Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

CALCULATION COVER PAGE

Part 1 – General

Project Number: 09-4179 Project Name: Calvert Cliffs NPP Unit 3.
Calculation Title: Triaxial Compression & Direct Shear Testing
Calculation Number: 09-4179-F16 Revision No.:
Number of Pages in Calculation: 35.
If this is a revision to a calculation, explain reason for revision:

Part 2 – Completed by Originator

1. Does the calculation contain the information required by Section 4.4 of QP-15? ☑ Yes ☐ No
   If Answer is No, explain:
2. Has design or analysis software been used for the calculation? ☐ Yes ☑ No
   If Yes, complete the following:
   Software Name: Version Number:
   V&V Revision Number V&V Date:

Printed Name of Originator: Azekah T. Griffiths / Diego Rivera
Signature: Date: 9/15/2009.

Part 3 – Completed by Checker

1. Were the design inputs correctly selected and appropriately documented? ☑ Yes ☐ No
2. Has the appropriate calculation methodology been used? ☑ Yes ☐ No
3. Are assumptions described and justified? ☑ Yes ☐ No
4. Has the input been correctly selected and incorporated into the calculation? ☑ Yes ☐ No
5. Is information and equations from external sources referenced and appropriate? ☑ Yes ☐ No
6. Are numerical calculations correct and have they been completely documented? ☑ Yes ☐ No
7. Are results reasonable considering the input? ☑ Yes ☐ No

Printed Name of Checker: XIAOSONG XIA
Signature Date: 9/16/2009.

Part 4 – Approval (Completed by Project Manager or Principal-in-Charge)

Printed Name: Mel Koleber
Signature

By:	ATG/ DRB	**Date:**	8/11/2009	**Subject:**	Triaxial Compression & Direct Shear Testing Calvert Cliffs Unit 3	**Sheet No.**	1 of 8
✓**By:**	XS	**Date:**	8/11/09			**Project. No.**	09-4179.01

ATG – Azekah T. Griffiths

DRB – Diego Rivera

XS – Xiaosong Xia

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Appendix

1 PURPOSE

To present the laboratory strength results for each layer at the Calvert Cliffs Unit 3 site from CIU-bar Triaxial Compression and Direct Shear Tests.

2 METHODOLOGY

Results of the strength tests were reported in Schnabel (2007) and Mactec (2009) reports. Using 09-4179.01-F9 *"Soil Strata – Thicknesses and Termination Elevations"* (RIZZO 2009), the friction angle (Φ), effective friction angle (Φ'), cohesion (c) and effective cohesion (c') were assigned to various soil layers using the boring number and sample depth. In addition, the secant elastic modulus was obtained from the CIU-bar triaxial tests.

3 ANALYSIS

The excel file "Triaxial Compression & Direct Shear Testing" contains strength properties obtained from laboratory testing, and the soil layers where each sample was obtained. Attached Tables A.1 through A.4 presents the lab results for all the samples tested for the Entire Site, Unit 3, Construction Layout Area (CLA) and Intake areas respectively.

<u>Secant Elastic Modulus (E_{50}) from Consolidated Undrained Triaxial Tests</u>

See Attached Sheets For This Calculation.
Figures 1 through 3 presents the secant modulus for different confinements.

4 RESULTS

Tables 3.1 through 3.4 summarize the minimum, maximum, average and standard deviation of strength properties for each layer for the various areas. Table 3.5 summarizes the E_{50} modulus from triaxial tests.

Table 3.1. Summary of Strength Test– Entire Site

Stratum		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)
Stratum I - Terrace Sand	Minimum	0.05	22.4	0.50	13.3
	Maximum	0.45	32.2	0.58	38.3
	Average	0.22	27.4	0.54	25.8
	Standard Deviation	0.12	2.9	0.05	17.7
Stratum IIa - Chesapeake Clay/Silt	Minimum	0.22	16.4	0.36	3.1
	Maximum	1.06	36.6	3.77	17.0
	Average	0.53	25.8	1.55	9.4
	Standard Deviation	0.25	6.1	1.27	4.6
Stratum IIb - Chesapeake Cemented Sand					
Layer 1	Minimum	0.30	25.5	0.59	19.5
	Maximum	0.41	33.5	0.59	19.5
	Average	0.34	29.0	0.59	19.5
	Standard Deviation	0.06	4.1	-	-
Layer 2	Minimum	0.02	27.0	0.97	13.4
	Maximum	0.82	34.6	2.34	20.0
	Average	0.43	30.6	1.66	15.8
	Standard Deviation	0.28	3.2	0.69	3.6
Layer 3	Minimum	0.00	28.2	-	-
	Maximum	0.23	38.0	-	-
	Average	0.11	31.7	-	-
	Standard Deviation	0.12	4.3	-	-
Stratum IIc - Chesapeake Clay/Silt	Minimum	0.00	18.5	1.35	0.0
	Maximum	2.34	38.7	3.84	18.7
	Average	0.69	29.7	2.05	12.6
	Standard Deviation	0.69	6.3	1.03	7.3
Stratum III - Nanjemoy Sand	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-

Table 3.2. Summary of Strength Tests – Unit 3

Stratum		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)
Stratum I - Terrace Sand	Minimum	0.21	24.9	0.58	13.3
	Maximum	0.45	27.9	0.58	13.3
	Average	0.31	26.3	0.58	13.3
	Standard Deviation	0.12	1.5	-	-
Stratum IIa - Chesapeake Clay/Silt	Minimum	0.22	19.0	0.36	12.5
	Maximum	0.69	32.1	1.03	17.0
	Average	0.45	25.8	0.70	14.8
	Standard Deviation	0.19	5.9	0.47	3.2
Stratum IIb - Chesapeake Cemented Sand					
Layer 1	Minimum	0.30	33.5	0.59	19.5
	Maximum	0.30	33.5	0.59	19.5
	Average	0.30	33.5	0.59	19.5
	Standard Deviation	-	-	-	-
Layer 2	Minimum	0.02	30.0	0.97	13.4
	Maximum	0.50	34.6	1.68	20.0
	Average	0.26	32.3	1.33	16.7
	Standard Deviation	0.34	3.3	0.50	4.7
Layer 3	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-
Stratum IIc - Chesapeake Clay/Silt	Minimum	0.00	29.0	-	-
	Maximum	0.79	35.0	-	-
	Average	0.40	32.0	-	-
	Standard Deviation	0.56	4.2	-	-
Stratum III - Nanjemoy Sand	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-

Table 3.3. Summary of Strength Tests – CLA

Stratum		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)
Stratum I - Terrace Sand	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-
Stratum IIa - Chesapeake Clay/Silt	Minimum	0.30	19.3	0.44	8.3
	Maximum	0.73	31.4	0.95	10.4
	Average	0.52	24.0	0.70	9.4
	Standard Deviation	0.18	5.8	0.36	1.5
Stratum IIb - Chesapeake Cemented Sand					
Layer 1	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-
Layer 2	Minimum	0.24	27.0	2.34	14.1
	Maximum	0.82	34.0	2.34	14.1
	Average	0.49	30.4	2.34	14.1
	Standard Deviation	0.30	3.5	-	-
Layer 3	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-
Stratum IIc - Chesapeake Clay/Silt	Minimum	0.95	18.5	1.53	15.4
	Maximum	2.34	29.1	1.53	15.4
	Average	1.65	22.2	1.53	15.4
	Standard Deviation	0.70	6.0	-	-
Stratum III - Nanjemoy Sand	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-

Table 3.4. Summary of Strength Tests – Intake

Stratum		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)
Stratum I - Terrace Sand	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-
Stratum IIa - Chesapeake Clay/Silt	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-
Stratum IIb - Chesapeake Cemented Sand					
Layer 1	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-
Layer 2	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-
Layer 3	Minimum	0.00	28.2	-	-
	Maximum	0.23	38.0	-	-
	Average	0.12	33.1	-	-
	Standard Deviation	0.16	6.9	-	-
Stratum IIc - Chesapeake Clay/Silt	Minimum	0.00	19.4	1.35	0.0
	Maximum	1.81	38.7	3.84	18.7
	Average	0.50	31.1	2.17	11.9
	Standard Deviation	0.52	5.6	1.14	8.3
Stratum III - Nanjemoy Sand	Minimum	-	-	-	-
	Maximum	-	-	-	-
	Average	-	-	-	-
	Standard Deviation	-	-	-	-

By: ATG/DRB Date: 8/11/2009 Subject: Triaxial Compression & Direct Shear Testing Calvert Cliffs Unit 3 Sheet No. 7 of 8

✓By: XS Date: 8/11/09 Project. No. 09-4179.01

Table 3.5. Summary of Results - E_{50} Modulus from Triaxial Tests (1)

Borehole	Depth (ft)		G.S (ft)	Elevation		Stratum	σ_3 (2) (psi)	E_{50} (3) (psf)	σ_3 (2) (psi)	E_{50} (3) (psf)	σ_3 (2) (psi)	E_{50} (3) (psf)
	top	bottom		top	bottom							
B-320	38.5	40.5	106.4	67.9	65.9	I	11	1.90E+05	13	8.05E+05	25	9.62E+05
B-317	28.5	30.5	94.4	65.9	63.9	IIA	10	2.19E+05	20	2.20E+05	40	4.80E+05
B-317	48.5	50.5	94.4	45.9	43.9	IIA	15	5.07E+05	30	1.36E+06	60	2.56E+06
B-316	53.5	55.5	108.1	54.6	52.6	IIA	8	2.26E+05	20	9.70E+05		
B-414	68.0	70.0	121.2	53.2	51.2	IIA	25	1.74E+05	100	1.52E+05		
B-433	48.5	50.5	97.5	49.0	47.0	IIA	15	9.87E+04	60	1.30E+05		
B-328	63.5	65.5	76.3	12.8	10.8	IIB-2	20	2.18E+05	40	2.15E+05	65	8.85E+05
B-423	103.5	105.5	110.1	6.6	4.6	IIB-2	30	2.97E+05	55	7.58E+05	107.5	1.94E+06
B-321	73.5	75.5	70.7	-2.8	-4.8	IIB-2	20	2.48E+05	40	4.40E+05	80	1.23E+06
B-420	128.5	130.5	62.6	-65.9	-67.9	IIC	30	7.98E+05	120	3.21E+06		

(1) Depths and ground surface elevations (G.S) of all borehole samples are presented in Ref. 3

(2) Confinement stress (total stress)

(3) Secant modulus:

$$E_{50}=\frac{(\sigma_1-\sigma_3)_{50\%}}{\delta_{50\%}}$$

where $(\sigma_1-\sigma_3)_{50\%}$ is the deviator stress at 50% of the ultimate load and $\delta_{50\%}$ is the axial strain at 50% of the ultimate load

5 REFERENCES

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Schnabel Engineering North, LLC (Schnabel), (2007). "Geotechnical Subsurface Investigation Data Report" (Revision No. 1), Schnabel Project No. 06120048, December 13, 2007, Gaithersburg, MD.

Paul C. Rizzo Associates, Inc. (RIZZO), (2009). 09-4179.01-F9 "Soil Strata – Thicknesses and Termination Elevations"

APPENDIX

Table A.1. Summary of Laboratory Strength Tests - Entire Site

Area	Boring Number	Depth (ft)		Soil Layer	CU Triaxial Test				Direct Shear	
		From	To		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)	c' (tsf)	Φ' (degees)
Unit 3	B-317	48.5	50.5	Layer 1	0.30	33.5	0.59	19.5		
Intake Slope	B-778	81.5	83.5	Layer 1					0.31	25.5
Intake Slope	B-778	101.5	103.5	Layer 1					0.41	28.1
				Minimum	**0.30**	**33.5**	**0.59**	**19.5**	**0.31**	**25.5**
				Maximum	**0.30**	**33.5**	**0.59**	**19.5**	**0.41**	**28.1**
				Average	**0.30**	**33.5**	**0.59**	**19.5**	**0.36**	**26.8**
				Standard deviation					**0.07**	**1.8**
Unit 3	B-321	73.5	75.5	Layer 2	0.50	30.0	0.97	20.0		
Unit 3	B-328	63.5	65.5	Layer 2	0.02	34.6	1.68	13.4		
CLA	B-420	63.5	65.5	Layer 2					0.24	34.0
CLA	B-423	103.5	105.5	Layer 2	0.82	27.0	2.34	14.1		
CLA	B-440	51	53	Layer 2					0.40	30.3
Cooling Tower Area	B-724	73.5	75.5	Layer 2					0.59	27.5
				Minimum	**0.02**	**27.0**	**0.97**	**13.4**	**0.24**	**27.5**
				Maximum	**0.82**	**34.6**	**2.34**	**20.0**	**0.59**	**34.0**
				Average	**0.45**	**30.5**	**1.66**	**15.8**	**0.41**	**30.6**
				Standard deviation	**0.40**	**3.8**	**0.69**	**3.63**	**0.18**	**3.3**
intake	B-773A	23	25	Layer 3					0.23	28.2
Intake Slope	B-779	81.5	83.4	Layer 3					0.20	30.5
intake	B-774	11.5	13.1	Layer 3	0.00	38.0				
Intake Slope	B-779	96.5	98.5	Layer 3					0.00	30.0
				Minimum	**0.00**	**38.0**			**0.00**	**28.2**
				Maximum	**0.00**	**38.0**			**0.23**	**30.5**
				Average	**0.00**	**38.0**			**0.14**	**29.6**
				Standard deviation	**-**	**-**			**0.13**	**1.2**
Unit 3	B-316	53.5	55.5	Stratum a	0.49	32.1	1.03	12.5		
Unit 3	B-316	53.5	55.5	Stratum a					0.32	30.1
Unit 3	B-317	28.5	30.5	Stratum a	0.22	31.0	0.36	17.0		
Unit 3	B-319	43.5	45.2	Stratum a					0.65	20.8
Unit 3	B-320	48.5	50	Stratum a					0.69	21.6
Unit 3	B-326	43.5	45.5	Stratum a					0.35	19.0
CLA	B-413	73	75	Stratum a					0.46	31.4
CLA	B-414	68	70	Stratum a	0.73	20.0	0.95	10.4		
CLA	B-427	63.5	65.5	Stratum a					0.44	29.2
CLA	B-433	38.5	40.5	Stratum a					0.68	20.2
CLA	B-433	48.5	50.5	Stratum a	0.30	19.3	0.44	8.3		
Cooling Tower Area	B-735	28	30	Stratum a					0.35	27.2
Cooling Tower Area	B-737	10.5	12.5	Stratum a					0.37	22.7
Intake Slope	B-778	51.5	53.5	Stratum a					0.26	25.6
Intake Slope	B-779	41.5	43.5	Stratum a	0.37	35.6	2.78	5.1		
Intake Slope	B-779	61.5	63.5	Stratum a	0.95	25.6	1.50	9.4		
Intake Slope	B-779	71.5	73.5	Stratum a	0.91	36.6	3.77	3.1		
Intake Slope	B-778	71.5	73.5	Stratum a					1.06	16.4
				Minimum	**0.22**	**19.3**	**0.36**	**3.1**	**0.26**	**16.4**
				Maximum	**0.95**	**36.6**	**3.77**	**17.0**	**1.06**	**31.4**
				Average	**0.57**	**28.6**	**1.55**	**9.4**	**0.51**	**24.0**

Table A.1. Summary of Laboratory Strength Tests - Entire Site

Area	Boring Number	Depth (ft)		Soil Layer	CU Triaxial Test				Direct Shear	
		From	To		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)	c' (tsf)	Φ' (degees)
				Standard deviation	**0.30**	**7.1**	**1.27**	**4.6**	**0.24**	**5.0**
Unit 3	B-307	178.5	180.4	Stratum c					0.00	35.0
Unit 3	B-313	93.5	94.7	Stratum c					0.79	29.0
CLA	B-401	173.5	174.4	Stratum c					2.34	18.9
CLA	B-420	128.5	130.3	Stratum c	0.95	29.1	1.53	15.4		
CLA	B-423	188.5	180	Stratum c					1.66	18.5
intake	B-771	31.5	33.5	Stratum c					0.28	29.8
intake	B-771	41.5	43.5	Stratum c					0.14	38.7
intake	B-771	51.5	53.5	Stratum c	0.87	35.0	1.35	18.7		
intake	B-773A	93	95	Stratum c					0.00	32.6
intake	B-773A	113	115	Stratum c	0.00	37.3	1.56	16.0		
intake	B-773A	123	125	Stratum c	1.81	19.4	3.84	0.0		
intake	B-774	21.5	23.5	Stratum c	0.36	35.8	1.95	13.0		
intake	B-774	31.5	33.5	Stratum c					0.38	28.3
intake	B-774	41.5	43.5	Stratum c					0.45	31.7
intake	B-774	51.5	53.5	Stratum c					0.40	33.0
intake	B-774	121.5	123.5	Stratum c					0.22	27.6
intake	B-774	141.5	143.5	Stratum c					1.05	24.4
				Minimum	**0.00**	**19.4**	**1.35**	**0.0**	**0.00**	**18.5**
				Maximum	**1.81**	**37.3**	**3.84**	**18.7**	**2.34**	**38.7**
				Average	**0.80**	**31.3**	**2.05**	**12.6**	**0.64**	**29.0**
				Standard deviation	**0.69**	**7.4**	**1.03**	**7.3**	**0.72**	**6.1**
Intake Slope	B-778	33.5	35.5	Terrace Sand					0.05	29.1
Unit 3	B-319	33.5	35.5	Terrace Sand					0.45	24.9
Intake Slope	B-778	41.5	43.5	Terrace Sand					0.31	22.4
Intake Slope	B-778	11.5	13.5	Terrace Sand					0.16	28.6
Intake Slope	B-779	21.5	23.5	Terrace Sand					0.16	28.7
Unit 3	B-320	38.5	40.5	Terrace Sand	0.27	27.9	0.58	13.3	0.21	26.0
Cooling Tower Area	B-743	23.5	25.5	Terrace Sand					0.27	29.2
Intake Slope	B-779	11.5	13.5	Terrace Sand	0.09	32.2	0.50	38.3		
Intake Slope	B-779	31.5	33.5	Terrace Sand					0.26	24.5
				Minimum	**0.09**	**27.9**	**0.50**	**13.3**	**0.05**	**22.4**
				Maximum	**0.27**	**32.2**	**0.58**	**38.3**	**0.45**	**29.2**
				Average	**0.18**	**30.1**	**0.54**	**25.8**	**0.23**	**26.7**
				Standard deviation	**0.13**	**3.0**	**0.05**	**17.7**	**0.12**	**2.6**

Table A.2. Summary of Laboratory Strength Tests - Unit 3

Area	Boring Number	Depth (ft)		Soil Layer	CU Triaxial Test				Direct Shear	
		From	To		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)	c' (tsf)	Φ' (degees)
Unit 3	B-317	48.5	50.5	Layer 1	0.30	33.5	0.59	19.5		
				Minimum	**0.30**	**33.5**	**0.59**	**19.5**		
				Maximum	**0.30**	**33.5**	**0.59**	**19.5**		
				Average	**0.30**	**33.5**	**0.59**	**19.5**		
				Standard deviation						
Unit 3	B-321	73.5	75.5	Layer 2	0.50	30.0	0.97	20.0		
Unit 3	B-328	63.5	65.5	Layer 2	0.02	34.6	1.68	13.4		
				Minimum	**0.02**	**30.0**	**0.97**	**13.4**		
				Maximum	**0.50**	**34.6**	**1.68**	**20.0**		
				Average	**0.26**	**32.3**	**1.33**	**16.7**		
				Standard deviation	**0.34**	**3.3**	**0.50**	**4.67**		
Unit 3	B-316	53.5	55.5	Stratum a	0.49	32.1	1.03	12.5		
Unit 3	B-316	53.5	55.5	Stratum a					0.32	30.1
Unit 3	B-317	28.5	30.5	Stratum a	0.22	31.0	0.36	17.0		
Unit 3	B-319	43.5	45.2	Stratum a					0.65	20.8
Unit 3	B-320	48.5	50	Stratum a					0.69	21.6
Unit 3	B-326	43.5	45.5	Stratum a					0.35	19.0
				Minimum	**0.22**	**31.0**	**0.36**	**12.5**	**0.32**	**19.0**
				Maximum	**0.49**	**32.1**	**1.03**	**17.0**	**0.69**	**30.1**
				Average	**0.36**	**31.6**	**0.70**	**14.8**	**0.50**	**22.9**
				Standard deviation	**0.19**	**0.8**	**0.47**	**3.2**	**0.19**	**4.9**
Unit 3	B-307	178.5	180.4	Stratum c					0.00	35.0
Unit 3	B-313	93.5	94.7	Stratum c					0.79	29.0
				Minimum					**0.00**	**29.0**
				Maximum					**0.79**	**35.0**
				Average					**0.40**	**32.0**
				Standard deviation					**0.56**	**4.2**
Unit 3	B-319	33.5	35.5	Terrace Sand					0.45	24.9
Unit 3	B-320	38.5	40.5	Terrace Sand	0.27	27.9	0.58	13.3	0.21	26.0
				Minimum	**0.27**	**27.9**	**0.58**	**13.3**	**0.21**	**24.9**
				Maximum	**0.27**	**27.9**	**0.58**	**13.3**	**0.45**	**26.0**
				Average	**0.27**	**27.9**	**0.58**	**13.3**	**0.33**	**25.5**
				Standard deviation	-	-	-	-	**0.17**	**0.8**

Table A.3. Summary of Laboratory Strength Tests - CLA

Area	Boring Number	Depth (ft)		Soil Layer	CU Triaxial Test				Direct Shear	
		From	To		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)	c' (tsf)	Φ' (degees)
CLA	B-420	63.5	65.5	Layer 2					0.24	34.0
CLA	B-423	103.5	105.5	Layer 2	0.82	27.0	2.34	14.1		
CLA	B-440	51	53	Layer 2					0.40	30.3
				Minimum	**0.82**	**27.0**	**2.34**	**14.1**	**0.24**	**30.3**
				Maximum	**0.82**	**27.0**	**2.34**	**14.1**	**0.40**	**34.0**
				Average	**0.82**	**27.0**	**2.34**	**14.1**	**0.32**	**32.2**
				Standard deviation					**0.11**	**2.6**
CLA	B-413	73	75	Stratum a					0.46	31.4
CLA	B-414	68	70	Stratum a	0.73	20.0	0.95	10.4		
CLA	B-427	63.5	65.5	Stratum a					0.44	29.2
CLA	B-433	38.5	40.5	Stratum a					0.68	20.2
CLA	B-433	48.5	50.5	Stratum a	0.30	19.3	0.44	8.3		
				Minimum	**0.30**	**19.3**	**0.44**	**8.3**	**0.44**	**20.2**
				Maximum	**0.73**	**20.0**	**0.95**	**10.4**	**0.68**	**31.4**
				Average	**0.52**	**19.7**	**0.70**	**9.4**	**0.53**	**26.9**
				Standard deviation	**0.30**	**0.5**	**0.36**	**1.5**	**0.13**	**5.9**
CLA	B-401	173.5	174.4	Stratum c					2.34	18.9
CLA	B-420	128.5	130.3	Stratum c	0.95	29.1	1.53	15.4		
CLA	B-423	188.5	180	Stratum c					1.66	18.5
				Minimum	**0.95**	**29.1**	**1.53**	**15.4**	**1.66**	**18.5**
				Maximum	**0.95**	**29.1**	**1.53**	**15.4**	**2.34**	**18.9**
				Average	**0.95**	**29.1**	**1.53**	**15.4**	**2.00**	**18.7**
				Standard deviation					**0.48**	**0.3**

Table A.4. Summary of Laboratory Strength Tests - Intake

Area	Boring Number	Depth (ft)		Soil Layer	CU Triaxial Test				Direct Shear	
		From	To		c' (tsf)	Φ' (degees)	c (tsf)	Φ (degrees)	c' (tsf)	Φ' (degees)
intake	B-773A	23	25	Layer 3					0.23	28.2
intake	B-774	11.5	13.1	Layer 3	0.00	38.0				
				Minimum	**0.00**	**38.0**			**0.23**	**28.2**
				Maximum	**0.00**	**38.0**			**0.23**	**28.2**
				Average	**0.00**	**38.0**			**0.23**	**28.2**
				Standard deviation	**-**	**-**				
intake	B-771	31.5	33.5	Stratum c					0.28	29.8
intake	B-771	41.5	43.5	Stratum c					0.14	38.7
intake	B-771	51.5	53.5	Stratum c	0.87	35.0	1.35	18.7		
intake	B-773A	93	95	Stratum c					0.00	32.6
intake	B-773A	113	115	Stratum c	0.00	37.3	1.56	16.0		
intake	B-773A	123	125	Stratum c	1.81	19.4	3.84	0.0		
intake	B-774	21.5	23.5	Stratum c	0.36	35.8	1.95	13.0		
intake	B-774	31.5	33.5	Stratum c					0.38	28.3
intake	B-774	41.5	43.5	Stratum c					0.45	31.7
intake	B-774	51.5	53.5	Stratum c					0.40	33.0
intake	B-774	121.5	123.5	Stratum c					0.22	27.6
intake	B-774	141.5	143.5	Stratum c					1.05	24.4
				Minimum	**0.00**	**19.4**	**1.35**	**0.0**	**0.00**	**24.4**
				Maximum	**1.81**	**37.3**	**3.84**	**18.7**	**1.05**	**38.7**
				Average	**0.76**	**31.9**	**2.17**	**11.9**	**0.37**	**30.8**
				Standard deviation	**0.79**	**8.4**	**1.14**	**8.3**	**0.31**	**4.3**

Secant Elastic Modulus (E_{50}) from Consolidated Undrained Triaxial Tests

Input data from all boreholes is obtained from Ref. 2 (Schnabel Project No. 06120048, Appendix I: Soil Laboratory Testing. CIU-bar Triaxial Compression Results). Cofinement stresses (σ_3) are total stresses. The elastic modulus E_{50} corresponds to the secant modulus at 50% of the ultimate load. E_{50} modulus are calculated for different confinement stresses (σ_3) at different depths for each boehole.

Boring = **316**

Depth = **53.5 - 55.5** **ft**

σ_3 (psi) = 8		σ_3 (psi) = 20	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00
0.16	10.13	0.13	18.40
0.26	11.17	0.26	20.15
0.42	12.86	0.26	22.17
0.61	14.03	0.29	24.26
0.67	15.33	0.35	26.47
0.80	16.38	0.42	29.07
0.99	18.00	0.48	31.81
1.12	19.76	0.51	34.35
1.41	21.65	0.58	36.82
1.92	24.78	0.67	39.04
2.21	27.25	0.70	41.19
2.30	28.88	0.80	43.73
2.50	30.18	0.90	46.33
2.62	31.81	1.02	49.85
2.82	34.28	1.12	51.54
2.98	36.11	1.18	52.91
3.14	37.67	1.28	54.73
3.23	39.23	1.34	56.49
3.36	40.47	1.34	57.86
3.55	41.97	1.47	59.68
3.71	43.20	1.63	61.18

σ_3 (psi) =	8	
P max =	44.2	psi
50% Pmax =	22.1	psi
Approx =	21.65	psi
row =	10	
50% d =	1.41	%
E 50% =	1568.9	psi
E 50% =	**2.26E+05**	**psf**

σ_3 (psi) =	20	
P max =	69.0	psi
50% Pmax =	34.5	psi
Approx =	34.35	psi
row =	9	
50% d =	0.51	%
E 50% =	6737.4	psi
E 50% =	**9.70E+05**	**psf**

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σ_3 (psi) = 8		σ_3 (psi) = 20	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
3.74	43.92	1.66	62.28
3.94	44.18	1.82	63.39
4.19	43.92	1.89	64.82
4.32	43.47	2.05	65.93
4.32	43.01	2.14	66.71
4.42	42.49	2.21	67.23
4.58	41.77	2.21	67.56
4.74	40.99	2.27	67.88
4.96	40.47	2.34	68.08
5.15	39.88	2.46	68.21
5.47	39.36	2.50	68.40
5.82	38.78	2.56	68.60
6.11	38.13	2.59	68.99
6.46	37.67	2.69	68.67
6.78	37.34	2.82	68.34
7.20	36.95	2.94	68.08
7.55	36.50	3.23	67.88
7.90	36.04	3.42	67.75
8.22	36.04	3.58	67.10
8.45	35.78	3.71	66.32
8.58	35.26	3.97	65.60
8.80	35.00	4.22	64.82
9.09	34.80	4.48	63.72
9.38	34.74	4.90	62.74
9.57	34.22	5.22	61.96
10.08	34.09	5.57	61.37
10.46	33.89	5.86	60.85
10.91	34.09	6.21	60.27
11.26	34.15	6.43	59.94
11.90	34.48	6.69	59.35
12.32	34.93	6.88	58.64
12.77	35.33	7.04	57.99
13.09	35.33	7.14	57.07
13.44	35.26	7.17	56.23

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σ_3 (psi) = 8		σ_3 (psi) = 20	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
13.89	35.91	7.20	55.58
14.14	36.37	7.36	54.99
14.37	36.63	7.55	54.40
14.66	36.63	7.81	53.82
14.91	36.95	8.13	53.30
15.07	37.28	8.54	52.84
		8.96	52.39
		9.47	52.32
		10.05	52.32
		10.53	52.52
		10.94	52.65
		11.55	52.91
		12.03	53.04
		12.38	53.10
		12.64	53.17
		12.99	53.04
		13.47	52.84
		13.82	52.65
		14.14	52.26
		14.46	51.73
		14.69	51.08
		14.82	50.43
		15.07	49.65

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Boring = **317**
Depth = **28.5 - 30.5** **ft**

σ_3 (psi) = 10		σ_3 (psi) = 20		σ_3 (psi) = 40	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00	0.00	0.00
0.21	6.84	0.24	8.10	0.14	6.56
0.45	8.80	0.38	11.04	0.35	13.56
0.77	10.20	0.80	14.12	0.42	15.24
1.08	12.16	1.12	16.50	0.42	17.76
1.33	14.12	1.54	17.76	0.56	20.56
1.64	16.08	1.96	21.12	0.70	22.38
2.27	18.88	2.59	24.20	0.80	24.34
2.62	20.70	3.08	27.00	0.91	25.60
3.15	22.52	4.16	31.48	1.08	27.14
4.09	22.94	5.11	33.02	1.15	28.40
5.11	23.22	6.16	34.14	1.61	32.60
6.26	23.08	7.31	33.44	2.10	36.66
7.17	23.08	8.19	29.52	2.55	39.74
8.15	22.38	9.20	29.52	3.15	42.68
9.24	21.82	10.22	30.22	4.13	46.04
10.15	22.52	11.16	29.24	5.11	46.32
11.09	21.54	12.18	28.26	6.12	44.78
12.18	21.54	13.16	28.40	7.17	41.14
13.16	21.96	14.10	28.82	8.19	39.88
14.14	21.54	15.15	28.40	8.99	38.48
15.05	21.26			10.08	37.64
				11.16	36.94
				12.07	37.08
				13.09	37.50
				14.07	37.64
				15.05	37.50

σ_3 (psi) =	10	
P max =	23.2	psi
50% Pmax =	11.6	psi
Approx =	10.20	psi
row =	4	
50% d =	0.77	%
E 50% =	1517.6	psi
E 50% =	**2.19E+05**	**psf**

σ_3 (psi) =	20	
P max =	34.1	psi
50% Pmax =	17.1	psi
Approx =	16.50	psi
row =	5	
50% d =	1.12	%
E 50% =	1530.9	psi
E 50% =	**2.20E+05**	**psf**

σ_3 (psi) =	40	
P max =	46.3	psi
50% Pmax =	23.2	psi
Approx =	22.38	psi
row =	7	
50% d =	0.70	%
E 50% =	3332.4	psi
E 50% =	**4.80E+05**	**psf**

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Boring = **317**
Depth = **48.5 - 50.5** **ft**

σ_3 (psi) = 15		σ_3 (psi) = 30		σ_3 (psi) = 60	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00	0.00	0.00
0.29	11.68	0.36	32.50	0.24	38.24
0.38	13.56	0.49	38.78	0.36	46.32
0.53	15.90	0.58	43.45	0.36	51.35
0.65	18.23	0.69	48.03	0.53	62.38
0.69	20.65	0.78	51.26	0.62	70.37
0.78	22.90	0.83	53.77	0.76	77.01
0.97	25.59	1.01	55.65	0.85	80.33
1.06	28.10	1.06	57.36	1.03	81.95
1.48	38.69	1.58	61.67	1.12	83.21
2.05	45.51	2.09	64.63	1.62	82.58
2.52	49.82	2.63	66.15	2.09	83.21
3.13	54.49	3.11	67.14	2.70	84.01
4.10	60.41	4.06	68.31	3.15	84.82
5.03	64.99	5.07	68.58	4.12	83.03
6.14	68.67	6.16	68.22	5.07	80.15
7.08	70.55	7.06	67.50	6.11	77.19
8.03	72.44	7.92	66.78	7.06	76.03
9.11	73.87	9.09	65.44	8.08	74.50
10.07	74.86	10.06	64.36	9.03	71.18
11.08	74.68	11.08	63.28	10.04	68.67
12.03	74.95	12.01	63.28	11.06	67.32
13.07	74.50	13.00	63.82	12.12	66.15
14.08	74.41	14.11	64.27	13.11	66.69
15.12	73.87	15.10	65.17	14.11	68.40
				15.05	69.83

σ_3 (psi) =	15	
P max =	74.9	psi
50% Pmax =	37.5	psi
Approx =	28.10	psi
row =	9	
50% d =	1.06	%
E 50% =	3521.7	psi
E 50% =	**5.07E+05**	**psf**

σ_3 (psi) =	30	
P max =	68.6	psi
50% Pmax =	34.3	psi
Approx =	32.50	psi
row =	2	
50% d =	0.36	%
E 50% =	9417.3	psi
E 50% =	**1.36E+06**	**psf**

σ_3 (psi) =	60	
P max =	84.8	psi
50% Pmax =	42.4	psi
Approx =	38.24	psi
row =	2	
50% d =	0.24	%
E 50% =	17784.9	psi
E 50% =	**2.56E+06**	**psf**

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Boring = **320**
Depth = **38.5 - 40.5** **ft**

σ_3 (psi) = 11		σ_3 (psi) = 13		σ_3 (psi) = 25	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00	0.00	0.00
0.02	5.46	-0.02	8.35	0.00	9.44
0.20	8.08	0.02	10.79	0.00	11.43
0.47	10.97	0.07	13.59	0.00	14.41
0.82	12.96	0.33	16.94	0.07	17.66
1.18	15.40	0.60	19.46	0.20	20.37
1.62	17.93	0.69	21.18	0.24	22.99
1.89	20.37	0.87	22.99	0.42	26.60
2.38	22.90	1.04	25.34	0.56	31.03
2.87	25.43	1.31	27.23	0.82	34.55
3.40	27.41	1.58	28.77	1.04	38.61
4.11	29.04	1.71	30.66	1.00	40.60
4.69	30.12	1.93	32.11	1.27	43.40
5.18	30.94	2.29	33.65	1.62	46.38
5.76	31.03	2.56	34.82	1.98	49.18
6.60	31.12	2.91	35.81	2.24	51.44
7.22	31.12	3.13	36.35	2.47	52.61
7.84	31.12	3.31	36.99	2.73	53.43
8.69	31.03	3.44	37.26	2.96	54.33
9.58	30.75	3.49	36.90	3.22	55.14
10.47	30.66	3.49	36.26	3.62	55.77
11.27	30.66	3.67	35.45	3.93	56.23
11.93	30.57	3.89	34.55	4.29	56.41
12.69	30.21	4.16	33.28	4.73	56.14
13.40	29.85	4.60	32.11	4.91	55.86
13.84	29.58	5.00	31.57	5.13	55.05
14.51	29.40	5.36	30.85	5.44	54.51
		5.89	30.39	5.71	53.97
		6.11	29.85	5.93	53.88
		6.47	29.40	6.24	53.25
		7.00	28.95	6.42	52.79
		7.76	28.41	6.73	52.70
		8.33	28.41	7.09	52.70
		8.87	28.32	7.44	52.61
		9.27	28.05	7.76	52.61
		9.89	28.05	8.16	52.34
		10.20	28.23	8.47	52.07
		10.60	28.23	8.87	51.53
		11.18	28.41	8.91	50.90
		11.31	28.68	9.13	50.35

σ_3 (psi) =	11	
P max =	31.1	psi
50% Pmax =	15.6	psi
Approx =	15.40	psi
row =	6	
50% d =	1.18	%
E 50% =	1321.0	psi
E 50% =	**1.90E+05**	**psf**

σ_3 (psi) =	13	
P max =	37.3	psi
50% Pmax =	18.6	psi
Approx =	16.94	psi
row =	5	
50% d =	0.33	%
E 50% =	5588.7	psi
E 50% =	**8.05E+05**	**psf**

σ_3 (psi) =	25	
P max =	56.4	psi
50% Pmax =	28.2	psi
Approx =	26.60	psi
row =	8	
50% d =	0.42	%
E 50% =	6679.7	psi
E 50% =	**9.62E+05**	**psf**

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σ_3 (psi) = 11		σ_3 (psi) = 13		σ_3 (psi) = 25	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
		11.53	28.77	9.40	49.63
		12.11	28.86	9.62	49.63
		12.60	28.86	9.80	49.63
		13.27	28.95	10.02	49.27
		13.76	29.13	10.07	48.82
		14.33	29.13	10.42	47.92
				10.69	47.65
				10.82	47.74
				10.91	47.83
				11.00	48.01
				11.44	47.46
				11.71	47.19
				12.11	47.01
				12.38	47.28
				12.60	47.28
				12.82	47.65
				12.96	47.92
				13.09	48.10
				13.27	48.37
				13.44	48.46
				13.53	48.46
				13.67	49.00
				13.80	49.45
				13.89	50.08
				14.07	51.17
				14.29	51.89
				14.29	52.61
				14.38	53.06
				14.60	53.06
				14.78	53.15

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Boring = 321
Depth = 73.5 - 75.5 ft

σ_3 (psi) = 20		σ_3 (psi) = 40		σ_3 (psi) = 80	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00	0.00	0.00
0.70	25.20	0.33	19.11	0.29	22.80
1.23	30.37	0.62	26.86	0.33	33.32
1.54	35.17	0.96	33.51	0.37	40.34
2.05	39.78	1.13	37.75	0.47	46.43
2.56	44.03	1.58	48.28	0.45	51.97
3.14	48.83	2.07	59.54	0.55	57.14
4.08	57.14	2.71	69.51	0.66	63.97
5.01	63.60	3.18	77.82	0.78	70.98
6.03	70.25	4.12	90.55	0.92	75.05
7.08	76.52	5.11	101.82	1.03	79.66
8.06	81.69	6.13	109.38	1.19	84.28
8.98	86.31	7.08	115.29	1.42	88.71
10.07	91.48	8.12	120.83	1.68	94.06
11.04	95.17	9.11	124.15	1.99	97.57
12.02	99.05	10.01	125.82	2.22	100.71
13.05	102.55	11.04	126.74	2.61	103.85
14.05	105.32	12.04	126.37	2.93	107.91
15.04	108.28	13.01	124.89	3.51	110.86
		14.03	121.57	4.02	114.74
		15.12	118.98	4.49	117.69
				5.01	121.20
				5.76	124.89
				6.40	128.77
				6.97	131.35
				7.47	134.12
				8.00	136.71
				8.57	139.11
				9.21	141.88
				10.09	145.38
				11.16	148.52
				12.08	151.11
				13.03	152.95
				14.15	155.54
				15.06	158.31

σ_3 (psi) =	20	
P max =	108.3	psi
50% Pmax =	54.1	psi
Approx =	48.83	psi
row =	7	
50% d =	3.14	%
E 50% =	1725.0	psi
E 50% =	**2.48E+05**	**psf**

σ_3 (psi) =	40	
P max =	126.7	psi
50% Pmax =	63.4	psi
Approx =	59.54	psi
row =	7	
50% d =	2.07	%
E 50% =	3058.7	psi
E 50% =	**4.40E+05**	**psf**

σ_3 (psi) =	80	
P max =	158.3	psi
50% Pmax =	79.2	psi
Approx =	75.05	psi
row =	10	
50% d =	0.92	%
E 50% =	8575.0	psi
E 50% =	**1.23E+06**	**psf**

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By ATG/DRB Date 08/6/09 Subject Triaxial Compression & Direct Shear Sheet No. B-9 of B-21
Chkd. By LS Date 8/11/09 Testing - Calvert Cliffs Unit 3 Proj. No. 09-4179.01

Boring = **328**
Depth = **63.5 - 65.5** **ft**

σ_3 (psi) = 20		σ_3 (psi) = 40		σ_3 (psi) = 65	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00	0.00	0.00
0.39	19.53	0.36	17.21	0.39	22.60
0.72	25.88	0.51	24.51	0.46	27.37
1.40	29.69	0.90	27.47	0.57	33.50
1.84	32.23	1.32	30.54	0.57	39.43
2.33	34.35	1.63	32.87	0.70	44.30
2.61	36.57	2.04	35.09	0.80	47.90
3.08	39.43	2.46	38.16	0.88	51.07
3.55	41.97	2.85	40.59	0.98	54.67
4.01	44.62	3.19	43.45	1.14	58.37
4.48	46.84	3.65	45.99	1.42	62.08
5.05	49.48	4.17	48.74	1.79	64.94
5.52	52.13	4.48	50.86	2.07	67.48
6.01	53.93	4.92	53.61	2.43	70.44
6.66	56.57	5.31	56.36	2.80	72.66
7.44	58.80	5.88	58.59	3.16	75.52
8.27	61.34	6.40	61.55	3.65	77.95
9.15	63.35	6.87	63.67	4.20	79.86
10.16	65.46	7.41	65.57	4.61	81.76
11.40	67.37	7.90	68.00	5.29	84.09
12.49	68.64	8.60	70.65	5.78	85.57
13.37	69.17	9.23	72.77	6.48	87.58
14.18	69.91	9.80	74.67	7.26	88.64
14.98	69.91	10.37	76.37	7.80	88.43
15.97	70.44	11.12	78.06	8.40	90.23
16.64	70.54	11.84	79.75	9.04	92.03
17.39	70.54	12.47	80.60	9.82	93.30
18.07	70.65	13.01	81.76	10.50	94.36
18.66	70.54	13.61	82.19	11.27	95.63
19.26	70.23	14.33	82.82	12.18	96.58
		15.16	83.24	13.04	97.53
		15.79	84.30	13.81	98.38
		16.46	83.98	14.46	98.38
		17.16	84.62	15.47	97.95
		17.91	84.83	16.30	97.95
		18.64	84.94	16.93	97.85
		19.00	85.04	17.55	97.21
				18.22	96.79
				18.77	96.16
				19.31	95.52

σ_3 (psi) =	20	
P max =	70.7	psi
50% Pmax =	35.3	psi
Approx =	34.35	psi
row =	6	
50% d =	2.33	%
E 50% =	1516.3	psi
E 50% =	**2.18E+05**	**psf**

σ_3 (psi) =	40	
P max =	85.0	psi
50% Pmax =	42.5	psi
Approx =	40.59	psi
row =	9	
50% d =	2.85	%
E 50% =	1493.0	psi
E 50% =	**2.15E+05**	**psf**

σ_3 (psi) =	65	
P max =	98.4	psi
50% Pmax =	49.2	psi
Approx =	47.90	psi
row =	7	
50% d =	0.80	%
E 50% =	6148.6	psi
E 50% =	**8.85E+05**	**psf**

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09-4179.01-F16

By ATG/DRB Date 08/6/09 Subject Triaxial Compression & Direct Shear Sheet No. B-10 of B-21
Chkd. By LS Date 8/11/09 Testing - Calvert Cliffs Unit 3 Proj. No. 09-4179.01

Boring = **414**
Depth = **68 - 70** **ft**

σ_3 (psi) = 25		σ_3 (psi) = 100	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00
0.18	7.96	0.18	2.74
0.28	10.02	0.55	3.76
0.65	11.32	0.92	4.51
0.97	13.19	1.29	5.35
1.29	14.40	1.62	6.38
1.66	16.18	1.98	7.22
1.75	18.88	2.31	7.78
1.85	21.68	2.45	8.90
2.03	24.76	2.77	9.64
2.17	27.38	2.91	10.86
2.40	29.80	2.95	12.26
2.54	33.26	2.95	13.56
2.72	35.59	3.00	14.78
3.28	36.52	3.05	16.18
3.92	37.18	3.09	17.95
4.57	36.43	3.09	19.44
5.35	35.22	3.18	21.31
5.86	35.03	3.28	22.90
6.18	36.24	3.28	25.04
6.42	37.92	3.37	27.19
7.25	39.14	3.32	29.71
8.17	38.76	3.46	31.48
8.95	38.02	3.46	33.82
9.32	39.60	3.55	36.06
9.65	41.28	3.65	37.92
10.34	42.03	3.69	39.70
10.98	42.50	3.78	42.31
11.72	42.50	3.92	44.92
12.83	42.03	4.02	47.07
13.62	41.75	4.11	49.31

σ_3 (psi) =	25	
P max =	42.5	psi
50% Pmax =	21.2	psi
Approx =	18.88	psi
row =	8	
50% d =	1.75	%
E 50% =	1211.6	psi
E 50% =	**1.74E+05**	**psf**

σ_3 (psi) =	100	
P max =	77.2	psi
50% Pmax =	38.6	psi
Approx =	37.92	psi
row =	26	
50% d =	3.65	%
E 50% =	1058.9	psi
E 50% =	**1.52E+05**	**psf**

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By ATG/DRB Date 08/6/09 Subject Triaxial Compression & Direct Shear Sheet No. 9-11 of B-21
Chkd. By XS Date 8/11/09 Testing - Calvert Cliffs Unit 3 Proj. No. 09-4179.01

σ_3 (psi) = 25		σ_3 (psi) = 100	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
14.12	40.26	4.29	52.02
14.68	39.04	4.52	54.82
15.37	38.39	4.57	57.80
16.29	38.48	4.80	60.04
16.75	38.76	5.08	62.84
17.26	38.02	5.17	65.92
17.86	37.18	5.49	69.10
18.60	36.52	5.72	71.71
19.52	36.71	6.00	73.86
20.17	37.08	6.14	75.82
		6.55	77.22
		7.06	76.10
		7.52	74.51
		7.98	73.20
		8.45	71.99
		8.58	70.40
		9.32	69.00
		9.97	67.60
		10.66	67.04
		11.22	67.51
		11.63	68.07
		12.23	67.04
		13.02	65.83
		13.38	64.62
		13.89	63.31
		14.49	62.84
		14.91	61.91
		15.09	60.70
		15.74	60.51
		16.11	61.63
		16.38	60.04
		16.57	58.27
		16.57	56.78
		17.35	56.40

σ_3 (psi) = 25		σ_3 (psi) = 100	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
		17.95	55.56
		18.78	54.44
		19.25	52.67
		19.38	50.71
		19.52	48.94
		20.03	47.63

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By ATG/DRB Date 08/6/09 Subject Triaxial Compression & Direct Shear Sheet No. B-13 of B-21
Chkd. By XS Date 8/11/09 Testing - Calvert Cliffs Unit 3 Proj. No. 09-4179.01

Boring = **420**
Depth = **128.5** **ft**

σ_3 (psi) = 30		σ_3 (psi) = 120	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00
0.04	14.30	-0.02	17.88
0.15	20.70	0.02	25.78
0.32	26.34	0.11	33.68
0.53	30.86	0.17	41.96
0.70	35.94	0.21	52.69
0.96	41.21	0.25	61.53
1.21	44.78	0.32	67.74
1.40	48.36	0.34	75.08
1.64	52.88	0.43	80.16
1.87	57.02	0.51	85.24
2.13	61.16	0.60	92.02
2.43	64.35	0.62	97.47
2.74	67.37	0.72	102.74
2.98	70.56	0.83	109.89
3.28	73.95	1.00	116.85
3.64	76.02	1.09	124.38
4.06	77.34	1.25	130.97
4.57	76.40	1.58	140.00
4.81	74.89	1.98	143.01
4.91	72.07	2.49	143.01
5.15	70.00	2.83	140.94
5.40	69.06	3.28	138.49
5.79	68.49	3.81	136.42
6.21	67.93	4.36	133.60
6.64	67.55	4.74	131.34
7.26	67.37	5.15	128.15
7.92	67.37	5.58	126.64
8.51	67.37	5.94	125.32
8.98	66.42	6.38	123.44
9.70	66.42	6.89	120.43

σ_3 (psi) =	30	
P max =	77.3	psi
50% Pmax =	38.7	psi
Approx =	35.94	psi
row =	6	
50% d =	0.70	%
E 50% =	5539.1	psi
E 50% =	**7.98E+05**	**psf**

σ_3 (psi) =	120	
P max =	143.0	psi
50% Pmax =	71.5	psi
Approx =	67.74	psi
row =	8	
50% d =	0.32	%
E 50% =	22292.9	psi
E 50% =	**3.21E+06**	**psf**

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σ_3 (psi) = 30		σ_3 (psi) = 120	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
10.34	65.86	7.40	116.10
10.72	65.48	7.85	112.15
11.11	64.35	8.23	108.76
11.66	62.66	8.62	106.13
12.21	60.97	9.17	102.18
12.68	60.03	9.79	100.11
13.11	58.71	10.49	97.10
13.64	58.33	11.00	94.84
13.98	57.20	11.57	92.96
14.40	55.70	12.02	92.02
14.79	54.38	12.72	91.08
15.17	54.19	13.42	90.89
		14.08	90.51
		14.79	88.25
		15.45	87.50

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09-4179.01-F16

By ATG/DRB Date 08/6/09 Subject Triaxial Compression & Direct Shear Sheet No. B-15 of B-21
Chkd. By XS Date 8/11/09 Testing - Calvert Cliffs Unit 3 Proj. No. 09-4179.01

Boring = **423**
Depth = **103.5** **ft**

σ_3 (psi) = 30		σ_3 (psi) = 55		σ_3 (psi) = 107.5	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00	0.00	0.00
0.40	6.54	0.25	10.04	0.34	51.74
0.52	16.89	0.49	20.39	0.46	59.04
0.89	30.28	0.65	27.39	0.55	67.11
1.35	37.13	0.71	34.70	0.62	75.02
1.85	43.67	0.71	40.78	0.77	81.87
2.40	49.46	0.92	46.26	0.92	88.87
3.23	54.17	1.08	53.57	1.20	93.89
3.88	57.98	1.23	59.35	1.88	97.85
4.03	62.39	1.54	65.13	2.43	101.80
4.74	67.41	1.85	69.09	3.14	105.00
5.57	70.15	2.25	73.20	4.09	108.96
6.25	73.96	2.55	76.85	4.83	111.85
6.86	78.52	2.77	80.20	5.38	114.13
7.69	80.65	3.17	82.78	6.28	118.09
8.77	83.54	3.60	85.52	7.02	120.98
9.42	86.59	3.88	88.87	8.09	124.48
10.15	89.78	4.46	91.15	8.83	127.37
10.89	91.00	4.89	94.50	9.42	130.57
11.78	92.22	5.63	96.78	10.43	132.54
12.98	93.59	5.88	99.83	11.23	135.43
13.72	94.65	6.34	102.72	11.72	139.24
14.62	95.41	6.80	104.24	12.62	141.37
15.60	95.72	7.54	106.83	13.72	143.04
16.74	96.93	8.31	108.96	14.65	145.33
18.00	97.70	8.92	111.70	15.72	147.15
19.17	97.54	9.51	113.67	16.80	148.07
19.91	99.07	10.22	114.59	17.57	148.52
		10.77	116.11	18.43	149.13
		11.11	118.24	19.45	147.91
		11.32	121.59		
		11.75	124.93		
		12.34	127.52		
		12.98	129.65		
		14.12	129.20		
		14.98	129.04		
		15.60	128.74		
		16.15	127.67		
		16.92	125.70		
		17.54	124.48		

σ_3 (psi) =	30	
P max =	99.1	psi
50% Pmax =	49.5	psi
Approx =	49.46	psi
row =	7	
50% d =	2.40	%
E 50% =	2063.9	psi
E 50% =	**2.97E+05**	**psf**

σ_3 (psi) =	55	
P max =	129.7	psi
50% Pmax =	64.8	psi
Approx =	59.35	psi
row =	9	
50% d =	1.23	%
E 50% =	5267.1	psi
E 50% =	**7.58E+05**	**psf**

σ_3 (psi) =	107.5	
P max =	149.1	psi
50% Pmax =	74.6	psi
Approx =	67.11	psi
row =	4	
50% d =	0.55	%
E 50% =	13463.2	psi
E 50% =	**1.94E+06**	**psf**

By ATG/DRB Date 08/6/09 Subject Triaxial Compression & Direct Shear Sheet No. B-16 of B-21

Chkd. By XS Date 8/11/09 Testing - Calvert Cliffs Unit 3 Proj. No. 09-4179.01

σ_3 (psi) = 30		σ_3 (psi) = 55		σ_3 (psi) = 107.5	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
		18.22	123.57		
		18.86	123.26		
		19.42	121.59		
		19.88	120.83		

By ATG/DRB Date 08/6/09 Subject Triaxial Compression & Direct Shear Testing - Calvert Cliffs Unit 3 Sheet No. B-17 of B-21

Chkd. By XS Date 8/11/09 Proj. No. 09-4179.01

Boring = **433**

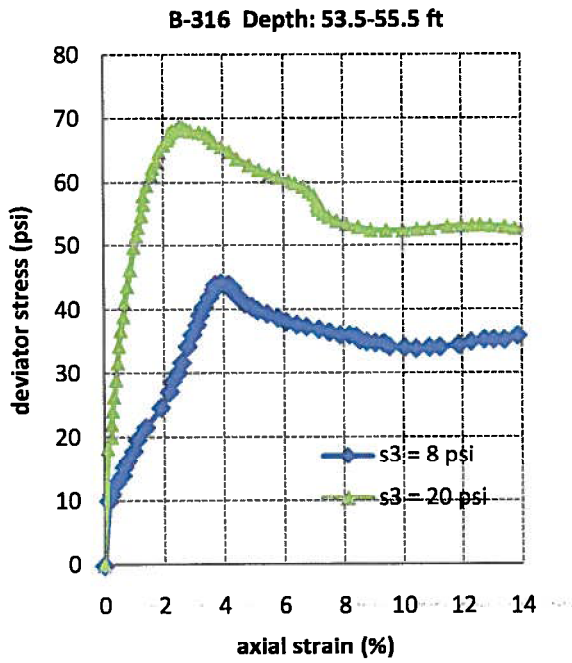
Depth = **48.5 - 50.5** **ft**

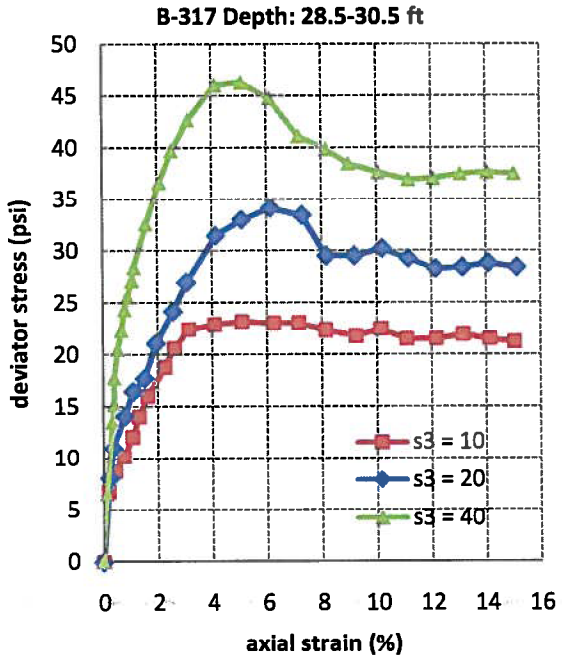
σ_3 (psi) = 15		σ_3 (psi) = 60	
Axial strain (%)	Deviator stress (psi)	Axial strain (%)	Deviator stress (psi)
0.00	0.00	0.00	0.00
0.40	4.25	0.27	0.73
0.53	5.84	0.40	1.55
0.80	7.40	0.64	2.37
1.13	8.35	0.87	2.97
1.42	9.04	0.96	3.70
1.82	9.86	1.07	4.43
2.44	11.00	1.31	5.11
2.93	11.60	1.36	6.35
3.62	12.33	1.38	7.81
4.29	13.15	1.44	9.31
4.84	13.83	1.51	10.59
5.44	14.38	1.58	11.92
6.00	14.84	1.71	13.28
6.80	15.48	1.71	14.11
7.47	15.98	1.78	15.16
7.93	16.39	1.89	16.75
8.40	16.66	2.04	18.03
8.82	16.89	2.09	19.08
9.38	16.94	2.38	20.09
9.91	16.98	2.58	21.59
10.33	17.07	2.69	23.01
10.80	17.58	2.98	24.38
11.47	18.12	3.13	25.61
12.13	18.44	3.44	26.62
12.67	18.40	3.76	27.80
13.36	18.90	4.13	28.94
13.93	19.17	4.44	29.90
14.73	19.17	4.87	30.95
15.69	19.22	5.40	32.00
16.20	19.36	6.07	32.78

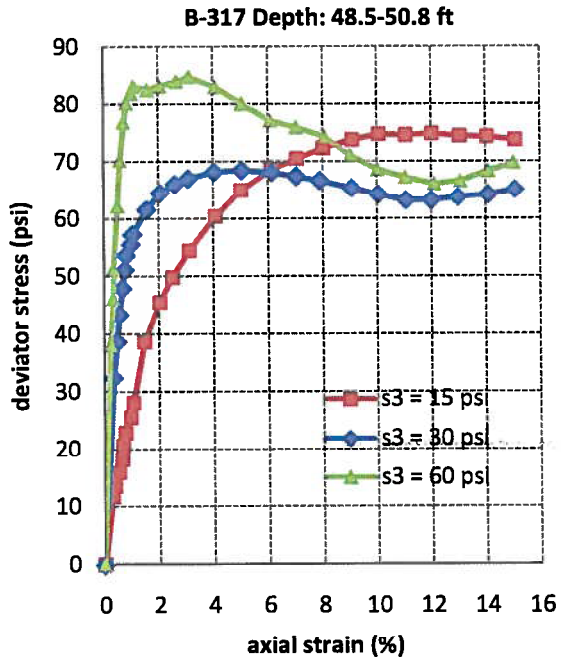
σ_3 (psi) =	15	
P max =	19.5	psi
50% Pmax =	9.7	psi
Approx =	9.04	psi
row =	6	
50% d =	1.42	%
E 50% =	685.3	psi
E 50% =	**9.87E+04**	**psf**

σ_3 (psi) =	60	
P max =	34.0	psi
50% Pmax =	17.0	psi
Approx =	16.75	psi
row =	17	
50% d =	1.89	%
E 50% =	900.3	psi
E 50% =	**1.30E+05**	**psf**

σ_3 (psi) = 15		σ_3 (psi) = 60	
Axial strain	Deviator stress	Axial strain	Deviator stress
16.87	19.45	6.91	33.65
17.27	19.49	7.53	33.83
		8.11	33.97
		8.76	34.01
		9.53	33.92
		10.18	33.65
		10.60	33.10
		11.13	32.92
		11.58	32.96
		12.24	33.19
		12.80	32.78
		13.22	32.37
		13.91	32.32
		14.36	32.14
		14.76	32.05
		15.20	31.77
		15.60	31.64
		15.91	31.55







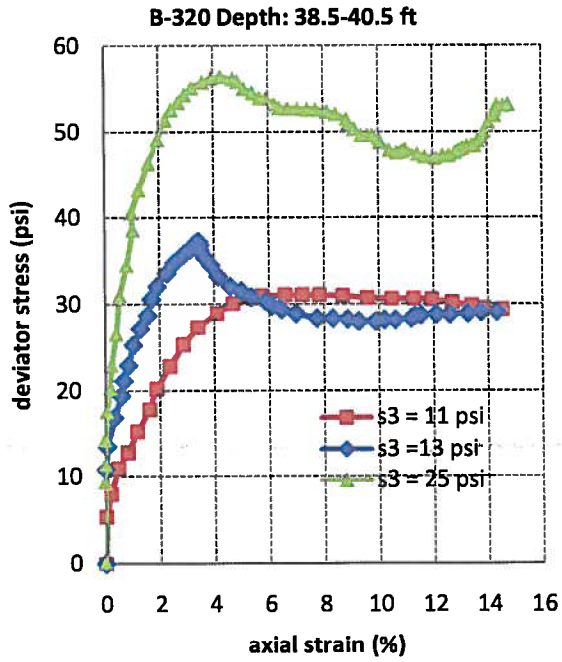


FIGURE 1

Consolidated undrained triaxial tests
Secant modulus E_{50} for different confinement

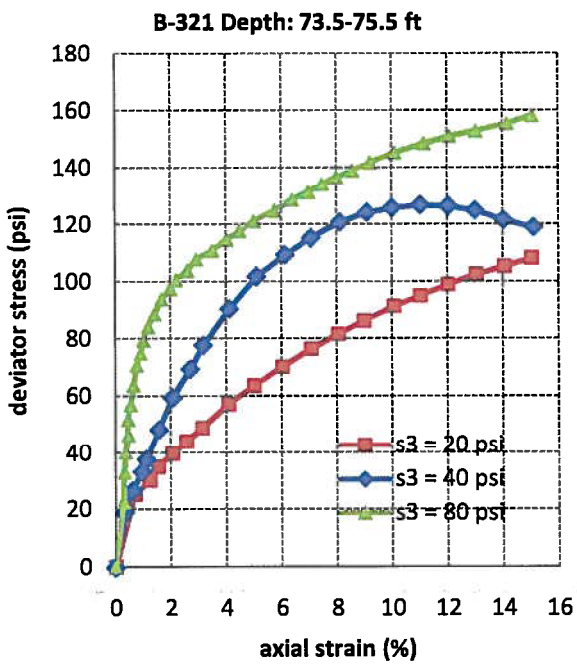
PREPARED FOR

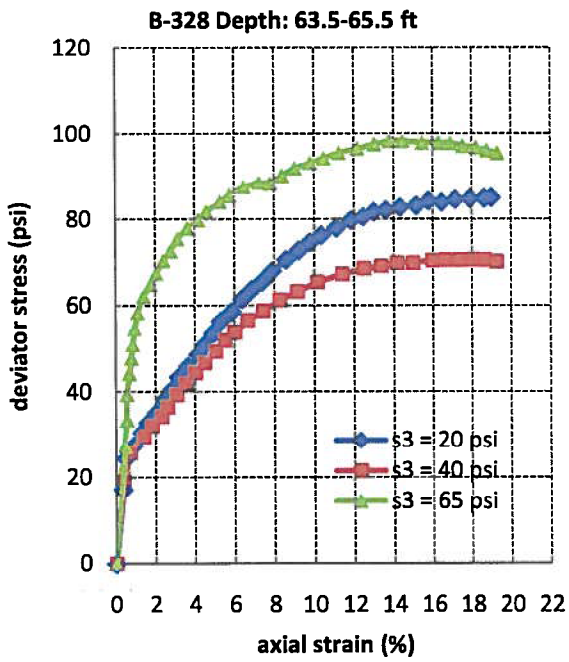
Unistar

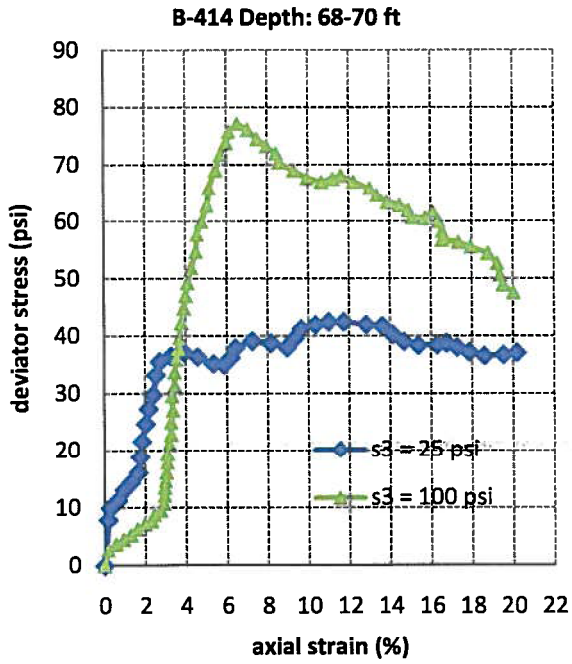
Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

Not to Scale

Triaxial Compression Results.xls	FILE NUMBER			CHECKED BY	APPROVED BY	DRB	7/30/2009	DRAWN BY	PLOT 1=1







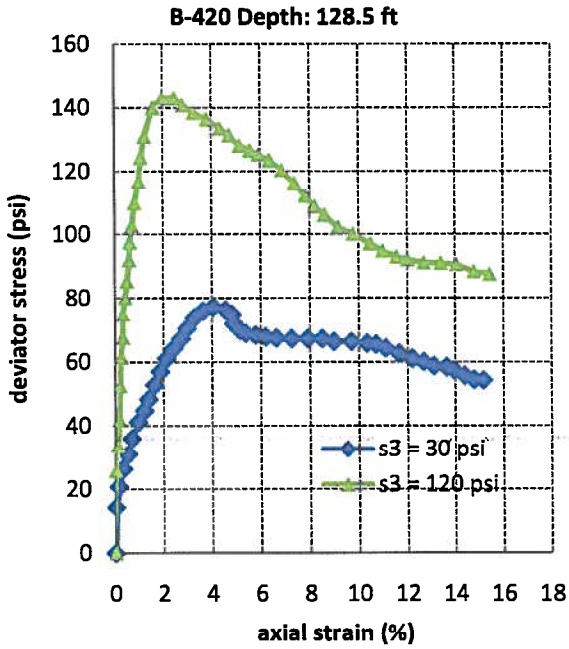


FIGURE 2

Consolidated undrained triaxial tests
Secant modulus E_{50} for different confinement

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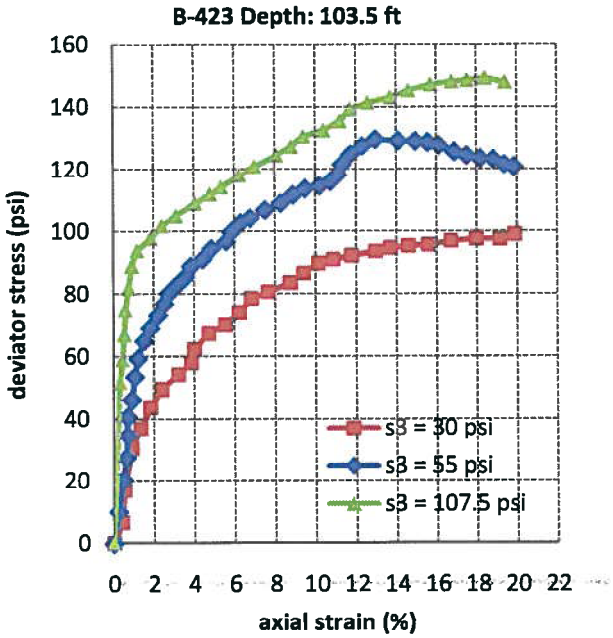
PLOT	DRAWN BY	DRB	CHECKED BY		FILE NUMBER	Triaxial Compression Results.xls
1=1		7/30/2009	APPROVED BY			



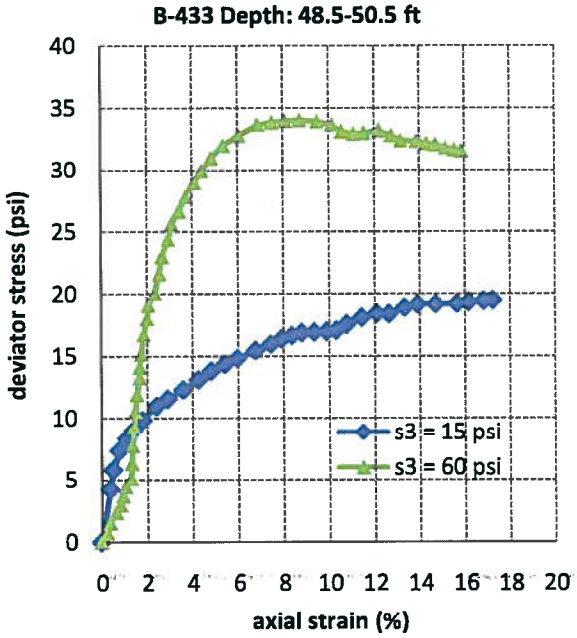


FIGURE 3

Consolidated undrained triaxial tests
Secant modulus E_{50} for different confinement

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PLOT	DRAWN BY	DRB	CHECKED BY		FILE NUMBER	Triaxial Compression Results.xls
1=1		7/30/2009	APPROVED BY			