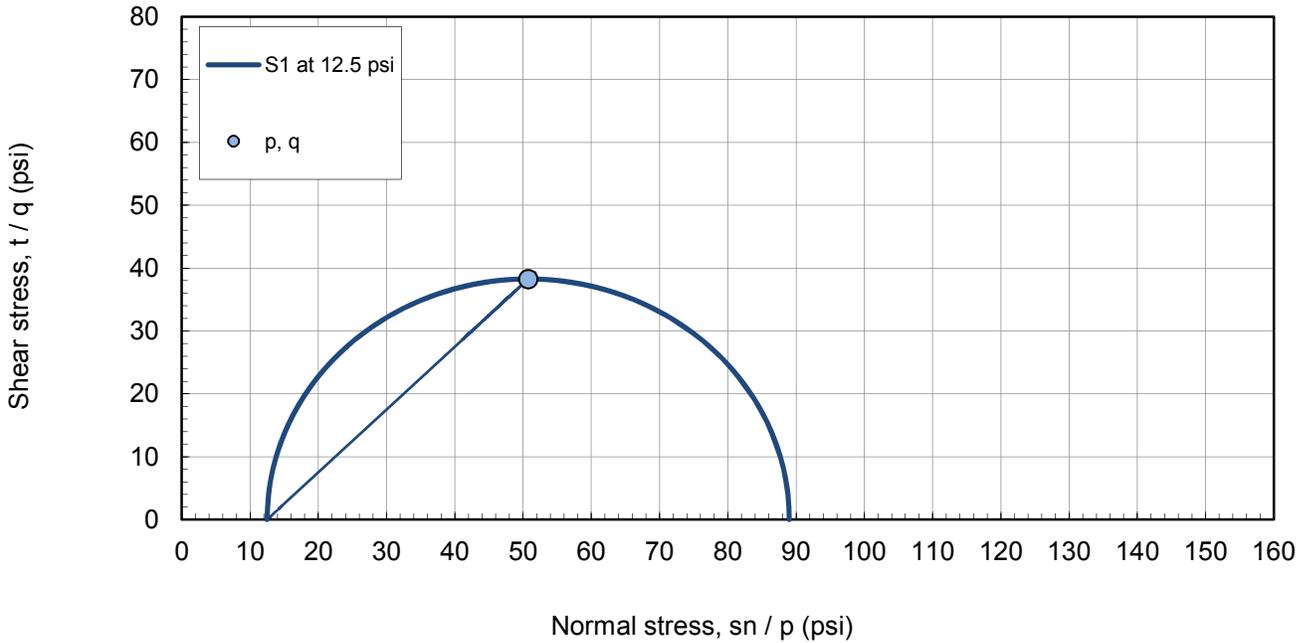


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Project: Cell Crete
No: 14GCI498

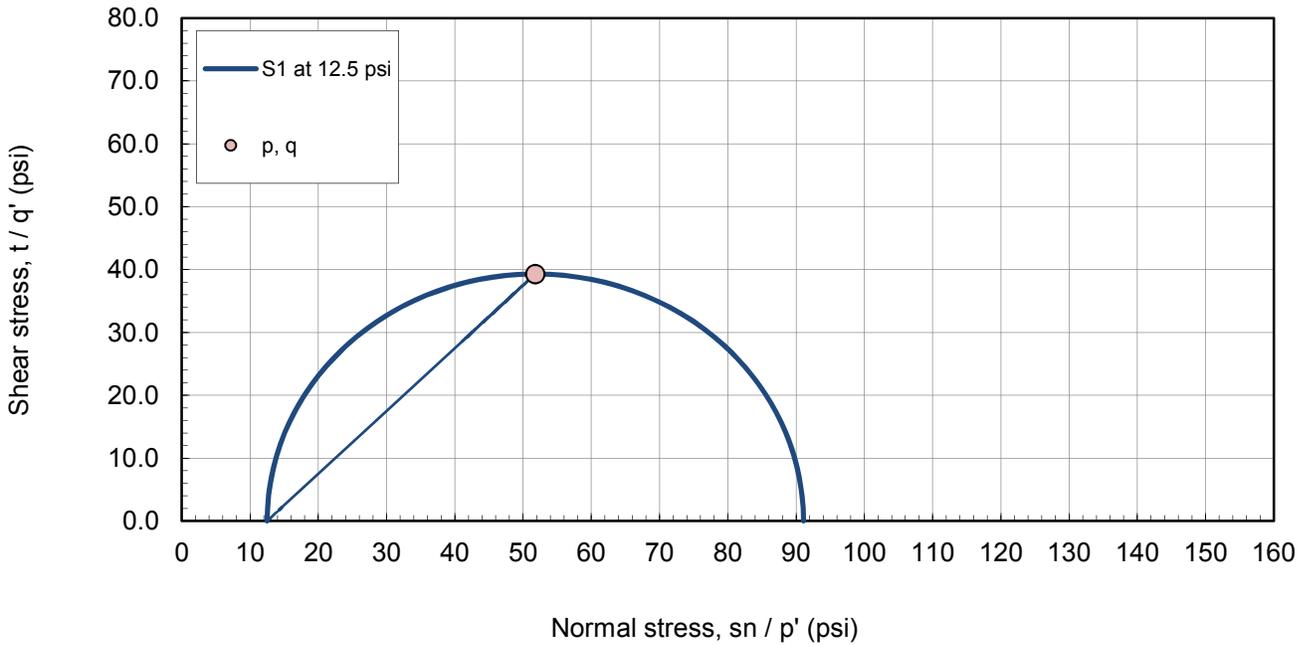
Cellular concrete type: Class IV (Low Density)
Sample: 213-16

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and p - q space plots - effective stress results

Total stress results

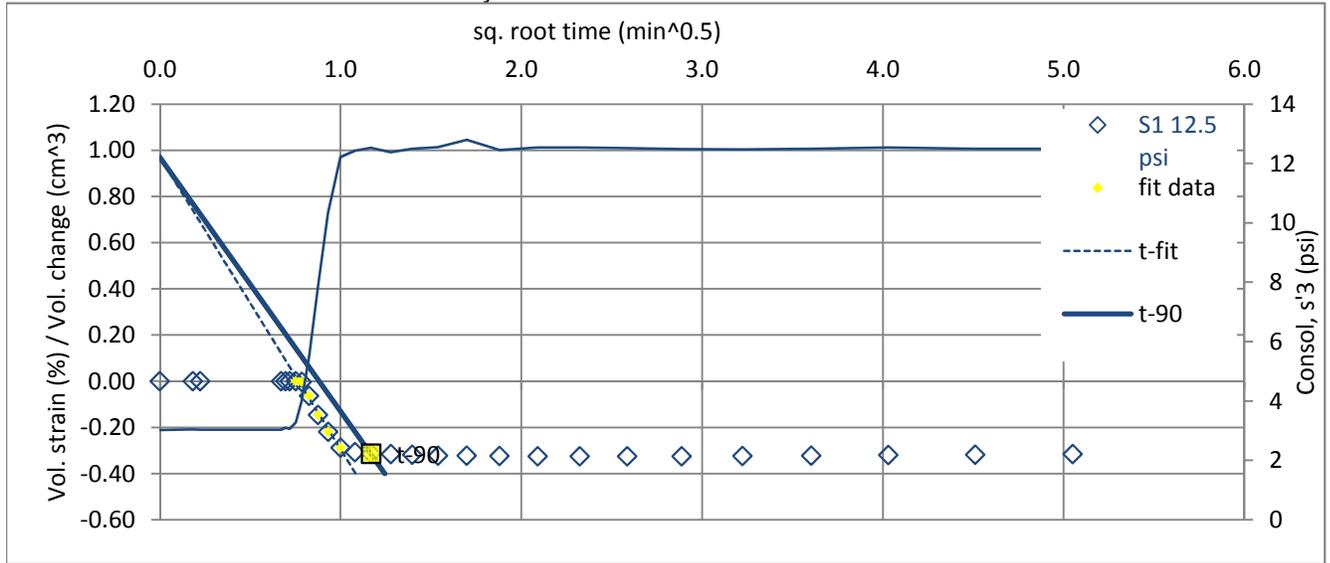


Peak deviator stress (s_1-s_3), failure criteria Mohr and p - q space plots

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-16

Time rate of consolidation data and analysis



Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750

Project: **Cell Crete** Cellular concrete type: **Class IV (Low Density)**
 No: **14GCI498** Sample: **213-15**
 Date cast: **13-Feb-15** Sample description: **Cellular concrete cast on 2/13/15**
 Date: **24-Mar-15** USCS classification: **not applicable**
 Tested by: **zmg** Sample type: **cast**
 Reduced by: **zmg** Age of sample (days): **39**
 Checked by: **rbm/rtc**

| | Test Number | 30 psi | |
|-------------------------------------|-------------------------------------|---------|--------------------------------|
| | | S1 | Bef. Shr. MethodA ^d |
| | | Initial | |
| | 0° | 5.884 | |
| Sample ht., H (in) | 120° | 5.888 | |
| | 240° | 5.872 | |
| Avg. height, Havg (in) | | 5.881 | 5.881 |
| Avg. height, Havg (cm) | | 14.939 | 14.939 |
| ΔHsc (in) ^a | | | 0.00 |
| | top | 2.973 | |
| | mid | 2.948 | |
| Sample dia., D (in) | bot | 2.917 | |
| | | | |
| | | | |
| Avg. dia., Davg (in) | | 2.947 | 2.956 |
| Avg. dia., Davg (cm) | | 7.484 | 7.508 |
| Avg. area, Aavg (in ²) | | 6.819 | 6.862 |
| Avg. area, Aavg (cm ²) | | 43.992 | 44.271 |
| Wt. rings + wet soil (g) | | 341.58 | 607.05 |
| Wt. rings (g) | | 0.00 | 0.00 |
| Volume, Vo (in ³) | | 40.1 | 40.4 |
| Vo (cm ³) | | 657.2 | 661.3 |
| Vo (ft ³) | | 0.0232 | 0.0234 |
| ΔVs (cm ³) ^b | | | 0.00 |
| ΔVc (cm ³) ^b | | | -4.18 |
| Moisture | Wet soil + tare (g) | 341.58 | 751.70 |
| | Dry soil + tare (g) | 221.64 | 366.29 |
| | Tare (g) | 0.00 | 144.65 |
| | Moisture content, w (%) | 54.1 | 173.9 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 341.6 | 812.6 |
| | Mass of solids (g) | 221.6 | 221.6 |
| | Volume (cm ³) | 657.2 | 661.3 |
| | Volume of water (cm ³) | 119.9 | 591.0 |
| | Volume of solids (cm ³) | 70.4 | 70.4 |
| | Volume of voids (cm ³) | 586.8 | 591.0 |
| | Volume of air (cm ³) | 466.9 | 0.0 |
| | Void ratio, e | 8.340 | 8.399 |
| | Porosity, n | 0.893 | 0.894 |
| | Volumetric moisture, T | 0.183 | 0.894 |
| | Saturation, S (%) ^b | 20.44 | 100.00 |
| | Dry density (gm/cm ³) | 0.337 | 0.335 |
| Wet unit wt., gm (pcf) | 32.4 | 57.3 | |
| Dry unit wt., gd (pcf) | 21.1 | 20.9 | |

Photo of sample after testing



Notes:

- ^a ΔHsc (in) = change in height during saturation and consolidation
- ^b ΔVs = change in volume during saturation, ΔVc = change in volume during consolidation
- ^c Saturation before shear set to 100% for phase calculations
- ^d Before shear Aavg using method A; where Ac (Method A) = (Vo-DVs - DVc)/(Ho-DHsc)

Triaxial Test - Isotropic Consolidated Sheared Undrained
Measuring Pore Pressure (CIU-PP) - After ASTM D4767 and USBR 5750



Project: Cell Crete
No: 14GCI498
 Date cast: 13-Feb-15
 Date: 24-Mar-15
 Tested by: zmg

Cellular concrete type: Class IV (Low Density)
Sample: 213-15
 Sample description: Cellular concrete cast on 2/13/1
 USCS classification: not applicable
 Sample type: cast

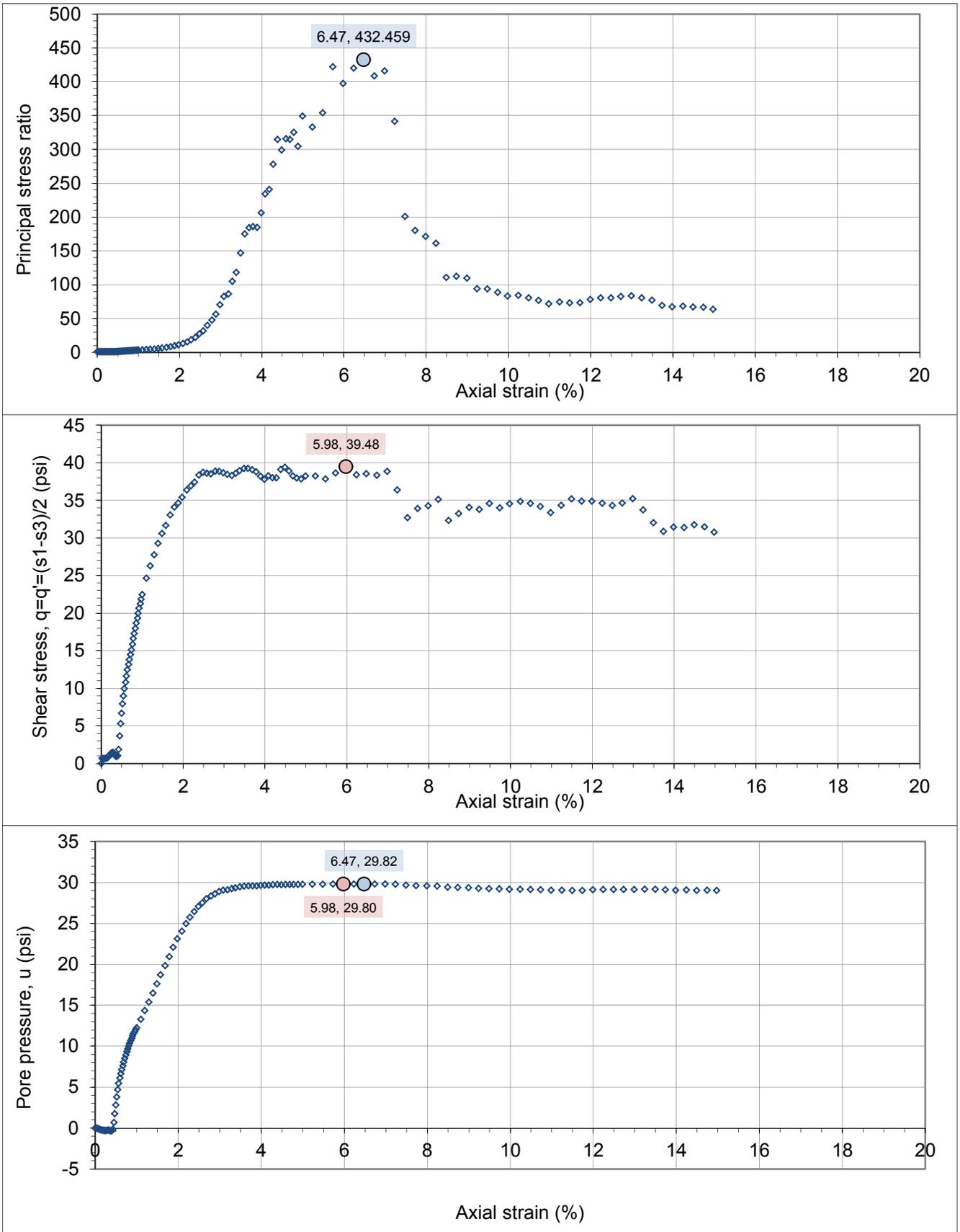
X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_CU1pts_TypeIV_30psi-v02.xlsx]SUM

| Test Number | S1 at 30 psi | |
|--|---|-----------------|
| Test information | Total backpressure (psi) | 75.0 |
| | Skempton B | 0.87 |
| | t-90 (min) | 0.6 |
| | t-100 (min) | |
| | t-50 (min) | 0.1 |
| | Strain rate (%/hr) | 6.00 |
| | Strain rate (%/min) | 0.10 |
| | Membrane correction | Yes |
| | Filter paper correction | No filter paper |
| Max principal stress ratio (s1/s3), failure criteria | Strain at failure, ef (%) | 6.47 |
| | Time to failure, tf (min) | 64.7 |
| | Obliquity, s'1/s'3 | 432.459 |
| | Excess pore pressure, u (psi) | 29.82 |
| | $q = q' = (s1-s3)/2$ (psi) | 38.55 |
| | $p' = (s'1+s'3)/2$ (psi) | 38.73 |
| | $p = (s1+s3)/2$ (psi) | 68.55 |
| | Effective major principal stress, s'1 (psi) | 77.27 |
| | Effective minor principal stress, s'3 (psi) | 0.18 |
| | Total major principal stress, s1 (psi) | 107.09 |
| Total minor principal stress, s3 (psi) | 30.00 | |
| Skempton A at failure, Af | 0.39 | |
| Peak deviator stress (s1-s3), failure criteria | Strain at failure, ef (%) | 5.98 |
| | Time to failure, tf (min) | 59.8 |
| | Deviator stress, s1-s3 (psi) | 78.95 |
| | Excess pore pressure, u (psi) | 29.80 |
| | $q = q' = (s1-s3)/2$ (psi) | 39.48 |
| | $p' = (s'1+s'3)/2$ (psi) | 39.68 |
| | $p = (s1+s3)/2$ (psi) | 69.48 |
| | Effective major principal stress, s'1 (psi) | 79.15 |
| | Effective minor principal stress, s'3 (psi) | 0.20 |
| | Total major principal stress, s1 (psi) | 108.95 |
| Total minor principal stress, s3 (psi) | 30.00 | |
| Skempton A at failure, Af | 0.38 | |

Comments:

Project: Cell Crete
 No: 14GCI498

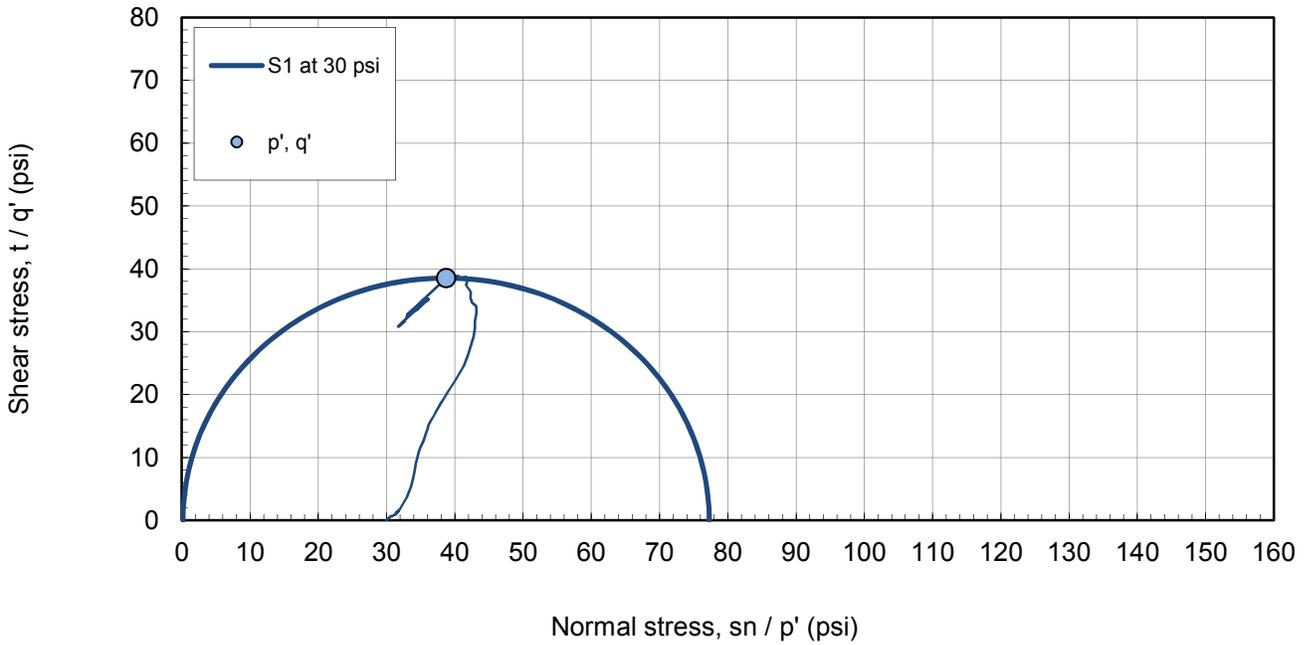
Cellular concrete type: Class IV (Low Density)
 Sample: 213-15



