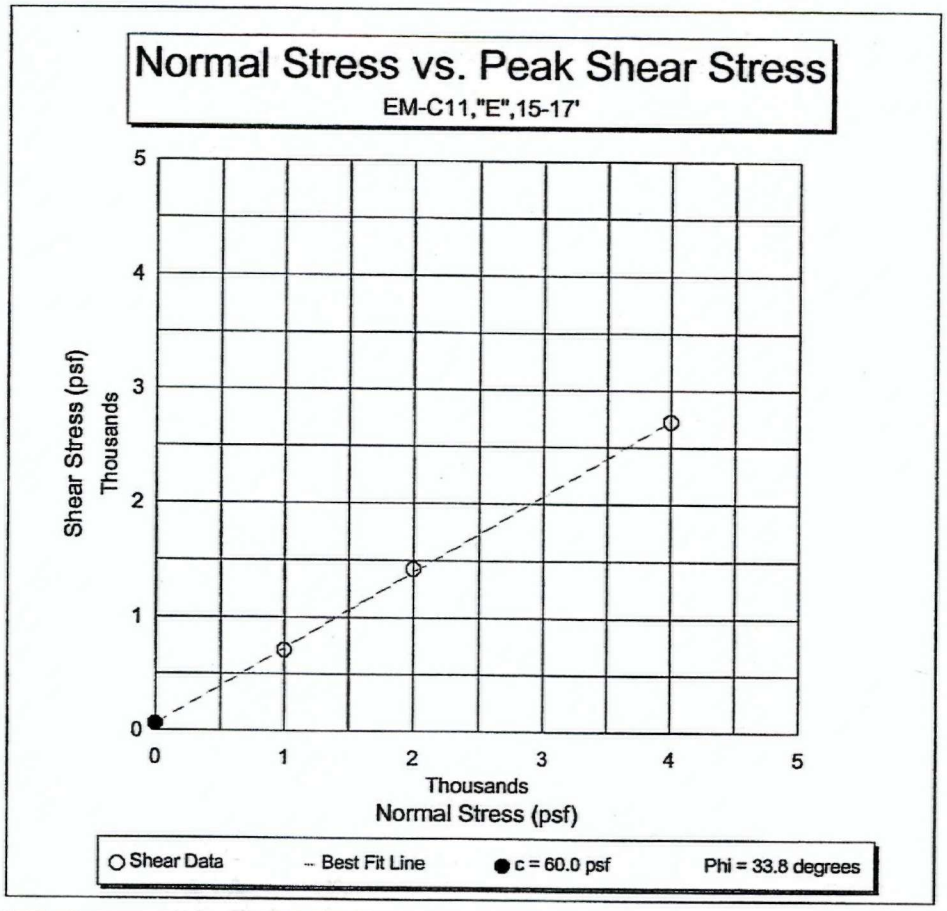
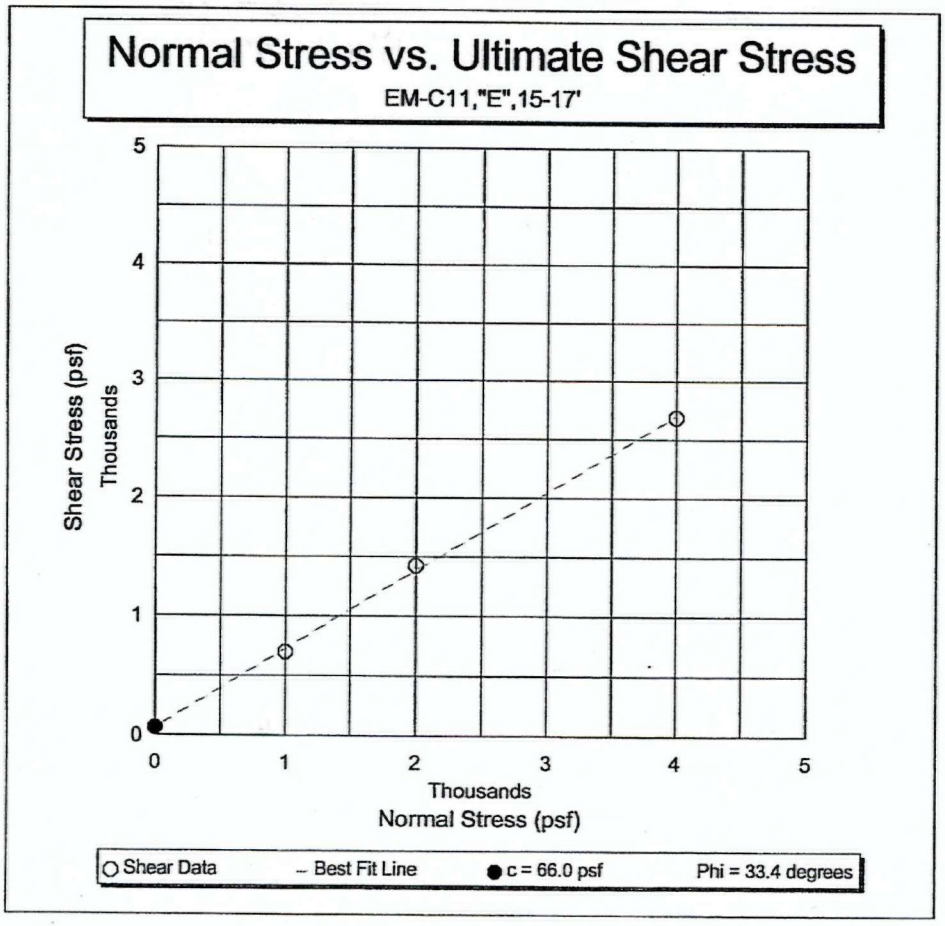
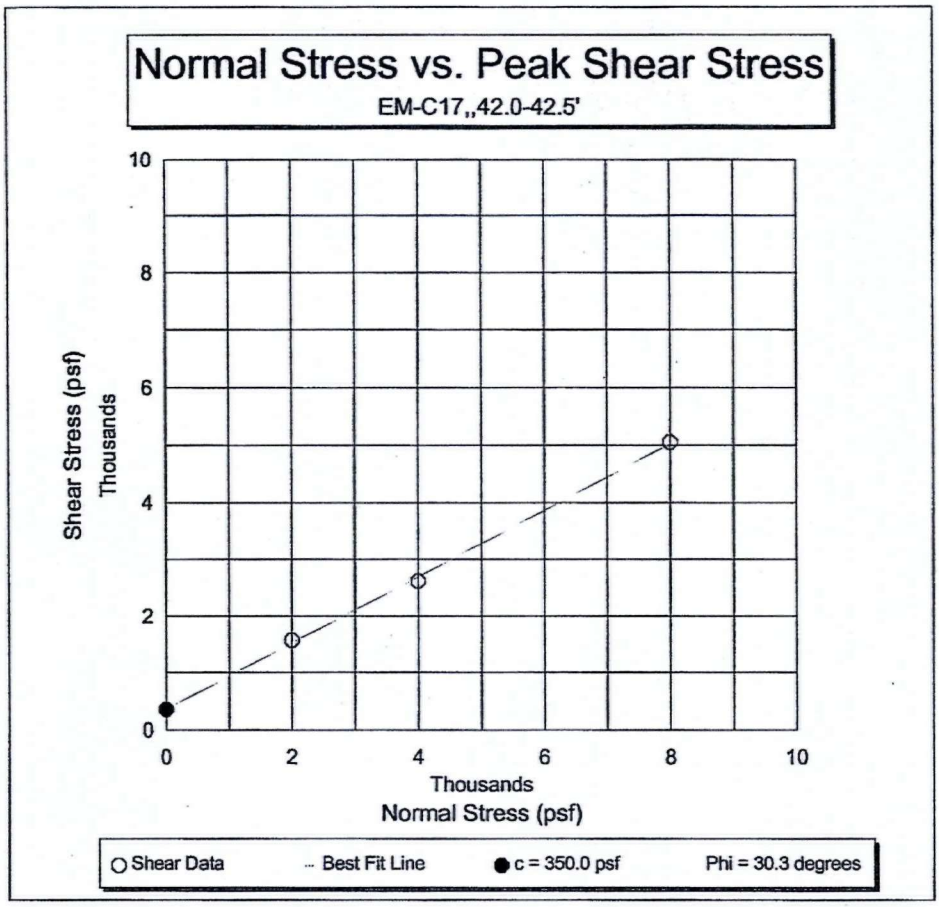
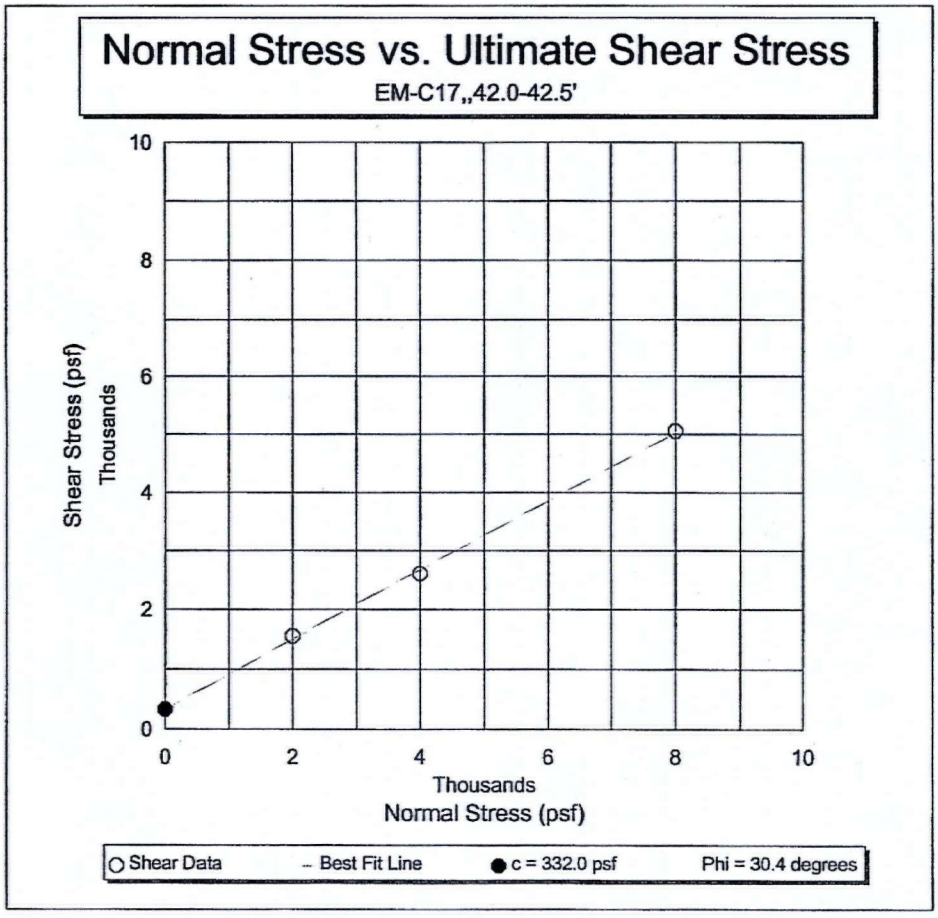
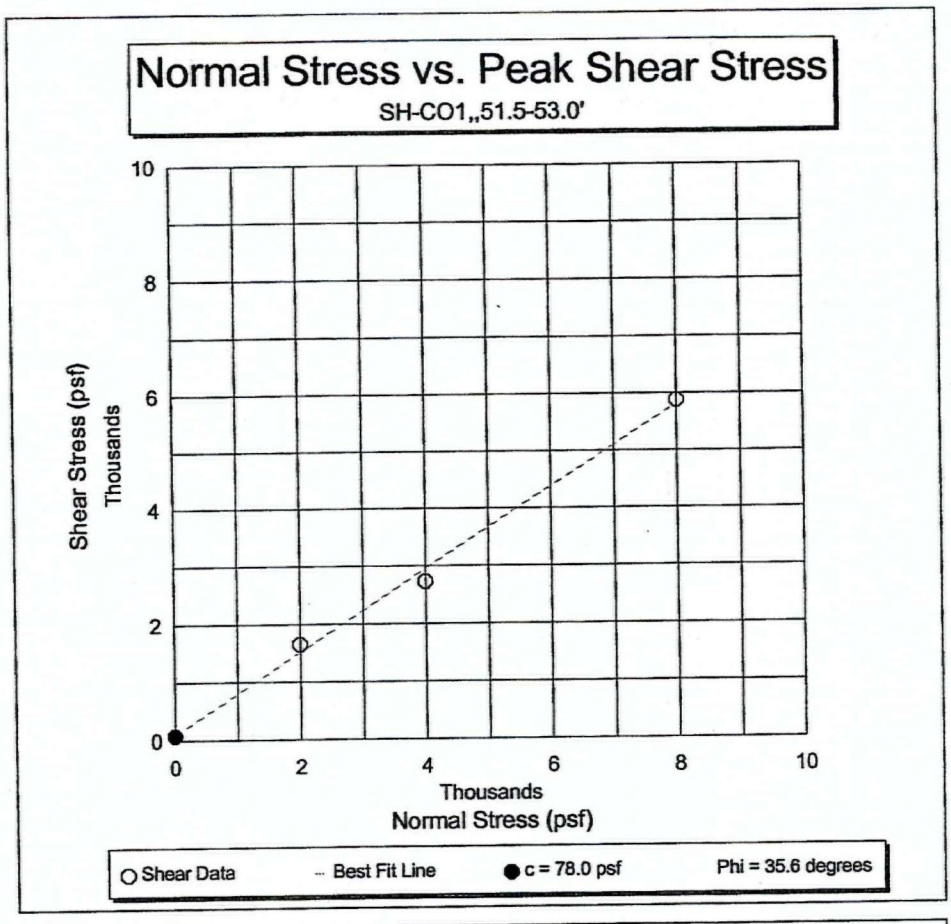

Normal Stress vs. Peak Shear Stress
EM-C11,"E",15-17'
Shear Stress (psf)
Thousands
0
1
2
3
4
5
Thousands
Normal Stress (psf)
Shear Data
Best Fit Line
c = 60.0 psf
Phi = 33.8 degrees

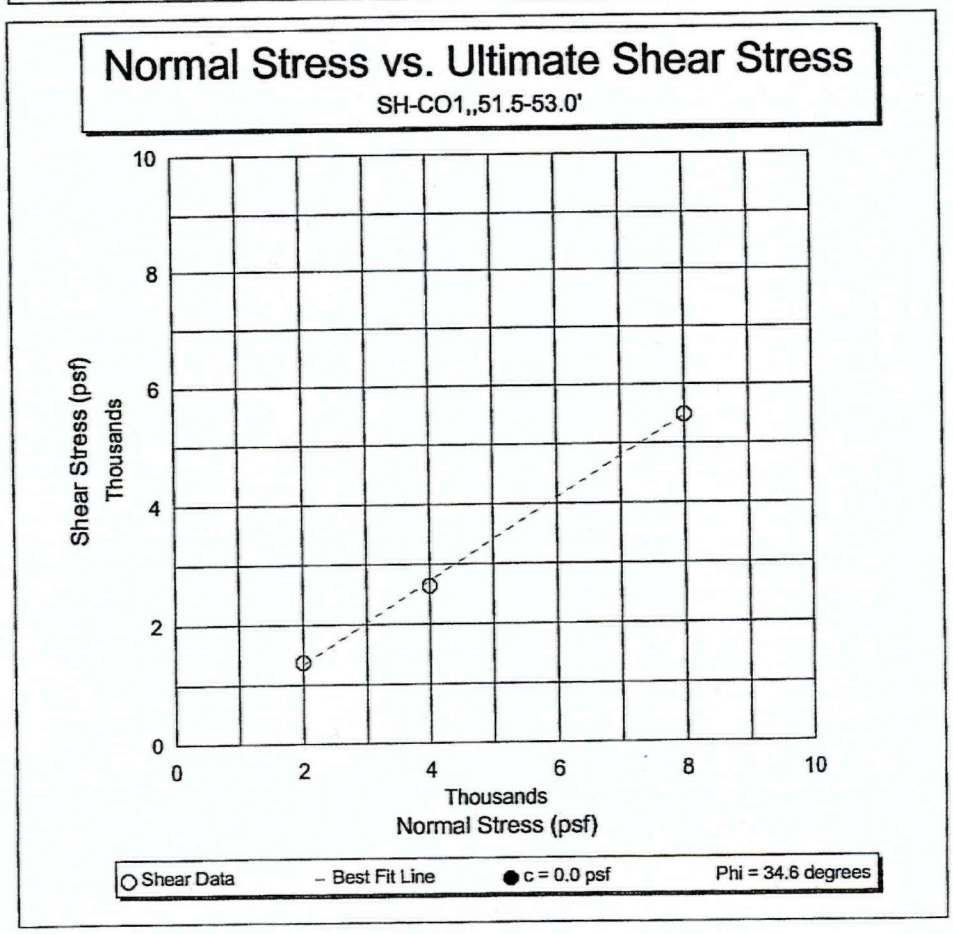

Normal Stress vs. Ultimate Shear Stress
EM-C11,"E",15-17'
Shear Stress (psf)
Thousands
0
1
2
3
4
5
Thousands
Normal Stress (psf)
Shear Data
Best Fit Line
c = 66.0 psf
Phi = 33.4 degrees





ADVANCED TERRA TESTING, INC.


Normal Stress vs. Peak Shear Stress
SH-CO1,,51.5-53.0'
Shear Stress (psf)
Thousands
Normal Stress (psf)
Thousands
0
2
4
6
8
10
Shear Data
Best Fit Line
c = 78.0 psf
Phi = 35.6 degrees


Normal Stress vs. Ultimate Shear Stress
SH-CO1,,51.5-53.0'
Shear Stress (psf)
Thousands
Normal Stress (psf)
Thousands
0
2
4
6
8
10
Shear Data
Best Fit Line
c = 0.0 psf
Phi = 34.6 degrees

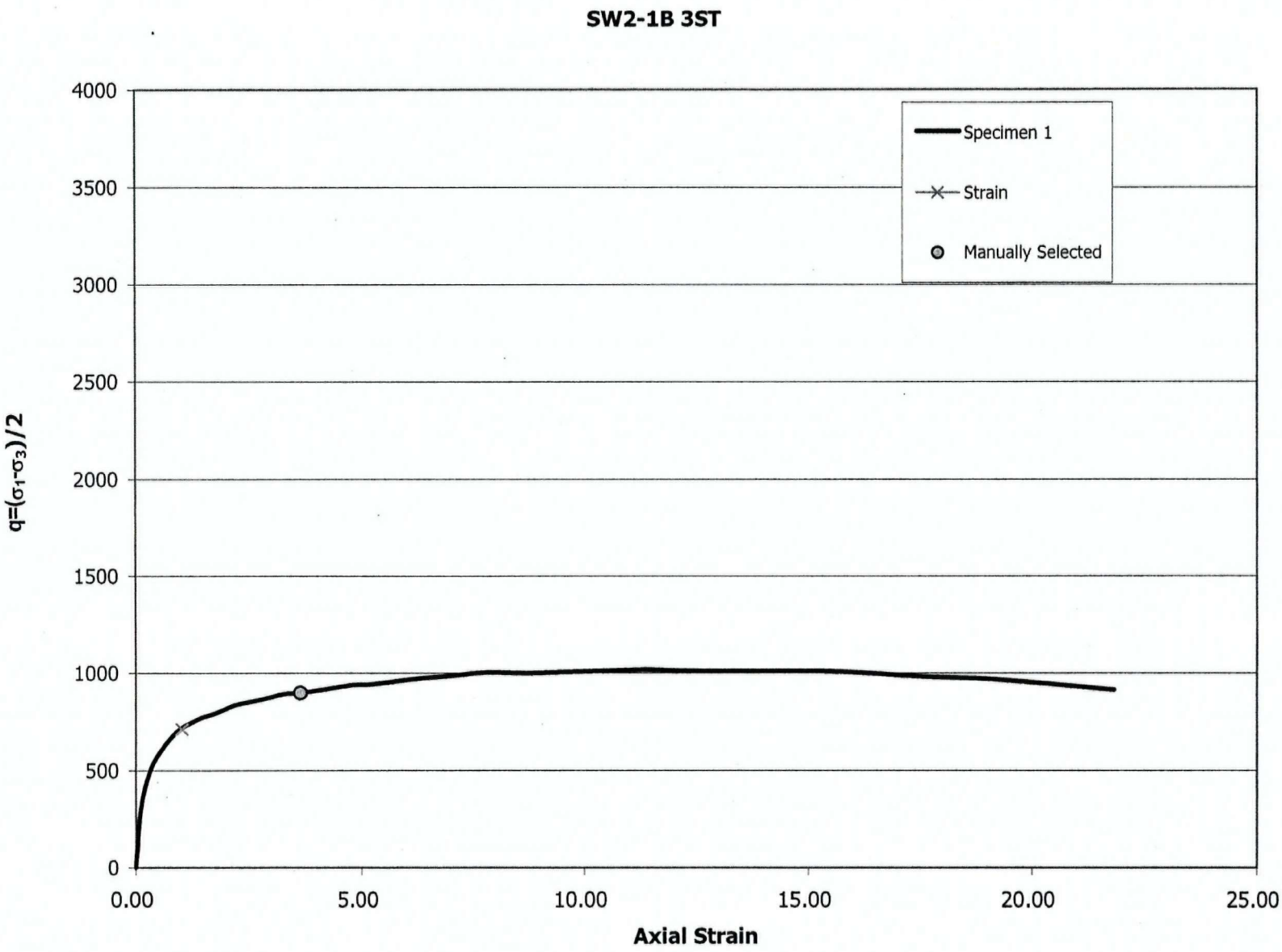
SW2-1B 3 ST

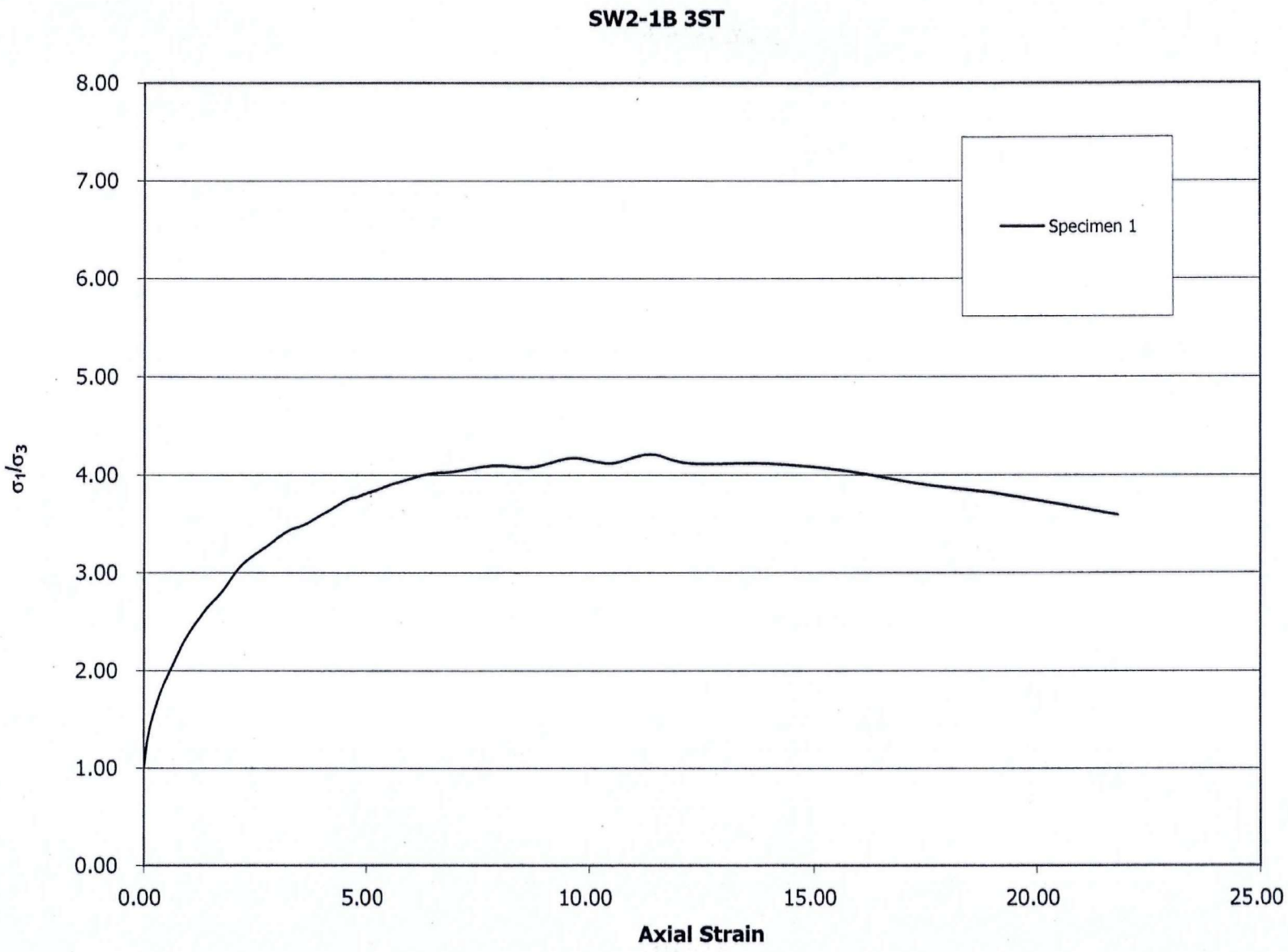
Strain Criteria: 1

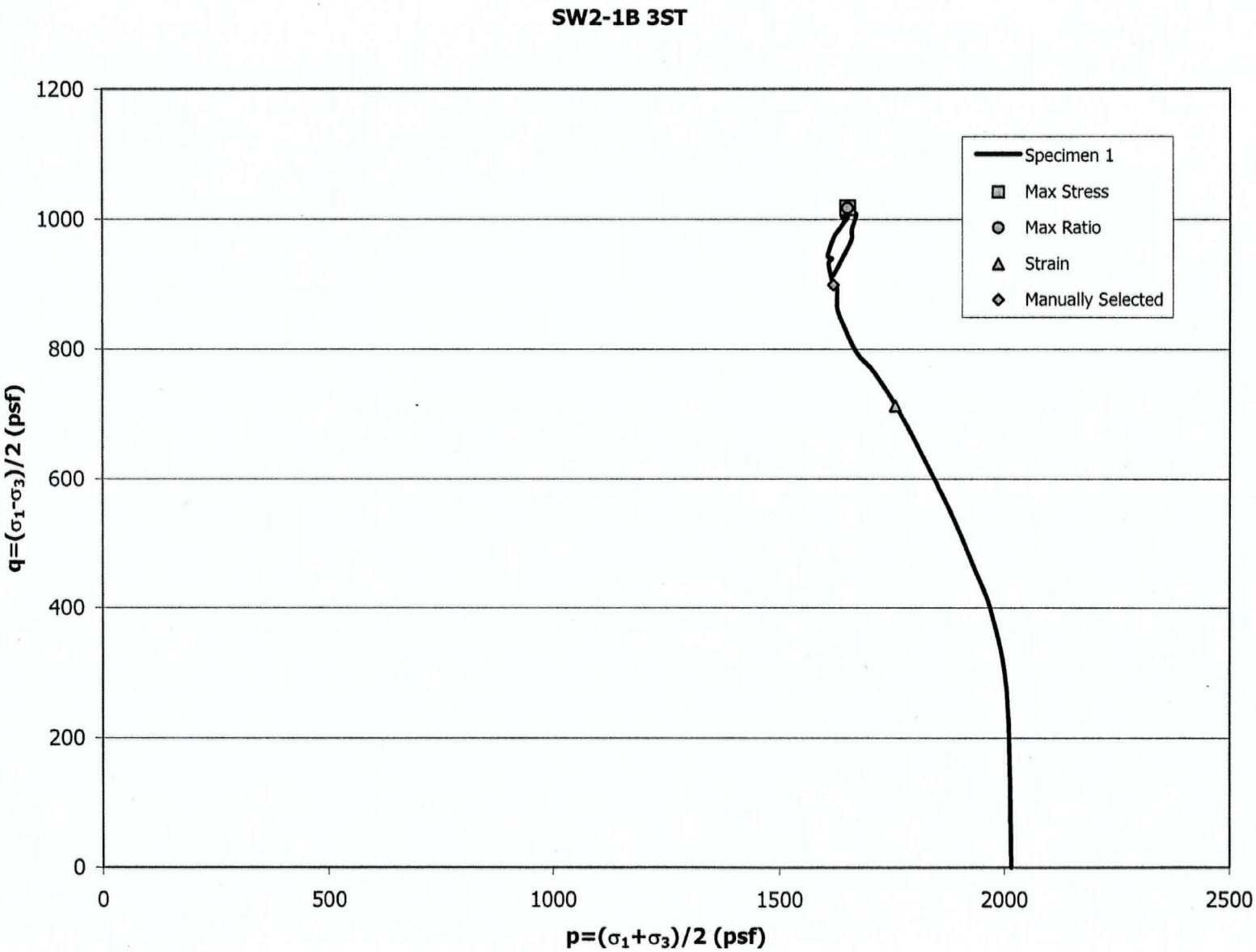
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'
Max Stress	2016	11	1651	1017	
Max Ratio	2016		1651	1017	4.2
Strain	2016	1.0	1758	712	
Manually Selected	2016	3.6	1619	899	

Assumed Strength

c (psf)	ϕ	0	181
190	18	8000	2653


SW2-1B 3ST
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
q=(σ1-σ3)/2
Specimen 1
Strain
Manually Selected


SW2-1B 3ST
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
Specimen 1


SW2-1B 3ST
1200
1000
800
600
400
200
0
0
500
1000
1500
2000
2500
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
Specimen 1
Max Stress
Max Ratio
Strain
Manually Selected

SW1-3 5ST

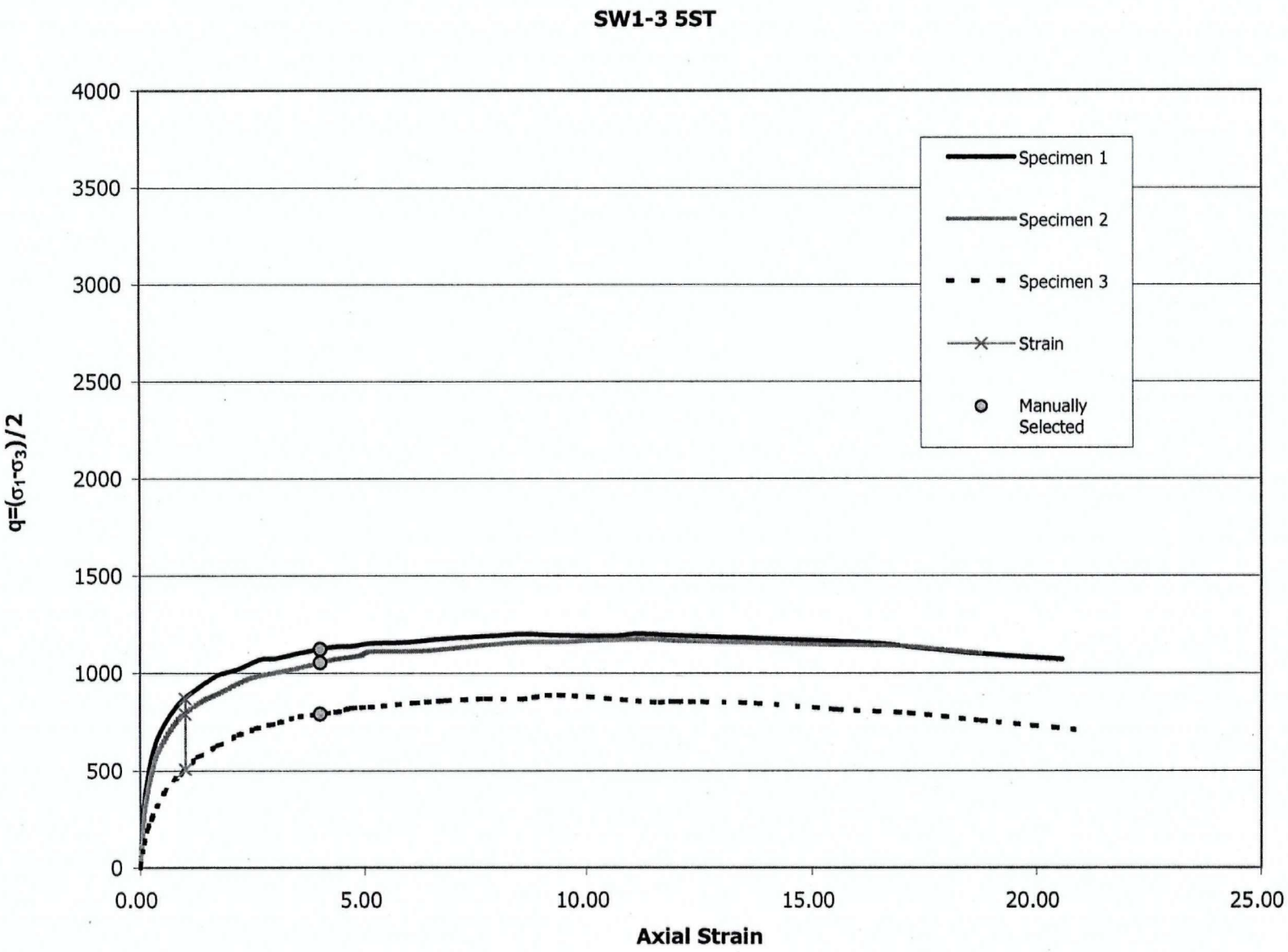
Strain Criteria: 1

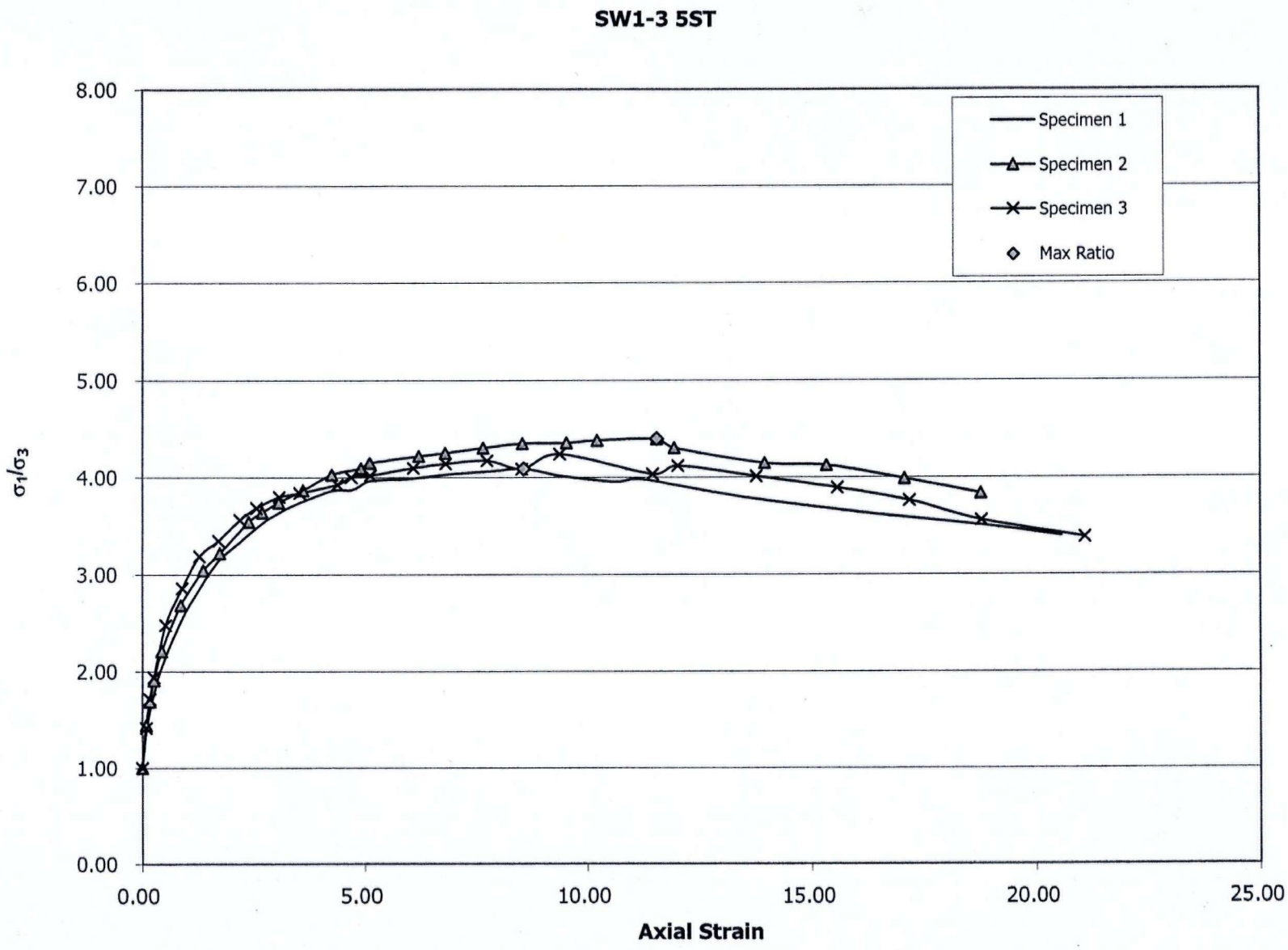
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	2160		2008	1202		69	0.58	84	35.1
	1440		1865	1173					
	619.2		1434	887					
Max Ratio	2160	9	1977	1200	4.1	76	0.58	93	35.3
	1440	12	1865	1173	4.4				
	619.2	9	1413	887	4.2				
Strain	2160	1.0	1940	869		97	0.40	106	23.8
	1440	1.0	1676	789					
	619.2	1.0	1025	506					
Manually Selected	2160	4.0	1919	1122		16	0.58	20	35.5
	1440	4.0	1764	1053					
		4.0	1336	789					

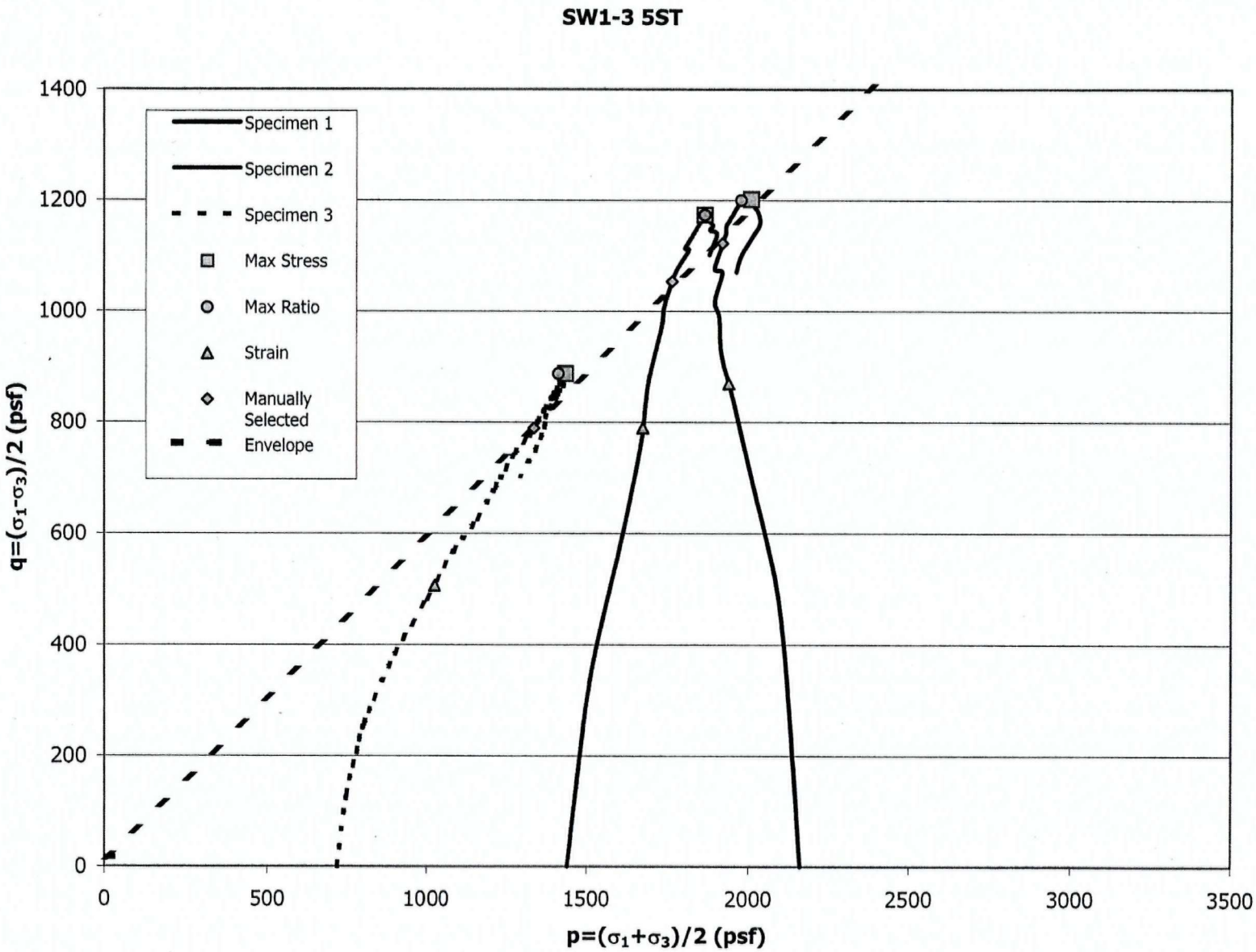
Envelope

c (psf)	ϕ	0	16
20	35.5	3000	1758

Note: Overconsolidation was intentionally induced in the two specimens tested at lower confining stresses, in order to evaluate the effect of OCR on the undrained strength ratio. Each specimen initially consolidated to effective confining stress of 2160 psf, and then the confining stress was reduced and the sample allowed to consolidate again.


