Schnabel Engineering

# Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *Calvert Cliffs Nuclear Power Plant*

Location: *Calvert County, MD*

Schnabel Contract: *06120048*
Boring No.: *B-317*
Depth: *28.5-30.5ft.*
Elevation: *65.9 to 63.9*
Confining Stress (psi): *40.0*

Date: *10/12/2006*

Reviewed by: *CJS*

| | Specimen Conditions | |
|---|---|---|
| | Initial | Consolidated |
| Diameter (in) | 2.891 | 2.86 |
| Height (in) | 5.835 | 5.75 |
| Area (in²) | 6.57 | 6.41 |
| Moisture (%) | 31.3 | |
| $W_{solids}$ (lbs) | 2.05 | |
| $\rho_{wet}$ (pcf) | 121.2 | |
| $\rho_{dry}$ (pcf) | 92.3 | 95.9 |
| Void Ratio | 0.86 | 0.79 |
| Saturation, % | 100 | 98 |

| Shear Testing Conditions | |
|---|---|
| Cell Pressure (psi): | 65.0 |
| Back Pressure (psi): | 25.0 |
| Eff. Confining Stress (psi): | 40.0 |
| Final B check | 0.98 |
| $t_{50}$ (min.): | 10.9 |
| Rate of Strain (%/min): | 0.0232 |

Filter strips used? *YES*

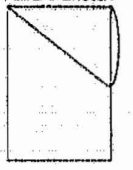
Specimen Type: *Tube Sample*

Soil Description: *LEAN CLAY (CL), trace sand - gray*

Liquid Limit: *27*
Plasticity Index: *8*
% finer that No. 200: *97.8*
Specific Gravity: *2.75*

Remarks:

Failure Sketch

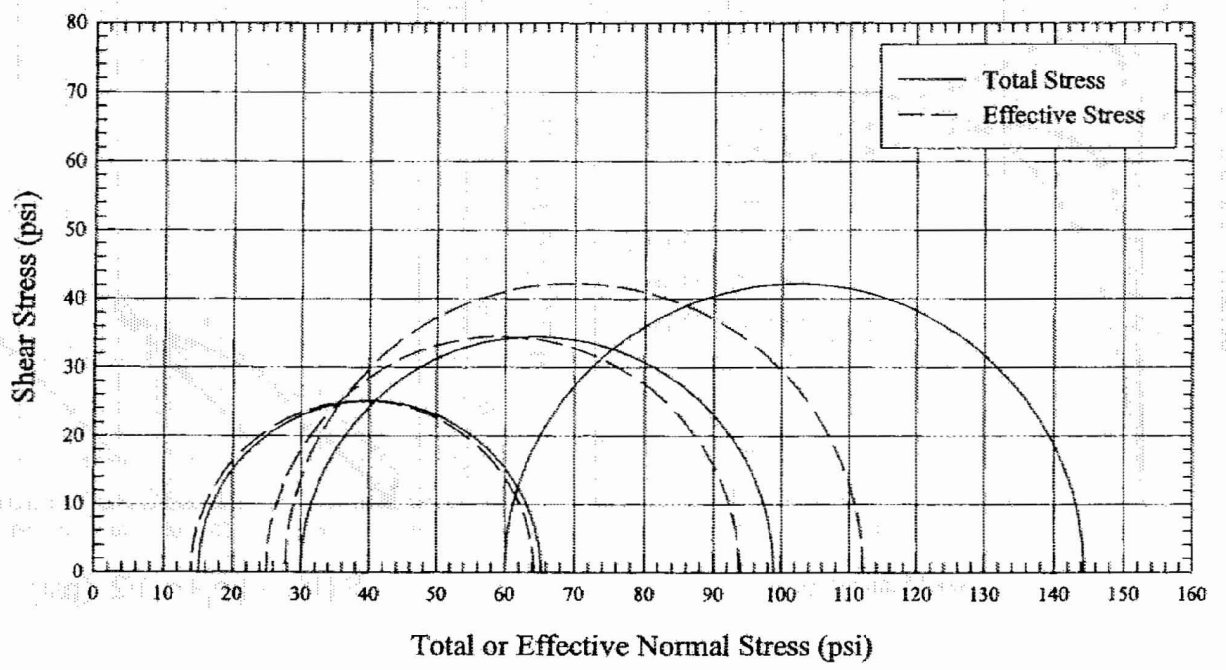


| Reading No. | Deviator Load (lbs) | Corrected[1] Dev. Load (lbs.) | Axial Deformation (in.) | Axial Strain (%) | Pore Pressure (psi) | Change in Pore Press. (psi) | Corrected Area[2] (in²) | $\sigma_1$ (psi) | $\sigma_3$ (psi) | $\sigma'_1$ (psi) | $\sigma'_3$ (psi) | Deviator Stress (psi) | Principal Stress Ratio | $A_{bar}$ | P (psi) | P' (psi) | q (psi) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zero | 0.0 | 0.0 | 0.000 | 0.00 | 25.0 | 0.0 | 6.41 | 40.0 | 40.0 | 40.0 | 40.0 | 0.0 | 1.00 | 0.00 | 40.0 | 40.0 | 0.0 |
| 1 | 4.2 | 4.1 | 0.006 | 0.10 | 25.8 | 0.8 | 6.42 | 40.6 | 40.0 | 39.8 | 39.2 | 0.6 | 1.02 | 1.26 | 40.3 | 39.5 | 0.3 |
| 2 | 62.3 | 62.1 | 0.012 | 0.21 | 29.9 | 4.9 | 6.43 | 49.7 | 40.0 | 44.8 | 35.1 | 9.7 | 1.28 | 0.51 | 44.8 | 39.9 | 4.8 |
| 3 | 102.5 | 102.1 | 0.018 | 0.31 | 34.0 | 9.0 | 6.43 | 55.9 | 40.0 | 46.9 | 31.0 | 15.9 | 1.51 | 0.57 | 47.9 | 38.9 | 7.9 |
| 4 | 124.5 | 124.0 | 0.023 | 0.40 | 36.6 | 11.6 | 6.44 | 58.3 | 40.0 | 47.7 | 28.4 | 19.3 | 1.68 | 0.60 | 49.6 | 38.0 | 9.8 |
| 5 | 140.8 | 140.2 | 0.029 | 0.50 | 38.6 | 13.6 | 6.44 | 61.8 | 40.0 | 48.2 | 26.4 | 21.8 | 1.82 | 0.63 | 50.9 | 37.3 | 10.9 |
| 6 | 153.3 | 152.6 | 0.035 | 0.61 | 40.1 | 15.1 | 6.45 | 63.6 | 40.0 | 48.5 | 24.9 | 23.6 | 1.95 | 0.64 | 51.8 | 36.7 | 11.8 |
| 7 | 163.9 | 163.1 | 0.041 | 0.71 | 41.4 | 16.4 | 6.46 | 65.2 | 40.0 | 48.8 | 23.6 | 25.2 | 2.07 | 0.65 | 52.6 | 36.2 | 12.6 |
| 8 | 173.4 | 172.4 | 0.047 | 0.82 | 42.5 | 17.5 | 6.47 | 66.7 | 40.0 | 49.2 | 22.5 | 26.7 | 2.19 | 0.66 | 53.3 | 35.8 | 13.3 |
| 9 | 182.1 | 181.0 | 0.053 | 0.92 | 43.3 | 18.3 | 6.47 | 68.0 | 40.0 | 49.7 | 21.7 | 28.0 | 2.29 | 0.65 | 54.0 | 35.7 | 14.0 |
| 10 | 190.7 | 189.5 | 0.058 | 1.01 | 44.0 | 19.0 | 6.48 | 69.3 | 40.0 | 50.3 | 21.0 | 29.3 | 2.39 | 0.65 | 54.6 | 35.6 | 14.6 |
| 11 | 217.6 | 215.9 | 0.082 | 1.43 | 46.1 | 21.1 | 6.51 | 73.2 | 40.0 | 52.1 | 18.9 | 33.2 | 2.76 | 0.64 | 56.6 | 35.5 | 16.6 |
| 12 | 244.6 | 242.3 | 0.111 | 1.93 | 47.4 | 22.4 | 6.54 | 77.1 | 40.0 | 54.7 | 17.6 | 37.1 | 3.11 | 0.60 | 58.5 | 36.1 | 18.5 |
| 13 | 267.4 | 264.9 | 0.140 | 2.43 | 48.2 | 23.2 | 6.57 | 80.3 | 40.0 | 57.1 | 16.8 | 40.3 | 3.40 | 0.58 | 60.2 | 37.0 | 20.2 |
| 14 | 287.8 | 285.2 | 0.172 | 2.99 | 48.4 | 23.4 | 6.61 | 83.1 | 40.0 | 59.7 | 16.6 | 43.1 | 3.60 | 0.54 | 61.6 | 38.2 | 21.6 |
| 15 | 310.8 | 308.0 | 0.228 | 3.96 | 48.0 | 23.0 | 6.68 | 86.1 | 40.0 | 63.1 | 17.0 | 46.1 | [illegible] | 0.50 | 63.1 | 40.1 | 23.1 |
| 16 | 318.7 | 315.7 | 0.286 | 4.97 | 47.2 | 22.2 | 6.75 | 86.8 | 40.0 | 64.6 | 17.8 | [illegible] | 3.63 | 0.47 | 63.4 | 41.2 | 23.4 |
| 17 | 309.0 | 305.8 | 0.344 | 5.98 | 46.1 | 21.1 | 6.82 | 84.8 | 40.0 | 63.7 | 18.9 | 44.8 | 3.37 | 0.47 | 62.4 | 41.3 | 22.4 |
| 18 | 288.0 | 284.5 | 0.403 | 7.00 | 45.8 | 20.8 | 6.90 | 81.3 | 40.0 | 60.5 | 19.2 | 41.3 | 3.15 | 0.50 | 60.6 | 39.8 | 20.6 |
| 19 | 284.2 | 280.5 | 0.461 | 8.01 | 45.7 | 20.7 | 6.97 | 80.2 | 40.0 | 59.5 | 19.3 | 40.2 | 3.09 | 0.51 | 60.1 | 39.4 | 20.1 |
| 20 | 278.1 | 274.2 | 0.514 | 8.93 | 45.6 | 20.6 | 7.04 | 78.9 | 40.0 | 58.3 | 19.4 | 38.9 | 3.01 | 0.53 | 59.5 | 38.9 | 19.5 |
| 21 | 273.6 | 269.5 | 0.572 | 9.94 | 45.5 | 20.5 | 7.12 | 77.9 | 40.0 | 57.4 | 19.5 | 37.9 | 2.94 | 0.54 | 58.9 | 38.4 | 18.9 |
| 22 | 274.2 | 269.9 | 0.630 | 10.95 | 45.2 | 20.2 | 7.20 | 77.5 | 40.0 | 57.3 | 19.8 | 37.5 | 2.89 | 0.54 | 58.7 | 38.5 | 18.7 |
| 23 | 277.2 | 272.7 | 0.689 | 11.98 | 45.0 | 20.0 | 7.28 | 77.4 | 40.0 | 57.4 | 20.0 | 37.4 | 2.87 | 0.53 | 58.7 | 38.7 | 18.7 |
| 24 | 283.6 | 278.9 | 0.747 | 12.98 | 44.7 | 19.7 | 7.37 | 77.8 | 40.0 | 58.1 | 20.3 | 37.8 | 2.86 | 0.52 | 58.9 | 39.2 | 18.9 |
| 25 | 287.0 | 282.0 | 0.806 | 14.01 | 44.7 | 19.7 | 7.46 | 77.8 | 40.0 | 58.1 | 20.3 | 37.8 | 2.86 | 0.52 | 58.9 | 39.2 | 18.9 |
| 26 | 290.8 | 285.6 | 0.859 | 14.93 | 44.5 | 19.5 | 7.54 | 77.9 | 40.0 | 58.4 | 20.5 | 37.9 | 2.85 | 0.51 | 58.9 | 39.4 | 18.9 |