Project: Cell Crete
No: 14GCI498

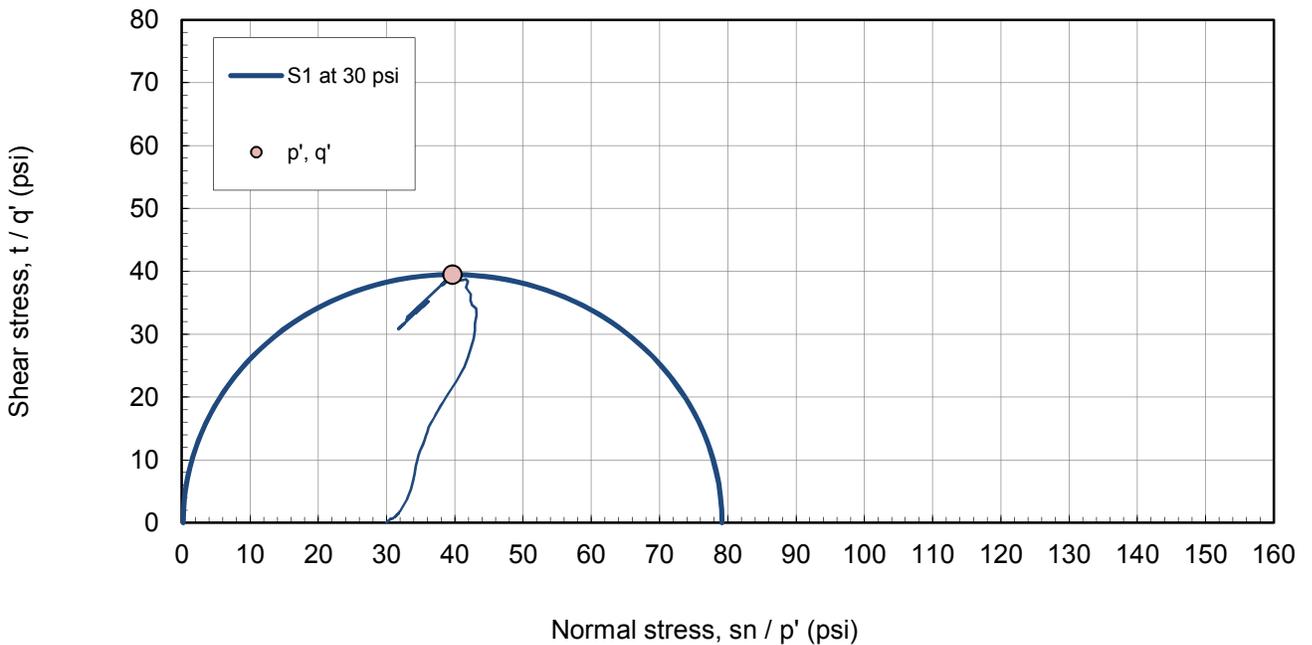
Cellular concrete type: Class IV (Low Density)
Sample: 213-15

Effective stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p' - q'$ space plots

Effective stress results

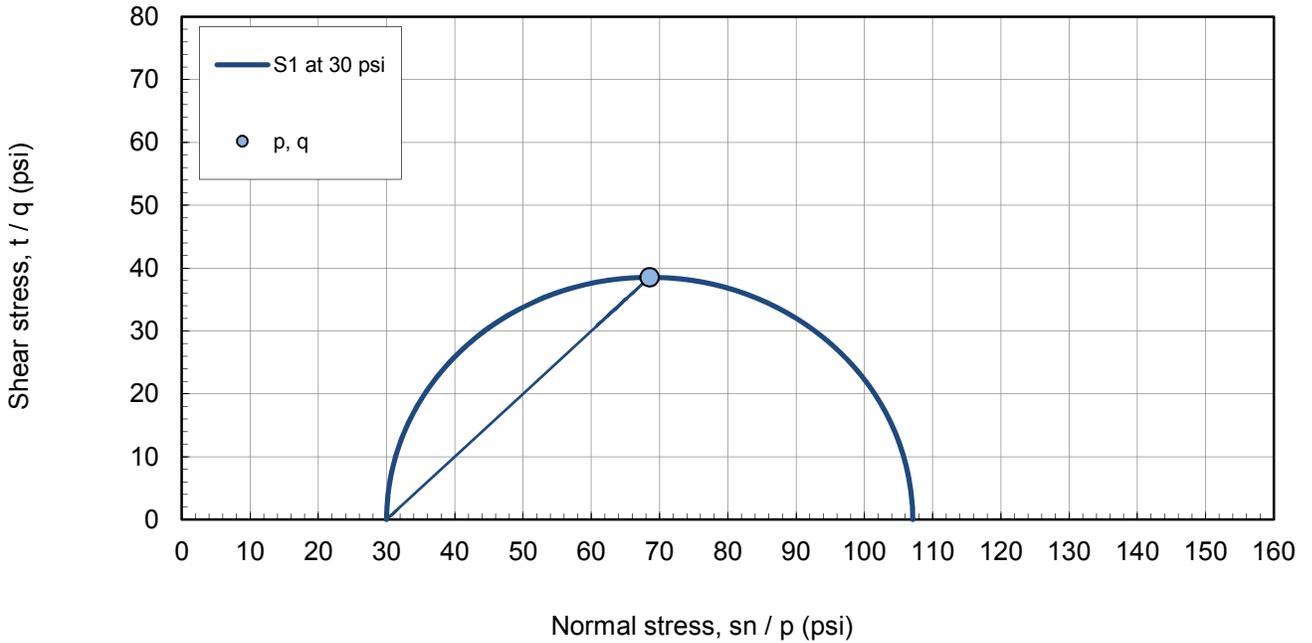


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p' - q'$ space plots

Project: Cell Crete
 No: 14GCI498

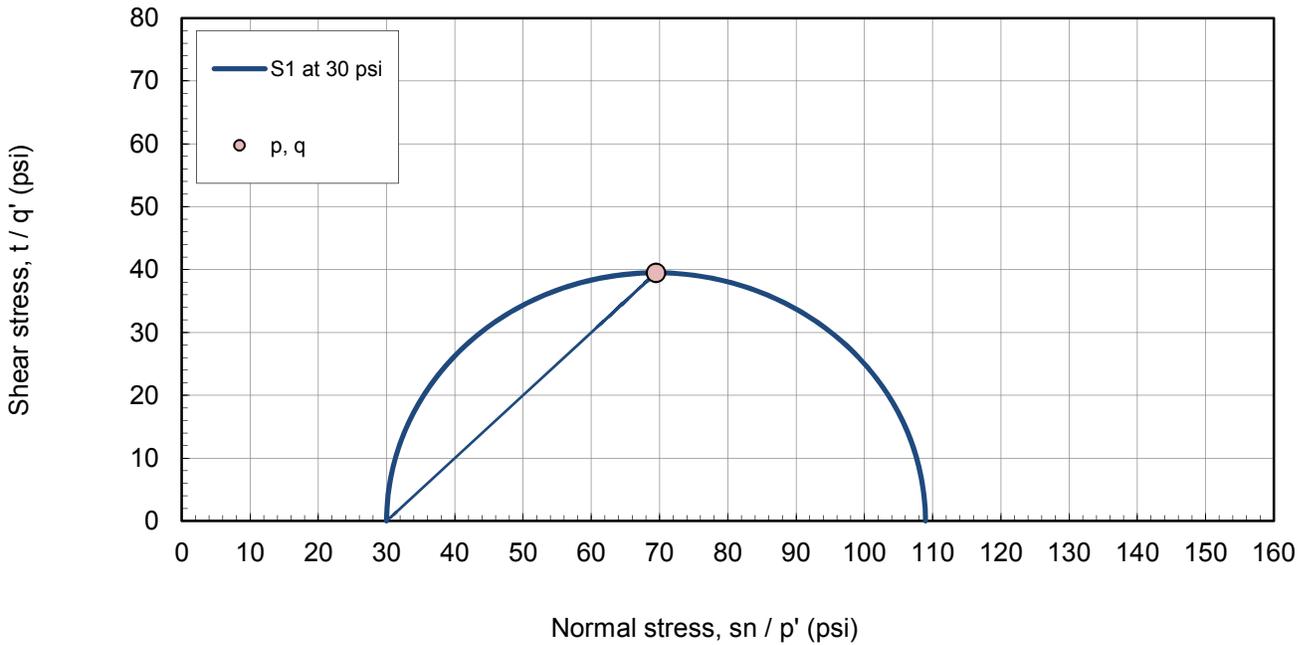
Cellular concrete type: Class IV (Low Density)
 Sample: 213-15

Total stress results



Max principal stress ratio (s_1/s_3), failure criteria Mohr and $p - q$ space plots - effective stress results

Total stress results

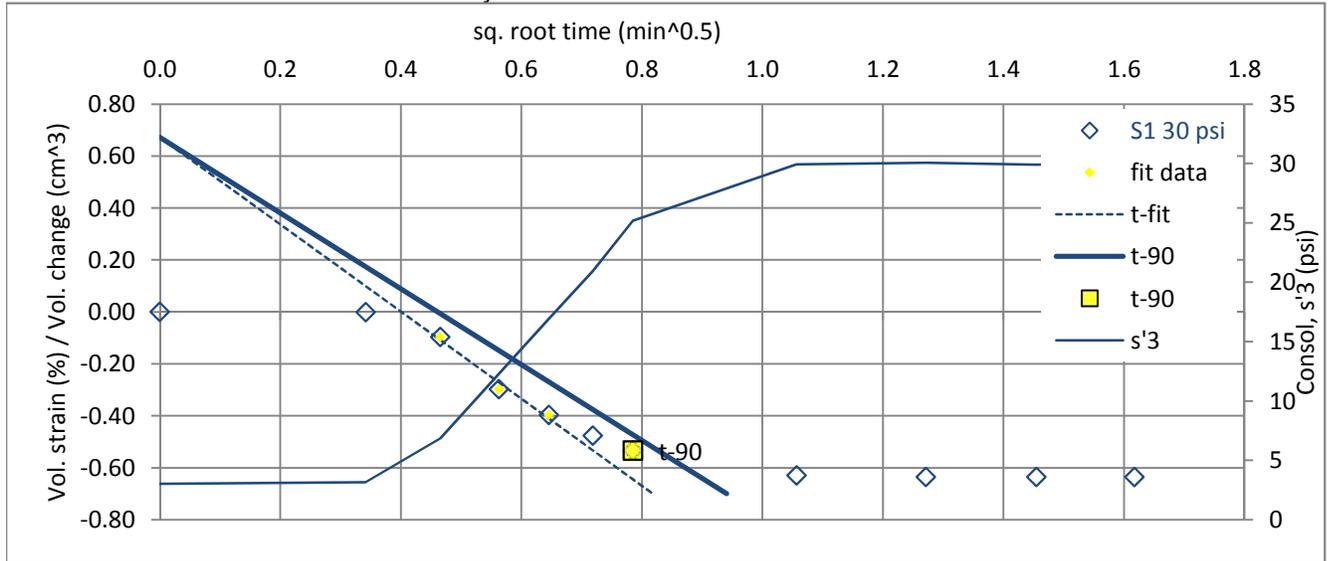


Peak deviator stress (s_1-s_3), failure criteria Mohr and $p - q$ space plots

Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-15

Time rate of consolidation data and analysis



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M



Project: Cell Crete

Sample: 213-04

No: 14GCI498

Cellular concrete type: Class IV (Low Density)

Date cast: 13-Feb-15

Location: ---

Sample description: not requested

Age of sample (days): 29

Date: 14-Mar-15

USCS classification: not requested

Tested by: zmg

Sample type: Cell Crete

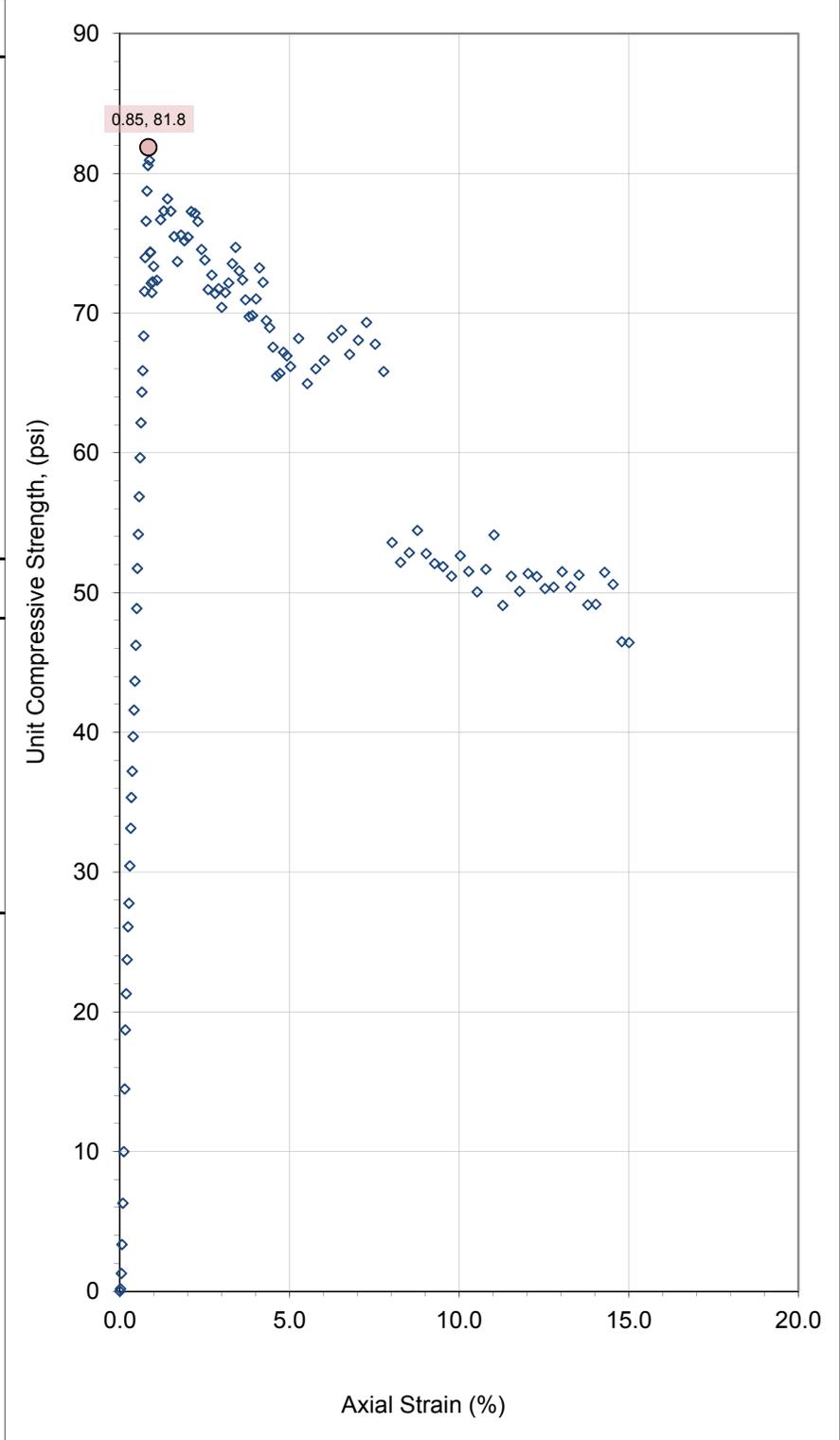
Reduced by: zmg

Type of cap: no cap

Checked by: rbm

| Test Number 6 | | |
|--------------------------|------------------------------------|--------|
| Unit weight data | 0° | 5.536 |
| | Sample ht., H (in) 120° | 5.565 |
| | 240° | 5.545 |
| | Avg. height, Havg (in) | 5.549 |
| | Avg. height, Havg (cm) | 14.094 |
| | top | 2.976 |
| | Sample dia., D (in) mid | 2.947 |
| | bot | 2.922 |
| | Avg. dia., Davg (in) | 2.948 |
| | Avg. dia., Davg (cm) | 7.488 |
| | Avg. area, Aavg (in ²) | 6.826 |
| | Avg. area, Aavg (cm ²) | 44.036 |
| | Wt. rings + wet soil (g) | 319.48 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in ³) | 37.9 |
| | Vo (cm ³) | 620.6 |
| | Vo (ft ³) | 0.0219 |
| Gs, from mix design | 3.15 | |
| Moist unit wt., gm (pcf) | 32.1 | |

| | | |
|----------------------------------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 0.85 |
| | Time to failure, tf (min) | 0.9 |
| | Maximum vertical load (lbs) | 557.9 |
| | Unit compressive strength, (psi) | 81.8 |
| Unit compressive strength, (psf) | 11785 | |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M



Project: Cell Crete
No: 14GCI498

Sample: 213-05

Cellular concrete type: Class IV (Low Density)

Date cast: 13-Feb-15

Location: ---
Date: 14-Mar-15

Sample description: not requested

Age of sample (days): 29

Tested by: zmg

USCS classification: not requested

Sample type: Cell Crete

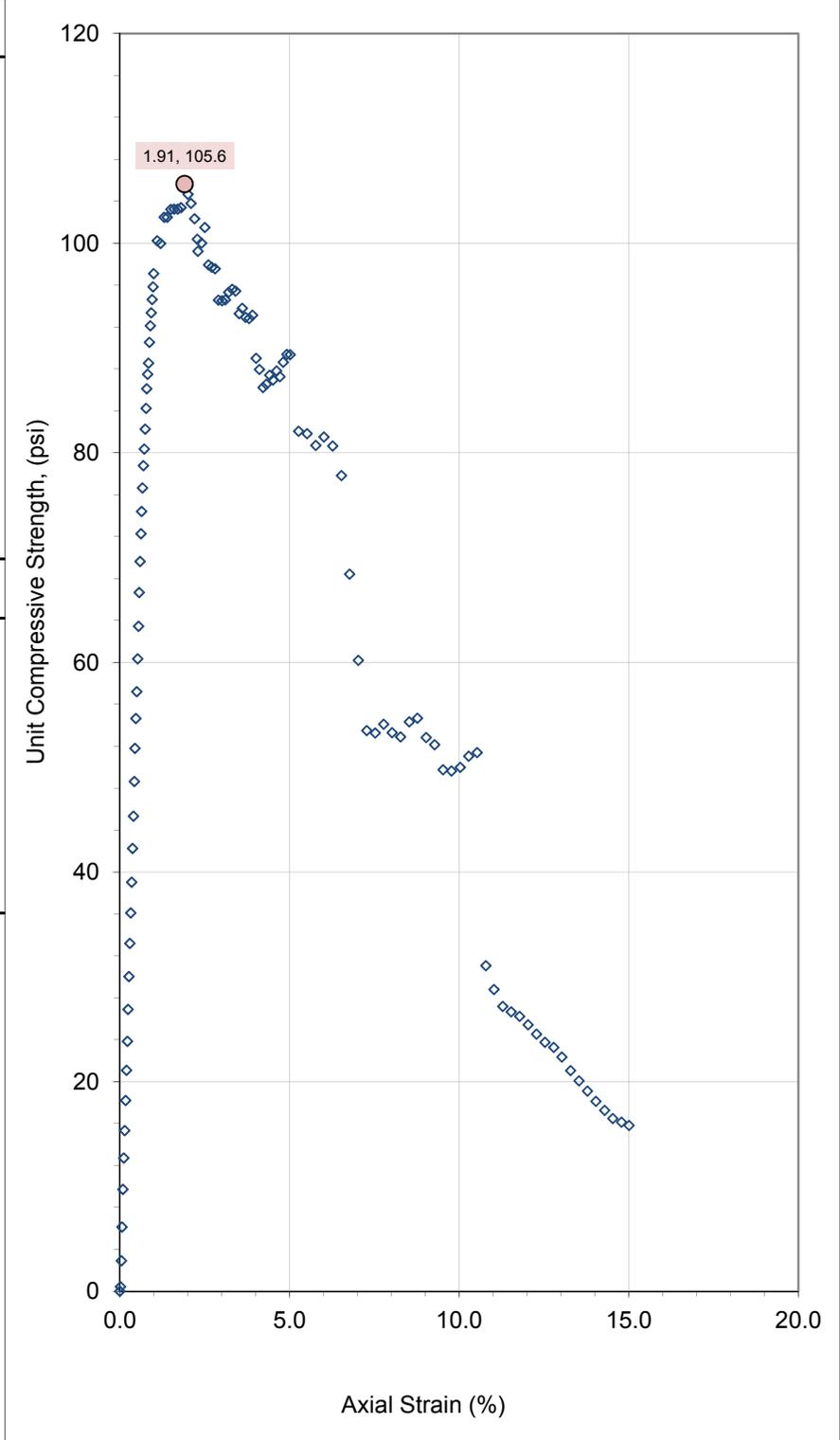
Reduced by: zmg

Type of cap: no cap

Checked by: rbm

| Test Number 7 | | |
|------------------|------------------------------------|-----------------------------|
| | 0° | 5.751 |
| Unit weight data | Sample ht., H (in) | 120° 5.780 |
| | | 240° 5.779 |
| | Avg. height, Havg (in) | 5.770 |
| | Avg. height, Havg (cm) | 14.656 |
| | | top 2.988 |
| | Sample dia., D (in) | mid 2.949 |
| | | bot 2.939 |
| | Avg. dia., Davg (in) | 2.956 |
| | Avg. dia., Davg (cm) | 7.509 |
| | Avg. area, Aavg (in ²) | 6.864 |
| | Avg. area, Aavg (cm ²) | 44.283 |
| | Wt. rings + wet soil (g) | 348.77 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in ³) | 39.6 |
| | | Vo (cm ³) 649.0 |
| | Vo (ft ³) 0.0229 | |
| | Gs, from mix design | 3.15 |
| | Moist unit wt., gm (pcf) | 33.5 |

| | | |
|-----------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 1.91 |
| | Time to failure, tf (min) | 1.9 |
| | Maximum vertical load (lbs) | 725.3 |
| | Unit compressive strength, (psi) | 105.6 |
| | Unit compressive strength, (psf) | 15212 |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M