SW1-3 5ST
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
q=(σ1-σ3)/2
Specimen 1
Specimen 2
Specimen 3
Strain
Manually Selected


SW1-3 5ST
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
Specimen 1
Specimen 2
Specimen 3
Max Ratio


SW1-3 5ST
Specimen 1
Specimen 2
Specimen 3
Max Stress
Max Ratio
Strain
Manually Selected
Envelope
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
0
200
400
600
800
1000
1200
1400
0
500
1000
1500
2000
2500
3000
3500

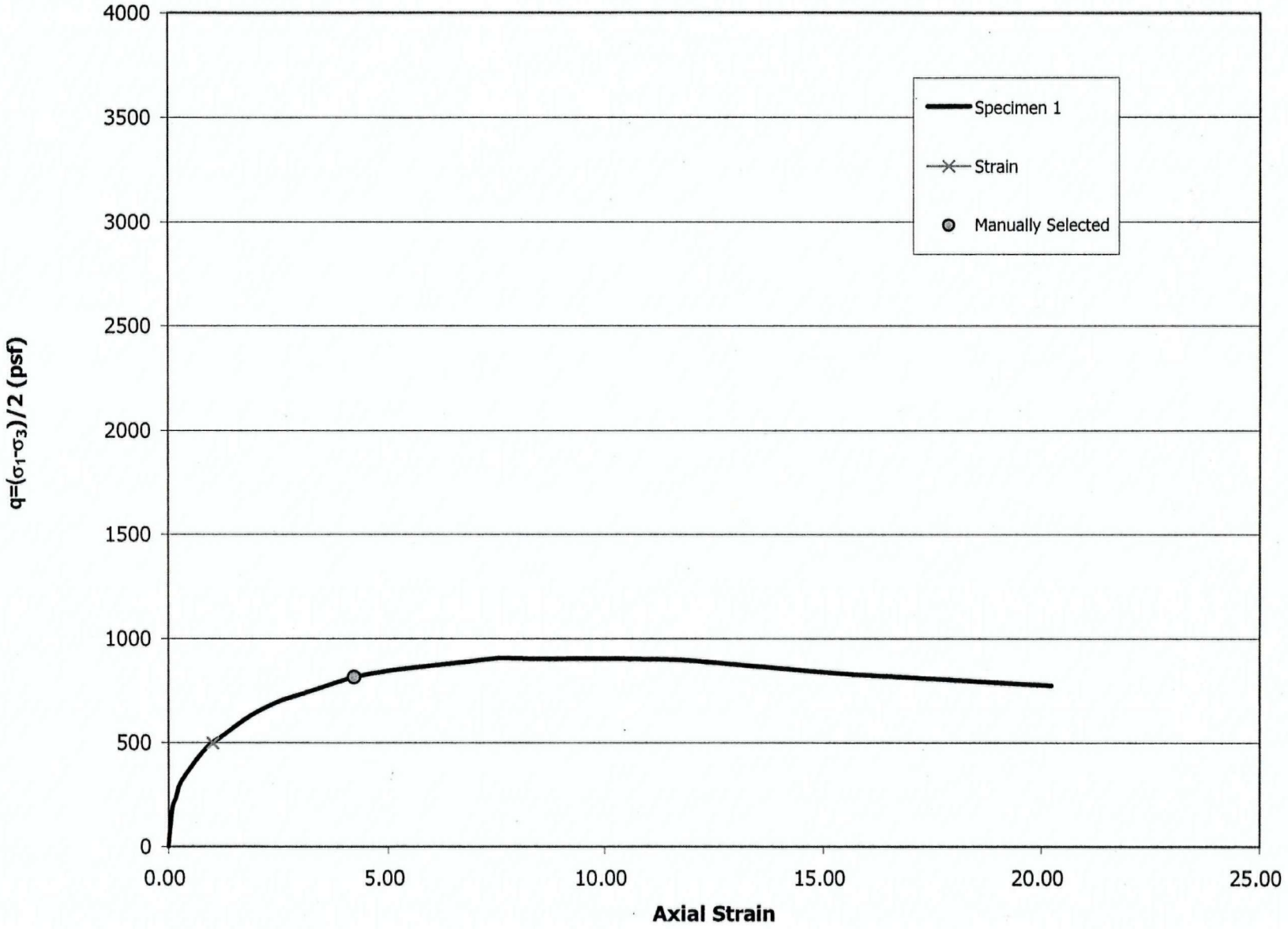
EB2 ST8

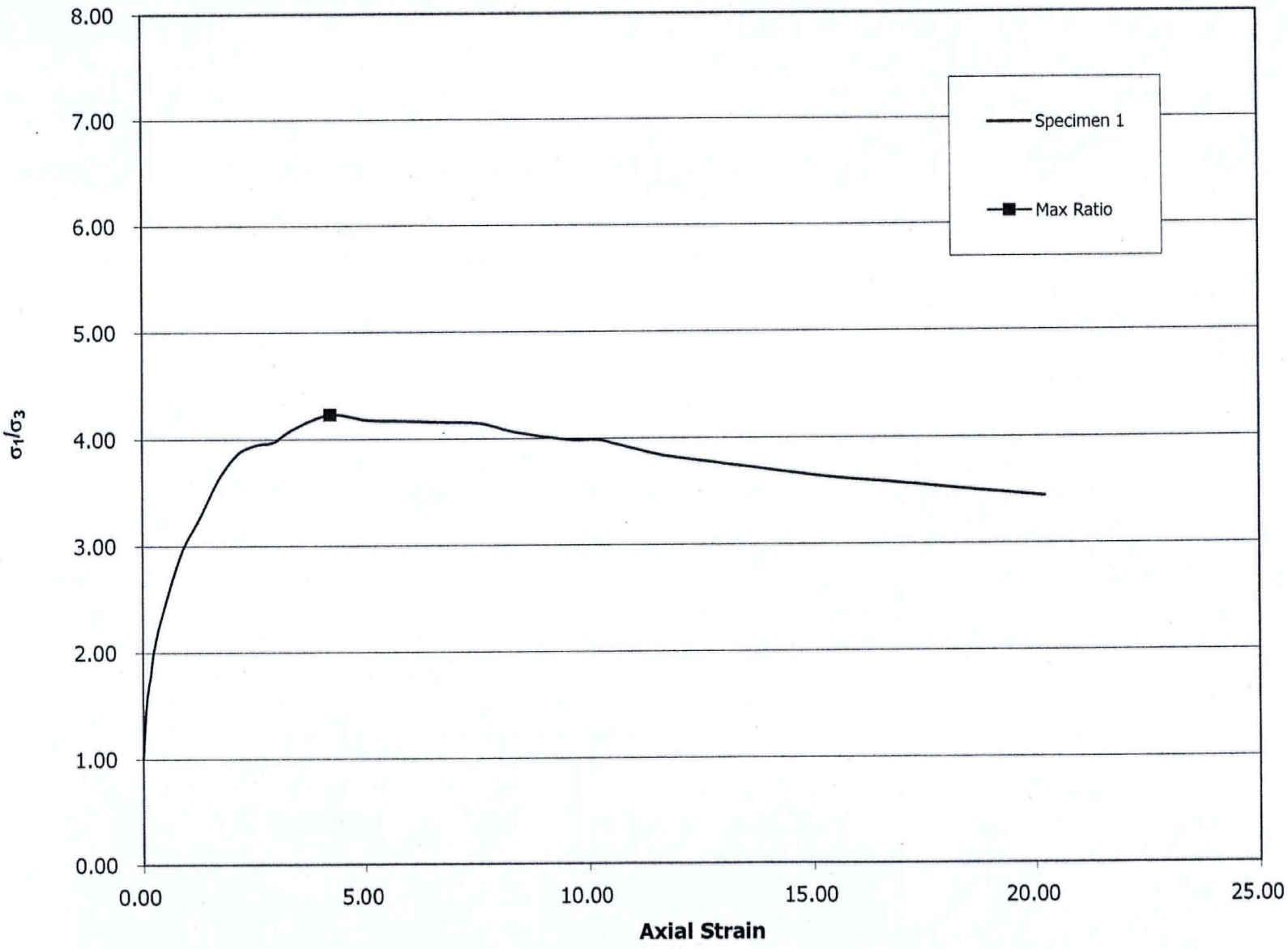
Strain Criteria: 1

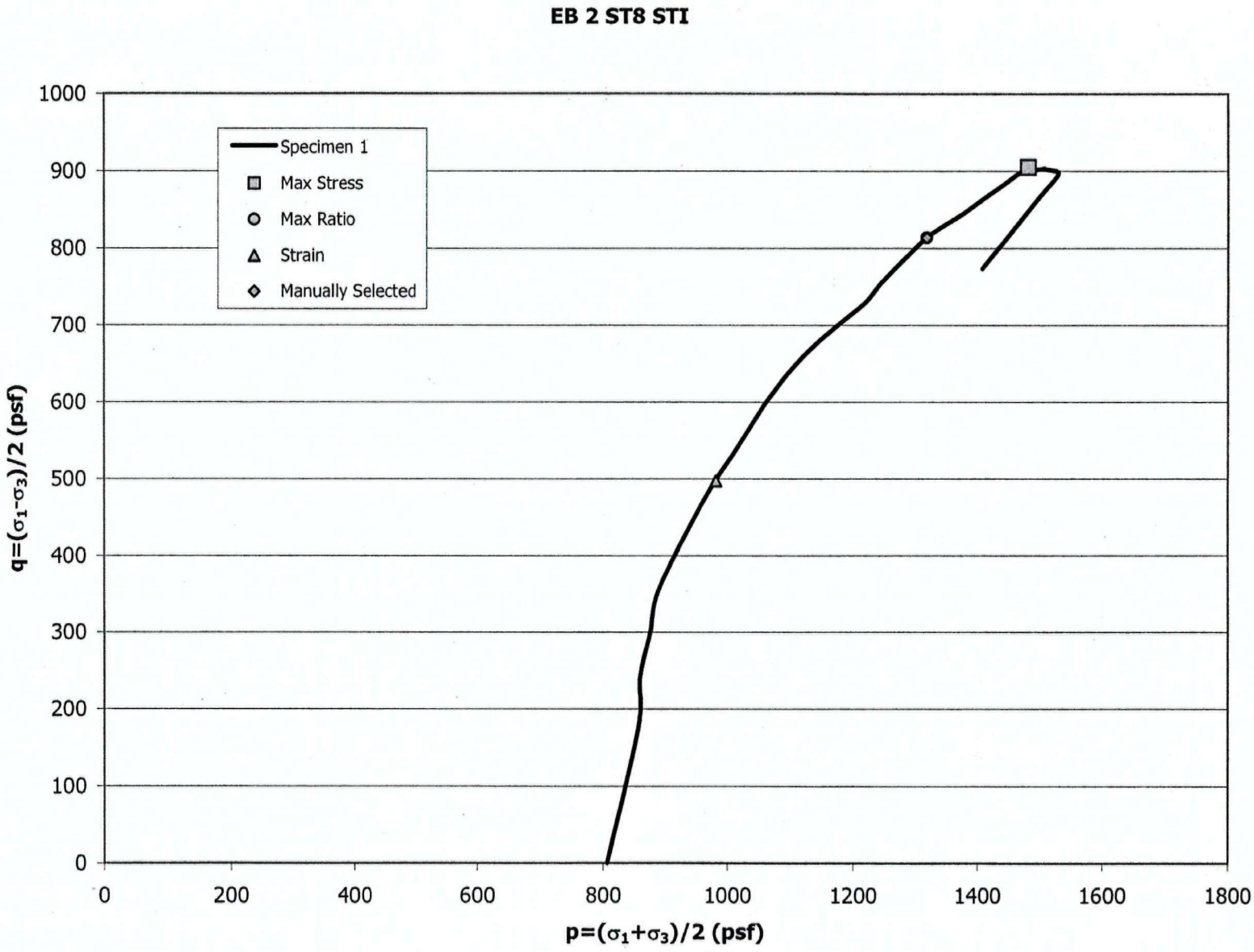
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	806.4	8	1481	905					
Max Ratio	806.4	4	1317	813	4.2				
Strain	806.4	1.0	981	497					
Manually Selected	806.4	4.2	1317.4	813.4					

Envelope

c (psf)	ϕ	0	181
190	18	8000	2653


4000
3500
3000
2500
2000
1500
1000
500
0
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
q=(σ1-σ3)/2 (psf)
Specimen 1
Strain
Manually Selected


8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
Specimen 1
Max Ratio


EB 2 ST8 STI
Specimen 1
Max Stress
Max Ratio
Strain
Manually Selected
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
0
100
200
300
400
500
600
700
800
900
1000
0
200
400
600
800
1000
1200
1400
1600
1800

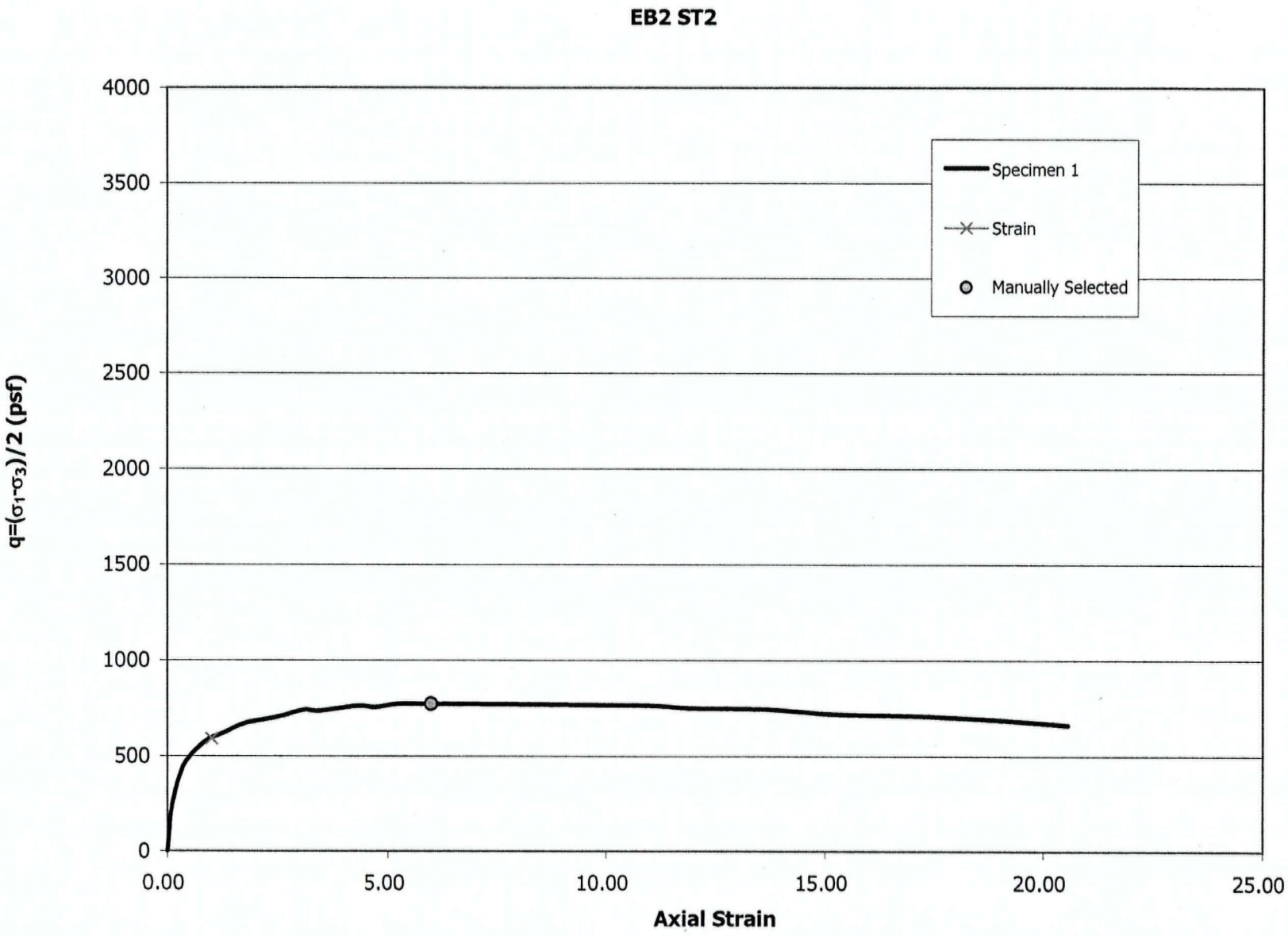
EB2 ST2

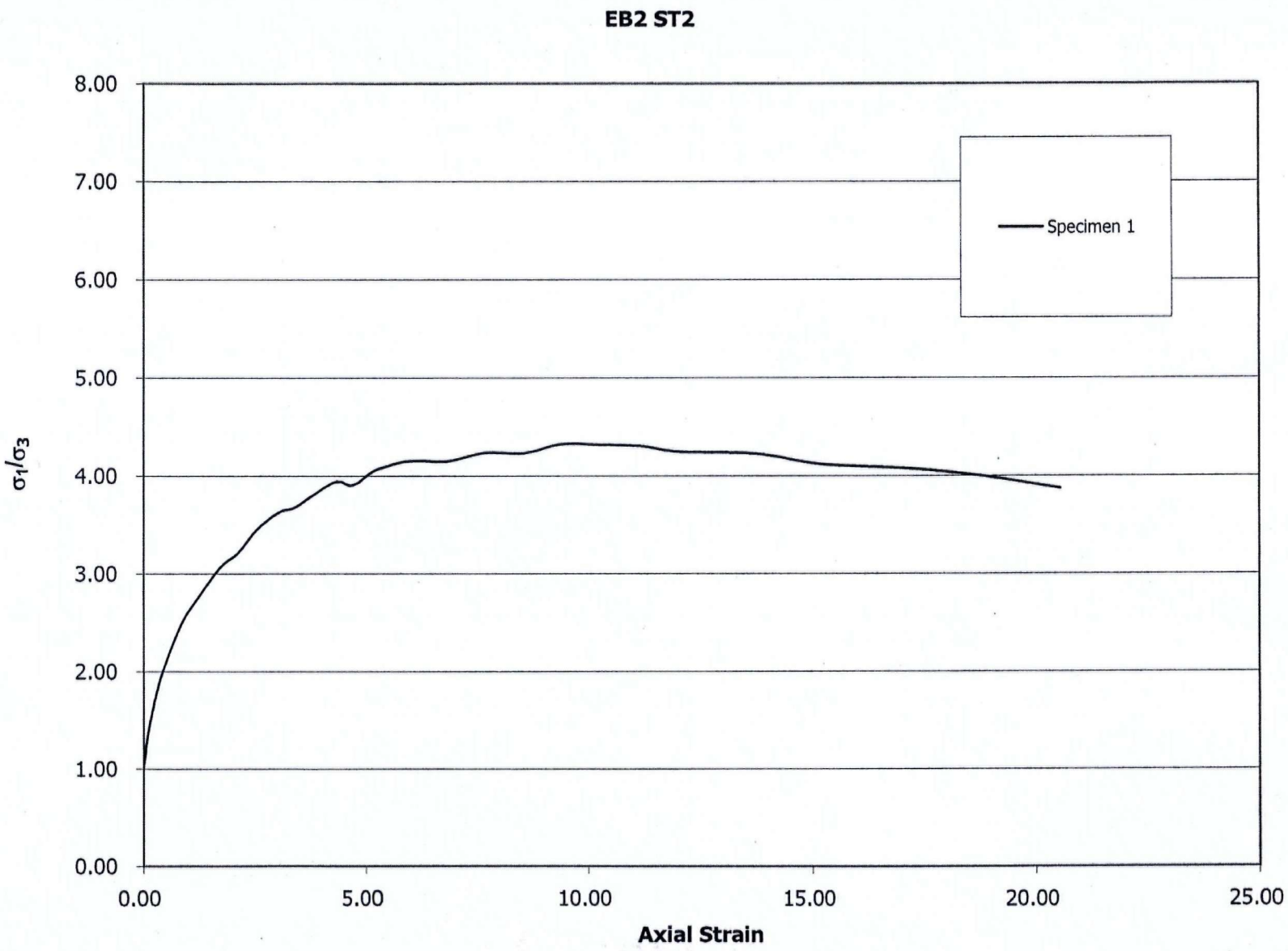
Strain Criteria: 1

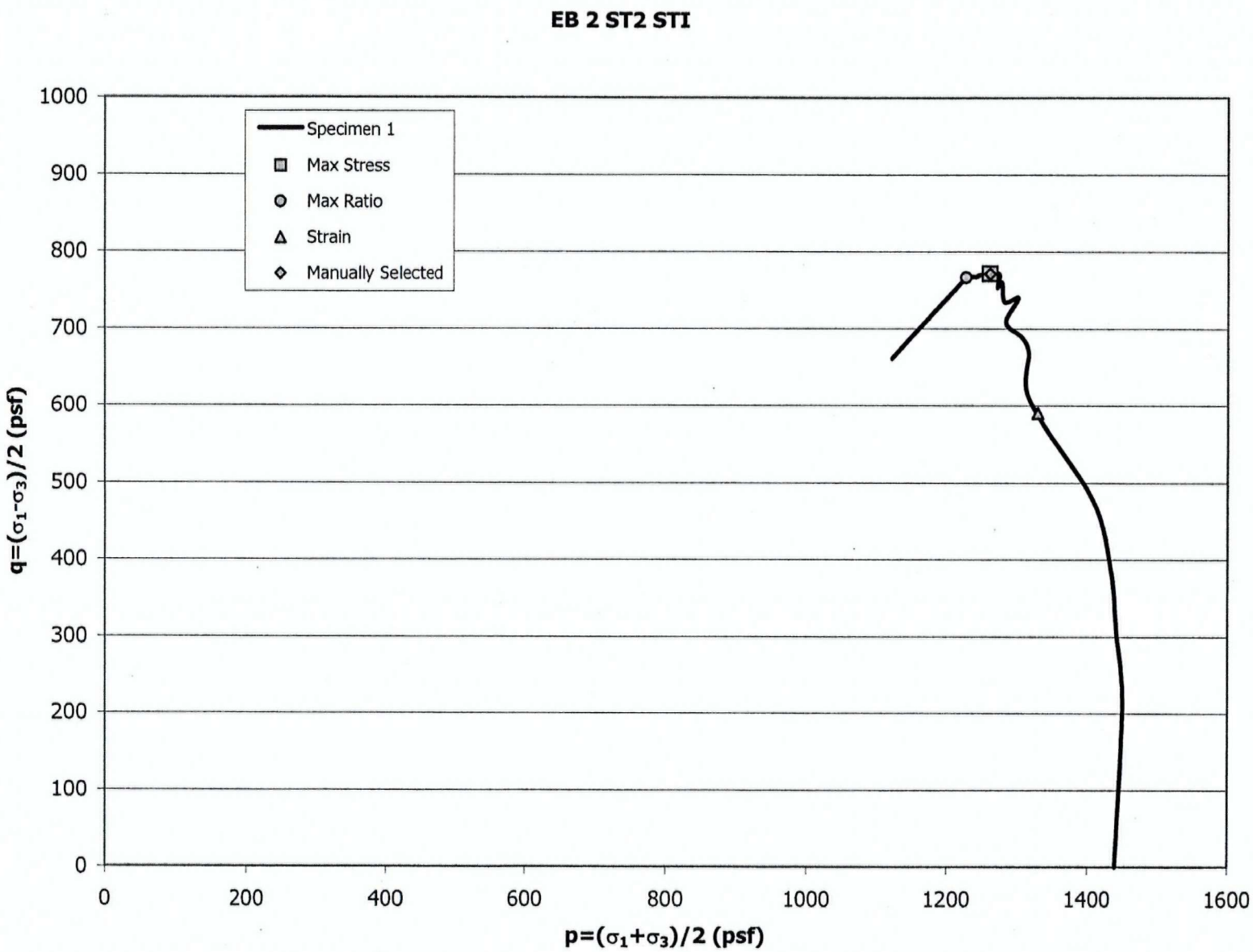
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1440	6	1261	771					
Max Ratio	1440		1227	766	4.3				
Strain	1440	1.0	1329	590					
Manually Selected	1440	6.0	1261	771					

Envelope

c (psf)	ϕ	0	181
190	18	8000	2653


EB2 ST2
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
q=(σ1-σ3)/2 (psf)
Specimen 1
Strain
Manually Selected


EB2 ST2
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
Specimen 1


EB 2 ST2 STI
Specimen 1
Max Stress
Max Ratio
Strain
Manually Selected
1000
900
800
700
600
500
400
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)

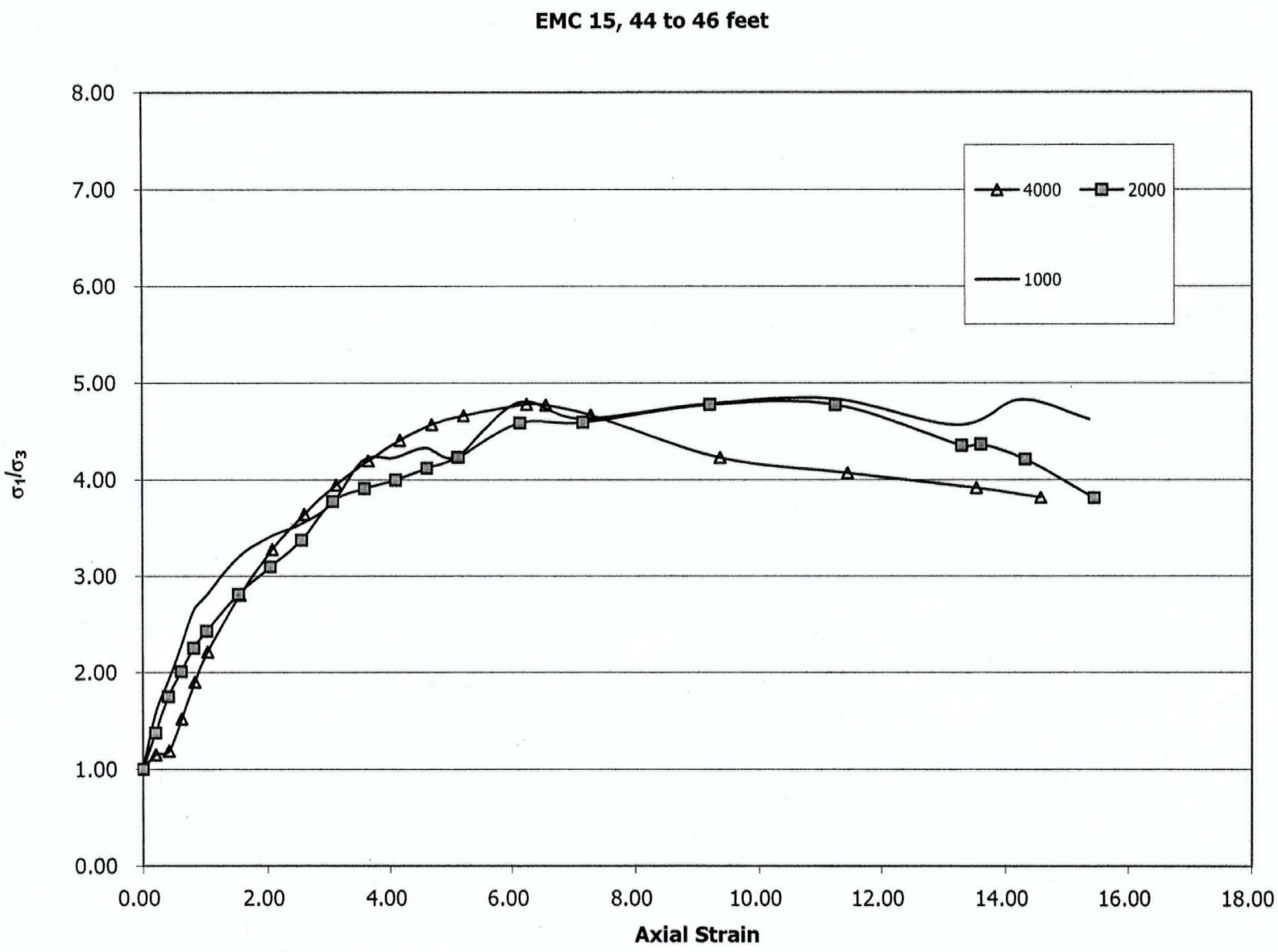
EM-C15 **44-46'**

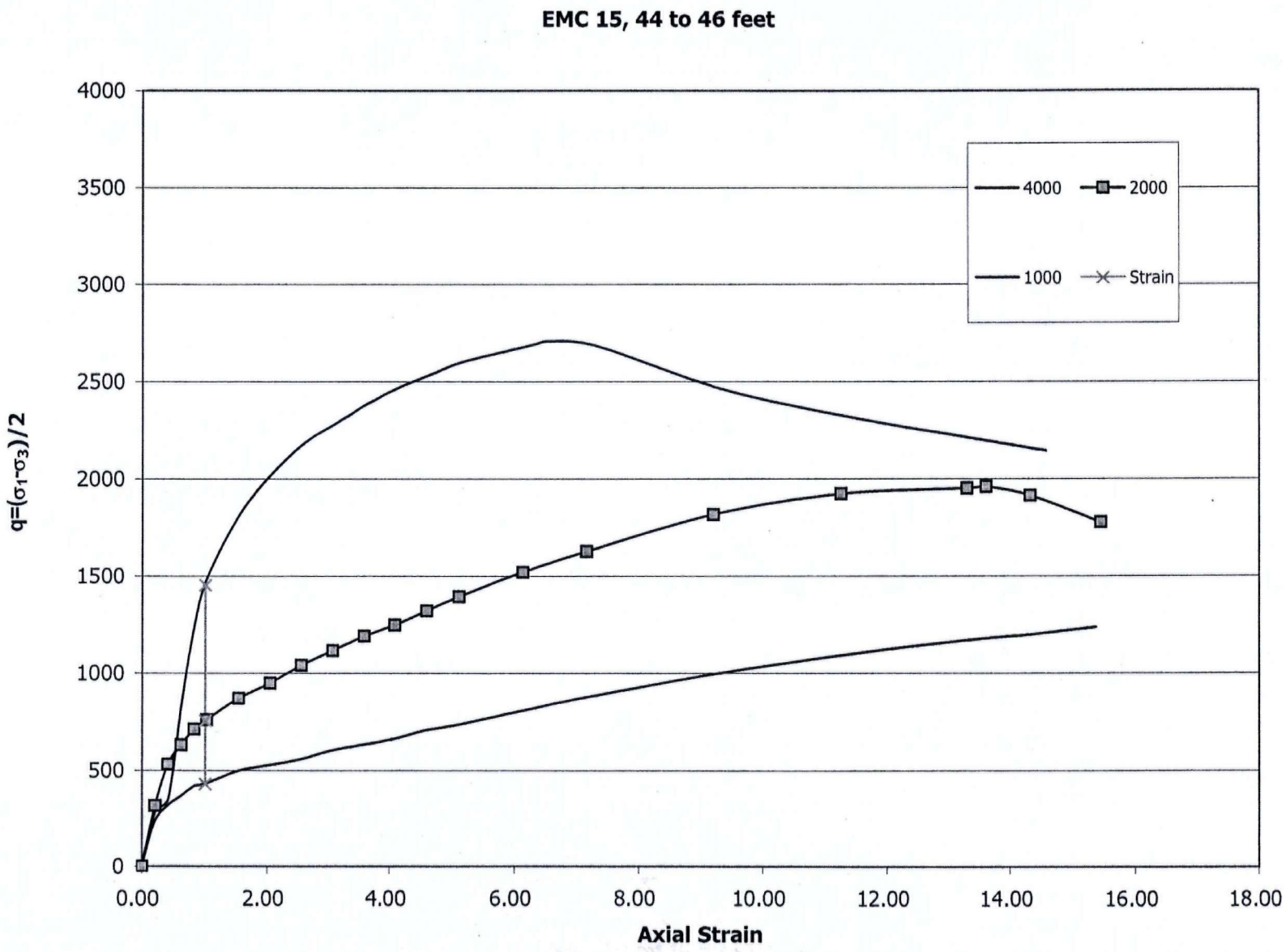
Strain Criteria: 1

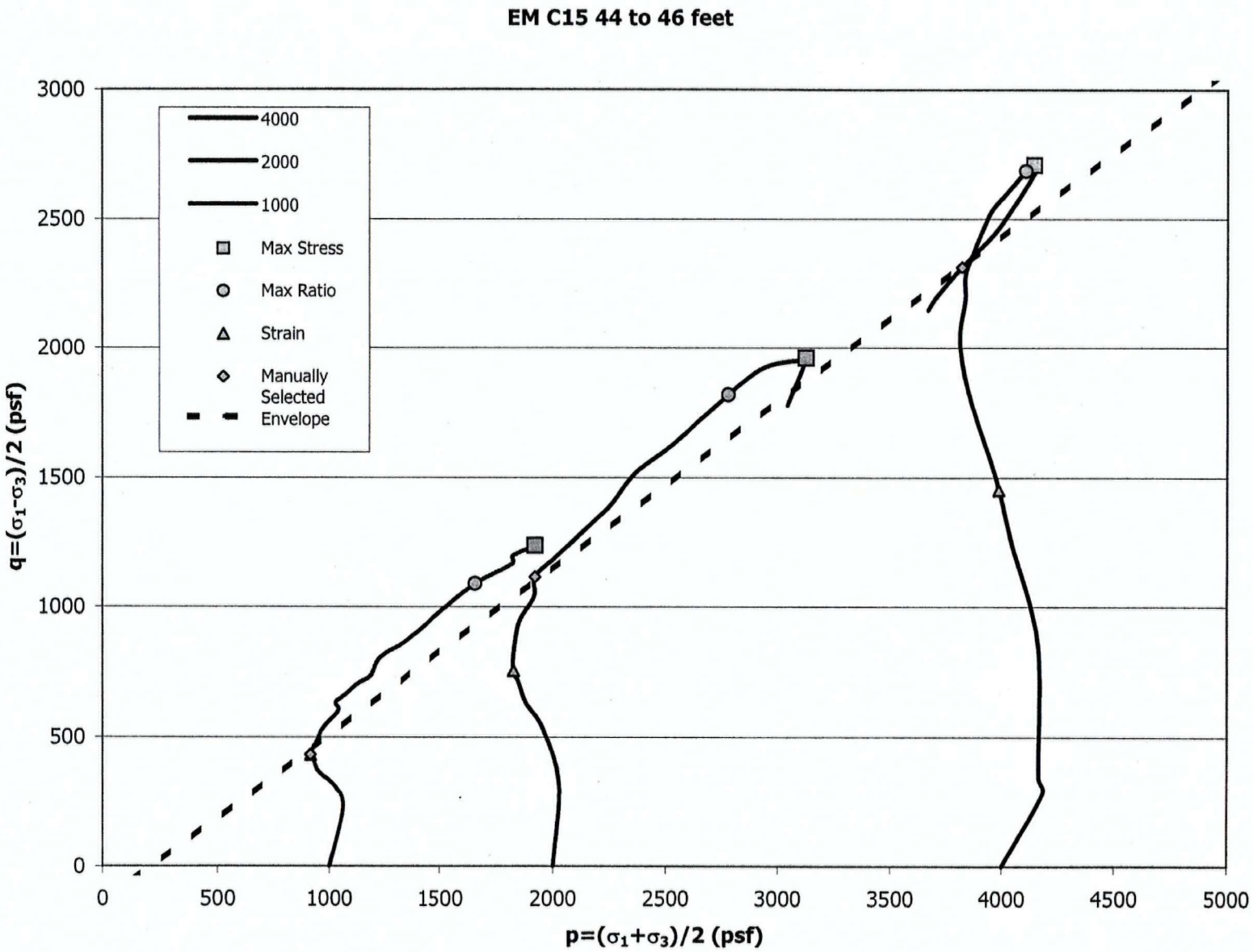
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1000		1920	1237		-51	0.66	-68	41.2
	2000		3125	1960					
	4000		4144	2708					
Max Ratio	1000		1657	1089	4.8	9	0.65	11	40.6
	2000		2781	1818	4.8				
	4000		4107	2685	4.8				
Strain	1000	1	915	431		106	0.35	114	20.8
	2000	1	1826	754					
	4000	1	3988	1451					
Manually Selected	1000	4.3	914	432		-143	0.64	-187	40.1
	2000	3.1	1921	1116					
	4000	11.5	3821	2312					