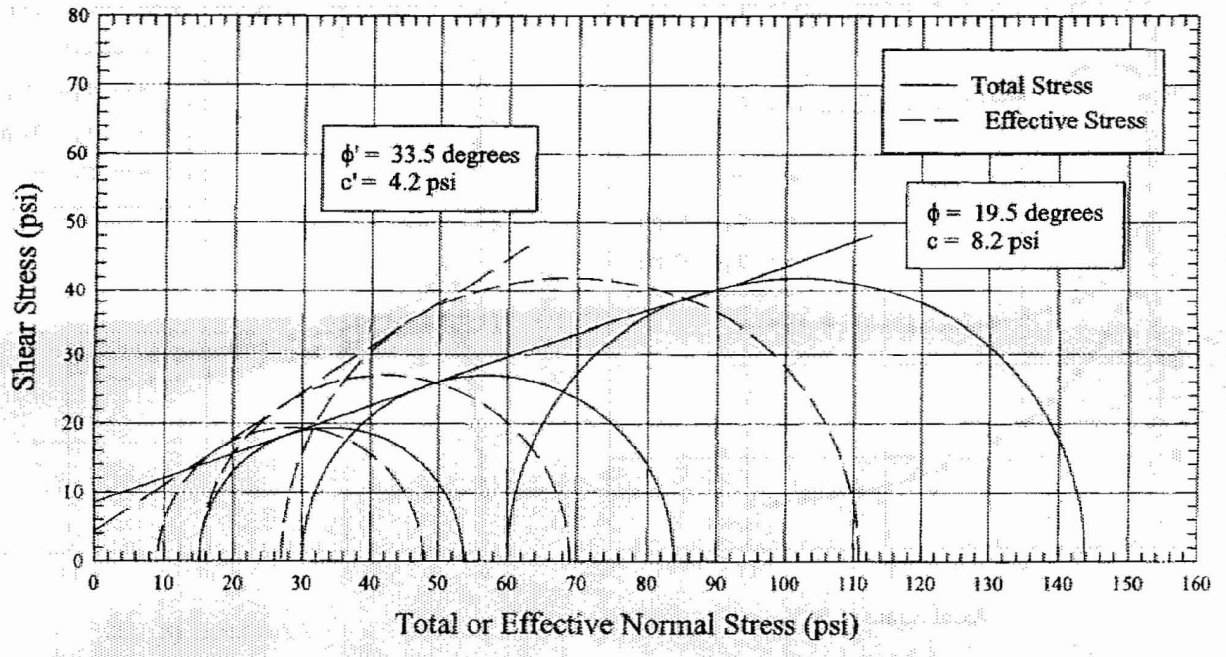
Notes: Deviator load corrected for membrane and filter cage (if applicable) effects.
Right Cylinder Correction Method

# Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

## Mohr Stress Circles at Maximum Deviator Stress Criterion




## Mohr Stress Circles at Maximum Principal Stress Ratio Criterion




Boring No.: *B-317* Depth: *48.5-50.5 ft* SEI Contract: *06120048* Date: *10/12/06*

Sample Description: *Sandy LEAN CLAY (CL) - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Specific Gravity: *2.70* LL: *35* PI: *18* %<200: *69.8*

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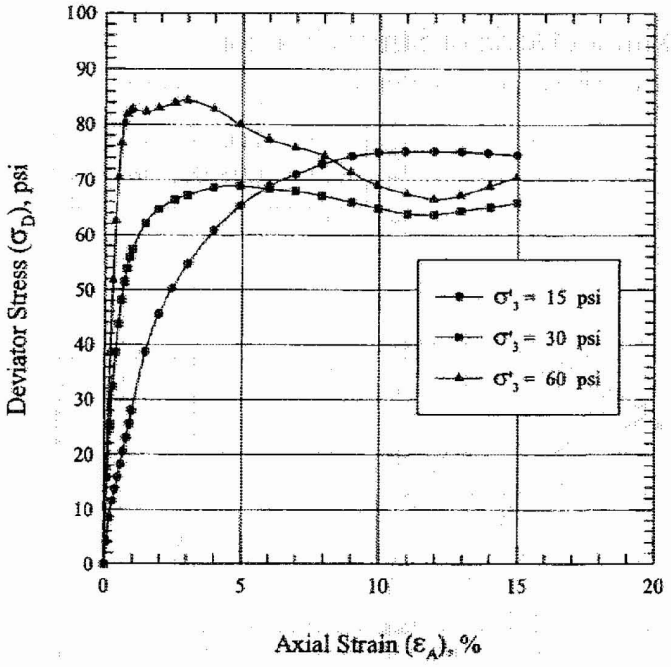
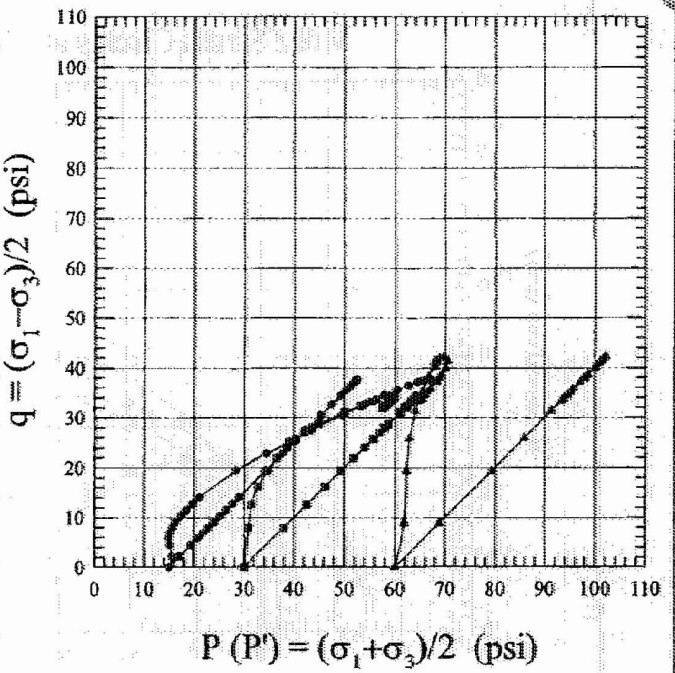
*Calvert Cliffs Nuclear Power Plant*
*Calvert County, Maryland*

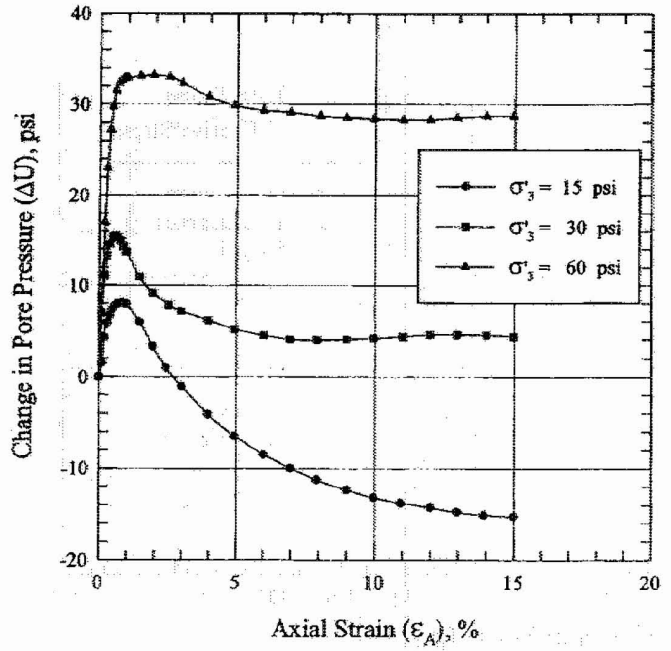
## Deviator Stress vs. Axial Strain



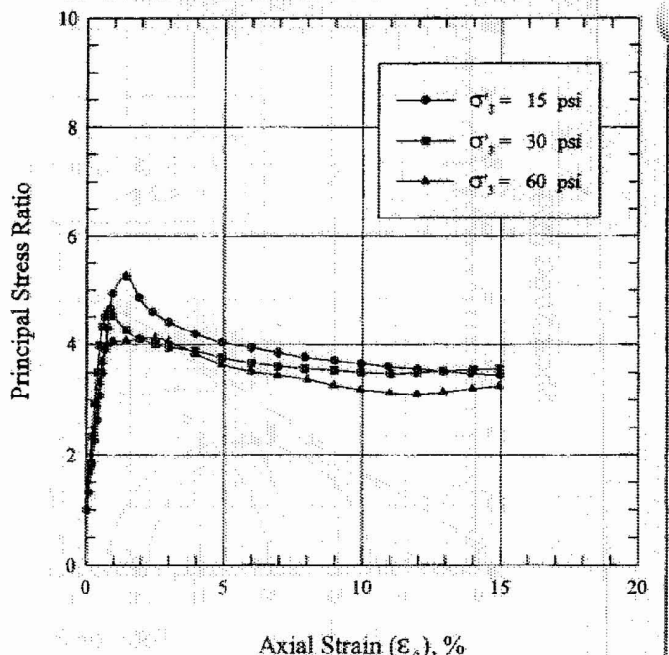

## Stress Paths




## Change in Pore Pressure vs. Axial Strain




## Principal Stress Ratio vs. Axial Strain




Boring No.: *B-317* Depth: *48.5-50.5 ft* SEI Contract: *06120048* Date: *10/12/06*

Sample Description: *Sandy LEAN CLAY (CL) - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* *Specific Gravity:* 2.70 LL: *35* PI: *18* %<200: *69.8*

Schnabel Engineering

*Calvert Cliffs Nuclear Power Plant*
*Calvert County, Maryland*

Schnabel Engineering

# Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *Calvert Cliffs Nuclear Power Plant*

Location: *Calvert County, MD*

Schnabel Contract: *06120048*
Boring No.: *B-317*
Depth: *48.5-50.5ft.*
Elevation: *45.9 to 43.9*
Confining Stress (psi): *15.0*

Date: *10/12/2006*

Reviewed by: *CJS*

| | Specimen Conditions | |
|---|---|---|
| | Initial | Consolidated |
| Diameter (in) | 2.691 | 2.68 |
| Height (in) | 5.823 | 5.80 |
| Area ($in^2$) | 6.57 | 6.53 |
| Moisture (%) | 24.1 | |
| $W_{solids}$ (lbs) | 2.20 | |
| $\rho_{wet}$ (pcf) | 123.6 | |
| $\rho_{dry}$ (pcf) | 99.6 | 100.5 |
| Void Ratio | 0.69 | 0.68 |
| Saturation, % | 94 | 95 |

| Shear Testing Conditions | |
|---|---|
| Cell Pressure (psi): | 50.0 |
| Back Pressure (psi): | 35.0 |
| Eff. Confining Stress (psi): | 15.0 |
| Final B check | 0.98 |
| $t_{50}$ (min.): | 0.4 |
| Rate of Strain (%/min): | 0.125 |

Filter strips used? *YES*

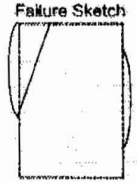
Specimen Type: *Tube Sample*

Soil Description: *Sandy LEAN CLAY (CL) - gray*

Liquid Limit: *35*
Plasticity Index: *18*
% finer that No. 200: *89.6*
Specific Gravity: *2.70*

Remarks:

Failure Sketch



| Reading No. | Deviator Load (lbs) | Corrected[1] Dev. Load (lbs.) | Axial Deformation (in.) | Axial Strain (%) | Pore Pressure (psi) | Change in Pore Press. (psi) | Corrected Area[2] ($in^2$) | $\sigma_1$ (psi) | $\sigma_3$ (psi) | $\sigma'_1$ (psi) | $\sigma'_3$ (psi) | Deviator Stress (psi) | Principal Stress Ratio | $A_{bar}$ | P (psi) | P' (psi) | q (psi) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zero | 0.0 | 0.0 | 0.000 | 0.00 | 35.0 | 0.0 | 6.53 | 15.0 | 15.0 | 15.0 | 15.0 | 0.0 | 1.00 | 0.00 | 15.0 | 15.0 | 0.0 |
| 1 | 27.2 | 27.1 | 0.006 | 0.10 | 36.5 | 1.5 | 6.54 | 19.1 | 15.0 | 17.6 | 13.5 | 4.1 | 1.31 | 0.36 | 17.1 | 15.6 | 2.1 |
| 2 | 57.1 | 56.9 | 0.011 | 0.19 | 39.2 | 4.2 | 6.54 | 23.7 | 15.0 | 19.5 | 10.8 | 8.7 | 1.80 | 0.48 | 19.3 | 15.1 | 4.3 |
| 3 | 75.5 | 75.2 | 0.017 | 0.29 | 40.8 | 5.8 | 6.55 | 26.5 | 15.0 | 20.7 | 9.2 | 11.5 | 2.25 | 0.51 | 20.7 | 14.9 | 5.7 |
| 4 | 90.1 | 89.6 | 0.023 | 0.40 | 41.6 | 6.6 | 6.56 | 28.7 | 15.0 | 22.1 | 8.4 | 13.7 | 2.63 | 0.48 | 21.8 | 15.2 | 6.8 |
| 5 | 104.9 | 104.3 | 0.028 | 0.48 | 42.3 | 7.3 | 6.56 | 30.9 | 15.0 | 23.6 | 7.7 | 15.9 | 3.06 | 0.46 | 22.9 | 15.6 | 7.9 |
| 6 | 120.1 | 119.4 | 0.034 | 0.59 | 42.7 | 7.7 | 6.57 | 33.2 | 15.0 | 25.5 | 7.3 | 18.2 | 3.49 | 0.42 | 24.1 | 16.4 | 9.1 |
| 7 | 135.9 | 135.1 | 0.039 | 0.67 | 42.9 | 7.9 | 6.58 | 35.5 | 15.0 | 27.8 | 7.1 | 20.5 | 3.89 | 0.38 | 25.3 | 17.4 | 10.3 |
| 8 | 152.3 | 151.4 | 0.045 | 0.78 | 43.0 | 8.0 | 6.58 | 38.0 | 15.0 | 30.0 | 7.0 | 23.0 | 4.28 | 0.35 | 26.5 | 18.5 | 11.5 |
| 9 | 169.2 | 168.2 | 0.051 | 0.88 | 43.0 | 8.0 | 6.59 | 40.5 | 15.0 | 32.5 | 7.0 | 25.5 | 4.65 | 0.31 | 27.8 | 19.8 | 12.8 |
| 10 | 185.6 | 184.4 | 0.056 | 0.97 | 42.9 | 7.9 | 6.60 | 43.0 | 15.0 | 35.1 | 7.1 | 28.0 | 4.94 | 0.28 | 29.0 | 21.1 | 14.0 |
| 11 | 258.1 | 256.4 | 0.084 | 1.45 | 40.9 | 5.9 | 6.63 | 53.7 | 15.0 | 47.8 | 9.1 | 38.7 | [illegible] | 0.15 | 34.3 | 28.4 | 19.3 |
| 12 | 305.2 | 302.9 | 0.112 | 1.93 | 38.2 | 3.2 | 6.66 | 60.5 | 15.0 | 57.3 | 11.8 | 45.5 | 4.85 | 0.07 | 37.7 | 34.5 | 22.7 |
| 13 | 338.6 | 336.1 | 0.140 | 2.41 | 36.0 | 1.0 | 6.69 | 65.2 | 15.0 | 64.2 | 14.0 | [illegible] | 4.59 | 0.02 | 40.1 | 39.1 | 25.1 |
| 14 | 371.2 | 368.6 | 0.174 | 3.00 | 33.9 | -1.1 | 6.73 | 69.7 | 15.0 | 70.8 | 16.1 | 54.7 | 4.40 | -0.02 | 42.4 | 43.5 | 27.4 |
| 15 | 416.4 | 413.6 | 0.230 | 3.97 | 30.9 | -4.1 | 6.80 | 75.8 | 15.0 | 79.9 | 19.1 | 60.8 | 4.18 | -0.07 | 45.4 | 49.5 | 30.4 |
| 16 | 451.4 | 448.4 | 0.286 | 4.93 | 28.5 | -6.5 | 6.87 | 80.3 | 15.0 | 86.8 | 21.5 | 65.3 | 4.04 | -0.10 | 47.6 | 54.1 | 32.6 |
| 17 | 481.5 | 478.2 | 0.348 | 6.00 | 26.5 | -8.5 | 6.95 | 83.8 | 15.0 | 92.3 | 23.5 | 68.8 | 3.93 | -0.12 | 49.4 | 57.9 | 34.4 |
| 18 | 502.1 | 498.6 | 0.404 | 6.97 | 25.0 | -10.0 | 7.02 | 86.0 | 15.0 | 96.0 | 25.0 | 71.0 | 3.84 | -0.14 | 50.5 | 60.5 | 35.5 |
| 19 | 520.2 | 516.5 | 0.460 | 7.93 | 23.7 | -11.3 | 7.09 | 87.8 | 15.0 | 99.1 | 26.3 | 72.8 | 3.77 | -0.16 | 51.4 | 62.7 | 36.4 |
| 20 | 536.7 | 532.8 | 0.522 | 9.00 | 22.6 | -12.4 | 7.18 | 89.2 | 15.0 | 101.6 | 27.4 | 74.2 | 3.71 | -0.17 | 52.1 | 64.5 | 37.1 |
| 21 | 547.3 | 543.2 | 0.578 | 9.97 | 21.8 | -13.2 | 7.26 | 89.9 | 15.0 | 103.1 | 28.2 | 74.9 | 3.65 | -0.18 | 52.4 | 65.6 | 37.4 |
| 22 | 554.9 | 550.6 | 0.634 | 10.93 | 21.2 | -13.8 | 7.33 | 90.1 | 15.0 | 103.9 | 28.8 | 75.1 | 3.61 | -0.18 | 52.5 | 66.3 | 37.5 |
| 23 | 561.7 | 557.1 | 0.695 | 11.99 | 20.7 | -14.3 | 7.42 | 90.1 | 15.0 | 104.4 | 29.3 | 75.1 | 3.58 | -0.19 | 52.5 | 66.8 | 37.5 |
| 24 | 567.8 | 563.0 | 0.751 | 12.95 | 20.2 | -14.8 | 7.50 | 90.0 | 15.0 | 104.8 | 29.8 | 75.0 | 3.52 | -0.20 | 52.5 | 67.3 | 37.5 |
| 25 | 572.5 | 567.5 | 0.807 | 13.92 | 19.9 | -15.1 | 7.59 | 89.8 | 15.0 | 104.9 | 30.1 | 74.8 | 3.48 | -0.20 | 52.4 | 67.5 | 37.4 |
| 26 | 576.7 | 571.5 | 0.869 | 14.99 | 19.7 | -15.3 | 7.68 | 89.4 | 15.0 | 104.7 | 30.3 | 74.4 | 3.45 | -0.21 | 52.2 | 67.5 | 37.2 |

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.

2. Right Cylinder Correction Method

Schnabel Engineering

# Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *Calvert Cliffs Nuclear Power Plant*

Location: *Calvert County, MD*

Schnabel Contract: *06120048*
Boring No.: *B-317*
Depth: *48.5-50.5ft.*
Elevation: *45.9 to 43.9*
Confining Stress (psi): *30.0*

Date: *10/12/2006*

Reviewed by: *CJS*

| | Specimen Conditions | |
|---|---|---|
| | Initial | Consolidated |
| Diameter (in) | 2.865 | 2.87 |
| Height (in) | 5.826 | 5.81 |
| Area ($in^2$) | 6.54 | 6.48 |
| Moisture (%) | 24.8 | |
| $W_{solids}$ (lbs) | 2.18 | |
| $\rho_{wet}$ (pcf) | 123.7 | |
| $\rho_{dry}$ (pcf) | 99.1 | 100.4 |
| Void Ratio | 0.70 | 0.68 |
| Saturation, % | 96 | 99 |

| Shear Testing Conditions | |
|---|---|
| Cell Pressure (psi): | 65.0 |
| Back Pressure (psi): | 35.0 |
| Eff. Confining Stress (psi): | 30.0 |
| Final B check | 0.98 |
| $t_{50}$ (min.): | 0.8 |
| Rate of Strain (%/min): | 0.125 |

Filter strips used? *YES*

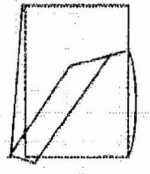
Specimen Type: *Tube Sample*

Soil Description: *Sandy LEAN CLAY (CL) - gray*

Liquid Limit: *35*
Plasticity Index: *18*
% finer that No. 200: *69.8*
Specific Gravity: *2.70*

Remarks:

Failure Sketch



| Reading No. | Deviator Load (lbs) | Corrected[1] Dev. Load (lbs.) | Axial Deformation (in.) | Axial Strain (%) | Pore Pressure (psi) | Change in Pore Press. (psi) | Corrected Area[2] ($in^2$) | $\sigma_1$ (psi) | $\sigma_3$ (psi) | $\sigma'_1$ (psi) | $\sigma'_3$ (psi) | Deviator Stress (psi) | Principal Stress Ratio | $A_{bar}$ | P (psi) | P' (psi) | q (psi) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zero | 0.0 | 0.0 | 0.000 | 0.00 | 35.0 | 0.0 | 6.48 | 30.0 | 30.0 | 30.0 | 30.0 | 0.0 | 1.00 | 0.00 | 30.0 | 30.0 | 0.0 |
| 1 | 103.0 | 103.0 | 0.006 | 0.10 | 42.0 | 7.0 | 6.48 | 45.9 | 30.0 | 38.9 | 23.0 | 15.9 | 1.69 | 0.44 | 37.9 | 30.9 | 7.9 |
| 2 | 164.0 | 164.0 | 0.012 | 0.21 | 46.1 | 11.1 | 6.49 | 55.3 | 30.0 | 44.2 | 18.9 | 25.3 | 2.34 | 0.44 | 42.6 | 31.5 | 12.6 |
| 3 | 210.4 | 210.3 | 0.017 | 0.29 | 48.3 | 13.3 | 6.50 | 62.4 | 30.0 | 49.1 | 16.7 | 32.4 | 2.94 | 0.41 | 46.2 | 32.9 | 16.2 |
| 4 | 251.4 | 251.3 | 0.023 | 0.40 | 49.6 | 14.6 | 6.50 | 68.6 | 30.0 | 54.0 | 15.4 | 38.6 | 3.51 | 0.38 | 49.3 | 34.7 | 19.3 |
| 5 | 284.8 | 284.7 | 0.028 | 0.48 | 50.3 | 15.3 | 6.51 | 73.7 | 30.0 | 58.4 | 14.7 | 43.7 | 3.98 | 0.35 | 51.9 | 36.6 | 21.9 |
| 6 | 313.9 | 313.8 | 0.034 | 0.59 | 50.5 | 15.5 | 6.52 | 78.2 | 30.0 | 62.7 | 14.5 | 48.2 | 4.32 | 0.32 | 54.1 | 38.6 | 24.1 |
| 7 | 336.0 | 335.9 | 0.040 | 0.69 | 50.3 | 15.3 | 6.52 | 81.5 | 30.0 | 66.2 | 14.7 | 51.5 | 4.50 | 0.30 | 55.7 | 40.4 | 25.7 |
| 8 | 351.9 | 351.7 | 0.045 | 0.78 | 49.9 | 14.9 | 6.53 | 83.9 | 30.0 | 69.0 | 15.1 | 53.9 | [illegible] | 0.28 | 56.9 | 42.0 | 26.9 |
| 9 | 365.7 | 365.5 | 0.051 | 0.88 | 49.3 | 14.3 | 6.53 | 85.9 | 30.0 | 71.6 | 15.7 | 55.9 | 4.56 | 0.26 | 58.0 | 43.7 | 28.0 |
| 10 | 375.8 | 375.6 | 0.056 | 0.96 | 48.7 | 13.7 | 6.54 | 87.4 | 30.0 | 73.7 | 16.3 | 57.4 | 4.52 | 0.24 | 58.7 | 45.0 | 28.7 |
| 11 | 408.6 | 408.3 | 0.084 | 1.45 | 45.9 | 10.9 | 6.57 | 92.1 | 30.0 | 81.2 | 19.1 | 62.1 | 4.25 | 0.18 | 61.1 | 50.2 | 31.1 |
| 12 | 427.8 | 427.4 | 0.112 | 1.93 | 44.1 | 9.1 | 6.60 | 94.7 | 30.0 | 85.6 | 20.9 | 64.7 | 4.10 | 0.14 | 62.4 | 53.3 | 32.4 |
| 13 | 441.8 | 441.3 | 0.146 | 2.51 | 42.8 | 7.8 | 6.64 | 96.4 | 30.0 | 88.6 | 22.2 | 66.4 | 3.99 | 0.12 | 63.2 | 55.4 | 33.2 |
| 14 | 449.8 | 449.2 | 0.174 | 3.00 | 42.1 | 7.1 | 6.68 | 97.3 | 30.0 | 90.2 | 22.9 | 67.3 | 3.94 | 0.11 | 63.6 | 56.5 | 33.6 |
| 15 | 463.8 | 462.9 | 0.230 | 3.96 | 41.1 | 6.1 | 6.74 | 98.6 | 30.0 | 92.5 | 23.9 | 68.6 | 3.87 | 0.09 | 64.3 | 58.2 | 34.3 |
| 16 | 470.5 | 469.4 | 0.286 | 4.93 | 40.1 | 5.1 | 6.81 | 98.9 | 30.0 | 93.8 | 24.9 | [illegible] | 3.77 | 0.07 | 64.5 | 59.4 | 34.5 |
| 17 | 472.1 | 470.8 | 0.348 | 5.99 | 39.4 | 4.4 | 6.89 | 98.3 | 30.0 | 93.9 | 25.6 | 68.3 | 3.67 | 0.06 | 64.2 | 59.8 | 34.2 |
| 18 | 474.5 | 473.0 | 0.404 | 6.96 | 39.0 | 4.0 | 6.96 | 97.9 | 30.0 | 93.9 | 26.0 | 67.9 | 3.61 | 0.06 | 64.0 | 60.0 | 34.0 |
| 19 | 473.8 | 472.1 | 0.460 | 7.92 | 38.9 | 3.9 | 7.03 | 97.1 | 30.0 | 93.2 | 26.1 | 67.1 | 3.57 | 0.06 | 63.6 | 59.7 | 33.6 |
| 20 | 471.6 | 469.7 | 0.522 | 8.99 | 39.0 | 4.0 | 7.12 | 96.0 | 30.0 | 92.0 | 26.0 | 66.0 | 3.54 | 0.06 | 63.0 | 59.0 | 33.0 |
| 21 | 469.2 | 467.0 | 0.578 | 9.96 | 39.1 | 4.1 | 7.19 | 94.9 | 30.0 | 90.8 | 25.9 | 64.9 | 3.51 | 0.06 | 62.5 | 58.4 | 32.5 |
| 22 | 467.2 | 464.8 | 0.639 | 11.01 | 39.3 | 4.3 | 7.28 | 93.9 | 30.0 | 89.6 | 25.7 | 63.9 | 3.48 | 0.07 | 61.9 | 57.6 | 31.9 |
| 23 | 471.5 | 468.9 | 0.695 | 11.97 | 39.5 | 4.5 | 7.36 | 93.7 | 30.0 | 89.2 | 25.5 | 63.7 | 3.50 | 0.07 | 61.9 | 57.4 | 31.9 |
| 24 | 481.7 | 478.9 | 0.751 | 12.94 | 39.5 | 4.5 | 7.44 | 94.4 | 30.0 | 89.9 | 25.5 | 64.4 | 3.52 | 0.07 | 62.2 | 57.7 | 32.2 |
| 25 | 493.2 | 490.2 | 0.813 | 14.00 | 39.5 | 4.5 | 7.53 | 95.1 | 30.0 | 90.6 | 25.5 | 65.1 | 3.55 | 0.07 | 62.5 | 58.0 | 32.5 |
| 26 | 505.1 | 501.9 | 0.869 | 14.97 | 39.3 | 4.3 | 7.62 | 95.9 | 30.0 | 91.6 | 25.7 | 65.9 | 3.56 | 0.07 | 62.9 | 58.6 | 32.9 |