Project: Cell Crete

No: 14GCI498

Location: ---

Date: 14-Mar-15

Tested by: zmg

Reduced by: zmg

Checked by: rbm

Sample: 213-07

Cellular concrete type: Class IV (Low Density)

Sample description: not requested

USCS classification: not requested

Sample type: Cell Crete

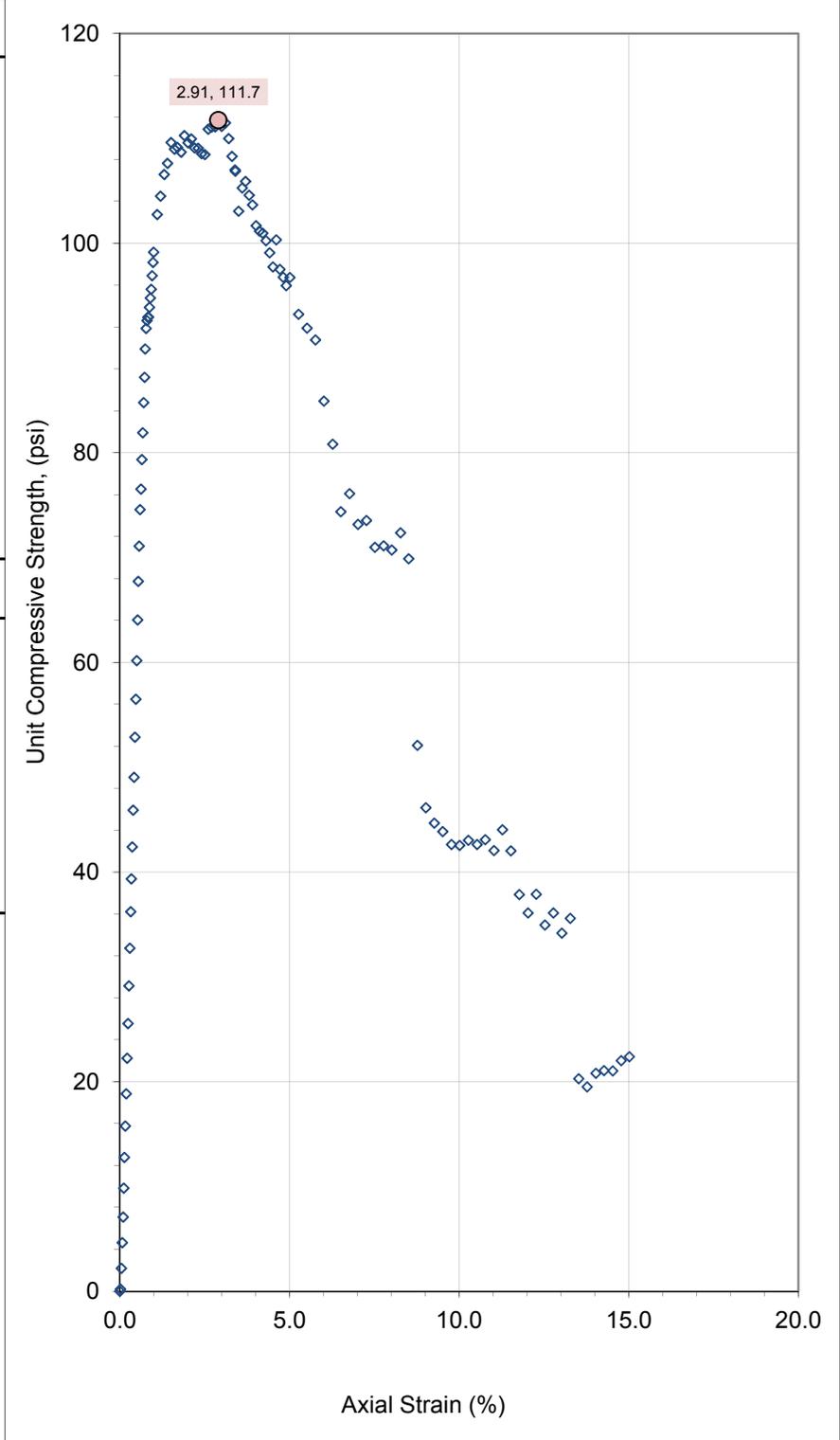
Type of cap: no cap

Date cast: 13-Feb-15

Age of sample (days): 29

| Test Number 8 | | |
|--------------------------|------------------------------------|------------------------------|
| Unit weight data | 0° | 5.748 |
| | Sample ht., H (in) | 120° 5.766 |
| | | 240° 5.762 |
| | Avg. height, Havg (in) | 5.759 |
| | Avg. height, Havg (cm) | 14.627 |
| | | top 2.994 |
| | Sample dia., D (in) | mid 2.958 |
| | | bot 2.924 |
| | Avg. dia., Davg (in) | 2.959 |
| | Avg. dia., Davg (cm) | 7.515 |
| | Avg. area, Aavg (in ²) | 6.874 |
| | Avg. area, Aavg (cm ²) | 44.351 |
| | Wt. rings + wet soil (g) | 345.41 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in ³) | 39.6 |
| | | Vo (cm ³) 648.7 |
| | | Vo (ft ³) 0.0229 |
| Gs, from mix design | 3.15 | |
| Moist unit wt., gm (pcf) | 33.2 | |

| | | |
|----------------------------------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 2.91 |
| | Time to failure, tf (min) | 2.9 |
| | Maximum vertical load (lbs) | 768.2 |
| | Unit compressive strength, (psi) | 111.7 |
| Unit compressive strength, (psf) | 16088 | |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M



Project: Cell Crete

Sample: 213-10

No: 14GCI498

Cellular concrete type: Class IV (Low Density)

Date cast: 13-Feb-15

Location: ---

Sample description: not requested

Age of sample (days): 29

Date: 14-Mar-15

USCS classification: not requested

Tested by: zmg

Sample type: Cell Crete

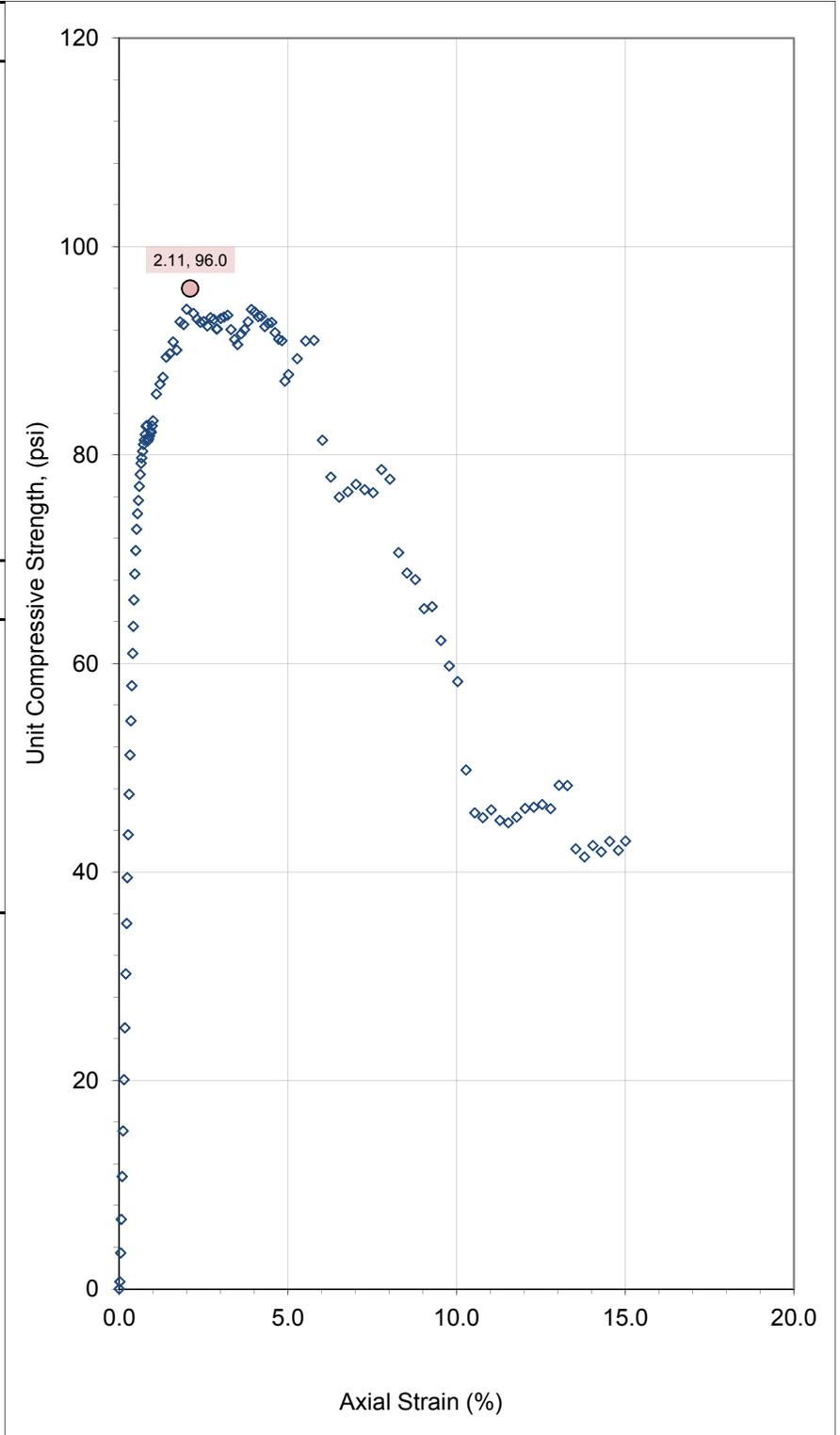
Reduced by: zmg

Type of cap: no cap

Checked by: rbm

| Test Number 9 | | |
|--------------------------|--------------------------|-----------------|
| | 0° | 5.744 |
| Unit weight data | Sample ht., H (in) | 120° 5.768 |
| | | 240° 5.753 |
| | Avg. height, Havg (in) | 5.755 |
| | Avg. height, Havg (cm) | 14.618 |
| | | top 2.986 |
| | Sample dia., D (in) | mid 2.948 |
| | | bot 2.932 |
| | Avg. dia., Davg (in) | 2.954 |
| | Avg. dia., Davg (cm) | 7.502 |
| | Avg. area, Aavg (in^2) | 6.851 |
| | Avg. area, Aavg (cm^2) | 44.201 |
| | Wt. rings + wet soil (g) | 351.50 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in^3) | 39.4 |
| | | Vo (cm^3) 646.1 |
| | Vo (ft^3) 0.0228 | |
| Gs, from mix design | 3.15 | |
| Moist unit wt., gm (pcf) | 34.0 | |

| | | |
|----------------------------------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 2.11 |
| | Time to failure, tf (min) | 2.1 |
| | Maximum vertical load (lbs) | 657.1 |
| | Unit compressive strength, (psi) | 96.0 |
| Unit compressive strength, (psf) | 13820 | |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M

Project: Cell Crete

Sample: 213-12

No: 14GCI498

Cellular concrete type: Class IV (Low Density)

Date cast: 13-Feb-15

Location: ---

Sample description: not requested

Age of sample (days): 29

Date: 14-Mar-15

USCS classification: not requested

Tested by: zmg

Sample type: Cell Crete

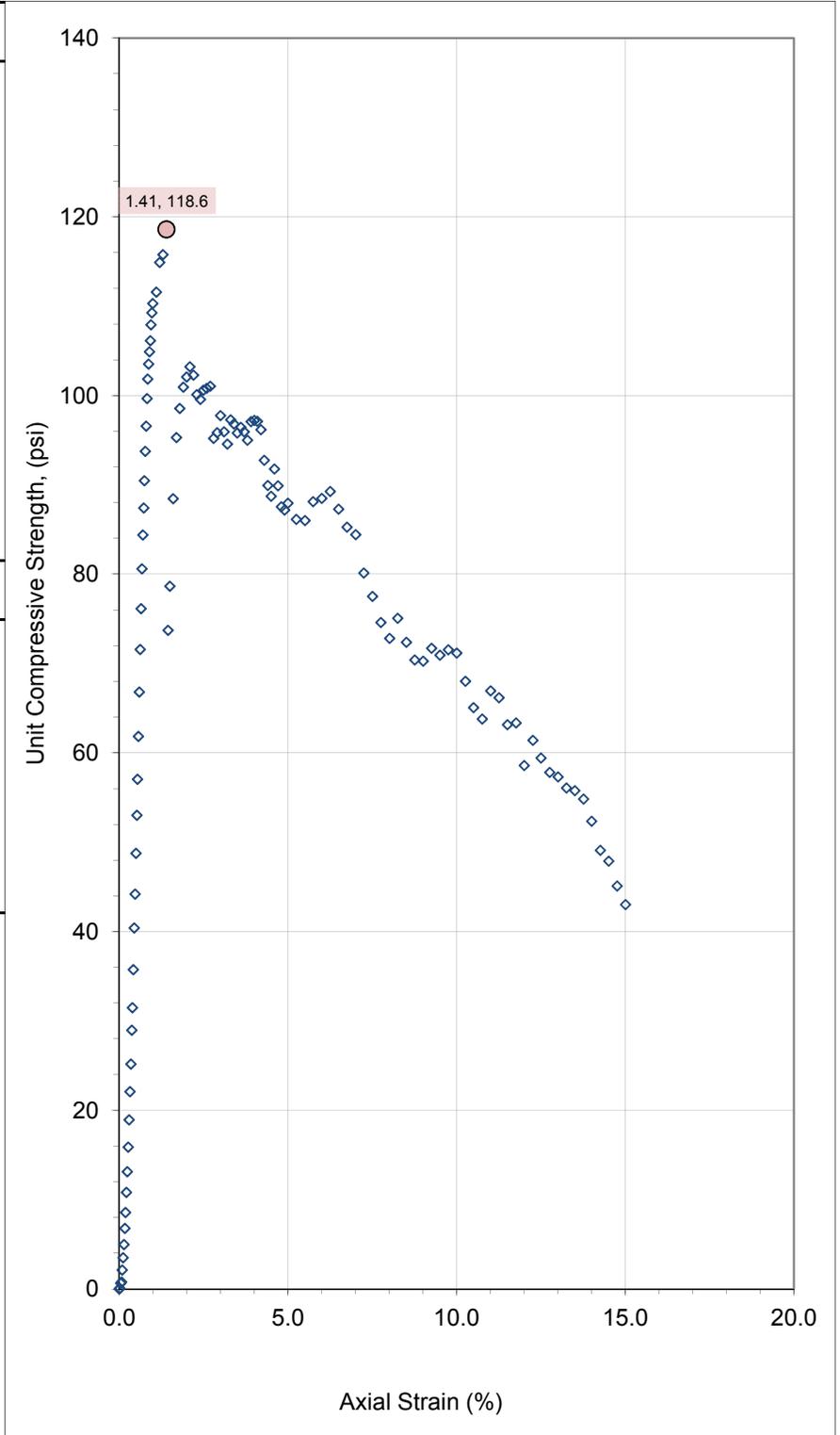
Reduced by: zmg

Type of cap: no cap

Checked by: rbm

| Test Number 10 | | |
|--------------------------|------------------------------------|------------------------------|
| | 0° | 5.747 |
| Unit weight data | Sample ht., H (in) | 120° 5.750 |
| | | 240° 5.763 |
| | Avg. height, Havg (in) | 5.753 |
| | Avg. height, Havg (cm) | 14.613 |
| | | top 2.982 |
| | Sample dia., D (in) | mid 2.968 |
| | | bot 2.921 |
| | Avg. dia., Davg (in) | 2.960 |
| | Avg. dia., Davg (cm) | 7.518 |
| | Avg. area, Aavg (in ²) | 6.880 |
| | Avg. area, Aavg (cm ²) | 44.388 |
| | Wt. rings + wet soil (g) | 339.32 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in ³) | 39.6 |
| | | Vo (cm ³) 648.7 |
| | | Vo (ft ³) 0.0229 |
| | Gs, from mix design | 3.15 |
| Moist unit wt., gm (pcf) | 32.7 | |

| | | |
|-----------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 1.41 |
| | Time to failure, tf (min) | 1.4 |
| | Maximum vertical load (lbs) | 815.6 |
| | Unit compressive strength, (psi) | 118.6 |
| | Unit compressive strength, (psf) | 17073 |
| Comments: | | |



Unconfined Compression of Light Weight Material (UC)

After ASTM C495/C495M



Project: Cell Crete

Sample: 213-13

No: 14GCI498

Cellular concrete type: Class IV (Low Density)