Envelope

c (psf)	ϕ		
		0	-143
-187	40	7000	4368


EMC 15, 44 to 46 feet
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain
4000
2000
1000


EMC 15, 44 to 46 feet
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain
q=(σ1-σ3)/2
4000
2000
1000
Strain


EM C15 44 to 46 feet
4000
2000
1000
Max Stress
Max Ratio
Strain
Manually Selected Envelope
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

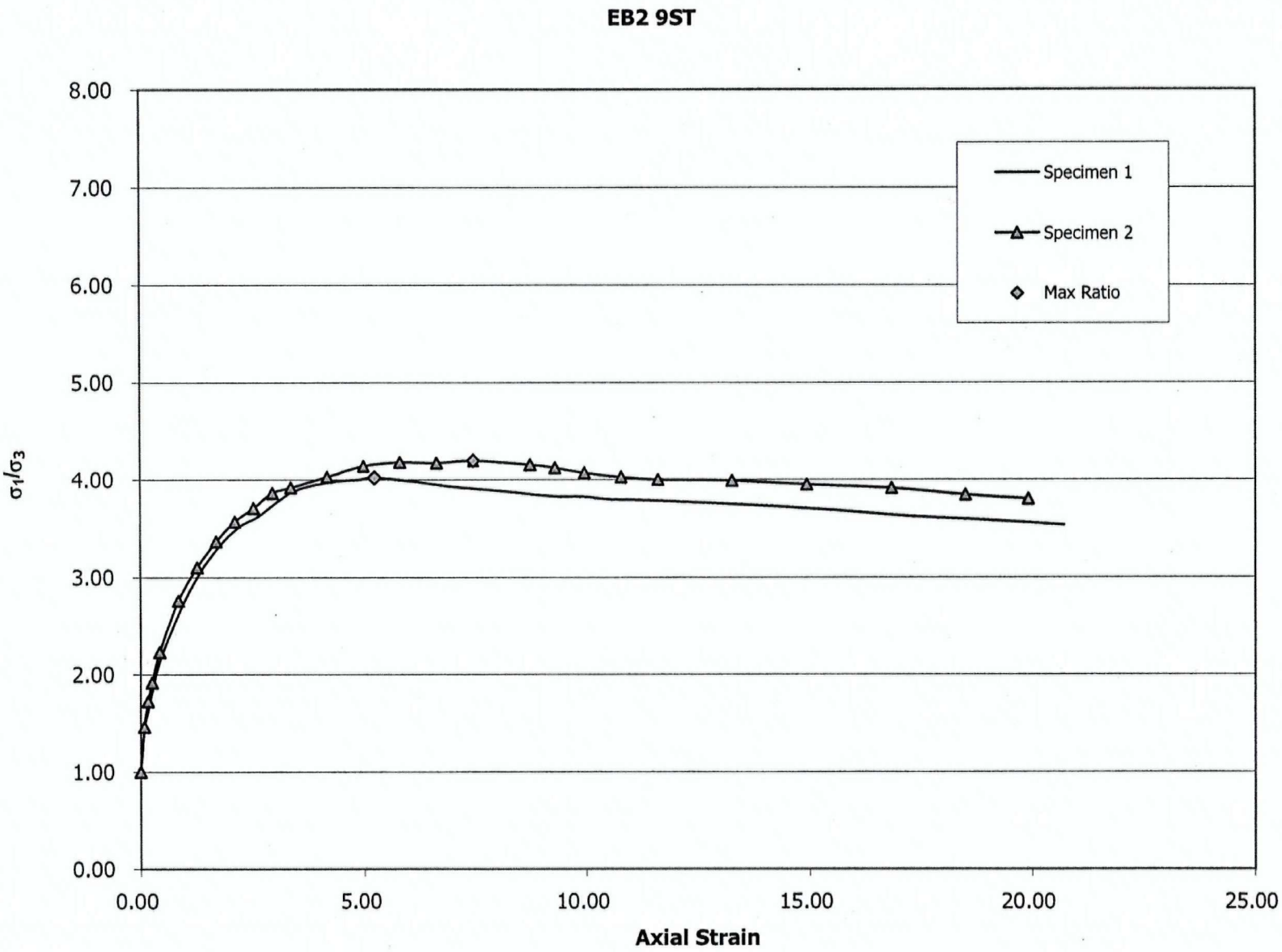
EB2 9ST

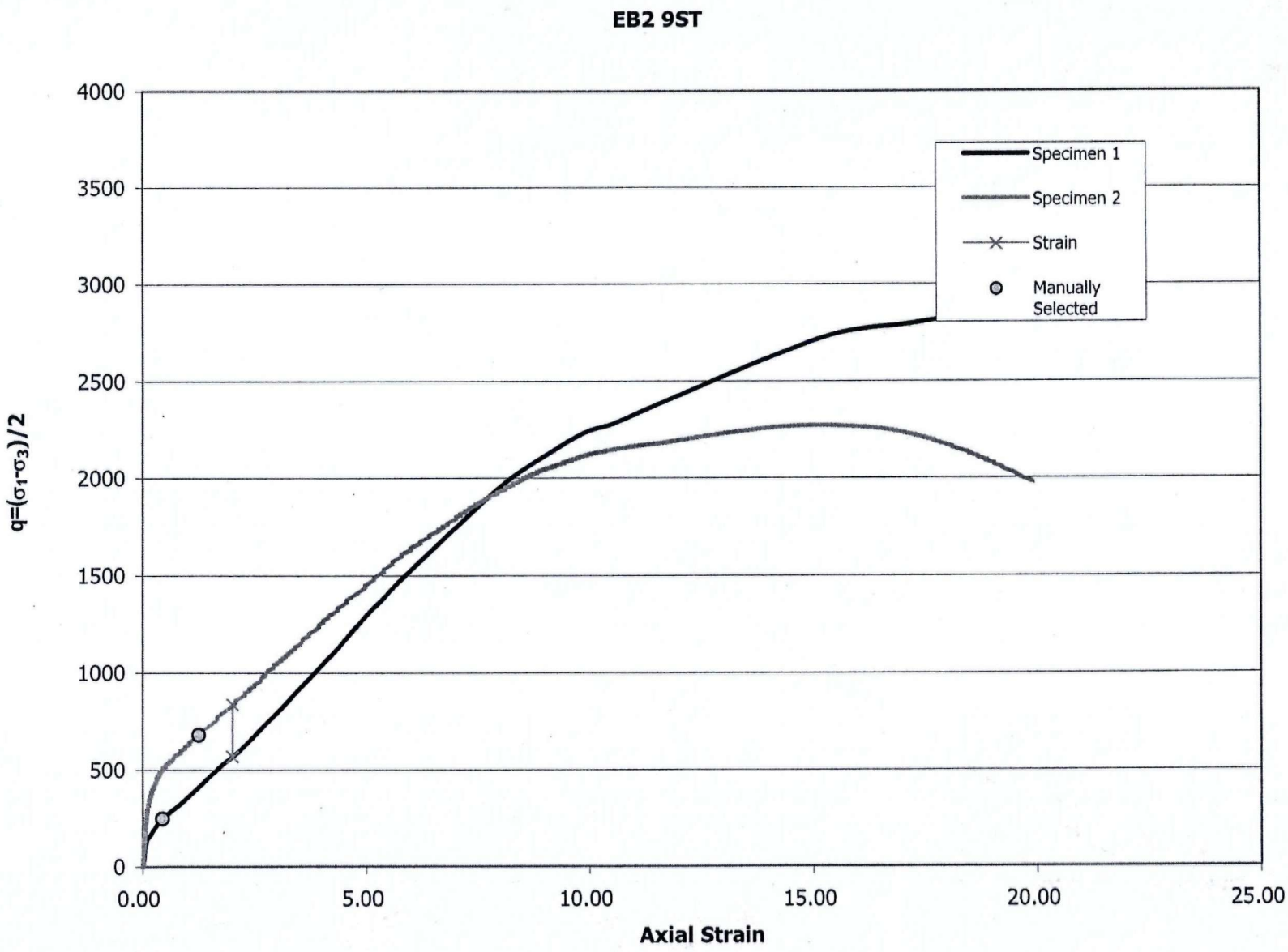
Strain Criteria: 2

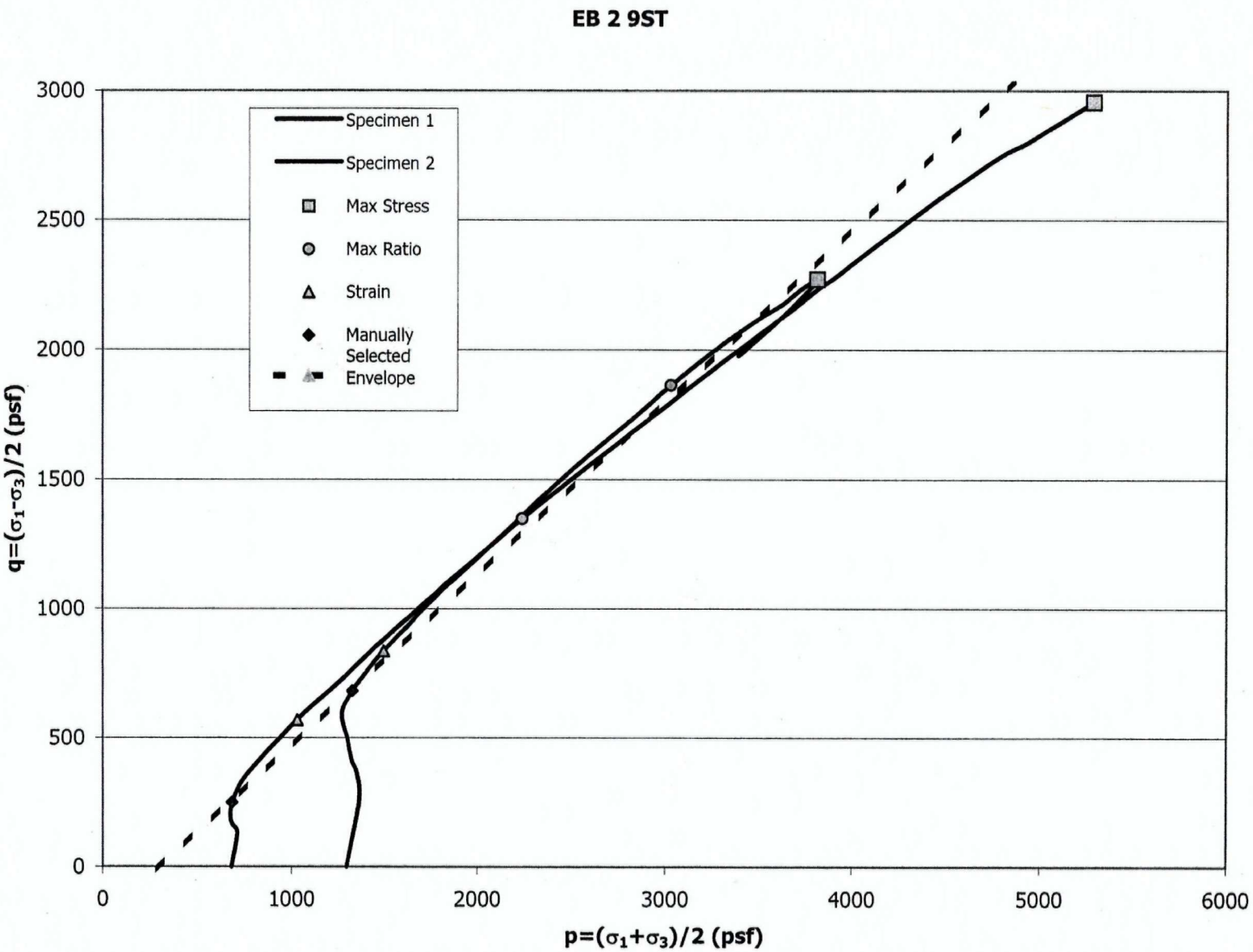
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	676.8		5287	2954		503	0.46	567	27.6
	1296		3810	2270					
Max Ratio	676.8	5	2240	1347	4.0	-116	0.65	-154	40.8
	1296	7	3029	1863	4.2				
Strain	676.8	2.0	1032	568		-29	0.58	-36	35.3
	1296	2.0	1495	835					
Manually Selected	676.8	0.4	680	248		-205	0.67	-275	41.8
	1296	1.2	1328	680					

Envelope

c (psf)	ϕ	0	-205
-275	41.8	8000	5128


EB2 9ST
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
Specimen 1
Specimen 2
Max Ratio


EB2 9ST
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
q=(σ1-σ3)/2
Specimen 1
Specimen 2
Strain
Manually Selected


EB 2 9ST
Specimen 1
Specimen 2
Max Stress
Max Ratio
Strain
Manually Selected Envelope
3000
2500
2000
1500
1000
500
0
0
1000
2000
3000
4000
5000
6000
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)

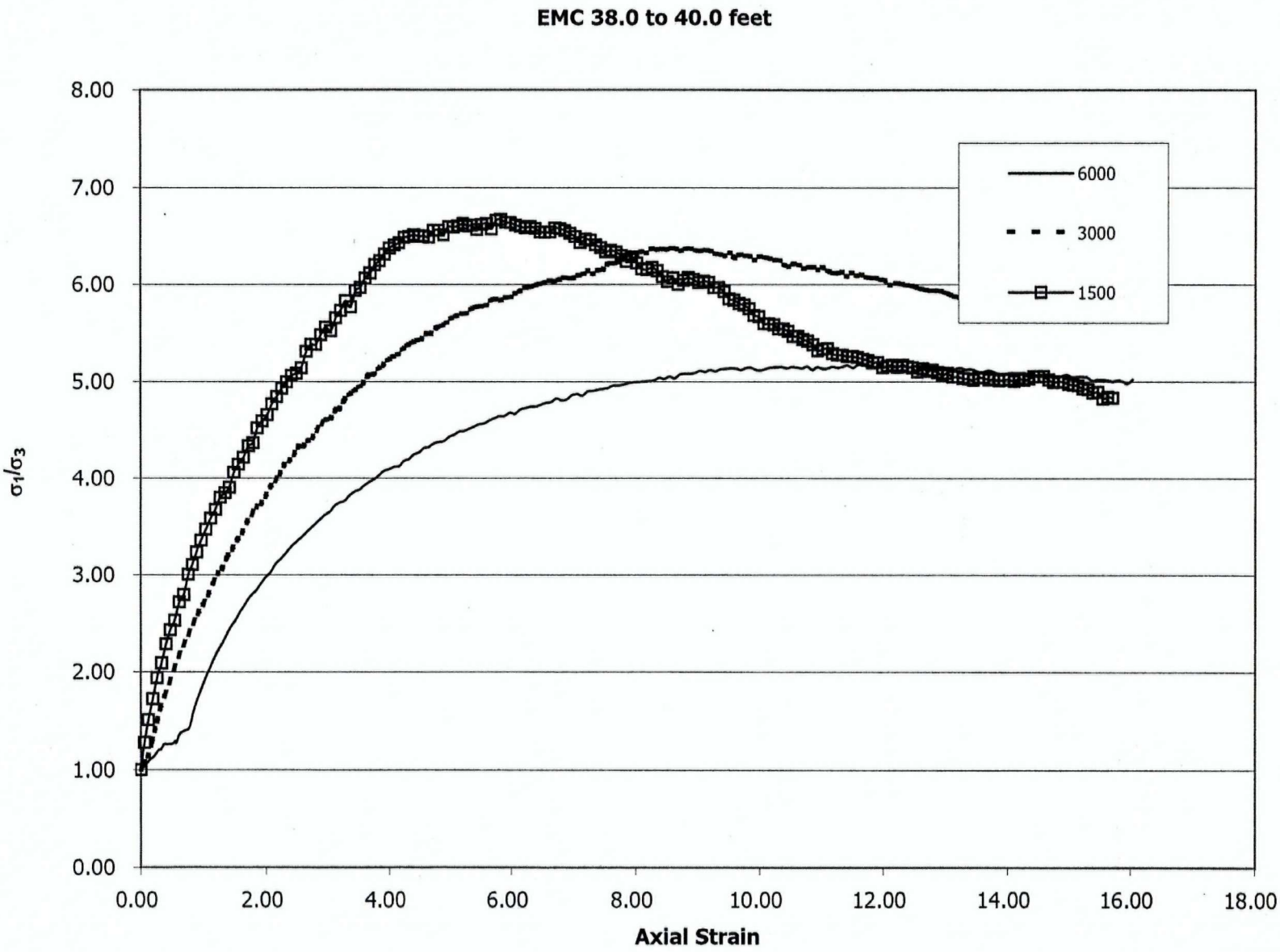
EMC 3 38.0 to 40.0 feet

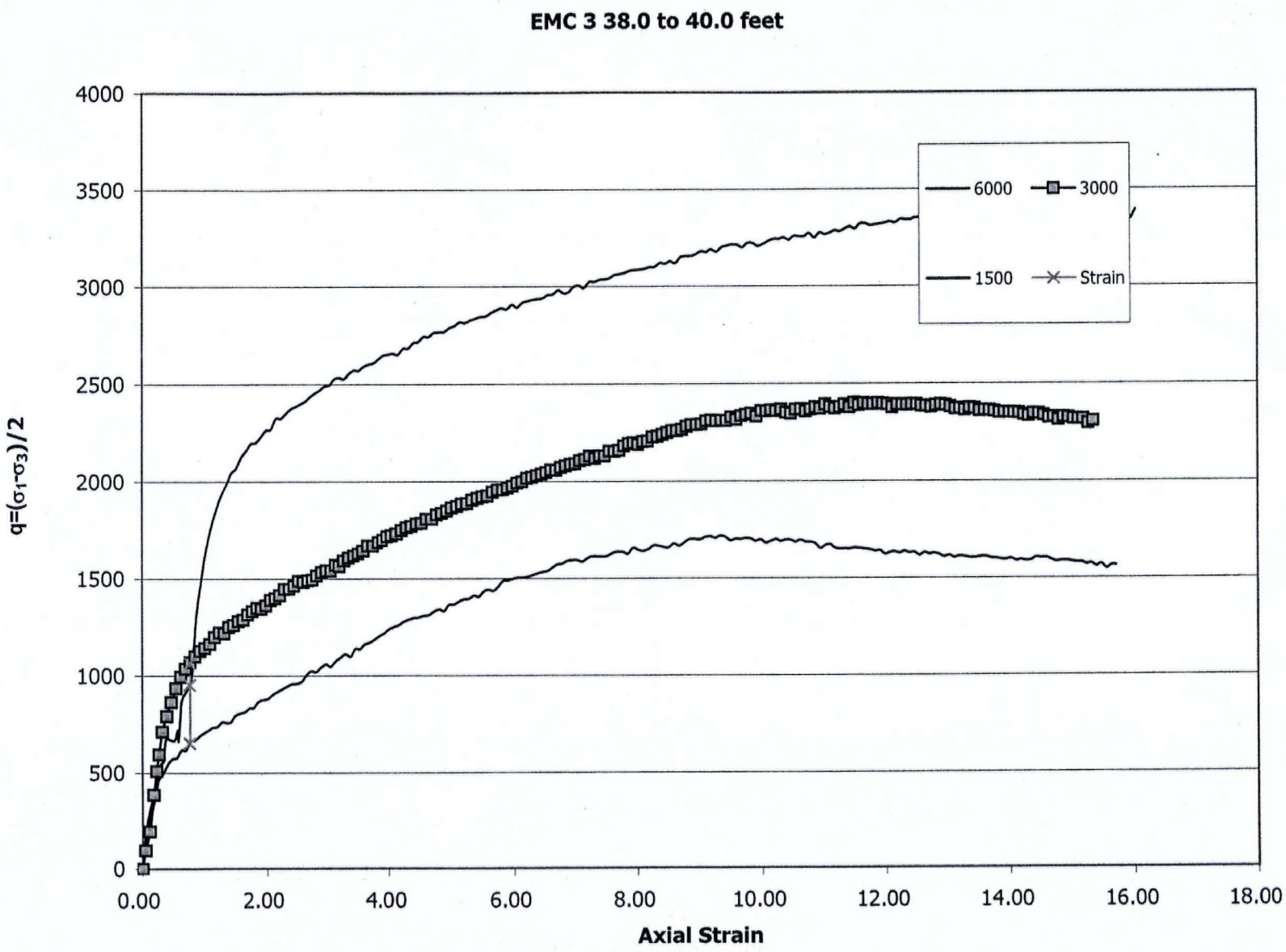
Strain Criteria: 0.75

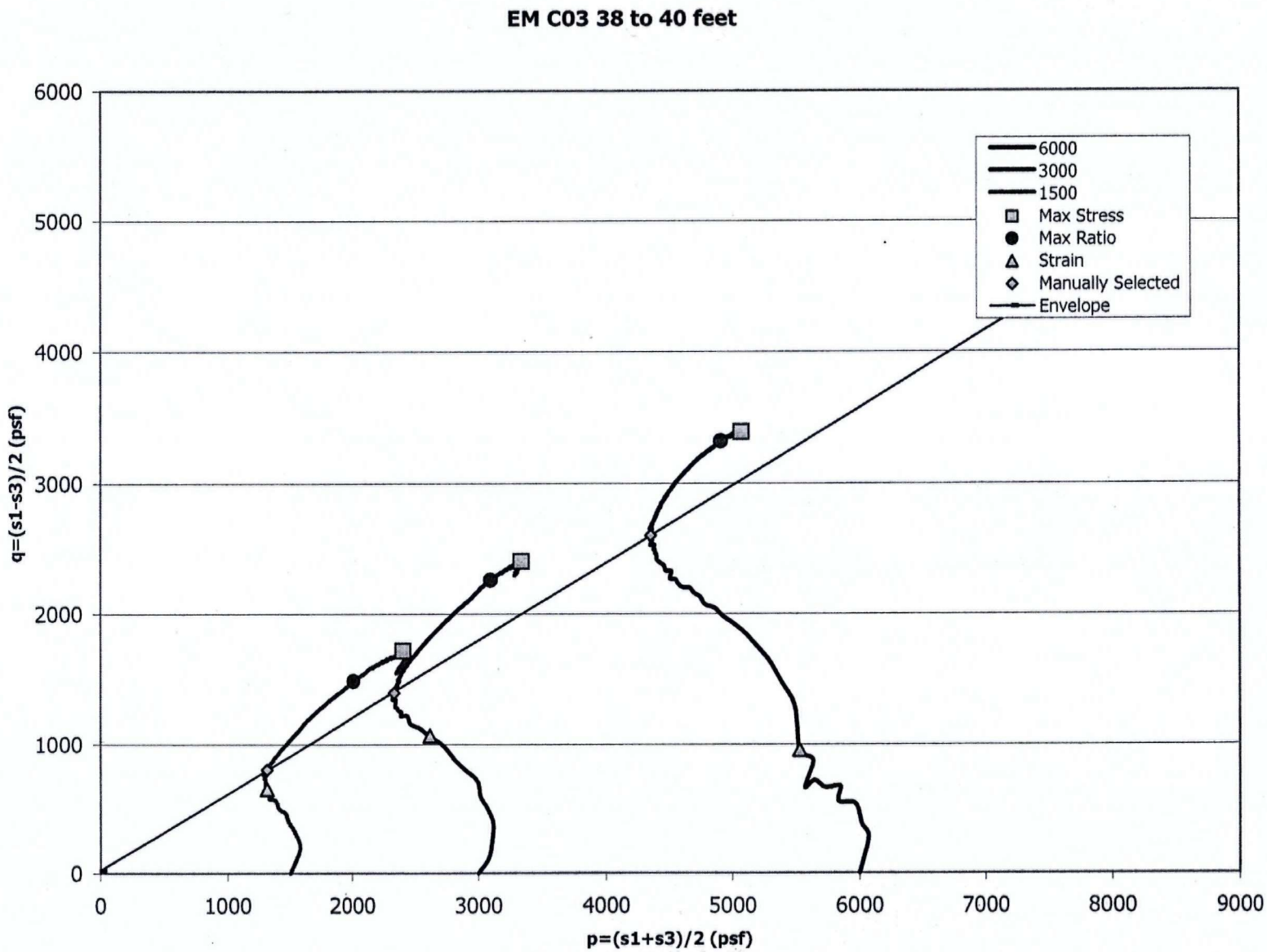
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
			0	266					
Max Stress	1500		2408	1716		266	0.62	339	38.3
	3000		3339	2401					
	6000		5074	3389					
Max Ratio	1500		2009	1486	6.7	260	0.63	334	38.8
	3000		3099	2258	6				
	6000		4913	3320	5				
Strain	1500	0.75	1314	652		238	0.32	250	18.4
	3000	0.75	2620	1065					
	6000	0.75	5530	954					
Manually Selected	1500	1.56	1315	803		21	0.59	26	36.3
	3000	2.14	2337	1396					
	6000	3.67	4356	2600					

Assumed Strength

c (psf)	ϕ	0	21
26	36	8000	4753


EMC 38.0 to 40.0 feet
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain
6000
3000
1500


EMC 3 38.0 to 40.0 feet
4000
3500
3000
2500
2000
1500
1000
500
0
q=(σ1-σ3)/2
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain
6000
3000
1500
Strain


EM C03 38 to 40 feet
6000
5000
4000
3000
2000
1000
0
q=(s1-s3)/2 (psf)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
p=(s1+s3)/2 (psf)
6000
3000
1500
Max Stress
Max Ratio
Strain
Manually Selected
Envelope

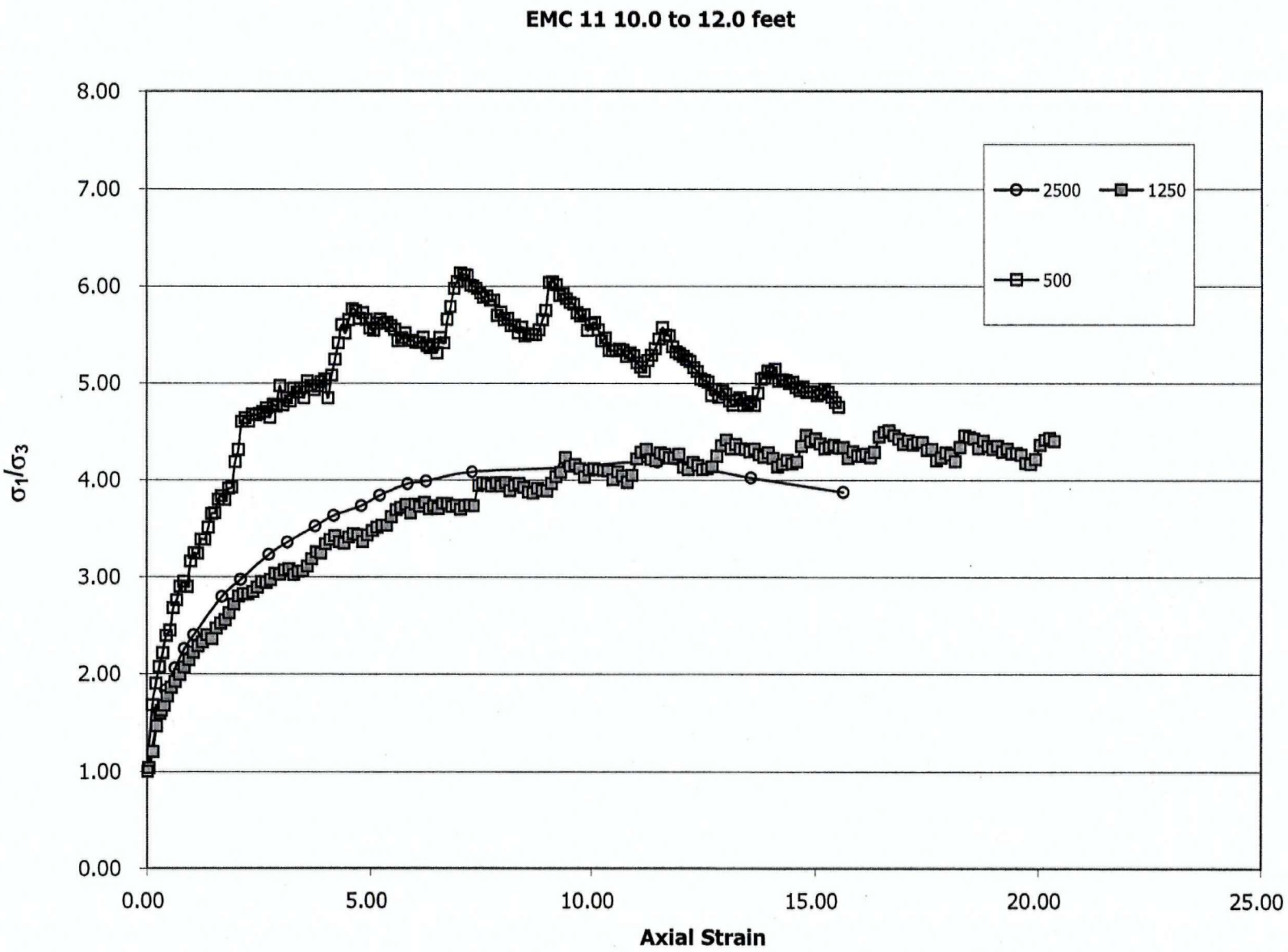
EM-C11 10-12'

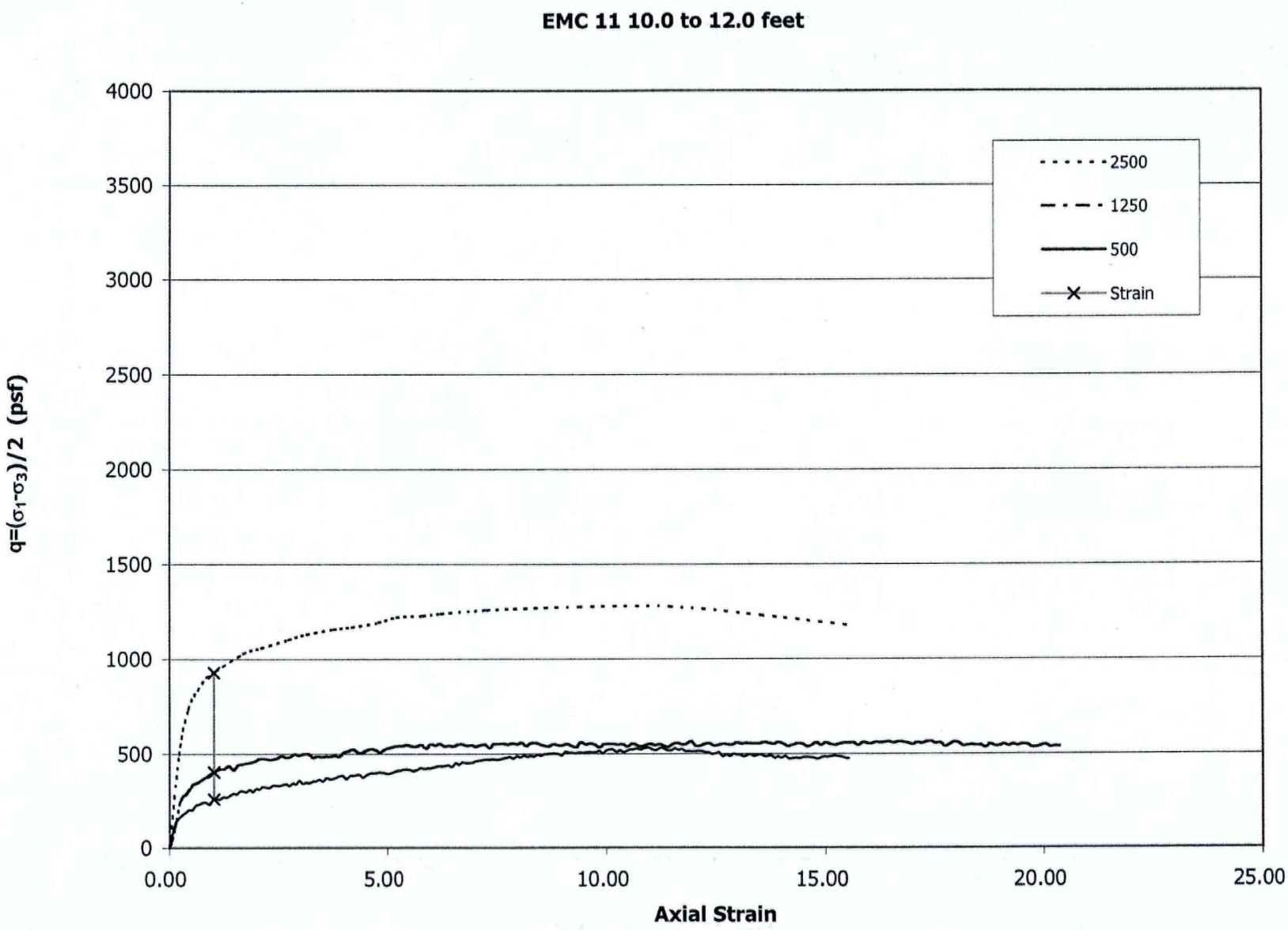
Strain Criteria: 1

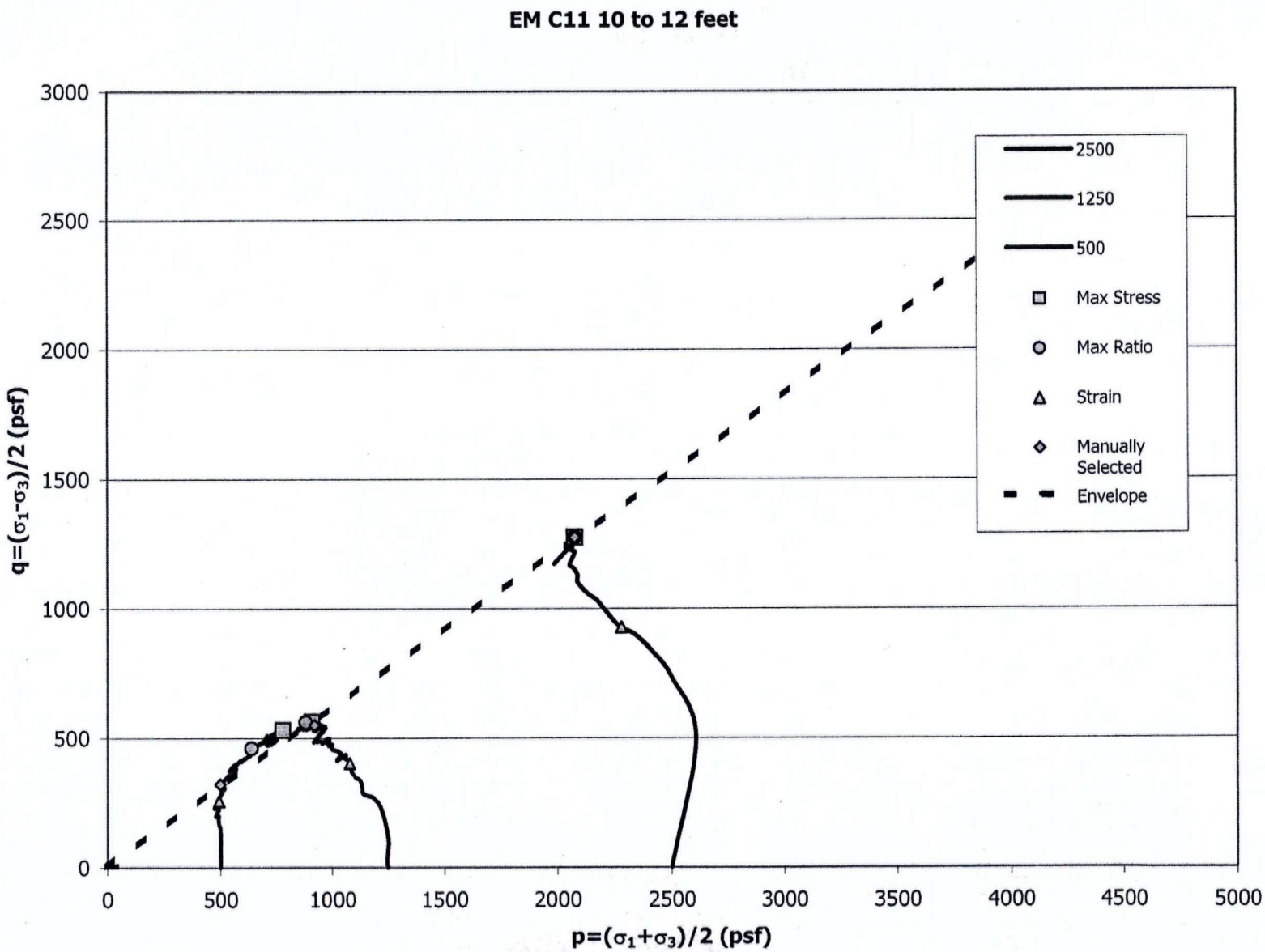
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	500		779	531		52	0.59	64	36.0
	1250		908	563					
	2500		2077	1276					
Max Ratio	500		640	460	6.1	74	0.58	90	35.3
	1250		882	561	4.5				
	2500		2077	1276	4.2				
Strain	500	1.0	493	258		37	0.38	40	22.6
	1250	1.0	1076	403					
	2500	1.0	2281	927					
Manually Selected	500	2.2	499	322		5	0.61	7	38
	1250	9.1	921	550					
	2500	11.5	2077	1276					