Notes: Deviator load corrected for membrane and filter cage (if applicable) effects.
Right Cylinder Correction Method

Schnabel Engineering

# Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *Calvert Cliffs Nuclear Power Plant*

Location: *Calvert County, MD*

Schnabel Contract: *06120048*
Boring No.: *B-317*
Depth: *48.5-50.5ft.*
Elevation: *45.9 to 43.9*
Confining Stress (psi): *60.0*

Date: *10/12/2006*

Reviewed by: *CJS*

| | Specimen Conditions | |
|---|---|---|
| | Initial | Consolidated |
| Diameter (in) | 2.862 | 2.86 |
| Height (in) | 5.847 | 5.81 |
| Area (in²) | 6.53 | 6.44 |
| Moisture (%) | 25.6 | |
| $W_{solids}$ (lbs) | 2.11 | |
| $\rho_{wet}$ (pcf) | 119.8 | |
| $\rho_{dry}$ (pcf) | 95.4 | 97.2 |
| Void Ratio | 0.77 | 0.73 |
| Saturation, % | 90 | 100 |

| Shear Testing Conditions | |
|---|---|
| Cell Pressure (psi): | 95.0 |
| Back Pressure (psi): | 35.0 |
| Eff. Confining Stress (psi): | 60.0 |
| Final B check | 0.96 |
| $t_{50}$ (min.): | 1.9 |
| Rate of Strain (%/min): | 0.125 |

Filter strips used? *YES*

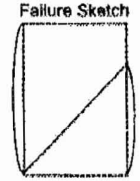
Specimen Type: *Tube Sample*

Soil Description: *Sandy LEAN CLAY (CL) - gray*

Liquid Limit: *35*
Plasticity Index: *18*
% finer that No. 200: *69.8*
Specific Gravity: *2.70*

Remarks:

Failure Sketch

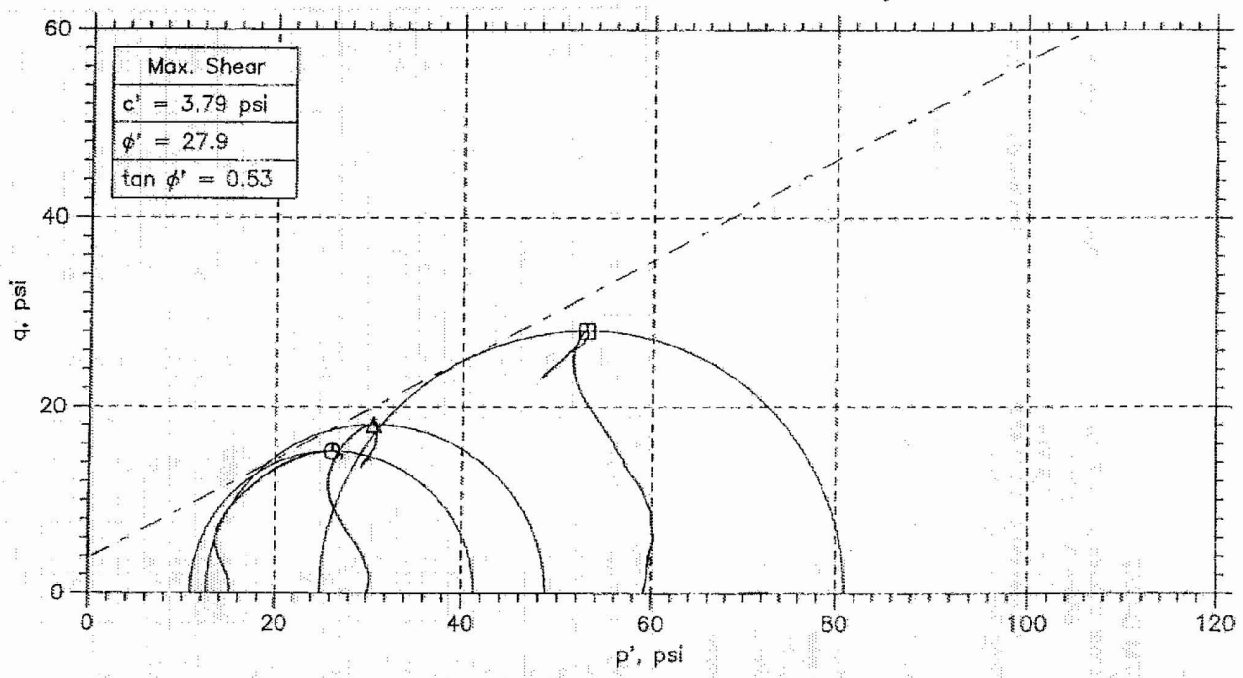


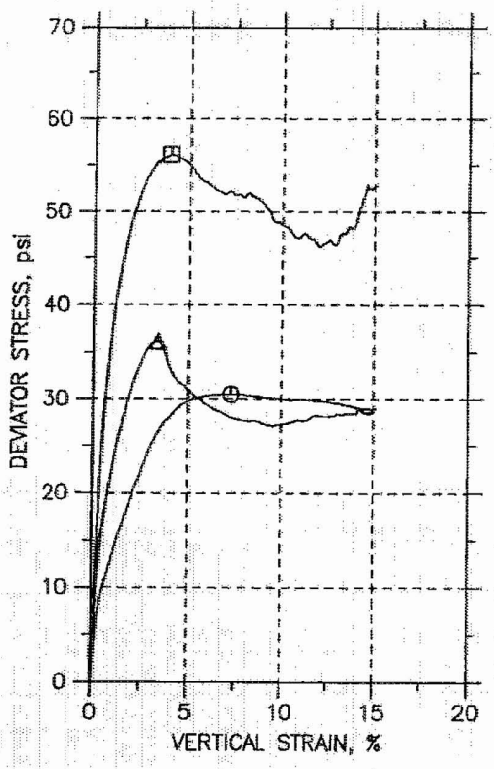
| Reading No. | Deviator Load (lbs) | Corrected[1] Dev. Load (lbs.) | Axial Deformation (in.) | Axial Strain (%) | Pore Pressure (psi) | Change in Pore Press. (psi) | Corrected Area[2] (in²) | $\sigma_1$ (psi) | $\sigma_3$ (psi) | $\sigma'_1$ (psi) | $\sigma'_3$ (psi) | Deviator Stress (psi) | Principal Stress Ratio | $A_{bar}$ | P (psi) | P' (psi) | q (psi) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zero | 0.0 | 0.0 | 0.000 | 0.00 | 35.0 | 0.0 | 6.44 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 | 1.00 | 0.00 | 60.0 | 60.0 | 0.0 |
| 1 | 114.1 | 114.0 | 0.006 | 0.10 | 42.0 | 7.0 | 6.45 | 77.7 | 60.0 | 70.7 | 53.0 | 17.7 | 1.33 | 0.40 | 68.8 | 61.8 | 8.8 |
| 2 | 249.1 | 248.9 | 0.012 | 0.21 | 52.0 | 17.0 | 6.45 | 96.8 | 60.0 | 81.6 | 43.0 | 36.6 | 1.90 | 0.44 | 79.3 | 62.3 | 19.3 |
| 3 | 334.6 | 334.3 | 0.017 | 0.29 | 58.0 | 23.0 | 6.46 | 111.7 | 60.0 | 88.7 | 37.0 | 51.7 | 2.40 | 0.44 | 85.9 | 62.9 | 25.9 |
| 4 | 405.5 | 405.0 | 0.023 | 0.40 | 62.2 | 27.2 | 6.47 | 122.6 | 60.0 | 95.4 | 32.8 | 62.6 | 2.91 | 0.43 | 91.3 | 64.1 | 31.3 |
| 5 | 456.5 | 455.9 | 0.028 | 0.48 | 64.7 | 29.7 | 6.47 | 130.5 | 60.0 | 100.8 | 30.3 | 70.5 | 3.33 | 0.42 | 95.2 | 65.5 | 35.2 |
| 6 | 496.8 | 496.1 | 0.034 | 0.58 | 66.5 | 31.5 | 6.48 | 136.8 | 60.0 | 105.1 | 28.5 | 76.8 | 3.69 | 0.41 | 98.3 | 66.8 | 38.3 |
| 7 | 521.8 | 521.0 | 0.040 | 0.69 | 67.3 | 32.3 | 6.48 | 140.3 | 60.0 | 108.0 | 27.7 | 80.3 | 3.90 | 0.40 | 100.2 | 67.9 | 40.2 |
| 8 | 532.2 | 531.3 | 0.045 | 0.77 | 67.6 | 32.6 | 6.49 | 141.9 | 60.0 | 109.3 | 27.4 | 81.9 | 3.99 | 0.40 | 100.9 | 68.3 | 40.9 |
| 9 | 536.5 | 535.5 | 0.051 | 0.88 | 67.8 | 32.8 | 6.50 | 142.4 | 60.0 | 109.6 | 27.2 | 82.4 | 4.03 | 0.40 | 101.2 | 68.4 | 41.2 |
| 10 | 539.0 | 537.9 | 0.056 | 0.96 | 67.9 | 32.9 | 6.50 | 142.7 | 60.0 | 109.8 | 27.1 | 82.7 | 4.05 | 0.40 | 101.4 | 68.5 | 41.4 |
| 11 | 539.2 | 537.5 | 0.084 | 1.44 | 68.1 | 33.1 | 6.53 | 142.2 | 60.0 | 109.1 | 26.9 | 82.2 | 4.06 | 0.40 | 101.1 | 68.0 | 41.1 |
| 12 | 547.0 | 544.7 | 0.112 | 1.93 | 68.2 | 33.2 | 6.57 | 142.9 | 60.0 | 109.7 | 26.8 | 82.9 | 4.10 | 0.40 | 101.5 | 68.3 | 41.5 |
| 13 | 556.6 | 554.1 | 0.146 | 2.51 | 68.0 | 33.0 | 6.61 | 143.9 | 60.0 | 110.9 | 27.0 | 83.9 | [illegible] | 0.39 | 101.9 | 68.9 | 41.9 |
| 14 | 562.7 | 560.1 | 0.174 | 2.99 | 67.3 | 32.3 | 6.64 | 144.4 | 60.0 | 112.1 | 27.7 | [illegible] | 4.05 | 0.38 | 102.2 | 69.9 | 42.2 |
| 15 | 558.1 | 555.3 | 0.230 | 3.96 | 65.8 | 30.8 | 6.71 | 142.8 | 60.0 | 112.0 | 29.2 | 82.8 | 3.84 | 0.37 | 101.4 | 70.6 | 41.4 |
| 16 | 544.0 | 541.0 | 0.288 | 4.92 | 64.8 | 29.8 | 6.77 | 139.9 | 60.0 | 110.1 | 30.2 | 79.9 | 3.64 | 0.37 | 99.9 | 70.1 | 39.9 |
| 17 | 532.9 | 529.7 | 0.348 | 5.99 | 64.3 | 29.3 | 6.85 | 137.3 | 60.0 | 108.0 | 30.7 | 77.3 | 3.52 | 0.38 | 98.7 | 69.4 | 38.7 |
| 18 | 528.4 | 524.9 | 0.404 | 6.95 | 64.1 | 29.1 | 6.92 | 135.8 | 60.0 | 106.7 | 30.9 | 75.8 | 3.45 | 0.38 | 97.9 | 68.8 | 37.9 |
| 19 | 523.9 | 520.2 | 0.466 | 8.02 | 63.7 | 28.7 | 7.00 | 134.3 | 60.0 | 105.6 | 31.3 | 74.3 | 3.37 | 0.39 | 97.2 | 68.5 | 37.2 |
| 20 | 508.9 | 505.0 | 0.522 | 8.98 | 63.5 | 28.5 | 7.08 | 131.4 | 60.0 | 102.9 | 31.5 | 71.4 | 3.27 | 0.40 | 95.7 | 67.2 | 35.7 |
| 21 | 497.8 | 493.7 | 0.578 | 9.94 | 63.4 | 28.4 | 7.15 | 129.0 | 60.0 | 100.8 | 31.6 | 69.0 | 3.18 | 0.41 | 94.5 | 66.1 | 34.5 |
| 22 | 492.4 | 488.1 | 0.639 | 10.99 | 63.3 | 28.3 | 7.24 | 127.6 | 60.0 | 99.2 | 31.7 | 67.5 | 3.13 | 0.42 | 93.7 | 65.4 | 33.7 |
| 23 | 490.8 | 486.3 | 0.695 | 11.95 | 63.3 | 28.3 | 7.31 | 126.5 | 60.0 | 98.2 | 31.7 | 66.5 | 3.10 | 0.43 | 93.2 | 64.9 | 33.2 |
| 24 | 501.3 | 496.6 | 0.751 | 12.92 | 63.5 | 28.5 | 7.40 | 127.1 | 60.0 | 98.6 | 31.5 | 67.1 | 3.13 | 0.42 | 93.6 | 65.1 | 33.6 |
| 25 | 520.7 | 515.7 | 0.813 | 13.98 | 63.7 | 28.7 | 7.49 | 128.9 | 60.0 | 100.2 | 31.3 | 68.9 | 3.20 | 0.42 | 94.4 | 65.7 | 34.4 |
| 26 | 536.8 | 533.6 | 0.869 | 14.95 | 63.7 | 28.7 | 7.57 | 130.5 | 60.0 | 101.8 | 31.3 | 70.5 | 3.25 | 0.41 | 95.2 | 66.5 | 35.2 |