Date cast: 13-Feb-15

Location: ---

Sample description: not requested

Age of sample (days): 29

Date: 14-Mar-15

USCS classification: not requested

Tested by: zmg

Sample type: Cell Crete

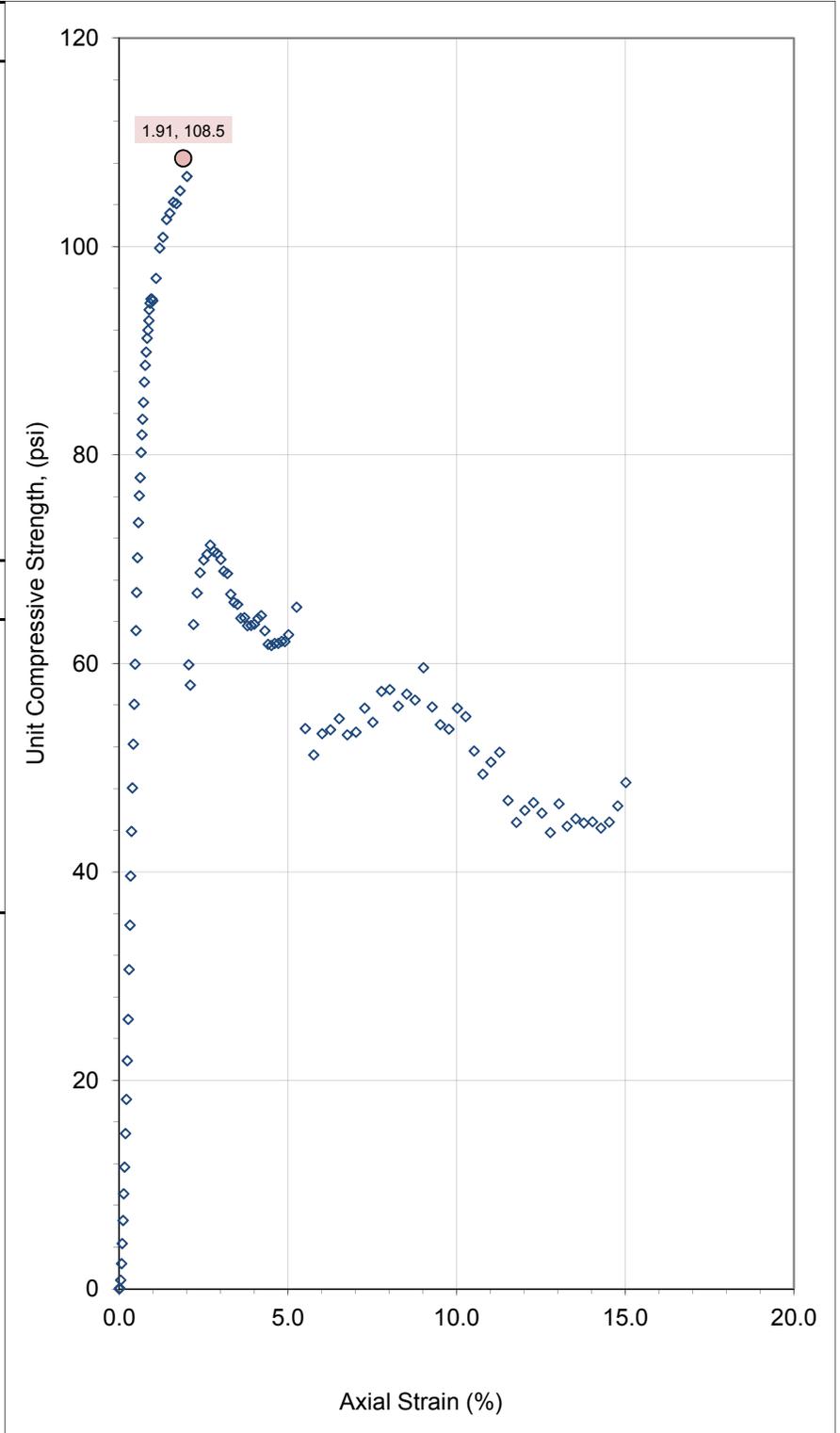
Reduced by: zmg

Type of cap: no cap

Checked by: rbm

| Test Number 11 | | |
|--------------------------|------------------------------------|-----------------------------|
| | 0° | 5.626 |
| Unit weight data | Sample ht., H (in) | 120° 5.628 |
| | | 240° 5.628 |
| | Avg. height, Havg (in) | 5.627 |
| | Avg. height, Havg (cm) | 14.293 |
| | | top 2.971 |
| | Sample dia., D (in) | mid 2.943 |
| | | bot 2.919 |
| | Avg. dia., Davg (in) | 2.944 |
| | Avg. dia., Davg (cm) | 7.478 |
| | Avg. area, Aavg (in ²) | 6.807 |
| | Avg. area, Aavg (cm ²) | 43.917 |
| | Wt. rings + wet soil (g) | 314.57 |
| | Wt. rings (g) | 0.00 |
| | Volume, Vo (in ³) | 38.3 |
| | | Vo (cm ³) 627.7 |
| | Vo (ft ³) 0.0222 | |
| Gs, from mix design | 3.15 | |
| Moist unit wt., gm (pcf) | 31.3 | |

| | | |
|-----------|----------------------------------|-------|
| Results | Strain rate (%/hr) | 60.00 |
| | Strain rate (%/min) | 1.00 |
| | Strain at failure, ef (%) | 1.91 |
| | Time to failure, tf (min) | 1.9 |
| | Maximum vertical load (lbs) | 738.5 |
| | Unit compressive strength, (psi) | 108.5 |
| | Unit compressive strength, (psf) | 15618 |
| Comments: | | |



K₀ Consolidation Test Using Strain Controlled Axial Loading and Automated Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-29

Location: ---
 Date: 16-Mar-15
 Date cast: 13-Feb-15
 Tested by: zmg
 Reduced by: zmg
 Checked by: rbm/rtc

Sample description: Cellular concrete cast on 2/13/15
 USCS classification: not applicable
 Sample type: cast
 Age of sample (days): 31

- Comments:
1. No shearing of sample was performed after the Ko consolidation phase
 2. Initial sample moisture content was back calculated from oven dried sample
 3. Automated lateral pressure adjustment using TruePath software

| | | Sample: 213-29 | |
|-------------------------------|-------------------------------------|----------------|--------|
| | | Initial | Final |
| Unit weight data | Sample ht., H (in) | 0° 5.804 | |
| | | 120° 5.815 | |
| | | 240° 5.824 | |
| | Avg. height, Havg (in) | 5.814 | |
| | Avg. height, Havg (cm) | 14.768 | |
| | ΔHsc (in) ^a | | |
| | | top 2.982 | |
| | Sample dia., D (in) | mid 2.950 | |
| | | bot 2.923 | |
| | Avg. dia., Davg (in) | 2.951 | |
| | Avg. dia., Davg (cm) | 7.496 | |
| | Avg. area, Aavg (in ²) | 6.841 | |
| | Avg. area, Aavg (cm ²) | 44.134 | |
| | Wt. rings + wet soil (g) | 347.88 | |
| | Wt. rings (g) | 0.00 | |
| Volume, Vo (in ³) | 39.8 | | |
| | Vo (cm ³) 651.8 | | |
| | Vo (ft ³) 0.0230 | | |
| Moisture | Wet soil + tare (g) | 347.88 | 742.33 |
| | Dry soil + tare (g) | 232.22 | 405.28 |
| | Tare (g) | 0.00 | 173.06 |
| | Moisture content, w (%) | 49.8 | 145.1 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 347.9 | 569.3 |
| | Mass of solids (g) | 232.2 | 232.2 |
| | Volume (cm ³) | 651.8 | 410.8 |
| | Volume of water (cm ³) | 115.7 | 337.1 |
| | Volume of solids (cm ³) | 73.7 | 73.7 |
| | Volume of voids (cm ³) | 578.1 | 337.1 |
| | Volume of air (cm ³) | 462.4 | 0.0 |
| | Void ratio, e | 7.841 | 4.572 |
| | Porosity, n | 0.887 | 0.821 |
| | Volumetric moisture, T | 0.177 | 0.821 |
| | Saturation, S (%) | 20.01 | 100.00 |
| | Dry density (gm/cm ³) | 0.356 | 0.565 |
| | Wet unit wt., gm (pcf) | 33.3 | 86.5 |
| Dry unit wt., gd (pcf) | 22.2 | 35.3 | |

Notes:

^a ΔHsc (in) = change in height during saturation and consolidation (end of test)

K0 Consolidation Test Using Strain Controlled Axial Loading and Automated*Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89***Project: Cell Crete
No: 14GCI498****Cellular concrete type: Class IV (Low Density)
Sample: 213-29**

Location: ---

Sample description: Cellular concrete cast on 2/13/15

Date: 16-Mar-15

USCS classification: not applicable

Tested by: zmg

Sample type: cast

Checked by: rbm/rtc

X:\PROJECTS\14GCI498 Cell Crete Lab Testing\[TX_K0CU1pts_213-29-v01.xlsm]SUM

Sample 213-29

| | | |
|------------------|-----------------------------------|------|
| Test information | Total backpressure (psi) | 80.0 |
| | Skempton B | 0.91 |
| | Consolidation strain rate (%/hr) | 1.00 |
| | Consolidation strain rate (%/min) | 0.02 |
| | Unloading strain rate (%/hr) | --- |
| | Shear strain rate (%/hr) | --- |
| | Consolidation membrane correction | Yes |
| | Shear membrane correction | N/A |
| | Filter paper correction | No |

Photo of sample after testing

**Comments:**

Initial consolidation strain rate varied during beginning of test to a strain of 0.38%. Final consolidation strain rate selected based on sample resistance.

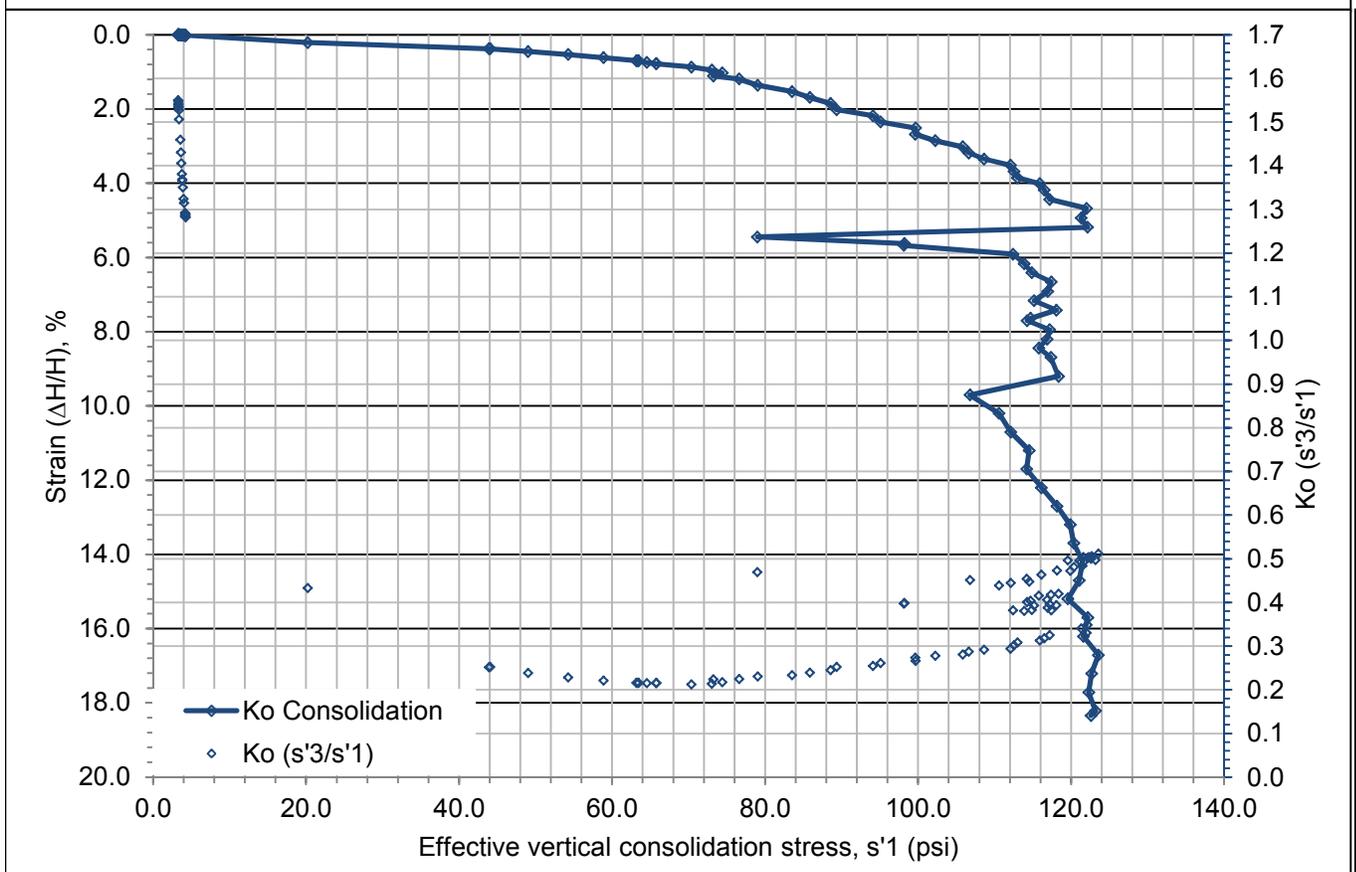
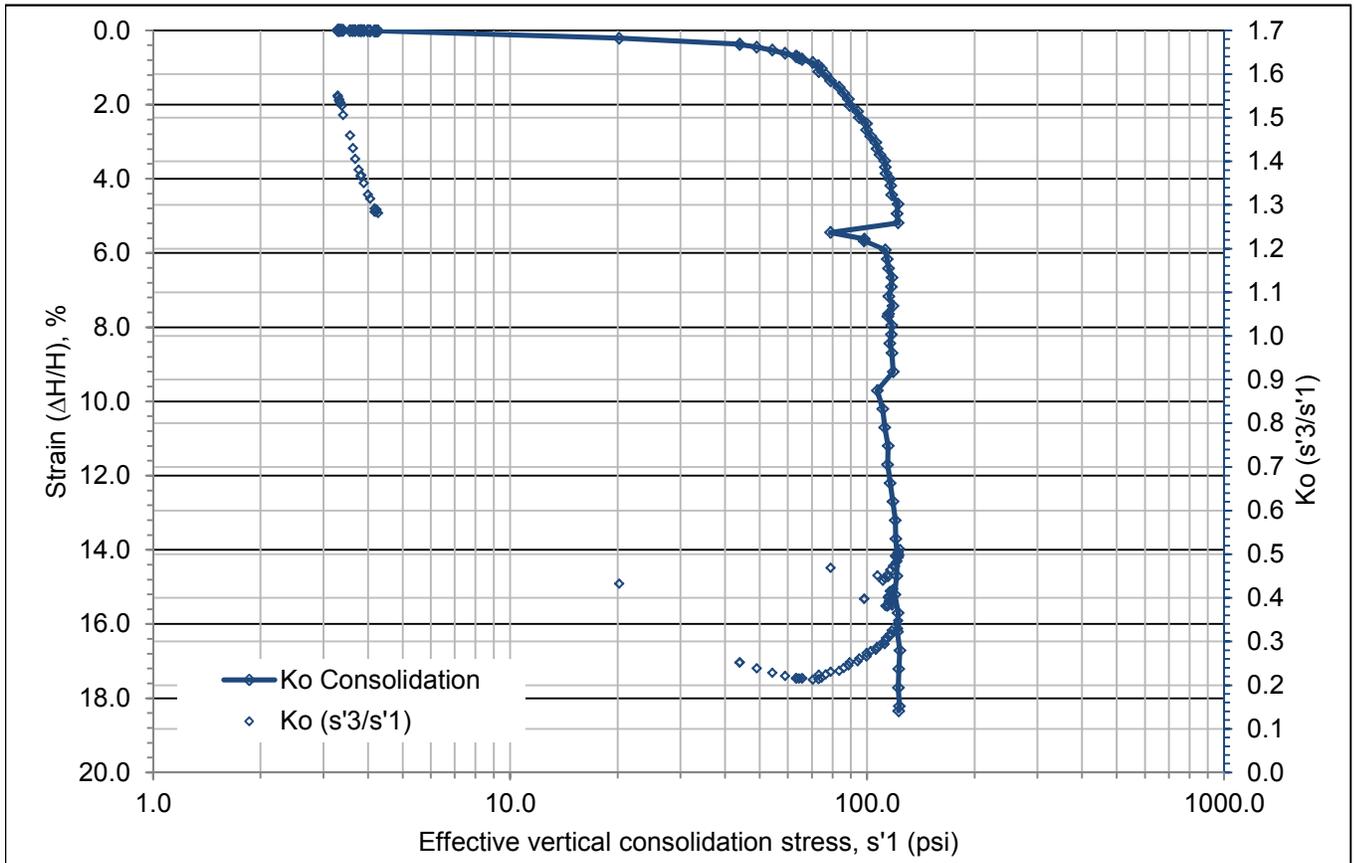
K0 Consolidation Test Using Strain Controlled Axial Loading and Automated

Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89



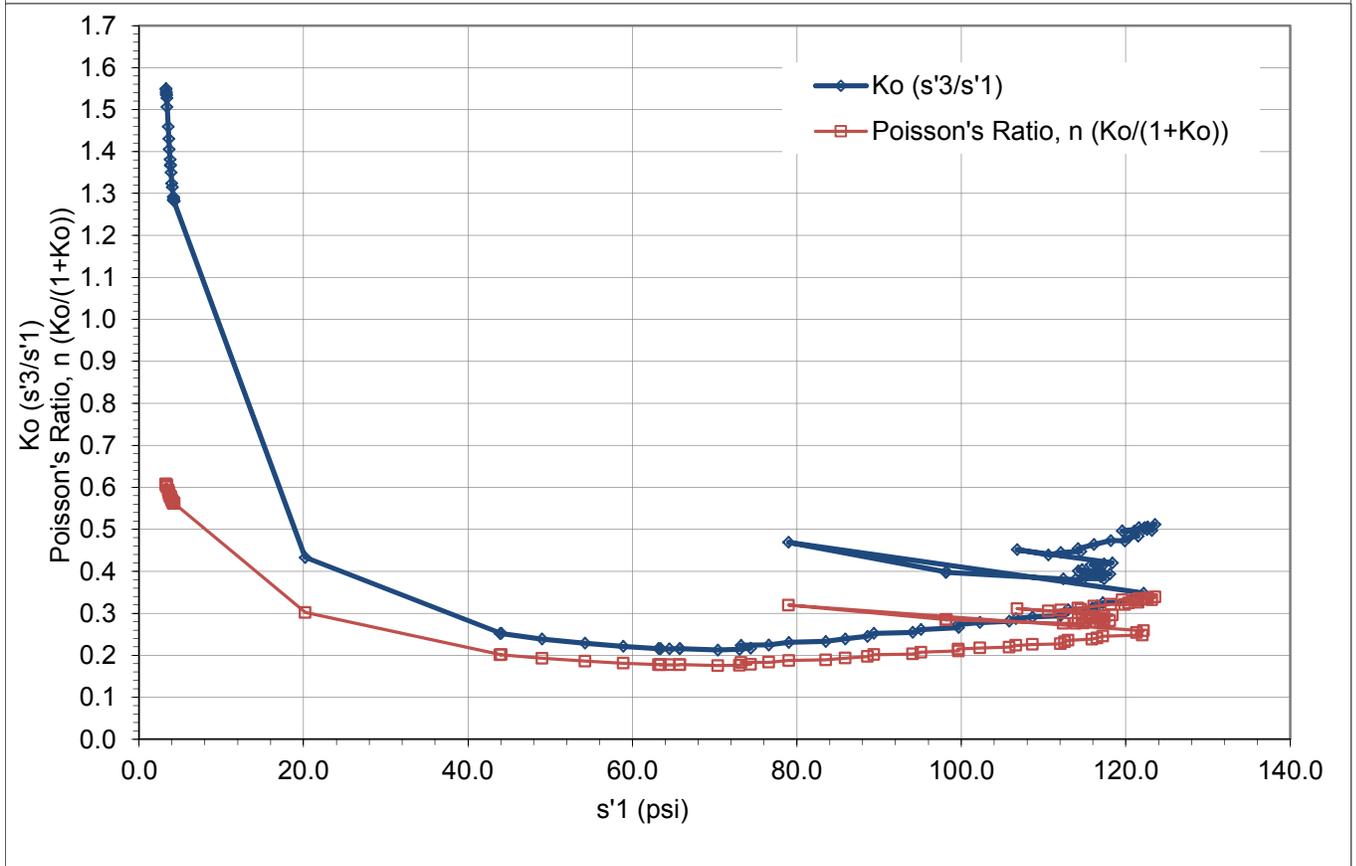
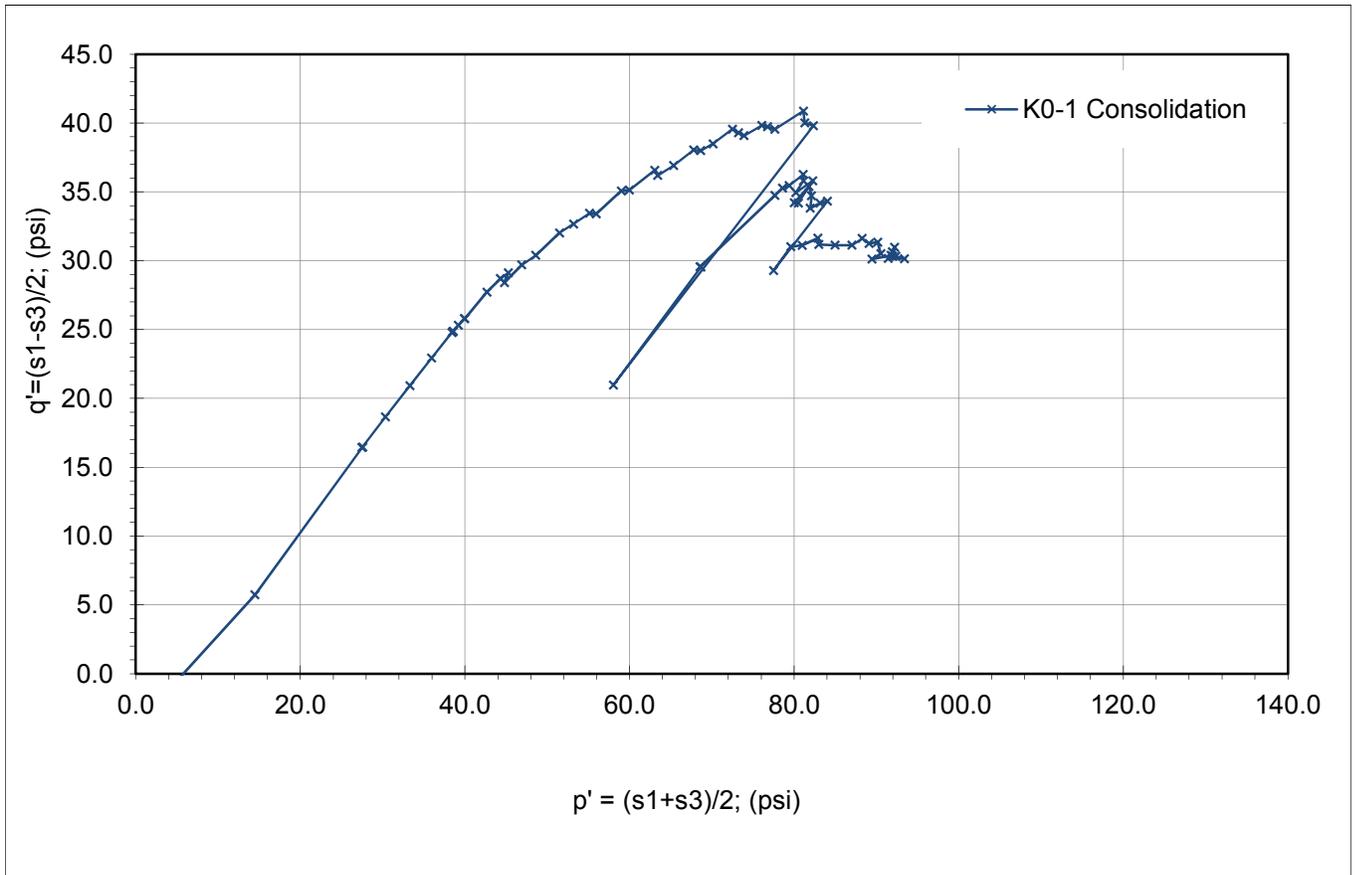
Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-29



