RELATIONSHIP BETWEEN ERODIBILITY AND PROPERTIES OF SOILS

APPENDICES REPORT

A Dissertation

by

IMAN SHAFII

Submitted to the Office of Graduate and Professional Studies of

Texas A&M University

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Jean-Louis Briaud
Committee Members,	Zenon Medina-Cetina
	Hamn-Ching Chen
	Mary Jo Richardson
Head of Department,	Robin Autenrieth

December 2018

Major Subject: Civil Engineering

TABLE OF CONTENT

Page

Page

Page

Page

Page

Page

Page

Page

Page

Page

Page

Page

Page

Page

Page

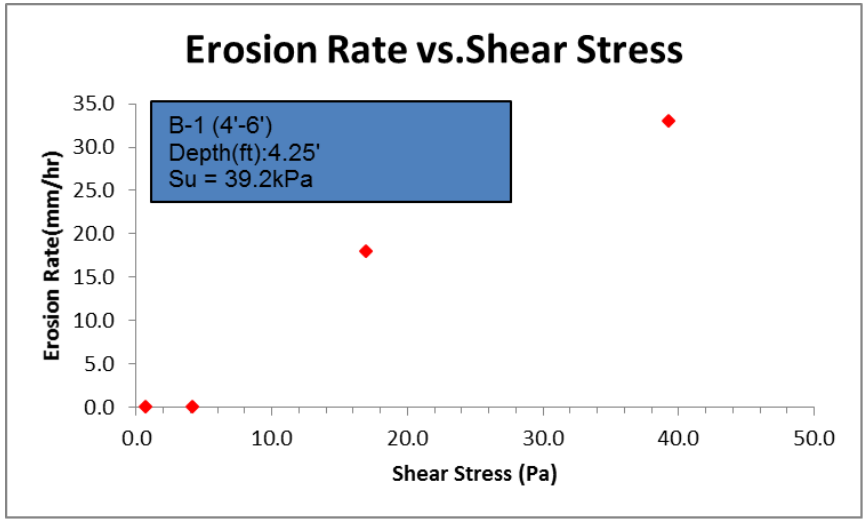
APPENDIX 1 – EROSION TEST RESULTS SPREADSHEETS

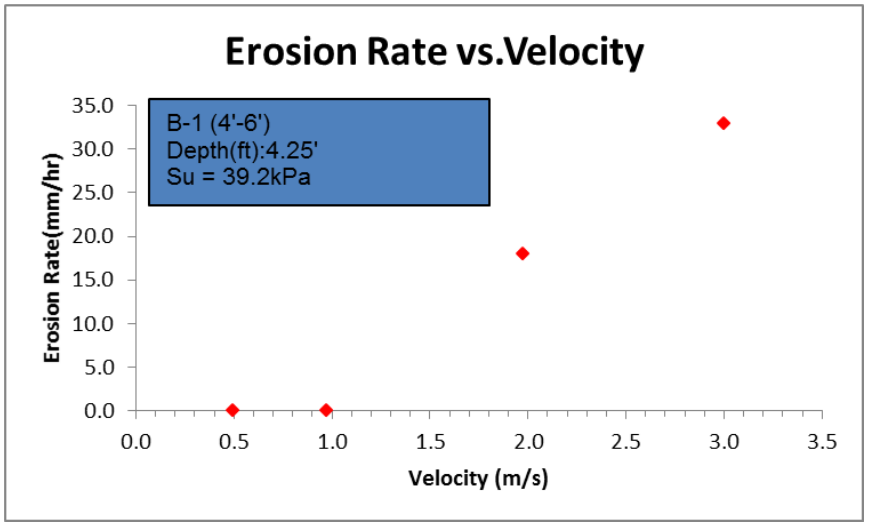
Clay Samples - EFA

B-1 (4'-6') Beaumont Formation

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.490	0.002	29743	0.024	0.720	0	1200	0.000
0.970	0.500	58914	0.035	4.119	0	1200	0.000
1.970	0.500	119584	0.035	16.972	6	1200	18.000
2.995	0.500	181828	0.035	39.239	5.5	600	33.000

Velocity(m/sec)	0.490	0.970	1.970	2.995
Shear stress(P_a)	0.720	4.119	16.972	39.239
Erosion Rate(mm/hr)	0.100	0.100	18.000	33.000

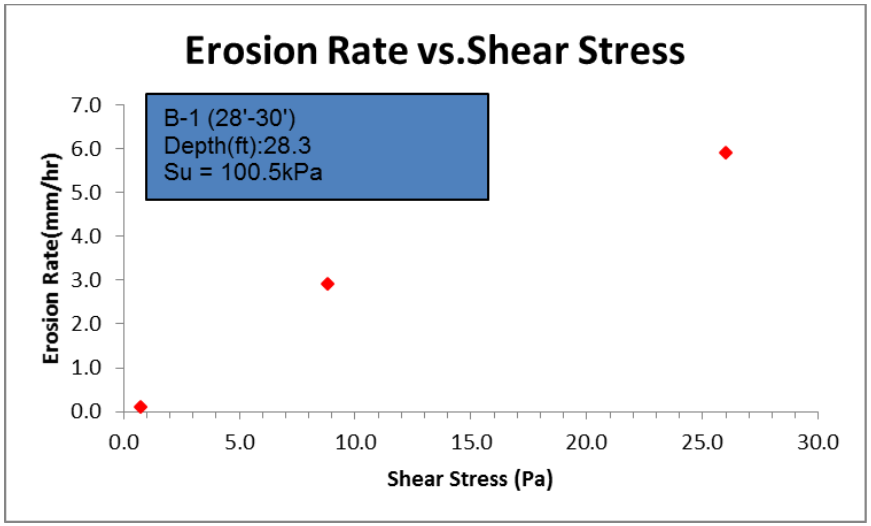


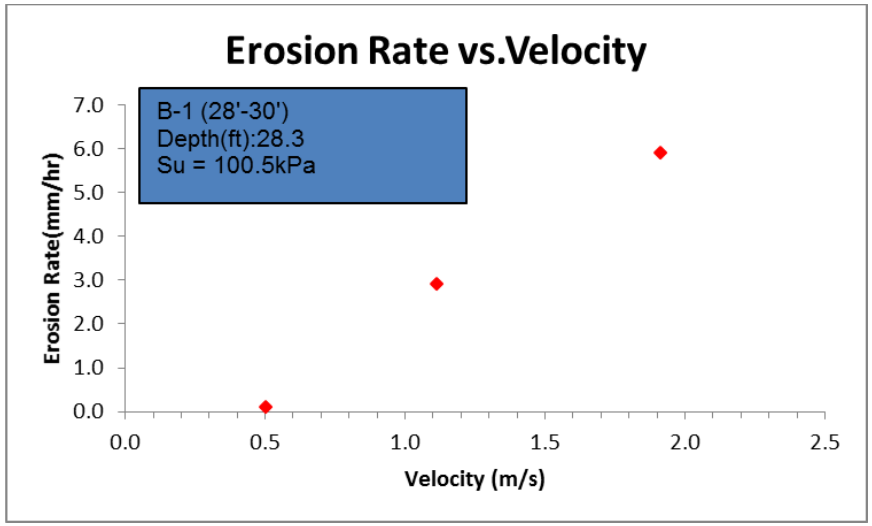


B-1 (28'-30') Beaumont Formation

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.503	0.003	30539	0.023	0.727	0	1200	0.000
1.111	2.000	67452	0.057	8.794	1	1230	2.927
1.910	2.000	115946	0.057	25.985	2	1215	5.926

Velocity(m/sec)	0.503	1.111	1.910
Shear stress(P_a)	0.727	8.794	25.985
Erosion Rate(mm/hr)	0.100	2.927	5.926

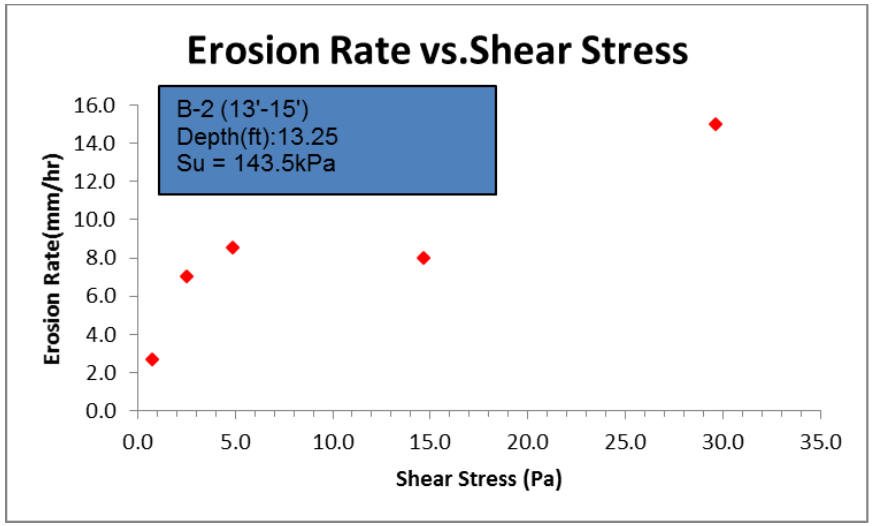


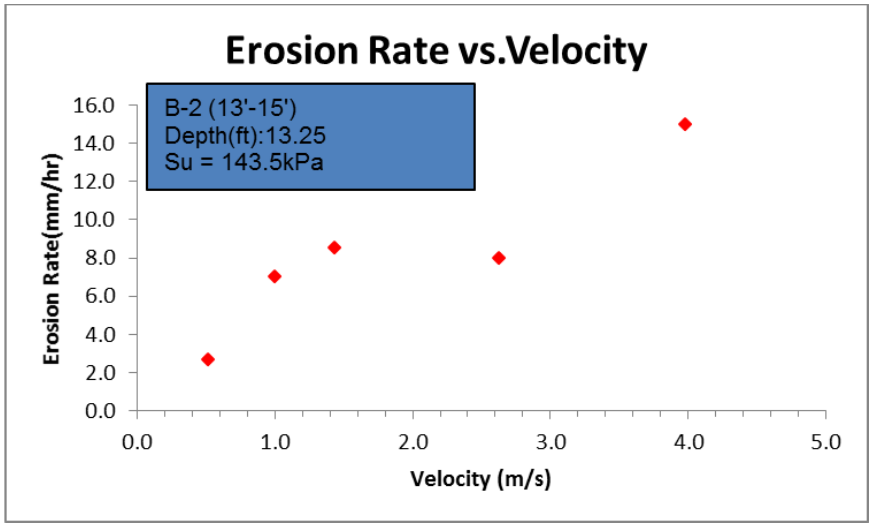


B-2 (13'-15') Beaumont Formation

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.512	0.002	31108	0.023	0.755	1	1339.8	2.687
0.997	0.002	60517	0.020	2.484	2	1020	7.059
1.435	0.002	87129	0.019	4.891	3	1260	8.571
2.627	0.002	159508	0.017	14.667	2	900	8.000
3.976	0.002	241386	0.015	29.638	1	240	15.000

Velocity(m/sec)	0.512	0.997	1.435	2.627	3.976
Shear stress(P_a)	0.755	2.484	4.891	14.667	29.638
Erosion Rate(mm/hr)	2.687	7.059	8.571	8.000	15.000

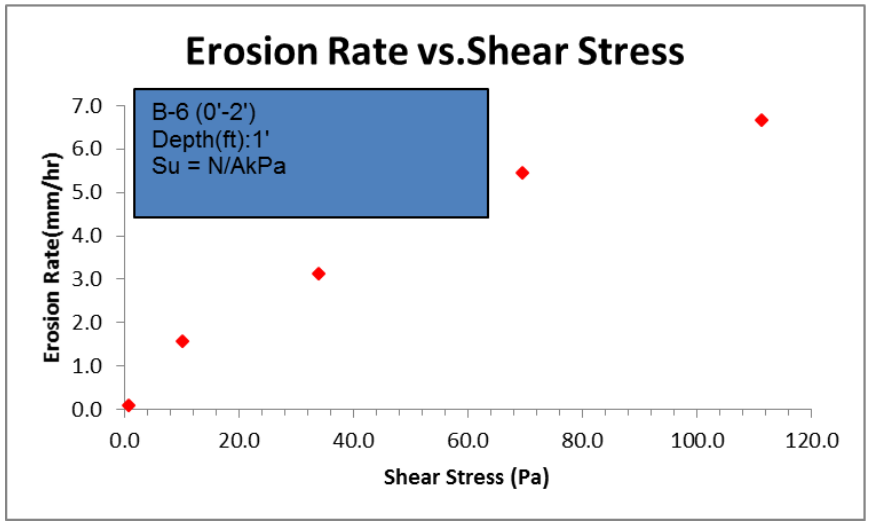


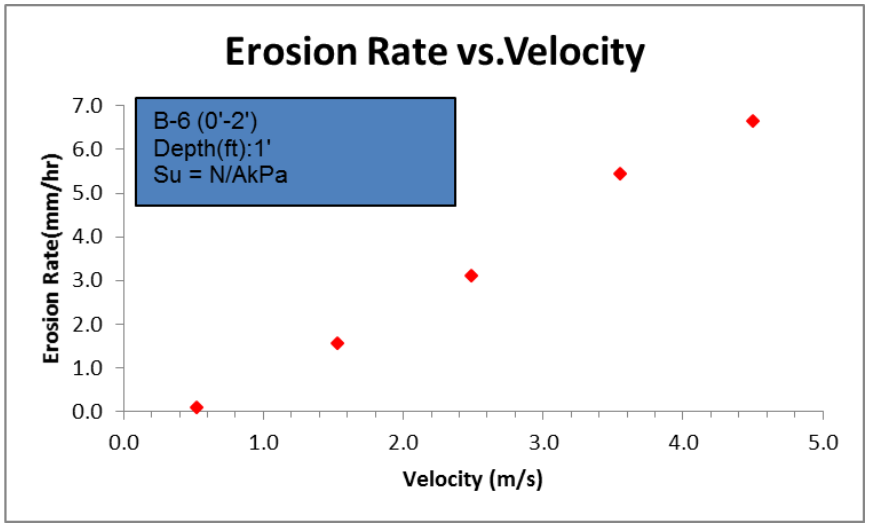


B-6 (0'-2') Beaumont Formation

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.524	0.004	31812	0.023	0.789	0	1201.002	0.000
1.526	0.500	92666	0.035	10.192	0.5	1143	1.575
2.483	1.000	150740	0.044	33.903	1	1153.002	3.122
3.554	1.000	215799	0.044	69.483	1.5	990	5.455
4.497	1.000	273011	0.044	111.210	2	1080	6.667

Velocity(m/sec)	**0.524**	**1.526**	**2.483**	**3.554**	**4.497**
Shear stress(P_a)	**0.789**	**10.192**	**33.903**	**69.483**	**111.210**
Erosion Rate(mm/hr)	**0.100**	**1.575**	**3.122**	**5.455**	**6.667**

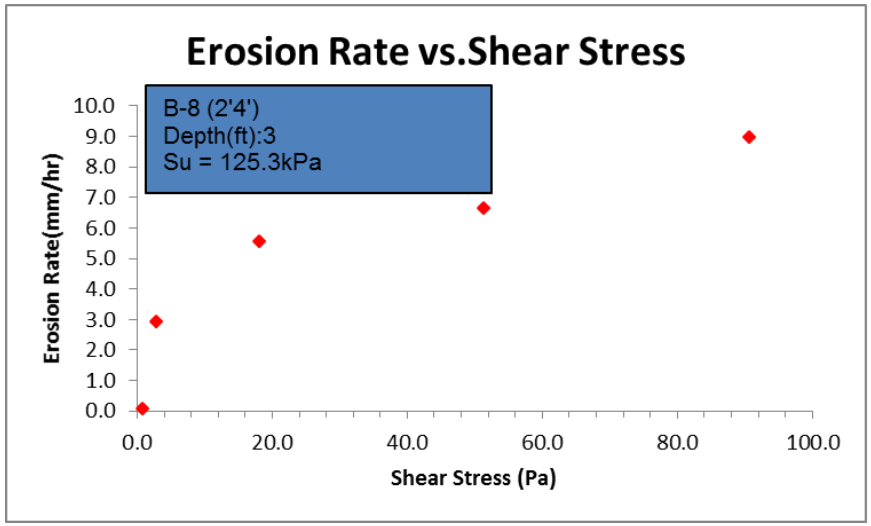


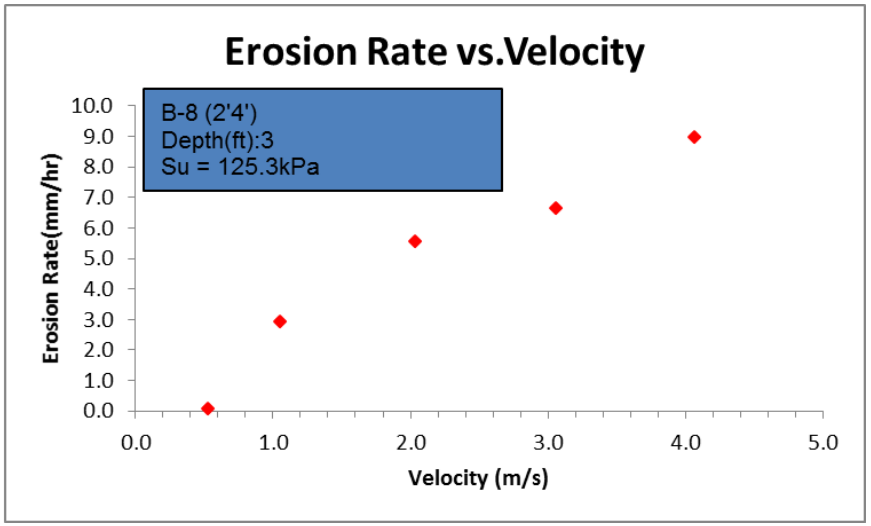


B-8 (2'-4') 5694 Alluvium

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.529	0.003	32091	0.023	0.803	0	1011	0.000
1.048	0.003	63631	0.020	2.746	1	1230	2.927
2.036	0.500	123628	0.035	18.140	2	1296	5.556
3.053	1.000	185346	0.044	51.257	3	1624.002	6.650
4.059	1.000	246451	0.044	90.624	3	1200	9.000

Velocity(m/sec)	**0.529**	**1.048**	**2.036**	**3.053**	**4.059**
Shear stress(P_a)	**0.803**	**2.746**	**18.140**	**51.257**	**90.624**
Erosion Rate(mm/hr)	**0.100**	**2.927**	**5.556**	**6.650**	**9.000**

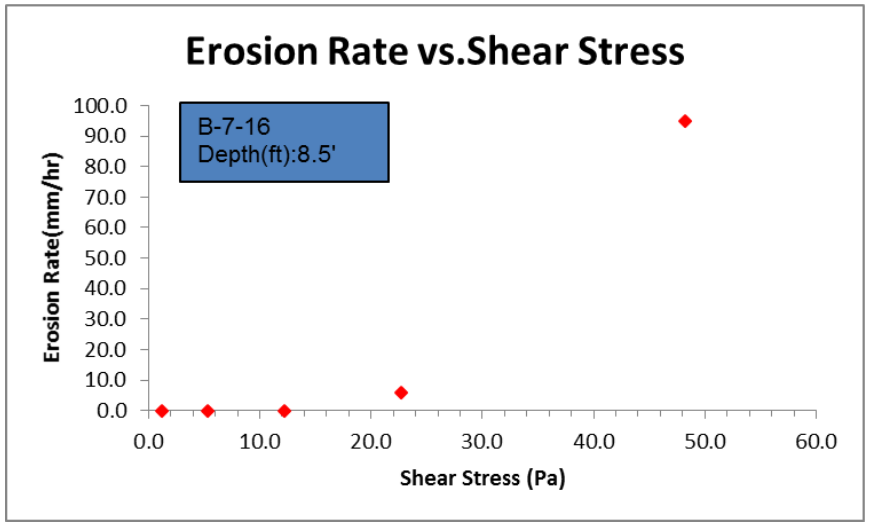


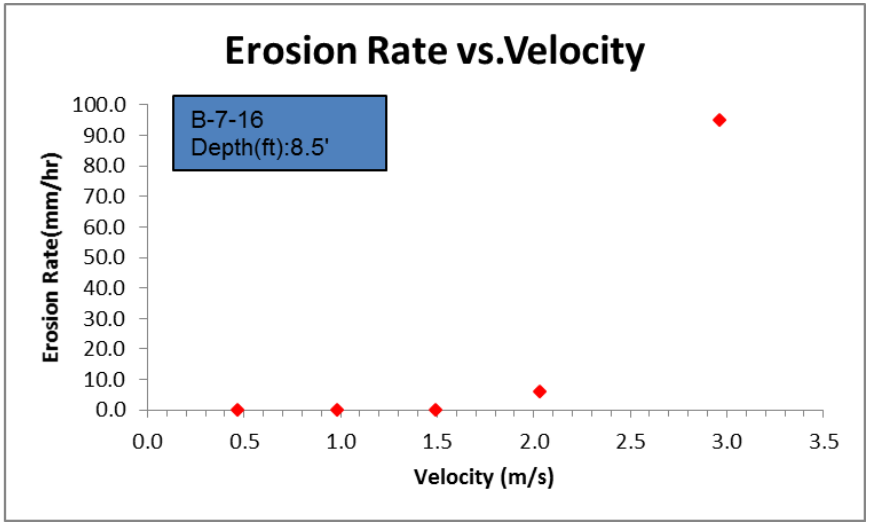


B-7-16 (8'-10.5') Top

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.468	1.000	28388	0.045	1.230	0	450	0.000
0.984	1.000	59744	0.044	5.326	0	480	0.000
1.489	1.000	90393	0.044	12.191	0	1140	0.000
2.031	1.000	123314	0.044	22.688	2	1200	6.000
2.960	1.000	179731	0.044	48.198	7	265.2	95.023

Velocity(m/sec)	**0.468**	**0.984**	**1.489**	**2.031**	**2.960**
Shear stress(P_a)	**1.230**	**5.326**	**12.191**	**22.688**	**48.198**
Erosion Rate(mm/hr)	**0.100**	**0.100**	**0.100**	**6.000**	**95.023**

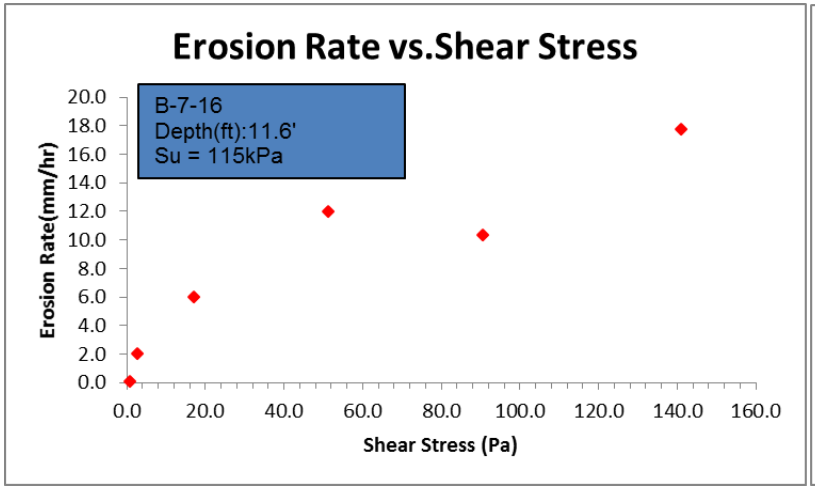


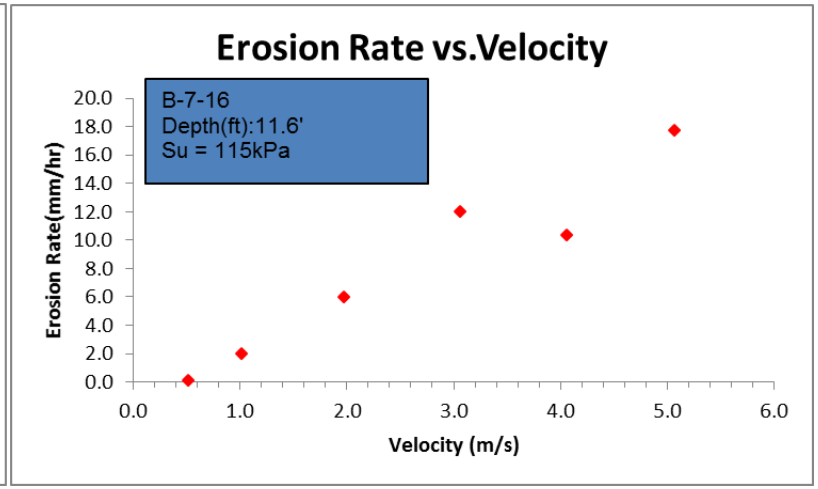


B-7-16 (10.5'-13') Bottom

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.519	0.003	31510	0.023	0.774	0	1800	0.000
1.016	0.003	61701	0.020	2.582	1	1800	2.000
1.975	0.500	119886	0.035	17.058	3	1800	6.000
3.055	1.000	185483	0.044	51.332	6	1800	12.000
4.059	1.000	246424	0.044	90.604	4	1390.02	10.360
5.065	1.000	307498	0.044	141.080	8	1620	17.778

Velocity(m/sec)	0.519	1.016	1.975	3.055	4.059	5.065
Shear stress(P_a)	0.774	2.582	17.058	51.332	90.604	141.080
Erosion Rate(mm/hr)	0.100	2.000	6.000	12.000	10.360	17.778

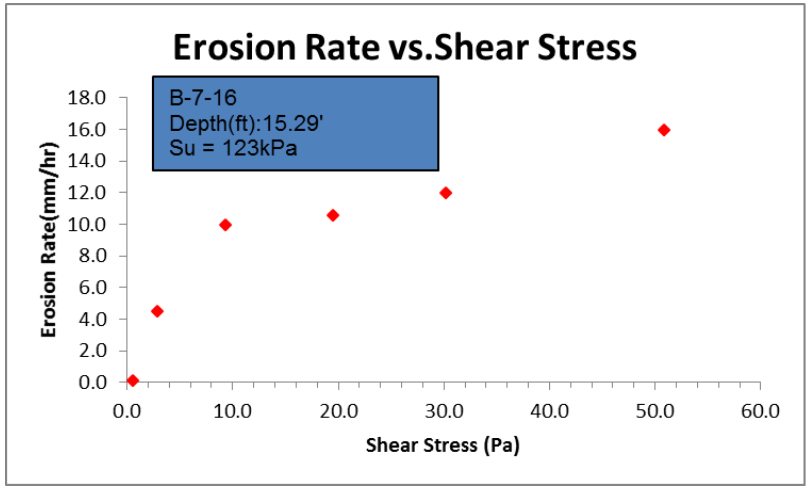


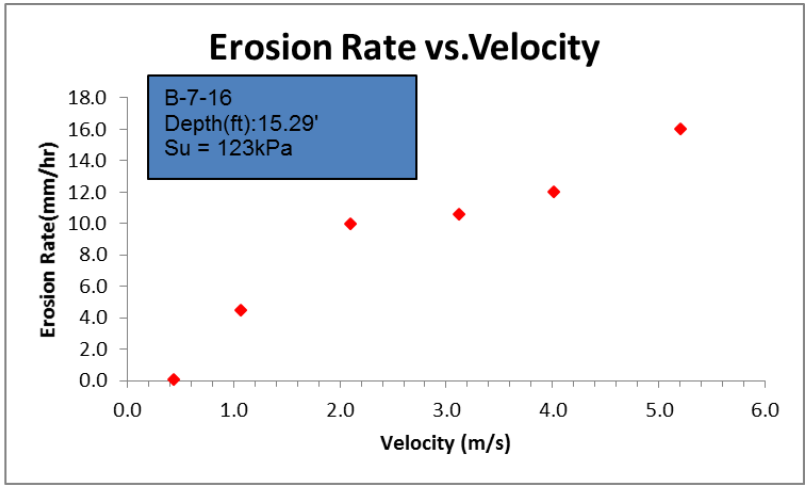


B-7-16 (13'-15.5') Bottom

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.442	0.003	26810	0.024	0.585	0	1260	0.000
1.063	0.003	64559	0.020	2.827	1.5	1200	4.500
2.098	0.003	127368	0.017	9.352	2.5	900	10.000
3.124	0.003	189672	0.016	19.519	3	1020	10.588
4.013	0.003	243663	0.015	30.199	3	900	12.000
5.206	0.003	316103	0.015	50.825	4	900	16.000

Velocity(m/sec)	0.442	1.063	2.098	3.124	4.013	5.206
Shear stress(P_a)	0.585	2.827	9.352	19.519	30.199	50.825
Erosion Rate(mm/hr)	0.100	4.500	10.000	10.588	12.000	16.000

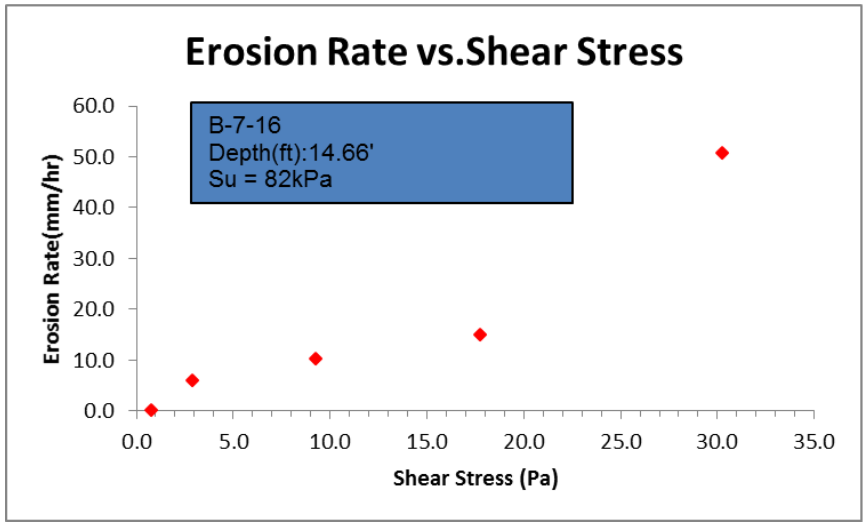


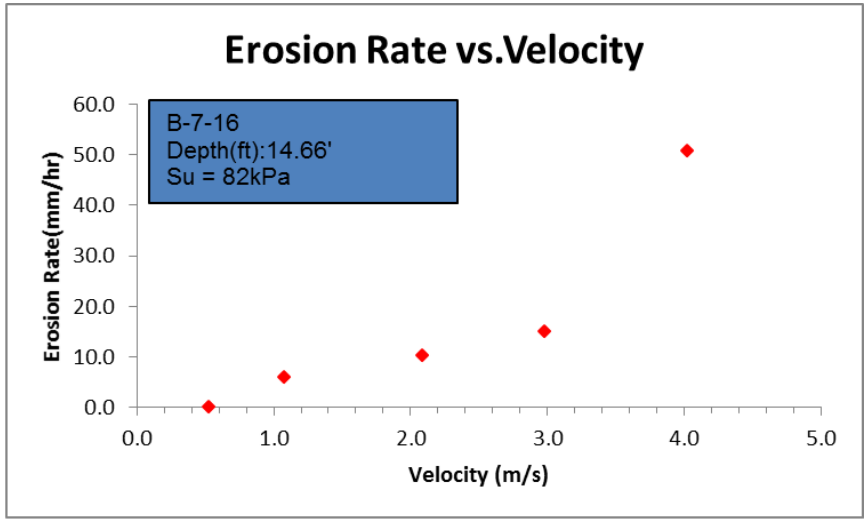


B-7-16 (13'-15.5') Middle

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.521	0.003	31653	0.023	0.781	0	1210.002	0.000
1.074	0.003	65191	0.020	2.882	2	1170	6.154
2.086	0.003	126664	0.017	9.249	4	1380	10.435
2.979	0.003	180844	0.016	17.744	4.5	1080	15.000
4.016	0.003	243840	0.015	30.243	11	780	50.769

Velocity(m/sec)	**0.521**	**1.074**	**2.086**	**2.979**	**4.016**
Shear stress(P_a)	**0.781**	**2.882**	**9.249**	**17.744**	**30.243**
Erosion Rate(mm/hr)	**0.100**	**6.154**	**10.435**	**15.000**	**50.769**

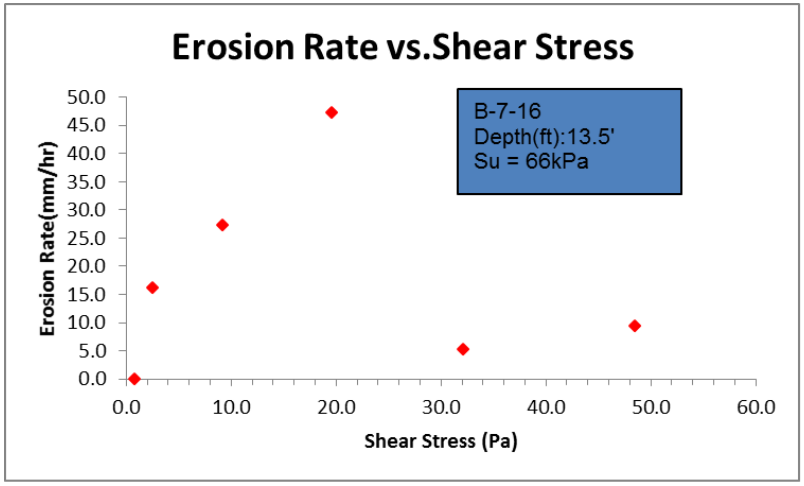


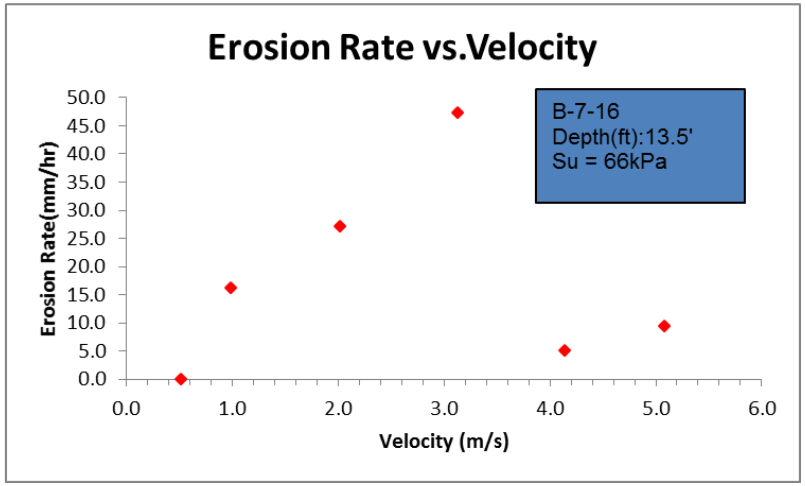


B-7-16 (13'-15.5') Top

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.516	0.003	31329	0.023	0.766	0	1800	0.000
0.987	0.003	59938	0.020	2.436	5	1105.002	16.290
2.017	0.003	122490	0.018	9.158	10	1320	27.273
3.126	0.003	189820	0.016	19.549	15	1140	47.368
4.137	0.003	251175	0.015	32.090	2	1380	5.217
5.084	0.003	308698	0.015	48.472	3	1140	9.474

Velocity(m/sec)	0.516	0.987	2.017	3.126	4.137	5.084
Shear stress(P_a)	0.766	2.436	9.158	19.549	32.090	48.472
Erosion Rate(mm/hr)	0.100	16.290	27.273	47.368	5.217	9.474

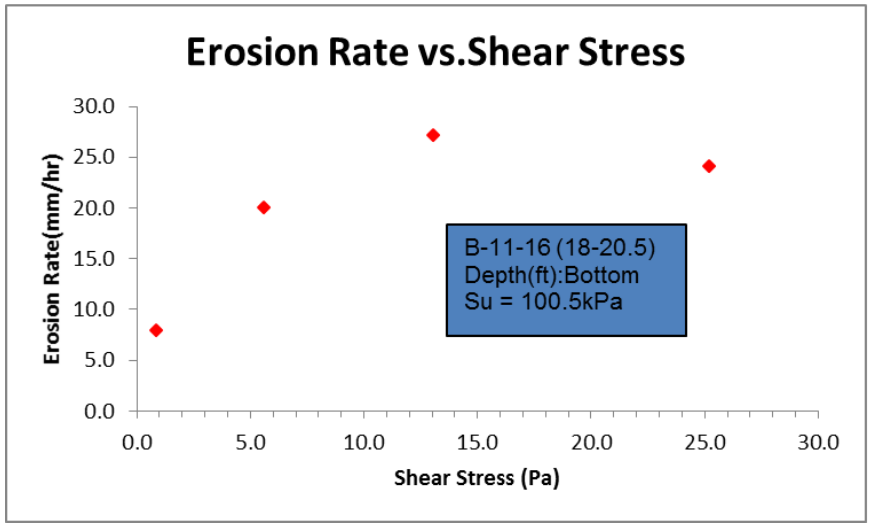


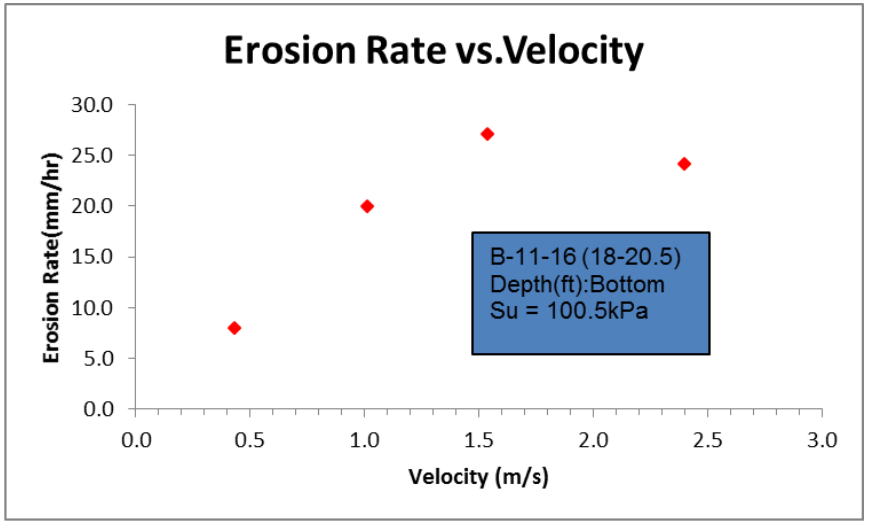


B-11-16 (18'- 20.5') Bottom

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.430	0.500	26107	0.037	0.855	2	900	8.000
1.010	1.000	61321	0.044	5.611	5	900	20.000
1.540	1.000	93500	0.044	13.044	8	1060.002	27.170
2.400	0.500	145714	0.035	25.200	5	745.0002	24.161

Velocity(m/sec)	0.430	1.010	1.540	2.400
Shear stress(P_a)	0.855	5.611	13.044	25.200
Erosion Rate(mm/hr)	8.000	20.000	27.170	24.161

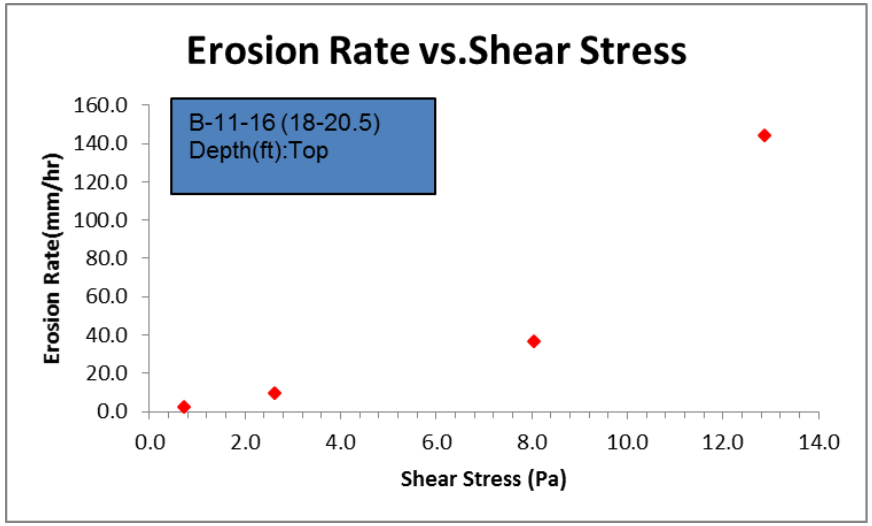


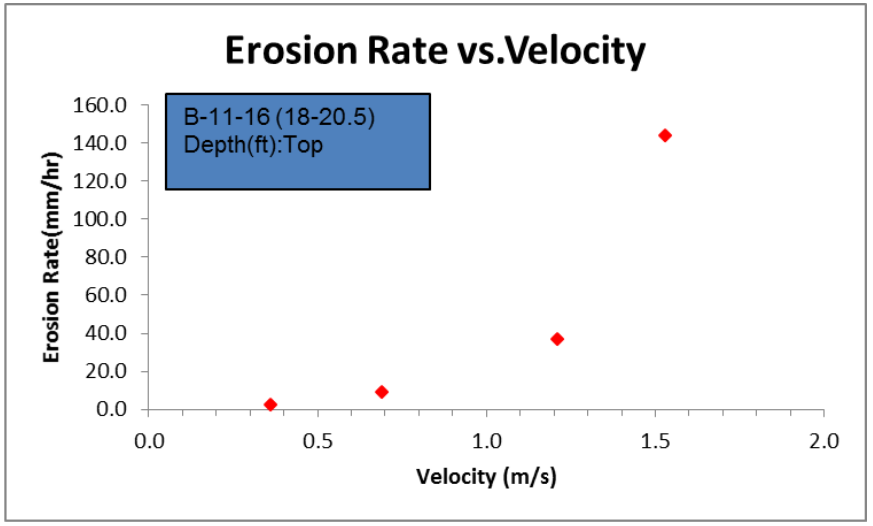


B-11-16 (18'- 20.5') Top

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.360	1.000	21857	0.045	0.729	1	1339.8	2.687
0.690	1.000	41893	0.044	2.619	2	760.002	9.474
1.210	1.000	73464	0.044	8.053	12	1170	36.923
1.530	1.000	92893	0.044	12.875	6	150	144.000

Velocity(m/sec)	0.360	0.690	1.210	1.530
Shear stress(P_a)	0.729	2.619	8.053	12.875
Erosion Rate(mm/hr)	2.687	9.474	36.923	144.000

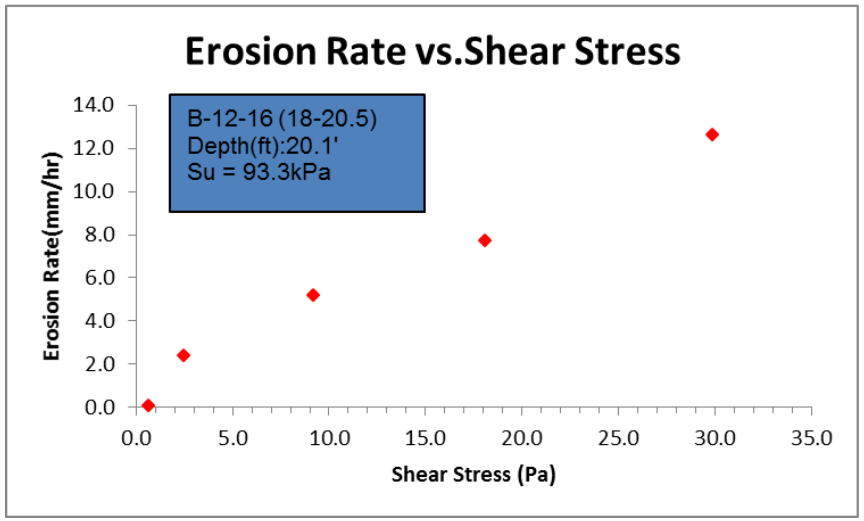


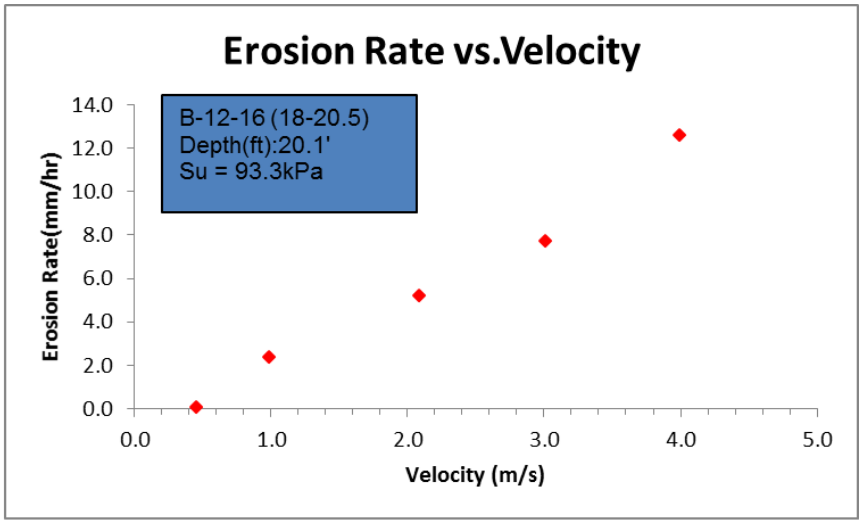


B-12-16 (18'- 20.5') Bottom

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.452	0.001	27419	0.024	0.612	0	1212	0.000
0.985	0.001	59815	0.020	2.426	1	1500	2.400
2.081	0.001	126341	0.017	9.202	2	1380	5.217
3.006	0.001	182499	0.016	18.070	3	1399.998	7.714
3.990	0.001	242280	0.015	29.858	4	1140	12.632

Velocity(m/sec)	0.452	0.985	2.081	3.006	3.990
Shear stress(P_a)	0.612	2.426	9.202	18.070	29.858
Erosion Rate(mm/hr)	0.100	2.400	5.217	7.714	12.632

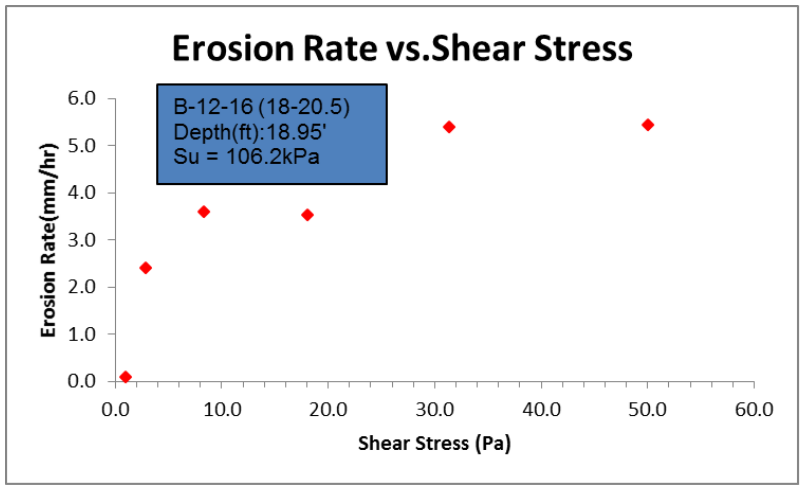


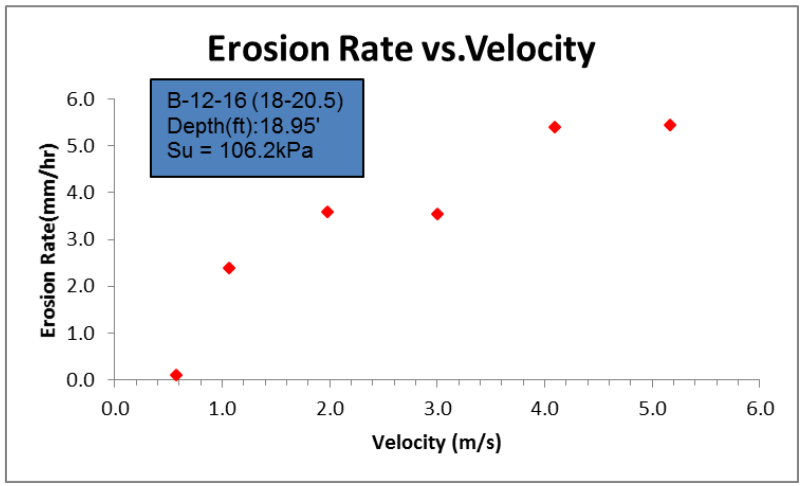


B-12-16 (18'- 20.5') Middle

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.566	0.001	34357	0.023	0.921	0	900	0.000
1.060	0.001	64335	0.020	2.807	1	1500	2.400
1.977	0.001	120033	0.017	8.306	1.5	1500	3.600
3.003	0.001	182312	0.016	18.034	1.5	1527	3.536
4.088	0.001	248214	0.015	31.338	2	1335	5.393
5.165	0.001	313575	0.015	50.015	3	1980	5.455

Velocity(m/sec)	0.566	1.060	1.977	3.003	4.088	5.165
Shear stress(P_a)	0.921	2.807	8.306	18.034	31.338	50.015
Erosion Rate(mm/hr)	0.100	2.400	3.600	3.536	5.393	5.455

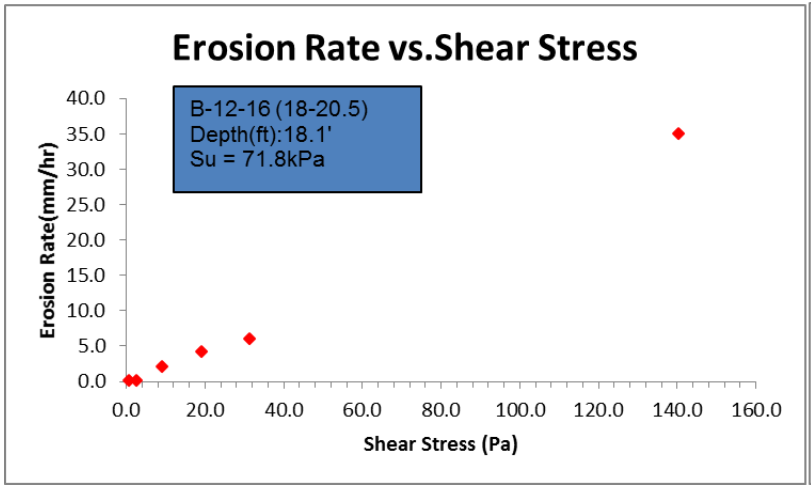


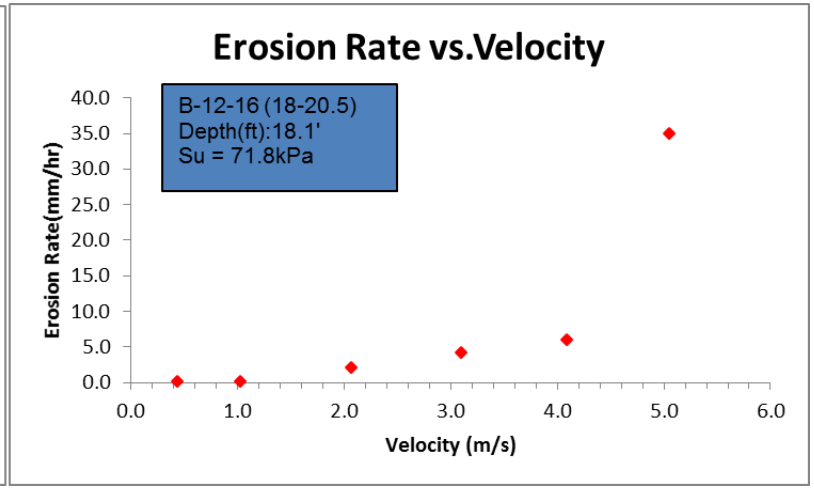


B-12-16 (18'- 20.5') Top

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.435	0.001	26393	0.024	0.567	0	1320	0.000
1.020	0.001	61941	0.020	2.602	0	1579.998	0.000
2.063	0.001	125274	0.017	9.047	1	1701	2.116
3.099	0.001	188146	0.016	19.206	2	1710	4.211
4.091	0.001	248403	0.015	31.386	2	1200.96	5.995
5.051	1.000	306696	0.044	140.345	7	720	35.000

Velocity(m/sec)	0.435	1.020	2.063	3.099	4.091	5.051
Shear stress(P_a)	0.567	2.602	9.047	19.206	31.386	140.345
Erosion Rate(mm/hr)	0.100	0.100	2.116	4.211	5.995	35.000

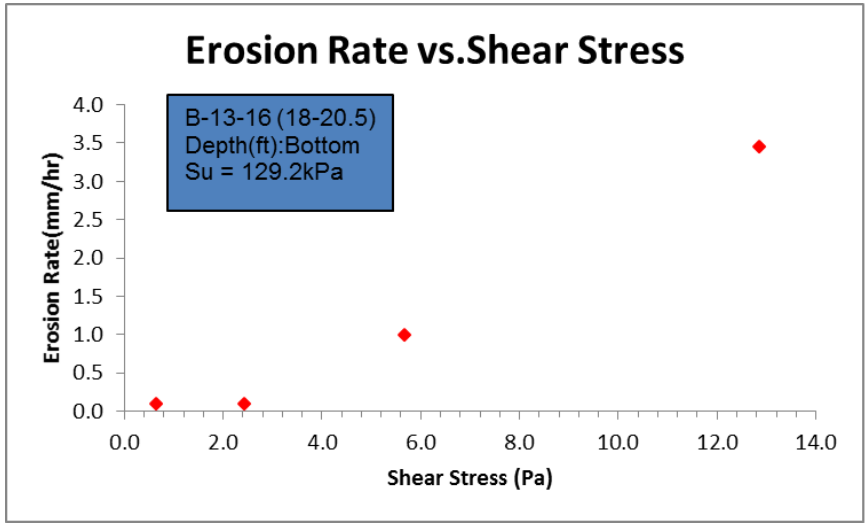


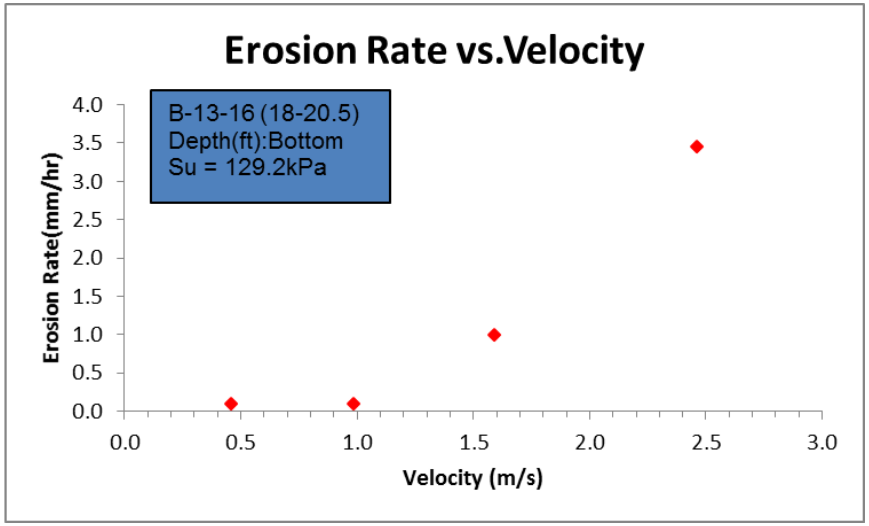


B-13-16 (18'- 20.5') Bottom

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.461	0.004	27990	0.024	0.638	0	1477.998	0.000
0.984	0.004	59745	0.020	2.421	0	1500	0.000
1.589	0.004	96466	0.018	5.680	0.5	1800	1.000
2.460	0.004	149365	0.017	12.861	1.5	1560	3.462

Velocity(m/sec)	0.461	0.984	1.589	2.460
Shear stress(P_a)	0.638	2.421	5.680	12.861
Erosion Rate(mm/hr)	0.100	0.100	1.000	3.462

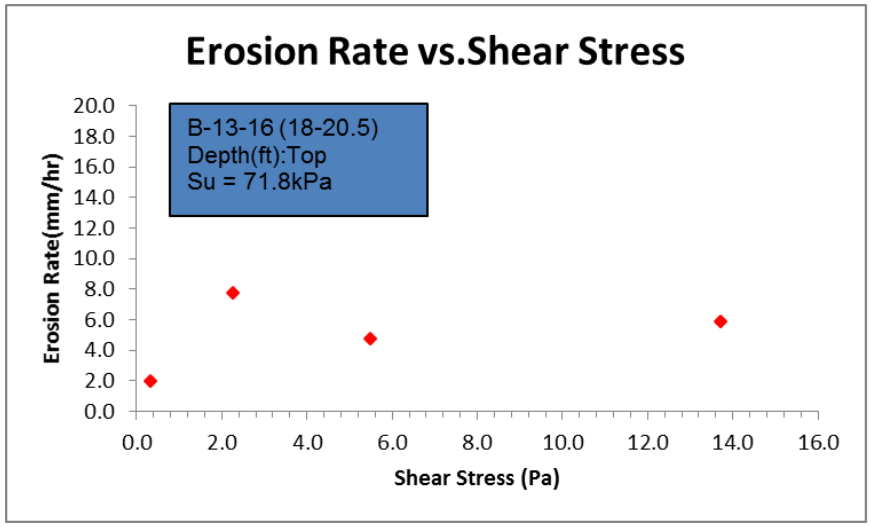


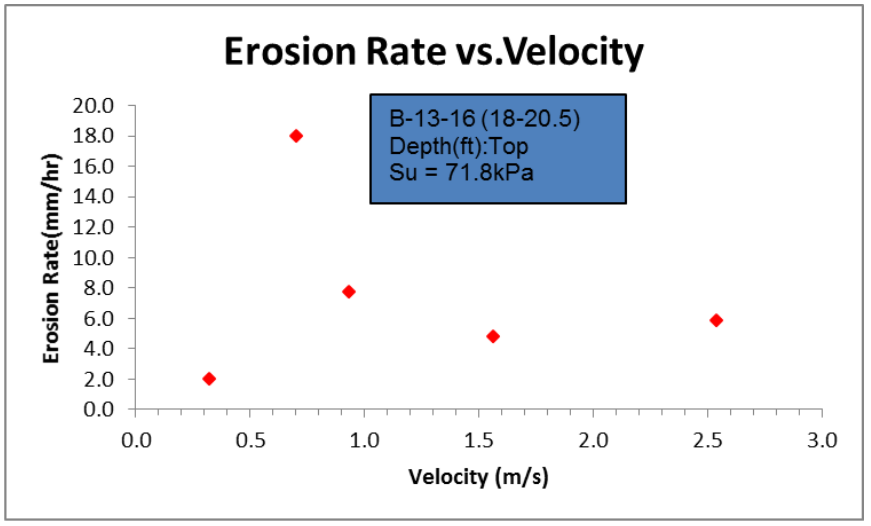


B-13-16 (18'- 20.5') Top

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.320	0.004	19429	0.026	0.333	1	1800	2.000
0.700	0.004	42500	0.022	1.348	3	600	18.000
0.930	0.004	56464	0.021	2.270	2	930	7.742
1.560	0.004	94714	0.018	5.476	2	1500	4.800
2.540	0.004	154214	0.017	13.710	2	1230	5.854

Velocity(m/sec)	**0.320**	**0.700**	**0.930**	**1.560**	**2.540**
Shear stress(P_a)	**0.333**	**1.348**	**2.270**	**5.476**	**13.710**
Erosion Rate(mm/hr)	**2.000**	**18.000**	**7.742**	**4.800**	**5.854**

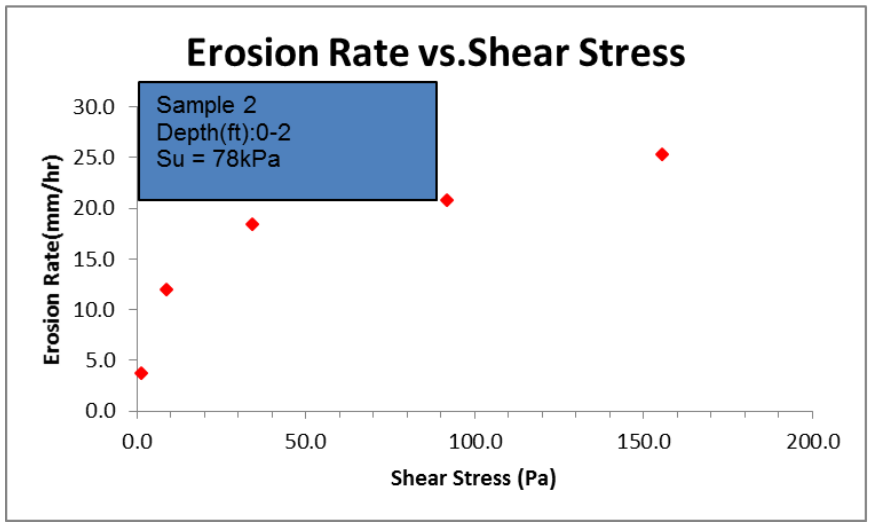


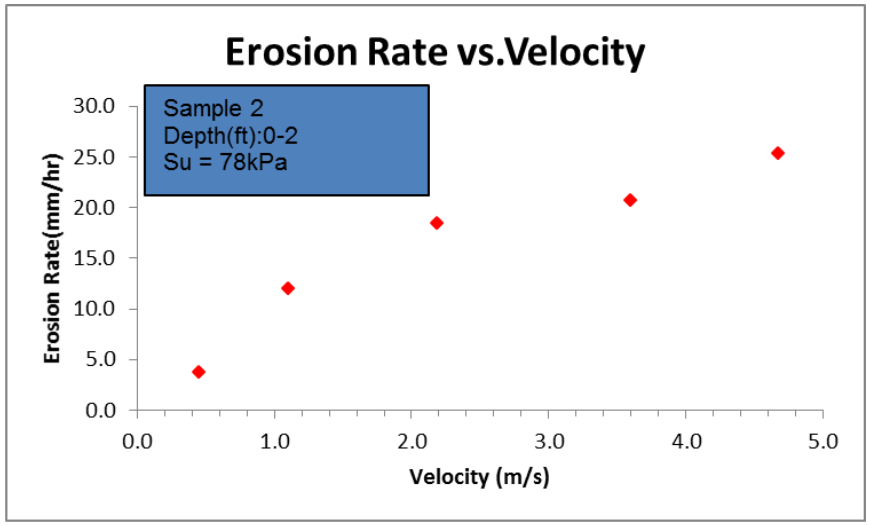


GEER Sample #2

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.446	1.000	27070	0.045	1.118	1	960	3.750
1.101	2.000	66818	0.057	8.630	3	900	12.000
2.187	2.000	132804	0.057	34.090	6	1170	18.462
3.590	2.000	217966	0.057	91.829	4.5	780	20.769
4.673	2.000	283744	0.057	155.617	5.5	780	25.385

Velocity(m/sec)	0.446	1.101	2.187	3.590	4.673
Shear stress(P_a)	1.118	8.630	34.090	91.829	155.617
Erosion Rate(mm/hr)	3.750	12.000	18.462	20.769	25.385

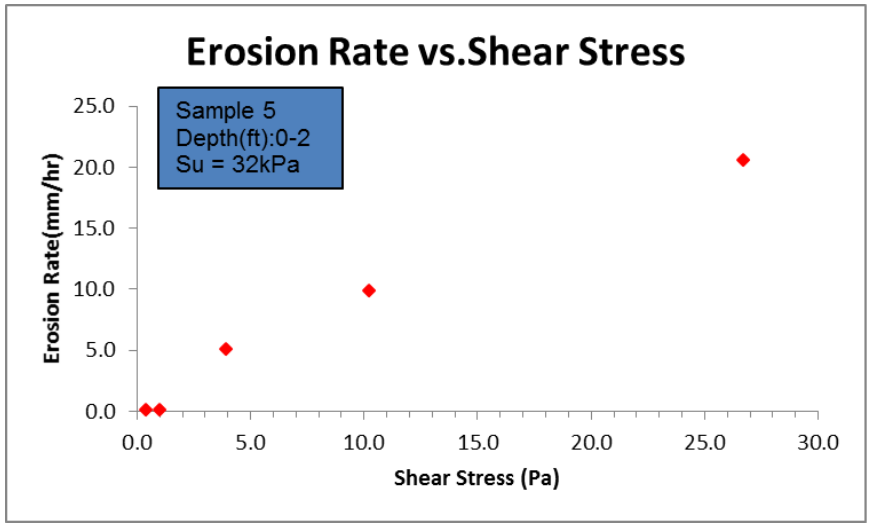


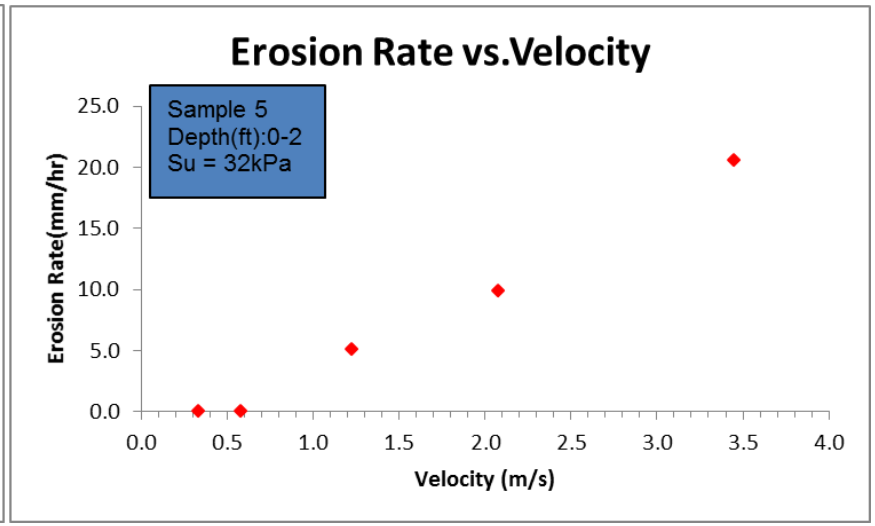


GEER Sample #5

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.329	0.029	19947	0.027	0.364	0	915	0.000
0.577	0.029	35019	0.024	0.998	0	945	0.000
1.222	0.029	74218	0.021	3.923	1.5	1060.9998	5.090
2.072	0.029	125800	0.019	10.196	3.5	1270.02	9.921
3.444	0.029	209118	0.018	26.692	6	1050	20.571

Velocity(m/sec)	**0.329**	**0.577**	**1.222**	**2.072**	**3.444**
Shear stress(P_a)	**0.364**	**0.998**	**3.923**	**10.196**	**26.692**
Erosion Rate(mm/hr)	**0.100**	**0.100**	**5.090**	**9.921**	**20.571**

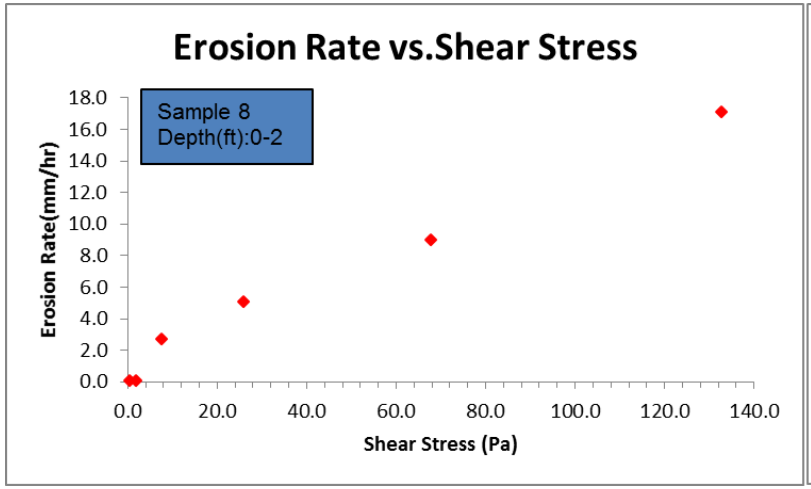


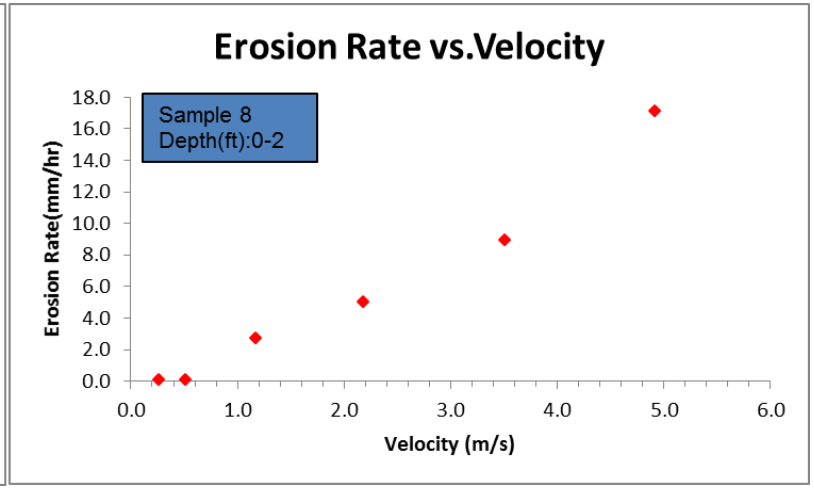


GEER Sample #8

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.261	1.000	15850	0.046	0.392	0	870	0.000
0.508	2.000	30862	0.058	1.873	0	790.00002	0.000
1.167	1.000	70829	0.044	7.485	1	1320	2.727
2.172	1.000	131892	0.044	25.955	2	1420.9998	5.067
3.509	1.000	213050	0.044	67.724	3	1201.002	8.992
4.913	1.000	298297	0.044	132.764	3	631.00002	17.116

Velocity(m/sec)	0.261	0.508	1.167	2.172	3.509	4.913
Shear stress(P_a)	0.392	1.873	7.485	25.955	67.724	132.764
Erosion Rate(mm/hr)	0.100	0.100	2.727	5.067	8.992	17.116

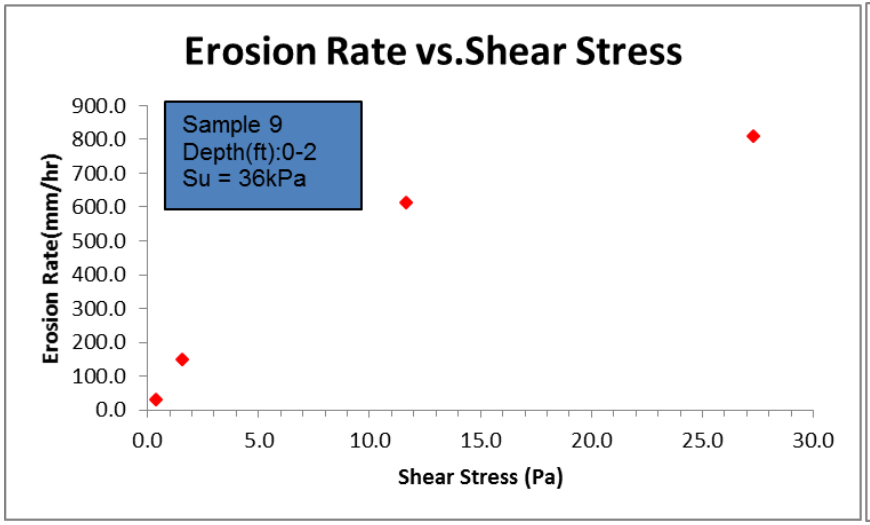


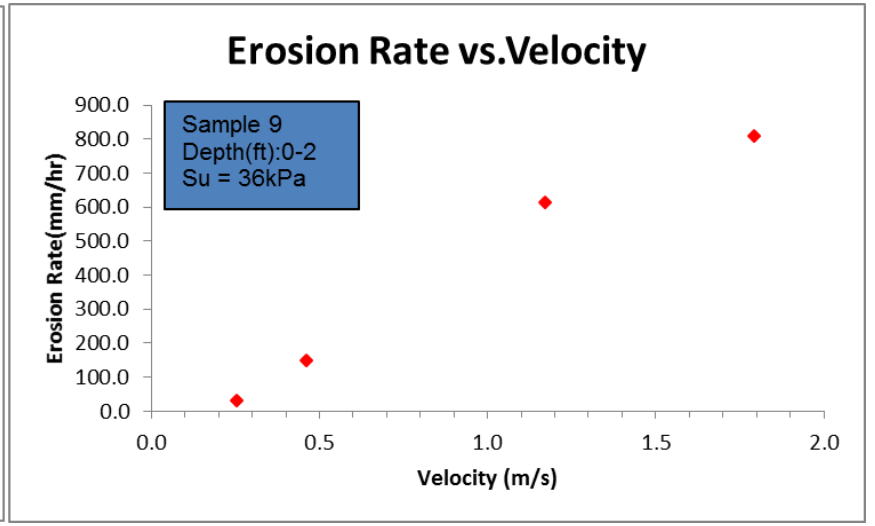


GEER Sample #9

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.255	1.000	15463	0.046	0.373	6	690	31.304
0.462	2.000	28049	0.058	1.547	22	529.998	149.435
1.170	3.000	71034	0.068	11.635	41	240	615.000
1.792	3.000	108770	0.068	27.281	27	120	810.000

Velocity(m/sec)	**0.255**	**0.462**	**1.170**	**1.792**
Shear stress(P_a)	**0.373**	**1.547**	**11.635**	**27.281**
Erosion Rate(mm/hr)	**31.304**	**149.435**	**615.000**	**810.000**



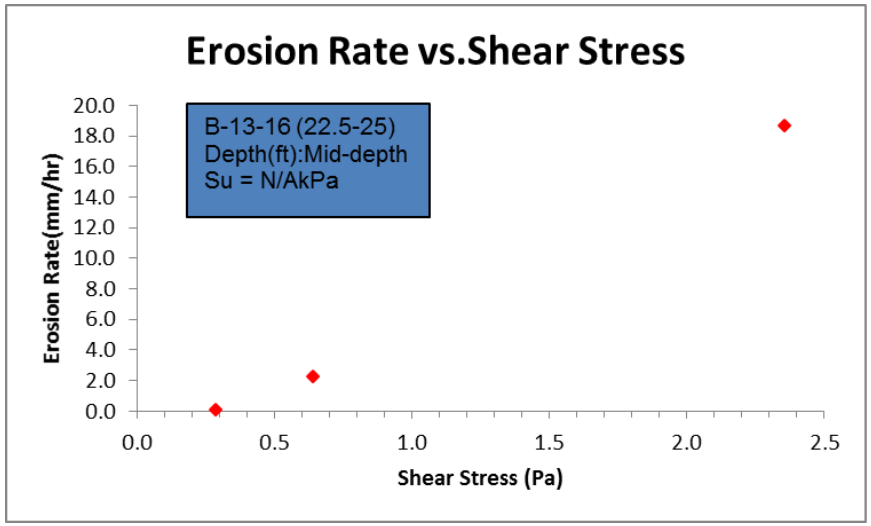


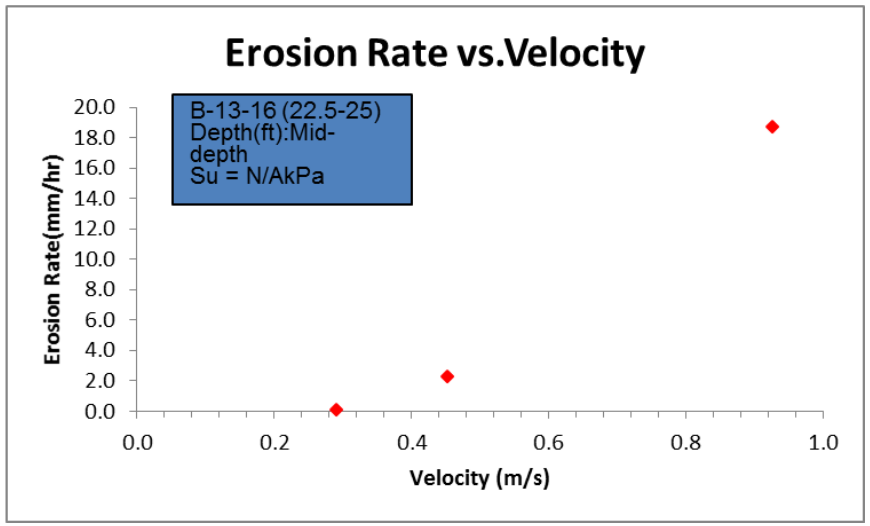
Silt Samples - EFA

B-13-16 (22.5'-25')

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.291	0.022	17641	0.027	0.285	0	949.998	0.000
0.452	0.022	27446	0.025	0.639	1	1590	2.264
0.926	0.022	56208	0.022	2.357	4	769.998	18.701

Velocity(m/sec)	**0.291**	**0.452**	**0.926**
Shear stress(P_a)	**0.285**	**0.639**	**2.357**
Erosion Rate(mm/hr)	**0.100**	**2.264**	**18.701**

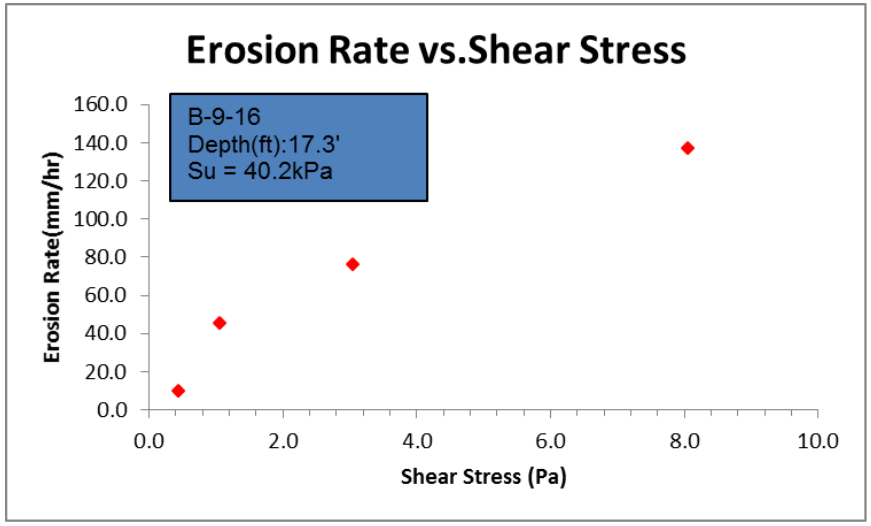


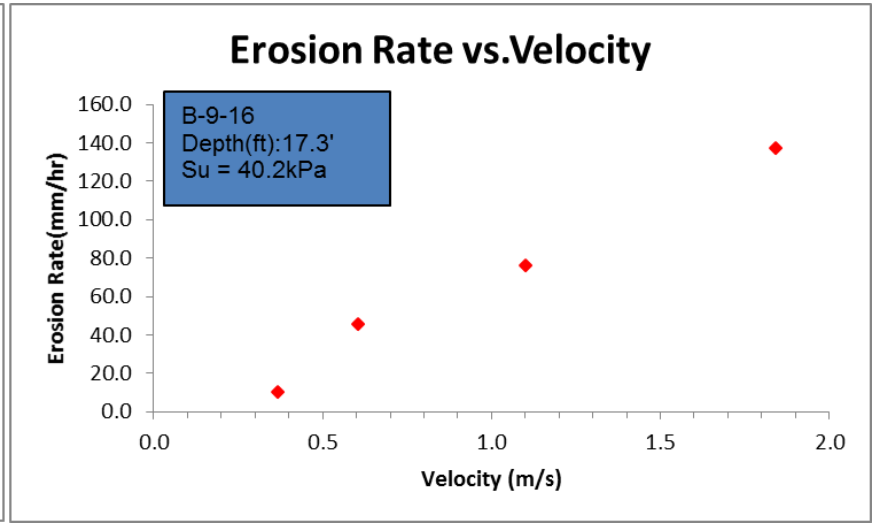


B-9-16 (16'-17.5') Bottom

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.368	0.012	22344	0.026	0.440	1	360	10.000
0.604	0.012	36675	0.023	1.049	8	630	45.714
1.102	0.012	66890	0.020	3.034	10	471	76.433
1.841	0.012	111796	0.019	8.053	12	315	137.143

Velocity(m/sec)	**0.368**	**0.604**	**1.102**	**1.841**
Shear stress(P_a)	**0.440**	**1.049**	**3.034**	**8.053**
Erosion Rate(mm/hr)	**10.000**	**45.714**	**76.433**	**137.143**

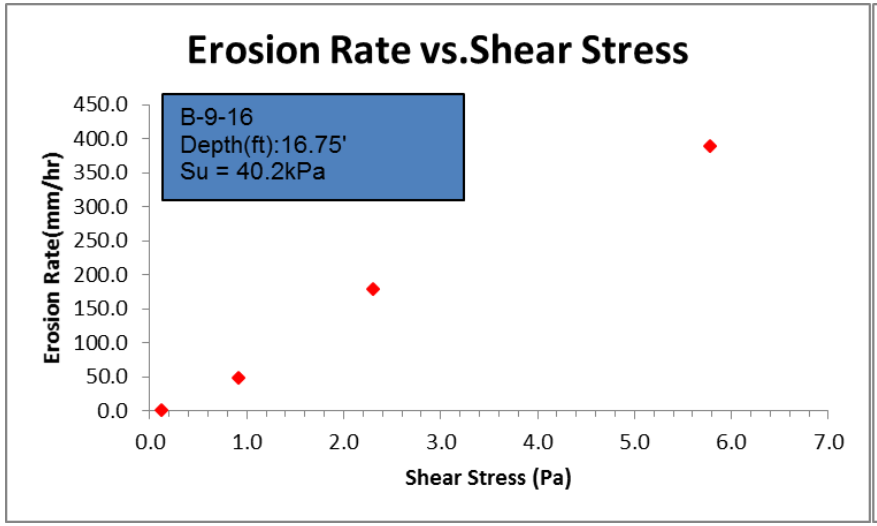


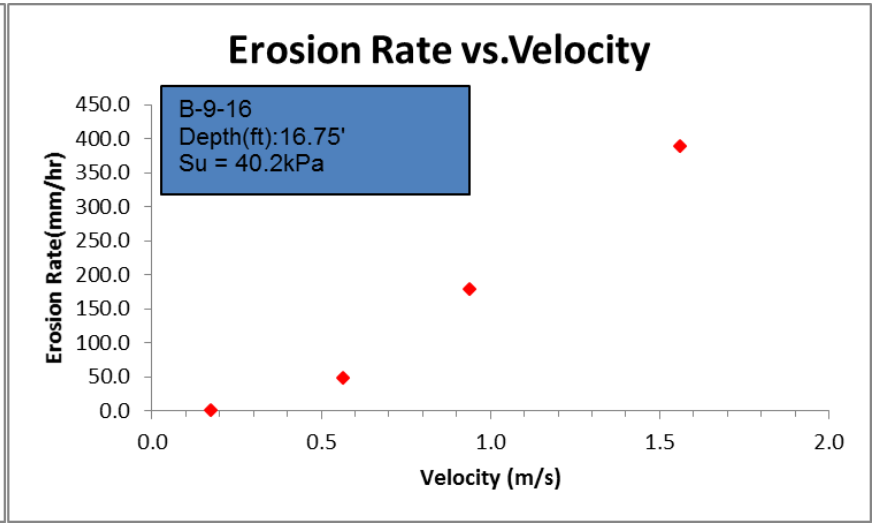


B-9-16 (16'-17.5') Middle

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.174	0.012	10588	0.031	0.118	0	360	0.000
0.565	0.012	34319	0.023	0.919	4	300	48.000
0.936	0.012	56857	0.021	2.302	12	241.0002	179.253
1.561	0.012	94756	0.019	5.785	20	184.99998	389.189

Velocity(m/sec)	0.174	0.565	0.936	1.561
Shear stress(P_a)	0.118	0.919	2.302	5.785
Erosion Rate(mm/hr)	0.100	48.000	179.253	389.189

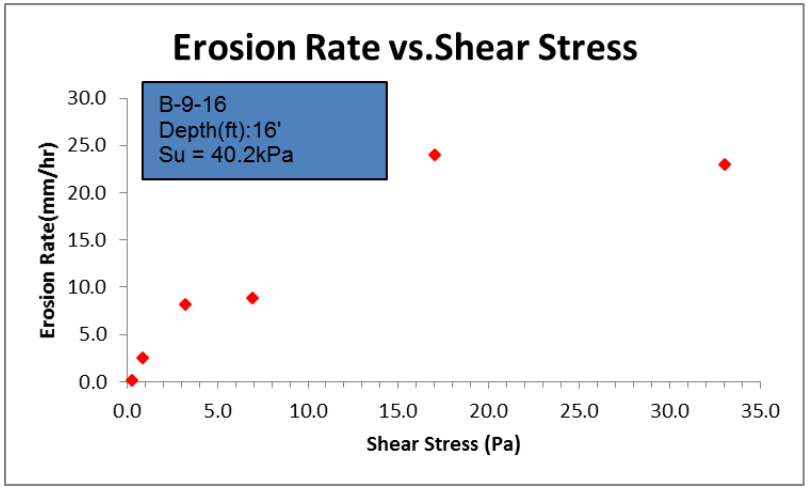


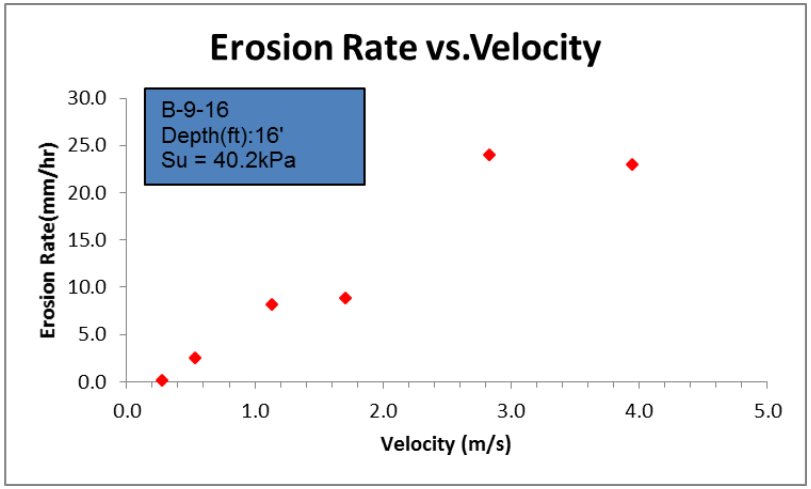


B-9-16 (16'-17.5') Top

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.278	0.012	16897	0.027	0.261	0	900	0.000
0.531	0.012	32224	0.024	0.845	0.5	721.002	2.497
1.133	0.012	68773	0.020	3.208	1.5	661.002	8.169
1.707	0.012	103635	0.019	6.920	2	810	8.889
2.831	0.012	171883	0.017	17.031	8	1200	24.000
3.942	0.012	239335	0.017	33.021	6	940.0002	22.979

Velocity(m/sec)	0.278	0.531	1.133	1.707	2.831	3.942
Shear stress(P_a)	0.261	0.845	3.208	6.920	17.031	33.021
Erosion Rate(mm/hr)	0.100	2.497	8.169	8.889	24.000	22.979

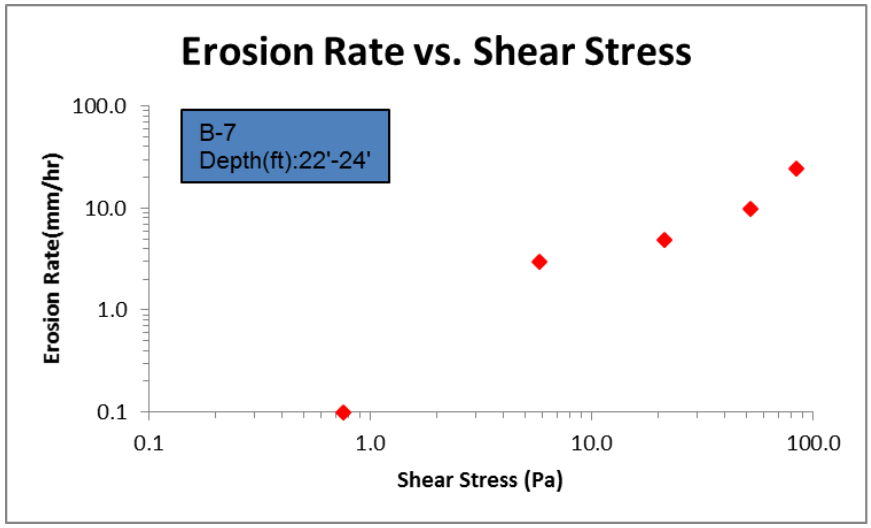


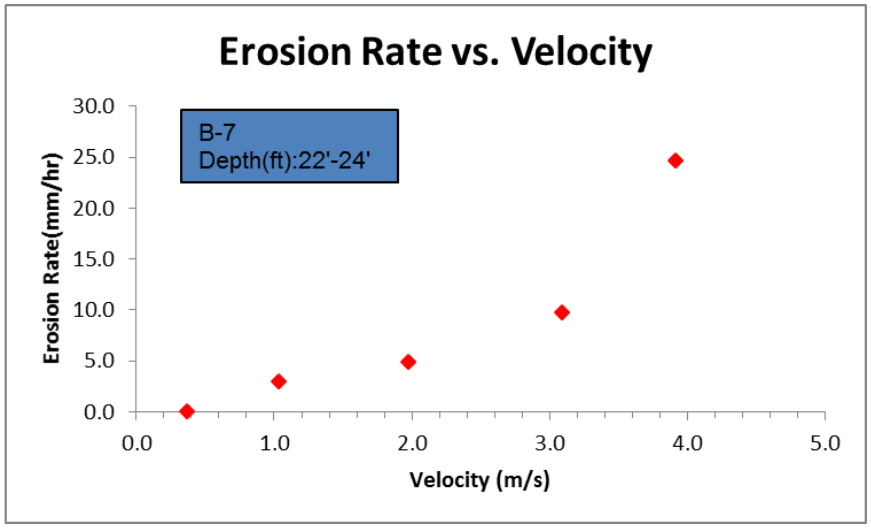


B-7 (22'-24') Tittabawsee River

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.367	1.000	22259	0.045	0.756	0	1200	0.000
1.031	1.000	62601	0.044	5.847	1	1200	3.000
1.974	1.000	119845	0.044	21.430	2	1464	4.918
3.089	1.000	187530	0.044	52.472	3	1110	9.730
3.919	1.000	237928	0.044	84.464	8	1170	24.615

Velocity(m/sec)	0.367	1.031	1.974	3.089	3.919
Shear stress(P_a)	0.756	5.847	21.430	52.472	84.464
Erosion Rate(mm/hr)	0.100	3.000	4.918	9.730	24.615

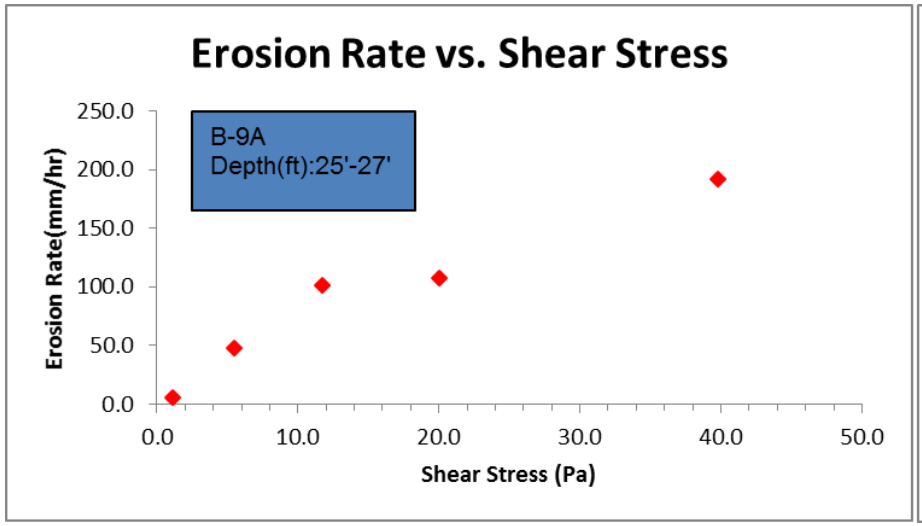


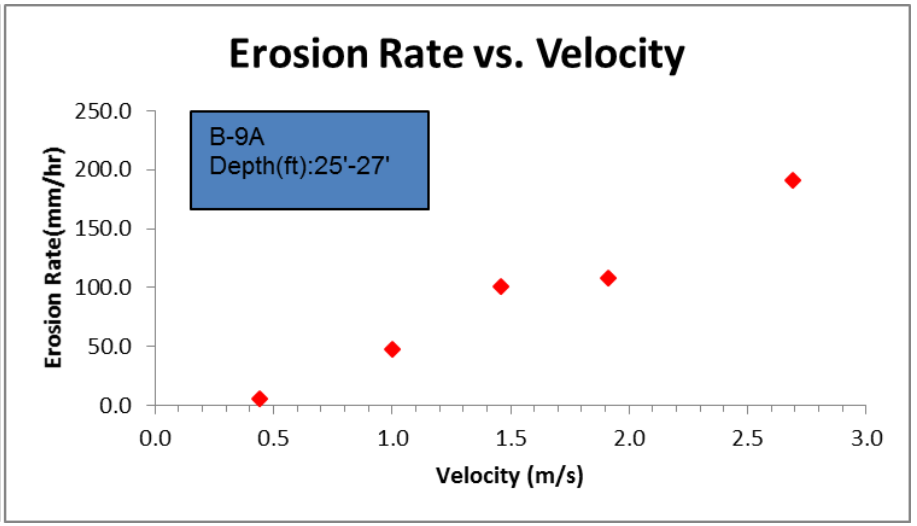


B-9A (25'-27') Tittabawsee River

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.440	1.000	26714	0.045	1.089	2	1390.02	5.180
1.000	1.000	60714	0.044	5.500	8	604.02	47.681
1.460	1.000	88643	0.044	11.724	9	319.8	101.313
1.910	1.000	115964	0.044	20.065	18	600	108.000
2.690	1.000	163321	0.044	39.799	17	319.8	191.370

Velocity(m/sec)	**0.440**	**1.000**	**1.460**	**1.910**	**2.690**
Shear stress(P_a)	**1.089**	**5.500**	**11.724**	**20.065**	**39.799**
Erosion Rate(mm/hr)	**5.180**	**47.681**	**101.313**	**108.000**	**191.370**

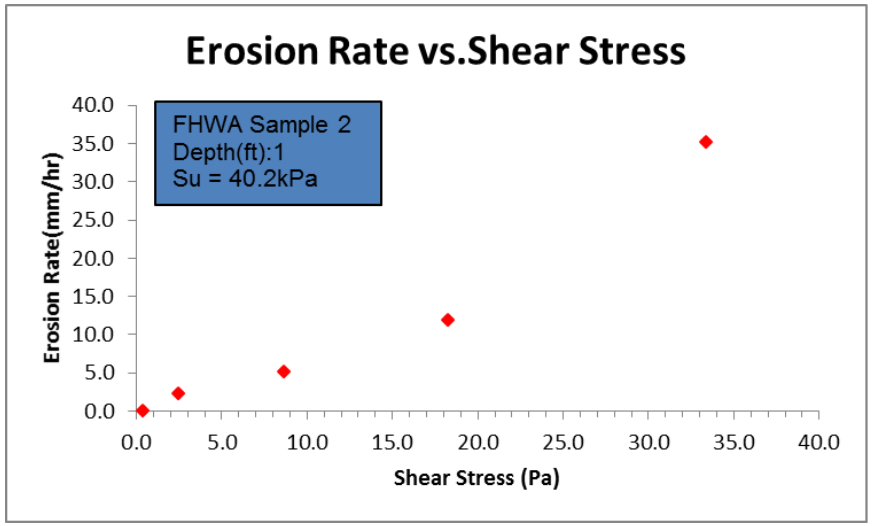


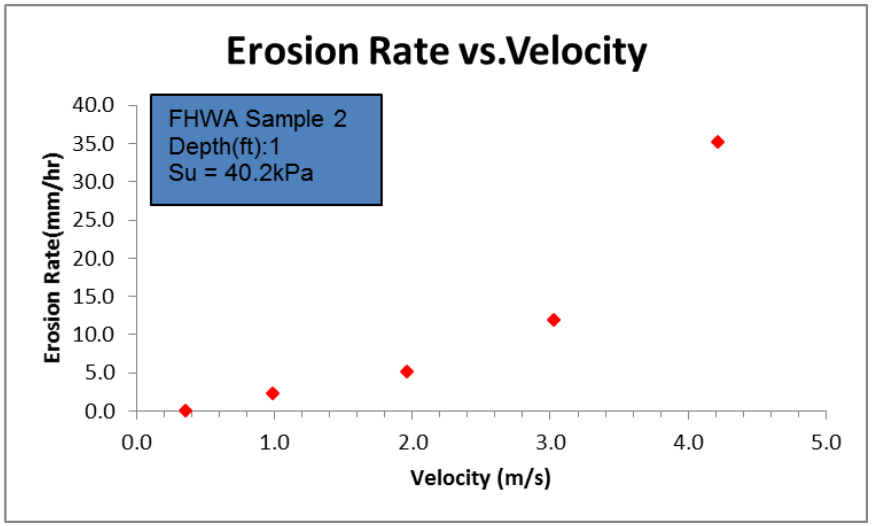


FHWA Sample #2

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.350	0.003	21256	0.026	0.398	0	1504.8	0.000
0.987	0.003	59951	0.020	2.438	1	1504.062	2.394
1.962	0.003	119102	0.018	8.658	2	1371	5.252
3.021	0.003	183424	0.016	18.254	4	1200	12.000
4.217	0.003	256025	0.015	33.341	9	919.98	35.218

Velocity(m/sec)	0.350	0.987	1.962	3.021	4.217
Shear stress(P_a)	0.398	2.438	8.658	18.254	33.341
Erosion Rate(mm/hr)	0.100	2.394	5.252	12.000	35.218

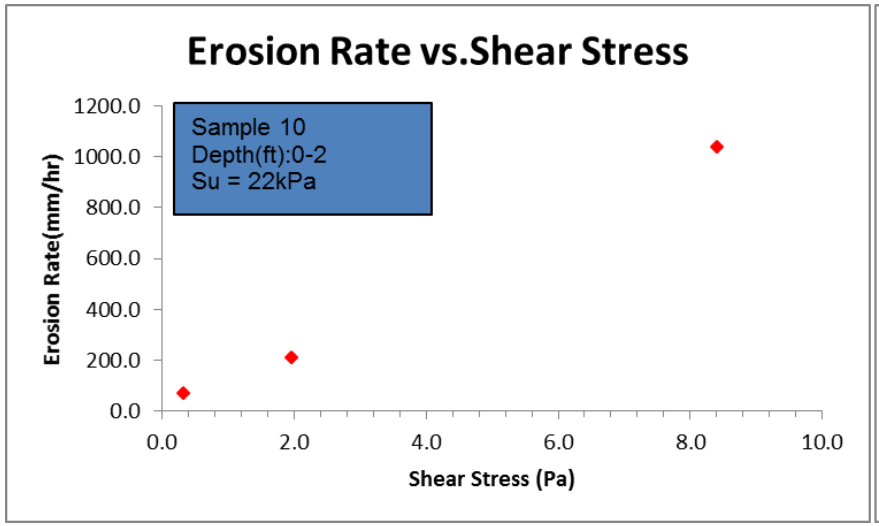


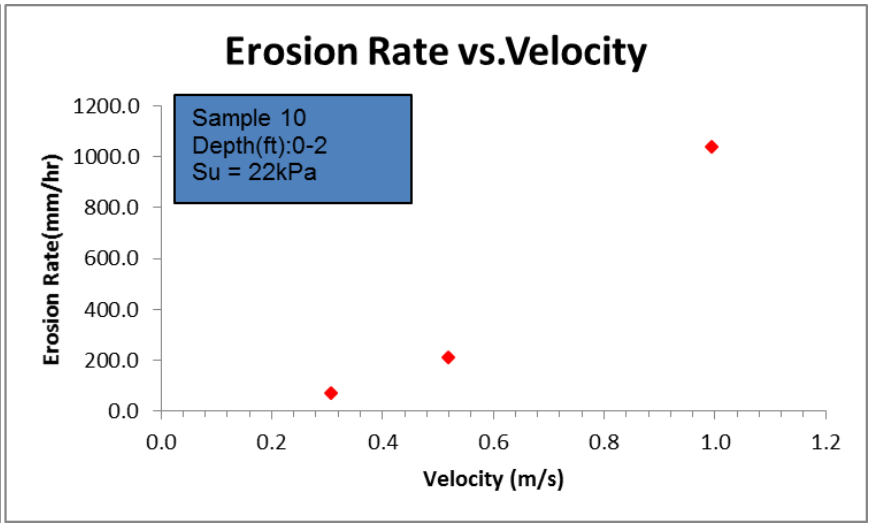


GEER Sample #10

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.308	0.032	18702	0.027	0.320	6	300	72.000
0.519	2.000	31514	0.058	1.953	20	340.0002	211.765
0.994	3.000	60354	0.068	8.399	35	121.0062	1041.269

Velocity(m/sec)	**0.308**	**0.519**	**0.994**
Shear stress(P_a)	**0.320**	**1.953**	**8.399**
Erosion Rate(mm/hr)	**72.000**	**211.765**	**1041.269**



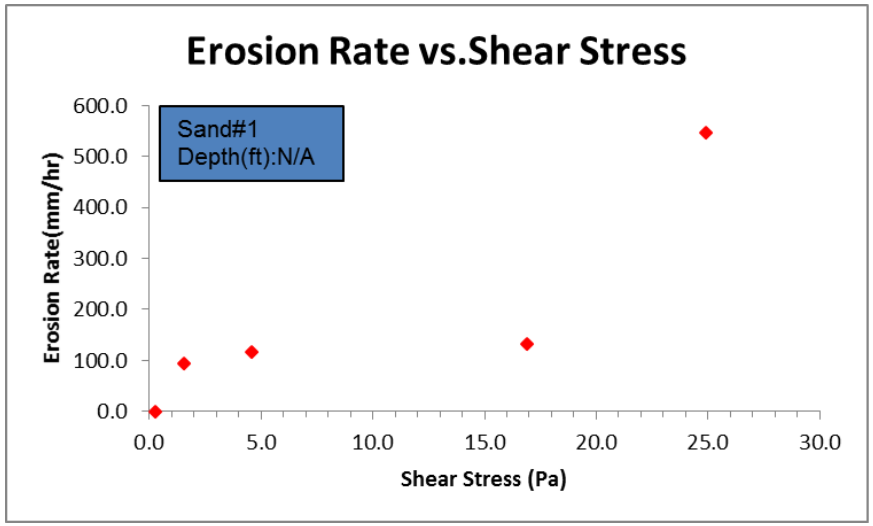


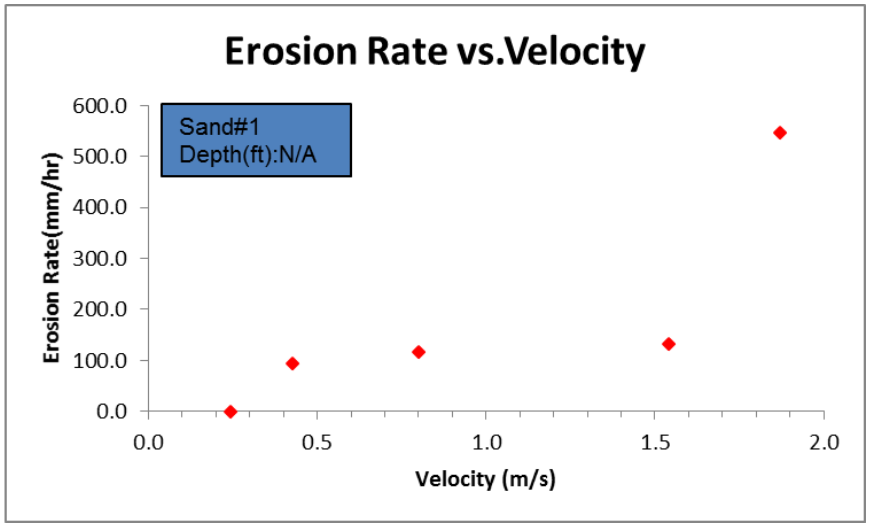
Sand Samples - EFA

Sand #1

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.244	0.500	14817	0.039	0.290	0	1110	0.000
0.428	3.000	25975	0.069	1.579	11	420	94.286
0.801	2.000	48605	0.057	4.566	11	340.002	116.470
1.539	2.000	93452	0.057	16.880	11	300	132.000
1.869	2.000	113465	0.057	24.885	24	157.998	546.842

Velocity(m/sec)	0.244	0.428	0.801	1.539	1.869
Shear stress(P_a)	0.290	1.579	4.566	16.880	24.885
Erosion Rate(mm/hr)	0.100	94.286	116.470	132.000	546.842

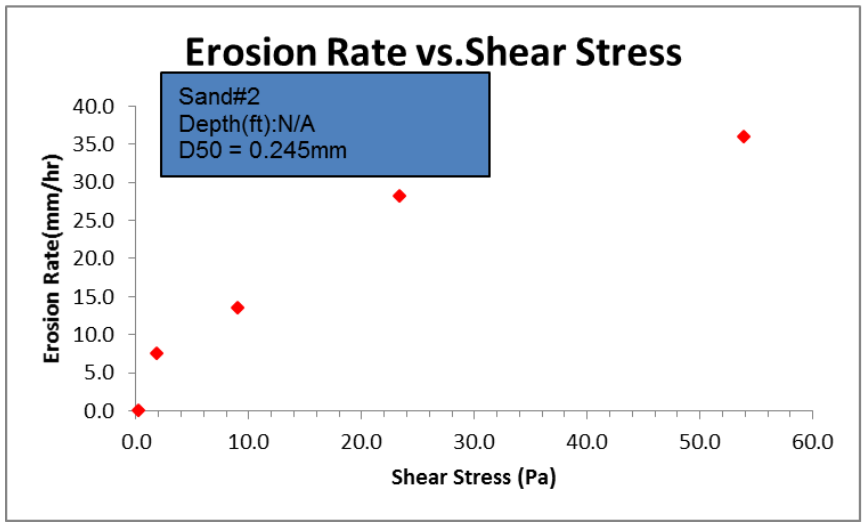


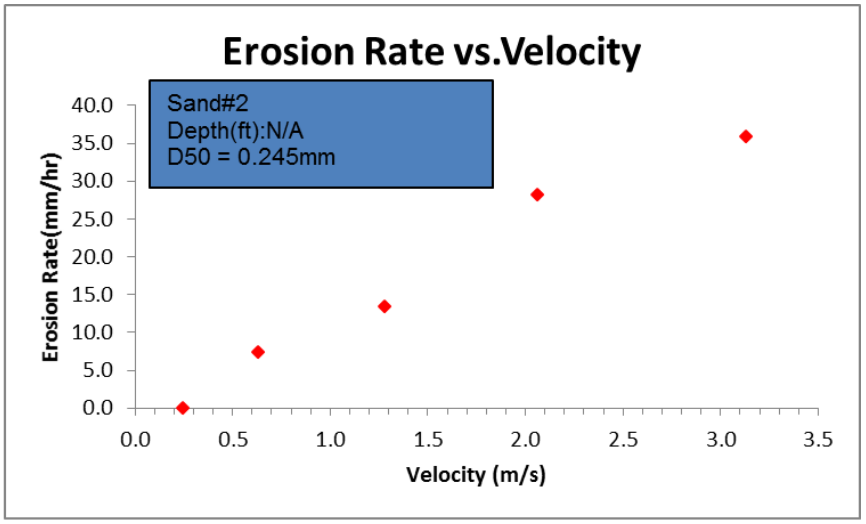


Sand #2

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.244	0.123	14819	0.031	0.231	0	900	0.000
0.633	0.500	38424	0.036	1.802	2.5	1201.002	7.494
1.276	1.000	77494	0.044	8.960	4.5	1200	13.500
2.059	1.000	124993	0.044	23.311	8	1020	28.235
3.130	1.000	190053	0.044	53.893	9	900	36.000

Velocity(m/sec)	**0.244**	**0.633**	**1.276**	**2.059**	**3.130**
Shear stress(P_a)	**0.231**	**1.802**	**8.960**	**23.311**	**53.893**
Erosion Rate(mm/hr)	**0.100**	**7.494**	**13.500**	**28.235**	**36.000**

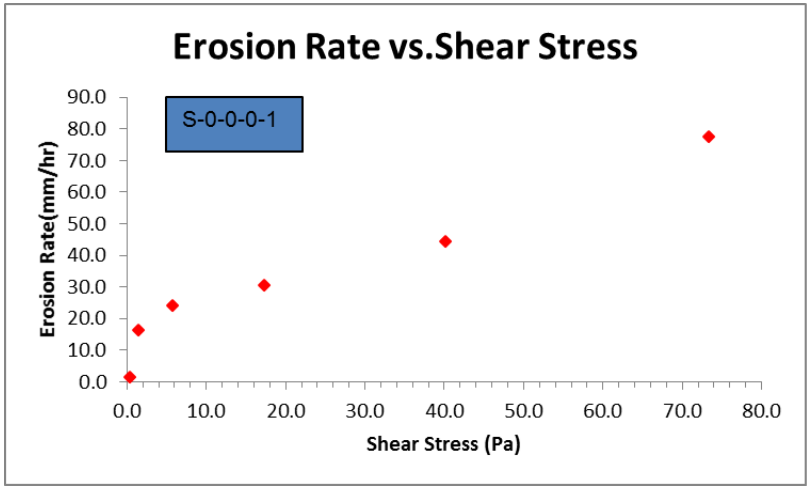


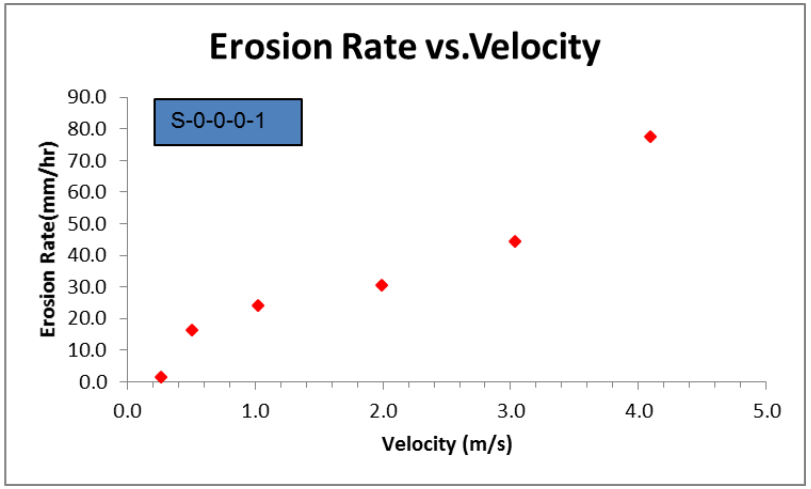


S-0-0-0

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.265	0.500	16083	0.038	0.333	0.5	1200	1.500
0.504	1.000	30624	0.045	1.431	5.5	1200	16.500
1.021	1.000	61988	0.044	5.733	8	1200	24.000
1.990	0.500	120804	0.035	17.321	10.5	1230	30.732
3.031	0.500	184031	0.035	40.195	11.5	931.998	44.421
4.093	0.500	248506	0.035	73.294	12	556.0002	77.698

Velocity(m/sec)	0.265	0.504	1.021	1.990	3.031	4.093
Shear stress(P_a)	0.333	1.431	5.733	17.321	40.195	73.294
Erosion Rate(mm/hr)	1.500	16.500	24.000	30.732	44.421	77.698

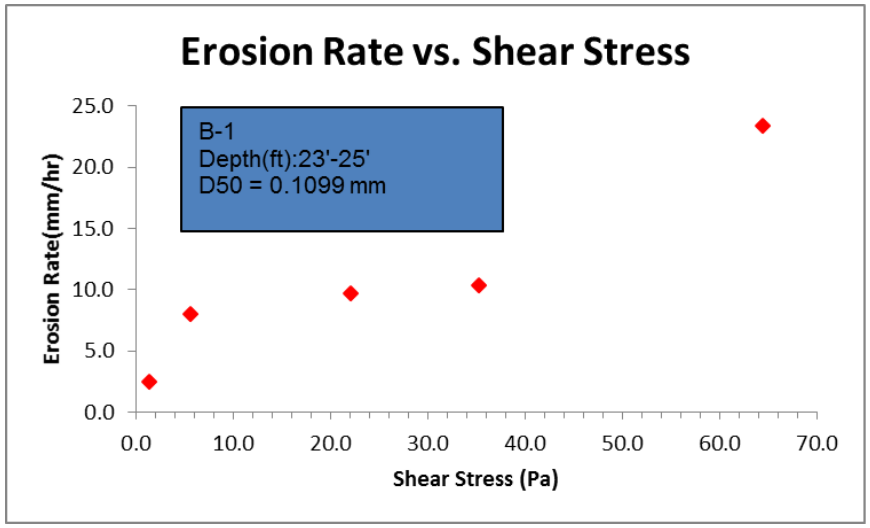


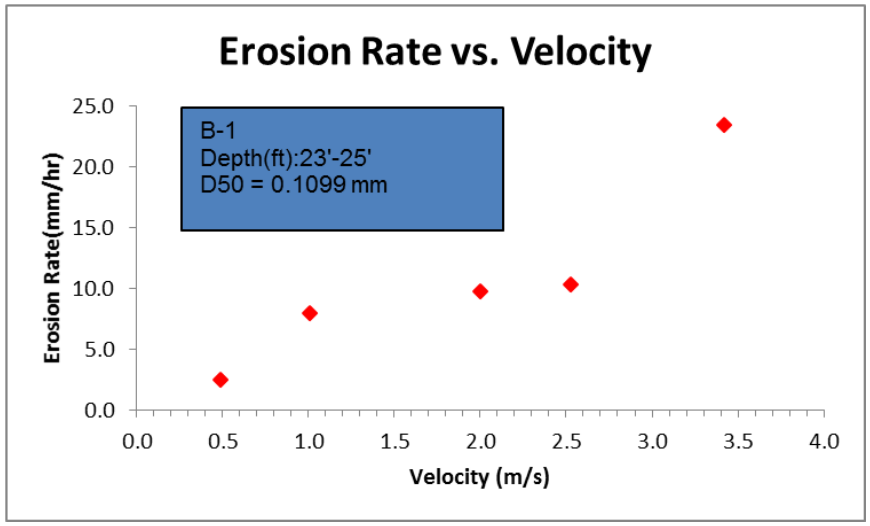


B-1 (23'-25') Tittabawsee River

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.490	1.000	29750	0.045	1.351	1	1461	2.464
1.010	1.000	61321	0.044	5.611	2	900	8.000
2.000	1.000	121429	0.044	22.000	3	1110	9.730
2.530	1.000	153607	0.044	35.205	4	1395	10.323
3.420	1.000	207643	0.044	64.330	4	615	23.415

Velocity(m/sec)	0.490	1.010	2.000	2.530	3.420
Shear stress(P_a)	1.351	5.611	22.000	35.205	64.330
Erosion Rate(mm/hr)	2.464	8.000	9.730	10.323	23.415

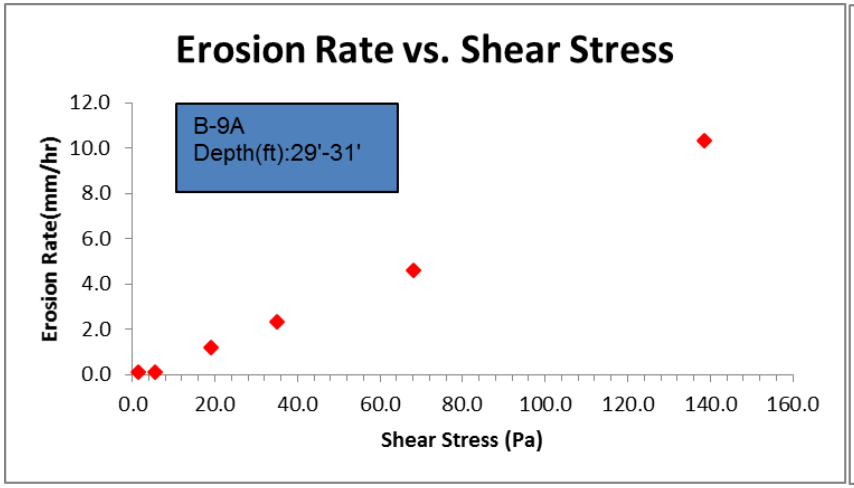


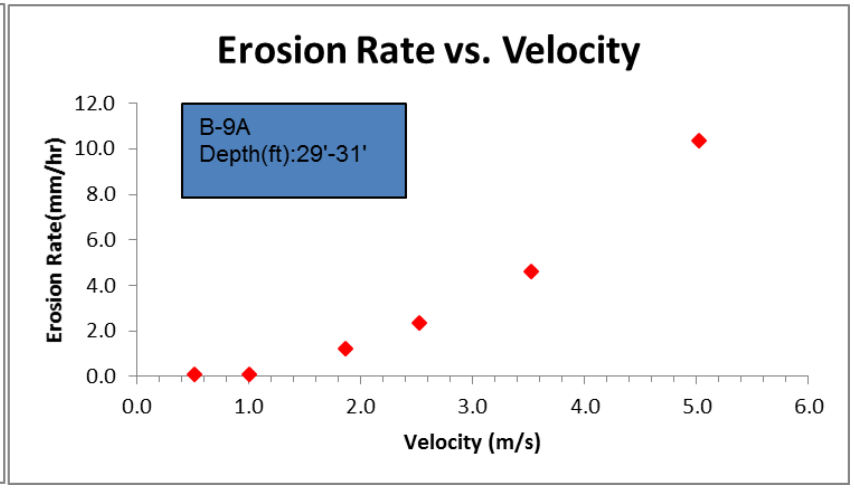


B-9A (29'-31') Tittabawsee River

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.520	1.000	31571	0.045	1.521	0	900	0.000
1.010	1.000	61321	0.044	5.611	0	1800	0.000
1.860	1.000	112929	0.044	19.028	0.5	1500	1.200
2.520	1.000	153000	0.044	34.927	1	1540.2	2.337
3.520	1.000	213714	0.044	68.147	1.5	1170	4.615
5.020	1.000	304786	0.044	138.602	3.5	1218	10.345

Velocity(m/sec)	0.520	1.010	1.860	2.520	3.520	5.020
Shear stress(P_a)	1.521	5.611	19.028	34.927	68.147	138.602
Erosion Rate(mm/hr)	0.100	0.100	1.200	2.337	4.615	10.345

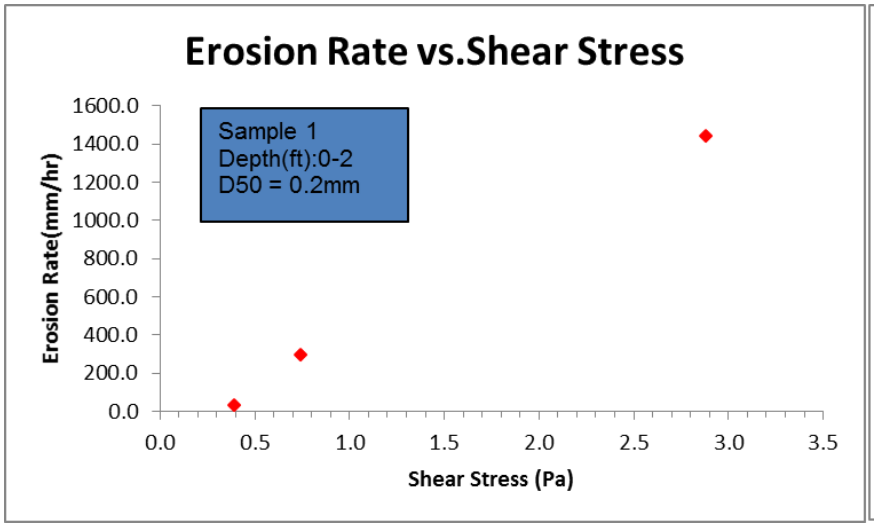


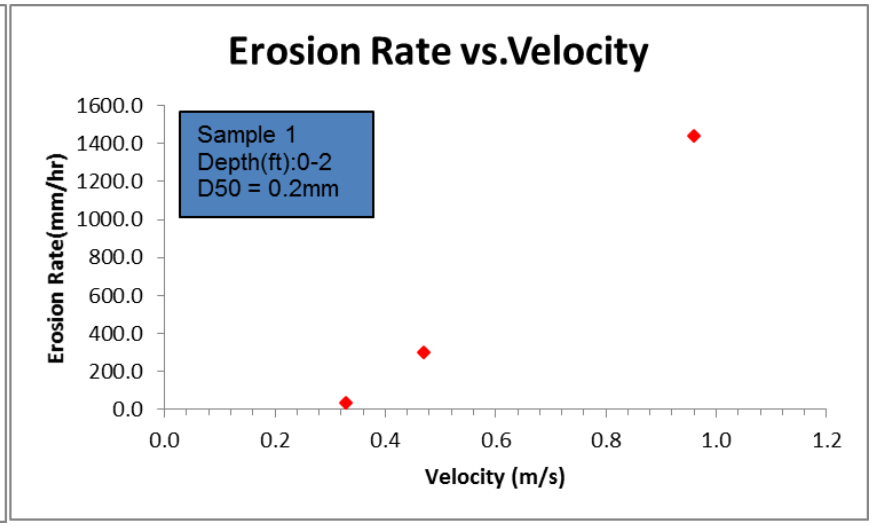


GEER Sample #1

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.328	0.100	19927	0.029	0.391	9	900	36.000
0.469	0.100	28499	0.027	0.744	25	300	300.000
0.960	0.100	58259	0.025	2.877	48	120	1440.000

Velocity(m/sec)	0.328	0.469	0.960
Shear stress(P_a)	0.391	0.744	2.877
Erosion Rate(mm/hr)	36.000	300.000	1440.000

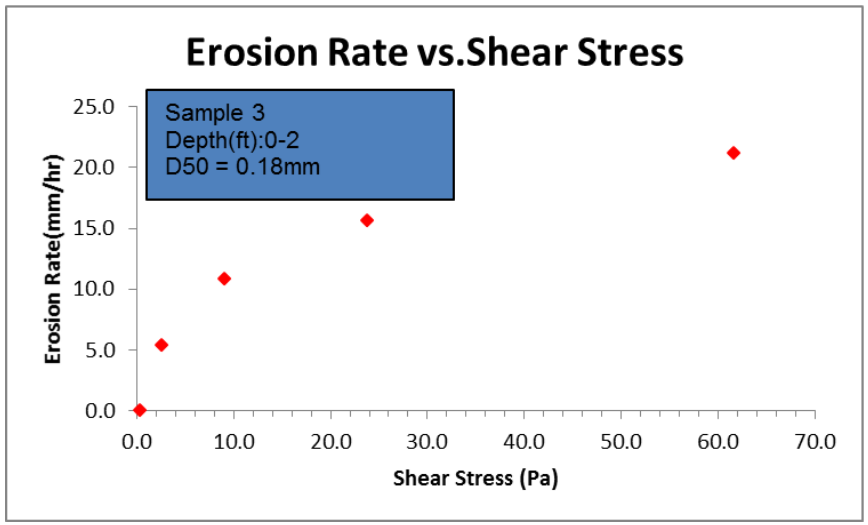


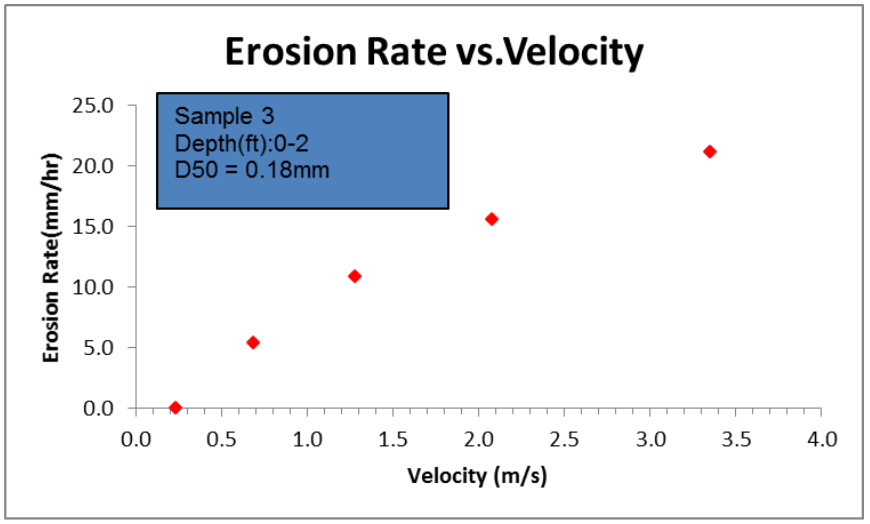


GEER Sample #3

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.232	1.000	14076	0.047	0.316	0	690	0.000
0.686	1.000	41663	0.044	2.590	1	660	5.455
1.277	1.000	77514	0.044	8.965	2	660	10.909
2.080	1.000	126272	0.044	23.790	3	690	15.652
3.346	1.000	203152	0.044	61.578	5	850.0002	21.176

Velocity(m/sec)	0.232	0.686	1.277	2.080	3.346
Shear stress(P_a)	0.316	2.590	8.965	23.790	61.578
Erosion Rate(mm/hr)	0.100	5.455	10.909	15.652	21.176

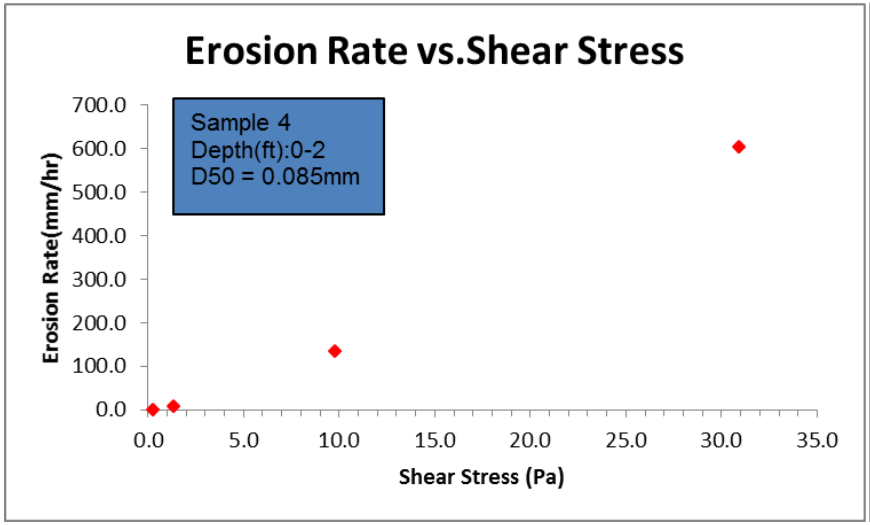


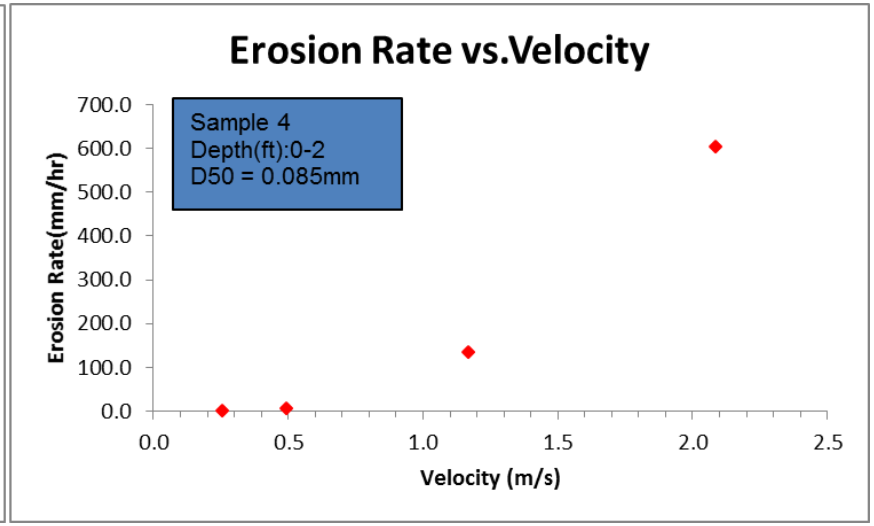


GEER Sample #4

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.253	0.043	15352	0.029	0.232	0	480	0.000
0.491	1.000	29824	0.045	1.357	1	480	7.500
1.170	2.000	71024	0.057	9.750	15	400.0002	135.000
2.083	2.000	126470	0.057	30.916	47	280.0002	604.285

Velocity(m/sec)	0.253	0.491	1.170	2.083
Shear stress(P_a)	0.232	1.357	9.750	30.916
Erosion Rate(mm/hr)	0.100	7.500	135.000	604.285

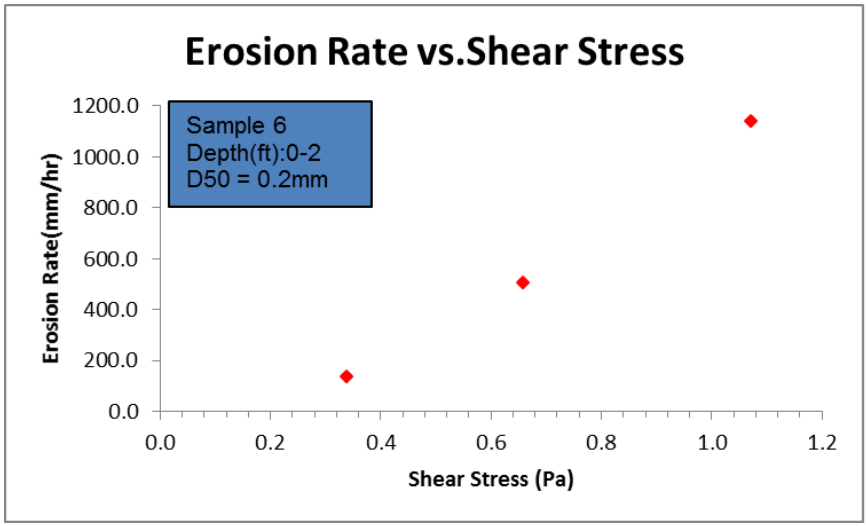


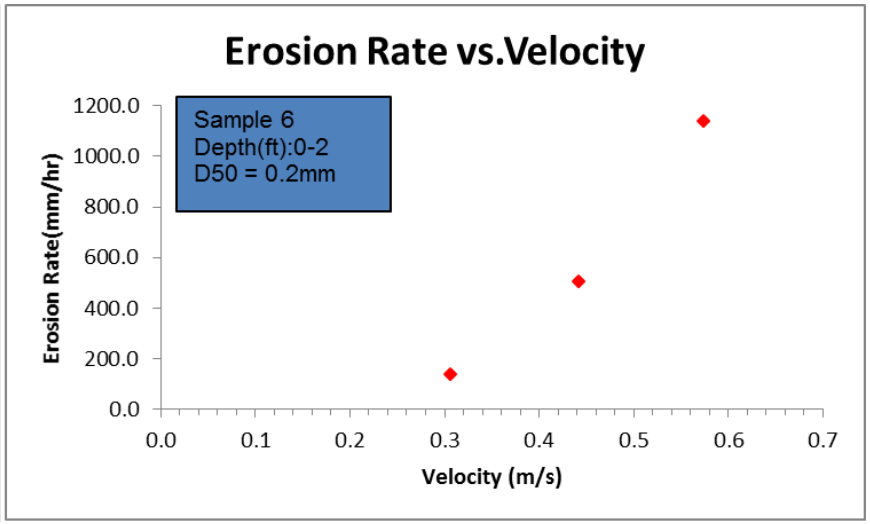


GEER Sample #6

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.306	0.100	18565	0.029	0.339	15	390	138.462
0.441	0.100	26797	0.027	0.657	38	270	506.667
0.574	0.100	34844	0.026	1.070	38	120	1140.000

Velocity(m/sec)	**0.306**	**0.441**	**0.574**
Shear stress(P_a)	**0.339**	**0.657**	**1.070**
Erosion Rate(mm/hr)	**138.462**	**506.667**	**1140.000**

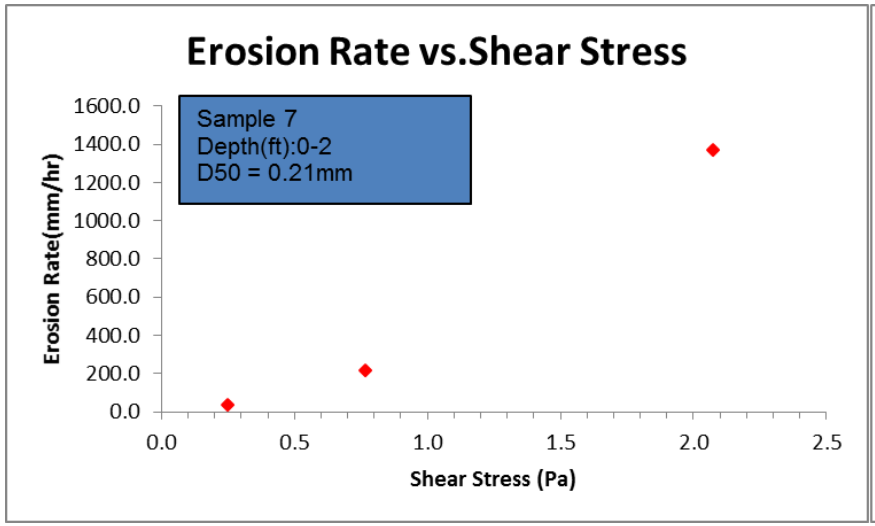


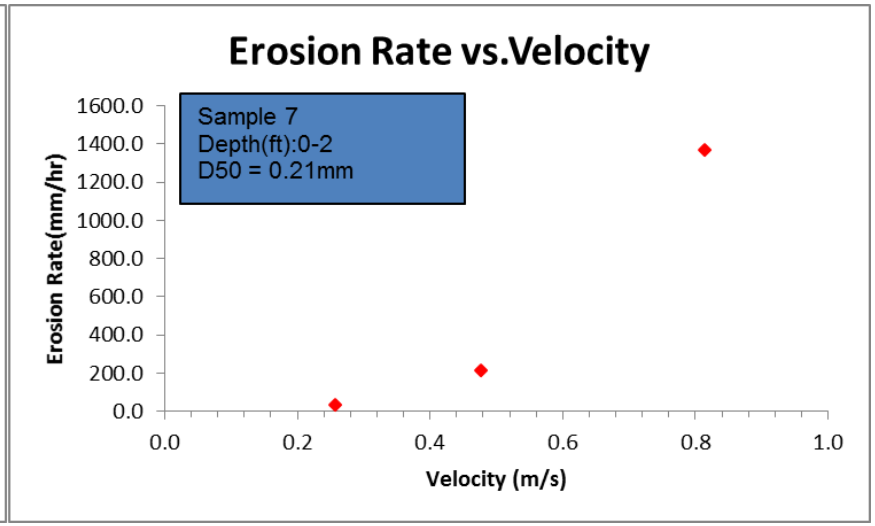


GEER Sample #7

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.258	0.105	15653	0.030	0.249	7	730.0002	34.521
0.476	0.105	28893	0.027	0.764	18	298.00002	217.450
0.814	0.105	49445	0.025	2.073	48	126	1371.429

Velocity(m/sec)	**0.258**	**0.476**	**0.814**
Shear stress(P_a)	**0.249**	**0.764**	**2.073**
Erosion Rate(mm/hr)	**34.521**	**217.450**	**1371.429**



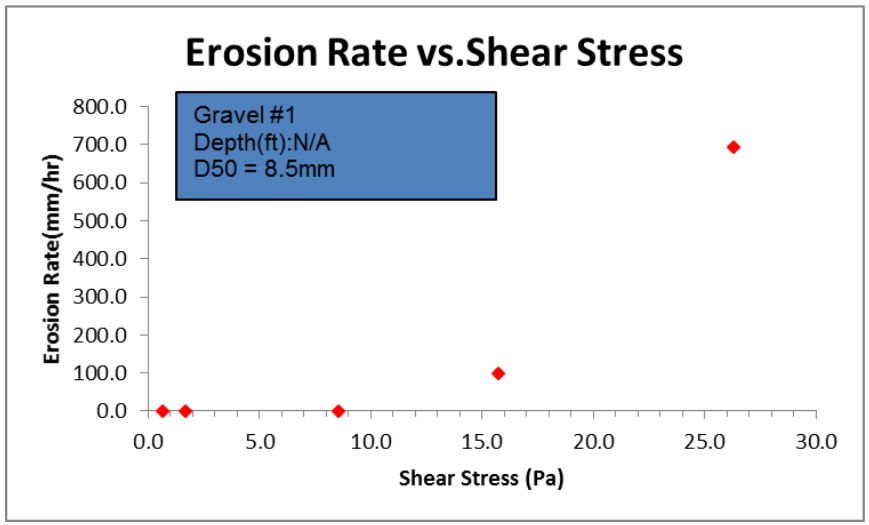


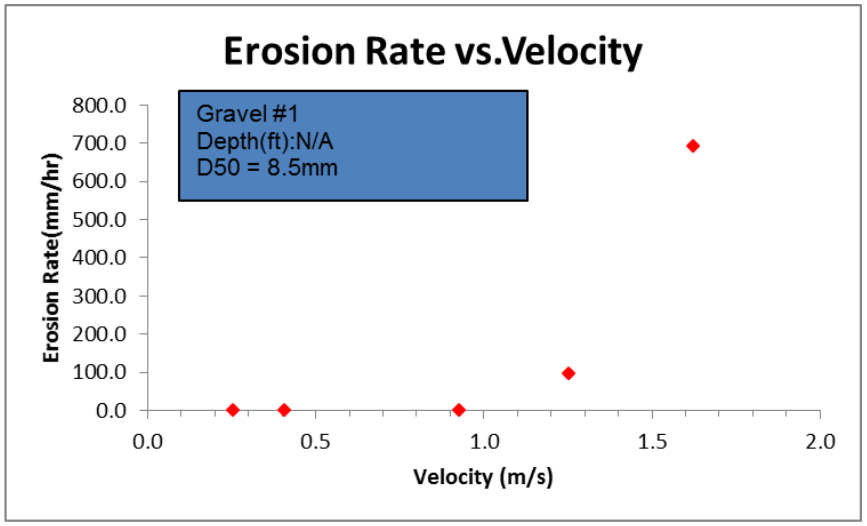
Gravel Samples - EFA

Gravel #1

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.252	4.250	15291	0.081	0.642	0	1399.98	0.000
0.407	4.250	24696	0.080	1.654	0	780	0.000
0.925	4.250	56166	0.080	8.558	0	741	0.000
1.253	4.250	76089	0.080	15.706	18	660	98.182
1.622	4.250	98459	0.080	26.299	52	270	693.333