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.

2. Right Cylinder Correction Method

# CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

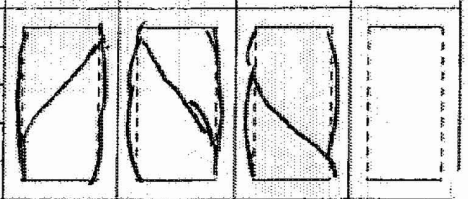



| Symbol | | ⊙ | △ | ⊡ |
|---|---|---|---|---|
| Sample No. | | S-11 | S-11 | S-11 |
| Test No. | | CU7 | CU8 | CU9 |
| Depth | | 38.5-40.5 | 38.5-40.5 | 38.5-40.5 |
| Initial | Diameter, in | 2.87 | 2.87 | 2.87 |
| | Height, in | 5.96 | 5.85 | 6.05 |
| | Water Content, % | 24.6 | 28.4 | 26.6 |
| | Dry Density, pcf | 99.56 | 93.62 | 95.99 |
| | Saturation, % | 99.9 | 99.0 | 98.7 |
| | Void Ratio | 0.649 | 0.754 | 0.71 |
| Before Shear | Water Content, % | 28.1 | 27.2 | 26.0 |
| | Dry Density, pcf | 94.41 | 95.77 | 97.51 |
| | Saturation*, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.739 | 0.714 | 0.684 |
| | Back Press., psi | 100. | 100. | 57.99 |
| Ver. Eff. Cons. Stress, psi | | 14.99 | 30. | 60.01 |
| Shear Strength, psi | | 15.24 | 18.08 | 28.05 |
| Strain at Failure, % | | 7.29 | 3.4 | 3.99 |
| Strain Rate, %/min | | 0.032 | 0.032 | 0.032 |
| B-Value | | 0.95 | 0.95 | 0.96 |
| Measured Specific Gravity | | 2.63 | 2.63 | 2.63 |
| Liquid Limit | | 36 | 36 | 36 |
| Plastic Limit | | 16 | 16 | 16 |

**GeoTesting express**
a subsidiary of Geocomp Corporation

Project: Calvert Cliffs Nuclear PP
Location: Calvert County, MD
Project No.: GTX-6880
Boring No.: B-320
Sample Type: tube

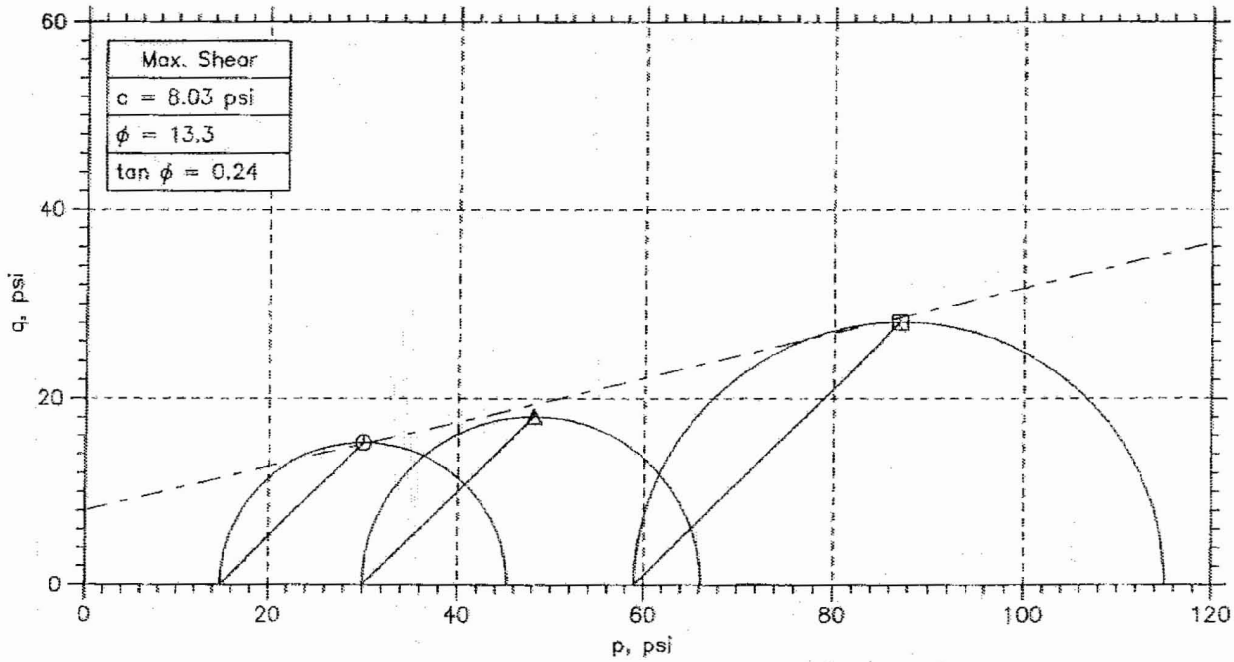


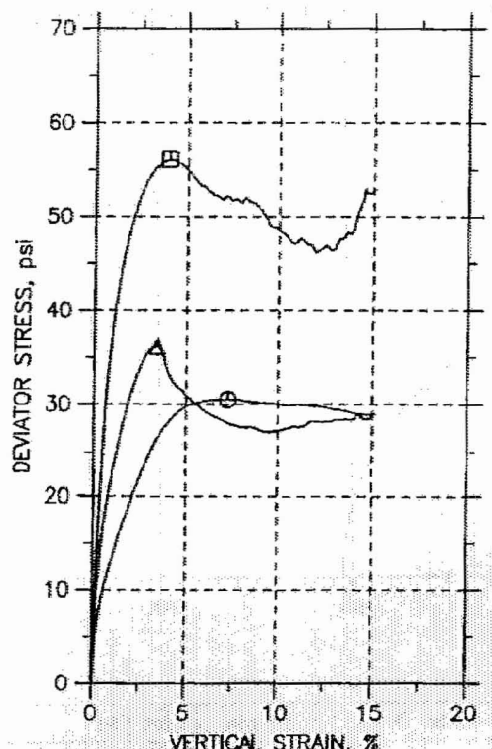
Description: Moist, very dark gray clayey sand (SC), 49% passing #200 sieve
Remarks: System B - t50 = 12.5 min, Triaxial Rev 1.0.6.318

Wed, 15-NOV-2006 14:19:06

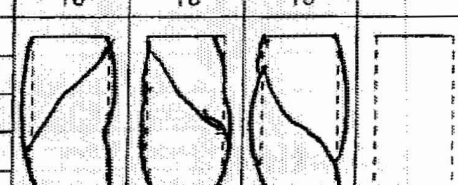
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

# CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767




| Symbol | | ⊙ | △ | ⊡ |
|---|---|---|---|---|
| Sample No. | | S-11 | S-11 | S-11 |
| Test No. | | CU7 | CU8 | CU9 |
| Depth | | 38.5-40.5 | 38.5-40.5 | 38.5-40.5 |
| Initial | Diameter, in | 2.87 | 2.87 | 2.87 |
| | Height, in | 5.96 | 5.85 | 6.05 |
| | Water Content, % | 24.6 | 28.4 | 26.6 |
| | Dry Density, pcf | 99.56 | 93.62 | 95.99 |
| | Saturation, % | 99.9 | 99.0 | 98.7 |
| | Void Ratio | 0.649 | 0.754 | 0.71 |
| Before Shear | Water Content, % | 28.1 | 27.2 | 26.0 |
| | Dry Density, pcf | 94.41 | 95.77 | 97.51 |
| | Saturation*, % | 100.0 | 100.0 | 100.0 |
| | Void Ratio | 0.739 | 0.714 | 0.684 |
| | Back Press., psi | 100. | 100. | 57.99 |
| Ver. Eff. Cons. Stress, psi | | 14.99 | 30. | 60.01 |
| Shear Strength, psi | | 15.24 | 18.08 | 28.05 |
| Strain at Failure, % | | 7.29 | 3.4 | 3.99 |
| Strain Rate, %/min | | 0.032 | 0.032 | 0.032 |
| B-Value | | 0.95 | 0.95 | 0.96 |
| Measured Specific Gravity | | 2.63 | 2.63 | 2.63 |
| Liquid Limit | | 36 | 36 | 36 |
| Plastic Limit | | 16 | 16 | 16 |



