# HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: Specimen Calculations & Summary

KAW 7/16/08 B-2319

Project Number: 0411-08-1686 | Cell No.: 15 | File Name: B-2319_UD4dV

Task Number: NA | Specific Gravity: 2.720 | [X] Measured; [ ] Assumed

Boring No.: B-2319UD | Sample No.: UD4 | Specimen No.: D | Depth (ft): 25.0 - 27.0

Type Test: Permeability Vert. | Specimen: [X] "Undisturbed"; [ ] Reconstituted; [ ]

Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = _____ ppm

| | Inital Water Contents (WC), ($W_o$) over Saturation, ($S_o$), in (%): | | | | | | Calculated Mass of Dry Soil (g) | |
|---|---|---|---|---|---|---|---|---|
| | Top, $W_{o,1}$ | Botttom, $W_{o,2}$ | Sides, $W_{o,3}$ | Avg., $W_{o,avg}$ | Selct., $W_{o,s}$ | Back Cal., $W_{o,bc}$ | Initial Selected WC, $w_o$ (%) | 20.38 |
| $W_o$ | 20.72 | 20.64 | | 20.68 | 20.38 | 20.38 | Initial, $M_{d,o}$ | 492.63 |
| $S_o$ | 95.3 | 95.1 | | 95.2 | 94.4 | 94.4 | Final, $M_{d,at}$ | 492.63 |
| | Measured final mass of moist soil, $M_{t,at}$ (g) | | | | | 604.45 | Selected, $M_d$ | 492.63 |
| | Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g) | | | | | 604.45 | | |

| Consolidation Data | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | |
|---|---|---|---|---|---|---|---|---|
| Changes in Height (mm) and Volume ($cm^3$) Within Given Consolidation Stages/Columns | At Initial Seating Stress | During Back-Pressuring | 1st Consol. Increment (1) | Column 2 or 3 to **1st Test** Stage (1) | Column 4 to **2nd Test** Stage | Column 5 to **3rd Test** Stage | Column 6 to **4th Test** Stage | |
| Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec. | | | | | | | | |
| Change in Height, $\Delta H_{c,n}$ | 0.06 | -1.58 | | 1.02 | NA | NA | NA | |
| Sum of changes in (+ out) | 0.80 | | | 10.15 | NA | NA | NA | |
| burette readings, $\Delta b_{r,n}$ (- in) | | -21.54 | NA | NA | NA | NA | NA | 2 |
| Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$ | 0.75 | -19.84 | | 12.81 | NA | NA | NA | |
| Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$ | 1.00 | 0.75 | | 0.79 | NA | NA | NA | |
| Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$ | 0.75 | -14.88 | NA | NA | NA | NA | NA | 3 |
| Selected $\Delta V_{c,n}$ | 0.75 | -14.88 | | 10.15 | NA | NA | NA | |

| Summary For Test Stages | | | | | Vol. Factor used to cal. $\Delta V_{HC,n}$ |
|---|---|---|---|---|---|
| Test Stage: | 1st = 1 | 2nd = 2 | 3rd = 3 | 4th = 4 | in perm. stage(2)= NA |
| Cell Pressure, $\sigma_{c,n}$ (psi) | 100.00 | NA | NA | NA | Number of |
| Back Pressure, $U_{b,n}$ (psi) | 80.00 | NA | NA | NA | Test Stages = 1 |
| Axial Force Reading, $P_{r,n}$ (lbf) | NA | NA | NA | NA | Ht. change during permation |
| Eff. Consol. Stress ($\sigma'_c$ or $\sigma'_{v,c}$) (4), (ksf) | 2.88 | NA | NA | NA | & removal of cell pressure, (5) |
| $t_c$, ON or in X days hrs | 5.00 | NA | NA | NA | $\Delta H_{td}$ (mm) = -0.04 |

**At Final Test Stress/Stage - Summary of Calculation of $\Delta V_c$ ($cm^3$) by Different Procedures**

| By Selected Volumes | By Saturation = 100 % | By Change in Mass (6) | For Diff. in Meas. Vol. ($V_o$-$V_{at}$), | For Selected $\Delta V_c$, required |
|---|---|---|---|---|
| $\Delta V_c$ = -3.98 | $\Delta V_c$ = -5.50 | $\Delta V_c$ = 10.08 | & corr. for $\Delta H_{td}$ $\Delta V_c$= -11.10 | $G_s$ for $S_c$ = 100 %: 2.743 |

**At Final Test Stress/Stage - Consolidation Conclusions**

| | | | | | |
|---|---|---|---|---|---|
| $\Delta H_{c,f}$ (mm) = -0.50 | $\Delta V_{c,f}$ ($cm^3$) = -4.74 | Back Cal. $G_s$ for S=100% = 2.731 | Normalized | Ht. Ch. (%) = | 0.87 |
| $\varepsilon_{ac,c}$ (%) = -0.73 | $\varepsilon_{vc,f}$ (%) = -1.65 | | Diff. in: | Vol. Ch. (%) = | 2.11 |

**Summary of Specimen Physical Properties**

| Specific Gravity: $G_s$ = 2.720 Measured Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Volumetric Water Content | Porosity n | Skempton B parameter %(7) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial: | 68.80 | 287.96 | 41.85 | 20.4 | 128.56 | 106.80 | 94.4 | 0.587 | 0.3493 | 0.370 | 100.0 |
| After Consol.: to 1st $\sigma'_c$ | 69.30 | 292.70 | 42.24 | 22.7 | 128.92 | 105.07 | 100.7 | 0.613 | 0.3827 | 0.380 | |
| to 2nd $\sigma'_c$ | | | | | | | | | | | NA |
| to 3rd $\sigma'_c$ | | | | | | | | | | | " |
| to 4th $\sigma'_c$ | | | | | | | | | | | " |

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.

(2) The ht. changes occuring within each permeation stage (1 - 4) are recorded in these rows (after Column 3).

(3) The volume changes occuring within each permeation stage (1 - 4) are calculated/recorded in these rows (after Column 3).

(4) Stresses are not corr. for membrane. (5) Log as a **negative** number if change in height is upward.

(6) ~ $M_{t,o}$-($M_{tat,c}$+$\Delta V_{in,column1\&2}$) (7) Initial value is after back pressuring

NA - Not Applicable ON - Over Night; WC - Water Content Remarks: _____

Calculated By: RC,jr Reviewed By: HP HP

# HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: ASTM D 5084-03, METHOD F:
## Using Flexible Wall Permeameter and Mercury Constant Volume - Falling Head Hydraulic System

Project Number: 0411-08-1686
Task Number: NA
Project Name: Exelon (Victoria)

Test Type: Permeability Vert.
Test Stage: 1 of 1
Test No.: NA
Test Series No.: NA

Cell No.: 15
Test Station No.: 2
Hyd. App. No. (Permometer): 3
File Name: 2319_UD4dV

Boring/Exploration No.: B-2319UD
Sample No.: UD4
Penetration/Depth (ft): 25.0 - 27.0
Composite Sample No.:

Axial Load Cell No.: NA
Vert. Dial/DT No.: DG-026

Factor, (lbf/V/V): NA
Factor, (mm/V/V):

Excit. Volt, V: NA
Excit. Volt, V:

Ch. No.: NA
Ch. No.:

Ht. Reading before Perm. (mm): 2.740
Ht. Reading at $\sigma_c$ = 0 (mm): 2.780

### Permeation & Specimen Information

Permeant: [X] Tap Water; [ ] Other
Direction of Flow: [X] Up; [ ] Down
Perm. Orientation: [X] Vertical; [ ] Horizontal
Specimen: [X] "Undisturbed;" [ ] Reconstituted; [ ]

| Back Pressure, $U_b$ (psi) = 80.0 | Stage | Height, $L_{t,n}$ (mm) | Area, $A_{t,n}$ ($cm^2$) |
|---|---|---|---|
| | Preliminary: | 69.302 | 42.10 |
| | Final: | 69.302 | 42.24 |

Prelim. change in height during consol., $\Delta H_{c,p}$ (mm) = -0.5

### Hydraulic System Constants

**Mercury U-Tube Manometer**

Area headwater tube, $a_{in}$ ($cm^2$): 0.7671
Area tailwater tube, $a_{out}$ ($cm^2$): 0.03142
$\Delta Hg_{eq}$ at equilibrium (cm): 0.4
Fluid Density Const. (15-25°C): 12.57

Remarks: Stop Watch ID # SW-006

### Mercury Head Settings (D 5084)

| Estimated $k_t$ (cm/sec) | Max. Gradient ($i_o = h/L_{t,p}$) | Permometer $\Delta$Hg Setting (cm) | Min. Cell Pressure (psi) |
|---|---|---|---|
| 1.0E-4 to 1.0E-5 | ≤5 | 2.4 | 81.0 |
| 1.0E-5 to 1.0E-6 | ≤10 | 5.1 | 82.0 |
| 1.0E-6 to 1.0E-7 | ≤20 | 10.7 | 83.9 |
| <1.0E-7 or <3.0E-2 (m/yr) | ≤30 | 16.2 | 85.9 |
| For Special Gradient, $i_o$ | | | |

| Trial No. | Readings By | Date y= 2008 (m/d) | Time (1) hr:min | Temp. °C | Δt (min) | Axial Force [ ] (volt) | Pressure Cell, $\sigma_c$ (psi) | Pressure Back, $U_b$ (psi) | [X] Dial [ ] DT Reading (mm) | Mercury Head Readings (2) Tail, $tw_r$ (cm) (3&4) | Mercury Head Readings (2) Head, $hw_r$ (cm) | Total Head Loss (cm of water) | Initial Hyd. Gradient, $i_o$ Preliminary / Final | Hydraulic Conductivity, k Preliminary, $k_t$ (m/yr) (cm/s) | Hydraulic Conductivity, k Final, $k_{20°C}$ (m/yr) (cm/s) | Minimum Allowable $tw_r$ (cm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | rc,jr | 4/8 | 8:22 | 21.6 | 26.0 | NA | 100.0 | 80.0 | 2.740 | 16.50 | 0.7 | 203.3 | 29.3 | 2.61E-03 | 2.51E-03 | 12.62 |
| 1 | rc,jr | 4/8 | | 21.6 | | NA | 100.0 | 80.0 | 2.730 | 16.00 | XXXXX | 196.7 | 29.3 | 8.29E-09 | 7.95E-09 | |
| | rc,jr | 4/8 | 8:48 | 21.6 | 50.0 | NA | 100.0 | 80.0 | 2.730 | 16.50 | 0.7 | 203.3 | 29.3 | 1.36E-03 | 1.30E-03 | 12.62 |
| 2 | rc,jr | 4/8 | | 21.6 | | NA | 100.0 | 80.0 | 2.730 | 16.00 | XXXXX | 196.7 | 29.3 | 4.31E-09 | 4.14E-09 | |
| | rc,jr | 4/8 | 9:39 | 21.6 | 60.0 | NA | 100.0 | 80.0 | 2.730 | 16.50 | 0.7 | 203.3 | 29.3 | 1.13E-03 | 1.09E-03 | 12.62 |
| * 3 | rc,jr | 4/8 | | 21.6 | | NA | 100.0 | 80.0 | 2.730 | 16.00 | XXXXX | 196.7 | 29.3 | 3.59E-09 | 3.45E-09 | |
| | rc,jr | 4/8 | 10:48 | 21.6 | 62.0 | NA | 100.0 | 80.0 | 2.730 | 16.50 | 0.7 | 203.3 | 29.3 | 1.10E-03 | 1.05E-03 | 12.62 |
| * 4 | rc,jr | 4/8 | | 21.6 | | NA | 100.0 | 80.0 | 2.720 | 16.00 | XXXXX | 196.7 | 29.3 | 3.48E-09 | 3.33E-09 | |
| | rc,jr | 4/8 | 11:51 | 21.6 | 63.5 | NA | 100.0 | 80.0 | 2.720 | 16.50 | 0.7 | 203.3 | 29.3 | 1.07E-03 | 1.03E-03 | 12.62 |
| * 5 | rc,jr | 4/8 | | 21.6 | | NA | 100.0 | 80.0 | 2.720 | 16.00 | XXXXX | 196.7 | 29.3 | 3.39E-09 | 3.26E-09 | |

(*) Indicates trials used for calculations of: Average $k_{20°C}$, Max. Dev. from mean, and Average ($i_o$).
(1) If a stopwatch is used to obtain Δt, only record the initial time reading.
(2) Read both mercury levels at top of meniscus.
(3) The tailwater column is the column of mercury which is higher than the other (headwater) column.

| | | |
|---|---|---|
| Average $k_{20°C}$: | 3.35E-09 | cm/s |
| Max. Dev. from Mean: | 3.0% | |
| Avg. Initial Gradient ($i_o$): | 29.3 | |
| Intrinsic (Absolute) Permeability, *K*: | 3.43E-14 | cm^2 |

(4) To meet the reading accuracy requirement of 5%, the drop in the tail water reading has to be > 1 cm. For CMT testing with k < about $5\times10^{-8}$ cm/sec, that requirement can be reduced by about ½.

Prelim. Calc. By: RC,jr  Final Calc. By: RC,jr  Reviewed By: HP HP

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# HYDRAULIC CONDUCTIVITY

| | | | |
|---|---|---|---|
| Project No. | *6468-07-1777* | Tested By | *HJ* |
| Project Name | *Exelon Texas COL (Victoria)* | Test Date | *4/8/2008* |
| Boring No. | *B-2319UD* | Reviewed By | *JW* JW |
| Sample No. | *UD-5* | Review Date | 5/7/08 |
| Sample Depth | *35-37 Ft.* | Lab No. | *8354* |

Sample Description *Brownish Yellow Sandy SILT (ML) Visual*

*ASTM D5084 - Method F (CVFH)*

| | |
|---|---|
| Sample Type: | *UD* |
| Sample Orientation: | *Vertical* |
| Initial Water Content, %: | *18.8* |
| Wet Unit Weight, pcf: | *126.1* |
| Dry Unit Weight, pcf: | *106.2* |
| Compaction, %: | *N/A* |
| **Hydraulic Conductivity, cm/sec. @20 °C** | ***1.1E-06*** |

Remarks: B Value = 0.96

KAW 5/9/08

# PERMEABILITY TEST
## (ASTM D5084 - 03) (Method F, Constant Volume Falling Head)

MACTEC

| | | | |
|---|---|---|---|
| Project Number | 6468-07-1777 | Tested By | HJ |
| Project Name | Exelon Texas COL (Victoria) | Test Date | 04/08/08 |
| Boring No. | B-2319UD | Reviewed By | JW JW |
| Sample No. | UD-5 | Review Date | 5/7/08 |
| Sample Depth | 35-37 Ft. | Lab No. | 8354 |
| Sample Description | Brownish Yellow Sandy SILT (ML) Visual | | |

| Initial Sample Data | | | | Final Sample Data | |
|---|---|---|---|---|---|
| Length, in | | Diameter, in | | Pan No. | T-3 |
| Location 1 | 4.113 | Location 1 | 2.879 | Wet Soil+Pan, grams | 944.58 |
| Location 2 | 4.119 | Location 2 | 2.881 | Dry Soil + Pan, grams | 799.14 |
| Location3 | 4.115 | Location 3 | 2.885 | Pan Weight, grams | 51.18 |
| Average | 4.116 | Average | 2.882 | Moisture Content, % | 19.4 |
| Volume, $in^3$ | 26.84 | Wet Soil + Tare, grams | 888.48 | Dry Unit Weight, pcf | 110.9 |
| SG Measured | 2.72 | Tare Weight, grams | 0.00 | Saturation, % | 99.8 |
| Soil Sample Wt., g | 888.48 | Dry Soil +Tare, grams | 747.96 | Diameter, in. | N/M |
| Dry UW, pcf | 106.2 | Moisture Content, % | 18.8 | Length, in. | N/M |
| Saturation, % | 85.3 | | | Volume, $in^3$ | N/M |

N/M - not measured due to the nature of sample

### Consolidation

| | |
|---|---|
| Chamber Pressure, psi | 54 |
| Back Pressure, psi | 24 |
| Confining Pressure, psi | 30 |
| Initial Burett Reading | 24 |
| Final Burett Reading | 5.1 |
| Volume Change, cc | 18.9 |

Permeant used water

| Elapsed Time (sec) | $z_o$ (cm) | za (cm) | zb (cm) | $\Delta z_p$ (cm) | Temp (°C) | Intial Hydraulic Gradient | Final Hydraulic Gradient | k cm/sec | k cm/sec at 20 °C |
|---|---|---|---|---|---|---|---|---|---|
| 120 | 1.70 | 9.80 | 8.10 | 1.70 | 24.6 | 9.7 | 7.6 | 1.23E-06 | 1.10E-06 |
| 240 | 1.70 | 9.80 | 6.90 | 2.90 | 24.6 | 9.7 | 6.1 | 1.16E-06 | 1.04E-06 |
| 360 | 1.70 | 9.80 | 5.90 | 3.90 | 24.6 | 9.7 | 4.9 | 1.15E-06 | 1.03E-06 |
| 480 | 1.70 | 9.80 | 5.10 | 4.70 | 24.6 | 9.7 | 3.9 | 1.15E-06 | 1.03E-06 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| No. of Trials | Sample Type | Max. Density (pcf) | Compaction % | Sample Orientation |
|---|---|---|---|---|
| 4 | UD | N/A | N/A | Vertical |

**Avg. k at 20 °C** **1.1E-06** **cm/sec**

$a_a$ = 0.76712 $cm^2$
A = 42.08 $cm^2$
L = 10.45 cm
S=L/A= 0.24844 1/cm

$a_p$= 0.031416 $cm^2$
$M_1$= 0.03018
$M_2$= 1.04095
$C = M_1S/(G_{Hg}-1)$= 0.0005965 for 15° to 25°

Remarks: B Value = 0.96

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# HYDRAULIC CONDUCTIVITY

| | | | |
|---|---|---|---|
| Project No. | *6468-07-1777* | Tested By | *HJ* |
| Project Name | *Exelon Texas COL (Victoria)* | Test Date | *4/8/2008* |
| Boring No. | *B-2319UD* | Reviewed By | *JW* JW |
| Sample No. | *UD-6* | Review Date | 5/7/08 |
| Sample Depth | *55-57 Ft. (Top)* | Lab No. | *8355* |

Sample Description *Light Yellowish Brown Sandy SILT (ML) Visual*

*ASTM D5084 - Method F (CVFH)*

| | |
|---|---|
| Sample Type: | *UD* |
| Sample Orientation: | *Vertical* |
| Initial Water Content, %: | *30.7* |
| Wet Unit Weight, pcf: | *120.1* |
| Dry Unit Weight, pcf: | *91.9* |
| Compaction, %: | *N/A* |
| **Hydraulic Conductivity, cm/sec. @20 °C** | ***1.5E-06*** |

Remarks: B Value = 0.96

KAW 5/9/08

# PERMEABILITY TEST
## (ASTM D5084 - 03) (Method F, Constant Volume Falling Head)

MACTEC

| | | | |
|---|---|---|---|
| Project Number | 6468-07-1777 | Tested By | HJ |
| Project Name | Exelon Texas COL (Victoria) | Test Date | 04/08/08 |
| Boring No. | B-2319UD | Reviewed By | JW JW |
| Sample No. | UD-6 | Review Date | 5/7/08 |
| Sample Depth | 55-57 Ft. (Top) | Lab No. | 8355 |
| Sample Description | Light Yellowish Brown Sandy SILT (ML) Visual | | |

| Initial Sample Data | | | | Final Sample Data | |
|---|---|---|---|---|---|
| Length, in | | Diameter, in | | Pan No. | T-19 |
| Location 1 | 4.130 | Location 1 | 2.846 | Wet Soil+Pan, grams | 857.47 |
| Location 2 | 4.140 | Location 2 | 2.841 | Dry Soil + Pan, grams | 685.07 |
| Location3 | 4.135 | Location 3 | 2.852 | Pan Weight, grams | 50.4 |
| Average | 4.135 | Average | 2.846 | Moisture Content, % | 27.2 |
| Volume, $in^3$ | 26.31 | Wet Soil + Tare, grams | 829.38 | Dry Unit Weight, pcf | 97.4 |
| SG Measured | 2.71 | Tare Weight, grams | 0.00 | Saturation, % | 99.9 |
| Soil Sample Wt., g | 829.38 | Dry Soil +Tare, grams | 634.67 | Diameter, in. | N/M |
| Dry UW, pcf | 91.9 | Moisture Content, % | 30.7 | Length, in. | N/M |
| Saturation, % | 99.0 | | | Volume, $in^3$ | N/M |

N/M - not measured due to the nature of sample

### Consolidation

| | |
|---|---|
| Chamber Pressure, psi | 79 |
| Back Pressure, psi | 34 |
| Confining Pressure, psi | 45 |
| Initial Burett Reading | 24.6 |
| Final Burett Reading | 0.3 |
| Volume Change, cc | 24.3 |

Permeant used water

| Elapsed Time (sec) | $z_o$ (cm) | za (cm) | zb (cm) | $\Delta z_p$ (cm) | Temp (°C) | Intial Hydraulic Gradient | Final Hydraulic Gradient | k cm/sec | k cm/sec at 20 °C |
|---|---|---|---|---|---|---|---|---|---|
| 60 | 1.70 | 7.00 | 6.20 | 0.80 | 24.4 | 6.3 | 5.3 | 1.75E-06 | 1.58E-06 |
| 120 | 1.70 | 7.00 | 5.60 | 1.40 | 24.4 | 6.3 | 4.6 | 1.65E-06 | 1.48E-06 |
| 180 | 1.70 | 7.00 | 5.00 | 2.00 | 24.4 | 6.3 | 3.9 | 1.70E-06 | 1.53E-06 |
| 240 | 1.70 | 7.00 | 4.60 | 2.40 | 24.4 | 6.3 | 3.4 | 1.63E-06 | 1.47E-06 |
| 300 | 1.70 | 7.00 | 4.20 | 2.80 | 24.4 | 6.3 | 2.9 | 1.63E-06 | 1.47E-06 |
| | | | | | | | | | |
| | | | | | | | | | |

| No. of Trials | Sample Type | Max. Density (pcf) | Compaction % | Sample Orientation |
|---|---|---|---|---|
| 5 | UD | N/A | N/A | Vertical |

**Avg. k at 20 °C** **1.5E-06** **cm/sec**

$a_a$ = 0.76712 $cm^2$
A = 41.05 $cm^2$
L = 10.50 cm
S=L/A= 0.25585 1/cm

$a_p$= 0.031416 $cm^2$
$M_1$= 0.03018
$M_2$= 1.04095
$C = M_1S/(G_{Hg}-1)$= 0.0006143 for 15° to 25°

Remarks: B Value = 0.96

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# HYDRAULIC CONDUCTIVITY

| | | | |
|---|---|---|---|
| Project No. | *6468-07-1777* | Tested By | *HJ* |
| Project Name | *Exelon Texas COL (Victoria)* | Test Date | *4/21/2008* |
| Boring No. | *B-2319UD* | Reviewed By | JW |
| Sample No. | *UD-10* | Review Date | 5/9/08 |
| Sample Depth | *95-97 Ft (Bottom)* | Lab No. | *8357* |

Sample Description *Mottled Light Gray and Brownish Yellow Poorly Graded SAND (SP) Visual*

***ASTM D5084-03 - (Method C Falling Head Rising Tail)***

| | |
|---|---|
| Sample Type: | *UD* |
| Sample Orientation: | *Vertical* |
| Initial Water Content, %: | *11.2* |
| Wet Unit Weight, pcf: | *114.8* |
| Dry Unit Weight, pcf: | *103.2* |
| Compaction, %: | *N/A* |
| **Hydraulic Conductivity, cm/sec. @20 °C** | ***7.7E-04*** |

Remarks: B Value = 0.95

KAW 5/9/08

# PERMEABILITY TEST
## (ASTM D5084 - 03) (Method C, Increasing Tailwater Level)

MACTEC

Project Number 6468-07-1777 Tested By HJ
Project Name Exelon Texas COL (Victoria) Test Date 04/21/08
Boring No. B-2319UD Reviewed By JW
Sample No. UD-10 Review Date 5/9/08
Sample Depth 95-97 Ft (Bottom) Lab No. 8357
Sample Description Mottled Light Gray and Brownish Yellow Poorly Graded SAND (SP) Visual

| Initial Sample Data | | | | Final Sample Data | |
|---|---|---|---|---|---|
| Length, in | | Diameter, in | | Pan No. | BC-2 |
| Location 1 | 4.500 | Location 1 | 2.865 | Wet Soil+Pan, g | 1047.58 |
| Location 2 | 4.495 | Location 2 | 2.860 | Dry Soil + Pan, g | 866.83 |
| Location3 | 4.505 | Location 3 | 2.864 | Pan Weight, g | 82.15 |
| Average | 4.500 | Average | 2.863 | Moisture Content, % | 23.0 |
| Volume, $in^3$ | 28.97 | Wet Soil + Tare, g | 872.90 | Dry Unit Weight, pcf | 104.2 |
| SG Measured | 2.72 | Tare Weight, g | 0.00 | Saturation, % | 99.7 |
| Soil Sample Wt., g | 872.9 | Dry Soil + Tare, g | 784.68 | Diameter, in. | N/M |
| Dry UW, pcf | 103.2 | Moisture Content, % | 11.2 | Length, in. | N/M |
| Saturation, % | 47.4 | | | Volume, $in^3$ | N/M |

N/M - not measured due to the nature of sample.

| Consolidation | |
|---|---|
| Chamber Pressure, psi | 95 |
| Back Pressure, psi | 30 |
| Confining Pressure, psi | 65 |
| Initial Burette Reading | 23.5 |
| Finial Burette Reading | 18.8 |
| Volume Change, cc | 4.7 |
| Permeant used | Water |

| Time (sec) | $H_a$ (cm) | $H_1$ (cm) | $H_b$ (cm) | $H_2$ (cm) | Temp (°C) | Initial Hydraulic Gradient | Final Hydraulic Gradient | k cm/sec | k cm/sec at 20 °C |
|---|---|---|---|---|---|---|---|---|---|
| 60 | 5.0 | 20.6 | 7.5 | 18.2 | 25.0 | 1.4 | 0.9 | 8.65E-04 | 7.69E-04 |
| 120 | 5.0 | 20.6 | 9.1 | 16.3 | 25.0 | 1.4 | 0.6 | 8.87E-04 | 7.88E-04 |
| 180 | 5.0 | 20.6 | 10.2 | 15.4 | 25.0 | 1.4 | 0.5 | 8.40E-04 | 7.47E-04 |
| 60 | 3.8 | 20.8 | 6.6 | 18.1 | 25.0 | 1.5 | 1.0 | 8.96E-04 | 7.97E-04 |
| 180 | 3.8 | 20.8 | 9.6 | 15.2 | 25.0 | 1.5 | 0.5 | 8.49E-04 | 7.55E-04 |
| | | | | | | | | | |
| | | | | | | | | | |

| No. of Trials | Sample Type | Max. Density (pcf) | Compaction % | Sample Orientation |
|---|---|---|---|---|
| 5 | UD | N/A | N/A | Vertical |

**Avg. k at 20 °C** **7.71E-04 cm/sec**

a = area of burette in $cm^2$
L = length of sample in cm
A = area of sample in $cm^2$

Ha = initial inlet head in cm
$H_1$ = initial outlet head in cm
t = time in seconds

$H_b$ = final inlet head in cm
$H_2$ = final outlet head in cm

a = 1.00 $cm^2$
A = 41.53 $cm^2$
L = 11.43 cm

Remarks: B Value = 0.95

# HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: Specimen Setup / Take Down
## ASTM D 5084-03

Project Number: 0411-08-1686 | Test Type: Permeability Vert. | Cell No.: 9 | File Name: B-2321_UD3dV

Project Name: Exelon (Victoria) | Test Stress(es), $\sigma'_c$ or $\sigma'_{v,c}$ = 10 , NA , NA & NA psi (1)

Task No.: NA | Perm. Orientation: [X] Vert.; [ ] Horiz. $G_s$ = 2.710 [X] Meas.; [ ] Assumed

Test No.: NA | Test Series No.: NA | Hydraulic System Used: [ ] Hg (CV-FH) [X] FH (Open System)

Part of Hyd. Conductivity Series: [X] No.; [ ] Yes; if yes with [ ] Vert.; [ ] Horiz.; [ ] Remolded [ ]

Assig. Remarks:

| | | | | |
|---|---|---|---|---|
| [X] Tube [ ] Field Extruded | [ ] Liner [ ] Remolded | [ ] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = |
| Boring No.: B-2321 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= | No. Layers = |
| Sample No.: UD3 | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = |
| Depth (ft): 10.0 - 11.7 | Specimen No.: D | [ ] Kneading | [ ] Undercompaction: $U_{ni}$ (%) = | Dia. (in.) = |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [ ] | Ref. Effort= | % Comp. = ± Opt. = |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Type** | [X] | Isotropic | [ ] | $K_o$ stress path | [ ] | Rings | Piston: | [X] | Yes ; | [ ] | No | [ ] Attached to top cap |
| **Consolidation:** | [ ] | Anisotropic | [ ] | 45° stress path | | | Piston diameter: | [ ] | 1/2"; | [ ] | 1/4"; | [X] 1/8"; [ ] |

| **Water Content (WC);** | Initial - Trimming Location | | | Final ($W_{at}$) | **SOIL MASSES:** | Initial | Final |
|---|---|---|---|---|---|---|---|
| | Top ($W_{o,1}$) | Bottom ($W_{o,2}$) | Sides ($W_{o,3}$) | (see below) | Moist + Tare (etc.)(g): | 623.92 | 633.95 |
| Container No | 814 | 833 | | 4120 | Tare (etc.) (g): | 0.00 | 0.00 |
| Mass Moist Soil + Cont. (g) | 87.85 | 126.56 | | 148.68 | Spec. Moist Mass (g): | 623.92 | 633.95 |
| Mass Dry Soil + Cont. (g) | 80.08 | 113.03 | | 130.26 | EXCESS DRY SOIL (soil stuck to stones, filter paper, membrane, etc.) | | |
| Mass Container (g) | 31.92 | 31.51 | | 30.12 | Container No: | | |
| Water Content, $W_{o,n}$ (%) | 16.13 | 16.60 | | 18.39 | Mass Dry Soil + Container (g): | | |
| Avg. Initial WC, $W_{o,avg}$ (%) | 16.37 | Final ($W_{at}$); [X] Slice; [ ] | | Whole Spec. | Mass Container (g): | | |
| [ ] See attached data sheet(s) for additional water contents | | | | | Mass Excess Dry Soil (g): | | 0.00 |

**Specimen Dimensions**

| | Height (mm) | | | Diameter (mm) | |
|---|---|---|---|---|---|
| | Initial ($H_o$) | Final ($H_{at}$) | | Initial ($D_o$) | Final ($D_{at}$) |
| GB | 70.000 | 70.000 | T | 73.00 | 73.10 |
| 1 | 1.47 | 1.32 | M | 73.00 | 73.00 |
| 2 | 1.79 | 1.26 | B | 73.00 | 73.00 |
| 3 | 1.38 | 1.32 | T' | | |
| 4 | 1.39 | 1.16 | M' | | |
| 5 | 1.42 | 1.49 | B' | | |
| Avg. | 71.49 | 71.31 | Avg. | 73.00 | 73.03 |

**Measuring Devices:**

| | | | | | |
|---|---|---|---|---|---|
| Pi Tape: | [X] | Dia. | | $A_o$ ($cm^2$) = | 41.85 |
| | | | | $V_o$ ($cm^3$) = | 299.21 |
| Calipers: | [ ] | Ht.; | [ ] Dia. | $A_{at}$ ($cm^2$)= | 41.89 |
| Dial Comparator: | [X] | Ht.; | [ ] Dia. | $V_{at}$ ($cm^3$) = | 298.73 |

NA - Not Applicable; UK - Unknown; GB - Gage Block

**Estimated Initial Unit Weight:**

Total, $\gamma_{t,o}$ (lb/ft$^3$) = 130.17 | Dry, $\gamma_{d,o}$ (lb/ft$^3$)= 111.87

**Membrane / Filter Paper / Platens**

| Membrane (mm) | | | Top | Bottom |
|---|---|---|---|---|
| Thickness: | [ ] | Single | 0.67 | 0.75 |
| | [X] | Double | 0.68 | 0.77 |
| Circumference ($C_{rm}$) | | | 216.00 | 216.00 |
| Summary: | | | Thickness | Diameter |
| [ ] Nominal Value | | Average: | 0.36 | 68.75 |

Filter Paper : Top + Bottom : [X] Yes ; [ ] No

Whatman No. 54: [X] Yes ; [ ] Other:

Mass top cap, $M_{tc}$ (g) = ; ÷ 454 = lbf

Mass (cap, dial, piston, etc.) (g) = NA ; NA lbf

Note: (1) Each Test Stress is identified as a Test Stage on other data sheets.

Final Specimen Description (USCS group name & symbol, color, layering, max. part. size, slickensided, fissured, blocky, honeycombed, etc.):

Mottled Very Pale Brown and Brownish Yellow Fat CLAY (CH)

[ ] Photo taken (internal sliced surface & outside surface)

Other Remarks

Trimmed / Reconstituted By: RC,jr | Setup By: RC,jr | Take Down By: RC,jr

Date: 3/27/2008 | Date: 3/27/2008 | Date: 4/9/2008

Prelim. Calc. By: RC,jr | Calculated By: RC,jr | Reviewed By: HP HP

KAW 7/16/08

# HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: Specimen Calculations & Summary

KAW 7/16/08 B-2321

Project Number: 0411-08-1686 | Cell No.: 9 | File Name: B-2321_UD3dV

Task Number: NA | Specific Gravity: 2.710 [X] Measured; [ ] Assumed

Boring No.: B-2321 | Sample No.: UD3 | Specimen No.: D | Depth (ft): 10.0 - 11.7

Type Test: Permeability Vert. | Specimen: [X] "Undisturbed"; [ ] Reconstituted; [ ]

Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = _____ ppm

| | Inital Water Contents (WC), ($W_o$) over Saturation, ($S_o$), in (%): | | | | | | Calculated Mass of Dry Soil (g) | |
|---|---|---|---|---|---|---|---|---|
| | Top, $W_{o,1}$ | Botttom, $W_{o,2}$ | Sides, $W_{o,3}$ | Avg., $W_{o,avg}$ | Selct., $W_{o,s}$ | Back Cal., $W_{o,bc}$ | Initial Selected WC, $w_o$ (%) | 16.37 |
| $W_o$ | 16.13 | 16.60 | | 16.37 | 16.37 | 16.52 | Initial , $M_{d,o}$ | 536.15 |
| $S_o$ | 86.3 | 87.7 | | 87.0 | 87.0 | 87.5 | Final, $M_{d,at}$ | 535.46 |
| | Measured final mass of moist soil, $M_{t,at}$ (g) | | | | | 633.95 | Selected, $M_d$ | 535.80 |
| | Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g) | | | | | 633.95 | | |

| Consolidation Data | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | |
|---|---|---|---|---|---|---|---|---|
| Changes in Height (mm) and Volume ($cm^3$) Within Given Consolidation Stages/Columns | At Initial Seating Stress | During Back-Pressuring | 1st Consol. Increment (1) | Column 2 or 3 to **1st Test** Stage (1) | Column 4 to **2nd Test** Stage | Column 5 to **3rd Test** Stage | Column 6 to **4th Test** Stage | |
| Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec. | | | | | | | | |
| Change in Height, $\Delta H_{c,n}$ | 0.19 | -0.17 | | 0.33 | NA | NA | NA | |
| Sum of changes in (+ out) | 1.50 | | | 3.72 | NA | NA | NA | |
| burette readings, $\Delta b_{r,n}$ (- in) | | -14.06 | NA | NA | NA | NA | NA | 2 |
| Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$ | 2.39 | -2.13 | | 4.14 | NA | NA | NA | |
| Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$ | 0.50 | 0.50 | | 0.90 | NA | NA | NA | |
| Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$ | 1.19 | -1.07 | NA | NA | NA | NA | NA | 3 |
| Selected $\Delta V_{c,n}$ | 1.19 | -1.07 | | 3.72 | NA | NA | NA | |

| Summary For Test Stages | | | | | Vol. Factor used to cal. $\Delta V_{HC,n}$ |
|---|---|---|---|---|---|
| Test Stage: | 1st = 1 | 2nd = 2 | 3rd = 3 | 4th = 4 | in perm. stage(2)= Consol.Val. |
| Cell Pressure, $\sigma_{c,n}$ (psi) | 90.00 | NA | NA | NA | Number of |
| Back Pressure, $U_{b,n}$ (psi) | 80.00 | NA | NA | NA | Test Stages = 1 |
| Axial Force Reading, $P_{r,n}$ (lbf) | NA | NA | NA | NA | Ht. change during permation |
| Eff. Consol. Stress ($\sigma'_c$ or $\sigma'_{v,c}$) (4), (ksf) | 1.44 | NA | NA | NA | & removal of cell pressure, (5) |
| $t_c$, ON or in [X] days [ ] hrs | 5.00 | NA | NA | NA | $\Delta H_{td}$ (mm) = -0.04 |

**At Final Test Stress/Stage - Summary of Calculation of $\Delta V_c$ ($cm^3$) by Different Procedures**

| By Selected Volumes | By Saturation = 100 % | By Change in Mass (6) | For Diff. in Meas. Vol. ($V_o$-$V_{at}$), | For Selected $\Delta V_c$, required |
|---|---|---|---|---|
| $\Delta V_c$ = 3.85 | $\Delta V_c$ = 2.82 | $\Delta V_c$ = 4.00 | & corr. for $\Delta H_{td}$ $\Delta V_c$= 0.18 | $G_s$ for $S_c$ = 100 %: 2.724 |

**At Final Test Stress/Stage - Consolidation Conclusions**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\Delta H_{c,f}$ (mm) = | 0.35 | $\Delta V_{c,f}$ ($cm^3$) = | 3.33 | Back Cal. $G_s$ for S=100% = | 2.717 | Normalized Ht. Ch. (%) = | 0.18 |
| $\varepsilon_{ac,c}$ (%) = | 0.49 | $\varepsilon_{vc,f}$ (%) = | 1.11 | | | Diff. in: Vol. Ch. (%) = | 0.95 |

**Summary of Specimen Physical Properties**

| Specific Gravity: $G_s$ = 2.710 Measured Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Volumetric Water Content | Porosity n | Skempton B para-meter %(7) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial: | 71.49 | 299.21 | 41.85 | 16.4 | 130.17 | 111.79 | 87.3 | 0.511 | 0.2950 | 0.338 | 99.0 |
| After Consol.: to 1st $\sigma'_c$ | 71.14 | 295.88 | 41.59 | 18.3 | 133.76 | 113.05 | 100.5 | 0.494 | 0.3323 | 0.331 | |
| to 2nd $\sigma'_c$ | | | | | | | | | | | NA |
| to 3rd $\sigma'_c$ | | | | | | | | | | | " |
| to 4th $\sigma'_c$ | | | | | | | | | | | " |

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.

(2) The ht. changes occuring within each permeation stage (1 - 4) are recorded in these rows (after Column 3).

(3) The volume changes occuring within each permeation stage (1 - 4) are calculated/recorded in these rows (after Column 3).

(4) Stresses are not corr. for membrane. (5) Log as a **negative** number if change in height is upward.

(6) ~ $M_{t,o}$-($M_{tat,c}$+$\Delta V_{in,column1\&2}$) (7) Initial value is after back pressuring

NA - Not Applicable ON - Over Night; WC - Water Content Remarks: _____

Calculated By: RC,jr Reviewed By: HP HP

# HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: ASTM D 5084-03, METHOD C (Falling Head/Rising Tail Method):
## Flexible Wall Permeameter Using Water/"Fluid" Open Faling Head Hydraulic System - First Sheet

Project No.: 0411-08-1686 | Test Type: Permeability Vert. | Cell No.: 9 | Boring/Exploration No.: B-2321
Task Number: NA | Test Stage: 1 of 1 | Test Station No.: 1 | Sample No.: UD3
Project Name: Exelon (Victoria) | Test No.: NA | File Name: B-2321_UD3dV | Penetration/Depth (ft): 10.0 - 11.7
Test Series No.: NA | Test Sheet: 1 of ____ | Composite Sample No.: ____
Material Description: Mottled Very Pale Brown and Brownish Yellow Fat CLAY (CH) | Specimen No.: D

Axial Load Cell No.: NA | Factor, (lbf/V/V): NA | Excit. Volt, V: NA | Ch. No.: NA | Ht. Reading before Perm. (mm): 2.170
Vert. Dial/DT No.: ____ | Factor, (mm/V/V): ____ | Excit. Volt, V: ____ | Ch. No.: ____ | Ht. Reading at $\sigma_c$ = 0 (mm): 2.21

**Permeation & Specimen Information**

Permeant: [X] Tap Water; [ ] Other
Direction of Flow: [X] Up; [ ] Down
Perm. Orientation: [X] Vertical; [ ] Horizontal
Specimen: [X] "Undisturded;" [ ] Reconstituted; [ ]

| Required Units: | Calc. Stage; | Height, $L_{t,n}$ (mm) | Area, $A_{t,n}$ ($cm^2$) |
|---|---|---|---|
| [X] cm/s | Preliminary: | 71.140 | 41.69 |
| [ ] m/yr | Final: | 71.140 | 41.59 |

Prelim. change in height during consol., $\Delta H_{c,p}$ (mm) = 0.35
Applied back pressure, $U_b$ (psi) = 80.0
Bladder Inteface: $H_f$ & $H_b$ in cm, with $H_f$ = NA | $H_b$ = NA

**Test Station Constants/App. Imfo.**

| | |
|---|---|
| Area headwater tube, $a_{in}$ ($cm^2$): | 0.1969 |
| Area tailwater tube, $a_{out}$ ($cm^2$): | 0.1969 |
| Permeant/Fluid Density, at 22°C, $\rho_{f,n}$ ($g/cm^3$); Accum. | NA |
| System | 0.9978 |

Elev. Heads by: [X] Vol. (1) [ ] Elev.
If by Vol.: [X] Case 2 [ ] Case 3
Differential Pressure Head System
[ ] Differential Manometer (cm Hg):
[ ] U-tube; [ ] Vert. Column
[X] Pressure Trans./Gage (psi): [ ] Differential

**Pressure Head Settings (D 5084)**

| Estimated $k_t$ (cm/sec) | Max. Initial Gradient, $i_o$ ($i_o$ = h/Lc,p) | Max. Press. Head Setting (psi) | Min. Cell Pressure (psi) |
|---|---|---|---|
| 1.0E-4 to 1.0E-5 | ≤5 | 80.15 | 80.6 |
| 1.0E-5 to 1.0E-6 | ≤10 | 80.65 | 81.1 |
| 1.0E-6 to 1.0E-7 | ≤20 | 81.66 | 82.2 |
| <1.0E-7 or <3.0E-2 (m/yr) | ≤30 | 82.67 | 83.4 |
| For Special Gradtient, i | | | |

Remarks: Stop Watch # SW-012

| Trial No. | Readings By | Date y= 2008 (m/d) | Time hr:min | Temp. °C | Δt (min) | Axial Force [X] (volt) | Pressure Cell, $\sigma_c$ (psi) | Pressure Back, $U_b$ (psi) | Dial Reading (mm) | Head Readings Pressure (2) Differential or Head | Pressure (2) Tail | Fluid (3) Head, $hw_r$ cm^3 | Fluid (3) Tail, $tw_r$ cm^3 | Flow Ratio; outflow to inflow | Total Head Loss (cm of water) | Initial Hyd. Gradient, $i_o$ Preliminary Final | Hyd. Conductivity, k Preliminary, $k_t$ Final, $k_{20°C}$ cm/s |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RC,jr | 4/8 | 11:33 | 21.6 | 6.3 | NA | 90.00 | 80.00 | 2.170 | 80.00 | 80.00 | 3.00 | 7.00 | 1.00 | 20.32 | 2.9 | 1.27E-05 |
| 1 | RC,jr | 4/8 | | 21.6 | | NA | 90.00 | 80.00 | 2.170 | 80.00 | 80.00 | 3.50 | 6.50 | | 15.24 | 2.9 | 1.23E-05 |
| | RC,jr | 4/8 | 11:40 | 21.6 | 8.5 | NA | 90.00 | 80.00 | 2.170 | 80.00 | 80.00 | 3.00 | 7.00 | 1.00 | 20.320 | 2.9 | 9.47E-06 |
| * 2 | RC,jr | 4/8 | | 21.6 | | NA | 90.00 | 80.00 | 2.170 | 80.00 | 80.00 | 3.50 | 6.50 | | 15.240 | 2.9 | 9.16E-06 |
| | RC,jr | 4/8 | 11:49 | 21.6 | 9.5 | NA | 90.00 | 80.00 | 2.170 | 80.00 | 80.00 | 3.00 | 7.00 | 1.00 | 20.32 | 2.9 | 8.48E-06 |
| * 3 | RC,jr | 4/8 | | 21.6 | | NA | 90.00 | 80.00 | 2.160 | 80.00 | 80.00 | 3.50 | 6.50 | | 15.24 | 2.9 | 8.20E-06 |
| | RC,jr | 4/8 | 11:59 | 21.6 | 9.8 | NA | 90.00 | 80.00 | 2.160 | 80.00 | 80.00 | 3.00 | 7.00 | 1.00 | 20.32 | 2.9 | 8.26E-06 |
| * 4 | RC,jr | 4/8 | | 21.6 | | NA | 90.00 | 80.00 | 2.160 | 80.00 | 80.00 | 3.50 | 6.50 | | 15.24 | 2.9 | 7.99E-06 |
| | RC,jr | 4/8 | 12:11 | 21.6 | 10.0 | NA | 90.00 | 80.00 | 2.160 | 80.00 | 80.00 | 3.00 | 7.00 | 1.00 | 20.32 | 2.9 | 8.05E-06 |
| * 5 | RC,jr | 4/8 | | 21.6 | | NA | 90.00 | 80.00 | 2.160 | 80.00 | 80.00 | 3.50 | 6.50 | | 15.24 | 2.9 | 7.79E-06 |

(*) Indicates trials used for calculations (Average $k_{20°C}$, Max. Dev. from mean, Average (i)).

Notes: (1) If by vol.: Case 2-Burettes have equal areas, scales & elev.; while for Case 3 they are not equal & see attached sheet.
(2) A manometer reads differential pressure between the headwater and tailwater burettes, while gage does not (unless differential).
(3) Make sure the SCF in Cells A51, A54, A57, A60 & A63 are correct.

| | | |
|---|---|---|
| Average $k_{20°C}$: | 8.28E-06 | cm/s |
| Max. Dev. from mean: | 10.6% | |
| Avg. Initial Gradient ($i_o$): | 2.9 | |
| Intrinsic (Absolute) Permability, *K*: | 8.48E-11 | cm^2 |

Prelim. Calc. By: RC,jr | Final Calc. By: RC,jr | Reviewed By: HP



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# HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: Specimen Setup / Take Down
## ASTM D 5084-03

Project Number: 0411-08-1686 Test Type: Permeability Vert. Cell No.: 8 File Name: B-2321_UD6cV
Project Name: Exelon (Victoria) Test Stress(es), $\sigma'_c$ or $\sigma'_{v,c}$ = 25 , NA , NA & NA psi (1)
Task No.: NA Perm. Orientation: [X] Vert.; [ ] Horiz. $G_s$ = 2.720 [X] Meas.; [ ] Assumed
Test No.: NA Test Series No.: NA Hydraulic System Used: [X] Hg (CV-FH) [ ] FH (Open System)
Part of Hyd. Conductivity Series: [X] No.; [ ] Yes; if yes with [ ] Vert.; [ ] Horiz.; [ ] Remolded
Assig. Remarks:

| | | | | |
|---|---|---|---|---|
| [X] Tube [ ] Field Extruded | [ ] Liner [ ] Remolded | [ ] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = |
| Boring No.: B-2321 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= | No. Layers = |
| Sample No.: UD6 Compostite No.: | | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = |
| Depth (ft): 28.5 - 36.2 Specimen No.: C | | [ ] Kneading | [ ] Undercompaction: $U_{ni}$ (%) = | Dia. (in.) = |
| [ ] Spec. Selection by X-ray; [ ] Geomarine Sample | | [ ] | Ref. Effort= % Comp. = | ± Opt. = |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Type** | [X] Isotropic | [ ] $K_o$ stress path | [ ] Rings | Piston: | [X] Yes ; | [ ] No | [ ] Attached to top cap | | | | |
| **Consolidation:** | [ ] Anisotropic | [ ] 45° stress path | | Piston diameter: | [ ] 1/2"; | [ ] 1/4"; | [X] 1/8"; | [ ] | | | |

| **Water Content (WC);** | Initial - Trimming Location | | | Final ($W_{at}$) | **SOIL MASSES:** | Initial | Final |
|---|---|---|---|---|---|---|---|
| | Top ($W_{o,1}$) | Bottom ($W_{o,2}$) | Sides ($W_{o,3}$) | (see below) | Moist + Tare (etc.)(g): | 524.68 | 529.39 |
| Container No | 692 | 723 | | 4125 | Tare (etc.) (g): | 0.00 | 0.00 |
| Mass Moist Soil + Cont. (g) | 123.87 | 123.88 | | 141.67 | Spec. Moist Mass (g): | 524.68 | 529.39 |
| Mass Dry Soil + Cont. (g) | 105.26 | 104.96 | | 118.46 | EXCESS DRY SOIL (soil stuck to stones, filter paper, membrane, etc.) | | |
| Mass Container (g) | 31.54 | 31.29 | | 30.35 | Container No: | | |
| Water Content, $W_{o,n}$ (%) | 25.24 | 25.68 | | 26.34 | Mass Dry Soil + Container (g): | | |
| Avg. Initial WC, $W_{o,avg}$ (%) | 25.46 | Final ($W_{at}$); [X] Slice; [ ] | | Whole Spec. | Mass Container (g): | | |
| [ ] See attached data sheet(s) for additional water contents | | | | | Mass Excess Dry Soil (g): | | 0.00 |

**Specimen Dimensions**

| | Height (mm) | | | Diameter (mm) | |
|---|---|---|---|---|---|
| | Initial ($H_o$) | Final ($H_{at}$) | | Initial ($D_o$) | Final ($D_{at}$) |
| GB | 70.000 | 70.000 | T | 73.00 | 73.25 |
| 1 | -5.30 | -5.87 | M | 73.00 | 73.00 |
| 2 | -5.29 | -5.73 | B | 73.00 | 73.15 |
| 3 | -5.36 | -6.04 | T' | | |
| 4 | -5.24 | -6.08 | M' | | |
| 5 | -5.34 | -5.74 | B' | | |
| Avg. | 64.69 | 64.11 | Avg. | 73.00 | 73.13 |

**Measuring Devices:**

| | | | | | |
|---|---|---|---|---|---|
| Pi Tape: | [X] | Dia. | $A_o$ ($cm^2$) = | 41.85 |
| | | | $V_o$ ($cm^3$) = | 270.77 |
| Calipers: | [ ] Ht.; | [ ] Dia. | $A_{at}$ ($cm^2$)= | 42.01 |
| Dial Comparator: | [X] Ht.; | [ ] Dia. | $V_{at}$ ($cm^3$) = | 269.30 |

NA - Not Applicable; UK - Unknown; GB - Gage Block

**Estimated Initial Unit Weight:**

Total, $\gamma_{t,o}$ (lb/ft$^3$) = 120.97 Dry, $\gamma_{d,o}$ (lb/ft$^3$)= 96.42

**Membrane / Filter Paper / Platens**

| Membrane (mm) | | | Top | Bottom |
|---|---|---|---|---|
| Thickness: | [ ] | Single | 0.66 | 0.75 |
| | [X] | Double | 0.67 | 0.74 |
| Circumference ($C_{rm}$) | | | 216.00 | 216.00 |
| Summary: | | | Thickness | Diameter |
| [ ] Nominal Value | | Average: | 0.35 | 68.75 |

Filter Paper : Top + Bottom : [X] Yes ; [ ] No
Whatman No. 54: [X] Yes ; [ ] Other:

Mass top cap, $M_{tc}$ (g) = ; ÷ 454 = lbf
Mass (cap, dial, piston, etc.) (g) = NA ; NA lbf

Note: (1) Each Test Stress is identified as a Test Stage on other data sheets.