Envelope

c (psf)	ϕ	0	5
7	38	4000	2444


EMC 11 10.0 to 12.0 feet
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
2500
1250
500


EMC 11 10.0 to 12.0 feet
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
q=(σ1-σ3)/2 (psf)
2500
1250
500
Strain


EM C11 10 to 12 feet
3000
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
2500
1250
500
Max Stress
Max Ratio
Strain
Manually Selected
Envelope

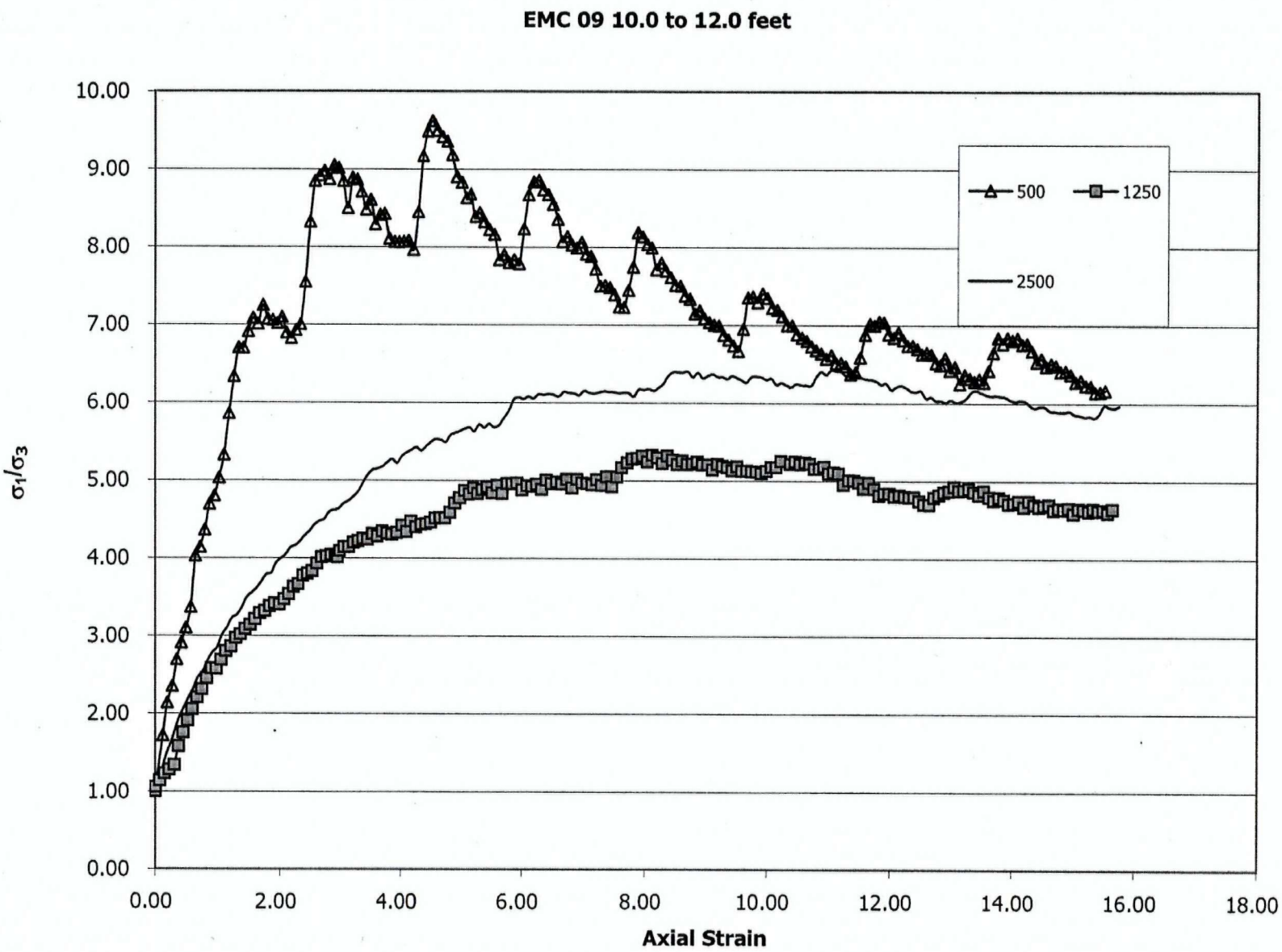
EM-C09 **10.0-12.0'**

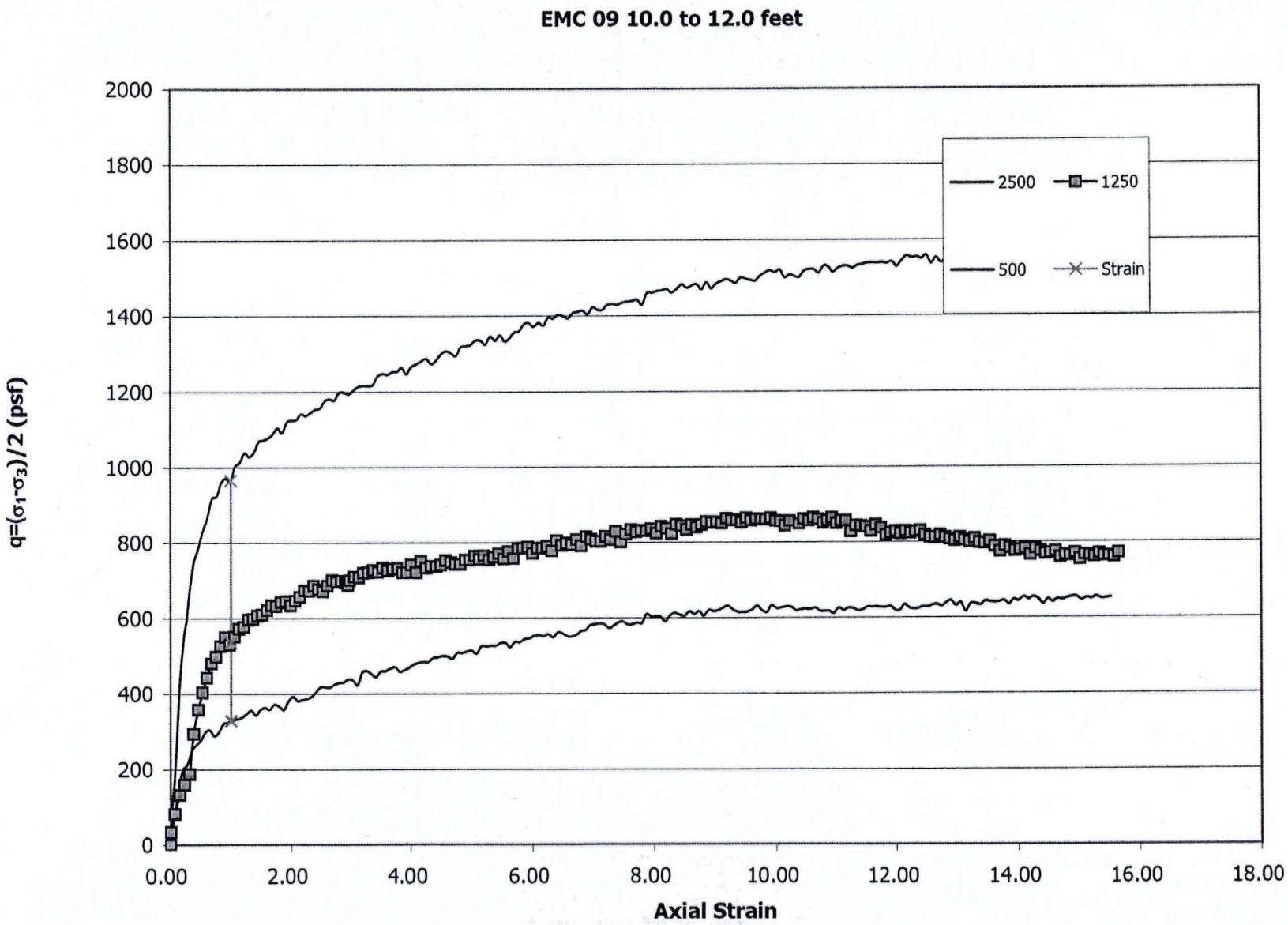
Strain Criteria: 1

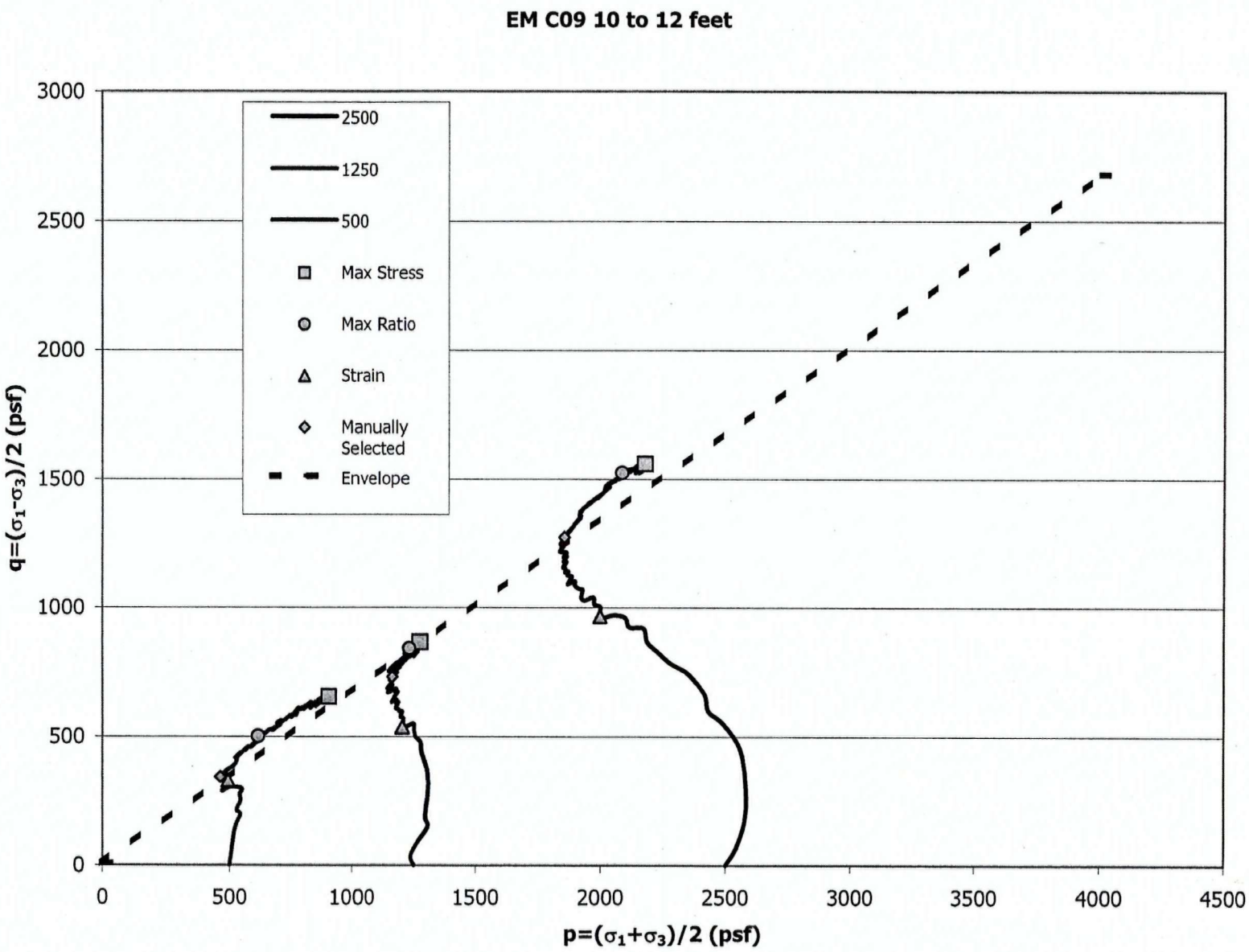
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	500		904	653		-21	0.72	-31	46.2
	1250		1273	865					
	2500		2179	1560					
Max Ratio	500		617	501	9.6	34	0.70	47	44.7
	1250		1231	842	5.3				
	2500		2087	1525	6.4				
Strain	500	1.0	495	329		86	0.43	95	25.2
	1250	1.0	1202	537					
	2500	1.0	1998	965					
Manually Selected	500	1.4	464	343		7	0.67	10	41.9
	1250	4.3	1164	732					
	2500	4.3	1854	1273					

Envelope

c (psf)	ϕ	0	7
10	41.9	4000	2681


EMC 09 10.0 to 12.0 feet
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain
500
1250
2500


EMC 09 10.0 to 12.0 feet
2500
1250
500
Strain
q=(σ1-σ3)/2 (psf)
Axial Strain
0
200
400
600
800
1000
1200
1400
1600
1800
2000
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00


EM C09 10 to 12 feet
2500
1250
500
Max Stress
Max Ratio
Strain
Manually Selected
Envelope
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
0
500
1000
1500
2000
2500
3000
3500
4000
4500

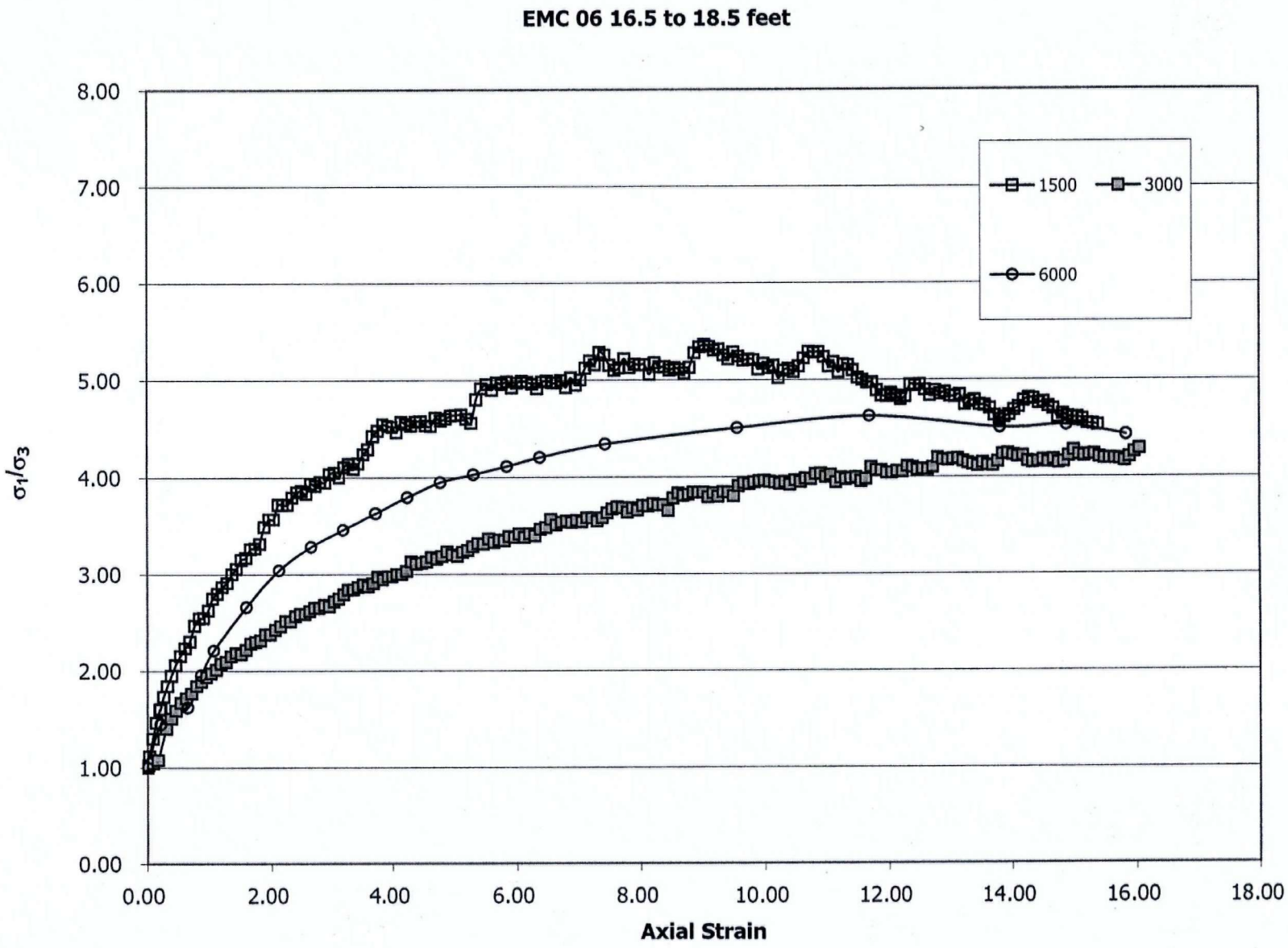
EM-CO6 **16.5-18.5'**

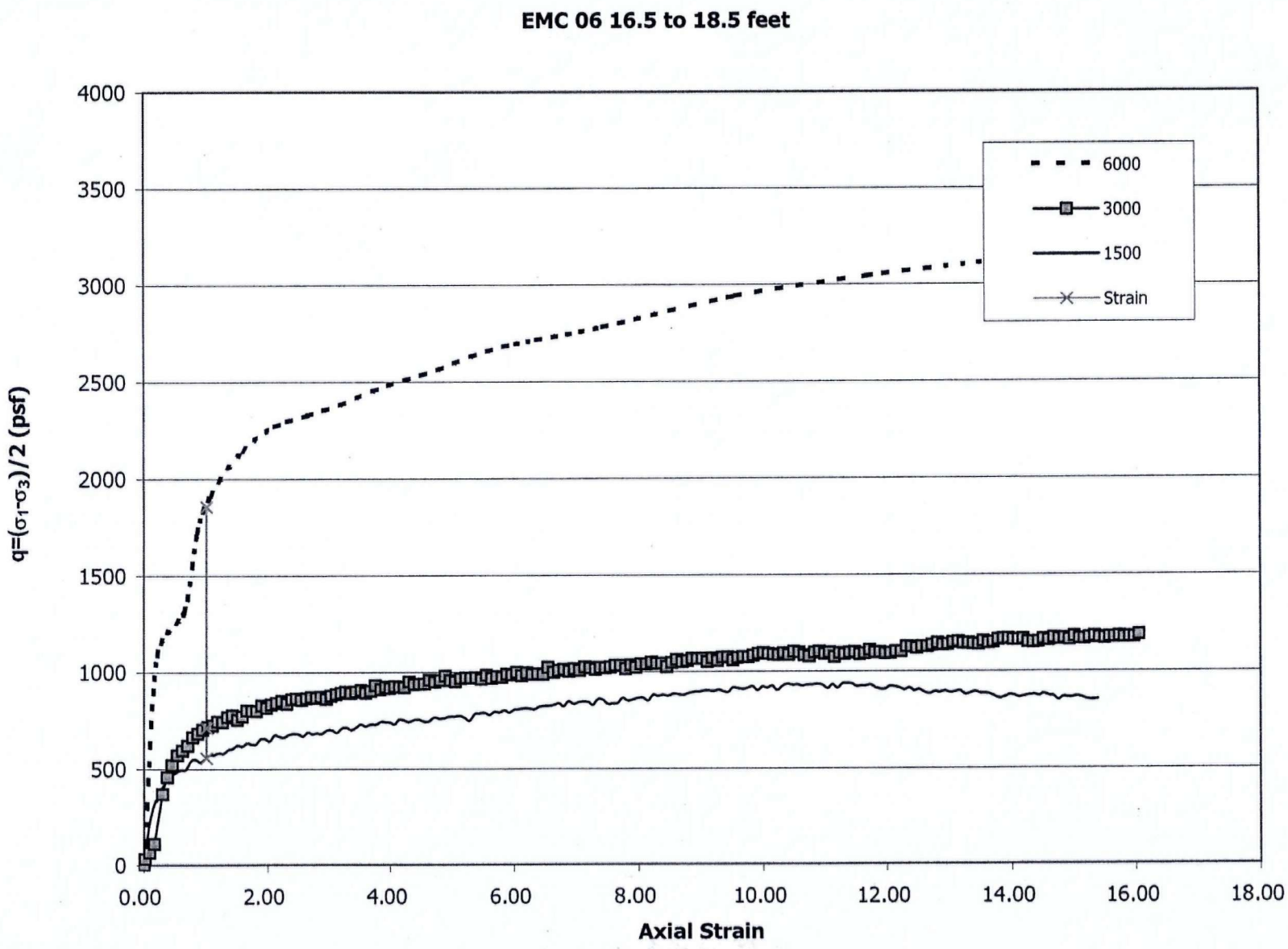
Strain Criteria: 1

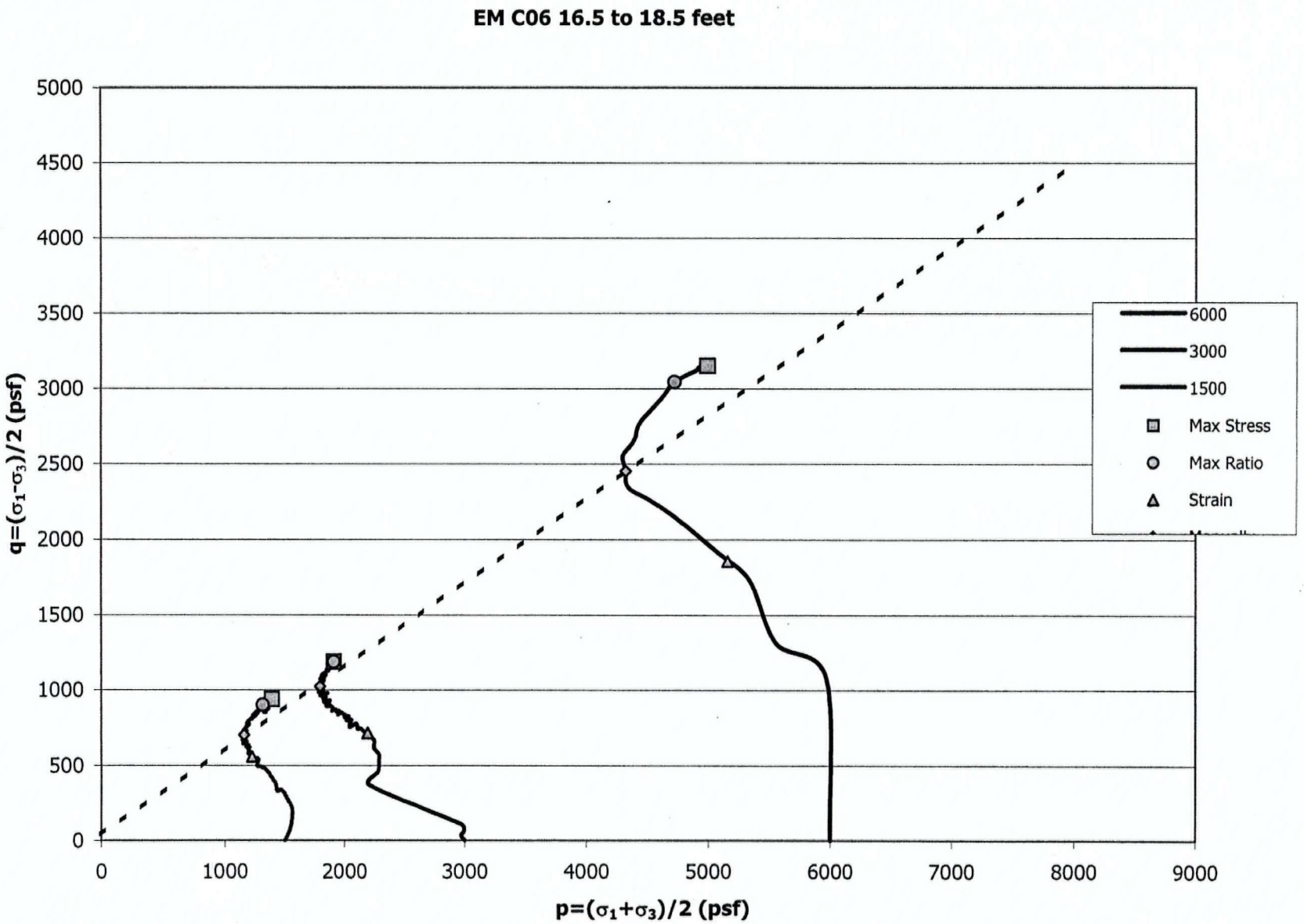
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1500		1391	938		38	0.62	48	38.5
	3000		1909	1187					
	6000		4989	3150					
Max Ratio	1500		1314	901	5.4	20	0.64	26	39.6
	3000		1909	1187	4.3				
	6000		4722	3042	4.6				
Strain	1500	1	1224	558		61	0.34	65	20.1
	3000	1	2190	713					
	6000	1	5153	1857					
Manually Selected	1500	3.36	1157	702		42	0.56	51	33.9
	3000	8.45	1796	1024					
	6000	3.72	4321	2454					

Envelope

c (psf)	ϕ	0	42
51	33.9	8000	4500


EMC 06 16.5 to 18.5 feet
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain
1500
3000
6000


EMC 06 16.5 to 18.5 feet
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Axial Strain
q=(σ1-σ3)/2 (psf)
6000
3000
1500
Strain


EM C06 16.5 to 18.5 feet
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
6000
3000
1500
Max Stress
Max Ratio
Strain

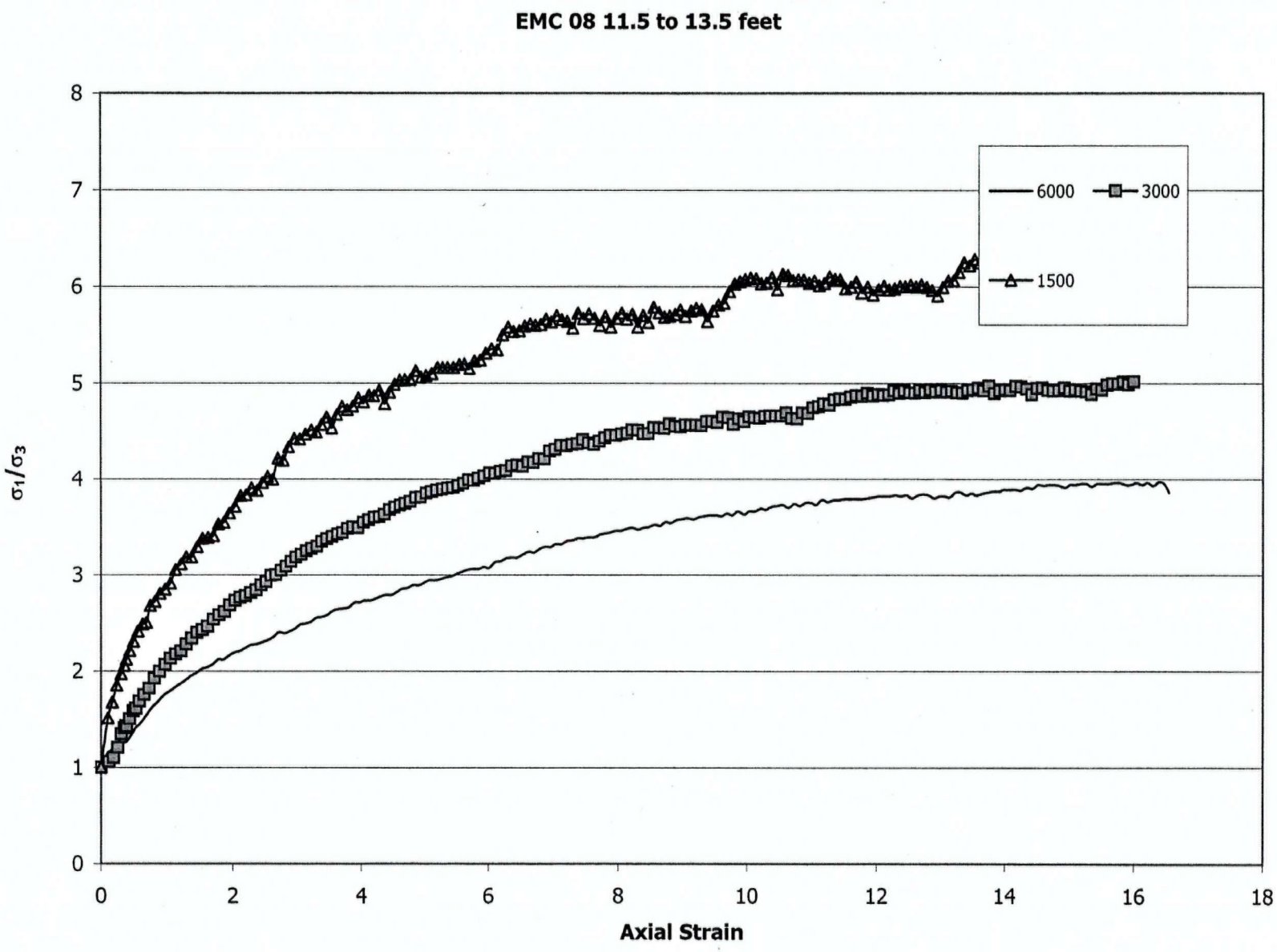
EM-C08 11.5-13.5'

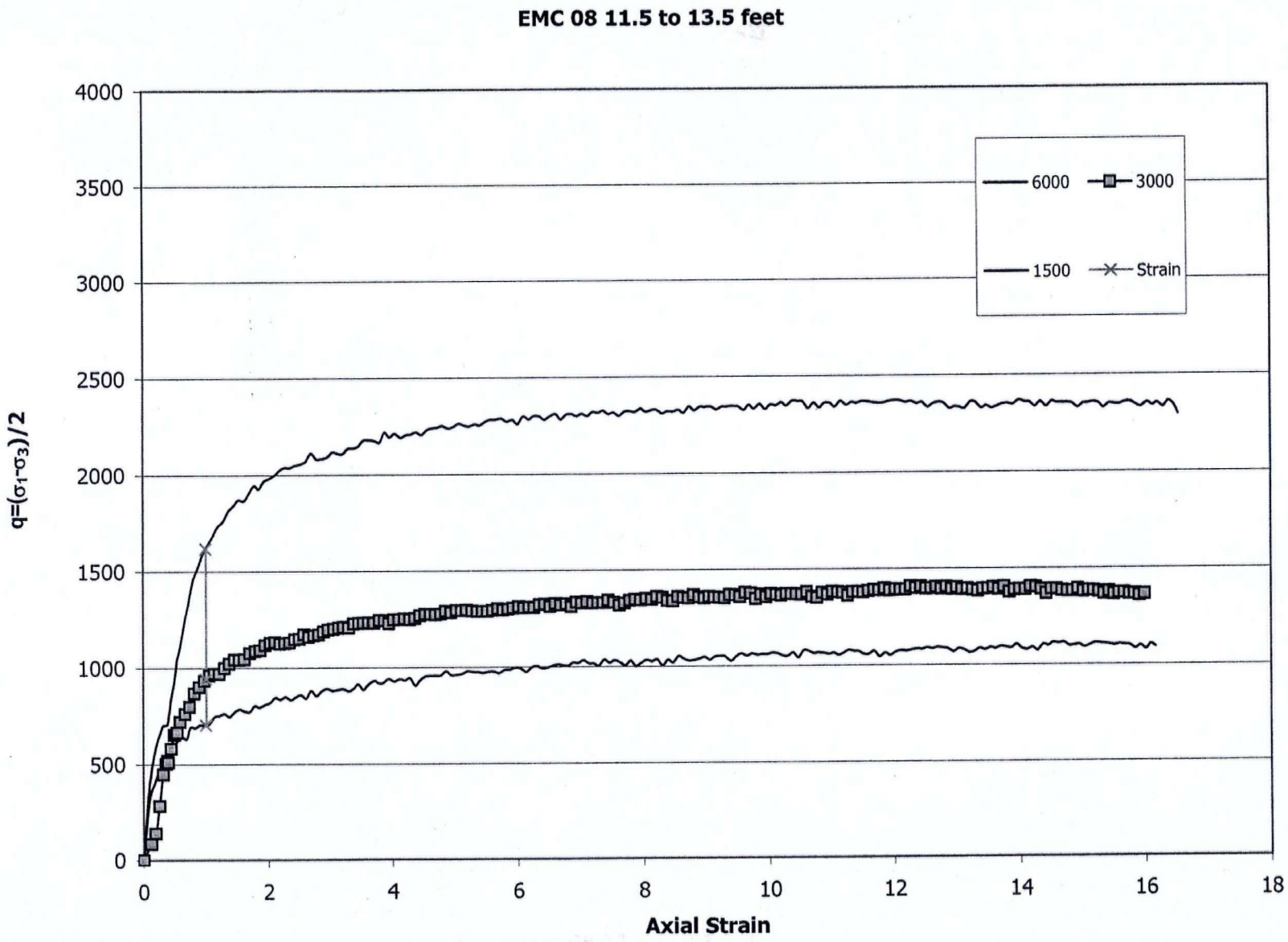
Strain Criteria: 1

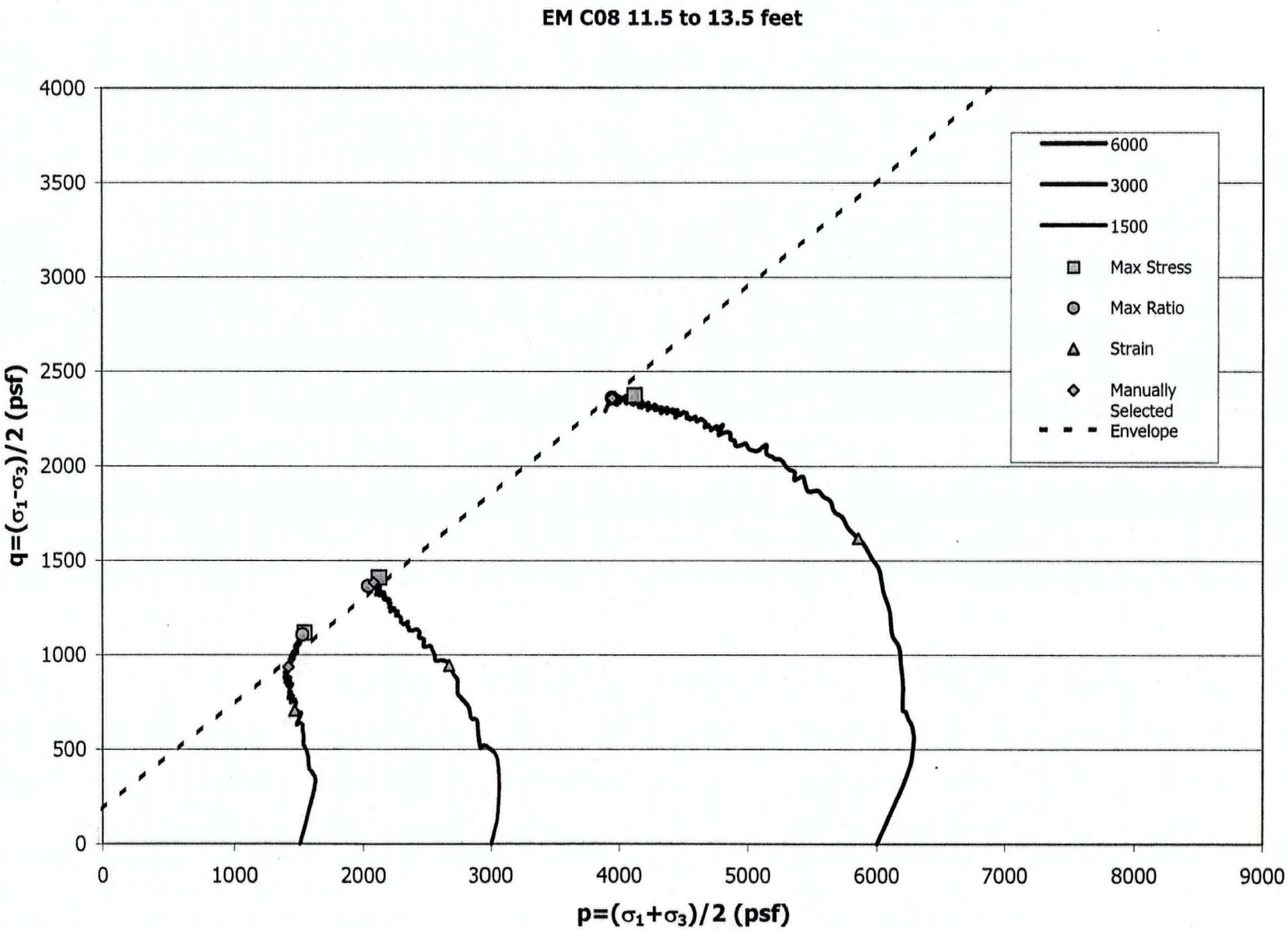
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1500		1537	1114		370	0.49	424	29.1
	3000		2124	1406					
	6000		4121	2372					
Max Ratio	1500		1522	1105	6.3	310	0.52	362	31.3
	3000		2041	1362	5.0				
	6000		3948	2360	4.0				
Strain	1500	1.0	1458	704		393	0.21	402	12.0
	3000	1.0	2675	942					
	6000	1.0	5856	1617					
Manually Selected	1500	4.4	1412	934		183	0.55	220	33.7
	3000	15.1	2086	1382					
	6000	16.4	3948	2360					