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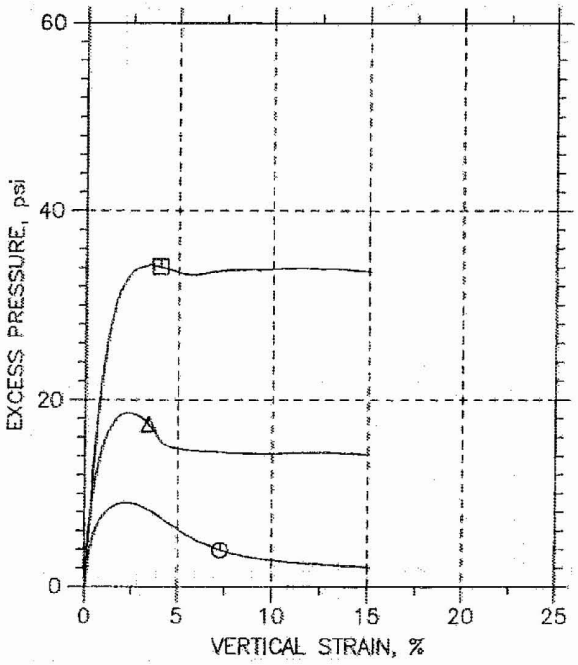
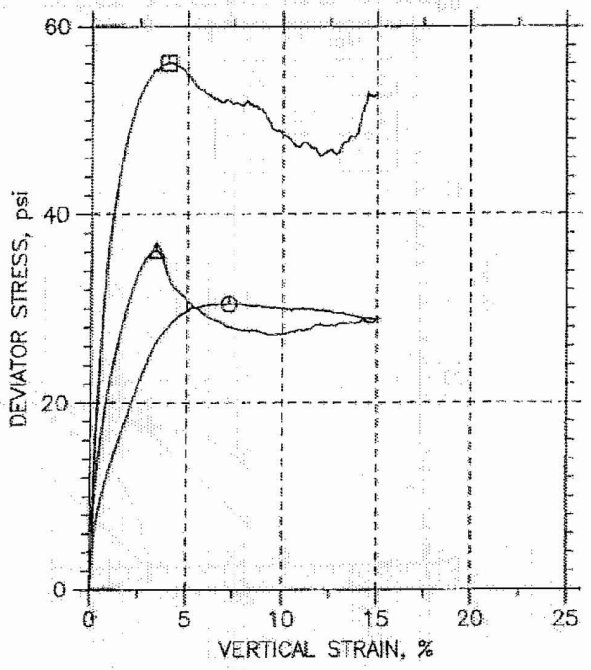
Project: Calvert Cliffs Nuclear PP
Location: Calvert County, MD
Project No.: GTX-6880
Boring No.: B-320
Sample Type: tube
Description: Moist, very dark gray clayey sand (SC), 49% passing #200 sieve
Remarks: System B - t50 = 12.5 min, Triaxial Rev 1.0.6.318

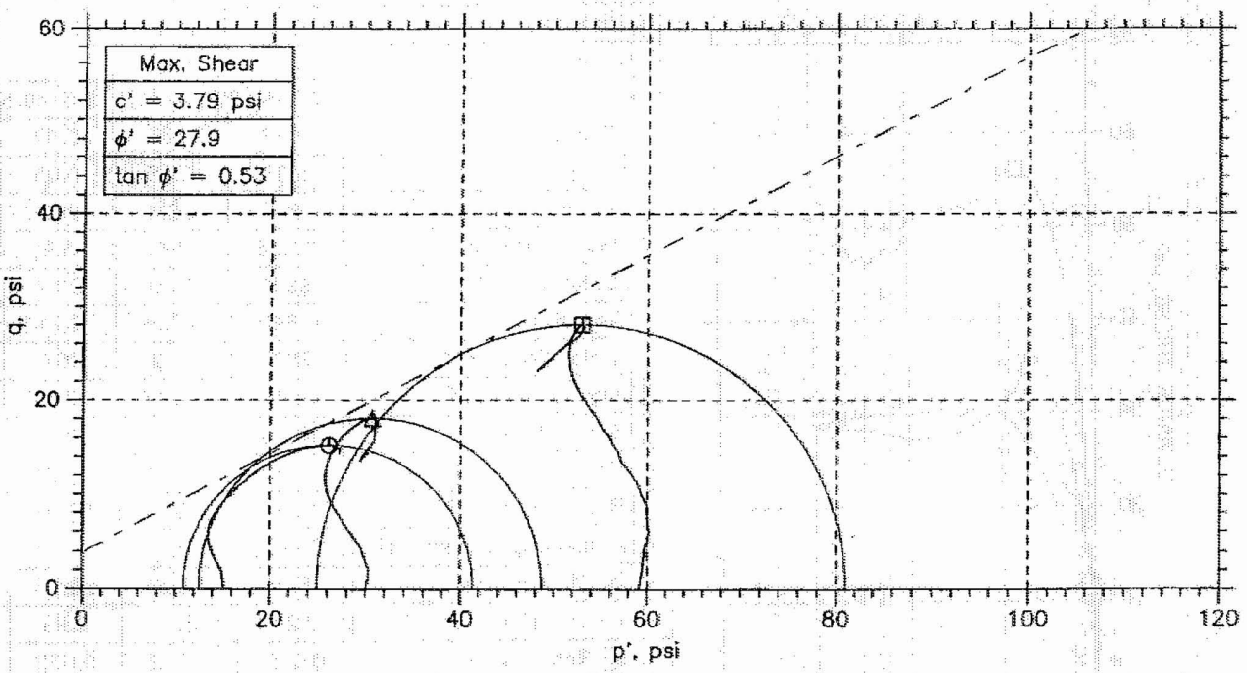
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Thu, 16-NOV-2006 14:11:28

# CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767




| | Sample No. | Test No. | Depth | Tested By | Test Date | Checked By | Check Date | Test File |
|---|---|---|---|---|---|---|---|---|
| ○ | S-11 | CU7 | 38.5-40.5 | njh | 10/18/06 | jdt | | 6880-CU7n.dat |
| △ | S-11 | CU8 | 38.5-40.5 | njh | 10/18/06 | jdt | | 6880-CU8n.dat |
| □ | S-11 | CU9 | 38.5-40.5 | njh | 10/18/06 | jdt | | 6880-CU9n.dat |
| | | | | | | | | |

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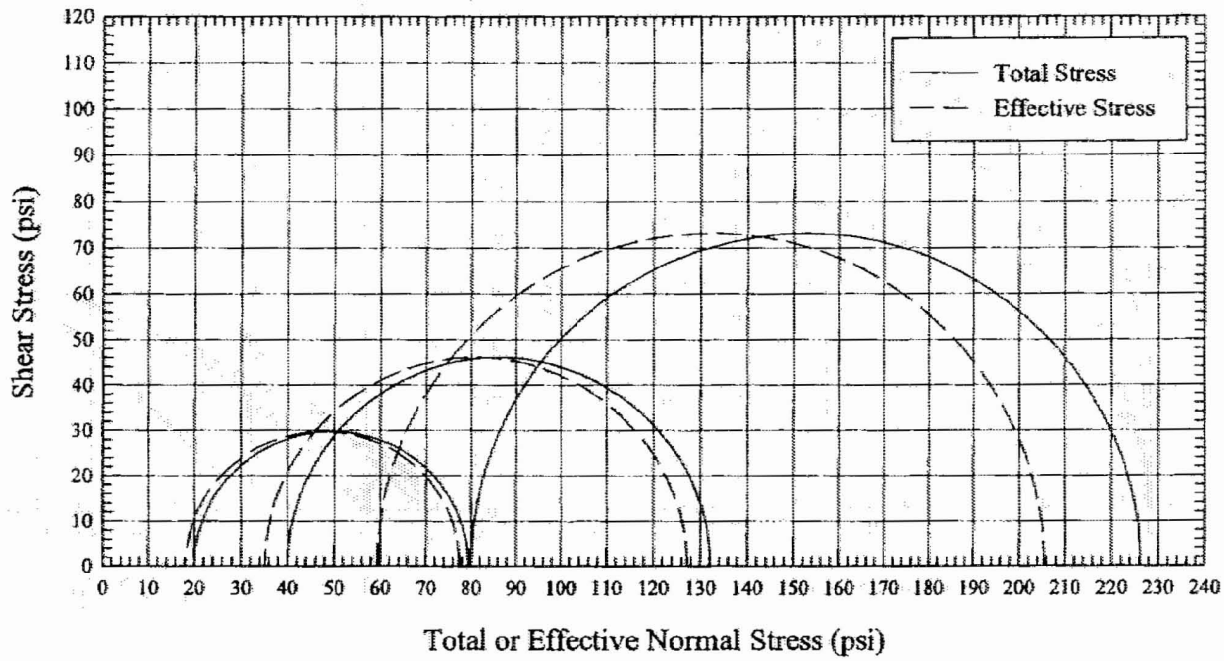
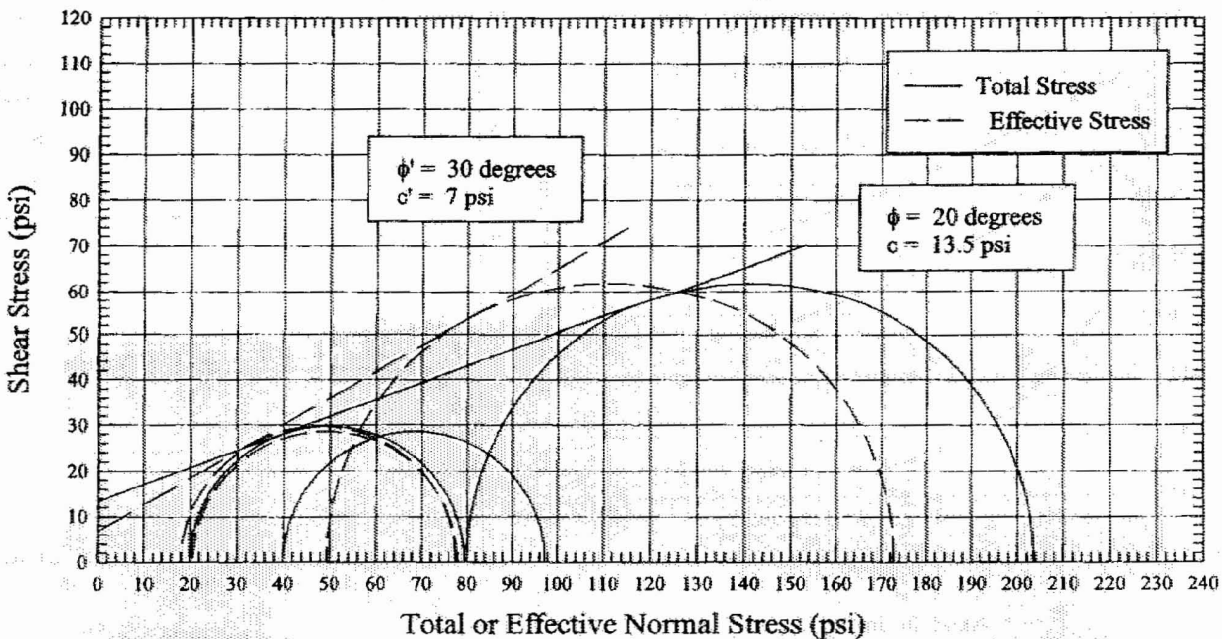
| | | |
|---|---|---|
| Project: Calvert Cliffs Nuclear PP | Location: Calvert County, MD | Project No.: GTX-6880 |
| Boring No.: B-320 | Sample Type: tube | |
| Description: Moist, very dark gray clayey sand (SC), 49% passing #200 sieve | | |
| Remarks: System B - t50 = 12.5 min, Triaxial Rev 1.0.6.318 | | |

# Consolidated Undrained (CU) Triaxial Shear (ASTM D4767)

## Mohr Stress Circles at Maximum Deviator Stress Criterion




## Mohr Stress Circles at Maximum Principal Stress Ratio Criterion




Boring No.: *B-321* Depth: *73.5-75.5 ft* SEI Contract: *06120048* Date: *10/20/06*

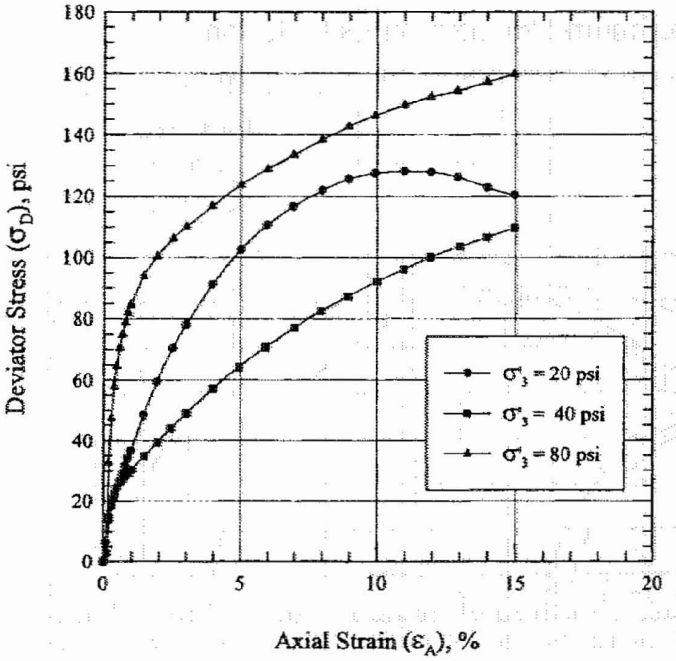
Sample Description: *Fine SILTY SAND (SM) - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* Specific Gravity: *2.67* LL: --- PI: *NP* %<200: *15.3*

