

# APPENDIX B

## DIRECT SHEAR DATA

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**Direct Shear Data Sheet**

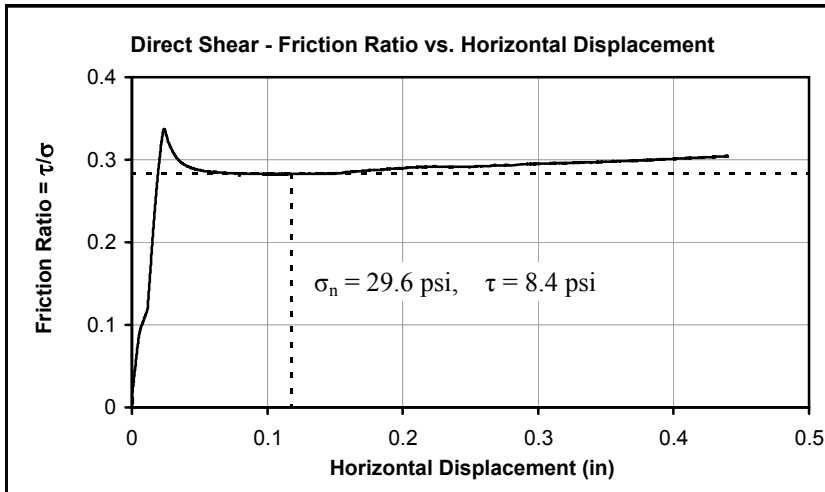
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	5/12/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	5/19/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Hanger Load	Normal Stress			$t_{50}$	Max. Shear Rate	$t_{50}$	Max. Shear Rate
(kg)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
10.0	2580	17.91	1.29	Shear rate based on data from earlier tests.			
20.0	4530	31.46	2.27				
40.0	8430	58.54	4.22				
70.0	14286	99.21	7.14				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

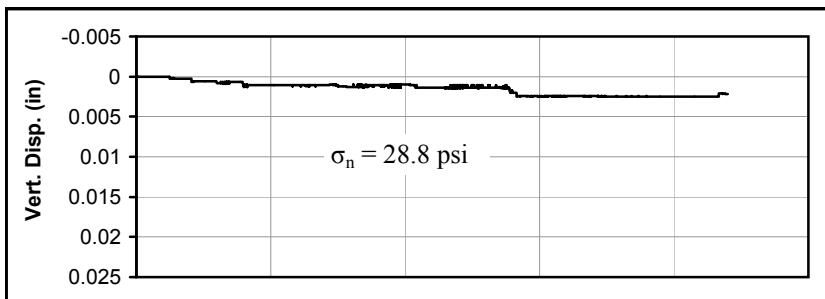
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			$\Delta H$
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-051204-1	18.0	4266	29.62	2.13	1206	8.38	0.60	0.0022



Initial Normal Stress:	
28.75	(psi)
Friction Ratio at Failure	
0.2828	(none)
Displacement at Failure:	
0.118	(in)
Arctan(Friction Ratio):	
15.8	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.



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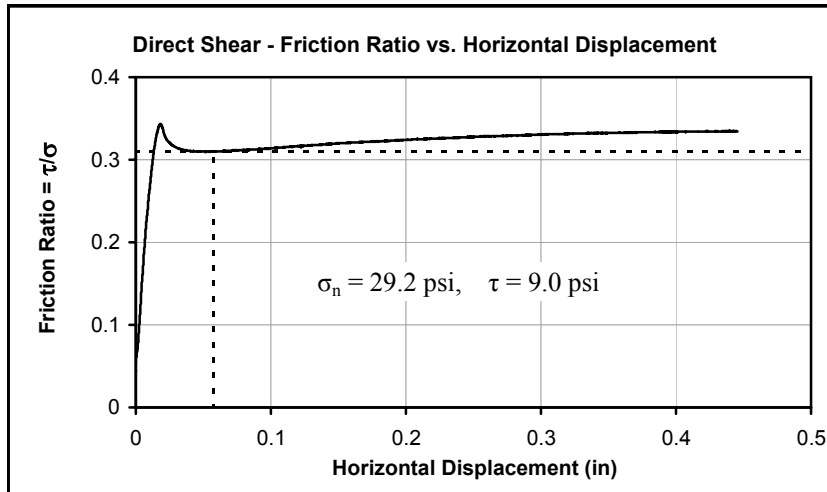
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	5/19/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	5/27/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Hanger Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(kg)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
10.0	2583	17.94	1.29	Shear rate based on data from earlier tests.			
20.0	4541	31.53	2.27				
40.0	8433	58.56	4.22				
70.0	14284	99.19	7.14				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

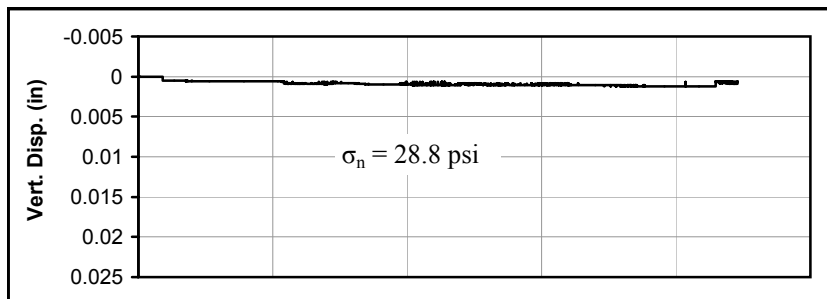
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-051904-1	18.0	4201	29.17	2.10	1302	9.04	0.65	0.0009



Initial Normal Stress:	
28.75	(psi)
Friction Ratio at Failure	
0.3099	(none)
Displacement at Failure:	
0.058	(in)
Arctan(Friction Ratio):	
17.2	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.



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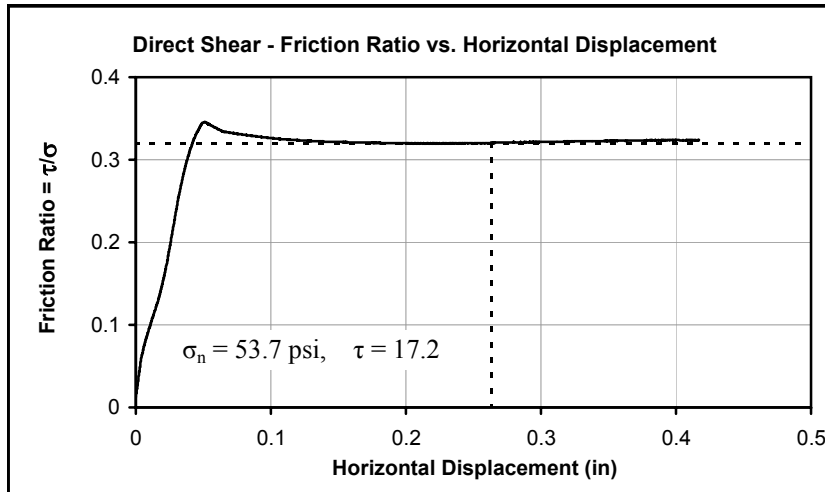
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	5/27/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	6/3/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Hanger Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(kg)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
10.0	2583	17.94	1.29				
20.0	4541	31.53	2.27				
40.0	8433	58.56	4.22				
70.0	14284	99.19	7.14				
Shear rate based on data from earlier tests.							

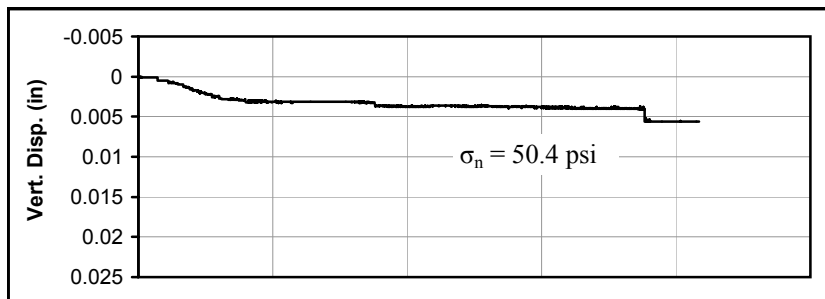
Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-052704-1	34.0	7771	53.96	3.89	2484	17.25	1.24	0.0056



Initial Normal Stress:	
50.42	(psi)
Friction Ratio at Failure	
0.3197	(none)
Displacement at Failure:	
0.263	(in)
Arctan(Friction Ratio):	
17.7	(deg)

- Notes:**
1. Specimen removed at LL.
  2. Specimen pushed through the #40 sieve.
  3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.



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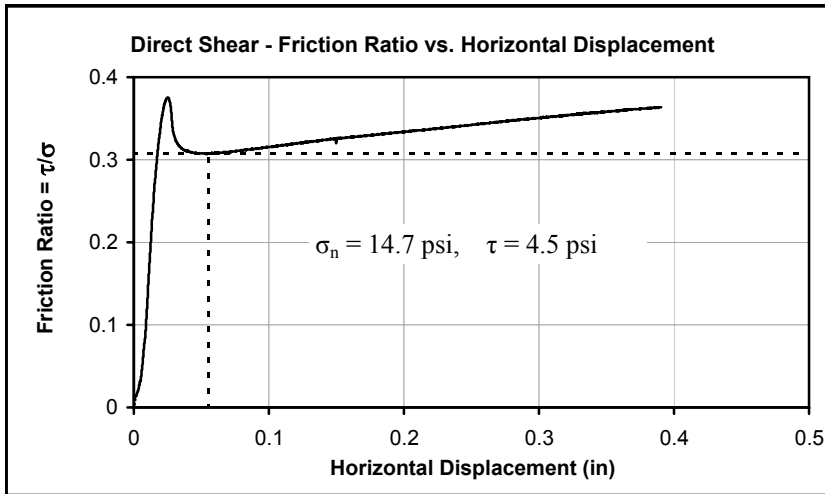
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	6/10/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	6/12/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

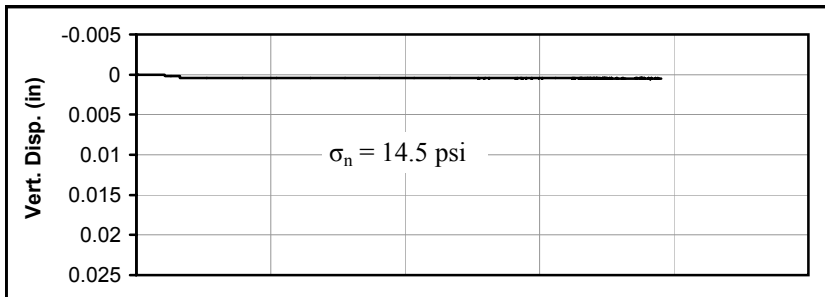
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-061004-1	7.5	2123	14.74	1.06	652	4.53	0.33	0.0005



Initial Normal Stress:	
14.54	(psi)
Friction Ratio at Failure	
0.3074	(none)
Displacement at Failure:	
0.055	(in)
Arctan(Friction Ratio):	
17.1	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 6/7/04.



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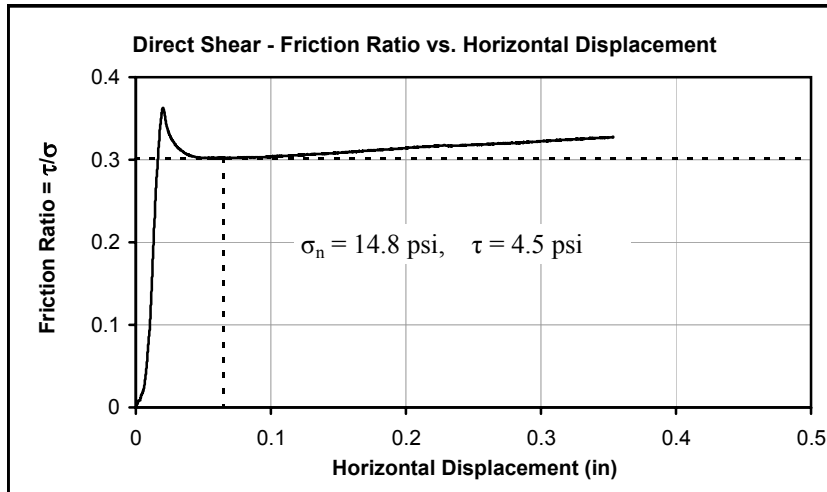
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	6/27/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	7/2/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

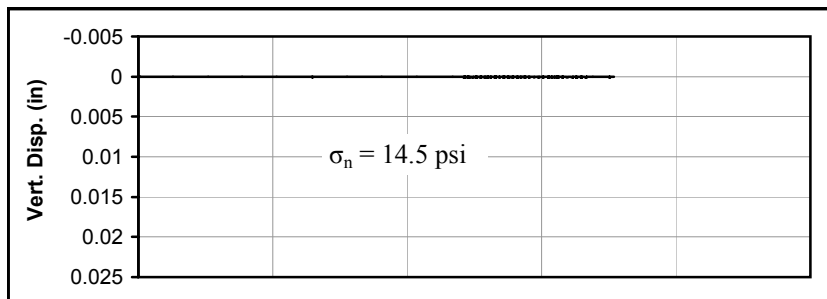
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-062704-1	7.5	2128	14.78	1.06	642	4.46	0.32	0.0001



Initial Normal Stress:	
14.54	(psi)
Friction Ratio at Failure	
0.3018	(none)
Displacement at Failure:	
0.065	(in)
Arctan(Friction Ratio):	
16.8	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 6/27/04.



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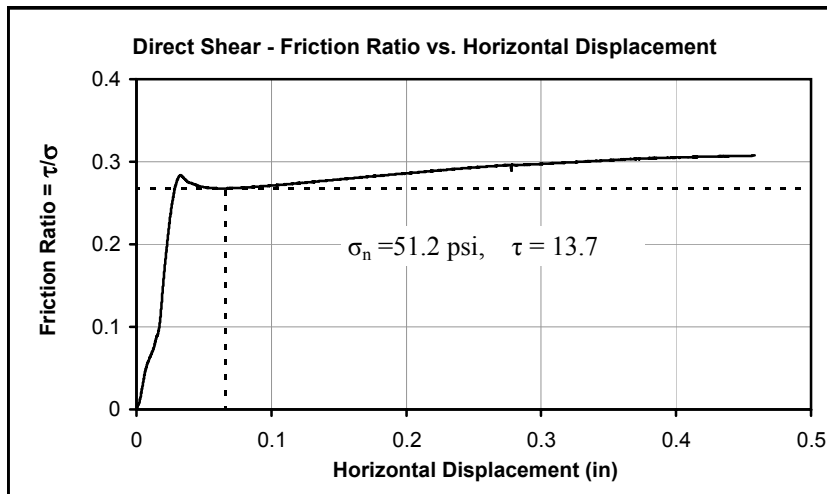
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	7/30/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	8/4/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

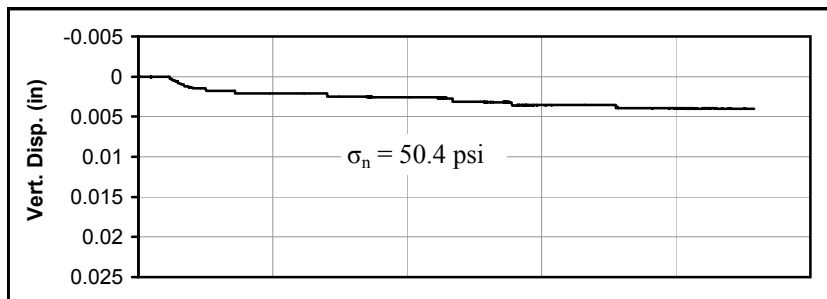
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-073004-1	34.0	7378	51.23	3.69	1973	13.70	0.99	0.0040



Initial Normal Stress:	
50.39	(psi)
Friction Ratio at Failure	
0.2675	(none)
Displacement at Failure:	
0.066	(in)
Arctan(Friction Ratio):	
15.0	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 7/27/04.



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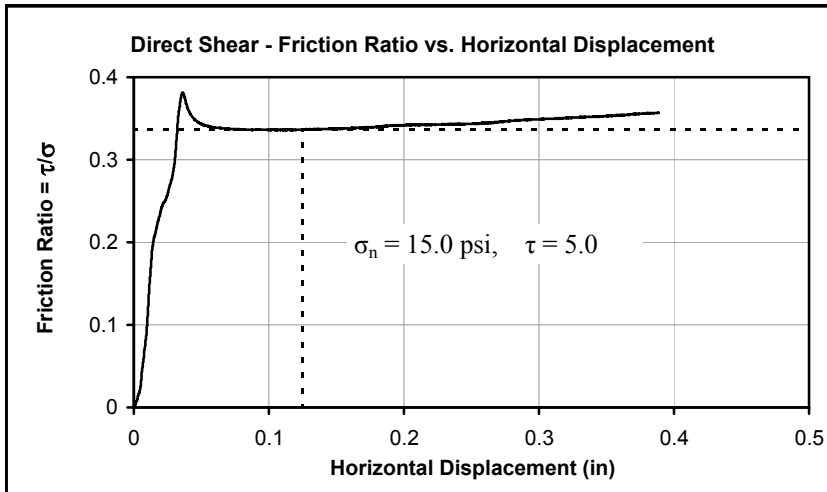
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	8/16/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	8/19/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

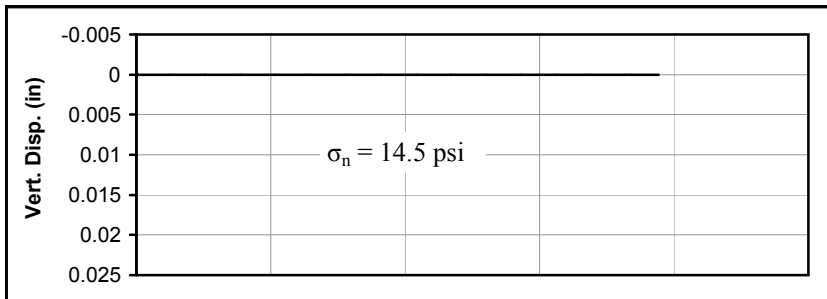
Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-081604-2	7.5	2161	15.01	1.08	726	5.04	0.36	0.0001



Initial Normal Stress:	
14.54	(psi)
Friction Ratio at Failure	
0.3361	(none)
Displacement at Failure:	
0.125	(in)
Arctan(Friction Ratio):	
18.6	(deg)

- Notes:**
1. Specimen removed at LL.
  2. Specimen pushed through the #40 sieve.
  3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
  4. External load frame used to consolidate specimens.
  5. Started consolidating on 8/13/04.





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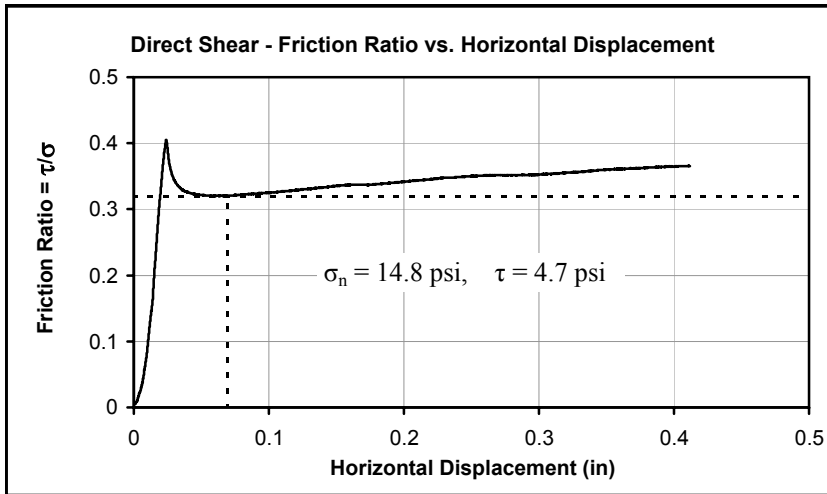
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	8/19/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	8/21/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

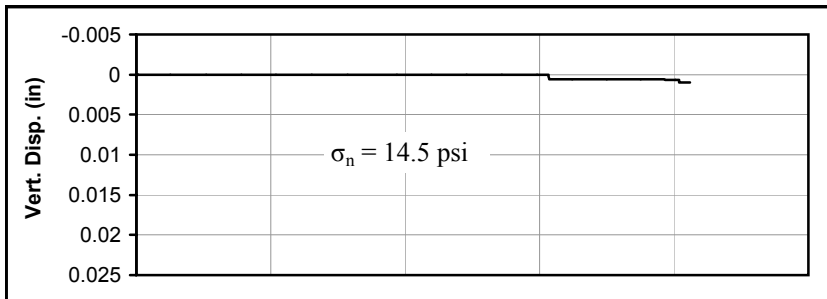
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-081904-1	7.5	2130	14.79	1.07	682	4.74	0.34	0.0010



Initial Normal Stress:	
14.54	(psi)
Friction Ratio at Failure	
0.3202	(none)
Displacement at Failure:	
0.069	(in)
Arctan(Friction Ratio):	
17.8	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 8/16/04.



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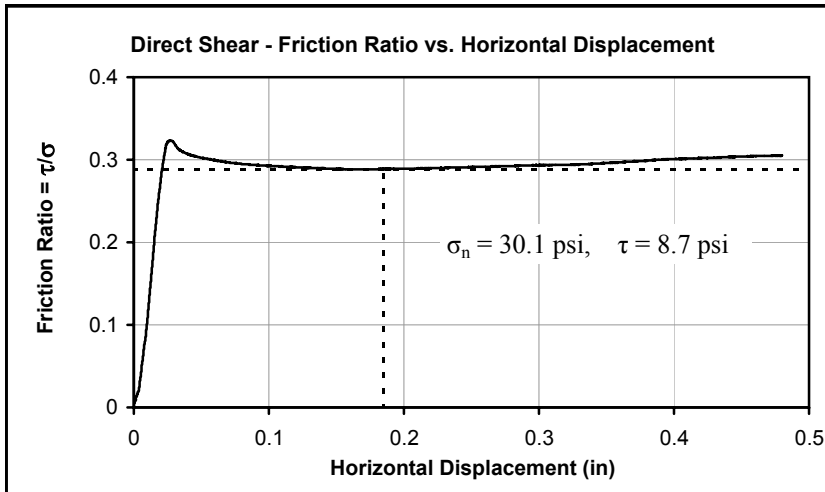
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	8/23/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	8/26/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			$t_{50}$	Max. Shear Rate	$t_{50}$	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

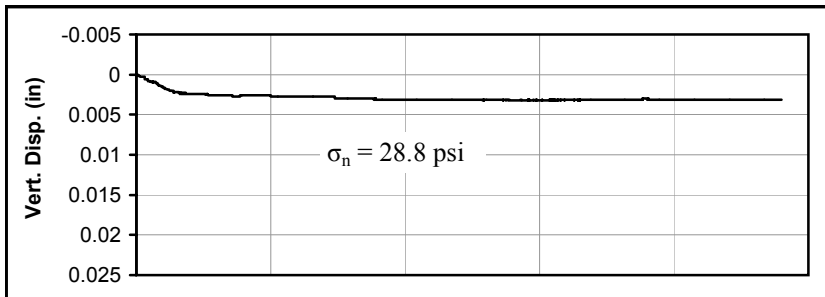
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			$\Delta H$
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-082304-2	18.0	4340	30.14	2.17	1252	8.70	0.63	0.0031



Initial Normal Stress:	
28.75	(psi)
Friction Ratio at Failure	
0.2885	(none)
Displacement at Failure:	
0.185	(in)
Arctan(Friction Ratio):	
16.1	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 8/19/04.



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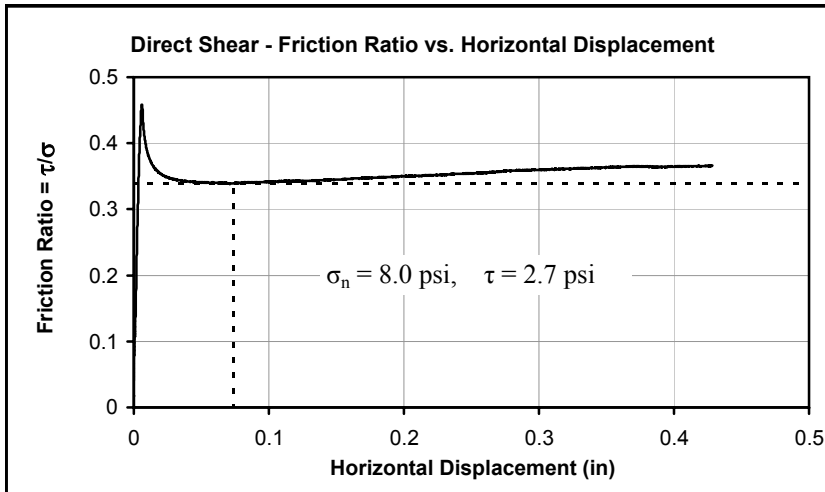
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	9/3/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	9/6/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			$t_{50}$	Max. Shear Rate	$t_{50}$	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

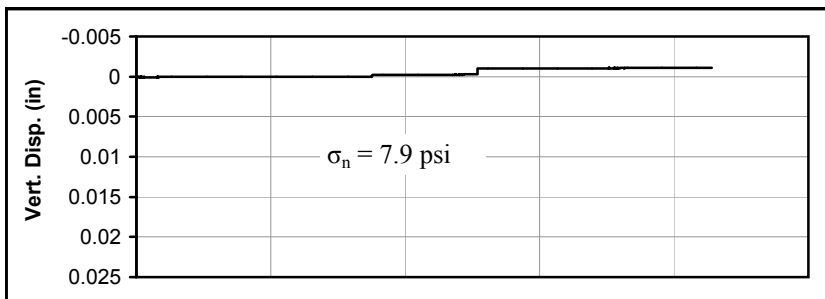
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			$\Delta H$
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-090304-1	2.3	1156	8.03	0.58	392	2.72	0.20	-0.0011



Initial Normal Stress:	
7.88	(psi)
Friction Ratio at Failure	
0.3392	(none)
Displacement at Failure:	
0.074	(in)
Arctan(Friction Ratio):	
18.7	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 8/30/04.



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**Direct Shear Data Sheet**

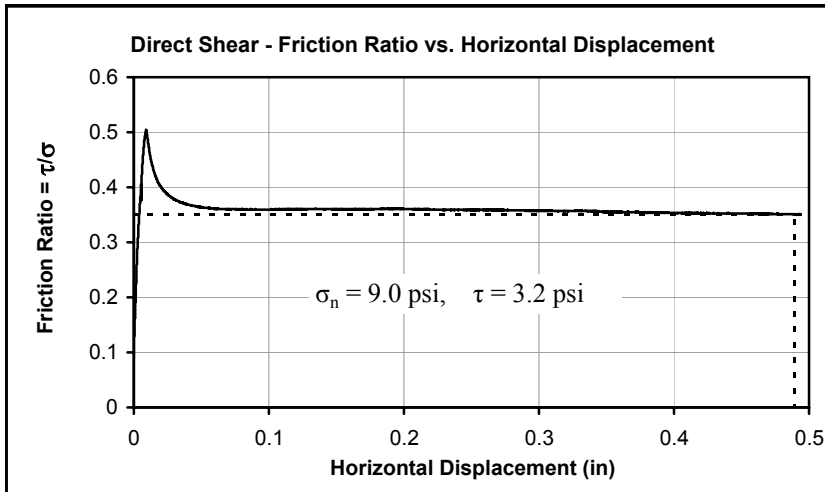
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	9/15/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	9/18/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			$t_{50}$	Max. Shear Rate	$t_{50}$	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

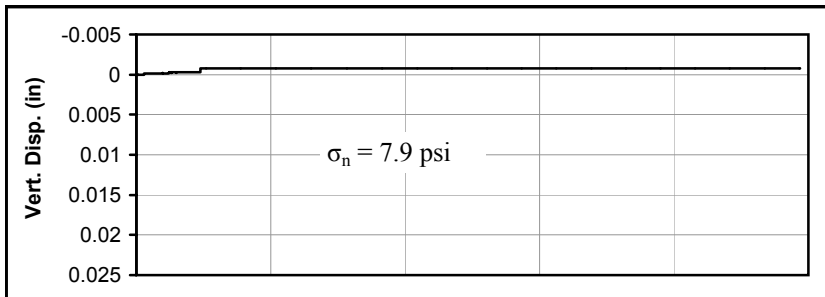
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			$\Delta H$
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-091504-1	2.3	1293	8.98	0.65	453	3.15	0.23	-0.0008



Initial Normal Stress:	
7.88	(psi)
Friction Ratio at Failure	
0.3505	(none)
Displacement at Failure:	
0.489	(in)
Arctan(Friction Ratio):	
19.3	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 9/8/04.



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**Direct Shear Data Sheet**

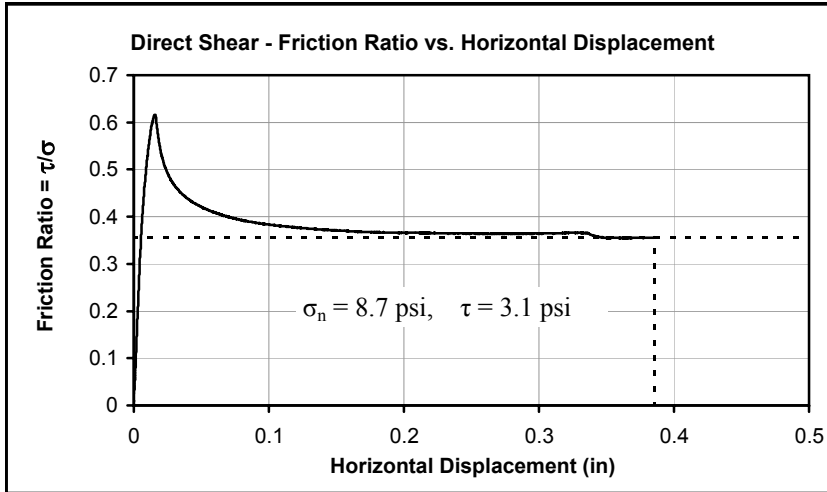
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	9/27/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	9/29/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

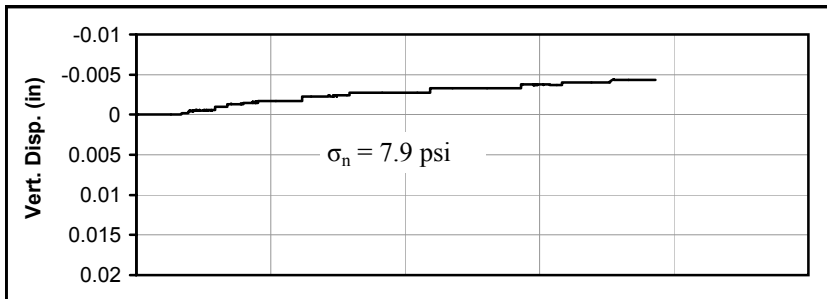
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-092704-1	2.3	1256	8.72	0.63	446	3.10	0.22	-0.0043



Initial Normal Stress:	
7.88	(psi)
Friction Ratio at Failure	
0.3552	(none)
Displacement at Failure:	
0.386	(in)
Arctan(Friction Ratio):	
19.6	(deg)

**Notes:**

1. Specimen remolded at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 9/24/04.



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**Direct Shear Data Sheet**

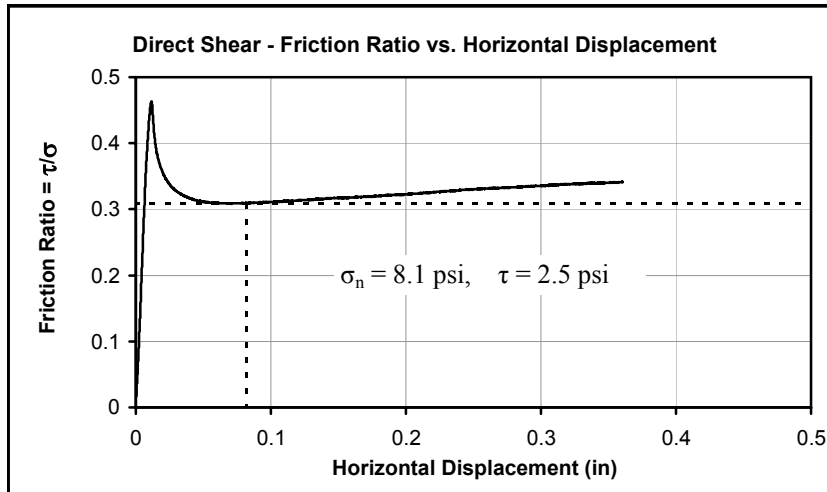
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	10/1/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	10/3/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30				
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				
Shear rate based on data from earlier tests.							

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

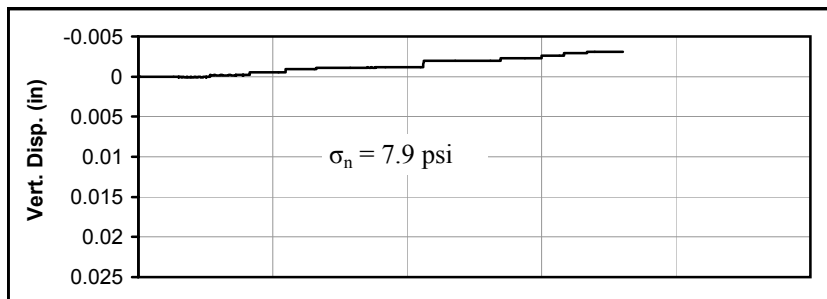
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-100104-1	2.3	1159	8.05	0.58	358	2.48	0.18	-0.0031



Initial Normal Stress:	
7.88	(psi)
Friction Ratio at Failure	
0.3087	(none)
Displacement at Failure:	
0.082	(in)
Arctan(Friction Ratio):	
17.2	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 9/24/04.



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**Direct Shear Data Sheet**

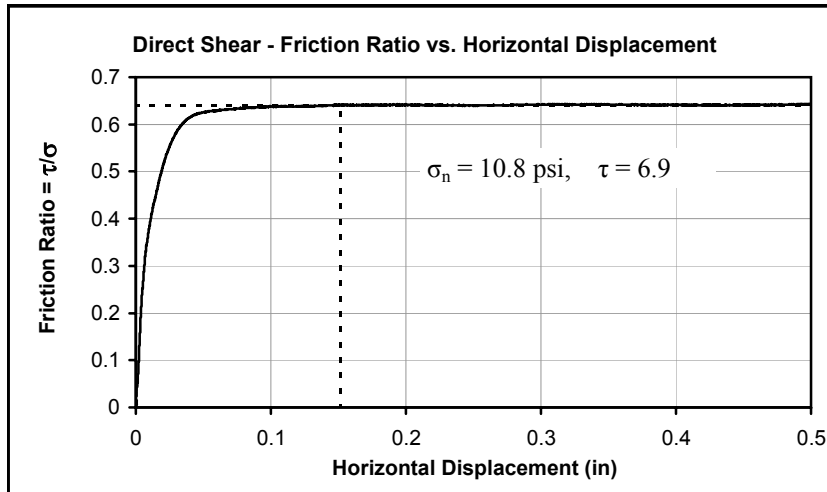
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	9/22/05
Sample I.D./Loc.:	Rancho Solano Clay #2	Finished:	9/25/05
Classification:	Brown Lean Clay (CL)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

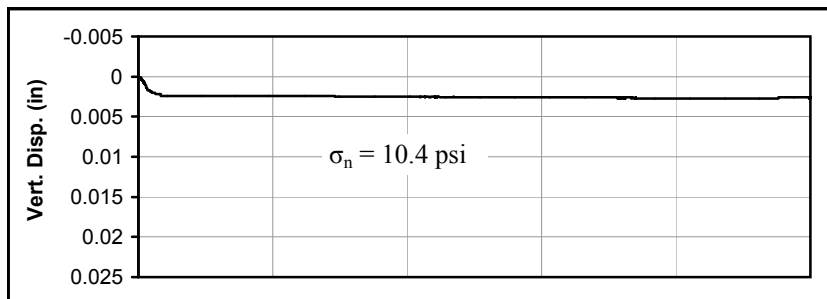
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-092205-1	4.2	1561	10.84	0.78	1000	6.94	0.50	0.0026



Initial Normal Stress:	
10.43	(psi)
Friction Ratio at Failure	
0.6406	(none)
Displacement at Failure:	
0.151	(in)
Arctan(Friction Ratio):	
32.6	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 9/20/05.



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**Direct Shear Data Sheet**

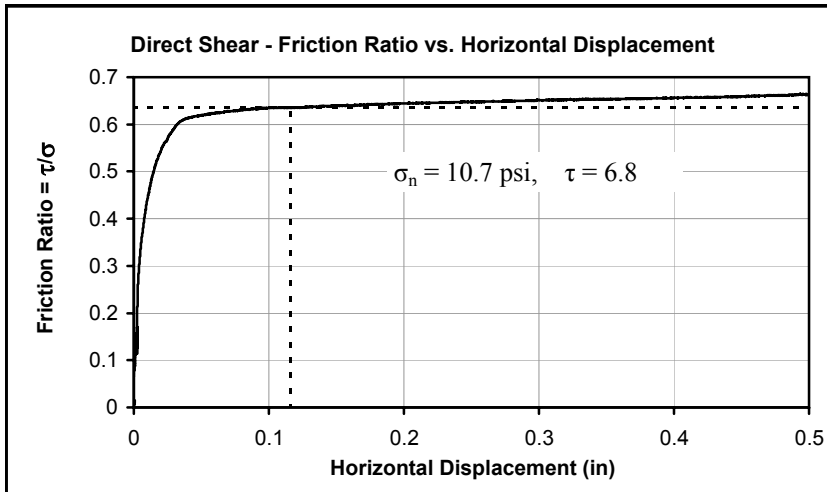
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	9/26/05
Sample I.D./Loc.:	Rancho Solano Clay #2	Finished:	9/29/05
Classification:	Brown Lean Clay (CL)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30				
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				
Shear rate based on data from earlier tests.							

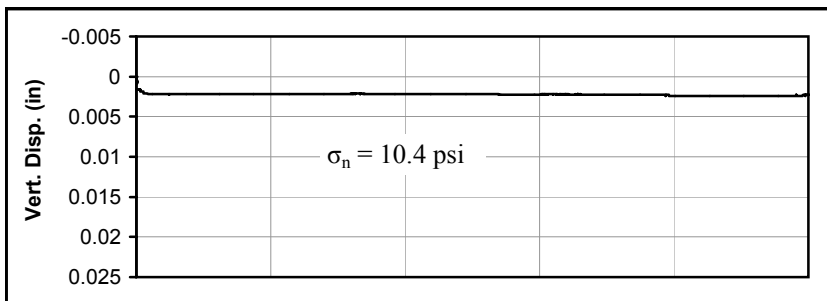
Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-092605-1	4.2	1547	10.74	0.77	984	6.83	0.49	0.0024



Initial Normal Stress:	10.43	(psi)
Friction Ratio at Failure	0.6361	(none)
Displacement at Failure:	0.116	(in)
Arctan(Friction Ratio):	32.5	(deg)

- Notes:**
1. Specimen removed at LL.
  2. Specimen pushed through the #40 sieve.
  3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
  4. External load frame used to consolidate specimens.
  5. Started consolidating on 9/24/05.





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**Direct Shear Data Sheet**

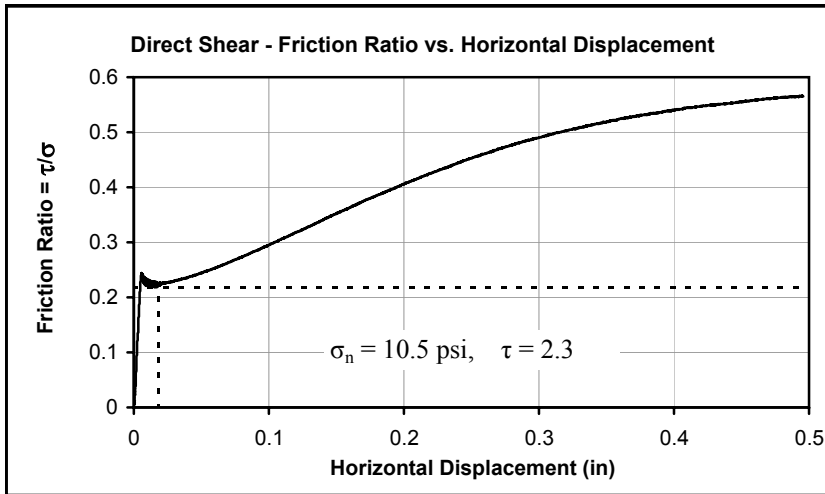
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	10/15/05
Sample I.D./Loc.:	Rancho Solano Clay #2	Finished:	10/18/05
Classification:	Brown Lean Clay (CL)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			$t_{50}$	Max. Shear Rate	$t_{50}$	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

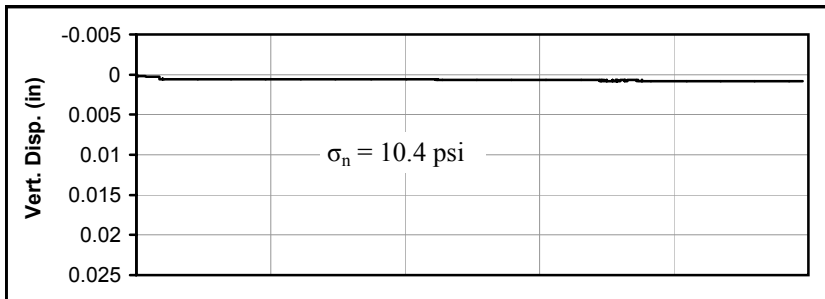
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			$\Delta H$
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-101505-2	4.2	1509	10.48	0.75	329	2.29	0.16	0.0008



Initial Normal Stress:	
10.43	(psi)
Friction Ratio at Failure	
0.2183	(none)
Displacement at Failure:	
0.018	(in)
Arctan(Friction Ratio):	
12.3	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 10/13/05.



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**Direct Shear Data Sheet**

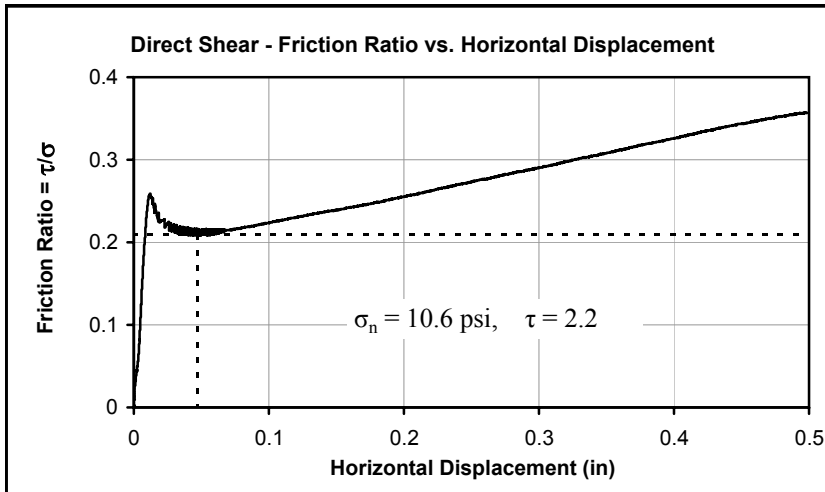
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	10/25/05
Sample I.D./Loc.:	Rancho Solano Clay #2	Finished:	10/28/05
Classification:	Brown Lean Clay (CL)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

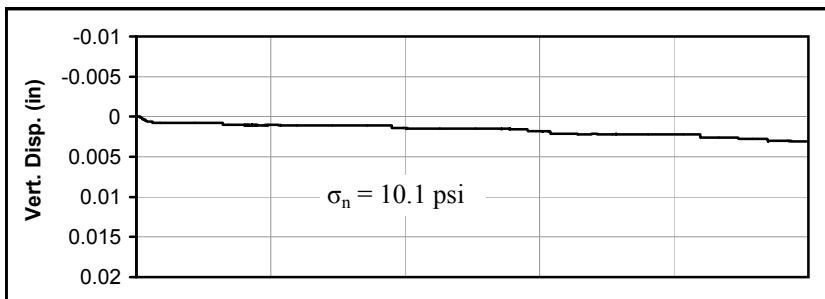
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-102505-1	4.2	1520	10.55	0.76	318	2.21	0.16	0.0031



Initial Normal Stress:	
10.43	(psi)
Friction Ratio at Failure	
0.2093	(none)
Displacement at Failure:	
0.047	(in)
Arctan(Friction Ratio):	
11.8	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 10/23/05.



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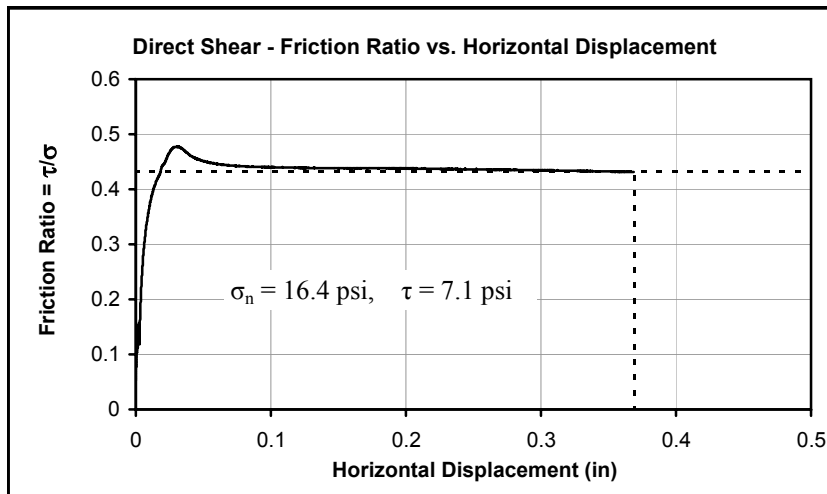
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	11/2/04
Sample I.D./Loc.:	San Francisco Bay Mud	Finished:	11/5/04
Classification:	Grey Elastic Silt (MH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

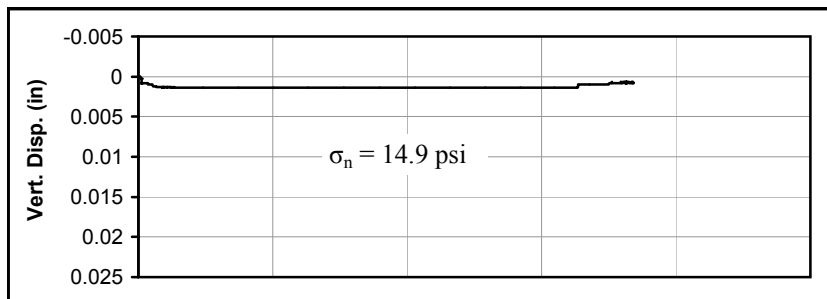
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-110204-1	7.5	2365	16.42	1.18	1020	7.08	0.51	0.0014



Initial Normal Stress:	
14.91	(psi)
Friction Ratio at Failure	
0.4313	(none)
Displacement at Failure:	
0.369	(in)
Arctan(Friction Ratio):	
23.3	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 10/29/04.



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**Direct Shear Data Sheet**

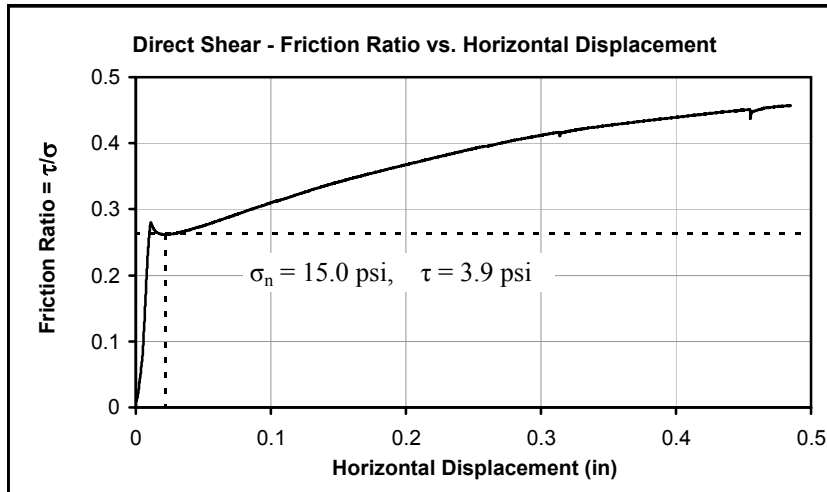
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	11/7/05
Sample I.D./Loc.:	San Francisco Bay Mud	Finished:	11/10/05
Classification:	Grey Elastic Silt (MH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

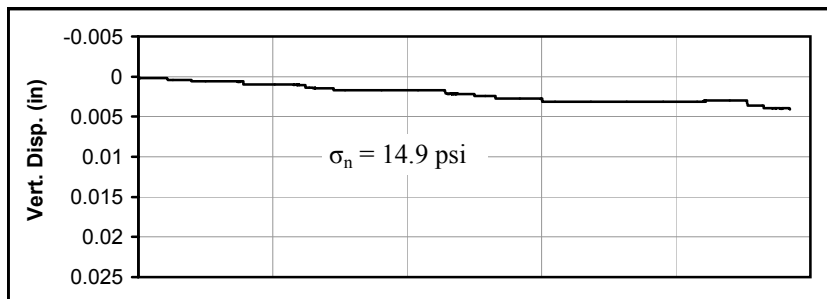
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-110705-1	7.5	2159	14.99	1.08	566	3.93	0.28	0.0041



Initial Normal Stress:	
14.91	(psi)
Friction Ratio at Failure	
0.2622	(none)
Displacement at Failure:	
0.022	(in)
Arctan(Friction Ratio):	
14.7	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 11/4/05.



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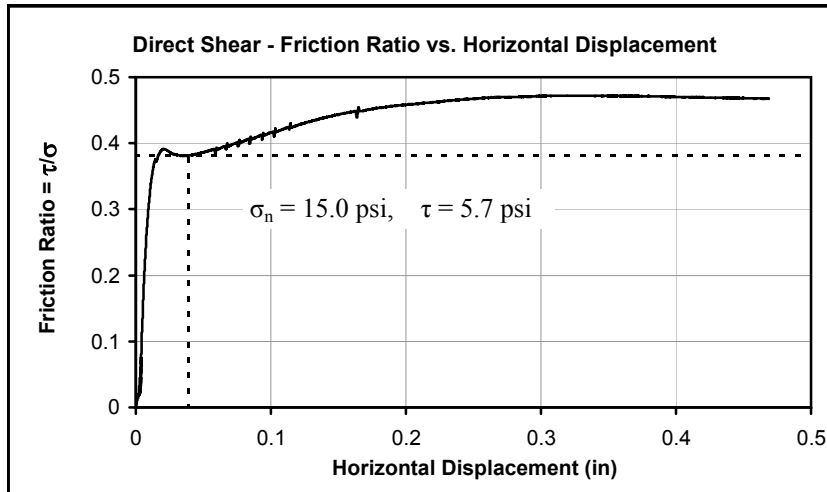
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	11/11/05
Sample I.D./Loc.:	San Francisco Bay Mud	Finished:	11/14/05
Classification:	Grey Elastic Silt (MH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			$t_{50}$	Max. Shear Rate	$t_{50}$	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Shear rate based on data from earlier tests.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.000123 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	0.003124 mm/min.

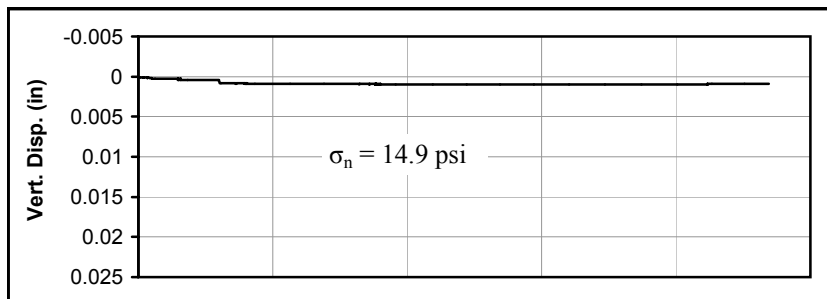
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			$\Delta H$
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-111105-1	7.5	2168	15.06	1.08	827	5.74	0.41	0.0009



Initial Normal Stress:	
14.91	(psi)
Friction Ratio at Failure	
0.3815	(none)
Displacement at Failure:	
0.039	(in)
Arctan(Friction Ratio):	
20.9	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 11/4/05.



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**Geotechnical Engineering Laboratory**  
**Direct Shear Data Sheet**

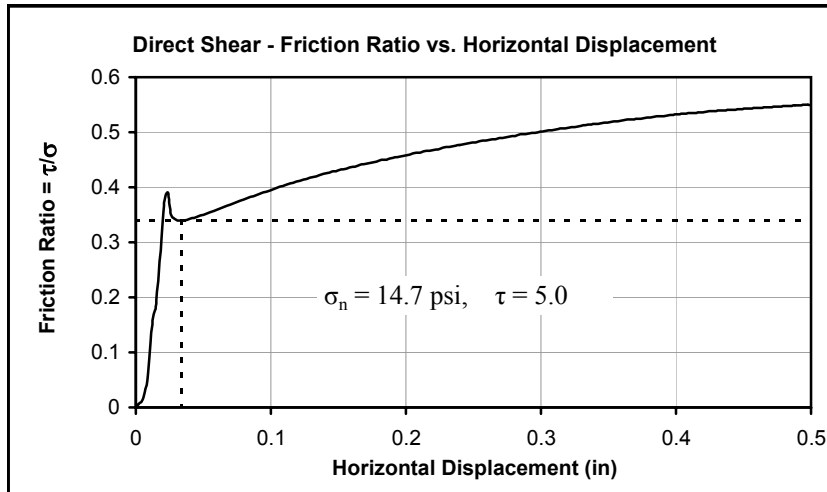
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	8/13/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	8/13/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Fast shear test.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.048 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	1.219 mm/min.

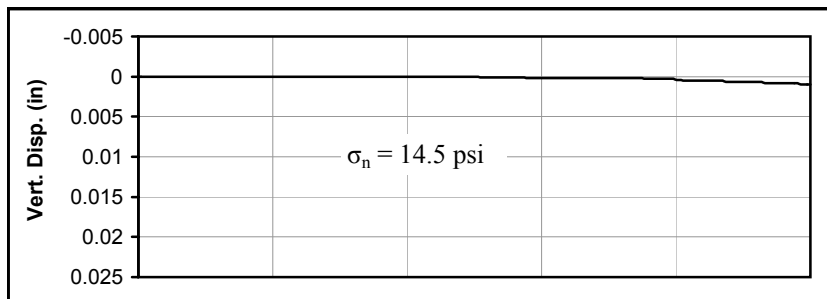
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-081304-1	7.5	2111	14.66	1.06	717	4.98	0.36	0.0010



Initial Normal Stress:	
14.54	(psi)
Friction Ratio at Failure	
0.3396	(none)
Displacement at Failure:	
0.034	(in)
Arctan(Friction Ratio):	
18.8	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 8/11/04.



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**Direct Shear Data Sheet**

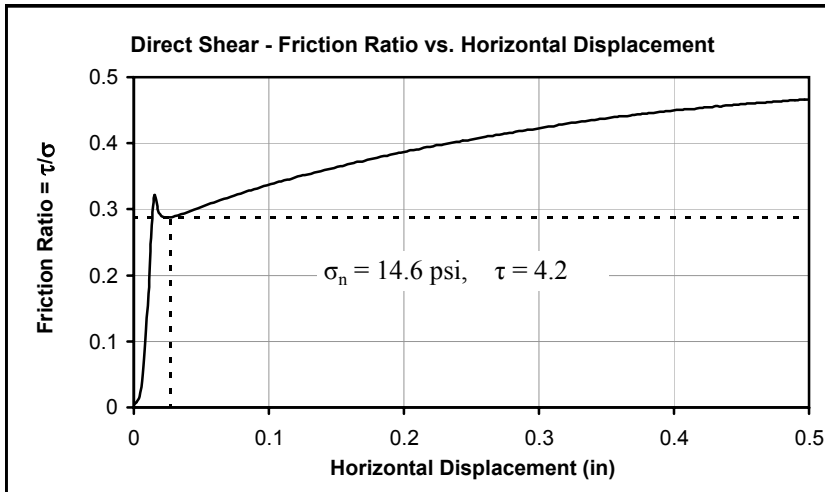
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	8/16/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	8/16/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Fast shear test.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.048 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	1.219 mm/min.

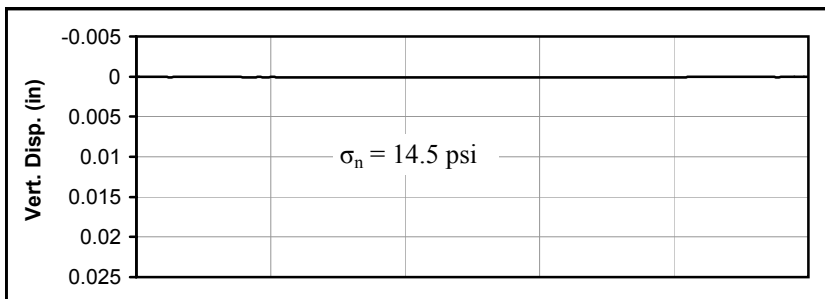
Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-081604-1	7.5	2108	14.64	1.05	606	4.21	0.30	0.0001



Initial Normal Stress:	
14.54	(psi)
Friction Ratio at Failure	
0.2876	(none)
Displacement at Failure:	
0.027	(in)
Arctan(Friction Ratio):	
16.0	(deg)

**Notes:**

1. Specimen removed at LL.
2. Specimen pushed through the #40 sieve.
3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
4. External load frame used to consolidate specimens.
5. Started consolidating on 8/13/04.



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**Direct Shear Data Sheet**

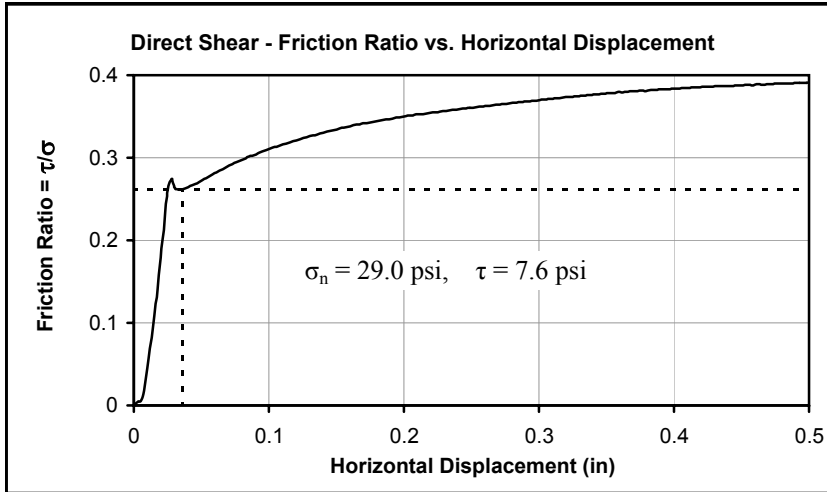
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	8/23/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	8/23/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Fast shear test.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

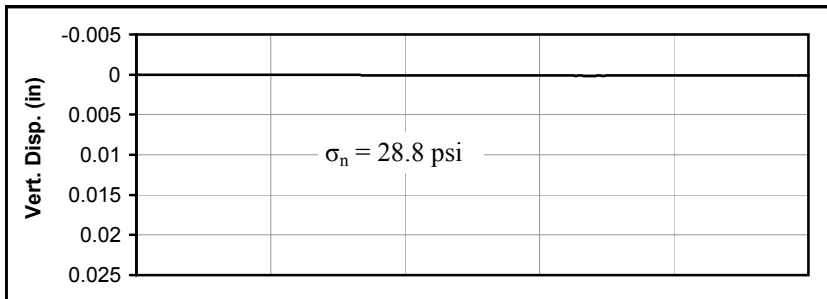
Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.048 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	1.219 mm/min.

Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-082304-1	18.0	4177	29.01	2.09	1092	7.58	0.55	0.0001



Initial Normal Stress:	
28.75	(psi)
Friction Ratio at Failure	
0.2614	(none)
Displacement at Failure:	
0.036	(in)
Arctan(Friction Ratio):	
14.6	(deg)

- Notes:**
1. Specimen removed at LL.
  2. Specimen pushed through the #40 sieve.
  3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
  4. External load frame used to consolidate specimens.
  5. Started consolidating on 8/19/04.





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**Direct Shear Data Sheet**

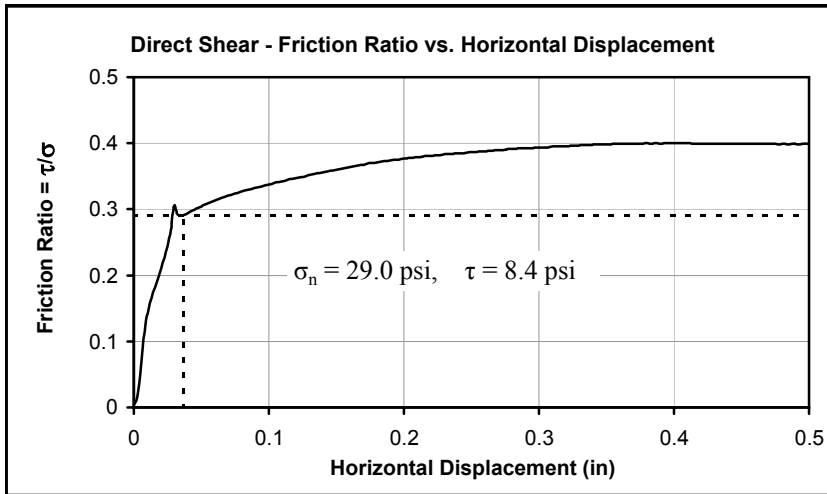
Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces	Started:	8/26/04
Sample I.D./Loc.:	Rancho Solano Clay #1	Finished:	8/26/04
Classification:	Brown Fat Clay (CH)	Shear Device Used:	WF Direct Shear #1

Initial Thickness of Specimen	0.5	(in.)	Preformed slickensided plane?	Yes
Square Box Width	4	(in.)	Failure Surface Location	Middle of Specimen

Consolidation Steps				Casagrande		Taylor	
Air Load	Normal Stress			t <sub>50</sub>	Max. Shear Rate	t <sub>50</sub>	Max. Shear Rate
(psi)	(psf)	(psi)	(tsf)	(min.)	(in/min.)	(min.)	(in/min.)
9.5	2602	18.07	1.30	Fast shear test.			
15.5	4505	31.29	2.25				
28.0	8470	58.82	4.23				
46.3	14258	99.01	7.13				

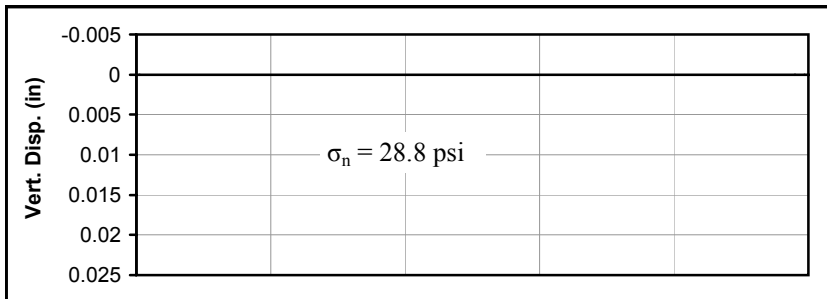
Minimum calc. shear rate =	in/min.	Test performed at shear rate =	0.048 in/min.
Estim. Failure displacement =	0.5 in.	Test performed at shear rate =	1.219 mm/min.

Test Number	Hanger Load	Residual Normal Stress			Residual Shear Stress			ΔH
	(kg)	(psf)	(psi)	(tsf)	(psf)	(psi)	(tsf)	(in.)
D1-082604-1	18.0	4178	29.02	2.09	1215	8.44	0.61	0.0000



Initial Normal Stress:	
28.75	(psi)
Friction Ratio at Failure	
0.2908	(none)
Displacement at Failure:	
0.037	(in)
Arctan(Friction Ratio):	
16.2	(deg)

- Notes:**
1. Specimen removed at LL.
  2. Specimen pushed through the #40 sieve.
  3. Specimen was preconsol. to approximately 50 psi in batch consol., pressed into direct shear box, and consolidated using the above load steps.
  4. External load frame used to consolidate specimens.
  5. Started consolidating on 8/23/04.



**Virginia Polytechnic Institute and State University**  
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**Cyclic Direct Shear Data Sheet**

Project:	Determining the Cyclic Shear Strength of Slicksided Slip Surfaces		
Location:	W.C. English Laboratory	Test Date:	4/8/2005
Sample ID:	Rancho Solano Clay #1	Tested By:	Derek Martowska
Classification:	Brown Fat Clay (CH)		
Test Device:	Cyclic Direct Shear Device (modification of existing simple shear device)		

Sample Preconsolidation			
Applied Air Load	Normal Stress		
(psi)	(psi)	(psf)	(tsf)
6.0	17.78	2560	1.28
10.5	31.11	4480	2.24
20.0	59.26	8533	4.27
33.8	100.00	14400	7.20

Test No.	D2-040805-1		
Initial Specimen Thickness	0.5	in.	
Square Box Width	2.5	in.	
Presheared	No	-	in./min
Preformed slickensided plane?	Yes		
Failure Surface Location	Middle		

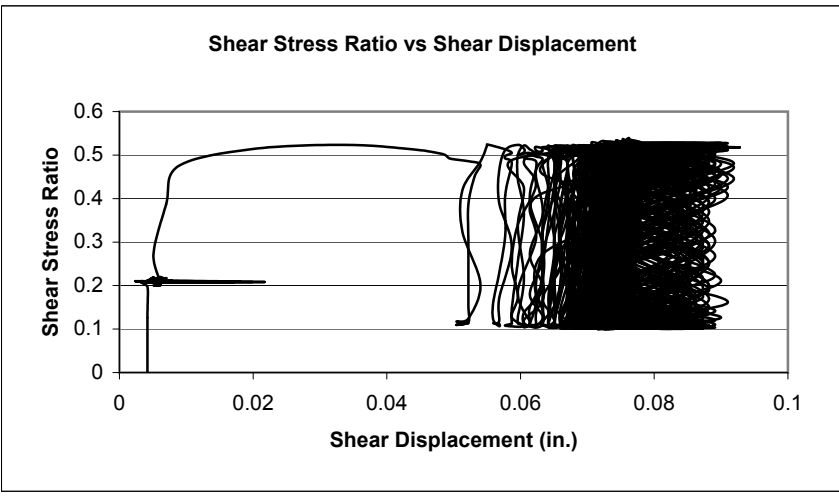
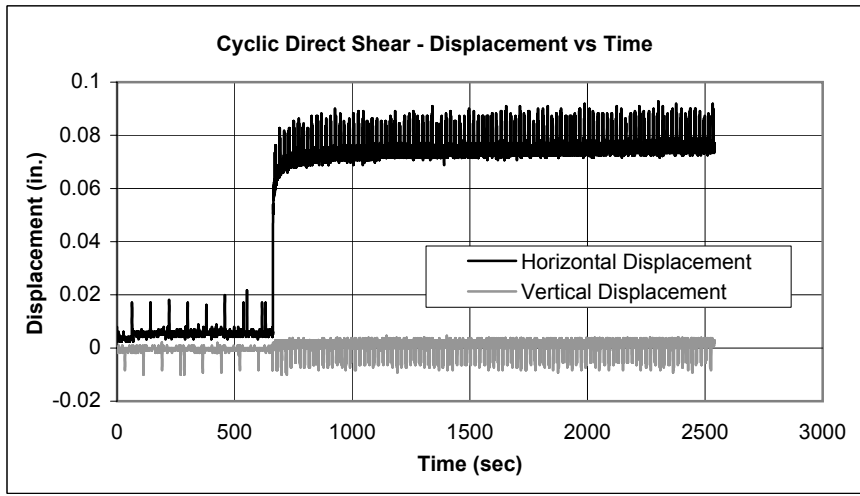
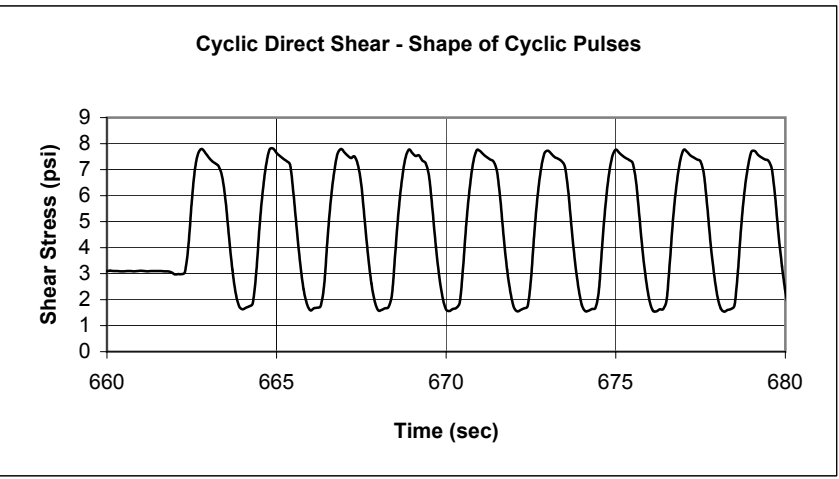
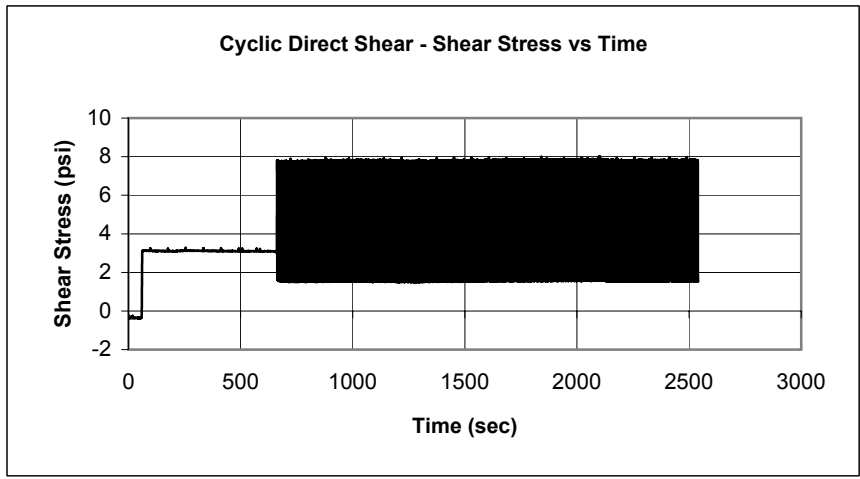
Normal Load		
Air Load	4.0	psi
Normal Stress		
(psi)	(psf)	(tsf)
14.89	2144	1.07

Time allowed for dissipation of pore pressures after static load application	10	min
Cyclic pulse frequency	0.5	Hz
Cyclic pulse period	2	sec

$T_{peak}$	$\tau_{peak}$			$\tau_{peak}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
48	7.68	1106	0.55	0.52
$T_{static}$	$\tau_{static}$			$\tau_{static}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
19.5	3.12	449	0.22	0.21

No. of cycles tested?	500
Reason for stopping test?	Test limited to 500 cycles

Notes: Specimen remolded at LL  
 Specimen pushed through #40 sieve  
 Monotonic static shear load and backpressure applied gradually to ~70% theoretical static shear strength



**Virginia Polytechnic Institute and State University**  
**Geotechnical Engineering Laboratory**  
**Cyclic Direct Shear Data Sheet**

Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces		
Location:	W.C. English Laboratory	Test Date:	4/29/2005
Sample ID:	Rancho Solano Clay #1	Tested By:	Derek Martowska
Classification:	Brown Fat Clay (CH)		
Test Device:	Cyclic Direct Shear Device (modification of existing simple shear device)		

Sample Preconsolidation			
Applied Air Load	Normal Stress		
(psi)	(psi)	(psf)	(tsf)
6.0	17.78	2560	1.28
10.5	31.11	4480	2.24
20.0	59.26	8533	4.27
33.8	100.00	14400	7.20

Test No.	D2-042905-1		
Initial Specimen Thickness	0.5	in.	
Square Box Width	2.5	in.	
Presheared	No	-	in./min
Preformed slickensided plane?	Yes		
Failure Surface Location	Middle		

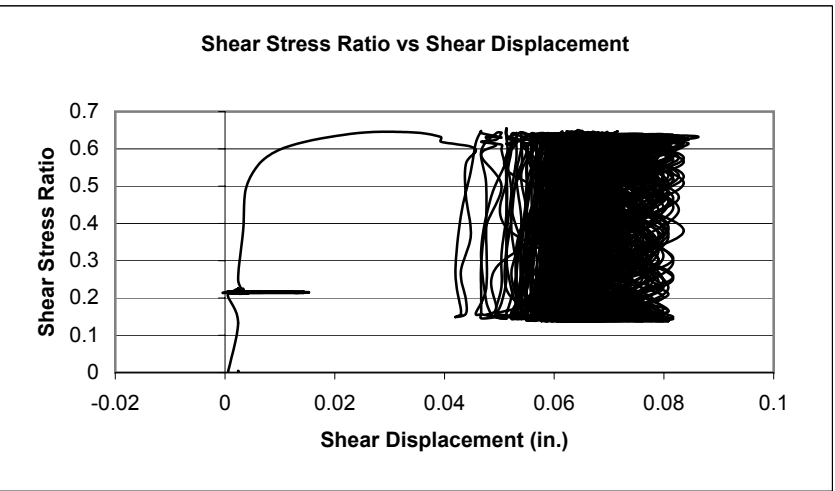
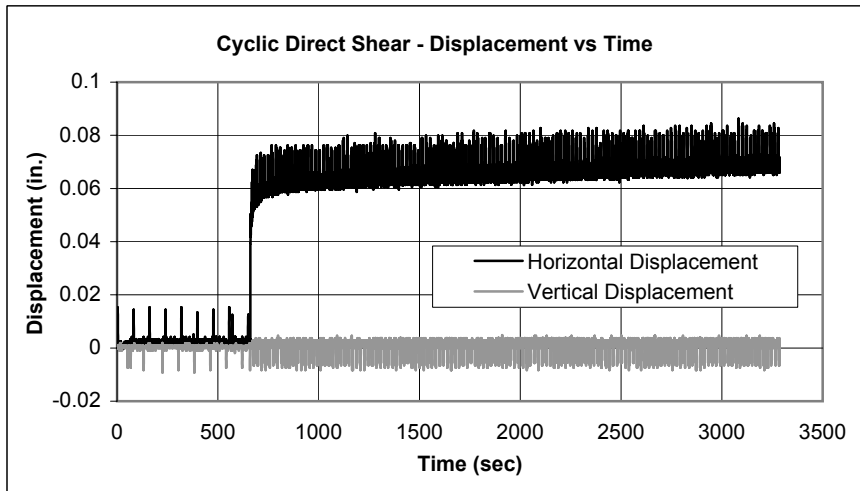
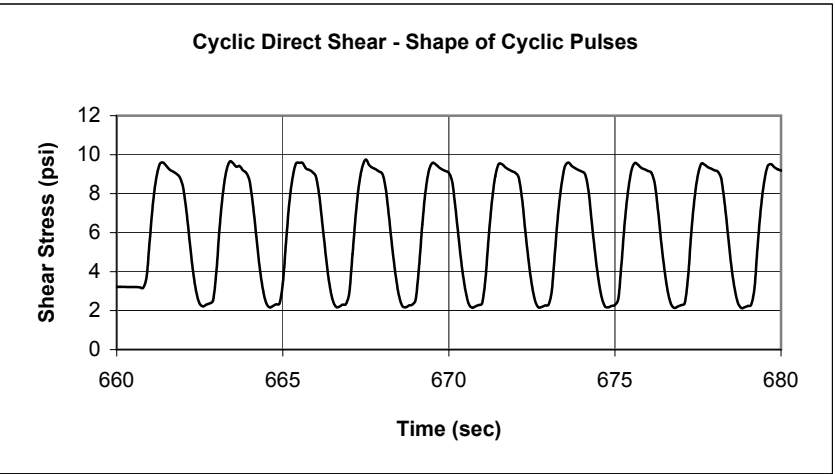
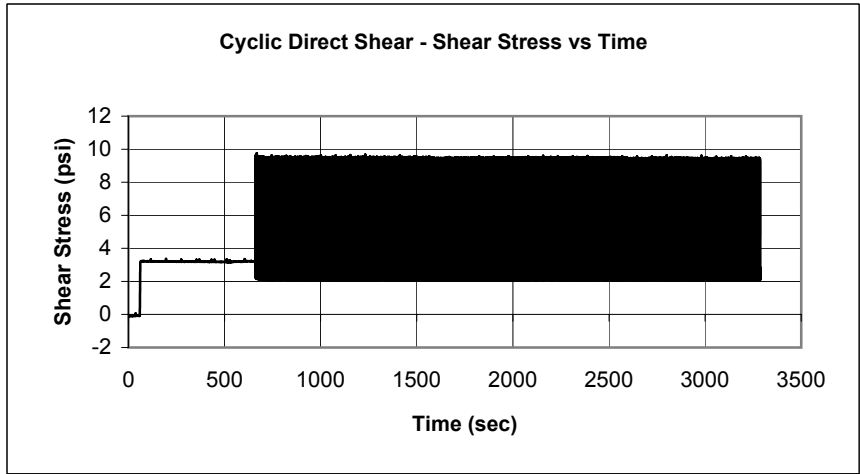
Normal Load		
Air Load	4.0	psi
Normal Stress		
(psi)	(psf)	(tsf)
14.89	2144	1.07

Time allowed for dissipation of pore pressures after static load application	10	min
Cyclic pulse frequency	0.5	Hz
Cyclic pulse period	2	sec

$T_{peak}$	$\tau_{peak}$			$\tau_{peak}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
60	9.60	1382	0.69	0.64
$T_{static}$	$\tau_{static}$			$\tau_{static}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
20.1	3.22	463	0.23	0.22

No. of cycles tested?	500
Reason for stopping test?	Test limited to 500 cycles

Notes: Specimen remolded at LL  
 Specimen pushed through #40 sieve  
 Monotonic static shear load and backpressure applied gradually to ~70% theoretical static shear strength



**Virginia Polytechnic Institute and State University**  
**Geotechnical Engineering Laboratory**  
**Cyclic Direct Shear Data Sheet**

Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces		
Location:	W.C. English Laboratory	Test Date:	6/21/2005
Sample ID:	Rancho Solano Clay #1	Tested By:	Derek Martowska
Classification:	Brown Fat Clay (CH)		
Test Device:	Cyclic Direct Shear Device (modification of existing simple shear device)		

Sample Preconsolidation			
Applied Air Load	Normal Stress		
(psi)	(psi)	(psf)	(tsf)
6.0	17.78	2560	1.28
10.5	31.11	4480	2.24
20.0	59.26	8533	4.27
33.8	100.00	14400	7.20

Test No.	D2-062105-1		
Initial Specimen Thickness	0.5	in.	
Square Box Width	2.5	in.	
Presheared	No	-	in./min
Preformed slickensided plane?	Yes		
Failure Surface Location	Middle		

Normal Load		
Air Load	4.0	psi
Normal Stress		
(psi)	(psf)	(tsf)
14.89	2144	1.07

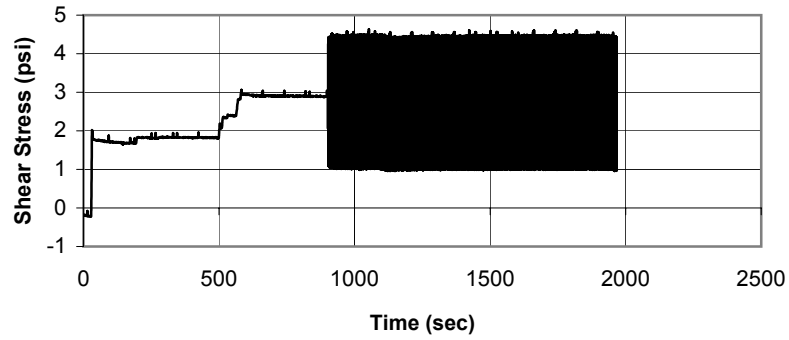
Time allowed for dissipation of pore pressures after static load application	5	min
Cyclic pulse frequency	0.5	Hz
Cyclic pulse period	2	sec

T <sub>peak</sub>	τ <sub>peak</sub>			τ <sub>peak</sub> /σ' <sub>vc</sub>
(lb)	(psi)	(psf)	(tsf)	
27.6	4.42	636	0.32	0.30
T <sub>static</sub>	τ <sub>static</sub>			τ <sub>static</sub> /σ' <sub>vc</sub>
(lb)	(psi)	(psf)	(tsf)	
18.1	2.90	417	0.21	0.19

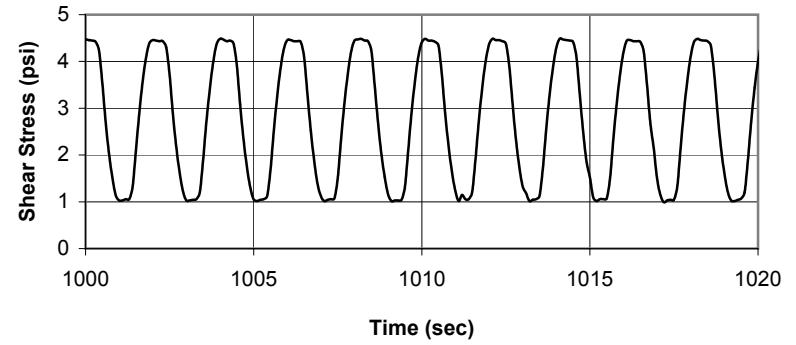
No. of cycles tested?	500
Reason for stopping test?	Test limited to 500 cycles

Notes: Specimen remolded at LL  
Specimen pushed through #40 sieve  
Monotonic static shear load and backpressure applied gradually to ~70% theoretical static shear strength

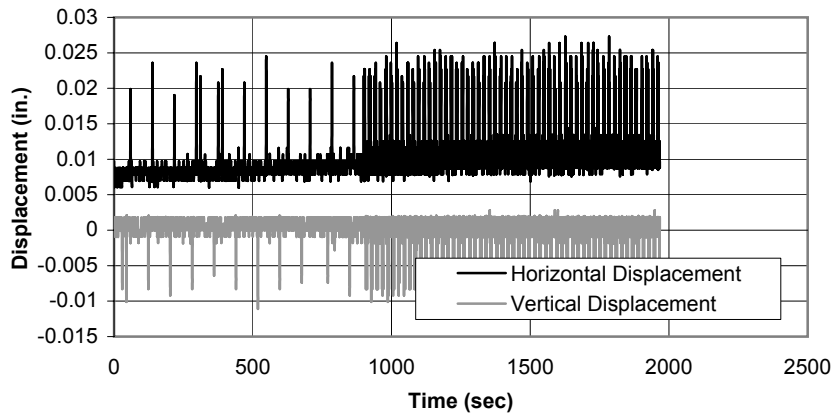
Cyclic Direct Shear - Shear Stress vs Time



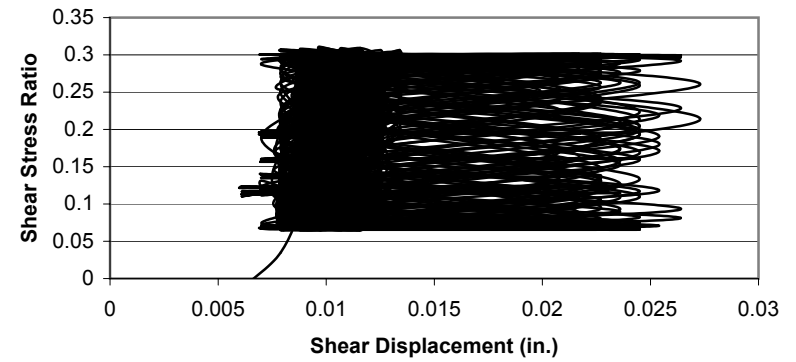
Cyclic Direct Shear - Shape of Cyclic Pulses



Cyclic Direct Shear - Displacement vs Time



Shear Stress Ratio vs Shear Displacement



**Virginia Polytechnic Institute and State University**  
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**Cyclic Direct Shear Data Sheet**

Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces		
Location:	W.C. English Laboratory	Test Date:	6/27/2005
Sample ID:	Rancho Solano Clay #1	Tested By:	Derek Martowska
Classification:	Brown Fat Clay (CH)		
Test Device:	Cyclic Direct Shear Device (modification of existing simple shear device)		

Sample Preconsolidation			
Applied Air Load	Normal Stress		
(psi)	(psi)	(psf)	(tsf)
6.0	17.78	2560	1.28
10.5	31.11	4480	2.24
20.0	59.26	8533	4.27
33.8	100.00	14400	7.20

Test No.	D2-062705-1		
Initial Specimen Thickness	0.5	in.	
Square Box Width	2.5	in.	
Presheared	No	-	in./min
Preformed slickensided plane?	Yes		
Failure Surface Location	Middle		

Normal Load		
Air Load	4.0	psi
Normal Stress		
(psi)	(psf)	(tsf)
14.89	2144	1.07

Time allowed for dissipation of pore pressures after static load application	10	min
Cyclic pulse frequency	0.5	Hz
Cyclic pulse period	2	sec

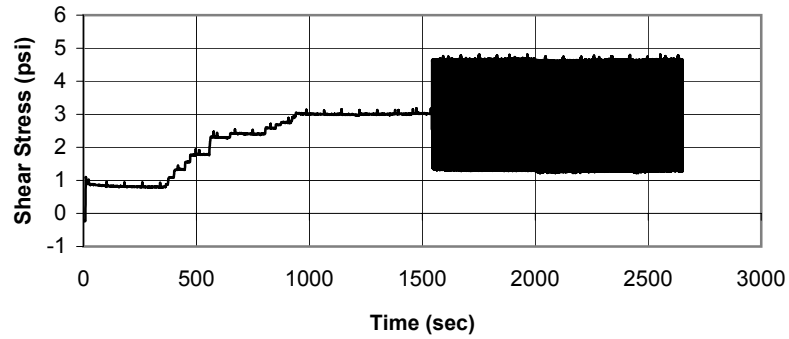
T <sub>peak</sub>	τ <sub>peak</sub>			τ <sub>peak</sub> /σ' <sub>vc</sub>
(lb)	(psi)	(psf)	(tsf)	
29	4.64	668	0.33	0.31
T <sub>static</sub>	τ <sub>static</sub>			τ <sub>static</sub> /σ' <sub>vc</sub>
(lb)	(psi)	(psf)	(tsf)	
18.9	3.02	435	0.22	0.20

No. of cycles tested?	500
Reason for stopping test?	Test limited to 500 cycles

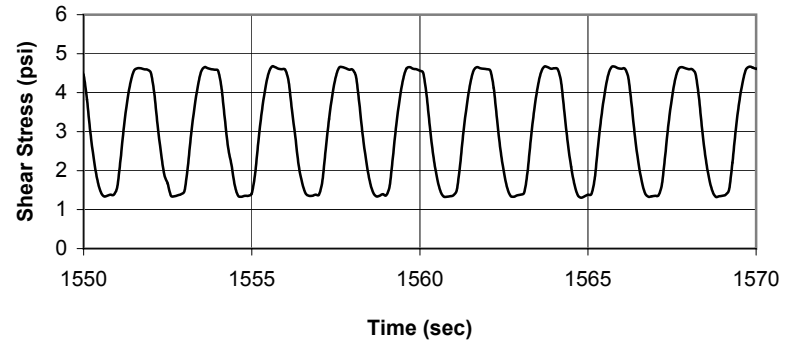
Notes: Specimen remolded at LL  
Specimen pushed through #40 sieve  
Monotonic static shear load and backpressure applied gradually to ~70% theoretical static shear strength



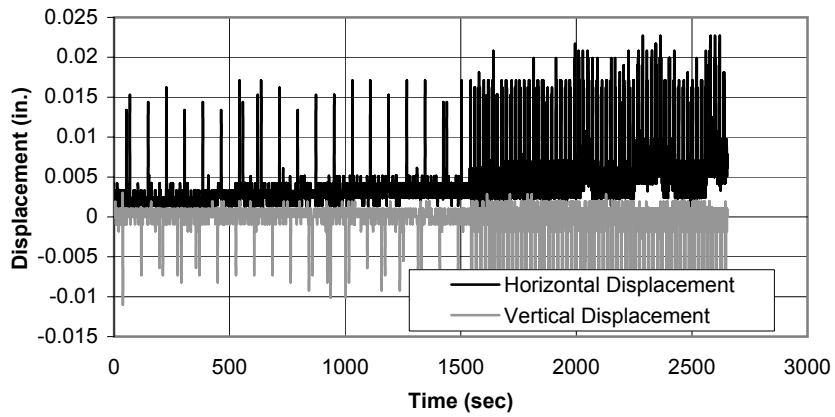
Cyclic Direct Shear - Shear Stress vs Time



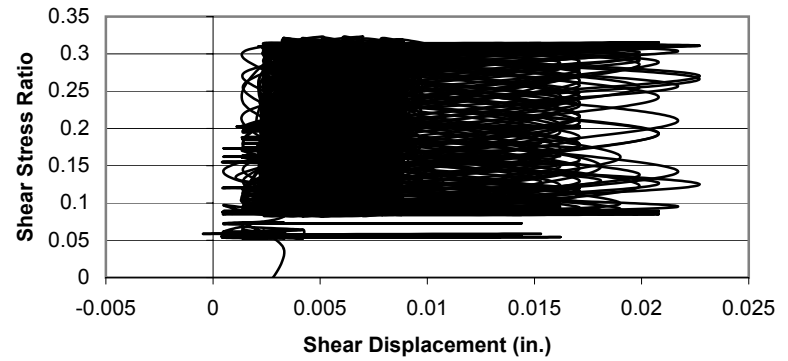
Cyclic Direct Shear - Shape of Cyclic Pulses



Cyclic Direct Shear - Displacement vs Time



Shear Stress Ratio vs Shear Displacement



**Virginia Polytechnic Institute and State University**  
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**Cyclic Direct Shear Data Sheet**

Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces		
Location:	W.C. English Laboratory	Test Date:	6/28/2005
Sample ID:	Rancho Solano Clay #1	Tested By:	Derek Martowska
Classification:	Brown Fat Clay (CH)		
Test Device:	Cyclic Direct Shear Device (modification of existing simple shear device)		

Sample Preconsolidation			
Applied Air Load	Normal Stress		
(psi)	(psi)	(psf)	(tsf)
6.0	17.78	2560	1.28
10.5	31.11	4480	2.24
20.0	59.26	8533	4.27
33.8	100.00	14400	7.20

Test No.	D2-062805-1		
Initial Specimen Thickness	0.5	in.	
Square Box Width	2.5	in.	
Presheared	No	-	in./min
Preformed slickensided plane?	Yes		
Failure Surface Location	Middle		

Normal Load		
Air Load	4.0	psi
Normal Stress		
(psi)	(psf)	(tsf)
14.89	2144	1.07

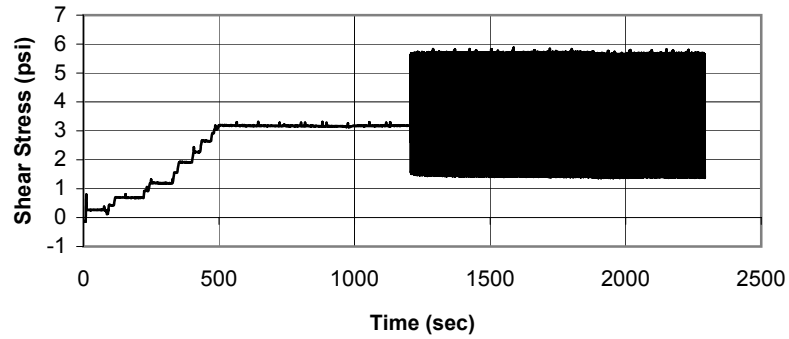
Time allowed for dissipation of pore pressures after static load application	12	min
Cyclic pulse frequency	0.5	Hz
Cyclic pulse period	2	sec

$T_{peak}$	$\tau_{peak}$			$\tau_{peak}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
35.2	5.63	811	0.41	0.38
$T_{static}$	$\tau_{static}$			$\tau_{static}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
19.9	3.18	458	0.23	0.21

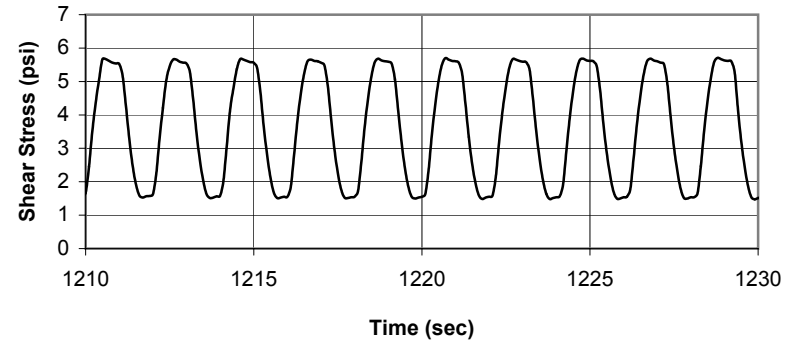
No. of cycles tested?	500
Reason for stopping test?	Test limited to 500 cycles

Notes: Specimen remolded at LL  
Specimen pushed through #40 sieve  
Monotonic static shear load and backpressure applied gradually to ~70% theoretical static shear strength

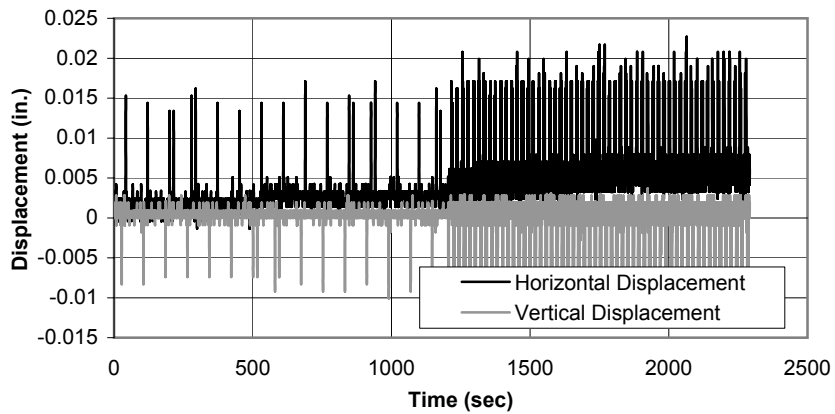
Cyclic Direct Shear - Shear Stress vs Time



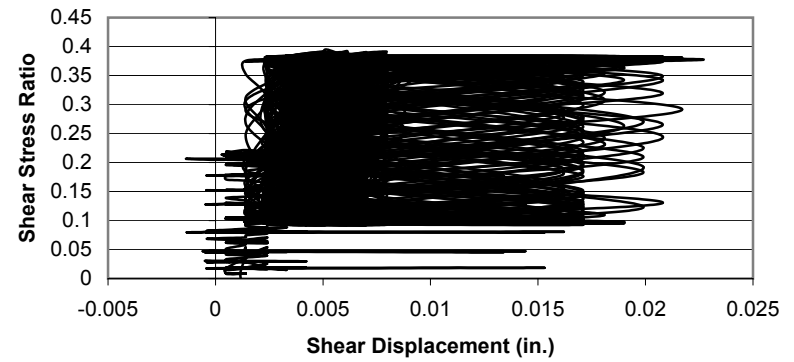
Cyclic Direct Shear - Shape of Cyclic Pulses



Cyclic Direct Shear - Displacement vs Time



Shear Stress Ratio vs Shear Displacement



**Virginia Polytechnic Institute and State University**  
**Geotechnical Engineering Laboratory**  
**Cyclic Direct Shear Data Sheet**

Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces		
Location:	W.C. English Laboratory	Test Date:	9/1/2005
Sample ID:	Rancho Solano Clay #1	Tested By:	Derek Martowska
Classification:	Brown Fat Clay (CH)		
Test Device:	Cyclic Direct Shear Device (modification of existing simple shear device)		

Sample Preconsolidation			
Applied Air Load	Normal Stress		
(psi)	(psi)	(psf)	(tsf)
6.0	17.78	2560	1.28
10.5	31.11	4480	2.24
20.0	59.26	8533	4.27
33.8	100.00	14400	7.20

Test No.	D2-090105-1		
Initial Specimen Thickness	0.5	in.	
Square Box Width	2.5	in.	
Presheared	No	-	in./min
Preformed slickensided plane?	Yes		
Failure Surface Location	Middle		

Normal Load		
Air Load	4.0	psi
Normal Stress		
(psi)	(psf)	(tsf)
14.89	2144	1.07

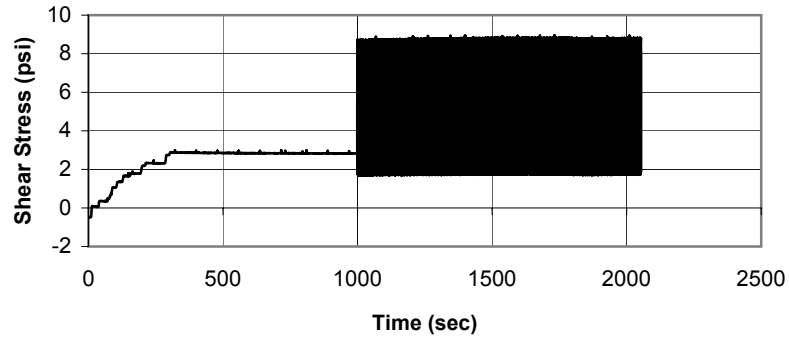
Time allowed for dissipation of pore pressures after static load application	11	min
Cyclic pulse frequency	0.5	Hz
Cyclic pulse period	2	sec

$T_{peak}$	$\tau_{peak}$			$\tau_{peak}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
54.4	8.70	1253	0.63	0.58
$T_{static}$	$\tau_{static}$			$\tau_{static}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
17.7	2.83	408	0.20	0.19

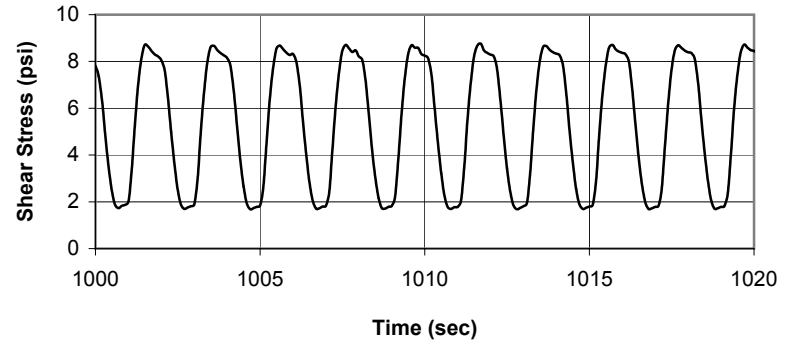
No. of cycles tested?	500
Reason for stopping test?	Test limited to 500 cycles

Notes: Specimen remolded at LL  
Specimen pushed through #40 sieve  
Monotonic static shear load and backpressure applied gradually to ~70% theoretical static shear strength

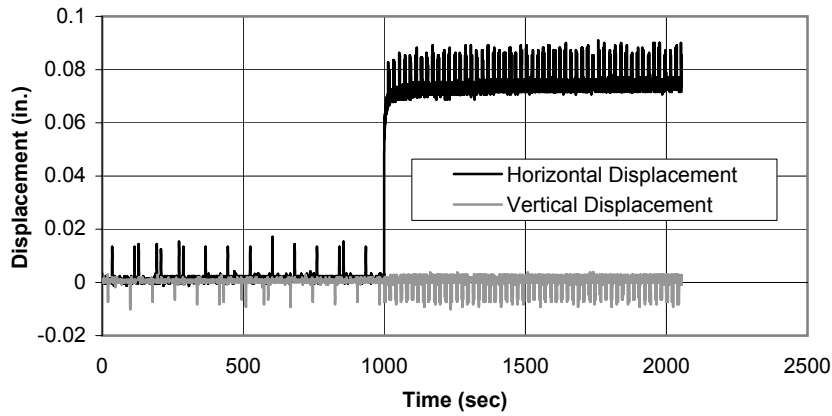
Cyclic Direct Shear - Shear Stress vs Time



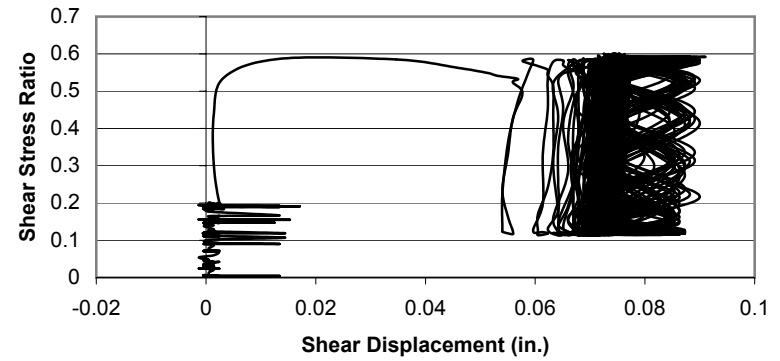
Cyclic Direct Shear - Shape of Cyclic Pulses



Cyclic Direct Shear - Displacement vs Time



Shear Stress Ratio vs Shear Displacement



**Virginia Polytechnic Institute and State University**  
**Geotechnical Engineering Laboratory**  
**Cyclic Direct Shear Data Sheet**

Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces		
Location:	W.C. English Laboratory	Test Date:	9/27/2005
Sample ID:	Rancho Solano Clay #1	Tested By:	Derek Martowska
Classification:	Brown Fat Clay (CH)		
Test Device:	Cyclic Direct Shear Device (modification of existing simple shear device)		

Sample Preconsolidation			
Applied Air Load	Normal Stress		
(psi)	(psi)	(psf)	(tsf)
6.0	17.78	2560	1.28
10.5	31.11	4480	2.24
20.0	59.26	8533	4.27
33.8	100.00	14400	7.20

Test No.	D2-092705-1		
Initial Specimen Thickness	0.5	in.	
Square Box Width	2.5	in.	
Presheared	No	-	in./min
Preformed slickensided plane?	Yes		
Failure Surface Location	Middle		

Normal Load		
Air Load	4.0	psi
Normal Stress		
(psi)	(psf)	(tsf)
14.89	2144	1.07

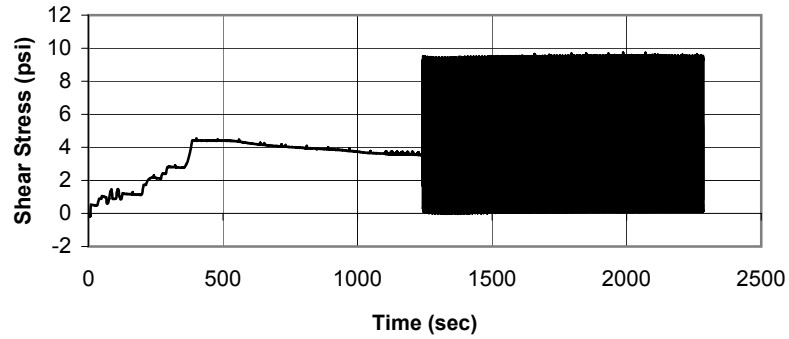
Time allowed for dissipation of pore pressures after static load application	14	min
Cyclic pulse frequency	0.5	Hz
Cyclic pulse period	2	sec

$T_{peak}$	$\tau_{peak}$			$\tau_{peak}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
59	9.44	1359	0.68	0.63
$T_{static}$	$\tau_{static}$			$\tau_{static}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
22.1	3.54	509	0.25	0.24

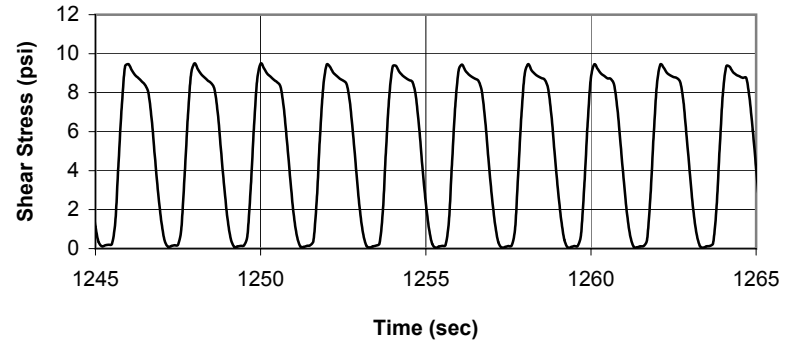
No. of cycles tested?	500
Reason for stopping test?	Test limited to 500 cycles

Notes: Specimen remolded at LL  
Specimen pushed through #40 sieve  
Monotonic static shear load and backpressure applied gradually to ~70% theoretical static shear strength

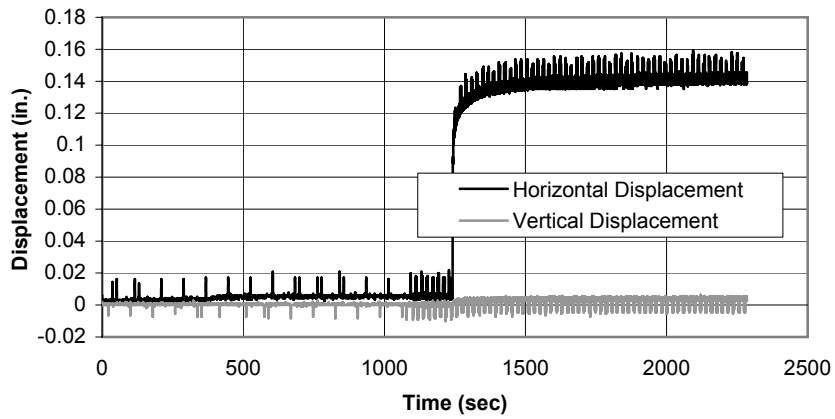
Cyclic Direct Shear - Shear Stress vs Time



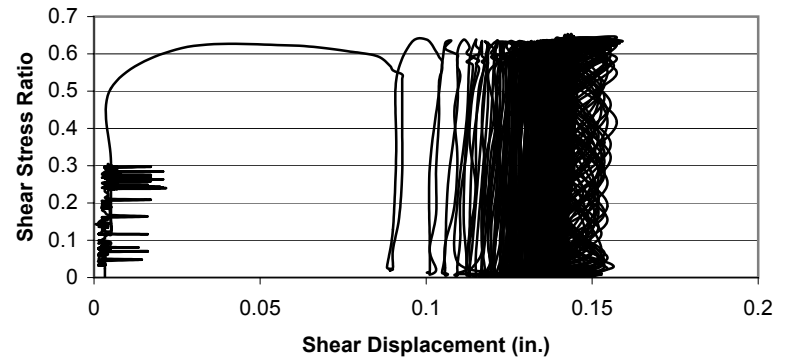
Cyclic Direct Shear - Shape of Cyclic Pulses



Cyclic Direct Shear - Displacement vs Time



Shear Stress Ratio vs Shear Displacement



**Virginia Polytechnic Institute and State University**  
**Geotechnical Engineering Laboratory**  
**Cyclic Direct Shear Data Sheet**

Project:	Determining the Cyclic Shear Strength of Slickensided Slip Surfaces		
Location:	W.C. English Laboratory	Test Date:	9/29/2005
Sample ID:	Rancho Solano Clay #1	Tested By:	Derek Martowska
Classification:	Brown Fat Clay (CH)		
Test Device:	Cyclic Direct Shear Device (modification of existing simple shear device)		

Sample Preconsolidation			
Applied Air Load	Normal Stress		
(psi)	(psi)	(psf)	(tsf)
6.0	17.78	2560	1.28
10.5	31.11	4480	2.24
20.0	59.26	8533	4.27
33.8	100.00	14400	7.20

Test No.	D2-092905-1		
Initial Specimen Thickness	0.5	in.	
Square Box Width	2.5	in.	
Presheared	No	-	in./min
Preformed slickensided plane?	Yes		
Failure Surface Location	Middle		

Normal Load		
Air Load	4.0	psi
Normal Stress		
(psi)	(psf)	(tsf)
14.89	2144	1.07

Time allowed for dissipation of pore pressures after static load application	11	min
Cyclic pulse frequency	0.5	Hz
Cyclic pulse period	2	sec

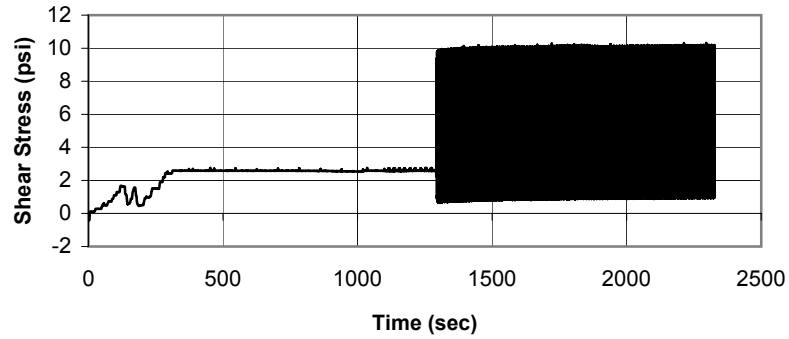
$T_{peak}$	$\tau_{peak}$			$\tau_{peak}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
61	9.76	1405	0.70	0.66
$T_{static}$	$\tau_{static}$			$\tau_{static}/\sigma'_{fc}$
(lb)	(psi)	(psf)	(tsf)	
16.2	2.59	373	0.19	0.17

No. of cycles tested?	500
Reason for stopping test?	Test limited to 500 cycles

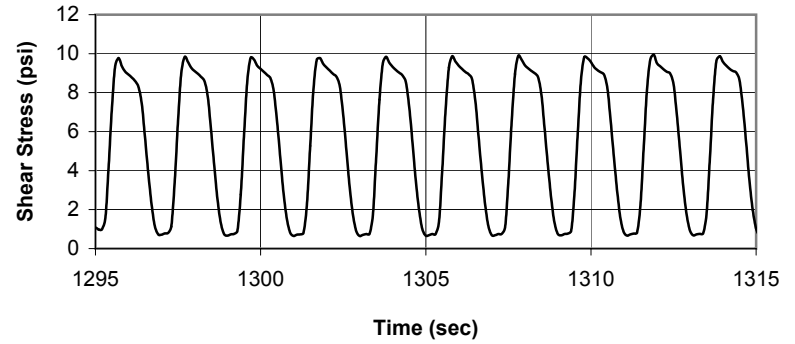
Notes: Specimen remolded at LL  
Specimen pushed through #40 sieve  
Monotonic static shear load and backpressure applied gradually to ~70% theoretical static shear strength



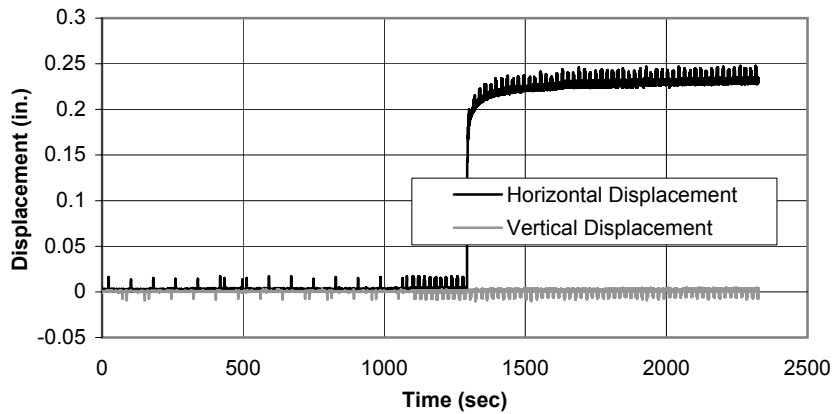
Cyclic Direct Shear - Shear Stress vs Time



Cyclic Direct Shear - Shape of Cyclic Pulses



Cyclic Direct Shear - Displacement vs Time



Shear Stress Ratio vs Shear Displacement