Envelope

c (psf)	ϕ	0	183
220	33.7	8000	4618


EMC 08 11.5 to 13.5 feet
6000
3000
1500
σ1/σ3
Axial Strain
0
1
2
3
4
5
6
7
8
0
2
4
6
8
10
12
14
16
18


EMC 08 11.5 to 13.5 feet
4000
3500
3000
2500
2000
1500
1000
500
0
q=(σ1-σ3)/2
0
2
4
6
8
10
12
14
16
18
Axial Strain
6000
3000
1500
Strain


EM C08 11.5 to 13.5 feet
4000
3500
3000
2500
2000
1500
1000
500
0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
6000
3000
1500
Max Stress
Max Ratio
Strain
Manually Selected
Envelope

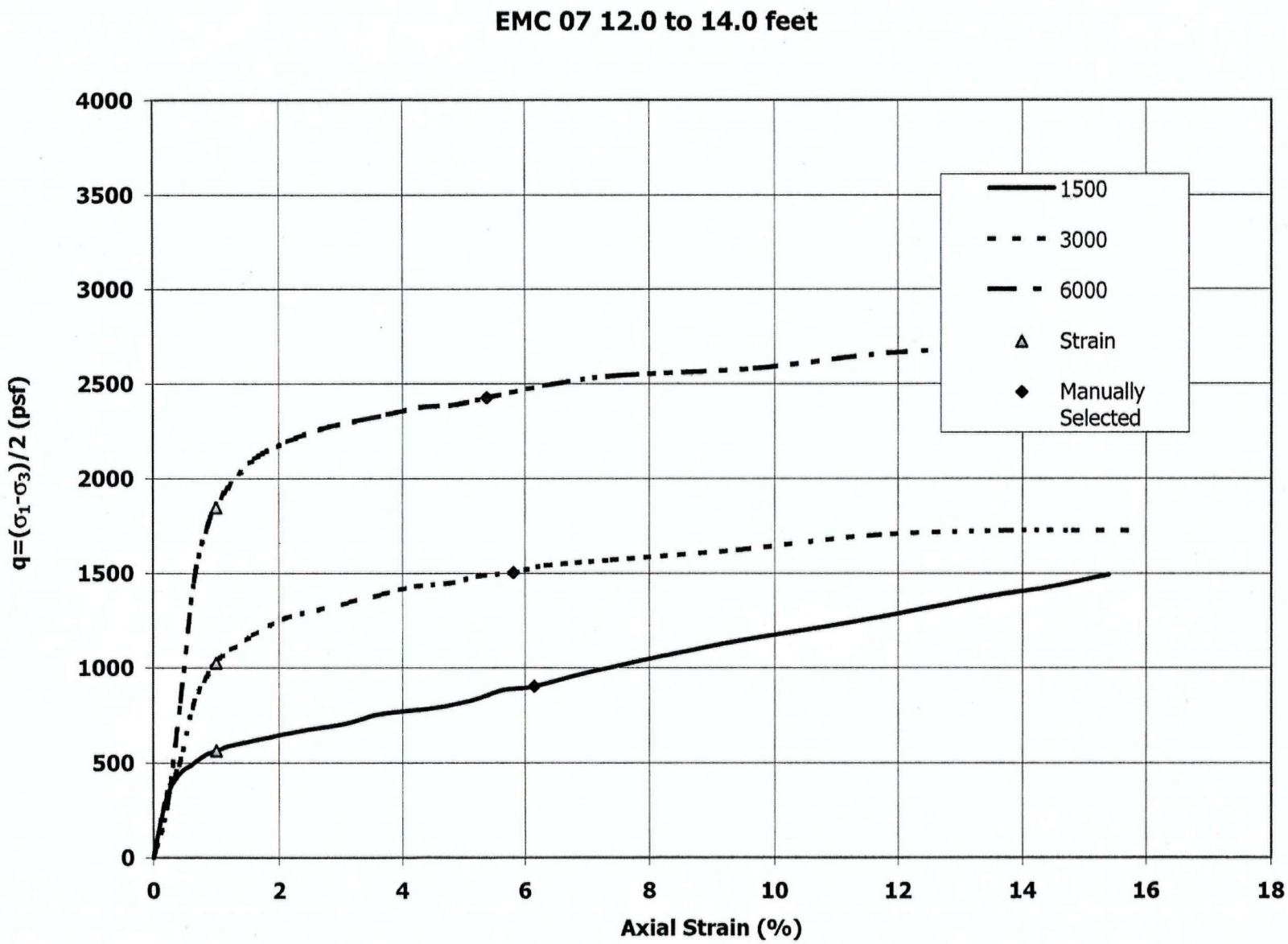
EM-CO7 **12.0-14.0'**

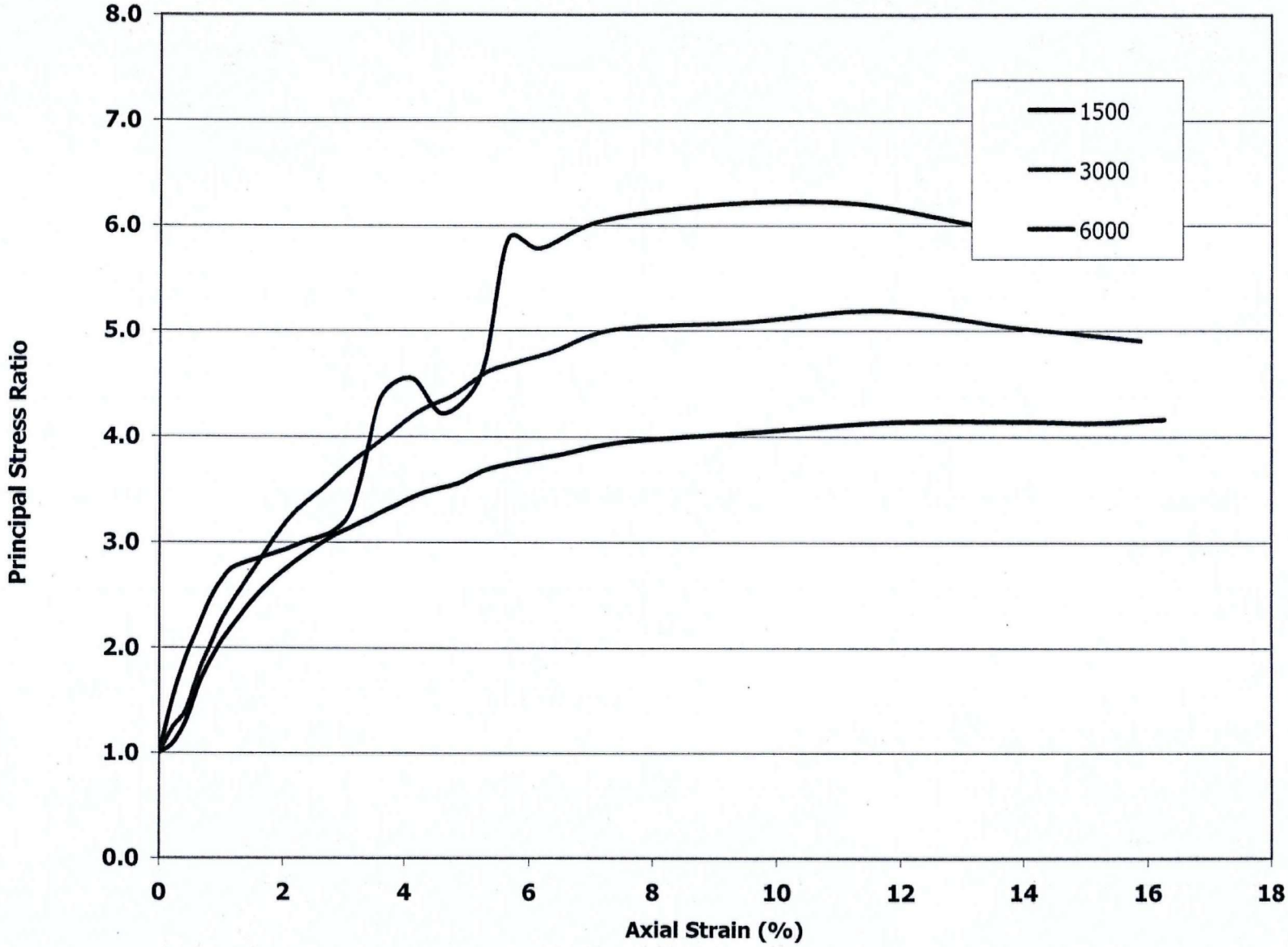
Strain Criteria: 1

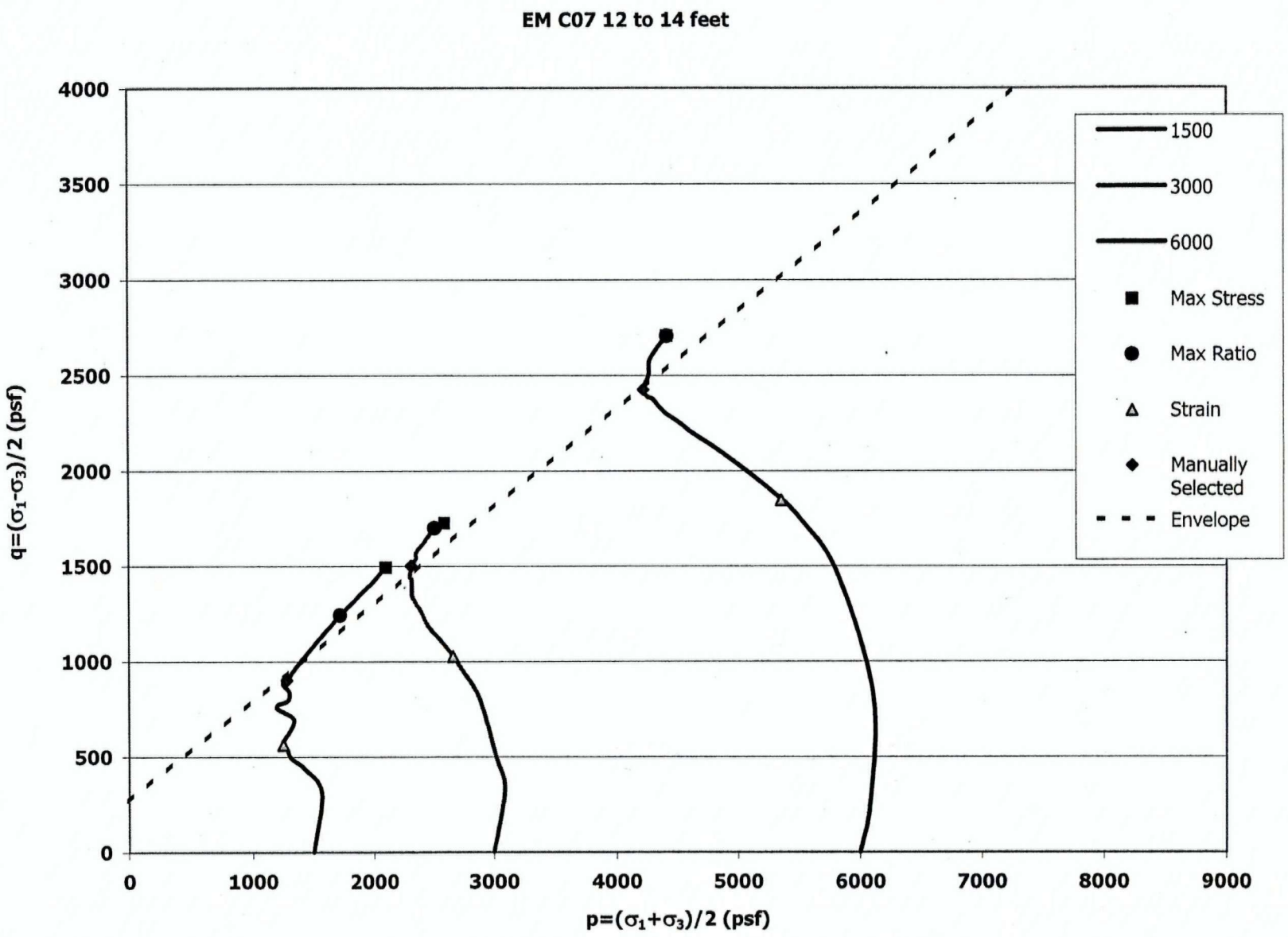
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1500		2099	1492		371	0.53	437	31.9
	3000		2594	1725					
	6000		4414	2705					
Max Ratio	1500		1720	1242	6.2	326	0.54	387	32.7
	3000		2511	1700	5.2				
	6000		4414	2705	4.2				
Strain	1500	1.0	1248	562		181	0.31	190	18.2
	3000	1.0	2669	1025					
	6000	1.0	5356	1845					
Manually Selected	1500	6.2	1277	900		271	0.51	316	30.9
	3000	5.8	2313	1502					
	6000	5.4	4220	2425					

Envelope

c (psf)	ϕ		
316	30.9	0	271
		8000	4382


EMC 07 12.0 to 14.0 feet
4000
3500
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
14
16
18
Axial Strain (%)
q=(σ1-σ3)/2 (psf)
1500
3000
6000
Strain
Manually Selected


8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Principal Stress Ratio
0
2
4
6
8
10
12
14
16
18
Axial Strain (%)
1500
3000
6000


EM C07 12 to 14 feet
4000
3500
3000
2500
2000
1500
1000
500
0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
1500
3000
6000
Max Stress
Max Ratio
Strain
Manually Selected
Envelope

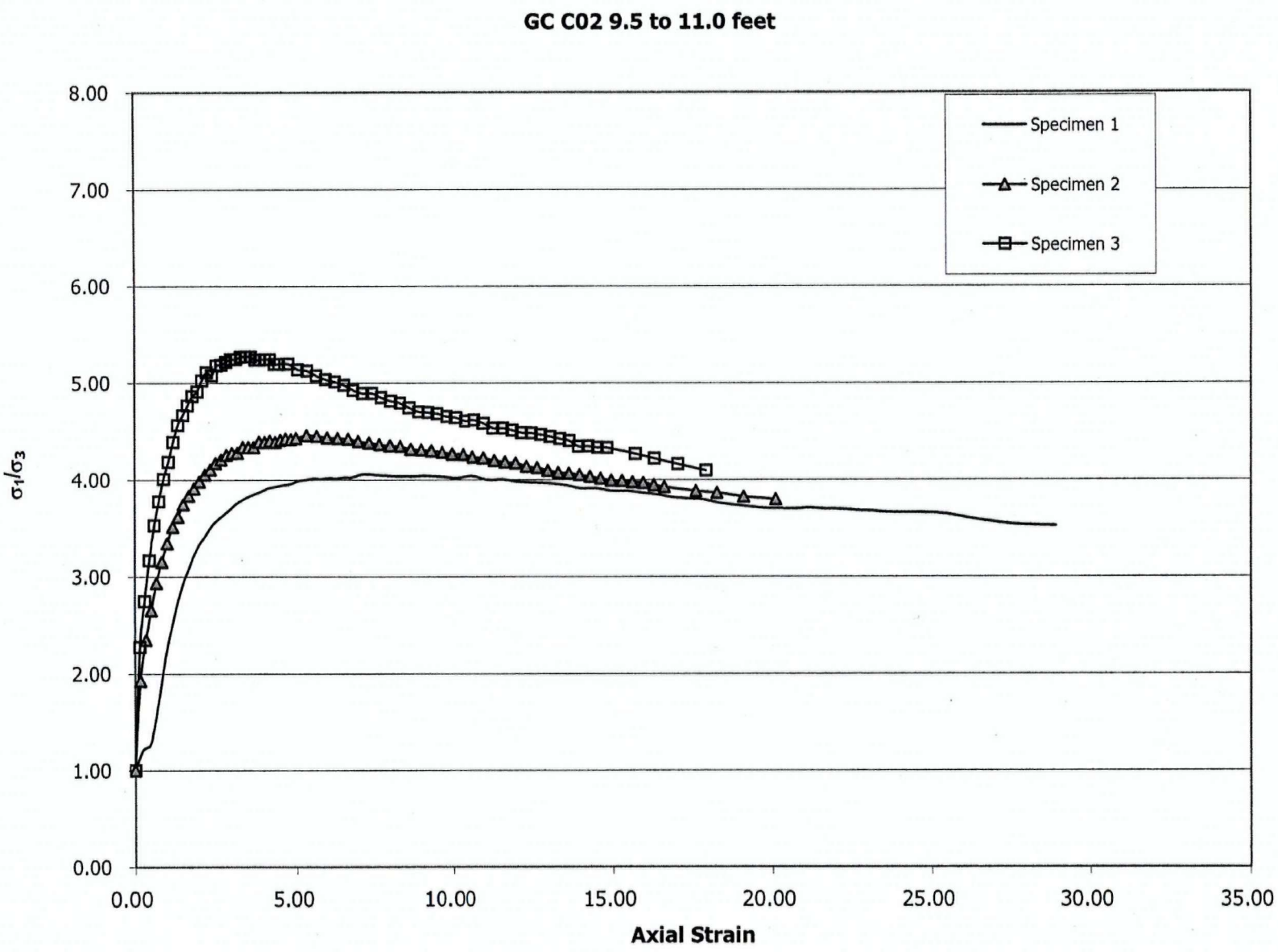
GC-C02 10.5-11.0'

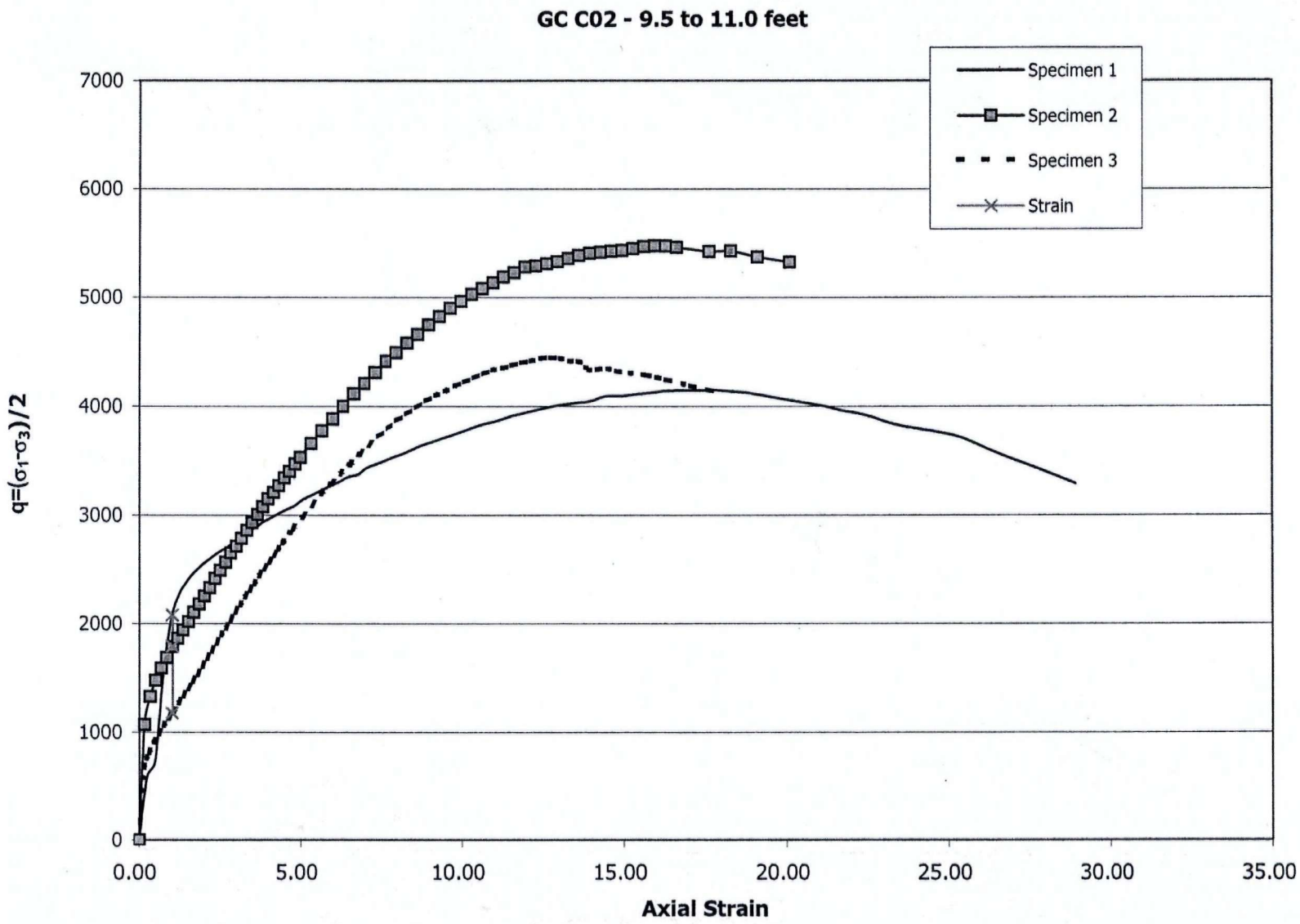
Strain Criteria: 1

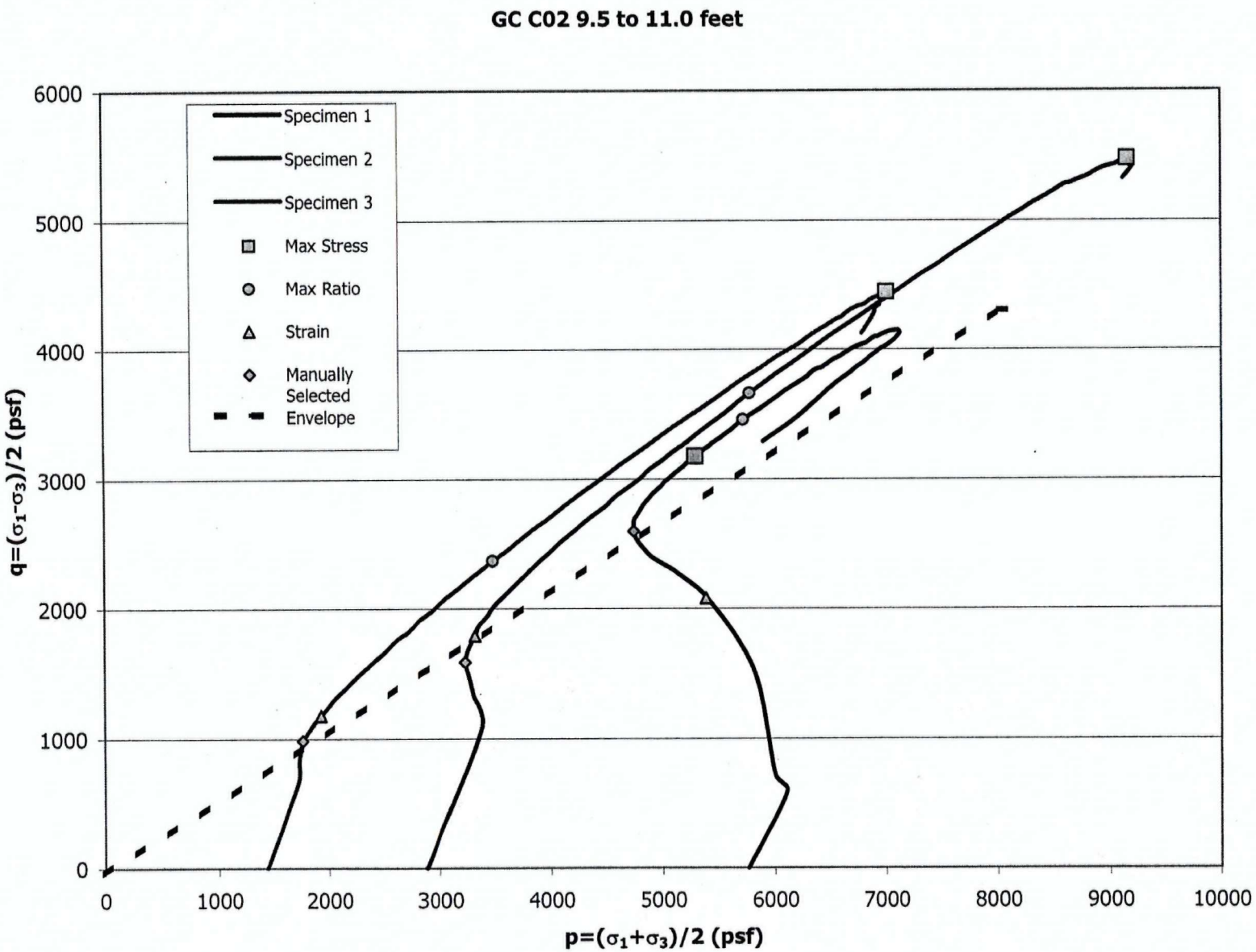
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1440		7006	4443		149	0.59	185	36.1
	2880		9159	5473					
	5760		5292	3176					
Max Ratio	1440		3477	2368	5.3	538	0.53	632	31.7
	2880		5776	3660	4.5				
	5760		5717	3457	4.1				
Strain	1440	1.0	1925	1176		791	0.25	817	14.6
	2880	1.0	3315	1790					
	5760	1.0	5385	2079					
Manually Selected	1440	0.6	1761	983		-36	0.54	-42	32.8
	2880	0.7	3230	1588					
	5760	2.2	4743	2597					

Envelope

c (psf)	ϕ	0	-36
-42	32.8	8000	4299


GC C02 9.5 to 11.0 feet
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Axial Strain
Specimen 1
Specimen 2
Specimen 3


GC C02 - 9.5 to 11.0 feet
Specimen 1
Specimen 2
Specimen 3
Strain
7000
6000
5000
4000
3000
2000
1000
0
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Axial Strain
q=(σ1-σ3)/2


GC C02 9.5 to 11.0 feet
Specimen 1
Specimen 2
Specimen 3
Max Stress
Max Ratio
Strain
Manually Selected Envelope
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

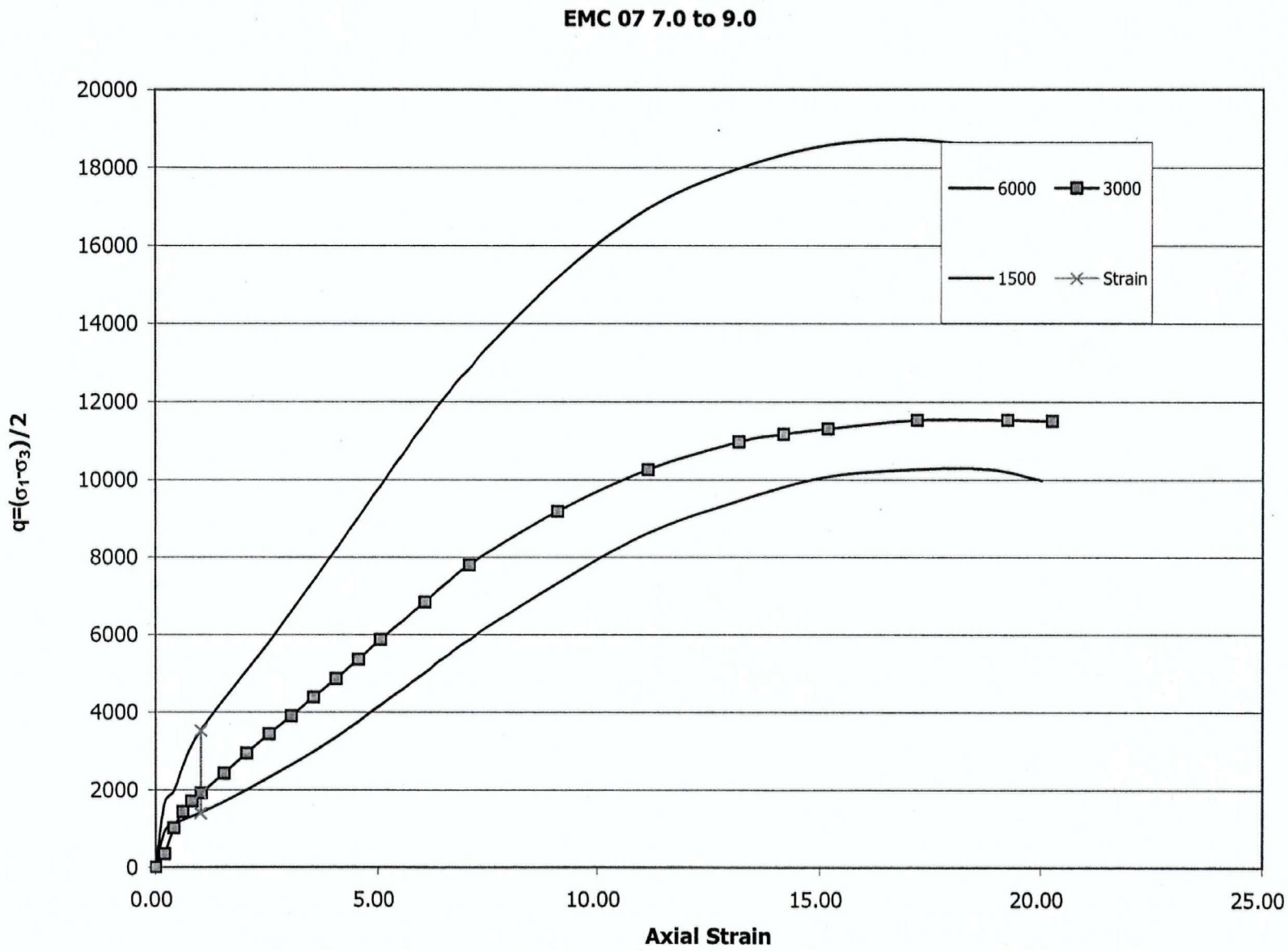
EM-CO7 7.0-9.0'

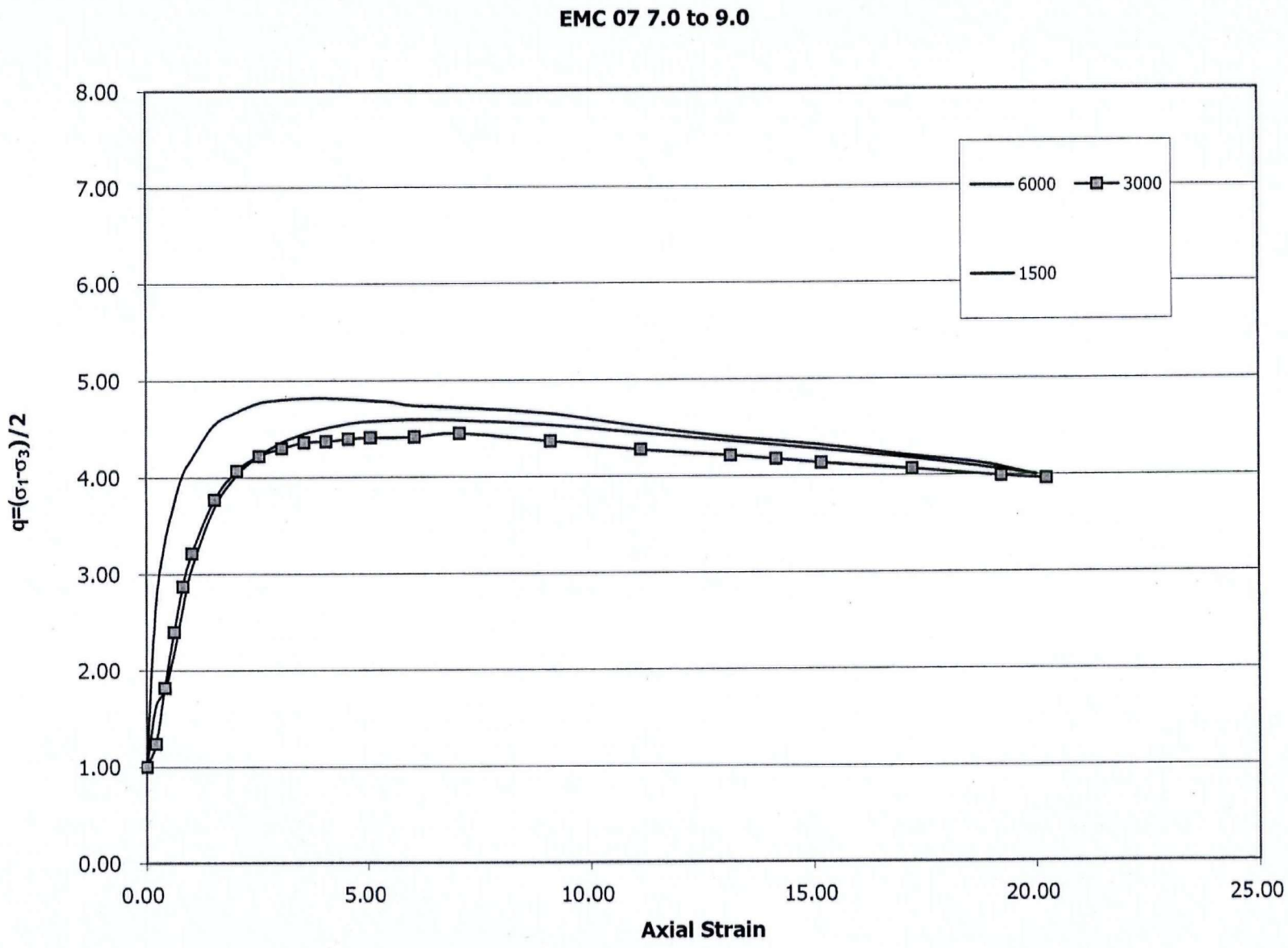
Strain Criteria: 1

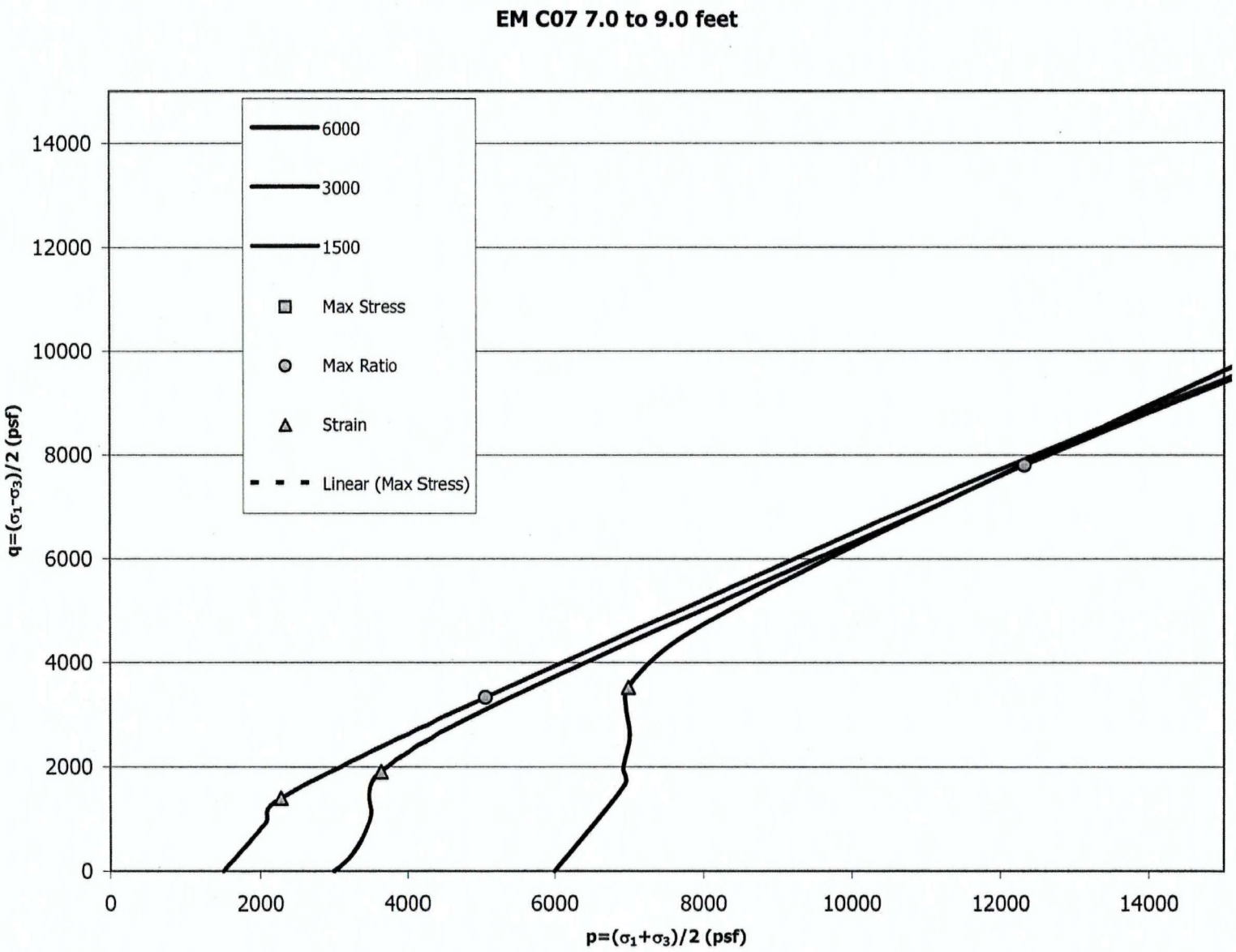
	Effective Confining Stress (psf)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)		Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1500	16870.0	10272.4		-274.7	0.6	-350.9	38.5
	3000	19066.2	11530.2					
	6000	30506.5	18717.7					
Max Ratio	1500	5073.7	3328.9	4.8	62.9	0.6	81.4	39.5
	3000	12323.1	7796.7	4.4				
	6000	17734.8	11389.2	4.6				
Strain	1500	2280.4	1400.0	1	308.8	0.5	347.2	27.2
	3000	3642.0	1904.1	1				
	6000	6985.1	3520.9	1				
Manually S	1500	2109.0	1214		114.0	0.5	130.2	28.9
	3000	3518.0	1699					
	6000	6985.0	3521					

	c (psf)	ϕ
Envelope	470	21

0	439
10000	4022


EMC 07 7.0 to 9.0
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
q=(σ1-σ3)/2
6000
3000
1500
Strain