Velocity(m/sec)	**0.252**	**0.407**	**0.925**	**1.253**	**1.622**
Shear stress(P_a)	**0.642**	**1.654**	**8.558**	**15.706**	**26.299**
Erosion Rate(mm/hr)	**0.100**	**0.100**	**0.100**	**98.182**	**693.333**

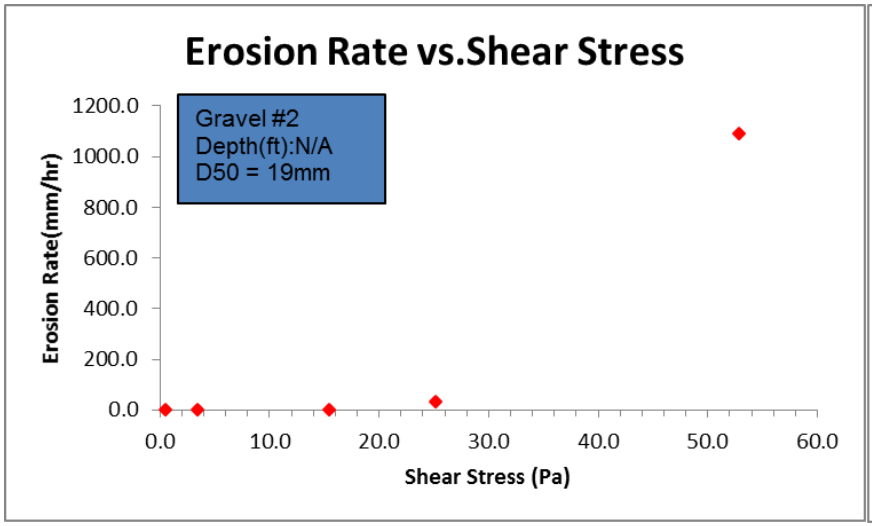


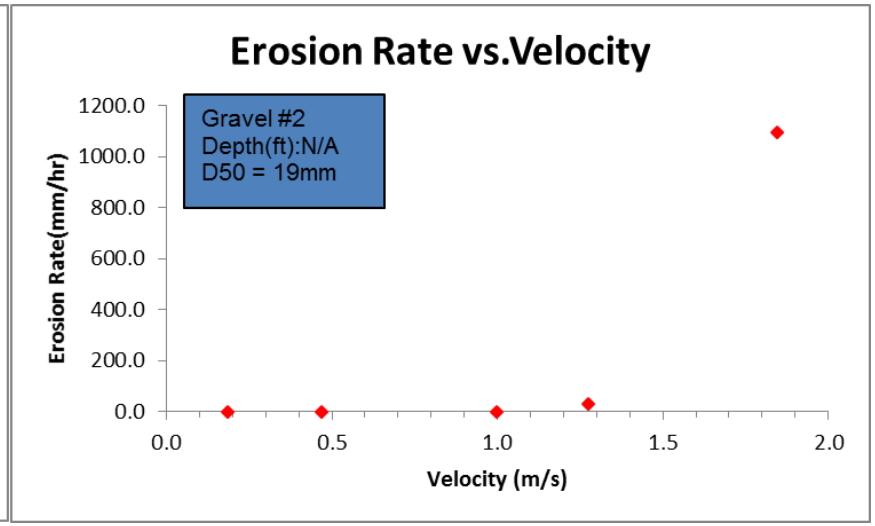


Gravel #2

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.185	9.500	11216	0.125	0.533	0	660	0.000
0.469	9.500	28457	0.124	3.405	0	720	0.000
0.998	9.500	60567	0.124	15.425	0	751.002	0.000
1.275	9.500	77386	0.124	25.181	6	690	31.304
1.846	9.500	112074	0.124	52.815	58	190.9998	1093.195

Velocity(m/sec)	0.185	0.469	0.998	1.275	1.846
Shear stress(P_a)	0.533	3.405	15.425	25.181	52.815
Erosion Rate(mm/hr)	0.100	0.100	0.100	31.304	1093.195

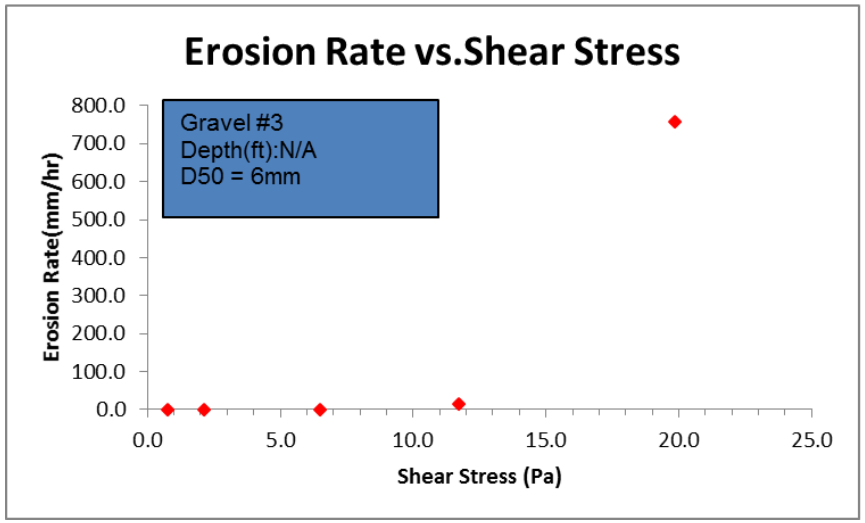


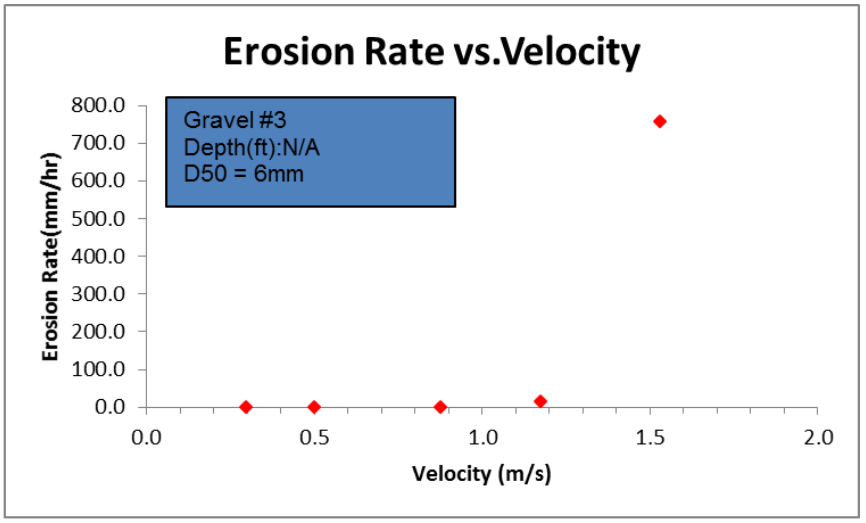


Gravel #3

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.297	3.000	18011	0.069	0.759	0	1030.0002	0.000
0.499	3.000	30315	0.068	2.119	0	511.00002	0.000
0.875	3.000	53101	0.068	6.502	0	510	0.000
1.173	3.000	71247	0.068	11.705	3	720	15.000
1.528	3.000	92775	0.068	19.847	78	370.000002	758.919

Velocity(m/sec)	0.297	0.499	0.875	1.173	1.528
Shear stress(P_a)	0.759	2.119	6.502	11.705	19.847
Erosion Rate(mm/hr)	0.100	0.100	0.100	15.000	758.919

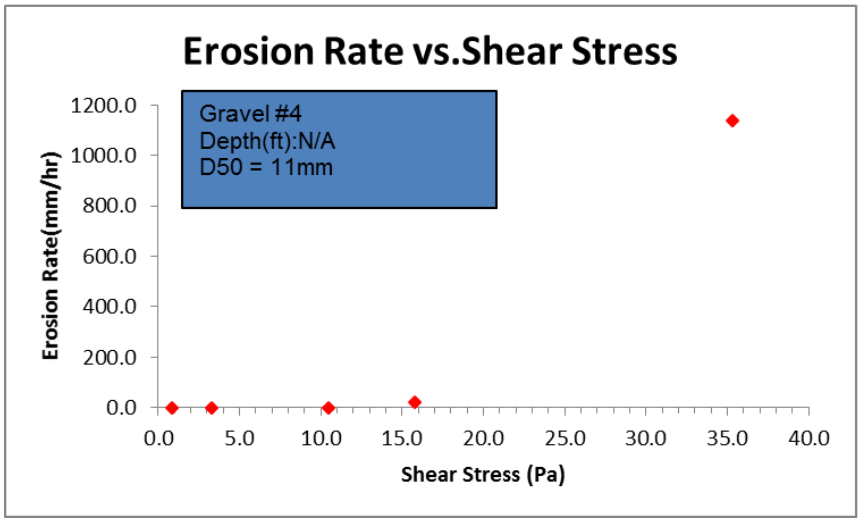


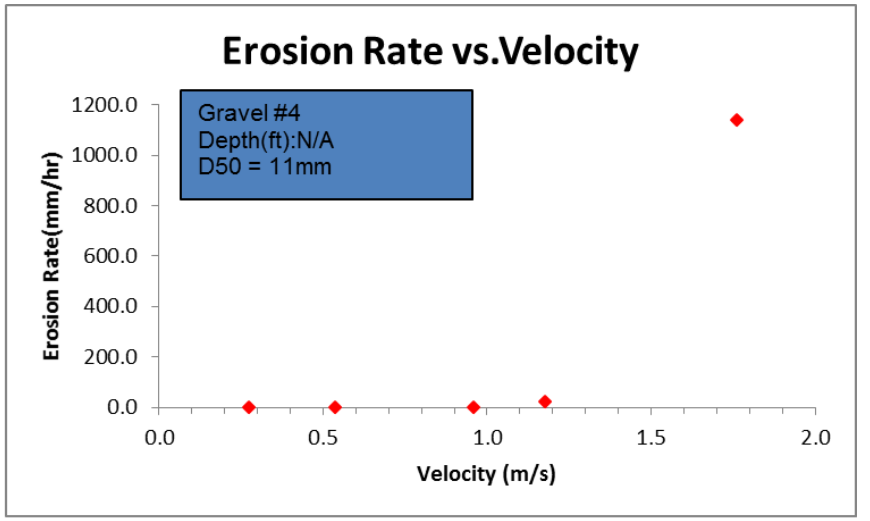


Gravel #4

Velocity	Equivalent Roughness	Reynolds Number	Friction Factor	Shear Stress	Erosion Reading	Test Time	Erosion Rate
m/sec	mm	R_e	Moody chart	P_a	mm	sec	mm/hr
0.275	5.500	16680	0.092	0.868	0	1429.9998	0.000
0.536	5.500	32549	0.091	3.269	0	1084.9998	0.000
0.959	5.500	58214	0.091	10.458	0	649.9998	0.000
1.177	5.500	71434	0.091	15.746	6	985.00002	21.929
1.762	5.500	106971	0.091	35.310	38	120	1140.000

Velocity(m/sec)	0.275	0.536	0.959	1.177	1.762
Shear stress(P_a)	0.868	3.269	10.458	15.746	35.310
Erosion Rate(mm/hr)	0.100	0.100	0.100	21.929	1140.000





Clay Samples – JET

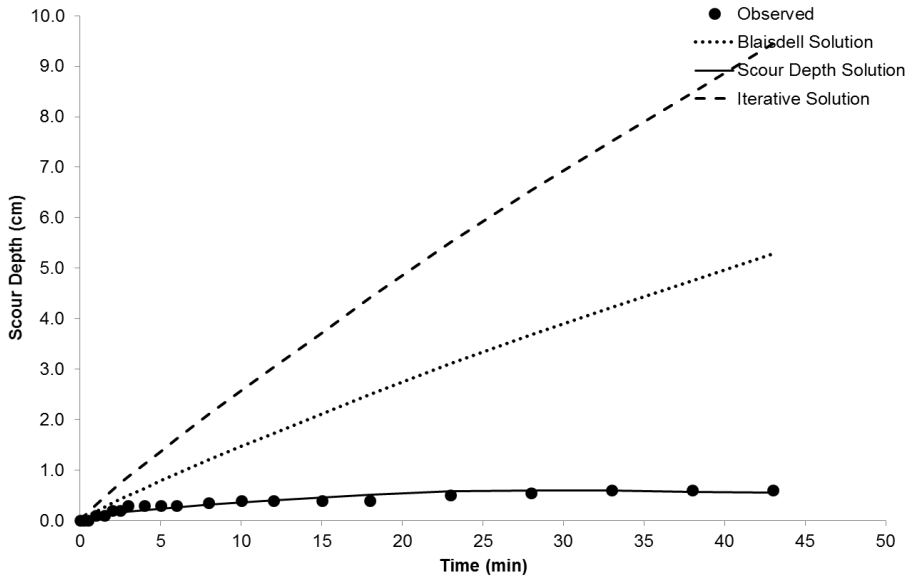
B-1 (2'-4') Beaumont Formation

Site:	Beamunt Formation
Date:	4/2/2017
Test #:	B-1 (2'-4')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1181

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	40	0.131	0.869	0.000	0	45.16
0.25	0.25	40	0.131	0.869	0.000	0.25	45.16
0.5	0.25	40	0.131	0.869	0.000	0.5	45.16
1	0.5	41	0.135	0.865	0.003	1	45.16
1.5	0.5	41	0.135	0.865	0.003	1.5	45.16
2	0.5	42	0.138	0.862	0.007	2	45.16
2.5	0.5	42	0.138	0.862	0.007	2.5	45.16
3	0.5	43	0.141	0.859	0.010	3	45.16
4	1	43	0.141	0.859	0.010	4	45.16
5	1	43	0.141	0.859	0.010	5	45.16
6	1	43	0.141	0.859	0.010	6	45.16
8	2	43.5	0.143	0.857	0.011	8	45.16
10	2	44	0.144	0.856	0.013	10	45.16
12	2	44	0.144	0.856	0.013	12	45.16
15	3	44	0.144	0.856	0.013	15	45.16
18	3	44	0.144	0.856	0.013	18	45.16
23	5	45	0.148	0.852	0.016	23	45.16
28	5	45.5	0.149	0.851	0.018	28	45.16
33	5	46	0.151	0.849	0.020	33	45.16
38	5	46	0.151	0.849	0.020	38	45.16
43	5	46	0.151	0.849	0.020	43	45.16



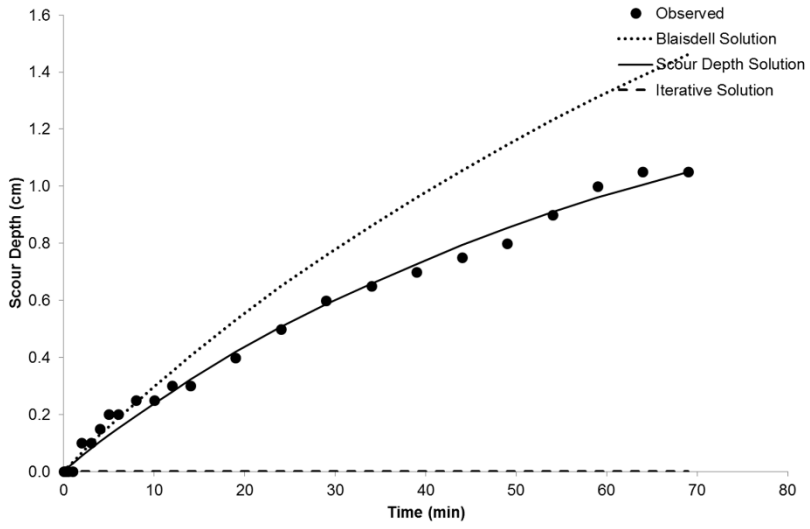
B-1 (4’-6’) Beaumont Formation

Site:	Beamunt Formation
Date:	7/29/2017
Test #:	B-1 (4'-6')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0984

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	34	0.112	0.888	0.000	0	45.16
0.25	0.25	34	0.112	0.888	0.000	0.25	45.16
0.5	0.25	34	0.112	0.888	0.000	0.5	45.16
1	0.5	34	0.112	0.888	0.000	1	45.16
2	1	35	0.115	0.885	0.003	2	45.16
3	1	35	0.115	0.885	0.003	3	45.16
4	1	35.5	0.116	0.884	0.005	4	45.16
5	1	36	0.118	0.882	0.007	5	45.16
6	1	36	0.118	0.882	0.007	6	45.16
8	2	36.5	0.120	0.880	0.008	8	45.16
10	2	36.5	0.120	0.880	0.008	10	45.16
12	2	37	0.121	0.879	0.010	12	45.16
14	2	37	0.121	0.879	0.010	14	45.16
19	5	38	0.125	0.875	0.013	19	45.16
24	5	39	0.128	0.872	0.016	24	45.16
29	5	40	0.131	0.869	0.020	29	45.16
34	5	40.5	0.133	0.867	0.021	34	45.16
39	5	41	0.135	0.865	0.023	39	45.16
44	5	41.5	0.136	0.864	0.025	44	45.16
49	5	42	0.138	0.862	0.026	49	45.16
54	5	43	0.141	0.859	0.030	54	45.16
59	5	44	0.144	0.856	0.033	59	45.16
64	5	44.5	0.146	0.854	0.034	64	45.16
69	5	44.5	0.146	0.854	0.034	69	45.16



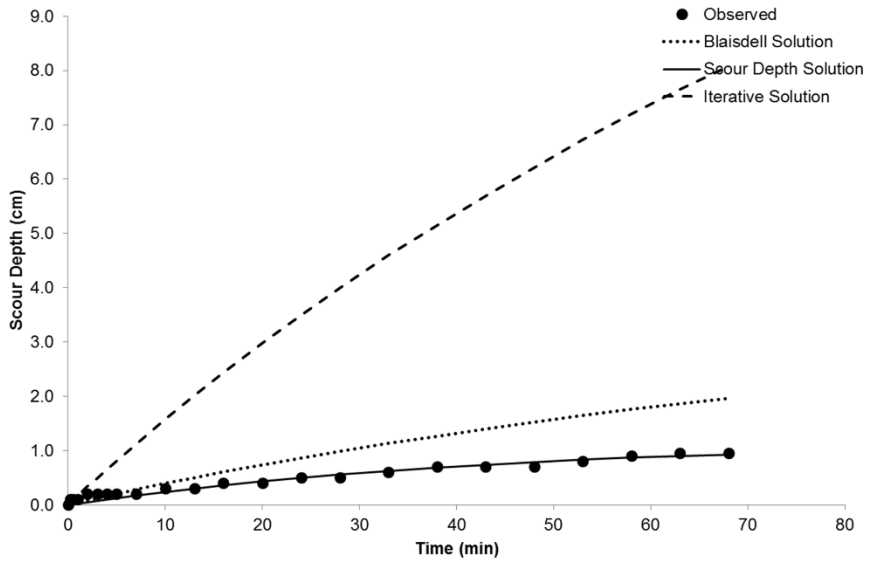
B-1 (8’-10’) Beaumont Formation

Site:	Beamunt Formation
Date:	3/31/2017
Test #:	B-1 (8'-10')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1181

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	40	0.131	0.869	0.000	0	45.16
0.25	0.25	41	0.135	0.865	0.003	0.25	45.16
0.5	0.25	41	0.135	0.865	0.003	0.5	45.16
1	0.5	41	0.135	0.865	0.003	1	45.16
2	1	42	0.138	0.862	0.007	2	45.16
3	1	42	0.138	0.862	0.007	3	45.16
4	1	42	0.138	0.862	0.007	4	45.16
5	1	42	0.138	0.862	0.007	5	45.16
7	2	42	0.138	0.862	0.007	7	45.16
10	3	43	0.141	0.859	0.010	10	45.16
13	3	43	0.141	0.859	0.010	13	45.16
16	3	44	0.144	0.856	0.013	16	45.16
20	4	44	0.144	0.856	0.013	20	45.16
24	4	45	0.148	0.852	0.016	24	45.16
28	4	45	0.148	0.852	0.016	28	45.16
33	5	46	0.151	0.849	0.020	33	45.16
38	5	47	0.154	0.846	0.023	38	45.16
43	5	47	0.154	0.846	0.023	43	45.16
48	5	47	0.154	0.846	0.023	48	45.16
53	5	48	0.157	0.843	0.026	53	45.16
58	5	49	0.161	0.839	0.030	58	45.16
63	5	49.5	0.162	0.838	0.031	63	45.16
68	5	49.5	0.162	0.838	0.031	68	45.16



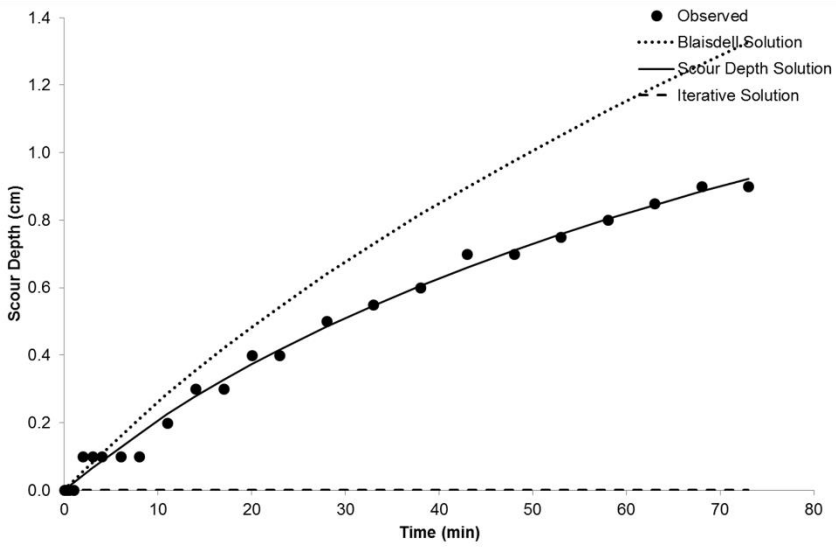
B-1 (10'-12') Beaumont Formation

Site:	Beaumont Formation
Date:	4/19/2017
Test #:	B-1 (10'-12')
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0984

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	34	0.112	0.888	0.000	0	45.00
0.25	0.25	34	0.112	0.888	0.000	0.25	45.00
0.5	0.25	34	0.112	0.888	0.000	0.5	45.00
1	0.5	34	0.112	0.888	0.000	1	45.00
2	1	35	0.115	0.885	0.003	2	45.00
3	1	35	0.115	0.885	0.003	3	45.00
4	1	35	0.115	0.885	0.003	4	45.00
6	2	35	0.115	0.885	0.003	6	45.00
8	2	35	0.115	0.885	0.003	8	45.00
11	3	36	0.118	0.882	0.007	11	45.00
14	3	37	0.121	0.879	0.010	14	45.00
17	3	37	0.121	0.879	0.010	17	45.00
20	3	38	0.125	0.875	0.013	20	45.00
23	3	38	0.125	0.875	0.013	23	45.00
28	5	39	0.128	0.872	0.016	28	45.00
33	5	39.5	0.130	0.870	0.018	33	45.00
38	5	40	0.131	0.869	0.020	38	45.00
43	5	41	0.135	0.865	0.023	43	45.00
48	5	41	0.135	0.865	0.023	48	45.00
53	5	41.5	0.136	0.864	0.025	53	45.00
58	5	42	0.138	0.862	0.026	58	45.00
63	5	42.5	0.139	0.861	0.028	63	45.00
68	5	43	0.141	0.859	0.030	68	45.00
73	5	43	0.141	0.859	0.030	73	45.00



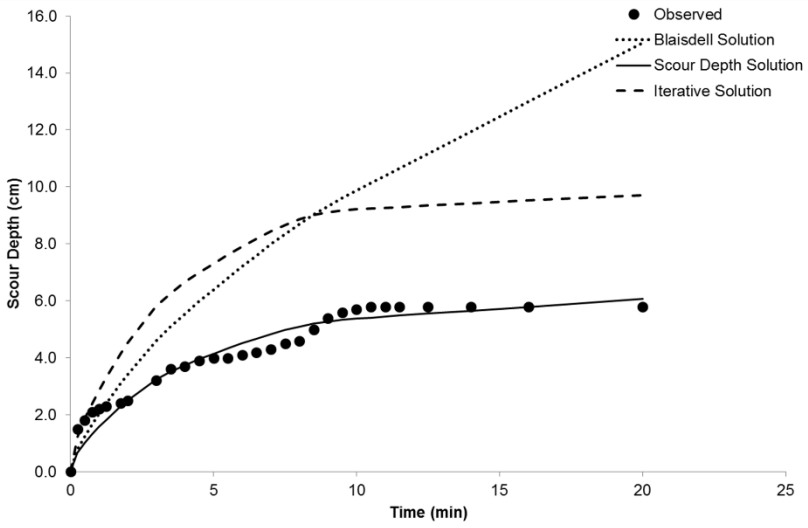
B-1 (13'-15') Beaumont Formation

Site:	Beamunt Formation
Date:	3/29/2017
Test #:	B-1 (13'-15')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1017

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	35	0.115	0.885	0.000	0	45.16
0.25	0.25	50	0.164	0.836	0.049	0.25	45.16
0.5	0.25	53	0.174	0.826	0.059	0.5	45.16
0.75	0.25	56	0.184	0.816	0.069	0.75	45.16
1	0.25	57	0.187	0.813	0.072	1	45.16
1.25	0.25	58	0.190	0.810	0.075	1.25	45.16
1.75	0.5	59	0.194	0.806	0.079	1.75	45.16
2	0.25	60	0.197	0.803	0.082	2	45.16
3	1	67	0.220	0.780	0.105	3	45.16
3.5	0.5	71	0.233	0.767	0.118	3.5	45.16
4	0.5	72	0.236	0.764	0.121	4	45.16
4.5	0.5	74	0.243	0.757	0.128	4.5	45.16
5	0.5	75	0.246	0.754	0.131	5	45.16
5.5	0.5	75	0.246	0.754	0.131	5.5	45.16
6	0.5	76	0.249	0.751	0.135	6	45.16
6.5	0.5	77	0.253	0.747	0.138	6.5	45.16
7	0.5	78	0.256	0.744	0.141	7	45.16
7.5	0.5	80	0.262	0.738	0.148	7.5	45.16
8	0.5	81	0.266	0.734	0.151	8	45.16
8.5	0.5	85	0.279	0.721	0.164	8.5	45.16
9	0.5	89	0.292	0.708	0.177	9	45.16
9.5	0.5	91	0.299	0.701	0.184	9.5	45.16
10	0.5	92	0.302	0.698	0.187	10	45.16
10.5	0.5	93	0.305	0.695	0.190	10.5	45.16
11	0.5	93	0.305	0.695	0.190	11	45.16
11.5	0.5	93	0.305	0.695	0.190	11.5	45.16
12.5	1	93	0.305	0.695	0.190	12.5	45.16
14	1.5	93	0.305	0.695	0.190	14	45.16
16	2	93	0.305	0.695	0.190	16	45.16
20	4	93	0.305	0.695	0.190	20	45.16



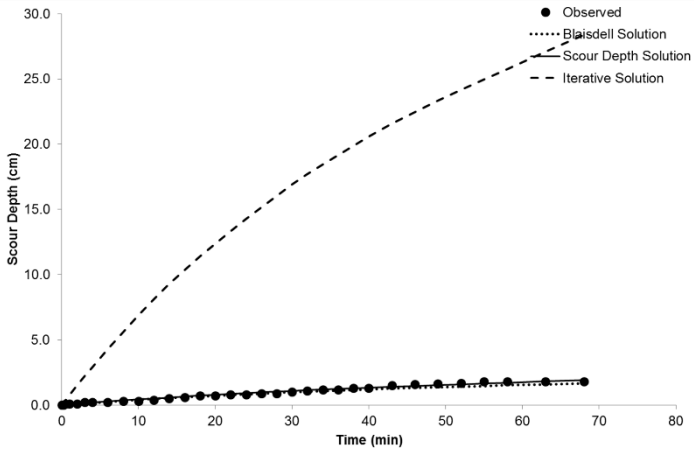
B-1 (18’-20’) Beaumont Formation

Site:	Beamunt Formation
Date:	4/2/2017
Test #:	B-1 (18'-20')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0984

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d (cm^3/N·s):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	34	0.112	0.888	0.000	0	45.16
0.25	0.25	34	0.112	0.888	0.000	0.25	45.16
0.5	0.25	35	0.115	0.885	0.003	0.5	45.16
1	0.5	35	0.115	0.885	0.003	1	45.16
2	1	35	0.115	0.885	0.003	2	45.16
3	1	36	0.118	0.882	0.007	3	45.16
4	1	36	0.118	0.882	0.007	4	45.16
6	2	36	0.118	0.882	0.007	6	45.16
8	2	37	0.121	0.879	0.010	8	45.16
10	2	37	0.121	0.879	0.010	10	45.16
12	2	38	0.125	0.875	0.013	12	45.16
14	2	39	0.128	0.872	0.016	14	45.16
16	2	40	0.131	0.869	0.020	16	45.16
18	2	41	0.135	0.865	0.023	18	45.16
20	2	41	0.135	0.865	0.023	20	45.16
22	2	42	0.138	0.862	0.026	22	45.16
24	2	42	0.138	0.862	0.026	24	45.16
26	2	43	0.141	0.859	0.030	26	45.16
28	2	43	0.141	0.859	0.030	28	45.16
30	2	44	0.144	0.856	0.033	30	45.16
32	2	45	0.148	0.852	0.036	32	45.16
34	2	46	0.151	0.849	0.039	34	45.16
36	2	46	0.151	0.849	0.039	36	45.16
38	2	47	0.154	0.846	0.043	38	45.16
40	2	47	0.154	0.846	0.043	40	45.16
43	3	49	0.161	0.839	0.049	43	45.16
46	3	50	0.164	0.836	0.052	46	45.16
49	3	50.5	0.166	0.834	0.054	49	45.16
52	3	51	0.167	0.833	0.056	52	45.16
55	3	52	0.171	0.829	0.059	55	45.16
58	3	52	0.171	0.829	0.059	58	45.16
63	5	52	0.171	0.829	0.059	63	45.16
68	5	52	0.171	0.829	0.059	68	45.16



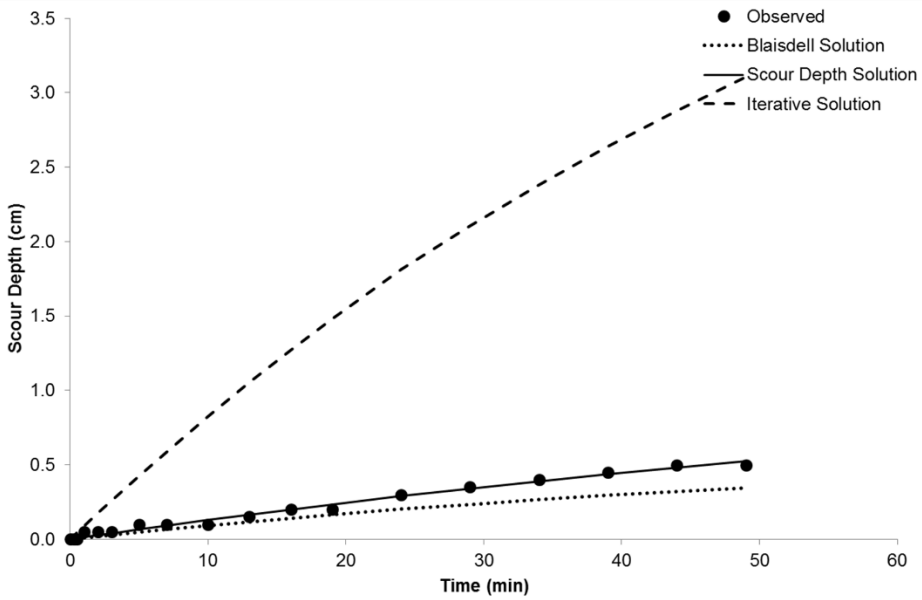
B-1 (28’-30’) Beaumont Formation

Site:	Beamunt Formation
Date:	8/2/2017
Test #:	B-1 (28'-30')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0951

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	33	0.108	0.892	0.000	0	45.16
0.25	0.25	33	0.108	0.892	0.000	0.25	45.16
0.5	0.25	33	0.108	0.892	0.000	0.5	45.16
1	0.5	33.5	0.110	0.890	0.002	1	45.16
2	1	33.5	0.110	0.890	0.002	2	45.16
3	1	33.5	0.110	0.890	0.002	3	45.16
5	2	34	0.112	0.888	0.003	5	45.16
7	2	34	0.112	0.888	0.003	7	45.16
10	3	34	0.112	0.888	0.003	10	45.16
13	3	34.5	0.113	0.887	0.005	13	45.16
16	3	35	0.115	0.885	0.007	16	45.16
19	3	35	0.115	0.885	0.007	19	45.16
24	5	36	0.118	0.882	0.010	24	45.16
29	5	36.5	0.120	0.880	0.011	29	45.16
34	5	37	0.121	0.879	0.013	34	45.16
39	5	37.5	0.123	0.877	0.015	39	45.16
44	5	38	0.125	0.875	0.016	44	45.16
49	5	38	0.125	0.875	0.016	49	45.16



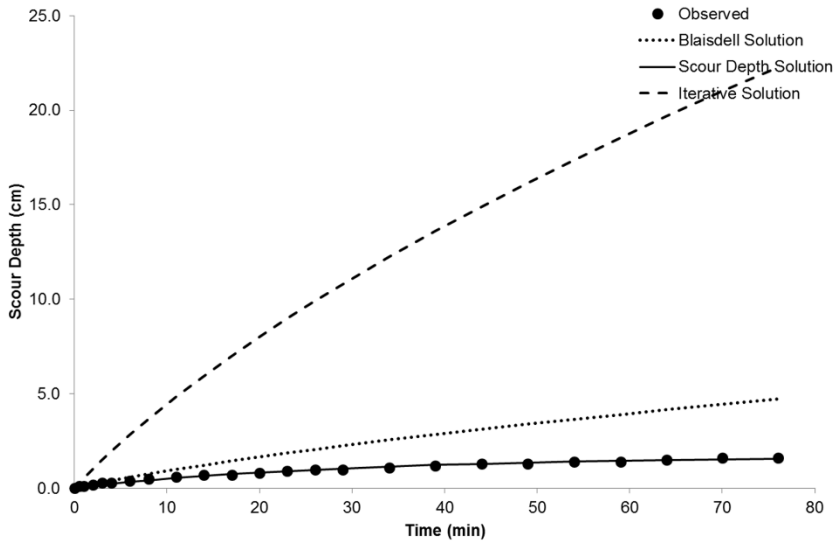
B-2 (2’-4’) Beaumont Formation

Site:	Beamunt Formation
Date:	3/26/2017
Test #:	B-2 (2'-4')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1083

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	37	0.121	0.879	0.000	0	45.16
0.5	0.5	38	0.125	0.875	0.003	0.5	45.16
1	0.5	38	0.125	0.875	0.003	1	45.16
2	1	39	0.128	0.872	0.007	2	45.16
3	1	40	0.131	0.869	0.010	3	45.16
4	1	40	0.131	0.869	0.010	4	45.16
6	2	41	0.135	0.865	0.013	6	45.16
8	2	42	0.138	0.862	0.016	8	45.16
11	3	43	0.141	0.859	0.020	11	45.16
14	3	44	0.144	0.856	0.023	14	45.16
17	3	44	0.144	0.856	0.023	17	45.16
20	3	45	0.148	0.852	0.026	20	45.16
23	3	46	0.151	0.849	0.030	23	45.16
26	3	47	0.154	0.846	0.033	26	45.16
29	3	47	0.154	0.846	0.033	29	45.16
34	5	48	0.157	0.843	0.036	34	45.16
39	5	49	0.161	0.839	0.039	39	45.16
44	5	50	0.164	0.836	0.043	44	45.16
49	5	50	0.164	0.836	0.043	49	45.16
54	5	51	0.167	0.833	0.046	54	45.16
59	5	51	0.167	0.833	0.046	59	45.16
64	5	52	0.171	0.829	0.049	64	45.16
70	6	53	0.174	0.826	0.052	70	45.16
76	6	53	0.174	0.826	0.052	76	45.16



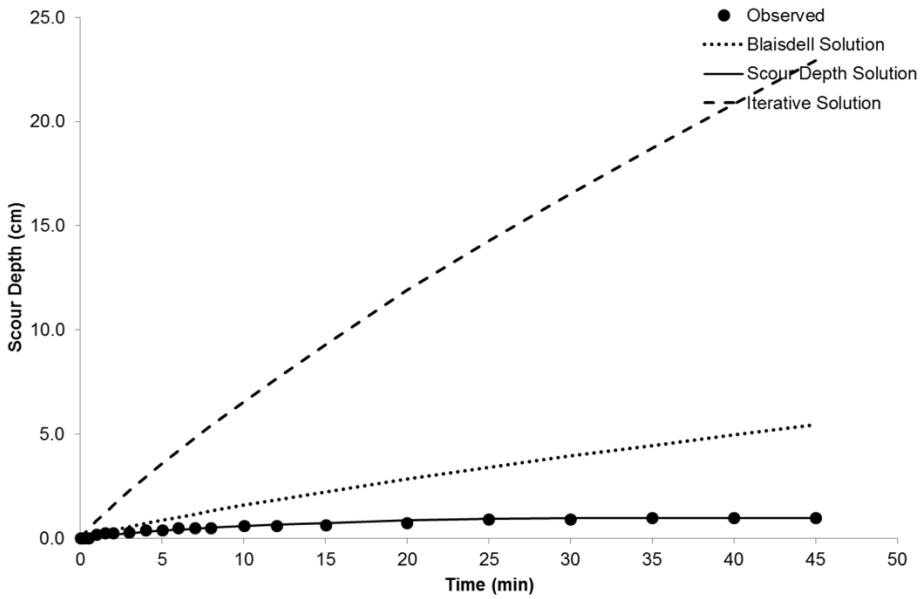
B-2 (8'-10') Lissie Formation

Site:	Lissie Formation
Date:	5/20/2017
Test #:	B-2 (8'-10')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0951

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	33	0.108	0.892	0.000	0	45.00
0.25	0.25	33	0.108	0.892	0.000	0.25	45.00
0.5	0.25	33	0.108	0.892	0.000	0.5	45.00
1	0.5	35	0.115	0.885	0.007	1	45.00
1.5	0.5	35.5	0.116	0.884	0.008	1.5	45.00
2	0.5	35.5	0.116	0.884	0.008	2	45.00
3	1	36	0.118	0.882	0.010	3	45.00
4	1	37	0.121	0.879	0.013	4	45.00
5	1	37	0.121	0.879	0.013	5	45.00
6	1	38	0.125	0.875	0.016	6	45.00
7	1	38	0.125	0.875	0.016	7	45.00
8	1	38	0.125	0.875	0.016	8	45.00
10	2	39	0.128	0.872	0.020	10	45.00
12	2	39	0.128	0.872	0.020	12	45.00
15	3	39.5	0.130	0.870	0.021	15	45.00
20	5	40.5	0.133	0.867	0.025	20	45.00
25	5	42	0.138	0.862	0.030	25	45.00
30	5	42	0.138	0.862	0.030	30	45.00
35	5	43	0.141	0.859	0.033	35	45.00
40	5	43	0.141	0.859	0.033	40	45.00
45	5	43	0.141	0.859	0.033	45	45.00



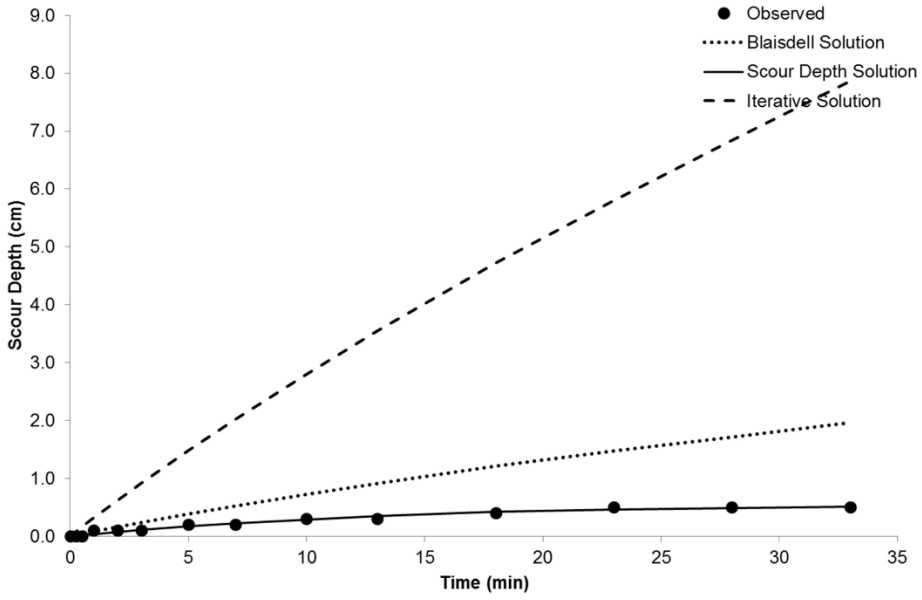
B-2 (13'-15') Beaumont Formation

Site:	Beamunt Formation
Date:	3/26/2017
Test #:	B-2 (13'-15')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1017

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	35	0.115	0.885	0.000	0	45.00
0.25	0.25	35	0.115	0.885	0.000	0.25	45.00
0.5	0.25	35	0.115	0.885	0.000	0.5	45.00
1	0.5	36	0.118	0.882	0.003	1	45.00
2	1	36	0.118	0.882	0.003	2	45.00
3	1	36	0.118	0.882	0.003	3	45.00
5	2	37	0.121	0.879	0.007	5	45.00
7	2	37	0.121	0.879	0.007	7	45.00
10	3	38	0.125	0.875	0.010	10	45.00
13	3	38	0.125	0.875	0.010	13	45.00
18	5	39	0.128	0.872	0.013	18	45.00
23	5	40	0.131	0.869	0.016	23	45.00
28	5	40	0.131	0.869	0.016	28	45.00
33	5	40	0.131	0.869	0.016	33	45.00



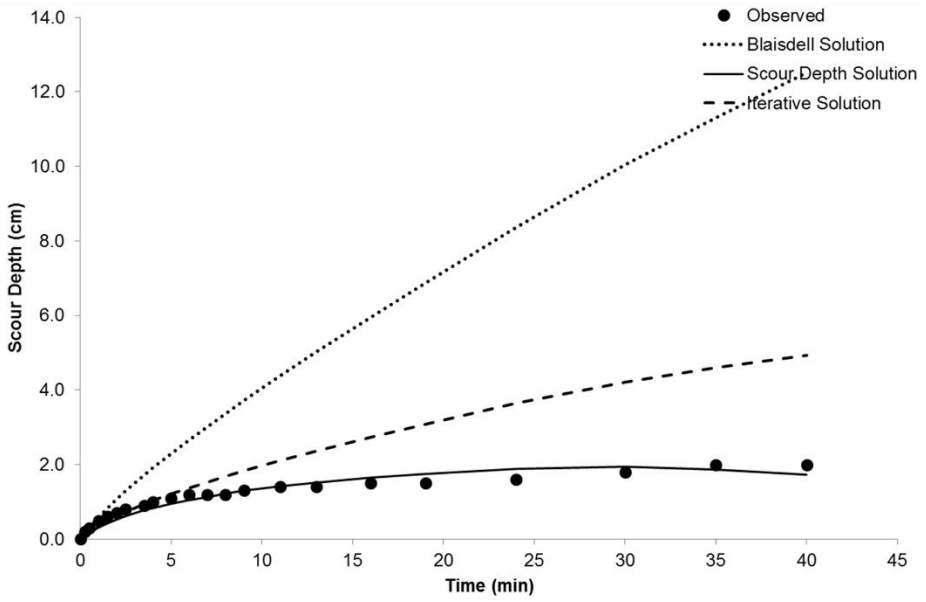
B-4 (8'-10') Beaumont Formation

Site:	Beamunt Formation
Date:	3/25/2017
Test #:	B-4 (8'-10')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1115

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	38	0.125	0.875	0.000	0	45.00
0.25	0.25	40	0.131	0.869	0.007	0.25	45.00
0.5	0.25	41	0.135	0.865	0.010	0.5	45.00
1	0.5	43	0.141	0.859	0.016	1	45.00
1.5	0.5	44	0.144	0.856	0.020	1.5	45.00
2	0.5	45	0.148	0.852	0.023	2	45.00
2.5	0.5	46	0.151	0.849	0.026	2.5	45.00
3.5	1	47	0.154	0.846	0.030	3.5	45.00
4	0.5	48	0.157	0.843	0.033	4	45.00
5	1	49	0.161	0.839	0.036	5	45.00
6	1	50	0.164	0.836	0.039	6	45.00
7	1	50	0.164	0.836	0.039	7	45.00
8	1	50	0.164	0.836	0.039	8	45.00
9	1	51	0.167	0.833	0.043	9	45.00
11	2	52	0.171	0.829	0.046	11	45.00
13	2	52	0.171	0.829	0.046	13	45.00
16	3	53	0.174	0.826	0.049	16	45.00
19	3	53	0.174	0.826	0.049	19	45.00
24	5	54	0.177	0.823	0.052	24	45.00
30	6	56	0.184	0.816	0.059	30	45.00
35	5	58	0.190	0.810	0.066	35	45.00
40	5	58	0.190	0.810	0.066	40	45.00



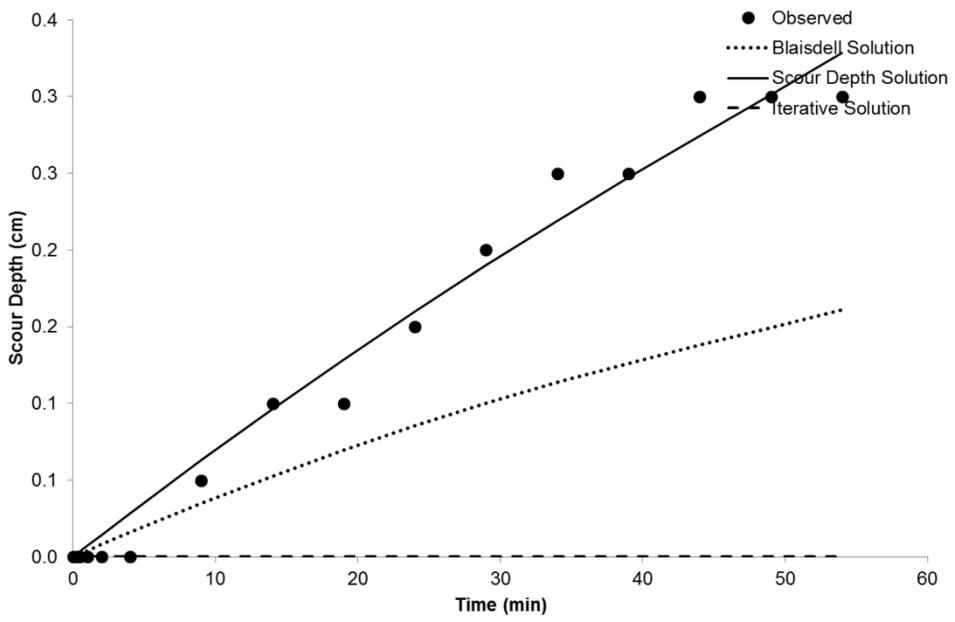
B-5 (4'-6') Beaumont Formation

Site:	Beaumont Formation
Date:	5/18/2017
Test #:	B-5 (4'-6')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1017

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	35	0.115	0.885	0.000	0	45.00
0.25	0.25	35	0.115	0.885	0.000	0.25	45.00
0.5	0.25	35	0.115	0.885	0.000	0.5	45.00
1	0.5	35	0.115	0.885	0.000	1	45.00
2	1	35	0.115	0.885	0.000	2	45.00
4	2	35	0.115	0.885	0.000	4	45.00
9	5	35.5	0.116	0.884	0.002	9	45.00
14	5	36	0.118	0.882	0.003	14	45.00
19	5	36	0.118	0.882	0.003	19	45.00
24	5	36.5	0.120	0.880	0.005	24	45.00
29	5	37	0.121	0.879	0.007	29	45.00
34	5	37.5	0.123	0.877	0.008	34	45.00
39	5	37.5	0.123	0.877	0.008	39	45.00
44	5	38	0.125	0.875	0.010	44	45.00
49	5	38	0.125	0.875	0.010	49	45.00
54	5	38	0.125	0.875	0.010	54	45.00



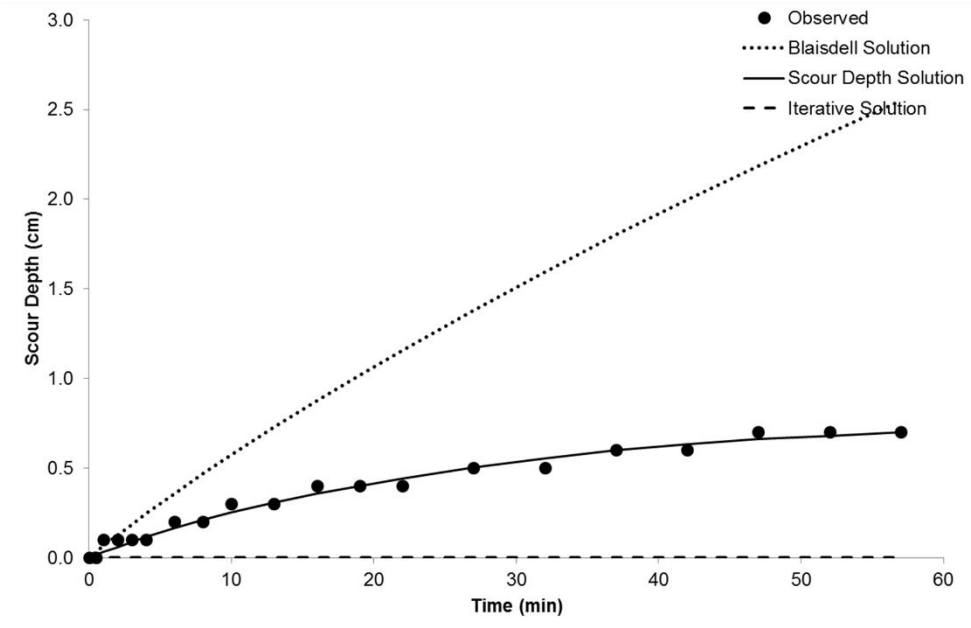
B-5 (6’-8’) Beaumont Formation

Site:	Beamunt Formation
Date:	3/29/2017
Test #:	B-5 (6'-8')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1083

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	37	0.121	0.879	0.000	0	45.00
0.5	0.5	37	0.121	0.879	0.000	0.5	45.00
1	0.5	38	0.125	0.875	0.003	1	45.00
2	1	38	0.125	0.875	0.003	2	45.00
3	1	38	0.125	0.875	0.003	3	45.00
4	1	38	0.125	0.875	0.003	4	45.00
6	2	39	0.128	0.872	0.007	6	45.00
8	2	39	0.128	0.872	0.007	8	45.00
10	2	40	0.131	0.869	0.010	10	45.00
13	3	40	0.131	0.869	0.010	13	45.00
16	3	41	0.135	0.865	0.013	16	45.00
19	3	41	0.135	0.865	0.013	19	45.00
22	3	41	0.135	0.865	0.013	22	45.00
27	5	42	0.138	0.862	0.016	27	45.00
32	5	42	0.138	0.862	0.016	32	45.00
37	5	43	0.141	0.859	0.020	37	45.00
42	5	43	0.141	0.859	0.020	42	45.00
47	5	44	0.144	0.856	0.023	47	45.00
52	5	44	0.144	0.856	0.023	52	45.00
57	5	44	0.144	0.856	0.023	57	45.00



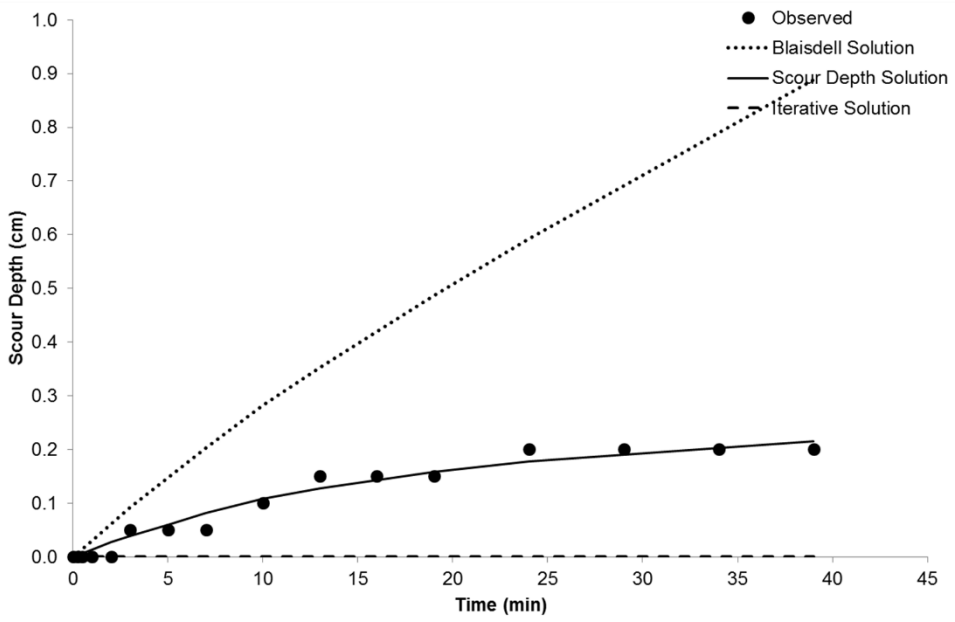
B-6 (0'-2') Beaumont Formation

Site:	Beaumont Formation
Date:	4/19/2017
Test #:	B-6 (0'-2')
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1017

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	35	0.115	0.885	0.000	0	45.00
0.25	0.25	35	0.115	0.885	0.000	0.25	45.00
0.5	0.25	35	0.115	0.885	0.000	0.5	45.00
1	0.5	35	0.115	0.885	0.000	1	45.00
2	1	35	0.115	0.885	0.000	2	45.00
3	1	35.5	0.116	0.884	0.002	3	45.00
5	2	35.5	0.116	0.884	0.002	5	45.00
7	2	35.5	0.116	0.884	0.002	7	45.00
10	3	36	0.118	0.882	0.003	10	45.00
13	3	36.5	0.120	0.880	0.005	13	45.00
16	3	36.5	0.120	0.880	0.005	16	45.00
19	3	36.5	0.120	0.880	0.005	19	45.00
24	5	37	0.121	0.879	0.007	24	45.00
29	5	37	0.121	0.879	0.007	29	45.00
34	5	37	0.121	0.879	0.007	34	45.00
39	5	37	0.121	0.879	0.007	39	45.00



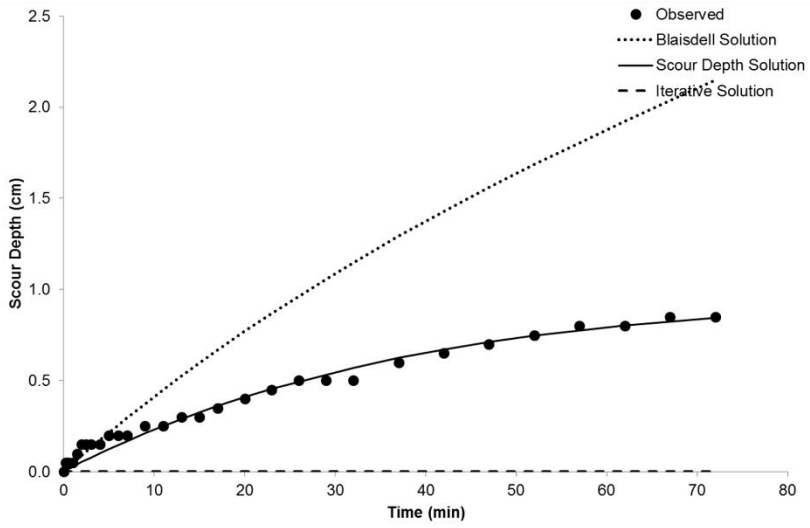
B-8 (2'-4') 5694 Alluvium

Site:	Alluvium Formation
Date:	4/20/2017
Test #:	B-8 (2'-4')
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1017

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	35	0.115	0.885	0.000	0	45.00
0.25	0.25	35.5	0.116	0.884	0.002	0.25	45.00
0.5	0.25	35.5	0.116	0.884	0.002	0.5	45.00
1	0.5	35.5	0.116	0.884	0.002	1	45.00
1.5	0.5	36	0.118	0.882	0.003	1.5	45.00
2	0.5	36.5	0.120	0.880	0.005	2	45.00
2.5	0.5	36.5	0.120	0.880	0.005	2.5	45.00
3	0.5	36.5	0.120	0.880	0.005	3	45.00
4	1	36.5	0.120	0.880	0.005	4	45.00
5	1	37	0.121	0.879	0.007	5	45.00
6	1	37	0.121	0.879	0.007	6	45.00
7	1	37	0.121	0.879	0.007	7	45.00
9	2	37.5	0.123	0.877	0.008	9	45.00
11	2	37.5	0.123	0.877	0.008	11	45.00
13	2	38	0.125	0.875	0.010	13	45.00
15	2	38	0.125	0.875	0.010	15	45.00
17	2	38.5	0.126	0.874	0.011	17	45.00
20	3	39	0.128	0.872	0.013	20	45.00
23	3	39.5	0.130	0.870	0.015	23	45.00
26	3	40	0.131	0.869	0.016	26	45.00
29	3	40	0.131	0.869	0.016	29	45.00
32	3	40	0.131	0.869	0.016	32	45.00
37	5	41	0.135	0.865	0.020	37	45.00
42	5	41.5	0.136	0.864	0.021	42	45.00
47	5	42	0.138	0.862	0.023	47	45.00
52	5	42.5	0.139	0.861	0.025	52	45.00
57	5	43	0.141	0.859	0.026	57	45.00
62	5	43	0.141	0.859	0.026	62	45.00
67	5	43.5	0.143	0.857	0.028	67	45.00
72	5	43.5	0.143	0.857	0.028	72	45.00



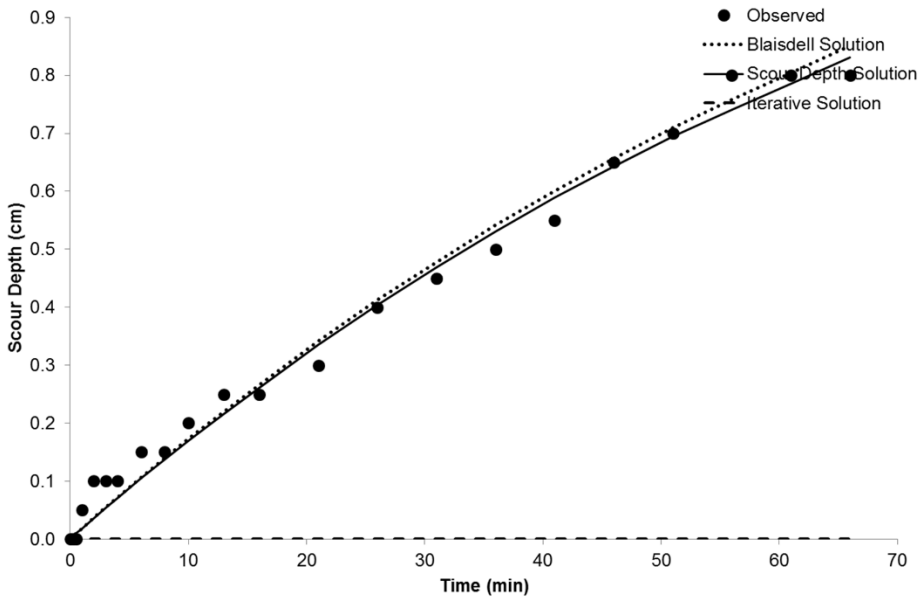
B-13 (18'-20') Bottom Alluvium

Site:	Alluvium Freeport TX
Date:	6/8/2017
Test #:	B-13 (18'-20') Bottom
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1115

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	38	0.125	0.875	0.000	0	45.00
0.25	0.25	38	0.125	0.875	0.000	0.25	45.00
0.5	0.25	38	0.125	0.875	0.000	0.5	45.00
1	0.5	38.5	0.126	0.874	0.002	1	45.00
2	1	39	0.128	0.872	0.003	2	45.00
3	1	39	0.128	0.872	0.003	3	45.00
4	1	39	0.128	0.872	0.003	4	45.00
6	2	39.5	0.130	0.870	0.005	6	45.00
8	2	39.5	0.130	0.870	0.005	8	45.00
10	2	40	0.131	0.869	0.007	10	45.00
13	3	40.5	0.133	0.867	0.008	13	45.00
16	3	40.5	0.133	0.867	0.008	16	45.00
21	5	41	0.135	0.865	0.010	21	45.00
26	5	42	0.138	0.862	0.013	26	45.00
31	5	42.5	0.139	0.861	0.015	31	45.00
36	5	43	0.141	0.859	0.016	36	45.00
41	5	43.5	0.143	0.857	0.018	41	45.00
46	5	44.5	0.146	0.854	0.021	46	45.00
51	5	45	0.148	0.852	0.023	51	45.00
56	5	46	0.151	0.849	0.026	56	45.00
61	5	46	0.151	0.849	0.026	61	45.00
66	5	46	0.151	0.849	0.026	66	45.00



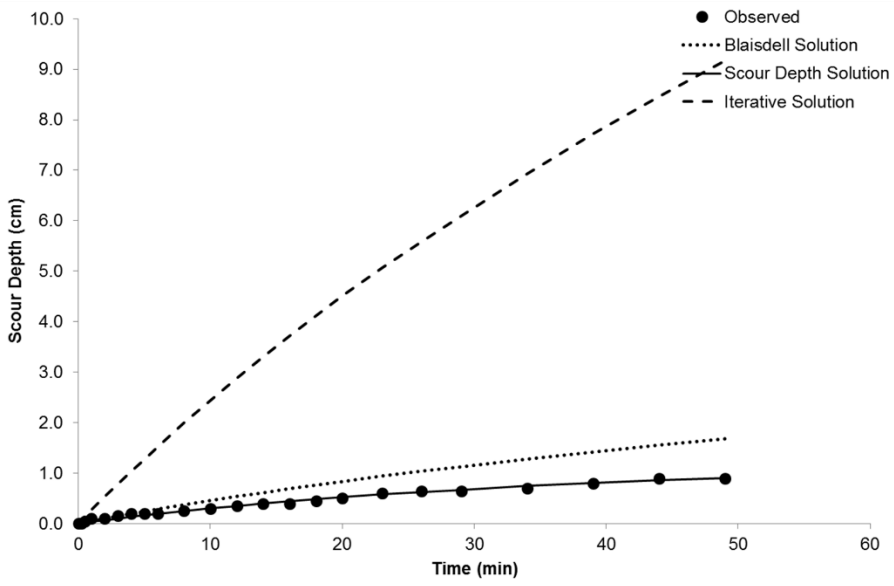
B-13 (18'-20') Top Alluvium

Site:	Alluvium Freeport TX
Date:	5/11/2017
Test #:	B-13 (18'-20') Top
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1083

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	37	0.121	0.879	0.000	0	45.00
0.25	0.25	37	0.121	0.879	0.000	0.25	45.00
0.5	0.25	37.5	0.123	0.877	0.002	0.5	45.00
1	0.5	38	0.125	0.875	0.003	1	45.00
2	1	38	0.125	0.875	0.003	2	45.00
3	1	38.5	0.126	0.874	0.005	3	45.00
4	1	39	0.128	0.872	0.007	4	45.00
5	1	39	0.128	0.872	0.007	5	45.00
6	1	39	0.128	0.872	0.007	6	45.00
8	2	39.5	0.130	0.870	0.008	8	45.00
10	2	40	0.131	0.869	0.010	10	45.00
12	2	40.5	0.133	0.867	0.011	12	45.00
14	2	41	0.135	0.865	0.013	14	45.00
16	2	41	0.135	0.865	0.013	16	45.00
18	2	41.5	0.136	0.864	0.015	18	45.00
20	2	42	0.138	0.862	0.016	20	45.00
23	3	43	0.141	0.859	0.020	23	45.00
26	3	43.5	0.143	0.857	0.021	26	45.00
29	3	43.5	0.143	0.857	0.021	29	45.00
34	5	44	0.144	0.856	0.023	34	45.00
39	5	45	0.148	0.852	0.026	39	45.00
44	5	46	0.151	0.849	0.030	44	45.00
49	5	46	0.151	0.849	0.030	49	45.00



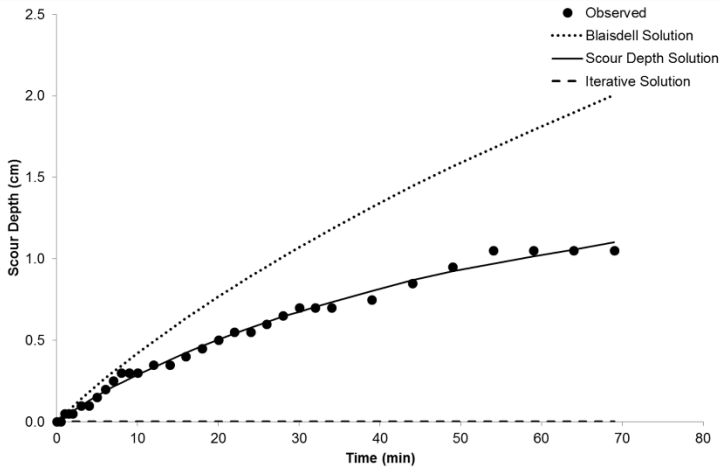
GEER Sample #2

Site:	Bay City Bridge
Date:	9/20/2017
Test #:	Sample #2 - Bay City Bridge
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0869

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	30.5	0.100	0.900	0.000	0	45.16
0.5	0.5	30.5	0.100	0.900	0.000	0.5	45.16
1	0.5	31	0.102	0.898	0.002	1	45.16
1.5	0.5	31	0.102	0.898	0.002	1.5	45.16
2	0.5	31	0.102	0.898	0.002	2	45.16
3	1	31.5	0.103	0.897	0.003	3	45.16
4	1	31.5	0.103	0.897	0.003	4	45.16
5	1	32	0.105	0.895	0.005	5	45.16
6	1	32.5	0.107	0.893	0.007	6	45.16
7	1	33	0.108	0.892	0.008	7	45.16
8	1	33.5	0.110	0.890	0.010	8	45.16
9	1	33.5	0.110	0.890	0.010	9	45.16
10	1	33.5	0.110	0.890	0.010	10	45.16
12	2	34	0.112	0.888	0.011	12	45.16
14	2	34	0.112	0.888	0.011	14	45.16
16	2	34.5	0.113	0.887	0.013	16	45.16
18	2	35	0.115	0.885	0.015	18	45.16
20	2	35.5	0.116	0.884	0.016	20	45.16
22	2	36	0.118	0.882	0.018	22	45.16
24	2	36	0.118	0.882	0.018	24	45.16
26	2	36.5	0.120	0.880	0.020	26	45.16
28	2	37	0.121	0.879	0.021	28	45.16
30	2	37.5	0.123	0.877	0.023	30	45.16
32	2	37.5	0.123	0.877	0.023	32	45.16
34	2	37.5	0.123	0.877	0.023	34	45.16
39	5	38	0.125	0.875	0.025	39	45.16
44	5	39	0.128	0.872	0.028	44	45.16
49	5	40	0.131	0.869	0.031	49	45.16
54	5	41	0.135	0.865	0.034	54	45.16
59	5	41	0.135	0.865	0.034	59	45.16
64	5	41	0.135	0.865	0.034	64	45.16
69	5	41	0.135	0.865	0.034	69	45.16



Silt Samples – JET

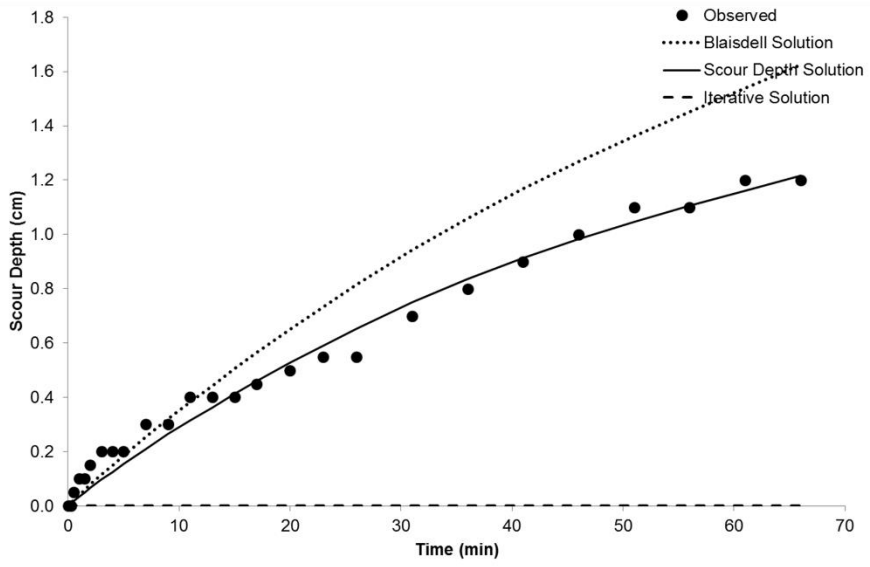
B-1 (23'-25') Tittabawsee River

Site:	M-20 Bridge on Tittabawsee River
Date:	5/17/2017
Test #:	B-1 (23'-25')
JET #:	1
Operator:	Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0951

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	33	0.108	0.892	0.000	0	45.00
0.25	0.25	33	0.108	0.892	0.000	0.25	45.00
0.5	0.25	33.5	0.110	0.890	0.002	0.5	45.00
1	0.5	34	0.112	0.888	0.003	1	45.00
1.5	0.5	34	0.112	0.888	0.003	1.5	45.00
2	0.5	34.5	0.113	0.887	0.005	2	45.00
3	1	35	0.115	0.885	0.007	3	45.00
4	1	35	0.115	0.885	0.007	4	45.00
5	1	35	0.115	0.885	0.007	5	45.00
7	2	36	0.118	0.882	0.010	7	45.00
9	2	36	0.118	0.882	0.010	9	45.00
11	2	37	0.121	0.879	0.013	11	45.00
13	2	37	0.121	0.879	0.013	13	45.00
15	2	37	0.121	0.879	0.013	15	45.00
17	2	37.5	0.123	0.877	0.015	17	45.00
20	3	38	0.125	0.875	0.016	20	45.00
23	3	38.5	0.126	0.874	0.018	23	45.00
26	3	38.5	0.126	0.874	0.018	26	45.00
31	5	40	0.131	0.869	0.023	31	45.00
36	5	41	0.135	0.865	0.026	36	45.00
41	5	42	0.138	0.862	0.030	41	45.00
46	5	43	0.141	0.859	0.033	46	45.00
51	5	44	0.144	0.856	0.036	51	45.00
56	5	44	0.144	0.856	0.036	56	45.00
61	5	45	0.148	0.852	0.039	61	45.00
66	5	45	0.148	0.852	0.039	66	45.00



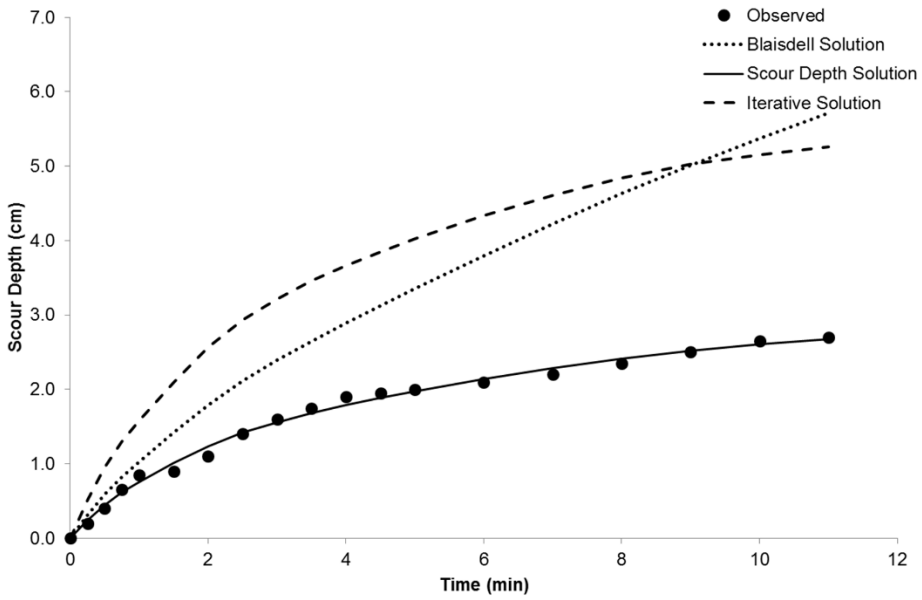
B-3 (8'-10') Beaumont Formation

Site:	Baumont Formation
Date:	6/15/2017
Test #:	B-3 (8'-10') 5487
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0919

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	32	0.105	0.895	0.000	0	45.00
0.25	0.25	34	0.112	0.888	0.007	0.25	45.00
0.5	0.25	36	0.118	0.882	0.013	0.5	45.00
0.75	0.25	38.5	0.126	0.874	0.021	0.75	45.00
1	0.25	40.5	0.133	0.867	0.028	1	45.00
1.5	0.5	41	0.135	0.865	0.030	1.5	45.00
2	0.5	43	0.141	0.859	0.036	2	45.00
2.5	0.5	46	0.151	0.849	0.046	2.5	45.00
3	0.5	48	0.157	0.843	0.052	3	45.00
3.5	0.5	49.5	0.162	0.838	0.057	3.5	45.00
4	0.5	51	0.167	0.833	0.062	4	45.00
4.5	0.5	51.5	0.169	0.831	0.064	4.5	45.00
5	0.5	52	0.171	0.829	0.066	5	45.00
6	1	53	0.174	0.826	0.069	6	45.00
7	1	54	0.177	0.823	0.072	7	45.00
8	1	55.5	0.182	0.818	0.077	8	45.00
9	1	57	0.187	0.813	0.082	9	45.00
10	1	58.5	0.192	0.808	0.087	10	45.00
11	1	59	0.194	0.806	0.089	11	45.00



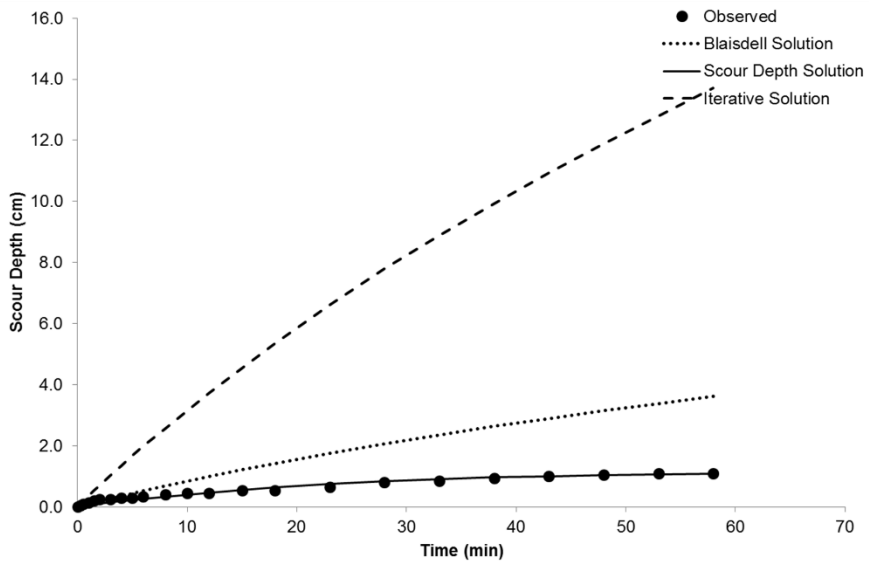
B-7 (22’-24’) Tittabawsee River

Site:	Tittabawsee River
Date:	6/9/2017
Test #:	B-7 (22'-24')
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1165

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	39.5	0.130	0.870	0.000	0	45.00
0.25	0.25	40	0.131	0.869	0.002	0.25	45.00
0.5	0.25	40.5	0.133	0.867	0.003	0.5	45.00
1	0.5	41	0.135	0.865	0.005	1	45.00
1.5	0.5	41.5	0.136	0.864	0.007	1.5	45.00
2	0.5	42	0.138	0.862	0.008	2	45.00
3	1	42	0.138	0.862	0.008	3	45.00
4	1	42.5	0.139	0.861	0.010	4	45.00
5	1	42.5	0.139	0.861	0.010	5	45.00
6	1	43	0.141	0.859	0.011	6	45.00
8	2	43.5	0.143	0.857	0.013	8	45.00
10	2	44	0.144	0.856	0.015	10	45.00
12	2	44	0.144	0.856	0.015	12	45.00
15	3	45	0.148	0.852	0.018	15	45.00
18	3	45	0.148	0.852	0.018	18	45.00
23	5	46	0.151	0.849	0.021	23	45.00
28	5	47.5	0.156	0.844	0.026	28	45.00
33	5	48	0.157	0.843	0.028	33	45.00
38	5	49	0.161	0.839	0.031	38	45.00
43	5	49.5	0.162	0.838	0.033	43	45.00
48	5	50	0.164	0.836	0.034	48	45.00
53	5	50.5	0.166	0.834	0.036	53	45.00
58	5	50.5	0.166	0.834	0.036	58	45.00



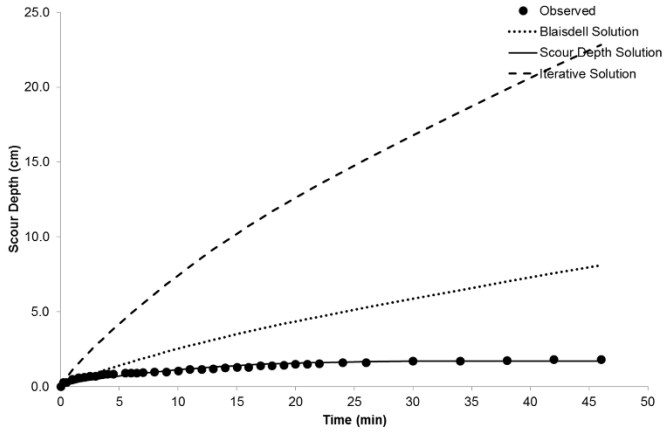
B-9A (25'-27') Middle Tittabawsee River

Site:	Tittabawsee River
Date:	5/10/2017
Test #:	B-9A (25-27)
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0787

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	28	0.092	0.908	0.000	0	45.00
0.25	0.25	31	0.102	0.898	0.010	0.25	45.00
0.5	0.25	31	0.102	0.898	0.010	0.5	45.00
1	0.5	33	0.108	0.892	0.016	1	45.00
1.5	0.5	34	0.112	0.888	0.020	1.5	45.00
2	0.5	34.5	0.113	0.887	0.021	2	45.00
2.5	0.5	35	0.115	0.885	0.023	2.5	45.00
3	0.5	35	0.115	0.885	0.023	3	45.00
3.5	0.5	36	0.118	0.882	0.026	3.5	45.00
4	0.5	36.5	0.120	0.880	0.028	4	45.00
4.5	0.5	36.5	0.120	0.880	0.028	4.5	45.00
5.5	1	37	0.121	0.879	0.030	5.5	45.00
6	0.5	37	0.121	0.879	0.030	6	45.00
6.5	0.5	37	0.121	0.879	0.030	6.5	45.00
7	0.5	37.5	0.123	0.877	0.031	7	45.00
8	1	38	0.125	0.875	0.033	8	45.00
9	1	38	0.125	0.875	0.033	9	45.00
10	1	38.5	0.126	0.874	0.034	10	45.00
11	1	39.5	0.130	0.870	0.038	11	45.00
12	1	39.5	0.130	0.870	0.038	12	45.00
13	1	40	0.131	0.869	0.039	13	45.00
14	1	40.5	0.133	0.867	0.041	14	45.00
15	1	41	0.135	0.865	0.043	15	45.00
16	1	41	0.135	0.865	0.043	16	45.00
17	1	42	0.138	0.862	0.046	17	45.00
18	1	42	0.138	0.862	0.046	18	45.00
19	1	42.5	0.139	0.861	0.048	19	45.00
20	1	43	0.141	0.859	0.049	20	45.00
21	1	43	0.141	0.859	0.049	21	45.00
22	1	43.5	0.143	0.857	0.051	22	45.00
24	2	44	0.144	0.856	0.052	24	45.00
26	2	44	0.144	0.856	0.052	26	45.00
30	4	45	0.148	0.852	0.056	30	45.00
34	4	45	0.148	0.852	0.056	34	45.00
38	4	45.5	0.149	0.851	0.057	38	45.00
42	4	46	0.151	0.849	0.059	42	45.00
46	4	46	0.151	0.849	0.059	46	45.00



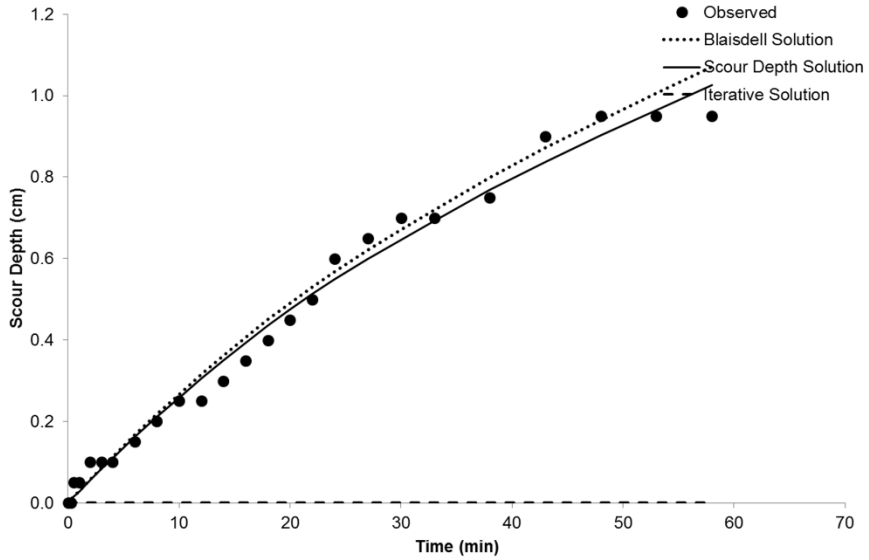
B-9A (25’-27’) Top Tittabawsee River

Site:	Tittabawsee River
Date:	6/7/2017
Test #:	B-9A (25'-27') Top
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0886

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	31	0.102	0.898	0.000	0	45.00
0.25	0.25	31	0.102	0.898	0.000	0.25	45.00
0.5	0.25	31.5	0.103	0.897	0.002	0.5	45.00
1	0.5	31.5	0.103	0.897	0.002	1	45.00
2	1	32	0.105	0.895	0.003	2	45.00
3	1	32	0.105	0.895	0.003	3	45.00
4	1	32	0.105	0.895	0.003	4	45.00
6	2	32.5	0.107	0.893	0.005	6	45.00
8	2	33	0.108	0.892	0.007	8	45.00
10	2	33.5	0.110	0.890	0.008	10	45.00
12	2	33.5	0.110	0.890	0.008	12	45.00
14	2	34	0.112	0.888	0.010	14	45.00
16	2	34.5	0.113	0.887	0.011	16	45.00
18	2	35	0.115	0.885	0.013	18	45.00
20	2	35.5	0.116	0.884	0.015	20	45.00
22	2	36	0.118	0.882	0.016	22	45.00
24	2	37	0.121	0.879	0.020	24	45.00
27	3	37.5	0.123	0.877	0.021	27	45.00
30	3	38	0.125	0.875	0.023	30	45.00
33	3	38	0.125	0.875	0.023	33	45.00
38	5	38.5	0.126	0.874	0.025	38	45.00
43	5	40	0.131	0.869	0.030	43	45.00
48	5	40.5	0.133	0.867	0.031	48	45.00
53	5	40.5	0.133	0.867	0.031	53	45.00
58	5	40.5	0.133	0.867	0.031	58	45.00



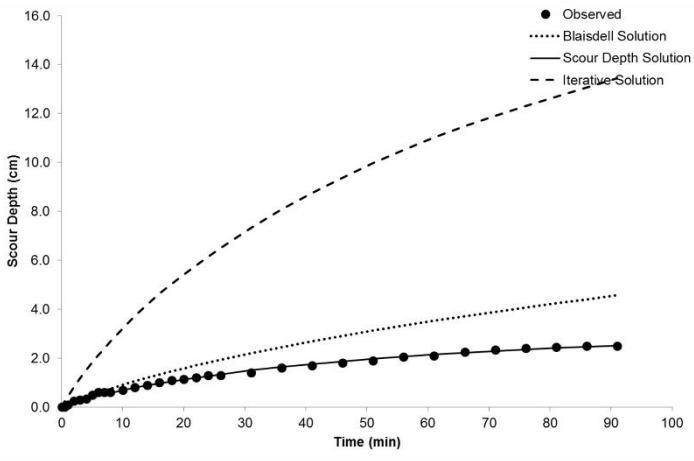
FHWA Sample 2

Site:	FHWA Erosion Lab
Date:	7/27/2017
Test #:	Sample 2
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0984

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	34	0.112	0.888	0.000	0	45.00
0.25	0.25	34	0.112	0.888	0.000	0.25	45.00
0.5	0.25	34	0.112	0.888	0.000	0.5	45.00
1	0.5	35	0.115	0.885	0.003	1	45.00
2	1	36.5	0.120	0.880	0.008	2	45.00
3	1	37	0.121	0.879	0.010	3	45.00
4	1	37.5	0.123	0.877	0.011	4	45.00
5	1	39	0.128	0.872	0.016	5	45.00
6	1	40	0.131	0.869	0.020	6	45.00
7	1	40	0.131	0.869	0.020	7	45.00
8	1	40	0.131	0.869	0.020	8	45.00
10	2	41	0.135	0.865	0.023	10	45.00
12	2	42	0.138	0.862	0.026	12	45.00
14	2	43	0.141	0.859	0.030	14	45.00
16	2	44	0.144	0.856	0.033	16	45.00
18	2	45	0.148	0.852	0.036	18	45.00
20	2	45.5	0.149	0.851	0.038	20	45.00
22	2	46	0.151	0.849	0.039	22	45.00
24	2	47	0.154	0.846	0.043	24	45.00
26	2	47	0.154	0.846	0.043	26	45.00
31	5	48	0.157	0.843	0.046	31	45.00
36	5	50	0.164	0.836	0.052	36	45.00
41	5	51	0.167	0.833	0.056	41	45.00
46	5	52	0.171	0.829	0.059	46	45.00
51	5	53	0.174	0.826	0.062	51	45.00
56	5	54.5	0.179	0.821	0.067	56	45.00
61	5	55	0.180	0.820	0.069	61	45.00
66	5	56.5	0.185	0.815	0.074	66	45.00
71	5	57.5	0.189	0.811	0.077	71	45.00
76	5	58	0.190	0.810	0.079	76	45.00
81	5	58.5	0.192	0.808	0.080	81	45.00
86	5	59	0.194	0.806	0.082	86	45.00
91	5	59	0.194	0.806	0.082	91	45.00



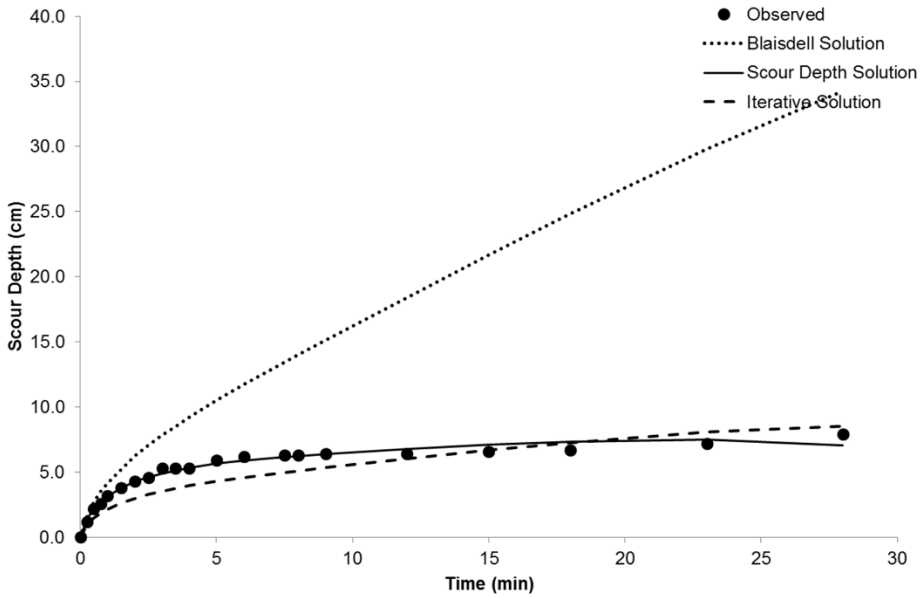
Teton Dam Left Core

Site:	Teton Dam
Date:	7/12/2017
Test #:	Left Core
JET #:	1
Operator:	Mabel and Iman
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1181

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	40	0.131	0.869	0.000	0	45.00
0.25	0.25	52	0.171	0.829	0.039	0.25	45.00
0.5	0.25	62	0.203	0.797	0.072	0.5	45.00
0.75	0.25	66	0.217	0.783	0.085	0.75	45.00
1	0.25	72	0.236	0.764	0.105	1	45.00
1.5	0.5	78	0.256	0.744	0.125	1.5	45.00
2	0.5	83	0.272	0.728	0.141	2	45.00
2.5	0.5	86	0.282	0.718	0.151	2.5	45.00
3	0.5	93	0.305	0.695	0.174	3	45.00
3.5	0.5	93	0.305	0.695	0.174	3.5	45.00
4	0.5	93	0.305	0.695	0.174	4	45.00
5	1	99	0.325	0.675	0.194	5	45.00
6	1	102	0.335	0.665	0.203	6	45.00
7.5	1.5	103	0.338	0.662	0.207	7.5	45.00
8	0.5	103	0.338	0.662	0.207	8	45.00
9	1	104	0.341	0.659	0.210	9	45.00
12	3	104	0.341	0.659	0.210	12	45.00
15	3	106	0.348	0.652	0.217	15	45.00
18	3	107	0.351	0.649	0.220	18	45.00
23	5	112	0.367	0.633	0.236	23	45.00
28	5	119	0.390	0.610	0.259	28	45.00



Sand Samples – JET

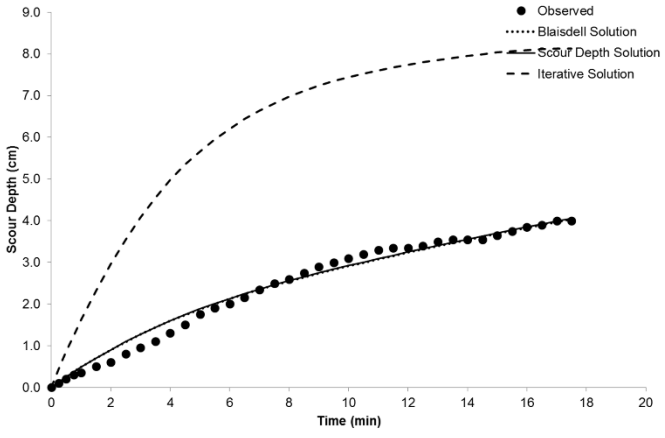
Sand #1

Site:	FHWA Erosion Lab
Date:	11/16/2017
Test #:	Sand #1
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1345

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	45	0.148	0.852	0.000	0	45.00
0.25	0.25	46	0.151	0.849	0.003	0.25	45.00
0.5	0.25	47	0.154	0.846	0.007	0.5	45.00
0.75	0.25	48	0.157	0.843	0.010	0.75	45.00
1	0.25	48.5	0.159	0.841	0.011	1	45.00
1.5	0.5	50	0.164	0.836	0.016	1.5	45.00
2	0.5	51	0.167	0.833	0.020	2	45.00
2.5	0.5	53	0.174	0.826	0.026	2.5	45.00
3	0.5	54.5	0.179	0.821	0.031	3	45.00
3.5	0.5	56	0.184	0.816	0.036	3.5	45.00
4	0.5	58	0.190	0.810	0.043	4	45.00
4.5	0.5	60	0.197	0.803	0.049	4.5	45.00
5	0.5	62.5	0.205	0.795	0.057	5	45.00
5.5	0.5	64	0.210	0.790	0.062	5.5	45.00
6	0.5	65	0.213	0.787	0.066	6	45.00
6.5	0.5	66.5	0.218	0.782	0.071	6.5	45.00
7	0.5	68.5	0.225	0.775	0.077	7	45.00
7.5	0.5	70	0.230	0.770	0.082	7.5	45.00
8	0.5	71	0.233	0.767	0.085	8	45.00
8.5	0.5	72.5	0.238	0.762	0.090	8.5	45.00
9	0.5	74	0.243	0.757	0.095	9	45.00
9.5	0.5	75	0.246	0.754	0.098	9.5	45.00
10	0.5	76	0.249	0.751	0.102	10	45.00
10.5	0.5	77	0.253	0.747	0.105	10.5	45.00
11	0.5	78	0.256	0.744	0.108	11	45.00
11.5	0.5	78.5	0.258	0.742	0.110	11.5	45.00
12	0.5	78.5	0.258	0.742	0.110	12	45.00
12.5	0.5	79	0.259	0.741	0.112	12.5	45.00
13	0.5	80	0.262	0.738	0.115	13	45.00
13.5	0.5	80.5	0.264	0.736	0.116	13.5	45.00
14	0.5	80.5	0.264	0.736	0.116	14	45.00
14.5	0.5	80.5	0.264	0.736	0.116	14.5	45.00
15	0.5	81.5	0.267	0.733	0.120	15	45.00
15.5	0.5	82.5	0.271	0.729	0.123	15.5	45.00
16	0.5	83.5	0.274	0.726	0.126	16	45.00
16.5	0.5	84	0.276	0.724	0.128	16.5	45.00
17	0.5	85	0.279	0.721	0.131	17	45.00
17.5	0.5	85	0.279	0.721	0.131	17.5	45.00
18	0.5	85.5	0.281	0.719	0.133	18	45.00
18.5	0.5	85.5	0.281	0.719	0.133	18.5	45.00
19	0.5	85.5	0.281	0.719	0.133	19	45.00
20	1	86	0.282	0.718	0.135	20	45.00
21	1	86	0.282	0.718	0.135	21	45.00



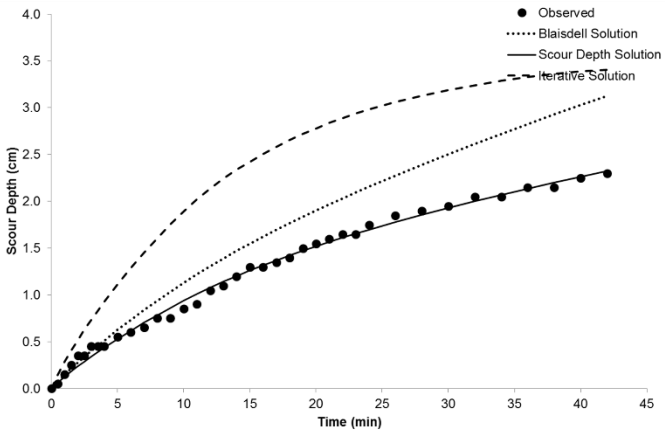
Sand #2

Site:	FHWA Erosion Lab
Date:	11/16/2017
Test #:	Sand #2
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1001

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	34.5	0.113	0.887	0.000	0	45.00
0.5	0.5	35	0.115	0.885	0.002	0.5	45.00
1	0.5	36	0.118	0.882	0.005	1	45.00
1.5	0.5	37	0.121	0.879	0.008	1.5	45.00
2	0.5	38	0.125	0.875	0.011	2	45.00
2.5	0.5	38	0.125	0.875	0.011	2.5	45.00
3	0.5	39	0.128	0.872	0.015	3	45.00
3.5	0.5	39	0.128	0.872	0.015	3.5	45.00
4	0.5	39	0.128	0.872	0.015	4	45.00
5	1	40	0.131	0.869	0.018	5	45.00
6	1	40.5	0.133	0.867	0.020	6	45.00
7	1	41	0.135	0.865	0.021	7	45.00
8	1	42	0.138	0.862	0.025	8	45.00
9	1	42	0.138	0.862	0.025	9	45.00
10	1	43	0.141	0.859	0.028	10	45.00
11	1	43.5	0.143	0.857	0.030	11	45.00
12	1	45	0.148	0.852	0.034	12	45.00
13	1	45.5	0.149	0.851	0.036	13	45.00
14	1	46.5	0.153	0.847	0.039	14	45.00
15	1	47.5	0.156	0.844	0.043	15	45.00
16	1	47.5	0.156	0.844	0.043	16	45.00
17	1	48	0.157	0.843	0.044	17	45.00
18	1	48.5	0.159	0.841	0.046	18	45.00
19	1	49.5	0.162	0.838	0.049	19	45.00
20	1	50	0.164	0.836	0.051	20	45.00
21	1	50.5	0.166	0.834	0.052	21	45.00
22	1	51	0.167	0.833	0.054	22	45.00
23	1	51	0.167	0.833	0.054	23	45.00
24	1	52	0.171	0.829	0.057	24	45.00
26	2	53	0.174	0.826	0.061	26	45.00
28	2	53.5	0.176	0.824	0.062	28	45.00
30	2	54	0.177	0.823	0.064	30	45.00
32	2	55	0.180	0.820	0.067	32	45.00
34	2	55	0.180	0.820	0.067	34	45.00
36	2	56	0.184	0.816	0.071	36	45.00
38	2	56	0.184	0.816	0.071	38	45.00
40	2	57	0.187	0.813	0.074	40	45.00
42	2	57.5	0.189	0.811	0.075	42	45.00
44	2	58	0.190	0.810	0.077	44	45.00
46	2	58.5	0.192	0.808	0.079	46	45.00
48	2	59	0.194	0.806	0.080	48	45.00
50	2	59	0.194	0.806	0.080	50	45.00
52	2	60	0.197	0.803	0.084	52	45.00



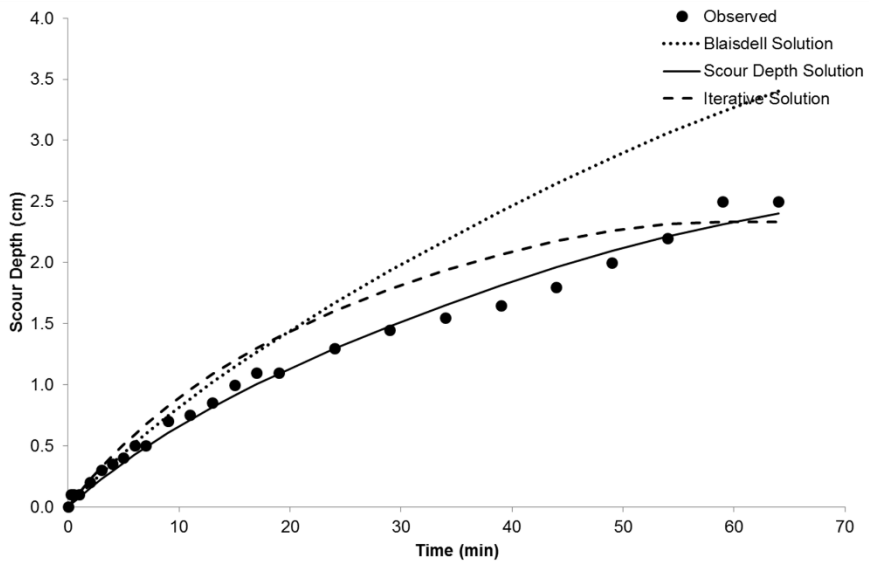
S-0-0-0

Site:	Man-made at A&M Lab
Date:	7/28/2017
Test #:	S-0-0-0
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.1411

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	47	0.154	0.846	0.000	0	45.16
0.25	0.25	48	0.157	0.843	0.003	0.25	45.16
0.5	0.25	48	0.157	0.843	0.003	0.5	45.16
1	0.5	48	0.157	0.843	0.003	1	45.16
2	1	49	0.161	0.839	0.007	2	45.16
3	1	50	0.164	0.836	0.010	3	45.16
4	1	50.5	0.166	0.834	0.011	4	45.16
5	1	51	0.167	0.833	0.013	5	45.16
6	1	52	0.171	0.829	0.016	6	45.16
7	1	52	0.171	0.829	0.016	7	45.16
9	2	54	0.177	0.823	0.023	9	45.16
11	2	54.5	0.179	0.821	0.025	11	45.16
13	2	55.5	0.182	0.818	0.028	13	45.16
15	2	57	0.187	0.813	0.033	15	45.16
17	2	58	0.190	0.810	0.036	17	45.16
19	2	58	0.190	0.810	0.036	19	45.16
24	5	60	0.197	0.803	0.043	24	45.16
29	5	61.5	0.202	0.798	0.048	29	45.16
34	5	62.5	0.205	0.795	0.051	34	45.16
39	5	63.5	0.208	0.792	0.054	39	45.16
44	5	65	0.213	0.787	0.059	44	45.16
49	5	67	0.220	0.780	0.066	49	45.16
54	5	69	0.226	0.774	0.072	54	45.16
59	5	72	0.236	0.764	0.082	59	45.16
64	5	72	0.236	0.764	0.082	64	45.16



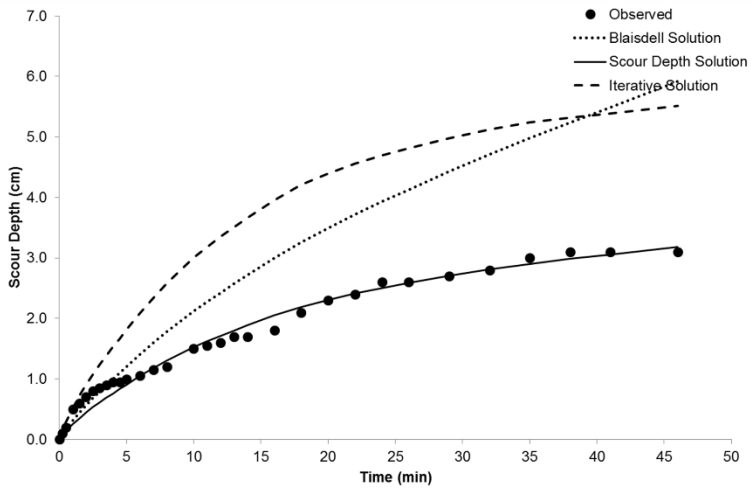
B-3 (10'-12') Lissie Formation

Site:	Lissie Formation
Date:	6/6/2017
Test #:	B-3 (10'-12')
JET #:	1
Operator:	Iman Shafii
Test Location:	A&M Erosion Lab

Pt Gage Reading at Nozzle (mm):	4
Ref. Pt Gage Reading at Nozzle (ft):	0.9869
Nozzle Diameter (in):	0.125
Nozzle Height (ft):	0.0984

Initial guess* for τ_c (Pa):	1
Initial guess* for k_d ($cm^3/N{\cdot}s$):	1

Scour Depth Readings						Head Setting	
Time (min)	Diff Time (min)	Pt Gage Reading (mm)	Depth (ft)	Pt Gage Reading (ft)	Maximum Depth of Scour (ft)	Time (min)	Head (in)
0	0	34	0.112	0.888	0.000	0	45.00
0.25	0.25	35	0.115	0.885	0.003	0.25	45.00
0.5	0.25	36	0.118	0.882	0.007	0.5	45.00
1	0.5	39	0.128	0.872	0.016	1	45.00
1.5	0.5	40	0.131	0.869	0.020	1.5	45.00
2	0.5	41	0.135	0.865	0.023	2	45.00
2.5	0.5	42	0.138	0.862	0.026	2.5	45.00
3	0.5	42.5	0.139	0.861	0.028	3	45.00
3.5	0.5	43	0.141	0.859	0.030	3.5	45.00
4	0.5	43.5	0.143	0.857	0.031	4	45.00
4.5	0.5	43.5	0.143	0.857	0.031	4.5	45.00
5	0.5	44	0.144	0.856	0.033	5	45.00
6	1	44.5	0.146	0.854	0.034	6	45.00
7	1	45.5	0.149	0.851	0.038	7	45.00
8	1	46	0.151	0.849	0.039	8	45.00
10	2	49	0.161	0.839	0.049	10	45.00
11	1	49.5	0.162	0.838	0.051	11	45.00
12	1	50	0.164	0.836	0.052	12	45.00
13	1	51	0.167	0.833	0.056	13	45.00
14	1	51	0.167	0.833	0.056	14	45.00
16	2	52	0.171	0.829	0.059	16	45.00
18	2	55	0.180	0.820	0.069	18	45.00
20	2	57	0.187	0.813	0.075	20	45.00
22	2	58	0.190	0.810	0.079	22	45.00
24	2	60	0.197	0.803	0.085	24	45.00
26	2	60	0.197	0.803	0.085	26	45.00
29	3	61	0.200	0.800	0.089	29	45.00
32	3	62	0.203	0.797	0.092	32	45.00
35	3	64	0.210	0.790	0.098	35	45.00
38	3	65	0.213	0.787	0.102	38	45.00
41	3	65	0.213	0.787	0.102	41	45.00
46	5	65	0.213	0.787	0.102	46	45.00

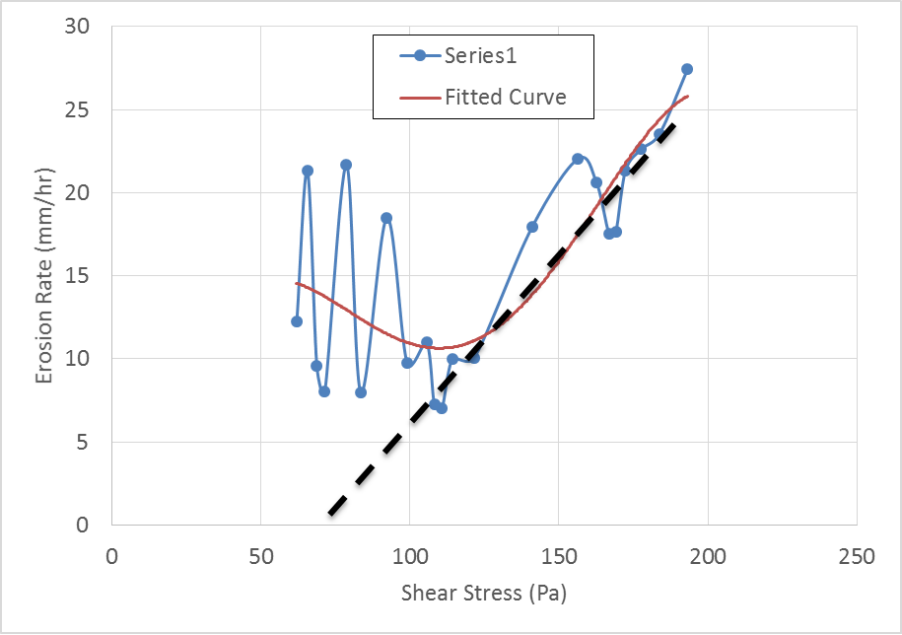


Clay Samples – HET

Clay #1

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.86	3.26	23.5	5.0	18.5	470
0.50	30	0.86	3.26	23.5	5.0	18.5	470
1.00	60	0.92	3.48	23.5	5.0	18.5	470
2.00	120	0.92	3.48	23.5	5.0	18.5	470
3.00	180	0.92	3.48	23.5	5.0	18.5	470
4.00	240	1.08	4.09	23.5	5.0	18.5	470
5.00	300	1.11	4.20	24.0	5.0	19.0	483
6.00	360	1.27	4.81	24.5	5.0	19.5	495
8.00	480	1.37	5.19	24.5	5.0	19.5	495
9.00	540	1.46	5.53	25.0	5.0	20.0	508
10.00	600	1.49	5.64	25.0	5.0	20.0	508
11.00	660	1.52	5.75	25.0	5.0	20.0	508
12.00	720	1.59	6.02	25.0	5.0	20.0	508
14.00	840	1.74	6.59	25.0	5.0	20.0	508
17.00	1020	2.32	8.78	25.0	5.0	20.0	508
18.00	1080	2.66	10.07	26.0	5.0	21.0	533
19.00	1140	2.92	11.05	26.0	5.2	20.8	528
20.00	1200	3.13	11.85	26.0	5.5	20.5	521
21.00	1260	3.33	12.61	26.0	6.0	20.0	508
22.00	1320	3.6	13.63	26.0	6.5	19.5	495
23.00	1380	3.92	14.84	26.0	6.8	19.2	488
24.00	1440	4.28	16.20	26.0	7.0	19.0	483
25.00	1500	4.76	18.02	26.0	7.0	19.0	483

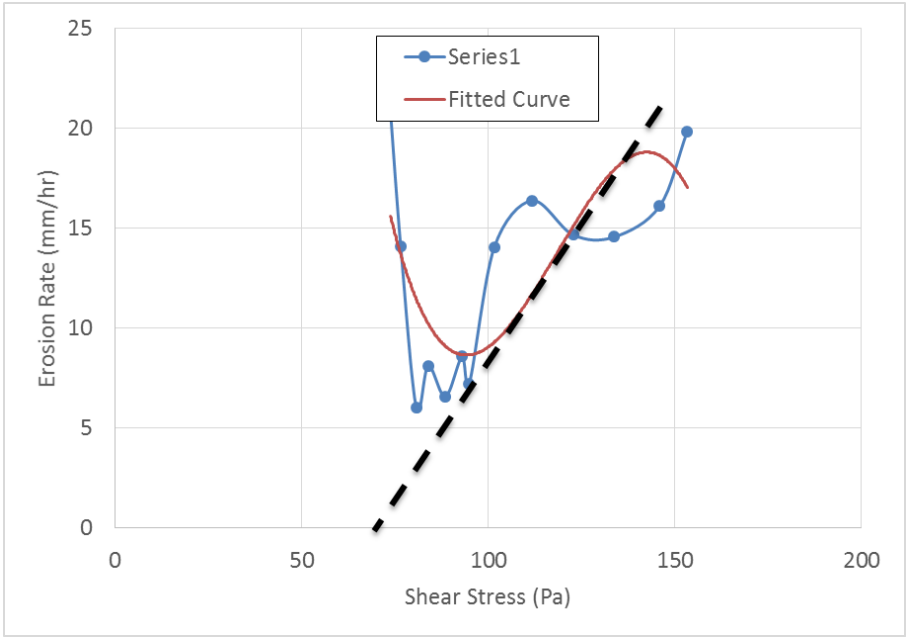
	Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
	length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
	115	4.086086957	5.4258E-05	31.2722	16.2963	0.0060000	0.0060000	11159.185	11159.185	0.006
	115	4.086086957	5.4258E-05	3.4217E+01	1.9270E+01	0.0061827	0.0062046	10829.420	10791.260	0.006204568
	115	4.086086957	5.8043E-05	3.7161E+01	2.2245E+01	0.0064997	0.0065598	11019.968	10918.913	0.006559847
	115	4.086086957	5.8043E-05	4.3051E+01	2.8193E+01	0.0068264	0.0068782	10492.627	10413.497	0.006878227
	115	4.086086957	5.8043E-05	4.8940E+01	3.4141E+01	0.0071244	0.0071467	10053.632	10022.336	0.007146677
	115	4.086086957	6.8137E-05	5.4829E+01	4.0089E+01	0.0078057	0.0078688	10772.024	10685.633	0.007868805
	115	4.196521739	7.0030E-05	6.0719E+01	4.6037E+01	0.0080777	0.0081352	10698.455	10622.811	0.00813521
	115	4.306956522	8.0125E-05	6.6608E+01	5.1986E+01	0.0086382	0.0087510	11446.355	11298.730	0.008751034
	115	4.306956522	8.6434E-05	7.8387E+01	6.3882E+01	0.0093533	0.0093999	11403.546	11346.989	0.009399943
	115	4.417391304	9.2112E-05	8.4276E+01	6.9830E+01	0.0097051	0.0097659	11712.223	11639.280	0.009765894
	115	4.417391304	9.4004E-05	9.0165E+01	7.5778E+01	0.0099936	0.0100080	11607.796	11591.129	0.010007966
	115	4.417391304	9.5897E-05	9.6055E+01	8.1727E+01	0.0102747	0.0102417	11517.592	11554.643	0.010241707
	115	4.417391304	1.0031E-04	1.0194E+02	8.7675E+01	0.0106390	0.0105754	11635.445	11705.403	0.010575381
	115	4.417391304	1.0978E-04	1.1372E+02	9.9571E+01	0.0113705	0.0112463	11913.956	12045.528	0.011246275
	115	4.417391304	1.4637E-04	1.3139E+02	1.1742E+02	0.0131320	0.0130408	13754.433	13850.661	0.013040755
	115	4.63826087	1.6782E-04	1.3728E+02	1.2336E+02	0.0137219	0.0137757	15092.250	15033.226	0.013775734
	115	4.594086957	1.8422E-04	1.4317E+02	1.2931E+02	0.0144006	0.0144623	15786.599	15719.238	0.014462275
	115	4.527826087	1.9747E-04	1.4906E+02	1.3526E+02	0.0150097	0.0150477	16235.189	16194.228	0.015047673
	115	4.417391304	2.1009E-04	1.5495E+02	1.4121E+02	0.0156503	0.0156355	16565.571	16581.252	0.015635515
	115	4.306956522	2.2712E-04	1.6084E+02	1.4716E+02	0.0164012	0.0163470	17088.863	17145.469	0.016347013
	115	4.240695652	2.4731E-04	1.6673E+02	1.5311E+02	0.0171654	0.0171010	17779.451	17846.416	0.017100953
	115	4.196521739	2.7003E-04	1.7262E+02	1.5905E+02	0.0179438	0.0178856	18570.159	18630.543	0.017885601
	115	4.196521739	3.0031E-04	1.7851E+02	1.6500E+02	0.0188000	0.0188000	19712.167	19712.167	0.0188



Clay #2

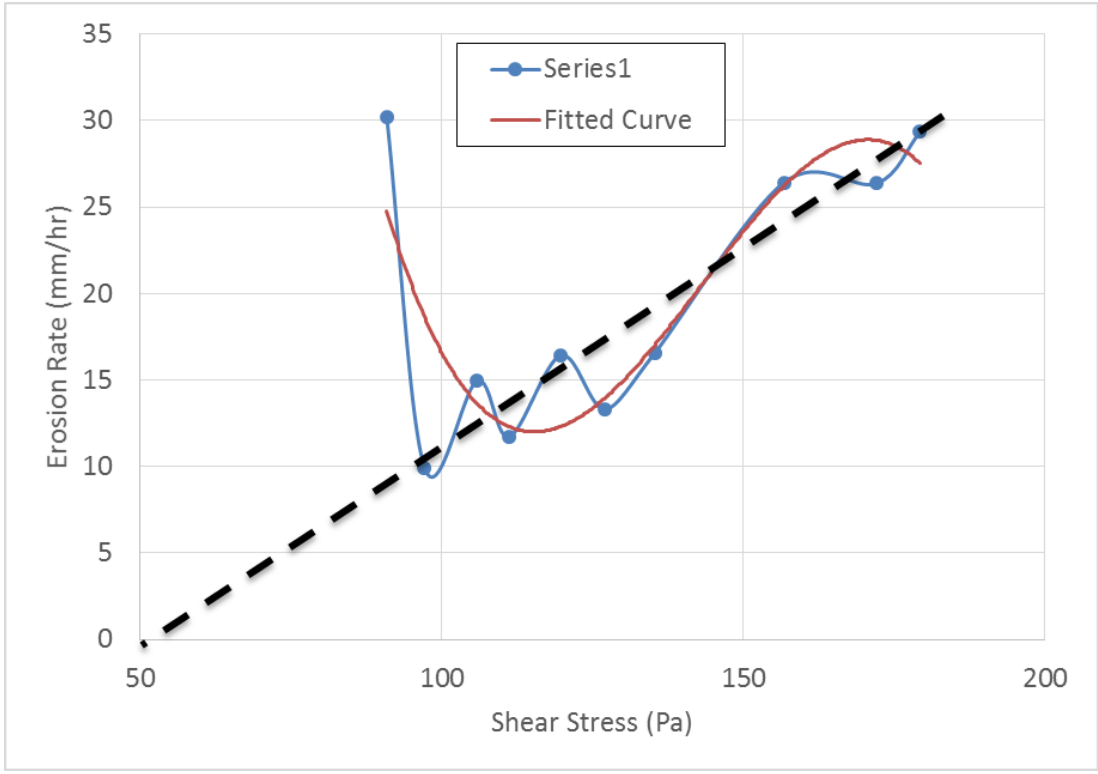
Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	1.08	4.09	26.0	5.0	21.0	533
0.50	30	1.19	4.50	26.5	5.0	21.5	546
1.00	60	1.24	4.69	26.5	5.0	21.5	546
2.00	120	1.24	4.69	27.0	5.0	22.0	559
3.00	180	1.27	4.81	27.0	5.0	22.0	559
4.00	240	1.30	4.92	27.5	5.0	22.5	572
5.00	300	1.36	5.15	27.8	5.0	22.8	578
6.00	360	1.39	5.26	27.5	5.0	22.5	572
8.00	480	1.65	6.25	27.5	6.0	21.5	546
10.00	600	2.03	7.68	27.5	6.5	21.0	533
12.00	720	2.41	9.12	27.5	6.5	21.0	533
14.00	840	2.82	10.67	27.5	6.5	21.0	533
16.00	960	3.33	12.61	27.5	6.5	21.0	533
18.00	1080	3.96	14.99	27.5	7.5	20.0	508
20.00	1200	4.38	16.58	27.5	8.0	19.5	495
22.00	1320	4.76	18.02	27.5	8.5	19.0	483
24.00	1440	5.01	18.96	27.3	8.5	18.8	476
26.00	1560	5.3	20.06	28.0	9.0	19.0	483
28.00	1680	5.55	21.01	28.0	9.5	18.5	470

Sample length	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
115	4.63826087	6.8137E-05	28.2670	11.7297	0.0060000	0.0060000	14013.860	14013.860	0.006
115	4.748695652	7.5077E-05	3.0003E+01	1.3103E+01	0.0062721	0.0063471	14771.343	14596.729	0.00634712
115	4.748695652	7.8232E-05	3.1738E+01	1.4477E+01	0.0064791	0.0065824	14900.313	14666.294	0.006582435
115	4.859130435	7.8232E-05	3.5209E+01	1.7225E+01	0.0066559	0.0067840	14504.346	14230.610	0.006783963
115	4.859130435	8.0125E-05	3.8681E+01	1.9972E+01	0.0069228	0.0070549	14282.626	14015.147	0.007054908
115	4.969565217	8.2017E-05	4.2152E+01	2.2720E+01	0.0071260	0.0072743	14203.004	13913.548	0.007274292
115	5.024782609	8.5803E-05	4.5623E+01	2.5468E+01	0.0074001	0.0075611	14308.289	14003.583	0.007561101
115	4.969565217	8.7695E-05	4.9094E+01	2.8215E+01	0.0076667	0.0078025	14115.295	13869.665	0.007802506
115	4.748695652	1.0410E-04	5.6036E+01	3.3710E+01	0.0086131	0.0087383	14914.462	14700.855	0.008738293
115	4.63826087	1.2807E-04	6.2979E+01	3.9205E+01	0.0096712	0.0098309	16341.855	16076.417	0.009830872
115	4.63826087	1.5205E-04	6.9921E+01	4.4701E+01	0.0106037	0.0108092	17694.731	17358.351	0.010809207
115	4.63826087	1.7791E-04	7.6863E+01	5.0196E+01	0.0115320	0.0117803	19038.299	18637.043	0.011780328
115	4.63826087	2.1009E-04	8.3806E+01	5.5691E+01	0.0125455	0.0128546	20665.227	20168.361	0.012854609
115	4.417391304	2.4984E-04	9.0748E+01	6.1186E+01	0.0138726	0.0141766	22224.047	21747.518	0.014176557
115	4.306956522	2.7633E-04	9.7690E+01	6.6681E+01	0.0148281	0.0150922	22997.067	22594.762	0.015092167
115	4.196521739	3.0031E-04	1.0463E+02	7.2176E+01	0.0157337	0.0159345	23553.861	23256.962	0.01593453
115	4.141304348	3.1608E-04	1.1158E+02	7.7672E+01	0.0164232	0.0165484	23750.093	23570.436	0.016548376
115	4.196521739	3.3438E-04	1.1852E+02	8.3167E+01	0.0169990	0.0171127	24273.731	24112.568	0.017112666
115	4.086086957	3.5015E-04	1.2546E+02	8.8662E+01	0.0177500	0.0177500	24343.325	24343.325	0.01775



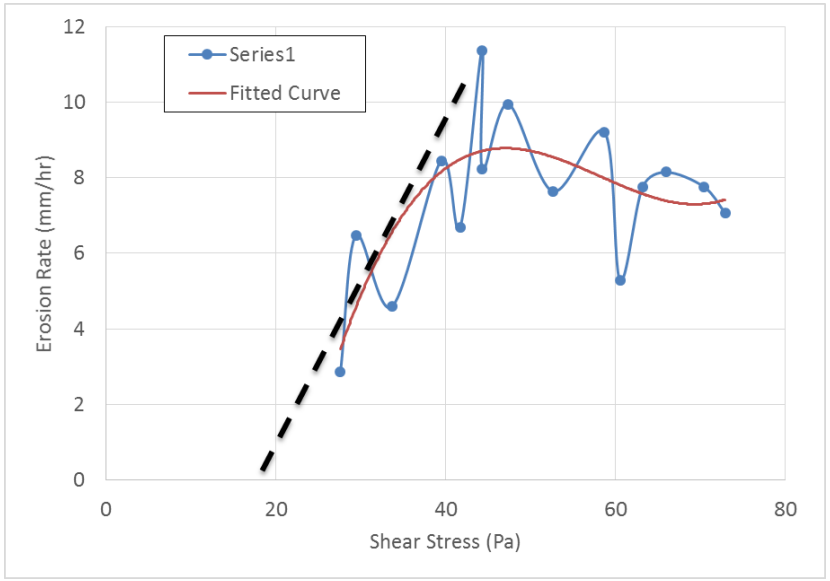
Clay #3

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential			Sample length	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
												If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)		L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
0.00	0	0.70	2.65	26.0	5.0	21.0	533		115	4.63826087	4.4163E-05	43.6120	27.9215	0.0060000	0.0060000	9083.057	9083.057	0.006
1.00	60	0.98	3.71	29.0	5.0	24.0	610		115	5.300869565	6.1828E-05	5.0388E+01	3.5357E+01	0.0067366	0.0070067	11325.927	10889.270	0.007006685
2.00	120	1.01	3.82	29.5	5.0	24.5	622		115	5.411304348	6.3721E-05	5.7164E+01	4.2793E+01	0.0070483	0.0073373	11156.379	10716.863	0.007337345
3.00	180	1.11	4.20	30.0	5.0	25.0	635		115	5.52173913	7.0030E-05	6.3941E+01	5.0229E+01	0.0074997	0.0078361	11522.992	11028.267	0.007836118
4.00	240	1.17	4.43	30.0	5.0	25.0	635		115	5.52173913	7.3815E-05	7.0717E+01	5.7665E+01	0.0078931	0.0082269	11540.516	11072.191	0.008226926
5.00	300	1.30	4.92	30.3	5.0	25.3	641		115	5.576956522	8.2017E-05	7.7493E+01	6.5101E+01	0.0084005	0.0087743	12048.251	11534.994	0.008774275
6.00	360	1.40	5.30	31.0	5.5	25.5	648		115	5.632173913	8.8326E-05	8.4269E+01	7.2537E+01	0.0088256	0.0092177	12350.122	11824.686	0.009217724
8.00	480	1.65	6.25	31.0	6.8	24.3	616		115	5.356086957	1.0410E-04	9.7822E+01	8.7409E+01	0.0099630	0.0103212	12893.686	12446.243	0.010321217
10.00	600	2.25	8.52	31.0	7.0	24.0	610		115	5.300869565	1.4195E-04	1.1137E+02	1.0228E+02	0.0115764	0.0120825	15131.881	14498.052	0.012082537
12.00	720	2.89	10.94	31.0	8.0	23.0	584		115	5.08	1.8233E-04	1.2493E+02	1.1715E+02	0.0132617	0.0138399	16966.224	16257.379	0.013839888
14.00	840	3.62	13.70	31.0	10.0	21.0	533		115	4.63826087	2.2839E-04	1.3848E+02	1.3203E+02	0.0152504	0.0157957	18480.475	17842.461	0.015795707
16.00	960	4.19	15.86	31.0	12.5	18.5	470		115	4.086086957	2.6435E-04	1.5203E+02	1.4690E+02	0.0172312	0.0175478	18931.474	18589.907	0.017547776
18.00	1080	4.60	17.41	29.5	13.0	16.5	419		115	3.644347826	2.9021E-04	1.6558E+02	1.6177E+02	0.0190000	0.0190000	18849.051	18849.051	0.019



Clay #4

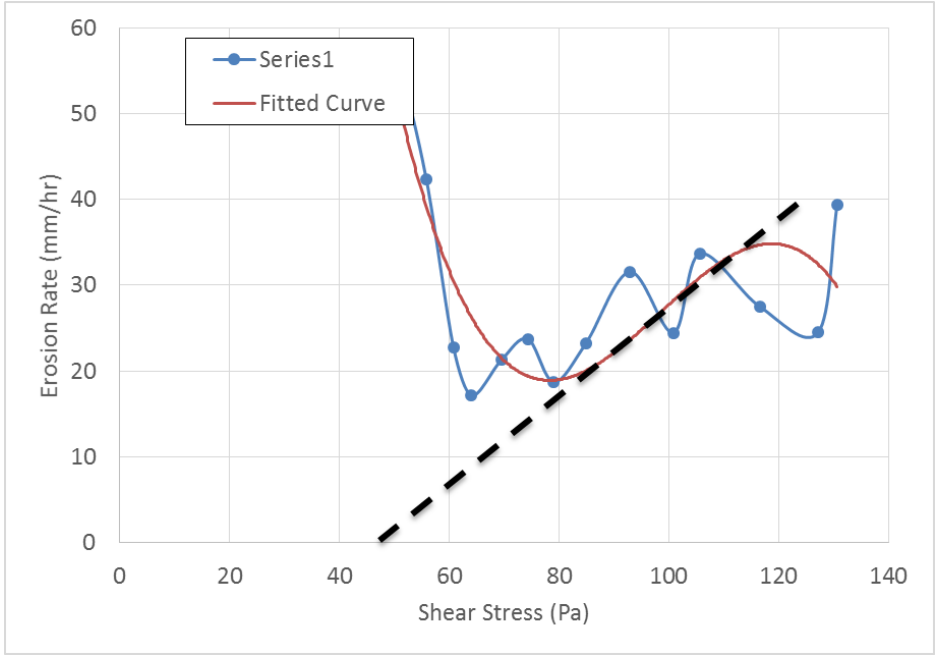
Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential			Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
									length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)		L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
0.00	0	0.73	2.76	12.0	5.0	7.0	178		115	1.546086957	4.6056E-05	17.7234	12.7696	0.0065000	0.0065000	8743.690	8743.690	0.0065
1.00	60	0.76	2.88	12.8	5.0	7.8	197		115	1.71173913	4.7949E-05	1.8670E+01	1.4028E+01	0.0064795	0.0065953	9131.843	8971.487	0.006595298
3.00	180	0.82	3.10	12.8	5.0	7.8	197		115	1.71173913	5.1734E-05	2.0563E+01	1.6546E+01	0.0068631	0.0070270	9302.041	9085.077	0.007027009
5.00	300	0.89	3.37	13.5	5.0	8.5	216		115	1.877391304	5.6150E-05	2.2456E+01	1.9063E+01	0.0070430	0.0073330	9838.293	9449.224	0.007332957
7.00	420	1.05	3.97	14.3	5.0	9.3	235		115	2.043043478	6.6245E-05	2.4349E+01	2.1581E+01	0.0074330	0.0078964	10997.929	10352.535	0.007896377
9.00	540	1.14	4.32	14.5	5.3	9.3	235		115	2.043043478	7.1923E-05	2.6242E+01	2.4098E+01	0.0078326	0.0083425	11331.382	10638.797	0.008342526
11.00	660	1.33	5.03	15.0	6.0	9.0	229		115	1.987826087	8.3910E-05	2.8134E+01	2.6615E+01	0.0085167	0.0091009	12158.067	11377.592	0.009100946
13.00	780	1.43	5.41	15.0	6.5	8.5	216		115	1.877391304	9.0219E-05	3.0027E+01	2.9133E+01	0.0090880	0.0096493	12250.485	11537.891	0.009649279
15.00	900	1.62	6.13	15.5	7.0	8.5	216		115	1.877391304	1.0221E-04	3.1920E+01	3.1650E+01	0.0096689	0.0103125	13044.358	12230.239	0.010312532
17.00	1020	1.81	6.85	16.5	7.5	9.0	229		115	1.987826087	1.1419E-04	3.3813E+01	3.4167E+01	0.0100345	0.0108222	14043.210	13021.176	0.010822152
19.00	1140	2.06	7.80	17.0	7.5	9.5	241		115	2.09826087	1.2997E-04	3.5706E+01	3.6685E+01	0.0104782	0.0114358	15306.188	14024.416	0.01143583
21.00	1260	2.15	8.14	17.0	7.5	9.5	241		115	2.09826087	1.3564E-04	3.7599E+01	3.9202E+01	0.0108132	0.0117886	15479.959	14199.162	0.011788567
23.00	1380	2.32	8.78	17.0	7.5	9.5	241		115	2.09826087	1.4637E-04	3.9492E+01	4.1720E+01	0.0112741	0.0123051	16021.094	14678.663	0.012305146
25.00	1500	2.51	9.50	17	7.5	9.5	241.3		115	2.09826087	0.000158356	41.38499955	44.23703979	0.01175585	0.012848432	16622.83012	15209.2869	0.012848432
27.00	1620	2.73	10.33	17	7.25	9.75	247.65		115	2.153478261	0.000172236	43.27793008	46.75443258	0.012165534	0.013365858	17470.95902	15901.97488	0.013365858
29.00	1740	2.9	10.98	17	7.25	9.75	247.65		115	2.153478261	0.000182961	45.17086062	49.27182537	0.012591387	0.013837135	17931.21361	16316.87932	0.013837135
31.00	1860	2.95	11.17	17	7.25	9.75	247.65		115	2.153478261	0.000186116	47.06379116	51.78921816	0.012837815	0.014071614	17890.24063	16321.62411	0.014071614
33.00	1980	3.11	11.77	17.25	9.5	7.75	196.85		115	1.71173913	0.00019621	48.95672169	54.30661095	0.014291572	0.015190865	16942.03805	15939.07608	0.015190865
36.00	2160	3.29	12.45	17.25	10	7.25	184.15		115	1.601304348	0.000207567	51.7961175	58.08270013	0.015171949	0.015958361	16882.61826	16050.65983	0.015958361
39.00	2340	3.46	13.10	17.25	10.5	6.75	171.45		115	1.490869565	0.000218292	54.63551331	61.85878931	0.016084422	0.016727003	16747.72867	16104.35148	0.016727003
42.00	2520	3.55	13.44	17.25	10.5	6.75	171.45		115	1.490869565	0.00022397	57.47490911	65.6348785	0.016498987	0.017101164	16751.60141	16161.73343	0.017101164
45.00	2700	3.68	13.93	17	11.25	5.75	146.05		115	1.27	0.000232172	60.31430492	69.41096768	0.01790014	0.018115876	16005.77302	15815.16584	0.018115876
48.00	2880	3.96	14.99	17.25	12	5.25	133.35		115	1.159565217	0.000249837	63.15370072	73.18705687	0.0192	0.0192	16057.54788	16057.54788	0.0192



Clay #5

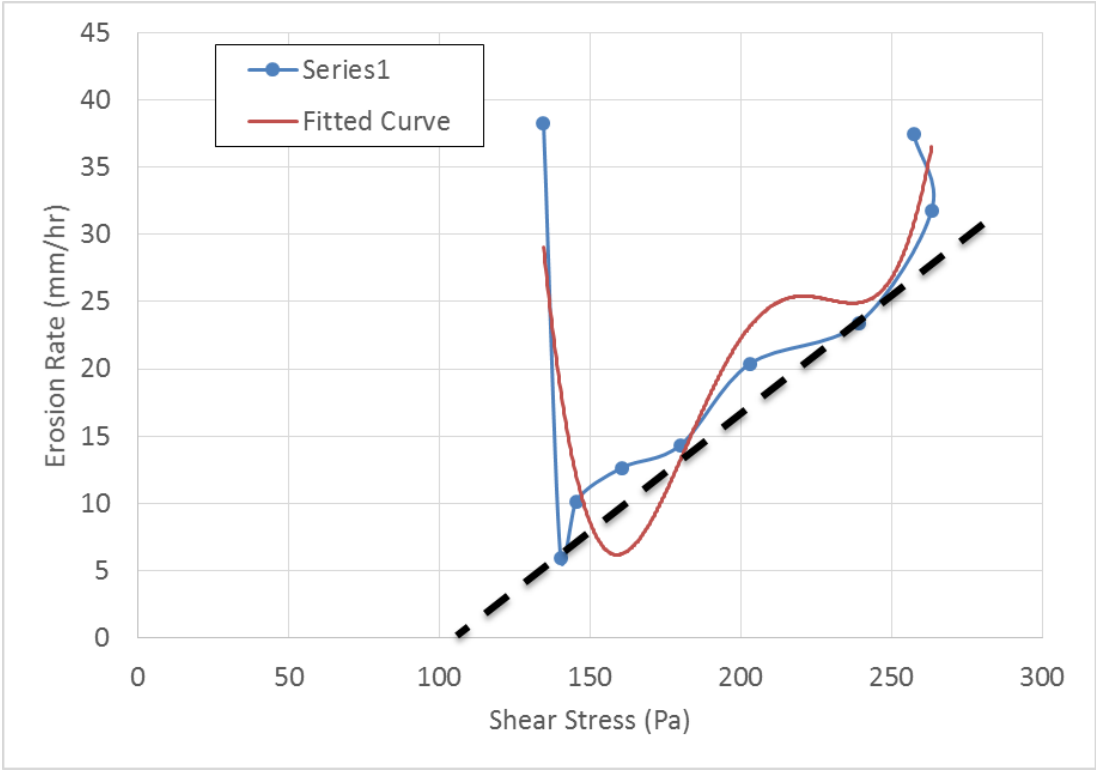
Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.60	2.27	18.0	5.0	13.0	330
0.50	30	0.79	2.99	18.5	5.0	13.5	343
1.00	60	0.92	3.48	18.5	5.0	13.5	343
1.50	90	0.98	3.71	19.0	5.0	14.0	356
2.00	120	1.01	3.82	19.3	5.0	14.3	362
3.00	180	1.11	4.20	19.5	5.3	14.3	362
4.00	240	1.24	4.69	19.5	5.5	14.0	356
5.00	300	1.34	5.07	19.5	5.5	14.0	356
6.00	360	1.50	5.68	19.8	5.8	14.0	356
7.00	420	1.77	6.70	20.0	6.0	14.0	356
8.00	480	1.99	7.53	20.5	6.3	14.3	362
9.00	540	2.29	8.67	20.0	6.3	13.8	349
10.00	600	2.61	9.88	21.5	7.3	14.3	362
11.00	660	2.91	11.02	22.5	7.75	14.75	374.65
12.00	720	3.33	12.61	22.0	8	14	355.6
13.00	780	3.51	13.29	22.0	9	13	330.2
14.00	840	3.89	14.73	23.5	10	13.5	342.9

	Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
	length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
	115	2.871304348	3.7854E-05	31.4976	23.5264	0.0060000	0.0060000	7785.478	7785.478	0.006
	115	2.98173913	4.9841E-05	3.6094E+01	2.9296E+01	0.0067957	0.0069457	9050.632	8855.186	0.006945678
	115	2.98173913	5.8043E-05	4.0691E+01	3.5066E+01	0.0074412	0.0076523	9625.711	9360.072	0.007652334
	115	3.092173913	6.1828E-05	4.5288E+01	4.0836E+01	0.0077806	0.0080323	9806.088	9498.828	0.008032326
	115	3.147391304	6.3721E-05	4.9884E+01	4.6606E+01	0.0080689	0.0083180	9745.260	9453.338	0.008318049
	115	3.147391304	7.0030E-05	5.9078E+01	5.8145E+01	0.0088098	0.0090290	9809.374	9571.301	0.00902895
	115	3.092173913	7.8232E-05	6.8271E+01	6.9685E+01	0.0096494	0.0098206	10004.770	9830.328	0.009820621
	115	3.092173913	8.4541E-05	7.7464E+01	8.1224E+01	0.0103280	0.0104453	10101.222	9987.762	0.010445323
	115	3.092173913	9.4635E-05	8.6658E+01	9.2764E+01	0.0111322	0.0112216	10490.506	10406.902	0.011221607
	115	3.092173913	1.1167E-04	9.5851E+01	1.0430E+02	0.0121657	0.0122742	11327.164	11227.078	0.012274161
	115	3.147391304	1.2555E-04	1.0504E+02	1.1584E+02	0.0129656	0.0130894	11949.360	11836.348	0.013089426
	115	3.036956522	1.4448E-04	1.1424E+02	1.2738E+02	0.0141396	0.0142123	12609.076	12544.596	0.01421229
	115	3.147391304	1.6467E-04	1.2343E+02	1.3892E+02	0.0149764	0.0151292	13568.098	13431.046	0.015129199
	115	3.257826087	0.000183592	132.6248058	150.4621471	0.015724068	0.015946024	14408.32008	14207.76799	0.015946024
	115	3.092173913	0.00021009	141.8181922	162.0017564	0.017113508	0.01725934	15149.22635	15021.22366	0.01725934
	115	2.871304348	0.000221446	151.0115785	173.5413656	0.018229762	0.01813773	14990.33648	15066.39843	0.01813773
	115	2.98173913	0.000245421	160.2049649	185.0809749	0.019	0.019	15939.74131	15939.74131	0.019