Final Specimen Description (USCS group name & symbol, color, layering, max. part. size, slickensided, fissured, blocky, honeycombed, etc.):
Mottled Brownish Yellow and Light Gray Fat CLAY (CH)

[ ] Photo taken (internal sliced surface & outside surface)

Other Remarks

Trimmed / Reconstituted By: RC,jr Setup By: RC,jr Take Down By: RC,jr
Date: 3/28/2008 Date: 3/28/2008 Date: 4/9/2008

Prelim. Calc. By: RC,jr Calculated By: RC,jr Reviewed By: HP

KAW 7/16/08

# HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: Specimen Calculations & Summary

KAW 7/16/08 B-2321

Project Number: 0411-08-1686 | Cell No.: 8 | File Name: B-2321_UD6cV

Task Number: NA | Specific Gravity: 2.720 | [X] Measured; [ ] Assumed

Boring No.: B-2321 | Sample No.: UD6 | Specimen No.: C | Depth (ft): 28.5 - 36.2

Type Test: Permeability Vert. | Specimen: [X] "Undisturbed"; [ ] Reconstituted; [ ]

Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = _____ ppm

| | Inital Water Contents (WC), ($W_o$) over Saturation, ($S_o$), in (%): | | | | | | Calculated Mass of Dry Soil (g) | |
|---|---|---|---|---|---|---|---|---|
| | Top, $W_{o,1}$ | Botttom, $W_{o,2}$ | Sides, $W_{o,3}$ | Avg., $W_{o,avg}$ | Selct., $W_{o,s}$ | Back Cal., $W_{o,bc}$ | Initial Selected WC, $w_o$ (%) | 25.46 |
| $W_o$ | 25.24 | 25.68 | | 25.46 | 25.46 | 25.22 | Initial , $M_{d,o}$ | 418.21 |
| $S_o$ | 91.0 | 91.8 | | 91.4 | 91.4 | 90.9 | Final, $M_{d,at}$ | 419.01 |
| | Measured final mass of moist soil, $M_{t,at}$ (g) | | | | | 529.39 | Selected, $M_d$ | 418.61 |
| | Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g) | | | | | 529.39 | | |

| Consolidation Data | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | |
|---|---|---|---|---|---|---|---|---|
| Changes in Height (mm) and Volume ($cm^3$) Within Given Consolidation Stages/Columns | At Initial Seating Stress | During Back-Pressuring | 1st Consol. Increment (1) | Column 2 or 3 to **1st Test** Stage (1) | Column 4 to **2nd Test** Stage | Column 5 to **3rd Test** Stage | Column 6 to **4th Test** Stage | |
| Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec. | | | | | | | | |
| Change in Height, $\Delta H_{c,n}$ | 0.22 | 0.07 | | 1.11 | NA | NA | NA | |
| Sum of changes in burette readings, $\Delta b_{r,n}$ (+ out) | 1.60 | | | 9.34 | NA | NA | NA | |
| (- in) | | -13.52 | NA | NA | NA | NA | NA | 2 |
| Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$ | 2.76 | 0.88 | | 13.94 | NA | NA | NA | |
| Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$ | 0.25 | 1.00 | | 0.67 | NA | NA | NA | |
| Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$ | 0.69 | 0.88 | NA | NA | NA | NA | NA | 3 |
| Selected $\Delta V_{c,n}$ | 0.69 | -3.52 | | 9.34 | NA | NA | NA | |

| Summary For Test Stages | | | | | Vol. Factor used to cal. $\Delta V_{HC,n}$ |
|---|---|---|---|---|---|
| Test Stage: | 1st = 1 | 2nd = 2 | 3rd = 3 | 4th = 4 | in perm. stage(2)= NA |
| Cell Pressure, $\sigma_{c,n}$ (psi) | 105.00 | NA | NA | NA | Number of |
| Back Pressure, $U_{b,n}$ (psi) | 80.00 | NA | NA | NA | Test Stages = 1 |
| Axial Force Reading, $P_{r,n}$ (lbf) | NA | NA | NA | NA | Ht. change during permation |
| Eff. Consol. Stress ($\sigma'_c$ or $\sigma'_{v,c}$) (4), (ksf) | 3.60 | NA | NA | NA | & removal of cell pressure, (5) |
| $t_c$, ON or in days hrs | 5.00 | NA | NA | NA | $\Delta H_{td}$ (mm) = -0.07 |

**At Final Test Stress/Stage - Summary of Calculation of $\Delta V_c$ ($cm^3$) by Different Procedures**

| By Selected Volumes | By Saturation = 100 % | By Change in Mass (6) | For Diff. in Meas. Vol. ($V_o$-$V_{at}$), | For Selected $\Delta V_c$, required |
|---|---|---|---|---|
| $\Delta V_c$ = 6.51 | $\Delta V_c$ = 5.61 | $\Delta V_c$ = 8.79 | & corr. for $\Delta H_{td}$ $\Delta V_c$= 0.94 | $G_s$ for $S_c$ = 100 %: 2.736 |

**At Final Test Stress/Stage - Consolidation Conclusions**

| | | | | | |
|---|---|---|---|---|---|
| $\Delta H_{c,f}$ (mm) = 1.40 | $\Delta V_{c,f}$ ($cm^3$) = 6.06 | Back Cal. $G_s$ for S=100% = 2.728 | Normalized | Ht. Ch. (%) = | 1.15 |
| $\varepsilon_{ac,c}$ (%) = 2.16 | $\varepsilon_{vc,f}$ (%) = 2.24 | | Diff. in: | Vol. Ch. (%) = | 1.69 |

**Summary of Specimen Physical Properties**

| Specific Gravity: $G_s$ = 2.720 Measured | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Volumetric Water Content | Porosity n | Skempton B parameter %(7) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Condition:** | | | | | | | | | | | |
| Initial: | 64.69 | 270.77 | 41.85 | 25.3 | 120.97 | 96.51 | 91.1 | 0.756 | 0.3924 | 0.431 | 98.0 |
| After Consol.: to 1st $\sigma'_c$ | 63.29 | 264.71 | 41.82 | 26.5 | 124.85 | 98.72 | 100.4 | 0.717 | 0.4192 | 0.418 | |
| to 2nd $\sigma'_c$ | | | | | | | | | | | NA |
| to 3rd $\sigma'_c$ | | | | | | | | | | | " |
| to 4th $\sigma'_c$ | | | | | | | | | | | " |

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.

(2) The ht. changes occuring within each permeation stage (1 - 4) are recorded in these rows (after Column 3).

(3) The volume changes occuring within each permeation stage (1 - 4) are calculated/recorded in these rows (after Column 3).

(4) Stresses are not corr. for membrane. (5) Log as a **negative** number if change in height is upward.

(6) ~ $M_{t,o}$-($M_{tat,c}$+$\Delta V_{in,column1\&2}$) (7) Initial value is after back pressuring

NA - Not Applicable ON - Over Night; WC - Water Content Remarks: _____

Calculated By: RC,jr Reviewed By: HP

# HYDRAULIC CONDUCTIVITY (PERMEABILITY) TEST: ASTM D 5084-03, METHOD F:
## Using Flexible Wall Permeameter and Mercury Constant Volume - Falling Head Hydraulic System

Project Number: 0411-08-1686
Task Number: NA
Project Name: Exelon (Victoria)

Test Type: Permeability Vert.
Test Stage: 1 of 1
Test No.: NA
Test Series No.: NA

Cell No.: 8
Test Station No.: 3
Hyd. App. No. (Permometer): 1
File Name: 2321_UD6cV

Boring/Exploration No.: B-2321
Sample No.: UD6
Penetration/Depth (ft): 28.5 - 36.2
Composite Sample No.:

Axial Load Cell No.: NA
Vert. Dial/DT No.:

Factor, (lbf/V/V): NA
Factor, (mm/V/V):

Excit. Volt, V: NA  Ch. No.: NA
Excit. Volt, V:  Ch. No.:

Ht. Reading before Perm. (mm): 0.790
Ht. Reading at $\sigma_c$ = 0 (mm): 0.860

### Permeation & Specimen Information

Permeant: [X] Tap Water; [ ] Other
Direction of Flow: [X] Up; [ ] Down
Perm. Orientation: [X] Vertical; [ ] Horizontal
Specimen: [X] "Undisturbed;" [ ] Reconstituted; [ ]

| Back Pressure, $U_b$ (psi) | Stage | Height, $L_{t,n}$ (mm) | Area, $A_{t,n}$ ($cm^2$) |
|---|---|---|---|
| = 80.0 | Preliminary: | 63.294 | 41.11 |
| | Final: | 63.294 | 41.82 |

Prelim. change in height during consol., $\Delta H_{c,p}$ (mm) = 1.4

### Hydraulic System Constants

**Mercury U-Tube Manometer**

| | |
|---|---|
| Area headwater tube, $a_{in}$ ($cm^2$): | 0.7671 |
| Area tailwater tube, $a_{out}$ ($cm^2$): | 0.03142 |
| $\Delta Hg_{eq}$ at equilibrium (cm): | 0.4 |
| Fluid Density Const. (15-25°C): | 12.57 |

Remarks: Stop Watch # SW-005

### Mercury Head Settings (D 5084)

| Estimated $k_t$ (cm/sec) | Max. Gradient ($i_o = h/L_{t,p}$) | Permometer $\Delta$Hg Setting (cm) | Min. Cell Pressure (psi) |
|---|---|---|---|
| 1.0E-4 to 1.0E-5 | ≤5 | 2.1 | 80.9 |
| 1.0E-5 to 1.0E-6 | ≤10 | 4.7 | 81.8 |
| 1.0E-6 to 1.0E-7 | ≤20 | 9.7 | 83.6 |
| <1.0E-7 or <3.0E-2 (m/yr) | ≤30 | 14.7 | 85.4 |
| For Special Gradient, $i_o$ | | | |

| Trial No. | Readings By | Date y= 2008 (m/d) | Time (1) hr:min | Temp. °C | Δt (min) | Axial Force [ ] (volt) | Pressure Cell, $\sigma_c$ (psi) | Pressure Back, $U_b$ (psi) | [X] Dial [ ] DT Reading (mm) | Mercury Head Readings (2) Tail, $tw_r$ (cm) (3&4) | Mercury Head Readings (2) Head, $hw_r$ (cm) | Total Head Loss (cm of water) | Initial Hyd. Gradient, $i_o$ Preliminary / Final | Hydraulic Conductivity, k Preliminary, $k_t$ (m/yr) (cm/s) | Hydraulic Conductivity, k Final, $k_{20°C}$ (m/yr) (cm/s) | Minimum Allowable $tw_r$ (cm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | rc,jr | 4/8 | 8:26 | 21.6 | 19.8 | NA | 105.0 | 80.0 | 0.790 | 15.00 | 1.2 | 178.1 | 28.1 | 8.26E-03 | 7.81E-03 | 11.60 |
| 1 | rc,jr | 4/8 | | 21.6 | | NA | 105.0 | 80.0 | 0.790 | 13.90 | XXXXX | 163.7 | 28.1 | 2.62E-08 | 2.48E-08 | |
| | rc,jr | 4/8 | 8:47 | 21.6 | 23.5 | NA | 105.0 | 80.0 | 0.790 | 15.00 | 1.2 | 178.1 | 28.1 | 6.97E-03 | 6.59E-03 | 11.60 |
| 2 | rc,jr | 4/8 | | 21.6 | | NA | 105.0 | 80.0 | 0.790 | 13.90 | XXXXX | 163.7 | 28.1 | 2.21E-08 | 2.09E-08 | |
| | rc,jr | 4/8 | 9:11 | 21.6 | 33.0 | NA | 105.0 | 80.0 | 0.790 | 15.00 | 1.2 | 178.1 | 28.1 | 6.39E-03 | 6.05E-03 | 11.60 |
| * 3 | rc,jr | 4/8 | | 21.6 | | NA | 105.0 | 80.0 | 0.790 | 13.60 | XXXXX | 159.8 | 28.1 | 2.03E-08 | 1.92E-08 | |
| | rc,jr | 4/8 | 9:45 | 21.6 | 43.0 | NA | 105.0 | 80.0 | 0.790 | 15.00 | 1.2 | 178.1 | 28.1 | 6.03E-03 | 5.70E-03 | 11.60 |
| * 4 | rc,jr | 4/8 | | 21.6 | | NA | 105.0 | 80.0 | 0.790 | 13.30 | XXXXX | 155.9 | 28.1 | 1.91E-08 | 1.81E-08 | |
| | rc,jr | 4/8 | 10:29 | 21.6 | 46.8 | NA | 105.0 | 80.0 | 0.790 | 15.00 | 1.2 | 178.1 | 28.1 | 5.54E-03 | 5.25E-03 | 11.60 |
| * 5 | rc,jr | 4/8 | | 21.6 | | NA | 105.0 | 80.0 | 0.790 | 13.30 | XXXXX | 155.9 | 28.1 | 1.76E-08 | 1.66E-08 | |

(*) Indicates trials used for calculations of: Average $k_{20°C}$, Max. Dev. from mean, and Average ($i_o$).
(1) If a stopwatch is used to obtain Δt, only record the initial time reading.
(2) Read both mercury levels at top of meniscus.
(3) The tailwater column is the column of mercury which is higher than the other (headwater) column.

| | | |
|---|---|---|
| **Average $k_{20°C}$:** | 1.80E-08 | cm/s |
| **Max. Dev. from Mean:** | 7.4% | |
| **Avg. Initial Gradient ($i_o$):** | 28.1 | |
| **Intrinsic (Absolute) Permeability, *K*:** | 1.84E-13 | cm^2 |

(4) To meet the reading accuracy requirement of 5%, the drop in the tail water reading has to be > 1 cm. For CMT testing with k < about $5\times10^{-8}$ cm/sec, that requirement can be reduced by about ½.

Prelim. Calc. By: RC,jr  Final Calc. By: RC,jr  Reviewed By: HP

MACTEC

# HYDRAULIC CONDUCTIVITY

| | | | |
|---|---|---|---|
| Project No. | *6468-07-1777* | Tested By | *HJ* |
| Project Name | *Exelon Texas COL (Victoria)* | Test Date | *4/8/2008* |
| Boring No. | *B-2321UD* | Reviewed By | *JW* SW |
| Sample No. | *UD-7* | Review Date | 5/7/08 |
| Sample Depth | *38.5-40.2 Ft* | Lab No. | *8358* |

Sample Description *Very Pale Brown Mottled Brownish Yellow Fat CLAY (CH)*

*ASTM D5084 - Method F (CVFH)*

| | |
|---|---|
| Sample Type: | *UD* |
| Sample Orientation: | *Vertical* |
| Initial Water Content, %: | *21.0* |
| Wet Unit Weight, pcf: | *124.4* |
| Dry Unit Weight, pcf: | *102.8* |
| Compaction, %: | *N/A* |
| **Hydraulic Conductivity, cm/sec. @20 °C** | ***8.4E-09*** |

Remarks: B Value = 0.97

KAW 5/12/08

# PERMEABILITY TEST
## (ASTM D5084 - 03) (Method F, Constant Volume Falling Head)

MACTEC

| | | | |
|---|---|---|---|
| Project Number | 6468-07-1777 | Tested By | HJ |
| Project Name | Exelon Texas COL (Victoria) | Test Date | 04/08/08 |
| Boring No. | B-2321UD | Reviewed By | JW JW |
| Sample No. | UD-7 | Review Date | 5/7/08 |
| Sample Depth | 38.5-40.2 Ft | Lab No. | 8358 |

Sample Description: Very Pale Brown Mottled Brownish Yellow Fat CLAY (CH)

| Initial Sample Data | | | | Final Sample Data | |
|---|---|---|---|---|---|
| Length, in | | Diameter, in | | Pan No. | N-11 |
| Location 1 | 3.010 | Location 1 | 2.844 | Wet Soil+Pan, grams | 682.31 |
| Location 2 | 3.000 | Location 2 | 2.865 | Dry Soil + Pan, grams | 570.28 |
| Location3 | 3.020 | Location 3 | 2.867 | Pan Weight, grams | 48.97 |
| Average | 3.010 | Average | 2.859 | Moisture Content, % | 21.5 |
| Volume, $in^3$ | 19.32 | Wet Soil + Tare, grams | 630.78 | Dry Unit Weight, pcf | 108.4 |
| SG Measured | 2.78 | Tare Weight, grams | 0.00 | Saturation, % | 99.6 |
| Soil Sample Wt., g | 630.78 | Dry Soil +Tare, grams | 521.31 | Diameter, in. | N/M |
| Dry UW, pcf | 102.8 | Moisture Content, % | 21.0 | Length, in. | N/M |
| Saturation, % | 84.9 | | | Volume, $in^3$ | N/M |

N/M - not measured due to the nature of sample

**Consolidation**

| | |
|---|---|
| Chamber Pressure, psi | 69 |
| Back Pressure, psi | 34 |
| Confining Pressure, psi | 35 |
| Initial Burett Reading | 24 |
| Final Burett Reading | 7.5 |
| Volume Change, cc | 16.5 |

Permeant used: water

| Elapsed Time (sec) | $z_o$ (cm) | za (cm) | zb (cm) | $\Delta z_p$ (cm) | Temp (°C) | Intial Hydraulic Gradient | Final Hydraulic Gradient | k cm/sec | k cm/sec at 20 °C |
|---|---|---|---|---|---|---|---|---|---|
| 17820 | 1.70 | 15.00 | 11.10 | 3.90 | 23.6 | 21.9 | 15.2 | 9.06E-09 | 8.32E-09 |
| 40860 | 1.70 | 15.00 | 7.55 | 7.45 | 23.6 | 21.9 | 9.1 | 9.49E-09 | 8.72E-09 |
| 148074 | 1.70 | 15.00 | 2.80 | 12.20 | 23.6 | 21.9 | 1.0 | 9.27E-09 | 8.52E-09 |
| 176040 | 1.70 | 15.00 | 2.65 | 12.35 | 23.6 | 21.9 | 0.7 | 8.56E-09 | 7.86E-09 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| No. of Trials | Sample Type | Max. Density (pcf) | Compaction % | Sample Orientation |
|---|---|---|---|---|
| 4 | UD | N/A | N/A | Vertical |

**Avg. k at 20 °C** **8.4E-09** **cm/sec**

$a_a$ = 0.76712 $cm^2$
A = 41.41 $cm^2$
L = 7.65 cm
S=L/A= 0.18464 1/cm

$a_p$= 0.031416 $cm^2$
$M_1$= 0.03018
$M_2$= 1.04095
$C = M_1S/(G_{Hg}-1)$= 0.0004433 for 15° to 25°

Remarks: B Value = 0.97

MACTEC

# HYDRAULIC CONDUCTIVITY

| | | | |
|---|---|---|---|
| Project No. | *6468-07-1777* | Tested By | *HJ* |
| Project Name | *Exelon Texas COL (victoria)* | Test Date | *4/10/2008* |
| Boring No. | *B-2321UD* | Reviewed By | JW |
| Sample No. | *UD-12* | Review Date | 5/7/08 |
| Sample Depth | *93-95.7 ft* | Lab No. | *8359* |

Sample Description *Light Yellowish Brown Poorly Graded SAND with silt (SP-SM) Visual*

***ASTM D5084-03 - (Method B Falling Head Constant Tail)***

| | |
|---|---|
| Sample Type: | *UD* |
| Sample Orientation: | *Vertical* |
| Initial Water Content, %: | *21.3* |
| Wet Unit Weight, pcf: | *123.5* |
| Dry Unit Weight, pcf: | *101.9* |
| Compaction, %: | *N/A* |
| **Hydraulic Conductivity, cm/sec. @20 °C** | ***1.1E-04*** |

Remarks: B Value = 0.96

KAW 5/12/08

# PERMEABILITY TEST
## (ASTM D5084 - 03) (Method B, Falling Head, Constant Tail)

MACTEC

| | | | |
|---|---|---|---|
| Project Number | 6468-07-1777 | Tested By | HJ |
| Project Name | Exelon Texas COL (victoria) | Test Date | 04/10/08 |
| Boring No. | B-2321UD | Reviewed By | JW |
| Sample No. | UD-12 | Review Date | 5/7/08 |
| Sample Depth | 93-95.7 ft | Lab No. | 8359 |

Sample Description: Light Yellowish Brown Poorly Graded SAND with silt (SP-SM) Visual

| Initial Sample Data | | | | Final Sample Data | |
|---|---|---|---|---|---|
| Length, in | | Diameter, in | | Pan No. | AB-25 |
| Location 1 | 4.110 | Location 1 | 2.876 | Wet Soil+Pan, g | 959.75 |
| Location 2 | 4.120 | Location 2 | 2.849 | Dry Soil + Pan, g | 792.06 |
| Location3 | 4.130 | Location 3 | 2.857 | Pan Weight, g | 84.18 |
| Average | 4.120 | Average | 2.861 | Moisture Content, % | 23.7 |
| Volume, $in^3$ | 26.48 | Wet Soil + Tare, g | 858.33 | Dry Unit Weight, pcf | 103.6 |
| SG Measured | 2.69 | Tare Weight, g | 0.00 | Saturation, % | 102.8 |
| Soil Sample Wt., g | 858.33 | Dry Soil + Tare, g | 707.88 | Diameter, in. | N/M |
| Dry UW, pcf | 101.9 | Moisture Content, % | 21.3 | Length, in. | N/M |
| Saturation, % | 88.2 | | | Volume, $in^3$ | N/M |

N/M - not measured due to the nature of sample.

| Consolidation | |
|---|---|
| Chamber Pressure, psi | 84 |
| Back Pressure, psi | 24 |
| Confining Pressure, psi | 60 |
| Initial Burette Reading | 24.0 |
| Finial Burette Reading | 16.6 |
| Volume Change, cc | 7.4 |
| Permeant used | Water |

| Time (sec) | Division Start | Division Finish | $H_0$ (cm) | $H_f$ (cm) | Temp (°C) | Initial Hydraulic Gradient | Final Hydraulic Gradient | k cm/sec | k cm/sec at 20 °C |
|---|---|---|---|---|---|---|---|---|---|
| 425 | 0.0 | 24.0 | 146.40 | 122.4 | 23.6 | 14.0 | 11.7 | 1.06E-04 | 9.76E-05 |
| 324 | 0.0 | 20.0 | 146.40 | 126.4 | 23.6 | 14.0 | 12.1 | 1.14E-04 | 1.05E-04 |
| 296 | 0.0 | 20.0 | 146.40 | 126.4 | 23.6 | 14.0 | 12.1 | 1.25E-04 | 1.15E-04 |
| 303 | 0.0 | 20.0 | 146.40 | 126.4 | 23.6 | 14.0 | 12.1 | 1.22E-04 | 1.12E-04 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| No. of Trials | Sample Type | Max. Density (pcf) | Compaction % | Sample Orientation |
|---|---|---|---|---|
| 4 | UD | N/A | N/A | Vertical |

**Avg. k at 20 °C** **1.08E-04 cm/sec**

a = area of burette in $cm^2$
L = length of sample in cm
A = area of sample in $cm^2$

Ha = initial inlet head in cm
$H_1$ = initial outlet head in cm
t = time in seconds

$H_b$ = final inlet head in cm
$H_2$ = final outlet head in cm

a = 1.00 $cm^2$
A = 41.47 $cm^2$
L = 10.46 cm

Remarks: B Value = 0.96

MACTEC

# HYDRAULIC CONDUCTIVITY

| | | | |
|---|---|---|---|
| Project No. | *6468-07-1777* | Tested By | *HJ* |
| Project Name | *Exelon Texas COL (Victoria)* | Test Date | *4/15/2008* |
| Boring No. | *B-2321UD* | Reviewed By | *JW* JW |
| Sample No. | *UD-14* | Review Date | 5/7/08 |
| Sample Depth | *128.5-130.25 ft* | Lab No. | *8360* |
| Sample Description | *Pale Yellow Fat Clay with SAND (CH)* | | |

*ASTM D5084 - Method F (CVFH)*

| | |
|---|---|
| Sample Type: | *UD* |
| Sample Orientation: | *Vertical* |
| Initial Water Content, %: | *25.0* |
| Wet Unit Weight, pcf: | *121.3* |
| Dry Unit Weight, pcf: | *97.0* |
| Compaction, %: | *N/A* |
| **Hydraulic Conductivity, cm/sec. @20 °C** | ***2.5E-09*** |

Remarks: B Value = 0.97

KAW 5/9/08

# PERMEABILITY TEST
## (ASTM D5084 - 03) (Method F, Constant Volume Falling Head)

MACTEC

| | | | |
|---|---|---|---|
| Project Number | 6468-07-1777 | Tested By | HJ |
| Project Name | Exelon Texas COL (Victoria) | Test Date | 04/15/08 |
| Boring No. | B-2321UD | Reviewed By | JW |
| Sample No. | UD-14 | Review Date | 5/7/08 |
| Sample Depth | 128.5-130.25 ft | Lab No. | 8360 |
| Sample Description | Pale Yellow Fat Clay with SAND (CH) | | |

| Initial Sample Data | | | | Final Sample Data | |
|---|---|---|---|---|---|
| Length, in | | Diameter, in | | Pan No. | X-5 |
| Location 1 | 4.490 | Location 1 | 2.851 | Wet Soil+Pan, grams | 939.44 |
| Location 2 | 4.490 | Location 2 | 2.841 | Dry Soil + Pan, grams | 770.85 |
| Location3 | 4.490 | Location 3 | 2.831 | Pan Weight, grams | 46.24 |
| Average | 4.490 | Average | 2.841 | Moisture Content, % | 23.3 |
| Volume, $in^3$ | 28.46 | Wet Soil + Tare, grams | 905.99 | Dry Unit Weight, pcf | 104.6 |
| SG Measured | 2.75 | Tare Weight, grams | 0.00 | Saturation, % | 99.9 |
| Soil Sample Wt., g | 905.99 | Dry Soil +Tare, grams | 724.61 | Diameter, in. | N/M |
| Dry UW, pcf | 97.0 | Moisture Content, % | 25.0 | Length, in. | N/M |
| Saturation, % | 89.5 | | | Volume, $in^3$ | N/M |

N/M - not measured due to the nature of sample

| Consolidation | |
|---|---|
| Chamber Pressure, psi | 93 |
| Back Pressure, psi | 18 |
| Confining Pressure, psi | 75 |
| Initial Burett Reading | 25 |
| Final Burett Reading | -9 |
| Volume Change, cc | 34 |

Permeant used water

| Elapsed Time (sec) | $z_o$ (cm) | za (cm) | zb (cm) | $\Delta z_p$ (cm) | Temp (°C) | Intial Hydraulic Gradient | Final Hydraulic Gradient | k cm/sec | k cm/sec at 20 °C |
|---|---|---|---|---|---|---|---|---|---|
| 12569 | 1.70 | 21.50 | 20.30 | 1.20 | 24.4 | 21.8 | 20.4 | 3.47E-09 | 3.13E-09 |
| 23100 | 1.70 | 21.50 | 19.75 | 1.75 | 24.4 | 21.8 | 19.8 | 2.80E-09 | 2.52E-09 |
| 30660 | 1.70 | 21.50 | 19.30 | 2.20 | 24.4 | 21.8 | 19.3 | 2.68E-09 | 2.42E-09 |
| 79740 | 1.70 | 21.50 | 17.10 | 4.40 | 25.0 | 21.8 | 16.8 | 2.21E-09 | 1.96E-09 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| No. of Trials | Sample Type | Max. Density (pcf) | Compaction % | Sample Orientation |
|---|---|---|---|---|
| 4 | UD | N/A | N/A | Vertical |

**Avg. k at 20 °C** **2.5E-09** **cm/sec**

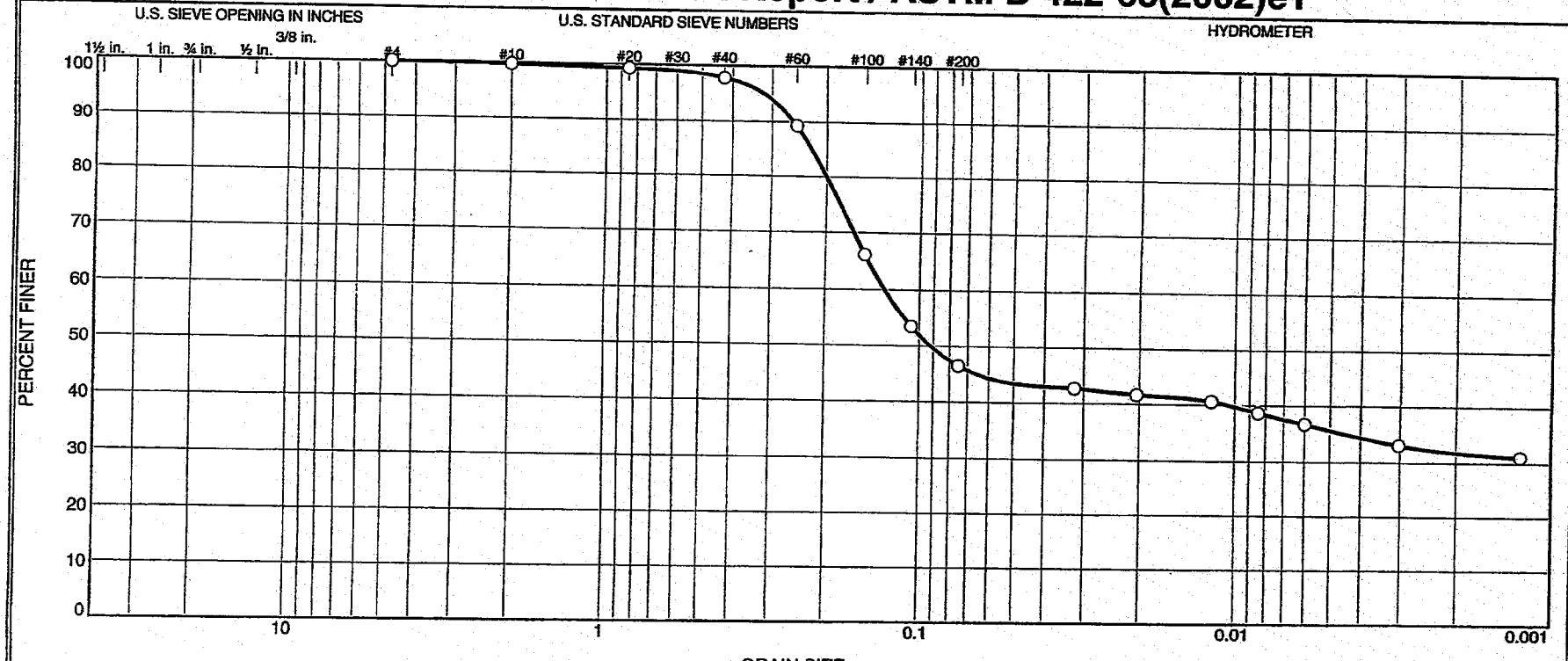
$a_a$ = 0.76712 $cm^2$
A = 40.90 $cm^2$
L = 11.40 cm
S=L/A= 0.27886 1/cm

$a_p$= 0.031416 $cm^2$
$M_1$= 0.03018
$M_2$= 1.04095
$C = M_1S/(G_{Hg}-1)$= 0.0006695 for 15° to 25°

Remarks: B Value = 0.97

# Soil Index & Compaction Test Results - Composite Soils

# Particle Size Distribution Report / ASTM D 422-63(2002)e1




| | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| ○ | 0.0 | 0.0 | 0.2 | 2.0 | 51.4 | 10.6 | 35.8 |

| | Source | Sample # | Depth/Elev. | Date Sampled | USCS | Material Description | NM % | LL | PL |
|---|---|---|---|---|---|---|---|---|---|
| ○ | TP-2319&TP2334 | Comp-A | NA | 1/20/08 | SC | Light Brown Clayey SAND | 12.7 | 34 | 12 |

Client Bechtel

Project Exelon Texas COL (Victoria)

Project No. 6468071777 Figure NA

**MACTEC, Inc.**

**Raleigh, North Carolina**

○ Specific gravity = 2.659 (ASTM D854-06)
Organic content = 0.7% (ASTM D2974-07)

KAW 4/10/08

**Tested By:** CS **Checked By:** LBJ

## GRAIN SIZE DISTRIBUTION TEST DATA

4/10/2008

**Client:** Bechtel
**Project:** Exelon Texas COL (Victoria)
**Project Number:** 6468071777
**Location:** TP-2319&TP2334
**Depth:** NA
**Sample Number:** Comp-A
**Material Description:** Light Brown Clayey SAND
**Date:** 1/20/08
**Natural Moisture:** 12.7
**Liquid Limit:** 34
**Plastic Limit:** 12
**USCS Class.:** SC
**Testing Remarks:** Specific gravity = 2.659 (ASTM D854-06)
Organic content = 0.7% (ASTM D2974-07)
**Tested by:** CS
**Checked by:** LBJ

### Sieve Test Data

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 480.68 | 0.00 | 0.00 | #4 | 0.00 | 100.0 |
| | | | #10 | 0.82 | 99.8 |
| 53.18 | 0.00 | 0.00 | #20 | 0.29 | 99.3 |
| | | | #40 | 1.07 | 97.8 |
| | | | #60 | 5.61 | 89.3 |
| | | | #100 | 17.91 | 66.2 |
| | | | #140 | 24.68 | 53.5 |
| | | | #200 | 28.44 | 46.4 |

### Hydrometer Test Data

**Hydrometer test uses material passing #10**
**Percent passing #10 based upon complete sample =** 99.8
**Weight of hydrometer sample =**53.18
**Hygroscopic moisture correction:**
**Moist weight and tare =** 27.45
**Dry weight and tare =** 27.24
**Tare weight =** 15.51
**Hygroscopic moisture =** 1.8%
**Table of composite correction values:**

| | | |
|---|---|---|
| **Temp., deg. C:** | 11.2 | 28.4 |
| **Comp. corr.:** | -8.0 | -4.0 |

**Meniscus correction only =** 1.0
**Specific gravity of solids =** 2.659
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =** 16.294964 - 0.164 **x Rm**

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.3 | 28.0 | 22.3 | 0.0134 | 29.0 | 11.5 | 0.0322 | 42.6 |
| 5.00 | 21.2 | 27.5 | 21.8 | 0.0134 | 28.5 | 11.6 | 0.0204 | 41.6 |
| 15.00 | 21.1 | 27.0 | 21.3 | 0.0134 | 28.0 | 11.7 | 0.0119 | 40.6 |
| 30.00 | 21.1 | 26.0 | 20.3 | 0.0134 | 27.0 | 11.9 | 0.0084 | 38.7 |
| 60.00 | 21.1 | 25.0 | 19.3 | 0.0134 | 26.0 | 12.0 | 0.0060 | 36.8 |
| 240.00 | 21.5 | 23.0 | 17.4 | 0.0134 | 24.0 | 12.4 | 0.0030 | 33.2 |
| 1440.00 | 21.2 | 22.0 | 16.3 | 0.0134 | 23.0 | 12.5 | 0.0013 | 31.1 |

**MACTEC, Inc.**

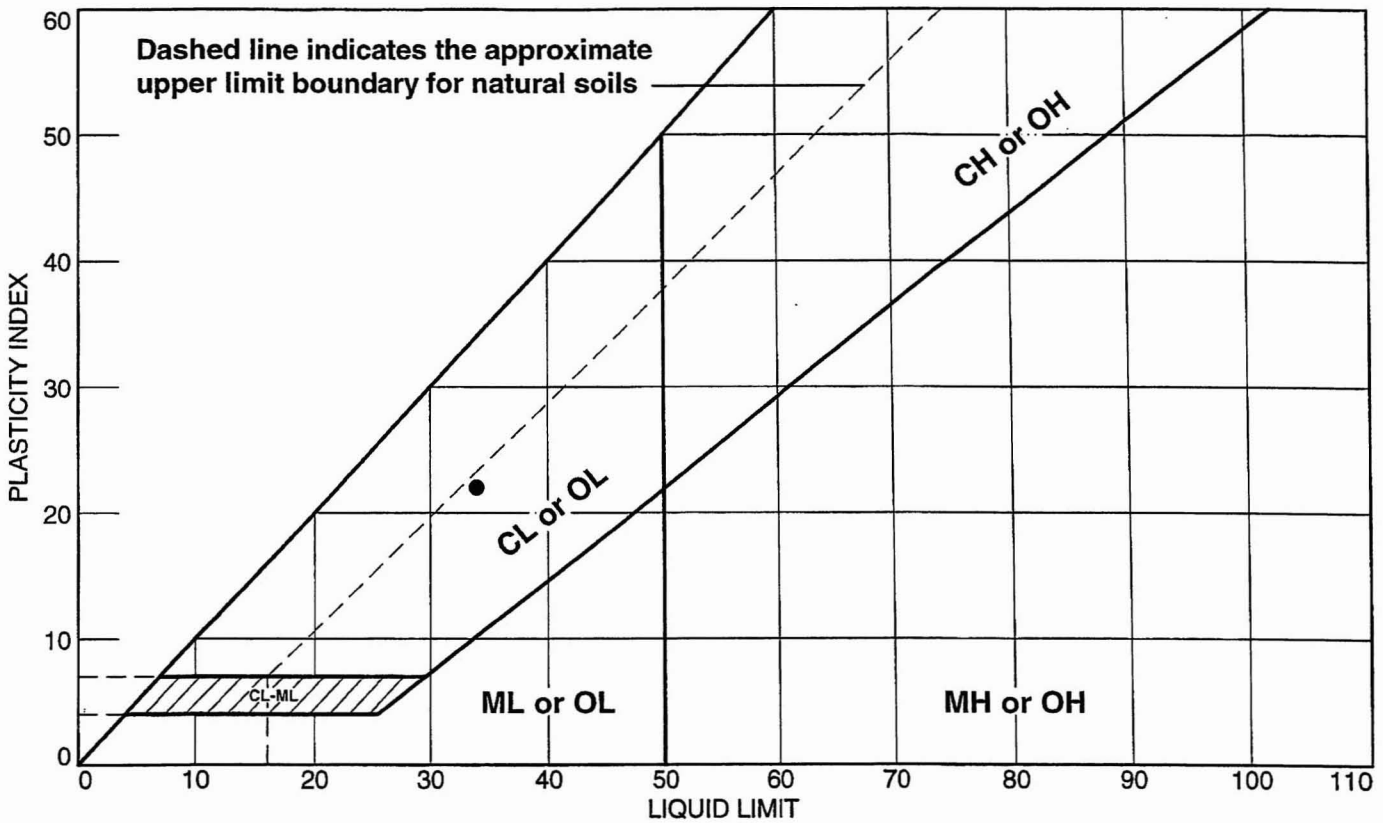
## Fractional Components

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 2.0 | 51.4 | 53.6 | 10.6 | 35.8 | 46.4 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0920 | 0.1291 | 0.1999 | 0.2234 | 0.2554 | 0.3168 |

| Fineness Modulus |
|---|
| 0.41 |

# LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)




**SOIL DATA**

| | SOURCE | SAMPLE NO. | DEPTH (ft.) | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
|---|---|---|---|---|---|---|---|---|
| ● | TP-2319&TP2334 | Comp-A | NA | 12.7 | 12 | 34 | 22 | SC |

| | |
|---|---|
| **MACTEC, Inc.**<br><br>**Raleigh, North Carolina** | **Client:** Bechtel<br>**Project:** Exelon Texas COL (Victoria)<br><br>**Project No.:** 6468071777 **Figure** NA |

**Tested By:** CS **Checked By:** LBJ KAW 4/10/08

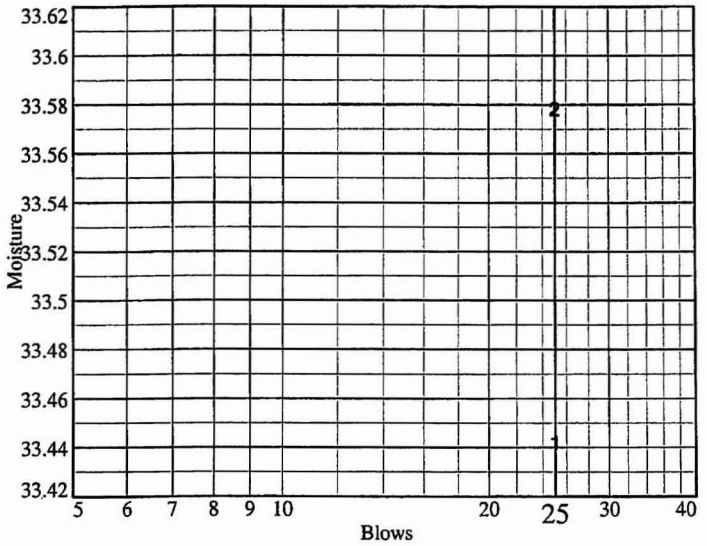
## LIQUID AND PLASTIC LIMIT TEST DATA

4/10/2008

**Client:** Bechtel
**Project:** Exelon Texas COL (Victoria)
**Project Number:** 6468071777
**Location:** TP-2319&TP2334
**Depth:** NA
**Sample Number:** Comp-A
**Material Description:** Light Brown Clayey SAND
**USCS:** SC
**AASHTO:** A-6(6)
**Tested by:** CS
**Checked by:** LBJ

### Liquid Limit Data

| Run No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Wet+Tare | 31.67 | 32.12 | | | | |
| Dry+Tare | 27.57 | 28.01 | | | | |
| Tare | 15.31 | 15.77 | | | | |
| # Blows | 25 | 25 | | | | |
| Moisture | 33.4 | 33.6 | | | | |




**Liquid Limit=** 34
**Plastic Limit=** 12
**Plasticity Index=** 22
**Natural Moisture=** 12.7
**Liquidity Index=** 0.0

### Plastic Limit Data

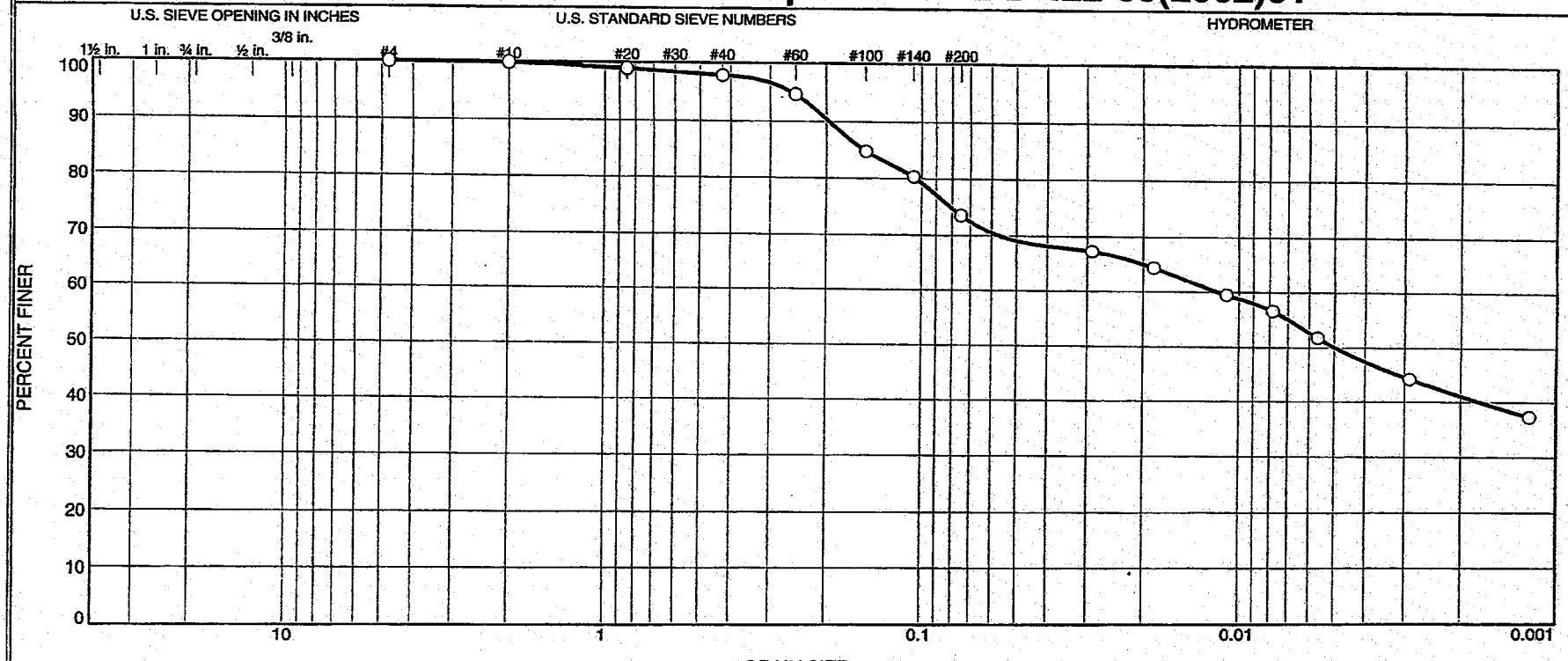
| Run No. | 1 | 2 | 3 | 4 | |
|---|---|---|---|---|---|
| Wet+Tare | 23.44 | 22.87 | | | |
| Dry+Tare | 22.61 | 22.09 | | | |
| Tare | 15.45 | 15.61 | | | |
| Moisture | 11.6 | 12.0 | | | |

### Natural Moisture Data

| Wet+Tare | Dry+Tare | Tare | Moisture |
|---|---|---|---|
| 382.73 | 340.98 | 13.41 | 12.7 |

MACTEC, Inc.