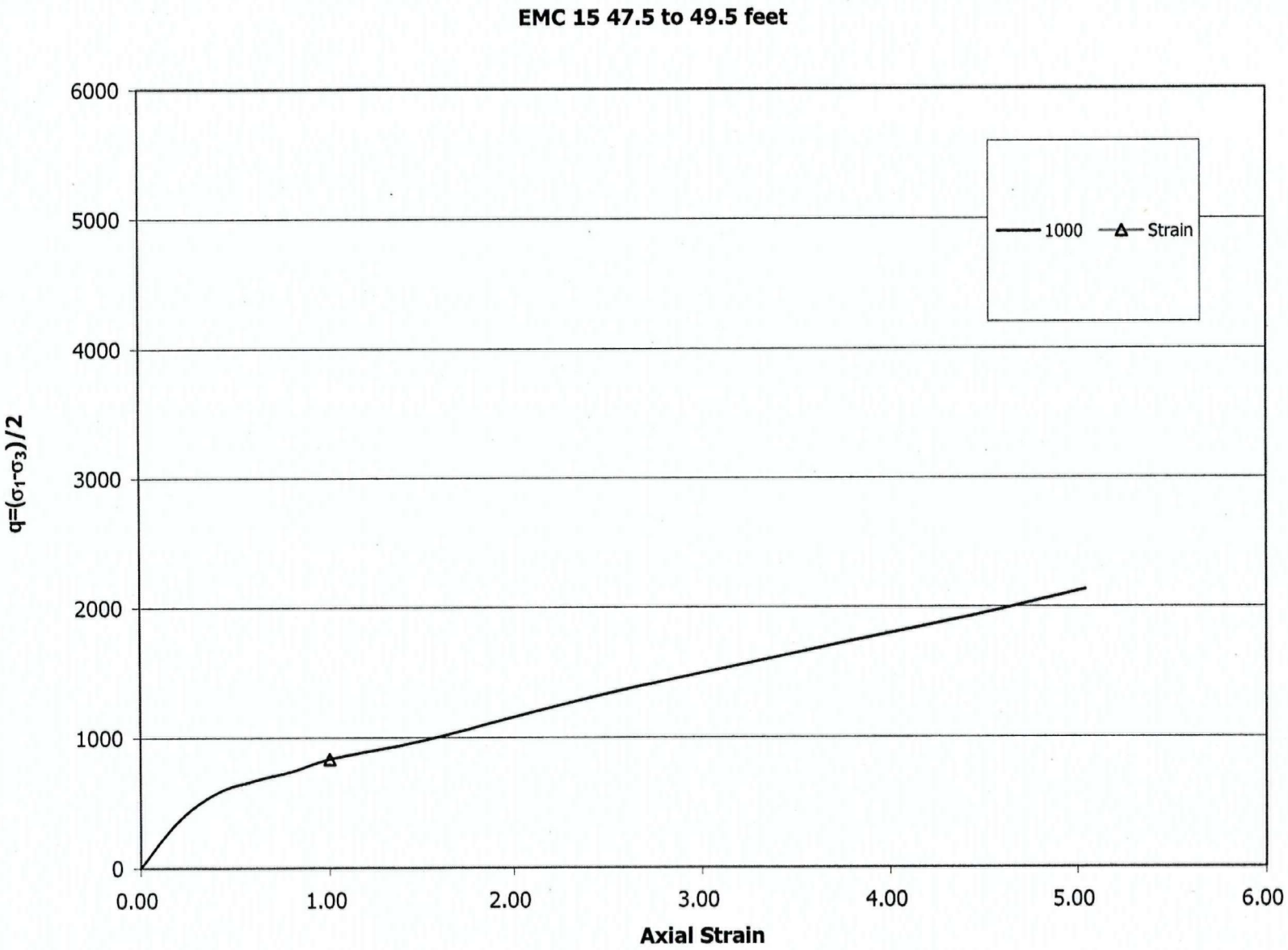

EMC 07 7.0 to 9.0
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
q=(σ1-σ3)/2
0.00
5.00
10.00
15.00
20.00
25.00
Axial Strain
6000
3000
1500

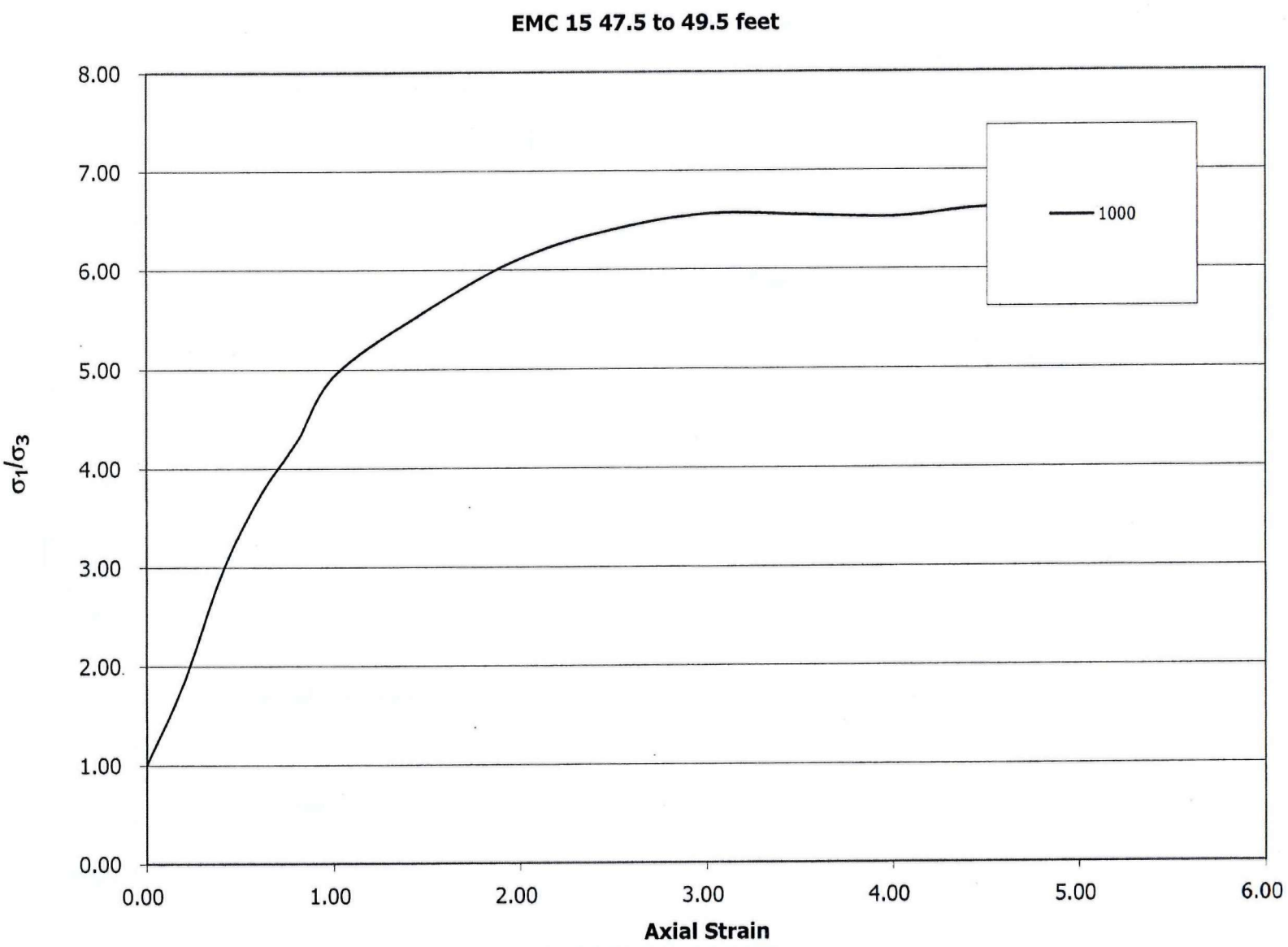

EM C07 7.0 to 9.0 feet
6000
3000
1500
Max Stress
Max Ratio
Strain
Linear (Max Stress)
14000
12000
10000
8000
6000
4000
2000
0
0
2000
4000
6000
8000
10000
12000
14000
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)

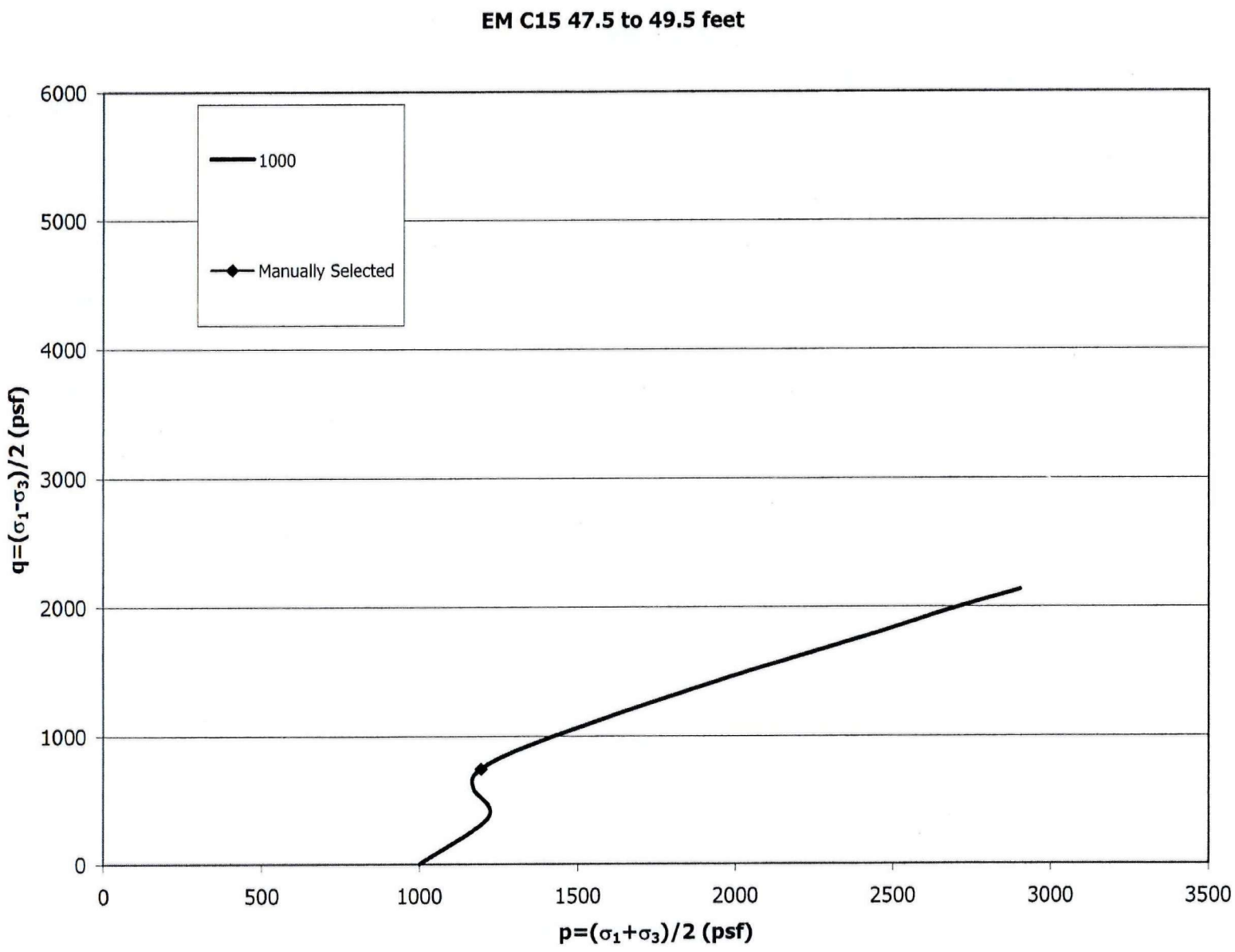
EM-C15 47.5'-49.5'

Strain Criteria: 1

	Effective Confining Stress (psf)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)		Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1000	2903.23215	2134					
Max Ratio	1000	2658.06619	1960.466193	6.6				
Strain	1000	1257.83687	832.3968727	1				
Manually Selected		1196	743					


EMC 15 47.5 to 49.5 feet
6000
5000
4000
3000
2000
1000
0
q=(σ1-σ3)/2
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Axial Strain
1000
Strain

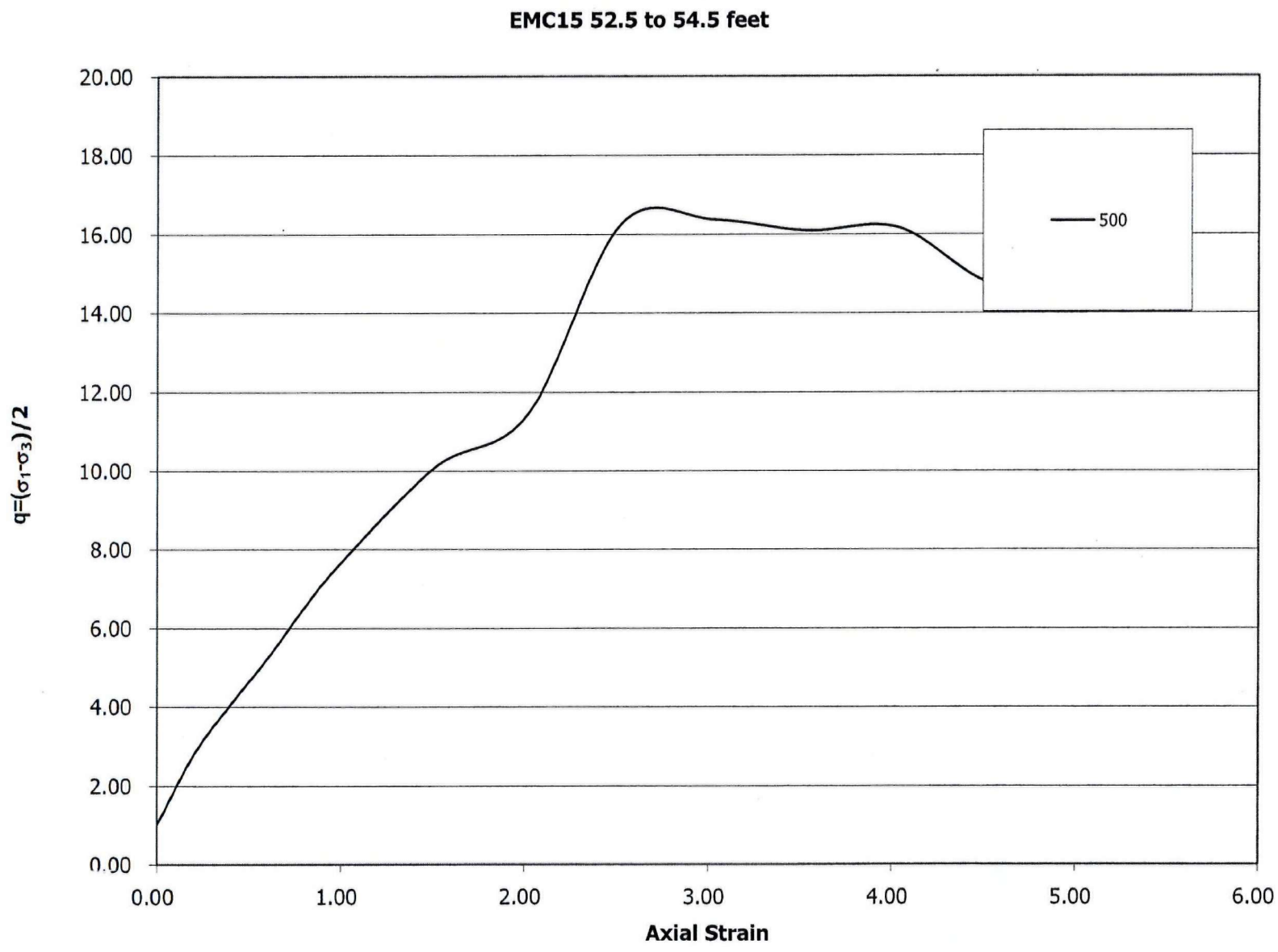

EMC 15 47.5 to 49.5 feet
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Axial Strain
1000

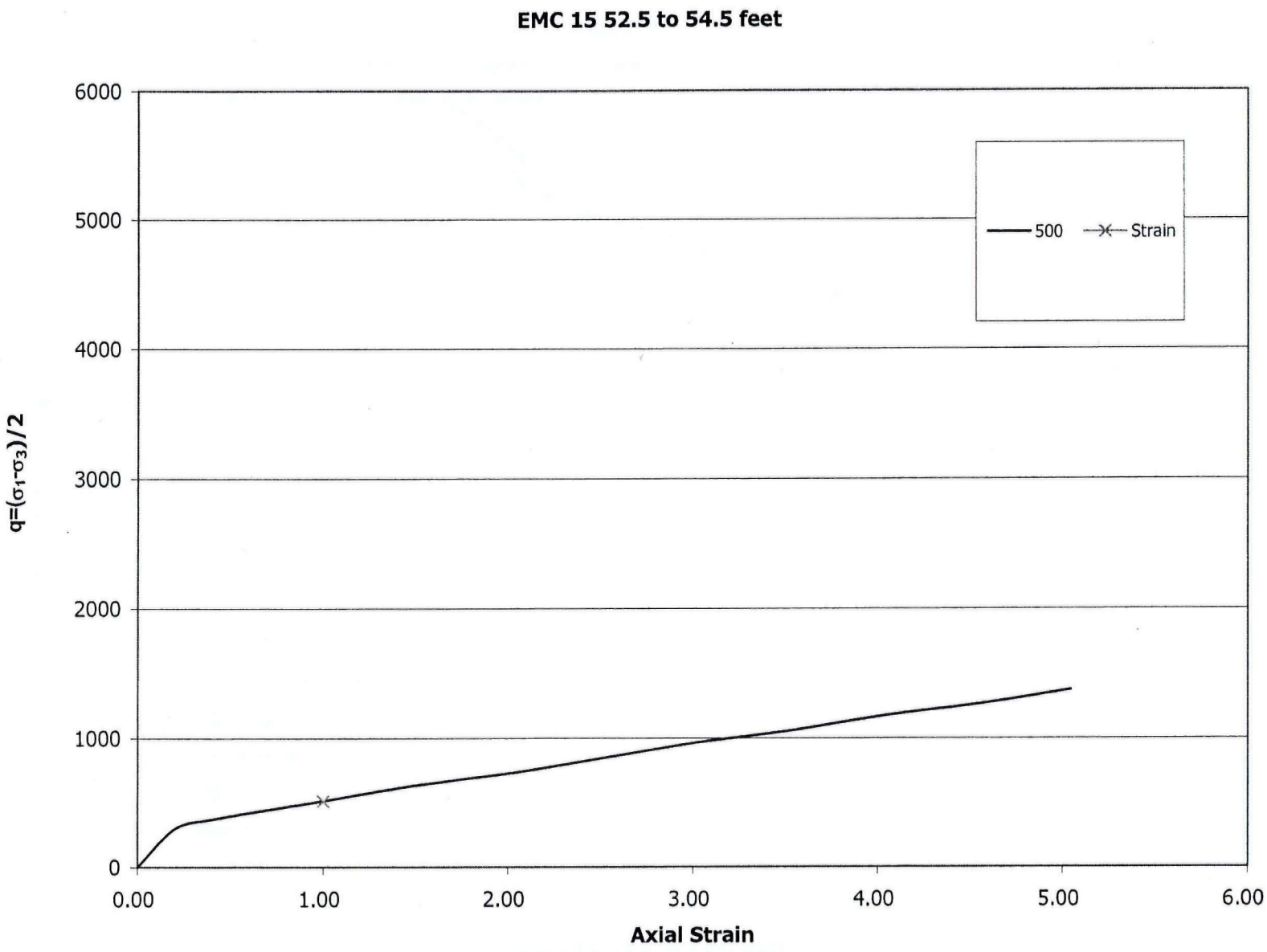

EM C15 47.5 to 49.5 feet
1000
Manually Selected
6000
5000
4000
3000
2000
1000
0
0
500
1000
1500
2000
2500
3000
3500
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)

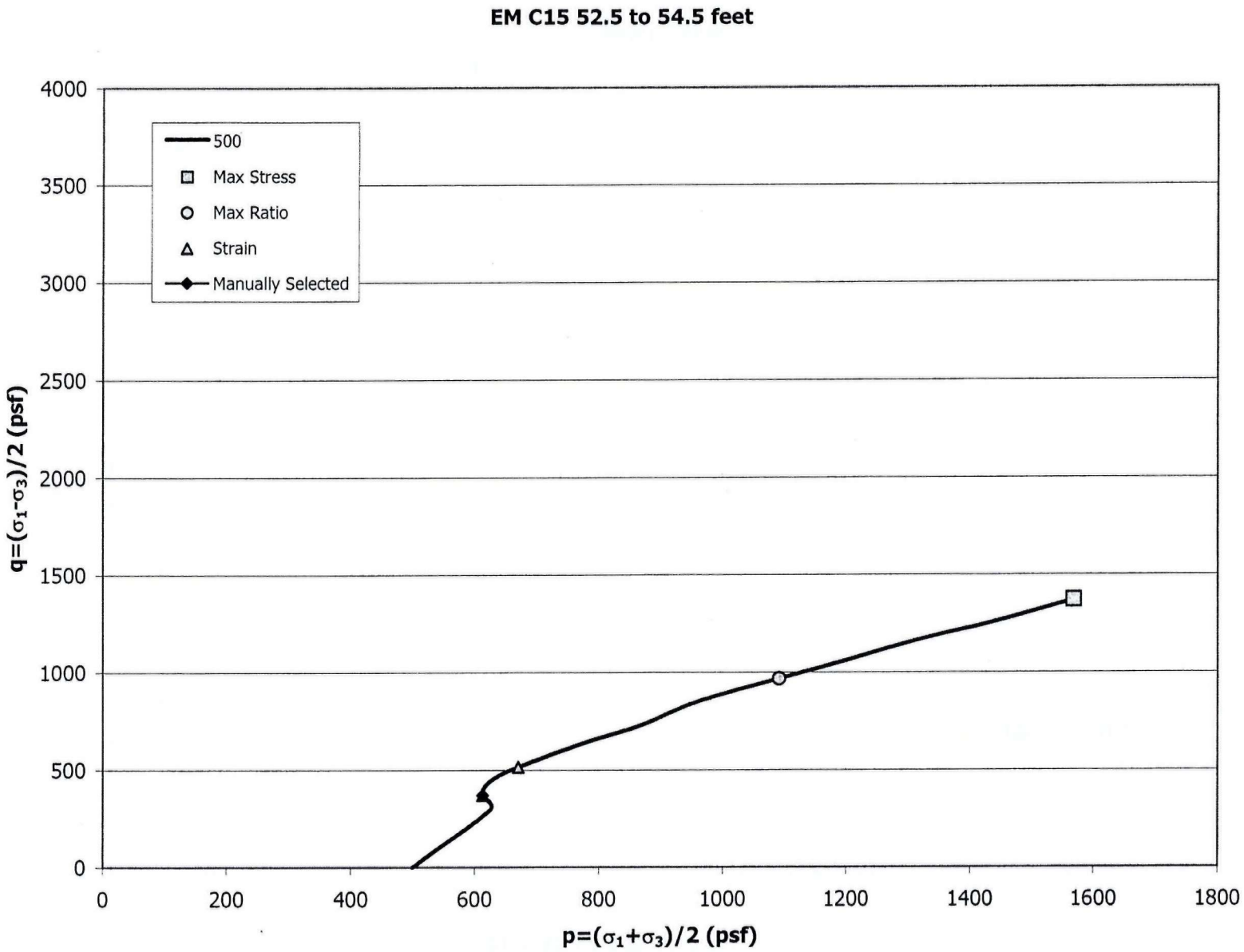
EM-C15 52.5-54.5'

Strain Criteria: 1

		P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	
Max Stress	500	1568.188	1371	
Max Ratio	500	1090.939	965.339	16.4
Strain	500	670.0921	514.9901	1
Manually Selected		613	372	


EMC15 52.5 to 54.5 feet
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
q=(σ1-σ3)/2
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Axial Strain
500

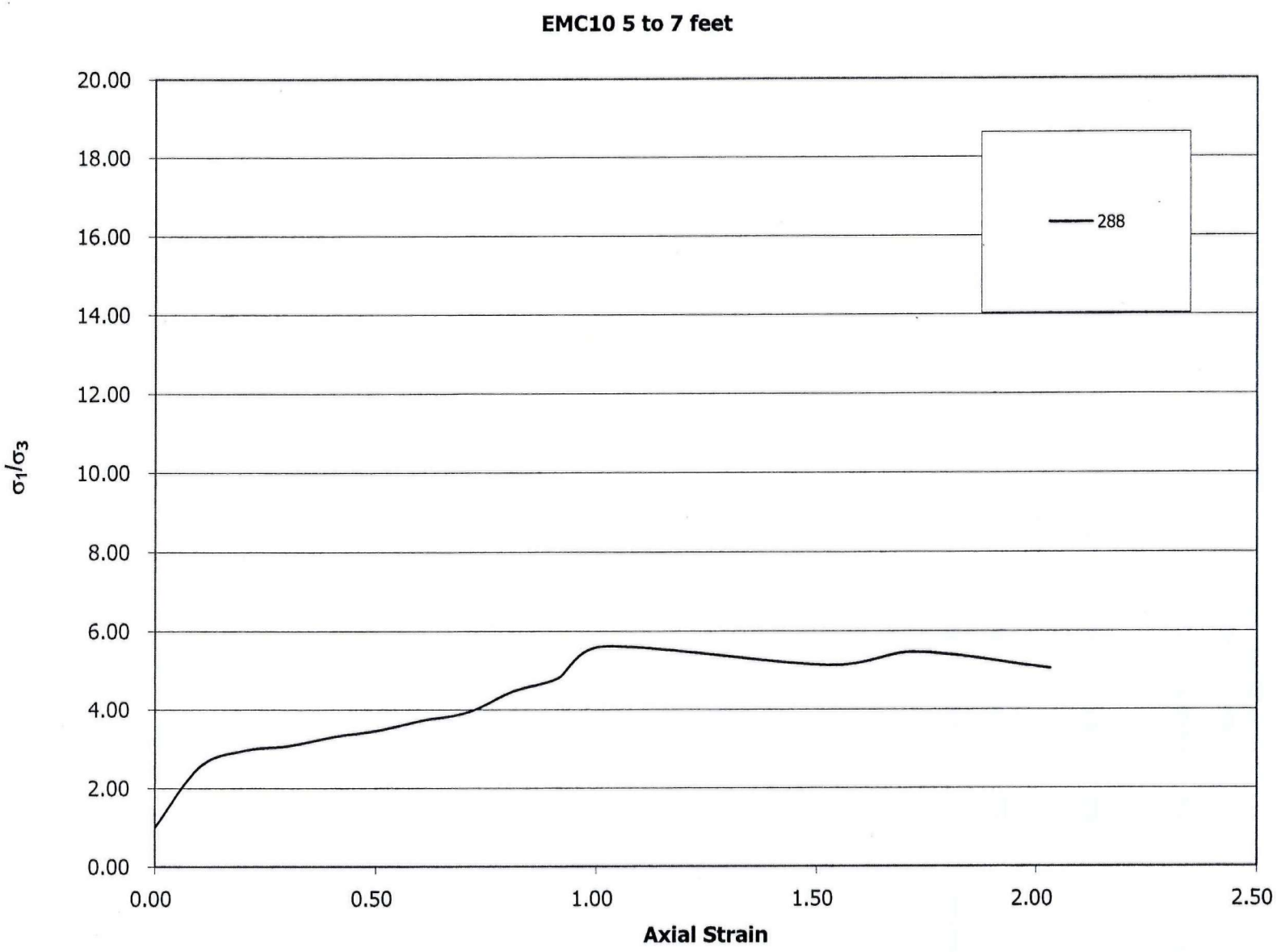

EMC 15 52.5 to 54.5 feet
6000
5000
4000
3000
2000
1000
0
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Axial Strain
q=(σ1-σ3)/2
500
Strain

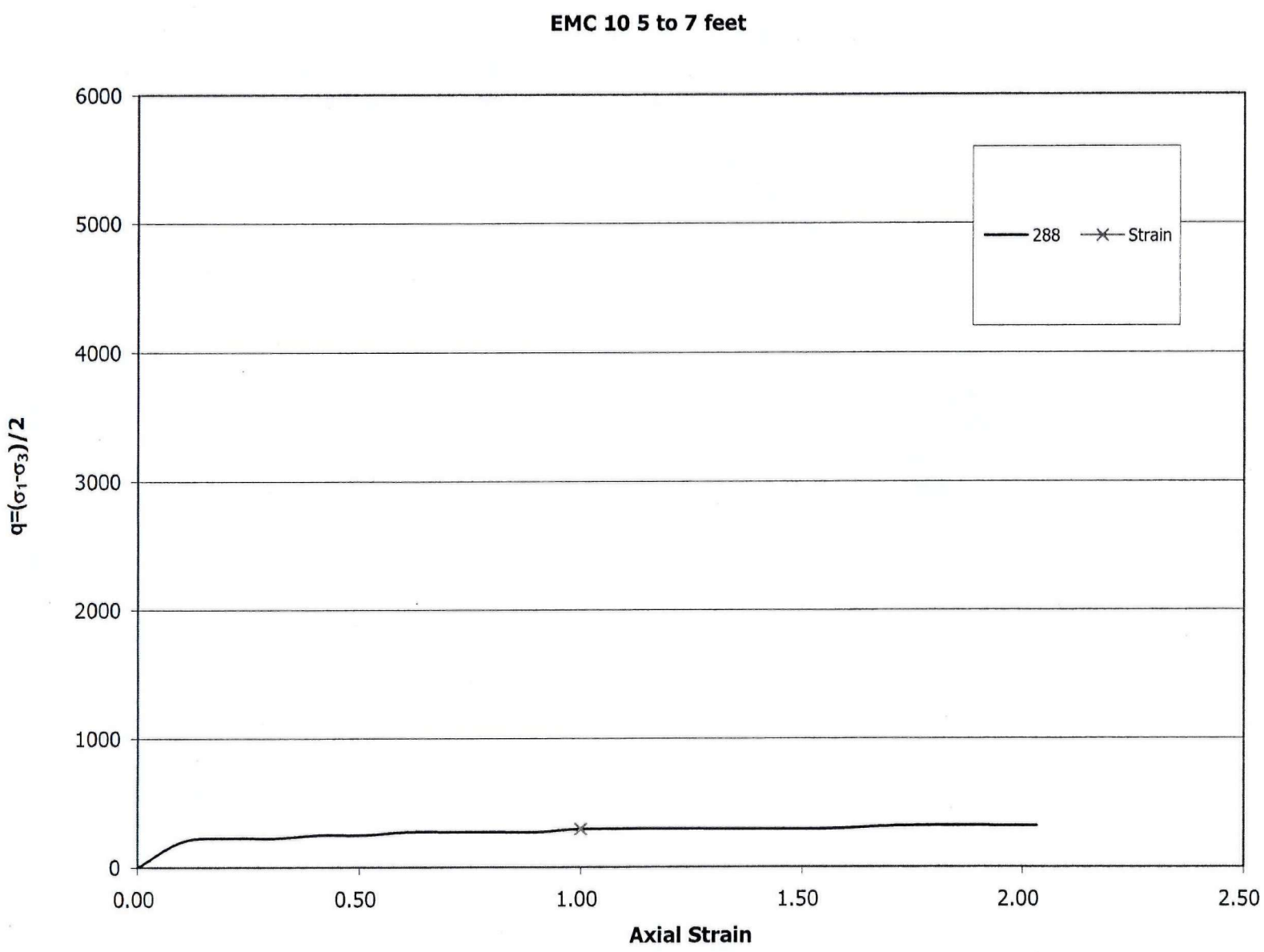

EM C15 52.5 to 54.5 feet
500
Max Stress
Max Ratio
Strain
Manually Selected
4000
3500
3000
2500
2000
1500
1000
500
0
0
200
400
600
800
1000
1200
1400
1600
1800
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)

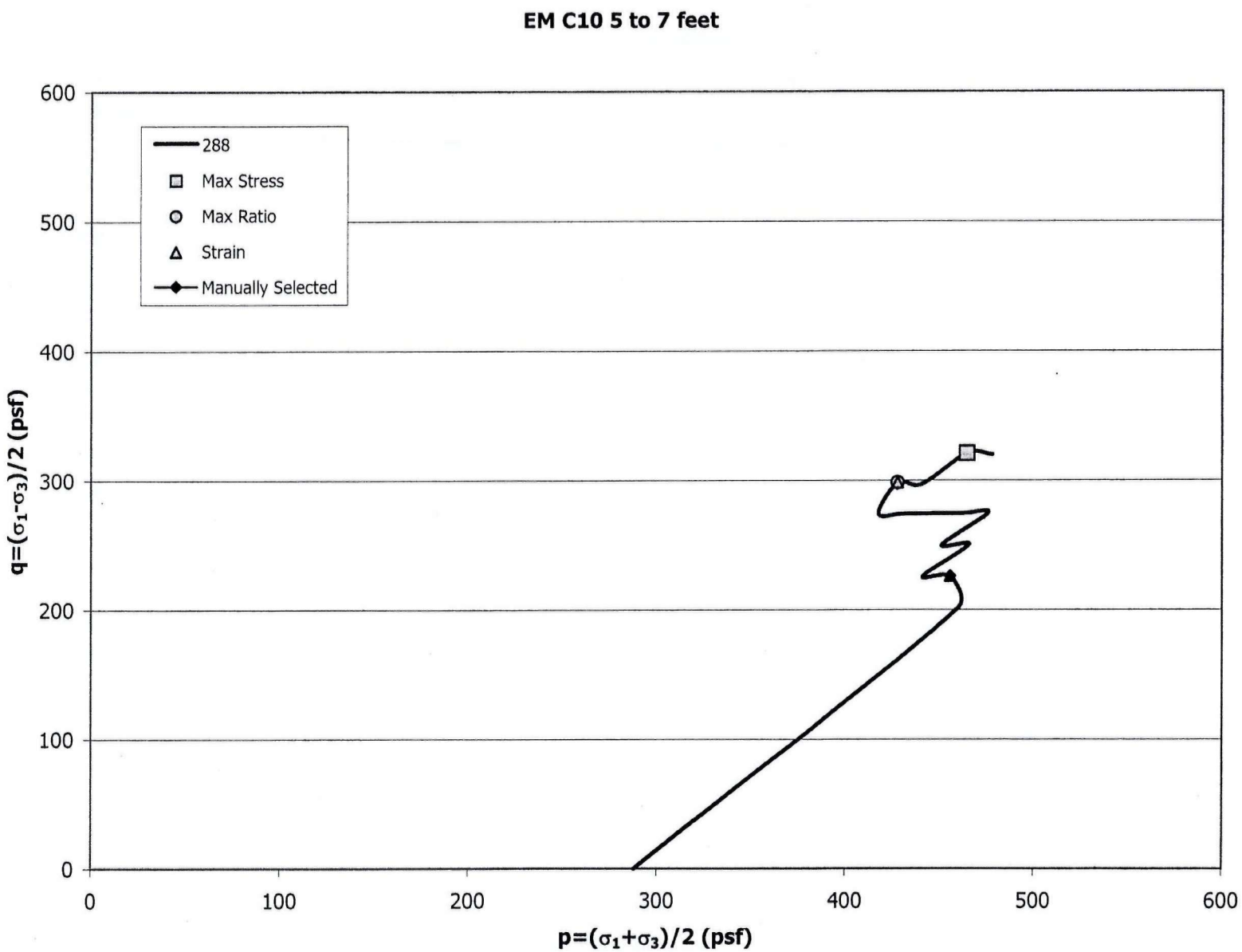
EM-C10 **5-7'**

Strain Criteria: 1

		P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	
Max Stress	288	464.8316	321	
Max Ratio	288	428	298	5.6
Strain	288	428	298	1
Manually Selected		456	226	


EMC10 5 to 7 feet
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
σ1/σ3
0.00
0.50
1.00
1.50
2.00
2.50
Axial Strain
288


EMC 10 5 to 7 feet
6000
5000
4000
3000
2000
1000
0
q=(σ1-σ3)/2
0.00
0.50
1.00
1.50
2.00
2.50
Axial Strain
288
Strain


EM C10 5 to 7 feet
288
Max Stress
Max Ratio
Strain
Manually Selected
600
500
400
300
200
100
0
0
100
200
300
400
500
600
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)