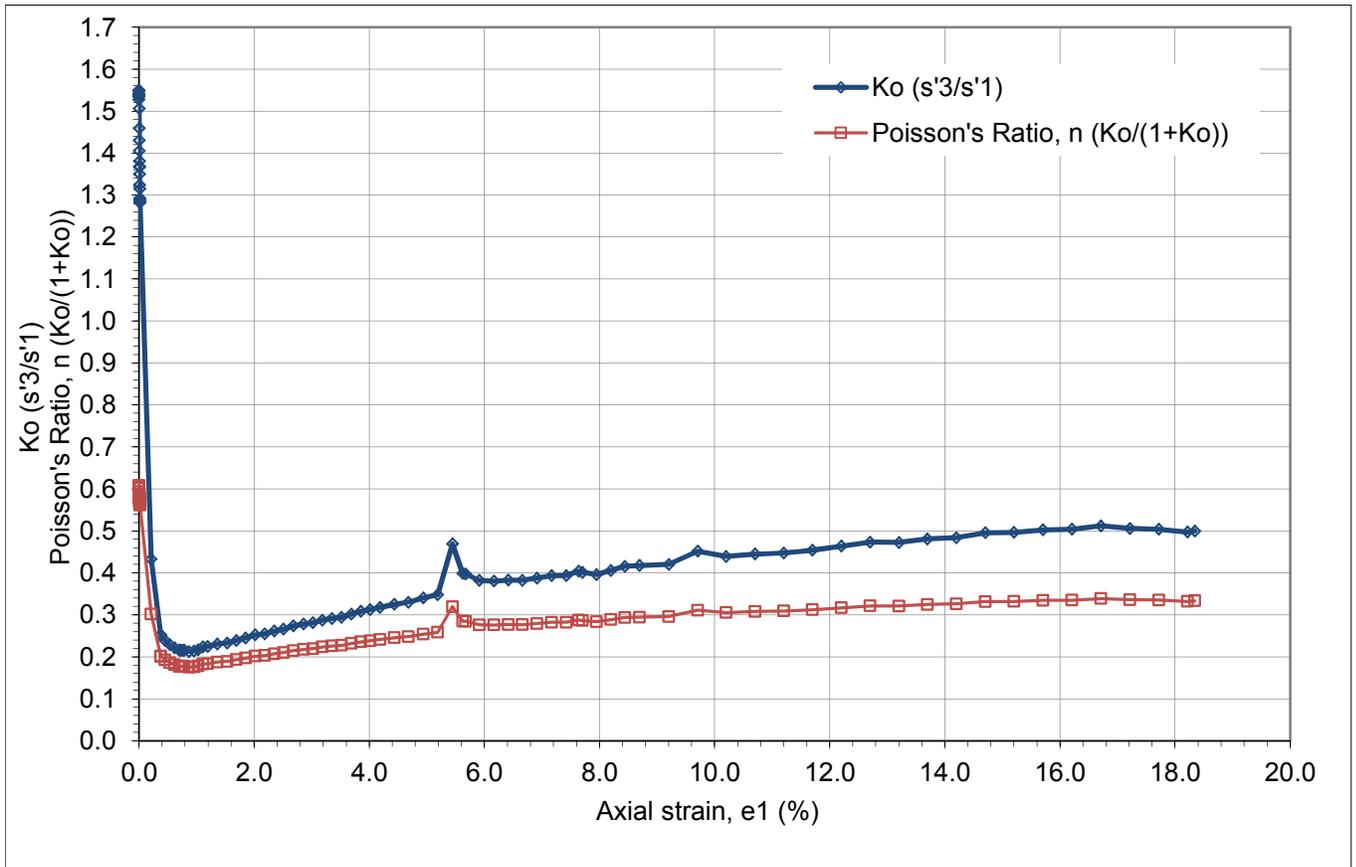
Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-29



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-29



K₀ Consolidation Test Using Strain Controlled Axial Loading and Automated Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-30

Location: ---
Date: 18-Mar-15
Date cast: 13-Feb-15
Tested by: zmg
Reduced by: zmg
Checked by: rbm/rtc

Sample description: Cellular concrete cast on 2/13/15
USCS classification: not applicable
Sample type: cast
Age of sample (days): 33

- Comments:
1. No shearing of sample was performed after the Ko consolidation phase
 2. Initial sample moisture content was back calculated from oven dried sample
 3. Automated lateral pressure adjustment using TruePath software

| | | Sample: 213-30 | |
|-------------------------------|-------------------------------------|----------------|--------|
| | | Initial | Final |
| Unit weight data | Sample ht., H (in) | 0° 5.847 | |
| | | 120° 5.841 | |
| | | 240° 5.854 | |
| | Avg. height, Havg (in) | 5.847 | |
| | Avg. height, Havg (cm) | 14.852 | |
| | ΔHsc (in) ^a | | |
| | | top 2.986 | |
| | Sample dia., D (in) | mid 2.951 | |
| | | bot 2.906 | |
| | Avg. dia., Davg (in) | 2.949 | |
| | Avg. dia., Davg (cm) | 7.489 | |
| | Avg. area, Aavg (in ²) | 6.828 | |
| | Avg. area, Aavg (cm ²) | 44.051 | |
| | Wt. rings + wet soil (g) | 337.92 | |
| | Wt. rings (g) | 0.00 | |
| Volume, Vo (in ³) | 39.9 | | |
| | Vo (cm ³) 654.3 | | |
| | Vo (ft ³) 0.0231 | | |
| Moisture | Wet soil + tare (g) | 337.92 | 707.51 |
| | Dry soil + tare (g) | 228.37 | 373.76 |
| | Tare (g) | 0.00 | 145.39 |
| | Moisture content, w (%) | 48.0 | 146.1 |
| Phase Relationships | Gs, from mix design | 3.15 | 3.15 |
| | Mass total (g) | 337.9 | 562.1 |
| | Mass of solids (g) | 228.4 | 228.4 |
| | Volume (cm ³) | 654.3 | 406.2 |
| | Volume of water (cm ³) | 109.6 | 333.8 |
| | Volume of solids (cm ³) | 72.5 | 72.5 |
| | Volume of voids (cm ³) | 581.8 | 333.8 |
| | Volume of air (cm ³) | 472.2 | 0.0 |
| | Void ratio, e | 8.024 | 4.604 |
| | Porosity, n | 0.889 | 0.822 |
| | Volumetric moisture, T | 0.167 | 0.822 |
| | Saturation, S (%) | 18.83 | 100.00 |
| | Dry density (gm/cm ³) | 0.349 | 0.562 |
| | Wet unit wt., gm (pcf) | 32.2 | 86.4 |
| Dry unit wt., gd (pcf) | 21.8 | 35.1 | |

Notes:

^a ΔHsc (in) = change in height during saturation and consolidation (end of test)

K0 Consolidation Test Using Strain Controlled Axial Loading and Automated*Lateral Pressure Adjustment After ASTM D4767 and USBR 5740-89***Project: Cell Crete****No: 14GCI498**

Location: ---

Date: 18-Mar-15

Tested by: zmg

Checked by: rbm/rtc

Cellular concrete type: Class IV (Low Density)**Sample: 213-30**

Sample description: Cellular concrete cast on 2/13/15

USCS classification: not applicable

Sample type: cast

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Sample 213-30

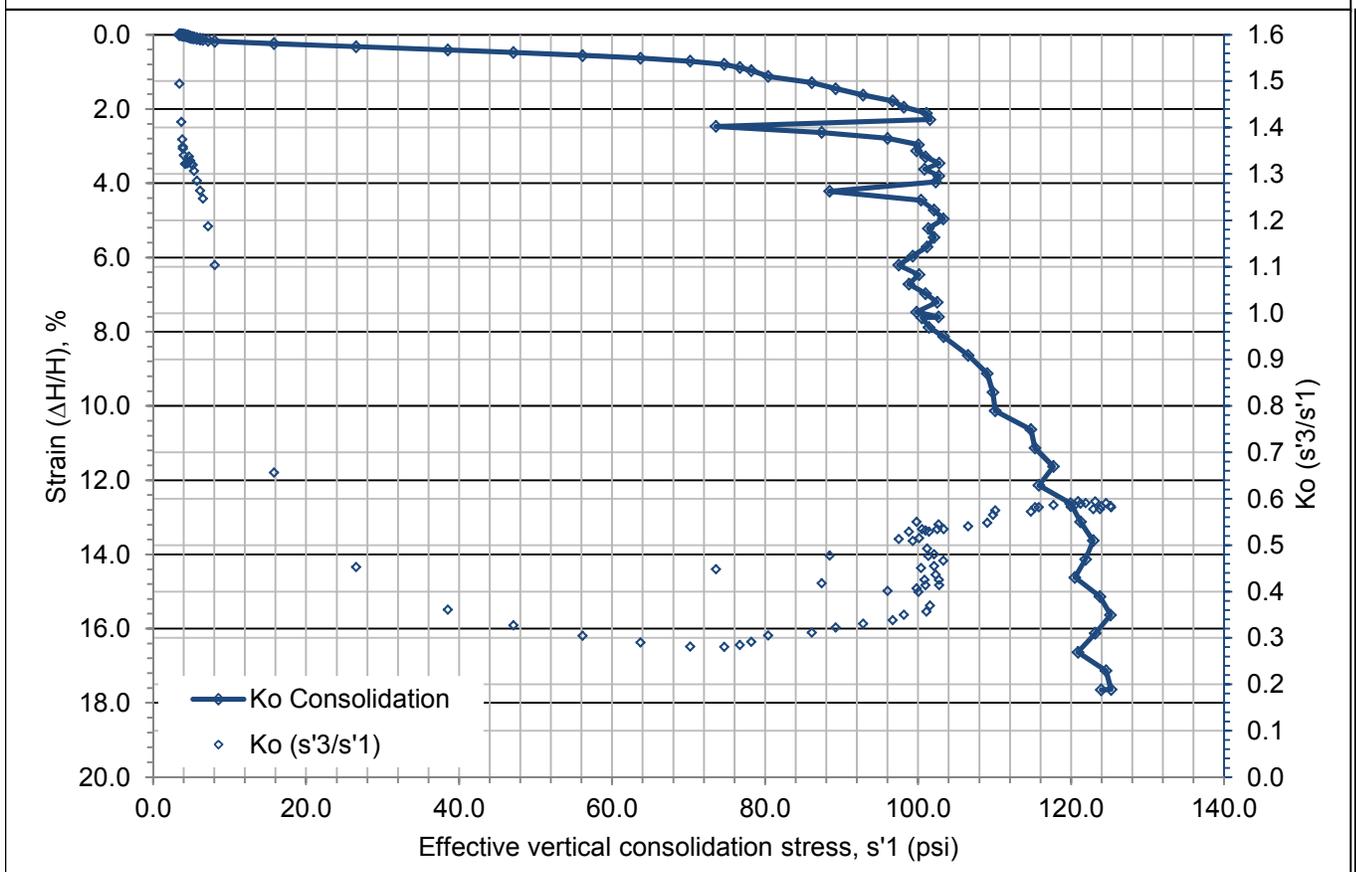
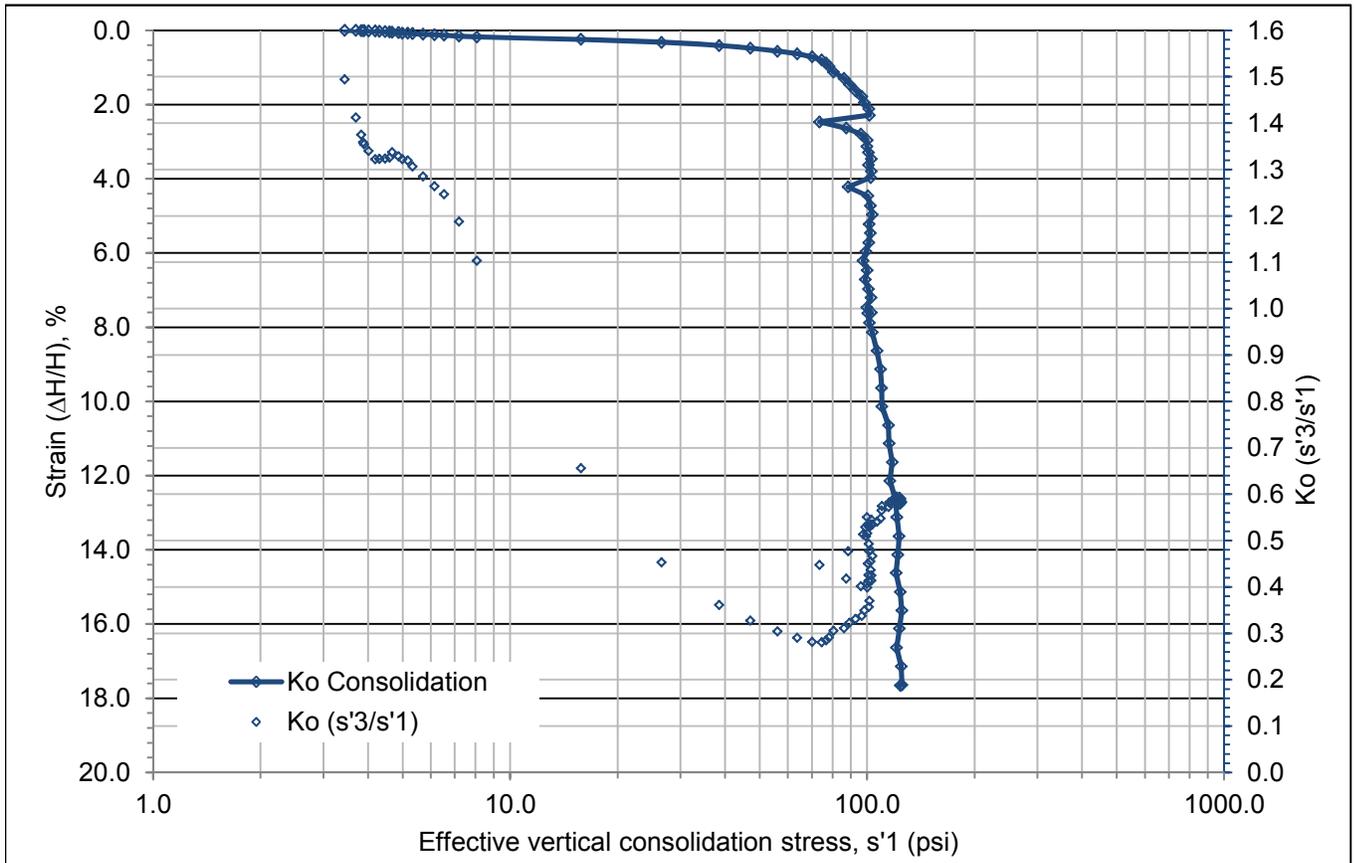
| | | |
|------------------|-----------------------------------|------|
| Test information | Total backpressure (psi) | 80.0 |
| | Skempton B | 0.80 |
| | Consolidation strain rate (%/hr) | 1.00 |
| | Consolidation strain rate (%/min) | 0.02 |
| | Unloading strain rate (%/hr) | --- |
| | Shear strain rate (%/hr) | --- |
| | Consolidation membrane correction | Yes |
| | Shear membrane correction | N/A |
| | Filter paper correction | No |

[Photo of sample after testing](#)

Comments:

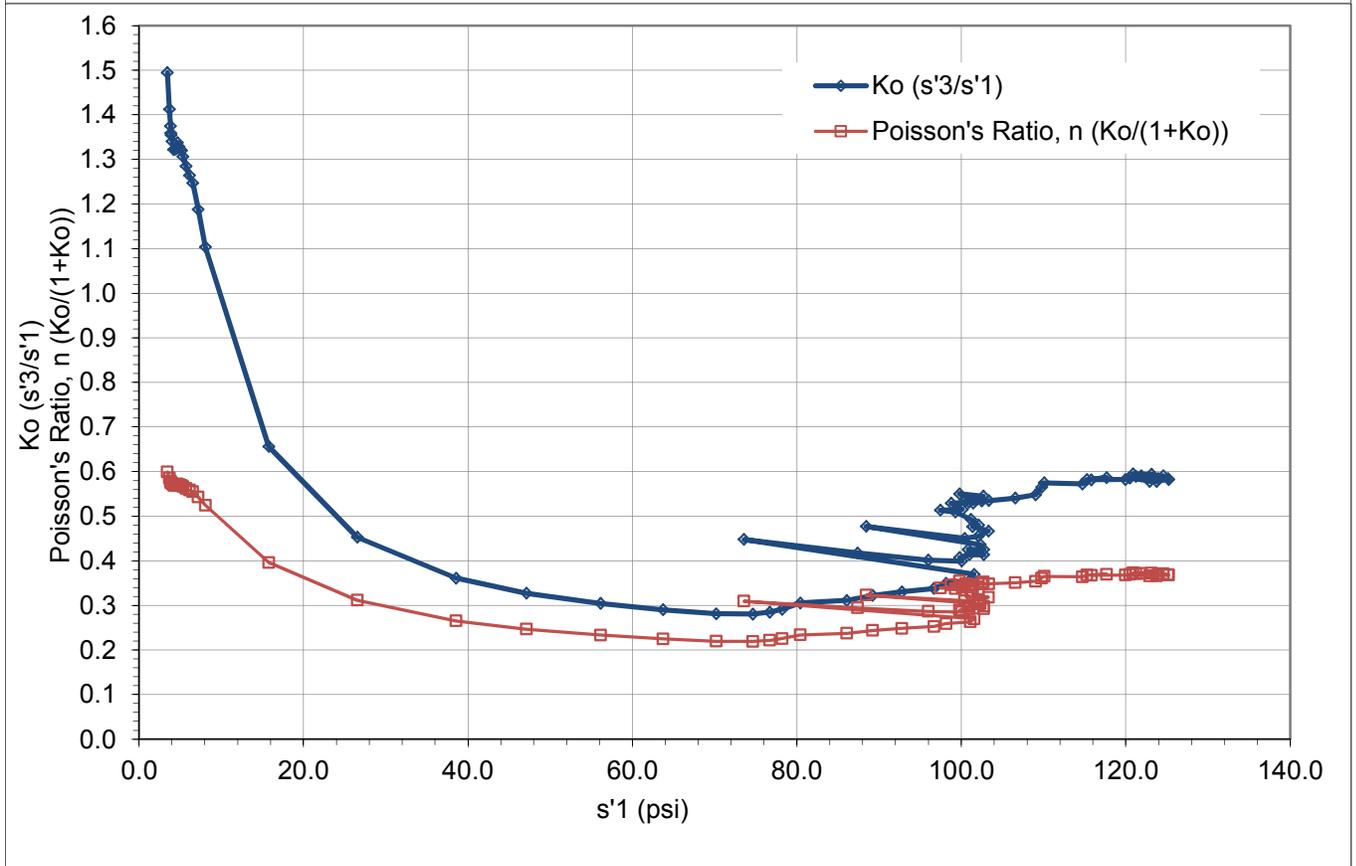
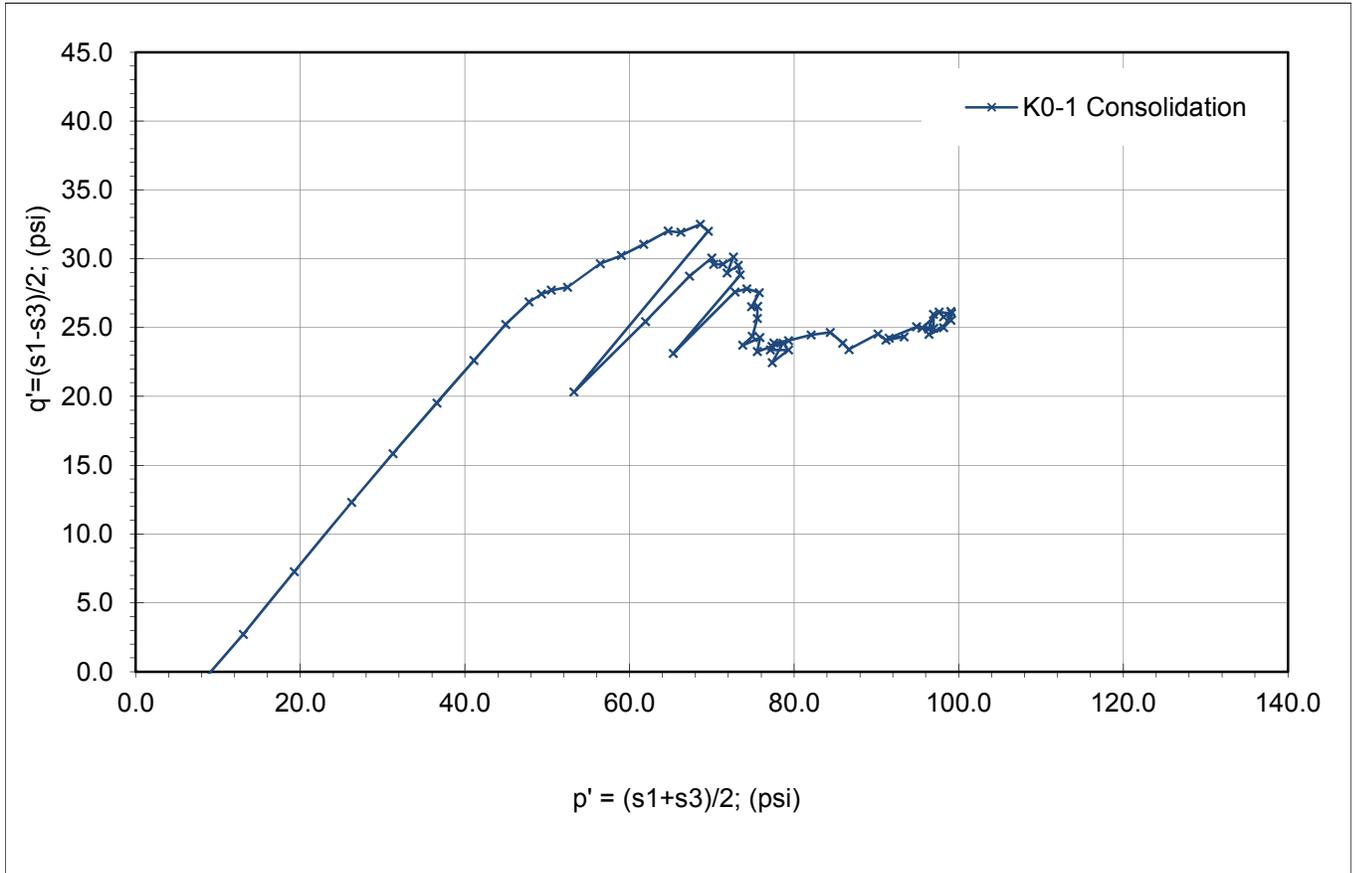
Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-30



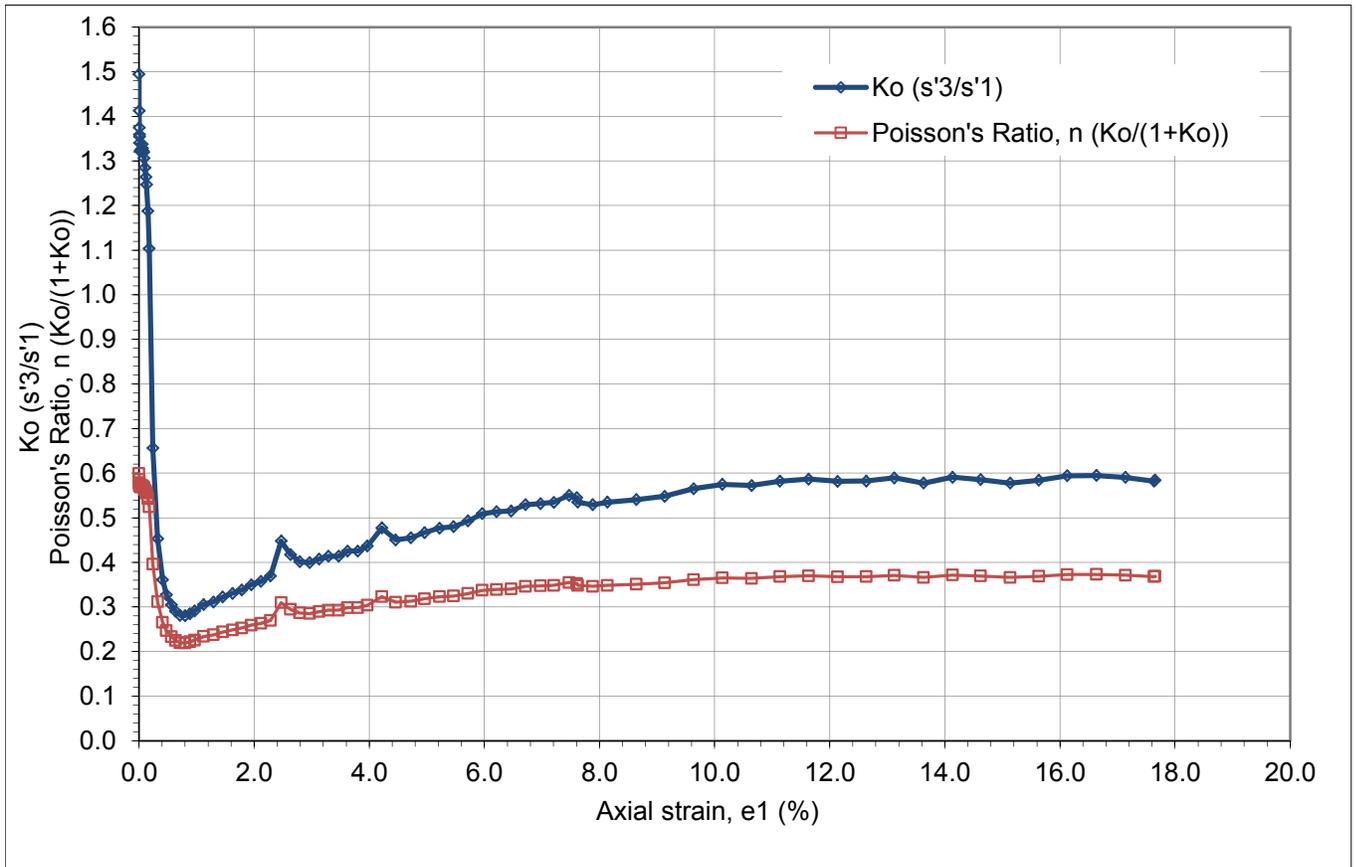
Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-30



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-30



One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



| | |
|----------------------------|---|
| Project: Cell Crete | Cellular concrete type: Class IV (Low Density) |
| No: 14GCI498 | Sample: 213-06 |
| Location: -- | Sample description: Cellular concrete cast on 2/13/15 |
| Date: 13-Mar-15 | USCS classification: not applicable |
| Cast date: 13-Feb-15 | Sample type: cast |
| | Inundation stress (psf): 100, beginning |
| Tested by: zmg | Swell pressure (psf): not recorded |
| Reduced by: zmg | Test method: B |
| Checked by: rbm/rtc | Preparation procedure: trimmed |
| Comments: | Age of sample (days): 28 |

Phase Relationships

Vertical Stress - Deformation Results

| | Initial | Final | Vert. stress (psf) | Vert. stress (psi) | Corr. Dial, dfc ^a (in) | Hc ^b (in) | Vert. strain, ev | Load (lb) | Load duration (min) ^c |
|-----------------------------------|---------|--------|--------------------|--------------------|-----------------------------------|----------------------|------------------|-----------|----------------------------------|
| Height, H (in) | 1.0000 | 0.5245 | Seating | Seating | 0.0000 | 1.0000 | 0.0000 | 4.1 | 0 |
| Height, H (cm) | 2.540 | 1.332 | 100 | 0.69 | 0.0003 | 0.9997 | 0.0003 | 4.6 | 5 |
| Dia., D (in) | 2.500 | 2.500 | 200 | 1.39 | 0.0015 | 0.9985 | 0.0015 | 7.0 | 7 |
| Dia., D (cm) | 6.350 | 6.350 | 400 | 2.78 | 0.0034 | 0.9966 | 0.0034 | 13.6 | 5 |
| Wt. rings + wet soil (g) | 258.39 | 263.75 | 800 | 5.56 | 0.0061 | 0.9939 | 0.0061 | 28.0 | 3 |
| Wt. rings (g) | 214.58 | 214.58 | 1,600 | 11.11 | 0.0106 | 0.9894 | 0.0106 | 52.5 | 3 |
| Wet soil + tare (g) | 187.79 | 221.46 | 3,200 | 22.22 | 0.0152 | 0.9848 | 0.0152 | 107.8 | 3 |
| Dry soil + tare (g) | 174.37 | 202.42 | 6,400 | 44.44 | 0.0222 | 0.9778 | 0.0222 | 221.6 | 3 |
| Tare (g) | 144.99 | 173.45 | 12,800 | 88.89 | 0.0363 | 0.9637 | 0.0363 | 437.0 | 4 |
| Moisture cont., w (%) | 45.7 | 63.5 | 19,200 | 133.33 | 0.1183 | 0.8817 | 0.1183 | 660.0 | 7 |
| Gs, from mix design | 3.15 | 3.15 | 22,400 | 155.56 | 0.3522 | 0.6478 | 0.3522 | 764.0 | 8 |
| Mass total (g) | 43.8 | 49.2 | 25,600 | 177.78 | 0.3808 | 0.6192 | 0.3808 | 870.9 | 10 |
| Mass of solids (g) | 30.1 | 30.1 | 30,000 | 208.33 | 0.4057 | 0.5943 | 0.4057 | 1024.2 | 8 |
| Volume (cm ³) | 80.4 | 42.2 | 35,000 | 243.06 | 0.4300 | 0.5700 | 0.4300 | 1189.7 | 6 |
| Vol. of water (cm ³) | 13.7 | 19.1 | 40,000 | 277.78 | 0.4480 | 0.5520 | 0.4480 | 1366.9 | 4 |
| Vol. of solids (cm ³) | 9.5 | 9.5 | 70,000 | 486.11 | 0.5245 | 0.4755 | 0.5245 | 2388.9 | 6 |
| Vol. of voids (cm ³) | 70.9 | 32.6 | | | | | | | |
| Vol. of air (cm ³) | 57.2 | 13.5 | | | | | | | |
| Area, A (cm ²) | 31.7 | 31.7 | | | | | | | |
| Ht. solids, Hs (cm) | 0.301 | 0.301 | | | | | | | |
| Void ratio, e | 7.426 | 3.419 | | | | | | | |
| Porosity, n | 0.881 | 0.774 | | | | | | | |
| Vol.moisture, T | 0.171 | 0.453 | | | | | | | |
| Saturation, S (%) | 19 | 59 | | | | | | | |
| Dry density (gm/cm ³) | 0.374 | 0.713 | | | | | | | |
| Wet unit wt., gm (pcf) | 34.0 | 72.8 | | | | | | | |
| Dry unit wt., gd (pcf) | 23.3 | 44.5 | | | | | | | |

Notes: ^a dfc = end of increment deformation corrected for machine, porous stone, and filter paper deformation
^b Hc = height at end of consolidation of each vert. stress
^c Loading advanced after the change in deformation was observed to be less than 1% of initial height

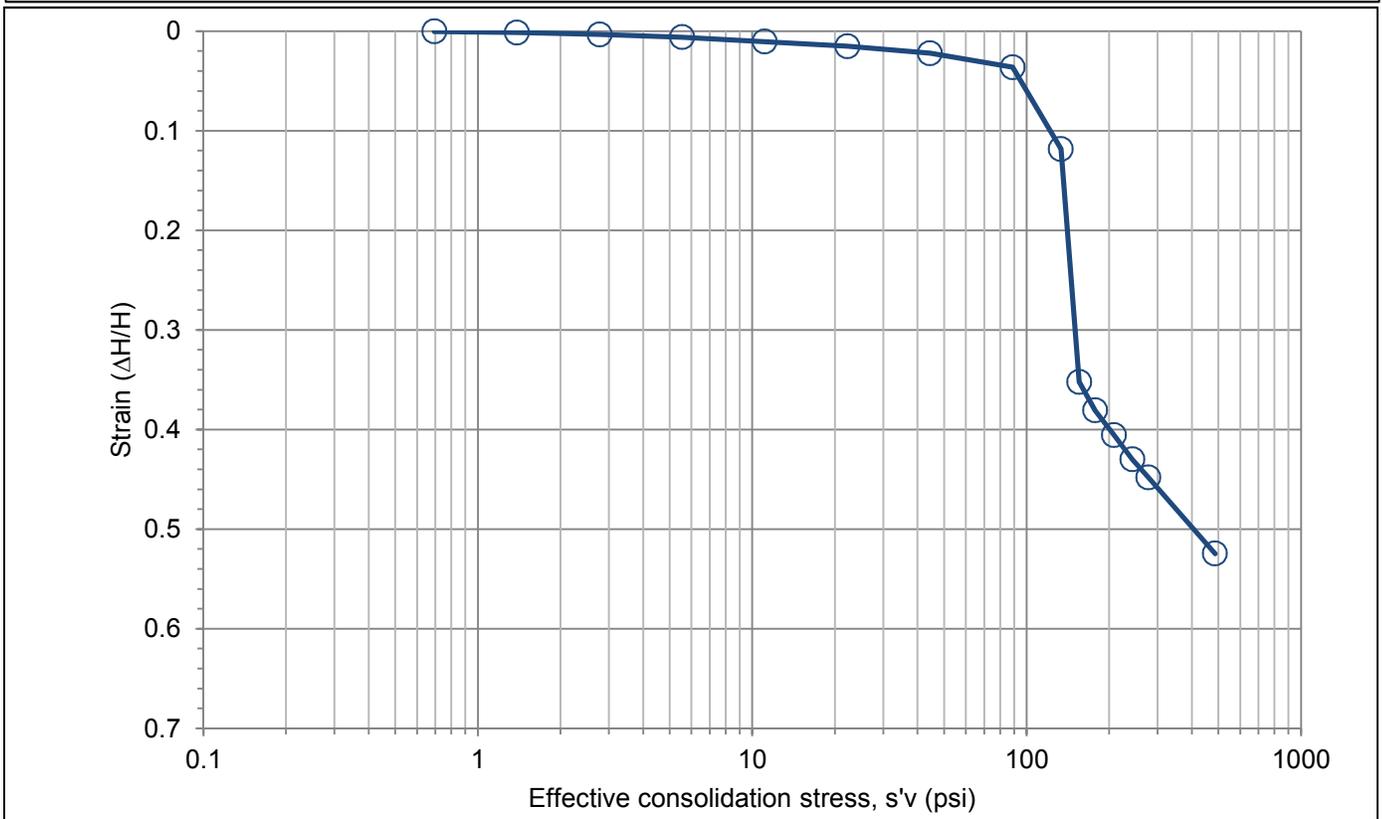
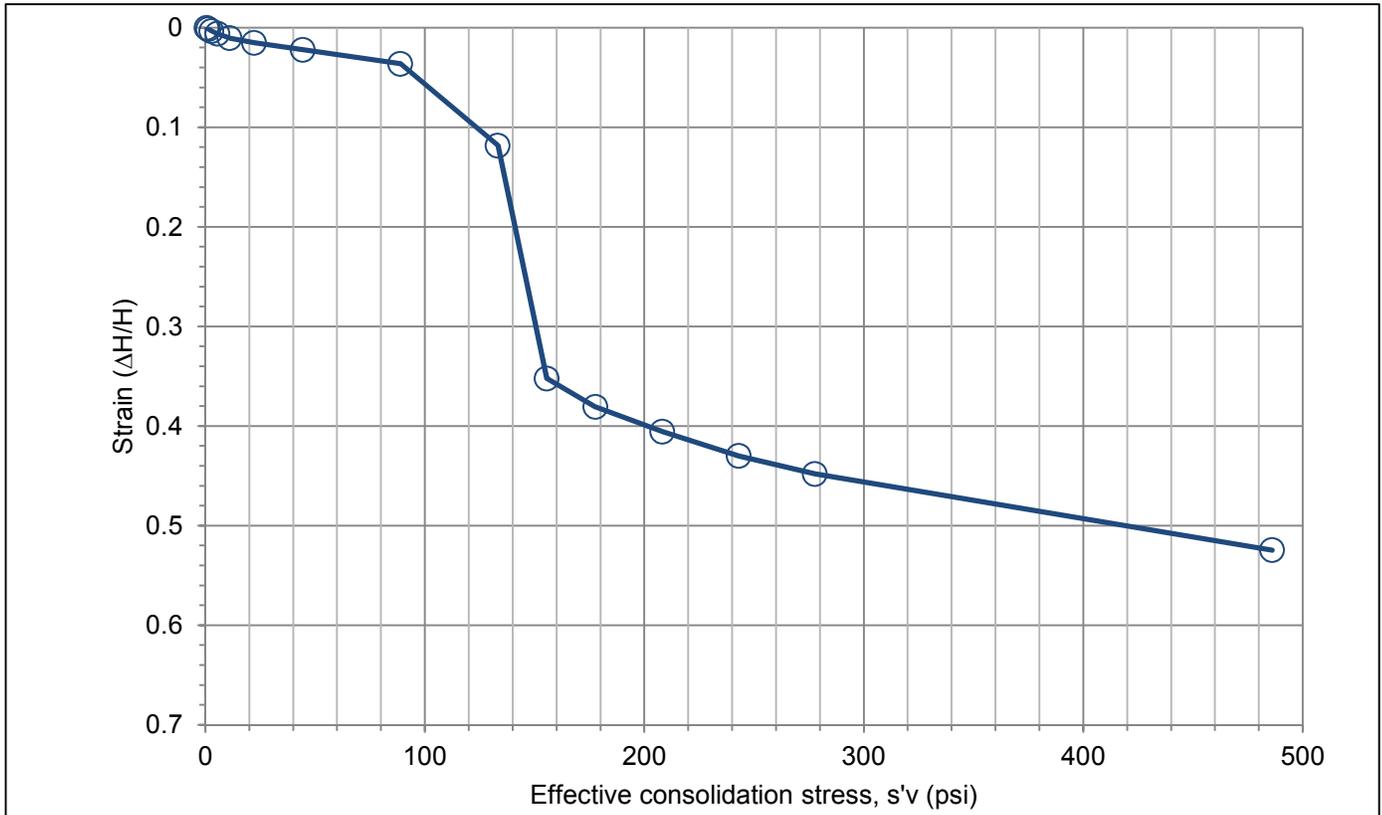
One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-06