# Particle Size Distribution Report / ASTM D 422-63(2002)e1




| | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| O | 0.0 | 0.0 | 0.1 | 2.0 | 24.3 | 23.5 | 50.1 |

| | Source | Sample # | Depth/Elev. | Date Sampled | USCS | Material Description | NM % | LL | PL |
|---|---|---|---|---|---|---|---|---|---|
| O | TP-2317&2334 | Comp-B | NA | 1/20/08 | CL | Gray Lean CLAY with sand | 18.1 | 44 | 15 |

Client Bechtel

Project Exelon Texas COL (Victoria)

Project No. 6468071777 Figure NA

**MACTEC, Inc.**

**Raleigh, North Carolina**

O Specific Gravity = 2.693 (ASTM D854-06)
Organic content = 1.5% (ASTM D2974-07)

KAW 4/10/08

**Tested By:** CS **Checked By:** LBJ

## GRAIN SIZE DISTRIBUTION TEST DATA

4/10/2008

**Client:** Bechtel
**Project:** Exelon Texas COL (Victoria)
**Project Number:** 6468071777
**Location:** TP-2317&2334
**Depth:** NA **Sample Number:** Comp-B
**Material Description:** Gray Lean CLAY with sand
**Date:** 1/20/08 **Natural Moisture:** 18.1
**Liquid Limit:** 44 **Plastic Limit:** 15 **USCS Class.:** CL
**Testing Remarks:** Specific Gravity = 2.693 (ASTM D854-06)
Organic content = 1.5% (ASTM D2974-07)
**Tested by:** CS **Checked by:** LBJ

### Sieve Test Data

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer |
|---|---|---|---|---|---|
| 492.14 | 0.00 | 0.00 | #4 | 0.00 | 100.0 |
| | | | #10 | 0.57 | 99.9 |
| 52.23 | 0.00 | 0.00 | #20 | 0.48 | 99.0 |
| | | | #40 | 1.02 | 97.9 |
| | | | #60 | 2.71 | 94.7 |
| | | | #100 | 7.88 | 84.8 |
| | | | #140 | 10.22 | 80.3 |
| | | | #200 | 13.77 | 73.6 |

### Hydrometer Test Data

**Hydrometer test uses material passing #10**
**Percent passing #10 based upon complete sample =** 99.9
**Weight of hydrometer sample =**52.23
**Hygroscopic moisture correction:**
**Moist weight and tare =** 27.44
**Dry weight and tare =** 27.21
**Tare weight =** 15.57
**Hygroscopic moisture =** 2.0%
**Table of composite correction values:**

| | | |
|---|---|---|
| **Temp., deg. C:** | 11.2 | 28.4 |
| **Comp. corr.:** | -8.0 | -4.0 |

**Meniscus correction only =** 1.0
**Specific gravity of solids =** 2.693
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L = 16.294964 - 0.164 x Rm**

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer |
|---|---|---|---|---|---|---|---|---|
| 2.00 | 21.2 | 40.5 | 34.8 | 0.0133 | 41.5 | 9.5 | 0.0289 | 67.3 |
| 5.00 | 21.2 | 39.0 | 33.3 | 0.0133 | 40.0 | 9.7 | 0.0185 | 64.4 |
| 15.00 | 21.1 | 36.5 | 30.8 | 0.0133 | 37.5 | 10.1 | 0.0109 | 59.5 |
| 30.00 | 21.1 | 35.0 | 29.3 | 0.0133 | 36.0 | 10.4 | 0.0078 | 56.6 |
| 60.00 | 21.1 | 32.5 | 26.8 | 0.0133 | 33.5 | 10.8 | 0.0056 | 51.8 |
| 240.00 | 21.4 | 28.5 | 22.9 | 0.0132 | 29.5 | 11.5 | 0.0029 | 44.2 |
| 1440.00 | 21.2 | 25.0 | 19.3 | 0.0133 | 26.0 | 12.0 | 0.0012 | 37.3 |

**MACTEC, Inc.**

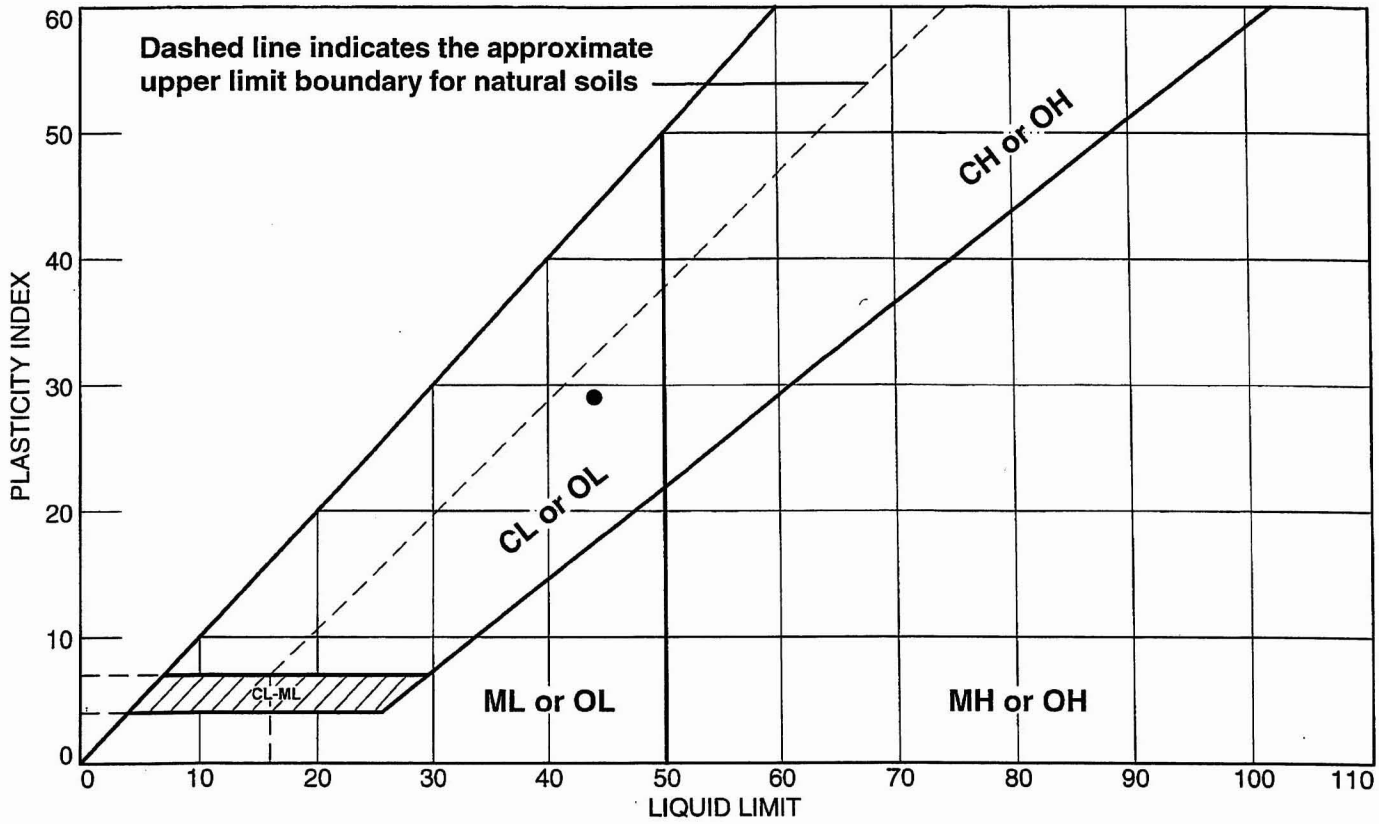
## Fractional Components

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 2.0 | 24.3 | 26.4 | 23.5 | 50.1 | 73.6 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0050 | 0.0116 | 0.1039 | 0.1518 | 0.1956 | 0.2552 |

| Fineness Modulus |
|---|
| 0.21 |

# LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)




**SOIL DATA**

| | SOURCE | SAMPLE NO. | DEPTH (ft.) | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
|---|---|---|---|---|---|---|---|---|
| ● | TP-2317&2334 | Comp-B | NA | 18.1 | 15 | 44 | 29 | CL |

| | |
|---|---|
| **MACTEC, Inc.**<br><br>**Raleigh, North Carolina** | **Client:** Bechtel<br>**Project:** Exelon Texas COL (Victoria)<br><br>**Project No.:** 6468071777 **Figure** N/A |

**Tested By:** CS **Checked By:** LBJ KAW 4/10/08

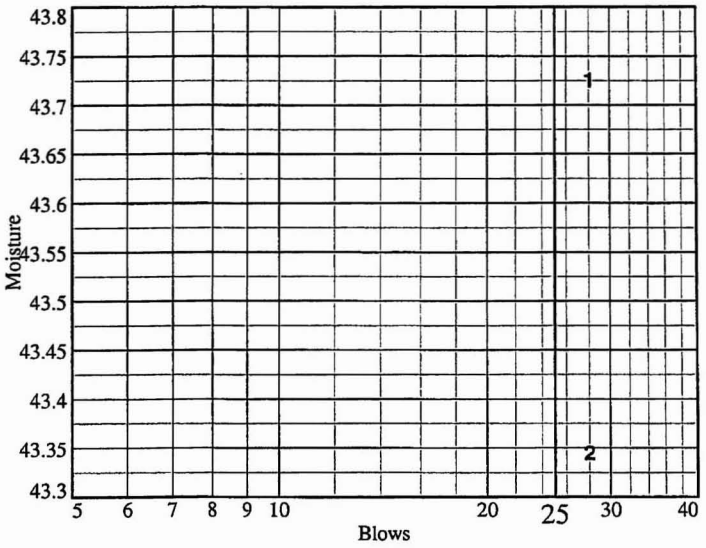
## LIQUID AND PLASTIC LIMIT TEST DATA

4/10/2008

**Client:** Bechtel
**Project:** Exelon Texas COL (Victoria)
**Project Number:** 6468071777
**Location:** TP-2317&2334
**Depth:** NA
**Sample Number:** Comp-B
**Material Description:** Gray Lean CLAY with sand
**USCS:** CL
**AASHTO:** A-7-6(20)
**Tested by:** CS
**Checked by:** LBJ

### Liquid Limit Data

| Run No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Wet+Tare | 30.37 | 26.56 | | | | |
| Dry+Tare | 25.84 | 21.87 | | | | |
| Tare | 15.48 | 11.05 | | | | |
| # Blows | 28 | 28 | | | | |
| Moisture | 43.7 | 43.3 | | | | |




**Liquid Limit=** 44
**Plastic Limit=** 15
**Plasticity Index=** 29
**Natural Moisture=** 18.1
**Liquidity Index=** 0.1

### Plastic Limit Data

| Run No. | 1 | 2 | 3 | 4 | |
|---|---|---|---|---|---|
| Wet+Tare | 23.71 | 22.38 | | | |
| Dry+Tare | 22.67 | 21.48 | | | |
| Tare | 15.61 | 15.40 | | | |
| Moisture | 14.7 | 14.8 | | | |

### Natural Moisture Data

| Wet+Tare | Dry+Tare | Tare | Moisture |
|---|---|---|---|
| 675.96 | 574.57 | 13.32 | 18.1 |

MACTEC, Inc.

MACTEC

# ORGANIC CONTENT TEST REPORT

## (ASTM D2974-07)

**Project No.** 6468071777
**Tested By** CS
**Test Date** 4/30/2008

**Project Name** Exelon COL
**Reviewed By** LBJ ZHU
**Review Date** 5/16/2008 6-12-08

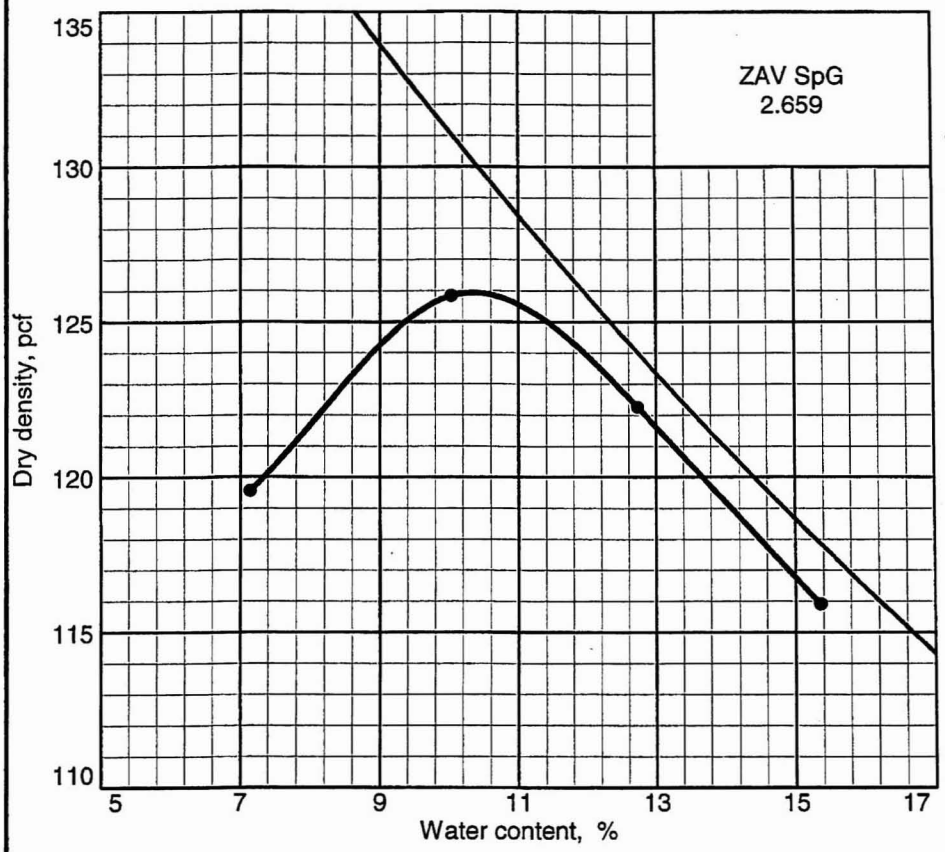
| Boring No. | TP2317&2334 | TP2319&2334 | | |
|---|---|---|---|---|
| Sample No. | Comp. A | Comp. B | | |
| Sample Depth, Ft. | NA | NA | | |
| A) Tare No. | N/A | N/A | | |
| B) Tare Weight, grams | N/A | N/A | | |
| C) Wet Soil + Tare, grams | N/A | N/A | | |
| D) Dry Soil + Tare, grams | N/A | N/A | | |
| E) Weight of Dry Soil, grams [D - B] | N/A | N/A | | |
| F) Weight of Moisture, grams [C - D] | N/A | N/A | | |
| G) Moisture Content, % [F * 100 / E] | N/A | N/A | | |
| (based on oven-dried weight) | | | | |
| | | | | |
| H) Tare No. | G | 9 | | |
| I) Weight of Tare, grams | 53.09 | 53.88 | | |
| J) Weight of Over-Dried Soil + Tare, grams | 177.11 | 135.77 | | |
| K) Weight of Oven- Dried Soil, grams [J - I] | 124.02 | 81.89 | | |
| L) Weight of Ignited Soil + Tare, grams | 176.04 | 134.81 | | |
| M) Ash, grams [L - I] | 122.95 | 80.93 | | |
| N) Ash Content, % [M *100 / K] | 99.1 | 98.8 | | |
| O) Organic Matter, % [100 - N] | **0.9** | **1.2** | | |

Remarks: Furnace temperature set @ 440° C

Equipment used:

oven: 5.1.16 muffle furnace 5.1.17
scales: 3.1.19

# COMPACTION TEST REPORT/ ASTM D-1557-02e1




**Curve No.**
**Composite A**

**Test Specification:**
ASTM D 1557-02 Method A Standard

**Preparation Method** Dry
**Hammer Wt.** 10 lb.
**Hammer Drop** 18 in (mechanical).
**Number of Layers** five
**Blows per Layer** 25
**Mold Size** .03316 cu.ft.

**Test Performed on Material Passing** No.4 **Sieve**

**NM** 12.7 **LL** 34 **PI** 22
**Sp.G. (ASTM D 854)** 2.659
**%>No.4** 0.0 **%<No.200** 46.4
**USCS** SC **AASHTO** A-6(6)
**Date Sampled** 1/20/08
**Date Tested** 3/17/08
**Tested By** AWH

**TESTING DATA**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **WM + WS** | 6141.3 | 6297.2 | 6287.6 | 6225.7 | | |
| **WM** | 4214.0 | 4214.0 | 4214.0 | 4214.0 | | |
| **WW + T #1** | 524.10 | 579.40 | 671.10 | 612.20 | | |
| **WD + T #1** | 489.60 | 527.20 | 596.10 | 531.60 | | |
| **TARE #1** | 6.70 | 6.70 | 6.90 | 6.80 | | |
| **WW + T #2** | N/A | N/A | N/A | N/A | | |
| **WD + T #2** | N/A | N/A | N/A | N/A | | |
| **TARE #2** | N/A | N/A | N/A | N/A | | |
| **MOISTURE** | 7.1 | 10.0 | 12.7 | 15.4 | | |
| **DRY DENSITY** | 119.6 | 125.8 | 122.3 | 115.9 | | |

**TEST RESULTS**

Maximum dry density = 126.0 pcf

Optimum moisture = 10.5 %

**Material Description**

Light Brown Clayey SAND

**Remarks:**
Natural Moisture Value determined after combining Bulk samples

**Project No.** 6468071777 **Client:** Bechtel
**Project:** Exelon Texas COL (Victoria)

● **Source:** TP-2319&TP2334 **Sample No.:** Comp-A **Elev./Depth:** NA

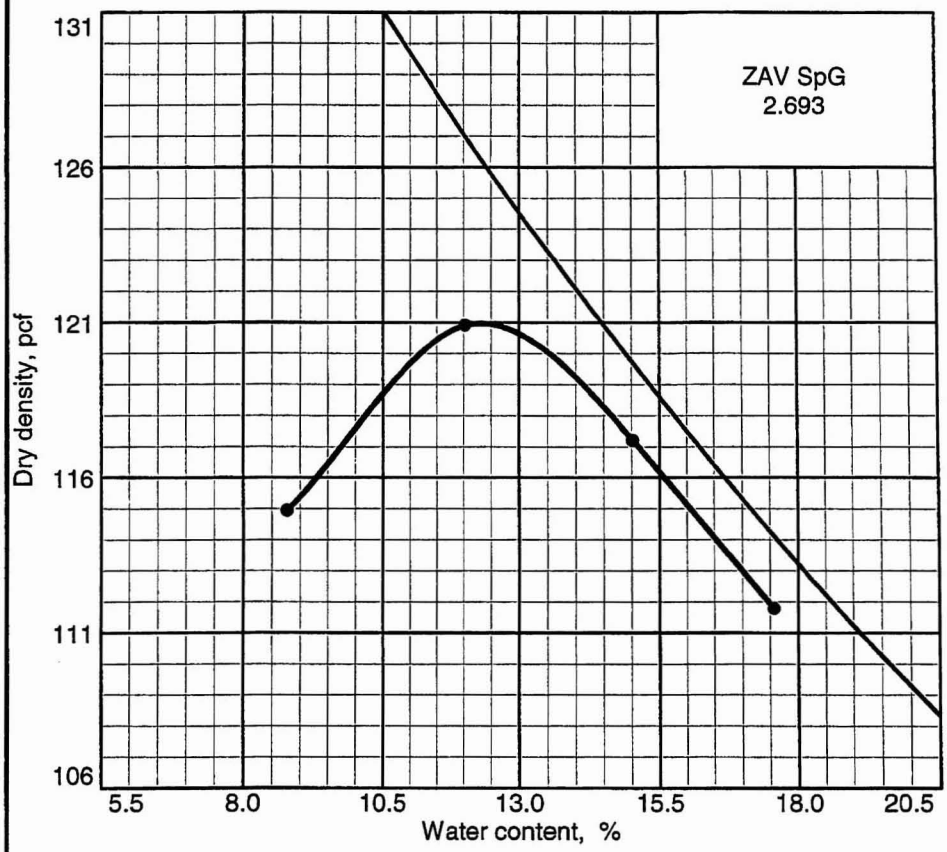
**Checked by:** LBJ
**Title:** LAB MANAGER

**MACTEC, Inc.**
**Raleigh, North Carolina**

Figure NA

KAW 4/10/08

# COMPACTION TEST REPORT/ ASTM D-1557-02e1




## Curve No.
## Composite B

**Test Specification:**
ASTM D 1557-02 Method A Standard

**Preparation Method** Dry
**Hammer Wt.** 10 lb.
**Hammer Drop** 18 in (mechanical).
**Number of Layers** five
**Blows per Layer** 25
**Mold Size** .03316 cu.ft.
**Test Performed on Material Passing** No.4 **Sieve**

**NM** 18.1 **LL** 44 **PI** 29
**Sp.G. (ASTM D 854)** 2.693
**%>No.4** 0.0 **%<No.200** 73.6
**USCS** CL **AASHTO** A-7-6(20)
**Date Sampled** 1/20/08
**Date Tested** 3/17/08
**Tested By** AWH

### TESTING DATA

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| WM + WS | 6095.0 | 6251.9 | 6242.2 | 6191.2 | | |
| WM | 4214.0 | 4214.0 | 4214.0 | 4214.0 | | |
| WW + T #1 | 535.20 | 526.60 | 641.70 | 576.00 | | |
| WD + T #1 | 492.60 | 470.80 | 558.80 | 490.90 | | |
| TARE #1 | 6.80 | 6.90 | 6.80 | 6.60 | | |
| WW + T #2 | N/A | N/A | N/A | N/A | | |
| WD + T #2 | N/A | N/A | N/A | N/A | | |
| TARE #2 | N/A | N/A | N/A | N/A | | |
| MOISTURE | 8.8 | 12.0 | 15.0 | 17.6 | | |
| DRY DENSITY | 114.9 | 120.9 | 117.2 | 111.8 | | |

**TEST RESULTS**

Maximum dry density = 121.0 pcf

Optimum moisture = 12.5 %

**Material Description**

Gray Lean CLAY with sand

**Remarks:**
Natural Moisture Value determined after combining bulk samples

**Project No.** 6468071777 **Client:** Bechtel
**Project:** Exelon Texas COL (Victoria)

● **Source:** TP-2317&2334 **Sample No.:** Comp-B **Elev./Depth:** NA

**Checked by:** LBJ
**Title:** LAB MANAGER

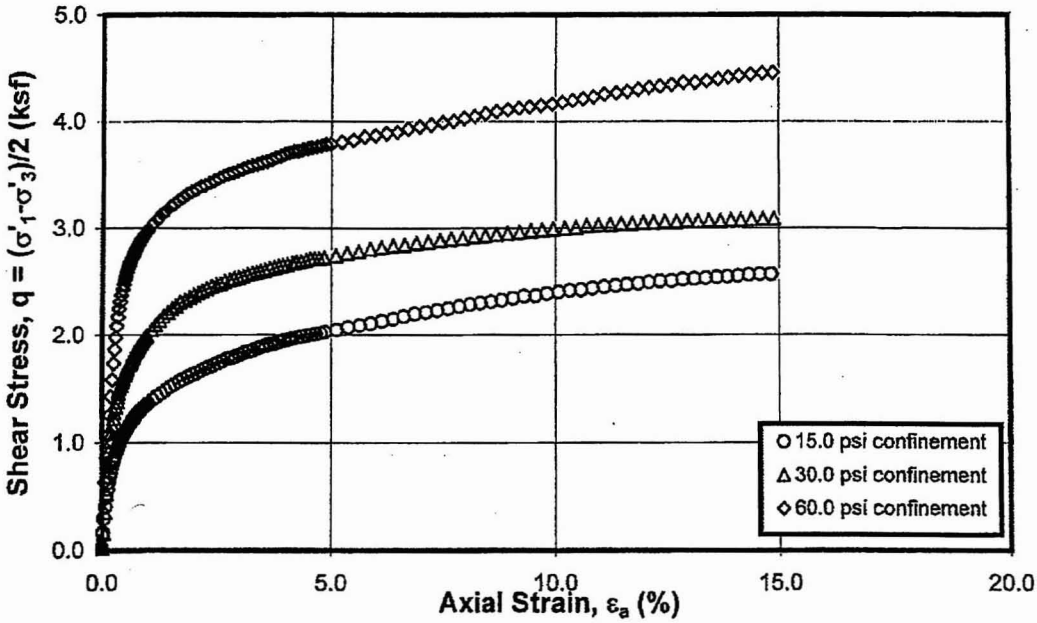
**MACTEC, Inc.**
**Raleigh, North Carolina**

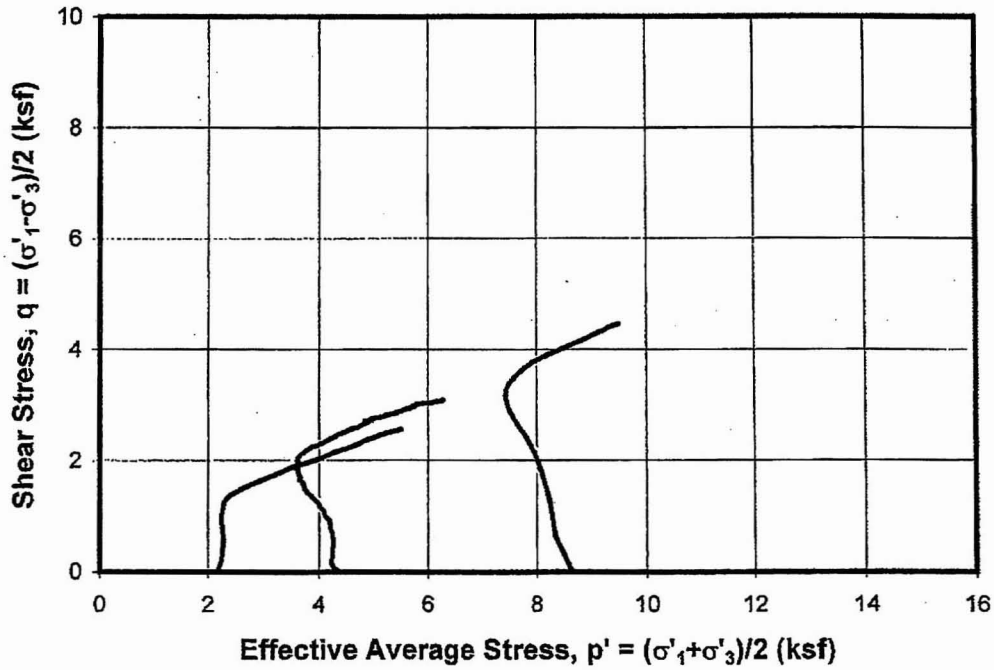
**Figure** NA



KAW 4/10/08
DCN# EXE808

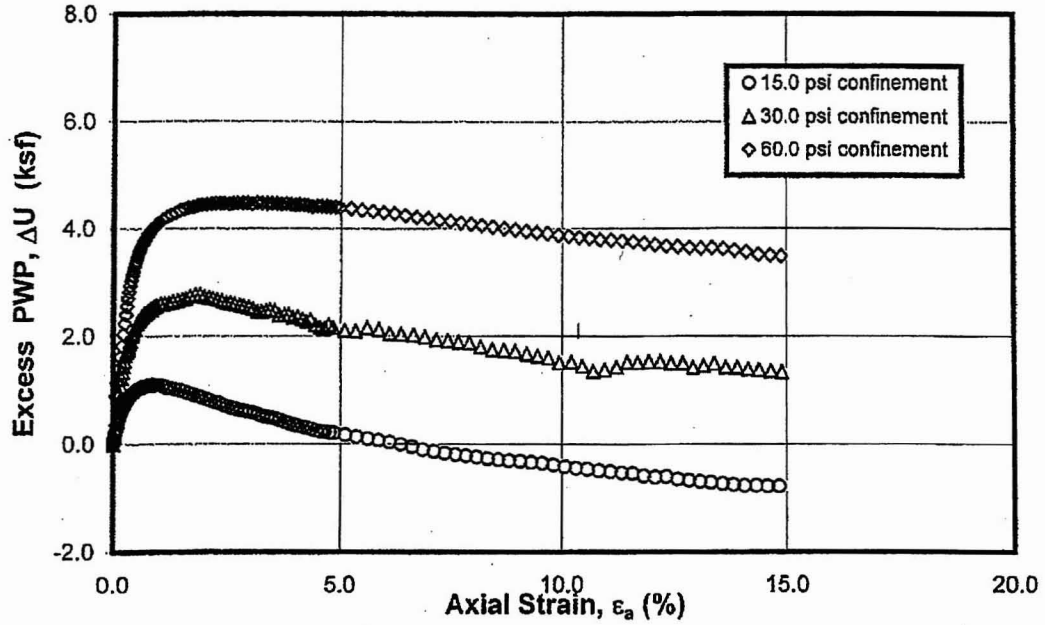
# Consolidation Undrained Triaxial Compression Test Results – Composite Soils

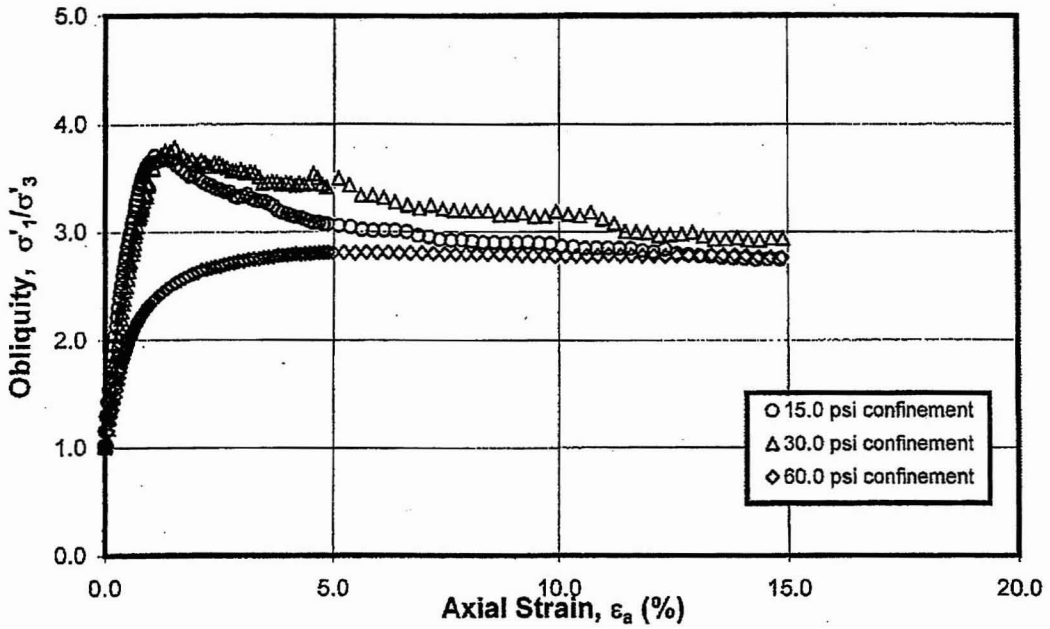



**MULTI STAGE UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. A - Depth: NA
Boring TP-2319 - TP-2334

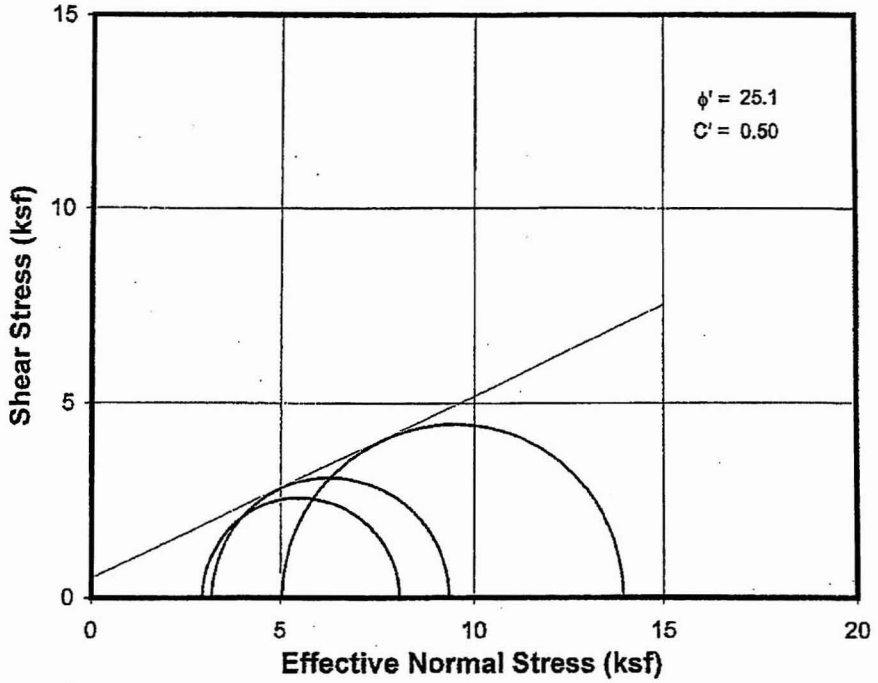
Reviewed By: WLD

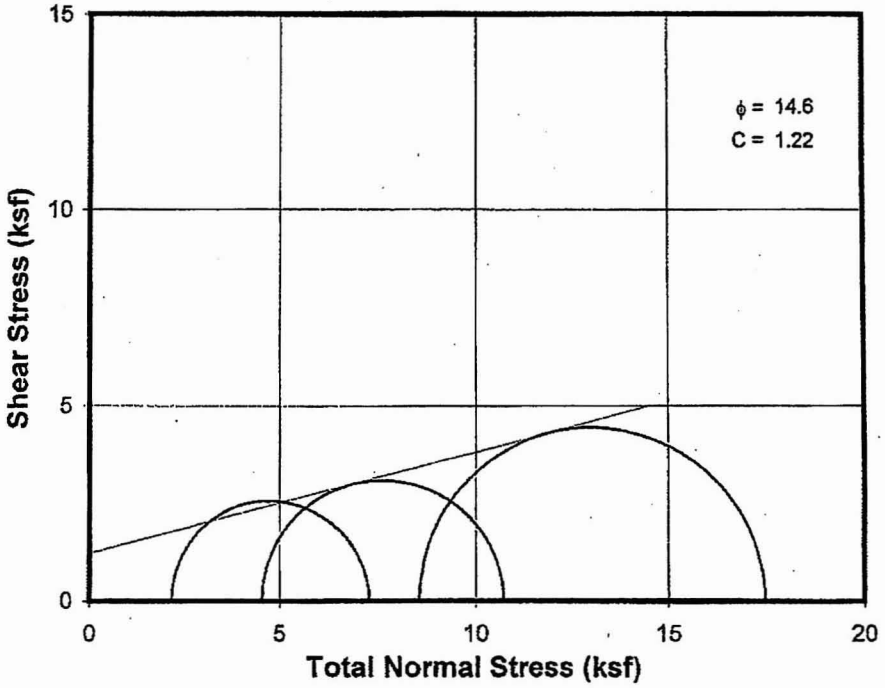



**MULTI STAGE UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. A - Depth: NA
Boring TP-2319 - TP-2334

Reviewed By: WLP



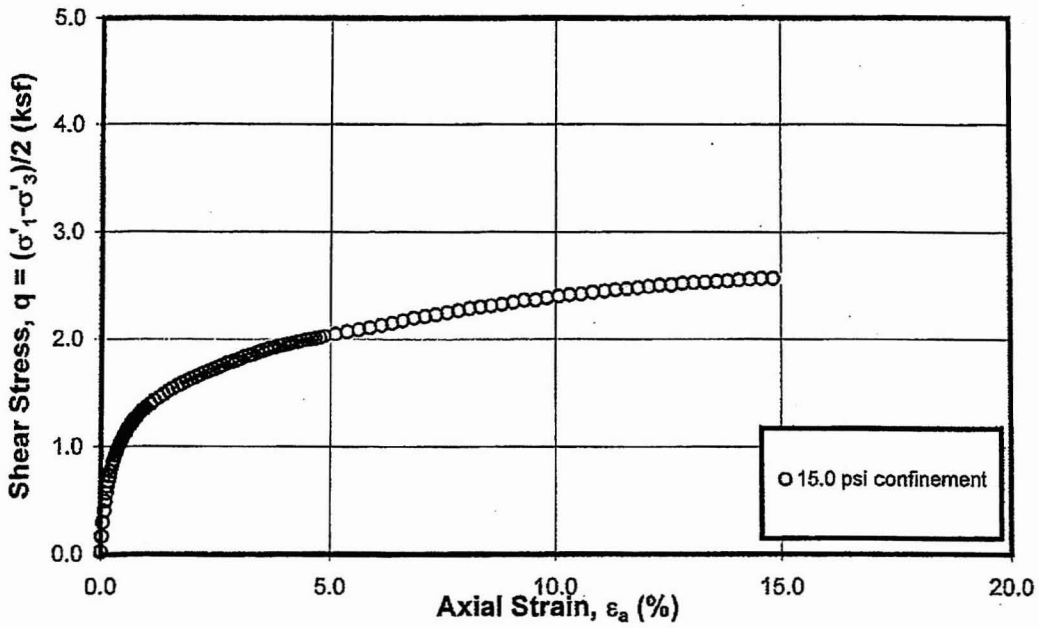

**MULTI STAGE UNDRAINED TRIAXIAL COMPRESSION TEST**

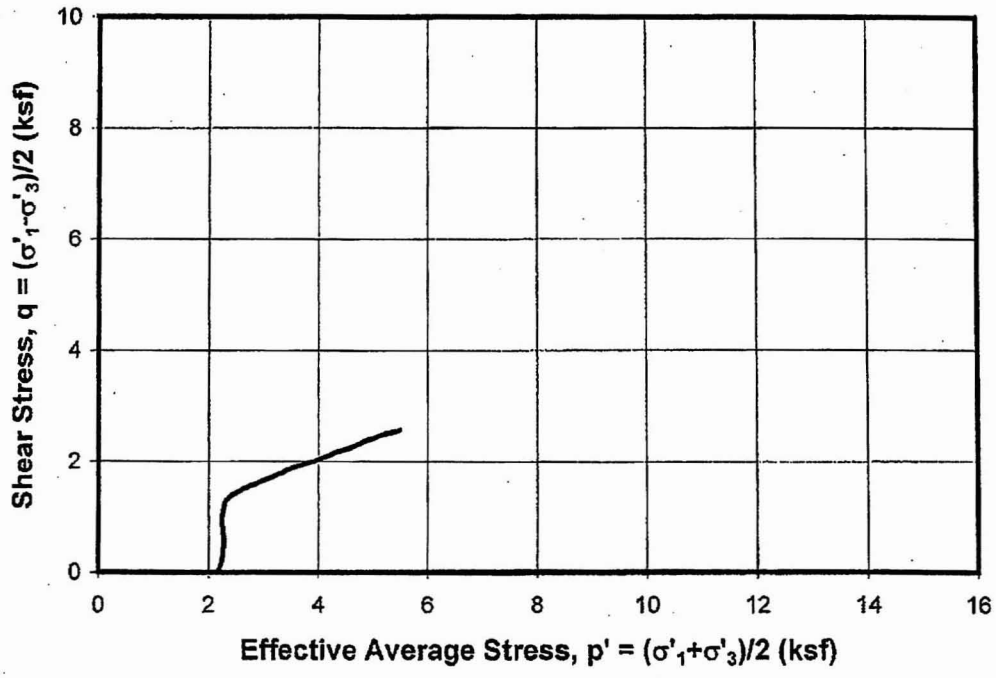
Isotropically Consolidated- Mohr's Circles

Sample: Comp. A - Depth: NA

Boring TP-2319 - TP-2334

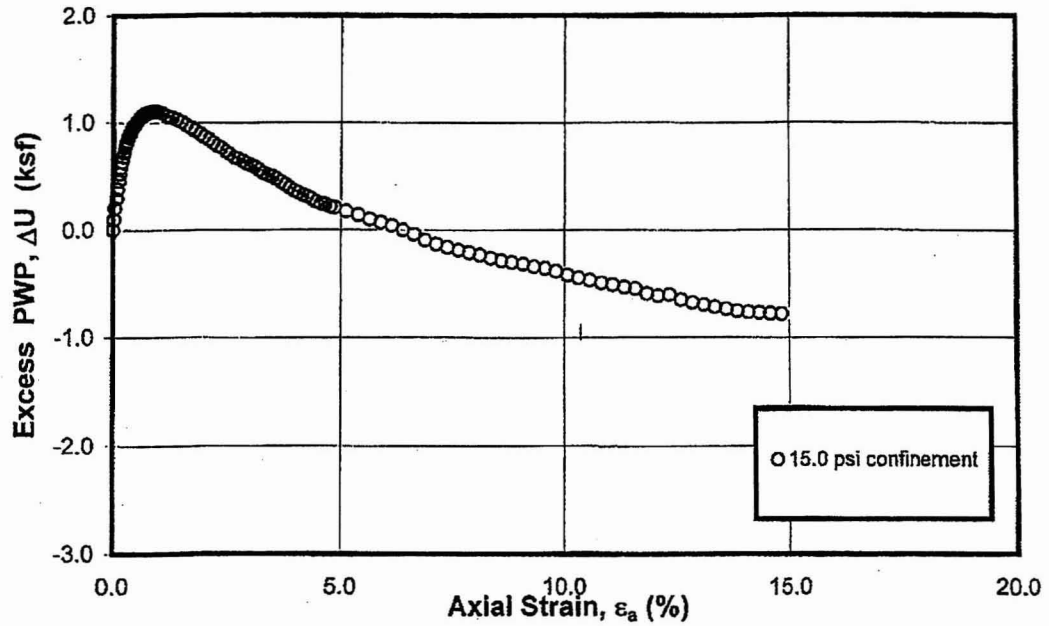
Reviewed By: WZD

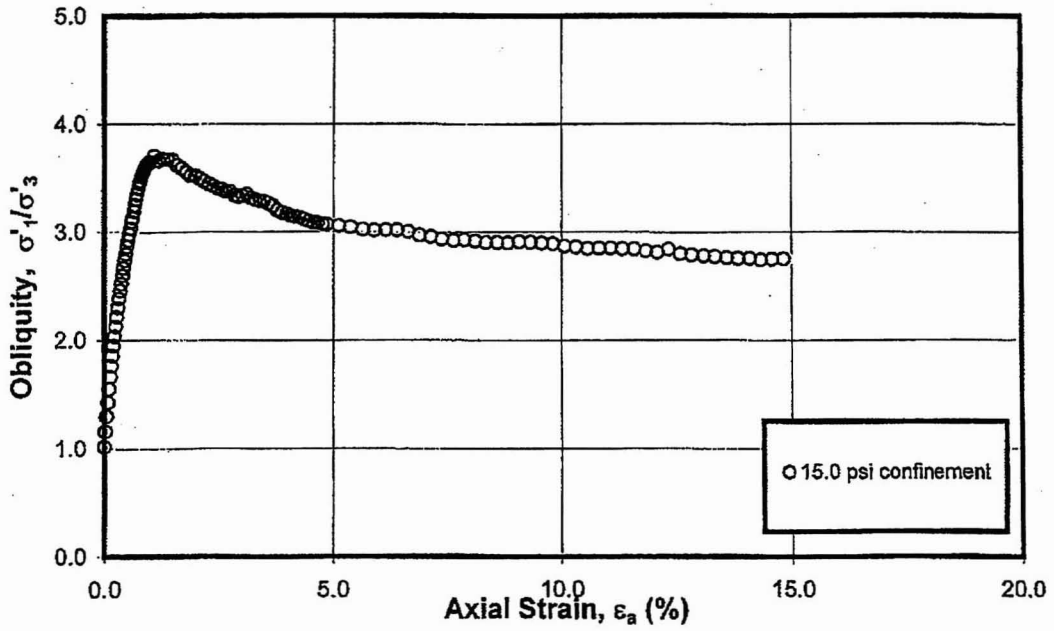



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. AA - Depth: NA
Boring TP-2319 - TP-2334

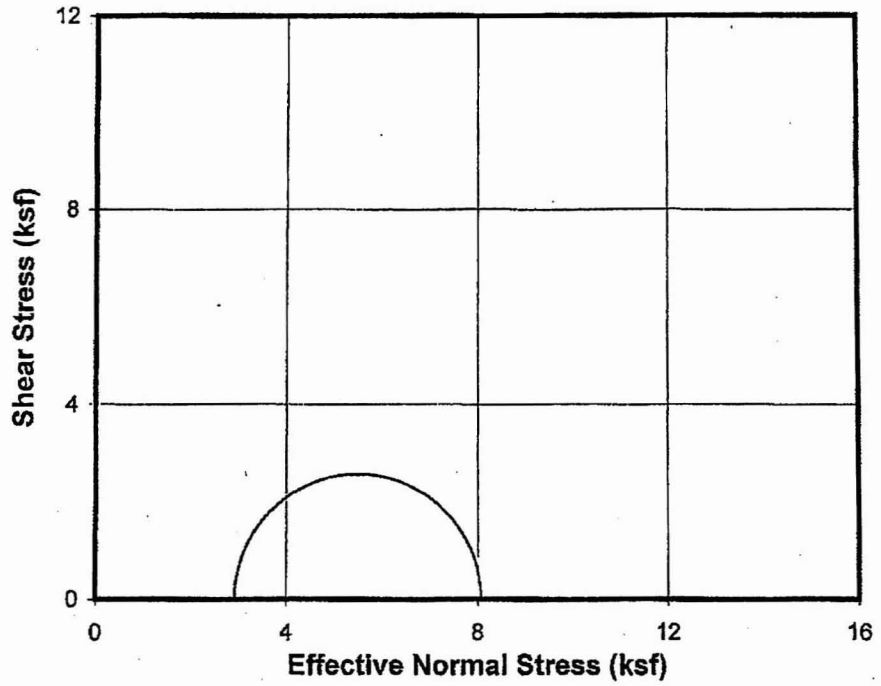
Reviewed By: WEP

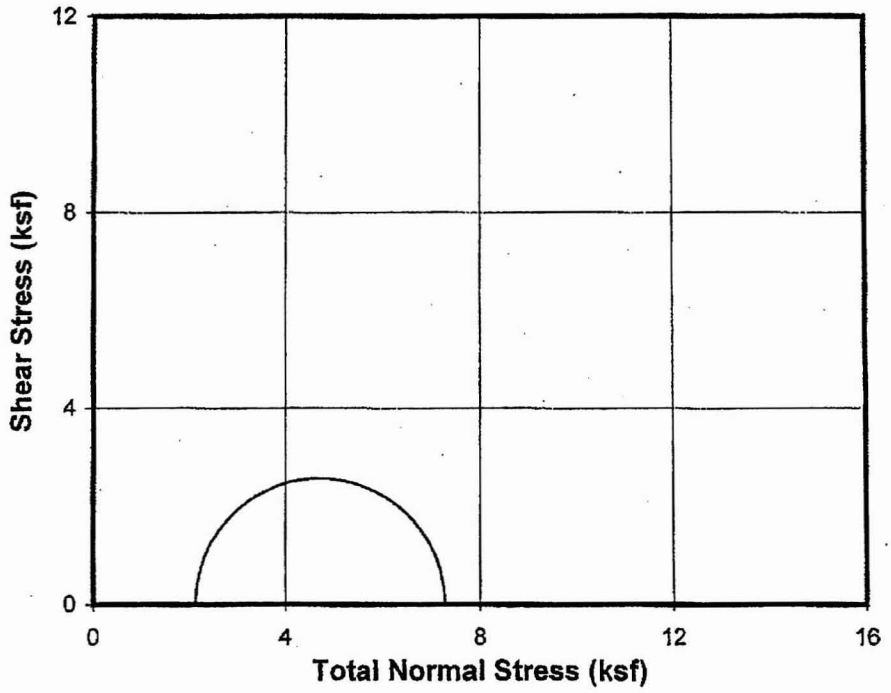



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. AA - Depth: NA
Boring TP-2319 - TP-2334

Reviewed By: WLP




**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated- Mohr's Circles
Sample: Comp. AA - Depth: NA
Boring TP-2319 - TP-2334

Reviewed By: WLR

# TRIAXIAL TEST (ASTM D 4767-04): Specimen Setup / Take Down

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | Cell No.: CYC-3 | File Name: Comp. Aa
Task No.: NA | Test Stress(es), $\sigma'_c$ or $\sigma'_{v,c}$ = 2.16 , _____ , _____ & _____ ksf
Project Name: Exelon (Victoria) | $k(\sigma'_{h,c}/\sigma'_{v,c})$ = 1.00 | Induced OCR = 1.00 | $K_{ua}(\sigma_{d,ua}/2\sigma'_{v,c})$ = NA

Assig. Remarks: _____ Specific Gravity: 2.659 [X] Meas.; [ ] Assumed

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [X] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = | 10-16 |
| Boring No.: TP-2319 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= 4.50 | No. Layers = | 4.00 |
| Sample No.: Comp. A | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = | 0.5-1 |
| Depth (ft): NA | Specimen No.: A | [ ] Kneading | [X] Undercompaction: $U_{ni}$ (%) = | Dia. (in.) = | 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD | % Comp. = 95% | ± Opt. = 4 % |

| | | | | |
|---|---|---|---|---|
| Type | [X] Isotropic | [ ] $K_o$ stress path | [ ] Used automated system: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/h) = |
| Consolidation : | [ ] Anistropic | [ ] 45° stress path | Remarks: | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading | [X] Static | [X] Undrained | [X] Comp. | [X] Strain | [ ] Stress | [X] Constant Cell Pressure | [ ] Cyclic (Hz) | [ ] Stress | [ ] Strain |
| Conditions : | [ ] Post Cyclic | [ ] Drained | [ ] Ext. | [ ] Stress Path | | [ ] Variable Cell Pressure | Rate: [ ] 0.1; | [ ] 1; | Other: |

| Water Content (WC); | Initial - Trimming Location | | | Final, $W_{at}$ |
|---|---|---|---|---|
| | Top ($W_{o,1}$) | Bottom ($W_{o,2}$) | Sides ($W_{o,3}$) | (see below) |
| Container No | 685 | | | 115 |
| Mass Moist Soil + Cont. (g) | 114.15 | | | 129.11 |
| Mass Dry Soil + Container (g) | 103.73 | | | 115.77 |
| Mass Container (g) | 31.63 | | | 31.72 |
| Water Content, $W_{o,n}$ (%) | 14.45 | | | 15.87 |
| Avg. Initial WC, $W_{o,avg}$ (%) | 14.45 | Final ($W_{at}$); | [X] Slice ; | Whole Spec. |
| [ ] See attached data sheet(s) for additional water contents | | | | |

| SOIL MASSES: | Initial | Final |
|---|---|---|
| Moist + Tare (etc.)(g) | 988.47 | 511.03 |
| Tare (etc.) (g) | 484.24 | 0.00 |
| Mass Moist Spec., $M_{tn}$ (g) | 504.23 | 511.03 |
| Excess Dry Soil (soil not included in final mass measurement) | | |
| Container No | | |
| Mass Dry Soil + Cont. (g) | | |
| Mass Container (g) | | |
| Mass Excess Dry Soil, $M_{d,es}$ (g) | | 0.00 |

## Specimen Dimensions, (mm)

| | Height | | | Dia., X indicates with membrane | | |
|---|---|---|---|---|---|---|
| | Initial ($H_o$) | Final ($H_{at}$) | | Initial ($D_o$) | Final ($D_{at}$) | |
| GB | 100.000 | 100.000 | 1 T | 50.29 | 52.85 | [ ] For |
| 1 | 15.74 | -0.32 | 2 M | 50.28 | 58.15 | Wedge |
| 2 | 15.86 | -0.60 | 3 B | 50.24 | 52.63 | Failure |
| 3 | 18.92 | -0.22 | 1'T | | | = $d_{max}$ |
| 4 | 15.88 | -0.26 | 2'M | | | = $d_{min}$ |
| 5 | 15.90 | -0.50 | 3'B | | | = $\Delta d$ |
| Avg. | 116.46 | 99.62 | Avg. | 50.27 | 54.54 | xxxxx |

Measuring Devices:
Pi Tape: [X] Dia
Calipers: [ ] Ht.; [ ] Dia
Dial Comparator [X] Ht.; [ ] Dia
Remarks: ID# PI-002

| | |
|---|---|
| $A_o = \pi D^2/400$ (cm²) | 19.85 |
| $V_o$ (cm³) | 231.14 |
| $A_{atb,m} = \pi (D^*_{at})^2/400$ (cm²) | 24.14 |
| $A_{atw,m} = (d_{min} - 2\Delta d) d_{max} \pi/400$ (cm²) | NA |
| $D^*_{at} = (D_T + 2D_M + D_B)/4$ (mm) | 55.45 |

## Estimated Initial Unit Weight

Total, $\gamma_{t,o}$ (lb/ft³) = 136.18 | Dry, $\gamma_{d,o}$ (lb/ft³)= 118.99

## Membrane / Filter Paper / Apparatus

| Membrane (mm): | | Top | Bottom |
|---|---|---|---|
| Number: | Thickness: | 0.75 | 0.65 |
| = 1 | [ ] Single; [X] Double | 0.68 | 0.64 |
| | Circumference ($C_{rm,o}$) | 152.0 | 152.0 |
| | | Total Thickness | Dia.($C_{rm,o}/\pi$) |
| | Average: | 0.34 | 48.38 |

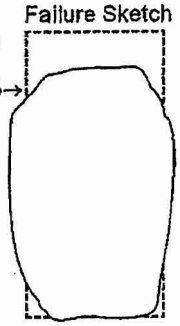
Filter Paper: Top + Bottom: [X] Yes ; [ ] No
Filter Strips: [X] Yes ; [ ] No Number = 8
Type of Filter Strips [ ] Vertical: ¼ in. & Whatman #54
[X] Spiral: ¼ in. & Whatman #1

Apparatus: Mass Top Cap, $M_{tc}$ = 53.4 g, 0.12 lbf
Mass Displ. System, $M_{ds}$ (cap, dial, piston, etc.) = NA g, NA lbf

[ ] Photo Taken.