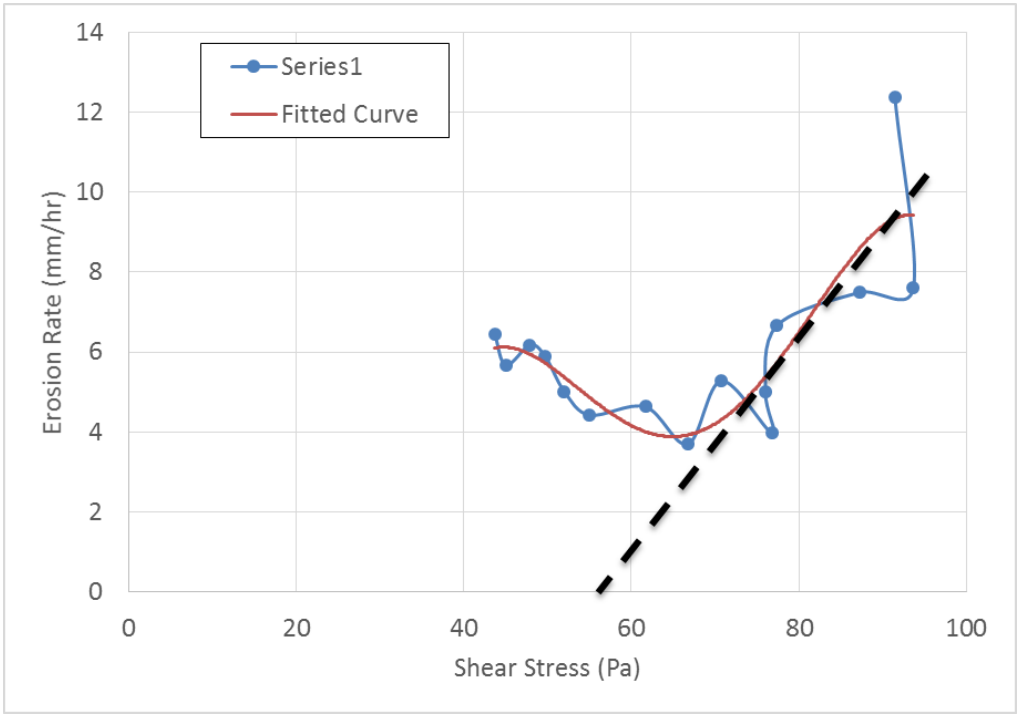
Clay #6

Flowrate		U/S Tube	D/S Tube	Pressure Differential			Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
							length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
(gpm)	(l/min)	in	in	(in)	(mm)		L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
1.27	4.81	43.0	5.5	37.5	953		115	8.282608696	8.0125E-05	42.9252	15.1474	0.0060000	0.0060000	16479.261	16479.261	0.006
1.46	5.53	43.0	5.5	37.5	953		115	8.282608696	9.2112E-05	4.6801E+01	1.8994E+01	0.0064692	0.0066378	17570.709	17124.340	0.006637802
1.40	5.30	44.0	5.5	38.5	978		115	8.503478261	8.8326E-05	5.0677E+01	2.2840E+01	0.0064936	0.0067370	16785.372	16178.869	0.006736978
1.36	5.15	43.5	5.5	38.0	965		115	8.393043478	8.5803E-05	5.8429E+01	3.0532E+01	0.0067730	0.0070758	15632.936	14963.958	0.007075835
1.46	5.53	43.5	6.0	37.5	953		115	8.282608696	9.2112E-05	7.3932E+01	4.5916E+01	0.0075343	0.0079195	15086.779	14352.967	0.007919476
1.68	6.36	43.5	6.0	37.5	953		115	8.282608696	1.0599E-04	8.9436E+01	6.1301E+01	0.0084124	0.0088752	15548.017	14737.228	0.008875212
2.12	8.03	43.2	6.5	36.7	931		115	8.098550725	1.3375E-04	1.0494E+02	7.6685E+01	0.0096603	0.0102327	17085.609	16129.861	0.010232706
2.79	10.56	45.0	7.5	37.5	953		115	8.282608696	1.7602E-04	1.2044E+02	9.2070E+01	0.0110012	0.0117931	19744.601	18418.855	0.011793069
3.77	14.27	45.0	10.0	35.0	889		115	7.730434783	2.3785E-04	1.3595E+02	1.0745E+02	0.0129580	0.0139103	22651.128	21100.414	0.013910272
4.85	18.36	43.0	14.0	29.0	737		115	6.405217391	3.0599E-04	1.5145E+02	1.2284E+02	0.0155547	0.0164079	24275.393	23013.087	0.016407867
5.23	19.80	36.0	16.0	20.0	508		115	4.417391304	3.2996E-04	1.6695E+02	1.3822E+02	0.0186500	0.0186500	21832.734	21832.734	0.01865



Clay #7

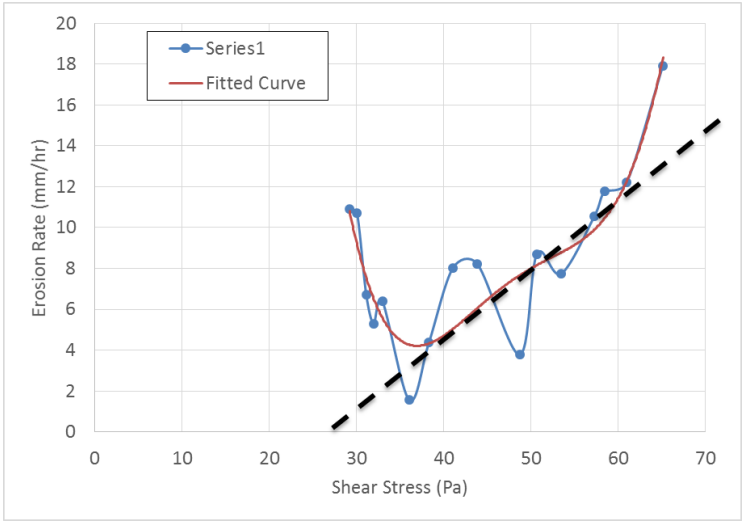
Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential		Sample length	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
											If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
0.00	0	0.89	3.37	18.0	5.0	13.0	330	115	2.871304348	5.6150E-05	21.2343	10.6925	0.0060000	0.0060000	11548.459	11548.459	0.006
1.00	60	0.89	3.37	18.0	5.0	13.0	330	115	2.871304348	5.6150E-05	2.2848E+01	1.2752E+01	0.0061483	0.0062151	11269.855	11148.773	0.006215101
2.00	120	0.89	3.37	18.0	5.0	13.0	330	115	2.871304348	5.6150E-05	2.4462E+01	1.4811E+01	0.0062898	0.0064040	11016.328	10819.943	0.006403985
4.00	240	0.92	3.48	18.0	5.0	13.0	330	115	2.871304348	5.8043E-05	2.7691E+01	1.8929E+01	0.0066280	0.0068158	10806.659	10508.818	0.006815838
6.00	360	0.95	3.60	17.8	5.0	12.8	324	115	2.816086957	5.9936E-05	3.0919E+01	2.3047E+01	0.0069952	0.0072091	10573.233	10259.604	0.007209054
8.00	480	0.98	3.71	17.8	5.0	12.8	324	115	2.816086957	6.1828E-05	3.4147E+01	2.7165E+01	0.0073060	0.0075433	10443.188	10114.688	0.007543256
11.00	660	1.02	3.86	17.8	5.0	12.8	324	115	2.816086957	6.4352E-05	3.8989E+01	3.3342E+01	0.0077387	0.0079856	10261.682	9944.433	0.007985561
14.00	840	1.11	4.20	18.5	5.0	13.5	343	115	2.98173913	7.0030E-05	4.3831E+01	3.9520E+01	0.0081205	0.0084488	10642.114	10228.576	0.008448762
17.00	1020	1.17	4.43	19.0	5.0	14.0	356	115	3.092173913	7.3815E-05	4.8673E+01	4.5697E+01	0.0084549	0.0088185	10773.708	10329.446	0.008818487
20.00	1200	1.27	4.81	19.0	5.0	14.0	356	115	3.092173913	8.0125E-05	5.3516E+01	5.1874E+01	0.0089683	0.0093466	11025.058	10578.764	0.009346609
26.00	1560	1.40	5.30	19.0	5.0	14.0	356	115	3.092173913	8.8326E-05	6.3200E+01	6.4229E+01	0.0097925	0.0101424	11130.592	10746.671	0.010142367
30.00	1800	1.49	5.64	19.0	6.0	13.0	330	115	2.871304348	9.4004E-05	6.9656E+01	7.2465E+01	0.0105858	0.0108113	10958.418	10729.811	0.010811338
35.00	2100	1.71	6.47	19.0	7.0	12.0	305	115	2.650434783	1.0788E-04	7.7726E+01	8.2760E+01	0.0118064	0.0119205	11276.229	11168.291	0.011920506
40.00	2400	2.09	7.91	19.5	7.3	12.3	311	115	2.705652174	1.3186E-04	8.5797E+01	9.3056E+01	0.0129564	0.0131689	12558.804	12356.162	0.013168853
45.00	2700	2.47	9.35	19.5	7.5	12.0	305	115	2.650434783	1.5583E-04	9.3867E+01	1.0335E+02	0.0142123	0.0144369	13530.578	13320.134	0.014436889
50.00	3000	3.04	11.51	18.8	8.5	10.3	260	115	2.263913043	1.9179E-04	1.0194E+02	1.1365E+02	0.0165000	0.0165000	14344.153	14344.153	0.0165



Clay #8

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.54	2.04	13.8	5.0	8.8	222
0.50	30	0.57	2.16	13.8	5.0	8.8	222
1.00	60	0.60	2.27	13.8	5.0	8.8	222
2.00	120	0.63	2.38	13.8	5.0	8.8	222
3.00	180	0.65	2.46	13.8	5.0	8.8	222
4.00	240	0.68	2.57	13.8	5.0	8.8	222
5.00	300	0.70	2.65	14.5	5.0	9.5	241
8.00	480	0.75	2.84	14.8	5.3	9.5	241
10.00	600	0.85	3.22	14.8	5.3	9.5	241
12.00	720	0.96	3.63	14.8	5.3	9.5	241
14.00	840	1.03	3.90	15.5	5.3	10.3	260
16.00	960	1.15	4.35	15.8	5.8	10.0	254
18.00	1080	1.27	4.81	15.8	5.8	10.0	254
20.00	1200	1.46	5.53	16.0	6.0	10.0	254
22.00	1320	1.65	6.25	16.0	6.5	9.5	241
24.00	1440	1.88	7.12	16.0	6.8	9.3	235
26.00	1560	2.28	8.63	16.0	7.0	9.0	229
28.00	1680	2.42	9.16	15.8	7.0	8.8	222
30.00	1800	2.61	9.88	15.8	7.5	8.3	210
32.00	1920	2.82	10.67	15.8	7.5	8.3	210
34.00	2040	2.98	11.28	15.8	8.0	7.8	197
36.00	2160	3.11	11.77	15.8	8.5	7.3	184
38.00	2280	3.17	12.00	15.8	8.5	7.3	184
40.00	2400	3.20	12.11	15.0	9.0	6.0	152
42.00	2520	3.27	12.38	15.0	9.0	6.0	152

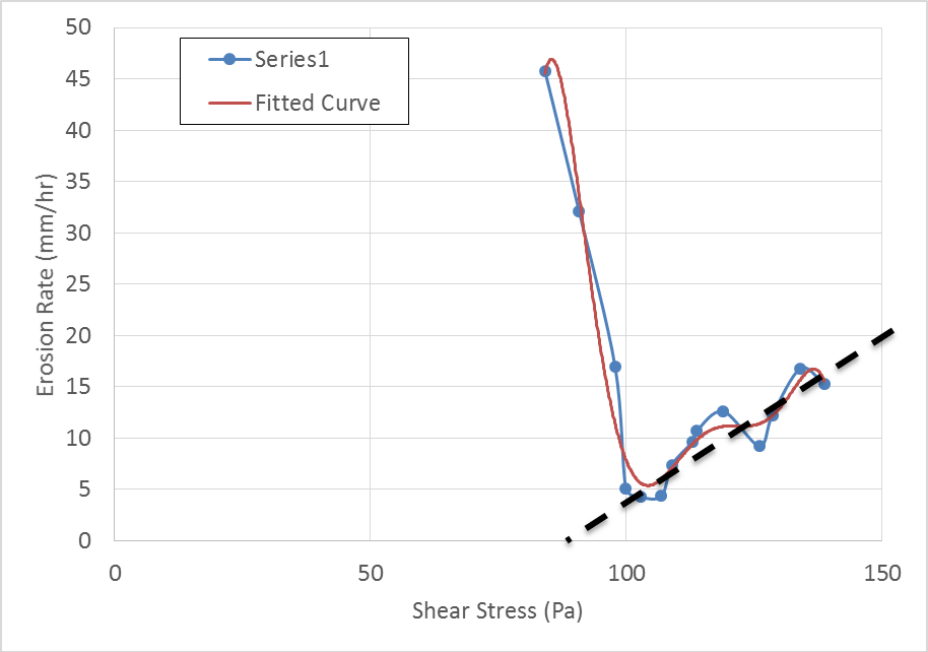
	Sample length	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
				If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
	115	1.932608696	3.4069E-05	23.5559	19.5495	0.0060000	0.0060000	7006.930	7006.930	0.006
	115	1.932608696	3.5961E-05	2.4133E+01	2.0374E+01	0.0061586	0.0061821	7205.744	7178.389	0.006182059
	115	1.932608696	3.7854E-05	2.4710E+01	2.1199E+01	0.0063143	0.0063605	7397.919	7344.223	0.006360492
	115	1.932608696	3.9747E-05	2.5864E+01	2.2849E+01	0.0065162	0.0065838	7527.116	7449.901	0.00658378
	115	1.932608696	4.1009E-05	2.7018E+01	2.4498E+01	0.0066810	0.0067602	7574.577	7485.818	0.006760197
	115	1.932608696	4.2901E-05	2.8171E+01	2.6148E+01	0.0068774	0.0069736	7697.819	7591.653	0.006973613
	115	2.09826087	4.4163E-05	2.9325E+01	2.7798E+01	0.0068475	0.0070253	7958.922	7757.452	0.007025289
	115	2.09826087	4.7318E-05	3.2787E+01	3.2746E+01	0.0072723	0.0074624	8029.281	7824.663	0.007462441
	115	2.09826087	5.3627E-05	3.5095E+01	3.6046E+01	0.0077560	0.0079976	8532.339	8274.512	0.007997639
	115	2.09826087	6.0567E-05	3.7403E+01	3.9345E+01	0.0082504	0.0085450	9059.063	8746.750	0.008544955
	115	2.263913043	6.4983E-05	3.9711E+01	4.2644E+01	0.0084010	0.0087969	9545.379	9115.745	0.008796913
	115	2.208695652	7.2554E-05	4.2018E+01	4.5943E+01	0.0089544	0.0093776	9998.801	9547.531	0.009377608
	115	2.208695652	8.0125E-05	4.4326E+01	4.9243E+01	0.0094220	0.0098937	10494.091	9993.807	0.009893684
	115	2.208695652	9.2112E-05	4.6634E+01	5.2542E+01	0.0100386	0.0105977	11323.051	10725.748	0.010597674
	115	2.09826087	1.0410E-04	4.8942E+01	5.5841E+01	0.0108094	0.0113817	11884.100	11286.551	0.011381722
	115	2.043043478	1.1861E-04	5.1250E+01	5.9140E+01	0.0115671	0.0121949	12653.715	12002.266	0.012194946
	115	1.987826087	1.4385E-04	5.3557E+01	6.2440E+01	0.0126326	0.0133902	14051.627	13256.668	0.013390159
	115	1.932608696	1.5268E-04	5.5865E+01	6.5739E+01	0.0131919	0.0139334	14282.191	13522.077	0.013933404
	115	1.822173913	1.6467E-04	5.8173E+01	6.9038E+01	0.0139838	0.0146741	14531.156	13847.595	0.014674099
	115	1.822173913	1.7791E-04	6.0481E+01	7.2337E+01	0.0145365	0.0152774	15103.370	14370.926	0.015277406
	115	1.71173913	1.8801E-04	6.2789E+01	7.5637E+01	0.0153081	0.0159566	15155.843	14539.877	0.015956616
	115	1.601304348	1.9621E-04	6.5096E+01	7.8936E+01	0.0160688	0.0165905	15068.252	14594.392	0.016590506
	115	1.601304348	2.0000E-04	6.7404E+01	8.2235E+01	0.0163603	0.0168553	15085.236	14642.282	0.016855272
	115	1.325217391	2.0189E-04	6.9712E+01	8.5534E+01	0.0176777	0.0177103	14093.217	14067.249	0.017710306
	115	1.325217391	2.0630E-04	7.2020E+01	8.8834E+01	0.0180000	0.0180000	14143.618	14143.618	0.018



Clay #9

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.44	1.67	27.8	5.0	22.8	578
0.50	30	0.60	2.27	28.0	5.0	23.0	584
1.00	60	0.73	2.76	28.0	5.0	23.0	584
2.00	120	0.89	3.37	28.0	5.0	23.0	584
3.00	180	0.95	3.60	28.0	5.0	23.0	584
4.00	240	1.01	3.82	28.5	5.3	23.3	591
5.00	300	1.08	4.09	29.0	5.3	23.8	603
6.00	360	1.17	4.43	28.8	5.3	23.5	597
7.00	420	1.30	4.92	29.0	5.5	23.5	597
8.00	480	1.43	5.41	29.0	6.3	22.8	578
9.00	540	1.62	6.13	29.0	6.3	22.8	578
10.50	630	1.87	7.08	29.5	6.5	23.0	584
11.00	660	1.98	7.50	29.5	6.5	23.0	584
12.00	720	2.28	8.63	29.5	6.8	22.8	578
13.00	780	2.58	9.77	29.5	7.0	22.5	572
15.00	900	3.04	11.51	29.5	7.5	22.0	559
16.00	960	3.23	12.23	29.5	7.5	22.0	559
17.00	1020	3.48	13.17	29.5	9.0	20.5	521
18.00	1080	3.69	13.97	29.5	9.5	20.0	508
19.00	1140	3.81	14.42	28.0	10.0	18.0	457
20.00	1200	3.96	14.99	27.0	10.5	16.5	419
21.00	1260	4.00	15.14	25.0	11.0	14.0	356

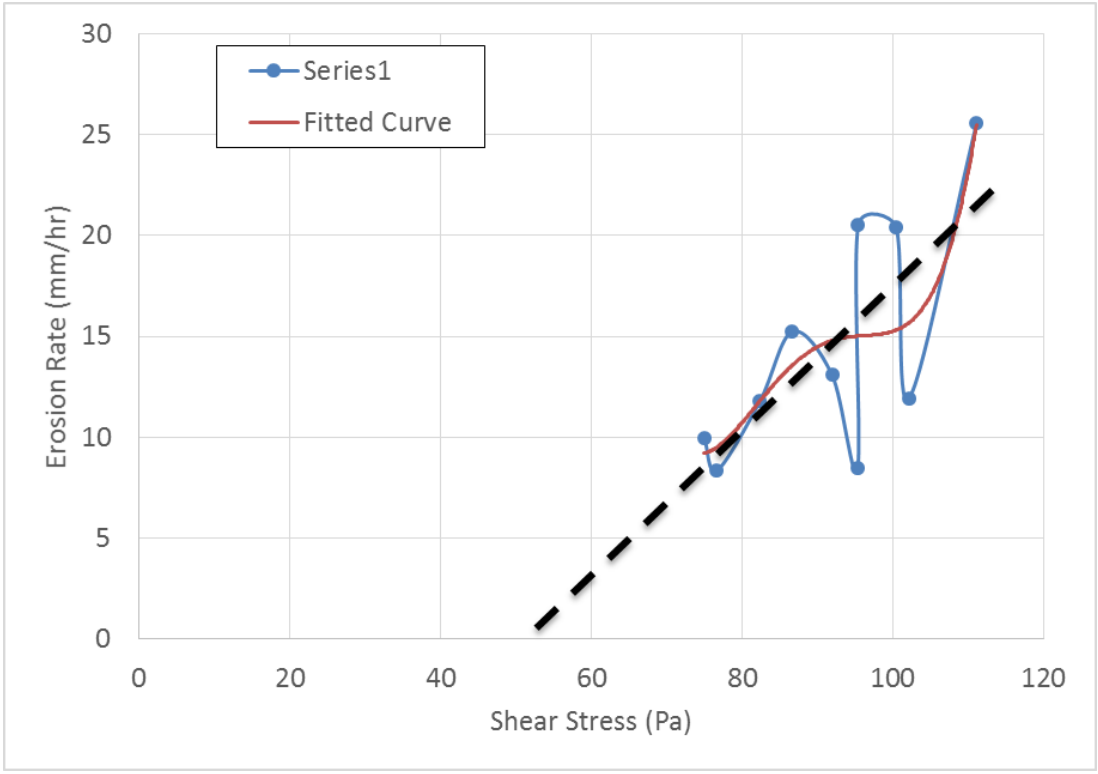
	Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
	length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
	115	5.024782609	2.7760E-05	75.1646	76.5582	0.0060000	0.0060000	5709.350	5709.350	0.006
	115	5.08	3.7854E-05	7.4952E+01	7.5713E+01	0.0066231	0.0067627	7053.060	6907.470	0.00676266
	115	5.08	4.6056E-05	7.4740E+01	7.4868E+01	0.0070638	0.0072981	8045.805	7787.474	0.007298129
	115	5.08	5.6150E-05	7.4315E+01	7.3179E+01	0.0075319	0.0078642	9199.681	8810.888	0.007864219
	115	5.08	5.9936E-05	7.3890E+01	7.1489E+01	0.0076828	0.0080345	9627.018	9205.533	0.00803452
	115	5.135217391	6.3721E-05	7.3465E+01	6.9799E+01	0.0077980	0.0081768	10083.781	9616.659	0.008176782
	115	5.245652174	6.8137E-05	7.3040E+01	6.8110E+01	0.0079025	0.0083224	10640.077	10103.279	0.008322363
	115	5.190434783	7.3815E-05	7.2616E+01	6.6420E+01	0.0081290	0.0085682	11205.520	10631.205	0.008568181
	115	5.190434783	8.2017E-05	7.2191E+01	6.4730E+01	0.0084032	0.0088911	12044.435	11383.485	0.008891057
	115	5.024782609	9.0219E-05	7.1766E+01	6.3041E+01	0.0087515	0.0092476	12721.564	12039.016	0.009247627
	115	5.024782609	1.0221E-04	7.1341E+01	6.1351E+01	0.0091050	0.0096681	13852.218	13045.426	0.009668119
	115	5.08	1.1798E-04	7.0704E+01	5.8816E+01	0.0094880	0.0101312	15344.453	14370.375	0.010131151
	115	5.08	1.2492E-04	7.0492E+01	5.7971E+01	0.0096608	0.0103355	15956.441	14914.852	0.0103355
	115	5.024782609	1.4385E-04	7.0067E+01	5.6282E+01	0.0101425	0.0108948	17501.506	16292.990	0.010894802
	115	4.969565217	1.6277E-04	6.9642E+01	5.4592E+01	0.0105867	0.0114026	18973.441	17615.686	0.01140264
	115	4.859130435	1.9179E-04	6.8792E+01	5.1213E+01	0.0112198	0.0120756	21094.656	19599.742	0.012075594
	115	4.859130435	2.0378E-04	6.8367E+01	4.9523E+01	0.0114253	0.0122893	22010.091	20462.649	0.012289266
	115	4.527826087	2.1955E-04	6.7943E+01	4.7833E+01	0.0119668	0.0127525	22640.486	21245.622	0.012752492
	115	4.417391304	2.3280E-04	6.7518E+01	4.6144E+01	0.0122780	0.0130255	23398.277	22055.491	0.013025515
	115	3.975652174	2.4037E-04	6.7093E+01	4.4454E+01	0.0128262	0.0133741	23126.551	22179.142	0.013374129
	115	3.644347826	2.4984E-04	6.6668E+01	4.2764E+01	0.0133465	0.0137140	23100.128	22480.970	0.01371404
	115	3.092173913	2.5236E-04	6.6243E+01	4.1074E+01	0.0141150	0.0141150	22062.990	22062.990	0.014115



Clay #10

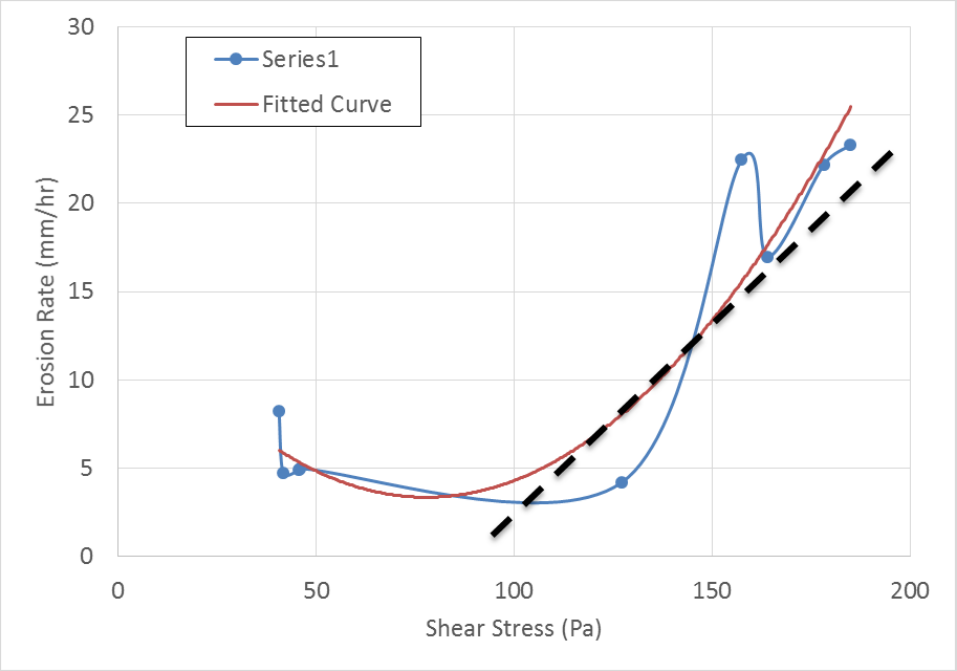
Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	1.01	3.82	27.5	5.0	22.5	572
0.50	30	1.05	3.97	27.5	5.0	22.5	572
1.00	60	1.08	4.09	27.5	5.0	22.5	572
2.00	120	1.20	4.54	27.8	5.0	22.8	578
3.00	180	1.36	5.15	27.5	5.3	22.3	565
4.00	240	1.51	5.72	27.5	5.3	22.3	565
5.00	300	1.59	6.02	27.5	5.3	22.3	565
6.00	360	1.81	6.85	27.0	6.5	20.5	521
7.00	420	2.09	7.91	27.0	7.0	20.0	508
8.00	480	2.22	8.40	26.5	7.0	19.5	495
9.00	540	2.66	10.07	27.5	8.0	19.5	495
10.00	600	2.82	10.67	27.5	8.0	19.5	495
11.00	660	2.90	10.98	27.0	7.5	19.5	495
12.00	720	2.92	11.05	27.0	8.0	19.0	483

	Sample length	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
				If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
	115	4.969565217	6.3721E-05	32.3851	14.3699	0.0060000	0.0060000	13105.554	13105.554	0.006
	115	4.969565217	6.6245E-05	3.3707E+01	1.5240E+01	0.0061598	0.0061660	13271.139	13257.815	0.006165987
	115	4.969565217	6.8137E-05	3.5029E+01	1.6109E+01	0.0062982	0.0063055	13350.420	13334.962	0.006305467
	115	5.024782609	7.5708E-05	3.7674E+01	1.7849E+01	0.0066589	0.0066983	14030.228	13947.608	0.006698334
	115	4.914347826	8.5803E-05	4.0318E+01	1.9588E+01	0.0071541	0.0072064	14800.151	14692.869	0.007206387
	115	4.914347826	9.5266E-05	4.2962E+01	2.1328E+01	0.0075666	0.0076433	15536.825	15380.826	0.007643329
	115	4.914347826	1.0031E-04	4.5606E+01	2.3067E+01	0.0078527	0.0079261	15763.861	15617.866	0.007926121
	115	4.527826087	1.1419E-04	4.8250E+01	2.4807E+01	0.0085861	0.0086100	16412.163	16366.681	0.008610002
	115	4.417391304	1.3186E-04	5.0895E+01	2.6546E+01	0.0092453	0.0092901	17600.003	17514.989	0.009290128
	115	4.306956522	1.4006E-04	5.3539E+01	2.8286E+01	0.0096750	0.0096876	17864.318	17841.114	0.009687602
	115	4.306956522	1.6782E-04	5.6183E+01	3.0025E+01	0.0104426	0.0105393	19831.708	19649.677	0.010539293
	115	4.306956522	1.7791E-04	5.8827E+01	3.1765E+01	0.0108124	0.0109106	20305.515	20122.604	0.010910639
	115	4.306956522	1.8296E-04	6.1471E+01	3.3504E+01	0.0110748	0.0111517	20386.764	20246.161	0.011151688
	115	4.196521739	1.8422E-04	6.4116E+01	3.5244E+01	0.0113550	0.0113550	20020.779	20020.779	0.011355



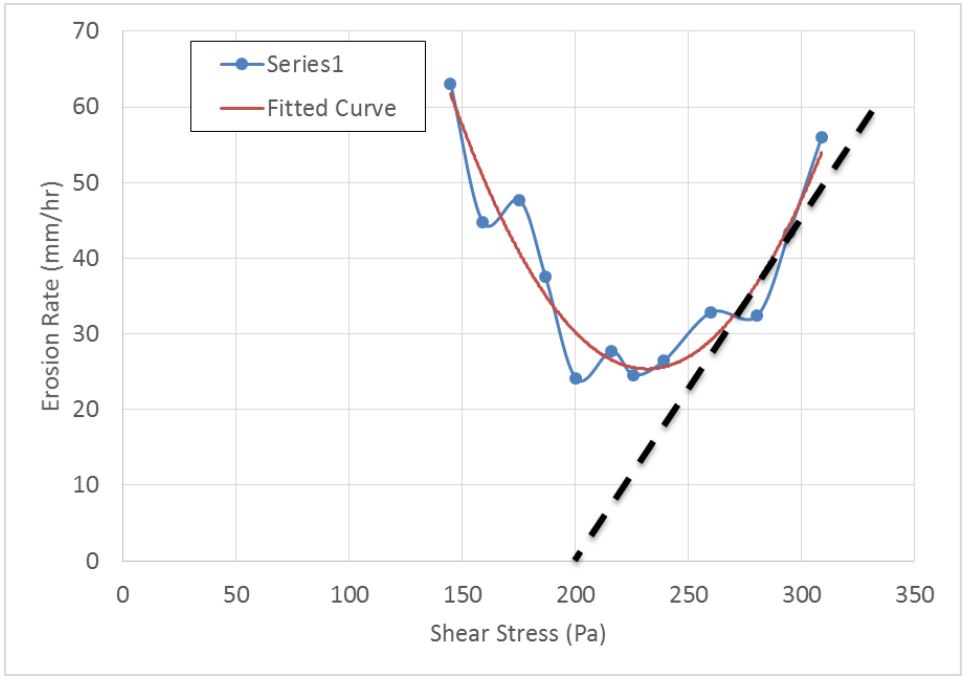
Clay #11

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential			Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
									length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)		L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
0.00	0	0.73	2.76	17.0	5.0	12.0	305		115	2.650434783	4.6056E-05	23.8970	14.6707	0.0060000	0.0060000	9472.331	9472.331	0.006
1.00	60	0.76	2.88	17.0	5.0	12.0	305		115	2.650434783	4.7949E-05	2.6770E+01	1.6922E+01	0.0063156	0.0062741	9368.741	9430.809	0.006274078
2.00	120	0.76	2.88	17.0	5.0	12.0	305		115	2.650434783	4.7949E-05	2.9643E+01	1.9174E+01	0.0065340	0.0064328	9055.708	9198.103	0.006432808
4.00	240	0.79	2.99	17.5	5.0	12.5	318		115	2.760869565	4.9841E-05	3.5390E+01	2.3678E+01	0.0069266	0.0067593	8879.549	9099.296	0.006759344
6.00	360	0.80	3.03	18.0	6.0	12.0	305		115	2.650434783	5.0472E-05	4.1136E+01	2.8181E+01	0.0074137	0.0070918	8401.197	8782.454	0.007091847
7.00	420	1.33	5.03	39.5	7.0	32.5	826		115	7.17826087	8.3910E-05	4.4009E+01	3.0433E+01	0.0064441	0.0072310	16068.520	14319.782	0.007231036
8.00	480	1.74	6.59	43.5	7.0	36.5	927		115	8.06173913	1.0978E-04	4.6883E+01	3.2685E+01	0.0069249	0.0079799	19562.395	16976.057	0.007979905
9.00	540	1.97	7.46	43.0	7.5	35.5	902		115	7.840869565	1.2429E-04	4.9756E+01	3.4936E+01	0.0074305	0.0085460	20641.178	17946.810	0.008546026
10.00	600	2.35	8.90	43.0	7.5	35.5	902		115	7.840869565	1.4826E-04	5.2629E+01	3.7188E+01	0.0080293	0.0092860	22786.367	19702.576	0.009286031
11.00	660	2.73	10.33	42.5	8.5	34.0	864		115	7.509565217	1.7224E-04	5.5502E+01	3.9440E+01	0.0087161	0.0100629	24385.225	21121.452	0.010062923
12.00	720	3.11	11.77	39.0	10.0	29.0	737		115	6.405217391	1.9621E-04	5.8375E+01	4.1691E+01	0.0097616	0.0110663	24804.190	21879.813	0.01106629
13.50	810	3.21	12.15	30.0	10.0	20.0	508		115	4.417391304	2.0252E-04	6.2685E+01	4.5069E+01	0.0114341	0.0122614	21856.826	20382.175	0.012261392
14.50	870	3.17	12.00	25.0	10.0	15.0	381		115	3.313043478	2.0000E-04	6.5558E+01	4.7321E+01	0.0127210	0.0130492	19400.930	18913.008	0.013049201
16.00	960	3.22	12.19	23.0	10.0	13.0	330		115	2.871304348	2.0315E-04	6.9868E+01	5.0698E+01	0.0137000	0.0137000	18298.714	18298.714	0.0137



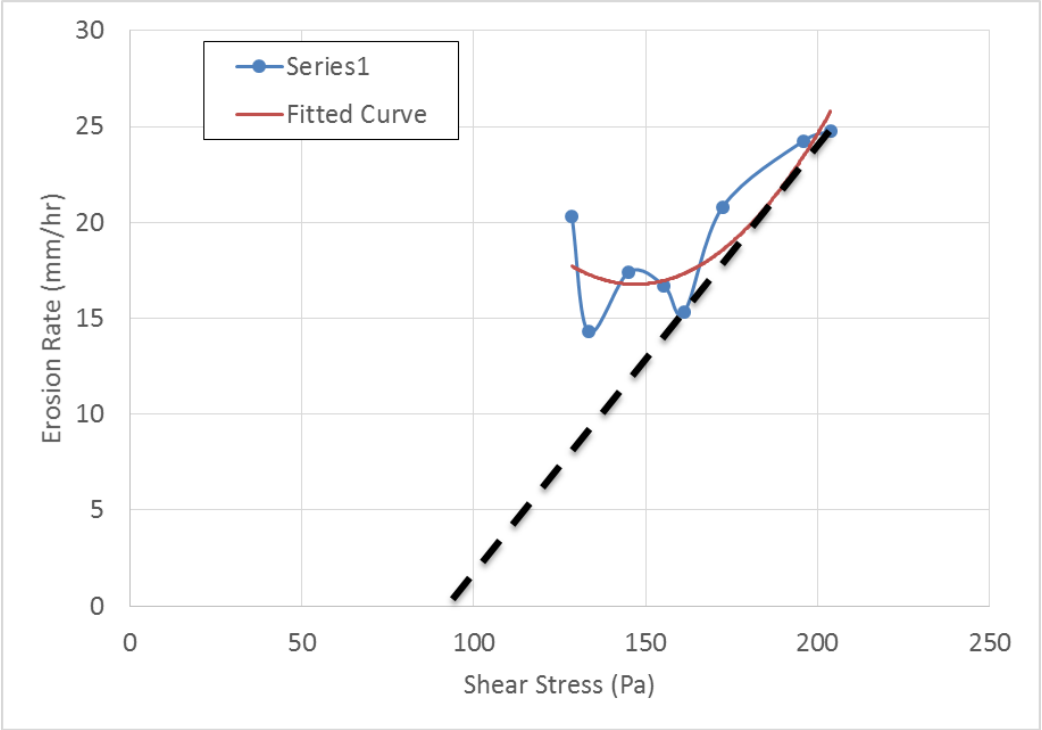
Clay #12

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential		Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
								length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
0.00	0	1.21	4.58	41.5	5.0	36.5	927	115	8.06173913	7.6339E-05	43.8523	16.2419	0.0060000	0.0060000	15700.713	15700.713	0.006
0.50	30	1.33	5.03	43.0	5.0	38.0	965	115	8.393043478	8.3910E-05	5.5640E+01	3.1374E+01	0.0066142	0.0070513	15655.303	14684.848	0.007051272
1.00	60	1.40	5.30	43.0	5.3	37.8	959	115	8.337826087	8.8326E-05	6.7428E+01	4.6507E+01	0.0071891	0.0077972	15161.399	13978.918	0.007797219
1.50	90	1.55	5.87	43.0	5.3	37.8	959	115	8.337826087	9.7790E-05	7.9216E+01	6.1640E+01	0.0078475	0.0085919	15377.448	14045.187	0.008591905
2.00	120	1.65	6.25	43.0	5.5	37.5	953	115	8.282608696	1.0410E-04	9.1004E+01	7.6772E+01	0.0084106	0.0092171	15273.600	13937.117	0.009217142
3.00	180	1.71	6.47	43.0	6.0	37.0	940	115	8.172173913	1.0788E-04	1.1458E+02	1.0704E+02	0.0092319	0.0100192	14420.833	13287.647	0.010019206
4.00	240	1.87	7.08	43.0	6.5	36.5	927	115	8.06173913	1.1798E-04	1.3816E+02	1.3730E+02	0.0101694	0.0109441	14316.301	13302.859	0.010944146
5.00	300	2.00	7.57	42.5	7.0	35.5	902	115	7.840869565	1.2618E-04	1.6173E+02	1.6757E+02	0.0110626	0.0117645	14075.361	13235.574	0.011764473
6.00	360	2.19	8.29	42.5	7.5	35.0	889	115	7.730434783	1.3817E-04	1.8531E+02	1.9783E+02	0.0119880	0.0126471	14222.725	13481.480	0.012647125
7.00	420	2.51	9.50	42.5	7.5	35.0	889	115	7.730434783	1.5836E-04	2.0888E+02	2.2810E+02	0.0130565	0.0137419	14966.914	14220.364	0.013741947
8.00	480	2.85	10.79	42.5	7.5	35.0	889	115	7.730434783	1.7981E-04	2.3246E+02	2.5836E+02	0.0141156	0.0148231	15719.257	14968.958	0.014823083
9.00	540	3.33	12.61	42.5	9.0	33.5	851	115	7.399130435	2.1009E-04	2.5604E+02	2.8863E+02	0.0155796	0.0162706	16640.752	15934.003	0.016270639
10.00	600	4.03	15.26	42.5	11.0	31.5	800	115	6.957391304	2.5425E-04	2.7961E+02	3.1889E+02	0.0174518	0.0181367	17978.377	17299.485	0.018136652
11.00	660	4.63	17.53	42.0	14.5	27.5	699	115	6.073913043	2.9211E-04	3.0319E+02	3.4916E+02	0.0196476	0.0200604	18346.636	17969.159	0.02006035
12.00	720	5.26	19.91	40.0	16.5	23.5	597	115	5.190434783	3.3185E-04	3.2676E+02	3.7942E+02	0.0221500	0.0221500	18488.313	18488.313	0.02215



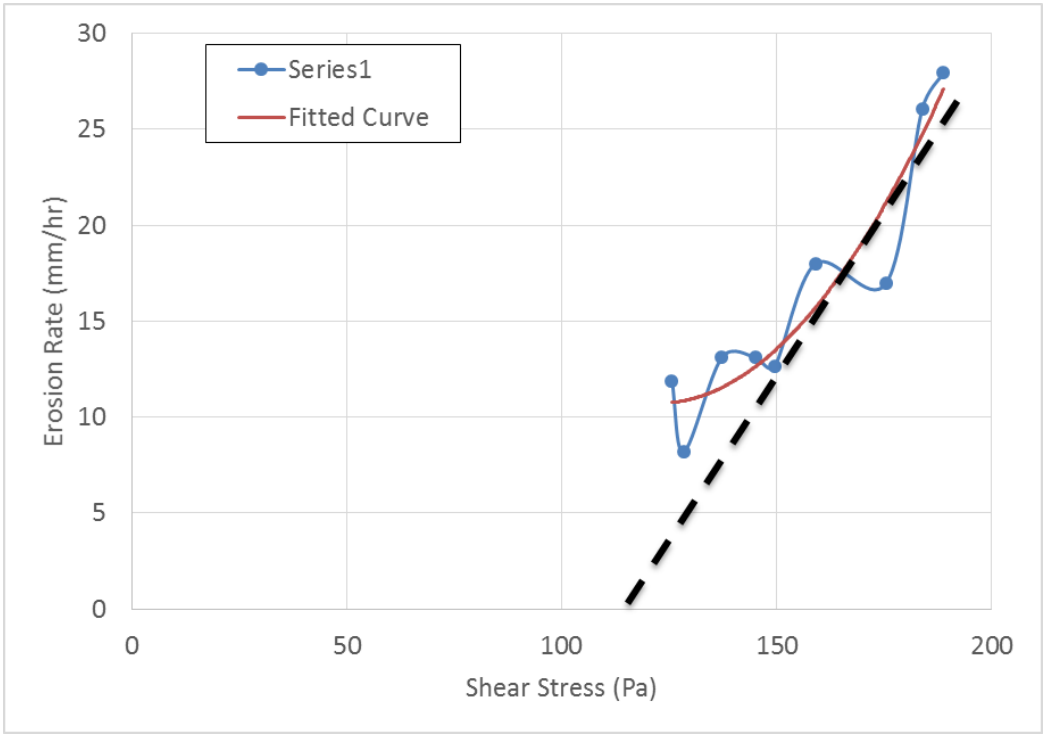
Clay #13

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential			Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
									length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)		L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
0.00	0	1.01	3.82	42.5	5.0	37.5	953		115	8.282608696	6.3721E-05	53.9752	23.9499	0.0060000	0.0060000	13105.554	13105.554	0.006
0.50	30	1.13	4.28	42.5	5.0	37.5	953		115	8.282608696	7.1292E-05	5.4987E+01	2.5179E+01	0.0062675	0.0063387	14036.942	13879.175	0.006338698
1.00	60	1.21	4.58	42.5	5.0	37.5	953		115	8.282608696	7.6339E-05	5.5998E+01	2.6408E+01	0.0064511	0.0065769	14602.880	14323.493	0.006576907
2.00	120	1.43	5.41	42.5	5.0	37.5	953		115	8.282608696	9.0219E-05	5.8021E+01	2.8865E+01	0.0069016	0.0071577	16131.267	15554.286	0.007157663
3.00	180	1.65	6.25	42.8	5.5	37.3	946		115	8.227391304	1.0410E-04	6.0044E+01	3.1323E+01	0.0073383	0.0077145	17505.357	16651.775	0.007714516
4.00	240	1.84	6.97	42.8	6.5	36.3	921		115	8.006521739	1.1609E-04	6.2067E+01	3.3780E+01	0.0077645	0.0082256	18449.762	17415.513	0.008225586
5.00	300	2.16	8.18	42.8	7.0	35.8	908		115	7.896086957	1.3627E-04	6.4089E+01	3.6238E+01	0.0083172	0.0089192	20219.072	18854.345	0.008919234
6.50	390	2.83	10.71	42.8	7.0	35.8	908		115	7.896086957	1.7855E-04	6.7124E+01	3.9925E+01	0.0092424	0.0101315	23838.917	21746.838	0.010131543
7.00	420	3.08	11.66	42.8	7.0	35.8	908		115	7.896086957	1.9432E-04	6.8135E+01	4.1153E+01	0.0095544	0.0105442	25097.531	22741.632	0.010544218
8.00	480	3.08	11.66	30.5	7.5	23.0	584		115	5.08	1.9432E-04	7.0158E+01	4.3611E+01	0.0111761	0.0116510	21455.877	20581.349	0.011650972
10.00	600	3.08	11.66	24.0	7.5	16.5	419		115	3.644347826	1.9432E-04	7.4204E+01	4.8526E+01	0.0127200	0.0127200	18851.629	18851.629	0.01272



Clay #14

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential			Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
									length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)		L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
0.00	0	0.87	3.29	42.5	5.0	37.5	953		115	8.282608696	5.4888E-05	62.6609	32.2781	0.0060000	0.0060000	11288.943	11288.943	0.006
0.50	30	0.95	3.60	42.5	5.0	37.5	953		115	8.282608696	5.9936E-05	6.3007E+01	3.1852E+01	0.0061899	0.0061984	11948.850	11932.472	0.006198383
1.00	60	1.01	3.82	42.5	5.0	37.5	953		115	8.282608696	6.3721E-05	6.3353E+01	3.1426E+01	0.0063291	0.0063350	12424.119	12412.498	0.006335012
2.00	120	1.21	4.58	42.5	5.0	37.5	953		115	8.282608696	7.6339E-05	6.4044E+01	3.0573E+01	0.0067463	0.0067724	13963.783	13909.970	0.006772429
3.00	180	1.43	5.41	42.8	5.5	37.3	946		115	8.227391304	9.0219E-05	6.4736E+01	2.9721E+01	0.0071742	0.0072092	15518.400	15443.003	0.007209241
4.00	240	1.65	6.25	42.8	6.5	36.3	921		115	8.006521739	1.0410E-04	6.5427E+01	2.8868E+01	0.0076202	0.0076311	16857.805	16833.889	0.007631058
5.00	300	2.01	7.61	42.8	7.0	35.8	908		115	7.896086957	1.2681E-04	6.6119E+01	2.8016E+01	0.0082049	0.0082314	19072.584	19011.165	0.008231379
6.50	390	2.63	9.96	42.8	7.0	35.8	908		115	7.896086957	1.6593E-04	6.7156E+01	2.6737E+01	0.0090208	0.0090807	22698.417	22548.728	0.009080693
7.00	420	2.98	11.28	42.8	7.0	35.8	908		115	7.896086957	1.8801E-04	6.7502E+01	2.6311E+01	0.0094205	0.0095154	24627.806	24382.268	0.009515408
7.50	450	3.35	12.68	42.5	7.5	35.0	889		115	7.730434783	2.1135E-04	6.7848E+01	2.5885E+01	0.0098816	0.0099812	26393.826	26130.527	0.009981181
9.00	540	4.22	15.97	42.5	8.0	34.5	876		115	7.62	2.6624E-04	6.8885E+01	2.4606E+01	0.0107778	0.0108677	30483.701	30231.460	0.010867724
10.00	600	5.06	19.15	41.5	9.5	32.0	813		115	7.067826087	3.1924E-04	6.9577E+01	2.3754E+01	0.0117800	0.0117800	33441.865	33441.865	0.01178

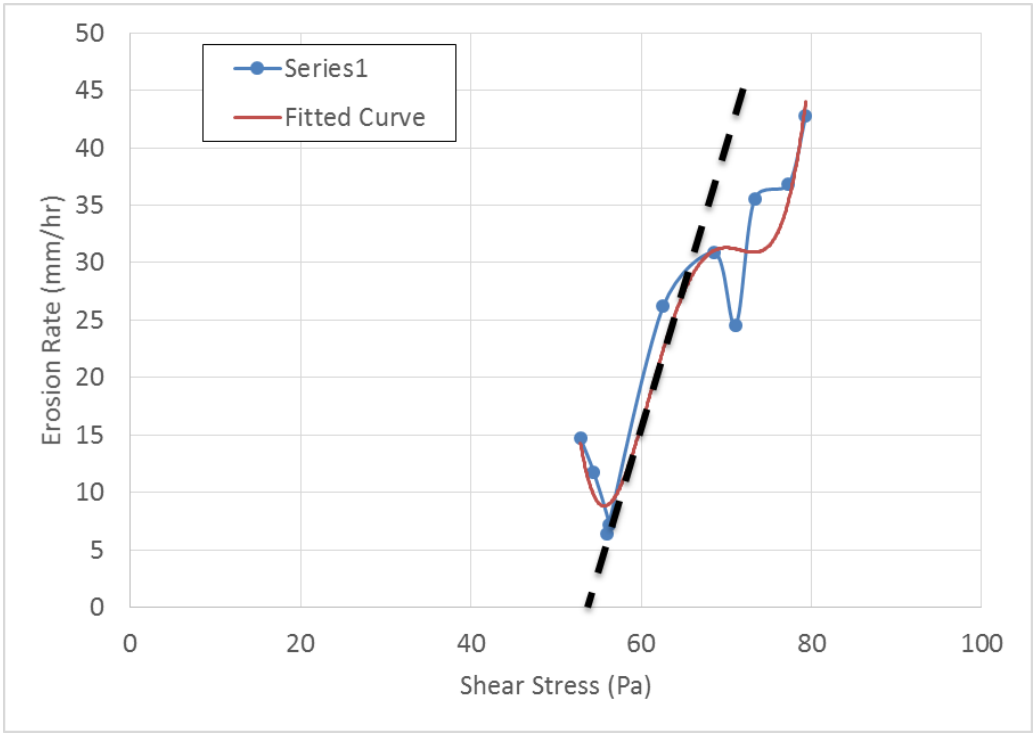


Silt Samples – HET

Silt #1

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.69	2.61	20.0	5.5	14.5	368
0.50	30	0.76	2.88	20.0	5.5	14.5	368
1.00	60	0.82	3.10	20.0	5.5	14.5	368
2.00	120	0.90	3.41	20.0	5.5	14.5	368
3.00	180	0.96	3.63	20.0	6.0	14.0	356
4.00	240	1.28	4.85	20.0	6.0	14.0	356
5.00	300	1.71	6.47	19.9	6.3	13.7	347
6.00	360	2.08	7.87	19.8	6.8	13.0	330
7.00	420	2.66	10.07	19.5	7.5	12.0	305
7.50	450	3.05	11.55	19.8	7.8	12.0	305
8.50	510	3.91	14.80	19.0	8.0	11.0	279
9.50	570	4.14	15.67	19.0	8.0	11.0	279
10.50	630	4.40	16.66	19.0	8.3	10.8	273
12.00	720	4.96	18.78	18.8	8.5	10.3	260

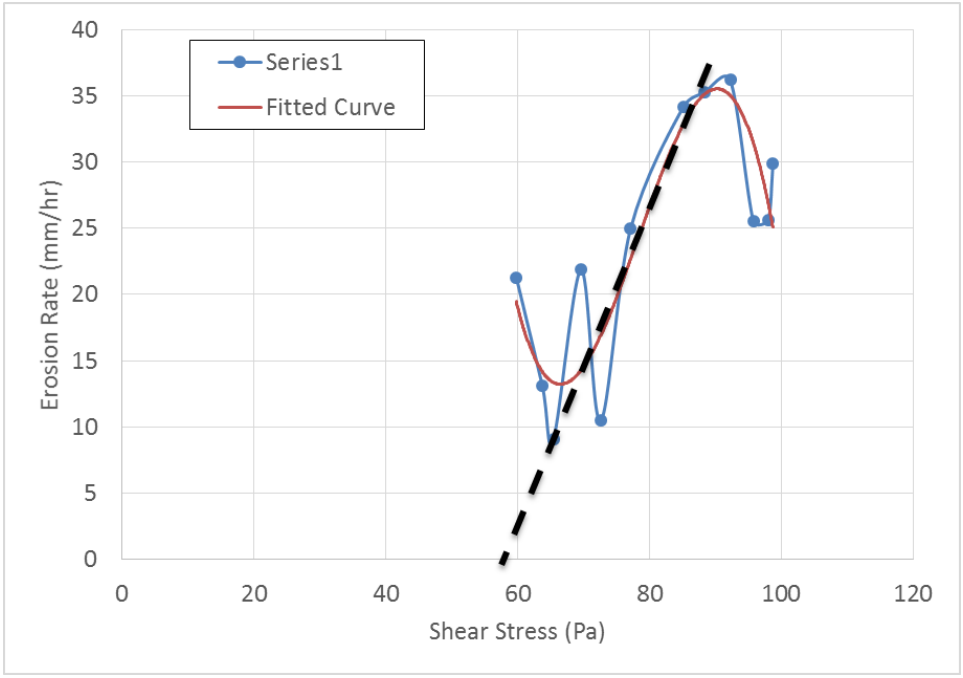
Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
115	3.202608696	4.3532E-05	38.8410	29.6071	0.0065000	0.0065000	8264.584	8264.584	0.0065
115	3.202608696	4.7949E-05	3.9054E+01	2.9363E+01	0.0067250	0.0067450	8798.433	8772.384	0.006744989
115	3.202608696	5.1734E-05	3.9267E+01	2.9120E+01	0.0069101	0.0069416	9238.848	9196.905	0.006941565
115	3.202608696	5.6781E-05	3.9693E+01	2.8632E+01	0.0071535	0.0071806	9795.071	9758.097	0.007180632
115	3.092173913	6.0567E-05	4.0119E+01	2.8145E+01	0.0074215	0.0073949	10070.880	10107.081	0.007394874
115	3.092173913	8.0755E-05	4.0546E+01	2.7657E+01	0.0081972	0.0082678	12157.109	12053.312	0.008267778
115	3.014869565	1.0788E-04	4.0972E+01	2.7170E+01	0.0091363	0.0092973	14571.657	14319.354	0.009297323
115	2.871304348	1.3123E-04	4.1398E+01	2.6683E+01	0.0099469	0.0101170	16280.186	16006.570	0.010116967
115	2.650434783	1.6782E-04	4.1824E+01	2.6195E+01	0.0111267	0.0113013	18612.365	18324.756	0.011301308
115	2.650434783	1.9243E-04	4.2037E+01	2.5951E+01	0.0116656	0.0119147	20355.324	19929.712	0.011914727
115	2.429565217	2.4668E-04	4.2463E+01	2.5464E+01	0.0130895	0.0133397	23256.244	22820.038	0.013339687
115	2.429565217	2.6119E-04	4.2890E+01	2.4977E+01	0.0133857	0.0135955	24079.253	23707.691	0.013595536
115	2.374347826	2.7760E-04	4.3316E+01	2.4489E+01	0.0138108	0.0139400	24803.816	24573.988	0.013939985
115	2.263913043	3.1293E-04	4.3955E+01	2.3758E+01	0.0146750	0.0146750	26314.119	26314.119	0.014675



Silt #2

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.68	2.57	22.0	5.5	16.5	419
1.00	60	0.88	3.33	22.0	5.5	16.5	419
2.00	120	1.01	3.82	22.0	5.5	16.5	419
3.00	180	1.09	4.13	21.8	5.5	16.3	413
4.00	240	1.33	5.03	21.8	6.0	15.8	400
5.00	300	1.45	5.49	21.8	6.0	15.8	400
6.00	360	1.77	6.70	21.5	6.3	15.3	387
7.00	420	2.30	8.71	21.5	6.5	15.0	381
8.00	480	2.85	10.79	21.5	7.5	14.0	356
9.00	540	3.49	13.21	21.3	8.0	13.3	337
10.00	600	3.98	15.07	20.9	8.0	12.9	328
11.25	675	4.59	17.38	20.5	8.3	12.3	311
12.00	720	5.03	19.04	20.3	8.5	11.8	298
13.00	780	5.34	20.21	20.0	9.0	11.0	279

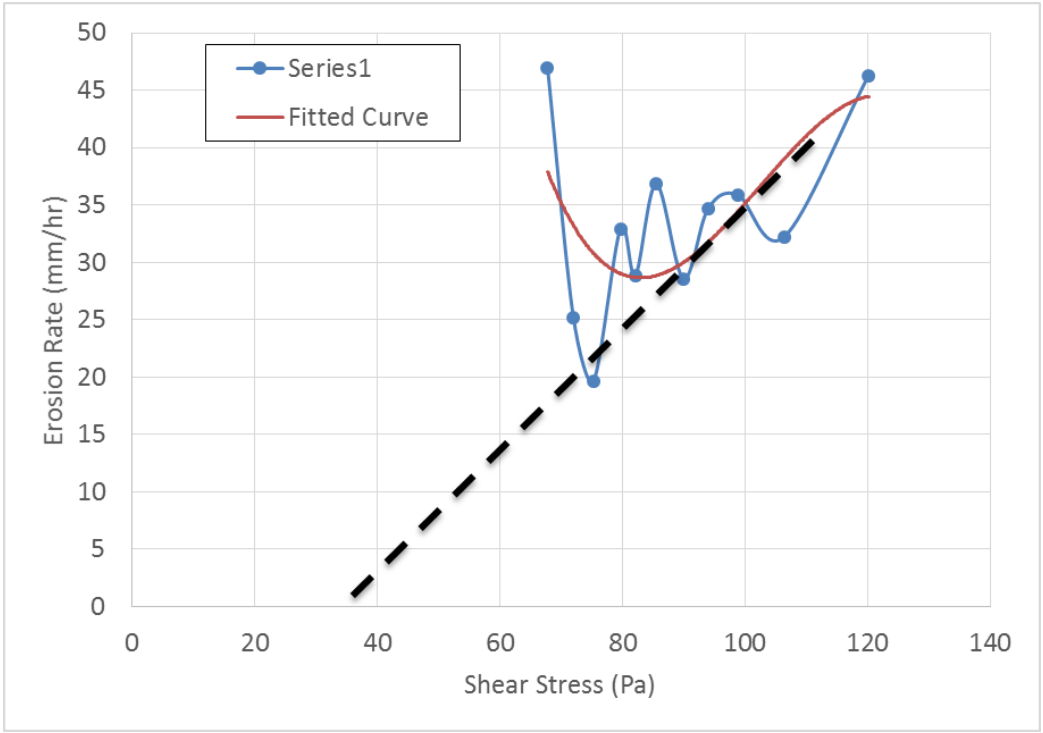
	Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
	length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
	115	3.644347826	4.2901E-05	35.2744	23.2478	0.0060000	0.0060000	8823.541	8823.541	0.006
	115	3.644347826	5.5519E-05	3.7112E+01	2.4251E+01	0.0066501	0.0067082	10302.467	10213.131	0.006708247
	115	3.644347826	6.3721E-05	3.8949E+01	2.5253E+01	0.0070757	0.0071460	11113.173	11003.796	0.007146018
	115	3.589130435	6.8768E-05	4.0787E+01	2.6256E+01	0.0074078	0.0074476	11455.787	11394.544	0.007447574
	115	3.478695652	8.3910E-05	4.2624E+01	2.7259E+01	0.0081171	0.0081763	12756.703	12664.317	0.008176269
	115	3.478695652	9.1481E-05	4.4462E+01	2.8262E+01	0.0084725	0.0085251	13324.154	13241.997	0.008525106
	115	3.36826087	1.1167E-04	4.6299E+01	2.9265E+01	0.0092771	0.0093578	14854.019	14726.036	0.009357777
	115	3.313043478	1.4511E-04	4.8136E+01	3.0268E+01	0.0103124	0.0104963	17364.146	17059.892	0.010496314
	115	3.092173913	1.7981E-04	4.9974E+01	3.1271E+01	0.0114765	0.0116710	19333.955	19011.774	0.011670984
	115	2.926521739	2.2018E-04	5.1811E+01	3.2273E+01	0.0126571	0.0128773	21467.256	21100.208	0.012877275
	115	2.849217391	2.5110E-04	5.3649E+01	3.3276E+01	0.0134981	0.0137287	22955.915	22570.344	0.013728723
	115	2.705652174	2.8958E-04	5.5945E+01	3.4530E+01	0.0146039	0.0147946	24469.656	24154.235	0.014794649
	115	2.595217391	3.1734E-04	5.7324E+01	3.5282E+01	0.0153914	0.0155417	25443.448	25197.367	0.015541685
	115	2.429565217	3.3690E-04	5.9161E+01	3.6285E+01	0.0162200	0.0162200	25631.598	25631.598	0.01622



Silt #3

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.75	2.84	24.0	5.5	18.5	470
0.50	30	0.99	3.75	24.0	5.5	18.5	470
1.00	60	1.12	4.24	24.0	5.5	18.5	470
1.50	90	1.22	4.62	24.0	5.5	18.5	470
2.00	120	1.41	5.34	24.0	5.8	18.3	464
2.50	150	1.57	5.94	24.0	6.3	17.8	451
3.00	180	1.80	6.81	24.0	6.8	17.3	438
3.50	210	2.00	7.57	24.3	7.0	17.3	438
4.00	240	2.25	8.52	24.5	7.5	17.0	432
5.00	300	2.77	10.49	24.0	8.0	16.0	406
6.00	360	3.32	12.57	24.0	8.3	15.8	400
6.50	390	3.91	14.80	25.3	8.5	16.8	425
7.00	420	4.21	15.94	25.3	8.8	16.5	419
7.50	450	4.66	17.64	25.0	9.0	16.0	406

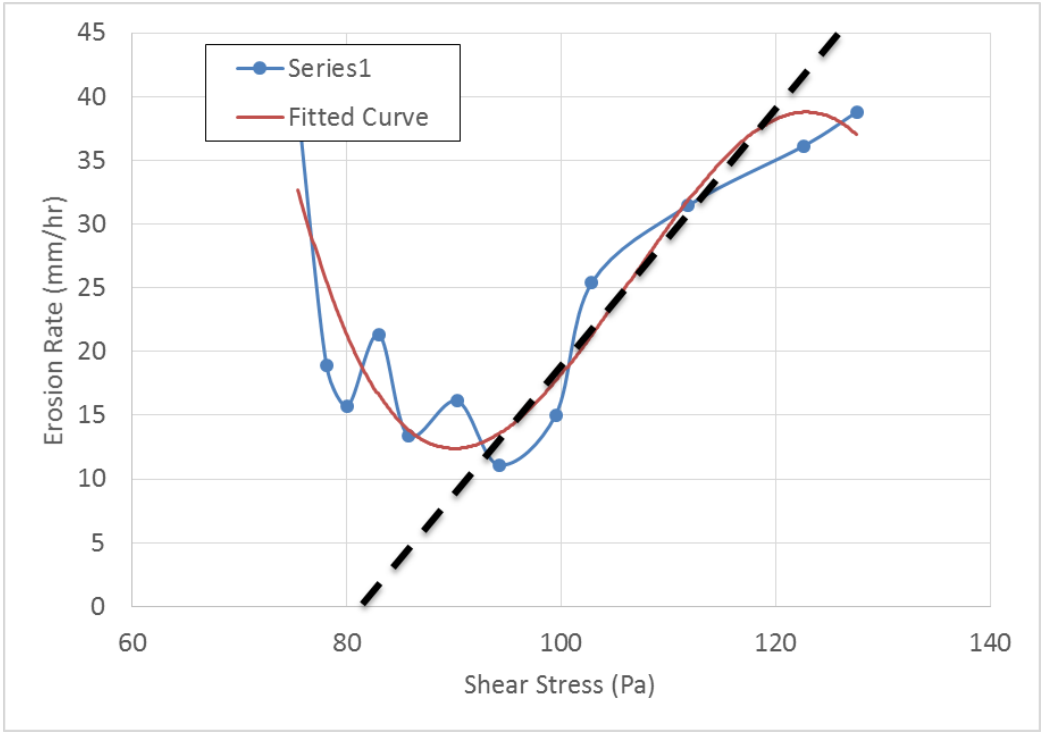
	Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
	length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
	115	4.086086957	4.7318E-05	35.8588	21.4272	0.0060000	0.0060000	9731.847	9731.847	0.006
	115	4.086086957	6.2459E-05	3.8213E+01	2.2682E+01	0.0067228	0.0067815	11464.915	11365.666	0.006781497
	115	4.086086957	7.0661E-05	4.0568E+01	2.3938E+01	0.0071461	0.0072017	12202.151	12107.828	0.007201733
	115	4.086086957	7.6970E-05	4.2923E+01	2.5193E+01	0.0074923	0.0075289	12677.388	12615.723	0.007528925
	115	4.030869565	8.8957E-05	4.5278E+01	2.6448E+01	0.0080402	0.0080776	13653.214	13590.100	0.008077589
	115	3.920434783	9.9052E-05	4.7632E+01	2.7703E+01	0.0085544	0.0085584	14288.753	14282.053	0.008558434
	115	3.81	1.1356E-04	4.9987E+01	2.8958E+01	0.0091855	0.0091722	15256.490	15278.600	0.009172215
	115	3.81	1.2618E-04	5.2342E+01	3.0214E+01	0.0096609	0.0096486	16117.438	16138.102	0.009648567
	115	3.754782609	1.4195E-04	5.4696E+01	3.1469E+01	0.0102460	0.0102265	17096.767	17129.330	0.010226509
	115	3.533913043	1.7476E-04	5.9406E+01	3.3979E+01	0.0115182	0.0114230	18723.158	18879.319	0.011422962
	115	3.478695652	2.0946E-04	6.4115E+01	3.6490E+01	0.0126162	0.0124969	20487.742	20683.413	0.012496867
	115	3.699565217	2.4668E-04	6.6470E+01	3.7745E+01	0.0132105	0.0132681	23043.226	22943.235	0.013268058
	115	3.644347826	2.6561E-04	6.8825E+01	3.9000E+01	0.0137669	0.0137974	23808.406	23755.828	0.013797398
	115	3.533913043	2.9400E-04	7.1179E+01	4.0255E+01	0.0145500	0.0145500	24934.932	24934.932	0.01455



Silt #4

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.89	3.37	26.00	5.0	21.0	533
0.50	30	1.14	4.32	26.00	5.0	21.0	533
1.00	60	1.26	4.77	26.00	5.3	20.8	527
1.50	90	1.36	5.15	26.00	5.5	20.5	521
2.00	120	1.51	5.72	26.00	5.8	20.3	514
3.00	180	1.69	6.40	26.00	6.3	19.8	502
4.00	240	1.94	7.34	26.00	6.5	19.5	495
5.00	300	2.12	8.03	26.25	6.8	19.5	495
6.00	360	2.39	9.05	26.50	7.0	19.5	495
7.00	420	2.84	10.75	26.00	7.5	18.5	470
8.00	480	3.54	13.40	26.00	7.8	18.3	464
8.50	510	4.08	15.44	27.00	8.0	19.0	483
9.00	540	4.59	17.38	28.00	9.3	18.8	476
11.00	660	4.96	18.78	28.25	10.0	18.3	464

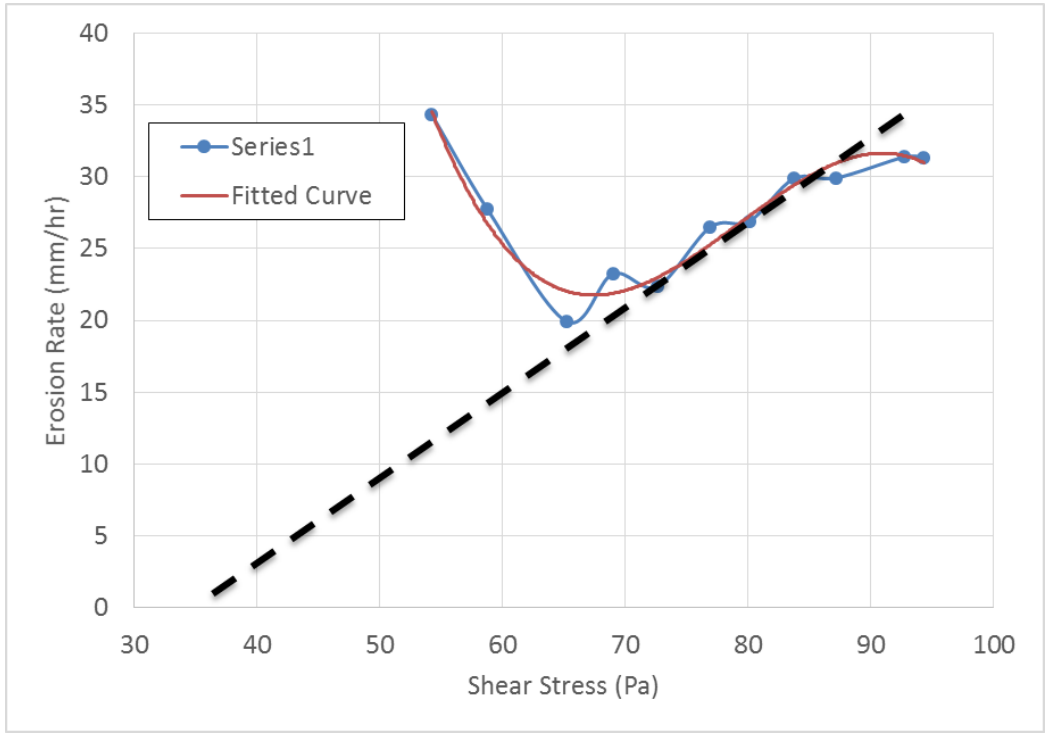
	Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
	length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
	L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
	115	4.63826087	5.6150E-05	34.3016	17.2725	0.0060000	0.0060000	11548.459	11548.459	0.006
	115	4.63826087	7.1923E-05	3.5331E+01	1.7620E+01	0.0065807	0.0066510	13487.106	13344.584	0.006650971
	115	4.583043478	7.9494E-05	3.6361E+01	1.7967E+01	0.0068969	0.0069664	14223.399	14081.537	0.006966358
	115	4.527826087	8.5803E-05	3.7391E+01	1.8314E+01	0.0071698	0.0072275	14767.883	14649.960	0.007227494
	115	4.472608696	9.5266E-05	3.8420E+01	1.8661E+01	0.0075225	0.0075833	15627.920	15502.543	0.007583318
	115	4.362173913	1.0662E-04	4.0480E+01	1.9355E+01	0.0080139	0.0080309	16418.348	16383.441	0.008030949
	115	4.306956522	1.2239E-04	4.2539E+01	2.0049E+01	0.0085673	0.0085684	17629.699	17627.362	0.008568399
	115	4.306956522	1.3375E-04	4.4599E+01	2.0743E+01	0.0089646	0.0089386	18411.547	18465.100	0.008938599
	115	4.306956522	1.5079E-04	4.6658E+01	2.1437E+01	0.0094715	0.0094396	19645.508	19711.971	0.00943959
	115	4.086086957	1.7918E-04	4.8718E+01	2.2131E+01	0.0103578	0.0102864	21346.985	21495.225	0.010286357
	115	4.030869565	2.2334E-04	5.0777E+01	2.2825E+01	0.0113534	0.0113344	24275.214	24315.820	0.011334428
	115	4.196521739	2.5741E-04	5.1807E+01	2.3172E+01	0.0118237	0.0119364	26865.293	26611.571	0.011936443
	115	4.141304348	2.8958E-04	5.2836E+01	2.3519E+01	0.0124329	0.0125828	28742.642	28400.131	0.012582809
	115	4.030869565	3.1293E-04	5.6955E+01	2.4907E+01	0.0132000	0.0132000	29254.522	29254.522	0.0132



Silt #5

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	1.03	3.90	23.50	5.5	18.0	457
0.50	30	1.21	4.58	23.50	5.5	18.0	457
1.00	60	1.35	5.11	23.50	5.5	18.0	457
2.00	120	1.52	5.75	23.50	5.5	18.0	457
2.50	150	1.65	6.25	23.50	5.5	18.0	457
3.00	180	1.78	6.74	23.50	5.5	18.0	457
3.50	210	1.96	7.42	23.50	5.5	18.0	457
4.00	240	2.14	8.10	23.75	6.0	17.8	451
4.50	270	2.36	8.93	24.00	6.5	17.5	445
5.00	300	2.59	9.80	23.50	6.3	17.3	438
6.00	360	3.09	11.70	23.50	7.0	16.5	419
7.00	420	3.56	13.48	24.00	8.8	15.3	387
8.00	480	3.89	14.73	21.00	9.0	12.0	305
9.00	540	4.06	15.37	25.50	11.0	14.5	368

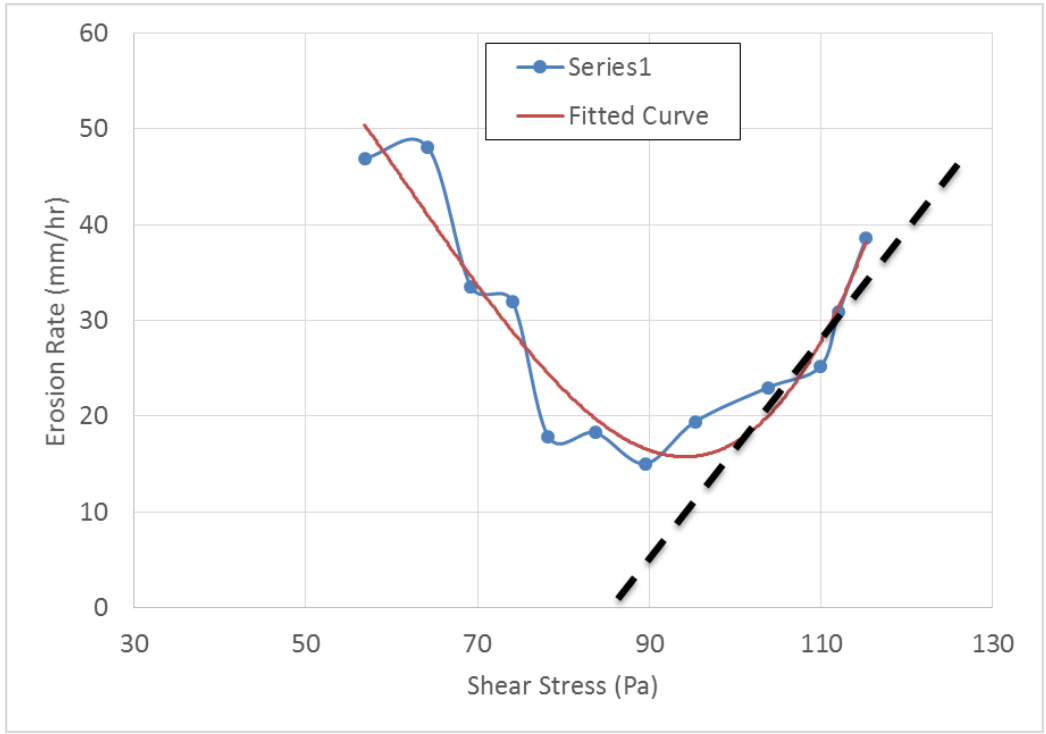
Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
115	3.975652174	6.4983E-05	14.7020	4.4423	0.0050000	0.0050000	16038.084	16038.084	0.005
115	3.975652174	7.6339E-05	1.6604E+01	5.5350E+00	0.0054942	0.0055725	17146.229	16905.161	0.005572516
115	3.975652174	8.5172E-05	1.8507E+01	6.6277E+00	0.0059082	0.0060356	17789.533	17414.028	0.006035591
115	3.975652174	9.5897E-05	2.2312E+01	8.8131E+00	0.0065417	0.0067000	18089.956	17662.488	0.006700034
115	3.975652174	1.0410E-04	2.4214E+01	9.9058E+00	0.0069090	0.0070874	18593.121	18125.245	0.007087373
115	3.975652174	1.1230E-04	2.6117E+01	1.0999E+01	0.0072668	0.0074602	19070.435	18576.193	0.007460167
115	3.975652174	1.2366E-04	2.8019E+01	1.2091E+01	0.0076819	0.0079015	19864.263	19312.174	0.007901512
115	3.920434783	1.3501E-04	2.9922E+01	1.3184E+01	0.0081231	0.0083503	20510.501	19952.441	0.008350318
115	3.865217391	1.4889E-04	3.1824E+01	1.4277E+01	0.0086073	0.0088481	21346.735	20765.707	0.008848111
115	3.81	1.6340E-04	3.3726E+01	1.5369E+01	0.0090953	0.0093468	22170.138	21573.654	0.009346765
115	3.644347826	1.9495E-04	3.7531E+01	1.7555E+01	0.0101456	0.0103928	23711.808	23147.816	0.010392828
115	3.36826087	2.2460E-04	4.1336E+01	1.9740E+01	0.0112761	0.0114384	24579.633	24230.977	0.011438375
115	2.650434783	2.4542E-04	4.5141E+01	2.1926E+01	0.0129550	0.0126970	23377.520	23852.446	0.012697024
115	3.202608696	2.5615E-04	4.8946E+01	2.4111E+01	0.0126750	0.0126750	24938.098	24938.098	0.012675



Silt #6

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.63	2.38	22.25	5.5	16.8	425
0.50	30	0.81	3.07	22.25	5.5	16.8	425
1.00	60	1.02	3.86	22.25	5.5	16.8	425
1.50	90	1.16	4.39	22.25	5.5	16.8	425
2.00	120	1.30	4.92	22.25	5.5	16.8	425
3.00	180	1.40	5.30	22.25	5.8	16.5	419
4.00	240	1.53	5.79	22.25	5.8	16.5	419
5.00	300	1.64	6.21	22.50	5.8	16.8	425
6.00	360	1.81	6.85	22.75	6.0	16.8	425
7.00	420	2.06	7.80	23.25	6.3	17.0	432
8.00	480	2.33	8.82	23.50	6.8	16.8	425
9.00	540	2.65	10.03	23.00	7.3	15.8	400
10.00	600	3.11	11.77	23.00	8.3	14.8	375
11.00	660	3.51	13.29	23.75	10.3	13.5	343

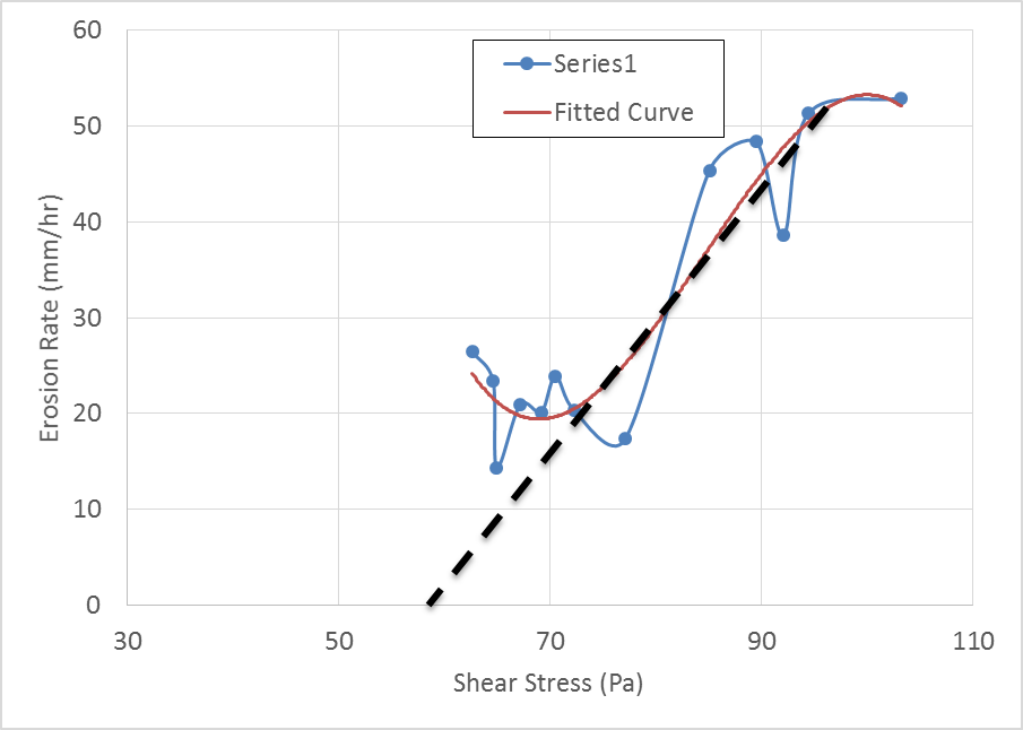
Sample length	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
115	3.699565217	3.9747E-05	29.7710	17.7953	0.0055000	0.0055000	8917.911	8917.911	0.0055
115	3.699565217	5.1103E-05	3.2949E+01	2.0936E+01	0.0061863	0.0062826	10193.921	10037.702	0.00628255
115	3.699565217	6.4352E-05	3.6128E+01	2.4076E+01	0.0068886	0.0070847	11527.980	11208.935	0.007084694
115	3.699565217	7.3185E-05	3.9306E+01	2.7216E+01	0.0073953	0.0076439	12211.953	11814.909	0.007643863
115	3.699565217	8.2017E-05	4.2485E+01	3.0356E+01	0.0078833	0.0081770	12838.623	12377.615	0.008176956
115	3.644347826	8.8326E-05	4.8842E+01	3.6636E+01	0.0085075	0.0087721	12811.863	12425.334	0.008772133
115	3.644347826	9.6528E-05	5.5198E+01	4.2917E+01	0.0091278	0.0093815	13049.949	12697.064	0.009381524
115	3.699565217	1.0347E-04	6.1555E+01	4.9197E+01	0.0096388	0.0098830	13246.704	12919.282	0.009883044
115	3.699565217	1.1419E-04	6.7912E+01	5.5478E+01	0.0102926	0.0105308	13691.055	13381.469	0.010530768
115	3.754782609	1.2997E-04	7.4269E+01	6.1758E+01	0.0110170	0.0112970	14557.518	14196.744	0.011297016
115	3.699565217	1.4700E-04	8.0626E+01	6.8038E+01	0.0118557	0.0121355	15300.754	14947.997	0.012135514
115	3.478695652	1.6719E-04	8.6983E+01	7.4319E+01	0.0129556	0.0131653	15924.843	15671.163	0.013165274
115	3.257826087	1.9621E-04	9.3340E+01	8.0599E+01	0.0143000	0.0144537	16932.108	16751.968	0.014453726
115	2.98173913	2.2145E-04	9.9697E+01	8.6879E+01	0.0156750	0.0156750	17433.510	17433.510	0.015675



Silt #7

Time	Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(mins)	(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0.00	0	0.73	2.76	24.00	5.5	18.5	470
0.50	30	0.85	3.22	23.50	5.5	18.0	457
1.00	60	0.96	3.63	23.00	5.5	17.5	445
1.50	90	1.02	3.86	22.50	5.5	17.0	432
2.00	120	1.13	4.28	22.50	5.8	16.8	425
2.50	150	1.24	4.69	22.50	6.0	16.5	419
3.00	180	1.37	5.19	22.50	6.5	16.0	406
3.50	210	1.49	5.64	22.25	6.5	15.8	400
4.00	240	1.63	6.17	22.75	6.5	16.3	413
4.50	270	2.00	7.57	23.00	6.5	16.5	419
5.00	300	2.39	9.05	23.50	7.5	16.0	406
5.50	330	2.71	10.26	23.50	8.0	15.5	394
6.00	360	3.16	11.96	23.25	8.5	14.8	375
6.50	390	3.78	14.31	24.00	9.0	15.0	381

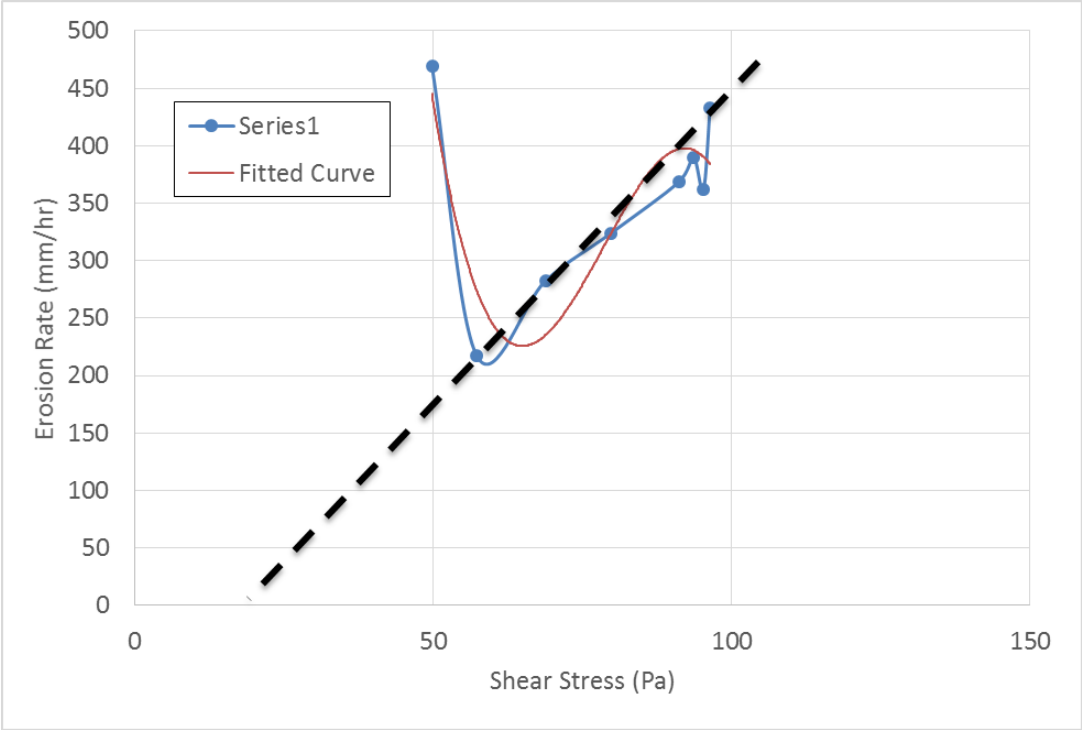
Sample	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
length			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
115	4.086086957	4.6056E-05	36.8412	22.6173	0.0060000	0.0060000	9472.331	9472.331	0.006
115	3.975652174	5.3627E-05	3.8240E+01	2.3135E+01	0.0064498	0.0064407	10260.260	10274.701	0.006440728
115	3.865217391	6.0567E-05	3.9640E+01	2.3653E+01	0.0068619	0.0068304	10892.131	10942.378	0.006830379
115	3.754782609	6.4352E-05	4.1039E+01	2.4170E+01	0.0071522	0.0070693	11103.180	11233.392	0.00706927
115	3.699565217	7.1292E-05	4.2438E+01	2.4688E+01	0.0075208	0.0074181	11697.727	11859.613	0.007418109
115	3.644347826	7.8232E-05	4.3837E+01	2.5205E+01	0.0078810	0.0077542	12249.662	12449.960	0.007754235
115	3.533913043	8.6434E-05	4.5236E+01	2.5723E+01	0.0083180	0.0081526	12822.923	13083.045	0.008152617
115	3.478695652	9.4004E-05	4.6635E+01	2.6241E+01	0.0086869	0.0084914	13353.893	13661.232	0.008491447
115	3.589130435	1.0284E-04	4.8035E+01	2.6758E+01	0.0089458	0.0087814	14185.793	14451.353	0.008781412
115	3.644347826	1.2618E-04	4.9434E+01	2.7276E+01	0.0096201	0.0095376	16185.850	16325.853	0.009537606
115	3.533913043	1.5079E-04	5.0833E+01	2.7794E+01	0.0104103	0.0103441	17873.884	17988.333	0.010344089
115	3.423478261	1.7097E-04	5.2232E+01	2.8311E+01	0.0110709	0.0109871	19057.809	19203.187	0.010987054
115	3.257826087	1.9936E-04	5.3631E+01	2.8829E+01	0.0119516	0.0118427	20584.708	20774.105	0.011842681
115	3.313043478	2.3848E-04	5.5031E+01	2.9346E+01	0.0127250	0.0127250	23126.999	23126.999	0.012725



Teton Dam Left Core

Time	Flowrate		U/S Tube	D/S Tube	Pressure Differential	
(s)	(gpm)	(l/min)	in	in	(in)	(mm)
0	0.71	2.69	14.3	5.00	9.3	236
15	0.79	2.99	14.3	5.00	9.3	236
30	0.86	3.26	14.3	5.25	9.1	230
45	1.12	4.24	14.3	5.25	9.1	230
60	1.49	5.64	14.3	5.50	8.8	224
75	2.00	7.57	14.3	5.75	8.5	216
90	2.51	9.50	14.3	6.75	7.5	191
105	3.00	11.36	15.5	8.75	6.8	171
120	3.66	13.85	16.5	10.50	6.0	152
180	4.51	17.07	18.0	12.00	6.0	152

Sample length	Gradient	Flow rate	Friction Factor		Hole diameter (m)		Reynold's No.		Diameter
			If Laminar	If Turbulent	If Laminar	If Turbulent	If Laminar	If Turbulent	
L (mm)	S	Q (m3/s)	f_l	f_t	D_l	D_t	Re(l)	Re(t)	D (m)
115	2.054086957	4.4794E-05	19.0419	12.0194	0.0060000	0.0060000	9212.815	9212.815	0.006
115	2.054086957	4.9841E-05	4.9446E+01	1.1919E+02	0.0085457	0.0099076	7197.207	6207.860	0.009907646
115	1.998869565	5.4258E-05	7.9850E+01	2.2636E+02	0.0104080	0.0117165	6433.074	5714.597	0.011716505
115	1.998869565	7.0661E-05	1.1025E+02	3.3353E+02	0.0126564	0.0140719	6889.562	6196.554	0.01407191
115	1.943652174	9.4004E-05	1.4066E+02	4.4070E+02	0.0152387	0.0167716	7612.460	6916.658	0.016771628
115	1.877391304	1.2618E-04	1.7106E+02	5.4787E+02	0.0181515	0.0198441	8578.339	7846.625	0.019844144
115	1.656521739	1.5836E-04	2.0147E+02	6.5504E+02	0.0215573	0.0230930	9064.914	8462.126	0.023092953
115	1.490869565	1.8927E-04	2.3187E+02	7.6221E+02	0.0248320	0.0261079	9405.789	8946.129	0.026107865
115	1.325217391	2.3091E-04	2.6228E+02	8.6939E+02	0.0287532	0.0297148	9910.161	9589.446	0.0297148
115	1.325217391	2.8454E-04	3.8389E+02	1.2981E+03	0.0350000	0.0350000	10032.144	10032.144	0.035



APPENDIX 2 – GEOTECHNICAL PROPERTIES SPREADSHEETS

Clay Samples - EFA

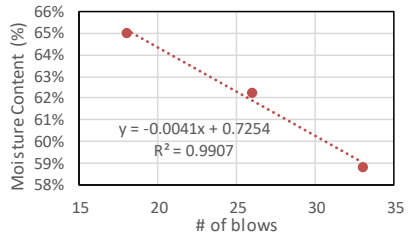
B-1 (4'-6') Beaumont Formation - Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (4'-6')	Iman Shafii	B-1	6/30/2017	Clay	From :	4	2	
						To :	6		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4916	Wet Density	Wet Denisty (kN/m3)	18.92
height (ft)	0.492	h	Depth of middle of the core (ft)	0.246				Sample Diameter (ft)	0.229		Wet Denisty (pcf)	120.5
								Sample Volume (ft^3)	0.0202	Dry Density	Dry Denisty (kg/m^3)	1533.4
height (mm)	149.929	d	Depth of lower side of the core (ft)	0.492	Core Diameter (ft)	0.229		Sample weight (lb)	2.439		Dry Denisty (kN/m^3)	15.04
								Wet Denisty (pcf)	120.46		Dry Denisty (pcf)	95.7

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	4.25	3	1	23.9	22.9	19.3	18.3	4.6	18.3	25.14%
2	4.25	45	1	15.3	14.3	12.3	11.3	3	11.3	26.55%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.246	25-35	33	W	1	9.1	6.1	58.8%
2		20-30	26	A	1	8.3	5.5	62.2%
3		15-25	18	#45	1	10.9	7	65.0%
Liquid Limit		62.3%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	4.246	$3	1	9.9	8.3	21.9%
	2	4.246	B1	1	11	9.2	22.0%
Average Plastic Limit	21.93%		Plasticity Index	40.36%	Liquidity Index	9.68%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	1.36666667	39.2	Type B

Notes:

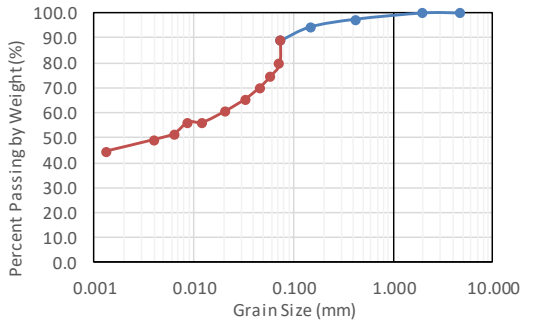
Pocket Erodometer was almost 0.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-1 (4’-6’) Beaumont Formation - Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (4'-6')	Iman Shafii	Beaumont Fromation, Light brown	Cemented	29.76915, -95.17980	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	350.0	350.0	0.0	0.0	100.0
		10	2.00	475.0	475.0	0	0.0	100.0
0.4	161.4	40	0.43	363.0	367.0	4	2.5	97.5
		100	0.15	321.0	326.0	5	5.6	94.4
		200	0.07	317.0	326.0	9	11.2	88.85
		Pan	0.00	360.0	503.4	143.4	100.0	0.0
		∑ soil mass after sieve (gr)		161.4				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	11.2%	88.8%	N/A	N/A	0.00489	0.01961	#VALUE!	#VALUE!	CH	A-7-6 (39.2)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.5	6.5	1	151H
0.4	30				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	61.992	99.98197	0.9981	161.78	17.77	173	2.725
						$G_{s,\ 20c}$	2.725051	

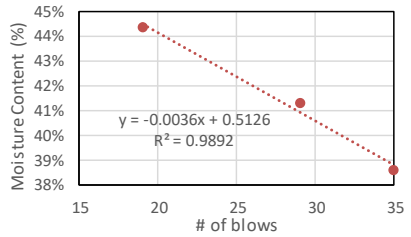
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.12	0.116667	1.023	0.003	1.0200	19.4	0.01354	10.2	0.074000	100.00	143.40	88.85
0.38	0.383333	1.02	0.003	1.0170	19.4	0.01354	11.00	0.072542	89.52	128.37	79.53
0.58	0.583333	1.019	0.003	1.0160	19.4	0.01354	11.30	0.059602	84.25	120.81	74.85
1	1	1.018	0.003	1.0150	19.4	0.01354	11.50	0.045923	78.98	113.26	70.18
2	2	1.017	0.003	1.0140	19.4	0.01354	11.8	0.032893	73.72	105.71	65.50
5	5	1.016	0.003	1.0130	19.1	0.01359	12.1	0.021146	68.45	98.16	60.82
15	15	1.015	0.003	1.0120	18.7	0.01366	12.3	0.012371	63.19	90.61	56.14
30	30	1.015	0.003	1.0120	18.3	0.01373	12.3	0.008791	63.19	90.61	56.14
60	60	1.014	0.003	1.0110	17.7	0.01383	12.6	0.006340	57.92	83.06	51.46
155	155	1.0135	0.003	1.0105	16.6	0.01403	12.8	0.004024	55.29	79.28	49.12
1466	1466	1.0125	0.003	1.0095	16.3	0.01409	13.0	0.001326	50.02	71.73	44.44

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (28'-30')	Iman Shafii	B-1	7/26/2017	Clay	From :	28	2	
						To :	30		

Sample Dimensions			Depth of upper side of the core (ft)	28	Notes:		Density Calcs.	Sample Height (ft)	0.5118	Wet Density	Wet Denisty (kN/m3)	20.95
height (ft)	0.512	h	Depth of middle of the core (ft)	28.256				Sample Diameter (ft)	0.2313		Wet Denisty (pcf)	133.4
								Sample Volume (ft^3)	0.0215	Dry Density	Dry Denisty (kg/m^3)	1824.6
height (mm)	156.102	d	Depth of lower side of the core (ft)	28.512	Core Diameter (ft)	0.231		Sample weight (lb)	2.8687		Dry Denisty (kN/m^3)	17.89
								Wet Denisty (pcf)	133.39		Dry Denisty (pcf)	114

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	56.26	M	1	18.7	17.7	16.4	15.4	2.3	15.4	14.94%
2	56.26	$33	1	20.8	19.8	17.6	16.6	3.2	16.6	19.28%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	56.256	25-35	35	$3	1	10.7	8	38.6%
2		20-30	29	45	1	9.9	7.3	41.3%
3		15-25	19	G9	1	10.6	7.65	44.4%
Liquid Limit		42.26%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	56.256	A	1	11.4	10	15.6%
	2	56.256	B1	1	6.5	5.75	15.8%
Average Plastic Limit	15.7%		Plasticity Index	26.6%	Liquidity Index	5.4%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	S_u (kPa)*	
	19	29	90	N/A	3.50	100.5	Type A

Notes:

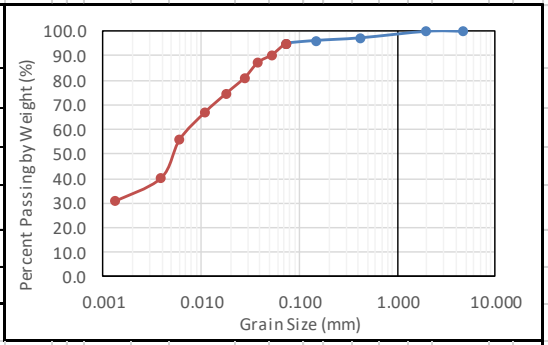
Pocket Erodometer was almost 6 mm at some loose parts and 0 at stiff parts.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-1 (28’-30’) Beaumont Formation - Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (28'-30')	Iman Shafii	Beaumont Formation, Brown	Cemented	29.58344, -95.86388	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	450.0	450.0	0.0	0.0	100.0
		10	2.000	378.0	378.0	0	0.0	100.0
0.425	186	40	0.425	362.0	367.0	5	2.7	97.3
		100	0.149	320.0	322.0	2	3.8	96.2
		200	0.074	316.0	318.0	2	4.8	95.2
		Pan	0.000	359.0	536.0	177	100.0	0.0
		∑ soil mass after sieve (gr)		186				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	4.8%	95.2%	N/A	0.00132	0.00526	0.007877	#VALUE!	#VALUE!	CL	A-7-6 (26)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	5.2	5	0.961538462	151H
0.425	50.11				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
19.72	100006	63.36	99.89281	0.9983	163.08	5.02	166.2	2.699
						$G_{s,\ 20c}$	2.699087	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0325	0.003	1.0295	21.3	0.01323	7.7	0.074000	97.26	172.15	95.16
0.25	0.25	1.0325	0.003	1.0295	21.3	0.01323	7.70	0.073435	97.26	172.15	95.16
0.50	0.5	1.031	0.003	1.0280	21.3	0.01323	8.10	0.053258	92.31	163.40	90.46
1	1	1.03	0.003	1.0270	21.3	0.01323	8.40	0.038350	89.02	157.56	87.32
2	2	1.028	0.003	1.0250	21.3	0.01323	8.9	0.027913	82.42	145.89	81.05
5	5	1.026	0.003	1.0230	20.9	0.01330	9.4	0.018231	75.83	134.22	74.77
15	15	1.0235	0.003	1.0205	20.6	0.01334	10.1	0.010950	67.59	119.63	66.93
54	54	1.02	0.003	1.0170	19.8	0.01347	11.0	0.006081	56.05	99.20	55.95
148	148	1.015	0.003	1.0120	18.9	0.01363	12.3	0.003928	39.56	70.03	40.26
1495	1495	1.012	0.003	1.0090	16.2	0.01410	13.1	0.001320	29.67	52.52	30.85

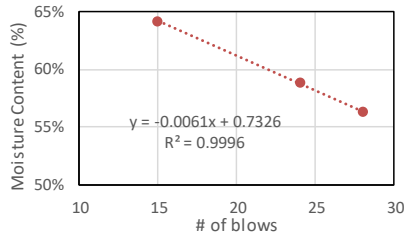
B-2 (13’-15’) Beaumont Formation - Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-2 (13'-15')	Iman Shafii	B-2	3/26/2017	Clay	From :	13	2	
						To :	15		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4895	Wet Density	Wet Denisty (kN/m3)	21.49
height (ft)	0.490	h	Depth of middle of the core (ft)	0.245				Sample Diameter (ft)	0.2309		Wet Denisty (pcf)	136.8
								Sample Volume (ft^3)	0.0205	Dry Density	Dry Denisty (kg/m^3)	1842.4
height (mm)	149.298	d	Depth of lower side of the core (ft)	0.490	Core Diameter (ft)	0.231		Sample weight (lb)	2.8043		Dry Denisty (kN/m^3)	18.07
								Wet Denisty (pcf)	136.78		Dry Denisty (pcf)	115

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.24	29	0.9	40.4	39.5	34.2	33.3	6.2	33.3	18.62%
2	0.24	45	0.9	56.7	55.8	47.7	46.8	9	46.8	19.23%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.245	25-35	28	G1	0.9	8.4	5.7	56.3%
2		20-30	24	2	1	9.1	6.1	58.8%
3		15-25	15	15	1	9.7	6.3	64.2%
Liquid Limit		58.01%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.245	29	1	5.2	4.4	23.5%
	2	0.245	45	1	4.4	3.8	21.4%
Average Plastic Limit	22.48%		Plasticity Index	35.53%	Liquidity Index	-10.00%	

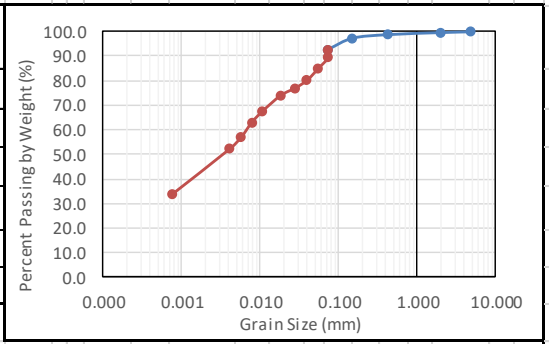
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was 1.63 mm
H, D	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					5	143.5		

B-2 (13’-15’) Beaumont Formation - Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-2 (13'-15')	Iman Shafii	Beaumont Formation, Red	Uncemented	29.58296, -95.86375	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.7	0.7	0.0	100.0
		10	2.00	624	624.8	0.8	0.3	99.7
2	456.5	40	0.43	362	365.9	3.9	1.2	98.8
		100	0.15	322	328.8	6.8	2.7	97.3
		200	0.07	317	337.8	20.8	7.2	92.8
		Pan	0.00	360.0	783.5	423.5	100.0	0.0
		∑ soil mass after sieve (gr)		456.5				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.2%	7.1%	92.8%	N/A	0.0006	0.00368	0.00676	#VALUE!	#VALUE!	CH	A-7-6 (36.6)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	18.6	18.1	0.97311828	151H
2	51.31				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	69.236	99.90744	0.9976	168.9	8.22	173.9	2.514
						$G_{s,\ 20c}$	2.512158	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.1	0.01363	7.3	0.074000	100.00	423.50	92.77
0.25	0.25	1.033	0.003	1.0300	24.1	0.01363	7.30	0.073674	99.82	422.72	89.41
0.50	0.5	1.0315	0.003	1.0285	24.1	0.01363	7.95	0.054365	94.83	401.59	84.78
1	1	1.03	0.003	1.0270	24.1	0.01363	8.40	0.039515	89.84	380.45	80.15
2	2	1.029	0.003	1.0260	24.1	0.01363	8.6	0.028272	86.51	366.36	77.06
5	5	1.028	0.003	1.0250	23.9	0.01367	8.9	0.018233	83.18	352.27	73.98
15	15	1.026	0.003	1.0230	23.6	0.01371	9.4	0.010856	76.53	324.09	67.80
30	30	1.0245	0.003	1.0215	23.5	0.01373	9.9	0.007867	71.54	302.95	63.17
60	60	1.0225	0.003	1.0195	23.3	0.01376	10.4	0.005716	64.88	274.77	57.00
120	120	1.021	0.003	1.0180	23.3	0.01376	10.7	0.004109	59.89	253.63	52.37
4080	4080	1.015	0.003	1.0120	23.6	0.01371	12.3	0.000753	39.93	169.09	33.85

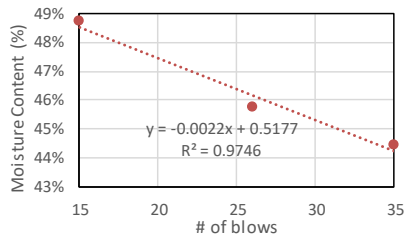
B-6 (0'-2') Beaumont Formation - Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-6 (0'-2')	Iman Shafii	B-6	4/19/2017	Clay	From :	0	2	
						To :	2		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4406	Wet Density	Wet Denisty (kN/m3)	19.72
height (ft)	0.441	h	Depth of middle of the core (ft)	0.220				Sample Diameter (ft)	0.2314		Wet Denisty (pcf)	125.5
								Sample Volume (ft^3)	0.0185	Dry Density	Dry Denisty (kg/m^3)	1722.2
height (mm)	134.371	d	Depth of lower side of the core (ft)	0.441	Core Diameter (ft)	0.231		Sample weight (lb)	2.3268		Dry Denisty (kN/m^3)	16.89
								Wet Denisty (pcf)	125.55		Dry Denisty (pcf)	108

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.22	29	0.9	11.2	10.3	9.7	8.8	1.5	8.8	17.05%
2	0.22	#1B	1	13	12	11.3	10.3	1.7	10.3	16.50%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.220	25-35	35	A	1	10.1	7.3	44.4%
2		20-30	26	B	1	9.6	6.9	45.8%
3		15-25	15	H	1	12.6	8.8	48.7%
Liquid Limit		46.27%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.220	G1	1	12	10.4	17.0%
	2	0.220	45	1.1	12.6	10.8	18.6%
Average Plastic Limit	17.79%		Plasticity Index	28.48%	Liquidity Index	-3.56%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	S_u (kPa)*	
	19	29	90	N/A	> 4.5	> 129	Type A

Notes:

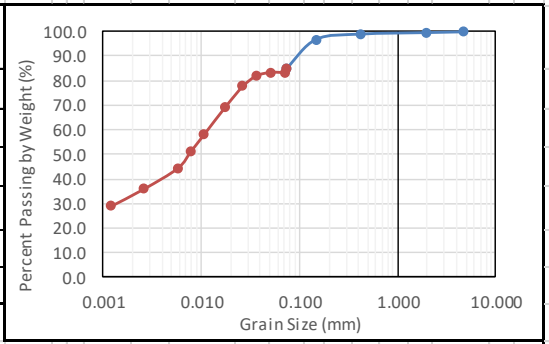
Pocket Erodometer was almost 0 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-6 (0’-2’) Beaumont Formation - Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-6 (0'-2')	Iman Shafii	Beaumont Form., Dark Brown/	cemented	29.63747, -95.57872	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.5	501.6	0.1	0.0	100.0
		10	2.000	623.8	625.1	1.3	0.3	99.7
2	460	40	0.425	362.7	365.5	2.8	0.9	99.1
		100	0.149	321.0	331.0	10	3.1	96.9
		200	0.074	316.9	372.1	55.2	15.1	84.92
		Pan	0.000	252.3	643.1	390.8	100.0	0.0
		∑ soil mass after sieve (gr)		460.2				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	15.1%	84.9%	N/A	0.0012	0.00743	0.0118	#VALUE!	#VALUE!	CL	A-7-6 (24.5)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	14.9	14.5	0.973154362	151H
2	50				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	102.866	249.4379	0.9981	351.82	20.59	364.7	2.684
						$G_{s,\ 20c}$	2.684082	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0325	0.003	1.0295	23.7	0.01306	7.7	0.074000	96.63	377.62	84.92
0.25	0.25	1.032	0.003	1.0290	23.7	0.01306	7.80	0.072938	94.99	371.22	83.53
0.50	0.5	1.032	0.003	1.0290	23.7	0.01306	7.80	0.051575	94.99	371.22	83.53
1	1	1.0315	0.003	1.0285	23.7	0.01306	7.95	0.036818	93.35	364.82	82.14
2	2	1.03	0.003	1.0270	23.7	0.01306	8.4	0.026761	88.44	345.62	77.96
5	5	1.027	0.003	1.0240	23.4	0.01311	9.2	0.017778	78.61	307.22	69.62
15	15	1.023	0.003	1.0200	23.3	0.01312	10.2	0.010821	65.51	256.01	58.49
30	30	1.0205	0.003	1.0175	23.2	0.01314	10.9	0.007901	57.32	224.01	51.53
60	60	1.018	0.003	1.0150	22.8	0.01320	11.5	0.005779	49.13	192.01	44.57
312	312	1.015	0.003	1.0120	22.4	0.01326	12.3	0.002633	39.31	153.61	36.22
1440	1440	1.0125	0.003	1.0095	25.0	0.01286	13.1	0.001224	31.12	121.61	29.27

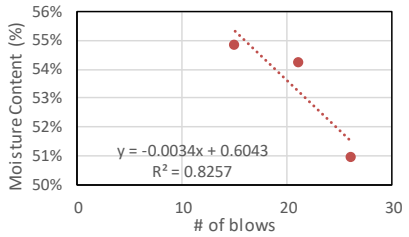
B-8 (2'-4') 5694 Alluvium - Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-8 (2'-4')	Iman Shafii	B-8	4/20/2017	Clay	From :	2	2	
						To :	4		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3347	Wet Density	Wet Denisty (kN/m3)	18.34
height (ft)	0.335	h	Depth of middle of the core (ft)	0.167				Sample Diameter (ft)	0.2395		Wet Denisty (pcf)	116.7
								Sample Volume (ft^3)	0.0151	Dry Density	Dry Denisty (kg/m^3)	1523.7
height (mm)	102.097	d	Depth of lower side of the core (ft)	0.335	Core Diameter (ft)	0.239		Sample weight (lb)	1.76		Dry Denisty (kN/m^3)	14.94
								Wet Denisty (pcf)	116.72		Dry Denisty (pcf)	95.1

Moisture Content				Wet		Dry				
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)	Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
1	2.17	#1B	1	26.9	25.9	22.2	21.2	4.7	21.2	22.17%
2	2.17	3	1	30.7	29.7	25.1	24.1	5.6	24.1	23.24%

Liquid Limit						Wet	Dry		
Test #	Core depth at middle (ft)	Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	
1	2.167	25-35	26	33	1	8.7	6.1	51.0%	
2		20-30	21	xx	1	10.1	6.9	54.2%	
3		15-25	15	z	1	10.6	7.2	54.8%	
Liquid Limit		51.93%		Notes:					



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	2.167	M	1.1	10.2	8.6	21.3%
	2	2.167	2	1	13.6	11.4	21.2%
Average Plastic Limit	21.24%		**Plasticity Index**	30.69%	**Liquidity Index**	4.76%	

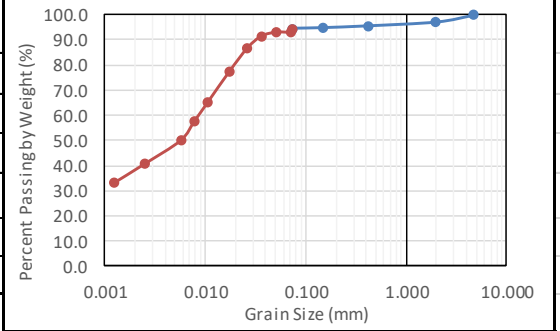
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was less than 1 mm.
					tsf or kg/cm²	S_u (kPa)*		* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
	19	29	90	N/A	4.367	125.3	Type A	

B-8 (2'-4') 5694 Alluvium - Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-8 (2'-4')	Iman Shafii	Alluvium, Brown	Cemented	29.07225, -9559505	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.7	503.9	2.2	0.0	100.0
		10	2.000	624.1	630.7	6.6	2.9	97.1
3	301.6	40	0.425	362.9	367.7	4.8	4.5	95.5
		100	0.149	321.2	323.5	2.3	5.3	94.7
		200	0.074	316.9	317.7	0.8	5.5	94.46
		Pan	0.000	252.4	537.0	284.6	100.0	0.0
		∑ soil mass after sieve (gr)		301.3				
		Error (%)		0.1%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	4.8%	94.5%	N/A	0.001	0.005752	0.00878	#VALUE!	#VALUE!	CH	A-7-6(31.9)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	16.1	15.7	0.97515528	151H
3	50.31				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	101.37	249.7946	0.9981	350.68	22.56	364.8	2.679
						$G_{s,\ 20c}$	2.678933	

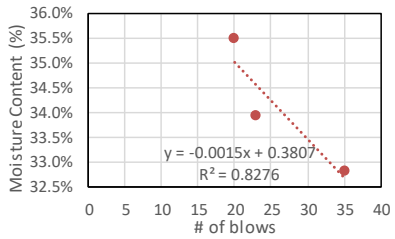
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0325	0.003	1.0295	24.0	0.01301	7.7	0.074000	95.95	273.06	94.46
0.25	0.25	1.032	0.003	1.0290	24.0	0.01301	7.80	0.072670	94.32	268.43	92.92
0.50	0.5	1.032	0.003	1.0290	24.0	0.01301	7.80	0.051385	94.32	268.43	92.92
1	1	1.0315	0.003	1.0285	24.0	0.01301	7.95	0.036683	92.69	263.80	91.39
2	2	1.03	0.003	1.0270	24.0	0.01301	8.4	0.026663	87.81	249.92	86.78
5	5	1.027	0.003	1.0240	23.7	0.01306	9.2	0.017713	78.06	222.15	77.58
15	15	1.023	0.003	1.0200	23.7	0.01306	10.2	0.010768	65.05	185.13	65.30
30	30	1.0205	0.003	1.0175	23.3	0.01312	10.9	0.007891	56.92	161.98	57.63
60	60	1.018	0.003	1.0150	23.2	0.01314	11.5	0.005752	48.79	138.84	49.96
335	335	1.015	0.003	1.0120	22.3	0.01328	12.3	0.002544	39.03	111.08	40.75
1386	1386	1.0125	0.003	1.0095	25.0	0.01286	13.1	0.001248	30.90	87.93	33.08

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-7-16	Iman Shafii	B-7-16	2-Dec	Clay	From :	8		
						To :	10.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	0.000	Notes: Tube was deformed, from 9' to 10.5'		Density Calcs.	Sample Height (ft)	0.183	Wet Density	Wet Denisty (kN/m3)	18.5
height (ft)	0.183	h	Depth of middle of the core (ft)	0.092				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	117.9
								Sample Volume (ft^3)	0.009	Dry Density	Dry Denisty (kg/m^3)	1585.0
height (mm)	55.917	d	Depth of lower side of the core (ft)	0.183	Core Diameter (ft)	0.25		Sample weight (lb)	1.061		Dry Denisty (kN/m^3)	15.5
								Wet Denisty (pcf)	117.9		Dry Denisty (pcf)	99

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	8.5'	50	0.8	25.2	24.4	21.3	20.5	3.9	20.5	19.02%
2	8.5'	45	0.9	23.8	22.9	20.1	19.2	3.7	19.2	19.27%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	8.09	25-35	35	Z	1	9.5	7.4	32.8%
2		20-30	23	#1B	1.1	8.6	6.7	33.9%
3		15-25	20	XX	1.1	9.5	7.3	35.5%
Liquid Limit (%)		34.3%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	8.09	G1	1.1	9.2	8.1	15.7%
	2						#DIV/0!
Average Plastic Limit (%)	15.7%		Plasticity Index	18.6%	Liquidity Index	18.45%	

Notes:

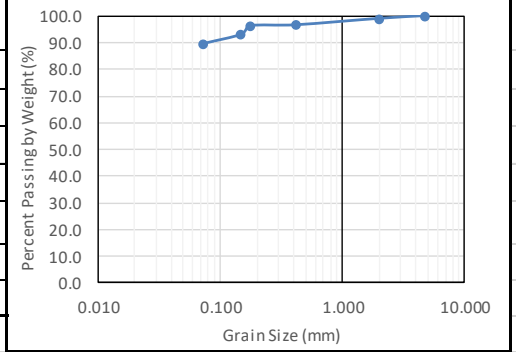
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		OSHA Category
					Unconfined Strength		
					tsf or kg/cm^2	kPa	
	19	29	90	34	1.5	143.5	Type A

Notes:

Pocket Erodometer was 2.08 mm

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-7-16	Iman Shafii	Alcona Dam, Light Brown	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	506.0	5	0.0	100.0
		10	2.00	624	625.0	1	1.0	99.0
4.8	590	40	0.43	363	377.0	14	3.4	96.6
		80	0.18	524	526.0	2	3.7	96.3
		100	0.15	321	340.0	19	6.9	93.1
		200	0.07	317	337.0	20	10.3	89.7
		Pan	0.00	360	889.0	529	100.0	0.0
		∑ soil mass after sieve (gr)		590				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	9.5%	89.7%	N/A	N/A	N/A	N/A	#VALUE!	#VALUE!	CL	A-7-6 (15.8)

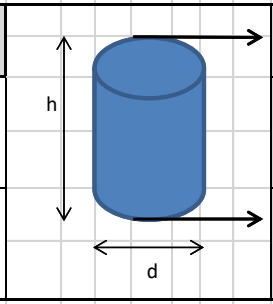
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H
4.8					

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	Ms	$M_{pws,t}$	G_t
22.1	0.99954	102.834	249.4372	0.9978	351.71	17	362.6	2.78
						$G_{s,\ 20c}$	2.781044	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333		0.003	-0.0030				0.074000	#######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	#######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	#######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	#######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	#######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	#######	#DIV/0!	####
15	15		0.003	-0.0030				0.000000	#######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	#######	#DIV/0!	####
60	60		0.003	-0.0030				0.000000	#######	#DIV/0!	####
120	120		0.003	-0.0030				0.000000	#######	#DIV/0!	####
1440	1440		0.003	-0.0030				0.000000	#######	#DIV/0!	####

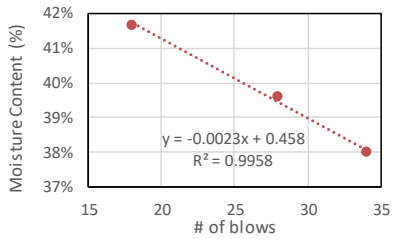
B-7-16 (10.5'-13') Bottom - Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-7-16	Iman Shafii	B-7-16	1-Dec	Clay	From :	10.5		
						To :	13	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	10.813	Notes: Sample was not excatly from 10.5 to 13'. There was 3.75" missing at 10.5'. So it started at 10.813'.		Density Calcs.	Sample Height (ft)	0.292	Wet Density	Wet Denisty (kN/m3)	18.5
height (ft)	2.188		Depth of middle of the core (ft)	11.906				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	117.8
height (mm)	667.188		Depth of lower side of the core (ft)	13.000	Core Diameter (ft)	0.25		Sample Volume (ft^3)	0.0143	Dry Density	Dry Denisty (kg/m^3)	1428.9
								Sample weight (lb)	1.686		Dry Denisty (kN/m^3)	14
								Wet Denisty (pcf)	117.79		Dry Denisty (pcf)	89.2

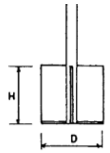
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	11.91	122	1	25.5	24.5	19.3	18.3	6.2	18.3	33.88%
2	11.91	#1B	15.08	77.22	62.14	62.8	47.72	14.42	47.72	30.22%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	11.91	25-35	34	45	1	7.9	6	38%
2		20-30	28	49	0.9	7.6	5.7	40%
3		15-25	18	122	1	6.1	4.6	42%
Liquid Limit (%)		40.05%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	11.91	O	1	15.3	13.1	18%
	2						#DIV/0!
Average Plastic Limit (%)	18.18%		Plasticity Index	21.87%	Liquidity Index	63.41%	

Notes:

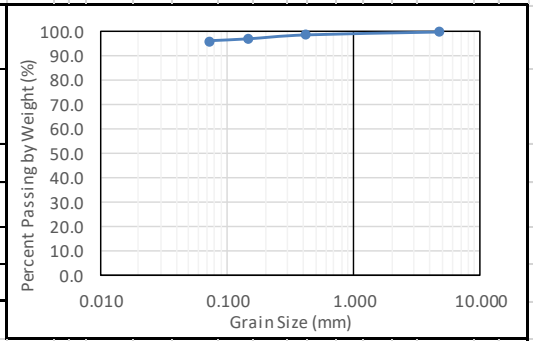
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	115	3.375	322.9	Type A

Notes:

Pocket Erodometer was ~1 mm

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	B-7-16	Iman Shafii	Alcona Dam, Light Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	507.6	6.6	0.0	100.0
4.8	1094	40	0.425	362	369.4	7.4	1.3	98.7
		100	0.149	321	340.2	19.2	3.0	97.0
		200	0.074	317	326.1	9.1	3.9	96.1
		Pan	0.000	360	1411.7	1051.7	100.0	0.0
		∑ soil mass after sieve (gr)		1094				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.6%	3.3%	96.1%	N/A	N/A	N/A	N/A	#VALUE!	#VALUE!	CL	A-7-6 (21.9)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	-	-	#VALUE!	151H
4.8	-				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	Ms	$M_{pws,t}$	G_t
22.1	0.99954	102.25	246.4345	0.9978	348.13	22.89	362.6	2.72
						$G_{s,\ 20c}$	2.717277	

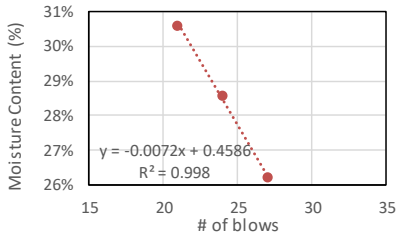
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333		0.003	-0.0030				0.074000	######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	######	#DIV/0!	####
15	15		0.003	-0.0030				0.000000	######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	######	#DIV/0!	####
60	60		0.003	-0.0030				0.000000	######	#DIV/0!	####
120	120		0.003	-0.0030				0.000000	######	#DIV/0!	####
1440	1440		0.003	-0.0030				0.000000	######	#DIV/0!	####

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-7-16 (bottom)	Iman Shafii	B-7-16	5-Dec	Clay	From :	13		
						To :	15.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	15.292	Notes:		Density Calcs.	Sample Height (ft)	0.083	Wet Density	Wet Denisty (kN/m3)	19.5
height (ft)	0.083	h	Depth of middle of the core (ft)	15.333				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	124.4
								Sample Volume (ft^3)	0.0041	Dry Density	Dry Denisty (kg/m^3)	1744.0
height (mm)	25.417	d	Depth of lower side of the core (ft)	15.375	Core Diameter (ft)	0.25		Sample weight (lb)	0.509		Dry Denisty (kN/m^3)	17.1
								Wet Denisty (pcf)	124.43		Dry Denisty (pcf)	109

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	15.33	29	0.9	26.3	25.4	23.1	22.2	3.2	22.2	14.41%
2	15.33	122	0.9	13.8	12.9	12.2	11.3	1.6	11.3	14.16%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	15.33	25-35	27	H	1.1	8.8	7.2	26.2%
2		20-30	24	A	1.1	10.1	8.1	28.6%
3		15-25	21	122.00	1	8.9	7.05	30.6%
Liquid Limit (%)		27.86%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	15.29	175	1	20.6	18.2	13.95%
	2						#DIV/0!
Average Plastic Limit (%)	13.95%		Plasticity Index	13.91%	Liquidity Index	2.40%	

Notes:

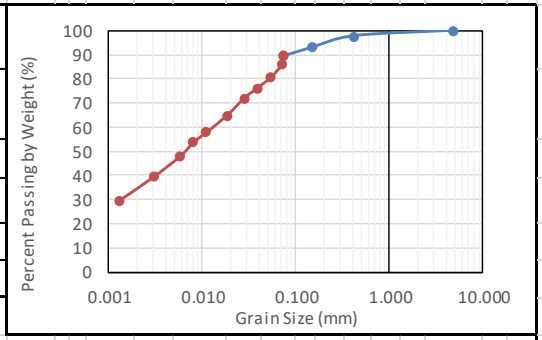
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	123	4.5	430.5	Type A

Notes:

Pocket Penetrometer was 1.24 mm

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-7-16 (bottom)	Iman Shafii	1	2	3		
			Alcona Dam, Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	506.2	5.2	0.0	100.0
4.8	524	40	0.43	363	369.2	6.2	2.2	97.8
		100	0.15	321	345.7	24.7	6.9	93.1
		200	0.07	317	335.8	18.8	10.5	89.5
		Pan	0.00	360	829.1	469.1	100.0	0.0
		∑ soil mass after sieve (gr)		524.0				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	9.5%	89.5%	N/A	0.0013	0.00662	0.01335	#VALUE!	#VALUE!	CL	A-6 (10.5)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	11	10.9	0.990909091	151H
4.8	51.4				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	Ms	$M_{pws,t}$	G_t
22.1	0.99954	101.92	248.6996	0.9978	350.06	22.4	364	2.64
						$G_{s,\ 20c}$	2.643412	

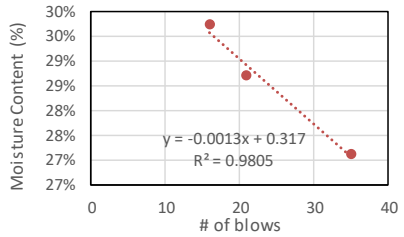
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.035	0.003	1.0320	21.5	0.01340	7.0	0.074000	100.00	469.1	89.52
0.27	0.266667	1.0335	0.003	1.0305	21.5	0.01340	7.6	0.071536	96.32	451.8	86.23
0.50	0.5	1.0315	0.003	1.0285	21.5	0.01340	8.0	0.053432	90.00	422.2	80.58
1	1	1.03	0.003	1.0270	21.5	0.01340	8.40	0.038837	85.27	400.0	76.33
2	2	1.0285	0.003	1.0255	21.4	0.01341	8.8	0.028049	80.53	377.8	72.09
5	5	1.026	0.003	1.0230	21.1	0.01348	9.4	0.018483	72.64	340.7	65.03
15	15	1.0235	0.003	1.0205	20.8	0.01357	10.1	0.011135	64.74	303.7	57.96
30	30	1.022	0.003	1.0190	20.5	0.01356	10.5	0.008022	60.00	281.5	53.72
60	60	1.02	0.003	1.0170	20.0	0.01365	11.0	0.005845	53.69	251.8	48.06
240	240	1.017	0.003	1.0140	19.0	0.01386	11.8	0.003073	44.21	207.4	39.58
1406	1406	1.0135	0.003	1.0105	18.9	0.01386	12.8	0.001320	33.16	155.6	29.69

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-7-16 (middle)	Iman Shafii	B-7-16	6-Dec	CL	From :	13		
						To :	15.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	14.667	Notes:		Density Calcs.	Sample Height (ft)	0.083	Wet Density	Wet Denisty (kN/m3)	20.6
height (ft)	0.083	h	Depth of middle of the core (ft)	14.708				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	131.0
								Sample Volume (ft^3)	0.0041	Dry Density	Dry Denisty (kg/m^3)	1791.0
height (mm)	25.417	d	Depth of lower side of the core (ft)	14.750	Core Diameter (ft)	0.25		Sample weight (lb)	0.536		Dry Denisty (kN/m^3)	17.6
								Wet Denisty (pcf)	130.96		Dry Denisty (pcf)	112

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	14.71	#1B	1	68.5	67.5	58.7	57.7	9.8	57.7	16.98%
2	14.71	122	0.9	13.8	12.9	11.9	11	1.9	11	17.27%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	14.71	25-35	35	29	1	8.5	6.9	27.12%
2		20-30	21	45	1	14	11.1	28.71%
3		15-25	16	49	1	10.6	8.4	29.73%
Liquid Limit (%)		28.45%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	14.71	M	1	10	8.9	13.92%
	2						#DIV/0!
Average Plastic Limit (%)	13.92%		Plasticity Index	14.53%	Liquidity Index	22.06%	

Notes:

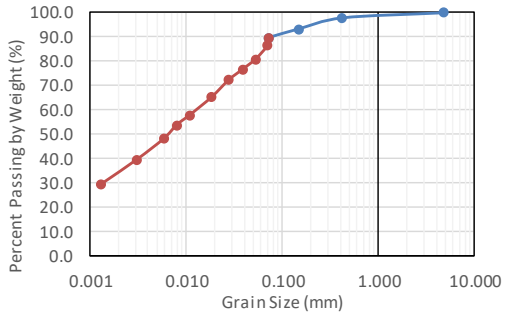
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	82	2.5	239.2	Type A

Notes:

Pocket Penetrometer was 1.92 mm

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-7-16 (middle)	Iman Shafii	1	2	3		
			Alcona Dam, Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	506.2	5.2	0.0	100.0
4.8	524	40	0.43	363	369.2	6.2	2.2	97.8
		100	0.15	321	345.7	24.7	6.9	93.1
		200	0.07	317	335.8	18.8	10.5	89.52
		Pan	0.00	360	829.1	469.1	100.0	0.0
		∑ soil mass after sieve (gr)		524				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	9.5%	89.5%	N/A	0.0013	0.00662	0.01335	#VALUE!	#VALUE!	CL	A-6 (11.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	11	10.9	0.990909091	151H
4.8	51.4				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	Ms	$M_{pws,t}$	G_t
22.1	0.99954	101.92	248.6996	0.9978	350.06	22.4	364	2.64
						$G_{s,\ 20c}$	2.643412	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.035	0.003	1.0320	21.5	0.01340	7.0	0.074000	100.00	469.1	89.52
0.27	0.266667	1.0335	0.003	1.0305	21.5	0.01340	7.6	0.071536	96.32	451.8	86.23
0.50	0.5	1.0315	0.003	1.0285	21.5	0.01340	8.0	0.053432	90.00	422.2	80.58
1	1	1.03	0.003	1.0270	21.5	0.01340	8.40	0.038837	85.27	400.0	76.33
2	2	1.0285	0.003	1.0255	21.4	0.01341	8.8	0.028049	80.53	377.8	72.09
5	5	1.026	0.003	1.0230	21.1	0.01348	9.4	0.018483	72.64	340.7	65.03
15	15	1.0235	0.003	1.0205	20.8	0.01357	10.1	0.011135	64.74	303.7	57.96
30	30	1.022	0.003	1.0190	20.5	0.01356	10.5	0.008022	60.00	281.5	53.72
60	60	1.02	0.003	1.0170	20.0	0.01365	11.0	0.005845	53.69	251.8	48.06
240	240	1.017	0.003	1.0140	19.0	0.01386	11.8	0.003073	44.21	207.4	39.58
1406	1406	1.0135	0.003	1.0105	18.9	0.01386	12.8	0.001320	33.16	155.6	29.69

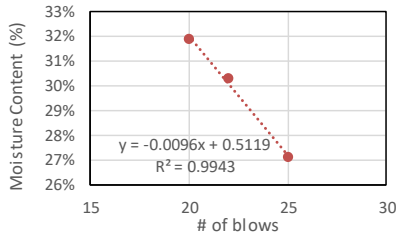
B-7-16 (13'-15.5') Top - Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-7-16 (top)	Iman Shafii	B-7-16	5-Dec	Clay	From :	13		
						To :	15.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	13.667	Notes:		Density Calcs.	Sample Height (ft)	0.083	Wet Density	Wet Denisty (kN/m3)	20.7
height (ft)	0.083	h	Depth of middle of the core (ft)	13.709				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	131.5
								Sample Volume (ft^3)	0.0041	Dry Density	Dry Denisty (kg/m^3)	1658.2
height (mm)	25.315	d	Depth of lower side of the core (ft)	13.750	Core Diameter (ft)	0.25		Sample weight (lb)	0.538		Dry Denisty (kN/m^3)	16.3
								Wet Denisty (pcf)	131.52		Dry Denisty (pcf)	104

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	13.50	45	1	9.9	8.9	8	7	1.9	7	27.14%
2	13.50	49	1	15.6	14.6	12.5	11.5	3.1	11.5	26.96%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	13.50	25-35	25	A1	0.9	9.1	7.35	27.13%
2		20-30	22	O	1	9.6	7.6	30.30%
3		15-25	20	46.00	1	10.1	7.9	31.88%
Liquid Limit (%)		27.19%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	13.5	45	1	12.7	11.3	13.59%
	2	13.5	W	1	6.2	5.6	13.04%
Average Plastic Limit (%)	13.32%		Plasticity Index	13.87%	Liquidity Index	98.99%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	66	2.5	239.2	Type A

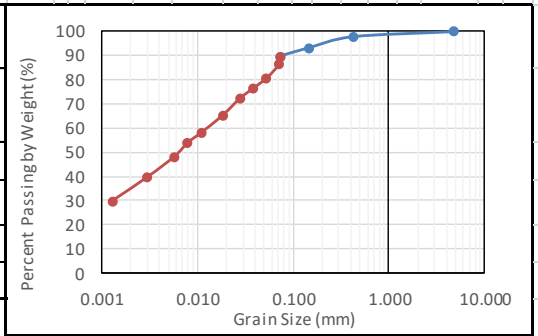
Notes:

Pocket Penetrometer was 2.32 mm

B-7-16 (13'-15.5') Top - Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2-Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-7-16 (top)	Iman Shafii	1	2	3		
			Alcona Dam, Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	506.2	5.2	0.0	100.0
4.8	524	40	0.43	363	369.2	6.2	2.2	97.8
		100	0.15	321	345.7	24.7	6.9	93.1
		200	0.07	317	335.8	18.8	10.5	89.5
		Pan	0.00	360	829.1	469.1	100.0	0.0
		∑ soil mass after sieve (gr)		524				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	9.5%	89.5%	N/A	0.0013	0.00662	0.01335	#VALUE!	#VALUE!	CL	A-6 (10.3)

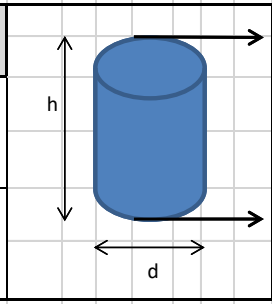
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	11	10.9	0.990909091	151H
4.8	51.4				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	Ms	$M_{pws,t}$	G_t
22.1	0.99954	101.92	248.6996	0.9978	350.06	22.4	364	2.64
						$G_{s,\ 20c}$	2.643412	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.035	0.003	1.0320	21.5	0.01340	7.0	0.074000	100.00	469.1	89.52
0.27	0.266667	1.0335	0.003	1.0305	21.5	0.01340	7.6	0.071536	96.32	451.8	86.23
0.50	0.5	1.0315	0.003	1.0285	21.5	0.01340	8.0	0.053432	90.00	422.2	80.58
1	1	1.03	0.003	1.0270	21.5	0.01340	8.40	0.038837	85.27	400.0	76.33
2	2	1.0285	0.003	1.0255	21.4	0.01341	8.8	0.028049	80.53	377.8	72.09
5	5	1.026	0.003	1.0230	21.1	0.01348	9.4	0.018483	72.64	340.7	65.03
15	15	1.0235	0.003	1.0205	20.8	0.01357	10.1	0.011135	64.74	303.7	57.96
30	30	1.022	0.003	1.0190	20.5	0.01356	10.5	0.008022	60.00	281.5	53.72
60	60	1.02	0.003	1.0170	20.0	0.01365	11.0	0.005845	53.69	251.8	48.06
240	240	1.017	0.003	1.0140	19.0	0.01386	11.8	0.003073	44.21	207.4	39.58
1406	1406	1.0135	0.003	1.0105	18.9	0.01386	12.8	0.001320	33.16	155.6	29.69

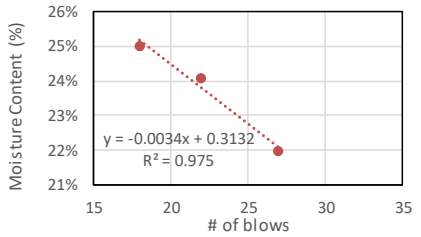
B-11-16 (18’-20.5’) Bottom - Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-11-16 (18'-20.5')	Iman Shafii	B-11-16	13-Feb	Sandy Clay	From :	18		
						To :	20.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	20.000	Notes:		Density Calcs.	Sample Height (ft)	0.284	Wet Density	Wet Denisty (kN/m3)	18.6
height (ft)	0.284		Depth of middle of the core (ft)	20.142				Sample Diameter (ft)	0.23		Wet Denisty (pcf)	118.2
								Sample Volume (ft^3)	0.0118	Dry Density	Dry Denisty (kg/m^3)	1669.5
height (mm)	86.671		Depth of lower side of the core (ft)	20.284	Core Diameter (ft)	0.230		Sample weight (lb)	1.396		Dry Denisty (kN/m^3)	16.4
								Wet Denisty (pcf)	118.2		Dry Denisty (pcf)	104

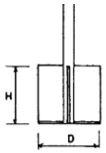
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	18.10	122	1	26.3	25.3	23.7	22.7	2.6	22.7	11.45%
2	18.10	175	1	43.8	42.8	38.1	37.1	5.7	37.1	15.36%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	20.14	25-35	27	A	1.1	6.1	5.2	21.95%
2		20-30	22	M	1	7.7	6.4	24.07%
3		15-25	18	45	1	6	5	25.00%
Liquid Limit (%)		22.82%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.10	122	1	9	8.1	12.68%
	2	18.10	X	1	7.8	7	13.33%
Average Plastic Limit (%)	13.00%		Plasticity Index	9.82%	Liquidity Index	4.12%	

Notes:

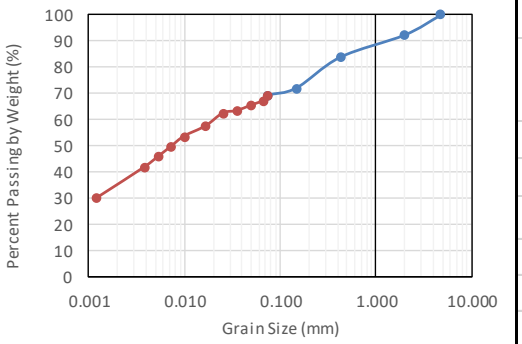
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	N/A	3.5	334.8	Type A