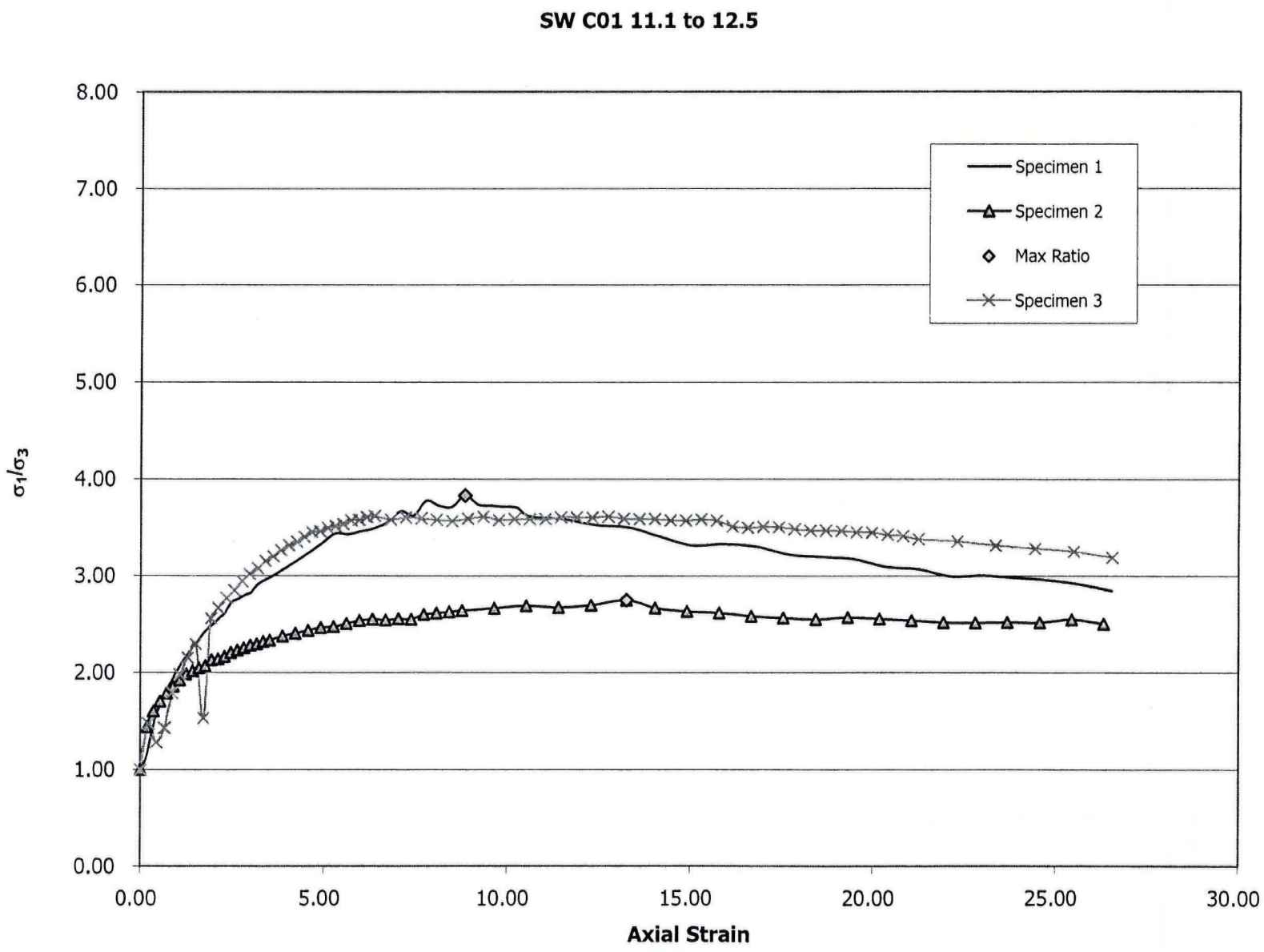
SW C01 11.1 to 12.5

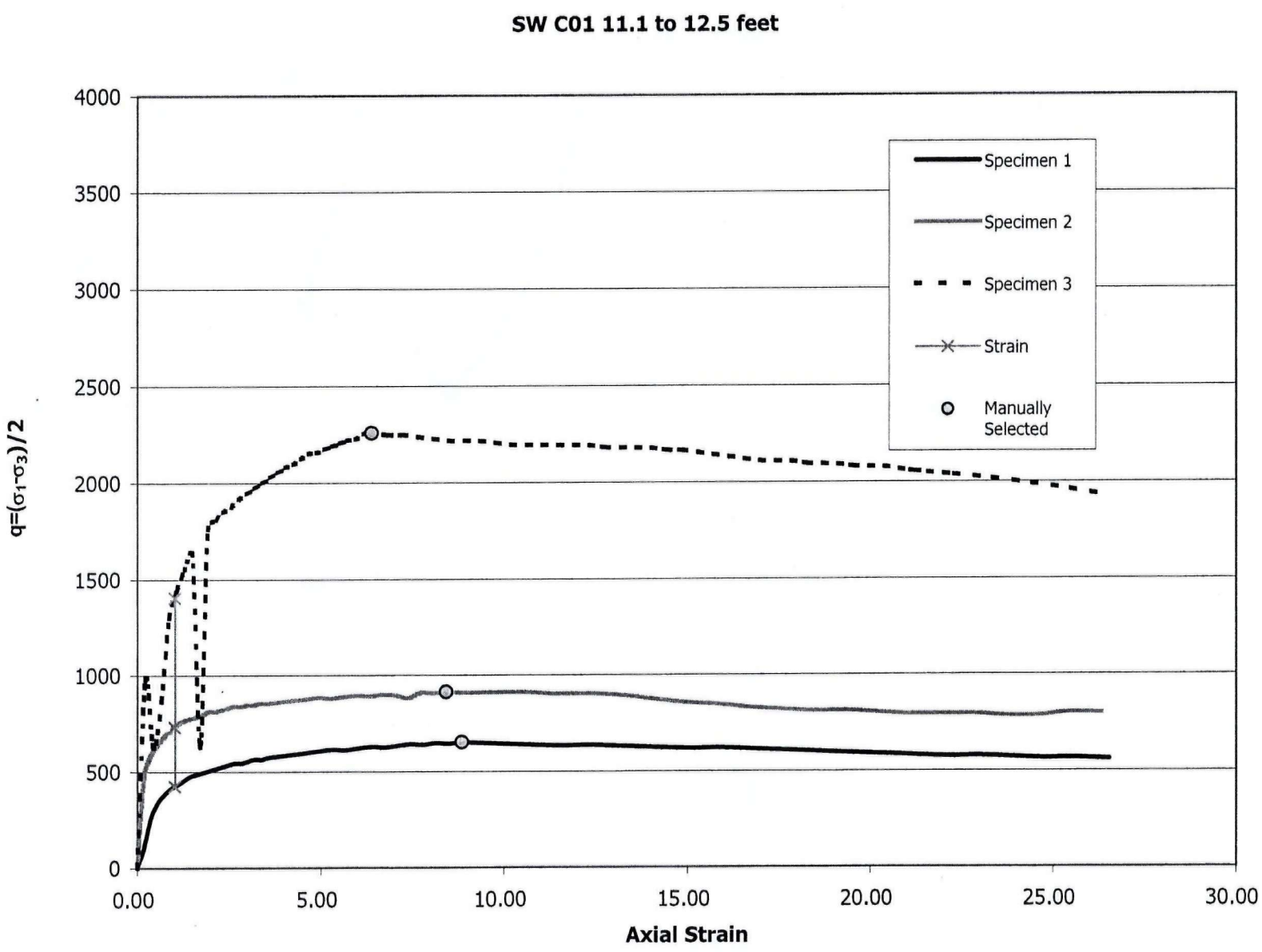
Strain Criteria: 1

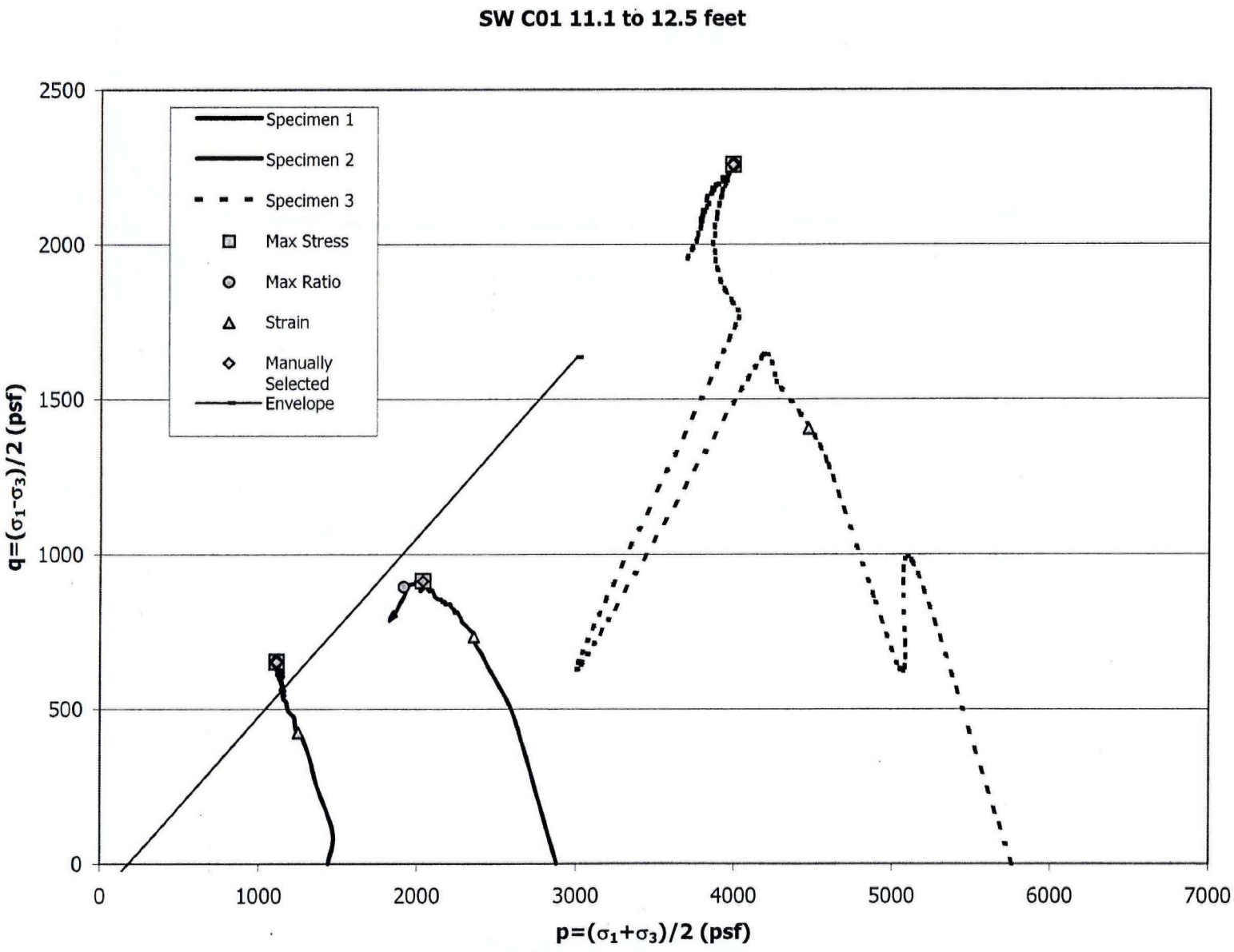
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1440		1112	652		-103	0.58	-127	35.4
	2880		2035	912					
	5760		3985	2257					
Max Ratio	1440	9	1112	652	3.8	-84	0.58	-103	35.3
	2880	13	1916	893	2.7				
	5760	6	3989	2257	3.6				
Strain	1440	1.0	1250	423		27	0.31	29	17.9
	2880	1.0	2358	732					
	5760	1.0	4464	1404					
Manually Selected	1440	9	1112	652		-103	0.58	-127	35.4
	2880	8	2035	912					
		6	3985	2257					

Envelope

c (psf)	ϕ	0	-103
-127	35.4	3000	1634


SW C01 11.1 to 12.5
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Axial Strain
Specimen 1
Specimen 2
Max Ratio
Specimen 3


SW C01 11.1 to 12.5 feet
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Axial Strain
q=(σ1-σ3)/2
Specimen 1
Specimen 2
Specimen 3
Strain
Manually Selected


SW C01 11.1 to 12.5 feet
Specimen 1
Specimen 2
Specimen 3
Max Stress
Max Ratio
Strain
Manually Selected Envelope
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
0
500
1000
1500
2000
2500
0
1000
2000
3000
4000
5000
6000
7000

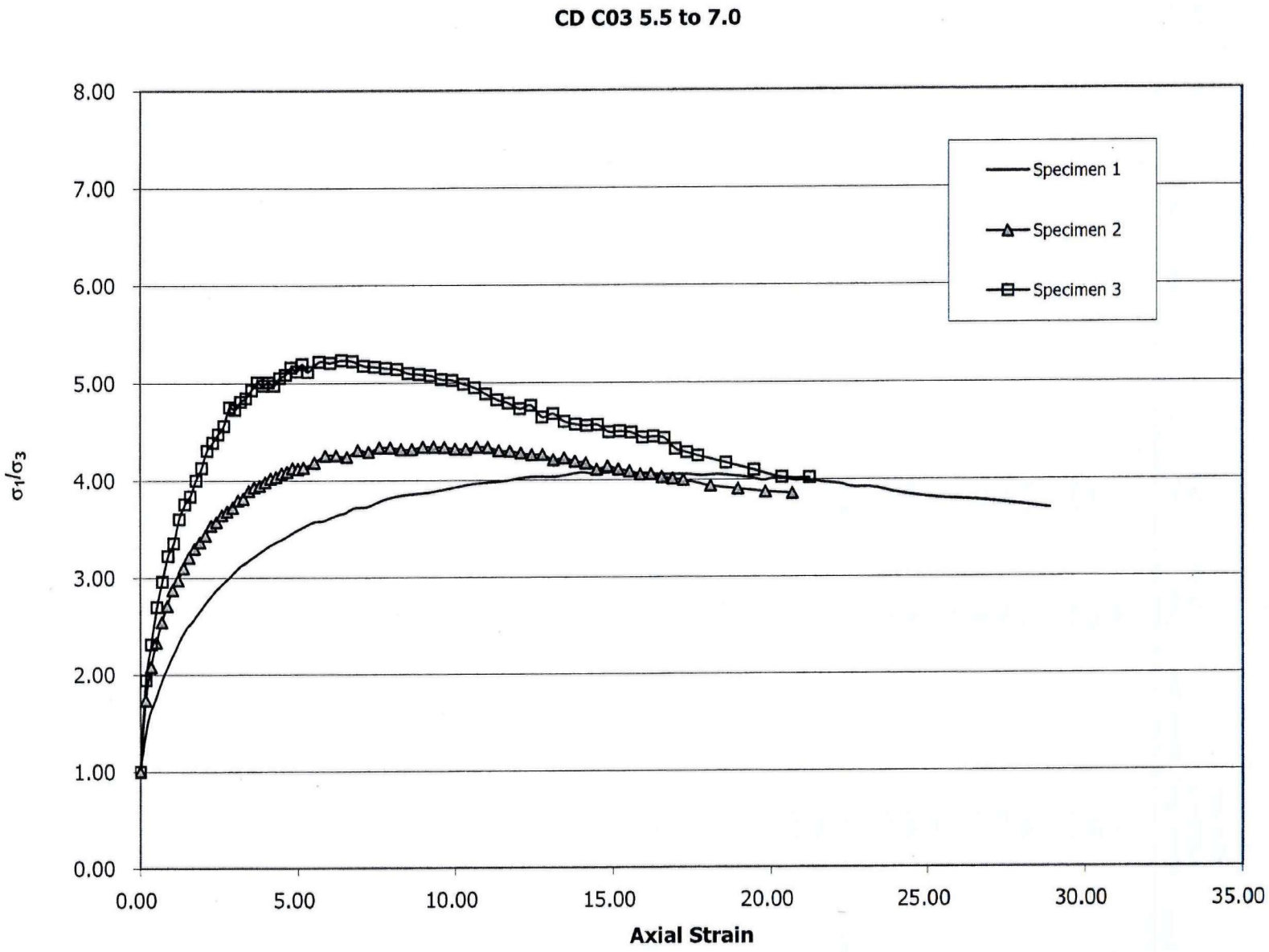
CD-C03 5.5-6.0'

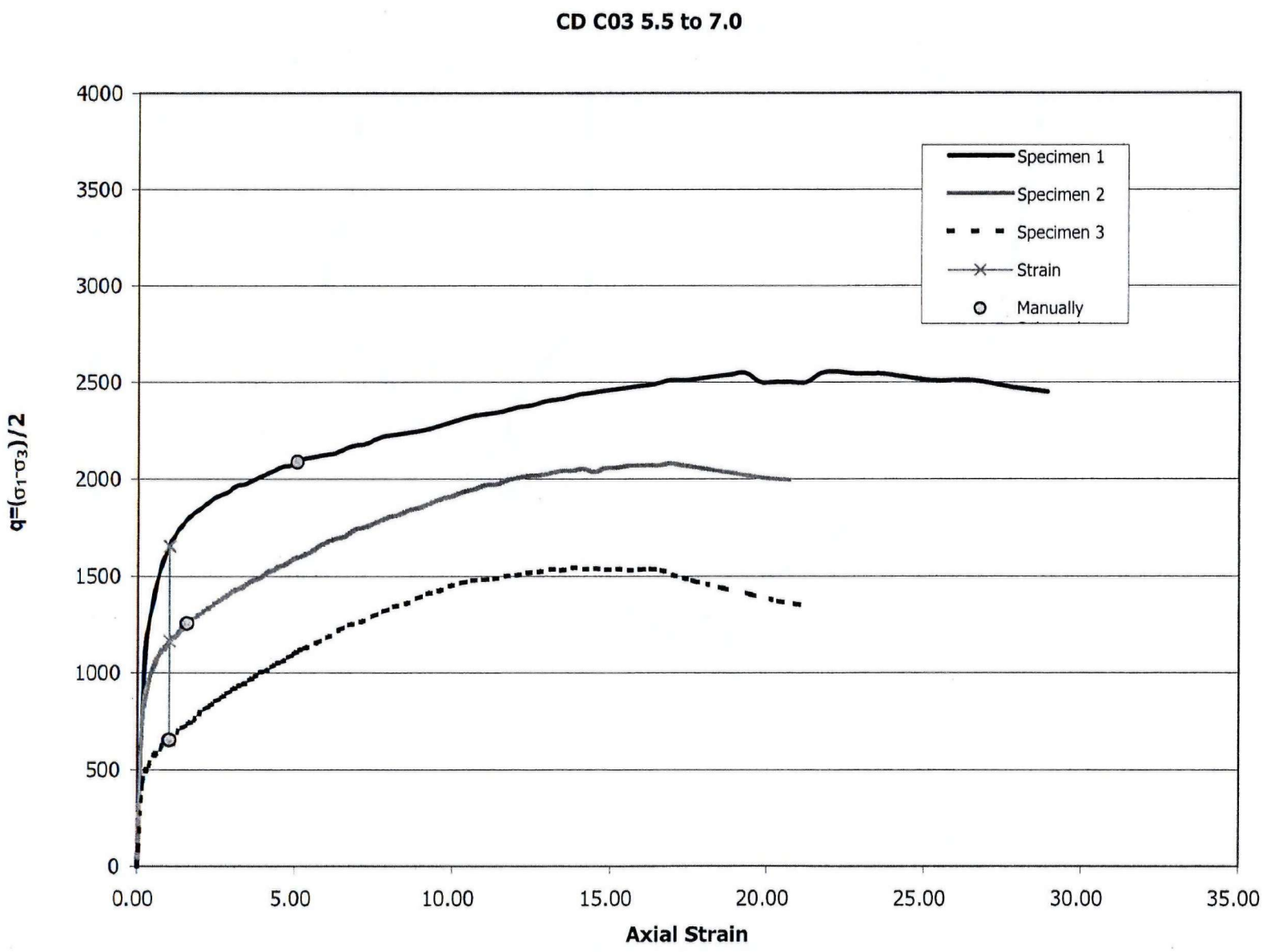
Strain Criteria: 1

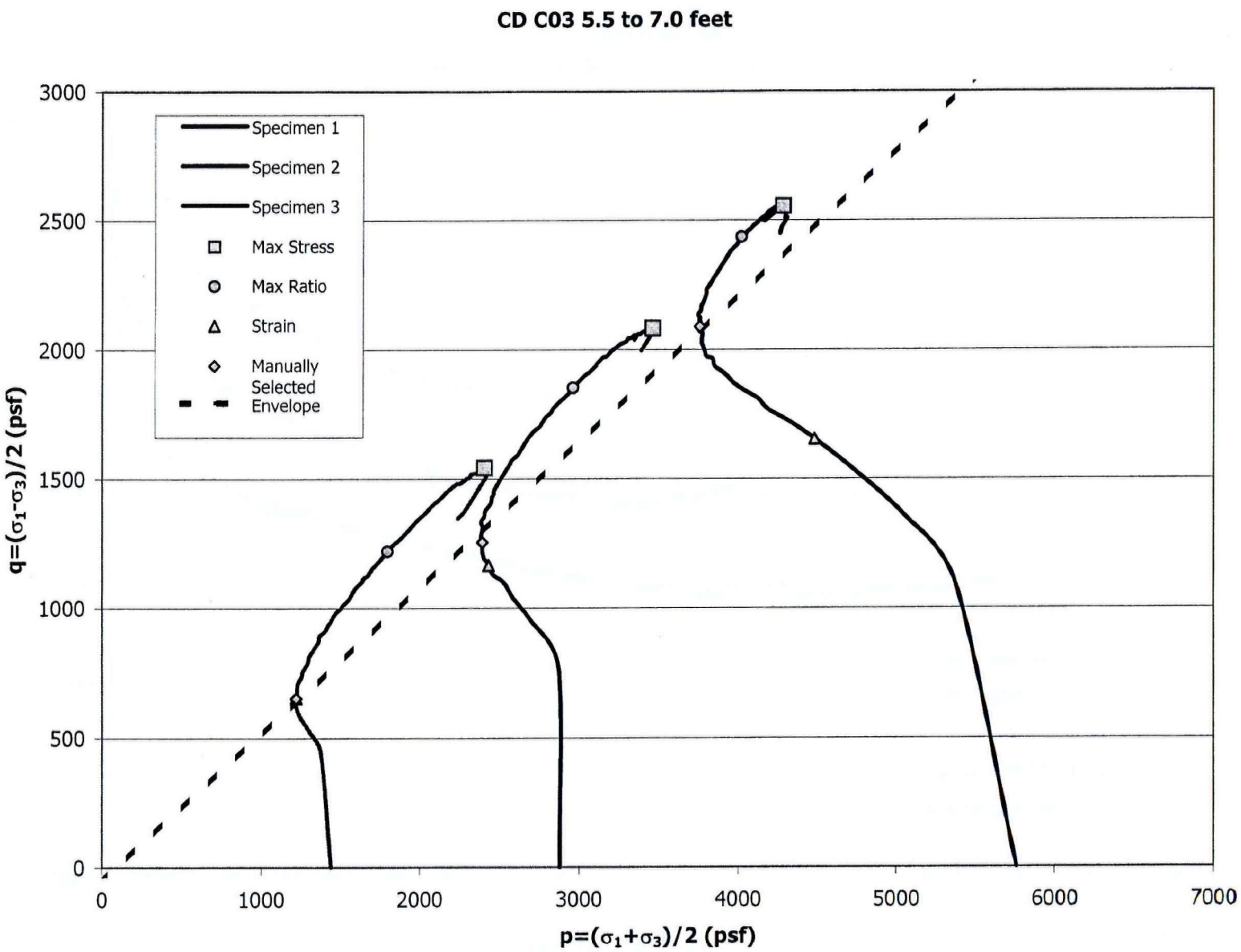
Failure Criteria	Effective Confining Stress (psf)	Strain (%)	P $(\sigma_1'+\sigma_3')/2$ (psf)	Q $(\sigma_1'-\sigma_3')/2$ (psf)	σ_1'/σ_3'	Intercept	Slope	Cohesion (psf)	Friction Angle (deg)
Max Stress	1440		2405	1541		238	0.54	282	32.6
	2880		3463	2080					
	5760		4282	2554					
Max Ratio	1440		1795	1219	5.2	236	0.55	282	33.1
	2880		2961	1852	4.3				
	5760		4019	2435	4.1				
Strain	1440	1.0	1220	653		345	0.30	362	17.4
	2880	1.0	2431	1164					
	5760	1.0	4482	1653					
Manually Selected	1440	1.0	1220	653		-60	0.57	-73	34.5
	2880	1.6	2392	1254					
	5760	5.1	3757	2087					

Envelope

c (psf)	ϕ	0	-60
-73	34.5	8000	4472


CD C03 5.5 to 7.0
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
σ1/σ3
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Axial Strain
Specimen 1
Specimen 2
Specimen 3


CD C03 5.5 to 7.0
4000
3500
3000
2500
2000
1500
1000
500
0
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Axial Strain
q=(σ1-σ3)/2
Specimen 1
Specimen 2
Specimen 3
Strain
Manually


CD C03 5.5 to 7.0 feet
Specimen 1
Specimen 2
Specimen 3
Max Stress
Max Ratio
Strain
Manually Selected Envelope
q=(σ1-σ3)/2 (psf)
p=(σ1+σ3)/2 (psf)
0
500
1000
1500
2000
2500
3000
0
1000
2000
3000
4000
5000
6000
7000

Sample ID	Depth (feet) From	Depth (feet) To	Layer Description	Specimen	Soil Classification (field)	% Passing 4.75 mm (#4 sieve)	% Passing 2.0 mm (#10 sieve)	% Passing 0.425 mm (#40 sieve)	% Passing 0.075 mm (#200 sieve)	% Passing 0.005 mm (Hydrometer)	Majority Constituent (ASTM D-422)	Plastic Limit	Liquid Limit	Plasticity Index	Atterberg Classification (ASTM)	Specific Gravity	Direct Shear Stress State	Direct Shear Normal Stress Range (psf)	Direct Shear Cohesion (psf)	Direct Shear Friction Angle (deg.)	Dry Unit Weight (pcf)	Source of Dry Unit Weight (Test)	Water Content (%)	Natural Water Content (%)	Permeability (cm/s) A	Permeability (cm/s) B	Total Volatile Solids (%)	pH
BAM-TPS1-NP-50-50(-1)1/2					SC							22	30	8										1.69				
BF-C01	3.50	4.50	SEDIMENT													2.68								30.95				
BF-C01	4.50	5.00	SEDIMENT		SM	100.00	100.00	99.10	12.00		FINE SAND	NP	NP	NP	NP									30.95				
BF-C01	5.00	5.50	SEDIMENT																					30.95				
CD-C03	5.40	5.50	SEDIMENT																		74.8	CONSOLIDATION	28.30					
CD-C03	5.50	6.00	SEDIMENT																		75.8	TRIAXIAL COMPRESSION		45.29	1.30E-05	1.00E-05		
CD-C03	6.00	6.50	SEDIMENT		ML	100.00	100.00	99.90	95.00	6.52	SILT	NP	NP	NP	NP	2.76					74.2	TRIAXIAL COMPRESSION						
CD-C03	6.50	7.00	SEDIMENT																		78.3	TRIAXIAL COMPRESSION						
CD-C03	12.25	12.75	SEDIMENT																		67.1	TRIAXIAL COMPRESSION						
CD-C03	12.75	13.00	SEDIMENT			100.00	100.00	100.00	99.90	60.92	CLAY	42	64	22	MH	2.84					65.2	TRIAXIAL COMPRESSION						
CD-C03	13.00	13.25	SEDIMENT			100.00	100.00	99.90	97.00	28.47	SILT	36	56	20	MH	2.56												
CD-C03	13.40	13.50	SEDIMENT																		71.3	CONSOLIDATION	33.96					
CD-C03	13.60	14.00	SEDIMENT																		76.7	TRIAXIAL COMPRESSION		53.57				
CD-C04	0.00	0.50	SEDIMENT		SP	100.00	100.00	98.60	1.30		FINE SAND	NP	NP	NP	NP	2.65								29.49				
EB-C01	13.50	14.00	SEDIMENT		SP	97.10	95.00	54.30	2.70		FINE SAND	NP	NP	NP	NP	2.64								25.95				
EB-C01	15.50	17.20		A																	64.6	TRIAXIAL COMPRESSION	62.10					
EB-C01	15.50	17.20		B																	66.3	TRIAXIAL COMPRESSION	58.40					
EB-C01	15.50	17.20		C																	74.3	TRIAXIAL COMPRESSION	47.60					
EB-C01	17.20	17.50	SEDIMENT			100.00	100.00	99.60	99.30	62.59	CLAY	39	65	26	MH	2.88					52.6	CONSOLIDATION	47.91	75.28				
EM-C01	5.00	6.50	FILL		GW-GM	49.30	35.80	27.10	9.80		GRAVEL													1.76				
EM-C01	15.00	16.50	FILL		GP-GM	51.20	35.70	26.00	11.50		GRAVEL													3.55				
EM-C01	20.00	21.50	FILL		SW-SM	67.10	53.60	38.40	9.20	0.75	GRAVEL													3.32				
EM-C01	25.00	26.50	FILL		GW-GM	53.70	39.00	29.30	10.20	1.87	GRAVEL													6.33				
EM-C01	33.00	34.50	SEDIMENT		SM	68.80	55.10	43.80	14.40		GRAVEL					2.60								10.48				
EM-C01	45.00	46.50	ALLUVIUM		SP-SM	56.60	46.60	36.70	6.60		GRAVEL					2.64								14.49				
EM-C01	50.00	51.50	ALLUVIUM		GW-GM	51.80	36.50	26.20	6.70		GRAVEL					2.62								9.01				
EM-C02	4.50	6.00	FILL		GW	50.00	35.00	22.70	3.90		GRAVEL													2.62				
EM-C02	19.50	21.00	FILL/ALL		SP	73.30	61.20	38.20	2.80		FINE SAND													2.88				
EM-C02	34.50	36.00	ALLUVIUM		SP	62.80	54.50	44.50	2.20		FINE SAND													15.78				
EM-C02	39.50	41.00	ALLUVIUM		SP-SM	99.30	98.50	96.50	7.50		FINE SAND					2.70								22.65				
EM-C02	49.50	51.00	ALLUVIUM		SP	87.60	78.60	59.80	2.50		FINE SAND					2.66								17.16				
EM-C03	6.00	7.00	FILL		GP-GM	40.10	26.00	17.60	7.30		GRAVEL													1.85				
EM-C03	9.50	11.00	FILL		GW-GM	48.70	37.00	26.00	8.00		GRAVEL													2.80				
EM-C03	19.50	21.00	FILL		GP	6.70	4.50	3.40	1.20		GRAVEL													2.19				
EM-C03	24.50	26.50	SEDIMENT		SP-SM	100.00	100.00	99.60	9.40	3.08	FINE SAND	NP	NP	NP	NP	2.66					88.3	PERMEABILITY	33.30		7.30E-06			
EM-C03	24.50	26.50	SEDIMENT																		76.6	CONSOLIDATION	38.70					
EM-C03	31.50	33.50	SEDIMENT													2.60					64.7	CONSOLIDATION	55.00					
EM-C03	38.00	40.00	SEDIMENT	A																	76.2	TRIAXIAL COMPRESSION	43.80					
EM-C03	38.00	40.00	SEDIMENT	B												2.62					72.5	TRIAXIAL COMPRESSION	42.80					
EM-C03	38.00	40.00	SEDIMENT	C																	76.6	TRIAXIAL COMPRESSION	42.70					
EM-C03	38.00	40.00	SEDIMENT		ML	100.00	99.90	99.50	58.40	35.37	FINE SAND	28.5	34.7	6.2	ML						76.0	CONSOLIDATION	44.70					
EM-C03	54.50	56.00	ALLUVIUM		GW	47.30	32.90	25.80	4.60		GRAVEL					2.58								9.67				
EM-C03	59.50	61.00	ALLUVIUM		GW-GM	39.50	31.60	28.00	8.30		GRAVEL					2.63								8.71				
EM-C04	9.00	11.00	FILL		GP-GC	48.30	30.40	22.60	10.90		GRAVEL													2.90				
EM-C04	19.50	21.00	FILL		GP	40.30	29.90	17.50	2.50		GRAVEL													4.08				
EM-C04	29.00	31.00	SEDIMENT		MH	100.00	100.00	100.00	99.70	41.86	SILT	31.4	52	20.6	MH	2.79					81.8	CONSOLIDATION	28.00					
EM-C04	29.00	31.00	SEDIMENT		SP-SM	100.00	99.80	98.70	7.40		FINE SAND					2.69					69.6	CONSOLIDATION	54.00					
EM-C04	38.50	40.50	SEDIMENT	A, B	SM	100.00	100.00	99.30	19.60		FINE SAND					2.66					82.5	TRIAXIAL COMPRESSION	40.20		9.00E-04			
EM-C04	38.50	40.50	SEDIMENT	A																	79.6	TRIAXIAL COMPRESSION	40.20					
EM-C04	38.50	40.50	SEDIMENT	B																	81.7	PERMEABILITY	37.20					
EM-C04	38.50	40.50	SEDIMENT	C	SM											2.66					81.9	CONSOLIDATION	28.00					
EM-C04	38.50	40.50	SEDIMENT	D	MH	100.00	100.00	100.00	99.80	45.54	SILT	32.4	57.1	24.7	MH						70.3	CONSOLIDATION	52.40					
EM-C04	45.00	46.00	SEDIMENT	B	CH	100.00	100.00	99.90	96.50		FINE GRAINED	27.2	60.8	33.6	CH	2.64					70.4	TRIAXIAL COMPRESSION	50.30					
EM-C04	45.00	46.00	SEDIMENT																		60.2	CONSOLIDATION	68.80					
EM-C04	49.50	50.50	ALLUVIUM		SP-SM	65.40	52.30	41.70	5.50		FINE SAND					2.66								9.40				
EM-C04	54.50	56.00	ALLUVIUM		GP-GM	47.80	36.90	29.60	5.50		GRAVEL					2.64								7.64				
EM-C05	4.50	6.00	FILL		GW-GM	48.30	30.40	22.60	10.90		GRAVEL													1.33				
EM-C05	14.50	16.00	FILL		GW-GM	46.00	34.00	24.90	5.00		GRAVEL													1.97				
EM-C05	34.50	35.70	ALLUVIUM		GW-GM	40.70	26.60	19.00	8.10		GRAVEL													3.15				
EM-C05	39.50	41.00	ALLUVIUM		GP-GM	47.10	29.90	22.30	9.30		GRAVEL					2.67								5.92				
EM-C05	44.50	45.50	ALLUVIUM		SP	99.90	99.30	97.50	1.80		FINE SAND													28.00				
EM-C05	45.50	46.00	ALLUVIUM		GP-GM	51.70	40.80	33.10	8.40		GRAVEL					2.66								7.91				
EM-C05	49.50	51.00	ALLUVIUM		SP-SM	58.90	52.10	47.70	6.60		FINE SAND					2.58								12.33				
EM-C06	1.50	3.50	SEDIMENT	C	ML	100.00	100.00	99.00	62.50	16.19	SILT	NP	NP	NP	NP	2.65					59.6	UNCONFINED COMPRESSIVE STRENGTH	68.40					
EM-C06	16.50	18.50	SEDIMENT		CL	100.00	100.00	99.80	84.80	28.55	SILT	25.6	49.1	23.5	CL	2.71												
EM-C06	16.50	18.50	SEDIMENT	B																	61.1	TRIAXIAL COMPRESSION	64.20		2.50E-07	1.60E-07		
EM-C06	16.50	18.50	SEDIMENT	C																	66.3	TRIAXIAL COMPRESSION	58.40					
EM-C06	16.50	18.50	SEDIMENT	A																	70.8	TRIAXIAL COMPRESSION	51.40					
EM-C06	16.50	18.50	SEDIMENT	D																	64.0	PERMEABILITY	58.90					
EM-C06	16.50	18.50	SEDIMENT	D																	72.3	PERMEABILITY	58.90					
EM-C06	30.00	31.50	ALLUVIUM		GP	40.10	21.30	6.80	0.20		GRAVEL					2.60								5.28				
EM-C06	35.00	36.50	ALLUVIUM		GP	34.70	16.90	2.60	0.10		GRAVEL													4.25				
EM-C07	7.00	9.00	SEDIMENT	D, E, F	SP-SM	99.90	99.60	78.40	6.30	2.17	FINE SAND	NP	NP	NP	NP	2.70									1.00E-04	6.70E-05		
EM-C07	7.00	9.00	SEDIMENT	D																	96.6	TRIAXIAL COMPRESSION	26.10					
EM-C07	7.00	9.00	SEDIMENT	E																	93.9	TRIAXIAL COMPRESSION	27.20					
EM-C07	7.00	9.00	SEDIMENT	F																	93.2	TRIAXIAL COMPRESSION	27.90					
EM-C07	7.00	9.00	SEDIMENT	G																	89.3	PERMEABILITY	28.60					
EM-C07	7.00	9.00	SEDIMENT	G																	87.5	PERMEABILITY	28.60					
EM-C07	7.00	9.00	SEDIMENT																		92.0	CONSOLIDATION	29.10					