Failure Sketch

$\varepsilon_a$=
20%→



Failure Mode:
[X] Bulge
[ ] Wedge
[ ] Parabolic
Wedge/Bulge Ht.= NA (mm)

NA - Not Applicable
GB - Gage Block
Other Remarks:
LL=34 PL=12 PI=22

Top Cap Attached: [ ] Yes; [X] No;
Piston Dia.(in.): [X] ½; [ ] ¾; [ ]
Load Cell: [ ] External [X] Internal
Top Cap - Rotation [ ] Fixed,<1°; [X] Limited,<5°; [ ] Unlimited, >5°
With: [ ] Frictionless End Caps; [ ] Lat. Movement Top Cap
[ ] Internal LVDT Jacket

Final Visual Classification: Light Brown Clayey SAND (SC)

Trimmed / Reconstituted By: RC,jr | Set Up By: RC,jr | Taken Down By: RC,jr
Date: 6/14/2008 | Date: 6/14/2008 | Date: 6/30/2008
Prelim. Calc. By: RC,jr | Final Calc. By: TP | Reviewed By: WTH

[ ] See more detailed sketch on attached sheet. Remarks:

# MULTISTAGE TRIAXIAL TEST: Specimen Calculations & Summary(1)

Project Number: 0411-08-1686 Cell No.: CYC-3 File Name: Comp. Aa
Task Number: NA Specific Gravity: 2.659 [X] Measured; [ ] Assumed
Boring No.: TP-2319 - TP-2334 Sample No.: Comp. A Specimen No.: A Depth (ft): NA
Type Test: CIU Triaxial Specimen: [ ] "Undisturbed"; [ ] Reconstituted; [X] Recompacted
Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = _____ ppm

| | Inital Water Contents (WC), ($W_o$) over Saturation, ($S_o$), in (%): | | | | | | Calculated Mass of Dry Soil (g) | |
|---|---|---|---|---|---|---|---|---|
| | Top, $W_{o,1}$ | Botttom, $W_{o,2}$ | Sides, $W_{o,3}$ | Avg., $W_{o,avg}$ | Selct., $W_{o,s}$ | Back Cal., $W_{o,bc}$ | Initial Selected WC, $w_o$ (%) | 14.45 |
| $W_c$ | 14.45 | | | 14.45 | 14.45 | 124.13 | Initial , $M_{d,o}$ | 440.57 |
| $S_o$ | 97.9 | | | 97.9 | 97.9 | 844.0 | Final, $M_{d,at}$ | 441.03 |
| | Measured final mass of moist soil, $M_{t,at}$ (g) | | | | | 511.03 | Selected, $M_d$ | 441.03 |
| | Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g) | | | | | 511.03 | | |

| Consolidation Data | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | |
|---|---|---|---|---|---|---|---|---|
| Changes in Height (mm) and Volume ($cm^3$) Within Given Consolidation Stages/Columns | At Initial Seating Stress | During Back-Pressuring | 1st Consol. Increment (1) | Column 2 or 3 to 1st Test Stage (1) | Column 4 to 2nd Test Stage | Column 5 to 3rd Test Stage | Column 6 to 4th Test Stage | |
| Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec. | | | | | | | | |
| Change in Height, $\Delta H_{c,n}$ | 0.02 | -0.94 | | 0.69 | NA | NA | NA | |
| Sum of changes in (+ out) | 0.03 | | | 4.10 | NA | NA | NA | |
| burette readings, $\Delta b_{r,n}$ (- in) | | -7.50 | NA | 16.67 | NA | NA | NA | (2) |
| Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$ | 0.12 | -5.60 | | 4.11 | NA | NA | NA | |
| Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$ | 0.50 | 0.50 | | 1.00 | NA | NA | NA | |
| Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$ | 0.06 | -2.80 | NA | 0.00 | NA | NA | NA | (3) |
| Selected $\Delta V_{c,n}$ | 0.12 | -7.50 | | 4.10 | NA | NA | NA | |

| Summary For Test Stages | | | | | |
|---|---|---|---|---|---|
| Test Stage: | 1st = 1 | 2nd = 2 | 3rd = 3 | 4th = 4 | |
| Cell Pressure, $\sigma_{c,n}$ (psi) | 75.00 | NA | NA | NA | Number of |
| Back Pressure, $U_{b,n}$ (psi) | 60.00 | NA | NA | NA | Test Stages = 1 |
| Axial Force Reading, $P_{r,n}$ (lbf) | 1.00 | NA | NA | NA | $t_{50}$ = 200 min |
| Eff. Consol. Stress ($\sigma'_c$ or $\sigma'_{v,c}$) (4), (ksf) | 2.20 | NA | NA | NA | |
| $t_c$, ON or in [X] days [ ] hrs | 2.00 | NA | NA | NA | |

**At Final Test Stress/Stage - Summary of Calculation of $\Delta V_c$ ($cm^3$) by Different Procedures**

| By Selected Volumes | By Saturation = 100 % | By Change in Mass (5) | For Diff. in Meas. Vol. ($V_o$-$V_{at}$), | For Selected $\Delta V_c$, required |
|---|---|---|---|---|
| $\Delta V_c$ = -3.28 | $\Delta V_c$ = -5.14 | $\Delta V_c$ = 0.69 | & corr. for $\Delta H_{td}$ $\Delta V_c$= | $G_s$ for $S_c$ = 100 %: 2.689 |

**At Final Test Stress/Stage - Consolidation Conclusions**

| | | | | |
|---|---|---|---|---|
| $\Delta H_{c,f}$ (mm) = -0.23 | $\Delta V_{c,f}$ ($cm^3$) = -3.28 | Back Cal. $G_s$ for S=100% = 2.689 | Normalized | Ht. Ch. (%) = -0.35 |
| $\varepsilon_{ac,c}$ (%) = -0.20 | $\varepsilon_{vc,f}$ (%) = -1.42 | | Diff. in: | Vol. Ch. (%) = |

**Summary of Specimen Physical Properties**

| Specific Gravity: $G_s$ = 2.659 Measured Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Volumetric Water Content | Porosity n | Skempton B para-meter %(6) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial: | 116.46 | 231.14 | 19.85 | 14.33 | 136.18 | 119.11 | 97.4 | 0.391 | 0.2739 | 0.281 | 97.0 |
| After Consol.: to 1st $\sigma'_c$ | 116.69 | 234.42 | 20.09 | 15.87 | 136.09 | 117.45 | 102.7 | 0.411 | 0.2991 | 0.291 | |
| to 2nd $\sigma'_c$ | | | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | | | |

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.
(2) The height changes occuring within each shearing and unloading stage (1 - 4) are recorded in these rows (after Column 3).
(3) The volume changes occuring within each shearing and unloading stage (1 - 4) are calculated/recorded in these rows (after Column 3).
(4) Stresses are corrected for membrane. (5) ~ $M_{t,o}$-($M_{tat,c}$+$\rho_{water}$x$\Delta V_{in,column1\&2}$)
(6) Initial value is after back pressuring
NA - Not Applicable ON - Over Night; WC - Water Content Remarks: Wet Method used in the Saturation Stage
Calculated By: TP Reviewed By: WFD

## MULTISTAGE TRIAXIAL TEST: Specimen Calculations Summary(2)

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | App. No.: CYC-3 | File Name: Comp. Aa
Project Name: Exelon (Victoria) | Task No.: NA | Test No.: 0 | Test Series for: 0

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [X] Tamping | [X] Constant Effort: | Blows/Tamps per Layer = | 10-16 |
| Boring No.: TP-2319 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= | 4.50 | No. Layers = 4.00 |
| Sample No.: Comp. A | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | | Drop (in.) = 0.5-1 |
| Depth (ft): NA | Specimen No.: A | [ ] Kneading | [X] Undercompaction: | $U_{pl}$ (%) = | Dia. (in.) = 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD | % Comp. = 95% | ± Opt. = 4 % |

| | | | | | |
|---|---|---|---|---|---|
| Type Consolidation | [X] Isotropic / [ ] Anistropic | [ ] $K_o$ stress path / [ ] 45° stress path | [ ] Used automated system | Remarks: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/hr.)= |
| Loading Conditions: | [X] Static / [ ] Post Cyclic | [X] Undrained / [ ] Drained | [X] Comp. / [ ] Ext. | [X] Strain [ ] Stress / [ ] Stress Path | [X] Constant Cell pressure / [ ] Variable Cell pressure |
| [ ] Cyclic (Hz) Rate: [ ] 0.1; | [ ] Stress [ ] Strain / [ ] 1; Other: | | | | |

| Specific Gravity: $G_s$ = 2.659 Measured / Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Skempton B parameter %(1) |
|---|---|---|---|---|---|---|---|---|---|
| Initial: | 116.46 | 231.14 | 19.85 | 14.33 | 136.18 | 119.11 | 97.41 | 0.39 | 97.0 |
| After Consol.: to 1st $\sigma'_c$ | 116.69 | 234.42 | 20.09 | 15.87 | 136.09 | 117.45 | 102.71 | 0.41 | |
| to 2nd $\sigma'_c$ | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | |

Unit for Stresses: (ksf)

### Consolidation Stress Summary and Loading Summary

| Item | Unit | 1st Stage | 2nd Stage | 3rd Stage | 4th Stage |
|---|---|---|---|---|---|
| Axial Strain during Consol., $\varepsilon_{a,c}$: | % | -0.197 | NA | NA | NA |
| Vol. Strain during Consol., $\varepsilon_{v,c}$: | % | -1.419 | NA | NA | NA |
| Effective Vertical Stress, $\sigma'_v$: | (ksf) | 2.202 | NA | NA | NA |
| Effective Horizontal Stress, $\sigma'_h$: | (ksf) | 2.156 | NA | NA | NA |
| Consol. Stress Ratio, k ($\sigma'_h$ / $\sigma'_v$): | - | 0.979 | | | |
| Induced OCR: | - | 1.00 | NA | NA | NA |
| Eff. Average Stress, ($\sigma'_v$ + $\sigma'_h$)/2: | (ksf) | 4.358 | | | |
| Eff. Mean Stress, ($\sigma'_v$ + 2*$\sigma'_h$)/3: | (ksf) | 2.171 | | | |
| Undr. Ambient Shear Stress, $\tau_a$: | (ksf) | NA | NA | NA | NA |
| Undr. Ambient Shear Strain, $\varepsilon_{a,ua}$ | % | NA | NA | NA | NA |

Notes: See Fugro South, Inc. Notation Listing for definition of symbols and acronyms.

(1) Initial B is after saturation

NA - Not Applicable

### Membrane Correction

Type: Bulge
Modulus: 150.0 psi
Diameter: 48.38 mm
Thickness: 0.34 mm

### Area Correction

Type: Bulge

| Stage | Area Corr. Const.: | Final Area ($cm^2$): |
|---|---|---|
| 1st | 1.246 | 24.14 |
| 2nd | | |
| 3rd | | |
| 4th | | |

### Filter Paper Correction

Type: None | Type Strips: Sprial #1
Strips: 8
Force: 0.000 lbf/strip

Final Visual Description and Remarks: Light Brown Clayey SAND (SC)

### Loading Summary

| Stage | Stress Status | $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | ΔU (ksf) | $\sigma_1'$ (ksf) | $\sigma_3'$ (ksf) |
|---|---|---|---|---|---|---|---|
| 1st | Max Shear Stress | 14.83 | 2.568 | 5.499 | -0.781 | 8.066 | 2.931 |
| | Max Obliquity | 1.07 | 1.396 | 2.429 | 1.087 | 3.825 | 1.033 |
| 2nd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 3rd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 4th | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |

Remarks: Stain Rate (%/min) =2.00E-03

# STAGE 1

Project: 0411-08-1686 Boring No.: TP-2319 - TP-2334 Depth (ft.): NA

Test Type: CIU Triaxial Sample No.: Comp. A Stage No.: 1

Specimen No.: A

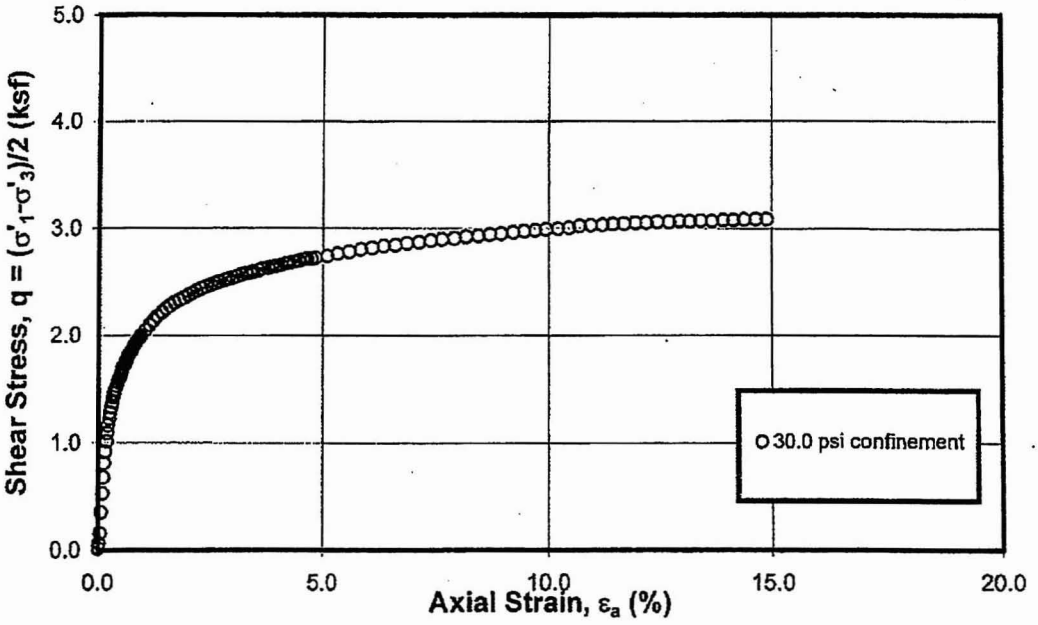
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, ΔU (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.000 | 0.023 | 2.179 | 0.000 | 0.000 | 1.022 | 0.000 | - | - |
| 12.5 | 0.021 | 0.167 | 2.230 | 0.098 | 0.000 | 1.162 | 0.323 | 1337.3 | 1295.5 |
| 25.0 | 0.042 | 0.296 | 2.257 | 0.205 | 0.000 | 1.302 | 0.357 | 1296.3 | 997.3 |
| 37.5 | 0.071 | 0.402 | 2.262 | 0.291 | 0.000 | 1.432 | 0.390 | 1071.9 | 784.9 |
| 50.0 | 0.093 | 0.493 | 2.275 | 0.382 | 0.000 | 1.553 | 0.398 | 1014.3 | 710.0 |
| 62.5 | 0.118 | 0.569 | 2.282 | 0.456 | 0.000 | 1.665 | 0.405 | 921.7 | 591.7 |
| 75.0 | 0.140 | 0.632 | 2.278 | 0.523 | 0.000 | 1.767 | 0.418 | 872.0 | 518.3 |
| 87.5 | 0.162 | 0.682 | 2.267 | 0.581 | 0.000 | 1.860 | 0.433 | 812.7 | 420.6 |
| 100.0 | 0.186 | 0.729 | 2.261 | 0.635 | 0.000 | 1.951 | 0.442 | 759.6 | 393.2 |
| 112.5 | 0.207 | 0.771 | 2.256 | 0.683 | 0.000 | 2.039 | 0.449 | 720.8 | 363.9 |
| 125.0 | 0.232 | 0.813 | 2.253 | 0.720 | 0.000 | 2.129 | 0.453 | 680.3 | 331.0 |
| 137.5 | 0.256 | 0.852 | 2.251 | 0.767 | 0.000 | 2.217 | 0.456 | 646.8 | 300.0 |
| 150.0 | 0.281 | 0.886 | 2.250 | 0.804 | 0.000 | 2.300 | 0.459 | 613.9 | 263.3 |
| 162.5 | 0.308 | 0.920 | 2.246 | 0.829 | 0.000 | 2.387 | 0.463 | 582.2 | 243.3 |
| 175.0 | 0.331 | 0.947 | 2.245 | 0.864 | 0.000 | 2.459 | 0.465 | 558.1 | 224.8 |
| 187.5 | 0.354 | 0.972 | 2.245 | 0.890 | 0.000 | 2.526 | 0.465 | 535.4 | 216.0 |
| 200.0 | 0.380 | 1.000 | 2.250 | 0.913 | 0.000 | 2.600 | 0.464 | 514.1 | 210.7 |
| 212.5 | 0.403 | 1.023 | 2.250 | 0.931 | 0.000 | 2.668 | 0.465 | 496.2 | 199.6 |
| 225.0 | 0.427 | 1.047 | 2.251 | 0.955 | 0.000 | 2.739 | 0.465 | 479.3 | 191.3 |
| 237.5 | 0.451 | 1.069 | 2.258 | 0.971 | 0.000 | 2.799 | 0.462 | 463.5 | 178.2 |
| 250.0 | 0.475 | 1.089 | 2.257 | 0.980 | 0.000 | 2.866 | 0.463 | 449.1 | 163.4 |
| 262.6 | 0.501 | 1.110 | 2.262 | 1.002 | 0.000 | 2.926 | 0.462 | 434.0 | 137.7 |
| 275.1 | 0.529 | 1.127 | 2.266 | 1.014 | 0.000 | 2.978 | 0.461 | 416.9 | 139.0 |
| 287.6 | 0.552 | 1.145 | 2.270 | 1.021 | 0.000 | 3.033 | 0.459 | 406.4 | 157.6 |
| 300.1 | 0.576 | 1.164 | 2.274 | 1.036 | 0.000 | 3.095 | 0.458 | 395.8 | 131.5 |
| 312.6 | 0.602 | 1.177 | 2.283 | 1.047 | 0.000 | 3.129 | 0.455 | 383.4 | 117.9 |
| 325.1 | 0.624 | 1.192 | 2.278 | 1.058 | 0.000 | 3.194 | 0.458 | 374.3 | 138.1 |
| 337.6 | 0.647 | 1.209 | 2.281 | 1.062 | 0.000 | 3.253 | 0.457 | 366.3 | 121.6 |
| 350.1 | 0.673 | 1.221 | 2.281 | 1.075 | 0.000 | 3.304 | 0.457 | 355.8 | 116.5 |
| 362.6 | 0.694 | 1.235 | 2.286 | 1.081 | 0.000 | 3.351 | 0.456 | 349.3 | 130.3 |
| 375.1 | 0.720 | 1.251 | 2.291 | 1.084 | 0.000 | 3.406 | 0.454 | 341.3 | 117.4 |
| 387.6 | 0.743 | 1.264 | 2.297 | 1.090 | 0.000 | 3.448 | 0.452 | 334.0 | 99.3 |
| 400.1 | 0.770 | 1.276 | 2.307 | 1.095 | 0.000 | 3.474 | 0.449 | 325.5 | 90.9 |
| 412.6 | 0.794 | 1.287 | 2.311 | 1.098 | 0.000 | 3.514 | 0.448 | 318.3 | 97.9 |
| 425.1 | 0.817 | 1.299 | 2.321 | 1.095 | 0.000 | 3.541 | 0.444 | 312.3 | 104.4 |
| 437.6 | 0.844 | 1.314 | 2.337 | 1.102 | 0.000 | 3.567 | 0.439 | 305.6 | 95.3 |
| 450.1 | 0.868 | 1.323 | 2.345 | 1.103 | 0.000 | 3.591 | 0.436 | 299.7 | 79.1 |
| 462.6 | 0.895 | 1.333 | 2.354 | 1.096 | 0.000 | 3.614 | 0.433 | 292.8 | 77.9 |

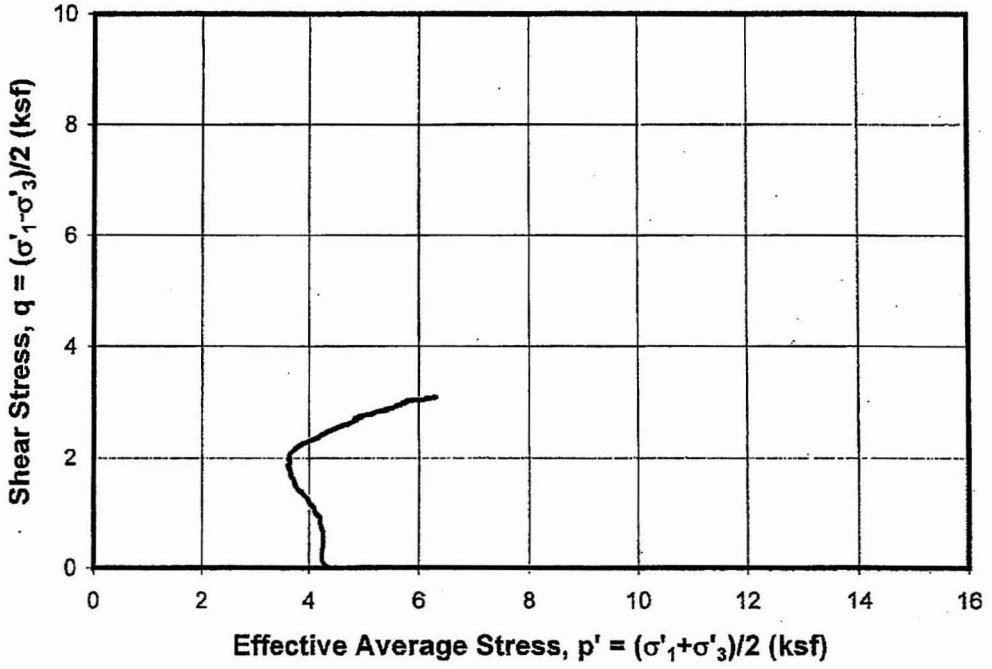
# STAGE 1

| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 475.1 | 0.918 | 1.343 | 2.365 | 1.100 | 0.000 | 3.627 | 0.430 | 287.5 | 71.1 |
| 487.6 | 0.943 | 1.350 | 2.377 | 1.101 | 0.000 | 3.631 | 0.425 | 281.5 | 71.2 |
| 500.1 | 0.968 | 1.361 | 2.389 | 1.099 | 0.000 | 3.646 | 0.421 | 276.3 | 76.5 |
| 550.1 | 1.067 | 1.396 | 2.429 | 1.087 | 0.000 | 3.703 | 0.409 | 257.4 | 70.5 |
| 600.1 | 1.164 | 1.430 | 2.506 | 1.058 | 0.000 | 3.657 | 0.384 | 241.6 | 64.1 |
| 650.1 | 1.263 | 1.459 | 2.551 | 1.046 | 0.000 | 3.672 | 0.370 | 227.3 | 58.4 |
| 700.1 | 1.361 | 1.487 | 2.601 | 1.028 | 0.000 | 3.670 | 0.356 | 215.2 | 58.4 |
| 750.1 | 1.461 | 1.517 | 2.656 | 1.008 | 0.000 | 3.663 | 0.340 | 204.5 | 52.7 |
| 800.1 | 1.560 | 1.540 | 2.716 | 0.979 | 0.000 | 3.619 | 0.323 | 194.4 | 48.5 |
| 850.1 | 1.662 | 1.565 | 2.775 | 0.953 | 0.000 | 3.589 | 0.307 | 185.6 | 47.9 |
| 900.1 | 1.759 | 1.588 | 2.831 | 0.925 | 0.000 | 3.552 | 0.291 | 177.8 | 44.3 |
| 950.1 | 1.856 | 1.608 | 2.886 | 0.894 | 0.000 | 3.518 | 0.277 | 170.8 | 43.1 |
| 1000.1 | 1.951 | 1.629 | 2.922 | 0.865 | 0.000 | 3.519 | 0.269 | 164.6 | 40.8 |
| 1050.1 | 2.050 | 1.648 | 2.971 | 0.843 | 0.000 | 3.491 | 0.256 | 158.5 | 39.4 |
| 1100.1 | 2.146 | 1.667 | 3.022 | 0.813 | 0.000 | 3.462 | 0.244 | 153.2 | 41.1 |
| 1150.1 | 2.243 | 1.688 | 3.071 | 0.783 | 0.000 | 3.440 | 0.232 | 148.4 | 34.7 |
| 1200.1 | 2.338 | 1.701 | 3.103 | 0.764 | 0.000 | 3.425 | 0.224 | 143.5 | 35.6 |
| 1250.1 | 2.433 | 1.722 | 3.155 | 0.730 | 0.000 | 3.401 | 0.213 | 139.6 | 38.6 |
| 1300.1 | 2.531 | 1.738 | 3.190 | 0.707 | 0.000 | 3.394 | 0.205 | 135.5 | 36.3 |
| 1350.1 | 2.626 | 1.757 | 3.238 | 0.676 | 0.000 | 3.372 | 0.195 | 132.0 | 40.9 |
| 1400.1 | 2.724 | 1.777 | 3.275 | 0.663 | 0.000 | 3.374 | 0.188 | 128.8 | 30.7 |
| 1450.1 | 2.821 | 1.786 | 3.315 | 0.639 | 0.000 | 3.337 | 0.178 | 125.0 | 24.3 |
| 1500.1 | 2.915 | 1.800 | 3.349 | 0.617 | 0.000 | 3.326 | 0.171 | 121.9 | 32.2 |
| 1550.1 | 3.008 | 1.817 | 3.374 | 0.601 | 0.000 | 3.333 | 0.167 | 119.2 | 37.2 |
| 1600.1 | 3.103 | 1.835 | 3.400 | 0.586 | 0.000 | 3.347 | 0.163 | 116.8 | 31.5 |
| 1650.1 | 3.198 | 1.846 | 3.443 | 0.557 | 0.000 | 3.313 | 0.153 | 114.0 | 24.9 |
| 1700.1 | 3.294 | 1.859 | 3.478 | 0.529 | 0.000 | 3.297 | 0.146 | 111.5 | 30.5 |
| 1750.1 | 3.393 | 1.876 | 3.518 | 0.511 | 0.000 | 3.286 | 0.139 | 109.2 | 30.5 |
| 1800.1 | 3.485 | 1.888 | 3.542 | 0.498 | 0.000 | 3.284 | 0.135 | 107.0 | 25.0 |
| 1850.1 | 3.581 | 1.900 | 3.576 | 0.476 | 0.000 | 3.266 | 0.128 | 104.8 | 28.5 |
| 1900.1 | 3.676 | 1.916 | 3.622 | 0.450 | 0.000 | 3.245 | 0.119 | 103.0 | 22.9 |
| 1950.1 | 3.772 | 1.921 | 3.668 | 0.424 | 0.000 | 3.200 | 0.108 | 100.6 | 19.1 |
| 2000.1 | 3.870 | 1.934 | 3.707 | 0.396 | 0.000 | 3.183 | 0.100 | 98.8 | 24.4 |
| 2050.1 | 3.970 | 1.946 | 3.738 | 0.368 | 0.000 | 3.171 | 0.094 | 96.8 | 21.8 |
| 2100.1 | 4.066 | 1.956 | 3.772 | 0.349 | 0.000 | 3.154 | 0.088 | 95.0 | 23.3 |
| 2150.2 | 4.162 | 1.968 | 3.807 | 0.327 | 0.000 | 3.140 | 0.081 | 93.4 | 20.7 |
| 2200.2 | 4.262 | 1.976 | 3.826 | 0.313 | 0.000 | 3.136 | 0.078 | 91.6 | 16.2 |
| 2250.2 | 4.360 | 1.984 | 3.856 | 0.291 | 0.000 | 3.120 | 0.072 | 89.9 | 18.9 |
| 2300.2 | 4.463 | 1.995 | 3.892 | 0.263 | 0.000 | 3.102 | 0.065 | 88.3 | 15.5 |
| 2350.2 | 4.563 | 2.000 | 3.917 | 0.248 | 0.000 | 3.086 | 0.060 | 86.6 | 14.8 |
| 2400.2 | 4.662 | 2.009 | 3.934 | 0.241 | 0.000 | 3.088 | 0.058 | 85.2 | 18.3 |
| 2450.2 | 4.762 | 2.018 | 3.964 | 0.221 | 0.000 | 3.073 | 0.052 | 83.8 | 19.5 |
| 2500.2 | 4.861 | 2.029 | 3.986 | 0.213 | 0.000 | 3.074 | 0.050 | 82.5 | 19.6 |

## STAGE 1

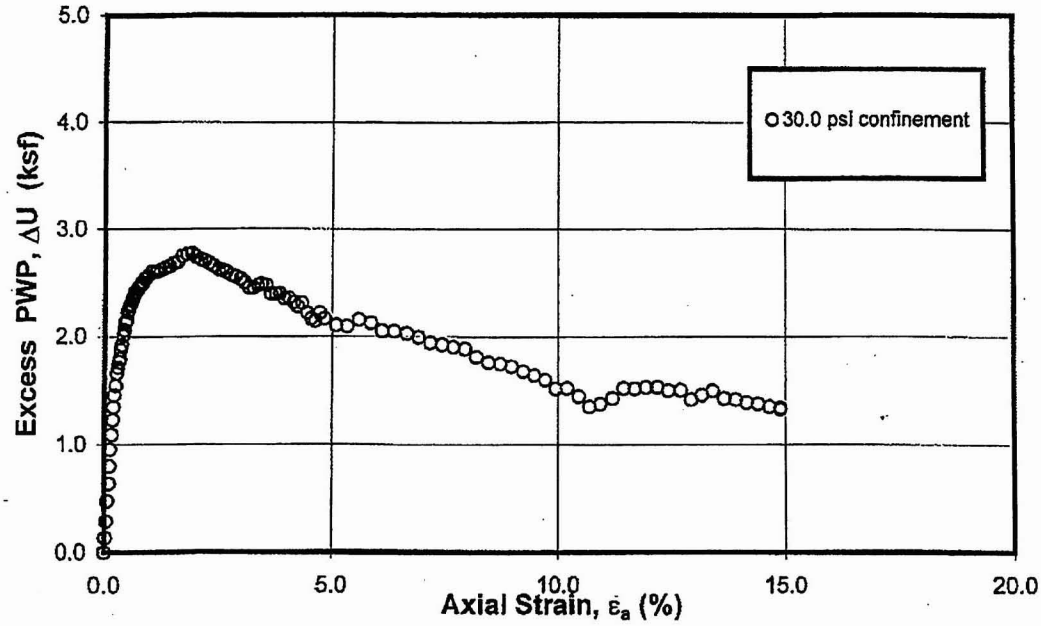
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 2625.2 | 5.115 | 2.051 | 4.043 | 0.177 | 0.000 | 3.059 | 0.040 | 79.3 | 16.9 |
| 2750.2 | 5.364 | 2.071 | 4.094 | 0.142 | 0.000 | 3.048 | 0.032 | 76.4 | 16.8 |
| 2875.2 | 5.617 | 2.093 | 4.162 | 0.101 | 0.000 | 3.024 | 0.021 | 73.7 | 15.8 |
| 3000.2 | 5.863 | 2.111 | 4.206 | 0.073 | 0.000 | 3.015 | 0.015 | 71.2 | 15.5 |
| 3125.2 | 6.111 | 2.132 | 4.244 | 0.041 | 0.000 | 3.018 | 0.010 | 69.0 | 17.5 |
| 3250.2 | 6.356 | 2.154 | 4.292 | 0.000 | 0.000 | 3.015 | 0.004 | 67.0 | 17.5 |
| 3375.2 | 6.602 | 2.175 | 4.346 | -0.040 | 0.000 | 3.003 | -0.004 | 65.2 | 18.7 |
| 3500.2 | 6.848 | 2.200 | 4.434 | -0.094 | 0.000 | 2.970 | -0.018 | 63.6 | 16.1 |
| 3625.2 | 7.096 | 2.214 | 4.478 | -0.131 | 0.000 | 2.956 | -0.025 | 61.8 | 13.0 |
| 3750.2 | 7.340 | 2.232 | 4.542 | -0.162 | 0.000 | 2.933 | -0.035 | 60.2 | 14.7 |
| 3875.2 | 7.589 | 2.250 | 4.591 | -0.188 | 0.000 | 2.923 | -0.042 | 58.7 | 14.9 |
| 4000.2 | 7.836 | 2.269 | 4.623 | -0.209 | 0.000 | 2.927 | -0.044 | 57.3 | 14.8 |
| 4125.2 | 8.081 | 2.287 | 4.674 | -0.231 | 0.000 | 2.916 | -0.051 | 56.0 | 13.2 |
| 4250.2 | 8.325 | 2.301 | 4.719 | -0.261 | 0.000 | 2.903 | -0.058 | 54.7 | 10.9 |
| 4375.2 | 8.569 | 2.313 | 4.745 | -0.284 | 0.000 | 2.903 | -0.060 | 53.5 | 10.9 |
| 4500.2 | 8.813 | 2.328 | 4.783 | -0.301 | 0.000 | 2.896 | -0.065 | 52.3 | 12.9 |
| 4625.2 | 9.064 | 2.345 | 4.805 | -0.315 | 0.000 | 2.907 | -0.065 | 51.2 | 14.4 |
| 4750.2 | 9.314 | 2.364 | 4.844 | -0.339 | 0.000 | 2.906 | -0.069 | 50.3 | 8.6 |
| 4875.2 | 9.567 | 2.367 | 4.862 | -0.355 | 0.000 | 2.897 | -0.072 | 49.0 | 8.8 |
| 5000.2 | 9.816 | 2.386 | 4.908 | -0.382 | 0.000 | 2.892 | -0.078 | 48.1 | 13.9 |
| 5125.2 | 10.069 | 2.402 | 4.971 | -0.416 | 0.000 | 2.869 | -0.087 | 47.2 | 12.1 |
| 5250.2 | 10.320 | 2.416 | 5.011 | -0.442 | 0.000 | 2.862 | -0.092 | 46.4 | 7.9 |
| 5375.2 | 10.575 | 2.422 | 5.041 | -0.464 | 0.000 | 2.849 | -0.097 | 45.4 | 8.9 |
| 5500.2 | 10.829 | 2.439 | 5.073 | -0.487 | 0.000 | 2.851 | -0.099 | 44.6 | 11.1 |
| 5625.2 | 11.083 | 2.450 | 5.093 | -0.507 | 0.000 | 2.853 | -0.101 | 43.8 | 8.9 |
| 5750.2 | 11.336 | 2.461 | 5.126 | -0.528 | 0.000 | 2.848 | -0.104 | 43.0 | 8.2 |
| 5875.2 | 11.582 | 2.470 | 5.148 | -0.543 | 0.000 | 2.845 | -0.107 | 42.3 | 8.6 |
| 6000.2 | 11.835 | 2.483 | 5.201 | -0.588 | 0.000 | 2.827 | -0.114 | 41.6 | 9.1 |
| 6125.2 | 12.084 | 2.493 | 5.243 | -0.612 | 0.000 | 2.814 | -0.120 | 40.9 | 9.1 |
| 6250.2 | 12.328 | 2.505 | 5.226 | -0.600 | 0.000 | 2.841 | -0.114 | 40.3 | 6.1 |
| 6375.2 | 12.584 | 2.508 | 5.295 | -0.647 | 0.000 | 2.800 | -0.127 | 39.5 | 6.7 |
| 6500.2 | 12.832 | 2.522 | 5.342 | -0.674 | 0.000 | 2.788 | -0.133 | 38.9 | 7.0 |
| 6625.2 | 13.083 | 2.526 | 5.363 | -0.694 | 0.000 | 2.780 | -0.136 | 38.3 | 4.2 |
| 6750.2 | 13.331 | 2.532 | 5.387 | -0.714 | 0.000 | 2.774 | -0.139 | 37.6 | 4.9 |
| 6875.2 | 13.582 | 2.538 | 5.417 | -0.734 | 0.000 | 2.763 | -0.144 | 37.0 | 5.2 |
| 7000.2 | 13.826 | 2.545 | 5.442 | -0.753 | 0.000 | 2.758 | -0.147 | 36.5 | 6.1 |
| 7125.2 | 14.073 | 2.553 | 5.462 | -0.766 | 0.000 | 2.755 | -0.149 | 35.9 | 6.5 |
| 7250.2 | 14.319 | 2.561 | 5.500 | -0.772 | 0.000 | 2.743 | -0.154 | 35.4 | 5.5 |
| 7375.2 | 14.568 | 2.567 | 5.502 | -0.778 | 0.000 | 2.749 | -0.153 | 34.9 | 2.4 |
| 7500.2 | 14.819 | 2.567 | 5.501 | -0.782 | 0.000 | 2.750 | -0.153 | 34.3 | 4.2 |
| 7505.3 | 14.829 | 2.568 | 5.499 | -0.781 | 0.000 | 2.752 | -0.152 | 34.3 | 7.9 |
| | | | | | | | | | |

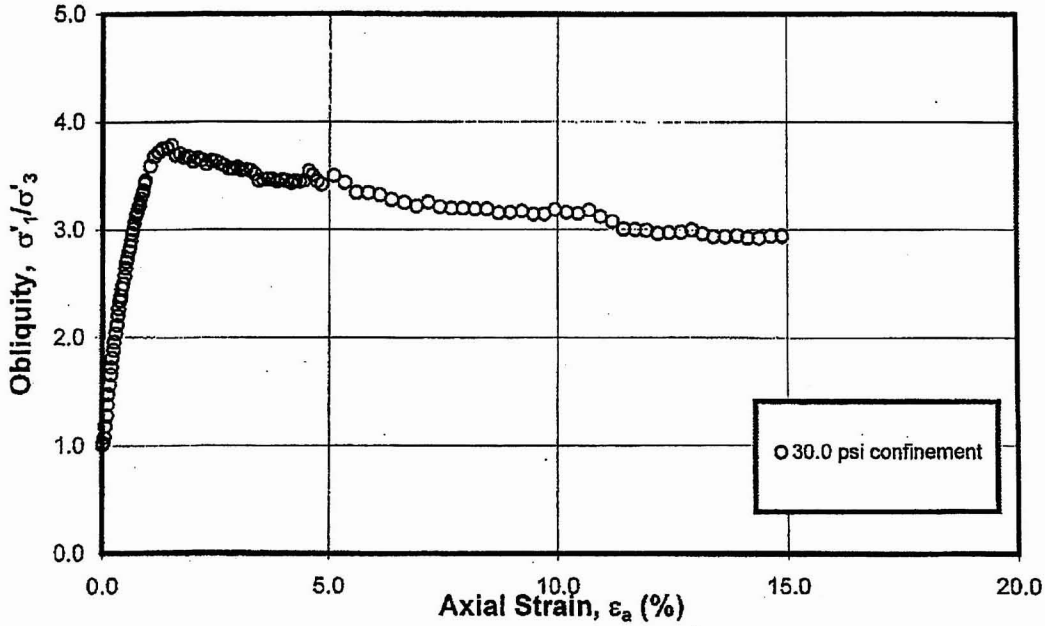



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. AB - Depth: NA
Boring TP-2319 - TP-2334

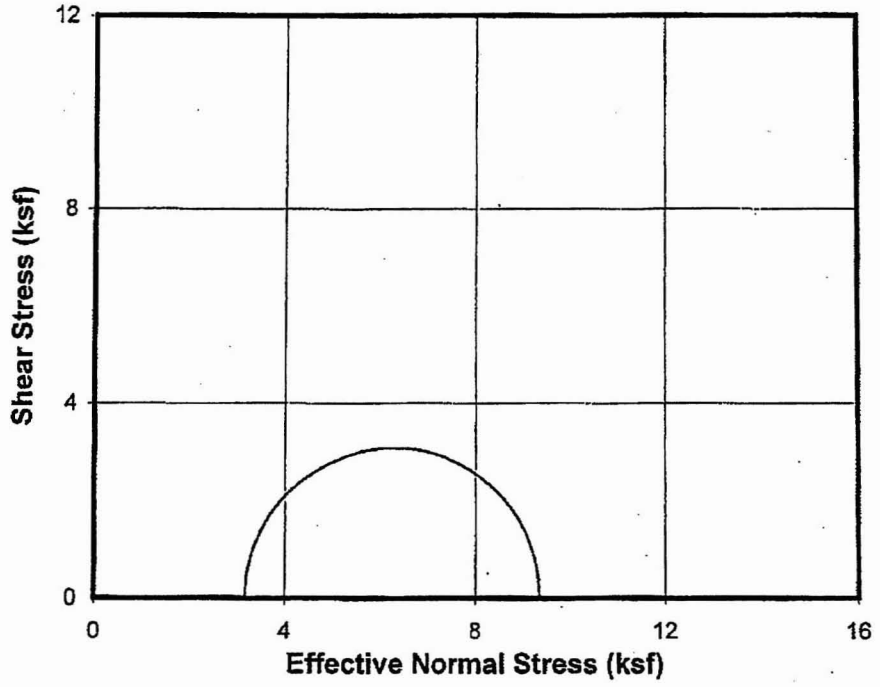
Reviewed By: WIP

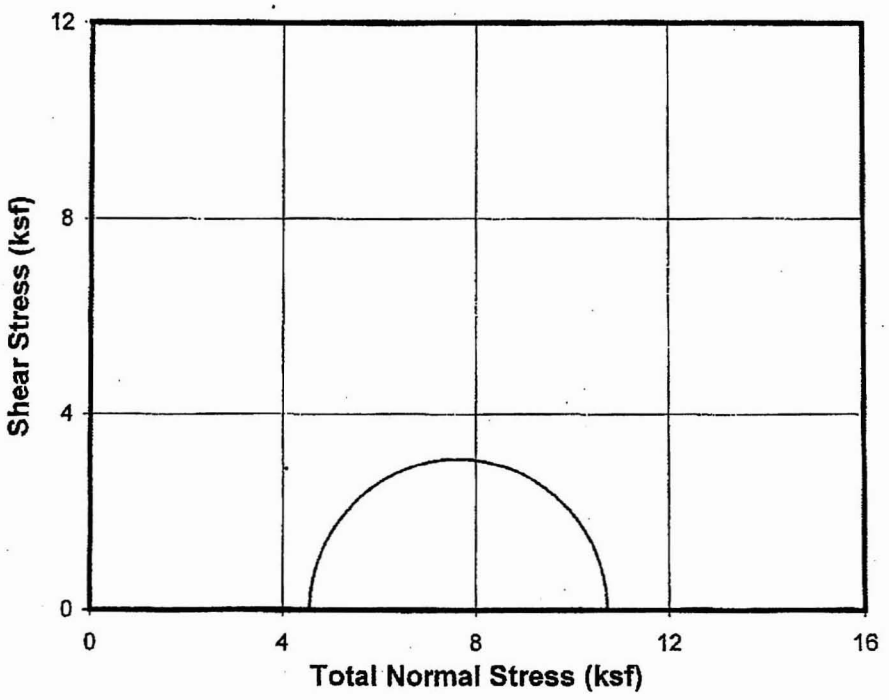



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. AB - Depth: NA
Boring TP-2319 - TP-2334

Reviewed By: WFR




**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated- Mohr's Circles
Sample: Comp. AB - Depth: NA
Boring TP-2319 - TP-2334

Reviewed By: WID

# TRIAXIAL TEST (ASTM D 4767-04): Specimen Setup / Take Down

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | Cell No.: CYC2 | File Name: Comp. Ab

Task No.: NA | Test Stress(es), $\sigma'_c$ or $\sigma'_{v,c}$ = 4.32 , _____ , _____ & _____ ksf

Project Name: Exelon (Victoria) | $k$ ($\sigma'_{h,c} / \sigma'_{v,c}$) = 1.00 | Induced OCR = 1.00 | $K_{ua}$ ($\sigma_{d,ua}/2\sigma'_{v,c}$) = NA

Assig. Remarks: 95% max dry density (+/- 1.0 lb) and +4.0 % opt mc(+/- 0.5%) Specific Gravity: 2.659 [X] Meas.; [ ] Assumed

| | | | | |
|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [X] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = 10-16 |
| Boring No.: TP-2319 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= 4.50 | No. Layers = 4.00 |
| Sample No.: Comp. A | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = 0.5-1 |
| Depth (ft): NA | Specimen No.: B | [ ] Kneading | [X] Undercompaction: $U_{ni}$ (%) = | Dia. (in.) = 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD | % Comp. = 95% ± Opt. = 4 % |

| | | | | |
|---|---|---|---|---|
| Type | [X] Isotropic | [ ] $K_o$ stress path | [ ] Used automated system: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/h) = |
| Consolidation : | [ ] Anistropic | [ ] 45° stress path | Remarks: | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading | [X] Static | [X] Undrained | [X] Comp. | [X] Strain | [ ] Stress | [X] Constant Cell Pressure | [ ] Cyclic (Hz) | [ ] Stress | [ ] Strain |
| Conditions : | [ ] Post Cyclic | [ ] Drained | [ ] Ext. | [ ] Stress Path | | [ ] Variable Cell Pressure | Rate: [ ] 0.1; | [ ] 1; | Other: |

| Water Content (WC); | Initial - Trimming Location | | | Final, $W_{at}$ |
|---|---|---|---|---|
| | Top ($W_{o,1}$) | Bottom ($W_{o,2}$) | Sides ($W_{o,3}$) | (see below) |
| Container No | 707 | | | 1130 |
| Mass Moist Soil + Cont. (g) | 127.86 | | | 143.45 |
| Mass Dry Soil + Container (g) | 116.06 | | | 129.06 |
| Mass Container (g) | 31.91 | | | 32.50 |
| Water Content, $W_{o,n}$ (%) | 14.02 | | | 14.90 |
| Avg. Initial WC, $W_{o,avg}$ (%) | 14.02 | Final ($W_{at}$); | [X] Slice ; | Whole Spec. |
| [ ] See attached data sheet(s) for additional water contents | | | | |

| SOIL MASSES: | Initial | Final |
|---|---|---|
| Moist + Tare (etc.)(g) | 988.54 | 505.05 |
| Tare (etc.) (g) | 484.29 | 0.00 |
| Mass Moist Spec., $M_{tn}$ (g) | 504.25 | 505.05 |
| Excess Dry Soil (soil not included in final mass measurement) | | |
| Container No. | | |
| Mass Dry Soil + Cont. (g) | | |
| Mass Container (g) | | |
| Mass Excess Dry Soil, $M_{d,es}$ (g) | | 0.00 |

## Specimen Dimensions, (mm)

| | Height | | | Dia., X indicates with membrane | | |
|---|---|---|---|---|---|---|
| | Initial ($H_o$) | Final ($H_{at}$) | | Initial ($D_o$) | Final ($D_{at}$) | |
| GB | 100.000 | 100.000 | 1 T | 50.11 | 54.00 | [ ] For |
| 1 | 15.99 | -1.00 | 2 M | 50.22 | 56.02 | Wedge |
| 2 | 15.95 | -1.00 | 3 B | 50.29 | 55.00 | Failure |
| 3 | 15.99 | -1.25 | 1'T | | | = $d_{max}$ |
| 4 | 16.00 | -1.13 | 2'M | | | = $d_{min}$ |
| 5 | 16.02 | -1.08 | 3'B | | | = $\Delta d$ |
| Avg. | 115.99 | 98.91 | Avg. | 50.21 | 55.01 | xxxxx |

| Measuring Devices: | | | |
|---|---|---|---|
| Pi Tape: [X] Dia | $A_o = \pi D^2/400$ (cm$^2$) | 19.80 |
| | $V_o$ (cm$^3$) | 229.63 |
| Calipers: [ ] Ht.; [ ] Dia | $A_{atb,m} = \pi (D^*_{at})^2 /400$ (cm$^2$) | 23.98 |
| Dial Comparator [X] Ht.; [ ] Dia | $A_{atw,m} = (d_{min} - 2\Delta d) d_{max} \pi /400$ (cm$^2$) | NA |
| Remarks: ID# PI-002 | $D^*_{at} = (D_T + 2D_M + D_B)/4$ (mm) | 55.26 |

## Estimated Initial Unit Weight

Total, $\gamma_{t,o}$ (lb/ft$^3$) = 137.09 | Dry, $\gamma_{d,o}$ (lb/ft$^3$)= 120.23

## Membrane / Filter Paper / Apparatus

| Membrane (mm): | | Top | Bottom |
|---|---|---|---|
| Number: | Thickness: | 0.75 | 0.65 |
| = 1 | [ ] Single; [X] Double | 0.68 | 0.64 |
| | Circumference ($C_{rm,o}$) | 152.0 | 152.0 |
| | | Total Thickness | Dia.($C_{rm,o}/\pi$) |
| | Average: | 0.34 | 48.38 |

Filter Paper: Top + Bottom: [X] Yes ; [ ] No

Filter Strips: [X] Yes ; [ ] No Number = 8

Type of Filter Strips [ ] Vertical: ¼ in. & Whatman #54

[X] Spiral: ¼ in. & Whatman #1

Apparatus: Mass Top Cap, $M_{tc}$ = 53.4 g, 0.12 lbf

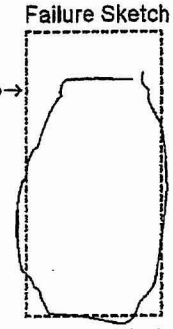
Mass Displ. System, $M_{ds}$ (cap, dial, piston, etc.) = NA g, NA lbf

[ ] Photo Taken.