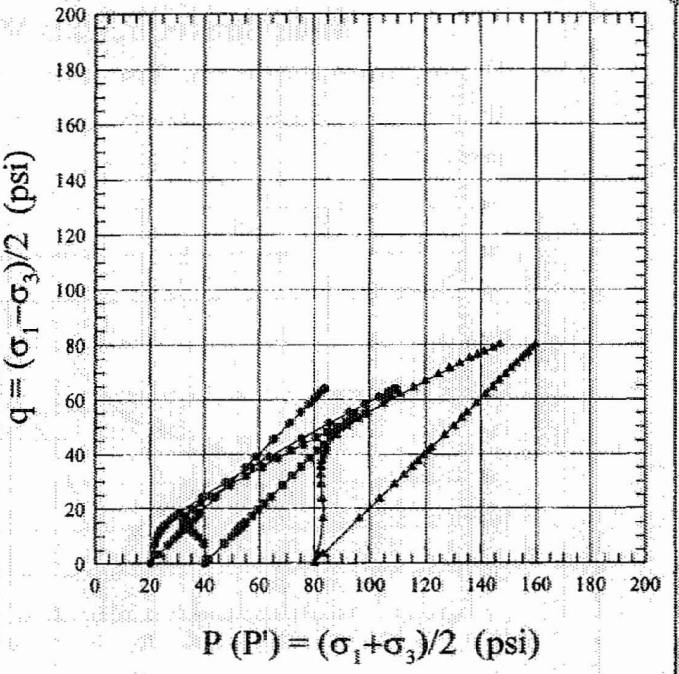
Schnabel Engineering

*Calvert Cliffs Nuclear Power Plant*
*Calvert County, Maryland*

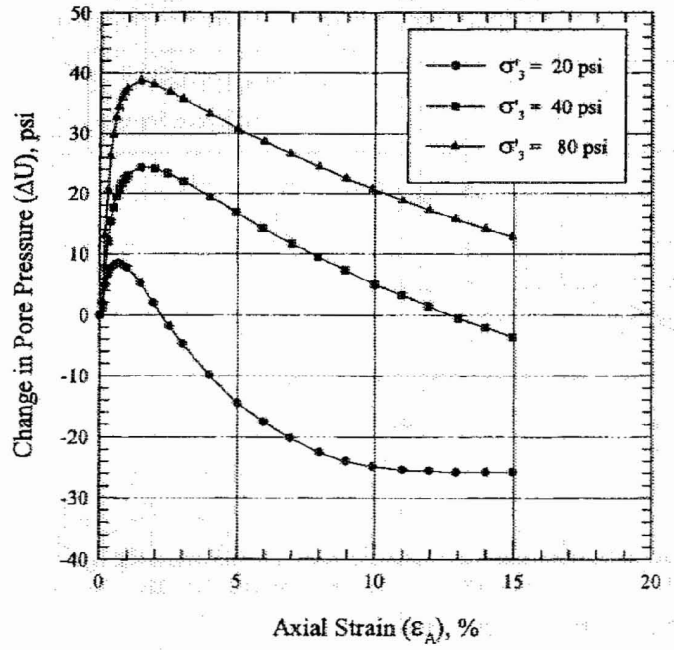
## Deviator Stress vs. Axial Strain



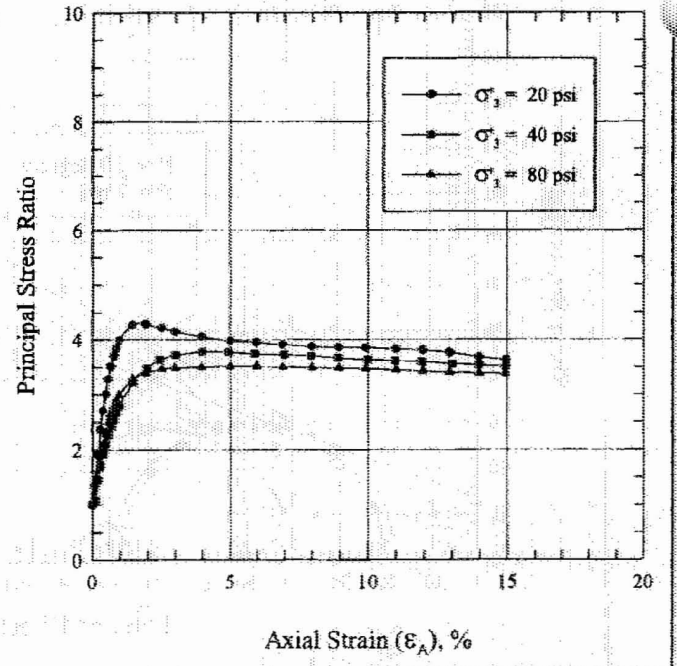

## Stress Paths




## Change in Pore Pressure vs. Axial Strain




## Principal Stress Ratio vs. Axial Strain




Boring No.: *B-321* Depth: *73.5-75.5 ft* SEI Contract: *06120048* Date: *10/20/06*

Sample Description: *Fine SILTY SAND (SM) - gray* Reviewed By: *CJS*

Specimen Type: *Tube Sample* *Specific Gravity*: 2.67 LL: --- PI: *NP* %<200: *15.3*

Schnabel Engineering

*Calvert Cliffs Nuclear Power Plant*
*Calvert County, Maryland*

Schnabel Engineering

# Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *Calvert Cliffs Nuclear Power Plant*

Location: *Calvert County, MD*

Schnabel Contract: *06120048*
Boring No.: *B-321*
Depth: *73.5-75.5ft.*
Elevation: *-2.8 to -4.8*
Confining Stress (psi): *20.0*

Date: *10/20/2006*

Reviewed by: *CJS*

| | Specimen Conditions | |
|---|---|---|
| | Initial | Consolidated |
| Diameter (in) | 2.896 | 2.88 |
| Height (in) | 5.833 | 5.81 |
| Area ($in^2$) | 6.59 | 6.53 |
| Moisture (%) | 21.9 | |
| $W_{solids}$ (lbs) | 2.23 | |
| $\rho_{wet}$ (pcf) | 122.0 | |
| $\rho_{dry}$ (pcf) | 100.1 | 101.3 |
| Void Ratio | 0.66 | 0.64 |
| Saturation, % | 88 | 100 |

| Shear Testing Conditions | |
|---|---|
| Cell Pressure (psi): | 40.0 |
| Back Pressure (psi): | 20.0 |
| Eff. Confining Stress (psi): | 20.0 |
| Final B check | 0.95 |
| $t_{50}$ (min.): | 0.1 |
| Rate of Strain (%/min): | 0.125 |

Filter strips used? *NO*

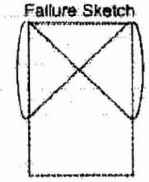
Specimen Type: *Tube Sample*

Soil Description: *Fine SILTY SAND (SM) - gray*

Liquid Limit: ---
Plasticity Index: *NP*
% finer that No. 200: *15.3*
Specific Gravity: *2.67*

Remarks:

Failure Sketch



| Reading No. | Deviator Load (lbs) | Corrected[1] Dev. Load (lbs.) | Axial Deformation (in.) | Axial Strain (%) | Pore Pressure (psi) | Change in Pore Press. (psi) | Corrected Area[2] ($in^2$) | $\sigma_1$ (psi) | $\sigma_3$ (psi) | $\sigma'_1$ (psi) | $\sigma'_3$ (psi) | Deviator Stress (psi) | Principal Stress Ratio | $A_{bar}$ | P (psi) | P' (psi) | q (psi) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zero | 0.0 | 0.0 | 0.000 | 0.00 | 20.0 | 0.0 | 6.53 | 20.0 | 20.0 | 20.0 | 20.0 | 0.0 | 1.00 | 0.00 | 20.0 | 20.0 | 0.0 |
| 1 | 41.9 | 41.9 | 0.005 | 0.09 | 22.0 | 2.0 | 6.54 | 26.4 | 20.0 | 24.4 | 18.0 | 6.4 | 1.36 | 0.31 | 23.2 | 21.2 | 3.2 |
| 2 | 89.5 | 89.5 | 0.011 | 0.19 | 24.9 | 4.9 | 6.55 | 33.7 | 20.0 | 28.8 | 15.1 | 13.7 | 1.91 | 0.36 | 26.8 | 21.9 | 6.8 |
| 3 | 118.7 | 118.6 | 0.017 | 0.29 | 26.6 | 6.6 | 6.55 | 38.1 | 20.0 | 31.5 | 13.4 | 18.1 | 2.35 | 0.36 | 29.1 | 22.5 | 9.1 |
| 4 | 139.9 | 139.8 | 0.022 | 0.38 | 27.5 | 7.5 | 6.56 | 41.3 | 20.0 | 33.8 | 12.5 | 21.3 | 2.71 | 0.35 | 30.7 | 23.2 | 10.7 |
| 5 | 157.9 | 157.8 | 0.028 | 0.48 | 28.0 | 8.0 | 6.57 | 44.0 | 20.0 | 36.0 | 12.0 | 24.0 | 3.00 | 0.33 | 32.0 | 24.0 | 12.0 |
| 6 | 175.2 | 175.1 | 0.033 | 0.57 | 28.3 | 8.3 | 6.57 | 46.6 | 20.0 | 38.3 | 11.7 | 26.6 | 3.28 | 0.31 | 33.3 | 25.0 | 13.3 |
| 7 | 191.9 | 191.8 | 0.039 | 0.67 | 28.4 | 8.4 | 6.58 | 49.2 | 20.0 | 40.8 | 11.6 | 29.2 | 3.51 | 0.29 | 34.6 | 26.2 | 14.6 |
| 8 | 208.9 | 208.7 | 0.045 | 0.77 | 28.3 | 8.3 | 6.58 | 51.7 | 20.0 | 43.4 | 11.7 | 31.7 | 3.71 | 0.26 | 35.8 | 27.5 | 15.8 |
| 9 | 225.0 | 224.8 | 0.050 | 0.86 | 28.0 | 8.0 | 6.59 | 54.1 | 20.0 | 46.1 | 12.0 | 34.1 | 3.84 | 0.23 | 37.1 | 29.1 | 17.1 |
| 10 | 241.8 | 241.6 | 0.056 | 0.96 | 27.7 | 7.7 | 6.60 | 56.6 | 20.0 | 48.9 | 12.3 | 36.6 | 3.98 | 0.21 | 38.3 | 30.6 | 18.3 |
| 11 | 320.8 | 320.5 | 0.084 | 1.45 | 25.2 | 5.2 | 6.63 | 68.3 | 20.0 | 63.1 | 14.8 | 48.3 | 4.27 | 0.11 | 44.2 | 39.0 | 24.2 |
| 12 | 395.9 | 395.5 | 0.112 | 1.93 | 21.9 | 1.9 | 6.66 | 79.4 | 20.0 | 77.5 | 18.1 | [illegible] | [illegible] | 0.03 | 49.7 | 47.8 | 29.7 |
| 13 | 472.1 | 471.6 | 0.146 | 2.51 | 18.1 | -1.9 | 6.70 | 90.4 | 20.0 | 92.3 | 21.9 | 70.4 | 4.21 | -0.03 | 55.2 | 57.1 | 35.2 |
| 14 | 525.2 | 524.5 | 0.174 | 2.99 | 15.2 | -4.8 | 6.74 | 97.9 | 20.0 | 102.7 | 24.8 | 77.9 | 4.14 | -0.06 | 58.9 | 63.7 | 38.9 |
| 15 | 620.7 | 619.8 | 0.230 | 3.96 | 10.1 | -9.9 | 6.80 | 111.1 | 20.0 | 121.0 | 29.9 | 91.1 | 4.05 | -0.11 | 65.6 | 75.5 | 45.6 |
| 16 | 706.2 | 705.1 | 0.291 | 5.01 | 5.5 | -14.5 | 6.88 | 122.5 | 20.0 | 137.0 | 34.5 | 102.5 | 3.97 | -0.14 | 71.3 | 85.6 | 51.3 |
| 17 | 769.6 | 768.3 | 0.347 | 5.97 | 2.4 | -17.6 | 6.95 | 130.6 | 20.0 | 148.2 | 37.6 | 110.6 | 3.94 | -0.16 | 75.3 | 92.9 | 55.3 |
| 18 | 820.2 | 818.7 | 0.403 | 6.94 | -0.2 | -20.2 | 7.02 | 136.6 | 20.0 | 156.8 | 40.2 | 116.6 | 3.90 | -0.17 | 78.3 | 98.5 | 58.3 |
| 19 | 868.5 | 864.8 | 0.465 | 8.00 | -2.5 | -22.5 | 7.10 | 141.8 | 20.0 | 164.3 | 42.5 | 121.8 | 3.86 | -0.18 | 80.9 | 103.4 | 60.9 |
| 20 | 903.4 | 901.4 | 0.521 | 8.97 | -4.0 | -24.0 | 7.18 | 145.6 | 20.0 | 169.6 | 44.0 | 125.6 | 3.85 | -0.19 | 82.8 | 106.8 | 62.8 |
| 21 | 927.0 | 924.8 | 0.577 | 9.93 | -4.8 | -24.8 | 7.25 | 147.5 | 20.0 | 172.3 | 44.8 | 127.5 | 3.85 | -0.19 | 83.7 | 108.5 | 63.7 |
| 22 | 942.7 | 940.3 | 0.639 | 11.00 | -5.4 | -25.4 | 7.34 | 148.1 | 20.0 | 173.5 | 45.4 | 128.1 | 3.82 | -0.20 | 84.0 | 109.4 | 64.0 |
| 23 | 951.5 | 948.9 | 0.695 | 11.96 | -5.6 | -25.6 | 7.42 | 147.9 | 20.0 | 173.5 | 45.6 | 127.9 | 3.80 | -0.20 | 83.9 | 109.5 | 63.9 |
| 24 | 950.3 | 947.5 | 0.751 | 12.92 | -5.8 | -25.8 | 7.50 | 146.3 | 20.0 | 172.1 | 45.8 | 126.3 | 3.76 | -0.20 | 83.1 | 108.9 | 63.1 |
| 25 | 935.1 | 932.1 | 0.813 | 13.99 | -5.8 | -25.8 | 7.60 | 142.7 | 20.0 | 168.5 | 45.8 | 122.7 | 3.68 | -0.21 | 81.3 | 107.1 | 61.3 |
| 26 | 927.1 | 923.8 | 0.869 | 14.95 | -5.8 | -25.8 | 7.68 | 140.2 | 20.0 | 166.0 | 45.8 | 120.2 | 3.63 | -0.21 | 80.1 | 105.9 | 60.1 |