One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



| | |
|----------------------------|---|
| Project: Cell Crete | Cellular concrete type: Class IV (Low Density) |
| No: 14GCI498 | Sample: 213-11 |
| Location: -- | Sample description: Cellular concrete cast on 2/13/15 |
| Date: 13-Mar-15 | USCS classification: not applicable |
| Cast date: 13-Feb-15 | Sample type: cast |
| Tested by: zmg | Inundation stress (psf): 100, beginning |
| Reduced by: zmg | Swell pressure (psf): not recorded |
| Checked by: rbm/rtc | Test method: B |
| Comments: | Preparation procedure: trimmed |
| | Age of sample (days): 28 |

Phase Relationships

Vertical Stress - Deformation Results

| | Initial | Final | Vert. stress (psf) | Vert. stress (psi) | Corr. Dial, dfc ^a (in) | Hc ^b (in) | Vert. strain, ev | Load (lb) | Load duration (min) ^c |
|-----------------------------------|---------|--------|--------------------|--------------------|-----------------------------------|----------------------|------------------|-----------|----------------------------------|
| Height, H (in) | 1.0000 | 0.4995 | Seating | Seating | 0.0000 | 1.0000 | 0.0000 | 0.7 | 0 |
| Height, H (cm) | 2.540 | 1.269 | 100 | 0.69 | 0.0002 | 0.9998 | 0.0002 | 4.2 | 2 |
| Dia., D (in) | 2.500 | 2.500 | 200 | 1.39 | 0.0008 | 0.9992 | 0.0008 | 4.3 | 4 |
| Dia., D (cm) | 6.350 | 6.350 | 400 | 2.78 | 0.0016 | 0.9984 | 0.0016 | 14.3 | 4 |
| Wt. rings + wet soil (g) | 258.24 | 264.12 | 800 | 5.56 | 0.0040 | 0.9960 | 0.0040 | 28.3 | 3 |
| Wt. rings (g) | 214.58 | 214.58 | 1,600 | 11.11 | 0.0067 | 0.9933 | 0.0067 | 55.0 | 3 |
| Wet soil + tare (g) | 201.27 | 168.47 | 3,200 | 22.22 | 0.0095 | 0.9905 | 0.0095 | 109.3 | 4 |
| Dry soil + tare (g) | 184.15 | 149.02 | 6,400 | 44.44 | 0.0126 | 0.9874 | 0.0126 | 220.3 | 4 |
| Tare (g) | 145.08 | 119.27 | 12,800 | 88.89 | 0.0208 | 0.9792 | 0.0208 | 438.9 | 6 |
| Moisture cont., w (%) | 43.8 | 63.2 | 16,000 | 111.11 | 0.0269 | 0.9731 | 0.0269 | 549.1 | 7 |
| Gs, from mix design | 3.15 | 3.15 | 19,200 | 133.33 | 0.0387 | 0.9613 | 0.0387 | 654.9 | 6 |
| Mass total (g) | 43.7 | 49.5 | 20,800 | 144.44 | 0.1618 | 0.8382 | 0.1618 | 709.6 | 9 |
| Mass of solids (g) | 30.4 | 30.4 | 22,400 | 155.56 | 0.2948 | 0.7052 | 0.2948 | 762.6 | 11 |
| Volume (cm ³) | 80.4 | 40.2 | 25,600 | 177.78 | 0.3338 | 0.6662 | 0.3338 | 876.5 | 8 |
| Vol. of water (cm ³) | 13.3 | 19.2 | 30,000 | 208.33 | 0.3651 | 0.6349 | 0.3651 | 1023.7 | 5 |
| Vol. of solids (cm ³) | 9.6 | 9.6 | 35,000 | 243.06 | 0.3938 | 0.6062 | 0.3938 | 1196.7 | 4 |
| Vol. of voids (cm ³) | 70.8 | 30.5 | 40,000 | 277.78 | 0.4180 | 0.5820 | 0.4180 | 1367.3 | 4 |
| Vol. of air (cm ³) | 57.5 | 11.4 | 70,000 | 486.11 | 0.4995 | 0.5005 | 0.4995 | 2388.4 | 3 |
| Area, A (cm ²) | 31.7 | 31.7 | | | | | | | |
| Ht. solids, Hs (cm) | 0.304 | 0.304 | | | | | | | |
| Void ratio, e | 7.347 | 3.170 | | | | | | | |
| Porosity, n | 0.880 | 0.760 | | | | | | | |
| Vol.moisture, T | 0.165 | 0.477 | | | | | | | |
| Saturation, S (%) | 19 | 63 | | | | | | | |
| Dry density (gm/cm ³) | 0.377 | 0.755 | | | | | | | |
| Wet unit wt., gm (pcf) | 33.9 | 77.0 | | | | | | | |
| Dry unit wt., gd (pcf) | 23.6 | 47.2 | | | | | | | |

Notes: ^a dfc = end of increment deformation corrected for machine, porous stone, and filter paper deformation
^b Hc = height at end of consolidation of each vert. stress
^c Loading advanced after the change in deformation was observed to be less than 1% of initial height

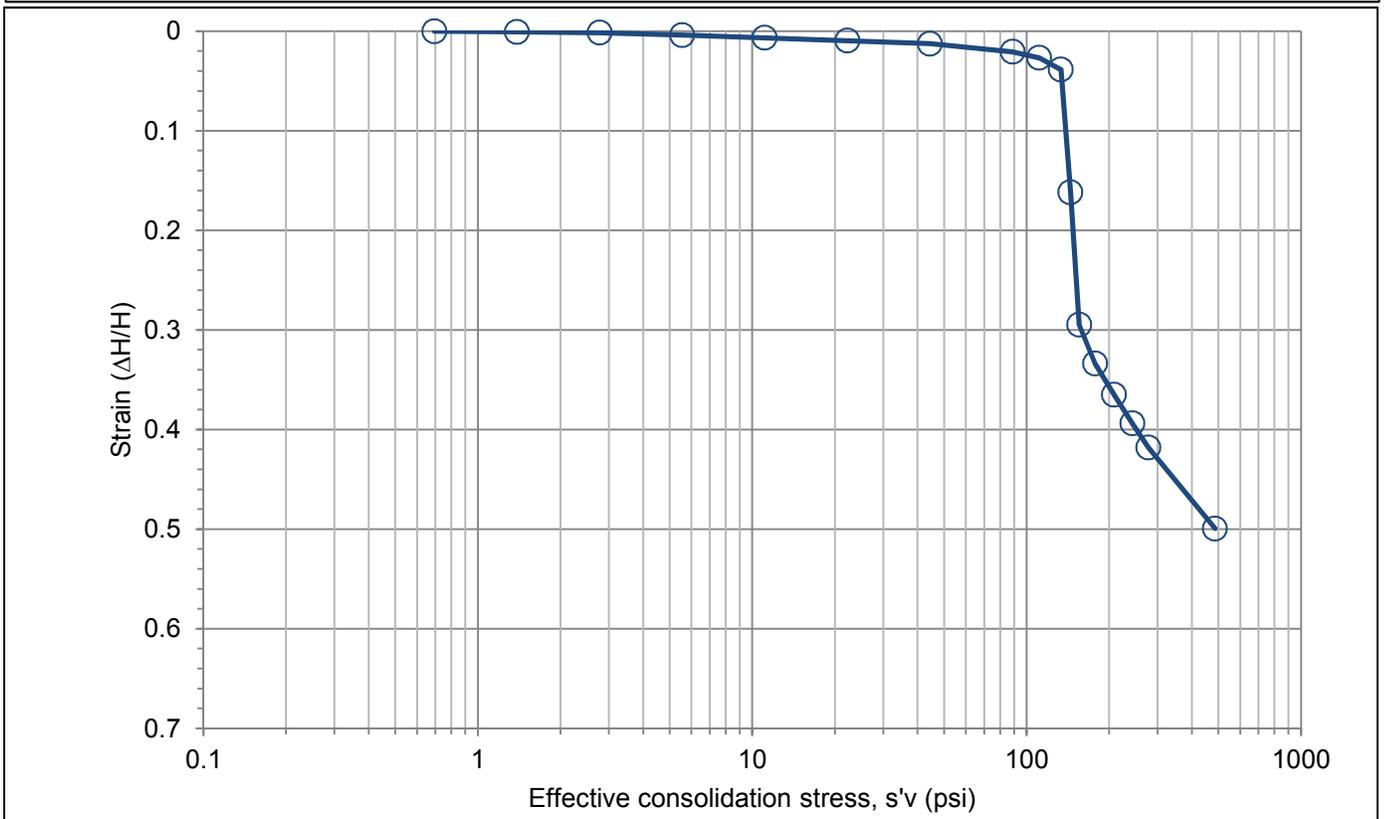
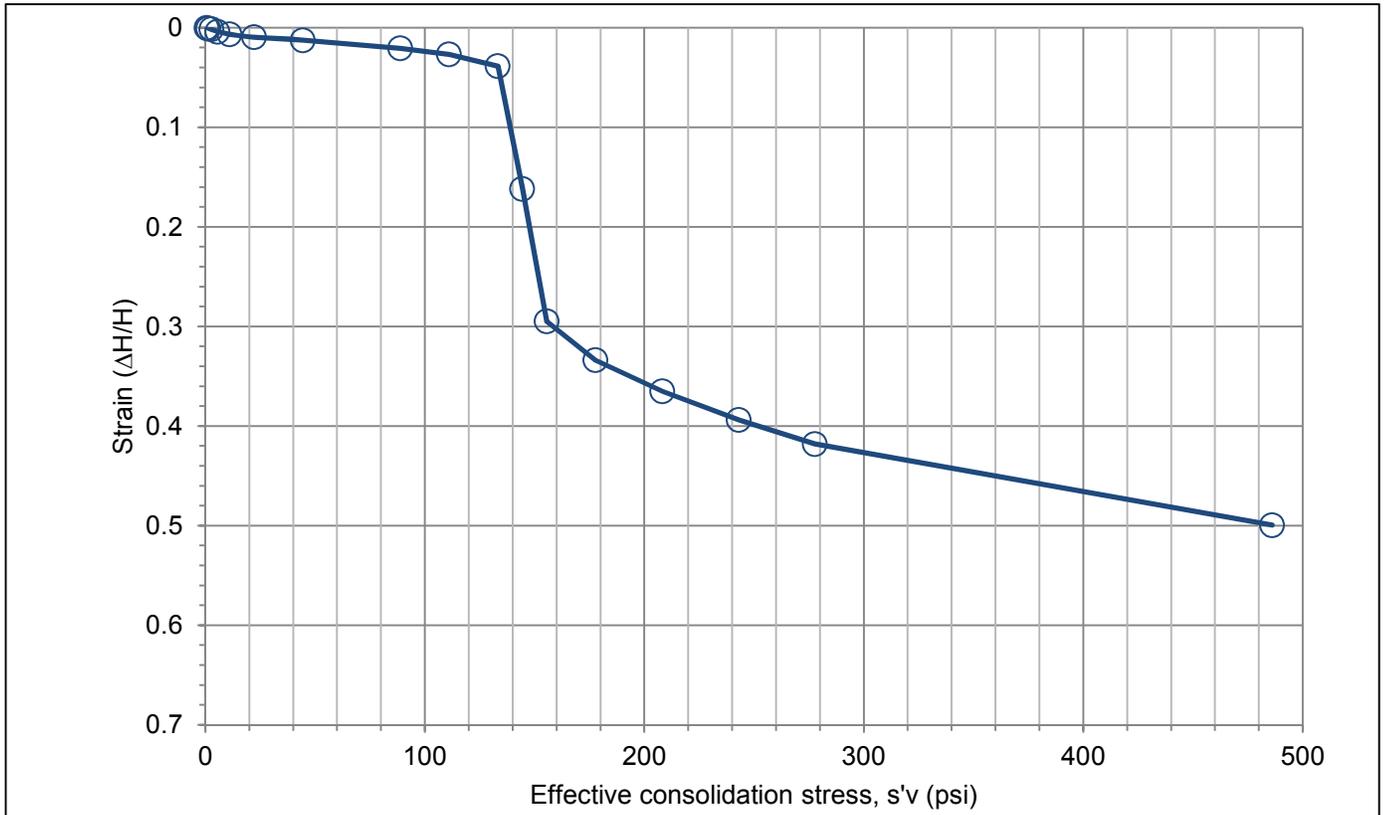
One-Dimensional Consolidation Properties of Soils

After ASTM D2435 and USBR 5700



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-11



Hydraulic Conductivity Test - Back Pressure, Flexible Wall

after ASTM D5084 Method C



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-21

Cast date: 13-Feb-15

Sample description: Cellular concrete cast on 2/13/15

Date: 16-Mar-15

USCS classification: not applicable

Tested by: zmg

Sample type: cast

Reduced by: zmg

Age of sample (days): 31

Reviewed by: rbm/rtc

Comments:

Initial sample moisture content was back calculated from the oven dried sample after

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| Sample Height, H (in) | 3.373 | 3.373 |
| Sample Diameter, D (in) | 2.975 | 3.000 |
| Sample Length, L (cm) | 8.567 | 8.567 |
| Sample Area, A (cm ²) | 44.847 | 45.617 |
| Sample Volume, V (cm ³) | 384.22 | 390.82 |
| Wt. Rings + Wet Soil (g) | 206.18 | 400.89 |
| Wt. Rings (g) | 0.00 | 0.00 |
| Wet Soil + Tare (g) | 206.18 | 545.97 |
| Dry Soil + Tare (g) | 140.62 | 286.58 |
| Tare (g) | 0.00 | 145.96 |
| Weight of solids, Ws (g) | 140.62 | 140.62 |
| Moisture Content, w (%) | 46.62 | 184.46 |
| Wet Unit Wt., g _m (pcf) | 33.5 | 64.0 |
| Dry Unit Wt., g _d (pcf) | 22.8 | 22.5 |
| Volume solids (cm ³) | 44.64 | 44.64 |
| Volume of voids (cm ³) | 339.58 | 346.18 |
| Void ratio, e | 7.61 | 5.81 |
| Porosity, n | 0.88 | 0.85 |
| Volumetric moisture, T | 0.17 | 0.85 |
| Saturation, S (%) | 19.3 | 100.0 |

| Cell No. / Base No. / Top No. | A1 | A2 | A3 |
|------------------------------------|---------------|---------|----|
| pw (gm/cm ³) | 1.00 | Assumed | |
| Permeant liquid used | deaired water | | |
| Total backpressure (psi) | 80 | | |
| Effective horiz. con. stress (psi) | 12.5 | | |
| Effective vert. con. stress (psi) | 12.5 | | |

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| B value | 0.10 | 0.80 |
| External Burette (cm ³) | 1.00 | 9.40 |
| Cell Pressure (psi) | 5.0 | 80.0 |

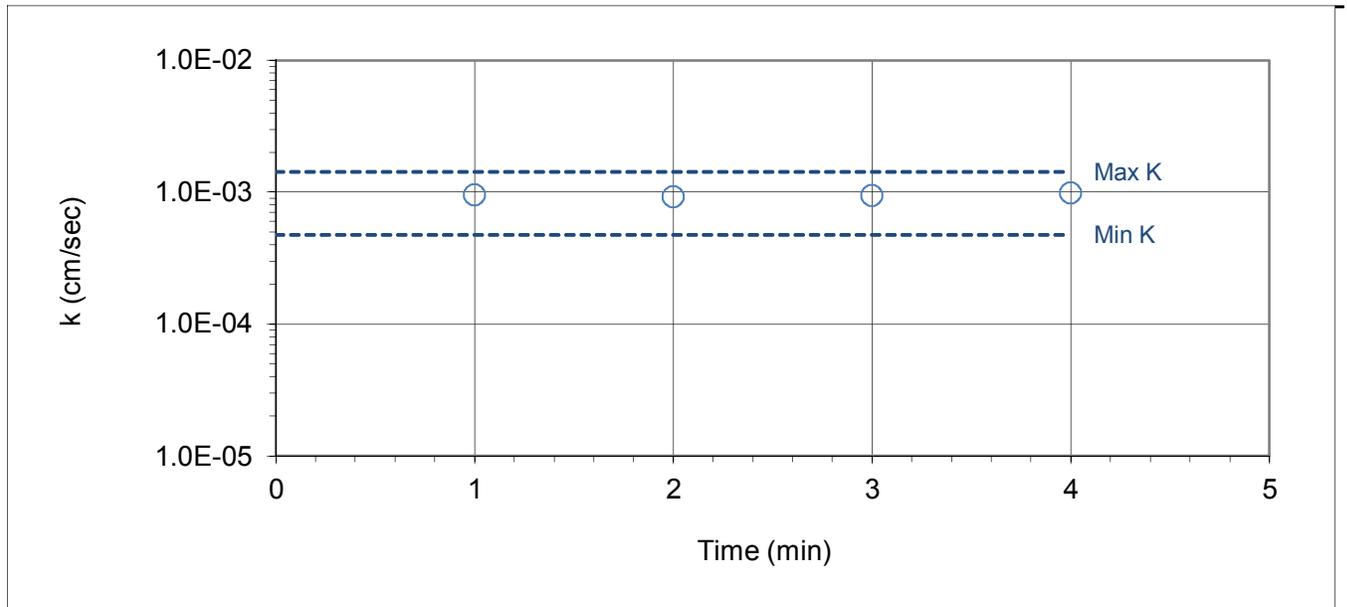
| | |
|--|-------------|
| System volume coefficient (cm ³ /psi) | 0.20 |
| System volume change (cm ³) | 15.00 |
| Net sample volume change (cm ³) | 6.60 |
| Base burette ground length, l _b (cm) | 69.5 |
| Top burette ground length, l _t (cm) | 69.5 |
| Pipet area, a _{pi} / a _{po} (cm ²) | 0.865 0.865 |
| Annulus area, a _{ai} / a _{ao} (cm ²) | 3.105 4.176 |
| Conversion, reading to cm head (cm/rd) | 1.156 |

G_s, from mix design 3.15

^a Saturation set to 100% for phase calculations

K average last 4 values = 9.5E-04

^b K corrected to 20°C



Project: **Cell Crete**

No: **14GCI498**

Cellular concrete type: **Class IV (Low Density)**

Sample: **213-21**

Cast date: **13-Feb-15**

Sample description: **Cellular concrete cast on 2/13/15**

Permeability Data

| time (min) | time (sec) | Burrett reading | | hp (psi) | $h_{(i/f)}$ (cm) | i | K (cm/sec) | Avg. Temp (°C) | Visc. Ratio Rt | Pore Vol | K^b (cm/sec) |
|---------------|---------------|-----------------|-------|-------------|---------------------|-----|---------------|----------------------|----------------------|-------------|-------------------|
| | | Base | Top | | | | | | | | |
| 0 | [pipet] | 0.00 | 24.50 | 0.2 | 42.4 | 4.9 | | | | | |
| 1.0 | 60 | 9.70 | 14.50 | 0.2 | 19.6 | 2.3 | 1.0E-03 | 23.9 | 0.91 | 0.03 | 9.5E-04 |
| | [pipet] | 0.00 | 24.50 | 0.0 | 28.3 | 3.3 | | | | | |
| 1.0 | 60 | 6.40 | 18.00 | 0.0 | 13.4 | 1.6 | 1.0E-03 | 23.9 | 0.91 | 0.05 | 9.2E-04 |
| | [pipet] | 0.00 | 24.50 | 0.0 | 28.3 | 3.3 | | | | | |
| 1.0 | 60 | 6.50 | 17.90 | 0.0 | 13.2 | 1.5 | 1.0E-03 | 23.9 | 0.91 | 0.07 | 9.4E-04 |
| | [pipet] | 0.00 | 24.50 | 0.0 | 28.3 | 3.3 | | | | | |
| 1.0 | 60 | 6.60 | 17.70 | 0.0 | 12.8 | 1.5 | 1.1E-03 | 23.9 | 0.91 | 0.09 | 9.8E-04 |

K average last 4 values = 9.5E-04

^b *K corrected to 20°C*

Hydraulic Conductivity Test - Back Pressure, Flexible Wall

after ASTM D5084 Method C



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-31

Cast date: 13-Feb-15

Sample description: Cellular concrete cast on 2/13/15

Date: 20-Mar-15

USCS classification: not applicable

Tested by: zmg

Sample type: cast

Reduced by: zmg

Age of sample (days): 35

Reviewed by: rbm/rtc

Comments:

Initial sample moisture content was back calculated from the oven dried sample after

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| Sample Height, H (in) | 3.102 | 3.102 |
| Sample Diameter, D (in) | 2.961 | 2.988 |
| Sample Length, L (cm) | 7.879 | 7.879 |
| Sample Area, A (cm ²) | 44.426 | 45.251 |
| Sample Volume, V (cm ³) | 350.03 | 356.53 |
| Wt. Rings + Wet Soil (g) | 175.11 | 366.96 |
| Wt. Rings (g) | 0.00 | 0.00 |
| Wet Soil + Tare (g) | 175.11 | 510.10 |
| Dry Soil + Tare (g) | 124.07 | 268.46 |
| Tare (g) | 0.00 | 144.39 |
| Weight of solids, Ws (g) | 124.07 | 124.07 |
| Moisture Content, w (%) | 41.14 | 194.76 |
| Wet Unit Wt., g _m (pcf) | 31.2 | 64.3 |
| Dry Unit Wt., g _d (pcf) | 22.1 | 21.8 |
| Volume solids (cm ³) | 39.39 | 39.39 |
| Volume of voids (cm ³) | 310.65 | 317.15 |
| Void ratio, e | 7.89 | 6.13 |
| Porosity, n | 0.89 | 0.86 |
| Volumetric moisture, T | 0.15 | 0.86 |
| Saturation, S (%) | 16.4 | 100.0 |

| Cell No. / Base No. / Top No. | A1 | A2 | A3 |
|------------------------------------|---------------|------|---------|
| pw (gm/cm ³) | | 1.00 | Assumed |
| Permeant liquid used | deaired water | | |
| Total backpressure (psi) | 80 | | |
| Effective horiz. con. stress (psi) | 5 | | |
| Effective vert. con. stress (psi) | 5 | | |

| | Initial (o) | Final (f) |
|-------------------------------------|-------------|-----------|
| B value | 0.06 | 0.92 |
| External Burette (cm ³) | 0.00 | 8.50 |
| Cell Pressure (psi) | 5.0 | 80.0 |

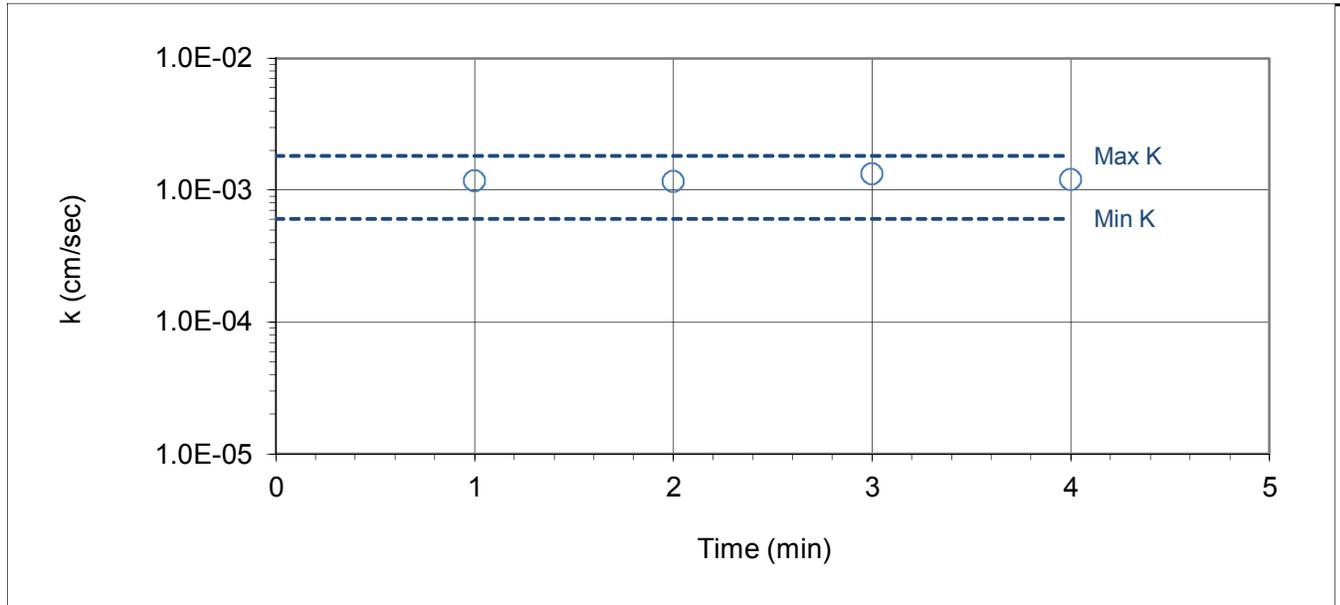
| | |
|--|---------------|
| System volume coefficient (cm ³ /psi) | 0.20 |
| System volume change (cm ³) | 15.00 |
| Net sample volume change (cm ³) | 6.50 |
| Base burette ground length, l _b (cm) | 69.5 |
| Top burette ground length, l _t (cm) | 69.5 |
| Pipet area, a _{pi} / a _{po} (cm ²) | 0.865 / 0.865 |
| Annulus area, a _{ai} / a _{ao} (cm ²) | 3.105 / 4.176 |
| Conversion, reading to cm head (cm/rd) | 1.156 |

G_s, from mix design 3.15

^a Saturation set to 100% for phase calculations

K average last 4 values = 1.2E-03

^b K corrected to 20°C



Project: **Cell Crete**

No: **14GCI498**

Cellular concrete type: **Class IV (Low Density)**

Sample: **213-31**

Cast date: **13-Feb-15**

Sample description: **Cellular concrete cast on 2/13/15**

Permeability Data

| time (min) | time (sec) | Burrett reading | | hp (psi) | $h_{(i/f)}$ (cm) | i | K (cm/sec) | Avg. Temp (°C) | Visc. Ratio Rt | Pore Vol | K^b (cm/sec) |
|---------------|---------------|-----------------|-------|-------------|---------------------|-----|---------------|----------------------|----------------------|-------------|-------------------|
| 0 | [pipet] | 0.00 | 24.50 | 0.0 | 28.3 | 3.6 | | | | | |
| 1.0 | 60 | 7.80 | 16.60 | 0.0 | 10.2 | 1.3 | 1.3E-03 | 23.9 | 0.91 | 0.03 | 1.2E-03 |
| | [pipet] | 0.00 | 24.50 | 0.0 | 28.3 | 3.6 | | | | | |
| 1.0 | 60 | 7.80 | 16.70 | 0.0 | 10.3 | 1.3 | 1.3E-03 | 23.9 | 0.91 | 0.05 | 1.2E-03 |
| | [pipet] | 0.00 | 24.50 | 0.2 | 42.4 | 5.4 | | | | | |
| 1.0 | 60 | 12.60 | 11.90 | 0.2 | 13.3 | 1.7 | 1.5E-03 | 23.9 | 0.91 | 0.09 | 1.3E-03 |
| | [pipet] | 0.00 | 24.50 | 0.2 | 42.4 | 5.4 | | | | | |
| 1.0 | 60 | 11.90 | 12.60 | 0.2 | 14.9 | 1.9 | 1.3E-03 | 23.9 | 0.91 | 0.13 | 1.2E-03 |

K average last 4 values = 1.2E-03

^b *K corrected to 20°C*

Infiltration Rate of Pervious Concrete

after ASTM C1701



Project: Cell Crete
No: 14GCI498

Date cast: 13-Feb-15

Date: 13-Mar-15

Tested by: zmg

Reduced by: zmg

Reviewed by: rbm/rtc

Cellular concrete type: Class IV (Low Density)

Sample: 213-33

Sample description: Cellular concrete cast on 2/13/15

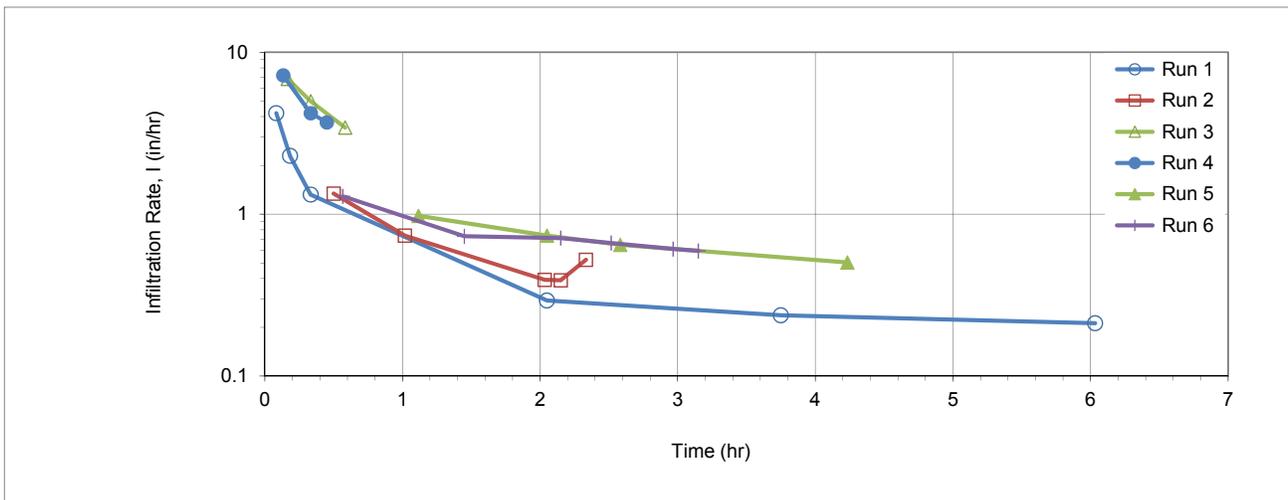
USCS classification: not applicable

Sample type: cast

Age of sample (days): 28

Comments:

| | Initial | Final |
|--------------------------------------|-----------|---------|
| | 0° | 5.447 |
| Sample ht., H (in) | 120° | 5.433 |
| | 240° | 5.436 |
| Avg. sample height, Havg (in) | | 5.439 |
| Avg. sample height, Havg (cm) | | 13.814 |
| | top | 2.980 |
| Sample dia., D (in) | mid | 2.960 |
| | bot | 2.920 |
| Avg. sample dia., Davg (in) | | 2.955 |
| Avg. sample dia., Davg (cm) | | 7.506 |
| Avg. area, Aavg (in^2) | | 6.858 |
| Avg. area, Aavg (cm^2) | | 44.246 |
| Wt. rings + wet soil (g) | | 323.83 |
| Wt. rings (g) | | 0.00 |
| Wet Soil + Tare (g) | | 323.83 |
| Dry Soil + Tare (g) | | 223.89 |
| Tare (g) | | 0.00 |
| Moisture Content, w (%) | | 44.64 |
| Volume, Vo (in^3) | | 37.299 |
| | Vo (cm^3) | 611.221 |
| | Vo (ft^3) | 0.0216 |
| diameter of undeformed membrane (in) | | 2.8 |
| diameter of undeformed membrane (cm) | | 7.112 |
| area of undeformed membrane (in^2) | | 6.158 |
| area of undeformedmemb. (cm^2) | | 39.726 |
| Wet unit wt., gm (pcf) | | 33.1 |
| Dry unit wt., gd (pcf) | | 22.9 |
| Gs, from mix design | | 3.15 |



Infiltration Rate of Pervious Concrete

after ASTM C1701



Project: Cell Crete
No: 14GCI498

Cellular concrete type: Class IV (Low Density)
Sample: 213-33

| Run Number | Incremental time (min) | Time (min) | Time (hr) | Height from base to meniscus (in) | Head (in) | Infiltration (inch/hr) |
|------------|------------------------|------------|--------------|-----------------------------------|-----------|------------------------|
| Run 1 | | | [start test] | 9.10 | 3.66 | |
| | 5.0 | 5.0 | 0.1 | 8.75 | 3.31 | 4.20 |
| | 6.0 | 11.0 | 0.2 | 8.68 | 3.24 | 2.29 |
| | 9.0 | 20.0 | 0.3 | 8.66 | 3.22 | 1.32 |
| | 103.0 | 123.0 | 2.0 | 8.50 | 3.06 | 0.29 |
| | 102.0 | 225.0 | 3.8 | 8.21 | 2.77 | 0.24 |
| Run 2 | 137.0 | 362.0 | 6.0 | 7.82 | 2.38 | 0.21 |
| | | | [reset] | 9.51 | 4.07 | |
| | 30.0 | 30.0 | 0.5 | 8.84 | 3.40 | 1.34 |
| | 31.0 | 61.0 | 1.0 | 8.76 | 3.32 | 0.74 |
| | 61.0 | 122.0 | 2.0 | 8.71 | 3.27 | 0.39 |
| Run 3 | 7.0 | 129.0 | 2.2 | 8.67 | 3.23 | 0.39 |
| | 11.0 | 140.0 | 2.3 | 8.29 | 2.85 | 0.52 |
| | | | [reset] | 9.28 | 3.84 | |
| | 10.0 | 10.0 | 0.2 | 8.14 | 2.70 | 6.84 |
| Run 4 | 10.0 | 20.0 | 0.3 | 7.62 | 2.18 | 4.98 |
| | 15.0 | 35.0 | 0.6 | 7.28 | 1.84 | 3.43 |
| | | | [reset] | 9.19 | 3.75 | |
| Run 5 | 8.0 | 8.0 | 0.1 | 8.23 | 2.79 | 7.20 |
| | 12.0 | 20.0 | 0.3 | 7.79 | 2.35 | 4.20 |
| | 7.0 | 27.0 | 0.5 | 7.53 | 2.09 | 3.69 |
| Run 6 | | | [reset] | 9.58 | 4.14 | |
| | 67.0 | 67.0 | 1.1 | 8.49 | 3.05 | 0.98 |
| | 56.0 | 123.0 | 2.0 | 8.07 | 2.63 | 0.74 |
| | 32.0 | 155.0 | 2.6 | 7.91 | 2.47 | 0.65 |
| Run 6 | 99.0 | 254.0 | 4.2 | 7.45 | 2.01 | 0.50 |
| | | | [reset] | 9.40 | 3.96 | |
| | 34.0 | 34.0 | 0.6 | 8.67 | 3.23 | 1.29 |
| | 53.0 | 87.0 | 1.5 | 8.34 | 2.90 | 0.73 |
| | 42.0 | 129.0 | 2.2 | 7.87 | 2.43 | 0.71 |
| Run 6 | 22.0 | 151.0 | 2.5 | 7.73 | 2.29 | 0.66 |
| | 27.0 | 178.0 | 3.0 | 7.59 | 2.15 | 0.61 |
| Run 6 | 11.0 | 189.0 | 3.1 | 7.53 | 2.09 | 0.59 |

Slake Durability of Shales and Similar Weak Rocks

After ASTM D 4644



Project: Cell Crete

No: 14GCI498

Date: 11-Apr-15

Tested by: zmg

Reduced by: zmg

Reviewed by: rbm

Cellular concrete type: Class IV (Low Density)

Sample: 213-35

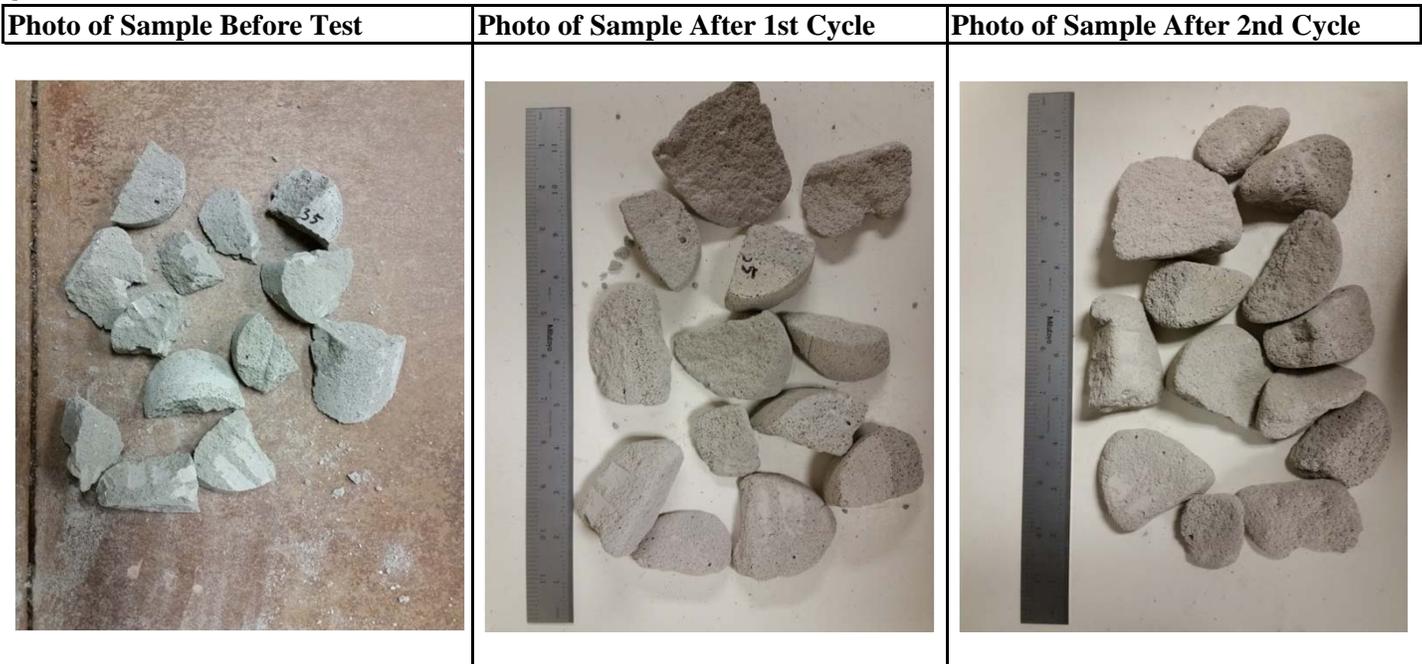
Date cast: 13-Feb-15

Description: Cell Crete

Fluid: Distilled water

Age of sample (days): 54

| | | |
|--------------|--|---------|
| Moisture | Wet sample + drum (g) | 1520.25 |
| | Dry sample + drum (g) | 1445.13 |
| | Mass of drum (g) | 1261.78 |
| | Natural moisture content (%) | 41.0 |
| Test Data | Water temperature before 1st cycle (°C) | 25 |
| | Water temperature after 1st cycle (°C) | 25 |
| | Average water temperature 1st cycle (°C) | 25 |
| | Dry sample + drum after 1st cycle (g) | 1437.21 |
| | Water temperature before 2nd cycle (°C) | 26 |
| | Water temperature after 2nd cycle (°C) | 26 |
| | Average water temperature 2nd cycle (°C) | 26 |
| Test Results | Dry sample + drum after 2nd cycle (g) | 1432.66 |
| | Slake durability index; 2nd cycle (%) | 93.2 |
| | Standard verbal description | I |



Slake Durability of Shales and Similar Weak Rocks

After ASTM D 4644

Project: Cell Crete

No: 14GCI498

Date: 11-Apr-15

Tested by: zmg

Reduced by: zmg

Reviewed by: rbm

Cellular concrete type: Class IV (Low Density)

Sample: 213-34

Date cast: 13-Feb-15

Description: Cell Crete

Fluid: Distilled water

Age of sample (days): 54

| | | |
|--------------|--|---------|
| Moisture | Wet sample + drum (g) | 1495.82 |
| | Dry sample + drum (g) | 1428.14 |
| | Mass of drum (g) | 1260.40 |
| | Natural moisture content (%) | 40.3 |
| Test Data | Water temperature before 1st cycle (°C) | 25 |
| | Water temperature after 1st cycle (°C) | 25 |
| | Average water temperature 1st cycle (°C) | 25 |
| | Dry sample + drum after 1st cycle (g) | 1418.94 |
| | Water temperature before 2nd cycle (°C) | 26 |
| | Water temperature after 2nd cycle (°C) | 26 |
| | Average water temperature 2nd cycle (°C) | 26 |
| Test Results | Dry sample + drum after 2nd cycle (g) | 1411.80 |
| | Slake durability index; 2nd cycle (%) | 90.3 |
| | Standard verbal description | I |