Failure Sketch

$\varepsilon_a$=

20%→



Failure Mode:

[X] Bulge

[ ] Wedge

[ ] Parabolic

Wedge/Bulge Ht.= NA (mm)

NA - Not Applicable

GB - Gage Block

Other Remarks:

LL=34 PL=12 PI=22

Top Cap Attached: [ ] Yes; [X] No; Piston Dia.(in.) [X] ½; [ ] ¾; [ ] Load Cell: [ ] External [X] Internal

Top Cap - Rotation [ ] Fixed,<1°; [X] Limited,<5°; [ ] Unlimited, >5°

With: [ ] Frictionless End Caps; [ ] Lat. Movement Top Cap

[ ] Internal LVDT Jacket

Final Visual Classification: Light Brown Clayey SAND (SC)

Trimmed / Reconstituted By: RC,jr/YR | Set Up By: RC,jr | Taken Down By: RC,jr

Date: 6/14/2008 | Date: 6/14/2008 | Date: 6/23/2008

Prelim. Calc. By: RC,jr | Final Calc. By: TP | Reviewed By: WHD

[ ] See more detailed sketch on attached sheet. Remarks:

# MULTISTAGE TRIAXIAL TEST: Specimen Calculations & Summary(1)

Project Number: 0411-08-1686 Cell No.: CYC2 File Name: Comp. Ab
Task Number: NA Specific Gravity: 2.659 [X] Measured; [ ] Assumed
Boring No.: TP-2319 - TP-2334 Sample No.: Comp. A Specimen No.: B Depth (ft): NA
Type Test: CIU Triaxial Specimen: [ ] "Undisturbed"; [ ] Reconstituted; [X] Recompacted
Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = _____ ppm

| | Inital Water Contents (WC), ($W_o$) over Saturation, ($S_o$), in (%): | | | | | | Calculated Mass of Dry Soil (g) | |
|---|---|---|---|---|---|---|---|---|
| | Top, $W_{o,1}$ | Botttom, $W_{o,2}$ | Sides, $W_{o,3}$ | Avg., $W_{o,avg}$ | Selct., $W_{o,s}$ | Back Cal., $W_{o,bc}$ | Initial Selected WC, $w_o$ (%) | 14.02 |
| $W_o$ | 14.02 | | | 14.02 | 14.02 | 124.90 | Initial , $M_{d,o}$ | 442.25 |
| $S_o$ | 98.6 | | | 98.6 | 98.6 | 859.0 | Final, $M_{d,at}$ | 439.55 |
| | Measured final mass of moist soil, $M_{t,at}$ (g) | | | | | 505.05 | Selected, $M_d$ | 442.25 |
| | Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g) | | | | | 505.05 | | |

| Consolidation Data | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | |
|---|---|---|---|---|---|---|---|---|
| Changes in Height (mm) and Volume ($cm^3$) Within Given Consolidation Stages/Columns | At Initial Seating Stress | During Back-Pressuring | 1st Consol. Increment (1) | Column 2 or 3 to **1st Test** Stage (1) | Column 4 to **2nd Test** Stage | Column 5 to **3rd Test** Stage | Column 6 to **4th Test** Stage | |
| Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec. | | | | | | | | |
| Change in Height, $\Delta H_{c,n}$ | 0.03 | -0.31 | | 1.11 | NA | NA | NA | |
| Sum of changes in (+ out) | 0.40 | | | 7.10 | NA | NA | NA | |
| burette readings, $\Delta b_{r,n}$ (- in) | | -6.80 | NA | 16.68 | NA | NA | NA | (2) |
| Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$ | 0.18 | -1.84 | | 6.59 | NA | NA | NA | |
| Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$ | 0.50 | 0.50 | | 1.08 | NA | NA | NA | |
| Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$ | 0.09 | -0.92 | NA | 0.00 | NA | NA | NA | (3) |
| Selected $\Delta V_{c,n}$ | 0.40 | -6.80 | | 7.10 | NA | NA | NA | |

| Summary For Test Stages | | | | | |
|---|---|---|---|---|---|
| Test Stage: | 1st = 1 | 2nd = 2 | 3rd = 3 | 4th = 4 | |
| Cell Pressure, $\sigma_{c,n}$ (psi) | 90.00 | NA | NA | NA | Number of |
| Back Pressure, $U_{b,n}$ (psi) | 60.00 | NA | NA | NA | Test Stages = 1 |
| Axial Force Reading, $P_{r,n}$ (lbf) | 1.00 | NA | NA | NA | $t_{50}$ = 120 min |
| Eff. Consol. Stress ($\sigma'_c$ or $\sigma'_{v,c}$) (4), (ksf) | 4.38 | NA | NA | NA | |
| $t_c$, ON or in [X] days [ ] hrs | 2.00 | NA | NA | NA | |

**At Final Test Stress/Stage - Summary of Calculation of $\Delta V_c$ ($cm^3$) by Different Procedures**

| By Selected Volumes | By Saturation = 100 % | By Change in Mass (5) | For Diff. in Meas. Vol. ($V_o$-$V_{at}$), & corr. for $\Delta H_{td}$ | For Selected $\Delta V_c$, required |
|---|---|---|---|---|
| $\Delta V_c$ = 0.70 | $\Delta V_c$ = 0.10 | $\Delta V_c$ = 5.99 | $\Delta V_c$= | $G_s$ for $S_c$ = 100 %: 2.669 |

**At Final Test Stress/Stage - Consolidation Conclusions**

| | | | | |
|---|---|---|---|---|
| $\Delta H_{c,f}$ (mm) = 0.83 | $\Delta V_{c,f}$ ($cm^3$) = 0.70 | Back Cal. $G_s$ for S=100% = 2.669 | Normalized | Ht. Ch. (%) = 0.37 |
| $\varepsilon_{ac,c}$ (%) = 0.72 | $\varepsilon_{vc,f}$ (%) = 0.30 | | Diff. in: | Vol. Ch. (%) = |

**Summary of Specimen Physical Properties**

| Specific Gravity: $G_s$ = 2.659 Measured Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Volumetric Water Content | Porosity n | Skempton B parameter %(6) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial: | 115.99 | 229.63 | 19.80 | 14.02 | 137.09 | 120.23 | 98.5 | 0.378 | 0.2705 | 0.274 | 96.0 |
| After Consol.: to 1st $\sigma'_c$ | 115.16 | 228.93 | 19.88 | 14.20 | 137.72 | 120.60 | 100.9 | 0.374 | 0.2748 | 0.272 | |
| to 2nd $\sigma'_c$ | | | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | | | |

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.
(2) The height changes occuring within each shearing and unloading stage (1 - 4) are recorded in these rows (after Column 3).
(3) The volume changes occuring within each shearing and unloading stage (1 - 4) are calculated/recorded in these rows (after Column 3).
(4) Stresses are corrected for membrane. (5) ~ $M_{t,o}$-($M_{tat,c}$+$\rho_{water}$x$\Delta V_{in,column1\&2}$)
(6) Initial value is after back pressuring
NA - Not Applicable ON - Over Night; WC - Water Content Remarks: Wet Method used in the Saturation Stage
Calculated By: TP Reviewed By: RZD

## MULTISTAGE TRIAXIAL TEST: Specimen Calculations Summary(2)

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | App. No.: CYC2 | File Name: Comp. Ab
Project Name: Exelon (Victoria) | Task No.: NA | Test No.: 0 | Test Series for: 0

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [X] Tamping | [X] Constant Effort: | Blows/Tamps per Layer = | 10-16 |
| Boring No.: TP-2319 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= | 4.50 | No. Layers = 4.00 |
| Sample No.: Comp. A | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | | Drop (in.) = 0.5-1 |
| Depth (ft): NA | Specimen No.: B | [ ] Kneading | [X] Undercompaction: | $U_{nl}$ (%) = | Dia. (in.) = 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD | % Comp. = 95% | ± Opt. = 4 % |

| | | | | |
|---|---|---|---|---|
| Type Consolidation | [X] Isotropic / [ ] Anistropic | [ ] $K_o$ stress path / [ ] 45° stress path | [ ] Used automated system / Remarks: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/hr.)= |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading Conditions: | [X] Static / [ ] Post Cyclic | [X] Undrained / [ ] Drained | [X] Comp. / [ ] Ext. | [X] Strain / [ ] Stress Stress Path | [X] Constant Cell pressure / [ ] Variable Cell pressure | [ ] Cyclic (Hz) Rate: [ ] 0.1; | [ ] Stress / [ ] Strain 1; Other: |

| Specific Gravity: $G_s$ = 2.659 Measured | Height | Volume | Area | Water Content | Unit Weight Total | Unit Weight Dry | Saturation | Void Ratio | Skempton B parameter %(1) |
|---|---|---|---|---|---|---|---|---|---|
| **Condition:** | (mm) | ($cm^3$) | ($cm^2$) | (%) | (pcf) | (pcf) | (%) | e | |
| Initial: | 115.99 | 229.63 | 19.80 | 14.02 | 137.09 | 120.23 | 98.55 | 0.38 | 96.0 |
| After Consol.: to 1st $\sigma'_c$ | 115.16 | 228.93 | 19.88 | 14.20 | 137.72 | 120.60 | 100.94 | 0.37 | |
| to 2nd $\sigma'_c$ | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | |

Unit for Stresses: (ksf)

### Consolidation Stress Summary and Loading Summary

| Item | Unit | 1st Stage | 2nd Stage | 3rd Stage | 4th Stage |
|---|---|---|---|---|---|
| Axial Strain during Consol., $\varepsilon_{a,c}$: | % | 0.716 | NA | NA | NA |
| Vol. Strain during Consol., $\varepsilon_{v,c}$: | % | 0.305 | NA | NA | NA |
| Effective Vertical Stress, $\sigma'_v$: | (ksf) | 4.376 | NA | NA | NA |
| Effective Horizontal Stress, $\sigma'_h$: | (ksf) | 4.344 | NA | NA | NA |
| Consol. Stress Ratio, k ($\sigma'_h$ / $\sigma'_v$): | - | 0.993 | | | |
| Induced OCR: | - | 1.00 | NA | NA | NA |
| Eff. Average Stress, ($\sigma'_v$ + $\sigma'_h$)/2: | (ksf) | 8.721 | | | |
| Eff. Mean Stress, ($\sigma'_v$ + 2*$\sigma'_h$)/3: | (ksf) | 4.355 | | | |
| Undr. Ambient Shear Stress, $\tau_{ba}$: | (ksf) | NA | NA | NA | NA |
| Undr. Ambient Shear Strain, $\varepsilon_{a,ua}$ | % | NA | NA | NA | NA |

Notes: See Fugro South, Inc. Notation Listing for definition of symbols and acronyms.

(1) Initial B is after saturation

NA - Not Applicable

### Membrane Correction

Type: Bulge
Modulus: 150.0 psi
Diameter: 48.38 mm
Thickness: 0.34 mm

### Area Correction

Type: Bulge

| Stage | Area Corr. Const.: | Final Area ($cm^2$): |
|---|---|---|
| 1st | 1.205 | 23.98 |
| 2nd | | |
| 3rd | | |
| 4th | | |

### Filter Paper Correction

Type: None | Type Strips: Sprial #1
Strips: 8
Force: 0.000 lbf/strip

Final Visual Description and Remarks: Light Brown Clayey SAND (SC)

### Loading Summary

| Stage | Stress Status | $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | ΔU (ksf) | $\sigma_1'$ (ksf) | $\sigma_3'$ (ksf) |
|---|---|---|---|---|---|---|---|
| 1st | Max Shear Stress | 14.64 | 3.086 | 6.268 | 1.354 | 9.354 | 3.183 |
| | Max Obliquity | 1.51 | 2.249 | 3.865 | 2.683 | 6.114 | 1.617 |
| 2nd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 3rd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 4th | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |

Remarks: Stain Rate (%/min) =3.33E-03

# STAGE 1

Project: 0411-08-1686 Boring No.: TP-2319 - TP-2334 Depth (ft.): NA

Test Type: CIU Triaxial Sample No.: Comp. A Stage No.: 1

Specimen No.: B

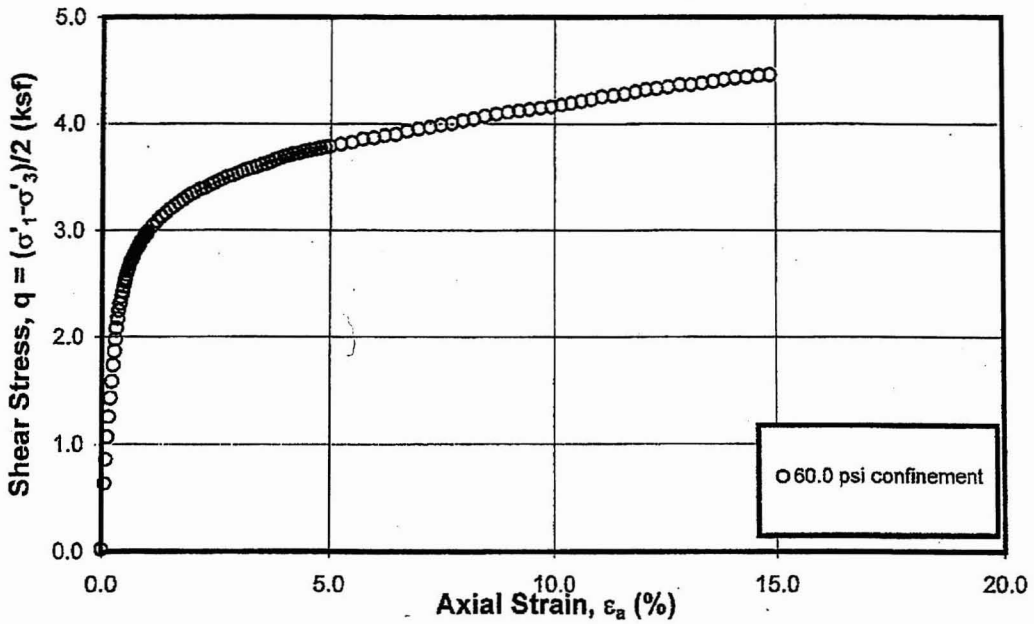
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.000 | 0.016 | 4.360 | 0.000 | 0.000 | 1.007 | 0.000 | - | - |
| 7.5 | 0.023 | 0.064 | 4.287 | 0.135 | 0.000 | 1.030 | 1.267 | 417.3 | 855.8 |
| 15.0 | 0.037 | 0.157 | 4.230 | 0.288 | 0.000 | 1.077 | 0.963 | 756.9 | 1499.4 |
| 22.5 | 0.061 | 0.356 | 4.249 | 0.476 | 0.000 | 1.183 | 0.664 | 1121.8 | 1396.6 |
| 30.0 | 0.093 | 0.530 | 4.261 | 0.638 | 0.000 | 1.284 | 0.597 | 1110.3 | 1455.0 |
| 37.5 | 0.109 | 0.683 | 4.249 | 0.800 | 0.000 | 1.383 | 0.584 | 1219.7 | 1878.4 |
| 45.0 | 0.123 | 0.814 | 4.210 | 0.955 | 0.000 | 1.479 | 0.594 | 1298.1 | 1370.6 |
| 52.5 | 0.150 | 0.923 | 4.200 | 1.093 | 0.000 | 1.563 | 0.588 | 1208.9 | 731.6 |
| 60.0 | 0.178 | 1.014 | 4.107 | 1.228 | 0.000 | 1.655 | 0.627 | 1123.4 | 816.8 |
| 67.5 | 0.194 | 1.091 | 4.092 | 1.347 | 0.000 | 1.727 | 0.625 | 1111.2 | 989.6 |
| 75.0 | 0.208 | 1.164 | 4.026 | 1.456 | 0.000 | 1.813 | 0.646 | 1103.7 | 710.3 |
| 82.5 | 0.238 | 1.226 | 3.992 | 1.544 | 0.000 | 1.886 | 0.652 | 1018.0 | 510.3 |
| 90.0 | 0.256 | 1.281 | 3.945 | 1.660 | 0.000 | 1.962 | 0.664 | 988.0 | 475.1 |
| 97.5 | 0.285 | 1.332 | 3.901 | 1.717 | 0.000 | 2.037 | 0.674 | 922.4 | 327.4 |
| 105.0 | 0.316 | 1.379 | 3.849 | 1.768 | 0.000 | 2.117 | 0.687 | 862.7 | 453.6 |
| 112.5 | 0.330 | 1.423 | 3.788 | 1.798 | 0.000 | 2.203 | 0.703 | 851.2 | 552.2 |
| 120.0 | 0.346 | 1.461 | 3.771 | 1.879 | 0.000 | 2.266 | 0.704 | 835.8 | 407.5 |
| 127.5 | 0.370 | 1.500 | 3.739 | 1.924 | 0.000 | 2.339 | 0.709 | 800.9 | 258.3 |
| 135.0 | 0.402 | 1.533 | 3.744 | 2.009 | 0.000 | 2.386 | 0.703 | 753.6 | 264.1 |
| 142.5 | 0.423 | 1.566 | 3.715 | 2.062 | 0.000 | 2.457 | 0.708 | 732.5 | 273.3 |
| 150.0 | 0.448 | 1.594 | 3.720 | 2.130 | 0.000 | 2.499 | 0.703 | 704.2 | 221.3 |
| 157.5 | 0.478 | 1.626 | 3.699 | 2.149 | 0.000 | 2.569 | 0.705 | 673.9 | 222.3 |
| 165.0 | 0.502 | 1.654 | 3.664 | 2.228 | 0.000 | 2.645 | 0.713 | 652.5 | 295.7 |
| 172.5 | 0.516 | 1.680 | 3.654 | 2.245 | 0.000 | 2.702 | 0.712 | 644.4 | 298.2 |
| 180.0 | 0.537 | 1.704 | 3.670 | 2.282 | 0.000 | 2.733 | 0.704 | 628.5 | 185.4 |
| 187.5 | 0.572 | 1.728 | 3.649 | 2.299 | 0.000 | 2.799 | 0.708 | 598.9 | 153.9 |
| 195.0 | 0.598 | 1.750 | 3.649 | 2.337 | 0.000 | 2.844 | 0.705 | 579.9 | 182.5 |
| 202.5 | 0.621 | 1.773 | 3.638 | 2.364 | 0.000 | 2.900 | 0.705 | 565.8 | 212.7 |
| 210.0 | 0.641 | 1.796 | 3.625 | 2.380 | 0.000 | 2.964 | 0.707 | 555.1 | 210.7 |
| 217.5 | 0.662 | 1.815 | 3.630 | 2.415 | 0.000 | 3.001 | 0.703 | 544.0 | 164.3 |
| 225.0 | 0.689 | 1.834 | 3.620 | 2.415 | 0.000 | 3.054 | 0.704 | 527.7 | 117.3 |
| 232.5 | 0.727 | 1.853 | 3.595 | 2.452 | 0.000 | 3.127 | 0.708 | 505.4 | 154.4 |
| 240.0 | 0.743 | 1.870 | 3.618 | 2.452 | 0.000 | 3.138 | 0.700 | 499.1 | 212.6 |
| 247.5 | 0.760 | 1.888 | 3.631 | 2.469 | 0.000 | 3.166 | 0.695 | 492.7 | 171.8 |
| 255.0 | 0.782 | 1.903 | 3.625 | 2.482 | 0.000 | 3.209 | 0.695 | 482.2 | 124.8 |
| 262.5 | 0.811 | 1.920 | 3.643 | 2.504 | 0.000 | 3.228 | 0.688 | 469.6 | 121.0 |
| 270.0 | 0.836 | 1.935 | 3.627 | 2.496 | 0.000 | 3.288 | 0.691 | 458.9 | 106.7 |
| 277.5 | 0.872 | 1.951 | 3.626 | 2.540 | 0.000 | 3.330 | 0.690 | 444.1 | 117.5 |

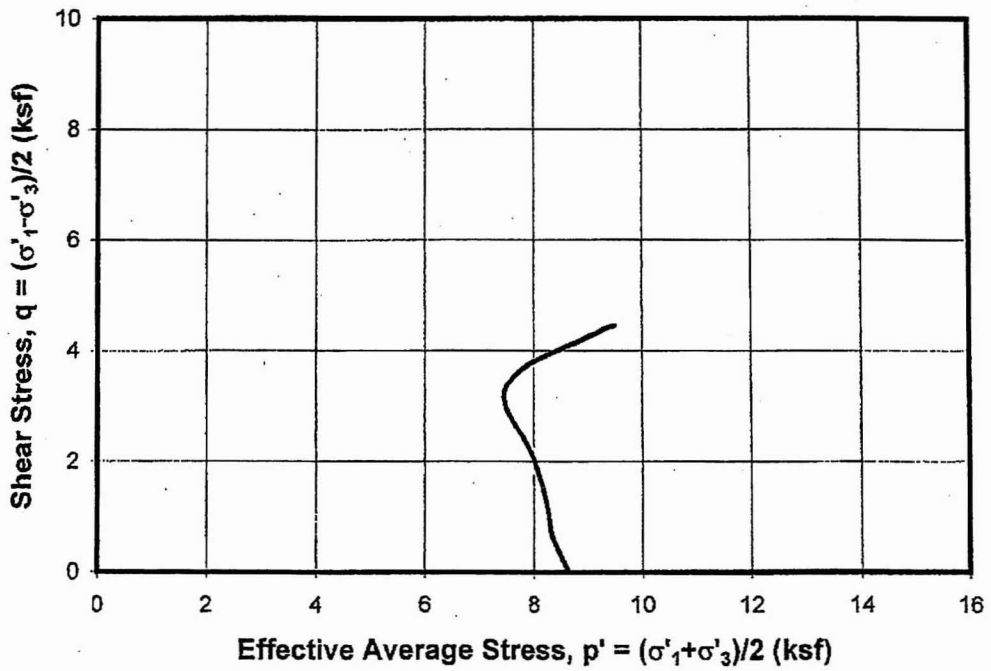
## STAGE 1

| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, ΔU (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 285.0 | 0.894 | 1.968 | 3.635 | 2.538 | 0.000 | 3.360 | 0.686 | 436.5 | 130.5 |
| 292.5 | 0.919 | 1.982 | 3.616 | 2.554 | 0.000 | 3.426 | 0.689 | 428.0 | 117.6 |
| 300.0 | 0.940 | 1.995 | 3.622 | 2.563 | 0.000 | 3.452 | 0.687 | 420.9 | 111.6 |
| 330.0 | 1.039 | 2.047 | 3.630 | 2.604 | 0.000 | 3.586 | 0.680 | 390.9 | 108.2 |
| 360.0 | 1.129 | 2.097 | 3.667 | 2.606 | 0.000 | 3.671 | 0.667 | 368.5 | 101.6 |
| 390.0 | 1.220 | 2.139 | 3.715 | 2.618 | 0.000 | 3.714 | 0.652 | 348.0 | 92.4 |
| 420.0 | 1.309 | 2.180 | 3.767 | 2.638 | 0.000 | 3.747 | 0.637 | 330.7 | 80.3 |
| 450.0 | 1.416 | 2.216 | 3.828 | 2.654 | 0.000 | 3.751 | 0.621 | 310.8 | 67.8 |
| 480.0 | 1.512 | 2.249 | 3.865 | 2.683 | 0.000 | 3.782 | 0.611 | 295.3 | 63.7 |
| 510.0 | 1.598 | 2.275 | 3.967 | 2.693 | 0.000 | 3.689 | 0.587 | 282.6 | 61.1 |
| 539.9 | 1.690 | 2.303 | 4.006 | 2.747 | 0.000 | 3.704 | 0.577 | 270.7 | 53.0 |
| 569.9 | 1.800 | 2.327 | 4.074 | 2.769 | 0.000 | 3.665 | 0.562 | 256.8 | 44.6 |
| 599.9 | 1.900 | 2.350 | 4.112 | 2.774 | 0.000 | 3.668 | 0.553 | 245.7 | 46.7 |
| 629.9 | 1.993 | 2.372 | 4.176 | 2.742 | 0.000 | 3.631 | 0.539 | 236.4 | 45.4 |
| 659.9 | 2.094 | 2.394 | 4.194 | 2.718 | 0.000 | 3.659 | 0.535 | 227.1 | 42.3 |
| 689.9 | 2.181 | 2.412 | 4.239 | 2.705 | 0.000 | 3.641 | 0.525 | 219.7 | 41.2 |
| 719.9 | 2.279 | 2.432 | 4.298 | 2.687 | 0.000 | 3.607 | 0.513 | 212.0 | 39.1 |
| 749.9 | 2.385 | 2.452 | 4.313 | 2.657 | 0.000 | 3.635 | 0.510 | 204.2 | 33.5 |
| 779.9 | 2.485 | 2.467 | 4.341 | 2.628 | 0.000 | 3.632 | 0.504 | 197.2 | 32.8 |
| 809.9 | 2.571 | 2.482 | 4.382 | 2.620 | 0.000 | 3.613 | 0.496 | 191.8 | 34.8 |
| 839.9 | 2.666 | 2.498 | 4.424 | 2.603 | 0.000 | 3.595 | 0.487 | 186.2 | 30.1 |
| 869.9 | 2.782 | 2.514 | 4.472 | 2.574 | 0.000 | 3.567 | 0.478 | 179.5 | 25.6 |
| 899.9 | 2.869 | 2.524 | 4.494 | 2.559 | 0.000 | 3.564 | 0.473 | 174.9 | 25.0 |
| 929.9 | 2.970 | 2.537 | 4.508 | 2.541 | 0.000 | 3.575 | 0.471 | 169.8 | 24.2 |
| 959.9 | 3.063 | 2.548 | 4.547 | 2.505 | 0.000 | 3.548 | 0.463 | 165.3 | 27.4 |
| 989.9 | 3.164 | 2.564 | 4.571 | 2.457 | 0.000 | 3.555 | 0.459 | 161.0 | 28.7 |
| 1019.9 | 3.265 | 2.577 | 4.601 | 2.458 | 0.000 | 3.546 | 0.453 | 156.8 | 22.4 |
| 1049.9 | 3.358 | 2.586 | 4.644 | 2.478 | 0.000 | 3.513 | 0.445 | 153.0 | 17.7 |
| 1079.9 | 3.444 | 2.593 | 4.707 | 2.491 | 0.000 | 3.453 | 0.433 | 149.6 | 19.6 |
| 1109.9 | 3.548 | 2.605 | 4.721 | 2.481 | 0.000 | 3.462 | 0.430 | 145.9 | 27.2 |
| 1139.9 | 3.647 | 2.620 | 4.748 | 2.401 | 0.000 | 3.463 | 0.426 | 142.8 | 21.1 |
| 1169.9 | 3.755 | 2.626 | 4.759 | 2.397 | 0.000 | 3.463 | 0.424 | 139.0 | 17.9 |
| 1199.9 | 3.846 | 2.637 | 4.794 | 2.403 | 0.000 | 3.446 | 0.417 | 136.3 | 21.2 |
| 1229.9 | 3.944 | 2.646 | 4.800 | 2.356 | 0.000 | 3.457 | 0.416 | 133.4 | 19.6 |
| 1259.9 | 4.043 | 2.657 | 4.823 | 2.360 | 0.000 | 3.453 | 0.412 | 130.6 | 24.2 |
| 1289.9 | 4.152 | 2.671 | 4.868 | 2.319 | 0.000 | 3.432 | 0.404 | 127.9 | 19.1 |
| 1319.9 | 4.238 | 2.676 | 4.860 | 2.281 | 0.000 | 3.450 | 0.406 | 125.5 | 12.8 |
| 1349.9 | 4.334 | 2.683 | 4.882 | 2.310 | 0.000 | 3.441 | 0.402 | 123.1 | 17.7 |
| 1379.9 | 4.445 | 2.695 | 4.892 | 2.219 | 0.000 | 3.453 | 0.401 | 120.5 | 26.2 |
| 1409.9 | 4.544 | 2.710 | 4.843 | 2.167 | 0.000 | 3.542 | 0.410 | 118.6 | 19.2 |
| 1439.9 | 4.631 | 2.713 | 4.881 | 2.147 | 0.000 | 3.504 | 0.403 | 116.5 | 2.4 |
| 1469.9 | 4.733 | 2.712 | 4.929 | 2.217 | 0.000 | 3.447 | 0.395 | 113.9 | 9.6 |
| 1499.9 | 4.834 | 2.723 | 4.974 | 2.166 | 0.000 | 3.419 | 0.387 | 112.0 | 17.5 |

## STAGE 1

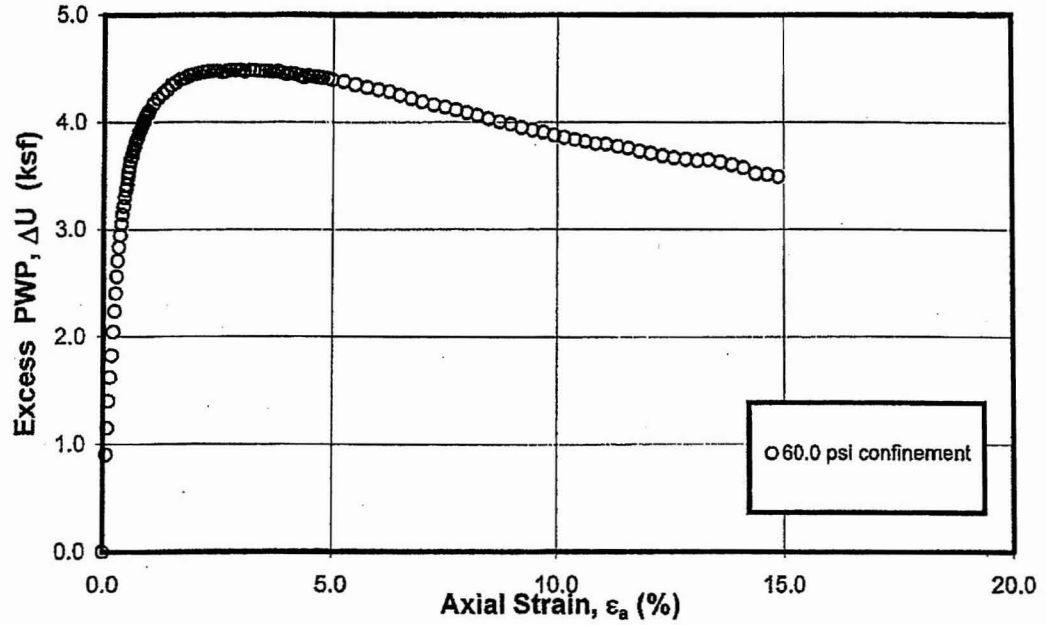
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 1574.9 | 5.096 | 2.741 | 4.934 | 2.107 | 0.000 | 3.499 | 0.395 | 106.9 | 16.5 |
| 1649.9 | 5.335 | 2.764 | 5.033 | 2.097 | 0.000 | 3.436 | 0.378 | 103.0 | 16.6 |
| 1724.9 | 5.593 | 2.782 | 5.156 | 2.157 | 0.000 | 3.343 | 0.356 | 98.9 | 15.2 |
| 1799.8 | 5.851 | 2.803 | 5.198 | 2.125 | 0.000 | 3.342 | 0.350 | 95.3 | 14.4 |
| 1874.8 | 6.099 | 2.818 | 5.246 | 2.051 | 0.000 | 3.322 | 0.342 | 91.9 | 12.6 |
| 1949.8 | 6.354 | 2.835 | 5.323 | 2.048 | 0.000 | 3.279 | 0.329 | 88.7 | 10.4 |
| 2024.8 | 6.621 | 2.845 | 5.373 | 2.030 | 0.000 | 3.251 | 0.321 | 85.5 | 9.7 |
| 2099.8 | 6.878 | 2.860 | 5.440 | 1.995 | 0.000 | 3.218 | 0.310 | 82.7 | 9.4 |
| 2174.8 | 7.140 | 2.870 | 5.418 | 1.945 | 0.000 | 3.252 | 0.315 | 79.9 | 10.2 |
| 2249.8 | 7.399 | 2.887 | 5.495 | 1.926 | 0.000 | 3.214 | 0.302 | 77.6 | 11.7 |
| 2324.8 | 7.650 | 2.899 | 5.536 | 1.905 | 0.000 | 3.199 | 0.296 | 75.4 | 7.9 |
| 2399.8 | 7.909 | 2.907 | 5.553 | 1.887 | 0.000 | 3.197 | 0.294 | 73.1 | 8.1 |
| 2474.8 | 8.168 | 2.920 | 5.584 | 1.814 | 0.000 | 3.193 | 0.289 | 71.1 | 9.4 |
| 2549.8 | 8.430 | 2.931 | 5.605 | 1.762 | 0.000 | 3.193 | 0.287 | 69.2 | 8.6 |
| 2624.7 | 8.687 | 2.943 | 5.671 | 1.751 | 0.000 | 3.157 | 0.276 | 67.4 | 7.4 |
| 2699.7 | 8.941 | 2.950 | 5.679 | 1.724 | 0.000 | 3.162 | 0.275 | 65.6 | 7.8 |
| 2774.7 | 9.205 | 2.963 | 5.689 | 1.678 | 0.000 | 3.174 | 0.275 | 64.0 | 8.7 |
| 2849.7 | 9.457 | 2.973 | 5.747 | 1.642 | 0.000 | 3.143 | 0.265 | 62.5 | 8.0 |
| 2924.7 | 9.705 | 2.983 | 5.764 | 1.601 | 0.000 | 3.145 | 0.263 | 61.1 | 6.8 |
| 2999.7 | 9.946 | 2.989 | 5.723 | 1.515 | 0.000 | 3.187 | 0.271 | 59.8 | 5.7 |
| 3074.7 | 10.208 | 2.997 | 5.770 | 1.523 | 0.000 | 3.162 | 0.264 | 58.4 | 6.3 |
| 3149.7 | 10.463 | 3.006 | 5.803 | 1.448 | 0.000 | 3.149 | 0.259 | 57.1 | 10.4 |
| 3224.7 | 10.702 | 3.023 | 5.793 | 1.352 | 0.000 | 3.182 | 0.262 | 56.2 | 9.4 |
| 3299.7 | 10.954 | 3.028 | 5.885 | 1.377 | 0.000 | 3.120 | 0.247 | 55.0 | 3.2 |
| 3374.6 | 11.217 | 3.031 | 5.950 | 1.428 | 0.000 | 3.076 | 0.236 | 53.8 | 4.4 |
| 3449.6 | 11.455 | 3.039 | 6.072 | 1.523 | 0.000 | 3.004 | 0.217 | 52.8 | 5.1 |
| 3524.6 | 11.703 | 3.043 | 6.087 | 1.518 | 0.000 | 2.999 | 0.215 | 51.7 | 4.6 |
| 3599.6 | 11.950 | 3.050 | 6.112 | 1.531 | 0.000 | 2.993 | 0.211 | 50.8 | 4.2 |
| 3674.6 | 12.193 | 3.053 | 6.164 | 1.535 | 0.000 | 2.963 | 0.203 | 49.8 | 3.7 |
| 3749.6 | 12.435 | 3.059 | 6.165 | 1.502 | 0.000 | 2.970 | 0.204 | 48.9 | 2.2 |
| 3824.6 | 12.697 | 3.058 | 6.154 | 1.506 | 0.000 | 2.976 | 0.205 | 47.9 | 3.9 |
| 3899.6 | 12.928 | 3.068 | 6.143 | 1.421 | 0.000 | 2.996 | 0.208 | 47.2 | 2.9 |
| 3974.6 | 13.166 | 3.065 | 6.191 | 1.459 | 0.000 | 2.961 | 0.200 | 46.3 | 0.9 |
| 4049.6 | 13.406 | 3.070 | 6.247 | 1.500 | 0.000 | 2.933 | 0.191 | 45.6 | 1.4 |
| 4124.6 | 13.660 | 3.068 | 6.244 | 1.427 | 0.000 | 2.933 | 0.191 | 44.7 | 2.7 |
| 4199.5 | 13.913 | 3.077 | 6.245 | 1.421 | 0.000 | 2.943 | 0.192 | 44.0 | 2.6 |
| 4274.5 | 14.144 | 3.075 | 6.276 | 1.392 | 0.000 | 2.922 | 0.187 | 43.3 | 1.6 |
| 4349.5 | 14.389 | 3.081 | 6.292 | 1.379 | 0.000 | 2.920 | 0.185 | 42.6 | 4.1 |
| 4424.5 | 14.641 | 3.086 | 6.268 | 1.354 | 0.000 | 2.939 | 0.189 | 41.9 | 1.4 |
| 4499.5 | 14.888 | 3.085 | 6.263 | 1.342 | 0.000 | 2.941 | 0.190 | 41.2 | 3.5 |
| 4500.1 | 14.890 | 3.085 | 6.274 | 1.331 | 0.000 | 2.935 | 0.188 | 41.2 | 7.6 |
| | | | | | | | | | |

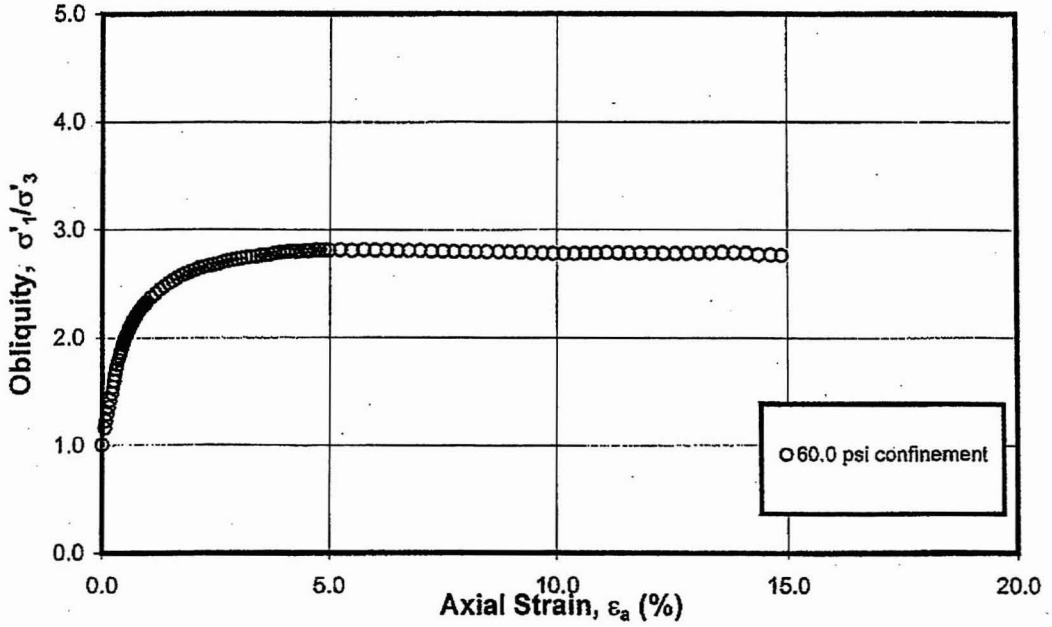



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. AC - Depth: NA
Boring TP-2319 - TP-2334

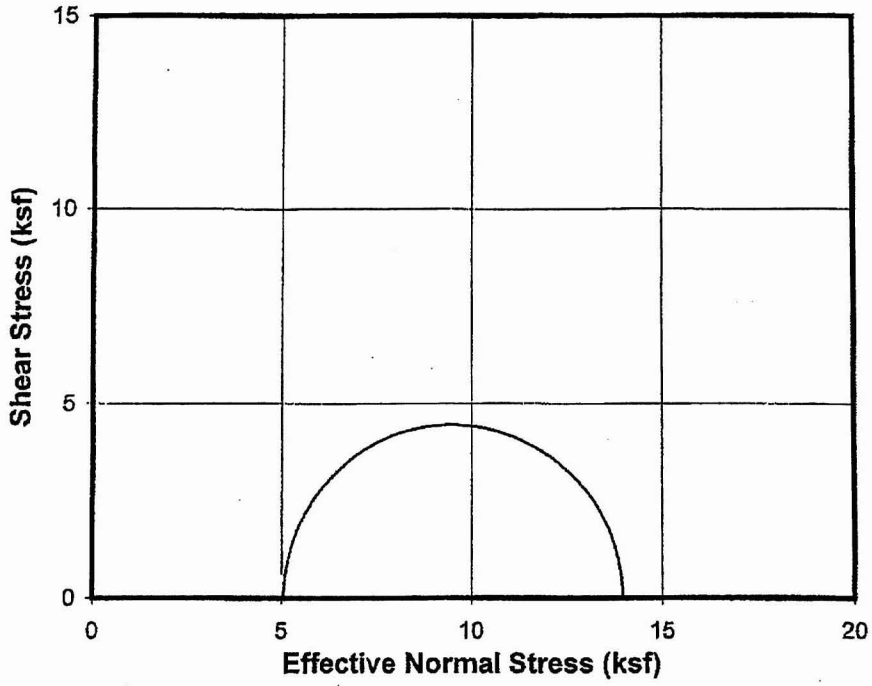
Reviewed By: DLR

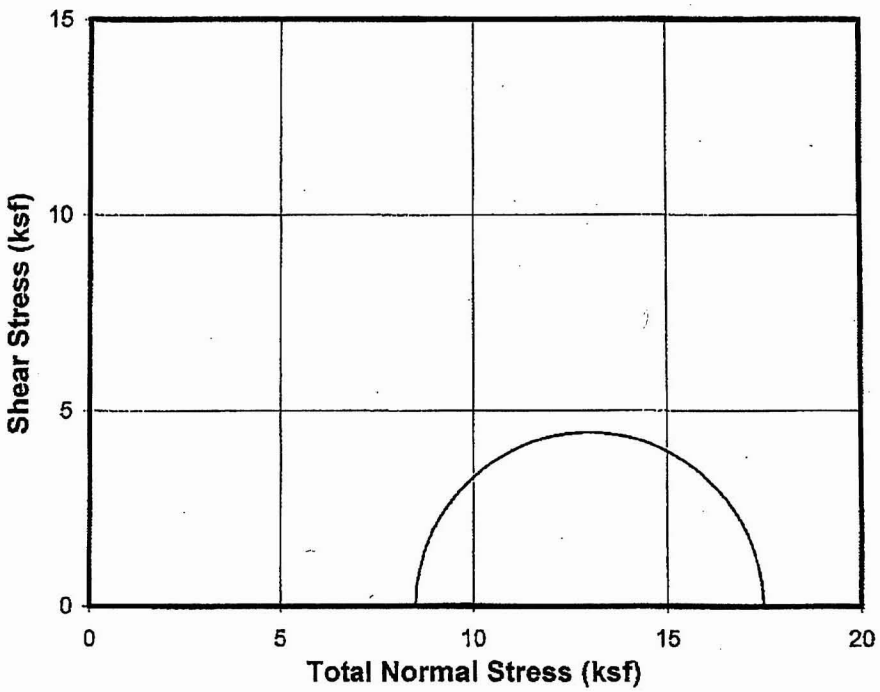



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. AC - Depth: NA
Boring TP-2319 - TP-2334

Reviewed By: 10/10




**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated- Mohr's Circles
Sample: Comp. AC - Depth: NA
Boring TP-2319 - TP-2334

Reviewed By: WER

# TRIAXIAL TEST (ASTM D 4767-04): Specimen Setup / Take Down

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | Cell No.: CYC-14 | File Name: Comp. Ac
Task No.: NA | Test Stress(es), $\sigma'_c$ or $\sigma'_{v,c}$ = 8.64 , _____ , _____ & _____ ksf
Project Name: Exelon (Victoria) | k ($\sigma'_{h,c}$ / $\sigma'_{v,c}$) = 1.00 | Induced OCR = 1.00 | $K_{ua}$ ($\sigma_{d,ua}/2\sigma'_{v,c}$) = NA

Assig. Remarks: _____ Specific Gravity: 2.659 [X] Meas.; [ ] Assumed

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [X] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = | 10-16 |
| Boring No.: TP-2319 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= 4.50 | No. Layers = | 4.00 |
| Sample No.: Comp. A | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = | 0.5-1 |
| Depth (ft): NA | Specimen No.: C | [ ] Kneading | [X] Undercompaction: $U_{ni}$ (%) = | Dia. (in.) = | 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD % Comp. = 95% | ± Opt. = | 4 % |

| | | | | |
|---|---|---|---|---|
| Type | [X] Isotropic | [ ] $K_o$ stress path | [ ] Used automated system: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/h) = |
| Consolidation : | [ ] Anistropic | [ ] 45° stress path | Remarks: | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading | [X] | Static | [X] | Undrained | [X] | Comp. | [X] | Strain | [ ] | Stress | [X] | Constant Cell Pressure | [ ] | Cyclic (Hz) | [ ] | Stress | [ ] Strain |
| Conditions : | [ ] | Post Cyclic | [ ] | Drained | [ ] | Ext. | [ ] | Stress Path | | | [ ] | Variable Cell Pressure | Rate: | [ ] 0.1; | [ ] | 1; | Other: |

| Water Content (WC); | Initial - Trimming Location | | | Final, $W_{at}$ |
|---|---|---|---|---|
| | Top ($W_{o,1}$) | Bottom ($W_{o,2}$) | Sides ($W_{o,3}$) | (see below) |
| Container No | 4160 | | | 659 |
| Mass Moist Soil + Cont. (g) | 131.45 | | | 140.91 |
| Mass Dry Soil + Container (g) | 118.97 | | | 127.45 |
| Mass Container (g) | 29.93 | | | 31.92 |
| Water Content, $W_{o,n}$ (%) | 14.02 | | | 14.09 |
| Avg. Initial WC, $W_{o,avg}$ (%) | 14.02 | Final ($W_{at}$); | [X] Slice ; [ ] | Whole Spec. |

[ ] See attached data sheet(s) for additional water contents

| SOIL MASSES: | Initial | Final |
|---|---|---|
| Moist + Tare (etc.)(g) | 503.92 | 505.75 |
| Tare (etc.) (g) | 0.00 | 0.00 |
| Mass Moist Spec., $M_{tn}$ (g) | 503.92 | 505.75 |
| Excess Dry Soil (soil not included in final mass measurement) | | |
| Container No | | |
| Mass Dry Soil + Cont. (g) | | |
| Mass Container (g) | | |
| Mass Excess Dry Soil, $M_{d,es}$ (g) | | 0.00 |

## Specimen Dimensions, (mm)

| | Height | | | Dia., X indicates with membrane | | |
|---|---|---|---|---|---|---|
| | Initial ($H_o$) | Final ($H_{at}$) | | Initial ($D_o$) | Final ($D_{at}$) | |
| GB | 100.000 | 100.000 | 1 T | 50.72 | 53.30 | For |
| 1 | 16.11 | -0.67 | 2 M | 50.26 | 56.00 | Wedge |
| 2 | 16.16 | -0.74 | 3 B | 50.18 | 52.22 | Failure |
| 3 | 16.17 | -0.67 | 1'T | | | = $d_{max}$ |
| 4 | 16.01 | -0.59 | 2'M | | | = $d_{min}$ |
| 5 | 16.15 | -0.87 | 3'B | | | = $\Delta d$ |
| Avg. | 116.12 | 99.29 | Avg. | 50.39 | 53.84 | xxxxx |

| Measuring Devices: | | | | |
|---|---|---|---|---|
| Pi Tape: | [X] Dia | $A_o = \pi D^2/400$ (cm$^2$) | 19.94 |
| Calipers: | [ ] Ht.; [ ] Dia | $V_o$ (cm$^3$) | 231.54 |
| | | $A_{atb,m}=\pi (D^*_{at})^2/400$ (cm$^2$) | 23.23 |
| Dial Comparator | [X] Ht.; [ ] Dia | $A_{atw,m}=(d_{min}-2\Delta d)d_{max}\pi/400$ (cm$^2$) | NA |
| Remarks: ID# PI-002 | | $D^*_{at}=(D_T+2D_M+D_B)/4$ (mm) | 54.38 |

## Estimated Initial Unit Weight

Total, $\gamma_{t,o}$ (lb/ft$^3$) = 135.87 | Dry, $\gamma_{d,o}$ (lb/ft$^3$)= 119.16

## Membrane / Filter Paper / Apparatus

| Membrane (mm): | | Top | Bottom |
|---|---|---|---|
| Number: | Thickness: | 0.48 | 0.65 |
| = 1 | [ ] Single; [X] Double | 0.52 | 0.63 |
| | Circumference ($C_{rm,o}$) | 152.0 | 152.0 |
| | | Total Thickness | Dia.($C_{rm,o}/\pi$) |
| | Average: | 0.29 | 48.38 |

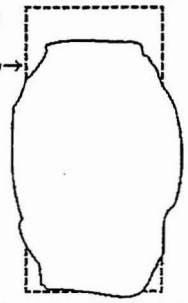
**Filter Paper:** Top + Bottom: [X] Yes ; [ ] No
Filter Strips: [X] Yes ; [ ] No Number = 8
Type of Filter Strips [ ] Vertical: ¼ in. & Whatman #54
[X] Spiral: ¼ in. & Whatman #1

**Apparatus:** Mass Top Cap, $M_{tc}$ = 53.4 g, 0.12 lbf
Mass Displ. System, $M_{ds}$ (cap, dial, piston, etc.) = NA g, NA lbf

[ ] Photo Taken.

Failure Sketch

$\varepsilon_a$=
20%→



Failure Mode:
[X] Bulge
[ ] Wedge
[ ] Parabolic
Wedge/Bulge Ht.= NA (mm)

NA - Not Applicable
GB - Gage Block
Other Remarks:
LL=34 PL=12 PI=22

Top Cap Attached: [ ] Yes; [X] No; Piston Dia.(in.) [X] ½; [ ] ¾; [ ] Load Cell: [ ] External [X] Internal
Top Cap - Rotation [ ] Fixed,<1°; [X] Limited,<5°; [ ] Unlimited, >5°
With: [ ] Frictionless End Caps; [ ] Lat. Movement Top Cap
[ ] Internal LVDT Jacket

Final Visual Classification: Light Brown Clayey SAND (SC)

Trimmed / Reconstituted By: YR | Set Up By: RC,jr | Taken Down By: RC,jr
Date: 6/16/2008 | Date: 6/16/2008 | Date: 6/26/2008
Prelim. Calc. By: RC,jr | Final Calc. By: TP | Reviewed By: WTD

[ ] See more detailed sketch on attached sheet. Remarks:

# MULTISTAGE TRIAXIAL TEST: Specimen Calculations & Summary(1)

Project Number: 0411-08-1686 | Cell No.: CYC-14 | File Name: Comp. Ac
Task Number: NA | Specific Gravity: 2.659 [X] Measured; [ ] Assumed
Boring No.: TP-2319 - TP-2334 | Sample No.: Comp. A | Specimen No.: C | Depth (ft): NA
Type Test: CIU Triaxial | Specimen: [ ] "Undisturbed"; [ ] Reconstituted; [X] Recompacted
Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = _____ ppm

| | Inital Water Contents (WC), ($W_o$) over Saturation, ($S_o$), in (%): | | | | | | Calculated Mass of Dry Soil (g) | |
|---|---|---|---|---|---|---|---|---|
| | Top, $W_{o,1}$ | Botttom, $W_{o,2}$ | Sides, $W_{o,3}$ | Avg., $W_{o,avg}$ | Selct., $W_{o,s}$ | Back Cal., $W_{o,bc}$ | Initial Selected WC, $w_o$ (%) | 14.02 |
| $W_o$ | 14.02 | | | 14.02 | 14.02 | 13.68 | Initial , $M_{d,o}$ | 441.96 |
| $S_o$ | 95.4 | | | 95.4 | 95.5 | 94.1 | Final, $M_{d,at}$ | 443.29 |
| | Measured final mass of moist soil, $M_{t,at}$ (g) | | | | | 505.75 | Selected, $M_d$ | 443.29 |
| | Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g) | | | | | 505.75 | | |

| Consolidation Data | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | |
|---|---|---|---|---|---|---|---|---|
| Changes in Height (mm) and Volume ($cm^3$) Within Given Consolidation Stages/Columns | At Initial Seating Stress | During Back-Pressuring | 1st Consol. Increment (1) | Column 2 or 3 to 1st Test Stage (1) | Column 4 to 2nd Test Stage | Column 5 to 3rd Test Stage | Column 6 to 4th Test Stage | |
| Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec. | | | | | | | | |
| Change in Height, $\Delta H_{c,n}$ | 0.01 | -0.84 | | 2.11 | NA | NA | NA | |
| Sum of changes in (+ out) | 0.40 | | | 13.40 | NA | NA | NA | |
| burette readings, $\Delta b_{r,n}$ (- in) | | -9.70 | NA | 16.45 | NA | NA | NA | (2) |
| Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$ | 0.06 | -5.02 | | 12.62 | NA | NA | NA | |
| Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$ | | | | 1.06 | NA | NA | NA | |
| Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$ | | | NA | 0.00 | NA | NA | NA | (3) |
| Selected $\Delta V_{c,n}$ | 0.40 | -9.70 | | 12.40 | NA | NA | NA | |

| Summary For Test Stages | | | | | |
|---|---|---|---|---|---|
| Test Stage: | 1st = 1 | 2nd = 2 | 3rd = 3 | 4th = 4 | |
| Cell Pressure, $\sigma_{c,n}$ (psi) | 120.00 | NA | NA | NA | Number of |
| Back Pressure, $U_{b,n}$ (psi) | 60.00 | NA | NA | NA | Test Stages = 1 |
| Axial Force Reading, $P_{r,n}$ (lbf) | 1.00 | NA | NA | NA | $t_{50}$ = 90 min |
| Eff. Consol. Stress ($\sigma'_c$ or $\sigma'_{v,c}$) (4), (ksf) | 8.66 | NA | NA | NA | |
| $t_c$, ON or in X days hrs | 5.00 | NA | NA | NA | |

**At Final Test Stress/Stage - Summary of Calculation of $\Delta V_c$ ($cm^3$) by Different Procedures**

| By Selected Volumes | By Saturation = 100 % | By Change in Mass (5) | For Diff. in Meas. Vol. ($V_o$-$V_{at}$), & corr. for $\Delta H_{td}$ | For Selected $\Delta V_c$, required |
|---|---|---|---|---|
| $\Delta V_c$ = 3.10 | $\Delta V_c$ = 1.95 | $\Delta V_c$ = 7.85 | $\Delta V_c$= | $G_s$ for $S_c$ = 100 %: 2.677 |

**At Final Test Stress/Stage - Consolidation Conclusions**

| | | | | | |
|---|---|---|---|---|---|
| $\Delta H_{c,f}$ (mm) = 1.28 | $\Delta V_{c,f}$ ($cm^3$) = 3.10 | Back Cal. $G_s$ for S=100% = 2.677 | Normalized | Ht. Ch. (%) = | 0.78 |
| $\varepsilon_{ac,c}$ (%) = 1.10 | $\varepsilon_{vc,f}$ (%) = 1.34 | | Diff. in: | Vol. Ch. (%) = | |

**Summary of Specimen Physical Properties**

| Specific Gravity: $G_s$ = 2.659 Measured Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Volumetric Water Content | Porosity n | Skempton B parameter %(6) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial: | 116.12 | 231.54 | 19.94 | 13.68 | 135.87 | 119.52 | 94.1 | 0.386 | 0.2623 | 0.279 | 99.0 |
| After Consol.: to 1st $\sigma'_c$ | 114.84 | 228.44 | 19.89 | 14.09 | 138.21 | 121.14 | 101.8 | 0.368 | 0.2739 | 0.269 | |
| to 2nd $\sigma'_c$ | | | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | | | |

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.
(2) The height changes occuring within each shearing and unloading stage (1 - 4) are recorded in these rows (after Column 3).
(3) The volume changes occuring within each shearing and unloading stage (1 - 4) are calculated/recorded in these rows (after Column 3).
(4) Stresses are corrected for membrane. (5) ~ $M_{t,o}$-($M_{tat,c}$+$\rho_{water}$x$\Delta V_{in,column1\&2}$)
(6) Initial value is after back pressuring
NA - Not Applicable ON - Over Night; WC - Water Content Remarks: Wet Method used in the Saturation Stage
Calculated By: TP Reviewed By: WED

## MULTISTAGE TRIAXIAL TEST: Specimen Calculations Summary(2)

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | App. No.: CYC-14 | File Name: Comp. Ac
Project Name: Exelon (Victoria) | Task No.: NA | Test No.: 0 | Test Series for: 0

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [X] Tamping | [X] Constant Effort: | Blows/Tamps per Layer = 10-16 |
| Boring No.: TP-2319 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= 4.50 | No. Layers = 4.00 |
| Sample No.: Comp. A | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = 0.5-1 |
| Depth (ft): NA | Specimen No.: C | [ ] Kneading | [X] Undercompaction: $U_{nl}$ (%) = | Dia. (in.) = 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD % Comp. = 95% | ± Opt. = 4 % |

| | | | | | |
|---|---|---|---|---|---|
| Type Consolidation | [X] Isotropic | [ ] $K_o$ stress path | [ ] Used automated system | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/hr.)= | |
| | [ ] Anistropic | [ ] 45° stress path | Remarks: | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading Conditions: | [X] Static | [X] Undrained | [X] Comp. | [X] Strain | [ ] Stress | [X] Constant Cell pressure | [ ] Cyclic (Hz) | [ ] Stress | [ ] Strain |
| | [ ] Post Cyclic | [ ] Drained | [ ] Ext. | [ ] Stress Path | | [ ] Variable Cell pressure | Rate: [ ] 0.1; | [ ] 1; | Other: |

| Specific Gravity: $G_s$ = 2.659 Measured Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Skempton B parameter %(1) |
|---|---|---|---|---|---|---|---|---|---|
| Initial: | 116.12 | 231.54 | 19.94 | 13.68 | 135.87 | 119.52 | 94.11 | 0.39 | 99.0 |
| After Consol.: to 1st $\sigma'_c$ | 114.84 | 228.44 | 19.89 | 14.09 | 138.21 | 121.14 | 101.84 | 0.37 | |
| to 2nd $\sigma'_c$ | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | |

Unit for Stresses: (ksf)

### Consolidation Stress Summary and Loading Summary

| Item | Unit | 1st Stage | 2nd Stage | 3rd Stage | 4th Stage |
|---|---|---|---|---|---|
| Axial Strain during Consol., $\varepsilon_{a,c}$: | % | 1.102 | NA | NA | NA |
| Vol. Strain during Consol., $\varepsilon_{v,c}$: | % | 1.339 | NA | NA | NA |
| Effective Vertical Stress, $\sigma'_v$ | (ksf) | 8.656 | NA | NA | NA |
| Effective Horizontal Stress, $\sigma'_h$: | (ksf) | 8.610 | NA | NA | NA |
| Consol. Stress Ratio, k ($\sigma'_h$ / $\sigma'_v$) : | - | 0.995 | | | |
| Induced OCR : | - | 1.00 | NA | NA | NA |
| Eff. Average Stress, ($\sigma'_v$ + $\sigma'_h$)/2 : | (ksf) | 17.266 | | | |
| Eff. Mean Stress, ($\sigma'_v$ + 2*$\sigma'_h$)/3 : | (ksf) | 8.625 | | | |
| Undr. Ambient Shear Stress, $\tau_{ba}$: | (ksf) | NA | NA | NA | NA |
| Undr. Ambient Shear Strain, $\varepsilon_{a,ua}$ | % | NA | NA | NA | NA |

Notes: See Fugro South, Inc. Notation Listing for definition of symbols and acronyms.