Notes: 1. Deviator load corrected for membrane and filter cage (if applicable) effects.

2. Right Cylinder Correction Method

Schnabel Engineering

# Consolidated Undrained Triaxial Compression Test

ASTM D4767

Project: *Calvert Cliffs Nuclear Power Plant*

Location: *Calvert County, MD*

Schnabel Contract: *06120048*
Boring No.: *B-321*
Depth: *73.5-75.5ft.*
Elevation: *-2.8 to -4.8*
Confining Stress (psi): *40.0*

Date: *10/20/2006*

Reviewed by: *CJS*

| | Specimen Conditions | |
|---|---|---|
| | Initial | Consolidated |
| Diameter (in) | 2.881 | 2.86 |
| Height (in) | 5.808 | 5.76 |
| Area ($in^2$) | 6.52 | 6.41 |
| Moisture (%) | 28.5 | |
| $W_{solids}$ (lbs) | 2.04 | |
| $\rho_{wet}$ (pcf) | 119.7 | |
| $\rho_{dry}$ (pcf) | 93.2 | 95.3 |
| Void Ratio | 0.79 | 0.75 |
| Saturation, % | 97 | 98 |

| Shear Testing Conditions | |
|---|---|
| Cell Pressure (psi): | 55.0 |
| Back Pressure (psi): | 15.0 |
| Eff. Confining Stress (psi): | 40.0 |
| Final B check | 0.96 |
| $t_{50}$ (min.): | 0.1 |
| Rate of Strain (%/min): | 0.125 |

Filter strips used? *NO*

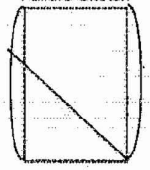
Specimen Type: *Tube Sample*

Soil Description: *Fine SILTY SAND (SM) - gray*

Liquid Limit: —
Plasticity Index: *NP*
% finer that No. 200: *15.3*
Specific Gravity: *2.67*

Remarks:

Failure Sketch



| Reading No. | Deviator Load (lbs) | Corrected[1] Dev. Load (lbs.) | Axial Deformation (in.) | Axial Strain (%) | Pore Pressure (psi) | Change in Pore Press. (psi) | Corrected Area[2] ($in^2$) | $\sigma_1$ (psi) | $\sigma_3$ (psi) | $\sigma'_1$ (psi) | $\sigma'_3$ (psi) | Deviator Stress (psi) | Principal Stress Ratio | $A_{bar}$ | P (psi) | P' (psi) | q (psi) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zero | 0.0 | 0.0 | 0.000 | 0.00 | 15.0 | 0.0 | 6.41 | 40.0 | 40.0 | 40.0 | 40.0 | 0.0 | 1.00 | 0.00 | 40.0 | 40.0 | 0.0 |
| 1 | 18.2 | 18.2 | 0.008 | 0.10 | 16.2 | 1.2 | 6.42 | 42.8 | 40.0 | 41.6 | 38.8 | 2.8 | 1.07 | 0.42 | 41.4 | 40.2 | 1.4 |
| 2 | 92.8 | 92.8 | 0.012 | 0.21 | 22.6 | 7.6 | 6.42 | 54.4 | 40.0 | 46.8 | 32.4 | 14.4 | 1.45 | 0.53 | 47.2 | 39.6 | 7.2 |
| 3 | 125.4 | 125.3 | 0.017 | 0.29 | 27.1 | 12.1 | 6.43 | 59.5 | 40.0 | 47.4 | 27.9 | 19.5 | 1.70 | 0.62 | 49.7 | 37.6 | 9.7 |
| 4 | 145.4 | 145.3 | 0.023 | 0.40 | 30.3 | 15.3 | 6.43 | 62.6 | 40.0 | 47.3 | 24.7 | 22.6 | 1.91 | 0.68 | 51.3 | 36.0 | 11.3 |
| 5 | 158.4 | 158.3 | 0.028 | 0.48 | 32.6 | 17.6 | 6.44 | 64.6 | 40.0 | 47.0 | 22.4 | 24.6 | 2.10 | 0.72 | 52.3 | 34.7 | 12.3 |
| 6 | 168.6 | 168.5 | 0.034 | 0.59 | 34.4 | 19.4 | 6.45 | 66.1 | 40.0 | 46.7 | 20.6 | 26.1 | 2.27 | 0.74 | 53.1 | 33.7 | 13.1 |
| 7 | 177.0 | 176.9 | 0.040 | 0.69 | 35.7 | 20.7 | 6.45 | 67.4 | 40.0 | 46.7 | 19.3 | 27.4 | 2.42 | 0.76 | 53.7 | 33.0 | 13.7 |
| 8 | 183.8 | 183.6 | 0.045 | 0.78 | 36.7 | 21.7 | 6.46 | 68.4 | 40.0 | 46.7 | 18.3 | 28.4 | 2.55 | 0.76 | 54.2 | 32.5 | 14.2 |
| 9 | 190.3 | 190.1 | 0.051 | 0.88 | 37.4 | 22.4 | 6.47 | 69.4 | 40.0 | 47.0 | 17.6 | 29.4 | 2.67 | 0.76 | 54.7 | 32.3 | 14.7 |
| 10 | 196.8 | 196.6 | 0.057 | 0.99 | 38.0 | 23.0 | 6.47 | 70.4 | 40.0 | 47.4 | 17.0 | 30.4 | 2.79 | 0.76 | 55.2 | 32.2 | 15.2 |
| 11 | 226.8 | 226.5 | 0.085 | 1.47 | 39.3 | 24.3 | 6.50 | 74.8 | 40.0 | 50.5 | 15.7 | 34.8 | 3.22 | 0.70 | 57.4 | 33.1 | 17.4 |
| 12 | 257.9 | 257.5 | 0.113 | 1.95 | 39.1 | 24.1 | 6.54 | 79.4 | 40.0 | 55.3 | 15.9 | 39.4 | 3.48 | 0.61 | 59.7 | 35.6 | 19.7 |
| 13 | 289.1 | 288.6 | 0.141 | 2.44 | 38.3 | 23.3 | 6.57 | 83.9 | 40.0 | 60.6 | 16.7 | 43.9 | 3.63 | 0.53 | 62.0 | 38.7 | 22.0 |
| 14 | 323.8 | 323.2 | 0.174 | 3.01 | 37.0 | 22.0 | 6.61 | 88.9 | 40.0 | 66.9 | 18.0 | 48.9 | 3.72 | 0.45 | 64.5 | 42.5 | 24.5 |
| 15 | 382.3 | 381.4 | 0.230 | 3.98 | 34.4 | 19.4 | 6.67 | 97.2 | 40.0 | 77.8 | 20.6 | 57.2 | [illegible] | 0.34 | 68.6 | 49.2 | 28.6 |
| 16 | 434.0 | 432.9 | 0.288 | 4.95 | 31.8 | 16.8 | 6.74 | 104.2 | 40.0 | 87.4 | 23.2 | 64.2 | 3.77 | 0.26 | 72.1 | 55.3 | 32.1 |
| 17 | 482.8 | 481.5 | 0.342 | 5.92 | 29.2 | 14.2 | 6.81 | 110.7 | 40.0 | 96.5 | 25.9 | 70.7 | 3.74 | 0.20 | 75.3 | 61.1 | 35.3 |
| 18 | 532.6 | 531.1 | 0.404 | 6.99 | 28.7 | 11.7 | 6.89 | 117.1 | 40.0 | 105.4 | 28.3 | 77.1 | 3.72 | 0.15 | 78.5 | 66.8 | 38.5 |
| 19 | 575.7 | 574.0 | 0.460 | 7.96 | 24.5 | 9.5 | 6.96 | 122.4 | 40.0 | 112.9 | 30.5 | 82.4 | 3.70 | 0.12 | 81.2 | 71.7 | 41.2 |
| 20 | 614.8 | 612.9 | 0.518 | 8.93 | 22.3 | 7.3 | 7.04 | 127.1 | 40.0 | 119.8 | 32.7 | 87.1 | 3.66 | 0.08 | 83.5 | 76.2 | 43.5 |
| 21 | 658.6 | 656.4 | 0.578 | 10.00 | 20.0 | 5.0 | 7.12 | 132.2 | 40.0 | 127.2 | 36.0 | [illegible] | 3.63 | 0.05 | 86.1 | 81.1 | 46.1 |
| 22 | 694.2 | 691.8 | 0.634 | 10.97 | 18.2 | 3.2 | 7.20 | 136.1 | 40.0 | 132.9 | 36.8 | 96.1 | 3.61 | 0.03 | 88.1 | 84.9 | 48.1 |
| 23 | 731.3 | 728.7 | 0.690 | 11.94 | 16.4 | 1.4 | 7.28 | 140.1 | 40.0 | 138.7 | 38.6 | 100.1 | 3.59 | 0.01 | 90.1 | 88.7 | 50.1 |
| 24 | 766.1 | 763.3 | 0.752 | 13.01 | 14.5 | -0.5 | 7.37 | 143.6 | 40.0 | 144.1 | 40.5 | 103.6 | 3.56 | 0.00 | 91.8 | 92.3 | 51.8 |
| 25 | 797.0 | 794.0 | 0.808 | 13.98 | 12.9 | -2.1 | 7.46 | 146.6 | 40.0 | 148.7 | 42.1 | 106.6 | 3.53 | -0.02 | 93.3 | 95.4 | 53.3 |
| 26 | 829.2 | 826.0 | 0.864 | 14.95 | 11.3 | -3.7 | 7.53 | 149.6 | 40.0 | 153.3 | 43.7 | 109.6 | 3.51 | -0.03 | 94.8 | 98.5 | 54.8 |

Notes: Deviator load corrected for membrane and filter cage (if applicable) effects.

Right Cylinder Correction Method