Notes:

Pocket Erodometer was more than 1 cm at the weak seam (sandy fissure) However, in the clayey parts, it was around 2 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2-Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	B-11-16 (18'-20.5')	Iman Shafii	Alcona Dam, Dark Brown	Semi-cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.6	518.4	16.8	0.0	100.00
4.7	351.3	10	2.000	624.3	634.5	10.2	7.7	92.30
		40	0.425	363.0	410.0	47.0	16.3	83.69
		100	0.149	321.6	346.4	24.8	28.2	71.84
		200	0.074	316.8	326.4	9.6	30.9	69.10
		Pan	0.000	360.5	602.9	242.4	100.0	0.0
		∑ soil mass after sieve (gr)		350.8				
		Error (%)		0.1%				



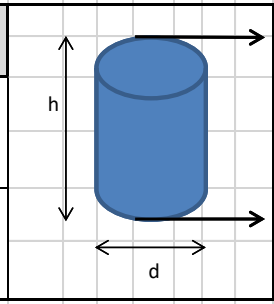
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
4.8%	26.1%	69.1%	N/A	0.0012	0.0073	0.02125	#VALUE!	#VALUE!	CL with Sand	A-4 (3.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	4.7	4.65	0.989361702	151H
4.7	56.91				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	102.996	249.6606	0.9974	352	21.07	365.26	2.698
						$G_{s,\ 20c}$	2.695584	

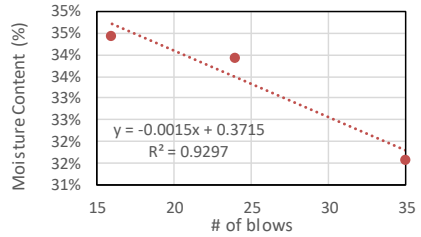
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.08	1.036	0.003	1.0330	23.6	0.01288	6.8	0.074000	93.18	225.9	69.10
0.25	0.25	1.035	0.003	1.0320	23.6	0.01288	7.0	0.068155	90.35	219.0	67.15
0.50	0.50	1.034	0.003	1.0310	23.6	0.01288	7.3	0.049214	87.53	212.2	65.21
1	1.00	1.033	0.003	1.0300	23.6	0.01288	7.6	0.035508	84.71	205.3	63.26
2	2.00	1.0325	0.003	1.0295	23.6	0.01288	7.7	0.025272	83.29	201.9	62.28
5	5.00	1.03	0.003	1.0270	23.3	0.01293	8.4	0.016753	76.23	184.8	57.41
15	15.00	1.028	0.003	1.0250	23.3	0.01293	8.9	0.009956	70.59	171.1	53.52
30	30.00	1.026	0.003	1.0230	23.0	0.01297	9.4	0.007260	64.94	157.4	49.62
60	60.00	1.024	0.003	1.0210	23.1	0.01297	10.0	0.005295	59.29	143.7	45.72
120	120.00	1.022	0.003	1.0190	23.0	0.01297	10.5	0.003837	53.65	130.0	41.83
1440	1440.00	1.016	0.003	1.0130	20.8	0.01331	12.1	0.001220	36.71	89.0	30.14

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-11-16 (18'-20.5')	Iman Shafii	B-11-16	2/13/2017	Sandy Clay	From :	18		
						To :	20.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	18.000	Notes:		Density Calcs.	Sample Height (ft)	0.375	Wet Density	Wet Denisty (kN/m3)	19.1
height (ft)	0.375		Depth of middle of the core (ft)	18.188				Sample Diameter (ft)	0.2292		Wet Denisty (pcf)	121.9
height (mm)	114.375		Depth of lower side of the core (ft)	18.375	Core Diameter (ft)	0.229		Sample Volume (ft^3)	0.0155	Dry Density	Dry Denisty (kg/m^3)	1732.4
								Sample weight (lb)	1.885		Dry Denisty (kN/m^3)	17
								Wet Denisty (pcf)	121.86		Dry Denisty (pcf)	108

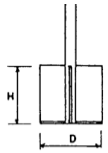
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	18.10	Z	1	31.6	30.6	28.1	27.1	3.5	27.1	12.92%
2	18.10	5	1	28.1	27.1	25.1	24.1	3	24.1	12.45%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	18.19	25-35	35	1B	1	8.5	6.7	31.58%
2		20-30	24	2	1	8.5	6.6	33.93%
3		15-25	16	33	1	9.2	7.1	34.43%
Liquid Limit (%)		33.40%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.1	A	1.1	6.4	5.7	15.22%
	2	18.1	O	1	7.5	6.6	16%
Average Plastic Limit (%)	15.22%		Plasticity Index	18.18%	Liquidity Index	-13.95%	

Notes:

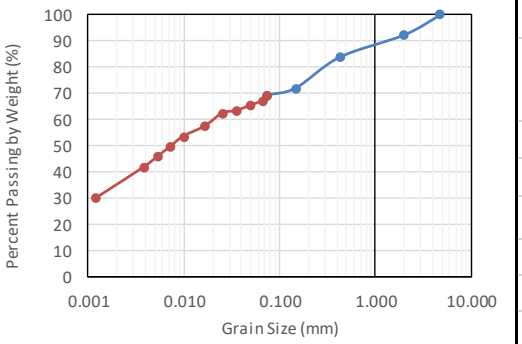
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	N/A	1.25	119.6	Type B

Notes:

Pocket Erodometer was 18.6 mm at the weak seam (sandy fissure)

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2-Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-11-16 (18'-20.5')	Iman Shafii	Alcona Dam, Dark Brown	Semi-cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.6	518.4	16.8	0.0	100.0
4.7	351.3	10	2.000	624.3	634.5	10.2	7.7	92.3
		40	0.425	363.0	410.0	47.0	16.3	83.7
		100	0.149	321.6	346.4	24.8	28.2	71.8
		200	0.074	316.8	326.4	9.6	30.9	69.10
		Pan	0.000	360.5	602.9	242.4	100.0	0.0
		∑ soil mass after sieve (gr)		350.8				
		Error (%)		0.1%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
4.8%	26.1%	69.1%	<0.001	0.0012	0.0073	0.02125	#VALUE!	#VALUE!	CL with Sand	A-4 (10.1)

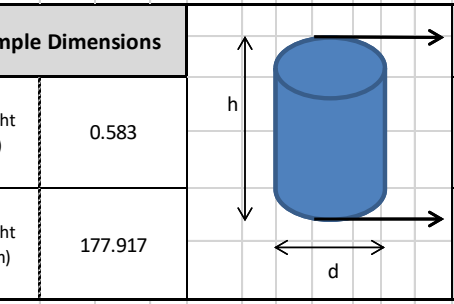
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	4.7	4.65	0.989361702	151H
4.7	56.91				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	102.996	249.6606	0.9974	352	21.07	365.26	2.698
						$G_{s,20c}$	2.695584	

Time (min)	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.08	1.036	0.003	1.0330	23.6	0.01288	6.8	0.074000	93.18	225.9	69.10
0.25	0.25	1.035	0.003	1.0320	23.6	0.01288	7.0	0.068155	90.35	219.0	67.15
0.50	0.50	1.034	0.003	1.0310	23.6	0.01288	7.3	0.049214	87.53	212.2	65.21
1	1.00	1.033	0.003	1.0300	23.6	0.01288	7.6	0.035508	84.71	205.3	63.26
2	2.00	1.0325	0.003	1.0295	23.6	0.01288	7.7	0.025272	83.29	201.9	62.28
5	5.00	1.03	0.003	1.0270	23.3	0.01293	8.4	0.016753	76.23	184.8	57.41
15	15.00	1.028	0.003	1.0250	23.3	0.01293	8.9	0.009956	70.59	171.1	53.52
30	30.00	1.026	0.003	1.0230	23.0	0.01297	9.4	0.007260	64.94	157.4	49.62
60	60.00	1.024	0.003	1.0210	23.1	0.01297	10.0	0.005295	59.29	143.7	45.72
120	120.00	1.022	0.003	1.0190	23.0	0.01297	10.5	0.003837	53.65	130.0	41.83
1440	1440.00	1.016	0.003	1.0130	20.8	0.01331	12.1	0.001220	36.71	89.0	30.14

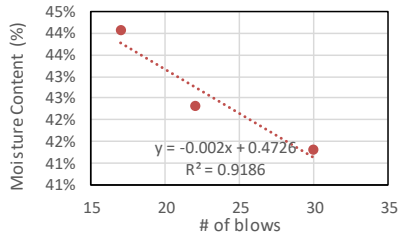
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-12-16 (bottom)	Iman Shafii	B-12-16	2/17/2017	Clay	From :	18		
						To :	20.5	2.5	

Sample Dimensions		Depth of upper side of the core (ft)	19.500	Notes:		Density Calcs.	Sample Height (ft)	0.583	Wet Density	Wet Denisty (kN/m3)	18.0
height (ft)	0.583	Depth of middle of the core (ft)	19.792				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	114.9
							Sample Volume (ft^3)	0.0286	Dry Density	Dry Denisty (kg/m^3)	1507.1
height (mm)	177.917	Depth of lower side of the core (ft)	20.083	Core Diameter (ft)	0.25		Sample weight (lb)	3.289		Dry Denisty (kN/m^3)	14.8
							Wet Denisty (pcf)	114.87		Dry Denisty (pcf)	94.1



Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	19.79	46	1	56	55	46.2	45.2	9.8	45.2	21.68%
2	19.79	49	1	29.3	28.3	24.1	23.1	5.2	23.1	22.51%

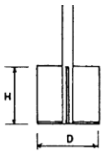
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	19.79	25-35	30	33	1.1	7.6	5.7	41.30%
2		20-30	22	#1B	1.1	8.5	6.3	42.31%
3		15-25	17	5	1	9.5	6.9	44.07%
Liquid Limit (%)		42.26%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	19.79	0100-1	0.9	11	9.5	17.44%
	2	19.79	45	1	8.3	7.2	17.74%
Average Plastic Limit (%)	17.59%		Plasticity Index	24.67%	Liquidity Index	18.26%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	>65	3.25	310.9	Type A

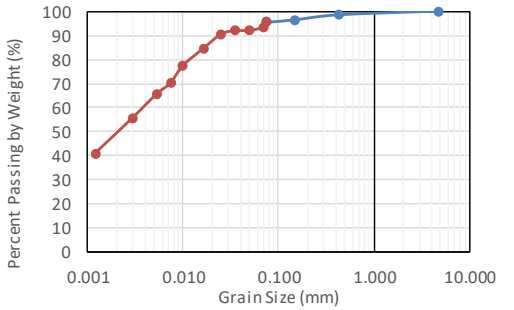


Notes:

Pocket Erodometer erosion was less than 1 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	B-12-16 (bottom)	Iman Shafii	Alcona Dam, Light Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.0	0.0	0.0	100.0
0.5	200	40	0.43	362	365.0	3.0	1.5	98.5
		100	0.15	321	325.0	4.0	3.5	96.5
		200	0.07	316	318.0	2.0	4.5	95.5
		Pan	0.00	360	551.0	191.0	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	4.5%	95.5%	N/A	N/A	0.00278	0.00399	#VALUE!	#VALUE!	CL	A-7-6 (24.6)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	7.5	7.45	0.993333333	151H
0.5	52.21				

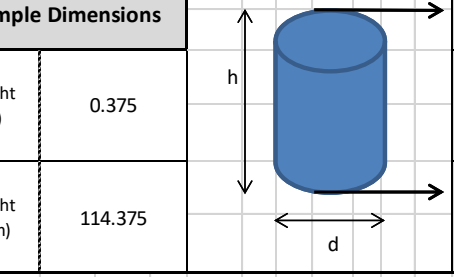
Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	101.502	249.4942	0.9974	350.34	10.87	357.19	2.704
						$G_{s,\ 20c}$	2.701736	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.037	0.003	1.0340	21.3	0.01323	6.5	0.074000	100.00	191.0	95.50
0.25	0.25	1.035	0.003	1.0320	21.3	0.01323	7.0	0.070017	97.96	187.1	93.55
0.50	0.5	1.0345	0.003	1.0315	21.3	0.01323	7.2	0.050037	96.43	184.2	92.09
1	1	1.0345	0.003	1.0315	21.3	0.01323	7.2	0.035382	96.43	184.2	92.09
2	2	1.034	0.003	1.0310	21.3	0.01323	7.3	0.025280	94.90	181.3	90.63
5	5	1.032	0.003	1.0290	21.2	0.01325	7.8	0.016547	88.78	169.6	84.78
15	15	1.0295	0.003	1.0265	20.8	0.01331	8.5	0.010021	81.12	154.9	77.47
30	30	1.027	0.003	1.0240	20.6	0.01334	9.2	0.007390	73.47	140.3	70.16
60	60	1.0255	0.003	1.0225	20.2	0.01341	9.6	0.005349	68.88	131.6	65.78
222	222	1.022	0.003	1.0190	19.6	0.01351	10.5	0.002938	58.16	111.1	55.55
1511	1511	1.017	0.003	1.0140	19.1	0.01359	11.8	0.001201	42.86	81.9	40.93

B-12-16 (18'-20.5') Middle - Page 1

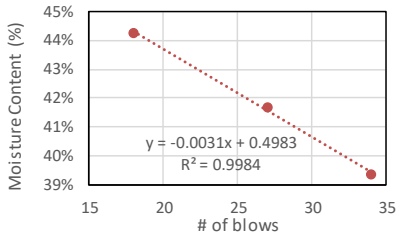
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-12-16 (middle)	Iman Shafii	B-12-16	1/17/2017	Clay	From :	18	2.5	
						To :	20.5		

Sample Dimensions		Depth of upper side of the core (ft)	18.750	Notes:		Density Calcs.	Sample Height (ft)	0.375	Wet Density	Wet Denisty (kN/m3)	18.2
height (ft)	0.375	Depth of middle of the core (ft)	18.938				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	115.8
							Sample Volume (ft^3)	0.0184	Dry Density	Dry Denisty (kg/m^3)	1539.4
height (mm)	114.375	Depth of lower side of the core (ft)	19.125	Core Diameter (ft)	0.25		Sample weight (lb)	2.132		Dry Denisty (kN/m^3)	15.1
							Wet Denisty (pcf)	115.81		Dry Denisty (pcf)	96.1



Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1		Z	1	34	33	28.4	27.4	5.6	27.4	20.44%
2		5	1	30.3	29.3	25.3	24.3	5	24.3	20.58%

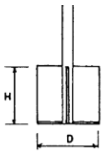
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	18.94	25-35	34	Z	1	9.5	7.1	39.34%
2		20-30	27	1	1	7.8	5.8	41.67%
3		15-25	18	5	1	9.8	7.1	44.26%
Liquid Limit (%)		42.08%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.94	A	1.1	9.3	8	18.84%
	2	18.94	O	1	8.1	7	18.33%
Average Plastic Limit (%)	18.59%		Plasticity Index	23.49%	Liquidity Index	8.17%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	N/A	3.7	354.0	Type A

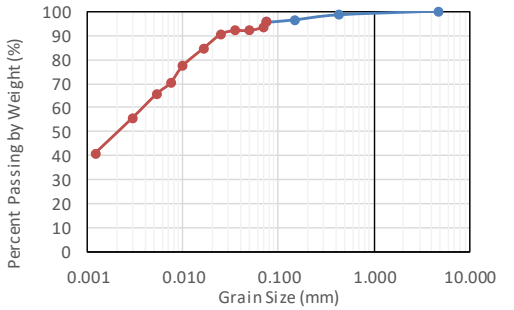


Notes:

Pocket Erodometer erosion was less than 1 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-12-16 (middle)	Iman Shafii	1	2	3		
			Alcona Dam, Light Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.0	0.0	0.0	100.0
0.5	200	40	0.43	362	365.0	3.0	1.5	98.5
		100	0.15	321	325.0	4.0	3.5	96.5
		200	0.07	316	318.0	2.0	4.5	95.5
		Pan	0.00	360	551.0	191.0	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	4.5%	95.5%	N/A	N/A	0.00278	0.00399	#VALUE!	#VALUE!	CL	A-7-6 (23.6)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	7.5	7.45	0.993333333	151H
0.5	52.21				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	101.502	249.4942	0.9974	350.34	10.87	357.19	2.704
						$G_{s,\ 20c}$	2.701736	

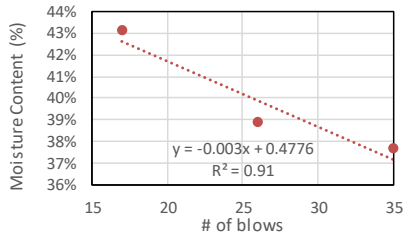
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.037	0.003	1.0340	21.3	0.01323	6.5	0.074000	100.00	191.0	95.50
0.25	0.25	1.035	0.003	1.0320	21.3	0.01323	7.0	0.070017	97.96	187.1	93.55
0.50	0.5	1.0345	0.003	1.0315	21.3	0.01323	7.2	0.050037	96.43	184.2	92.09
1	1	1.0345	0.003	1.0315	21.3	0.01323	7.2	0.035382	96.43	184.2	92.09
2	2	1.034	0.003	1.0310	21.3	0.01323	7.3	0.025280	94.90	181.3	90.63
5	5	1.032	0.003	1.0290	21.2	0.01325	7.8	0.016547	88.78	169.6	84.78
15	15	1.0295	0.003	1.0265	20.8	0.01331	8.5	0.010021	81.12	154.9	77.47
30	30	1.027	0.003	1.0240	20.6	0.01334	9.2	0.007390	73.47	140.3	70.16
60	60	1.0255	0.003	1.0225	20.2	0.01341	9.6	0.005349	68.88	131.6	65.78
222	222	1.022	0.003	1.0190	19.6	0.01351	10.5	0.002938	58.16	111.1	55.55
1511	1511	1.017	0.003	1.0140	19.1	0.01359	11.8	0.001201	42.86	81.9	40.93

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-12-16 (top)	Iman Shafii	B-12-16	1/13/2017	Clay	From :	18		
						To :	20.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	18.000	Notes:		Density Calcs.	Sample Height (ft)	0.292	Wet Density	Wet Denisty (kN/m3)	19.0
height (ft)	0.292	h	Depth of middle of the core (ft)	18.146				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	120.9
								Sample Volume (ft^3)	0.0143	Dry Density	Dry Denisty (kg/m^3)	1594.4
height (mm)	88.958	d	Depth of lower side of the core (ft)	18.292	Core Diameter (ft)	0.25		Sample weight (lb)	1.731		Dry Denisty (kN/m^3)	15.6
								Wet Denisty (pcf)	120.88		Dry Denisty (pcf)	99.5

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	18.10	1B	1	15.5	14.5	12.95	11.95	2.55	11.95	21.34%
2	18.10	5	1	16.8	15.8	14	13	2.8	13	21.54%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	18.15	25-35	35	2	31.4	43.1	39.9	37.65%
2		20-30	26	29	1	11	8.2	38.89%
3		15-25	17	30	1.1	9.4	6.9	43.10%
Liquid Limit (%)		40.26%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.15	G1	1	11.3	9.7	18.39%
	2						#DIV/0!
Average Plastic Limit (%)	18.39%		Plasticity Index	21.87%	Liquidity Index	13.94%	

Notes:

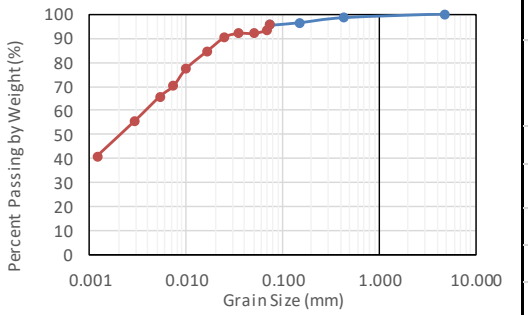
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	N/A	2.5	239.2	Type A

Notes:

Sample was extrduded and therefore no vane test could be performed on the extruded sample

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-12-16 (top)	Iman Shafii	Alcona Dam, Light Brown	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501.0	0.0	0.0	100.0
0.5	200	40	0.425	362	365.0	3.0	1.5	98.5
		100	0.149	321	325.0	4.0	3.5	96.5
		200	0.074	316	318.0	2.0	4.5	95.5
		Pan	0.000	360	551.0	191.0	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	4.5%	95.5%	N/A	N/A	0.00278	0.00399	#VALUE!	#VALUE!	CL	A-7-6 (21.7)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	7.5	7.45	0.993333333	151H
0.5	52.21				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	101.502	249.4942	0.9974	350.34	10.87	357.19	2.704
						$G_{s,\ 20c}$	2.701736	

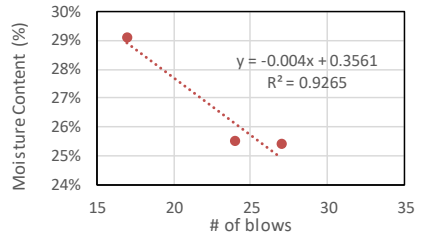
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.037	0.003	1.0340	21.3	0.01323	6.5	0.074000	100.00	191.0	95.50
0.25	0.25	1.035	0.003	1.0320	21.3	0.01323	7.0	0.070017	97.96	187.1	93.55
0.50	0.5	1.0345	0.003	1.0315	21.3	0.01323	7.2	0.050037	96.43	184.2	92.09
1	1	1.0345	0.003	1.0315	21.3	0.01323	7.2	0.035382	96.43	184.2	92.09
2	2	1.034	0.003	1.0310	21.3	0.01323	7.3	0.025280	94.90	181.3	90.63
5	5	1.032	0.003	1.0290	21.2	0.01325	7.8	0.016547	88.78	169.6	84.78
15	15	1.0295	0.003	1.0265	20.8	0.01331	8.5	0.010021	81.12	154.9	77.47
30	30	1.027	0.003	1.0240	20.6	0.01334	9.2	0.007390	73.47	140.3	70.16
60	60	1.0255	0.003	1.0225	20.2	0.01341	9.6	0.005349	68.88	131.6	65.78
222	222	1.022	0.003	1.0190	19.6	0.01351	10.5	0.002938	58.16	111.1	55.55
1511	1511	1.017	0.003	1.0140	19.1	0.01359	11.8	0.001201	42.86	81.9	40.93

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-13-16 (18'-20.5')	Iman Shafii	B-13-16	2/14/2017	Clay	From :	18		
						To :	20.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	19.500	Notes:		Density Calcs.	Sample Height (ft)	0.479	Wet Density	Wet Denisty (kN/m3)	20.3
height (ft)	0.479	h	Depth of middle of the core (ft)	19.740				Sample Diameter (ft)	0.2292		Wet Denisty (pcf)	129.2
								Sample Volume (ft^3)	0.0198	Dry Density	Dry Denisty (kg/m^3)	1809.0
height (mm)	146.146	d	Depth of lower side of the core (ft)	19.979	Core Diameter (ft)	0.22916667		Sample weight (lb)	2.553		Dry Denisty (kN/m^3)	17.7
								Wet Denisty (pcf)	129.17		Dry Denisty (pcf)	113

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	18.10	Z	1	27.5	26.5	23.6	22.6	3.9	22.6	17.26%
2	18.10	5	1	45.6	44.6	41	40	4.6	40	11.50%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	19.74	25-35	27	1B	1.1	9	7.4	25.40%
2		20-30	24	A	1.1	7.5	6.2	25.49%
3		15-25	17	29	1.1	8.2	6.6	29.09%
Liquid Limit (%)		25.61%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.1	122	1	9.3	8.3	13.70%
	2	18.1	175	1	8.1	7.3	12.70%
Average Plastic Limit (%)	13.70%		Plasticity Index	11.91%	Liquidity Index	5.71%	

Notes:

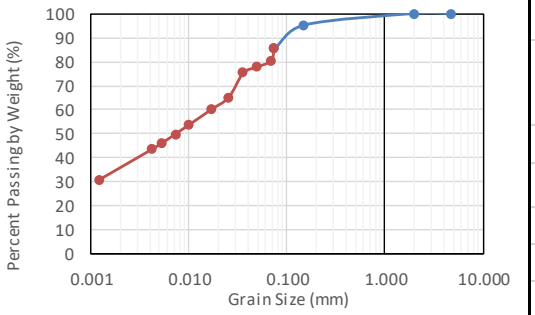
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	N/A	4.5	430.5	A

Notes:

Pocket Erodometer was less than 1 mm

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	B-13-16 (18'-20.5')	Iman Shafii	Alcona Dam, Brown	Unemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.5	501.5	0.0	0.0	100.00
2	245.8	10	2.000	624	624.2	0.0	0.0	100.00
		100	0.149	321	332.7	11.6	4.7	95.28
		200	0.074	317	340.6	23.8	14.4	85.59
		Pan	0.000	360	570.7	210.3	100.0	0.00
		∑ soil mass after sieve (gr)		245.7				
		Error (%)		0.04%				



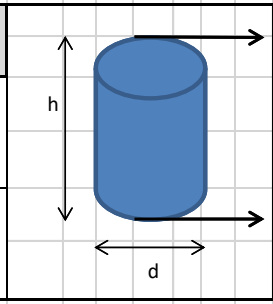
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	14.4%	85.6%	N/A	0.0012	0.0073	0.0168	#VALUE!	#VALUE!	CL	A-6 (7.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	8.7	8.6	0.988505747	151H
2	53.78				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	102.244	253.5629	0.9974	355.14	15.9	365.17	2.709
						$G_{s,\ 20c}$	2.706440	

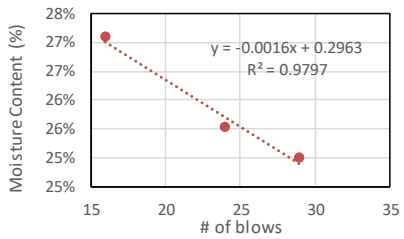
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	23.6	0.01288	6.8	0.074000	92.48	194.5	85.60
0.25	0.25	1.032	0.003	1.0290	23.6	0.01288	7.0	0.068155	86.52	181.9	80.49
0.50	0.5	1.031	0.003	1.0280	23.6	0.01288	7.3	0.049214	83.53	175.7	77.94
1	1	1.03	0.003	1.0270	23.6	0.01288	7.6	0.035508	80.55	169.4	75.39
2	2	1.026	0.003	1.0230	23.6	0.01288	7.7	0.025272	68.62	144.3	65.18
5	5	1.024	0.003	1.0210	23.3	0.01293	8.4	0.016753	62.65	131.8	60.07
15	15	1.0215	0.003	1.0185	23.3	0.01293	8.9	0.009956	55.19	116.1	53.69
30	30	1.02	0.003	1.0170	23.0	0.01297	9.4	0.007260	50.72	106.7	49.86
60	60	1.0185	0.003	1.0155	23.1	0.01297	10.0	0.005295	46.24	97.2	46.03
100	100	1.0175	0.003	1.0145	23.0	0.01297	10.5	0.004203	43.26	91.0	43.48
1440	1440	1.0125	0.003	1.0095	20.8	0.01331	12.1	0.001220	28.34	59.6	30.72

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-13-16 (18'-20.5')	Iman Shafii	B-13-16	14-Feb	Sandy Clay	From :	18		
						To :	20.5	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	18.000	Notes:		Density Calcs.	Sample Height (ft)	0.396	Wet Density	Wet Denisty (kN/m3)	19.9
height (ft)	0.396		Depth of middle of the core (ft)	18.198				Sample Diameter (ft)	0.2292		Wet Denisty (pcf)	126.9
								Sample Volume (ft^3)	0.0163	Dry Density	Dry Denisty (kg/m^3)	1724.0
height (mm)	120.729		Depth of lower side of the core (ft)	18.396	Core Diameter (ft)	0.229		Sample weight (lb)	2.072		Dry Denisty (kN/m^3)	16.9
								Wet Denisty (pcf)	126.93		Dry Denisty (pcf)	108

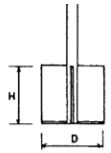
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	18.10	45	1	20.9	19.9	18	17	2.9	17	17.06%
2	18.10	100-1	1	29.1	28.1	24.65	23.65	4.45	23.65	18.82%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	18.20	25-35	29	0	1	7	5.8	25.00%
2		20-30	24	2	1.1	7	5.8	25.53%
3		15-25	16	33	1	7.1	5.8	27.08%
Liquid Limit (%)		25.63%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.1	X	1	10.7	9.5	14.12%
	2	18.2	45	1.1	7.4	6.5	16.67%
Average Plastic Limit (%)	14.12%		Plasticity Index	11.51%	Liquidity Index	33.18%	

Notes:

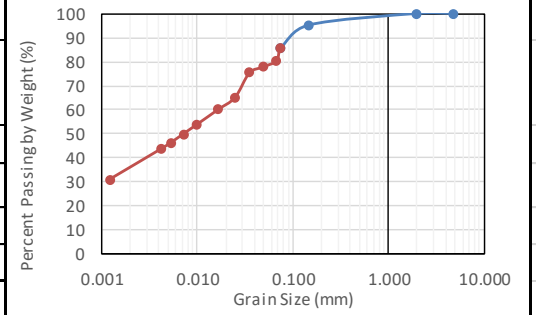
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	N/A	2.5	239.2	Type A

Notes:

Pocket Erodometer was about 6 mm at the weak seam (sandy fissure)

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-13-16 (18'-20.5')	Iman Shafii	1	2	3		
			Alcona Dam, Brown	Unemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.5	501.5	0.0	0.0	100.0
2	245.8	10	2.000	624	624.2	0.0	0.0	100.0
		100	0.149	321	332.7	11.6	4.7	95.3
		200	0.074	317	340.6	23.8	14.4	85.6
		Pan	0.000	360	570.7	210.3	100.0	0.0
		∑ soil mass after sieve (gr)		245.7				
		Error (%)		0.04%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	14.4%	85.6%	N/A	0.0012	0.0073	0.0168	#VALUE!	#VALUE!	CL	A-6 (7.6)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	8.7	8.6	0.988505747	151H
2	53.78				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	102.244	253.5629	0.9974	355.14	15.9	365.17	2.709
						$G_{s,\ 20c}$	2.706440	

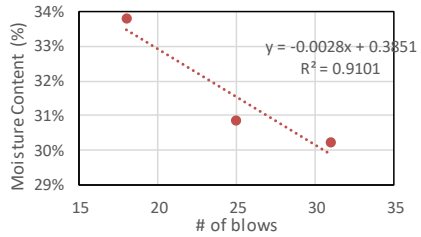
Time (min)	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	of total	% of fine
0.08	0.083333	1.034	0.003	1.0310	23.6	0.01288	6.8	0.074000	92.48	194.5	85.60
0.25	0.25	1.032	0.003	1.0290	23.6	0.01288	7.0	0.068155	86.52	181.9	80.49
0.50	0.5	1.031	0.003	1.0280	23.6	0.01288	7.3	0.049214	83.53	175.7	77.94
1	1	1.03	0.003	1.0270	23.6	0.01288	7.6	0.035508	80.55	169.4	75.39
2	2	1.026	0.003	1.0230	23.6	0.01288	7.7	0.025272	68.62	144.3	65.18
5	5	1.024	0.003	1.0210	23.3	0.01293	8.4	0.016753	62.65	131.8	60.07
15	15	1.0215	0.003	1.0185	23.3	0.01293	8.9	0.009956	55.19	116.1	53.69
30	30	1.02	0.003	1.0170	23.0	0.01297	9.4	0.007260	50.72	106.7	49.86
60	60	1.0185	0.003	1.0155	23.1	0.01297	10.0	0.005295	46.24	97.2	46.03
100	100	1.0175	0.003	1.0145	23.0	0.01297	10.5	0.004203	43.26	91.0	43.48
1440	1440	1.0125	0.003	1.0095	20.8	0.01331	12.1	0.001220	28.34	59.6	30.72

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #2	Iman Shafii	#2	10/20/2017	Sandy clay	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.5583	Wet Density	Wet Denisty (kN/m3)	20.27
height (ft)	0.558	h	Depth of middle of the core (ft)	0.279				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	129.0
								Sample Volume (ft^3)	0.0247	Dry Density	Dry Denisty (kg/m^3)	1727.9
height (mm)	170.292	d	Depth of lower side of the core (ft)	0.558	Core Diameter (ft)	0.238		Sample weight (lb)	3.1917		Dry Denisty (kN/m^3)	16.94
								Wet Denisty (pcf)	129.04		Dry Denisty (pcf)	108

Moisture Content				Wet		Dry				
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)	Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
1	0.28	46	1.1	26.7	25.6	22.5	21.4	4.2	21.4	19.63%
2	0.28	W	1	10	9	8.5	7.5	1.5	7.5	20.00%

Liquid Limit						Wet	Dry		
Test #	Core depth at middle (ft)	Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	
1	0.279	25-35	31	FF	0.9	10.6	8.35	30.2%	
2		20-30	25	XX	1	11.6	9.1	30.9%	
3		15-25	18	#1B	1	10.9	8.4	33.8%	
Liquid Limit		31.5%		Notes:					



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.279	$46	1	11.1	9.9	13.5%
	2	0.279	33	1	12	10.8	12.2%
Average Plastic Limit	12.86%		Plasticity Index	18.65%	Liquidity Index	36.27%	

Notes:

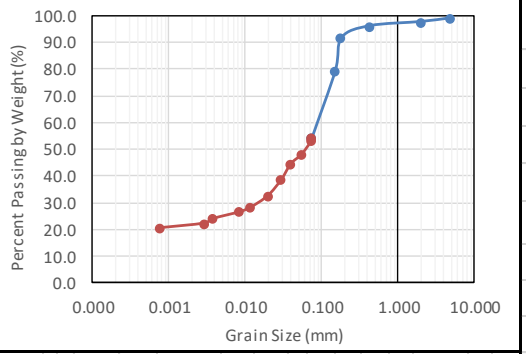
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	78	3.25	310.7	Type A

Notes:

Pocket Erodomoeter was 1.5 mm

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #2	Iman Shafii	Riverline-Bay City Bridge	Cemented	28.983764, -95.99934	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.0	506.0	5	1.1	98.9
		10	2.00	624.0	630.0	6	2.4	97.6
2	451	40	0.43	364.0	371.0	7	4.0	96.0
		80	0.18	524.0	544.0	20	8.4	91.6
		100	0.149	322.0	378.0	56	20.8	79.16
		200	0.074	317.0	429.0	112	45.7	54.32
		Pan	0.00	252.0	497.0	245	100.0	0.0
		∑ soil mass after sieve (gr)		451				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
1.1%	44.6%	54.3%	N/A	0.0151	0.0625	0.0911	#VALUE!	#VALUE!	CL with sand	A-6 (6.4)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	10.6	10.3	0.971698113	151H
2	52.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

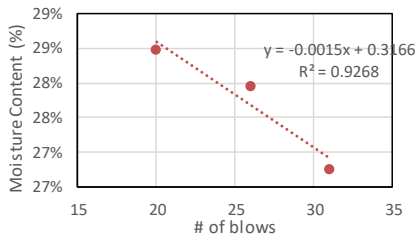
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.13	0.133333	1.035	0.003	1.0320	20.5	0.01357	7.3	0.074000	100.00	245.00	54.32
0.25	0.25	1.034	0.003	1.0310	20.5	0.01357	7.40	0.073802	97.60	239.11	53.02
0.50	0.5	1.031	0.003	1.0280	20.5	0.01357	8.10	0.054598	88.15	215.97	47.89
1	1	1.029	0.003	1.0260	20.5	0.01357	8.60	0.039780	81.85	200.54	44.47
2	2	1.0255	0.003	1.0225	20.5	0.01357	9.6	0.029642	70.84	173.55	38.48
5	5	1.022	0.003	1.0190	20.2	0.01362	10.5	0.019731	59.82	146.55	32.49
15	15	1.0195	0.003	1.0165	19.8	0.01368	11.2	0.011798	51.95	127.27	28.22
30	30	1.0185	0.003	1.0155	19.4	0.01375	11.4	0.008477	48.80	119.56	26.51
165	165	1.017	0.003	1.0140	17.4	0.01410	11.8	0.003770	44.08	107.99	23.94
293	293	1.016	0.003	1.0130	17.1	0.01415	12.1	0.002876	40.93	100.27	22.23
4260	4260	1.015	0.003	1.0120	15.3	0.01435	12.3	0.000771	37.78	92.56	20.52

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #5	Iman Shafii	#5	10/17/2017	Sandy Clay	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3594	Wet Density	Wet Denisty (kN/m3)	20.52
height (ft)	0.359	h	Depth of middle of the core (ft)	0.180				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	130.6
								Sample Volume (ft^3)	0.0159	Dry Density	Dry Denisty (kg/m^3)	1664.0
height (mm)	109.609		Depth of lower side of the core (ft)	0.359	Core Diameter (ft)	0.238		Sample weight (lb)	2.0798		Dry Denisty (kN/m^3)	16.32
		d						Wet Denisty (pcf)	130.64		Dry Denisty (pcf)	104

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.18	#2	1	21.75	20.75	17.5	16.5	4.25	16.5	25.76%
2	0.18	B	1	30.95	29.95	22.5	21.5	8.45	21.5	39.30%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.180	25-35	31	33	1.1	10.1	8.2	26.8%
2		20-30	26	46	1.1	11.4	9.15	28.0%
3		15-25	20	XX	1	10.25	8.2	28.5%
Liquid Limit		27.9%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.180	A	1.1	10.6	9.2	17.3%
	2	0.180	5	1.1	11.2	9.8	16.1%
Average Plastic Limit	16.69%		Plasticity Index	11.22%	Liquidity Index	80.82%	

Notes:

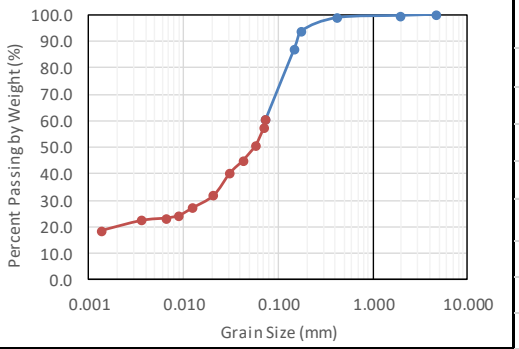
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	32	1.875	179.3	Tybe A

Notes:

Pocket Erodomoeter was 1 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #5	Iman Shafii	Bay City Bridge west riverside	Cemented	28.984104, -96.000591	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	502.0	502.0	0	0.0	100.0
		10	2.00	624.0	625.0	1	0.4	99.6
2	247	40	0.425	363.0	365.0	2	1.2	98.8
		80	0.180	525.0	537.0	12	6.1	93.9
		100	0.149	322.0	339.0	17	13.0	87.0
		200	0.074	318.0	384.0	66	39.7	60.32
		Pan	0.00	359.0	508.0	149	100.0	0.0
		∑ soil mass after sieve (gr)		247				
		Error (%)		0.0%				



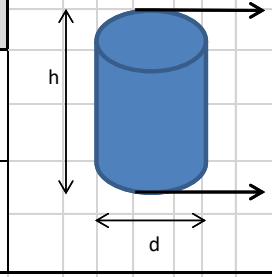
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	39.7%	60.3%	N/A	0.0177	0.0582	0.074	#VALUE!	#VALUE!	CL with sand	A-6 (4.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	11	10.8	0.981818182	151H
2	52				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

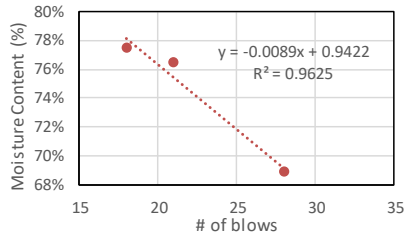
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.033	0.003	1.0300	19.0	0.01382	7.6	0.074000	94.37	140.62	60.32
0.30	0.3	1.0315	0.003	1.0285	19.0	0.01382	7.95	0.071143	89.65	133.59	57.47
0.50	0.5	1.028	0.003	1.0250	19.0	0.01382	8.90	0.058307	78.64	117.18	50.83
1	1	1.025	0.003	1.0220	19.0	0.01382	9.70	0.043042	69.21	103.12	45.14
2	2	1.0225	0.003	1.0195	19.0	0.01382	10.4	0.031439	61.34	91.40	40.39
5	5	1.018	0.003	1.0150	18.7	0.01387	11.5	0.021036	47.19	70.31	31.85
15	15	1.0155	0.003	1.0125	18.3	0.01394	12.2	0.012571	39.32	58.59	27.11
30	30	1.014	0.003	1.0110	18.0	0.01399	12.6	0.009067	34.60	51.56	24.26
57	57	1.0135	0.003	1.0105	17.4	0.01410	12.8	0.006668	33.03	49.22	23.32
201	201	1.013	0.003	1.0100	16.3	0.01430	12.9	0.003622	31.46	46.87	22.37
1450	1450	1.011	0.003	1.0080	16.3	0.01430	13.4	0.001374	25.17	37.50	18.57

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #8	Iman Shafii	#8	10/23/2017	Silt	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3917	Wet Density	Wet Denisty (kN/m3)	16.97
height (ft)	0.392		Depth of middle of the core (ft)	0.196				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	108.0
								Sample Volume (ft^3)	0.0174	Dry Density	Dry Denisty (kg/m^3)	1347.6
height (mm)	119.458		Depth of lower side of the core (ft)	0.392	Core Diameter (ft)	0.238		Sample weight (lb)	1.8739		Dry Denisty (kN/m^3)	13.22
								Wet Denisty (pcf)	108		Dry Denisty (pcf)	84.1

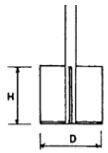
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	XX	1	34.25	33.25	26.9	25.9	7.35	25.9	28.38%
2	0.20				0		0	0	0	#DIV/0!

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.196	25-35	28	5	1	8.6	5.5	68.9%
2		20-30	21	XX	1	10	6.1	76.5%
3		15-25	18	FF	1	12	7.2	77.4%
Liquid Limit		72.0%		Notes:				



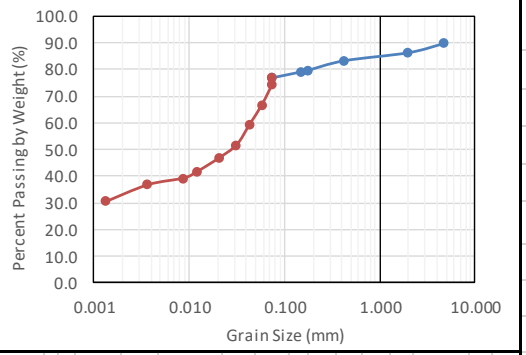
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.196	XX	1.1	9.1	7.75	20.3%
	2	0.196	FF	1	11.6	9.8	20.5%
Average Plastic Limit	20.38%		**Plasticity Index**	51.59%	**Liquidity Index**	15.51%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was 3.3 mm.
					tsf or kg/cm^2	kPa		
	19	29	90	34	1.5	143.5	Type B	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #8	Iman Shafii	Levee, Light Brown	Cemented	29.025775, -95.462337	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.6	526.6	25	10.0	90.0
		10	2.00	624.2	633.1	8.9	13.5	86.5
5	250	40	0.43	363.7	371.4	7.7	16.6	83.4
		80	0.18	524.8	533.8	9	20.2	79.8
		100	0.15	322.5	324.2	1.7	20.9	79.1
		200	0.07	317.3	323.0	5.7	23.2	76.83
		Pan	0.00	359.8	552.1	192.3	100.0	0.0
		∑ soil mass after sieve (gr)		250.3				
		Error (%)		-0.1%				



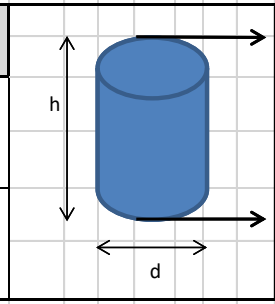
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
10.0%	13.2%	76.8%	N/A	0.0013	0.0275	0.043	#VALUE!	#VALUE!	CH	A-7-6 (40.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	10	9.9	0.99	151H
5	50				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	62.992	100.012	0.9981	162.81	16.5	173.1	2.657
						$G_{s,\ 20c}$	2.656606	

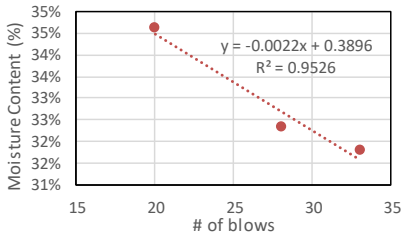
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.032	0.003	1.0290	19.1	0.01380	7.8	0.074000	94.09	180.94	76.83
0.28	0.283333	1.031	0.003	1.0280	19.1	0.01380	8.10	0.073802	90.85	174.70	74.33
0.50	0.5	1.028	0.003	1.0250	19.1	0.01380	8.90	0.058235	81.11	155.98	66.84
1	1	1.025	0.003	1.0220	19.1	0.01380	9.7	0.042989	71.38	137.26	59.36
2	2	1.022	0.003	1.0190	19.1	0.01380	10.5	0.031627	61.65	118.55	51.87
5	5	1.02	0.003	1.0170	18.9	0.01384	11.0	0.020524	55.16	106.07	46.88
15	15	1.018	0.003	1.0150	18.3	0.01394	11.5	0.012205	48.67	93.59	41.89
30	30	1.017	0.003	1.0140	17.9	0.01401	11.8	0.008785	45.42	87.35	39.39
180	180	1.016	0.003	1.0130	16.7	0.01422	12.1	0.003688	42.18	81.11	36.89
1440	1440	1.0135	0.003	1.0105	16.3	0.01430	12.8	0.001345	34.07	65.51	30.66

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #9	Iman Shafii	#9	10/20/2017	Sandy Clay	From :	0	1	
						To :	1		

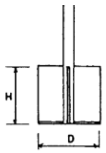
Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.5392	Wet Density	Wet Denisty (kN/m3)	17.25
height (ft)	0.539		Depth of middle of the core (ft)	0.270				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	109.8
								Sample Volume (ft^3)	0.0239	Dry Density	Dry Denisty (kg/m^3)	1499.0
height (mm)	164.446		Depth of lower side of the core (ft)	0.539	Core Diameter (ft)	0.238		Sample weight (lb)	2.6235		Dry Denisty (kN/m^3)	14.70
								Wet Denisty (pcf)	109.83		Dry Denisty (pcf)	93.6

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.27	1B	1.1	26.1	25	22.4	21.3	3.7	21.3	17.37%
2	0.27	A	1.1	14.1	13	12	10.9	2.1	10.9	19.27%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.270	25-35	33	3	1	9.7	7.6	31.8%
2		20-30	28	122	1	9.8	7.65	32.3%
3		15-25	20	175	1	14.8	11.25	34.6%
Liquid Limit		33.5%		Notes:				

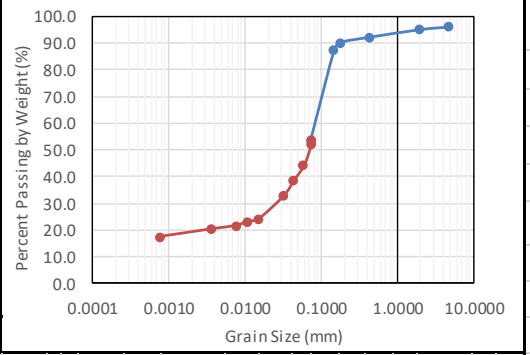


Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	0.270	FF	1	10.2	8.8	17.9%	
	2	0.270	O	1	10	8.7	16.9%	
Average Plastic Limit	17.42%		**Plasticity Index**	16.04%	**Liquidity Index**	-0.28%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	
					tsf or kg/cm^2	kPa		
	19	29	90	36	2	191.3	Type A	Pocket Erodomoeter was almost 22.5 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #9	Iman Shafii	Underground culvert	Semi cemented	29.544212, -95.743429	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.0	505.0	4	3.9	96.1
		10	2.00	662.0	663.0	1	4.9	95.1
2	103	40	0.425	363.0	366.0	3	7.8	92.2
		80	0.180	525.0	527.0	2	9.7	90.3
		100	0.149	322.0	325.0	3	12.6	87.4
		200	0.074	317.0	351.5	34.5	46.1	53.88
		Pan	0.00	359.5	415.0	55.5	100.0	0.0
		∑ soil mass after sieve (gr)		103				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
3.9%	42.2%	53.9%	0.0001	0.0264	0.0696	0.085	82.00	850.00	CL with sand	A-6 (5.5)

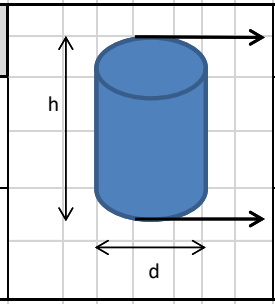
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.5	6.4	0.984615385	151H
2	46				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	61.504	100.1803	0.9981	161.49	12.05	169	2.648
						$G_{s,\ 20c}$	2.647954	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.13	0.133333	1.031	0.003	1.0280	19.9	0.01365	8.1	0.074000	99.29	55.10	53.88
0.29	0.291667	1.03	0.003	1.0270	19.9	0.01365	8.40	0.073254	95.74	53.14	51.97
0.50	0.5	1.026	0.003	1.0230	19.9	0.01365	9.40	0.059185	81.56	45.26	44.33
1	1	1.023	0.003	1.0200	19.9	0.01365	###	0.043595	70.92	39.36	38.59
2	2	1.02	0.003	1.0170	19.9	0.01365	11.0	0.032012	60.28	33.46	32.86
10	10	1.0155	0.003	1.0125	19.5	0.01370	12.2	0.015133	44.32	24.60	24.26
20	20	1.015	0.003	1.0120	19.1	0.01377	12.3	0.010798	42.55	23.62	23.31
40	40	1.0142	0.003	1.0112	18.5	0.01389	12.5	0.007764	39.72	22.04	21.78
184	184	1.0135	0.003	1.0105	16.8	0.01391	12.8	0.003660	37.23	20.66	20.44
4370	4370	1.012	0.003	1.0090	16.2	0.01410	13.1	0.000772	31.91	17.71	17.58

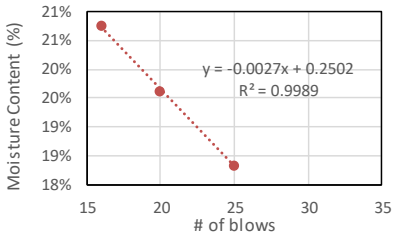
Silt Samples - EFA

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-13-16 (mid-depth)	Iman Shafii	B-13-16	2/22/2017	Silt	From :	22.5		
						To :	25	2.5	

Sample Dimensions			Depth of upper side of the core (ft)	24.000	Notes:		Density Calcs.	Sample Height (ft)	0.208	Wet Density	Wet Denisty (kN/m3)	19.7
height (ft)	0.208		Depth of middle of the core (ft)	24.104				Sample Diameter (ft)	0.23		Wet Denisty (pcf)	125.6
								Sample Volume (ft^3)	0.0087	Dry Density	Dry Denisty (kg/m^3)	1681.0
height (mm)	63.542		Depth of lower side of the core (ft)	24.208	Core Diameter (ft)	0.23		Sample weight (lb)	1.087		Dry Denisty (kN/m^3)	16.5
								Wet Denisty (pcf)	125.57		Dry Denisty (pcf)	105

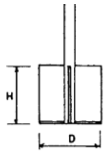
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	24.90	Z	1	39.8	38.8	33	32	6.8	32	21.25%
2	24.90	45	1	72.9	71.9	61.9	60.9	11	60.9	18.06%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	24.10	25-35	25	175	1	8.1	7	18.33%
2		20-30	20	29	1	7.1	6.1	19.61%
3		15-25	16	XX	1	7.4	6.3	20.75%
Liquid Limit (%)		18.27%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	24.90	FF	0.9	5.3	4.7	15.79%
	2	24.90	2	1	7.3	6.5	14.55%
Average Plastic Limit (%)	15.17%		Plasticity Index	3.10%	Liquidity Index	144.68%	

Notes:

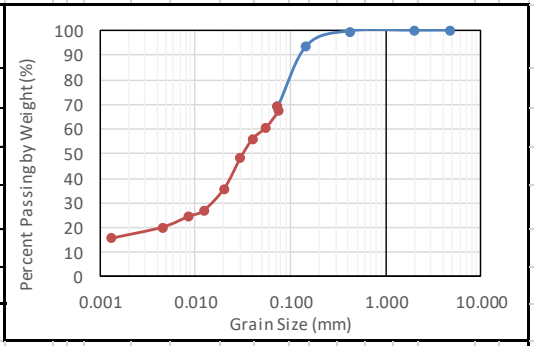
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			OSHA Category
					Unconfined Strength			
					tsf or kg/cm²	kPa		
	19	29	90	N/A	N/A	#VALUE!		N/A

Notes:

Pocket Erodometer was more than 15 mm. Sample was very sandy, and thus PP and Vane were not possible given the fact that samples were already extruded from the tube difficultly

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-13-16 (mid-depth)	Iman Shafii	1	2	3		
			Alcona Dam, Brown	Unemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.0	0	0.0	100.00
		10	2.00	624	624.1	0.1	0.0	99.97
2	303.2	40	0.43	363	363.7	0.7	0.3	99.74
		100	0.15	321	339.0	18	6.0	93.98
		200	0.07	317	393.0	76	30.4	69.63
		Pan	0.00	360	577.4	217.4	100.0	0.0
		∑ soil mass after sieve (gr)		312.2				
		Error (%)		-3.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	30.4%	69.6%	0.001	0.0152	0.04434	0.0563	4.10	56.30	ML with Sand	A-4 (0)

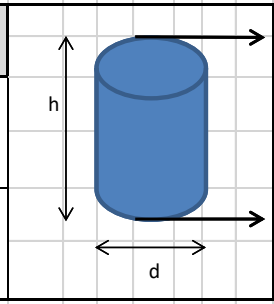
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	23.95	23.9	0.997912317	151H
2	50.55				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	102.846	249.6072	0.9976	351.845	40.07	377.2	2.719
						$G_{s,\ 20c}$	2.717641	

Time (min)	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	of total	% of fine
0.08	0.083333	1.032	0.003	1.0290	21.8	0.01335	7.8	0.074000	90.96	197.7	69.63
0.25	0.25	1.031	0.003	1.0280	21.8	0.01335	8.1	0.076001	87.82	190.9	67.38
0.50	0.5	1.028	0.003	1.0250	21.8	0.01335	8.9	0.056332	78.41	170.5	60.63
1	1	1.026	0.003	1.0230	21.8	0.01335	9.4	0.040936	72.14	156.8	56.14
2	2	1.0225	0.003	1.0195	21.8	0.01335	10.4	0.030374	61.16	133.0	48.26
5	5	1.017	0.003	1.0140	21.6	0.01338	11.8	0.020561	43.91	95.5	35.90
15	15	1.013	0.003	1.0100	21.3	0.01343	12.9	0.012456	31.37	68.2	26.90
31	31	1.012	0.003	1.0090	21.1	0.01346	13.1	0.008752	28.23	61.4	24.65
120	120	1.01	0.003	1.0070	20.6	0.01355	13.7	0.004578	21.96	47.7	20.15
1440	1440	1.008	0.003	1.0050	20.3	0.01343	14.2	0.001334	15.68	34.1	15.65

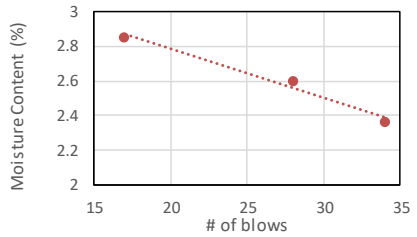
B-9-16 (16'-17.5') Bottom – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-9-16 (bottom)	Iman Shafii	B-9-16	12/22/2016	Silt	From :	16	1.5	
						To :	17.5		

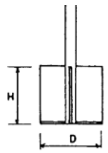
Sample Dimensions			Depth of upper side of the core (ft)	17.000	Notes:		Density Calcs.	Sample Height (ft)	0.375	Wet Density	Wet Denisty (kN/m3)	18.1
height (ft)	0.375		Depth of middle of the core (ft)	17.188				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	115.1
height (mm)	114.375		Depth of lower side of the core (ft)	17.375	Core Diameter (ft)	0.25		Sample Volume (ft^3)	0.0184	Dry Density	Dry Denisty (kg/m^3)	1592.3
								Sample weight (lb)	2.119		Dry Denisty (kN/m^3)	15.6
								Wet Denisty (pcf)	115.11		Dry Denisty (pcf)	99.4

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	24.90	49	1	68.8	67.8	59.8	58.8	9	58.8	15.31%
2	24.90	122	1	43.1	42.1	37.2	36.2	5.9	36.2	16.30%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	17.19	25-35	26	H	1.1	11.2	9.7	17.44%
2		20-30	19	A	1.1	8.7	7.5	18.75%
3		15-25	15	122	1	11.2	9.5	20.00%
Liquid Limit (%)		17.53%		Notes:				

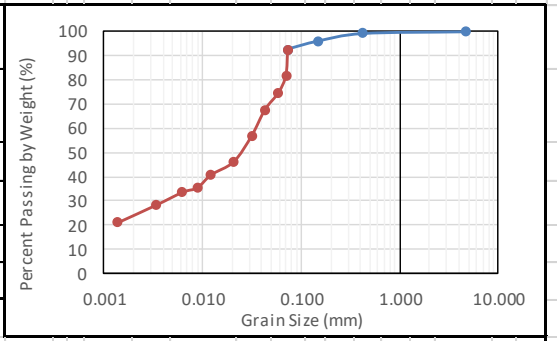


Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	114.375	175	1	22.7	19.7	16.04%	
	2						#DIV/0!	
Average Plastic Limit (%)	16.04%		Plasticity Index	1.49%	Liquidity Index	-16.17%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodometer: 15.42 mm
					tsf or kg/cm^2	kPa		
	19	29	90	N/A	1.4	133.9	Type B	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-9-16 (bottom)	Iman Shafii	1	2	3		
			Alcona Dam, Light Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.4	0.4	0.0	100.0
4.7	495	40	0.43	363	366.4	3.4	0.8	99.2
		100	0.15	321	337.8	16.8	4.2	95.8
		200	0.07	317	334.4	17.4	7.7	92.32
		Pan	0.00	360	817.0	457.0	100.0	0.0
		∑ soil mass after sieve (gr)		495				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	7.6%	92.3%	N/A	0.00427	0.0248	0.03524	#VALUE!	#VALUE!	ML	A-4 (0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.7	0.989795918	151H
4.7	42.2				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

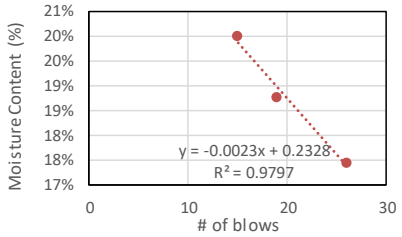
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.029	0.003	1.0260	21.7	0.01337	8.6	0.074000	100.00	457.0	92.32
0.33	0.333333	1.026	0.003	1.0230	21.7	0.01337	9.4	0.070989	88.44	404.2	81.65
0.50	0.5	1.024	0.003	1.0210	21.7	0.01337	10.0	0.059784	80.75	369.0	74.55
1	1	1.022	0.003	1.0190	21.7	0.01337	10.5	0.043317	73.06	333.9	67.45
2	2	1.019	0.003	1.0160	21.7	0.01337	11.3	0.031775	61.52	281.2	56.80
5	5	1.016	0.003	1.0130	21.5	0.01340	12.1	0.020846	49.99	228.4	46.15
15	15	1.0145	0.003	1.0115	21.1	0.01346	12.5	0.012266	44.22	202.1	40.82
30	30	1.013	0.003	1.0100	20.7	0.01353	12.9	0.008873	38.45	175.7	35.50
60	60	1.0125	0.003	1.0095	20.3	0.01360	13.0	0.006330	36.53	166.9	33.72
225	225	1.011	0.003	1.0080	18.9	0.01384	13.4	0.003377	30.76	140.6	28.40
1380	1380	1.009	0.003	1.0060	18.8	0.01385	13.9	0.001390	23.07	105.4	21.30

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-9-16 (middle)	Iman Shafii	B-9-16	12/20/2016	Low Plastic Silt	From :	16		
						To :	17.5	1.5	

Sample Dimensions			Depth of upper side of the core (ft)	16.750	Notes:		Density Calcs.	Sample Height (ft)	0.375	Wet Density	Wet Denisty (kN/m3)	17.7
height (ft)	0.375	h	Depth of middle of the core (ft)	16.938				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	112.6
								Sample Volume (ft^3)	0.0184	Dry Density	Dry Denisty (kg/m^3)	1518.3
height (mm)	114.375	d	Depth of lower side of the core (ft)	17.125	Core Diameter (ft)	0.25		Sample weight (lb)	2.072		Dry Denisty (kN/m^3)	14.9
								Wet Denisty (pcf)	112.56		Dry Denisty (pcf)	94.8

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	24.90	29	1.1	35.95	34.85	30.7	29.6	5.25	29.6	17.74%
2	24.90	50	1.1	11.4	10.3	9.7	8.6	1.7	8.6	19.77%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	16.94	25-35	26	H	1.1	11.2	9.7	17.44%
2		20-30	19	A	1.1	8.7	7.5	18.75%
3		15-25	15	122	1	11.2	9.5	20.00%
Liquid Limit (%)		17.53%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	114.375	175	1	22.7	19.7	16.04%
	2						#DIV/0!
Average Plastic Limit (%)	16.04%		Plasticity Index	1.49%	Liquidity Index	182.16%	

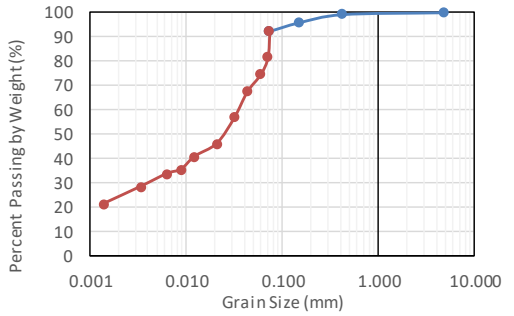
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		OSHA Category
					Unconfined Strength		
					tsf or kg/cm^2	kPa	
	19	29	90	N/A	1.4	133.9	Type B

Notes:

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-9-16 (middle)	Iman Shafii	1	2	3		
			Alcona Dam, Light Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.4	0.4	0.0	100.0
4.7	495	40	0.43	363	366.4	3.4	0.8	99.2
		100	0.15	321	337.8	16.8	4.2	95.8
		200	0.07	317	334.4	17.4	7.7	92.3
		Pan	0.00	360	817.0	457.0	100.0	0.0
		∑ soil mass after sieve (gr)		495				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	7.6%	92.3%	N/A	0.00427	0.0248	0.03524	#VALUE!	#VALUE!	ML	A-4 (0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.7	0.989795918	151H
4.7	42.2				

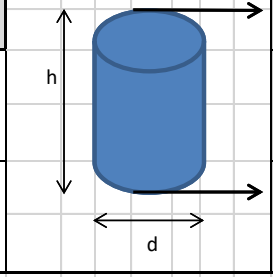
Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.029	0.003	1.0260	21.7	0.01337	8.6	0.074000	100.00	457.0	92.32
0.33	0.333333	1.026	0.003	1.0230	21.7	0.01337	9.4	0.070989	88.44	404.2	81.65
0.50	0.5	1.024	0.003	1.0210	21.7	0.01337	10.0	0.059784	80.75	369.0	74.55
1	1	1.022	0.003	1.0190	21.7	0.01337	10.5	0.043317	73.06	333.9	67.45
2	2	1.019	0.003	1.0160	21.7	0.01337	11.3	0.031775	61.52	281.2	56.80
5	5	1.016	0.003	1.0130	21.5	0.01340	12.1	0.020846	49.99	228.4	46.15
15	15	1.0145	0.003	1.0115	21.1	0.01346	12.5	0.012266	44.22	202.1	40.82
30	30	1.013	0.003	1.0100	20.7	0.01353	12.9	0.008873	38.45	175.7	35.50
60	60	1.0125	0.003	1.0095	20.3	0.01360	13.0	0.006330	36.53	166.9	33.72
225	225	1.011	0.003	1.0080	18.9	0.01384	13.4	0.003377	30.76	140.6	28.40
1380	1380	1.009	0.003	1.0060	18.8	0.01385	13.9	0.001390	23.07	105.4	21.30

B-9-16 (16'-17.5') Top – Page 1

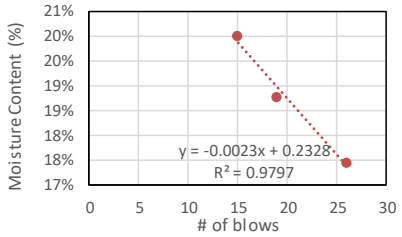
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-9-16 (top)	Iman Shafii	B-9-16	12/27/2016	Low Plastic Silt	From :	16		
						To :	17.5	1.5	

Sample Dimensions		Depth of upper side of the core (ft)	16.000	Notes:		Density Calcs.	Sample Height (ft)	0.271	Wet Density	Wet Denisty (kN/m3)	16.1
height (ft)	0.271	Depth of middle of the core (ft)	16.135				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	102.3
							Sample Volume (ft^3)	0.0133	Dry Density	Dry Denisty (kg/m^3)	1434.5
height (mm)	82.604	Depth of lower side of the core (ft)	16.271	Core Diameter (ft)	0.25		Sample weight (lb)	1.360		Dry Denisty (kN/m^3)	14.1
							Wet Denisty (pcf)	102.3		Dry Denisty (pcf)	89.6



Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	24.90	A	1.1	33	31.9	29	27.9	4	27.9	14.34%
2	24.90	H	1.1	22.1	21	19.5	18.4	2.6	18.4	14.13%

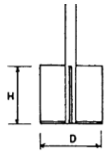
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	16.14	25-35	26	H	1.1	11.2	9.7	17.44%
2		20-30	19	A	1.1	8.7	7.5	18.75%
3		15-25	15	122	1	11.2	9.5	20.00%
Liquid Limit (%)		17.53%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	114.375	175	1	22.7	19.7	16.04%
	2						#DIV/0!
Average Plastic Limit (%)	16.04%		Plasticity Index	1.49%	Liquidity Index	-121.64%	

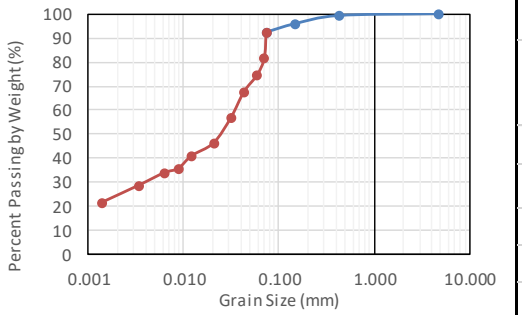
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodometer is 17.3 mm
					tsf or kg/cm^2	kPa		
	19	29	90	N/A	1.4	133.9	Type B	



Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	B-9-16 (top)	Iman Shafii	Alcona Dam, Light Brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.4	0.4	0.0	100.0
4.7	495	40	0.43	363	366.4	3.4	0.8	99.2
		100	0.15	321	337.8	16.8	4.2	95.8
		200	0.07	317	334.4	17.4	7.7	92.3
		Pan	0.00	360	817.0	457.0	100.0	0.0
		∑ soil mass after sieve (gr)		495				
		Error (%)		0.0%				



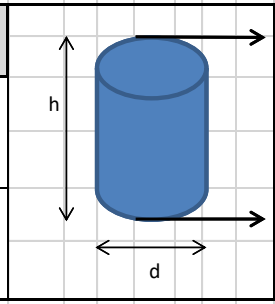
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	7.6%	92.3%	N/A	0.00427	0.0248	0.03524	#VALUE!	#VALUE!	ML	A-4 (0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.7	0.989795918	151H
4.7	42.2				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

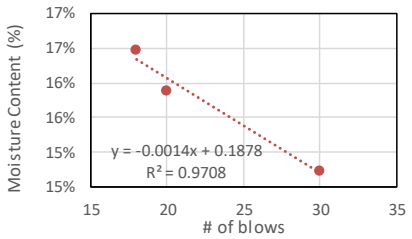
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.029	0.003	1.0260	21.7	0.01337	8.6	0.074000	100.00	457.0	92.32
0.33	0.333333	1.026	0.003	1.0230	21.7	0.01337	9.4	0.070989	88.44	404.2	81.65
0.50	0.5	1.024	0.003	1.0210	21.7	0.01337	10.0	0.059784	80.75	369.0	74.55
1	1	1.022	0.003	1.0190	21.7	0.01337	10.5	0.043317	73.06	333.9	67.45
2	2	1.019	0.003	1.0160	21.7	0.01337	11.3	0.031775	61.52	281.2	56.80
5	5	1.016	0.003	1.0130	21.5	0.01340	12.1	0.020846	49.99	228.4	46.15
15	15	1.0145	0.003	1.0115	21.1	0.01346	12.5	0.012266	44.22	202.1	40.82
30	30	1.013	0.003	1.0100	20.7	0.01353	12.9	0.008873	38.45	175.7	35.50
60	60	1.0125	0.003	1.0095	20.3	0.01360	13.0	0.006330	36.53	166.9	33.72
225	225	1.011	0.003	1.0080	18.9	0.01384	13.4	0.003377	30.76	140.6	28.40
1380	1380	1.009	0.003	1.0060	18.8	0.01385	13.9	0.001390	23.07	105.4	21.30

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-7 (22-24)	Iman Shafii	B-7	1/10/2017	Sandy Silt	From :	22	2	
						To :	24		

Sample Dimensions			Depth of upper side of the core (ft)	22.000	Notes:		Density Calcs.	Sample Height (ft)	0.750	Wet Density	Wet Denisty (kN/m3)	20.2
height (ft)	0.750		Depth of middle of the core (ft)	22.375				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	128.7
								Sample Volume (ft^3)	0.0368	Dry Density	Dry Denisty (kg/m^3)	1804.7
height (mm)	228.750		Depth of lower side of the core (ft)	22.750	Core Diameter (ft)	0.25		Sample weight (lb)	4.740		Dry Denisty (kN/m^3)	17.7
								Wet Denisty (pcf)	128.75		Dry Denisty (pcf)	113

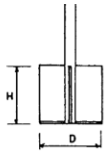
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	22.375	46	1.1	100.4	99.3	88.9	87.8	11.5	87.8	13.10%
2	22.375	A-1	1	71.2	70.2	61.8	60.8	9.4	60.8	15.46%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	22.375	25-35	30	I	1.1	19.8	17.4	14.72%
2		20-30	20	29	1	18.5	16.1	15.89%
3		15-25	18	49	1.1	15.6	13.55	16.47%
Liquid Limit (%)		15.28%		Notes:				



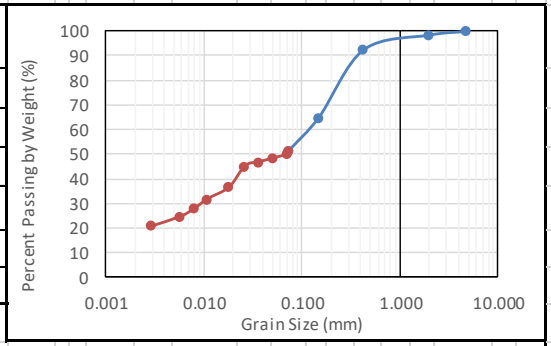
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	22.375	O	1	8.8	8.1	9.86%
	2	22.375	A	1.2	10.1	9.3	9.88%
Average Plastic Limit (%)	9.87%		Plasticity Index	5.41%	Liquidity Index	81.51%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Penetrometer was 2.67 mm.
					tsf or kg/cm^2	kPa		
	19	29	90	49	1.5	143.5	Type B	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-7 (22-24)	Iman Shafii	1	2	3		
			Riverline, Grayish brown	Uncemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.0	0	0.0	100.0
		10	2.00	624	627.0	3	1.5	98.5
2	200	40	0.425	363	375.0	12	7.5	92.5
		100	0.149	321	376.0	55	35.0	65.0
		200	0.074	317	344.0	27	48.5	51.5
		Pan	0.00	360	463.0	103	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	48.5%	51.5%	N/A	0.00947	0.0705	0.1212	#VALUE!	#VALUE!	ML-CL with Sand	A-4(0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	5	4.95	0.99	151H
2	51.62				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	63.386	99.7905	0.9976	162.938	9.1	168.8	2.80
						$G_{s,\ 20c}$	2.800043	

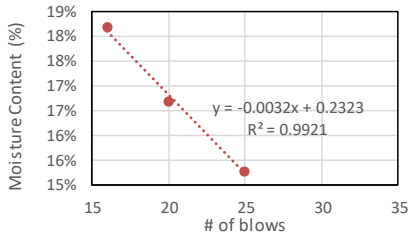
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	21.8	0.01279	7.3	0.074000	94.36	97.2	51.50
0.25	0.25	1.033	0.003	1.0300	21.8	0.01279	7.6	0.070519	91.32	94.1	49.93
0.50	0.5	1.032	0.003	1.0290	21.8	0.01279	7.8	0.050516	88.27	90.9	48.36
1	1	1.031	0.003	1.0280	21.8	0.01279	8.1	0.036401	85.23	87.8	46.79
2	2	1.03	0.003	1.0270	21.8	0.01279	8.4	0.026212	82.18	84.7	45.23
5	5	1.0245	0.003	1.0215	21.5	0.01284	9.9	0.018015	65.44	67.4	36.60
15	15	1.0215	0.003	1.0185	20.8	0.01294	10.6	0.010879	56.31	58.0	31.90
30	30	1.019	0.003	1.0160	20.4	0.01301	11.3	0.007982	48.70	50.2	27.98
60	60	1.017	0.003	1.0140	20.1	0.01305	11.8	0.005789	42.61	43.9	24.85
245	245	1.0145	0.003	1.0115	19.8	0.01310	12.5	0.002954	35.00	36.1	20.93
1537	1537	1.0115	0.003	1.0085	19.1	0.01321	13.3	0.001227	25.87	26.6	16.22

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-9A (25-27)	Iman Shafii	B-9A	1/11/2017	Silt	From :	25	2	
						To :	27		

Sample Dimensions			Depth of upper side of the core (ft)	25.000	Notes:		Density Calcs.	Sample Height (ft)	0.800	Wet Density	Wet Denisty (kN/m3)	21.1
height (ft)	0.800	h	Depth of middle of the core (ft)	25.400				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	134.3
								Sample Volume (ft^3)	0.0393	Dry Density	Dry Denisty (kg/m^3)	1950.0
height (mm)	244.000	d	Depth of lower side of the core (ft)	25.800	Core Diameter (ft)	0.25		Sample weight (lb)	5.275		Dry Denisty (kN/m^3)	19.1
								Wet Denisty (pcf)	134.32		Dry Denisty (pcf)	122

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	25.1	5	1	62.8	61.8	56.8	55.8	6	55.8	10.75%
2	25.1	#1B	1	38.7	37.7	35.3	34.3	3.4	34.3	9.91%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	25.4	25-35	25	01W-1	1	9.3	8.2	15.28%
2		20-30	20	#2	1	10.1	8.8	16.67%
3		15-25	16	X	1	7.5	6.5	18.18%
Liquid Limit (%)		15.23%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	25.4	5	1	16.8	15.3	10.49%
	2	25.4	29	1	16.5	14.9	11.51%
Average Plastic Limit (%)	11.00%		**Plasticity Index**	4.23%	**Liquidity Index**	-15.78%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	N/A	>4.5	>430	Type A

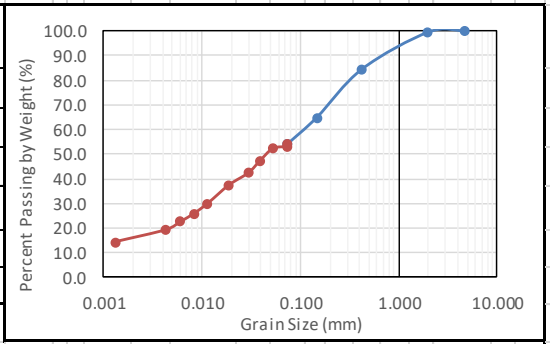
Notes:

Pocket Erodometer was 1.4 mm
Sample was too stiff to penetrate the vane and pocket penterometer

B-9A (25’-27’) Tittabawsee River – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	B-9A (25-27)	Iman Shafii	Riverline, Greysih brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501.0	0	0.0	100.0
		10	2.000	624	625.0	1	0.5	99.5
2	200	40	0.425	363	393.0	30	15.5	84.5
		100	0.149	322	361.0	39	35.0	65.0
		200	0.074	317	339.0	22	46.0	54.0
		Pan	0.000	360	468.0	108	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



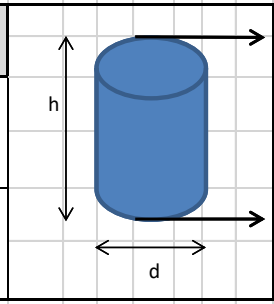
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	46.0%	54.0%	0.0012	0.0152	0.0733	0.103	1.87	85.83	Ml-CL with Sand	A-4(0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	4.7	4.7	1	151H
2	52.55				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	57.464	99.5185	0.9976	156.74	14.96	166.1	2.652
						$G_{s,\ 20c}$	2.650791	

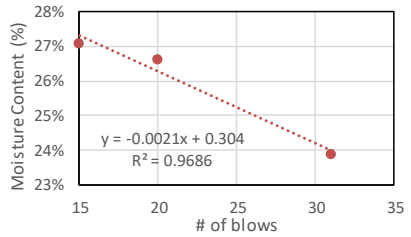
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.031	0.003	1.0280	23.6	0.01288	8.1	0.074000	85.56	92.4	54.00
0.25	0.25	1.0305	0.003	1.0275	23.6	0.01288	8.3	0.073990	84.03	90.8	53.18
0.50	0.5	1.03	0.003	1.0270	23.6	0.01288	8.4	0.052792	82.50	89.1	52.35
1	1	1.027	0.003	1.0240	23.6	0.01288	9.2	0.039067	73.34	79.2	47.40
2	2	1.024	0.003	1.0210	23.6	0.01288	10.7	0.029792	64.17	69.3	42.45
5	5	1.021	0.003	1.0180	23.3	0.01293	10.7	0.018908	55.00	59.4	37.50
15	15	1.0165	0.003	1.0135	23.2	0.01294	12.0	0.011550	41.25	44.6	30.08
30	30	1.014	0.003	1.0110	23.1	0.01296	12.6	0.008396	33.61	36.3	25.95
60	60	1.012	0.003	1.0090	23.1	0.01296	13.4	0.006122	27.50	29.7	22.65
120	120	1.01	0.003	1.0070	23.1	0.01296	13.7	0.004377	21.39	23.1	19.35
1440	1440	1.007	0.003	1.0040	21.0	0.01328	14.4	0.001328	12.22	13.2	14.40

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample 2	Iman Shafii	N/A	7/26/2017	Silt	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3642	Wet Density	Wet Denisty (kN/m3)	21.10
height (ft)	0.364		Depth of middle of the core (ft)	0.182				Sample Diameter (ft)	0.2379		Wet Denisty (pcf)	134.3
								Sample Volume (ft^3)	0.0162	Dry Density	Dry Denisty (kg/m^3)	1803.4
height (mm)	111.073		Depth of lower side of the core (ft)	0.364	Core Diameter (ft)	0.238		Sample weight (lb)	2.1738		Dry Denisty (kN/m^3)	17.69
								Wet Denisty (pcf)	134.33		Dry Denisty (pcf)	113

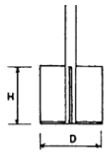
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.18	45	1	9	8	7.7	6.7	1.3	6.7	19.40%
2	0.18	$3	1	13.4	12.4	11.4	10.4	2	10.4	19.23%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.182	25-35	31	G1	1	9.3	7.7	23.9%
2		20-30	20	33	1	14.8	11.9	26.6%
3		15-25	15	M	1	11.8	9.5	27.1%
Liquid Limit		25.15%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.182	122	1	9.1	7.7	20.9%
	2	0.182	X	1	6	5.1	22.0%
Average Plastic Limit	21.42%		Plasticity Index	3.73%	Liquidity Index	-56.53%	

Notes:

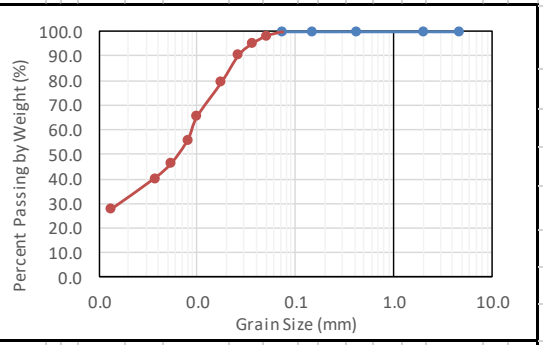
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	N/A	1.400	133.9	Type B

Notes:

Pocket Erodomoeter was almost 5 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	Sample 2	Iman Shafii	1	2	3		
			Handmade	Cemented	Pugger Mixer		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.0	501.0	0.0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.074	50.82	40	0.425	364.0	364.0	0	0.0	100.0
		100	0.149	322.0	322.0	0	0.0	100.0
		200	0.074	317.0	317.0	0	0.0	100.0
		Pan	0.000	252.0	302.8	50.82	100.0	0.0
		∑ soil mass after sieve (gr)		50.82				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	0.0%	100.0%	N/A	0.001695	0.00632	0.00876	#VALUE!	#VALUE!	ML	A-4(2.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9	8.9	0.988888889	151H
0.074	50.82				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
19.72	100006	61.98	99.97295	0.99827	161.78	8.8	167.4	2.750
						$G_{s,\ 20c}$	2.750165	

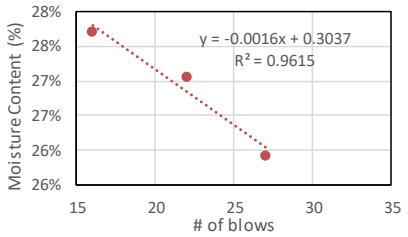
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	21.3	0.01305	7.3	0.074000	96.93	49.26	100.00
0.25	0.25	1.034	0.003	1.0310	21.3	0.01305	7.30	0.070491	96.93	49.26	100.00
0.50	0.5	1.0335	0.003	1.0305	21.3	0.01305	7.45	0.050354	95.37	48.47	98.44
1	1	1.0325	0.003	1.0295	21.3	0.01305	7.70	0.036198	92.24	46.88	95.31
2	2	1.031	0.003	1.0280	21.3	0.01305	8.1	0.026253	87.55	44.49	90.62
5	5	1.0275	0.003	1.0245	20.9	0.01311	9.05	0.017632	76.61	38.93	79.68
18	18	1.023	0.003	1.0200	20.6	0.01315	10.2	0.009902	62.54	31.78	65.61
30	30	1.02	0.003	1.0170	20.4	0.01319	11.0	0.007985	53.16	27.01	56.23
70	70	1.017	0.003	1.0140	19.6	0.01332	11.8	0.005468	43.77	22.25	46.84
165	165	1.015	0.003	1.0120	18.7	0.01347	12.3	0.003678	37.52	19.07	40.59
1452	1452	1.011	0.003	1.0080	16.2	0.01390	13.4	0.001336	25.01	12.71	28.08

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #10	Iman Shafii	#10	10/21/2017	Silt	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.6563	Wet Density	Wet Denisty (kN/m3)	18.21
height (ft)	0.656	h	Depth of middle of the core (ft)	0.328				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	115.9
								Sample Volume (ft^3)	0.0291	Dry Density	Dry Denisty (kg/m^3)	1577.3
height (mm)	200.156	d	Depth of lower side of the core (ft)	0.656	Core Diameter (ft)	0.238		Sample weight (lb)	3.3702		Dry Denisty (kN/m^3)	15.47
								Wet Denisty (pcf)	115.92		Dry Denisty (pcf)	98.5

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.33	FF	1	34.2	33.2	29.2	28.2	5	28.2	17.73%
2	0.33	Z	1.1	21.5	20.4	18.4	17.3	3.1	17.3	17.92%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.328	25-35	27	#1B	1	11.2	9.1	25.9%
2		20-30	22	46	1.1	11.2	9.05	27.0%
3		15-25	16	33	1.1	11.7	9.4	27.7%
Liquid Limit		26.4%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.328	Z	1.1	14.75	12.4	20.8%
	2	0.328					#DIV/0!
Average Plastic Limit	20.80%		Plasticity Index	5.57%	Liquidity Index	-55.01%	

Notes:

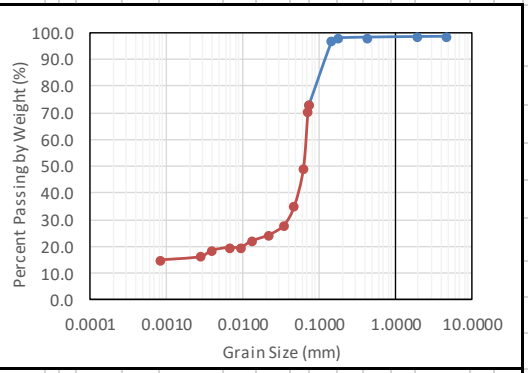
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	kPa	
	19	29	90	22	0.5	47.8	Type C

Notes:

Pocket Erodomoeter was almost 16.7 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #10	Iman Shafii	Underground culvert	Semi cemented	29.0824713, -95.743481	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.6	509.6	8	1.6	98.4
		10	2.00	624.2	624.6	0.4	1.7	98.3
2	500	40	0.43	363.7	364.8	1.1	1.9	98.1
		80	0.18	524.7	526.3	1.6	2.2	97.8
		100	0.15	322.1	327.1	5	3.2	96.8
		200	0.07	317.7	437.7	120	27.2	72.8
		Pan	0.00	359.7	723.6	363.9	100.0	0.0
		∑ soil mass after sieve (gr)		500				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	27.2%	72.8%	N/A	0.0387	0.063	0.0678	#VALUE!	#VALUE!	ML	A-4 (2.4)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.9	9.8	0.98989899	151H
2	50				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.10	0.1	1.031	0.003	1.0280	20.0	0.01365	8.1	0.074000	90.86	330.63	72.80
0.30	0.3	1.03	0.003	1.0270	20.0	0.01365	8.40	0.072229	87.61	318.82	70.43
0.50	0.5	1.021	0.003	1.0180	20.0	0.01365	10.70	0.063145	58.41	212.55	49.18
1	1	1.015	0.003	1.0120	20.0	0.01365	###	0.047872	38.94	141.70	35.01
2	2	1.012	0.003	1.0090	20.0	0.01365	13.1	0.034934	29.20	106.27	27.92
5	5	1.0105	0.003	1.0075	19.7	0.01370	13.6	0.022555	24.34	88.56	24.38
15	15	1.0095	0.003	1.0065	19.3	0.01377	13.8	0.013207	21.09	76.75	22.02
30	30	1.0085	0.003	1.0055	18.9	0.01389	14.1	0.009504	17.85	64.95	19.66
60	60	1.0085	0.003	1.0055	18.5	0.01391	14.1	0.006729	17.85	64.95	19.66
185	185	1.008	0.003	1.0050	17.4	0.01410	14.2	0.003906	16.22	59.04	18.48
371	371	1.007	0.003	1.0040	16.9	0.01419	14.4	0.002795	12.98	47.23	16.12
4270	4270	1.0065	0.003	1.0035	15.3	0.01435	14.6	0.000839	11.36	41.33	14.94

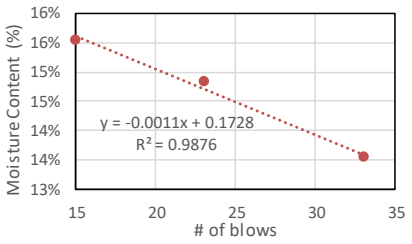
Sand Samples - EFA

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sand #1	Iman Shafii	N/A	8/18/2017	Clayey sand	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 16 blows per layer 2 x 3" layers		Density Calcs.	Sample Height (ft)	0.5	Wet Density	Wet Denisty (kN/m3)	18.12
height (ft)	0.500	h	Depth of middle of the core (ft)	0.250				Sample Diameter (ft)	0.2446		Wet Denisty (pcf)	115.4
								Sample Volume (ft^3)	0.0235	Dry Density	Dry Denisty (kg/m^3)	1675.5
height (mm)	152.500	d	Depth of lower side of the core (ft)	0.500	Core Diameter (ft)	0.245		Sample weight (lb)	2.71		Dry Denisty (kN/m^3)	16.43
								Wet Denisty (pcf)	115.36		Dry Denisty (pcf)	105

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.25	5	1	8.2	7.2	7.5	6.5	0.7	6.5	10.77%
2	0.25	$122	1	6.6	5.6	6.1	5.1	0.5	5.1	9.80%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.250	25-35	33	A	1	11.9	10.6	13.5%
2		20-30	23	XX	1.1	15.8	13.9	14.8%
3		15-25	15	5	1	12.9	11.3	15.5%
Liquid Limit		14.53%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.250	46	1.1	9.3	8.7	7.9%
	2	0.250	B	1	7.5	7.05	7.4%
Average Plastic Limit	7.67%		Plasticity Index	6.86%	Liquidity Index	38.18%	

Notes:

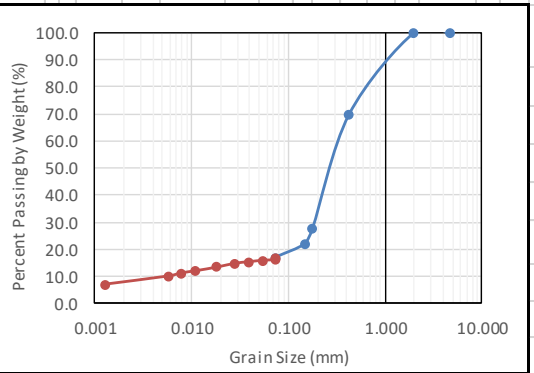
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	N/A	1.050	100.5	Type B

Notes:

Pocket Erodomoeter was almost 33 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	Sand #1	Iman Shafii	Man-made	Uncemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	479	40	0.425	363.0	508.0	145	30.3	69.7
		80	0.180	524.0	724.0	200	72.0	28.0
		100	0.149	322.0	350.0	28	77.9	22.1
		200	0.074	317.0	341.0	24	82.9	17.12
		Pan	0.000	359.0	441.0	82	100.0	0.0
		∑ soil mass after sieve (gr)		479				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	82.9%	17.1%	0.0058	0.19	0.28	0.31	20.08	53.45	SM - SC	A-2-4

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	62.992	99.88177	0.9981	162.68	14.17	171.5	2.654
						$G_{s,20c}$	2.653160	

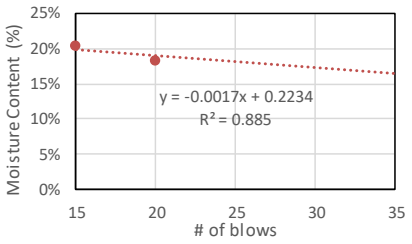
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.83	81.86	17.12
0.27	0.266667	1.0325	0.003	1.0295	19.7	0.01370	7.70	0.073623	95.00	77.90	16.29
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.39	76.58	16.02
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.17	73.94	15.47
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	86.95	71.30	14.91
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.89	64.69	13.54
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.84	58.09	12.16
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.01	54.13	11.33
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.57	48.85	10.23
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.86	34.33	7.20

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sand #1	Iman Shafii	N/A	8/18/2017	Clayey sand	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 17 blows per layer 2 x 2.5" layers		Density Calcs.	Sample Height (ft)	0.4167	Wet Density	Wet Denisty (kN/m3)	23.19
height (ft)	0.417	h	Depth of middle of the core (ft)	0.208				Sample Diameter (ft)	0.2446		Wet Denisty (pcf)	147.6
								Sample Volume (ft^3)	0.0196	Dry Density	Dry Denisty (kg/m^3)	2144.6
height (mm)	127.083	d	Depth of lower side of the core (ft)	0.417	Core Diameter (ft)	0.245		Sample weight (lb)	2.89		Dry Denisty (kN/m^3)	21.03
								Wet Denisty (pcf)	147.63		Dry Denisty (pcf)	134

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.21	$3	1	19.9	18.9	18.1	17.1	1.8	17.1	10.53%
2	0.21	$5	1	7.6	6.6	7	6	0.6	6	10.00%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.208	25-35	36	ww	1.1	12.4	10.8	16.5%
2		20-30	20	#1B	1.1	27	23	18.3%
3		15-25	15	Z	1.1	13.5	11.4	20.4%
Liquid Limit		18.09%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.208	$3	1.1	17.2	15.4	12.6%
	2	0.208	O	1	8.4	7.6	12.1%
Average Plastic Limit	12.35%		Plasticity Index	5.74%	Liquidity Index	-36.46%	

Notes:

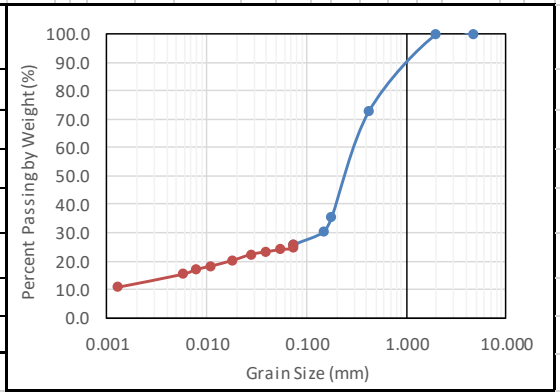
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	N/A	4.600	440.1	Type A

Notes:

Pocket Erodomoeter was almost 2 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Sand #1	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Uncemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	536	40	0.425	363.0	508.0	145	27.1	72.9
		80	0.180	524.0	724.0	200	64.4	35.6
		100	0.149	322.0	350.0	28	69.6	30.4
		200	0.074	317.0	341.0	24	74.1	25.93
		Pan	0.000	359.0	498.0	139	100.0	0.0
		∑ soil mass after sieve (gr)		536				
		Error (%)		0.0%				



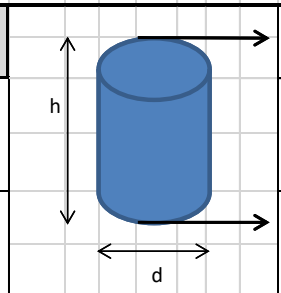
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	74.1%	25.9%	0.0013	0.149	0.245	0.299	57.12	230.00	SM-SC	A-2-4

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	62.992	99.88177	0.9981	162.68	14.17	171.5	2.654
						$G_{s,\ 20c}$	2.653160	

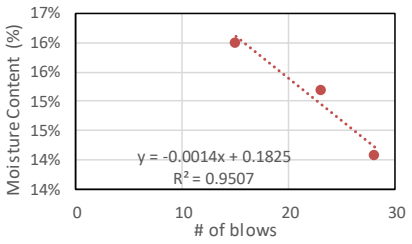
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.83	138.76	25.93
0.27	0.266667	1.0325	0.003	1.0295	19.7	0.01370	7.70	0.073623	95.00	132.04	24.68
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.39	129.81	24.26
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.17	125.33	23.42
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	86.95	120.85	22.59
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.89	109.66	20.50
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.84	98.47	18.41
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.01	91.76	17.16
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.57	82.81	15.49
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.86	58.19	10.90

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	S-0-0-0	Iman Shafii	N/A	5/10/2017	Silty Sand	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 2 layers of 800 gram each layer 3 in		Density Calcs.	Sample Height (ft)	0.5417	Wet Density	Wet Denisty (kN/m3)	22.80
height (ft)	0.542		Depth of middle of the core (ft)	0.271				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	145.1
								Sample Volume (ft^3)	0.024	Dry Density	Dry Denisty (kg/m^3)	2109.1
height (mm)	165.208		Depth of lower side of the core (ft)	0.542	Core Diameter (ft)	0.238		Sample weight (lb)	3.483		Dry Denisty (kN/m^3)	20.68
								Wet Denisty (pcf)	145.15		Dry Denisty (pcf)	132

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.27	Z	1.1	24.3	23.2	22.2	21.1	2.1	21.1	9.95%
2	0.27	B1	1	13.6	12.6	12.4	11.4	1.2	11.4	10.53%

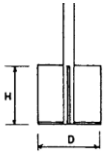
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.271	25-35	28	5	1	16.4	14.5	14.1%
2		20-30	23	175	1	10.1	8.9	15.2%
3		15-25	15	XX	1	12.6	11	16.0%
Liquid Limit		14.75%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.271	H	1	11.65	10.6	10.9%
	2	0.271	M	1	8.7	7.95	10.8%
Average Plastic Limit	10.86%		Plasticity Index	3.89%	Liquidity Index	-16.08%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	34	1.600	153.1	Type A

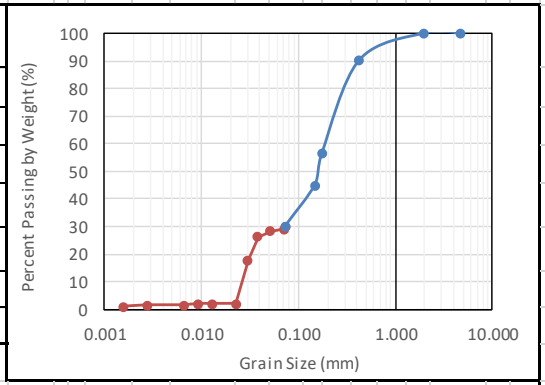


Notes:

Pocket Erodomoeter was 10.75 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	S-0-0-0	Iman Shafii	Man-made	Uncemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.0	501.0	0.0	0.0	100.0
		10	2.000	623.0	623.0	0	0.0	100.0
0.425	429	40	0.425	363.0	405.0	42	9.8	90.2
		80	0.177	523.0	666.0	143	43.2	56.8
		100	0.149	321.0	371.0	50	54.9	45.1
		200	0.074	317.0	381.0	64	69.9	30.14
		Pan	0.000	253.0	382.0	129	100.0	0.0
		∑ soil mass after sieve (gr)		428				
		Error (%)		0.2%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	69.9%	30.1%	0.028	0.074	0.163	0.2	0.98	7.14	SC-SM	A-2-4

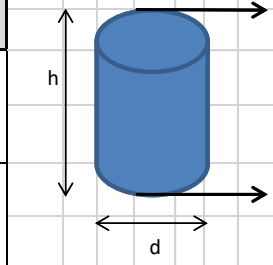
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.55	358.4	2.61
						$G_{s,20c}$	2.611759	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.08	1.034	0.003	1.0310	24.0	0.01314	7.3	0.074000	96.76	124.8	30.14
0.25	0.25	1.033	0.003	1.0300	24.0	0.01314	7.6	0.072426	93.63	120.8	29.21
0.50	0.5	1.032	0.003	1.0290	24.0	0.01314	7.8	0.051883	90.51	116.8	28.27
1	1	1.03	0.003	1.0270	24.0	0.01314	8.4	0.038071	84.27	108.7	26.39
2	2	1.021	0.003	1.0180	24.0	0.01314	10.7	0.030383	56.18	72.5	17.94
5	5	1.004	0.003	1.0010	24.0	0.01314	15.2	0.022903	3.12	4.0	1.99
15	15	1.004	0.003	1.0010	23.8	0.01314	15.2	0.013223	3.12	4.0	1.99
30	30	1.004	0.003	1.0010	23.7	0.01314	15.2	0.009350	3.12	4.0	1.99
60	60	1.0035	0.003	1.0005	23.6	0.01314	15.4	0.006644	1.56	2.0	1.52
360	360	1.0035	0.003	1.0005	23.0	0.01330	15.4	0.002745	1.56	2.0	1.52
1140	1140	1.003	0.003	1.0000	22.3	0.01346	15.5	0.001569	0.00	0.0	1.05

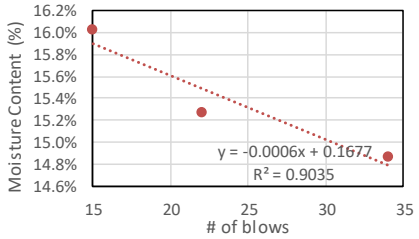
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (23-25)	Iman Shafii	B-1	1/5/2017	Silty Sand	From :	23	2	
						To :	25		

Sample Dimensions		Depth of upper side of the core (ft)	24.375	Notes:		Density Calcs.	Sample Height (ft)	0.625	Wet Density	Wet Denisty (kN/m3)	19.4
height (ft)	0.625	Depth of middle of the core (ft)	24.688				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	123.6
							Sample Volume (ft^3)	0.0307	Dry Density	Dry Denisty (kg/m^3)	1796.5
height (mm)	190.625	Depth of lower side of the core (ft)	25.000	Core Diameter (ft)	0.25		Sample weight (lb)	3.792		Dry Denisty (kN/m^3)	17.6
							Wet Denisty (pcf)	123.6		Dry Denisty (pcf)	112



Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	24.375	33	1	56.9	55.9	51.8	50.8	5.1	50.8	10.04%
2	24.275	O	1	80.8	79.8	73.3	72.3	7.5	72.3	10.37%

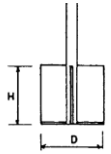
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	24.6875	25-35	34	3	1.1	18.1	15.9	14.86%
2		20-30	22	33	1	17.6	15.4	15.28%
3		15-25	15	1B	1.1	19.2	16.7	16.03%
Liquid Limit (%)		15.27%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	24.375	45	1	8.7	8.1	8.45%
	2	24.375	46	1.1	10.1	9.3	9.76%
Average Plastic Limit (%)	9.10%		Plasticity Index	6.17%	Liquidity Index	17.89%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	106	4.5	430.5	Type A



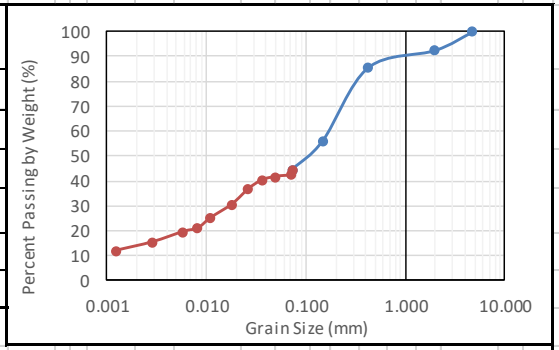
Notes:

Pocket Penetrometer was 1.97 mm

B-1 (23'-25') Tittabawsee River – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	B-1 (23-25)	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Tittabawsee Riverline, Gray	Uncemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.0	0	0.0	100.0
		10	2.00	624	639.0	15	7.5	92.5
4	200	40	0.425	362	376.0	14	14.5	85.5
		100	0.149	320	379.0	59	44.0	56.0
		200	0.074	317	340.0	23	55.5	44.5
		Pan	0.00	360	449.0	89	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	55.5%	44.5%	0.0011	0.0181	0.1099	0.1864	1.60	169.45	SC - SM	A-4 (0)

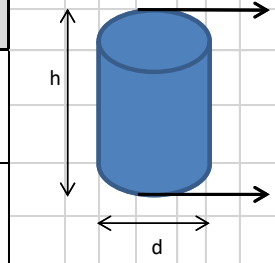
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6	5.95	0.991666667	151H
4	50.24				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	69.232	99.94086	0.9976	168.934	7.2	173.6	2.81
					$G_{s,\ 20c}$	2.806427		

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	22.0	0.01276	7.3	0.074000	96.67	86.0	44.50
0.25	0.25	1.0325	0.003	1.0295	22.0	0.01276	7.7	0.070815	91.99	81.9	42.42
0.50	0.5	1.032	0.003	1.0290	22.0	0.01276	7.8	0.050398	90.43	80.5	41.72
1	1	1.031	0.003	1.0280	22.0	0.01276	8.1	0.036316	87.31	77.7	40.33
2	2	1.0285	0.003	1.0255	22.0	0.01276	8.8	0.026689	79.52	70.8	36.86
5	5	1.024	0.003	1.0210	21.6	0.01282	10.0	0.018130	65.48	58.3	30.62
15	15	1.02	0.003	1.0170	21.1	0.01290	11.0	0.011043	53.01	47.2	25.07
30	30	1.017	0.003	1.0140	20.1	0.01305	11.8	0.008187	43.66	38.9	20.91
60	60	1.016	0.003	1.0130	19.8	0.01310	12.1	0.005884	40.54	36.1	19.52
266	266	1.013	0.003	1.0100	19.8	0.01310	12.9	0.002885	31.18	27.8	15.36
1554	1554	1.0105	0.003	1.0075	19.1	0.01321	13.7	0.001238	23.39	20.8	11.89

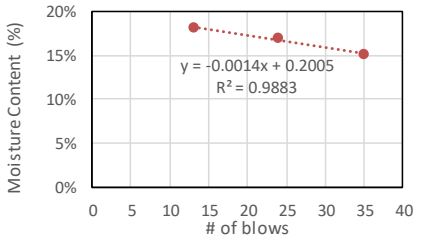
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-9A	Iman Shafii	B-9A	1/5/2017	Sand/Silt	From :	29	2	
						To :	31		

Sample Dimensions		Depth of upper side of the core (ft)	0.000	Notes: Sample was recovered almost from 28.5' to 31'		Density Calcs.	Sample Height (ft)	0.167	Wet Density	Wet Denisty (kN/m3)	20.5
height (ft)	0.167	Depth of middle of the core (ft)	0.083				Sample Diameter (ft)	0.25		Wet Denisty (pcf)	130.7
							Sample Volume (ft^3)	0.0082	Dry Density	Dry Denisty (kg/m^3)	1929.5
height (mm)	50.833	Depth of lower side of the core (ft)	0.167	Core Diameter (ft)	0.25		Sample weight (lb)	1.069		Dry Denisty (kN/m^3)	18.9
							Wet Denisty (pcf)	130.69		Dry Denisty (pcf)	120



Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	29.167	A-1	1	86.1	85.1	79.4	78.4	6.7	78.4	8.55%
2	29.167	46	1.1	54.4	53.3	50.25	49.15	4.15	49.15	8.44%

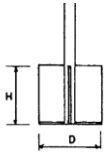
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	29.083	25-35	35	5	1	11.7	10.3	15.05%
2		20-30	24	1B	1.1	10.1	8.8	16.88%
3		15-25	13	$3	1.1	11.85	10.2	18.13%
Liquid Limit (%)		16.55%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	29	Z	1	14.1	12.8	11.02%
	2						#DIV/0!
Average Plastic Limit (%)	11.02%		Plasticity Index	5.53%	Liquidity Index	-45.58%	

Notes:

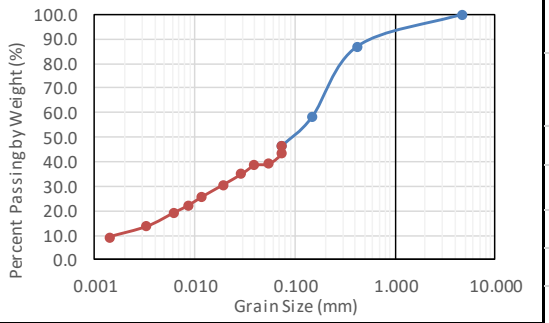
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	
					tsf or kg/cm^2	kPa		Pocket Penetrometer was 1.03 mm
	19	29	90	N/A	>4.5	>430.5	Type A	Sample was too stiff to penetrate the vane and pocket penterometer



B-9A (29'-31') Tittabawsee River – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-9A	Iman Shafii	Riverline, Grayish brown	Uncemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	524.0	23	0.0	100.0
4.8	500	40	0.425	363	405.0	42	13.0	87.0
		100	0.149	320	464.0	144	41.8	58.2
		200	0.074	317	376.0	59	53.6	46.4
		Pan	0.00	360	592.0	232	100.0	0.0
		∑ soil mass after sieve (gr)		500				
		Error (%)		0.0%				



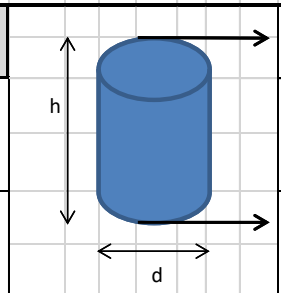
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
4.6%	49.0%	46.4%	0.0014	0.01935	0.09688	0.1663	1.61	118.79	SC - SM	A-4(0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	12.5	12.4	0.992	151H
4.8	54.4				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	57.464	99.99967	0.9976	157.22	11.94	164.4	2.519
						$G_{s,\ 20c}$	2.517381	

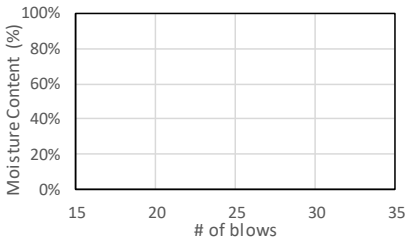
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.037	0.003	1.0340	21.5	0.01406	6.5	0.074000	104.53	242.5	46.40
0.25	0.25	1.035	0.003	1.0320	21.5	0.01406	7.0	0.074372	98.38	228.2	43.55
0.50	0.5	1.032	0.003	1.0290	21.5	0.01406	7.8	0.055513	89.15	206.8	39.27
1	1	1.0315	0.003	1.0285	21.5	0.01406	7.95	0.039629	87.62	203.3	38.55
2	2	1.029	0.003	1.0260	21.4	0.01407	8.6	0.029180	79.93	185.4	34.99
5	5	1.026	0.003	1.0230	21.1	0.01412	9.4	0.019364	70.71	164.0	30.71
15	15	1.0225	0.003	1.0195	20.7	0.01419	10.4	0.011816	59.95	139.1	25.72
30	30	1.02	0.003	1.0170	20.5	0.01423	11.0	0.008614	52.26	121.2	22.15
60	60	1.018	0.003	1.0150	20.0	0.01431	11.5	0.006265	46.11	107.0	19.30
240	240	1.014	0.003	1.0110	18.8	0.01453	12.6	0.003328	33.82	78.5	13.59
1428	1428	1.011	0.003	1.0080	18.8	0.01453	13.4	0.001407	24.59	57.1	9.31

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #1	Iman Shafii	#1	10/5/2017	Clean Sand	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.6458	Wet Density	Wet Denisty (kN/m3)	15.11
height (ft)	0.646		Depth of middle of the core (ft)	0.323				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	96.2
								Sample Volume (ft^3)	0.0286	Dry Density	Dry Denisty (kg/m^3)	1450.1
height (mm)	196.979		Depth of lower side of the core (ft)	0.646	Core Diameter (ft)	0.238		Sample weight (lb)	2.752		Dry Denisty (kN/m^3)	14.22
								Wet Denisty (pcf)	96.187		Dry Denisty (pcf)	90.5

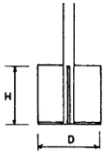
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.32	46	1	19.7	18.7	18.6	17.6	1.1	17.6	6.25%
2	0.32	Z	1.1	11	9.9	10.4	9.3	0.6	9.3	6.45%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.323	25-35						#DIV/0!
2		20-30						#DIV/0!
3		15-25						#DIV/0!
Liquid Limit		N/A		Notes:				



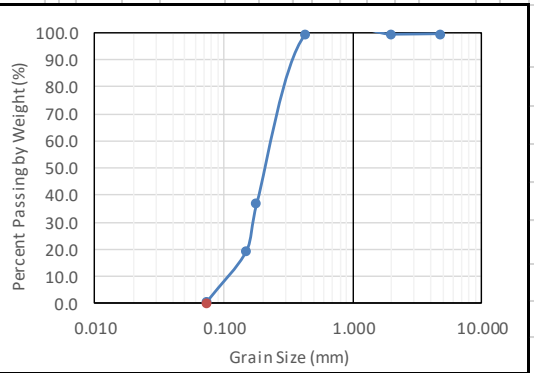
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.323					#DIV/0!
	2	0.323					#DIV/0!
Average Plastic Limit	N/A		Plasticity Index	#VALUE!	Liquidity Index	#VALUE!	

Notes: Non-Plastic

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was 69 mm.
					tsf or kg/cm²	kPa		
	19	29	90	10	0.7	67.0	Type B	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #1	Iman Shafii	Shore Bridge Abutment	Uncemented	27.8378010 ,262.94766	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.0	503.0	2	0.4	99.6
		10	2.00	662.0	663.0	1	0.6	99.4
0.2	528.8	40	0.43	363.0	364.0	1	0.8	99.2
		80	0.18	525.0	845.0	320	62.7	37.3
		100	0.15	322.0	415.0	93	80.7	19.3
		200	0.07	318.0	414.0	96	99.2	0.8
		Pan	0.00	359.0	363.0	4	100.0	0.0
		∑ soil mass after sieve (gr)		517				
		Error (%)		2.2%				



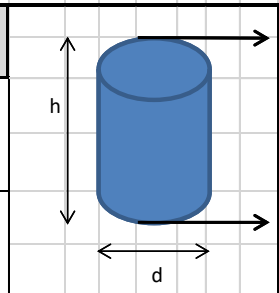
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.4%	98.8%	0.8%	0.105	0.18	0.2	0.23	1.34	2.19	SP	A-3

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H
0.2					

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

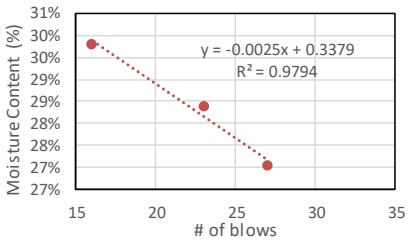
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333		0.003	-0.0030				0.074000	######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	######	#DIV/0!	####
17.5	17.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	######	#DIV/0!	####
60	60		0.003	-0.0030				0.000000	######	#DIV/0!	####
120	120		0.003	-0.0030				0.000000	######	#DIV/0!	####
1140	1140		0.003	-0.0030				0.000000	######	#DIV/0!	####

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #3	Iman Shafii	#3	10/15/2017	Clayey Sand w/ Gravel	From :	0		
						To :	1	1	

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4833	Wet Density	Wet Denisty (kN/m3)	17.52
height (ft)	0.483		Depth of middle of the core (ft)	0.242				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	111.5
								Sample Volume (ft^3)	0.0214	Dry Density	Dry Denisty (kg/m^3)	1525.4
height (mm)	147.417		Depth of lower side of the core (ft)	0.483	Core Diameter (ft)	0.238		Sample weight (lb)	2.3878		Dry Denisty (kN/m^3)	14.96
								Wet Denisty (pcf)	111.52		Dry Denisty (pcf)	95.2

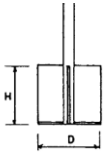
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.24	2	1	21.2	20.2	18.25	17.25	2.95	17.25	17.10%
2	0.24				0		0	0	0	#DIV/0!

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.242	25-35	27	O	1.1	10.5	8.5	27.0%
2		20-30	23	33	1.1	10.6	8.5	28.4%
3		15-25	16	46	1.1	13.3	10.5	29.8%
Liquid Limit		27.5%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.242	A	1.1	10.6	9.3	15.9%
	2	0.242	#1B	1.1	10.4	9.1	16.3%
Average Plastic Limit	16.05%		Plasticity Index	11.49%	Liquidity Index	9.14%	

Notes:

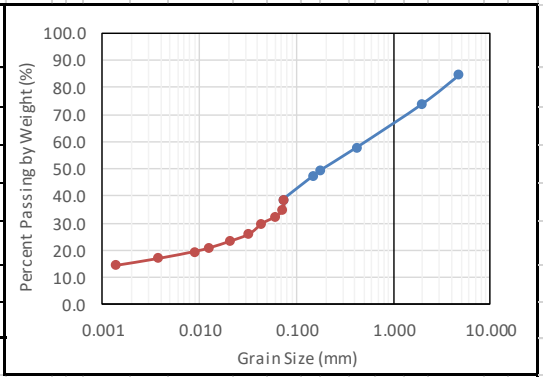
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	80	2.875	275.1	Type A

Notes:

Pocket Erodomoeter was almost 15.5 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #3	Iman Shafii	Riverline, Brown	Cemented	28.983464, -95.999612	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.5	577.6	76.1	15.2	84.8
		10	2.000	623.8	676.9	53.1	25.8	74.2
5	500	40	0.425	363.4	443.9	80.5	41.9	58.1
		80	0.180	524.8	567.1	42.3	50.4	49.6
		100	0.149	322.2	333.4	11.2	52.6	47.4
		200	0.074	317.2	359.9	42.7	61.2	38.82
		Pan	0.000	359.7	553.8	194.1	100.0	0.0
		∑ soil mass after sieve (gr)		500				
		Error (%)		0.0%				



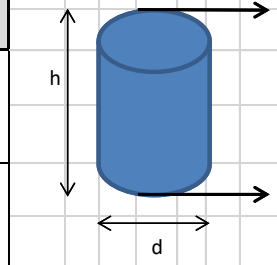
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
15.2	46.0%	38.8%	0.001	0.0441	0.183	0.5	3.89	500.00	SC with Gravel	A-6 (0.9)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	5.4	5.3	0.981481481	151H
5	50				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

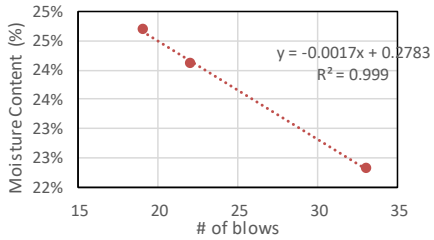
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.03	0.003	1.0270	19.1	0.01380	8.4	0.074000	88.36	171.51	38.74
0.33	0.333333	1.027	0.003	1.0240	19.1	0.01380	9.20	0.072515	78.55	152.46	34.93
0.50	0.5	1.025	0.003	1.0220	19.1	0.01380	9.70	0.060796	72.00	139.75	32.39
1	1	1.023	0.003	1.0200	19.1	0.01380	10.2	0.044083	65.45	127.05	29.85
2	2	1.02	0.003	1.0170	19.1	0.01380	11.0	0.032371	55.64	107.99	26.04
5	5	1.018	0.003	1.0150	18.9	0.01384	11.5	0.020985	49.09	95.29	23.50
15	15	1.016	0.003	1.0130	18.3	0.01394	12.1	0.012519	42.55	82.58	20.96
30	30	1.015	0.003	1.0120	17.9	0.01401	12.3	0.008969	39.27	76.23	19.69
180	180	1.013	0.003	1.0100	16.7	0.01422	12.9	0.003808	32.73	63.52	17.14
1430	1430	1.011	0.003	1.0080	16.3	0.01430	13.4	0.001384	26.18	50.82	14.60

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #4	Iman Shafii	#4	10/20/2017	Silty Sand	From :	0		
						To :	1	1	

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.5833	Wet Density	Wet Denisty (kN/m3)	19.08
height (ft)	0.583		Depth of middle of the core (ft)	0.292				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	121.4
								Sample Volume (ft^3)	0.0258	Dry Density	Dry Denisty (kg/m^3)	1494.2
height (mm)	177.917		Depth of lower side of the core (ft)	0.583	Core Diameter (ft)	0.238		Sample weight (lb)	3.1381		Dry Denisty (kN/m^3)	14.65
								Wet Denisty (pcf)	121.43		Dry Denisty (pcf)	93.3

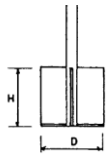
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.29	5	1	45	44	34.8	33.8	10.2	33.8	30.18%
2	0.29	A	1	18.5	17.5	14.3	13.3	4.2	13.3	31.58%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.292	25-35	33	FF	1	13.6	11.3	22.3%
2		20-30	22	46	1.1	9.85	8.15	24.1%
3		15-25	19	33	1.1	11.2	9.2	24.7%
Liquid Limit		23.6%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.292	A	1	11.2	9.5	20.0%
	2	0.292					#DIV/0!
Average Plastic Limit	20.00%		Plasticity Index	3.58%	Liquidity Index	284.29%	

Notes: Plastic Limit Not Possible

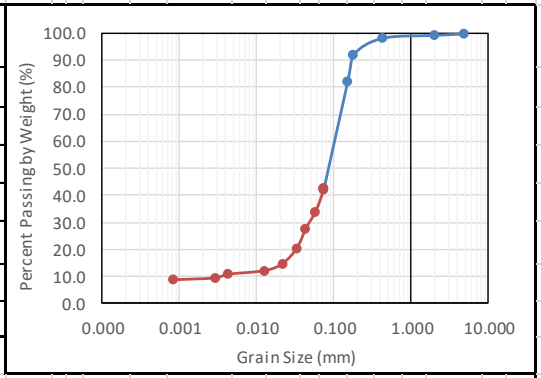
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	28	0	0.0	Type C

Notes:

Pocket Erodomoeter was 19 mm

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #4	Iman Shafii	Bay City Bridge east riverside	Semi cemented	28.983302, -95.999846	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	502.0	503.0	1	0.3	99.7
		10	2.00	624.0	626.0	2	0.8	99.2
2	383.7	40	0.43	363.0	367.0	4	1.8	98.2
		80	0.18	524.0	547.0	23	7.8	92.2
		100	0.15	322.0	361.0	39	18.0	82.02
		200	0.07	317.0	467.0	150	57.1	42.92
		Pan	0.00	360.0	524.7	164.7	100.0	0.0
		∑ soil mass after sieve (gr)		383.7				
		Error (%)		0.0%				



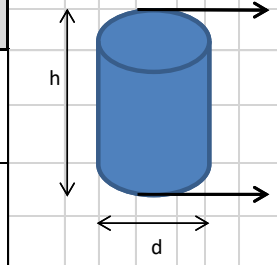
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.3%	56.8%	42.9%	0.00335	0.0481	0.085	0.1	6.91	29.85	SM	A-4 (0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.35	9.2	0.983957219	151H
2	51.4				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

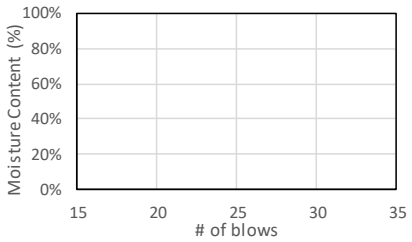
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.13	0.133333	1.0345	0.003	1.0315	20.0	0.01365	7.0	0.074000	100.00	164.70	42.92
0.25	0.25	1.034	0.003	1.0310	20.0	0.01365	7.30	0.073761	98.44	162.14	42.26
0.50	0.5	1.028	0.003	1.0250	20.0	0.01365	8.90	0.057589	79.39	130.75	34.08
1	1	1.0235	0.003	1.0205	20.0	0.01365	10.10	0.043380	65.10	107.22	27.94
2	2	1.018	0.003	1.0150	20.0	0.01365	11.5	0.032732	47.63	78.45	20.45
5	5	1.014	0.003	1.0110	19.8	0.01368	12.6	0.021723	34.93	57.53	14.99
15	15	1.012	0.003	1.0090	19.6	0.01372	13.1	0.012820	28.58	47.07	12.27
145	145	1.011	0.003	1.0080	17.6	0.01406	13.4	0.004275	25.40	41.84	10.90
333	333	1.01	0.003	1.0070	17.1	0.01415	13.7	0.002870	22.23	36.61	9.54
4260	4260	1.0095	0.003	1.0065	15.3	0.01435	13.8	0.000817	20.64	34.00	8.86

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #6	Iman Shafii	#6	10/12/2017	Clean Sand	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.585	Wet Density	Wet Denisty (kN/m3)	19.44
height (ft)	0.585		Depth of middle of the core (ft)	0.293				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	123.7
								Sample Volume (ft^3)	0.0259	Dry Density	Dry Denisty (kg/m^3)	1711.2
height (mm)	178.425		Depth of lower side of the core (ft)	0.585	Core Diameter (ft)	0.238		Sample weight (lb)	3.2064		Dry Denisty (kN/m^3)	16.78
								Wet Denisty (pcf)	123.72		Dry Denisty (pcf)	107

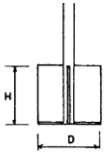
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.29	46	1.1	23.8	22.7	20.7	19.6	3.1	19.6	15.82%
2	0.29	O	1.1	17.3	16.2	14.8	13.7	2.5	13.7	18.25%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.293	25-35						#DIV/0!
2		20-30						#DIV/0!
3		15-25						#DIV/0!
Liquid Limit		N/A		Notes: Non Plastic				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.293					#DIV/0!
	2	0.293					#DIV/0!
Average Plastic Limit	#DIV/0!		Plasticity Index	#VALUE!	Liquidity Index	#DIV/0!	

Notes: Non Plastic

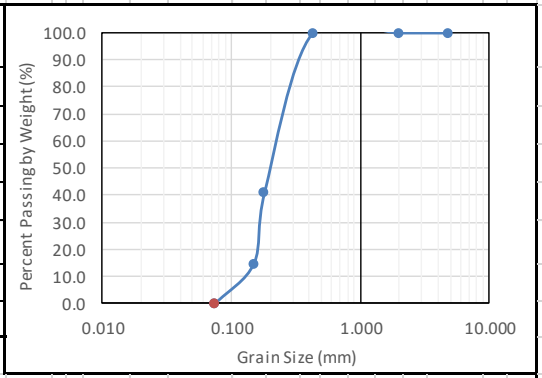
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	12	0.2	19.1	Type C

Notes:

Pocket Erodomoeter was almost 22 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #6	Iman Shafii	Riverline	Not cemented	29.0824713, -95.118056	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.6	501.6	0	0.0	100.0
		10	2.00	624.4	624.4	0	0.0	100.0
5	427	40	0.43	364.0	364.4	0.4	0.1	99.9
		80	0.18	525.1	776.2	251.1	58.8	41.2
		100	0.15	322.4	434.3	111.9	85.0	15.0
		200	0.07	317.2	381.2	64	100.0	0.0
		Pan	0.00	359.8	359.8	0	100.0	0.0
		∑ soil mass after sieve (gr)		427.4				
		Error (%)		-0.1%				



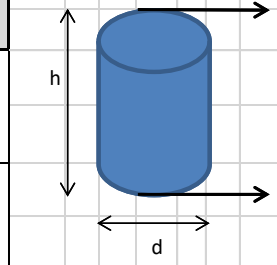
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	100.0%	0.0%	0.135	0.175	0.2	0.22	1.03	1.63	SP	A-3

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H
5					

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

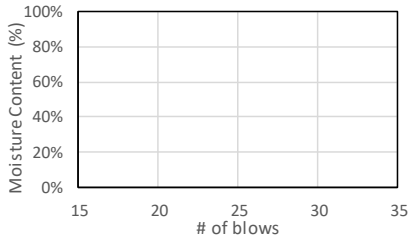
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333		0.003	-0.0030				0.074000	#######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	#######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	#######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	#######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	#######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	#######	#DIV/0!	####
17.5	17.5		0.003	-0.0030				0.000000	#######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	#######	#DIV/0!	####
60	60		0.003	-0.0030				0.000000	#######	#DIV/0!	####
120	120		0.003	-0.0030				0.000000	#######	#DIV/0!	####
1140	1140		0.003	-0.0030				0.000000	#######	#DIV/0!	####

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #7	Iman Shafii	#7	10/8/2017	Clean Sand	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.625	Wet Density	Wet Denisty (kN/m3)	17.78
height (ft)	0.625		Depth of middle of the core (ft)	0.313				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	113.2
								Sample Volume (ft^3)	0.0277	Dry Density	Dry Denisty (kg/m^3)	1602.4
height (mm)	190.625		Depth of lower side of the core (ft)	0.625	Core Diameter (ft)	0.238		Sample weight (lb)	3.1343		Dry Denisty (kN/m^3)	15.71
								Wet Denisty (pcf)	113.2		Dry Denisty (pcf)	100

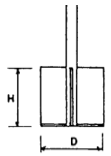
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.31	46	1	13.9	12.9	12.4	11.4	1.5	11.4	13.16%
2	0.31	X	1.1	11.2	10.1	10	8.9	1.2	8.9	13.48%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.313	25-35						#DIV/0!
2		20-30						#DIV/0!
3		15-25						#DIV/0!
Liquid Limit		N/A		Notes: Non Plastic				



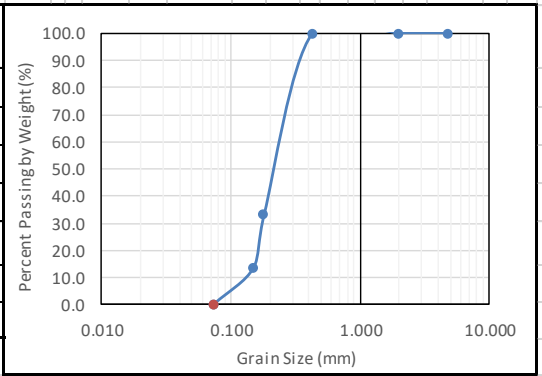
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.313					#DIV/0!
	2	0.313					#DIV/0!
Average Plastic Limit	#DIV/0!		Plasticity Index	#VALUE!	Liquidity Index	#DIV/0!	

Notes: Non-Plastic

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 18 mm.
	19	29	90	12	tsf or kg/cm^2	kPa	Type C	
					0.2	19.1		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #7	Iman Shafii	Riverline	Not cemented	29.0824713, -95.125308	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	502.0	502.0	0	0.0	100.0
		10	2.00	663.0	663.0	0	0.0	100.0
5	482	40	0.43	363.0	364.0	1	0.2	99.8
		80	0.180	525.0	845.0	320	66.6	33.4
		100	0.149	322.0	417.0	95	86.3	13.7
		200	0.074	318.0	382.0	64	99.6	0.4
		Pan	0.00	359.0	361.0	2	100.0	0.0
		∑ soil mass after sieve (gr)		482				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	99.6%	0.4%	0.14	0.179	0.202	0.24	0.95	1.71	SP	A-3

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H
5					

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####

$G_{s,\ 20c}$ #DIV/0!

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333		0.003	-0.0030				0.074000	######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	######	#DIV/0!	####
17.5	17.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	######	#DIV/0!	####
60	60		0.003	-0.0030				0.000000	######	#DIV/0!	####
120	120		0.003	-0.0030				0.000000	######	#DIV/0!	####
1140	1140		0.003	-0.0030				0.000000	######	#DIV/0!	####

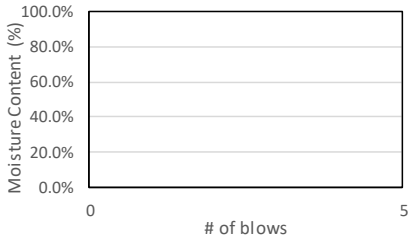
Gravel Samples - EFA

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Gravel #1	Iman Shafii	N/A	11/10/2017	Gravel	From :	0		
						To :	0.5	0.5	

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 22 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.375	Wet Density	Wet Denisty (kN/m3)	17.49
height (ft)	0.375	h	Depth of middle of the core (ft)	0.188				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	111.3
								Sample Volume (ft^3)	0.0166	Dry Density	Dry Denisty (kg/m^3)	1738.6
height (mm)	114.375		Depth of lower side of the core (ft)	0.375	Core Diameter (ft)	0.238		Sample weight (lb)	1.8497		Dry Denisty (kN/m^3)	17.05
		d						Wet Denisty (pcf)	111.34		Dry Denisty (pcf)	109

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.19	S	1	18	17	17.5	16.5	0.5	16.5	3.03%
2	0.19	22	1	34.5	33.5	33.8	32.8	0.7	32.8	2.13%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.188	25-35						#DIV/0!
2		20-30						#DIV/0!
3		15-25						#DIV/0!
Liquid Limit		N/A		Notes: N/A				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.188					#DIV/0!
	2	0.188					#DIV/0!
Average Plastic Limit	#DIV/0!		Plasticity Index	#VALUE!	Liquidity Index	#DIV/0!	

Notes: N/A

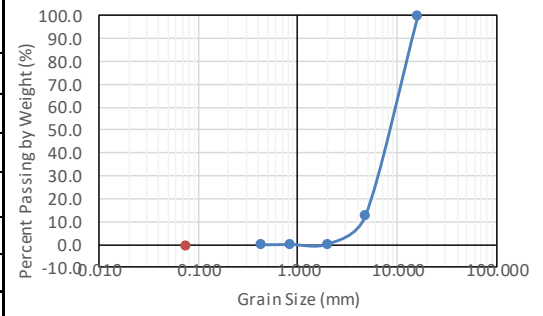
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	N/A	N/A	N/A	Type A

Notes:

Pocket Erodomoeter was less than 1 mm

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	Gravel #1	Iman Shafii	Handmade	Uncemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	5/8	16.000	767.0	767.0	0.0	0.0	100.0
		4	4.760	502.0	1233.0	731	87.1	12.9
12	839	10	2.000	624.0	727.0	103	99.4	0.6
		20	0.841	368.0	370.0	2	99.6	0.4
		40	0.420	363.0	364.0	1	99.8	0.2
		Pan	0.000	360.0	362.0	2	100.0	0.0
		∑ soil mass after sieve (gr)		839				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	99.8%	0.2%	4.11	6.5	8.5	9.9	1.04	2.41	GP	A-1-a

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H
12					

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
					$G_{s,20c}$	#DIV/0!		

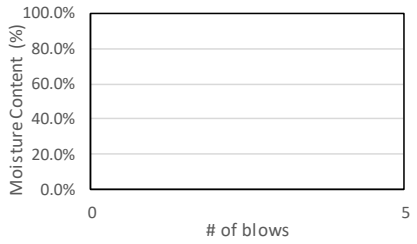
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.0833333		0.003	-0.0030				0.074000	######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	######	#DIV/0!	####
15	15		0.003	-0.0030				0.000000	######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	######	#DIV/0!	####
90	90		0.003	-0.0030				0.000000	######	#DIV/0!	####
182	182		0.003	-0.0030				0.000000	######	#DIV/0!	####
1530	1530		0.003	-0.0030				0.000000	######	#DIV/0!	####

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Gravel #2	Iman Shafii	N/A	11/10/2017	Gravel	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 22 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.5833	Wet Density	Wet Denisty (kN/m3)	16.16
height (ft)	0.583	h	Depth of middle of the core (ft)	0.292				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	102.9
								Sample Volume (ft^3)	0.0258	Dry Density	Dry Denisty (kg/m^3)	1583.3
height (mm)	177.917		Depth of lower side of the core (ft)	0.583	Core Diameter (ft)	0.238		Sample weight (lb)	2.6588		Dry Denisty (kN/m^3)	15.53
		d						Wet Denisty (pcf)	102.88		Dry Denisty (pcf)	98.8

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.29	X	1	26.5	25.5	25.3	24.3	1.2	24.3	4.94%
2	0.29	Z	1	20.1	19.1	19.5	18.5	0.6	18.5	3.24%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.292	25-35						#DIV/0!
2		20-30						#DIV/0!
3		15-25						#DIV/0!
Liquid Limit		27.95%		Notes: N/A				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.292					#DIV/0!
	2	0.292					#DIV/0!
Average Plastic Limit	#DIV/0!		Plasticity Index	#DIV/0!	Liquidity Index	#DIV/0!	

Notes: N/A

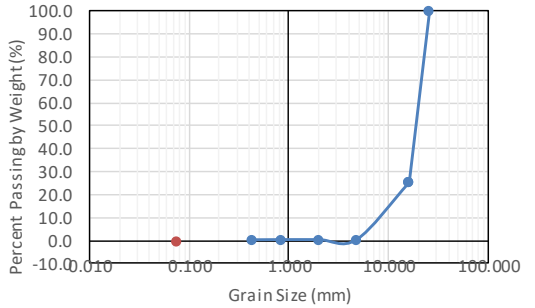
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	N/A	N/A	Type A

Notes:

Pocket Erodomoeter was not measurable.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Gravel #2	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Handmade	Uncemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	5/8	16.000	767.0	1665.0	898.0	74.5	25.5
		4	4.760	502.0	806.0	304	99.7	0.3
12	1206	10	2.000	663.0	663.0	0	99.7	0.3
		20	0.841	369.0	369.0	0	99.7	0.3
		40	0.420	363.0	364.0	1	99.8	0.2
		Pan	0.000	252.0	255.0	3	100.0	0.0
		∑ soil mass after sieve (gr)		1206				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	25.3%	0.2%	8	17	19	20	1.81	2.50	GP	A-1-a

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H
12					

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,\ 20c}$	#DIV/0!	

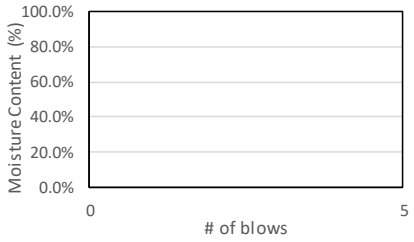
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333		0.003	-0.0030				0.074000	#######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	#######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	#######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	#######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	#######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	#######	#DIV/0!	####
15	15		0.003	-0.0030				0.000000	#######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	#######	#DIV/0!	####
90	90		0.003	-0.0030				0.000000	#######	#DIV/0!	####
182	182		0.003	-0.0030				0.000000	#######	#DIV/0!	####
1530	1530		0.003	-0.0030				0.000000	#######	#DIV/0!	####

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Gravel #3	Iman Shafii	N/A	11/15/2017	Limestone intermediate particles	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 22 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.9167	Wet Density	Wet Denisty (kN/m3)	15.35
height (ft)	0.917	h	Depth of middle of the core (ft)	0.458				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	97.7
								Sample Volume (ft^3)	0.0406	Dry Density	Dry Denisty (kg/m^3)	1522.5
height (mm)	279.583	d	Depth of lower side of the core (ft)	0.917	Core Diameter (ft)	0.238		Sample weight (lb)	3.9683		Dry Denisty (kN/m^3)	14.93
								Wet Denisty (pcf)	97.719		Dry Denisty (pcf)	95

Moisture Content				Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.46	#1B	1	17.9	16.9	17	16	0.9	16	5.62%
2	0.46				0		0	0	0	#DIV/0!

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.458	25-35						#DIV/0!
2		20-30						#DIV/0!
3		15-25						#DIV/0!
Liquid Limit		27.95%		Notes: N/A				

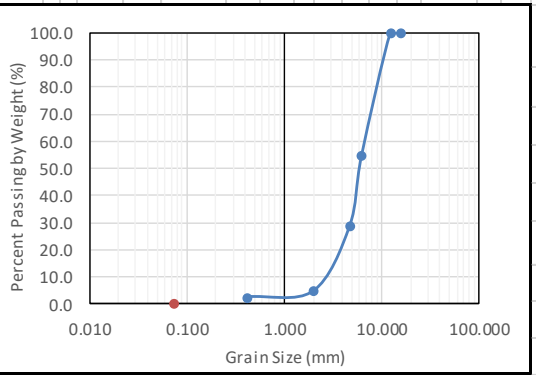


Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes: N/A
	1	0.458					#DIV/0!	
	2	0.458					#DIV/0!	
Average Plastic Limit	#DIV/0!		Plasticity Index	#DIV/0!	Liquidity Index	#DIV/0!		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was not measurable.
					tsf or kg/cm²	kPa		
	19	29	90	N/A	N/A	N/A	Type A	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	Gravel #3	Iman Shafii	Man-made	Uncemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	5/8	16.000	552.0	552.0	0	0.0	100.0
		1/2	12.500	784.0	784.0	0	0.0	100.0
8	619	1/4	6.350	516.0	795.0	279	45.1	54.9
		4	4.760	502.0	665.0	163	71.4	28.6
		10	2.000	662.0	810.0	148	95.3	4.7
		40	0.420	363.0	376.0	13	97.4	2.6
		Pan	0.000	252.0	268.0	16	100.0	0.0
		∑ soil mass after sieve (gr)		619				
		Error (%)		0.0%				



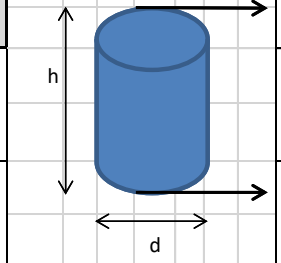
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
71.4%	26.0%	2.6%	2.9	5	6	7	1.23	2.41	GP with sand	A-1-a

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type	Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H	0.08	0.0833333		0.003	-0.0030				0.074000	######	#DIV/0!	####
						0.25	0.25		0.003	-0.0030				0.000000	######	#DIV/0!	####
8						0.50	0.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
						1	1		0.003	-0.0030				0.000000	######	#DIV/0!	####
						2	2		0.003	-0.0030				0.000000	######	#DIV/0!	####
						5	5		0.003	-0.0030				0.000000	######	#DIV/0!	####
						15	15		0.003	-0.0030				0.000000	######	#DIV/0!	####
						30	30		0.003	-0.0030				0.000000	######	#DIV/0!	####
						90	90		0.003	-0.0030				0.000000	######	#DIV/0!	####
						182	182		0.003	-0.0030				0.000000	######	#DIV/0!	####
						1530	1530		0.003	-0.0030				0.000000	######	#DIV/0!	####

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####

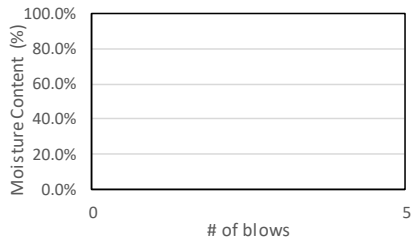
$G_{s,\ 20c}$	#DIV/0!

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Gravel #4	Iman Shafii	N/A	19-Nov	Limestone intermediate particles	From :	0	0.5	
						To :	0.5		

Sample Dimensions							Density Calcs.					
height (ft)	0.500		Depth of upper side of the core (ft)	0	Notes:			Sample Height (ft)	0.5	Wet Density	Wet Denisty (kN/m3)	14.67
			Depth of middle of the core (ft)	0.250				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	93.4
								Sample Volume (ft^3)	0.0222	Dry Density	Dry Denisty (kg/m^3)	1486.5
height (mm)	152.500		Depth of lower side of the core (ft)	0.500	Core Diameter (ft)	0.238		Sample weight (lb)	2.0679		Dry Denisty (kN/m^3)	14.58
								Wet Denisty (pcf)	93.358		Dry Denisty (pcf)	92.8

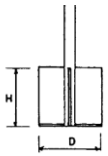
Moisture Content				Wet		Dry				
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)	Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
1	0.25	#1B	1	17.9	16.9	17.7	16.7	0.2	16.7	1.20%
2	0.25				0		0	0	0	#DIV/0!

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.250	25-35						#DIV/0!
2		20-30						#DIV/0!
3		15-25						#DIV/0!
Liquid Limit		27.95%		Notes: N/A				



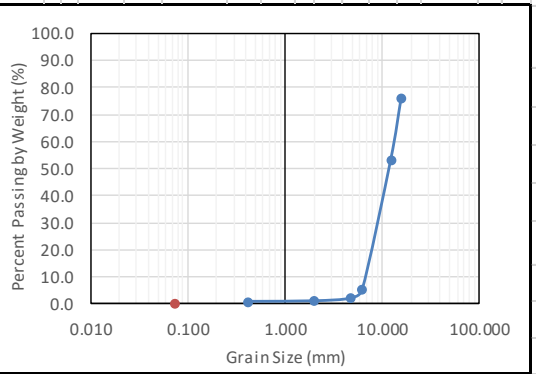
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.250					#DIV/0!
	2	0.250					#DIV/0!
Average Plastic Limit	#DIV/0!		Plasticity Index	#DIV/0!	Liquidity Index	#DIV/0!	

Notes: N/A

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was not measurable.
					tsf or kg/cm²	kPa		
	19	29	90	N/A	N/A	N/A	Type A	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	Gravel #4	Iman Shafii	Handmade	Not Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	5/8	16.000	767.0	992.0	225	24.0	76.0
		1/2	12.500	784.0	997.0	213	46.7	53.3
8	938	1/4	6.350	515.0	966.0	451	94.8	5.2
		4	4.760	501.0	530.0	29	97.9	2.1
		10	2.000	662.0	671.0	9	98.8	1.2
		40	0.420	363.0	365.0	2	99.0	1.0
		Pan	0.000	252.0	261.0	9	100.0	0.0
		∑ soil mass after sieve (gr)		938				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
97.9%	1.2%	1.0%	6	8.5	11	13	0.93	2.17	GP	A-1-a

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H
8					

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333		0.003	-0.0030				0.074000	######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	######	#DIV/0!	####
15	15		0.003	-0.0030				0.000000	######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	######	#DIV/0!	####
90	90		0.003	-0.0030				0.000000	######	#DIV/0!	####
182	182		0.003	-0.0030				0.000000	######	#DIV/0!	####
1530	1530		0.003	-0.0030				0.000000	######	#DIV/0!	####

Clay Samples - JET

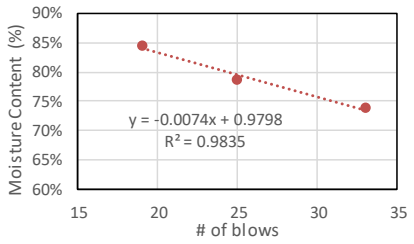
B-1 (2'-4') Beaumont Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (2'-4')	Iman Shafii	B-1	4/2/2017	Clay	From :	2	2	
						To :	4		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4688	Wet Density	Wet Denisty (kN/m3)	18.10
height (ft)	0.469	h	Depth of middle of the core (ft)	0.234				Sample Diameter (ft)	0.2329		Wet Denisty (pcf)	115.2
								Sample Volume (ft^3)	0.02	Dry Density	Dry Denisty (kg/m^3)	1369.6
height (mm)	142.974	d	Depth of lower side of the core (ft)	0.469	Core Diameter (ft)	0.233		Sample weight (lb)	2.3003		Dry Denisty (kN/m^3)	13.43
								Wet Denisty (pcf)	115.23		Dry Denisty (pcf)	85.5

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	2.23	M	1	24.3	23.3	18.2	17.2	6.1	17.2	35.47%
2	2.23	175	1	37.2	36.2	28	27	9.2	27	34.07%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	2.234	25-35	33	49	1	9	5.6	73.9%
2		20-30	25	XX	1	9.4	5.7	78.7%
3		15-25	19	Z	1.1	12.9	7.5	84.4%
Liquid Limit		79.48%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	2.234	45	1	15.9	12	35.5%
	2	2.234	A	1.1	15.7	12.1	32.7%
Average Plastic Limit	34.09%		Plasticity Index	45.39%	Liquidity Index	1.50%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	2.8125	80.7	Type A

Notes:

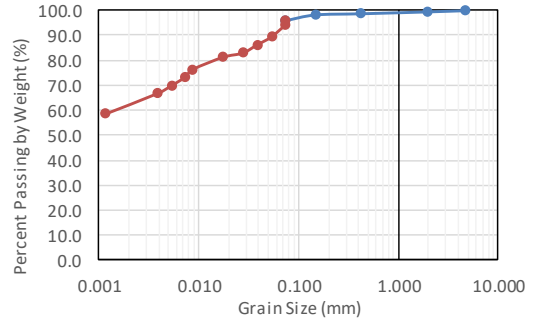
Pocket Erodomoeter was less than 1 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-1 (2'-4') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (2'-4')	Iman Shafii	Beaumont Formation Gray	Cemented	29.70588, -95.24985	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.5	501.5	0.0	0.0	100.0
		10	2.000	624.0	625.9	1.9	0.5	99.5
0.14	379	40	0.425	363.0	365.9	2.9	1.3	98.7
		100	0.149	321.2	323.0	1.8	1.7	98.26
		200	0.074	317.5	326.4	8.9	4.1	95.91
		Pan	0.000	360.5	724.4	363.9	100.0	0.0
		∑ soil mass after sieve (gr)		379.4				
		Error (%)		-0.1%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	4.1%	95.9%	N/A	N/A	<0.001	0.0016	#VALUE!	#VALUE!	CH	A-7-5(52.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	13.1	12.6	0.961832061	151H
0.14	50.17				

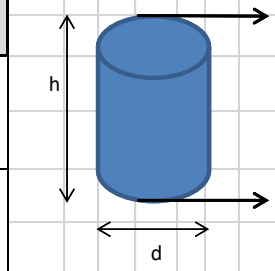
Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	69.334	99.88871	0.9974	168.96	15.37	178.46	2.618
					$G_{s,\ 20c}$	2.616225		

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.032	0.003	1.0290	24.0	0.01321	7.8	0.074000	97.28	354.01	95.91
0.25	0.25	1.0315	0.003	1.0285	24.0	0.01321	7.95	0.074493	95.60	347.90	94.29
0.50	0.5	1.03	0.003	1.0270	24.0	0.01321	8.40	0.054145	90.57	329.59	89.46
1	1	1.029	0.003	1.0260	24.0	0.01321	8.60	0.038739	87.22	317.38	86.24
2	2	1.028	0.003	1.0250	24.0	0.01321	8.9	0.027867	83.86	305.18	83.02
5	5	1.0275	0.003	1.0245	23.8	0.01324	9.1	0.017815	82.19	299.07	81.41
21	21	1.026	0.003	1.0230	23.8	0.01324	9.4	0.008859	77.15	280.76	76.58
32	32	1.025	0.003	1.0220	23.8	0.01324	9.7	0.007291	73.80	268.56	73.36
60	60	1.024	0.003	1.0210	23.8	0.01324	10.0	0.005406	70.44	256.35	70.14
120	120	1.023	0.003	1.0200	23.5	0.01329	10.2	0.003875	67.09	244.14	66.92
1440	1440	1.0205	0.003	1.0175	21.4	0.01363	10.9	0.001183	58.70	213.62	58.87

B-1 (4’-6’) Beaumont Formation – Page 1

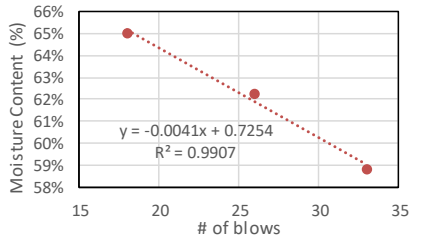
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (4'-6')	Iman Shafii	B-1	30-Jun	Clay	From :	4	2	
						To :	6		

Sample Dimensions		Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4916	Wet Density	Wet Denisty (kN/m3)	18.92
height (ft)	0.492	Depth of middle of the core (ft)	0.246				Sample Diameter (ft)	0.229		Wet Denisty (pcf)	120.5
							Sample Volume (ft^3)	0.0202	Dry Density	Dry Denisty (kg/m^3)	1533.4
height (mm)	149.929	Depth of lower side of the core (ft)	0.492	Core Diameter (ft)	0.229		Sample weight (lb)	2.439		Dry Denisty (kN/m^3)	15.04
							Wet Denisty (pcf)	120.46		Dry Denisty (pcf)	95.7



Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	4.25	3	1	23.9	22.9	19.3	18.3	4.6	18.3	25.14%
2	4.25	45	1	15.3	14.3	12.3	11.3	3	11.3	26.55%

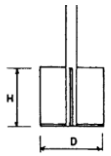
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.246	25-35	33	W	1	9.1	6.1	58.8%
2		20-30	26	A	1	8.3	5.5	62.2%
3		15-25	18	#45	1	10.9	7	65.0%
Liquid Limit		62.3%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	4.246	$3	1	9.9	8.3	21.9%
	2	4.246	B1	1	11	9.2	22.0%
Average Plastic Limit	21.93%		Plasticity Index	40.36%	Liquidity Index	9.68%	

Notes:

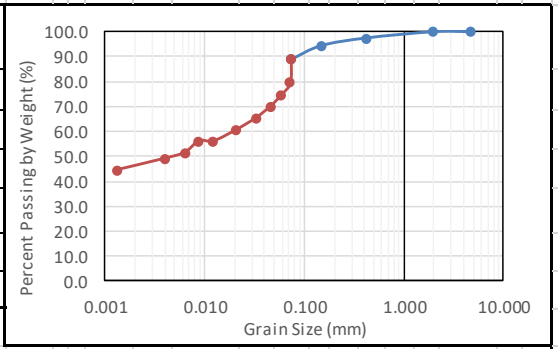
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 0.
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type B	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					1.36666667	39.2		



B-1 (4'-6') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (4'-6')	Iman Shafii	Beaumont Form., Light brown	Cemented	29.76915, -95.17980	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	350.0	350.0	0.0	0.0	100.0
		10	2.00	475.0	475.0	0	0.0	100.0
0.4	161.4	40	0.43	363.0	367.0	4	2.5	97.5
		100	0.15	321.0	326.0	5	5.6	94.4
		200	0.074	317.0	326.0	9	11.2	88.85
		Pan	0.00	360.0	503.4	143.4	100.0	0.0
		∑ soil mass after sieve (gr)		161.4				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	11.2%	88.8%	N/A	N/A	0.00489	0.01961	#VALUE!	#VALUE!	CH	A-7-6 (39.2)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.5	6.5	1	151H
0.4	30				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	61.992	99.98197	0.9981	161.78	17.77	173	2.725
					$G_{s,20c}$	2.725051		

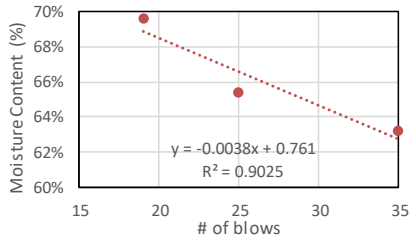
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.12	0.116667	1.023	0.003	1.0200	19.4	0.01354	10.2	0.074000	100.00	143.40	88.85
0.38	0.383333	1.02	0.003	1.0170	19.4	0.01354	11.00	0.072542	89.52	128.37	79.53
0.58	0.583333	1.019	0.003	1.0160	19.4	0.01354	11.30	0.059602	84.25	120.81	74.85
1	1	1.018	0.003	1.0150	19.4	0.01354	11.50	0.045923	78.98	113.26	70.18
2	2	1.017	0.003	1.0140	19.4	0.01354	11.8	0.032893	73.72	105.71	65.50
5	5	1.016	0.003	1.0130	19.1	0.01359	12.1	0.021146	68.45	98.16	60.82
15	15	1.015	0.003	1.0120	18.7	0.01366	12.3	0.012371	63.19	90.61	56.14
30	30	1.015	0.003	1.0120	18.3	0.01373	12.3	0.008791	63.19	90.61	56.14
60	60	1.014	0.003	1.0110	17.7	0.01383	12.6	0.006340	57.92	83.06	51.46
155	155	1.0135	0.003	1.0105	16.6	0.01403	12.8	0.004024	55.29	79.28	49.12
1466	1466	1.0125	0.003	1.0095	16.3	0.01409	13.0	0.001326	50.02	71.73	44.44

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (8'-10')	Iman Shafii	B-1	3/31/2017	Clay	From :	8	2	
						To :	10		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4463	Wet Density	Wet Denisty (kN/m3)	19.12
height (ft)	0.446	h	Depth of middle of the core (ft)	0.223				Sample Diameter (ft)	0.2315		Wet Denisty (pcf)	121.7
								Sample Volume (ft^3)	0.0188	Dry Density	Dry Denisty (kg/m^3)	1562.8
height (mm)	136.113	d	Depth of lower side of the core (ft)	0.446	Core Diameter (ft)	0.232		Sample weight (lb)	2.2862		Dry Denisty (kN/m^3)	15.33
								Wet Denisty (pcf)	121.7		Dry Denisty (pcf)	97.6

Moisture Content				Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	8.22	33	1	32.4	31.4	26.1	25.1	6.3	25.1	25.10%
2	8.22	a	0.95	34.1	33.15	27.6	26.65	6.5	26.65	24.39%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.223	25-35	35	49	1.1	10.4	6.8	63.2%
2		20-30	25	30	1.1	9.7	6.3	65.4%
3		15-25	19	XX	1	8.8	5.6	69.6%
Liquid Limit		66.60%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	8.223	G1	0.9	15.9	13.6	18.1%
	2	8.223	XX	1	12.8	11	18.0%
Average Plastic Limit	18.06%		**Plasticity Index**	48.54%	**Liquidity Index**	13.78%	

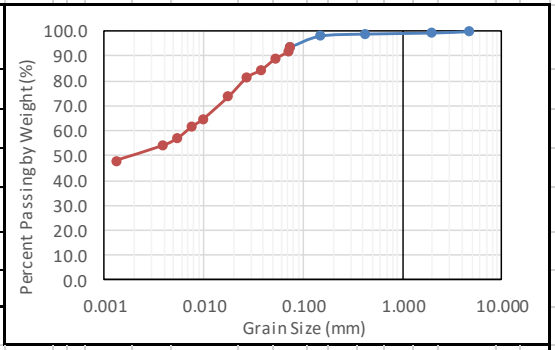
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	Pocket Erodomoeter was less than 1 mm.
					4	114.8		* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-1 (8'-10') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (8'-10')	Iman Shafii	Beaumont Form. Light brown	cemented	29.6950, -95.421027	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.6	502.9	1.3	0.0	100.0
		10	2.00	624.0	625.4	1.4	0.6	99.4
0.15	458.5	40	0.43	363.0	364.9	1.9	1.0	99.0
		100	0.15	321.3	325.2	3.9	1.8	98.2
		200	0.07	317.8	338.4	20.6	6.3	93.7
		Pan	0.00	360.3	791.2	430.9	100.0	0.0
		∑ soil mass after sieve (gr)		460				
		Error (%)		-0.3%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	6.0%	93.7%	N/A	N/A	0.00218	0.0068	#VALUE!	#VALUE!	CH	A-7-6(49.9)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	13.8	13.4	0.971014493	151H
0.15	50.47				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	61.986	99.97762	0.9976	161.72	12.69	169.7	2.700
					$G_{s,\ 20c}$	2.698278		

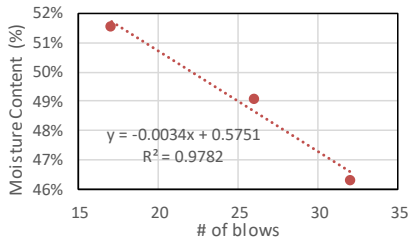
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.032	0.003	1.0290	24.1	0.01281	7.8	0.074000	94.02	405.13	93.70
0.25	0.25	1.0315	0.003	1.0285	24.1	0.01281	7.95	0.072209	92.40	398.14	92.18
0.50	0.5	1.0305	0.003	1.0275	24.1	0.01281	8.35	0.052328	89.16	384.17	89.13
1	1	1.029	0.003	1.0260	24.1	0.01281	8.60	0.037552	84.29	363.22	84.56
2	2	1.028	0.003	1.0250	23.8	0.01285	8.9	0.027107	81.05	349.25	81.51
5	5	1.0255	0.003	1.0225	23.8	0.01285	9.6	0.017759	72.95	314.32	73.89
17.5	17.5	1.0225	0.003	1.0195	23.8	0.01285	10.4	0.009882	63.22	272.41	64.75
30	30	1.0215	0.003	1.0185	23.8	0.01285	10.6	0.007638	59.98	258.44	61.71
60	60	1.02	0.003	1.0170	23.6	0.01288	11.0	0.005515	55.11	237.49	57.14
120	120	1.019	0.003	1.0160	23.7	0.01287	11.3	0.003948	51.87	223.52	54.09
1140	1140	1.017	0.003	1.0140	23.0	0.01297	11.8	0.001320	45.39	195.58	48.00

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (10'-12')	Iman Shafii	B-1	4/19/2017	Clay	From :	10	2	
						To :	12		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4455	Wet Density	Wet Denisty (kN/m3)	19.68
height (ft)	0.445	h	Depth of middle of the core (ft)	0.223				Sample Diameter (ft)	0.2333		Wet Denisty (pcf)	125.3
								Sample Volume (ft^3)	0.019	Dry Density	Dry Denisty (kg/m^3)	1619.3
height (mm)	135.869	d	Depth of lower side of the core (ft)	0.445	Core Diameter (ft)	0.233		Sample weight (lb)	2.3854		Dry Denisty (kN/m^3)	15.88
								Wet Denisty (pcf)	125.27		Dry Denisty (pcf)	101

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	10.22	46	1	18.2	17.2	14.9	13.9	3.3	13.9	23.74%
2	10.22	3	1	16.7	15.7	13.65	12.65	3.05	12.65	24.11%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	10.223	25-35	32	29	1	8.9	6.4	46.3%
2		20-30	26	46	1	8.9	6.3	49.1%
3		15-25	17	122	1	11	7.6	51.5%
Liquid Limit		49.01%		Notes:				



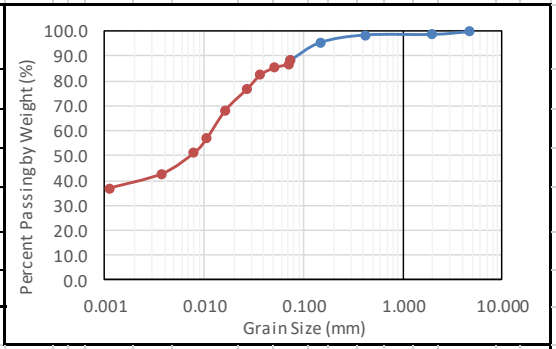
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	10.223	5	1	12.9	11.1	17.8%	
	2	10.223	175	1	14.5	12.4	18.4%	
Average Plastic Limit	18.12%		Plasticity Index	30.89%	Liquidity Index	18.79%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	
					tsf or kg/cm²	S_u (kPa)*		Pocket Erodomoeter was less than 1 mm.
	19	29	90	N/A	2.675	76.8	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-1 (10’-12’) Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (10'-12')	Iman Shafii	Beaumont Form. Green brown	Cemented	29.627, -95.23935	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.4	505.8	4.4	0.0	100.0
		10	2.000	623.9	624.3	0.4	1.1	98.9
4	424.8	40	0.425	362.9	363.8	0.9	1.3	98.7
		100	0.149	321.1	334.1	13	4.4	95.6
		200	0.074	317.1	347.9	30.8	11.7	88.34
		Pan	0.000	252.0	627.0	375	100.0	0.0
		∑ soil mass after sieve (gr)		424.5				
		Error (%)		0.1%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
1.0%	10.6%	88.3%	N/A	N/A	0.00728	0.01205	#VALUE!	#VALUE!	CL~CH	A-7-6 (28.4)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	14.1	13.6	0.964539007	151H
4	51.15				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.4	0.99947	101.384	249.5349	0.9977	350.34	24.86	366	2.693
						$G_{s,20c}$	2.691964	

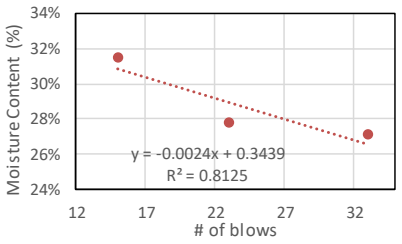
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	22.0	0.01312	7.30	0.074000	100.00	375.00	88.34
0.25	0.25	1.0335	0.003	1.0305	22.0	0.01312	7.45	0.071621	98.36	368.84	86.89
0.50	0.5	1.033	0.003	1.0300	22.0	0.01312	7.60	0.051151	96.75	362.80	85.46
1	1	1.032	0.003	1.0290	22.0	0.01312	7.80	0.036642	93.52	350.71	82.62
2	2	1.03	0.003	1.0270	22.0	0.01312	8.40	0.026888	87.07	326.52	76.92
6	6	1.027	0.003	1.0240	21.8	0.01315	9.20	0.016286	77.40	290.24	68.38
16	16	1.023	0.003	1.0200	21.5	0.01320	10.20	0.010539	64.50	241.87	57.00
30	30	1.021	0.003	1.0180	21.2	0.01325	10.70	0.007912	58.05	217.68	51.30
144	144	1.018	0.003	1.0150	21.0	0.01328	11.50	0.003753	48.37	181.40	42.76
1605	1605	1.016	0.003	1.0130	22.4	0.01306	12.10	0.001134	41.92	157.21	37.07

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (13'-15')	Iman Shafii	B-1	3/29/2017	Clay	From :	13	2	
						To :	15		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4012	Wet Density	Wet Denisty (kN/m3)	18.63
height (ft)	0.401	h	Depth of middle of the core (ft)	0.201				Sample Diameter (ft)	0.2356		Wet Denisty (pcf)	118.6
								Sample Volume (ft^3)	0.0175	Dry Density	Dry Denisty (kg/m^3)	1594.5
height (mm)	122.354	d	Depth of lower side of the core (ft)	0.401	Core Diameter (ft)	0.236		Sample weight (lb)	2.0745		Dry Denisty (kN/m^3)	15.64
								Wet Denisty (pcf)	118.59		Dry Denisty (pcf)	99.5

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	13.20	49	1.1	40.8	39.7	34.45	33.35	6.35	33.35	19.04%
2	13.20	30H	1.1	38.3	37.2	32.3	31.2	6	31.2	19.23%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.201	25-35	33	175	1	13.2	10.6	27.1%
2		20-30	23	W	1.05	12.1	9.7	27.7%
3		15-25	15	122	1.05	16.5	12.8	31.5%
Liquid Limit		28.39%		Notes:				



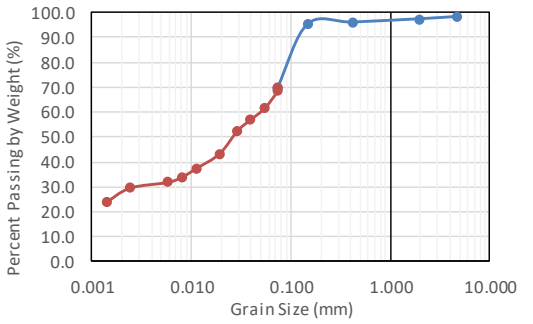
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	13.201	33	1	10.2	8.9	16.5%	
	2	13.201	S	1	9.1	8	15.7%	
Average Plastic Limit	16.08%		Plasticity Index	12.31%	Liquidity Index	24.79%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was (20.53+35.71)/2= 30.52 mm
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type B	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					0.775	22.2		

B-1 (13'-15') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (13'-15')	Iman Shafii	Beaumont Fromation, Red	Cemented	29.56916, -95.28548	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.6	509.3	7.7	1.69	98.3
		10	2.00	624.0	628.3	4.3	2.6	97.4
4.7	454.3	40	0.43	363.0	369.0	6.0	4.0	96.0
		100	0.15	321.3	324.7	3.4	4.7	95.3
		200	0.07	317.5	433.8	116.3	30.3	69.7
		Pan	0.00	360.3	676.7	316.4	100.0	0.0
		∑ soil mass after sieve (gr)		454.1				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
1.7%	28.6%	69.7%	N/A	0.0024	0.02636	0.0493	#VALUE!	#VALUE!	CL with Sand	A-6(6.2)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	7	6.8	0.971428571	151H
4.7	50.32				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	62.388	100.2062	0.9976	162.35	9.75	168.4	2.649
						$G_{s,\ 20c}$	2.647767	

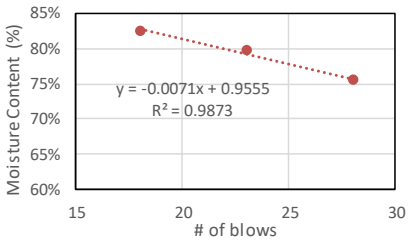
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0315	0.003	1.0285	24.1	0.01300	8.0	0.074000	93.64	296.27	69.70
0.25	0.25	1.031	0.003	1.0280	24.1	0.01300	8.10	0.073969	92.00	291.08	68.55
0.50	0.5	1.028	0.003	1.0250	24.1	0.01300	8.90	0.054826	82.14	259.89	61.69
1	1	1.026	0.003	1.0230	24.1	0.01300	9.40	0.039842	75.57	239.10	57.11
2	2	1.024	0.003	1.0210	24.1	0.01300	10.0	0.029058	69.00	218.31	52.53
5	5	1.02	0.003	1.0170	24.0	0.01301	11.0	0.019297	55.85	176.72	43.38
15	15	1.0175	0.003	1.0145	24.0	0.01301	11.7	0.011466	47.64	150.74	37.66
30	30	1.016	0.003	1.0130	23.8	0.01304	12.1	0.008283	42.71	135.14	34.23
60	60	1.015	0.003	1.0120	23.8	0.01304	12.3	0.005905	39.43	124.75	31.94
360	360	1.014	0.003	1.0110	23.6	0.01307	12.6	0.002446	36.14	114.35	29.65
1140	1140	1.0115	0.003	1.0085	23.0	0.01317	13.3	0.001420	27.93	88.36	23.93

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (18'-20')	Iman Shafii	B-1	4/2/2017	Clay	From :	18	2	
						To :	20		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4911	Wet Density	Wet Denisty (kN/m3)	19.39
height (ft)	0.491	h	Depth of middle of the core (ft)	0.246				Sample Diameter (ft)	0.2374		Wet Denisty (pcf)	123.4
								Sample Volume (ft^3)	0.0217	Dry Density	Dry Denisty (kg/m^3)	1571.9
height (mm)	149.785	d	Depth of lower side of the core (ft)	0.491	Core Diameter (ft)	0.237		Sample weight (lb)	2.6826		Dry Denisty (kN/m^3)	15.41
								Wet Denisty (pcf)	123.44		Dry Denisty (pcf)	98.1

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	18.25	33	1	36.4	35.4	29.1	28.1	7.3	28.1	25.98%
2	18.25	122	1.05	19.2	18.15	15.5	14.45	3.7	14.45	25.61%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	18.246	25-35	28	A	1	11	6.7	75.4%
2		20-30	23	33	1	12.5	7.4	79.7%
3		15-25	18	45	1	12.5	7.3	82.5%
Liquid Limit		77.80%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.246	G1	1	16.2	12.9	27.7%
	2	18.246	H	1	15.7	12.55	27.3%
Average Plastic Limit	27.50%		Plasticity Index	50.30%	Liquidity Index	-3.40%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	5.25	150.7	Type A

Notes:

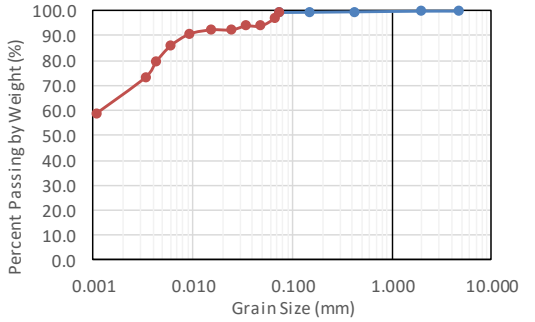
Pocket Erodomoeter was less than 1 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-1 (18’-20’) Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (18'-20')	Iman Shafii	Beaumont Formation, Brown	Cemented	29.71904, -9532804	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.6	501.6	0.0	0.0	100.0
		10	2.000	624.1	624.1	0	0.0	100.0
0.07	453.1	40	0.425	363.0	364.2	1.2	0.3	99.7
		100	0.149	321.4	322.2	0.8	0.4	99.6
		200	0.074	317.4	317.8	0.4	0.5	99.5
		Pan	0.000	360.5	811.6	451.1	100.0	0.0
		∑ soil mass after sieve (gr)		453.5				
		Error (%)		-0.1%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	0.5%	99.5%	N/A	N/A	< 0.001	0.0011	#VALUE!	#VALUE!	CH	A-7-6(59.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	10.1	9.7	0.96039604	151H
0.07	50.61				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	62.166	99.8466	0.9974	161.75	8.81	167.41	2.797
					$G_{s,\ 20c}$	2.794504		

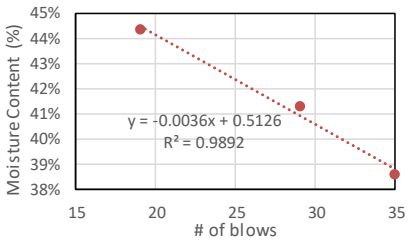
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0335	0.003	1.0305	24.0	0.01246	7.5	0.074000	100.00	451.10	99.56
0.25	0.25	1.0335	0.003	1.0305	24.0	0.01246	7.45	0.068018	97.72	440.80	97.29
0.50	0.5	1.0325	0.003	1.0295	24.0	0.01246	7.70	0.048897	94.51	426.35	94.10
1	1	1.0325	0.003	1.0295	24.0	0.01246	7.70	0.034575	94.51	426.35	94.10
2	2	1.032	0.003	1.0290	24.0	0.01246	7.8	0.024607	92.91	419.13	92.50
5	5	1.032	0.003	1.0290	23.8	0.01249	7.8	0.015600	92.91	419.13	92.50
14	14	1.0315	0.003	1.0285	23.8	0.01249	8.0	0.009412	91.31	411.90	90.91
36	36	1.03	0.003	1.0270	23.8	0.01249	8.4	0.006033	86.50	390.22	86.12
75	75	1.028	0.003	1.0250	23.5	0.01254	8.9	0.004318	80.10	361.32	79.74
130	130	1.026	0.003	1.0230	23.5	0.01254	9.4	0.003371	73.69	332.41	73.36
1440	1440	1.0215	0.003	1.0185	21.3	0.01287	10.6	0.001104	59.27	267.37	59.01

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (28'-30')	Iman Shafii	B-1	8/1/2017	Clay	From :	28	2	
						To :	30		

Sample Dimensions			Depth of upper side of the core (ft)	28	Notes:		Density Calcs.	Sample Height (ft)	0.5118	Wet Density	Wet Denisty (kN/m3)	20.95
height (ft)	0.512	h	Depth of middle of the core (ft)	28.256				Sample Diameter (ft)	0.2313		Wet Denisty (pcf)	133.4
								Sample Volume (ft^3)	0.0215	Dry Density	Dry Denisty (kg/m^3)	1824.6
height (mm)	156.102	d	Depth of lower side of the core (ft)	28.512	Core Diameter (ft)	0.231		Sample weight (lb)	2.8687		Dry Denisty (kN/m^3)	17.89
								Wet Denisty (pcf)	133.39		Dry Denisty (pcf)	114

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	28.26	M	1	18.7	17.7	16.4	15.4	2.3	15.4	14.94%
2	28.26	$33	1	20.8	19.8	17.6	16.6	3.2	16.6	19.28%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	28.256	25-35	35	$3	1	10.7	8	38.6%
2		20-30	29	45	1	9.9	7.3	41.3%
3		15-25	19	G1	1	10.6	7.65	44.4%
Liquid Limit		42.26%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	28.256	A	1	11.4	10	15.6%
	2	28.256	B1	1	6.5	5.75	15.8%
Average Plastic Limit	15.67%		Plasticity Index	26.59%	Liquidity Index	5.39%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	3.50	100.5	Type A

Notes:

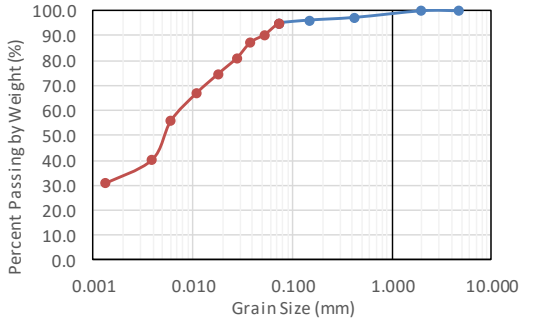
Pocket Erodomoeter was almost 6 mm at some loose parts and 0 at stiff parts.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-1 (28’-30’) Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-1 (28'-30')	Iman Shafii	Beaumont, Redish Brown	Cemented	29.58344, -95.86388	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	450.0	450.0	0.0	0.0	100.0
		10	2.000	378.0	378.0	0	0.0	100.0
0.425	186	40	0.425	362.0	367.0	5	2.7	97.3
		100	0.149	320.0	322.0	2	3.8	96.2
		200	0.074	316.0	318.0	2	4.8	95.16
		Pan	0.000	359.0	536.0	177	100.0	0.0
		∑ soil mass after sieve (gr)		186				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	4.8%	95.2%	N/A	0.00132	0.00526	0.007877	#VALUE!	#VALUE!	CL	A-7-6(26)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	5.2	5	0.961538462	151H
0.425	50.11				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
19.72	100006	63.36	99.89281	0.99827	163.08	5.02	166.2	2.699
						$G_{s,\ 20c}$	2.699087	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0325	0.003	1.0295	21.3	0.01323	7.7	0.074000	97.26	172.15	95.16
0.25	0.25	1.0325	0.003	1.0295	21.3	0.01323	7.70	0.073435	97.26	172.15	95.16
0.50	0.5	1.031	0.003	1.0280	21.3	0.01323	8.10	0.053258	92.31	163.40	90.46
1	1	1.03	0.003	1.0270	21.3	0.01323	8.40	0.038350	89.02	157.56	87.32
2	2	1.028	0.003	1.0250	21.3	0.01323	8.9	0.027913	82.42	145.89	81.05
5	5	1.026	0.003	1.0230	20.9	0.01330	9.4	0.018231	75.83	134.22	74.77
15	15	1.0235	0.003	1.0205	20.6	0.01334	10.1	0.010950	67.59	119.63	66.93
54	54	1.02	0.003	1.0170	19.8	0.01347	11.0	0.006081	56.05	99.20	55.95
148	148	1.015	0.003	1.0120	18.9	0.01363	12.3	0.003928	39.56	70.03	40.26
1495	1495	1.012	0.003	1.0090	16.2	0.01410	13.1	0.001320	29.67	52.52	30.85

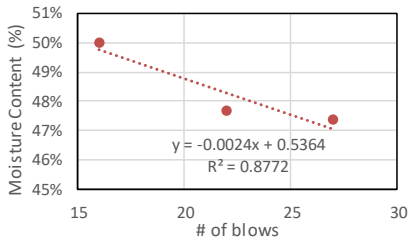
B-2 (2'-4') Beaumont Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-2 (2'-4')	Iman Shafii	B-2	26-Mar	Clay	From :	2	2	
						To :	4		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4384	Wet Density	Wet Denisty (kN/m3)	20.09
height (ft)	0.438	h	Depth of middle of the core (ft)	0.219				Sample Diameter (ft)	0.2281		Wet Denisty (pcf)	127.9
								Sample Volume (ft^3)	0.0179	Dry Density	Dry Denisty (kg/m^3)	1664.6
height (mm)	133.718	d	Depth of lower side of the core (ft)	0.438	Core Diameter (ft)	0.228		Sample weight (lb)	2.2906		Dry Denisty (kN/m^3)	16.32
								Wet Denisty (pcf)	127.86		Dry Denisty (pcf)	104

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	2.22	Z	1.1	13.1	12	10.8	9.7	2.3	9.7	23.71%
2	2.22	G1	1.05	33.05	32	27.2	26.15	5.85	26.15	22.37%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.219	25-35	27	175	1	9.4	6.7	47.4%
2		20-30	22	FF	1	10.6	7.5	47.7%
3		15-25	16	M	1	10.3	7.2	50.0%
Liquid Limit		47.64%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	2.219	#1B	1	5.3	4.8	13.2%
	2	2.219	A	1.1	6.3	5.6	15.6%
Average Plastic Limit	14.36%		Plasticity Index	33.28%	Liquidity Index	26.09%	

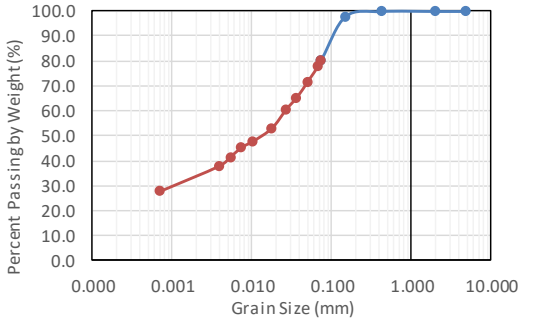
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was less than 1 mm
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					1.95	56.0		

B-2 (2'-4') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-2 (2'-4')	Iman Shafii	Beaumont, Gray	Uncemented	29.65633, -95.1247	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.7	501.7	0.0	0.0	100.0
		10	2.00	624.1	624.1	0	0.0	100.0
	421	40	0.43	363.2	363.3	0.1	0.0	100.0
		100	0.15	321.4	329.9	8.5	2.0	97.99
		200	0.07	317.2	392.3	75.1	19.6	80.45
		Pan	0.00	360.4	704.8	344.4	100.0	0.0
		∑ soil mass after sieve (gr)		428.1				
		Error (%)		-1.7%				



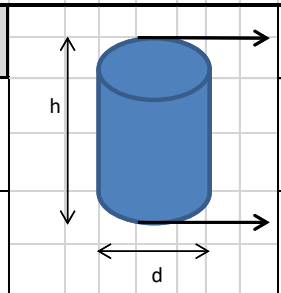
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	19.6%	80.4%	N/A	0.00133	0.01329	0.0266	#VALUE!	#VALUE!	CL~CH	A-7-6(26.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	20.3	19.7	0.97044335	151H
0	52.13				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	63.354	99.89873	0.9974	162.99	9.15	168.93	2.850
						$G_{s,\ 20c}$	2.848101	

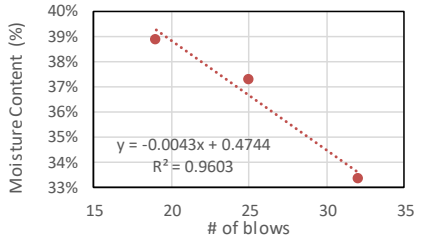
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.1	0.01228	7.3	0.074000	94.44	325.23	80.45
0.25	0.25	1.033	0.003	1.0300	24.1	0.01228	7.60	0.067685	91.39	314.74	77.91
0.50	0.5	1.0305	0.003	1.0275	24.1	0.01228	8.25	0.049865	83.77	288.51	71.68
1	1	1.028	0.003	1.0250	24.1	0.01228	8.90	0.036623	76.16	262.29	65.45
2	2	1.026	0.003	1.0230	24.1	0.01228	9.4	0.026614	70.06	241.30	60.47
5	5	1.023	0.003	1.0200	23.8	0.01232	10.2	0.017594	60.93	209.83	52.99
15	15	1.021	0.003	1.0180	23.6	0.01235	10.7	0.010427	54.83	188.85	48.01
30	30	1.02	0.003	1.0170	23.6	0.01235	11.0	0.007476	51.79	178.35	45.51
60	60	1.0185	0.003	1.0155	23.4	0.01237	11.4	0.005394	47.22	162.62	41.78
120	120	1.017	0.003	1.0140	23.2	0.01240	11.8	0.003889	42.65	146.88	38.04
4080	4080	1.013	0.003	1.0100	23.9	0.01230	13.7	0.000713	30.46	104.91	28.07

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-2 (8'-10')	Iman Shafii	B-2	5/20/2017	Clay	From :	8	2	
						To :	10		

Sample Dimensions			Depth of upper side of the core (ft)	8.000	Notes:		Density Calcs.	Sample Height (ft)	0.258	Wet Density	Wet Denisty (kN/m3)	19.7
height (ft)	0.258		Depth of middle of the core (ft)	8.129				Sample Diameter (ft)	0.2319		Wet Denisty (pcf)	125.2
								Sample Volume (ft^3)	0.0109	Dry Density	Dry Denisty (kg/m^3)	1807.7
height (mm)	78.818		Depth of lower side of the core (ft)	8.258	Core Diameter (ft)	0.232		Sample weight (lb)	1.366		Dry Denisty (kN/m^3)	17.7
								Wet Denisty (pcf)	125.15		Dry Denisty (pcf)	113

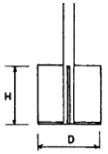
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	8.129	49	1.1	14.1	13	12.7	11.6	1.4	11.6	12.07%
2	8.129	O	1	13.4	12.4	12.3	11.3	1.1	11.3	9.73%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	8.13	25-35	32	z	1	8.2	6.4	33.33%
2		20-30	25	33	1	10.2	7.7	37.31%
3		15-25	19	122	1	9.75	7.3	38.89%
Liquid Limit (%)		36.69%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	8.129	49	1	8.2	7.3	14.29%
	2	8.129	29	1	5.4	4.85	14.29%
Average Plastic Limit (%)	14.29%		Plasticity Index	22.40%	Liquidity Index	-15.10%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	N/A	> 4.5	> 430.5	Type A

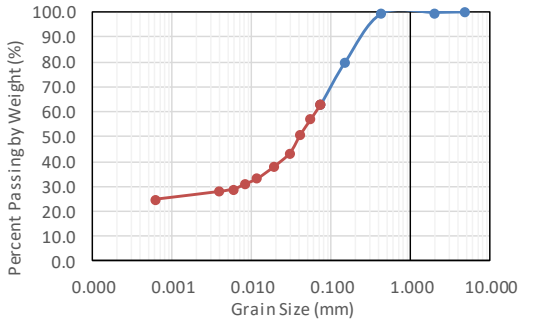
Notes:

Pocket Erodometer was < 1 mm
Sample was too stiff to penetrate the vane and pocket penterometer

B-2 (8'-10') Lissie Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-2 (8'-10')	Iman Shafii	Lissie Formation, Redish Brown	Semi-cemented	29.82581, -95.74614	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	650	650.0	0	0.0	100.0
		10	2.000	623	624.0	1	0.2	99.8
0.425	437	40	0.425	362	364.0	2	0.7	99.3
		100	0.149	320	405.0	85	20.0	80.0
		200	0.074	317	391.0	74	36.9	63.10
		Pan	0.000	360	637.0	277	100.0	0.0
		∑ soil mass after sieve (gr)		439				
		Error (%)		-0.5%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	36.9%	63.1%	N/A	0.0072	0.0403	0.0641	#VALUE!	#VALUE!	CL with Sand	A-6(11.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9	8.8	0.977777778	151H
0.425	50.51				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.4	0.99947	102.958	249.4207	0.9977	351.8	14.39	360.7	2.631
						$G_{s,\ 20c}$	2.629319	

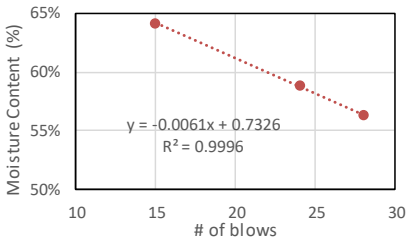
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.032	0.003	1.0290	23.0	0.01317	7.8	0.074000	94.76	262.5	63.10
0.25	0.25	1.032	0.003	1.0290	23.0	0.01317	7.8	0.073564	94.76	262.5	63.10
0.50	0.5	1.029	0.003	1.0260	23.0	0.01317	8.6	0.054620	84.96	235.3	56.89
1	1	1.026	0.003	1.0230	23.0	0.01317	9.4	0.040378	75.15	208.2	50.68
2	2	1.0225	0.003	1.0195	23.0	0.01317	10.4	0.029960	63.72	176.5	43.43
5	5	1.02	0.003	1.0170	22.8	0.01320	11.0	0.019579	55.55	153.9	38.25
15	15	1.0175	0.003	1.0145	22.5	0.01325	11.65	0.011673	47.38	131.2	33.07
30	30	1.0165	0.003	1.0135	22.4	0.01326	11.95	0.008369	44.11	122.2	31.00
60	60	1.0155	0.003	1.0125	22.2	0.01329	12.2	0.005993	40.84	113.1	28.93
140	140	1.015	0.003	1.0120	21.8	0.01335	12.3	0.003958	39.21	108.6	27.89
5640	5640	1.0135	0.003	1.0105	22.3	0.01328	12.75	0.000631	34.31	95.0	24.79

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-2 (13'-15')	Iman Shafii	B-2	3/26/2017	Clay	From :	13	2	
						To :	15		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4895	Wet Density	Wet Denisty (kN/m3)	21.49
height (ft)	0.490	h	Depth of middle of the core (ft)	0.245				Sample Diameter (ft)	0.2309		Wet Denisty (pcf)	136.8
								Sample Volume (ft^3)	0.0205	Dry Density	Dry Denisty (kg/m^3)	1842.4
height (mm)	149.298	d	Depth of lower side of the core (ft)	0.490	Core Diameter (ft)	0.231		Sample weight (lb)	2.8043		Dry Denisty (kN/m^3)	18.07
								Wet Denisty (pcf)	136.78		Dry Denisty (pcf)	115

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.24	29	0.9	40.4	39.5	34.2	33.3	6.2	33.3	18.62%
2	0.24	45	0.9	56.7	55.8	47.7	46.8	9	46.8	19.23%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.245	25-35	28	G1	0.9	8.4	5.7	56.3%
2		20-30	24	2	1	9.1	6.1	58.8%
3		15-25	15	15	1	9.7	6.3	64.2%
Liquid Limit		58.01%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.245	29	1	5.2	4.4	23.5%
	2	0.245	45	1	4.4	3.8	21.4%
Average Plastic Limit	22.48%		Plasticity Index	35.53%	Liquidity Index	-10.00%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	> 4.5	> 130	Type A

Notes:

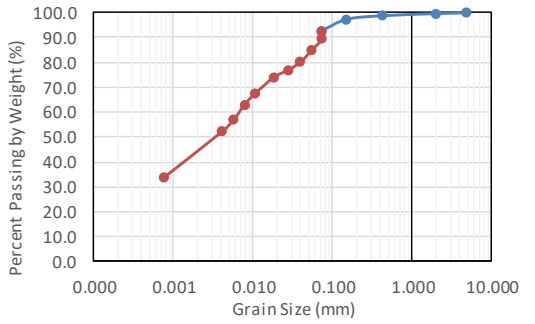
Pocket Erodomoeter was 1.63 mm

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-2 (13'-15') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-2 (13'-15')	Iman Shafii	Beaumont Formation, Red	Not Cemented	29.58296-95.86375	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.7	0.7	0.0	100.0
		10	2.00	624	624.8	0.8	0.3	99.7
2	456.5	40	0.43	362	365.9	3.9	1.2	98.8
		100	0.15	322	328.8	6.8	2.7	97.3
		200	0.07	317	337.8	20.8	7.2	92.8
		Pan	0.00	360.0	783.5	423.5	100.0	0.0
		∑ soil mass after sieve (gr)		456.5				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.2%	7.1%	92.8%	N/A	0.0006	0.00368	0.00676	#VALUE!	#VALUE!	CH	A-7-6 (36.6)

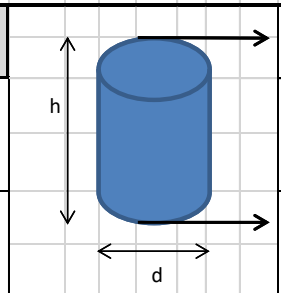
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	18.6	18.1	0.97311828	151H
2	51.31				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	69.236	99.90744	0.9976	168.9	8.22	173.9	2.514
						$G_{s,\ 20c}$	2.512158	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.1	0.01363	7.3	0.074000	100.00	423.50	92.77
0.25	0.25	1.033	0.003	1.0300	24.1	0.01363	7.30	0.073674	99.82	422.72	89.41
0.50	0.5	1.0315	0.003	1.0285	24.1	0.01363	7.95	0.054365	94.83	401.59	84.78
1	1	1.03	0.003	1.0270	24.1	0.01363	8.40	0.039515	89.84	380.45	80.15
2	2	1.029	0.003	1.0260	24.1	0.01363	8.6	0.028272	86.51	366.36	77.06
5	5	1.028	0.003	1.0250	23.9	0.01367	8.9	0.018233	83.18	352.27	73.98
15	15	1.026	0.003	1.0230	23.6	0.01371	9.4	0.010856	76.53	324.09	67.80
30	30	1.0245	0.003	1.0215	23.5	0.01373	9.9	0.007867	71.54	302.95	63.17
60	60	1.0225	0.003	1.0195	23.3	0.01376	10.4	0.005716	64.88	274.77	57.00
120	120	1.021	0.003	1.0180	23.3	0.01376	10.7	0.004109	59.89	253.63	52.37
4080	4080	1.015	0.003	1.0120	23.6	0.01371	12.3	0.000753	39.93	169.09	33.85

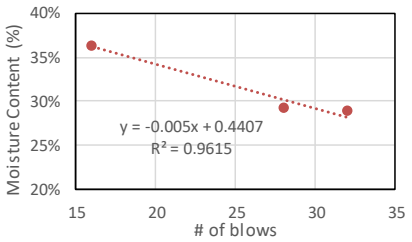
B-4 (8'-10') Beaumont Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-4 (8'-10')	Iman Shafii	B-4	3/25/2017	Clay	From :	8	2	
						To :	10		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.5092	Wet Density	Wet Denisty (kN/m3)	21.40
height (ft)	0.509		Depth of middle of the core (ft)	0.255				Sample Diameter (ft)	0.2378		Wet Denisty (pcf)	136.2
								Sample Volume (ft^3)	0.0226	Dry Density	Dry Denisty (kg/m^3)	1949.4
height (mm)	155.296		Depth of lower side of the core (ft)	0.509	Core Diameter (ft)	0.238		Sample weight (lb)	3.0799		Dry Denisty (kN/m^3)	19.12
								Wet Denisty (pcf)	136.22		Dry Denisty (pcf)	122

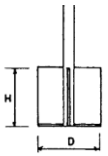
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.25	29	1	51.1	50.1	46	45	5.1	45	11.33%
2	0.25	45	1	39.6	38.6	35.3	34.3	4.3	34.3	12.54%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.255	25-35	32	A	1.1	6.9	5.6	28.9%
2		20-30	28	FF	0.9	6.2	5	29.3%
3		15-25	16	M	1	7	5.4	36.4%
Liquid Limit		31.57%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.255	122	1	5.2	4.7	13.5%
	2	0.255	175	1	4.9	4.5	11.4%
Average Plastic Limit	12.47%		Plasticity Index	19.10%	Liquidity Index	-2.81%	

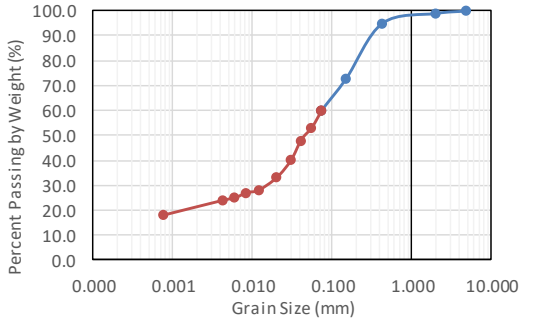
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was (6.49+7.89)/2= 7.19 mm
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					4.5	129.2		

B-4 (8'-10') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-4 (8'-10')	Iman Shafii	Beaumont, Yellowish brown	Uncemented	29.41910, -96.15145	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.5	505.0	3.5	0.0	100.0
		10	2.00	624	625.0	0.9	1.0	99.0
2	452.2	40	0.43	363	381.0	18.1	4.9	95.1
		100	0.15	323	425.0	101.6	27.3	72.7
		200	0.07	317	374.5	57.5	39.9	60.1
		Pan	0.00	360.3	634.1	273.8	100.0	0.0
		∑ soil mass after sieve (gr)		455.4				
		Error (%)		-0.7%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.8%	39.1%	60.1%	N/A	0.0149	0.0461	0.074	#VALUE!	#VALUE!	CL with Sand	A-6(8.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	14.2	13.8	0.971830986	151H
2	50.82				

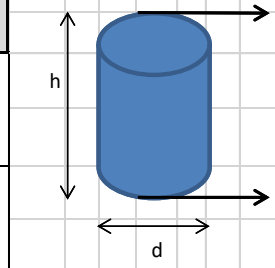
Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	64.456	99.94754	0.9976	164.16	10.51	170.6	2.595
					$G_{s,\ 20c}$	2.593407		

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.032	0.003	1.0290	24.0	0.01321	7.8	0.074000	95.57	261.67	60.10
0.25	0.25	1.032	0.003	1.0290	24.0	0.01321	7.80	0.073787	95.57	261.67	60.10
0.50	0.5	1.0285	0.003	1.0255	24.0	0.01321	8.75	0.055261	84.03	230.09	53.11
1	1	1.026	0.003	1.0230	24.0	0.01321	9.40	0.040501	75.80	207.53	48.12
2	2	1.022	0.003	1.0190	23.8	0.01324	10.5	0.030341	62.61	171.44	40.14
5	5	1.0185	0.003	1.0155	23.6	0.01327	11.4	0.020043	51.08	139.86	33.16
15	15	1.016	0.003	1.0130	23.5	0.01329	12.1	0.011936	42.84	117.30	28.17
30	30	1.0155	0.003	1.0125	23.5	0.01329	12.2	0.008475	41.19	112.79	27.17
60	60	1.0145	0.003	1.0115	23.3	0.01332	12.5	0.006068	37.90	103.76	25.18
120	120	1.014	0.003	1.0110	23.3	0.01332	12.6	0.004317	36.25	99.25	24.18
4080	4080	1.011	0.003	1.0080	23.6	0.01327	13.4	0.000761	26.36	72.18	18.19

B-5 (4’-6’) Beaumont Formation – Page 1

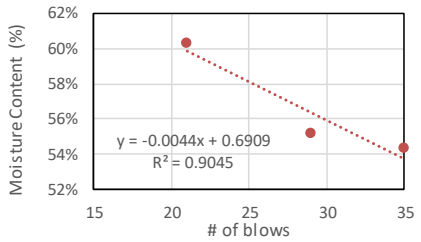
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-5 (4'-6')	Iman Shafii	B-5	5/18/2017	Clay	From :	4	2	
						To :	6		

Sample Dimensions		Depth of upper side of the core (ft)	4.000	Notes:		Density Calcs.	Sample Height (ft)	0.257	Wet Density	Wet Denisty (kN/m3)	19.8
height (ft)	0.257	Depth of middle of the core (ft)	4.129				Sample Diameter (ft)	0.2326		Wet Denisty (pcf)	126.2
							Sample Volume (ft^3)	0.0109	Dry Density	Dry Denisty (kg/m^3)	1692.3
height (mm)	78.438	Depth of lower side of the core (ft)	4.257	Core Diameter (ft)	0.233		Sample weight (lb)	1.379		Dry Denisty (kN/m^3)	16.6
							Wet Denisty (pcf)	126.18		Dry Denisty (pcf)	106



Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	4.129	29	1.1	24.8	23.7	20.9	19.8	3.9	19.8	19.70%
2	4.129	z	1.1	9.8	8.7	8.4	7.3	1.4	7.3	19.18%

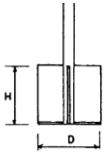
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	4.13	25-35	35	z	1	8.1	5.6	54.35%
2		20-30	29	122	1	10	6.8	55.17%
3		15-25	21	49	1	10.3	6.8	60.34%
Liquid Limit (%)		58.09%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	4.129	33	1	7.9	7	15.00%
	2	4.129	G1	1	6.6	5.85	15.46%
Average Plastic Limit (%)	15.23%		Plasticity Index	42.86%	Liquidity Index	9.81%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	N/A	2.98	285.4	Type A



Notes:

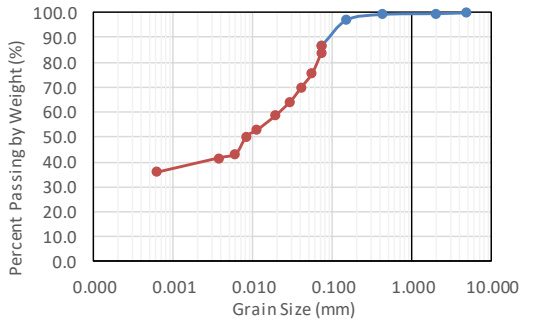
Pocket Erodometer was 0 mm

Sample was too stiff to penetrate the vane and pocket penterometer

B-5 (4’-6’) Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-5 (4'-6')	Iman Shafii	Beaumont, Yellowish Brown	Cemented	29.74237, -95.32978	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	650	650.0	0	0.0	100.0
		10	2.000	623	624.0	1	0.3	99.7
	307	40	0.425	363	364.0	1	0.7	99.3
		100	0.149	321	328.0	7	2.9	97.1
		200	0.074	317	348.0	31	13.0	86.97
		Pan	0.000	360	627.0	267	100.0	0.0
		∑ soil mass after sieve (gr)		307				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	13.0%	87.0%	N/A	N/A	0.00816	0.0215	#VALUE!	#VALUE!	CH	A-7-6(38.7)

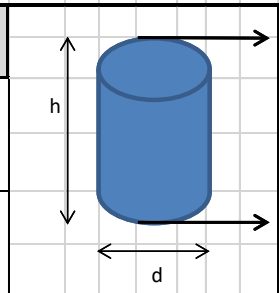
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.3	9.1	0.978494624	151H
0	50.82				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.4	0.99947	61.72	99.79152	0.9977	161.28	9.37	167.1	2.625
						$G_{s,\ 20c}$	2.623259	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.033	0.003	1.0300	23.0	0.01337	7.60	0.074000	97.49	260.3	86.97
0.27	0.266667	1.032	0.003	1.0290	23.0	0.01337	7.80	0.072309	94.24	251.6	84.15
0.50	0.5	1.029	0.003	1.0260	23.0	0.01337	8.60	0.055449	84.50	225.6	75.67
1	1	1.027	0.003	1.0240	23.0	0.01337	9.2	0.040553	78.00	208.2	70.01
2	2	1.025	0.003	1.0220	23.0	0.01337	9.7	0.029444	71.50	190.9	64.36
5	5	1.023	0.003	1.0200	22.8	0.01340	10.2	0.019142	65.00	173.5	58.71
15	15	1.021	0.003	1.0180	22.6	0.01343	10.7	0.011346	58.50	156.2	53.06
30	30	1.02	0.003	1.0170	22.3	0.01348	11.0	0.008164	55.25	147.5	50.23
60	60	1.0175	0.003	1.0145	22.1	0.01351	11.7	0.005955	47.12	125.8	43.16
159	159	1.017	0.003	1.0140	21.7	0.01358	11.8	0.003699	45.50	121.5	41.75
5670	5670	1.015	0.003	1.0120	22.3	0.01348	12.3	0.000628	39.00	104.1	36.10

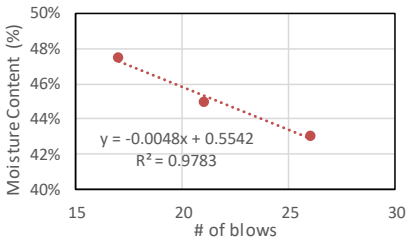
B-5 (6'-8') Beaumont Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-5 (6'-8')	Iman Shafii	B-5	3/29/2017	Clay	From :	6	2	
						To :	8		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4736	Wet Density	Wet Denisty (kN/m3)	20.61
height (ft)	0.474		Depth of middle of the core (ft)	0.237				Sample Diameter (ft)	0.2319		Wet Denisty (pcf)	131.2
								Sample Volume (ft^3)	0.02	Dry Density	Dry Denisty (kg/m^3)	1790.1
height (mm)	144.443		Depth of lower side of the core (ft)	0.474	Core Diameter (ft)	0.232		Sample weight (lb)	2.6235		Dry Denisty (kN/m^3)	17.55
								Wet Denisty (pcf)	131.18		Dry Denisty (pcf)	112

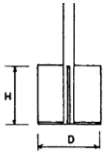
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.24	122	1.1	69.1	68	58.5	57.4	10.6	57.4	18.47%
2	0.24	XX	0.9	48	47.1	41.4	40.5	6.6	40.5	16.30%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.237	25-35	26	2	1	11.3	8.2	43.1%
2		20-30	21	29	1	11	7.9	44.9%
3		15-25	17	45	1	12.5	8.8	47.4%
Liquid Limit		43.42%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.237	1B	1.1	15.5	13.5	16.1%
	2	0.237	A	1.1	16.5	14.4	15.8%
Average Plastic Limit	15.96%		Plasticity Index	27.46%	Liquidity Index	5.18%	

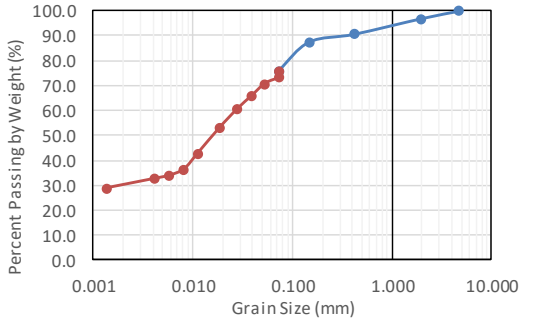
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was less than 1 mm
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					2.735	78.5		

B-5 (6'-8') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-5 (6'-8')	Iman Shafii	Beaumont, Yellowish brown	Cemented	30.04277, -95.05937	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.6	508.1	6.5	0.0	100.0
		10	2.00	624.1	631.6	7.5	3.1	96.9
2	452.6	40	0.43	363.1	392.3	29.2	9.4	90.6
		100	0.15	321.4	336.1	14.7	12.6	87.4
		200	0.07	317.2	370.2	53	24.2	75.8
		Pan	0.00	360.4	707.7	347.3	100.0	0.0
		∑ soil mass after sieve (gr)		458.2				
		Error (%)		-1.2%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	22.8%	75.8%	N/A	0.002	0.01646	0.0282	#VALUE!	#VALUE!	CL	A-7-6(19.5)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	15.6	15	0.961538462	151H
2	51				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	101.336	250.1936	0.9976	350.92	18.86	362.6	2.619
						$G_{s,\ 20c}$	2.617774	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.032	0.003	1.0290	24.0	0.01301	7.8	0.074000	95.69	332.34	75.80
0.25	0.25	1.031	0.003	1.0280	24.0	0.01301	8.10	0.074054	92.39	320.88	73.27
0.50	0.5	1.03	0.003	1.0270	24.0	0.01301	8.40	0.053325	89.09	309.42	70.73
1	1	1.028	0.003	1.0250	24.0	0.01301	8.90	0.038813	82.49	286.50	65.67
2	2	1.026	0.003	1.0230	24.0	0.01301	9.4	0.028205	75.89	263.58	60.61
5	5	1.023	0.003	1.0200	23.8	0.01304	10.2	0.018628	65.99	229.20	53.01
15	15	1.019	0.003	1.0160	23.8	0.01304	11.3	0.011320	52.80	183.36	42.88
30	30	1.0165	0.003	1.0135	23.7	0.01306	12.0	0.008241	44.55	154.71	36.55
60	60	1.0155	0.003	1.0125	23.6	0.01307	12.2	0.005895	41.25	143.25	34.02
120	120	1.015	0.003	1.0120	23.5	0.01309	12.3	0.004191	39.60	137.52	32.75
1140	1140	1.0135	0.003	1.0105	23.0	0.01317	12.5	0.001379	34.65	120.33	28.96

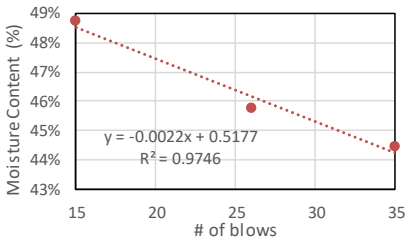
B-6 (0'-2') Beaumont Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-6 (0'-2')	Iman Shafii	B-6	4/19/2017	Clay	From :	0	2	
						To :	2		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4406	Wet Density	Wet Denisty (kN/m3)	19.72
height (ft)	0.441	h	Depth of middle of the core (ft)	0.220				Sample Diameter (ft)	0.2314		Wet Denisty (pcf)	125.5
								Sample Volume (ft^3)	0.0185	Dry Density	Dry Denisty (kg/m^3)	1722.2
height (mm)	134.371	d	Depth of lower side of the core (ft)	0.441	Core Diameter (ft)	0.231		Sample weight (lb)	2.3268		Dry Denisty (kN/m^3)	16.89
								Wet Denisty (pcf)	125.55		Dry Denisty (pcf)	108

Moisture Content				Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.22	29	0.9	11.2	10.3	9.7	8.8	1.5	8.8	17.05%
2	0.22	#1B	1	13	12	11.3	10.3	1.7	10.3	16.50%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.220	25-35	35	A	1	10.1	7.3	44.4%
2		20-30	26	B	1	9.6	6.9	45.8%
3		15-25	15	H	1	12.6	8.8	48.7%
Liquid Limit		46.27%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.220	G1	1	12	10.4	17.0%
	2	0.220	45	1.1	12.6	10.8	18.6%
Average Plastic Limit	17.79%		Plasticity Index	28.48%	Liquidity Index	-3.56%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	> 4.5	> 129	Type A

Notes:

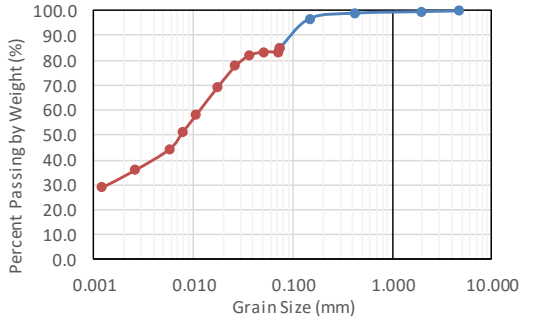
Pocket Erodomoeter was almost 0 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-6 (0'-2') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-6 (0'-2')	Iman Shafii	Beaumont, Dark Brown	Cemented	29.63747, -95.57872	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.5	501.6	0.1	0.0	100.0
		10	2.000	623.8	625.1	1.3	0.3	99.7
2	460	40	0.425	362.7	365.5	2.8	0.9	99.1
		100	0.149	321.0	331.0	10	3.1	96.9
		200	0.074	316.9	372.1	55.2	15.1	84.92
		Pan	0.000	252.3	643.1	390.8	100.0	0.0
		∑ soil mass after sieve (gr)		460.2				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	15.1%	84.9%	N/A	0.0012	0.00743	0.0118	#VALUE!	#VALUE!	CL	A-7-6(24.5)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	14.9	14.5	0.973154362	151H
2	50				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	102.866	249.4379	0.9981	351.82	20.59	364.7	2.684
						$G_{s,\ 20c}$	2.684082	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0325	0.003	1.0295	23.7	0.01306	7.7	0.074000	96.63	377.62	84.92
0.25	0.25	1.032	0.003	1.0290	23.7	0.01306	7.80	0.072938	94.99	371.22	83.53
0.50	0.5	1.032	0.003	1.0290	23.7	0.01306	7.80	0.051575	94.99	371.22	83.53
1	1	1.0315	0.003	1.0285	23.7	0.01306	7.95	0.036818	93.35	364.82	82.14
2	2	1.03	0.003	1.0270	23.7	0.01306	8.4	0.026761	88.44	345.62	77.96
5	5	1.027	0.003	1.0240	23.4	0.01311	9.2	0.017778	78.61	307.22	69.62
15	15	1.023	0.003	1.0200	23.3	0.01312	10.2	0.010821	65.51	256.01	58.49
30	30	1.0205	0.003	1.0175	23.2	0.01314	10.9	0.007901	57.32	224.01	51.53
60	60	1.018	0.003	1.0150	22.8	0.01320	11.5	0.005779	49.13	192.01	44.57
312	312	1.015	0.003	1.0120	22.4	0.01326	12.3	0.002633	39.31	153.61	36.22
1440	1440	1.0125	0.003	1.0095	25.0	0.01286	13.1	0.001224	31.12	121.61	29.27

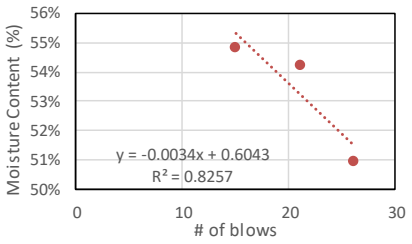
B-8 (2’-4’) Alluvium Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-8 (2'-4')	Iman Shafii	B-8	12:00:00 AM	Clay	From :	2	2	
						To :	4		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3347	Wet Density	Wet Denisty (kN/m3)	18.34
height (ft)	0.335	h	Depth of middle of the core (ft)	0.167				Sample Diameter (ft)	0.2395		Wet Denisty (pcf)	116.7
								Sample Volume (ft^3)	0.0151	Dry Density	Dry Denisty (kg/m^3)	1523.7
height (mm)	102.097	d	Depth of lower side of the core (ft)	0.335	Core Diameter (ft)	0.239		Sample weight (lb)	1.76		Dry Denisty (kN/m^3)	14.94
								Wet Denisty (pcf)	116.72		Dry Denisty (pcf)	95.1

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	2.17	#1B	1	26.9	25.9	22.2	21.2	4.7	21.2	22.17%
2	2.17	3	1	30.7	29.7	25.1	24.1	5.6	24.1	23.24%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	2.167	25-35	26	33	1	8.7	6.1	51.0%
2		20-30	21	xx	1	10.1	6.9	54.2%
3		15-25	15	z	1	10.6	7.2	54.8%
Liquid Limit		51.93%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	2.167	M	1.1	10.2	8.6	21.3%
	2	2.167	2	1	13.6	11.4	21.2%
Average Plastic Limit	21.24%		Plasticity Index	30.69%	Liquidity Index	4.76%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	4.367	125.3	Type A

Notes:

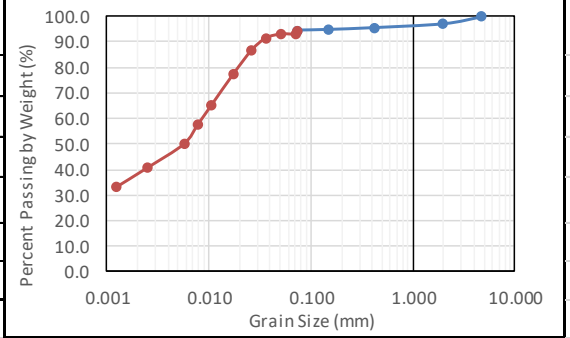
Pocket Erodomoeter was less than 1 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-8 (2'-4') Alluvium Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-8 (2'-4')	Iman Shafii	Alluvium, Brown	Cemented	29.07225, -9559505	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.7	503.9	2.2	0.0	100.0
3	301.6	10	2.000	624.1	630.7	6.6	2.9	97.1
		40	0.425	362.9	367.7	4.8	4.5	95.5
		100	0.149	321.2	323.5	2.3	5.3	94.7
		200	0.074	316.9	317.7	0.8	5.5	94.5
		Pan	0.000	252.4	537.0	284.6	100.0	0.0
		∑ soil mass after sieve (gr)		301.3				
		Error (%)		0.1%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.7%	4.8%	94.5%	N/A	0.001	0.005752	0.00878	#VALUE!	#VALUE!	CH	A-7-6 (31.9)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	16.1	15.7	0.97515528	151H
3	50.31				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	101.37	249.7946	0.9981	350.68	22.56	364.8	2.679
						$G_{s,20c}$	2.678933	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0325	0.003	1.0295	24.0	0.01301	7.7	0.074000	95.95	273.06	94.46
0.25	0.25	1.032	0.003	1.0290	24.0	0.01301	7.80	0.072670	94.32	268.43	92.92
0.50	0.5	1.032	0.003	1.0290	24.0	0.01301	7.80	0.051385	94.32	268.43	92.92
1	1	1.0315	0.003	1.0285	24.0	0.01301	7.95	0.036683	92.69	263.80	91.39
2	2	1.03	0.003	1.0270	24.0	0.01301	8.4	0.026663	87.81	249.92	86.78
5	5	1.027	0.003	1.0240	23.7	0.01306	9.2	0.017713	78.06	222.15	77.58
15	15	1.023	0.003	1.0200	23.7	0.01306	10.2	0.010768	65.05	185.13	65.30
30	30	1.0205	0.003	1.0175	23.3	0.01312	10.9	0.007891	56.92	161.98	57.63
60	60	1.018	0.003	1.0150	23.2	0.01314	11.5	0.005752	48.79	138.84	49.96
335	335	1.015	0.003	1.0120	22.3	0.01328	12.3	0.002544	39.03	111.08	40.75
1386	1386	1.0125	0.003	1.0095	25.0	0.01286	13.1	0.001248	30.90	87.93	33.08

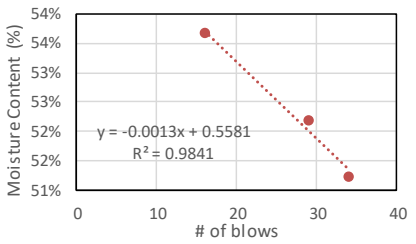
B-13 (18’-20’) Bottom Alluvium Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-13 (18'-20') Bottom	Iman Shafii	B-13	6/11/2017	Clay	From :	18	2	
						To :	20		

Sample Dimensions			Depth of upper side of the core (ft)	19	Notes:		Density Calcs.	Sample Height (ft)	0.3485	Wet Density	Wet Denisty (kN/m3)	18.66
height (ft)	0.349	h	Depth of middle of the core (ft)	19.174				Sample Diameter (ft)	0.227		Wet Denisty (pcf)	118.8
								Sample Volume (ft^3)	0.0141	Dry Density	Dry Denisty (kg/m^3)	1435.3
height (mm)	106.303		Depth of lower side of the core (ft)	19.349	Core Diameter (ft)	0.227		Sample weight (lb)	1.6755		Dry Denisty (kN/m^3)	14.08
		d						Wet Denisty (pcf)	118.76		Dry Denisty (pcf)	89.6

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	18.25	45	1.1	34.7	33.6	26.8	25.7	7.9	25.7	30.74%
2	18.25	M	1	23.3	22.3	17.6	16.6	5.7	16.6	34.34%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	19.17	25-35	34	29	1	13.4	9.2	51.2%
2		20-30	29	49	1	11.5	7.9	52.2%
3		15-25	16	z	1	13.6	9.2	53.7%
Liquid Limit		52.56%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.250	33	1	8.3	7.1	19.7%
	2	18.250	G1	1	7	6	20.0%
Average Plastic Limit	19.84%		Plasticity Index	32.72%	Liquidity Index	38.82%	

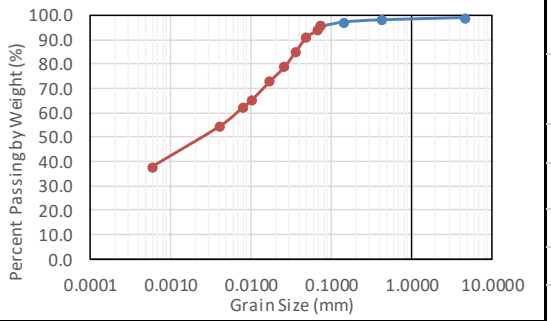
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was less than 1 mm.
					tsf or kg/cm^2	S_u (kPa)*		* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
	19	29	90	N/A	1.625	46.6	Type A	

B-13 (18'-20') Bottom Alluvium Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-13 (18'-20') Bottom	Iman Shafii	Alluvium, Dark Brown	Cemented	28.94365, -95.33034	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.0	504.0	3.0	1.20	98.8
2	248	40	0.425	362.0	364.0	2	2.01	98.0
		100	0.149	320.0	322.0	2	2.81	97.2
		200	0.074	317.0	321.0	4	4.42	95.58
		Pan	0.000	360.0	598.0	238	100.0	0.0
		∑ soil mass after sieve (gr)		249				
		Error (%)		-0.4%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
1.2%	3.2%	95.6%	N/A	N/A	0.00322	0.00694	#VALUE!	#VALUE!	CH	A-7-6 (34.2)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	8.3	8	0.963855422	151H
2	50.35				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
19.72	100006	154.22	7.09227	0.99827	161.3	9.82	167.7	2.855
						$G_{s,\ 20c}$	2.854822	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0325	0.003	1.0295	23.0	0.01243	7.7	0.074000	93.56	222.67	95.58
0.25	0.25	1.032	0.003	1.0290	23.0	0.01243	7.80	0.069430	91.97	218.90	94.06
0.50	0.5	1.031	0.003	1.0280	23.0	0.01243	8.10	0.050030	88.80	211.35	91.01
1	1	1.029	0.003	1.0260	23.0	0.01243	8.60	0.036452	82.46	196.25	84.92
2	2	1.027	0.003	1.0240	23.0	0.01243	9.2	0.026659	76.12	181.16	78.84
5	5	1.025	0.003	1.0220	22.8	0.01246	9.7	0.017355	69.77	166.06	72.75
15	15	1.0225	0.003	1.0195	22.5	0.01251	10.4	0.010387	61.84	147.19	65.14
26	26	1.0215	0.003	1.0185	22.5	0.01251	10.6	0.007985	58.67	139.64	62.10
102	102	1.019	0.003	1.0160	22.0	0.01258	11.3	0.004187	50.74	120.77	54.49
5610	5610	1.0135	0.003	1.0105	22.3	0.01254	12.8	0.000598	33.30	79.26	37.75

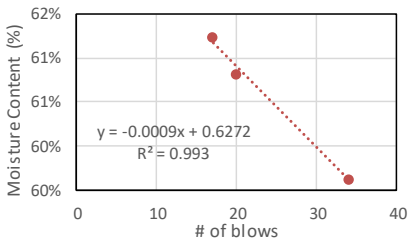
B-13 (18'-20') Top Alluvium Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-13 (18'-20') Top	Iman Shafii	B-13	4/20/2017	Clay	From :	18	2	
						To :	20		

Sample Dimensions			Depth of upper side of the core (ft)	18	Notes:		Density Calcs.	Sample Height (ft)	0.4914	Wet Density	Wet Denisty (kN/m3)	18.83
height (ft)	0.491	h	Depth of middle of the core (ft)	18.246				Sample Diameter (ft)	0.2262		Wet Denisty (pcf)	119.9
								Sample Volume (ft^3)	0.0198	Dry Density	Dry Denisty (kg/m^3)	1468.7
height (mm)	149.892	d	Depth of lower side of the core (ft)	18.491	Core Diameter (ft)	0.226		Sample weight (lb)	2.3684		Dry Denisty (kN/m^3)	14.40
								Wet Denisty (pcf)	119.9		Dry Denisty (pcf)	91.7

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	18.25	29	1	29.9	28.9	23.3	22.3	6.6	22.3	29.60%
2	18.25	122	1	32.4	31.4	24.8	23.8	7.6	23.8	31.93%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	18.25	25-35	34	z	1	9.3	6.2	59.6%
2		20-30	20	29	1	12.9	8.4	60.8%
3		15-25	17	49	1	8.9	5.9	61.2%
Liquid Limit		60.47%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	18.250	122	1	12.6	10.7	19.6%
	2	18.250	o	1	7.7	6.6	19.6%
Average Plastic Limit	19.62%		Plasticity Index	40.85%	Liquidity Index	27.29%	

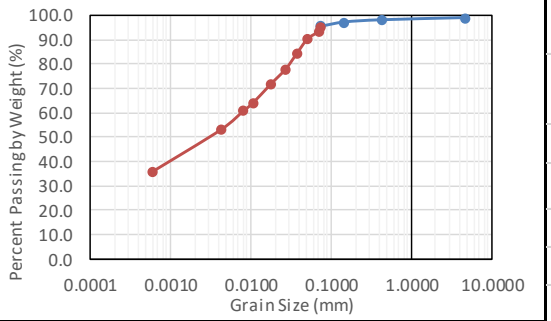
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was less than 1 mm.
	19	29	90	N/A	tsf or kg/cm^2	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					1.863	53.5		

B-13 (18'-20') Top Alluvium Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-13 (18'-20') Top	Iman Shafii	Alluvium, Freeport, Brown	Cemented	28.94365, -95.33034	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.0	504.0	3.0	1.20	98.8
2	248	40	0.425	362.0	364.0	2	2.01	98.0
		100	0.149	320.0	322.0	2	2.81	97.2
		200	0.074	317.0	321.0	4	4.42	95.58
		Pan	0.000	360.0	598.0	238	100.0	0.0
		∑ soil mass after sieve (gr)		249				
		Error (%)		-0.4%				



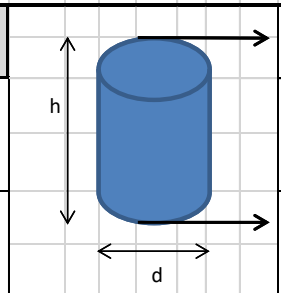
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
1.2%	3.2%	95.6%	N/A	N/A	0.0042	0.00821	#VALUE!	#VALUE!	CH	A-7-6 (43.2)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	8.3	8	0.963855422	151H
2	50.35				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	69.262	99.94189	0.9981	169.01	14.18	178	2.732
						$G_{s,\ 20c}$	2.731767	

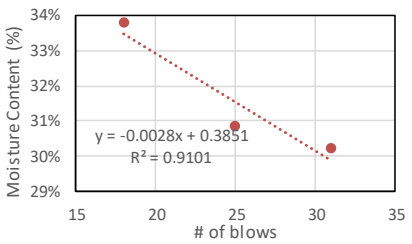
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0325	0.003	1.0295	23.0	0.01279	7.7	0.074000	95.89	228.21	95.08
0.25	0.25	1.032	0.003	1.0290	23.0	0.01279	7.80	0.071441	94.26	224.35	93.52
0.50	0.5	1.031	0.003	1.0280	23.0	0.01279	8.10	0.051479	91.01	216.61	90.40
1	1	1.029	0.003	1.0260	23.0	0.01279	8.60	0.037508	84.51	201.14	84.16
2	2	1.027	0.003	1.0240	23.0	0.01279	9.2	0.027431	78.01	185.67	77.93
5	5	1.025	0.003	1.0220	22.8	0.01282	9.7	0.017856	71.51	170.19	71.69
15	15	1.0225	0.003	1.0195	22.5	0.01287	10.4	0.010686	63.38	150.85	63.89
26	26	1.0215	0.003	1.0185	22.5	0.01287	10.6	0.008214	60.13	143.12	60.77
102	102	1.019	0.003	1.0160	22.0	0.01294	11.3	0.004307	52.01	123.78	52.97
5610	5610	1.0135	0.003	1.0105	22.3	0.01290	12.8	0.000615	34.13	81.23	35.81

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #2	Iman Shafii	#2	10/21/2017	Sandy clay	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.5583	Wet Density	Wet Denisty (kN/m3)	20.27
height (ft)	0.558		Depth of middle of the core (ft)	0.279				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	129.0
								Sample Volume (ft^3)	0.0247	Dry Density	Dry Denisty (kg/m^3)	1725.2
height (mm)	170.292		Depth of lower side of the core (ft)	0.558	Core Diameter (ft)	0.238		Sample weight (lb)	3.1917		Dry Denisty (kN/m^3)	16.92
								Wet Denisty (pcf)	129.04		Dry Denisty (pcf)	108

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.28	46	1.1	26.7	25.6	22.5	21.4	4.2	21.4	19.63%
2	0.28	W	1	10	9	8.5	7.5	1.5	7.5	20.00%

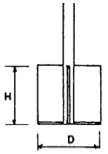
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.279	25-35	31	FF	0.9	10.6	8.35	30.2%
2		20-30	25	XX	1	11.6	9.1	30.9%
3		15-25	18	#1B	1	10.9	8.4	33.8%
Liquid Limit		31.5%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.279	$46	1	11.1	9.9	13.5%
	2	0.279	33	1	12	10.8	12.2%
Average Plastic Limit	12.86%		Plasticity Index	18.65%	Liquidity Index	37.27%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	78	3.25	310.9	Type A

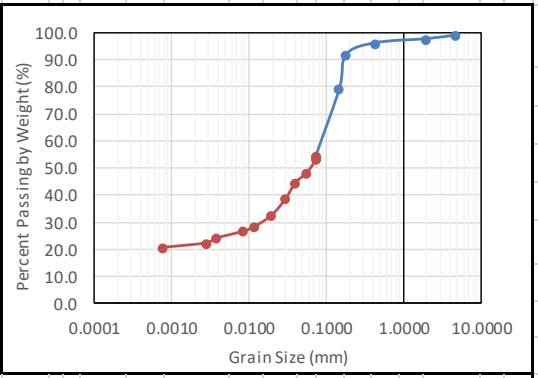


Notes:

Pocket Erodomoeter was almost 1.5 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #2	Iman Shafii	Riverline-Bay City Bridge	Cemented	28.983764, -95.99934	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.0	506.0	5	1.1	98.9
		10	2.00	624.0	630.0	6	2.4	97.6
2	451	40	0.43	364.0	371.0	7	4.0	96.0
		80	0.180	524.0	544.0	20	8.4	91.6
		100	0.149	322.0	378.0	56	20.8	79.2
		200	0.074	317.0	429.0	112	45.7	54.3
		Pan	0.00	252.0	497.0	245	100.0	0.0
		∑ soil mass after sieve (gr)		451				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
1.1%	44.6%	54.3%	N/A	0.0151	0.0625	0.0911	#VALUE!	#VALUE!	CL with sand	A-6 (6.4)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	10.6	10.3	0.971698113	151H
2	52.5				

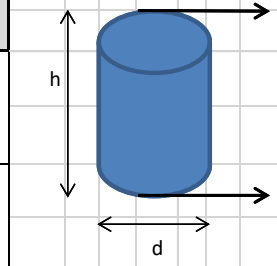
Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.13	0.133333	1.035	0.003	1.0320	20.5	0.01357	7.3	0.074000	100.00	245.00	54.32
0.25	0.25	1.034	0.003	1.0310	20.5	0.01357	7.40	0.073802	97.60	239.11	53.02
0.50	0.5	1.031	0.003	1.0280	20.5	0.01357	8.10	0.054598	88.15	215.97	47.89
1	1	1.029	0.003	1.0260	20.5	0.01357	8.60	0.039780	81.85	200.54	44.47
2	2	1.0255	0.003	1.0225	20.5	0.01357	9.6	0.029642	70.84	173.55	38.48
5	5	1.022	0.003	1.0190	20.2	0.01362	10.5	0.019731	59.82	146.55	32.49
15	15	1.0195	0.003	1.0165	19.8	0.01368	11.2	0.011798	51.95	127.27	28.22
30	30	1.0185	0.003	1.0155	19.4	0.01375	11.4	0.008477	48.80	119.56	26.51
165	165	1.017	0.003	1.0140	17.4	0.01410	11.8	0.003770	44.08	107.99	23.94
293	293	1.016	0.003	1.0130	17.1	0.01415	12.1	0.002876	40.93	100.27	22.23
4260	4260	1.015	0.003	1.0120	15.3	0.01435	12.3	0.000771	37.78	92.56	20.52

Silt Samples - JET

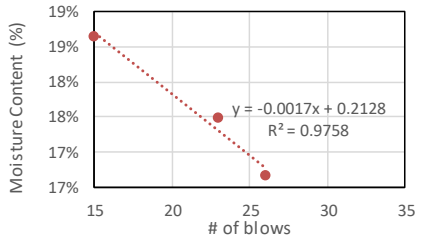
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-1 (23-25)	Iman Shafii	B-1	5/17/2017	Clay	From :	23	2	
						To :	25		

Sample Dimensions		Depth of upper side of the core (ft)	23.000	Notes:		Density Calcs.	Sample Height (ft)	0.518	Wet Density	Wet Denisty (kN/m3)	22.3
height (ft)	0.518	Depth of middle of the core (ft)	23.259				Sample Diameter (ft)	0.2272		Wet Denisty (pcf)	142.1
							Sample Volume (ft^3)	0.021	Dry Density	Dry Denisty (kg/m^3)	2078.6
height (mm)	157.867	Depth of lower side of the core (ft)	23.518	Core Diameter (ft)	0.22717629		Sample weight (lb)	2.981		Dry Denisty (kN/m^3)	20.4
							Wet Denisty (pcf)	142.07		Dry Denisty (pcf)	130



Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	23.259	FF	1	40	39	36.6	35.6	3.4	35.6	9.55%
2	23.259	46	1	25.4	24.4	23.3	22.3	2.1	22.3	9.42%

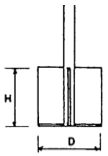
Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	23.26	25-35	26	FF	1	10.1	8.8	16.67%
2		20-30	23	O	1	9.4	8.15	17.48%
3		15-25	15	46	1	15	12.8	18.64%
Liquid Limit (%)		17.03%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	23.259	3	1	9.7	8.7	12.99%
	2	23.259	#1B	1	8.6	7.8	11.76%
Average Plastic Limit (%)	12.38%		**Plasticity Index**	4.65%	**Liquidity Index**	-62.14%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodometer was 1 mm Sample was too stiff to penetrate the vane and pocket penterometer
					tsf or kg/cm^2	kPa		
	19	29	90	N/A	4.5	430.5	Type A	

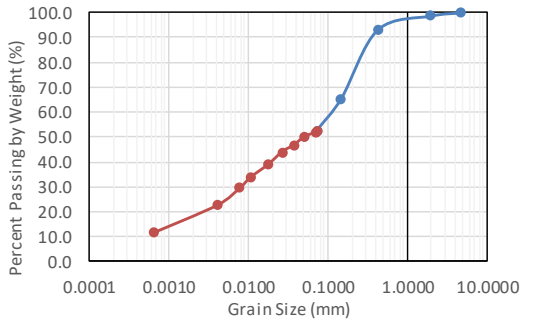


Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	B-1 (23-25)	Iman Shafii	Riverline, Brown	Uncemented	N/A		

Particle Size Distribution (ASTM 422)

Largest Particle (mm)	Mass of Portion (gr)
2	386

Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
4	4.760	563	563.0	0	0.0	100.0
10	2.000	623	628.0	5	1.3	98.7
40	0.425	362	384.0	22	6.9	93.1
100	0.149	321	429.0	108	34.6	65.4
200	0.074	316	366.0	50	47.4	52.56
Pan	0.000	360	565.0	205	100.0	0.0
∑ soil mass after sieve (gr)		390				
Error (%)		-1.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	47.4%	52.6%	0.0005	0.0079	0.051168	0.1175	1.06	235.00	ML with Sand	A-4(0)

Hydrometer Analysis (ASTM 422)

Largest Particle (mm)	Mass of Portion (gr)	Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
2	50.51	7	6.9	0.985714286	151H

Specific Gravity (ASTM D854-14)

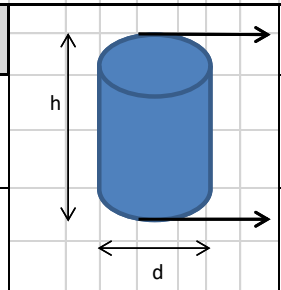
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	63.368	99.90582	0.9981	163.08	16.19	173.3	2.694

$G_{s,\ 20c}$ = 2.693440

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.0335	0.003	1.0305	23.1	0.01296	7.45	0.074000	97.43	199.7	52.56
0.25	0.25	1.033	0.003	1.0300	23.1	0.01296	7.6	0.071429	95.84	196.5	51.71
0.50	0.5	1.032	0.003	1.0290	23.1	0.01296	7.8	0.051168	92.64	189.9	50.01
1	1	1.03	0.003	1.0270	23.1	0.01296	8.4	0.037547	86.25	176.8	46.62
2	2	1.0285	0.003	1.0255	23.1	0.01296	8.8	0.027097	81.46	167.0	44.07
5	5	1.0255	0.003	1.0225	22.9	0.01299	9.55	0.017946	71.88	147.3	38.98
15	15	1.0225	0.003	1.0195	22.6	0.01303	10.35	0.010824	62.29	127.7	33.89
30	30	1.02	0.003	1.0170	22.5	0.01305	11.0	0.007899	54.31	111.3	29.65
120	120	1.016	0.003	1.0130	22.0	0.01312	12.1	0.004166	41.53	85.1	22.87
5640	5640	1.0095	0.003	1.0065	22.3	0.01308	13.8	0.000647	20.76	42.6	11.84

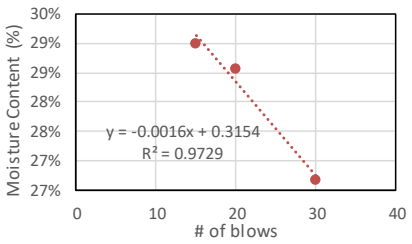
B-3 (8’-10’) Beaumont Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-3 (8'-10')	Iman Shafii	B-3	6/15/2017	Silt	From :	8	2	
						To :	10		

Sample Dimensions			Depth of upper side of the core (ft)	8	Notes:		Density Calcs.	Sample Height (ft)	0.3415	Wet Density	Wet Denisty (kN/m3)	22.51
height (ft)	0.342		Depth of middle of the core (ft)	8.171				Sample Diameter (ft)	0.2031		Wet Denisty (pcf)	143.3
								Sample Volume (ft^3)	0.0111	Dry Density	Dry Denisty (kg/m^3)	1892.8
height (mm)	104.172		Depth of lower side of the core (ft)	8.342	Core Diameter (ft)	0.203		Sample weight (lb)	1.5853		Dry Denisty (kN/m^3)	18.56
								Wet Denisty (pcf)	143.26		Dry Denisty (pcf)	118

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	8.17	G1	1	19.4	18.4	16.1	15.1	3.3	15.1	21.85%
2	8.17	z	1	27.9	26.9	23.3	22.3	4.6	22.3	20.63%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	8.17	25-35	30	$3	1	8.6	7	26.7%
2		20-30	20	33	1	8.2	6.6	28.6%
3		15-25	15	G1	1	9.9	7.9	29.0%
Liquid Limit		27.54%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	8.171	122	1	8.3	7.1	19.67%
	2	8.171	11	1	6.5	5.6	19.57%
Average Plastic Limit	19.62%		Plasticity Index	7.92%	Liquidity Index	20.48%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	1.650	47.4	Type A

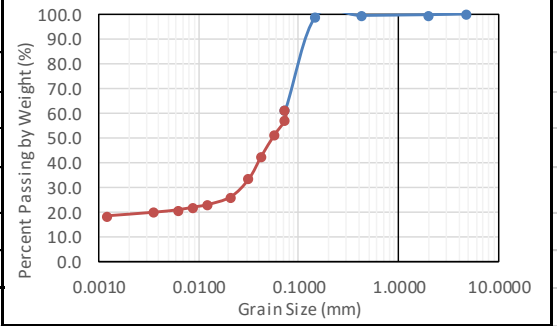
Notes:

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

B-3 (8'-10') Beaumont Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-3 (8'-10')	Iman Shafii	Beauont, yellowish brown	Cemented	29.23384, -95.19014	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	450	450.0	0	0.0	100.0
		10	2.000	624	625.0	1	0.3	99.7
2.5	302	40	0.425	363	364.0	1	0.6	99.4
		100	0.149	321	322.0	1	0.9	99.1
		200	0.074	317	438.0	121	38.6	61.4
		Pan	0.000	360	557.0	197	100.0	0.0
		∑ soil mass after sieve (gr)		321				
		Error (%)		-6.3%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	38.6%	61.4%	N/A	0.02708	0.0557	0.07399	#VALUE!	#VALUE!	ML-CL	A-4 (2.7)

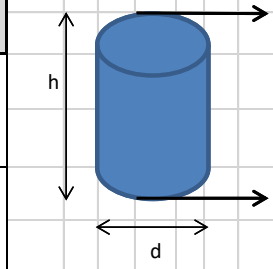
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	5.3	5.2	0.981132075	151H
2.5	51.18				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	61.75	99.7435	0.9981	161.3	12.49	169.1	2.657
						$G_{s,\ 20c}$	2.657048	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.031	0.003	1.0280	22.5	0.01325	8.1	0.074000	89.41	176.1	61.40
0.25	0.25	1.029	0.003	1.0260	22.5	0.01325	7.8	0.073983	83.03	163.6	57.24
0.50	0.5	1.026	0.003	1.0230	22.5	0.01325	9.4	0.057429	73.45	144.7	50.99
1	1	1.022	0.003	1.0190	22.5	0.01325	10.5	0.042919	60.67	119.5	42.66
2	2	1.0175	0.003	1.0145	22.4	0.01326	11.7	0.032003	46.30	91.2	33.28
5	5	1.014	0.003	1.0110	22.3	0.01328	12.6	0.021073	35.13	69.2	25.99
15	15	1.0125	0.003	1.0095	22.0	0.01332	13.0	0.012400	30.34	59.8	22.87
30	30	1.012	0.003	1.0090	21.7	0.01337	13.1	0.008834	28.74	56.6	21.83
60	60	1.0115	0.003	1.0085	21.5	0.01340	13.3	0.006297	27.14	53.5	20.79
190	190	1.011	0.003	1.0080	21.2	0.01345	13.4	0.003571	25.55	50.3	19.74
1650	1650	1.0103	0.003	1.0073	22.4	0.01326	13.6	0.001204	23.31	45.9	18.29

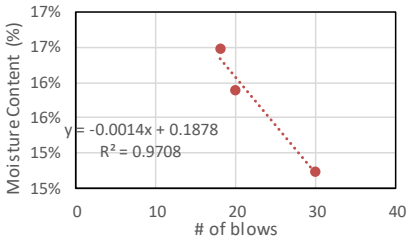
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-7 (22'-24')	Iman Shafii	B-7	6/9/2017	Low plastic silt	From :	22	2	
						To :	24		

Sample Dimensions		Depth of upper side of the core (ft)	23	Notes:		Density Calcs.	Sample Height (ft)	0.2854	Wet Density	Wet Denisty (kN/m3)	22.27
height (ft)	0.285	Depth of middle of the core (ft)	23.143				Sample Diameter (ft)	0.2408		Wet Denisty (pcf)	141.8
							Sample Volume (ft^3)	0.013	Dry Density	Dry Denisty (kg/m^3)	2006.6
height (mm)	87.044	Depth of lower side of the core (ft)	23.285	Core Diameter (ft)	0.241		Sample weight (lb)	1.8433		Dry Denisty (kN/m^3)	19.68
							Wet Denisty (pcf)	141.8		Dry Denisty (pcf)	125



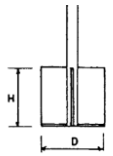
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	23.14	M	1	37.9	36.9	33.8	32.8	4.1	32.8	12.50%
2	23.14	45	1	37.9	36.9	33.4	32.4	4.5	32.4	13.89%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	23.14	25-35	30	I	1.1	19.8	17.4	14.7%
2		20-30	20	29	1	18.5	16.1	15.9%
3		15-25	18	49	1.1	15.6	13.55	16.5%
Liquid Limit		15.28%		Notes:				



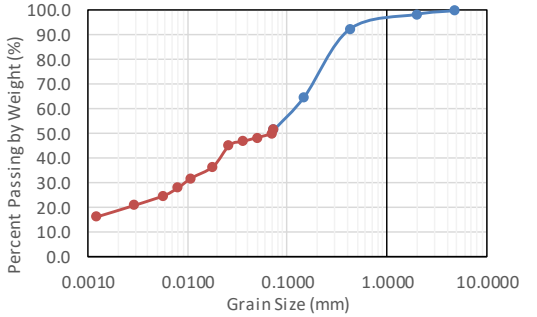
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	22.375	O	1	8.8	8.1	9.9%	
	2	22.375	A	1.2	10.1	9.3	9.9%	
Average Plastic Limit	9.87%		**Plasticity Index**	5.41%	**Liquidity Index**	61.47%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	
					tsf or kg/cm^2	kPa		
	19	29	90	49	1.5	143.5	Type B	Pocket Penetrometer was 2.67 mm.



Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-7 (22'-24')	Iman Shafii	Riverline, Grayish brown	uncemented	Riverline	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501	501.0	0	0.0	100.0
		10	2.00	624	627.0	3	1.5	98.5
2	200	40	0.43	363	375.0	12	7.5	92.5
		100	0.15	321	376.0	55	35.0	65.0
		200	0.074	317	344.0	27	48.5	51.5
		Pan	0.00	360	463.0	103	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



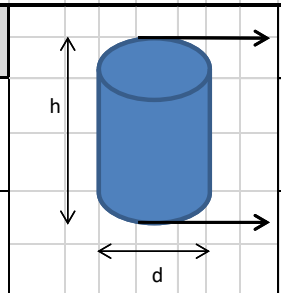
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	48.5%	51.5%	N/A	0.00947	0.0705	0.1212	#VALUE!	#VALUE!	ML-CL with Sand	A-4(0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	5	4.95	0.99	151H
2	51.62				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	63.386	99.7905	0.9976	162.938	9.1	168.8	2.80
					$G_{s,\ 20c}$	2.800043		

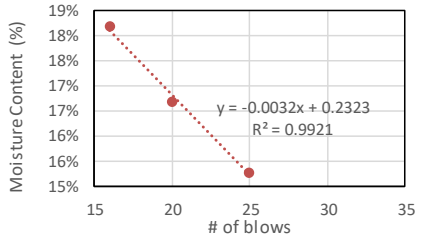
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	21.8	0.01279	7.3	0.074000	94.36	97.2	51.50
0.25	0.25	1.033	0.003	1.0300	21.8	0.01279	7.6	0.070519	91.32	94.1	49.93
0.50	0.5	1.032	0.003	1.0290	21.8	0.01279	7.8	0.050516	88.27	90.9	48.36
1	1	1.031	0.003	1.0280	21.8	0.01279	8.1	0.036401	85.23	87.8	46.79
2	2	1.03	0.003	1.0270	21.8	0.01279	8.4	0.026212	82.18	84.7	45.23
5	5	1.0245	0.003	1.0215	21.5	0.01284	9.9	0.018015	65.44	67.4	36.60
15	15	1.0215	0.003	1.0185	20.8	0.01294	10.6	0.010879	56.31	58.0	31.90
30	30	1.019	0.003	1.0160	20.4	0.01301	11.3	0.007982	48.70	50.2	27.98
60	60	1.017	0.003	1.0140	20.1	0.01305	11.8	0.005789	42.61	43.9	24.85
245	245	1.0145	0.003	1.0115	19.8	0.01310	12.5	0.002954	35.00	36.1	20.93
1537	1537	1.0115	0.003	1.0085	19.1	0.01321	13.3	0.001227	25.87	26.6	16.22

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth (ft):		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-9A (25-27) Middle	Iman Shafii	B-9A	5/11/2017	Silt	From :	25	2	
						To :	27		

Sample Dimensions			Depth of upper side of the core (ft)	25.800	Notes:		Density Calcs.	Sample Height (ft)	0.386	Wet Density	Wet Denisty (kN/m3)	22.7
height (ft)	0.386		Depth of middle of the core (ft)	25.993				Sample Diameter (ft)	0.2356		Wet Denisty (pcf)	144.6
								Sample Volume (ft^3)	0.0168	Dry Density	Dry Denisty (kg/m^3)	2113.9
height (mm)	117.630		Depth of lower side of the core (ft)	26.186	Core Diameter (ft)	0.23555337		Sample weight (lb)	2.430		Dry Denisty (kN/m^3)	20.7
								Wet Denisty (pcf)	144.58		Dry Denisty (pcf)	132

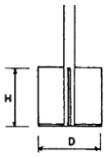
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	25.1	122	1.05	60.2	59.15	55.8	54.75	4.4	54.75	8.04%
2	25.1	29	1	49.1	48.1	44.3	43.3	4.8	43.3	11.09%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	25.99	25-35	25	01W-1	1	9.3	8.2	15.28%
2		20-30	20	#2	1	10.1	8.8	16.67%
3		15-25	16	X	1	7.5	6.5	18.18%
Liquid Limit (%)		15.23%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	25.4	5	1	16.8	15.3	10.49%
	2	25.4	29	1	16.5	14.9	11.51%
Average Plastic Limit (%)	11.00%		Plasticity Index	4.23%	Liquidity Index	-34.02%	

Notes:

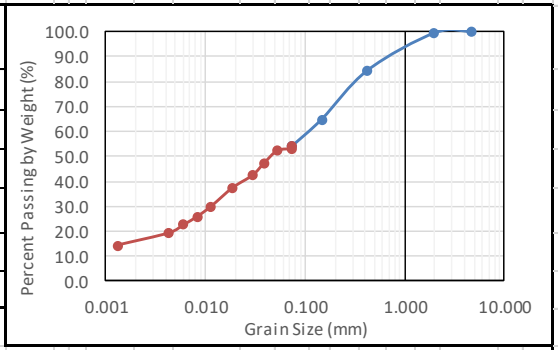
Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	kPa	
	19	29	90	N/A	>4.5	> 430.5	Type A

Notes:

Pocket Erodometer was 8.4 mm
Sample was too stiff to penetrate the vane and pocket penterometer

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	B-9A (25-27) Middle	Iman Shafii	1	2	3		
			Riverline, Greysih brown	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501.0	0	0.0	100.0
		10	2.000	624	625.0	1	0.5	99.5
2	200	40	0.425	363	393.0	30	15.5	84.5
		100	0.149	322	361.0	39	35.0	65.0
		200	0.074	317	339.0	22	46.0	54.0
		Pan	0.000	360	468.0	108	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



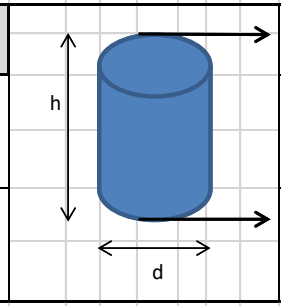
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	46.0%	54.0%	0.0012	0.0152	0.0733	0.103	1.87	85.83	ML-CL with Sand	A-4(0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	4.7	4.7	1	151H
2	52.55				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	57.464	99.5185	0.9976	156.74	14.96	166.1	2.652
						$G_{s,\ 20c}$	2.650791	

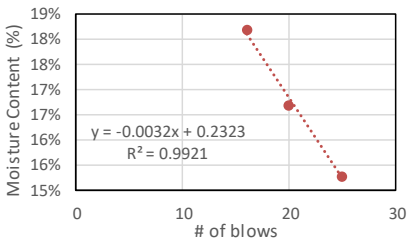
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.031	0.003	1.0280	23.6	0.01288	8.1	0.074000	85.56	92.4	54.00
0.25	0.25	1.0305	0.003	1.0275	23.6	0.01288	8.3	0.073990	84.03	90.8	53.18
0.50	0.5	1.03	0.003	1.0270	23.6	0.01288	8.4	0.052792	82.50	89.1	52.35
1	1	1.027	0.003	1.0240	23.6	0.01288	9.2	0.039067	73.34	79.2	47.40
2	2	1.024	0.003	1.0210	23.6	0.01288	10.7	0.029792	64.17	69.3	42.45
5	5	1.021	0.003	1.0180	23.3	0.01293	10.7	0.018908	55.00	59.4	37.50
15	15	1.0165	0.003	1.0135	23.2	0.01294	12.0	0.011550	41.25	44.6	30.08
30	30	1.014	0.003	1.0110	23.1	0.01296	12.6	0.008396	33.61	36.3	25.95
60	60	1.012	0.003	1.0090	23.1	0.01296	13.4	0.006122	27.50	29.7	22.65
120	120	1.01	0.003	1.0070	23.1	0.01296	13.7	0.004377	21.39	23.1	19.35
1440	1440	1.007	0.003	1.0040	21.0	0.01328	14.4	0.001328	12.22	13.2	14.40

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-9A (25-27) Top	Iman Shafii	B-9A	6/7/2017	Silt	From :	25	2	
						To :	27		

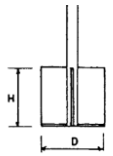
Sample Dimensions			Depth of upper side of the core (ft)	25	Notes:		Density Calcs.	Sample Height (ft)	0.3988	Wet Density	Wet Denisty (kN/m3)	23.05
height (ft)	0.399		Depth of middle of the core (ft)	25.199				Sample Diameter (ft)	0.2341		Wet Denisty (pcf)	146.7
								Sample Volume (ft^3)	0.0172	Dry Density	Dry Denisty (kg/m^3)	2144.0
height (mm)	121.636		Depth of lower side of the core (ft)	25.399	Core Diameter (ft)	0.234		Sample weight (lb)	2.5199		Dry Denisty (kN/m^3)	21.03
								Wet Denisty (pcf)	146.75		Dry Denisty (pcf)	134

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	25.20	z	1.1	18.9	17.8	17.4	16.3	1.5	16.3	9.20%
2	25.20	G1	1	16.3	15.3	14.9	13.9	1.4	13.9	10.07%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	25.20	25-35	25	01W-1	1	9.3	8.2	15.3%
2		20-30	20	#2	1	10.1	8.8	16.7%
3		15-25	16	X	1	7.5	6.5	18.2%
Liquid Limit		15.23%		Notes:				

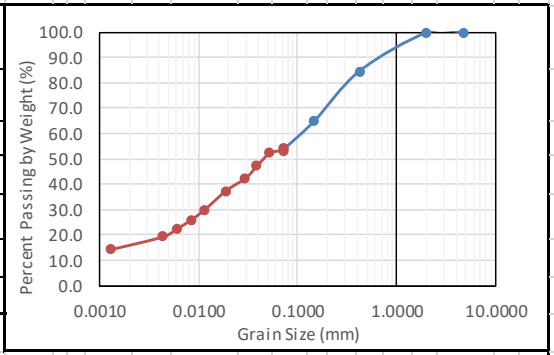


Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	25.4	5	1	16.8	15.3	10.5%	
	2	25.4	29	1	16.5	14.9	11.5%	
Average Plastic Limit	11.00%		Plasticity Index	4.23%	Liquidity Index	-32.22%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was less than 1 mm.
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					> 4.5	> 430.5		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-9A (25-27) Top	Iman Shafii	Riverline, Greysih brown	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501.0	0	0.0	100.0
		10	2.000	624	625.0	1	0.5	99.5
2	200	40	0.425	363	393.0	30	15.5	84.5
		100	0.149	322	361.0	39	35.0	65.0
		200	0.074	317	339.0	22	46.0	54.0
		Pan	0.000	360	468.0	108	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



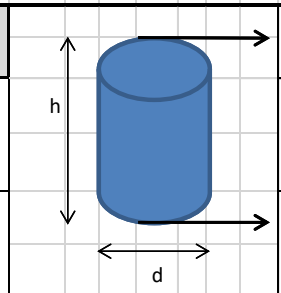
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	46.0%	54.0%	0.0012	0.0152	0.0733	0.103	1.87	85.83	ML-CL with Sand	A-4(0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	4.7	4.7	1	151H
2	52.55				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
22.89	0.99936	57.464	99.5185	0.9976	156.74	14.96	166.1	2.652
						$G_{s,\ 20c}$	2.650791	

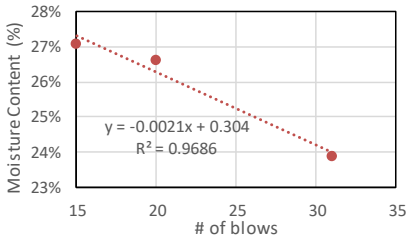
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.031	0.003	1.0280	23.6	0.01288	8.1	0.074000	85.56	92.4	54.00
0.25	0.25	1.0305	0.003	1.0275	23.6	0.01288	8.3	0.073990	84.03	90.8	53.18
0.50	0.5	1.03	0.003	1.0270	23.6	0.01288	8.4	0.052792	82.50	89.1	52.35
1	1	1.027	0.003	1.0240	23.6	0.01288	9.2	0.039067	73.34	79.2	47.40
2	2	1.024	0.003	1.0210	23.6	0.01288	10.7	0.029792	64.17	69.3	42.45
5	5	1.021	0.003	1.0180	23.3	0.01293	10.7	0.018908	55.00	59.4	37.50
15	15	1.0165	0.003	1.0135	23.2	0.01294	12.0	0.011550	41.25	44.6	30.08
30	30	1.014	0.003	1.0110	23.1	0.01296	12.6	0.008396	33.61	36.3	25.95
60	60	1.012	0.003	1.0090	23.1	0.01296	13.4	0.006122	27.50	29.7	22.65
120	120	1.01	0.003	1.0070	23.1	0.01296	13.7	0.004377	21.39	23.1	19.35
1440	1440	1.007	0.003	1.0040	21.0	0.01328	14.4	0.001328	12.22	13.2	14.40

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample 2	Iman Shafii	N/A	7/27/2017	Silt	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4724	Wet Density	Wet Denisty (kN/m3)	21.37
height (ft)	0.472		Depth of middle of the core (ft)	0.236				Sample Diameter (ft)	0.2369		Wet Denisty (pcf)	136.0
								Sample Volume (ft^3)	0.0208	Dry Density	Dry Denisty (kg/m^3)	1867.4
height (mm)	144.095		Depth of lower side of the core (ft)	0.472	Core Diameter (ft)	0.237		Sample weight (lb)	2.832		Dry Denisty (kN/m^3)	18.31
								Wet Denisty (pcf)	136.02		Dry Denisty (pcf)	117

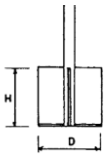
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.24	33	1	12.5	11.5	10.9	9.9	1.6	9.9	16.16%
2	0.24	M	1	19.4	18.4	16.7	15.7	2.7	15.7	17.20%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.236	25-35	31	G1	1	9.3	7.7	23.9%
2		20-30	20	33	1	14.8	11.9	26.6%
3		15-25	15	M	1	11.8	9.5	27.1%
Liquid Limit		25.15%		Notes:				



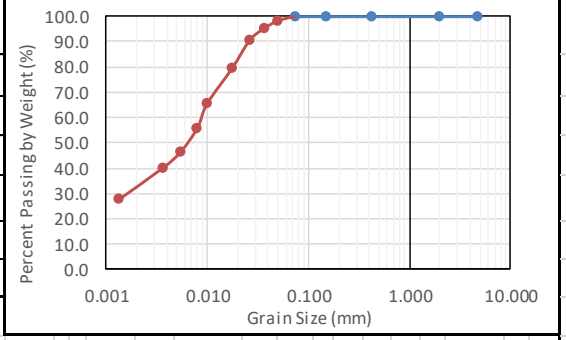
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.236	122	1	9.1	7.7	20.9%
	2	0.236	X	1	6	5.1	22.0%
Average Plastic Limit	21.42%		Plasticity Index	3.73%	Liquidity Index	-127.30%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 1.5 mm.
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type B	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					2.500	71.8		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	Sample 2	Iman Shafii	Handmade	Cemented	Pugger Mixer		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.0	501.0	0.0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.074	50.82	40	0.425	364.0	364.0	0	0.0	100.0
		100	0.149	322.0	322.0	0	0.0	100.0
		200	0.074	317.0	317.0	0	0.0	100.0
		Pan	0.000	252.0	302.8	50.82	100.0	0.0
		∑ soil mass after sieve (gr)		50.82				
		Error (%)		0.0%				



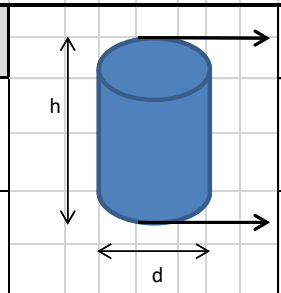
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	0.0%	100.0%	N/A	0.001695	0.00632	0.00876	#VALUE!	#VALUE!	ML	A-4(2.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9	8.9	0.988888889	151H
0.074	50.82				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
19.72	100006	61.98	99.97295	0.99827	161.78	8.8	167.4	2.750
						$G_{s,20c}$	2.750165	

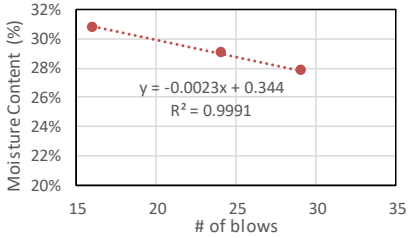
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	21.3	0.01305	7.3	0.074000	96.93	49.26	100.00
0.25	0.25	1.034	0.003	1.0310	21.3	0.01305	7.30	0.070491	96.93	49.26	100.00
0.50	0.5	1.0335	0.003	1.0305	21.3	0.01305	7.45	0.050354	95.37	48.47	98.44
1	1	1.0325	0.003	1.0295	21.3	0.01305	7.70	0.036198	92.24	46.88	95.31
2	2	1.031	0.003	1.0280	21.3	0.01305	8.1	0.026253	87.55	44.49	90.62
5	5	1.0275	0.003	1.0245	20.9	0.01311	9.05	0.017632	76.61	38.93	79.68
18	18	1.023	0.003	1.0200	20.6	0.01315	10.2	0.009902	62.54	31.78	65.61
30	30	1.02	0.003	1.0170	20.4	0.01319	11.0	0.007985	53.16	27.01	56.23
70	70	1.017	0.003	1.0140	19.6	0.01332	11.8	0.005468	43.77	22.25	46.84
165	165	1.015	0.003	1.0120	18.7	0.01347	12.3	0.003678	37.52	19.07	40.59
1452	1452	1.011	0.003	1.0080	16.2	0.01390	13.4	0.001336	25.01	12.71	28.08

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Left Core	Iman Shafii	N/A	6/25/2017	Sandy Silt	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3708	Wet Density	Wet Denisty (kN/m3)	17.62
height (ft)	0.371		Depth of middle of the core (ft)	0.185				Sample Diameter (ft)	0.2333		Wet Denisty (pcf)	112.2
								Sample Volume (ft^3)	0.0159	Dry Density	Dry Denisty (kg/m^3)	1561.5
height (mm)	113.104		Depth of lower side of the core (ft)	0.371	Core Diameter (ft)	0.233		Sample weight (lb)	1.7791		Dry Denisty (kN/m^3)	15.31
								Wet Denisty (pcf)	112.2		Dry Denisty (pcf)	97.5

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.19	45	1	7.8	6.8	6.9	5.9	0.9	5.9	15.25%
2	0.19	O	1.1	11.1	10	9.8	8.7	1.3	8.7	14.94%

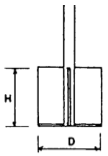
Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.185	25-35	29	Z	1	9.5	7.65	27.8%
2		20-30	24	S	1	9	7.2	29.0%
3		15-25	16	1B	1	9.5	7.5	30.8%
Liquid Limit		28.99%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.185	XX	1.1	11.37	9.25	26.06%
	2	0.185					#DIV/0!
Average Plastic Limit	26.06%		Plasticity Index	2.93%	Liquidity Index	-368.58%	

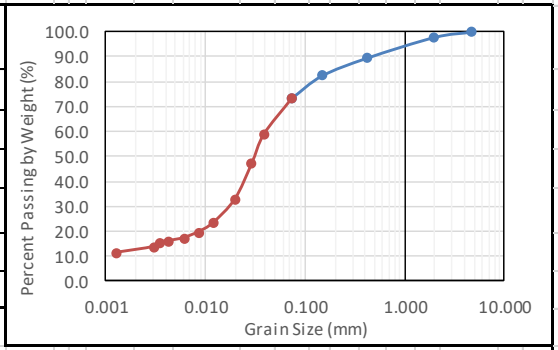
Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was 3 mm.
					tsf or kg/cm²	S_u (kPa)*		* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
	19	29	90	N/A	N/A	N/A	N/A	



Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	Left Core	Iman Shafii	Teton Dam, Light Brown	Uncemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	460	460.0	0.0	0.0	100.0
		10	2.00	623	631.0	8	2.1	97.9
2	376	40	0.43	362	393.0	31	10.4	89.6
		100	0.15	321	348.0	27	17.6	82.4
		200	0.07	317	351.0	34	26.6	73.4
		Pan	0.00	252.0	528.0	276	100.0	0.0
		∑ soil mass after sieve (gr)		376				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	26.6%	73.4%	0.001	0.0176	0.0318	0.04	7.74	40.00	ML with Sand	A-4(1.4)

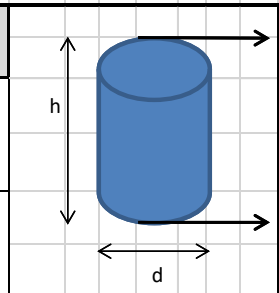
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	50	48.59	0.9718	151H
2	50				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	102.996	239.6342	0.9974	342	22.05	355.96	2.726
					$G_{s,\ 20c}$	2.723325		

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.50	0.5	1.031	0.003	1.0280	25.3	0.01256	8.1	0.074000	91.06	251.33	73.40
1.00	1	1.025	0.003	1.0220	25.3	0.01256	9.70	0.039105	71.55	197.48	59.08
2.00	2	1.02	0.003	1.0170	25.3	0.01256	11.00	0.029446	55.29	152.60	47.14
5	5	1.014	0.003	1.0110	25.3	0.01256	###	0.019932	35.77	98.74	32.82
15	15	1.01	0.003	1.0070	25.3	0.01256	13.7	0.012000	22.77	62.83	23.27
30	30	1.0085	0.003	1.0055	25.3	0.01256	14.1	0.008593	17.89	49.37	19.69
60	60	1.0075	0.003	1.0045	25.3	0.01256	14.3	0.006130	14.64	40.39	17.30
120	120	1.007	0.003	1.0040	25.3	0.01256	14.4	0.004350	13.01	35.90	16.11
180	180	1.0068	0.003	1.0038	25.3	0.01256	14.5	0.003559	12.36	34.11	15.63
250	250	1.006	0.003	1.0030	25.1	0.01258	14.7	0.003051	9.76	26.93	13.72
1440	1440	1.005	0.003	1.0020	25.0	0.01260	15.0	0.001286	6.50	17.95	11.33

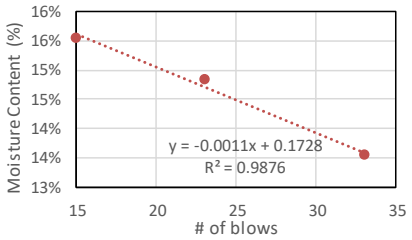
Sand Samples - JET

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sand #1 JET	Iman Shafii	N/A	11/16/2017	Clayey Sand	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3609	Wet Density	Wet Denisty (kN/m3)	19.20
height (ft)	0.361		Depth of middle of the core (ft)	0.180				Sample Diameter (ft)	0.2461		Wet Denisty (pcf)	122.2
								Sample Volume (ft^3)	0.0172	Dry Density	Dry Denisty (kg/m^3)	1771.0
height (mm)	110.072		Depth of lower side of the core (ft)	0.361	Core Diameter (ft)	0.246		Sample weight (lb)	2.0975		Dry Denisty (kN/m^3)	17.37
								Wet Denisty (pcf)	122.22		Dry Denisty (pcf)	111

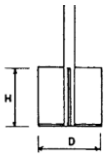
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.18	#1B	1	15.1	14.1	13.75	12.75	1.35	12.75	10.59%
2	0.18	S	1	11	10	10.05	9.05	0.95	9.05	10.50%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.180	25-35	33	A	1	11.9	10.6	13.5%
2		20-30	23	XX	1.1	15.8	13.9	14.8%
3		15-25	15	5	1	12.9	11.3	15.5%
Liquid Limit		14.53%		Notes:				



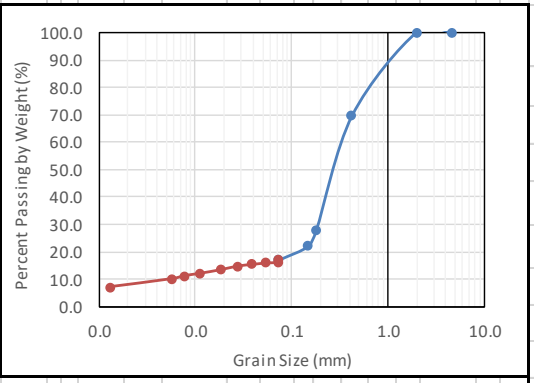
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.180	46	1.1	9.3	8.7	7.9%
	2	0.180	B	1	7.5	7.05	7.4%
Average Plastic Limit	7.67%		**Plasticity Index**	6.86%	**Liquidity Index**	41.91%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 5 mm.
	19	29	90	N/A	tsf or kg/cm²	kPa	Type B	
					1.050	100.5		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sand #1 JET	Iman Shafii	Man-made	Uncemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	479	40	0.425	363.0	508.0	145	30.3	69.7
		80	0.180	524.0	724.0	200	72.0	28.0
		100	0.149	322.0	350.0	28	77.9	22.1
		200	0.074	317.0	341.0	24	82.9	17.12
		Pan	0.000	359.0	441.0	82	100.0	0.0
		∑ soil mass after sieve (gr)		479				
		Error (%)		0.0%				



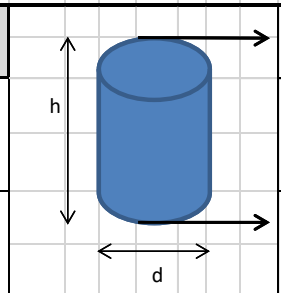
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	82.9%	17.1%	0.0058	0.19	0.28	0.31	20.08	53.45	SM-SC	A-2-4

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	62.992	99.88177	0.9981	162.68	14.17	171.5	2.654
						$G_{s,\ 20c}$	2.653160	

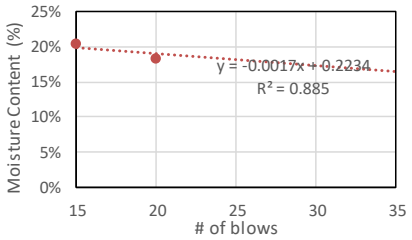
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	81.92	17.12
0.27	0.266667	1.0325	0.003	1.0295	19.7	0.01370	7.70	0.073623	95.06	77.95	16.29
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	76.63	16.02
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	73.99	15.47
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	71.35	14.91
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	64.74	13.54
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	58.13	12.16
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	54.17	11.33
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	48.89	10.23
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	34.35	7.19

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sand #1 JET	Iman Shafii	N/A	11/16/2017	Clayey Sand	From :	0	1	
						To :	1		

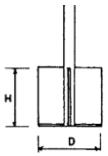
Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.4003	Wet Density	Wet Denisty (kN/m3)	24.29
height (ft)	0.400	h	Depth of middle of the core (ft)	0.200				Sample Diameter (ft)	0.2461		Wet Denisty (pcf)	154.6
								Sample Volume (ft^3)	0.019	Dry Density	Dry Denisty (kg/m^3)	2221.4
height (mm)	122.080	d	Depth of lower side of the core (ft)	0.400	Core Diameter (ft)	0.246		Sample weight (lb)	2.9432		Dry Denisty (kN/m^3)	21.78
								Wet Denisty (pcf)	154.63		Dry Denisty (pcf)	139

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	XX	1.1	17.3	16.2	15.6	14.5	1.7	14.5	11.72%
2	0.20	FF	1	37	36	33.35	32.35	3.65	32.35	11.28%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.200	25-35	36	ww	1.1	12.4	10.8	16.5%
2		20-30	20	#1B	1.1	27	23	18.3%
3		15-25	15	Z	1.1	13.5	11.4	20.4%
Liquid Limit		18.09%		Notes:				

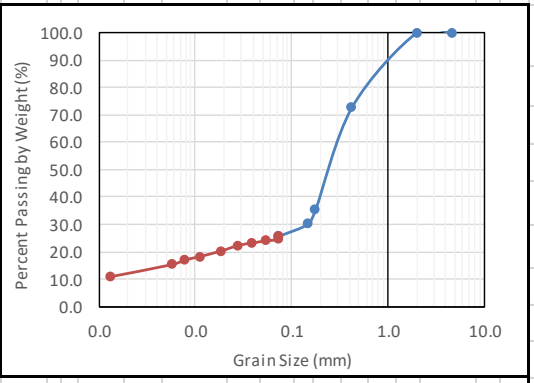


Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	0.200	$3	1.1	17.2	15.4	12.6%	
	2	0.200	O	1	8.4	7.6	12.1%	
Average Plastic Limit	12.35%		Plasticity Index	5.74%	Liquidity Index	-14.83%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 2 mm.
					tsf or kg/cm^2	kPa		
	19	29	90	-	2.500	239.2	Type A	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sand #1 JET	Iman Shafii	Man-made	Uncemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	536	40	0.425	363.0	508.0	145	27.1	72.9
		80	0.177	524.0	724.0	200	64.4	35.6
		100	0.149	322.0	350.0	28	69.6	30.4
		200	0.074	317.0	341.0	24	74.1	25.93
		Pan	0.000	359.0	498.0	139	100.0	0.0
		∑ soil mass after sieve (gr)		536				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	74.1%	25.9%	0.0013	0.149	0.245	0.299	57.12	230.00	SM-SC	A-2-4

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
20.7	0.99985	62.992	99.88177	0.9981	162.68	14.17	171.5	2.654
						$G_{s,\ 20c}$	2.653160	

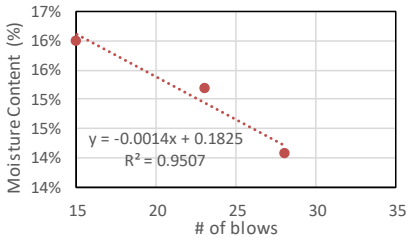
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.83	138.76	25.93
0.27	0.266667	1.0325	0.003	1.0295	19.7	0.01370	7.70	0.073623	95.00	132.04	24.68
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.39	129.81	24.26
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.17	125.33	23.42
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	86.95	120.85	22.59
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.89	109.66	20.50
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.84	98.47	18.41
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.01	91.76	17.16
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.57	82.81	15.49
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.86	58.19	10.90

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	S-0-0-0	Iman Shafii	N/A	7/29/2017	Silty Sand	From :	0		
						To :	1	1	

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3854	Wet Density	Wet Denisty (kN/m3)	23.12
height (ft)	0.385	h	Depth of middle of the core (ft)	0.193				Sample Diameter (ft)	0.2369		Wet Denisty (pcf)	147.2
								Sample Volume (ft^3)	0.017	Dry Density	Dry Denisty (kg/m^3)	2144.5
height (mm)	117.552	d	Depth of lower side of the core (ft)	0.385	Core Diameter (ft)	0.237		Sample weight (lb)	2.5		Dry Denisty (kN/m^3)	21.03
								Wet Denisty (pcf)	147.19		Dry Denisty (pcf)	134

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.19	a	1	14.5	13.5	13.3	12.3	1.2	12.3	9.76%
2	0.19	Z	1	9.7	8.7	8.9	7.9	0.8	7.9	10.13%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.193	25-35	28	5	1	16.4	14.5	14.1%
2		20-30	23	175	1	10.1	8.9	15.2%
3		15-25	15	XX	1	12.6	11	16.0%
Liquid Limit		14.75%		Notes:				

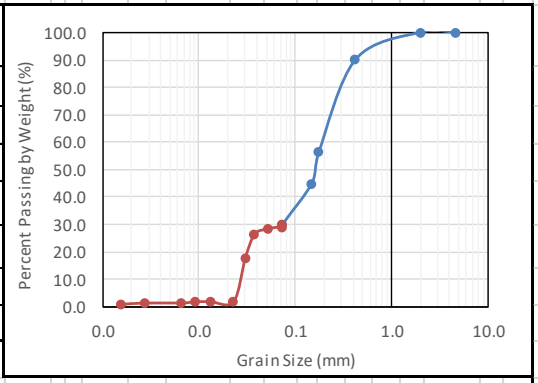


Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	0.193	H	1	11.65	10.6	10.9%	
	2	0.193	M	1	8.7	7.95	10.8%	
Average Plastic Limit	10.86%		Plasticity Index	3.89%	Liquidity Index	-23.76%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		OSHA Category	Notes:
					Unconfined Strength			
					tsf or kg/cm²	kPa		
	19	29	90	N/A	1.500	143.5	Type B	Pocket Erodomoeter was almost 5 mm.

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	S-0-0-0	Iman Shafii	Man-made	Uncemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.0	501.0	0.0	0.0	100.0
		10	2.000	623.0	623.0	0	0.0	100.0
0.425	429	40	0.425	363.0	405.0	42	9.8	90.2
		80	0.177	523.0	666.0	143	43.2	56.8
		100	0.149	321.0	371.0	50	54.9	45.1
		200	0.074	317.0	381.0	64	69.9	30.14
		Pan	0.000	253.0	382.0	129	100.0	0.0
		∑ soil mass after sieve (gr)		428				
		Error (%)		0.2%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	69.9%	30.1%	0.028	0.074	0.163	0.2	0.98	7.14	SC-SM	A-2-4

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.55	358.4	2.61
					$G_{s,\ 20c}$	2.611759		

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.08	1.034	0.003	1.0310	24.0	0.01314	7.3	0.074000	96.76	124.8	30.14
0.25	0.25	1.033	0.003	1.0300	24.0	0.01314	7.6	0.072426	93.63	120.8	29.21
0.50	0.5	1.032	0.003	1.0290	24.0	0.01314	7.8	0.051883	90.51	116.8	28.27
1	1	1.03	0.003	1.0270	24.0	0.01314	8.4	0.038071	84.27	108.7	26.39
2	2	1.021	0.003	1.0180	24.0	0.01314	10.7	0.030383	56.18	72.5	17.94
5	5	1.004	0.003	1.0010	24.0	0.01314	15.2	0.022903	3.12	4.0	1.99
15	15	1.004	0.003	1.0010	23.8	0.01314	15.2	0.013223	3.12	4.0	1.99
30	30	1.004	0.003	1.0010	23.7	0.01314	15.2	0.009350	3.12	4.0	1.99
60	60	1.0035	0.003	1.0005	23.6	0.01314	15.4	0.006644	1.56	2.0	1.52
360	360	1.0035	0.003	1.0005	23.0	0.01330	15.4	0.002745	1.56	2.0	1.52
1140	1140	1.003	0.003	1.0000	22.3	0.01346	15.5	0.001569	0.00	0.0	1.05

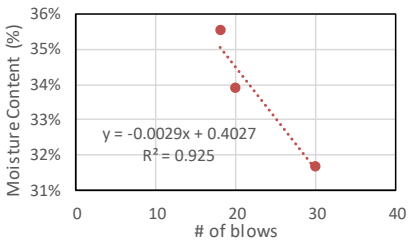
B-3 (10’-12’) Lissie Formation – Page 1

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	B-3 (10'-12')	Iman Shafii	B-3	6/6/2017	Clayey Sand	From :	10	2	
						To :	12		

Sample Dimensions			Depth of upper side of the core (ft)	10	Notes:		Density Calcs.	Sample Height (ft)	0.4891	Wet Density	Wet Denisty (kN/m3)	19.86
height (ft)	0.489	h	Depth of middle of the core (ft)	10.245				Sample Diameter (ft)	0.2311		Wet Denisty (pcf)	126.4
								Sample Volume (ft^3)	0.0205	Dry Density	Dry Denisty (kg/m^3)	1770.2
height (mm)	149.185		Depth of lower side of the core (ft)	10.489	Core Diameter (ft)	0.231		Sample weight (lb)	2.5937		Dry Denisty (kN/m^3)	17.36
		d						Wet Denisty (pcf)	126.42		Dry Denisty (pcf)	111

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	10.24	XX	1	21.1	20.1	18.5	17.5	2.6	17.5	14.86%
2	10.24	30H	1	28.8	27.8	25.4	24.4	3.4	24.4	13.93%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	10.24	25-35	30	G1	1	8.9	7	31.7%
2		20-30	20	122	1	8.9	6.9	33.9%
3		15-25	18	33	1	11.3	8.6	35.5%
Liquid Limit		33.02%		Notes:				



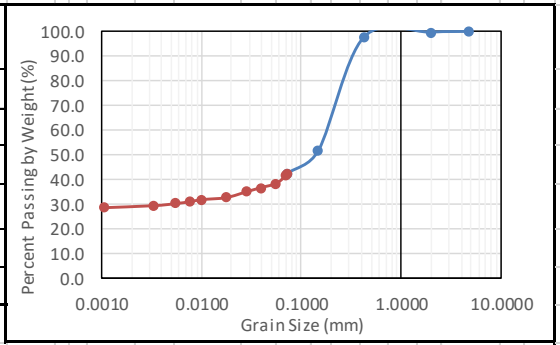
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	10.245	$3	1	9.2	8.2	13.9%	
	2	10.245	Z	1	8.4	7.5	13.8%	
Average Plastic Limit	13.87%		**Plasticity Index**	19.15%	**Liquidity Index**	2.76%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was (5.1+6.5)/2 = 5.8 mm
	19	29	90	N/A	tsf or kg/cm^2	kPa	Type A	
					4.500	430.5		

B-3 (10'-12') Lissie Formation – Page 2

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	B-3 (10'-12')	Iman Shafii	Lissie Formation, Yellowish Brown	Cemented	30.06826, -95.64199	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	450	450.0	0	0.0	100.0
		10	2.000	624	625.0	1	0.3	99.7
2	348	40	0.425	363	370.0	7	2.3	97.7
		100	0.149	321	481.0	160	48.3	51.7
		200	0.074	317	349.0	32	57.5	42.5
		Pan	0.000	360	508.0	148	100.0	0.0
		∑ soil mass after sieve (gr)		348				
		Error (%)		0.0%				



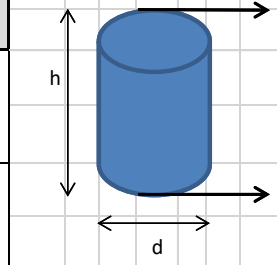
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	57.5%	42.5%	N/A	0.0055	0.1351	0.1988	#VALUE!	#VALUE!	SC	A-6 (3.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	7.6	7.3	0.960526316	151H
2	43.95				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
19.72	100006	101.336	249.7761	0.99827	350.68	18.61	362.4	2.705
					$G_{s,\ 20c}$	2.705104		

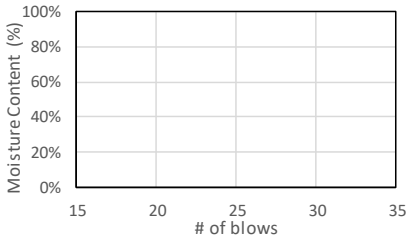
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.03	0.003	1.0270	22.3	0.01308	7.8	0.074000	100.00	148.0	42.53
0.27	0.266667	1.029	0.003	1.0260	22.3	0.01308	7.8	0.070714	97.71	144.6	41.55
0.50	0.5	1.027	0.003	1.0240	22.3	0.01308	9.2	0.056086	90.19	133.5	38.36
1	1	1.026	0.003	1.0230	22.3	0.01308	9.4	0.040087	86.44	127.9	36.76
2	2	1.025	0.003	1.0220	22.3	0.01308	9.7	0.028795	82.68	122.4	35.16
5.5	5.5	1.0235	0.003	1.0205	22.1	0.01311	10.1	0.017759	77.04	114.0	32.76
17	17	1.023	0.003	1.0200	21.8	0.01315	10.2	0.010187	75.16	111.2	31.97
30	30	1.0225	0.003	1.0195	21.5	0.01320	10.4	0.007753	73.28	108.5	31.17
60	60	1.022	0.003	1.0190	21.3	0.01323	10.5	0.005535	71.40	105.7	30.37
166	166	1.0215	0.003	1.0185	21.0	0.01328	10.6	0.003356	69.52	102.9	29.57
1627	1627	1.021	0.003	1.0180	22.4	0.01306	10.7	0.001059	67.65	100.1	28.77

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Sample #1	Iman Shafii	#1	10/5/2017	Sand	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.6458	Wet Density	Wet Denisty (kN/m3)	15.11
height (ft)	0.646		Depth of middle of the core (ft)	0.323				Sample Diameter (ft)	0.2375		Wet Denisty (pcf)	96.2
								Sample Volume (ft^3)	0.0286	Dry Density	Dry Denisty (kg/m^3)	1450.1
height (mm)	196.979		Depth of lower side of the core (ft)	0.646	Core Diameter (ft)	0.238		Sample weight (lb)	2.752		Dry Denisty (kN/m^3)	14.22
								Wet Denisty (pcf)	96.187		Dry Denisty (pcf)	90.5

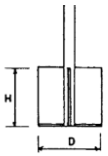
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.32	46	1	19.7	18.7	18.6	17.6	1.1	17.6	6.25%
2	0.32				0		0	0	0	#DIV/0!

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.323	25-35						#DIV/0!
2		20-30						#DIV/0!
3		15-25						#DIV/0!
Liquid Limit		N/A		Notes:				



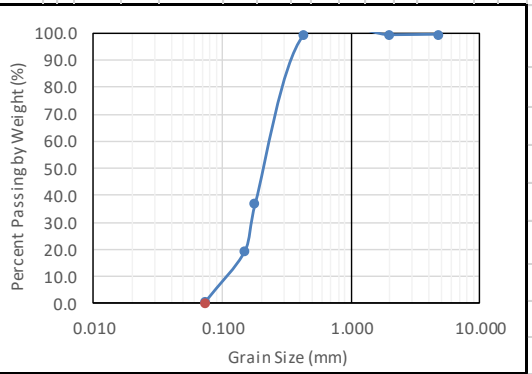
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.323					#DIV/0!
	2	0.323					#DIV/0!
Average Plastic Limit	N/A		Plasticity Index	#VALUE!	Liquidity Index	#VALUE!	

Notes: Plastic Limit Not Possible

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	
					tsf or kg/cm²	kPa		
	19	29	90	10	0.7	67.0	Type C	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Sample #1	Iman Shafii	Shore Bridge Abutment	Uncemented	27.837801, 262.94766	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	501.0	503.0	2	0.4	99.6
		10	2.00	662.0	663.0	1	0.6	99.4
0.2	528.8	40	0.43	363.0	364.0	1	0.8	99.2
		80	0.18	525.0	845.0	320	62.7	37.3
		100	0.15	322.0	415.0	93	80.7	19.3
		200	0.07	318.0	414.0	96	99.2	0.8
		Pan	0.00	359.0	363.0	4	100.0	0.0
		∑ soil mass after sieve (gr)		517				
		Error (%)		2.2%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	99.2%	0.8%	0.105	0.18	0.2	0.23	1.34	2.19	SP	A-3

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)			#DIV/0!	151H
0.2					

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
			#DIV/0!					####
						$G_{s,20c}$	#DIV/0!	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333		0.003	-0.0030				0.074000	######	#DIV/0!	####
0.25	0.25		0.003	-0.0030				0.000000	######	#DIV/0!	####
0.50	0.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
1	1		0.003	-0.0030				0.000000	######	#DIV/0!	####
2	2		0.003	-0.0030				0.000000	######	#DIV/0!	####
5	5		0.003	-0.0030				0.000000	######	#DIV/0!	####
17.5	17.5		0.003	-0.0030				0.000000	######	#DIV/0!	####
30	30		0.003	-0.0030				0.000000	######	#DIV/0!	####
60	60		0.003	-0.0030				0.000000	######	#DIV/0!	####
120	120		0.003	-0.0030				0.000000	######	#DIV/0!	####
1140	1140		0.003	-0.0030				0.000000	######	#DIV/0!	####

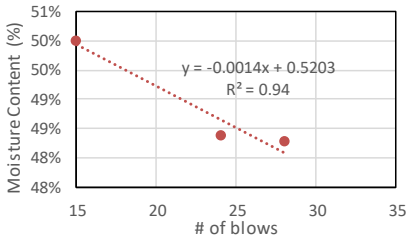
Clay Samples - HET

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #1	Iman Shafii	N/A	21-Aug	Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 22 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	18.86
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	120.0
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1587.0
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.572		Dry Denisty (kN/m^3)	15.56
								Wet Denisty (pcf)	120.03		Dry Denisty (pcf)	99.1

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	45	1	16.9	15.9	14	13	2.9	13	22.31%
2	0.20	W	1	8.8	7.8	7.5	6.5	1.3	6.5	20.00%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	28	5	1	9.6	6.8	48.3%
2		20-30	24	33	1	10.2	7.2	48.4%
3		15-25	15	M	1	10.6	7.4	50.0%
Liquid Limit		48.53%		Notes:				



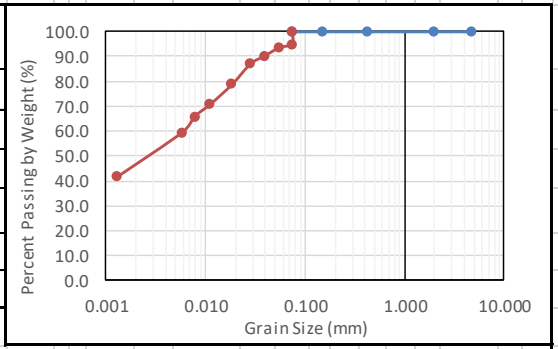
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	A	1.1	10.9	9.3	19.5%
	2	0.195	Z	1	8.2	7	20.0%
Average Plastic Limit	19.76%		Plasticity Index	28.77%	Liquidity Index	4.86%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was N/A
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					2.000	57.4		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Clay #1	Iman Shafii	Handmade	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0.0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.07	120	40	0.425	363.0	363.0	0	0.0	100.0
		100	0.149	322.0	322.0	0	0.0	100.0
		200	0.074	317.0	317.0	0	0.0	100.0
		Pan	0.000	359.0	479.0	120	100.0	0.0
		∑ soil mass after sieve (gr)		120				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	0.0%	100.0%	N/A	N/A	0.003	0.0058	#VALUE!	#VALUE!	CL (~CH)	A-7-6(31.7)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.07	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,\ 20c}$	2.650258	

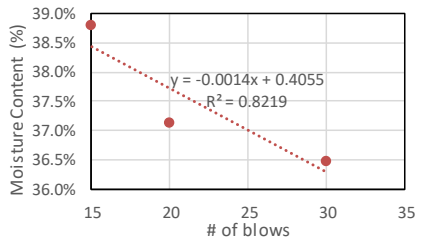
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	119.88	100.00
0.27	0.266667	1.0325	0.003	1.0295	19.7	0.01370	7.70	0.073623	95.06	114.08	95.16
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	112.14	93.55
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	108.28	90.33
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	104.41	87.11
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	94.74	79.05
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	85.07	71.00
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	79.27	66.16
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	71.54	59.72
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	50.27	41.99

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #2	Iman Shafii	N/A	8/22/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 23 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	20.11
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	128.0
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1683.5
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.677		Dry Denisty (kN/m^3)	16.51
								Wet Denisty (pcf)	128.05		Dry Denisty (pcf)	105

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	122	1	11.7	10.7	9.8	8.8	1.9	8.8	21.59%
2	0.20	$3	1	10.4	9.4	8.7	7.7	1.7	7.7	22.08%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	30	G1	1	11.1	8.4	36.5%
2		20-30	20	#1B	1.1	15.5	11.6	37.1%
3		15-25	15	49	1.1	10.4	7.8	38.8%
Liquid Limit		37.05%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	#2	1	16.8	14.7	15.3%
	2	0.195	FF	1	17	14.9	15.1%
Average Plastic Limit	15.22%		**Plasticity Index**	21.83%	**Liquidity Index**	30.31%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	2.500	71.8	Type A

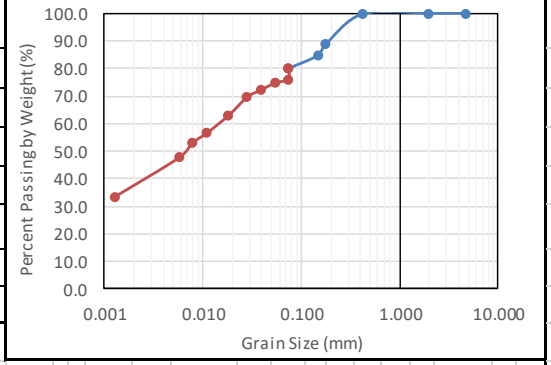
Notes:

Pocket Erodomoeter was 1.5 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #2	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	176.5	40	0.425	363.0	363.4	0.4	0.2	99.8
		80	0.180	524.0	543.2	19.2	11.1	88.9
		100	0.149	322.0	329.2	7.2	15.2	84.8
		200	0.074	318.0	326.4	8.4	19.9	80.06
		Pan	0.000	359.0	500.3	141.3	100.0	0.0
		∑ soil mass after sieve (gr)		176.5				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	19.9%	80.1%	N/A	0.001	0.00664	0.0147	#VALUE!	#VALUE!	CL	A-6(16)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,\ 20c}$	2.650258	

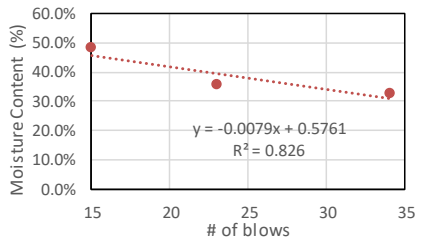
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	141.16	80.06
0.27	0.266667	1.0325	0.003	1.0295	19.7	0.01370	7.70	0.073623	95.06	134.33	76.19
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	132.05	74.90
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	127.50	72.32
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	122.94	69.74
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	111.56	63.29
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	100.18	56.84
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	93.35	52.97
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	84.24	47.81
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	59.19	33.62

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #3	Iman Shafii	N/A	8/23/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 23 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	19.81
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	126.1
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1641.7
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.6513		Dry Denisty (kN/m^3)	16.10
								Wet Denisty (pcf)	126.08		Dry Denisty (pcf)	102

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	5	1	11	10	9.1	8.1	1.9	8.1	23.46%
2	0.20	$3	1	16.2	15.2	13.4	12.4	2.8	12.4	22.58%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	34	M	1	12	9.3	32.5%
2		20-30	23	45	1	13.2	10	35.6%
3		15-25	15	122	1	12.7	8.9	48.1%
Liquid Limit		37.86%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	Z	1	13.3	11.7	15.0%
	2	0.195	XX	1	11.7	10.4	13.8%
Average Plastic Limit	14.39%		Plasticity Index	23.47%	Liquidity Index	36.76%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	1.500	43.1	Type B

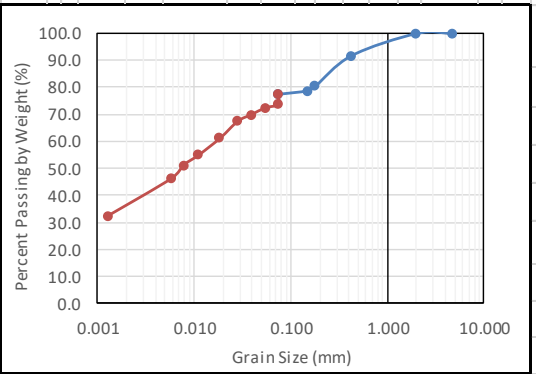
Notes:

Pocket Erodomoeter was 1.5 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #3	Iman Shafii	1	2	3		
			Man-made	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	176.5	40	0.425	363.0	377.5	14.5	8.2	91.8
		80	0.180	524.0	544.0	20	19.5	80.5
		100	0.149	322.0	324.8	2.8	21.1	78.9
		200	0.074	317.0	319.3	2.3	22.4	77.56
		Pan	0.000	359.0	495.9	136.9	100.0	0.0
		∑ soil mass after sieve (gr)		176.5				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	22.4%	77.6%	N/A	0.001	0.0075	0.0183	#VALUE!	#VALUE!	CL	A-6(16.5)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,\ 20c}$	2.650258	

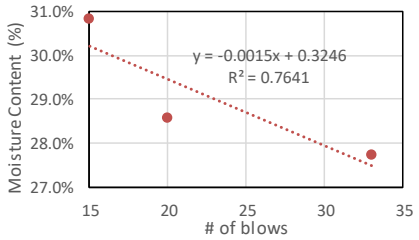
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	136.76	77.56
0.27	0.266667	1.0325	0.003	1.0295	19.7	0.01370	7.70	0.073623	95.06	130.14	73.82
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	127.94	72.57
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	123.53	70.07
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	119.11	67.57
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	108.08	61.32
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	97.06	55.07
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	90.44	51.32
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	81.62	46.32
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	57.35	32.57

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #4	Iman Shafii	N/A	8/24/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 23 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	18.77
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	119.5
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1583.2
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.5648		Dry Denisty (kN/m^3)	15.53
								Wet Denisty (pcf)	119.48		Dry Denisty (pcf)	98.8

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	175	1	21.8	20.8	18.2	17.2	3.6	17.2	20.93%
2	0.20	H	1	23.6	22.6	19.7	18.7	3.9	18.7	20.86%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	33	A	1	13.9	11.1	27.7%
2		20-30	20	46	1	16.3	12.9	28.6%
3		15-25	15	O	1	18.4	14.3	30.8%
Liquid Limit		28.71%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	33	1	14.5	13.1	11.6%
	2	0.195	G1	1	15.3	13.8	11.7%
Average Plastic Limit	11.64%		Plasticity Index	17.07%	Liquidity Index	54.19%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	0.250	7.2	Type C

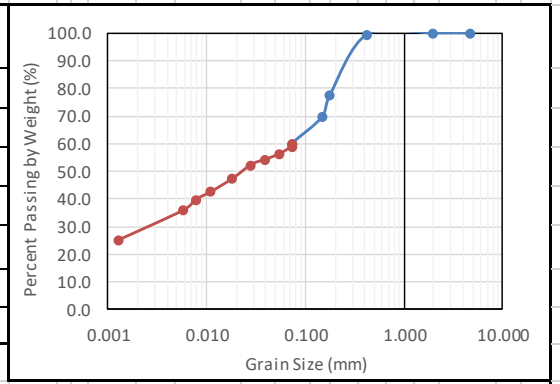
Notes:

Pocket Erodomoeter was less than 1 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #4	Iman Shafii	1	2	3		
			Man-made	Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	88.25	40	0.425	363.0	363.4	0.4	0.5	99.5
		80	0.180	524.0	543.2	19.2	22.2	77.8
		100	0.149	322.0	329.2	7.2	30.4	69.6
		200	0.074	318.0	326.4	8.4	39.9	60.11
		Pan	0.000	359.0	412.1	53.05	100.0	0.0
		∑ soil mass after sieve (gr)		88.25				
		Error (%)		0.0%				



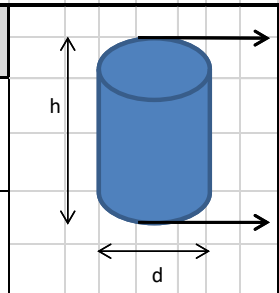
Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	39.9%	60.1%	N/A	0.003	0.0234	0.074	#VALUE!	#VALUE!	CL with Sand	A-6(6.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,\ 20c}$	2.650258	

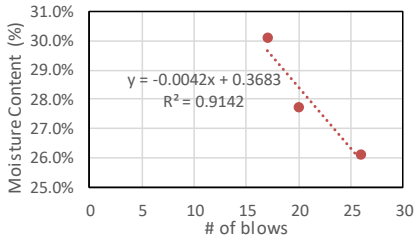
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	53.00	60.11
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	52.14	59.14
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	49.58	56.24
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	47.87	54.30
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	46.16	52.36
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	41.88	47.52
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	37.61	42.68
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	35.05	39.77
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	31.63	35.90
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	22.22	25.24

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #5	Iman Shafii	N/A	8/27/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 25 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	19.14
height (ft)	0.390		Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	121.9
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1630.2
height (mm)	119.077		Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.5961		Dry Denisty (kN/m^3)	15.99
								Wet Denisty (pcf)	121.87		Dry Denisty (pcf)	102

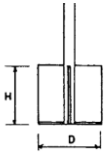
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	$3	1	12.7	11.7	10.8	9.8	1.9	9.8	19.39%
2	0.20	G1	1.1	11.55	10.45	9.8	8.7	1.75	8.7	20.11%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	26	46	1.1	12.7	10.3	26.1%
2		20-30	20	O	1	13.9	11.1	27.7%
3		15-25	17	33	1	13.1	10.3	30.1%
Liquid Limit		26.33%		Notes:				



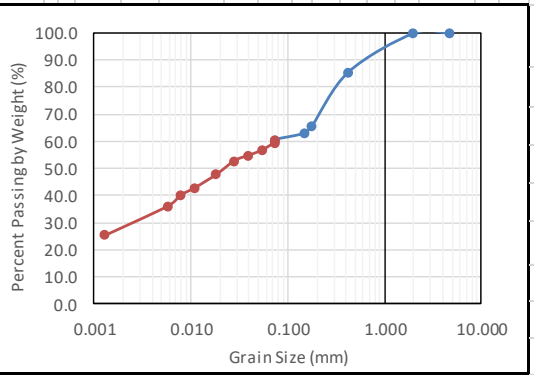
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	5	1	17.7	16	11.3%
	2	0.195	B	1	18.4	16.6	11.5%
Average Plastic Limit	11.44%		Plasticity Index	14.89%	Liquidity Index	55.83%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was less than 1 mm.
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type C	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					0.150	4.3		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #5	Iman Shafii	1	2	3		
			Man-made	Semi-cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	100.5	40	0.425	363.0	377.5	14.5	14.4	85.6
		80	0.180	524.0	544.0	20	34.3	65.7
		100	0.149	322.0	324.8	2.8	37.1	62.9
		200	0.074	317.0	319.3	2.3	39.4	60.60
		Pan	0.000	359.0	419.9	60.9	100.0	0.0
		∑ soil mass after sieve (gr)		100.5				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	39.4%	60.6%	N/A	0.003	0.0233	0.074	#VALUE!	#VALUE!	CL with Sand	A-6(5.6)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,\ 20c}$	2.650258	

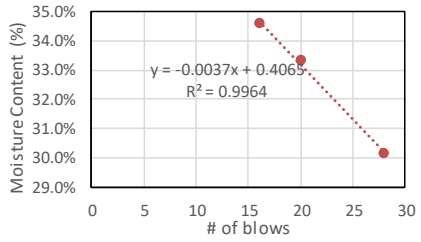
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	60.84	60.60
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	59.86	59.62
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	56.91	56.69
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	54.95	54.74
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	52.99	52.78
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	48.08	47.90
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	43.18	43.02
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	40.23	40.09
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	36.31	36.19
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	25.51	25.45

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #6	Iman Shafii	N/A	8/26/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 25 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	18.45
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	117.4
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1637.1
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.5379		Dry Denisty (kN/m^3)	16.05
								Wet Denisty (pcf)	117.43		Dry Denisty (pcf)	102

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	$49	1	11.7	10.7	10.3	9.3	1.4	9.3	15.05%
2	0.20	$122	1	8	7	7.1	6.1	0.9	6.1	14.75%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	28	A	1	10.5	8.3	30.1%
2		20-30	20	FF	1	11	8.5	33.3%
3		15-25	16	#2	1	11.9	9.1	34.6%
Liquid Limit		31.40%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	X	1	18.1	16.3	11.8%
	2	0.195	#1B	1	17.5	15.8	11.5%
Average Plastic Limit	11.63%		Plasticity Index	19.77%	Liquidity Index	16.58%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	4.375	125.6	Type A

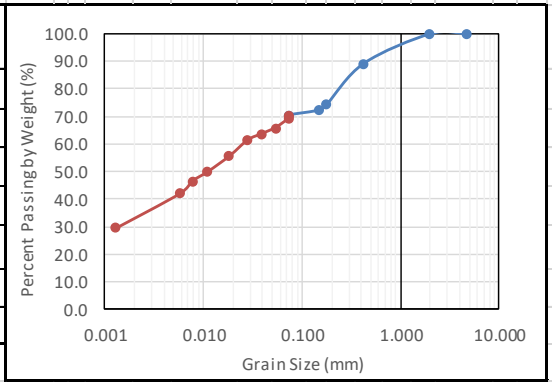
Notes:

Pocket Erodomoeter wasalmost 0.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #6	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Semi-cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	134	40	0.425	363.0	377.5	14.5	10.8	89.2
		80	0.180	524.0	544.0	20	25.7	74.3
		100	0.149	322.0	324.8	2.8	27.8	72.2
		200	0.074	317.0	319.3	2.3	29.6	70.45
		Pan	0.000	359.0	453.4	94.4	100.0	0.0
		∑ soil mass after sieve (gr)		134				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	29.6%	70.4%	N/A	0.0013	0.01114	0.028	#VALUE!	#VALUE!	CL with Sand	A-6(11)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,\ 20c}$	2.650258	

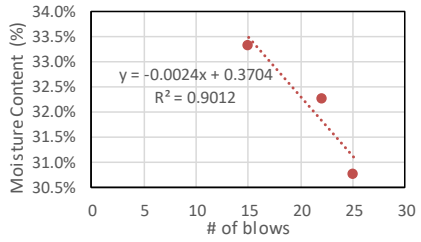
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	94.30	70.45
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	92.78	69.31
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	88.22	65.91
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	85.18	63.64
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	82.14	61.37
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	74.53	55.69
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	66.93	50.01
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	62.36	46.61
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	56.28	42.07
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	39.55	29.58

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #7	Iman Shafii	N/A	8/25/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 20 blows per layer 3 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	19.58
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	124.6
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1754.9
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.6321		Dry Denisty (kN/m^3)	17.21
								Wet Denisty (pcf)	124.62		Dry Denisty (pcf)	110

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	#1B	1	8.6	7.6	7.7	6.7	0.9	6.7	13.43%
2	0.20	Z	1	8.3	7.3	7.4	6.4	0.9	6.4	14.06%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	25	G1	1	12.9	10.1	30.8%
2		20-30	22	A	1	13.3	10.3	32.3%
3		15-25	15	$3	1	15.8	12.1	33.3%
Liquid Limit		31.04%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	#2	1	13.6	12.1	13.5%
	2	0.195	FF	1	12.6	11.2	13.7%
Average Plastic Limit	13.62%		Plasticity Index	17.42%	Liquidity Index	0.74%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	5.000	143.5	Type A

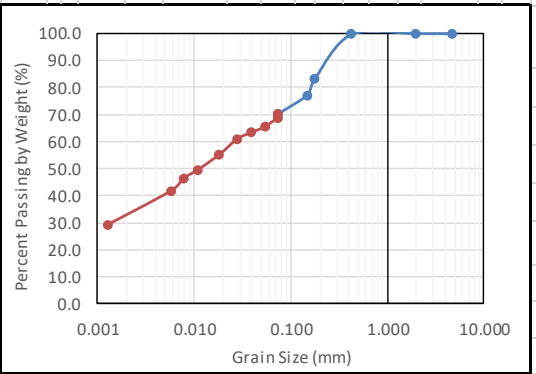
Notes:

Pocket Erodomoeter wasalmost 0.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #7	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	118	40	0.425	363.0	363.4	0.4	0.3	99.7
		80	0.180	524.0	543.2	19.2	16.6	83.4
		100	0.149	322.0	329.2	7.2	22.7	77.3
		200	0.074	318.0	326.4	8.4	29.8	70.17
		Pan	0.000	359.0	441.8	82.8	100.0	0.0
		∑ soil mass after sieve (gr)		118				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	29.8%	70.2%	N/A	0.0013	0.011141	0.028	#VALUE!	#VALUE!	CL with Sand	A-6(9.6)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,\ 20c}$	2.650258	

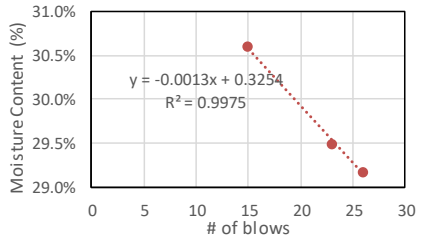
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	82.72	70.16
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	81.38	69.03
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	77.38	65.64
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	74.71	63.37
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	72.04	61.11
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	65.37	55.46
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	58.70	49.81
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	54.70	46.42
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	49.36	41.89
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	34.69	29.46

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #7	Iman Shafii	N/A	8/26/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 20 blows per layer 3 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	20.08
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	127.9
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1737.8
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.6744		Dry Denisty (kN/m^3)	17.04
								Wet Denisty (pcf)	127.85		Dry Denisty (pcf)	108

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	z	1.1	7.5	6.4	6.5	5.4	1	5.4	18.52%
2	0.20	5	1.05	10.6	9.55	9.2	8.15	1.4	8.15	17.18%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	26	122	1.1	10.4	8.3	29.2%
2		20-30	23	49	1.1	11.2	8.9	29.5%
3		15-25	15	$175	1	12.1	9.5	30.6%
Liquid Limit		29.29%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	46	1.1	11.3	10.2	12.1%
	2	0.195	O	1.1	11.5	10.4	11.8%
Average Plastic Limit	11.96%		Plasticity Index	17.33%	Liquidity Index	33.98%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	1.550	44.5	Type A

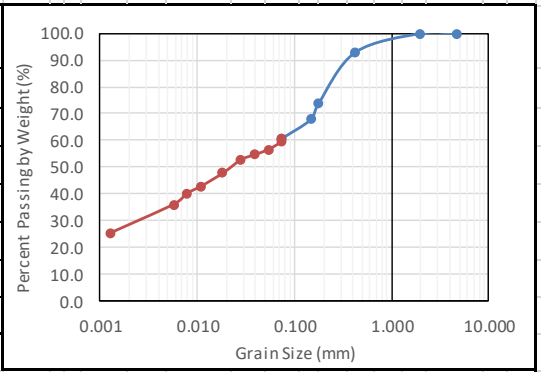
Notes:

Pocket Erodomoeter wasalmost 0.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #7	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Semi-cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	455	40	0.425	364.0	396.0	32	7.0	93.0
		80	0.180	524.0	610.0	86	25.9	74.1
		100	0.149	322.0	350.0	28	32.1	67.9
		200	0.074	317.0	350.0	33	39.3	60.66
		Pan	0.000	359.0	635.0	276	100.0	0.0
		∑ soil mass after sieve (gr)		455				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	39.3%	60.7%	N/A	0.00355	0.0233	0.074	#VALUE!	#VALUE!	CL with Sand	A-6(7.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,20c}$	2.650258	

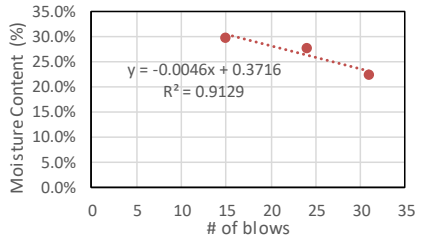
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	275.72	60.66
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	271.27	59.68
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	257.93	56.75
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	249.04	54.79
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	240.14	52.84
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	217.91	47.95
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	195.67	43.06
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	182.33	40.13
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	164.54	36.22
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	115.62	25.47

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #9	Iman Shafii	N/A	8/28/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 22 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	19.68
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	125.3
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1743.3
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.6411		Dry Denisty (kN/m^3)	17.10
								Wet Denisty (pcf)	125.31		Dry Denisty (pcf)	109

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	33	1.1	16.8	15.7	14.7	13.6	2.1	13.6	15.44%
2	0.20	XX	1	15.7	14.7	13.8	12.8	1.9	12.8	14.84%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	31	175	1	8.7	7.3	22.2%
2		20-30	24	#13	1.1	12.7	10.2	27.5%
3		15-25	15	G1	1	14.75	11.6	29.7%
Liquid Limit		25.66%		Notes:				



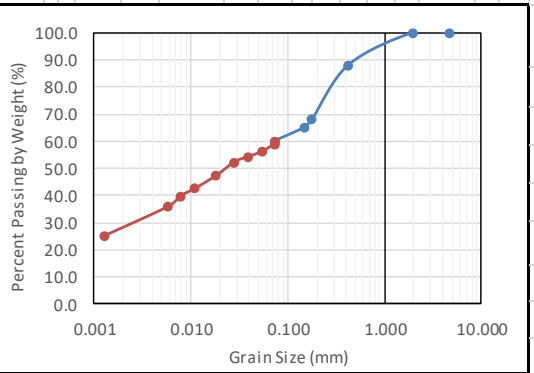
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	FF	1	11	10	11.1%
	2	0.195	S	1	8.8	8	11.4%
Average Plastic Limit	11.27%		Plasticity Index	14.39%	Liquidity Index	26.91%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 1 mm
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					3.400	97.6		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #9	Iman Shafii	1	2	3		
			Man-made	Semi-cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	200	40	0.425	364.0	388.0	24	12.0	88.0
		80	0.180	524.0	564.0	40	32.0	68.0
		100	0.149	322.0	328.0	6	35.0	65.0
		200	0.074	317.0	327.0	10	40.0	60.00
		Pan	0.000	359.0	479.0	120	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	40.0%	60.0%	N/A	0.003	0.0233	0.074	#VALUE!	#VALUE!	CL with sand	A-6(5.2)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,20c}$	2.650258	

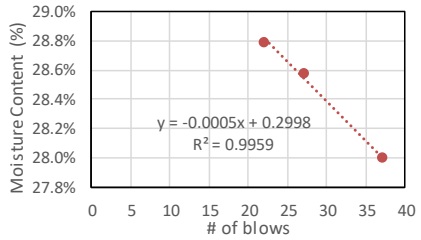
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	119.88	60.00
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	117.94	59.03
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	112.14	56.13
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	108.28	54.20
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	104.41	52.26
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	94.74	47.43
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	85.07	42.60
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	79.27	39.70
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	71.54	35.83
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	50.27	25.20

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #10	Iman Shafii	N/A	8/29/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 20 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	19.17
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	122.0
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1649.1
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.5983		Dry Denisty (kN/m^3)	16.17
								Wet Denisty (pcf)	122.04		Dry Denisty (pcf)	103

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	FF	1	18.1	17.1	15.4	14.4	2.7	14.4	18.75%
2	0.20	#2	1	28.1	27.1	23.9	22.9	4.2	22.9	18.34%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	37	5	1	10.6	8.5	28.0%
2		20-30	27	A	1	10.9	8.7	28.6%
3		15-25	22	Z	1.1	9.6	7.7	28.8%
Liquid Limit		28.73%		Notes:				



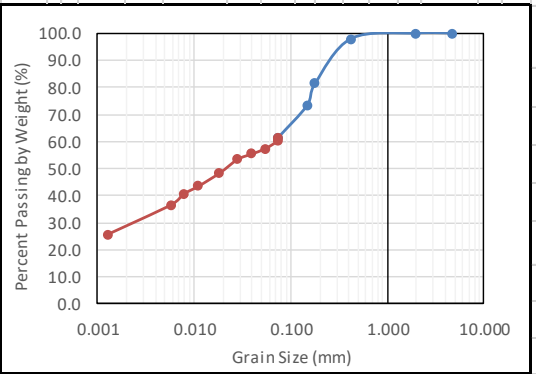
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	122	1.1	10.5	9.4	13.3%
	2	0.195	D	1.1	11.1	10	12.4%
Average Plastic Limit	12.81%		Plasticity Index	15.92%	Liquidity Index	36.04%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 0.5 mm
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type C	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					0.350	10.0		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #10	Iman Shafii	1	2	3		
			Man-made	Semi-cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	200	40	0.425	364.0	368.0	4	2.0	98.0
		80	0.180	524.0	557.0	33	18.5	81.5
		100	0.149	322.0	338.0	16	26.5	73.5
		200	0.074	317.0	341.0	24	38.5	61.50
		Pan	0.000	359.0	482.0	123	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	38.5%	61.5%	N/A	0.0022	0.0212	0.0736	#VALUE!	#VALUE!	CL with Sand	A-6(6.6)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,20c}$	2.650258	

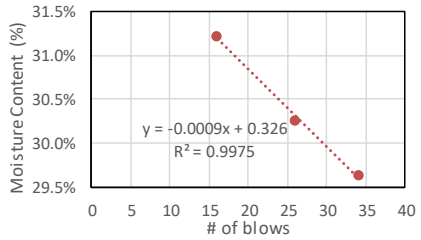
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	122.87	61.50
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	120.89	60.51
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	114.95	57.53
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	110.98	55.55
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	107.02	53.57
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	97.11	48.62
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	87.20	43.66
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	81.26	40.69
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	73.33	36.72
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	51.53	25.82

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #11	Iman Shafii	N/A	8/30/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 20 blows per layer 3 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	20.00
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	127.3
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1738.5
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.6678		Dry Denisty (kN/m^3)	17.05
								Wet Denisty (pcf)	127.35		Dry Denisty (pcf)	109

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	33	1.1	11.7	10.6	10.2	9.1	1.5	9.1	16.48%
2	0.20	A	1.1	16.7	15.6	14.3	13.2	2.4	13.2	18.18%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	34	O	1.1	11.6	9.2	29.6%
2		20-30	26	33	1.1	11	8.7	30.3%
3		15-25	16	Z	1.1	11.4	8.95	31.2%
Liquid Limit		30.35%		Notes:				



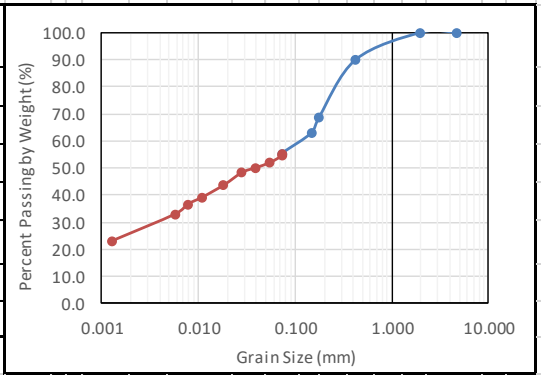
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	122	1	11.3	10	14.4%
	2	0.195	S	1	11.3	10	14.4%
Average Plastic Limit	14.44%		Plasticity Index	15.91%	Liquidity Index	18.16%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 0.5 mm
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type B	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					1.500	43.1		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3		
	Clay #11	Iman Shafii	Man-made	Not Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	200	40	0.425	364.0	384.0	20	10.0	90.0
		80	0.180	524.0	566.0	42	31.0	69.0
		100	0.149	322.0	334.0	12	37.0	63.0
		200	0.074	317.0	332.0	15	44.5	55.50
		Pan	0.000	359.0	470.0	111	100.0	0.0
		∑ soil mass after sieve (gr)		200				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	44.5%	55.5%	N/A	0.004	0.03899	0.105	#VALUE!	#VALUE!	CL with Sand	A-6(5.5)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,20c}$	2.650258	

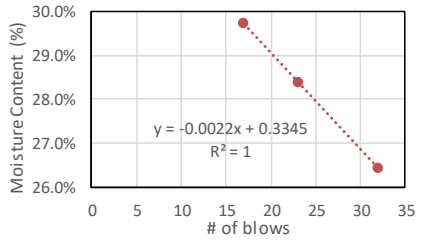
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	110.89	55.50
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	109.10	54.61
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	103.73	51.93
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	100.16	50.14
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	96.58	48.35
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	87.64	43.88
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	78.69	39.41
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	73.33	36.72
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	66.17	33.15
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	46.50	23.31

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #12	Iman Shafii	N/A	8/31/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 22 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	18.88
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	120.2
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1708.2
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.5743		Dry Denisty (kN/m^3)	16.75
								Wet Denisty (pcf)	120.21		Dry Denisty (pcf)	107

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	122	1	15.1	14.1	13.5	12.5	1.6	12.5	12.80%
2	0.20	X	1	10.8	9.8	9.7	8.7	1.1	8.7	12.64%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	32	XX	1	12	9.7	26.4%
2		20-30	23	#2	1	11.4	9.1	28.4%
3		15-25	17	S5	1	10.6	8.4	29.7%
Liquid Limit		27.95%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	122	1.1	15.1	13.6	12.0%
	2	0.195	FF	1	11.3	10.2	12.0%
Average Plastic Limit	11.98%		**Plasticity Index**	15.97%	**Liquidity Index**	4.66%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	4.800	137.8	Type A

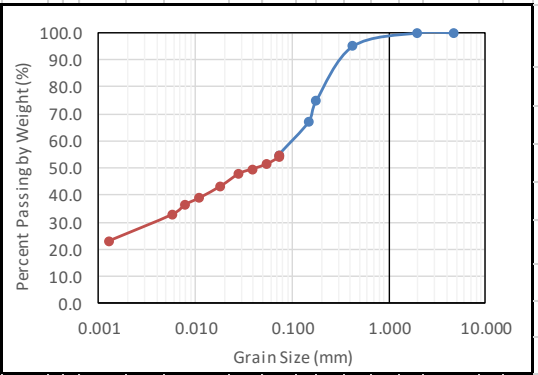
Notes:

Pocket Erodomoeter was less than 1 mm

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #12	Iman Shafii	1	2	3		
			Man-made	Not Cemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	100	40	0.425	364.0	369.0	5	5.0	95.0
		80	0.180	524.0	544.0	20	25.0	75.0
		100	0.149	322.0	330.0	8	33.0	67.0
		200	0.074	317.0	329.0	12	45.0	55.00
		Pan	0.000	359.0	414.0	55	100.0	0.0
		∑ soil mass after sieve (gr)		100				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	45.0%	55.0%	N/A	0.0044	0.0389	0.1	#VALUE!	#VALUE!	CL with Sand	A-6(5.2)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	6.2	6	0.967741935	151H
0.425	51.5				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.643	252.0745	0.9976	354.115	17.42	365	2.652
						$G_{s,20c}$	2.650258	

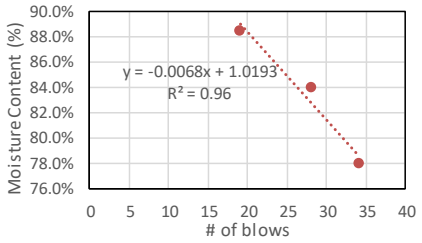
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	19.7	0.01370	7.3	0.074000	99.90	54.94	55.00
0.27	0.266667	1.0335	0.003	1.0305	19.7	0.01370	7.70	0.073623	98.29	54.06	54.12
0.50	0.5	1.032	0.003	1.0290	19.7	0.01370	7.80	0.054115	93.45	51.40	51.46
1	1	1.031	0.003	1.0280	19.7	0.01370	8.10	0.038994	90.23	49.63	49.69
2	2	1.03	0.003	1.0270	19.7	0.01370	8.4	0.028079	87.01	47.85	47.91
5	5	1.0275	0.003	1.0245	19.4	0.01375	9.1	0.018501	78.95	43.42	43.48
15	15	1.025	0.003	1.0220	18.8	0.01385	9.7	0.011141	70.90	38.99	39.05
32.5	32.5	1.0235	0.003	1.0205	18.2	0.01396	10.1	0.007780	66.06	36.33	36.39
62	62	1.0215	0.003	1.0185	17.8	0.01403	10.6	0.005800	59.62	32.79	32.85
1473	1473	1.016	0.003	1.0130	15.3	0.01435	12.1	0.001301	41.89	23.04	23.10

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #13	Iman Shafii	N/A	9/11/2017	Sandy Clay	From :	0		
						To :	0.5	0.5	

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 15 blows per layer 3 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	18.85
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	120.0
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1583.4
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.5715		Dry Denisty (kN/m^3)	15.53
								Wet Denisty (pcf)	119.99		Dry Denisty (pcf)	98.9

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	FF	1	17.2	16.2	14.3	13.3	2.9	13.3	21.80%
2	0.20	XX	1	39.95	38.95	33.2	32.2	6.75	32.2	20.96%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	34	3	1	11.5	6.9	78.0%
2		20-30	28	46	1	10.2	6	84.0%
3		15-25	19	O	1	10.8	6.2	88.5%
Liquid Limit		84.93%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	A	1.1	9.7	8.5	16.2%
	2	0.195	33	1	13.8	12.1	15.3%
Average Plastic Limit	15.77%		Plasticity Index	69.16%	Liquidity Index	8.12%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	0.950	27.3	Type C

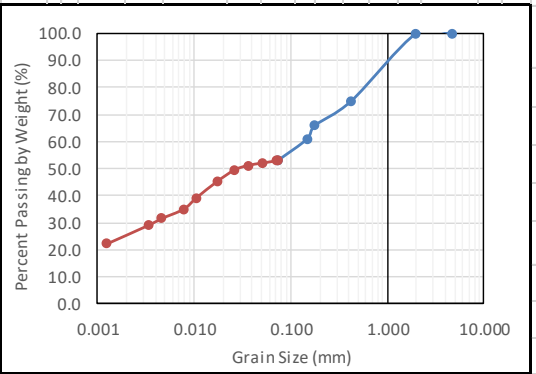
Notes:

Pocket Erodomoeter was less than 1 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #13	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Not Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	502.0	502.0	0	0.0	100.0
		10	2.000	624.0	624.0	0	0.0	100.0
0.425	100	40	0.425	364.0	389.0	25	25.0	75.0
		80	0.180	524.0	533.0	9	34.0	66.0
		100	0.149	322.0	327.0	5	39.0	61.0
		200	0.074	317.0	325.0	8	47.0	53.00
		Pan	0.000	359.0	412.0	53	100.0	0.0
		∑ soil mass after sieve (gr)		100				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	47.0%	53.0%	N/A	0.00376	0.0286	0.1396	#VALUE!	#VALUE!	CH with Sand	A-7-6(30.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	7.4	7.2	0.972972973	151H
0.425	50.32				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
19.72	100006	102.846	249.4055	0.99827	351.82	7.41	356.5	2.755
						$G_{s,20c}$	2.754812	

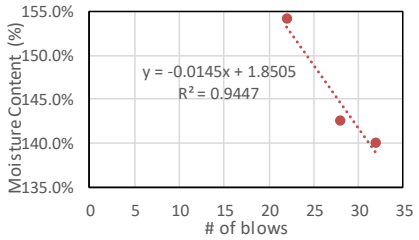
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.033	0.003	1.0300	21.3	0.01305	7.6	0.074000	96.19	50.98	53.00
0.25	0.25	1.033	0.003	1.0300	21.3	0.01305	7.60	0.071925	96.19	50.98	53.00
0.50	0.5	1.0325	0.003	1.0295	21.3	0.01305	7.70	0.051192	94.59	50.13	52.15
1	1	1.032	0.003	1.0290	21.3	0.01305	7.80	0.036433	92.99	49.28	51.30
2	2	1.031	0.003	1.0280	21.3	0.01305	8.10	0.026253	89.78	47.58	49.60
5	5	1.0285	0.003	1.0255	20.9	0.01311	8.75	0.017338	81.76	43.33	45.35
15	15	1.025	0.003	1.0220	20.3	0.01320	9.70	0.010616	70.54	37.39	39.41
30	30	1.0225	0.003	1.0195	20.0	0.01325	10.35	0.007783	62.53	33.14	35.16
90	90	1.0205	0.003	1.0175	19.3	0.01337	10.85	0.004642	56.11	29.74	31.76
182	182	1.019	0.003	1.0160	18.7	0.01347	11.3	0.003357	51.30	27.19	29.21
1530	1530	1.015	0.003	1.0120	16.1	0.01392	12.3	0.001248	38.48	20.39	22.41

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Clay #14	Iman Shafii	N/A	9/11/2017	Sandy Clay	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 15 blows per layer 3 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	20.63
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	131.3
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1774.5
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.7196		Dry Denisty (kN/m^3)	17.40
								Wet Denisty (pcf)	131.3		Dry Denisty (pcf)	111

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	XX	1	11.8	10.8	10.1	9.1	1.7	9.1	18.68%
2	0.20	V	1.1	6.9	5.8	6	4.9	0.9	4.9	18.37%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	32	A	1	10.6	5	140.0%
2		20-30	28	33	1	12.4	5.7	142.6%
3		15-25	22	z	1	10.4	4.7	154.1%
Liquid Limit		148.80%		Notes: High plasticity because of Bentonite				



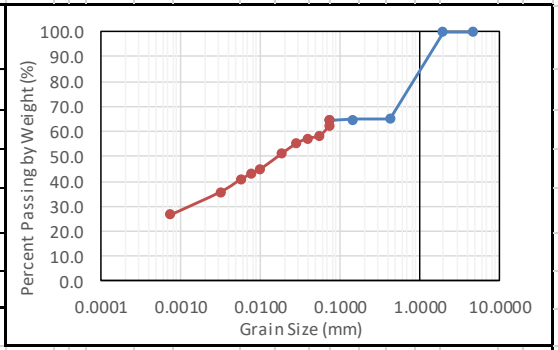
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	#1B	1	13.8	11.4	23.1%
	2	0.195	G1	1.1	9.7	8.1	22.9%
Average Plastic Limit	22.97%		Plasticity Index	125.83%	Liquidity Index	-3.53%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was less than 1 mm.
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type C	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					2.750	78.9		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Clay #14	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Not Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501.6	501.6	0.0	0.0	100.0
		10	2.000	623.8	623.8	0	0.0	100.0
0.425	250	40	0.425	363.3	450.5	87.2	34.8	65.2
		100	0.149	322.7	323.2	0.5	35.0	65.0
		200	0.074	317.0	318.2	1.2	35.5	64.48
		Pan	0.000	359.8	521.2	161.4	100.0	0.0
		∑ soil mass after sieve (gr)		250.3				
		Error (%)		-0.1%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	35.5%	64.5%	N/A	0.0016	0.0169	0.0628	#VALUE!	#VALUE!	CH with Sand	A-7-6(79.3)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	7.4	7.25	0.97972973	151H
0.425	51.78				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
19.72	100006	69.236	99.94691	0.99827	169.01	7.94	174	2.664
					$G_{s,\ 20c}$	2.664589		

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.13	0.133333	1.0345	0.003	1.0315	18.4	0.01392	7.2	0.074000	99.40	160.42	64.48
0.27	0.266667	1.0335	0.003	1.0305	18.4	0.01392	7.45	0.073586	96.24	155.33	62.44
0.50	0.5	1.0315	0.003	1.0285	18.4	0.01392	7.95	0.055514	89.93	145.15	58.37
1	1	1.031	0.003	1.0280	18.4	0.01392	8.10	0.039623	88.35	142.60	57.35
2	2	1.03	0.003	1.0270	18.4	0.01392	8.4	0.028532	85.20	137.51	55.31
5	5	1.028	0.003	1.0250	18.4	0.01392	8.9	0.018574	78.89	127.32	51.24
18.5	18.5	1.025	0.003	1.0220	18.0	0.01399	9.7	0.010130	69.42	112.04	45.13
33.5	33.5	1.024	0.003	1.0210	17.9	0.01401	10.0	0.007653	66.26	106.95	43.09
62	62	1.023	0.003	1.0200	17.5	0.01408	10.2	0.005711	63.11	101.86	41.05
218	218	1.0205	0.003	1.0175	16.7	0.01422	10.9	0.003173	55.22	89.12	35.96
4407	4407	1.016	0.003	1.0130	16.3	0.01430	12.1	0.000749	41.02	66.21	26.79

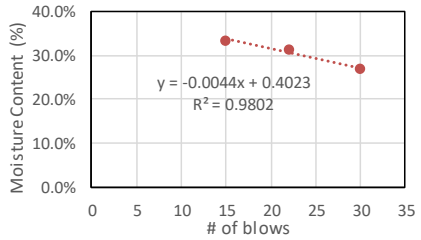
Silt Samples - HET

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Silt #1	Iman Shafii	N/A	9/6/2017	Sandy silt	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 25 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	17.44
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	111.0
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1568.1
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.4542		Dry Denisty (kN/m^3)	15.38
								Wet Denisty (pcf)	111.03		Dry Denisty (pcf)	97.9

Moisture Content				Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	S	1.1	9.7	8.6	8.7	7.6	1	7.6	13.16%
2	0.20	$33	1.1	6.5	5.4	5.85	4.75	0.65	4.75	13.68%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	30	z	1.1	10.1	8.2	26.8%
2		20-30	22	w	1	10.7	8.4	31.1%
3		15-25	15	O	1.1	11.5	8.9	33.3%
Liquid Limit		29.23%		Notes:				



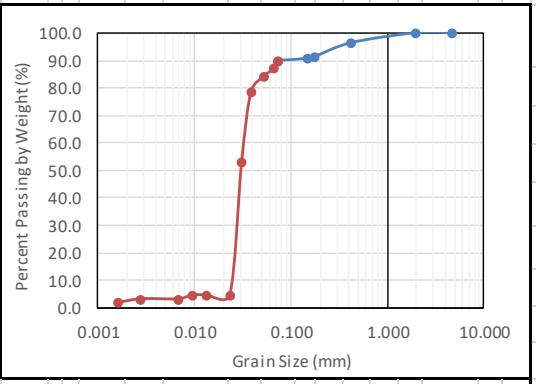
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	#1B	1.1	11.4	9.4	24.1%
	2	0.195	S	1	6.7	5.6	23.9%
Average Plastic Limit	24.00%		Plasticity Index	5.23%	Liquidity Index	-202.55%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter wasalmost 4.5 mm.
					tsf or kg/cm²	S_u (kPa)*		* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
	19	29	90	72	2.167	62.2	Type A	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Silt #1	Iman Shafii	Man-made	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501	0	0.0	100.0
		10	2.000	623	623	0	0.0	100.0
0.425	402	40	0.425	363	378	14.5	3.6	96.4
		80	0.180	524	544	20	8.6	91.4
		100	0.149	322	325	3	9.3	90.7
		200	0.074	317	320	3	10.1	89.93
		Pan	0.000	360	722	361.5	100.0	0.0
		∑ soil mass after sieve (gr)		402				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	10.1%	89.9%	0.023	0.028	0.03	0.0305	1.12	1.33	ML	A-4(4.5)

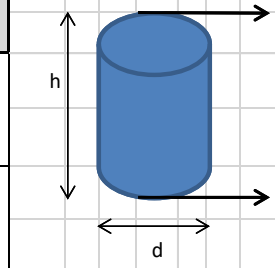
Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53.24				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.75	358.4	2.537
						$G_{s,\ 20c}$	2.535650	

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.0	0.01349	7.3	0.074000	98.15	354.8	89.93
0.30	0.3	1.033	0.003	1.0300	24.0	0.01349	7.6	0.067878	94.98	343.4	87.08
0.50	0.5	1.032	0.003	1.0290	24.0	0.01349	7.8	0.053265	91.81	331.9	84.23
1	1	1.03	0.003	1.0270	24.0	0.01349	8.4	0.039086	85.48	309.0	78.54
2	2	1.021	0.003	1.0180	24.0	0.01349	10.7	0.031193	56.99	206.0	52.92
5	5	1.004	0.003	1.0010	24.0	0.01349	15.2	0.023514	3.17	11.4	4.52
15	15	1.004	0.003	1.0010	23.8	0.01349	15.2	0.013576	3.17	11.4	4.52
30	30	1.004	0.003	1.0010	23.7	0.01349	15.2	0.009599	3.17	11.4	4.52
60	60	1.0035	0.003	1.0005	23.6	0.01349	15.4	0.006821	1.58	5.7	3.09
360	360	1.0035	0.003	1.0005	23.0	0.01365	15.4	0.002818	1.58	5.7	3.09
1140	1140	1.003	0.003	1.0000	22.3	0.01381	15.5	0.001610	0.00	0.0	1.67

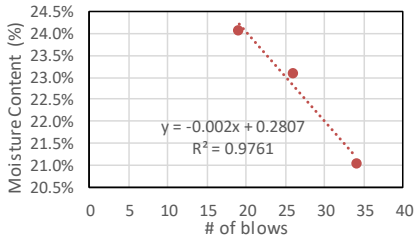
Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Silt #2	Iman Shafii	N/A	9/7/2017	Sandy silt	From :	0	0.5	
						To :	0.5		

Sample Dimensions		Depth of upper side of the core (ft)	0	Notes: 25 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	18.51
height (ft)	0.390	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	117.8
							Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1679.9
height (mm)	119.077	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.5432		Dry Denisty (kN/m^3)	16.47
							Wet Denisty (pcf)	117.83		Dry Denisty (pcf)	105



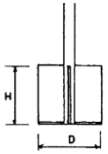
Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	A	1	11.6	10.6	10.4	9.4	1.2	9.4	12.77%
2	0.20	B1	1	9.9	8.9	8.95	7.95	0.95	7.95	11.95%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	34	Z	1	7.9	6.7	21.1%
2		20-30	26	O	1	9	7.5	23.1%
3		15-25	19	33	1.1	7.8	6.5	24.1%
Liquid Limit		23.07%		Notes:				



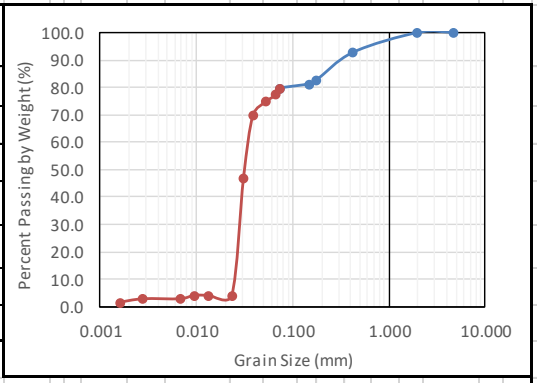
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)	Notes:
	1	0.195	z	1	7.9	6.8	19.0%	
	2	0.195	O	1.1	8.4	7.2	19.7%	
Average Plastic Limit	19.32%		**Plasticity Index**	3.75%	**Liquidity Index**	-185.57%		

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 6 mm.
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					1.950	56.0		



Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Silt #2	Iman Shafii	Man-made	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501	0	0.0	100.0
		10	2.000	623	623	0	0.0	100.0
0.425	201	40	0.425	363	378	14.5	7.2	92.8
		80	0.180	524	544	20	17.2	82.8
		100	0.149	322	325	3	18.7	81.3
		200	0.074	317	320	3	20.1	79.85
		Pan	0.000	360	521	160.5	100.0	0.0
		∑ soil mass after sieve (gr)		201				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	20.1%	79.9%	0.0245	0.0295	0.0302	0.033	1.08	1.35	ML with Sand	A-4(1.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53.24				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.75	358.4	2.537
						$G_{s,\ 20c}$	2.535650	

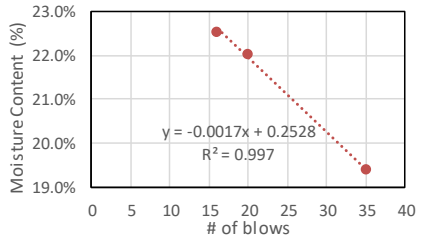
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.0	0.01349	7.3	0.074000	98.15	157.5	79.85
0.30	0.3	1.033	0.003	1.0300	24.0	0.01349	7.6	0.067878	94.98	152.4	77.32
0.50	0.5	1.032	0.003	1.0290	24.0	0.01349	7.8	0.053265	91.81	147.4	74.79
1	1	1.03	0.003	1.0270	24.0	0.01349	8.4	0.039086	85.48	137.2	69.74
2	2	1.021	0.003	1.0180	24.0	0.01349	10.7	0.031193	56.99	91.5	46.99
5	5	1.004	0.003	1.0010	24.0	0.01349	15.2	0.023514	3.17	5.1	4.01
15	15	1.004	0.003	1.0010	23.8	0.01349	15.2	0.013576	3.17	5.1	4.01
30	30	1.004	0.003	1.0010	23.7	0.01349	15.2	0.009599	3.17	5.1	4.01
60	60	1.0035	0.003	1.0005	23.6	0.01349	15.4	0.006821	1.58	2.5	2.74
360	360	1.0035	0.003	1.0005	23.0	0.01365	15.4	0.002818	1.58	2.5	2.74
1140	1140	1.003	0.003	1.0000	22.3	0.01381	15.5	0.001610	0.00	0.0	1.48

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Silt #3	Iman Shafii	N/A	9/8/2017	Sandy silt	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 20 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	16.13
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	102.7
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1487.9
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.3448		Dry Denisty (kN/m^3)	14.59
								Wet Denisty (pcf)	102.68		Dry Denisty (pcf)	92.9

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	z	1.1	17.9	16.8	16.2	15.1	1.7	15.1	11.26%
2	0.20	$33	1.1	14.5	13.4	13.3	12.2	1.2	12.2	9.84%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	35	A	1	9	7.7	19.4%
2		20-30	20	#B1	1	8.2	6.9	22.0%
3		15-25	16	2	1	7.8	6.55	22.5%
Liquid Limit		21.03%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	S	1	11	9.6	16.3%
	2	0.195	33	1.1	6.5	5.7	17.4%
Average Plastic Limit	16.84%		Plasticity Index	4.19%	Liquidity Index	-149.90%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	2.000	57.4	Type A

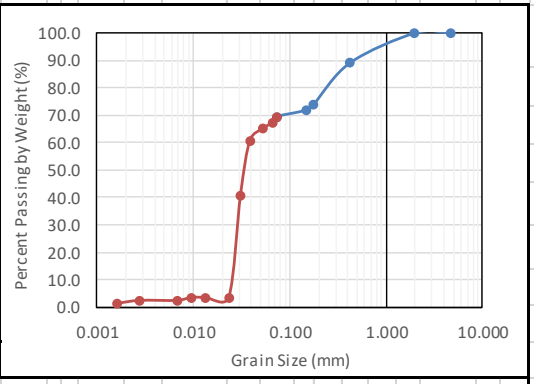
Notes:

Pocket Erodomoeter was almost 6.7 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Silt #3	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501	0	0.0	100.0
		10	2.000	623	623	0	0.0	100.0
0.425	133	40	0.425	363	378	14.5	10.9	89.1
		80	0.180	524	544	20	25.9	74.1
		100	0.149	322	325	3	28.2	71.8
		200	0.074	317	320	3	30.5	69.55
		Pan	0.000	360	453	92.5	100.0	0.0
		∑ soil mass after sieve (gr)		133				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	30.5%	69.5%	0.024	0.03	0.031	0.04	0.94	1.67	ML with Sand	A-4(0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53.24				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.75	358.4	2.537
						$G_{s,20c}$	2.535650	

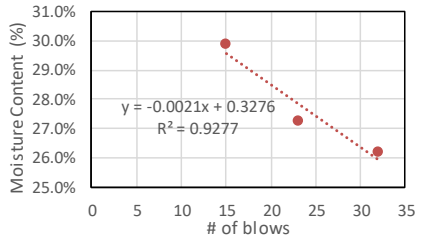
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.0	0.01349	7.3	0.074000	98.15	90.8	69.55
0.30	0.3	1.033	0.003	1.0300	24.0	0.01349	7.6	0.067878	94.98	87.9	67.35
0.50	0.5	1.032	0.003	1.0290	24.0	0.01349	7.8	0.053265	91.81	84.9	65.15
1	1	1.03	0.003	1.0270	24.0	0.01349	8.4	0.039086	85.48	79.1	60.74
2	2	1.021	0.003	1.0180	24.0	0.01349	10.7	0.031193	56.99	52.7	40.92
5	5	1.004	0.003	1.0010	24.0	0.01349	15.2	0.023514	3.17	2.9	3.49
15	15	1.004	0.003	1.0010	23.8	0.01349	15.2	0.013576	3.17	2.9	3.49
30	30	1.004	0.003	1.0010	23.7	0.01349	15.2	0.009599	3.17	2.9	3.49
60	60	1.0035	0.003	1.0005	23.6	0.01349	15.4	0.006821	1.58	1.5	2.39
360	360	1.0035	0.003	1.0005	23.0	0.01365	15.4	0.002818	1.58	1.5	2.39
1140	1140	1.003	0.003	1.0000	22.3	0.01381	15.5	0.001610	0.00	0.0	1.29

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Silt #4	Iman Shafii	N/A	9/10/2017	Sandy silt	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 25 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	17.98
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	114.5
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1650.6
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.4991		Dry Denisty (kN/m^3)	16.19
								Wet Denisty (pcf)	114.47		Dry Denisty (pcf)	103

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	#B1	1	11.2	10.2	10.25	9.25	0.95	9.25	10.27%
2	0.20	O	1	15.1	14.1	13.6	12.6	1.5	12.6	11.90%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	32	Z	1.1	7.6	6.25	26.2%
2		20-30	23	O	1	8	6.5	27.3%
3		15-25	15	W	1.1	11.1	8.8	29.9%
Liquid Limit		27.51%		Notes:				



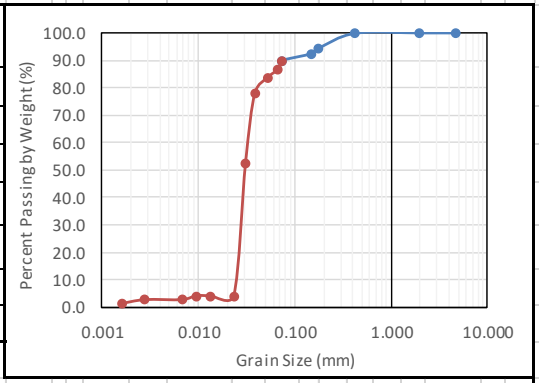
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	33	1.1	9.4	7.95	21.2%
	2	0.195					#DIV/0!
Average Plastic Limit	21.17%		Plasticity Index	6.34%	Liquidity Index	-158.94%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 4.4 mm.
	19	29	90	N/A	tsf or kg/cm²	S_u (kPa)*	Type A	* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
					2.050	58.8		

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Silt #4	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501	0	0.0	100.0
		10	2.000	623	623	0	0.0	100.0
0.425	350	40	0.425	363	363.4	0.4	0.1	99.9
		80	0.180	524	543.2	19.2	5.6	94.4
		100	0.149	322	329.2	7.2	7.7	92.3
		200	0.074	318	326.4	8.4	10.1	89.94
		Pan	0.000	359	673.8	314.8	100.0	0.0
		∑ soil mass after sieve (gr)		350				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0	10.1%	89.9%	0.0235	0.0285	0.0295	0.0303	1.14	1.29	ML	A-4(4.8)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53.24				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.75	358.4	2.537
						$G_{s,20c}$	2.535650	

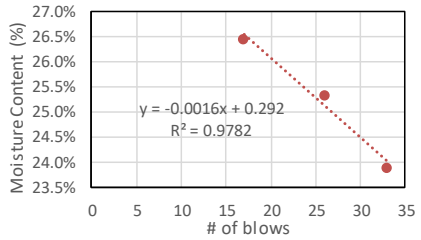
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.0	0.01349	7.3	0.074000	98.15	309.0	89.57
0.30	0.3	1.033	0.003	1.0300	24.0	0.01349	7.6	0.067878	94.98	299.0	86.72
0.50	0.5	1.032	0.003	1.0290	24.0	0.01349	7.8	0.053265	91.81	289.0	83.87
1	1	1.03	0.003	1.0270	24.0	0.01349	8.4	0.039086	85.48	269.1	78.18
2	2	1.021	0.003	1.0180	24.0	0.01349	10.7	0.031193	56.99	179.4	52.55
5	5	1.004	0.003	1.0010	24.0	0.01349	15.2	0.023514	3.17	10.0	4.14
15	15	1.004	0.003	1.0010	23.8	0.01349	15.2	0.013576	3.17	10.0	4.14
30	30	1.004	0.003	1.0010	23.7	0.01349	15.2	0.009599	3.17	10.0	4.14
60	60	1.0035	0.003	1.0005	23.6	0.01349	15.4	0.006821	1.58	5.0	2.71
360	360	1.0035	0.003	1.0005	23.0	0.01365	15.4	0.002818	1.58	5.0	2.71
1140	1140	1.003	0.003	1.0000	22.3	0.01381	15.5	0.001610	0.00	0.0	1.29

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Silt #5	Iman Shafii	N/A	9/12/2017	Sandy silt	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 25 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	17.19
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	109.4
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1523.0
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.433		Dry Denisty (kN/m^3)	14.94
								Wet Denisty (pcf)	109.42		Dry Denisty (pcf)	95.1

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	$33	1.1	9.9	8.8	8.8	7.7	1.1	7.7	14.29%
2	0.20	W	1.1	8.4	7.3	7.4	6.3	1	6.3	15.87%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	33	O	1	8	6.65	23.9%
2		20-30	26	#1B	1	10.4	8.5	25.3%
3		15-25	17	S	1	12	9.7	26.4%
Liquid Limit		25.20%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	Z	1	10.3	8.8	19.2%
	2	0.195					#DIV/0!
Average Plastic Limit	19.23%		Plasticity Index	5.97%	Liquidity Index	-69.55%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	1.617	46.4	Type A

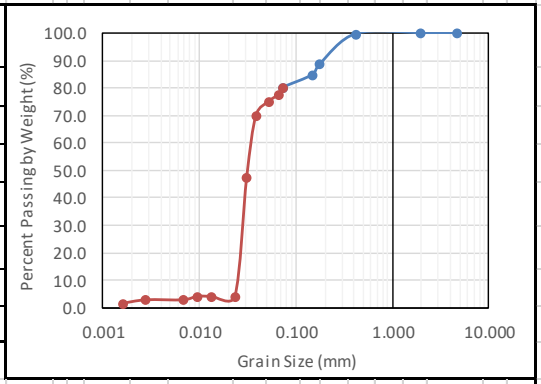
Notes:

Pocket Erodomoeter was almost 6 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Silt #5	Iman Shafii	Man-made	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501	0	0.0	100.0
		10	2.000	623	623	0	0.0	100.0
0.425	176.5	40	0.425	363	363.4	0.4	0.2	99.8
		80	0.180	524	543.2	19.2	11.1	88.9
		100	0.149	322	329.2	7.2	15.2	84.8
		200	0.074	318	326.0	8	19.7	80.28
		Pan	0.000	359	500.7	141.7	100.0	0.0
		∑ soil mass after sieve (gr)		176.5				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	19.7%	80.3%	0.024	0.0292	0.0302	0.033	1.08	1.38	ML with Sand	A-4(3.1)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53.24				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.75	358.4	2.537
						$G_{s,\ 20c}$	2.535650	

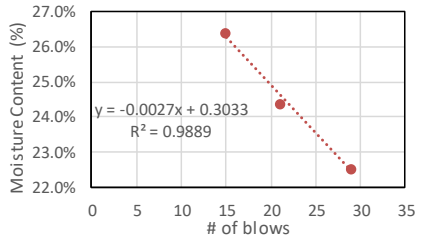
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.0	0.01349	7.3	0.074000	98.15	139.1	80.28
0.30	0.3	1.033	0.003	1.0300	24.0	0.01349	7.6	0.067878	94.98	134.6	77.73
0.50	0.5	1.032	0.003	1.0290	24.0	0.01349	7.8	0.053265	91.81	130.1	75.19
1	1	1.03	0.003	1.0270	24.0	0.01349	8.4	0.039086	85.48	121.1	70.11
2	2	1.021	0.003	1.0180	24.0	0.01349	10.7	0.031193	56.99	80.8	47.23
5	5	1.004	0.003	1.0010	24.0	0.01349	15.2	0.023514	3.17	4.5	4.02
15	15	1.004	0.003	1.0010	23.8	0.01349	15.2	0.013576	3.17	4.5	4.02
30	30	1.004	0.003	1.0010	23.7	0.01349	15.2	0.009599	3.17	4.5	4.02
60	60	1.0035	0.003	1.0005	23.6	0.01349	15.4	0.006821	1.58	2.2	2.75
360	360	1.0035	0.003	1.0005	23.0	0.01365	15.4	0.002818	1.58	2.2	2.75
1140	1140	1.003	0.003	1.0000	22.3	0.01381	15.5	0.001610	0.00	0.0	1.48

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Silt #6	Iman Shafii	N/A	9/12/2017	Sandy silt	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 25 blows per layer 3 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	20.10
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	127.9
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1837.7
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.6755		Dry Denisty (kN/m^3)	18.02
								Wet Denisty (pcf)	127.93		Dry Denisty (pcf)	115

Moisture Content				Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	WW	1	10.7	9.7	9.7	8.7	1	8.7	11.49%
2	0.20	#1	1.1	6.9	5.8	6.3	5.2	0.6	5.2	11.54%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	29	A	1.1	7.9	6.65	22.5%
2		20-30	21	O	1.1	8.5	7.05	24.4%
3		15-25	15	Z	1.1	12.6	10.2	26.4%
Liquid Limit		23.58%		Notes:				



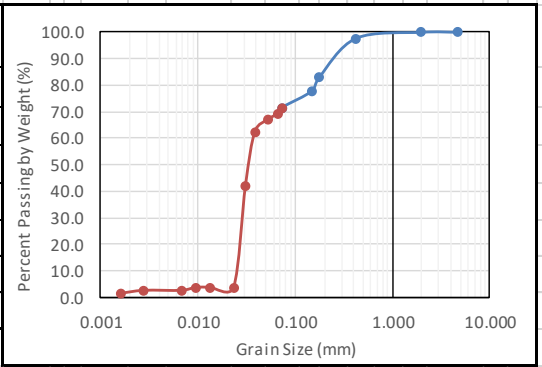
Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	#B1	1.1	13.8	12.1	15.5%
	2	0.195					#DIV/0!
Average Plastic Limit	15.45%		Plasticity Index	8.13%	Liquidity Index	-48.47%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer			Notes:
					Unconfined Strength		OSHA Category	Pocket Erodomoeter was almost 7 mm.
					tsf or kg/cm²	S_u (kPa)*		* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3
	19	29	90	N/A	2.333	67.0	Type A	

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY			1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
	Silt #6	Iman Shafii	Man-made	Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501	0	0.0	100.0
		10	2.000	623	623	0	0.0	100.0
0.425	132	40	0.425	363	366.0	3	2.3	97.7
		80	0.180	524	543.2	19.2	16.8	83.2
		100	0.149	322	329.2	7.2	22.3	77.7
		200	0.074	318	326.0	8	28.3	71.67
		Pan	0.000	359	453.6	94.6	100.0	0.0
		∑ soil mass after sieve (gr)		132				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	28.3%	71.7%	0.025	0.03	0.031	0.0399	0.90	1.60	ML with Sand	A-4(2.3)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53.24				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{\rho ws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.75	358.4	2.537
						$G_{s,\ 20c}$	2.535650	

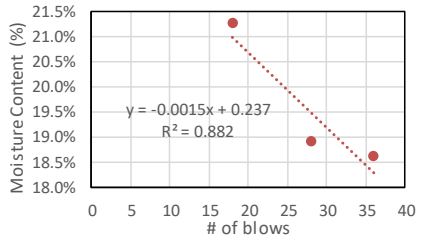
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.0	0.01349	7.3	0.074000	98.15	92.8	71.67
0.30	0.3	1.033	0.003	1.0300	24.0	0.01349	7.6	0.067878	94.98	89.9	69.40
0.50	0.5	1.032	0.003	1.0290	24.0	0.01349	7.8	0.053265	91.81	86.9	67.13
1	1	1.03	0.003	1.0270	24.0	0.01349	8.4	0.039086	85.48	80.9	62.59
2	2	1.021	0.003	1.0180	24.0	0.01349	10.7	0.031193	56.99	53.9	42.17
5	5	1.004	0.003	1.0010	24.0	0.01349	15.2	0.023514	3.17	3.0	3.60
15	15	1.004	0.003	1.0010	23.8	0.01349	15.2	0.013576	3.17	3.0	3.60
30	30	1.004	0.003	1.0010	23.7	0.01349	15.2	0.009599	3.17	3.0	3.60
60	60	1.0035	0.003	1.0005	23.6	0.01349	15.4	0.006821	1.58	1.5	2.46
360	360	1.0035	0.003	1.0005	23.0	0.01365	15.4	0.002818	1.58	1.5	2.46
1140	1140	1.003	0.003	1.0000	22.3	0.01381	15.5	0.001610	0.00	0.0	1.33

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Silt #7	Iman Shafii	N/A	9/15/2017	Sandy Silt	From :	0	0.5	
						To :	0.5		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes: 20 blows per layer 2 layers		Density Calcs.	Sample Height (ft)	0.3904	Wet Density	Wet Denisty (kN/m3)	17.53
height (ft)	0.390	h	Depth of middle of the core (ft)	0.195				Sample Diameter (ft)	0.2067		Wet Denisty (pcf)	111.6
								Sample Volume (ft^3)	0.0131	Dry Density	Dry Denisty (kg/m^3)	1570.3
height (mm)	119.077	d	Depth of lower side of the core (ft)	0.390	Core Diameter (ft)	0.207		Sample weight (lb)	1.4617		Dry Denisty (kN/m^3)	15.40
								Wet Denisty (pcf)	111.61		Dry Denisty (pcf)	98

Moisture Content				Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)	Container #	Weight of Container (gr)	W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.20	Z	1.1	16.7	15.6	14.7	13.6	2	13.6	14.71%
2	0.20	S	1.1	11.1	10	9.95	8.85	1.15	8.85	12.99%

Liquid Limit		Limits	# of blows	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.195	25-35	36	$2	1	11.2	9.6	18.6%
2		20-30	28	1B	1.1	9.9	8.5	18.9%
3		15-25	18	O	1	10.7	9	21.3%
Liquid Limit		19.95%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.195	22	1	9.1	8.05	14.9%
	2	0.195					#DIV/0!
Average Plastic Limit	14.89%		Plasticity Index	5.06%	Liquidity Index	-20.64%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm²	S_u (kPa)*	
	19	29	90	N/A	1.500	43.1	Type A

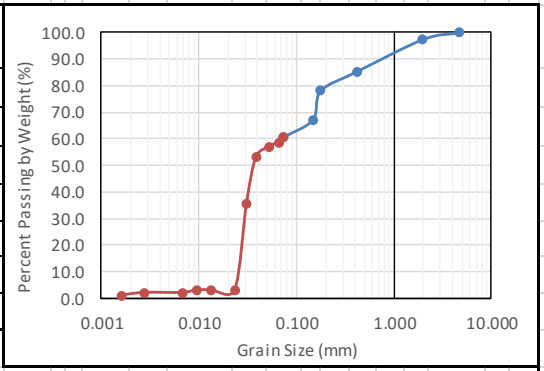
Notes:

Pocket Erodomoeter was almost 9.5 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.)	Page 2 of 2
TEXAS A&M UNIVERSITY	Silt #7	Iman Shafii	1	2	3	2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated	
			Man-made	Semi-Cemented	N/A	3-Geologic Coordinates	

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.760	501	501	0	0.0	100.0
		10	2.000	623	630	7	2.5	97.5
0.425	275	40	0.425	363	396.0	33	14.5	85.5
		80	0.180	524	544.0	20	21.8	78.2
		100	0.149	322	352.0	30	32.7	67.3
		200	0.074	318	336.0	18	39.3	60.73
		Pan	0.000	360	527.0	167	100.0	0.0
		∑ soil mass after sieve (gr)		275				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	39.3%	60.7%	0.0255	0.03	0.036	0.074	0.48	2.90	ML with Sand	A-4(0)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	9.8	9.6	0.979591837	151H
0.425	53.24				

Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
21.67	0.99940	102.847	249.6366	0.9976	351.887	10.75	358.4	2.537
						$G_{s,20c}$	2.535650	

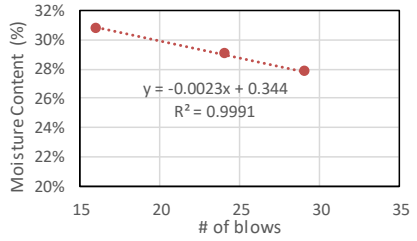
Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.08	0.083333	1.034	0.003	1.0310	24.0	0.01349	7.3	0.074000	98.15	163.9	60.73
0.30	0.3	1.033	0.003	1.0300	24.0	0.01349	7.6	0.067878	94.98	158.6	58.81
0.50	0.5	1.032	0.003	1.0290	24.0	0.01349	7.8	0.053265	91.81	153.3	56.89
1	1	1.03	0.003	1.0270	24.0	0.01349	8.4	0.039086	85.48	142.8	53.04
2	2	1.021	0.003	1.0180	24.0	0.01349	10.7	0.031193	56.99	95.2	35.74
5	5	1.004	0.003	1.0010	24.0	0.01349	15.2	0.023514	3.17	5.3	3.05
15	15	1.004	0.003	1.0010	23.8	0.01349	15.2	0.013576	3.17	5.3	3.05
30	30	1.004	0.003	1.0010	23.7	0.01349	15.2	0.009599	3.17	5.3	3.05
60	60	1.0035	0.003	1.0005	23.6	0.01349	15.4	0.006821	1.58	2.6	2.09
360	360	1.0035	0.003	1.0005	23.0	0.01365	15.4	0.002818	1.58	2.6	2.09
1140	1140	1.003	0.003	1.0000	22.3	0.01381	15.5	0.001610	0.00	0.0	1.13

Form # 0916	Sample name	Operator	Bore hole ID	Date	Layer type	Layer debth:		Layer thickness (ft)	Page 1 of 2
TEXAS A&M UNIVERSITY	Teton Dam Left Core	Iman Shafii	N/A	7/12/2017	Sandy Silt	From :	0	1	
						To :	1		

Sample Dimensions			Depth of upper side of the core (ft)	0	Notes:		Density Calcs.	Sample Height (ft)	0.3871	Wet Density	Wet Denisty (kN/m3)	18.68
height (ft)	0.387	h	Depth of middle of the core (ft)	0.194				Sample Diameter (ft)	0.2051		Wet Denisty (pcf)	118.9
								Sample Volume (ft^3)	0.0128	Dry Density	Dry Denisty (kg/m^3)	1654.7
height (mm)	118.077		Depth of lower side of the core (ft)	0.387	Core Diameter (ft)	0.205		Sample weight (lb)	1.52		Dry Denisty (kN/m^3)	16.23
		d						Wet Denisty (pcf)	118.89		Dry Denisty (pcf)	103

Moisture Content		Container #	Weight of Container (gr)	Wet		Dry		Weight of Water (gr)	Weight of Solids (gr)	Moisture (%)
Sample #	Core depth at middle (ft)			W_{c+s} (gr)	Ws (gr)	W_{c+s} (gr)	Ws (gr)			
1	0.19	45	1	7.8	6.8	6.9	5.9	0.9	5.9	15.25%
2	0.19	O	1.1	11.1	10	9.8	8.7	1.3	8.7	14.94%

Liquid Limit		Limits	# of blows (mm)	Container #	Weight of Container (gr)	Wet	Dry	WC (%)
Test #	Core depth at middle (ft)					Wc+s (gr)*	Wc+s (gr)	
1	0.194	25-35	29	Z	1	9.5	7.65	27.8%
2		20-30	24	S	1	9	7.2	29.0%
3		15-25	16	1B	1	9.5	7.5	30.8%
Liquid Limit		28.99%		Notes:				



Plastic Limit	Test #	Core deoth (ft)	Dish #	Weight of Dish (gr)	Wc+s (gr)*	Wc+s (gr)	WC (%)
	1	0.194	XX	1.1	11.37	9.25	26.06%
	2	0.194					#DIV/0!
Average Plastic Limit	26.06%		Plasticity Index	2.93%	Liquidity Index	-368.58%	

Notes:

Mini Vane Shear Test	D (mm)	H (mm)	Rotation Rate (°/min)	Su (kPa)	Pocket Penetrometer		
					Unconfined Strength		OSHA Category
					tsf or kg/cm^2	S_u (kPa)*	
	19	29	90	N/A	N/A	N/A	N/A

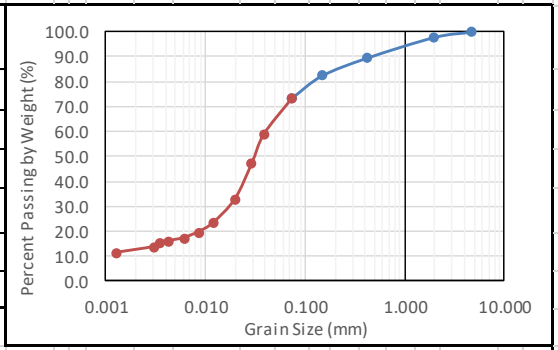
Notes:

Pocket Erodomoeter was 3 mm.

* Su from pocket penetrometer is the pocket penetrometer reading multiplied by 0.3

Form # 0916	Sample name	Operator	Geologic Category			1-General Geologic Information (i.e. Location, Color, etc.) 2- Cemented, uncemented, dessicated, overconsolidated, normally consolidated 3-Geologic Coordinates	Page 2 of 2
TEXAS A&M UNIVERSITY	Teton Dam Left Core	Iman Shafii	1	2	3		
			Teton Dam	Uncemented	N/A		

Particle Size Distribution (ASTM 422)		Sieve #	Opening (mm)	Sieve weight (gr)	Sieve+soil (gr)	Retained (gr)	Percent retained (%)	Percent passed (%)
Largest Particle (mm)	Mass of Portion (gr)	4	4.76	460	460.0	0.0	0.0	100.0
		10	2.00	623	631.0	8	2.1	97.9
2	376	40	0.43	362	393.0	31	10.4	89.6
		100	0.15	321	348.0	27	17.6	82.4
		200	0.07	317	351.0	34	26.6	73.4
		Pan	0.00	252.0	528.0	276	100.0	0.0
		∑ soil mass after sieve (gr)		376				
		Error (%)		0.0%				



Gravel Fraction (%)	Sand Fraction (%)	Fine Content (%)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	USCS Classification	AASHTO Classification
0.0%	26.6%	73.4%	0.001	0.0176	0.0318	0.04	7.74	40.00	ML with Sand	A-4(1.4)

Hydrometer Analysis (ASTM 422)		Air-dried weight (gr)	Oven-dried weight (gr)	Hygroscopic Correction Factor	Type
Largest Particle (mm)	Mass of Portion (gr)	50	48.59	0.9718	151H
2	50				

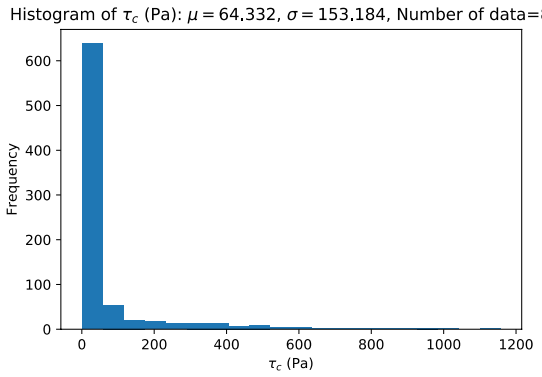
Specific Gravity (ASTM D854-14)								
Temp. (°C)	K	M_p (gr)	V_p (mL)	ρ_w (g/mL)	$M_{pw,t}$ (g)	M_s (g)	$M_{pws,t}$	G_t
23.67	0.99917	102.996	239.6342	0.9974	342	22.05	355.96	2.726
					$G_{s,\ 20c}$	2.723325		

Time	Elapsed Time (min)	Reading (rh)	CC	R_h	T (°C)	K	L cm	D (mm)	% sus	gr of passing 200	% of fine
0.50	0.5	1.031	0.003	1.0280	25.3	0.01256	8.1	0.074000	91.06	251.33	73.40
1.00	1	1.025	0.003	1.0220	25.3	0.01256	9.70	0.039105	71.55	197.48	59.08
2.00	2	1.02	0.003	1.0170	25.3	0.01256	11.00	0.029446	55.29	152.60	47.14
5	5	1.014	0.003	1.0110	25.3	0.01256	###	0.019932	35.77	98.74	32.82
15	15	1.01	0.003	1.0070	25.3	0.01256	13.7	0.012000	22.77	62.83	23.27
30	30	1.0085	0.003	1.0055	25.3	0.01256	14.1	0.008593	17.89	49.37	19.69
60	60	1.0075	0.003	1.0045	25.3	0.01256	14.3	0.006130	14.64	40.39	17.30
120	120	1.007	0.003	1.0040	25.3	0.01256	14.4	0.004350	13.01	35.90	16.11
180	180	1.0068	0.003	1.0038	25.3	0.01256	14.5	0.003559	12.36	34.11	15.63
250	250	1.006	0.003	1.0030	25.1	0.01258	14.7	0.003051	9.76	26.93	13.72
1440	1440	1.005	0.003	1.0020	25.0	0.01260	15.0	0.001286	6.50	17.95	11.33

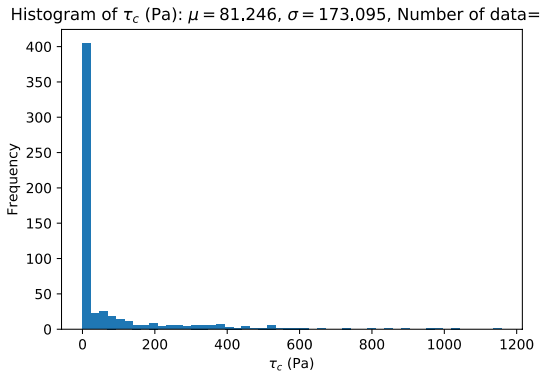
APPENDIX 3 – FIRST AND SECOND ORDER STASTICAL ANALYSES RESULTS

First Order Statistics of the Erodibility Parameters

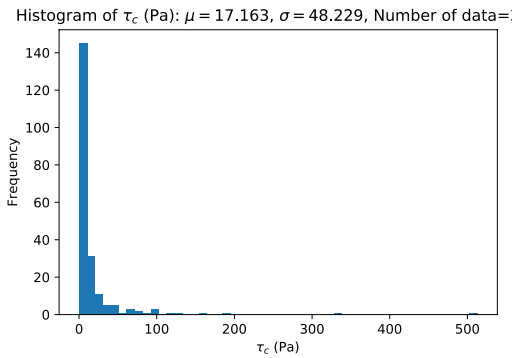
Critical Shear Stress (τ_c) Histograms



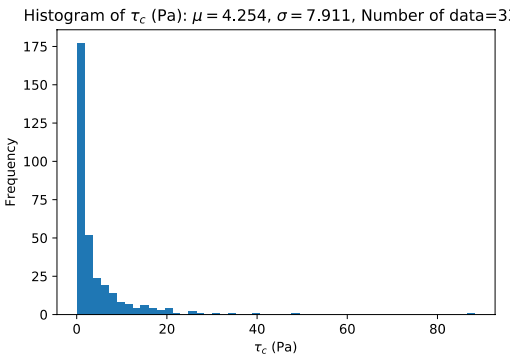
TAMU/Global



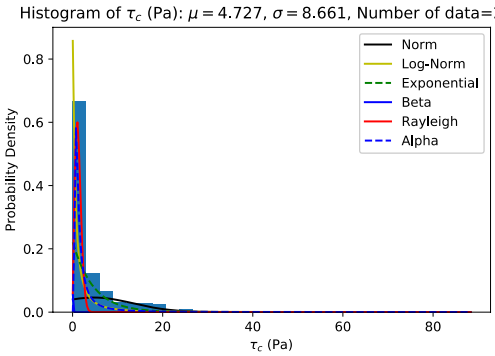
TAMU/Fine



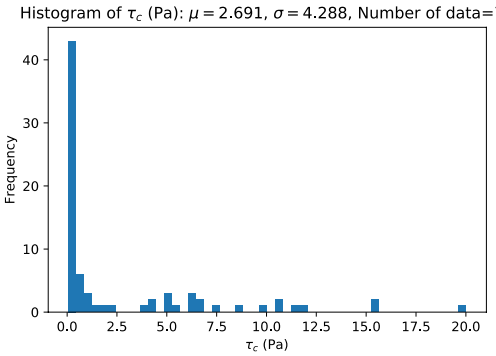
TAMU/Coarse



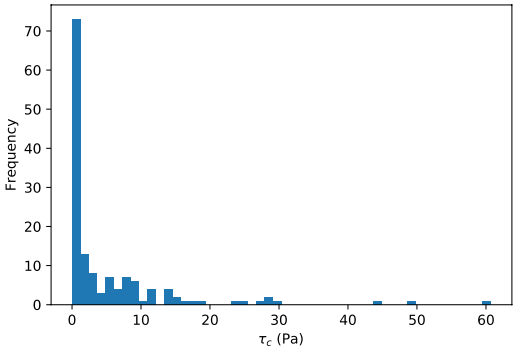
EFA/Global

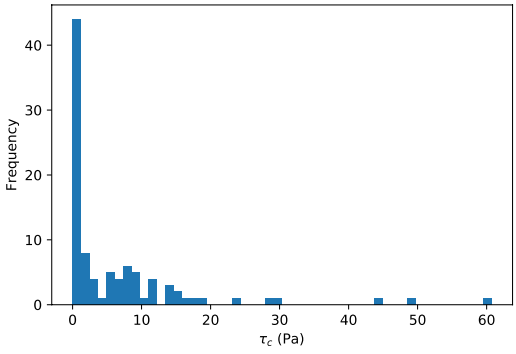


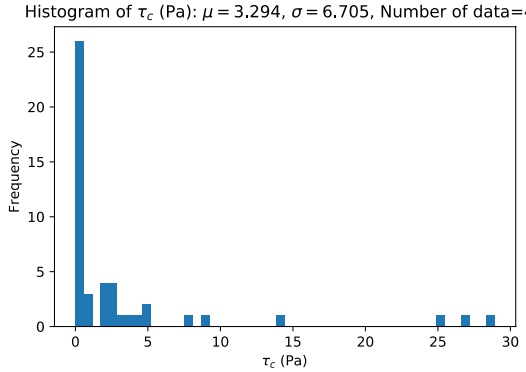
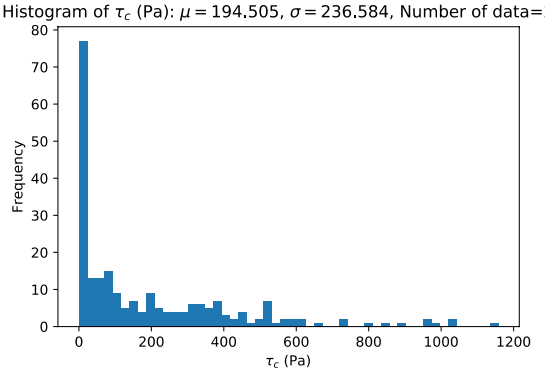
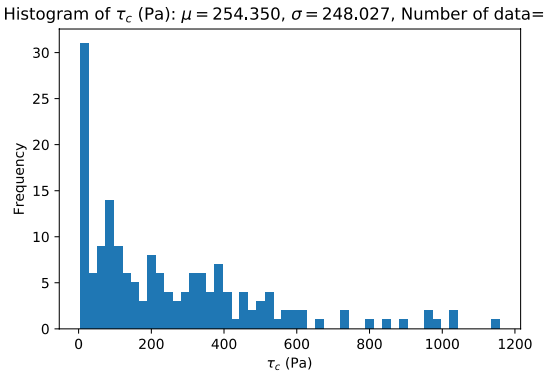
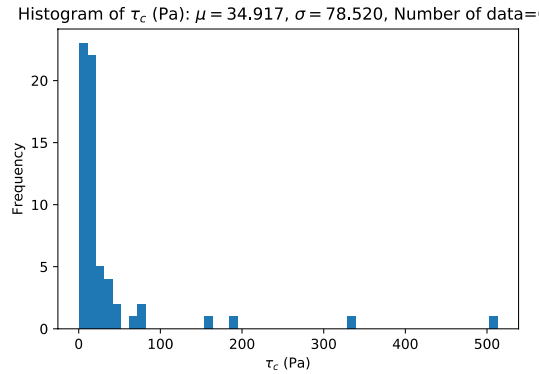
EFA/Fine



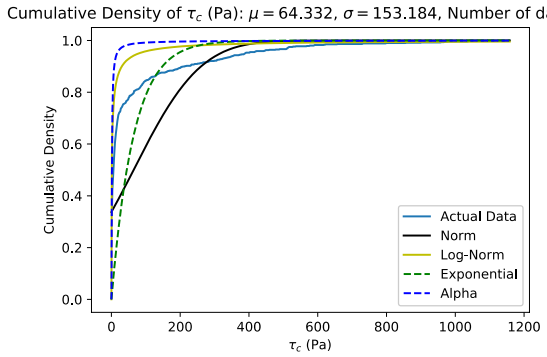
EFA/Coarse



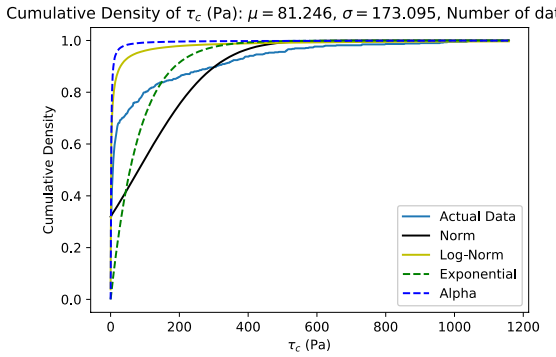


JET/Global	JET/Fine
	
JET/Coarse	**HET/Global**
	
HET/Fine	**HET/Coarse**

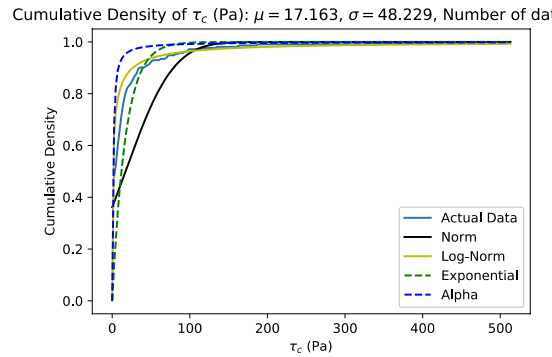
Critical Shear Stress (τ_c) Empirical Cumulative Density Functions (ECDFs)



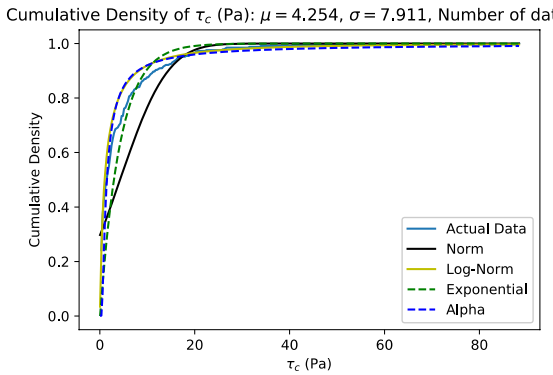
TAMU/Global



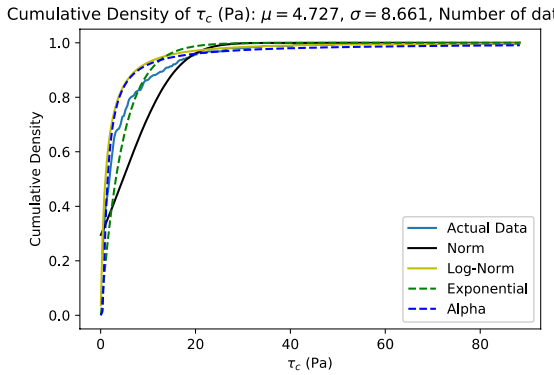
TAMU/Fine



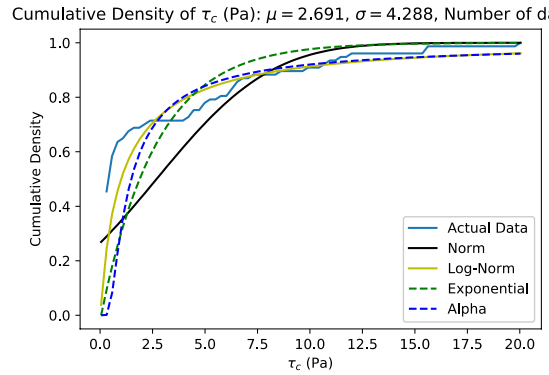
TAMU/Coarse



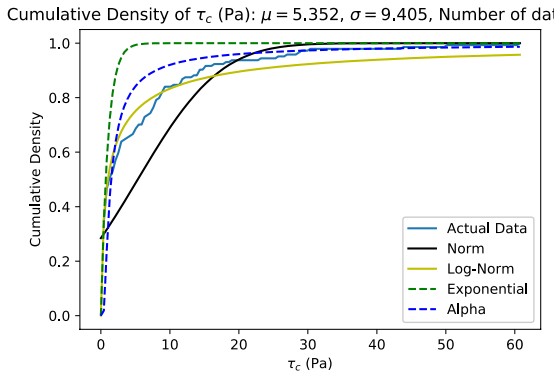
EFA/Global



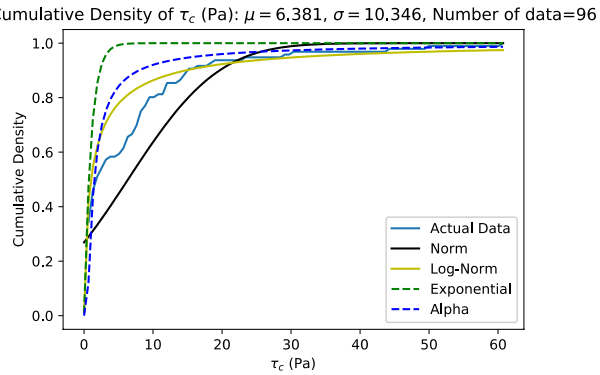
EFA/Fine



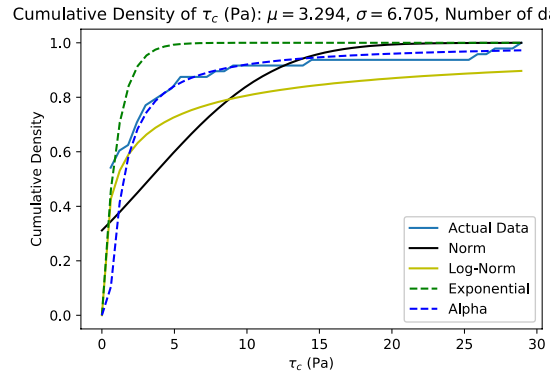
EFA/Coarse



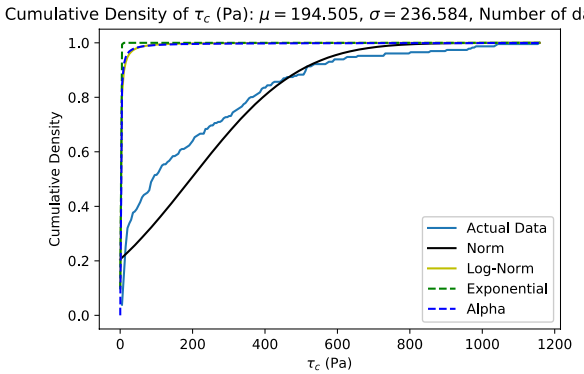
JET/Global



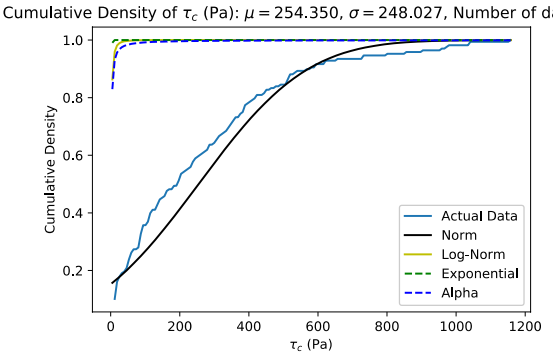
JET/Fine



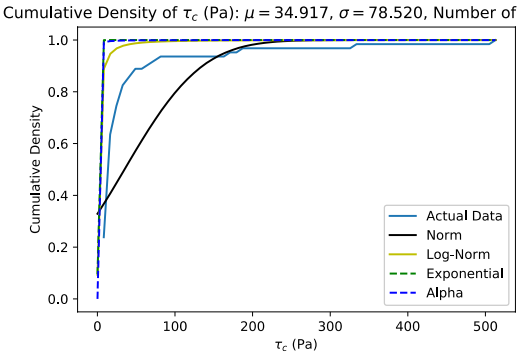
JET/Coarse



HET/Global

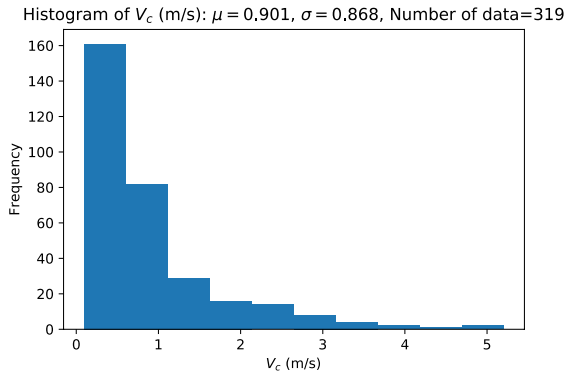


HET/Fine

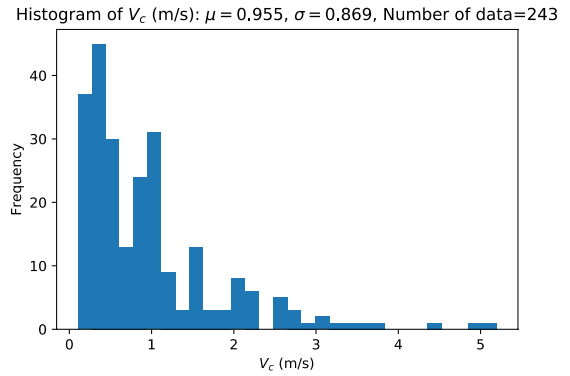


HET/Coarse

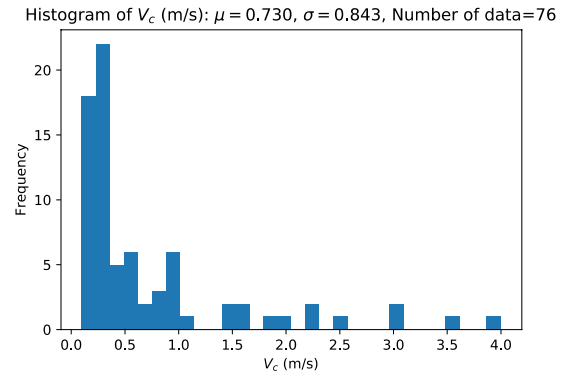
Critical Velocity (v_c) Histograms



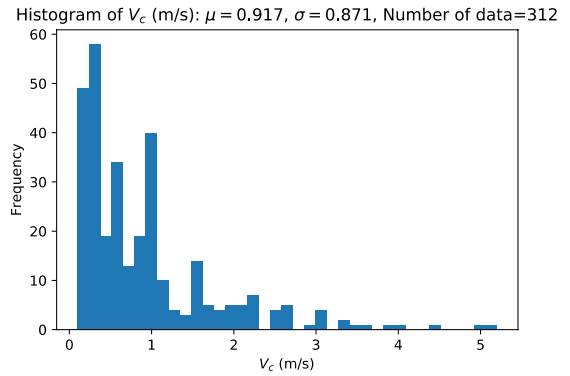
TAMU/Global



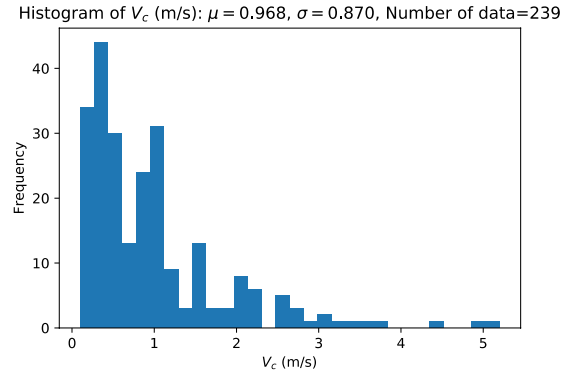
TAMU/Fine



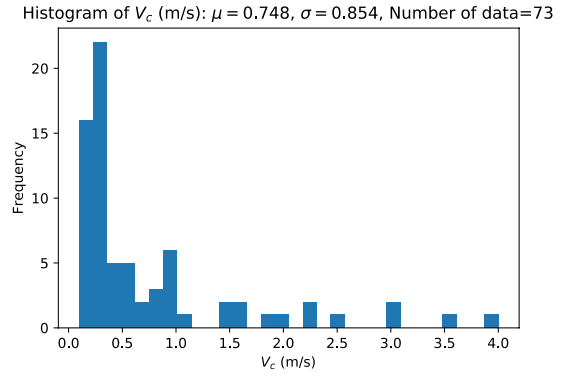
TAMU/Coarse



EFA/Global

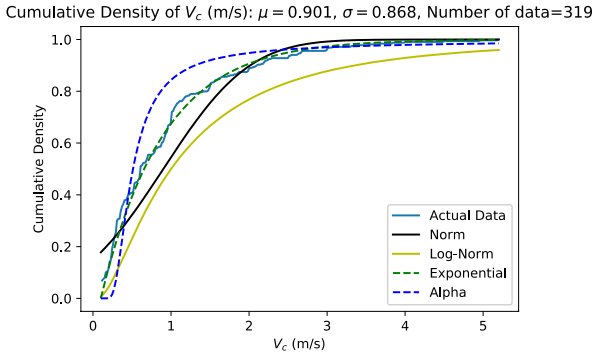


EFA/Fine

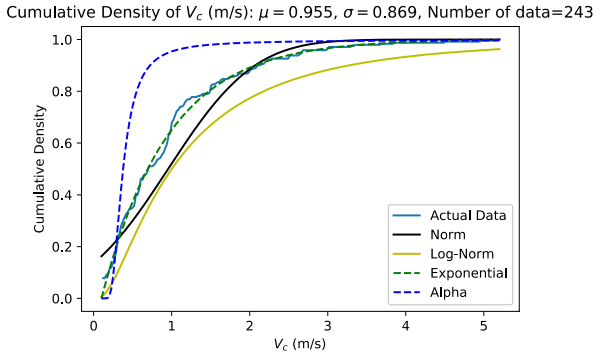


EFA/Coarse

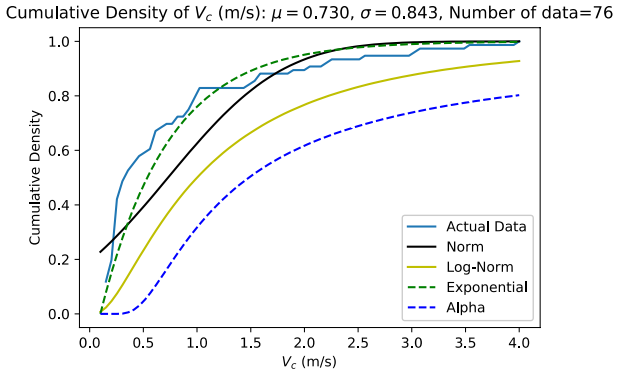
Critical Velocity (v_c) Empirical Cumulative Density Functions (ECDFs)



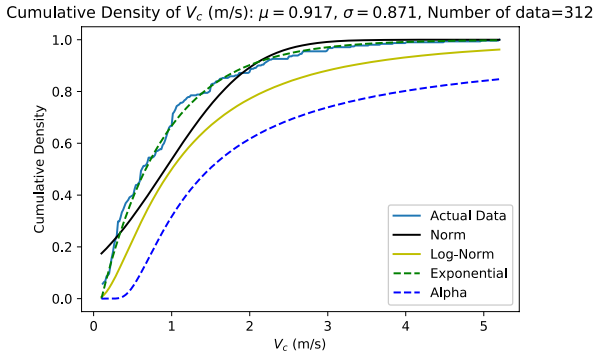
TAMU/Global



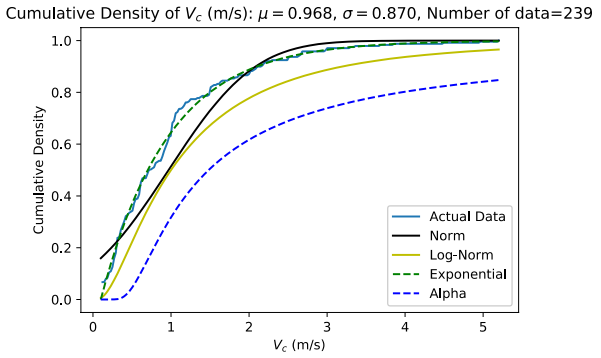
TAMU/Fine



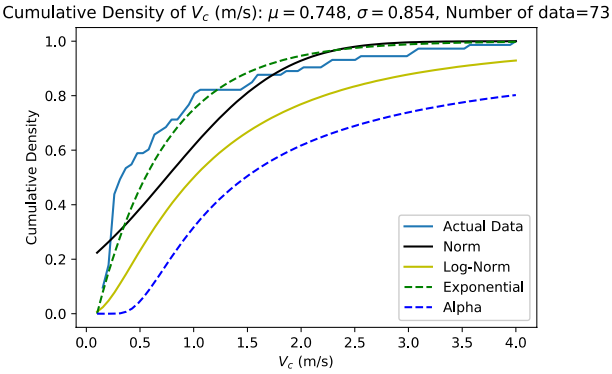
TAMU/Coarse



EFA/Global

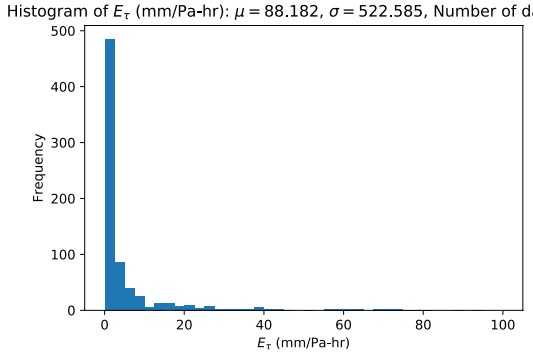


EFA/Fine

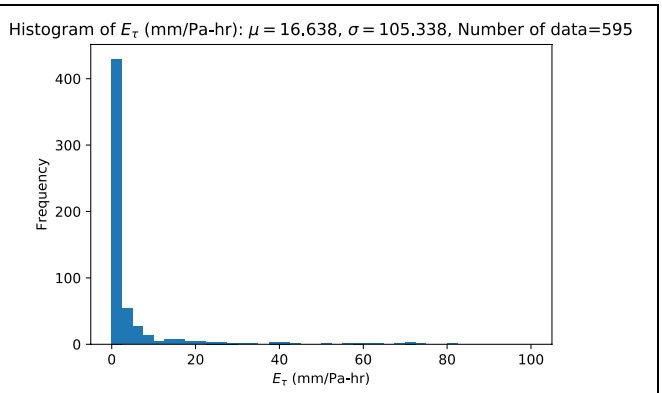


EFA/Coarse

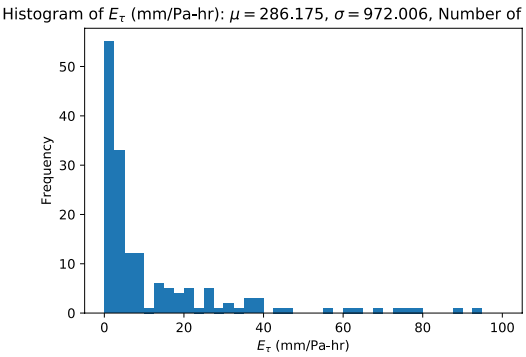
Shear Stress Slope (E_τ) Histograms



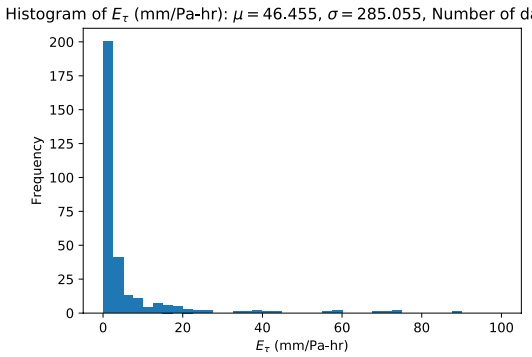
TAMU/Global



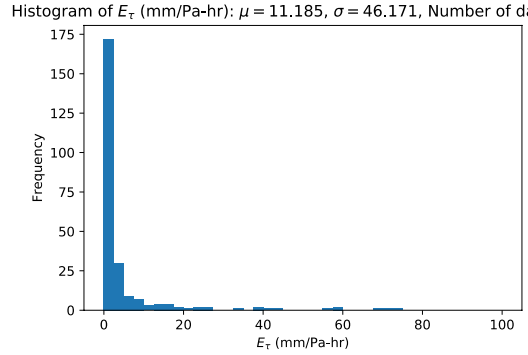
TAMU/Fine



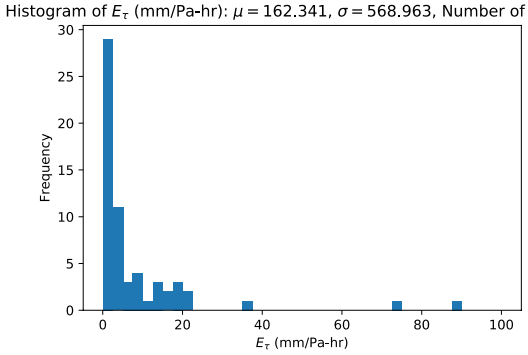
TAMU/Coarse



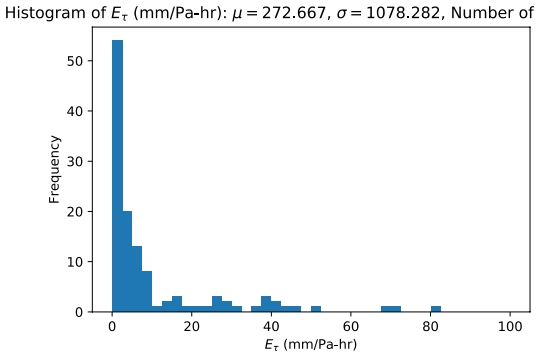
EFA/Global

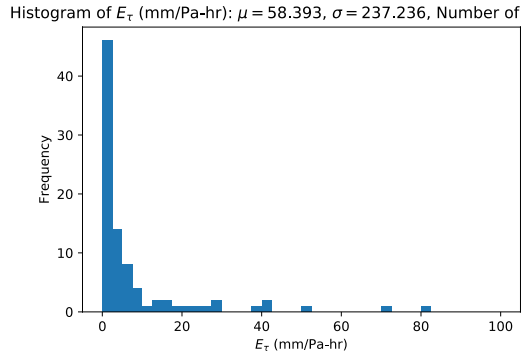


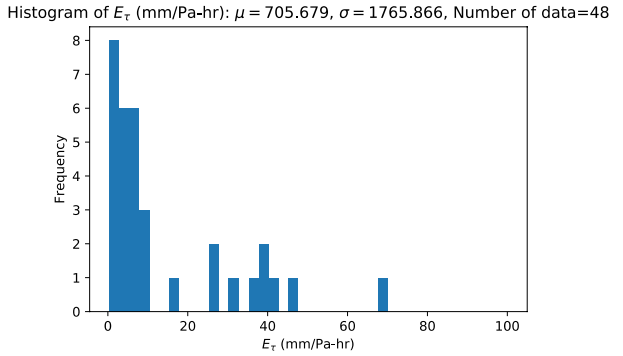
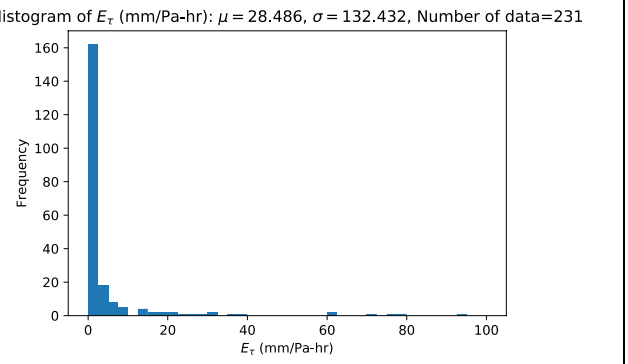
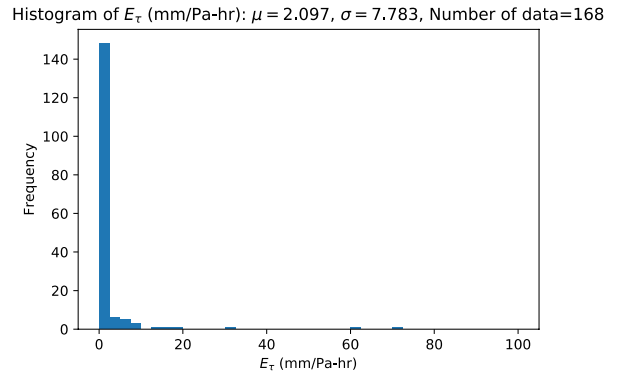
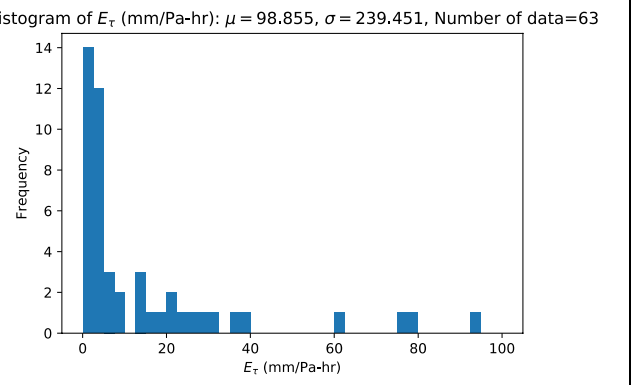
EFA/Fine



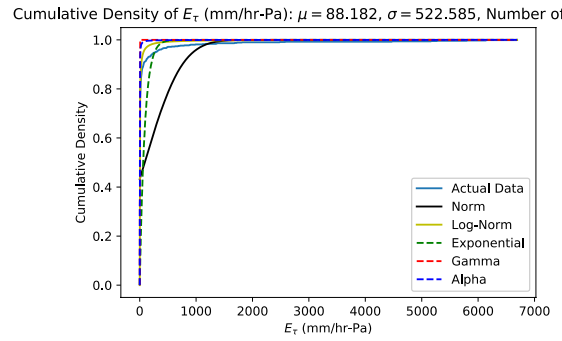
EFA/Coarse



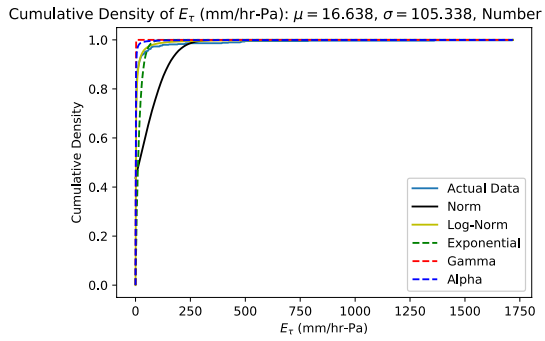


JET/Global	JET/Fine
	
JET/Coarse	**HET/Global**
	
HET/Fine	**HET/Coarse**

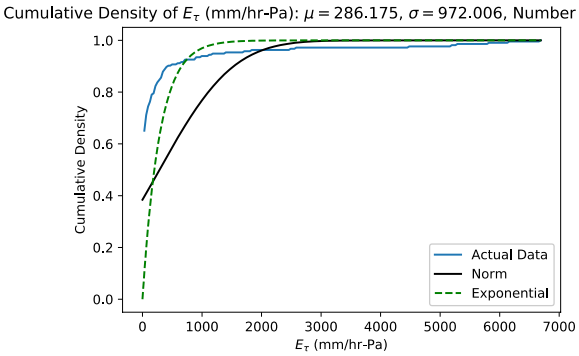
Shear Stress Slope (E_τ) Empirical Cumulative Density Functions (ECDFs)



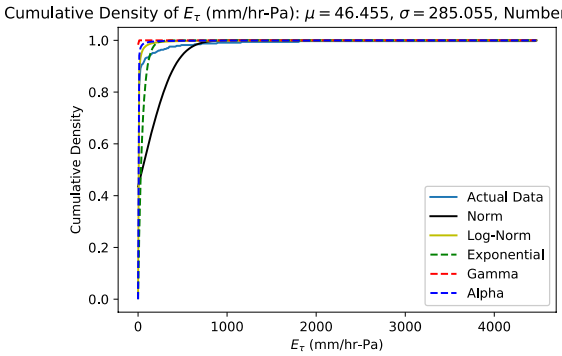
TAMU/Global



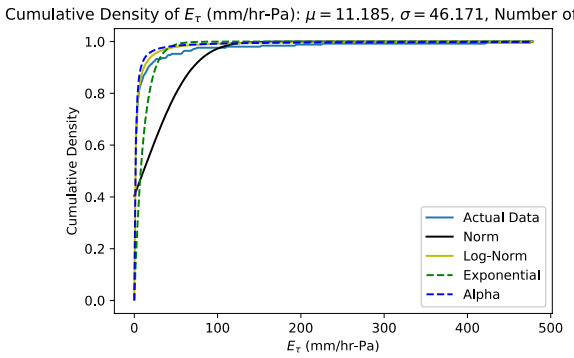
TAMU/Fine



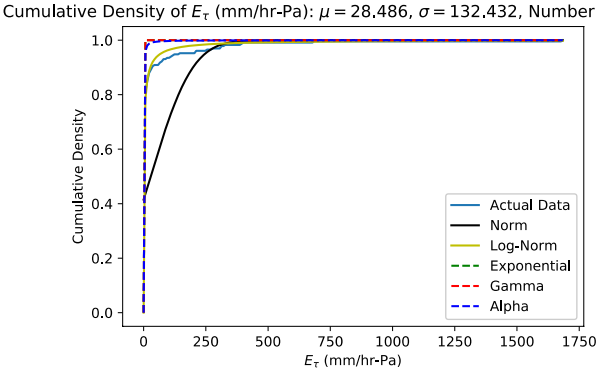
TAMU/Coarse



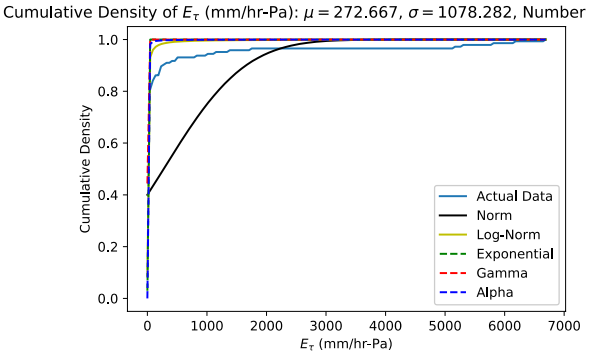
EFA/Global



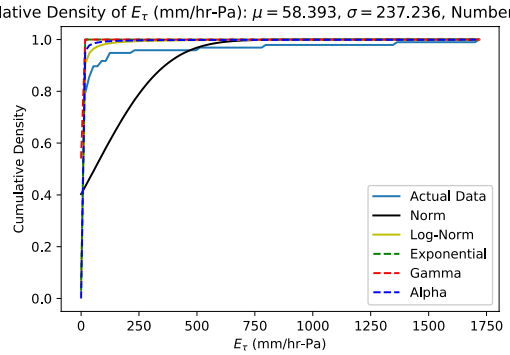
EFA/Fine



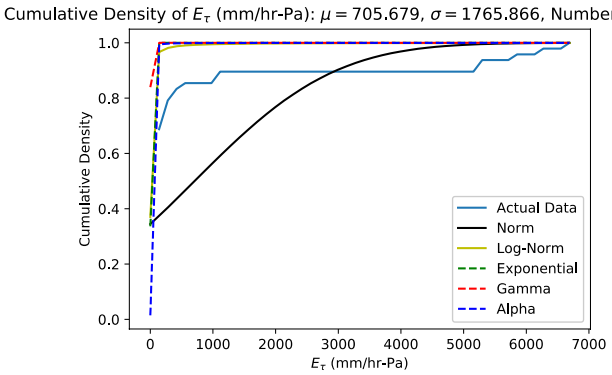
EFA/Coarse



JET/Global

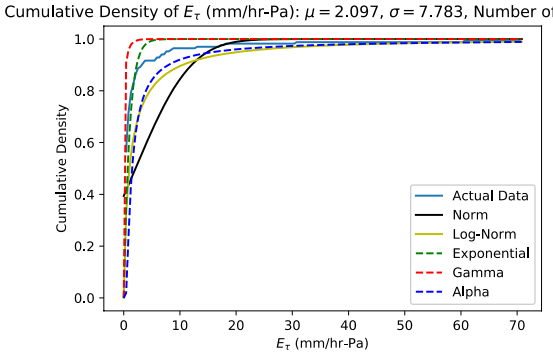


JET/Fine

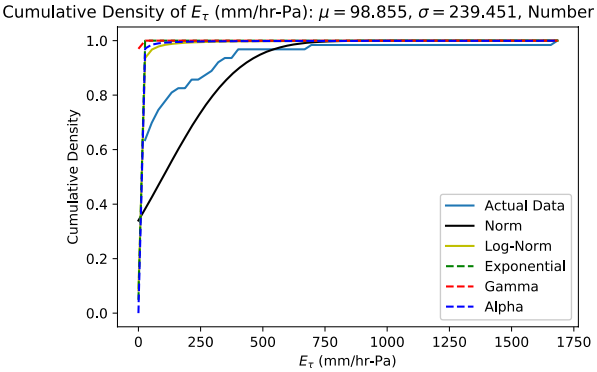


JET/Coarse

HET/Global

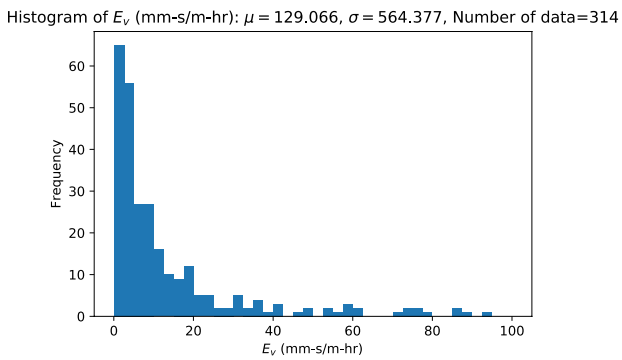


HET/Fine

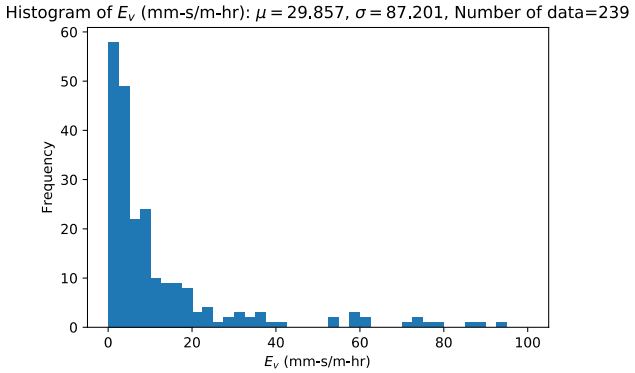


HET/Coarse

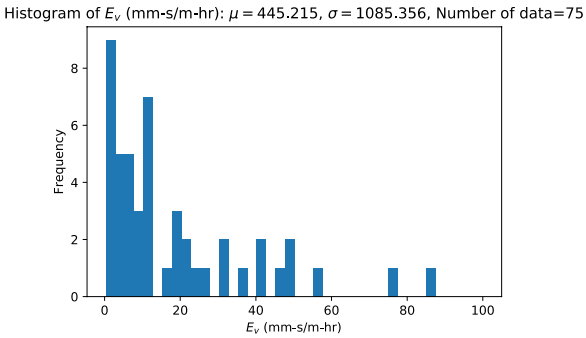
Velocity Slope (E_v) Histograms



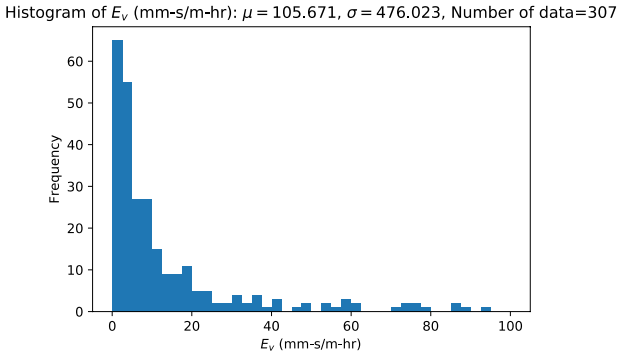
TAMU/Global



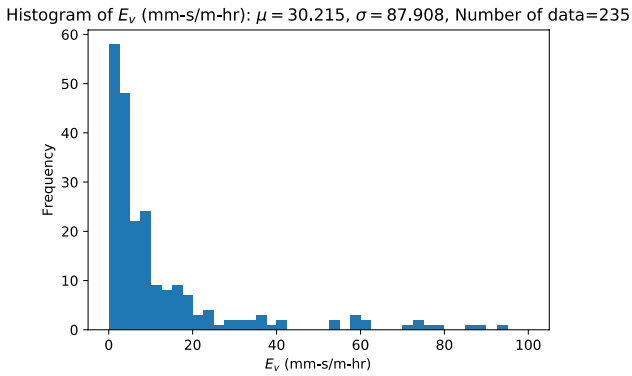
TAMU/Fine



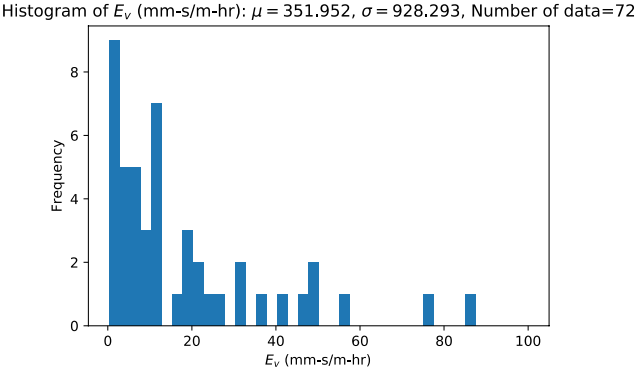
TAMU/Coarse



EFA/Global

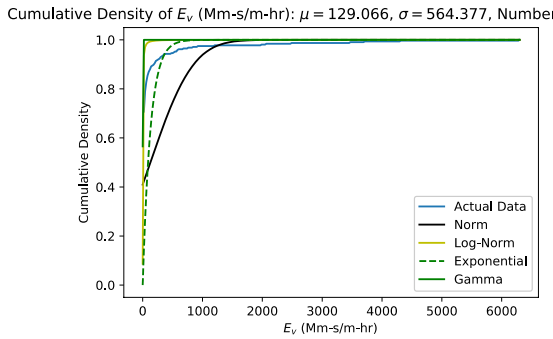


EFA/Fine

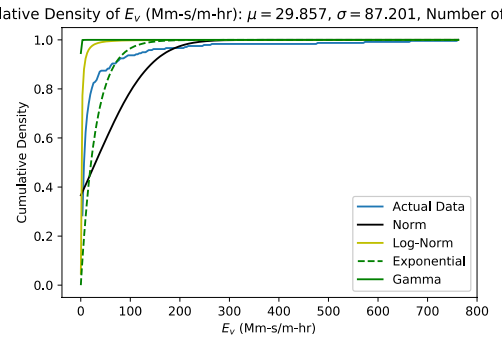


EFA/Coarse

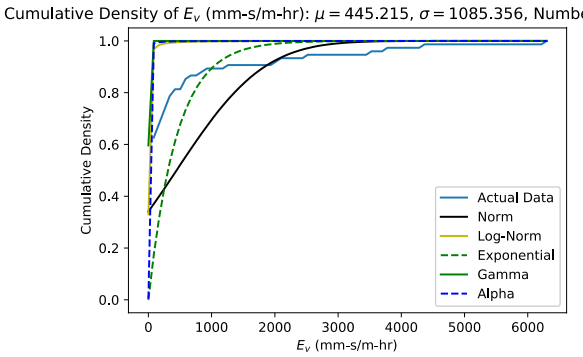
Velocity Slope (E_v) Empirical Cumulative Density Functions (ECDFs)



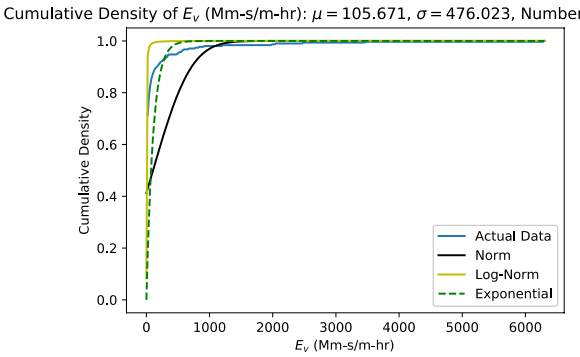
TAMU/Global



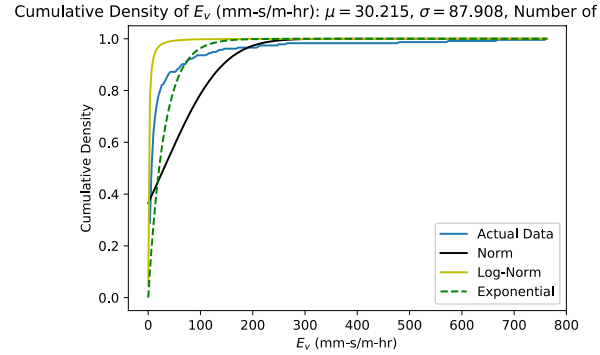
TAMU/Fine



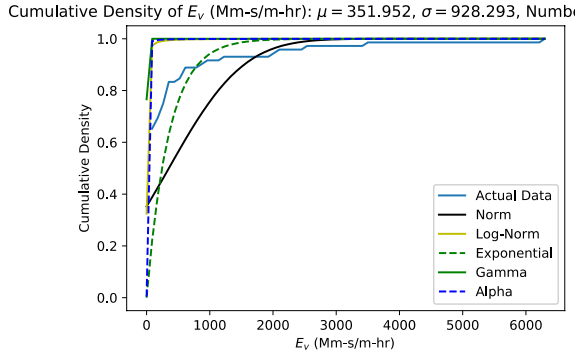
TAMU/Coarse



EFA/Global

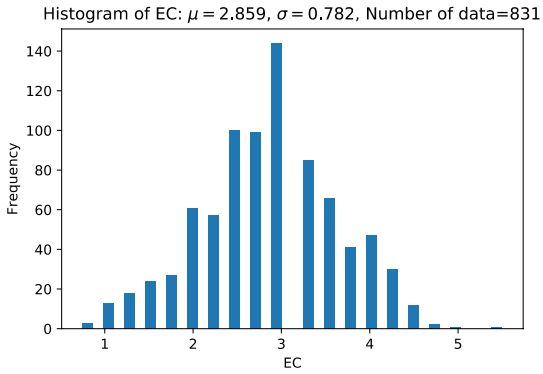


EFA/Fine

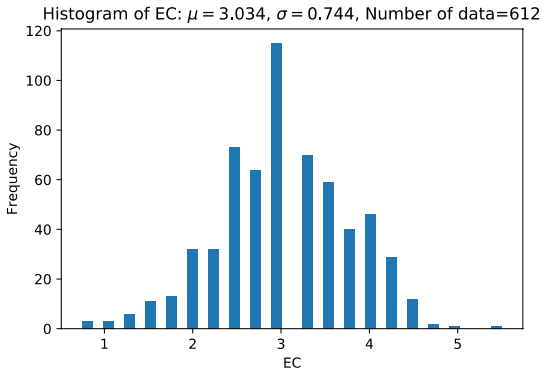


EFA/Coarse

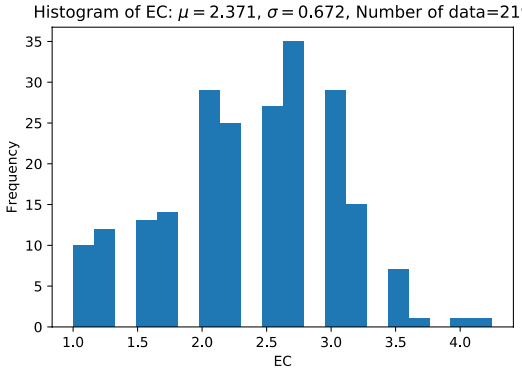
Erosion Category (EC) Histograms



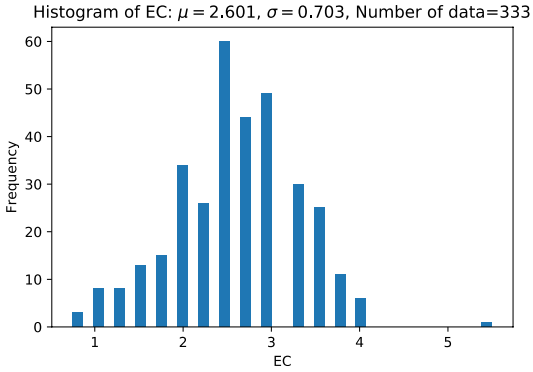
TAMU/Global



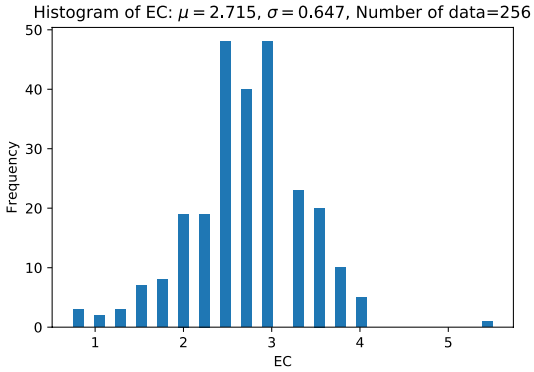
TAMU/Fine



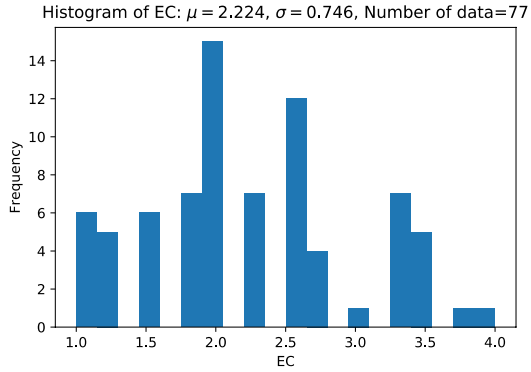
TAMU/Coarse



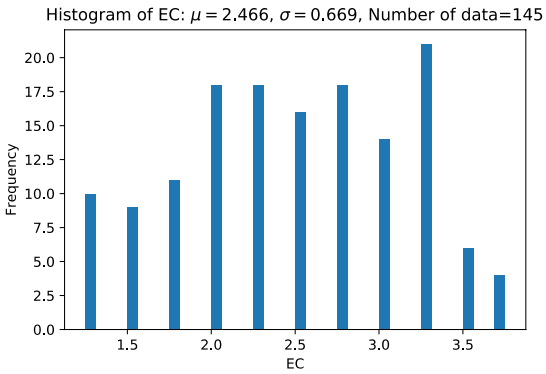
EFA/Global



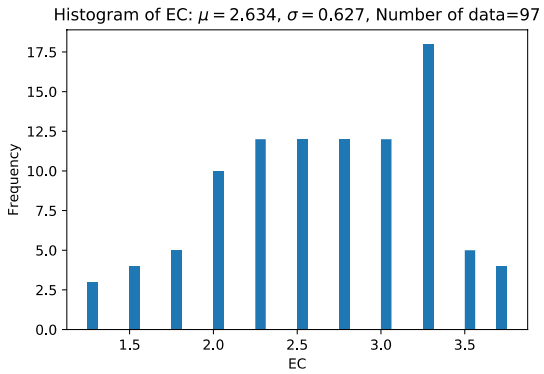
EFA/Fine



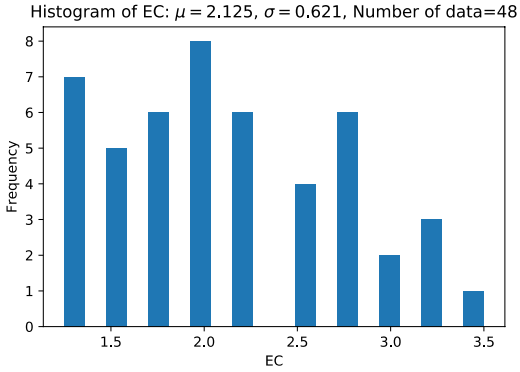
EFA/Coarse



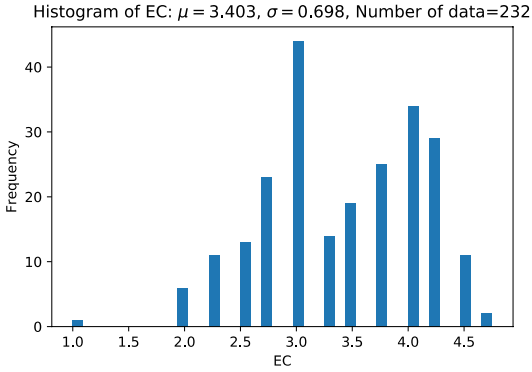
JET/Global



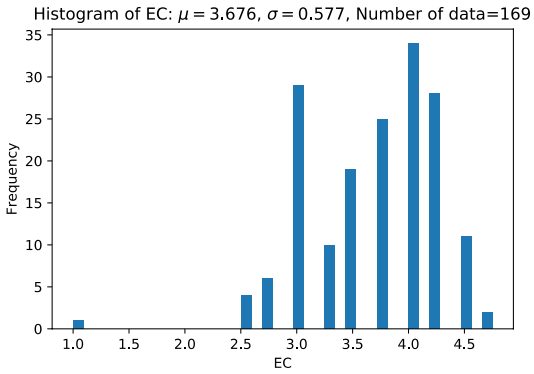
JET/Fine



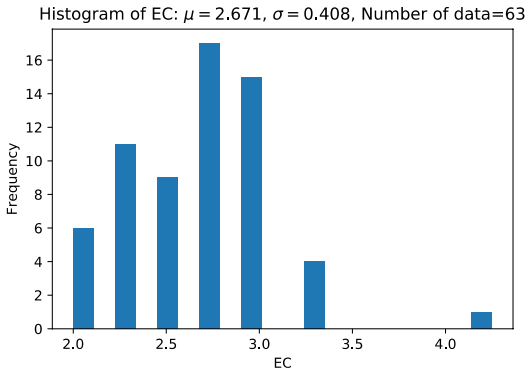
JET/Coarse



HET/Global

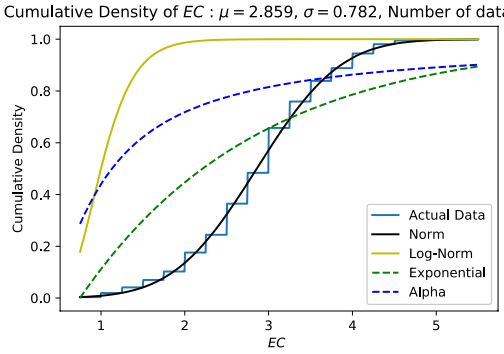


HET/Fine

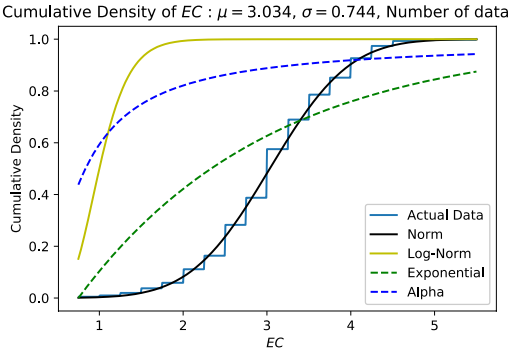


HET/Coarse

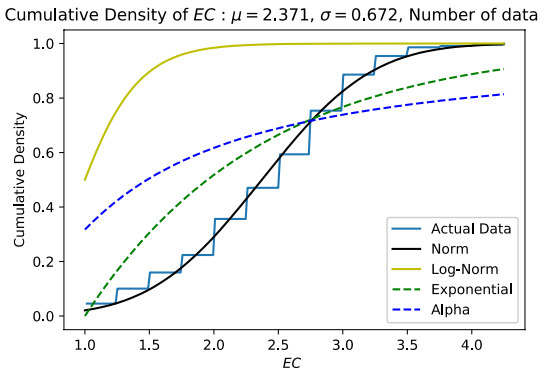
Erosion Category (EC) Empirical Cumulative Density Functions (ECDFs)



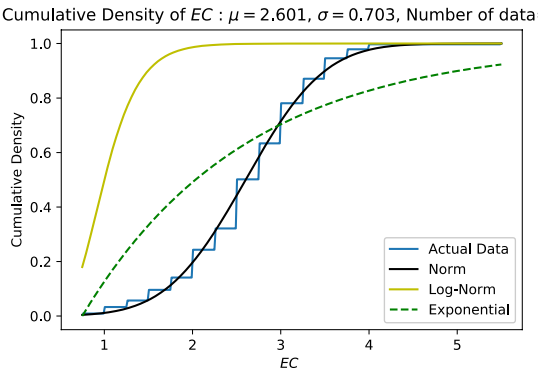
TAMU/Global



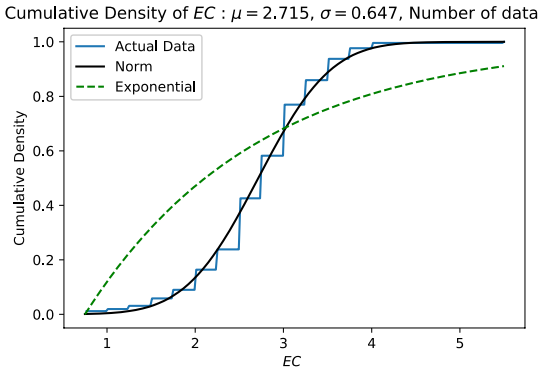
TAMU/Fine



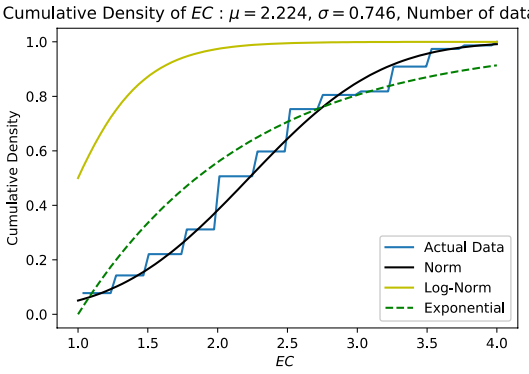
TAMU/Coarse



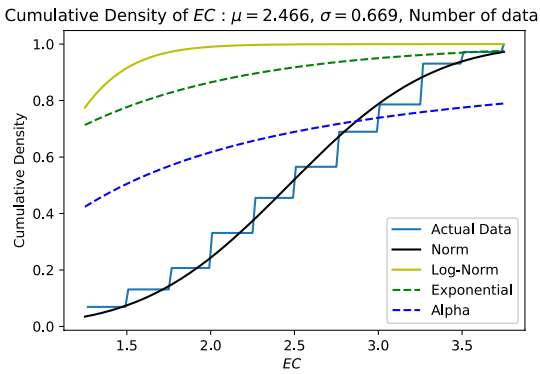
EFA/Global



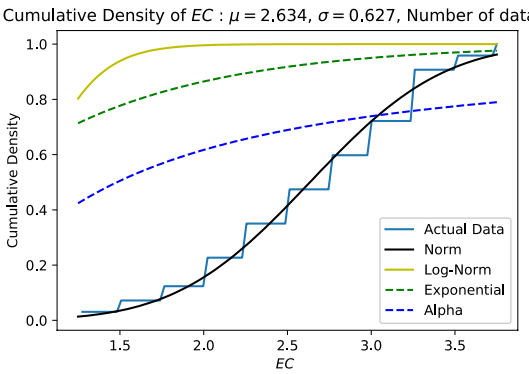
EFA/Fine



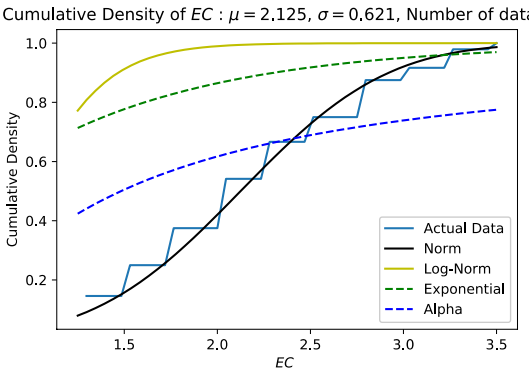
EFA/Coarse



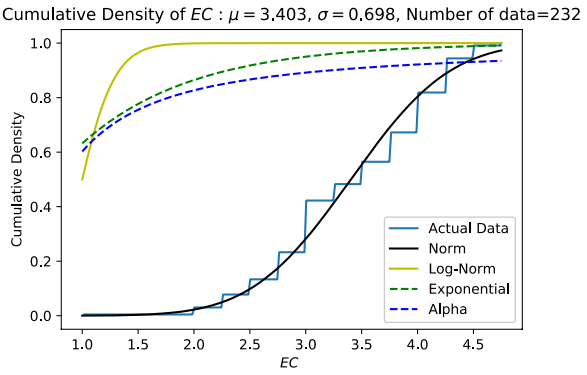
JET/Global



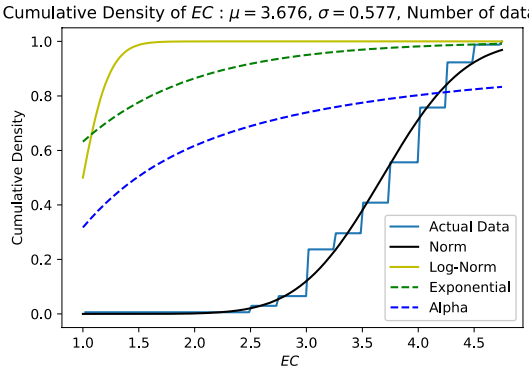
JET/Fine



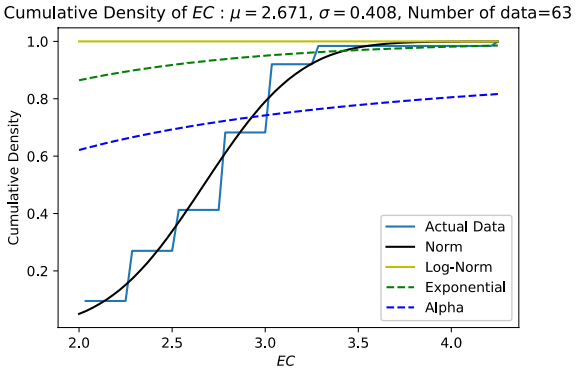
JET/Coarse



HET/Global



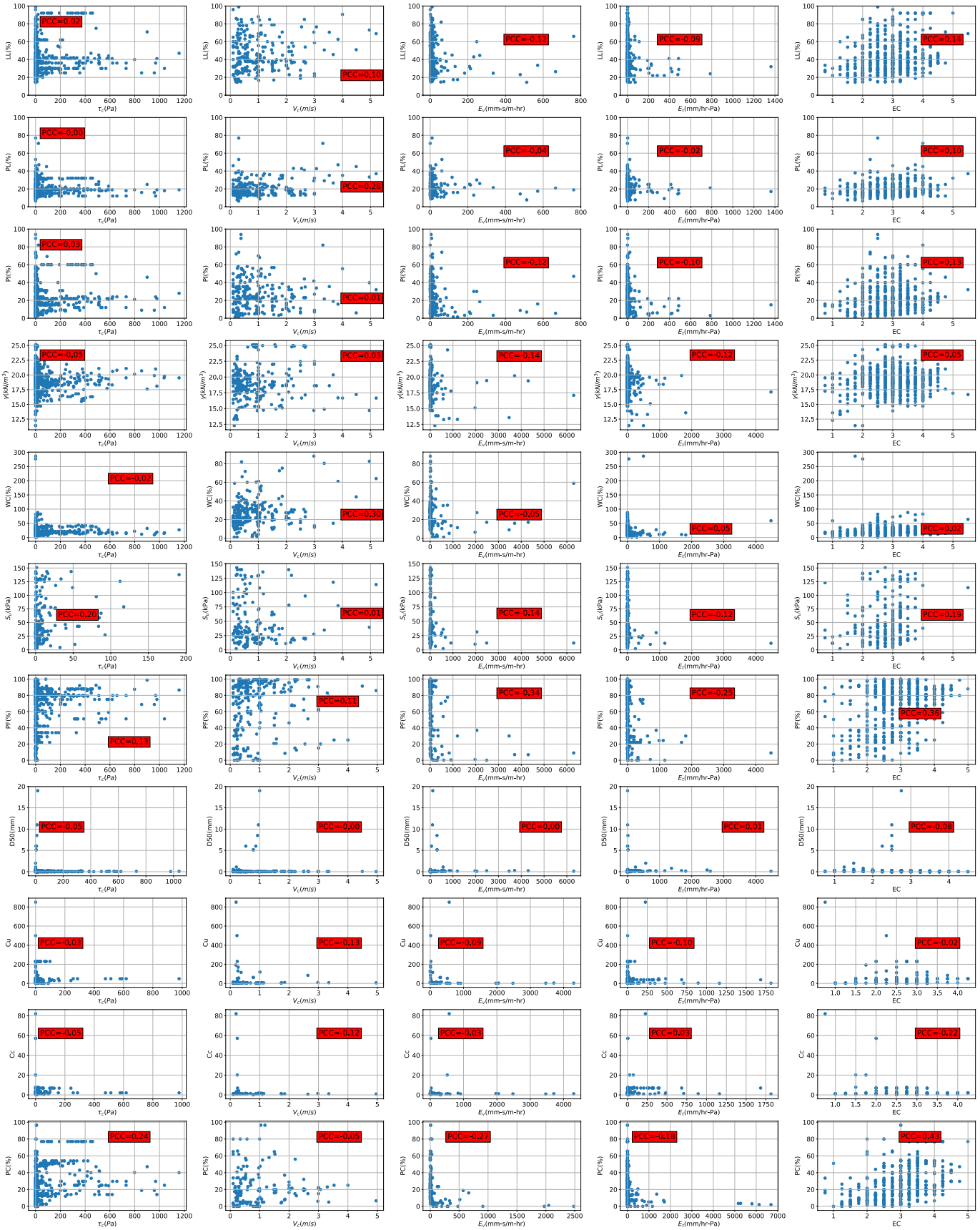
HET/Fine



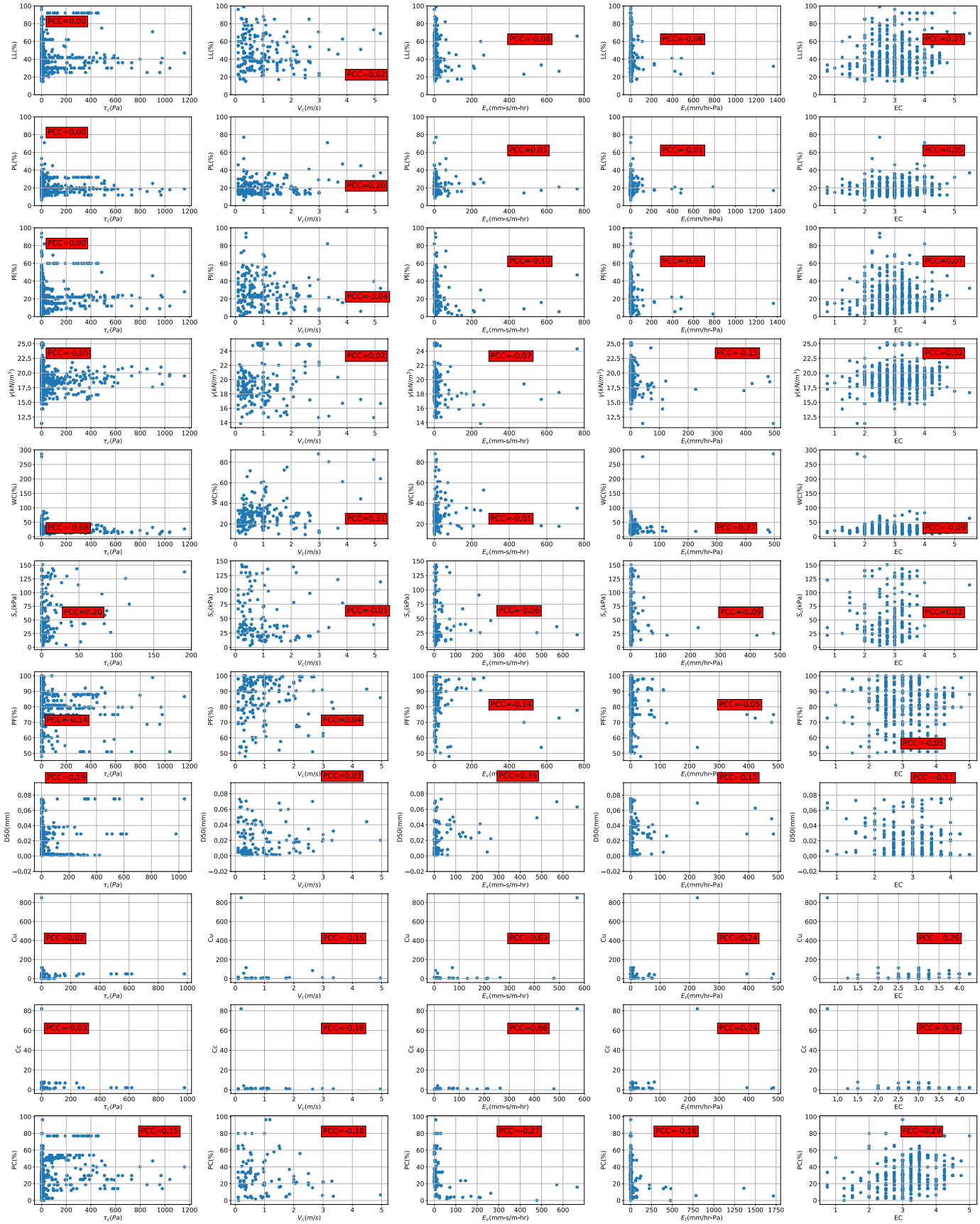
HET/Coarse

Second Order Statistics of the Erodibility Parameters

Correlation Matrix for TAMU/Global

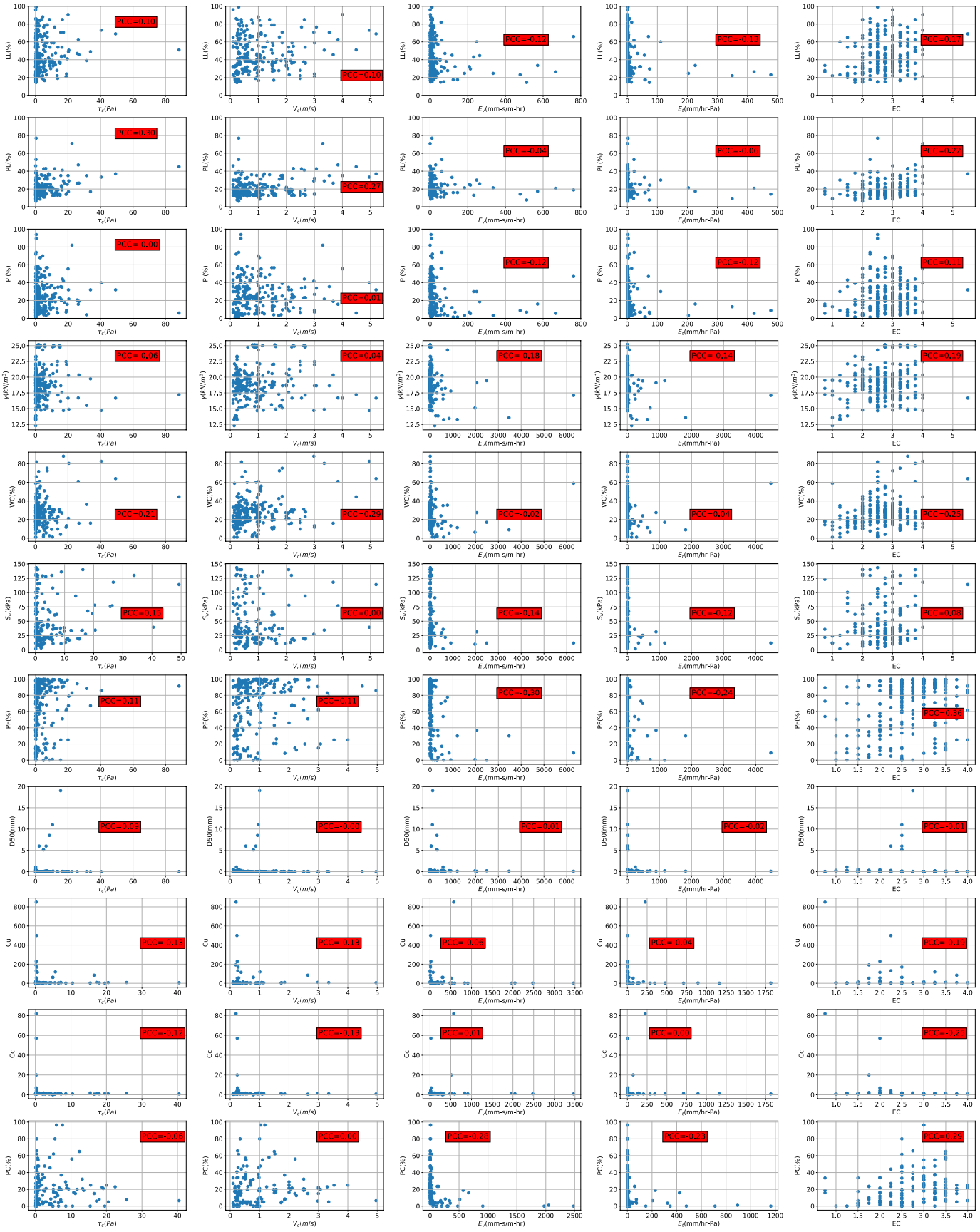


Correlation Matrix for TAMU/Fine

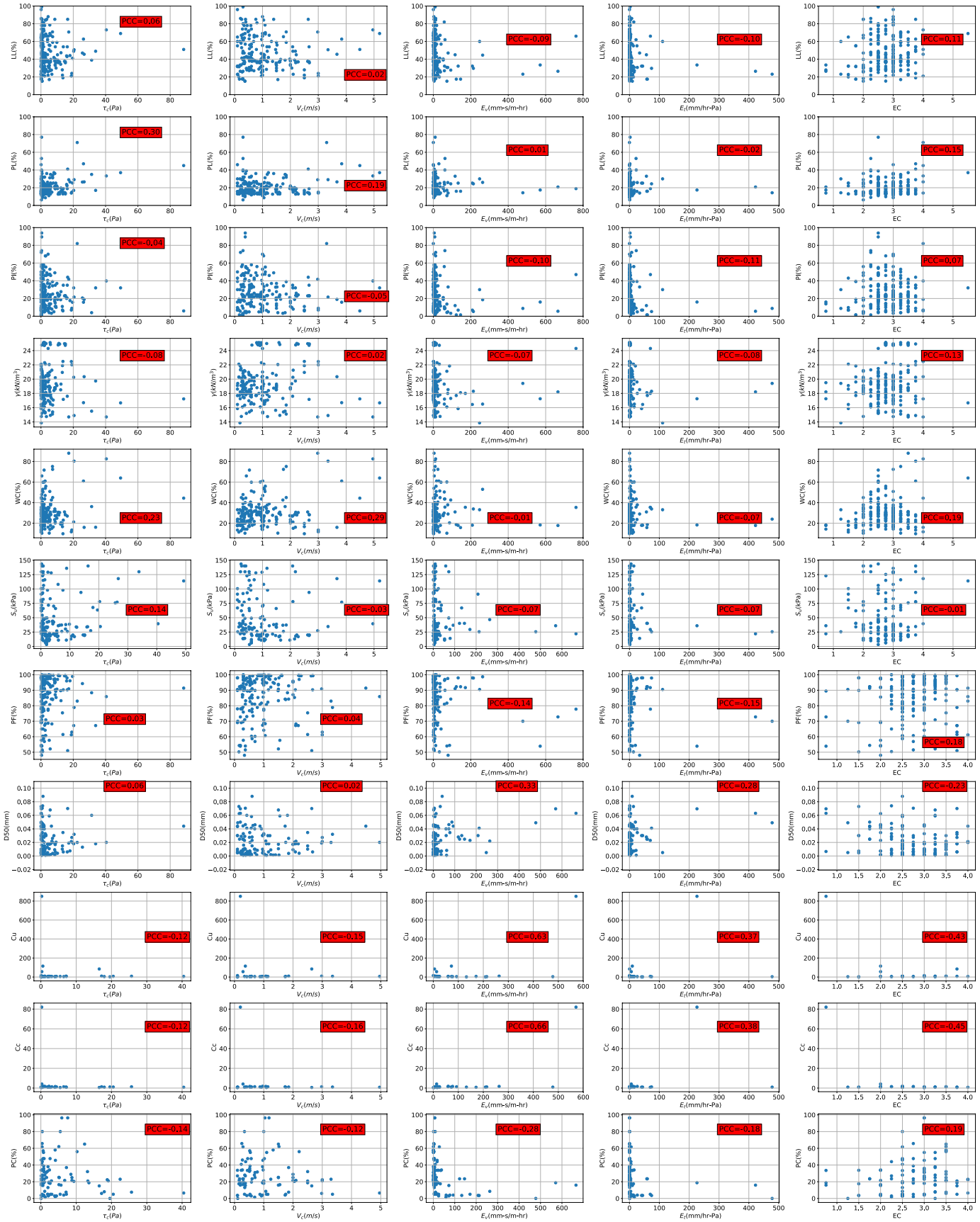


Correlation Matrix for TAMU/Coarse

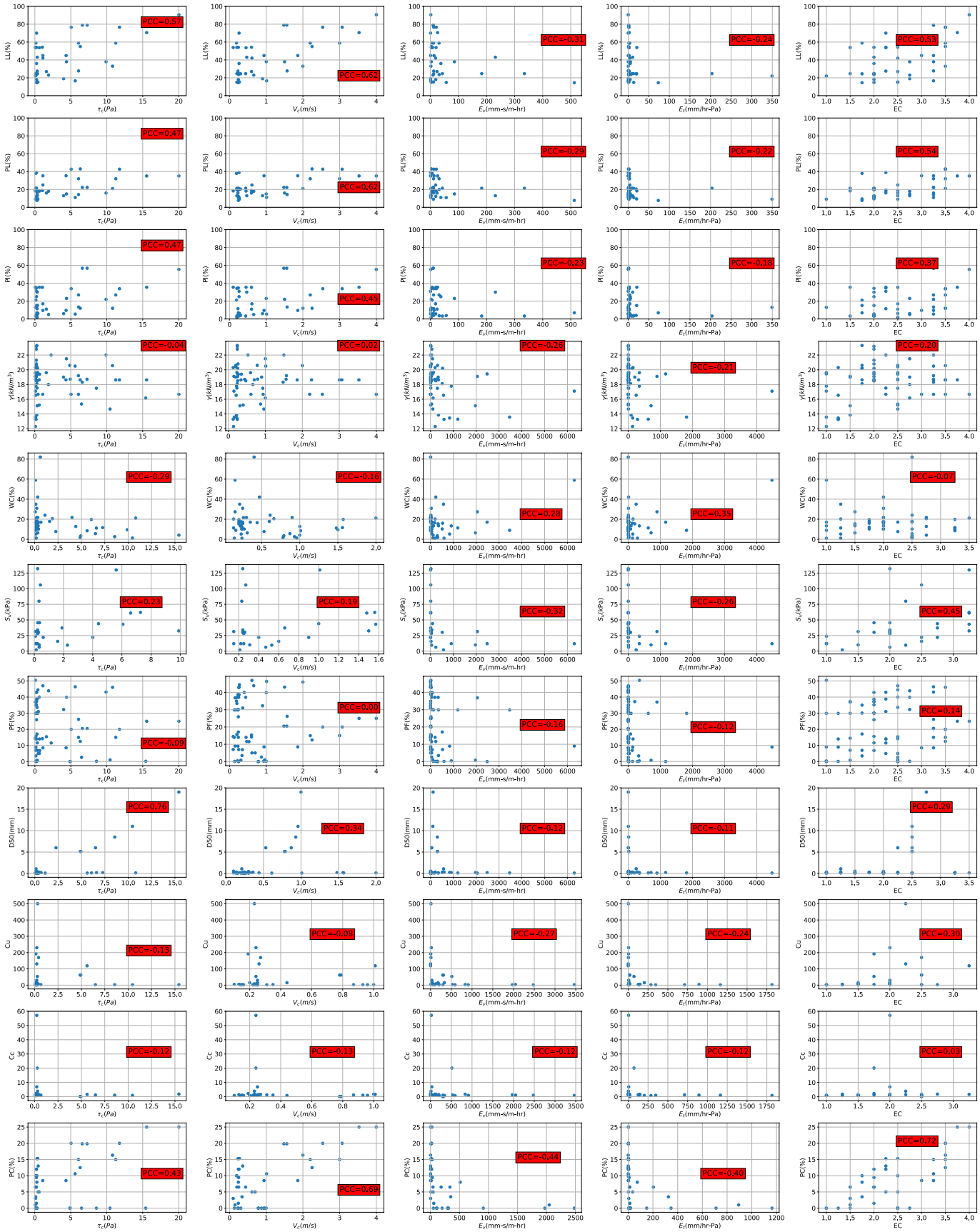
Correlation Matrix for EFA/Global



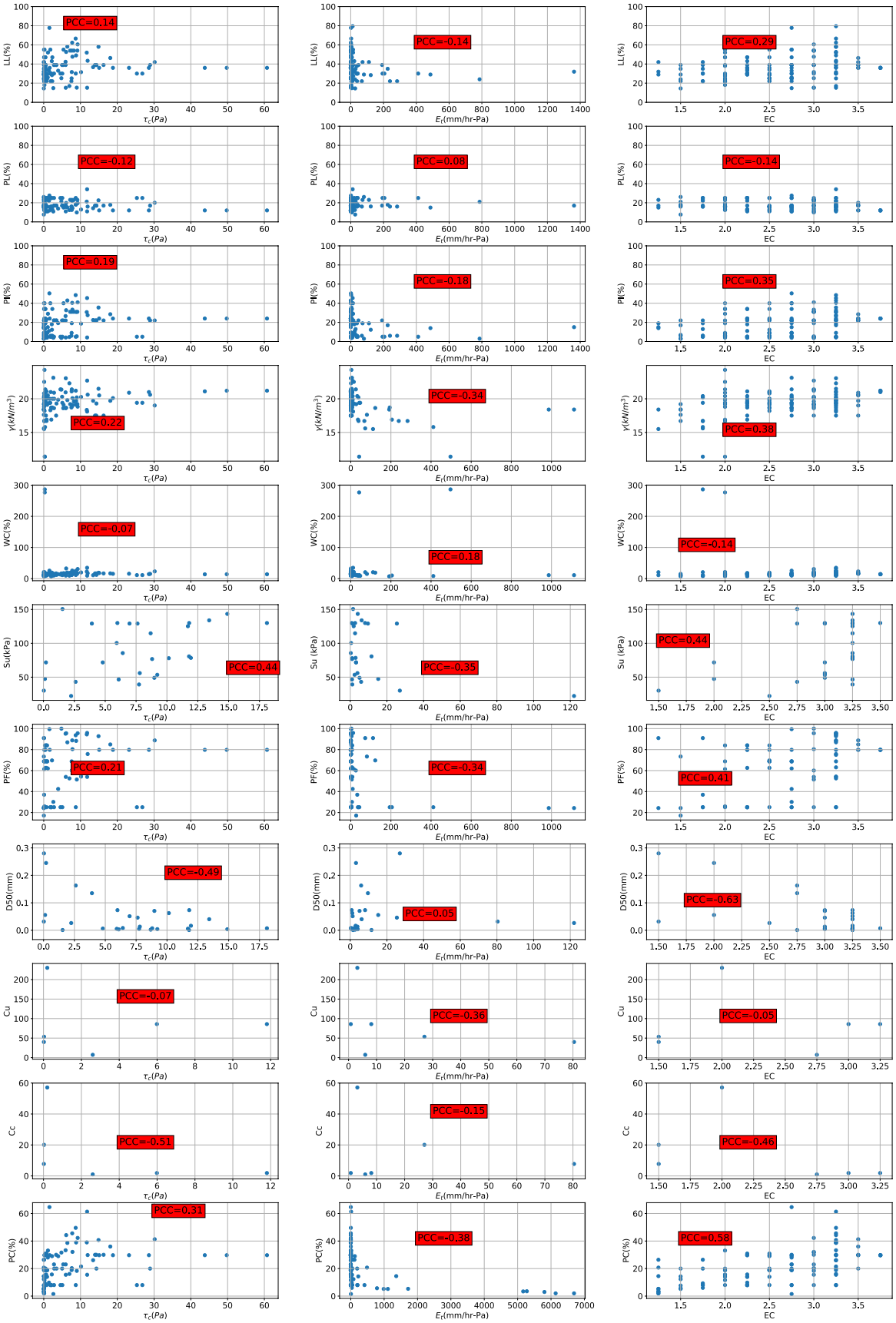
Correlation Matrix for EFA/Fine



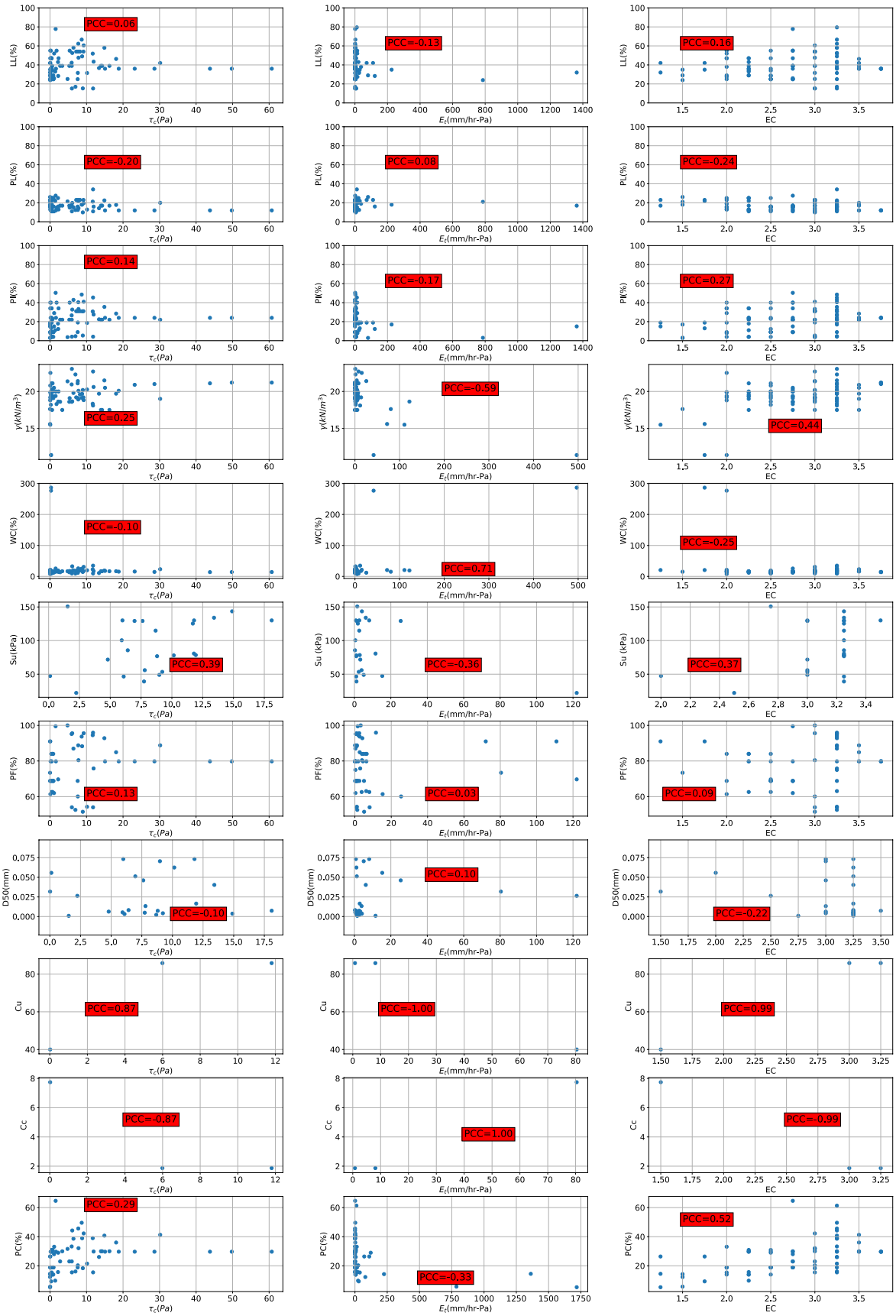
Correlation Matrix for EFA/Coarse



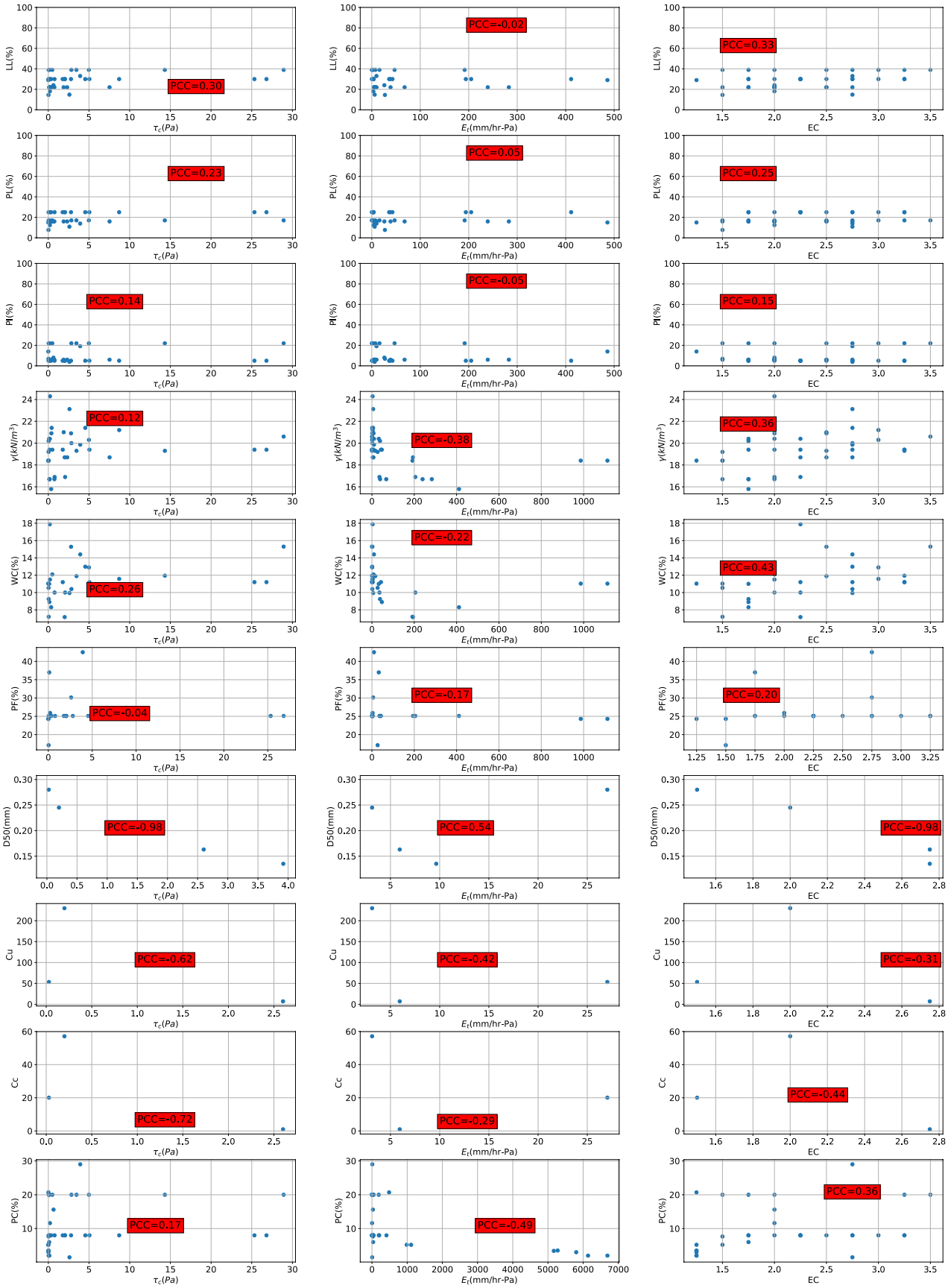
Correlation Matrix for JET/Global



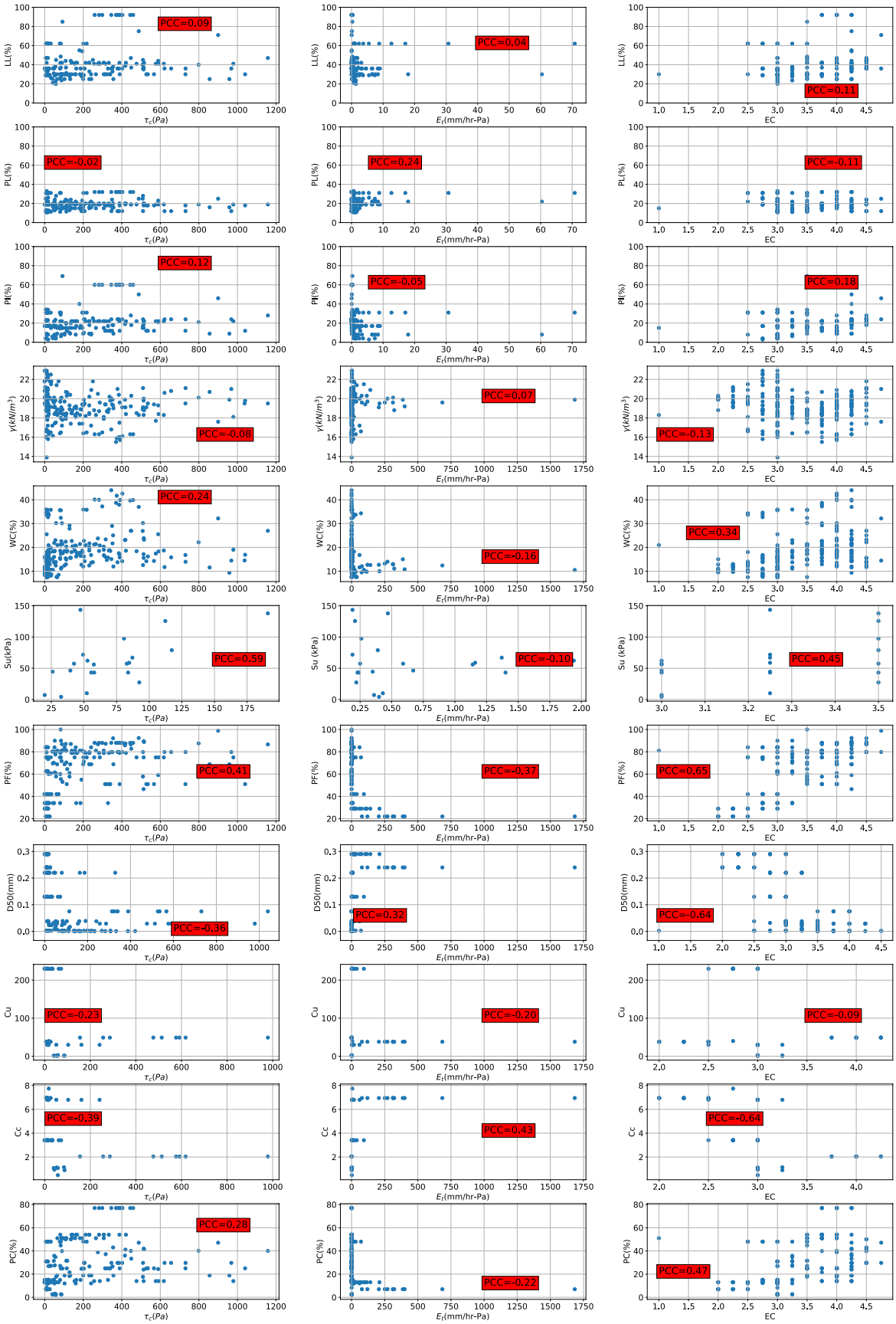
Correlation Matrix for JET/Fine



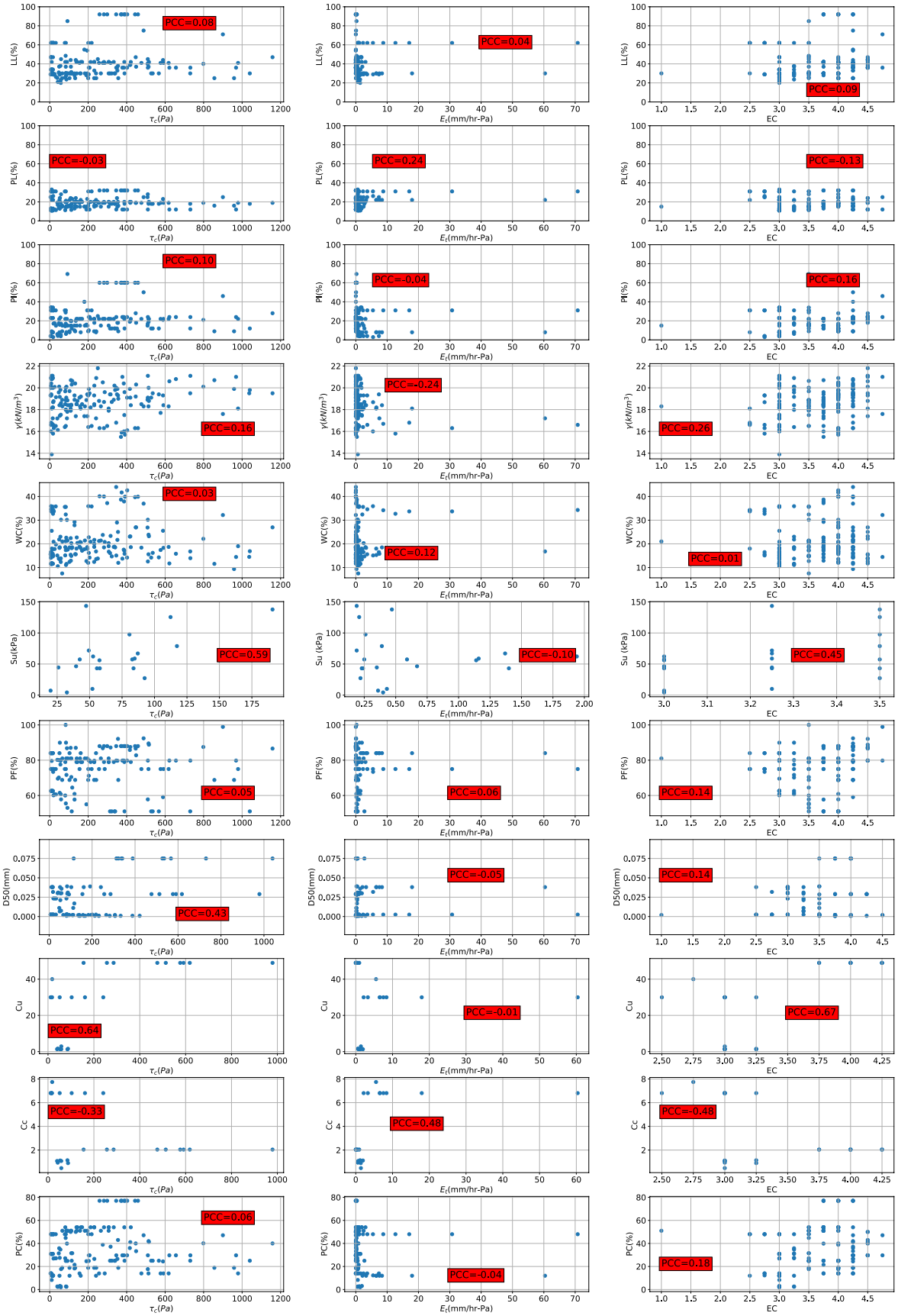
Correlation Matrix for JET/Coarse



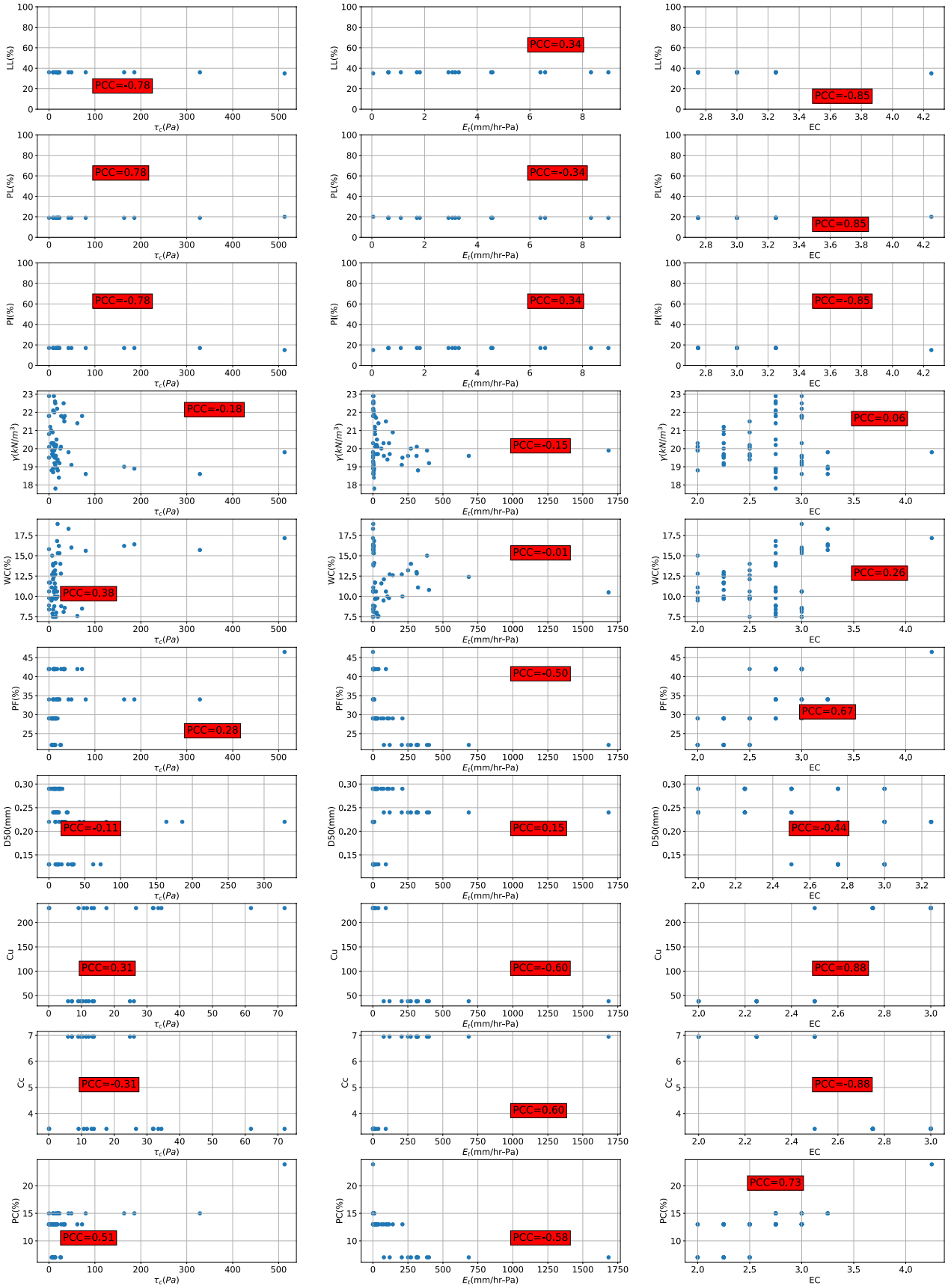
Correlation Matrix for HET/Global



Correlation Matrix for HET/Fine



Correlation Matrix for HET/Coarse



APPENDIX 4 – DETERMINISTIC FREQUENTISTS' REGRESSION ANALYSIS

Units of the Parameters Used in Regression Analyses

Parameter	Description	Unit
τ_c	Critical Shear Stress	Pa
C_c	Coefficient of Curvature	-
C_u	Coefficient of Uniformity	-
D50	Mean Particle Size	mm
EC	Erosion Category	-
E_v	Slope of Velocity-Erosion Rate	mm-s/m-hr
E_τ	Slope of Shear-Erosion Rate	Mm/hr-Pa
LL	Liquid Limit	%
PC	Clay Percentage (<0.002 mm)	%
PF	Percent Finer than Sieve #200	%
PI	Plasticity Index	%
PL	Plastic Limit	%
PP	Pocket Penetrometer Strength	kPa
S_u	Undrained Shear Strength	kPa
V_c	Critical Velcoity	m/s
VST	Vane Shear Strength	kPa
WC	Water Content	%
γ	Unit weight	kN/m^3

List of the Soil Parameter Combination Groups

Global and Fine Datasets

1- LL, PL, γ
2- LL, PL
3- LL, γ
4- LL, PL, γ, WC
5- LL, PL, γ, WC, S_u
6- LL, PF
7- PI, PF
8- PI, D50
9- PI, S_u
10- PI, WC
11- PI, γ, WC
12- PI, γ, S_u
13- PI, γ, PF
14- PI, γ, D50
15- PI, WC, S_u
16- PI, WC, PF
17- PI, WC, D50
18- PI, S_u, PF
19- PI, S_u, D50
20- γ, WC, S_u
21- γ, WC, PF
22- γ, WC, D50
23- WC, S_u, PF
24- WC, S_u, D50
25- S_u, γ, PF
26- S_u, γ, D50
27- PF, PI, D50
28- PF, γ, D50
29- PF, WC, D50
30- PF, S_u, D50
31- PI, γ, WC, S_u
32- PI, γ, WC, PF
33- PI, γ, WC, D50
34- PI, γ, S_u, PF
35- PI, γ, S_u, D50
36- PI, γ, PF, D50
37- PI, WC, S_u, PF
38- PI, WC, S_u, D50
39- PI, WC, PF, D50
40- PI, S_u, PF, D50
41- γ, WC, S_u, PF
42- γ, WC, S_u, D50
43- γ, S_u, PF, D50
44- WC, S_u, PF, D50
45- PI, S_u, PF, D50
46- γ, WC, PF, D50

47- PI, γ, WC, S_u, PF
48- PI, γ, WC, S_u, D50
49- γ, WC, S_u, PF, D50
50- PI, γ, S_u, PF, D50
51- PI, γ, WC, PF, D50
52- PI, WC, S_u, PF, D50
53- PI, γ, WC, S_u, PF, D50
54- LL, γ, WC
55- LL, γ, S_u
56- LL, γ, PF
57- LL, γ, D50
58- LL, WC, S_u
59- LL, WC, PF
60- LL, WC, D50
61- LL, S_u, PF
62- LL, S_u, D50
63- PF, LL, D50
64- LL, γ, WC, S_u
65- LL, γ, WC, PF
66- LL, γ, WC, D50
67- LL, γ, S_u, PF
68- LL, γ, S_u, D50
69- LL, γ, PF, D50
70- LL, WC, S_u, PF
71- LL, WC, S_u, D50
72- LL, WC, PF, D50
73- LL, S_u, PF, D50
74- LL, γ, WC, S_u, PF
75- LL, γ, WC, S_u, D50
76- LL, γ, S_u, PF, D50
77- LL, γ, WC, PF, D50
78- LL, WC, S_u, PF, D50
79- LL, γ, WC, S_u, PF, D50
80- PL, γ, WC
81- PL, γ, S_u
82- PL, γ, PF
83- PL, γ, D50
84- PL, WC, S_u
85- PL, WC, PF
86- PL, WC, D50
87- PL, S_u, PF
88- PL, S_u, D50
89- PF, PL, D50
90- PL, γ, WC, S_u
91- PL, γ, WC, PF
92- PL, γ, WC, D50
93- PL, γ, S_u, PF
94- PL, γ, S_u, D50

95- PL, γ, PF, D50
96- PL, WC, S_u, PF
97- PL, WC, S_u, D50
98- PL, WC, PF, D50
99- PL, S_u, PF, D50
100-PL, γ, WC, S_u, PF
101-PL, γ, WC, S_u, D50
102-PL, γ, S_u, PF, D50
103-PL, γ, WC, PF, D50
104-PL, WC, S_u, PF, D50
105-PL, γ, WC, S_u, PF, D50
106-PC, PL, γ
107-LL, PC
108-LL, PL, γ, PC, S_u
109-PC, γ, WC, S_u, PF, D50
110-PC, WC, S_u, PF, D50
111-PC, γ, WC, PF, D50
112-PC, γ, S_u, PF, D50
113-PC, γ, WC, S_u, D50
114-PC, γ, WC, S_u, PF
115-PC, S_u, PF, D50
116-PC, WC, PF, D50
117-PC, WC, S_u, D50
118-PC, WC, S_u, PF
119-PC, γ, PF, D50
120-PC, WC, D50
121-WC, A, γ
122-A, WC
123-A, PL, γ, WC, S_u
124-γ, A, WC, S_u, PF, D50
125-γ, WC, S_u, PF, A
126-D50, γ, WC, PF, A
127-D50, γ, S_u, PF, A
128-D50, γ, WC, S_u, A
129-LL, γ, A, S_u, PF
130-D50, S_u, PF, A
131-D50, WC, PF, A
132-A, WC, S_u, D50
133-A, WC, Su, PF
134-A, γ, PF, D50
135-A, WC, D50

Coarse Datasets

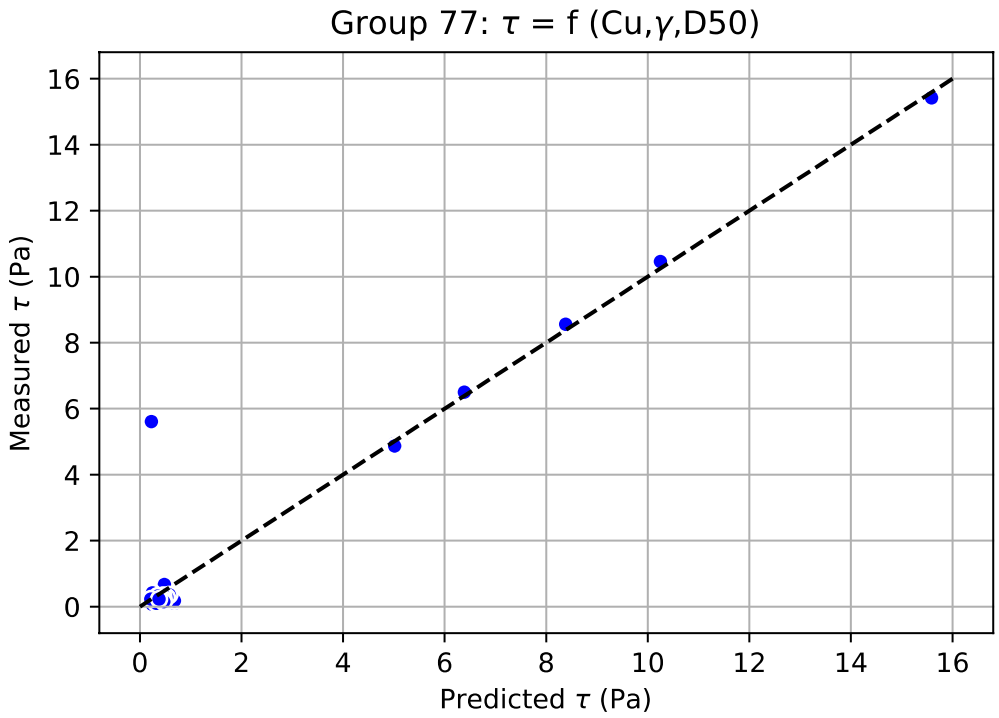
1- PI, PF
2- PI, D50
3- PI, VST
4- PI, WC
5- PI, γ, WC
6- PI, γ, VST
7- PI, γ, PF
8- PI, γ, D50
9- PI, WC, VST
10- PI, WC, PF
11- PI, WC, D50
12- PI, VST, PF
13- PI, VST, D50
14- γ, WC, VST
15- γ, WC, PF
16- γ, WC, D50
17- WC, VST, PF
18- WC, VST, D50
19- VST, γ, PF
20- VST, γ, D50
21- PF, PI, D50
22- PF, γ, D50
23- PF, WC, D50
24- PF, VST, D50
25- PI, γ, WC, VST
26- PI, γ, WC, PF
27- PI, γ, WC, D50
28- PI, γ, VST, PF
29- PI, γ, VST, D50
30- PI, γ, PF, D50
31- PI, WC, VST, PF
32- PI, WC, VST, D50
33- PI, WC, PF, D50
34- PI, VST, PF, D50
35- γ, WC, VST, PF
36- γ, WC, VST, D50
37- γ, VST, PF, D50
38- WC, VST, PF, D50
39- PI, VST, PF, D50
40- γ, WC, PF, D50
41- PI, γ, WC, VST, PF
42- PI, γ, WC, VST, D50
43- γ, WC, VST, PF, D50
44- PI, γ, VST, PF, D50
45- PI, γ, WC, PF, D50
46- PI, WC, VST, PF, D50

47- PI, γ, WC, VST, PF, D50
48- C_c, γ, WC
49- C_c, γ, VST
50- C_c, γ, PF
51- C_c, γ, D50
52- C_c, WC, VST
53- C_c, WC, PF
54- C_c, WC, D50
55- C_c, VST, PF
56- C_c, VST, D50
57- PF, C_c, D50
58- C_c, γ, WC, VST
59- C_c, γ, WC, PF
60- C_c, γ, WC, D50
61- C_c, γ, VST, PF
62- C_c, γ, VST, D50
63- C_c, γ, PF, D50
64- C_c, WC, VST, PF
65- C_c, WC, VST, D50
66- C_c, WC, PF, D50
67- C_c, VST, PF, D50
68- C_c, γ, WC, VST, PF
69- C_c, γ, WC, VST, D50
70- C_c, γ, VST, PF, D50
71- C_c, γ, WC, PF, D50
72- C_c, WC, VST, PF, D50
73- C_c, γ, WC, VST, PF, D50
74- C_u, γ, WC
75- C_u, γ, VST
76- C_u, γ, PF
77- C_u, γ, D50
78- C_u, WC, VST
79- C_u, WC, PF
80- C_u, WC, D50
81- C_u, VST, PF
82- C_u, VST, D50
83- PF, C_u, D50
84- C_u, γ, WC, VST
85- C_u, γ, WC, PF
86- C_u, γ, WC, D50
87- C_u, γ, VST, PF
88- C_u, γ, VST, D50
89- C_u, γ, PF, D50
90- C_u, WC, VST, PF
91- C_u, WC, VST, D50
92- C_u, WC, PF, D50
93- C_u, VST, PF, D50
94- C_u, γ, WC, VST, PF

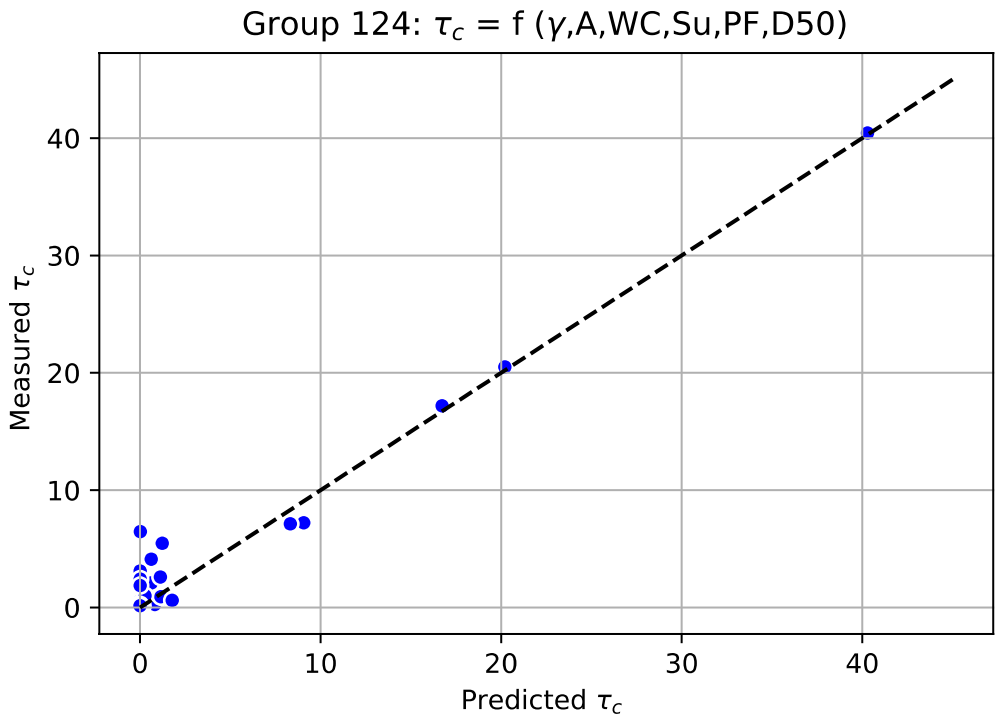
95- C_u, γ, WC, VST, D50
96- C_u, γ, VST, PF, D50
97- C_u, γ, WC, PF, D50
98- C_u, WC, VST, PF, D50
99- C_u, γ, WC, VST, PF, D50
100- C_c, C_u
101- C_c, C_u, PI
102- C_c, C_u, γ
103- C_c, C_u, WC
104- C_c, C_u, VST
105- C_c, C_u, PF

"Predicted vs. Measured" Plots for the Selected Correlation Equations

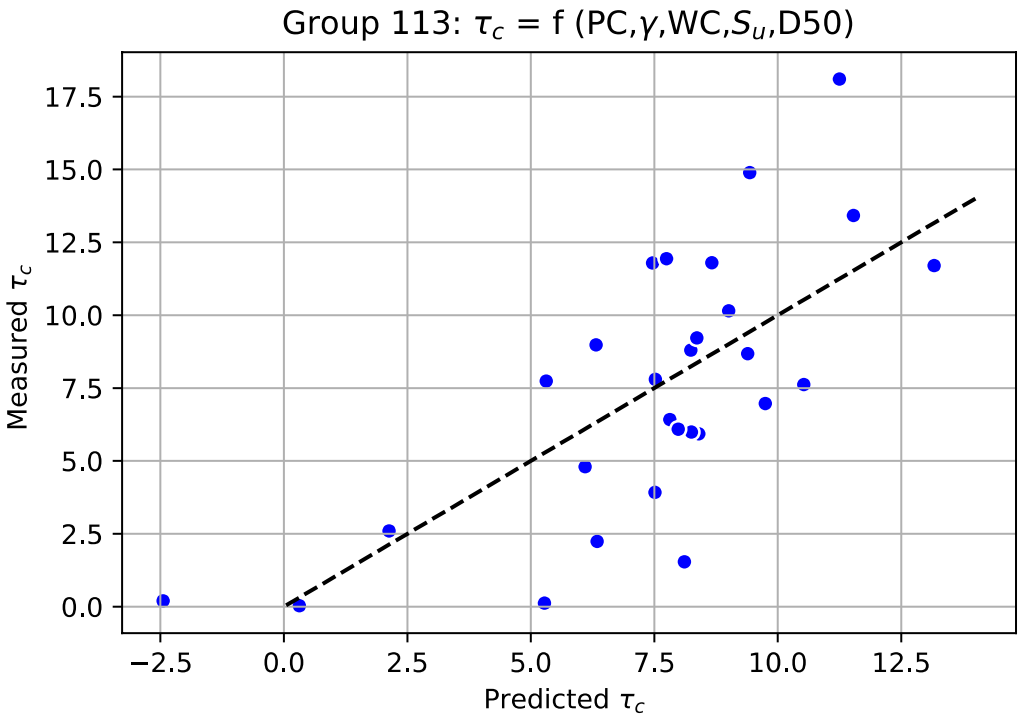
Group 77 in Table 50



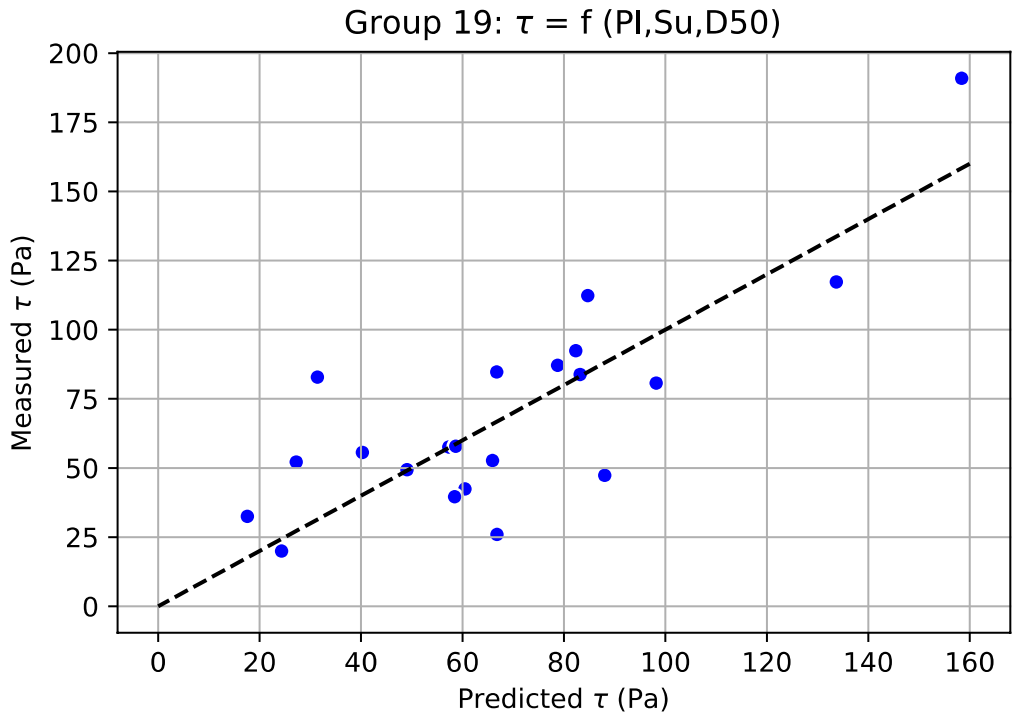
Group 124 in Table 48



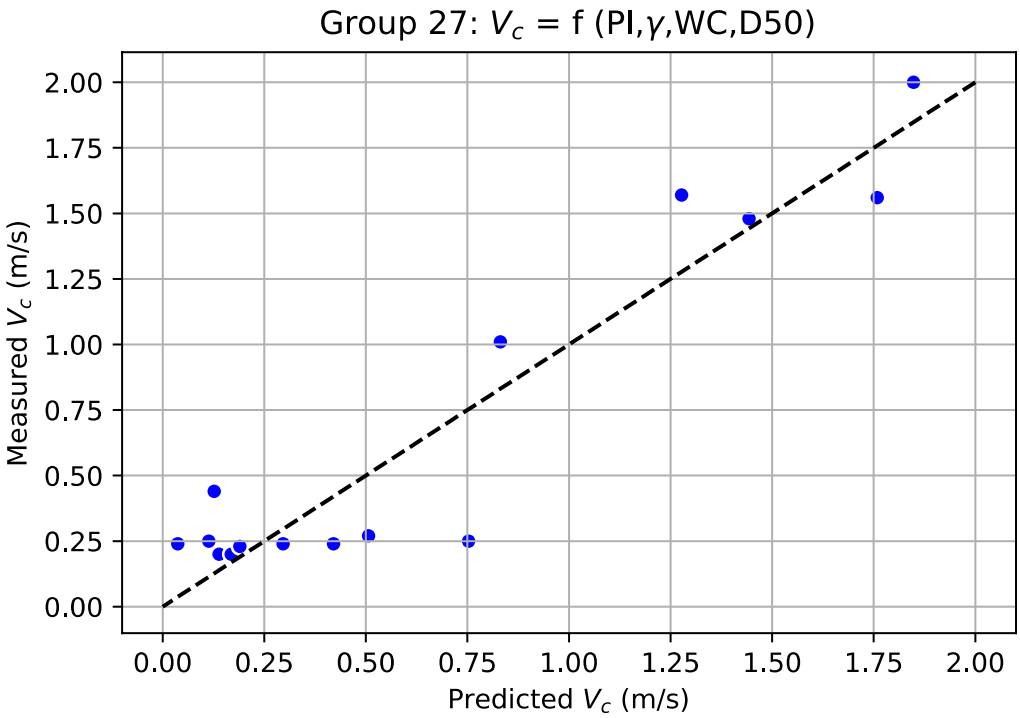
Group 113 in Table 51



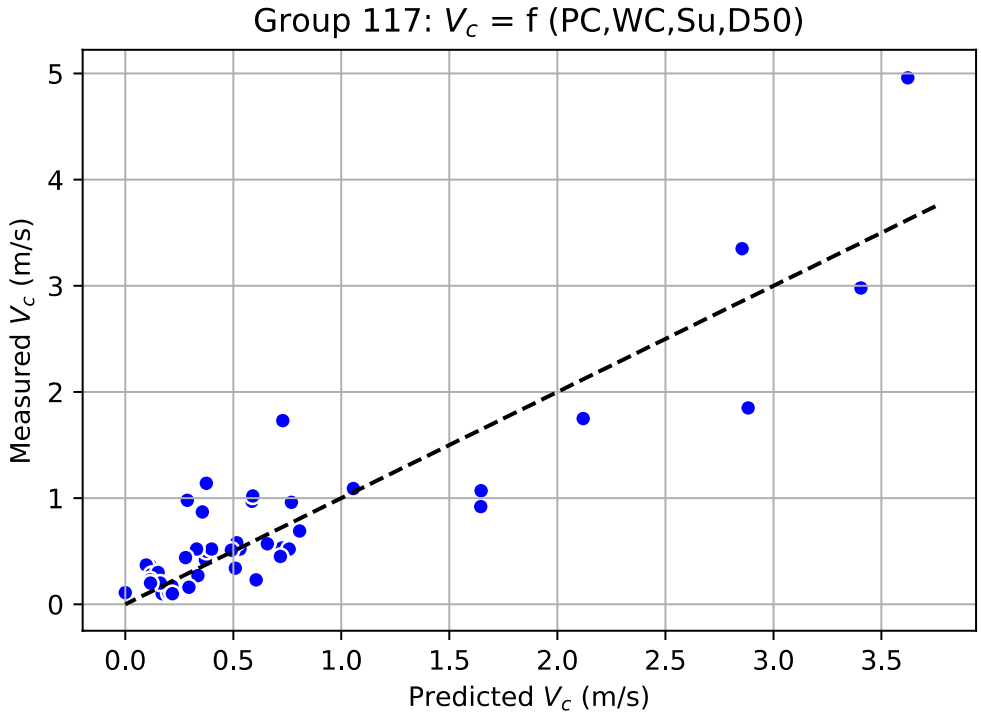
Group 19 in Table 54



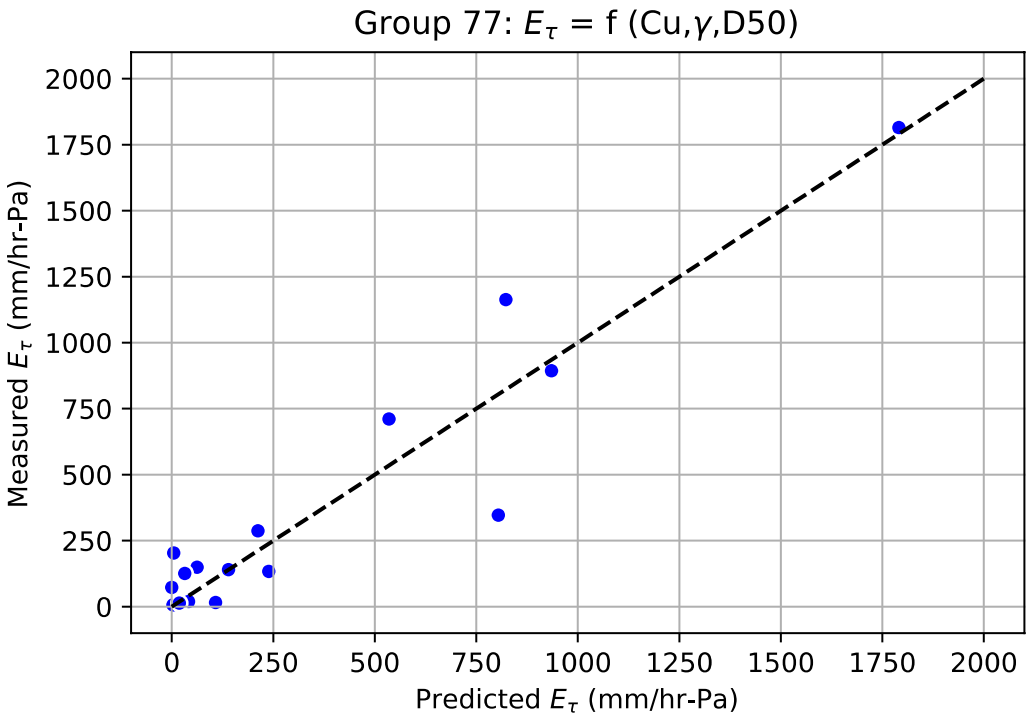
Group 27 in Table 58



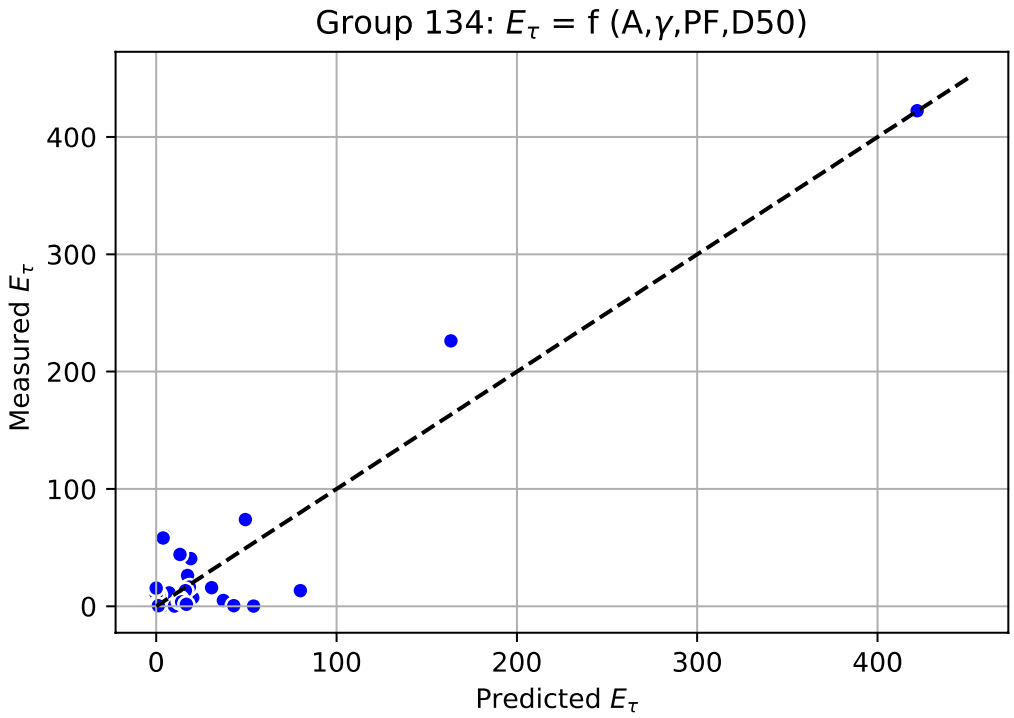
Group 117 in Table 56



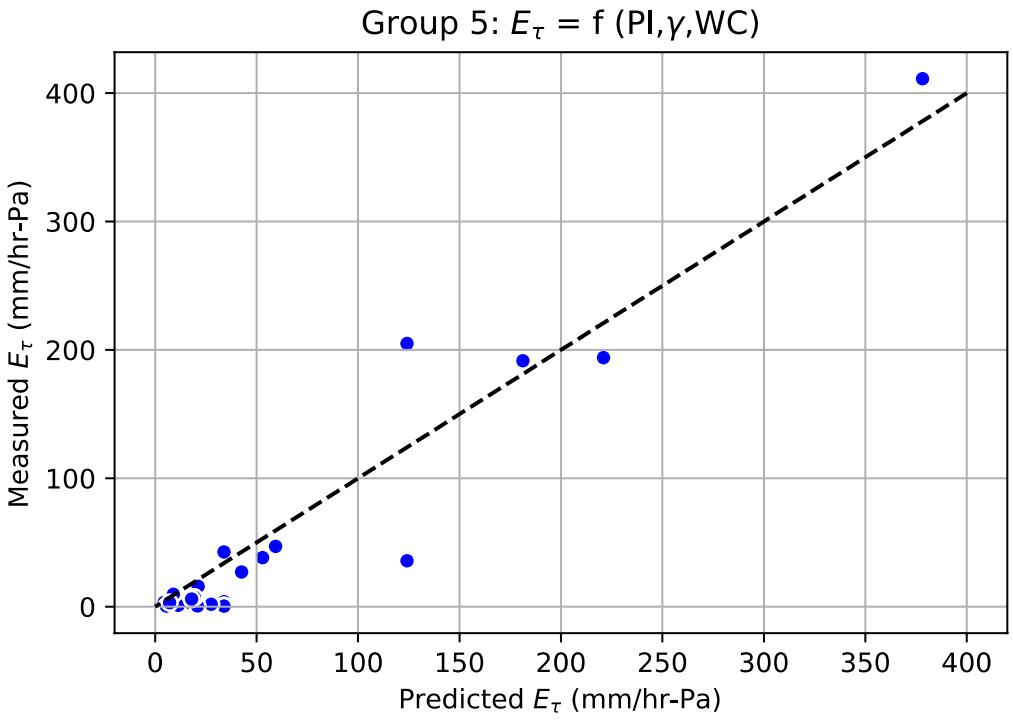
Group 77 in Table 61



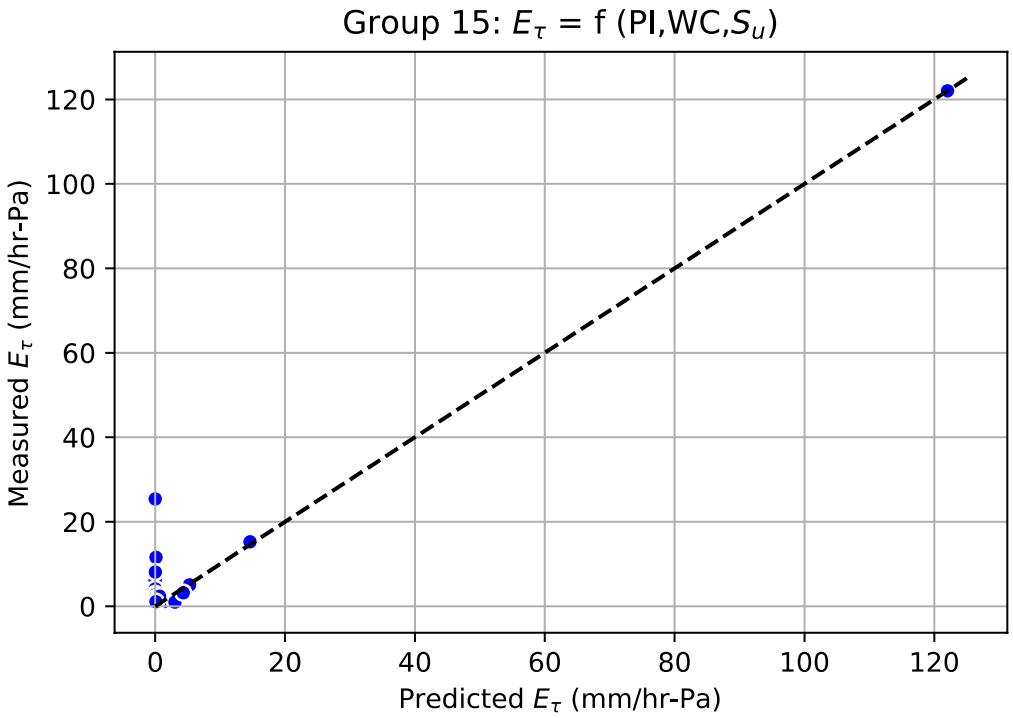
Group 134 in Table 59



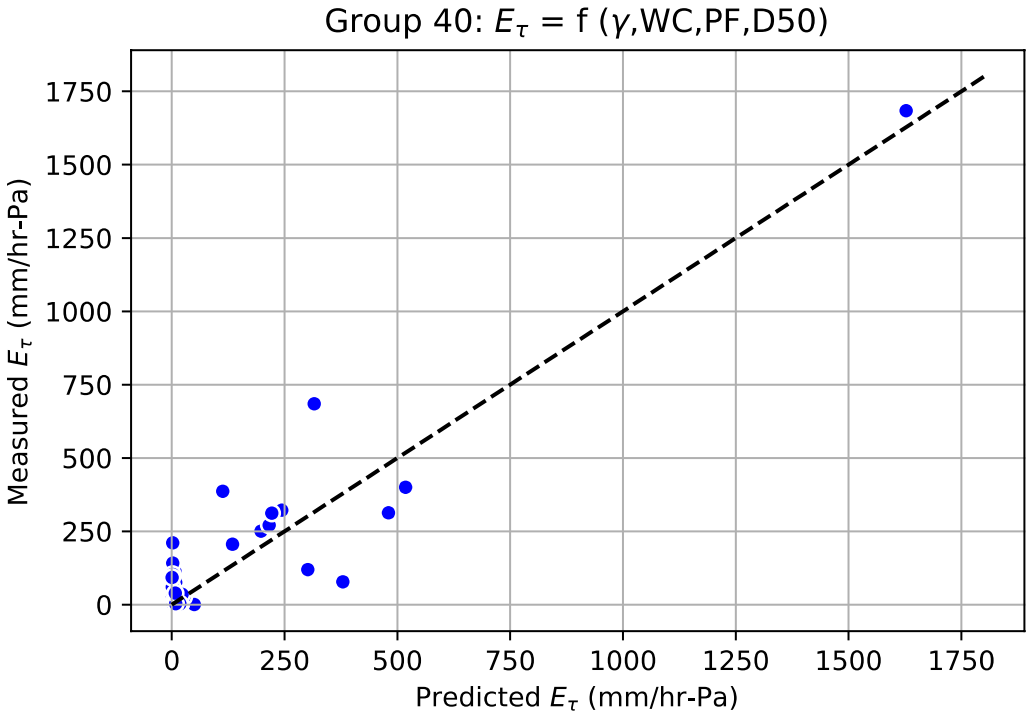
Group 5 in Table 65



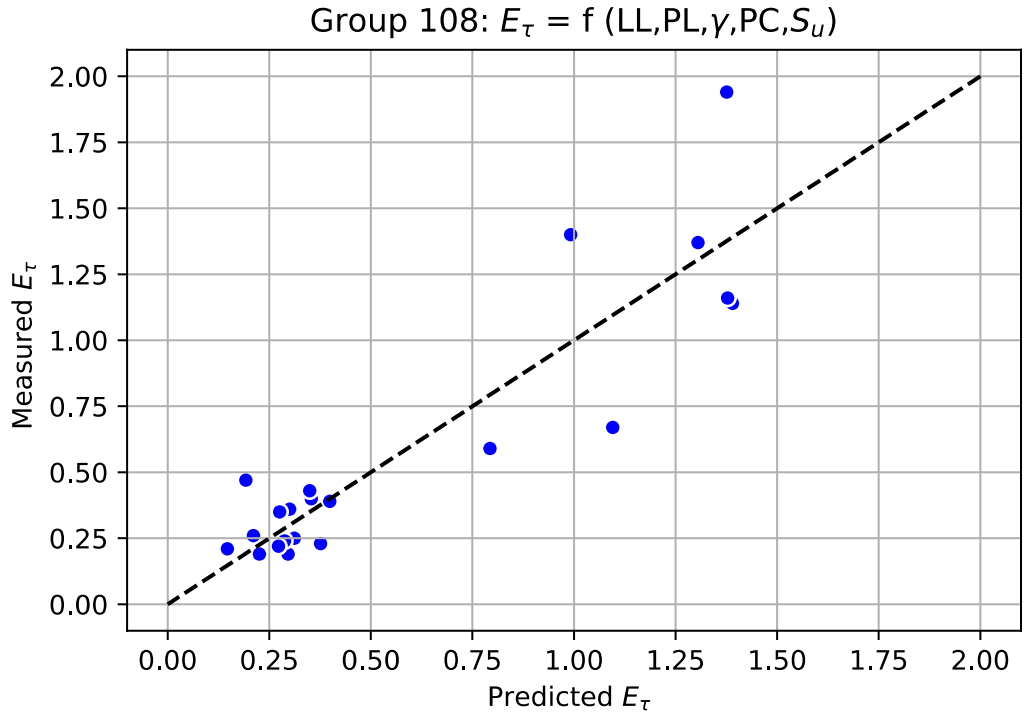
Group 15 in Table 63



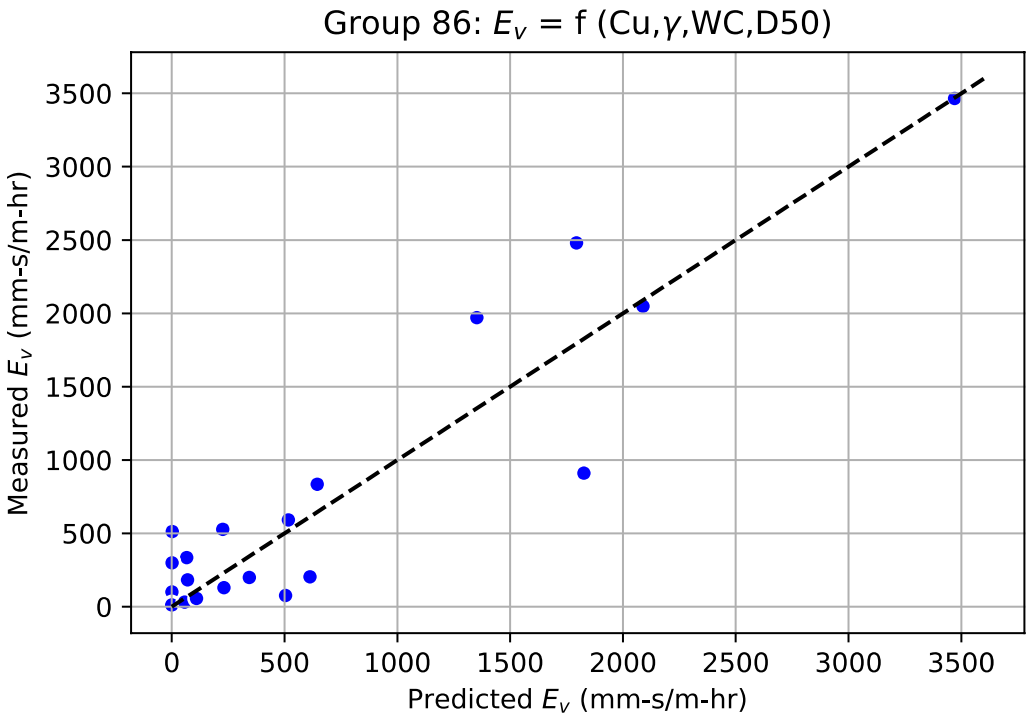
Group 40 in Table 66



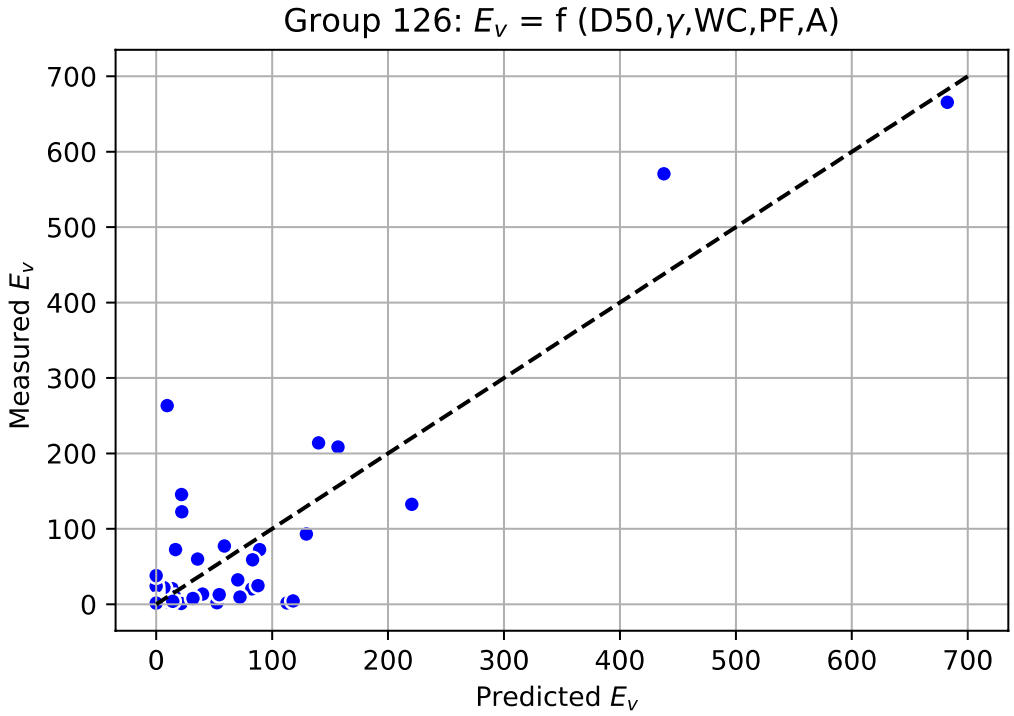
Group 108 in Table 68



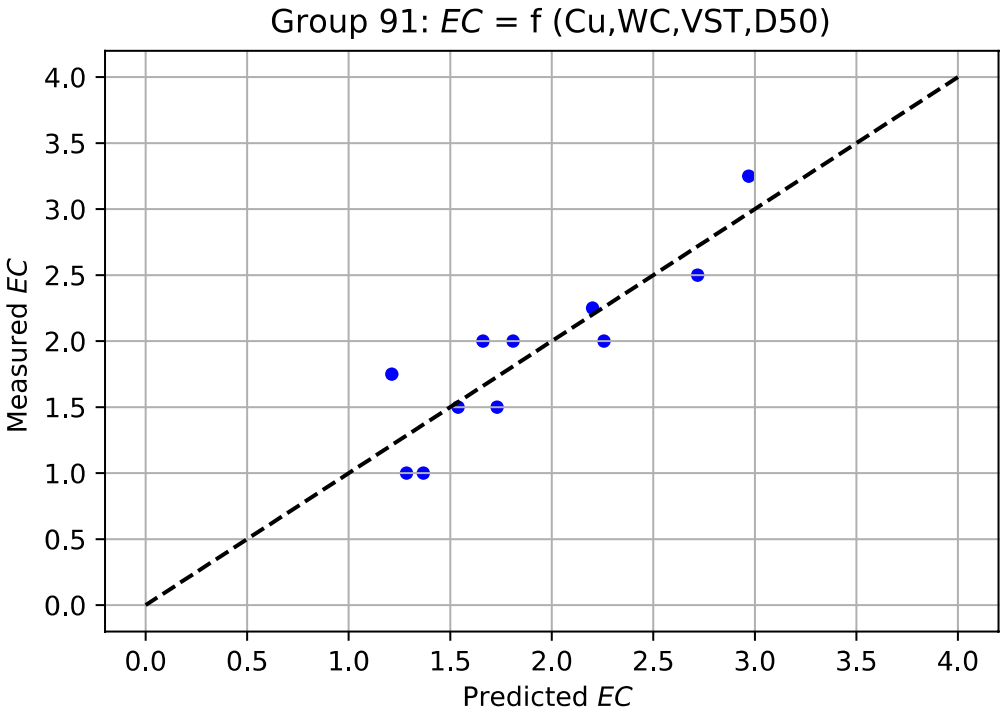
Group 86 in Table 71



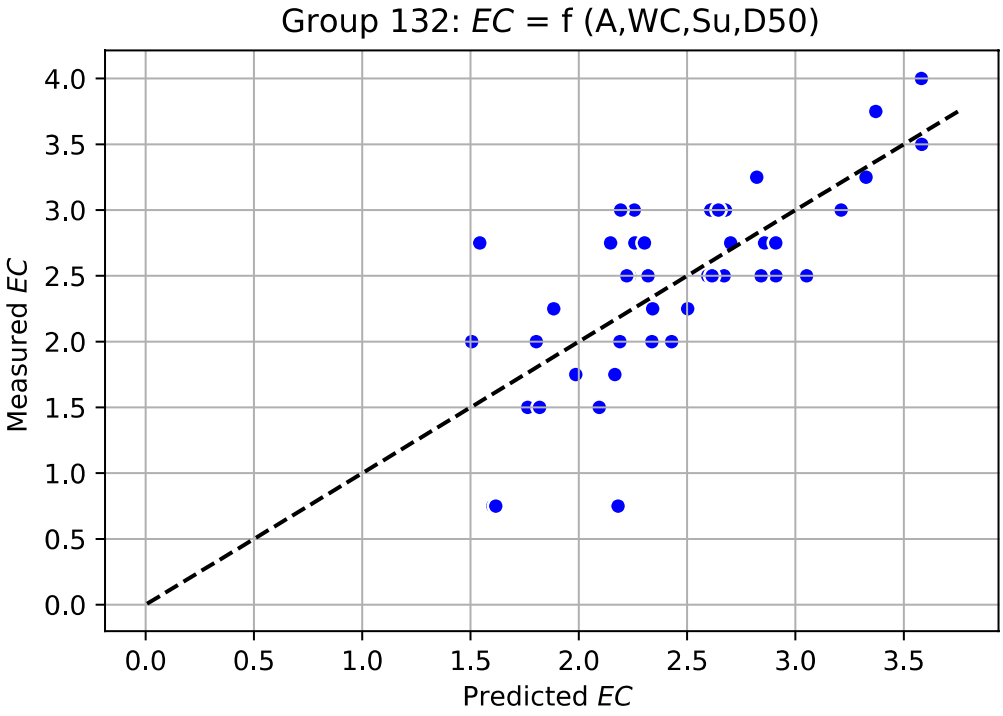
Group 126 in Table 69



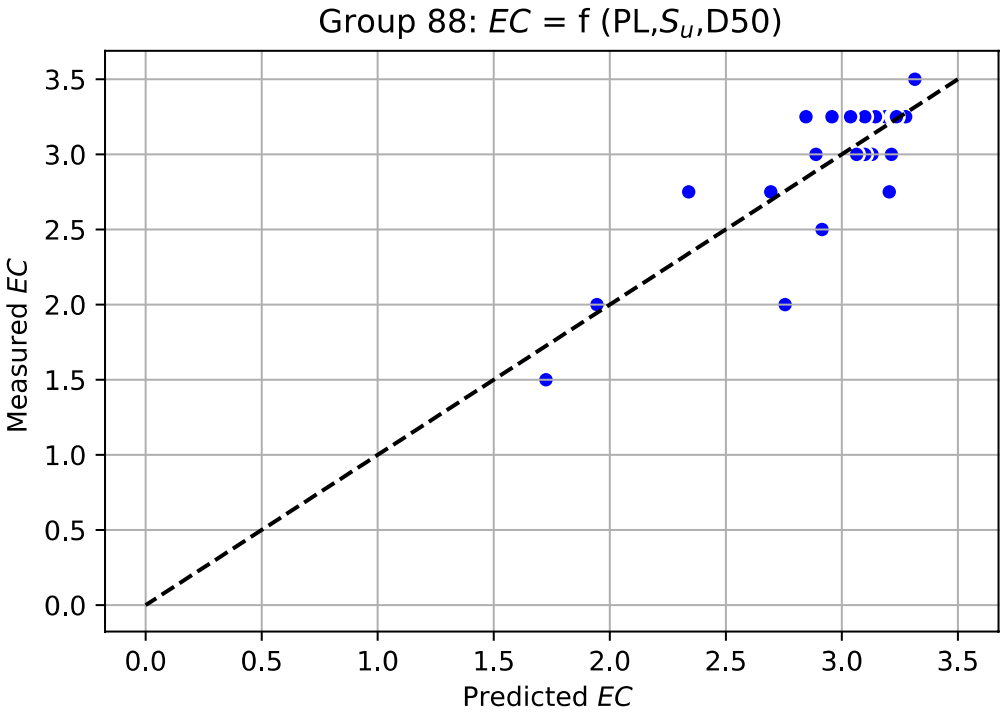
Group 91 in Table 75



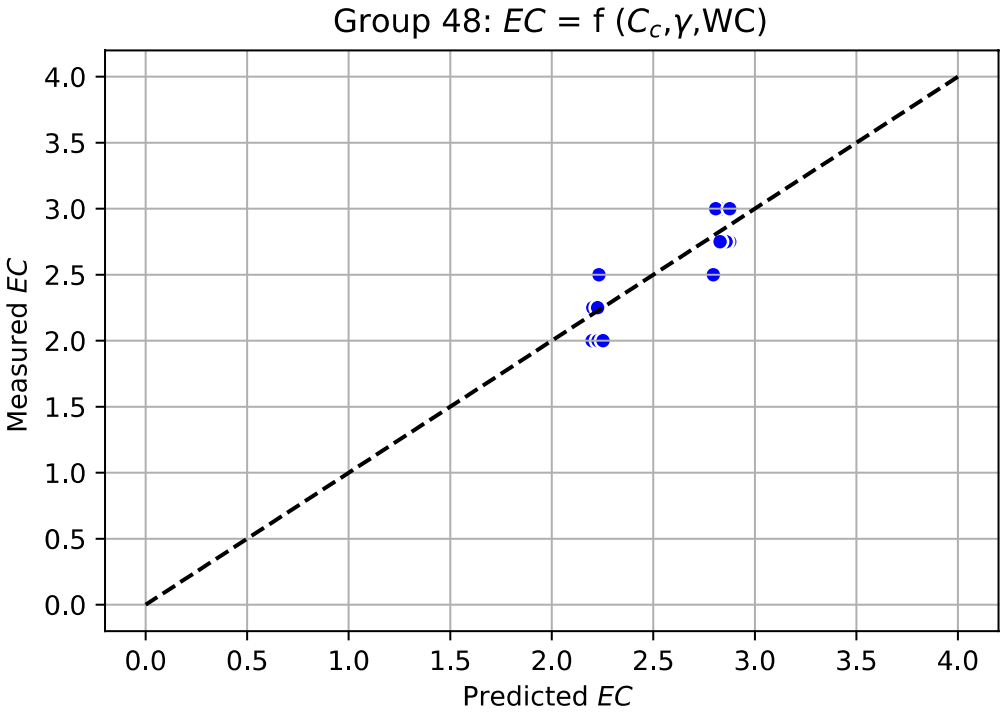
Group 132 in Table 73



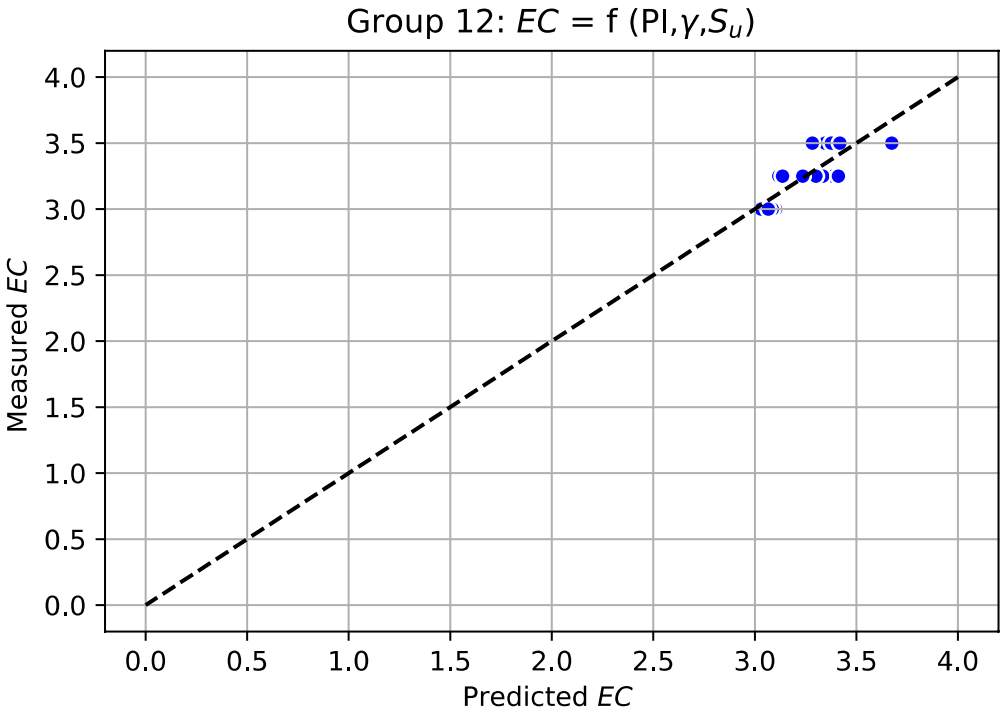
Group 88 in Table 76



Group 48 in Table 81



Group 12 in Table 79



APPENDIX 5 – PROBABILISTIC CALIBRATION RESULTS

Models for critical shear stress τ_c

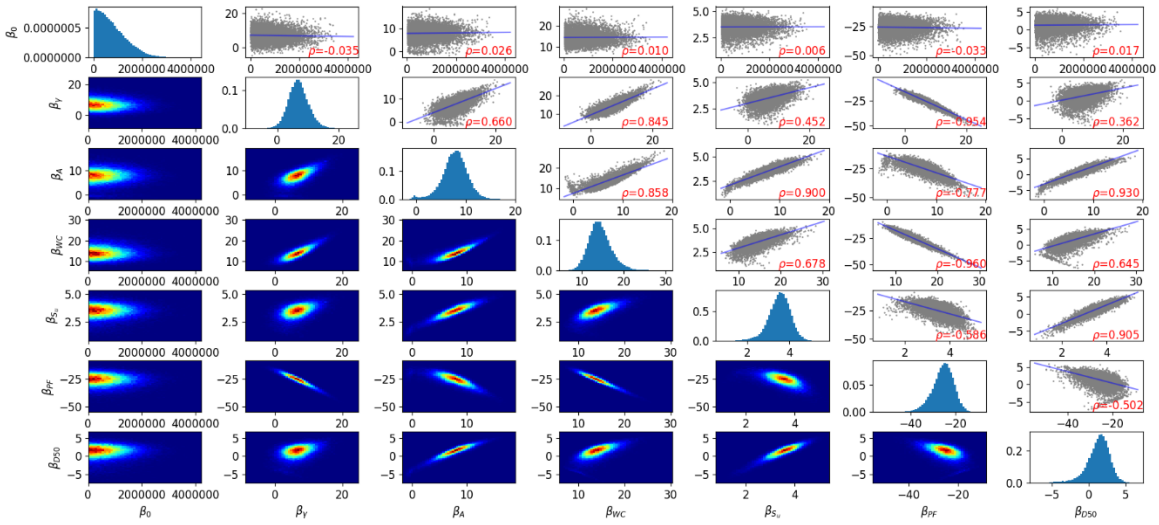
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
124	γ, A, WC, S_u, PF, D50	EFA/Fine 44	$\tau_c = (158.06) \times \gamma^5 \times A^{-0.46} \times WC^{10.03} \times S_u^{1.83} \times PF^{-18.28} \times D50^{-4.21}$	0.94	0.66

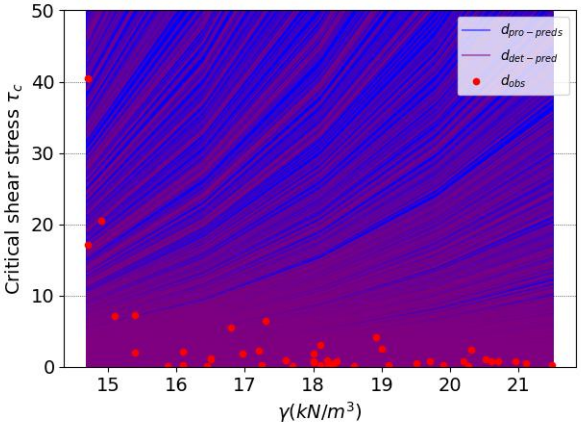
(2) Statistics of marginal posterior distribution:

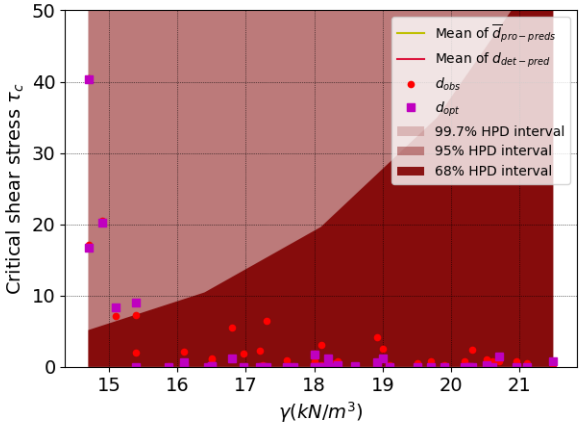
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	810371.44	605863.97	0.75	10257.49	9736.49	1969077.88
β_γ	6.94	3.29	0.47	15.29	0.75	13.79
β_A	7.79	2.57	0.33	13.65	2.66	13.08
β_{WC}	14.40	2.64	0.18	21.13	9.57	20.00
β_{S_u}	3.52	0.54	0.15	4.34	2.43	4.56
β_{PF}	-25.53	4.79	-0.19	-36.94	-35.70	-16.85
β_{D50}	1.31	1.58	1.20	4.12	-1.90	4.23

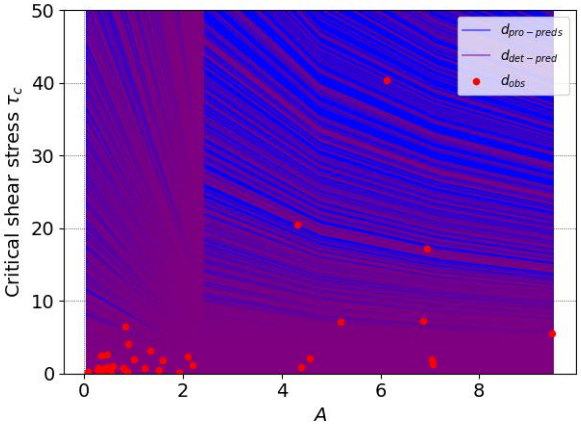
(3) Joint relative frequency histogram:

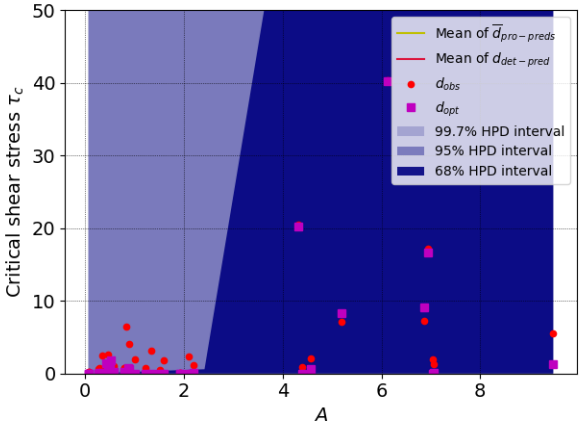


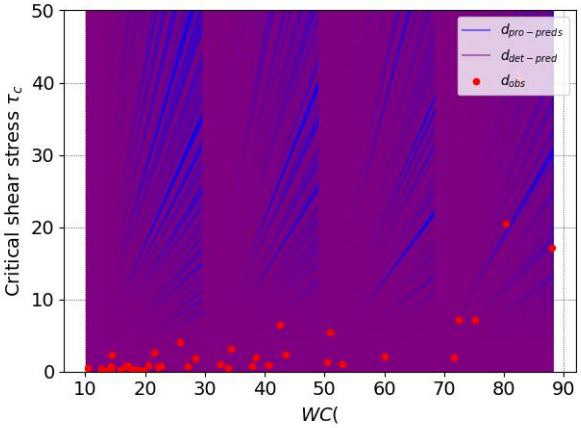
(4) Model realizations and first order statistics of model predictions:

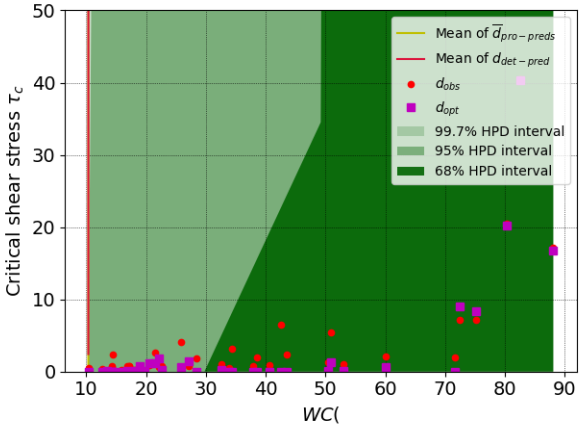

Critical shear stress τ_c
$\gamma(kN/m^3)$
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

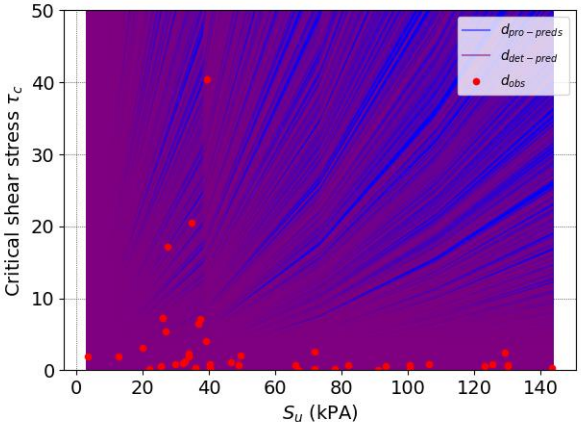

Critical shear stress τ_c
$\gamma(kN/m^3)$
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

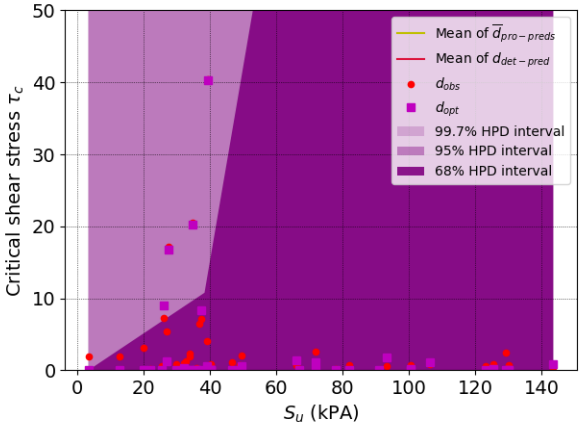

Critical shear stress τ_c
A
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

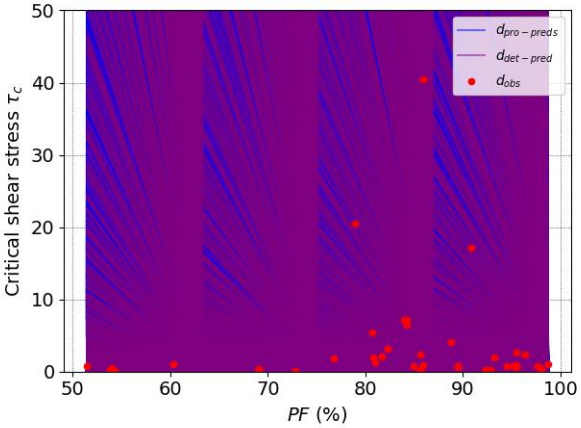

Critical shear stress τ_c
A
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

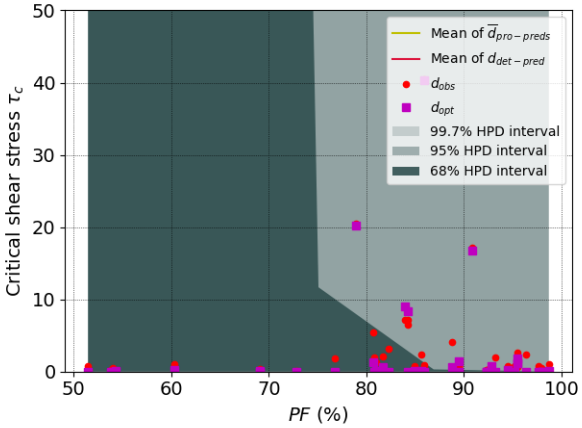

Critical shear stress τ_c
$WC($
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

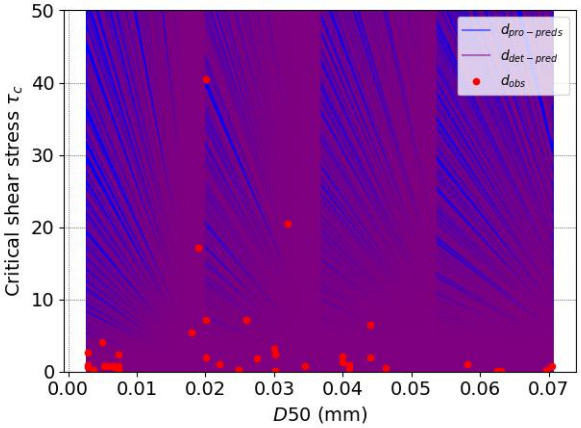

Critical shear stress τ_c
$WC($
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

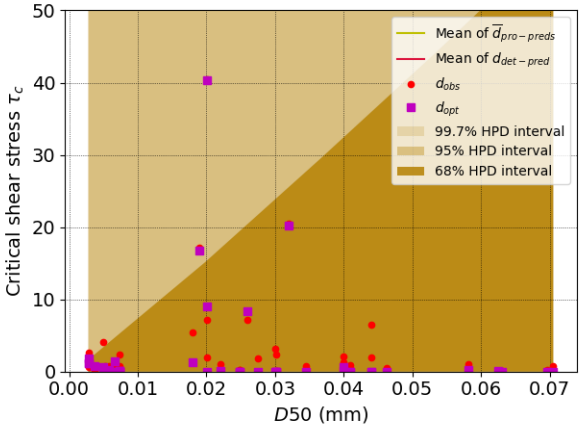

Critical shear stress τ_c
S_u (kPA)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

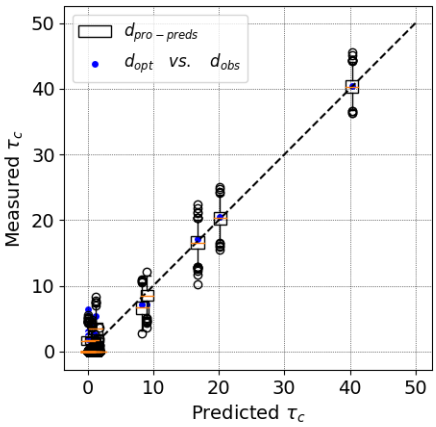

Critical shear stress τ_c
S_u (kPA)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

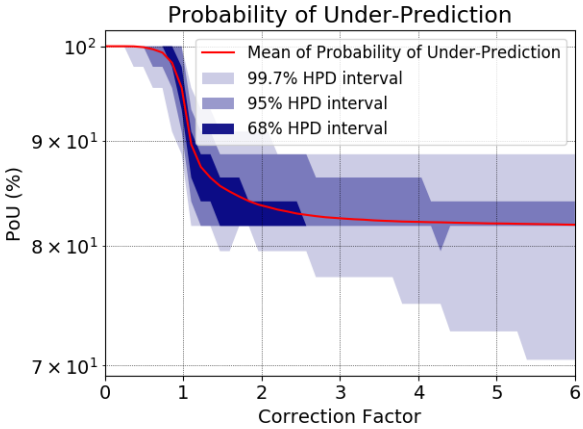

Critical shear stress τ_c
PF (%)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Critical shear stress τ_c
PF (%)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


Critical shear stress τ_c
$D50$ (mm)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Critical shear stress τ_c
$D50$ (mm)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured τ_c
Predicted τ_c
0
10
20
30
40
50


Probability of Under-Prediction
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
PoU (%)
10^2
9×10^1
8×10^1
7×10^1
Correction Factor
0
1
2
3
4
5
6

Models for critical shear stress τ_c

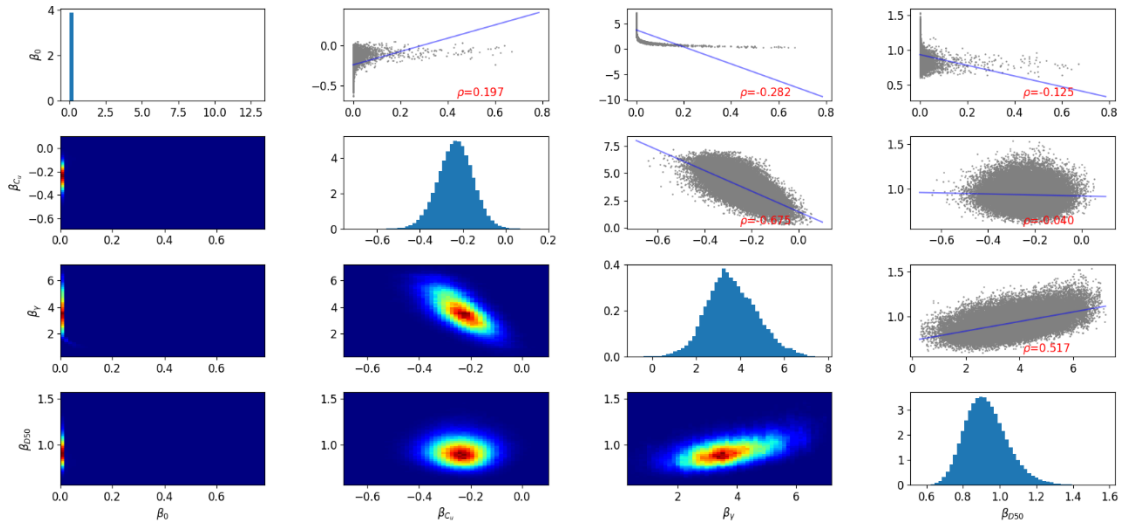
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
77	C_u, γ, D50	EFA/Coarse 28	$\tau_c = (1.58) \times C_u^{-0.04} \times \gamma^{0.02} \times D50^{0.77}$	0.93	0.99

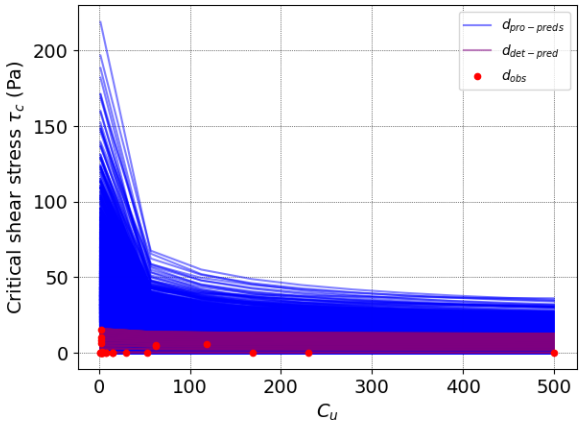
(2) Statistics of marginal posterior distribution:

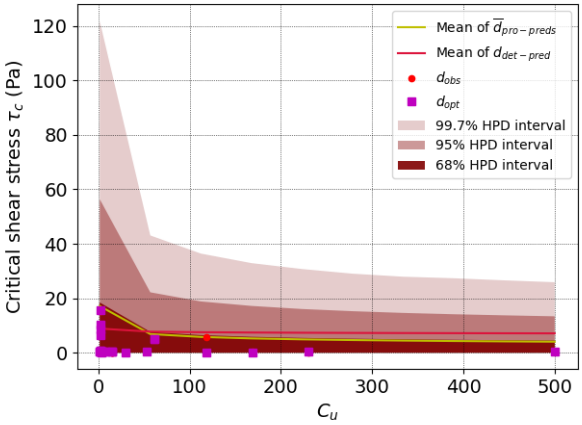
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	0.002	0.019	7.764	0.001	0.000	0.006
β_{C_u}	-0.239	0.081	-0.337	-0.231	-0.396	-0.080
β_γ	3.727	1.126	0.302	3.451	1.605	6.007
β_{D50}	0.932	0.116	0.125	0.901	0.715	1.165

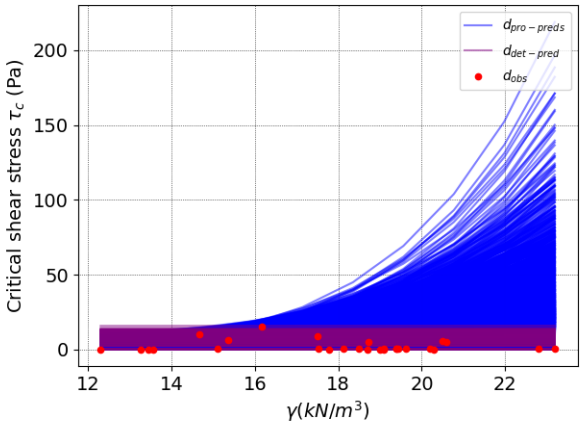
(3) Joint relative frequency histogram:

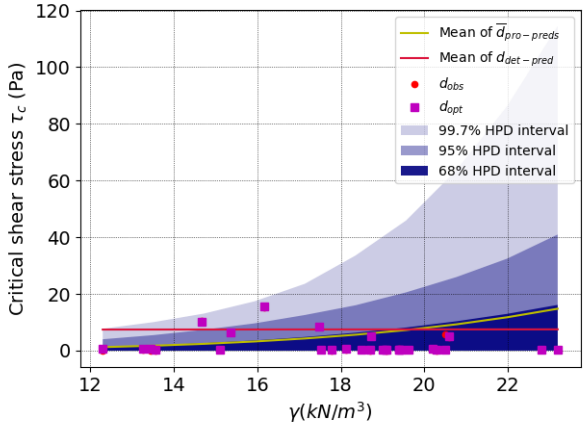


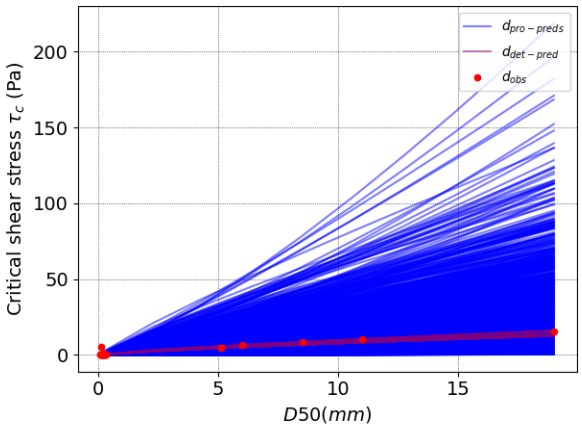
(4) Model realizations and first order statistics of model predictions:

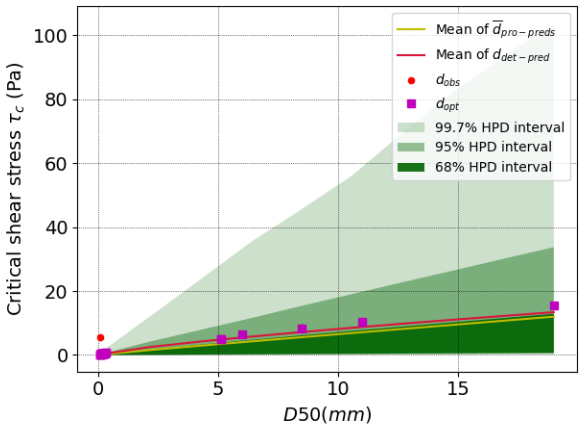

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical shear stress τ_c (Pa)
C_u

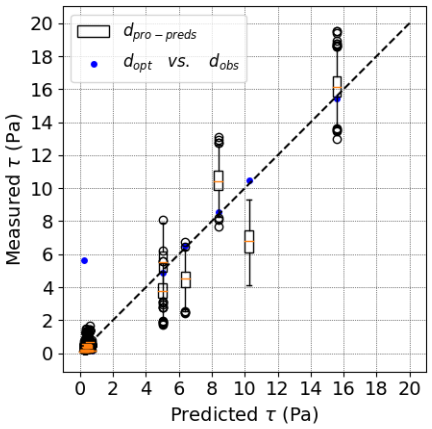

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical shear stress τ_c (Pa)
C_u

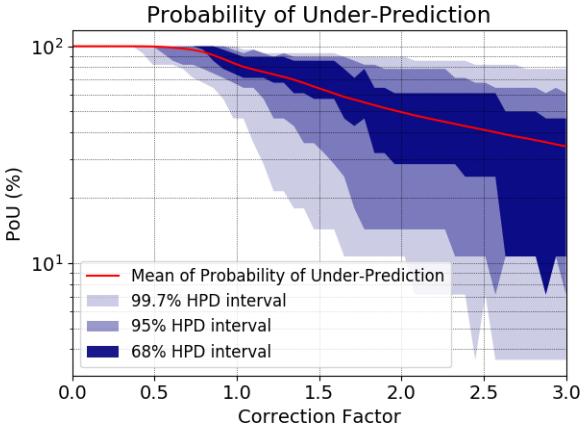

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical shear stress τ_c (Pa)
$\gamma(kN/m^3)$


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical shear stress τ_c (Pa)
$\gamma(kN/m^3)$


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical shear stress τ_c (Pa)
$D50(mm)$


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical shear stress τ_c (Pa)
$D50(mm)$


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured τ (Pa)
Predicted τ (Pa)
0 2 4 6 8 10 12 14 16 18 20


Probability of Under-Prediction
PoU (%)
10^2
10^1
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
0.0 0.5 1.0 1.5 2.0 2.5 3.0
Correction Factor

Models for critical shear stress τ_c

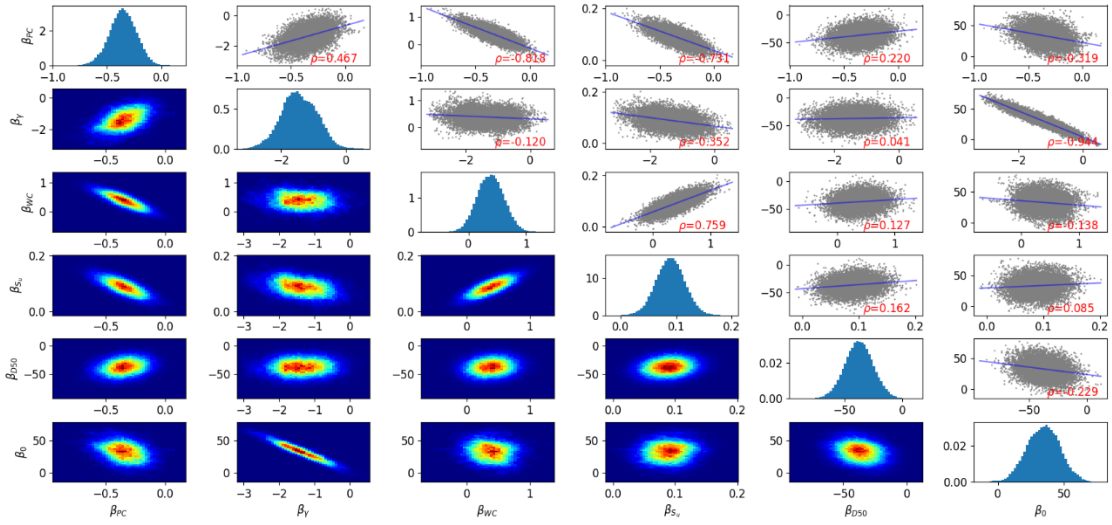
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
113	PC, γ, WC, S_u, D50	JET/Global 28	$\tau_c = -0.248 \times PC - 1.23 \times \gamma + 0.21 \times WC + 0.07 \times S_u - 36.89 \times D50 + 31.82$ $for\ D50 < 0.3\ mm$	0.50	0.10

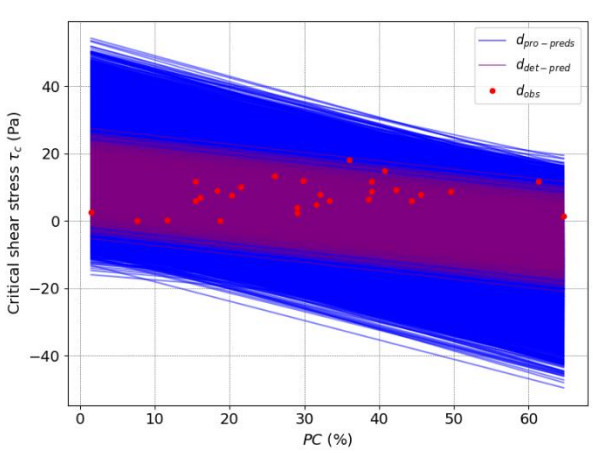
(2) Statistics of marginal posterior distribution:

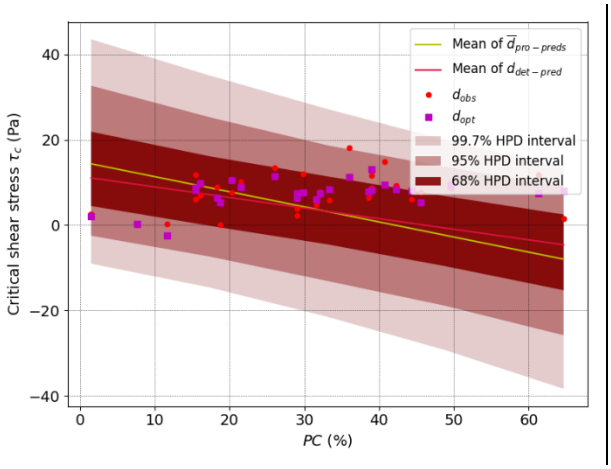
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_{PC}	-0.346	0.130	-0.377	-0.350	-0.608	-0.100
β_{γ}	-1.372	0.569	-0.414	-1.390	-2.455	-0.242
β_{WC}	0.390	0.244	0.625	0.420	-0.078	0.859
β_{S_u}	0.089	0.027	0.300	0.090	0.036	0.141
β_{D50}	-36.925	12.178	-0.330	-33.790	-60.861	-13.071
β_0	32.871	12.838	0.391	35.230	7.832	58.231

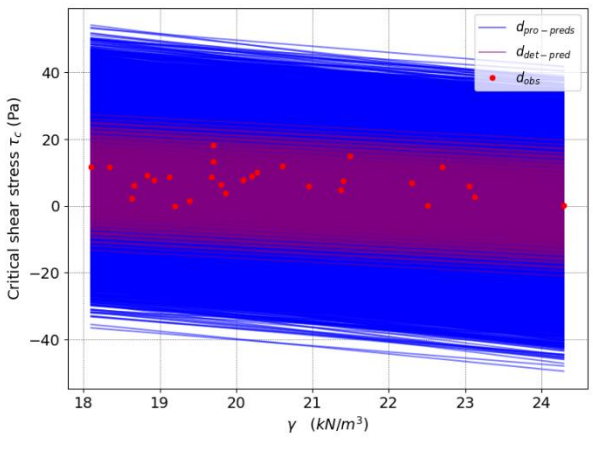
(3) Joint relative frequency histogram:

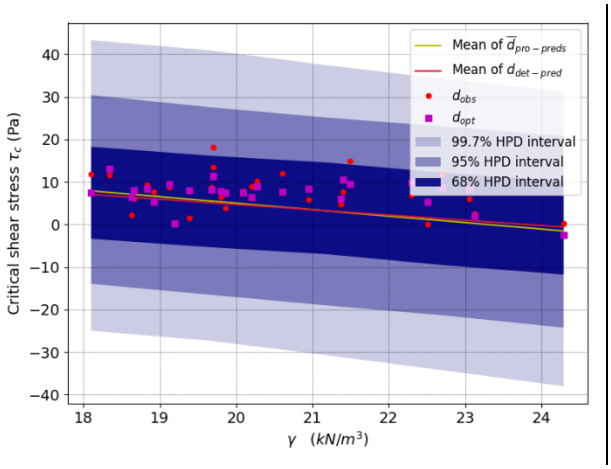


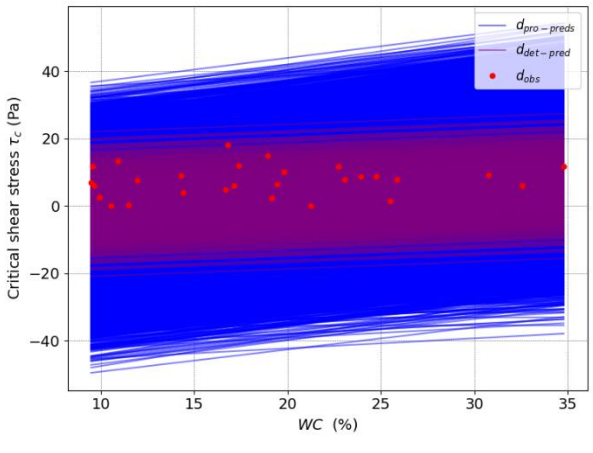
(4) Model realizations and first order statistics of model predictions:

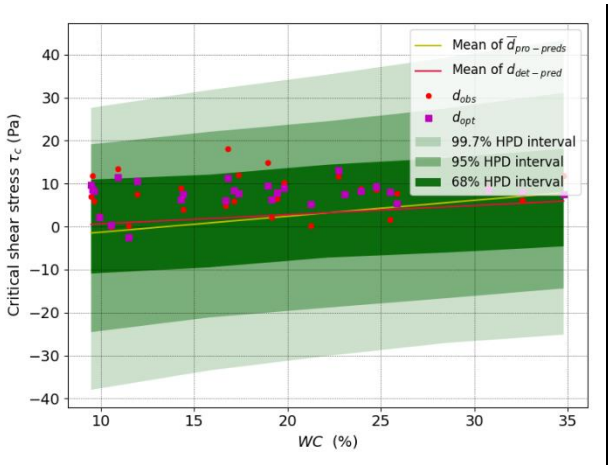

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical shear stress τ_c (Pa)
PC (%)

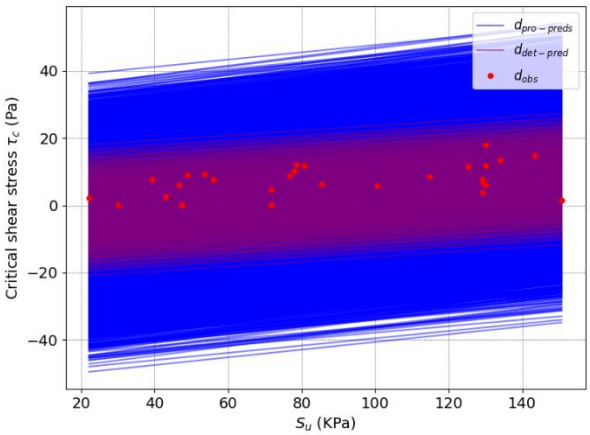

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical shear stress τ_c (Pa)
PC (%)

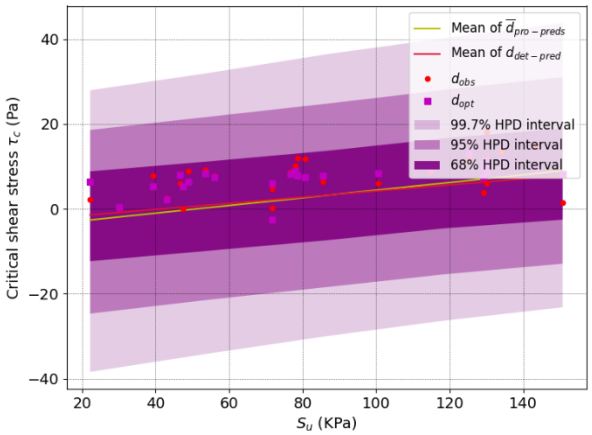

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical shear stress τ_c (Pa)
γ (kN/m^3)

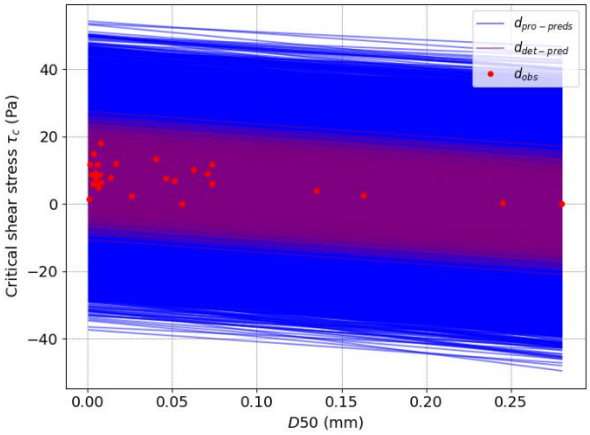

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical shear stress τ_c (Pa)
γ (kN/m^3)

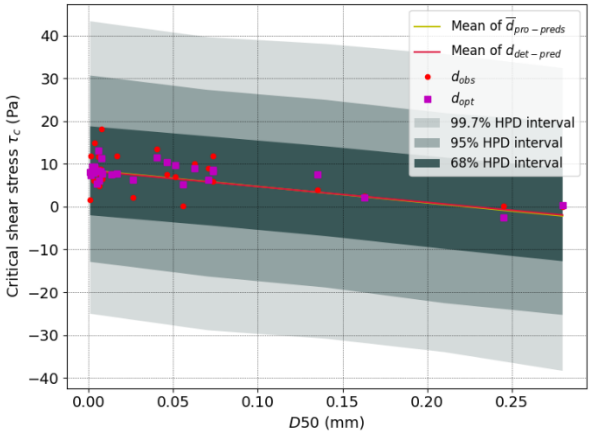

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical shear stress τ_c (Pa)
WC (%)

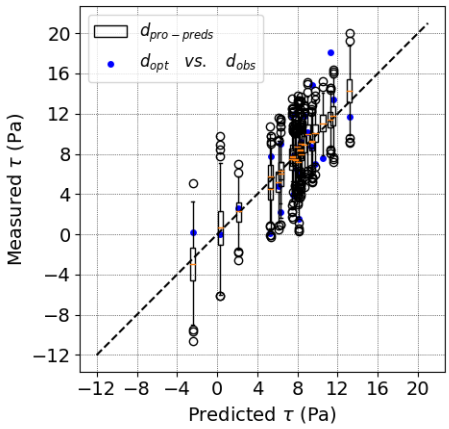

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical shear stress τ_c (Pa)
WC (%)

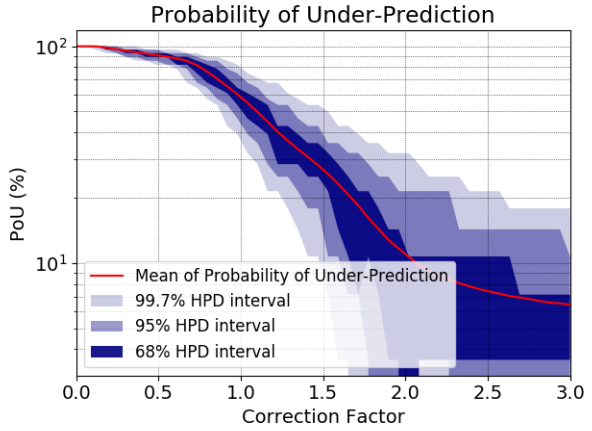

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical shear stress τ_c (Pa)
S_u (KPa)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical shear stress τ_c (Pa)
S_u (KPa)


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical shear stress τ_c (Pa)
$D50$ (mm)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical shear stress τ_c (Pa)
$D50$ (mm)


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured τ (Pa)
Predicted τ (Pa)


Probability of Under-Prediction
PoU (%)
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
Correction Factor

Models for critical shear stress τ_c

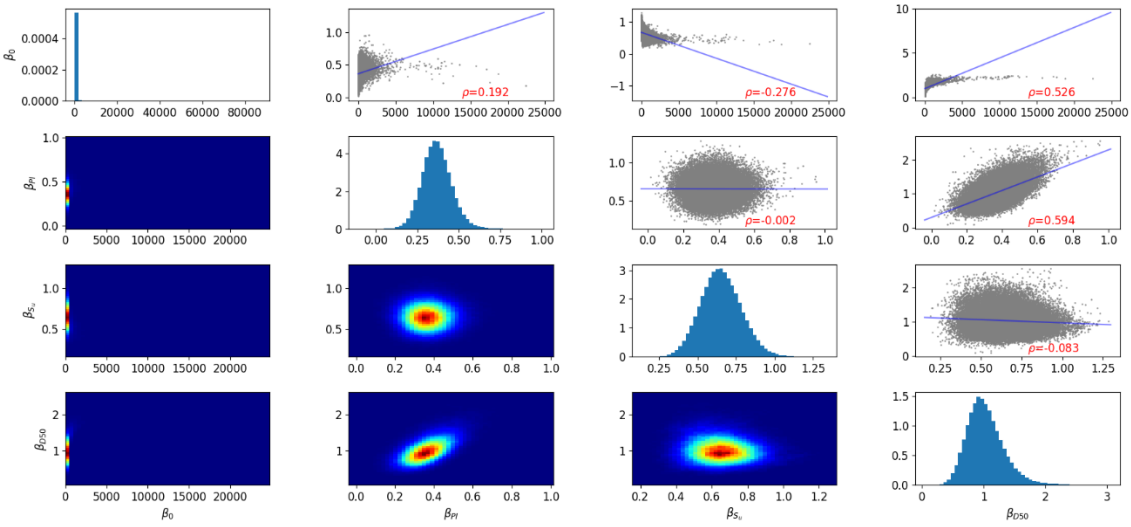
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
19	PI, S_u, D50	HET/Global 21	$\tau_c = (25.07) \times PI^{0.27} \times S_u^{0.55} \times D50^{0.5}$ $for\ D50 < 0.3\ mm$	0.64	0.43

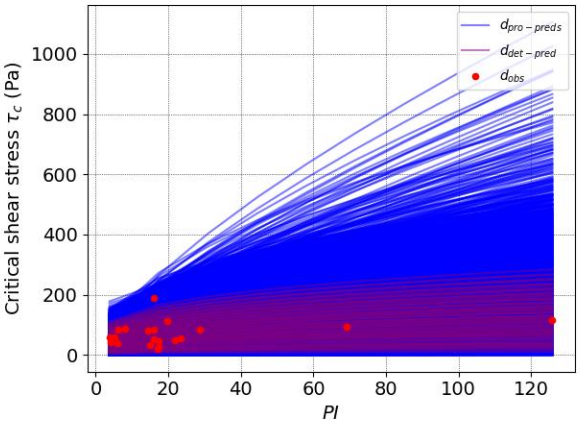
(2) Statistics of marginal posterior distribution:

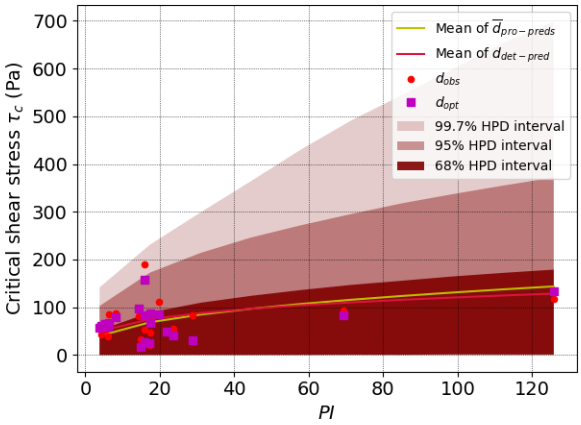
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	171.146	447.669	2.616	22.827	2.111	580.280
β_{PI}	0.368	0.088	0.238	0.360	0.198	0.543
β_{S_u}	0.655	0.131	0.201	0.647	0.399	0.911
β_{D50}	1.032	0.295	0.286	0.936	0.485	1.627

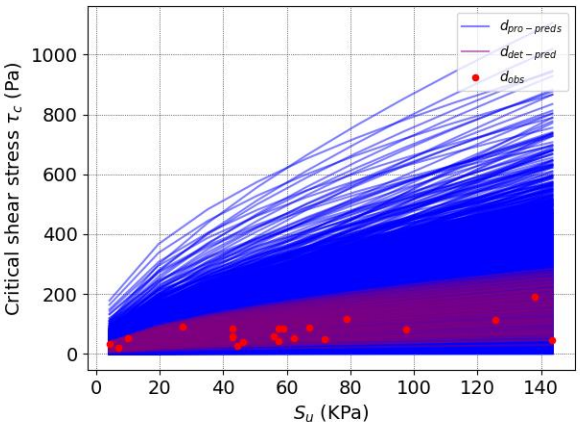
(3) Joint relative frequency histogram:

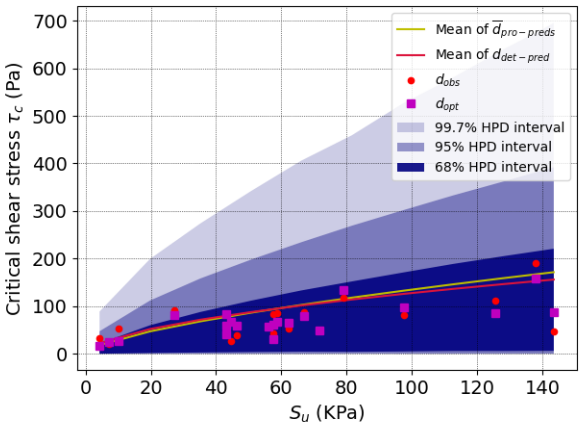


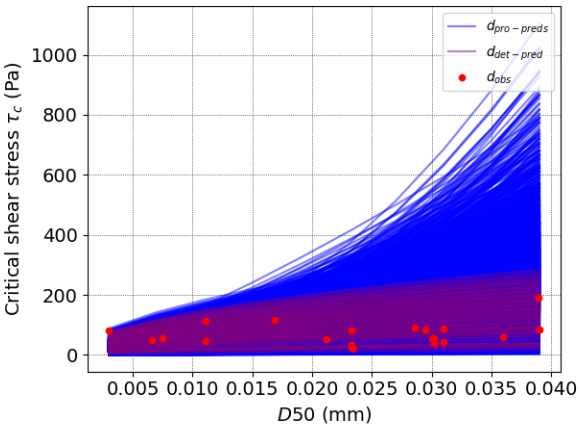
(4) Model realizations and first order statistics of model predictions:

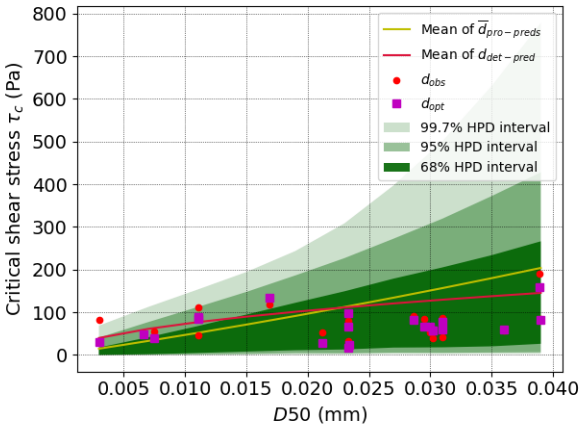

Critical shear stress τ_c (Pa)
PI
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

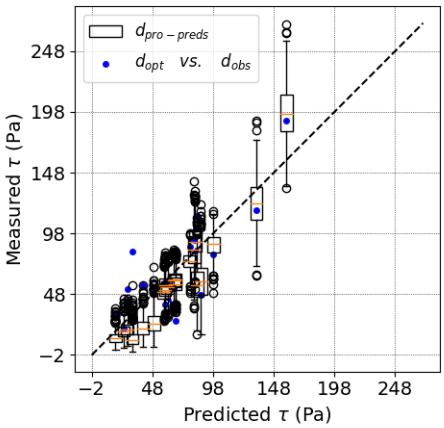

Critical shear stress τ_c (Pa)
PI
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

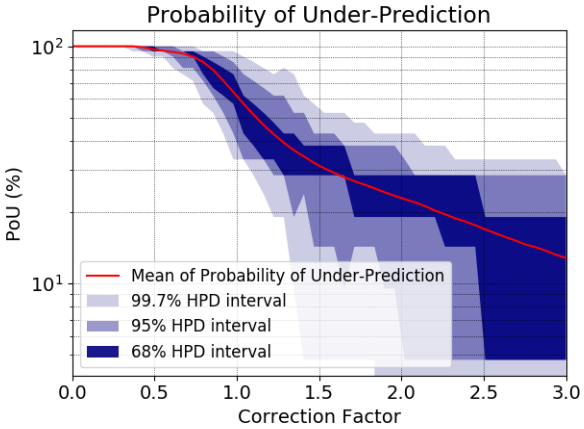

Critical shear stress τ_c (Pa)
S_u (KPa)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Critical shear stress τ_c (Pa)
S_u (KPa)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


Critical shear stress τ_c (Pa)
$D50$ (mm)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Critical shear stress τ_c (Pa)
$D50$ (mm)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


$d_{pro-preds}$
d_{opt} vs. d_{obs}
248
198
148
98
48
−2
Measured τ (Pa)
−2
48
98
148
198
248
Predicted τ (Pa)


Probability of Under-Prediction
10^2
10^1
PoU (%)
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Correction Factor

Models for critical velcoity v_c

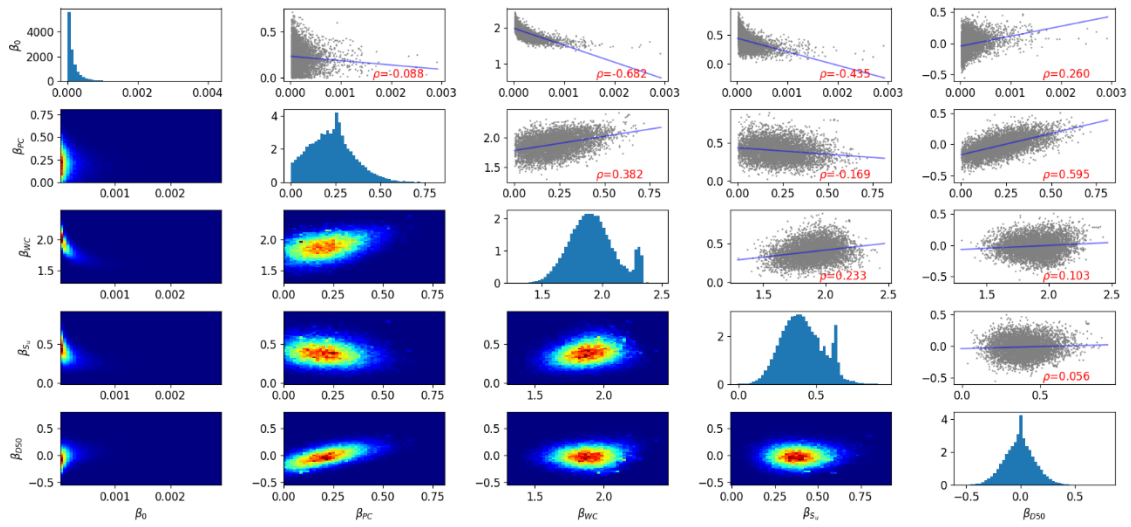
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
117	PC, WC, S_u, D50	EFA/Fine 46	$v_c = (2.518 \times 10^{-5}) \times PC^{0.2} \times WC^{2.06} \times S_u^{0.51} \times D50^{-0.13}$	0.80	0.80

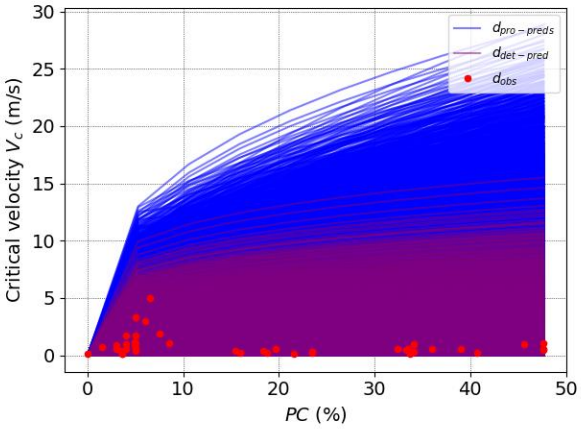
(2) Statistics of marginal posterior distribution:

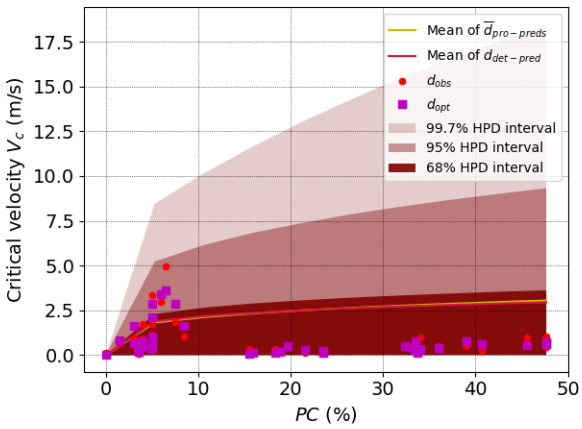
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	0.0002	0.0002	1.2303	0.0000	0.0000	0.0006
β_{PC}	0.2250	0.1260	0.5600	0.2135	0.0000	0.4496
β_{WC}	1.8904	0.1601	0.0847	2.1470	1.5718	2.1905
β_{S_u}	0.3968	0.1249	0.3148	0.5533	0.1579	0.6407
β_{D50}	-0.0130	0.1446	-11.1215	-0.0724	-0.3128	0.2518

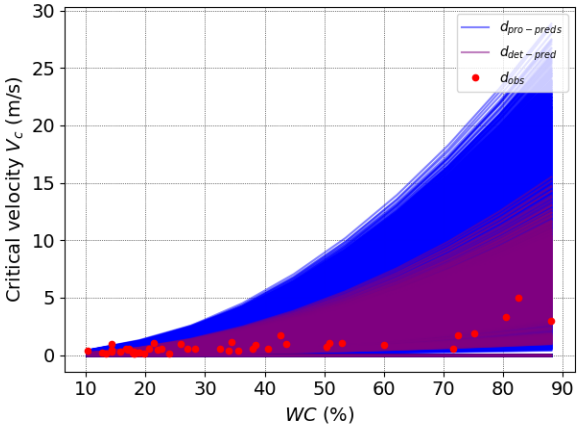
(3) Joint relative frequency histogram:

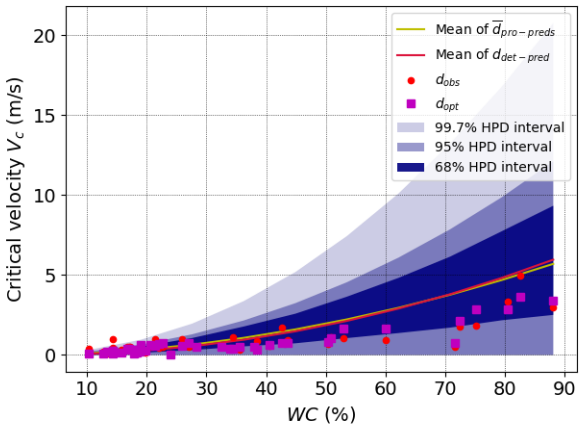


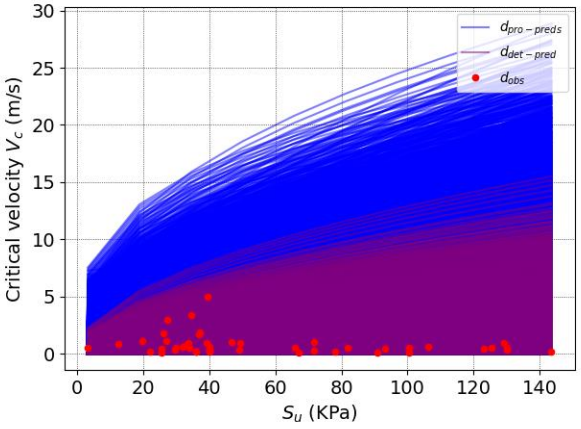
(4) Model realizations and first order statistics of model predictions:

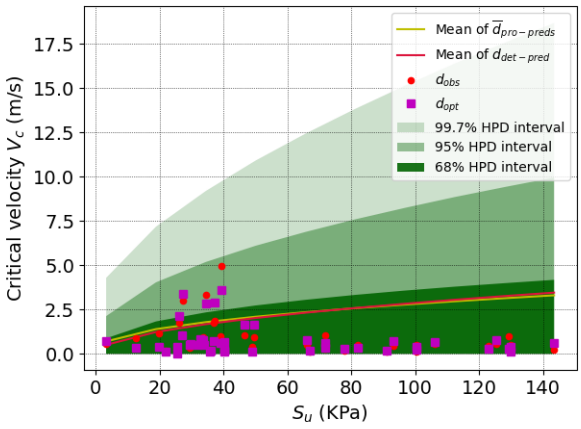

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
PC (%)

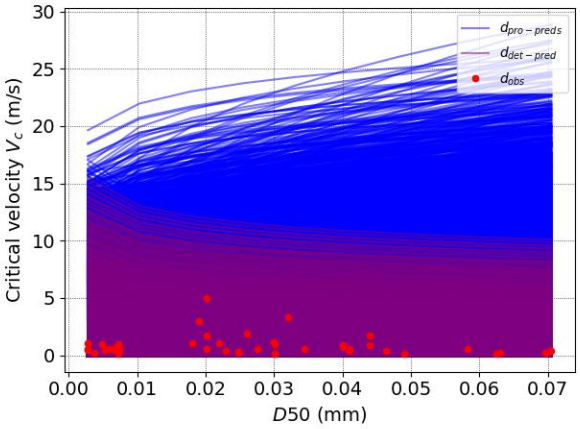

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
PC (%)

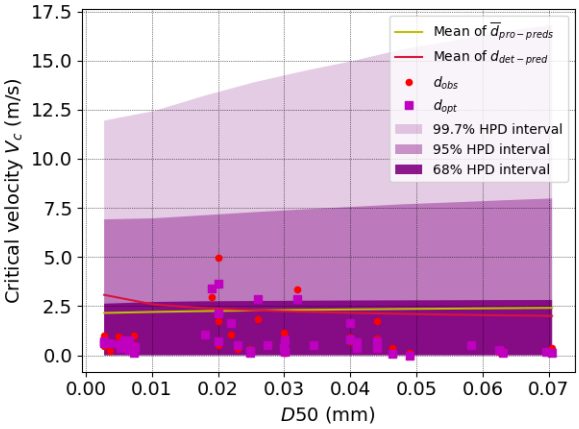

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
WC (%)

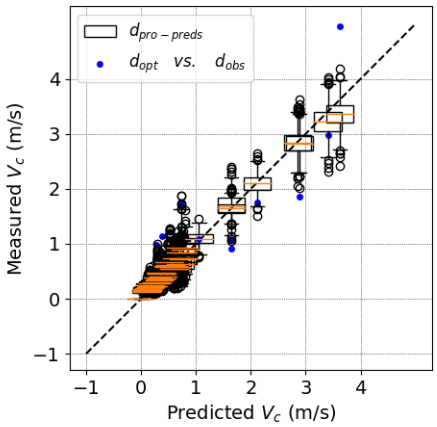

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
WC (%)

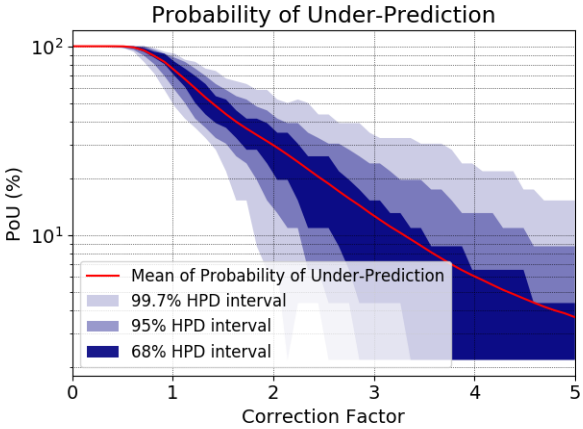

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
S_u (KPa)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
S_u (KPa)


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
$D50$ (mm)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
$D50$ (mm)


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured V_c (m/s)
Predicted V_c (m/s)


Probability of Under-Prediction
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
PoU (%)
Correction Factor

Models for critical velcoity v_c

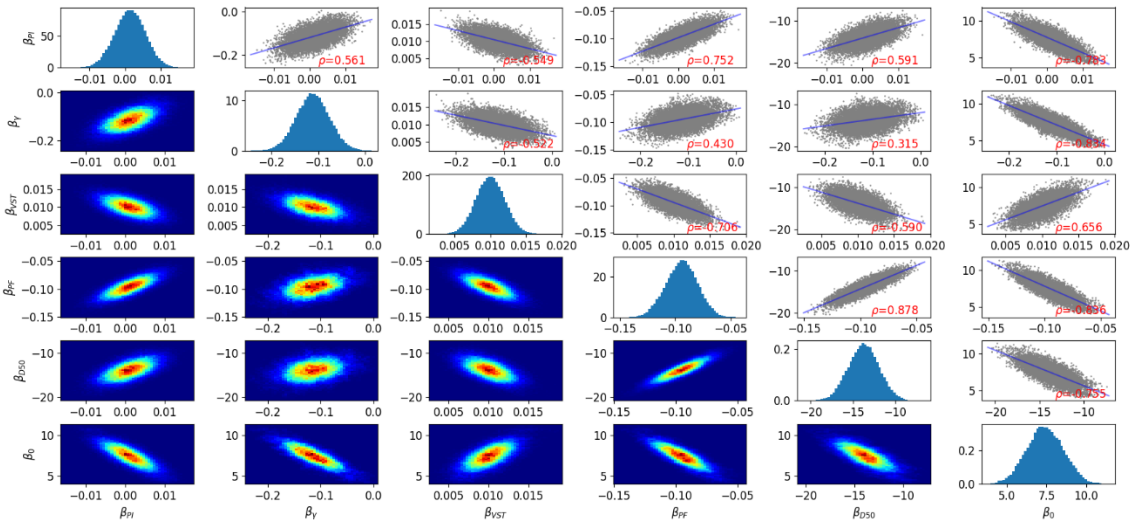
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
44	PI, γ, VST, PF, D50	EFA/Coarse 10	$v_c = 0.002 \times PI - 0.1 \times \gamma + 0.01 \times VST - 0.09 \times PF - 13.6 \times D50 + 7.21$ $for\ 0.074 < D50 < 0.3$	0.93	0.67

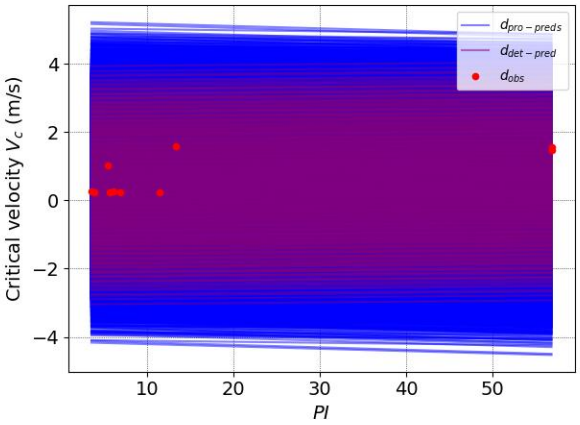
(2) Statistics of marginal posterior distribution:

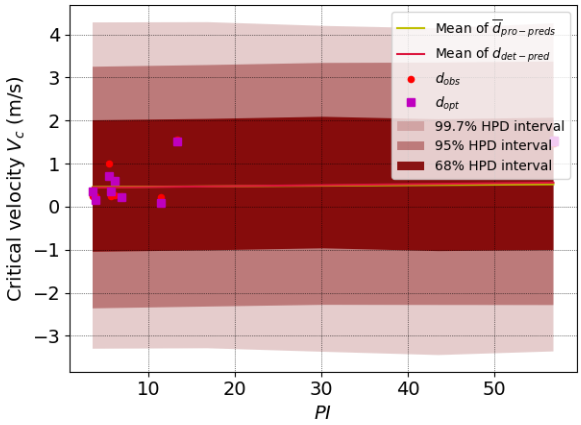
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_{PI}	0.001	0.004	3.655	0.000	-0.007	0.009
β_{γ}	-0.114	0.036	-0.313	-0.120	-0.184	-0.044
β_{VST}	0.010	0.002	0.198	0.010	0.006	0.014
β_{PF}	-0.095	0.014	-0.146	-0.090	-0.123	-0.069
β_{D50}	-13.810	1.783	-0.129	-13.850	-17.227	-10.271
β_0	7.496	1.136	0.152	7.650	5.321	9.755

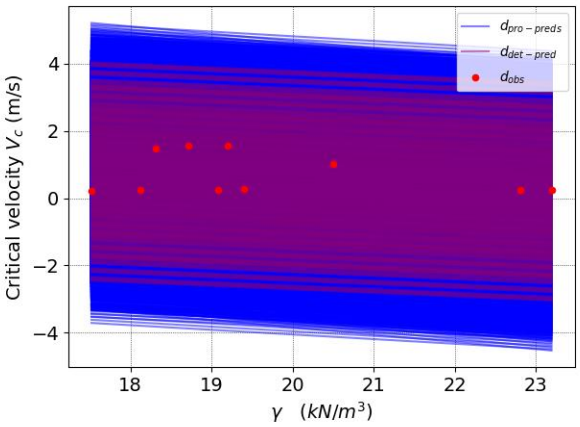
(3) Joint relative frequency histogram:

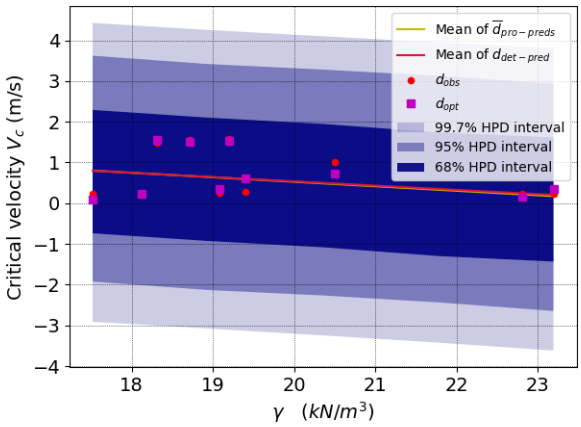


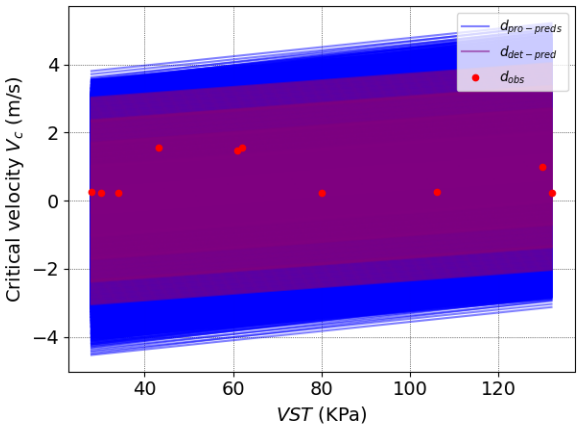
(4) Model realizations and first order statistics of model predictions:

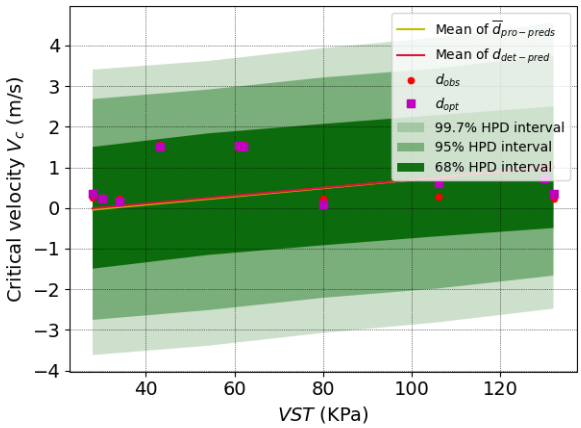

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
PI

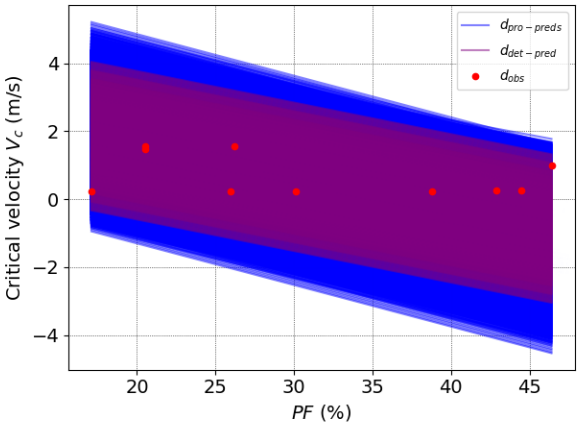

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
PI

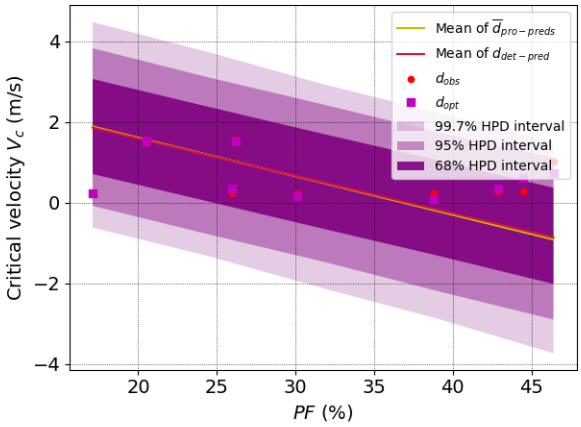

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
γ (kN/m^3)

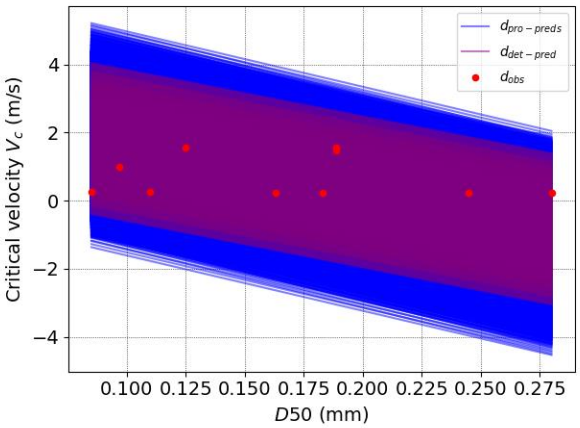

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
γ (kN/m^3)

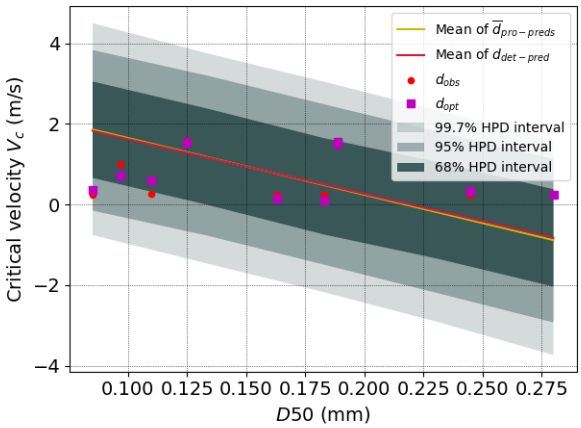

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
VST (KPa)

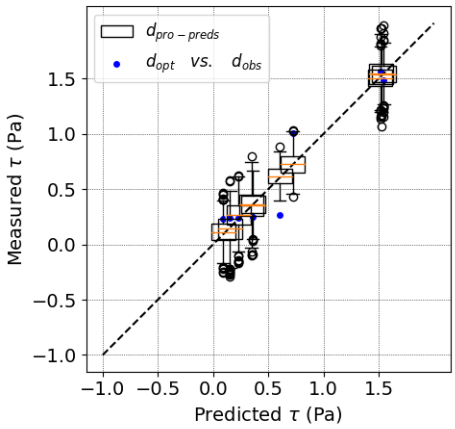

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
VST (KPa)

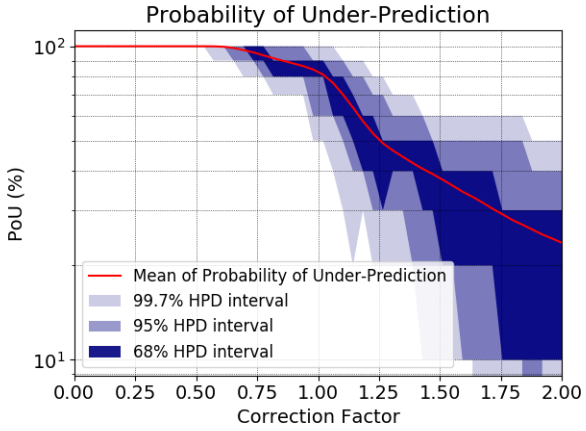

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
PF (%)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
PF (%)


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Critical velocity V_c (m/s)
$D50$ (mm)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Critical velocity V_c (m/s)
$D50$ (mm)


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured τ (Pa)
Predicted τ (Pa)


Probability of Under-Prediction
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
PoU (%)
Correction Factor

Models for Erosion Category EC

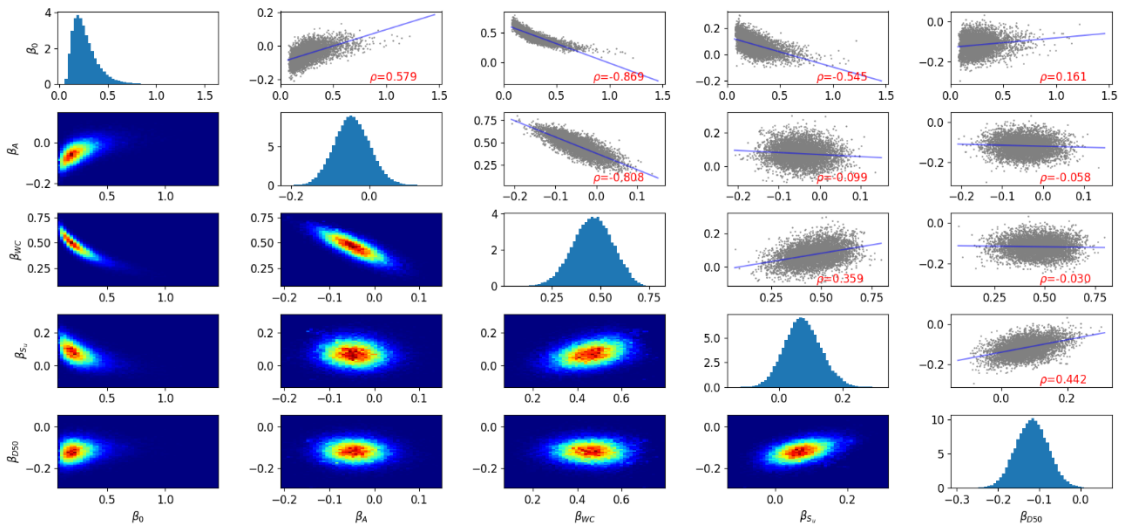
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
132	A, WC, S_u, D50	EFA/Fine 44	$EC = (0.1933) \times A^{-0.06} \times WC^{0.51} \times S_u^{0.09} \times D50^{-0.12}$	0.55	0.53

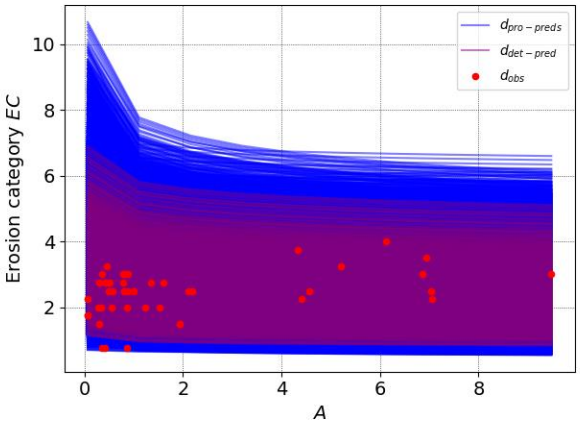
(2) Statistics of marginal posterior distribution:

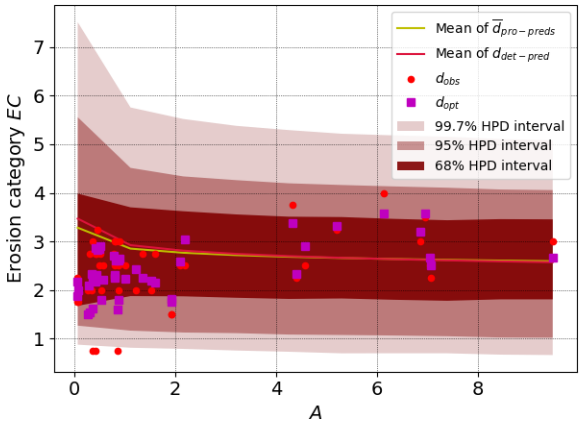
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	0.27	0.13	0.50	0.19	0.07	0.53
β_A	-0.04	0.05	-1.02	-0.04	-0.13	0.05
β_{WC}	0.46	0.10	0.22	0.49	0.27	0.66
β_{S_u}	0.07	0.06	0.77	0.07	-0.03	0.19
β_{D50}	-0.12	0.04	-0.34	-0.12	-0.19	-0.04

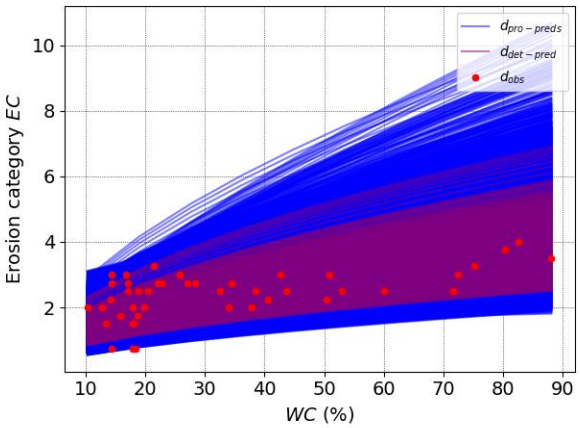
(3) Joint relative frequency histogram:

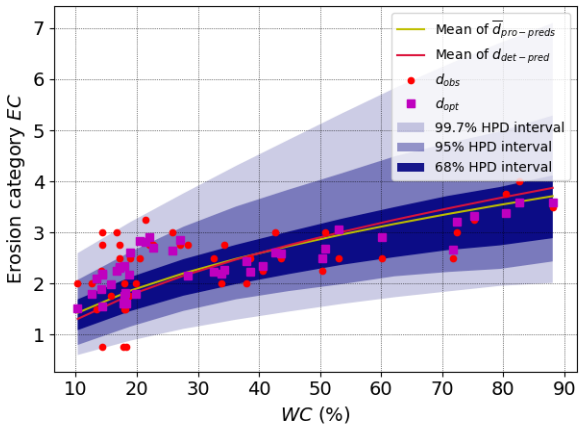


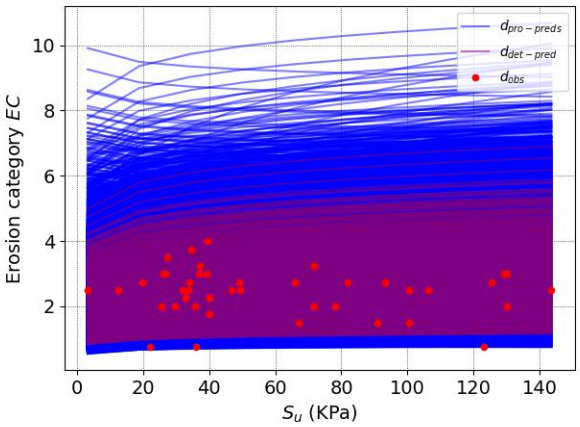
(4) Model realizations and first order statistics of model predictions:

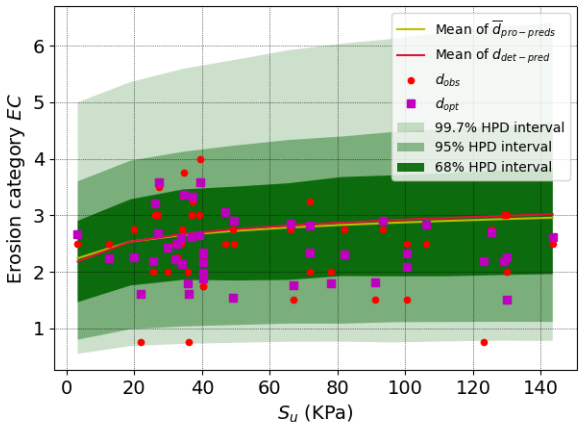

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
A

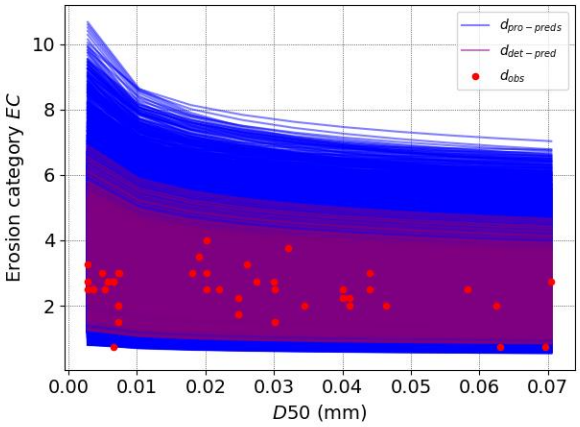

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
A

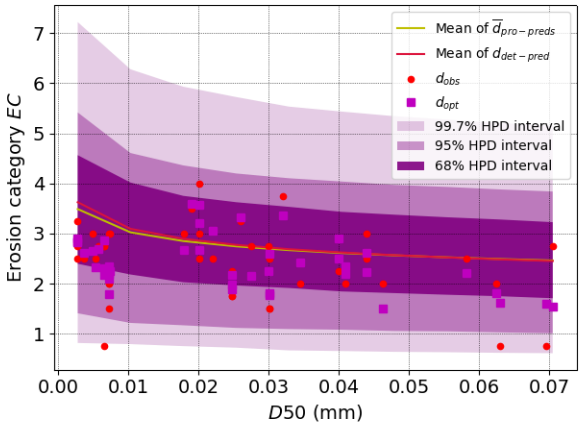

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
WC (%)

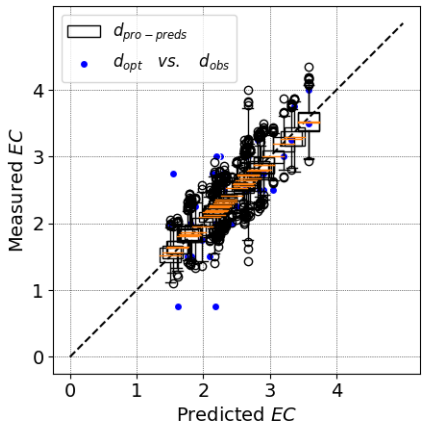

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
WC (%)

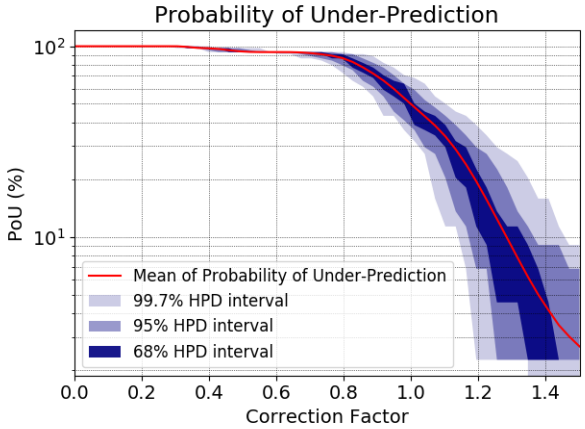

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
S_u (KPa)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
S_u (KPa)


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category *EC*
*D*50 (mm)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category *EC*
*D*50 (mm)


$d_{pro-preds}$
d_{opt} *vs.* d_{obs}
Measured *EC*
Predicted *EC*


Probability of Under-Prediction
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
PoU (%)
Correction Factor

Models for Erosion Category EC

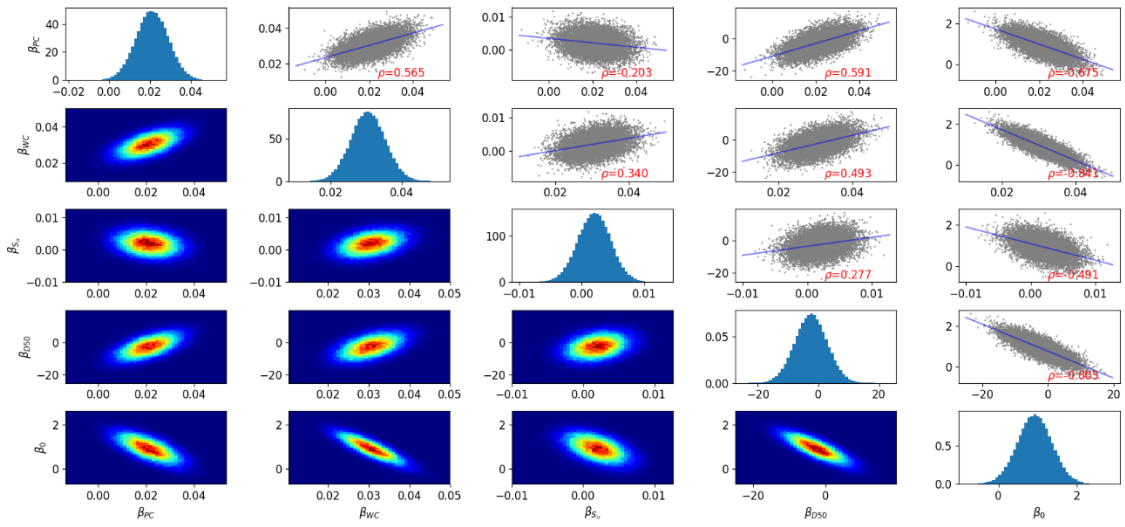
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
117	PC, WC, S_u, D50	EFA/Fine 44	$EC = 0.023 \times PC + 0.03 \times WC + 0.0017 \times S_u - 1.845 \times D50 + 0.8566$	0.56	0.43

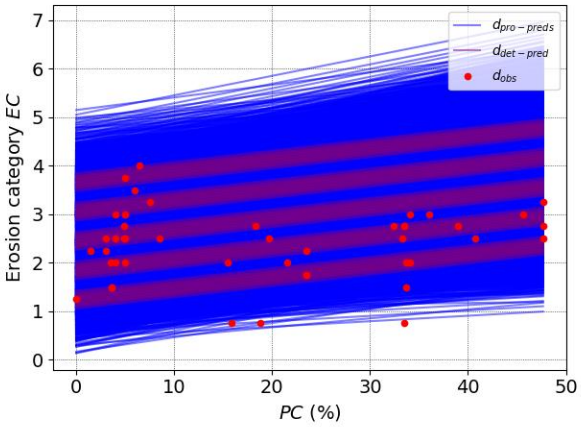
(2) Statistics of marginal posterior distribution:

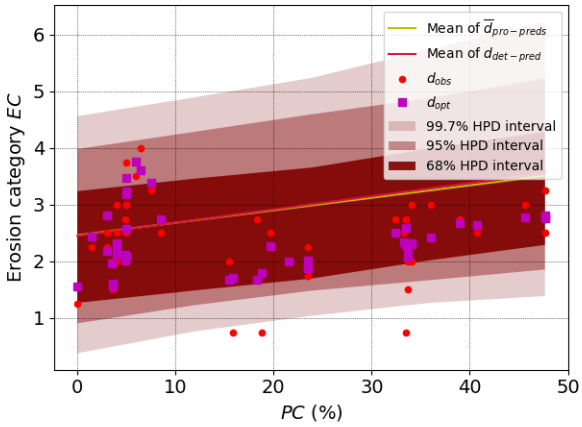
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_{PC}	0.021	0.008	0.378	0.021	0.006	0.037
β_{WC}	0.031	0.005	0.160	0.030	0.021	0.040
β_{S_u}	0.002	0.003	1.313	0.002	-0.003	0.007
β_{D50}	-2.396	5.349	-2.232	-1.137	-12.858	8.083
β_0	0.922	0.440	0.477	1.004	0.053	1.770

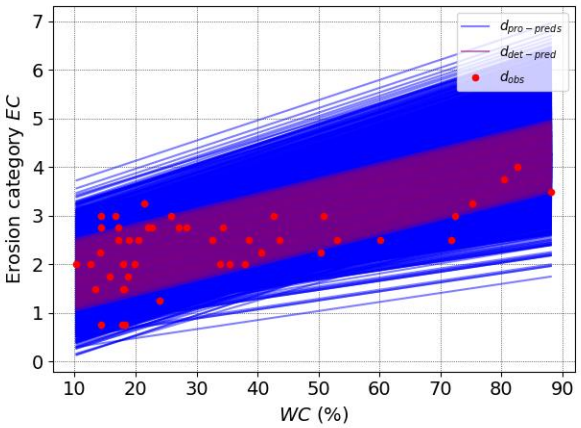
(3) Joint relative frequency histogram:

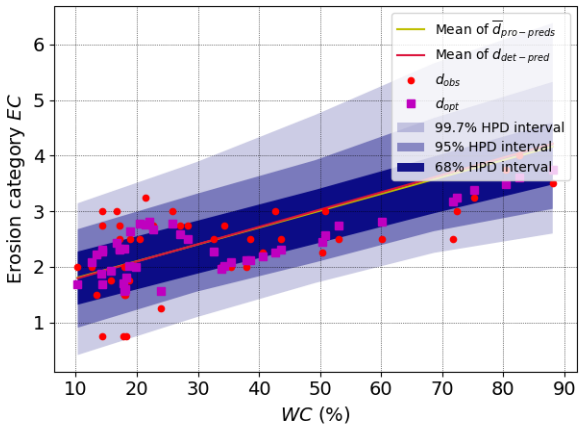


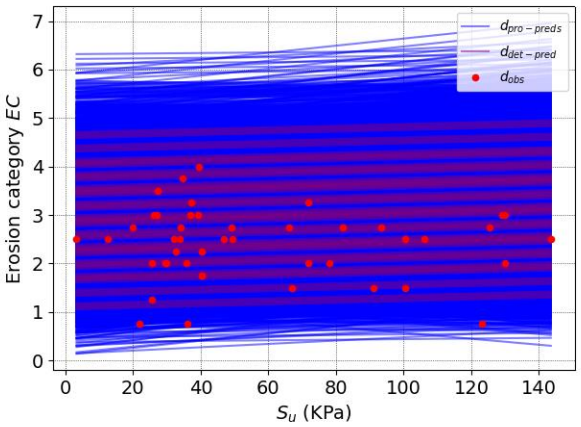
(4) Model realizations and first order statistics of model predictions:

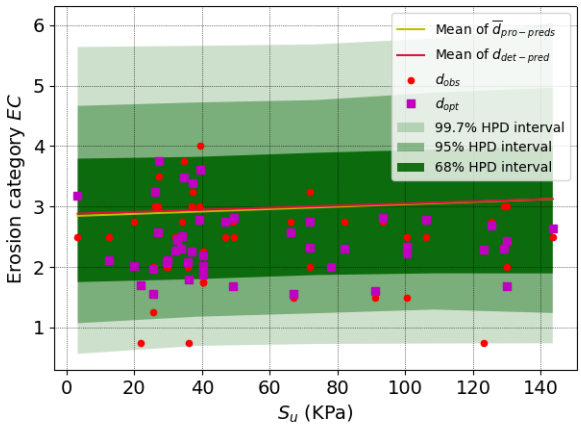

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
PC (%)

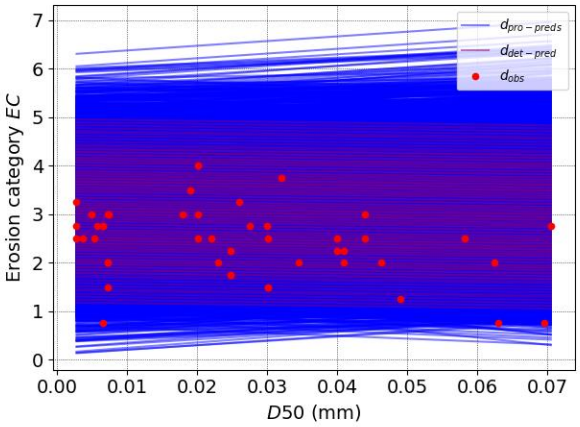

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
PC (%)

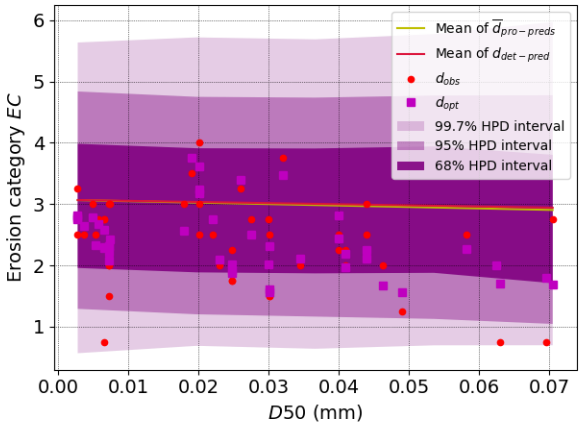

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
WC (%)

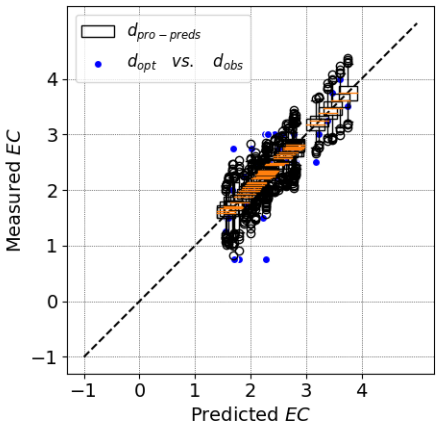

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
WC (%)

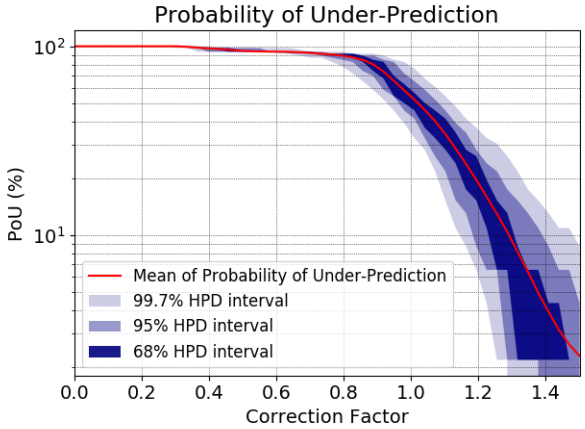

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
S_u (KPa)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
S_u (KPa)


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category *EC*
*D*50 (mm)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category *EC*
*D*50 (mm)


$d_{pro-preds}$
d_{opt} *vs.* d_{obs}
Measured *EC*
Predicted *EC*


Probability of Under-Prediction
PoU (%)
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
Correction Factor

Models for Erosion Category EC

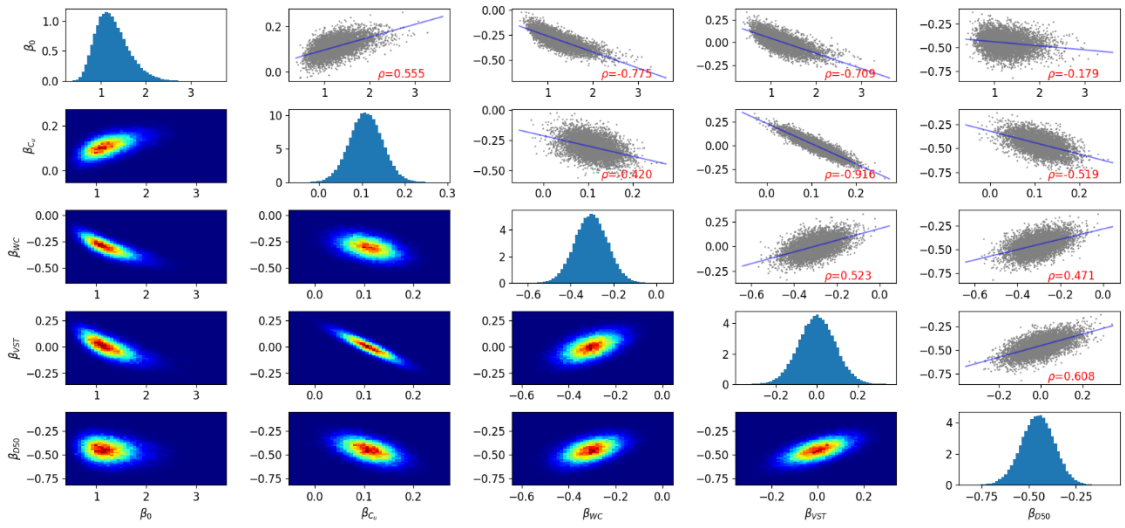
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
91	C_u, WC, VST, D50	EFA/Coarse 11	$EC = (1.12) \times C_u^{0.1} \times WC^{-0.28} \times VST^{0.02} \times D50^{-0.44}$ $for\ 0.074 < D50 < 0.3$	0.92	0.80

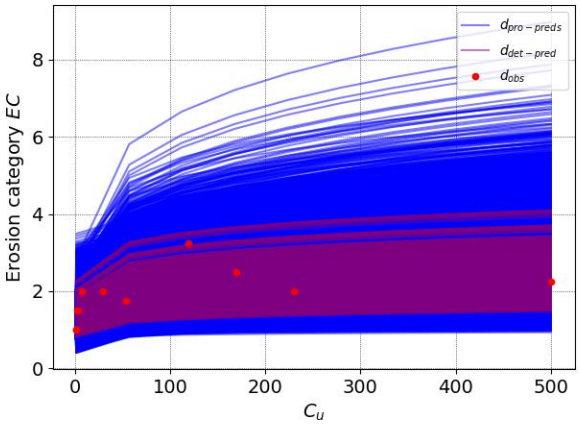
(2) Statistics of marginal posterior distribution:

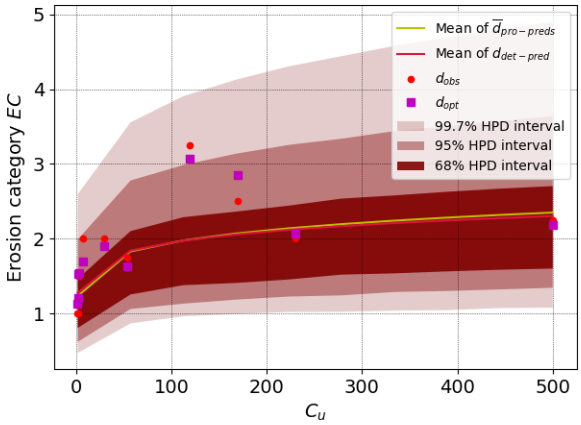
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	1.264	0.375	0.297	0.979	0.577	1.997
β_{C_u}	0.110	0.038	0.347	0.108	0.035	0.184
β_{WC}	-0.304	0.077	-0.254	-0.323	-0.454	-0.150
β_{VST}	0.000	0.088	1453.277	-0.010	-0.175	0.170
β_{D50}	-0.451	0.089	-0.197	-0.442	-0.624	-0.274

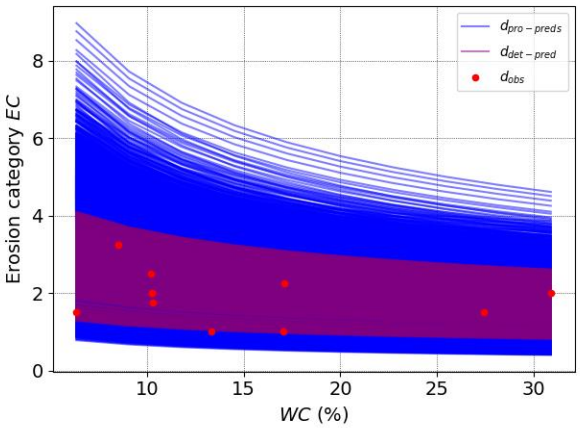
(3) Joint relative frequency histogram:

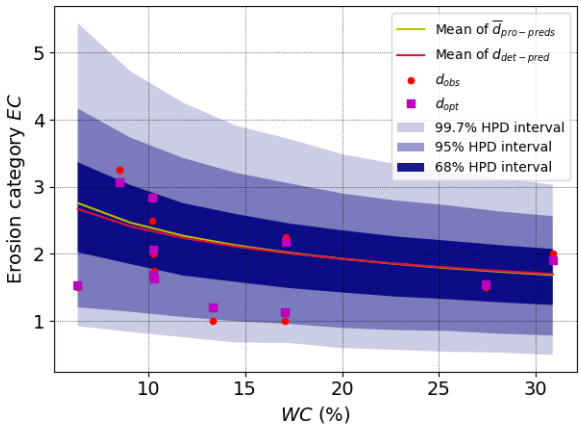


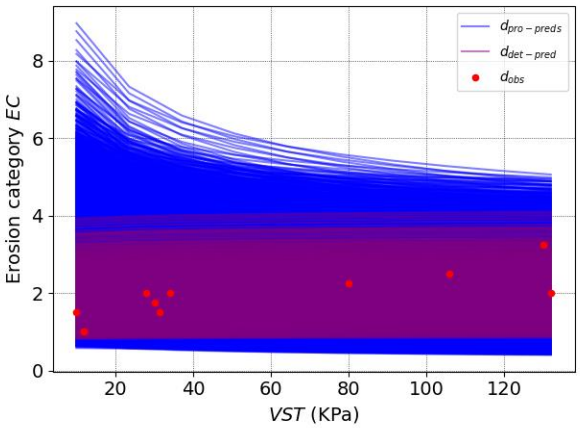
(4) Model realizations and first order statistics of model predictions:

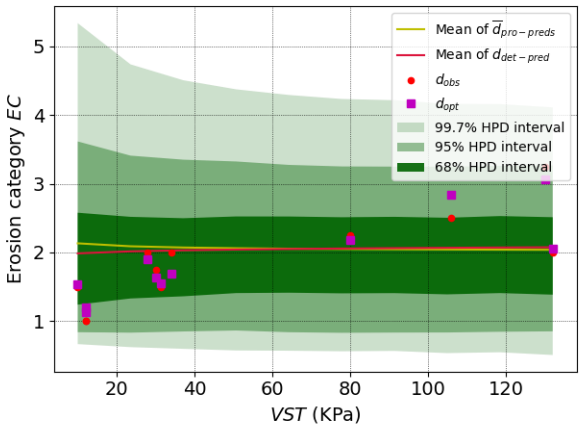

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
C_u

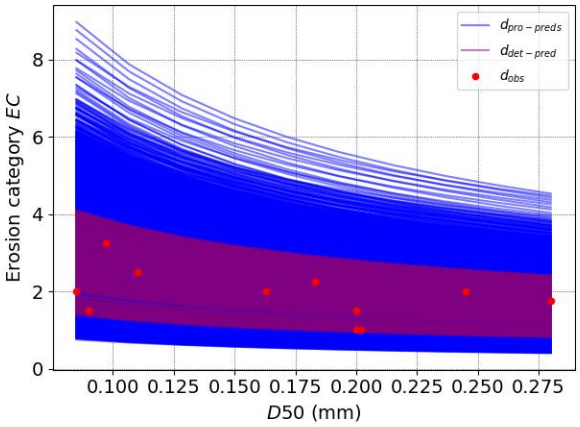

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
C_u

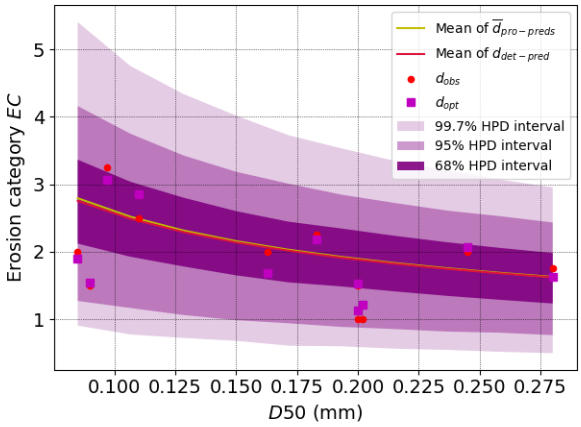

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
WC (%)

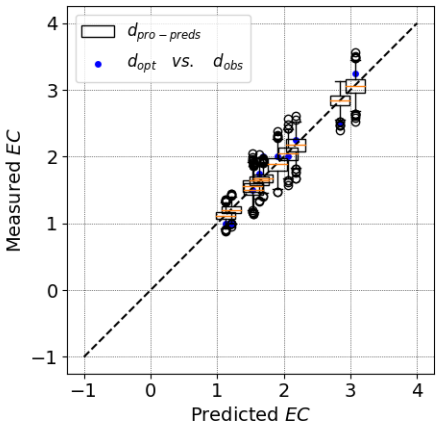

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
WC (%)

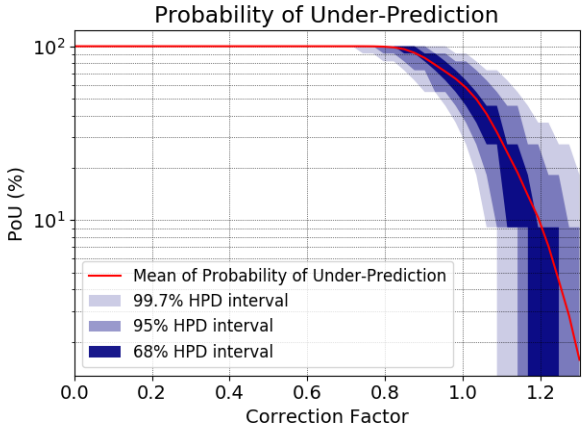

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
VST (KPa)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
VST (KPa)


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
$D50$ (mm)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
$D50$ (mm)


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured EC
Predicted EC


Probability of Under-Prediction
PoU (%)
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
Correction Factor

Models for Erosion Category EC

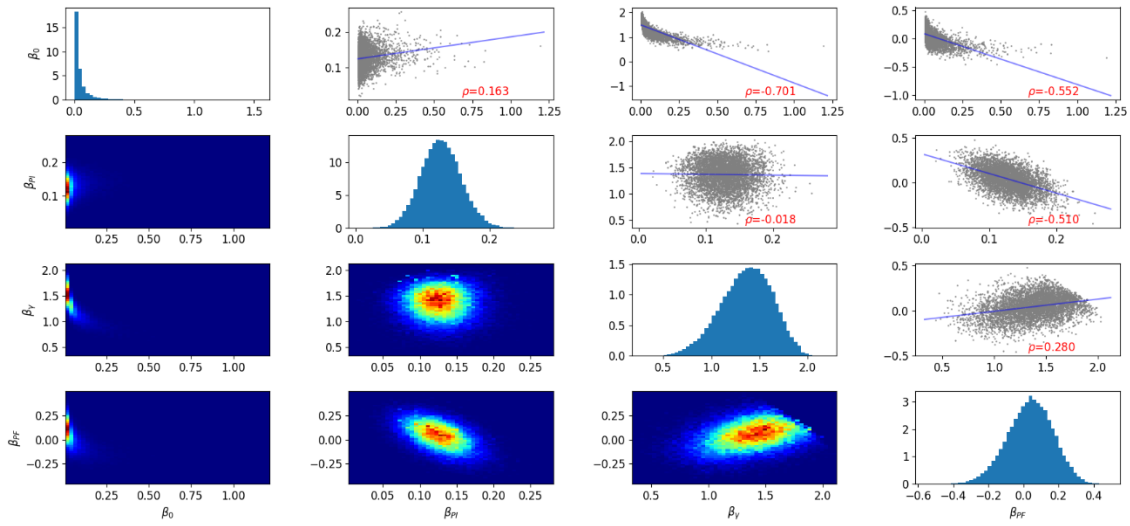
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
13	PI, γ, PF	JET/Fine 56	$EC = (0.00375) \times PI^{0.12} \times \gamma^{1.81} \times PF^{0.21}$	0.51	0.47

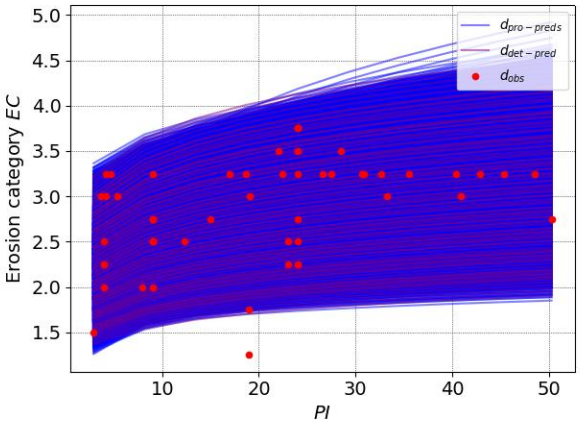
(2) Statistics of marginal posterior distribution:

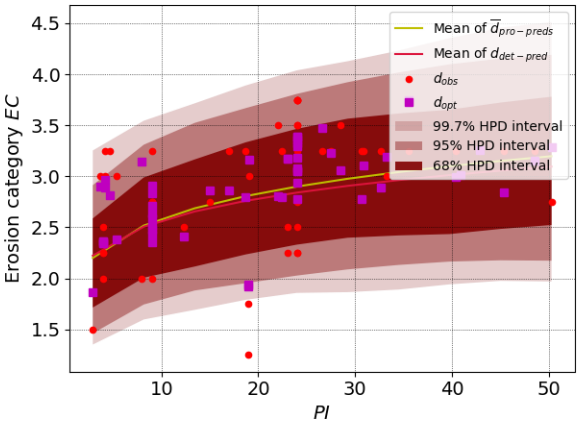
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	0.052	0.077	1.493	0.006	0.004	0.189
β_{PI}	0.127	0.029	0.232	0.120	0.070	0.184
β_γ	1.368	0.261	0.191	1.494	0.884	1.881
β_{PF}	0.042	0.126	3.016	0.071	-0.215	0.277

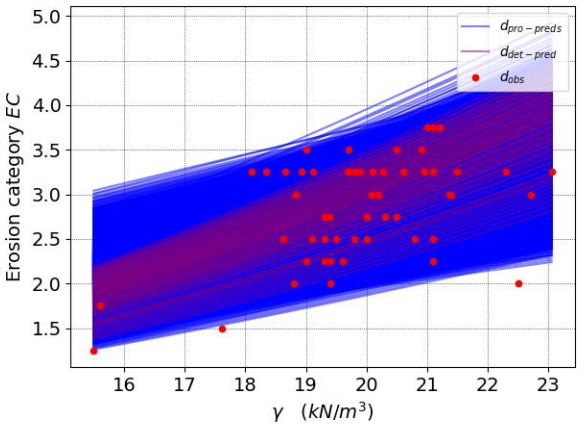
(3) Joint relative frequency histogram:

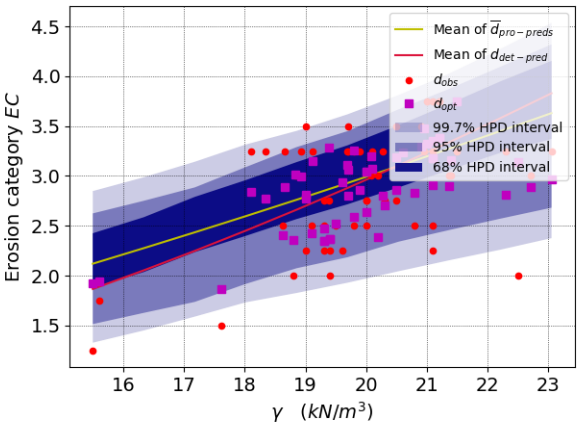


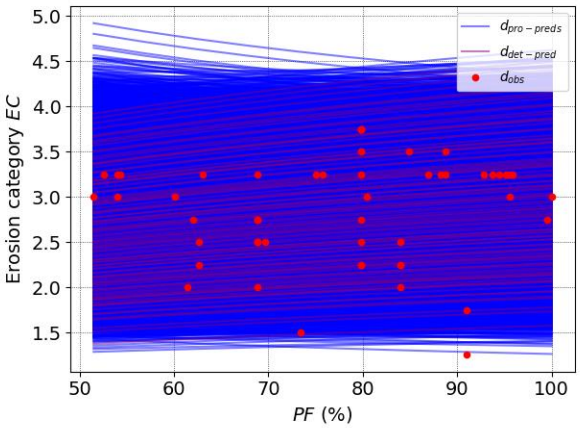
(4) Model realizations and first order statistics of model predictions:

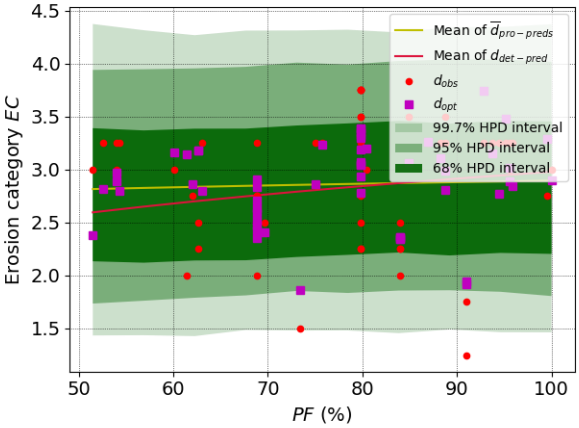

Erosion category EC
PI
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

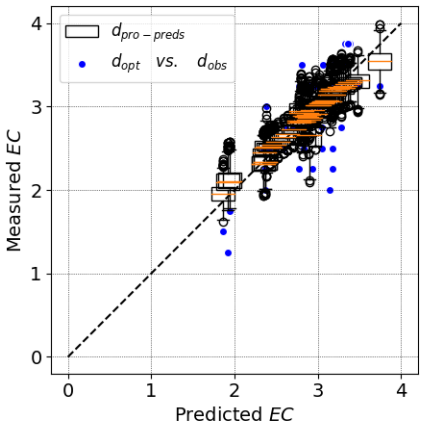

Erosion category EC
PI
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

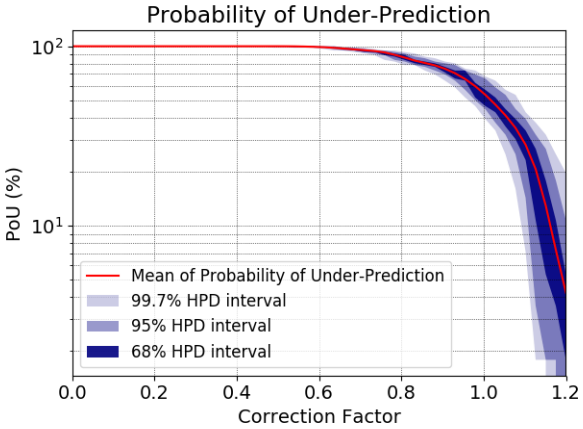

Erosion category EC
γ (kN/m³)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Erosion category EC
γ (kN/m³)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


Erosion category EC
PF (%)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Erosion category EC
PF (%)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured *EC*
Predicted *EC*
0
1
2
3
4


Probability of Under-Prediction
PoU (%)
10^2
10^1
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Correction Factor

Models for Erosion Category EC

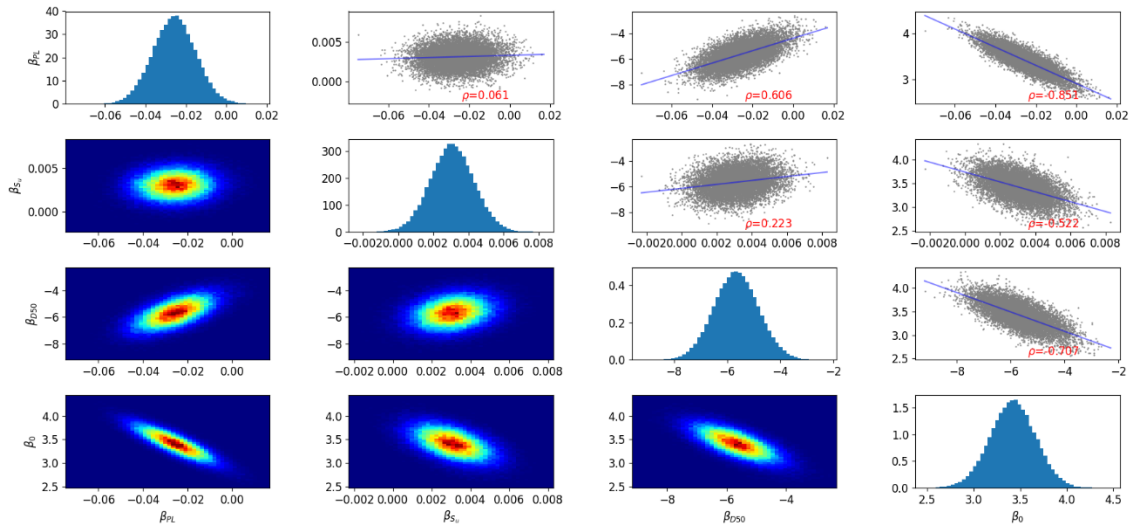
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
88	PL, S_u, D50	JET/Global 28	$EC = -0.022 \times PL + 0.0031 \times S_u - 5.5 \times D50 + 3.34$ $for\ D50 < 0.3\ mm$	0.70	0.58

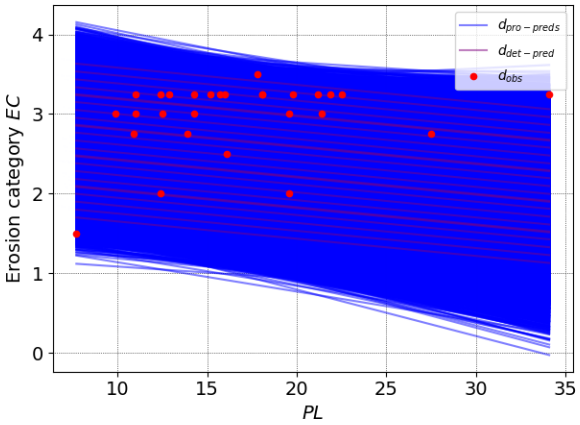
(2) Statistics of marginal posterior distribution:

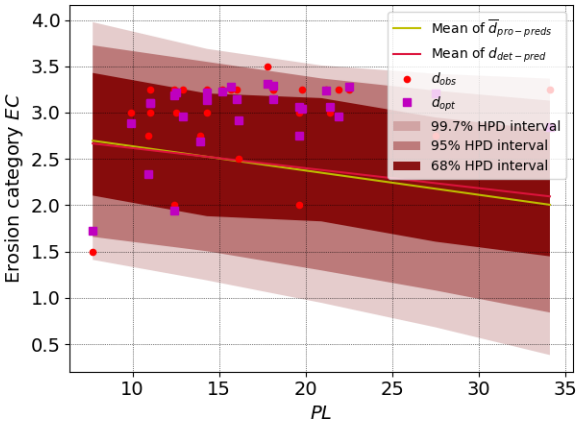
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_{PL}	-0.026	0.011	-0.417	-0.024	-0.047	-0.005
β_{S_u}	0.003	0.001	0.399	0.003	0.001	0.005
β_{D50}	-5.644	0.851	-0.151	-5.464	-7.294	-3.951
β_0	3.417	0.248	0.073	3.420	2.927	3.901

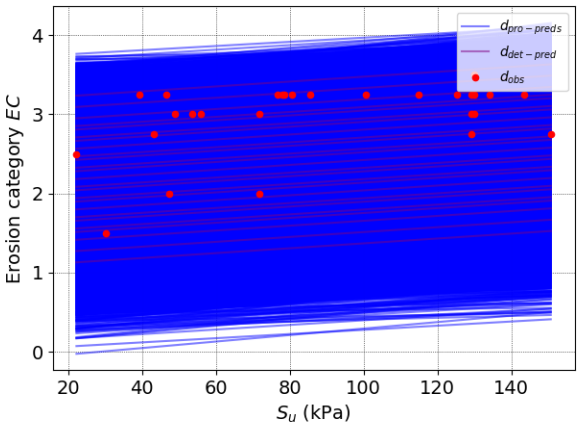
(3) Joint relative frequency histogram:

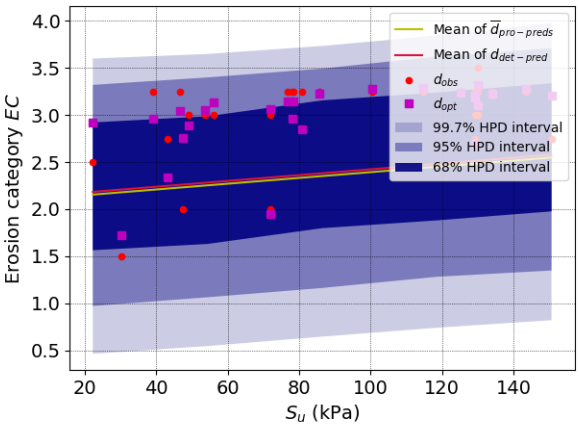


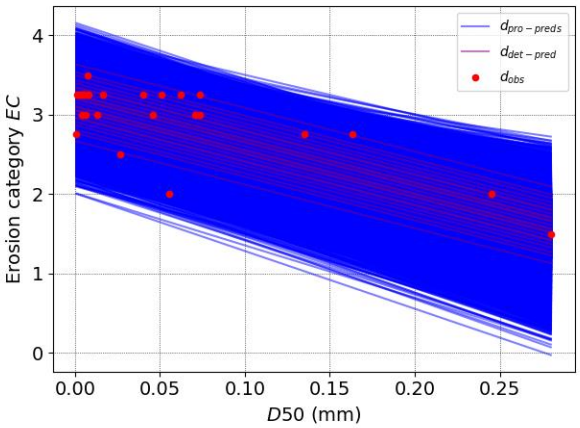
(4) Model realizations and first order statistics of model predictions:

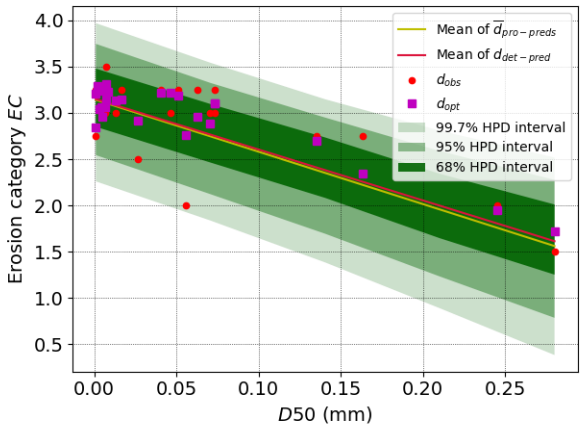

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
PL

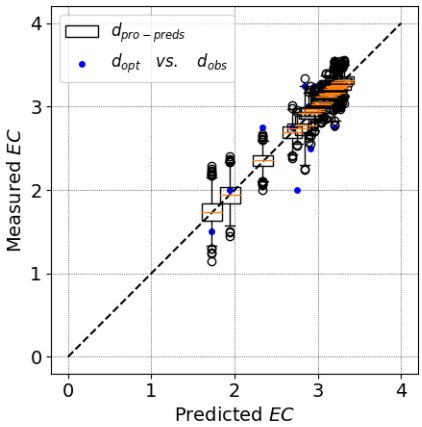

Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
PL

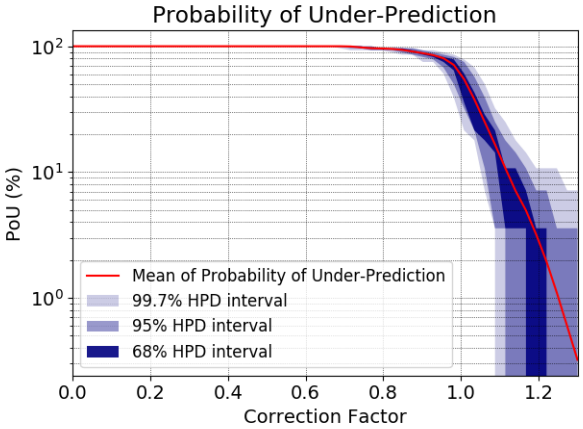

$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
S_u (kPa)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
S_u (kPa)


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Erosion category EC
$D50$ (mm)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Erosion category EC
$D50$ (mm)


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured *EC*
Predicted *EC*
0
1
2
3
4


Probability of Under-Prediction
PoU (%)
10^2
10^1
10^0
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Correction Factor

Models for Erosion Category EC

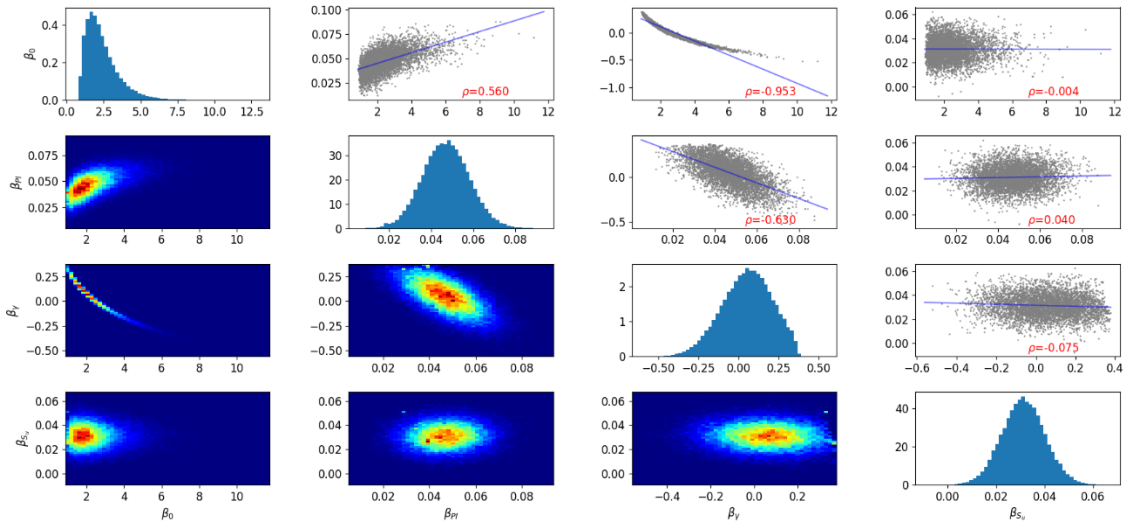
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
12	PI, γ, S_u	HET/Fine 21	$EC = (1.67) \times PI^{0.04} \times \gamma^{0.15} \times S_u^{0.03}$	0.70	0.54

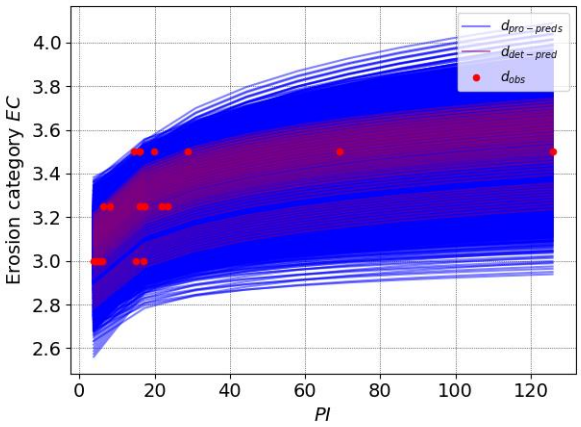
(2) Statistics of marginal posterior distribution:

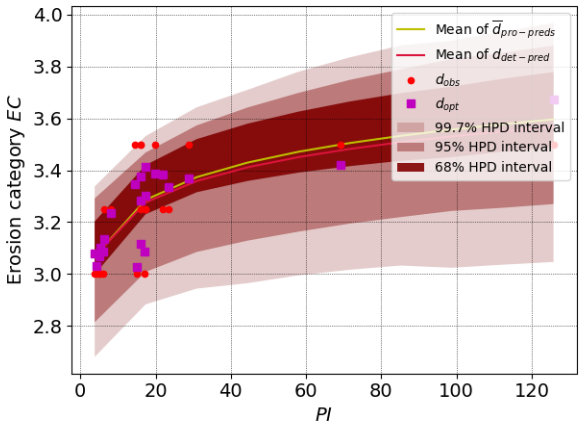
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	2.410	1.143	0.474	0.932	0.892	4.631
β_{PI}	0.047	0.011	0.235	0.049	0.026	0.069
β_γ	0.051	0.154	3.010	0.112	-0.232	0.347
β_{S_u}	0.031	0.009	0.286	0.031	0.014	0.049

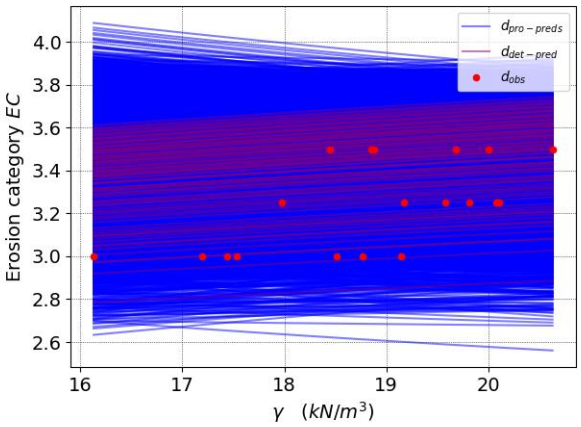
(3) Joint relative frequency histogram:

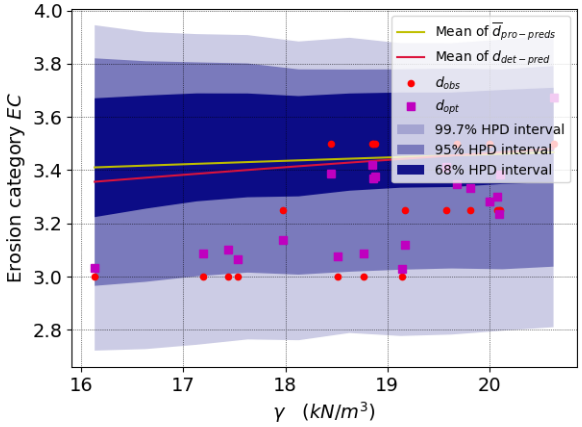


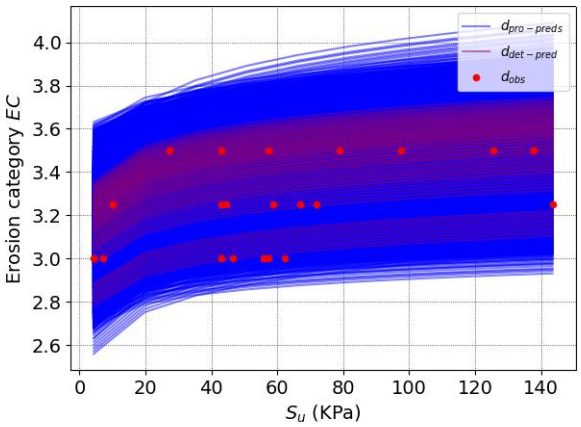
(4) Model realizations and first order statistics of model predictions:

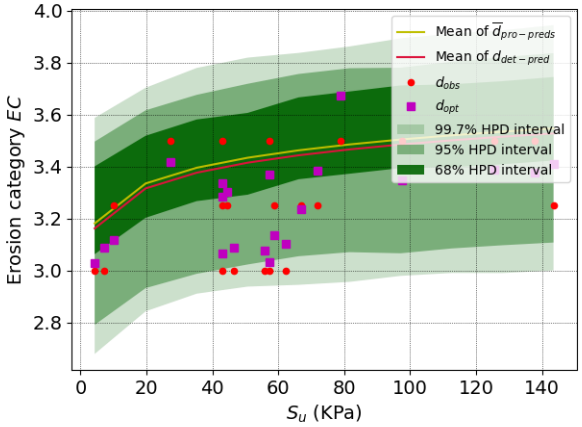

Erosion category EC
PI
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

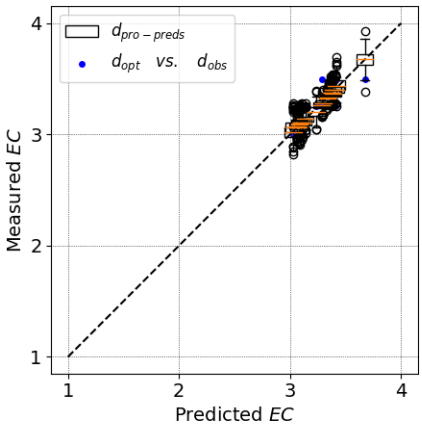

Erosion category EC
PI
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

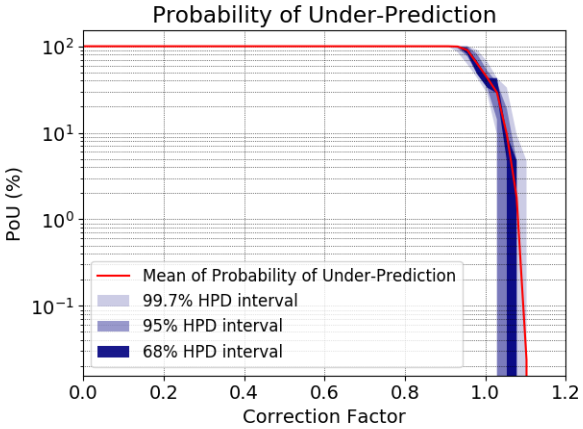

Erosion category EC
γ (kN/m^3)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Erosion category EC
γ (kN/m^3)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


Erosion category EC
S_u (KPa)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Erosion category EC
S_u (KPa)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured *EC*
Predicted *EC*
1
2
3
4


Probability of Under-Prediction
PoU (%)
Correction Factor
Mean of Probability of Under-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
0.0
0.2
0.4
0.6
0.8
1.0
1.2

Models for Velocity Slope E_v

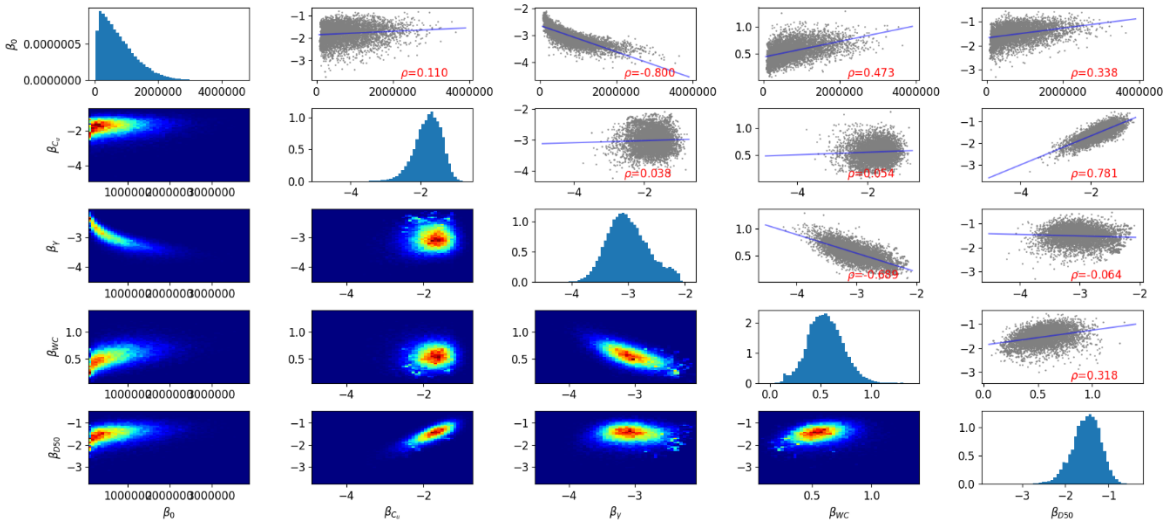
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
86	C_u, γ, WC, D50	EFA/Coarse 28	$E_v = (88969.4) \times C_u^{-1.77} \times \gamma^{-2.26} \times WC^{0.34} \times D50^{-1.69}$	0.86	0.64

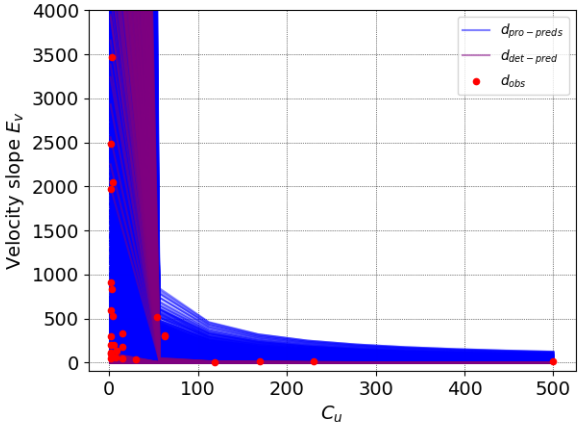
(2) Statistics of marginal posterior distribution:

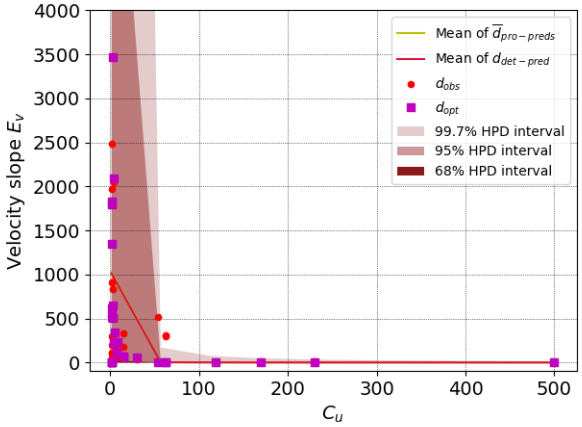
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	776485.449	554061.565	0.714	91446.538	67920.060	1856186.853
β_{C_u}	-1.794	0.391	-0.218	-2.331	-2.541	-1.087
β_γ	-3.017	0.340	-0.113	-2.265	-3.605	-2.322
β_{WC}	0.551	0.171	0.310	0.379	0.212	0.874
β_{D50}	-1.522	0.331	-0.218	-1.920	-2.215	-0.938

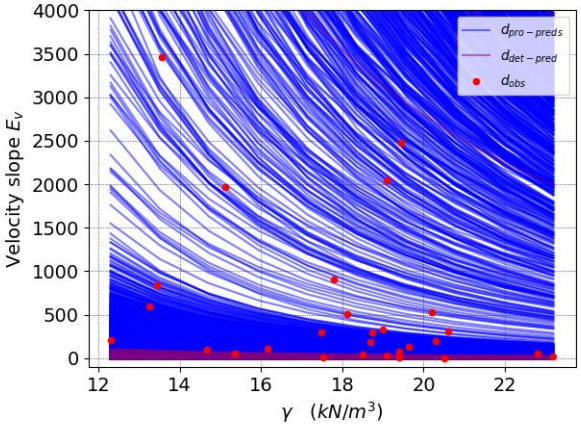
(3) Joint relative frequency histogram:

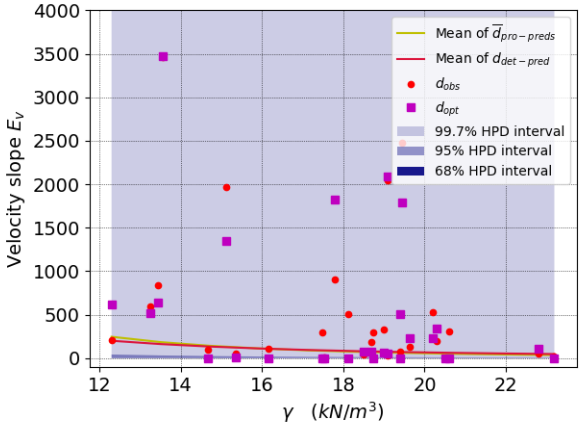


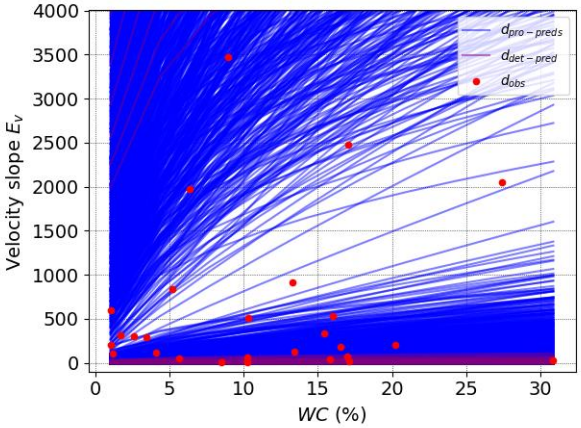
(4) Model realizations and first order statistics of model predictions:

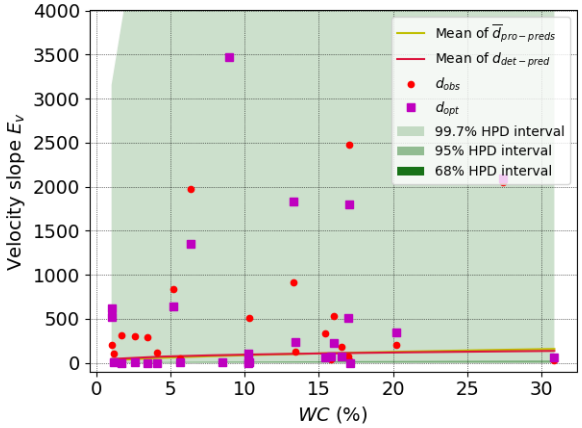

Velocity slope E_v
C_u
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

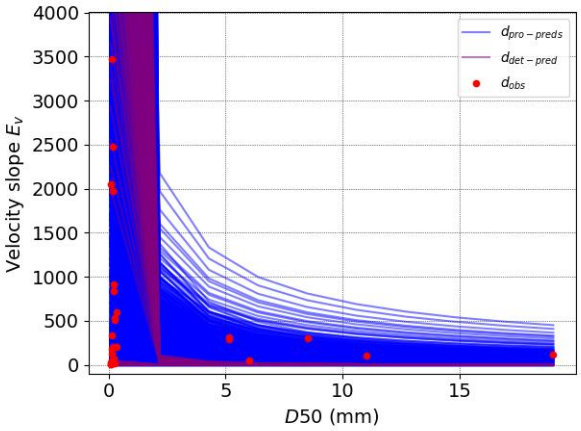

Velocity slope E_v
C_u
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

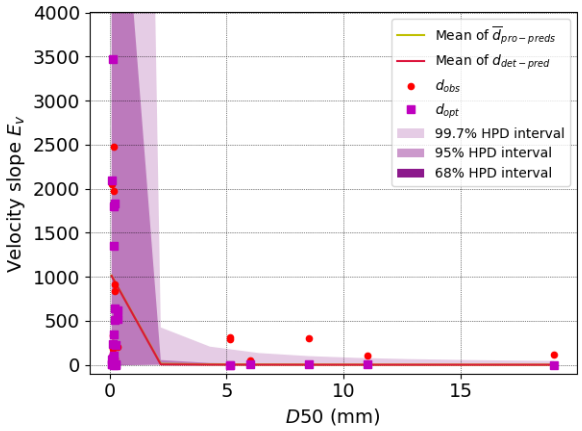

Velocity slope E_v
γ (kN/m^3)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

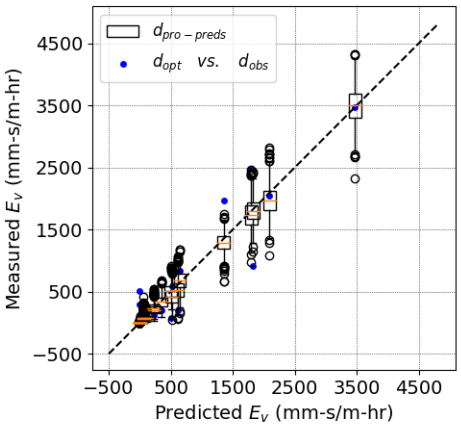

Velocity slope E_v
γ (kN/m^3)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

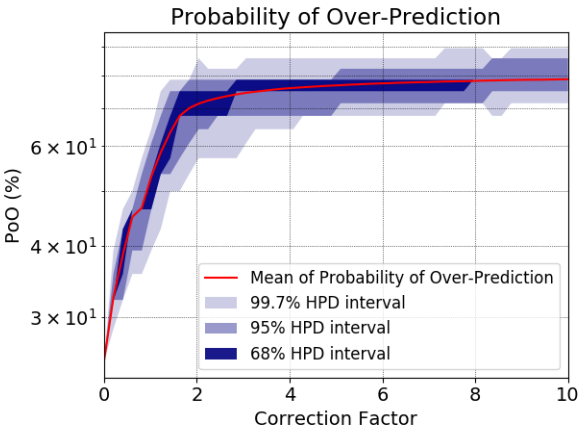

Velocity slope E_v
WC (%)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Velocity slope E_v
WC (%)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


$d_{pro-preds}$
$d_{det-pred}$
d_{obs}
Velocity slope E_v
$D50$ (mm)


Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval
Velocity slope E_v
$D50$ (mm)


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured E_v (mm-s/m-hr)
Predicted E_v (mm-s/m-hr)


Probability of Over-Prediction
Mean of Probability of Over-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
PoO (%)
Correction Factor

Models for Shear Stress Slope E_τ

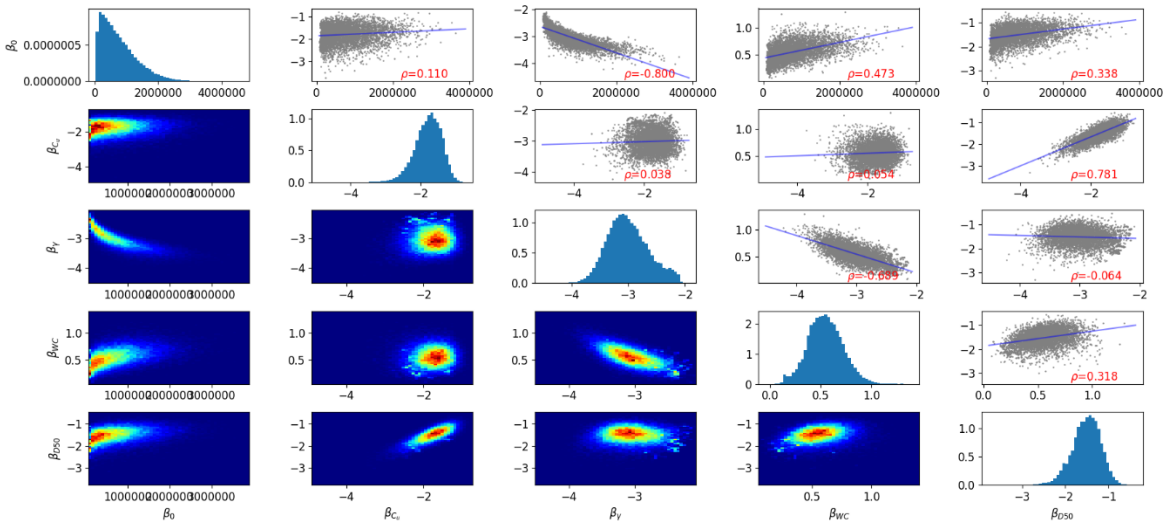
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
77	C_u, γ, D50	EFA/Coarse 28	$E_\tau = (3228.7) \times C_u^{-2.8} \times \gamma^{-1.58} \times D50^{-2.91}$	0.91	0.64

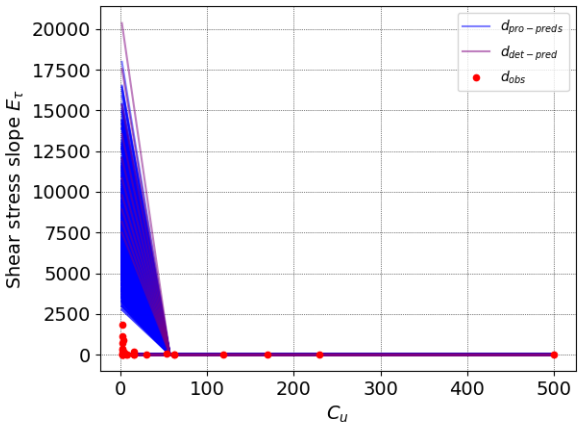
(2) Statistics of marginal posterior distribution:

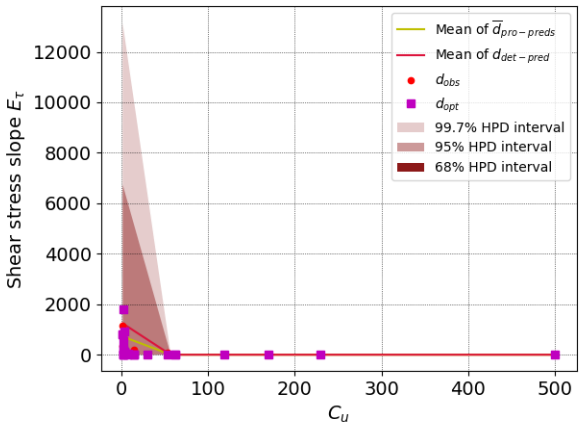
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	3181.776	3823.996	1.202	1067.800	21.313	9335.370
β_{C_u}	-2.040	0.308	-0.151	-2.000	-2.647	-1.443
β_γ	-1.193	0.320	-0.268	-1.200	-1.809	-0.556
β_{D50}	-2.249	0.241	-0.107	-2.200	-2.737	-1.794

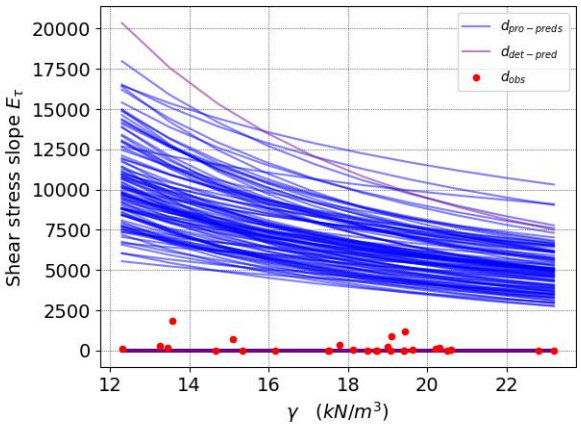
(3) Joint relative frequency histogram:

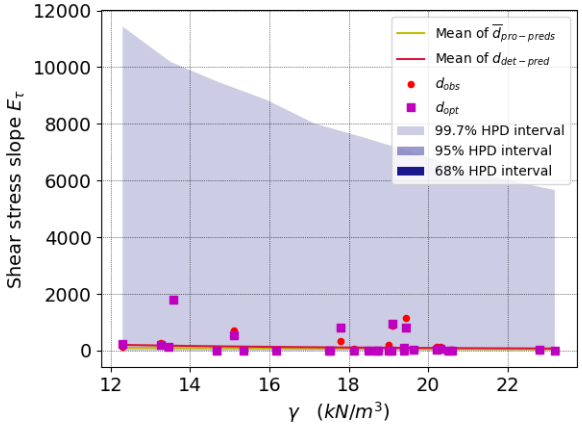


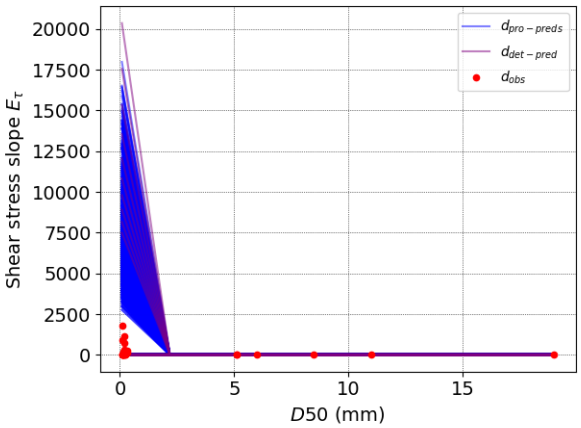
(4) Model realizations and first order statistics of model predictions:

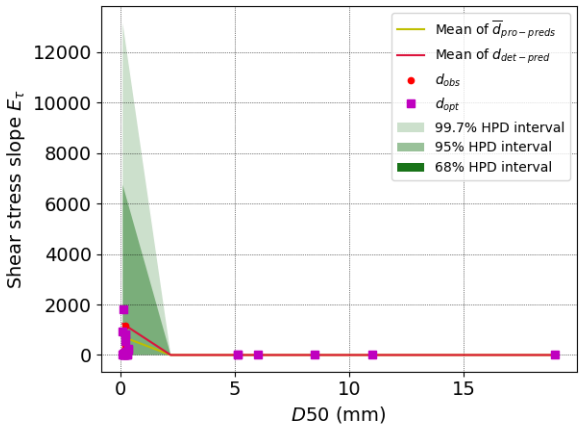

Shear stress slope E_τ
C_u
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

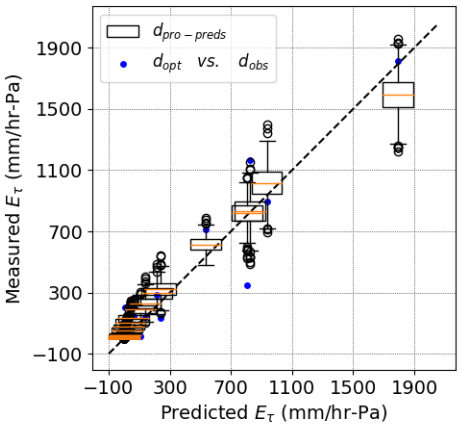

Shear stress slope E_τ
C_u
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

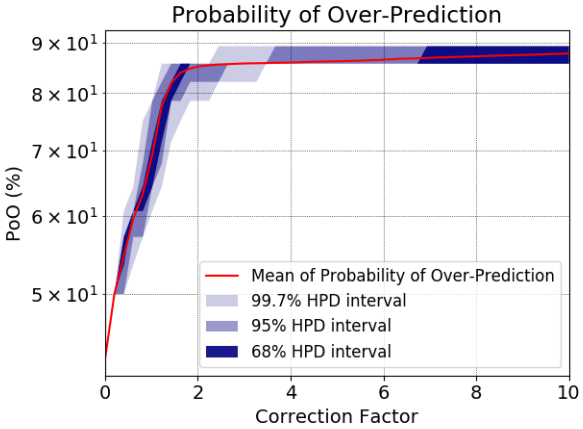

Shear stress slope E_τ
γ (kN/m^3)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Shear stress slope E_τ
γ (kN/m^3)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


Shear stress slope E_τ
$D50$ (mm)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Shear stress slope E_τ
$D50$ (mm)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


$d_{pro-preds}$
d_{opt} vs. d_{obs}
Measured E_τ (mm/hr-Pa)
Predicted E_τ (mm/hr-Pa)
1900
1500
1100
700
300
−100
−100
300
700
1100
1500
1900


Probability of Over-Prediction
PoO (%)
9×10^1
8×10^1
7×10^1
6×10^1
5×10^1
Mean of Probability of Over-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval
0
2
4
6
8
10
Correction Factor

Models for Shear Stress Slope E_τ

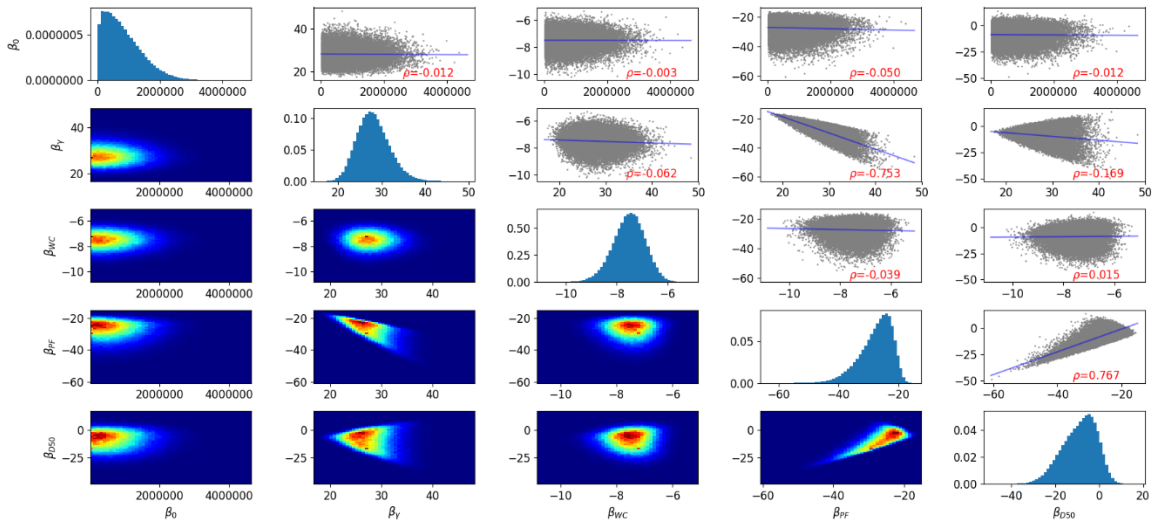
(1) Model characteristics:

Group No.	Independent variables	Dataset/ No. of data	Model expression (parameter values given by deterministic regression)	R^2	Cross-validation score
40	γ, WC, PF, D50	HET/Coarse 62	$E_\tau = (2.951) \times \gamma^{26.08} \times WC^{-7.48} \times PF^{-19.96} \times D50^{-5.32}$	0.86	0.55

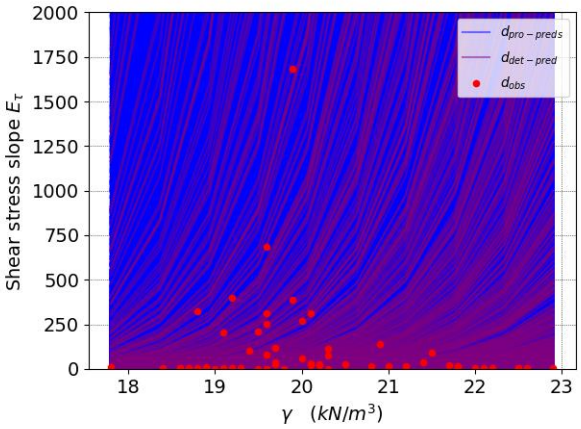
(2) Statistics of marginal posterior distribution:

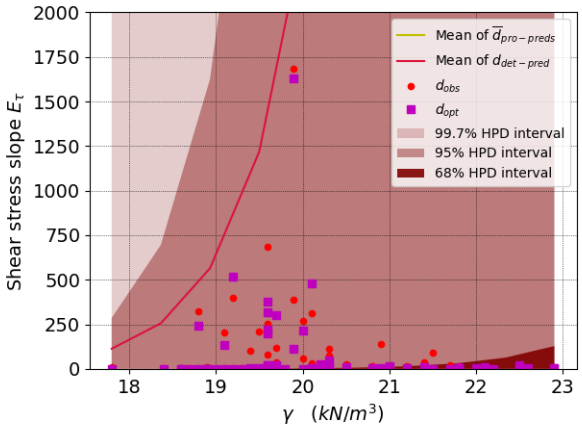
Parameters	Mean	SD	CoV	mode	95% HPD region (lower and upper bound)	
β_0	829973.740	605826.039	0.730	14235.580	14235.580	1993148.732
β_γ	28.075	3.667	0.131	26.940	21.203	35.423
β_{WC}	-7.508	0.632	-0.084	-7.206	-8.782	-6.310
β_{PF}	-27.489	5.471	-0.199	-28.886	-38.634	-18.538
β_{D50}	-8.953	7.805	-0.872	-16.508	-24.489	4.691

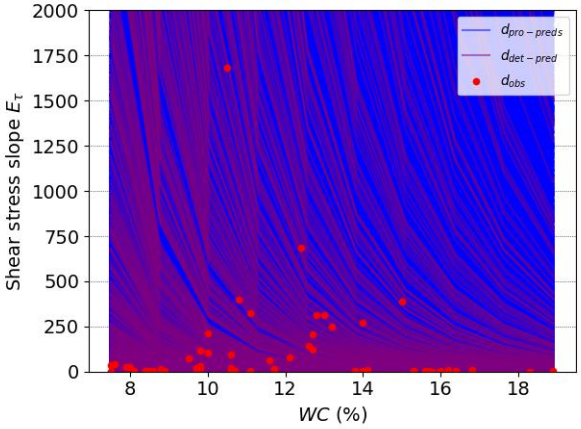
(3) Joint relative frequency histogram:

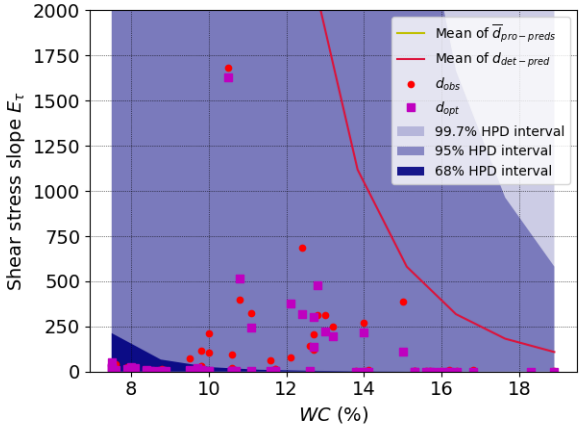


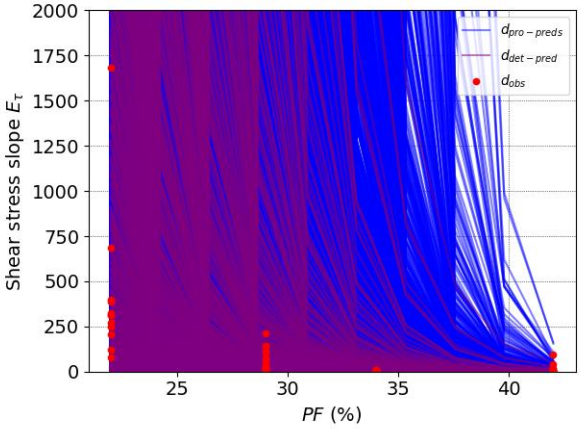
(4) Model realizations and first order statistics of model predictions:

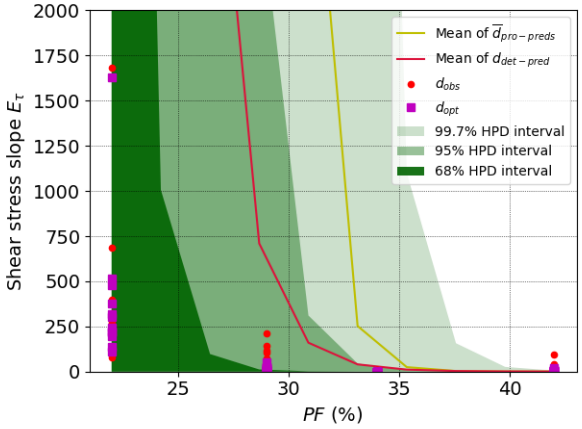

Shear stress slope E_τ
γ (kN/m^3)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

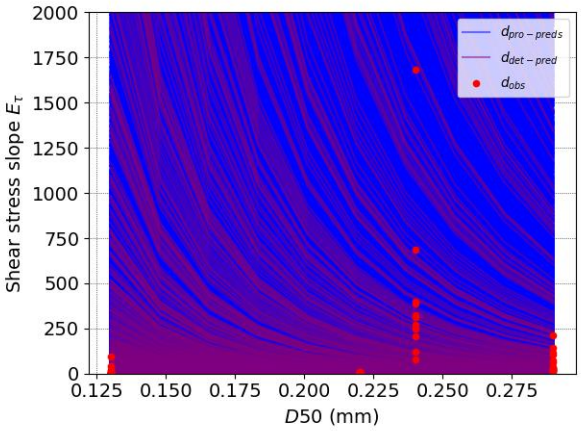

Shear stress slope E_τ
γ (kN/m^3)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

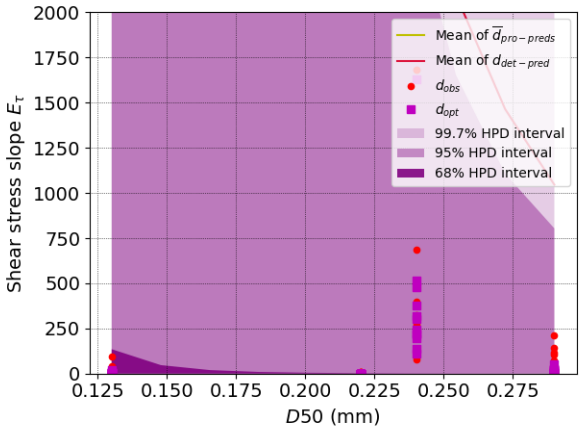

Shear stress slope E_τ
WC (%)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}

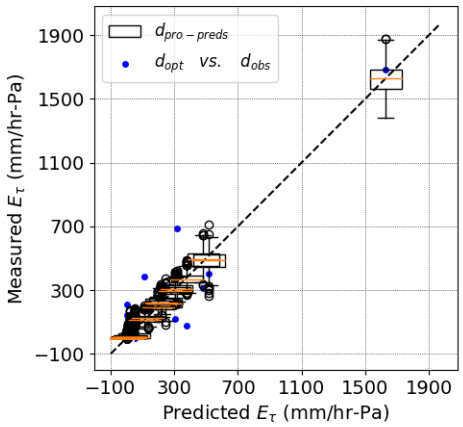

Shear stress slope E_τ
WC (%)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval

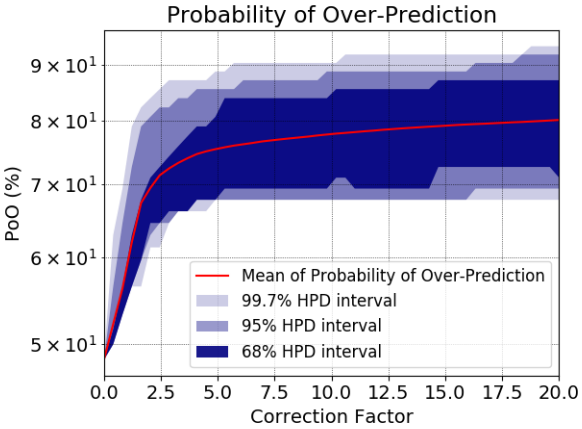

Shear stress slope E_τ
PF (%)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Shear stress slope E_τ
PF (%)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


Shear stress slope E_τ
$D50$ (mm)
$d_{pro-preds}$
$d_{det-pred}$
d_{obs}


Shear stress slope E_τ
$D50$ (mm)
Mean of $\overline{d}_{pro-preds}$
Mean of $d_{det-pred}$
d_{obs}
d_{opt}
99.7% HPD interval
95% HPD interval
68% HPD interval


Measured E_τ (mm/hr-Pa)
Predicted E_τ (mm/hr-Pa)
$d_{pro-preds}$
d_{opt} vs. d_{obs}


Probability of Over-Prediction
PoO (%)
Correction Factor
Mean of Probability of Over-Prediction
99.7% HPD interval
95% HPD interval
68% HPD interval