(1) Initial B is after saturation

NA - Not Applicable

### Membrane Correction

Type: Bulge
Modulus: 150.0 psi
Diameter: 48.38 mm
Thickness: 0.29 mm

### Area Correction

Type: Bulge

| Stage | Area Corr. Const.: | Final Area ($cm^2$): |
|---|---|---|
| 1st | 0.988 | 23.23 |
| 2nd | | |
| 3rd | | |
| 4th | | |

### Filter Paper Correction

Type: None | Type Strips: Sprial #1
Strips: 8
Force: 0.000 lbf/strip

Final Visual Description and Remarks: Light Brown Clayey SAND (SC)

### Loading Summary

| Stage | Stress Status | $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | ΔU (ksf) | $\sigma_1'$ (ksf) | $\sigma_3'$ (ksf) |
|---|---|---|---|---|---|---|---|
| 1st | Max Shear Stress | 14.87 | 4.455 | 9.512 | 3.493 | 13.967 | 5.056 |
| | Max Obliquity | 5.72 | 3.857 | 8.110 | 4.323 | 11.967 | 4.253 |
| 2nd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 3rd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 4th | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |

Remarks: Stain Rate (%/min) = 4.50E-03

# STAGE 1

Project: 0411-08-1686 Boring No.: TP-2319 - TP-2334 Depth (ft.): NA

Test Type: CIU Triaxial Sample No.: Comp. A Stage No.: 1

Specimen No.: C

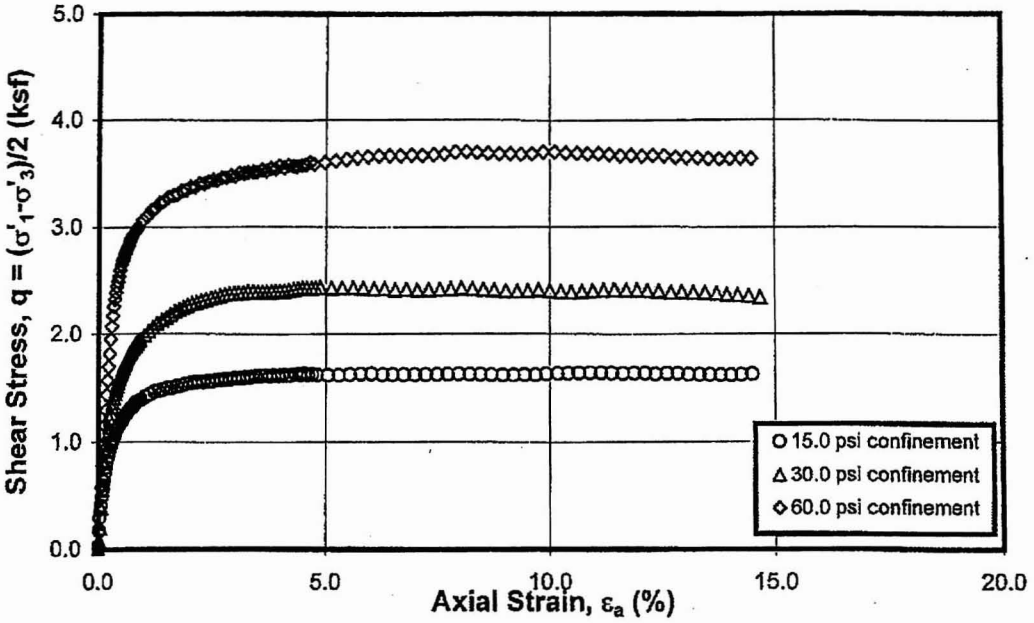
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, ΔU (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.000 | 0.023 | 8.633 | 0.000 | 0.000 | 1.005 | 0.000 | - | - |
| 16.7 | 0.058 | 0.635 | 8.342 | 0.904 | 0.000 | 1.165 | 0.737 | 2105.1 | 1857.8 |
| 22.2 | 0.086 | 0.859 | 8.306 | 1.154 | 0.000 | 1.231 | 0.695 | 1945.2 | 1641.8 |
| 27.8 | 0.111 | 1.069 | 8.276 | 1.404 | 0.000 | 1.297 | 0.670 | 1883.8 | 1394.7 |
| 33.4 | 0.145 | 1.256 | 8.241 | 1.625 | 0.000 | 1.360 | 0.659 | 1705.8 | 1087.1 |
| 38.9 | 0.178 | 1.433 | 8.201 | 1.831 | 0.000 | 1.423 | 0.653 | 1584.3 | 994.9 |
| 44.5 | 0.211 | 1.588 | 8.151 | 2.047 | 0.000 | 1.484 | 0.654 | 1481.4 | 1016.0 |
| 50.0 | 0.238 | 1.737 | 8.108 | 2.238 | 0.000 | 1.545 | 0.653 | 1437.9 | 1025.0 |
| 55.6 | 0.266 | 1.867 | 8.063 | 2.406 | 0.000 | 1.603 | 0.655 | 1387.9 | 965.9 |
| 61.1 | 0.289 | 1.980 | 8.024 | 2.564 | 0.000 | 1.655 | 0.656 | 1355.6 | 1012.6 |
| 66.7 | 0.309 | 2.085 | 7.985 | 2.707 | 0.000 | 1.707 | 0.657 | 1335.1 | 879.9 |
| 72.3 | 0.333 | 2.173 | 7.942 | 2.833 | 0.000 | 1.753 | 0.661 | 1289.6 | 682.3 |
| 77.8 | 0.356 | 2.247 | 7.909 | 2.944 | 0.000 | 1.794 | 0.663 | 1248.6 | 560.1 |
| 83.4 | 0.384 | 2.312 | 7.869 | 3.048 | 0.000 | 1.832 | 0.667 | 1192.6 | 478.1 |
| 88.9 | 0.408 | 2.372 | 7.835 | 3.140 | 0.000 | 1.868 | 0.670 | 1150.2 | 451.5 |
| 94.5 | 0.433 | 2.423 | 7.805 | 3.215 | 0.000 | 1.900 | 0.672 | 1108.5 | 429.5 |
| 100.0 | 0.455 | 2.472 | 7.779 | 3.297 | 0.000 | 1.932 | 0.674 | 1075.8 | 389.6 |
| 105.6 | 0.479 | 2.513 | 7.749 | 3.365 | 0.000 | 1.960 | 0.677 | 1039.2 | 377.3 |
| 111.2 | 0.496 | 2.547 | 7.722 | 3.415 | 0.000 | 1.984 | 0.680 | 1018.4 | 386.4 |
| 116.7 | 0.516 | 2.583 | 7.702 | 3.484 | 0.000 | 2.009 | 0.682 | 992.8 | 316.7 |
| 122.3 | 0.538 | 2.613 | 7.678 | 3.536 | 0.000 | 2.032 | 0.684 | 963.5 | 287.9 |
| 127.8 | 0.560 | 2.647 | 7.659 | 3.582 | 0.000 | 2.056 | 0.686 | 936.7 | 293.5 |
| 133.4 | 0.582 | 2.678 | 7.643 | 3.636 | 0.000 | 2.079 | 0.687 | 912.8 | 249.7 |
| 138.9 | 0.609 | 2.707 | 7.625 | 3.681 | 0.000 | 2.101 | 0.688 | 881.5 | 188.7 |
| 144.5 | 0.635 | 2.728 | 7.606 | 3.719 | 0.000 | 2.119 | 0.690 | 852.3 | 181.9 |
| 150.1 | 0.659 | 2.752 | 7.592 | 3.760 | 0.000 | 2.137 | 0.691 | 828.1 | 216.8 |
| 155.6 | 0.681 | 2.778 | 7.580 | 3.796 | 0.000 | 2.157 | 0.691 | 809.1 | 216.7 |
| 161.2 | 0.704 | 2.800 | 7.568 | 3.829 | 0.000 | 2.175 | 0.692 | 789.6 | 187.4 |
| 166.7 | 0.729 | 2.822 | 7.559 | 3.854 | 0.000 | 2.192 | 0.692 | 768.4 | 160.3 |
| 172.3 | 0.754 | 2.840 | 7.544 | 3.894 | 0.000 | 2.208 | 0.693 | 747.7 | 166.9 |
| 177.8 | 0.775 | 2.860 | 7.536 | 3.920 | 0.000 | 2.224 | 0.693 | 732.5 | 161.0 |
| 183.4 | 0.799 | 2.877 | 7.525 | 3.936 | 0.000 | 2.238 | 0.694 | 714.0 | 150.6 |
| 189.0 | 0.824 | 2.897 | 7.519 | 3.975 | 0.000 | 2.254 | 0.694 | 698.0 | 141.7 |
| 194.5 | 0.848 | 2.911 | 7.509 | 3.997 | 0.000 | 2.266 | 0.695 | 681.1 | 128.2 |
| 200.1 | 0.873 | 2.929 | 7.502 | 4.017 | 0.000 | 2.281 | 0.695 | 665.7 | 133.2 |
| 205.6 | 0.898 | 2.944 | 7.494 | 4.046 | 0.000 | 2.294 | 0.695 | 650.6 | 128.2 |
| 211.2 | 0.923 | 2.960 | 7.491 | 4.064 | 0.000 | 2.307 | 0.694 | 636.9 | 101.4 |
| 216.7 | 0.948 | 2.970 | 7.483 | 4.078 | 0.000 | 2.316 | 0.695 | 621.7 | 94.4 |

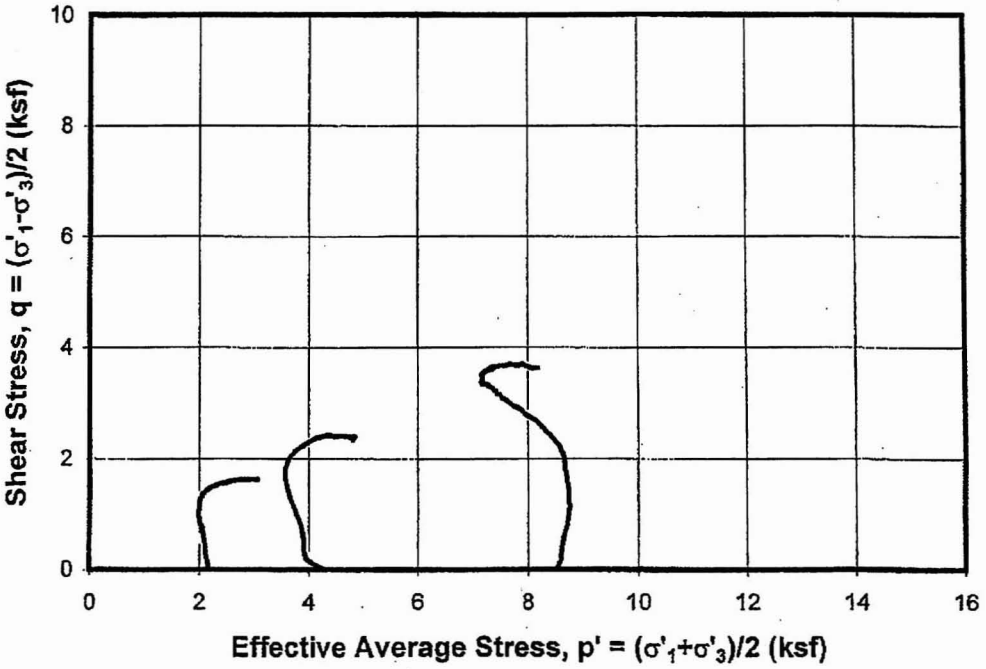
## STAGE 1

| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 222.3 | 0.971 | 2.983 | 7.479 | 4.098 | 0.000 | 2.327 | 0.695 | 609.7 | 116.9 |
| 244.5 | 1.068 | 3.039 | 7.466 | 4.166 | 0.000 | 2.373 | 0.693 | 564.9 | 102.2 |
| 266.8 | 1.166 | 3.083 | 7.456 | 4.218 | 0.000 | 2.410 | 0.692 | 525.0 | 89.9 |
| 289.0 | 1.261 | 3.126 | 7.451 | 4.262 | 0.000 | 2.446 | 0.691 | 492.1 | 78.3 |
| 311.2 | 1.361 | 3.159 | 7.442 | 4.296 | 0.000 | 2.475 | 0.690 | 461.0 | 73.1 |
| 333.4 | 1.458 | 3.198 | 7.445 | 4.342 | 0.000 | 2.506 | 0.687 | 435.6 | 70.0 |
| 355.6 | 1.553 | 3.226 | 7.446 | 4.366 | 0.000 | 2.529 | 0.685 | 412.6 | 62.5 |
| 377.9 | 1.645 | 3.256 | 7.449 | 4.392 | 0.000 | 2.553 | 0.683 | 393.2 | 63.2 |
| 400.1 | 1.743 | 3.286 | 7.457 | 4.405 | 0.000 | 2.576 | 0.680 | 374.4 | 61.5 |
| 422.3 | 1.836 | 3.315 | 7.471 | 4.429 | 0.000 | 2.595 | 0.677 | 358.6 | 55.9 |
| 444.5 | 1.930 | 3.338 | 7.480 | 4.442 | 0.000 | 2.612 | 0.674 | 343.6 | 44.9 |
| 466.8 | 2.032 | 3.359 | 7.488 | 4.451 | 0.000 | 2.627 | 0.672 | 328.3 | 49.5 |
| 489.0 | 2.129 | 3.387 | 7.503 | 4.461 | 0.000 | 2.646 | 0.668 | 316.0 | 41.8 |
| 511.2 | 2.230 | 3.400 | 7.510 | 4.470 | 0.000 | 2.654 | 0.666 | 302.9 | 33.3 |
| 533.4 | 2.331 | 3.421 | 7.531 | 4.474 | 0.000 | 2.665 | 0.662 | 291.6 | 42.2 |
| 555.7 | 2.428 | 3.442 | 7.551 | 4.472 | 0.000 | 2.675 | 0.658 | 281.6 | 44.8 |
| 577.9 | 2.533 | 3.466 | 7.583 | 4.463 | 0.000 | 2.684 | 0.652 | 271.9 | 43.2 |
| 600.1 | 2.631 | 3.485 | 7.589 | 4.473 | 0.000 | 2.699 | 0.651 | 263.2 | 40.1 |
| 622.3 | 2.729 | 3.506 | 7.609 | 4.480 | 0.000 | 2.708 | 0.647 | 255.2 | 31.9 |
| 644.6 | 2.833 | 3.518 | 7.618 | 4.481 | 0.000 | 2.716 | 0.645 | 246.7 | 28.9 |
| 666.8 | 2.939 | 3.536 | 7.632 | 4.483 | 0.000 | 2.726 | 0.642 | 239.1 | 33.2 |
| 689.0 | 3.043 | 3.552 | 7.653 | 4.469 | 0.000 | 2.733 | 0.639 | 232.0 | 33.1 |
| 711.2 | 3.152 | 3.571 | 7.669 | 4.484 | 0.000 | 2.743 | 0.636 | 225.2 | 29.4 |
| 733.5 | 3.261 | 3.584 | 7.683 | 4.481 | 0.000 | 2.749 | 0.633 | 218.4 | 21.4 |
| 755.7 | 3.376 | 3.595 | 7.699 | 4.475 | 0.000 | 2.752 | 0.631 | 211.6 | 26.3 |
| 777.9 | 3.481 | 3.613 | 7.713 | 4.472 | 0.000 | 2.762 | 0.628 | 206.3 | 30.0 |
| 800.1 | 3.582 | 3.626 | 7.733 | 4.474 | 0.000 | 2.766 | 0.625 | 201.2 | 26.8 |
| 822.4 | 3.684 | 3.640 | 7.756 | 4.463 | 0.000 | 2.769 | 0.621 | 196.4 | 36.6 |
| 844.6 | 3.782 | 3.663 | 7.772 | 4.469 | 0.000 | 2.783 | 0.618 | 192.5 | 36.2 |
| 866.8 | 3.886 | 3.676 | 7.795 | 4.455 | 0.000 | 2.785 | 0.615 | 188.1 | 31.5 |
| 889.0 | 3.983 | 3.694 | 7.822 | 4.446 | 0.000 | 2.790 | 0.610 | 184.3 | 26.1 |
| 911.3 | 4.078 | 3.702 | 7.832 | 4.449 | 0.000 | 2.792 | 0.609 | 180.4 | 24.1 |
| 933.5 | 4.174 | 3.717 | 7.852 | 4.443 | 0.000 | 2.798 | 0.606 | 177.0 | 20.1 |
| 955.7 | 4.273 | 3.721 | 7.866 | 4.431 | 0.000 | 2.796 | 0.604 | 173.1 | 19.6 |
| 977.9 | 4.374 | 3.737 | 7.888 | 4.417 | 0.000 | 2.800 | 0.600 | 169.8 | 24.9 |
| 1000.1 | 4.476 | 3.746 | 7.899 | 4.426 | 0.000 | 2.804 | 0.599 | 166.4 | 16.4 |
| 1022.4 | 4.572 | 3.753 | 7.909 | 4.421 | 0.000 | 2.806 | 0.597 | 163.2 | 16.2 |
| 1044.6 | 4.678 | 3.763 | 7.922 | 4.416 | 0.000 | 2.809 | 0.595 | 159.9 | 18.3 |
| 1066.8 | 4.775 | 3.772 | 7.936 | 4.407 | 0.000 | 2.811 | 0.593 | 157.0 | 18.0 |
| 1089.0 | 4.880 | 3.781 | 7.950 | 4.404 | 0.000 | 2.814 | 0.591 | 154.0 | 17.0 |
| 1111.3 | 4.982 | 3.789 | 7.972 | 4.394 | 0.000 | 2.812 | 0.588 | 151.2 | 16.2 |
| 1166.8 | 5.227 | 3.809 | 8.010 | 4.375 | 0.000 | 2.813 | 0.582 | 144.9 | 14.1 |
| 1222.4 | 5.473 | 3.824 | 8.051 | 4.348 | 0.000 | 2.809 | 0.577 | 138.9 | 19.7 |

## STAGE 1

| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 1277.9 | 5.720 | 3.857 | 8.110 | 4.323 | 0.000 | 2.814 | 0.568 | 134.1 | 17.7 |
| 1333.5 | 5.958 | 3.867 | 8.138 | 4.302 | 0.000 | 2.811 | 0.564 | 129.1 | 12.1 |
| 1389.1 | 6.202 | 3.887 | 8.174 | 4.284 | 0.000 | 2.813 | 0.559 | 124.6 | 13.4 |
| 1444.6 | 6.445 | 3.900 | 8.218 | 4.252 | 0.000 | 2.807 | 0.554 | 120.3 | 17.5 |
| 1500.2 | 6.693 | 3.930 | 8.278 | 4.219 | 0.000 | 2.807 | 0.545 | 116.7 | 20.8 |
| 1555.7 | 6.944 | 3.952 | 8.325 | 4.191 | 0.000 | 2.807 | 0.539 | 113.2 | 14.9 |
| 1611.3 | 7.200 | 3.967 | 8.368 | 4.162 | 0.000 | 2.803 | 0.534 | 109.6 | 14.1 |
| 1666.8 | 7.452 | 3.987 | 8.414 | 4.142 | 0.000 | 2.802 | 0.528 | 106.4 | 14.2 |
| 1722.4 | 7.701 | 4.003 | 8.456 | 4.116 | 0.000 | 2.798 | 0.522 | 103.4 | 17.1 |
| 1778.0 | 7.942 | 4.029 | 8.508 | 4.090 | 0.000 | 2.799 | 0.516 | 100.9 | 18.0 |
| 1833.5 | 8.185 | 4.046 | 8.551 | 4.065 | 0.000 | 2.797 | 0.510 | 98.3 | 17.0 |
| 1889.1 | 8.433 | 4.071 | 8.601 | 4.036 | 0.000 | 2.797 | 0.504 | 96.0 | 17.8 |
| 1944.6 | 8.690 | 4.091 | 8.649 | 4.008 | 0.000 | 2.795 | 0.498 | 93.6 | 14.0 |
| 2000.2 | 8.946 | 4.107 | 8.684 | 3.984 | 0.000 | 2.794 | 0.494 | 91.3 | 12.0 |
| 2055.7 | 9.189 | 4.121 | 8.726 | 3.955 | 0.000 | 2.790 | 0.489 | 89.2 | 11.6 |
| 2111.3 | 9.432 | 4.135 | 8.764 | 3.931 | 0.000 | 2.787 | 0.484 | 87.2 | 10.8 |
| 2166.9 | 9.680 | 4.148 | 8.794 | 3.912 | 0.000 | 2.785 | 0.480 | 85.2 | 9.7 |
| 2222.4 | 9.925 | 4.159 | 8.834 | 3.882 | 0.000 | 2.779 | 0.476 | 83.3 | 12.6 |
| 2278.0 | 10.154 | 4.177 | 8.872 | 3.862 | 0.000 | 2.779 | 0.471 | 81.8 | 15.6 |
| 2333.5 | 10.390 | 4.195 | 8.909 | 3.842 | 0.000 | 2.780 | 0.467 | 80.3 | 14.7 |
| 2389.1 | 10.622 | 4.212 | 8.940 | 3.824 | 0.000 | 2.781 | 0.463 | 78.9 | 14.5 |
| 2444.6 | 10.855 | 4.229 | 8.976 | 3.802 | 0.000 | 2.782 | 0.459 | 77.5 | 18.3 |
| 2500.2 | 11.096 | 4.255 | 9.014 | 3.797 | 0.000 | 2.788 | 0.455 | 76.3 | 15.4 |
| 2555.8 | 11.354 | 4.267 | 9.049 | 3.777 | 0.000 | 2.784 | 0.451 | 74.8 | 10.2 |
| 2611.3 | 11.597 | 4.281 | 9.079 | 3.761 | 0.000 | 2.784 | 0.448 | 73.4 | 14.0 |
| 2666.9 | 11.844 | 4.301 | 9.129 | 3.731 | 0.000 | 2.782 | 0.442 | 72.2 | 16.0 |
| 2722.4 | 12.089 | 4.320 | 9.169 | 3.709 | 0.000 | 2.782 | 0.438 | 71.1 | 11.7 |
| 2778.0 | 12.339 | 4.330 | 9.198 | 3.686 | 0.000 | 2.779 | 0.434 | 69.8 | 10.0 |
| 2833.5 | 12.591 | 4.345 | 9.229 | 3.669 | 0.000 | 2.779 | 0.431 | 68.7 | 13.4 |
| 2889.1 | 12.850 | 4.364 | 9.260 | 3.653 | 0.000 | 2.783 | 0.428 | 67.6 | 8.0 |
| 2944.7 | 13.107 | 4.366 | 9.266 | 3.641 | 0.000 | 2.782 | 0.427 | 66.3 | 6.0 |
| 3000.2 | 13.357 | 4.379 | 9.282 | 3.649 | 0.000 | 2.786 | 0.425 | 65.2 | 12.5 |
| 3055.8 | 13.612 | 4.397 | 9.317 | 3.630 | 0.000 | 2.788 | 0.422 | 64.3 | 14.2 |
| 3111.3 | 13.859 | 4.415 | 9.361 | 3.602 | 0.000 | 2.785 | 0.417 | 63.4 | 12.9 |
| 3166.9 | 14.111 | 4.430 | 9.401 | 3.574 | 0.000 | 2.782 | 0.413 | 62.5 | 9.7 |
| 3222.4 | 14.374 | 4.439 | 9.458 | 3.522 | 0.000 | 2.769 | 0.407 | 61.5 | 8.1 |
| 3278.0 | 14.633 | 4.451 | 9.488 | 3.513 | 0.000 | 2.767 | 0.403 | 60.5 | 6.3 |
| 3331.4 | 14.875 | 4.455 | 9.512 | 3.493 | 0.000 | 2.762 | 0.401 | 59.6 | 3.9 |
| | | | | | | | | | |



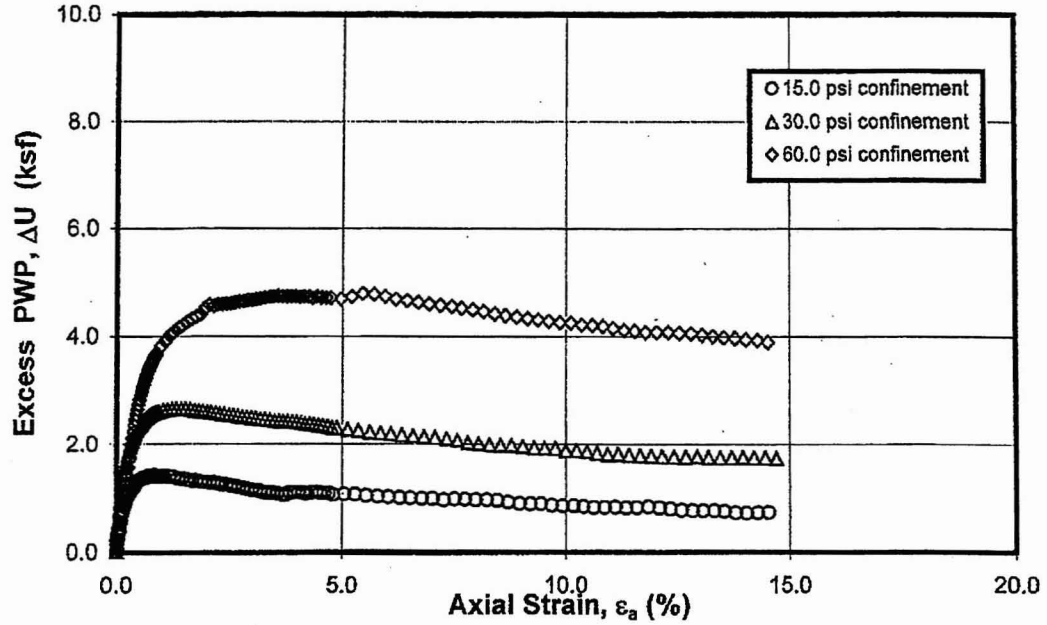

**MULTI STAGE UNDRAINED TRIAXIAL COMPRESSION TEST**

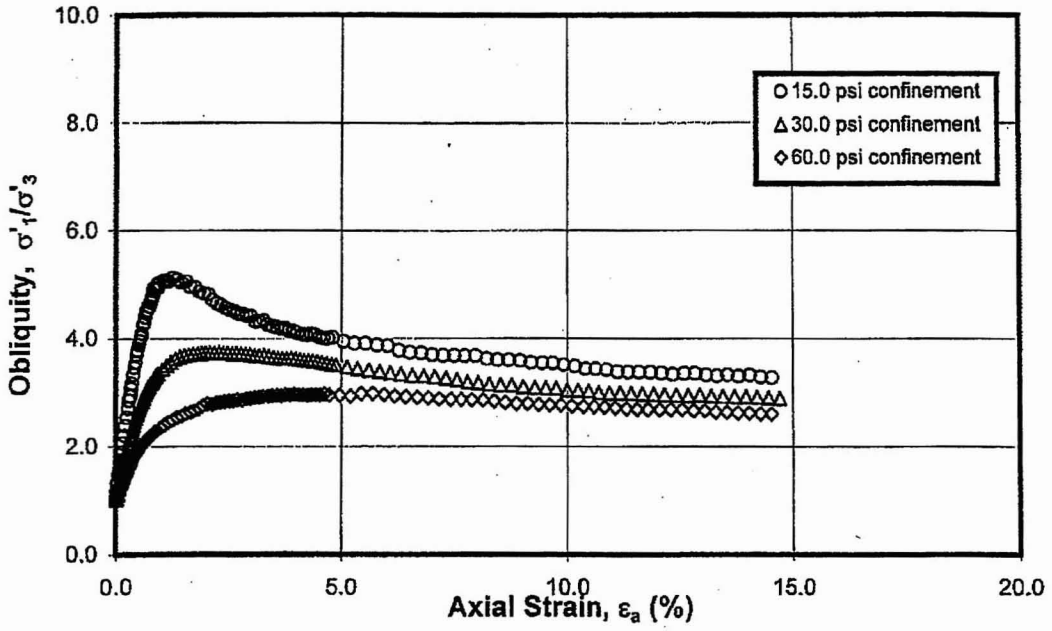
Isotropically Consolidated

Sample: Comp. B - Depth: NA

Boring TP-2317 - TP-2334

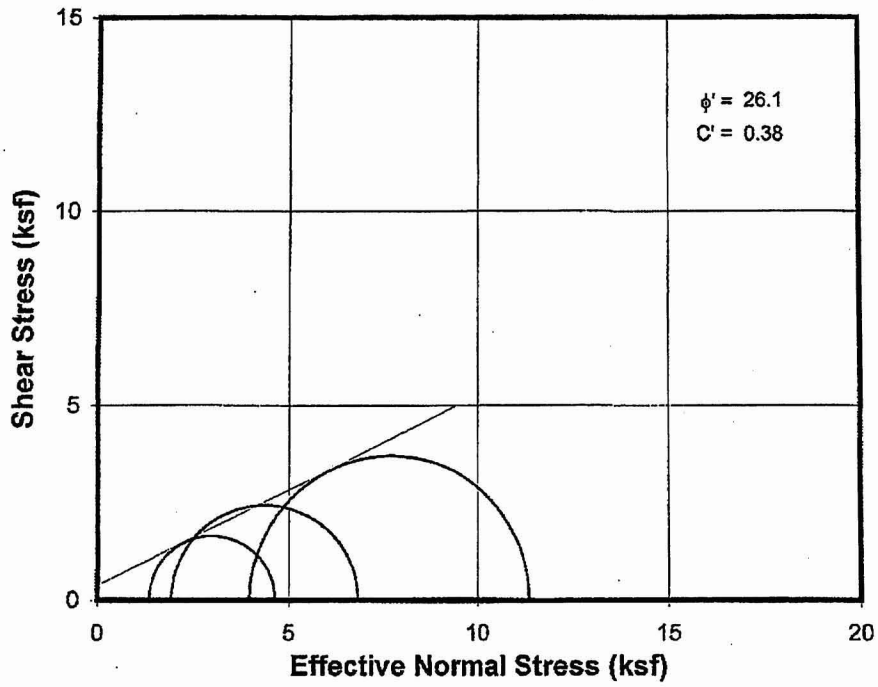
Reviewed By: WEA

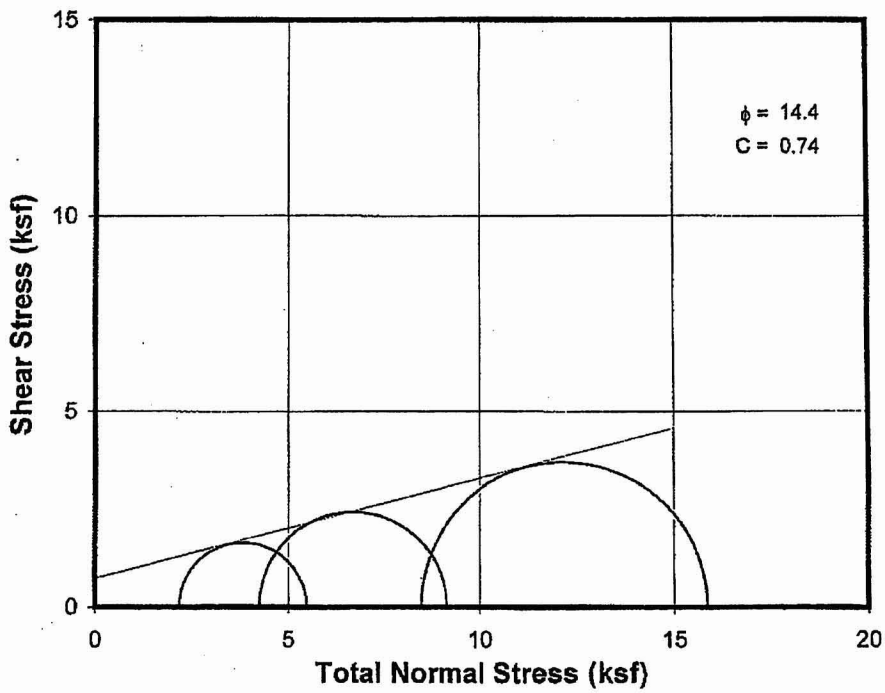



**MULTI STAGE UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. B - Depth: NA
Boring TP-2317 - TP-2334

Reviewed By: WFD



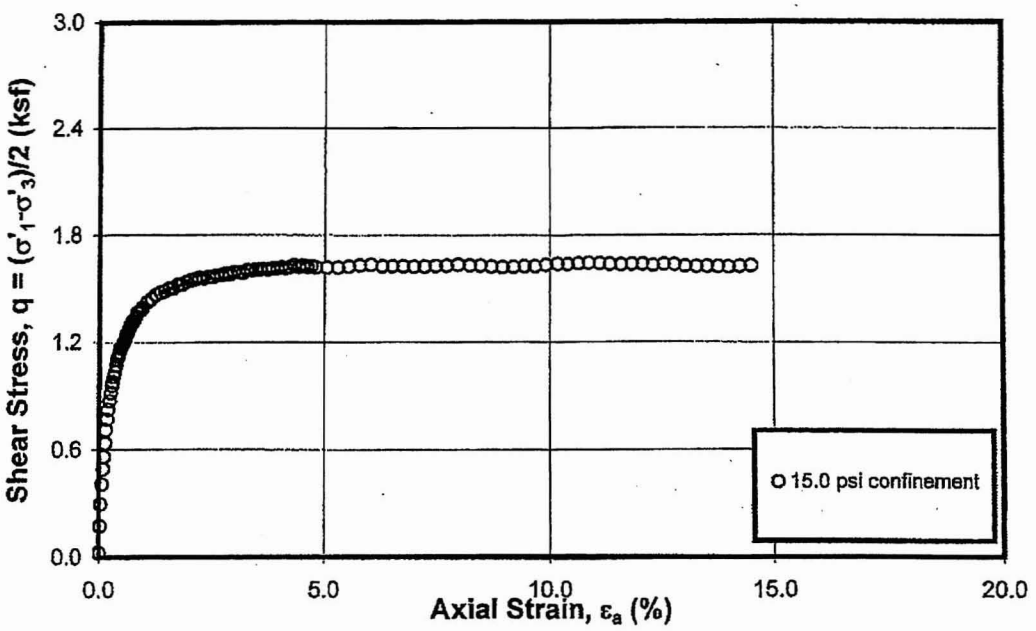

**MULTI STAGE UNDRAINED TRIAXIAL COMPRESSION TEST**

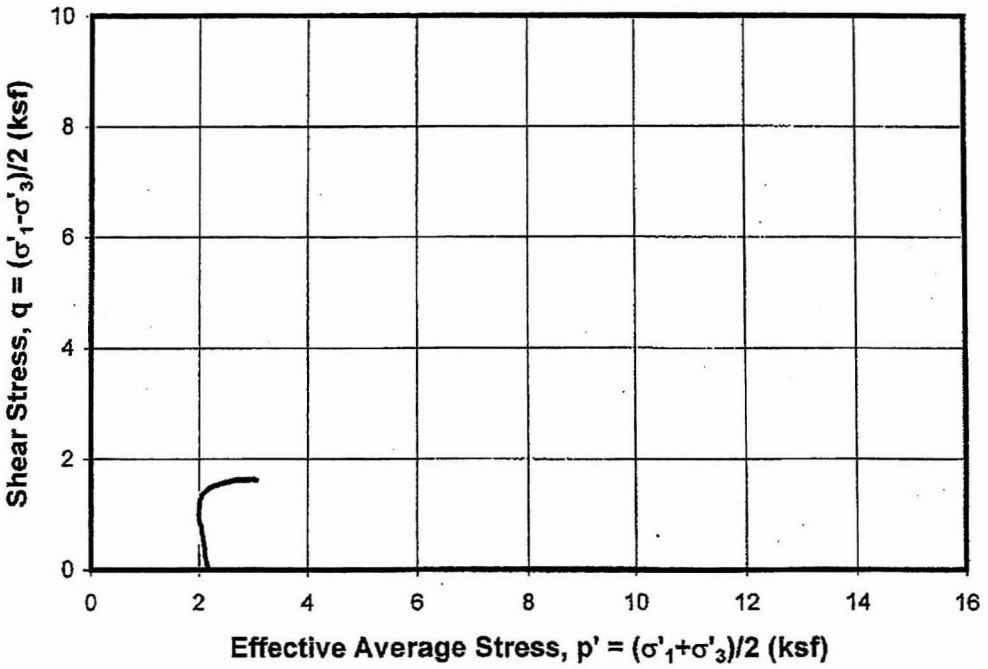
Isotropically Consolidated- Mohr's Circles

Sample: Comp. B - Depth: NA

Boring TP-2317 - TP-2334

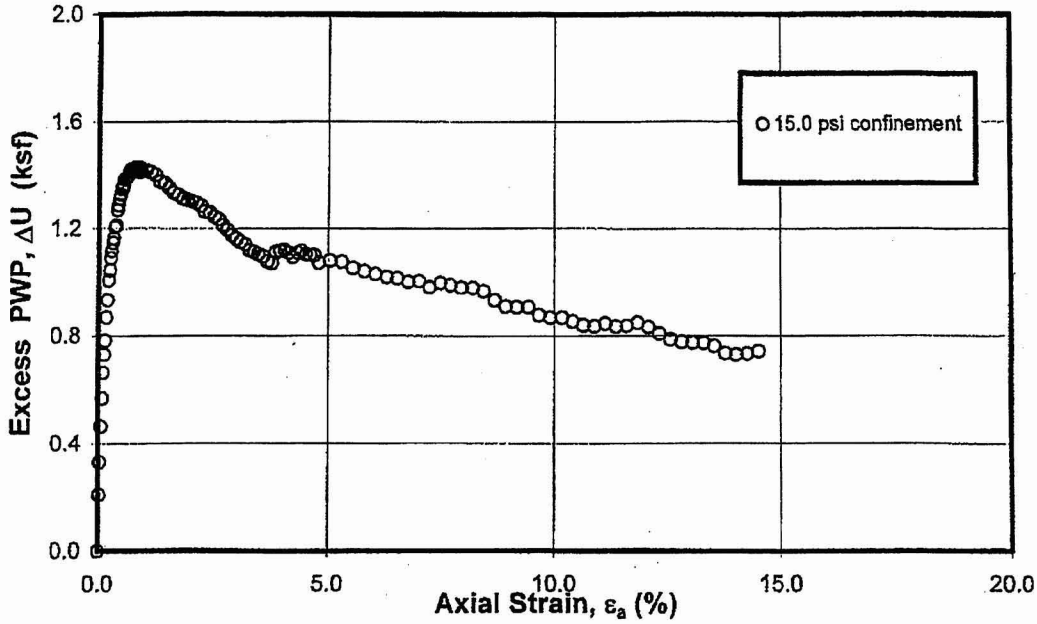
Reviewed By: WTD

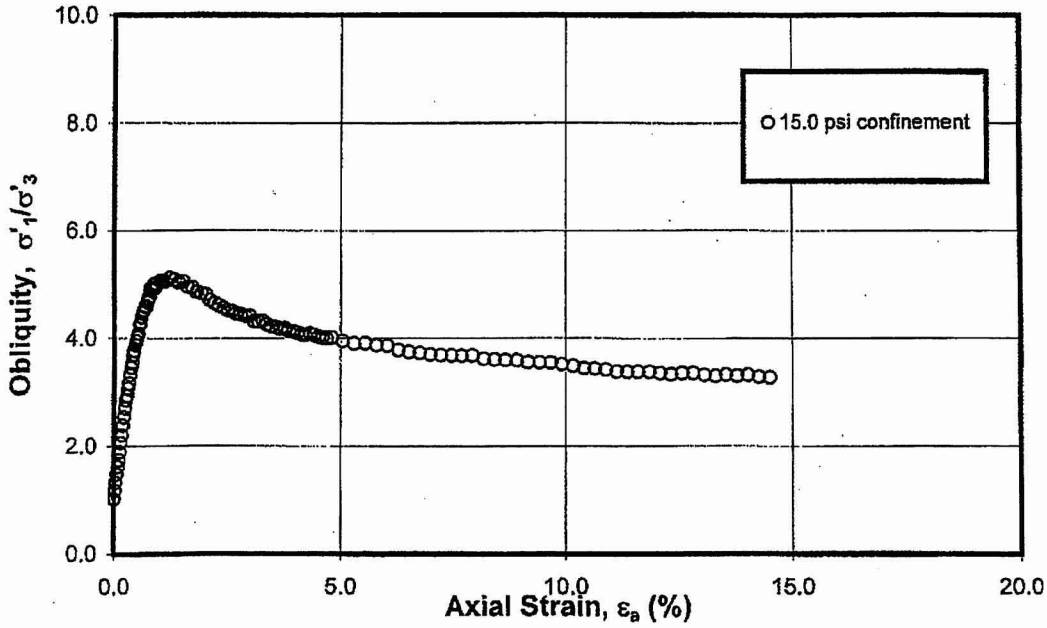



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. BA - Depth: NA
Boring TP-2317 - TP-2334

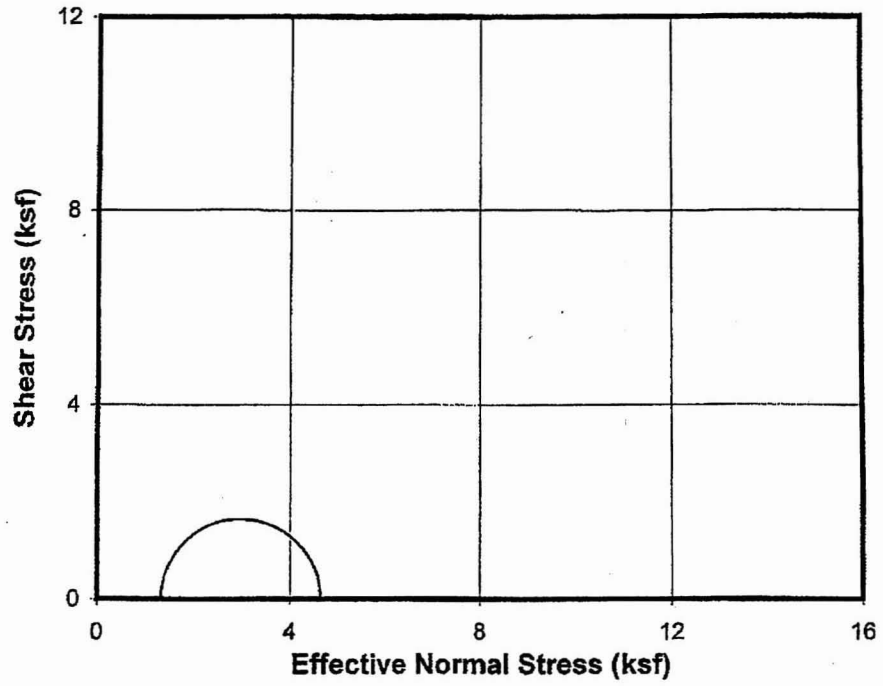
Reviewed By: DFD

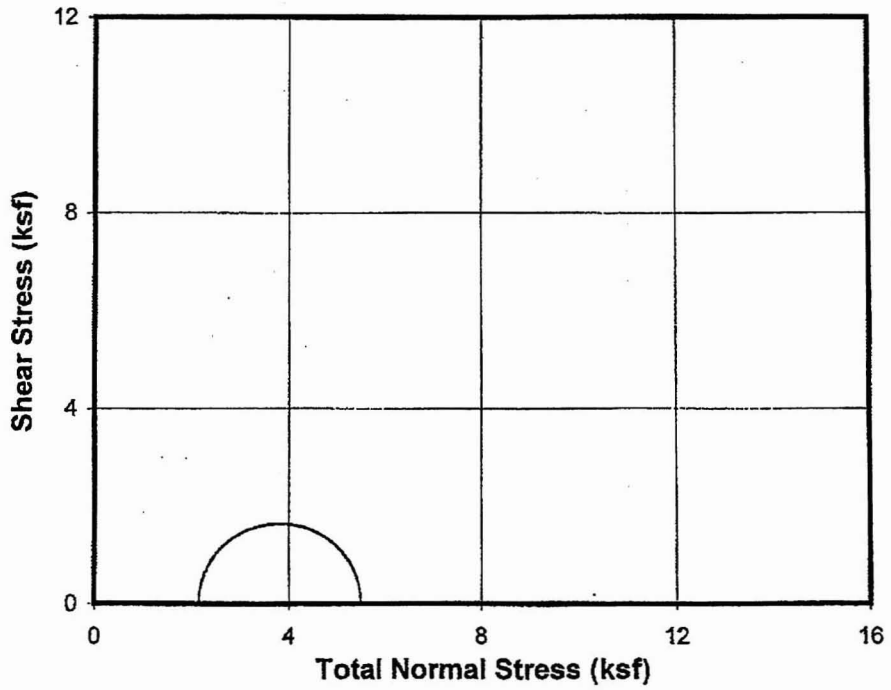



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. BA - Depth: NA
Boring TP-2317 - TP-2334

Reviewed By: WLP




**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated- Mohr's Circles
Sample: Comp. BA - Depth: NA
Boring TP-2317 - TP-2334

Reviewed By: WJD

# TRIAXIAL TEST (ASTM D 4767-04): Specimen Setup / Take Down

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | Cell No.: CYC-5 | File Name: Comp. Ba

Task No.: NA | Test Stress(es), $\sigma'_c$ or $\sigma'_{v,c}$ = 2.16 , _____ , _____ & _____ ksf

Project Name: Exelon (Victoria) | k ($\sigma'_{h,c}$ / $\sigma'_{v,c}$) = 1.00 | Induced OCR = 1.00 | $K_{ua}$ ($\sigma_{d,ua}/2\sigma'_{v,c}$) = NA

Assig. Remarks: _____ Specific Gravity: 2.693 [X] Meas.; [ ] Assumed

| | | | | |
|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [ ] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = 10-16 |
| Boring No.: TP-2317 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= 4.50 | No. Layers = 4.00 |
| Sample No.: Comp. B | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = 0.5-1 |
| Depth (ft): NA | Specimen No.: A | [ ] Kneading | [X] Undercompaction: $U_{ni}$ (%) = | Dia. (in.) = 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD | % Comp. = 95.0 ± Opt. = + 4% |

| | | | | |
|---|---|---|---|---|
| Type | [X] Isotropic | [ ] $K_o$ stress path | [ ] Used automated system: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/h) = |
| Consolidation : | [ ] Anistropic | [ ] 45° stress path | Remarks: | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading | [X] Static | [X] Undrained | [X] Comp. | [X] Strain | [ ] Stress | [X] Constant Cell Pressure | [ ] Cyclic (Hz) | [ ] Stress | [ ] Strain |
| Conditions : | [ ] Post Cyclic | [ ] Drained | [ ] Ext. | [ ] Stress Path | | [ ] Variable Cell Pressure | Rate: [ ] 0.1; | [ ] 1; | Other: |

| Water Content (WC); | Initial - Trimming Location | | | Final, $W_{at}$ |
|---|---|---|---|---|
| | Top ($W_{o,1}$) | Bottom ($W_{o,2}$) | Sides ($W_{o,3}$) | (see below) |
| Container No | 716 | | | 887 |
| Mass Moist Soil + Cont. (g) | 126.42 | | | 128.65 |
| Mass Dry Soil + Container (g) | 113.19 | | | 113.22 |
| Mass Container (g) | 31.85 | | | 32.25 |
| Water Content, $W_{o,n}$ (%) | 16.27 | | | 19.06 |
| Avg. Initial WC, $W_{o,avg}$ (%) | 16.27 | Final ($W_{at}$); | [X] Slice ; | Whole Spec. |

[ ] See attached data sheet(s) for additional water contents

| SOIL MASSES: | Initial | Final |
|---|---|---|
| Moist + Tare (etc.)(g) | 982.09 | 504.75 |
| Tare (etc.) (g) | 484.23 | 0.00 |
| Mass Moist Spec., $M_{tn}$ (g) | 497.86 | 504.75 |
| Excess Dry Soil (soil not included in final mass measurement) | | |
| Container No | | |
| Mass Dry Soil + Cont. (g) | | |
| Mass Container (g) | | |
| Mass Excess Dry Soil, $M_{d,es}$ (g) | | 0.00 |

## Specimen Dimensions, (mm)

| | Height | | | Dia., X indicates with membrane | | |
|---|---|---|---|---|---|---|
| | Initial ($H_o$) | Final ($H_{at}$) | | Initial ($D_o$) | Final ($D_{at}$) | |
| GB | 100.000 | 100.000 | 1 T | 50.52 | 58.00 | [ ] For |
| 1 | 16.33 | 0.82 | 2 M | 50.55 | 55.56 | Wedge |
| 2 | 16.40 | 0.74 | 3 B | 50.75 | 51.54 | Failure |
| 3 | 16.43 | 0.96 | 1'T | | | = $d_{max}$ |
| 4 | 16.45 | 0.92 | 2'M | | | = $d_{min}$ |
| 5 | 16.37 | 0.68 | 3'B | | | = $\Delta d$ |
| Avg | 116.40 | 100.82 | Avg. | 50.61 | 55.03 | xxxxx |

| Measuring Devices: | | | |
|---|---|---|---|
| | | $A_o = \pi D^2/400$ (cm$^2$) | 20.11 |
| PI Tape: | [X] Dia | $V_o$ (cm$^3$) | 234.12 |
| Calipers: | [ ] Ht.; [ ] Dia | $A_{atb,m}=\pi (D^*_{at})^2/400$ (cm$^2$) | 23.90 |
| Dial Comparator | [X] Ht.; [ ] Dia | $A_{atw,m}=(d_{min}-2\Delta d)d_{max}\pi/400$ (cm$^2$) | NA |
| Remarks: ID# PI-002 | | $D^*_{at}=(D_T+2D_M+D_B)/4$ (mm) | 55.17 |

## Estimated Initial Unit Weight

Total, $\gamma_{t,o}$ (lb/ft$^3$) = 132.75 | Dry, $\gamma_{d,o}$ (lb/ft$^3$) = 114.18

## Membrane / Filter Paper / Apparatus

| Membrane (mm): | | | Top | Bottom |
|---|---|---|---|---|
| Number: | Thickness: | | 0.75 | 0.65 |
| = 1 | [ ] Single; | [X] Double | 0.68 | 0.64 |
| | Circumference ($C_{rm,o}$) | | 152.0 | 152.0 |
| | | Total Thickness | | Dia.($C_{rm,o}/\pi$) |
| | Average: | | 0.34 | 48.38 |

Filter Paper: Top + Bottom: [X] Yes ; [ ] No

Filter Strips: [X] Yes ; [ ] No Number = 8

Type of Filter Strips [ ] Vertical: ¼ in. & Whatman #54

[X] Spiral: ¼ in. & Whatman #1

Apparatus: Mass Top Cap, $M_{tc}$ = 53.4 g, 0.12 lbf

Mass Displ. System, $M_{ds}$ (cap, dial, piston, etc.) = NA g, NA lbf

Top Cap Attached: [ ] Yes; [X] No; Piston Dia.(in.) [X] ½; [ ] ¾; [ ] Load Cell: [ ] External [X] Internal

Top Cap - Rotation [ ] Fixed,<1°; [X] Limited,<5°; [ ] Unlimited, >5°

With: [ ] Frictionless End Caps; [ ] Lat. Movement Top Cap

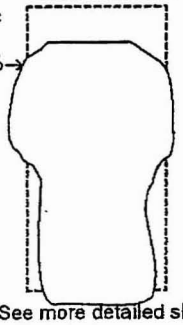
[ ] Internal LVDT Jacket

[ ] Photo Taken.