Sample ID	Depth (feet) From	Depth (feet) To	Layer Description	Specimen	Soil Classification (field)	% Passing 4.75 mm (#4 sieve)	% Passing 2.0 mm (#10 sieve)	% Passing 0.425 mm (#40 sieve)	% Passing 0.075 mm (#200 sieve)	% Passing 0.005 mm (Hydrometer)	Majority Constituent (ASTM D-422)	Plastic Limit	Liquid Limit	Plasticity Index	Atterberg Classification (ASTM)	Specific Gravity	Direct Shear Stress State	Direct Shear Normal Stress Range (psf)	Direct Shear Cohesion (psf)	Direct Shear Friction Angle (deg.)	Dry Unit Weight (pcf)	Source of Dry Unit Weight (Test)	Water Content (%)	Natural Water Content (%)	Permeability (cm/s) A	Permeability (cm/s) B	Total Volatile Solids (%)	pH
EM-C07	12.00	14.00	SEDIMENT	B, C, F	ML	100.00	100.00	99.40	73.80	20.22	SILT	27.5	40	12.5	ML	2.68												
EM-C07	12.00	14.00	SEDIMENT	B																	66.5	TRIAXIAL COMPRESSION	53.70					
EM-C07	12.00	14.00	SEDIMENT	C																	68.8	TRIAXIAL COMPRESSION	51.70					
EM-C07	12.00	14.00	SEDIMENT	F																	77.1	TRIAXIAL COMPRESSION	41.60					
EM-C07	12.00	14.00	SEDIMENT													2.70					66.6	CONSOLIDATION	56.30					
EM-C08	4.00	4.50	SEDIMENT		MH	100.00	99.90	99.90	99.80		FINE GRAINED	30.7	52	21.3	MH	2.82					61.9	UNCONFINED COMPRESSIVE STRENGTH	68.30					
EM-C08	4.50	5.00	SEDIMENT														Peak	500-2000	150.5	33.4	77.3	DIRECT SHEAR	43.90					
EM-C08	4.50	5.00	SEDIMENT														Ultimate	500-2000	114.5	32	74.6	DIRECT SHEAR	45.60					
EM-C08	4.50	5.00	SEDIMENT																		79.2	DIRECT SHEAR	40.60					
EM-C08	5.00	5.50	SEDIMENT		SP-SM	100.00	100.00	96.00	5.60		FINE SAND	NP	NP	NP	NP	2.66					85.8	CONSOLIDATION	32.00					
EM-C08	6.50	8.50	SEDIMENT		SP-SM	99.90	99.90	75.90	5.20		FINE SAND	NP	NP	NP	NP	2.67					95.1	CONSOLIDATION	26.10					
EM-C08	11.50	13.50	SEDIMENT	D, E, F	MH	100.00	100.00	99.80	97.40		FINE GRAINED	30.9	58.9	28	MH	2.73												
EM-C08	11.50	13.50	SEDIMENT	C																	68.3	CONSOLIDATION	53.50					
EM-C08	11.50	13.50	SEDIMENT	D																	61.5	TRIAXIAL COMPRESSION	63.20					
EM-C08	11.50	13.50	SEDIMENT	E																	61.5	TRIAXIAL COMPRESSION	63.50					
EM-C08	11.50	13.50	SEDIMENT	F																	60.5	TRIAXIAL COMPRESSION	97.40					
EM-C08	14.00	14.50	SEDIMENT																		64.4	CONSOLIDATION	57.70					
EM-C08	15.00	17.00	SEDIMENT		SM	99.40	99.30	97.80	36.60		FINE SAND	NP	NP	NP	NP	2.66	Peak	1000-4000	66.5	34.7	97.8	DIRECT SHEAR	26.40					
EM-C08	15.00	17.00	SEDIMENT														Ultimate	1000-4000	79	33.4	96.3	DIRECT SHEAR	27.40					
EM-C08	15.00	17.00	SEDIMENT																		96.6	DIRECT SHEAR	27.50					
EM-C08	15.00	17.00	SEDIMENT																		95.1	CONSOLIDATION	26.30					
EM-C08	25.00	27.00	ALLUVIUM		SP-SM	98.10	96.50	90.10	10.00		FINE SAND					2.67								24.87				
EM-C08	30.00	31.50	ALLUVIUM		SP	100.00	99.70	94.60	3.70		FINE SAND																	
EM-C08	30.50	31.00	ALLUVIUM		SP	99.40	98.10	88.00	0.80		FINE SAND					2.69					102.9	INDEPENDENT	22.80	22.80				
EM-C09	5.00	7.00	SEDIMENT	ST 4	SP-SM	99.90	99.90	96.00	8.00		FINE SAND	NP	NP	NP	NP	2.68	Peak	500-2500	209.6	37.5	91.4	DIRECT SHEAR	36.40					
EM-C09	5.00	7.00	SEDIMENT	ST 4													Ultimate	500-2500	20.6	34.3	85.1	DIRECT SHEAR	36.60					
EM-C09	5.00	7.00	SEDIMENT	ST 4																	83.7	DIRECT SHEAR	35.70					
EM-C09	5.00	7.00	SEDIMENT	ST 4																	86.4	CONSOLIDATION	30.7					
EM-C09	10.00	12.00	SEDIMENT	B, C, D	ML	100.00	99.90	98.50	73.50		FINE GRAINED	26.6	39.6	13	ML	2.70					55.8	CONSOLIDATION	78.60					
EM-C09	10.00	12.00	SEDIMENT	B																	64.3	TRIAXIAL COMPRESSION	57.80					
EM-C09	10.00	12.00	SEDIMENT	D																	66.8	TRIAXIAL COMPRESSION	51.20					
EM-C09	10.00	12.00	SEDIMENT	C																	66.6	TRIAXIAL COMPRESSION	56.10					
EM-C09	12.50	13.00	SEDIMENT	BC #8B	ML	100.00	100.00	99.90	94.40		FINE GRAINED	30.6	44.7	14.1	ML	2.68	Peak	500-2500	86.4	34.2	67.7	DIRECT SHEAR	52.80					
EM-C09	12.50	13.00	SEDIMENT	BC #8B													Ultimate	500-2500	89.5	33.4	64.1	DIRECT SHEAR	57.30					
EM-C09	12.50	13.00	SEDIMENT	BC #8B																	67.3	DIRECT SHEAR	53.40					
EM-C09	13.00	13.50	SEDIMENT																		66.3	UNCONFINED COMPRESSIVE STRENGTH	56.70					
EM-C09	15.00	17.00	SEDIMENT	ST #10	ML	99.70	99.70	99.40	75.40		FINE GRAINED	28.6	40.8	12.2	ML	2.62	Peak	1000-4000	115	32	69.5	DIRECT SHEAR	52.30					
EM-C09	15.00	17.00	SEDIMENT	ST #10													Ultimate	1000-4000	103	31.9	69.9	DIRECT SHEAR	51.80					
EM-C09	15.00	17.00	SEDIMENT																		70.4	DIRECT SHEAR	51.80					
EM-C09	15.00	17.00	SEDIMENT																		77.4	CONSOLIDATION	40.90					
EM-C09	25.00	27.00	ALLUVIUM		SW	53.20	34.60	16.70	4.80		GRAVEL																	
EM-C10	5.00	7.00	SEDIMENT	A, B	SM	99.80	99.80	95.30	30.80		FINE SAND	NP	NP	NP	NP	2.69	Peak	250-1000	60	39.6	90.2	DIRECT SHEAR	30.60					
EM-C10	5.00	7.00	SEDIMENT	A, B													Ultimate	250-1000	84.5	31.8	89.5	DIRECT SHEAR	32.50					
EM-C10	5.00	7.00	SEDIMENT	A, B																	75.7	DIRECT SHEAR	48.20					
EM-C10	5.00	7.00	SEDIMENT	D	ML	99.60	99.10	98.10	73.20		FINE GRAINED	34	46	12	ML	2.62												
EM-C10	5.00	7.00	SEDIMENT																		60.3	TRIAXIAL COMPRESSION	64.30					
EM-C10	5.00	7.00	SEDIMENT																		63.7	TRIAXIAL COMPRESSION	64.30					
EM-C10	5.00	7.00	SEDIMENT																		65.0	TRIAXIAL COMPRESSION	64.30					
EM-C11	10.00	12.00	SEDIMENT	ST #7	CL	100.00	100.00	98.10	94.60		FINE GRAINED	26.6	49.6	23	CL	2.74					55.7	CONSOLIDATION	77.00					
EM-C11	10.00	12.00	SEDIMENT	ST #7, C																	70.5	TRIAXIAL COMPRESSION	54.70					
EM-C11	10.00	12.00	SEDIMENT	ST #7, B																	61.8	TRIAXIAL COMPRESSION	68.70					
EM-C11	10.00	12.00	SEDIMENT	ST #7, A																	66.2	TRIAXIAL COMPRESSION	57.50					
EM-C11	12.50	13.00	SEDIMENT	BC #8S	CH	100.00	100.00	99.90	98.30		FINE GRAINED	31.1	62.1	31	CH	2.80	Peak	1000-4000	0	32.9	64.7	DIRECT SHEAR	57.80					
EM-C11	12.50	13.00	SEDIMENT	BC #8S													Ultimate	1000-4000	0	33.2	57.6	DIRECT SHEAR	69.50					
EM-C11	12.50	13.00	SEDIMENT	BC #8S																	60.3	DIRECT SHEAR	64.60					
EM-C11	12.50	13.00	SEDIMENT	BC #8S																	60.9	CONSOLIDATION	62.80					
EM-C11	13.00	13.50	SEDIMENT	BC #8C	MH	100.00	100.00	100.00	96.00		FINE GRAINED	31.1	60.5	29.4	MH	2.72					64.8	UNCONFINED COMPRESSIVE STRENGTH	58.70					
EM-C11	15.00	17.00	SEDIMENT	E	ML	100.00	99.90	99.20	63.90		FINE GRAINED	NP	NP	NP	NP	2.62	Peak	1000-4000	60	33.8	83.4	DIRECT SHEAR	37.50					
EM-C11	15.00	17.00	SEDIMENT	E													Ultimate	1000-4000	66	33.4	82.4	DIRECT SHEAR	39.20					
EM-C11	15.00	17.00	SEDIMENT	E																	84.4	DIRECT SHEAR	38.80					
EM-C11	15.00	17.00	SEDIMENT	G																	61.6	CONSOLIDATION	60.90					
EM-C11	15.00	17.00	SEDIMENT	F																	66.0	UNCONFINED COMPRESSIVE STRENGTH	51.90					
EM-C11	25.00	26.00	ALLUVIUM		GW	30.10	17.30	7.30	2.10		GRAVEL																	
EM-C12																												
EM-C14	56.50	57.75	ALLUVIUM		CL	98.20	98.10	94.70	83.00		FINE GRAINED	17.8	31.2	13.4	CL	2.71					94.4	CONSOLIDATION	30.00					
EM-C15	44.00	46.00	SEDIMENT		SM	98.80	98.20	96.60	43.30		FINE SAND	NP	NP	NP	NP	2.64					82.9	CONSOLIDATION	34.00					
EM-C15	44.00	46.00	SEDIMENT	A																	63.7	TRIAXIAL COMPRESSION	57.40					
EM-C15	44.00	46.00	SEDIMENT	B																	71.6	TRIAXIAL COMPRESSION	47.40					
EM-C15	44.00	46.00	SEDIMENT	C																	71.3	TRIAXIAL COMPRESSION	44.90					
EM-C15	47.50	49.50	SEDIMENT	E	SM	98.40	97.30	95.00	31.30		FINE SAND	NP	NP	NP	NP	2.66					80.6	CONSOLIDATION	36					
EM-C15	47.50	49.50	SEDIMENT	A	ML							33.6	39.9	6.3	ML	2.65					59.3	CONSOLIDATION	61.30					
EM-C15	47.50	49.50	SEDIMENT	B	SP-SM	98.70	98.20	95.00	10.50		FINE SAND	NP	NP	NP	NP	2.49					82.7	TRIAXIAL COMPRESSION	36.00					
EM-C15	47.50	49.50	SEDIMENT	B																	82.4	TRIAXIAL COMPRESSION	36.00					
EM-C15	47.50	49.50	SEDIMENT	B																	81.8	TRIAXIAL COMPRESSION	36.00					

Sample ID	Depth (feet) From	Depth (feet) To	Layer Description	Specimen	Soil Classification (field)	% Passing 4.75 mm (#4 sieve)	% Passing 2.0 mm (#10 sieve)	% Passing 0.425 mm (#40 sieve)	% Passing 0.075 mm (#200 sieve)	% Passing 0.005 mm (Hydrometer)	Majority Constituent (ASTM D-422)	Plastic Limit	Liquid Limit	Plasticity Index	Atterberg Classification (ASTM)	Specific Gravity	Direct Shear Stress State	Direct Shear Normal Stress Range (psf)	Direct Shear Cohesion (psf)	Direct Shear Friction Angle (deg.)	Dry Unit Weight (pcf)	Source of Dry Unit Weight (Test)	Water Content (%)	Natural Water Content (%)	Permeability (cm/s) A	Permeability (cm/s) B	Total Volatile Solids (%)	pH
EM-C15	50.50	51.00	SEDIMENT		ML	99.90	99.70	98.10	52.70		FINE GRAINED	NP	NP	NP	NP	2.60					61.7	CONSOLIDATION	61.20					
EM-C15	52.50	54.50	SEDIMENT	A	ML	99.30	99.00	98.50	84.60		FINE GRAINED	28.8	45.8	17	ML	2.59					79.3	TRIAXIAL COMPRESSION	42.30					
EM-C15	52.50	54.50	SEDIMENT	A																	80.3	TRIAXIAL COMPRESSION	42.30					
EM-C15	52.50	54.50	SEDIMENT	A																	78.3	TRIAXIAL COMPRESSION	42.30					
EM-C15	52.50	54.50	SEDIMENT	E	ML	100.00	100.00	99.70	77.00		FINE GRAINED	NP	NP	NP	NP	2.69					85.4	CONSOLIDATION	35					
EM-C15	56.00	57.50	SEDIMENT		ML	98.60	98.40	97.50	73.20		FINE GRAINED	26.5	32.7	6.2	ML	2.65					85.3	CONSOLIDATION	33.8					
EM-C15	56.00	57.50	SEDIMENT																		90.6	TRIAXIAL COMPRESSION	30.10					
EM-C17	42.00	42.50	ALLUVIUM		SC-SM	100.00	99.90	97.80	45.70		FINE SAND	18.1	22.7	4.6	CL-ML	2.67	Peak	2000-8000	350	30.3	99.7	DIRECT SHEAR	17.00					
EM-C17	42.00	42.50	ALLUVIUM														Ultimate	2000-8000	332	30.4	97.8	DIRECT SHEAR	17.90					
EM-C17	42.00	42.50	ALLUVIUM																		103.2	DIRECT SHEAR	14.80					
EM-C17	42.50	43.00	ALLUVIUM		SM	100.00	100.00	99.00	48.30		FINE SAND	18	21.7	3.7	ML	2.68					102.7	CONSOLIDATION	17.80					
EM-C17B																												
EM-C21	46.50	48.50	SEDIMENT		ML	100.00	100.00	99.90	52.50		FINE GRAINED	NP	NP	NP	NP	2.71					88.0	CONSOLIDATION	32.80					
GC-C01	1.50	3.00	SEDIMENT													2.60								31.76				
GC-C01	3.00	3.40	SEDIMENT		SP	95.10	89.50	46.20	3.40		MEDIUM SAND	NP	NP	NP	NP									31.76				
GC-C01	3.40	3.50	SEDIMENT									29	51	22	MH									31.76				
GC-C02	9.50	10.00	SEDIMENT																		86.4	TRIAXIAL COMPRESSION						
GC-C02	10.00	10.50	SEDIMENT																		85.7	TRIAXIAL COMPRESSION						
GC-C02	10.50	11.00	SEDIMENT		SP	100.00	100.00	95.00	2.50		FINE SAND	NP	NP	NP	NP	2.61					93.7	TRIAXIAL COMPRESSION		18.46	2.60E-03			
GC-C04	0.50	1.00	SEDIMENT																		70.0	TRIAXIAL COMPRESSION			1.10E-03			
GC-C04	1.00	1.40	SEDIMENT		SP	100.00	99.98	96.76	2.33		FINE SAND	NP	NP	NP	NP	2.64								30.98				
GC-C04	1.40	1.50	SEDIMENT																		81.9	CONSOLIDATION	30.20					
GC-C04	2.50	3.00	SEDIMENT																		91.1	TRIAXIAL COMPRESSION						
GC-C06	12.00	13.50	SEDIMENT			97.50	96.60	94.20	68.10		FINE GRAINED	35	53	18	MH	2.53								71.25				
GC-C06	18.50	19.00	SEDIMENT		GW							NP	NP	NP	NP	2.62								64.53				
GC-C06	19.00	19.50	SEDIMENT		SM	100.00	99.97	97.60	18.30		FINE SAND	37	65	28														
GC-C06	24.00	25.50	ALLUVIUM		GW	34.00	19.10	8.90	3.20		GRAVEL	NP	NP	NP	NP	2.69								6.28				
SH-C01	51.50	53.00	ALLUVIUM		SM	99.80	99.60	86.10	22.30		FINE SAND	NP	NP	NP	NP	2.74	Peak	2000-8000	78	35.6	99.2	DIRECT SHEAR	28.30					
SH-C01	51.50	53.00	ALLUVIUM														Ultimate	2000-8000	0	34.6	98.2	DIRECT SHEAR	28.00					
SH-C01	51.50	53.00	ALLUVIUM																		101.5	DIRECT SHEAR	26.40					
SH-C01	51.50	53.00	ALLUVIUM																		112.9	CONSOLIDATION	18.5					
SH-C01	51.50	53.00	ALLUVIUM																		101.0	UNCONFINED COMPRESSIVE STRENGTH	25.80					
SW-C01	2.50	3.00	SEDIMENT		SM	100.00	100.00	92.70	12.70		FINE SAND	NP	NP	NP	NP	2.69					82.8	INDEPENDENT		34.02				
SW-C01	11.10	11.50	SEDIMENT																		64.8	TRIAXIAL COMPRESSION		62.84				
SW-C01	11.50	12.00	SEDIMENT																		55.1	INDEPENDENT	79.84	62.84				
SW-C01	12.00	12.50	SEDIMENT			100.00	99.90	99.00	94.90	48.40	CLAY	35	59	24	MH	2.90					53.0	INDEPENDENT	87.82	62.84				
SW-C01	12.50	13.00	SEDIMENT									35	62	27	MH	2.60					53.7	CONSOLIDATION	53.33	62.84				
SW-C01	12.50	13.00	SEDIMENT																		55.7	INDEPENDENT	62.84	62.84				
SW-C01	23.00	24.50	ALLUVIUM		GW	22.20	12.80	5.30	1.70		GRAVEL	NP	NP	NP	NP	2.64								3.35				
TPS1-NP	1.00	2.00			ML	100.00	99.50	97.50	69.10	9.12	SILT	NP	NP	NP	NP	2.61					86.3	CONSOLIDATION	4.07	20.52				
TPS2-NP					ML							NP	NP	NP	NP	2.76												
EB-2	10.00	11.50	SEDIMENT		SP				7.00		FINE SAND													33.00				
EB-2	22.00	23.50	SEDIMENT		SM				33.00		FINE SAND													24.00				
EB-2	2.10	2.20	SEDIMENT						90.00		SILT	32	44	12	ML									53.20				
EB-2	4.00	4.10	SEDIMENT						91.00		SILT	34	56	22	MH									63.60				
EB-2	16.70	16.80	SEDIMENT						100.00		SILT	36	61	25	MH									74.20				
EB-2	19.70	19.80	SEDIMENT						85.00		SILT	28	48	20	ML									44.10				
EB-2	21.30	21.40	SEDIMENT						62.00		SILT	24	23	1	ML									29.50				
PB-1	5.00	6.50	SEDIMENT		SM	99.90	99.60	95.10	29.70		FINE SAND																	
PB-2	3.50	5.00	SEDIMENT		CL				88.00		CLAY													86.00				
PB-2	13.50	15.00	SEDIMENT		SM				41.00		FINE SAND													32.00				
PB-2	18.50	20.00	SEDIMENT		SM				44.00		FINE SAND													29.00				
SW1-1	1.30	2.80	SEDIMENT		ML				75.00		SILT													82.00				
SW1-1	4.70	4.80	SEDIMENT		ML				57.00		SILT													60.00				
SW1-1	6.10	6.20	SEDIMENT		ML				67.00		SILT													38.00				
SW1-1	9.70	9.90	SEDIMENT		SP				3.00		FINE SAND													24.00				
SW1-1	15.00	17.00	SEDIMENT		SP																			46.00		1.3	6.97	
SW1-1	17.50	19.00	SEDIMENT						92.10		SILT	37	76	39	MH													
SW1-1	20.20	20.30	SEDIMENT		CL				95.00		CLAY													49.00				
SW1-1	25.00	26.50	SEDIMENT		SM				35.00		FINE SAND													32.00				
SW1-1	30.00	31.50	ALLUVIUM		GP-GM	42.80	28.40	15.10	8.60		FINE GRAVEL																	
SW1-1	40.00	41.50	ALLUVIUM		SP																			18.00		0.2	7.86	
SW1-2	7.50	9.00	SEDIMENT		SP	99.80	98.50	62.00	2.40		FINE SAND													31.00		0.4	7.48	
SW1-2	20.00	21.50	ALLUVIUM		GP-GM																			17.00		0.4	7.14	
SW1-3	3.50	7.00	SEDIMENT		SP w/ organics				6.00		FINE SAND													57.00				
SW1-3	8.80	9.20	SEDIMENT									35	61	26	MH									85.00				
SW1-3	11.00	11.10	SEDIMENT									33	70	37	CH									65.00				
SW1-3	11.10	11.60	SEDIMENT		CL				97.00		CLAY													54.00				
SW1-3	13.00	14.40	SEDIMENT		CL w/ organics																			85.00		10.3	6.97	
SW1-3	17.50	19.00	ALLUVIUM		GP w/ sand																			4.00		0.3	5.04	
SW2-1	2.00	3.50	SEDIMENT		SP																			7.00		0.3	7.93	
SW2-1	7.00	8.50	SEDIMENT		CL																			54.00		4	7.22	
SW2-1B	9.00	9.50	SEDIMENT		CL				93.00		CLAY													58.00				
SW2-1B	9.50	9.60	SEDIMENT									30	52	22	MH									55.00				
SW2-2	7.50	9.00	SEDIMENT		CL																			66.00		5.4	7.26	
SW2-2	10.00	11.50	SEDIMENT		SP-SM				10.00		FINE SAND													13.00				
SW2-2	22.00	23.50	ALLUVIUM		SP w/ gravel																			13.00		0.2	4.6	
SW2-3	6.00	7.50	SEDIMENT		ML w/ organics				65.00		SILT													52.00		5.9	7.06	
SW3-1	7.50	9.00	SEDIMENT		CL w/ organics				66.00		CLAY													74.00				
SW3-1	11.70	12.00	SEDIMENT						94.00		SILT	30	44	14	ML													
SW3-1	16.50	16.70	SEDIMENT		ML				87.00		SILT													36.00				
SW3-1	37.00	39.00	ALLUVIUM		GW	10.30	7.20	3.10	2.40		COARSE GRAVEL																	
SW3-2	10.00	11.50	SEDIMENT		SP-SM				11.00		FINE SAND													31.00				
SW3-2	10.00	11.50	SEDIMENT		ML				82.00		SILT													39.00				
SW4-1	10.00	11.50	SEDIMENT		SM				42.00		FINE SAND													23.00		1.7	5.95	
SW4-1	30.00	31.50	ALLUVIUM		GP-GM																			10.00		0.3	6.31	
SW4-2	15.00	16.50	ALLUVIUM		SP-SM																			10.00		0.3	7.18	
SW4-2	40.00	41.50	ALLUVIUM		GP																			6.00		0.2	4.27	

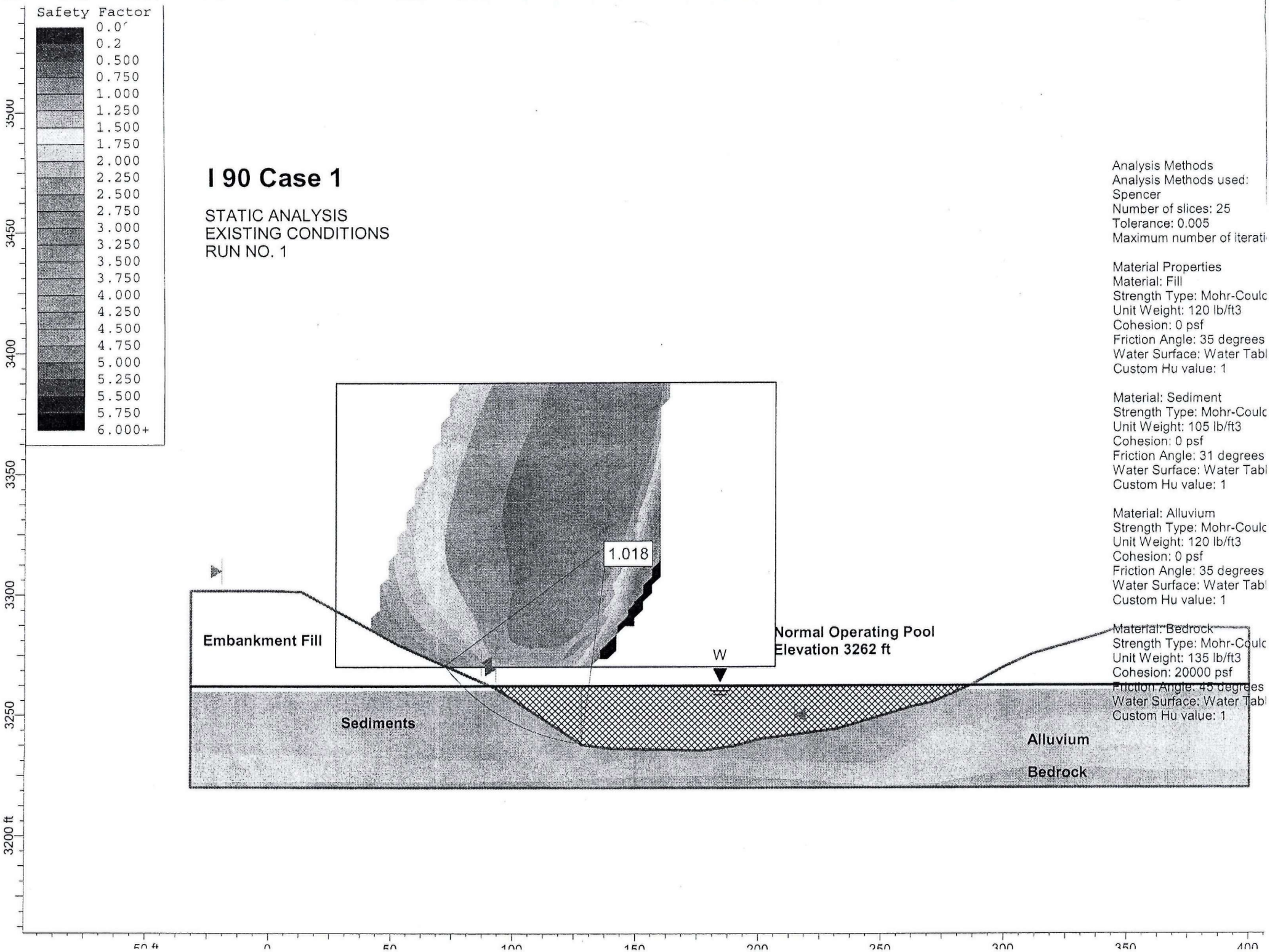
Appendix D

Prior Stability Analysis for Jet Grout Stabilization

Case 1 Analyses

I 90 Case 1

STATIC ANALYSIS
EXISTING CONDITIONS
RUN NO. 1



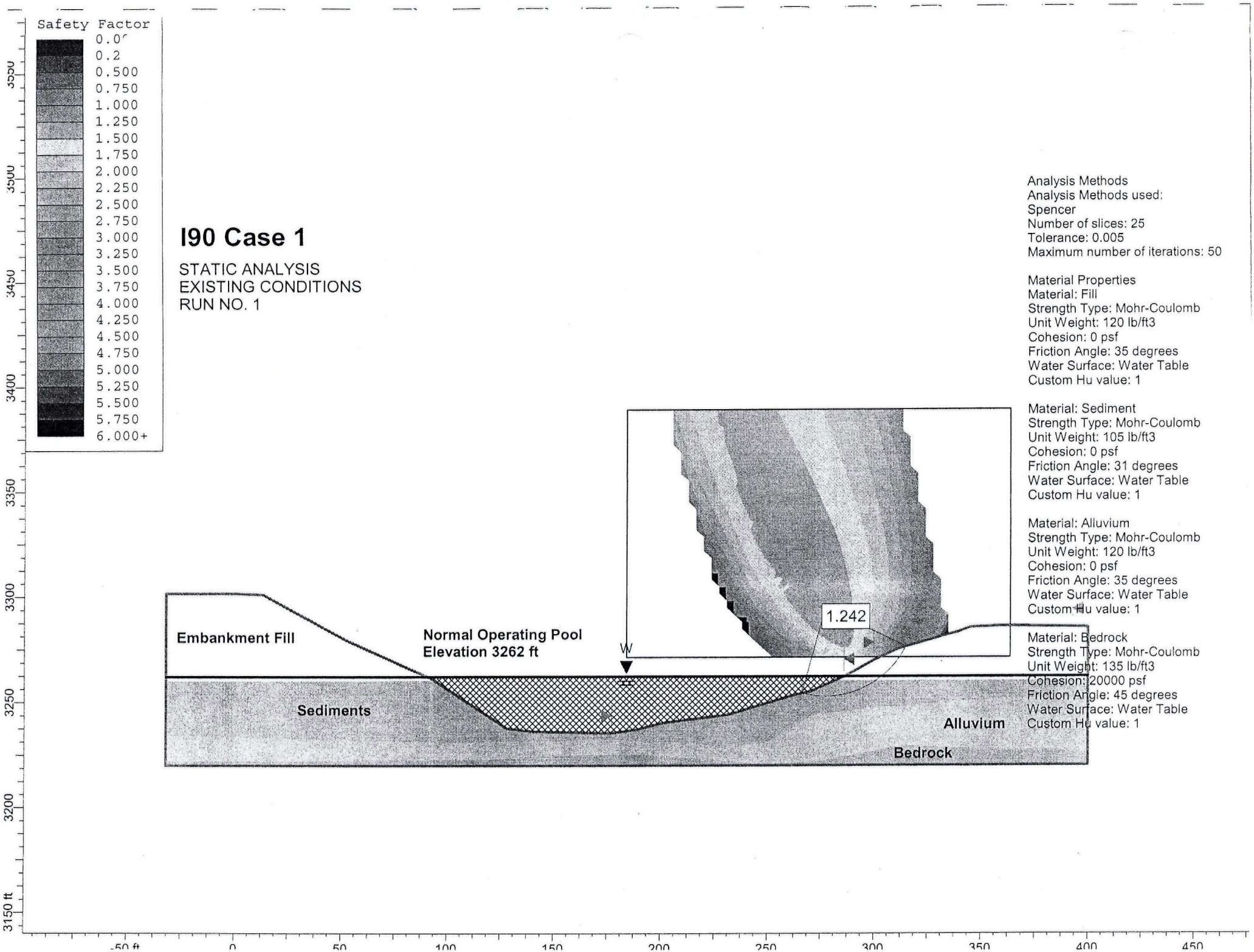
Analysis Methods
Analysis Methods used:
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterati

Material Properties
Material: Fill
Strength Type: Mohr-Coulc
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Tabl
Custom Hu value: 1

Material: Sediment
Strength Type: Mohr-Coulc
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 31 degrees
Water Surface: Water Tabl
Custom Hu value: 1

Material: Alluvium
Strength Type: Mohr-Coulc
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Tabl
Custom Hu value: 1

Material: Bedrock
Strength Type: Mohr-Coulc
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 45 degrees
Water Surface: Water Tabl
Custom Hu value: 1



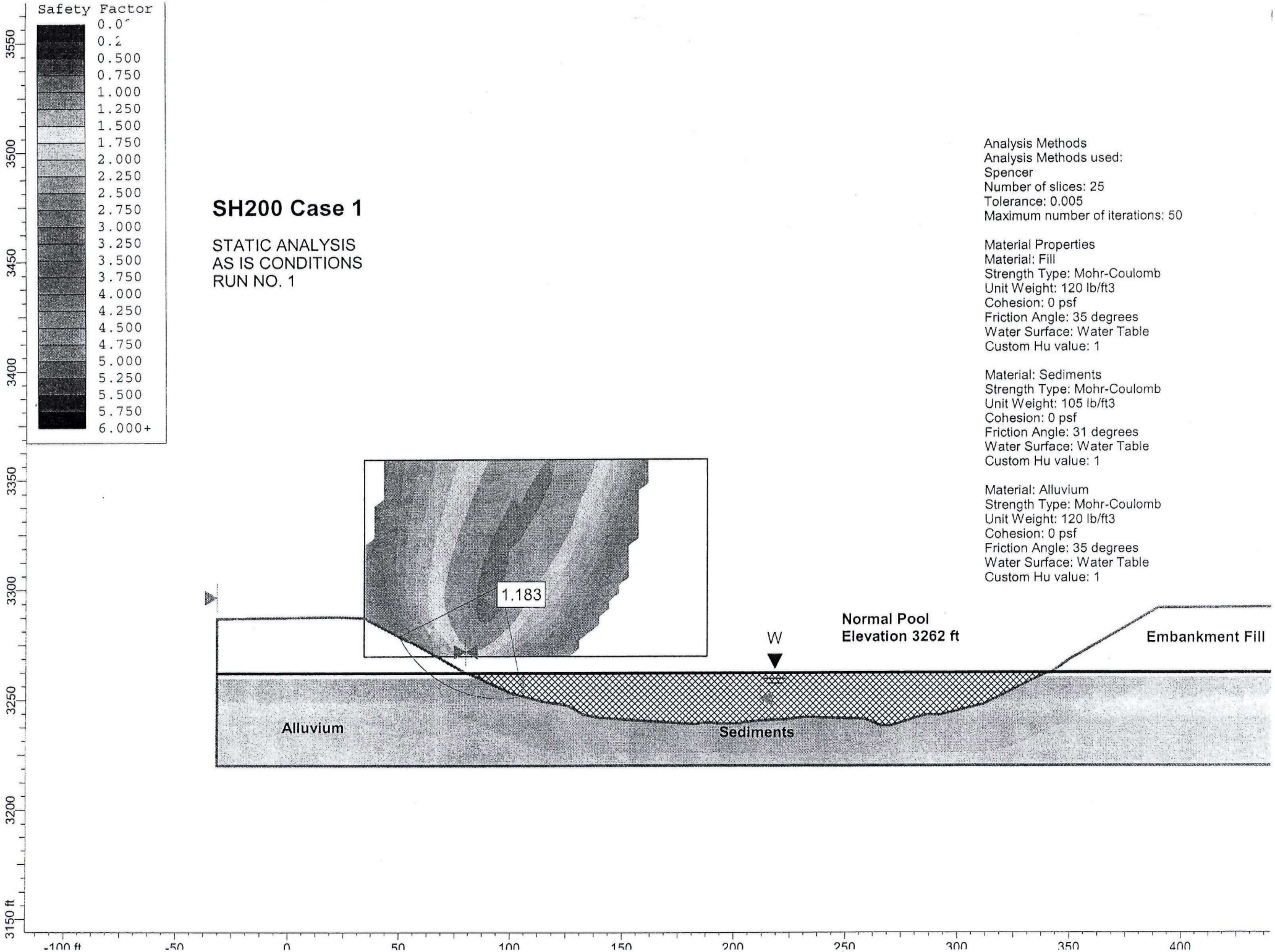
Analysis Methods
Analysis Methods used:
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

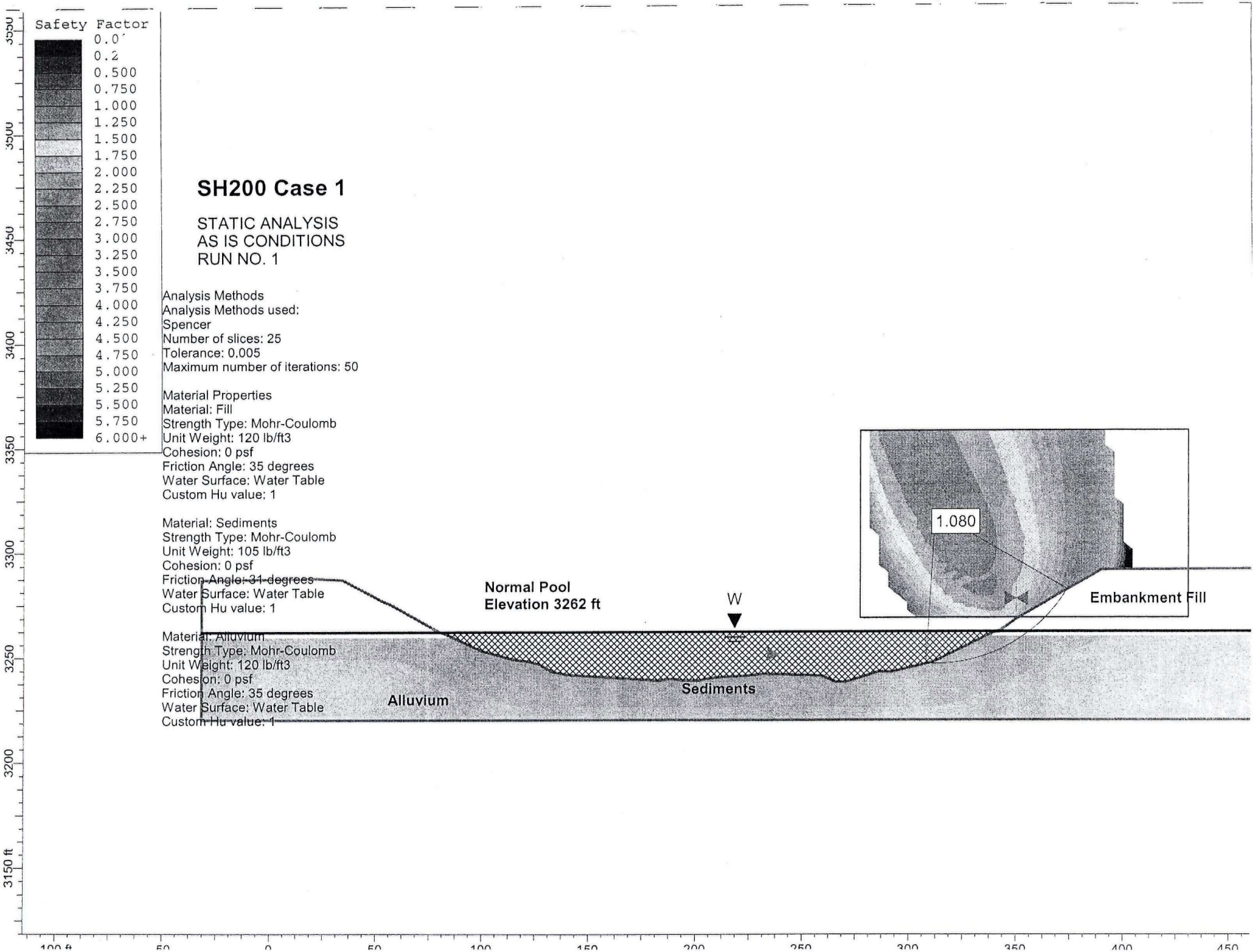
Material Properties
Material: Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sediment
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 31 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Alluvium
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Bedrock
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 45 degrees
Water Surface: Water Table
Custom Hu value: 1


Safety Factor
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
SH200 Case 1
STATIC ANALYSIS
AS IS CONDITIONS
RUN NO. 1
Analysis Methods
Analysis Methods used:
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Material Properties
Material: Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Sediments
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 31 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Alluvium
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1
1.183
W
Normal Pool
Elevation 3262 ft
Embankment Fill
Alluvium
Sediments
3550
3500
3450
3400
3350
3300
3250
3200
3150 ft
-100 ft
-50
0
50
100
150
200
250
300
350
400


Safety Factor
0.0
0.2
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
SH200 Case 1
STATIC ANALYSIS
AS IS CONDITIONS
RUN NO. 1
Analysis Methods
Analysis Methods used:
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Material Properties
Material: Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Sediments
Strength Type: Mohr-Coulomb
Unit Weight: 105 lb/ft3
Cohesion: 0 psf
Friction Angle: 31 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Alluvium
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1
Normal Pool
Elevation 3262 ft
W
1.080
Embankment Fill
Sediments
Alluvium
3550
3500
3450
3400
3350
3300
3250
3200
3150 ft
100 ft
50
0
50
100
150
200
250
300
350
400
450

Case 2 Analyses