Failure Sketch

$\varepsilon_a$=

20%→



Failure Mode:

[X] Bulge

[ ] Wedge

[ ] Parabolic

Wedge/Bulge Ht.= NA (mm)

NA - Not Applicable

GB - Gage Block

Other Remarks:

LL=44 PL=15 PI=29

Final Visual Classification: Gray Lean CLAY with sand (CL)

Trimmed / Reconstituted By: YR | Set Up By: RC,jr | Taken Down By: RC,jr

Date: 6/14/2008 | Date: 6/14/2008 | Date: 6/23/2008

Prelim. Calc. By: RC,jr | Final Calc. By: TP | Reviewed By: DFN

[ ] See more detailed sketch on attached sheet. Remarks:

# MULTISTAGE TRIAXIAL TEST: Specimen Calculations & Summary(1)

Project Number: 0411-08-1686 | Cell No.: CYC-5 | File Name: Comp. Ba

Task Number: NA | Specific Gravity: 2.693 [X] Measured; [ ] Assumed

Boring No.: TP-2317 - TP-2334 | Sample No.: Comp. B | Specimen No.: A | Depth (ft): NA

Type Test: CIU Triaxial | Specimen: [ ] "Undisturbed"; [ ] Reconstituted; [X] Recompacted

Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = _____ ppm

| | Inital Water Contents (WC), ($W_o$) over Saturation, ($S_o$), in (%): | | | | | | Calculated Mass of Dry Soil (g) | |
|---|---|---|---|---|---|---|---|---|
| | Top, $W_{o,1}$ | Botttom, $W_{o,2}$ | Sides, $W_{o,3}$ | Avg., $W_{o,avg}$ | Selct., $W_{o,s}$ | Back Cal., $W_{o,bc}$ | Initial Selected WC, $w_o$ (%) | 16.27 |
| $W_o$ | 16.27 | | | 16.27 | 16.27 | 131.65 | Initial, $M_{d,o}$ | 428.19 |
| $S_o$ | 93.2 | | | 93.2 | 93.3 | 731.8 | Final, $M_{d,at}$ | 423.96 |
| | Measured final mass of moist soil, $M_{t,at}$ (g) | | | | | 504.75 | Selected, $M_d$ | 428.19 |
| | Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g) | | | | | 504.75 | | |

| Consolidation Data | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | |
|---|---|---|---|---|---|---|---|---|
| Changes in Height (mm) and Volume ($cm^3$) Within Given Consolidation Stages/Columns | At Initial Seating Stress | During Back-Pressuring | 1st Consol. Increment (1) | Column 2 or 3 to 1st Test Stage (1) | Column 4 to 2nd Test Stage | Column 5 to 3rd Test Stage | Column 6 to 4th Test Stage | |
| Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec. | | | | | | | | |
| Change in Height, $\Delta H_{c,n}$ | 0.04 | -1.93 | | 1.12 | NA | NA | NA | |
| Sum of changes in (+ out) | 0.50 | | | 10.85 | NA | NA | NA | |
| burette readings, $\Delta b_{r,n}$ (- in) | | -10.80 | NA | 16.70 | NA | NA | NA | (2) |
| Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$ | 0.24 | -11.65 | | 6.76 | NA | NA | NA | |
| Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$ | 0.50 | 0.50 | | 1.61 | NA | NA | NA | |
| Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$ | 0.12 | -5.82 | NA | 0.00 | NA | NA | NA | (3) |
| Selected $\Delta V_{c,n}$ | 0.24 | -11.65 | | 10.85 | NA | NA | NA | |

| Summary For Test Stages | | | | | |
|---|---|---|---|---|---|
| Test Stage: | 1st = 1 | 2nd = 2 | 3rd = 3 | 4th = 4 | |
| Cell Pressure, $\sigma_{c,n}$ (psi) | 75.00 | NA | NA | NA | Number of |
| Back Pressure, $U_{b,n}$ (psi) | 60.00 | NA | NA | NA | Test Stages = 1 |
| Axial Force Reading, $P_{r,n}$ (lbf) | 1.00 | NA | NA | NA | $t_{50}$ = 133 min |
| Eff. Consol. Stress ($\sigma'_c$ or $\sigma'_{v,c}$) (4), (ksf) | 2.19 | NA | NA | NA | |
| $t_c$, ON or in [X] days [ ] hrs | 2.00 | NA | NA | NA | |

**At Final Test Stress/Stage - Summary of Calculation of $\Delta V_c$ ($cm^3$) by Different Procedures**

| By Selected Volumes | By Saturation = 100 % | By Change in Mass (5) | For Diff. in Meas. Vol. ($V_o$-$V_{at}$), | For Selected $\Delta V_c$, required |
|---|---|---|---|---|
| $\Delta V_c$ = -0.56 | $\Delta V_c$ = -1.86 | $\Delta V_c$ = 3.89 | & corr. for $\Delta H_{td}$ $\Delta V_c$= | $G_s$ for $S_c$ = 100 %: 2.715 |

**At Final Test Stress/Stage - Consolidation Conclusions**

| | | | | | |
|---|---|---|---|---|---|
| $\Delta H_{c,f}$ (mm) = -0.77 | $\Delta V_{c,f}$ ($cm^3$) = -0.56 | Back Cal. $G_s$ for S=100% = 2.715 | Normalized | Ht. Ch. (%) = 0.31 |
| $\varepsilon_{ac,c}$ (%) = -0.66 | $\varepsilon_{vc,f}$ (%) = -0.24 | | Diff. in: | Vol. Ch. (%) = |

**Summary of Specimen Physical Properties**

| Specific Gravity: $G_s$ = 2.693 Measured Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Volumetric Water Content | Porosity n | Skempton B parameter %(6) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial: | 116.40 | 234.12 | 20.11 | 16.27 | 132.75 | 114.18 | 93.2 | 0.470 | 0.2981 | 0.320 | 99.0 |
| After Consol.: to 1st $\sigma'_c$ | 117.17 | 234.68 | 20.03 | 17.88 | 134.27 | 113.90 | 101.7 | 0.473 | 0.3268 | 0.321 | |
| to 2nd $\sigma'_c$ | | | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | | | |

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.

(2) The height changes occuring within each shearing and unloading stage (1 - 4) are recorded in these rows (after Column 3).

(3) The volume changes occuring within each shearing and unloading stage (1 - 4) are calculated/recorded in these rows (after Column 3).

(4) Stresses are corrected for membrane. (5) ~ $M_{t,o}$-($M_{tat,c}$+$\rho_{water}$x$\Delta V_{in,column1\&2}$)

(6) Initial value is after back pressuring

NA - Not Applicable ON - Over Night; WC - Water Content Remarks: Wet Method used in the Saturation Stage

Calculated By: TP Reviewed By: [illegible]

## MULTISTAGE TRIAXIAL TEST: Specimen Calculations Summary(2)

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | App. No.: CYC-5 | File Name: Comp. Ba
Project Name: Exelon (Victoria) | Task No.: NA | Test No.: 0 | Test Series for: 0

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [ ] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = 10-16 |
| Boring No.: TP-2317 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= 4.50 | No. Layers = 4.00 |
| Sample No.: Comp. B | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = 0.5-1 |
| Depth (ft): NA | Specimen No.: A | [ ] Kneading | [X] Undercompaction: $U_{nl}$ (%) = | Dia. (in.) = 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD % Comp. = 95.0 | ± Opt. = + 4% |

| | | | | |
|---|---|---|---|---|
| Type | [X] Isotropic | [ ] $K_o$ stress path | [ ] Used automated system | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/hr.)= |
| Consolidation | [ ] Anistropic | [ ] 45° stress path | Remarks: | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading | [X] Static | [X] Undrained | [X] Comp. | [X] Strain | [ ] Stress | [X] Constant Cell pressure | [ ] Cyclic (Hz) | [ ] Stress | [ ] Strain |
| Conditions | [ ] Post Cyclic | [ ] Drained | [ ] Ext. | [ ] Stress Path | | [ ] Variable Cell pressure | Rate: [ ] 0.1; | [ ] 1; | Other: |

| Specific Gravity: $G_s$ = 2.693 Measured<br>Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Skempton B parameter %(1) |
|---|---|---|---|---|---|---|---|---|---|
| Initial: | 116.40 | 234.12 | 20.11 | 16.27 | 132.75 | 114.18 | 93.25 | 0.47 | 99.0 |
| After Consol.: to 1st $\sigma'_c$ | 117.17 | 234.68 | 20.03 | 17.88 | 134.27 | 113.90 | 101.71 | 0.47 | |
| to 2nd $\sigma'_c$ | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | |

Unit for Stresses: (ksf)

### Consolidation Stress Summary and Loading Summary

| Item | Unit | 1st Stage | 2nd Stage | 3rd Stage | 4th Stage |
|---|---|---|---|---|---|
| Axial Strain during Consol., $\varepsilon_{a,c}$ : | % | -0.662 | NA | NA | NA |
| Vol. Strain during Consol., $\varepsilon_{v,c}$ : | % | -0.239 | NA | NA | NA |
| Effective Vertical Stress, $\sigma'_v$ | (ksf) | 2.193 | NA | NA | NA |
| Effective Horizontal Stress, $\sigma'_h$: | (ksf) | 2.142 | NA | NA | NA |
| Consol. Stress Ratio, k ($\sigma'_h$ / $\sigma'_v$) : | - | 0.977 | | | |
| Induced OCR : | - | 1.00 | NA | NA | NA |
| Eff. Average Stress, ($\sigma'_v$ + $\sigma'_h$)/2 : | (ksf) | 4.335 | | | |
| Eff. Mean Stress, ($\sigma'_v$ + 2*$\sigma'_h$)/3 : | (ksf) | 2.159 | | | |
| Undr. Ambient Shear Stress, $\tau_{a}$ : | (ksf) | NA | NA | NA | NA |
| Undr. Ambient Shear Strain, $\varepsilon_{a,ua}$ | % | NA | NA | NA | NA |

Notes: See Fugro South, Inc. Notation Listing for definition of symbols and acronyms.

(1) Initial B is after saturation

NA - Not Applicable

### Membrane Correction

Type: Bulge
Modulus: 150.0 psi
Diameter: 48.38 mm
Thickness: 0.34 mm

### Area Correction

Type: Bulge

| Stage | Area Corr. Const.: | Final Area ($cm^2$): |
|---|---|---|
| 1st | 1.111 | 23.90 |
| 2nd | | |
| 3rd | | |
| 4th | | |

### Filter Paper Correction

Type: None | Type Strips: Sprial #1
Strips: 8
Force: 0.000 lbf/strip

Final Visual Description and Remarks: Gray Lean CLAY with sand (CL)

### Loading Summary

| Stage | Stress Status | $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | ΔU (ksf) | $\sigma_1'$ (ksf) | $\sigma_3'$ (ksf) |
|---|---|---|---|---|---|---|---|
| 1st | Max Shear Stress | 10.89 | 1.643 | 2.995 | 0.836 | 4.638 | 1.353 |
| | Max Obliquity | 1.25 | 1.466 | 2.177 | 1.399 | 3.642 | 0.711 |
| 2nd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 3rd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 4th | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |

Remarks: Stain Rate (%/min) = 3.00E-03

# STAGE 1

Project: 0411-08-1686 Boring No.: TP-2317 - TP-2334 Depth (ft.): NA

Test Type: CIU Triaxial Sample No.: Comp. B Stage No.: 1

Specimen No.: A

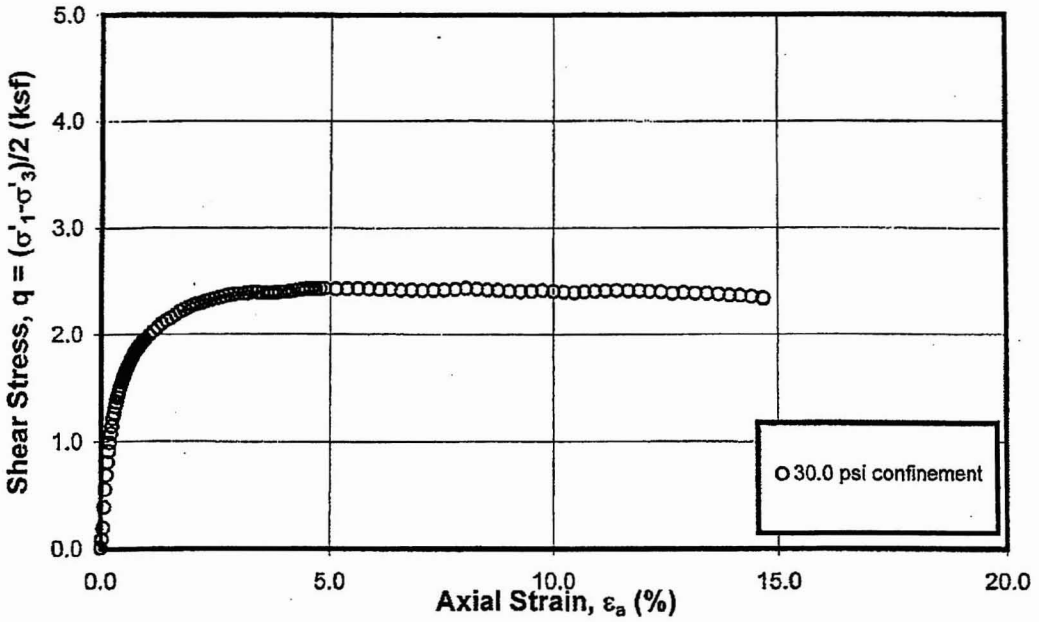
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.000 | 0.026 | 2.168 | 0.000 | 0.000 | 1.024 | 0.000 | - | - |
| 8.4 | 0.019 | 0.175 | 2.133 | 0.210 | 0.000 | 1.179 | 0.617 | 1576.1 | 1495.7 |
| 16.7 | 0.036 | 0.297 | 2.102 | 0.330 | 0.000 | 1.329 | 0.621 | 1499.9 | 1119.1 |
| 25.0 | 0.063 | 0.407 | 2.101 | 0.464 | 0.000 | 1.481 | 0.587 | 1210.8 | 768.4 |
| 33.4 | 0.087 | 0.494 | 2.088 | 0.569 | 0.000 | 1.619 | 0.586 | 1073.2 | 714.7 |
| 41.7 | 0.107 | 0.563 | 2.074 | 0.664 | 0.000 | 1.746 | 0.587 | 1008.0 | 668.8 |
| 50.0 | 0.131 | 0.639 | 2.065 | 0.732 | 0.000 | 1.895 | 0.584 | 936.7 | 685.5 |
| 58.4 | 0.150 | 0.710 | 2.042 | 0.784 | 0.000 | 2.065 | 0.591 | 912.8 | 570.5 |
| 66.7 | 0.181 | 0.770 | 2.049 | 0.869 | 0.000 | 2.205 | 0.579 | 824.0 | 438.1 |
| 75.0 | 0.203 | 0.825 | 2.016 | 0.934 | 0.000 | 2.386 | 0.595 | 786.1 | 421.9 |
| 83.4 | 0.230 | 0.873 | 2.004 | 1.008 | 0.000 | 2.544 | 0.596 | 736.7 | 352.4 |
| 91.7 | 0.256 | 0.919 | 1.994 | 1.045 | 0.000 | 2.707 | 0.597 | 696.5 | 357.8 |
| 100.1 | 0.278 | 0.959 | 1.992 | 1.090 | 0.000 | 2.857 | 0.594 | 671.1 | 267.3 |
| 108.4 | 0.302 | 0.978 | 1.989 | 1.117 | 0.000 | 2.936 | 0.594 | 631.4 | 213.6 |
| 116.7 | 0.324 | 1.007 | 1.980 | 1.147 | 0.000 | 3.071 | 0.596 | 606.4 | 242.7 |
| 125.1 | 0.347 | 1.033 | 1.986 | 1.164 | 0.000 | 3.169 | 0.590 | 580.3 | 243.6 |
| 133.4 | 0.375 | 1.070 | 1.988 | 1.206 | 0.000 | 3.330 | 0.586 | 557.1 | 285.8 |
| 141.7 | 0.396 | 1.102 | 1.999 | 1.211 | 0.000 | 3.459 | 0.578 | 543.7 | 219.7 |
| 150.1 | 0.423 | 1.120 | 1.996 | 1.269 | 0.000 | 3.558 | 0.579 | 518.0 | 163.1 |
| 158.4 | 0.447 | 1.143 | 1.991 | 1.287 | 0.000 | 3.699 | 0.579 | 500.2 | 196.8 |
| 166.7 | 0.470 | 1.166 | 2.005 | 1.314 | 0.000 | 3.781 | 0.571 | 485.7 | 142.0 |
| 175.1 | 0.498 | 1.178 | 1.997 | 1.328 | 0.000 | 3.879 | 0.574 | 462.5 | 111.3 |
| 183.4 | 0.520 | 1.193 | 2.002 | 1.349 | 0.000 | 3.949 | 0.571 | 449.4 | 100.7 |
| 191.7 | 0.540 | 1.199 | 1.992 | 1.350 | 0.000 | 4.025 | 0.575 | 434.7 | 105.6 |
| 200.1 | 0.561 | 1.215 | 2.001 | 1.362 | 0.000 | 4.091 | 0.570 | 424.2 | 163.7 |
| 208.4 | 0.587 | 1.238 | 1.999 | 1.383 | 0.000 | 4.252 | 0.570 | 413.3 | 136.9 |
| 216.7 | 0.616 | 1.252 | 2.014 | 1.387 | 0.000 | 4.283 | 0.562 | 398.1 | 125.6 |
| 225.1 | 0.638 | 1.269 | 2.017 | 1.390 | 0.000 | 4.396 | 0.561 | 389.6 | 121.7 |
| 233.4 | 0.665 | 1.281 | 2.014 | 1.396 | 0.000 | 4.493 | 0.561 | 377.5 | 106.3 |
| 241.8 | 0.689 | 1.296 | 2.032 | 1.410 | 0.000 | 4.523 | 0.553 | 368.7 | 124.8 |
| 250.1 | 0.717 | 1.313 | 2.044 | 1.419 | 0.000 | 4.594 | 0.548 | 359.3 | 53.7 |
| 258.4 | 0.740 | 1.311 | 2.043 | 1.415 | 0.000 | 4.584 | 0.549 | 347.4 | 36.6 |
| 266.8 | 0.761 | 1.321 | 2.041 | 1.415 | 0.000 | 4.667 | 0.549 | 340.2 | 89.4 |
| 275.1 | 0.781 | 1.329 | 2.042 | 1.420 | 0.000 | 4.733 | 0.548 | 333.9 | 101.7 |
| 283.4 | 0.808 | 1.345 | 2.056 | 1.424 | 0.000 | 4.784 | 0.542 | 326.7 | 142.3 |
| 291.8 | 0.832 | 1.365 | 2.062 | 1.427 | 0.000 | 4.920 | 0.540 | 322.1 | 94.8 |
| 300.1 | 0.861 | 1.368 | 2.069 | 1.422 | 0.000 | 4.905 | 0.537 | 311.9 | 36.3 |
| 308.4 | 0.884 | 1.374 | 2.075 | 1.424 | 0.000 | 4.924 | 0.534 | 305.0 | 50.3 |

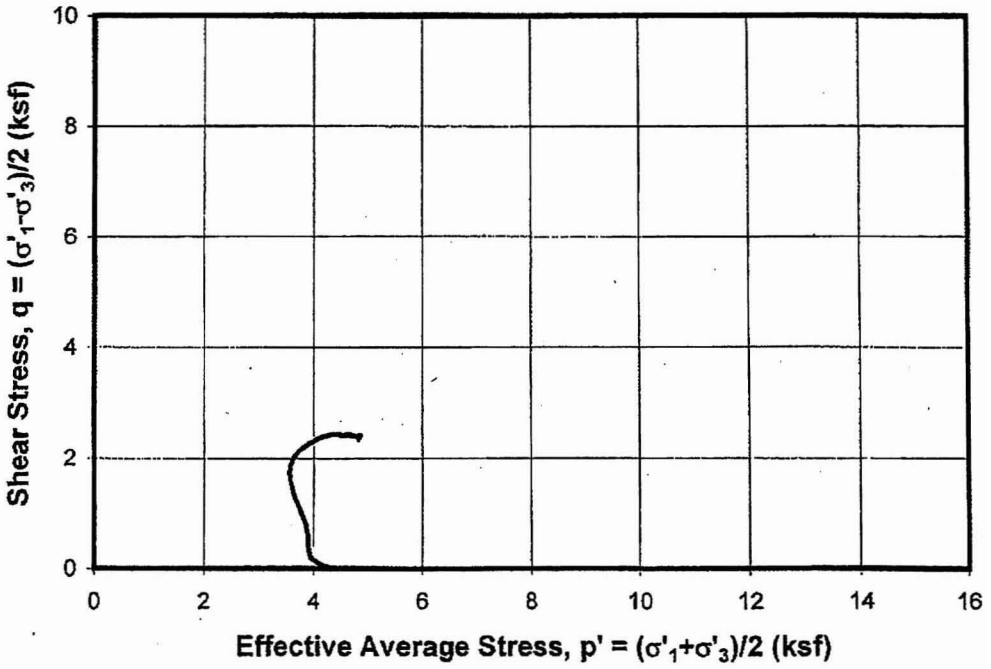
## STAGE 1

| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 316.8 | 0.907 | 1.380 | 2.069 | 1.412 | 0.000 | 5.001 | 0.536 | 298.6 | 39.9 |
| 325.1 | 0.931 | 1.383 | 2.086 | 1.425 | 0.000 | 4.939 | 0.530 | 291.8 | 56.1 |
| 333.4 | 0.954 | 1.393 | 2.085 | 1.415 | 0.000 | 5.023 | 0.530 | 286.7 | 71.2 |
| 366.8 | 1.048 | 1.422 | 2.121 | 1.416 | 0.000 | 5.067 | 0.517 | 266.4 | 51.1 |
| 400.1 | 1.152 | 1.443 | 2.153 | 1.411 | 0.000 | 5.062 | 0.505 | 246.0 | 43.2 |
| 433.5 | 1.251 | 1.466 | 2.177 | 1.399 | 0.000 | 5.121 | 0.497 | 230.2 | 33.8 |
| 466.8 | 1.349 | 1.476 | 2.198 | 1.376 | 0.000 | 5.092 | 0.490 | 215.1 | 20.4 |
| 500.1 | 1.446 | 1.485 | 2.221 | 1.369 | 0.000 | 5.037 | 0.482 | 201.9 | 23.6 |
| 533.5 | 1.546 | 1.499 | 2.239 | 1.350 | 0.000 | 5.055 | 0.476 | 190.7 | 18.0 |
| 566.8 | 1.639 | 1.503 | 2.263 | 1.334 | 0.000 | 4.958 | 0.468 | 180.3 | 19.4 |
| 600.1 | 1.742 | 1.519 | 2.288 | 1.325 | 0.000 | 4.951 | 0.460 | 171.5 | 19.6 |
| 633.5 | 1.841 | 1.523 | 2.312 | 1.311 | 0.000 | 4.864 | 0.452 | 162.7 | 18.5 |
| 666.8 | 1.938 | 1.537 | 2.339 | 1.306 | 0.000 | 4.835 | 0.443 | 156.0 | 22.6 |
| 700.1 | 2.035 | 1.545 | 2.355 | 1.301 | 0.000 | 4.817 | 0.438 | 149.3 | 16.1 |
| 733.5 | 2.130 | 1.553 | 2.389 | 1.295 | 0.000 | 4.712 | 0.427 | 143.4 | 13.7 |
| 766.8 | 2.227 | 1.558 | 2.412 | 1.284 | 0.000 | 4.651 | 0.420 | 137.6 | 4.2 |
| 800.1 | 2.315 | 1.557 | 2.418 | 1.262 | 0.000 | 4.614 | 0.418 | 132.3 | 6.4 |
| 833.5 | 2.418 | 1.565 | 2.443 | 1.259 | 0.000 | 4.564 | 0.410 | 127.4 | 7.9 |
| 866.8 | 2.512 | 1.565 | 2.454 | 1.243 | 0.000 | 4.521 | 0.407 | 122.6 | 9.1 |
| 900.1 | 2.611 | 1.574 | 2.472 | 1.234 | 0.000 | 4.506 | 0.402 | 118.6 | 10.4 |
| 933.5 | 2.700 | 1.575 | 2.484 | 1.211 | 0.000 | 4.466 | 0.398 | 114.8 | 8.8 |
| 966.8 | 2.799 | 1.583 | 2.501 | 1.194 | 0.000 | 4.448 | 0.393 | 111.3 | 5.2 |
| 1000.1 | 2.896 | 1.580 | 2.505 | 1.175 | 0.000 | 4.420 | 0.392 | 107.4 | 6.8 |
| 1033.5 | 2.990 | 1.589 | 2.519 | 1.161 | 0.000 | 4.419 | 0.388 | 104.6 | 10.2 |
| 1066.8 | 3.088 | 1.590 | 2.550 | 1.150 | 0.000 | 4.315 | 0.378 | 101.3 | -2.1 |
| 1100.1 | 3.182 | 1.587 | 2.546 | 1.141 | 0.000 | 4.312 | 0.379 | 98.2 | 12.0 |
| 1133.5 | 3.275 | 1.601 | 2.565 | 1.118 | 0.000 | 4.324 | 0.374 | 96.2 | 14.5 |
| 1166.8 | 3.369 | 1.601 | 2.584 | 1.113 | 0.000 | 4.256 | 0.368 | 93.5 | 5.1 |
| 1200.1 | 3.467 | 1.606 | 2.602 | 1.105 | 0.000 | 4.227 | 0.363 | 91.2 | 8.1 |
| 1233.5 | 3.567 | 1.609 | 2.613 | 1.096 | 0.000 | 4.205 | 0.359 | 88.8 | 4.8 |
| 1266.8 | 3.664 | 1.611 | 2.624 | 1.078 | 0.000 | 4.181 | 0.356 | 86.5 | 0.6 |
| 1300.1 | 3.759 | 1.609 | 2.618 | 1.072 | 0.000 | 4.191 | 0.358 | 84.3 | 4.5 |
| 1333.5 | 3.844 | 1.615 | 2.643 | 1.113 | 0.000 | 4.142 | 0.351 | 82.7 | 5.0 |
| 1366.8 | 3.945 | 1.614 | 2.644 | 1.116 | 0.000 | 4.131 | 0.350 | 80.5 | 3.5 |
| 1400.2 | 4.034 | 1.618 | 2.660 | 1.119 | 0.000 | 4.103 | 0.345 | 78.9 | 1.0 |
| 1433.5 | 4.137 | 1.614 | 2.663 | 1.110 | 0.000 | 4.077 | 0.344 | 76.8 | 2.4 |
| 1466.8 | 4.224 | 1.619 | 2.677 | 1.094 | 0.000 | 4.062 | 0.340 | 75.5 | 17.7 |
| 1500.2 | 4.326 | 1.631 | 2.687 | 1.109 | 0.000 | 4.087 | 0.338 | 74.2 | 0.9 |
| 1533.5 | 4.421 | 1.621 | 2.678 | 1.116 | 0.000 | 4.064 | 0.340 | 72.2 | 0.9 |
| 1566.8 | 4.514 | 1.631 | 2.710 | 1.105 | 0.000 | 4.025 | 0.331 | 71.2 | 0.4 |
| 1600.2 | 4.609 | 1.621 | 2.699 | 1.102 | 0.000 | 4.005 | 0.333 | 69.2 | -5.3 |
| 1633.5 | 4.699 | 1.626 | 2.710 | 1.102 | 0.000 | 4.000 | 0.331 | 68.1 | -0.2 |
| 1666.8 | 4.804 | 1.620 | 2.694 | 1.073 | 0.000 | 4.015 | 0.335 | 66.4 | -7.0 |

## STAGE 1

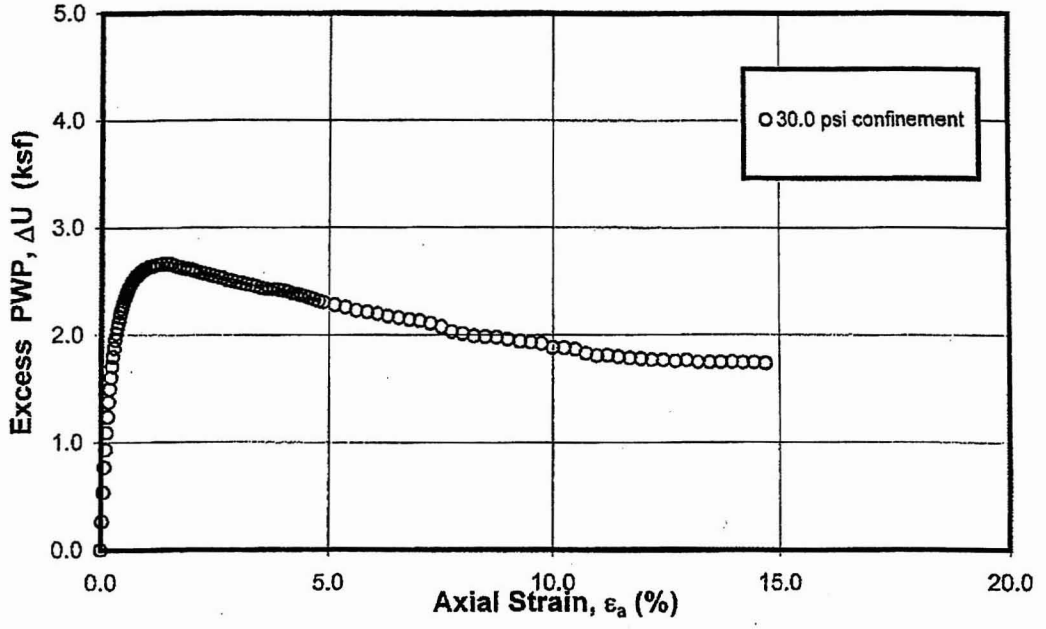
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 1750.2 | 5.050 | 1.617 | 2.713 | 1.081 | 0.000 | 3.951 | 0.329 | 63.0 | -1.1 |
| 1833.5 | 5.296 | 1.617 | 2.729 | 1.077 | 0.000 | 3.908 | 0.324 | 60.1 | 2.5 |
| 1916.8 | 5.543 | 1.623 | 2.740 | 1.053 | 0.000 | 3.909 | 0.321 | 57.7 | 5.2 |
| 2000.2 | 5.790 | 1.630 | 2.762 | 1.042 | 0.000 | 3.879 | 0.315 | 55.4 | 3.9 |
| 2083.5 | 6.037 | 1.633 | 2.771 | 1.031 | 0.000 | 3.870 | 0.312 | 53.3 | -1.8 |
| 2166.8 | 6.288 | 1.625 | 2.792 | 1.021 | 0.000 | 3.786 | 0.305 | 50.9 | -3.6 |
| 2250.2 | 6.521 | 1.624 | 2.805 | 1.016 | 0.000 | 3.750 | 0.301 | 49.0 | -0.2 |
| 2333.5 | 6.769 | 1.625 | 2.812 | 1.002 | 0.000 | 3.736 | 0.298 | 47.3 | -0.5 |
| 2416.8 | 7.009 | 1.623 | 2.823 | 1.004 | 0.000 | 3.704 | 0.295 | 45.6 | -0.8 |
| 2500.2 | 7.247 | 1.623 | 2.828 | 0.982 | 0.000 | 3.694 | 0.293 | 44.1 | 1.2 |
| 2583.5 | 7.492 | 1.626 | 2.834 | 0.998 | 0.000 | 3.690 | 0.292 | 42.7 | 2.4 |
| 2666.8 | 7.727 | 1.629 | 2.841 | 0.989 | 0.000 | 3.686 | 0.290 | 41.5 | 3.2 |
| 2750.2 | 7.969 | 1.633 | 2.849 | 0.981 | 0.000 | 3.688 | 0.288 | 40.4 | 0.2 |
| 2833.5 | 8.217 | 1.629 | 2.869 | 0.979 | 0.000 | 3.628 | 0.281 | 39.0 | -2.5 |
| 2916.8 | 8.458 | 1.627 | 2.874 | 0.967 | 0.000 | 3.611 | 0.280 | 37.9 | -2.5 |
| 3000.2 | 8.700 | 1.623 | 2.869 | 0.932 | 0.000 | 3.604 | 0.280 | 36.7 | -3.0 |
| 3083.5 | 8.949 | 1.620 | 2.867 | 0.909 | 0.000 | 3.598 | 0.281 | 35.6 | -0.7 |
| 3166.9 | 9.188 | 1.621 | 2.886 | 0.907 | 0.000 | 3.563 | 0.275 | 34.7 | 2.1 |
| 3250.2 | 9.433 | 1.625 | 2.896 | 0.906 | 0.000 | 3.557 | 0.272 | 33.9 | 1.3 |
| 3333.5 | 9.677 | 1.624 | 2.898 | 0.876 | 0.000 | 3.549 | 0.271 | 33.0 | 3.4 |
| 3416.9 | 9.920 | 1.633 | 2.928 | 0.868 | 0.000 | 3.523 | 0.264 | 32.4 | 5.5 |
| 3500.2 | 10.174 | 1.638 | 2.951 | 0.867 | 0.000 | 3.494 | 0.257 | 31.7 | 1.4 |
| 3583.5 | 10.407 | 1.637 | 2.975 | 0.854 | 0.000 | 3.447 | 0.250 | 31.0 | 1.0 |
| 3666.9 | 10.643 | 1.640 | 2.983 | 0.840 | 0.000 | 3.442 | 0.247 | 30.3 | 2.5 |
| 3750.2 | 10.889 | 1.643 | 2.995 | 0.836 | 0.000 | 3.429 | 0.244 | 29.7 | 0.9 |
| 3833.5 | 11.132 | 1.642 | 3.017 | 0.845 | 0.000 | 3.388 | 0.237 | 29.0 | -2.1 |
| 3916.9 | 11.370 | 1.638 | 3.013 | 0.834 | 0.000 | 3.382 | 0.238 | 28.4 | -3.1 |
| 4000.2 | 11.613 | 1.635 | 3.008 | 0.837 | 0.000 | 3.381 | 0.239 | 27.7 | 0.3 |
| 4083.5 | 11.862 | 1.639 | 3.017 | 0.849 | 0.000 | 3.378 | 0.237 | 27.2 | 1.7 |
| 4166.9 | 12.101 | 1.639 | 3.028 | 0.833 | 0.000 | 3.360 | 0.233 | 26.7 | -3.2 |
| 4250.2 | 12.341 | 1.631 | 3.026 | 0.808 | 0.000 | 3.337 | 0.232 | 26.0 | -1.2 |
| 4333.5 | 12.584 | 1.636 | 3.024 | 0.786 | 0.000 | 3.358 | 0.234 | 25.6 | 1.8 |
| 4416.9 | 12.824 | 1.635 | 3.022 | 0.778 | 0.000 | 3.358 | 0.235 | 25.1 | -4.6 |
| 4500.2 | 13.064 | 1.625 | 3.023 | 0.776 | 0.000 | 3.326 | 0.233 | 24.5 | -4.7 |
| 4583.5 | 13.314 | 1.624 | 3.031 | 0.775 | 0.000 | 3.308 | 0.230 | 24.0 | -0.4 |
| 4666.9 | 13.543 | 1.624 | 3.021 | 0.763 | 0.000 | 3.326 | 0.233 | 23.6 | -0.7 |
| 4750.2 | 13.786 | 1.622 | 3.029 | 0.736 | 0.000 | 3.307 | 0.230 | 23.2 | -1.6 |
| 4833.5 | 14.025 | 1.620 | 3.015 | 0.731 | 0.000 | 3.324 | 0.234 | 22.7 | 1.1 |
| 4916.9 | 14.271 | 1.625 | 3.045 | 0.735 | 0.000 | 3.289 | 0.226 | 22.4 | 3.2 |
| 4996.9 | 14.512 | 1.628 | 3.058 | 0.743 | 0.000 | 3.278 | 0.222 | 22.1 | 2.6 |
| | | | | | | | | | |

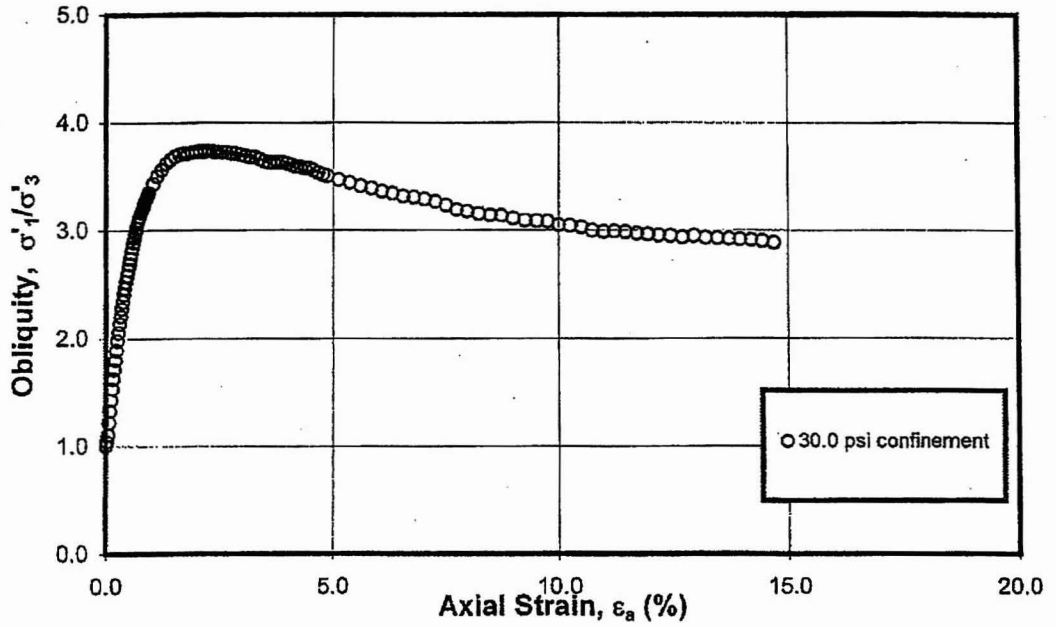



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. BB - Depth: NA
Boring TP-2317 - TP-2334

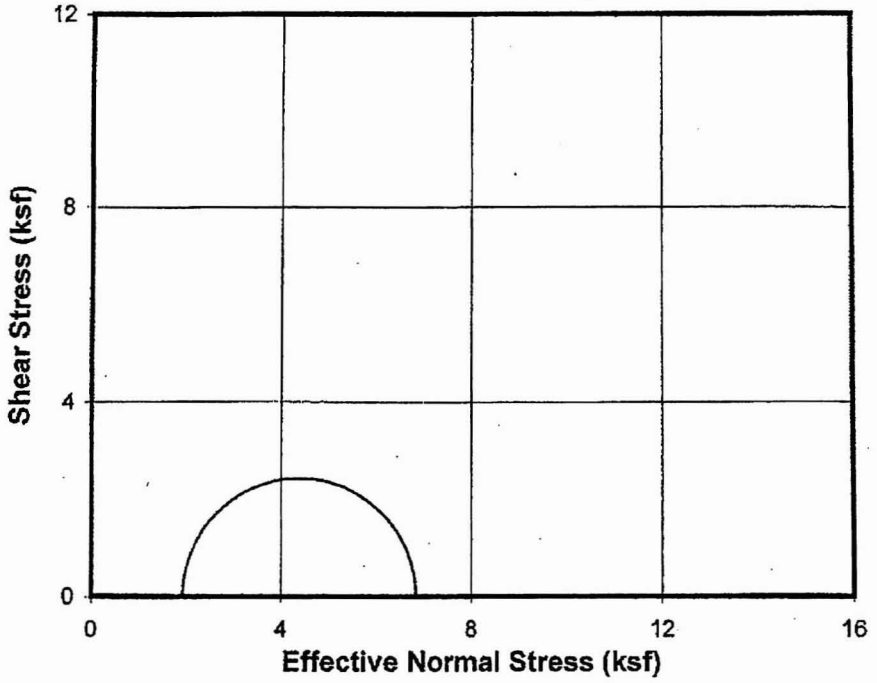
Reviewed By: WFR

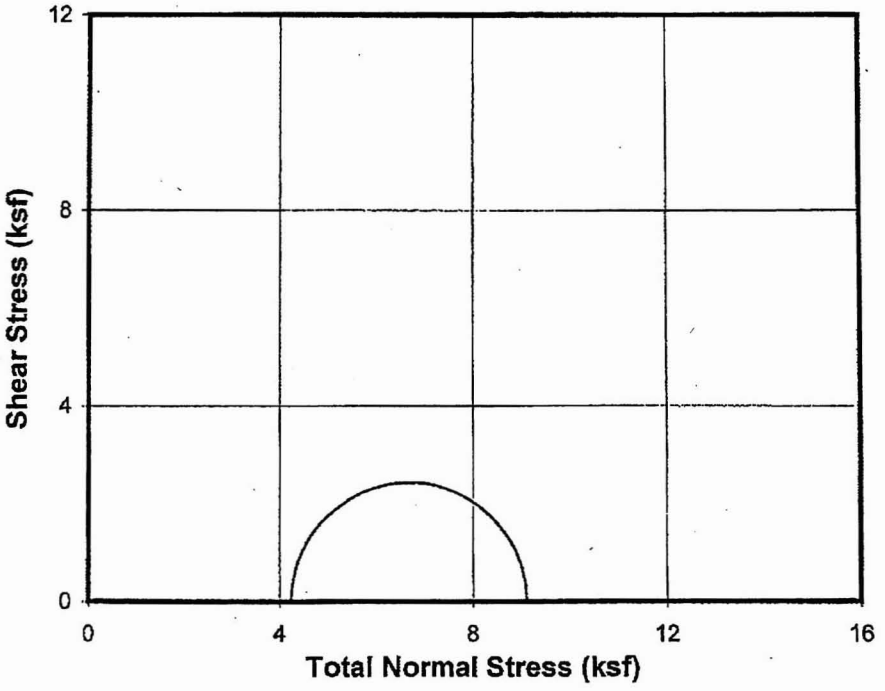



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. BB - Depth: NA
Boring TP-2317 - TP-2334

Reviewed By: WFD




**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated- Mohr's Circles
Sample: Comp. BB - Depth: NA
Boring TP-2317 - TP-2334

Reviewed By: WFP

# TRIAXIAL TEST (ASTM D 4767-04): Specimen Setup / Take Down

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | Cell No.: CYC-1 | File Name: Comp. Bb

Task No.: NA | Test Stress(es), $\sigma'_c$ or $\sigma'_{v,c}$ = 4.32 , _____ , _____ & _____ ksf

Project Name: Exelon (Victoria) | k ($\sigma'_{h,c}$ / $\sigma'_{v,c}$) = 1.00 | Induced OCR = 1.00 | $K_{ua}$ ($\sigma_{d,ua}/2\sigma'_{v,c}$) = NA

Assig. Remarks: _____ Specific Gravity: 2.693 [X] Meas.; [ ] Assumed

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [X] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = 10-16 | |
| Boring No.: TP-2317 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= 4.50 | No. Layers = 4.00 | |
| Sample No.: Comp. B | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = 0.5-1 | |
| Depth (ft): NA | Specimen No.: B | [ ] Kneading | [X] Undercompaction: $U_{ni}$ (%) = | Dia. (in.) = 1.50 | |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD | % Comp. = 95.0 | ± Opt. = + 4% |

| | | | | |
|---|---|---|---|---|
| Type Consolidation: | [X] Isotropic / [ ] Anistropic | [ ] $K_o$ stress path / [ ] 45° stress path | [ ] Used automated system: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/h) = |
| | | | Remarks: | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading Conditions: | [X] Static / [ ] Post Cyclic | [X] Undrained / [ ] Drained | [X] Comp. / [ ] Ext. | [X] Strain / [ ] Stress Path | [X] Constant Cell Pressure / [ ] Variable Cell Pressure | [ ] Cyclic (Hz) Rate: [ ] 0.1; | [ ] Stress / [ ] 1; | [ ] Strain Other: | | | | | | | | |

| Water Content (WC); | Initial - Trimming Location | | | Final, $W_{at}$ |
|---|---|---|---|---|
| | Top ($W_{o,1}$) | Bottom ($W_{o,2}$) | Sides ($W_{o,3}$) | (see below) |
| Container No | 692 | | | 861 |
| Mass Moist Soil + Cont. (g) | 130.99 | | | 119.17 |
| Mass Dry Soil + Container (g) | 116.69 | | | 105.58 |
| Mass Container (g) | 31.53 | | | 32.09 |
| Water Content, $W_{o,n}$ (%) | 16.79 | | | 18.49 |
| Avg. Initial WC, $W_{o,avg}$ (%) | 16.79 | Final ($W_{at}$); | [X] Slice ; | [ ] Whole Spec. |

[ ] See attached data sheet(s) for additional water contents

| SOIL MASSES: | Initial | Final |
|---|---|---|
| Moist + Tare (etc.)(g) | 494.06 | 497.61 |
| Tare (etc.) (g) | 0.00 | 0.00 |
| Mass Moist Spec., $M_n$ (g) | 494.06 | 497.61 |
| Excess Dry Soil (soil not included in final mass measurement) | | |
| Container No | | |
| Mass Dry Soil + Cont. (g) | | |
| Mass Container (g) | | |
| Mass Excess Dry Soil, $M_{d,es}$ (g) | | 0.00 |

## Specimen Dimensions, (mm)

| Height | | Dia., X indicates with membrane | | | |
|---|---|---|---|---|---|
| | Initial ($H_o$) | Final ($H_{at}$) | Initial ($D_o$) | Final ($D_{at}$) | |
| GB | 100.000 | 100.000 | 1 T 50.22 | 52.50 | For |
| 1 | 16.62 | 0.87 | 2 M 50.02 | 57.75 | Wedge |
| 2 | 16.61 | 1.42 | 3 B 50.08 | 52.75 | Failure |
| 3 | 16.63 | 0.17 | 1'T | | = $d_{max}$ |
| 4 | 16.62 | 0.87 | 2'M | | = $d_{min}$ |
| 5 | 16.59 | 0.81 | 3'B | | = $\Delta d$ |
| Avg | 116.61 | 100.83 | Avg. 50.11 | 54.33 | XXXXX |

| Measuring Devices: | | | | |
|---|---|---|---|---|
| PI Tape: | [X] Dia | $A_o = \pi D^2/400$ (cm²) | 19.72 |
| Calipers: | [ ] Ht.; [ ] Dia | $V_o$ (cm³) | 229.95 |
| | | $A_{atb,m} = \pi (D^*_{at})^2/400$ (cm²) | 23.92 |
| Dial Comparator | [X] Ht.; [ ] Dia | $A_{atw,m} = (d_{min} - 2\Delta d) d_{max} \pi/400$ (cm²) | NA |
| Remarks: ID# PI-002 | | $D^*_{at} = (D_T + 2D_M + D_B)/4$ (mm) | 55.19 |

## Estimated Initial Unit Weight

Total, $\gamma_{t,o}$ (lb/ft³) = 134.13 | Dry, $\gamma_{d,o}$ (lb/ft³) = 114.85

## Membrane / Filter Paper / Apparatus

| Membrane (mm): | | | Top | Bottom |
|---|---|---|---|---|
| Number: | Thickness: | | 0.75 | 0.65 |
| = 1 | [ ] Single; | [X] Double | 0.68 | 0.64 |
| | Circumference ($C_{rm,o}$) | | 152.0 | 152.0 |
| | | | Total Thickness | Dia.($C_{rm,o}/\pi$) |
| | Average: | | 0.34 | 48.38 |

Filter Paper: Top + Bottom: [X] Yes ; [ ] No

Filter Strips: [X] Yes ; [ ] No Number = 8

Type of Filter Strips [ ] Vertical: ¼ in. & Whatman #54

[X] Spiral: ¼ in. & Whatman #1

Apparatus: Mass Top Cap, $M_{tc}$ = 53.4 g, 0.12 lbf

Mass Displ. System, $M_{ds}$ (cap, dial, piston, etc.) = NA g, NA lbf

Top Cap Attached: [ ] Yes; [X] No; Piston Dia.(in.): [X] ½; [ ] ¾; [ ] Load Cell: [ ] External [X] Internal

Top Cap - Rotation [ ] Fixed,<1°; [X] Limited,<5°; [ ] Unlimited, >5°

With: [ ] Frictionless End Caps; [ ] Lat. Movement Top Cap

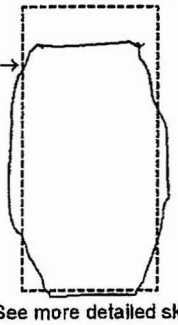
[ ] Internal LVDT Jacket

[ ] Photo Taken.

Failure Sketch

$\varepsilon_a$=

20%→



Failure Mode: [X] Bulge [ ] Wedge [ ] Parabolic

Wedge/Bulge Ht.= NA (mm)

NA - Not Applicable

GB - Gage Block

Other Remarks:

LL=44 PL=15 PI=29

Final Visual Classification: Gray Lean CLAY with sand (CL)

Trimmed / Reconstituted By: YR | Set Up By: RC,jr | Taken Down By: RC,jr

Date: 6/14/2008 | Date: 6/14/2008 | Date: 6/23/2008

Prelim. Calc. By: RC,jr | Final Calc. By: TP | Reviewed By: WEP

[ ] See more detailed sketch on attached sheet. Remarks:

# MULTISTAGE TRIAXIAL TEST: Specimen Calculations & Summary(1)

Project Number: 0411-08-1686 Cell No.: CYC-1 File Name: Comp. Bb .
Task Number: NA Specific Gravity: 2.693 [X] Measured; [ ] Assumed
Boring No.: TP-2317 - TP-2334 Sample No.: Comp. B Specimen No.: B Depth (ft): NA
Type Test: CIU Triaxial Specimen: [ ] "Undisturbed"; [ ] Reconstituted; [X] Recompacted
Calculations Corr. for Salt (dissolved solids): [X] No or, [ ] Yes, with concentration = _____ ppm

| | Inital Water Contents (WC), ($W_o$) over Saturation, ($S_o$), in (%): | | | | | | Calculated Mass of Dry Soil (g) | |
|---|---|---|---|---|---|---|---|---|
| | Top, $W_{o,1}$ | Botttom, $W_{o,2}$ | Sides, $W_{o,3}$ | Avg., $W_{o,avg}$ | Selct., $W_{o,s}$ | Back Cal., $W_{o,bc}$ | Initial Selected WC, $w_o$ (%) | 16.79 |
| $W_o$ | 16.79 | | | 16.79 | 16.79 | 17.65 | Initial , $M_{d,o}$ | 423.03 |
| $S_o$ | 98.0 | | | 98.0 | 98.0 | 100.7 | Final, $M_{d,at}$ | 419.95 |
| | Measured final mass of moist soil, $M_{t,at}$ (g) | | | | | 497.61 | Selected, $M_d$ | 423.03 |
| | Final mass of moist soil corrected for excess dry soil, $M_{tat,c}$ (g) | | | | | 497.61 | | |

| Consolidation Data | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | |
|---|---|---|---|---|---|---|---|---|
| Changes in Height (mm) and Volume ($cm^3$) Within Given Consolidation Stages/Columns | At Initial Seating Stress | During Back-Pressuring | 1st Consol. Increment (1) | Column 2 or 3 to 1st Test Stage (1) | Column 4 to 2nd Test Stage | Column 5 to 3rd Test Stage | Column 6 to 4th Test Stage | |
| Sign Convention: (+) Deformation in compression or Flow out of spec.; (-) Deformation in extension (swell) or Flow into spec. | | | | | | | | |
| Change in Height, $\Delta H_{c,n}$ | 0.04 | -0.87 | | 1.22 | NA | NA | NA | |
| Sum of changes in (+ out) | 0.35 | | | 7.90 | NA | NA | NA | |
| burette readings, $\Delta b_{r,n}$ (- in) | | -5.65 | NA | 16.60 | NA | NA | NA | (2) |
| Theoretical $\Delta V_{ct,n} = (3V_o \times \Delta H_{c,n}/H_o)$ | 0.24 | -5.15 | | 7.22 | NA | NA | NA | |
| Vol. Factor, $F_v = \Delta b_{r,n} / \Delta V_{t,n}$ | 0.50 | 0.50 | | 1.09 | NA | NA | NA | |
| Corrected $\Delta V_{ct,n} = F_v \times \Delta V_{t,n}$ | 0.12 | -2.57 | NA | 0.00 | NA | NA | NA | (3) |
| Selected $\Delta V_{c,n}$ | 0.00 | -5.65 | | 4.90 | NA | NA | NA | |

| Summary For Test Stages | | | | | |
|---|---|---|---|---|---|
| Test Stage: | 1st = 1 | 2nd = 2 | 3rd = 3 | 4th = 4 | |
| Cell Pressure, $\sigma_{c,n}$ (psi) | 90.00 | NA | NA | NA | Number of |
| Back Pressure, $U_{b,n}$ (psi) | 60.00 | NA | NA | NA | Test Stages = 1 |
| Axial Force Reading, $P_{r,n}$ (lbf) | 1.00 | NA | NA | NA | $t_{50}$ = 180 min |
| Eff. Consol. Stress ($\sigma'_c$ or $\sigma'_{v,c}$) (4), (ksf) | 4.31 | NA | NA | NA | |
| $t_c$, ON or in [X] days [ ] hrs | 2.00 | NA | NA | NA | |

**At Final Test Stress/Stage - Summary of Calculation of $\Delta V_c$ ($cm^3$) by Different Procedures**

| By Selected Volumes | By Saturation = 100 % | By Change in Mass (5) | For Diff. in Meas. Vol. ($V_o$-$V_{at}$), | For Selected $\Delta V_c$, required |
|---|---|---|---|---|
| $\Delta V_c$ = -0.75 | $\Delta V_c$ = -2.13 | $\Delta V_c$ = 2.09 | & corr. for $\Delta H_{td}$ $\Delta V_c$= | $G_s$ for $S_c$ = 100 %: 2.717 |

**At Final Test Stress/Stage - Consolidation Conclusions**

| | | | | | |
|---|---|---|---|---|---|
| $\Delta H_{c,f}$ (mm) = 0.39 | $\Delta V_{c,f}$ ($cm^3$) = -0.75 | Back Cal. $G_s$ for S=100% = 2.717 | Normalized | Ht. Ch. (%) = | 1.03 |
| $\varepsilon_{ac,c}$ (%) = 0.33 | $\varepsilon_{vc,f}$ (%) = -0.33 | | Diff. in: | Vol. Ch. (%) = | |

**Summary of Specimen Physical Properties**

| Specific Gravity: $G_s$ = 2.693 Measured Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Volumetric Water Content | Porosity n | Skempton B parameter %(6) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial: | 116.61 | 229.95 | 19.72 | 16.79 | 134.13 | 114.85 | 98.0 | 0.461 | 0.3094 | 0.316 | 97.0 |
| After Consol.: to 1st $\sigma'_c$ | 116.22 | 230.70 | 19.85 | 17.63 | 134.66 | 114.47 | 101.9 | 0.466 | 0.3238 | 0.318 | |
| to 2nd $\sigma'_c$ | | | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | | | |

Notes: (1) If the consol. stress in the 1st consol. increment & 1st test stage are equal, log the data in Column 4.
(2) The height changes occuring within each shearing and unloading stage (1 - 4) are recorded in these rows (after Column 3).
(3) The volume changes occuring within each shearing and unloading stage (1 - 4) are calculated/recorded in these rows (after Column 3).
(4) Stresses are corrected for membrane. (5) ~ $M_{t,o}$-($M_{tat,c}$+$\rho_{water}$x$\Delta V_{in,column1\&2}$)
(6) Initial value is after back pressuring
NA - Not Applicable ON - Over Night; WC - Water Content Remarks: Wet Method used in the Saturation Stage
Calculated By: TP Reviewed By: WEP

## MULTISTAGE TRIAXIAL TEST: Specimen Calculations Summary(2)

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | App. No.: CYC-1 | File Name: Comp. Bb
Project Name: Exelon (Victoria) | Task No.: NA | Test No.: 0 | Test Series for: 0

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [X] Tamping | [X] Constant Effort: | Blows/Tamps per Layer = | 10-16 |
| Boring No.: TP-2317 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= | 4.50 | No. Layers = 4.00 |
| Sample No.: Comp. B | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | | Drop (in.) = 0.5-1 |
| Depth (ft): NA | Specimen No.: B | [ ] Kneading | [X] Undercompaction: | $U_{ni}$ (%) = | Dia. (in.) = 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD | % Comp. = 95.0 | ± Opt. = + 4% |

| | | | | | |
|---|---|---|---|---|---|
| Type Consolidation | [X] Isotropic / [ ] Anistropic | [ ] $K_o$ stress path / [ ] 45° stress path | [ ] Used automated system | Remarks: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/hr.)= |
| Loading Conditions: | [X] Static / [ ] Post Cyclic | [X] Undrained / [ ] Drained | [X] Comp. / [ ] Ext. | [X] Strain [ ] Stress / [ ] Stress Path | [X] Constant Cell pressure / [ ] Variable Cell pressure |
| [ ] Cyclic (Hz) Rate: [ ] 0.1; | [ ] Stress [ ] Strain 1; Other: | | | | |

| Specific Gravity: $G_s$ = 2.693 Measured / Condition: | Height (mm) | Volume ($cm^3$) | Area ($cm^2$) | Water Content (%) | Unit Weight Total (pcf) | Unit Weight Dry (pcf) | Saturation (%) | Void Ratio e | Skempton B parameter %(1) |
|---|---|---|---|---|---|---|---|---|---|
| Initial: | 116.61 | 229.95 | 19.72 | 16.79 | 134.13 | 114.85 | 98.02 | 0.46 | 97.0 |
| After Consol.: to 1st $\sigma'_c$ | 116.22 | 230.70 | 19.85 | 17.63 | 134.66 | 114.47 | 101.86 | 0.47 | |
| to 2nd $\sigma'_c$ | | | | | | | | | |
| to 3rd $\sigma'_c$ | | | | | | | | | |
| to 4th $\sigma'_c$ | | | | | | | | | |

Unit for Stresses: (ksf)

### Consolidation Stress Summary and Loading Summary

| Item | Unit | 1st Stage | 2nd Stage | 3rd Stage | 4th Stage |
|---|---|---|---|---|---|
| Axial Strain during Consol., $\varepsilon_{a,c}$: | % | 0.334 | NA | NA | NA |
| Vol. Strain during Consol., $\varepsilon_{v,c}$: | % | -0.326 | NA | NA | NA |
| Effective Vertical Stress, $\sigma'_v$ | (ksf) | 4.314 | NA | NA | NA |
| Effective Horizontal Stress, $\sigma'_h$: | (ksf) | 4.289 | NA | NA | NA |
| Consol. Stress Ratio, k ($\sigma'_h$ / $\sigma'_v$): | - | 0.994 | | | |
| Induced OCR: | - | 1.00 | NA | NA | NA |
| Eff. Average Stress, ($\sigma'_v$ + $\sigma'_h$)/2: | (ksf) | 8.604 | | | |
| Eff. Mean Stress, ($\sigma'_v$ + 2*$\sigma'_h$)/3: | (ksf) | 4.298 | | | |
| Undr. Ambient Shear Stress, $\tau_a$: | (ksf) | NA | NA | NA | NA |
| Undr. Ambient Shear Strain, $\varepsilon_{a,ua}$ | % | NA | NA | NA | NA |

Notes: See Fugro South, Inc. Notation Listing for definition of symbols and acronyms.

(1) Initial B is after saturation

NA - Not Applicable

### Membrane Correction

Type: Bulge
Modulus: 150.0 psi
Diameter: 48.38 mm
Thickness: 0.34 mm

### Area Correction

Type: Bulge

| Stage | Area Corr. Const.: | Final Area ($cm^2$): |
|---|---|---|
| 1st | 1.230 | 23.92 |
| 2nd | | |
| 3rd | | |
| 4th | | |

### Filter Paper Correction

Type: None | Type Strips: Sprial #1
Strips: 8
Force: 0.000 lbf/strip

Final Visual Description and Remarks: Gray Lean CLAY with sand (CL)

### Loading Summary

| Stage | Stress Status | $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | ΔU (ksf) | $\sigma_1'$ (ksf) | $\sigma_3'$ (ksf) |
|---|---|---|---|---|---|---|---|
| 1st | Max Shear Stress | 4.87 | 2.433 | 4.376 | 2.305 | 6.809 | 1.943 |
| | Max Obliquity | 2.27 | 2.311 | 4.002 | 2.572 | 6.312 | 1.691 |
| 2nd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 3rd | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |
| 4th | Max Shear Stress | | | | | | |
| | Max Obliquity | | | | | | |

Remarks: Stain Rate (%/min) = 2.22E-03

# STAGE 1

Project: 0411-08-1686 Boring No.: TP-2317 - TP-2334 Depth (ft.): NA
Test Type: CIU Triaxial Sample No.: Comp. B Stage No.: 1
Specimen No.: B

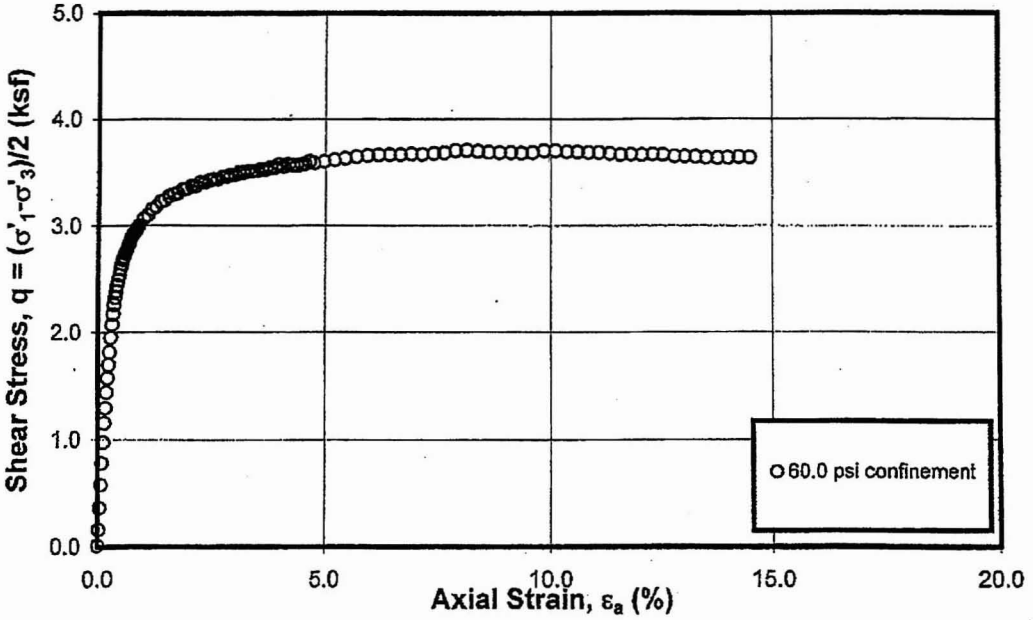
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.000 | 0.012 | 4.302 | 0.000 | 0.000 | 1.006 | 0.000 | - | - |
| 11.5 | 0.020 | 0.088 | 4.113 | 0.264 | 0.000 | 1.044 | 1.739 | 770.8 | 794.5 |
| 23.1 | 0.046 | 0.197 | 3.943 | 0.540 | 0.000 | 1.105 | 1.471 | 798.0 | 1309.6 |
| 34.6 | 0.068 | 0.390 | 3.906 | 0.772 | 0.000 | 1.222 | 1.025 | 1115.8 | 1642.1 |
| 46.2 | 0.090 | 0.555 | 3.909 | 0.934 | 0.000 | 1.331 | 0.862 | 1206.5 | 1325.6 |
| 57.7 | 0.113 | 0.689 | 3.879 | 1.095 | 0.000 | 1.432 | 0.813 | 1198.6 | 1095.8 |
| 69.3 | 0.137 | 0.810 | 3.854 | 1.243 | 0.000 | 1.533 | 0.781 | 1168.2 | 904.0 |
| 80.8 | 0.162 | 0.911 | 3.819 | 1.379 | 0.000 | 1.626 | 0.769 | 1107.6 | 854.0 |
| 92.3 | 0.180 | 0.992 | 3.779 | 1.500 | 0.000 | 1.712 | 0.767 | 1089.5 | 801.0 |
| 103.9 | 0.204 | 1.074 | 3.752 | 1.605 | 0.000 | 1.802 | 0.759 | 1041.2 | 661.4 |
| 115.4 | 0.226 | 1.145 | 3.720 | 1.710 | 0.000 | 1.889 | 0.757 | 1002.6 | 635.2 |
| 127.0 | 0.248 | 1.214 | 3.696 | 1.803 | 0.000 | 1.978 | 0.752 | 969.0 | 475.0 |
| 138.5 | 0.280 | 1.265 | 3.665 | 1.882 | 0.000 | 2.055 | 0.754 | 895.8 | 423.0 |
| 150.0 | 0.302 | 1.323 | 3.651 | 1.956 | 0.000 | 2.136 | 0.748 | 868.5 | 449.5 |
| 161.6 | 0.325 | 1.367 | 3.635 | 2.016 | 0.000 | 2.205 | 0.746 | 833.1 | 377.0 |
| 173.1 | 0.348 | 1.411 | 3.626 | 2.069 | 0.000 | 2.274 | 0.742 | 802.6 | 363.2 |
| 184.7 | 0.371 | 1.450 | 3.613 | 2.119 | 0.000 | 2.341 | 0.739 | 774.9 | 331.1 |
| 196.2 | 0.394 | 1.487 | 3.603 | 2.167 | 0.000 | 2.405 | 0.737 | 747.7 | 327.8 |
| 207.8 | 0.415 | 1.522 | 3.597 | 2.208 | 0.000 | 2.466 | 0.733 | 727.8 | 298.8 |
| 219.3 | 0.440 | 1.554 | 3.590 | 2.246 | 0.000 | 2.527 | 0.731 | 700.4 | 252.8 |
| 230.8 | 0.464 | 1.584 | 3.584 | 2.282 | 0.000 | 2.585 | 0.728 | 677.2 | 237.1 |
| 242.4 | 0.487 | 1.610 | 3.578 | 2.314 | 0.000 | 2.636 | 0.727 | 656.0 | 221.0 |
| 253.9 | 0.510 | 1.635 | 3.573 | 2.343 | 0.000 | 2.687 | 0.724 | 636.2 | 233.7 |
| 265.5 | 0.532 | 1.662 | 3.571 | 2.369 | 0.000 | 2.741 | 0.722 | 620.4 | 236.6 |
| 277.0 | 0.555 | 1.688 | 3.570 | 2.398 | 0.000 | 2.794 | 0.719 | 603.9 | 214.6 |
| 288.5 | 0.578 | 1.712 | 3.567 | 2.424 | 0.000 | 2.845 | 0.716 | 587.8 | 191.4 |
| 300.1 | 0.600 | 1.731 | 3.565 | 2.446 | 0.000 | 2.888 | 0.714 | 572.8 | 180.0 |
| 311.6 | 0.623 | 1.752 | 3.567 | 2.462 | 0.000 | 2.930 | 0.711 | 558.6 | 168.9 |
| 323.1 | 0.648 | 1.771 | 3.566 | 2.483 | 0.000 | 2.974 | 0.709 | 543.1 | 184.9 |
| 334.7 | 0.668 | 1.793 | 3.571 | 2.500 | 0.000 | 3.017 | 0.705 | 533.1 | 173.1 |
| 346.2 | 0.696 | 1.811 | 3.572 | 2.515 | 0.000 | 3.058 | 0.703 | 517.0 | 136.8 |
| 357.8 | 0.717 | 1.826 | 3.571 | 2.531 | 0.000 | 3.092 | 0.701 | 506.2 | 147.8 |
| 369.3 | 0.736 | 1.841 | 3.574 | 2.545 | 0.000 | 3.125 | 0.699 | 496.7 | 152.6 |
| 380.8 | 0.764 | 1.862 | 3.585 | 2.555 | 0.000 | 3.161 | 0.694 | 484.3 | 109.0 |
| 392.4 | 0.789 | 1.870 | 3.584 | 2.561 | 0.000 | 3.183 | 0.693 | 471.2 | 88.5 |
| 403.9 | 0.817 | 1.886 | 3.590 | 2.573 | 0.000 | 3.214 | 0.690 | 458.4 | 152.4 |
| 415.5 | 0.836 | 1.904 | 3.597 | 2.584 | 0.000 | 3.251 | 0.686 | 452.5 | 140.2 |
| 427.0 | 0.863 | 1.916 | 3.600 | 2.592 | 0.000 | 3.275 | 0.684 | 441.1 | 91.7 |

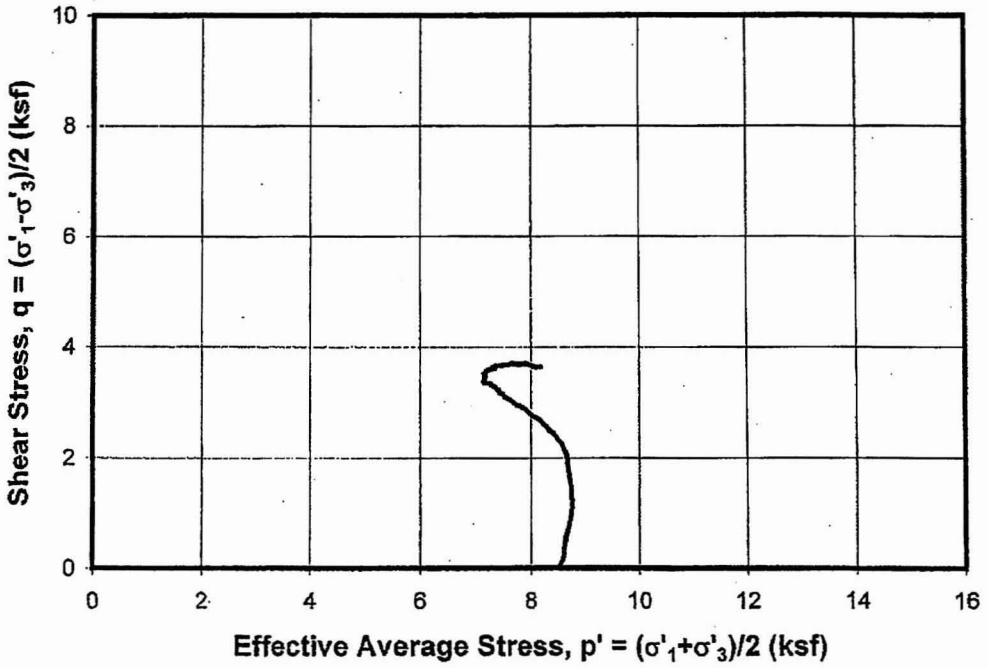
## STAGE 1

| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 438.5 | 0.885 | 1.926 | 3.604 | 2.597 | 0.000 | 3.297 | 0.682 | 432.8 | 102.2 |
| 450.1 | 0.907 | 1.939 | 3.608 | 2.606 | 0.000 | 3.322 | 0.680 | 424.6 | 95.0 |
| 461.6 | 0.934 | 1.950 | 3.613 | 2.612 | 0.000 | 3.344 | 0.678 | 414.7 | 84.6 |
| 507.8 | 1.032 | 1.992 | 3.632 | 2.633 | 0.000 | 3.428 | 0.669 | 383.7 | 86.4 |
| 553.9 | 1.121 | 2.030 | 3.655 | 2.642 | 0.000 | 3.499 | 0.660 | 360.1 | 81.6 |
| 600.1 | 1.212 | 2.065 | 3.680 | 2.654 | 0.000 | 3.558 | 0.652 | 338.7 | 77.1 |
| 646.3 | 1.310 | 2.104 | 3.712 | 2.660 | 0.000 | 3.616 | 0.641 | 319.2 | 66.9 |
| 692.4 | 1.414 | 2.132 | 3.741 | 2.660 | 0.000 | 3.652 | 0.632 | 299.8 | 51.8 |
| 738.6 | 1.512 | 2.156 | 3.765 | 2.660 | 0.000 | 3.680 | 0.625 | 283.6 | 52.9 |
| 784.7 | 1.611 | 2.185 | 3.805 | 2.648 | 0.000 | 3.697 | 0.614 | 269.6 | 59.4 |
| 830.9 | 1.704 | 2.213 | 3.846 | 2.634 | 0.000 | 3.711 | 0.604 | 258.3 | 52.3 |
| 877.0 | 1.798 | 2.233 | 3.881 | 2.621 | 0.000 | 3.712 | 0.595 | 247.0 | 41.3 |
| 923.2 | 1.892 | 2.252 | 3.908 | 2.613 | 0.000 | 3.720 | 0.588 | 236.7 | 38.8 |
| 969.3 | 1.980 | 2.269 | 3.933 | 2.604 | 0.000 | 3.727 | 0.582 | 227.9 | 35.3 |
| 1015.5 | 2.071 | 2.283 | 3.956 | 2.595 | 0.000 | 3.730 | 0.576 | 219.3 | 26.5 |
| 1061.7 | 2.170 | 2.294 | 3.976 | 2.583 | 0.000 | 3.727 | 0.571 | 210.2 | 28.0 |
| 1107.8 | 2.268 | 2.311 | 4.002 | 2.572 | 0.000 | 3.734 | 0.565 | 202.7 | 29.2 |
| 1154.0 | 2.368 | 2.322 | 4.025 | 2.561 | 0.000 | 3.729 | 0.560 | 195.1 | 25.1 |
| 1200.1 | 2.469 | 2.336 | 4.049 | 2.550 | 0.000 | 3.727 | 0.554 | 188.2 | 20.6 |
| 1246.3 | 2.568 | 2.343 | 4.064 | 2.539 | 0.000 | 3.723 | 0.551 | 181.6 | 20.1 |
| 1292.4 | 2.669 | 2.356 | 4.086 | 2.531 | 0.000 | 3.724 | 0.546 | 175.6 | 22.6 |
| 1338.6 | 2.770 | 2.366 | 4.110 | 2.512 | 0.000 | 3.713 | 0.541 | 169.9 | 18.8 |
| 1384.7 | 2.874 | 2.376 | 4.128 | 2.505 | 0.000 | 3.711 | 0.537 | 164.4 | 10.7 |
| 1430.9 | 2.973 | 2.377 | 4.139 | 2.495 | 0.000 | 3.699 | 0.534 | 159.1 | 5.4 |
| 1477.1 | 3.078 | 2.381 | 4.152 | 2.483 | 0.000 | 3.689 | 0.532 | 153.9 | 7.4 |
| 1523.2 | 3.179 | 2.385 | 4.166 | 2.474 | 0.000 | 3.678 | 0.529 | 149.3 | 14.6 |
| 1569.4 | 3.283 | 2.396 | 4.184 | 2.466 | 0.000 | 3.681 | 0.525 | 145.2 | 11.1 |
| 1615.5 | 3.390 | 2.396 | 4.197 | 2.454 | 0.000 | 3.661 | 0.522 | 140.6 | -5.1 |
| 1661.7 | 3.495 | 2.391 | 4.203 | 2.439 | 0.000 | 3.639 | 0.521 | 136.1 | -5.5 |
| 1707.8 | 3.592 | 2.391 | 4.209 | 2.433 | 0.000 | 3.629 | 0.519 | 132.4 | -1.0 |
| 1754.0 | 3.690 | 2.390 | 4.210 | 2.425 | 0.000 | 3.627 | 0.519 | 128.9 | 1.5 |
| 1800.1 | 3.785 | 2.392 | 4.213 | 2.426 | 0.000 | 3.627 | 0.519 | 125.7 | 6.1 |
| 1846.3 | 3.884 | 2.396 | 4.219 | 2.422 | 0.000 | 3.628 | 0.517 | 122.7 | 5.7 |
| 1892.5 | 3.983 | 2.398 | 4.229 | 2.415 | 0.000 | 3.619 | 0.515 | 119.8 | 6.9 |
| 1938.6 | 4.083 | 2.403 | 4.247 | 2.404 | 0.000 | 3.606 | 0.511 | 117.1 | 9.9 |
| 1984.8 | 4.179 | 2.407 | 4.266 | 2.387 | 0.000 | 3.590 | 0.507 | 114.6 | 13.3 |
| 2030.9 | 4.281 | 2.416 | 4.284 | 2.380 | 0.000 | 3.587 | 0.504 | 112.3 | 14.8 |
| 2077.1 | 4.376 | 2.422 | 4.300 | 2.368 | 0.000 | 3.579 | 0.500 | 110.1 | 12.1 |
| 2123.2 | 4.471 | 2.428 | 4.313 | 2.361 | 0.000 | 3.574 | 0.498 | 108.0 | 4.2 |
| 2169.4 | 4.567 | 2.426 | 4.323 | 2.346 | 0.000 | 3.557 | 0.496 | 105.7 | -0.7 |
| 2215.5 | 4.673 | 2.427 | 4.341 | 2.332 | 0.000 | 3.536 | 0.492 | 103.3 | 3.9 |
| 2261.7 | 4.769 | 2.430 | 4.360 | 2.314 | 0.000 | 3.517 | 0.488 | 101.4 | 6.1 |
| 2307.9 | 4.874 | 2.433 | 4.376 | 2.305 | 0.000 | 3.505 | 0.485 | 99.3 | 0.6 |

## STAGE 1

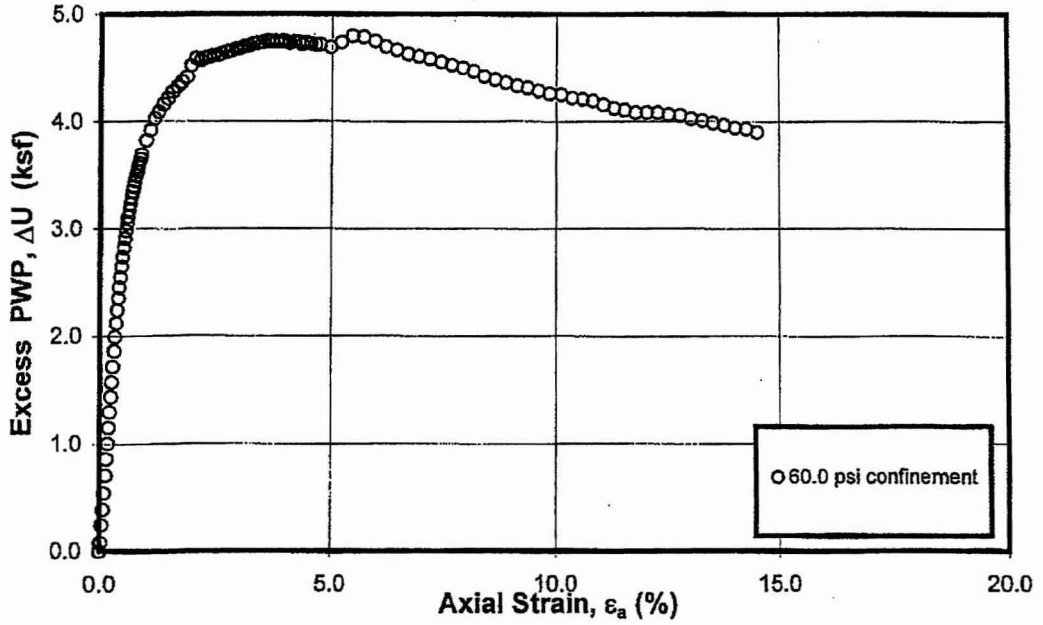
| Elapsed Time (min) | Axial Strain $\varepsilon_a$ (%) | q (ksf) | p' (ksf) | Excess PWP, $\Delta U$ (ksf) | Volume Change ($cm^3$) | Obliquity $\sigma'_1/\sigma'_3$ - | $A_f$ - | $E_S$ (ksf) | $E_T$ (ksf) |
|---|---|---|---|---|---|---|---|---|---|
| 2423.2 | 5.127 | 2.426 | 4.391 | 2.279 | 0.000 | 3.470 | 0.481 | 94.2 | -1.3 |
| 2538.6 | 5.370 | 2.430 | 4.419 | 2.258 | 0.000 | 3.443 | 0.476 | 90.0 | 1.6 |
| 2654.0 | 5.615 | 2.430 | 4.446 | 2.230 | 0.000 | 3.411 | 0.470 | 86.1 | -0.9 |
| 2769.4 | 5.855 | 2.428 | 4.456 | 2.214 | 0.000 | 3.393 | 0.468 | 82.5 | -3.5 |
| 2884.8 | 6.091 | 2.422 | 4.471 | 2.198 | 0.000 | 3.364 | 0.465 | 79.1 | -1.4 |
| 3000.2 | 6.329 | 2.424 | 4.492 | 2.175 | 0.000 | 3.344 | 0.460 | 76.2 | -4.2 |
| 3115.6 | 6.576 | 2.411 | 4.492 | 2.160 | 0.000 | 3.318 | 0.460 | 73.0 | -3.9 |
| 3230.9 | 6.820 | 2.414 | 4.506 | 2.143 | 0.000 | 3.308 | 0.457 | 70.4 | -0.8 |
| 3346.3 | 7.063 | 2.409 | 4.511 | 2.132 | 0.000 | 3.293 | 0.456 | 67.9 | -0.6 |
| 3461.7 | 7.309 | 2.413 | 4.540 | 2.110 | 0.000 | 3.269 | 0.450 | 65.7 | 2.0 |
| 3577.1 | 7.552 | 2.414 | 4.575 | 2.078 | 0.000 | 3.235 | 0.443 | 63.6 | 3.9 |
| 3692.5 | 7.794 | 2.423 | 4.631 | 2.033 | 0.000 | 3.194 | 0.432 | 61.8 | 6.0 |
| 3807.9 | 8.029 | 2.429 | 4.658 | 2.014 | 0.000 | 3.179 | 0.426 | 60.2 | 1.2 |
| 3923.3 | 8.276 | 2.425 | 4.676 | 1.992 | 0.000 | 3.154 | 0.422 | 58.3 | -4.7 |
| 4038.6 | 8.521 | 2.417 | 4.675 | 1.986 | 0.000 | 3.141 | 0.422 | 56.4 | -5.1 |
| 4154.0 | 8.767 | 2.413 | 4.670 | 1.982 | 0.000 | 3.138 | 0.423 | 54.8 | -4.9 |
| 4269.4 | 9.018 | 2.405 | 4.681 | 1.964 | 0.000 | 3.113 | 0.421 | 53.1 | -4.4 |
| 4384.8 | 9.272 | 2.401 | 4.697 | 1.945 | 0.000 | 3.092 | 0.417 | 51.5 | 0.4 |
| 4500.2 | 9.515 | 2.406 | 4.710 | 1.935 | 0.000 | 3.088 | 0.415 | 50.3 | 4.7 |
| 4615.6 | 9.755 | 2.413 | 4.727 | 1.923 | 0.000 | 3.085 | 0.411 | 49.2 | -0.6 |
| 4731.0 | 10.001 | 2.404 | 4.750 | 1.886 | 0.000 | 3.049 | 0.406 | 47.8 | -5.2 |
| 4846.3 | 10.244 | 2.400 | 4.747 | 1.884 | 0.000 | 3.045 | 0.407 | 46.6 | -4.3 |
| 4961.7 | 10.484 | 2.394 | 4.751 | 1.871 | 0.000 | 3.031 | 0.406 | 45.4 | -0.9 |
| 5077.1 | 10.718 | 2.398 | 4.791 | 1.834 | 0.000 | 3.003 | 0.397 | 44.5 | 4.6 |
| 5192.5 | 10.954 | 2.404 | 4.820 | 1.813 | 0.000 | 2.991 | 0.392 | 43.7 | 5.0 |
| 5307.9 | 11.194 | 2.409 | 4.827 | 1.815 | 0.000 | 2.993 | 0.391 | 42.8 | 3.6 |
| 5423.3 | 11.436 | 2.413 | 4.842 | 1.803 | 0.000 | 2.986 | 0.387 | 42.0 | 0.3 |
| 5538.7 | 11.687 | 2.410 | 4.852 | 1.789 | 0.000 | 2.974 | 0.385 | 41.0 | -1.7 |
| 5654.0 | 11.931 | 2.409 | 4.857 | 1.784 | 0.000 | 2.968 | 0.384 | 40.2 | -2.3 |
| 5769.4 | 12.164 | 2.405 | 4.865 | 1.772 | 0.000 | 2.955 | 0.382 | 39.3 | -4.4 |
| 5884.8 | 12.418 | 2.398 | 4.856 | 1.769 | 0.000 | 2.951 | 0.384 | 38.4 | -6.7 |
| 6000.2 | 12.676 | 2.388 | 4.852 | 1.762 | 0.000 | 2.937 | 0.384 | 37.5 | -2.2 |
| 6115.6 | 12.924 | 2.392 | 4.846 | 1.770 | 0.000 | 2.949 | 0.386 | 36.8 | -0.1 |
| 6231.0 | 13.182 | 2.387 | 4.856 | 1.752 | 0.000 | 2.934 | 0.383 | 36.0 | -2.8 |
| 6346.4 | 13.443 | 2.385 | 4.856 | 1.750 | 0.000 | 2.930 | 0.383 | 35.3 | -3.9 |
| 6461.7 | 13.699 | 2.377 | 4.849 | 1.750 | 0.000 | 2.924 | 0.384 | 34.5 | -7.3 |
| 6577.1 | 13.944 | 2.367 | 4.835 | 1.753 | 0.000 | 2.918 | 0.387 | 33.8 | -5.4 |
| 6692.5 | 14.189 | 2.364 | 4.835 | 1.748 | 0.000 | 2.913 | 0.387 | 33.1 | -5.0 |
| 6807.9 | 14.438 | 2.354 | 4.829 | 1.747 | 0.000 | 2.902 | 0.387 | 32.4 | -9.7 |
| 6923.3 | 14.684 | 2.340 | 4.819 | 1.741 | 0.000 | 2.888 | 0.389 | 31.7 | -20.2 |
| 6927.6 | 14.692 | 2.339 | 4.819 | 1.740 | 0.000 | 2.886 | 0.389 | 31.7 | -28.8 |
| | | | | | | | | | |

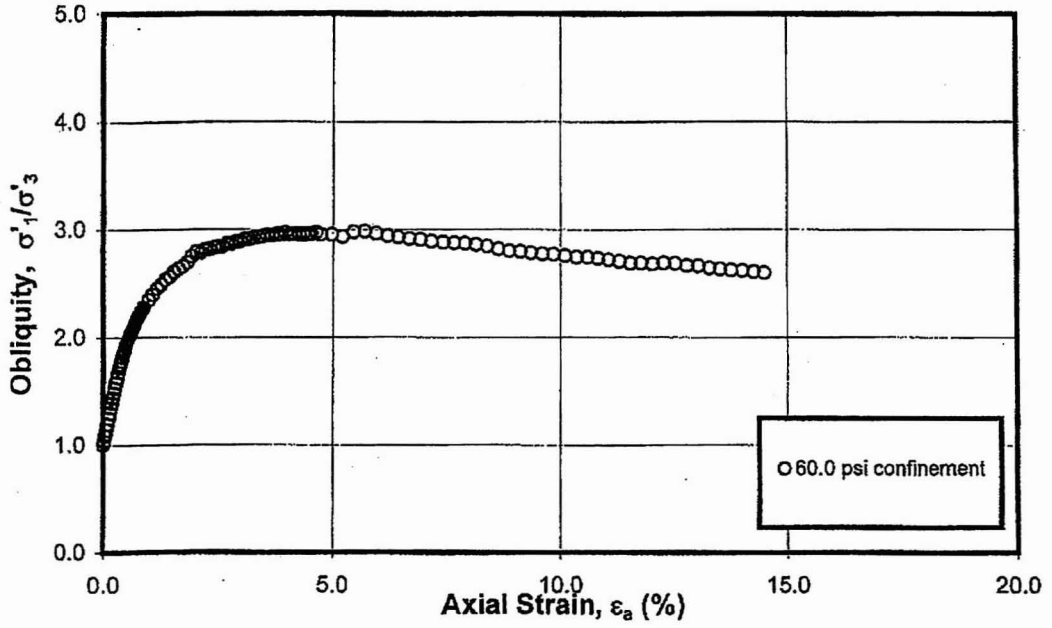



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. BC - Depth: NA
Boring TP-2317 - TP-2334

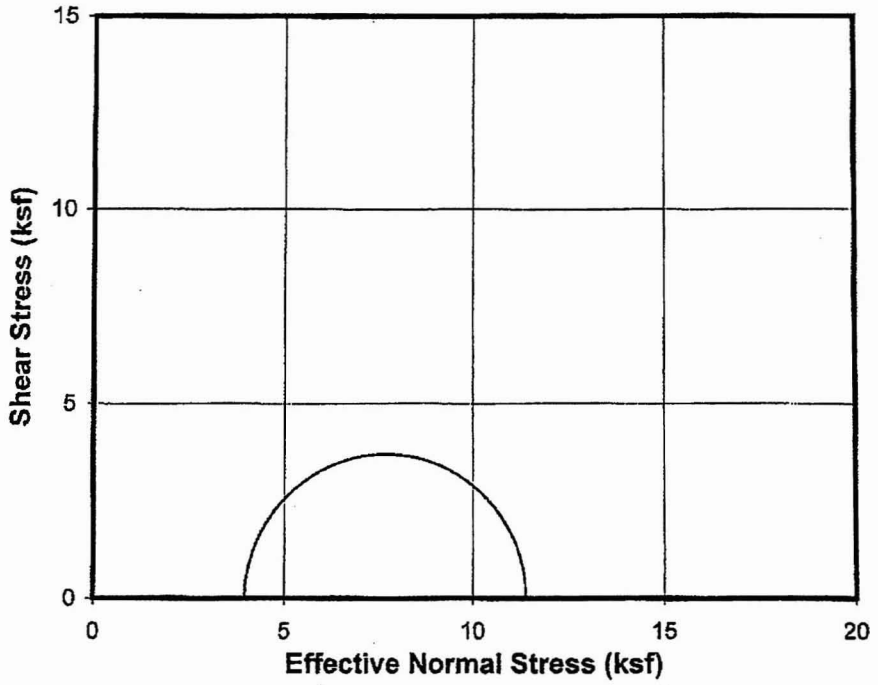
Reviewed By: WFP

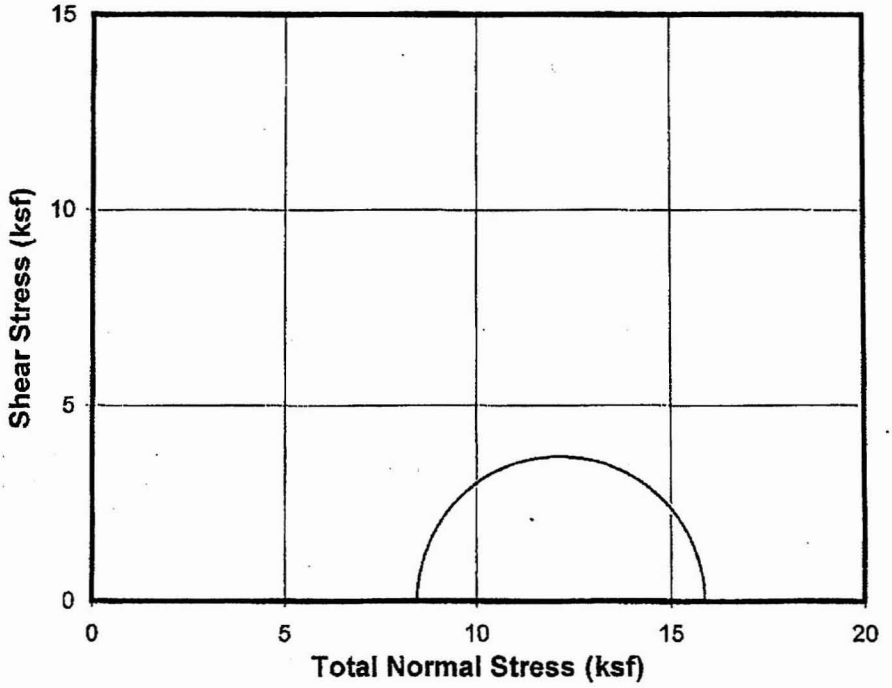



**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated
Sample: Comp. BC - Depth: NA
Boring TP-2317 - TP-2334

Reviewed By: 10 LA




**UNDRAINED TRIAXIAL COMPRESSION TEST**
Isotropically Consolidated- Mohr's Circles
Sample: Comp. BC - Depth: NA
Boring TP-2317 - TP-2334

Reviewed By: DFD

# TRIAXIAL TEST (ASTM D 4767-04): Specimen Setup / Take Down

Project Number: 0411-08-1686 | Test Type: CIU Triaxial | Cell No.: 17 | File Name: Comp. Bc
Task No.: NA | Test Stress(es), $\sigma'_c$ or $\sigma'_{v,c}$ = 8.64 , _____ , _____ & _____ ksf
Project Name: Exelon (Victoria) | $k$ ($\sigma'_{h,c}$ / $\sigma'_{v,c}$) = 1.00 | Induced OCR = 1.00 | $K_{ua}$ ($\sigma_{d,ua}/2\sigma'_{v,c}$) = NA

Assig. Remarks: _____ Specific Gravity: 2.693 [ ] Meas.; [X] Assumed

| | | | | | |
|---|---|---|---|---|---|
| [ ] Tube [ ] Field Extruded | [ ] Liner [X] Remolded | [ ] Tamping | [ ] Constant Effort: | Blows/Tamps per Layer = 10-16 |
| Boring No.: TP-2317 - TP-2334 | [ ] Reconstituted | [ ] Impact/Rammer | Rammer Wgt.(lbf)= 4.50 | No. Layers = 4.00 |
| Sample No.: Comp. B | Compostite No.: | [ ] Pluviated: | Tamper Force (lbf)= | Drop (in.) = 0.5-1 |
| Depth (ft): NA | Specimen No.: C | [ ] Kneading | [X] Undercompaction: $U_{ni}$ (%) = | Dia. (in.) = 1.50 |
| [ ] Spec. Selection by X-ray; | [ ] Geomarine Sample | [X] Recompacted | Ref. Effort = MOD % Comp. = 95.0 | ± Opt. = + 4% |

| | | | | |
|---|---|---|---|---|
| Type | [X] Isotropic | [ ] $K_o$ stress path | [ ] Used automated system: | Drained Axial Strain Rate, $\varepsilon_{a,rate}$ (%/h) = |
| Consolidation : | [ ] Anistropic | [ ] 45° stress path | Remarks: | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading | [X] Static | [X] Undrained | [X] Comp. | [X] Strain | [ ] Stress | [X] Constant Cell Pressure | [ ] Cyclic (Hz) | [ ] Stress | [ ] Strain |
| Conditions : | [ ] Post Cyclic | [ ] Drained | [ ] Ext. | [ ] Stress Path | | [ ] Variable Cell Pressure | Rate: [ ] 0.1; | [ ] 1; | Other: |

| Water Content (WC); | Initial - Trimming Location | | | Final, $W_{at}$ |
|---|---|---|---|---|
| | Top ($W_{o,1}$) | Bottom ($W_{o,2}$) | Sides ($W_{o,3}$) | (see below) |
| Container No | 4222 | | | 723 |
| Mass Moist Soil + Cont. (g) | 130.35 | | | 132.45 |
| Mass Dry Soil + Container (g) | 116.36 | | | 117.78 |
| Mass Container (g) | 30.21 | | | 31.32 |
| Water Content, $W_{o,n}$ (%) | 16.24 | | | 16.97 |
| Avg. Initial WC, $W_{o,avg}$ (%) | 16.24 | Final ($W_{at}$); | [X] Slice ; | [ ] Whole Spec. |
| [ ] See attached data sheet(s) for additional water contents | | | | |

| SOIL MASSES: | Initial | Final |
|---|---|---|
| Moist + Tare (etc.)(g) | 977.40 | 498.71 |
| Tare (etc.) (g) | 484.24 | 0.00 |
| Mass Moist Spec., $M_{in}$ (g) | 493.16 | 498.71 |
| Excess Dry Soil (soil not included in final mass measurement) | | |
| Container No | | |
| Mass Dry Soil + Cont. (g) | | |
| Mass Container (g) | | |
| Mass Excess Dry Soil, $M_{d,es}$ (g) | | 0.00 |

## Specimen Dimensions, (mm)

| | Height | | | Dia., X indicates with membrane | | |
|---|---|---|---|---|---|---|
| | Initial ($H_o$) | Final ($H_{at}$) | | Initial ($D_o$) | Final ($D_{at}$) | |
| GB | 100.000 | 100.000 | 1 T | 50.30 | 53.00 | For |
| 1 | 15.95 | 0.64 | 2 M | 50.16 | 56.25 | Wedge |
| 2 | 15.86 | 0.24 | 3 B | 50.14 | 55.48 | Failure |
| 3 | 16.01 | 0.72 | 1'T | | | = $d_{max}$ |
| 4 | 15.97 | 0.14 | 2'M | | | = $d_{min}$ |
| 5 | 16.00 | 0.72 | 3'B | | | = $\Delta d$ |
| Avg. | 115.96 | 100.49 | Avg. | 50.20 | 54.91 | xxxxx |

Measuring Devices:
Pi Tape: [X] Dia
Calipers: [ ] Ht.; [ ] Dia
Dial Comparator [X] Ht.; [ ] Dia
Remarks: ID# PI-002

| | |
|---|---|
| $A_o = \pi D^2/400$ (cm$^2$) | 19.79 |
| $V_o$ (cm$^3$) | 229.51 |
| $A_{atb,m}=\pi (D^*_{at})^2/400$ (cm$^2$) | 23.97 |
| $A_{atw,m}=(d_{min}-2\Delta d)d_{max}\pi/400$ (cm$^2$) | NA |
| $D^*_{at}=(D_T+2D_M+D_B)/4$ (mm) | 55.25 |

## Estimated Initial Unit Weight

Total, $\gamma_{t,o}$ (lb/ft$^3$) = 134.14 | Dry, $\gamma_{d,o}$ (lb/ft$^3$) = 115.40

## Membrane / Filter Paper / Apparatus

| Membrane (mm): | | Top | Bottom |
|---|---|---|---|
| Number: | Thickness: | 0.48 | 0.65 |
| = 1 | [ ] Single; [X] Double | 0.52 | 0.63 |
| | Circumference ($C_{rm,o}$) | 152.0 | 152.0 |
| | | Total Thickness | Dia.($C_{rm,o}/\pi$) |
| | Average: | 0.29 | 48.38 |

Filter Paper: Top + Bottom: [X] Yes ; [ ] No
Filter Strips: [X] Yes ; [ ] No Number = 8
Type of Filter Strips [ ] Vertical: ¼ in. & Whatman #54
[X] Spiral: ¼ in. & Whatman #1

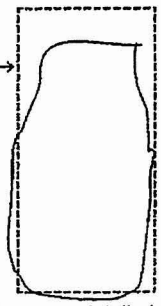
Apparatus: Mass Top Cap, $M_{tc}$ = NA g, NA lbf
Mass Displ. System, $M_{ds}$ (cap, dial, piston, etc.) = NA g, NA lbf

| Top Cap Attached: | Piston Dia.(in.) | Load Cell: |
|---|---|---|
| [ ] Yes; [X] No; | [ ] ½; [ ] ¾; [X] 0.375 | [ ] External [X] Internal |
| Top Cap - Rotation | [ ] Fixed,<1°; [X] Limited,<5°; | [ ] Unlimited, >5° |
| With: | [ ] Frictionless End Caps; | [ ] Lat. Movement Top Cap |
| | [ ] Internal LVDT Jacket | |

[ ] Photo Taken.

Failure Sketch

$\varepsilon_a$=
20%→



Failure Mode:
[X] Bulge
[ ] Wedge
[ ] Parabolic
Wedge/Bulge Ht.=
? Value (mm)

NA - Not Applicable
GB - Gage Block
Other Remarks:
LL=44 PL=15 PI=29

Final Visual Classification: Gray Lean CLAY with sand (CL)

Trimmed / Reconstituted By: YR | Set Up By: RC,jr | Taken Down By: RC,jr
Date: 6/16/2008 | Date: 6/16/2008 | Date: 6/26/2008
Prelim. Calc. By: RC,jr | Final Calc. By: TP | Reviewed By: WFD

[ ] See more detailed sketch on attached sheet. Remarks: