APPENDIX A

Summaries of vibration measurements at blast sites

NM-1
Date 2/13/2008
Shot 2:10 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot					(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	149	200	16.4	0.27	30.1	13.1	0.0094	0.13	0.20	19.6	12.4	0.0061	0.07	0.18	22.2	4.4	0.0044	0.09	0.27	30.1	13.1	R	126
2279				spiked	149	200	16.4	0.37	28.4	37.0	0.0112	0.17	0.23	23.2	12.4	0.0066	0.07	0.18	32.0	40.8	0.0031	0.10	0.37	28.4	37.0	R	123
3047			cluster	sandbag	149	200	16.4	0.38	22.2	37.1	0.0115	0.19	0.22	22.2	12.4	0.0060	0.09	0.19	36.5	40.8	0.0035	0.11	0.38	22.2	37.1	R	123
930				spiked round sensor	149	200	16.4	0.37	28.4	4.4	0.0107	0.17	0.23	22.2	12.4	0.0063	0.08	0.19	34.1	40.9	0.0033	0.10	0.37	28.4	4.4	R	124
3046				spiked with sandbag	149	200	16.4	0.39	30.1	37.1	0.0115	0.17	0.23	10.8	12.4	0.0064	0.09	0.17	28.4	40.6	0.0033	0.09	0.39	30.1	37.1	R	124
2241				short spikes	149	200	16.4	0.39	30.1	37.0	0.0117	0.19	0.25	22.2	12.4	0.0063	0.08	0.20	34.1	40.8	0.0031	0.11	0.39	30.1	37.0	R	124
3486			1st series	buried	149	100	8.2	0.52	39.3	4.3	0.0145	0.40	0.48	20.4	12.4	0.0097	0.33	0.33	51.2	41.0	0.0048	0.27	0.52	39.3	4.3	R	128
2240			last series	buried	149	300	24.6	0.20	9.6	5.3	0.0088	0.09	0.17	34.1	12.4	0.0050	0.09	0.13	32.0	39.3	0.0025	0.07	0.20	9.6	5.3	R	118

NM-2
Date 2/20/2008
Shot 2:25 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot					(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	150	200	16.3	0.19	12.4	7.0	0.0057	0.07	0.25	7.5	6.1	0.0073	0.05	0.15	20.4	6.4	0.0049	0.06	0.25	7.5	6.1	V	123
2279				spiked	150	200	16.3	0.20	12.1	6.6	0.0065	0.07	0.23	5.3	6.1	0.0076	0.05	0.13	26.9	31.5	0.0038	0.06	0.23	5.3	6.1	V	124
3047			cluster	sandbag	150	200	16.3	0.20	8.6	7.0	0.0058	0.07	0.27	10.4	6.5	0.0079	0.07	0.16	25.6	24.3	0.0031	0.07	0.27	10.4	6.5	V	123
930				spiked round sensor	150	200	16.3	0.20	12.1	6.6	0.0063	0.08	0.23	5.3	6.1	0.0075	0.05	0.13	19.6	31.5	0.0038	0.07	0.23	5.3	6.1	V	122
3046				spiked with sandbag	150	200	16.3	0.20	11.9	7.0	0.0060	0.07	0.24	10.6	6.1	0.0075	0.05	0.15	25.6	24.3	0.0041	0.07	0.24	10.6	6.1	V	123
2241				short spikes	150	200	16.3	0.22	12.4	7.0	0.0066	0.08	0.26	10.8	7.0	0.0076	0.07	0.15	28.4	6.4	0.0040	0.08	0.26	10.8	7.0	V	124
3486			1st series	buried	150	100	8.2	0.33	30.1	5.6	0.0094	0.18	0.30	16.5	6.5	0.0106	0.11	0.37	30.1	38.4	0.0067	0.17	0.37	30.1	38.4	T	128
2240			last series	buried	150	300	24.5	0.21	16.0	6.6	0.0062	0.09	0.19	8.9	6.4	0.0062	0.07	0.13	20.4	27.9	0.0033	0.07	0.21	16.0	6.6	R	120

NM-3
Date 2/27/2008
Shot 2:30 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot					(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	150	250	20.4	0.31	11.6	15.0	0.0066	0.12	0.30	13.8	15.0	0.0099	0.09	0.25	9.6	5.6	0.0101	0.08	0.31	11.6	15.0	R	123
2279				spiked	150	250	20.4	0.30	11.6	15.0	0.0068	0.12	0.31	13.8	15.0	0.0099	0.09	0.25	9.8	5.6	0.0097	0.09	0.31	13.8	15.0	V	123
3047			cluster	sandbag	150	250	20.4	na			0.0000	0.00				0.0000	0.00				0.0002	0.01				V	
930				spiked round sensor	150	250	20.4	0.30	11.3	15.0	0.0067	0.12	0.30	13.8	15.0	0.0099	0.09	0.25	10.0	5.6	0.0092	0.09	0.30	13.8	15.0	V	122
3046				spiked with sandbag	150	250	20.4	0.26	11.3	15.0	0.0072	0.12	0.30	13.4	15.0	0.0095	0.09	0.21	10.0	5.6	0.0087	0.08	0.30	13.4	15.0	V	122
2241				short spikes	150	250	20.4	0.28	11.1	15.0	0.0071	0.11	0.31	13.8	15.0	0.0097	0.08	0.23	9.8	5.6	0.0093	0.08	0.31	13.8	15.0	V	123
3487			1st series	buried	150	150	12.2	0.57	11.6	9.1	0.0144	0.20	0.40	11.6	6.6	0.0110	0.14	0.66	10.0	9.9	0.0166	0.13	0.66	10.0	9.9	T	124
3486			last series	buried	150	350	28.6	0.20	13.8	3.1	0.0049	0.06	0.22	7.7	7.6	0.0061	0.08	0.12	9.4	5.8	0.0057	0.04	0.22	7.7	7.6	V	120

NM-4
Date 2/26/2008
Shot 11:54

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot					(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	336	264	14.4	1.28	22.2	12.1	0.0253	0.62	1.06	22.2	18.4	0.0204	0.66	1.40	12.1	14.3	0.0265	0.58	1.40	12.1	14.3	T	132
2279				spiked	336	264	14.4	1.62	22.2	12.1	0.0262	0.82	1.32	21.3	20.4	0.0201	0.77	1.34	12.4	14.3	0.0301	0.50	1.62	22.2	12.1	R	125
930			cluster	spiked round sensor	336	264	14.4	1.58	24.3	12.1	0.0250	0.80	1.20	21.3	20.3	0.0199	0.72	1.48	12.1	14.3	0.0312	0.53	1.58	24.3	12.1	R	127
2241				short spikes	336	264	14.4	1.82	26.9	36.8	0.0284	0.93	1.32	21.3	18.4	0.0207	1.06	1.60	12.1	14.3	0.0320	0.60	1.82	26.9	36.8	R	126
3047				sandbag	336	264	14.4	1.32	13.1	12.1	0.0245	0.53	1.38	21.3	18.4	0.0206	0.74	1.38	18.2	13.8	0.0278	0.52	1.38	21.3	18.4	V	125
3046				spiked with sandbag	336	264	14.4	1.44	13.1	12.1	0.0249	0.66	1.42	22.2	20.4	0.0208	0.74	1.32	12.4	14.3	0.0296	0.53	1.44	13.1	12.1	R	126
3486			1st series	buried	336	164	8.9	2.56	28.4	15.0	0.0388	1.30	1.16	56.8	37.3	0.0107	0.90	1.70	25.6	36.3	0.0283	0.94	2.56	28.4	15.0	R	130
3487			last series	buried	336	364	19.9	0.58	12.4	20.0	0.0131	0.17	0.36	32.0	37.5	0.0045	0.22	0.45	14.6	12.4	0.0080	0.15	0.58	12.4	20.0	R	123

NM-5
Date 2/28/2008
Shot 1:30 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot					(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	425	600	29.1	0.27	12.8	9.4	0.0097	0.10	0.23	11.6	18.3	0.0075	0.07	0.27	13.4	8.0	0.0062	0.07	0.27	12.8	9.4	R	122
2279				spiked	425	600	29.1	0.29	8.1	9.4	0.0098	0.12	0.25	11.6	18.3	0.0077	0.07	0.30	13.1	8.0	0.0071	0.07	0.30	13.1	8.0	T	123
3048			cluster	sandbag	425	600	29.1	0.30	8.2	9.4	0.0095	0.13	0.25	12.1	18.3	0.0075	0.08	0.28	13.4	8.0	0.0071	0.07	0.30	8.2	9.4	R	123
3046				spiked with sandbag	425	600	29.1	0.30	8.1	9.4	0.0102	0.13	0.24	12.4	18.3	0.0075	0.08	0.28	13.1	8.0	0.0066	0.07	0.30	8.1	9.4	R	120
930				spiked round sensor	425	600	29.1	0.29	8.0	9.4	0.0099	0.11	0.23	11.3	18.3	0.0072	0.07	0.32	13.4	8.0	0.0074	0.07	0.32	13.4	8.0	T	123
2241				short spikes	425	600	29.1	0.29	8.1	9.4	0.0100	0.12	0.23	12.1	18.3	0.0077	0.07	0.30	13.1	8.0	0.0073	0.07	0.30	13.1	8.0	T	122
3487			1st series	buried	425	500	24.3	0.46	10.8	11.0	0.0127	0.15	0.35	14.2	18.1	0.0087	0.12	0.42	16.0	10.5	0.0093	0.11	0.46	10.8	11.0	R	122
706			last series	buried	425	700	34.0	0.26	13.4	6.9	0.0086	0.05	0.19	5.0	6.1	0.0078	0.05	0.15	8.5	10.1	0.0060	0.04	0.26	13.4	6.9	R	122

NM-6
Date 6/19/2008a
Shot 2:40 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a					(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3487				buried	6	100	40.8	0.10	42.6	42.1	0.0010	0.08	0.14	16.0	18.3	0.0025	0.04	0.12	34.1	35.8	0.0012	0.05	0.14	16.0	18.3	V	122
3044			Cluster 1	spiked	6	100	40.8	0.10	42.6	42.8	0.0010	0.07	0.12	16.5	18.4	0.0025	0.04	0.08	34.1	35.0	0.0009	0.05	0.12	16.5	18.4	V	116
4040				sandbag	6	100	40.8	0.12	42.6	42.4	0.0013	0.08	0.12	16.5	18.4	0.0025	0.40	0.13	34.1	35.0	0.0014	0.08	0.13	34.1	35.0	T	116
3048				buried	6	200	81.6	0.05	17.0	12.6	0.0013	0.03	0.05	12.1	9.3	0.0013	0.01	0.02	20.4	10.0	0.0005	0.01	0.05	17.0	12.6	R	110
3046			Cluster 2	spiked	6	200	81.6	0.05	36.5	41.5	0.0013	0.04	0.05	13.1	9.4	0.0013	0.01	0.06	13.1	12.0	0.0009	0.03	0.06	13.1	12.0	T	112
2241				sandbag	6	200	81.6	0.06	39.3	41.4	0.0012	0.04	0.06	11.6	9.4	0.0014	0.01	0.05	12.1	12.0	0.0008	0.03	0.06	39.3	41.4	R	<100
0001				buried	6	300	122.5	0.02	13.1	12.5	0.0006	0.01	0.05	13.8	13.1	0.0012	0.01	0.02	13.8	13.0	0.0003	0.01	0.05	13.8	13.1	V	112
3486			Cluster 3	spiked	6	300	122.5	0.02	12.4	12.8	0.0007	0.01	0.06	12.8	13.5	0.0013	0.01	0.02	14.6	12.8	0.0003	0.01	0.06	12.8	13.5	V	110
706				sandbag	6	300	122.5	0.02	12.4	12.4	0.0006	0.01	0.06	13.1	13.4	0.0013	0.01	0.02	14.6	12.6	0.0005	0.01	0.06	13.1	13.4	V	110
1792				buried	6	400	163.3	0.06	16.0	17.9	0.0016	0.02	0.05	13.8	11.8	0.0015	0.02	0.05	15.5	17.8	0.0011	0.01	0.06	16.0	17.9	R	106
3047			Cluster 4	spiked	6	400	163.3	0.06	14.2	18.1	0.0016	0.02	0.06	14.6	12.3	0.0016	0.02	0.05	17.0	17.9	0.0011	0.01	0.06	14.2	18.1	R	125
704				sandbag	6	400	163.3	0.07	16.0	17.8	0.0016	0.03	0.06	13.8	1.8	0.0016	0.02	0.05	14.6	18.1	0.0011	0.01	0.07	16.0	17.8	R	106
1010				buried	6	500	204.1	0.01	0.0	1.0	0.0003	0.01	0.03	12.1	10.4	0.0007	0.01	0.01	0.0	1.0	0.0003	0.01	0.03	12.1	10.4	V	110
930			Cluster 5	spiked	6	500	204.1	0.01	0.0	11.5	0.0003	0.01	0.03	13.8	11.8	0.0008	0.01	0.01	0.0	8.1	0.0003	0.01	0.03	13.8	11.8	V	106
1100				sandbag	6	500	204.1	0.02	15.5	9.3	0.0003	0.01	0.03	14.6	11.9	0.0008	0.01	0.01	0.0	11.5	0.0003	0.01	0.03	14.6	11.9	V	<100

NM-7
Date 6/19/2008b
Shot 3:04 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b					(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3487				buried	6	100	40.8	0.90	34.1	32.0	0.0103	0.56	0.42	23.2	15.9	0.0054	0.27	0.47	39.3	36.5	0.0045	0.38	0.90	34.1	32.0	R	122
3044			Cluster 1	spiked	6	100	40.8	1.24	32.0	41.8	0.0118	0.74	0.52	36.5	15.9	0.0082	0.42	0.93	36.5	36.6	0.0093	0.66	1.24	32.0	41.8	R	124
4040				sandbag	6	100	40.8	0.94	34.1	41.8	0.0109	0.57	0.49	30.1	18.1	0.0061	0.25	0.40	34.1	36.5	0.0050	0.32	0.94	34.1	41.8	R	123
3048				buried	6	200	81.6	0.10	25.6	15.9	0.0016	0.07	0.06	17.0	15.9	0.0012	0.03	0.04	30.1	8.8	0.0006	0.03	0.10	25.6	15.9	R	112
3046			Cluster 2	spiked	6	200	81.6	0.20	36.5	40.9	0.0024	0.12	0.06	17.6	15.9	0.0013	0.03	0.09	34.1	41.1	0.0009	0.05	0.20	36.5	40.9	R	122
2241				sandbag	6	200	81.6	0.17	36.5	41.0	0.0023	0.10	0.08	16.5	15.9	0.0013	0.04	0.07	39.3	40.5	0.0008	0.05	0.17	36.5	41.0	R	118
0001				buried	6	300	122.5	0.05	34.1	42.1	0.0009	0.03	0.05	15.5	17.4	0.0011	0.02	0.03	36.5	42.1	0.0004	0.03	0.05	15.5	17.4	V	112
3486			Cluster 3	spiked	6	300	122.5	0.05	32.0	6.5	0.0009	0.03	0.05	14.2	17.4	0.0011	0.02	0.03	42.6	42.1	0.0004	0.01	0.05	32.0	6.5	R	112
706				sandbag	6	300	122.5	0.06	34.1	42.1	0.0010	0.03	0.05	15.5	17.4	0.0011	0.02	0.04	42.6	42.1	0.0004	0.03	0.06	34.1	42.1	R	112
1792				buried	6	400	163.3	0.12	22.2	17.1	0.0019	0.04	0.05	22.2	14.3	0.0009	0.02	0.09	22.2	18.9	0.0013	0.04	0.12	22.2	17.1	R	123
3047			Cluster 4	spiked	6	400	163.3	0.11	19.6	17.4	0.0019	0.04	0.06	22.2	14.3	0.0010	0.02	0.08	20.4	18.9	0.0012	0.03	0.11	19.6	17.4	R	110
704				sandbag	6	400	163.3	0.12	19.6	17.1	0.0020	0.04	0.06	22.2	14.3	0.0010	0.02	0.08	21.3	18.9	0.0012	0.03	0.12	19.6	17.1	R	124
1010				buried	6	500	204.1	0.02	14.6	15.5	0.0004	0.01	0.04	15.0	14.3	0.0009	0.01	0.02	18.2	1.0	0.0002	0.01	0.04	15.0	14.3	V	110
930			Cluster 5	spiked	6	500	204.1	0.02	18.9	15.8	0.0004	0.01	0.04	16.5	14.3	0.0010	0.01	0.02	25.6	14.9	0.0003	0.01	0.04	16.5	14.3	V	106
1100				sandbag	6	500	204.1	0.02	19.6	15.9	0.0004	0.01	0.04	16.0	14.4	0.0009	0.01	0.02	18.2	14.9	0.0003	0.01	0.04	16.0	14.4	V	<100

KY-1
Date 3/3/2008
Shot a 12:30

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	37°44.262'	86°54.355'			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	154	656	52.9	0.51	20.4	15.5	0.0105	0.28	0.40	32.0	23.0	0.0058	0.21	0.52	19.6	23.0	0.0112	0.25	0.52	19.6	23.0	T	120
2279				spiked	154	656	52.9	0.55	30.1	27.1	0.0098	0.40	0.43	39.3	23.0	0.0061	0.25	0.62	21.3	23.0	0.0128	0.40	0.62	21.3	23.0	T	120
930				spiked round sensor	154	656	52.9	0.66	56.8	27.1	0.0091	0.61	0.45	39.3	23.0	0.0062	0.26	0.64	20.4	23.0	0.0140	0.41	0.66	56.8	27.1	R	120
2241	37°44.278'	86°54.49'	cluster	short spikes	154	656	52.9	0.74	46.5	27.1	0.0095	0.60	0.62	46.5	23.0	0.0064	0.51	0.90	42.6	23.0	0.0138	0.52	0.90	42.6	23.0	T	122
3048				sandbag	154	656	52.9	0.56	20.4	15.5	0.0113	0.27	0.58	30.1	23.0	0.0077	0.29	0.50	16.5	23.0	0.0127	0.21	0.58	30.1	23.0	V	123
3046				spiked with sandbag	154	656	52.9	0.52	20.4	15.5	0.0104	0.34	0.54	36.5	23.0	0.0066	0.25	0.51	17.0	23.0	0.0134	0.21	0.54	36.5	23.0	V	122
Instantel				buried	154	656	52.9	0.53	22.0	15.1	0.0031	0.33	0.45	30.0	23.0	0.0022	0.24	0.44	19.0	27.1	0.0042	0.20	0.53	22.0	15.1	R	119
704	37°44.268'	86°54.433'	first		154	388	31.3	0.93	13.8	7.6	0.0321	0.36	0.91	18.9	8.5	0.0181	0.44	0.91	12.4	15.4	0.0284	0.33	0.93	13.8	7.6	R	123
3487	37°44.27'	86°54.495'	1st series		154	508	40.9	0.84	11.3	23.0	0.0201	0.36	0.62	20.4	14.3	0.0109	0.29	0.74	18.9	22.9	0.0192	0.30	0.84	11.3	23.0	R	120
785	37°44.285'	86°54.505'	last series	buried	154	750	60.4	0.35	23.2	27.1	0.0078	0.20	0.34	39.3	27.2	0.0050	0.22	0.31	22.2	27.1	0.0087	0.13	0.35	23.2	27.1	R	118
3486	37°44.291'	86°54.535'	at house		154	895	72.1	0.29	18.2	23.0	0.0047	0.22	0.33	39.3	27.3	0.0030	0.18	0.28	19.6	22.9	0.0060	0.13	0.33	39.3	27.3	V	116
1100	37°44.295'	86°54.56'	at house		154	1019	82.1	0.35	18.9	21.1	0.0047	0.22	0.25	32.0	27.3	0.0035	0.21	0.43	24.3	19.5	0.0074	0.20	0.43	24.3	19.5	T	116

KY-2
Date 3/3/2008
Shot b 16:10

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	-48 ft from 1st shot				(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	154	608	49.0	0.49	9.3	5.6	0.0166	0.23	0.48	15.5	27.8	0.0082	0.23	0.42	16.0	5.5	0.0139	0.17	0.49	9.3	5.6	R	116
2279				spiked	154	608	49.0	0.54	14.6	5.6	0.0169	0.41	0.50	15.0	27.8	0.0089	0.25	0.51	18.9	5.5	0.0140	0.35	0.54	14.6	5.6	R	118
930				spiked round sensor	154	608	49.0	0.98	56.8	5.6	0.0173	1.01	0.49	14.6	27.8	0.0091	0.25	0.74	19.6	5.5	0.0141	0.57	0.98	56.8	5.6	R	118
2241	37°44.278'	86°54.49'	cluster	short spikes	154	608	49.0	0.72	28.4	5.6	0.0181	0.58	0.68	64.0	75.4	0.0102	0.62	0.68	56.8	5.5	0.0154	0.58	0.72	28.4	5.6	R	118
3046				spiked with sandbag	154	608	49.0	0.56	15.0	5.6	0.0168	0.27	0.52	22.2	27.8	0.0088	0.26	0.48	16.0	5.5	0.0147	0.16	0.56	15.0	5.6	R	118
3048				sandbag	154	608	49.0	0.57	10.2	5.6	0.0169	0.25	0.54	26.9	27.8	0.0089	0.29	0.47	11.9	5.5	0.0149	0.13	0.57	10.2	5.6	R	120
706				loose on surface	154	608	49.0	0.64	39.3	5.6	0.0179	0.42	0.70	32.0	39.9	0.0110	0.49	0.59	18.2	5.5	0.0153	0.25	0.70	32.0	39.9	V	120
Instantel				buried	154	608	49.0	0.48	16.0	5.4	0.0049	0.27	0.45	28.0	27.8	0.0031	0.23	0.47	17.0	5.6	0.0058	0.18	0.48	16.0	5.4	R	117
704	37°44.268'	86°54.433'	first		154	340	27.4	1.32	4.7	5.8	0.0690	0.36	0.60	8.1	8.0	0.0158	0.36	1.11	5.8	5.9	0.0511	0.30	1.32	4.7	5.8	R	124
3487	37°44.27'	86°54.495'	1st series		154	460	37.1	0.90	15.0	5.4	0.0280	0.29	0.46	20.4	16.1	0.0107	0.19	0.90	12.1	5.5	0.0304	0.23	0.90	15.0	5.4	R	123
785	37°44.285'	86°54.505'	last series	buried	154	702	56.6	0.31	10.8	5.6	0.0107	0.15	0.28	25.6	20.9	0.0056	0.14	0.42	19.6	5.6	0.0142	0.16	0.42	19.6	5.6	T	118
3486	37°44.291'	86°54.535'	at house		154	847	68.3	0.29	25.6	5.6	0.0075	0.19	0.31	34.1	27.8	0.0045	0.16	0.27	19.6	5.6	0.0089	0.12	0.31	34.1	27.8	V	116
1100	37°44.295'	86°54.56'	at house		154	971	78.2	0.32	34.1	22.0	0.0058	0.18	0.22	39.3	22.5	0.0045	0.18	0.38	19.6	20.8	0.0105	0.21	0.38	19.6	20.8	T	112

KY-3
Date 3/4/2008
Shot a 5:30 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	37°10.777'	86°6.722'			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	910	1996	66.2	0.07	23.2	14.3	0.0022	0.03	0.06	23.2	20.4	0.0019	0.03	0.05	10.8	14.3	0.0016	0.02	0.07	23.2	14.3	R	123
2279				spiked with sod-square	910	1996	66.2	0.09	21.3	14.4	0.0027	0.05	0.06	24.3	20.5	0.0017	0.04	0.06	16.5	14.3	0.0014	0.03	0.09	21.3	14.4	R	122
930				spiked round sensor	910	1996	66.2	0.08	18.9	14.3	0.0024	0.05	0.06	24.3	20.5	0.0017	0.04	0.05	17.0	14.4	0.0014	0.03	0.08	18.9	14.3	R	120
2241	37°10.517'	86°6.974'	cluster	short spikes	910	1996	66.2	0.08	17.6	14.4	0.0027	0.04	0.07	23.2	20.5	0.0017	0.04	0.05	15.5	8.6	0.0013	0.03	0.08	17.6	14.4	R	122
3046				spiked on surface	910	1996	66.2	0.09	17.0	14.3	0.0026	0.05	0.06	23.2	20.5	0.0017	0.05	0.06	16.0	14.3	0.0014	0.04	0.09	17.0	14.3	R	120
3048				sandbag	910	1996	66.2	0.12	39.3	45.5	0.0025	0.07	0.10	28.4	20.5	0.0022	0.04	0.09	17.0	14.4	0.0016	0.04	0.12	39.3	45.5	R	122
706				loose on surface	910	1996	66.2	0.11	16.5	14.3	0.0026	0.06	0.07	20.4	20.5	0.0019	0.04	0.08	14.2	14.4	0.0020	0.05	0.11	16.5	14.3	R	122
Instantel				spiked with sod	910	1996	66.2	0.10	43.0	14.3	0.0011	0.07	0.05	57.0	20.5	0.0005	0.06	0.06	39.0	14.3	0.0006	0.04	0.10	43.0	14.3	R	121
3486	37°10.5'	86°6.971'	1st series	buried	910	2092	69.3	0.07	9.3	10.3	0.0029	0.02	0.04	17.0	3.8	0.0015	0.02	0.05	10.4	10.8	0.0013	0.02	0.07	9.3	10.3	R	120
3487	37°10.485'	86°6.969'	last series	buried	910	2188	72.5	0.07	7.6	13.1	0.0023	0.02	0.04	19.6	3.6	0.0013	0.03	0.05	10.6	14.1	0.0010	0.02	0.07	7.6	13.1	R	120

KY-4
Date 3/5/2008
Shot a 4:24 PM Pre-split

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	37°46.261	87°20.512	pre-split		(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	125	1500	134.2	0.39	8.3	7.9	0.0150	0.17	0.45	56.8	9.6	0.0071	0.42	0.78	7.4	7.4	0.0343	0.29	0.78	7.4	7.4	T	114
930	37°46.144'	87°20.467'	cluster 1	buried and spiked round sensor	125	1500	134.2	0.38	8.1	7.3	0.0150	0.15	0.43	64.0	9.8	0.0065	0.39	0.78	7.4	7.4	0.0344	0.23	0.78	7.4	7.4	T	114
1100				buried round sensor	125	1500	134.2	0.39	8.2	7.9	0.0158	0.18	0.43	64.0	9.6	0.0092	0.40	0.79	7.4	7.4	0.0356	0.20	0.79	7.4	7.4	T	112
3046				spiked	125	1500	134.2	0.43	51.2	7.3	0.0163	0.44	0.57	85.3	9.6	0.0074	0.66	0.84	64.0	7.4	0.0360	0.88	0.84	64.0	7.4	T	122
3487	37°46.115'	87°20.45'	cluster 2	buried	125	1670	149.4	0.22	22.2	6.9	0.0053	0.17	0.48	46.5	33.8	0.0075	0.32	0.29	10.6	6.9	0.0118	0.19	0.48	46.5	33.8	V	110
2279				spiked	125	1670	149.4	0.42	64.0	6.9	0.0067	0.44	0.49	51.2	33.9	0.0074	0.42	0.34	64.0	6.9	0.1180	0.45	0.49	51.2	33.9	V	112
706	37°46.085'	87°20.437'	cluster 3	buried	125	1860	166.4																				
2241				spiked	125	1860	166.4	0.30	15.5	7.1	0.0116	0.24	0.46	64.0	73.9	0.0062	0.50	0.54	6.6	6.9	0.0251	0.17	0.54	6.6	6.9	T	110
3048	37°46.194'	87°20.49'	1st in array	buried	125	1155	103.3	0.56	16.5	9.9	0.0113	0.19	0.60	51.2	20.6	0.0082	0.42	0.54	8.6	10.0	0.0141	0.34	0.60	51.2	20.6	V	112
785	37°46.046'	87°20.4'	2nd in array	buried (front yard)	125	2140	191.4	0.23	8.1	9.5	0.0090	0.13	0.31	32.0	6.1	0.0049	0.26	0.18	7.7	9.1	0.0075	0.12	0.31	32.0	6.1	V	106
704	37°46.004'	87°20.373'	3rd in array	buried (bottom of hill)	125	2430	217.3	0.33	5.9	5.9	0.0174	0.09	0.23	51.2	6.1	0.0046	0.16	0.29	6.1	5.5	0.0138	0.07	0.33	5.9	5.9	R	106

KY-5
Date 3/5/2008
Shot b 4:30 PM Production

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	37°46.261'	87°20.512'	production		(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792	37°46.144'	87°20.467'	cluster 1	buried	209	744	51.5	0.70	32.0	7.4	0.0206	0.34	0.64	51.2	10.9	0.0132	0.57	0.74	21.3	6.9	0.0175	0.27	0.74	21.3	6.9	T	120
930				buried and spiked round sensor	209	744	51.5	0.66	30.1	7.4	0.0210	0.30	0.58	51.2	10.9	0.0129	0.53	0.74	22.2	7.0	0.0175	0.27	0.74	22.2	7.0	T	120
1100				buried-round sensor	209	744	51.5	0.63	10.4	7.4	0.0207	0.28	0.58	56.8	10.9	0.0123	0.53	0.69	23.2	7.5	0.0170	0.27	0.69	23.2	7.5	T	118
3046				spiked	209	744	51.5	1.08	42.6	7.4	0.0226	0.81	0.72	56.8	10.9	0.0131	0.68	0.78	25.6	7.0	0.0180	0.48	1.08	42.6	7.4	R	126
3487	37°46.115'	87°20.45'	cluster 2	buried	209	944	65.3	0.49	10.8	10.9	0.0102	0.23	0.76	34.1	35.6	0.0082	0.50	0.70	16.5	13.4	0.0147	0.32	0.76	34.1	35.6	V	118
2279				spiked	209	944	65.3	0.55	36.5	10.9	0.0105	0.45	0.68	36.5	44.6	0.0079	0.49	0.80	21.3	13.4	0.0150	0.40	0.80	21.3	13.4	T	119
706	37°46.085'	87°20.437'	cluster 3	buried	209	1144	79.1																				
2241				spiked	209	1144	79.1	0.43	28.4	14.6	0.0080	0.27	0.56	56.8	54.3	0.0052	0.58	0.44	24.3	21.1	0.0089	0.21	0.56	56.8	54.3	V	118
3048	37°46.194'	87°20.49'	1st in array	buried	209	410	28.4	1.06	25.6	10.8	0.0282	0.50	1.54	25.6	14.6	0.0271	1.06	1.08	21.3	21.3	0.0202	0.45	1.54	25.6	14.6	V	126
785	37°46.046'	87°20.4'	2nd in array	buried (front yard)	209	1444	99.9	0.33	16.5	8.1	0.0079	0.18	0.46	46.5	54.4	0.0045	0.41	0.30	23.2	21.3	0.0047	0.16	0.46	46.5	54.4	V	110
704	37°46.004'	87°20.373'	3rd in array	buried (bottom of hill)	209	1747	120.8	0.29	9.6	8.5	0.0092	0.17	0.31	36.5	54.3	0.0044	0.19	0.23	9.4	7.5	0.0071	0.09	0.31	36.5	54.3	V	110

IL-1
Date 3/6/2008
Shot a 3:30 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	38°26.844'	87°52.099'			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792	38°26.928'	87°52.149'	cluster	buried	841	563	19.4	0.78	3.8	10.0	0.0168	0.38	1.22	30.1	39.8	0.0164	0.62	1.06	13.1	11.6	0.0342	0.43	1.22	30.1	39.8	V	126
2279				spiked	841	563	19.4	1.34	26.9	29.9	0.0221	0.66	1.34	34.1	39.6	0.0175	0.74	1.62	15.0	15.3	0.0425	0.85	1.62	15.0	15.3	T	125
930				spiked round sensor	841	563	19.4	1.40	19.6	19.8	0.0252	0.52	1.38	34.1	39.6	0.0172	0.73	1.66	13.8	15.3	0.0429	0.66	1.66	13.8	15.3	T	125
2241				spiked and buried	841	563	19.4	0.78	28.4	10.0	0.0155	0.36	1.08	28.4	30.3	0.0149	0.52	1.14	2.3	11.6	0.0342	0.44	1.14	2.3	11.6	T	126
3048				sandbag	841	563	19.4	0.98	15.5	14.6	0.0201	0.29	1.16	28.4	39.6	0.0185	0.72	1.88	11.6	15.0	0.0537	0.45	1.88	11.6	15	T	125
3046				spiked with sandbag	841	563	19.4	0.90	17.0	14.8	0.0188	0.34	1.18	30.1	39.6	0.0211	0.80	1.80	13.1	15.0	0.0505	0.53	1.80	13.1	15	T	125
Instantel				buried	841	563	19.4	0.82	22.0	10.0	0.0064	0.45	0.93	37.0	39.8	0.0067	0.61	peg	15.0	11.6	0.0142	0.48	peg	15.0	11.6	T	126
785				loose on surface PEGGED	841	563		peg	25.6	19.9	0.0270	0.74	peg	32.0	39.8	0.0160	1.03	peg	28.4	15.1	0.0445	0.95	peg	25.6	19.9	R	125
3486	38°26.895'	87°52.154'	1st in array		841	405	14.0	1.34	13.4	9.9	0.0342	0.53	2.64	28.4	15.4	0.0297	1.03	2.72	15.0	15.3	0.0678	0.64	2.72	15.0	15.3	T	128
3487	38°26.962'	87°52.144'	2nd in array		841	750	25.9	0.58	9.8	9.4	0.0179	0.23	0.84	42.6	30.3	0.0094	0.52	0.90	15.0	10.4	0.0264	0.28	0.90	15.0	10.4	T	121
1100	38°27'	87°52.148'	3rd in array	buried	841	976	33.7	0.54	25.6	30.3	0.0109	0.27	0.55	39.3	39.9	0.0052	0.36	0.75	25.6	11.9	0.0198	0.32	0.75	25.6	11.9	T	120
704	38°27.04'	87°52.15'	4th in array		841	1215	41.9	0.40	30.1	45.4	0.0054	0.21	0.31	39.3	30.0	0.0047	0.26	0.47	21.3	24.8	0.0119	0.25	0.47	21.3	24.8	T	116
706	38°27.085'	87°52.149'	5th in array		841	1484	51.2	0.35	26.9	6.9	0.0068	0.13	0.18	36.5	30.1	0.0035	0.12	0.51	34.1	8.3	0.0110	0.25	0.51	34.1	8.3	T	114

IL-2
Date 3/6/2008
Shot b 3:33 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	38°26.666'	87°52.112'			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792	38°26.928'	87°52.149'	cluster	buried	190	1602	116.2	0.06	7.8	8.5	0.0014	0.02	0.04	30.1	15.9	0.0008	0.03	0.07	18.2	7.9	0.0016	0.03	0.07	18.2	7.9	T	110
2279				spiked	190	1602	116.2	0.08	28.4	8.5	0.0014	0.03	0.04	22.2	15.8	0.0008	0.03	0.09	20.4	7.8	0.0017	0.03	0.09	20.4	7.8	T	112
930				spiked round sensor	190	1602	116.2	0.08	10.6	8.5	0.0014	0.03	0.04	56.8	15.8	0.0008	0.03	0.10	20.4	7.9	0.0017	0.03	0.10	20.4	7.9	T	110
2241				spiked and buried	190	1602	116.2	0.06	7.8	8.5	0.0014	0.02	0.04	30.1	15.8	0.0009	0.02	0.07	18.2	7.9	0.0002	0.27	0.07	18.2	7.9	T	112
3048				sandbag	190	1602	116.2	0.10	25.6	8.0	0.0019	0.05	0.06	15.0	15.9	0.0009	0.03	0.12	20.4	28.1	0.0020	0.05	0.12	20.4	28.1	T	112
3046				spiked with sandbag	190	1602	116.2	0.08	23.2	8.5	0.0017	0.03	0.05	36.5	15.9	0.0008	0.03	0.12	20.4	28.3	0.0019	0.05	0.12	20.4	28.3	T	110
Instantel				buried	190	1602	116.2	0.05	11.0	8.0	0.0007	0.02	0.04	13.0	15.8	0.0004	0.02	0.07	18.0	7.8	0.0007	0.02	0.07	18.0	7.8	T	112
785				loose on surface PEGGED	190	1602		0.12	34.1	8.0	0.0016	0.06	0.05	28.4	15.9	0.0009	0.04	0.15	30.1	45.4	0.0019	0.08	0.15	30.1	45.4	T	112
3486	38°26.895'	87°52.154'	1st in array		190	1406	102.0	0.08	24.3	8.0	0.0021	0.05	0.06	28.4	14.3	0.0017	0.03	0.10	24.3	23.8	0.0021	0.05	0.10	24.3	23.8	T	114
3487	38°26.962'	87°52.144'	2nd in array		190	1805	130.9	0.06	18.9	7.5	0.0013	0.02	0.03	46.5	8.3	0.0007	0.02	0.06	12.1	8.0	0.0014	0.02	0.06	12.1	8	T	110
1100	38°27'	87°52.148'	3rd in array	buried	190	2037	147.8	0.05	16.0	16.1	0.0011	0.01	0.01	15.5	8.0	0.0005	0.02	0.03	18.2	8.3	0.0011	0.01	0.05	16.0	16.1	R	106
704	38°27.04'	87°52.15'	4th in array		190	2280	165.4	0.02	30.1	8.0	0.0008	0.01	0.02	32.0	23.4	0.0004	0.02	0.03	17.6	8.3	0.0011	0.01	0.03	17.6	8.3	T	106
706	38°27.085'	87°52.149'	5th in array		190	2552	185.1	0.03	12.4	8.0	0.0008	0.01	0.03	23.3	22.1	0.0006	0.01	0.03	17.6	8.1	0.0009	0.01	0.03	23.3	22.1	V	106

IN-1
Date 3/7/2008
Shot a 3:30 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	38°5.758'	87°18.41'			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792	38°5.577'	87°18.354'	cluster	buried	2298	1129	23.6	0.54	6.1	4.9	0.0233	0.15	0.50	6.4	9.5	0.0173	0.32	0.59	7.4	4.9	0.0247	0.13	0.59	7.4	4.9	T	124
2279				spiked	2298	1129	23.6	0.54	5.9	4.9	0.0229	0.27	0.41	15.0	9.5	0.0175	0.32	0.65	7.6	4.9	0.0234	0.24	0.65	7.6	4.9	T	124
930				spiked round sensor	2298	1129	23.6	0.53	6.0	5.0	0.0220	0.27	0.00	10.6	9.5	0.0173	0.32	0.70	7.5	4.9	0.0241	0.27	0.70	7.5	4.9	T	122
2241				spiked and buried	2298	1129	23.6	0.58	5.8	4.9	0.0243	0.15	0.43	6.4	9.5	0.0178	0.28	0.54	7.4	4.8	0.0218	0.15	0.58	5.8	4.9	R	125
3048				sandbag	2298	1129	23.6	0.59	6.4	5.0	0.0237	0.16	0.44	6.4	9.5	0.0176	0.30	0.60	8.5	4.9	0.0235	0.15	0.60	8.5	4.9	T	124
3046				spiked with sandbag	2298	1129	23.6	0.60	6.0	4.9	0.0238	0.21	0.39	15.5	9.5	0.0160	0.29	0.60	8.5	4.9	0.0230	0.17	0.60	6.0	4.9	R	123
Instantel				buried	2298	1129	23.6	0.60	9.7	4.9	0.0101	0.17	0.72	17.0	9.5	0.0053	0.28	0.52	6.5	0.0	0.0120	0.17	0.72	17.0	9.5	V	125
785				loose on surface	2298	1129		0.51	6.0	5.0	0.0218	0.19	0.41	16.5	9.5	0.0181	0.33	0.63	8.8	4.8	0.0224	0.17	0.63	8.8	4.8	T	124
3486	38°5.626'	87°18.37'	1st in array		2298	825	17.2	1.08	13.8	7.6	0.0586	0.27	1.02	30.1	9.9	0.0235	0.61	1.98	7.3	6.0	0.0811	0.32	1.98	7.3	6.0	T	126
3487	38°5.6'	87°18.371'	2nd in array		2298	976	20.4	1.64	5.8	4.8	0.1063	0.24	0.86	7.2	7.8	0.0395	0.29	1.28	5.9	4.5	0.0586	0.21	1.64	5.8	4.8	R	125
706	38°5.519'	87°18.355'	3rd in array	buried	2298	1476	30.8	0.64	10.2	7.6	0.0292	0.17	0.43	17.6	23.2	0.0106	0.22	0.70	6.6	9.3	0.0258	0.25	0.70	6.6	9.3	T	120
704	38°5.483'	87°18.34'	4th in array		2298	1704	35.5	0.51	7.8	9.3	0.0238	0.13	0.48	39.3	9.6	0.0087	0.33	0.96	7.8	9.6	0.0400	0.17	0.96	7.8	9.6	T	120

OH-2
Date 7/9/2008
Shot a 12:52 PM

Shot or S/N	GPS		Location	Coupling	Radial								Vertical					Transverse					Peaks				
	N	W			Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	39°44.678	82°10.046			(lbs/delay)	(ft)	(ft/lb$^{1/3}$)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)		(Db)
3047				buried	500	300	13.4	2.72	6.9	7.0	0.1151	0.38	0.72	13.8	6.8	0.0178	0.27	1.28	14.2	7.1	0.0440	0.32	2.72	6.9	7.0	R	134
3044	39°44.725	82°10.073	cluster 1	spiked	500	300	13.4	2.60	6.9	7.0	0.1168	0.41	0.70	13.8	6.8	0.0178	0.27	1.12	15.5	7.0	0.0424	0.32	2.60	6.9	7.0	R	134
3487				loose on surface	500	300	13.4	2.76	6.8	6.3	0.1214	0.46	0.72	13.4	6.8	0.0185	0.37	1.28	15.0	7.0	0.0434	0.34	2.76	6.8	6.3	R	135
1792				buried	500	600	26.8	0.66	6.2	5.6	0.0291	0.19	0.42	17.0	6.5	0.0131	0.13	0.49	10.0	4.8	0.3218	0.15	0.66	6.2	5.6	R	127
2241				loose on surface	500	600	26.8	0.82	6.1	5.6	0.0311	0.27	0.50	17.6	6.9	0.0127	0.24	0.72	24.3	4.8	0.0146	0.30	0.82	6.1	5.6	R	124
3048	39°44.825	82°10.085	cluster 2	sandbag	500	600	26.8	0.80	6.1	5.6	0.0285	0.21	0.57	19.6	7.0	0.0131	0.17	0.55	8.2	4.6	0.0148	0.16	0.80	6.1	5.6	R	124
3046				spiked with sandbag	500	600	26.8	0.78	6.2	5.6	0.0301	0.22	0.49	10.4	7.0	0.0119	0.13	0.52	8.5	4.6	0.0132	0.17	0.78	6.2	5.6	R	125
2279				spiked	500	600	26.8	0.68	6.3	5.6	0.0301	0.19	0.46	10.8	6.9	0.0114	0.13	0.58	8.6	4.6	0.0138	0.19	0.68	6.3	5.6	R	124
930				spiked round sensor	500	600	26.8	0.64	6.1	5.6	0.0289	0.18	0.47	11.1	7.0	0.0114	0.14	0.55	8.6	4.6	0.0130	0.20	0.64	6.1	5.6	R	125
3486				spiked	500	900	40.2	0.57	23.2	6.1	0.0134	0.23	0.31	13.8	6.6	0.0088	0.12	0.51	24.3	8.6	0.0099	0.19	0.57	23.2	6.1	R	121
1100	39°44.683	82°10.083	cluster 3	loose on surface	500	900	40.2	0.54	0.5	20.6	0.0148	0.17	0.57	0.6	43.0	0.0110	0.28	0.41	0.4	8.6	0.0120	0.15	0.57	0.6	43.0	V	118
001				buried	500	900	40.2	0.44	116.0	6.1	0.0124	0.16	0.26	8.9	6.6	0.0077	0.10	0.46	22.2	8.8	0.0093	0.15	0.46	22.2	8.8	T	120
704				spiked	500	1860	83.2	0.10	6.7	7.4	0.0041	0.04	0.12	6.3	6.5	0.0047	0.06	0.23	5.7	7.6	0.0075	0.07	0.23	5.7	7.6	T	114
4040	39°44.525	82°10.392	cluster 4	buried	500	1860	83.2	0.10	6.2	7.4	0.0044	0.02	0.12	6.3	6.1	0.0049	0.05	0.19	5.8	7.6	0.0073	0.04	0.19	5.8	7.6	T	114
706				loose on surface	500	1860	83.2	0.10	6.4	7.4	0.0041	0.04	0.24	42.6	6.0	0.0050	0.17	0.27	6.3	7.6	0.0076	0.08	0.27	6.3	7.6	T	117

OH-3
Date 7/10/2008
Shot a 9:30 AM

Shot or S/N	GPS		Location	Coupling	Radial								Vertical					Transverse					Peaks				
	N	W			Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	39°44.812	82°10.071			(lbs/delay)	(ft)	(ft/lb$^{1/3}$)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)		(Db)
3047				sandbag	380	300	15.4	2.28	11.1	9.8	0.0634	0.49	1.28	22.2	18.9	0.0224	0.74	1.44	12.4	10.6	0.0425	0.40	2.28	11.1	9.8	R	133
3044	39°44.772	82°10.044	cluster 1	spiked	380	300	15.4	2.08	11.3	9.8	0.0536	0.44	1.28	28.4	12.0	0.0244	0.74	1.36	12.1	10.1	0.0472	0.45	2.08	11.3	9.8	R	133
3487				buried	380	300	15.4	1.96	11.3	9.8	0.0553	0.42	1.32	25.6	10.1	0.0297	0.70	1.32	9.4	10.6	0.0424	0.49	1.96	11.3	9.8	R	132
1792				buried	380	600	30.8	0.70	12.4	8.4	0.0204	0.17	0.44	28.4	9.0	0.0079	0.19	0.98	7.8	8.9	0.0301	0.25	0.98	7.8	8.9	T	124
2241				loose on surface	380	600	30.8	0.80	10.8	8.9	0.0251	0.30	0.46	34.1	9.0	0.0101	0.25	0.88	14.2	8.9	0.0265	0.28	0.88	14.2	8.9	T	126
3048	39°44.724	82°10.074	cluster 2	sandbag	380	600	30.8	0.70	12.4	8.9	0.0222	0.24	0.46	28.4	9.0	0.0079	0.24	1.08	15.0	8.9	0.0310	0.28	1.08	15.0	8.9	T	124
3046				spiked with sandbag	380	600	30.8	0.88	10.4	8.9	0.0270	0.24	0.42	30.1	9.0	0.0084	0.21	0.86	15.5	8.9	0.0238	0.27	0.88	10.4	8.9	R	125
2279				spiked	380	600	30.8	0.76	12.4	8.9	0.0238	0.21	0.41	30.1	9.0	0.0097	0.21	0.92	15.0	8.9	0.0278	0.26	0.92	15.0	8.9	T	124
930				spiked round sensor	380	600	30.8	0.74	10.4	8.9	0.0234	0.22	0.40	34.1	9.0	0.0083	0.23	0.84	16.0	8.9	0.0253	0.23	0.84	16.0	8.9	T	131
3486				spiked	380	900	46.2	0.26	32.0	9.1	0.0086	0.16	0.29	23.2	8.9	0.0076	0.13	0.42	9.4	8.8	0.0122	0.19	0.42	9.4	8.8	T	122
1100	39°44.681	82°10.073	cluster 3	sandbag	380	900	46.2	0.29	25.6	9.0	0.0094	0.13	0.39	32.0	8.9	0.0075	0.21	0.50	10.4	8.8	0.0128	0.19	0.50	10.4	8.8	T	116
001				buried	380	900	46.2	0.31	26.9	9.0	0.0086	0.13	0.27	34.1	8.9	0.0074	0.15	0.40	9.6	8.8	0.0124	0.13	0.40	9.6	8.8	T	122
704				spiked	380	1860	95.4	0.15	14.2	8.8	0.0049	0.04	0.10	23.2	28.9	0.0021	0.05	0.19	20.4	20.1	0.0075	0.09	0.19	20.4	20.1	T	116
4040	39°44.515	82°10.027	cluster 4	buried	380	1860	95.4	0.13	12.8	8.9	0.0048	0.04	0.10	22.2	28.9	0.0023	0.04	0.17	18.9	3.6	0.0695	0.07	0.17	18.9	3.6	T	125
706				sandbag	380	1860	95.4	0.16	14.2	8.8	0.0051	0.04	0.12	17.0	29.1	0.0025	0.06	0.22	18.9	20.1	0.0075	0.10	0.22	18.9	20.1	T	117

OH-4
Date 7/10/2008
Shot b 2:01 PM

Shot or S/N	GPS		Location	Coupling	Radial								Vertical					Transverse					Peaks				
	N	W			Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	39°44.815	82°10.133			(lbs/delay)	(ft)	(ft/lb$^{1/3}$)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)	(in)	(g's)	(in/s)	(Hz)	(Hz)		(Db)
3047				sandbag	150	300	24.5	0.74	7.1	7.0	0.0263	0.19	0.59	15.5	10.4	0.0110	0.30	0.63	11.3	6.9	0.0229	0.23	0.74	7.1	7.0	R	126
3044	39°44.772	82°10.044	cluster 1	spiked	150	300	24.5	0.83	7.5	7.0	0.0287	0.29	0.54	16.0	10.4	0.0114	0.36	0.56	13.1	5.9	0.0156	0.23	0.83	7.5	7.0	R	126
3487				buried	150	300	24.5	0.82	7.1	7.0	0.0268	0.33	0.47	36.5	10.4	0.0104	0.37	0.54	13.4	6.0	0.0176	0.21	0.82	7.1	7.0	R	125
1792				buried	150	600	49.0	0.66	16.0	20.5	0.0149	0.21	0.60	34.1	20.3	0.0085	0.38	0.44	16.5	19.1	0.0137	0.17	0.66	16.0	20.5	R	123
2241				loose on surface	150	600	49.0	0.90	26.9	20.4	0.0159	0.59	0.68	26.9	26.9	0.0083	0.52	0.56	16.5	16.5	0.0169	0.31	0.90	26.9	20.4	R	120
3048	39°44.724	82°10.074	cluster 2	sandbag	150	600	49.0	0.68	14.6	20.5	0.0170	0.27	0.66	34.1	20.1	0.0082	0.37	0.55	20.4	19.0	0.0149	0.26	0.68	14.6	20.5	R	118
3046				spiked with sandbag	150	600	49.0	0.76	21.3	20.4	0.0150	0.34	0.66	34.1	20.1	0.0079	0.43	0.60	17.6	18.8	0.0165	0.24	0.76	21.3	20.4	R	120
2279				spiked	150	600	49.0	0.64	16.5	20.4	0.0154	0.32	0.62	32.0	20.3	0.0078	0.39	0.52	16.5	18.9	0.0157	0.24	0.64	16.5	20.4	R	125
930				spiked round sensor	150	600	49.0	0.62	16.0	20.4	0.0141	0.30	0.68	36.5	20.1	0.0083	0.40	0.51	16.5	18.9	0.0154	0.21	0.68	36.5	20.1	V	127
3486				spiked	150	900	73.5	0.52	25.6	19.8	0.0104	0.24	0.58	24.3	20.3	0.0061	0.37	0.45	22.2	19.1	0.0084	0.21	0.58	24.3	20.3	V	117
1100	39°44.681	82°10.073	cluster 3	sandbag	150	900	73.5	0.66	21.3	20.0	0.0124	0.25	0.42	32.0	35.0	0.0065	0.28	0.51	28.4	16.4	0.0086	0.23	0.66	21.3	20.0	R	118
001				buried	150	900	73.5	0.56	20.4	19.9	0.0106	0.21	0.48	23.2	20.1	0.0057	0.29	0.42	18.9	19.1	0.0083	0.19	0.56	20.4	19.9	R	116
704				spiked	150	1860	151.9	0.13	20.4	20.6	0.0033	0.07	0.12	34.1	37.3	0.0020	0.08	0.38	18.9	19.9	0.0086	0.15	0.38	18.9	19.9	T	110
4040	39°44.515	82°10.027	cluster 4	buried	150	1860	151.9	0.15	18.9	19.6	0.0031	0.05	0.13	34.1	37.3	0.0018	0.07	0.34	17.6	20.0	0.0078	0.11	0.34	17.6	20.0	T	112
706				sandbag	150	1860	151.9	0.19	21.3	19.0	0.0033	0.07	0.15	39.3	37.4	0.0025	0.10	0.48	20.4	19.9	0.0098	0.16	0.48	20.4	19.9	T	114

OH-5
Date 7/11/2008
Shot Time 12:35 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot	40°31.536	81°35.313			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	336	300	16.4	1.36	16.5	14.6	0.0299	0.33	0.89	18.9	14.1	0.0185	0.41	0.66	14.6	13.8	0.0183	0.29	1.36	16.5	14.6	R	128
2241				loose on surface	336	300	16.4	1.60	16.0	14.8	0.0361	0.52	0.98	19.6	14.1	0.0187	0.85	0.92	18.9	13.5	0.0201	0.37	1.60	16.0	14.8	R	126
3048	40°31.6	81°35.325	cluster 1	sandbag	336	300	16.4	1.32	17.0	14.8	0.0293	0.41	0.94	17.6	14.3	0.0220	0.54	0.84	16.5	13.4	0.0210	0.46	1.32	17.0	14.8	R	125
3046				spiked with sandbag	336	300	16.4	1.48	16.5	14.6	0.0325	0.45	0.91	13.8	14.1	0.0212	0.50	0.70	14.2	13.5	0.0192	0.37	1.48	16.5	14.6	R	127
2279				spiked	336	300	16.4	1.40	17.0	14.6	0.0298	0.72	0.98	11.9	14.1	0.0219	0.90	0.80	16.5	13.3	0.0203	0.44	1.40	17.0	14.6	R	125
930				spiked round sensor	336	300	16.4	1.36	16.5	14.6	0.0296	0.82	0.94	18.2	14.1	0.0207	0.68	0.72	15.5	13.4	0.0192	0.44	1.36	16.5	14.6	R	128
3047				sandbag	336	600	32.7	0.49	12.4	13.8	0.0121	0.11	0.28	13.1	13.8	0.0068	0.10	0.26	11.1	14.3	0.0087	0.06	0.49	12.4	13.8	R	122
3044	40°31.649	81°35.340	cluster 2	spiked	336	600	32.7	0.47	12.4	13.8	0.0119	0.10	0.29	12.8	13.8	0.0072	0.10	0.27	10.4	14.0	0.0088	0.07	0.47	12.4	13.8	R	122
3487				buried	336	600	32.7	0.47	12.4	13.8	0.0121	0.11	0.29	12.4	13.8	0.0071	0.11	0.23	9.3	14.4	0.0079	0.05	0.47	12.4	13.8	R	121
3486				spiked	336	1200	65.5	0.13	7.5	5.8	0.0040	0.04	0.17	8.6	9.4	0.0060	0.04	0.19	6.2	6.4	0.0096	0.03	0.185	6.2	6.4	T	114
1100	40°31.746	81°35.348	cluster 3	sandbag	336	1200	65.5	0.15	7.3	5.8	0.0049	0.04	0.15	9.3	9.4	0.0053	0.04	0.19	6.0	6.4	0.0096	0.03	0.185	6.0	6.4	T	112
001				buried	336	1200	65.5	0.17	7.3	5.9	0.0063	0.03	0.17	8.8	9.5	0.0059	0.04	0.13	5.9	6.4	0.0072	0.03	0.165	7.3	5.9	R	116
704				spiked	336	2000	109.1	0.09	18.2	5.3	0.0027	0.04	0.08	46.5	8.6	0.0018	0.06	0.09	10.6	3.8	0.0025	0.03	0.09	18.2	5.3	R	106
4040	40°31.836	81°35.393	cluster 4	buried	336	2000	109.1	0.08	25.6	5.3	0.0029	0.03	0.08	39.3	36.8	0.0016	0.06	0.07	10.4	3.8	0.0026	0.03	0.08	39.3	36.8	V	106
706				sandbag	336	2000	109.1	0.13	26.9	29.6	0.0032	0.06	0.11	39.3	36.9	0.0020	0.07	0.10	17.6	3.8	0.0026	0.03	0.13	26.9	29.6	R	106

OH-6
Date 7/11/2008
Shot Time 3:37 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot	40°23.892	81°29.549			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	938	400	13.1	0.90	9.3	4.9	0.0229	0.20	0.60	6.4	3.0	0.0148	0.19	0.59	4.8	3.4	0.0318	0.11	0.90	9.3	4.9	R	125
2241				loose on surface	938	400	13.1	1.03	9.4	12.3	0.0246	0.28	0.68	13.4	4.3	0.0150	0.23	0.60	4.9	4.4	0.0323	0.12	1.03	9.4	12.3	R	123
3048	40°23.829	81°20.516	cluster 1	sandbag	938	400	13.1	1.02	9.6	12.3	0.0241	0.24	0.65	15.5	3.0	0.0155	0.25	0.61	5.0	4.4	0.0340	0.11	1.02	9.6	12.3	R	123
3046				spiked with sandbag	938	400	13.1	1.05	9.4	4.9	0.0252	0.25	0.63	13.4	3.0	0.0158	0.21	0.61	11.9	3.4	0.0311	0.13	1.05	9.4	4.9	R	124
2279				spiked	938	400	13.1	1.06	9.3	12.1	0.0250	0.25	0.65	13.1	4.1	0.0153	0.21	0.60	11.6	4.4	0.0312	0.13	1.06	9.3	12.1	R	122
930				spiked round sensor	938	400	13.1	0.98	9.4	12.1	0.0234	0.25	0.68	6.4	4.3	0.0147	0.20	0.57	10.4	4.4	0.0312	0.13	0.98	9.4	12.1	R	124
3047				sandbag	938	800	26.1	0.44	12.1	7.9	0.0107	0.09	0.16	12.1	4.4	0.0087	0.05	0.30	5.6	4.3	0.0166	0.07	0.44	12.1	7.9	R	116
3044	40°23.757	81°29.512	cluster 2	spiked	938	800	26.1	0.41	11.9	7.9	0.0102	0.07	0.13	5.0	4.4	0.0080	0.05	0.32	5.4	4.3	0.0176	0.05	0.41	11.9	7.9	R	116
3487				buried	938	800	26.1	0.41	11.3	7.8	0.0108	0.08	0.13	4.9	4.5	0.0084	0.05	0.30	5.5	4.3	0.0169	0.05	0.41	11.3	7.8	R	116
3486				spiked	938	1270	41.5	0.20	19.6	4.8	0.0093	0.07	0.09	5.4	4.8	0.0049	0.04	0.16	28.4	3.3	0.0033	0.09	0.20	19.6	4.8	R	114
1100	40°23.689	81°29.466	cluster 3	sandbag	938	1270	41.5	0.25	22.2	4.8	0.0092	0.09	0.12	6.7	4.8	0.0050	0.04	0.14	28.4	3.3	0.0033	0.07	0.25	22.2	4.8	R	112
001				buried	938	1270	41.5	0.20	21.3	4.8	0.0079	0.08	0.11	6.1	4.8	0.0052	0.05	0.13	15.0	3.3	0.0051	0.05	0.20	21.3	4.8	R	112
		No 4th Cluster																									

KY-6
Date 7/14/2008
Shot a 1:27 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	37°23.849	83°10.152			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3047				buried	450	717	33.8	0.23	6.6	6.1	0.0105	0.03	0.20	11.6	12.1	0.0058	0.05	0.15	8.5	6.5	0.0059	0.03	0.23	6.6	6.1	R	114
3044	37°23.947	83°10.069	cluster 1	spiked	450	717	33.8	1.12	10.0	11.9	0.0368	0.19	0.36	15.5	18.1	0.0100	0.09	0.39	8.8	6.3	0.0143	0.08	1.12	10.0	11.9	R	126
3487				sandbag	450	717	33.8	0.92	10.2	7.3	0.0305	0.15	0.39	15.0	18.2	0.0108	0.11	0.77	10.4	12.1	0.0274	0.15	0.92	10.2	7.3	R	126
1792				buried	450	996	47.0	0.26	13.1	12.3	0.0074	0.05	0.17	15.0	12.2	0.0051	0.04	0.20	11.6	12.2	0.0061	0.04	0.26	13.1	12.3	R	122
2241				loose on surface	450	996	47.0	0.32	12.4	12.3	0.0083	0.07	0.17	15.5	12.2	0.0051	0.00	0.21	11.6	12.2	0.0062	0.05	0.32	12.4	12.3	R	121
3048	37°23.995	83°10.058	cluster 2	sandbag	450	996	47.0	0.32	13.4	12.3	0.0081	0.07	0.17	15.5	12.3	0.0048	0.05	0.21	12.1	12.2	0.0061	0.05	0.32	13.4	12.3	R	119
3046				spiked with sandbag	450	996	47.0	0.31	13.1	12.3	0.0082	0.07	0.16	15.5	12.2	0.0050	0.05	0.20	11.9	12.2	0.0060	0.04	0.31	13.1	12.3	R	120
2279				spiked	450	996	47.0	0.31	12.4	12.3	0.0083	0.07	0.17	15.5	12.2	0.0053	0.05	0.20	11.6	12.2	0.0061	0.04	0.31	12.4	12.3	R	119
930				ed on surface round se	450	996	47.0	0.31	12.4	12.3	0.0082	0.07	0.15	15.5	12.2	0.0049	0.04	0.20	11.6	12.1	0.0060	0.04	0.31	12.4	12.3	R	120
3486				buried	450	1604	75.6	0.12	8.9	6.0	0.0042	0.03	0.10	13.1	14.3	0.0029	0.02	0.13	12.8	11.8	0.0049	0.03	0.13	12.8	11.8	T	116
1100	37°24.092	83°10.022	cluster 3	sandbag	450	1604	75.6	0.13	9.4	11.6	0.0046	0.03	0.10	12.8	11.9	0.0030	0.03	0.13	18.2	11.9	0.0047	0.03	0.13	9.4	11.6	R	116
001				spiked	450	1604	75.6	0.06	9.1	7.1	0.0025	0.02	0.10	10.2	14.4	0.0033	0.02	0.15	10.6	11.9	0.0052	0.03	0.15	10.6	11.9	T	116
704				spiked	450	1887	89.0	0.22	8.3	6.1	0.0103	0.03	0.20	11.6	12.1	0.0055	0.04	0.15	8.6	6.5	0.0057	0.02	0.22	8.3	6.1	R	112
4040	37°24.132	83°9.991	cluster 4	buried	450	1887	89.0	0.19	6.3	6.0	0.0091	0.03	0.19	11.6	12.1	0.0057	0.04	0.18	8.6	6.5	0.0070	0.03	0.19	6.3	6.0	R	114
706				sandbag	450	1887	89.0	0.23	6.6	6.1	0.0105	0.03	0.20	11.6	12.1	0.0058	0.05	0.15	8.5	6.5	0.0059	0.03	0.23	6.6	6.1	R	114

KY-7
Date 7/14/2008
Shot b 4:20 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	37°23.794	83°9.690			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3047				buried	916	398	13.2	1.08	15.5	12.4	0.0297	0.32	0.69	16.0	11.6	0.0200	0.21	0.70	8.8	12.4	0.0241	0.21	1.08	15.5	12.4	R	126
3044	37°23.826	83°9.762	cluster 1	spiked	916	398	13.2	1.06	15.5	12.5	0.0294	0.32	0.76	16.0	11.7	0.0207	0.23	0.72	16.5	12.4	0.0242	0.24	1.06	15.5	12.5	R	126
3487				sandbag	916	398	13.2	1.08	15.5	12.4	0.0297	0.32	0.69	16.0	11.6	0.0200	0.21	0.70	8.8	12.4	0.0241	0.21	1.08	15.5	12.4	R	126
1792				buried	916	864	28.6	0.62	10.2	6.7	0.0202	0.11	0.62	12.8	13.6	0.0176	0.13	0.78	9.4	7.9	0.0328	0.13	0.78	9.4	7.9	T	124
2241				loose on surface	916	864	28.6	0.58	7.0	6.7	0.0271	0.11	0.60	13.1	13.6	0.0176	0.16	0.78	10.2	10.2	0.0278	0.14	0.78	10.2	10.2	T	122
3048	37°23.874	83°9.838	cluster 2	sandbag	916	864	28.6	0.54	8.0	6.7	0.0230	0.10	0.76	11.9	13.4	0.0212	0.17	0.78	10.0	10.1	0.0298	0.13	0.78	10.0	10.1	T	119
3046				spiked with sandbag	916	864	28.6	0.62	10.0	12.3	0.0204	0.11	0.64	12.8	13.6	0.0184	0.16	0.78	9.4	10.3	0.0333	0.14	0.78	9.4	10.3	T	121
2279				spiked	916	864	28.6	0.62	10.2	6.7	0.0196	0.11	0.64	12.8	4.2	0.0188	0.16	0.82	9.4	7.9	0.0345	0.13	0.82	9.4	7.9	T	120
930				spiked round sensor	916	864	28.6	0.60	10.0	6.8	0.0205	0.11	0.70	12.1	13.5	0.0202	0.16	0.76	9.3	7.8	0.0331	0.13	0.76	9.3	7.8	T	122
3486				buried	916	1642	54.2	0.10	20.4	4.0	0.0036	0.03	0.09	9.4	6.4	0.0041	0.02	0.10	4.9	2.3	0.0036	0.02	0.10	4.9	2.3	T	114
1100	37°23.993	83°9.920	cluster 3	sandbag	916	1642	54.2	0.09	24.3	4.0	0.0035	0.03	0.09	6.3	6.4	0.0040	0.02	0.11	4.7	2.4	0.0035	0.02	0.11	4.7	2.4	T	112
001				spiked	916	1642	54.2	0.09	22.2	4.0	0.0034	0.03	0.09	6.3	6.4	0.0038	0.02	0.10	4.7	2.4	0.0035	0.02	0.10	4.7	2.4	T	112
704				spiked	916	2538	83.9	0.14	8.8	2.8	0.0044	0.02	0.05	10.8	4.6	0.0024	0.01	0.11	4.6	2.5	0.0040	0.01	0.14	8.8	2.8	R	110
4040	37°24.112	83°10.031	cluster 4	buried	916	2538	83.9	0.15	7.5	2.7	0.0050	0.02	0.06	4.8	4.6	0.0026	0.01	0.09	7.3	2.5	0.0032	0.02	0.15	7.5	2.7	R	110
706				sandbag	916	2538	83.9	0.15	8.6	2.7	0.0050	0.03	0.06	4.6	4.6	0.0026	0.02	0.11	4.6	2.5	0.0042	0.02	0.15	8.6	2.7	R	112

KY-8
Date 7/15/2008
Shot 12:12 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot	37°25.697	82°31.867			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3047				buried	211	167	11.5	1.20	11.3	2.9	0.0517	0.23	0.61	16.0	8.8	0.0177	0.17	0.91	5.3	4.8	0.0464	0.15	1.20	11.3	2.9	R	139
3044	37°25.665	82°31.866	cluster 1	spiked	211	167	11.5	1.21	11.3	2.9	0.0555	0.23	0.65	15.5	8.8	0.0181	0.17	0.86	5.5	5.1	0.0425	0.13	1.21	11.3	2.9	R	139
3487				sandbag	211	167	11.5	1.13	11.3	2.9	0.0536	0.21	0.56	15.5	8.8	0.0168	0.16	0.75	5.3	5.1	0.0406	0.12	1.13	11.3	2.9	R	139
1792				buried	211	396	27.3	0.21	13.1	12.8	0.0068	0.08	0.17	14.6	20.1	0.0044	0.07	0.16	28.4	24.3	0.0023	0.07	0.21	13.1	12.8	R	128
2241				loose on surface	211	396	27.3	0.28	24.3	13.1	0.0072	0.13	0.19	23.2	10.1	0.0047	0.09	0.25	28.4	24.3	0.0028	0.11	0.28	24.3	13.1	R	128
3048	37°25.628	82°31.856	cluster 2	sandbag	211	396	27.3	0.28	16.0	24.8	0.0070	0.10	0.25	32.0	20.1	0.0051	0.14	0.21	26.9	24.3	0.0030	0.09	0.28	16.0	24.8	R	126
3046				spiked with sandbag	211	396	27.3	0.28	13.4	24.1	0.0069	0.11	0.22	32.0	20.1	0.0050	0.12	0.19	26.9	24.1	0.0029	0.08	0.28	13.4	24.1	R	128
2279				spiked	211	396	27.3	0.27	23.2	12.8	0.0075	0.11	0.17	14.6	17.5	0.0045	0.07	0.21	30.1	24.4	0.0025	0.09	0.27	23.2	12.8	R	127
930				spiked round sensor	211	1179	81.2																				125
3486				buried	211	1179	81.2	0.13	6.5	10.1	0.0036	0.03	0.09	12.8	5.9	0.0021	0.02	0.10	14.2	3.5	0.0033	0.03	0.13	6.5	10.1	R	125
1100	37°25.561	82°31.864	cluster 3	sandbag	211	1179	81.2	0.13	15.0	15.0	0.0033	0.03	0.09	13.8	13.8	0.0021	0.03	0.12	14.6	14.6	0.0040	0.03	0.13	15.0	15.0	R	120
001				spiked	211	1179	81.2	0.12	12.8	10.3	0.0032	0.03	0.08	12.4	5.9	0.0021	0.02	0.12	13.4	17.0	0.0043	0.03	0.12	13.4	17.0	T	124
704				spiked	211	2619	180.3	0.08	19.6	21.6	0.0016	0.03	0.04	28.4	6.0	0.0009	0.01	0.06	13.4	10.3	0.0017	0.01	0.08	19.6	21.6	R	118
4040	37°25.498	82°31.868	cluster 4	buried	211	2619	180.3	0.07	18.2	10.1	0.0016	0.02	0.03	28.4	5.9	0.0010	0.01	0.05	15.5	10.4	0.0015	0.01	0.07	18.2	10.1	R	118
706				sandbag	211	2619	180.3	0.07	18.9	10.1	0.0015	0.03	0.03	26.9	6.0	0.0010	0.01	0.05	12.1	10.3	0.0016	0.01	0.07	18.9	10.1	R	118

WV-1
Date 7/16/2008
Shot 3:41 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot	38°6.139	81°57.483			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3047				buried	6957	1277	15.3	3.08	10.8	13.4	0.0881	0.56	1.08	17.0	13.8	0.0213	0.34	1.08	12.8	11.9	0.0302	0.27	3.08	10.8	13.4	R	136
3044	37°23.826	83°9.762	cluster 1	spiked	6957	1277	15.3	3.08	11.1	10.4	0.0887	0.58	1.11	17.0	13.8	0.0191	0.37	1.11	12.8	11.9	0.0301	0.29	3.08	11.1	10.4	R	136
3487				sandbag	6957	1277	15.3	2.96	10.8	10.4	0.0867	0.57	1.10	17.6	13.8	0.0193	0.37	1.09	12.8	11.9	0.0295	0.03	2.96	10.8	10.4	R	135
1792				buried	6957	1878	22.5	0.22	6.0	4.5	0.0086	0.04	0.17	10.2	3.8	0.0110	0.05	0.18	3.6	3.9	0.0101	0.03	0.22	6.0	4.5	R	130
2241				loose on surface	6957	1878	22.5	0.28	6.1	4.8	0.0125	0.04	0.18	8.5	3.8	0.0113	0.05	0.19	7.5	4.0	0.0100	0.03	0.28	6.1	4.8	R	130
3048	37°23.874	83°9.838	cluster 2	sandbag	6957	1878	22.5	0.23	6.2	4.6	0.0087	0.04	0.18	10.2	3.8	0.0113	0.05	0.18	3.5	3.9	0.0096	0.03	0.23	6.2	4.6	R	129
3046				spiked with sandbag	6957	1878	22.5	0.22	5.9	4.5	0.0085	0.04						0.16	3.6	4.0	0.0097	0.03	0.22	5.9	4.5	R	130
2279				spiked	6957	1878	22.5	0.22	5.8	4.5	0.0086	0.04	0.18	10.0	3.8	0.0112	0.05	0.18	3.6	3.9	0.0106	0.03	0.22	5.8	4.5	R	129
930				spiked round sensor	6957	1878	22.5	0.20	5.3	4.5	0.0075	0.04	0.18	4.0	3.8	0.0109	0.05	0.21	4.3	3.9	0.0110	0.03	0.21	4.3	3.9	T	128
3486				buried	6957	3035	36.4	0.39	6.2	4.1	0.0238	0.05	0.21	8.8	9.1	0.0072	0.04	0.22	3.4	3.7	0.0121	0.03	0.39	6.2	4.1	R	121
1100	37°23.993	83°9.920	cluster 3	sandbag	6957	3035	36.4	0.39	6.3	4.1	0.0240	0.05	0.20	6.9	3.6	0.0065	0.04	0.22	3.5	4.1	0.0130	0.03	0.39	6.3	4.1	R	120
001				spiked	6957	3035	36.4	0.36	6.4	4.1	0.0223	0.05	0.20	7.6	9.1	0.0065	0.04	0.21	3.7	4.1	0.0141	0.03	0.36	6.4	4.1	R	122
704				spiked	6957	6514	78.1	0.07	13.4	10.3	0.0020	0.02	0.02	18.9	2.5	0.0012	0.01	0.08	11.6	9.8	0.0023	0.01	0.08	11.6	9.8	T	116
4040	37°24.112	83°10.031	cluster 4	buried	6957	6514	78.1	0.07	12.8	10.3	0.0020	0.02	0.02	17.6	2.6	0.0012	0.01	0.08	11.1	9.8	0.0024	0.01	0.08	11.1	9.8	T	117
706				sandbag	6957	6514	78.1	0.08	13.8	10.3	0.0021	0.02	0.03	7.7	3.5	0.0013	0.01	0.08	11.9	9.8	0.0013	0.01	0.08	13.8	10.3	R	118

WV-2

Date 7/17/2008

Shot a 3:35 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	38°12.285	81°39.140			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3047				buried	234	227	14.8	2.64	17.6	15.2	0.0529	1.59	4.36	17.6	19.6	0.0773	1.54	2.24	32.0	16.6	0.0549	1.33	4.36	17.6	19.6	V	140
3044	37°23.826	83°9.762	cluster 1	spiked	234	227	14.8	2.76	16.0	15.3	0.0587	1.68	4.24	17.6	19.6	0.0750	1.43	2.44	28.4	11.8	0.0613	1.06	4.24	17.6	19.6	V	139
3487				sandbag	234	227	14.8	2.28	24.3	15.1	0.0541	1.21	4.24	17.6	19.7	0.0754	1.43	2.16	28.4	16.5	0.0667	1.06	4.24	17.6	19.7	V	138
1792				buried	234	411	26.9	1.26	12.4	11.3	0.0332	0.57	1.22	28.4	24.7	0.0155	0.54	1.00	21.3	11.2	0.0210	0.38	1.26	12.4	11.3	R	132
2241				loose on surface	234	411	26.9	1.60	15.0	11.3	0.0391	0.56	1.34	25.6	24.8	0.0182	0.83	1.08	17.0	10.9	0.0226	0.51	1.60	15.0	11.3	R	130
3048	37°23.874	83°9.838	cluster 2	sandbag	234	411	26.9	1.26	13.4	11.4	0.0352	0.59	1.12	26.9	24.7	0.0162	0.50	1.02	19.6	10.9	0.0214	0.39	1.26	13.4	11.4	R	128
3046				spiked with sandbag	234	411	26.9	1.32	16.5	11.4	0.0347	0.51	0.00	0.0	0.0	0.0000	0.00	0.98	15.0	10.9	0.0227	0.38	1.32	16.5	11.4	R	130
2279				spiked	234	411	26.9	1.30	16.5	11.3	0.0311	0.49	1.10	25.6	24.9	0.0154	0.48	0.84	21.3	19.3	0.0191	0.34	1.30	16.5	11.3	R	128
930				spiked round sensor	234	411	26.9	1.36	16.5	11.3	0.0310	0.46	1.10	26.9	24.8	0.0162	0.48	0.78	15.5	18.9	0.0189	0.32	1.36	16.5	11.3	R	130
3486				buried	234	782	51.1	0.27	22.2	24.3	0.0049	0.16	0.19	24.3	10.9	0.0066	0.08	0.25	26.9	37.0	0.0040	0.13	0.27	22.2	24.3	R	122
1100	37°23.993	83°9.920	cluster 3	sandbag	234	782	51.1	0.24	21.3	24.3	0.0046	0.11	0.17	11.9	10.9	0.0066	0.08	0.22	32.0	36.8	0.0035	0.12	0.24	21.3	24.3	R	118
001				spiked	234	782	51.1	0.22	21.3	24.3	0.0044	0.13	0.18	25.6	11.2	0.0064	0.08	0.24	32.0	37.0	0.0037	0.14	0.24	32.0	37.0	T	122
704				spiked	234	1557	101.9	0.50	23.2	19.1	0.0076	0.17	0.20	22.2	18.8	0.0034	0.07	0.44	18.9	19.6	0.0074	0.13	0.50	23.2	19.1	R	116
4040	37°24.112	83°10.031	cluster 4	buried	234	1557	101.9	0.50	23.2	19.2	0.0079	0.17	0.20	22.2	18.8	0.0035	0.07	0.45	19.6	19.5	0.0075	0.14	0.50	23.2	19.2	R	117
706				sandbag	234	1557	101.9	0.45	22.2	19.1	0.0075	0.15	0.22	23.2	18.9	0.0037	0.09	0.47	18.2	19.5	0.0085	0.13	0.47	18.2	19.5	T	117

WV-3

Date 7/18/2008

Shot 3:08 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	38°12.451	81°39.013			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3047				buried	162	182	14.3	2.20	5.7	3.9	0.1082	0.58	1.14	34.1	2.4	0.0242	0.61	1.52	8.9	3.4	0.0611	0.56	2.20	5.7	3.9	R	142
3044	37°23.826	83°9.762	cluster 1	spiked	162	182	14.3	5.28	128.0	3.8	0.0972	NP	0.84	18.2	2.9	1.0200	NP	1.92	128.0	3.6	0.0458	NP	5.28	128.0	3.8	R	>148
3487				sandbag	162	182	14.3	2.48	10.6	3.8	0.1091	0.80	1.02	20.4	3.7	0.0244	0.93	1.52	9.3	3.6	0.0613	0.56	2.48	10.6	3.8	R	142
1792				buried	162	407	32.0	0.10	6.9	5.1	0.0048	0.02	0.07	12.4	8.4	0.0024	0.05	0.07	6.4	4.8	0.0030	0.02	0.10	6.9	5.1	R	143
2241				loose on surface	162	407	32.0	0.10	6.2	5.1	0.0047	0.03	0.07	12.4	8.4	0.0026	0.07	0.07	6.4	4.8	0.0033	0.05	0.10	6.2	5.1	R	142
3048	37°23.874	83°9.838	cluster 2	sand bag	162	407	32.0	0.09	6.4	5.0	0.0046	0.01	0.07	12.4	5.6	0.0026	0.04	0.07	6.9	4.8	0.0030	0.03	0.09	6.4	5.0	R	141
3046				spiked with sandbag	162	407	32.0	0.09	6.2	5.1	0.0046	0.01	0.01	0.0	5.4	0.0000	0.01	0.07	6.2	4.8	0.0036	0.02	0.09	6.2	5.1	R	142
2279				spiked	162	407	32.0	0.09	6.4	5.1	0.0047	0.03	0.07	11.9	8.5	0.0024	0.03	0.07	6.4	4.8	0.0036	0.02	0.09	6.4	5.1	R	142
930				spiked round sensor	162	407	32.0	0.09	6.4	5.1	0.0046	0.03	0.08	12.4	8.4	0.0024	0.03	0.06	6.4	4.8	0.0036	0.03	0.09	6.4	5.1	R	142
3486				buried	162	801	62.9	0.16	13.8	3.9	0.0055	0.05	0.16	15.5	5.7	0.0037	0.11	0.14	5.6	4.8	0.0053	0.05	0.16	13.8	3.9	R	142
1100	37°23.993	83°9.920	cluster 3	sandbag	162	801	62.9	0.14	15.0	15.4	0.0053	0.05	0.14	16.0	5.6	0.0037	0.08	0.13	5.6	4.8	0.0051	0.05	0.14	15.0	15.4	R	143
001				spiked	162	801	62.9	0.15	14.6	15.6	0.0050	0.04	0.15	17.0	5.8	0.0033	0.07	0.13	5.6	4.9	0.0051	0.05	0.15	14.6	15.6	R	148
704				spiked	162	1185	93.1	0.11	13.8	16.6	0.0032	0.03	0.07	6.7	9.4	0.0021	0.03	0.10	7.4	10.4	0.0032	0.03	0.11	13.8	16.6	R	133
4040	37°24.112	83°10.031	cluster 4	buried	162	1185	93.1	0.11	16.0	16.5	0.0033	0.03	0.07	6.9	9.4	0.0020	0.03	0.09	7.5	10.3	0.0032	0.03	0.11	16.0	16.5	R	135
706				sandbag	162	1185	93.1	0.12	14.2	16.6	0.0033	0.04	0.08	6.7	9.6	0.0021	0.03	0.10	7.6	10.5	0.0032	0.03	0.12	14.2	16.6	R	134

WY-1

Date 4/21/2008

Shot a 2:34 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	44°4.851'	105°25.891'			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3570	44°4.816'	105°25.894'	single	buried	1237	216	6.1	10.24	2.9	2.6	0.3121	2.23	4.80	3.9	3.3	0.2009	0.64	2.72	4.9	2.5	0.1114	0.64	10.24	4.9	3.3	R	140
1792				buried	1237	590	16.8	2.12	7.5	3.3	0.0862	0.30	1.76	4.8	3.1	0.0909	0.38	0.75	4.0	3.1	0.0479	0.19	2.12	7.5	3.3	R	129
3046				spiked	1237	590	16.8	2.20	7.3	3.3	0.0916	0.27	1.66	4.7	2.9	0.0884	0.29	0.74	4.3	3.7	0.0464	0.11	2.20	7.3	3.7	R	131
3048	44°4.754'	105°25.899'	cluster 1	sandbag	1237	590	16.8	2.24	7.5	3.3	0.0919	0.27	1.70	4.7	3.1	0.0865	0.34	0.72	4.4	3.8	0.0443	0.08	2.24	7.5	3.8	R	130
2279				spiked with sandbag	1237	590	16.8	2.20	7.6	3.3	0.0897	0.33	1.84	4.8	2.9	0.0899	0.38	0.74	4.3	3.7	0.0472	0.16	2.20	7.6	3.7	R	127
2241				loose on surface	1237	590	16.8	2.40	7.6	3.3	0.0936	0.32	1.76	5.0	2.9	0.0878	0.34	0.74	4.4	3.9	0.0467	0.21	2.40	7.6	3.9	R	125
2240				buried	1237	742	21.1	0.95	3.6	3.3	0.0481	0.15	1.36	4.1	5.1	0.0639	0.27	0.52	3.0	3.1	0.0366	0.11	1.36	4.1	5.1	V	128
3044	44°4.729'	105°25.898'	cluster 2	spiked	1237	742	21.1	0.96	4.2	3.3	0.0500	0.17	1.28	4.1	5.0	0.0676	0.24	0.50	2.8	3.1	0.0368	0.08	1.28	4.2	5.0	V	128
3047				sandbag	1237	742	21.1	0.97	4.3	3.3	0.0493	0.16	1.36	4.1	5.1	0.0640	0.24	0.54	3.1	3.1	0.0343	0.08	1.36	4.3	5.1	V	129
785				buried	1237	990	28.1	0.68	4.6	2.9	0.0397	0.08	0.94	3.3	3.1	0.0435	0.18	0.31	2.5	2.8	0.0204	0.08	0.94	4.6	3.1	V	130
1793	44°4.688'	105°25.894'	cluster 3	spiked	1237	990	28.1	0.66	5.1	3.2	0.0393	0.13	0.88	3.2	3.3	0.0429	0.20	0.29	2.8	2.8	0.0180	0.09	0.88	5.1	3.3	V	128
3487				sandbag	1237	990	28.1	0.66	5.5	2.9	0.0382	0.14	0.90	3.1	3.1	0.0439	0.20	0.42	5.0	3.2	0.0275	0.11	0.90	5.5	3.2	V	128

WY-2

Date 4/21/2008

Shot b 3:30 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	44°4.953'	105°26.01'			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3570	44°4.816'	105°25.894'	single	buried	1992	974	21.8	1.32	2.9	3.4	0.0770	0.11	0.69	2.9	2.2	0.0164	0.05	0.76	3.1	2.2	0.0270	0.11	1.32	3.1	3.4	R	126
1792				buried	1992	1300	29.1	0.38	2.9	2.9	0.0166	0.04	0.38	3.0	2.2	0.0189	0.04	0.30	2.9	2.2	0.0103	0.03	0.38	3.0	2.9	R	121
3046				spiked	1992	1300	29.1	0.38	2.8	2.9	0.0152	0.05	0.38	3.2	2.2	0.0191	0.03	0.32	2.0	2.3	0.0097	0.03	0.38	3.2	2.9	R	125
3048	44°4.754'	105°25.899'	cluster 1	sandbag	1992	1300	29.1	0.38	2.9	2.8	0.0157	0.05	0.38	3.2	2.3	0.0184	0.05	0.36	2.0	2.3	0.0113	0.05	0.38	3.2	2.8	R	124
2279				spiked with sandbag	1992	1300	29.1	0.38	2.8	2.8	0.0155	0.04	0.37	3.0	2.2	0.0184	0.04	0.30	3.0	2.2	0.0091	0.03	0.38	3.0	2.8	R	120
2241				loose on surface	1992	1300	29.1	0.38	3.0	2.9	0.0163	0.05	0.36	3.2	3.4	0.0181	0.05	0.34	2.0	2.3	0.0108	0.05	0.38	3.2	3.4	R	120
2240				buried	1992	1446	32.4	0.32	3.6	2.8	0.0169	0.03	0.27	3.2	3.4	0.0182	0.04	0.29	2.2	2.3	0.0068	0.03	0.32	3.6	3.4	R	119
3044	44°4.729'	105°25.898'	cluster 2	spiked	1992	1446	32.4	0.33	3.5	2.9	0.0167	0.03	0.29	3.2	3.1	0.0189	0.03	0.29	2.2	2.2	0.0071	0.02	0.33	3.5	3.1	R	122
3047				sandbag	1992	1446	32.4	0.31	3.6	2.9	0.0172	0.03	0.29	3.2	3.4	0.0183	0.04	0.29	2.2	2.3	0.0061	0.03	0.31	3.6	3.4	R	122
785				buried	1992	1688	37.8	0.21	3.2	1.8	0.0136	0.02	0.35	3.3	4.3	0.0197	0.02	0.30	2.5	2.3	0.0054	0.02	0.35	3.3	4.3	V	119
1793	44°4.688'	105°25.894'	cluster 3	spiked	1992	1688	37.8	0.21	3.2	2.3	0.0136	0.02	0.32	3.3	4.2	0.0191	0.02	0.29	2.5	2.3	0.0057	0.02	0.32	3.3	4.2	V	120
3487				sandbag	1992	1688	37.8	0.22	3.3	2.5	0.0131	0.03	0.37	3.2	2.9	0.0201	0.03	0.26	2.4	2.1	0.0060	0.02	0.37	3.3	2.9	V	120

WY-3

Date 4/22/2008

Shot a 11:34 AM coal shot

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	44°0.912'	105°22.651'			(lbs/delay)	(ft)	(ft/lb$^{1/6}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
2408	44°0.912'	105°22.723'	single	buried	3603	2685	44.7	nt																			
3570	44°0.914'	105°22.825'		buried	3603	2810	46.8	nt																			
1792				buried	3603	3077	51.3	0.23	2.4	1.5	0.0048	0.03	0.11	1.9	2.3	0.0035	0.03	0.11	3.0	2.9	0.0055	0.03	0.23	2.4	1.5	R	112
2279				spiked	3603	3077	51.3	0.21	2.4	1.5	0.0046	0.01	0.11	1.9	2.3	0.0036	0.04	0.11	2.9	2.6	0.0055	0.03	0.21	2.4	1.5	R	112
3048	44°0.909'	105°22.947'	cluster 1	sandbag	3603	3077	51.3	0.20	2.4	1.6	0.0044	0.03	0.10	2.2	1.3	0.0033	0.04	0.11	2.9	2.6	0.0054	0.03	0.20	2.4	1.6	R	116
3046				spiked with sandbag	3603	3077	51.3	0.22	2.4	1.5	0.0046	0.03	0.11	1.9	2.3	0.0035	0.04	0.10	6.0	2.6	0.0053	0.03	0.22	2.4	1.5	R	117
2241				loose on surface	3603	3077	51.3	0.22	2.4	1.5	0.0047	0.03	0.11	1.9	2.3	0.0036	0.04	0.11	6.6	2.6	0.0057	0.03	0.22	2.4	1.5	R	112
3486				buried with spikes	3603	3077	51.3	0.22	2.4	1.6	0.0046	0.03	0.10	2.2	1.3	0.0033	0.03	0.10	3.0	2.6	0.0055	0.03	0.22	2.4	1.6	R	114
2240				buried	3603	3963	66.0	0.10	1.4	1.7	0.0039	0.01	0.08	6.5	2.6	0.0034	0.03	0.10	3.4	1.9	0.0039	0.01	0.10	3.4	1.9	T	112
1793	44°0.913'	105°23.265'	cluster 2	spike	3603	3963	66.0	0.10	1.4	1.7	0.0044	0.01	0.07	5.0	2.6	0.0035	0.03	0.10	3.3	1.9	0.0039	0.01	0.10	1.4	1.7	R	112
3047				sand bag	3603	3963	66.0	0.10	6.0	1.7	0.0047	0.01	0.07	5.1	2.6	0.0035	0.03	0.11	3.3	1.9	0.0039	0.01	0.11	3.3	1.9	T	110
785				buried	3603	5860	97.6	0.04	3.2	1.2	0.0021	0.01	0.04	3.4	1.6	0.0011	0.01	0.05	3.0	1.8	0.0017	0.01	0.05	3.0	1.8	T	106
3044	44°0.906'	105°23.778'	cluster 3	spiked	3603	5860	97.6	0.04	3.2	1.3	0.0022	0.01	0.03	3.5	1.6	0.0012	0.01	0.05	3.1	1.8	0.0017	0.01	0.05	3.1	1.8	T	112
3487				sandbag	3603	5860	97.6	0.05	3.1	1.3	0.0022	0.01	0.03	1.7	1.6	0.0012	0.01	0.05	2.4	1.8	0.0017	0.01	0.05	2.4	1.8	T	112
1906				buried	3603	9195	153.2	0.03	3.1	1.5	0.0014	0.02	0.02	3.0	1.8	0.0009	0.01	0.02	2.4	1.9	0.0010	0.01	0.03	3.1	1.5	R	106
704	44°0.944'	105°24.612'	cluster 4	spiked	3603	9195	153.2	0.03	3.4	1.9	0.0016	0.02	0.02	2.0	1.4	0.0010	0.01	0.02	5.0	1.7	0.0006	0.00	0.03	3.4	1.9	R	114
706				sandbag	3603	9195	153.2	nt																			

WY-4
Date 4/22/2008
Shot b 1:10 PM overburden shot

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	44°1.342'	105°22.582'			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
2408	44°0.912'	105°22.723	single	buried	17701	315	2.4	2.92	3.5	1.6	0.1161	0.48	2.44	4.9	3.3	0.0911	0.53	1.88	3.2	1.9	0.0932	0.21	2.92	3.5	1.6	R	142
3570	44°0.914'	105°22.825		buried	17701	760	5.7	3.16	8.2	8.3	0.1435	0.42	2.48	8.3	2.4	0.0782	0.48	1.80	4.1	2.1	0.0459	0.27	3.16	8.2	8.3	R	134
1792				buried	17701	1294	9.7	1.40	7.2	2.4	0.0707	0.28	1.07	7.5	1.6	0.0413	0.29	1.32	3.5	2.1	0.0329	0.15	1.40	7.2	2.4	R	126
2279				spiked	17701	1294	9.7	1.64	6.8	2.4	0.0758	0.30	1.11	7.5	1.6	0.0426	0.32	1.05	2.0	2.1	0.0237	0.20	1.64	6.8	2.4	R	125
3048	44°0.909'	105°22.947	cluster 1	sandbag	17701	1294	9.7	1.68	6.7	2.4	0.0767	0.32	1.10	7.6	1.6	0.0416	0.36	1.08	2.0	2.1	0.0243	0.20	1.68	6.7	2.4	R	127
3046				spiked with sandbag	17701	1294	9.7	1.60	6.6	2.4	0.0748	0.29	1.08	7.6	1.6	0.0406	0.32	1.00	2.0	2.1	0.0227	0.17	1.60	6.6	2.4	R	128
2241				loose on surface	17701	1294	9.7	1.60	7.5	2.4	0.0790	0.37	1.28	8.1	1.6	0.0450	0.42	1.10	2.6	2.1	0.0234	0.29	1.60	7.5	2.4	R	124
3486				buried with spikes	17701	1294	9.7	1.56	6.8	2.4	0.0753	0.30	1.05	7.5	1.6	0.0396	0.30	1.04	2.0	2.1	0.0216	0.17	1.56	6.8	2.4	R	127
2240				buried	17701	2683	20.2	0.64	4.6	1.8	0.0299	0.11	0.59	4.6	2.4	0.0235	0.13	0.76	2.4	3.4	0.0305	0.20	0.76	2.4	3.4	T	122
1793	44°0.913'	105°23.265'	cluster 2	spike	17701	2683	20.2	0.66	5.4	2.4	0.0304	0.12	0.47	5.2	2.4	0.0267	0.11	0.80	2.1	3.4	0.0301	0.19	0.80	2.1	3.4	T	120
3047				sandbag	17701	2683	20.2	0.70	5.2	2.4	0.0323	0.13	0.49	5.0	2.4	0.0273	0.12	0.80	2.3	2.2	0.0300	0.19	0.80	2.3	2.2	T	123
785				buried	17701	4925	37.0	0.66	6.3	5.8	0.0359	0.07	0.31	3.6	3.4	0.0216	0.04	0.44	3.0	2.1	0.0287	0.06	0.66	6.3	5.8	R	118
3044	44°0.906'	105°23.778'	cluster 3	spiked	17701	4925	37.0	0.66	6.3	5.8	0.0375	0.11	0.31	3.8	3.3	0.0219	0.04	0.45	2.9	2.1	0.0293	0.07	0.66	6.3	5.8	R	114
3487				sandbag	17701	4925	37.0	0.64	6.4	5.8	0.0371	0.09	0.30	3.9	3.4	0.0214	0.04	0.45	2.8	2.1	0.0299	0.09	0.64	6.4	5.8	R	116
1906				buried	17701	8571	64.4	0.27	6.0	2.8	0.0162	0.03	0.20	4.6	2.1	0.0103	0.03	0.22	3.8	2.2	0.0123	0.02	0.27	6.0	2.8	R	112
704	44°0.944'	105°24.612'	cluster 4	spiked	17701	8571	64.4	0.29	5.6	4.2	0.0155	0.03	0.21	6.0	1.8	0.0110	0.03	0.23	3.2	2.1	0.0110	0.01	0.29	5.6	4.2	R	116
706				sandbag	17701	8571	64.4	nt																			

WY-5
Date 4/23/2008
Shot 3:10 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot #1	43°31.643	105°18.135			(lbs/delay)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
2408			single	buried	19230	255	1.8	5.92	3.1	2.5	0.1204	1.17	6.08	4.8	2.4	0.1680	1.64	5.28	4.3	2.5	0.1994	1.01	6.08	4.8	2.44	V	143
3570	43°31.627'	105°18.331'		buried	19230	869	6.3	3.04	2.9	2.4	0.1237	0.32	4.40	3.1	2.4	0.0849	0.42	3.40	4.7	2.6	0.0878	0.27	4.40	3.1	2.38	V	138
1792				buried	19230	1786	12.9	2.52	4.3	2.4	0.0715	0.49	1.68	3.0	2.8	0.0394	0.30	1.92	2.4	2.4	0.0516	0.42	2.52	4.3	2.38	R	128
2279				spiked	19230	1786	12.9	2.40	4.3	2.4	0.0744	0.56	1.80	3.0	2.6	0.0351	0.33	1.76	2.6	2.4	0.0527	0.46	2.40	4.3	2.39	R	128
3048	43°31.631'	105°18.54'	cluster 1	sandbag	19230	1786	12.9	2.44	4.4	2.4	0.0765	0.53	1.76	3.0	2.6	0.0350	0.30	1.80	2.4	2.4	0.0548	0.42	2.44	4.4	2.38	R	130
3046				spiked with sandbag	19230	1786	12.9	2.52	4.4	2.4	0.0768	0.53	1.84	3.0	2.6	0.0356	0.33	1.80	2.4	2.4	0.0542	0.44	2.52	4.4	2.38	R	131
2241				loose on surface	19230	1786	12.9	2.68	4.4	2.4	0.0749	0.52	1.88	3.1	2.6	0.0389	0.33	1.84	2.4	2.4	0.0558	0.42	2.68	4.4	2.38	R	128
3486				buried with spikes	19230	1786	12.9	2.40	4.2	2.4	0.0737	0.52	1.80	2.9	2.6	0.0329	0.33	1.76	2.4	2.4	0.0527	0.41	2.40	4.2	2.38	R	130
2240				buried	19230	3600	26.0	1.16	5.3	5.8	0.0630	0.19	0.64	2.5	2.8	0.0335	0.14	0.51	2.6	2.5	0.0200	0.11	1.16	5.3	5.75	R	121
1793	43°31.691'	105°18.957'	cluster 2	spiked	19230	3600	26.0	1.18	5.5	5.8	0.0633	0.17	0.60	2.5	2.8	0.0333	0.13	0.55	2.5	2.5	0.0160	0.12	1.18	5.5	5.75	R	120
3047				sandbag	19230	3600	26.0	1.24	5.3	5.8	0.0659	0.19	0.64	2.5	2.8	0.0320	0.13	0.58	3.9	2.5	0.0170	0.12	1.24	5.3	5.75	R	122
785				buried	19230	6132	44.2	0.48	6.9	2.6	0.0235	0.05	0.37	2.6	2.7	0.0104	0.06	0.31	5.6	2.5	0.0136	0.03	0.48	6.9	2.56	R	118
704	43°31.708'	105°19.524'	cluster 3	spiked	19230	6132	44.2	0.48	4.5	2.5	0.0249	0.07	0.40	2.6	2.7	0.0092	0.08	0.32	6.0	2.6	0.0133	0.04	0.48	4.5	2.5	R	114
3487				sandbag	19230	6132	44.2	0.48	5.5	2.5	0.0246	0.07	0.38	2.6	2.7	0.0092	0.06	0.33	6.0	2.6	0.0140	0.03	0.48	5.5	2.5	R	116
1906				buried	19230	8493	61.2	0.45	5.8	2.6	0.0194	0.06	0.25	3.0	2.5	0.0098	0.03	0.21	2.6	2.6	0.0070	0.04	0.45	5.8	2.63	R	114
3044	43°31.915'	105°20.026'	cluster 4	spiked	19230	8493	61.2	0.45	5.8	2.6	0.0193	0.05	0.26	3.1	2.5	0.0097	0.03	0.19	2.6	2.6	0.0069	0.02	0.45	5.8	2.63	R	116
706				sandbag	19230	8493	61.2	0.46	5.7	2.6	0.0196	0.06	0.26	3.1	2.5	0.0098	0.03	0.19	2.7	2.6	0.0071	0.03	0.46	5.7	2.63	R	112

WY-6
Date 4/24/2008
Shot a 5:00 PM coal

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge weight delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	44°9.348'	105°23.336'			(lbs)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
2408	44°9.636'	105°23.329'	single	buried	7056	1750	20.8	0.36	4.3	2.4	0.0166	0.05	0.20	5.6	4.3	0.0103	0.05	0.64	3.4	2.1	0.0218	0.05	0.64	3.4	2.1	T	120
3570	44°9.554'	105°23.405'		buried	7056	1287	15.3	0.64	3.8	2.4	0.0310	0.16	0.92	2.9	2.4	0.0367	0.11	1.32	4.5	3.0	0.0558	0.16	1.32	4.5	3.0	T	128
1792				buried	7056	1605	19.1	0.47	4.8	2.4	0.0178	0.07	0.75	3.8	2.4	0.0360	0.09	0.63	2.4	1.8	0.0237	0.08	0.75	3.8	2.4	V	124
3486			cluster 1	spiked	7056	1605	19.1	0.54	4.6	2.4	0.0183	0.05	0.72	3.2	3.8	0.0343	0.11	0.63	2.5	1.8	0.0245	0.08	0.72	3.2	3.8	V	123
3048	44°9.596'	105°23.463'		sandbag	7056	1605	19.1	0.53	4.4	2.4	0.0158	0.07	0.71	3.2	3.8	0.0328	0.09	0.61	2.4	1.8	0.0272	0.08	0.71	3.2	3.8	V	125
2241				buried	7056	2111	25.1	0.40	4.2	3.2	0.0169	0.04	0.45	2.7	2.9	0.0210	0.04	0.19	2.5	1.8	0.0070	0.03	0.45	2.7	2.9	V	112
2279			cluster 2	spiked	7056	2111	25.1	0.39	4.1	3.3	0.0165	0.03	0.46	2.7	2.9	0.0210	0.04	0.20	2.5	1.8	0.0067	0.03	0.46	2.7	2.9	V	116
3046				sandbag	7056	2111	25.1	0.39	4.2	3.2	0.0169	0.03	0.46	2.7	2.9	0.0208	0.04	0.21	2.1	1.8	0.0065	0.03	0.46	2.7	2.9	V	119
2240				buried	7056	3083	36.7	0.20	7.0	2.6	0.0117	0.03	0.26	2.6	2.3	0.0100	0.02	0.22	4.0	1.8	0.0058	0.01	0.26	2.6	2.3	V	112
1793	44°9.704'	105°23.84'	cluster 3	spiked	7056	3083	36.7	0.19	7.0	2.6	0.0111	0.03	0.25	2.6	2.3	0.0092	0.02	0.22	4.2	1.8	0.0059	0.02	0.25	2.6	2.3	V	110
3487				sandbag	7056	3083	36.7	0.20	6.9	2.6	0.0115	0.03	0.28	2.6	2.3	0.0098	0.02	0.23	4.2	1.8	0.0064	0.02	0.28	2.6	2.3	V	116
785				buried	7056	4169	49.6	0.25	5.3	1.8	0.0141	0.03	0.18	2.6	2.7	0.0081	0.02	0.27	5.0	2.6	0.0160	0.03	0.27	5.0	2.6	T	112
3044	44°9.747'	105°24.114'	cluster 4	spiked	7056	4169	49.6	0.24	5.5	1.8	0.0140	0.03	0.19	2.6	2.7	0.0085	0.02	0.30	5.0	2.6	0.0161	0.03	0.30	5.0	2.6	T	112
3047				sandbag	7056	4169	49.6	0.23	5.3	1.8	0.0137	0.03	0.18	2.6	2.7	0.0084	0.02	0.20	5.0	2.6	0.0167	0.03	0.23	5.3	1.8	R	110
1906				buried	7056	5202	61.9	0.13	3.6	2.6	0.0077	0.01	0.15	4.0	2.8	0.0055	0.01	0.11	4.4	2.7	0.0059	0.01	0.15	4.0	2.8	V	110
704	44°9.896'	105°24.253'	cluster 5	spiked	7056	5202	61.9	0.11	2.7	2.6	0.0070	0.01	0.15	4.2	2.8	0.0055	0.01	0.12	4.2	2.7	0.0065	0.01	0.15	4.2	2.8	V	112
706				sandbag	7056	5202	61.9	0.12	2.7	2.6	0.0073	0.01	0.15	4.1	2.8	0.0055	0.01	0.13	4.3	2.7	0.0067	0.01	0.15	4.1	2.8	V	114

WY-7
Date 4/24/2008
Shot b 5:01 PM overburden

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge weight delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	44°9.629'	105°23.258'			(lbs)	(ft)	(ft/lb$^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
2408	44°9.636'	105°23.329'	single	buried	3504	312	5.3	1.32	5.6	5.9	0.0482	0.27	1.76	6.7	3.6	0.0709	1.06	1.28	4.7	5.4	0.0508	0.27	1.76	6.7	3.6	V	134
3570	44°9.554'	105°23.405'		buried	3504	495	8.4	1.32	4.3	4.8	0.0866	0.21	1.76	4.3	5.0	0.1055	0.21	1.08	11.6	1.2	0.0495	0.21	1.76	4.3	5.0	V	134
1792				buried	3504	820	13.9	0.64	6.8	9.1	0.0229	0.08	0.74	4.1	2.8	0.0348	0.11	0.57	4.4	3.9	0.0361	0.05	0.74	4.1	2.8	V	131
3486	44°9.596'	105°23.463'	cluster 1	spiked	3504	820	13.9	0.67	6.3	9.2	0.0241	0.09	0.74	3.9	2.8	0.0315	0.09	0.57	3.3	3.9	0.0369	0.07	0.74	3.9	2.8	V	132
3048				sandbag	3504	820	13.9	0.70	6.0	9.2	0.0262	0.09	0.73	3.8	2.8	0.0294	0.08	0.57	4.6	3.9	0.0369	0.07	0.73	3.8	2.8	V	133
2241				buried	3504	1489	25.2	0.25	3.6	4.8	0.0142	0.04	0.49	5.3	4.6	0.0339	0.05	0.21	4.9	3.2	0.0103	0.04	0.49	5.3	4.6	V	119
2279	44°9.633'	105°23.613'	cluster 2	spiked	3504	1489	25.2	0.24	3.6	2.6	0.0136	0.04	0.49	5.2	4.6	0.0337	0.05	0.21	4.8	3.2	0.0101	0.04	0.49	5.2	4.6	V	121
3046				sandbag	3504	1489	25.2	0.25	3.6	2.6	0.0132	0.03	0.49	5.2	4.6	0.0344	0.05	0.18	5.0	3.1	0.0109	0.04	0.49	5.2	4.6	V	124
2240				buried	3504	2545	43.0	0.13	6.4	2.8	0.0066	0.02	0.23	2.9	2.6	0.0100	0.02	0.11	3.9	2.6	0.0085	0.01	0.23	2.9	2.6	V	116
1793	44°9.704'	105°23.84'	cluster 3	spiked	3504	2545	43.0	0.11	6.9	6.8	0.0070	0.01	0.22	2.9	2.8	0.0096	0.02	0.12	3.9	2.6	0.0084	0.01	0.22	2.9	2.8	V	116
3487				sandbag	3504	2545	43.0	0.12	6.5	6.8	0.0071	0.02	0.22	2.9	2.8	0.0099	0.01	0.13	3.5	2.6	0.0083	0.01	0.22	2.9	2.8	V	118
785				buried	3504	3768	63.7	0.12	3.6	2.8	0.0058	0.01	0.10	3.7	2.9	0.0064	0.01	0.11	5.1	5.9	0.0067	0.01	0.12	3.6	2.8	R	112
3044	44°9.747'	105°24.114'	cluster 4	spiked	3504	3768	63.7	0.12	3.5	2.8	0.0059	0.01	0.11	2.7	3.6	0.0064	0.01	0.12	5.3	3.6	0.0070	0.01	0.12	3.5	2.8	R	114
3047				sandbag	3504	3768	63.7	0.12	3.5	2.8	0.0060	0.01	0.11	2.7	3.6	0.0064	0.01	0.12	5.2	5.9	0.0071	0.01	0.12	3.5	2.8	R	112
1906				buried	3504	4632	78.3	0.09	4.2	3.3	0.0064	0.01	0.10	2.7	2.6	0.0046	0.01	0.11	3.9	4.3	0.0065	0.01	0.11	3.9	4.3	T	110
704	44°9.896'	105°24.253'	cluster 5	spiked	3504	4632	78.3	0.08	4.0	2.8	0.0059	0.01	0.10	3.5	2.6	0.0047	0.01	0.11	5.3	4.3	0.0068	0.01	0.11	5.3	4.3	T	112
706				sandbag	3504	4632	78.3	0.08	4.1	3.3	0.0062	0.01	0.10	3.5	2.6	0.0048	0.01	0.11	5.2	4.3	0.0071	0.01	0.11	5.2	4.3	T	114

OH-1
Date 7/8/2008
Shot 2:11 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot	40°17.232	83°7.919			(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
3047				buried	1280	400	11.2	1.24	18.2	26.0	0.0320	0.58	0.78	18.9	23.0	0.0138	0.27	2.08	19.0	9.0	0.0541	0.50	2.08	19.0	9.0	T	129
3044	40°17.318	83°7.895	cluster 1	spiked	1280	400	11.2	1.36	24.3	26.0	0.0359	0.69	0.81	18.2	23.0	0.0144	0.37	2.16	14.6	9.0	0.0515	0.64	2.16	14.6	9.0	T	128
3487				sandbag	1280	400	11.2	1.40	12.1	26.0	0.0408	0.48	1.16	18.2	23.0	0.0194	0.58	2.12	14.6	14.8	0.0523	0.60	2.12	14.6	14.8	T	128
1792				buried	1280	800	22.4	0.92	8.5	8.8	0.0205	0.29	0.52	23.2	28.1	0.0088	0.24	0.92	11.9	11.8	0.0294	0.27	0.92	8.5	8.8	R	128
2241				loose on surface	1280	800	22.4	1.26	10.4	8.8	0.0290	0.36	0.86	30.1	28.1	0.0092	0.38	0.96	11.3	11.8	0.0324	0.36	1.26	10.4	8.8	R	125
3048	40°17.372	83°7.864	cluster 2	sandbag	1280	800	22.4	0.98	9.8	8.8	0.0251	0.32	0.60	23.2	28.0	0.0091	0.24	1.06	13.1	11.8	0.0338	0.33	1.06	13.1	11.8	T	123
3046				spiked with sandbag	1280	800	22.4	0.90	8.6	8.8	0.0218	0.27	0.46	24.3	28.1	0.0068	0.24	1.00	12.4	11.8	0.0321	0.33	1.00	12.4	11.8	T	124
2279				spiked	1280	800	22.4	0.94	12.1	8.8	0.0204	0.36	0.47	26.9	28.1	0.0069	0.27	1.02	12.4	8.8	0.0317	0.34	1.02	12.4	8.8	T	125
930				spiked round sensor	1280	800	22.4	0.86	11.9	8.8	0.0186	0.44	0.47	25.6	28.1	0.0072	0.29	1.02	12.4	8.9	0.0312	0.34	1.02	12.4	8.9	T	125
3486				buried	1280	1200	33.5	0.44	17.0	14.4	0.0116	0.23	0.18	26.9	28.5	0.0033	0.11	0.68	11.9	8.9	0.0205	0.21	0.68	11.9	8.9	T	121
1100	40°17.436	83°7.863	cluster 3	sandbag	1280	1200	33.5	0.50	15.0	14.4	0.0120	0.19	0.34	13.1	8.9	0.0071	0.12	0.70	11.9	14.4	0.0217	0.19	0.70	11.9	14.4	T	118
001				spiked	1280	1200	33.5	0.35	15.0	14.4	0.0092	0.13	0.26	21.3	9.0	0.0054	0.13	0.62	11.9	8.9	0.0190	0.20	0.62	11.9	8.9	T	122
704				spiked	1280	1500	41.9	0.27	11.3	9.1	0.0059	0.13	0.14	15.0	8.8	0.0030	0.05	0.53	9.8	8.8	0.0139	0.12	0.53	9.8	8.8	T	120
4040	40°17.484	83°7.859	cluster 4	buried	1280	1500	41.9	0.27	11.3	9.1	0.0074	0.07	0.17	13.8	8.8	0.0039	0.06	0.47	10.0	8.8	0.0128	0.08	0.47	10.0	8.8	T	121
706				sandbag	1280	1500	41.9	0.30	13.1	9.1	0.0065	0.11	0.13	22.2	15.6	0.0260	0.05	0.57	9.4	8.8	0.0151	0.12	0.57	9.4	8.8	T	120

MI-1
Date 5/27/2008
Shot a 1:00 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	42°9.854'	83°10.861'			(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	82	387	42.7	0.10	46.5	35.0	0.0009	0.15	0.20	36.5	34.6	0.0019	0.17	0.07	32.0	34.8	0.0011	0.07	0.20	36.5	34.6	V	114
3044				spiked	82	387	42.7	0.10	102.4	69.5	0.0010	0.17	0.22	46.5	34.8	0.0019	0.23	0.09	51.2	34.9	0.0011	0.13	0.22	46.5	34.8	V	112
3048	42°9.81'	83°10.778'	cluster	sandbag	82	387	42.7	0.08	128.0	3.9	0.0009	0.13	0.20	42.6	34.8	0.0017	0.20	0.07	42.6	3.8	0.0011	0.08	0.20	42.6	34.8	V	112
3046				spiked with sandbag	82	387	42.7	0.11	128.0	53.3	0.0011	0.19	0.17	26.9	53.3	0.0017	0.15	0.09	128.0	34.9	0.0012	0.17	0.17	26.9	53.3	V	112
2241				loose on surface	82	387	42.7	0.13	46.5	35.0	0.0010	0.21	0.37	85.3	34.8	0.0021	0.48	0.19	128.0	68.4	0.0012	0.25	0.37	85.3	34.8	V	110
3487	42°9.934'	83°11.075'			82	1079	119.2	0.05	12.8	13.5	0.0007	0.04	0.08	25.6	16.8	0.0008	0.07	0.05	20.4	17.1	0.0008	0.04	0.08	25.6	16.8	V	122
2240	42°9.945'	83°11.225'			82	1730	191.1	nt																			
3047	42°9.953'	83°11.366'			82	2353	259.8	0.04	42.6	33.1	0.0003	0.05	0.03	73.1	34.4	0.0002	0.03	0.06	56.8	67.8	0.0004	0.06	0.06	56.8	67.8	T	106
1793	42°9.956'	83°11.48'	single	buried	82	2856	315.4	nt																			
706	42°9.956'	83°11.62'			82	3474	383.6	nt																			
1906	42°9.883'	83°11.492'			82	2847	314.4	0.01	56.8	20.5	0.0002	0.01	0.04	36.5	34.0	0.0003	0.23	0.03	30.1	34.0	0.0003	0.02	0.04	36.5	34.0	V	100
704	42°10.032'	83°11.468'			82	2940	324.7	0.01	51.2	17.0	0.0002	0.01	0.02	46.5	34.0	0.0002	0.01	0.02	24.3	13.0	0.0003	0.01	0.02	24.3	13.0	T	100

MI-2
Date 5/27/2008
Shot b 1:05 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	42°9.911	83°10.825			(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	82	540	59.6	0.07	46.5	46.8	0.0007	0.05	0.11	51.2	40.1	0.0013	0.09	0.08	51.2	57.8	0.0009	0.07	0.11	51.2	40.1	V	117
3044				spiked	82	540	59.6	0.07	51.2	58.1	0.0008	0.08	0.11	51.2	40.0	0.0012	0.12	0.08	51.2	46.6	0.0009	0.08	0.11	51.2	40.0	V	117
3048	42°9.81	83°10.778	cluster	sandbag	82	540	59.6	0.08	46.5	3.6	0.0007	0.05	0.11	51.2	40.1	0.0013	0.09	0.09	64.0	3.8	0.0009	0.08	0.11	51.2	40.1	V	114
3046				spiked with sandbag	82	540	59.6	0.08	51.2	58.1	0.0008	0.07	0.12	51.2	40.0	0.0013	0.12	0.10	51.2	61.0	0.0010	0.09	0.12	51.2	40.0	V	116
2241				loose on surface	82	540	59.6	0.10	64.0	58.0	0.0009	0.11	0.16	56.8	40.0	0.0014	0.15	0.14	56.8	61.1	0.0011	0.13	0.16	56.8	40.0	V	116
3487	42°9.934	83°11.075			82	1135	125.3	0.07	26.9	13.5	0.0009	0.05	0.14	24.3	34.1	0.0020	0.08	0.11	36.5	34.4	0.0011	0.07	0.14	24.3	34.1	V	119
2240	42°9.945	83°11.225			82	1813	200.2	0.04	26.9	34.6	0.0005	0.02	0.04	42.6	34.5	0.0006	0.02	0.05	36.5	34.4	0.0006	0.03	0.05	36.5	34.4	T	112
3047	42°9.953	83°11.366			82	2450	270.5	0.08	64.0	55.3	0.0005	0.08	0.04	56.8	34.3	0.0002	0.05	0.09	39.3	34.5	0.0006	0.10	0.09	39.3	34.5	T	110
1793	42°9.956	83°11.48	single	buried	82	2963	327.2	0.04	26.9	34.3	0.0006	0.02	0.03	51.2	34.9	0.0003	0.03	0.04	17.6	13.8	0.0008	0.03	0.04	26.9	34.3	R	100
706	42°9.956	83°11.62			82	3591	396.5	0.03	30.1	27.0	0.0004	0.02	0.04	39.3	34.4	0.0004	0.03	0.06	26.9	34.5	0.0008	0.03	0.06	26.9	34.5	T	106
1906	42°9.883	83°11.492			82	3009	332.3	0.02	26.9	25.5	0.0003	0.01	0.05	36.5	32.4	0.0005	0.03	0.03	24.3	32.1	0.0006	0.02	0.05	36.5	32.4	V	106
704	42°10.032	83°11.468			82	2988	329.9	0.02	56.8	13.8	0.0002	0.02	0.03	56.8	34.8	0.0002	0.02	0.05	36.5	34.5	0.0005	0.03	0.05	36.5	34.5	T	106

MI-3

Date 5/29/2008

Shot a 1:00 PM

	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot a	42°9.854	83°10.86			(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	82	346	38.2	0.10	34.1	9.3	0.0013	0.11	0.23	36.5	36.1	0.0019	0.13	0.08	20.4	35.8	0.0346	0.08	0.23	36.5	36.1	V	116
3044				spiked	82	346	38.2	0.09	128.0	9.3	0.0014	0.15	0.23	36.5	36.1	0.0019	0.17	0.10	42.6	35.5	0.0017	0.11	0.23	36.5	36.1	V	114
3048	42°9.81	83°10.778	cluster	sandbag	82	346	38.2	0.08	46.5	4.4	0.0015	0.08	0.21	30.1	36.0	0.0021	0.17	0.12	22.2	35.6	0.0020	0.09	0.21	30.1	36.0	V	114
3046				spiked with sandbag	82	346	38.2	0.09	56.8	9.3	0.0014	0.13	0.19	36.5	36.0	0.0023	0.15	0.11	21.3	35.5	0.0018	0.12	0.19	36.5	36.0	V	114
2241				loose on surface	82	346	38.2	0.16	56.8	35.8	0.0021	0.21	0.28	46.5	36.0	0.0029	0.30	0.16	56.8	35.6	0.0018	0.17	0.28	46.5	36.0	V	112
3487	42°9.873	83°10.846			82	125	13.8	1.26	56.8	35.1	0.0072	1.93	1.30	256.0	36.0	0.0042	2.54	1.04	73.1	2.8	0.0162	1.30	1.30	256.0	36.0	V	133
2240	42°9.879	83°10.86			82	152	16.8	2.12	46.5	38.6	0.0125	3.13	1.22	102.4	29.9	0.0062	2.01	2.72	56.8	38.9	0.0189	2.94	2.72	56.8	38.9	T	135
3047	42°9.894	83°10.907			82	322	35.6	0.50	128.0	61.9	0.0016	0.93	0.56	28.4	34.4	0.0055	0.49	0.33	170.6	62.4	0.0012	0.68	0.56	28.4	34.4	V	127
1793	42°9.899	83°10.935	single	buried	82	435	48.0	0.19	85.3	43.3	0.0010	0.21	0.54	39.3	38.4	0.0046	0.49	0.21	51.2	62.1	0.0011	0.23	0.54	39.3	38.4	V	124
706	42°9.907	83°11.031			82	835	92.2	0.18	46.5	50.6	0.0017	0.13	0.14	39.3	29.9	0.0011	0.12	0.27	36.5	34.6	0.0023	0.15	0.27	36.5	34.6	T	125
1906	42°9.948	83°11.289			82	2015	222.5	0.02	16.5	12.0	0.0004	0.01	0.01	19.6	13.3	0.0003	0.01	0.01	10.8	4.4	0.0005	0.00	0.02	16.5	12.0	R	100
704	42°9.958	83°11.487			82	2894	319.6	0.02	36.5	34.9	0.0003	0.02	0.02	46.5	30.1	0.0002	0.02	0.02	42.6	13.8	0.0003	0.02	0.02	42.6	13.8	T	100

MI-4

Date 5/29/2008

Shot b 1:05 PM

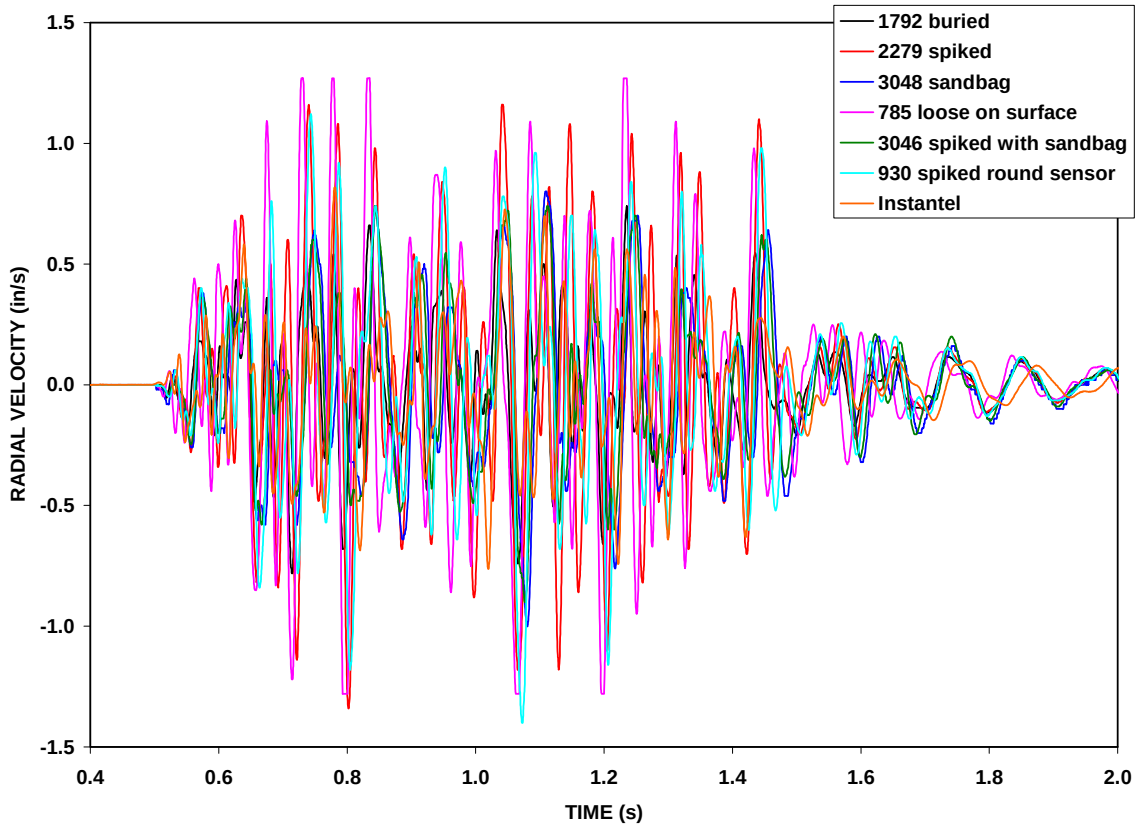
	GPS							Radial					Vertical					Transverse					Peaks				
Shot or S/N	N	W	Location	Coupling	Maximum charge-weight/delay	Distance from Blast	Scaled Distance	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Displacement	Acceleration	Peak Velocity	Peak Frequency	FFT	Component	Air-blast
Shot b	42°9.887	83°10.829			(lbs/delay)	(ft)	($ft/lb^{1/2}$)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)	(in)	(g)	(in/s)	(Hz)	(Hz)		(Db)
1792				buried	82	521	57.5	0.06	73.1	9.3	0.0007	0.05	0.13	51.2	34.3	0.0011	0.08	0.06	56.8	34.3	0.0006	0.07	0.13	51.2	34.3	V	114
3044				spiked	82	521	57.5	0.06	64.0	9.3	0.0007	0.05	0.13	51.2	39.1	0.0012	0.12	0.06	51.2	76.4	0.0005	0.05	0.13	51.2	39.1	V	114
3048	42°9.81	83°10.778	cluster	sandbag	82	521	57.5	0.06	34.1	9.8	0.0008	0.04	0.13	46.5	35.0	0.0012	0.12	0.06	56.8	35.0	0.0007	0.07	0.13	46.5	35.0	V	114
3046				spiked with sandbag	82	521	57.5	0.09	64.0	64.6	0.0009	0.08	0.12	46.5	39.1	0.0012	0.12	0.08	73.1	64.4	0.0006	0.08	0.12	46.5	39.1	V	112
2241				loose on surface	82	521	57.5	0.09	34.1	9.3	0.0008	0.13	0.19	51.2	39.3	0.0016	0.20	0.11	56.8	64.3	0.0007	0.15	0.19	51.2	39.3	V	112
3487	9.873	10.846			82	100	11.0	3.20	73.1	75.9	0.0136	5.04	1.66	170.6	34.1	0.0072	3.55	1.56	6.4	1.8	0.0490	1.96	3.20	73.1	75.9	R	142
2240	9.879	10.860			82	148	16.3	1.02	102.4	76.3	0.0032	1.78	0.36	30.1	25.8	0.0032	0.50	0.90	73.1	34.0	0.0041	1.25	1.02	102.4	76.3	R	142
3047	9.894	10.907			82	354	39.1	0.15	128.0	63.9	0.0009	0.33	0.27	39.3	32.4	0.0024	0.38	0.24	170.6	63.3	0.0008	0.44	0.27	39.3	32.4	V	129
1793	9.899	10.935	single	buried	82	483	53.3	0.14	102.4	61.5	0.0009	0.23	0.37	42.6	41.0	0.0028	0.40	0.23	128.0	62.6	0.0008	0.29	0.37	42.6	41.0	V	126
706	9.907	11.031			82	918	101.4	0.16	51.2	62.0	0.0010	0.13	0.07	73.1	37.8	0.0003	0.08	0.16	51.2	34.0	0.0014	0.10	0.16	51.2	34.0	T	122
1906	9.948	11.289			82	2105	232.4	0.02	73.1	4.4	0.0003	0.02	0.02	73.1	13.3	0.0002	0.02	0.03	36.5	4.4	0.0004	0.03	0.03	36.5	4.4	T	110
704	9.958	11.487			82	2995	330.7	0.01	39.3	29.5	0.0002	0.01	0.01	64.0	29.6	0.0001	0.01	0.03	13.4	13.0	0.0004	0.02	0.03	13.4	13.0	T	100

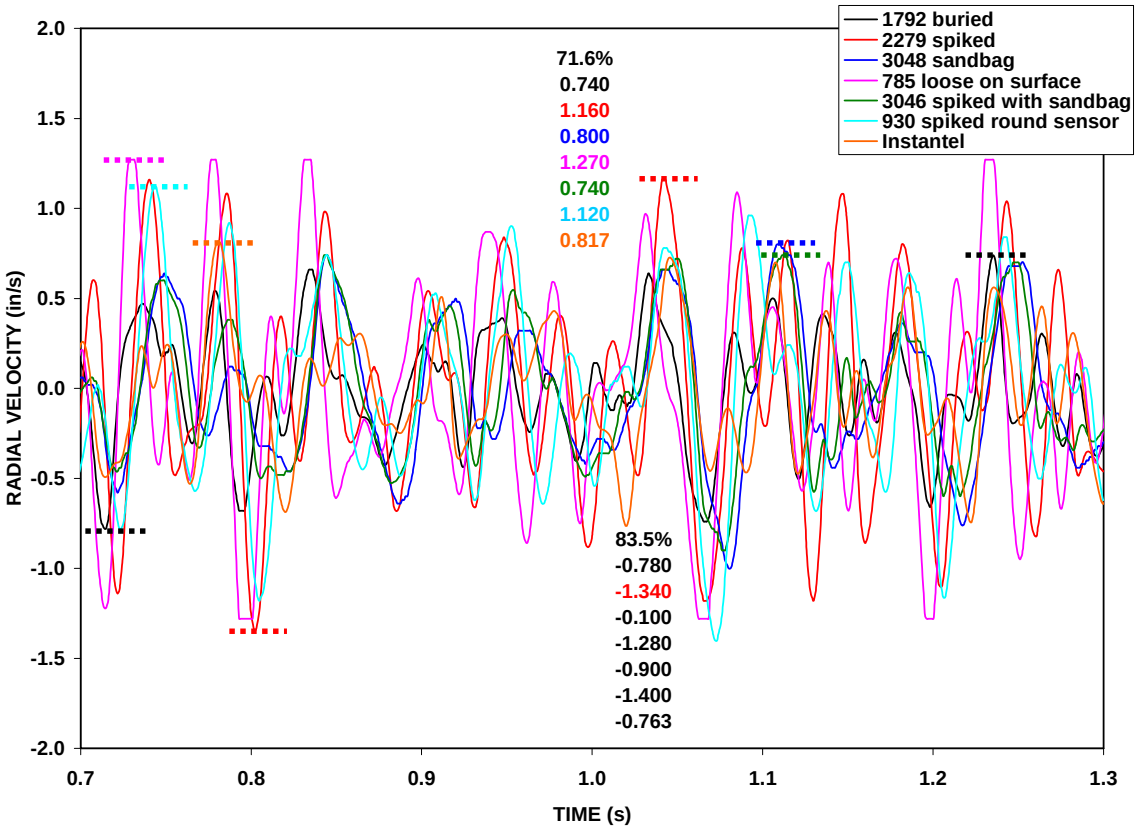
Appendix B

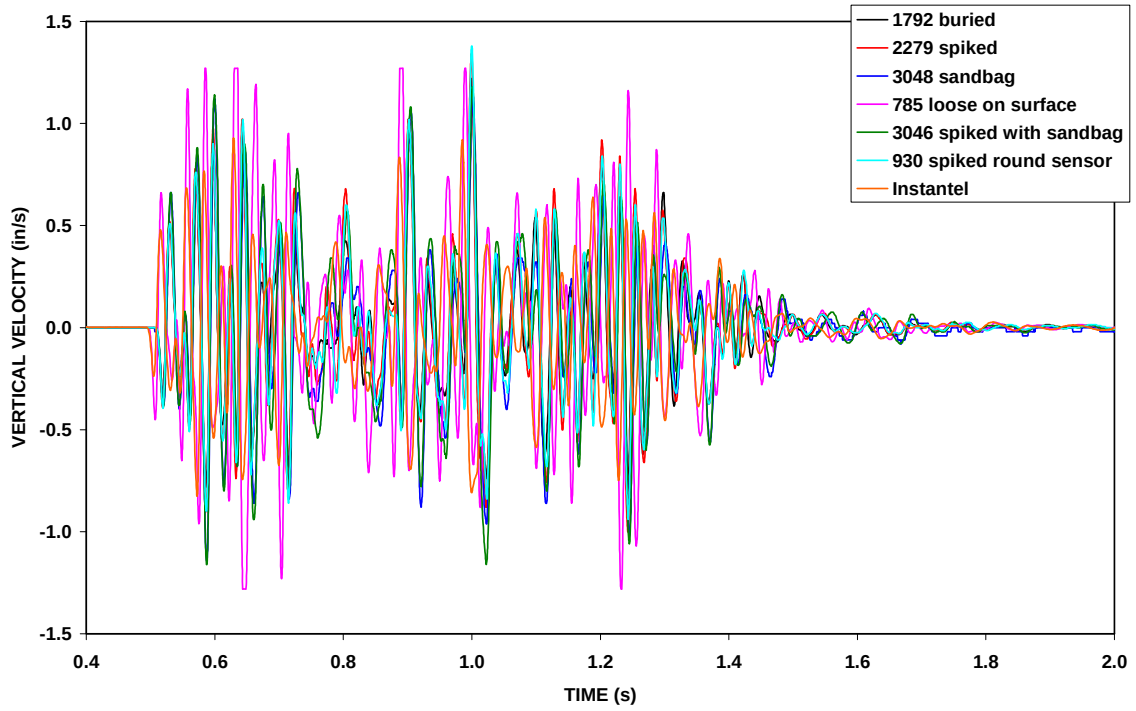
Time History Comparisons

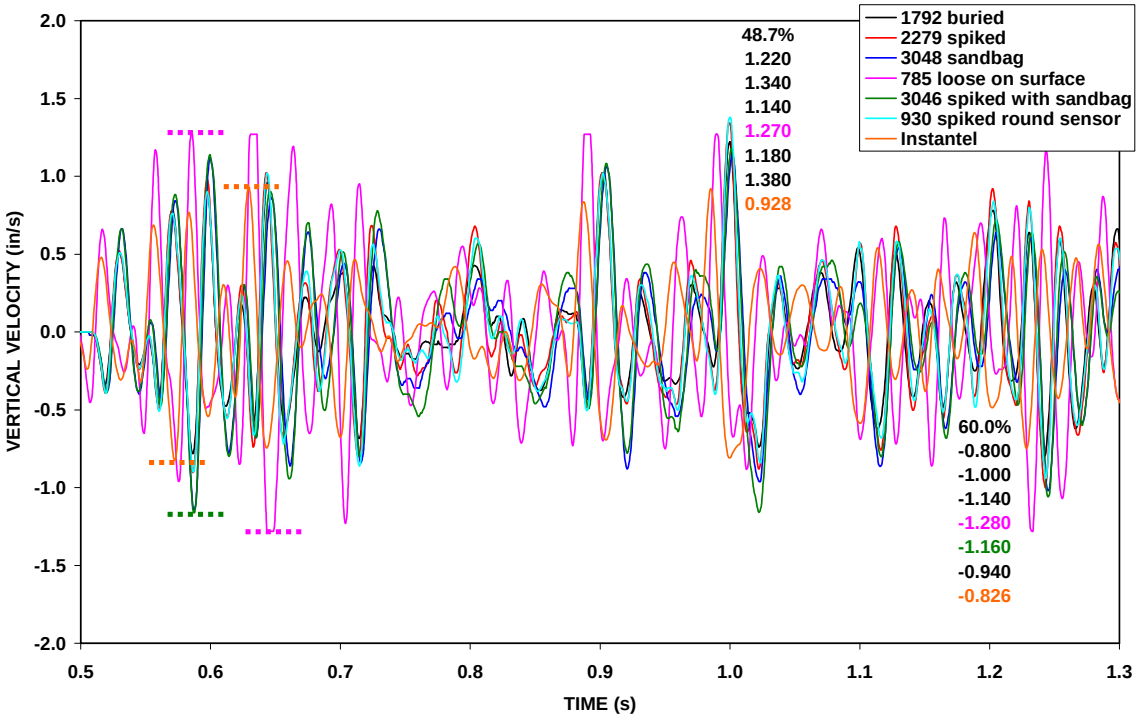
IL-1

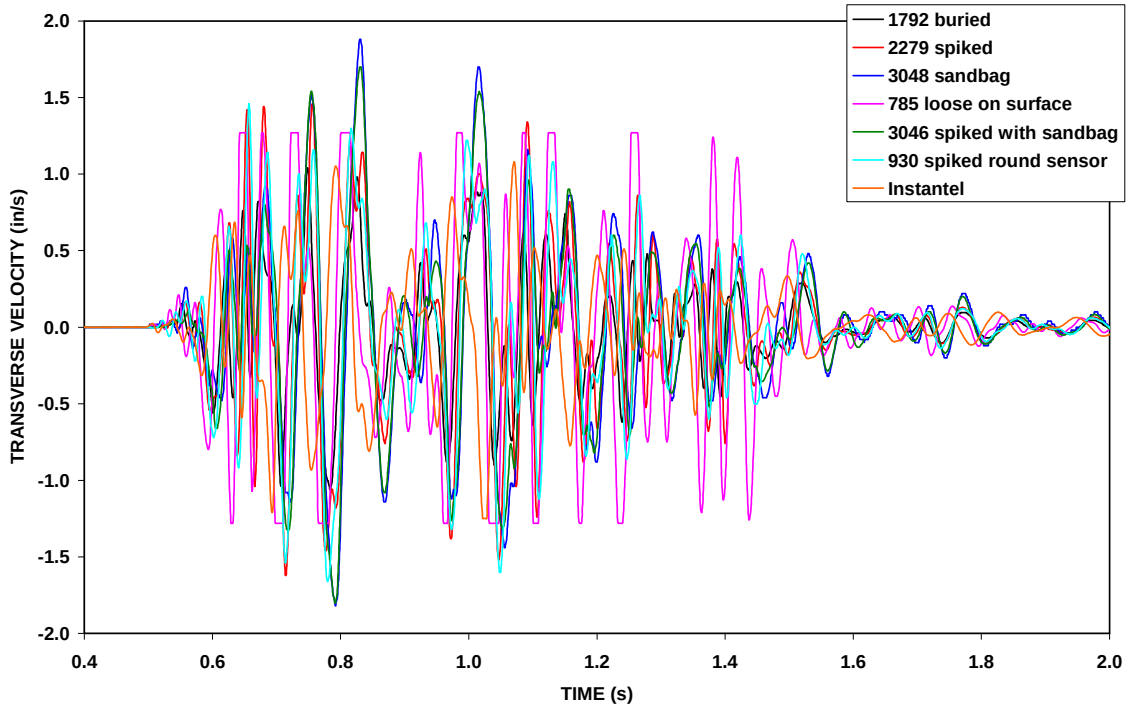
Single cluster SD 19.4 ft/lb$^{1/2}$

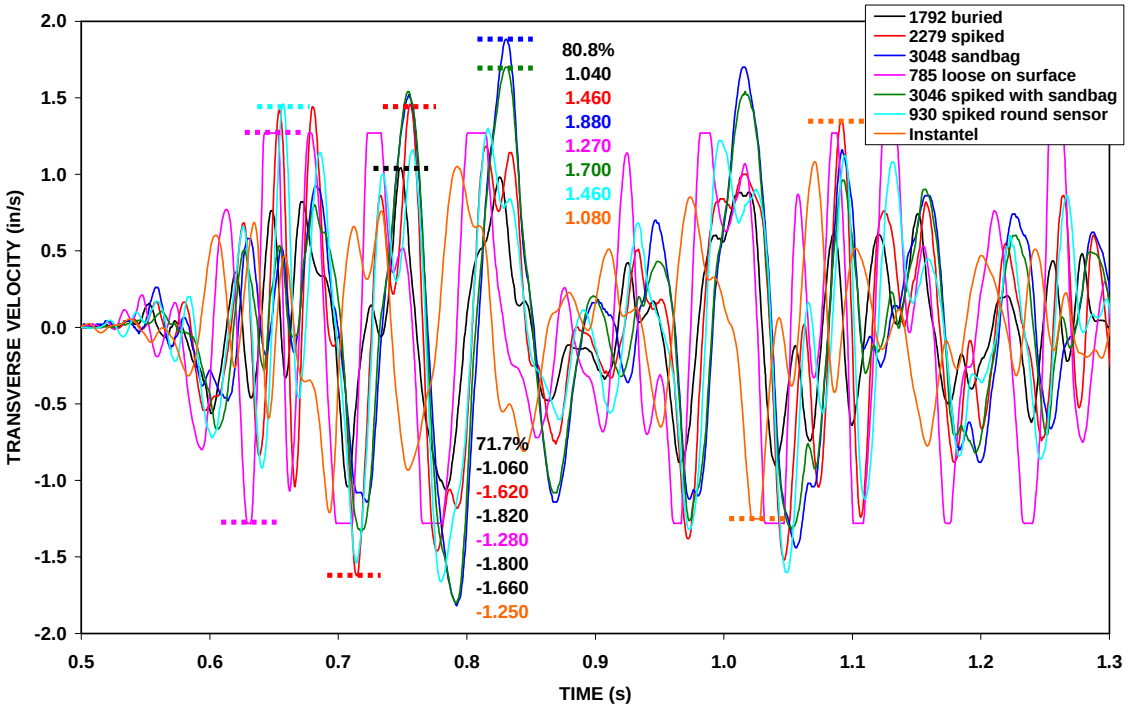

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

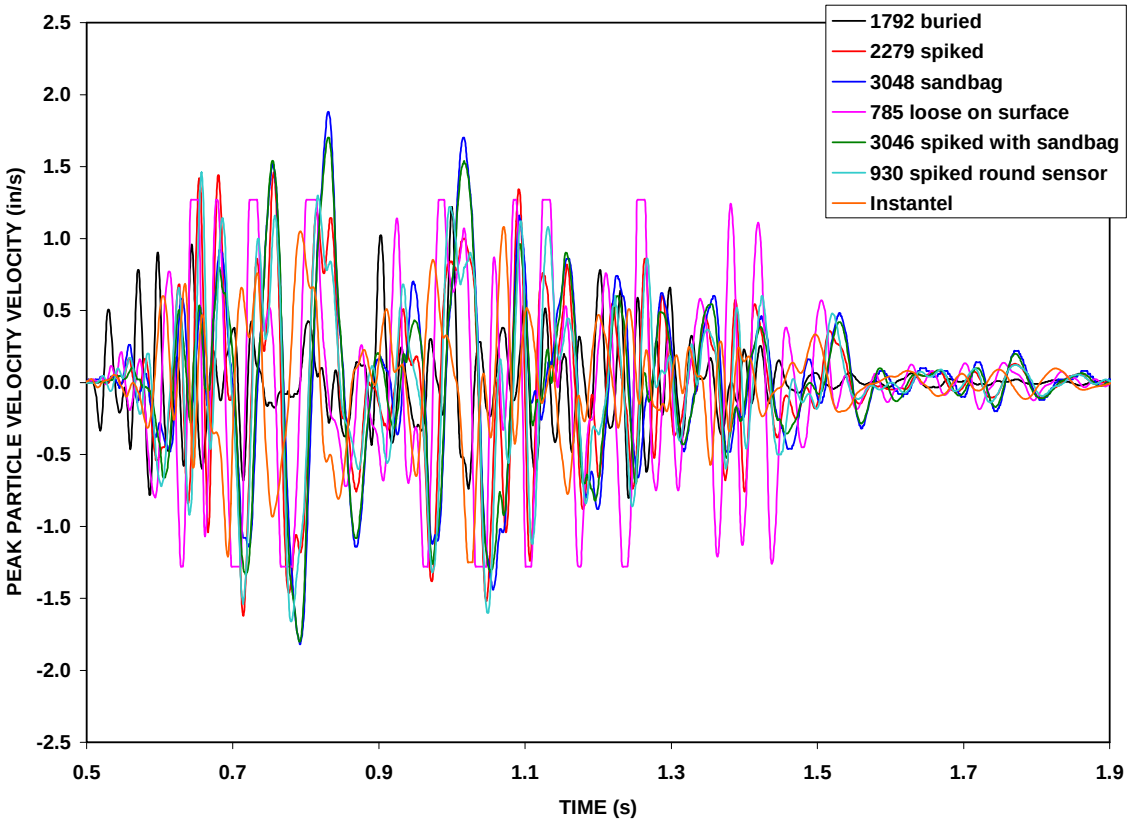

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
71.6%
0.740
1.160
0.800
1.270
0.740
1.120
0.817
83.5%
-0.780
-1.340
-0.100
-1.280
-0.900
-1.400
-0.763
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.7
0.8
0.9
1.0
1.1
1.2
1.3

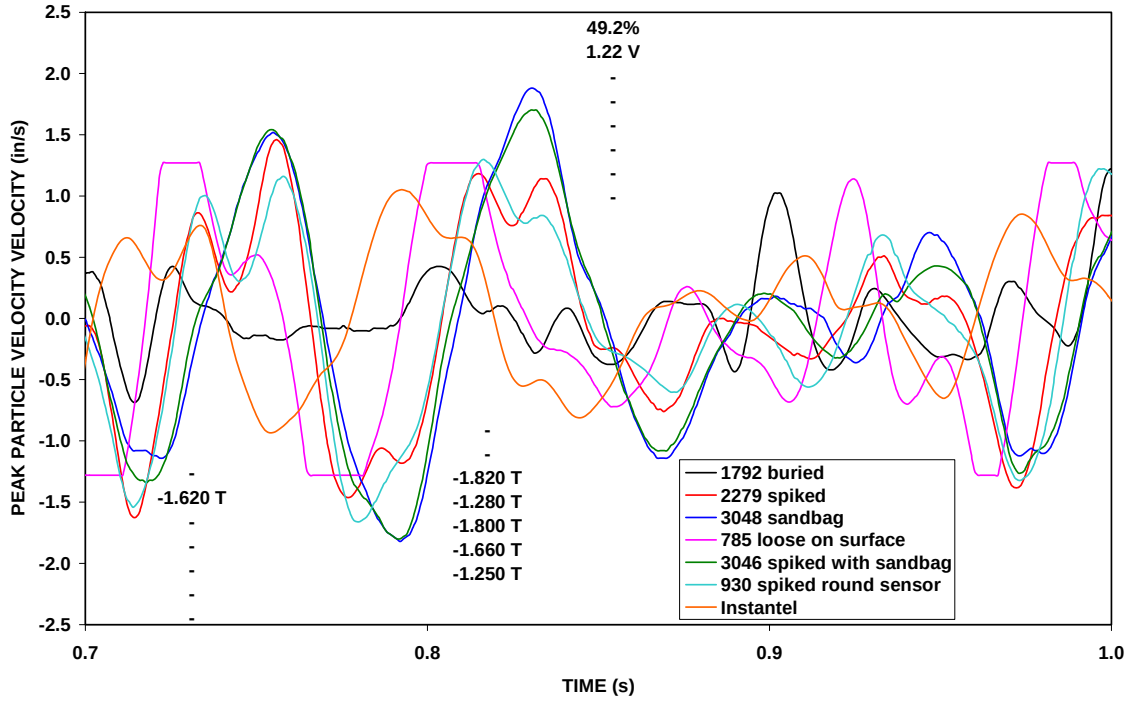

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0


1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
48.7%
1.220
1.340
1.140
1.270
1.180
1.380
0.928
60.0%
-0.800
-1.000
-1.140
-1.280
-1.160
-0.940
-0.826
VERTICAL VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3


1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
TRANSVERSE VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

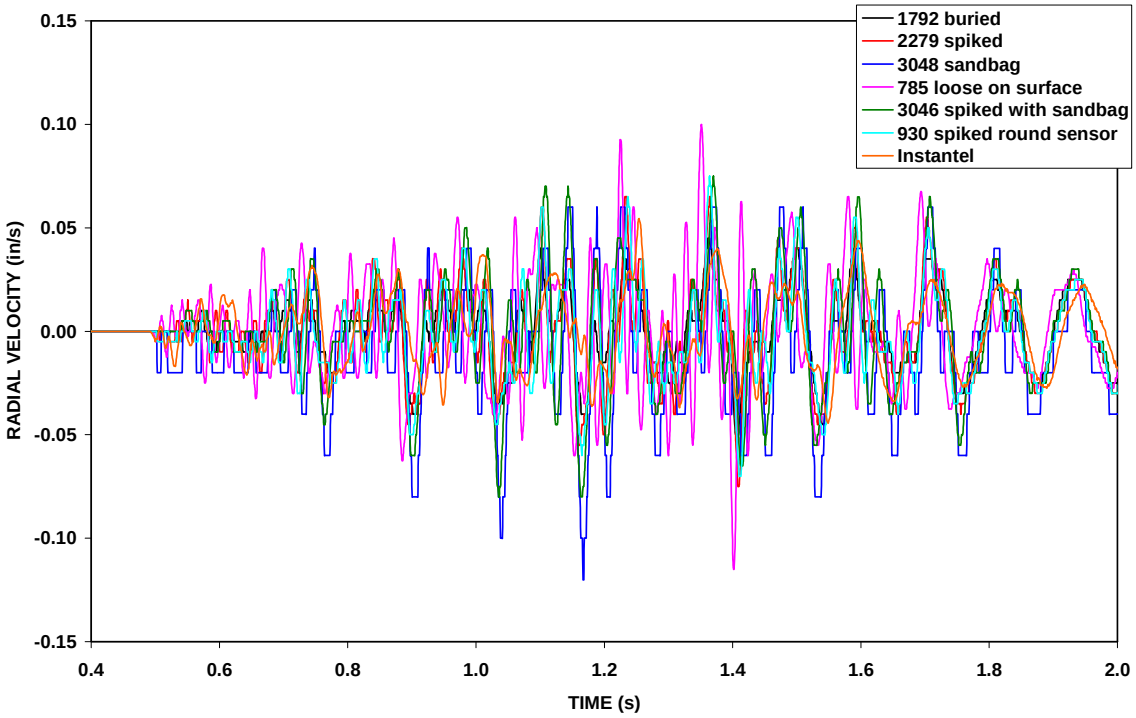

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
80.8%
1.040
1.460
1.880
1.270
1.700
1.460
1.080
71.7%
-1.060
-1.620
-1.820
-1.280
-1.800
-1.660
-1.250
TRANSVERSE VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3

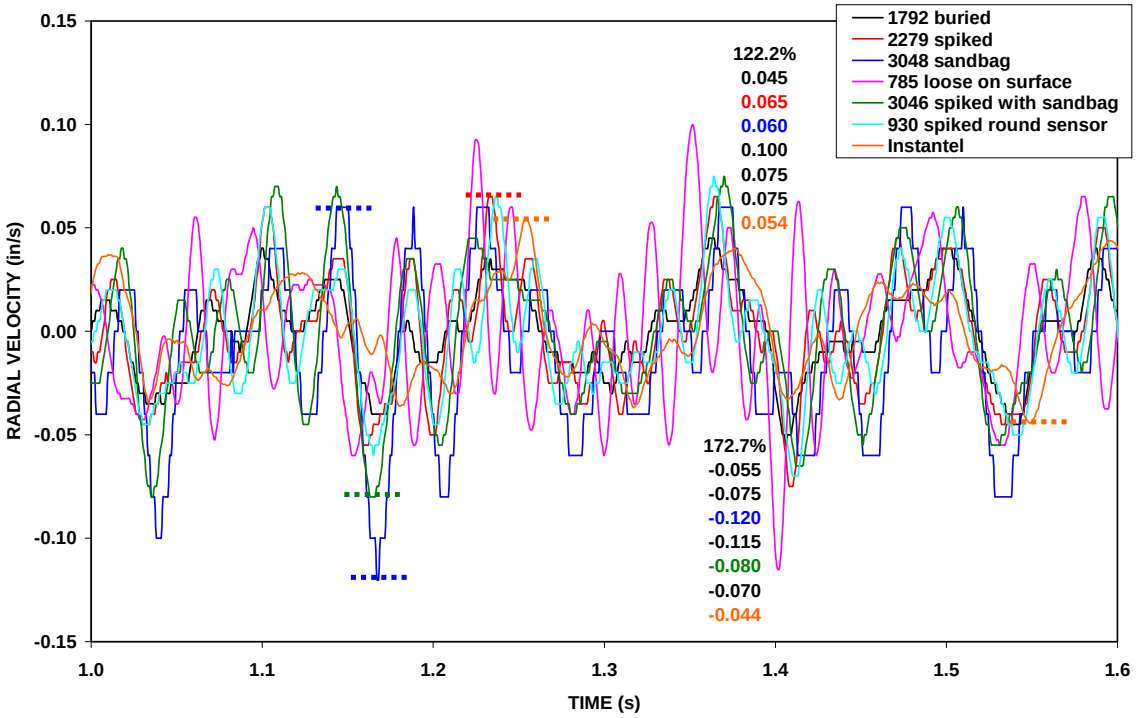

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
PEAK PARTICLE VELOCITY VELOCITY (in/s)
TIME (s)
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
0.5
0.7
0.9
1.1
1.3
1.5
1.7
1.9

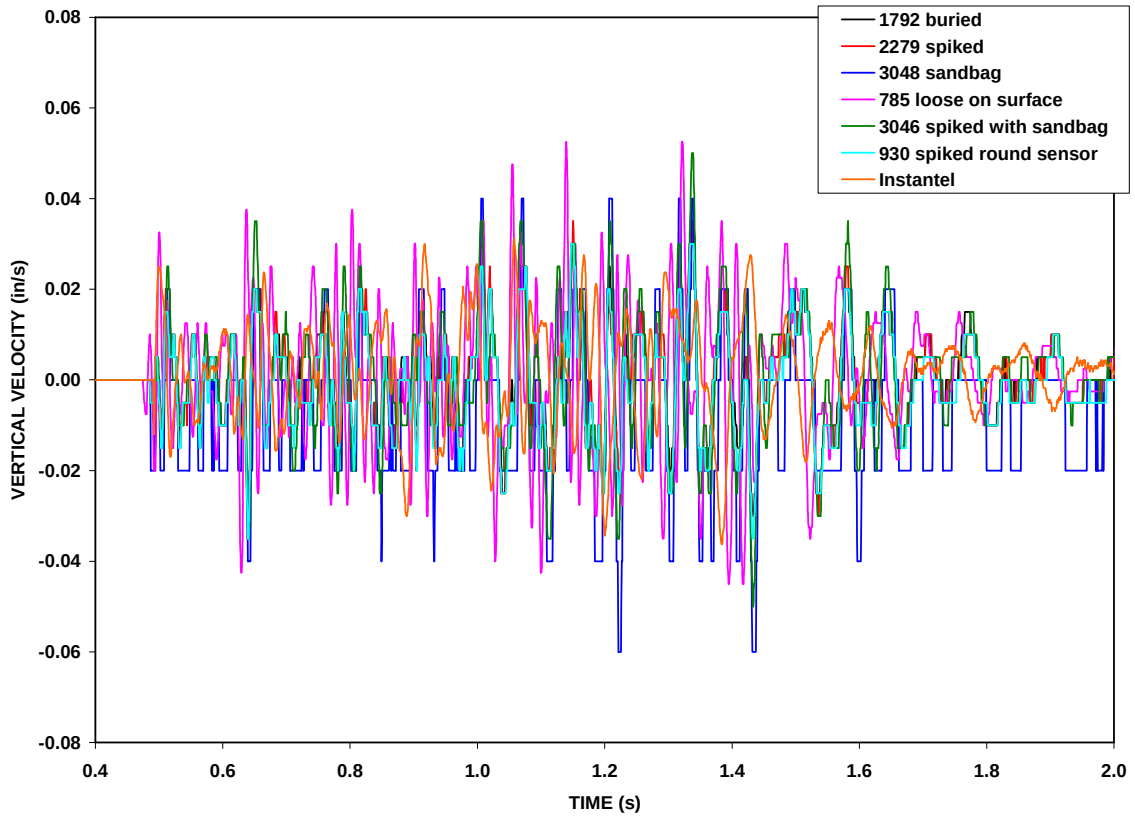

49.2%
1.22 V
-1.620 T
-1.820 T
-1.280 T
-1.800 T
-1.660 T
-1.250 T
1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
PEAK PARTICLE VELOCITY VELOCITY (in/s)
TIME (s)
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
0.7
0.8
0.9
1.0

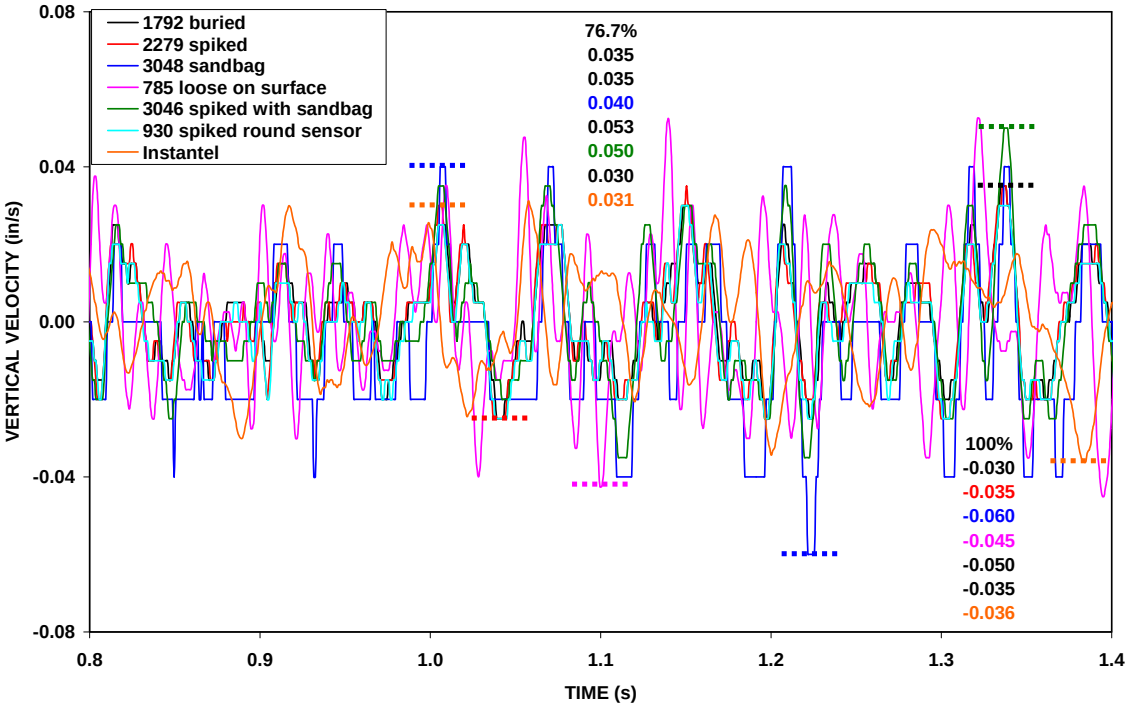
IL-2

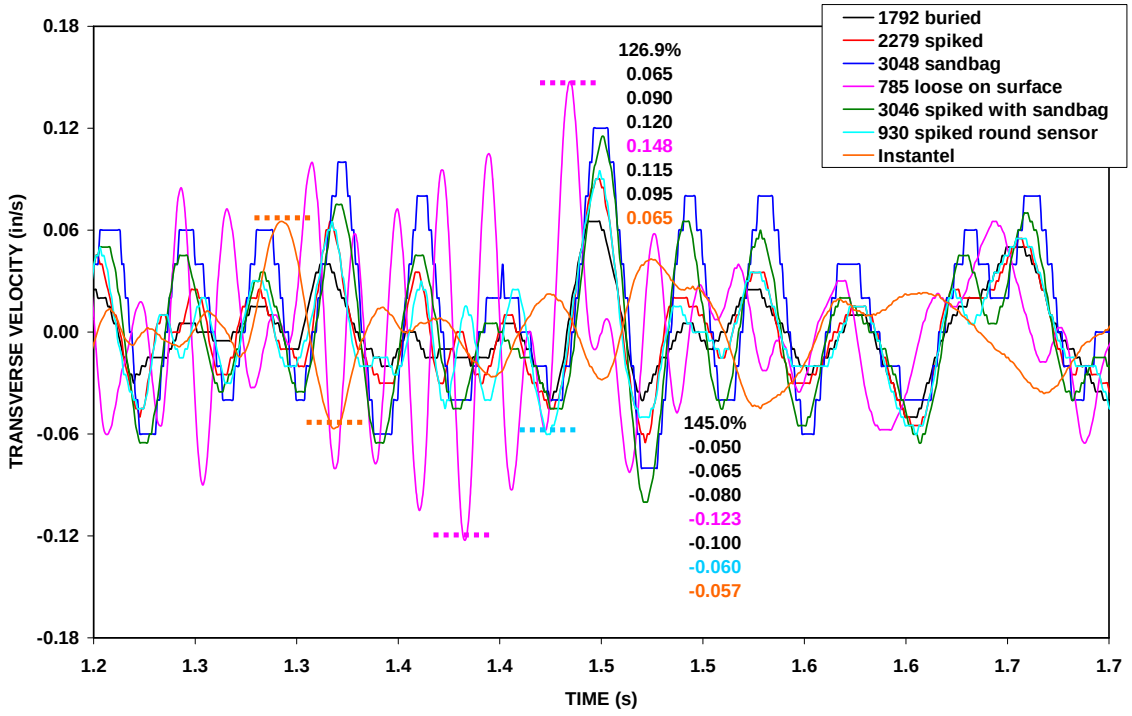
Single cluster SD 116.2 ft/lb$^{1/2}$

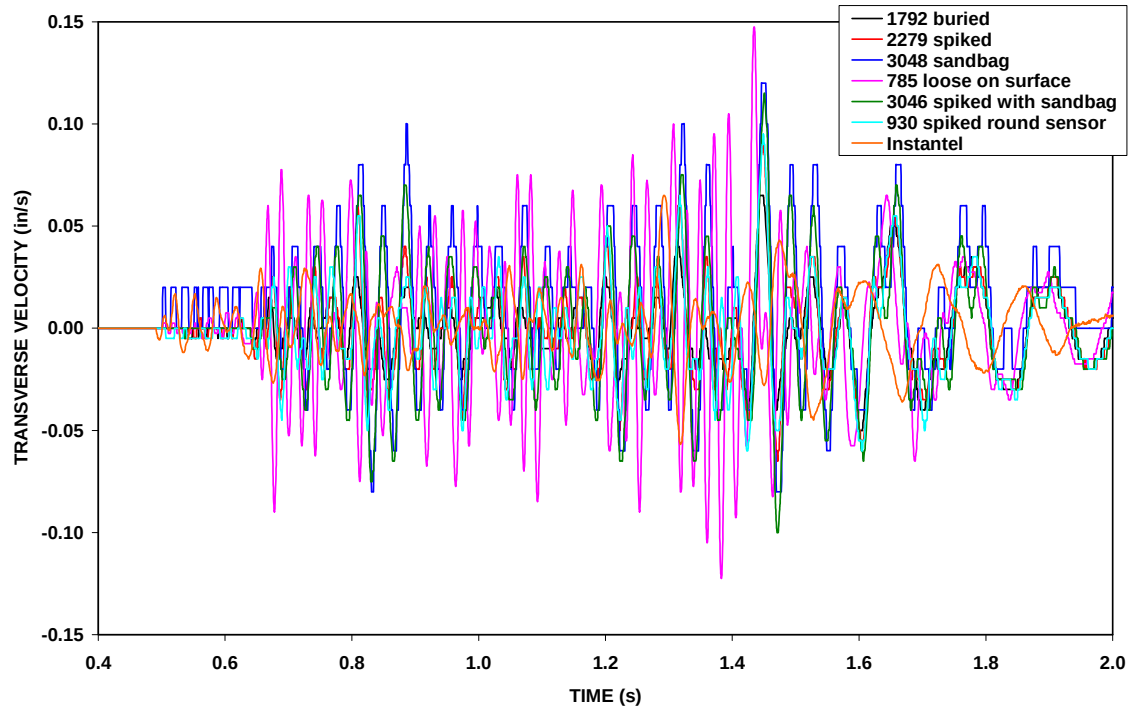

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

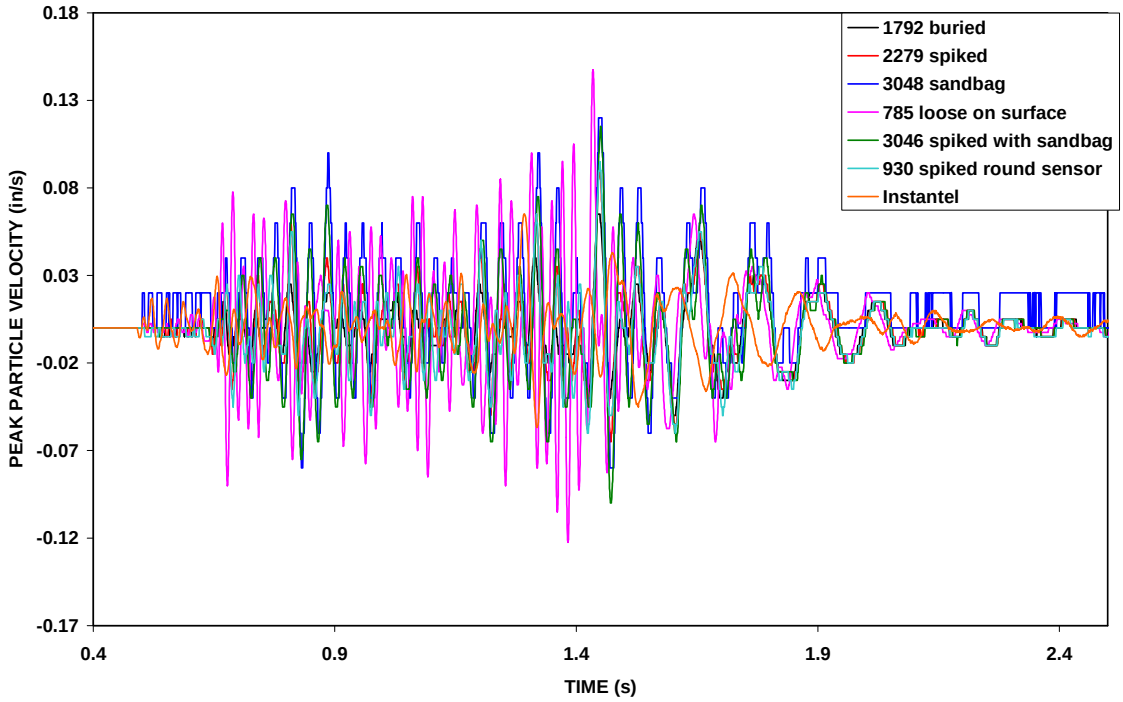

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
122.2%
0.045
0.065
0.060
0.100
0.075
0.075
0.054
172.7%
-0.055
-0.075
-0.120
-0.115
-0.080
-0.070
-0.044
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1.0
1.1
1.2
1.3
1.4
1.5
1.6

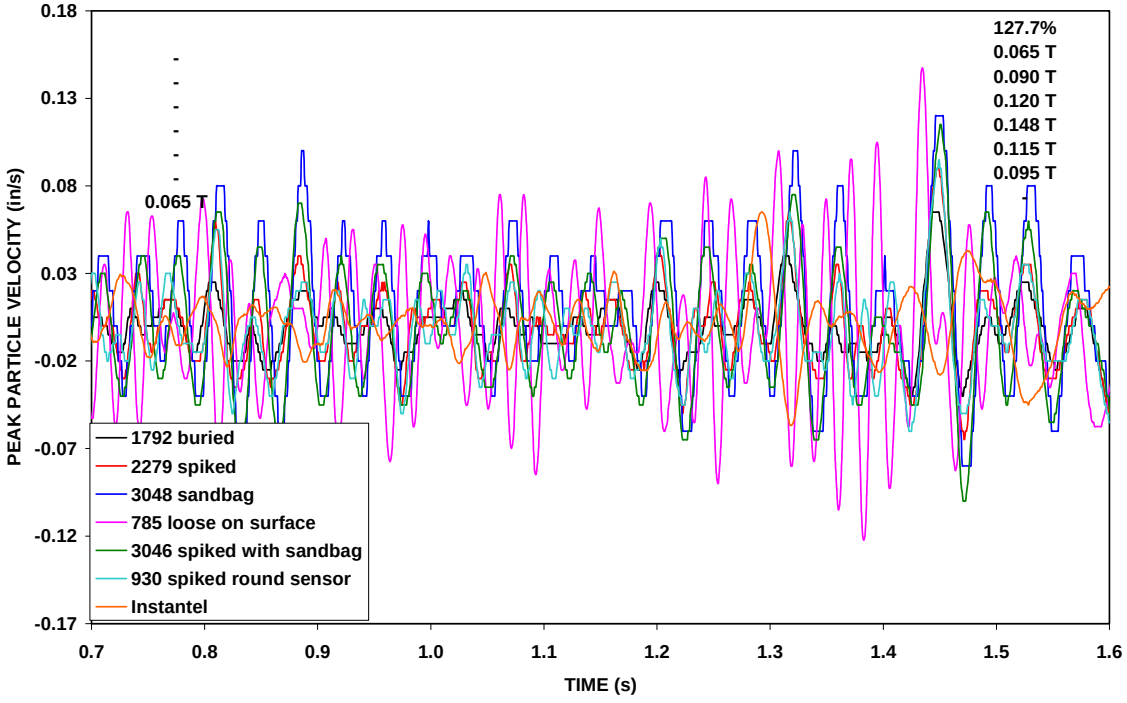

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
VERTICAL VELOCITY (in/s)
TIME (s)
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0


1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
76.7%
0.035
0.035
0.040
0.053
0.050
0.030
0.031
100%
-0.030
-0.035
-0.060
-0.045
-0.050
-0.035
-0.036
VERTICAL VELOCITY (in/s)
TIME (s)
0.08
0.04
0.00
-0.04
-0.08
0.8
0.9
1.0
1.1
1.2
1.3
1.4


1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
126.9%
0.065
0.090
0.120
0.148
0.115
0.095
0.065
145.0%
-0.050
-0.065
-0.080
-0.123
-0.100
-0.060
-0.057
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.18
0.12
0.06
0.00
-0.06
-0.12
-0.18
1.2
1.3
1.3
1.4
1.4
1.5
1.5
1.6
1.6
1.7
1.7

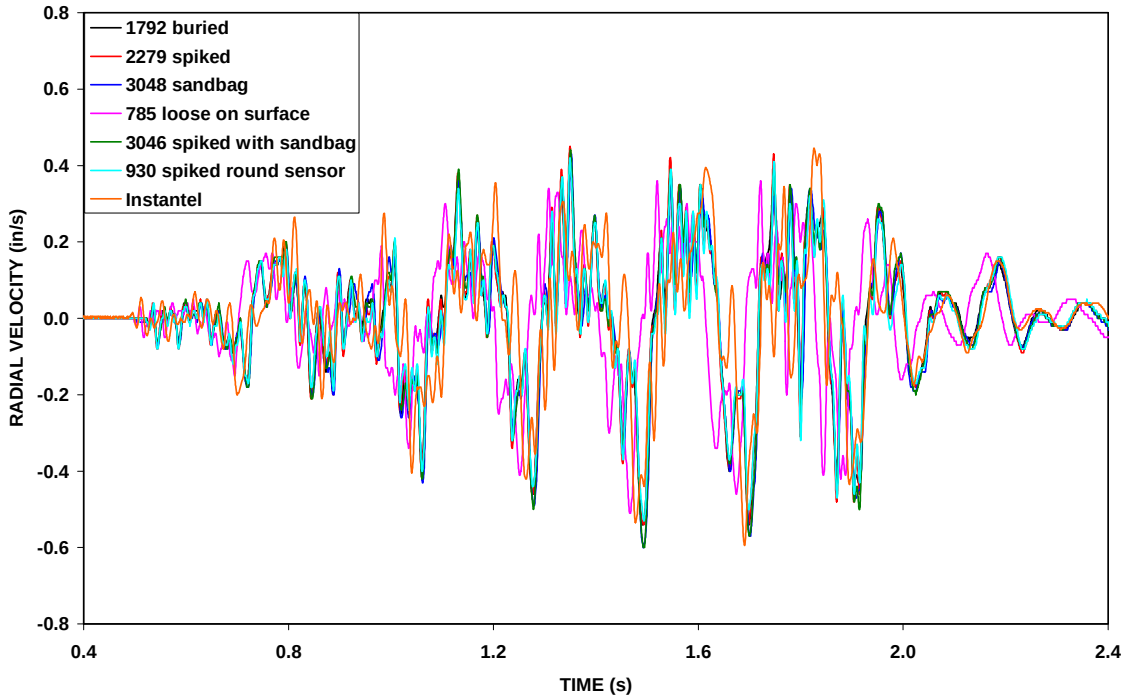

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

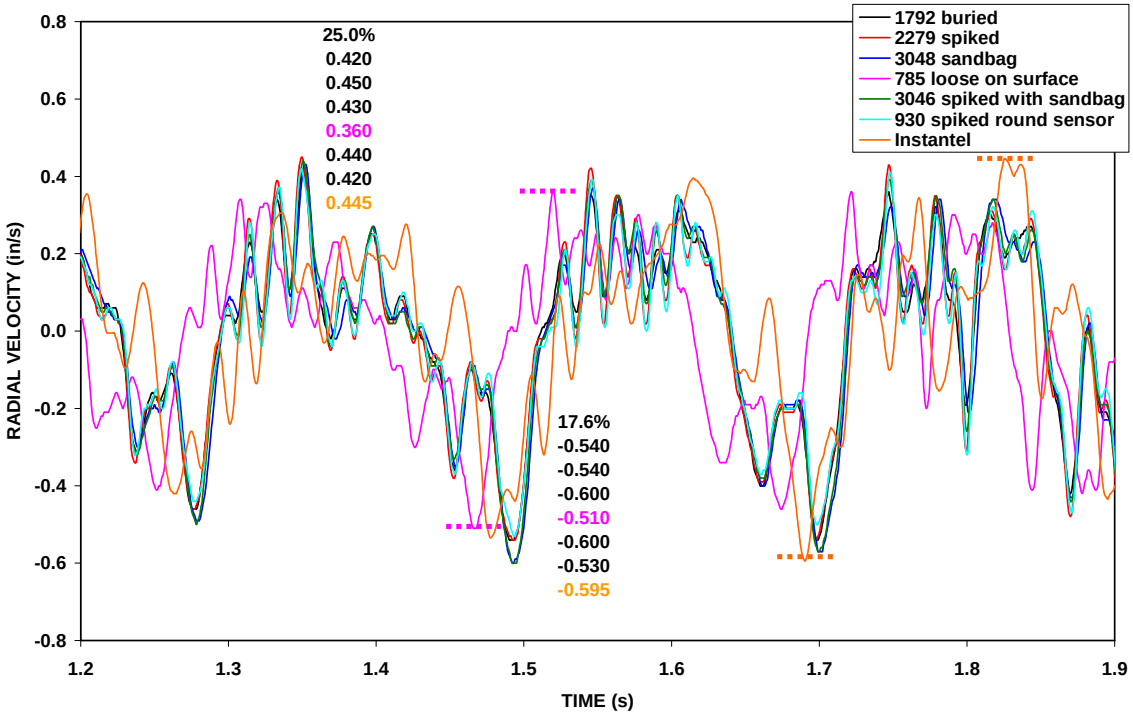

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
PEAK PARTICLE VELOCITY (in/s)
0.18
0.13
0.08
0.03
-0.02
-0.07
-0.12
-0.17
0.4
0.9
1.4
1.9
2.4
TIME (s)

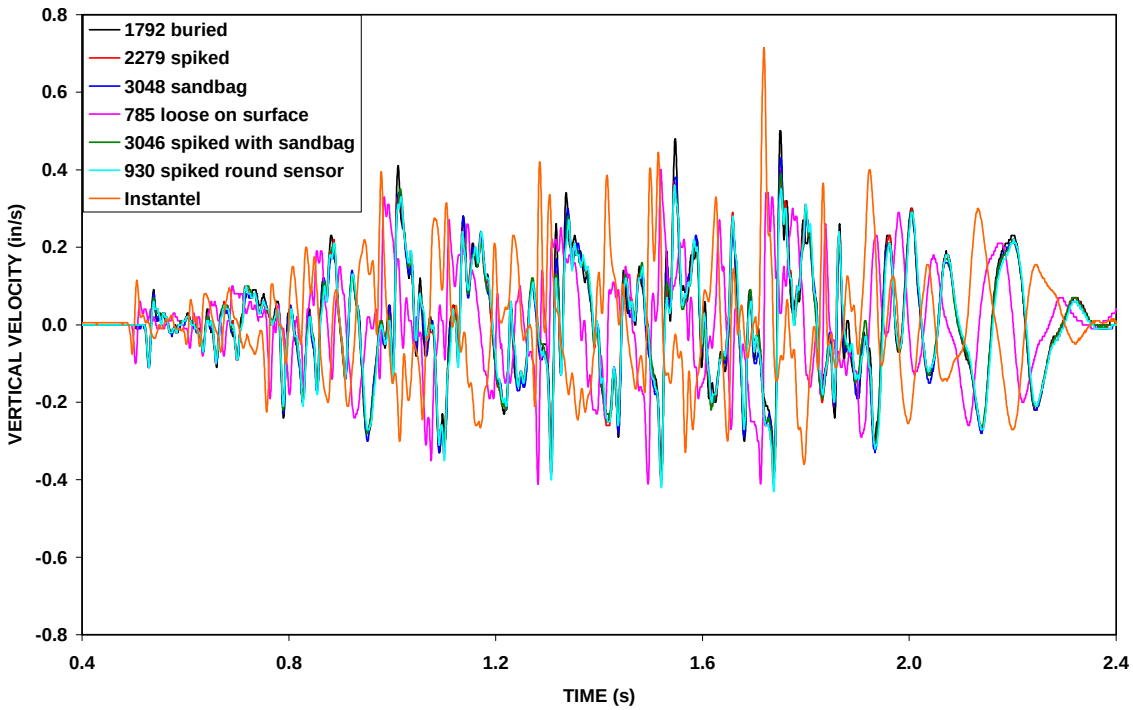

127.7%
0.065 T
0.090 T
0.120 T
0.148 T
0.115 T
0.095 T
0.065 T
1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
PEAK PARTICLE VELOCITY (in/s)
0.18
0.13
0.08
0.03
-0.02
-0.07
-0.12
-0.17
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
TIME (s)

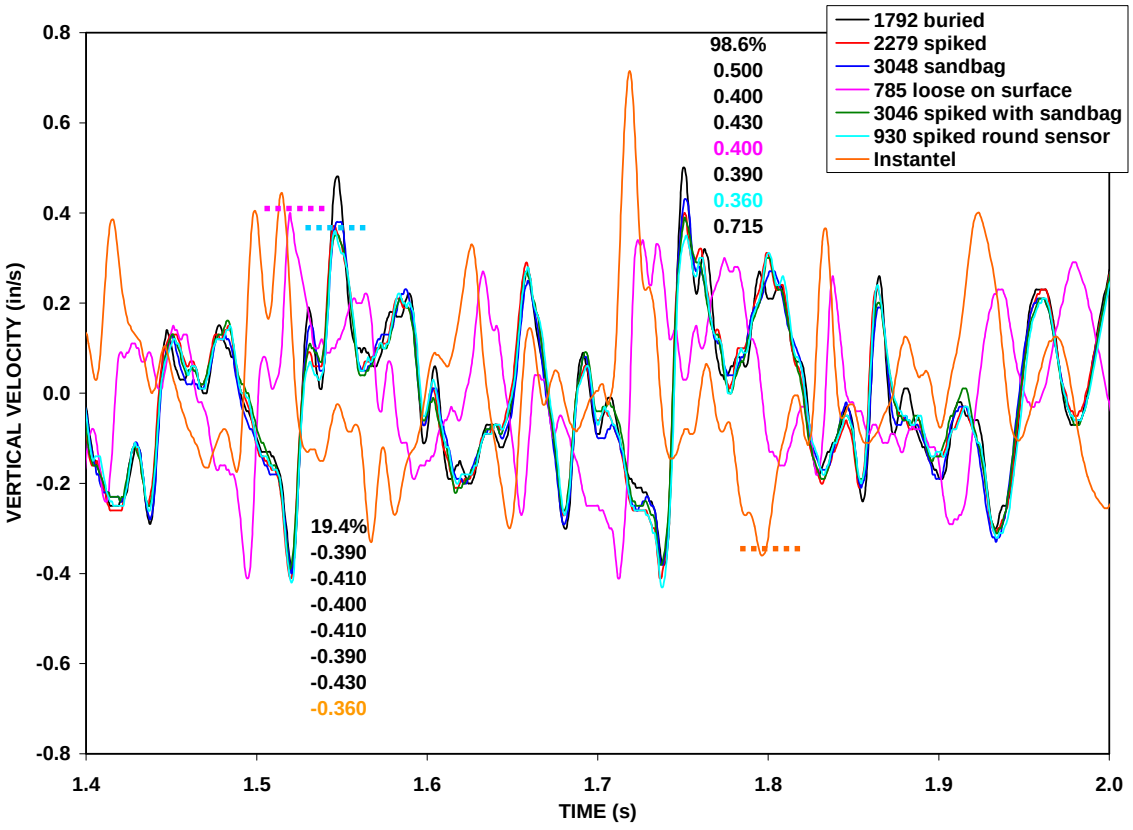
IN-1

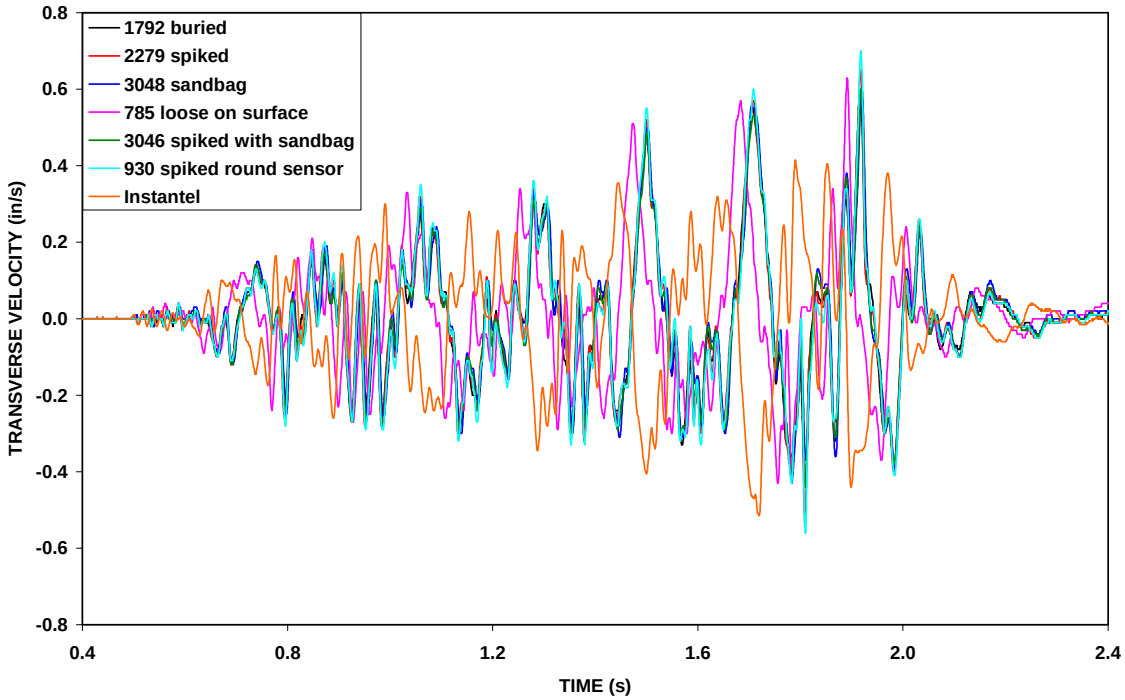
Single cluster SD 23.6 ft/lb$^{1/2}$

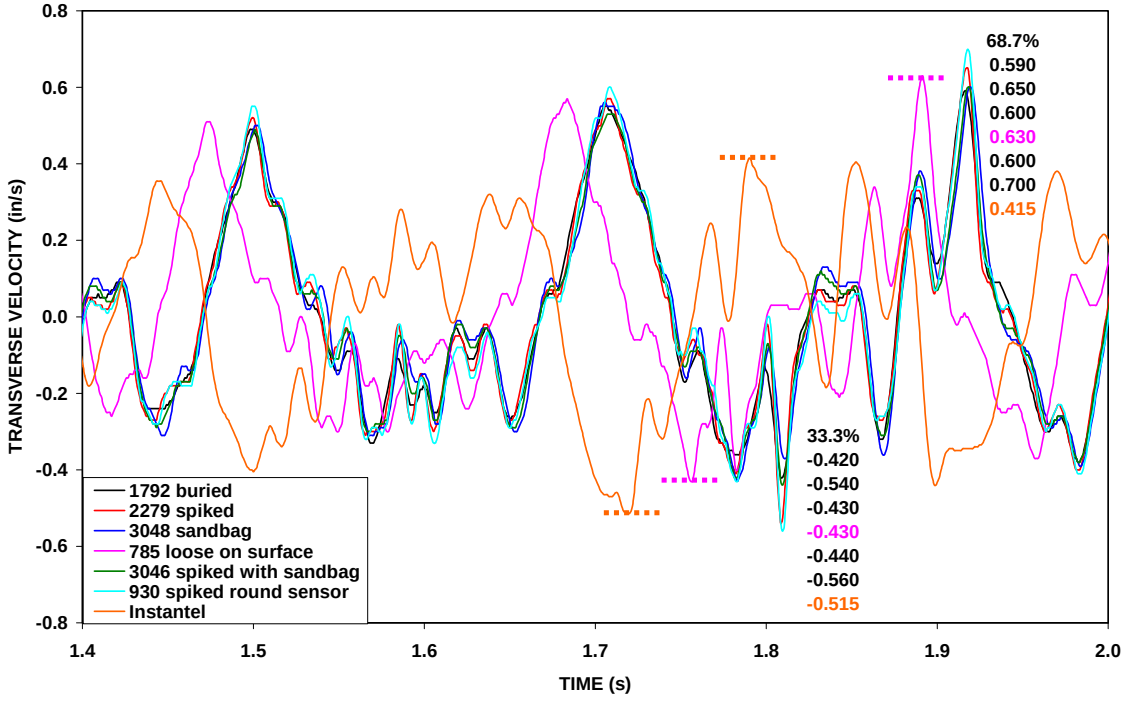

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
RADIAL VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.4
0.8
1.2
1.6
2.0
2.4

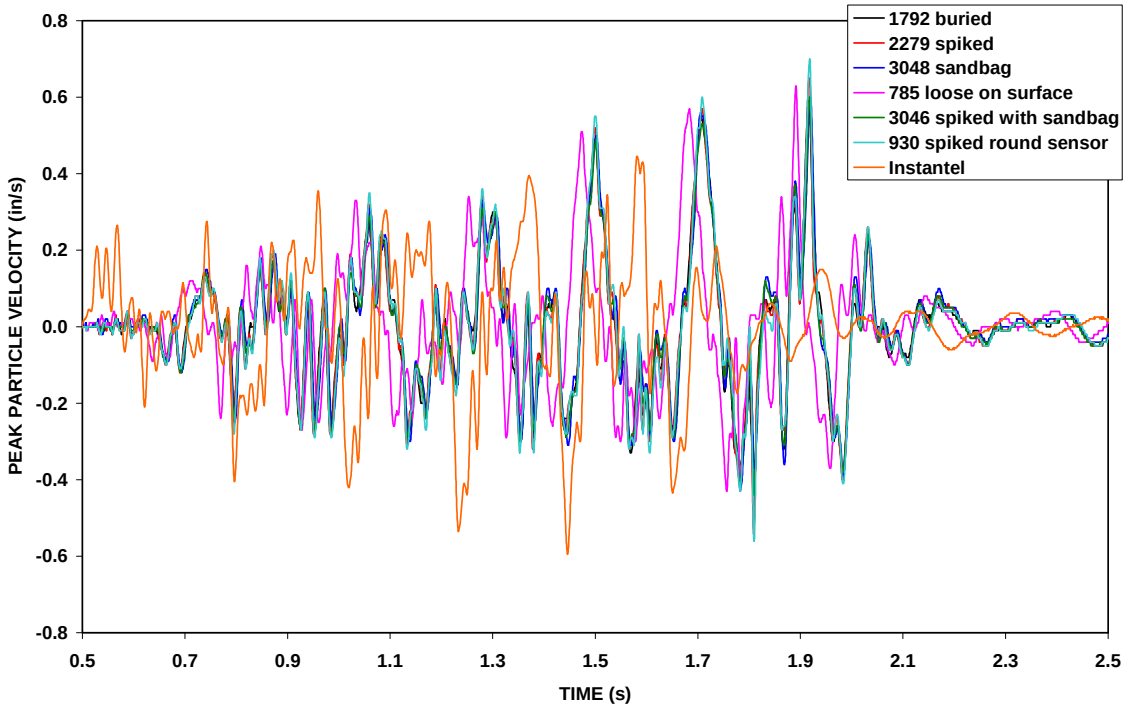

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
25.0%
0.420
0.450
0.430
0.360
0.440
0.420
0.445
17.6%
-0.540
-0.540
-0.600
-0.510
-0.600
-0.530
-0.595
RADIAL VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9

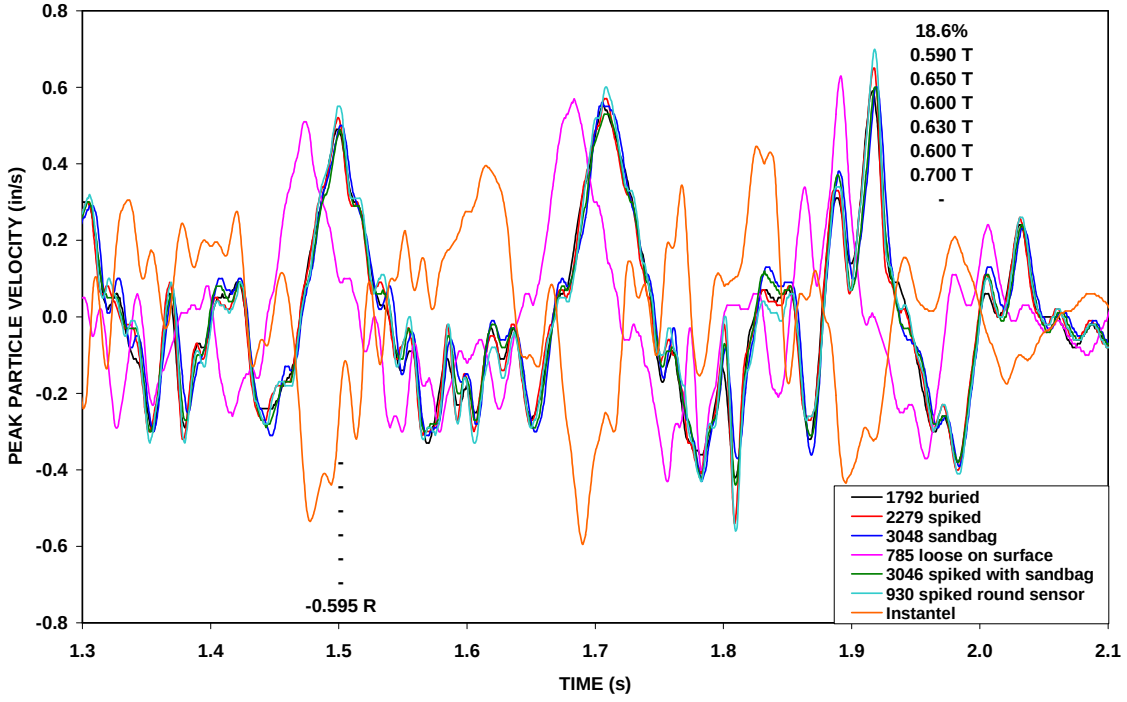

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
VERTICAL VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.4
0.8
1.2
1.6
2.0
2.4


1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
98.6%
0.500
0.400
0.430
0.400
0.390
0.360
0.715
19.4%
-0.390
-0.410
-0.400
-0.410
-0.390
-0.430
-0.360
VERTICAL VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
1.4
1.5
1.6
1.7
1.8
1.9
2.0


1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.4
0.8
1.2
1.6
2.0
2.4

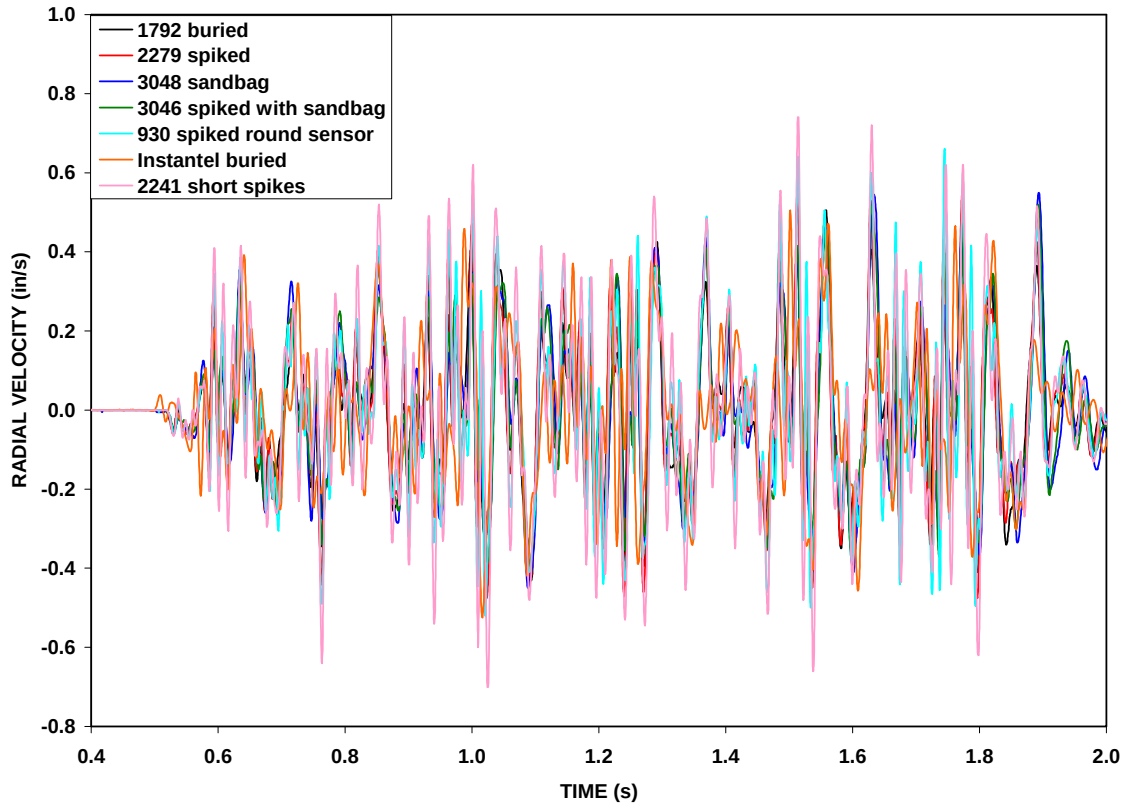

68.7%
0.590
0.650
0.600
0.630
0.600
0.700
0.415
33.3%
-0.420
-0.540
-0.430
-0.430
-0.440
-0.560
-0.515
1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
1.4
1.5
1.6
1.7
1.8
1.9
2.0

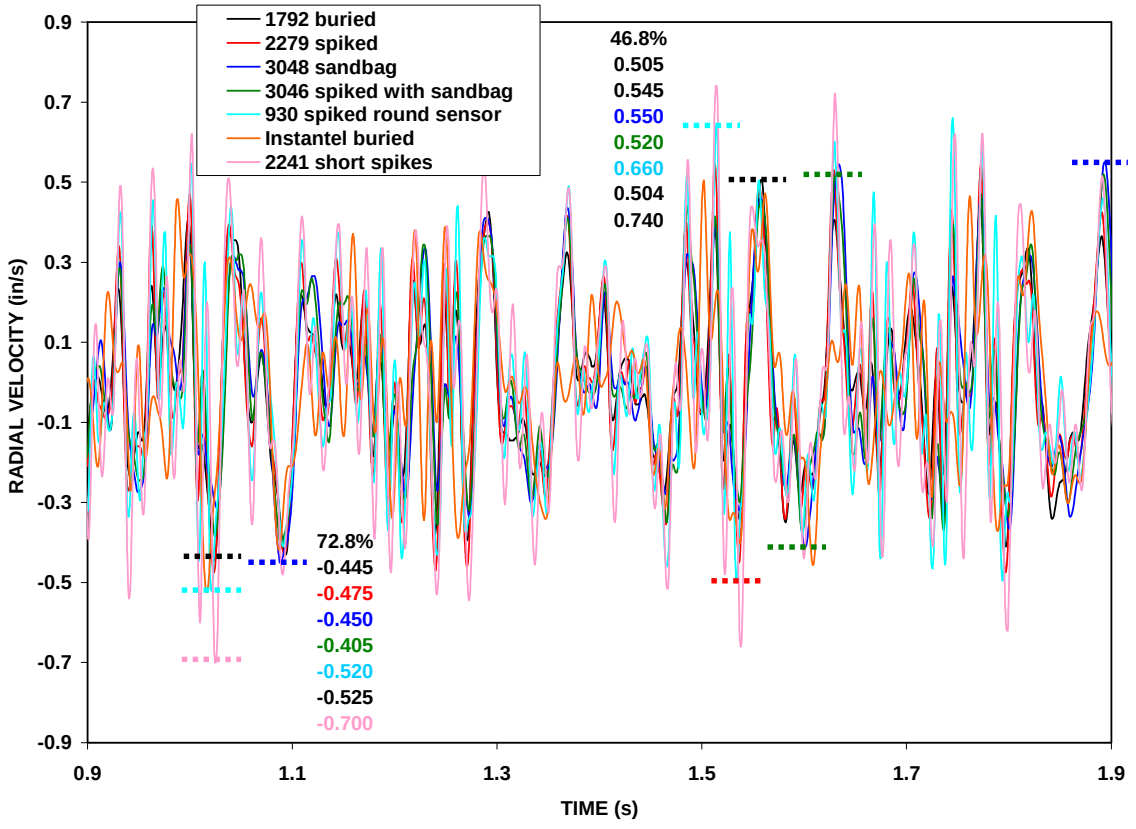

1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.5
0.7
0.9
1.1
1.3
1.5
1.7
1.9
2.1
2.3
2.5

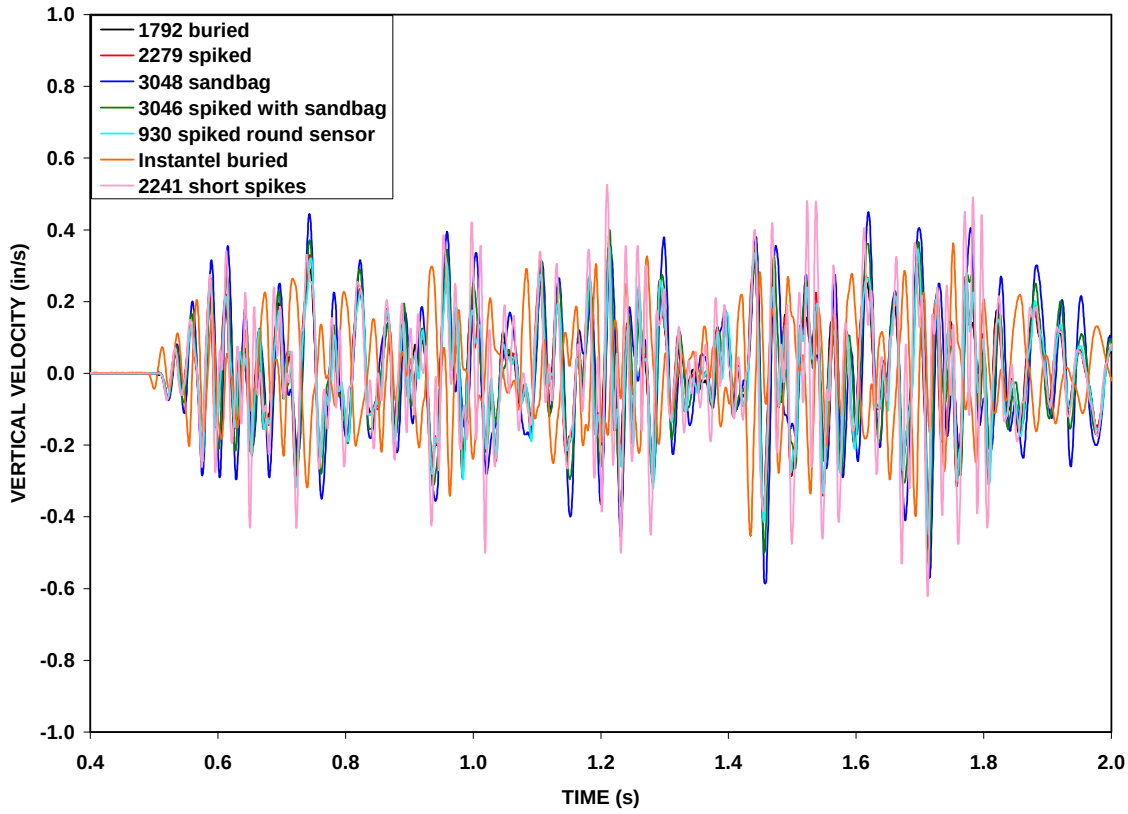

18.6%
0.590 T
0.650 T
0.600 T
0.630 T
0.600 T
0.700 T
-0.595 R
1792 buried
2279 spiked
3048 sandbag
785 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
2.1

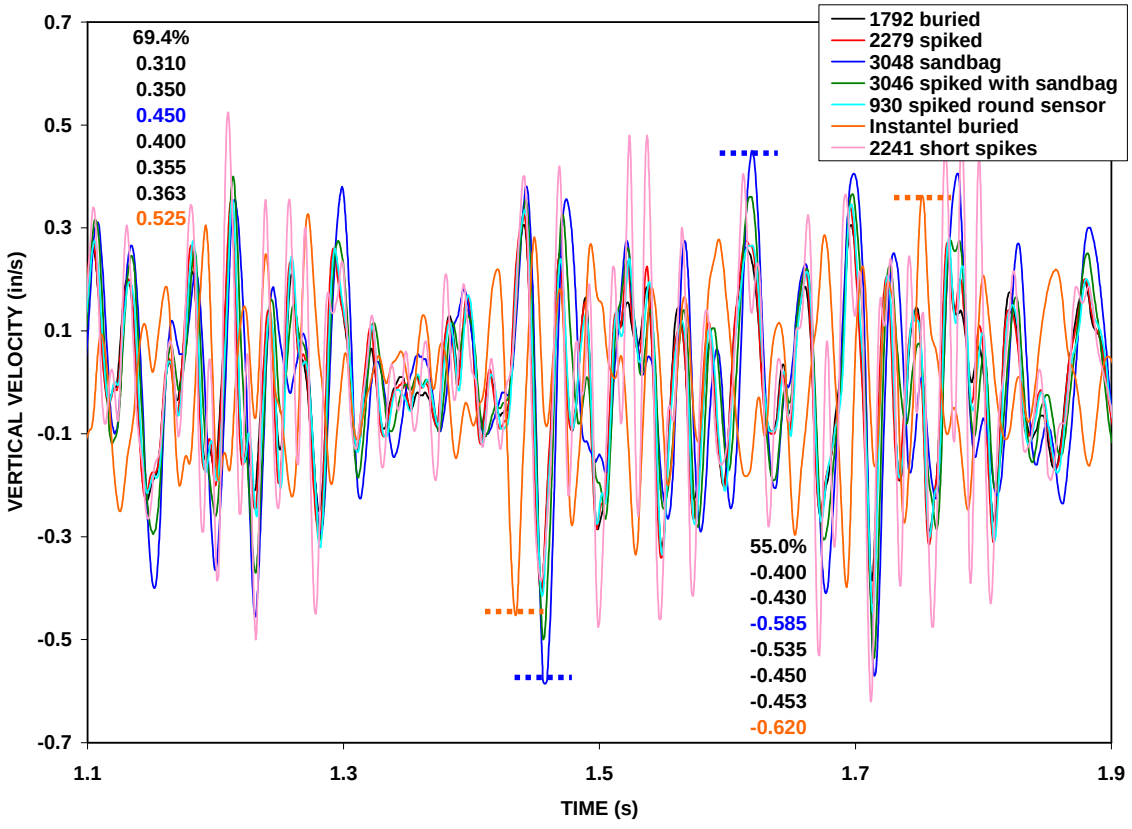
KY-1

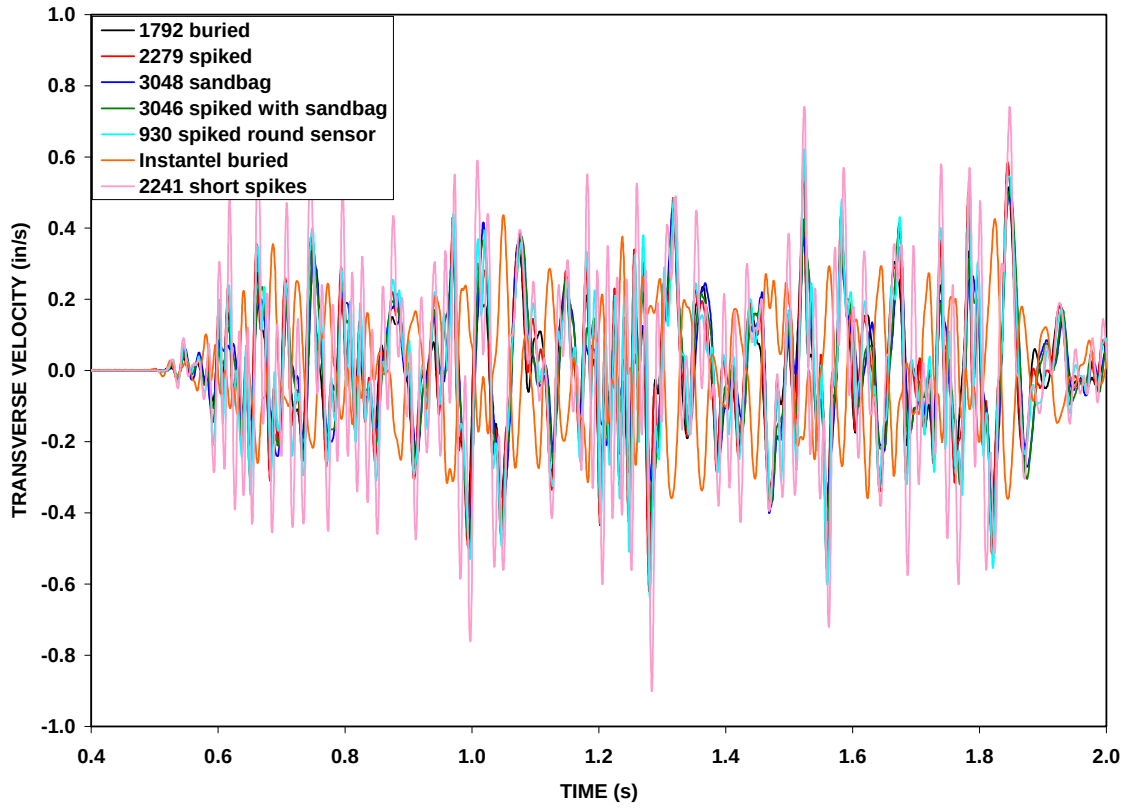
Single cluster SD 62.9 ft/lb$^{1/2}$

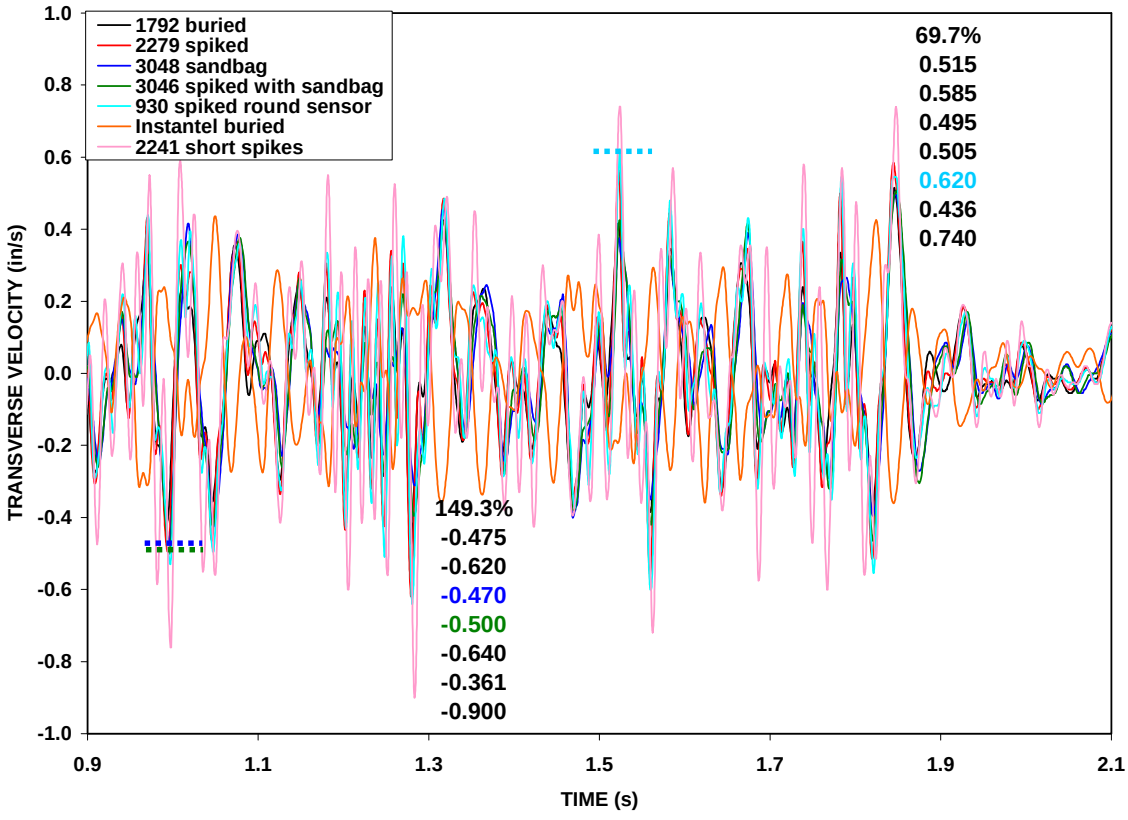

1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
Instantel buried
2241 short spikes
RADIAL VELOCITY (in/s)
TIME (s)

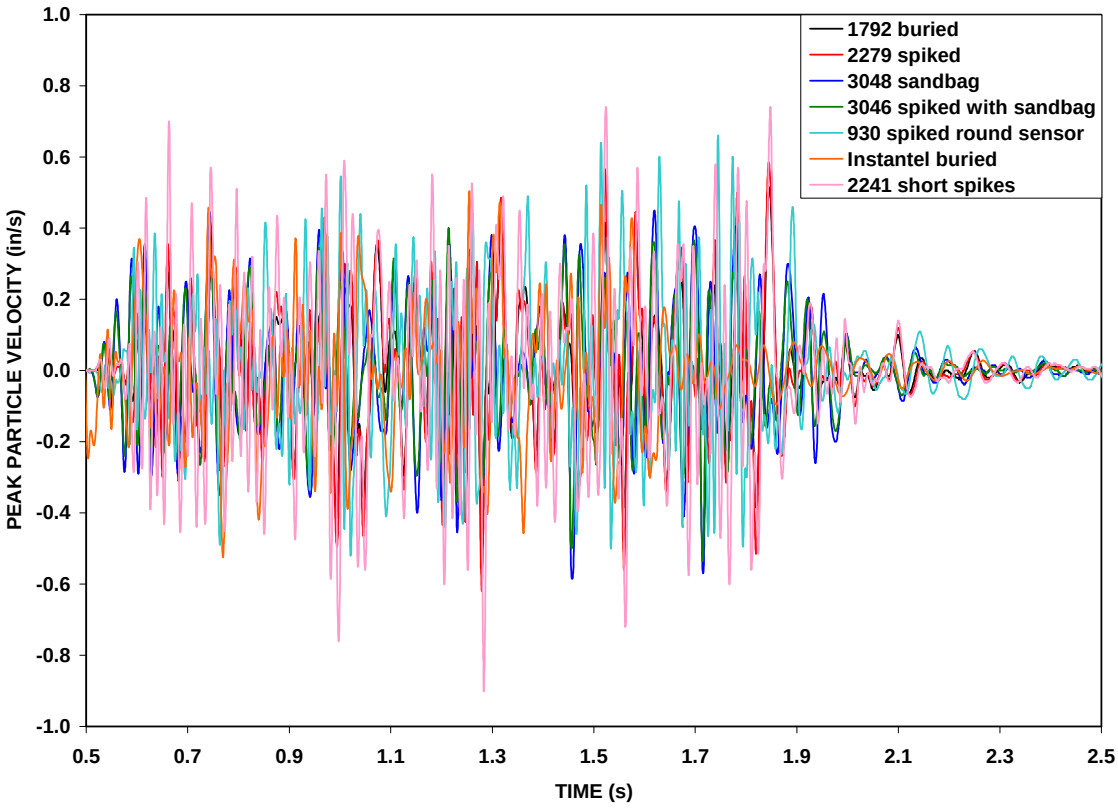

1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
Instantel buried
2241 short spikes
46.8%
0.505
0.545
0.550
0.520
0.660
0.504
0.740
72.8%
-0.445
-0.475
-0.450
-0.405
-0.520
-0.525
-0.700
RADIAL VELOCITY (in/s)
TIME (s)

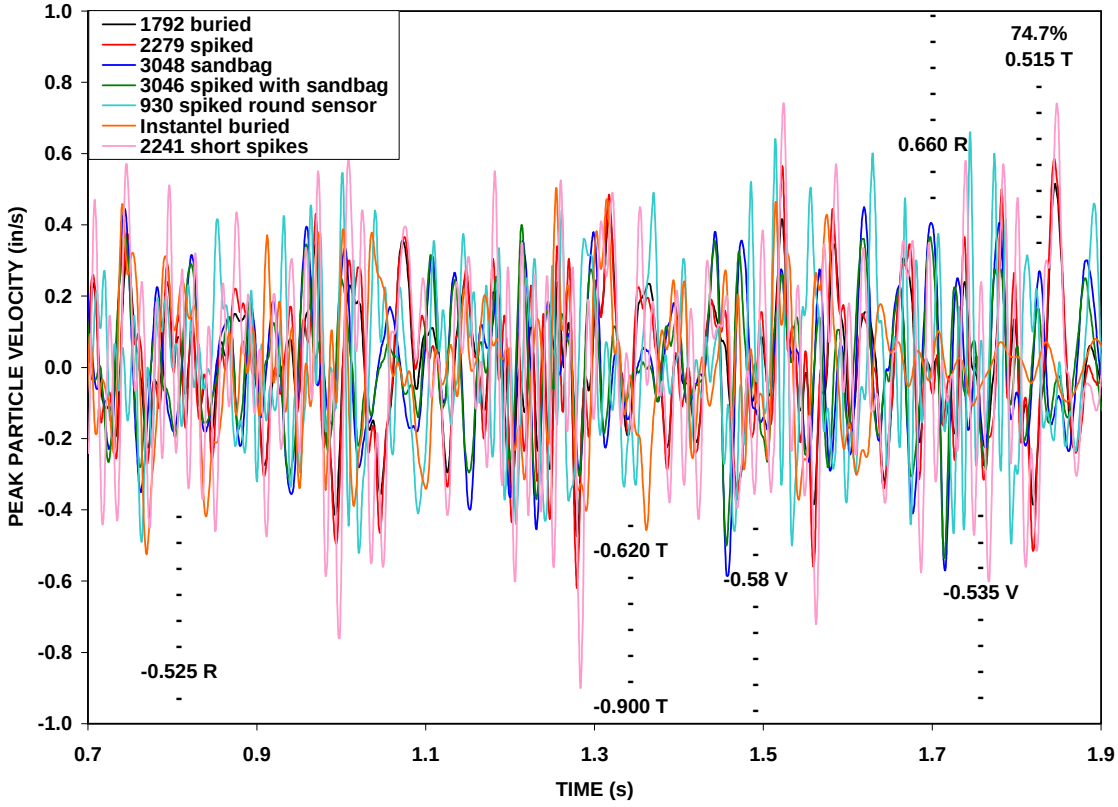

1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
Instantel buried
2241 short spikes
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0


1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
Instantel buried
2241 short spikes
69.4%
0.310
0.350
0.450
0.400
0.355
0.363
0.525
55.0%
-0.400
-0.430
-0.585
-0.535
-0.450
-0.453
-0.620
VERTICAL VELOCITY (in/s)
TIME (s)
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
-0.7
1.1
1.3
1.5
1.7
1.9


1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
Instantel buried
2241 short spikes
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

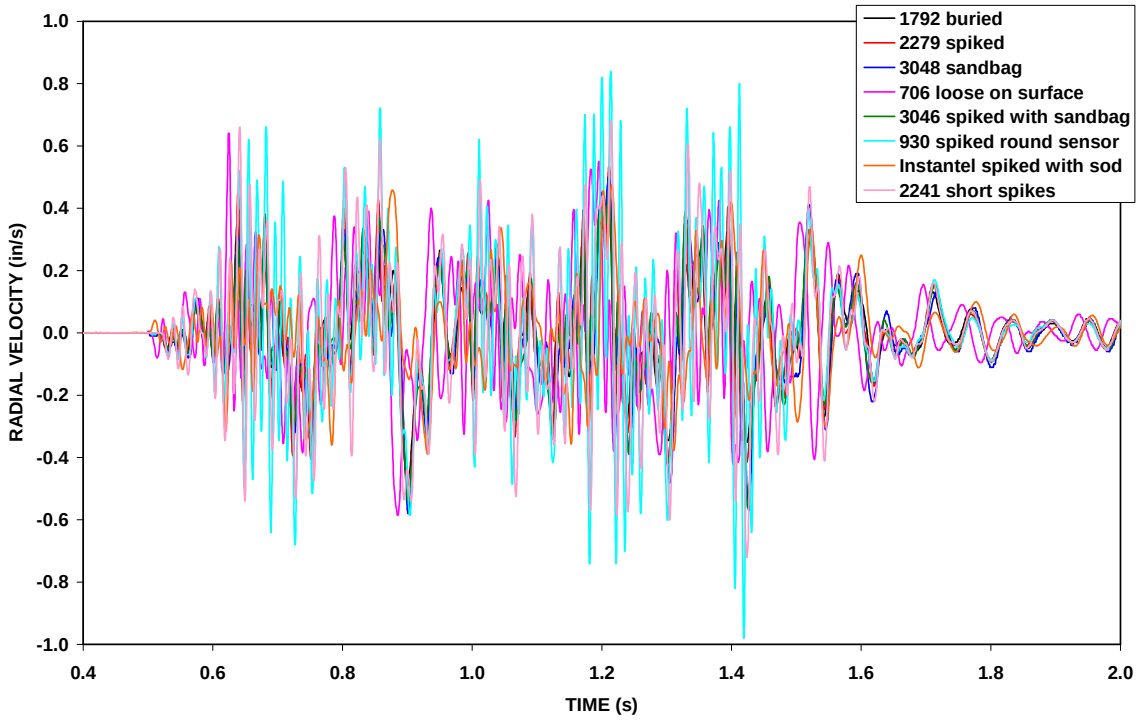

1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
Instantel buried
2241 short spikes
69.7%
0.515
0.585
0.495
0.505
0.620
0.436
0.740
149.3%
-0.475
-0.620
-0.470
-0.500
-0.640
-0.361
-0.900
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.9
1.1
1.3
1.5
1.7
1.9
2.1

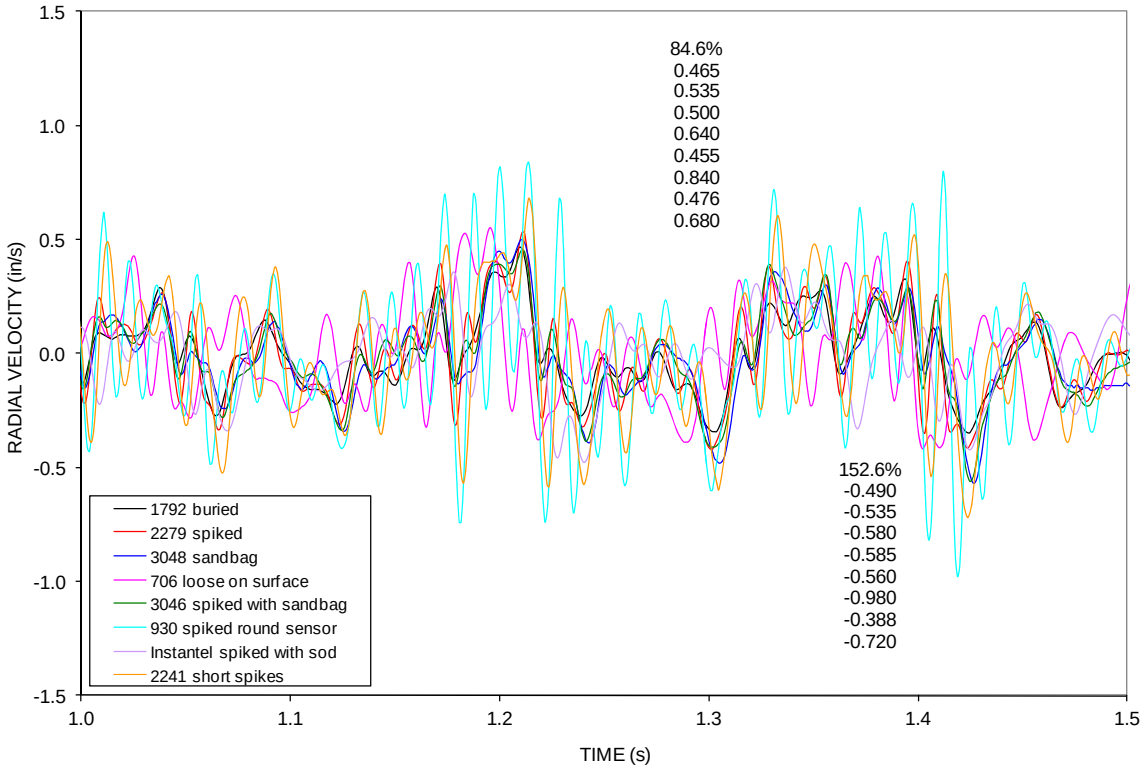

1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
Instantel buried
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.5
0.7
0.9
1.1
1.3
1.5
1.7
1.9
2.1
2.3
2.5

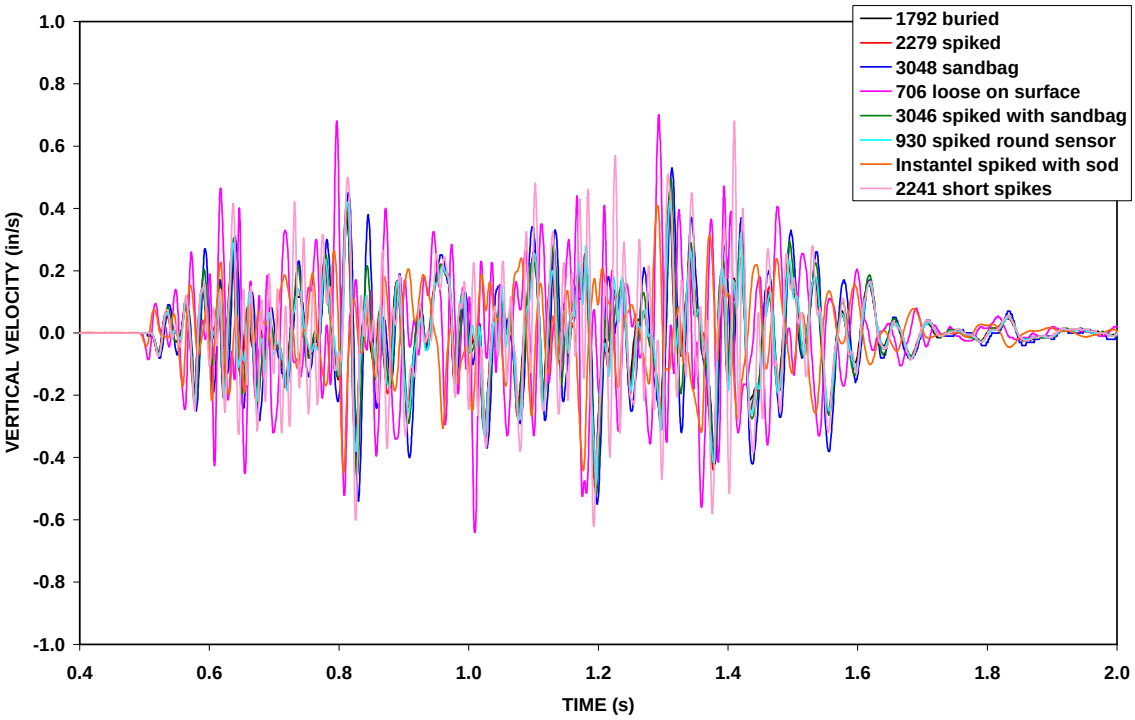

1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
Instantel buried
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
74.7%
0.515 T
0.660 R
-0.525 R
-0.620 T
-0.900 T
-0.58 V
-0.535 V
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.7
0.9
1.1
1.3
1.5
1.7
1.9

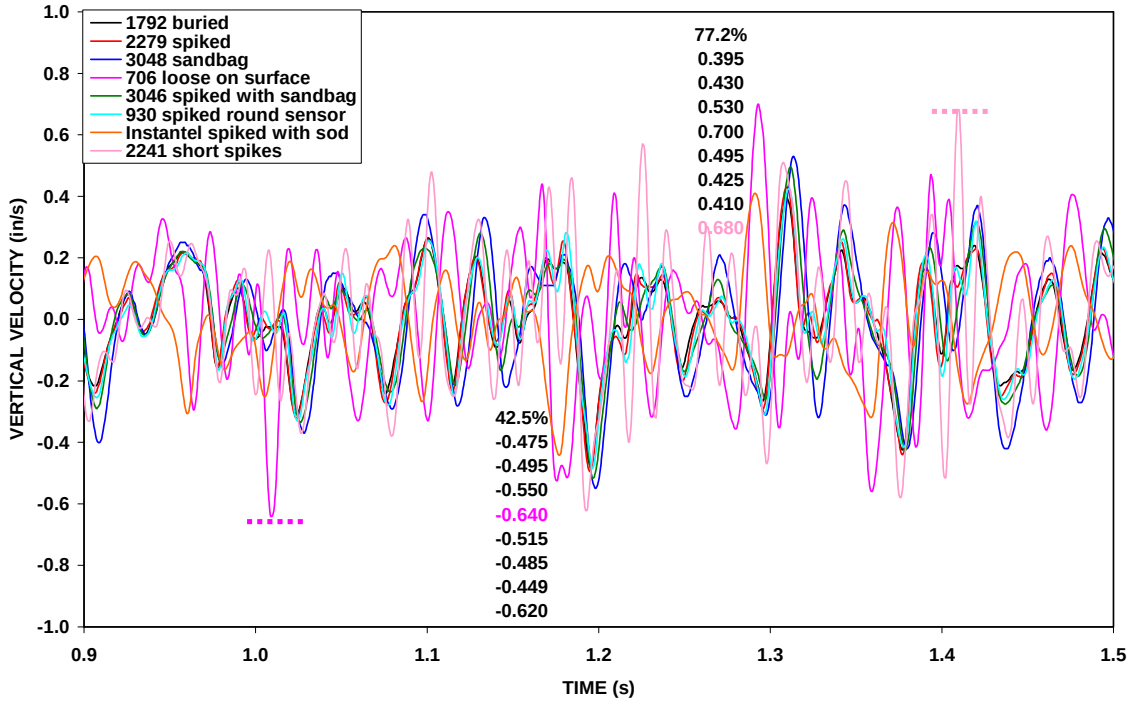
KY-2

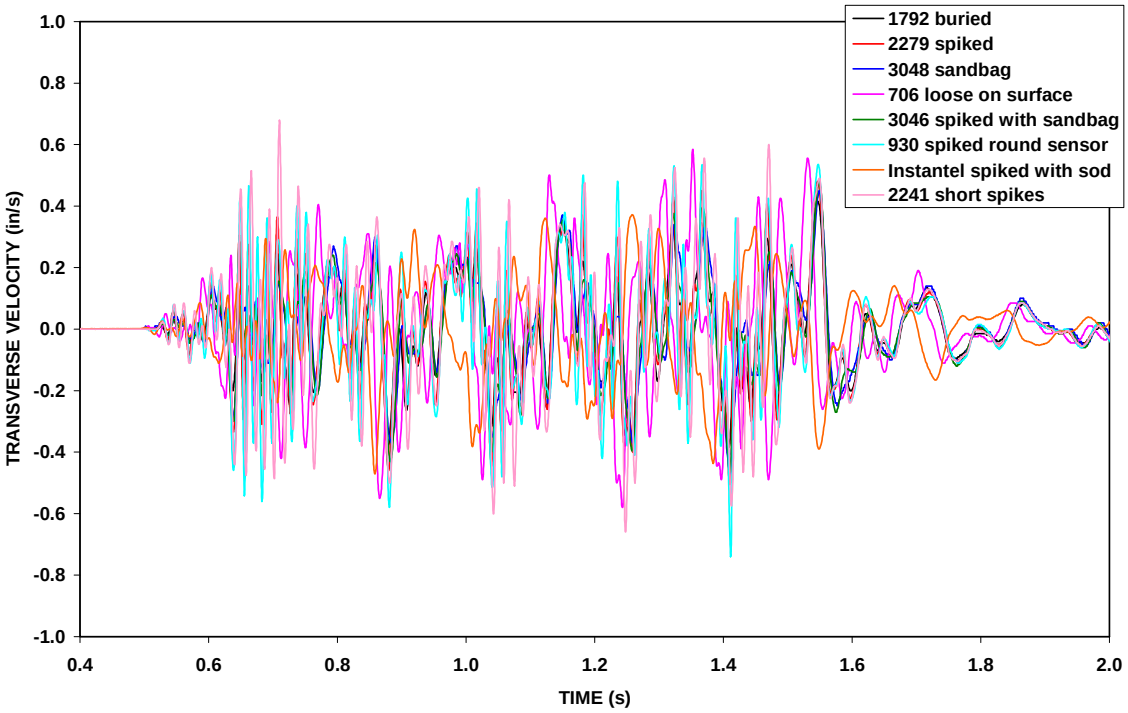
Single cluster SD 49.0 ft/lb$^{1/2}$

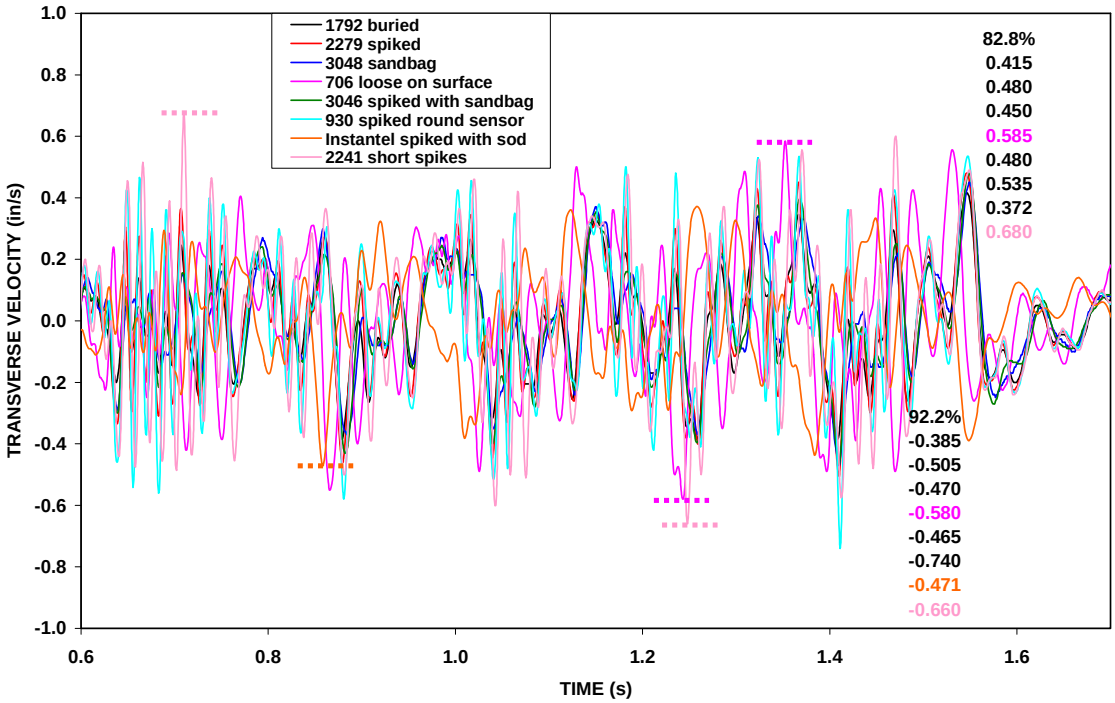

1792 buried
2279 spiked
3048 sandbag
706 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

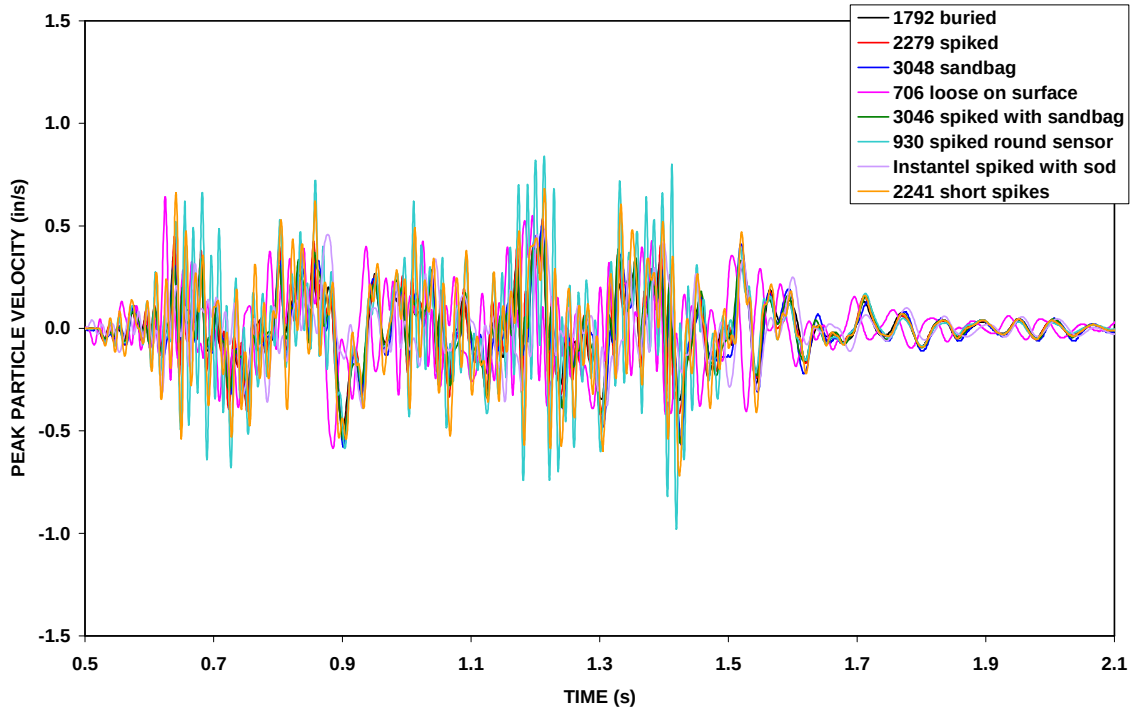

84.6%
0.465
0.535
0.500
0.640
0.455
0.840
0.476
0.680
152.6%
-0.490
-0.535
-0.580
-0.585
-0.560
-0.980
-0.388
-0.720
1792 buried
2279 spiked
3048 sandbag
706 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1.0
1.1
1.2
1.3
1.4
1.5

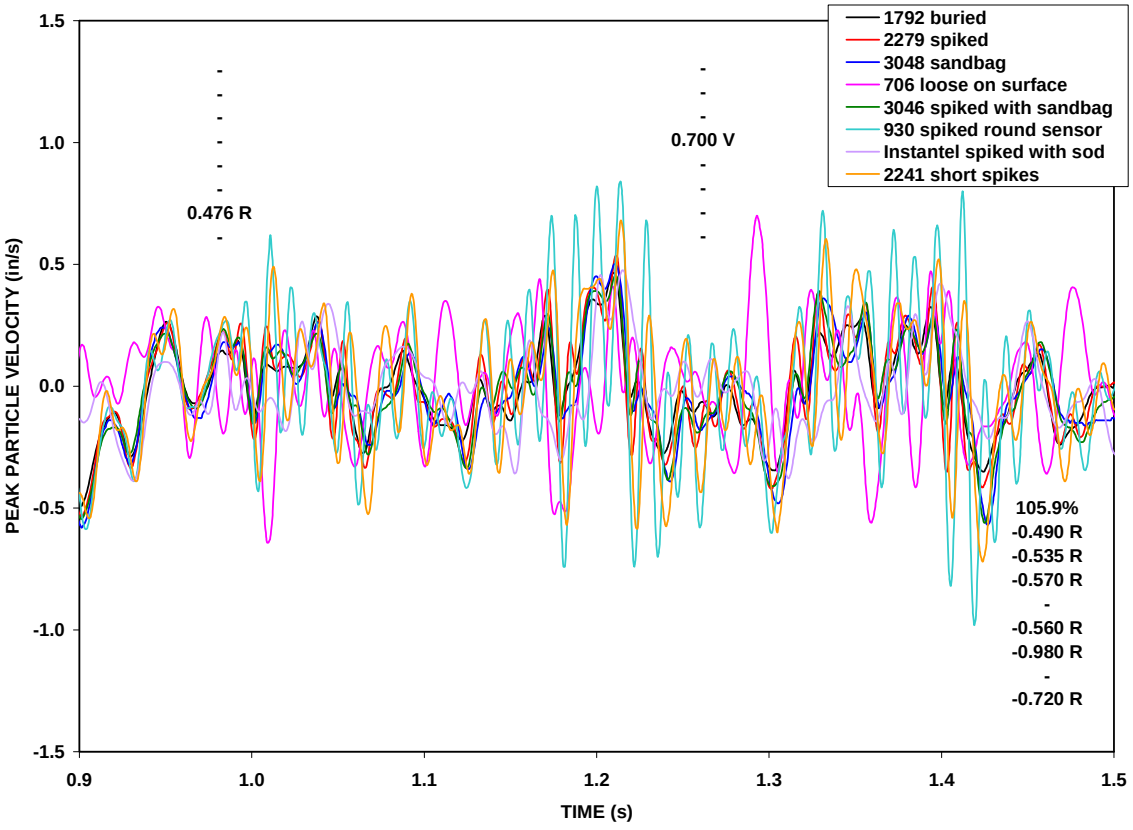

1792 buried
2279 spiked
3048 sandbag
706 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0


1792 buried
2279 spiked
3048 sandbag
706 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
77.2%
0.395
0.430
0.530
0.700
0.495
0.425
0.410
0.680
42.5%
-0.475
-0.495
-0.550
-0.640
-0.515
-0.485
-0.449
-0.620
VERTICAL VELOCITY (in/s)
TIME (s)
0.9
1.0
1.1
1.2
1.3
1.4
1.5


1792 buried
2279 spiked
3048 sandbag
706 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

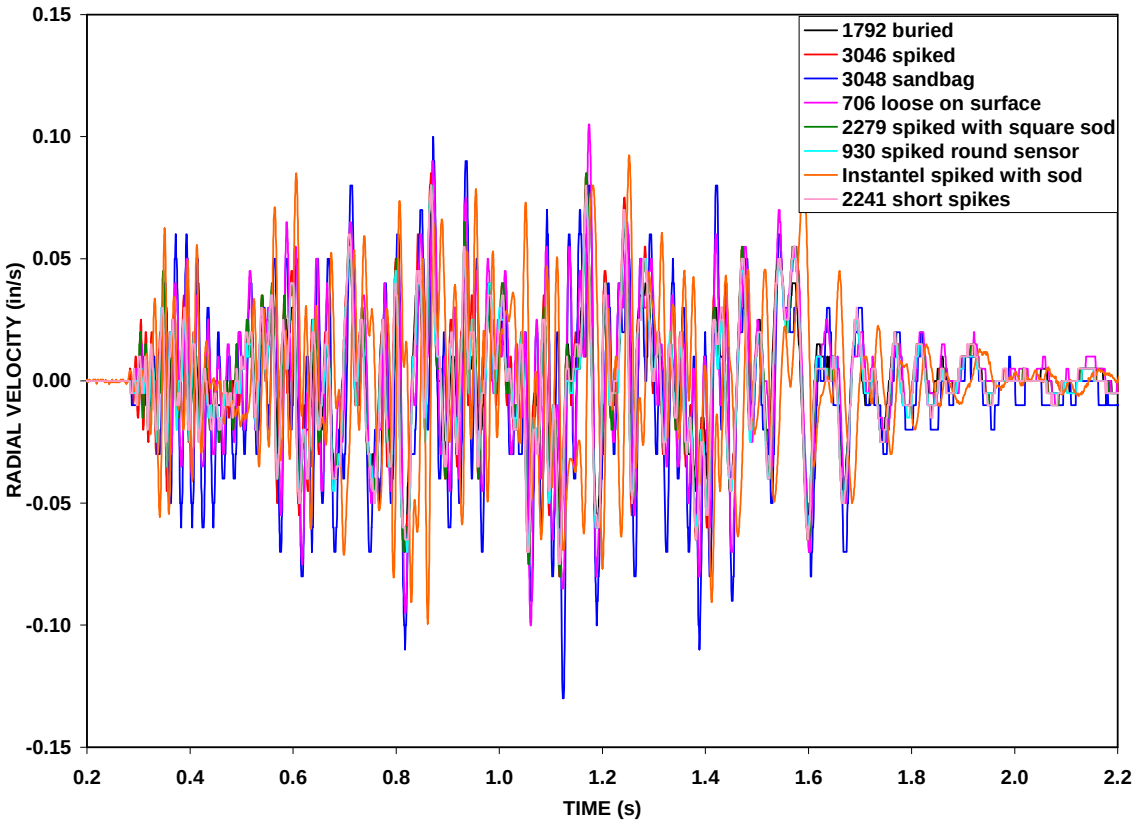

1792 buried
2279 spiked
3048 sandbag
706 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
82.8%
0.415
0.480
0.450
0.585
0.480
0.535
0.372
0.680
92.2%
-0.385
-0.505
-0.470
-0.580
-0.465
-0.740
-0.471
-0.660
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.6
0.8
1.0
1.2
1.4
1.6

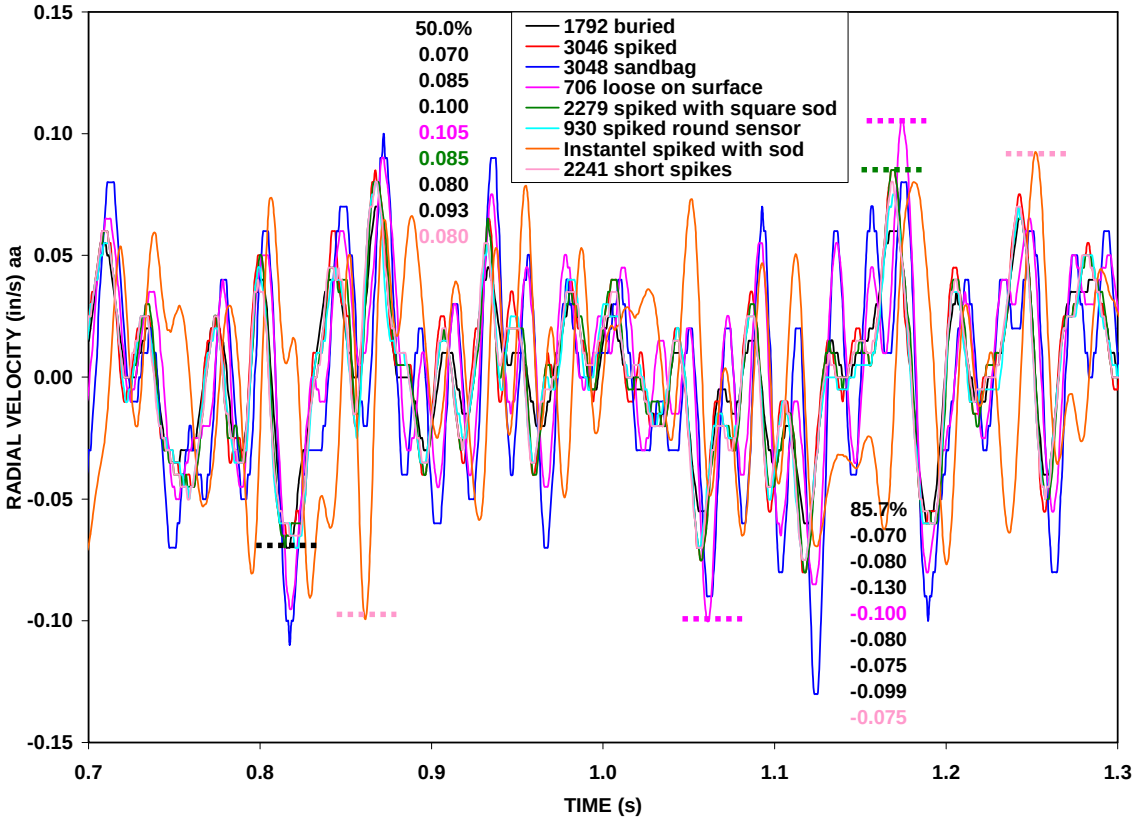

1792 buried
2279 spiked
3048 sandbag
706 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.5
0.7
0.9
1.1
1.3
1.5
1.7
1.9
2.1
TIME (s)

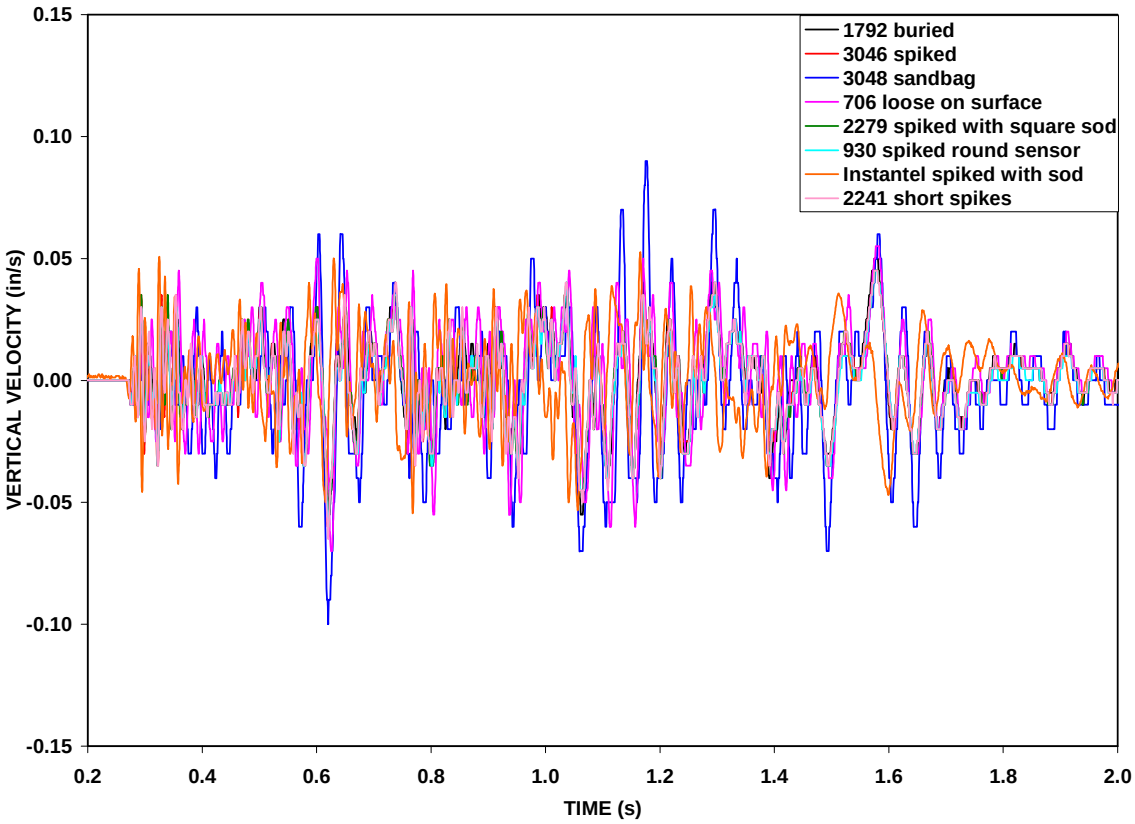

1792 buried
2279 spiked
3048 sandbag
706 loose on surface
3046 spiked with sandbag
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
0.476 R
0.700 V
105.9%
-0.490 R
-0.535 R
-0.570 R
-0.560 R
-0.980 R
-0.720 R
PEAK PARTICLE VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.9
1.0
1.1
1.2
1.3
1.4
1.5
TIME (s)

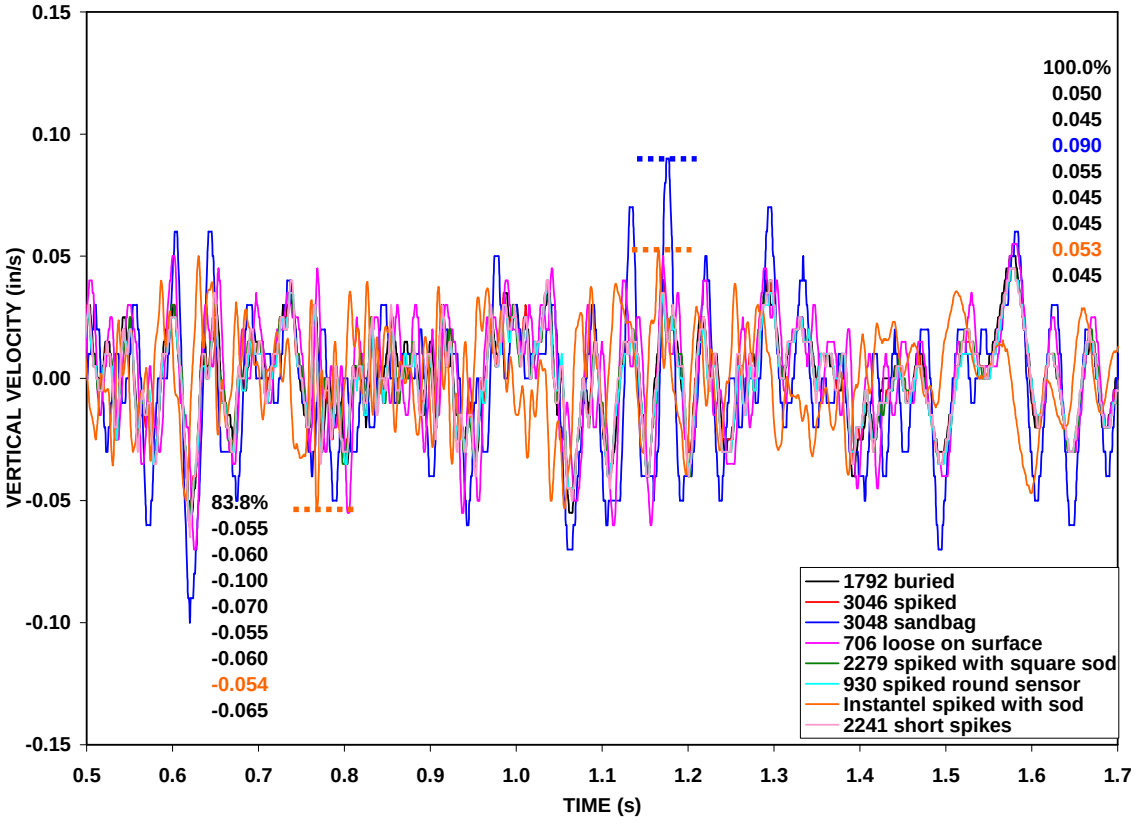
KY-3

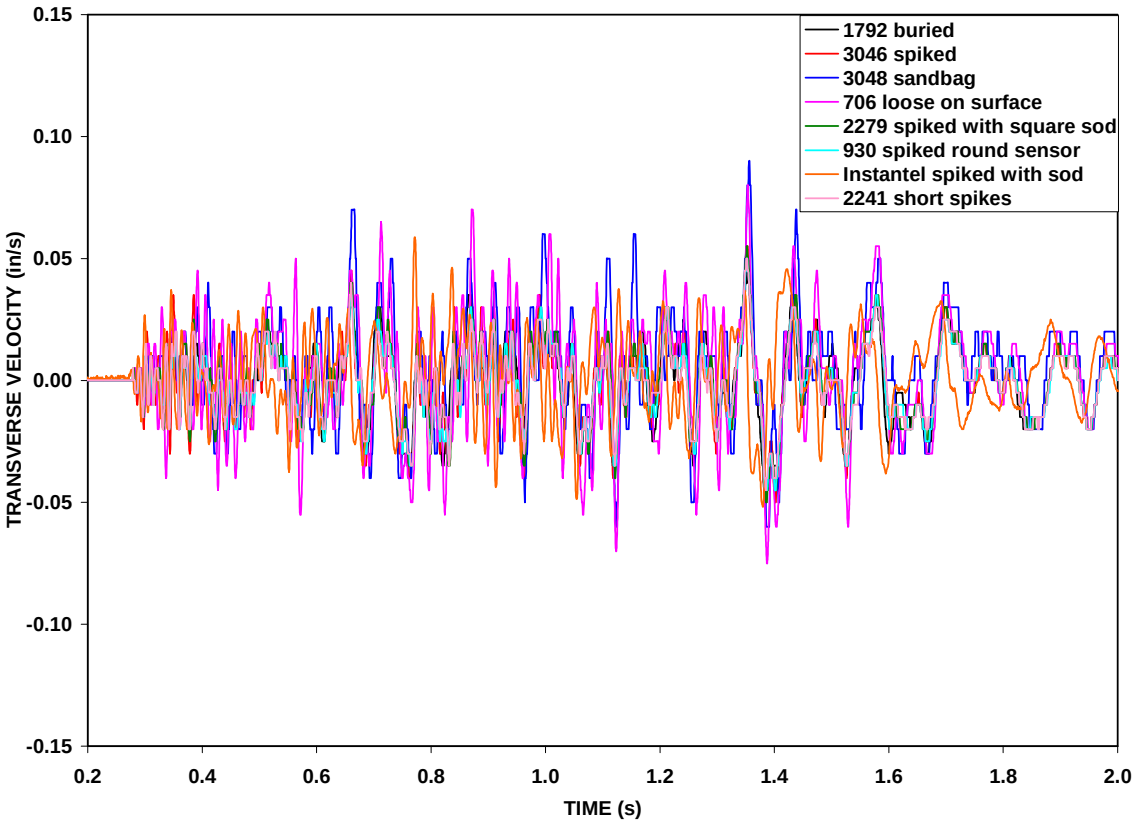
Single cluster SD 49.0 ft/lb$^{1/2}$

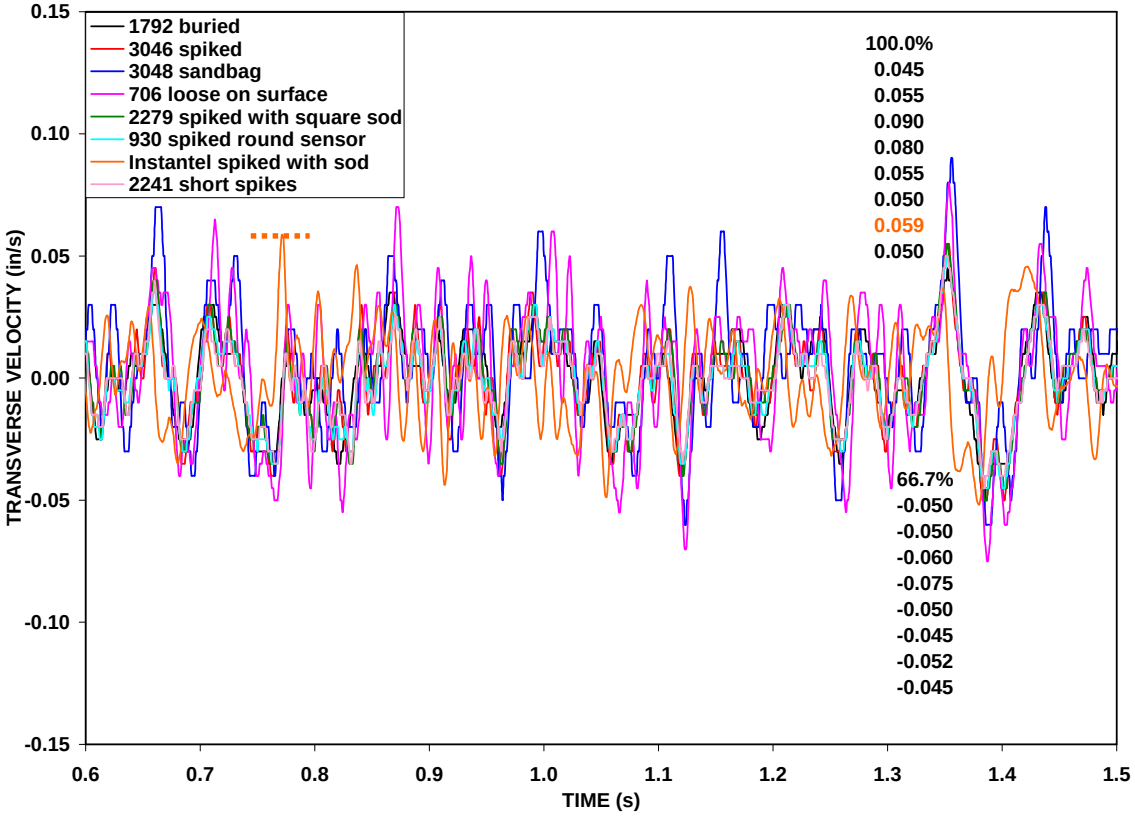

1792 buried
3046 spiked
3048 sandbag
706 loose on surface
2279 spiked with square sod
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2

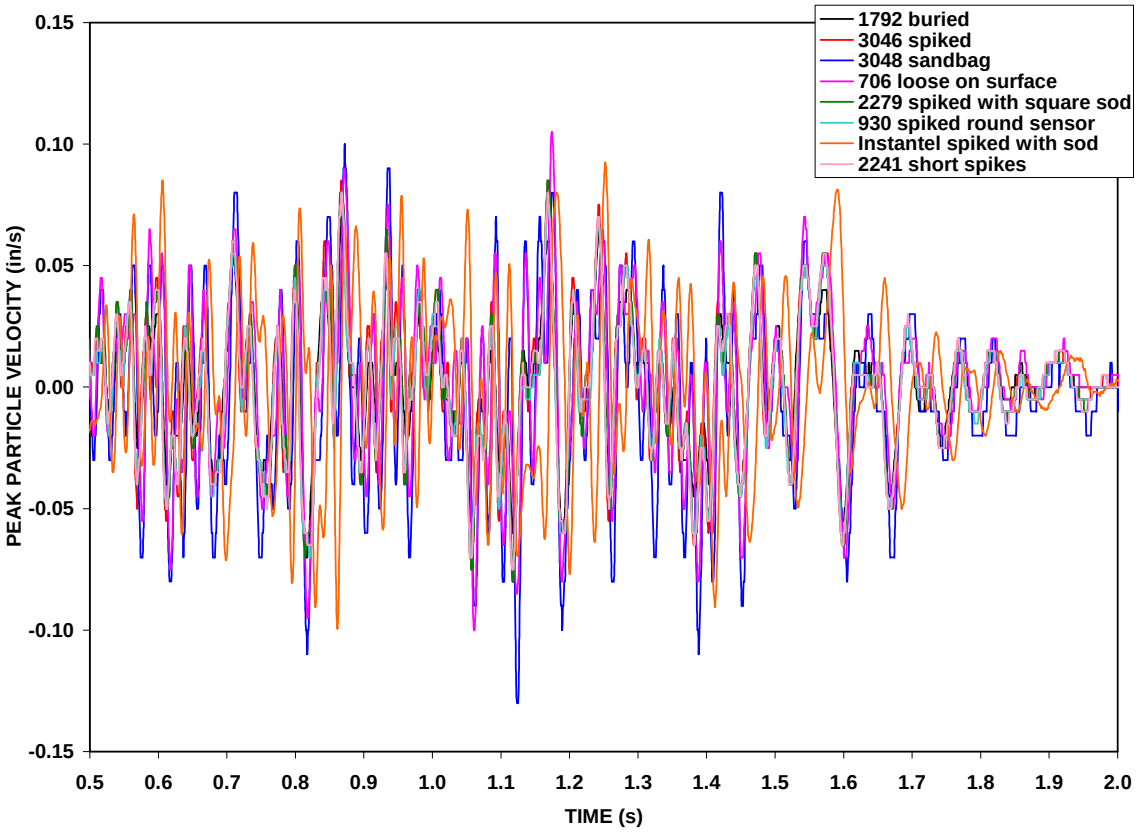

50.0%
0.070
0.085
0.100
0.105
0.085
0.080
0.093
0.080
1792 buried
3046 spiked
3048 sandbag
706 loose on surface
2279 spiked with square sod
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
85.7%
-0.070
-0.080
-0.130
-0.100
-0.080
-0.075
-0.099
-0.075
RADIAL VELOCITY (in/s) aa
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.7
0.8
0.9
1.0
1.1
1.2
1.3

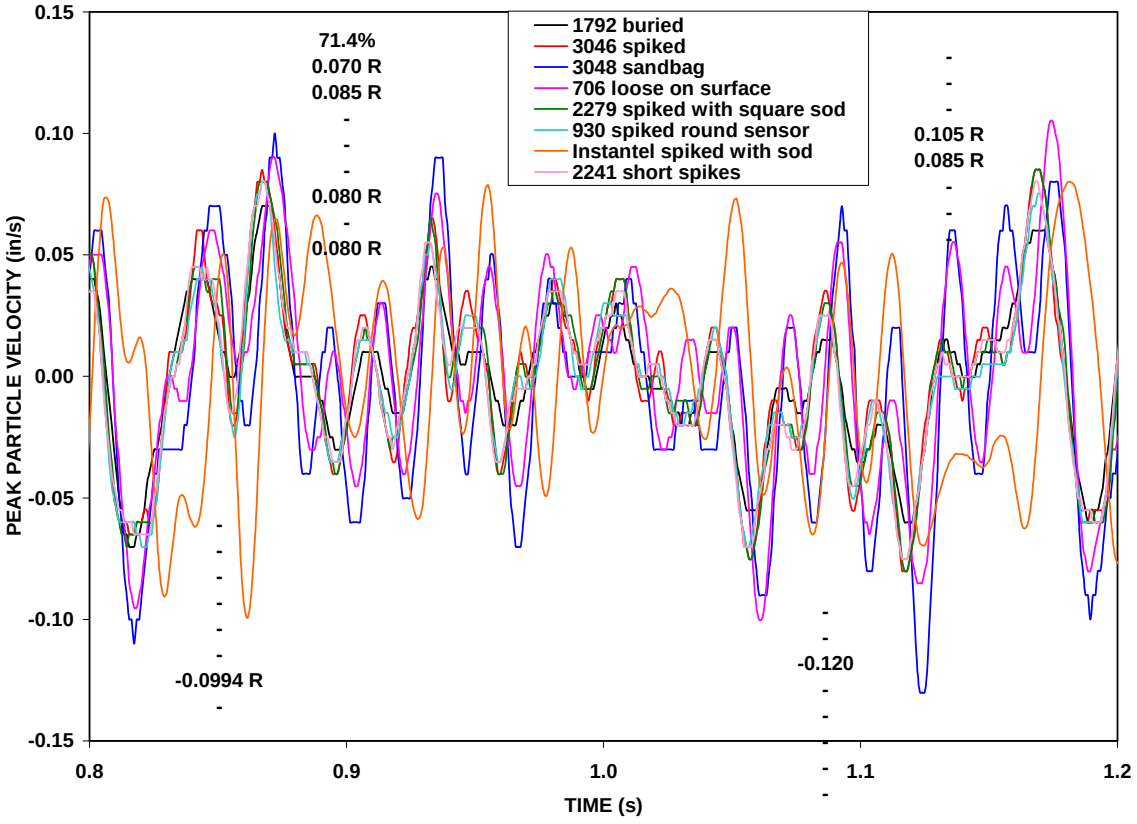

1792 buried
3046 spiked
3048 sandbag
706 loose on surface
2279 spiked with square sod
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
VERTICAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0


100.0%
0.050
0.045
0.090
0.055
0.045
0.045
0.053
0.045
83.8%
-0.055
-0.060
-0.100
-0.070
-0.055
-0.060
-0.054
-0.065
1792 buried
3046 spiked
3048 sandbag
706 loose on surface
2279 spiked with square sod
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
VERTICAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7


1792 buried
3046 spiked
3048 sandbag
706 loose on surface
2279 spiked with square sod
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

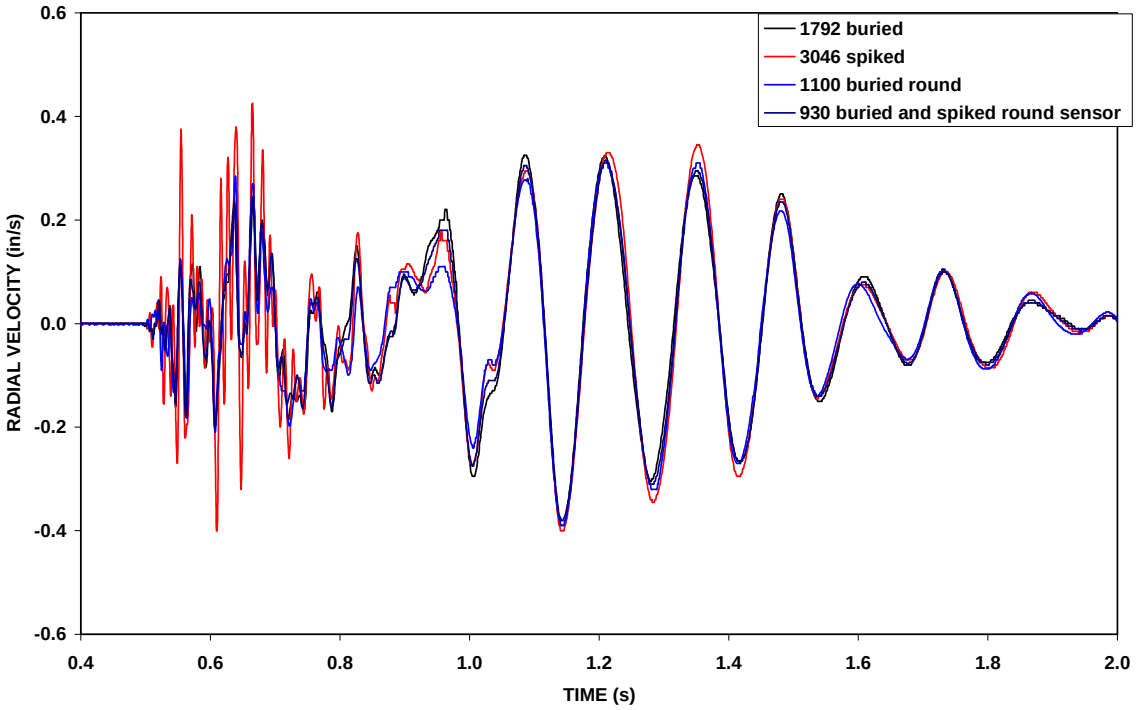

1792 buried
3046 spiked
3048 sandbag
706 loose on surface
2279 spiked with square sod
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
100.0%
0.045
0.055
0.090
0.080
0.055
0.050
0.059
0.050
66.7%
-0.050
-0.050
-0.060
-0.075
-0.050
-0.045
-0.052
-0.045
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5

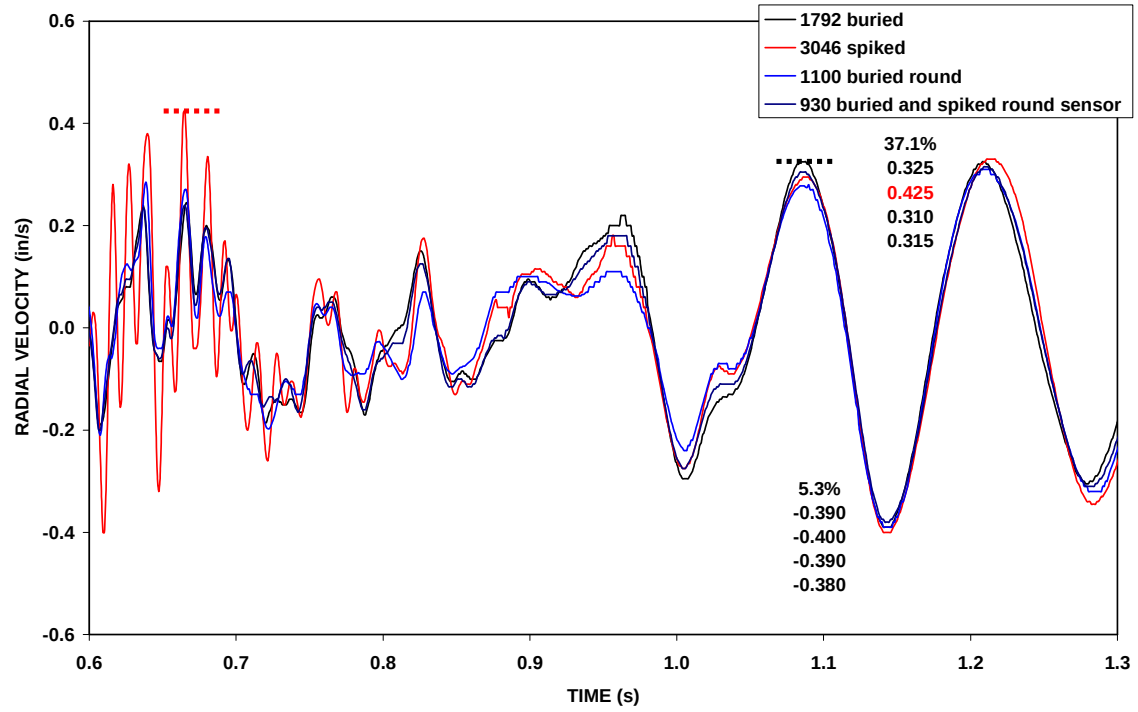

1792 buried
3046 spiked
3048 sandbag
706 loose on surface
2279 spiked with square sod
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
TIME (s)

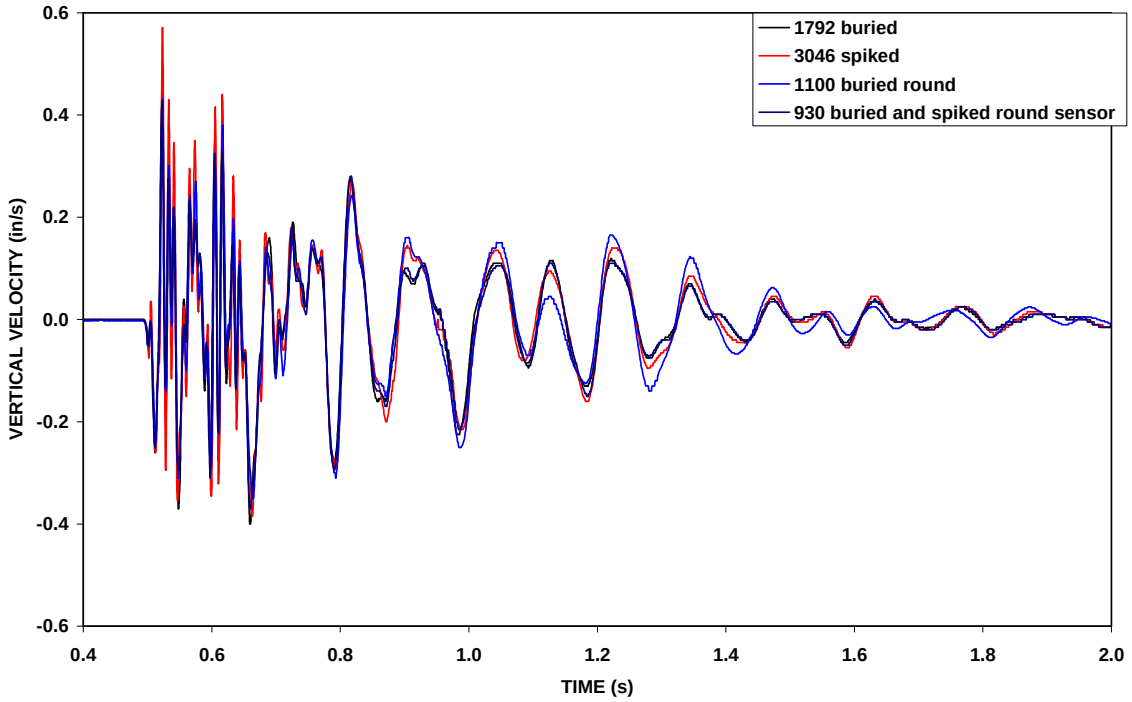

1792 buried
3046 spiked
3048 sandbag
706 loose on surface
2279 spiked with square sod
930 spiked round sensor
Instantel spiked with sod
2241 short spikes
71.4%
0.070 R
0.085 R
0.080 R
0.080 R
0.105 R
0.085 R
-0.0994 R
-0.120
PEAK PARTICLE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.8
0.9
1.0
1.1
1.2
TIME (s)

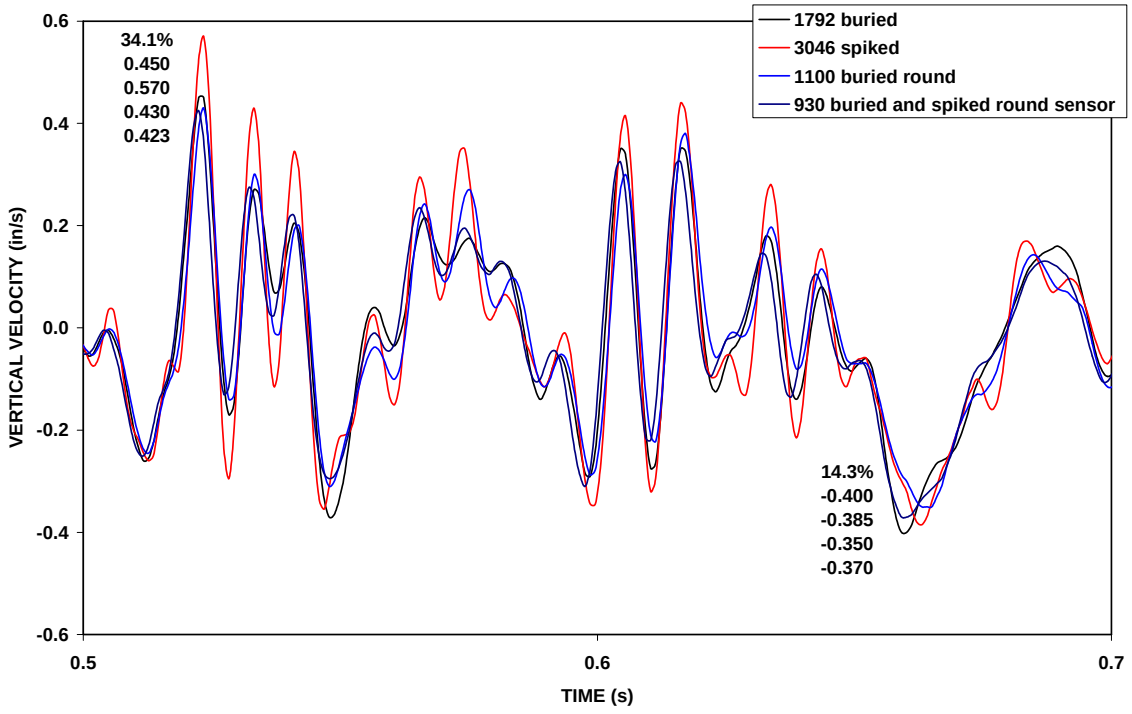
KY-3

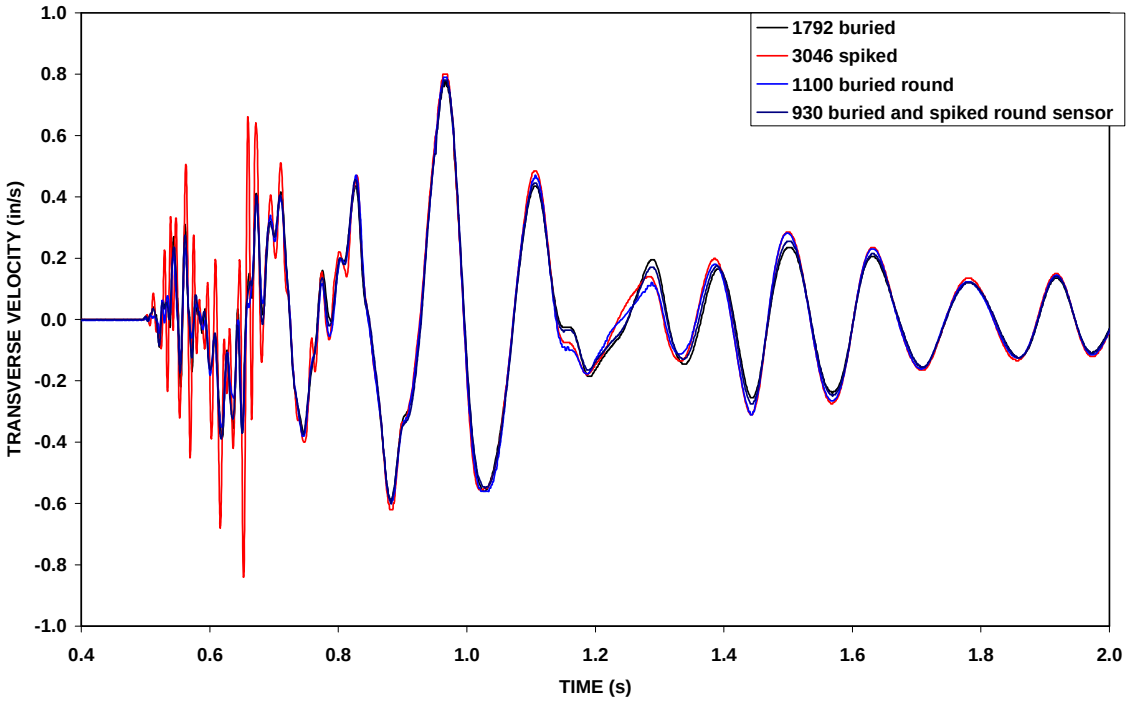
Cluster 1 SD 134.2 ft/lb$^{1/2}$

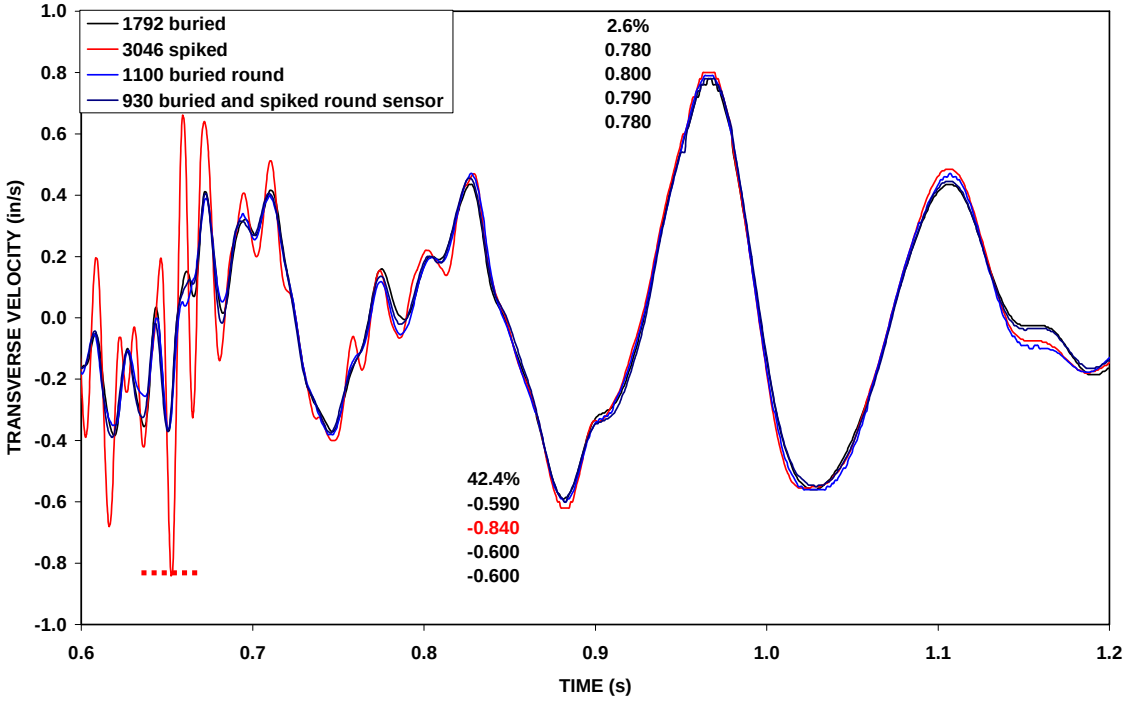

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

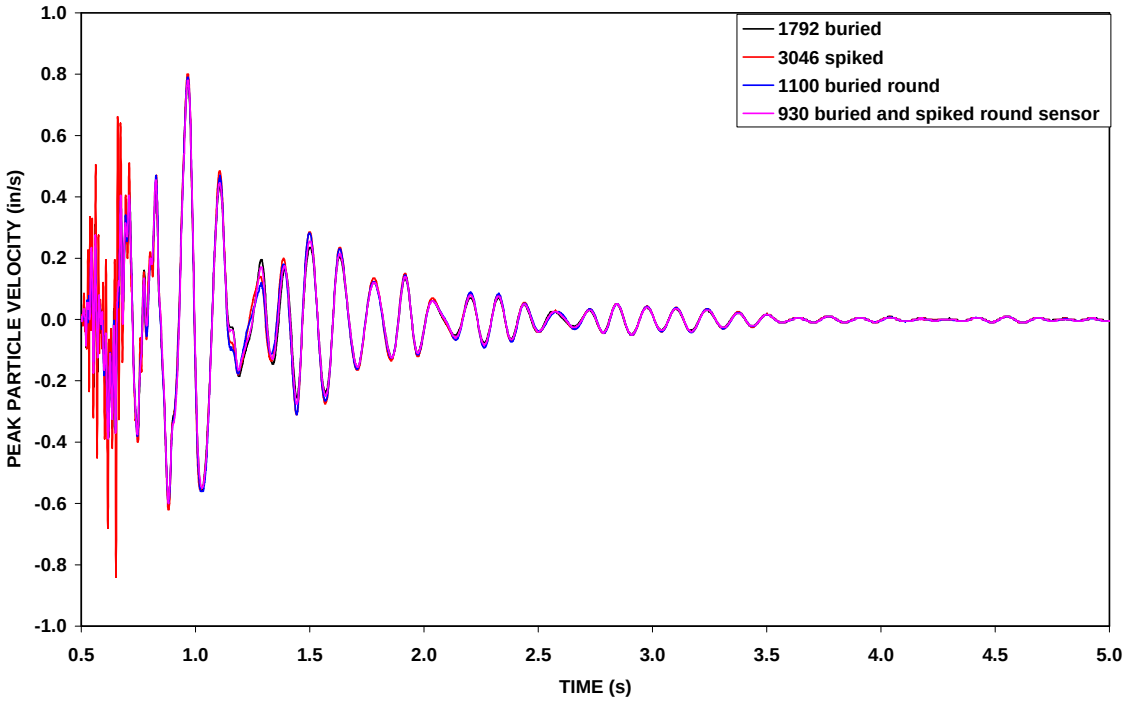

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
37.1%
0.325
0.425
0.310
0.315
5.3%
-0.390
-0.400
-0.390
-0.380
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3

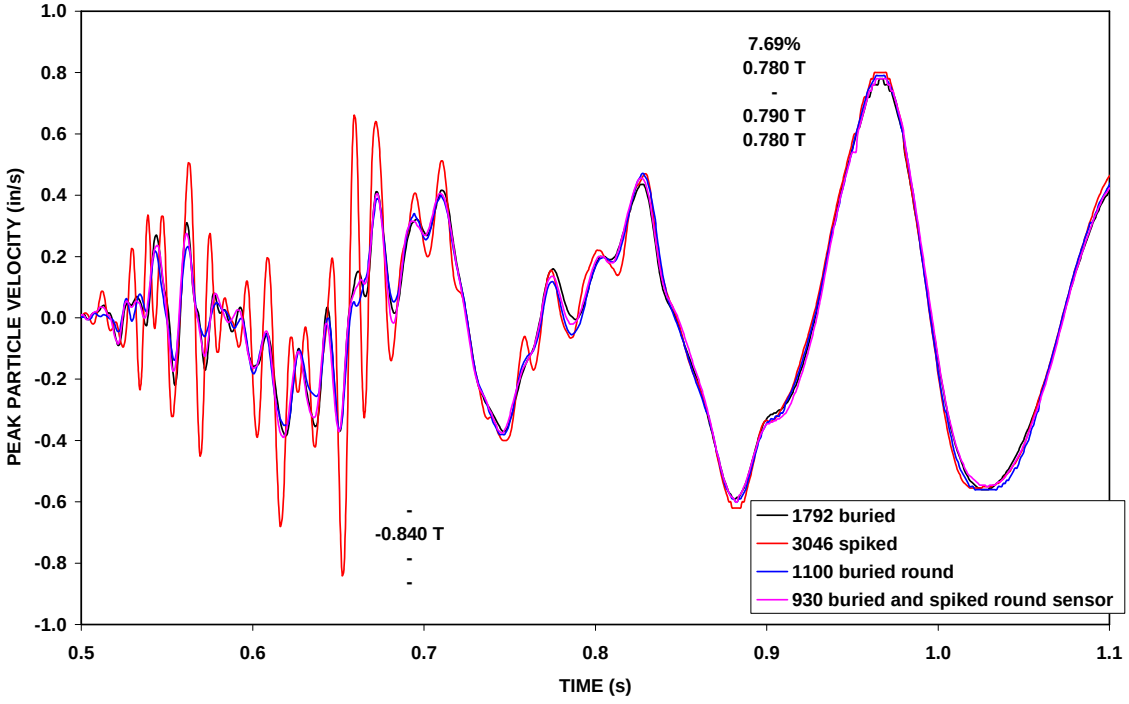

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0


1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
34.1%
0.450
0.570
0.430
0.423
14.3%
-0.400
-0.385
-0.350
-0.370
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.5
0.6
0.7


1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

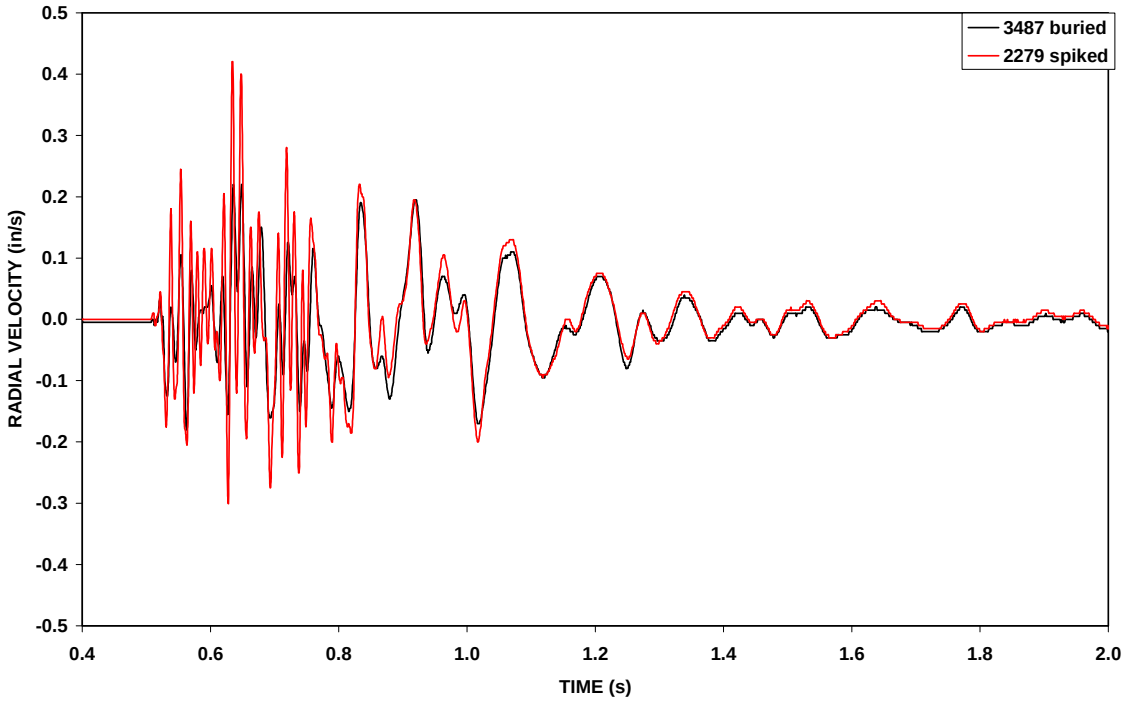

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
2.6%
0.780
0.800
0.790
0.780
42.4%
-0.590
-0.840
-0.600
-0.600
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.6
0.7
0.8
0.9
1.0
1.1
1.2

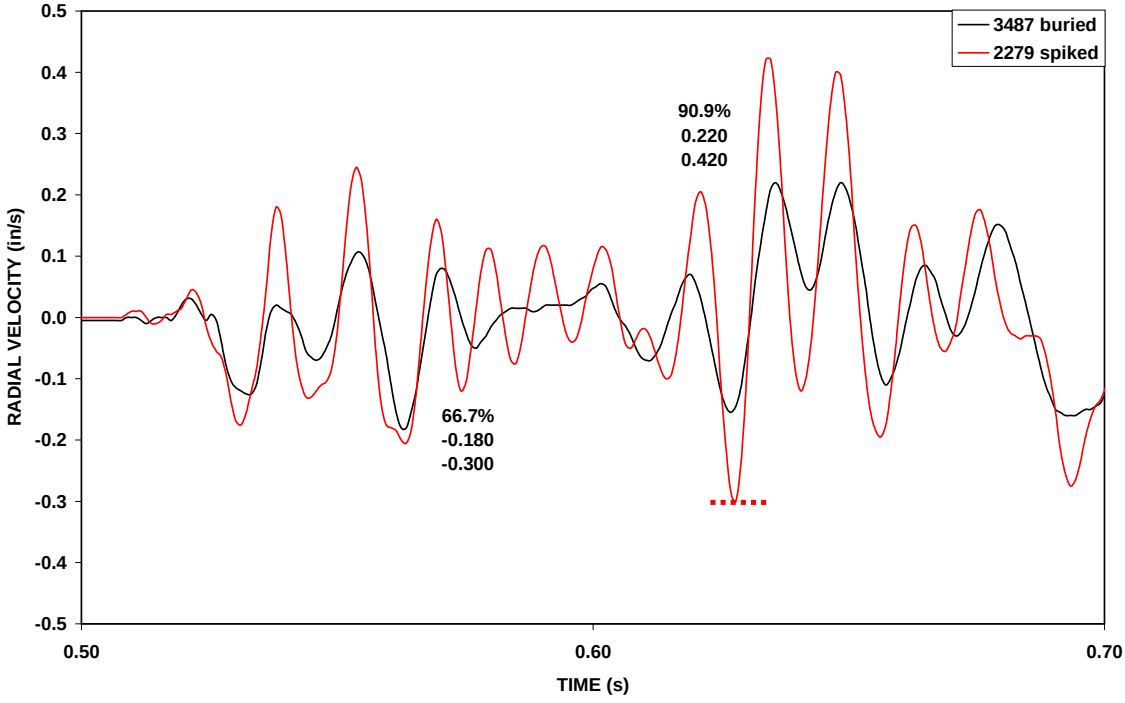

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

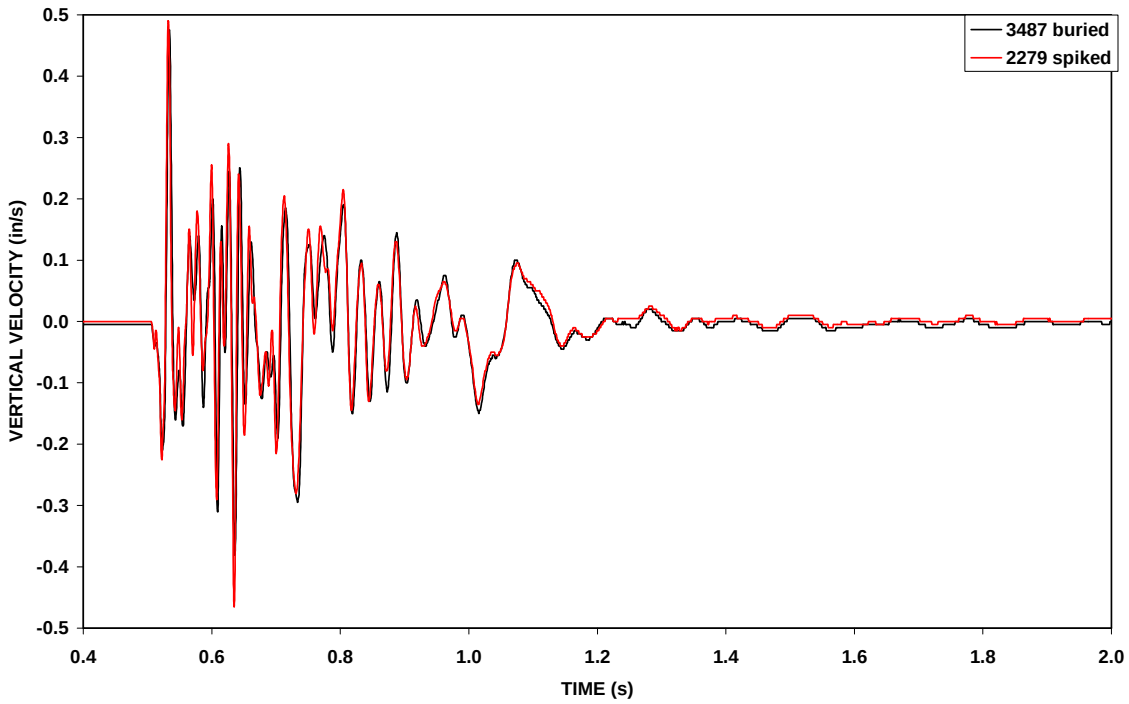

7.69%
0.780 T
-
0.790 T
0.780 T
-
-0.840 T
-
-
1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0.5
0.6
0.7
0.8
0.9
1.0
1.1

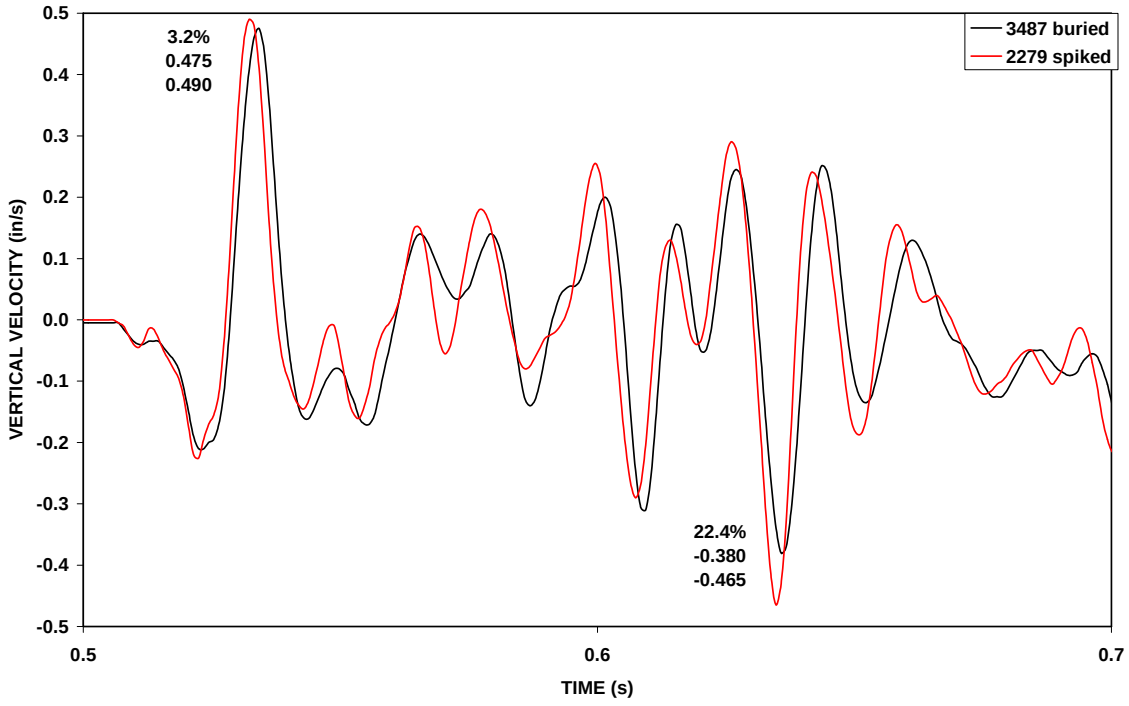
KY-4

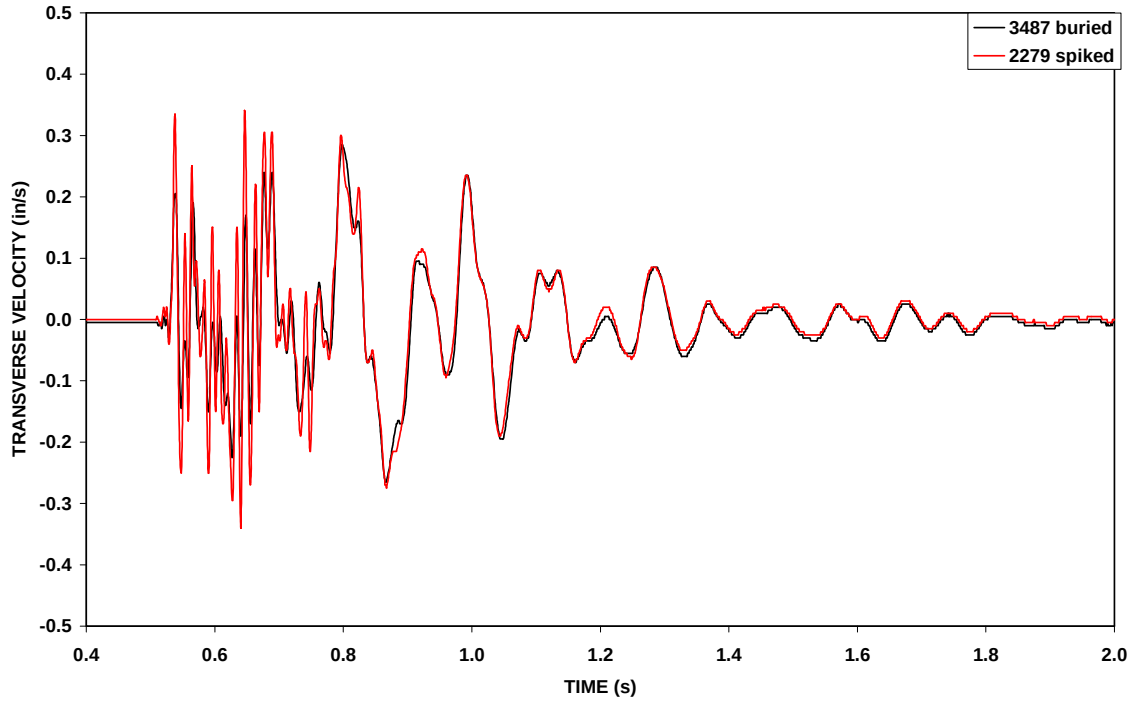
Cluster 2 SD 149.2 ft/lb$^{1/2}$

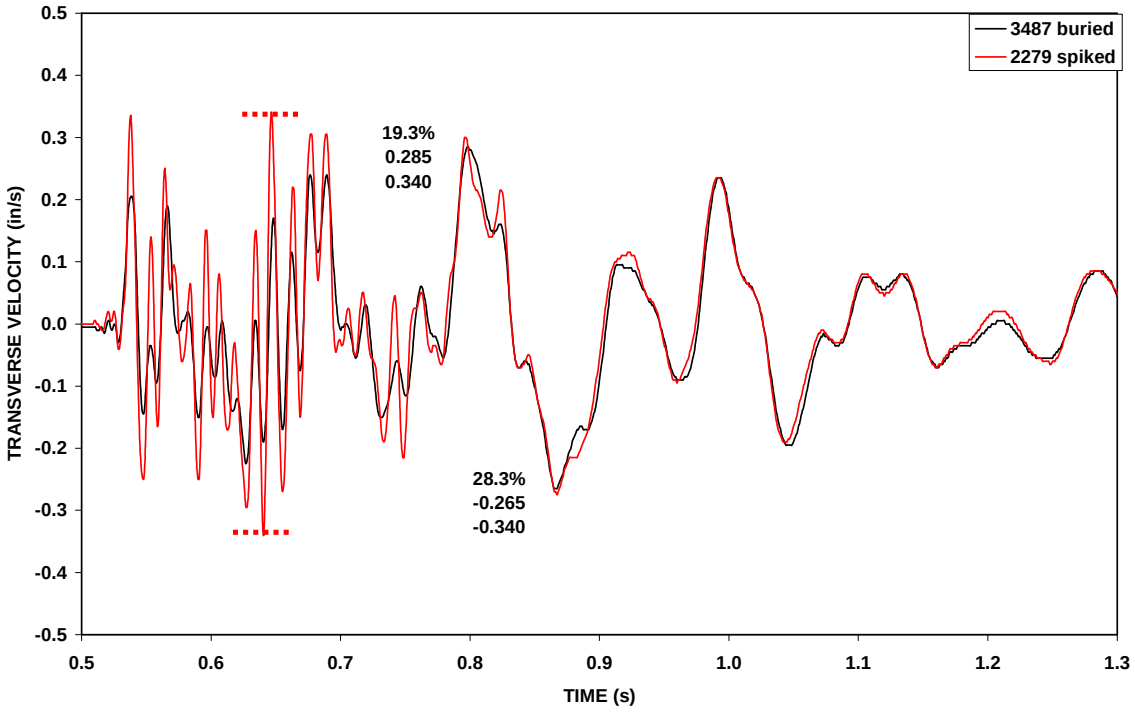

3487 buried
2279 spiked
RADIAL VELOCITY (in/s)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME (s)


3487 buried
2279 spiked
90.9%
0.220
0.420
66.7%
-0.180
-0.300
RADIAL VELOCITY (in/s)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
0.50
0.60
0.70
TIME (s)


3487 buried
2279 spiked
VERTICAL VELOCITY (in/s)
TIME (s)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

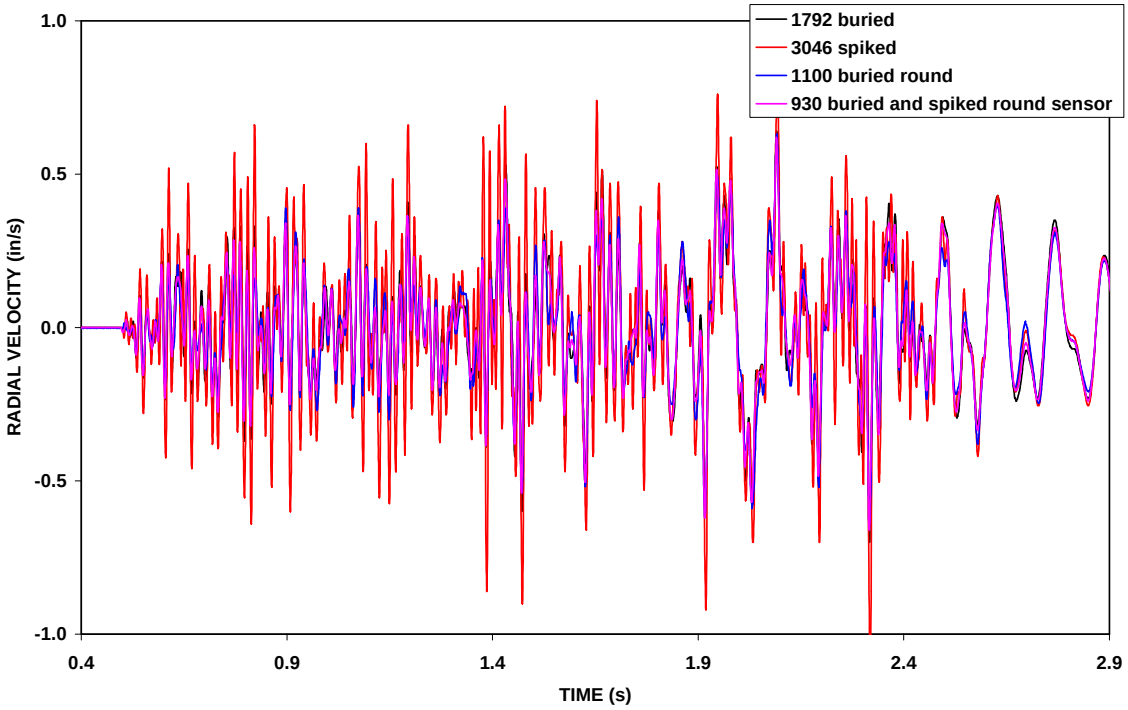

3487 buried
2279 spiked
3.2%
0.475
0.490
22.4%
-0.380
-0.465
VERTICAL VELOCITY (in/s)
TIME (s)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
0.5
0.6
0.7

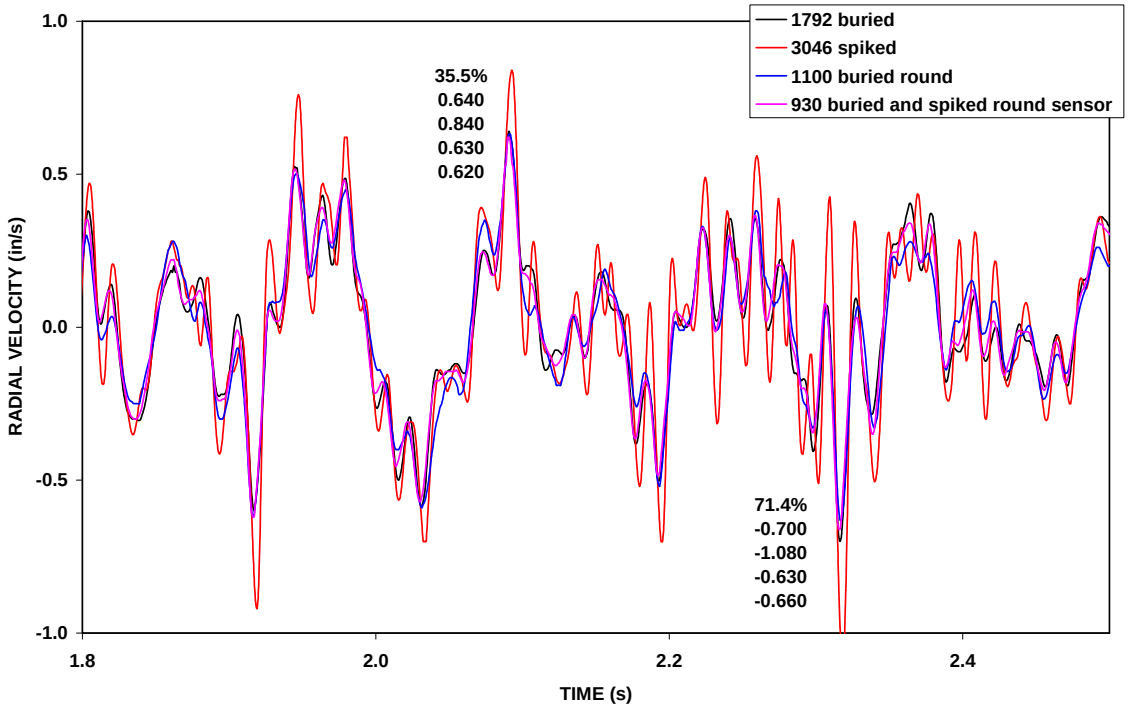

3487 buried
2279 spiked
TRANSVERSE VELOCITY (in/s)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME (s)

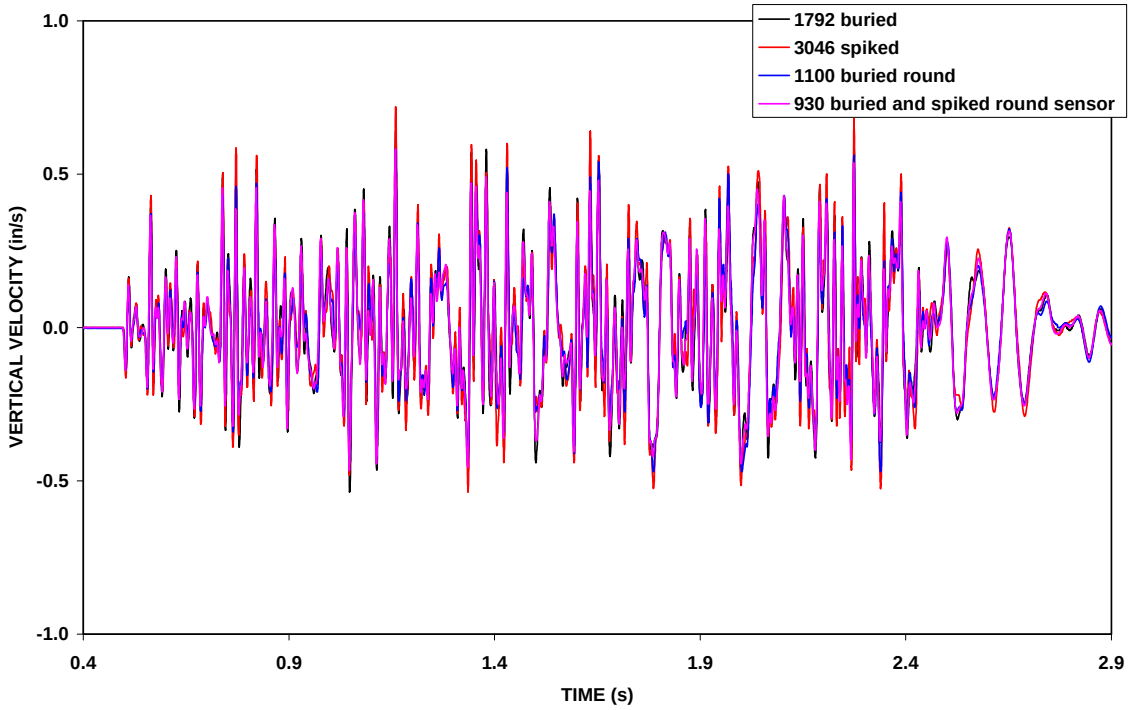

3487 buried
2279 spiked
19.3%
0.285
0.340
28.3%
-0.265
-0.340
TRANSVERSE VELOCITY (in/s)
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
TIME (s)

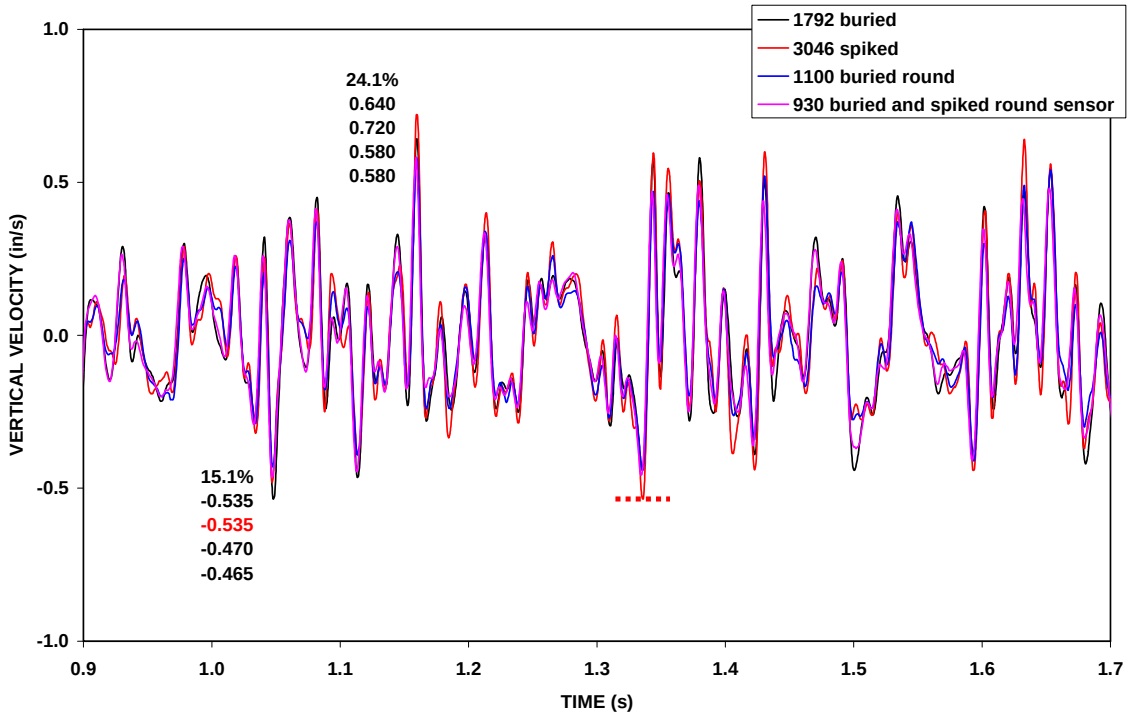
KY-5

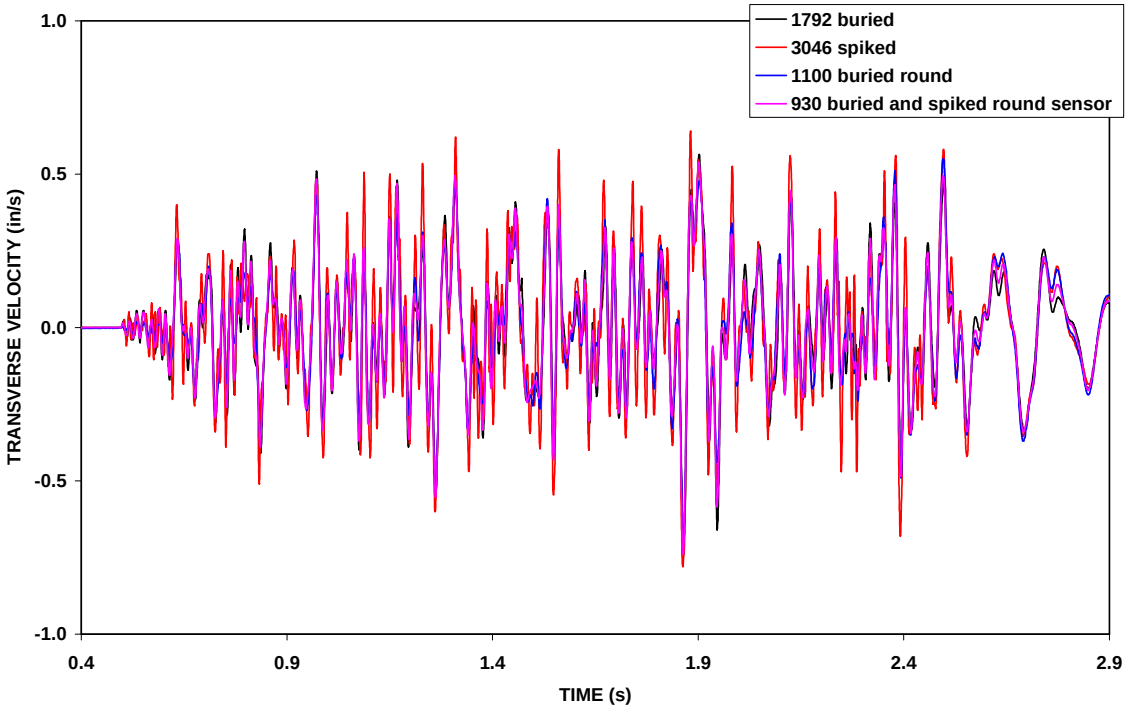
Cluster 1 SD 51.5 ft/lb$^{1/2}$

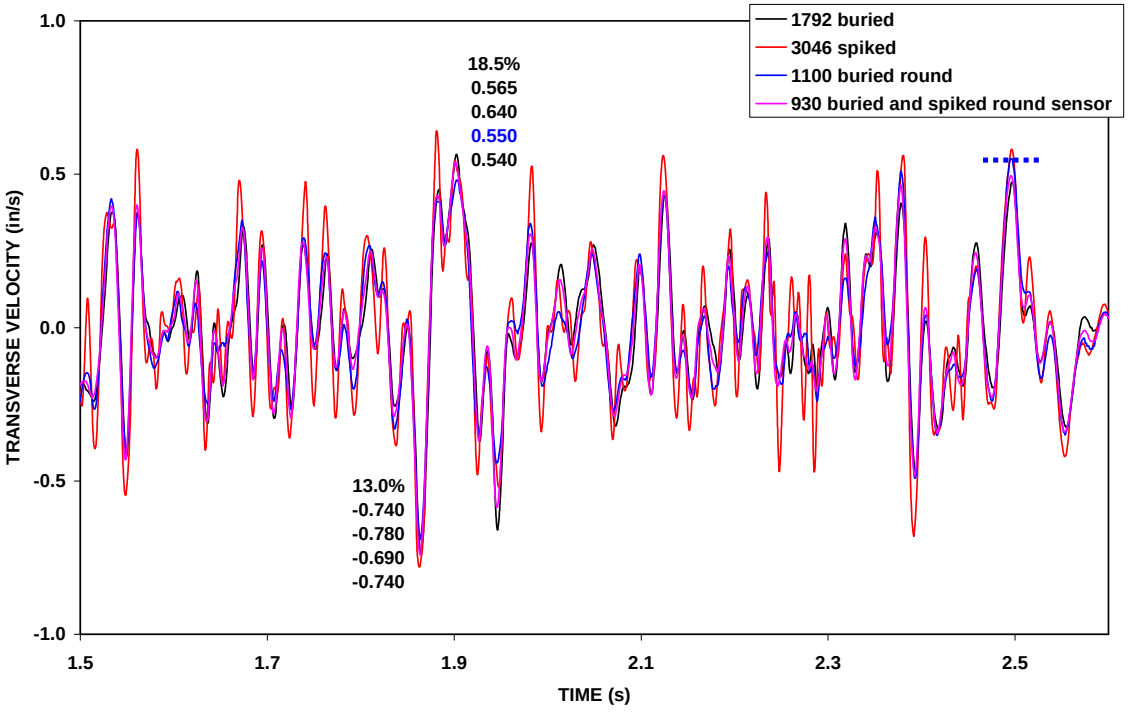

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
RADIAL VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.9
1.4
1.9
2.4
2.9
TIME (s)

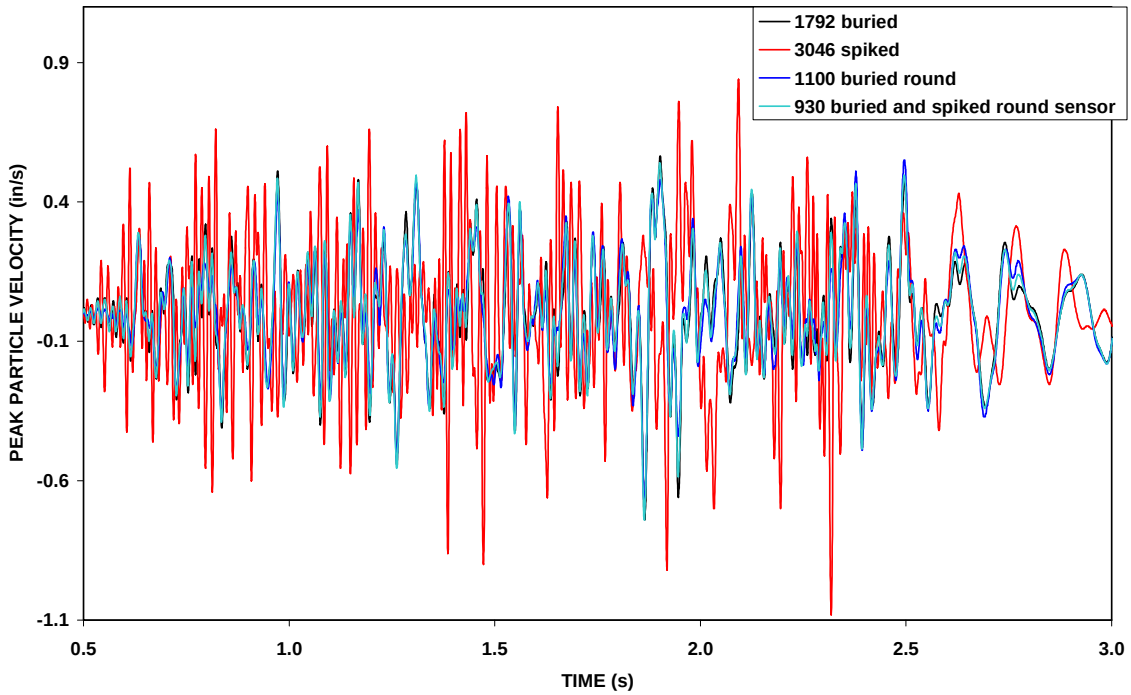

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
35.5%
0.640
0.840
0.630
0.620
71.4%
-0.700
-1.080
-0.630
-0.660
RADIAL VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
1.8
2.0
2.2
2.4
TIME (s)

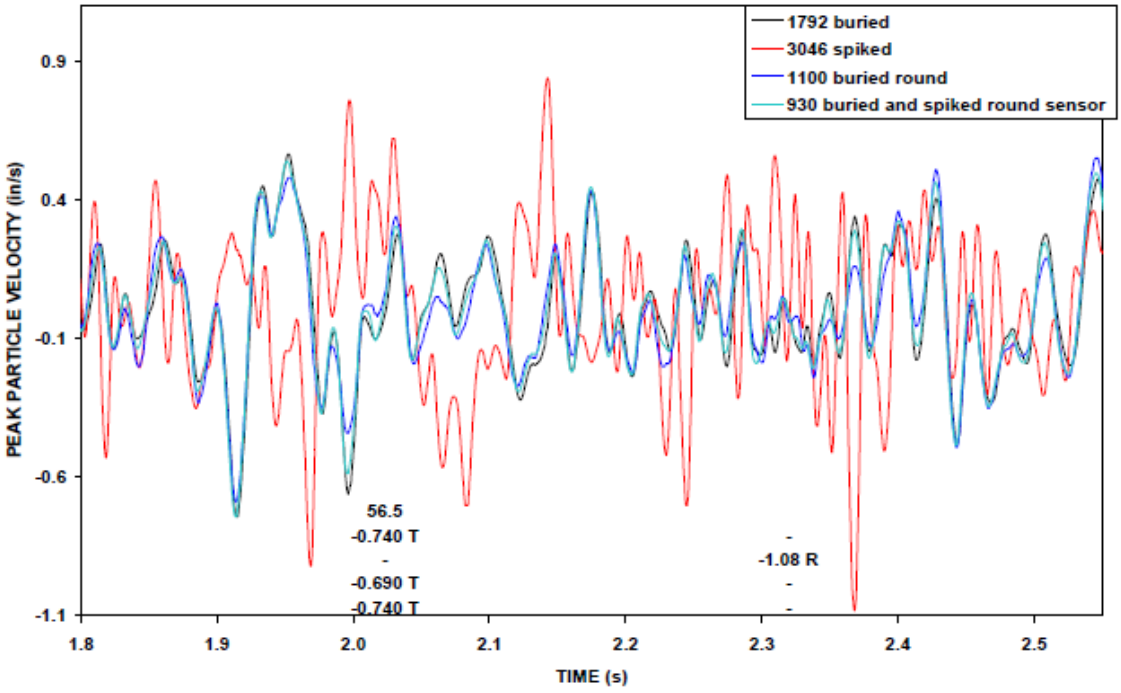

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
VERTICAL VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.9
1.4
1.9
2.4
2.9
TIME (s)


1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
24.1%
0.640
0.720
0.580
0.580
15.1%
-0.535
-0.535
-0.470
-0.465
VERTICAL VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
TIME (s)


1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
TRANSVERSE VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.9
1.4
1.9
2.4
2.9
TIME (s)

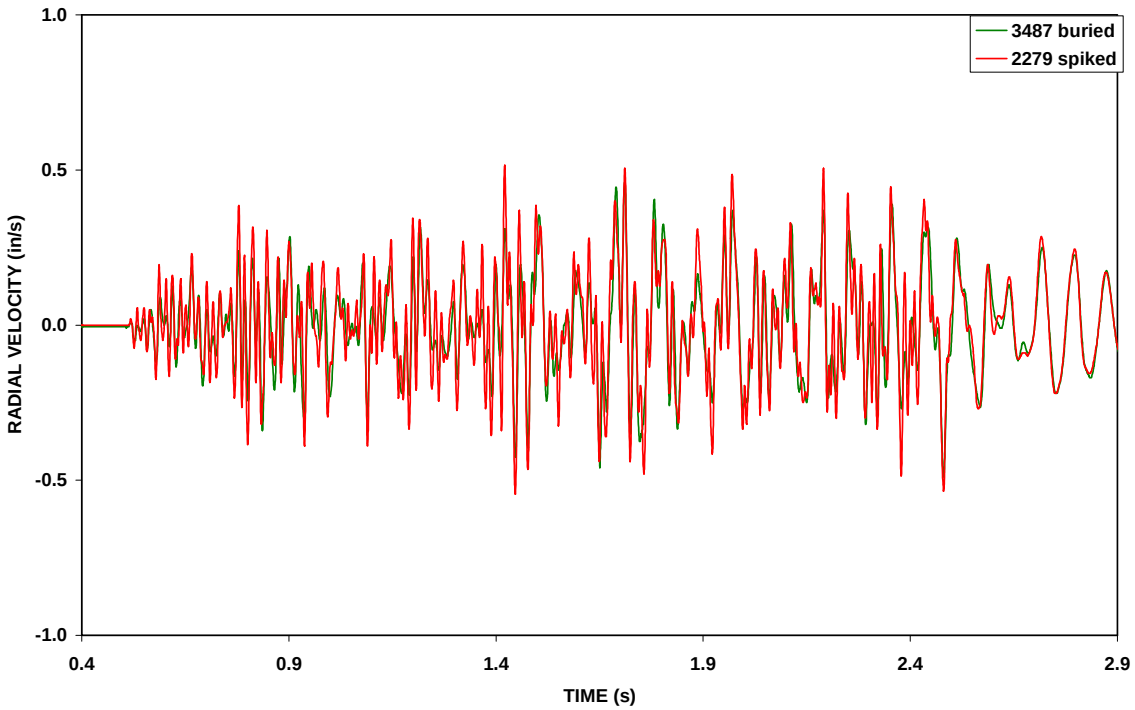

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
18.5%
0.565
0.640
0.550
0.540
13.0%
-0.740
-0.780
-0.690
-0.740
TRANSVERSE VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
1.5
1.7
1.9
2.1
2.3
2.5
TIME (s)

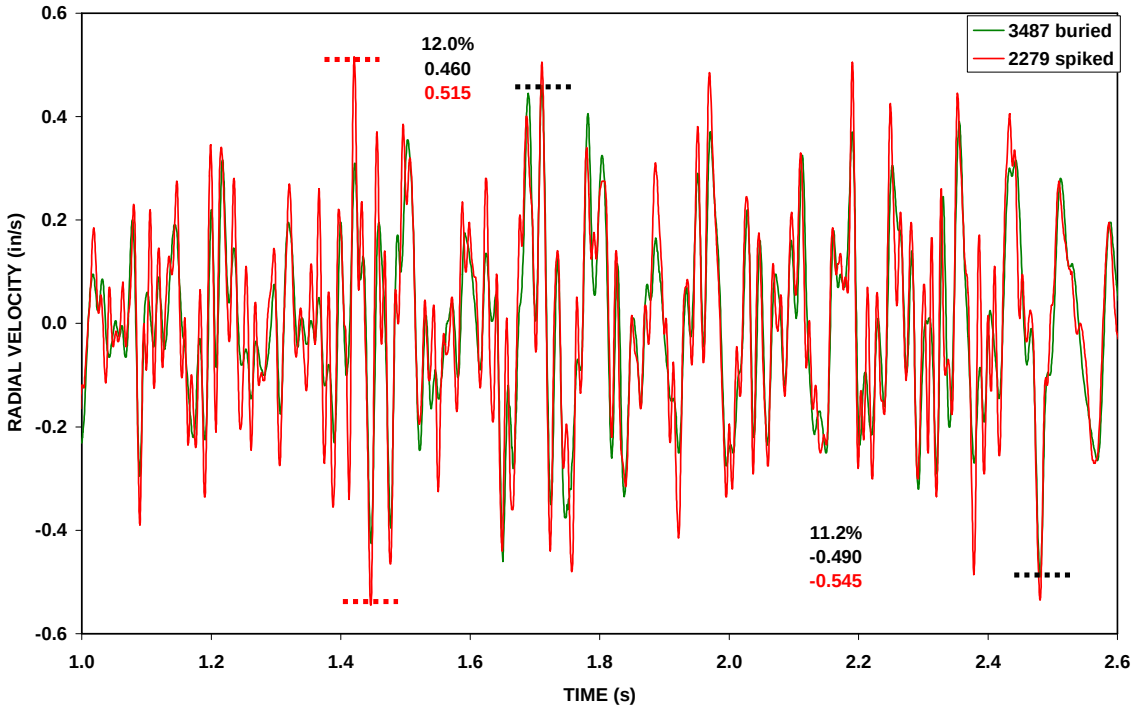

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
0.9
0.4
-0.1
-0.6
-1.1
0.5
1.0
1.5
2.0
2.5
3.0
TIME (s)

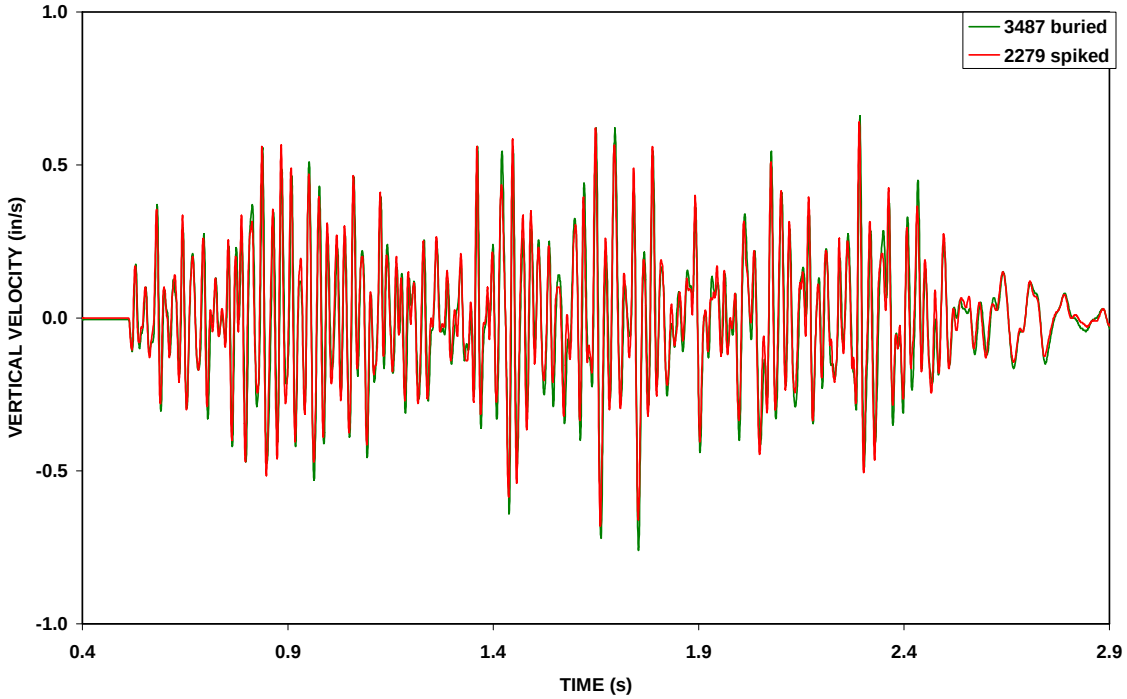

1792 buried
3046 spiked
1100 buried round
930 buried and spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
0.9
0.4
-0.1
-0.6
-1.1
56.5
-0.740 T
-
-0.690 T
-0.740 T
-
-1.08 R
-
-
1.8
1.9
2.0
2.1
2.2
2.3
2.4
2.5
TIME (s)

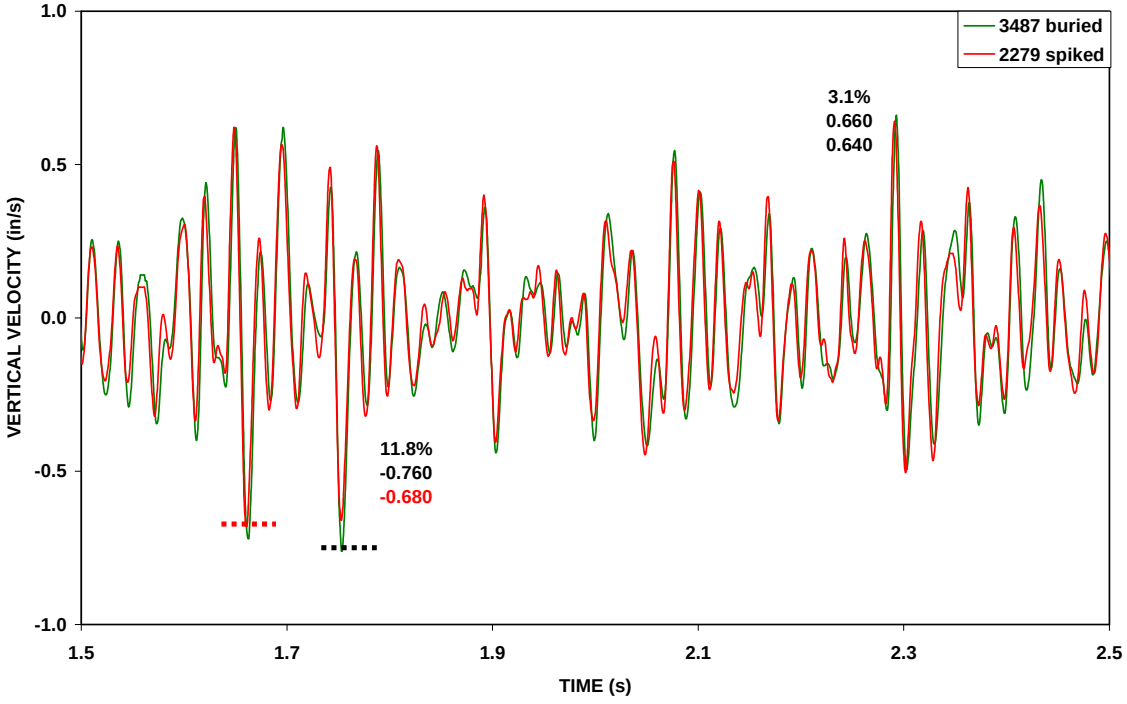
KY-5

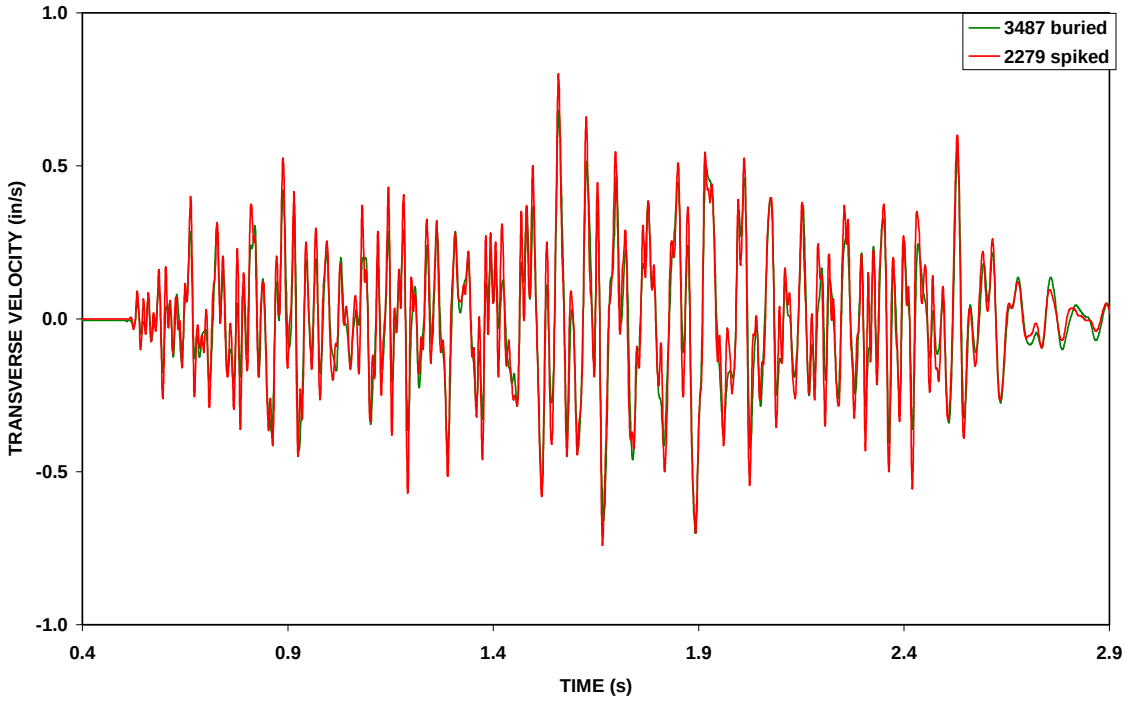
Cluster 2 SD 65.3 ft/lb$^{1/2}$

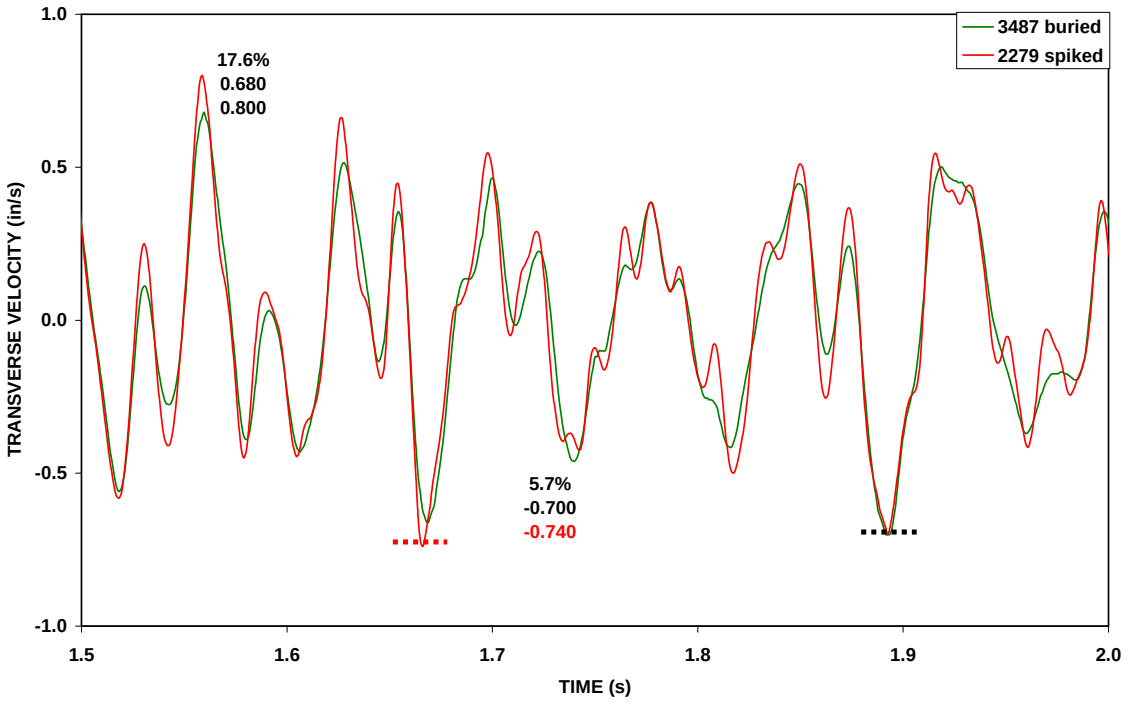

3487 buried
2279 spiked
RADIAL VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.9
1.4
1.9
2.4
2.9
TIME (s)


3487 buried
2279 spiked
12.0%
0.460
0.515
11.2%
-0.490
-0.545
RADIAL VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
TIME (s)


3487 buried
2279 spiked
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.9
1.4
1.9
2.4
2.9

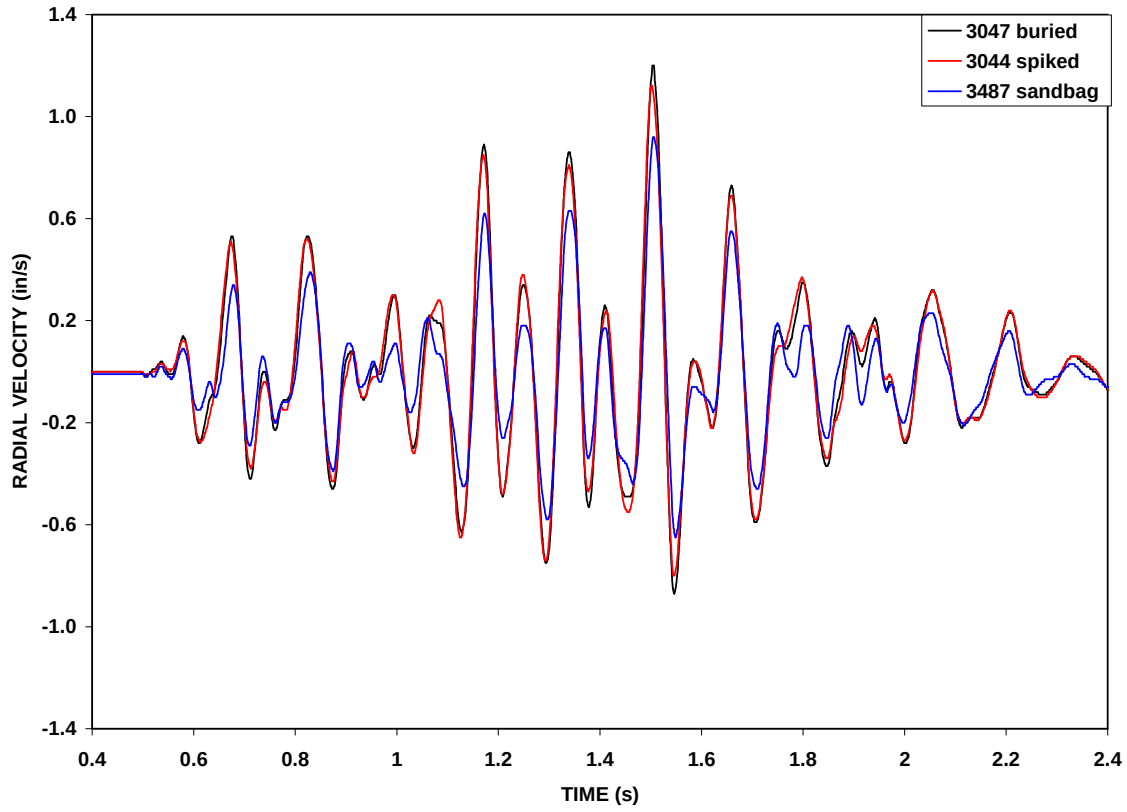

3487 buried
2279 spiked
3.1%
0.660
0.640
11.8%
-0.760
-0.680
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
1.5
1.7
1.9
2.1
2.3
2.5

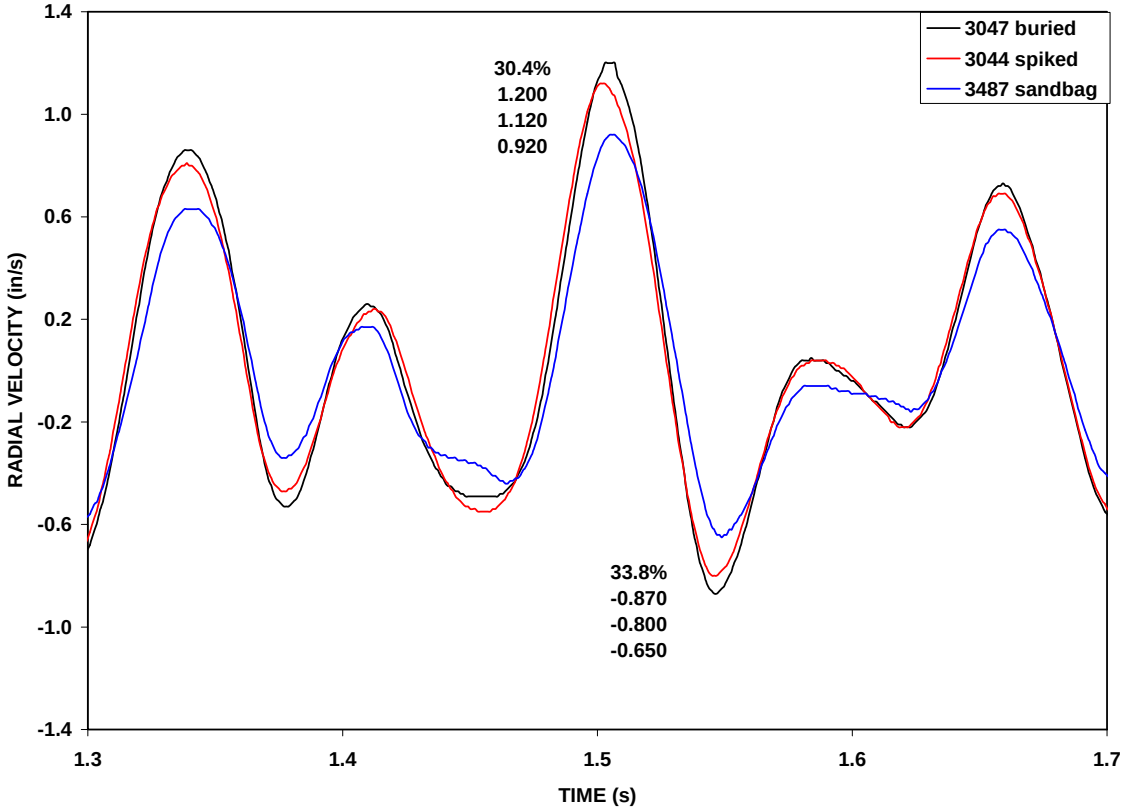

3487 buried
2279 spiked
TRANSVERSE VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.9
1.4
1.9
2.4
2.9
TIME (s)

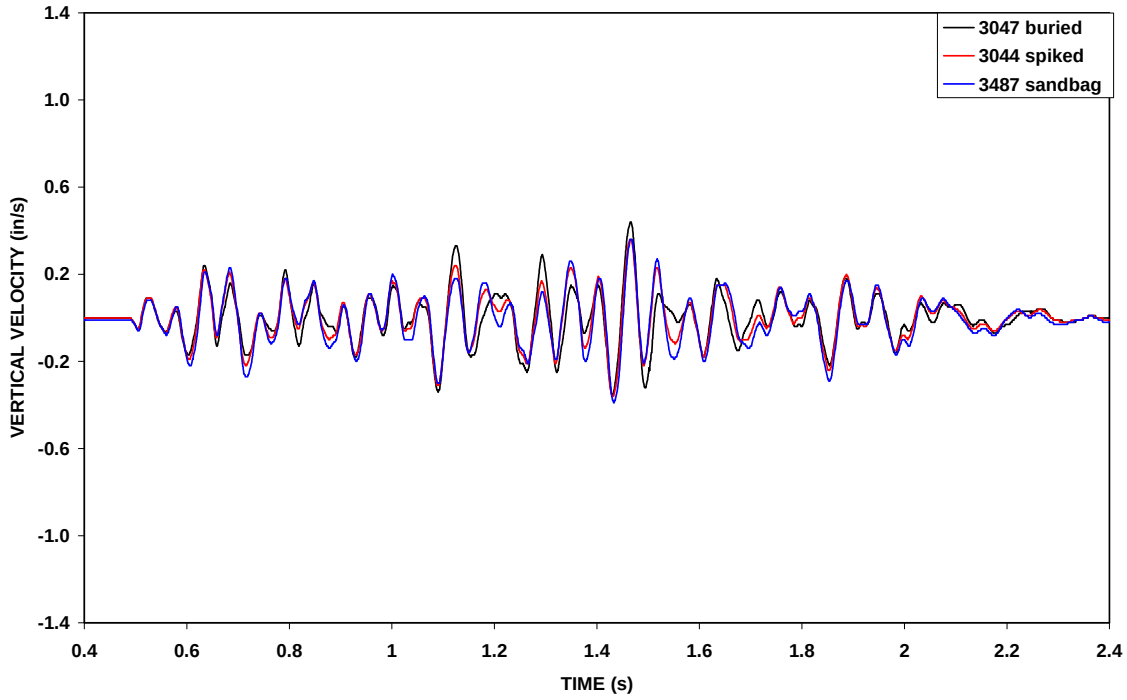

3487 buried
2279 spiked
17.6%
0.680
0.800
5.7%
-0.700
-0.740
TRANSVERSE VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
1.5
1.6
1.7
1.8
1.9
2.0
TIME (s)

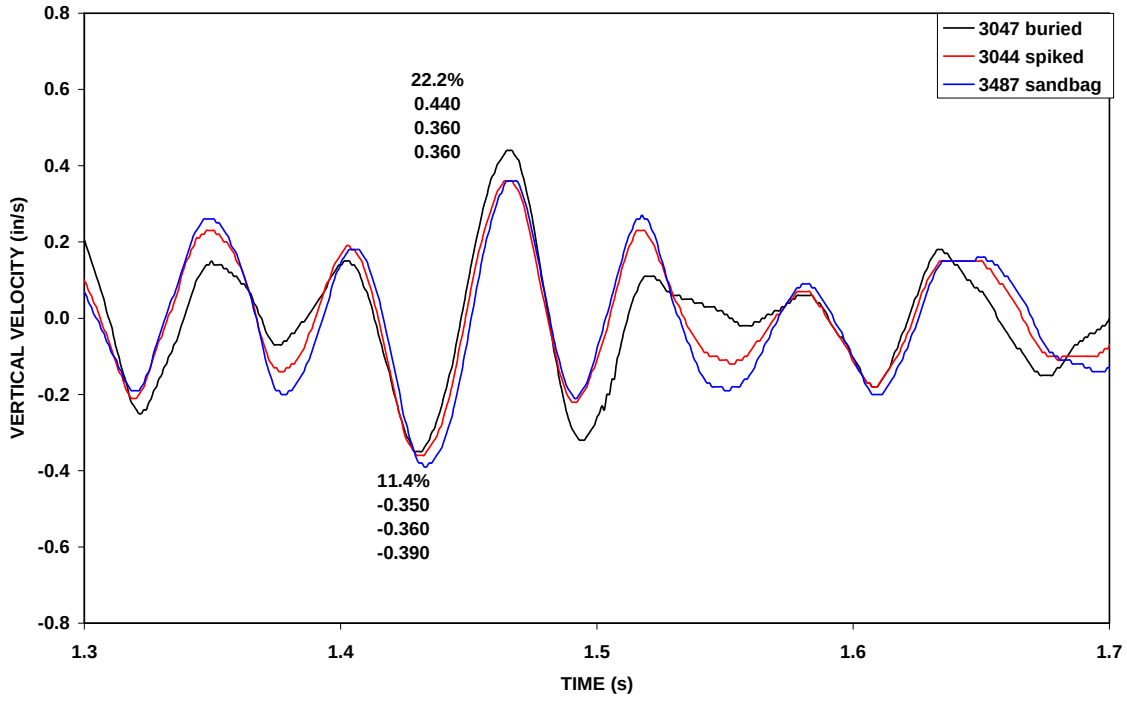
KY-6

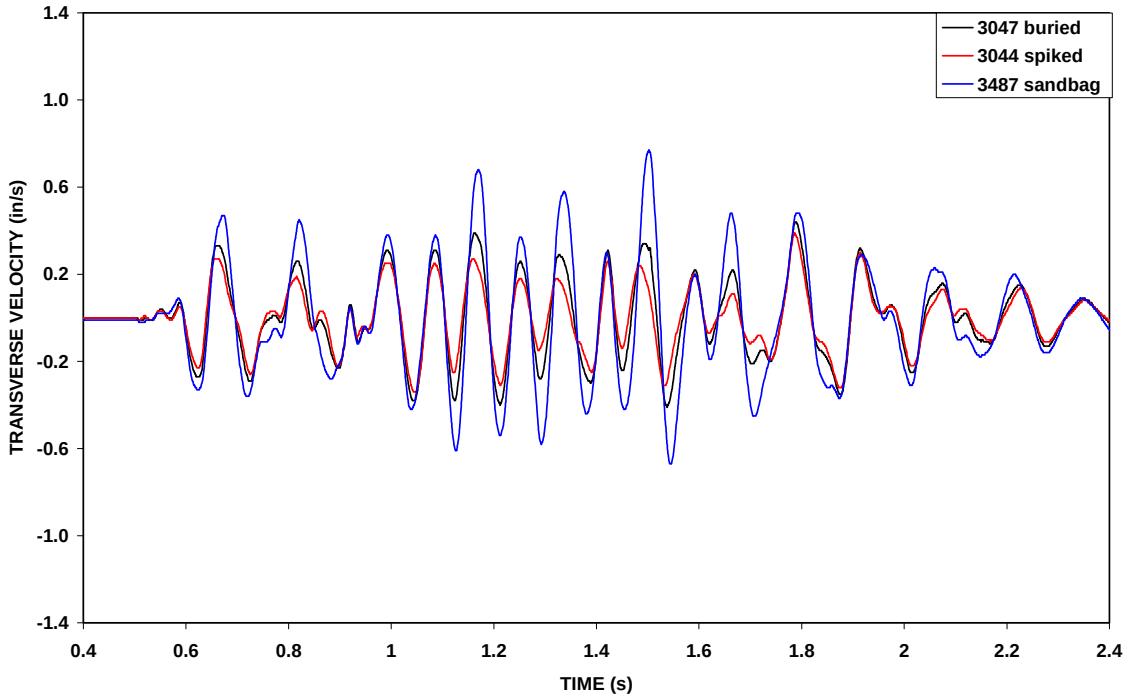
Cluster 1 SD 33.8 ft/lb$^{1/2}$

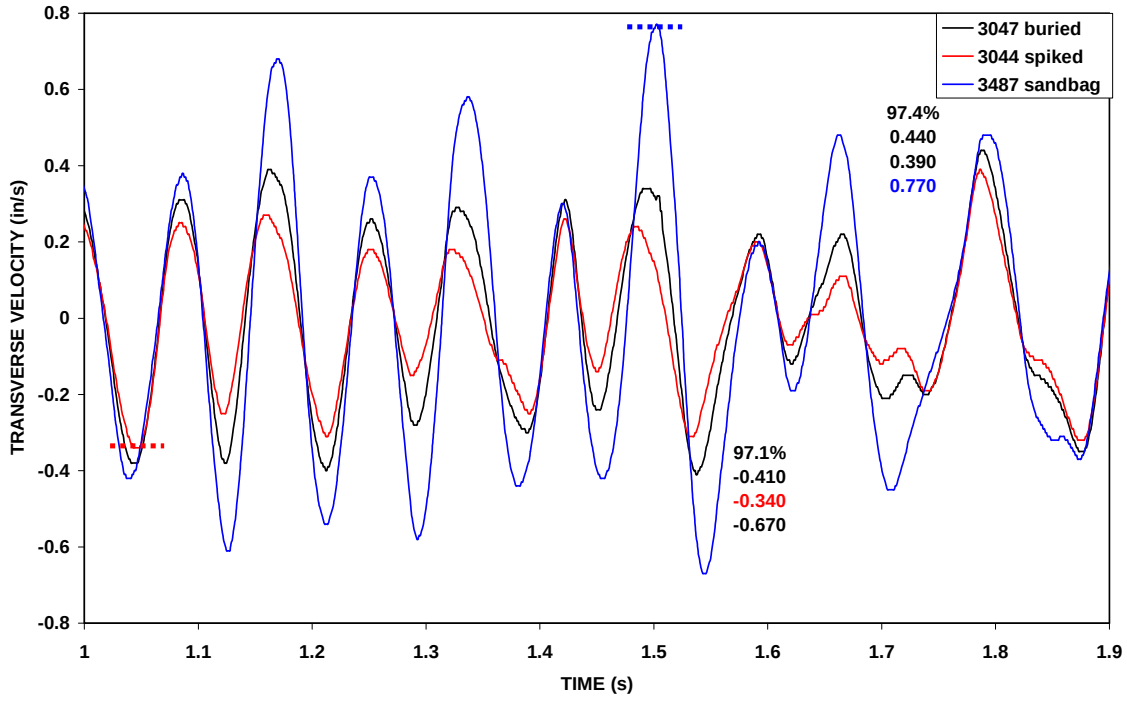

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.4
1.0
0.6
0.2
-0.2
-0.6
-1.0
-1.4
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4


3047 buried
3044 spiked
3487 sandbag
30.4%
1.200
1.120
0.920
33.8%
-0.870
-0.800
-0.650
RADIAL VELOCITY (in/s)
TIME (s)
1.4
1.0
0.6
0.2
-0.2
-0.6
-1.0
-1.4
1.3
1.4
1.5
1.6
1.7


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1.4
1.0
0.6
0.2
-0.2
-0.6
-1.0
-1.4
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4

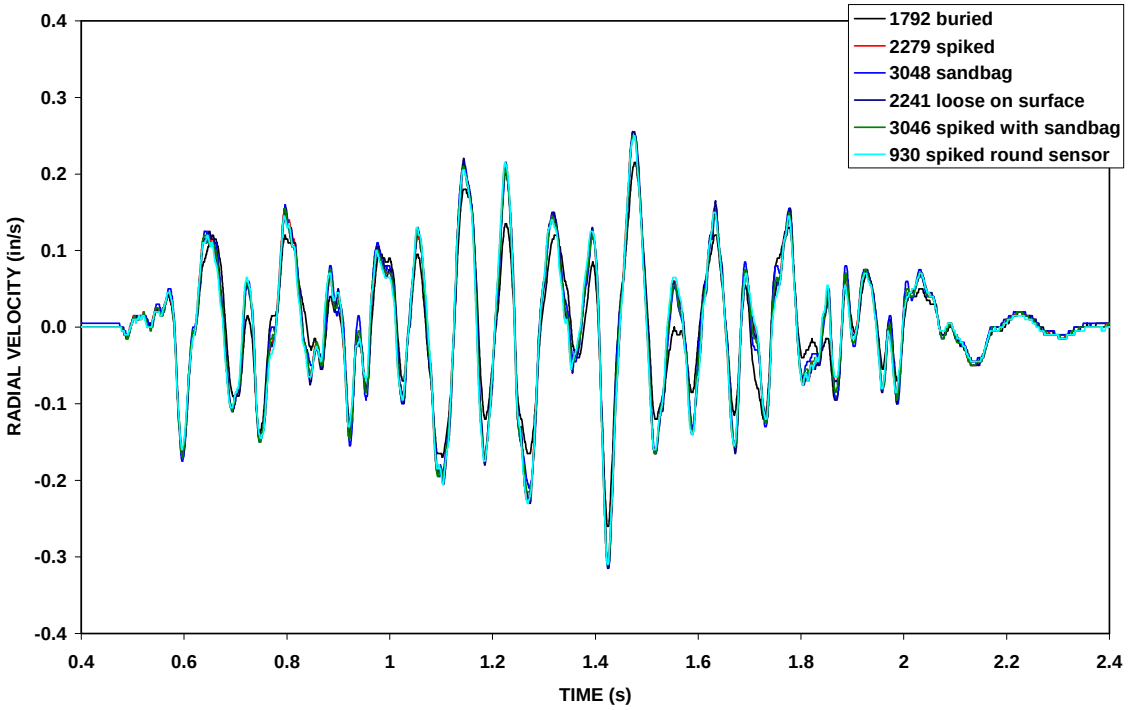

3047 buried
3044 spiked
3487 sandbag
22.2%
0.440
0.360
0.360
11.4%
-0.350
-0.360
-0.390
VERTICAL VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
1.3
1.4
1.5
1.6
1.7

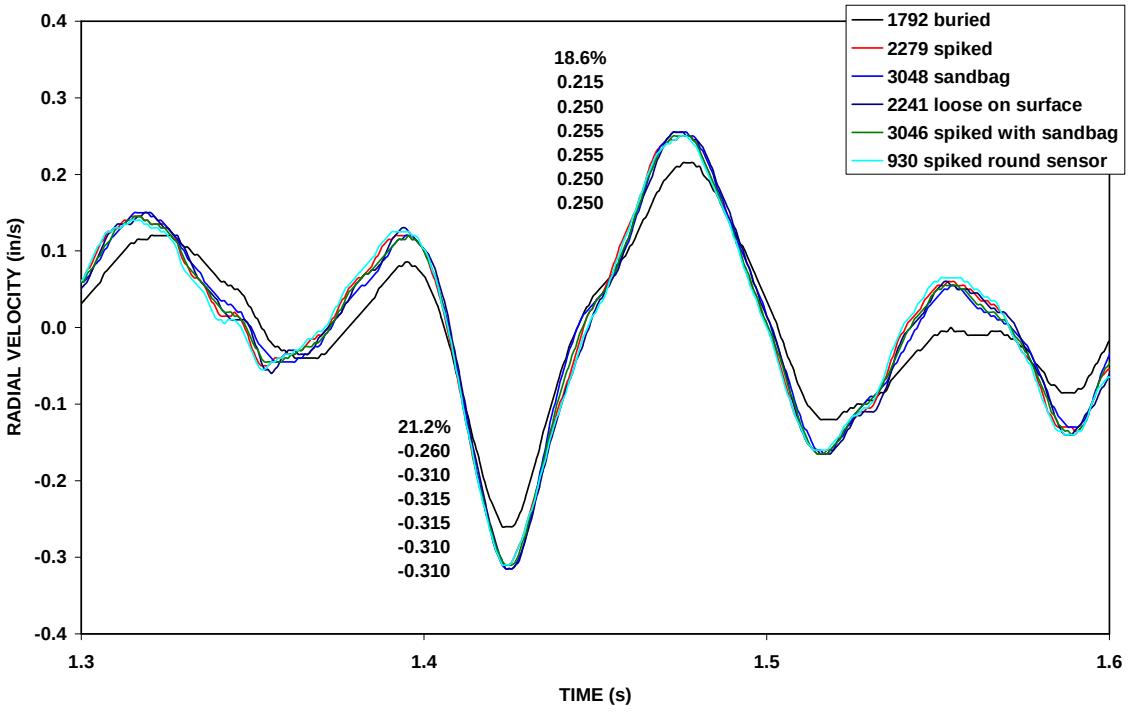

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.4
1.0
0.6
0.2
-0.2
-0.6
-1.0
-1.4
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4

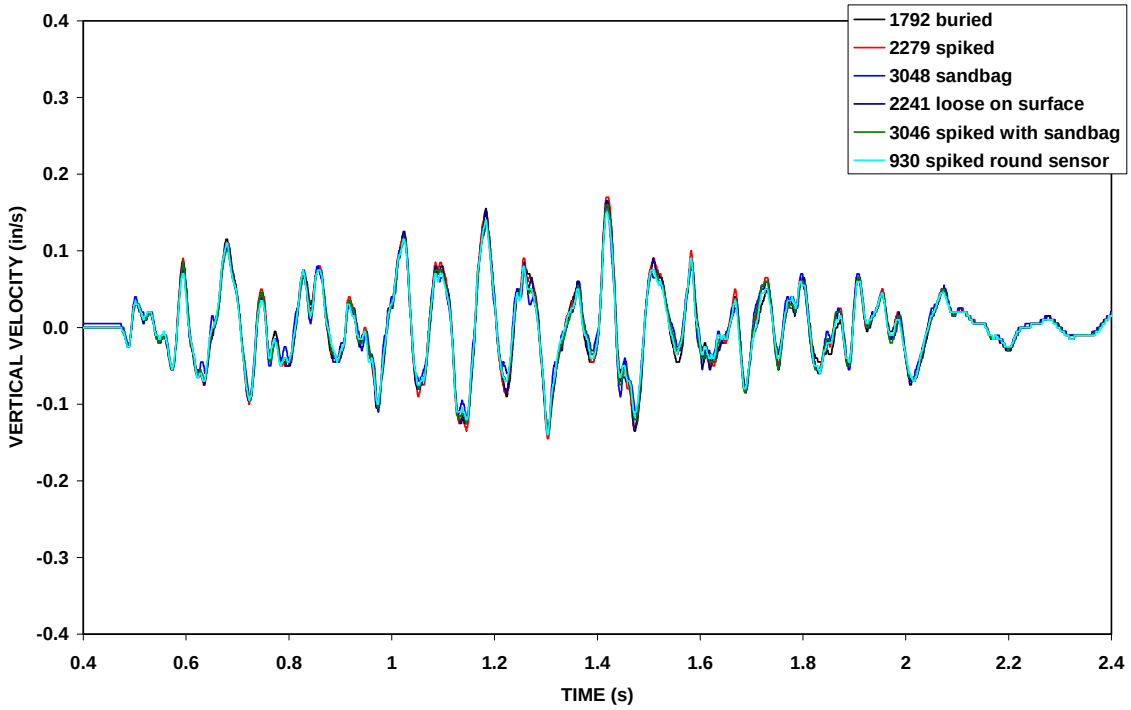

3047 buried
3044 spiked
3487 sandbag
97.4%
0.440
0.390
0.770
97.1%
-0.410
-0.340
-0.670
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9

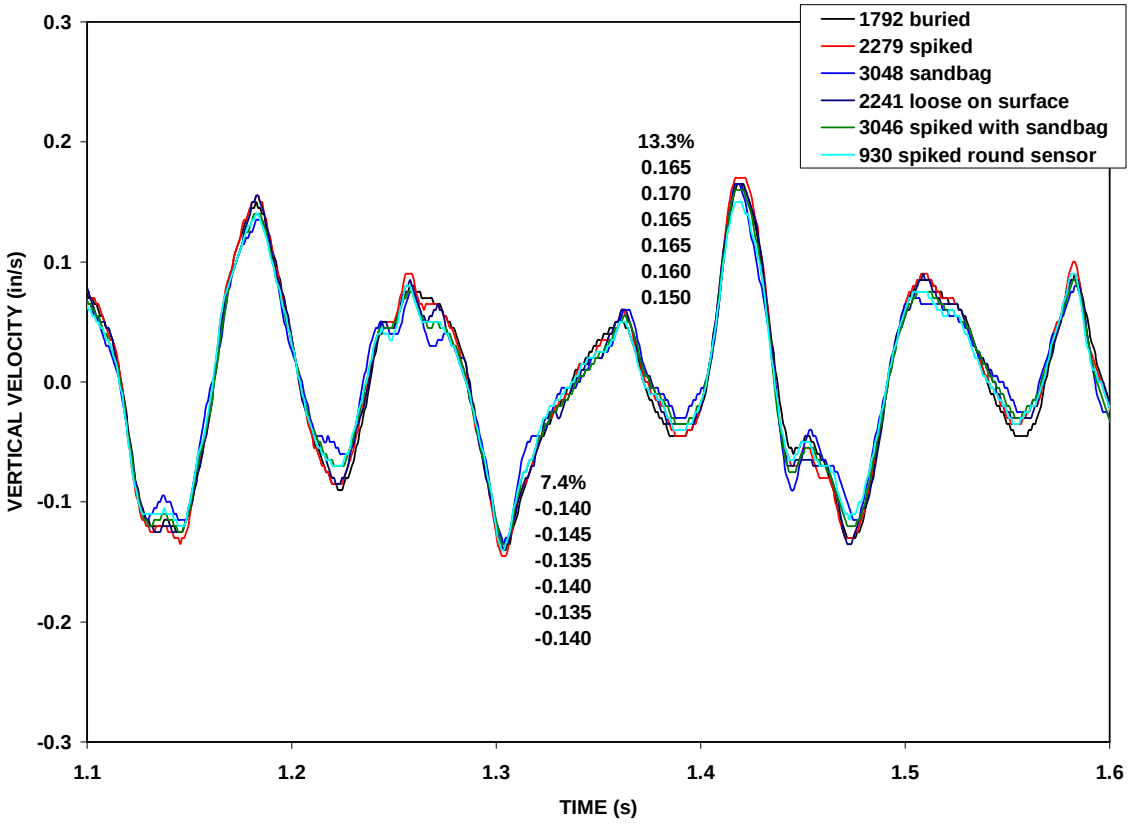
KY-6

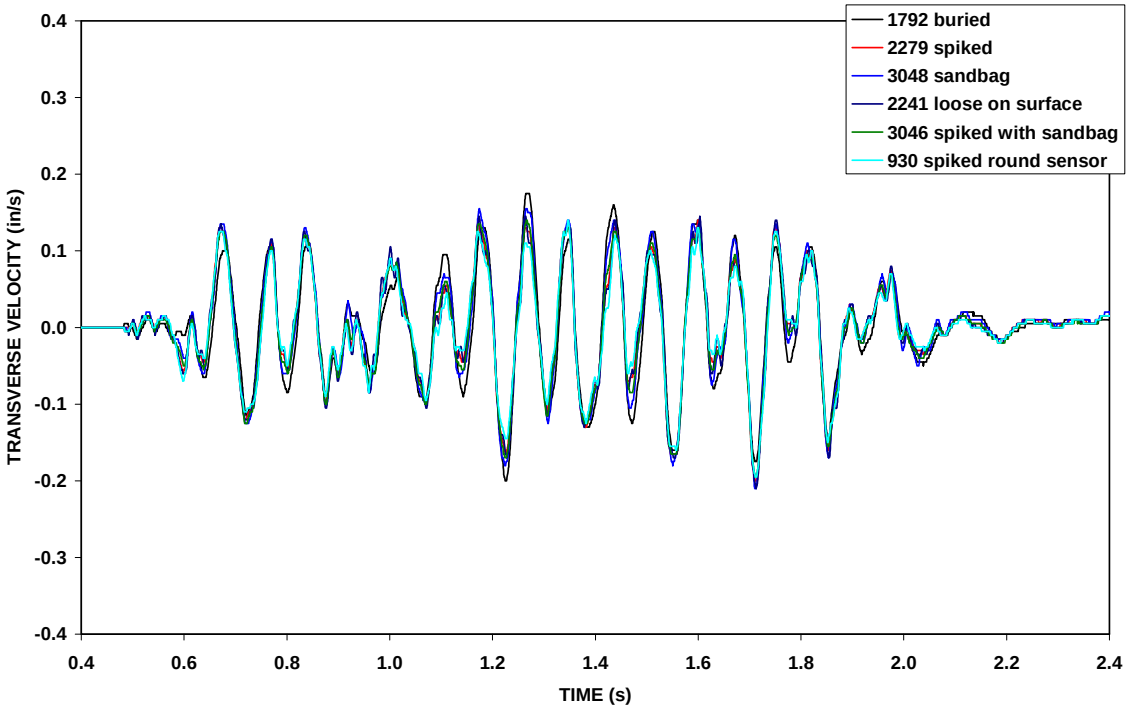
Cluster 2 SD 47.0 ft/lb$^{1/2}$

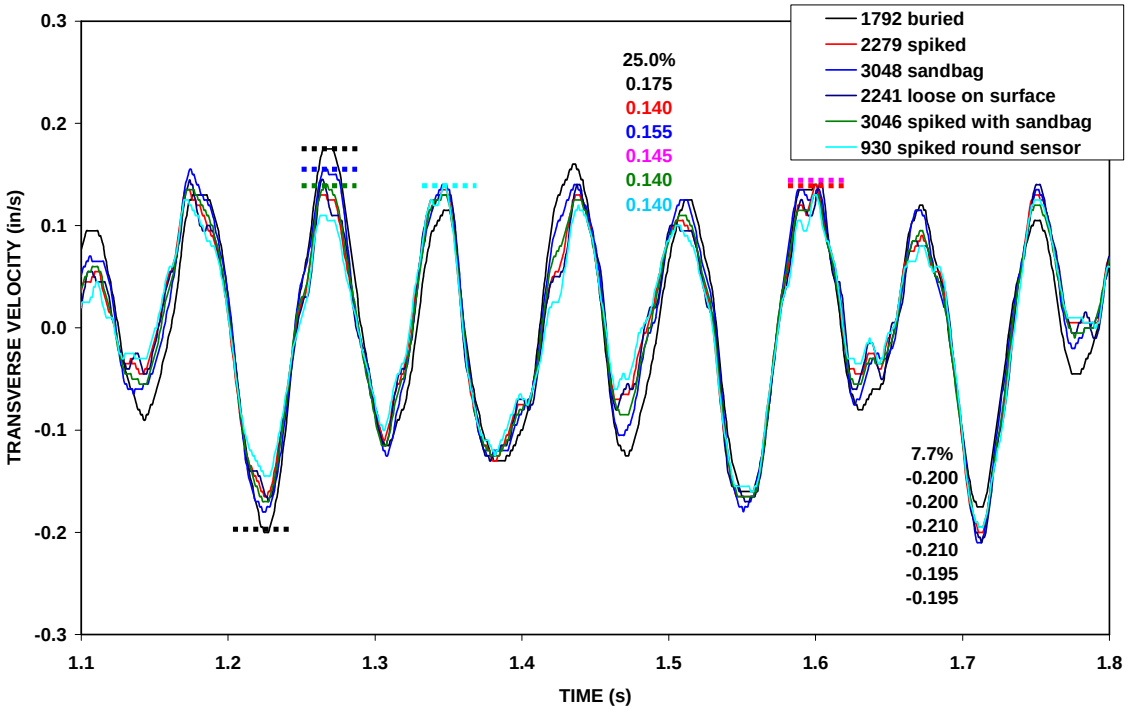

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
TIME (s)

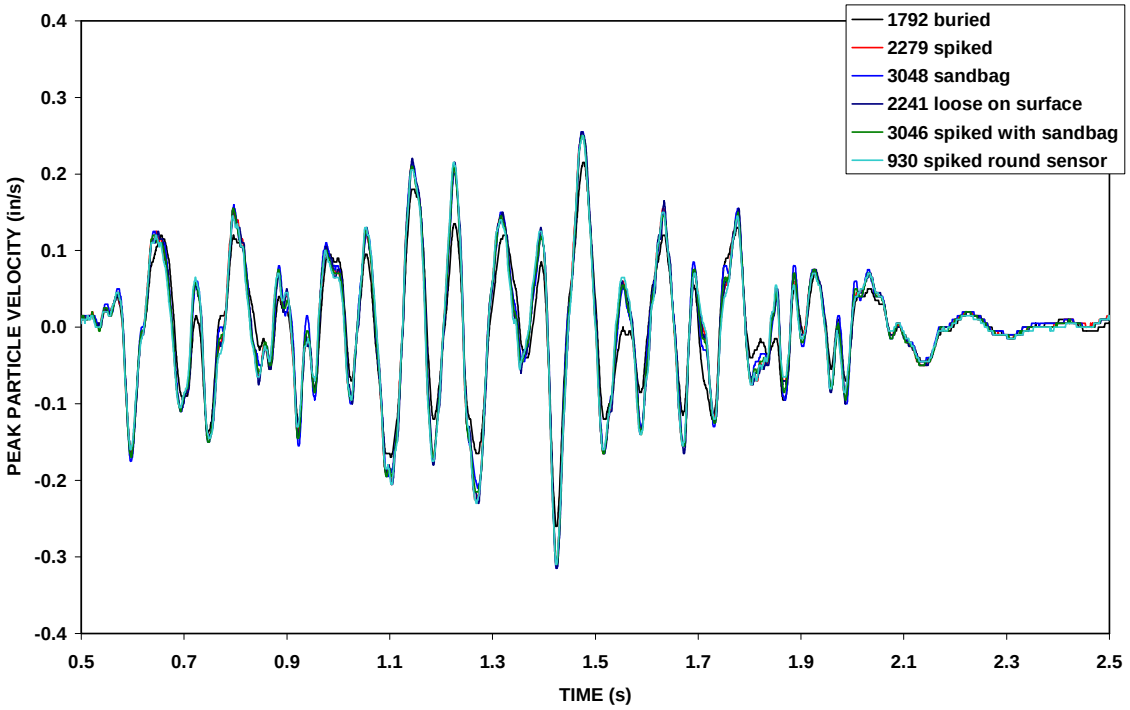

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
18.6%
0.215
0.250
0.255
0.255
0.250
0.250
21.2%
-0.260
-0.310
-0.315
-0.315
-0.310
-0.310
RADIAL VELOCITY (in/s)
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
1.3
1.4
1.5
1.6
TIME (s)

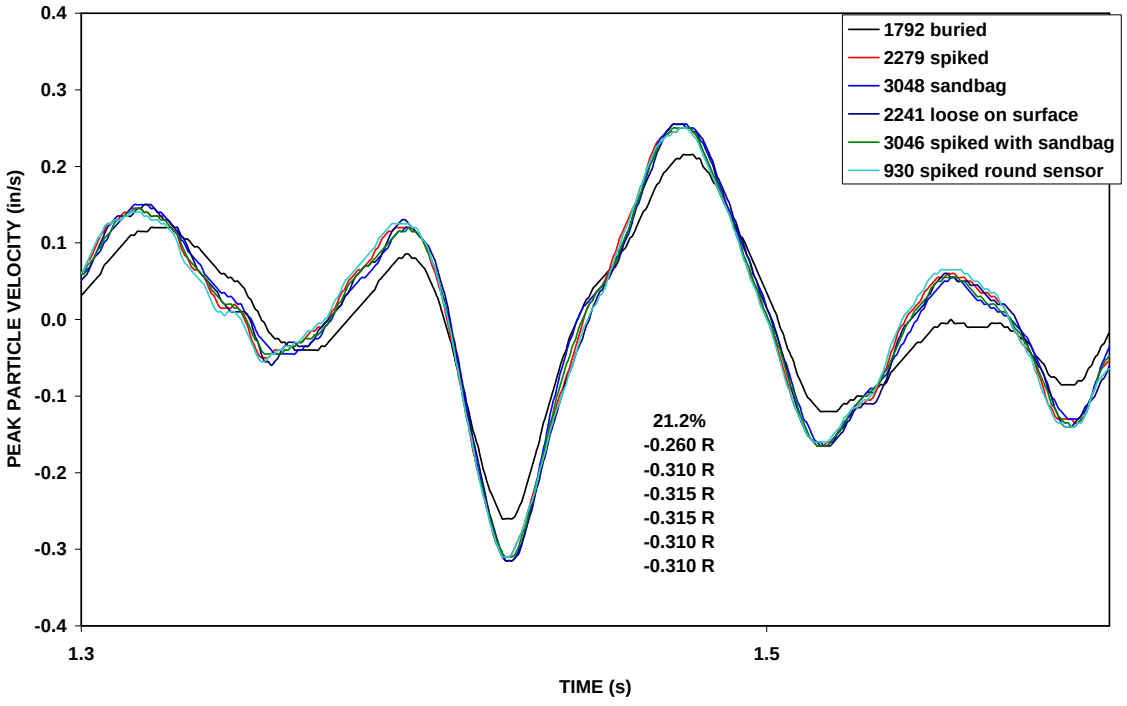

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
13.3%
0.165
0.170
0.165
0.165
0.160
0.150
7.4%
-0.140
-0.145
-0.135
-0.140
-0.135
-0.140
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
1.1
1.2
1.3
1.4
1.5
1.6


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4

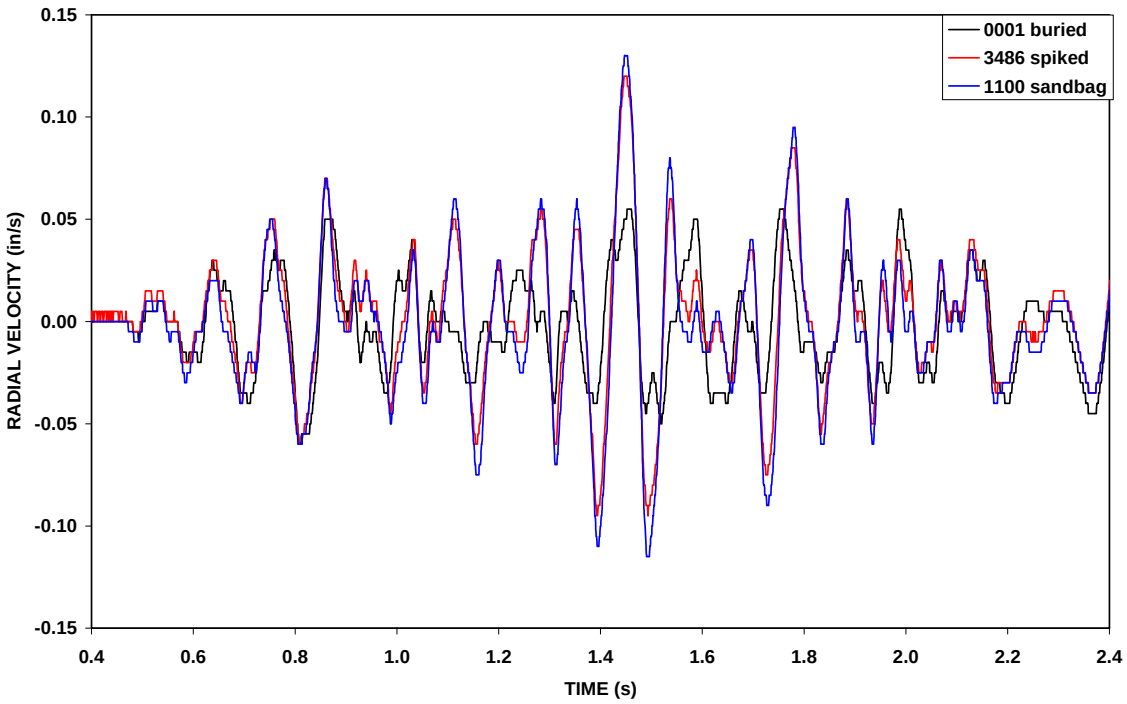

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
25.0%
0.175
0.140
0.155
0.145
0.140
0.140
7.7%
-0.200
-0.200
-0.210
-0.210
-0.195
-0.195
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8

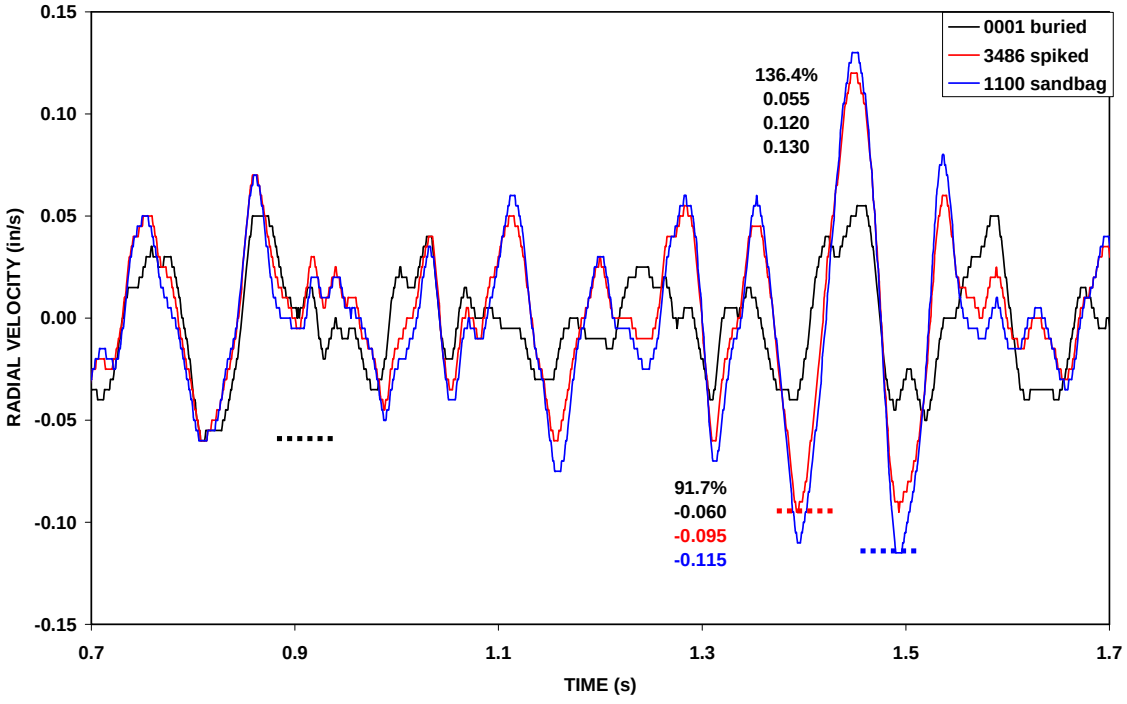

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
0.5
0.7
0.9
1.1
1.3
1.5
1.7
1.9
2.1
2.3
2.5
TIME (s)

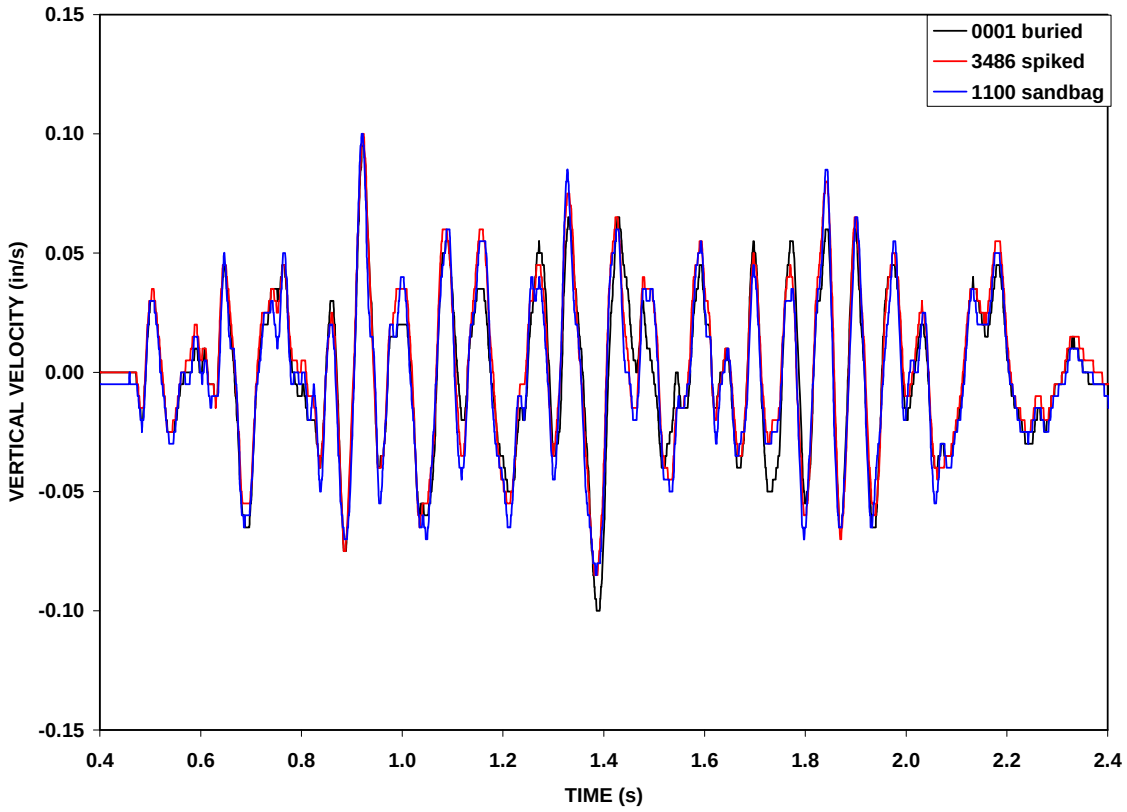

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
21.2%
-0.260 R
-0.310 R
-0.315 R
-0.315 R
-0.310 R
-0.310 R
1.3
1.5
TIME (s)

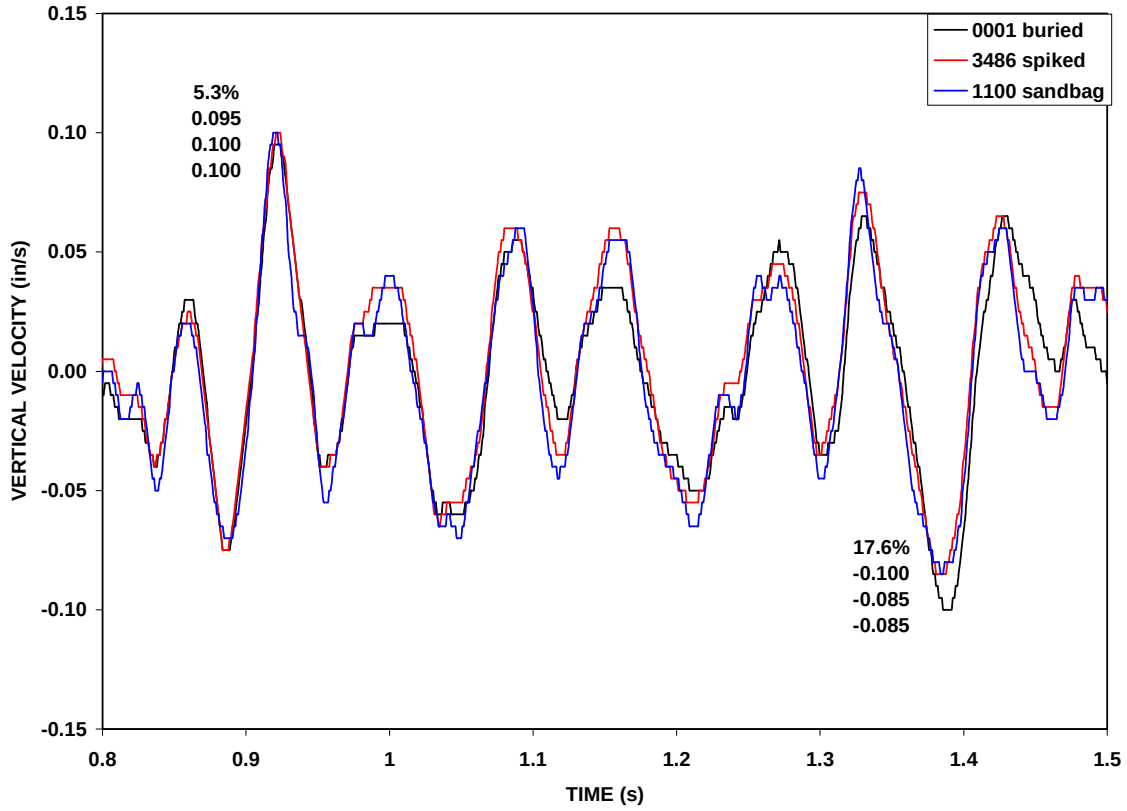
KY-6

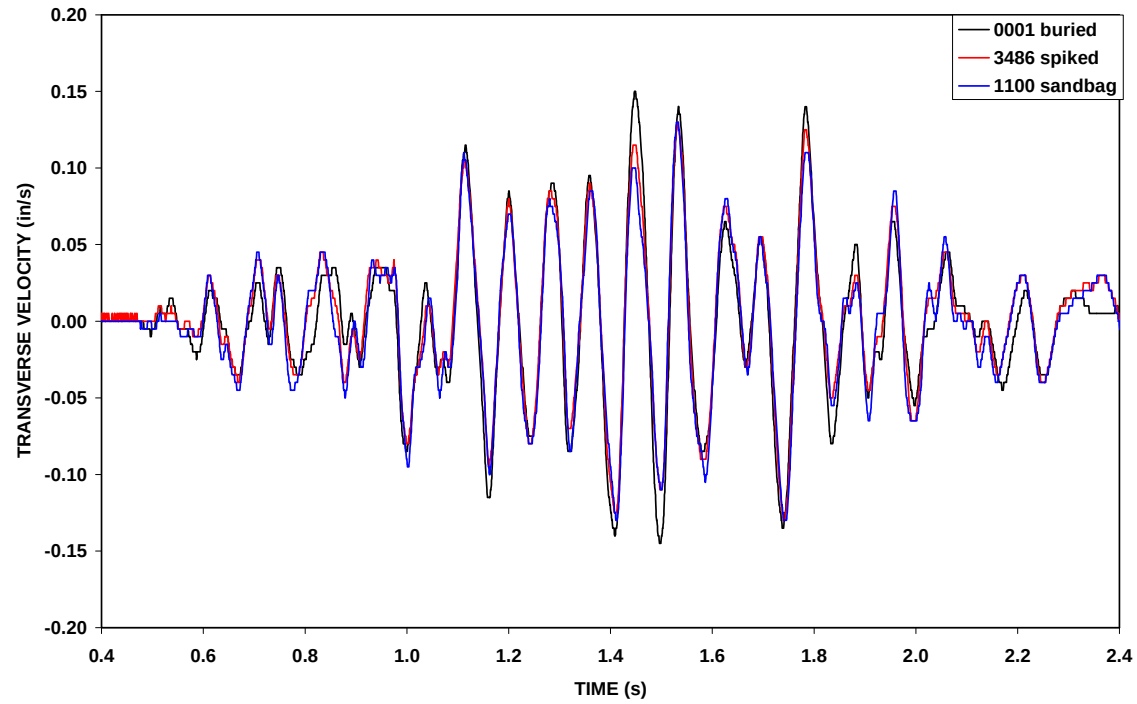
Cluster 3 SD 75.6 ft/lb$^{1/2}$

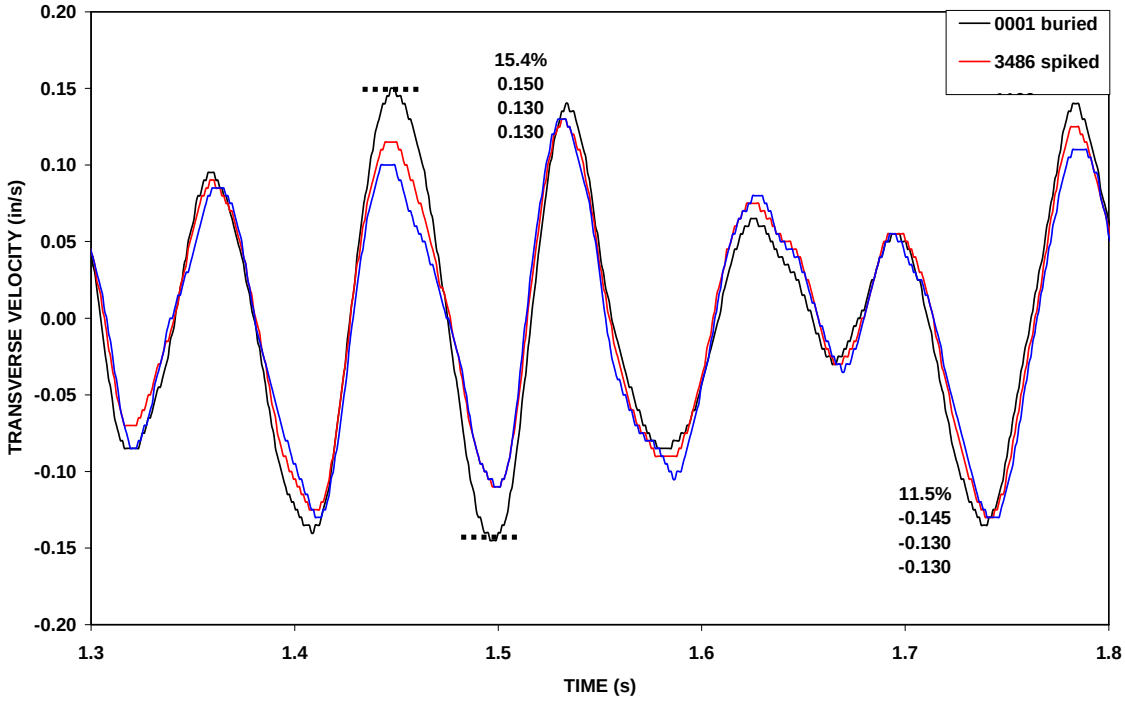

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4


0001 buried
3486 spiked
1100 sandbag
136.4%
0.055
0.120
0.130
91.7%
-0.060
-0.095
-0.115
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.7
0.9
1.1
1.3
1.5
1.7


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4

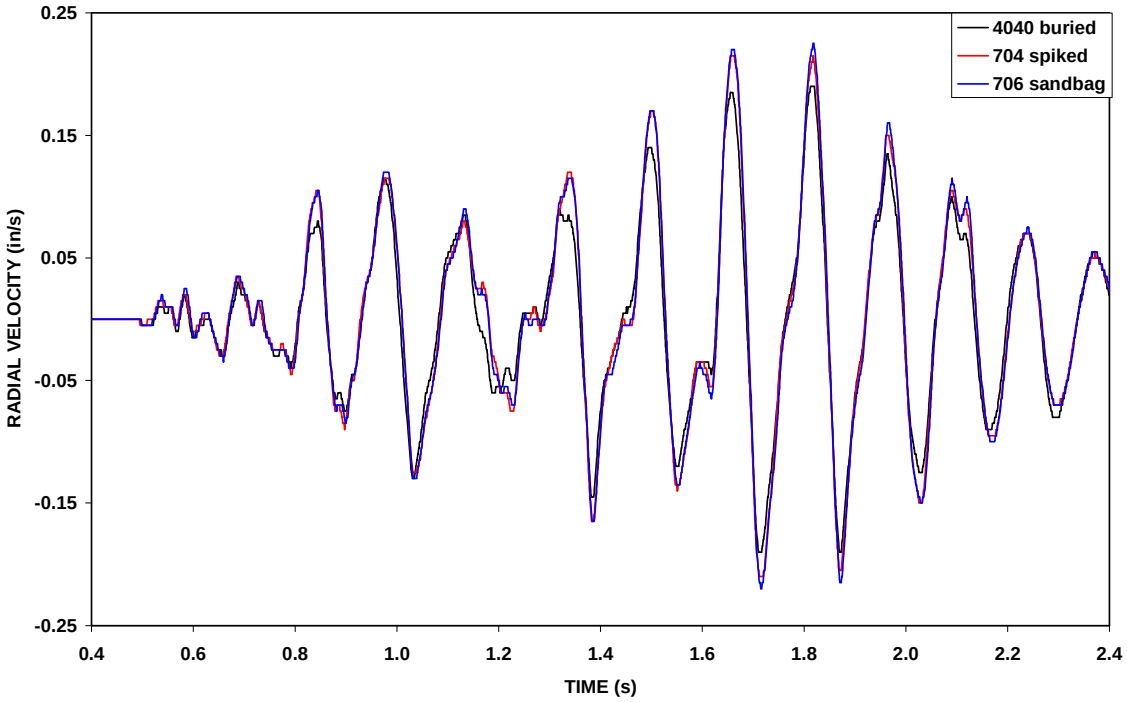

0001 buried
3486 spiked
1100 sandbag
5.3%
0.095
0.100
0.100
17.6%
-0.100
-0.085
-0.085
VERTICAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5

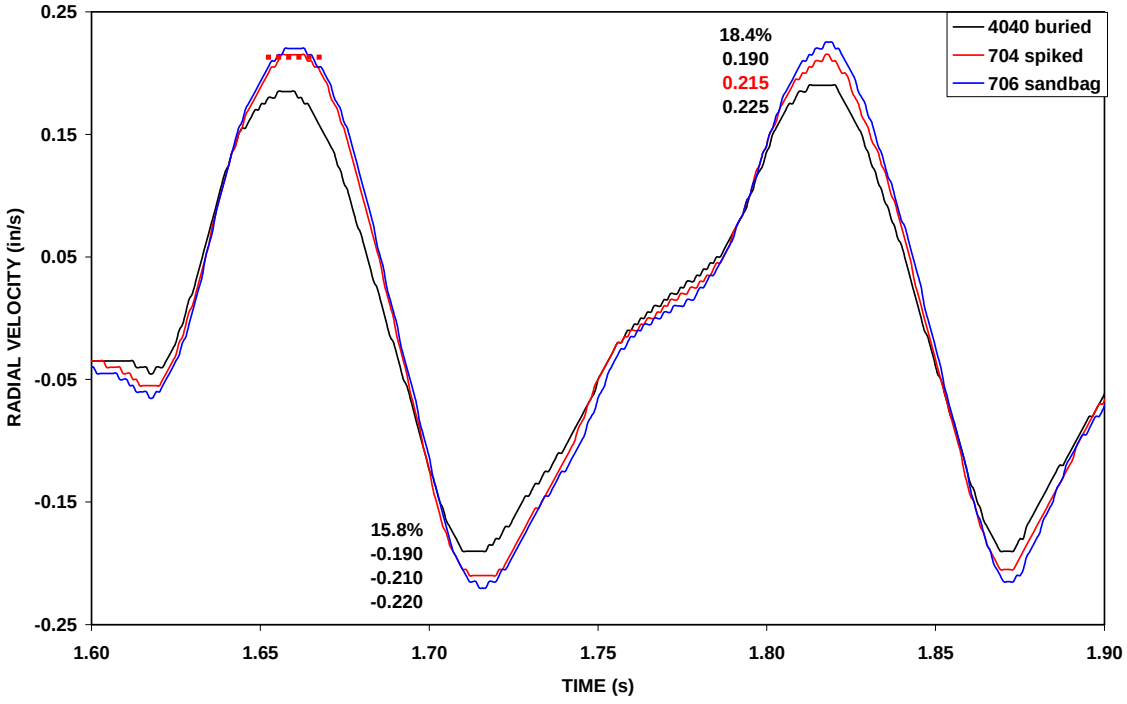

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4

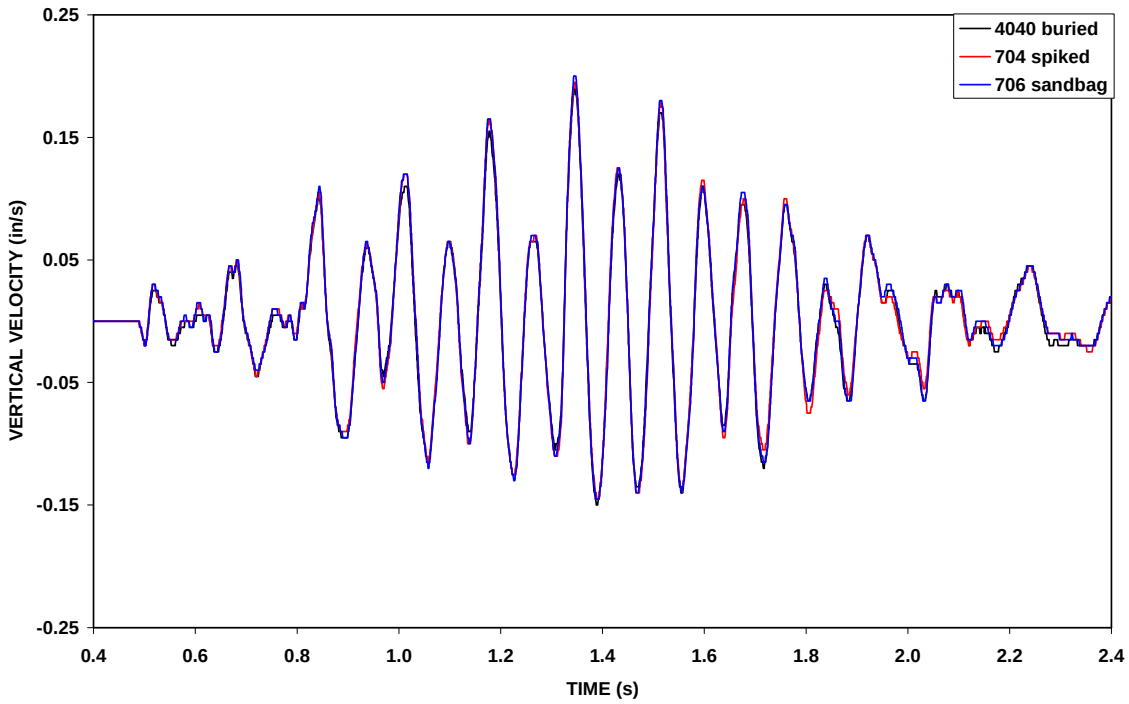

0001 buried
3486 spiked
15.4%
0.150
0.130
0.130
11.5%
-0.145
-0.130
-0.130
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
1.3
1.4
1.5
1.6
1.7
1.8

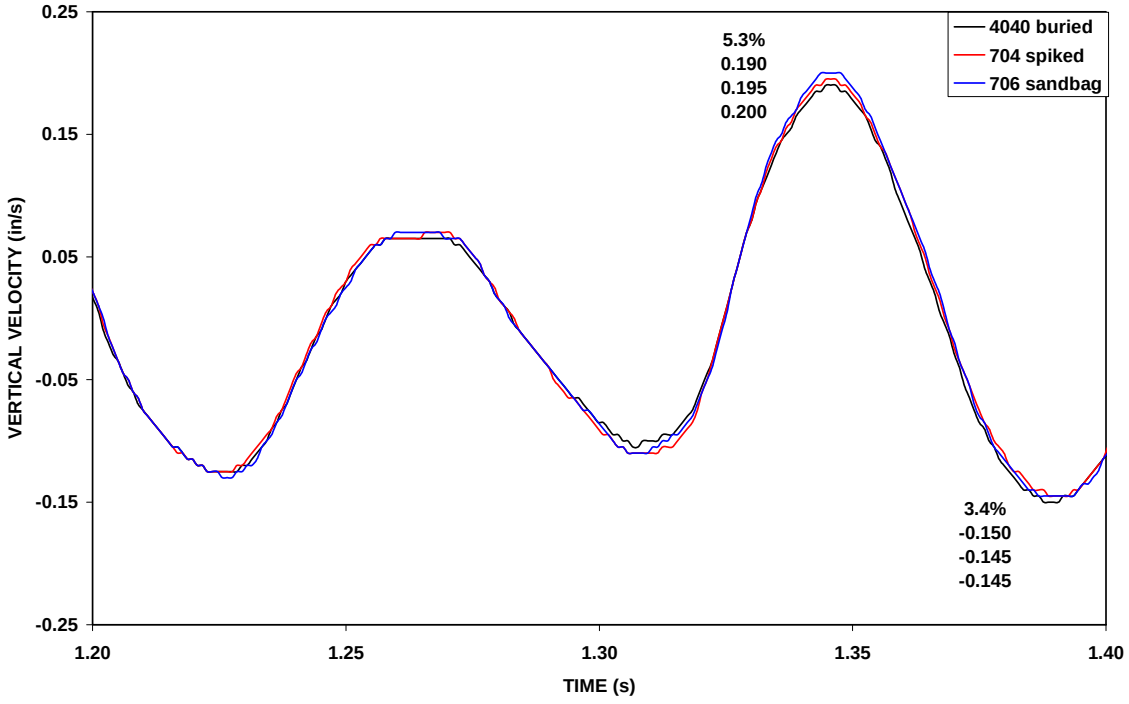
KY-6

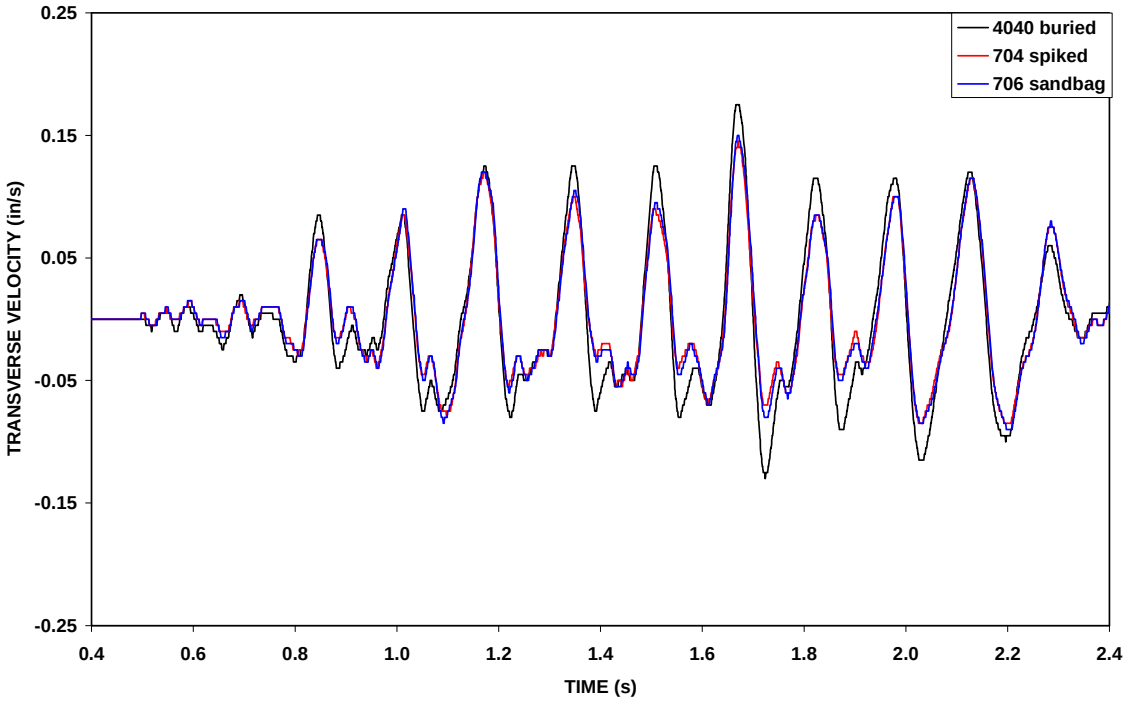
Cluster 4 SD 89.0 ft/lb$^{1/2}$

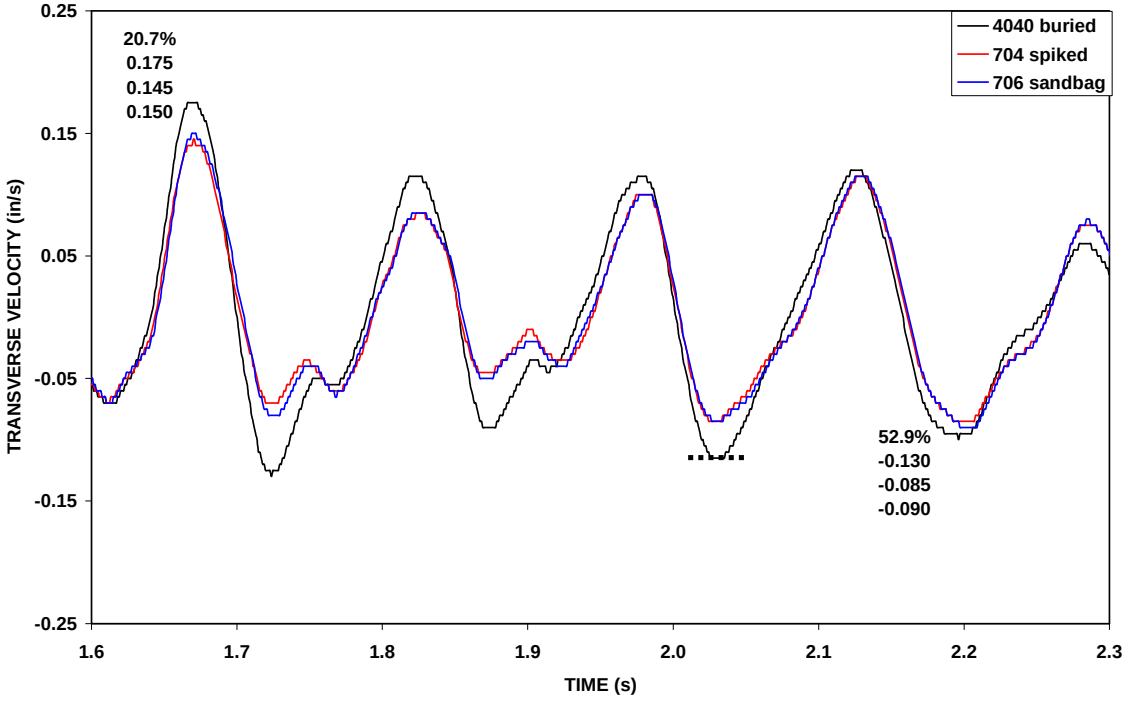

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4


4040 buried
704 spiked
706 sandbag
18.4%
0.190
0.215
0.225
15.8%
-0.190
-0.210
-0.220
RADIAL VELOCITY (in/s)
TIME (s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
1.60
1.65
1.70
1.75
1.80
1.85
1.90


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4

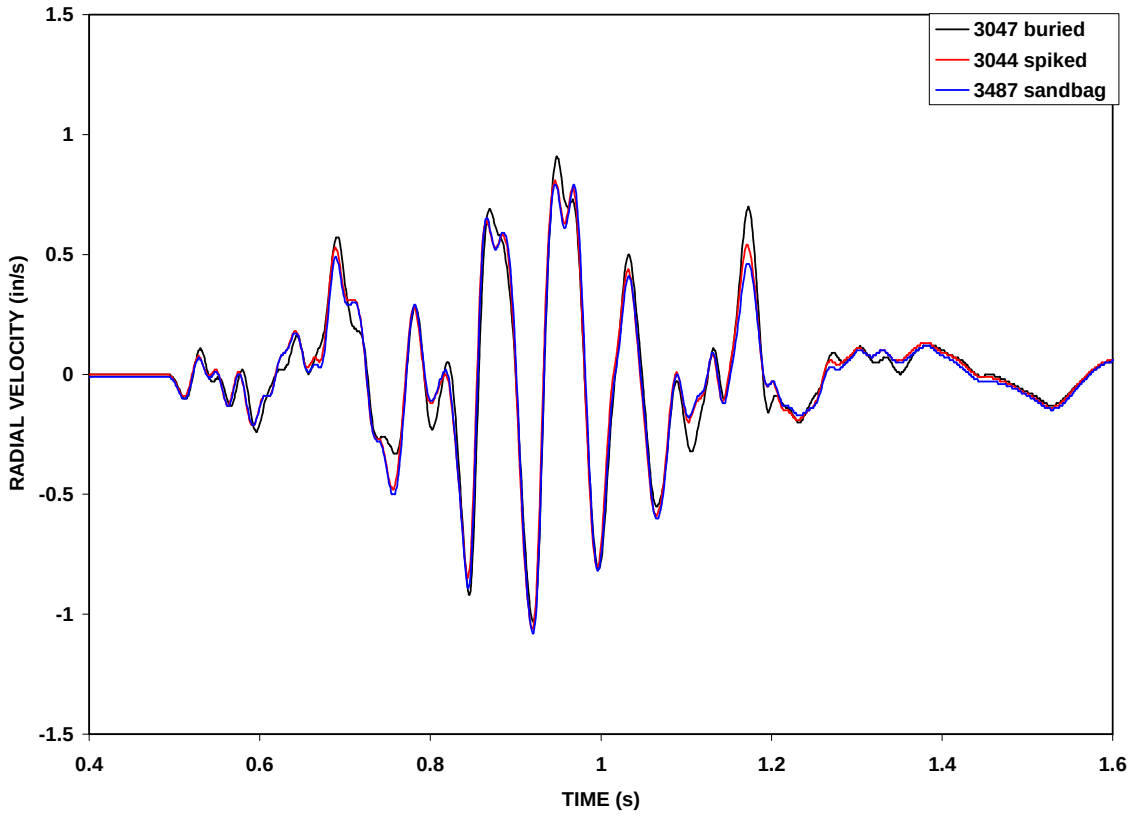

4040 buried
704 spiked
706 sandbag
5.3%
0.190
0.195
0.200
3.4%
-0.150
-0.145
-0.145
VERTICAL VELOCITY (in/s)
TIME (s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
1.20
1.25
1.30
1.35
1.40

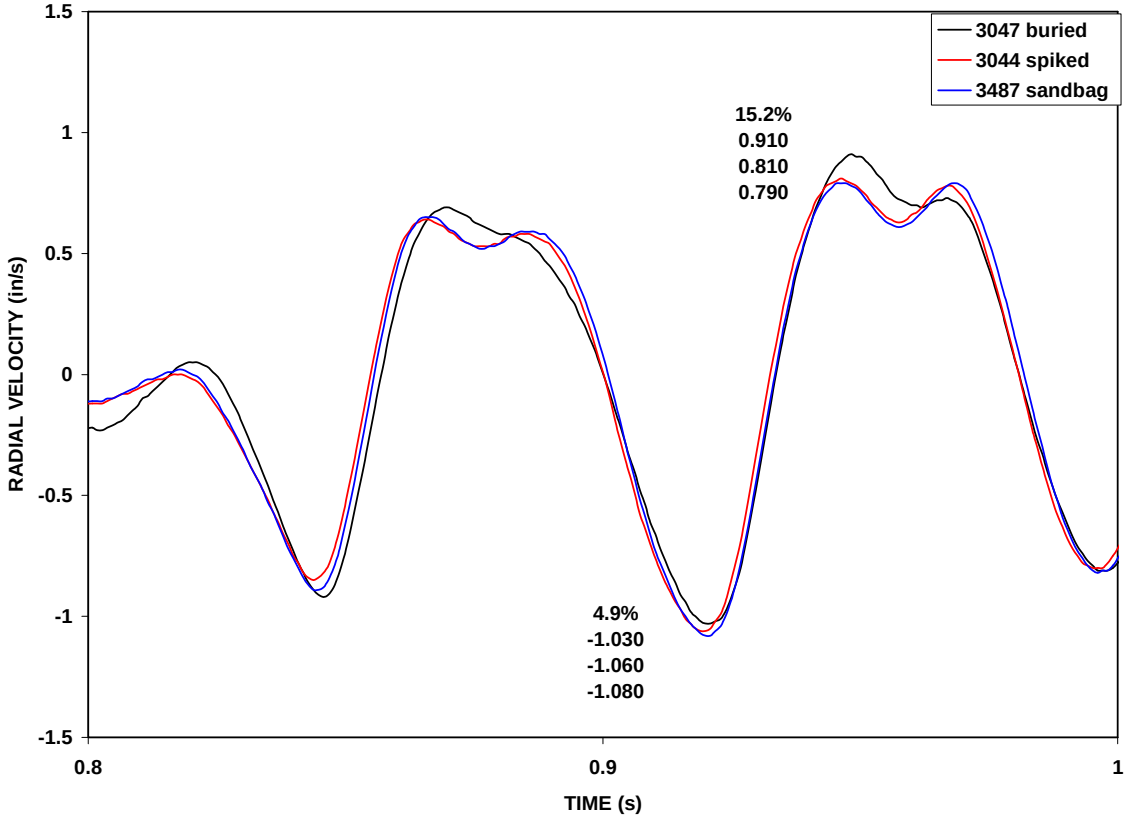

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4

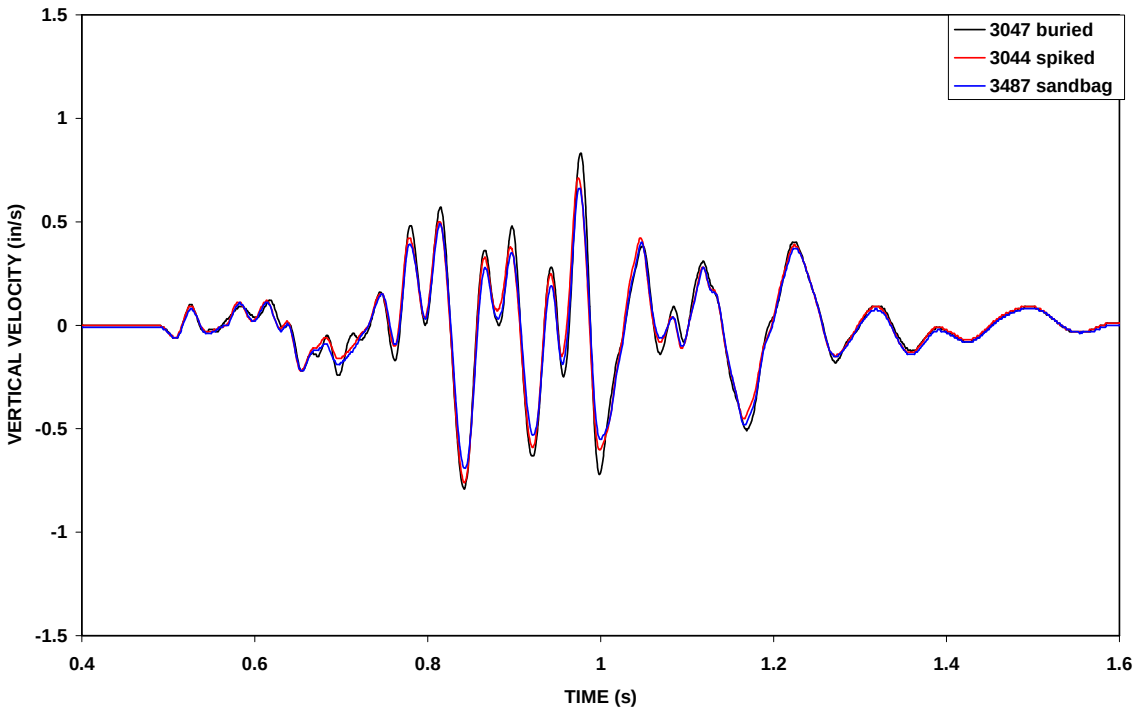

4040 buried
704 spiked
706 sandbag
20.7%
0.175
0.145
0.150
52.9%
-0.130
-0.085
-0.090
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3

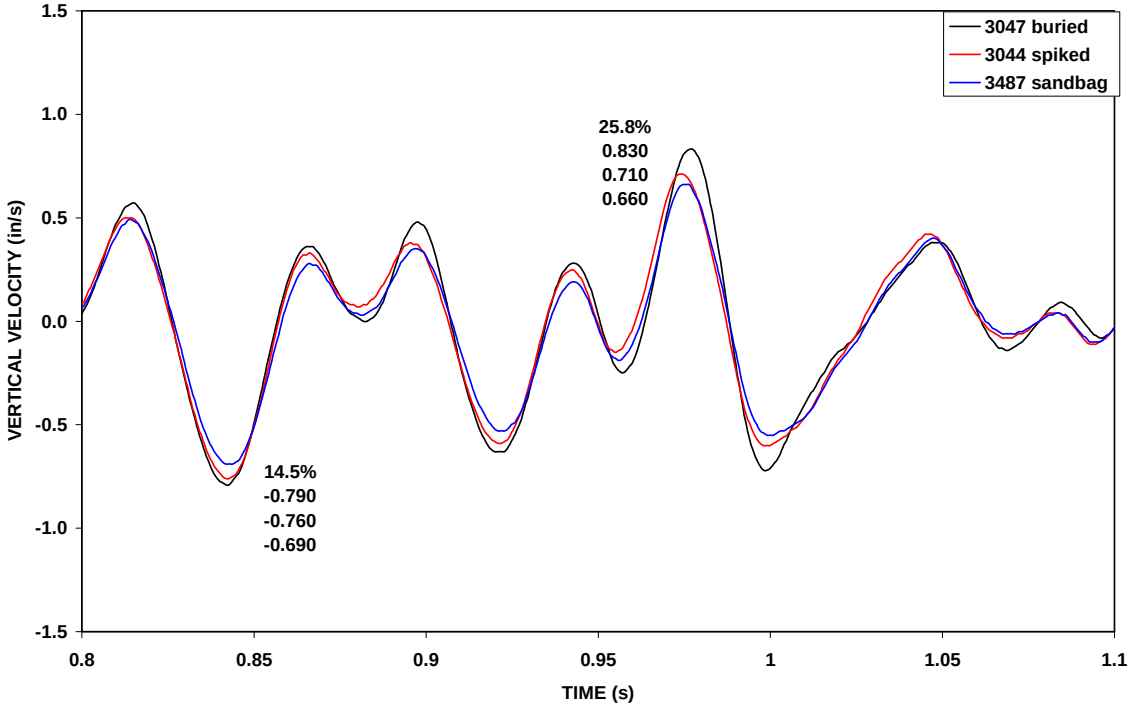
KY-7

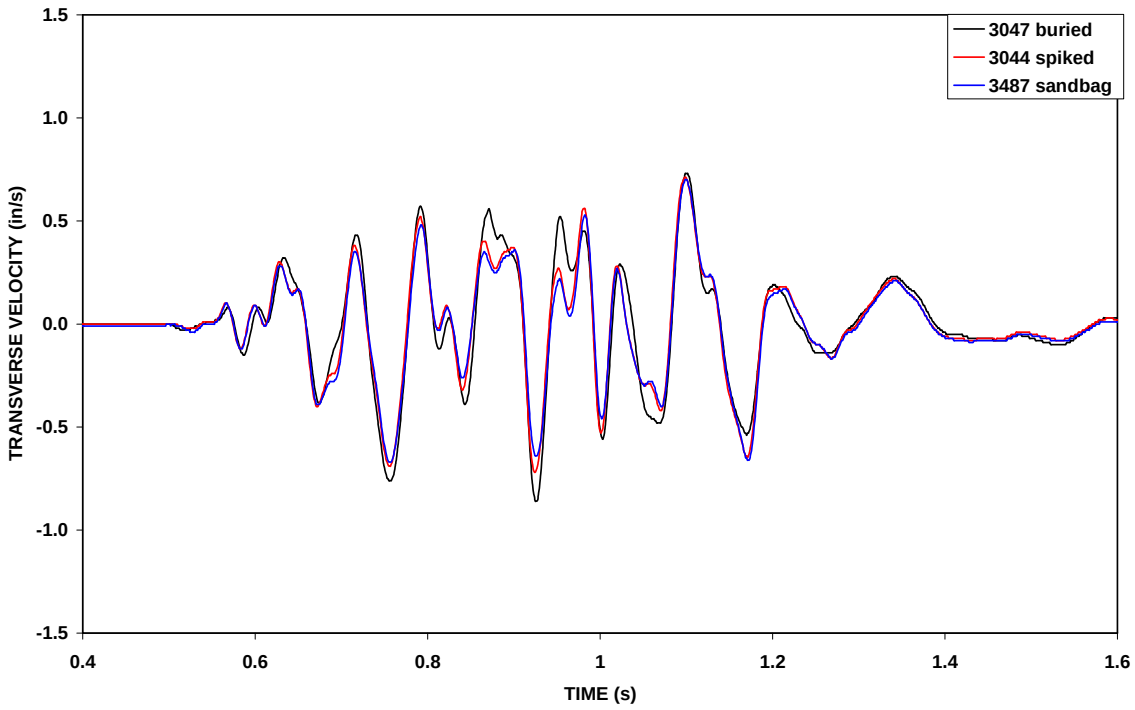
Cluster 1 SD 13.2 ft/lb$^{1/2}$

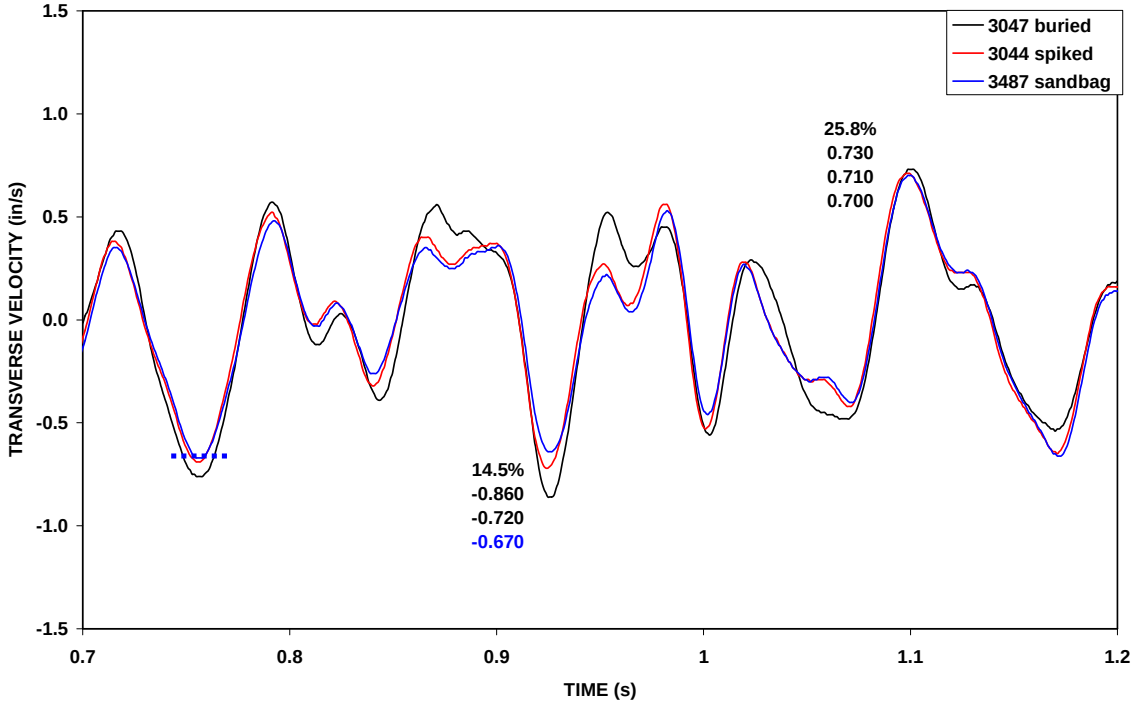

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1
0.5
0
-0.5
-1
-1.5
0.4
0.6
0.8
1
1.2
1.4
1.6


3047 buried
3044 spiked
3487 sandbag
15.2%
0.910
0.810
0.790
4.9%
-1.030
-1.060
-1.080
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1
0.5
0
-0.5
-1
-1.5
0.8
0.9
1


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1
0.5
0
-0.5
-1
-1.5
0.4
0.6
0.8
1
1.2
1.4
1.6

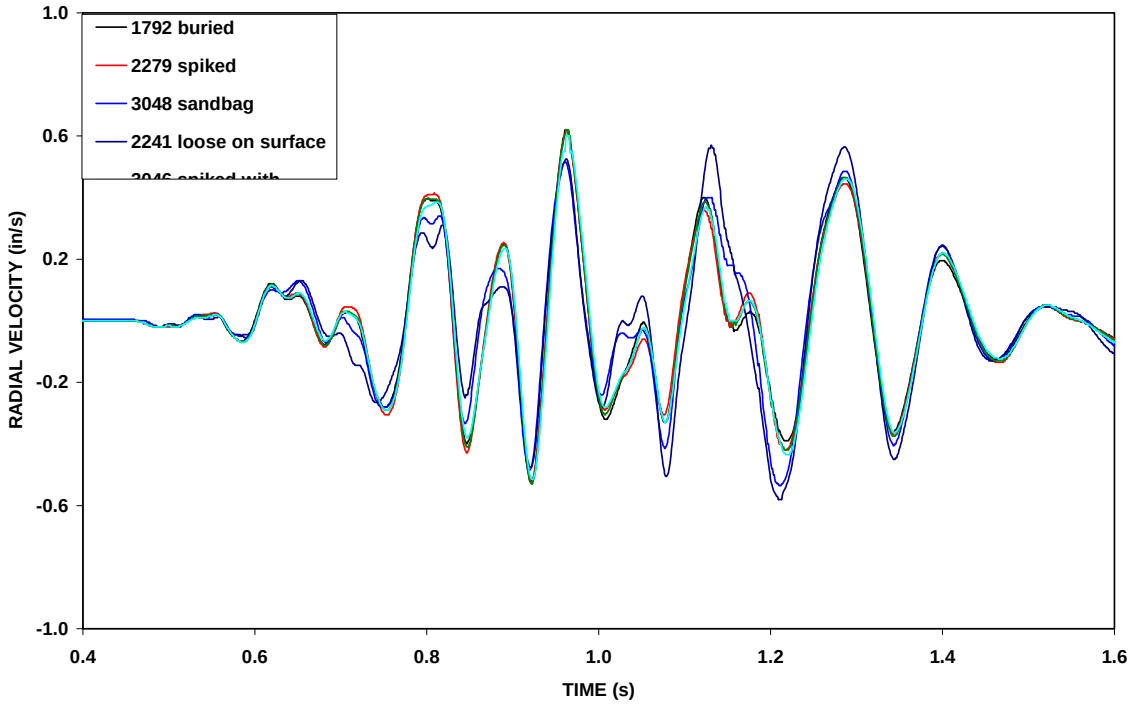

3047 buried
3044 spiked
3487 sandbag
25.8%
0.830
0.710
0.660
14.5%
-0.790
-0.760
-0.690
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.8
0.85
0.9
0.95
1
1.05
1.1

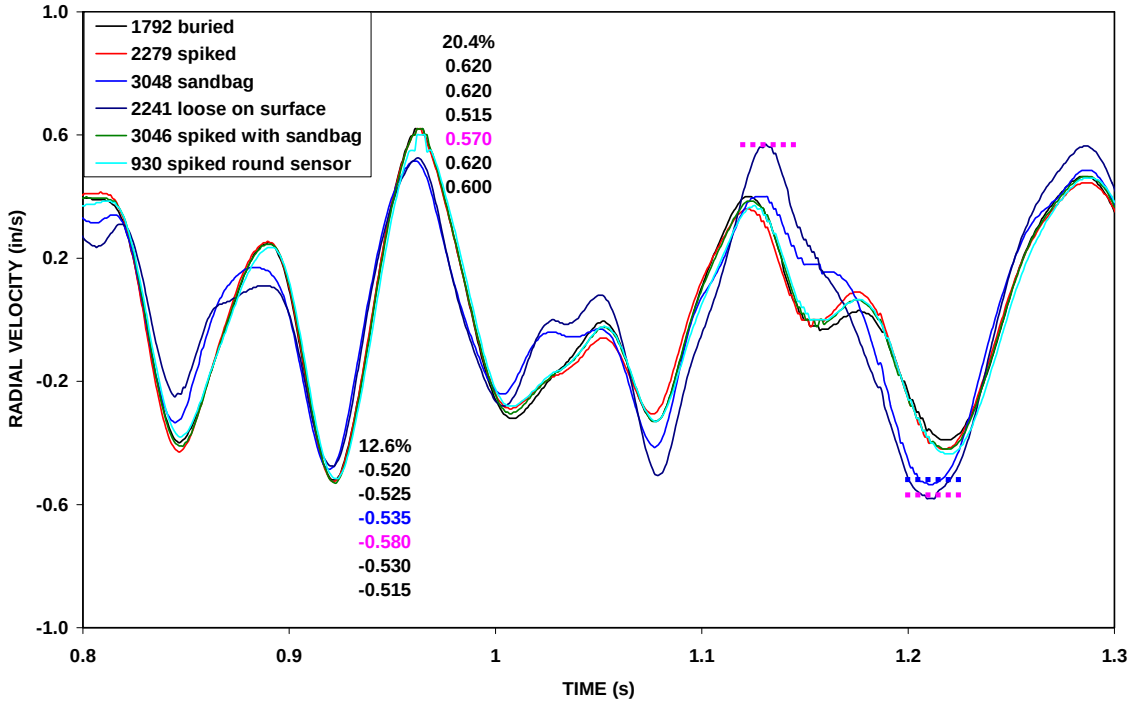

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1
1.2
1.4
1.6

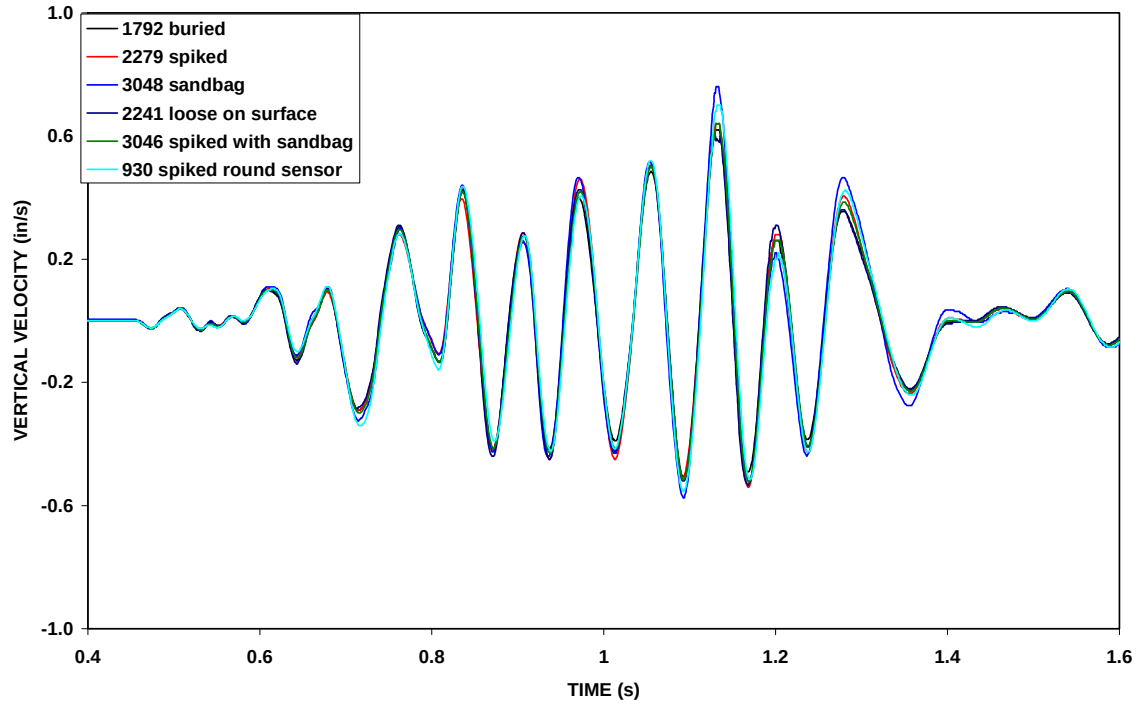

3047 buried
3044 spiked
3487 sandbag
25.8%
0.730
0.710
0.700
14.5%
-0.860
-0.720
-0.670
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.7
0.8
0.9
1
1.1
1.2

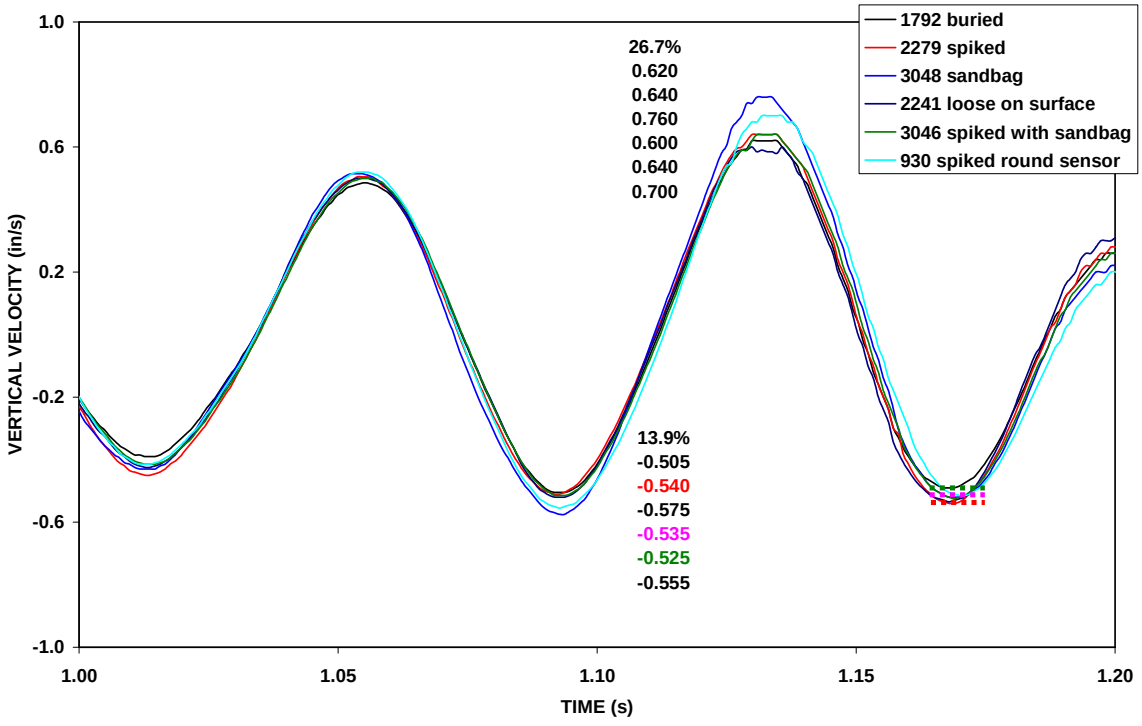
KY-7

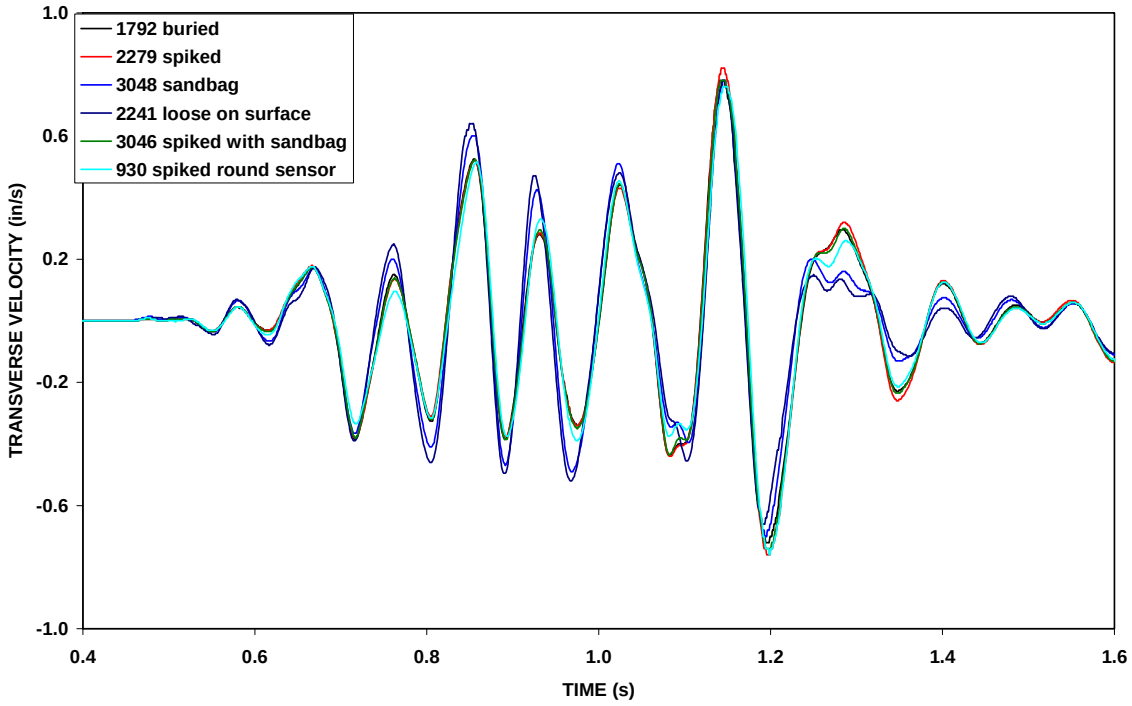
Cluster 2 SD 28.6 ft/lb$^{1/2}$

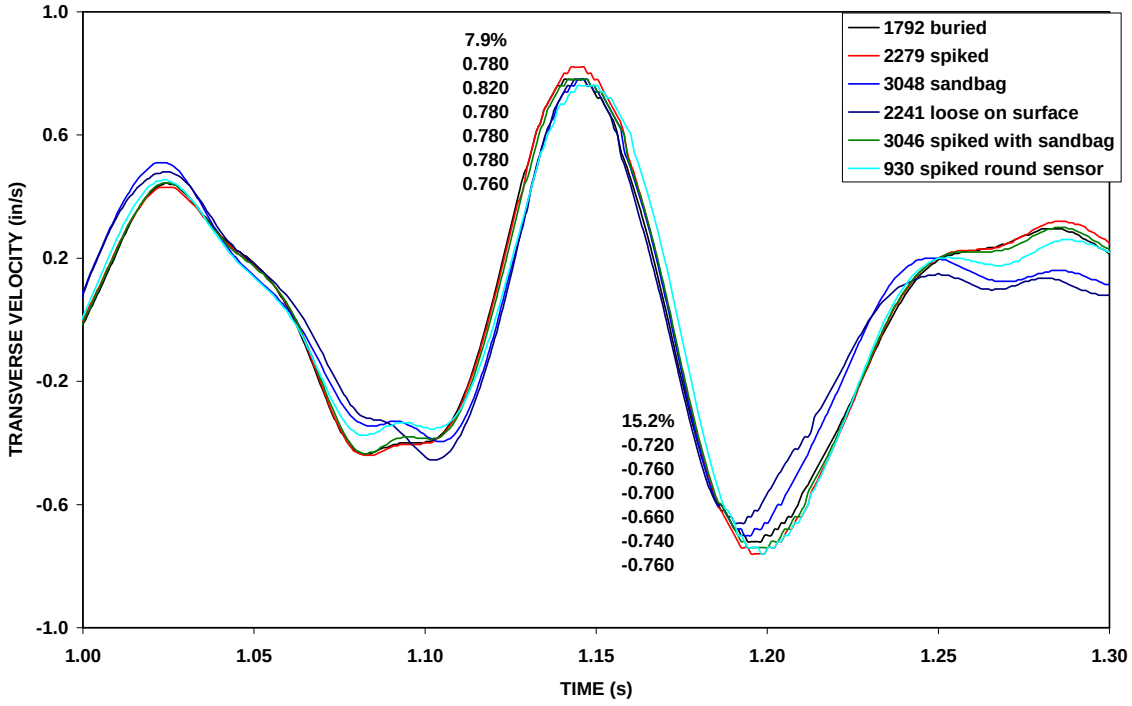

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6

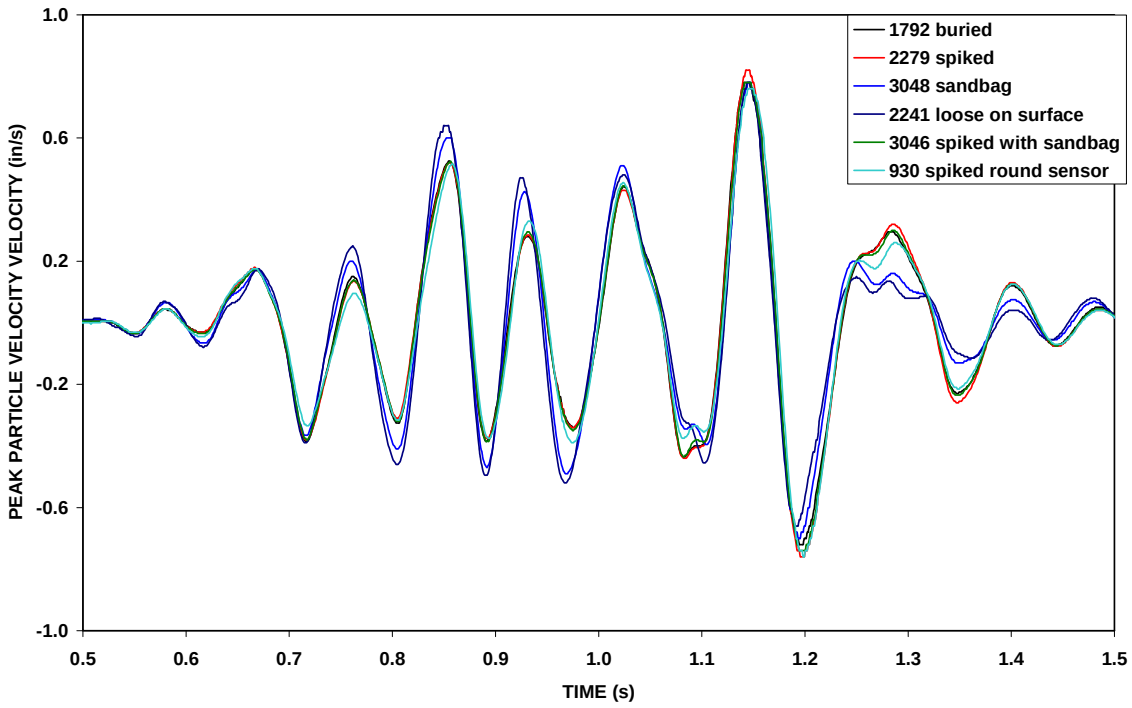

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
20.4%
0.620
0.620
0.515
0.570
0.620
0.600
12.6%
-0.520
-0.525
-0.535
-0.580
-0.530
-0.515
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
0.8
0.9
1
1.1
1.2
1.3

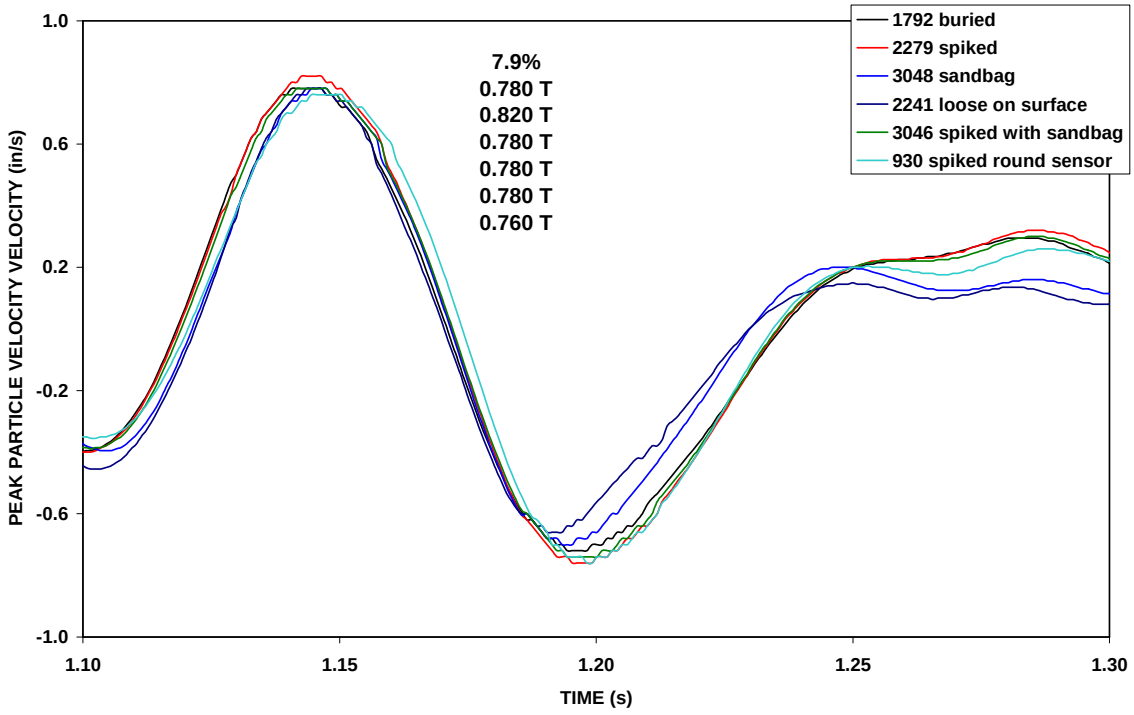

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
0.4
0.6
0.8
1
1.2
1.4
1.6


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
26.7%
0.620
0.640
0.760
0.600
0.640
0.700
13.9%
-0.505
-0.540
-0.575
-0.535
-0.525
-0.555
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
1.00
1.05
1.10
1.15
1.20


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6

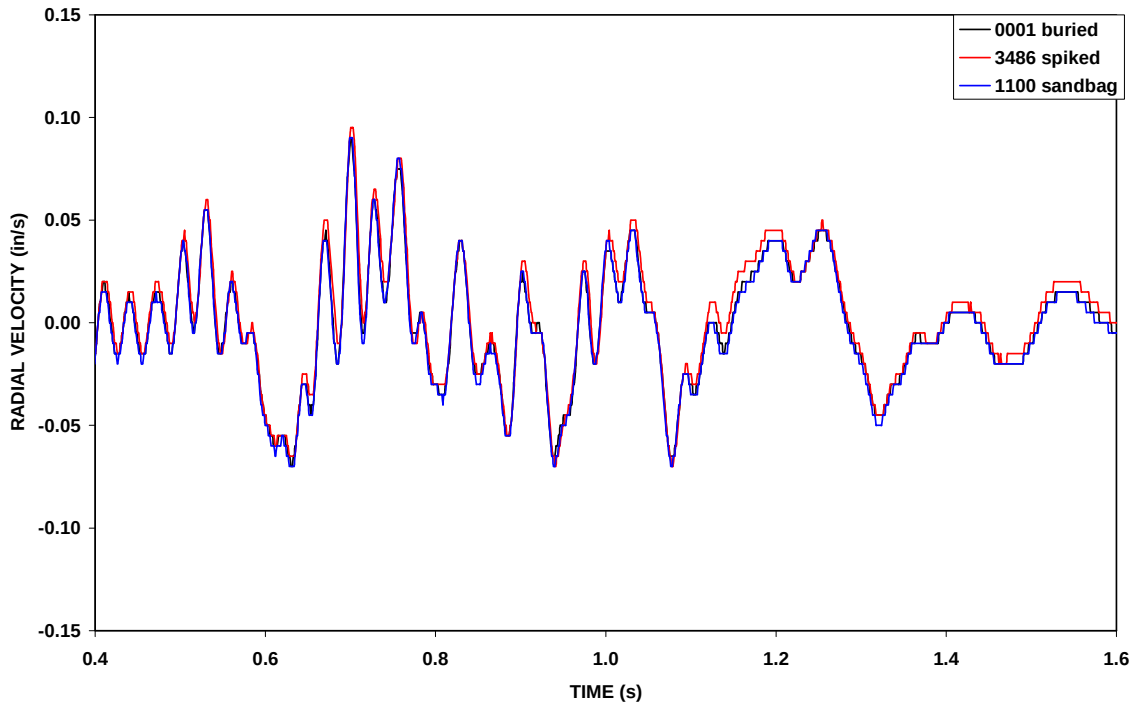

7.9%
0.780
0.820
0.780
0.780
0.780
0.760
15.2%
-0.720
-0.760
-0.700
-0.660
-0.740
-0.760
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
1.00
1.05
1.10
1.15
1.20
1.25
1.30

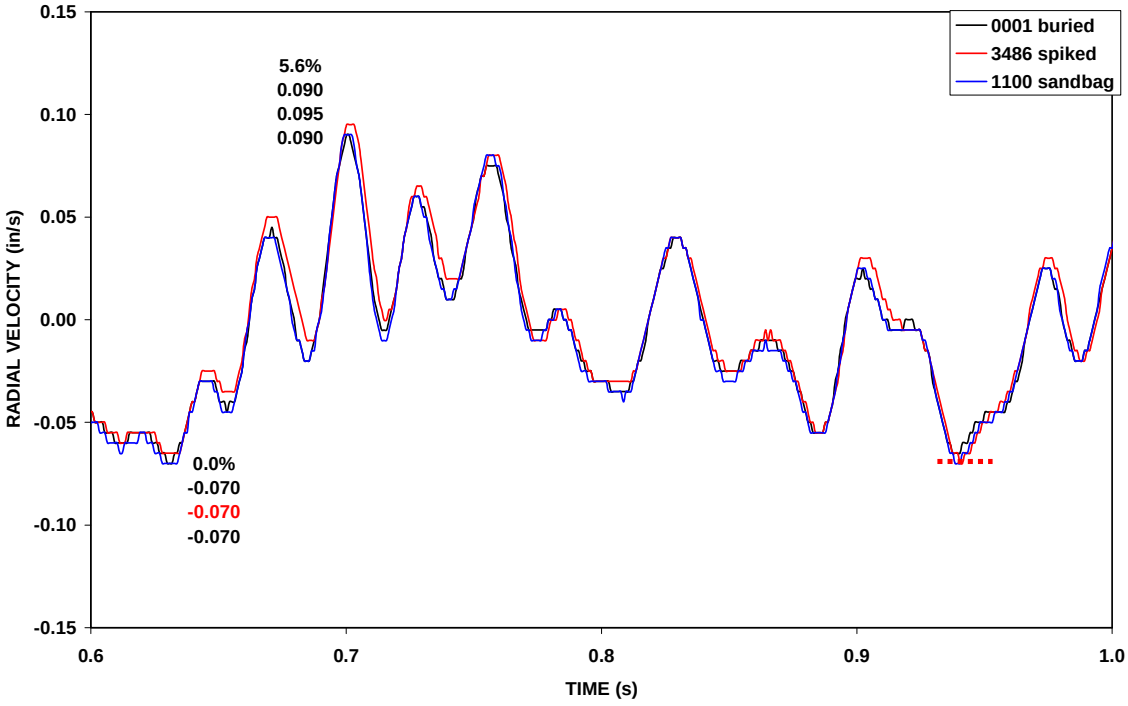

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5

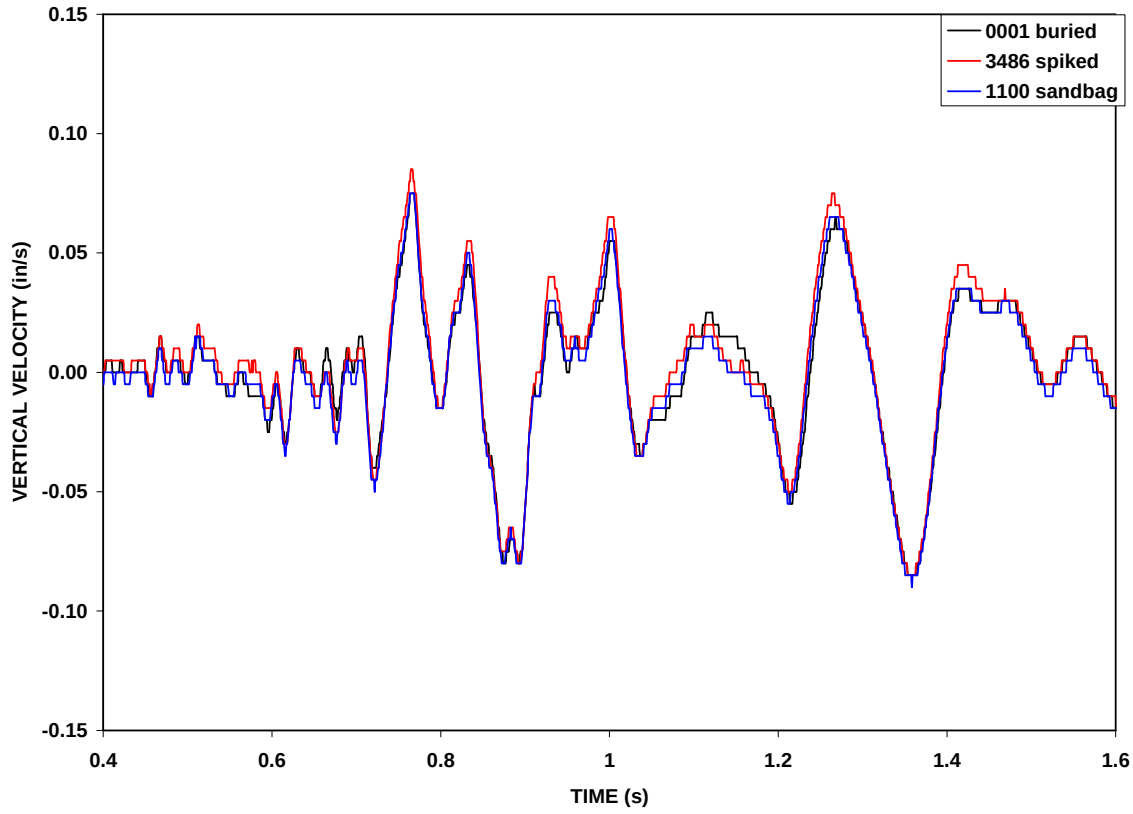

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
7.9%
0.780 T
0.820 T
0.780 T
0.780 T
0.780 T
0.760 T
PEAK PARTICLE VELOCITY VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
1.10
1.15
1.20
1.25
1.30

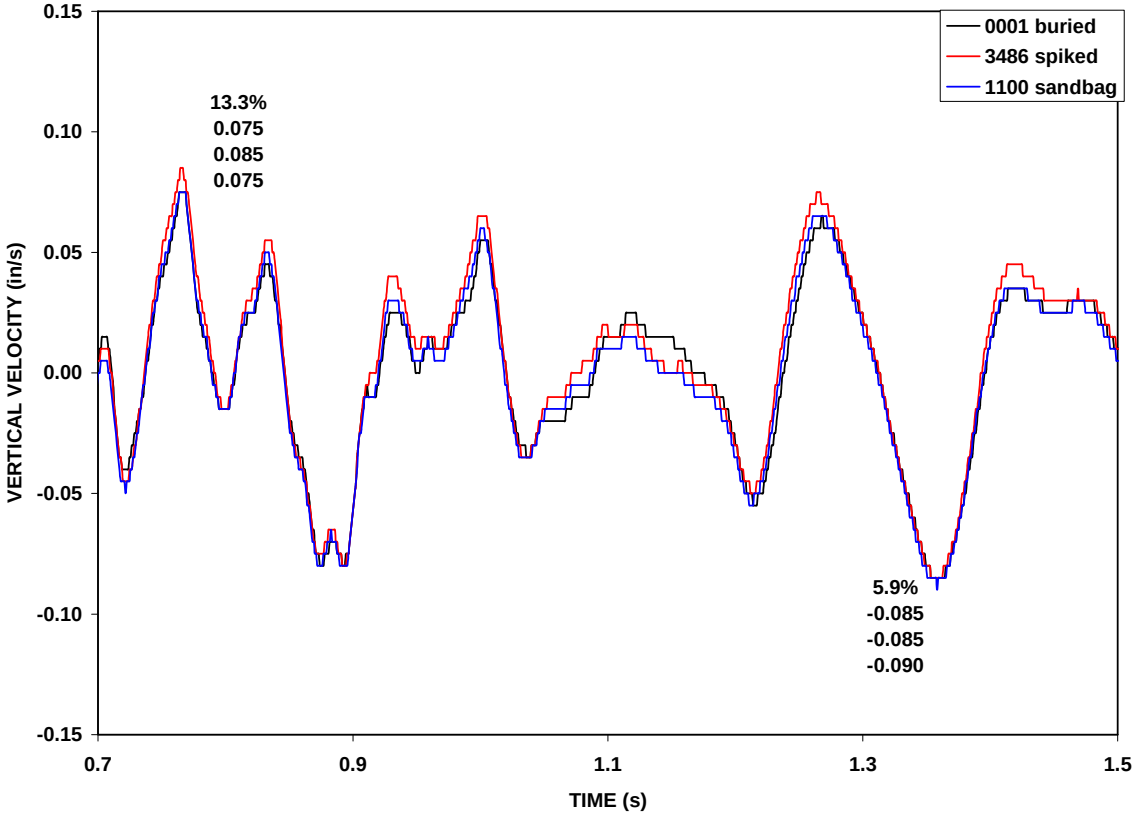
KY-7

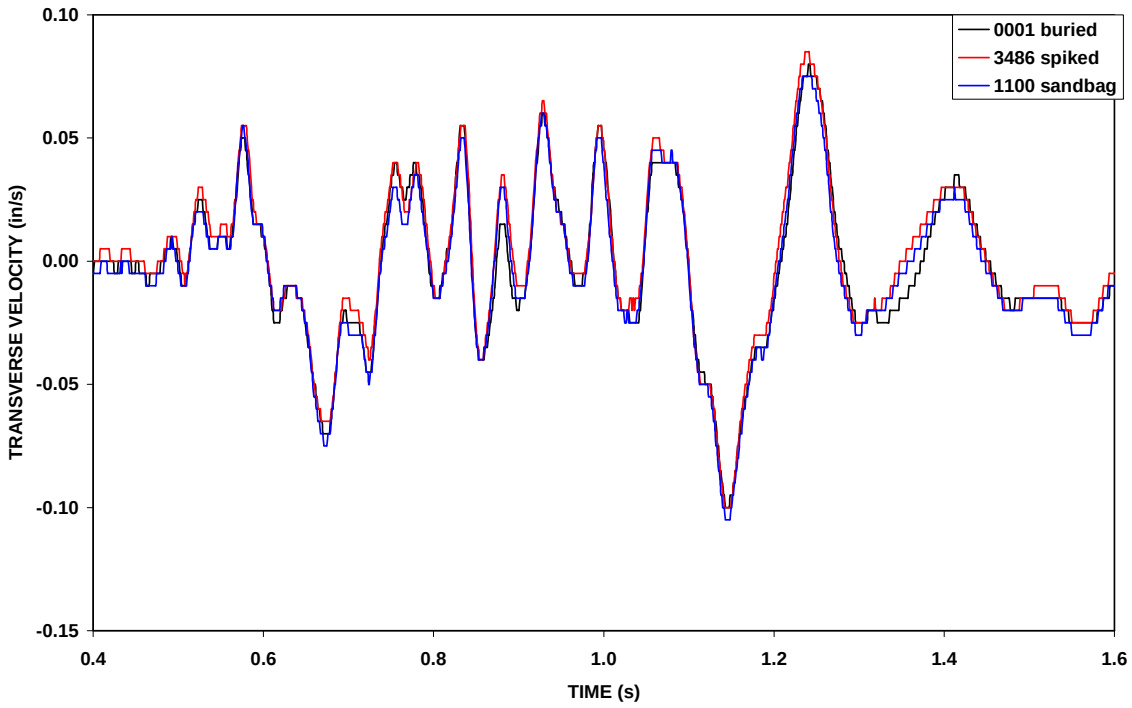
Cluster 3 SD 54.2 ft/lb$^{1/2}$

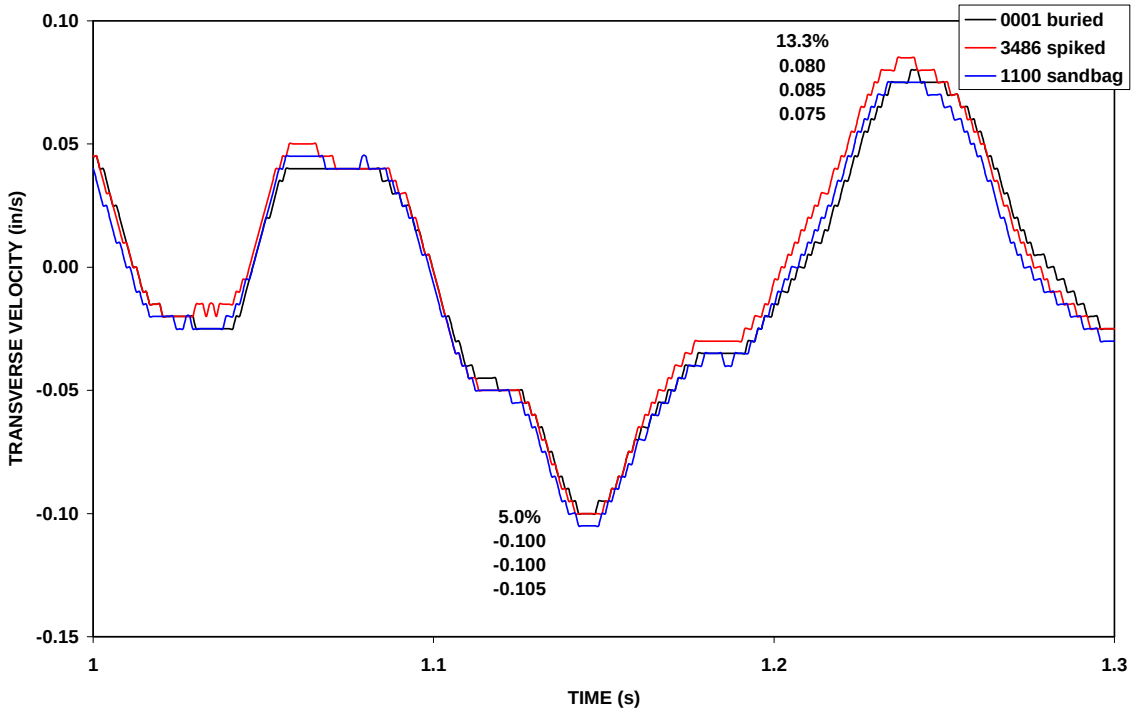

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4
1.6


0001 buried
3486 spiked
1100 sandbag
5.6%
0.090
0.095
0.090
0.0%
-0.070
-0.070
-0.070
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.6
0.7
0.8
0.9
1.0


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1
1.2
1.4
1.6
TIME (s)

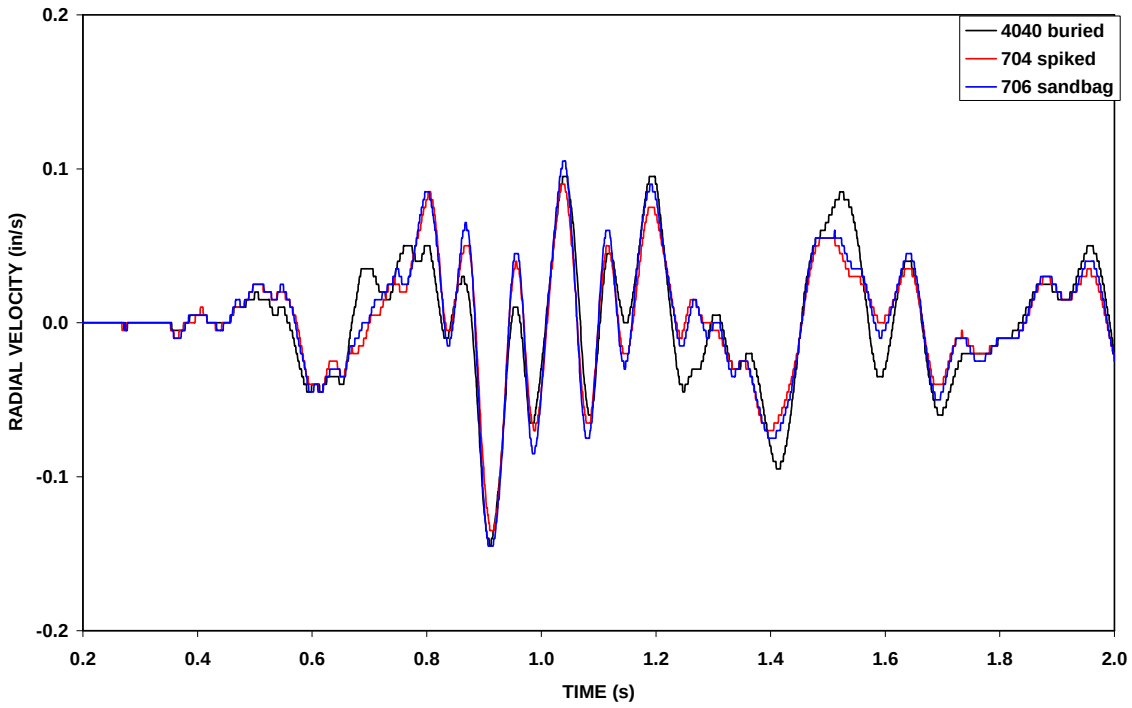

0001 buried
3486 spiked
1100 sandbag
13.3%
0.075
0.085
0.075
5.9%
-0.085
-0.085
-0.090
VERTICAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.7
0.9
1.1
1.3
1.5
TIME (s)

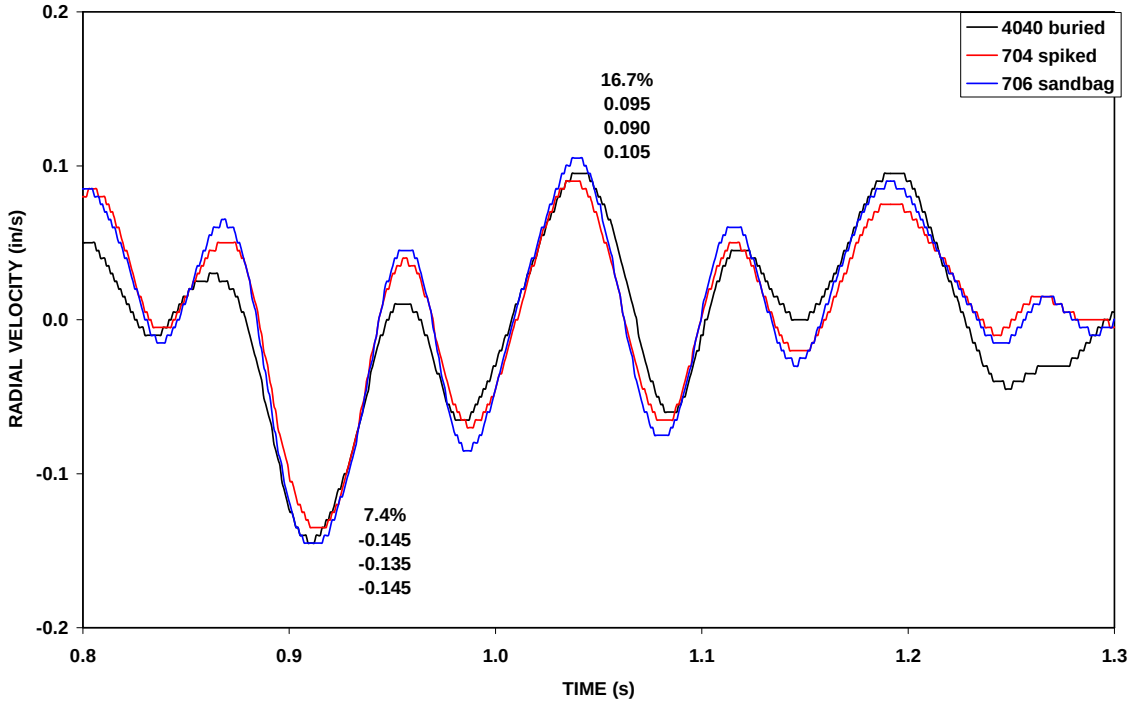

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4
1.6

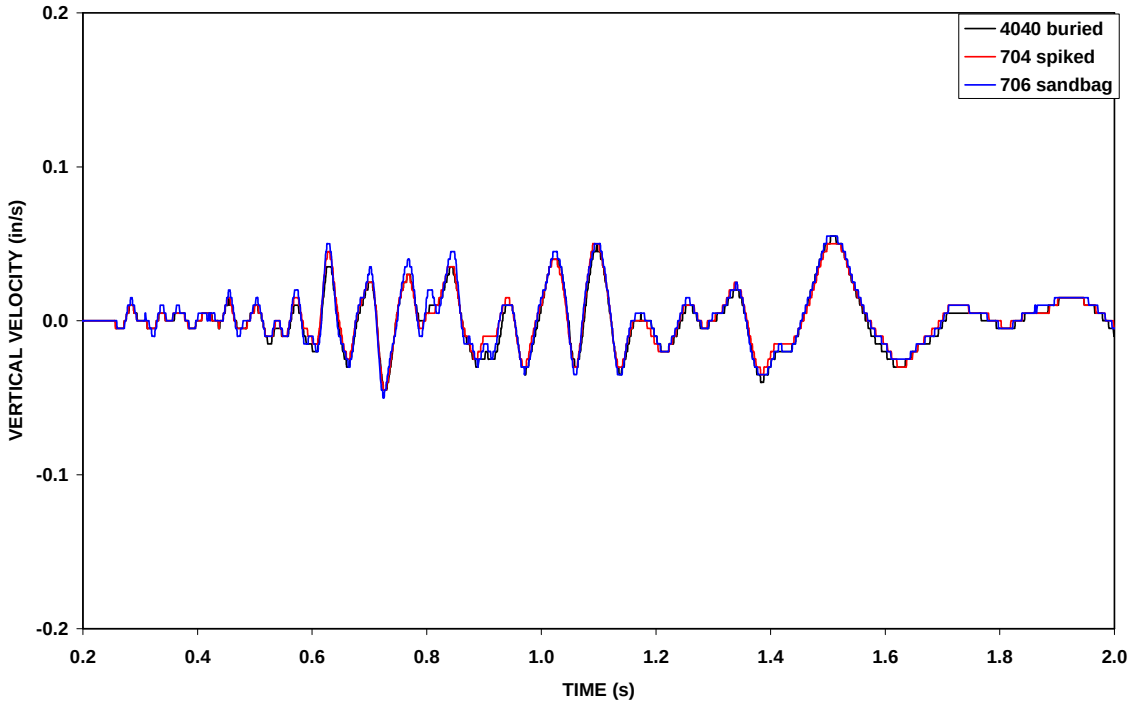

0001 buried
3486 spiked
1100 sandbag
13.3%
0.080
0.085
0.075
5.0%
-0.100
-0.100
-0.105
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
-0.15
1
1.1
1.2
1.3

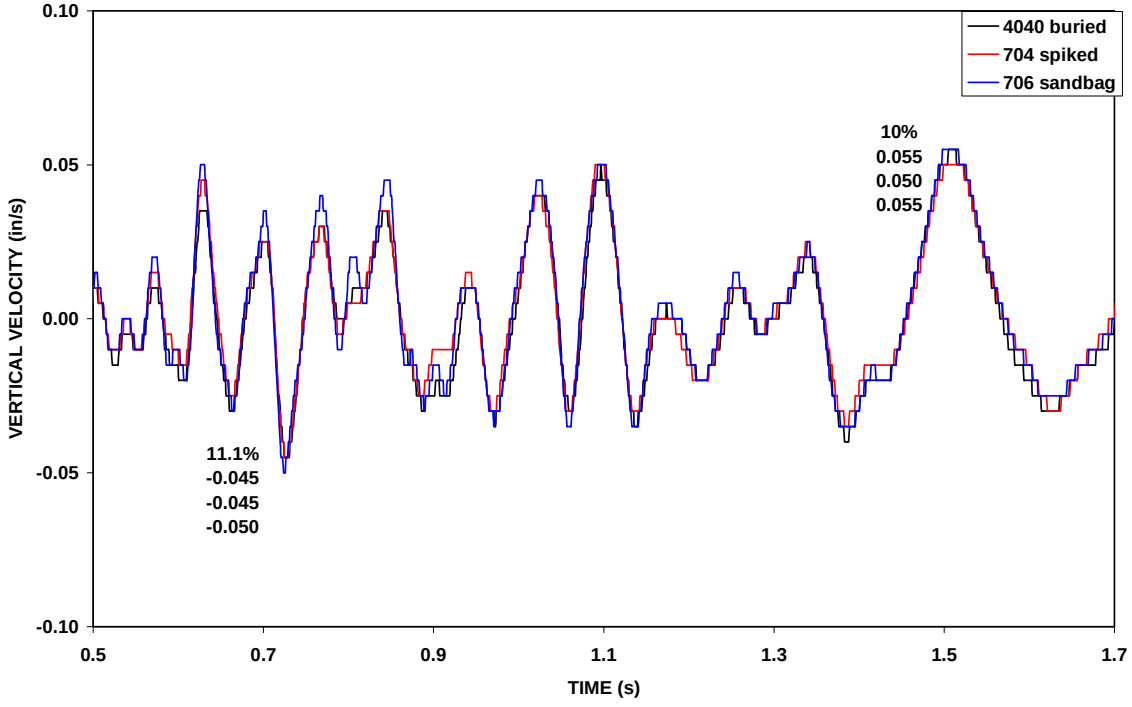
KY-7

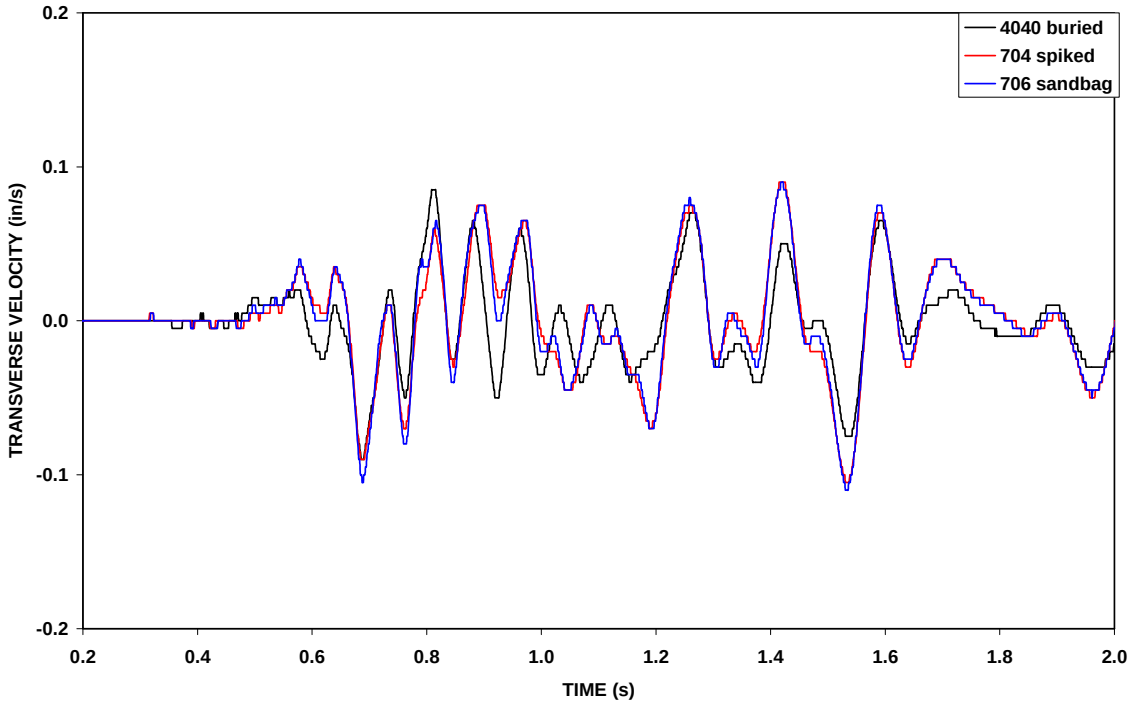
Cluster 4 SD 83.9 ft/lb$^{1/2}$

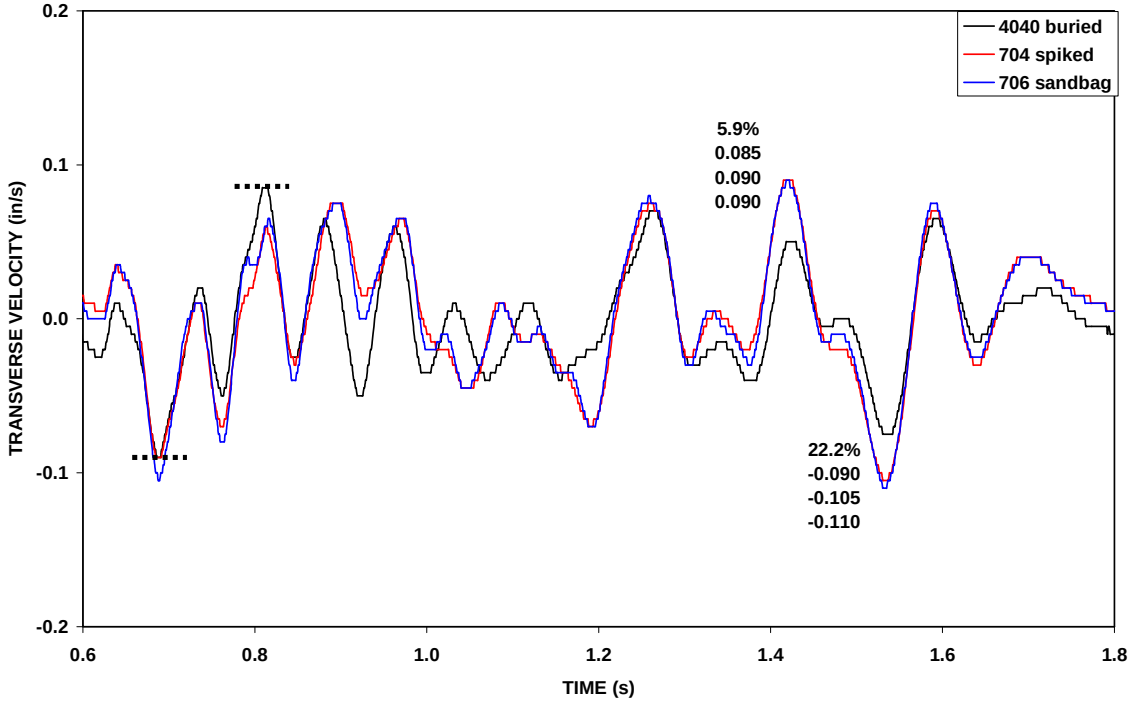

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0


4040 buried
704 spiked
706 sandbag
16.7%
0.095
0.090
0.105
7.4%
-0.145
-0.135
-0.145
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.8
0.9
1.0
1.1
1.2
1.3


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

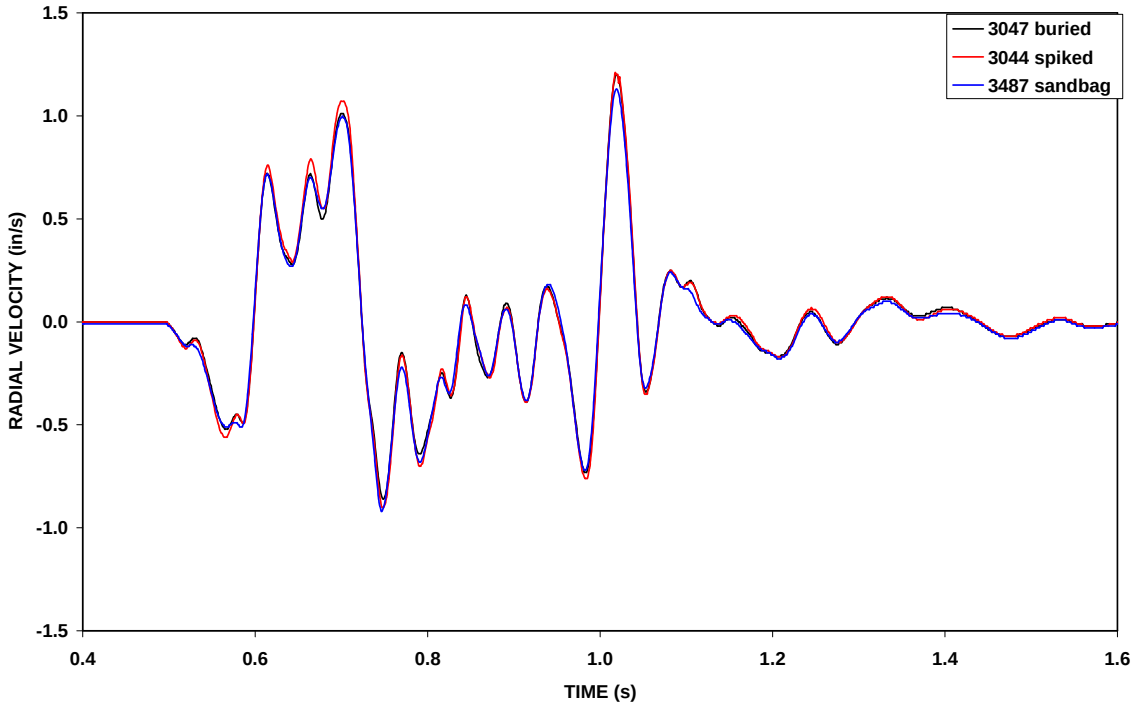

4040 buried
704 spiked
706 sandbag
10%
0.055
0.050
0.055
11.1%
-0.045
-0.045
-0.050
VERTICAL VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
0.5
0.7
0.9
1.1
1.3
1.5
1.7

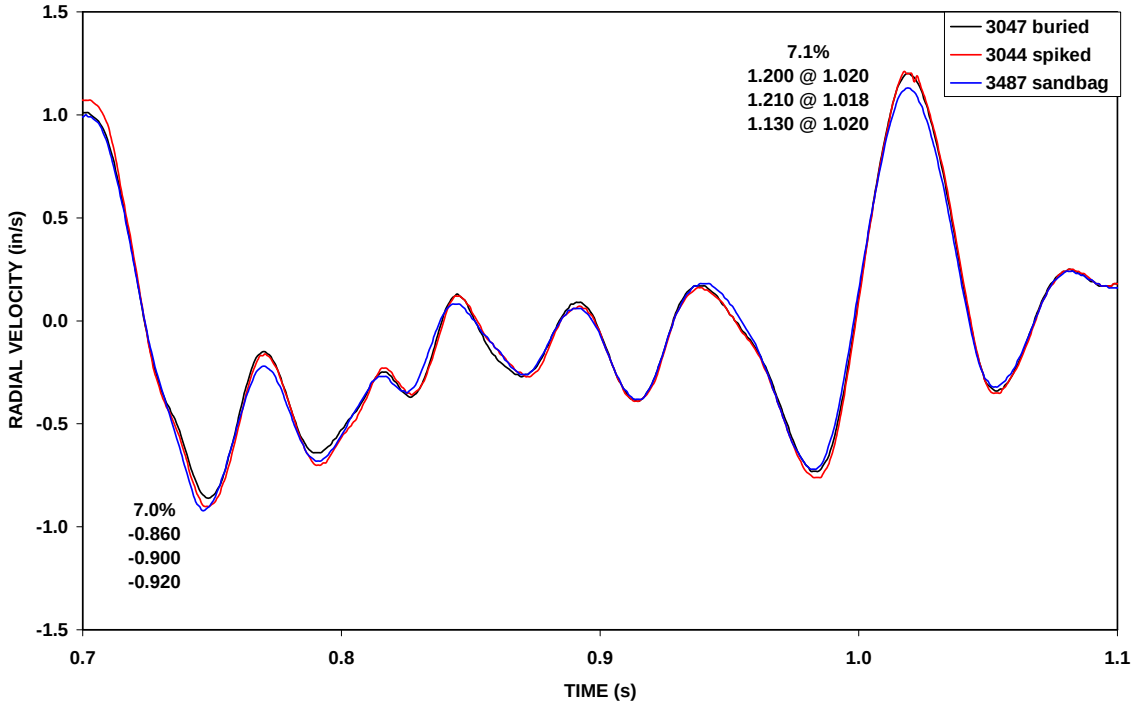

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

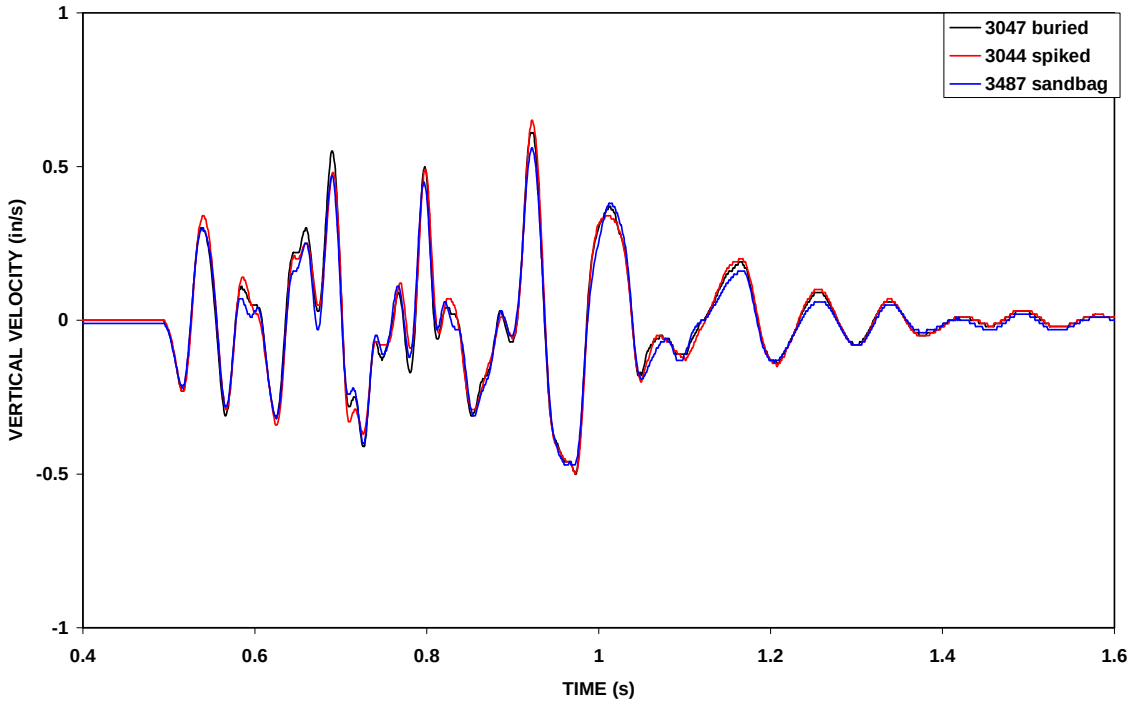

4040 buried
704 spiked
706 sandbag
5.9%
0.085
0.090
0.090
22.2%
-0.090
-0.105
-0.110
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.8
1.0
1.2
1.4
1.6
1.8

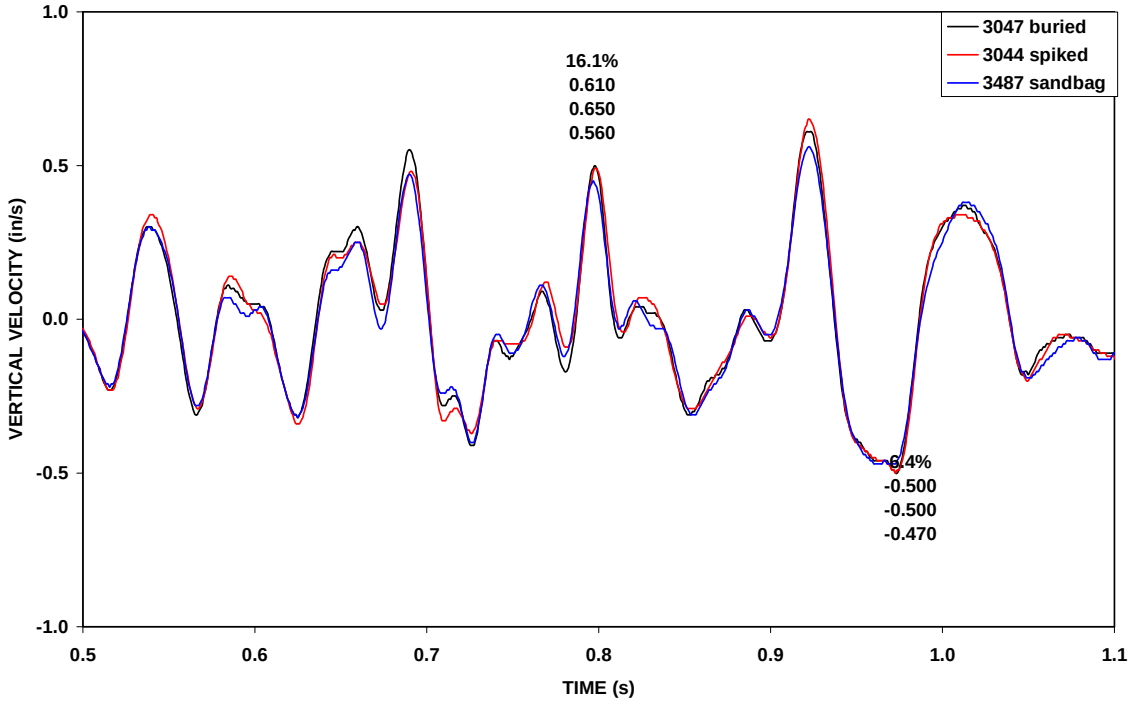
KY-8

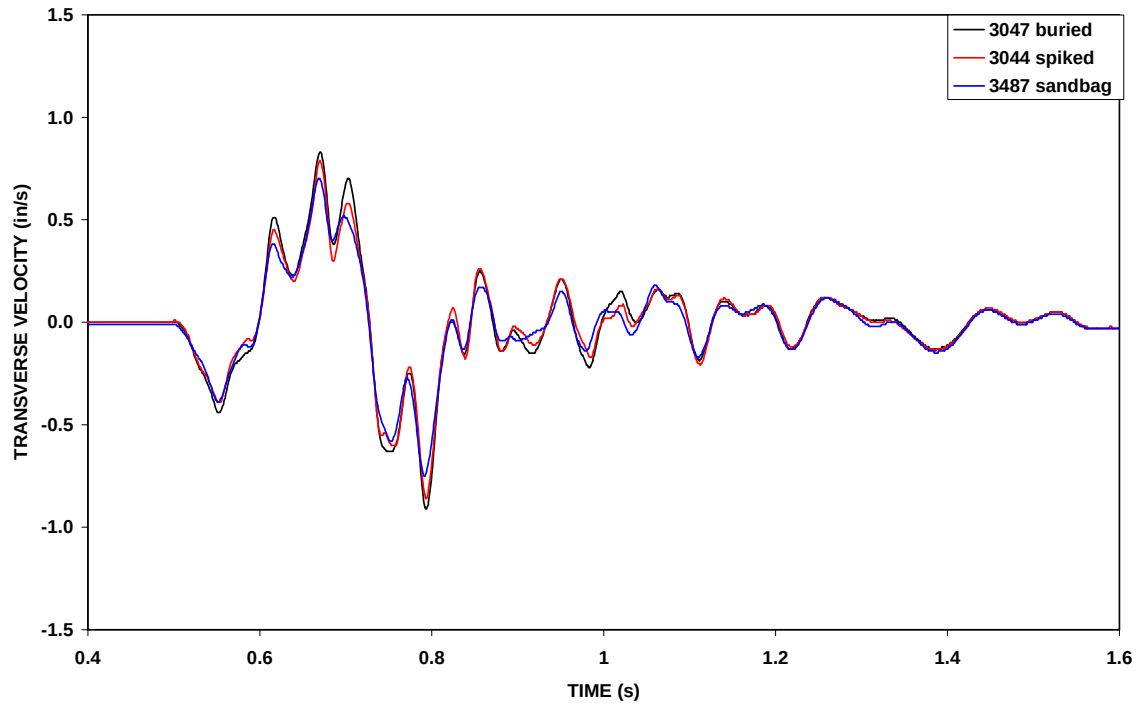
Cluster 1 SD 11.5 ft/lb$^{1/2}$

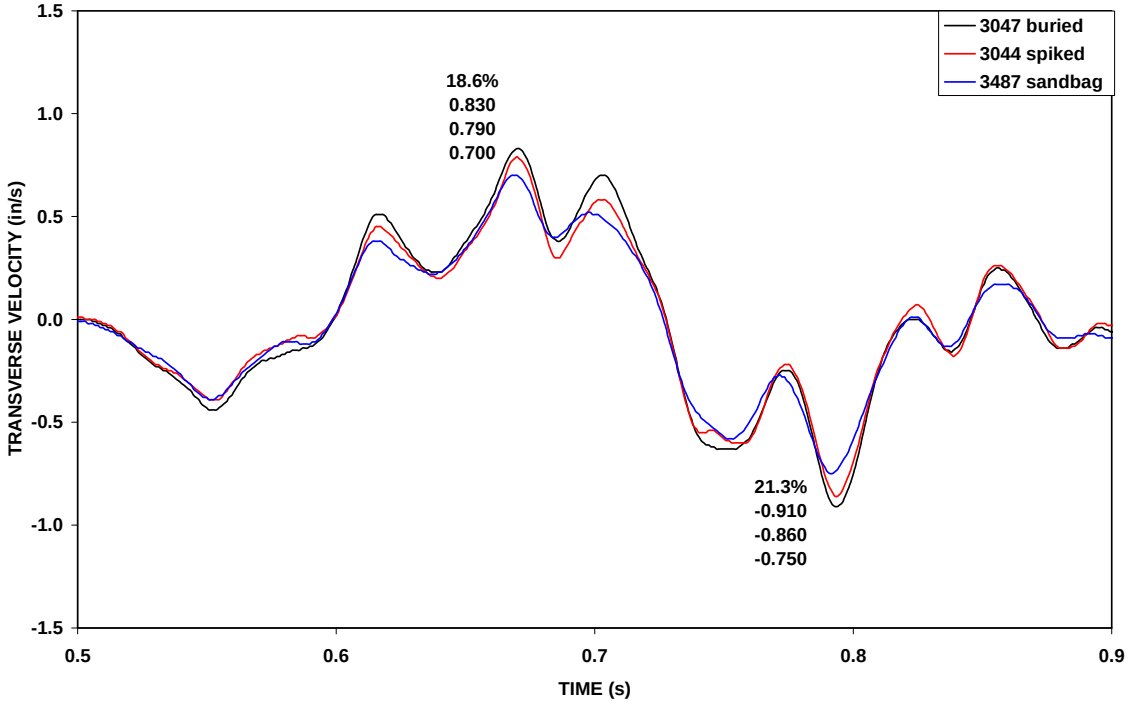

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6


3047 buried
3044 spiked
3487 sandbag
7.1%
1.200 @ 1.020
1.210 @ 1.018
1.130 @ 1.020
7.0%
-0.860
-0.900
-0.920
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.7
0.8
0.9
1.0
1.1


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1
0.5
0
-0.5
-1
0.4
0.6
0.8
1
1.2
1.4
1.6

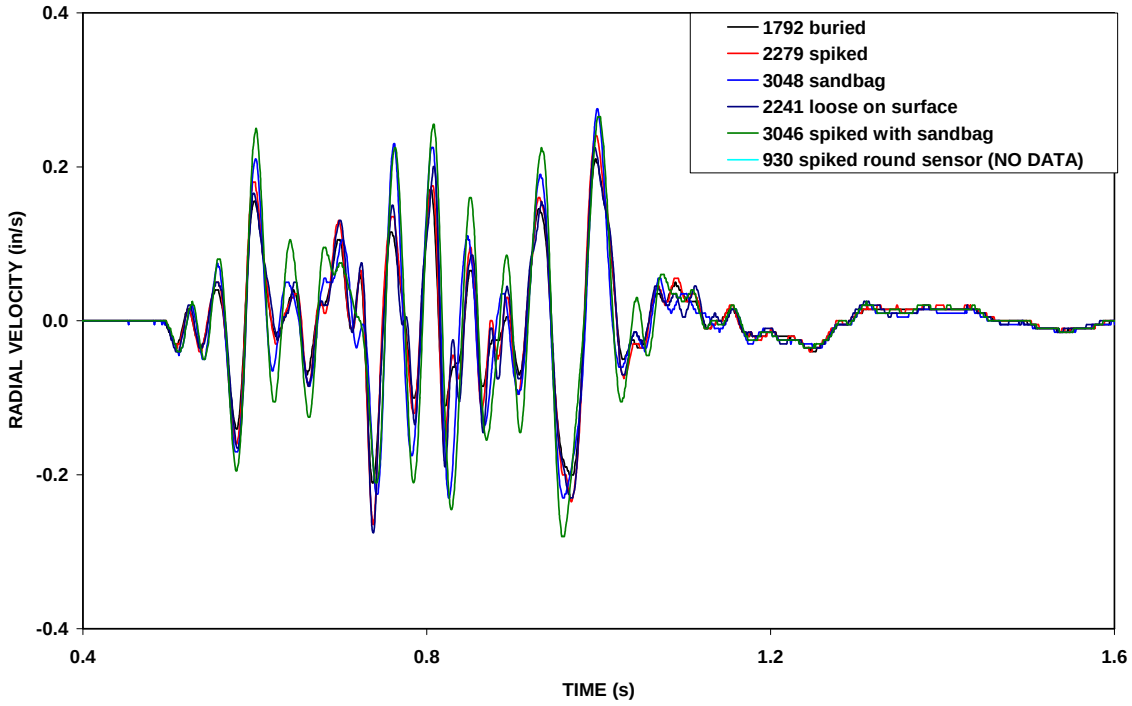

3047 buried
3044 spiked
3487 sandbag
16.1%
0.610
0.650
0.560
6.4%
-0.500
-0.500
-0.470
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.5
0.6
0.7
0.8
0.9
1.0
1.1

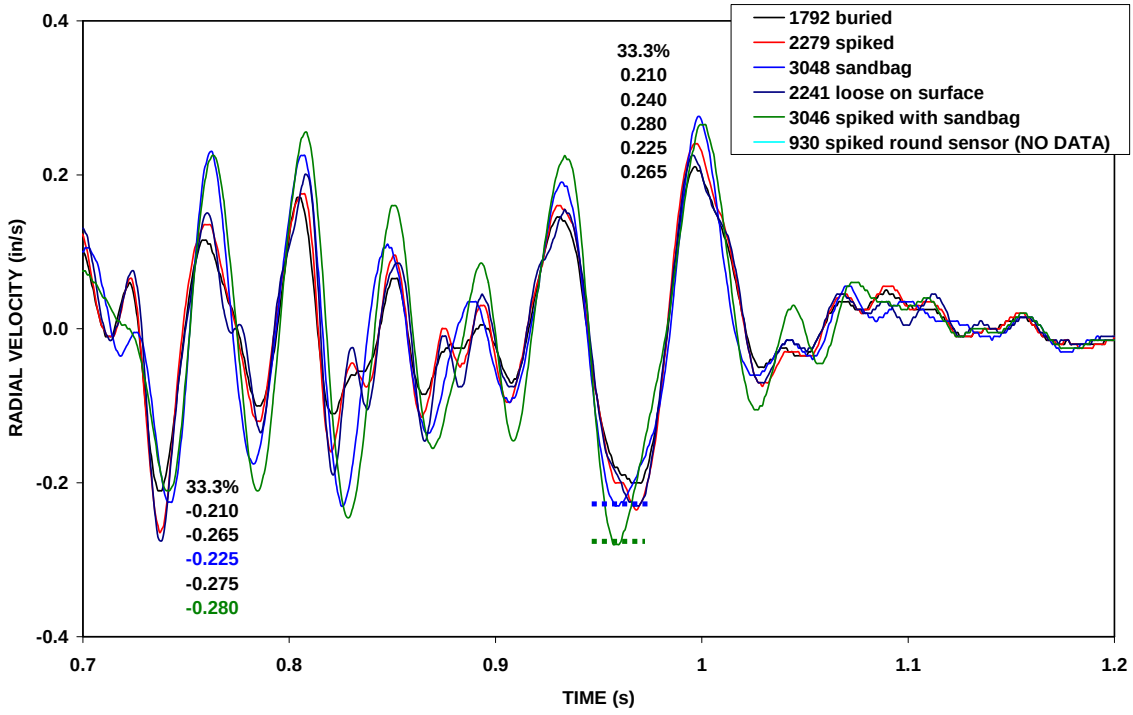

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1
1.2
1.4
1.6

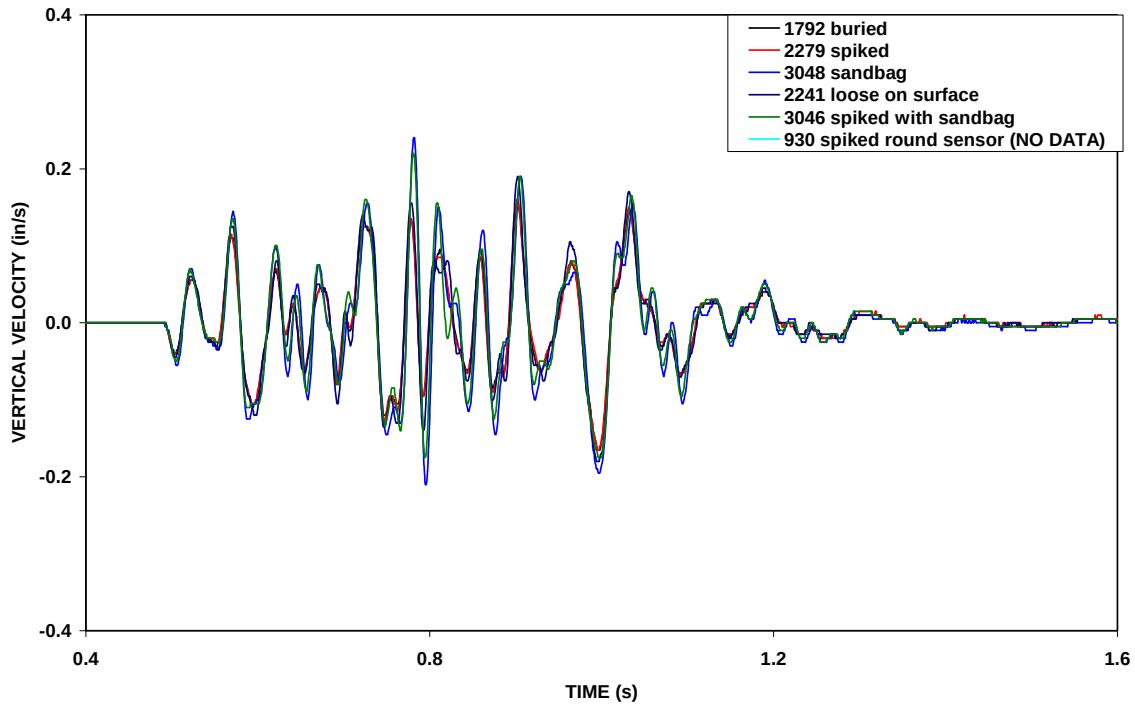

3047 buried
3044 spiked
3487 sandbag
18.6%
0.830
0.790
0.700
21.3%
-0.910
-0.860
-0.750
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.5
0.6
0.7
0.8
0.9

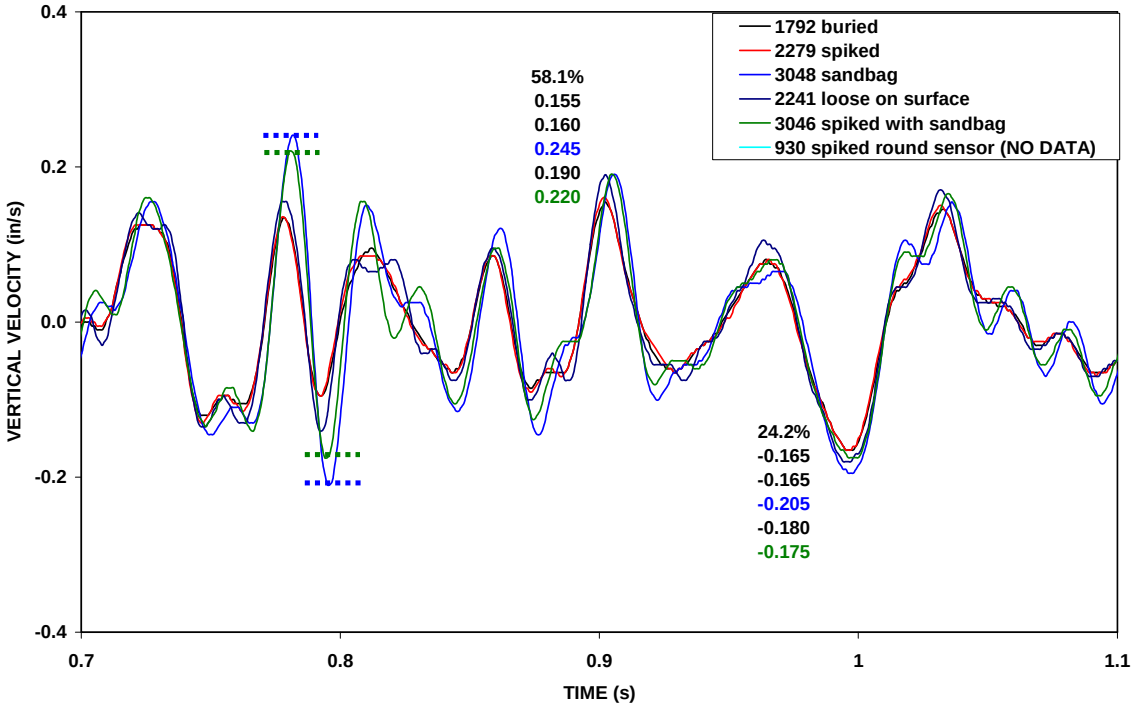
KY-8

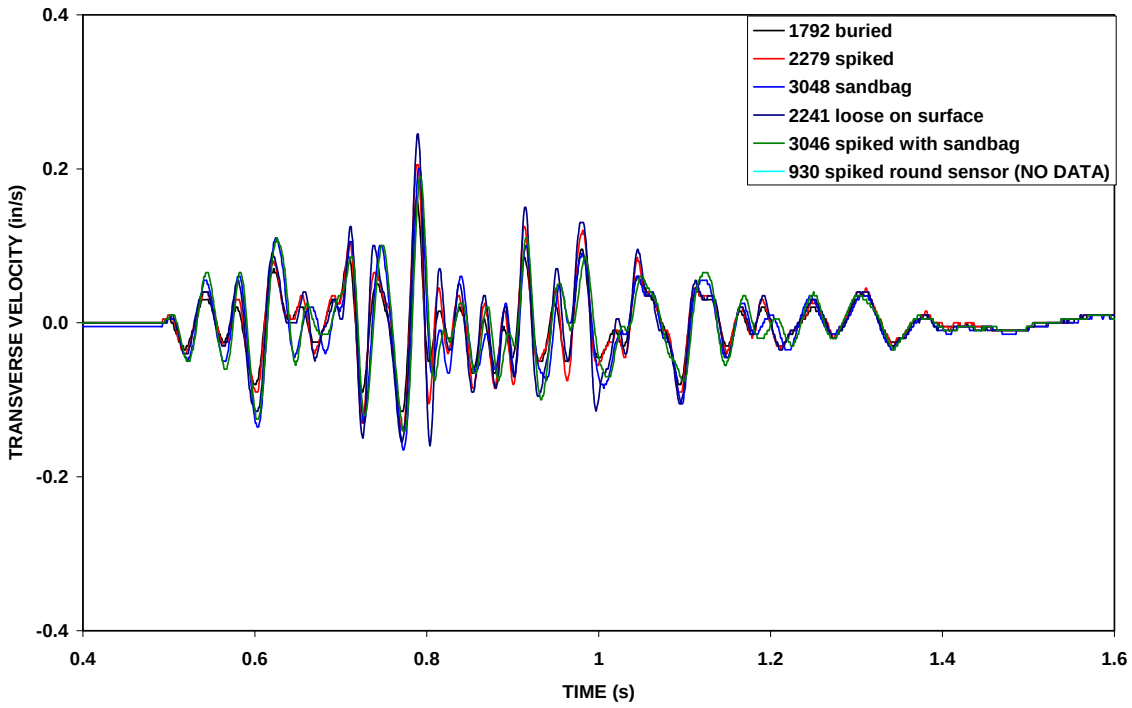
Cluster 2 SD 27.3 ft/lb$^{1/2}$

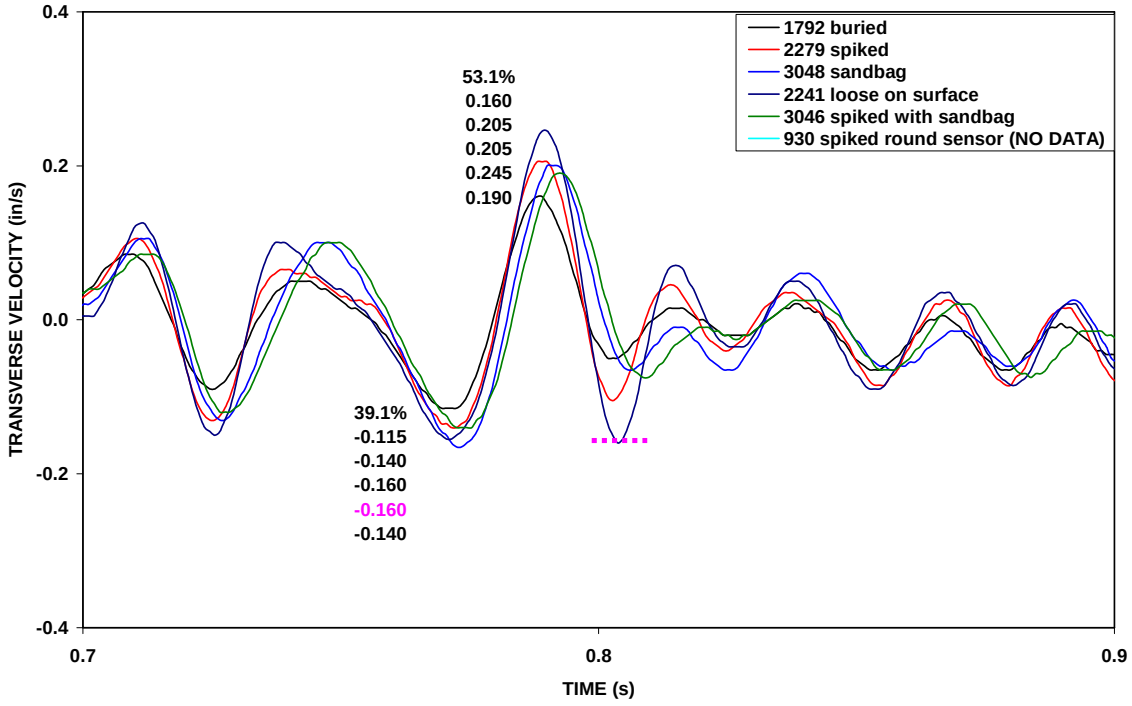

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor (NO DATA)
RADIAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6

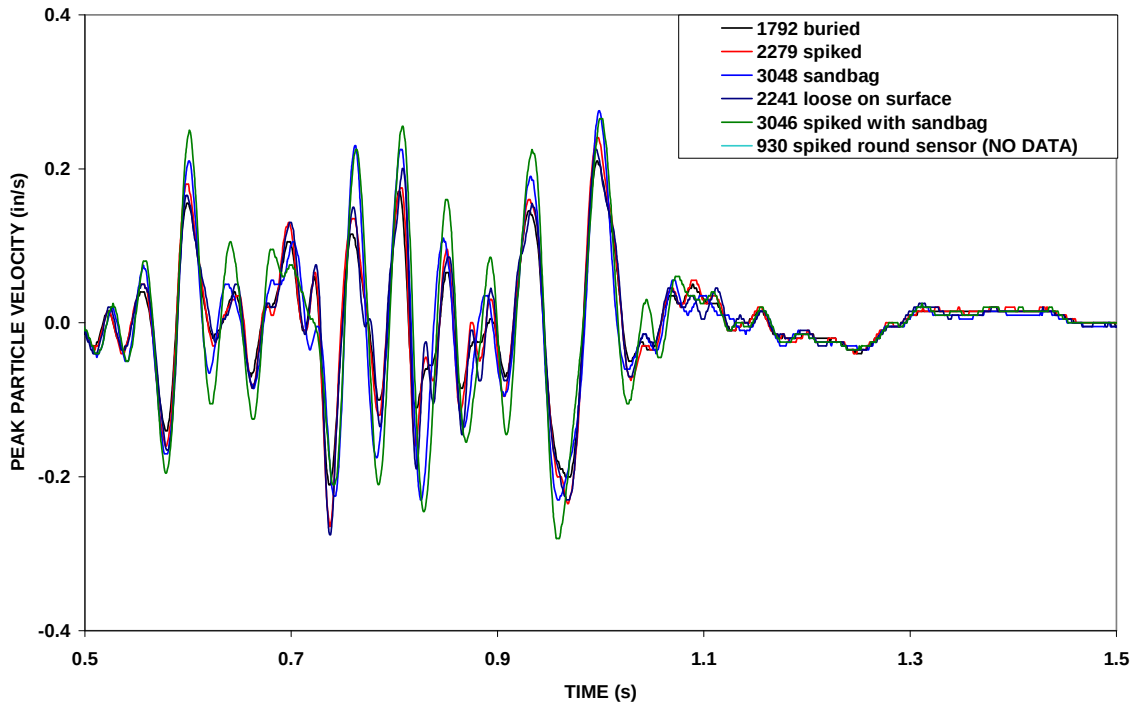

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor (NO DATA)
33.3%
0.210
0.240
0.280
0.225
0.265
33.3%
-0.210
-0.265
-0.225
-0.275
-0.280
RADIAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.7
0.8
0.9
1
1.1
1.2

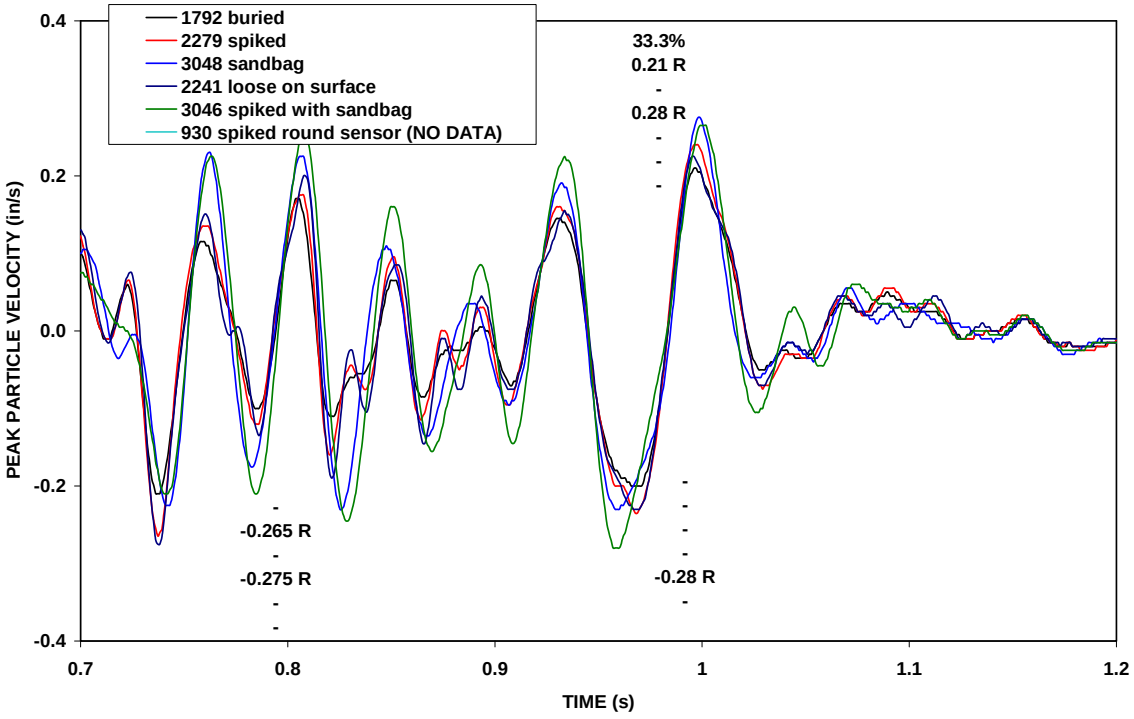

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor (NO DATA)
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor (NO DATA)
58.1%
0.155
0.160
0.245
0.190
0.220
24.2%
-0.165
-0.165
-0.205
-0.180
-0.175
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.7
0.8
0.9
1
1.1


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor (NO DATA)
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.6
0.8
1
1.2
1.4
1.6

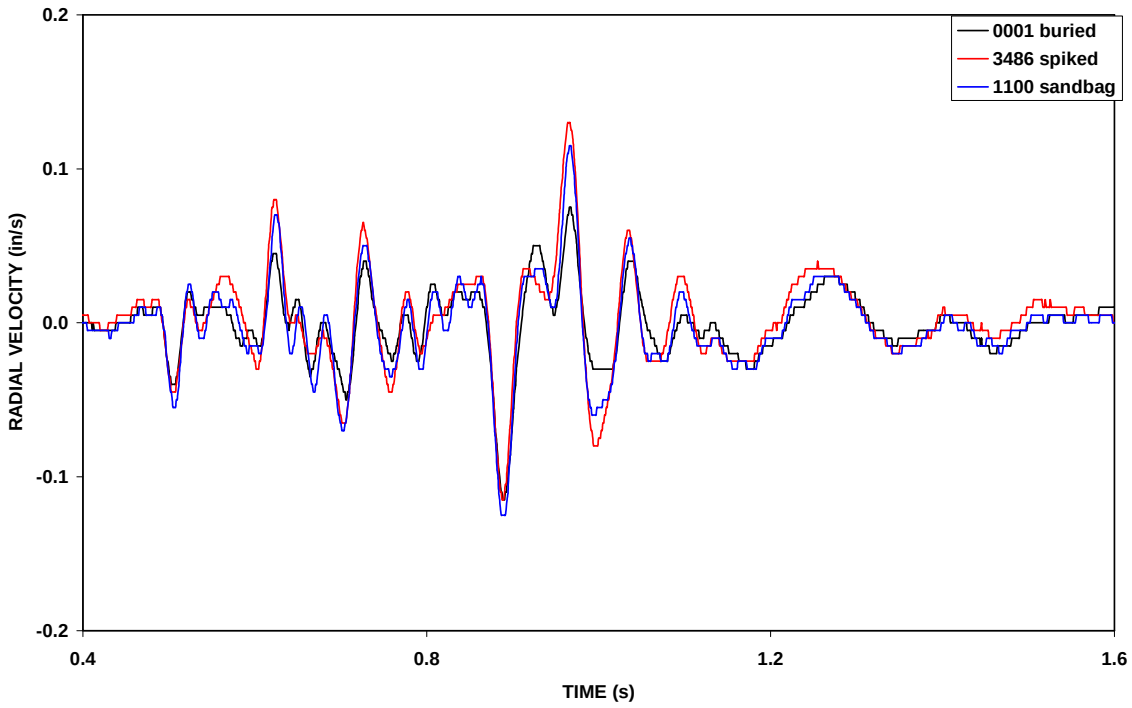

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor (NO DATA)
53.1%
0.160
0.205
0.205
0.245
0.190
39.1%
-0.115
-0.140
-0.160
-0.160
-0.140
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.7
0.8
0.9

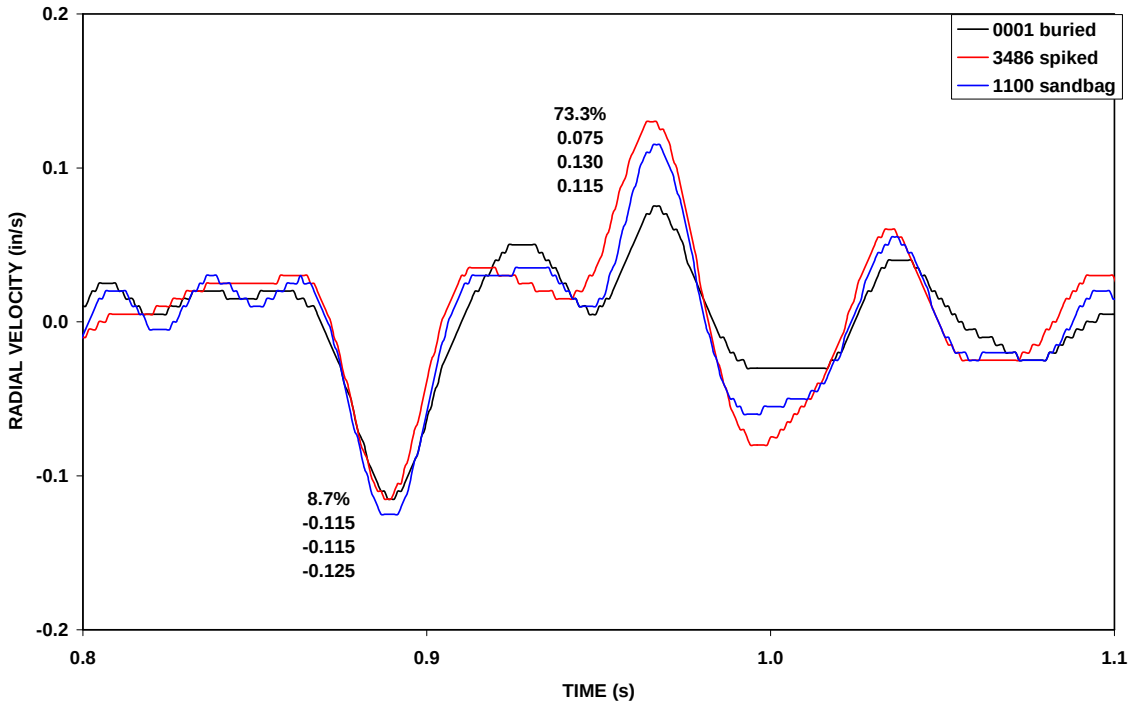

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor (NO DATA)
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.5
0.7
0.9
1.1
1.3
1.5

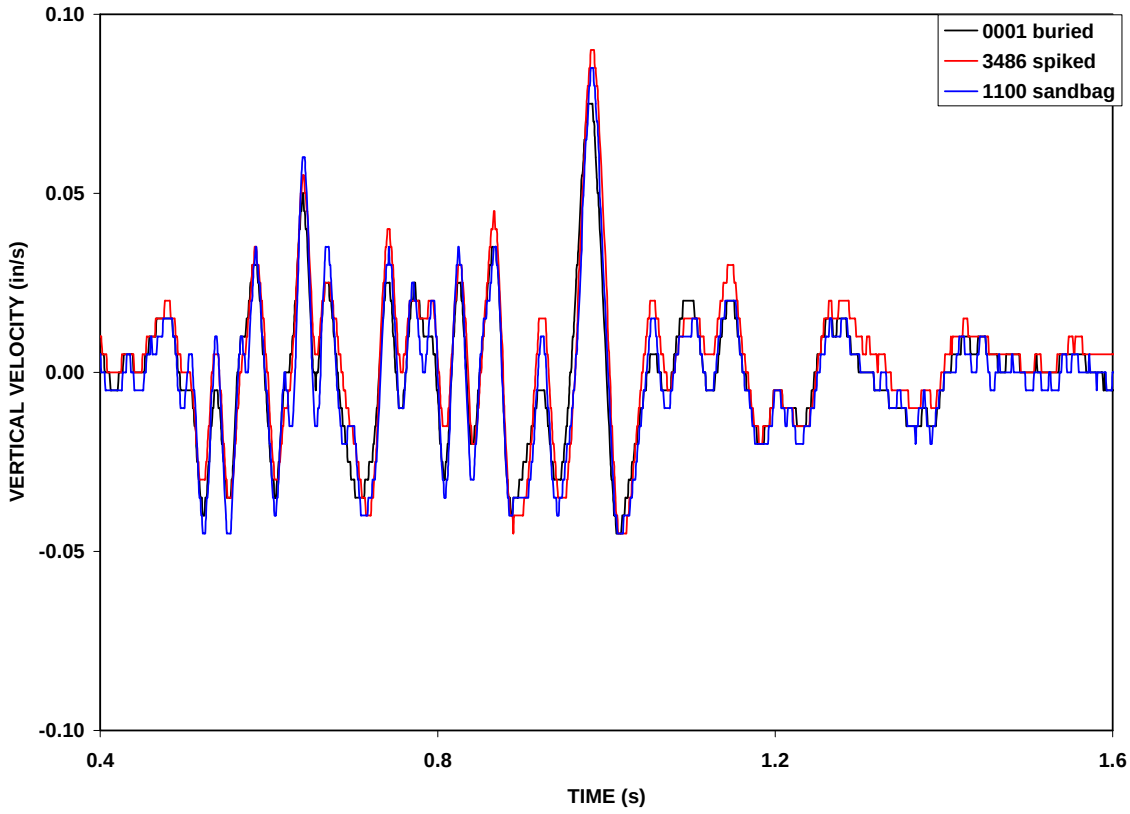

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor (NO DATA)
33.3%
0.21 R
0.28 R
-0.265 R
-0.275 R
-0.28 R
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.7
0.8
0.9
1
1.1
1.2

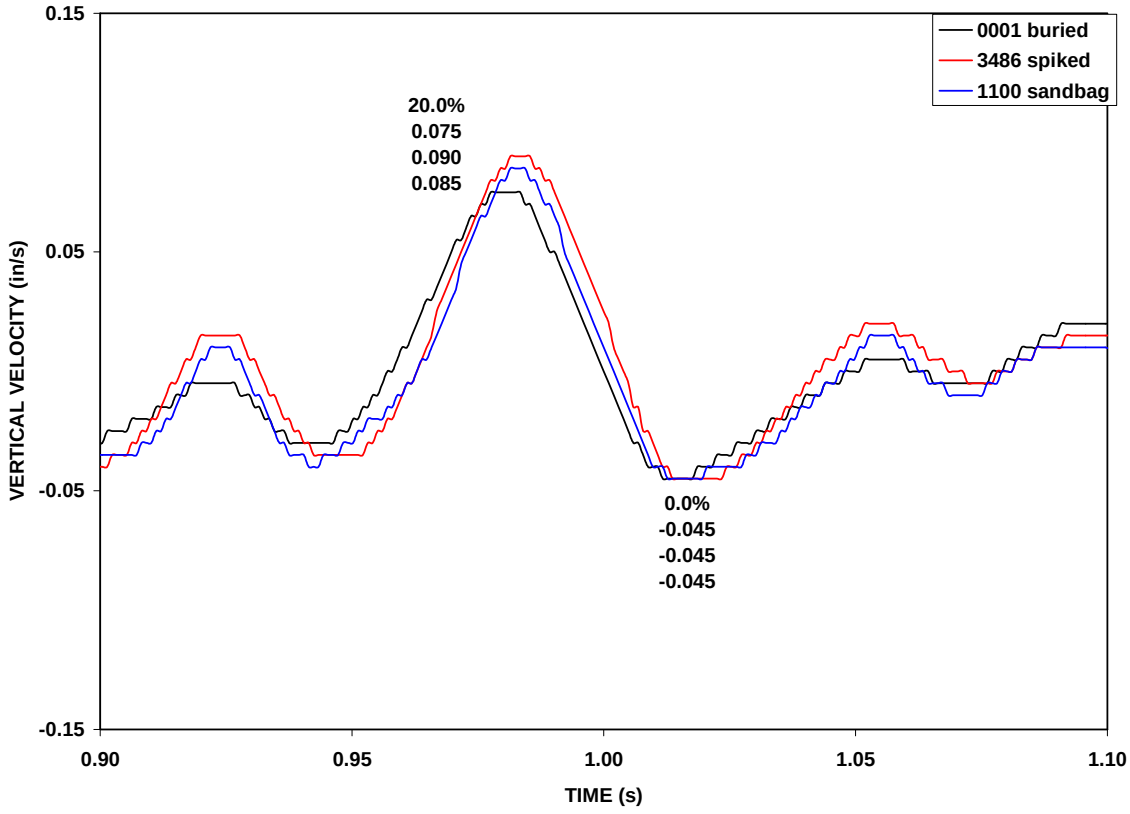
KY-8

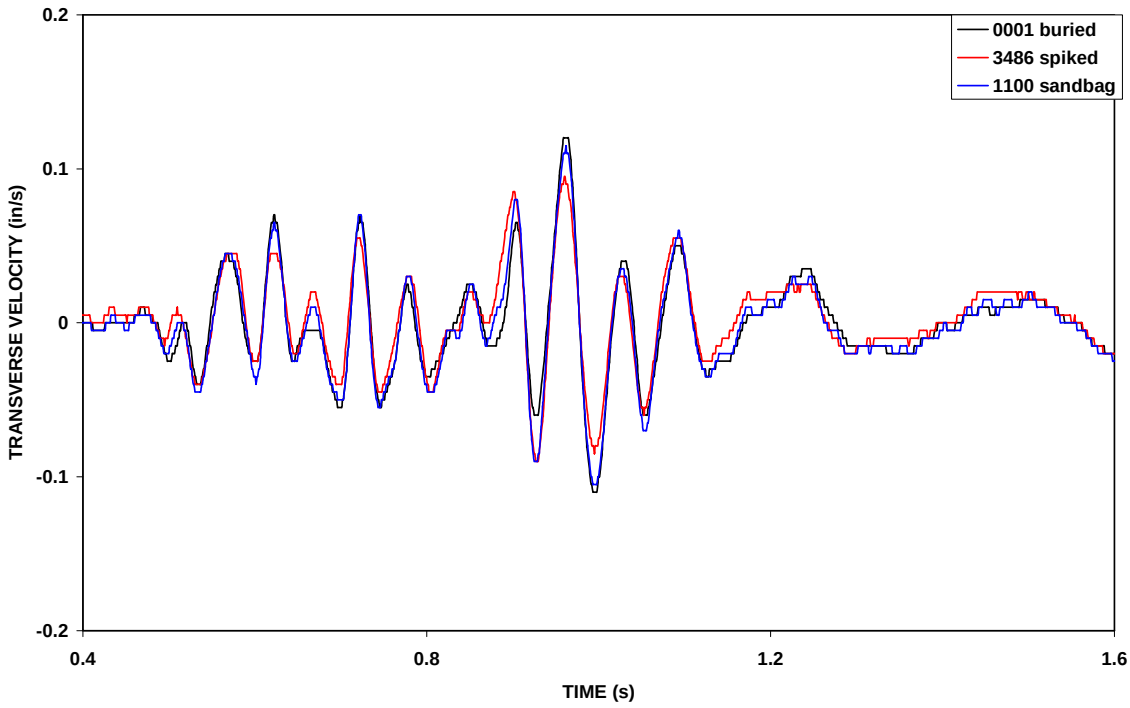
Cluster 2 SD 81.2 ft/lb$^{1/2}$

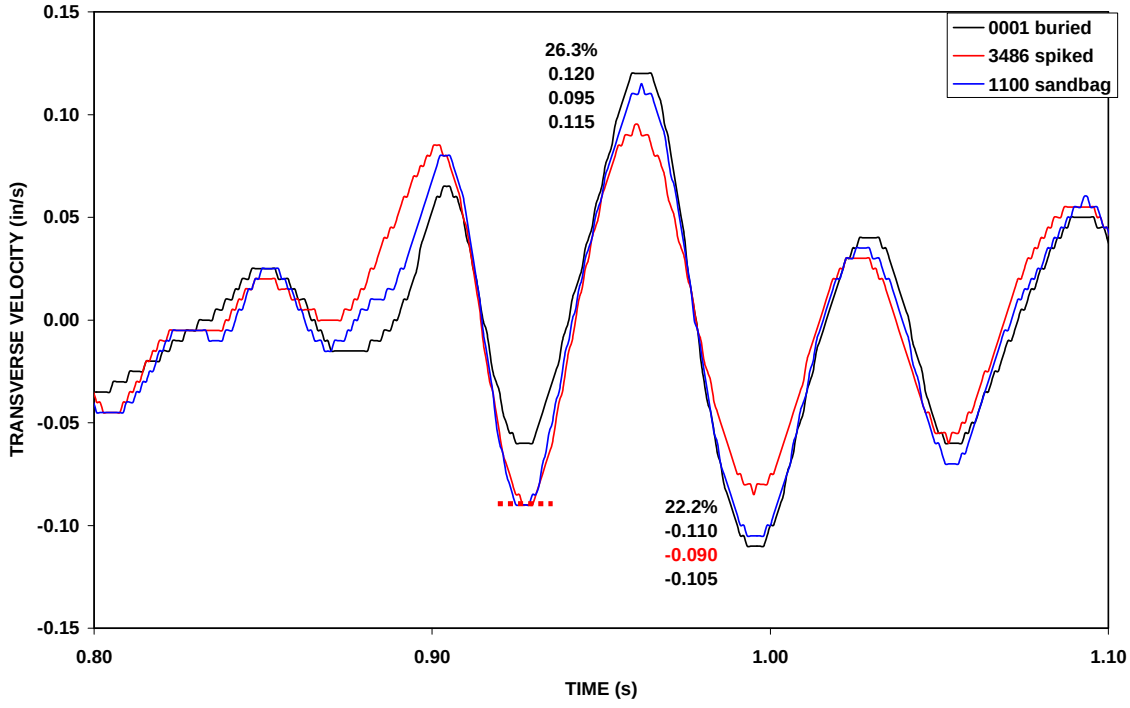

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.8
1.2
1.6
TIME (s)


0001 buried
3486 spiked
1100 sandbag
73.3%
0.075
0.130
0.115
8.7%
-0.115
-0.115
-0.125
RADIAL VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.8
0.9
1.0
1.1
TIME (s)


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
0.10
0.05
0.00
-0.05
-0.10
0.4
0.8
1.2
1.6
TIME (s)

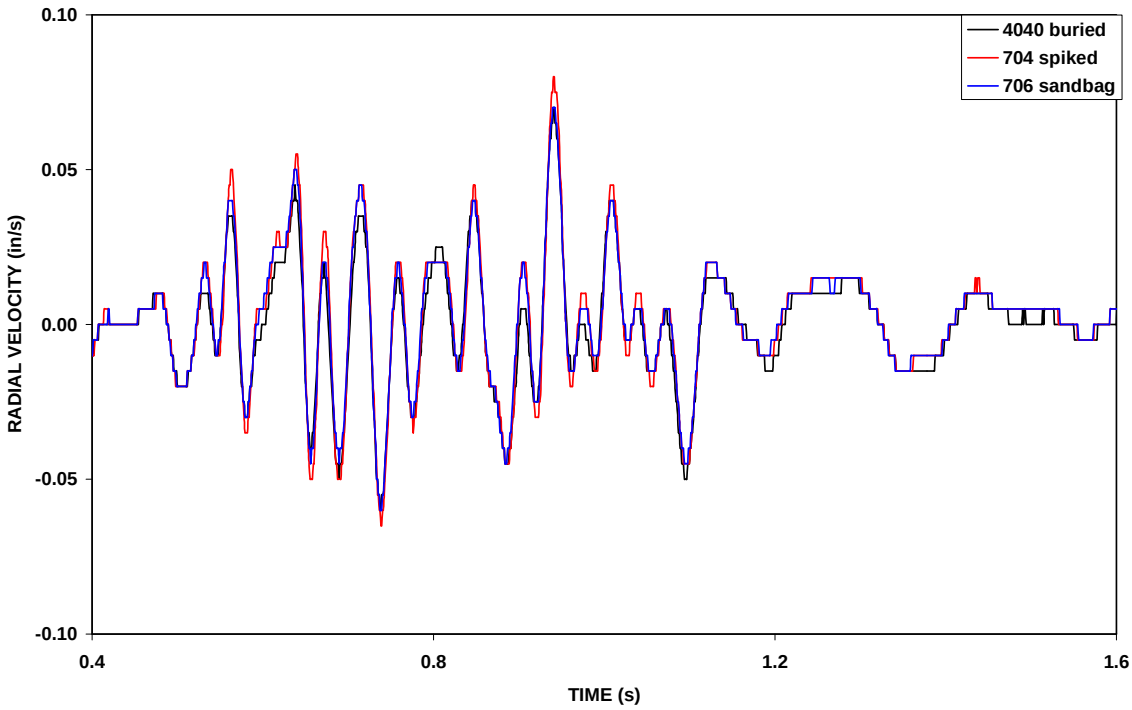

0001 buried
3486 spiked
1100 sandbag
20.0%
0.075
0.090
0.085
0.0%
-0.045
-0.045
-0.045
VERTICAL VELOCITY (in/s)
0.15
0.05
-0.05
-0.15
0.90
0.95
1.00
1.05
1.10
TIME (s)

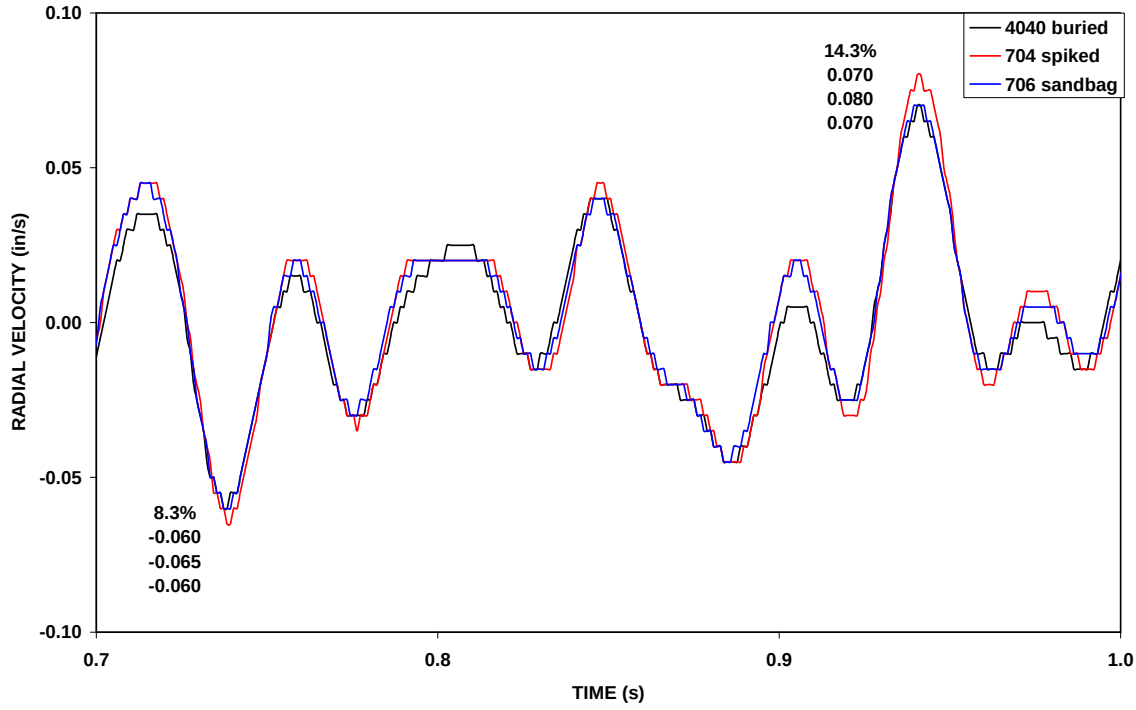

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0
-0.1
-0.2
0.4
0.8
1.2
1.6
TIME (s)

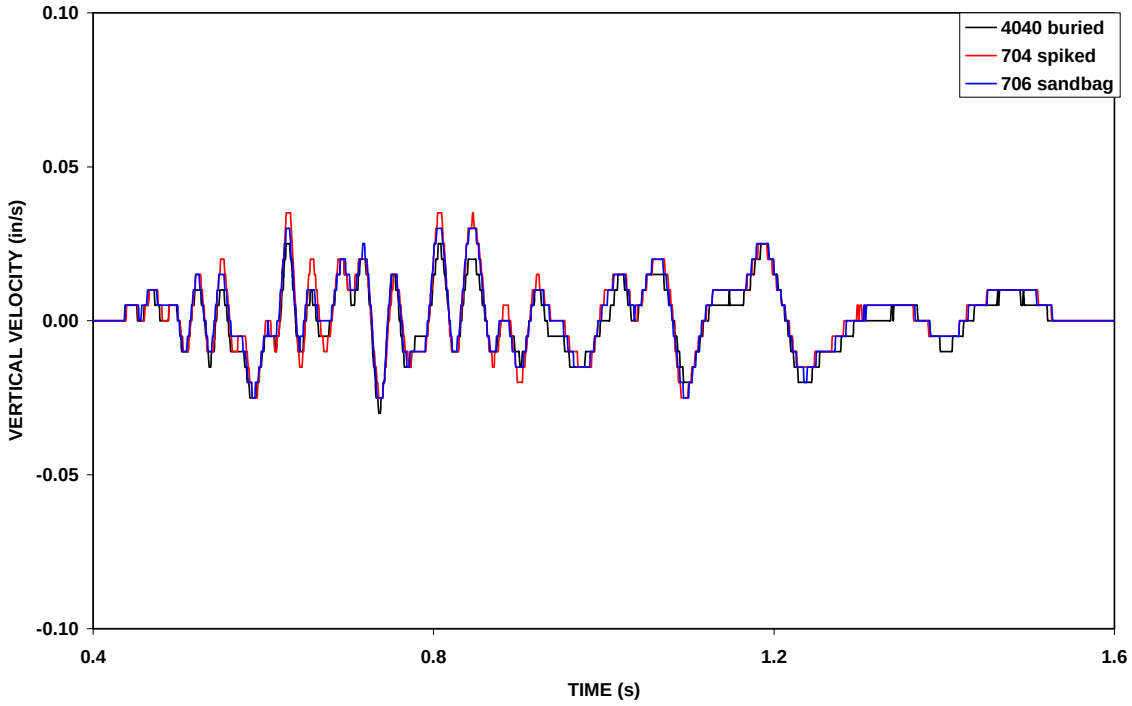

0001 buried
3486 spiked
1100 sandbag
26.3%
0.120
0.095
0.115
22.2%
-0.110
-0.090
-0.105
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.80
0.90
1.00
1.10
TIME (s)

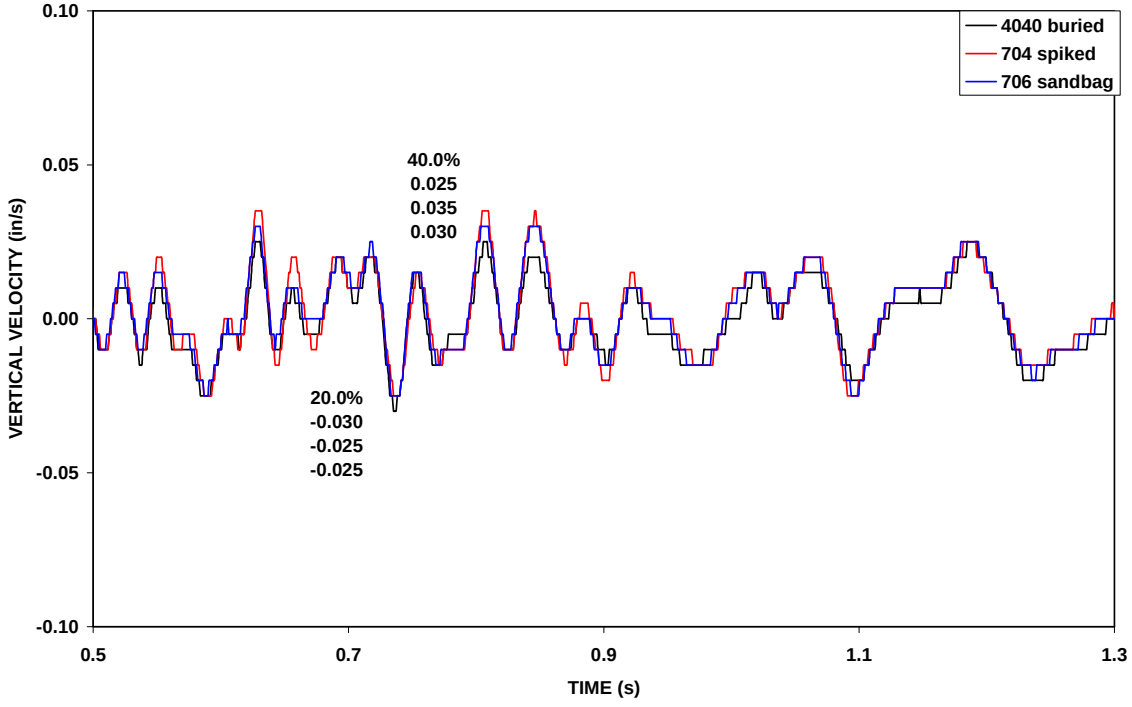
KY-8

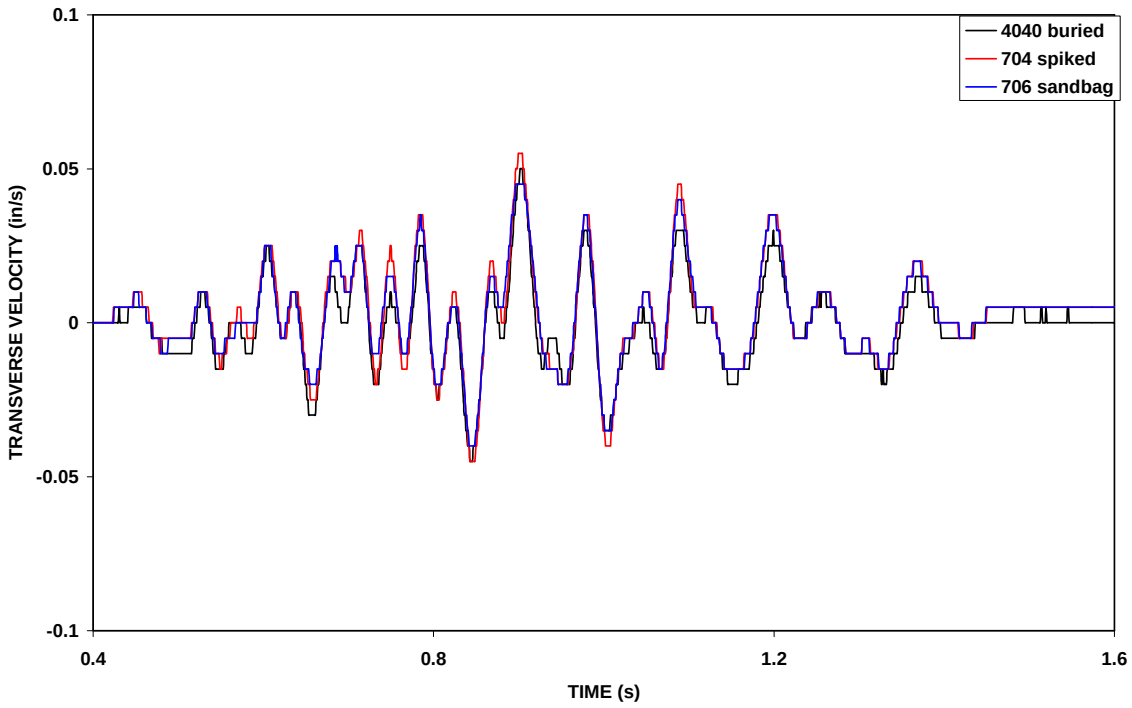
Cluster 4 SD 180.3 ft/lb$^{1/2}$

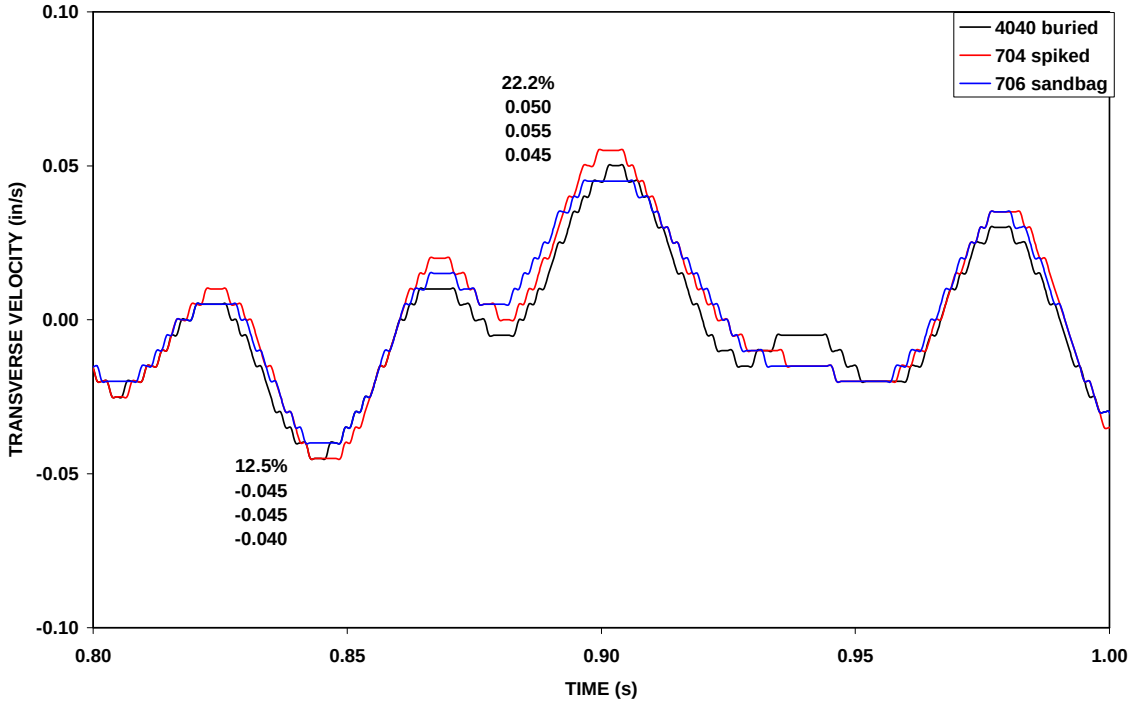

0.10
0.05
0.00
-0.05
-0.10
RADIAL VELOCITY (in/s)
0.4
0.8
1.2
1.6
TIME (s)
4040 buried
704 spiked
706 sandbag


0.10
0.05
0.00
-0.05
-0.10
RADIAL VELOCITY (in/s)
0.7
0.8
0.9
1.0
TIME (s)
4040 buried
704 spiked
706 sandbag
14.3%
0.070
0.080
0.070
8.3%
-0.060
-0.065
-0.060


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
0.10
0.05
0.00
-0.05
-0.10
0.4
0.8
1.2
1.6
TIME (s)

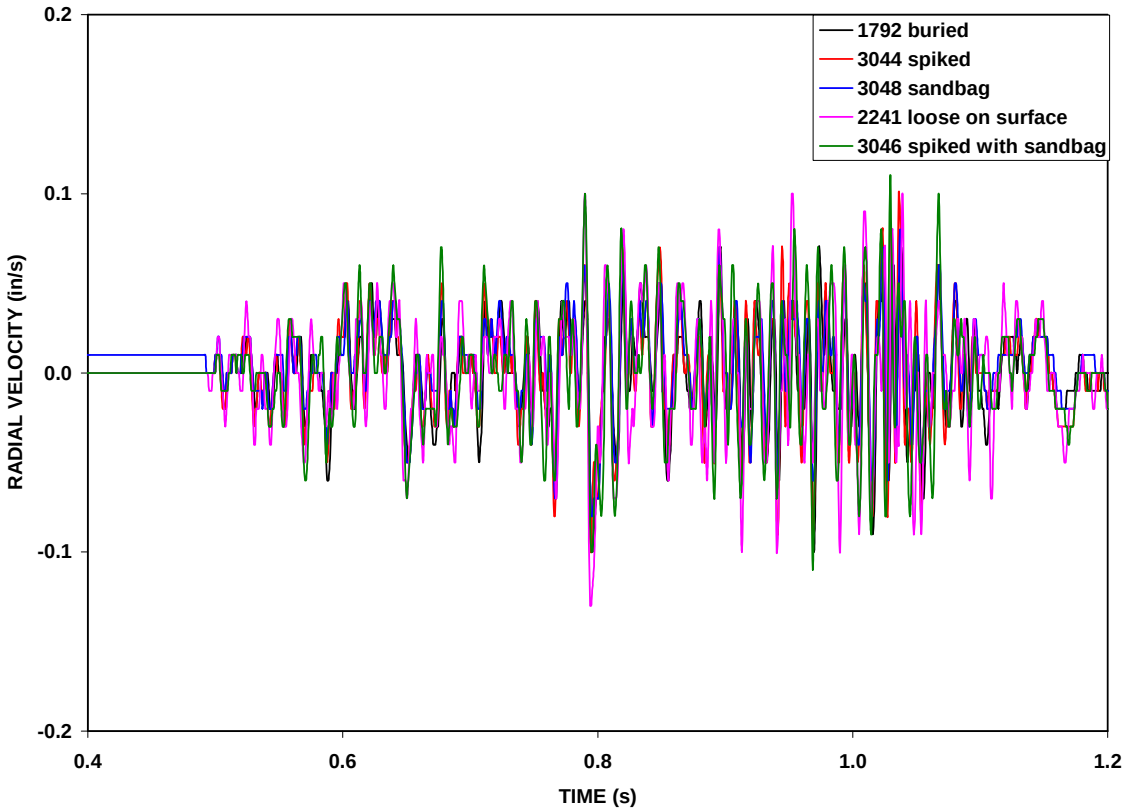

4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
40.0%
0.025
0.035
0.030
20.0%
-0.030
-0.025
-0.025
0.10
0.05
0.00
-0.05
-0.10
0.5
0.7
0.9
1.1
1.3
TIME (s)

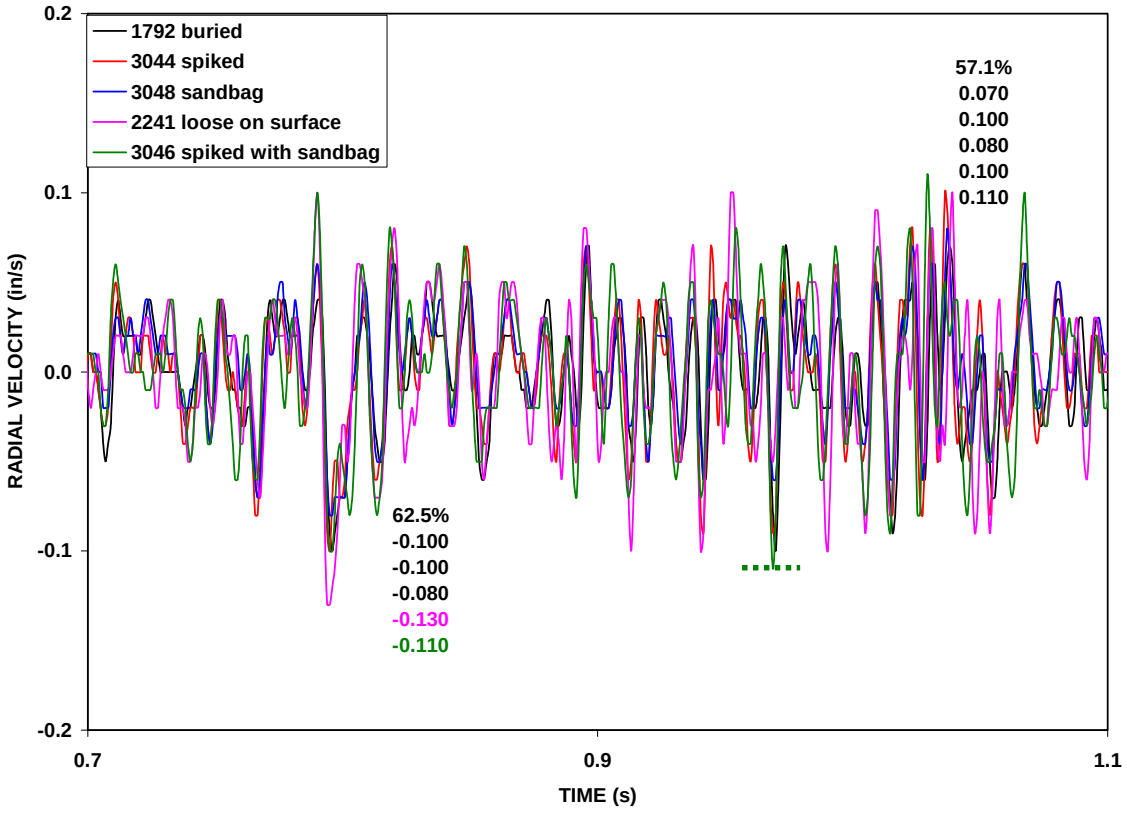

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
0.1
0.05
0
-0.05
-0.1
0.4
0.8
1.2
1.6
TIME (s)

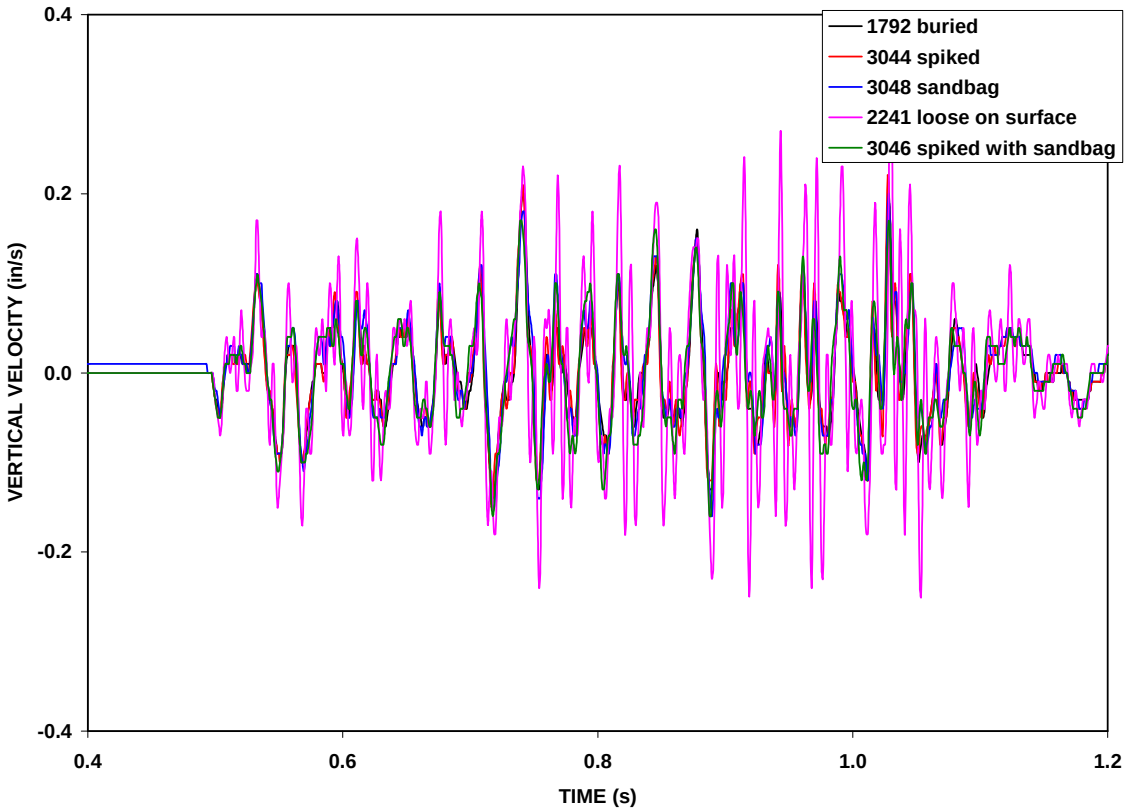

4040 buried
704 spiked
706 sandbag
22.2%
0.050
0.055
0.045
12.5%
-0.045
-0.045
-0.040
TRANSVERSE VELOCITY (in/s)
0.10
0.05
0.00
-0.05
-0.10
0.80
0.85
0.90
0.95
1.00
TIME (s)

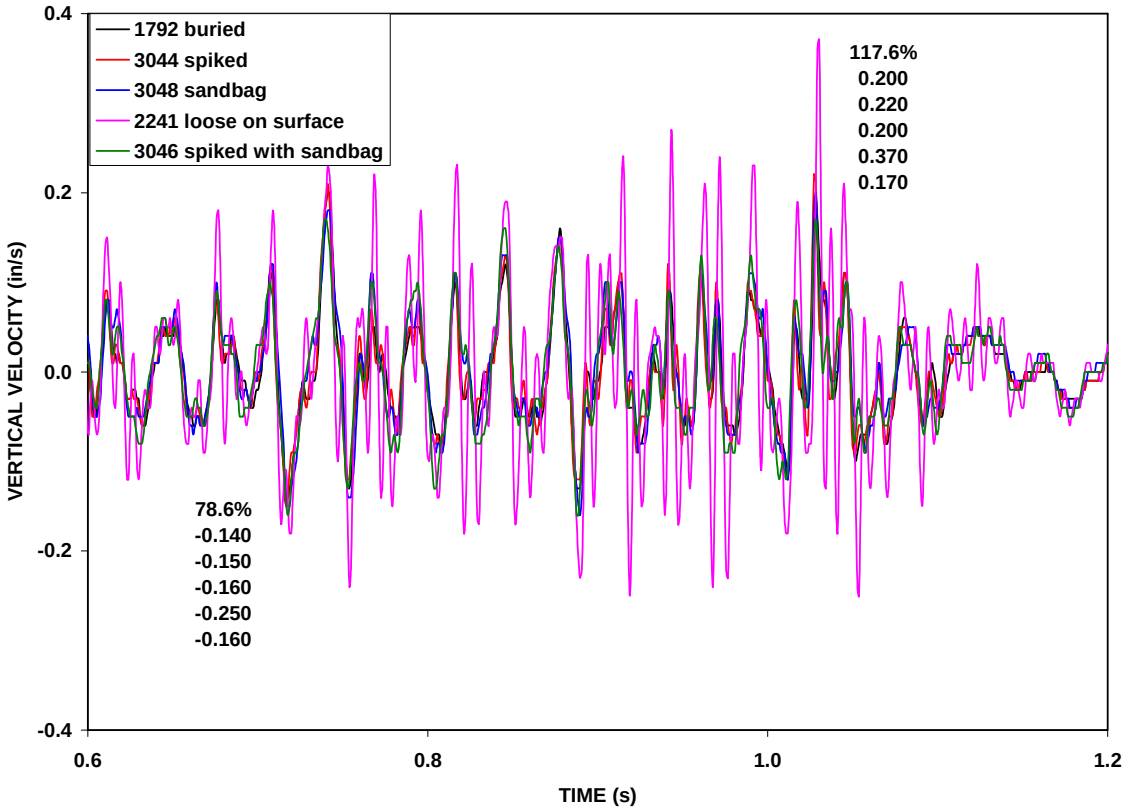
MI-1

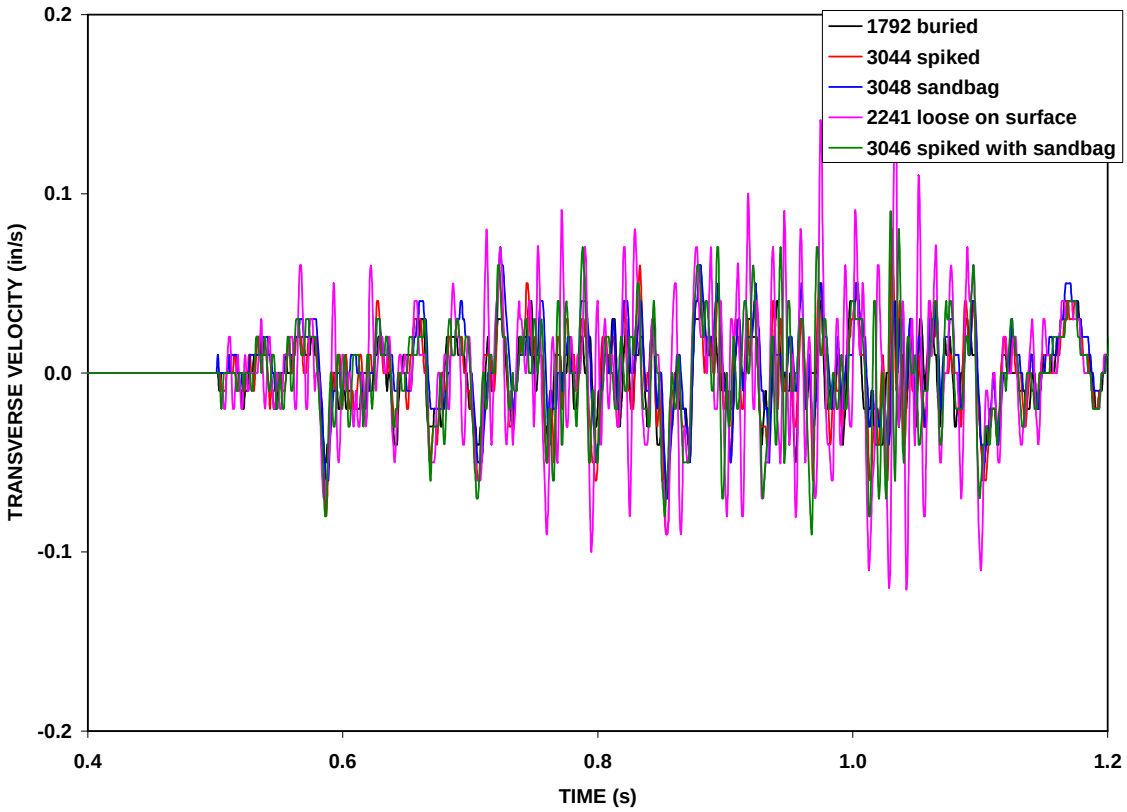
Cluster 1 SD 42.7 ft/lb$^{1/2}$

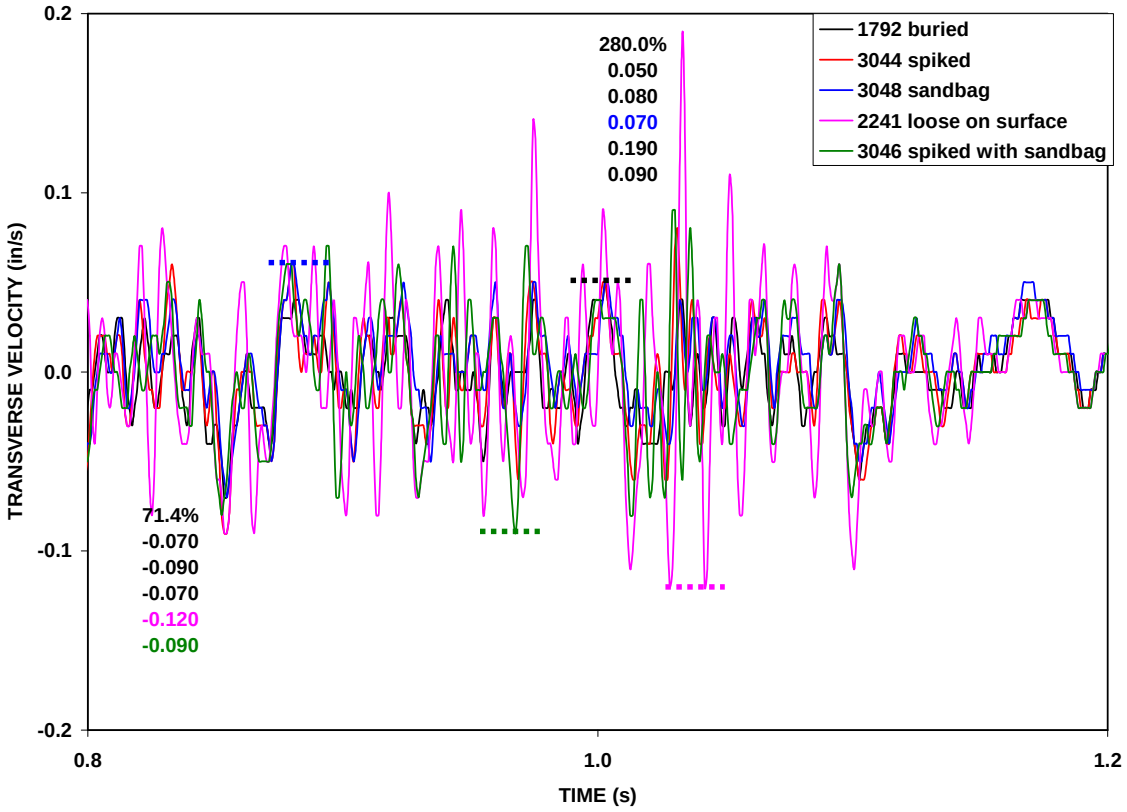

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2

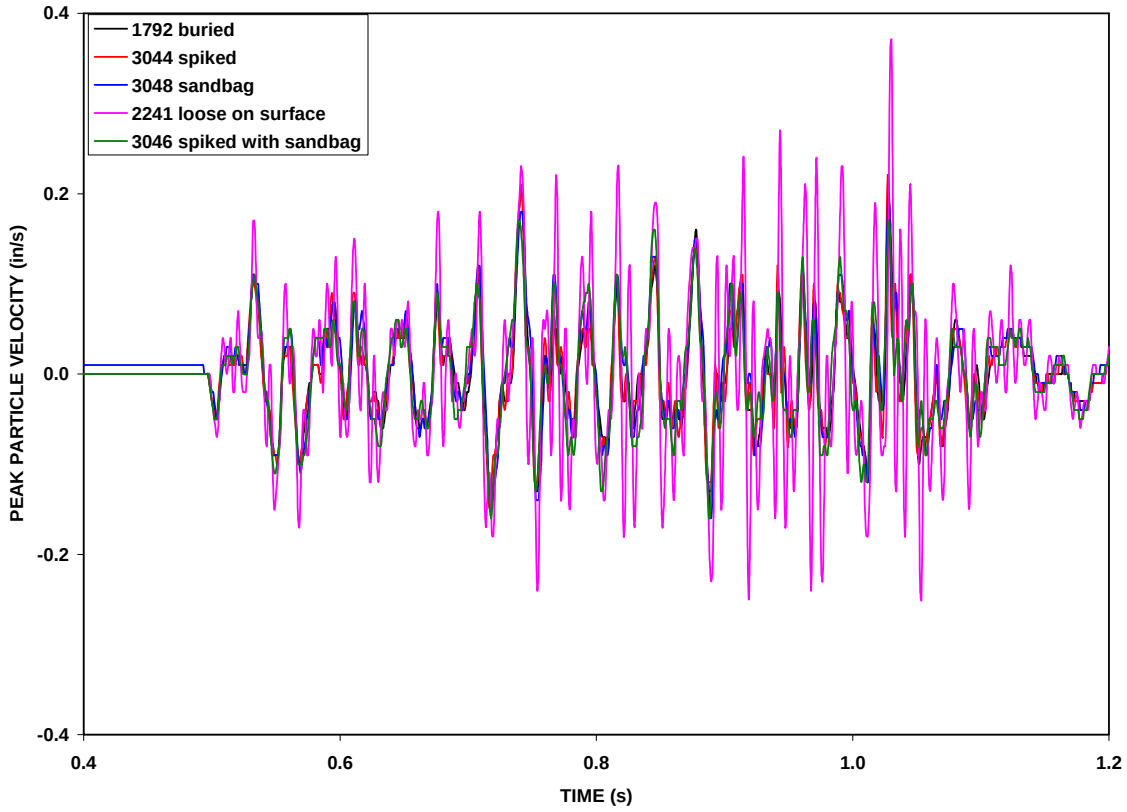

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
57.1%
0.070
0.100
0.080
0.100
0.110
62.5%
-0.100
-0.100
-0.080
-0.130
-0.110
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.7
0.9
1.1

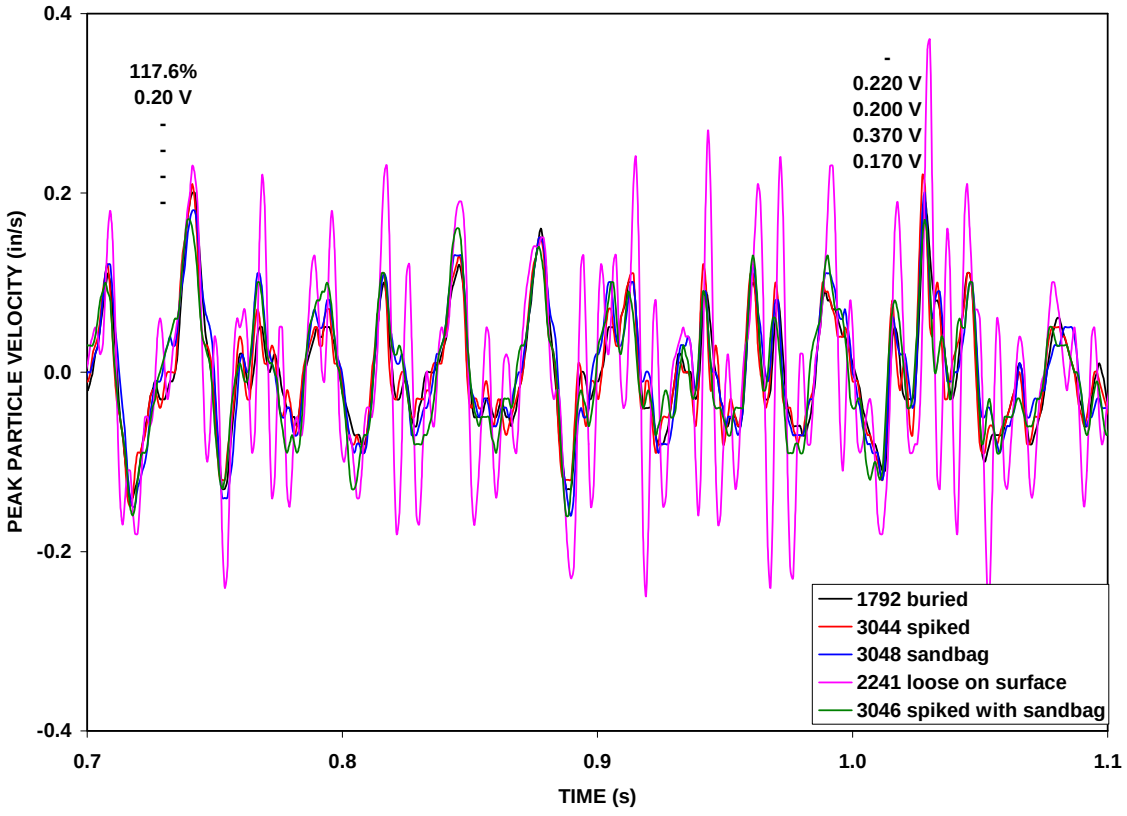

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.6
0.8
1.0
1.2


1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
117.6%
0.200
0.220
0.200
0.370
0.170
78.6%
-0.140
-0.150
-0.160
-0.250
-0.160
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.6
0.8
1.0
1.2


1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
TIME (s)

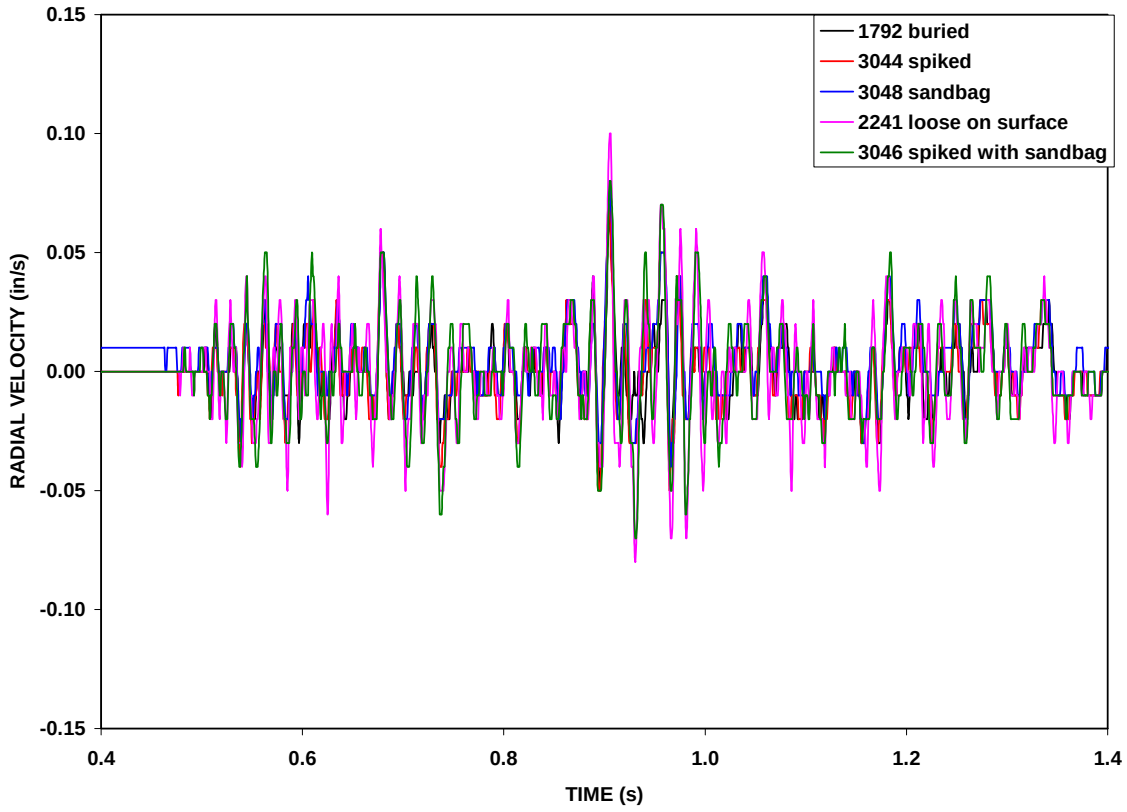

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
280.0%
0.050
0.080
0.070
0.190
0.090
71.4%
-0.070
-0.090
-0.070
-0.120
-0.090
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.8
1.0
1.2
TIME (s)

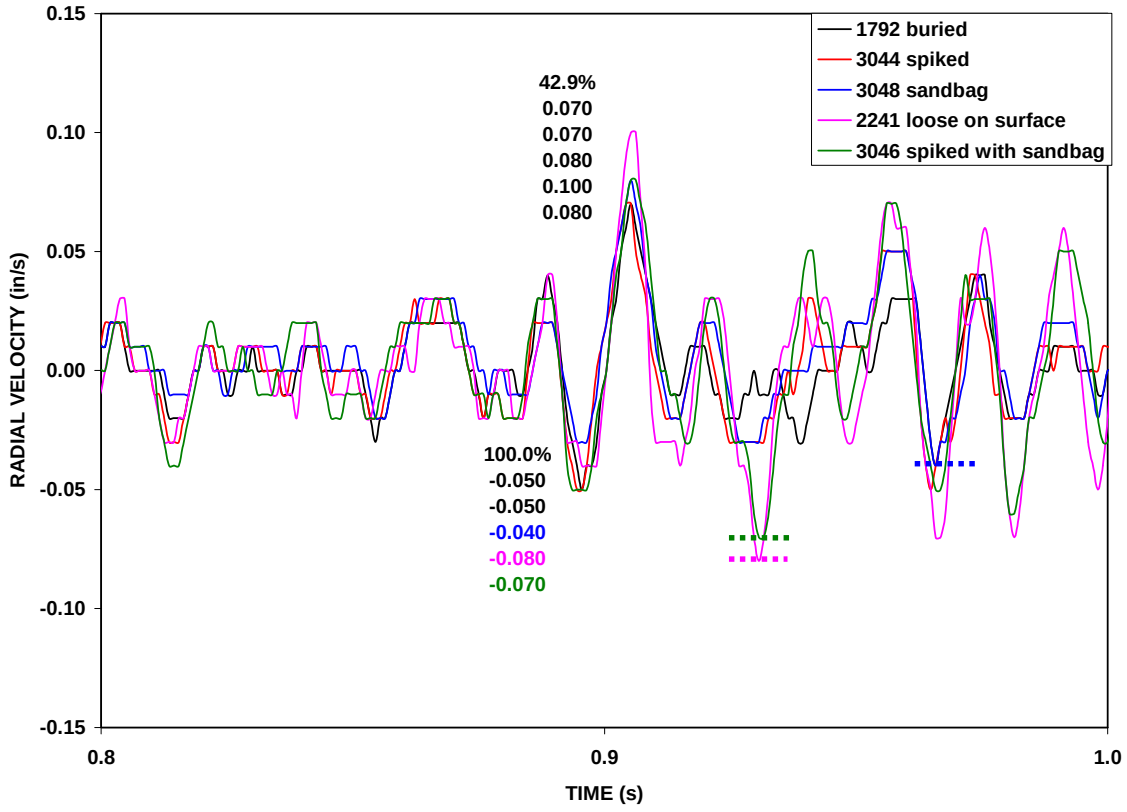

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.6
0.8
1.0
1.2

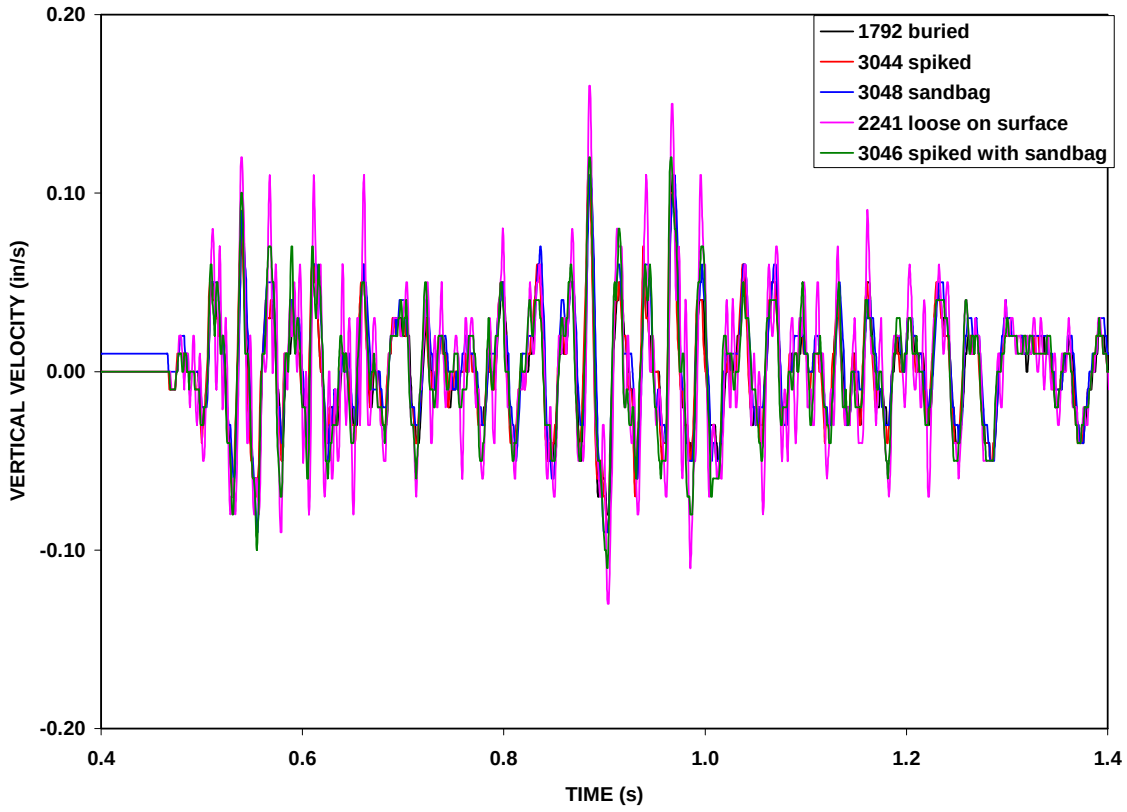

117.6%
0.20 V
-
-
-
-
-
0.220 V
0.200 V
0.370 V
0.170 V
1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.7
0.8
0.9
1.0
1.1

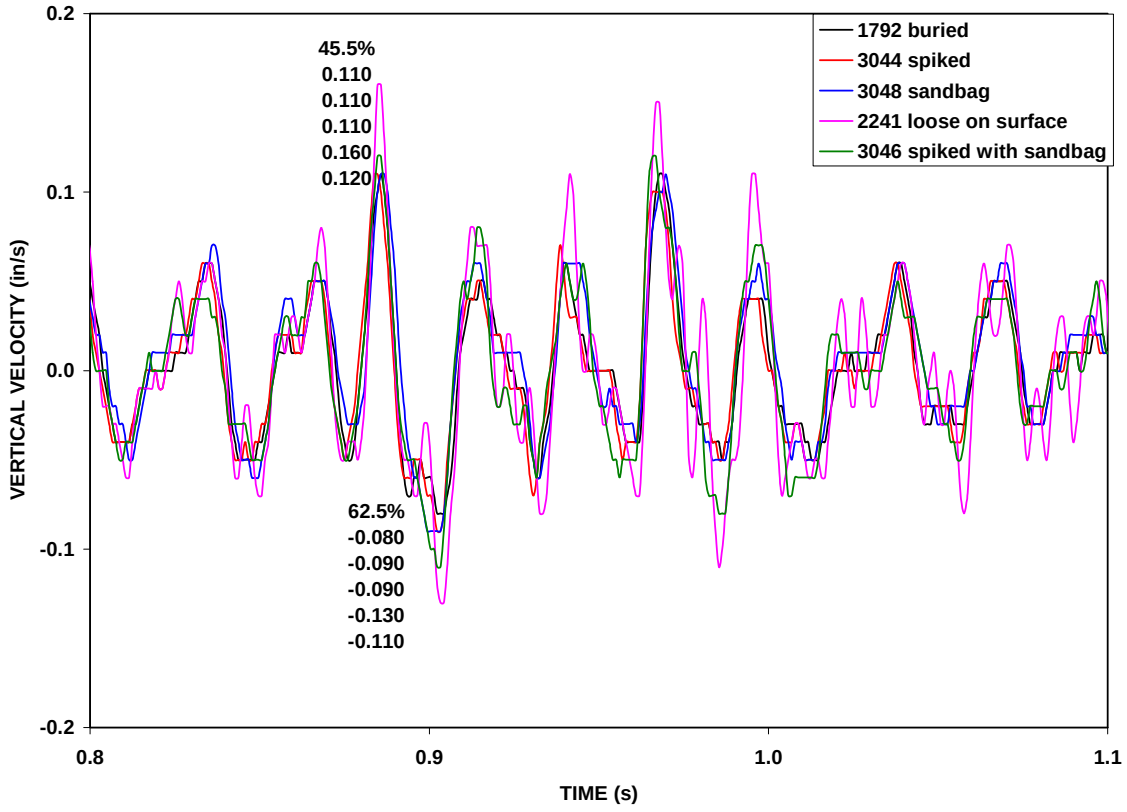
MI-2

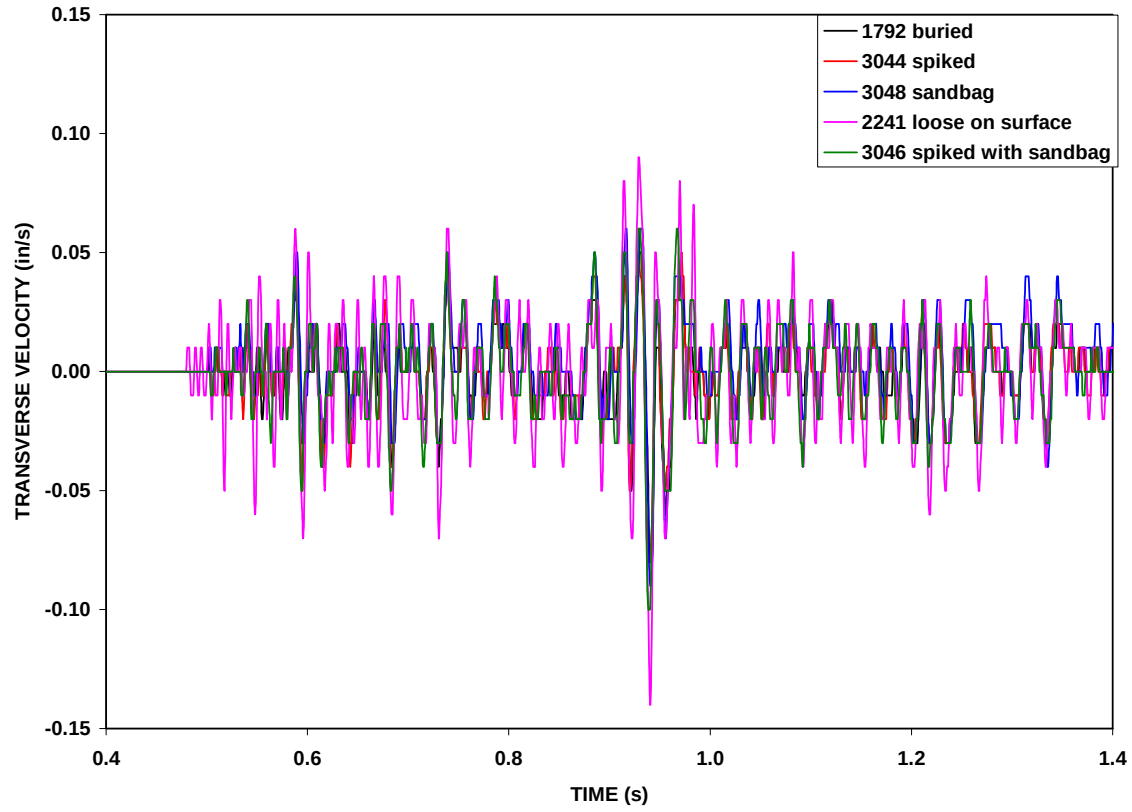
Cluster 1 SD 59.6 ft/lb$^{1/2}$

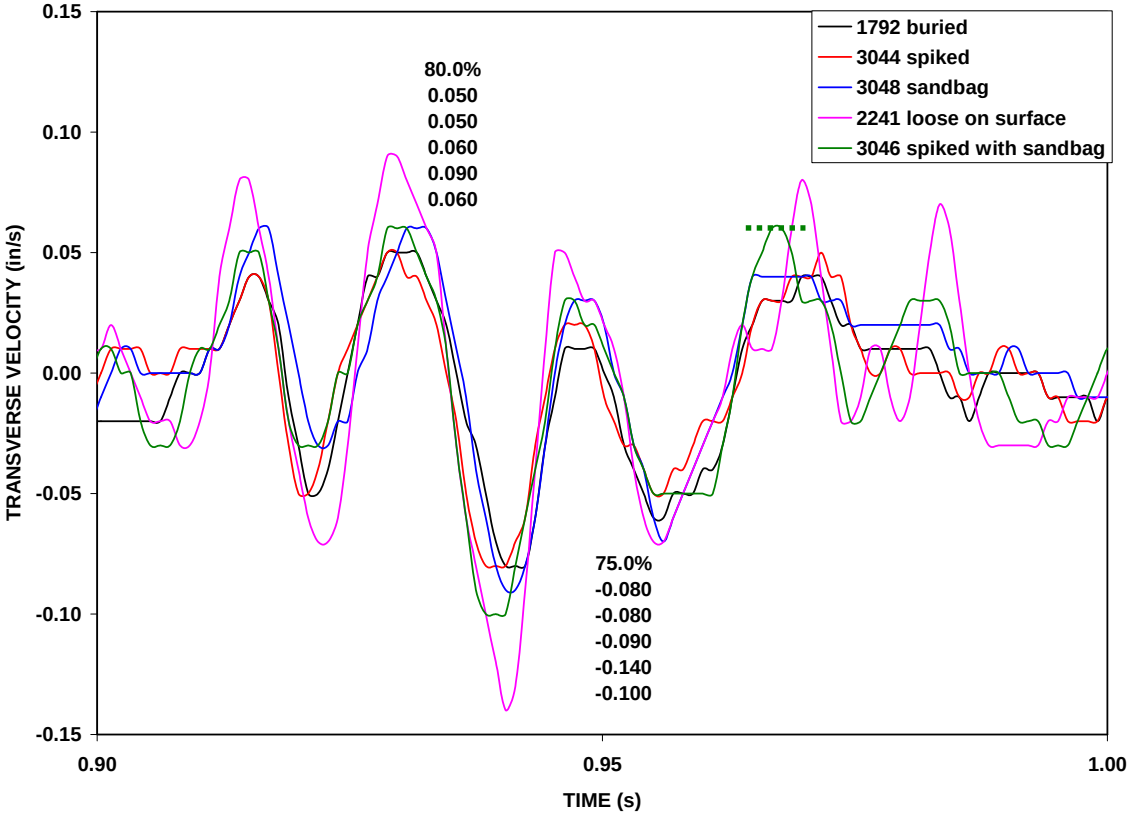

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4

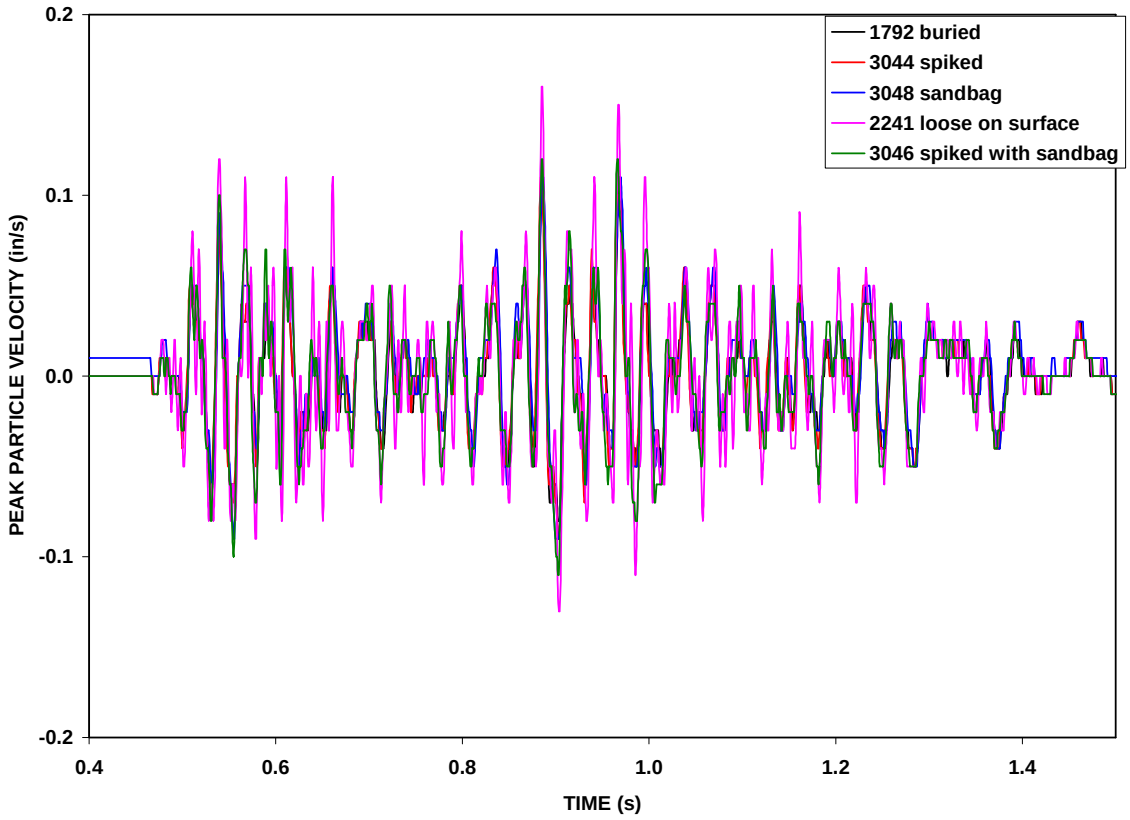

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
42.9%
0.070
0.070
0.080
0.100
0.080
100.0%
-0.050
-0.050
-0.040
-0.080
-0.070
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.8
0.9
1.0

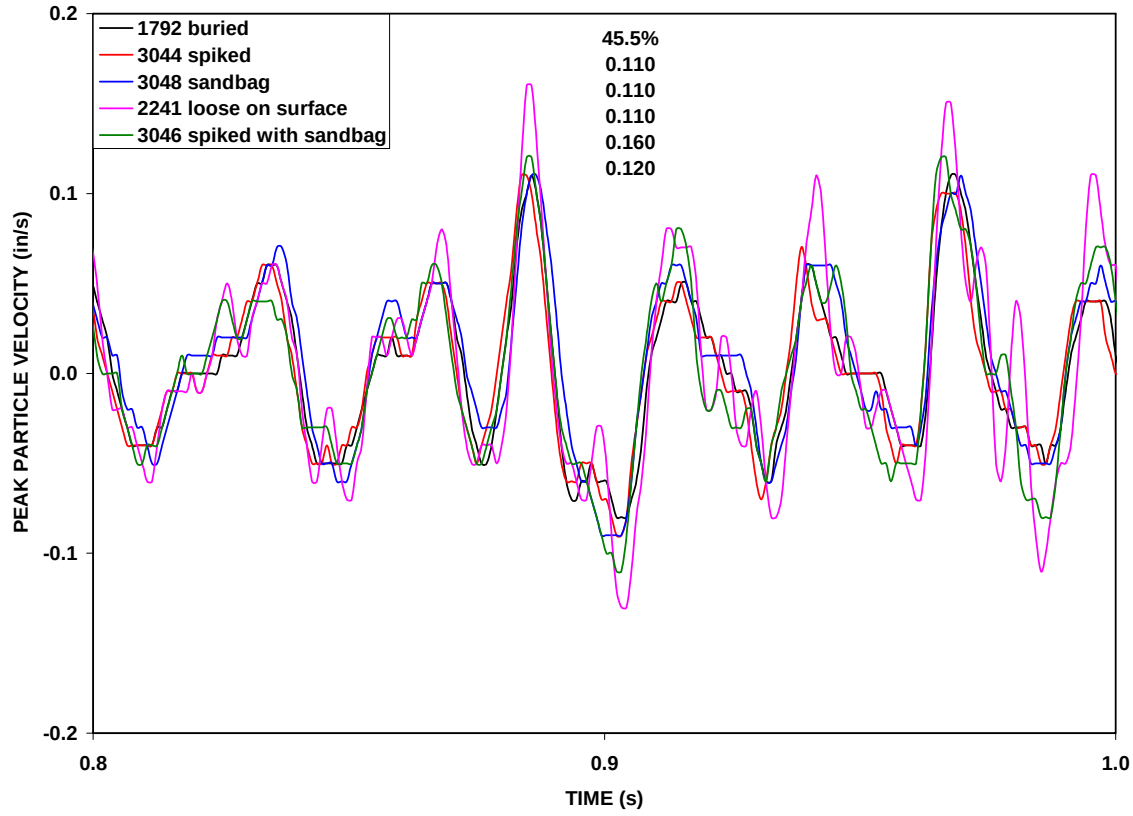

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.20
0.10
0.00
-0.10
-0.20
0.4
0.6
0.8
1.0
1.2
1.4


1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
45.5%
0.110
0.110
0.110
0.160
0.120
62.5%
-0.080
-0.090
-0.090
-0.130
-0.110
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.8
0.9
1.0
1.1


1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4

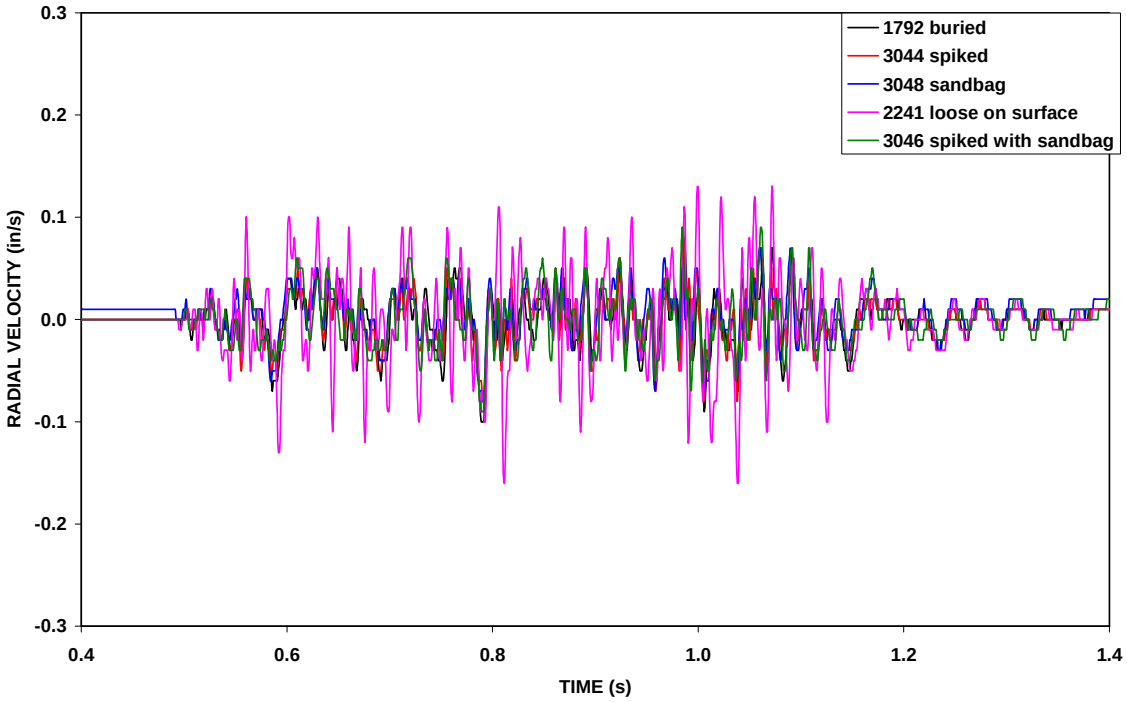

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
80.0%
0.050
0.050
0.060
0.090
0.060
75.0%
-0.080
-0.080
-0.090
-0.140
-0.100
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.90
0.95
1.00

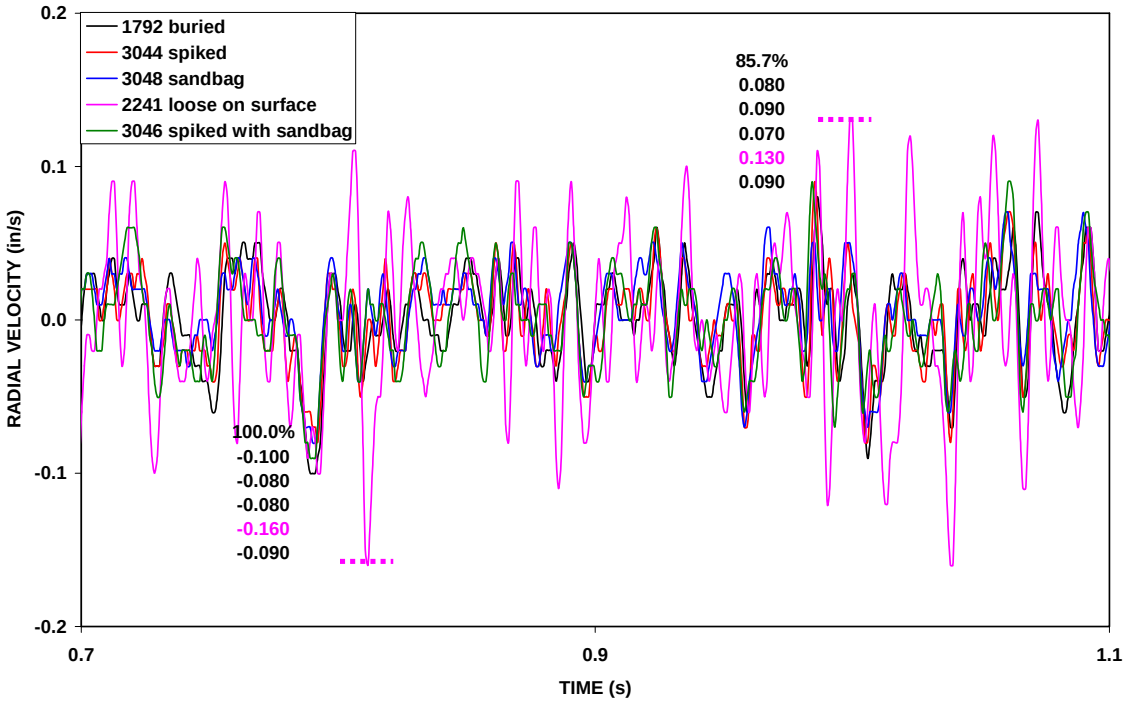

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4

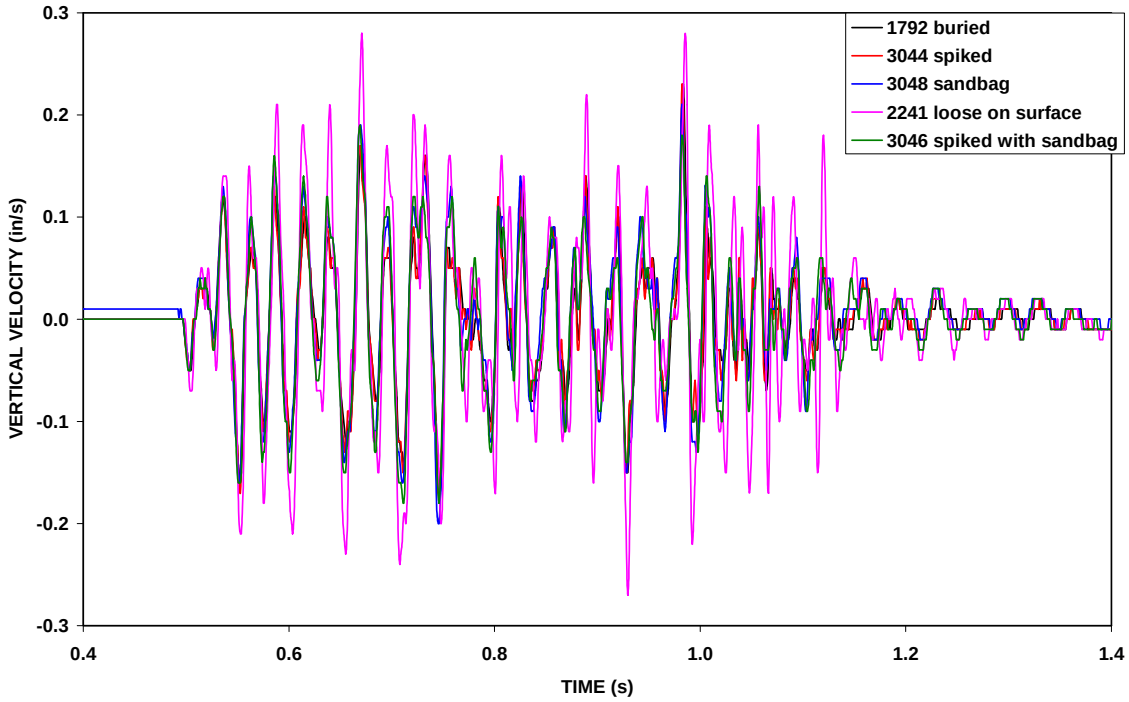

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
45.5%
0.110
0.110
0.110
0.160
0.120
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.8
0.9
1.0

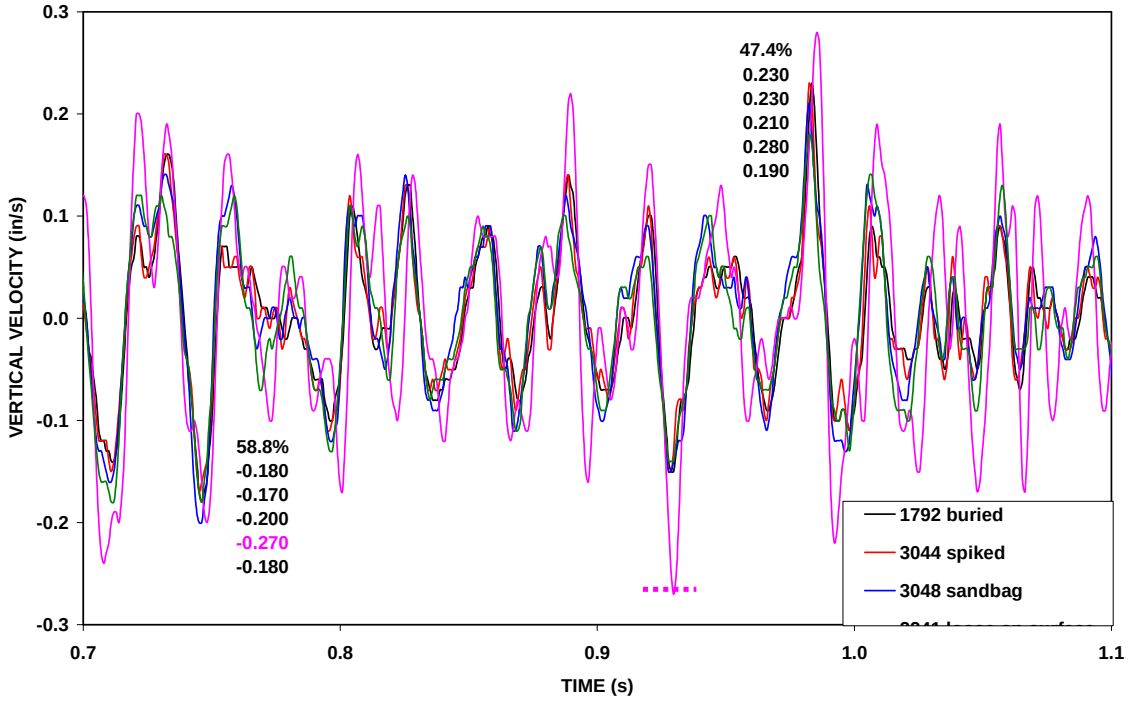
MI-3

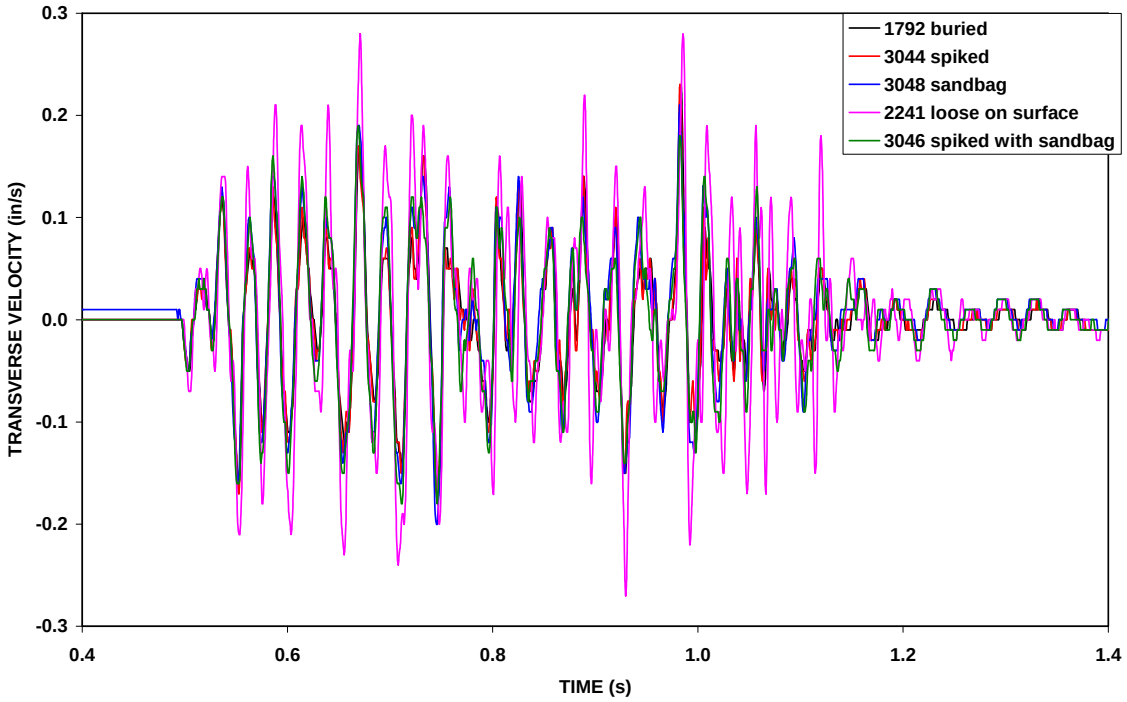
Cluster 1 SD 38.2 ft/lb$^{1/2}$

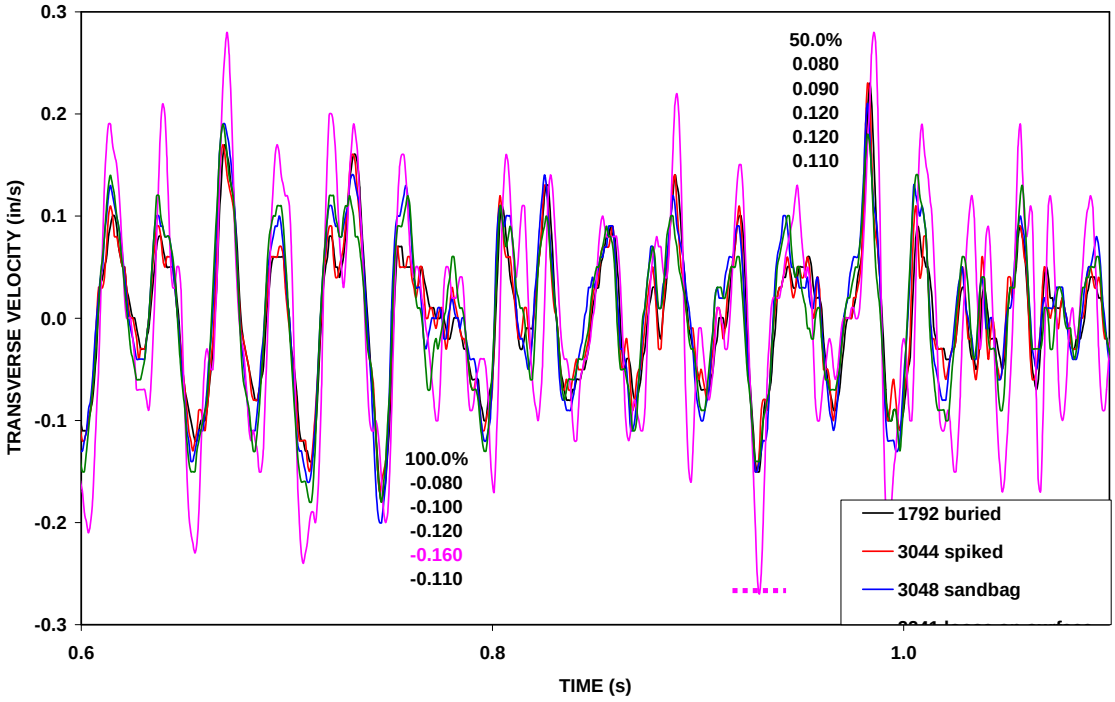

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4

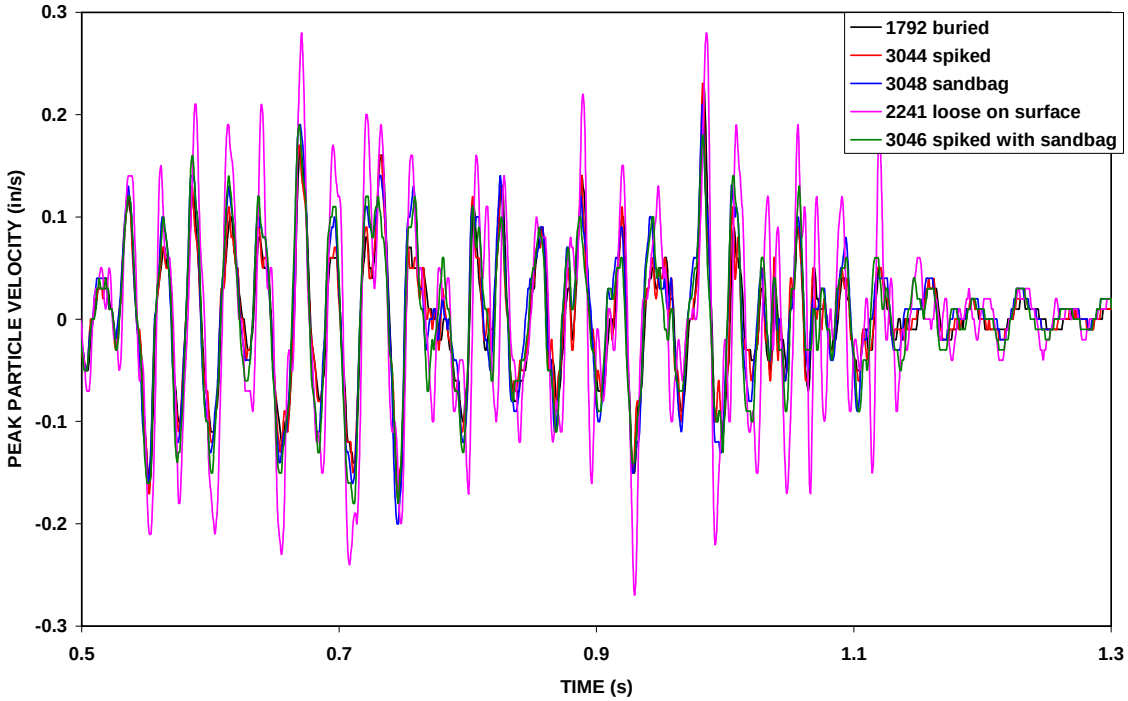

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
85.7%
0.080
0.090
0.070
0.130
0.090
100.0%
-0.100
-0.080
-0.080
-0.160
-0.090
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.7
0.9
1.1

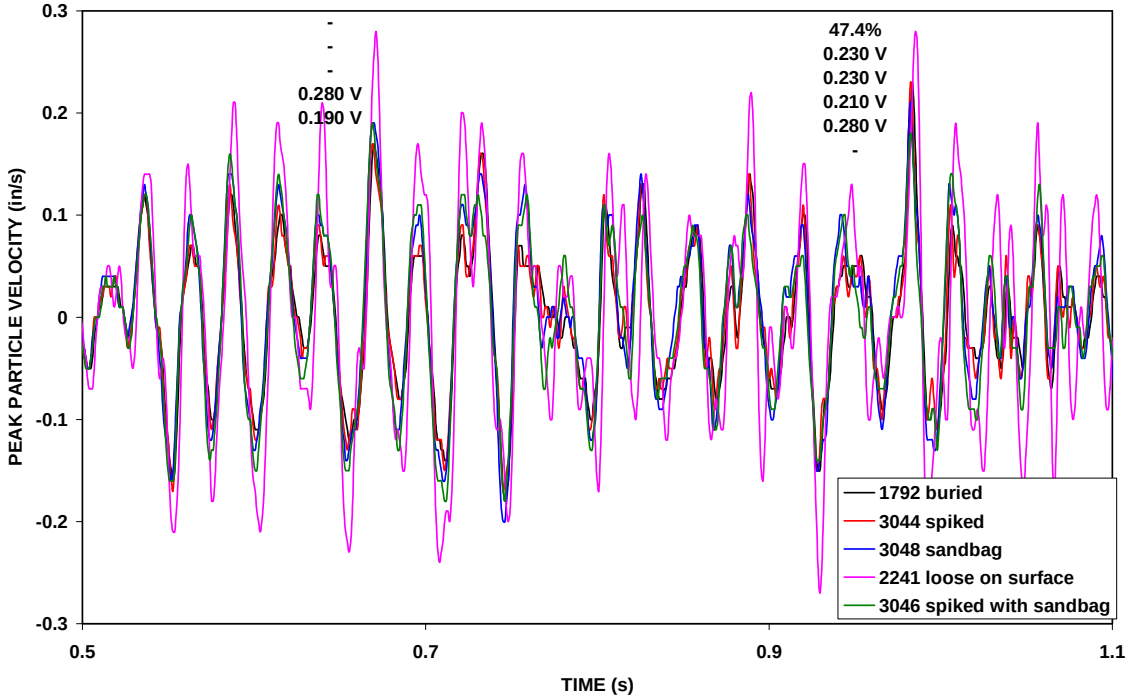

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4


47.4%
0.230
0.230
0.210
0.280
0.190
58.8%
-0.180
-0.170
-0.200
-0.270
-0.180
1792 buried
3044 spiked
3048 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.7
0.8
0.9
1.0
1.1


0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
TRANSVERSE VELOCITY (in/s)
0.4
0.6
0.8
1.0
1.2
1.4
TIME (s)
1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag

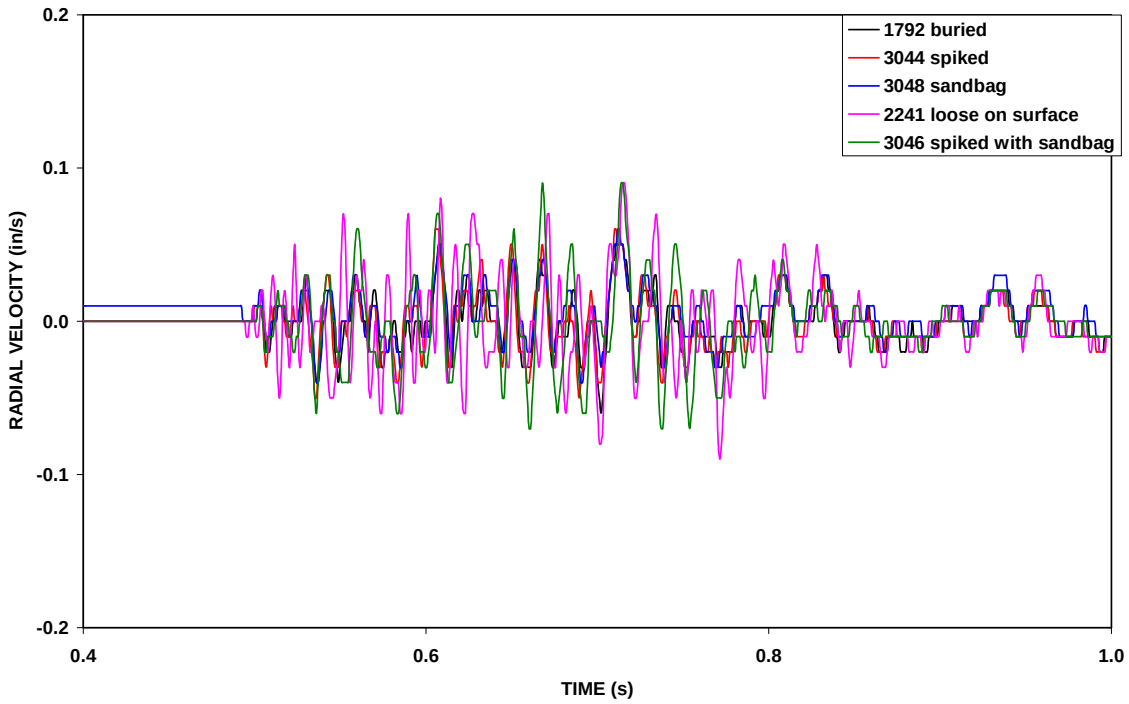

0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
TRANSVERSE VELOCITY (in/s)
0.6
0.8
1.0
TIME (s)
50.0%
0.080
0.090
0.120
0.120
0.110
100.0%
-0.080
-0.100
-0.120
-0.160
-0.110
1792 buried
3044 spiked
3048 sandbag

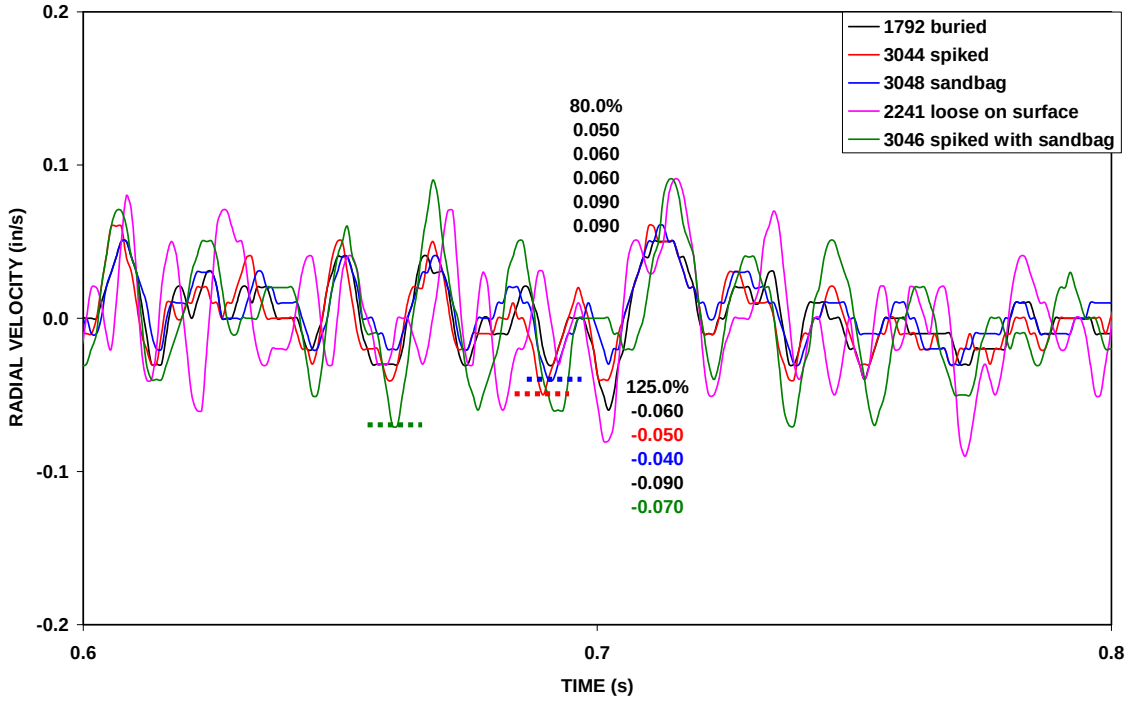

0.3
0.2
0.1
0
-0.1
-0.2
-0.3
PEAK PARTICLE VELOCITY (in/s)
0.5
0.7
0.9
1.1
1.3
TIME (s)
1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag

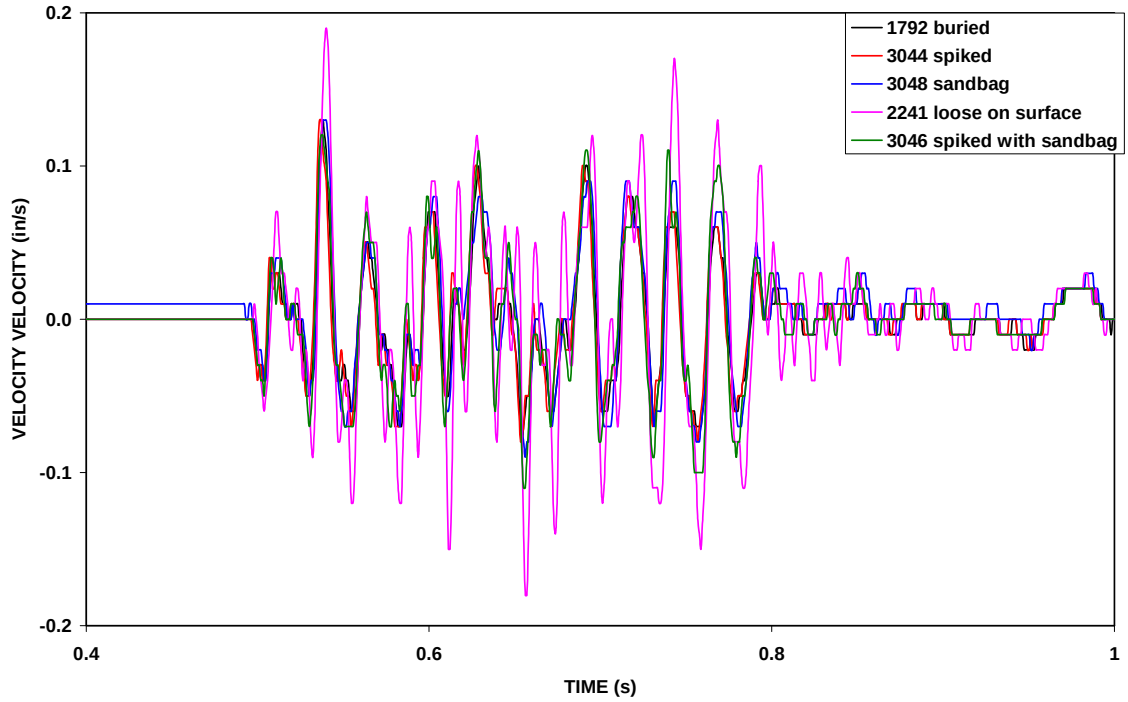

0.3
0.2
0.1
0
-0.1
-0.2
-0.3
PEAK PARTICLE VELOCITY (in/s)
0.5
0.7
0.9
1.1
TIME (s)
-
-
-
0.280 V
0.190 V
47.4%
0.230 V
0.230 V
0.210 V
0.280 V
-
1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag

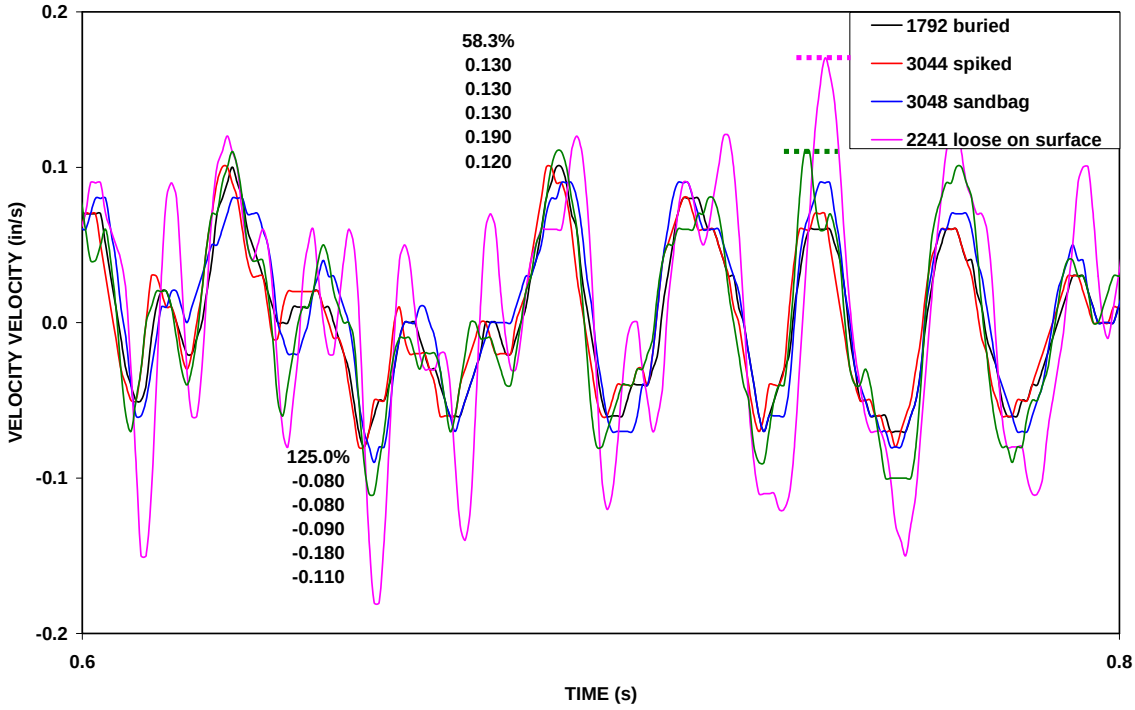
MI-4

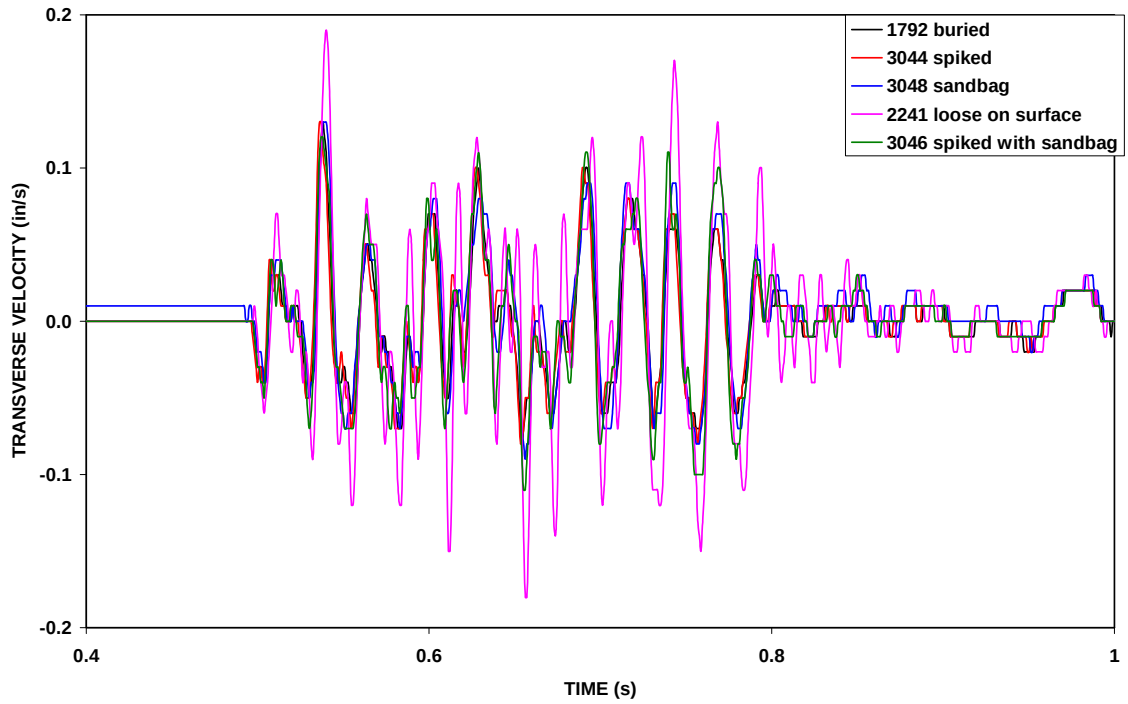
Cluster 1 SD 57.5 ft/lb$^{1/2}$

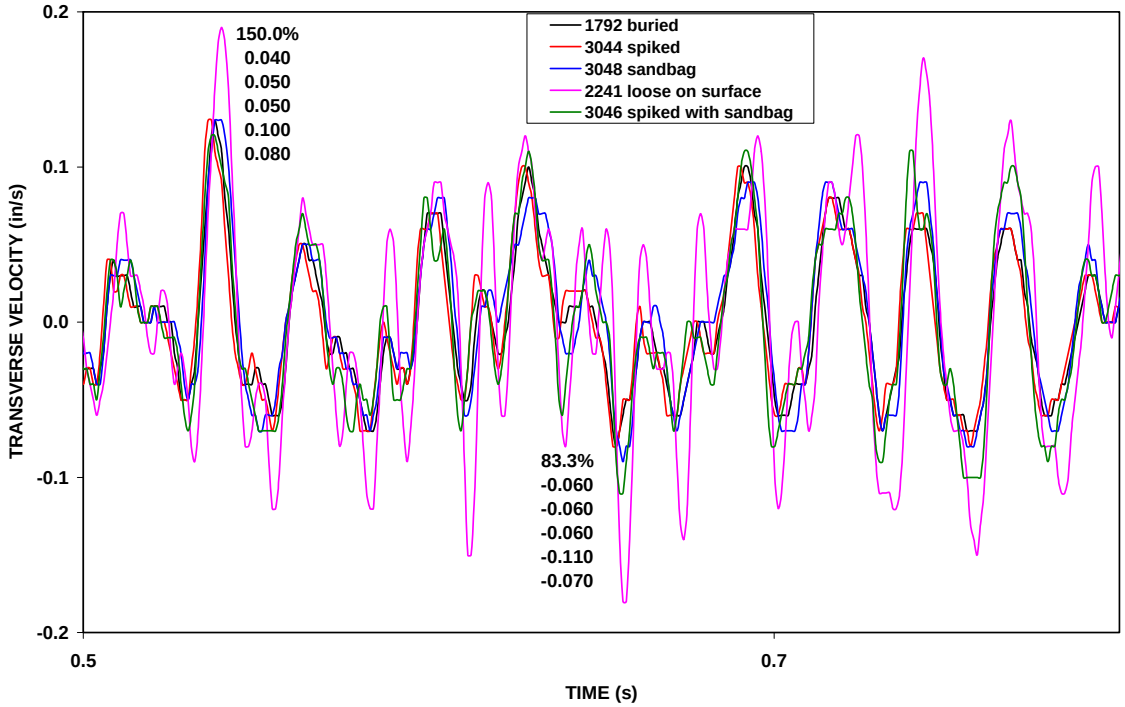

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0

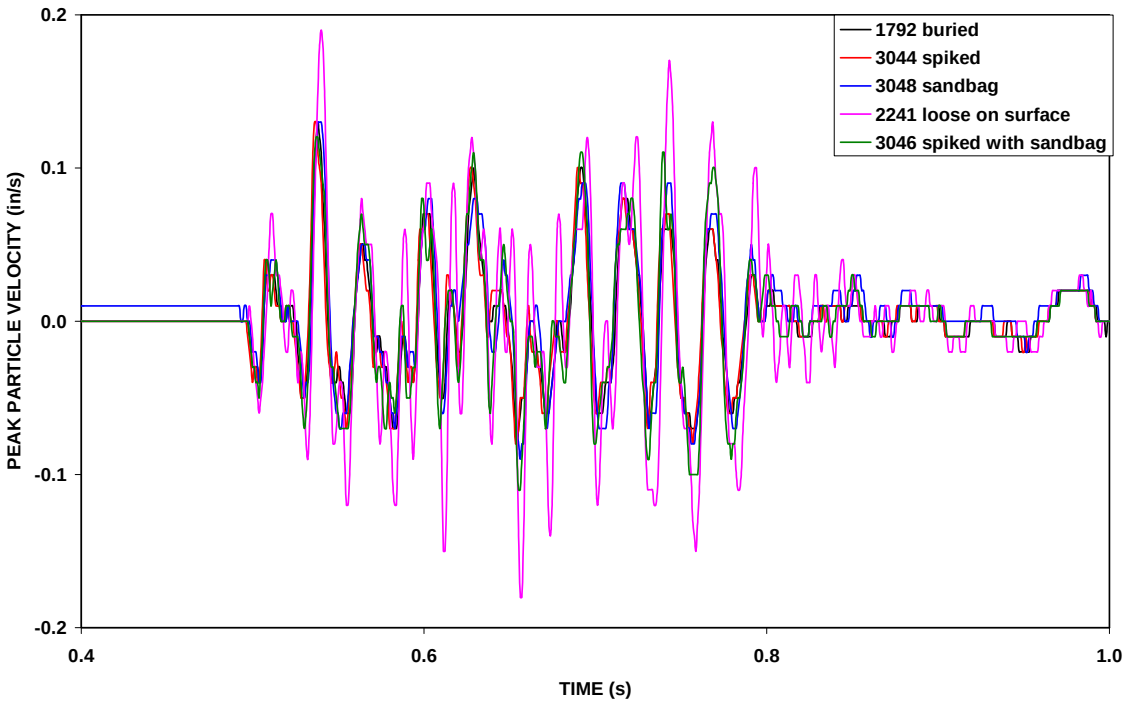

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
80.0%
0.050
0.060
0.060
0.090
0.090
125.0%
-0.060
-0.050
-0.040
-0.090
-0.070
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.7
0.8

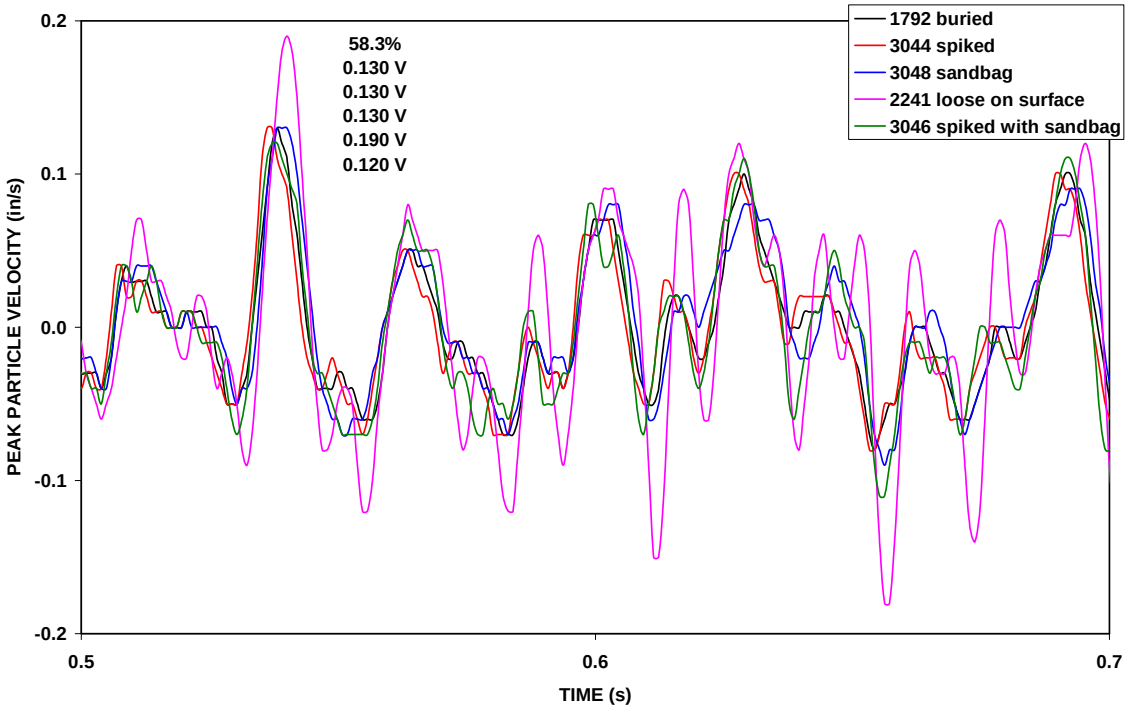

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
VELOCITY VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1


1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
58.3%
0.130
0.130
0.130
0.190
0.120
125.0%
-0.080
-0.080
-0.090
-0.180
-0.110
VELOCITY VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.8


1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1

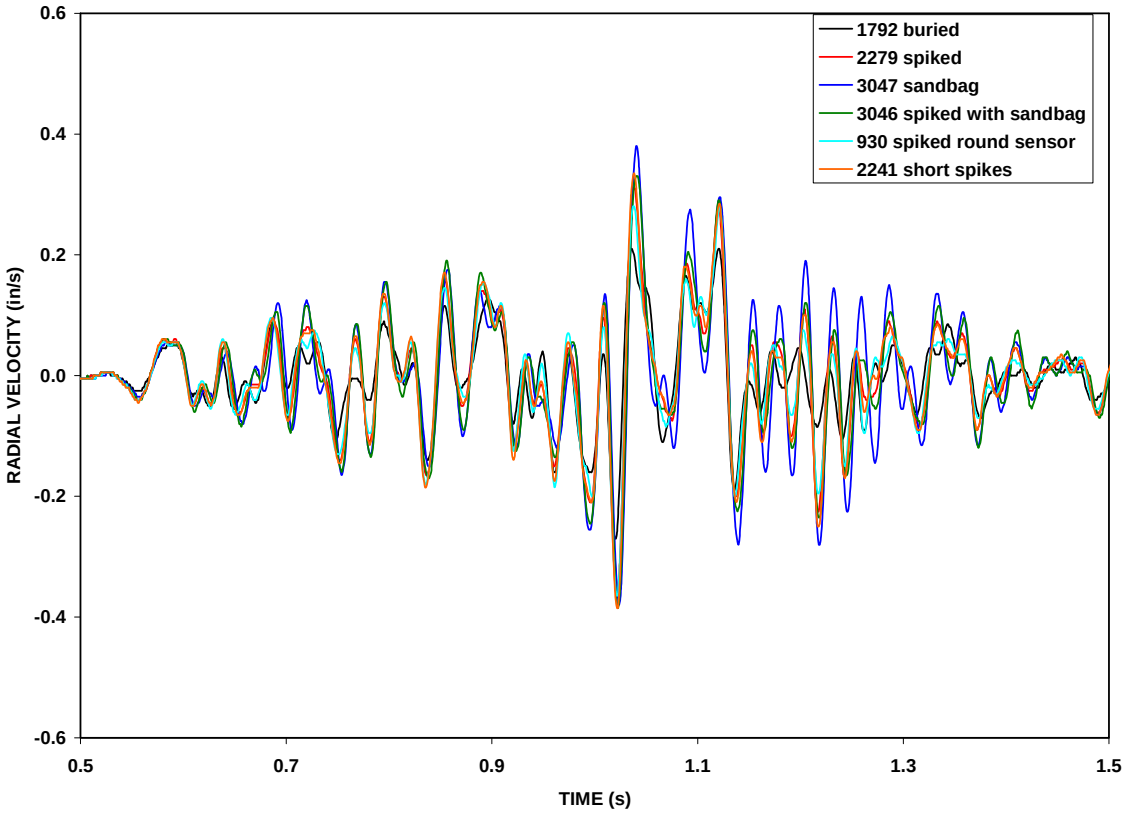

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
150.0%
0.040
0.050
0.050
0.100
0.080
83.3%
-0.060
-0.060
-0.060
-0.110
-0.070
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.5
0.7

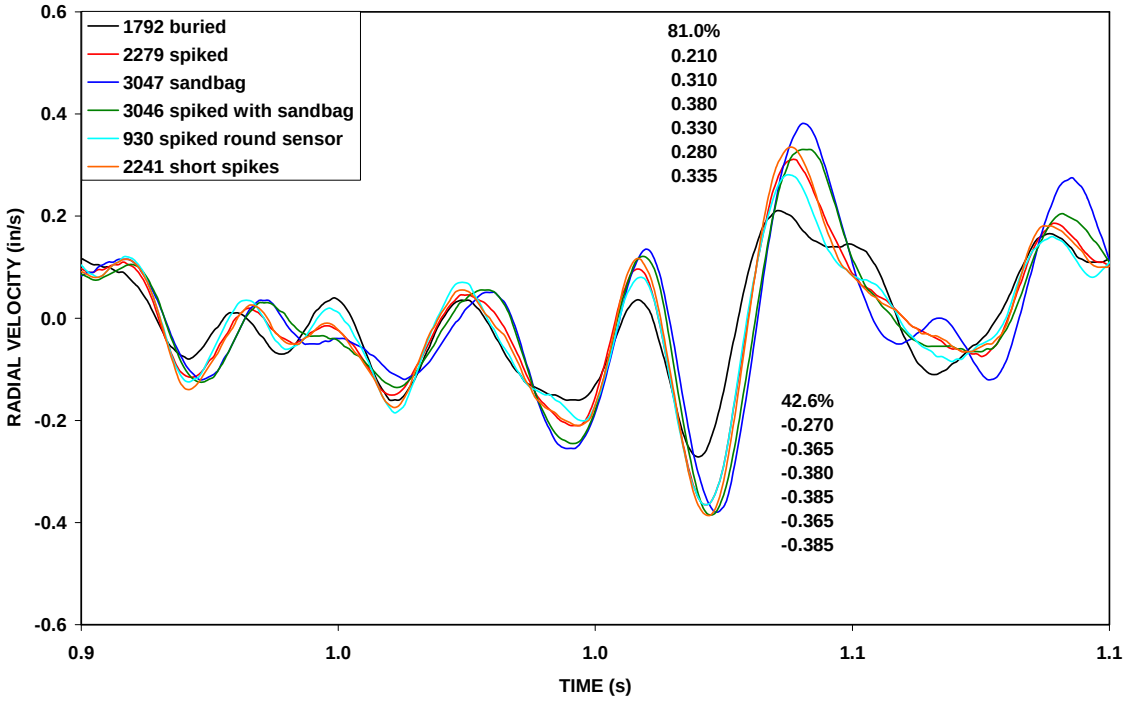

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
PEAK PARTICLE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
TIME (s)

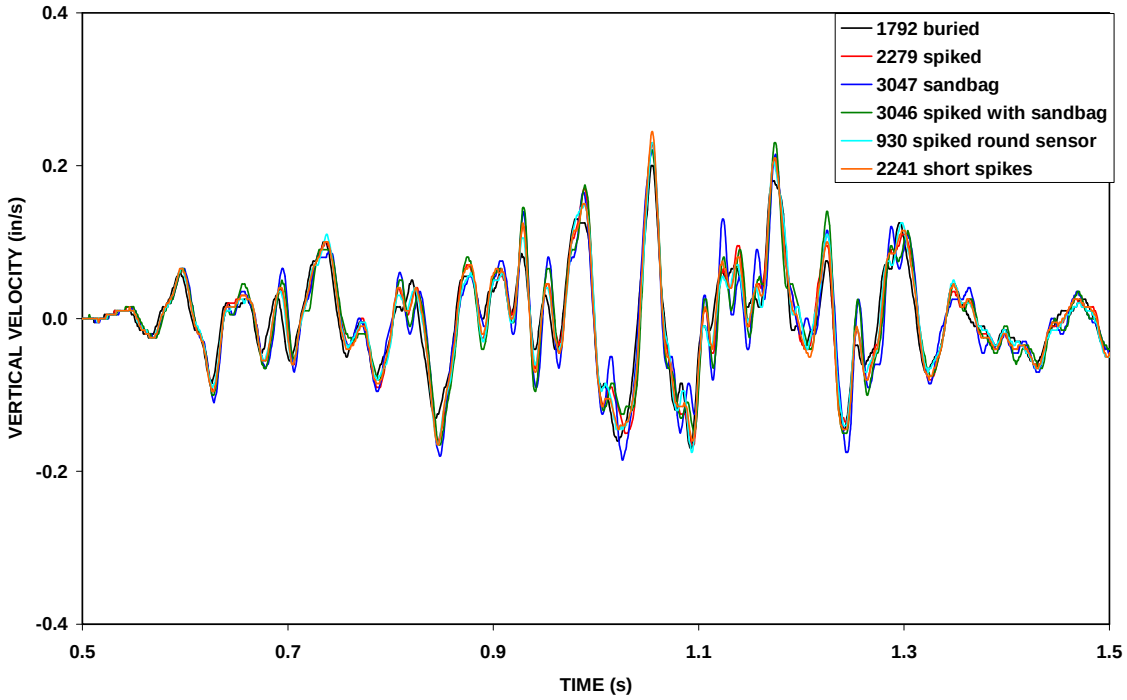

1792 buried
3044 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
58.3%
0.130 V
0.130 V
0.130 V
0.190 V
0.120 V
PEAK PARTICLE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.5
0.6
0.7
TIME (s)

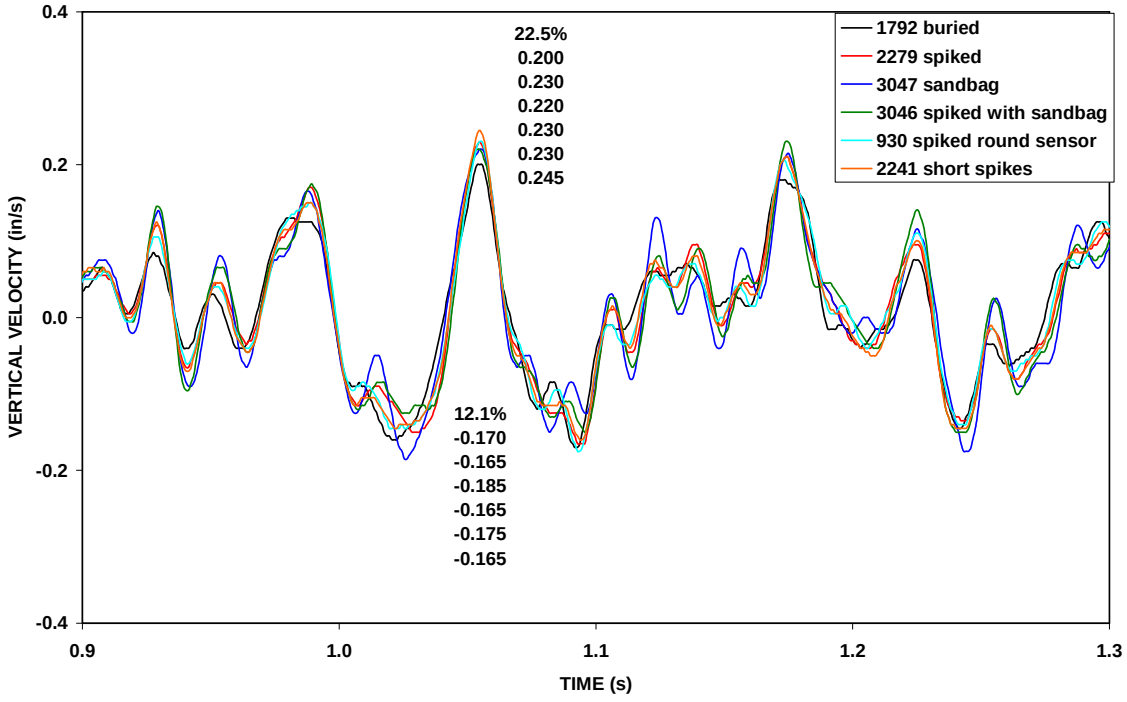
NM-1

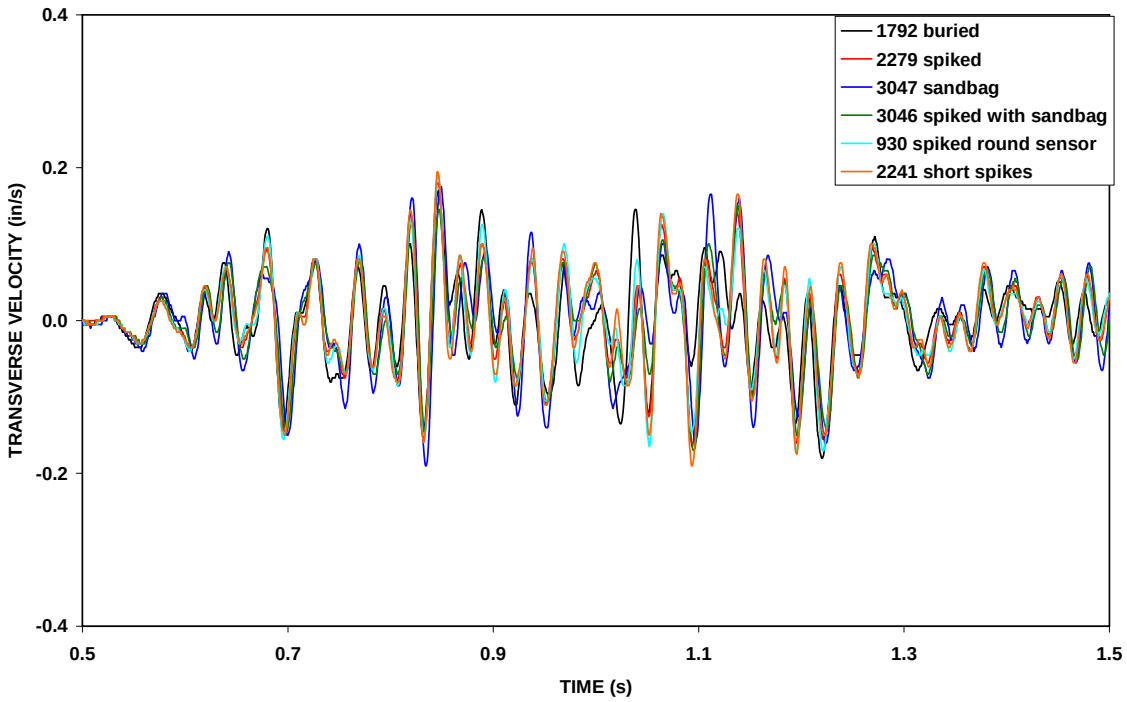
Cluster 1 SD 16.4 ft/lb$^{1/2}$

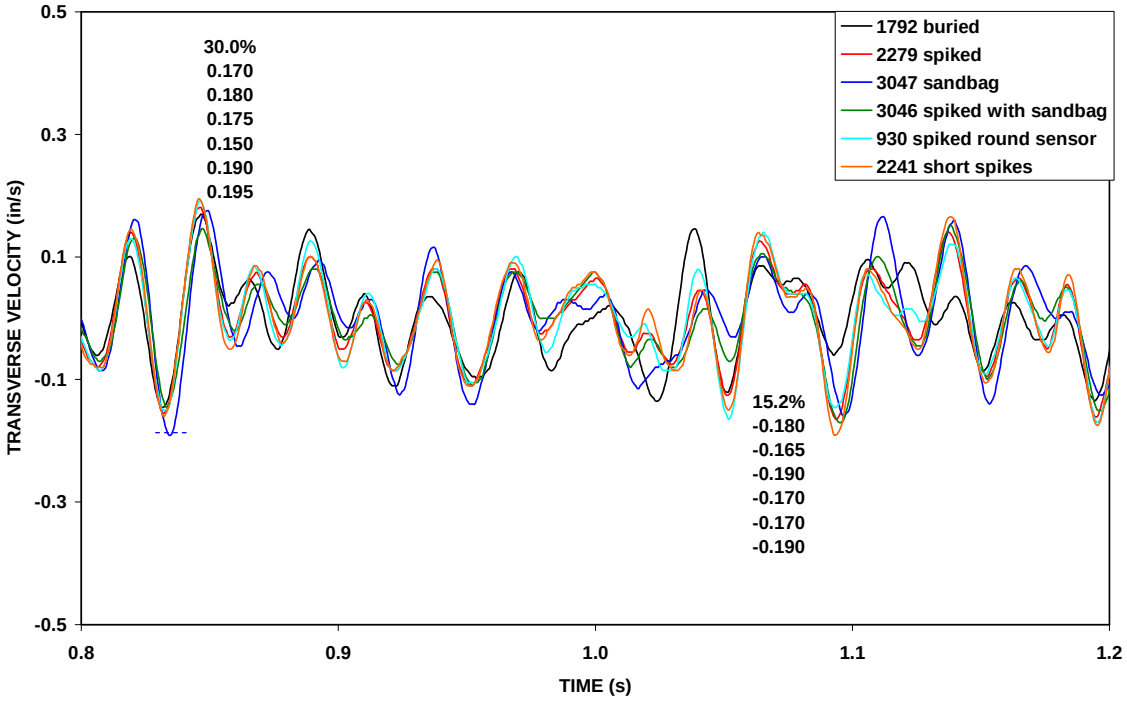

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.5
0.7
0.9
1.1
1.3
1.5

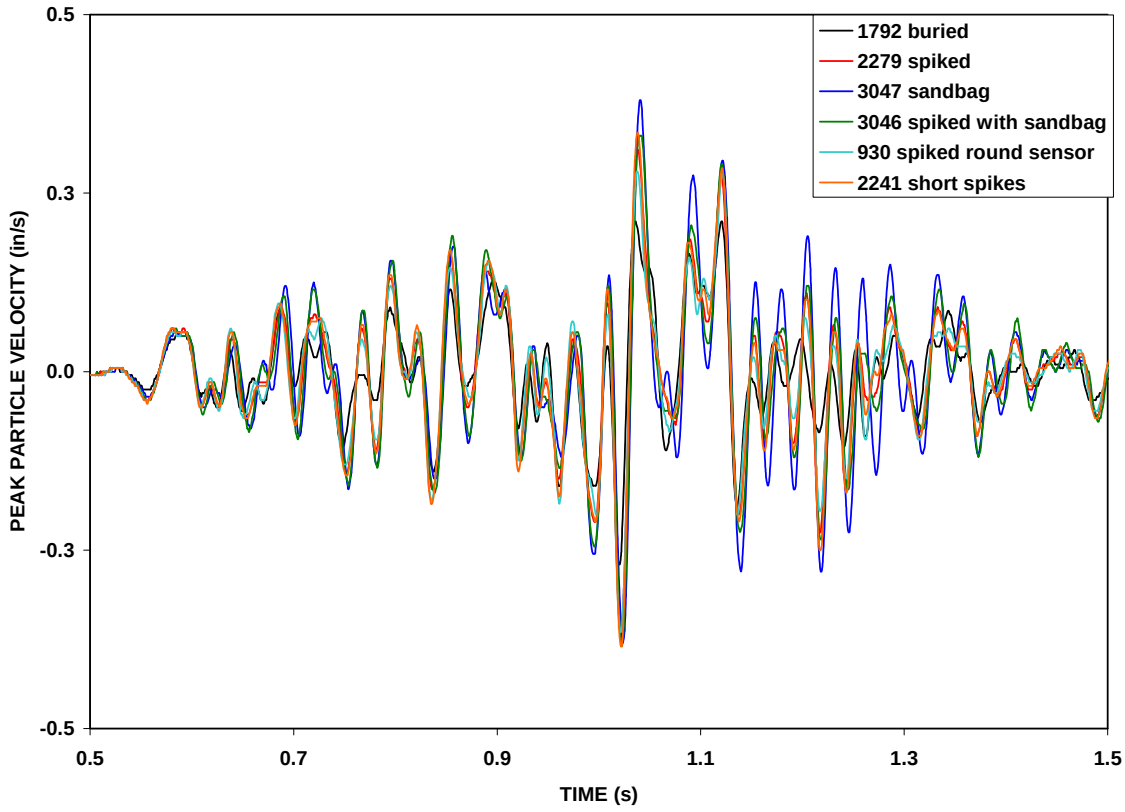

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
81.0%
0.210
0.310
0.380
0.330
0.280
0.335
42.6%
-0.270
-0.365
-0.380
-0.385
-0.365
-0.385
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.9
1.0
1.0
1.1
1.1

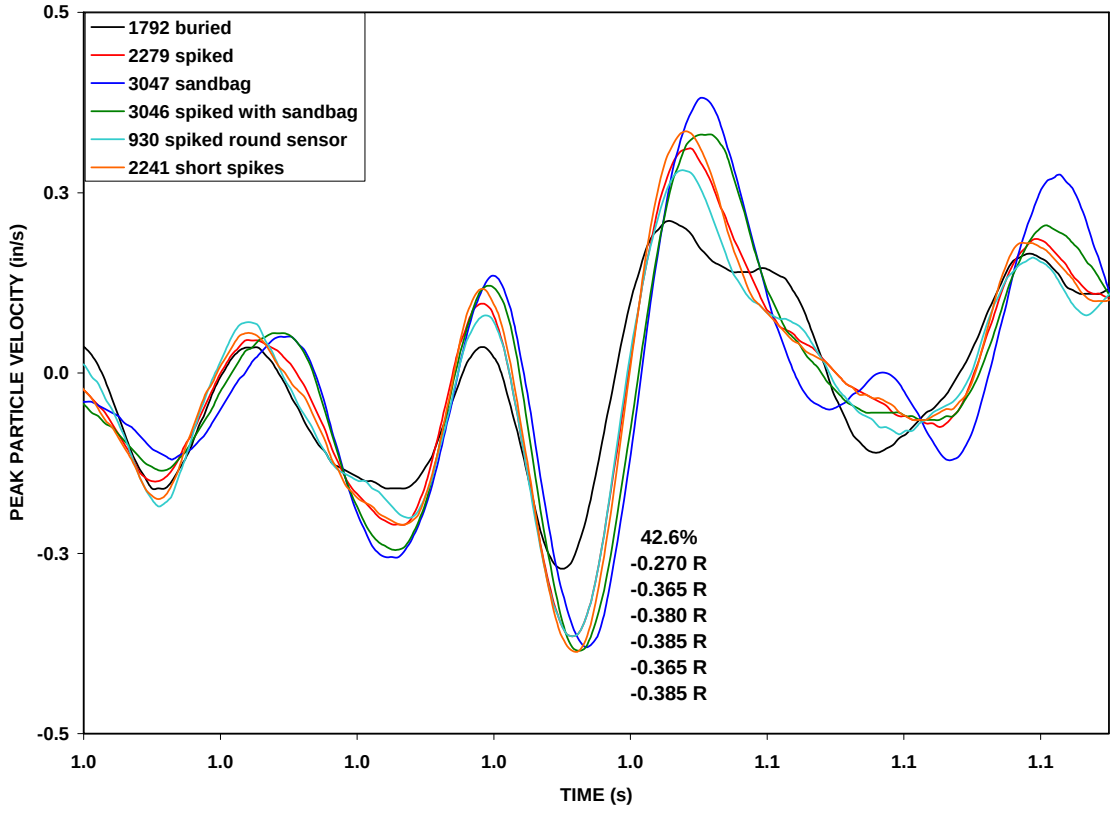

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.5
0.7
0.9
1.1
1.3
1.5


22.5%
0.200
0.230
0.220
0.230
0.230
0.245
12.1%
-0.170
-0.165
-0.185
-0.165
-0.175
-0.165
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.9
1.0
1.1
1.2
1.3


1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
TRANSVERSE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.5
0.7
0.9
1.1
1.3
1.5
TIME (s)

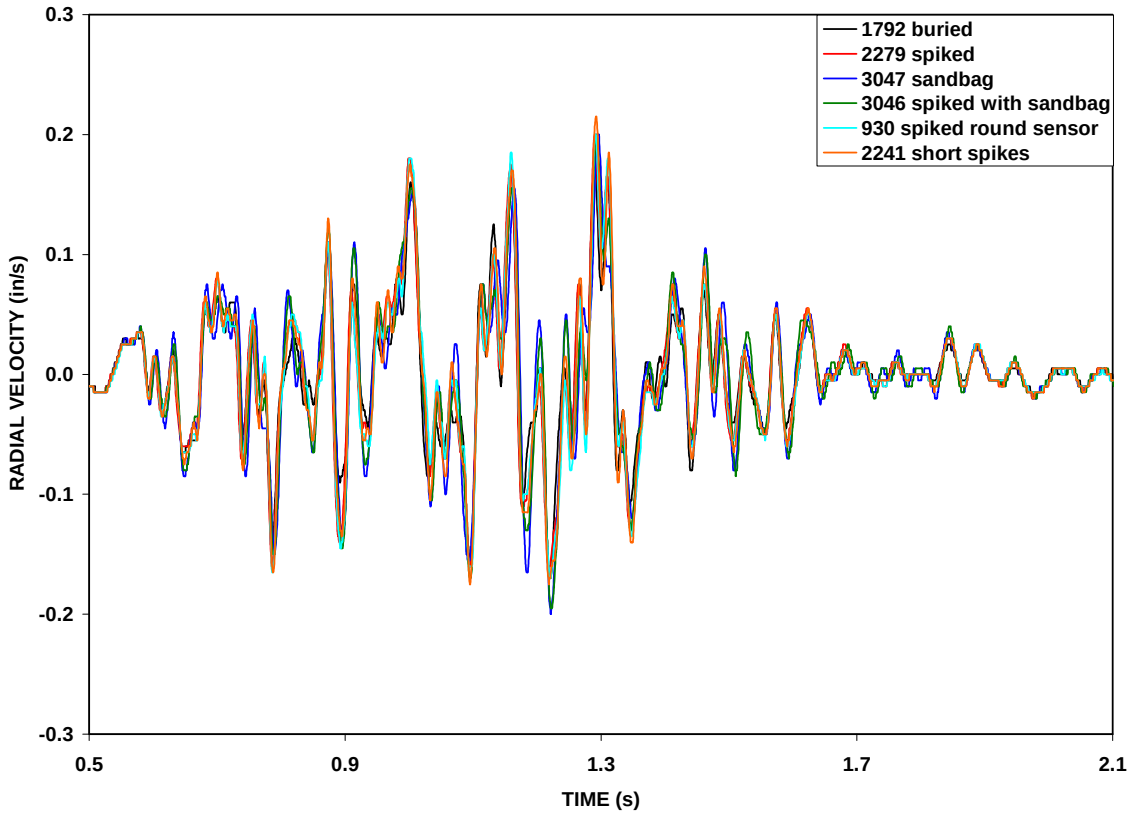

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
30.0%
0.170
0.180
0.175
0.150
0.190
0.195
15.2%
-0.180
-0.165
-0.190
-0.170
-0.170
-0.190
TRANSVERSE VELOCITY (in/s)
0.5
0.3
0.1
-0.1
-0.3
-0.5
0.8
0.9
1.0
1.1
1.2
TIME (s)

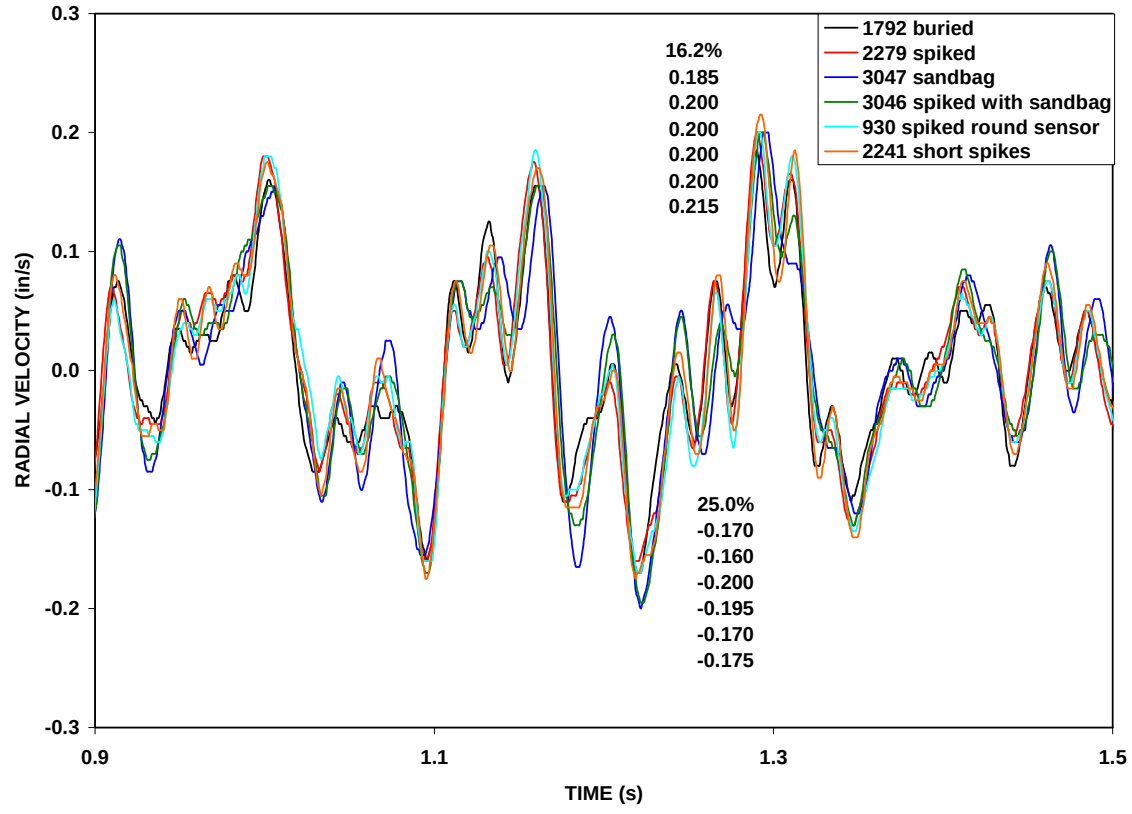

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
0.5
0.3
0.0
-0.3
-0.5
0.5
0.7
0.9
1.1
1.3
1.5
TIME (s)

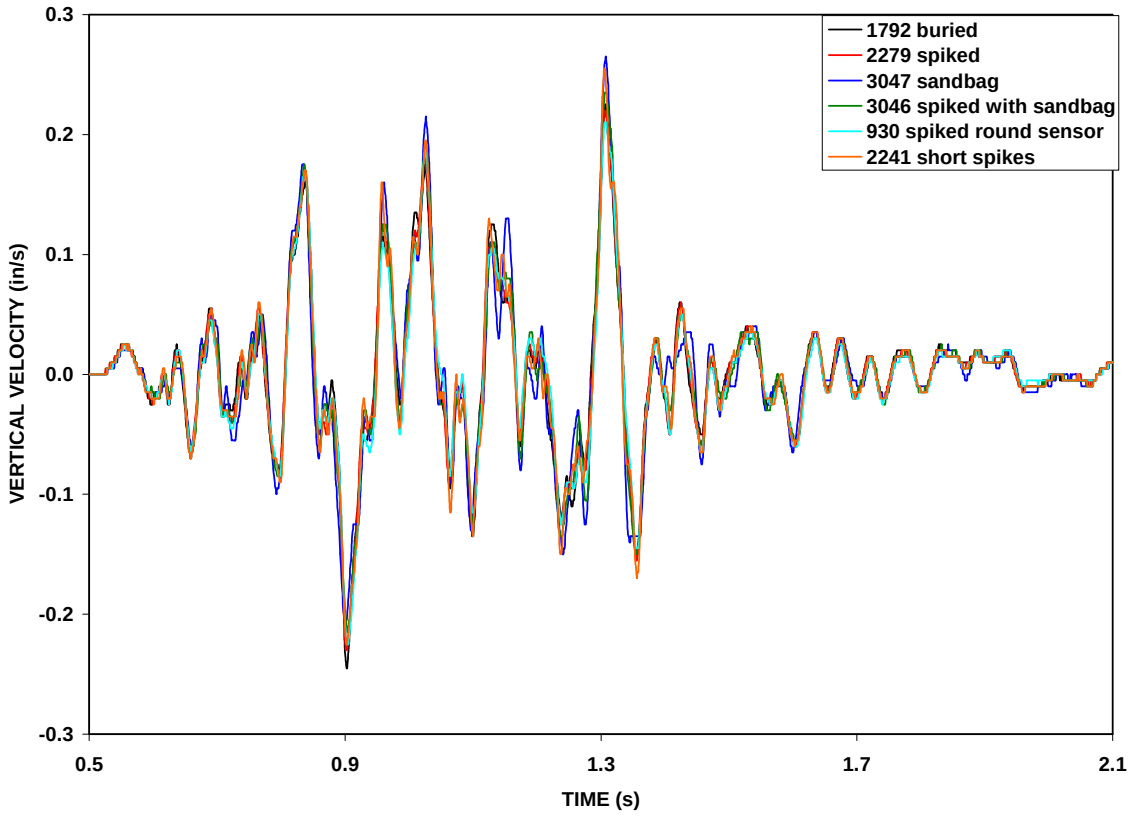

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
0.5
0.3
0.0
-0.3
-0.5
1.0
1.0
1.0
1.0
1.0
1.1
1.1
1.1
TIME (s)
42.6%
-0.270 R
-0.365 R
-0.380 R
-0.385 R
-0.365 R
-0.385 R

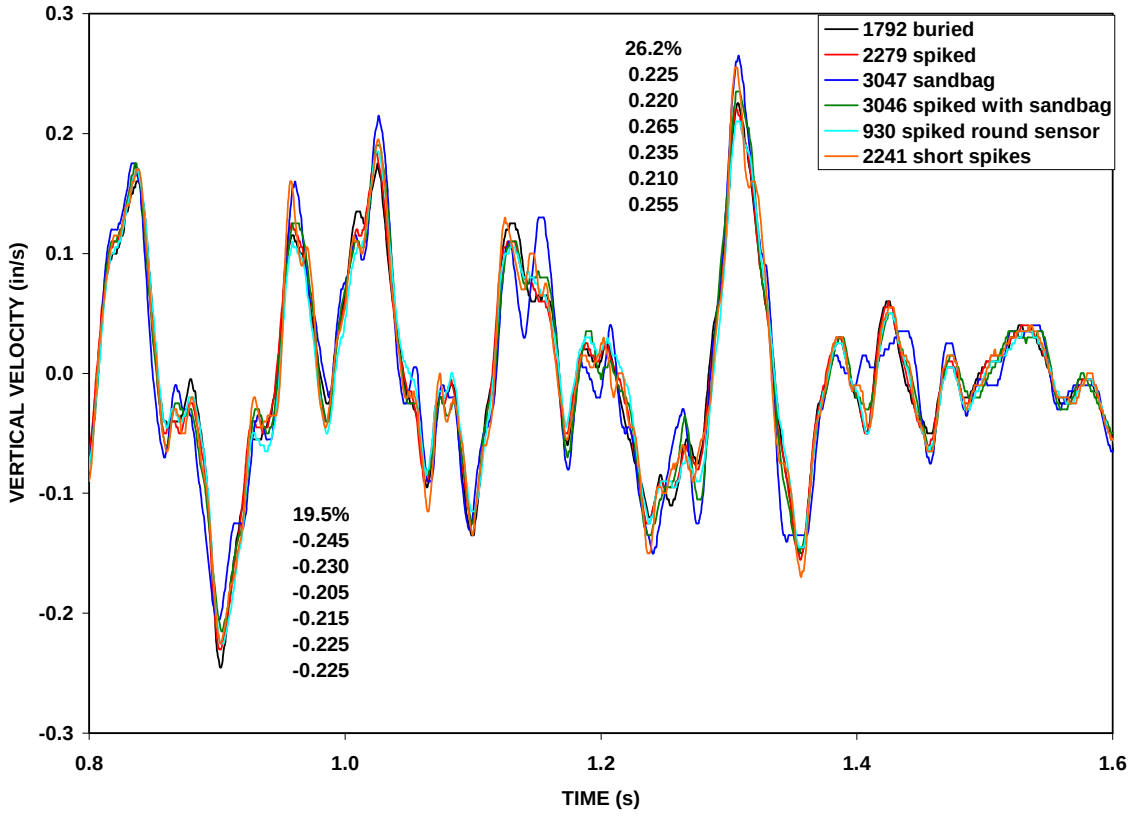
NM-2

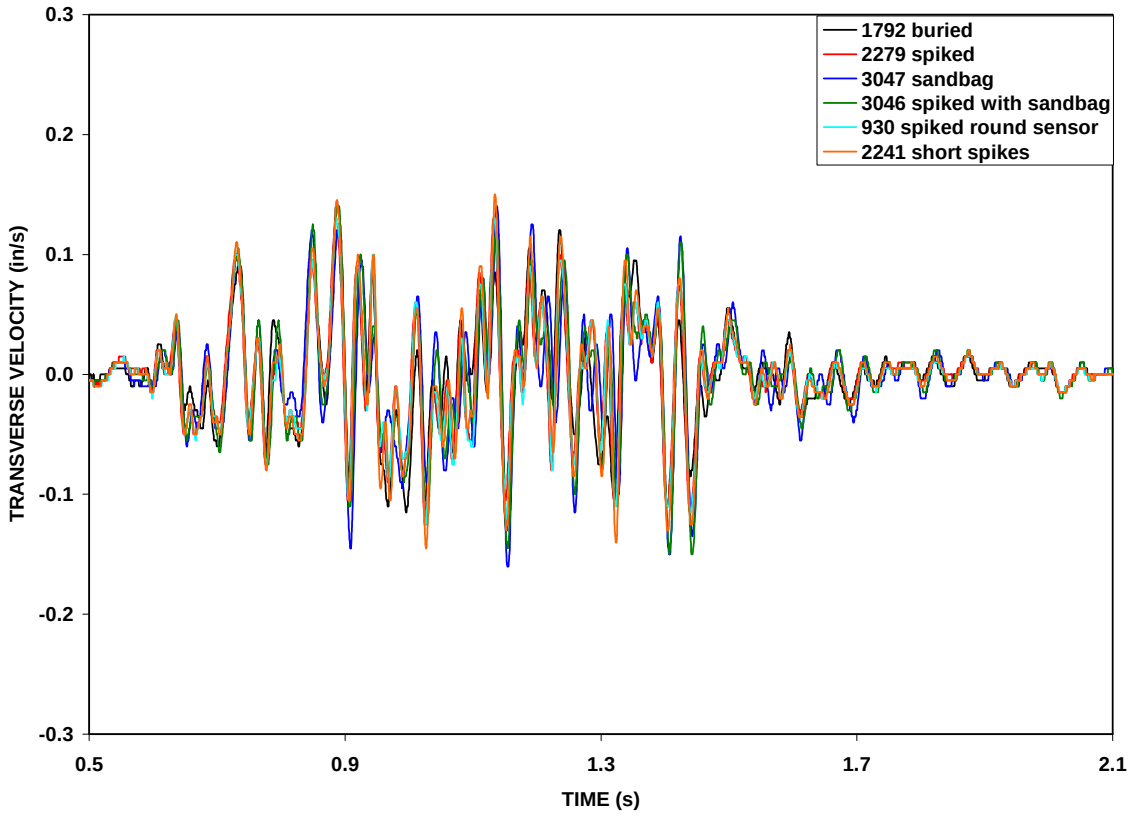
Cluster 1 SD 16.3 ft/lb$^{1/2}$

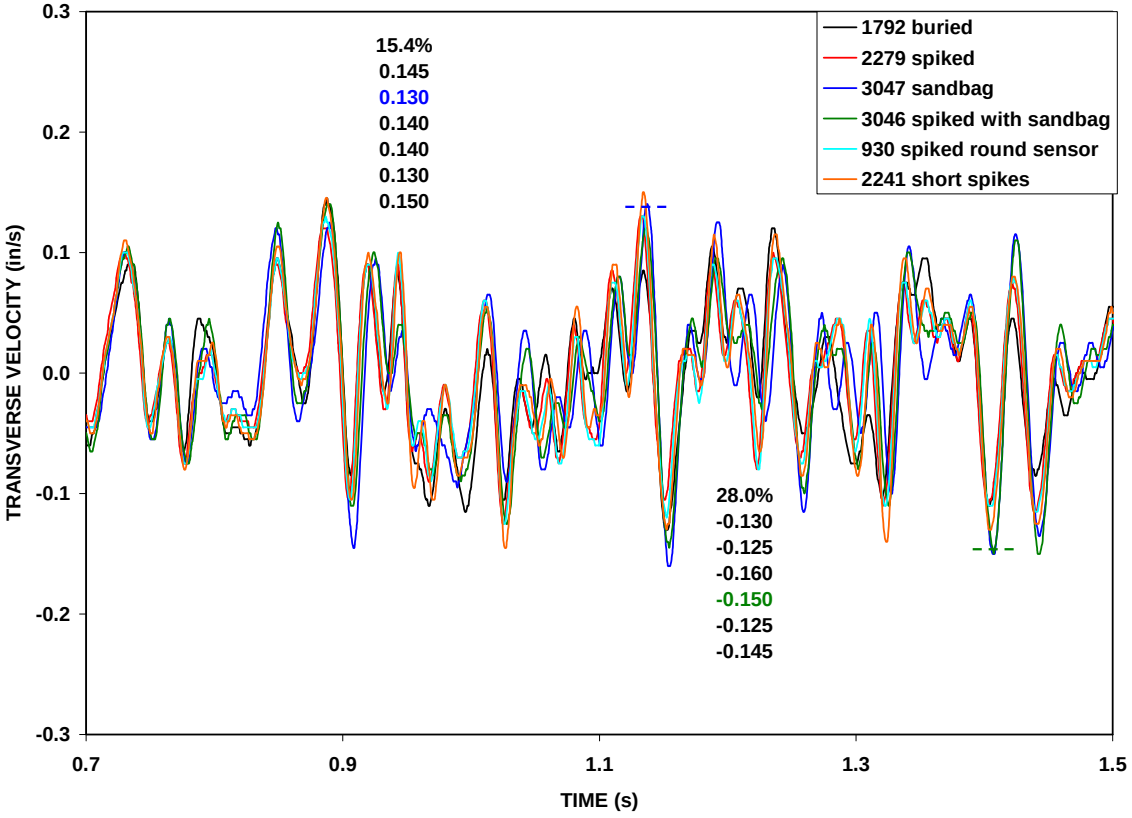

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
RADIAL VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.5
0.9
1.3
1.7
2.1
TIME (s)

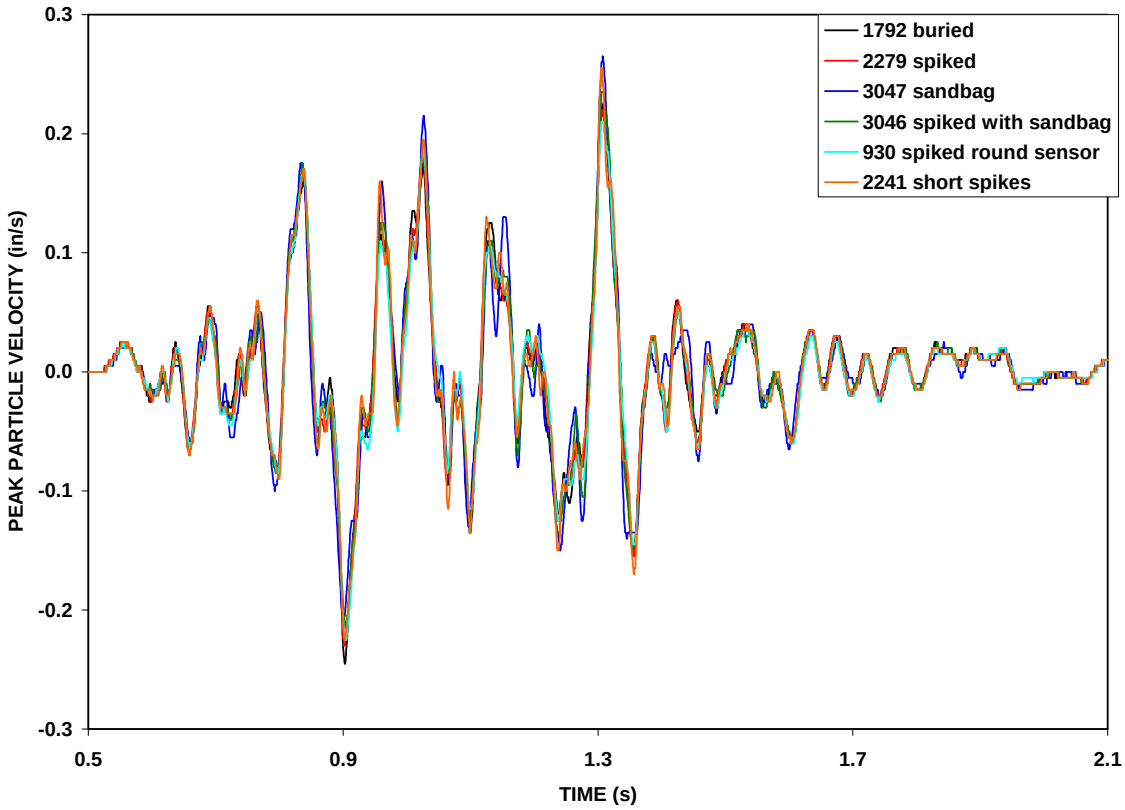

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
16.2%
0.185
0.200
0.200
0.200
0.200
0.215
25.0%
-0.170
-0.160
-0.200
-0.195
-0.170
-0.175
RADIAL VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.9
1.1
1.3
1.5
TIME (s)

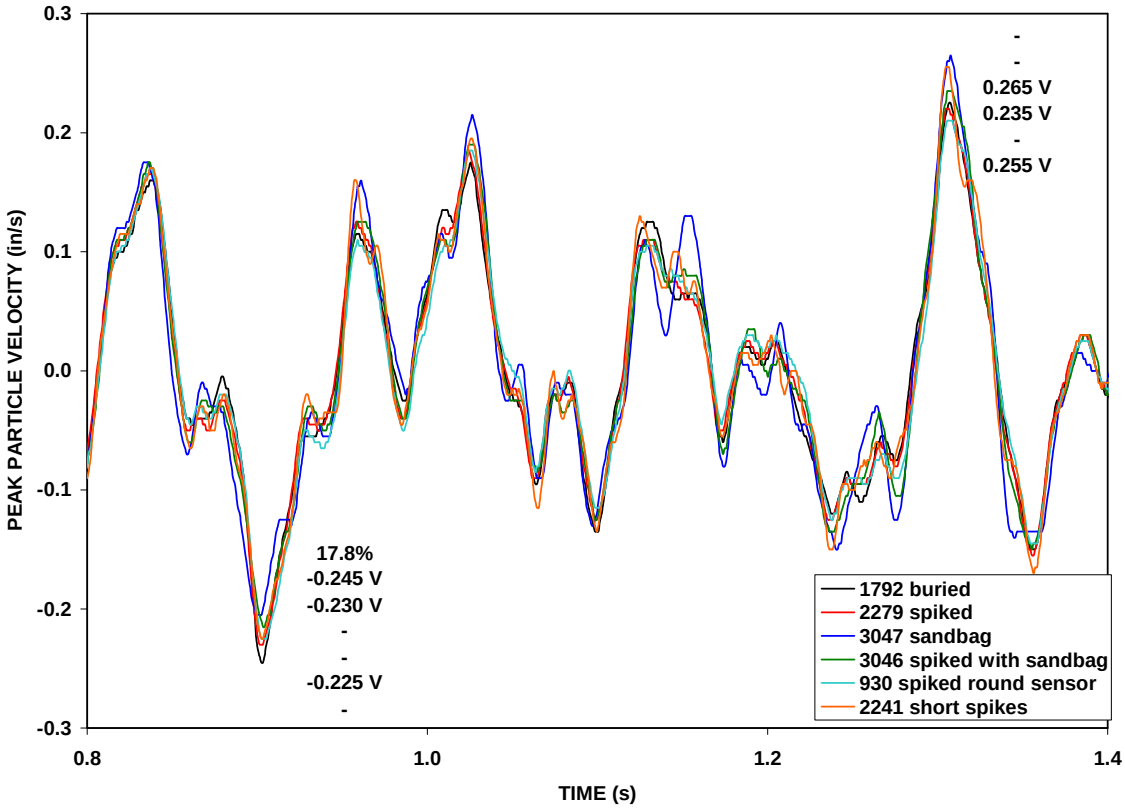

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
VERTICAL VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.5
0.9
1.3
1.7
2.1
TIME (s)


1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
26.2%
0.225
0.220
0.265
0.235
0.210
0.255
19.5%
-0.245
-0.230
-0.205
-0.215
-0.225
-0.225
VERTICAL VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.8
1.0
1.2
1.4
1.6
TIME (s)


1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.5
0.9
1.3
1.7
2.1
TIME (s)

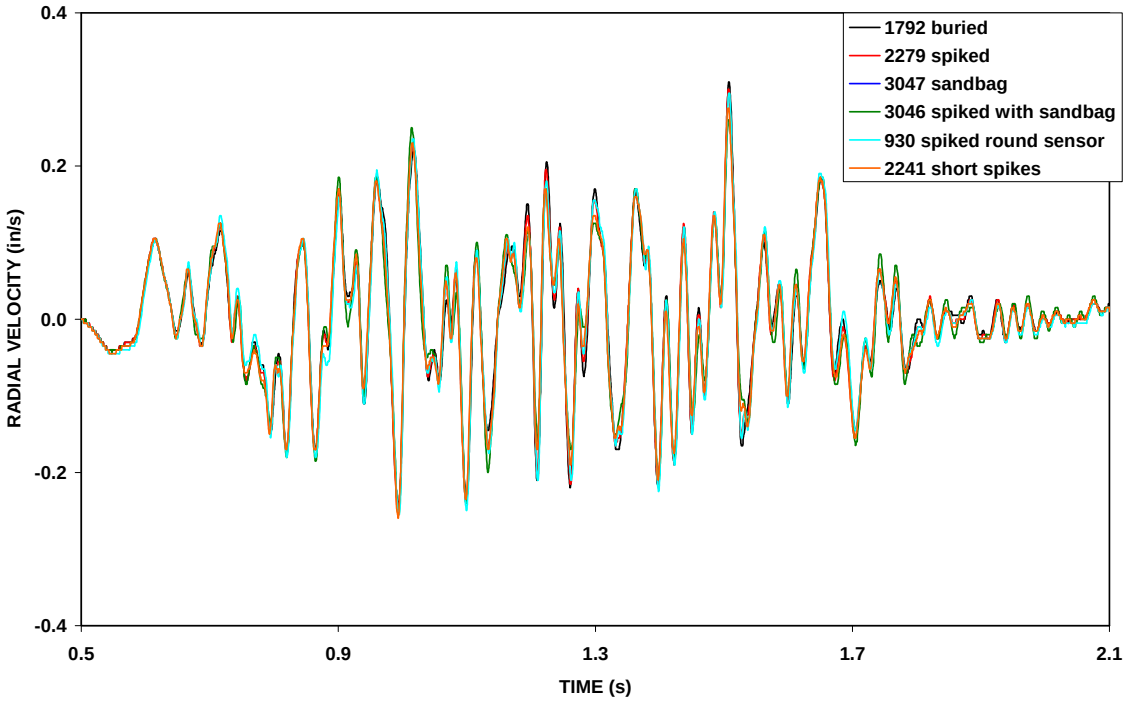

15.4%
0.145
0.130
0.140
0.140
0.130
0.150
28.0%
-0.130
-0.125
-0.160
-0.150
-0.125
-0.145
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.7
0.9
1.1
1.3
1.5
TIME (s)

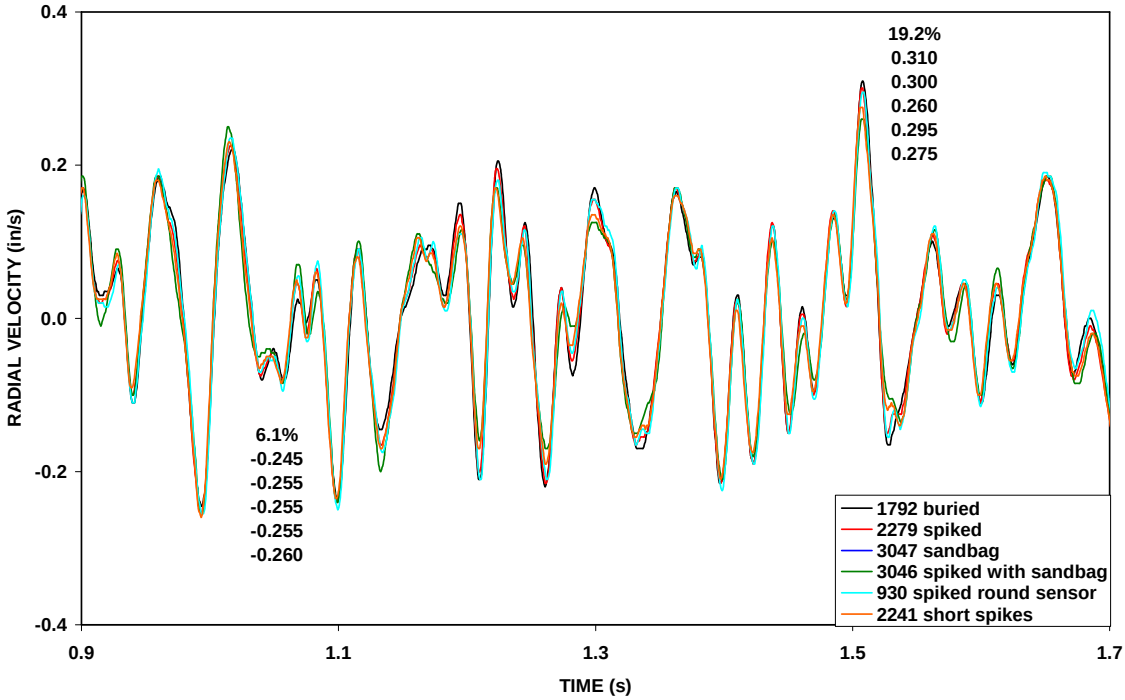

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.5
0.9
1.3
1.7
2.1
TIME (s)

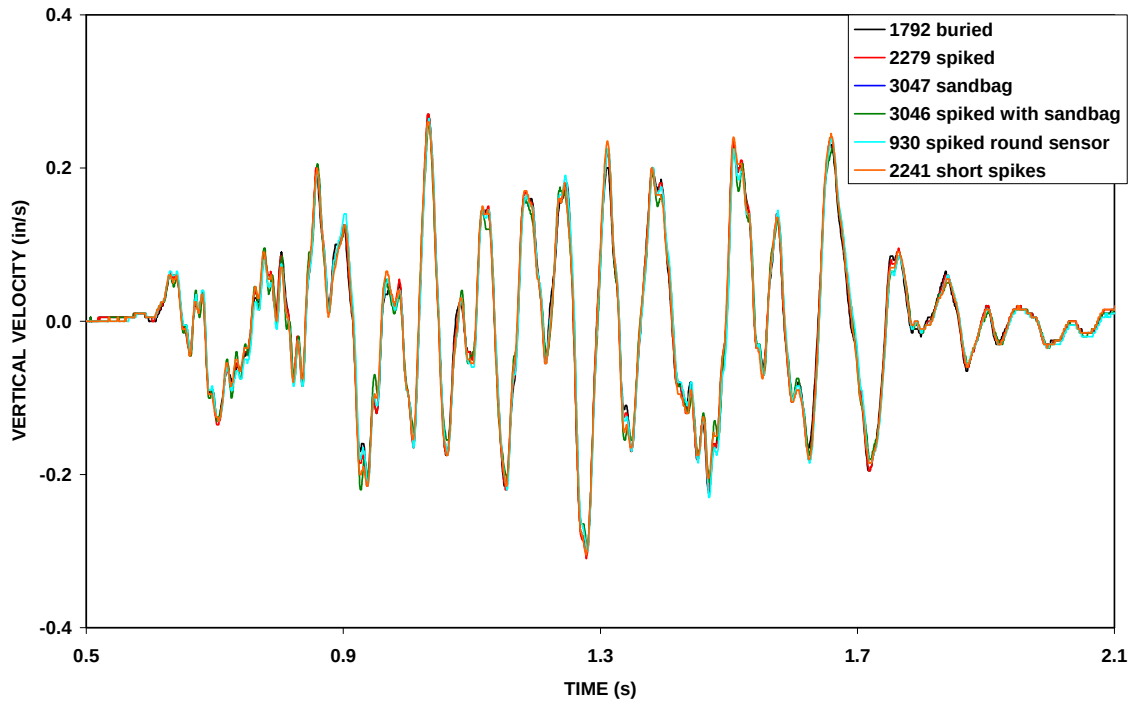

-
-
0.265 V
0.235 V
-
0.255 V
17.8%
-0.245 V
-0.230 V
-
-
-0.225 V
-
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.8
1.0
1.2
1.4
TIME (s)

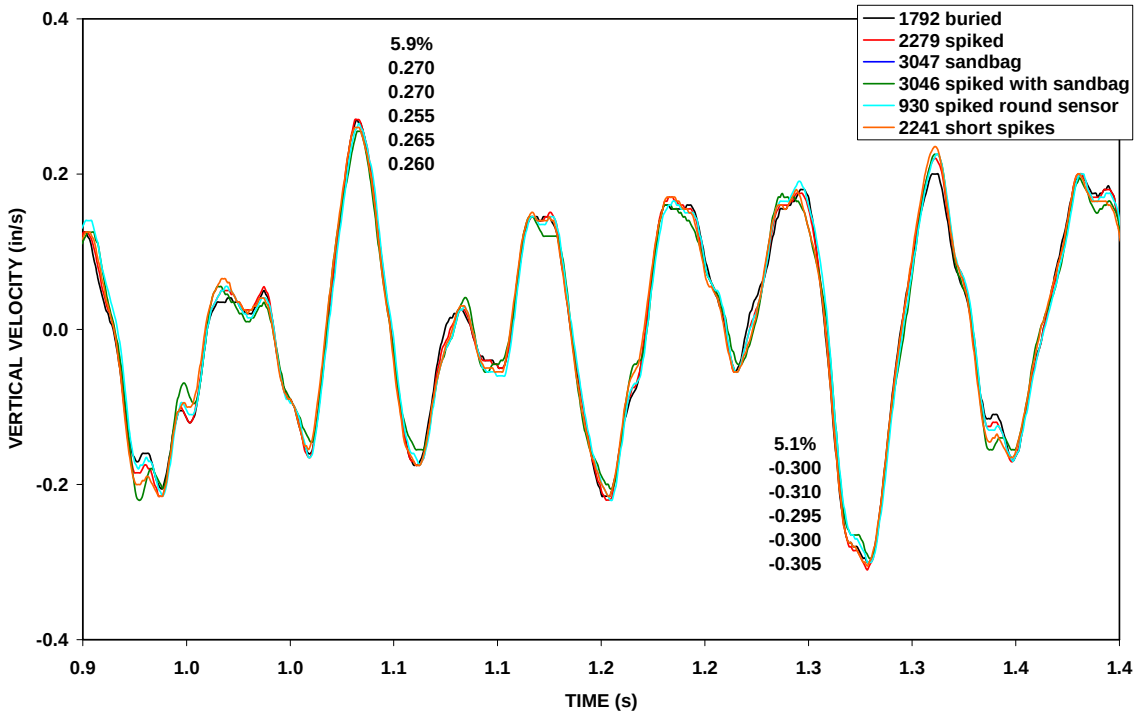
NM-3

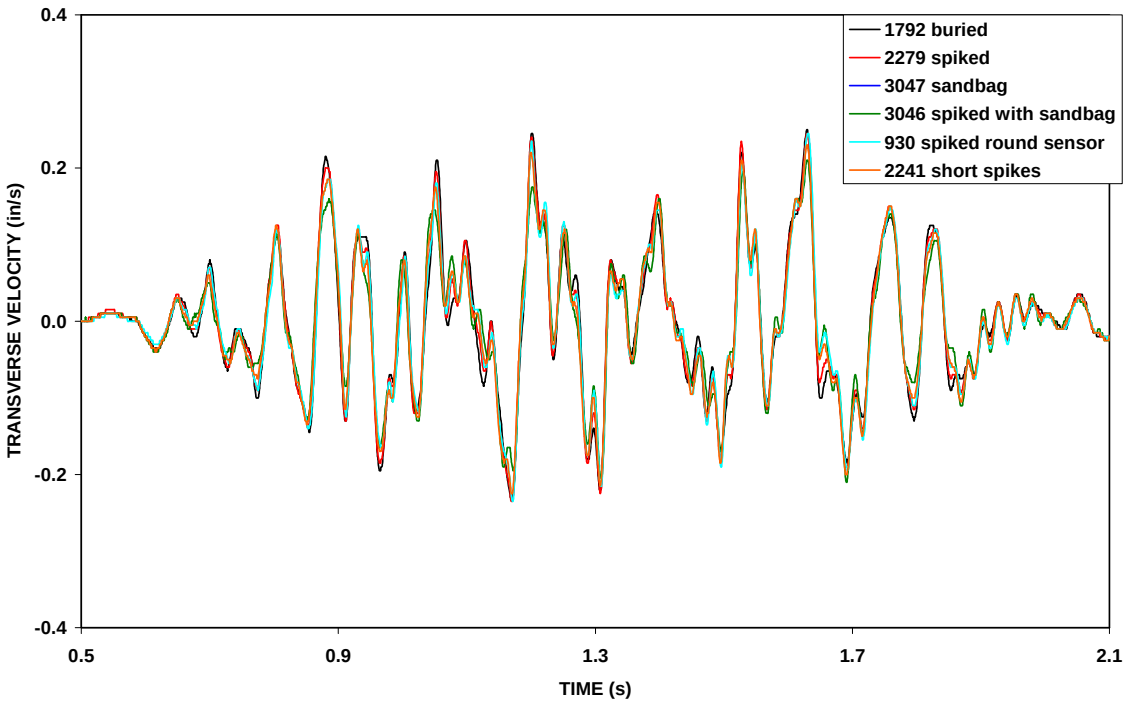
Cluster 1 SD 20.4 ft/lb$^{1/2}$

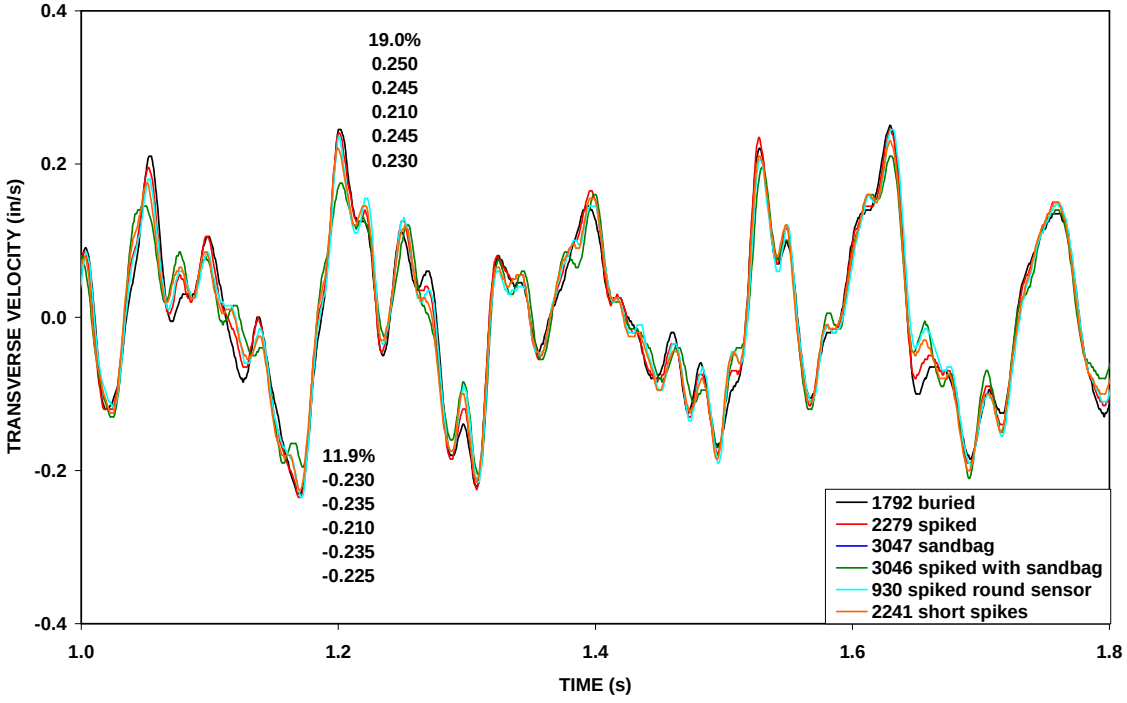

0.4
0.2
0.0
-0.2
-0.4
RADIAL VELOCITY (in/s)
0.5
0.9
1.3
1.7
2.1
TIME (s)
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

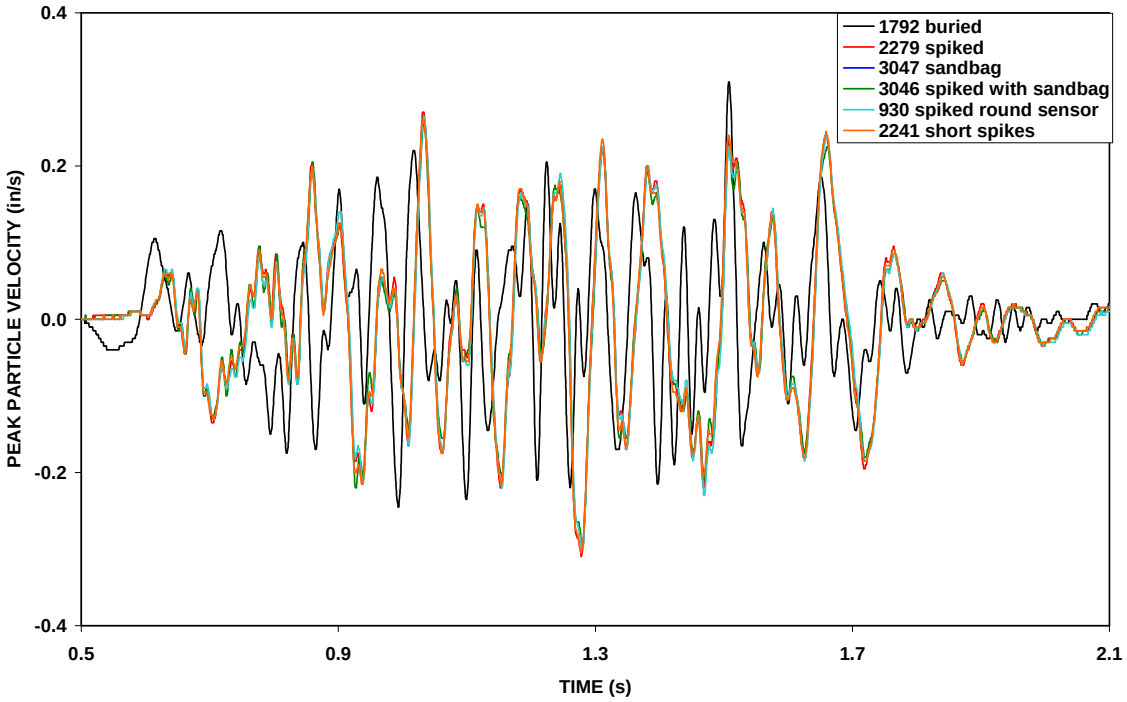

0.4
0.2
0.0
-0.2
-0.4
RADIAL VELOCITY (in/s)
0.9
1.1
1.3
1.5
1.7
TIME (s)
19.2%
0.310
0.300
0.260
0.295
0.275
6.1%
-0.245
-0.255
-0.255
-0.255
-0.260
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

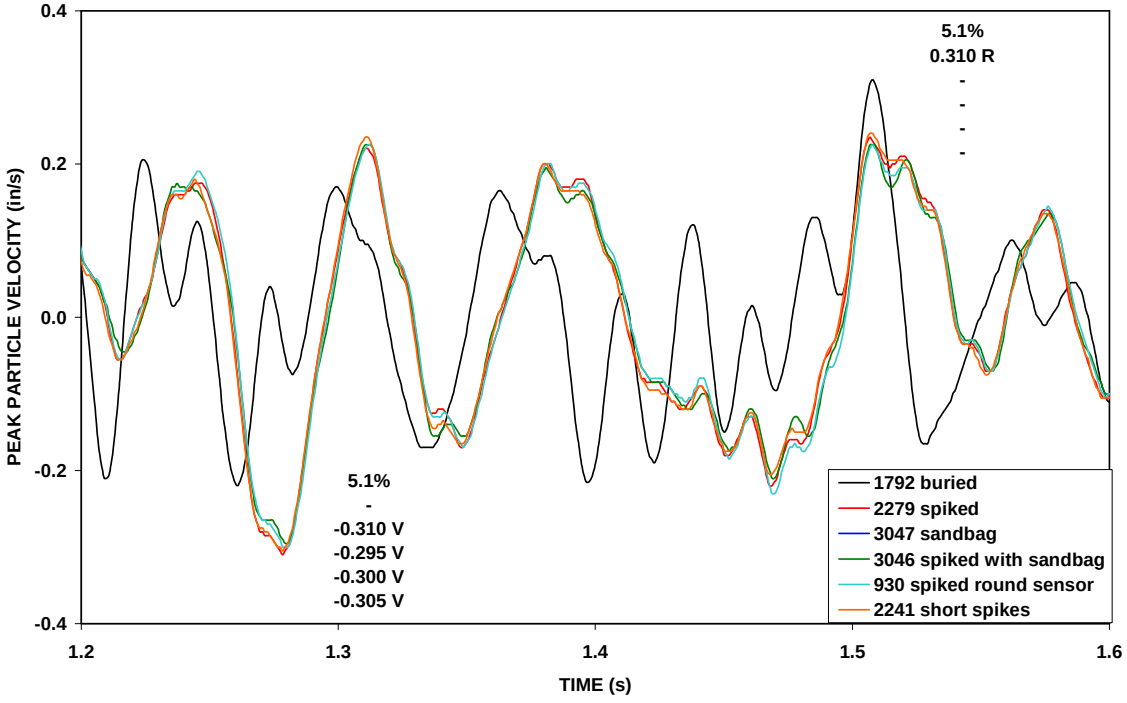

0.4
0.2
0.0
-0.2
-0.4
VERTICAL VELOCITY (in/s)
0.5
0.9
1.3
1.7
2.1
TIME (s)
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes


0.4
0.2
0.0
-0.2
-0.4
VERTICAL VELOCITY (in/s)
0.9
1.0
1.0
1.1
1.1
1.2
1.2
1.3
1.3
1.4
1.4
TIME (s)
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
5.9%
0.270
0.270
0.255
0.265
0.260
5.1%
-0.300
-0.310
-0.295
-0.300
-0.305


0.4
0.2
0.0
-0.2
-0.4
TRANSVERSE VELOCITY (in/s)
0.5
0.9
1.3
1.7
2.1
TIME (s)
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

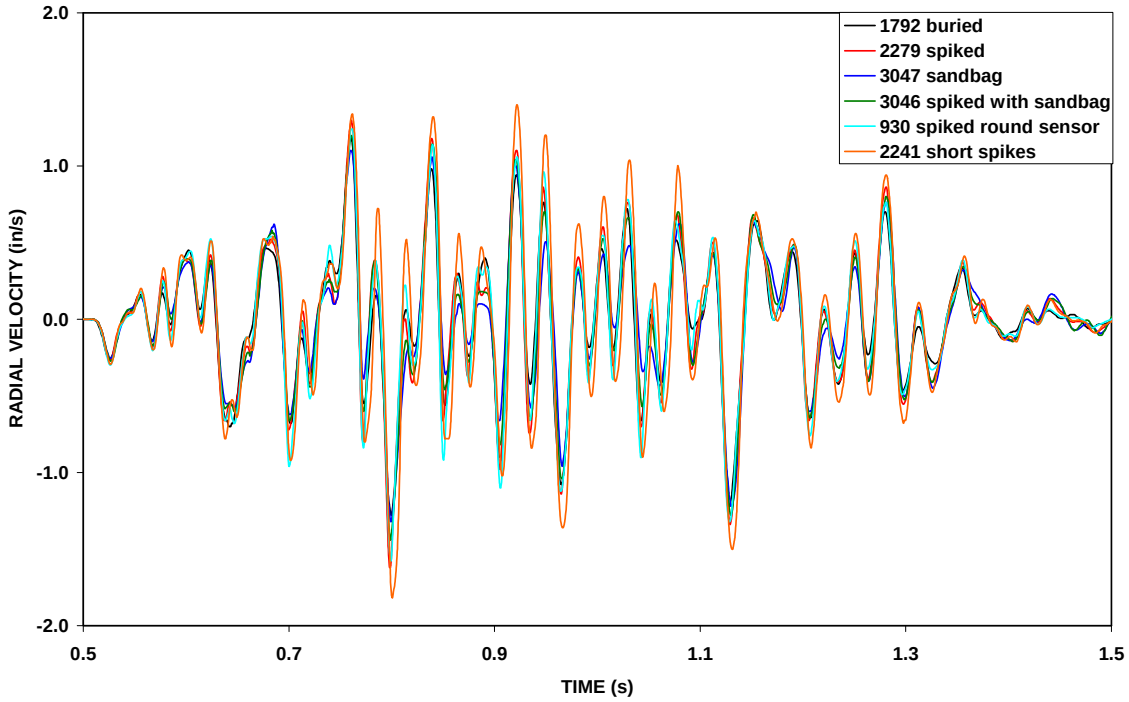

0.4
0.2
0.0
-0.2
-0.4
TRANSVERSE VELOCITY (in/s)
19.0%
0.250
0.245
0.210
0.245
0.230
11.9%
-0.230
-0.235
-0.210
-0.235
-0.225
1.0
1.2
1.4
1.6
1.8
TIME (s)
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

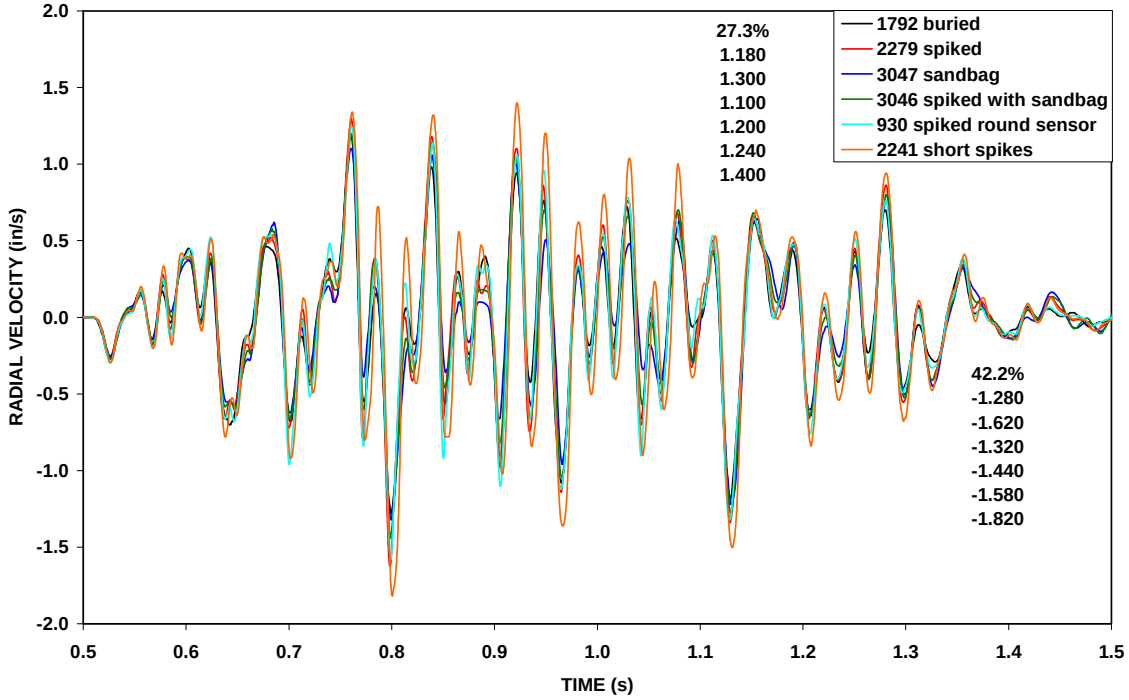

0.4
0.2
0.0
-0.2
-0.4
PEAK PARTICLE VELOCITY (in/s)
0.5
0.9
1.3
1.7
2.1
TIME (s)
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

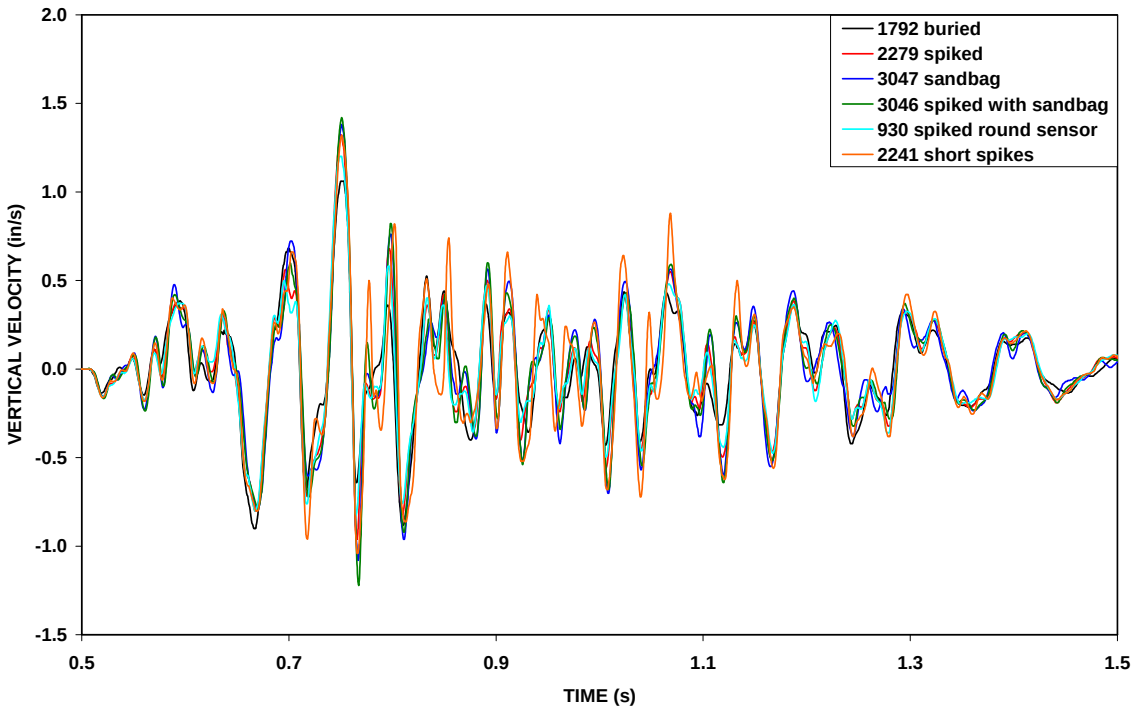

0.4
0.2
0.0
-0.2
-0.4
PEAK PARTICLE VELOCITY (in/s)
1.2
1.3
1.4
1.5
1.6
TIME (s)
5.1%
0.310 R
-
-
-
-
5.1%
-
-0.310 V
-0.295 V
-0.300 V
-0.305 V
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

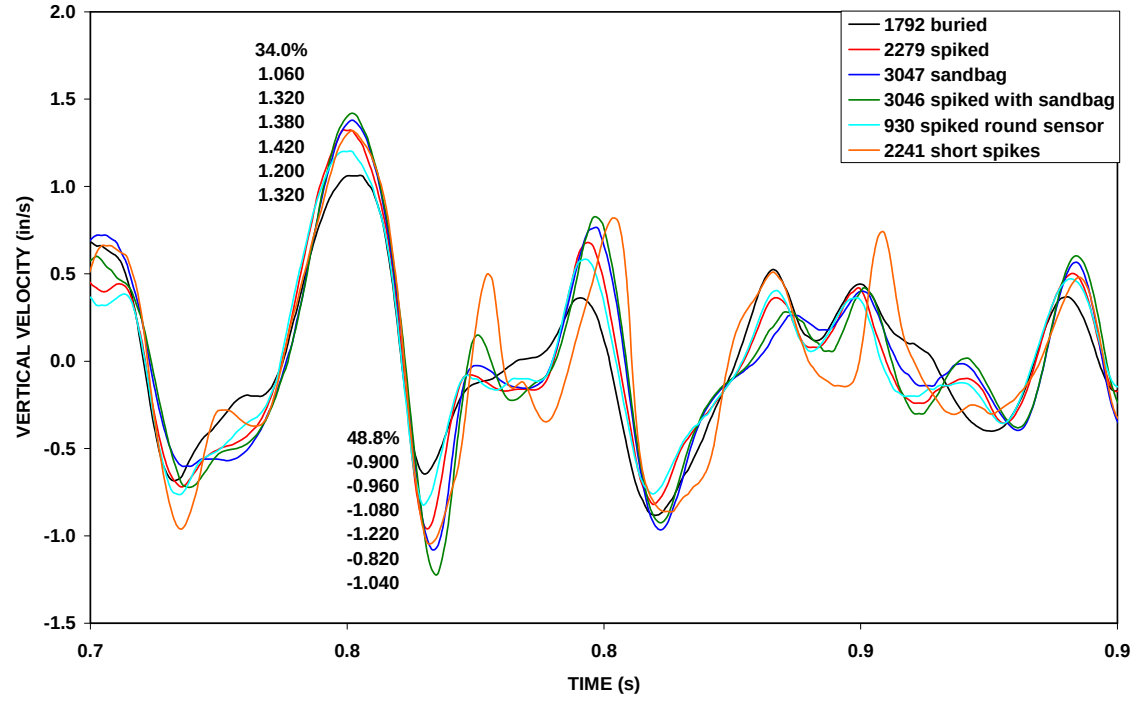
NM-4

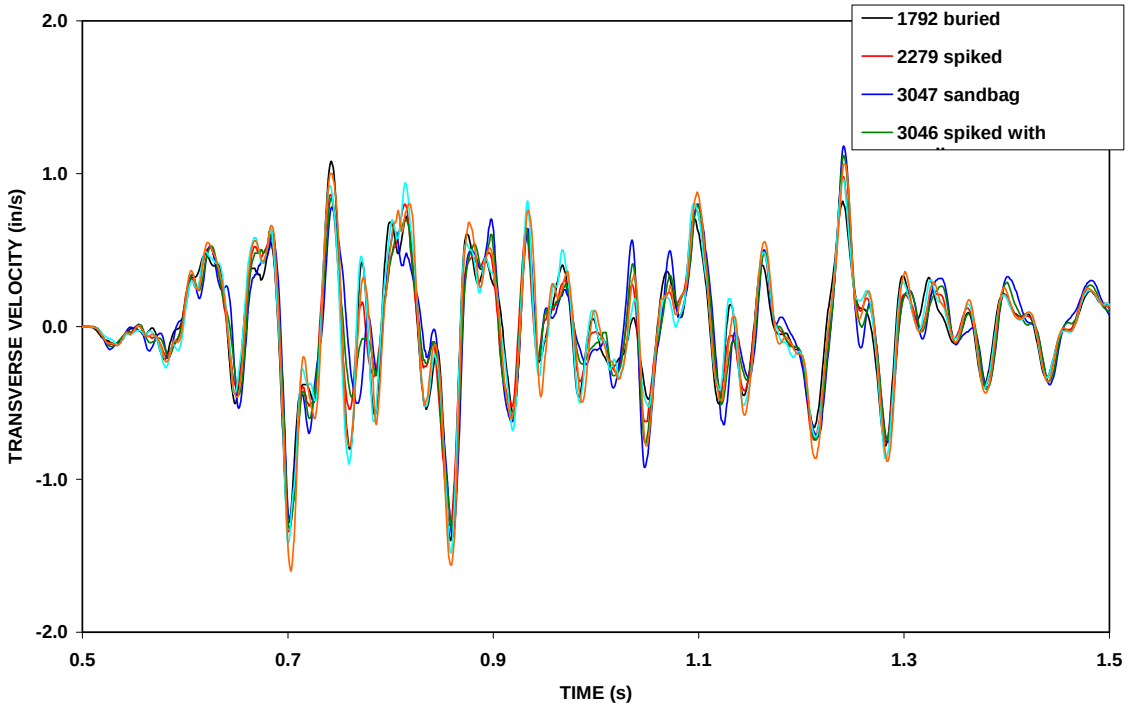
Cluster 1 SD 14.4 ft/lb$^{1/2}$

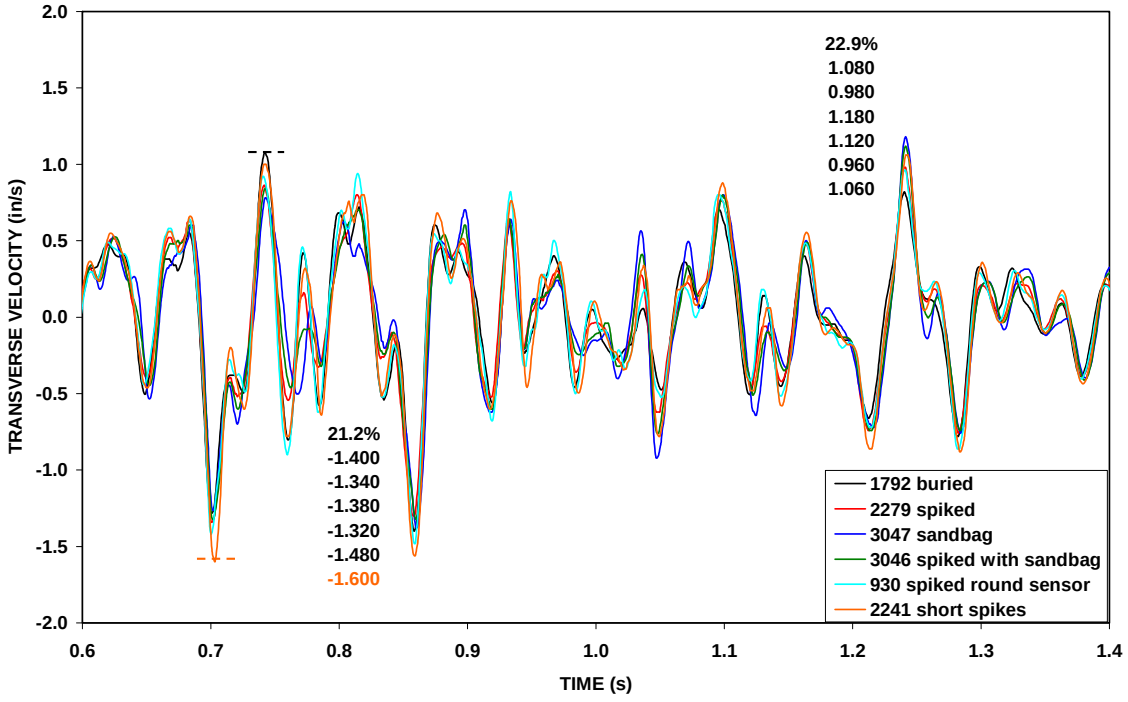

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.5
0.7
0.9
1.1
1.3
1.5

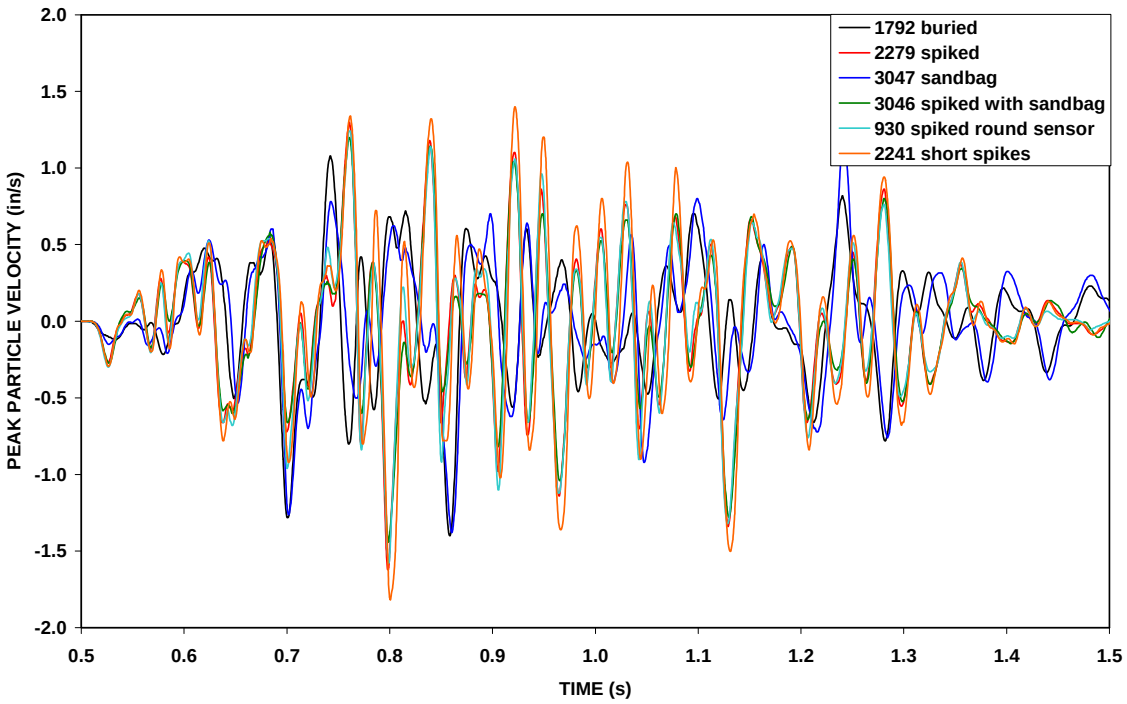

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
27.3%
1.180
1.300
1.100
1.200
1.240
1.400
42.2%
-1.280
-1.620
-1.320
-1.440
-1.580
-1.820
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5

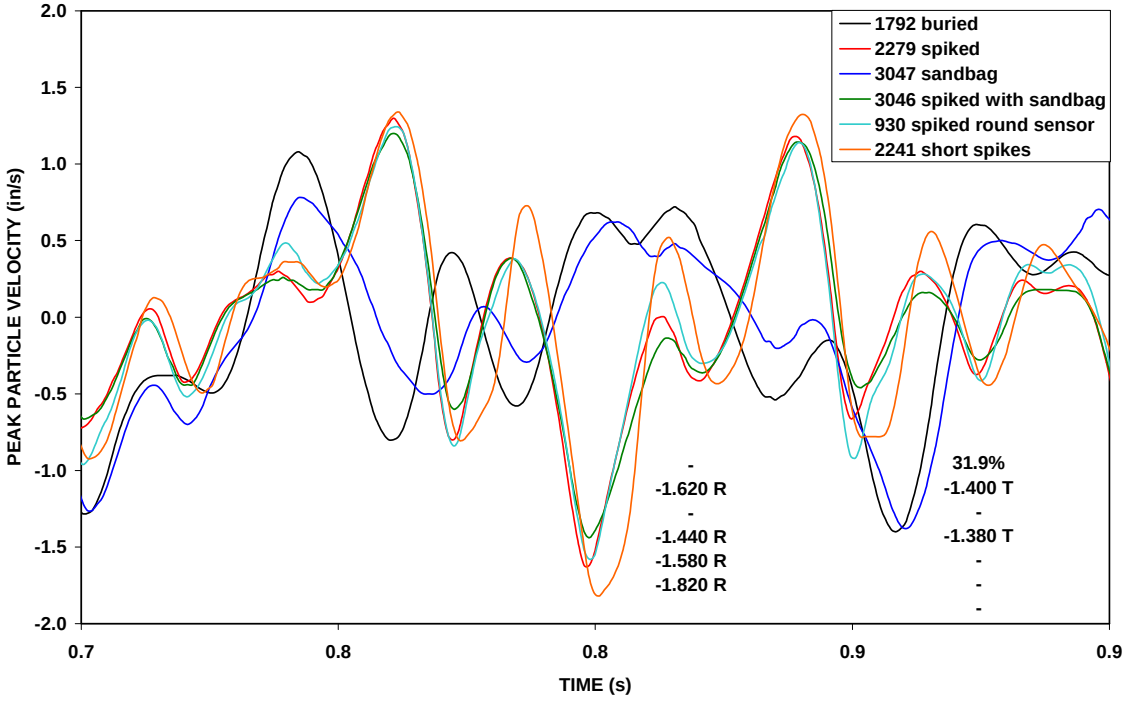

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
VERTICAL VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.5
0.7
0.9
1.1
1.3
1.5


1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
34.0%
1.060
1.320
1.380
1.420
1.200
1.320
48.8%
-0.900
-0.960
-1.080
-1.220
-0.820
-1.040
VERTICAL VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.7
0.8
0.8
0.9
0.9


1792 buried
2279 spiked
3047 sandbag
3046 spiked with
TRANSVERSE VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.5
0.7
0.9
1.1
1.3
1.5

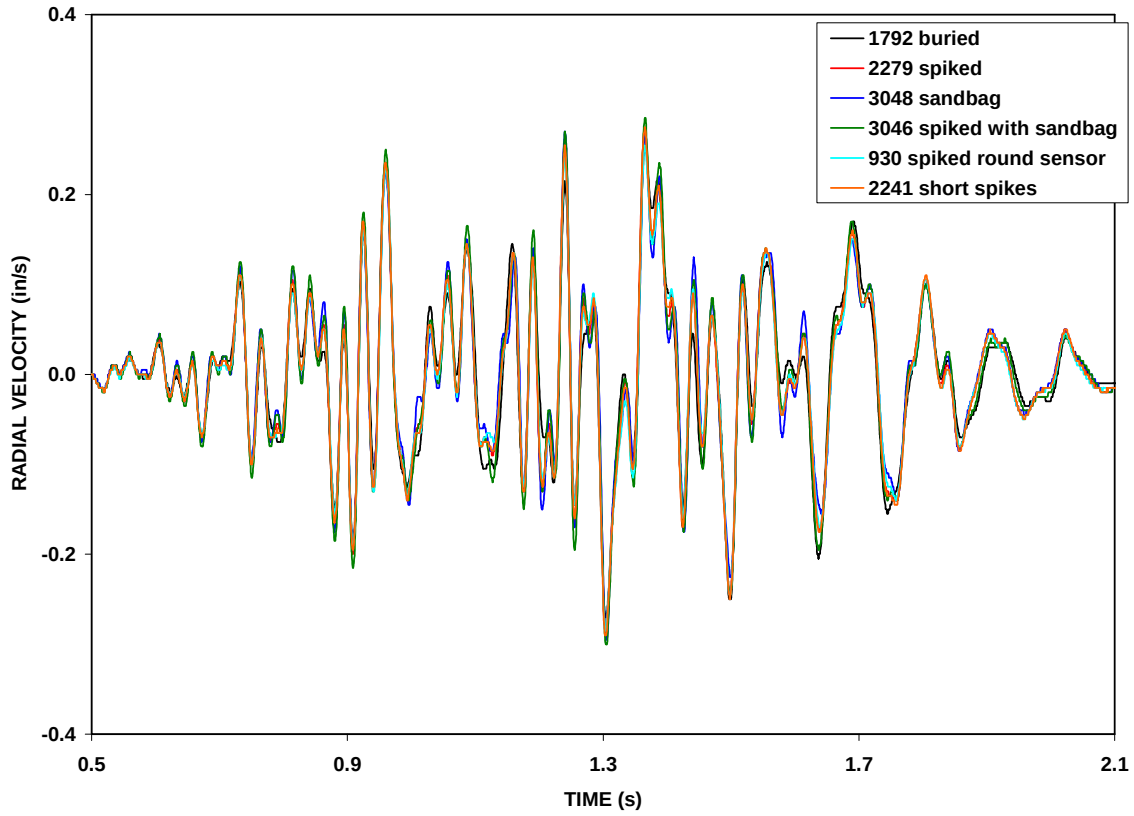

22.9%
1.080
0.980
1.180
1.120
0.960
1.060
21.2%
-1.400
-1.340
-1.380
-1.320
-1.480
-1.600
1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
TRANSVERSE VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4

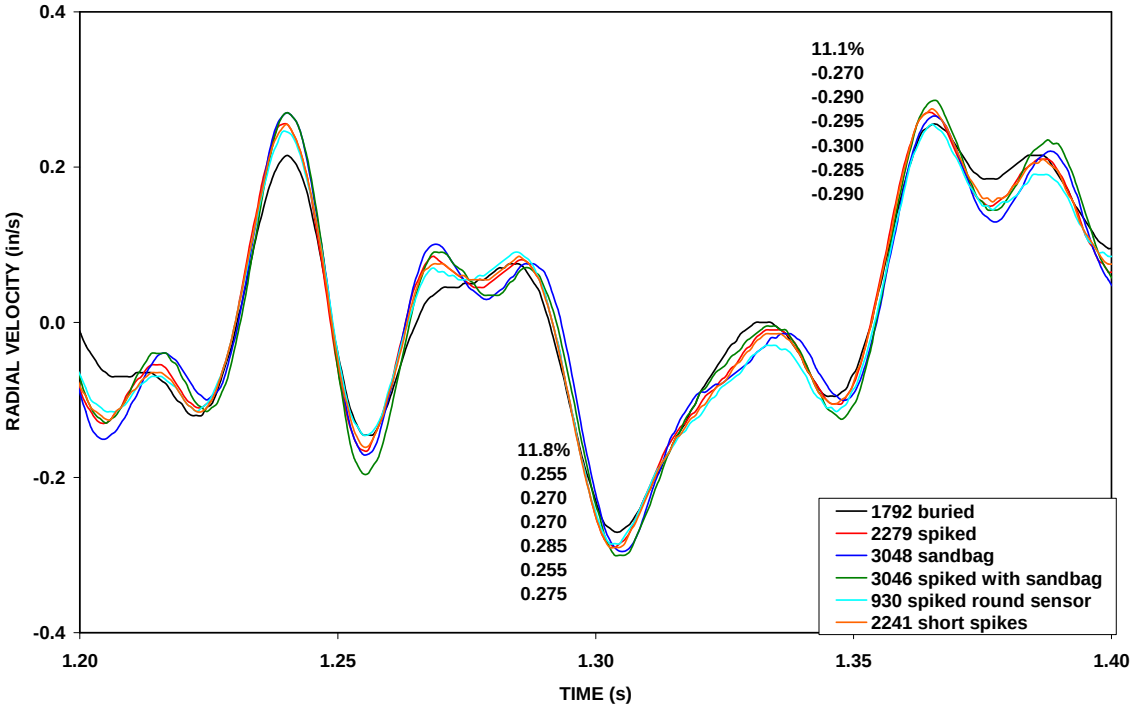

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
TIME (s)

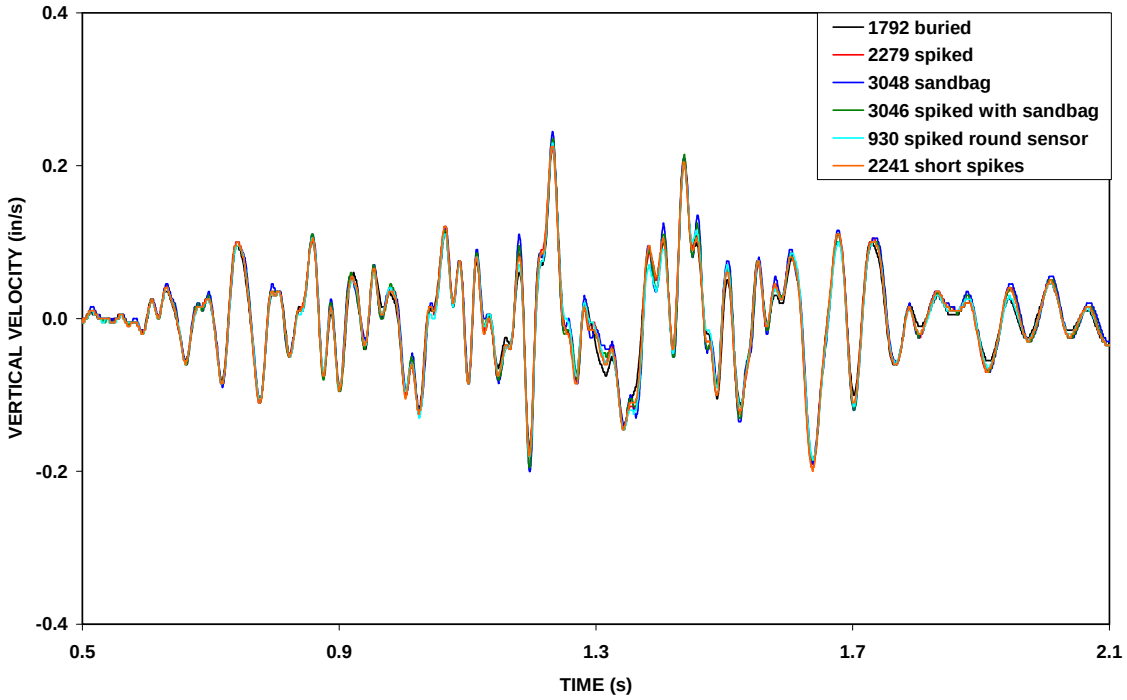

1792 buried
2279 spiked
3047 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.7
0.8
0.8
0.9
0.9
TIME (s)
-
-1.620 R
-
-1.440 R
-1.580 R
-1.820 R
31.9%
-1.400 T
-
-1.380 T
-
-
-

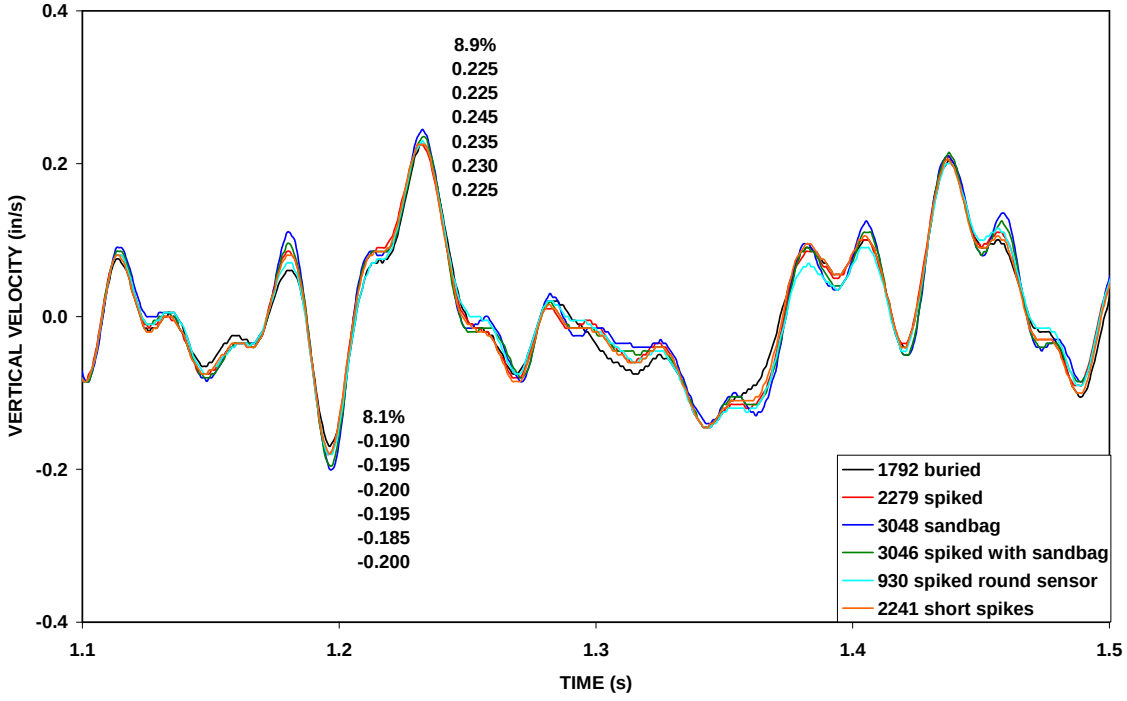
NM-5

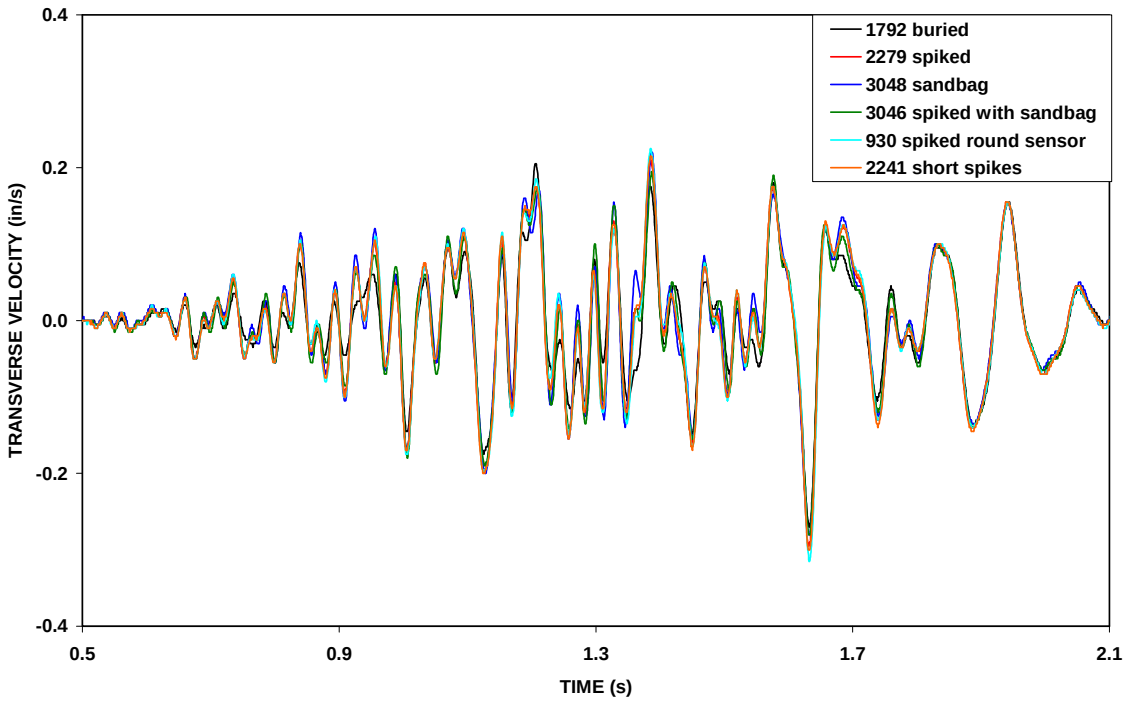
Cluster 1 SD 29.1 ft/lb$^{1/2}$

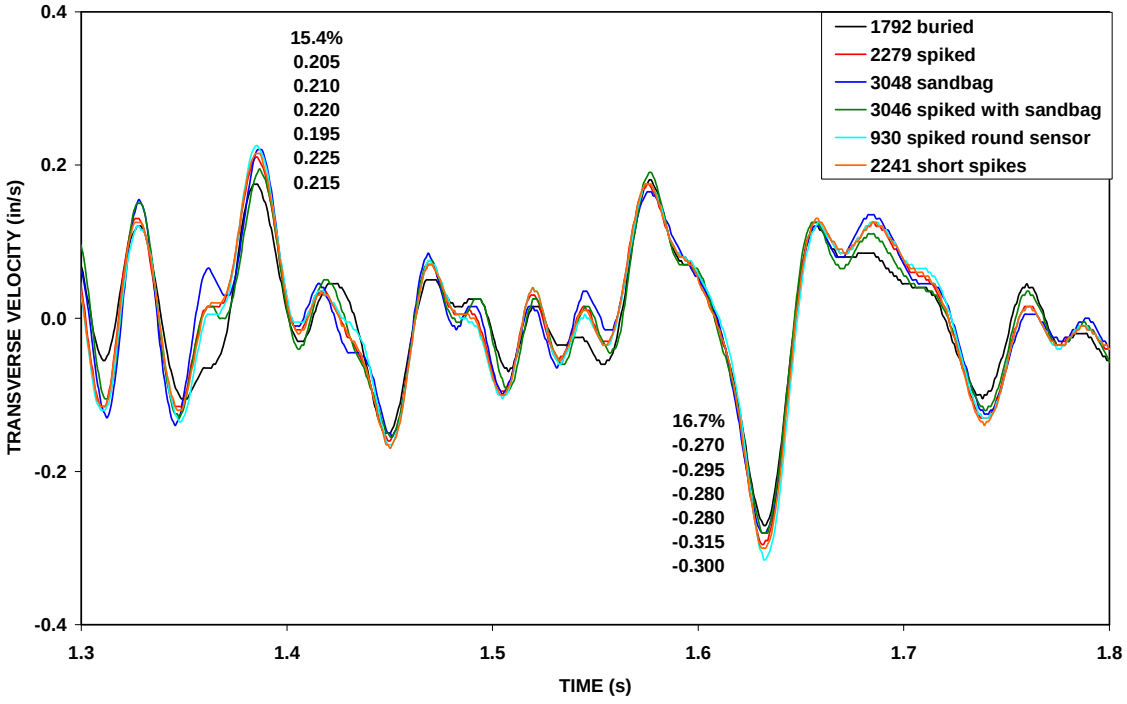

0.4
0.2
0.0
-0.2
-0.4
RADIAL VELOCITY (in/s)
0.5
0.9
1.3
1.7
2.1
TIME (s)
1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

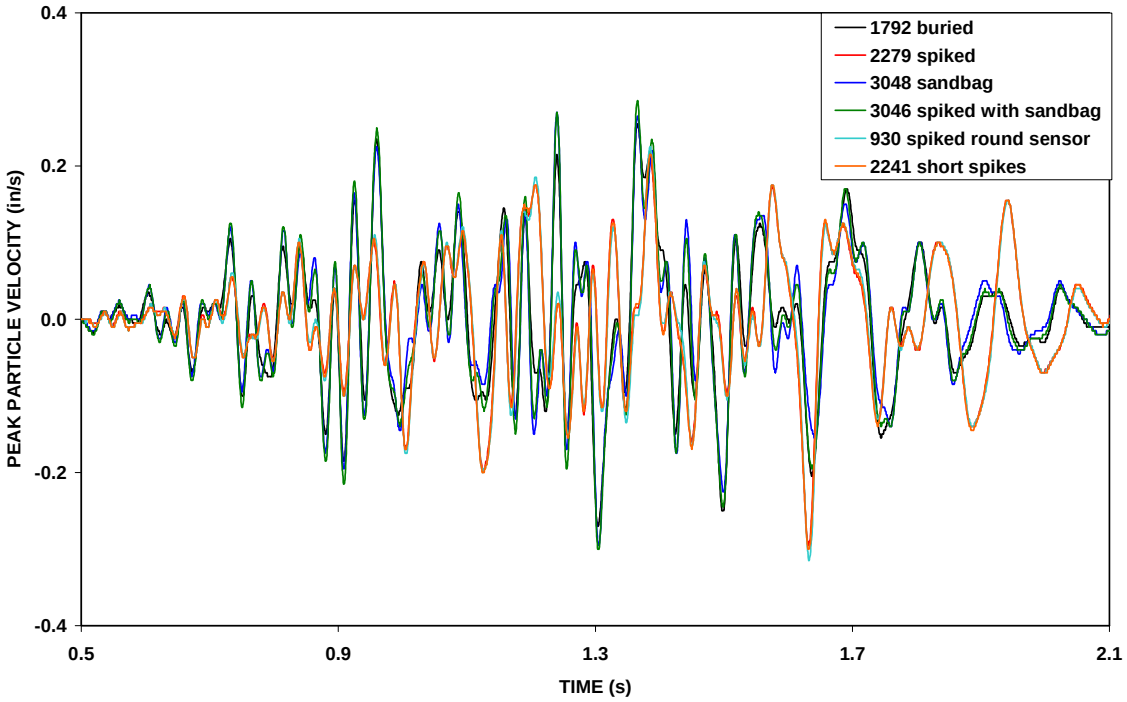

0.4
0.2
0.0
-0.2
-0.4
RADIAL VELOCITY (in/s)
1.20
1.25
1.30
1.35
1.40
TIME (s)
11.1%
-0.270
-0.290
-0.295
-0.300
-0.285
-0.290
11.8%
0.255
0.270
0.270
0.285
0.255
0.275
1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

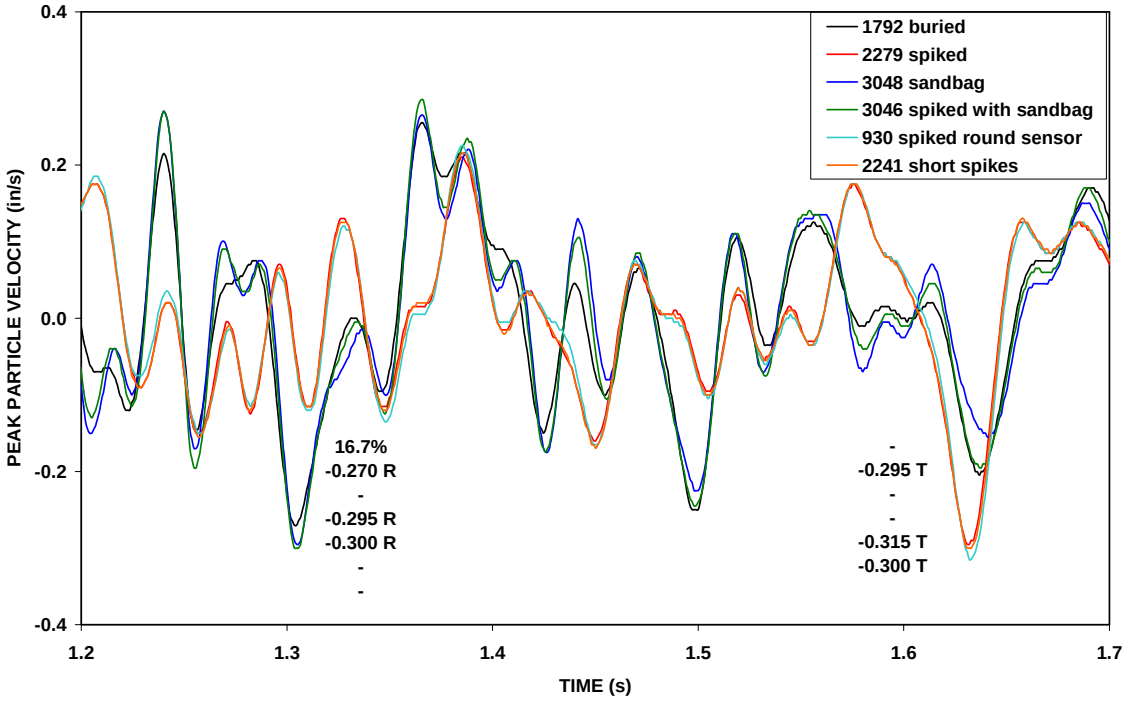

0.4
0.2
0.0
-0.2
-0.4
VERTICAL VELOCITY (in/s)
0.5
0.9
1.3
1.7
2.1
TIME (s)
1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes


0.4
0.2
0.0
-0.2
-0.4
VERTICAL VELOCITY (in/s)
1.1
1.2
1.3
1.4
1.5
TIME (s)
8.9%
0.225
0.225
0.245
0.235
0.230
0.225
8.1%
-0.190
-0.195
-0.200
-0.195
-0.185
-0.200
1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes


0.4
0.2
0.0
-0.2
-0.4
TRANSVERSE VELOCITY (in/s)
0.5
0.9
1.3
1.7
2.1
TIME (s)
1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

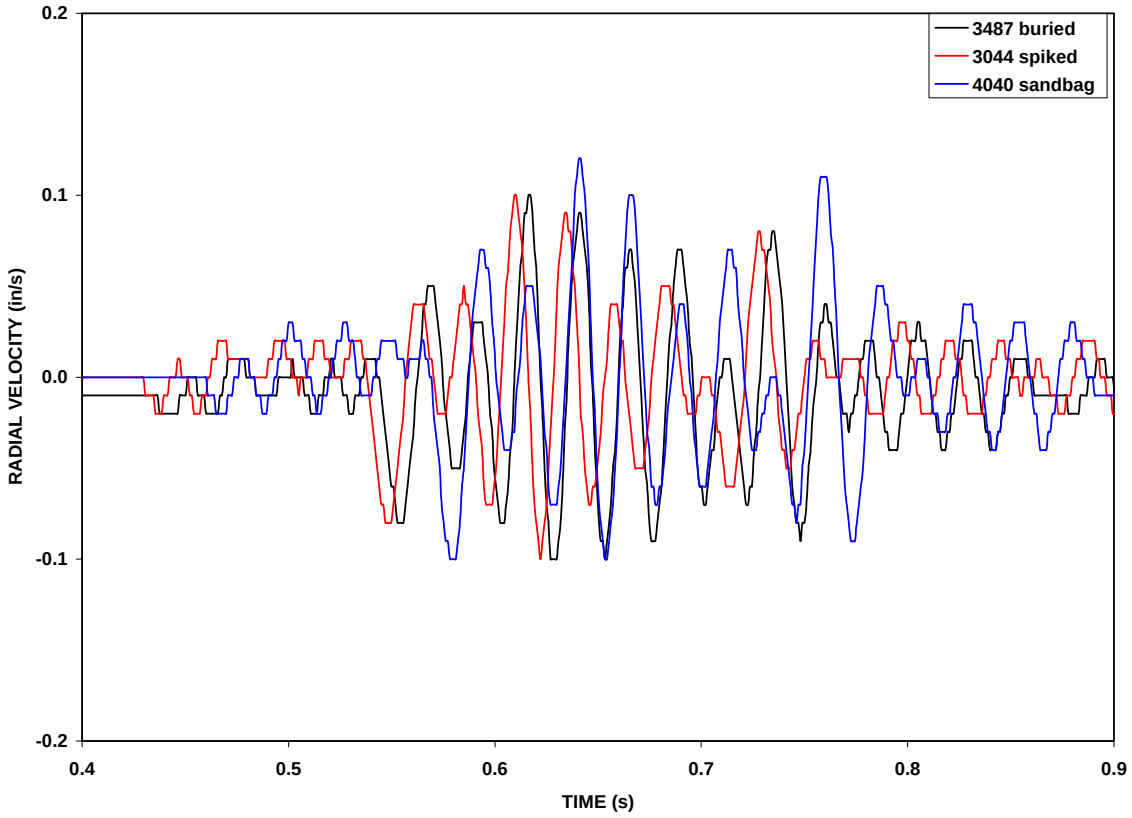

0.4
0.2
0.0
-0.2
-0.4
TRANSVERSE VELOCITY (in/s)
1.3
1.4
1.5
1.6
1.7
1.8
TIME (s)
15.4%
0.205
0.210
0.220
0.195
0.225
0.215
16.7%
-0.270
-0.295
-0.280
-0.280
-0.315
-0.300
1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes

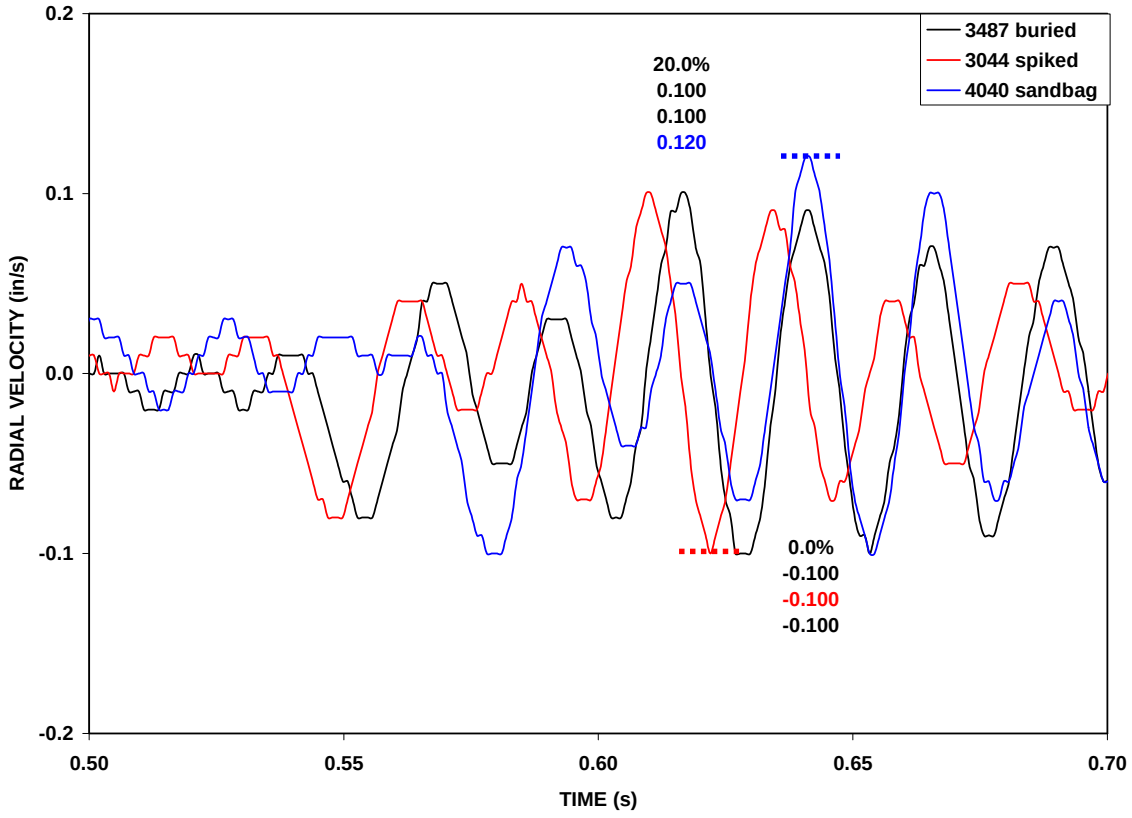

1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.5
0.9
1.3
1.7
2.1
TIME (s)

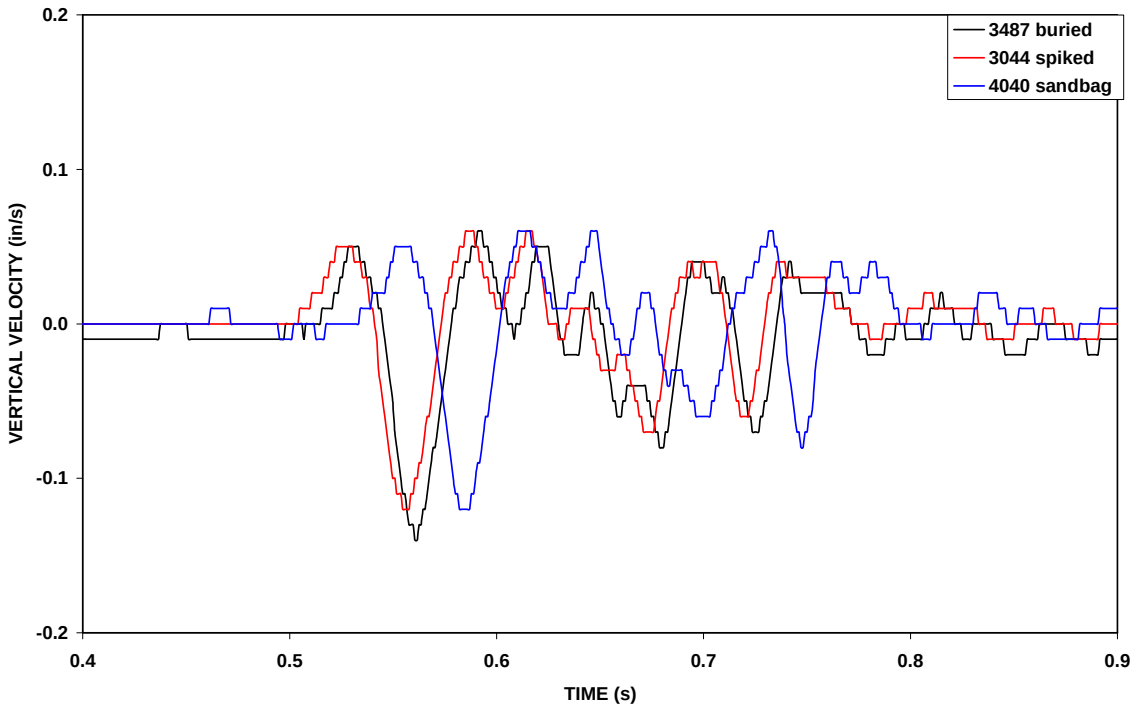

1792 buried
2279 spiked
3048 sandbag
3046 spiked with sandbag
930 spiked round sensor
2241 short spikes
PEAK PARTICLE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
16.7%
-0.270 R
-
-0.295 R
-0.300 R
-
-
-
-0.295 T
-
-
-0.315 T
-0.300 T
1.2
1.3
1.4
1.5
1.6
1.7
TIME (s)

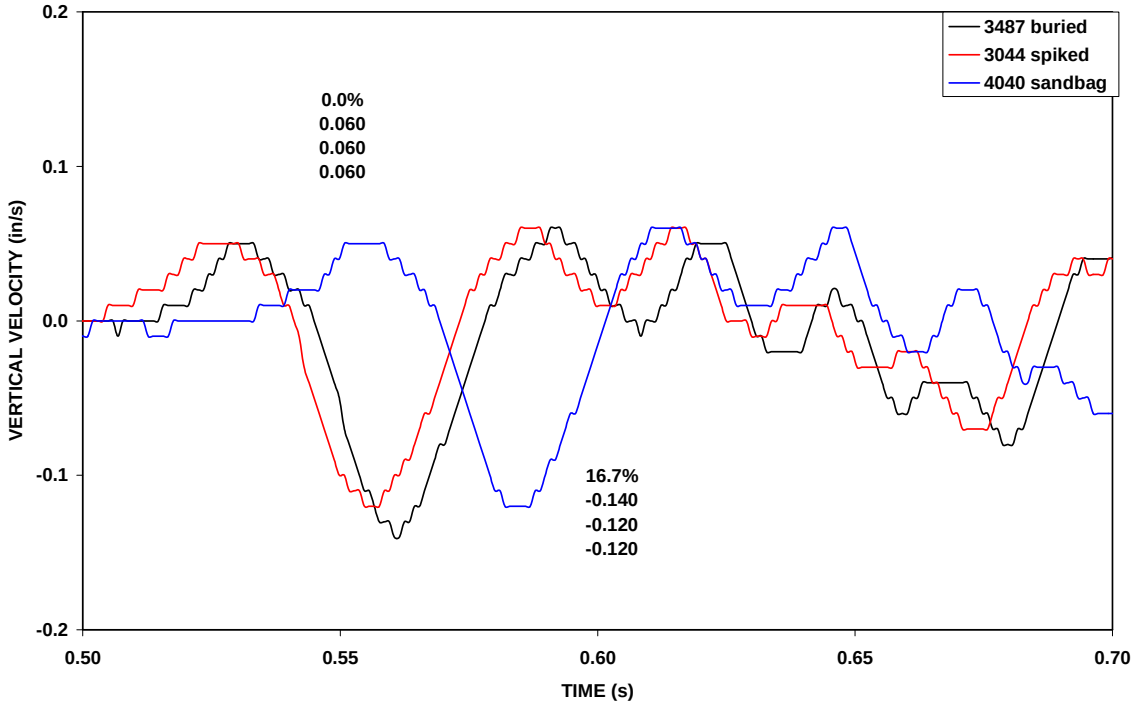
NM-6

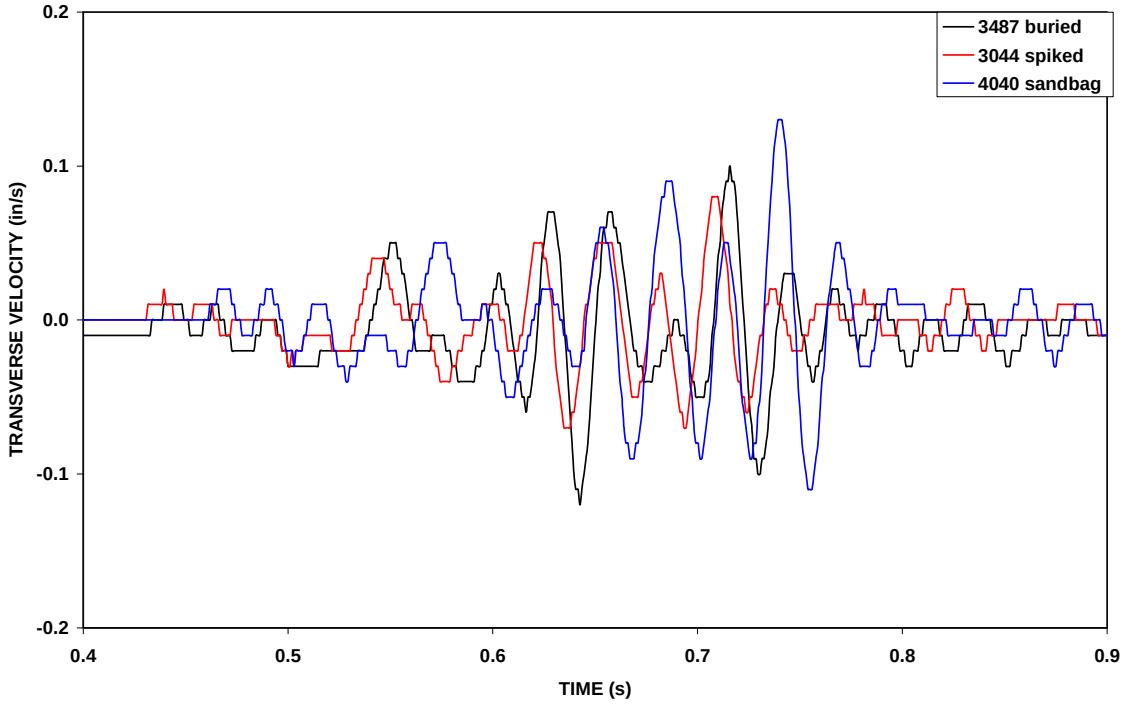
Cluster 1 SD 40.8 ft/lb$^{1/2}$

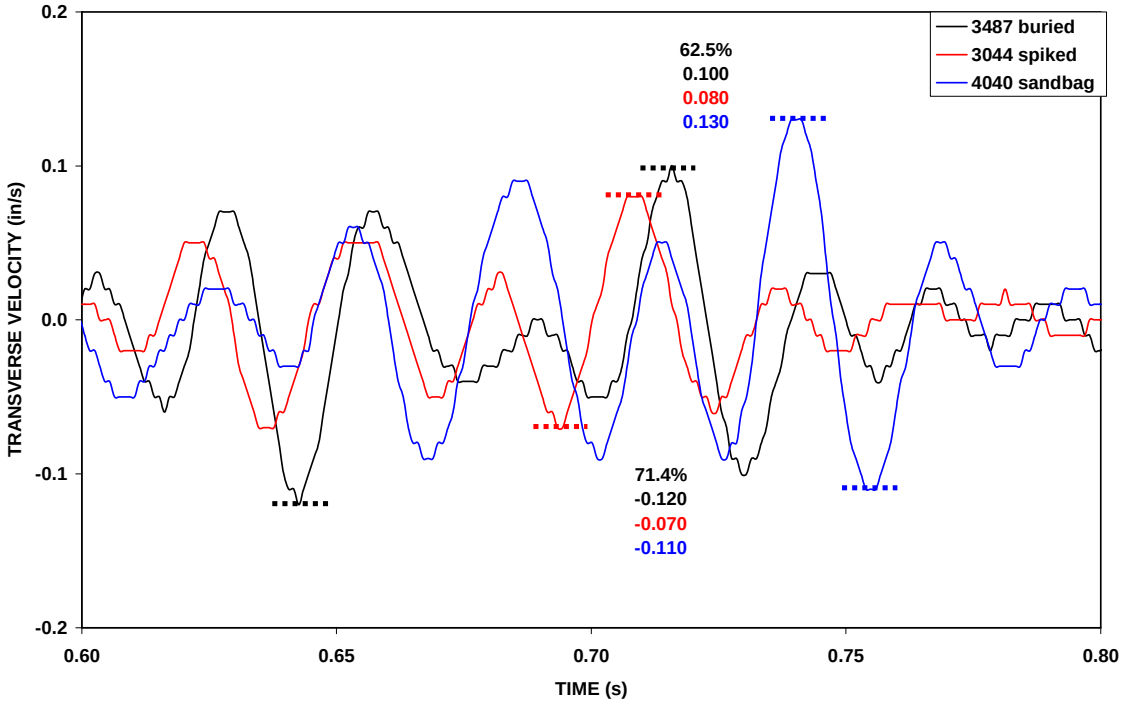

3487 buried
3044 spiked
4040 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.5
0.6
0.7
0.8
0.9

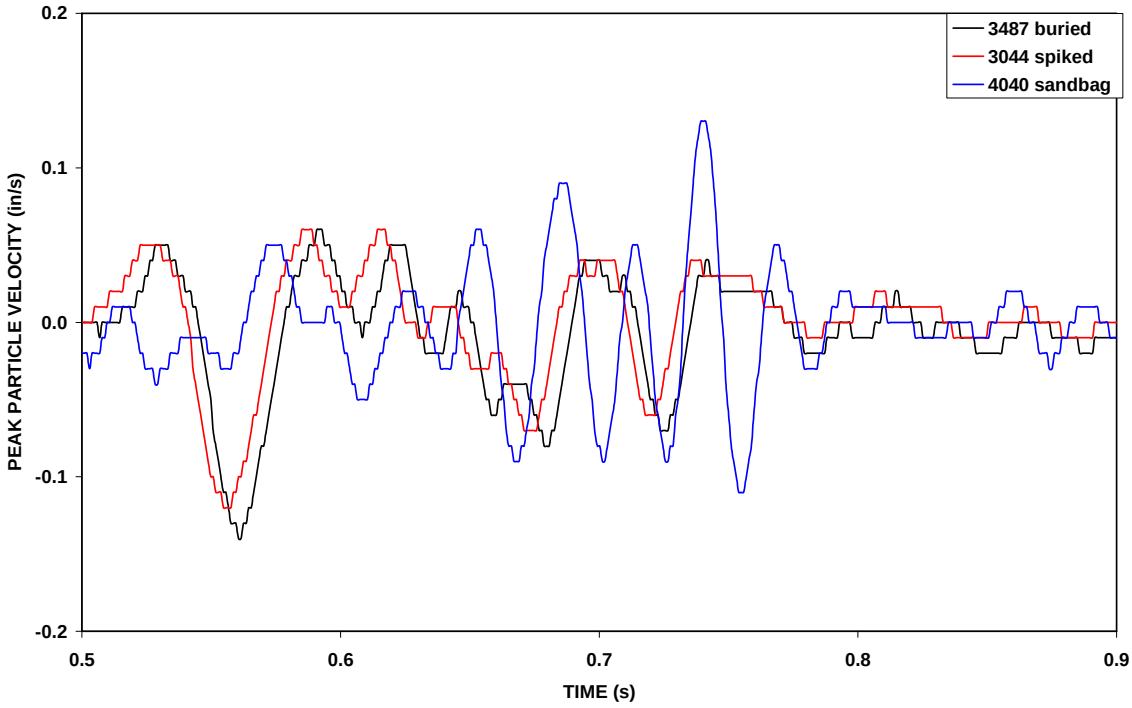

3487 buried
3044 spiked
4040 sandbag
20.0%
0.100
0.100
0.120
0.0%
-0.100
-0.100
-0.100
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.50
0.55
0.60
0.65
0.70

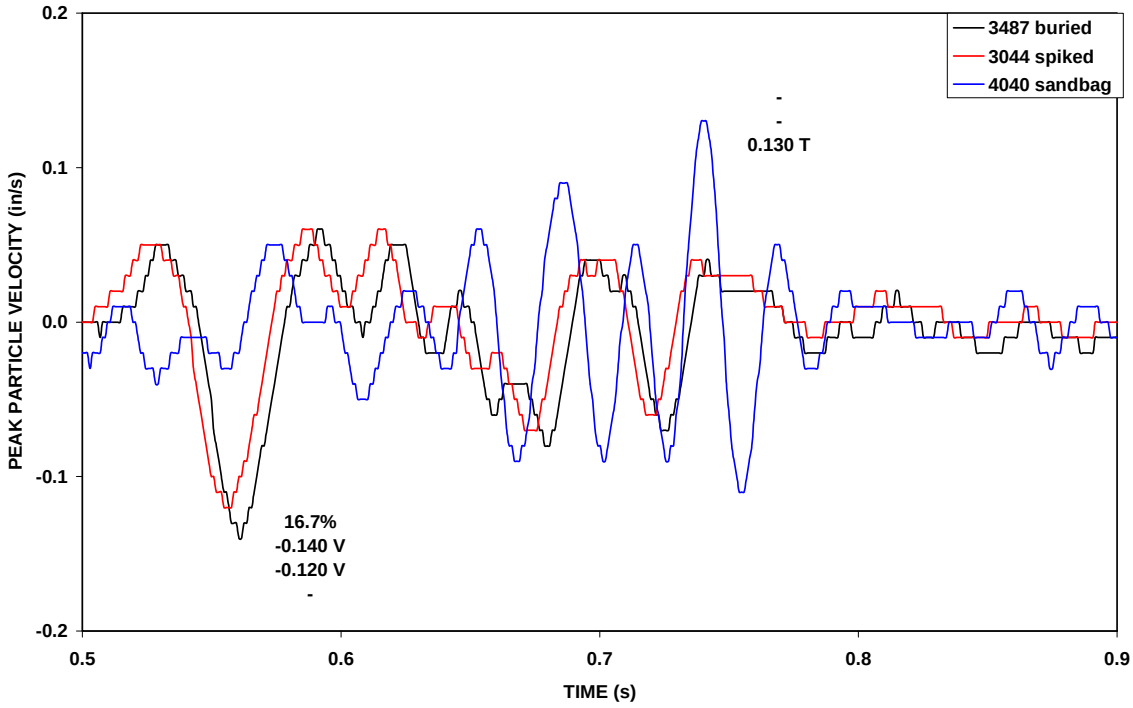

3487 buried
3044 spiked
4040 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.5
0.6
0.7
0.8
0.9


3487 buried
3044 spiked
4040 sandbag
0.0%
0.060
0.060
0.060
16.7%
-0.140
-0.120
-0.120
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.50
0.55
0.60
0.65
0.70


3487 buried
3044 spiked
4040 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.5
0.6
0.7
0.8
0.9

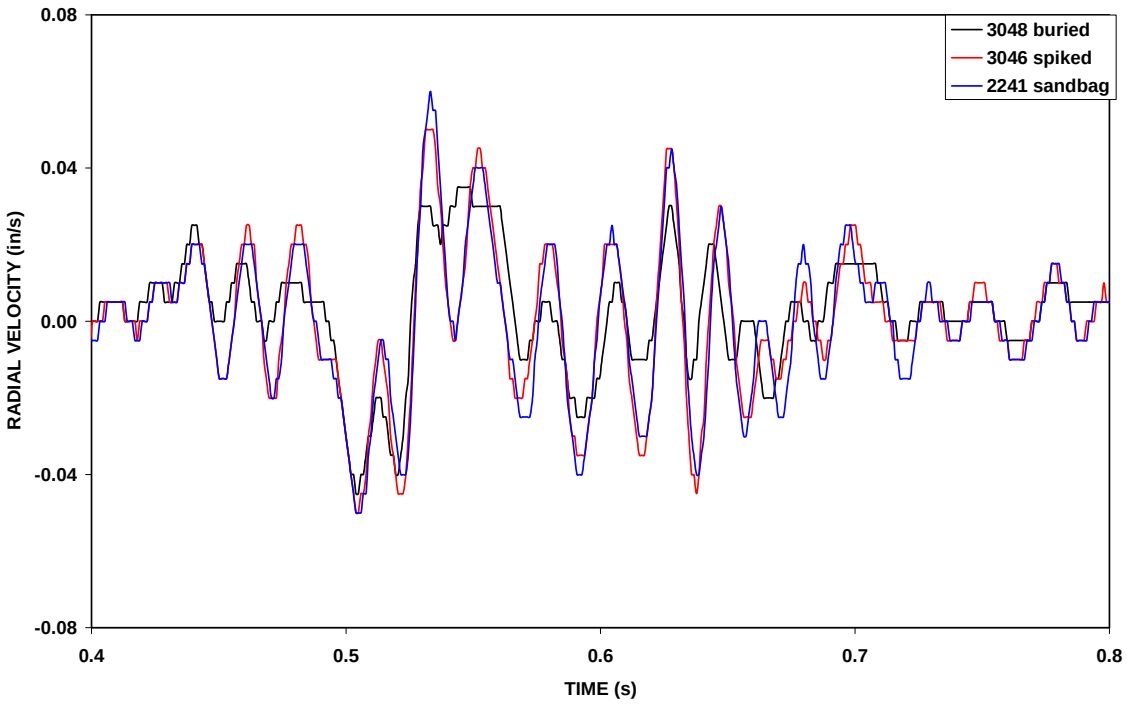

3487 buried
3044 spiked
4040 sandbag
62.5%
0.100
0.080
0.130
71.4%
-0.120
-0.070
-0.110
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.60
0.65
0.70
0.75
0.80

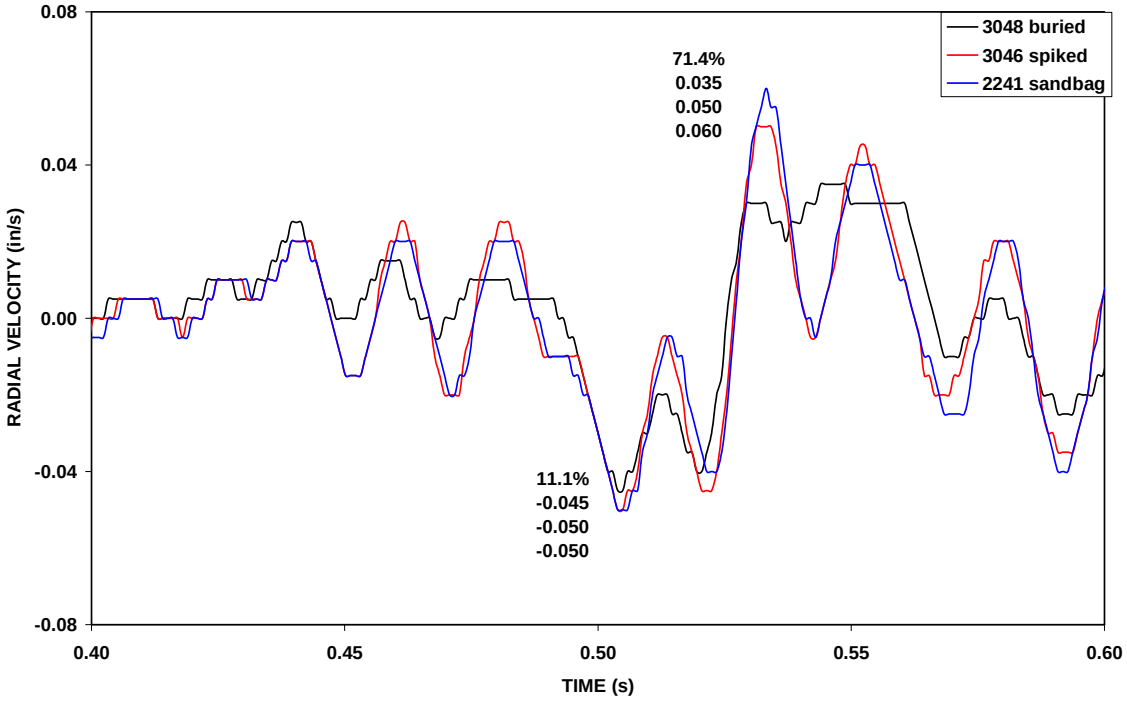

3487 buried
3044 spiked
4040 sandbag
PEAK PARTICLE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.5
0.6
0.7
0.8
0.9
TIME (s)

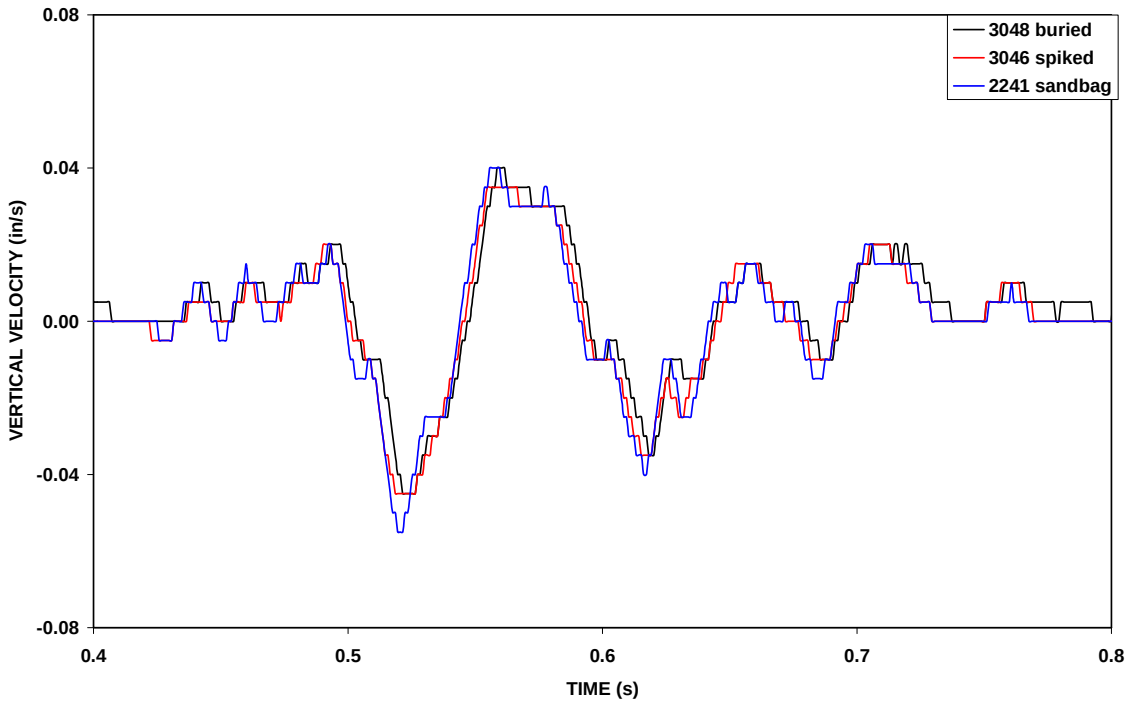

3487 buried
3044 spiked
4040 sandbag
-
-
0.130 T
16.7%
-0.140 V
-0.120 V
-
PEAK PARTICLE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.5
0.6
0.7
0.8
0.9
TIME (s)

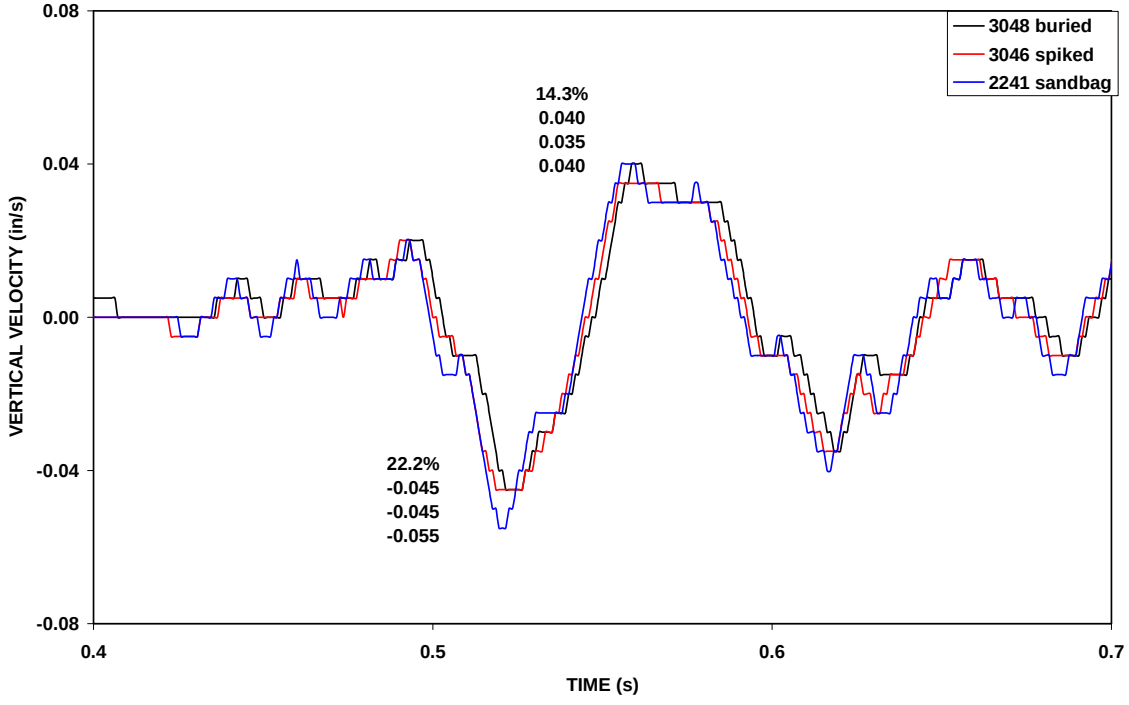
NM-6

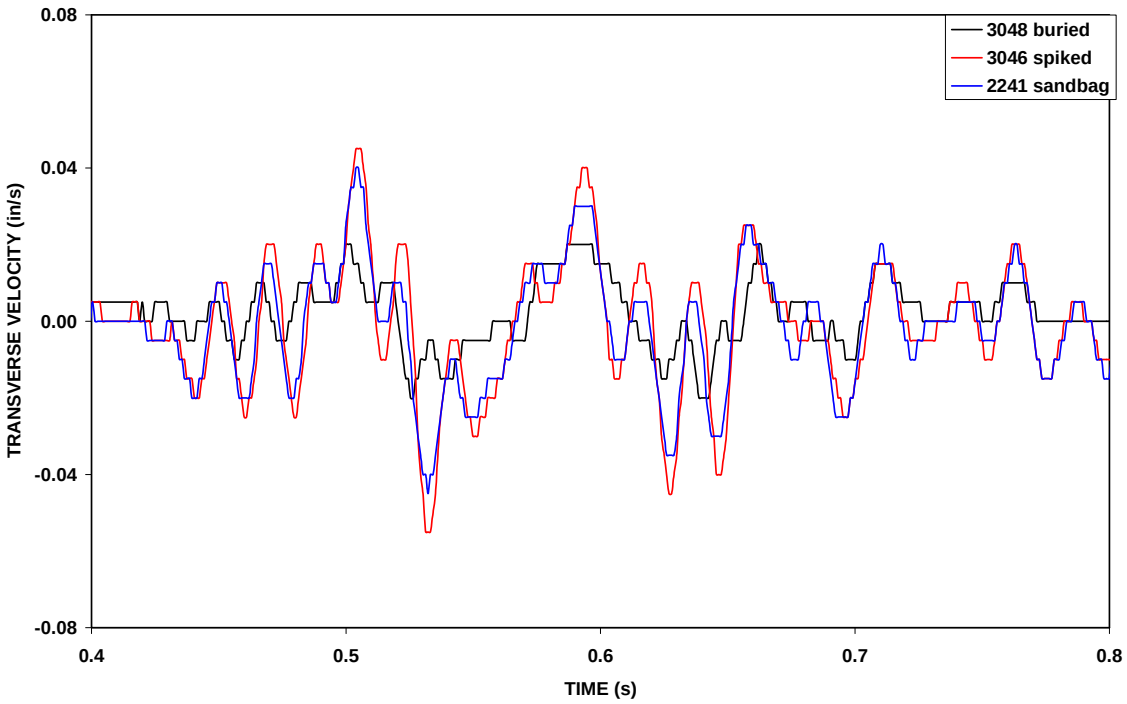
Cluster 2 SD 81.6 ft/lb$^{1/2}$

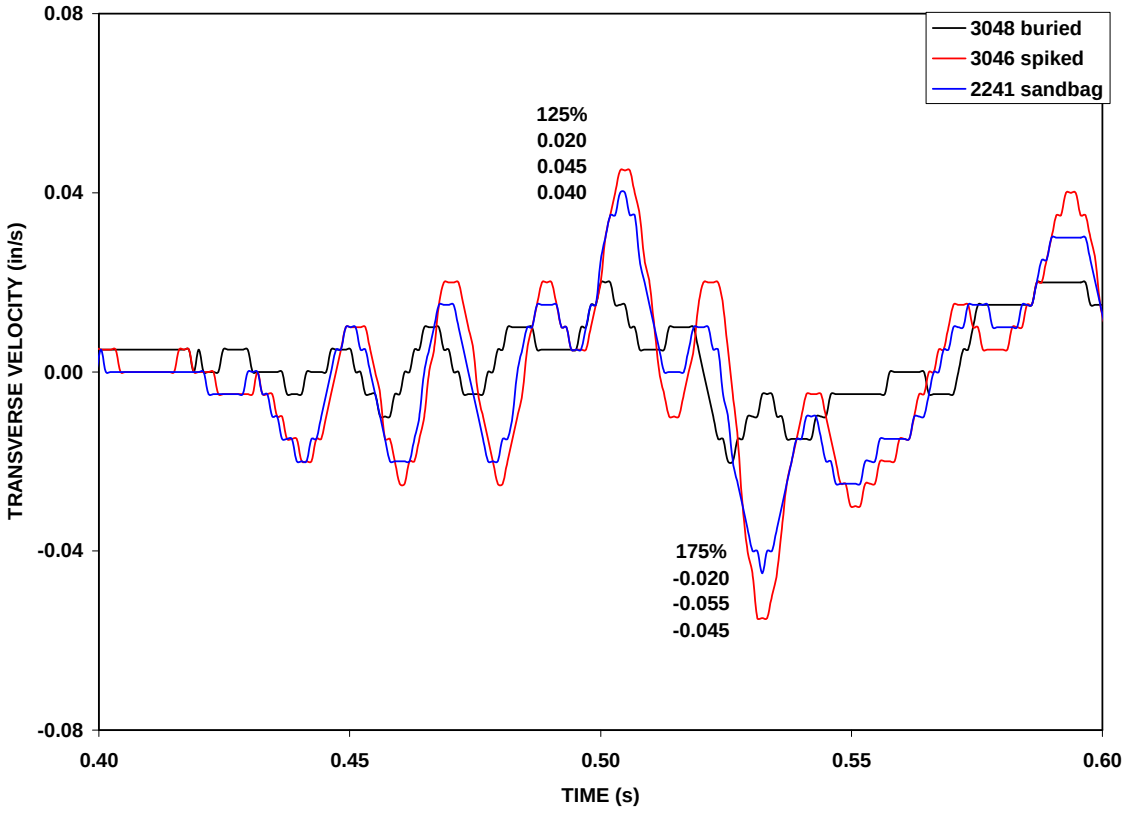

3048 buried
3046 spiked
2241 sandbag
RADIAL VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7
0.8
TIME (s)


3048 buried
3046 spiked
2241 sandbag
71.4%
0.035
0.050
0.060
11.1%
-0.045
-0.050
-0.050
RADIAL VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.40
0.45
0.50
0.55
0.60
TIME (s)


3048 buried
3046 spiked
2241 sandbag
VERTICAL VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7
0.8
TIME (s)

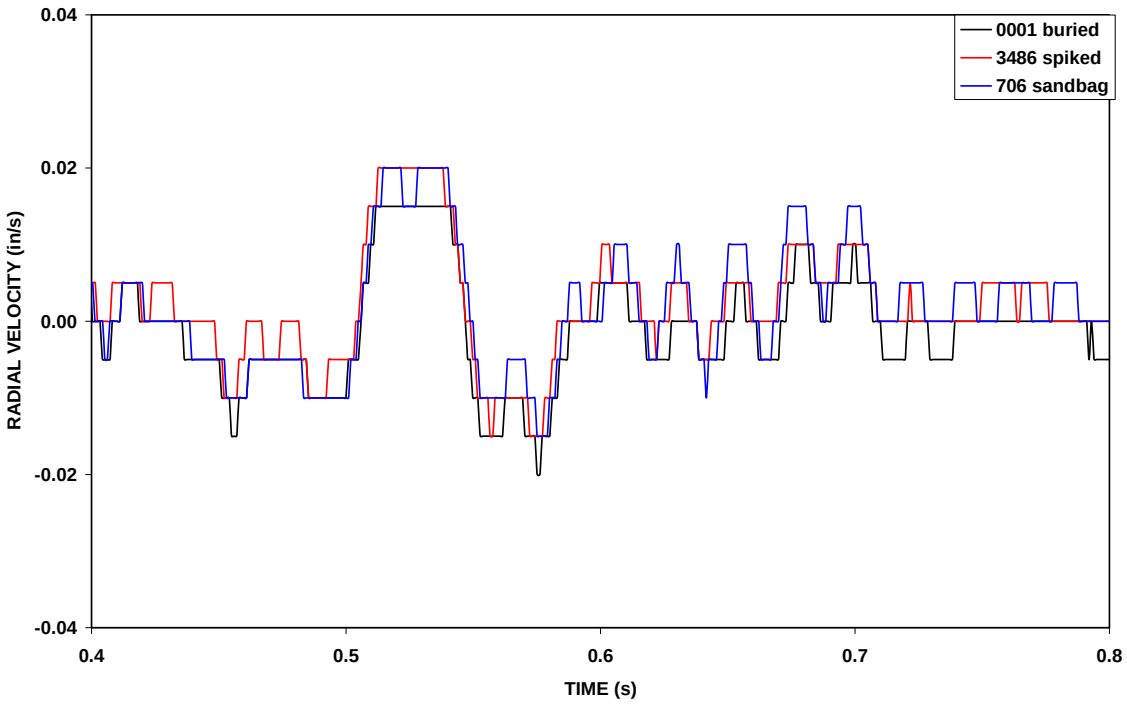

3048 buried
3046 spiked
2241 sandbag
14.3%
0.040
0.035
0.040
22.2%
-0.045
-0.045
-0.055
VERTICAL VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7
TIME (s)

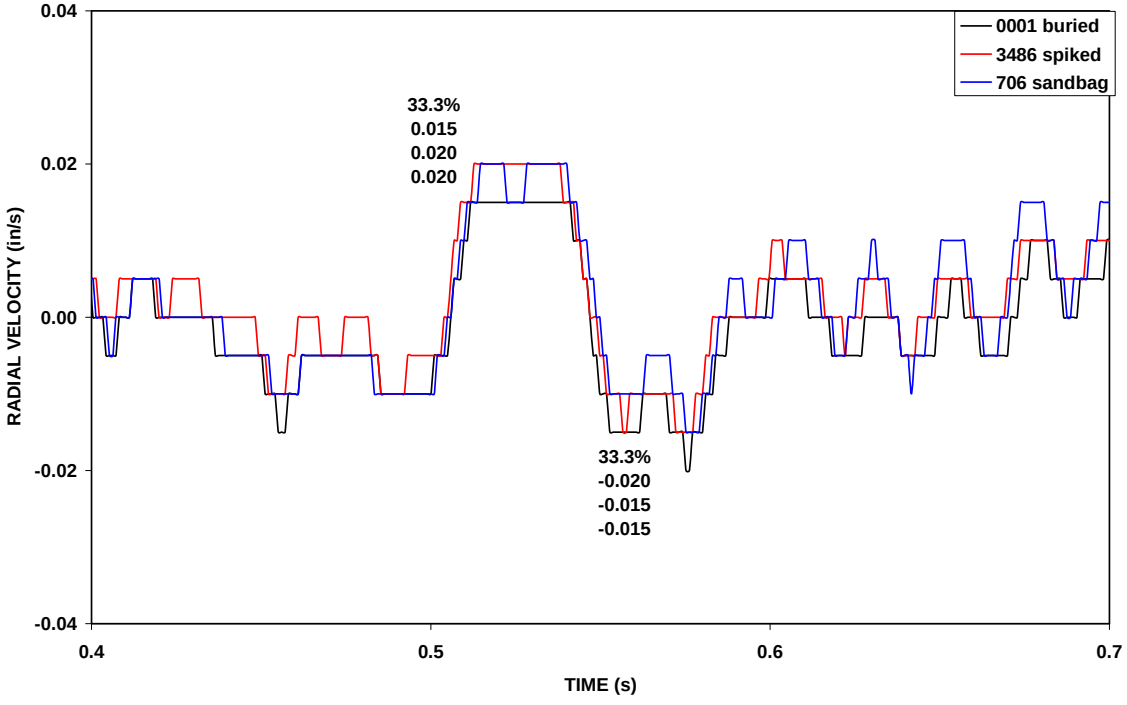

3048 buried
3046 spiked
2241 sandbag
TRANSVERSE VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7
0.8
TIME (s)

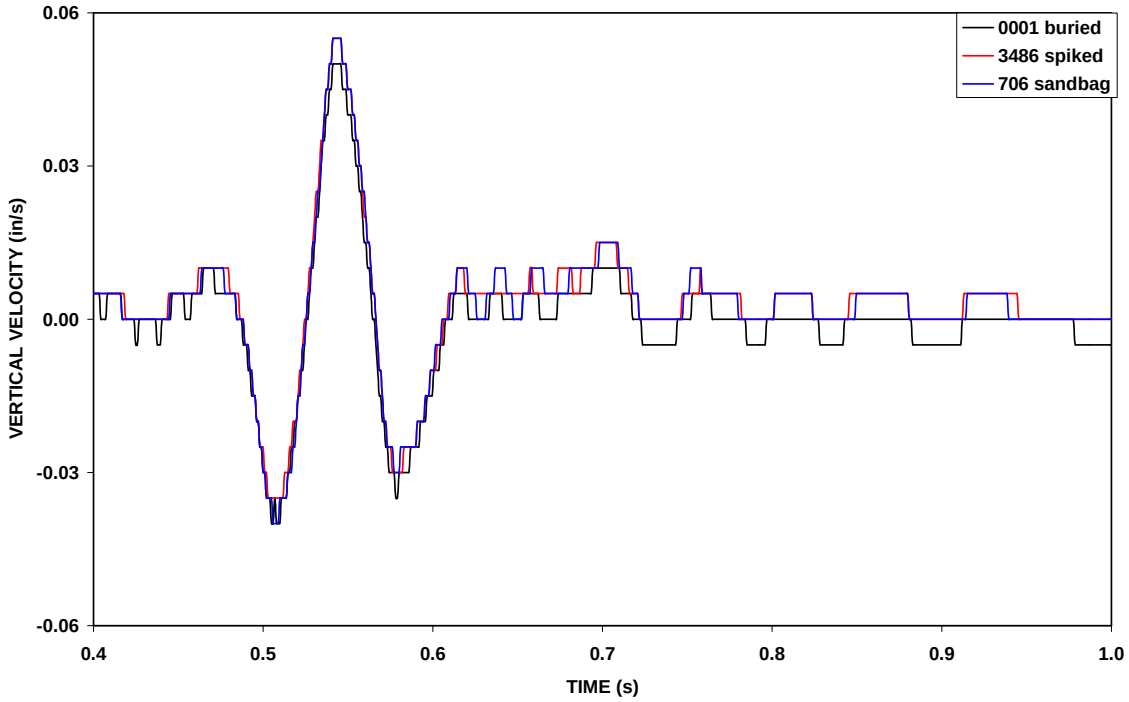

3048 buried
3046 spiked
2241 sandbag
125%
0.020
0.045
0.040
175%
-0.020
-0.055
-0.045
TRANSVERSE VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.40
0.45
0.50
0.55
0.60
TIME (s)

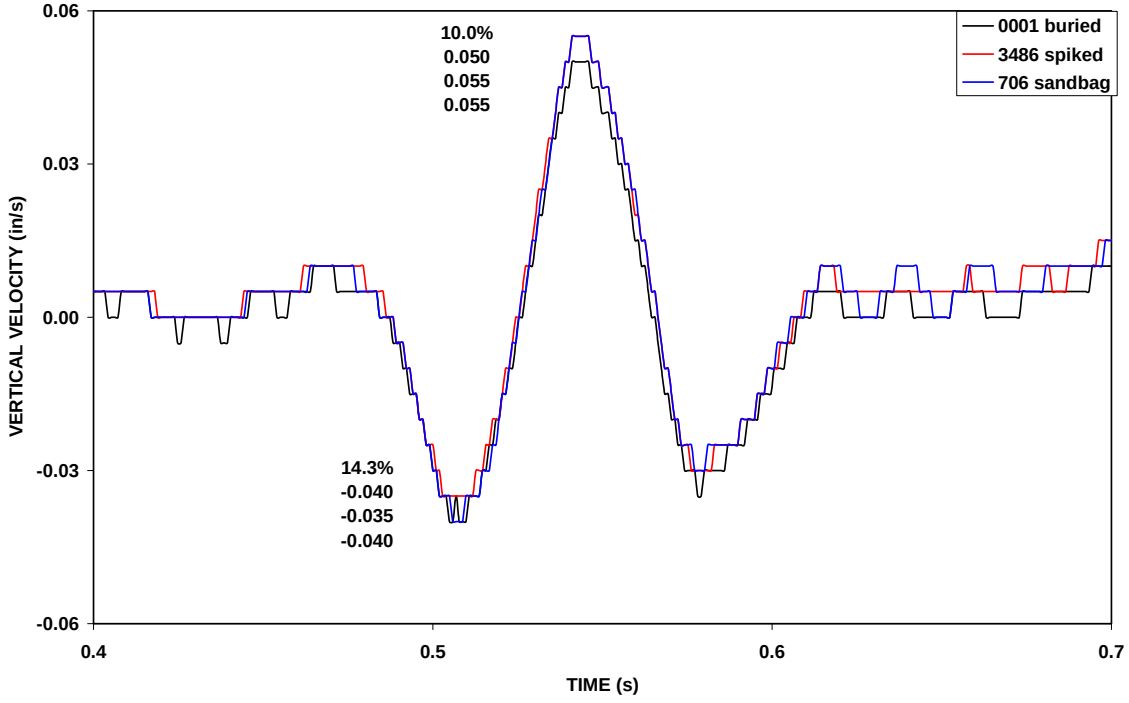
NM-6

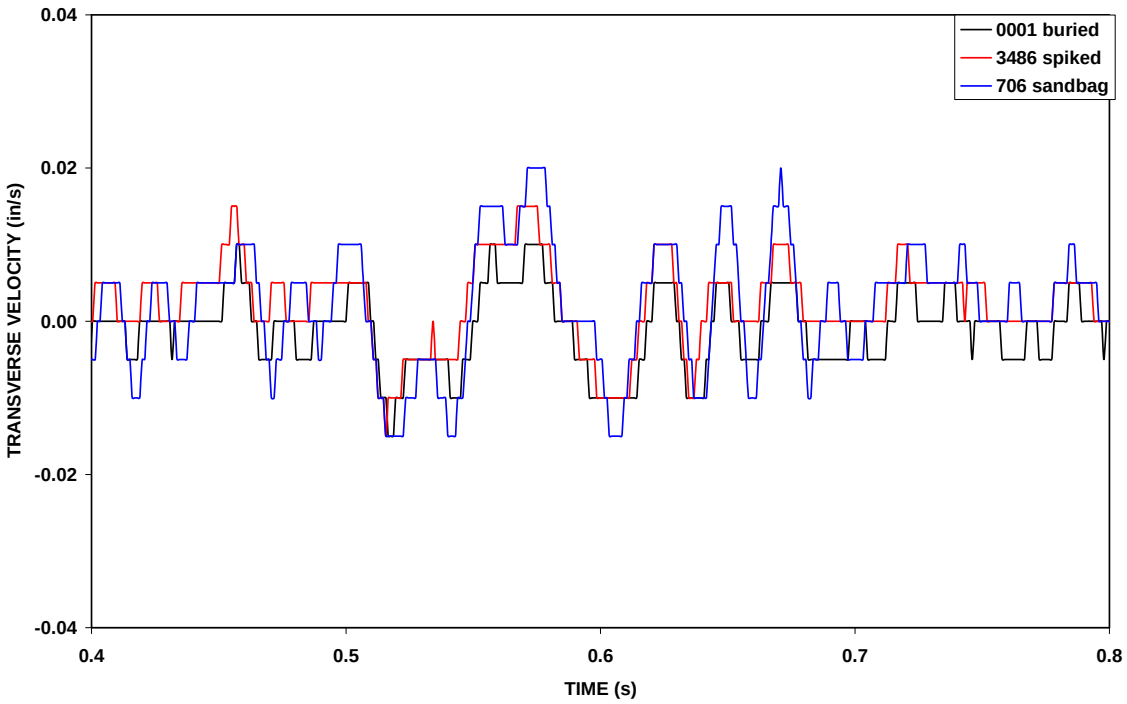
Cluster 3 SD 122.5 ft/lb$^{1/2}$

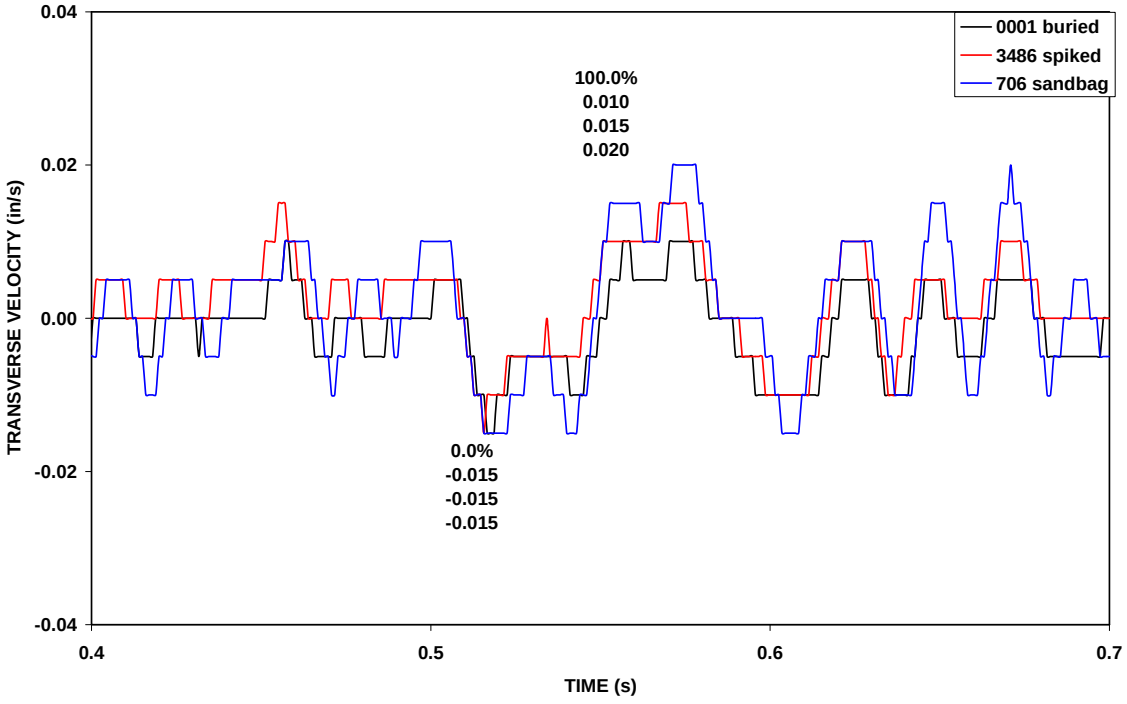

0001 buried
3486 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.04
0.02
0.00
-0.02
-0.04
0.4
0.5
0.6
0.7
0.8


0001 buried
3486 spiked
706 sandbag
33.3%
0.015
0.020
0.020
33.3%
-0.020
-0.015
-0.015
RADIAL VELOCITY (in/s)
TIME (s)
0.04
0.02
0.00
-0.02
-0.04
0.4
0.5
0.6
0.7


0001 buried
3486 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
0.06
0.03
0.00
-0.03
-0.06
0.4
0.5
0.6
0.7
0.8
0.9
1.0
TIME (s)

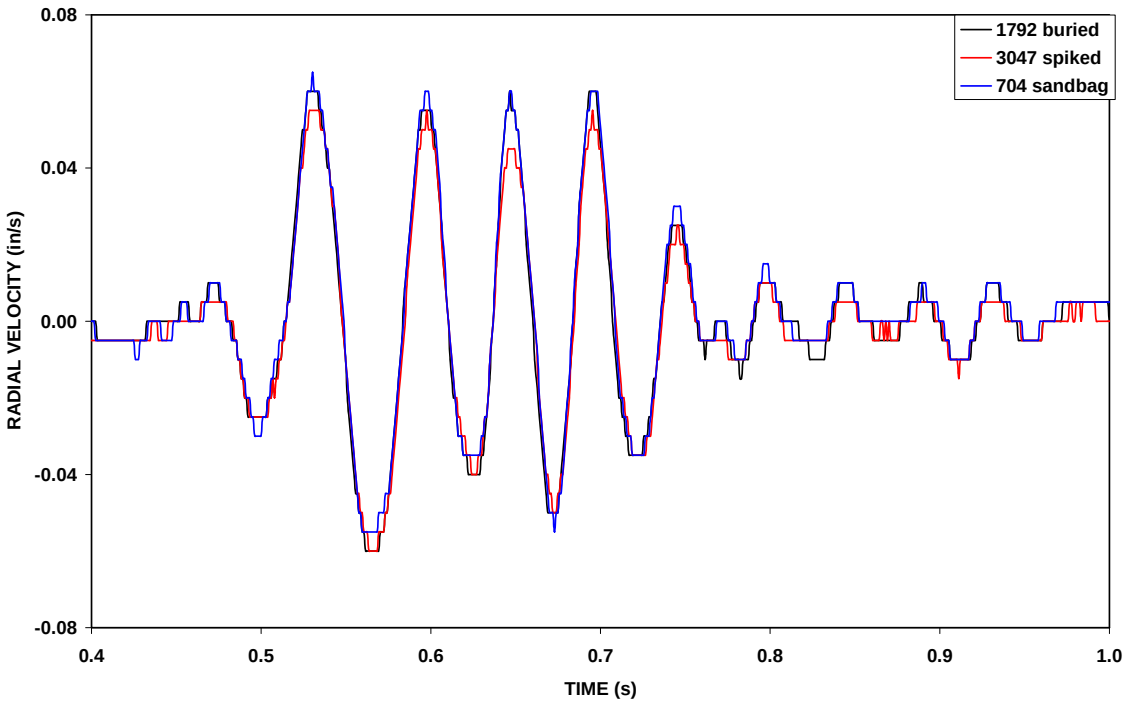

0001 buried
3486 spiked
706 sandbag
10.0%
0.050
0.055
0.055
14.3%
-0.040
-0.035
-0.040
VERTICAL VELOCITY (in/s)
0.06
0.03
0.00
-0.03
-0.06
0.4
0.5
0.6
0.7
TIME (s)

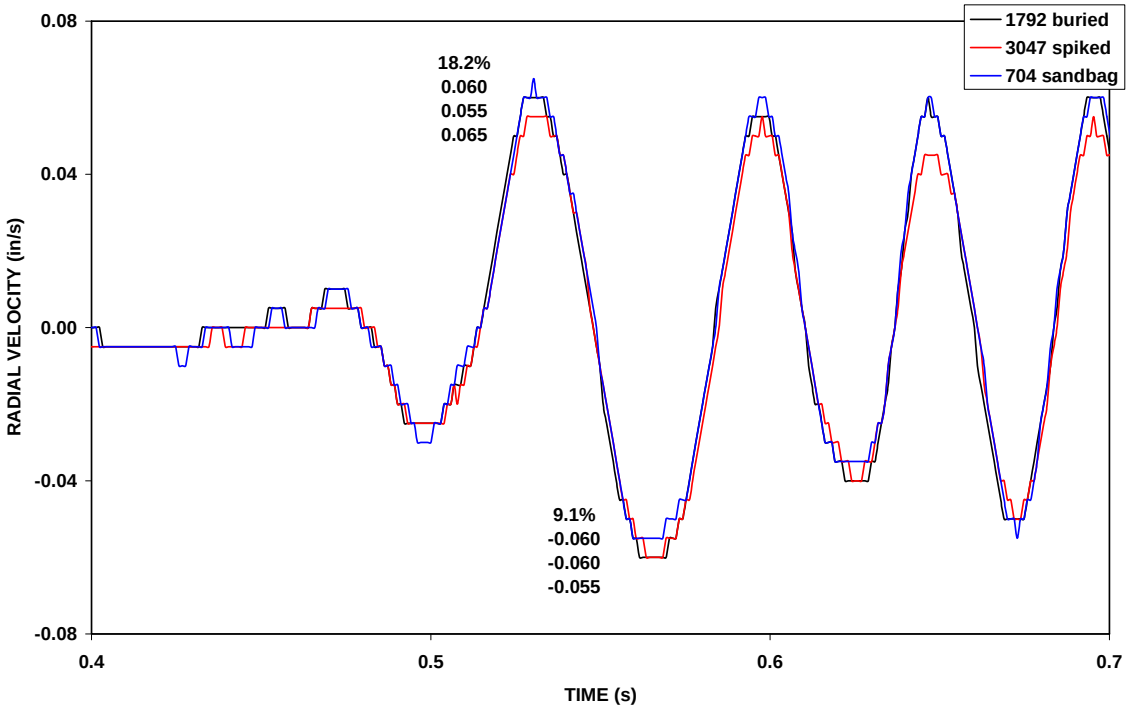

0.04
0.02
0.00
-0.02
-0.04
TRANSVERSE VELOCITY (in/s)
0.4
0.5
0.6
0.7
0.8
TIME (s)
0001 buried
3486 spiked
706 sandbag

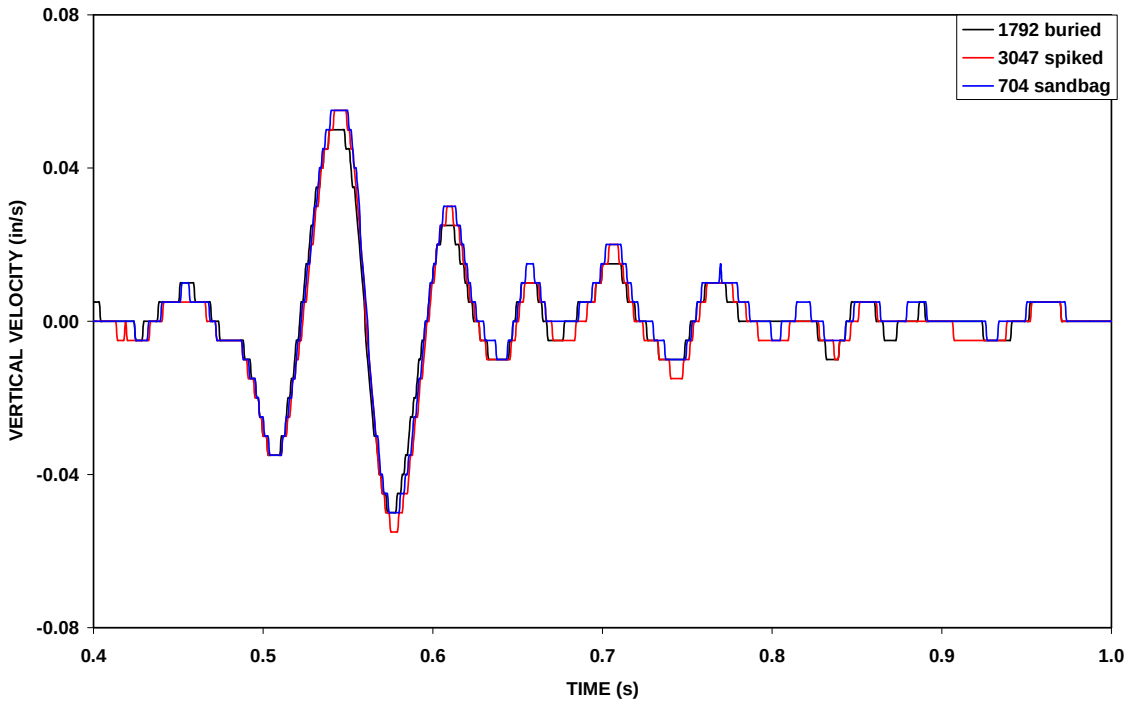

0.04
0.02
0.00
-0.02
-0.04
TRANSVERSE VELOCITY (in/s)
0.4
0.5
0.6
0.7
TIME (s)
0001 buried
3486 spiked
706 sandbag
100.0%
0.010
0.015
0.020
0.0%
-0.015
-0.015
-0.015

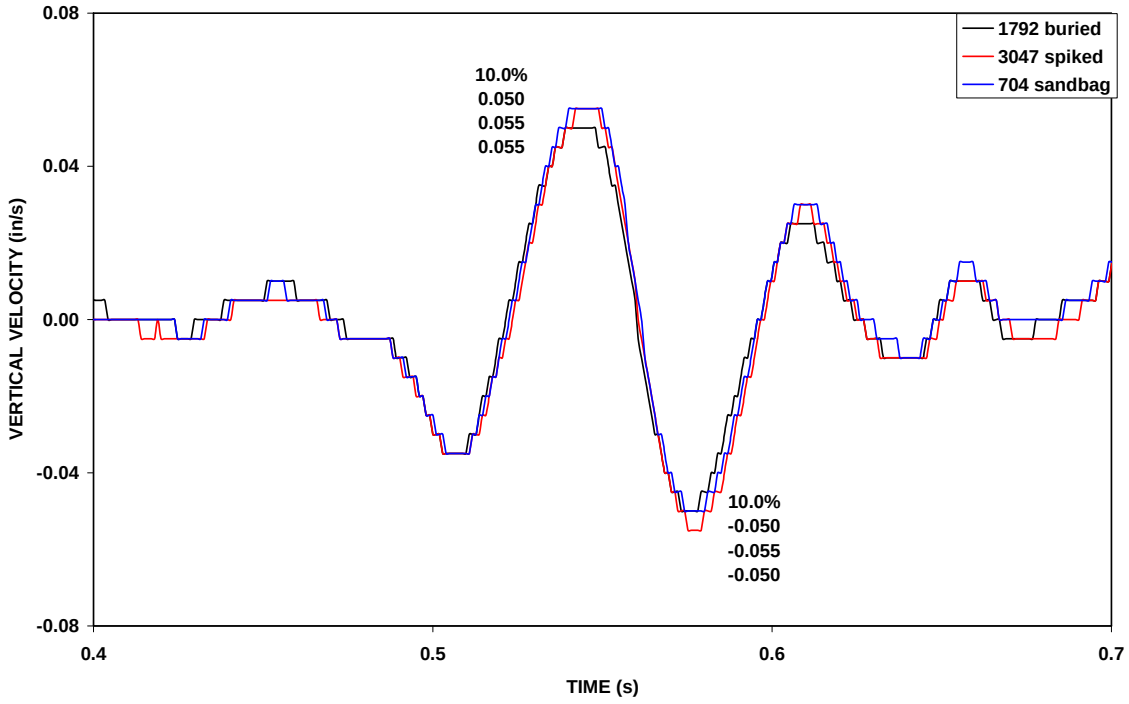
NM-6

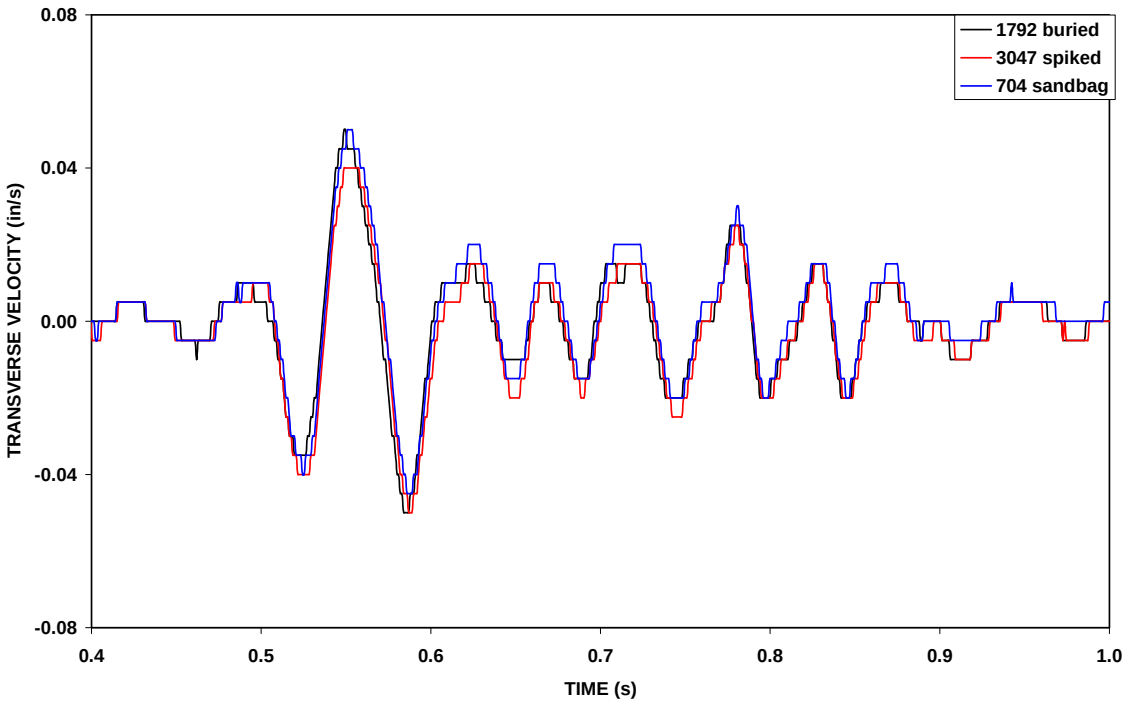
Cluster 4 SD 163.3 ft/lb$^{1/2}$

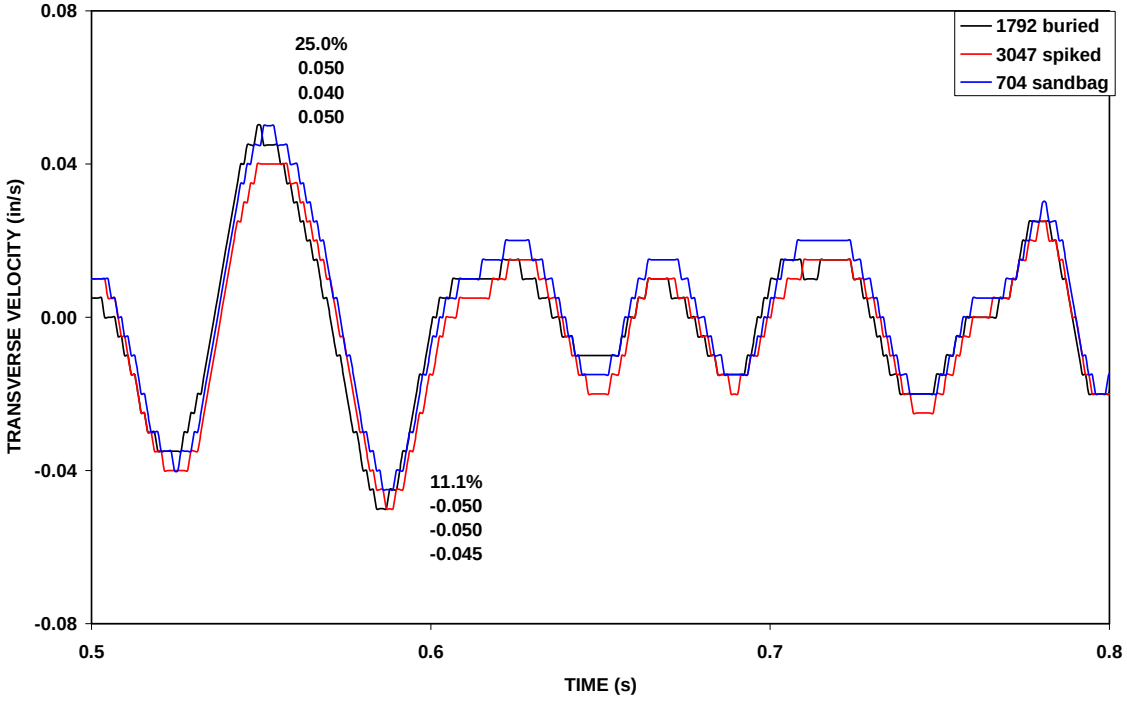

1792 buried
3047 spiked
704 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7
0.8
0.9
1.0


1792 buried
3047 spiked
704 sandbag
18.2%
0.060
0.055
0.065
9.1%
-0.060
-0.060
-0.055
RADIAL VELOCITY (in/s)
TIME (s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7


1792 buried
3047 spiked
704 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7
0.8
0.9
1.0

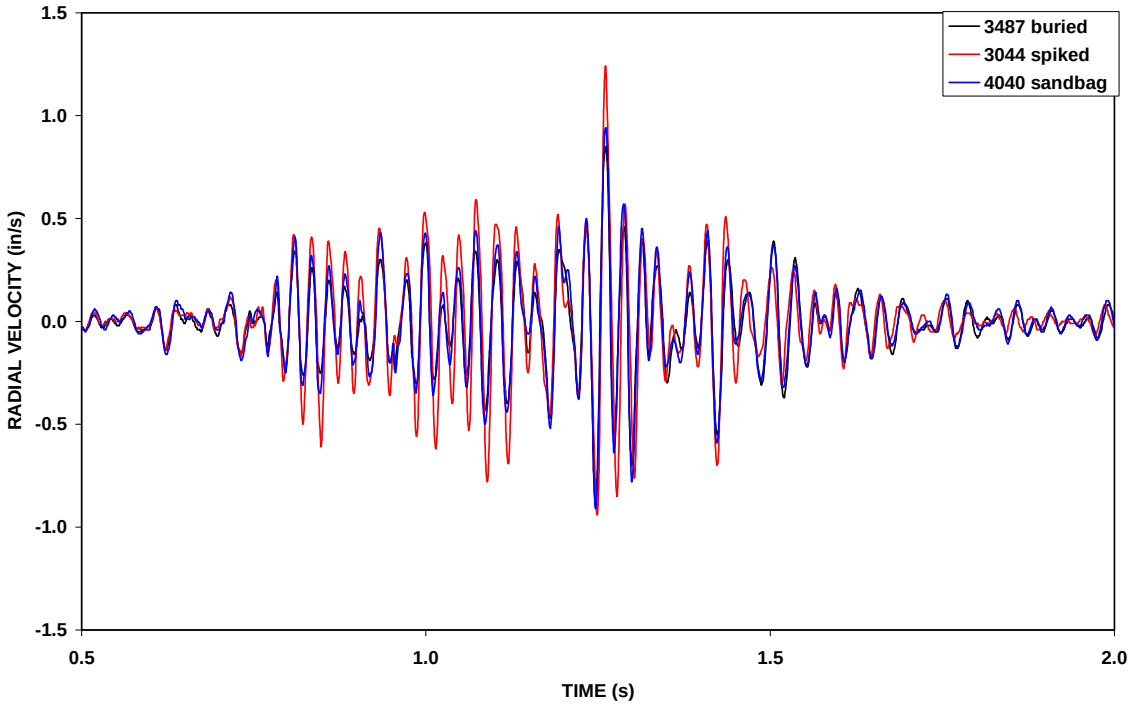

1792 buried
3047 spiked
704 sandbag
10.0%
0.050
0.055
0.055
10.0%
-0.050
-0.055
-0.050
VERTICAL VELOCITY (in/s)
TIME (s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7

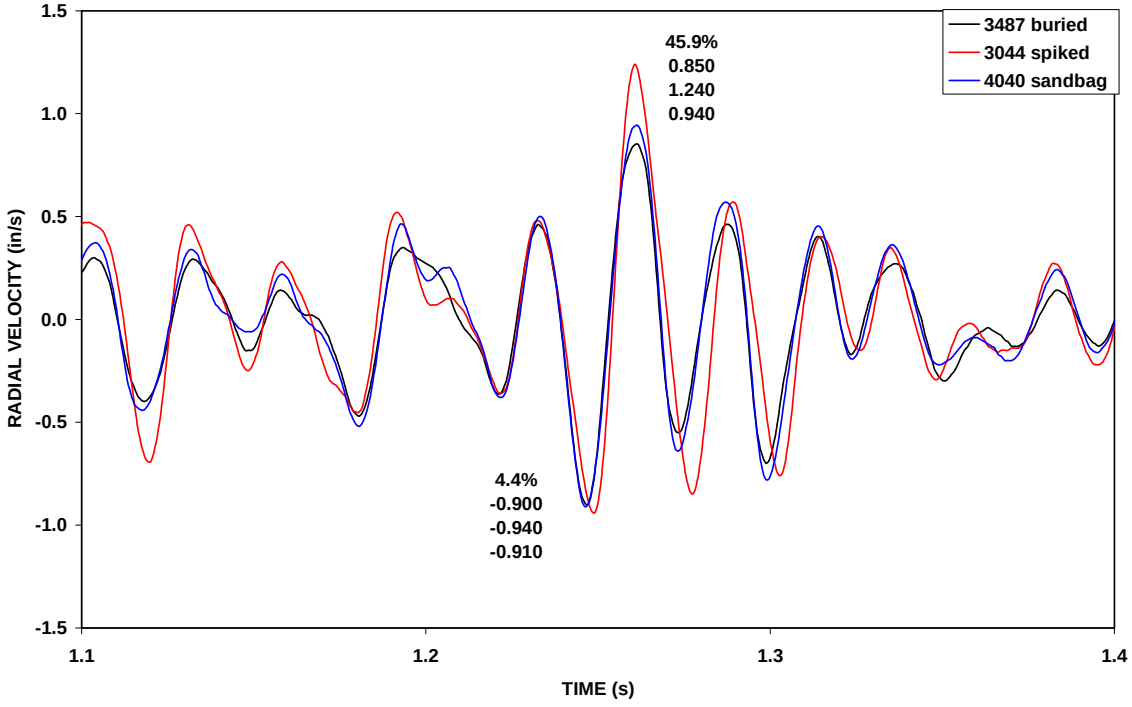

1792 buried
3047 spiked
704 sandbag
TRANSVERSE VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.5
0.6
0.7
0.8
0.9
1.0
TIME (s)

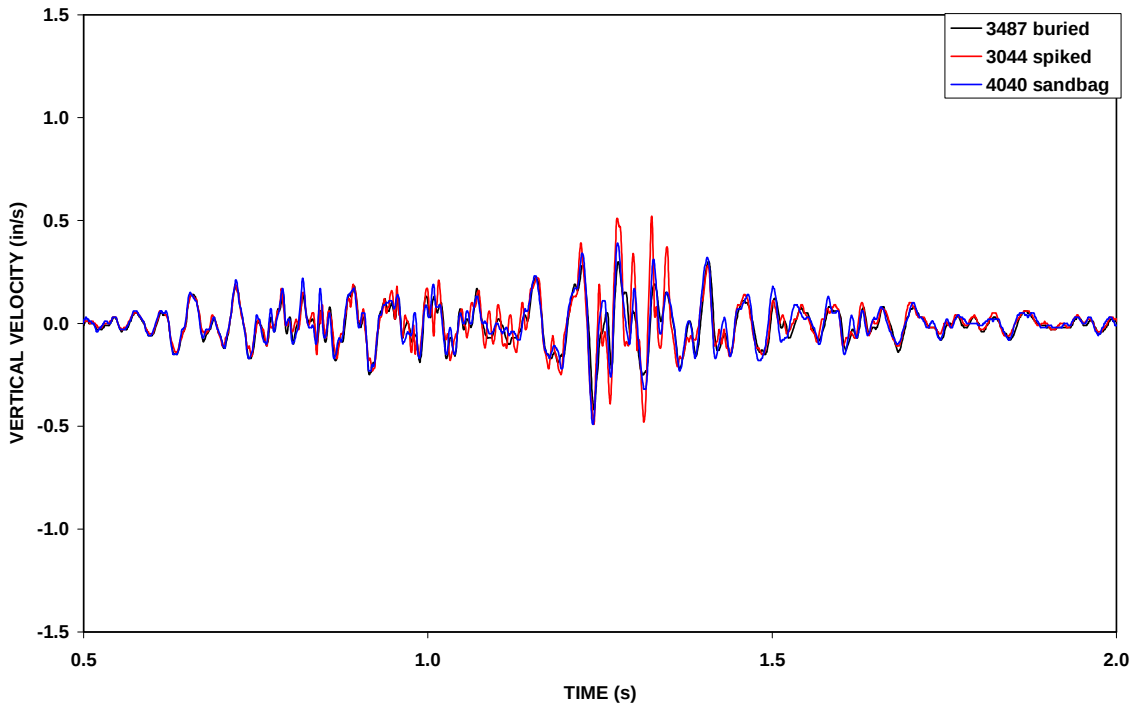

1792 buried
3047 spiked
704 sandbag
25.0%
0.050
0.040
0.050
11.1%
-0.050
-0.050
-0.045
TRANSVERSE VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.5
0.6
0.7
0.8
TIME (s)

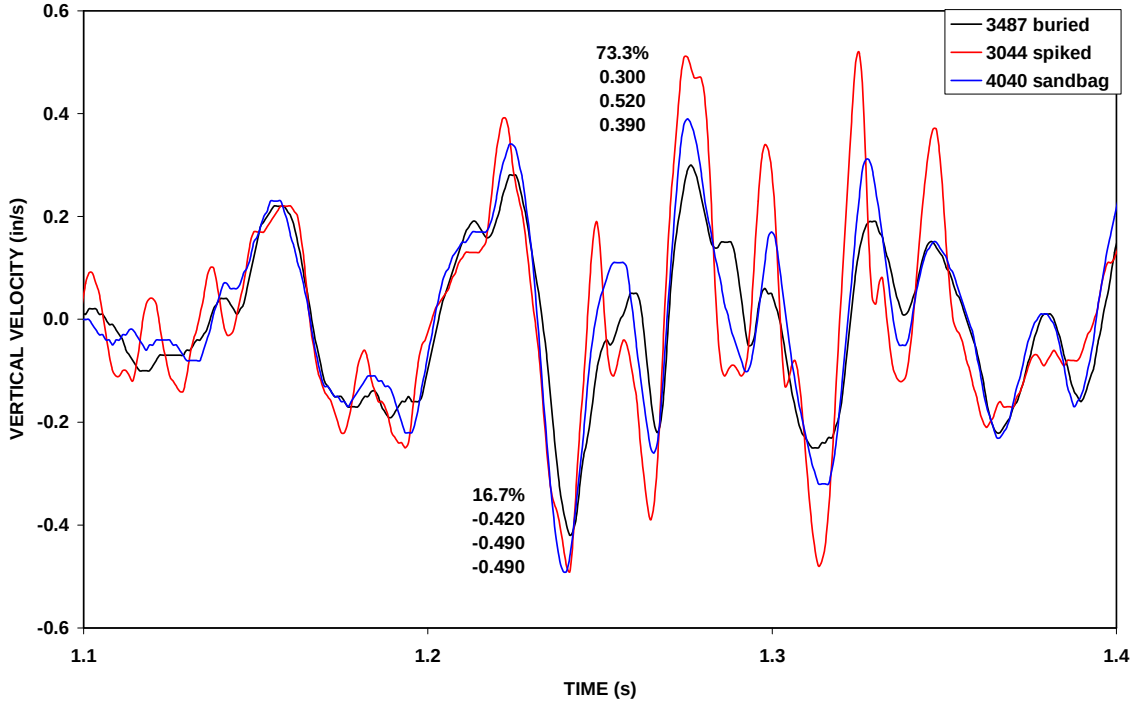
NM-7

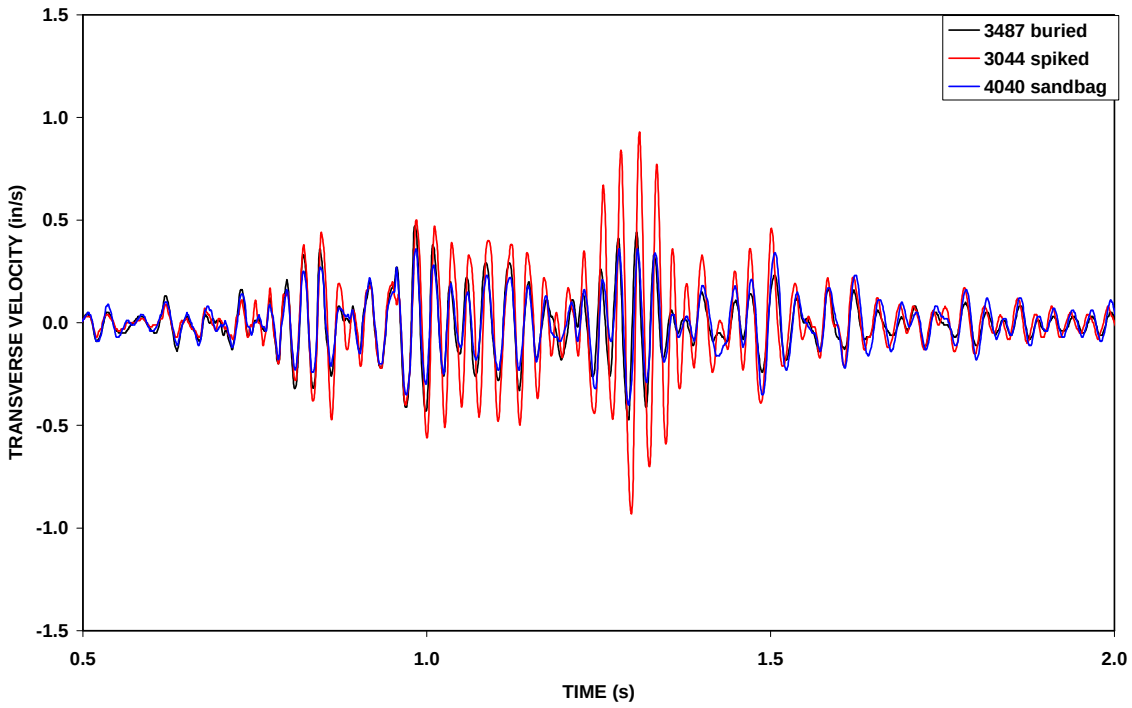
Cluster 1 SD 40.8 ft/lb$^{1/2}$

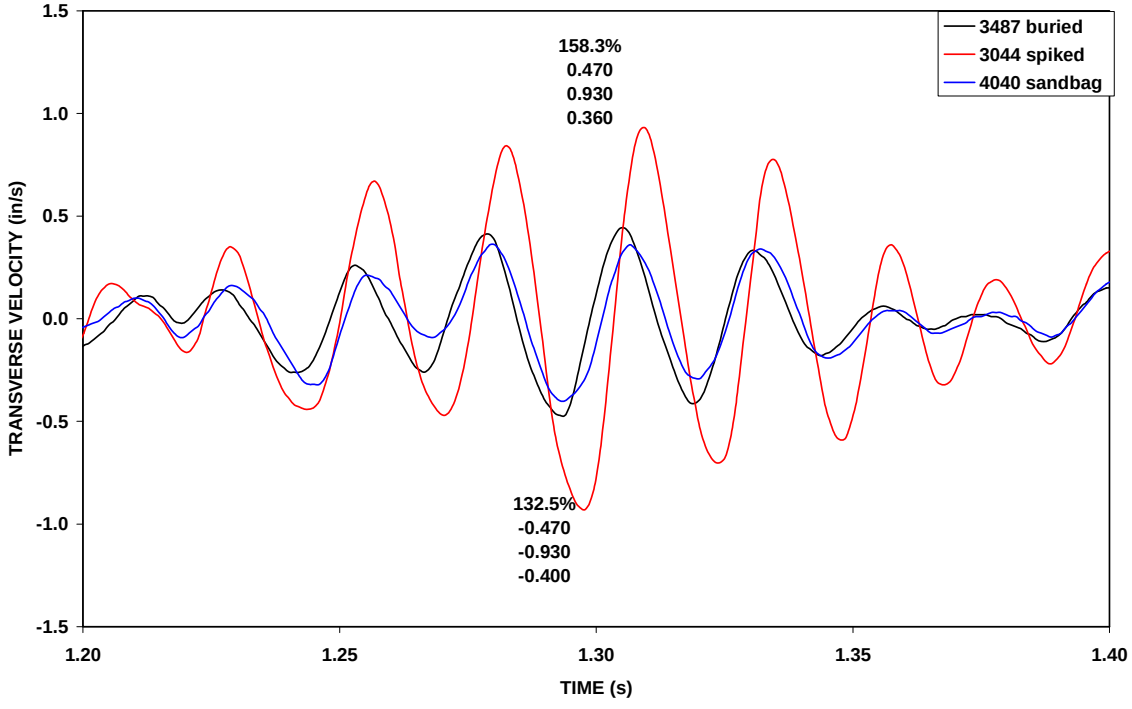

3487 buried
3044 spiked
4040 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.5
1.0
1.5
2.0


3487 buried
3044 spiked
4040 sandbag
45.9%
0.850
1.240
0.940
4.4%
-0.900
-0.940
-0.910
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1.1
1.2
1.3
1.4


3487 buried
3044 spiked
4040 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.5
1.0
1.5
2.0

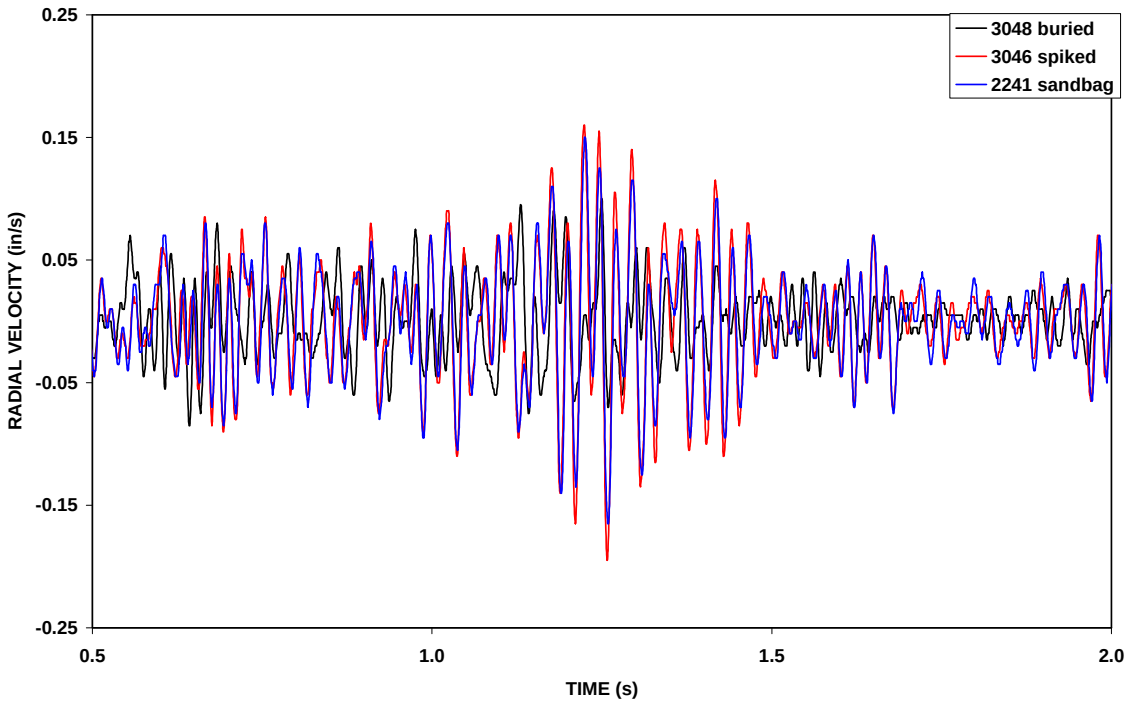

3487 buried
3044 spiked
4040 sandbag
73.3%
0.300
0.520
0.390
16.7%
-0.420
-0.490
-0.490
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1.1
1.2
1.3
1.4

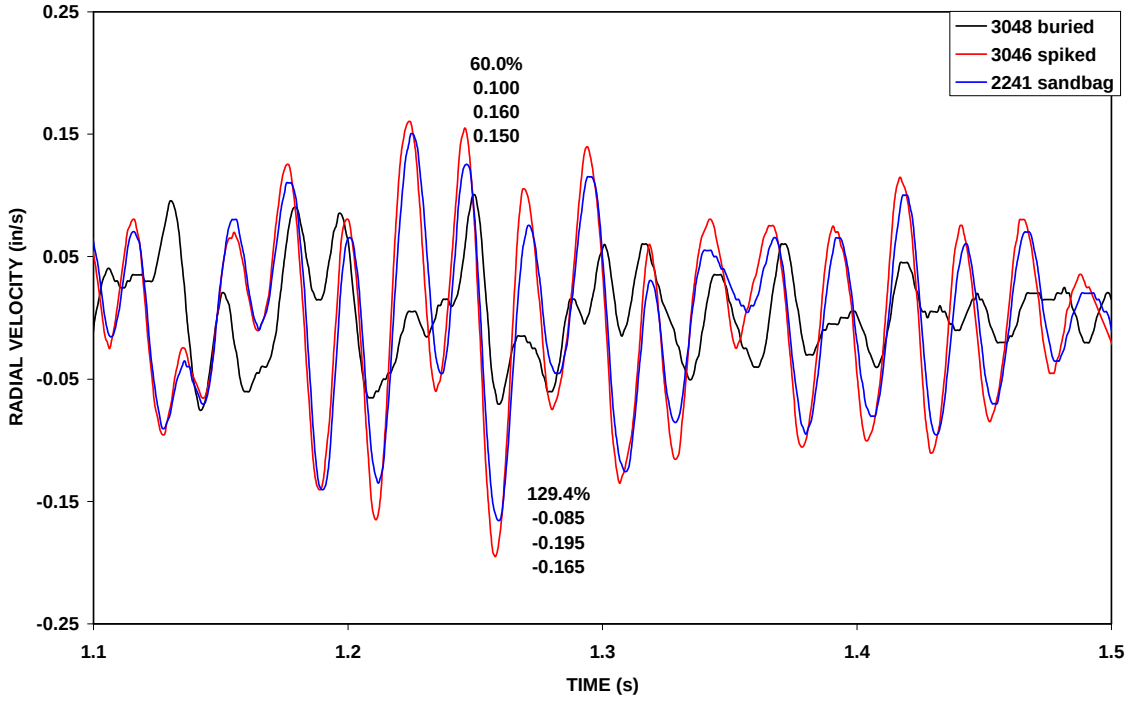

3487 buried
3044 spiked
4040 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.5
1.0
1.5
2.0

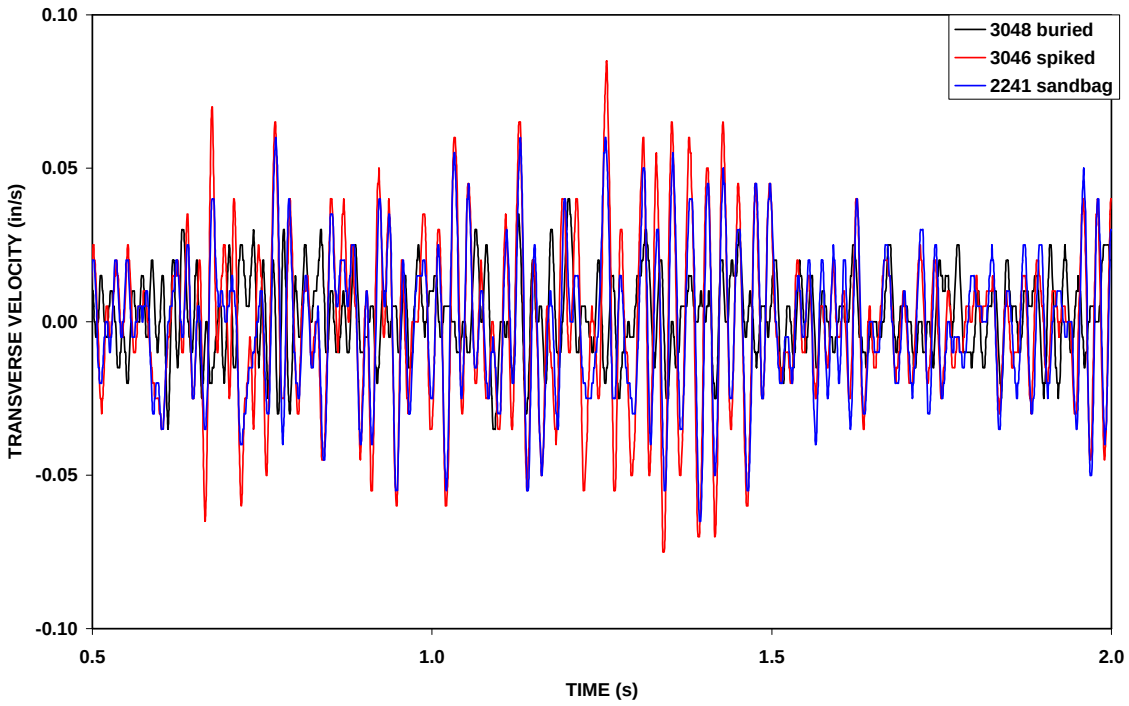

3487 buried
3044 spiked
4040 sandbag
158.3%
0.470
0.930
0.360
132.5%
-0.470
-0.930
-0.400
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1.20
1.25
1.30
1.35
1.40

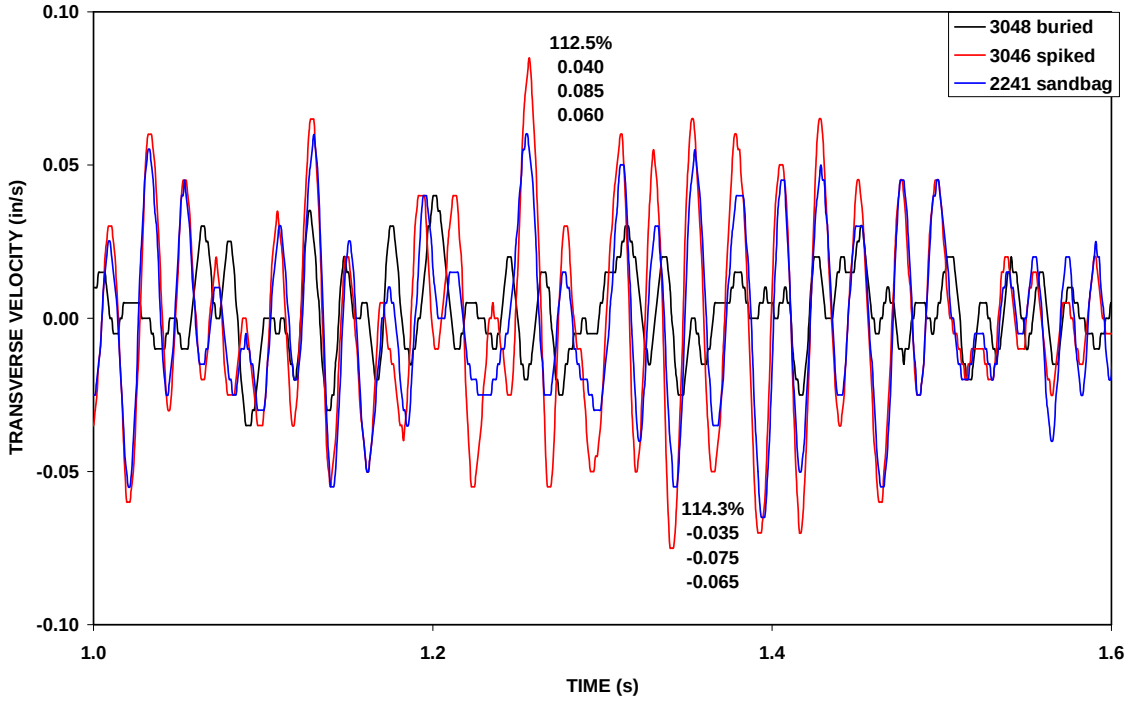
NM-7

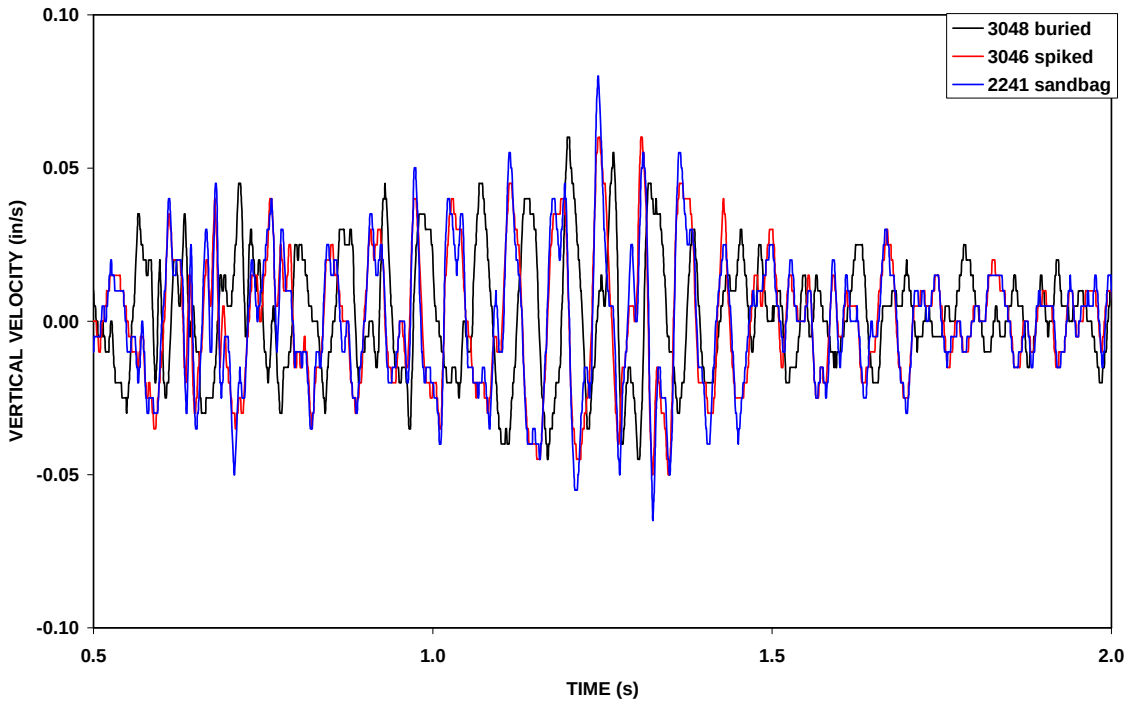
Cluster 2 SD 81.6 ft/lb$^{1/2}$

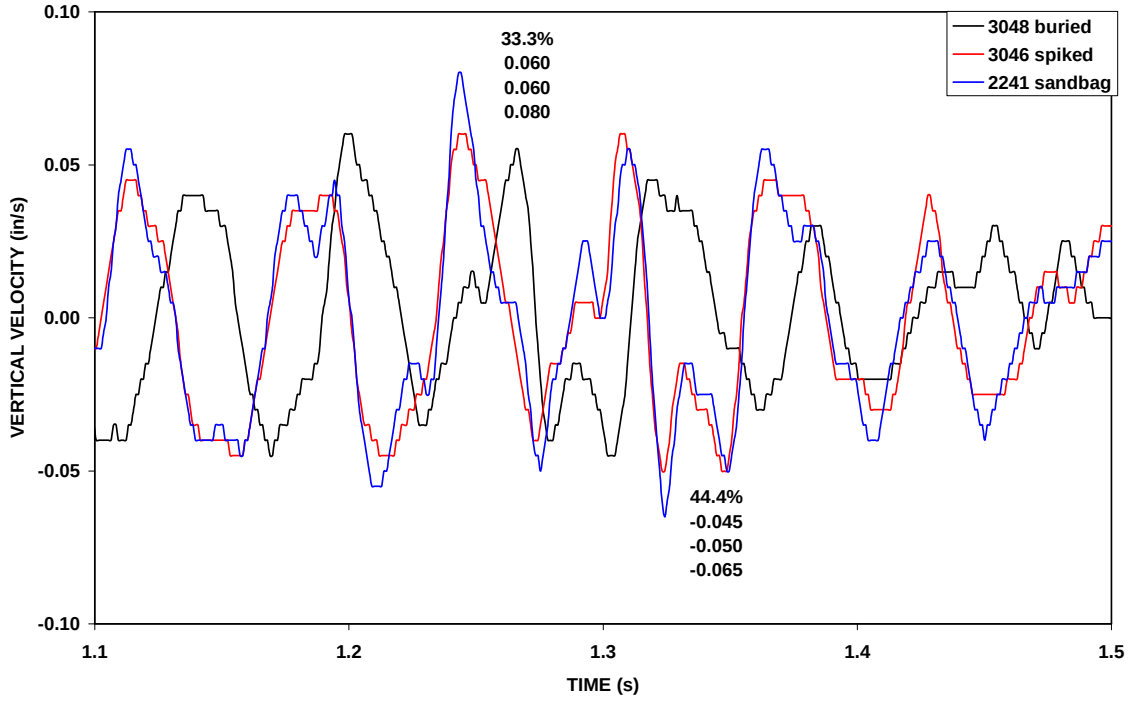

3048 buried
3046 spiked
2241 sandbag
RADIAL VELOCITY (in/s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
0.5
1.0
1.5
2.0
TIME (s)

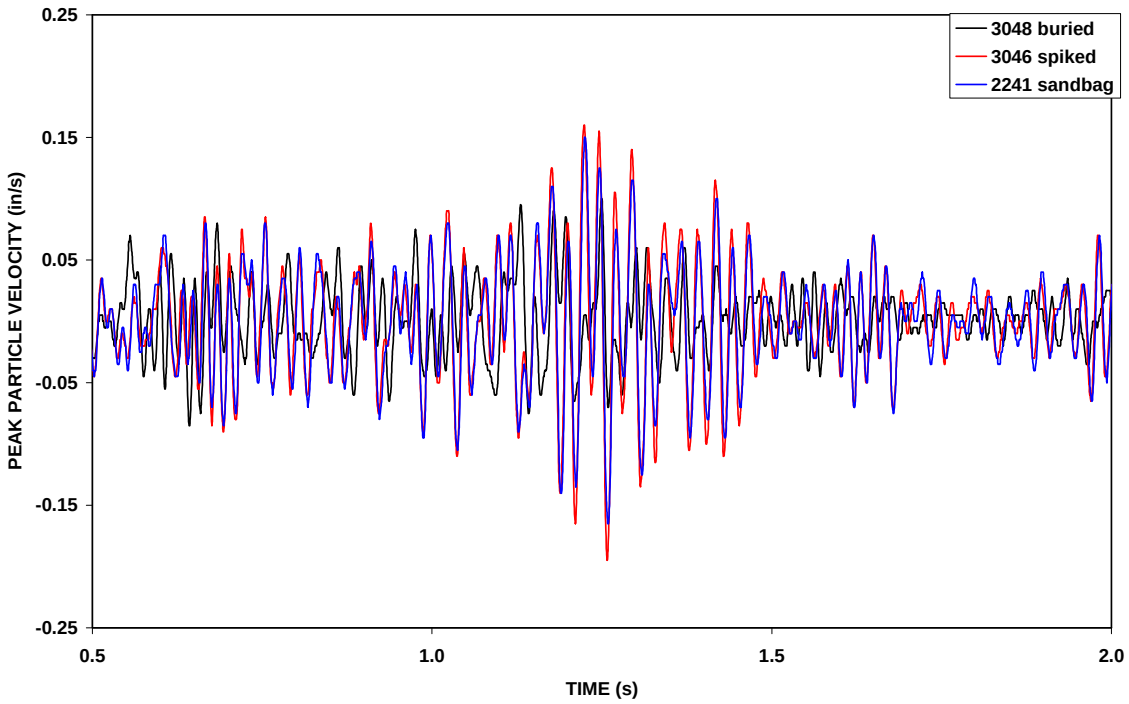

3048 buried
3046 spiked
2241 sandbag
60.0%
0.100
0.160
0.150
129.4%
-0.085
-0.195
-0.165
RADIAL VELOCITY (in/s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
1.1
1.2
1.3
1.4
1.5
TIME (s)

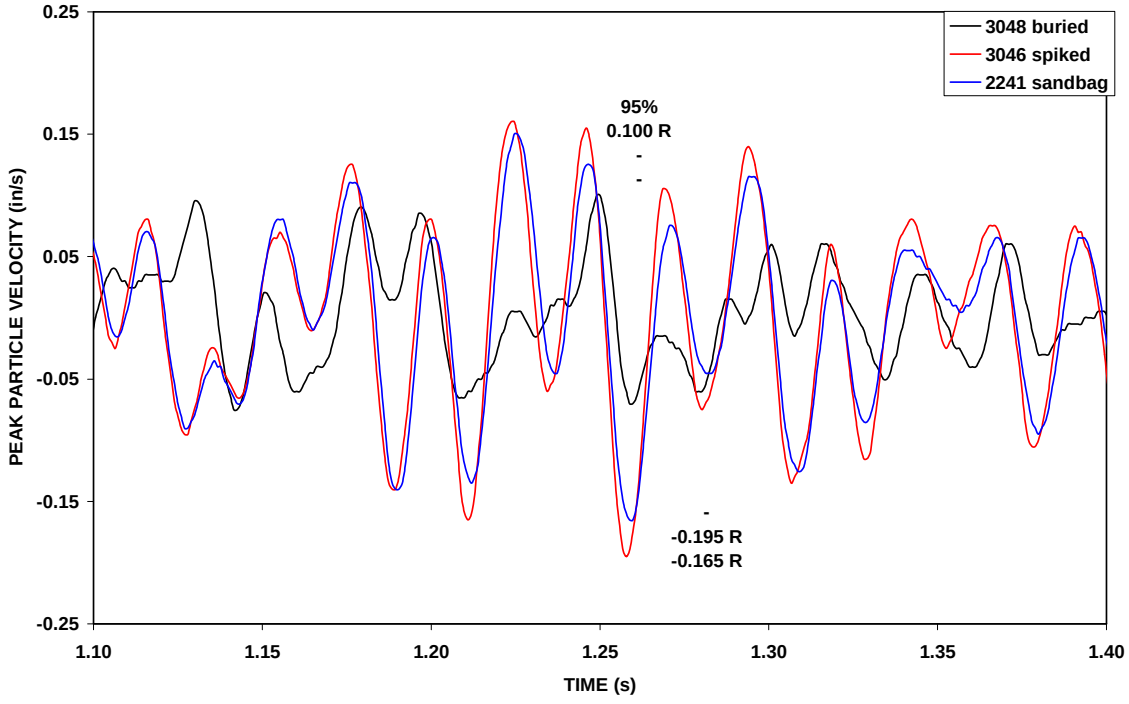

0.10
0.05
0.00
-0.05
-0.10
TRANSVERSE VELOCITY (in/s)
0.5
1.0
1.5
2.0
TIME (s)
3048 buried
3046 spiked
2241 sandbag


0.10
0.05
0.00
-0.05
-0.10
TRANSVERSE VELOCITY (in/s)
1.0
1.2
1.4
1.6
TIME (s)
3048 buried
3046 spiked
2241 sandbag
112.5%
0.040
0.085
0.060
114.3%
-0.035
-0.075
-0.065


3048 buried
3046 spiked
2241 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
0.5
1.0
1.5
2.0

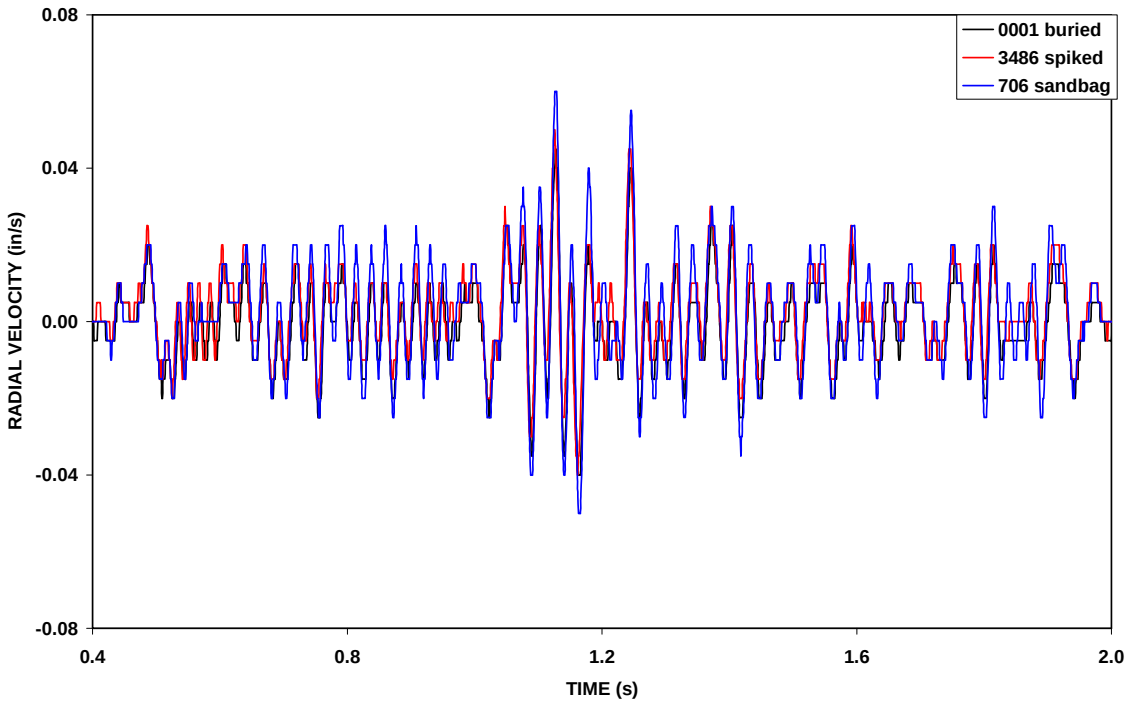

3048 buried
3046 spiked
2241 sandbag
33.3%
0.060
0.060
0.080
44.4%
-0.045
-0.050
-0.065
VERTICAL VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
1.1
1.2
1.3
1.4
1.5

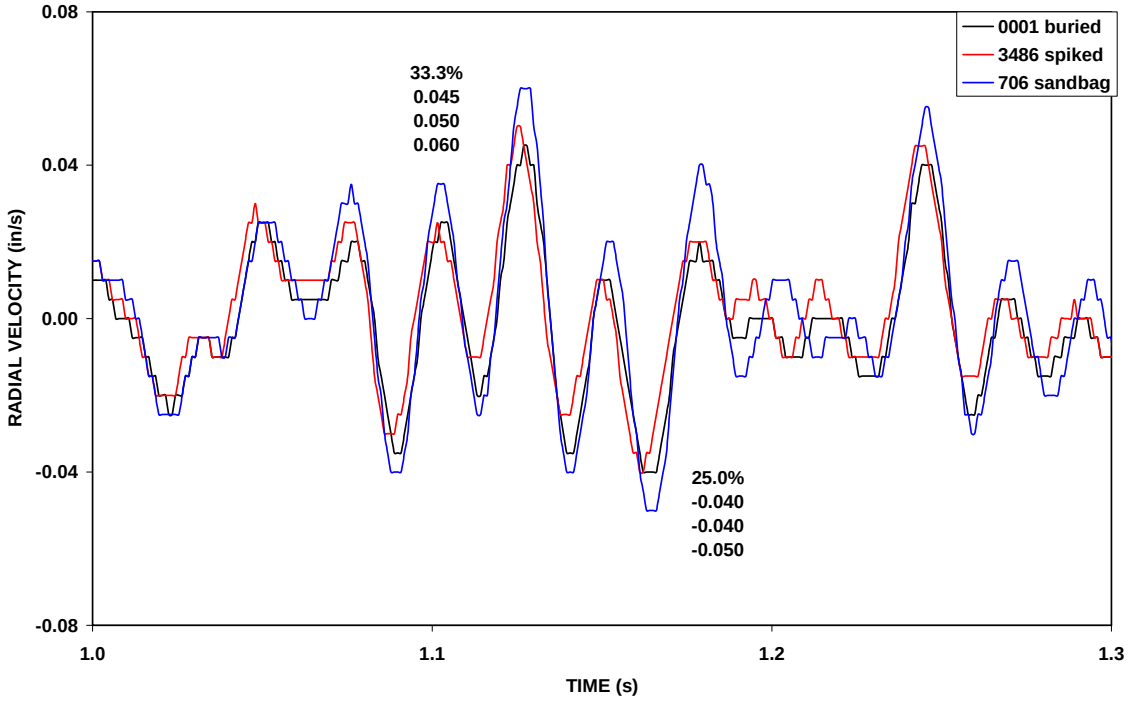

3048 buried
3046 spiked
2241 sandbag
PEAK PARTICLE VELOCITY (in/s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
0.5
1.0
1.5
2.0
TIME (s)

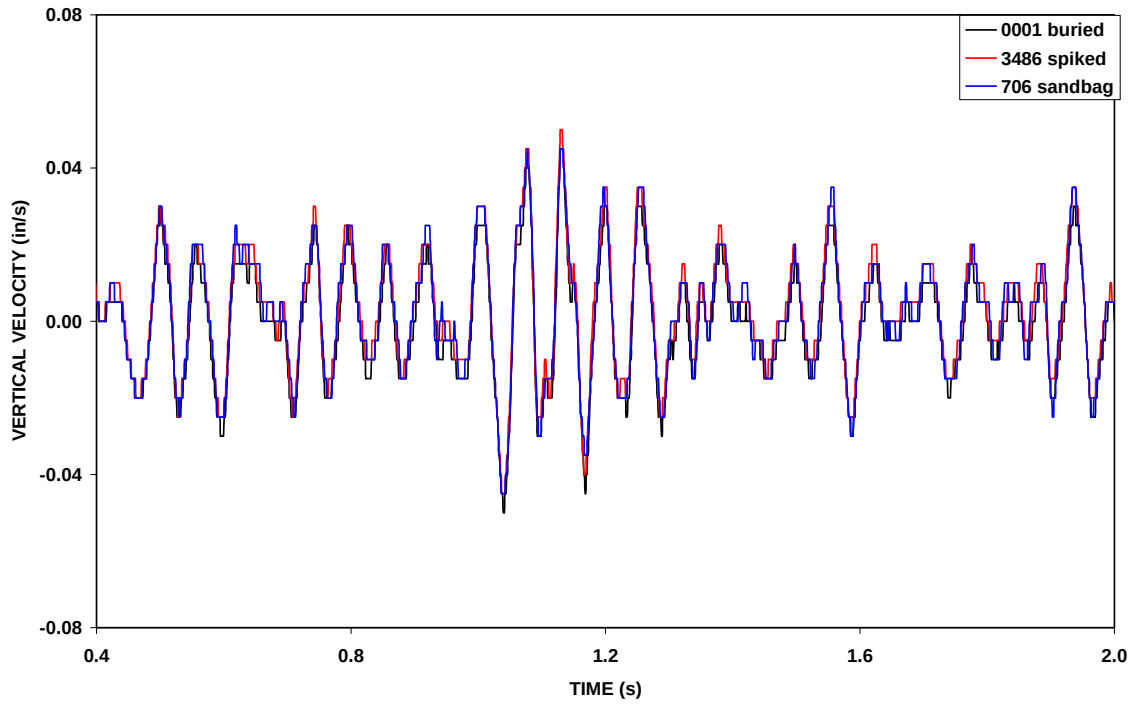

3048 buried
3046 spiked
2241 sandbag
95%
0.100 R
-
-
-
-0.195 R
-0.165 R
PEAK PARTICLE VELOCITY (in/s)
0.25
0.15
0.05
-0.05
-0.15
-0.25
1.10
1.15
1.20
1.25
1.30
1.35
1.40
TIME (s)

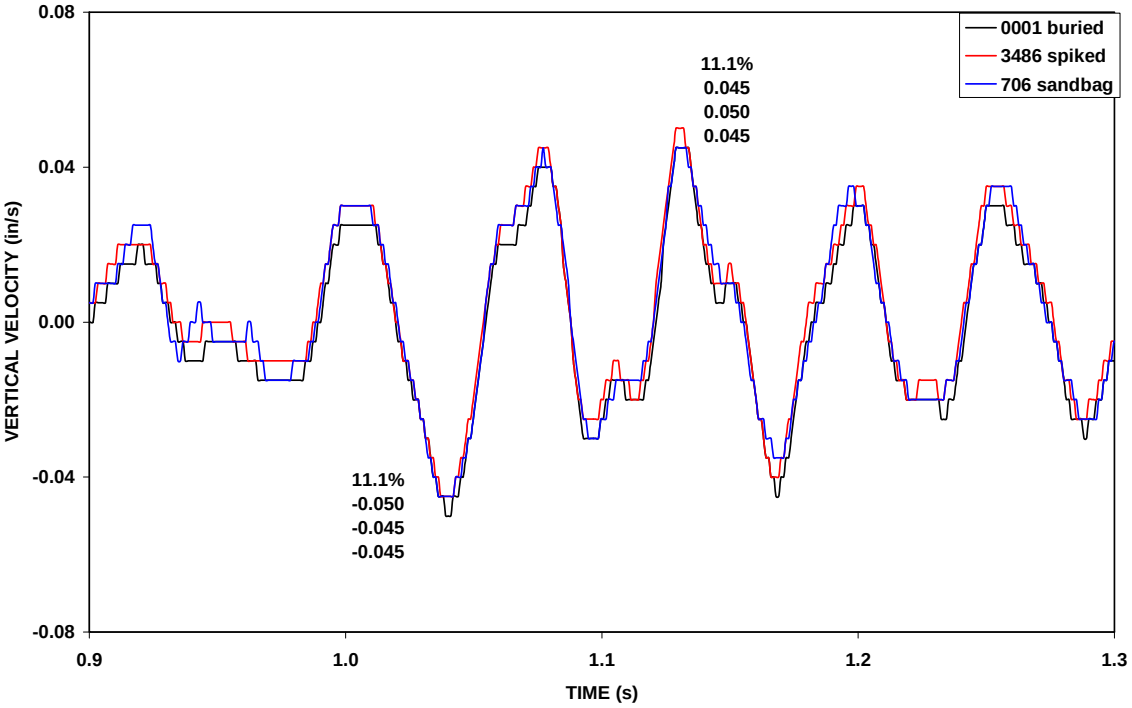
NM-7

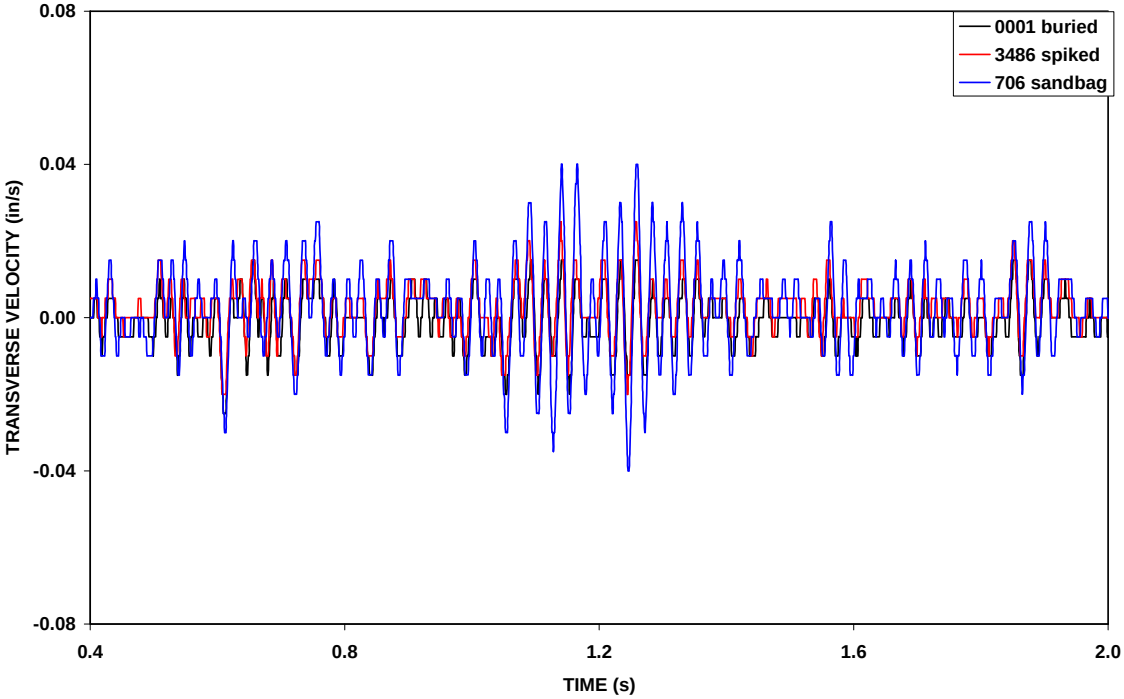
Cluster 3 SD 122.5 ft/lb$^{1/2}$

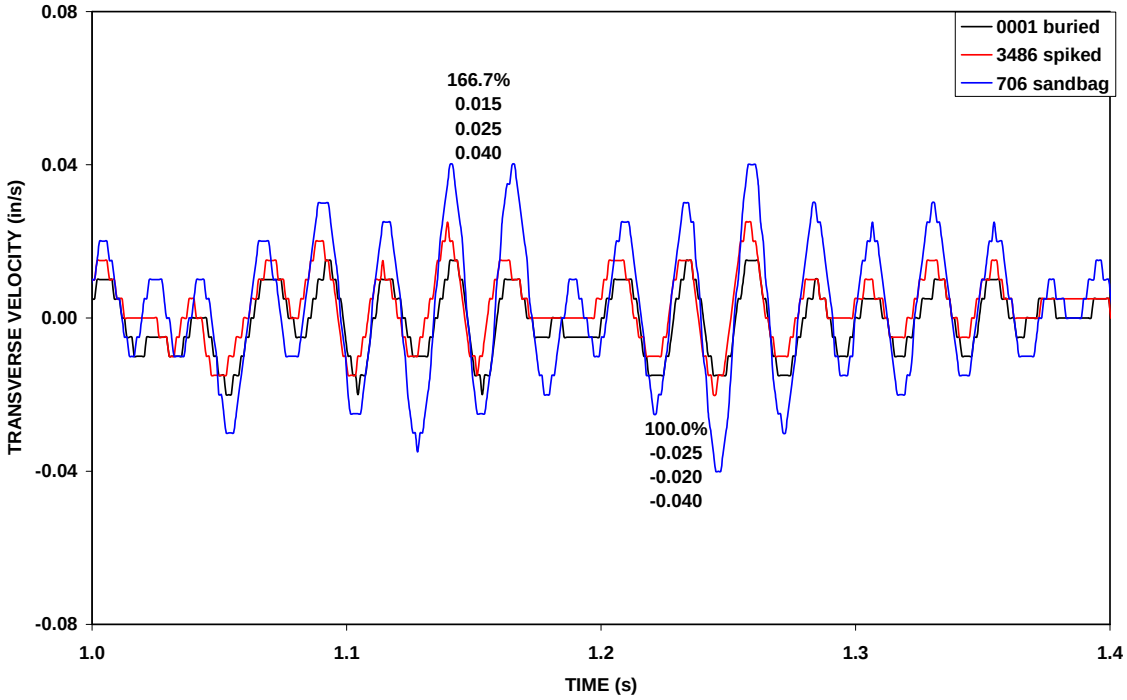

0001 buried
3486 spiked
706 sandbag
0.08
0.04
0.00
-0.04
-0.08
RADIAL VELOCITY (in/s)
0.4
0.8
1.2
1.6
2.0
TIME (s)


0001 buried
3486 spiked
706 sandbag
33.3%
0.045
0.050
0.060
25.0%
-0.040
-0.040
-0.050
0.08
0.04
0.00
-0.04
-0.08
RADIAL VELOCITY (in/s)
1.0
1.1
1.2
1.3
TIME (s)


0001 buried
3486 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.8
1.2
1.6
2.0
TIME (s)

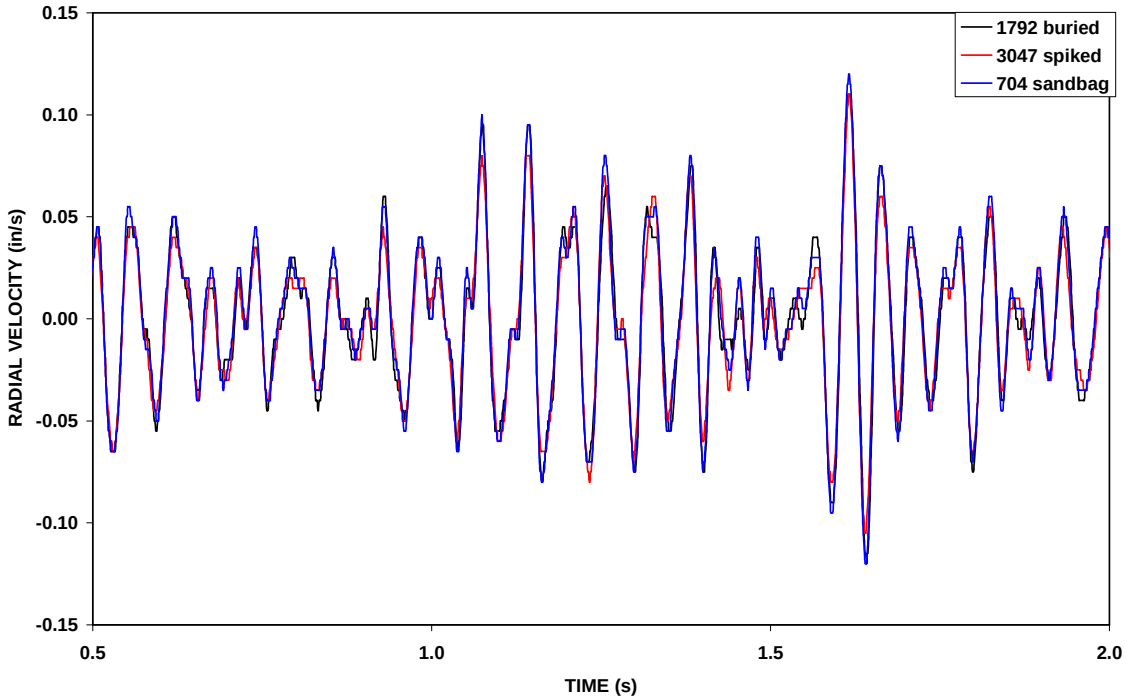

0001 buried
3486 spiked
706 sandbag
11.1%
0.045
0.050
0.045
11.1%
-0.050
-0.045
-0.045
VERTICAL VELOCITY (in/s)
0.08
0.04
0.00
-0.04
-0.08
0.9
1.0
1.1
1.2
1.3
TIME (s)

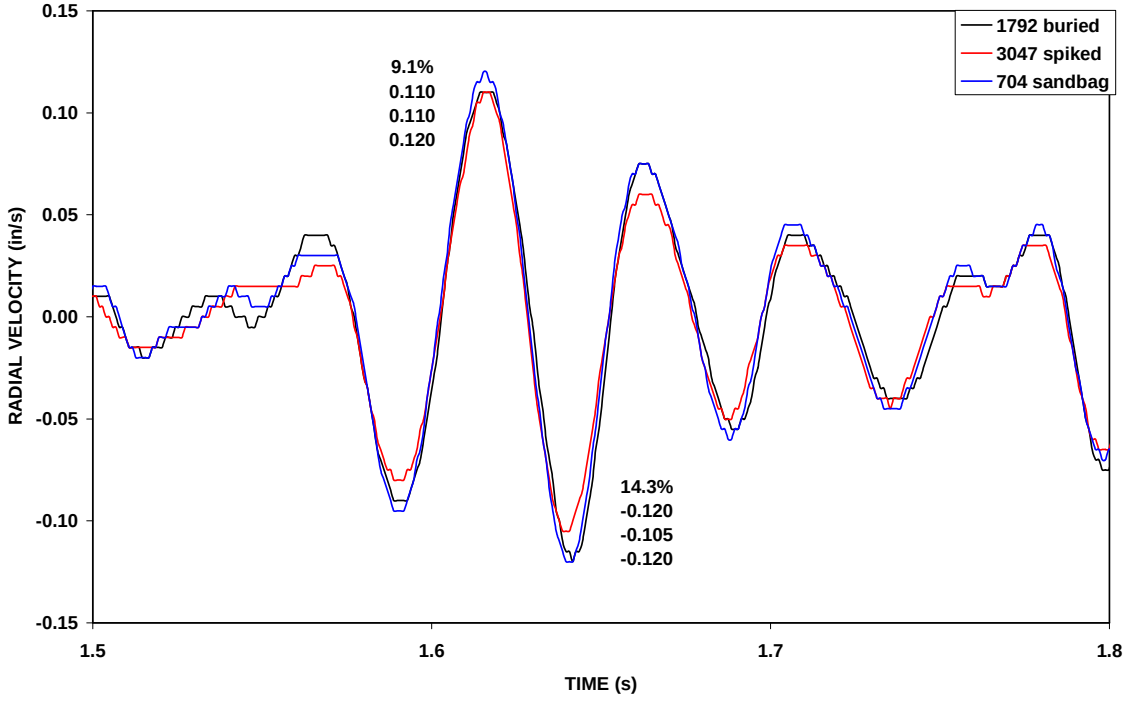

0.08
0.04
0.00
-0.04
-0.08
TRANSVERSE VELOCITY (in/s)
0.4
0.8
1.2
1.6
2.0
TIME (s)
0001 buried
3486 spiked
706 sandbag

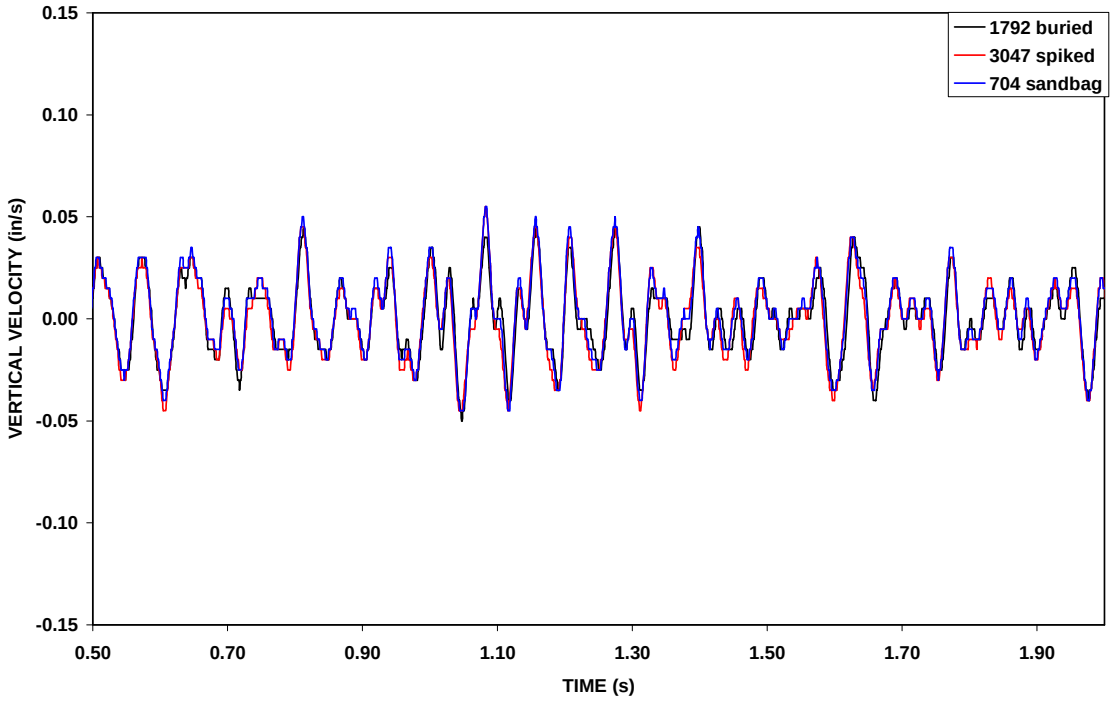

0.08
0.04
0.00
-0.04
-0.08
TRANSVERSE VELOCITY (in/s)
1.0
1.1
1.2
1.3
1.4
TIME (s)
0001 buried
3486 spiked
706 sandbag
166.7%
0.015
0.025
0.040
100.0%
-0.025
-0.020
-0.040

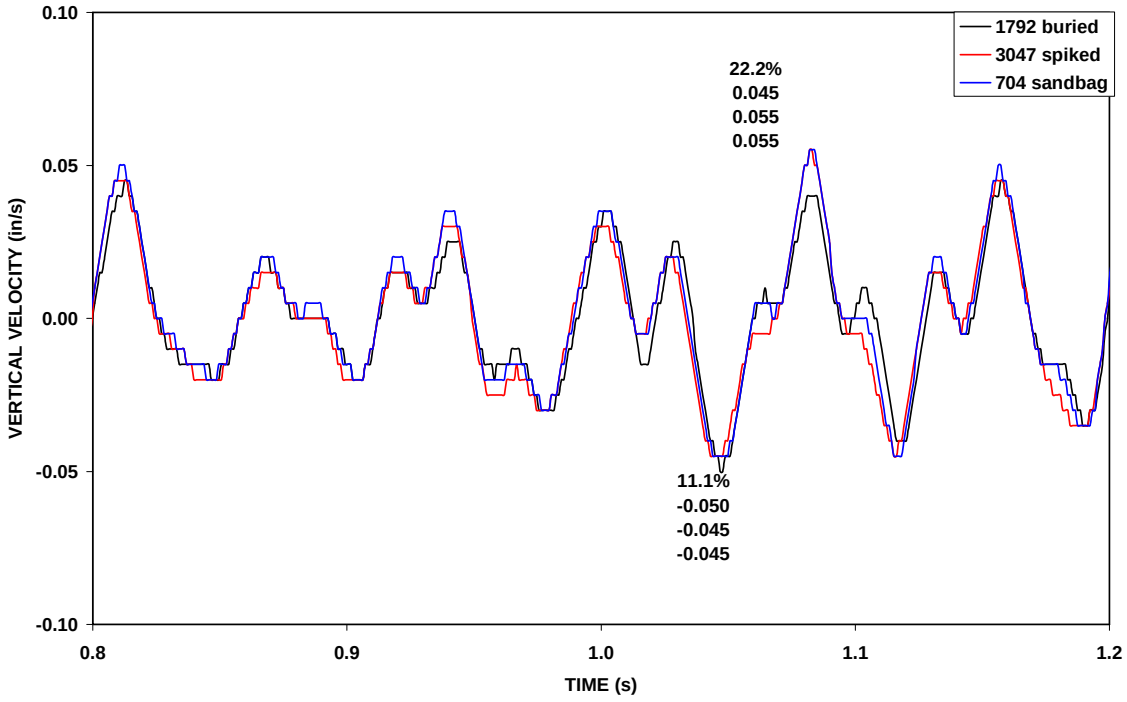
NM-7

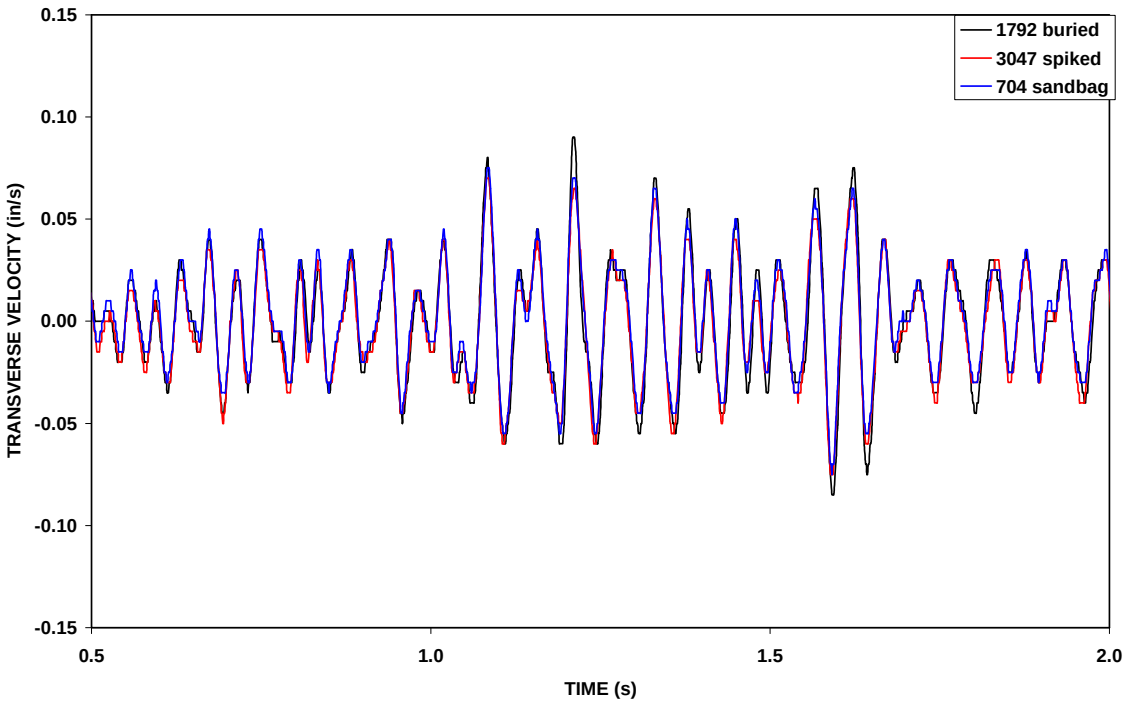
Cluster 4 SD 163.3 ft/lb$^{1/2}$

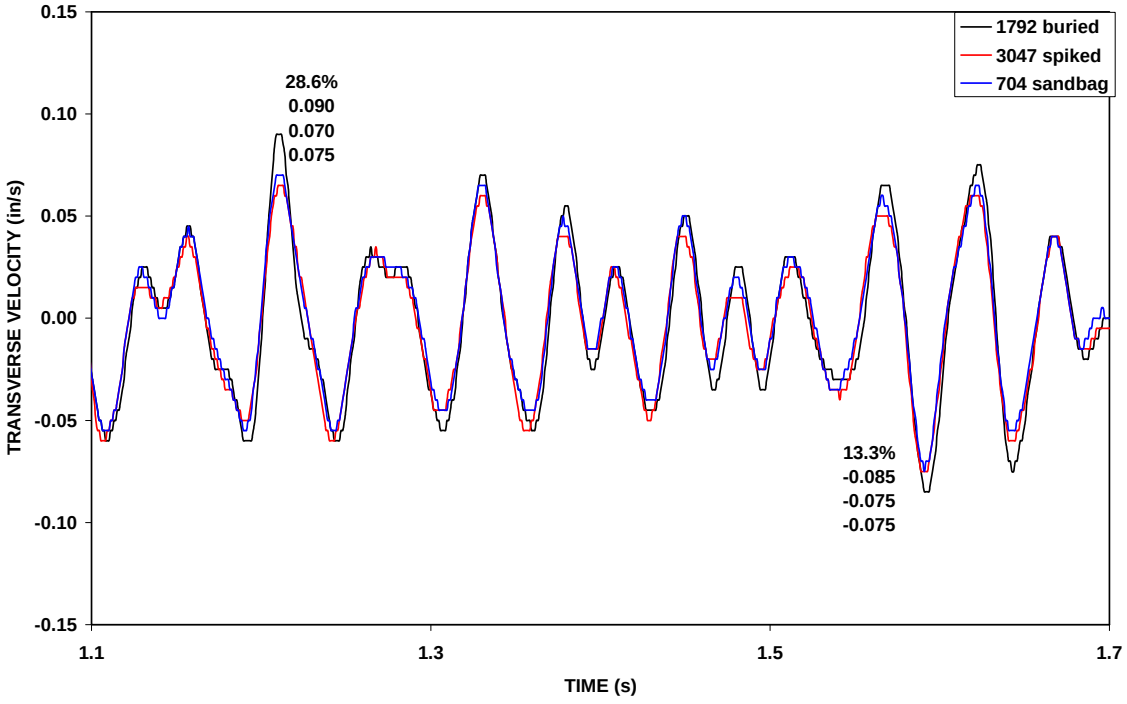

1792 buried
3047 spiked
704 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.5
1.0
1.5
2.0


1792 buried
3047 spiked
704 sandbag
9.1%
0.110
0.110
0.120
14.3%
-0.120
-0.105
-0.120
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1.5
1.6
1.7
1.8


1792 buried
3047 spiked
704 sandbag
VERTICAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.50
0.70
0.90
1.10
1.30
1.50
1.70
1.90
TIME (s)

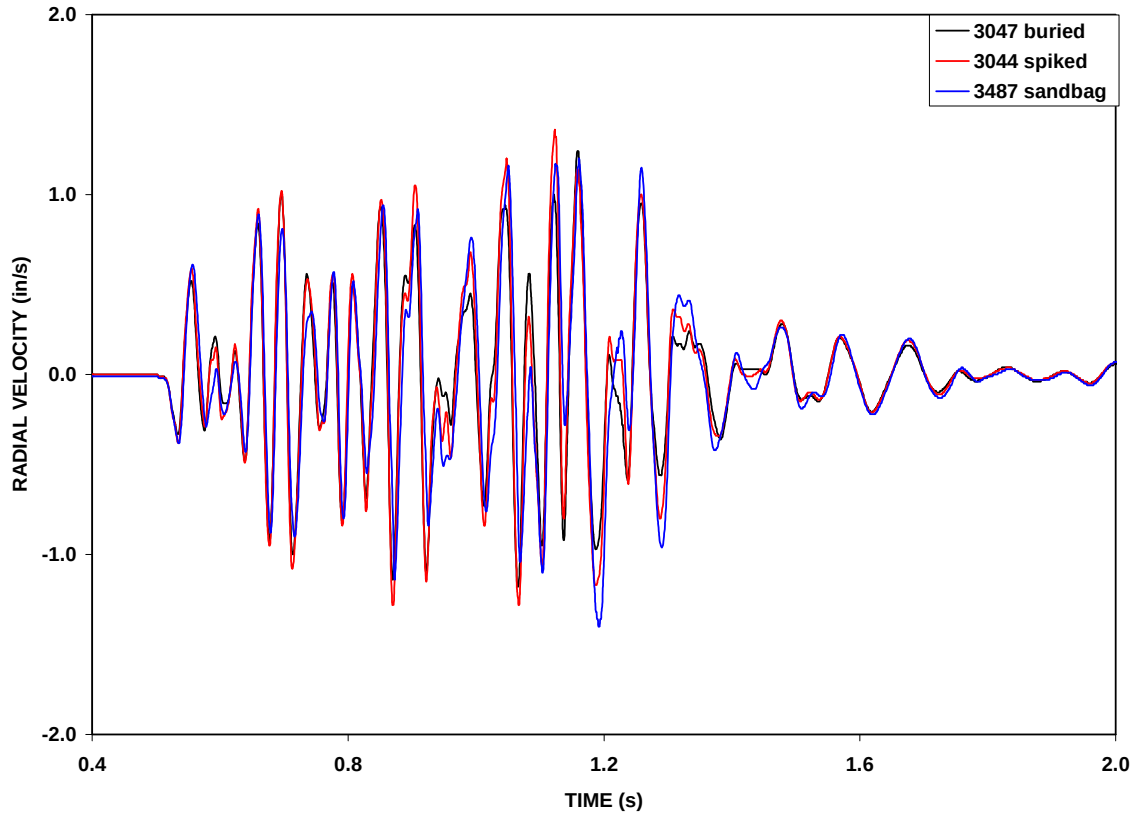

1792 buried
3047 spiked
704 sandbag
22.2%
0.045
0.055
0.055
11.1%
-0.050
-0.045
-0.045
VERTICAL VELOCITY (in/s)
0.10
0.05
0.00
-0.05
-0.10
0.8
0.9
1.0
1.1
1.2
TIME (s)

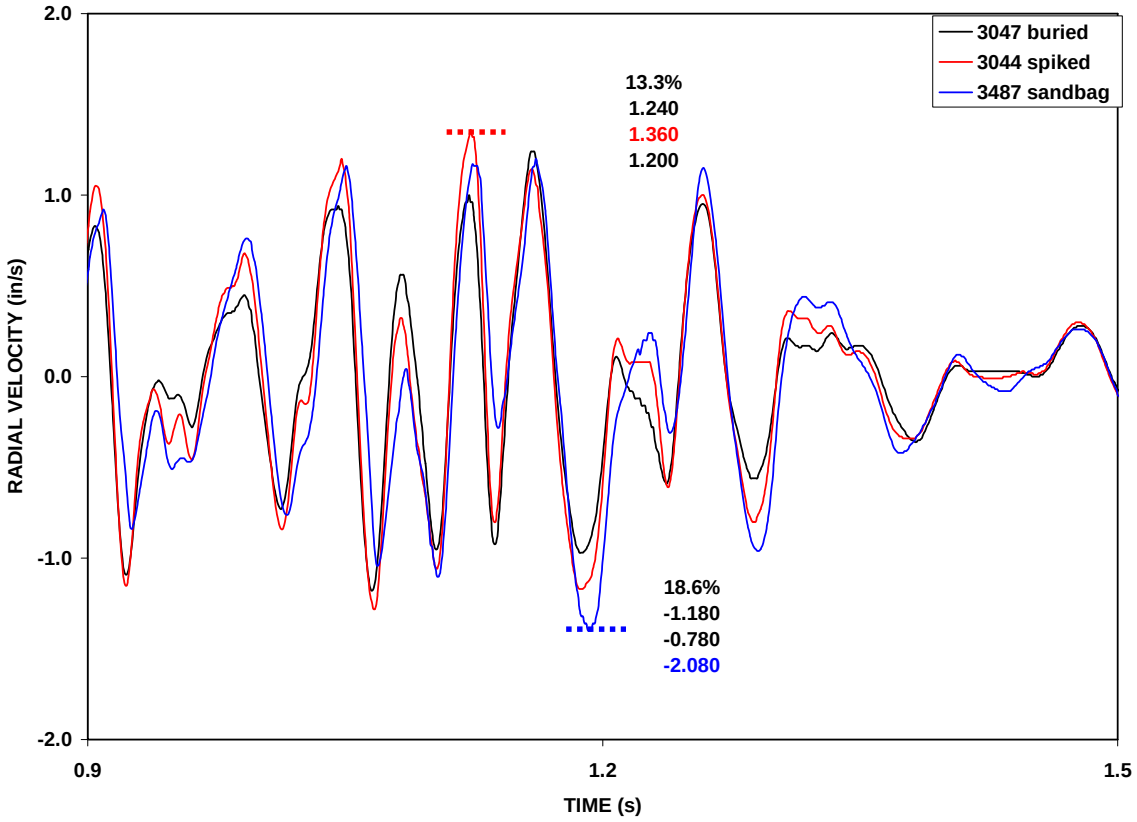

1792 buried
3047 spiked
704 sandbag
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.5
1.0
1.5
2.0
TIME (s)

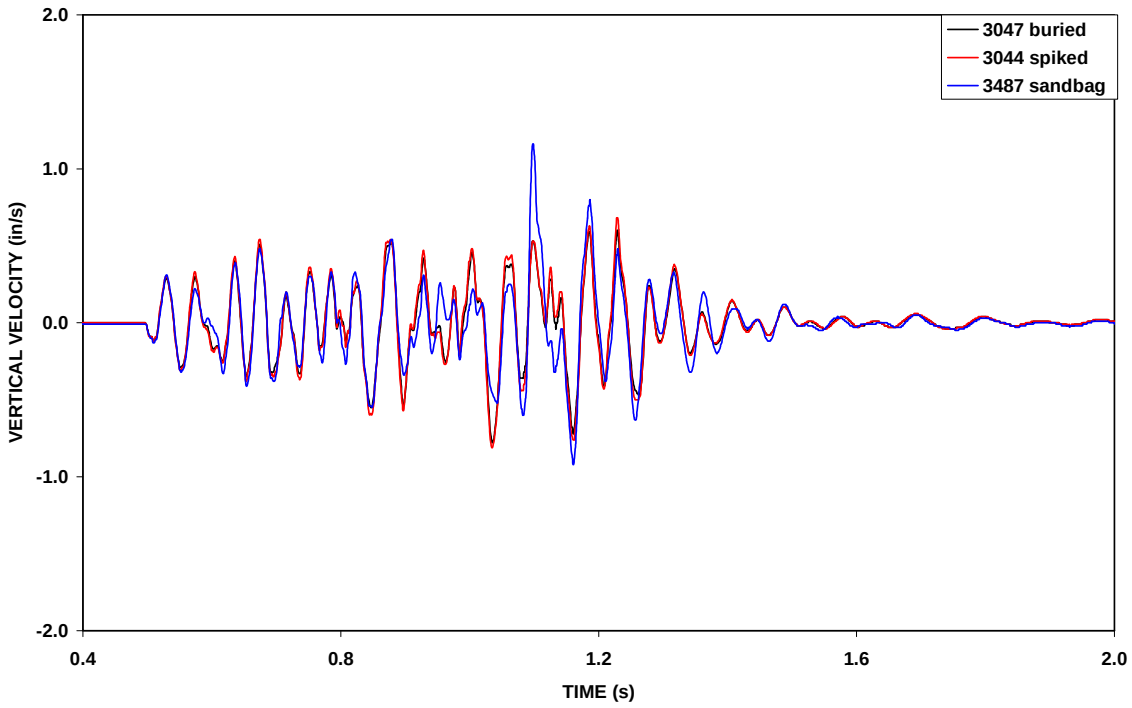

1792 buried
3047 spiked
704 sandbag
28.6%
0.090
0.070
0.075
13.3%
-0.085
-0.075
-0.075
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1.1
1.3
1.5
1.7
TIME (s)

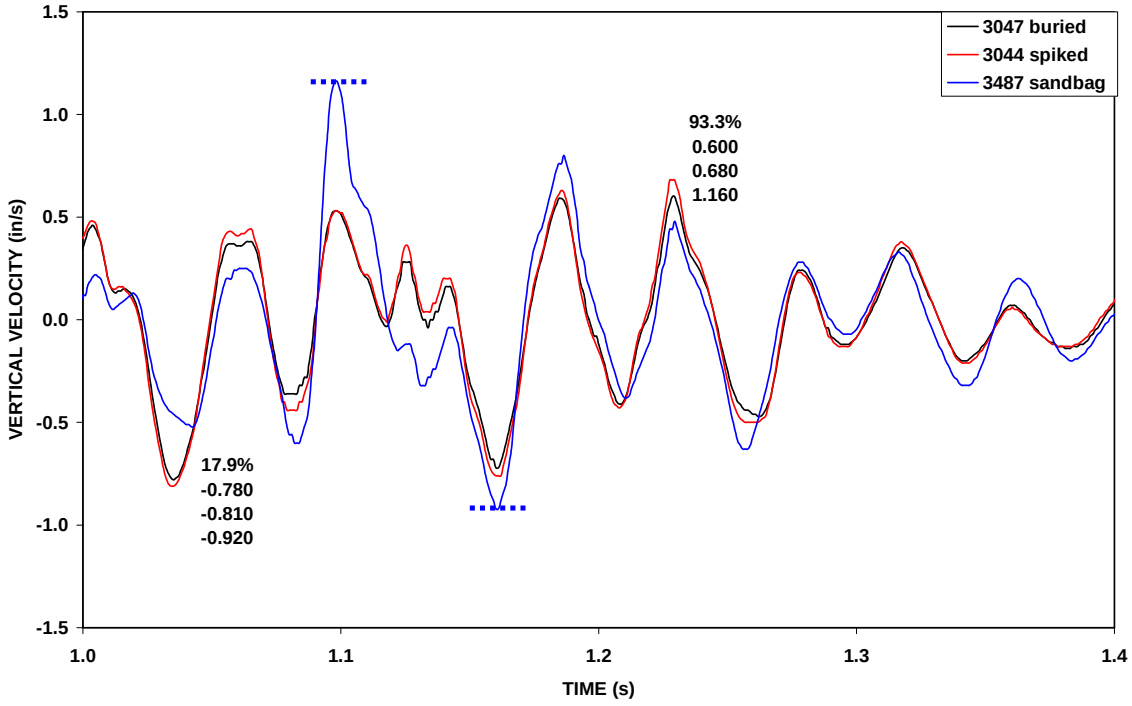
OH-1

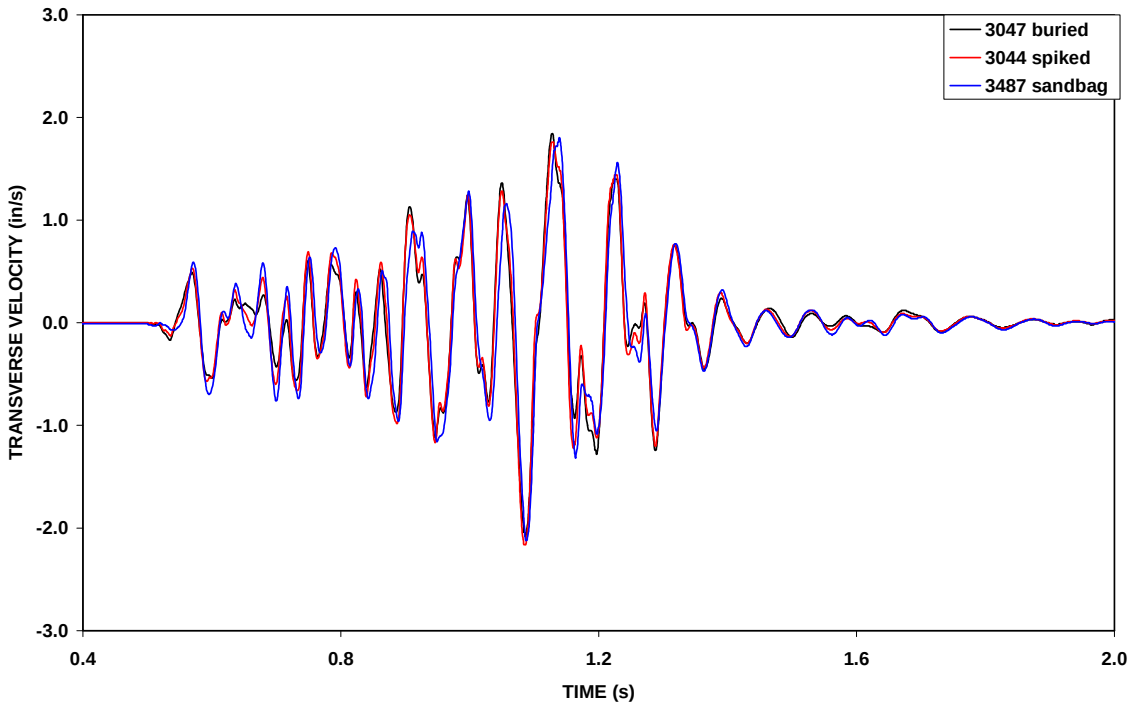
Cluster 1 SD 11.2 ft/lb$^{1/2}$

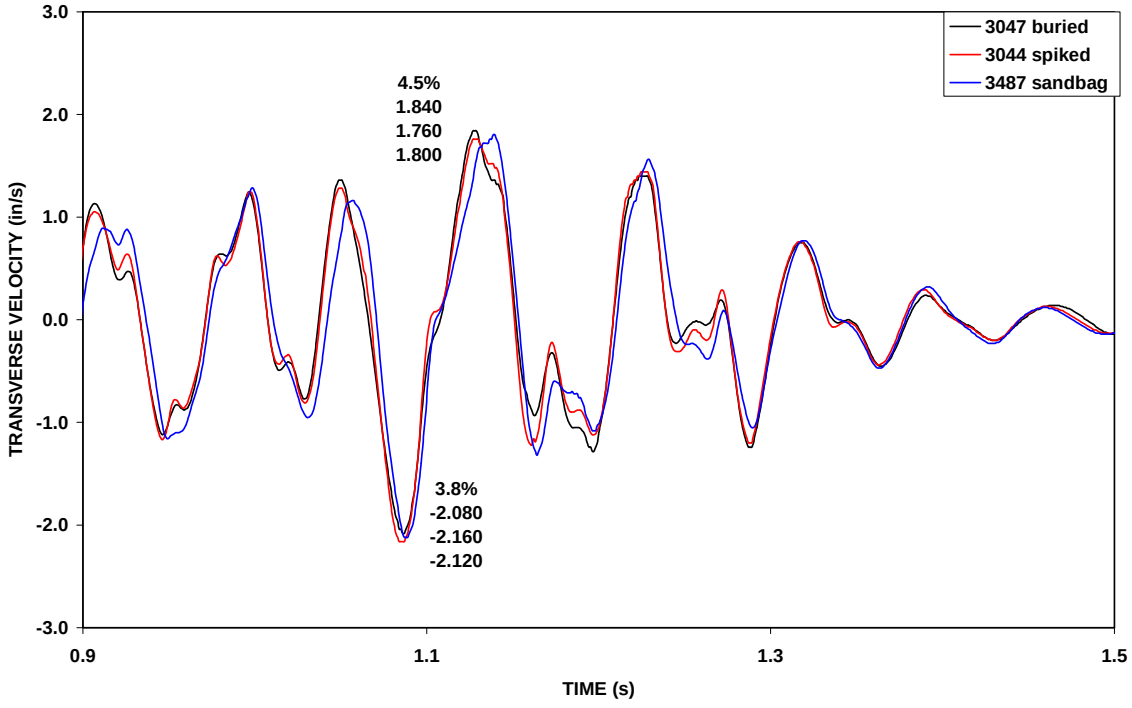

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.8
1.2
1.6
2.0


3047 buried
3044 spiked
3487 sandbag
13.3%
1.240
1.360
1.200
18.6%
-1.180
-0.780
-2.080
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.9
1.2
1.5


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.8
1.2
1.6
2.0

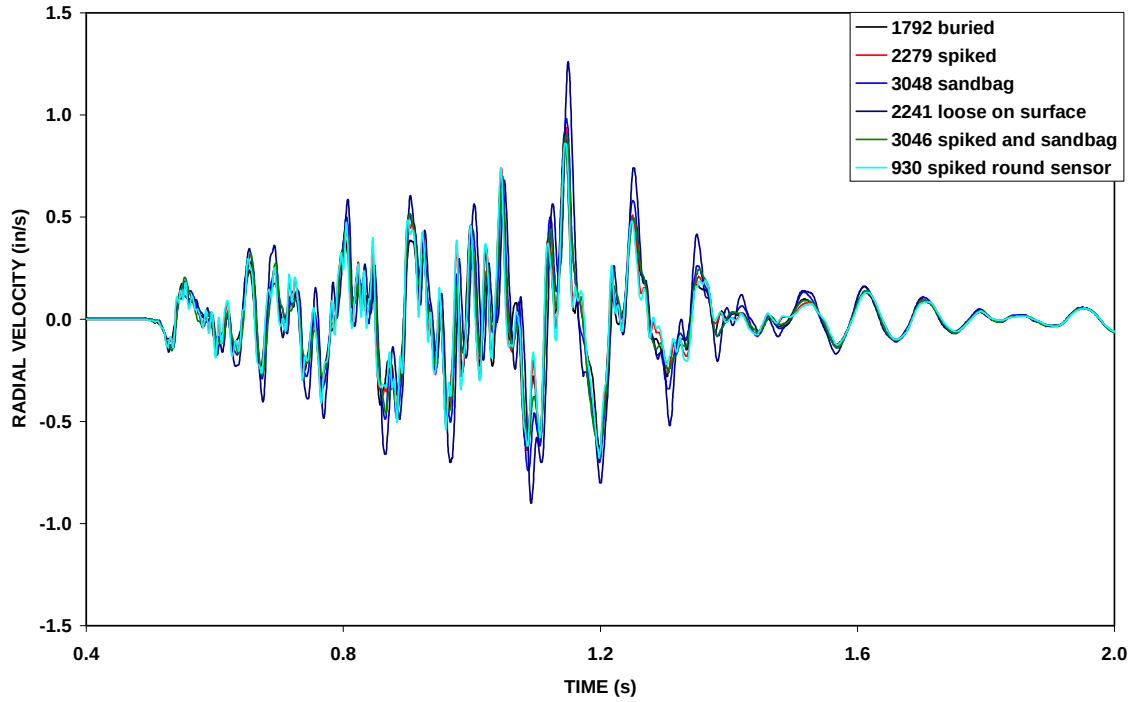

3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
93.3%
0.600
0.680
1.160
17.9%
-0.780
-0.810
-0.920
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1.0
1.1
1.2
1.3
1.4

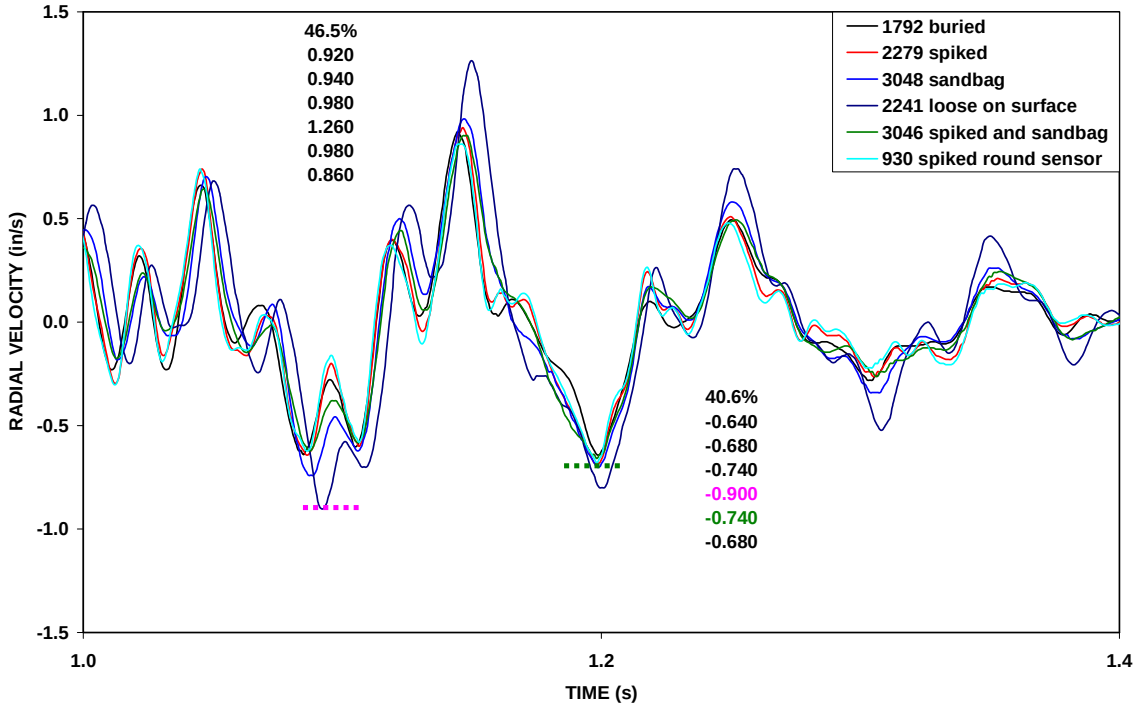

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6
2.0

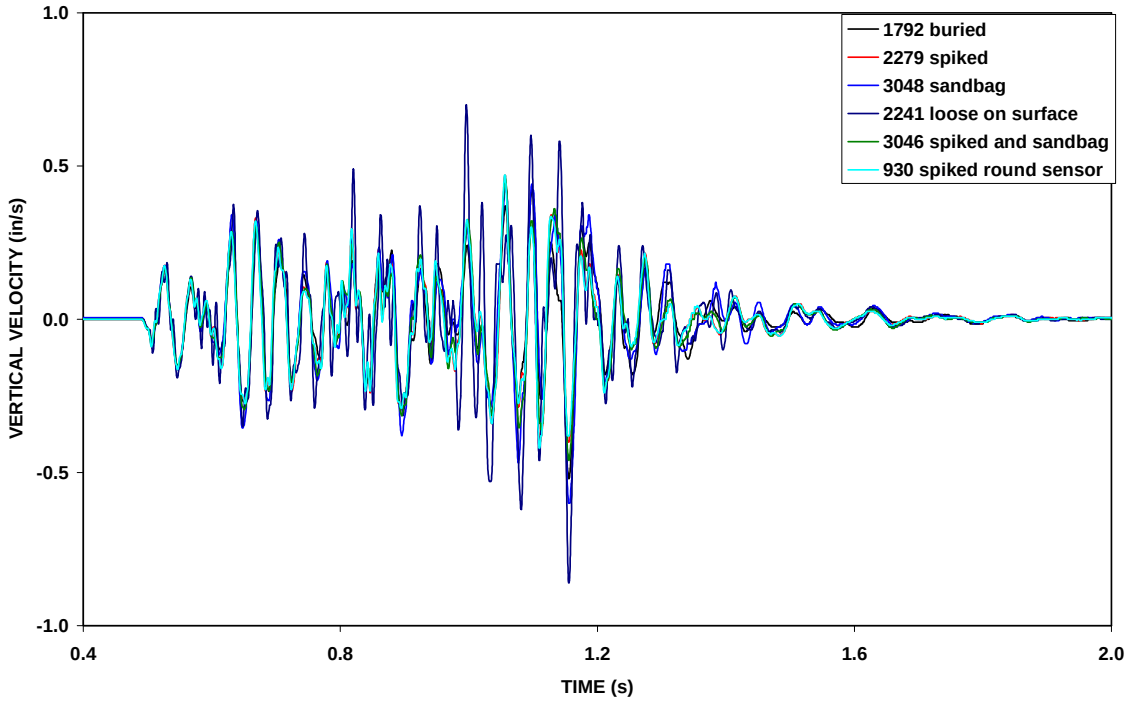

3047 buried
3044 spiked
3487 sandbag
4.5%
1.840
1.760
1.800
3.8%
-2.080
-2.160
-2.120
TRANSVERSE VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.9
1.1
1.3
1.5

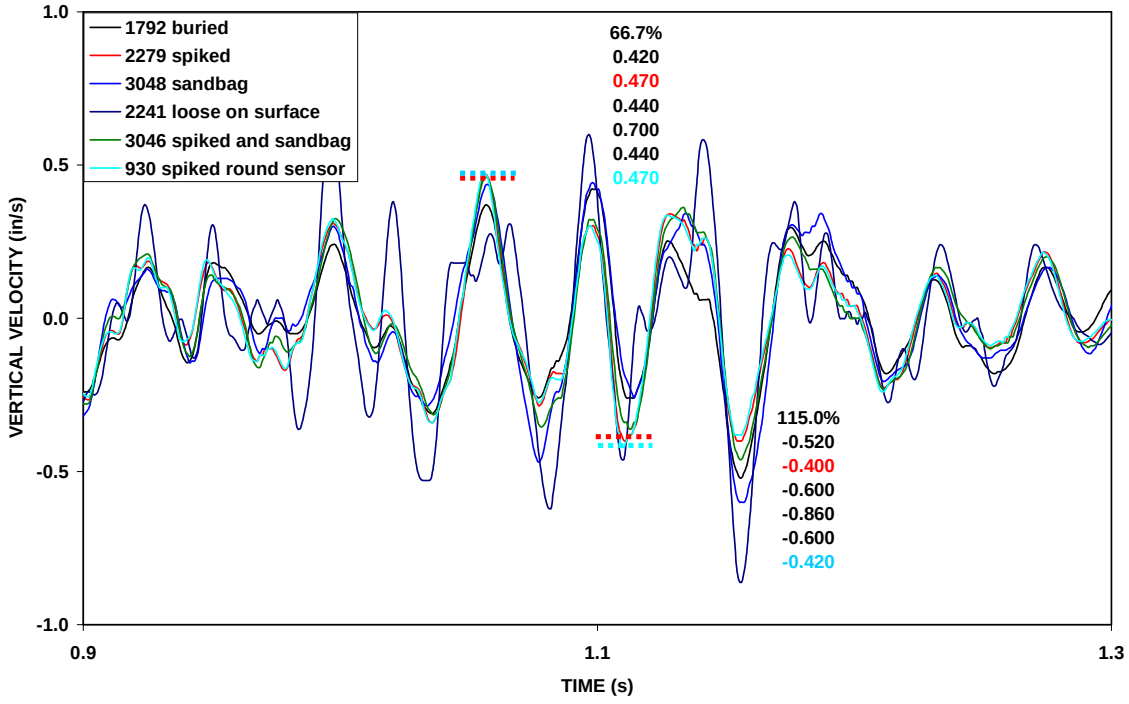
OH-1

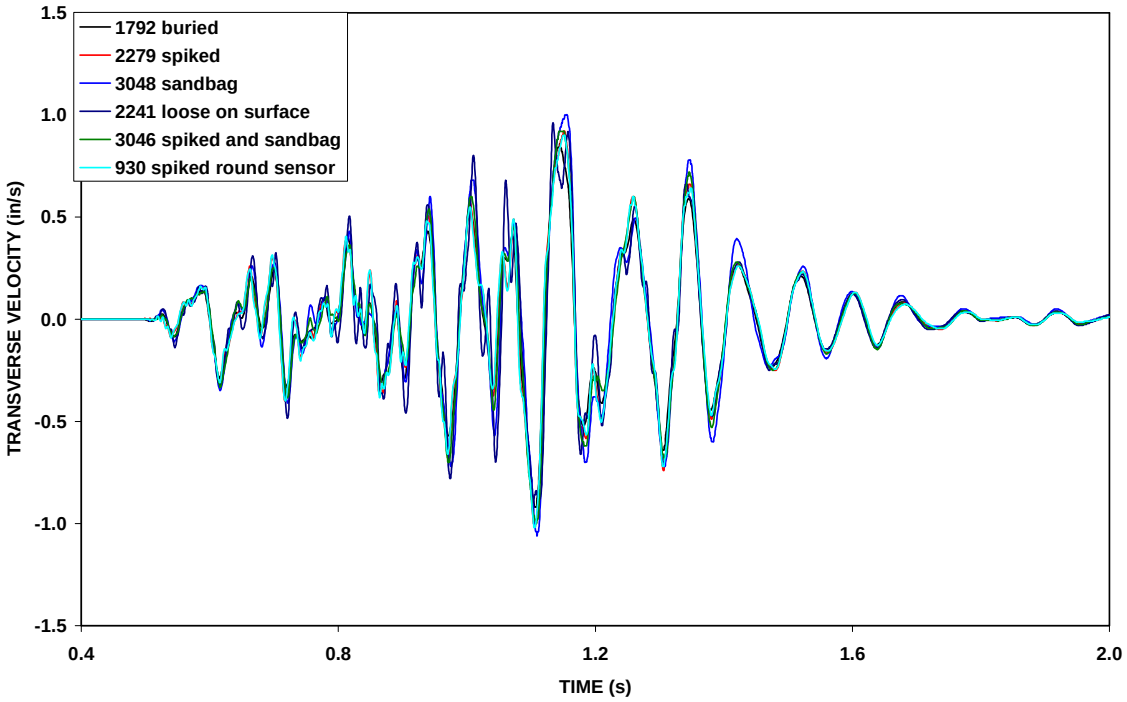
Cluster 2 SD 22.4 ft/lb$^{1/2}$

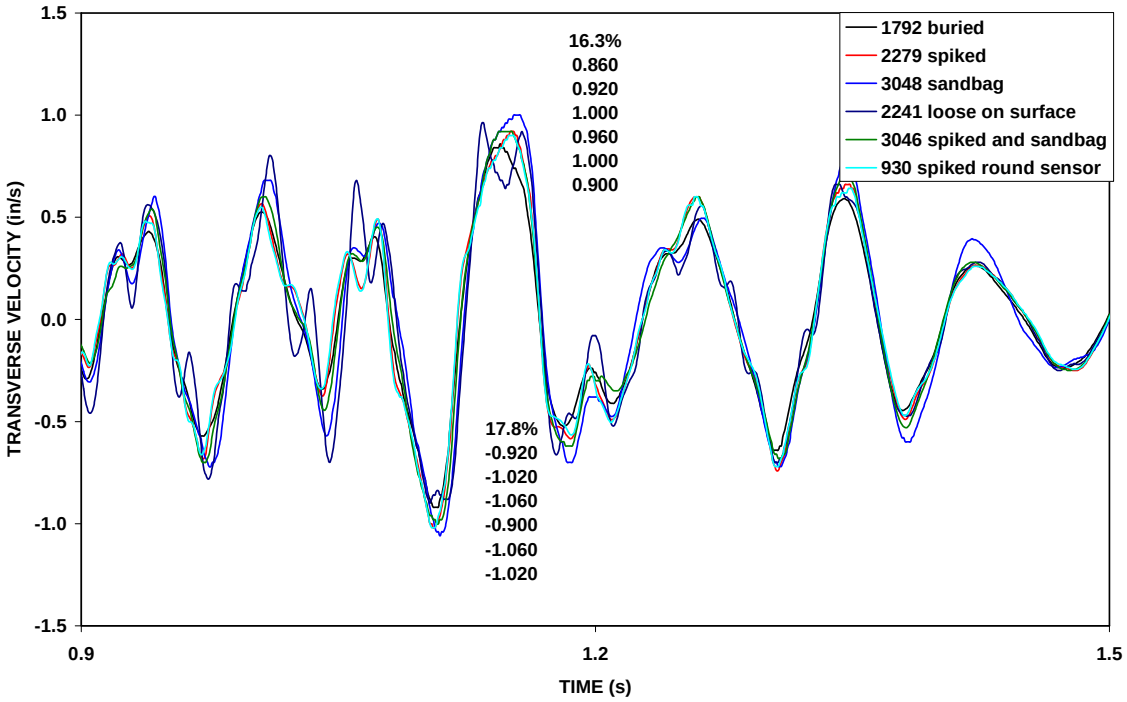

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked and sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.8
1.2
1.6
2.0

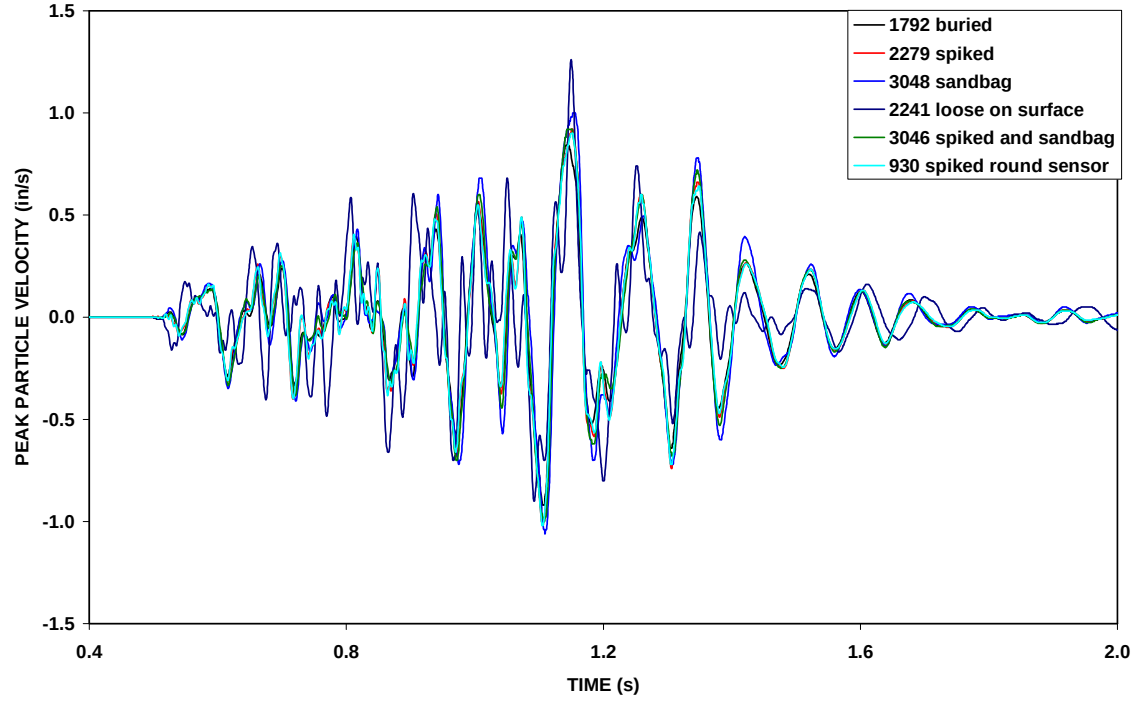

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked and sandbag
930 spiked round sensor
46.5%
0.920
0.940
0.980
1.260
0.980
0.860
40.6%
-0.640
-0.680
-0.740
-0.900
-0.740
-0.680
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1.0
1.2
1.4

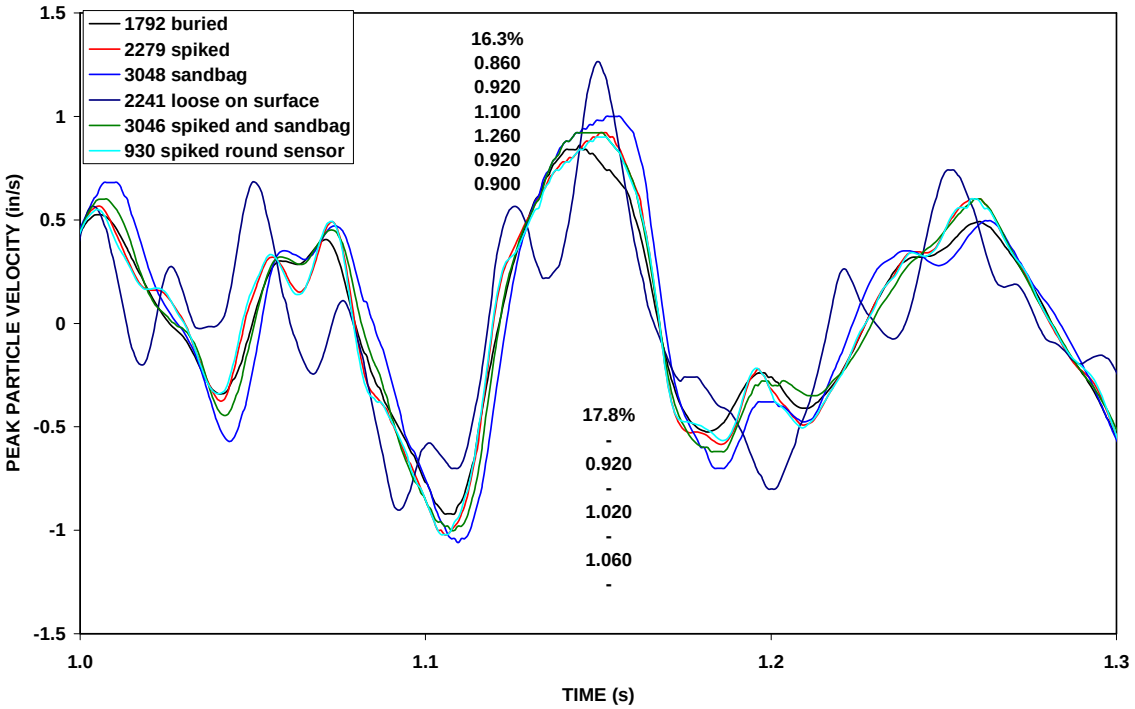

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked and sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.8
1.2
1.6
2.0
TIME (s)


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked and sandbag
930 spiked round sensor
66.7%
0.420
0.470
0.440
0.700
0.440
0.470
115.0%
-0.520
-0.400
-0.600
-0.860
-0.600
-0.420
VERTICAL VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.9
1.1
1.3
TIME (s)


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked and sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.8
1.2
1.6
2.0
TIME (s)

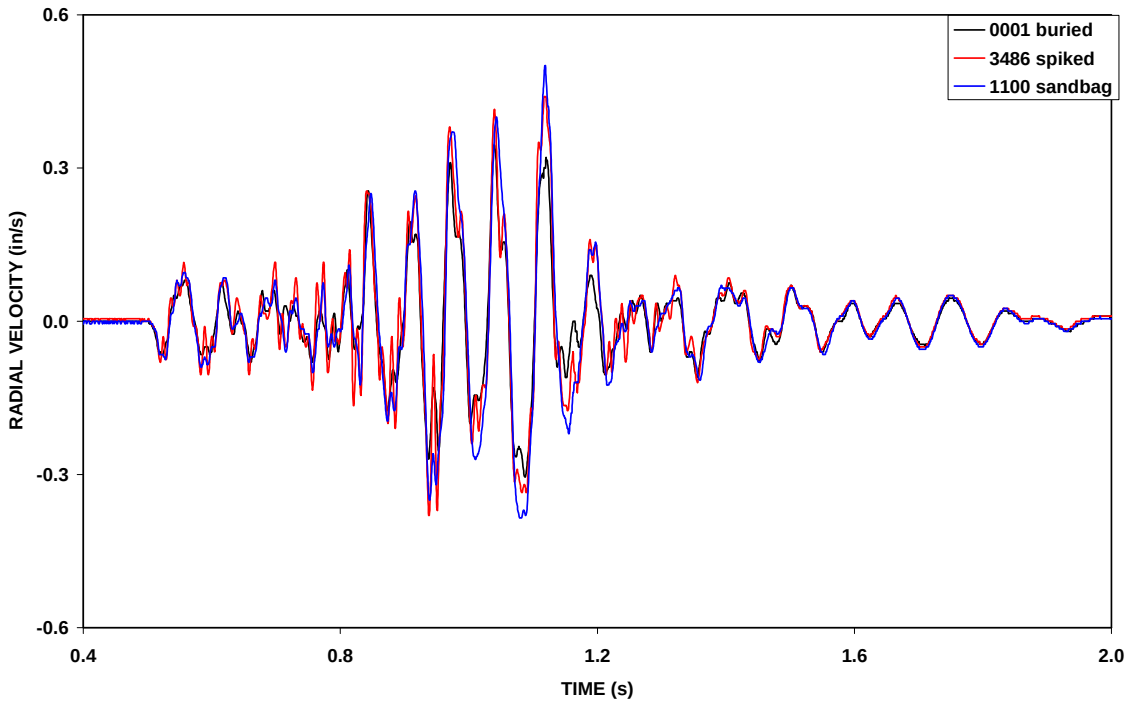

16.3%
0.860
0.920
1.000
0.960
1.000
0.900
17.8%
-0.920
-1.020
-1.060
-0.900
-1.060
-1.020
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked and sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.9
1.2
1.5
TIME (s)

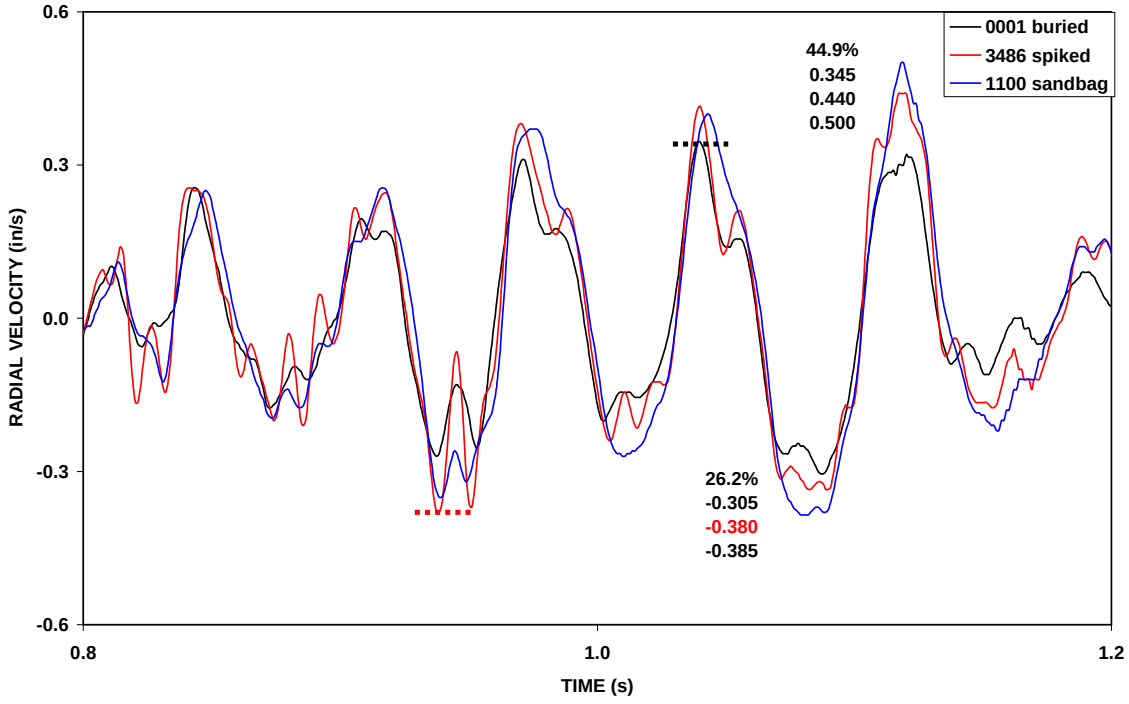

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked and sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.8
1.2
1.6
2.0

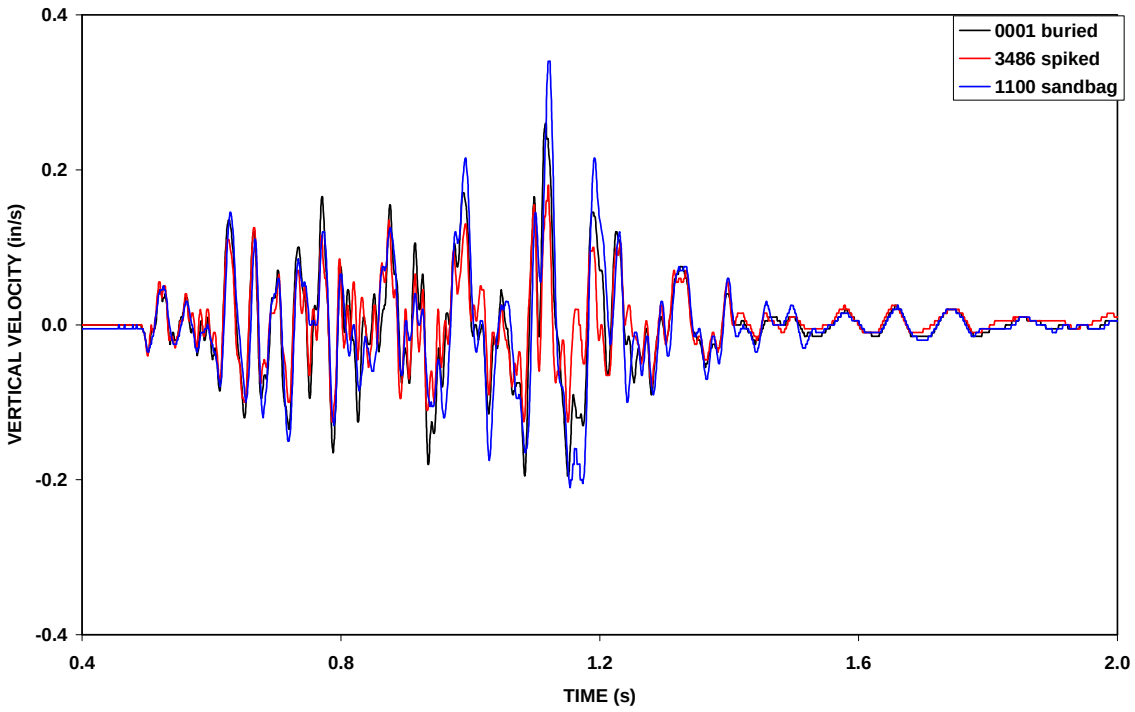

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked and sandbag
930 spiked round sensor
16.3%
0.860
0.920
1.100
1.260
0.920
0.900
17.8%
-
0.920
-
1.020
-
1.060
-
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
1.5
1
0.5
0
-0.5
-1
-1.5
1.0
1.1
1.2
1.3

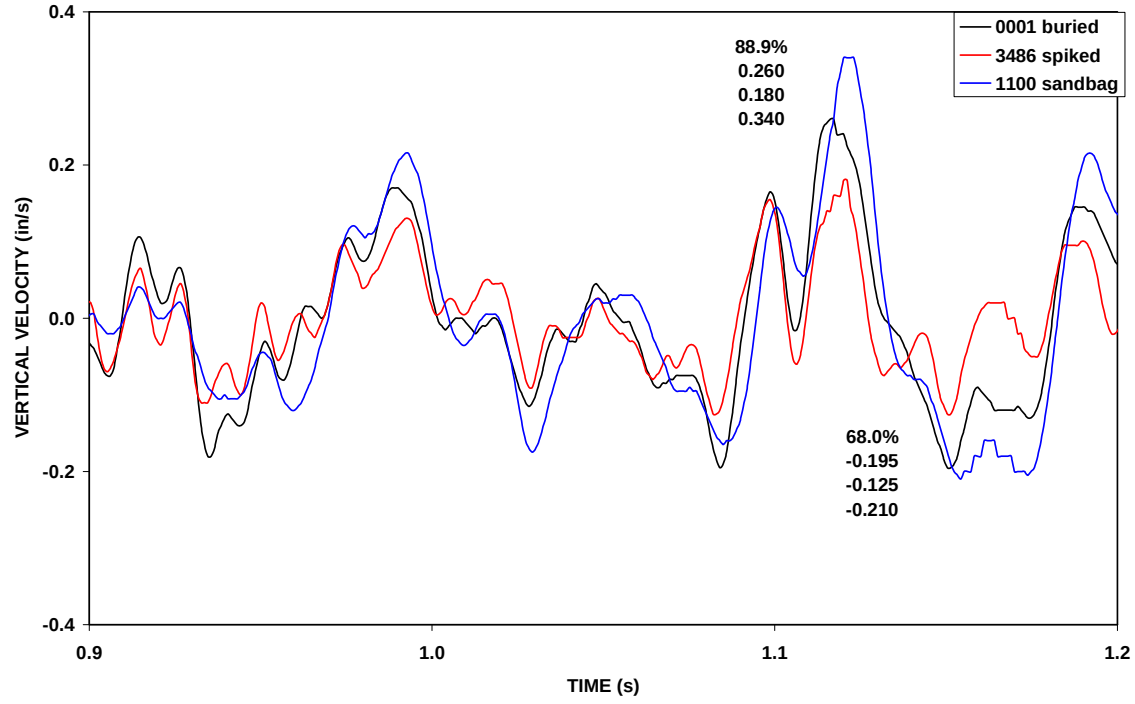
OH-1

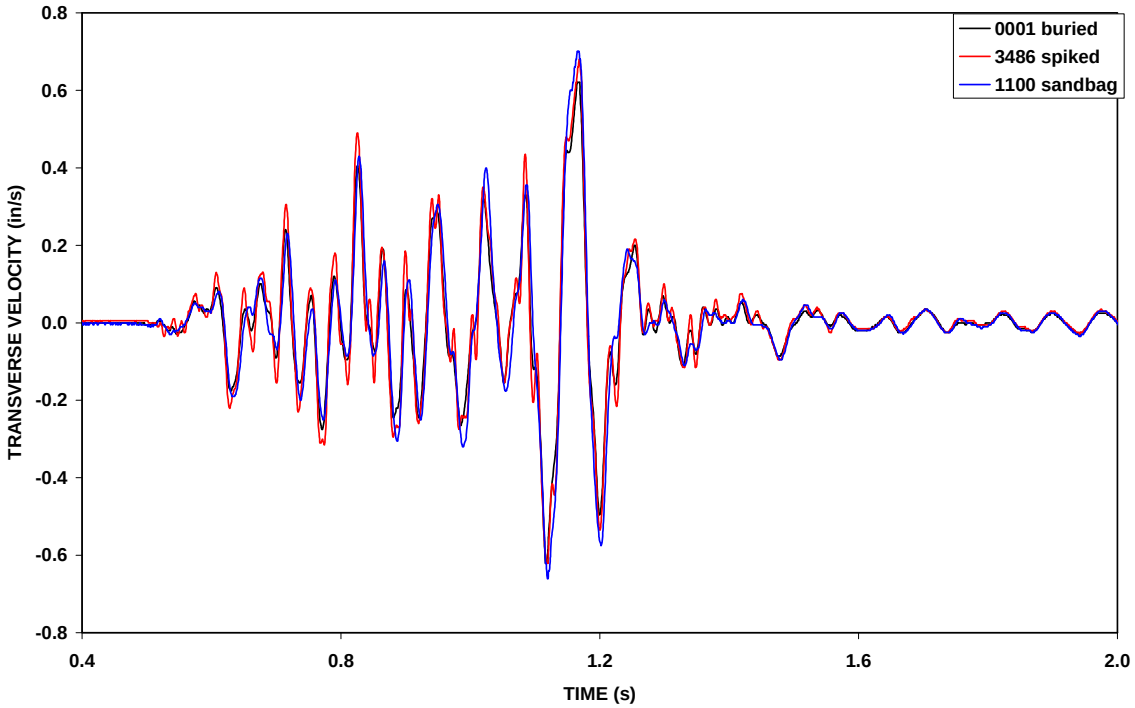
Cluster 3 SD 33.5 ft/lb$^{1/2}$

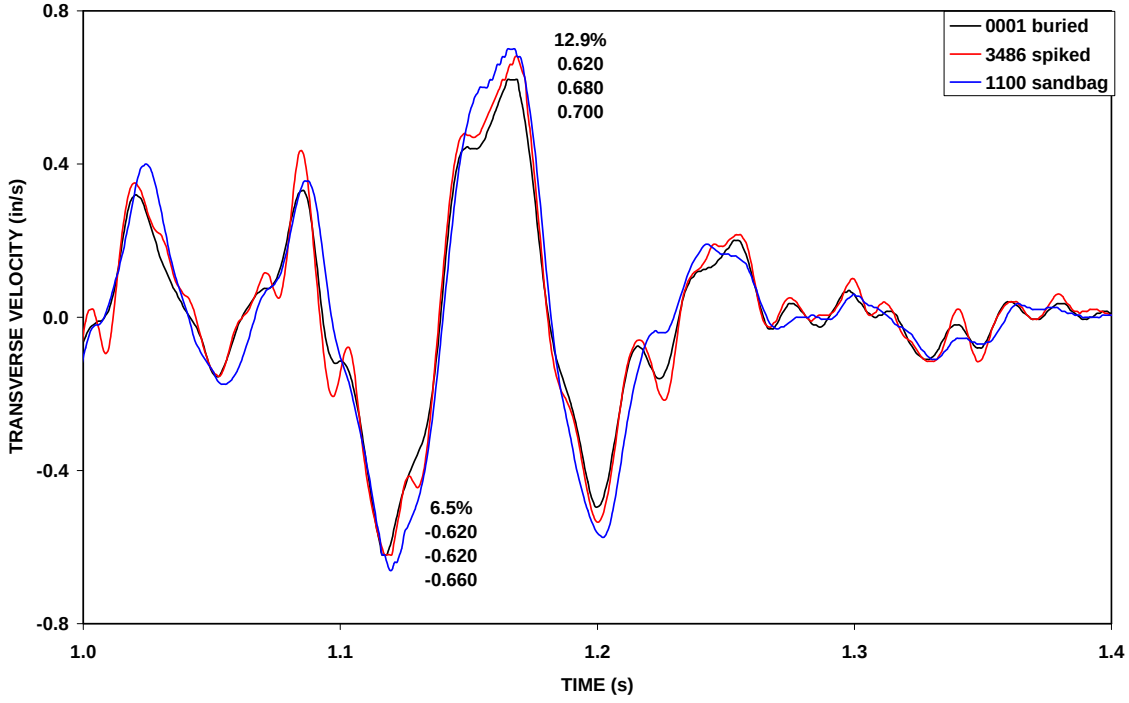

0.6
0.3
0.0
-0.3
-0.6
RADIAL VELOCITY (in/s)
0.4
0.8
1.2
1.6
2.0
TIME (s)
0001 buried
3486 spiked
1100 sandbag


0.6
0.3
0.0
-0.3
-0.6
RADIAL VELOCITY (in/s)
0.8
1.0
1.2
TIME (s)
0001 buried
3486 spiked
1100 sandbag
44.9%
0.345
0.440
0.500
26.2%
-0.305
-0.380
-0.385


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6
2.0

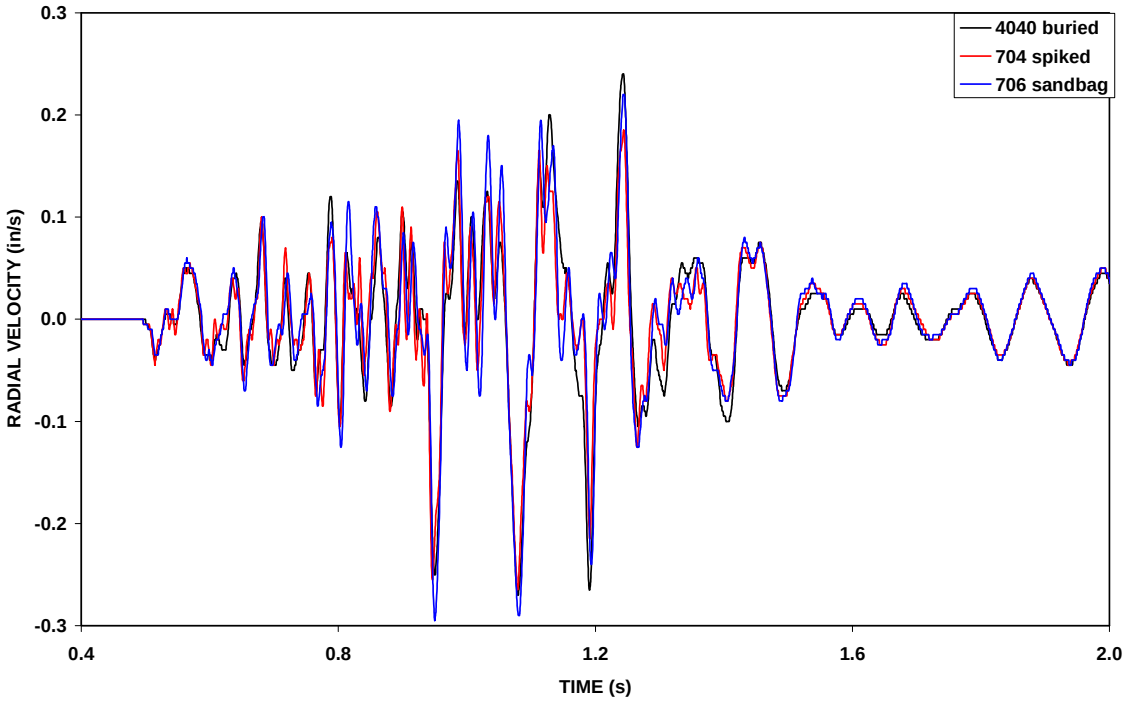

0001 buried
3486 spiked
1100 sandbag
88.9%
0.260
0.180
0.340
68.0%
-0.195
-0.125
-0.210
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.9
1.0
1.1
1.2

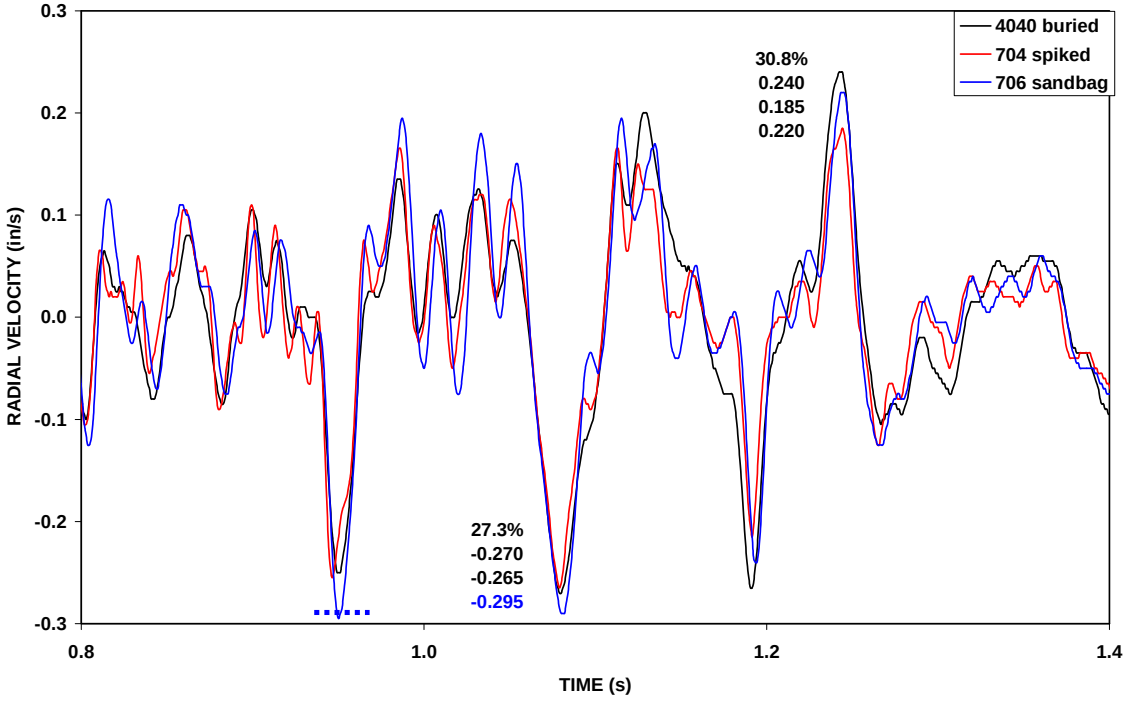

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.4
0.8
1.2
1.6
2.0

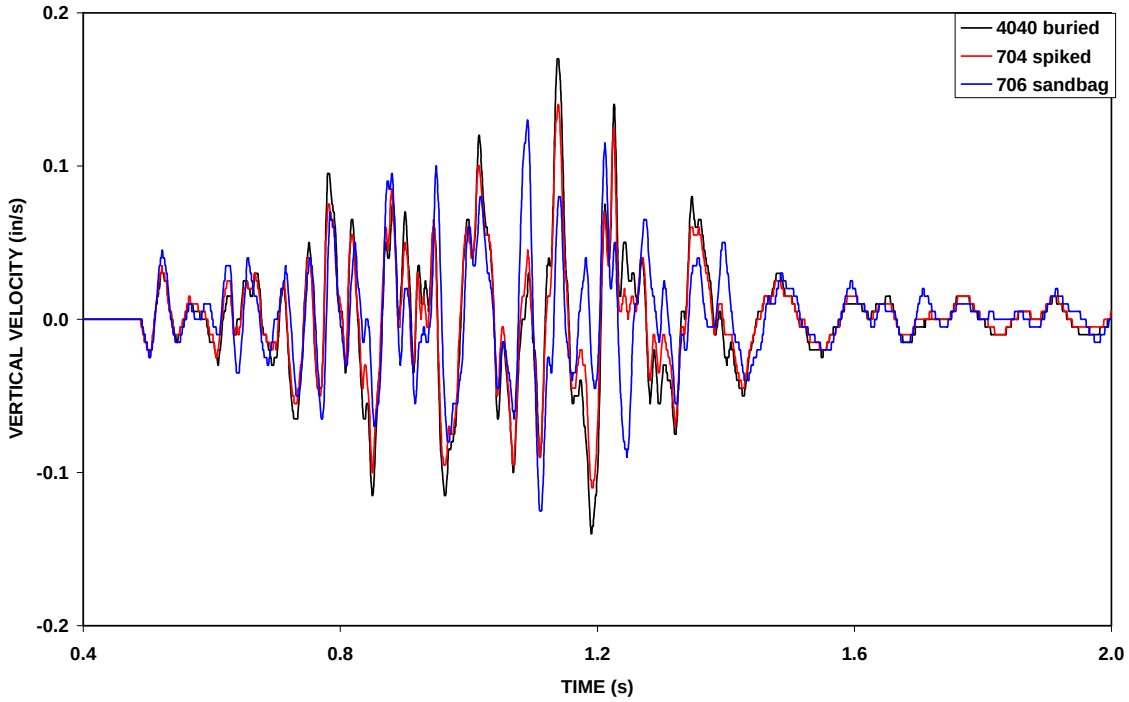

0001 buried
3486 spiked
1100 sandbag
12.9%
0.620
0.680
0.700
6.5%
-0.620
-0.620
-0.660
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
1.0
1.1
1.2
1.3
1.4

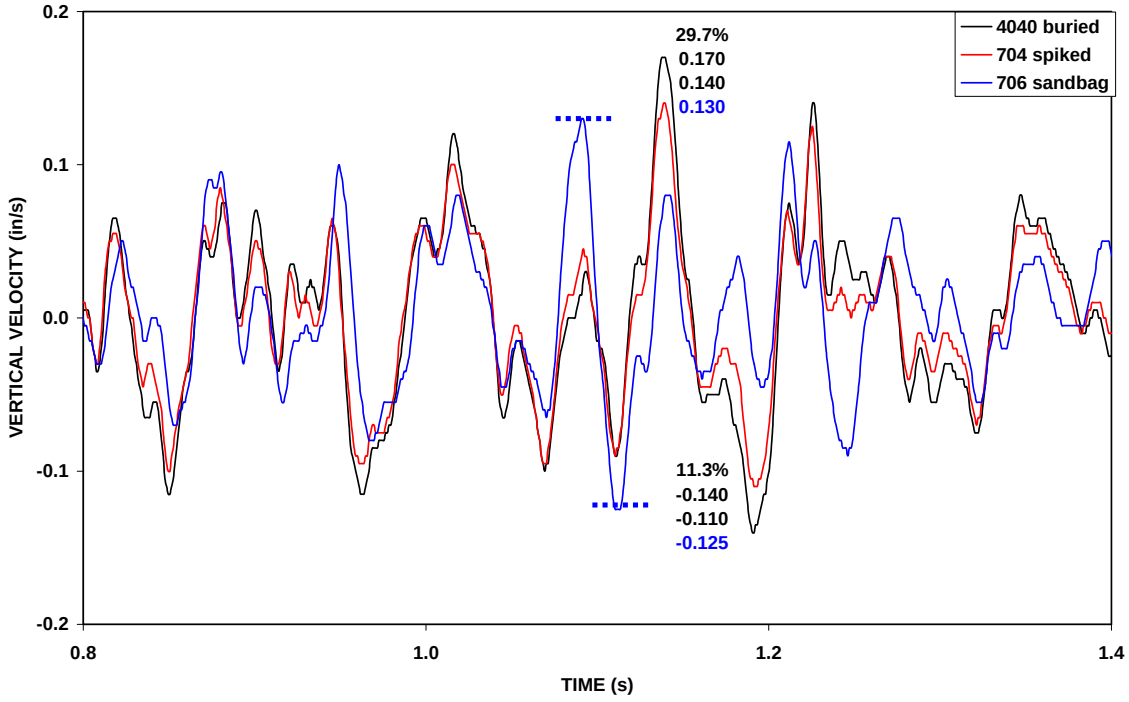
OH-1

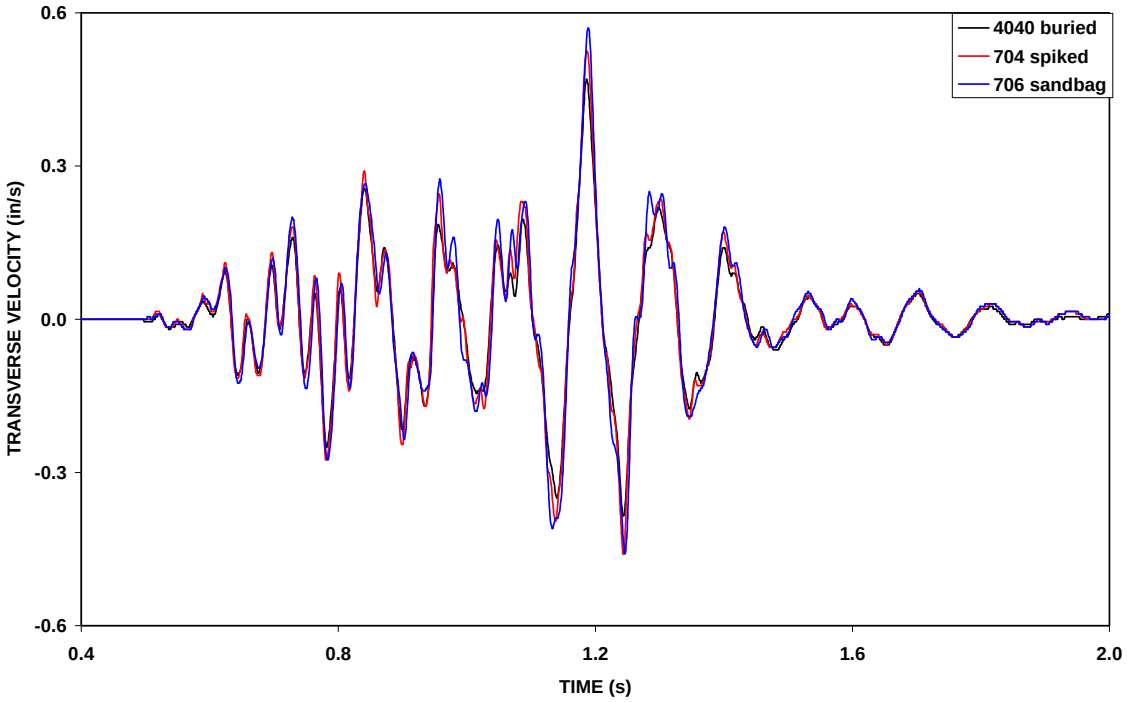
Cluster 4 SD 41.9 ft/lb$^{1/2}$

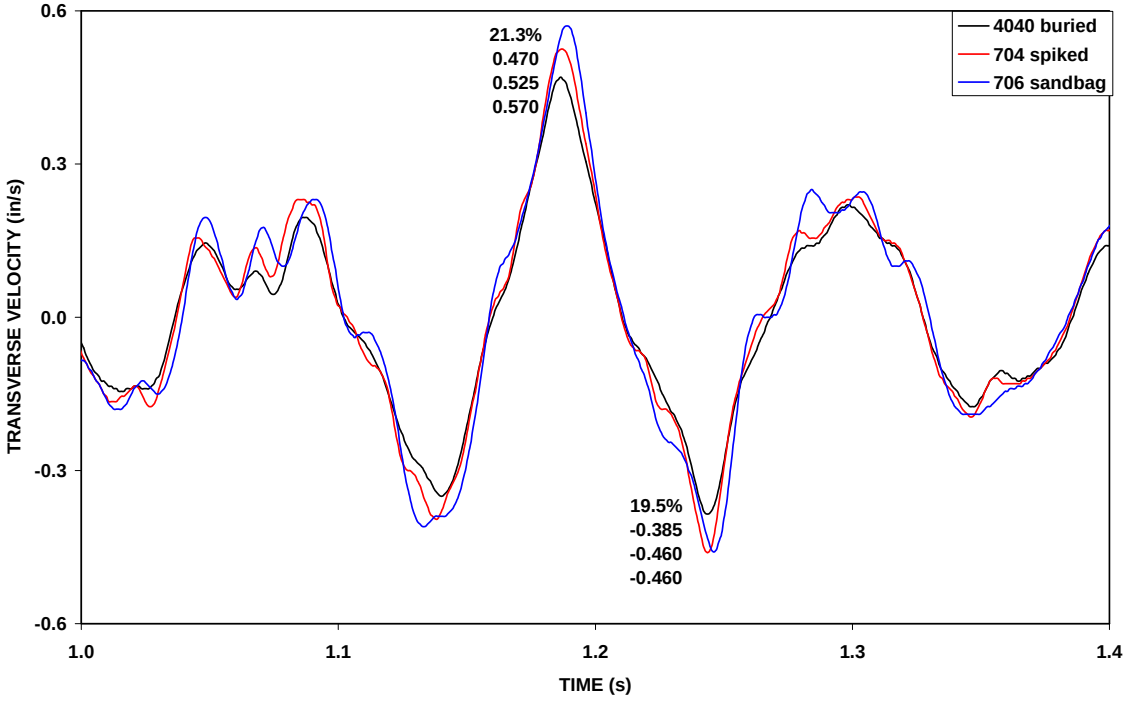

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.8
1.2
1.6
2.0


4040 buried
704 spiked
706 sandbag
30.8%
0.240
0.185
0.220
27.3%
-0.270
-0.265
-0.295
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.8
1.0
1.2
1.4


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.8
1.2
1.6
2.0

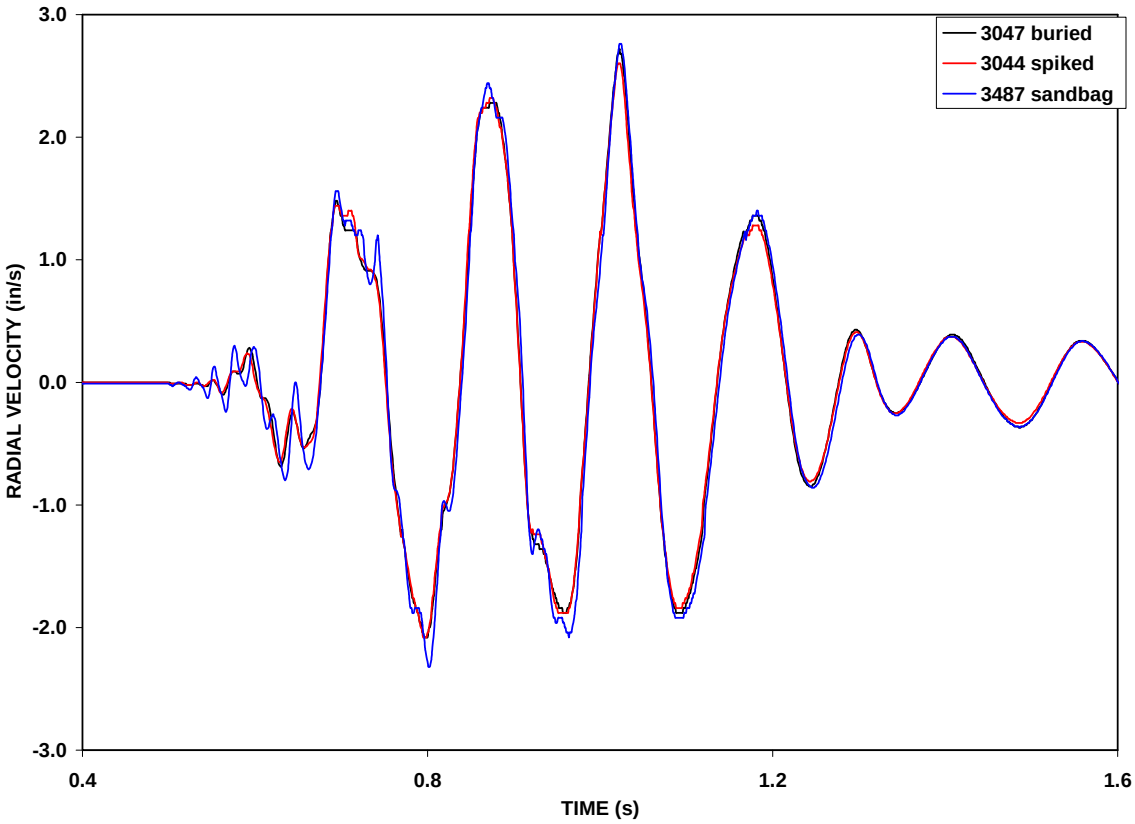

4040 buried
704 spiked
706 sandbag
29.7%
0.170
0.140
0.130
11.3%
-0.140
-0.110
-0.125
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.8
1.0
1.2
1.4

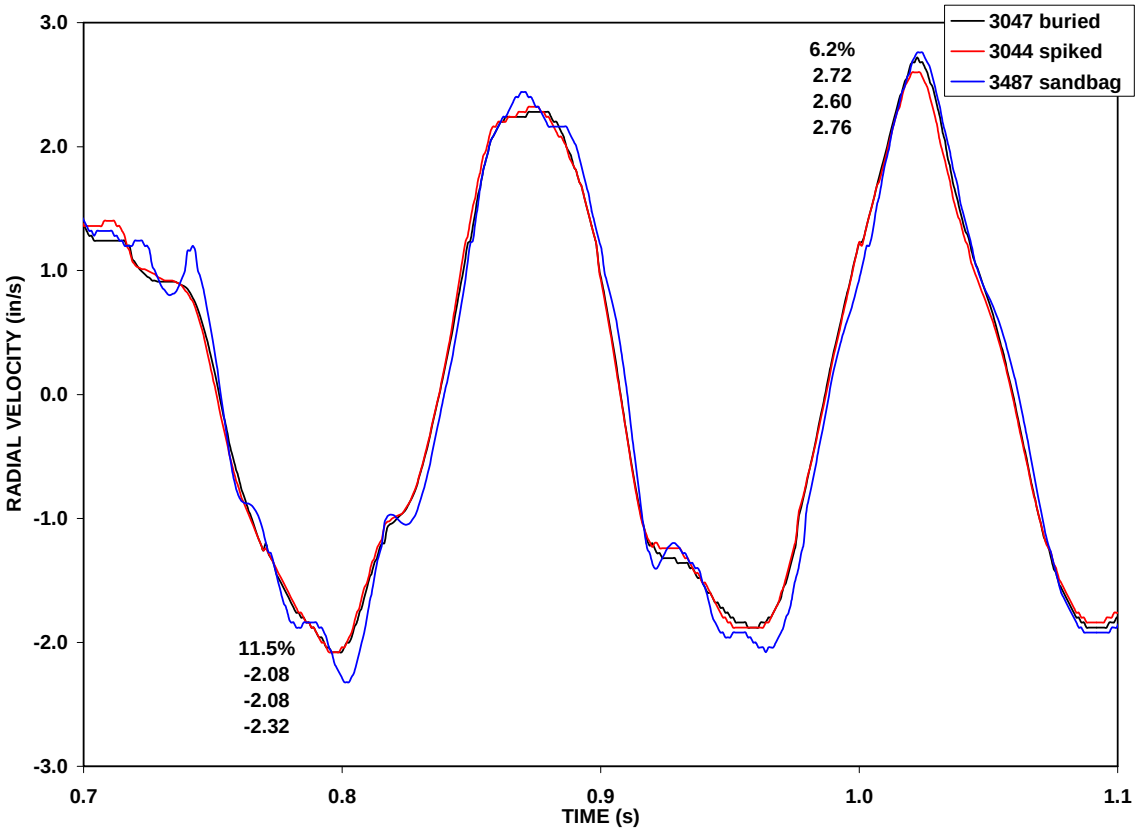

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
0.6
0.3
0.0
-0.3
-0.6
0.4
0.8
1.2
1.6
2.0
TIME (s)

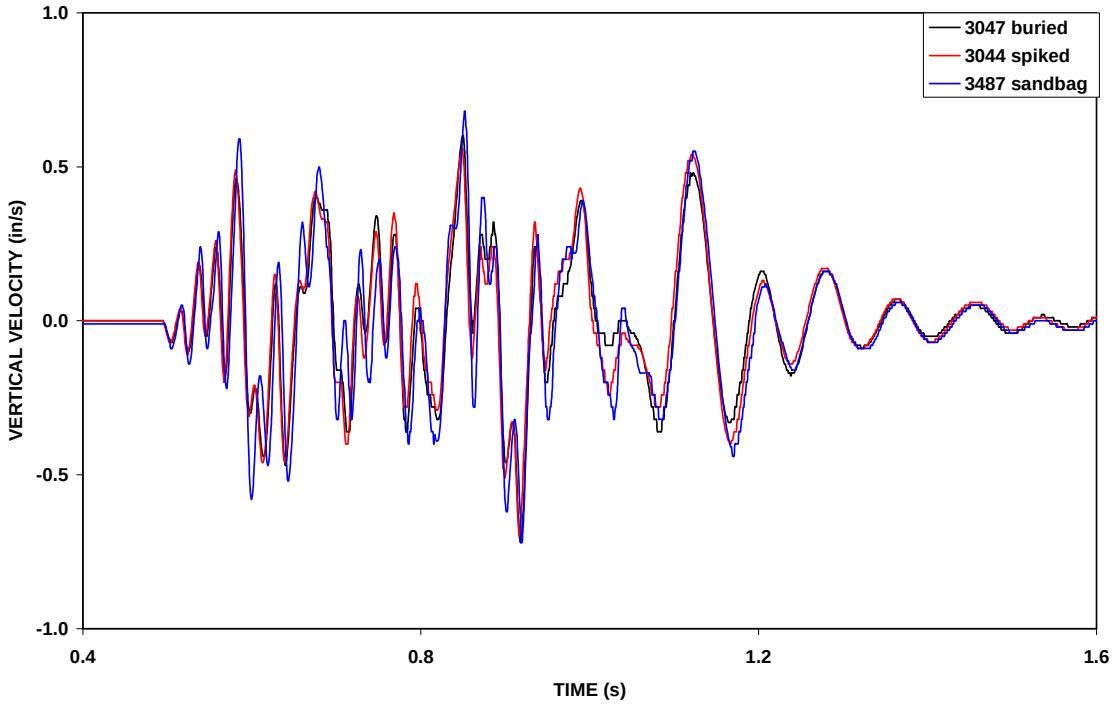

4040 buried
704 spiked
706 sandbag
21.3%
0.470
0.525
0.570
19.5%
-0.385
-0.460
-0.460
TRANSVERSE VELOCITY (in/s)
0.6
0.3
0.0
-0.3
-0.6
1.0
1.1
1.2
1.3
1.4
TIME (s)

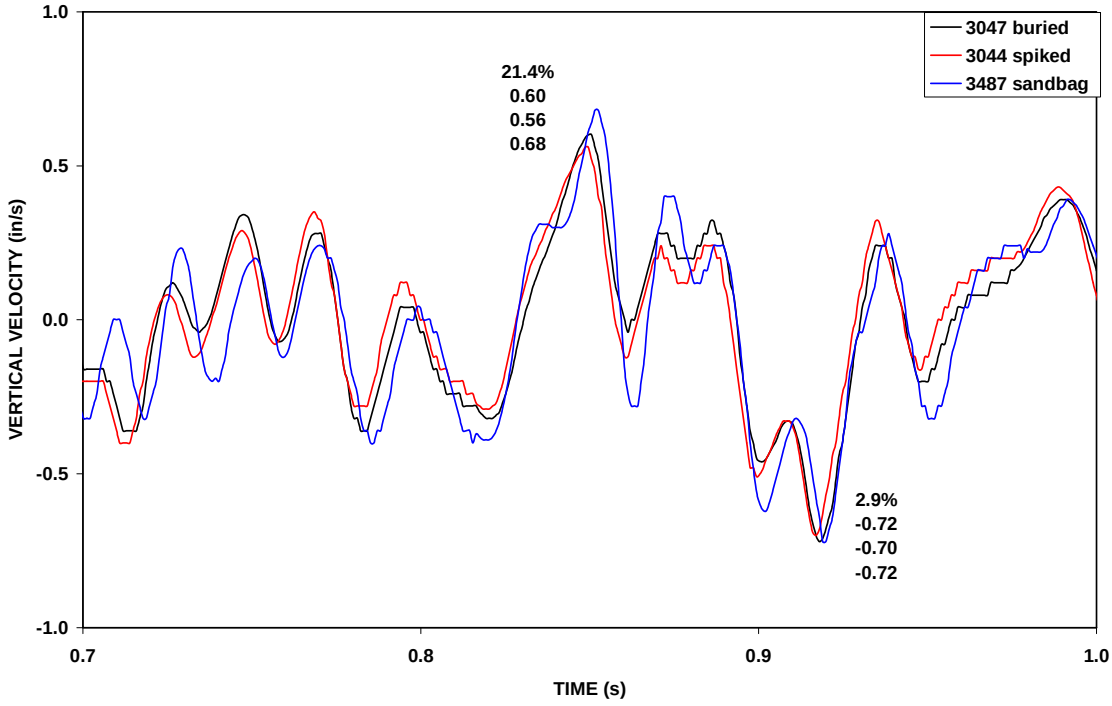
OH-2

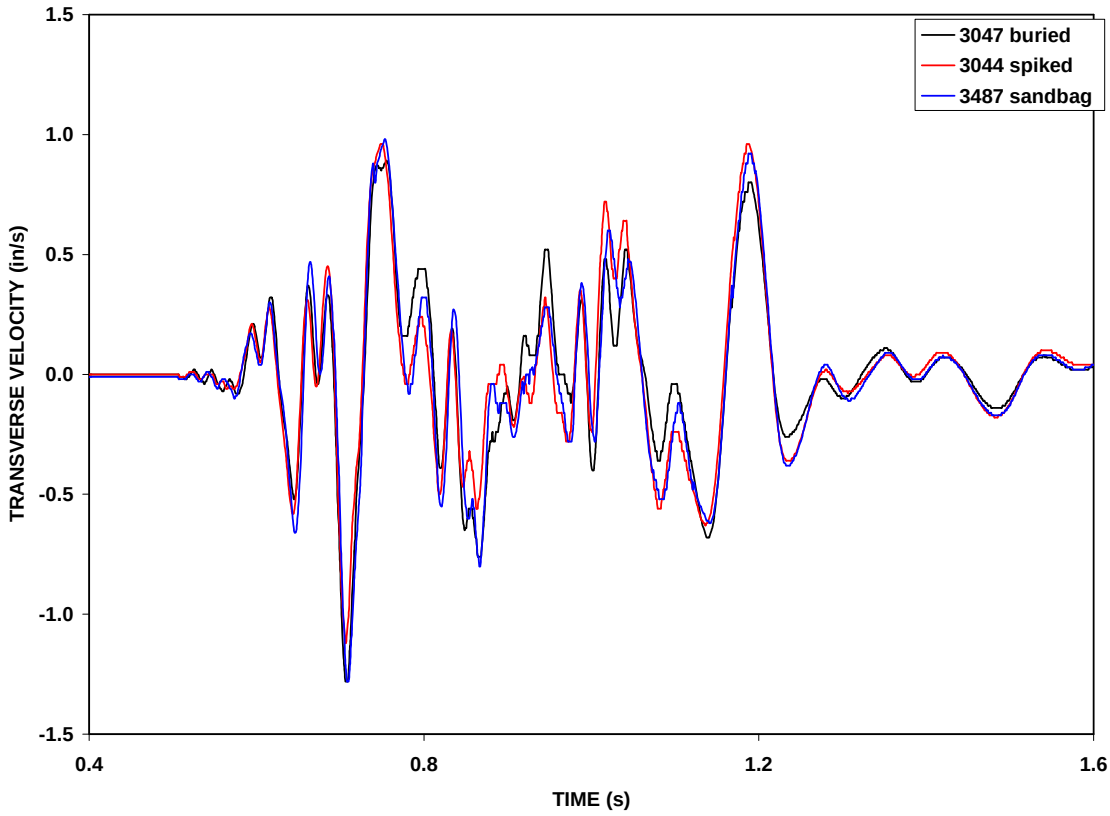
Cluster 1 SD 13.4 ft/lb$^{1/2}$

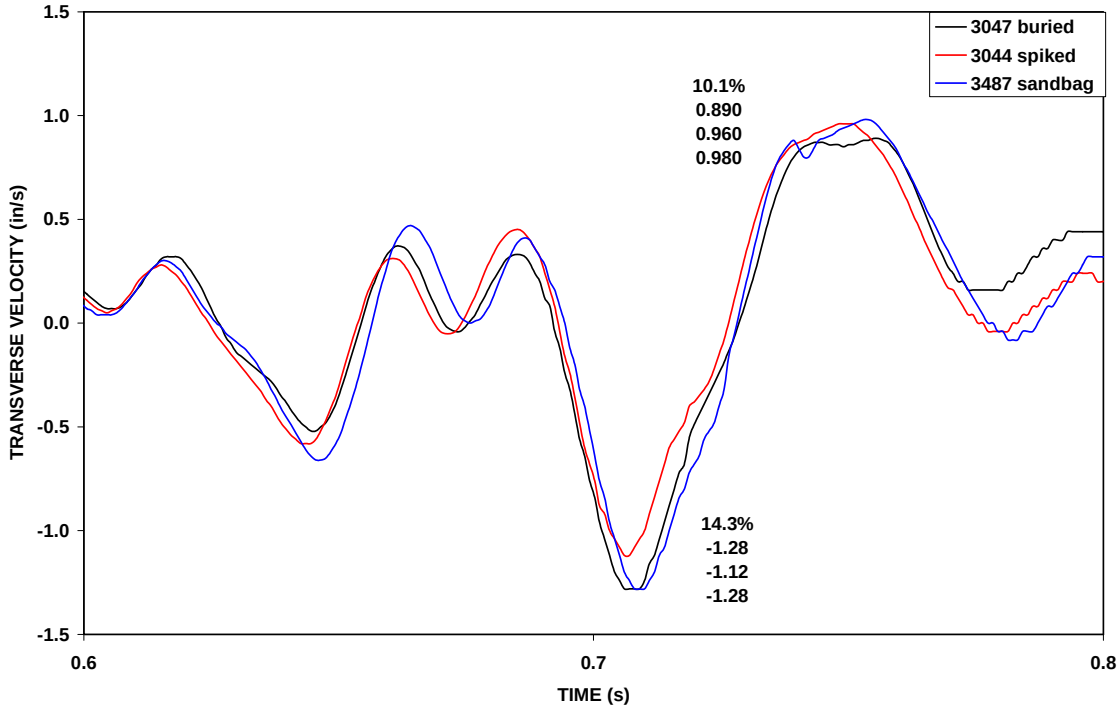

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6


3047 buried
3044 spiked
3487 sandbag
6.2%
2.72
2.60
2.76
11.5%
-2.08
-2.08
-2.32
RADIAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.7
0.8
0.9
1.0
1.1


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.8
1.2
1.6

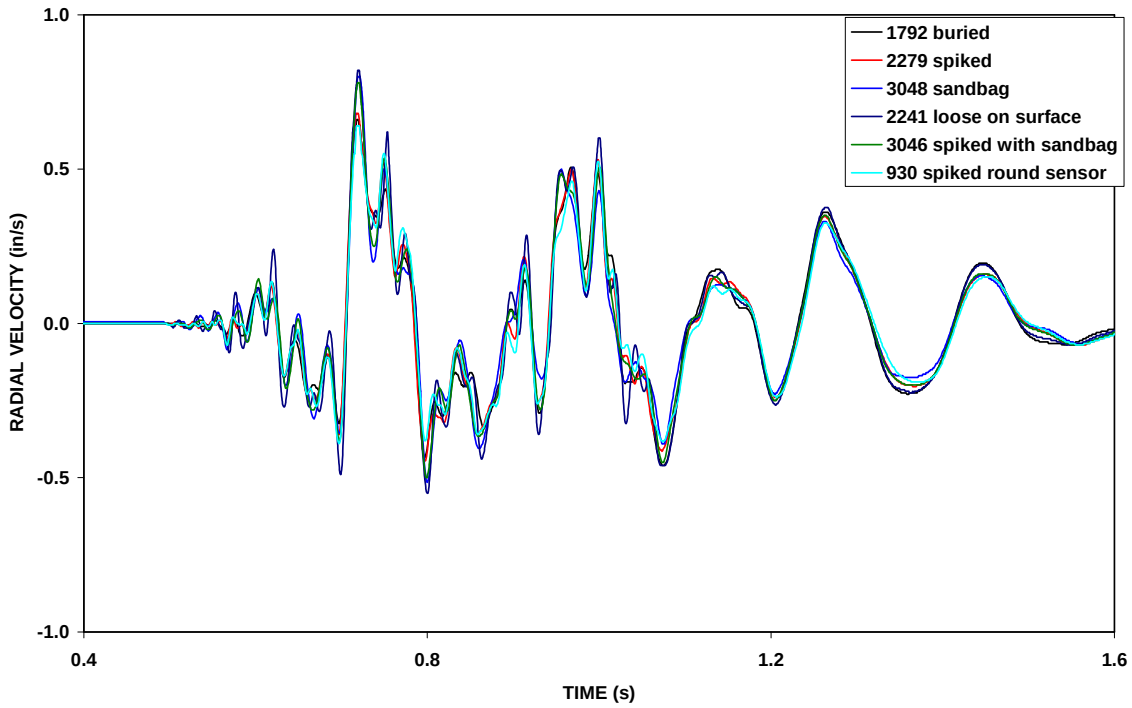

3047 buried
3044 spiked
3487 sandbag
21.4%
0.60
0.56
0.68
2.9%
-0.72
-0.70
-0.72
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.7
0.8
0.9
1.0

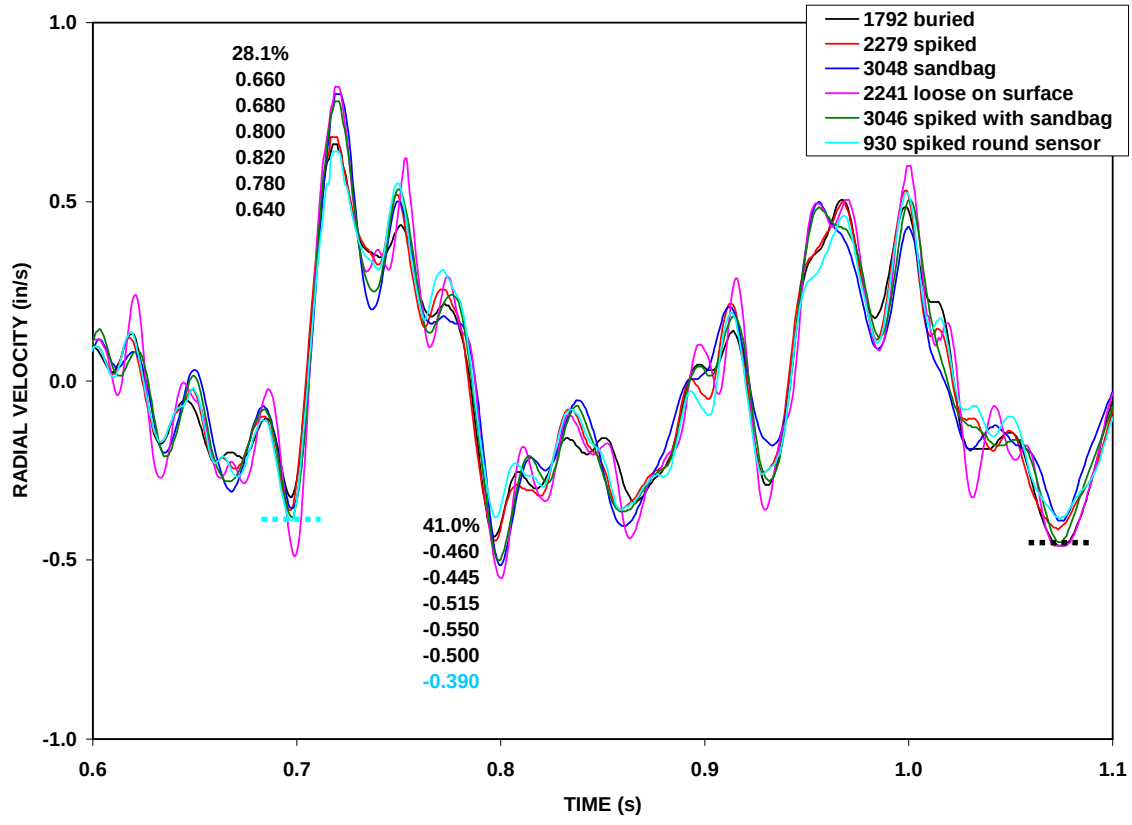

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.8
1.2
1.6

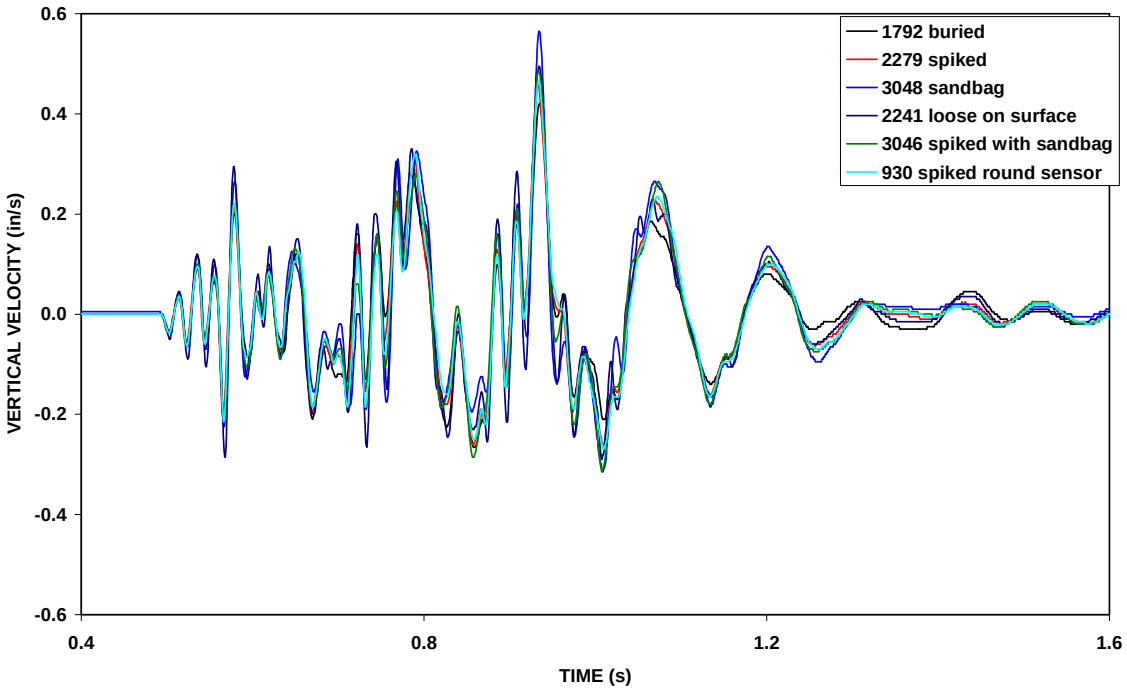

3047 buried
3044 spiked
3487 sandbag
10.1%
0.890
0.960
0.980
14.3%
-1.28
-1.12
-1.28
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.6
0.7
0.8

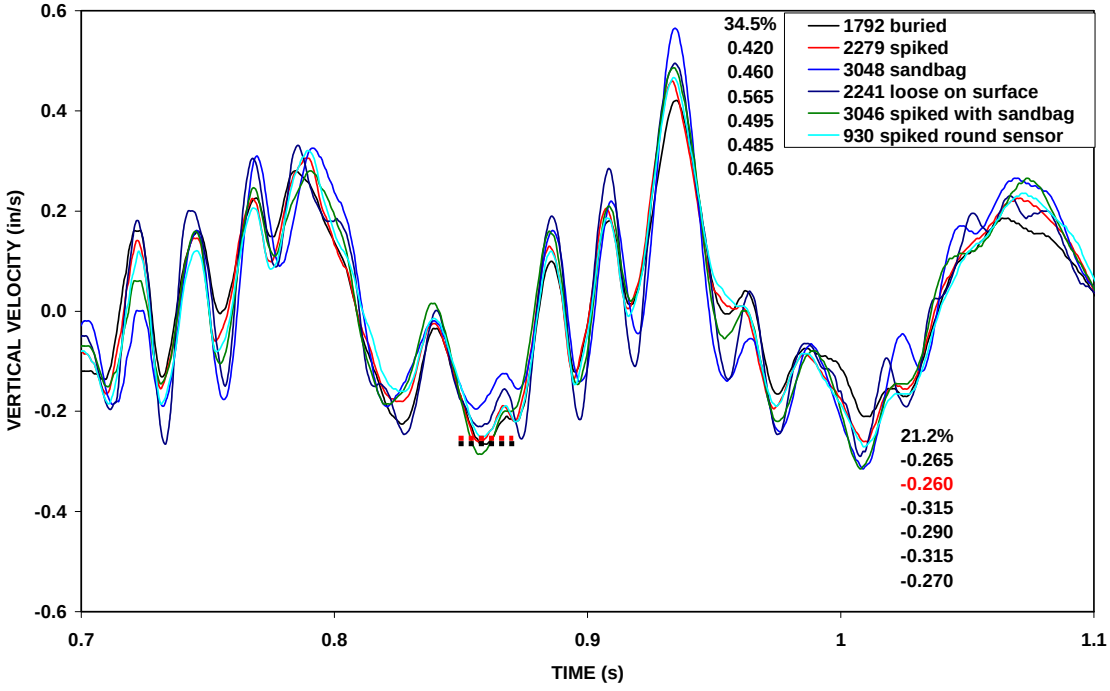
OH-2

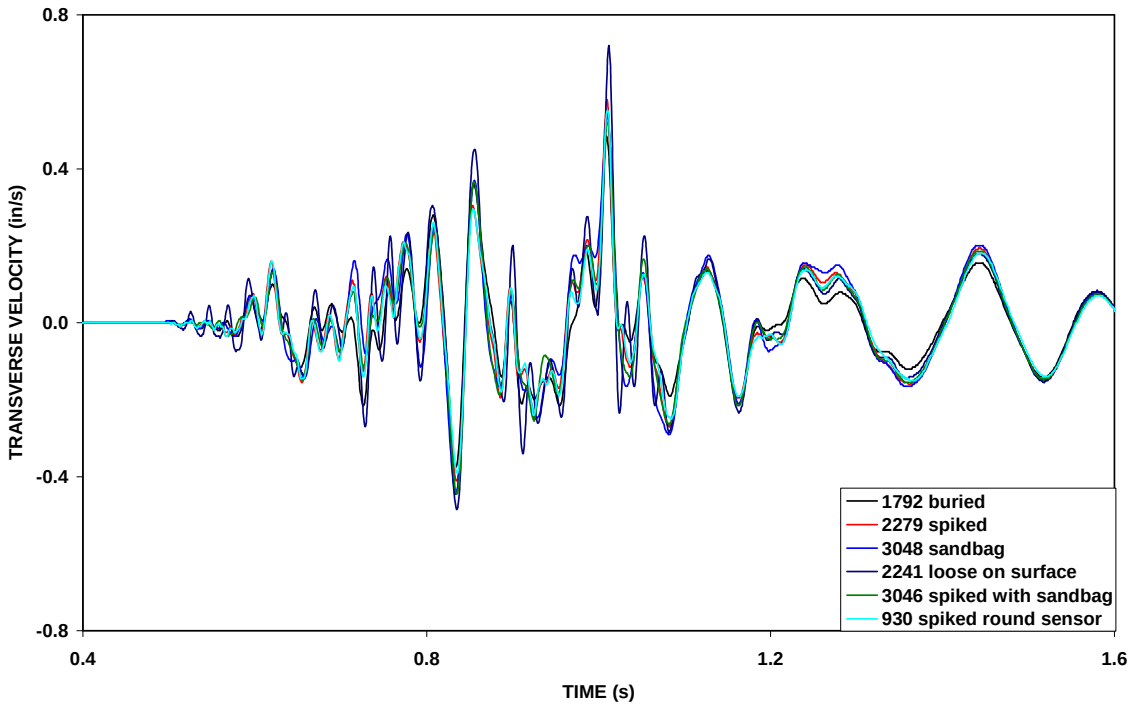
Cluster 2 SD 26.8 ft/lb$^{1/2}$

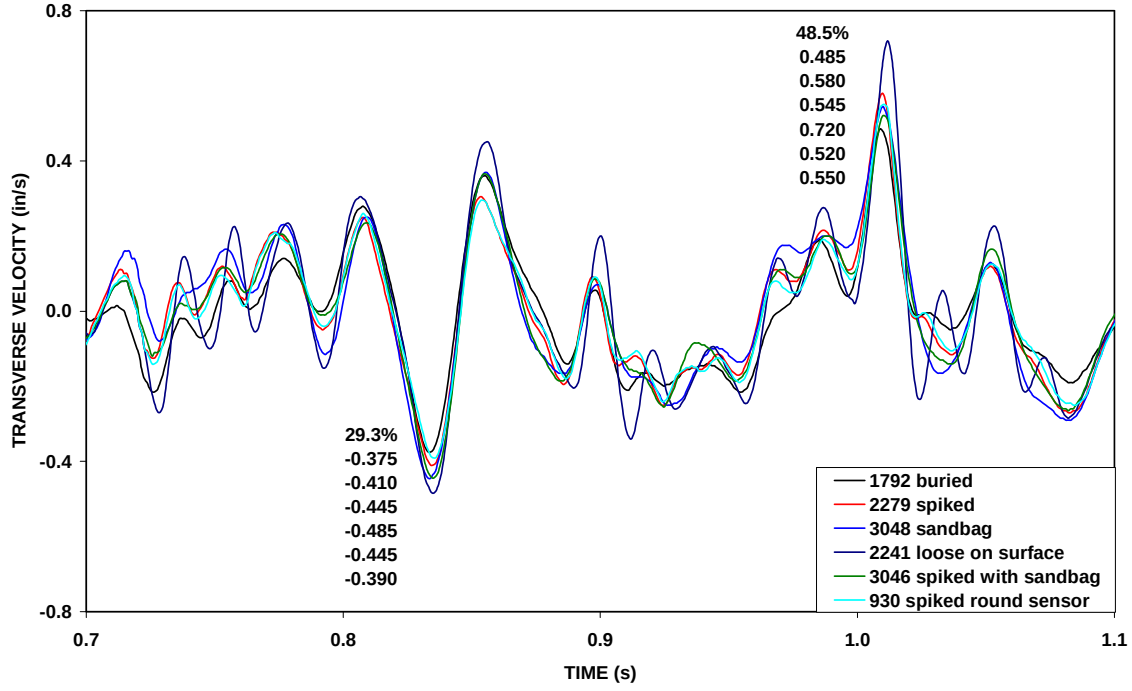

1.0
0.5
0.0
-0.5
-1.0
RADIAL VELOCITY (in/s)
0.4
0.8
1.2
1.6
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

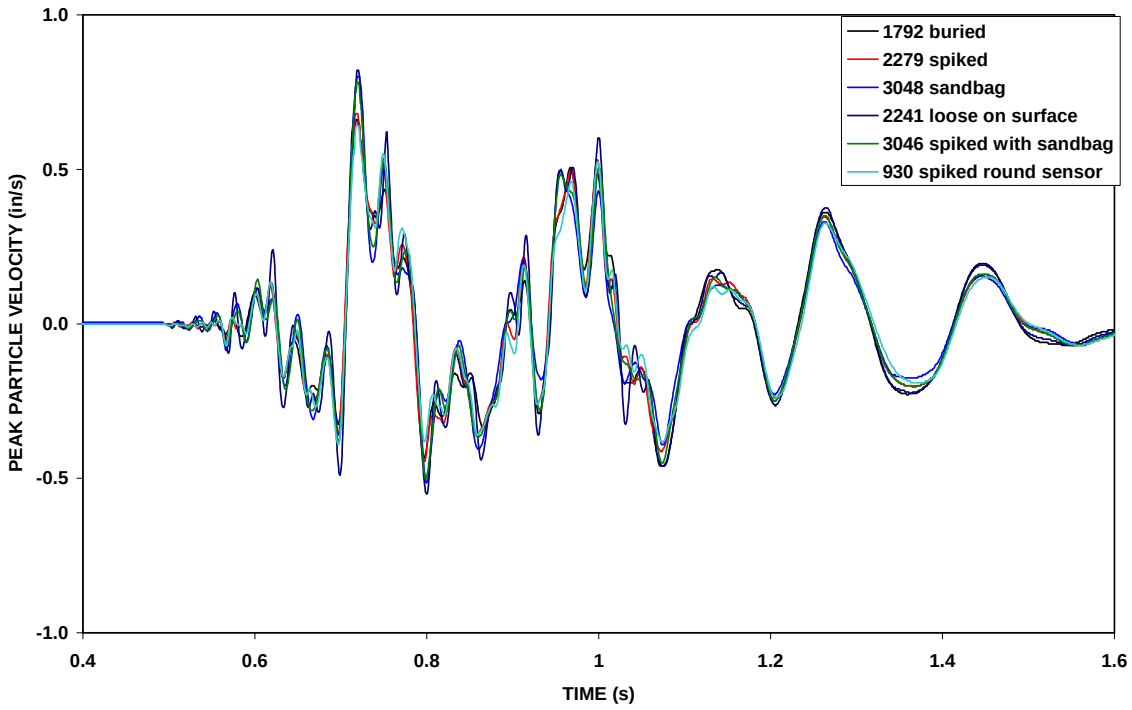

1.0
0.5
0.0
-0.5
-1.0
RADIAL VELOCITY (in/s)
0.6
0.7
0.8
0.9
1.0
1.1
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
28.1%
0.660
0.680
0.800
0.820
0.780
0.640
41.0%
-0.460
-0.445
-0.515
-0.550
-0.500
-0.390

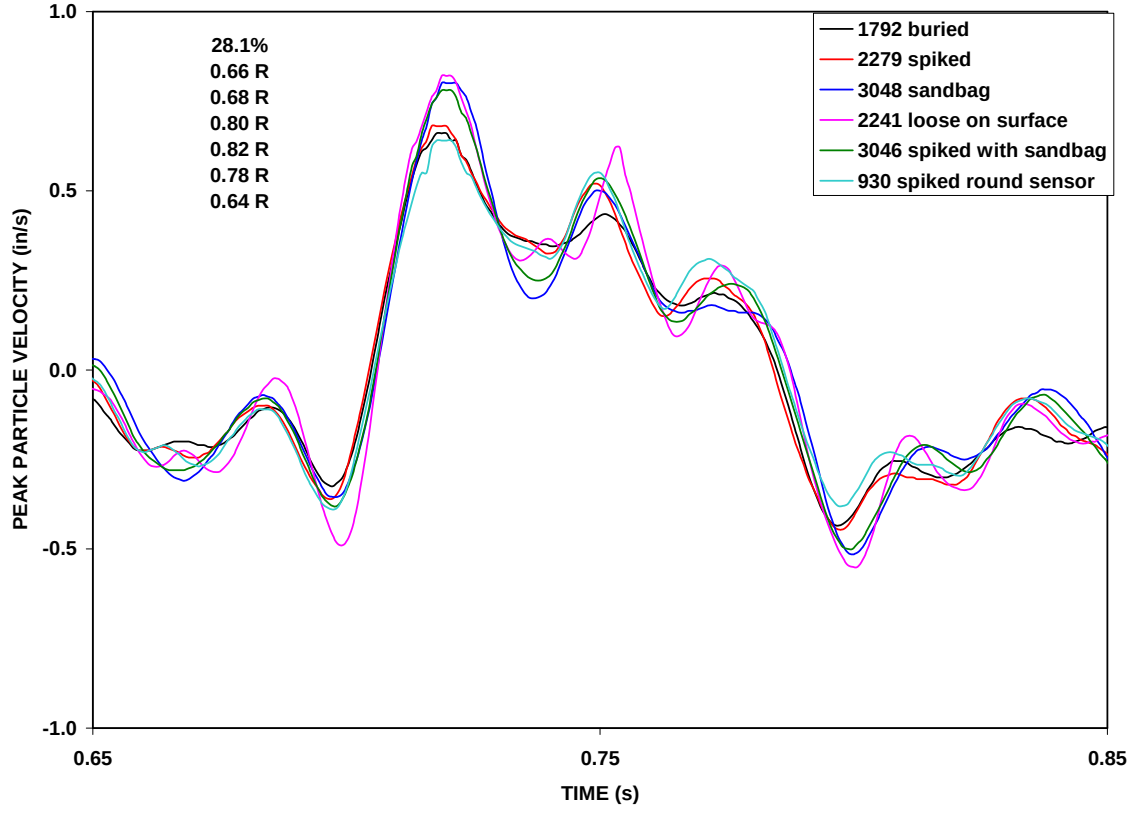

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.8
1.2
1.6


34.5%
0.420
0.460
0.565
0.495
0.485
0.465
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
21.2%
-0.265
-0.260
-0.315
-0.290
-0.315
-0.270
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.7
0.8
0.9
1
1.1


0.8
0.4
0.0
-0.4
-0.8
TRANSVERSE VELOCITY (in/s)
0.4
0.8
1.2
1.6
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

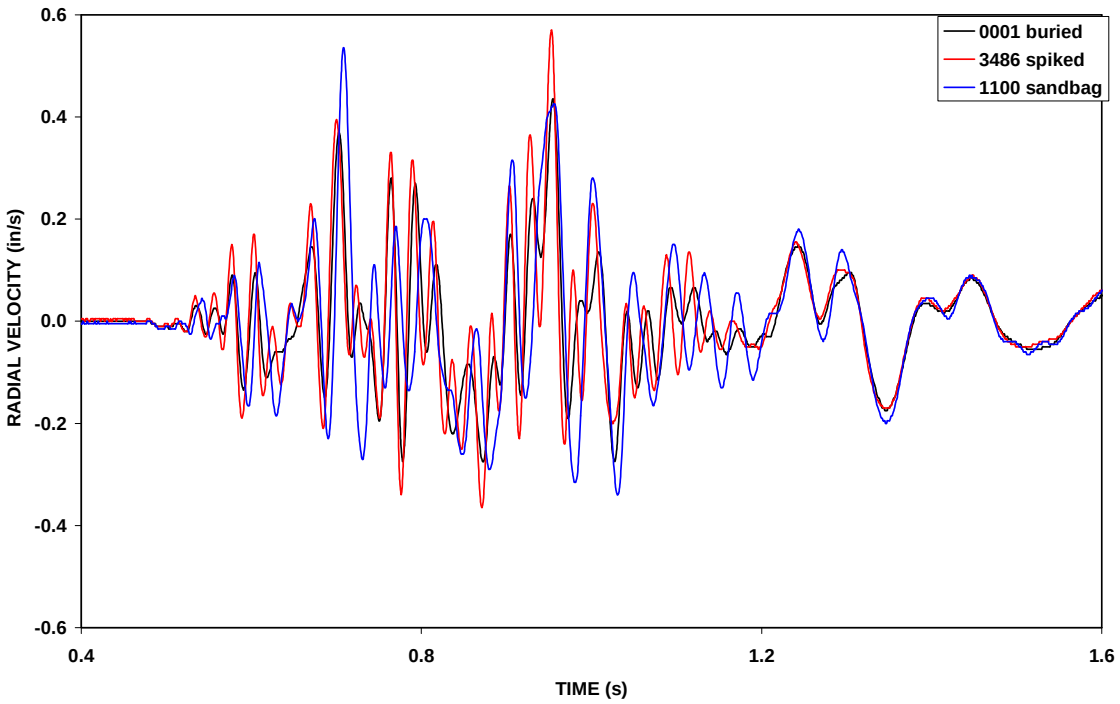

0.8
0.4
0.0
-0.4
-0.8
TRANSVERSE VELOCITY (in/s)
0.7
0.8
0.9
1.0
1.1
TIME (s)
48.5%
0.485
0.580
0.545
0.720
0.520
0.550
29.3%
-0.375
-0.410
-0.445
-0.485
-0.445
-0.390
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

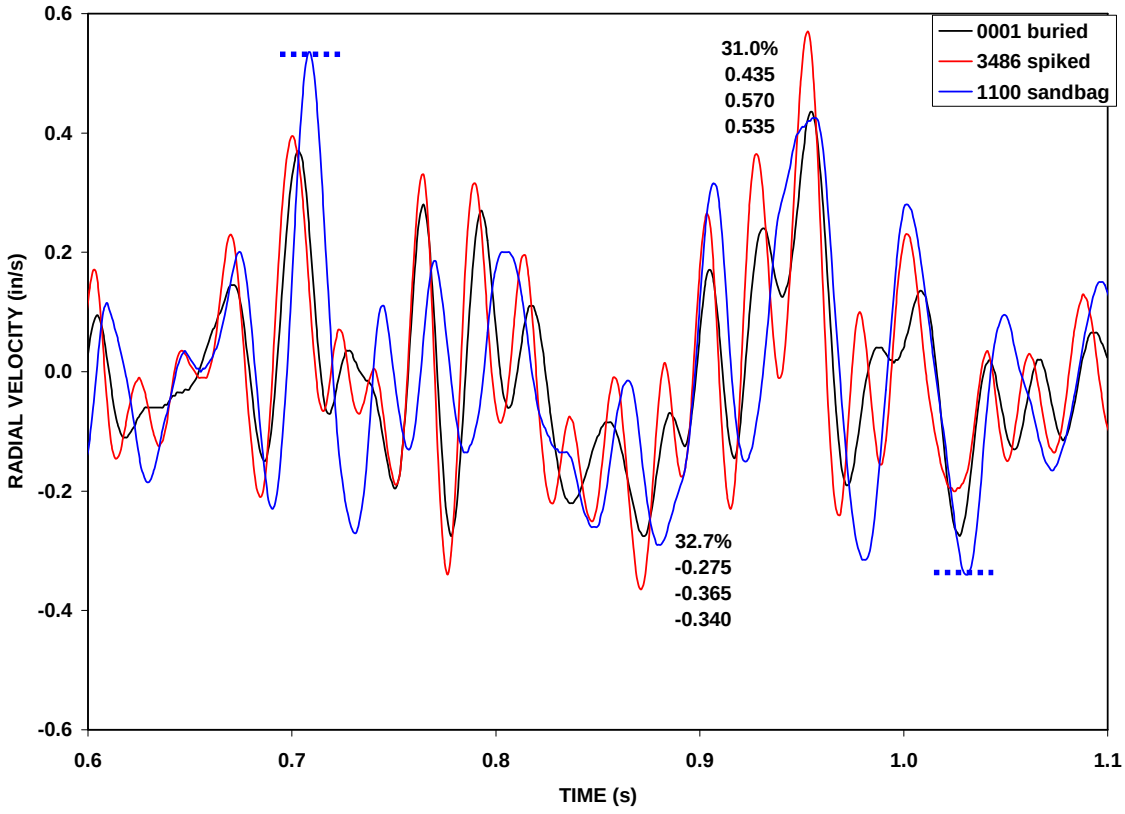

1.0
0.5
0.0
-0.5
-1.0
PEAK PARTICLE VELOCITY (in/s)
0.4
0.6
0.8
1
1.2
1.4
1.6
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

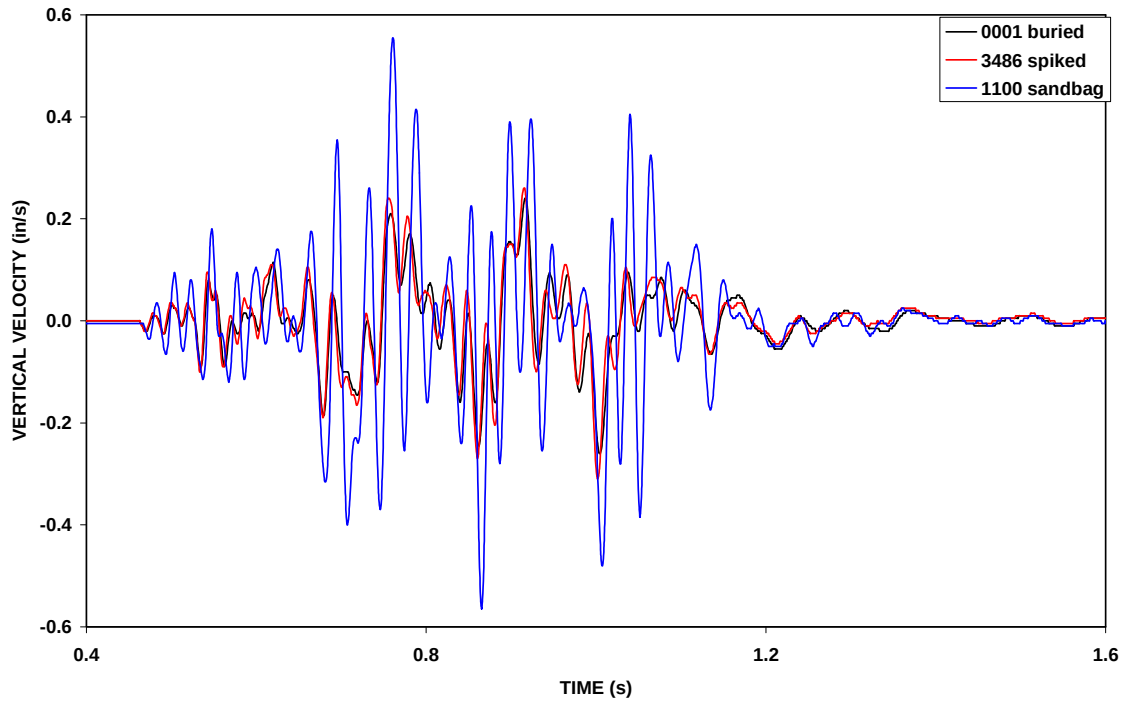

1.0
0.5
0.0
-0.5
-1.0
PEAK PARTICLE VELOCITY (in/s)
0.65
0.75
0.85
TIME (s)
28.1%
0.66 R
0.68 R
0.80 R
0.82 R
0.78 R
0.64 R
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

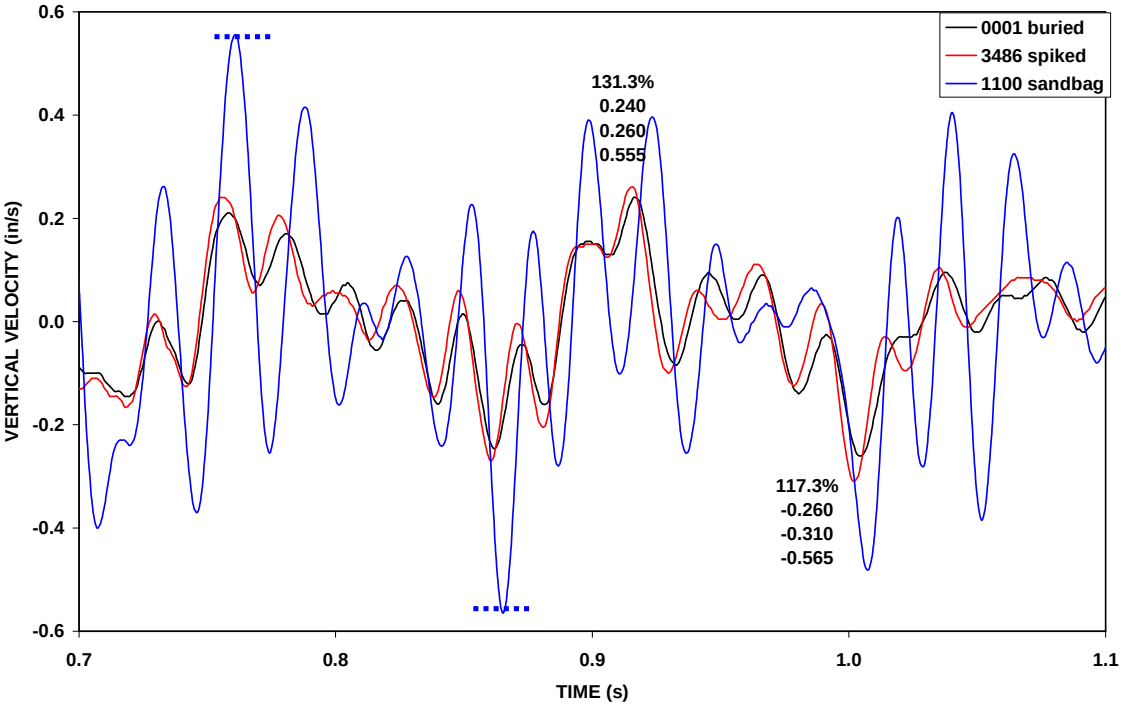
OH-2

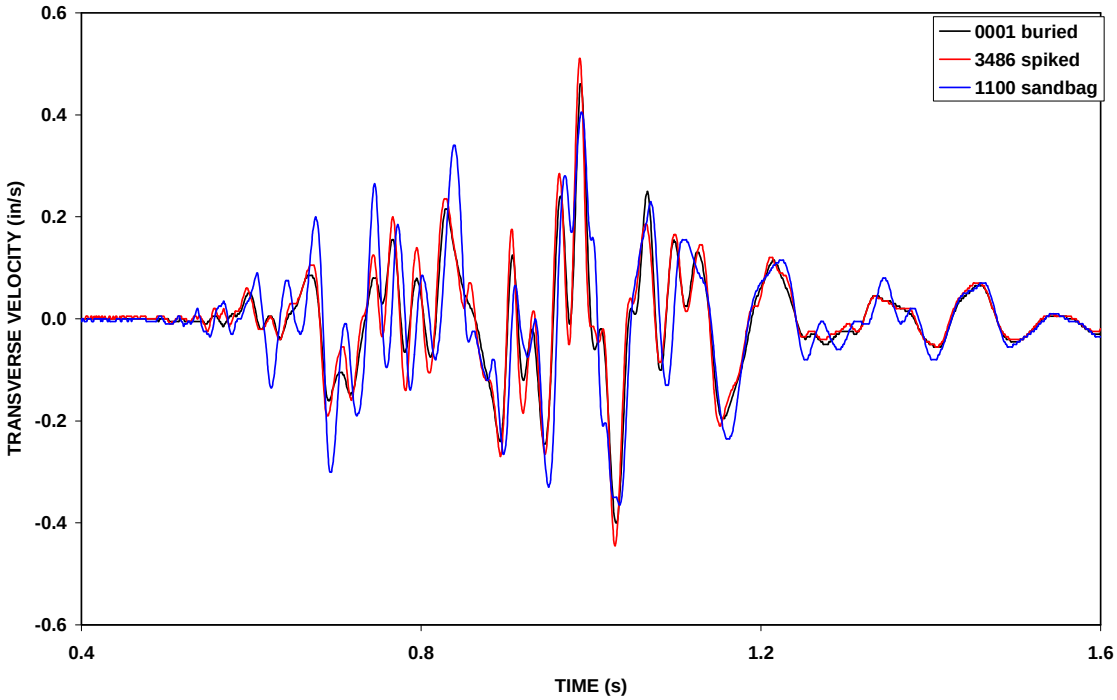
Cluster 3 SD 40.2 ft/lb$^{1/2}$

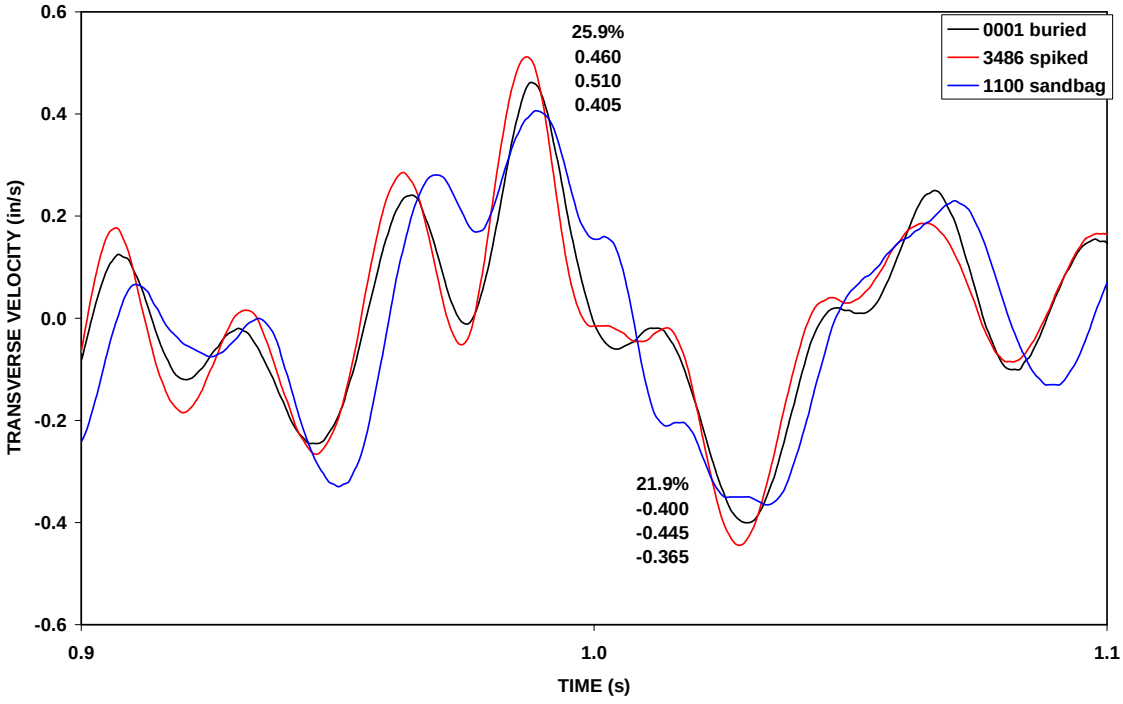

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.8
1.2
1.6


0001 buried
3486 spiked
1100 sandbag
31.0%
0.435
0.570
0.535
32.7%
-0.275
-0.365
-0.340
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.6
0.7
0.8
0.9
1.0
1.1


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.8
1.2
1.6

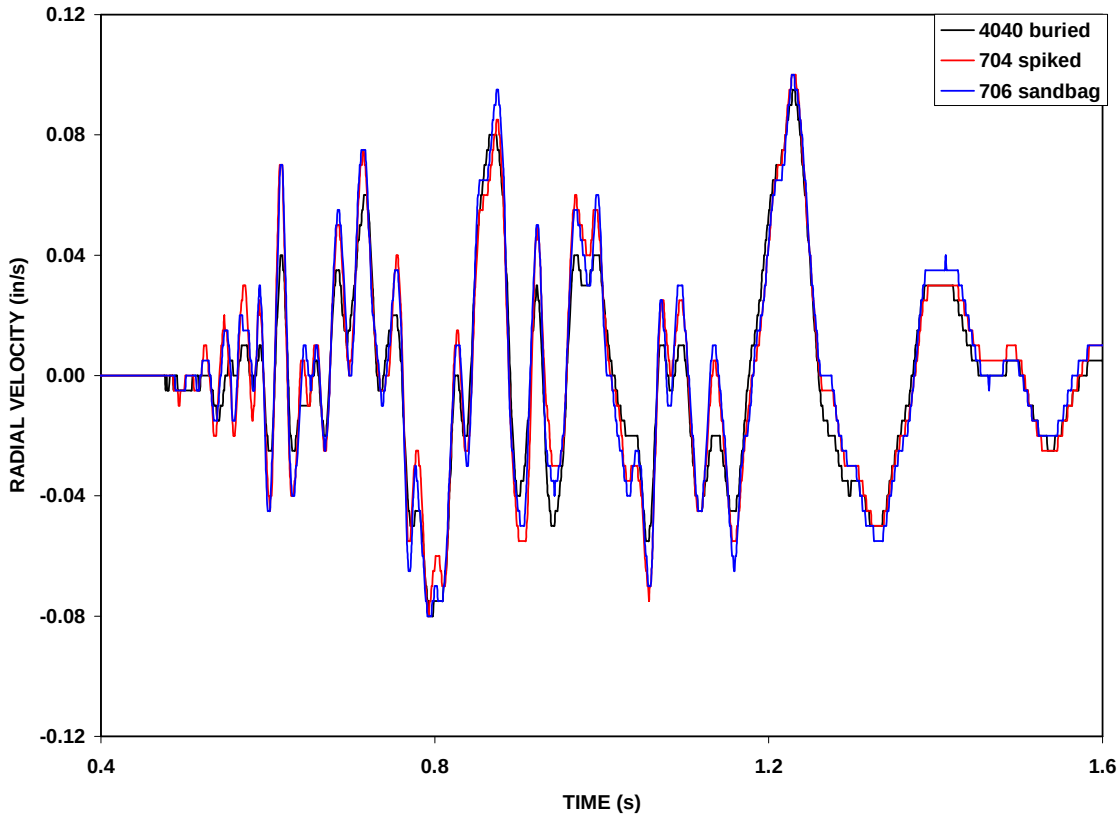

0001 buried
3486 spiked
1100 sandbag
131.3%
0.240
0.260
0.555
117.3%
-0.260
-0.310
-0.565
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.7
0.8
0.9
1.0
1.1

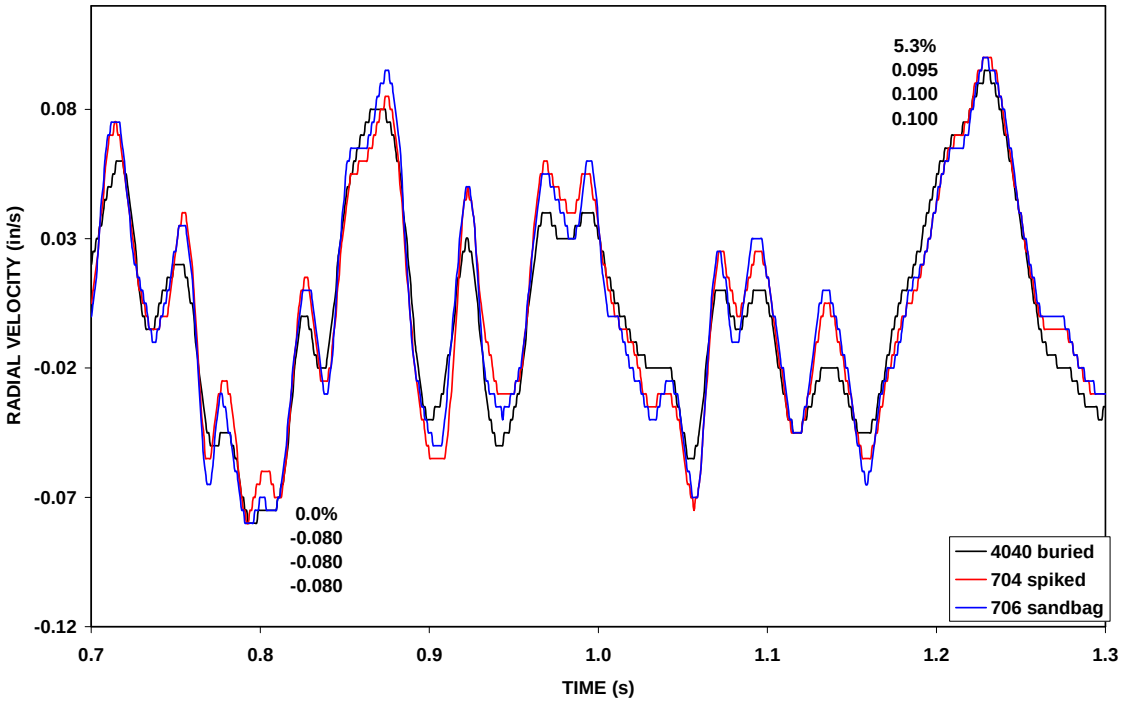

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.8
1.2
1.6
TIME (s)

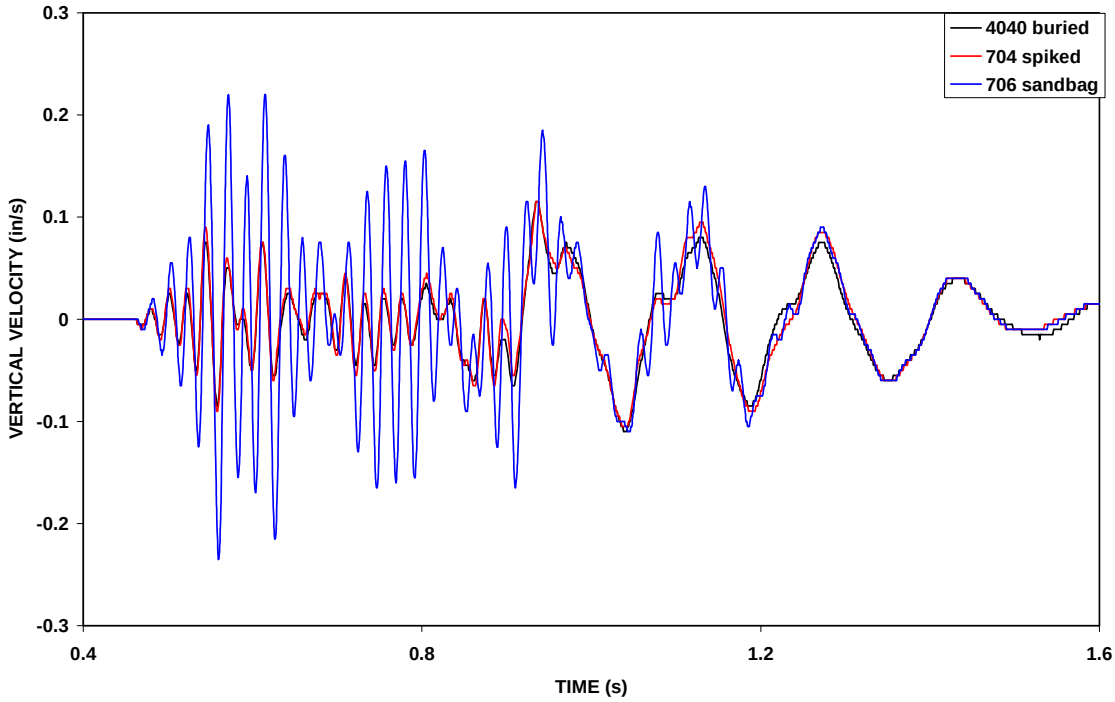

0001 buried
3486 spiked
1100 sandbag
25.9%
0.460
0.510
0.405
21.9%
-0.400
-0.445
-0.365
TRANSVERSE VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.9
1.0
1.1
TIME (s)

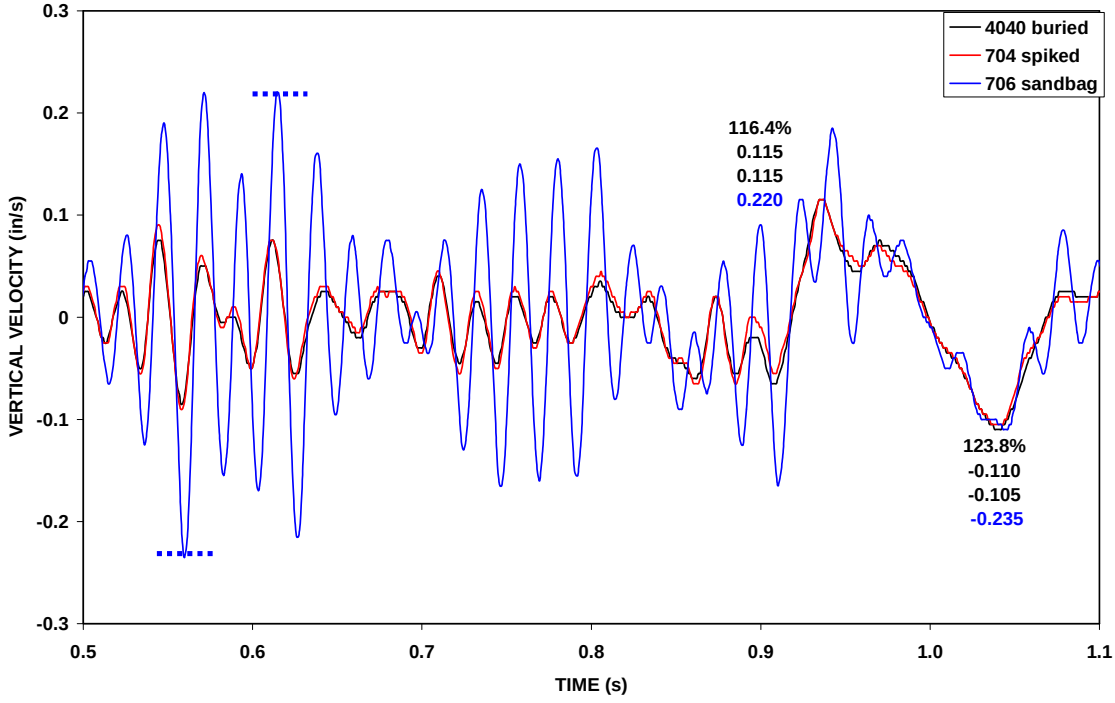
OH-2

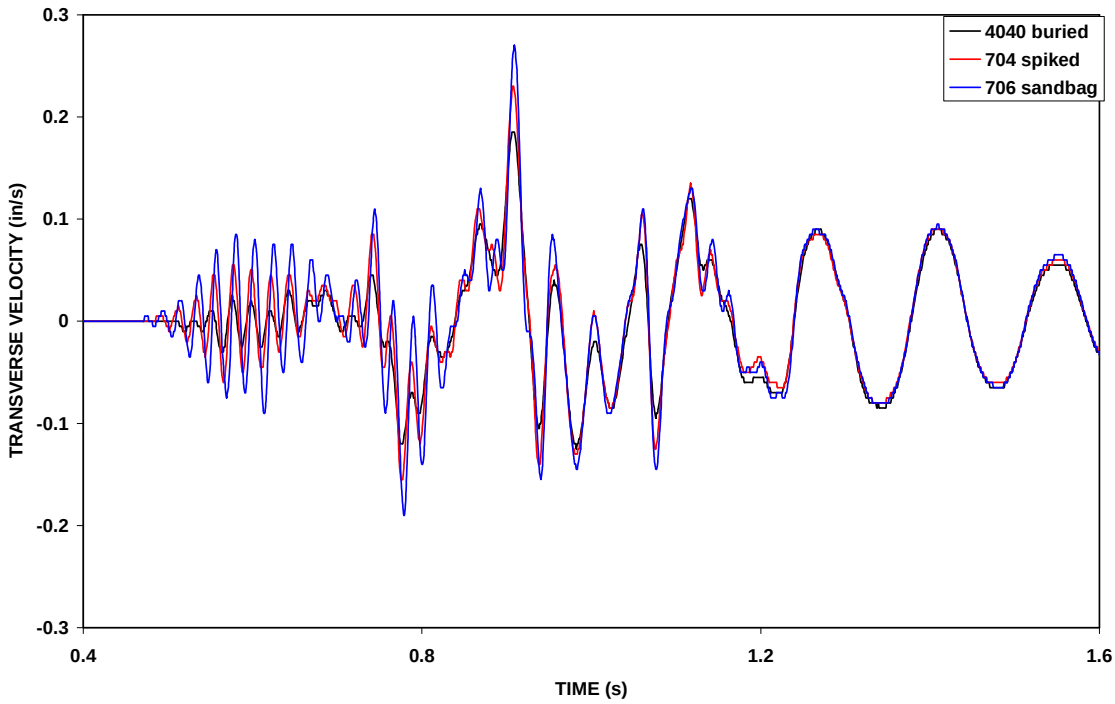
Cluster 4 SD 83.2 ft/lb$^{1/2}$

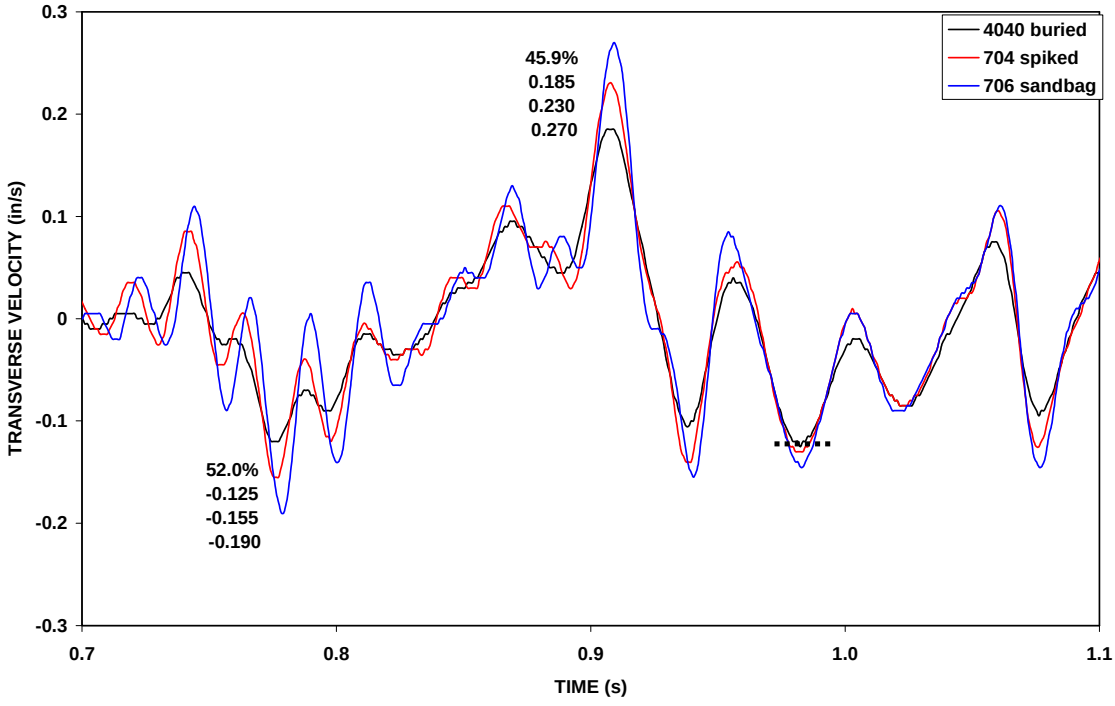

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.12
0.08
0.04
0.00
-0.04
-0.08
-0.12
0.4
0.8
1.2
1.6


5.3%
0.095
0.100
0.100
0.0%
-0.080
-0.080
-0.080
4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.08
0.03
-0.02
-0.07
-0.12
0.7
0.8
0.9
1.0
1.1
1.2
1.3


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0.4
0.8
1.2
1.6

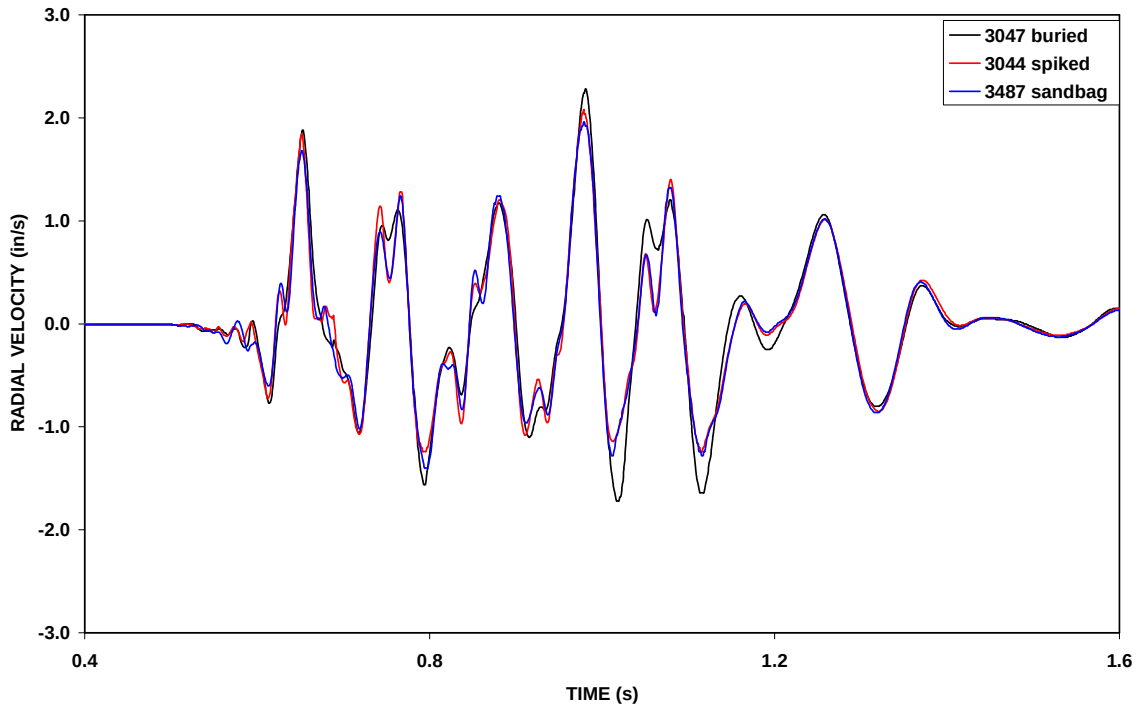

4040 buried
704 spiked
706 sandbag
116.4%
0.115
0.115
0.220
123.8%
-0.110
-0.105
-0.235
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0.5
0.6
0.7
0.8
0.9
1.0
1.1

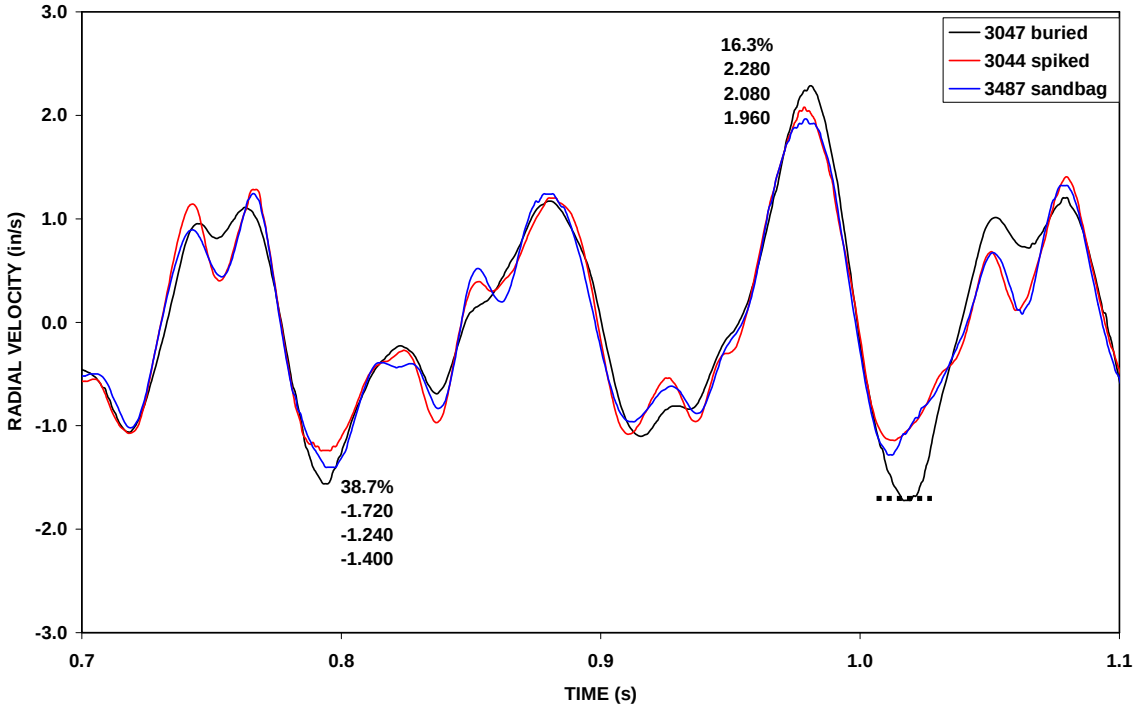

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0.4
0.8
1.2
1.6
TIME (s)

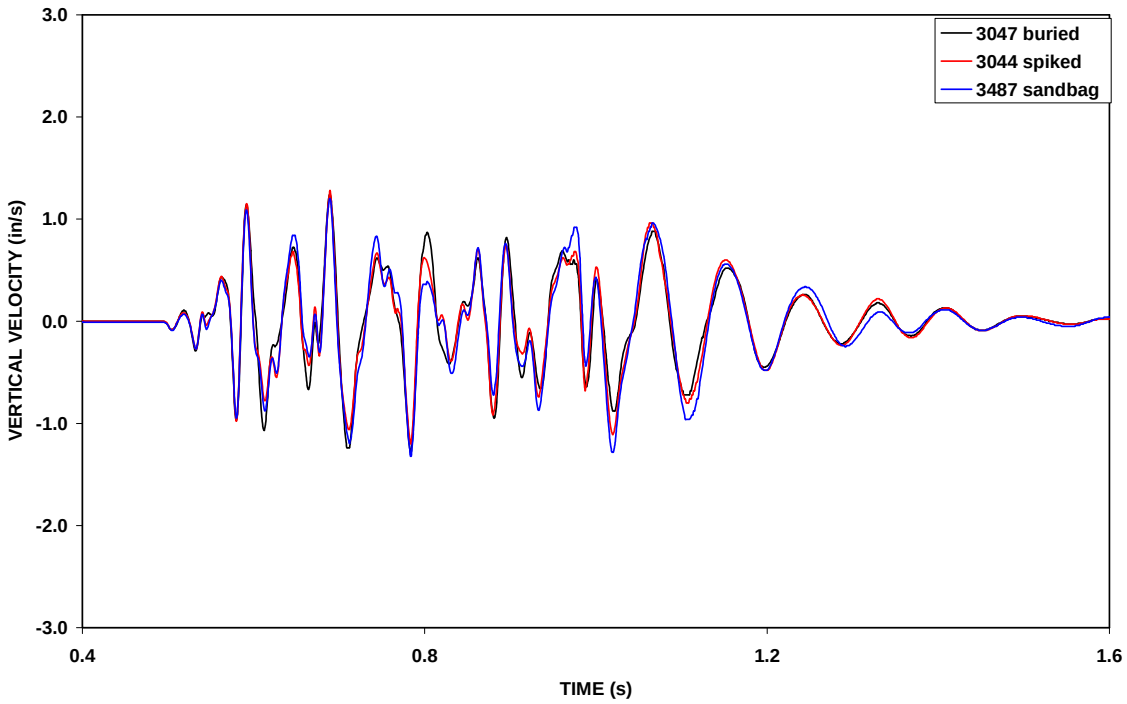

4040 buried
704 spiked
706 sandbag
45.9%
0.185
0.230
0.270
52.0%
-0.125
-0.155
-0.190
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0.7
0.8
0.9
1.0
1.1
TIME (s)

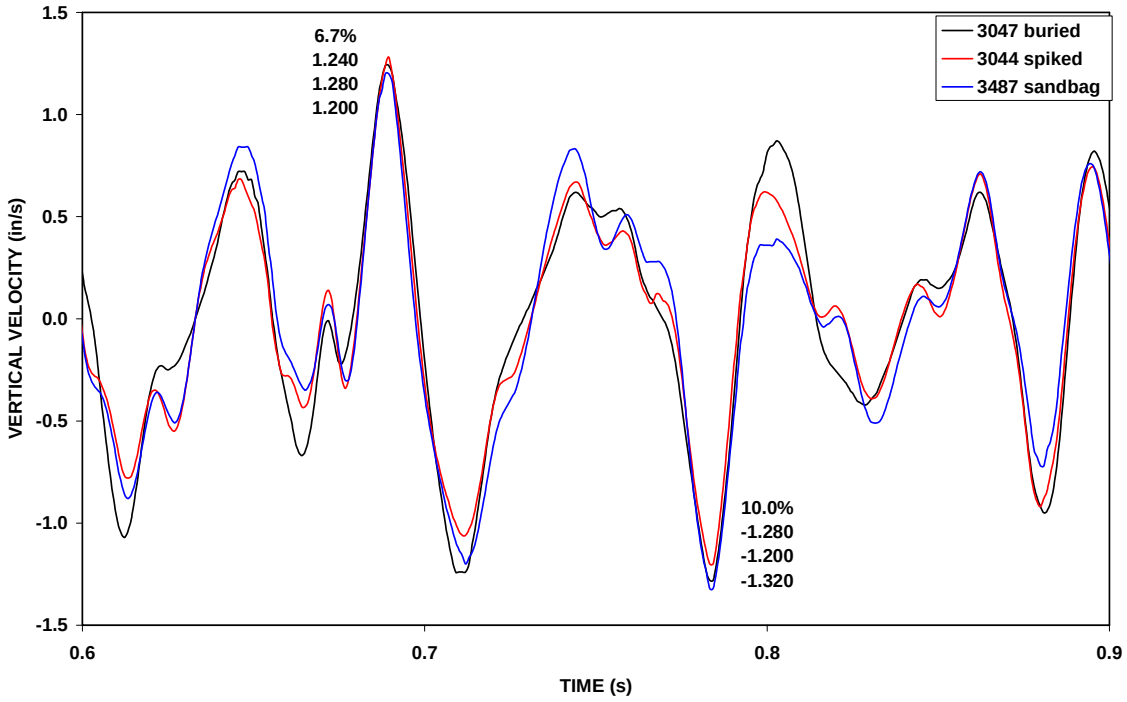
OH-3

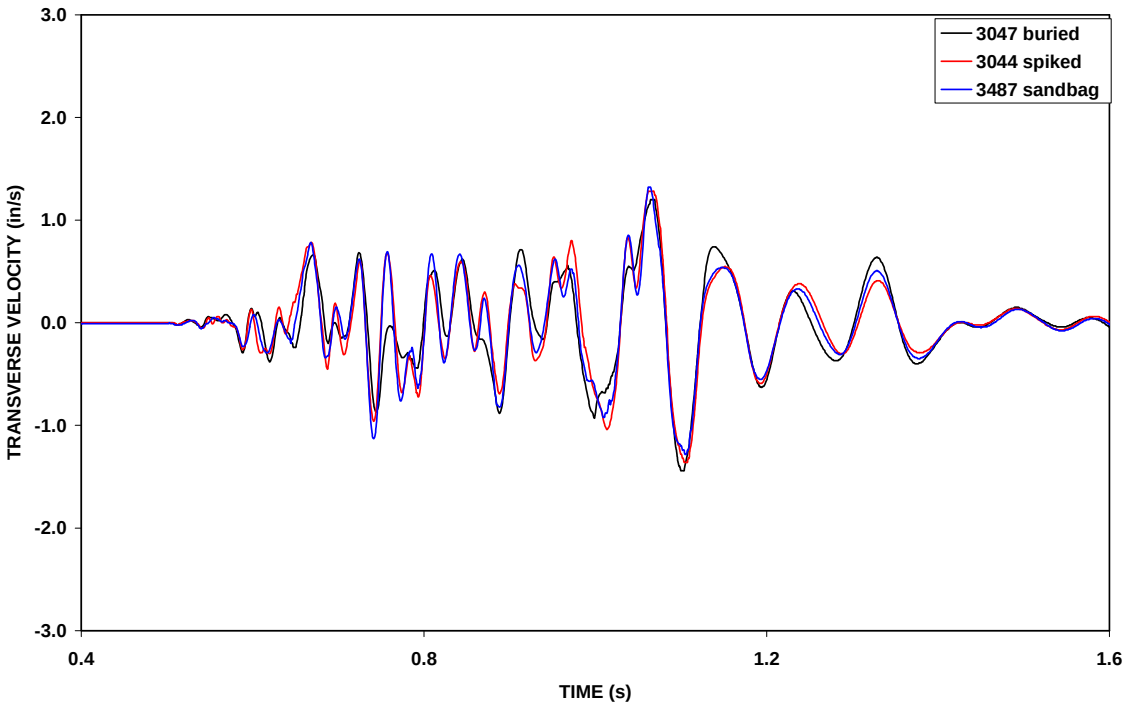
Cluster 1 SD 15.4 ft/lb$^{1/2}$

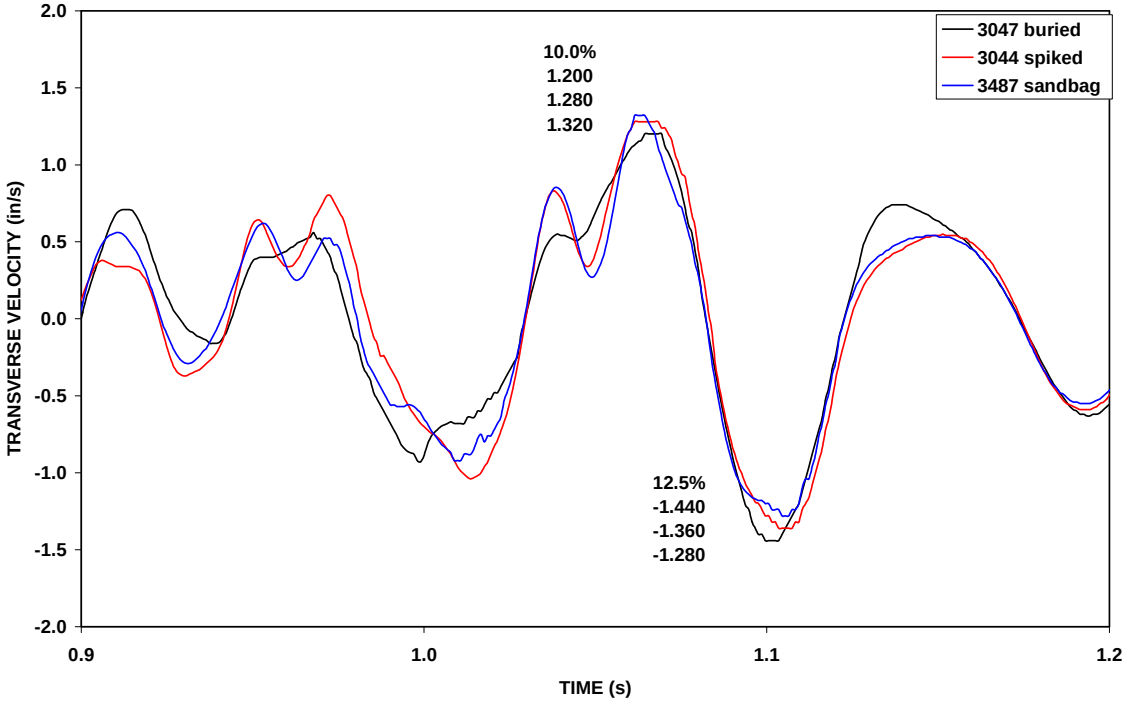

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6


3047 buried
3044 spiked
3487 sandbag
16.3%
2.280
2.080
1.960
38.7%
-1.720
-1.240
-1.400
RADIAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.7
0.8
0.9
1.0
1.1


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6

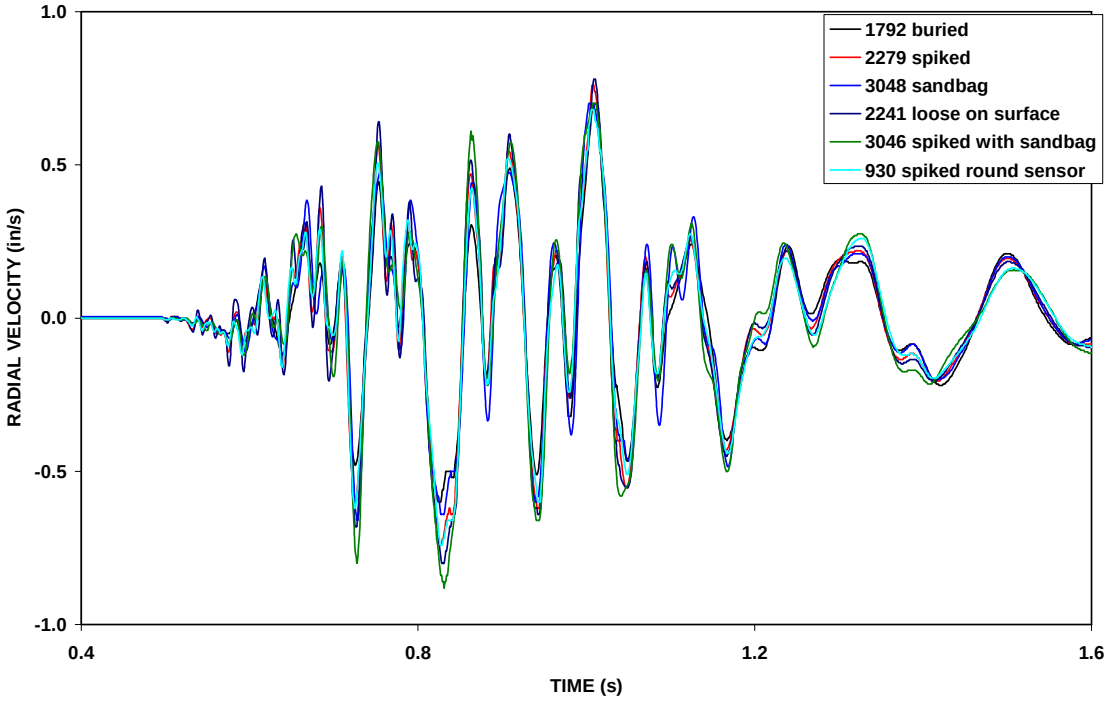

3047 buried
3044 spiked
3487 sandbag
6.7%
1.240
1.280
1.200
10.0%
-1.280
-1.200
-1.320
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.6
0.7
0.8
0.9

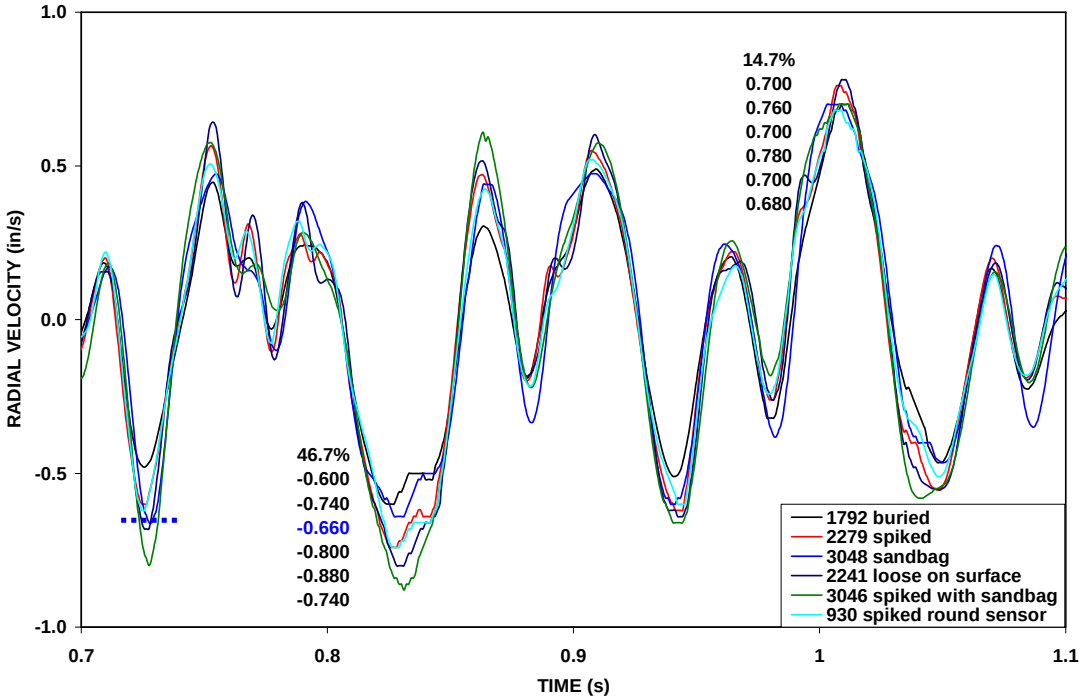

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6

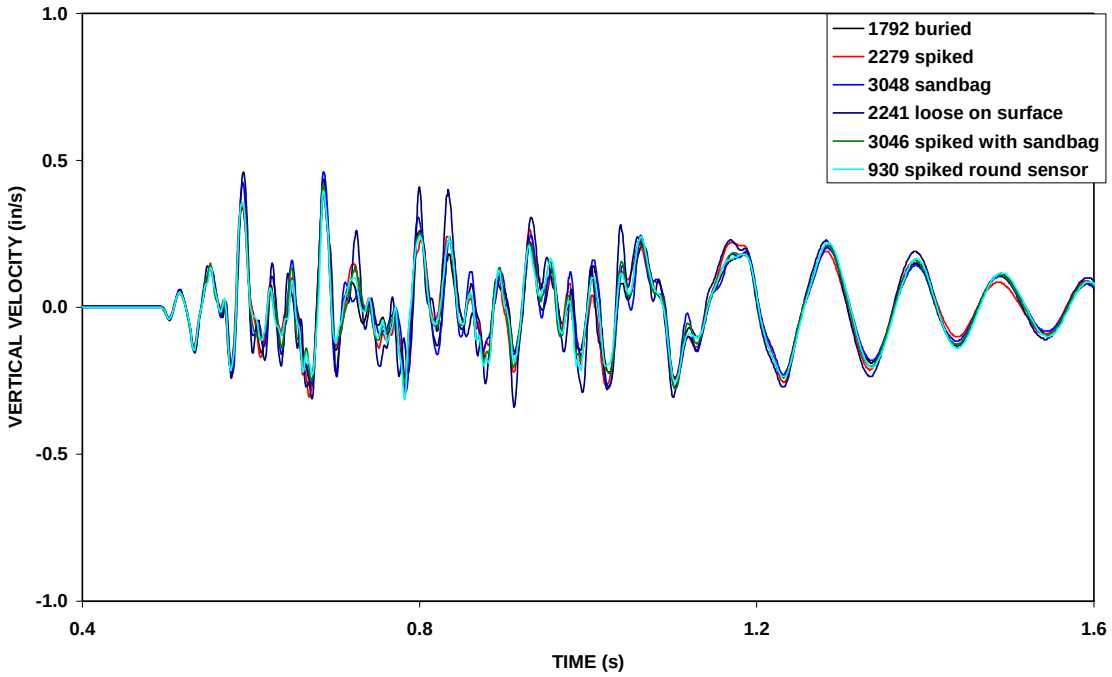

3047 buried
3044 spiked
3487 sandbag
10.0%
1.200
1.280
1.320
12.5%
-1.440
-1.360
-1.280
TRANSVERSE VELOCITY (in/s)
TIME (s)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0.9
1.0
1.1
1.2

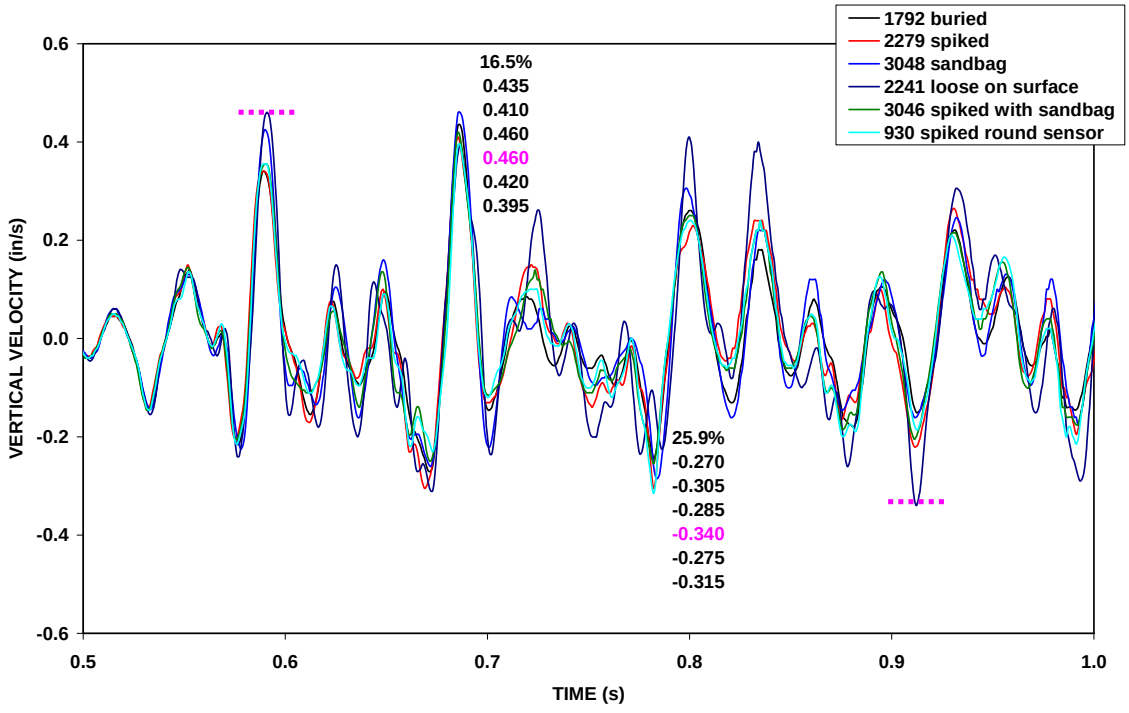
OH-3

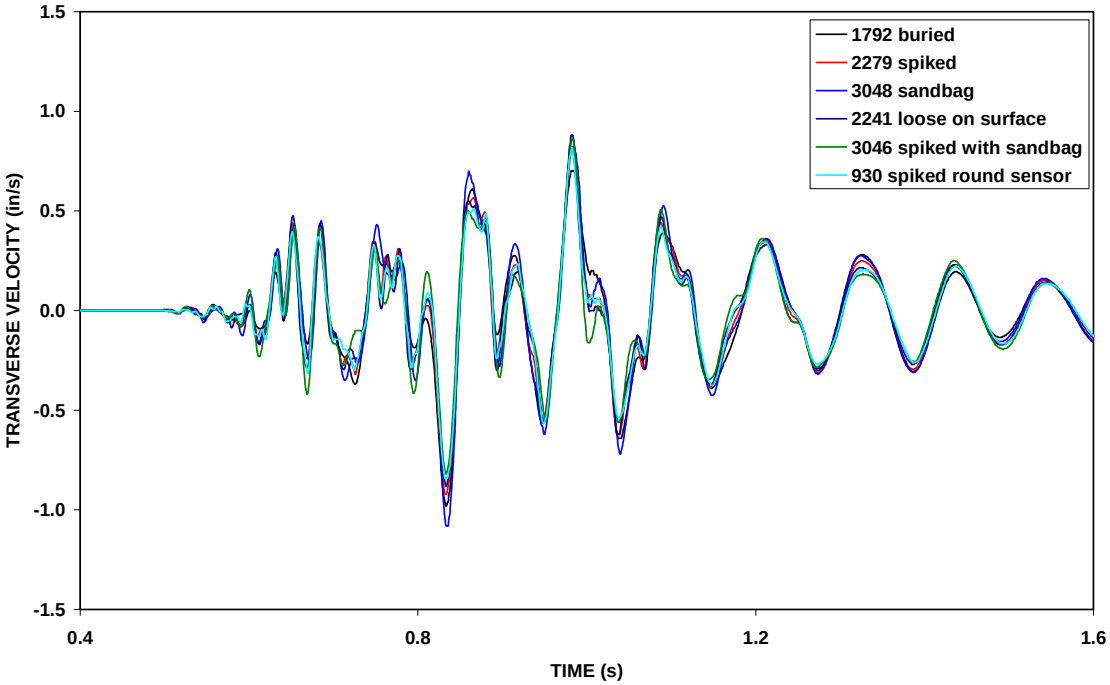
Cluster 2 SD 30.8 ft/lb$^{1/2}$

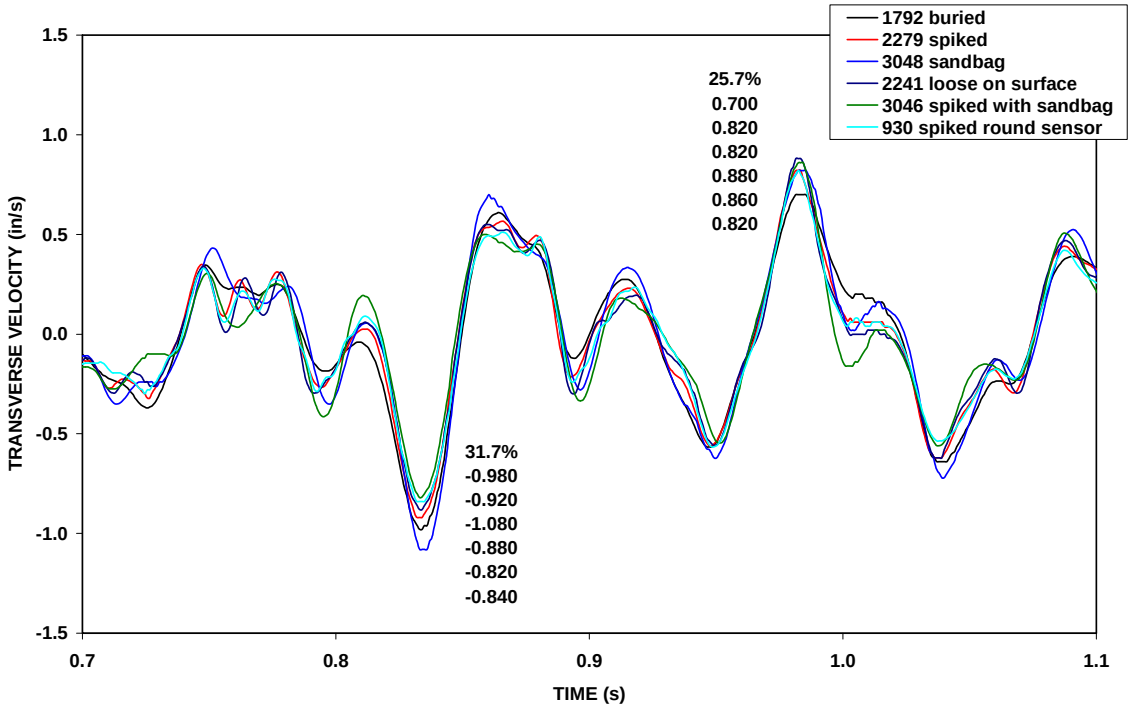

1.0
0.5
0.0
-0.5
-1.0
RADIAL VELOCITY (in/s)
0.4
0.8
1.2
1.6
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

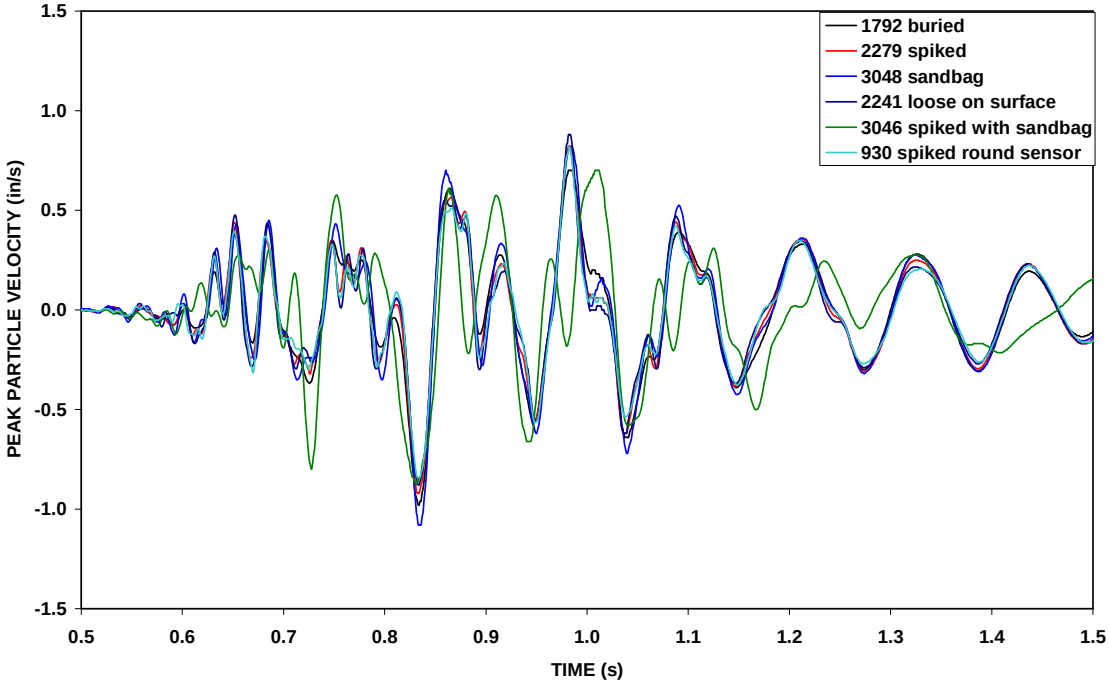

1.0
0.5
0.0
-0.5
-1.0
RADIAL VELOCITY (in/s)
0.7
0.8
0.9
1
1.1
TIME (s)
14.7%
0.700
0.760
0.700
0.780
0.700
0.680
46.7%
-0.600
-0.740
-0.660
-0.800
-0.880
-0.740
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

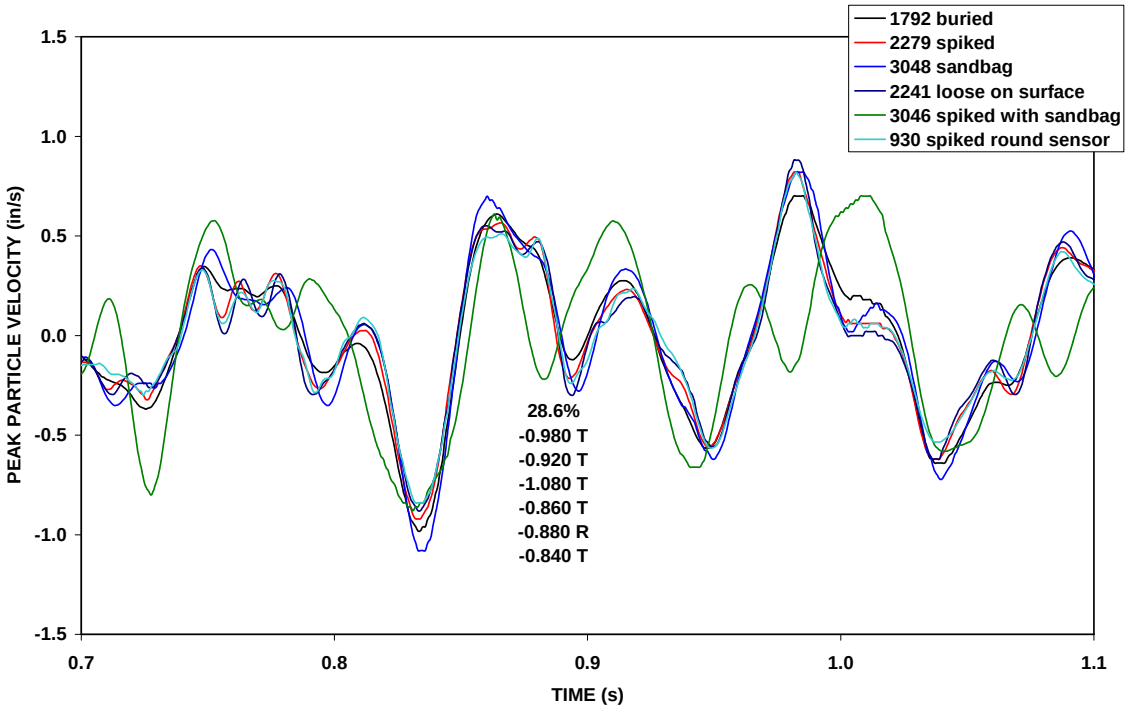

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.8
1.2
1.6
TIME (s)


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
16.5%
0.435
0.410
0.460
0.460
0.420
0.395
25.9%
-0.270
-0.305
-0.285
-0.340
-0.275
-0.315
VERTICAL VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.5
0.6
0.7
0.8
0.9
1.0
TIME (s)


1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
TRANSVERSE VELOCITY (in/s)
0.4
0.8
1.2
1.6
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

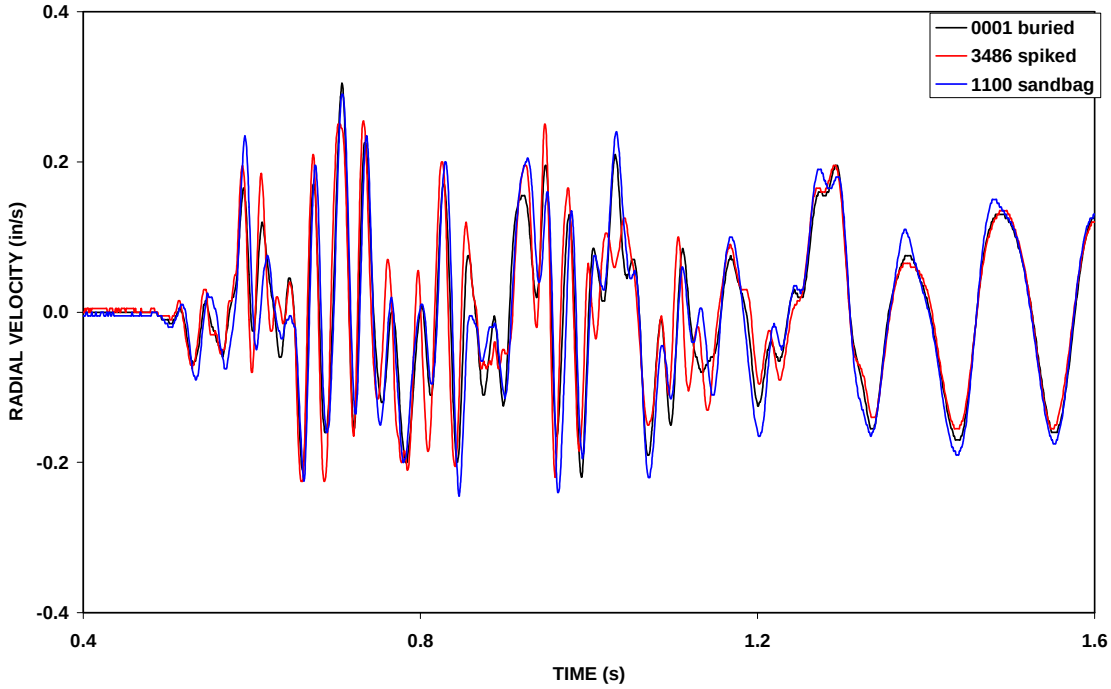

1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
TRANSVERSE VELOCITY (in/s)
0.7
0.8
0.9
1.0
1.1
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
25.7%
0.700
0.820
0.820
0.880
0.860
0.820
31.7%
-0.980
-0.920
-1.080
-0.880
-0.820
-0.840

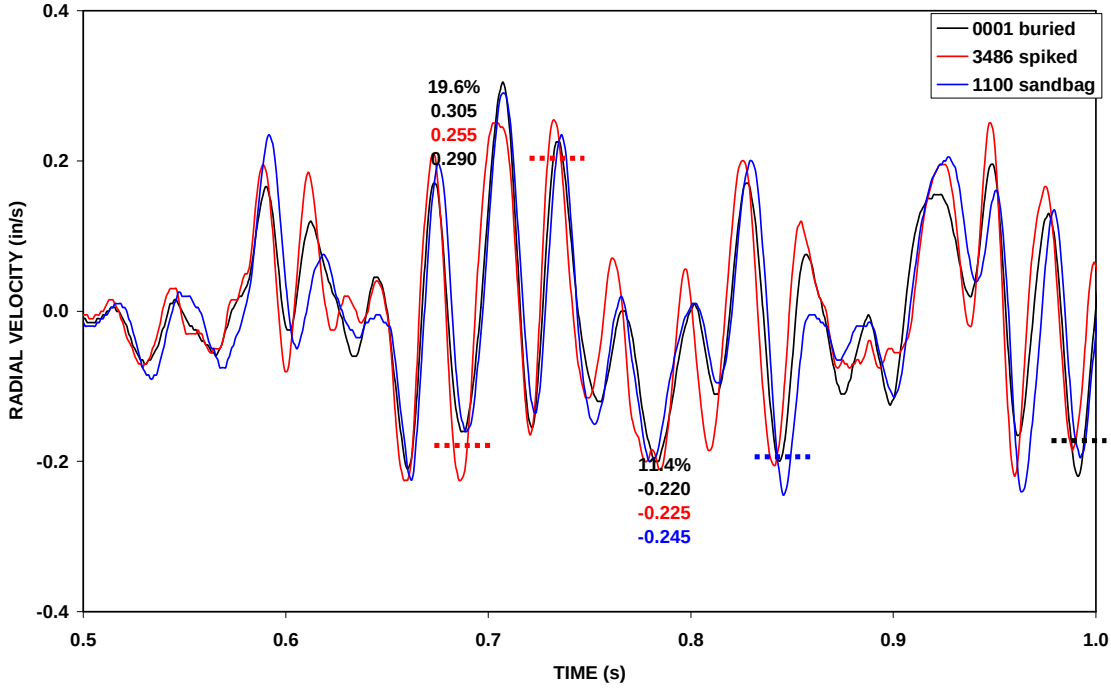

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
TIME (s)

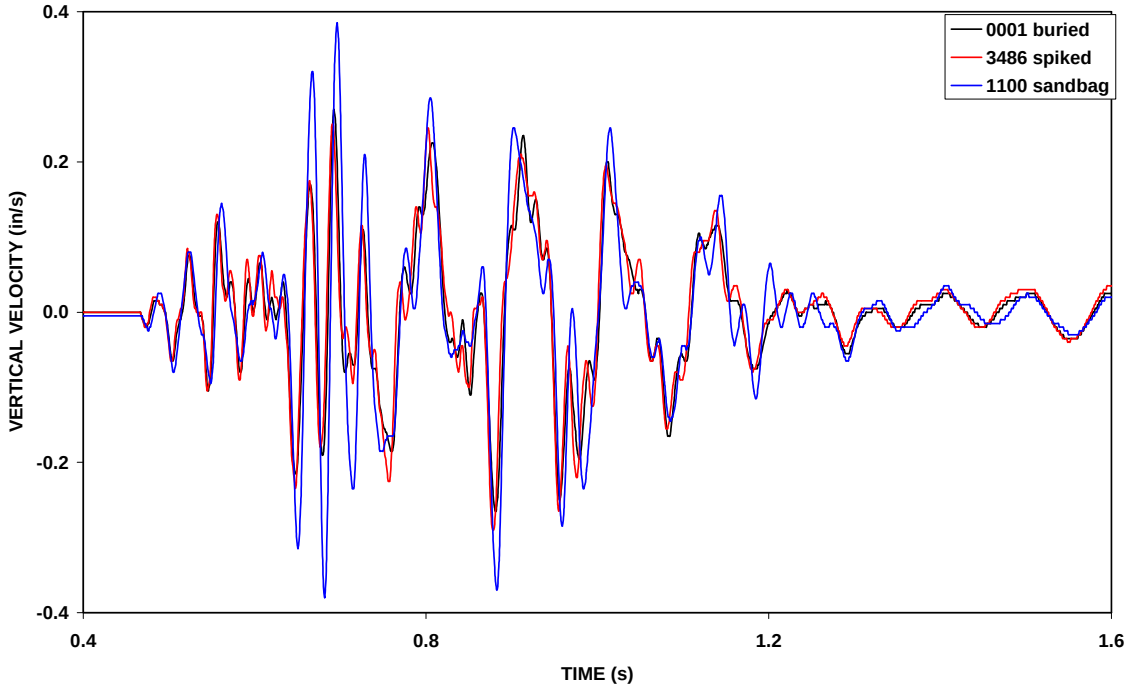

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
28.6%
-0.980 T
-0.920 T
-1.080 T
-0.860 T
-0.880 R
-0.840 T
0.7
0.8
0.9
1.0
1.1
TIME (s)

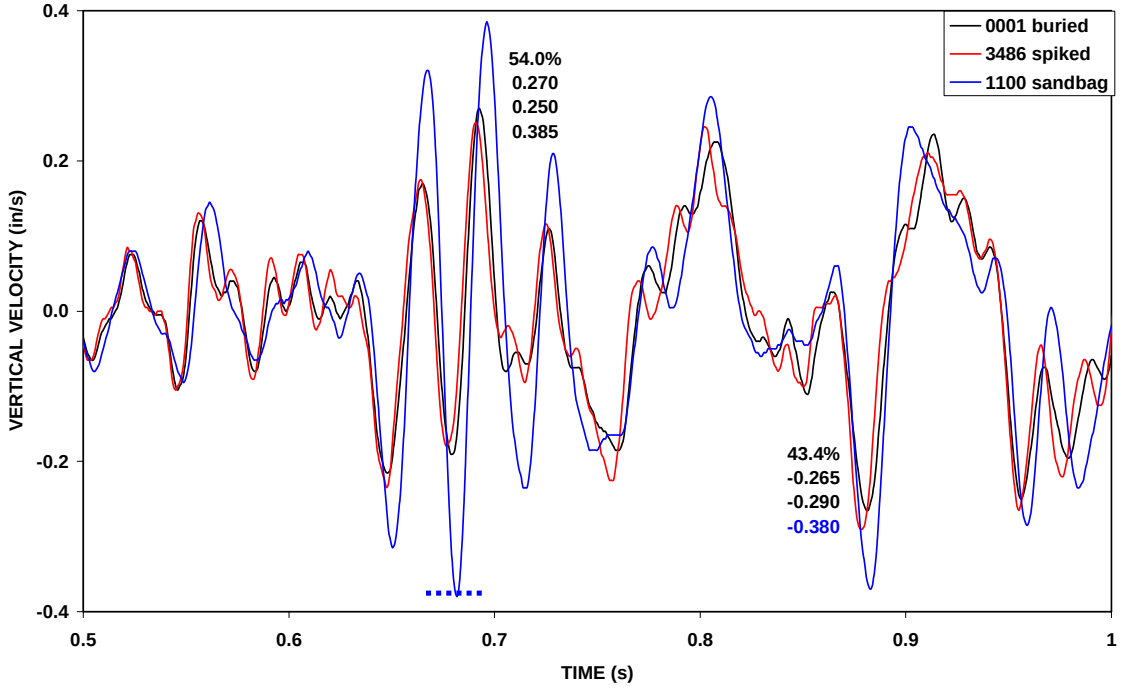
OH-3

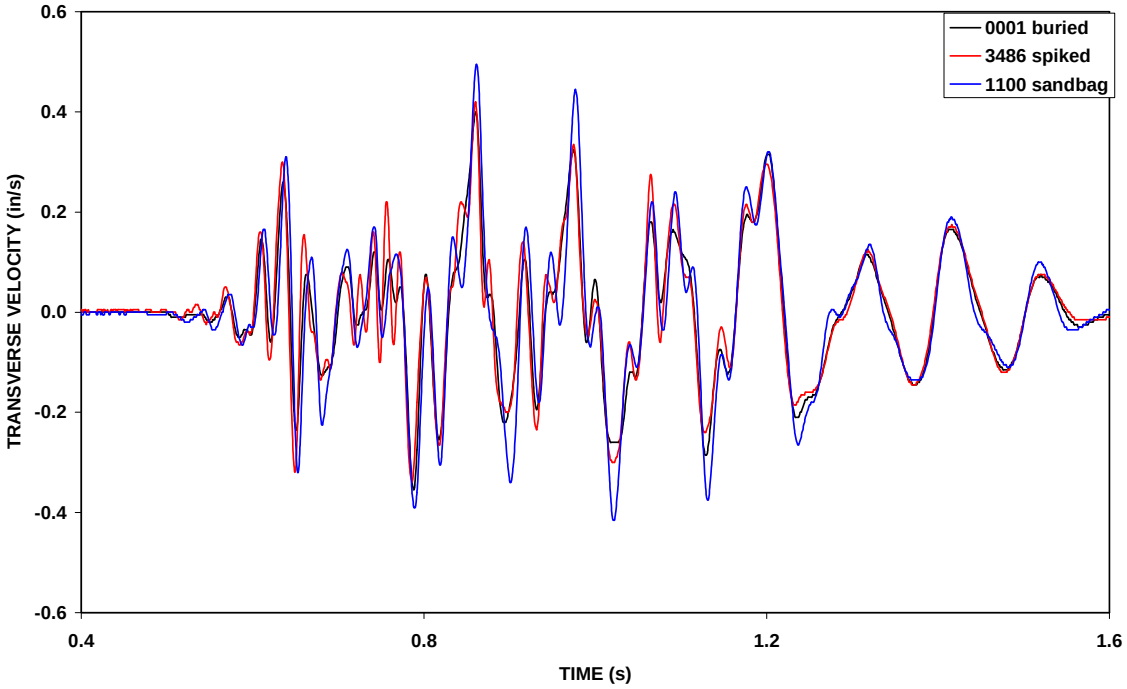
Cluster 3 SD 46.2 ft/lb$^{1/2}$

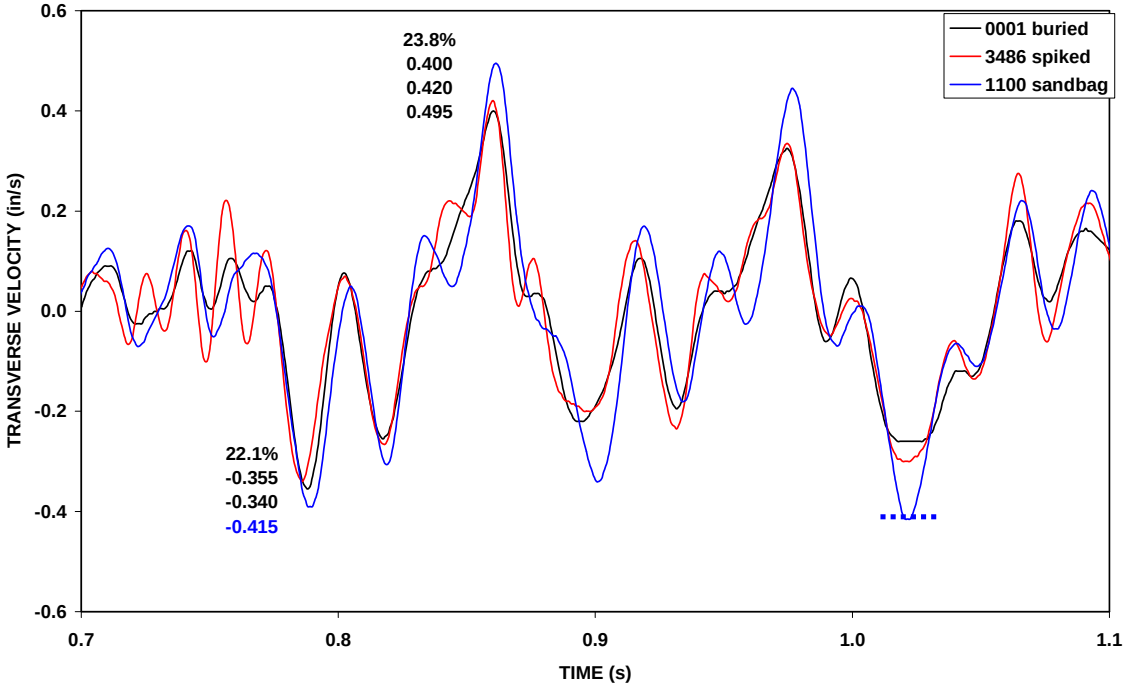

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6


0001 buried
3486 spiked
1100 sandbag
19.6%
0.305
0.255
0.290
11.4%
-0.220
-0.225
-0.245
RADIAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.5
0.6
0.7
0.8
0.9
1.0


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6
TIME (s)

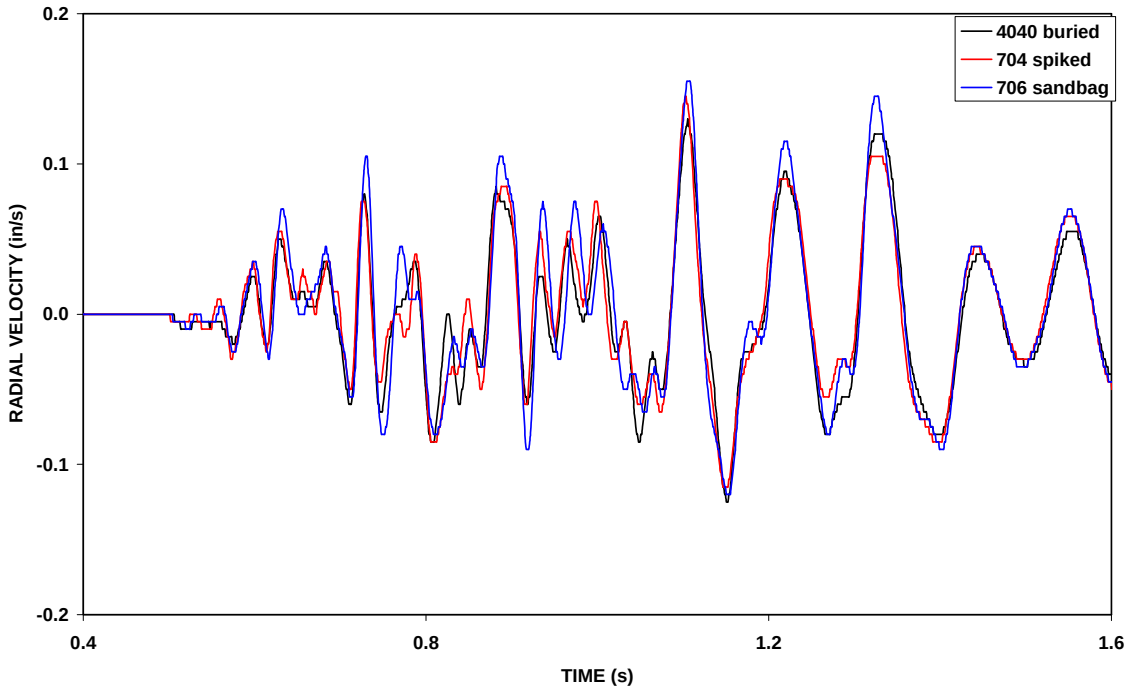

0001 buried
3486 spiked
1100 sandbag
54.0%
0.270
0.250
0.385
43.4%
-0.265
-0.290
-0.380
VERTICAL VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.5
0.6
0.7
0.8
0.9
1
TIME (s)

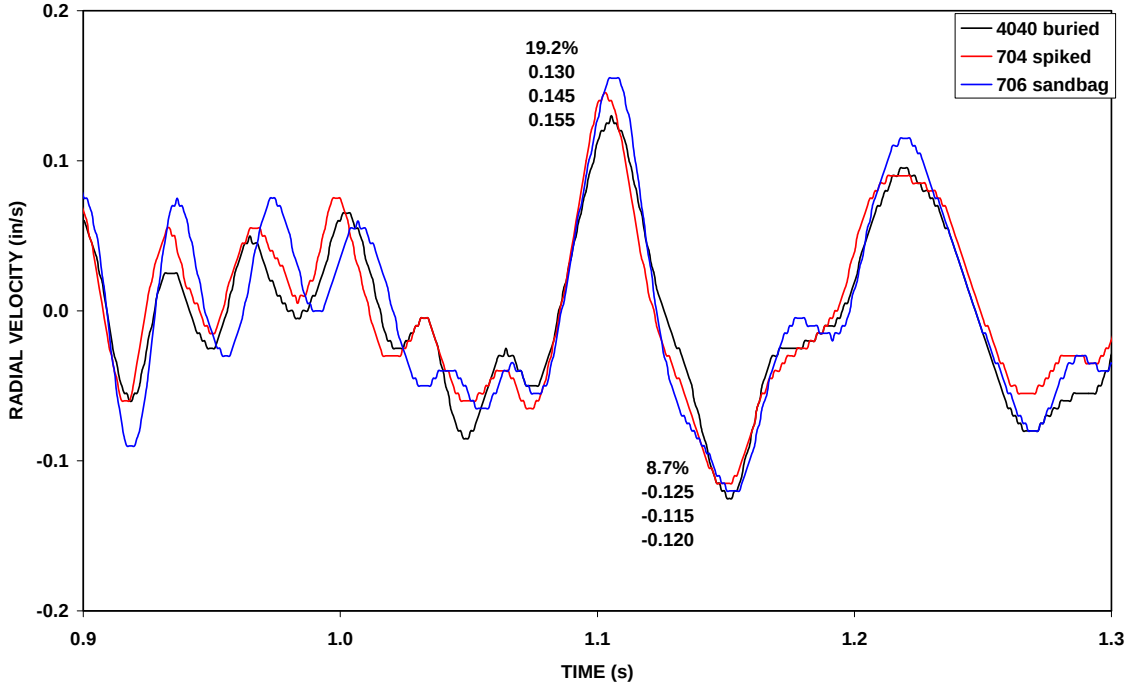

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.8
1.2
1.6
TIME (s)

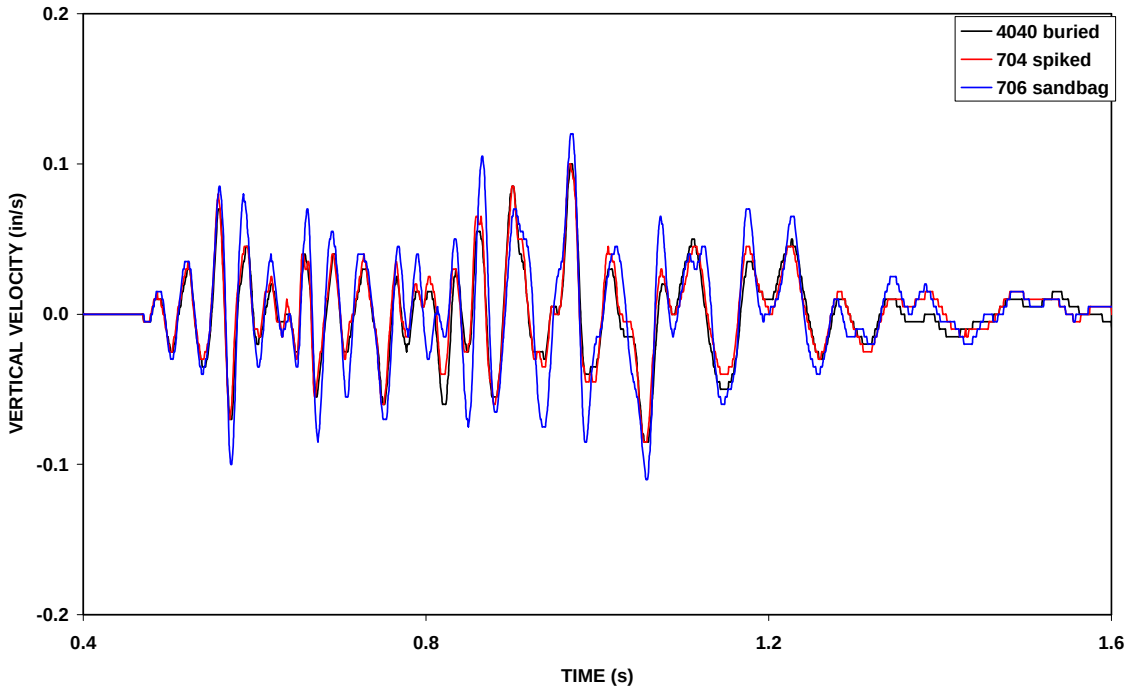

0001 buried
3486 spiked
1100 sandbag
23.8%
0.400
0.420
0.495
22.1%
-0.355
-0.340
-0.415
TRANSVERSE VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.7
0.8
0.9
1.0
1.1
TIME (s)

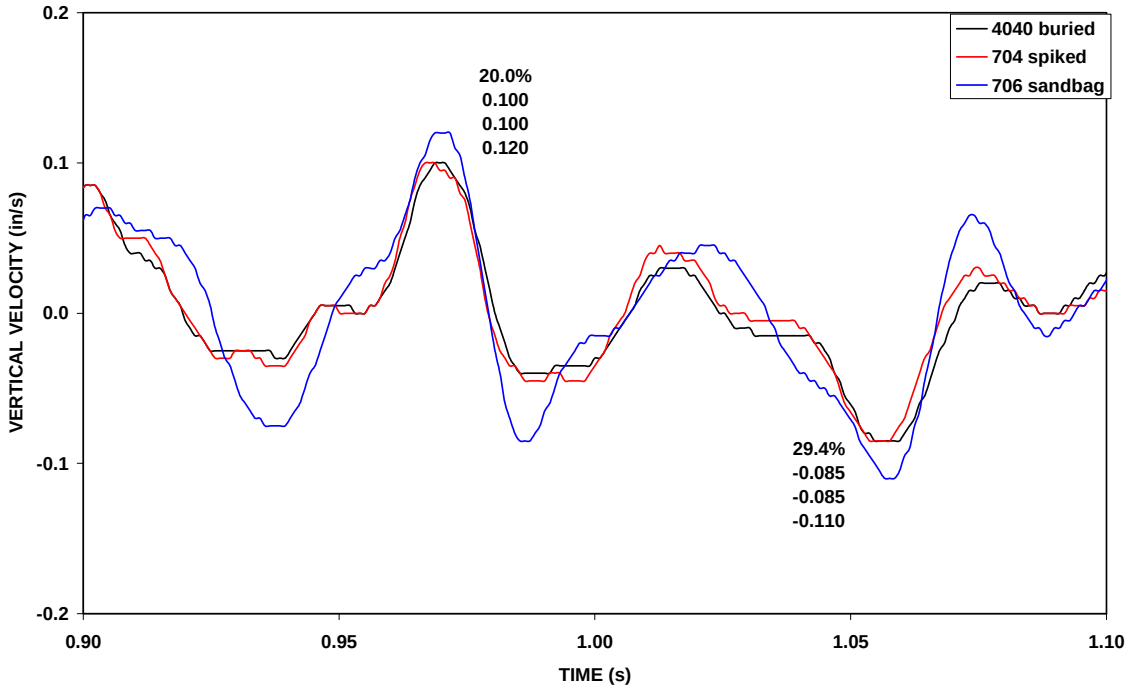
OH-3

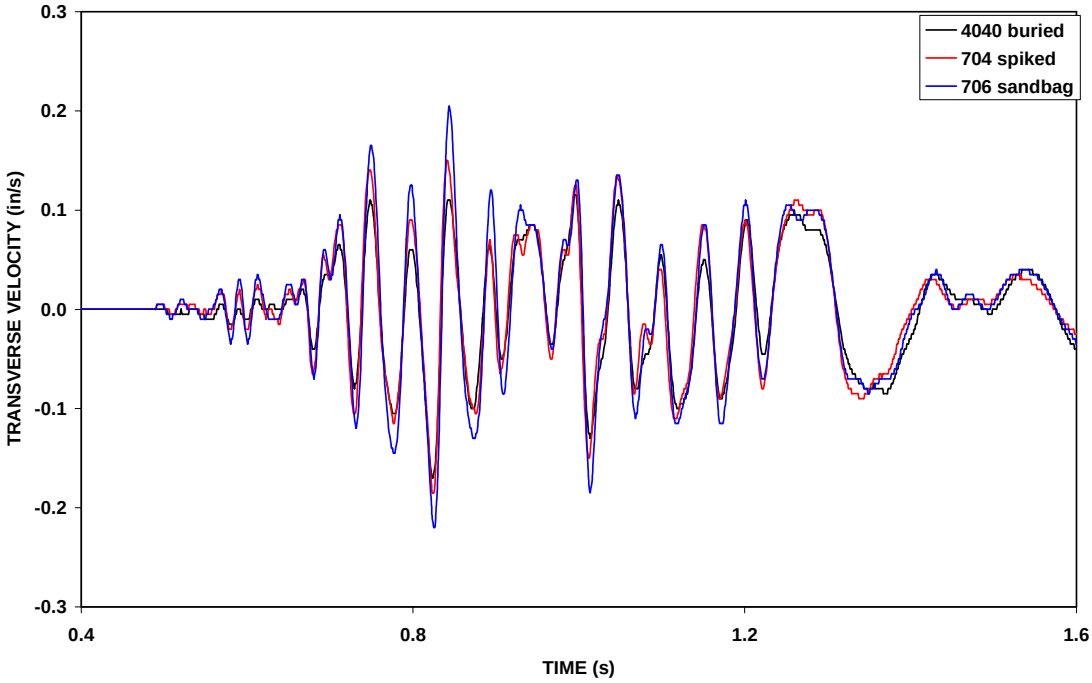
Cluster 4 SD 95.4 ft/lb$^{1/2}$

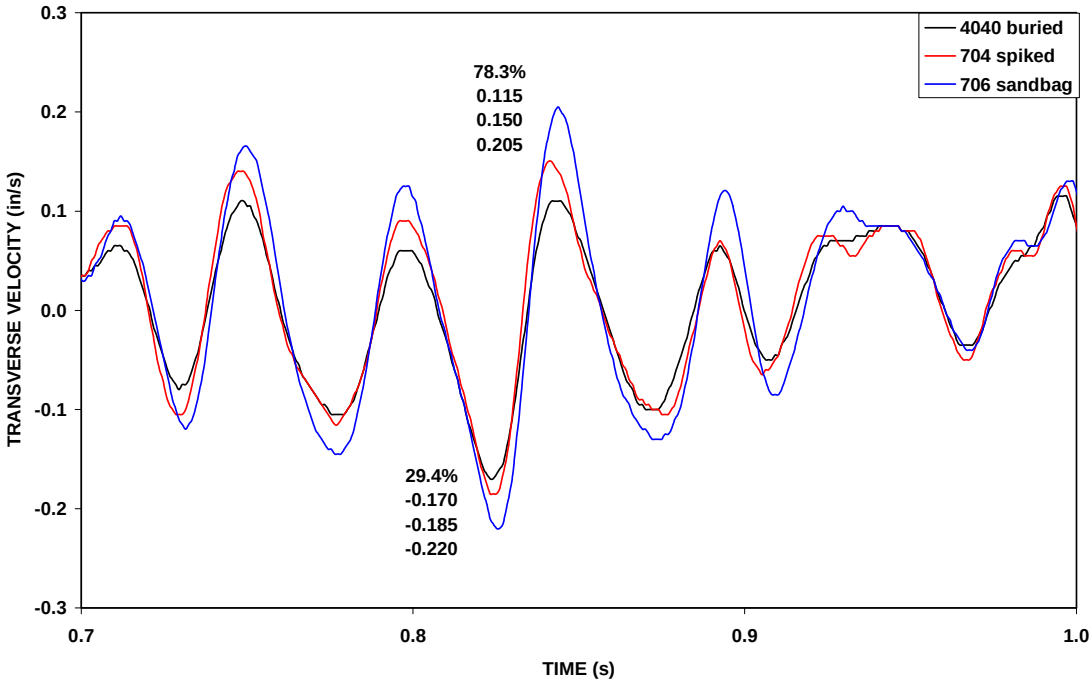

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.8
1.2
1.6


4040 buried
704 spiked
706 sandbag
19.2%
0.130
0.145
0.155
8.7%
-0.125
-0.115
-0.120
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.9
1.0
1.1
1.2
1.3


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.8
1.2
1.6

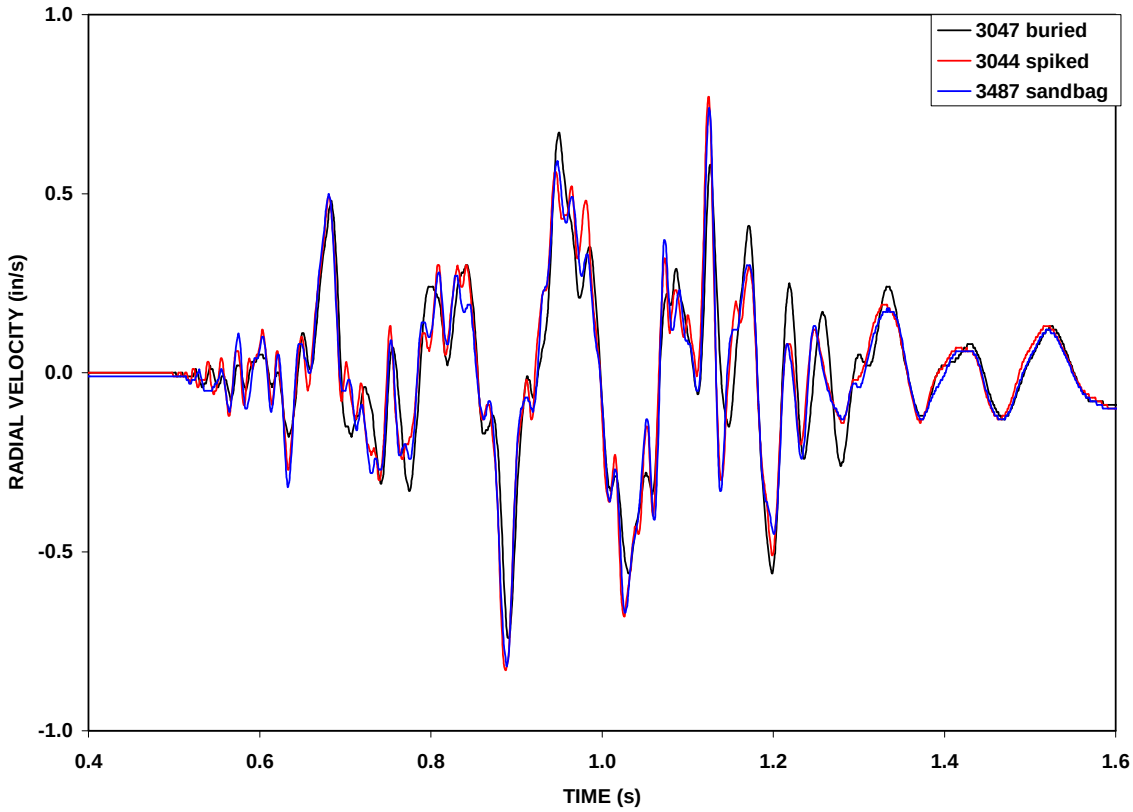

4040 buried
704 spiked
706 sandbag
20.0%
0.100
0.100
0.120
29.4%
-0.085
-0.085
-0.110
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.90
0.95
1.00
1.05
1.10

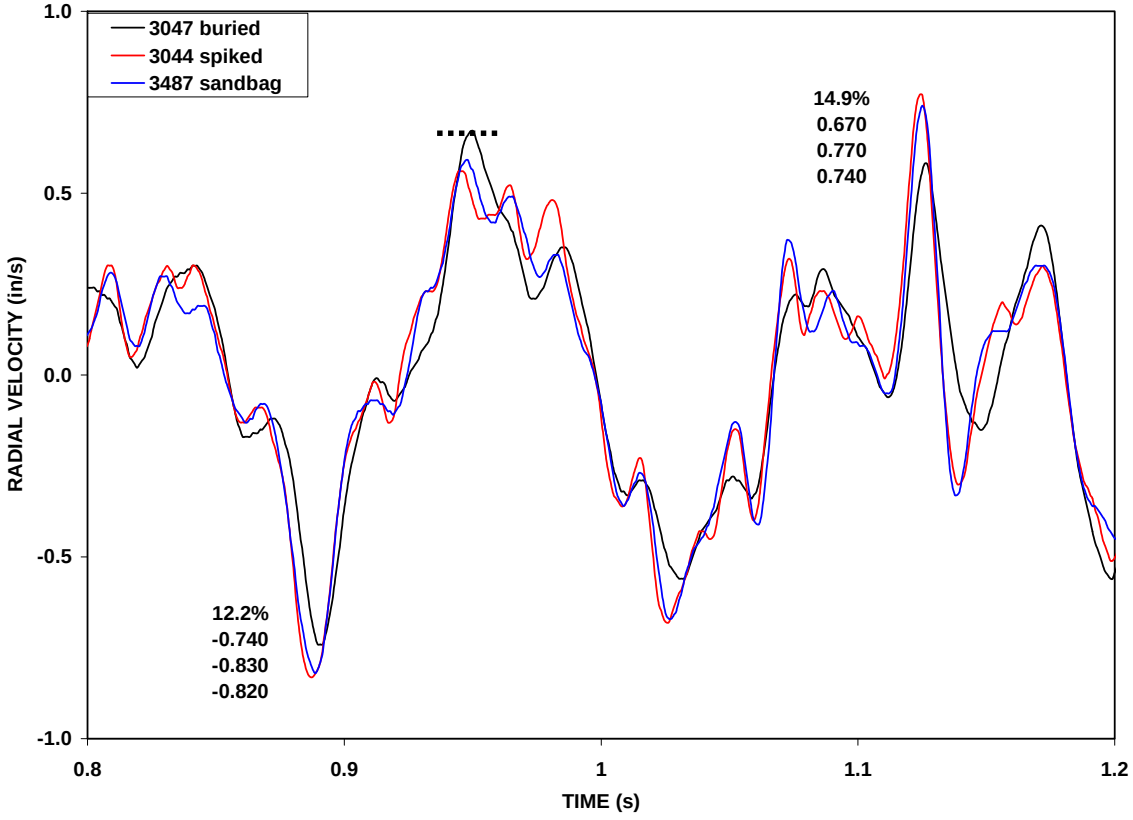

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.8
1.2
1.6
TIME (s)

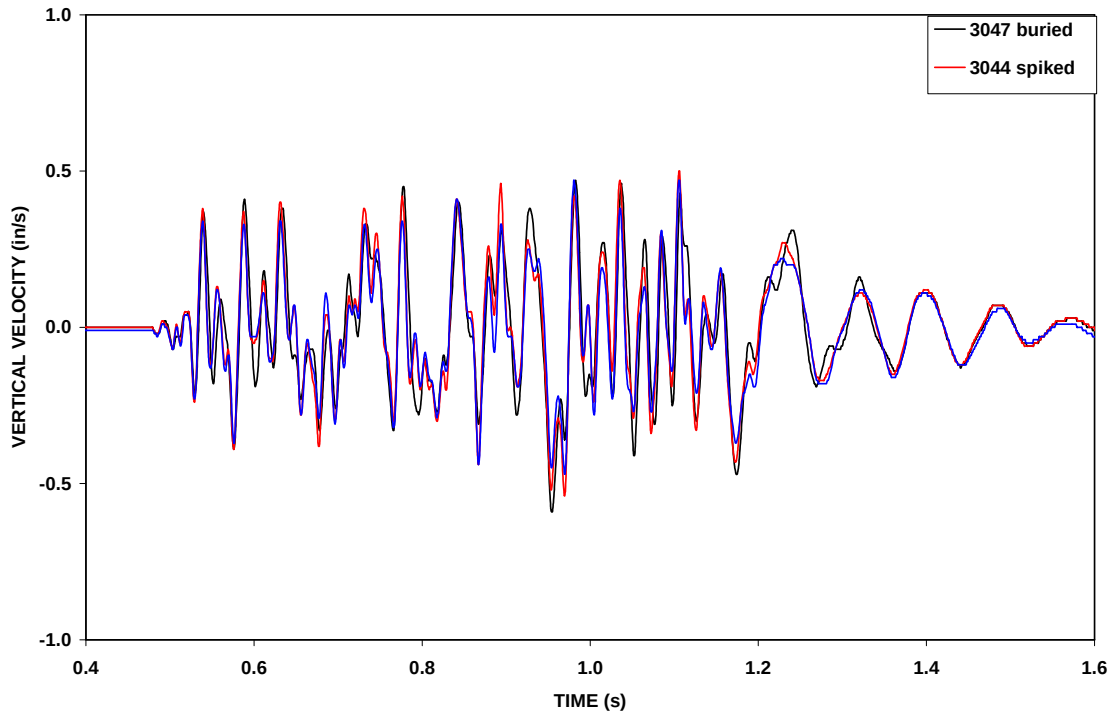

4040 buried
704 spiked
706 sandbag
78.3%
0.115
0.150
0.205
29.4%
-0.170
-0.185
-0.220
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.7
0.8
0.9
1.0
TIME (s)

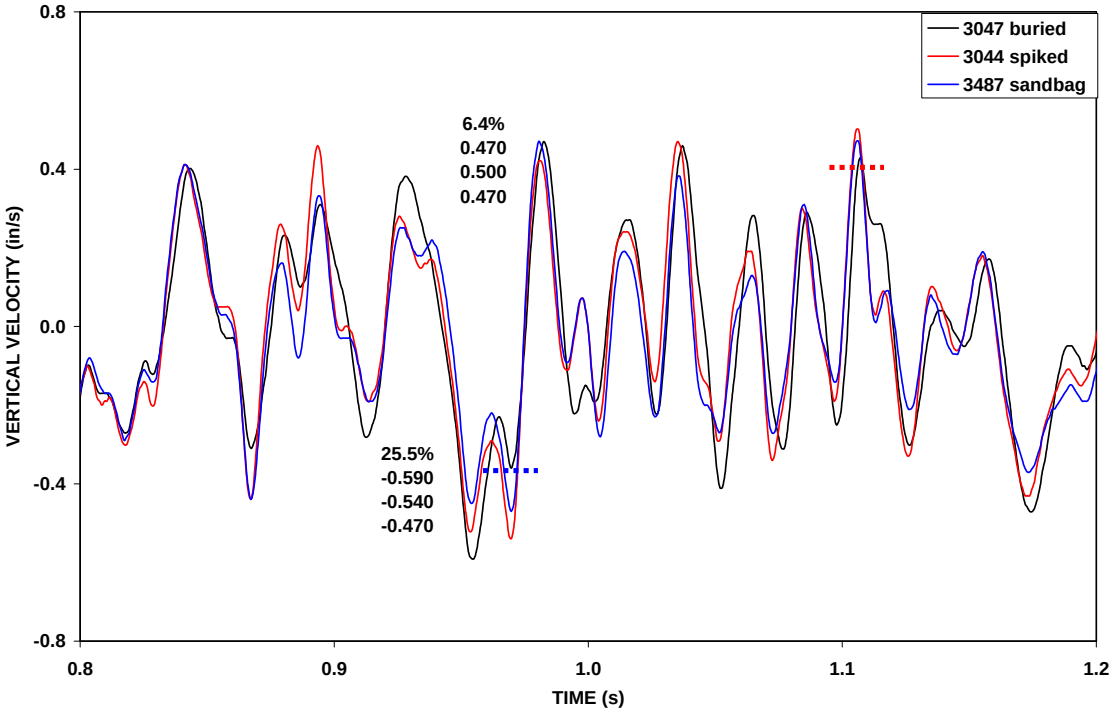
OH-4

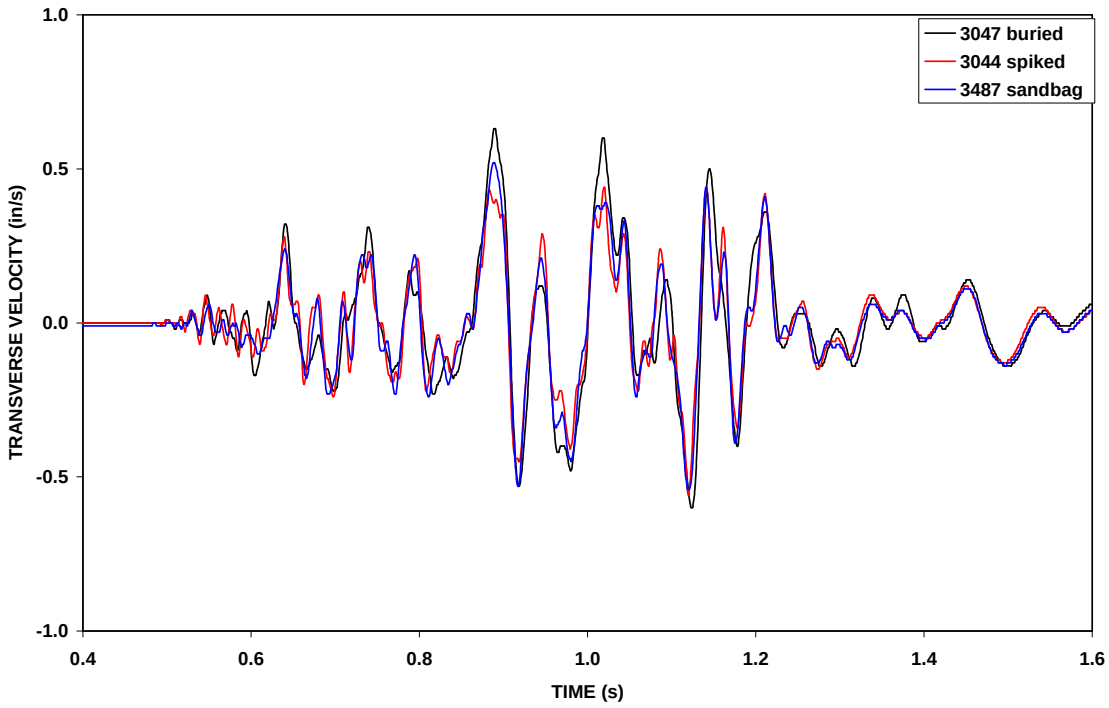
Cluster 1 SD 24.5 ft/lb$^{1/2}$

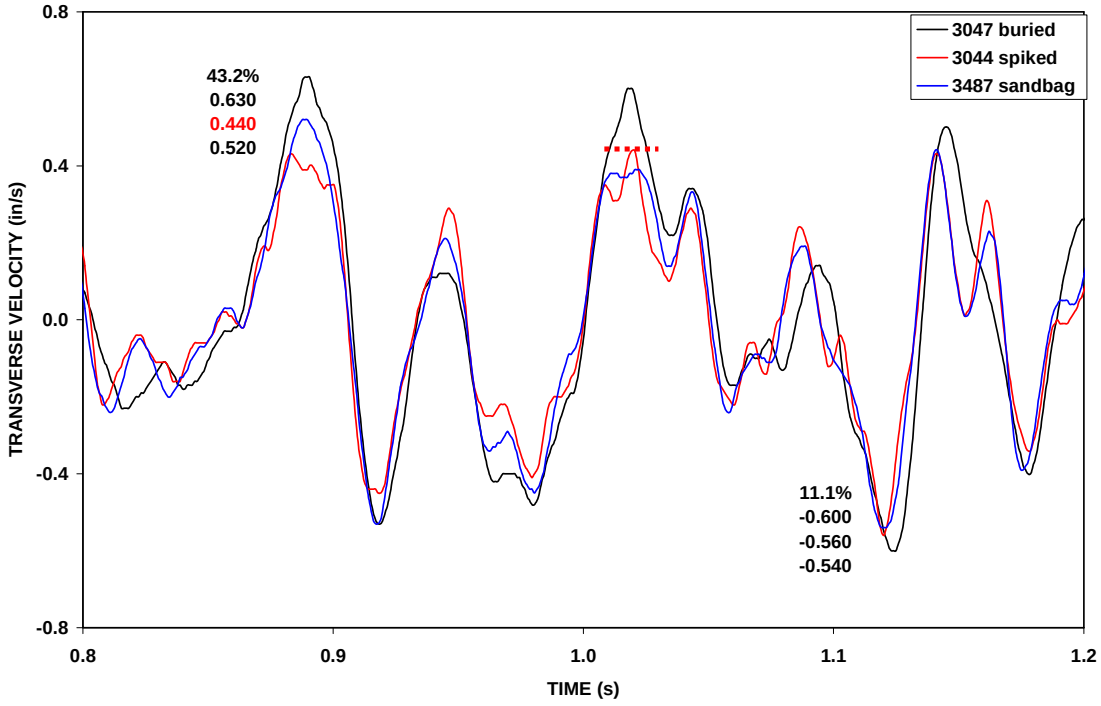

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6


3047 buried
3044 spiked
3487 sandbag
14.9%
0.670
0.770
0.740
12.2%
-0.740
-0.830
-0.820
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.8
0.9
1
1.1
1.2


3047 buried
3044 spiked
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6

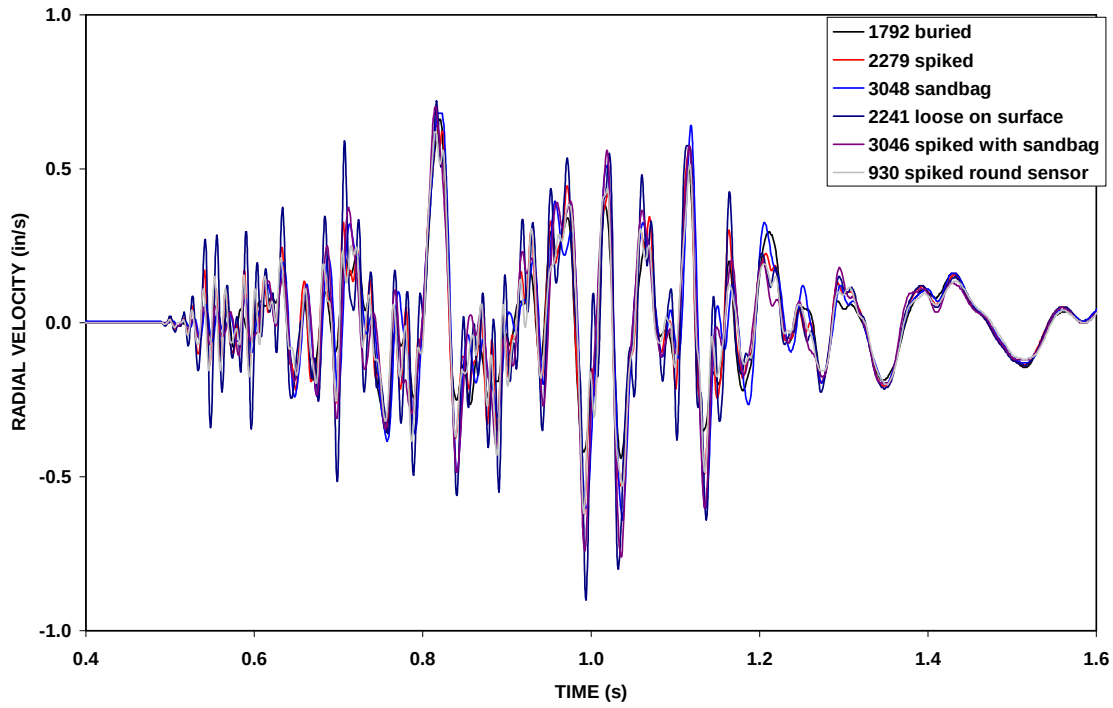

3047 buried
3044 spiked
3487 sandbag
6.4%
0.470
0.500
0.470
25.5%
-0.590
-0.540
-0.470
VERTICAL VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
0.8
0.9
1.0
1.1
1.2

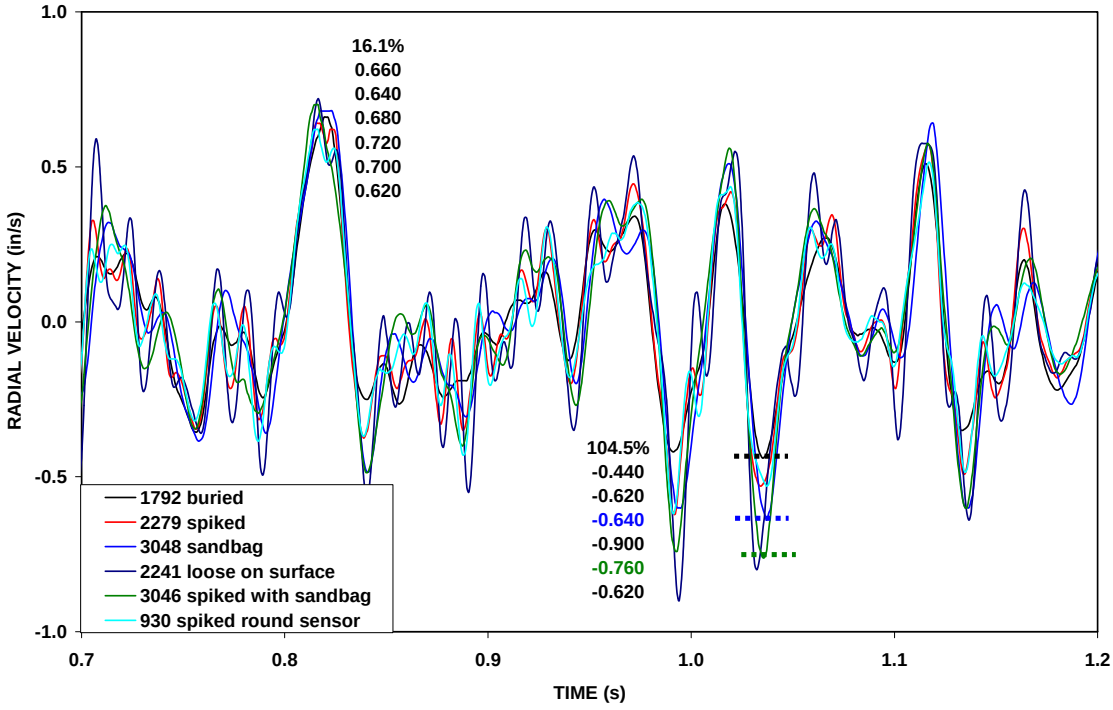

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6

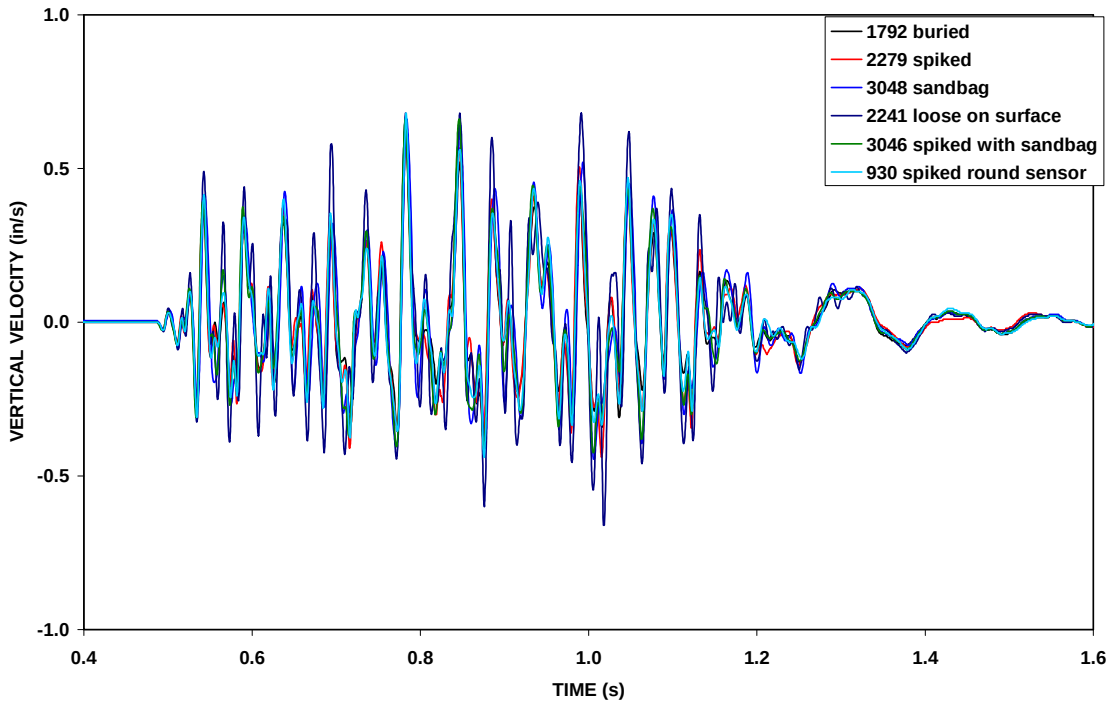

3047 buried
3044 spiked
3487 sandbag
43.2%
0.630
0.440
0.520
11.1%
-0.600
-0.560
-0.540
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
0.8
0.9
1.0
1.1
1.2

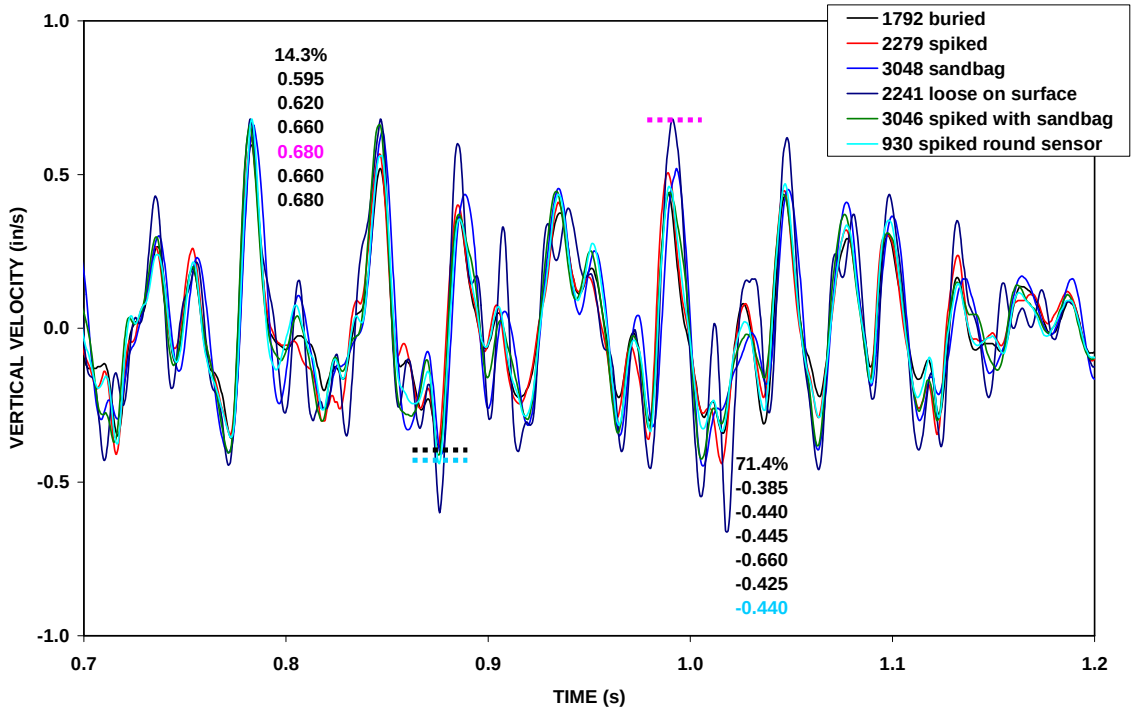
OH-4

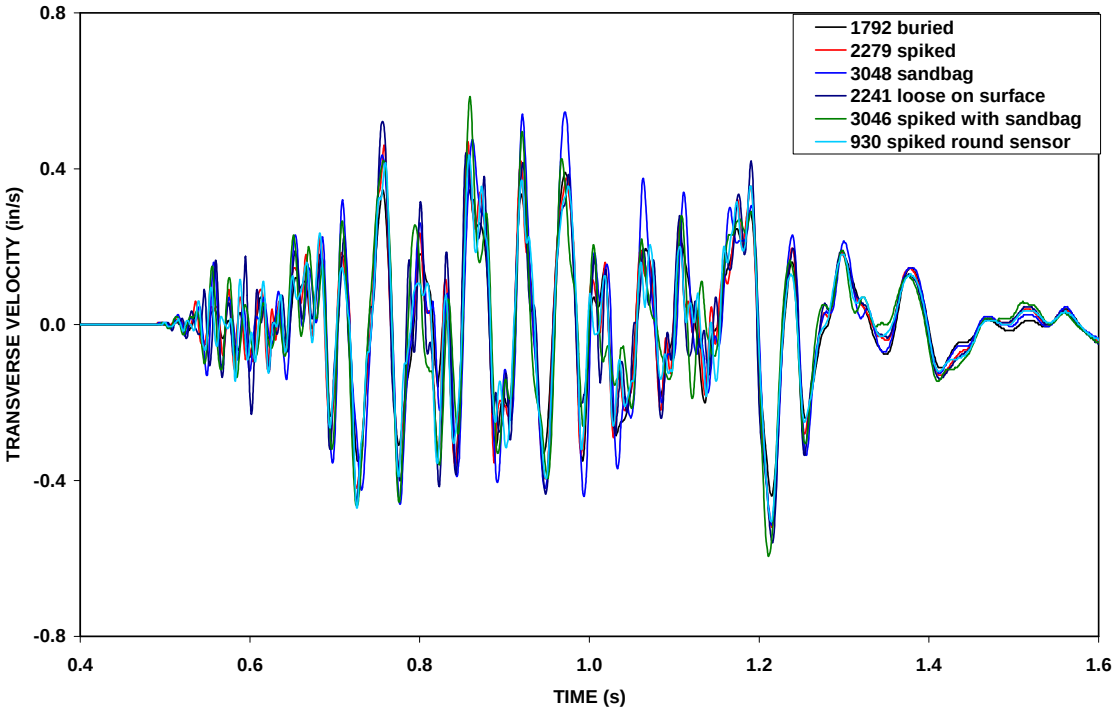
Cluster 2 SD 49.0 ft/lb$^{1/2}$

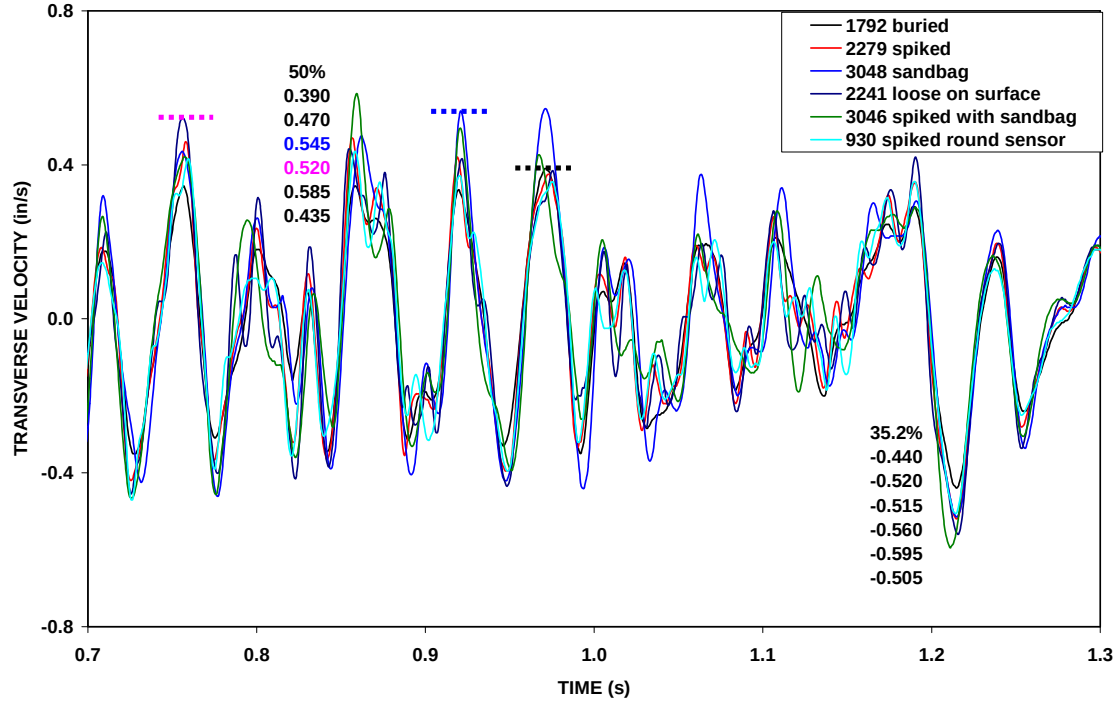

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6

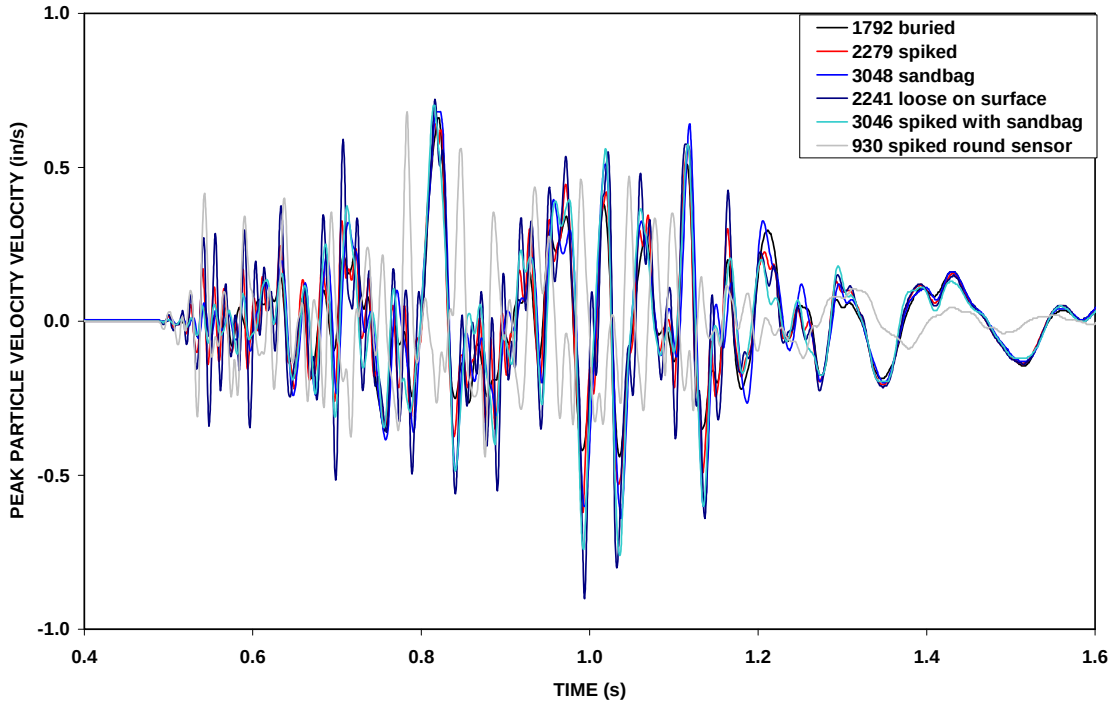

16.1%
0.660
0.640
0.680
0.720
0.700
0.620
104.5%
-0.440
-0.620
-0.640
-0.900
-0.760
-0.620
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.7
0.8
0.9
1.0
1.1
1.2

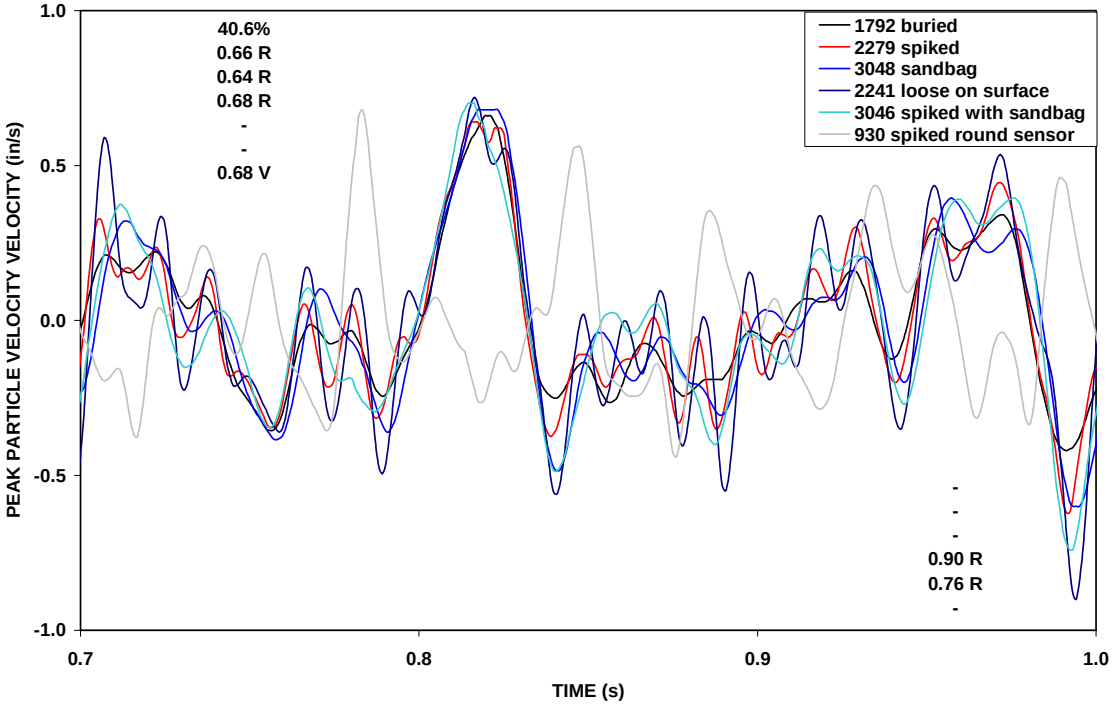

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
14.3%
0.595
0.620
0.660
0.680
0.660
0.680
71.4%
-0.385
-0.440
-0.445
-0.660
-0.425
-0.440
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.7
0.8
0.9
1.0
1.1
1.2


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
0.4
0.6
0.8
1.0
1.2
1.4
1.6

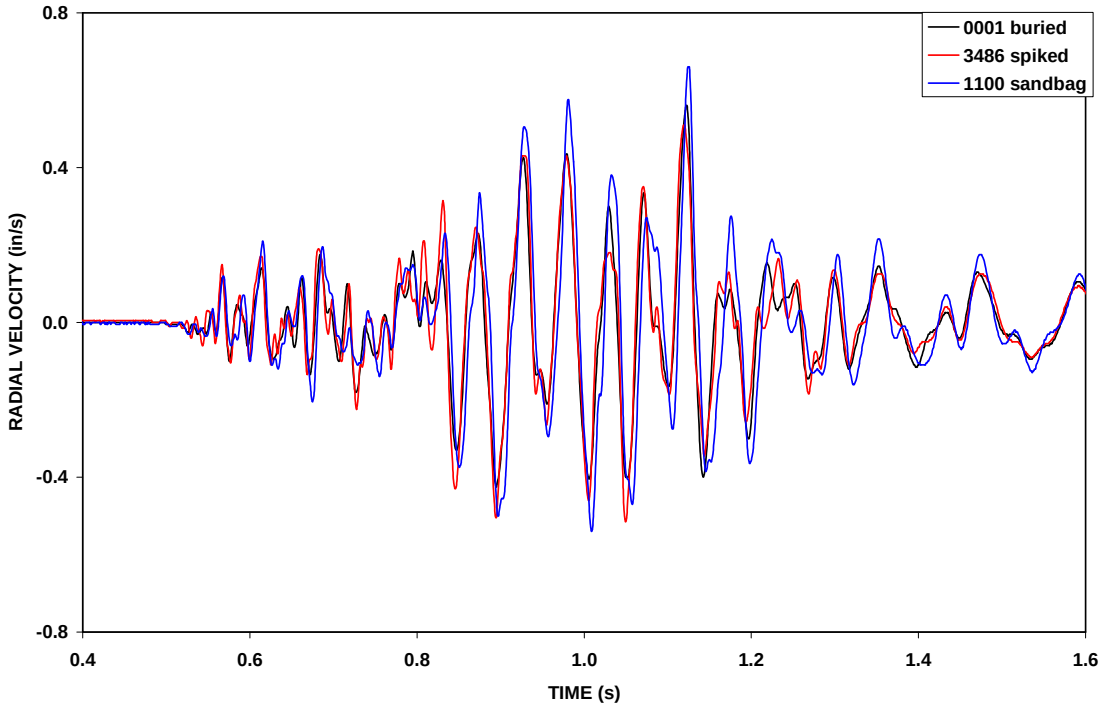

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
50%
0.390
0.470
0.545
0.520
0.585
0.435
35.2%
-0.440
-0.520
-0.515
-0.560
-0.595
-0.505
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
0.7
0.8
0.9
1.0
1.1
1.2
1.3

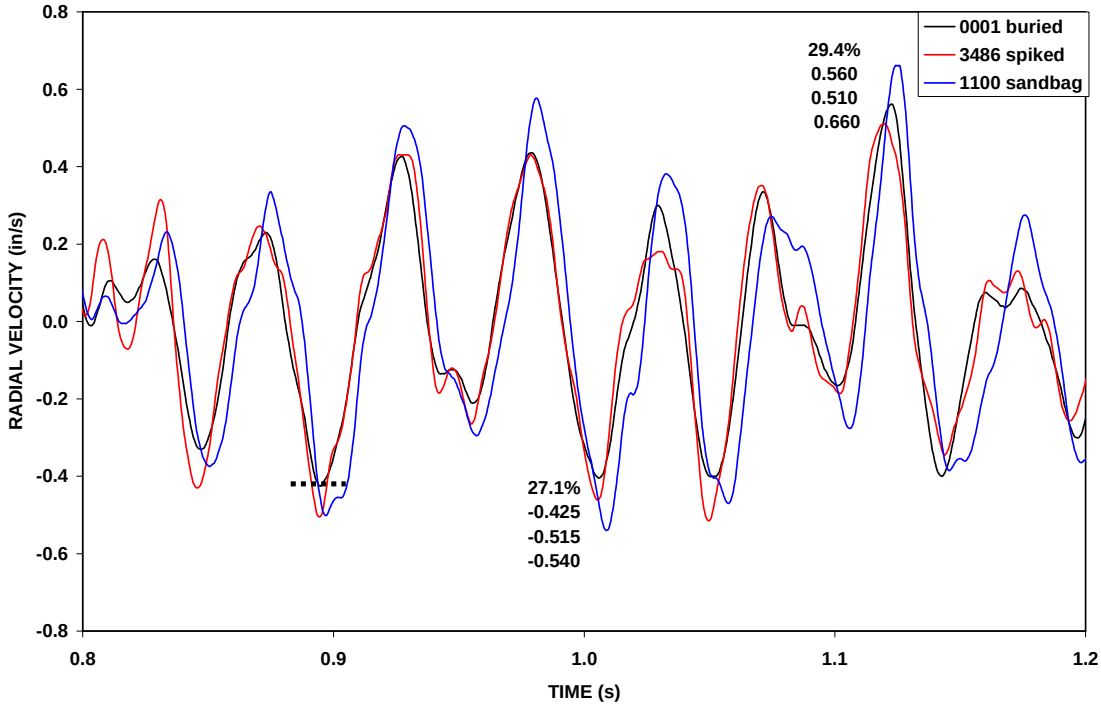

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

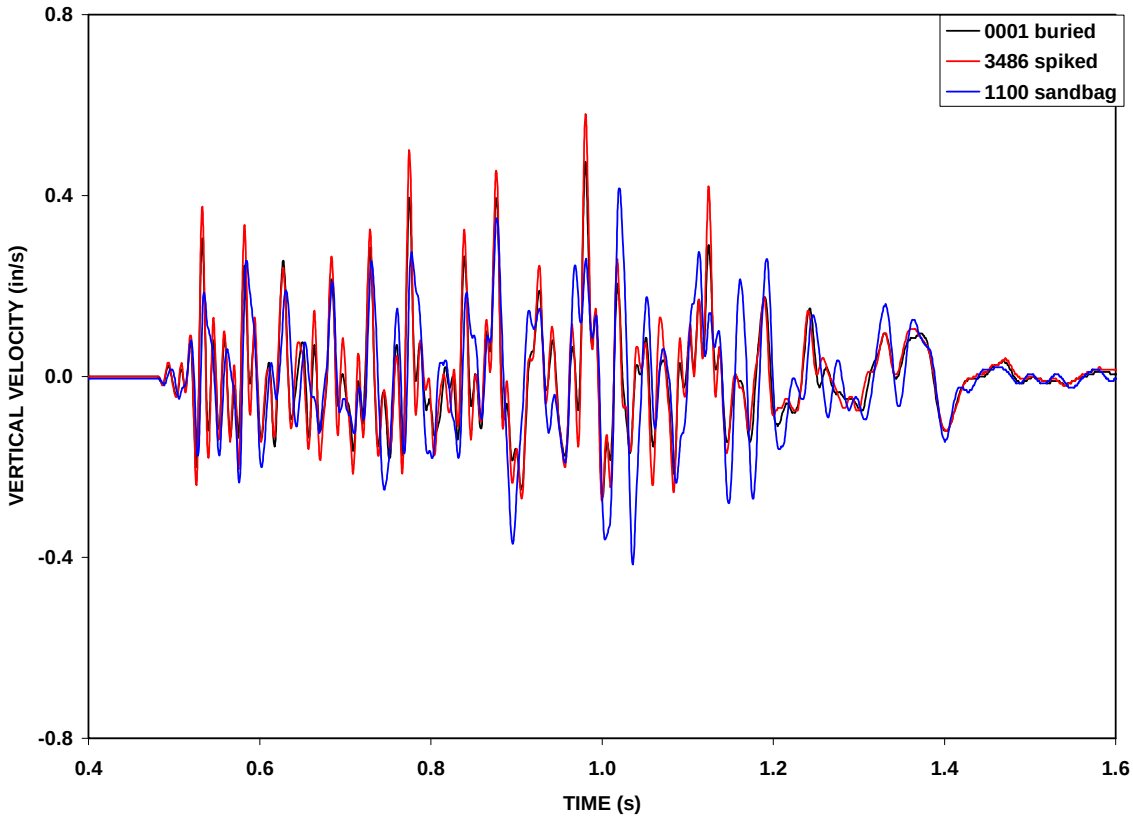

40.6%
0.66 R
0.64 R
0.68 R
-
-
0.68 V
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
-
-
-
0.90 R
0.76 R
-
PEAK PARTICLE VELOCITY VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.7
0.8
0.9
1.0
TIME (s)

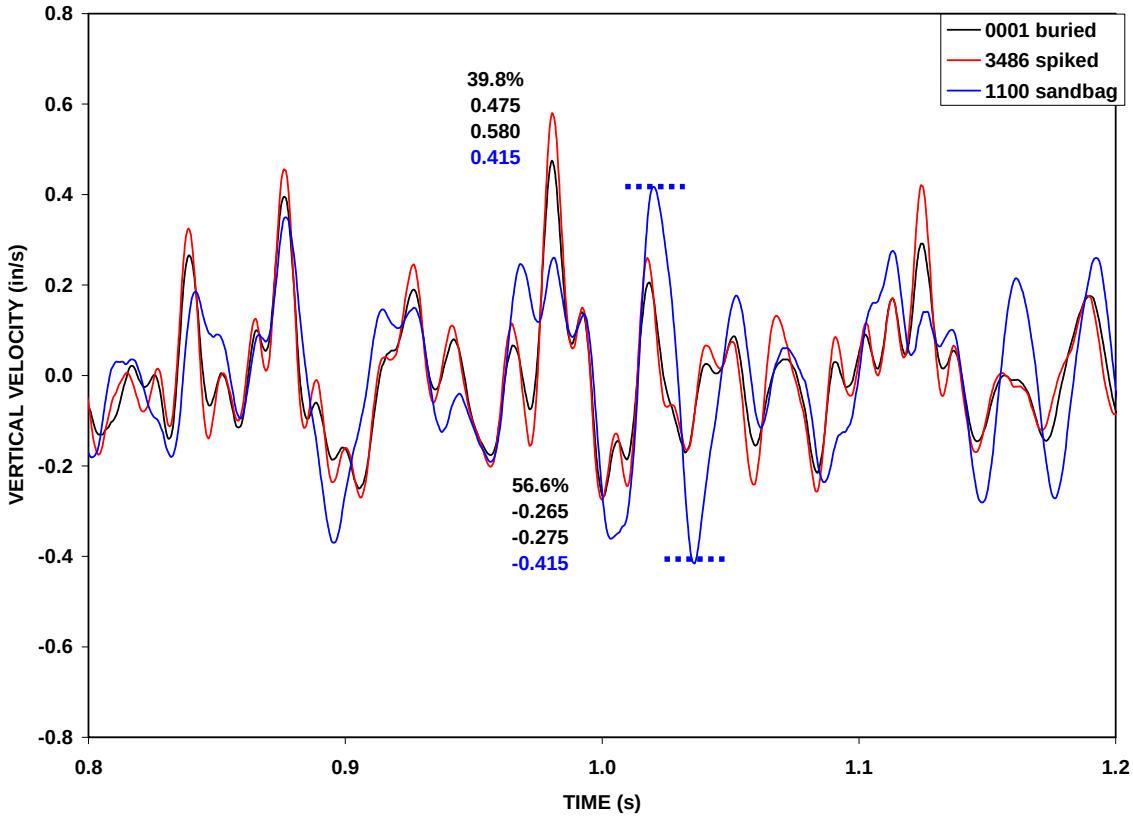
OH-4

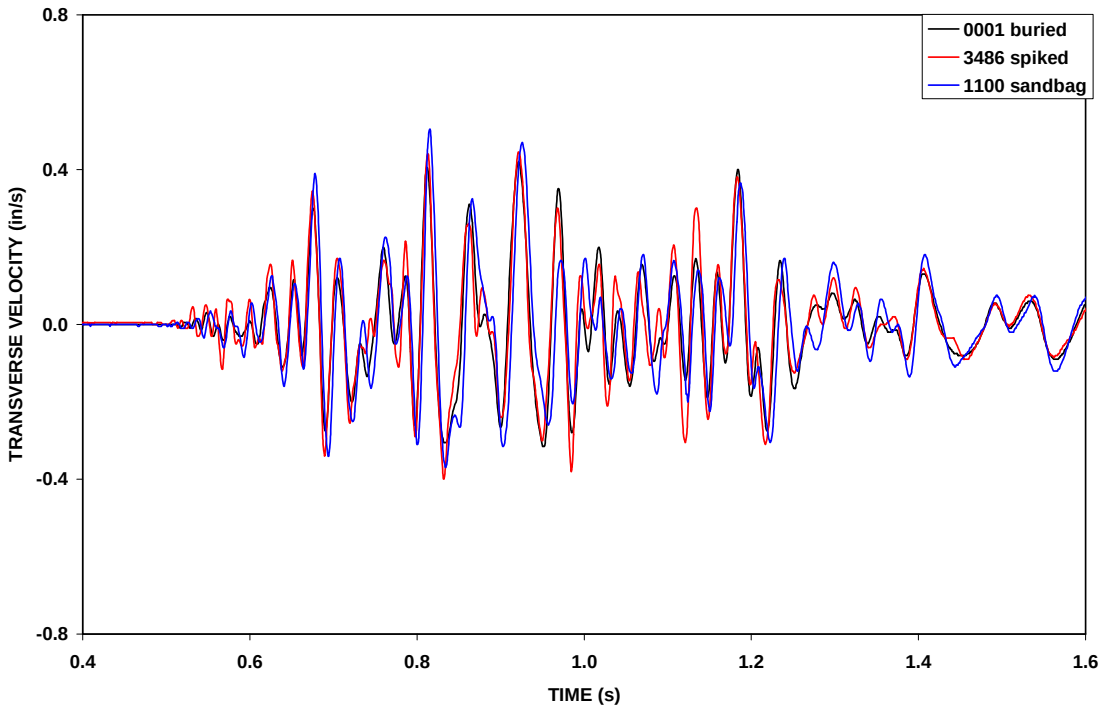
Cluster 3 SD 73.5 ft/lb$^{1/2}$

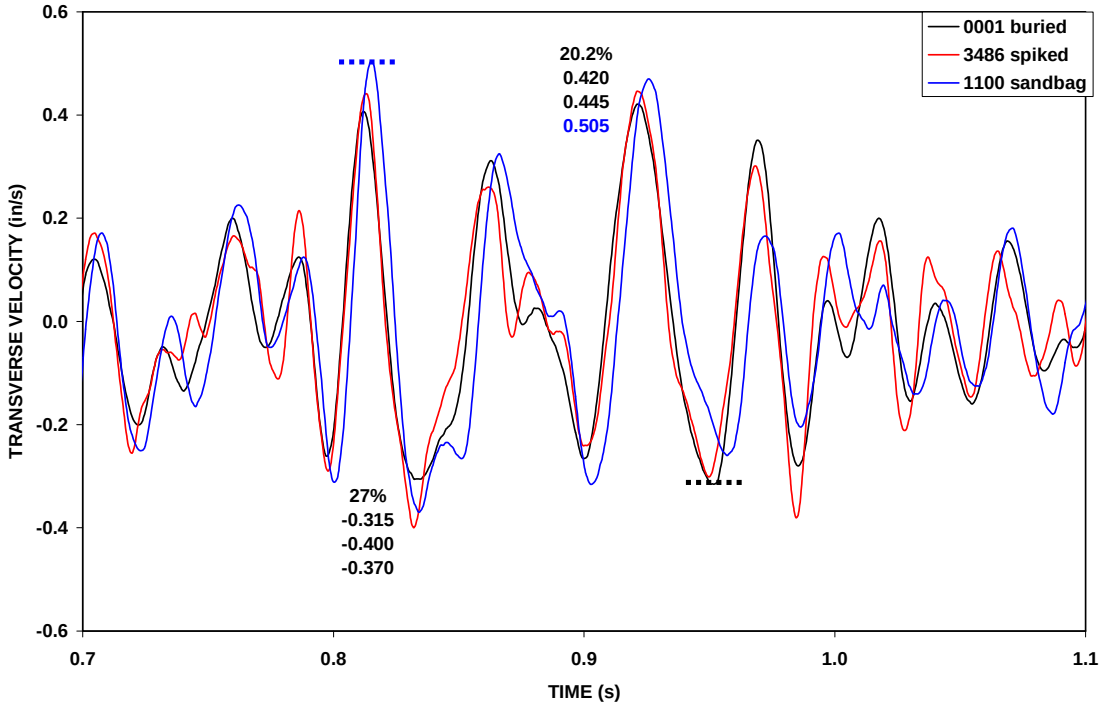

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
0.4
0.6
0.8
1.0
1.2
1.4
1.6


0001 buried
3486 spiked
1100 sandbag
29.4%
0.560
0.510
0.660
27.1%
-0.425
-0.515
-0.540
RADIAL VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.8
0.9
1.0
1.1
1.2


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
0.4
0.6
0.8
1.0
1.2
1.4
1.6

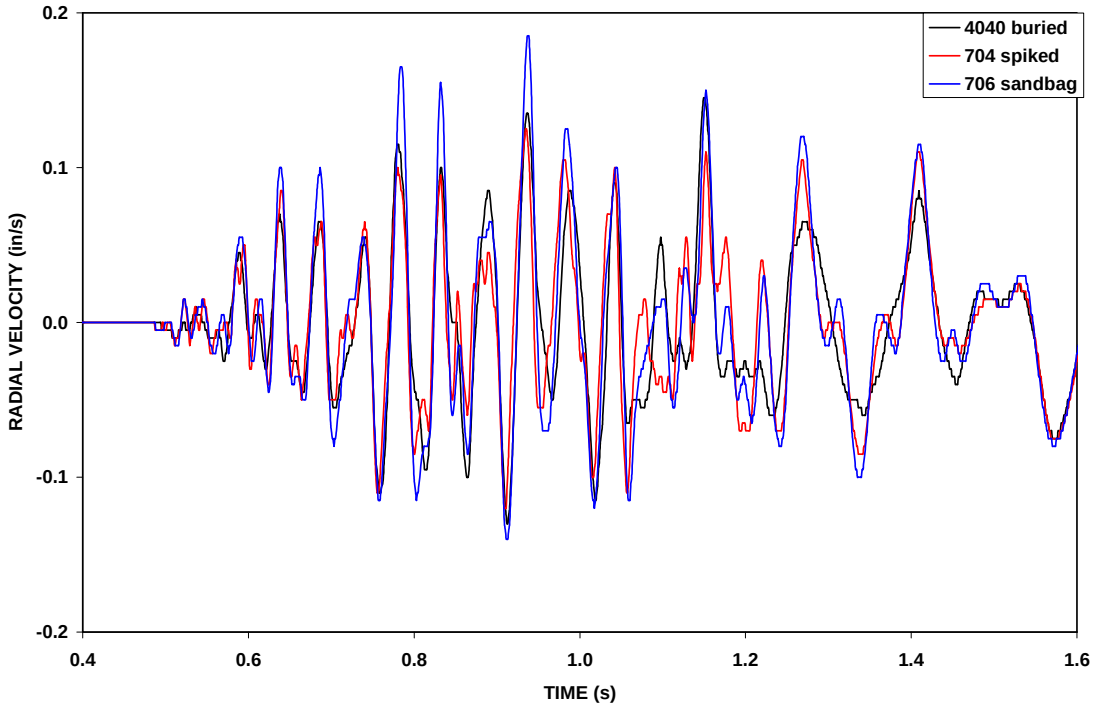

0001 buried
3486 spiked
1100 sandbag
39.8%
0.475
0.580
0.415
56.6%
-0.265
-0.275
-0.415
VERTICAL VELOCITY (in/s)
TIME (s)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
0.8
0.9
1.0
1.1
1.2

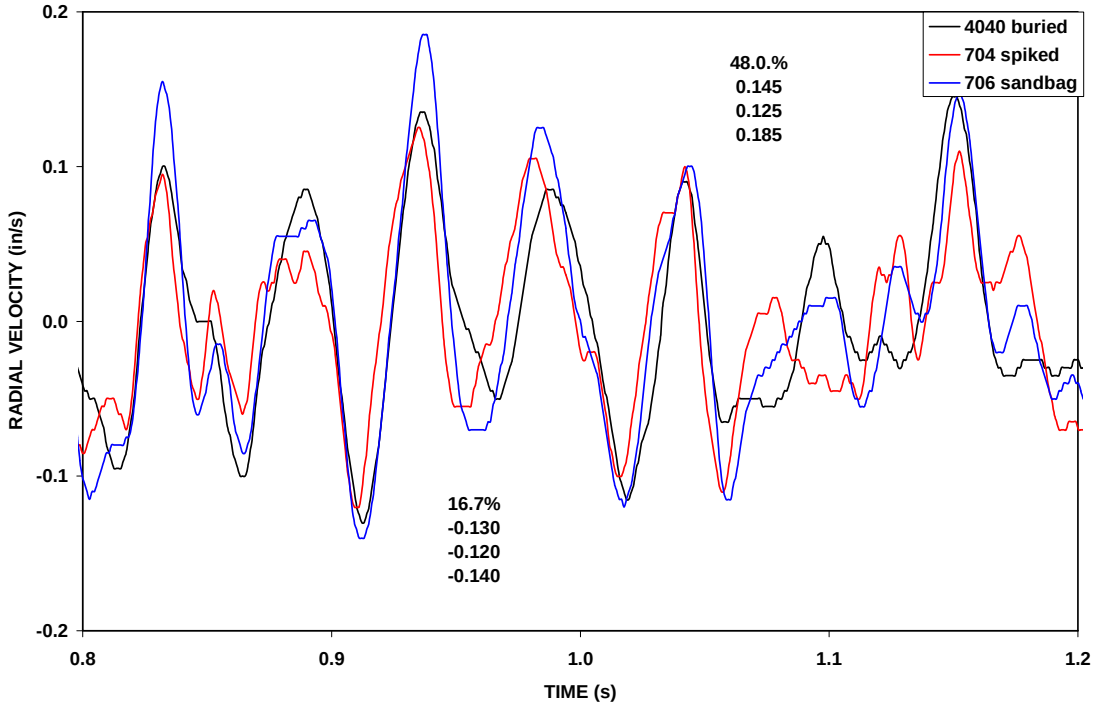

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

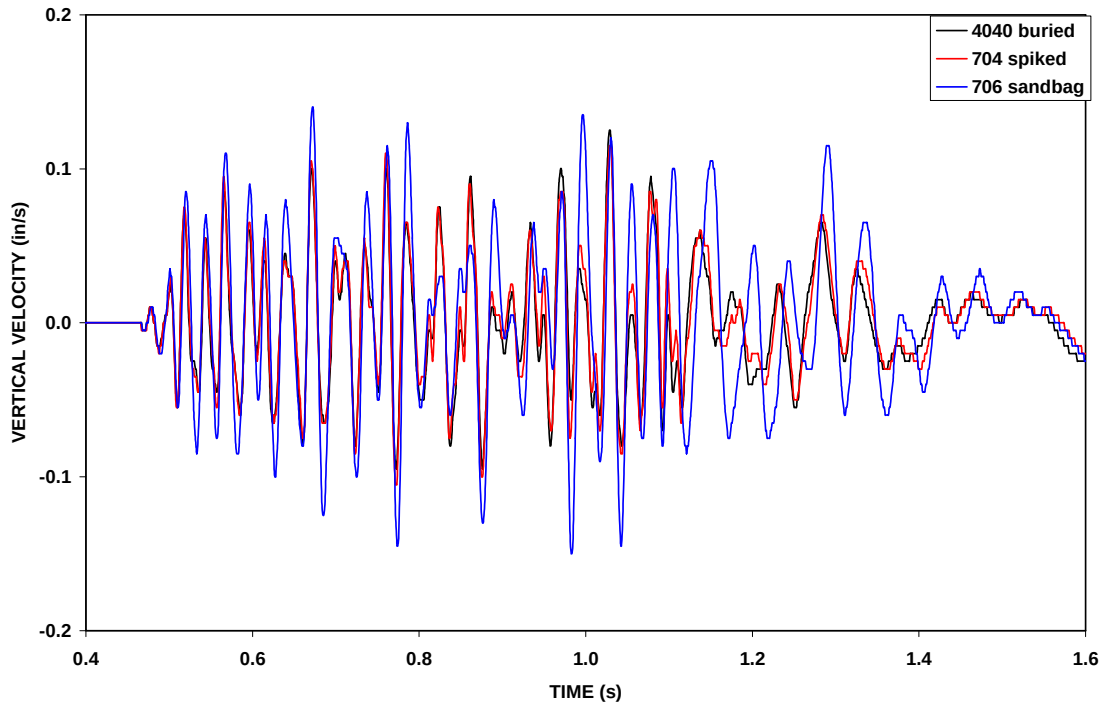

0001 buried
3486 spiked
1100 sandbag
20.2%
0.420
0.445
0.505
27%
-0.315
-0.400
-0.370
TRANSVERSE VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.7
0.8
0.9
1.0
1.1
TIME (s)

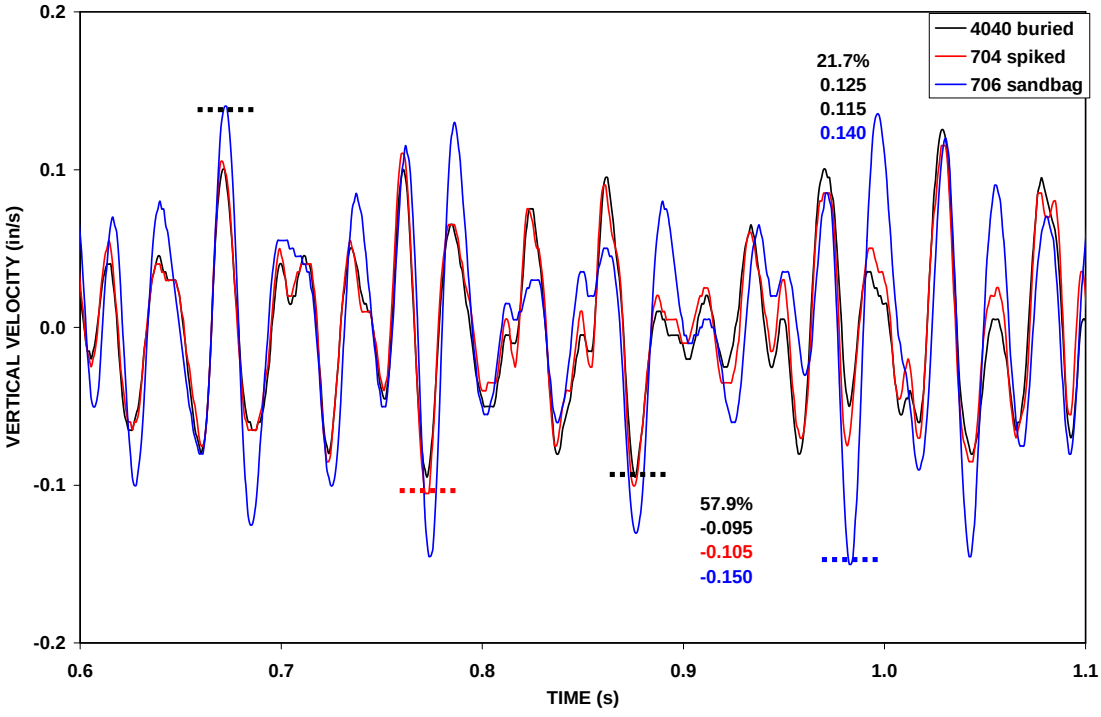
OH-4

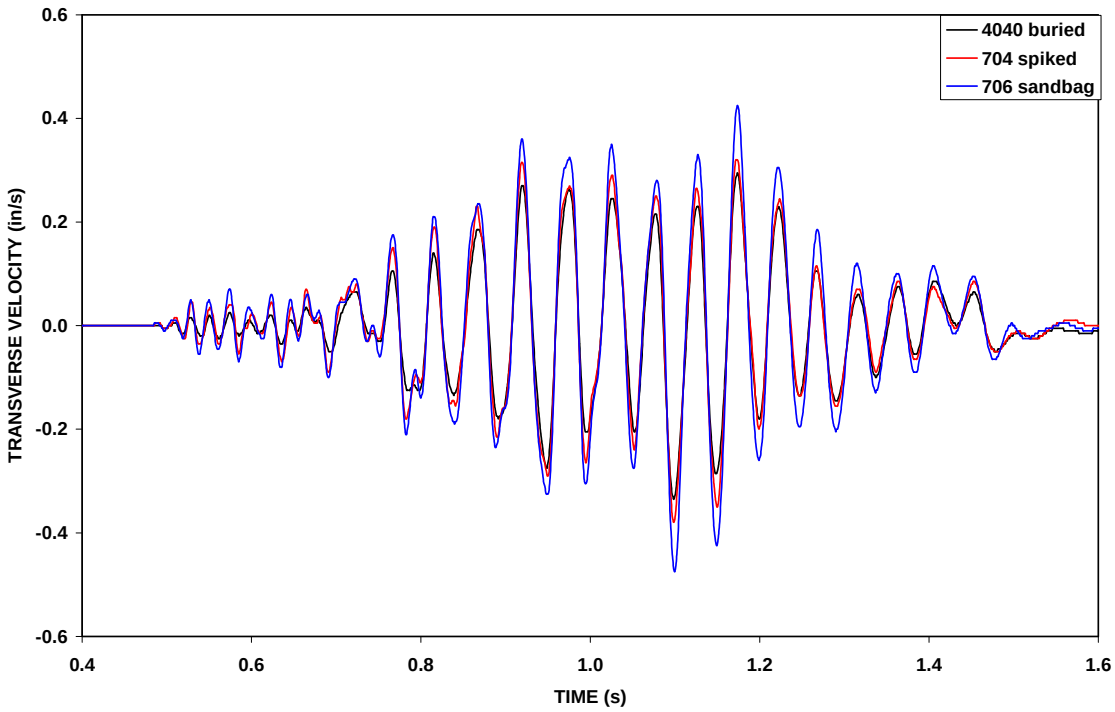
Cluster 4 SD 151.9 ft/lb$^{1/2}$

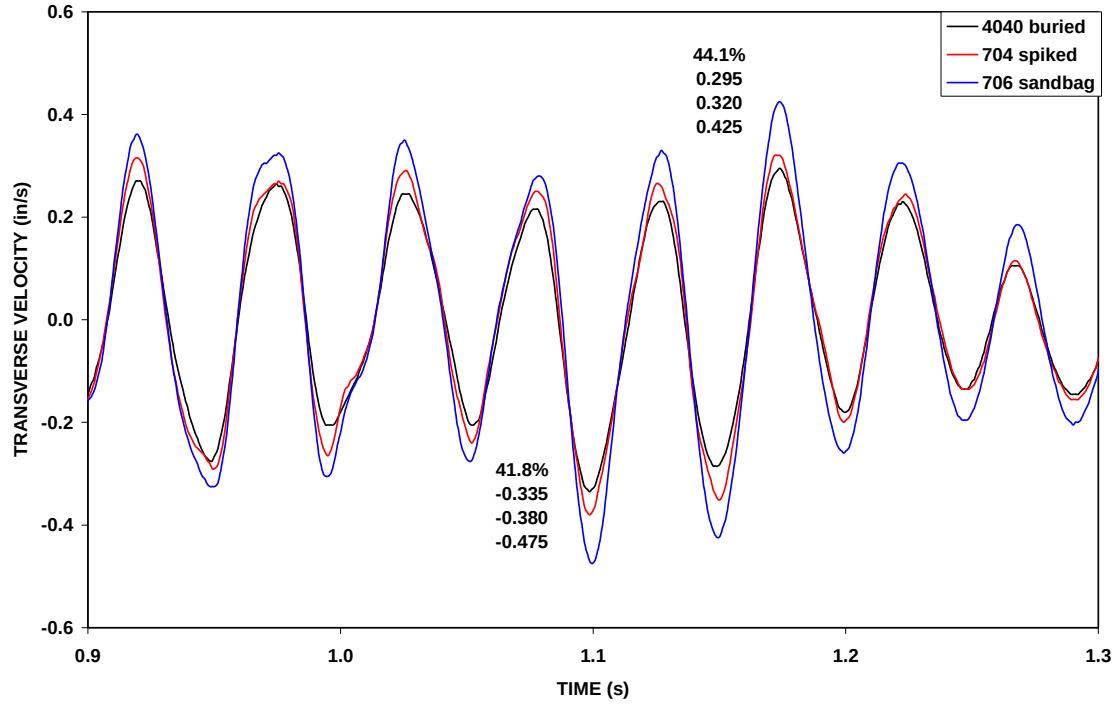

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6


4040 buried
704 spiked
706 sandbag
48.0.%
0.145
0.125
0.185
16.7%
-0.130
-0.120
-0.140
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.8
0.9
1.0
1.1
1.2


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

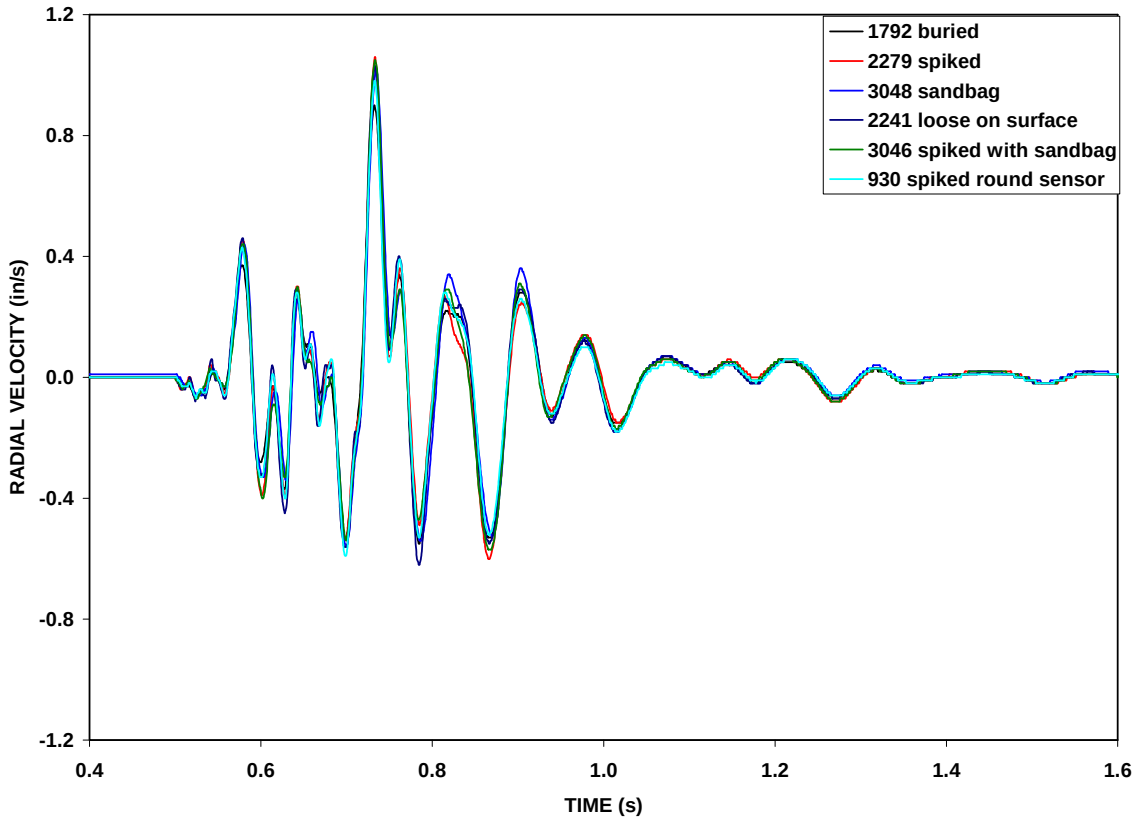

4040 buried
704 spiked
706 sandbag
21.7%
0.125
0.115
0.140
57.9%
-0.095
-0.105
-0.150
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.7
0.8
0.9
1.0
1.1

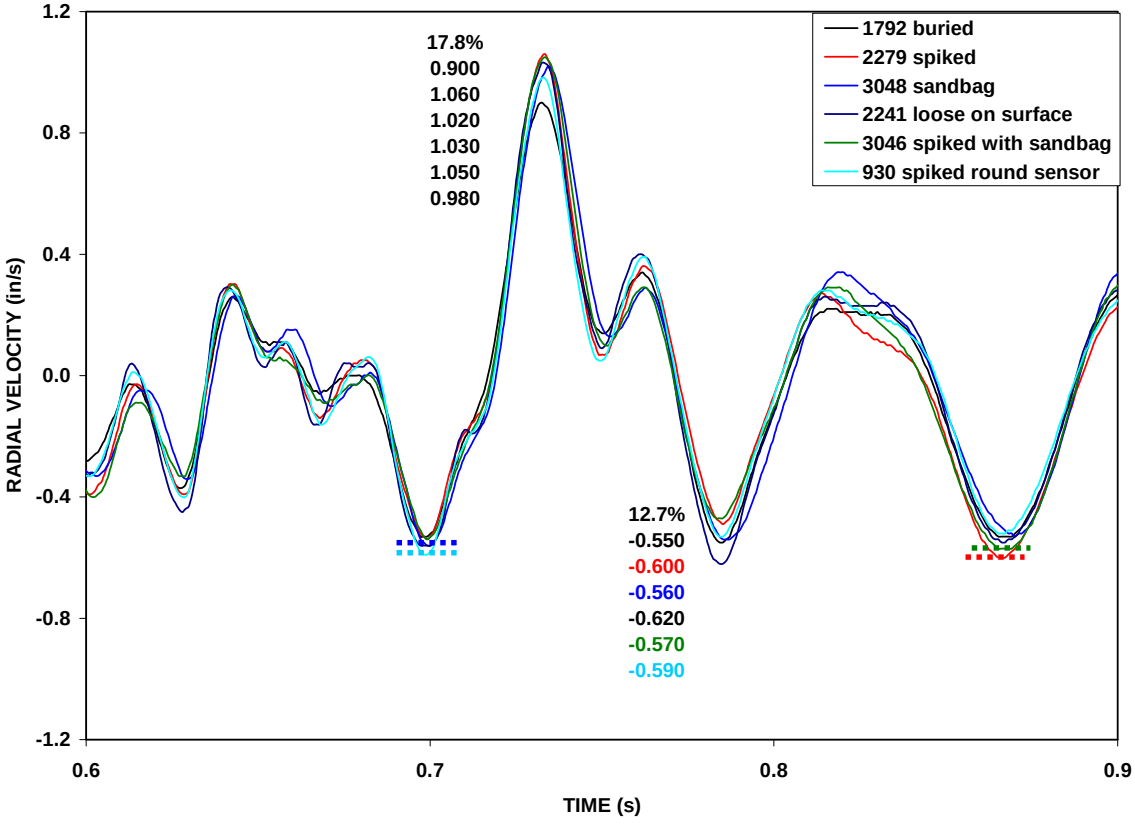

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6

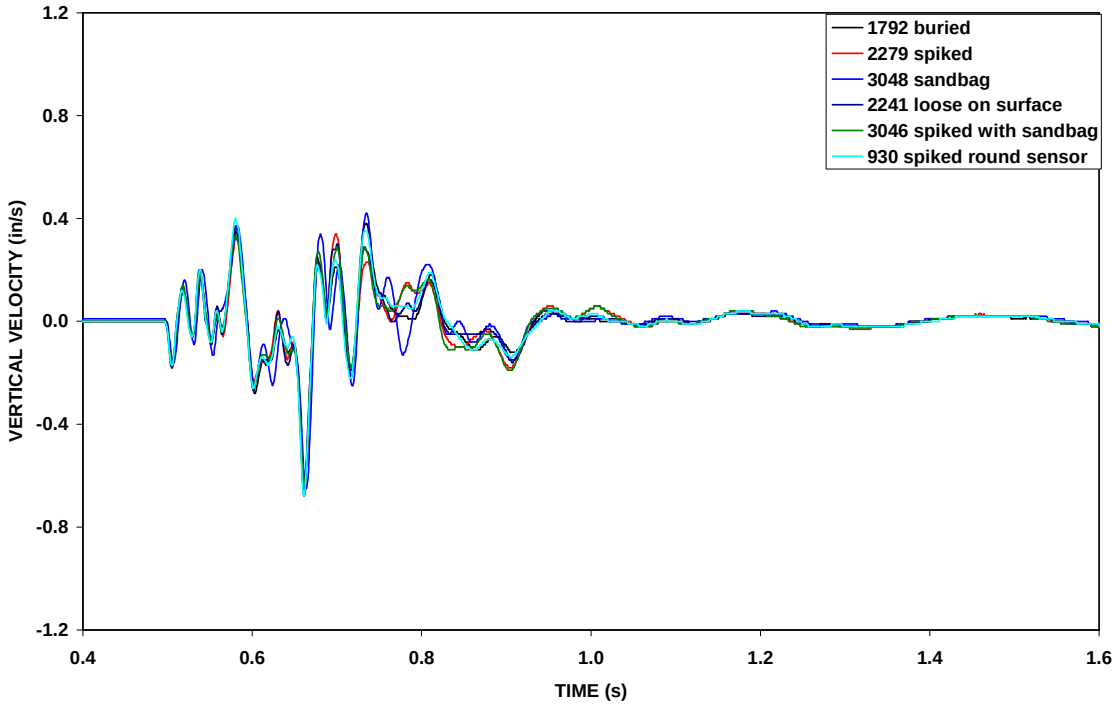

4040 buried
704 spiked
706 sandbag
44.1%
0.295
0.320
0.425
41.8%
-0.335
-0.380
-0.475
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.9
1.0
1.1
1.2
1.3

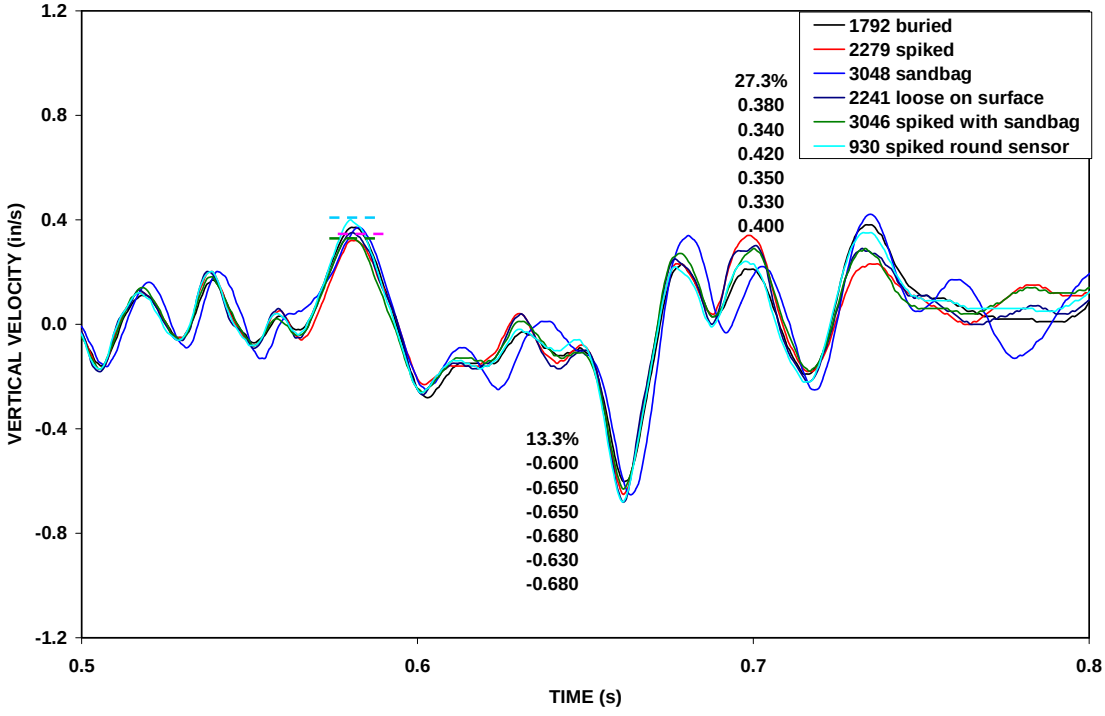
OH-5

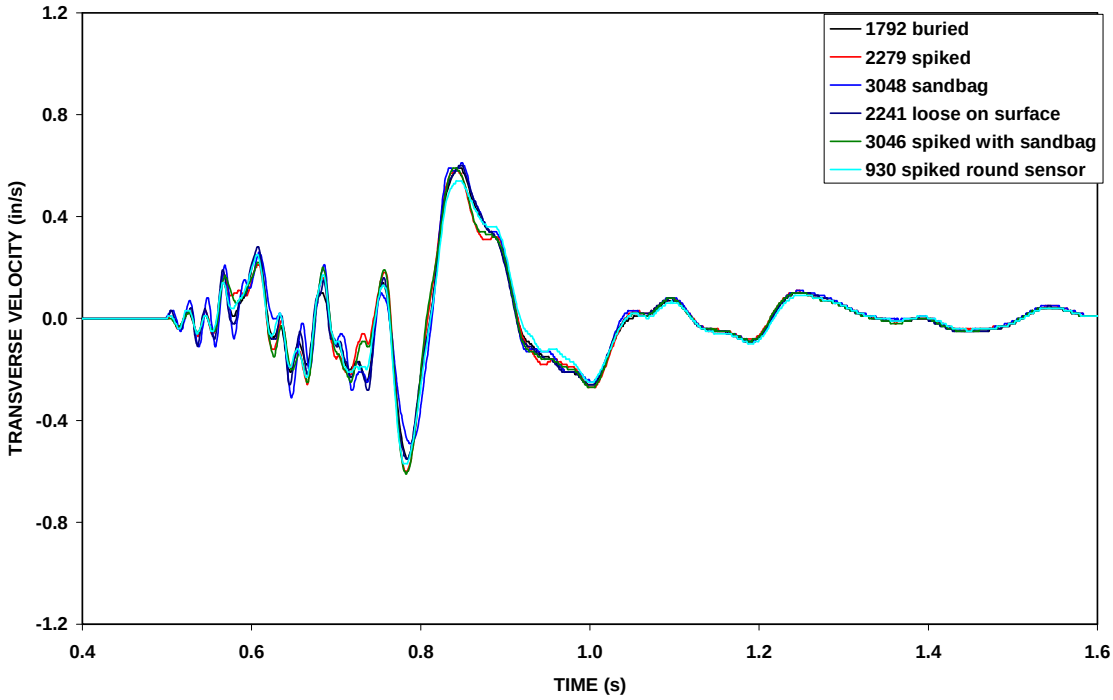
Cluster 1 SD 16.4 ft/lb$^{1/2}$

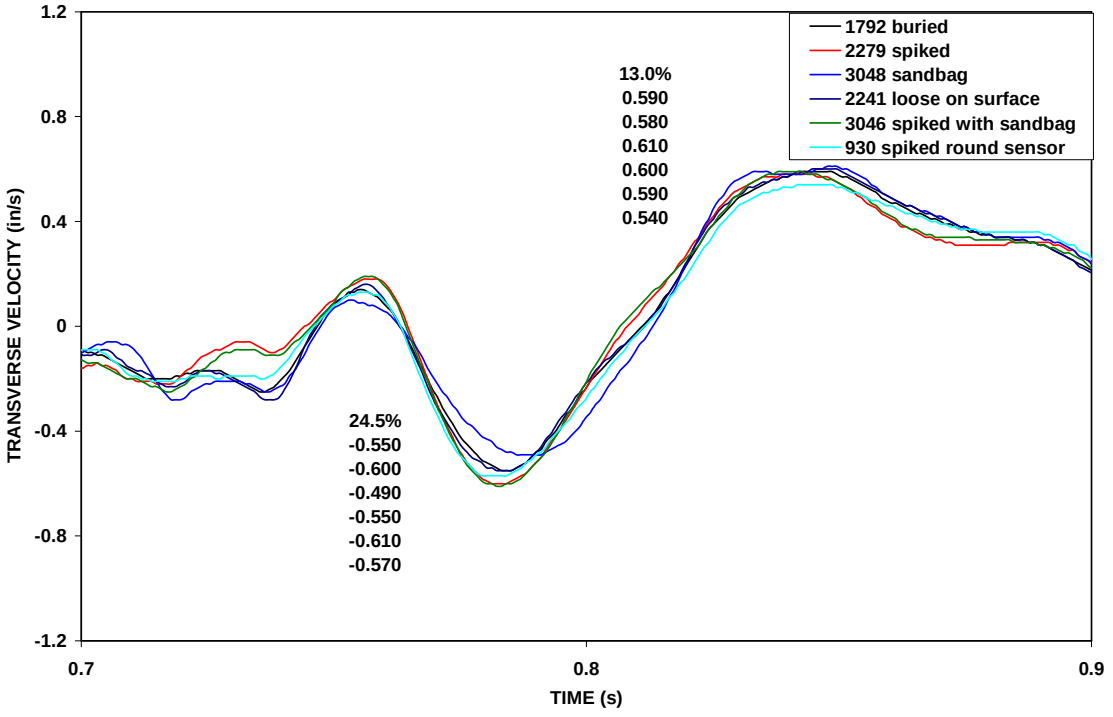

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
TIME (s)
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

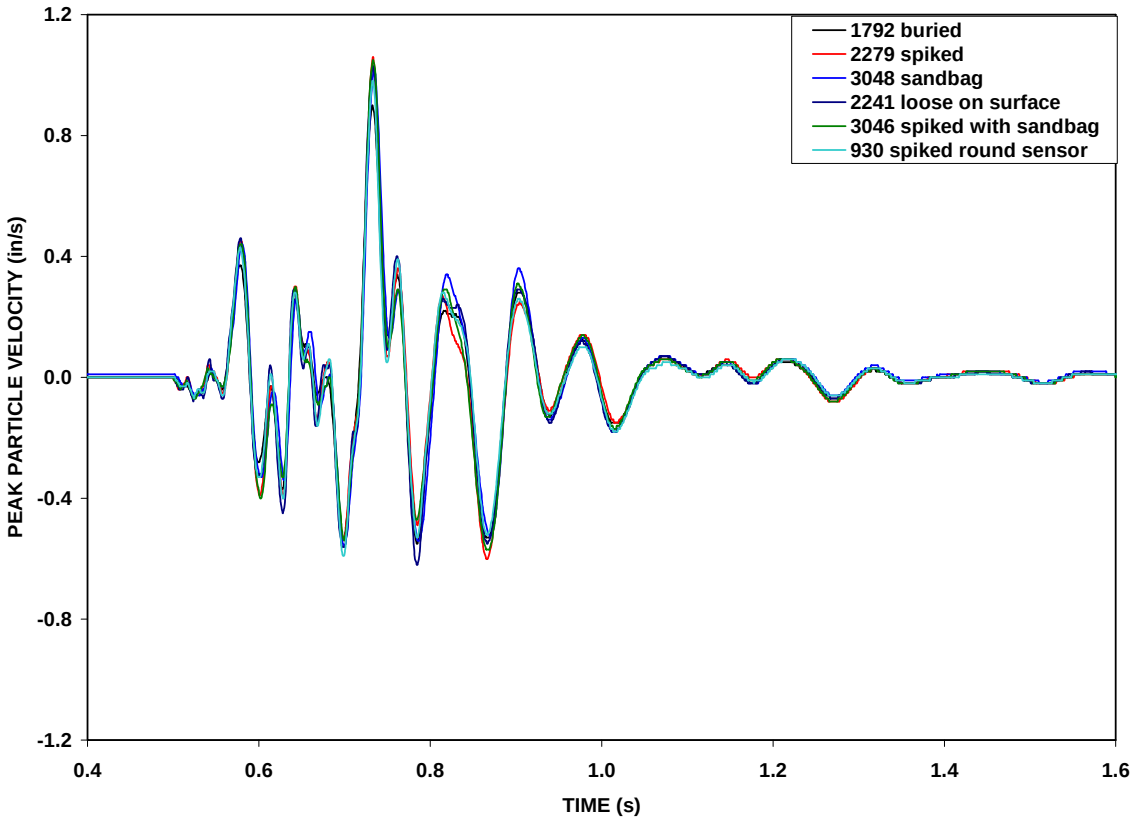

17.8%
0.900
1.060
1.020
1.030
1.050
0.980
12.7%
-0.550
-0.600
-0.560
-0.620
-0.570
-0.590
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
TIME (s)
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0.6
0.7
0.8
0.9

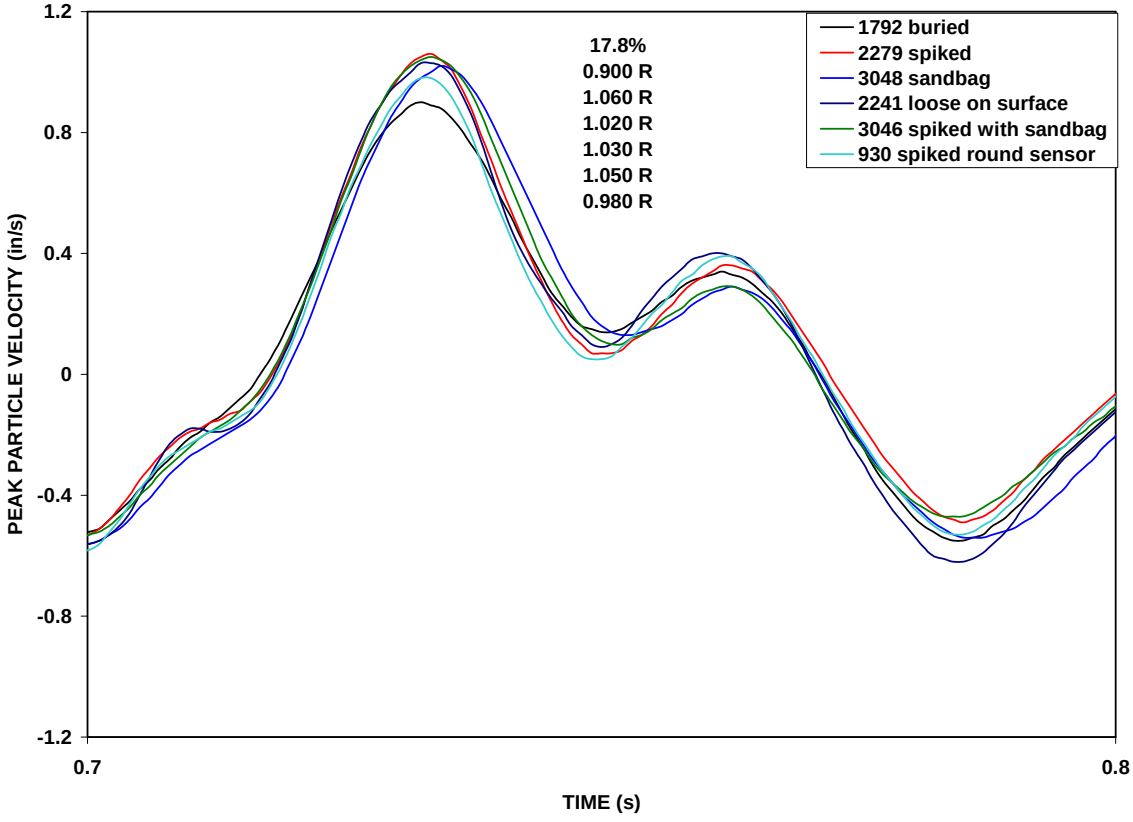

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
27.3%
0.380
0.340
0.420
0.350
0.330
0.400
13.3%
-0.600
-0.650
-0.650
-0.680
-0.630
-0.680
VERTICAL VELOCITY (in/s)
TIME (s)
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0.5
0.6
0.7
0.8


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

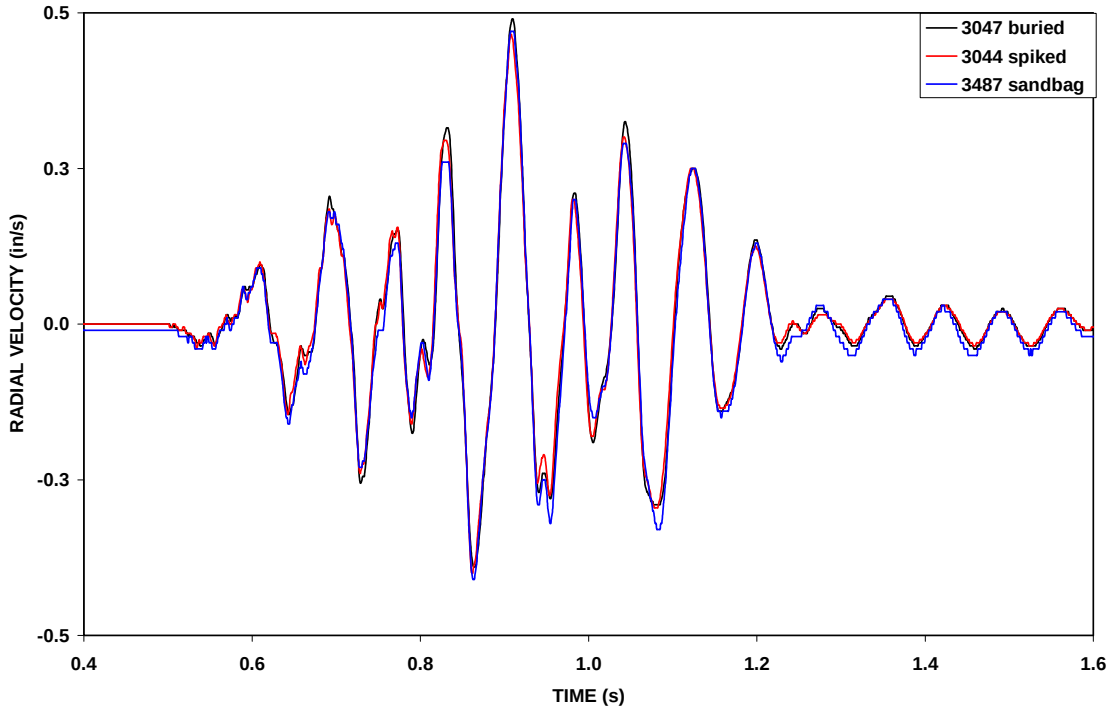

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
13.0%
0.590
0.580
0.610
0.600
0.590
0.540
24.5%
-0.550
-0.600
-0.490
-0.550
-0.610
-0.570
TRANSVERSE VELOCITY (in/s)
1.2
0.8
0.4
0
-0.4
-0.8
-1.2
0.7
0.8
0.9
TIME (s)

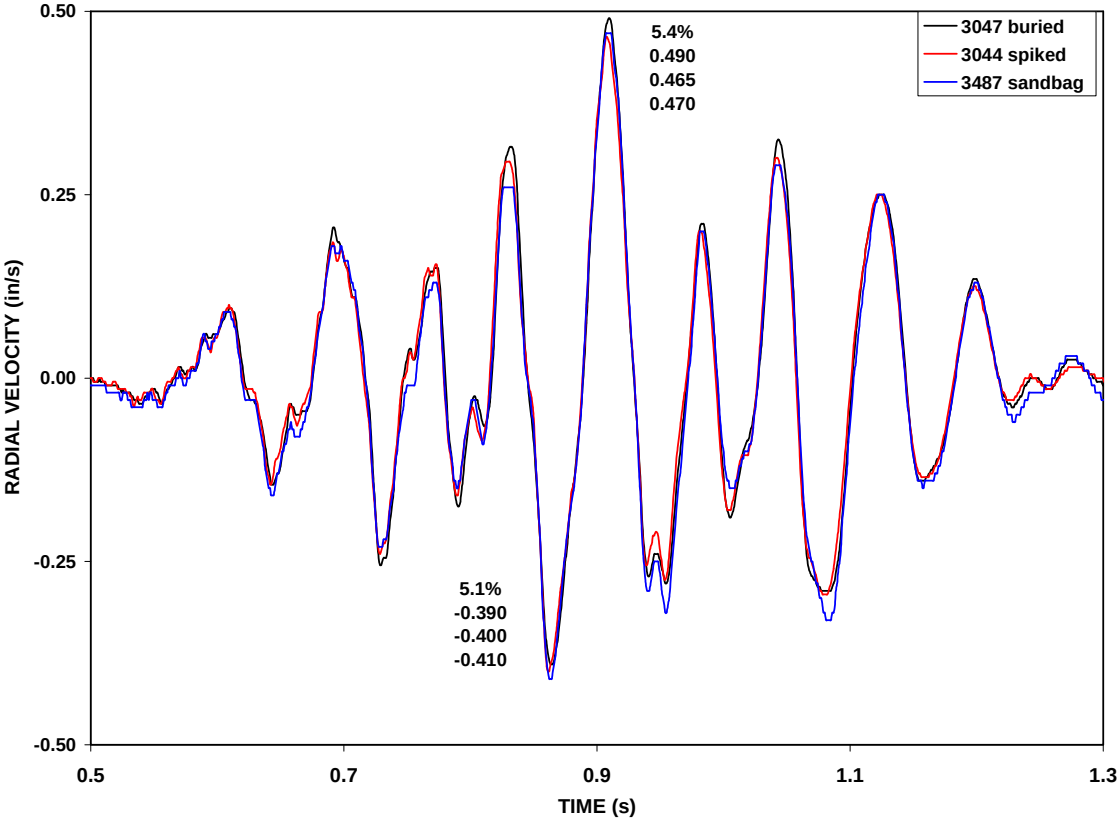

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

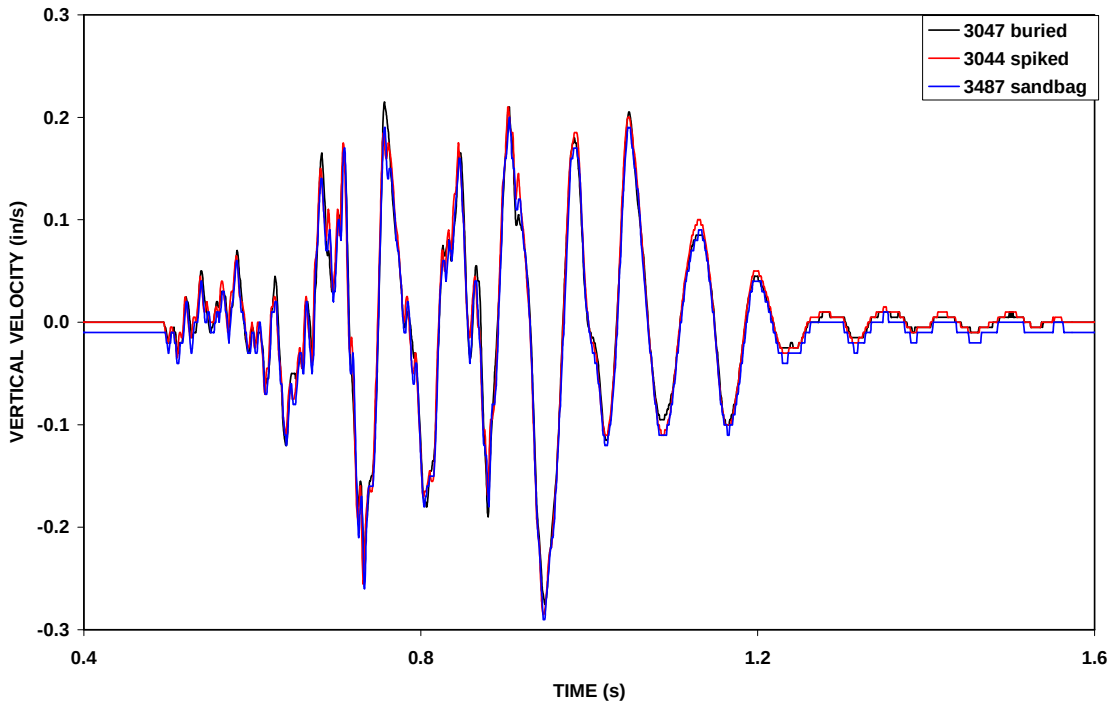

17.8%
0.900 R
1.060 R
1.020 R
1.030 R
1.050 R
0.980 R
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
1.2
0.8
0.4
0
-0.4
-0.8
-1.2
0.7
0.8
TIME (s)

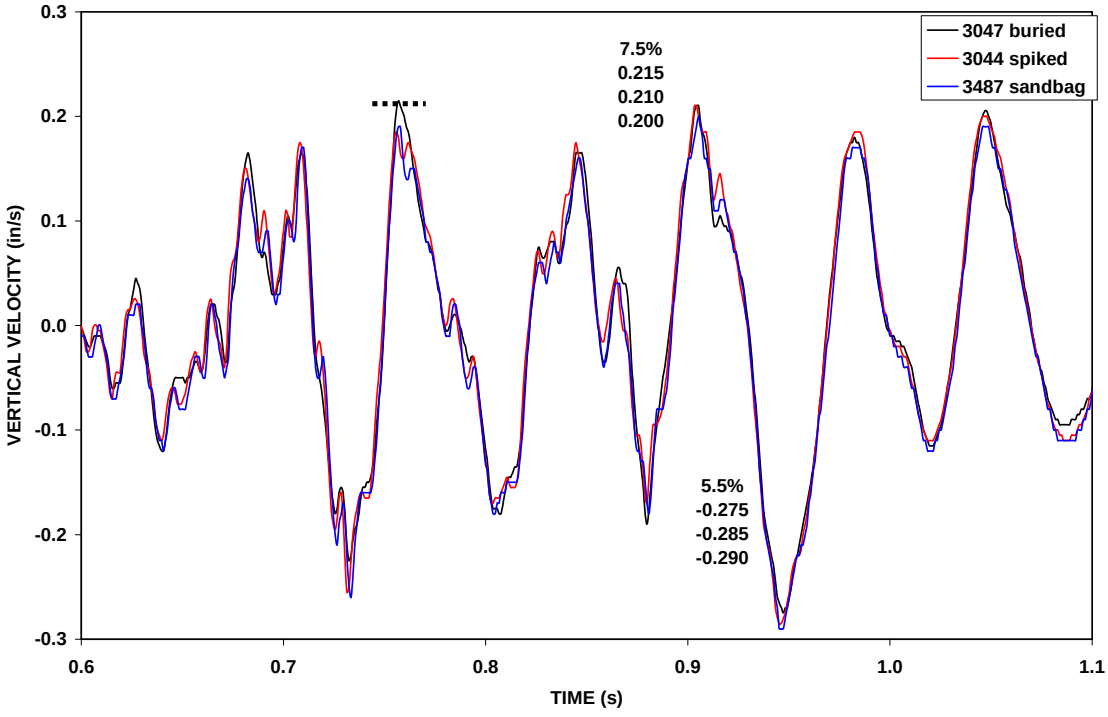
OH-5

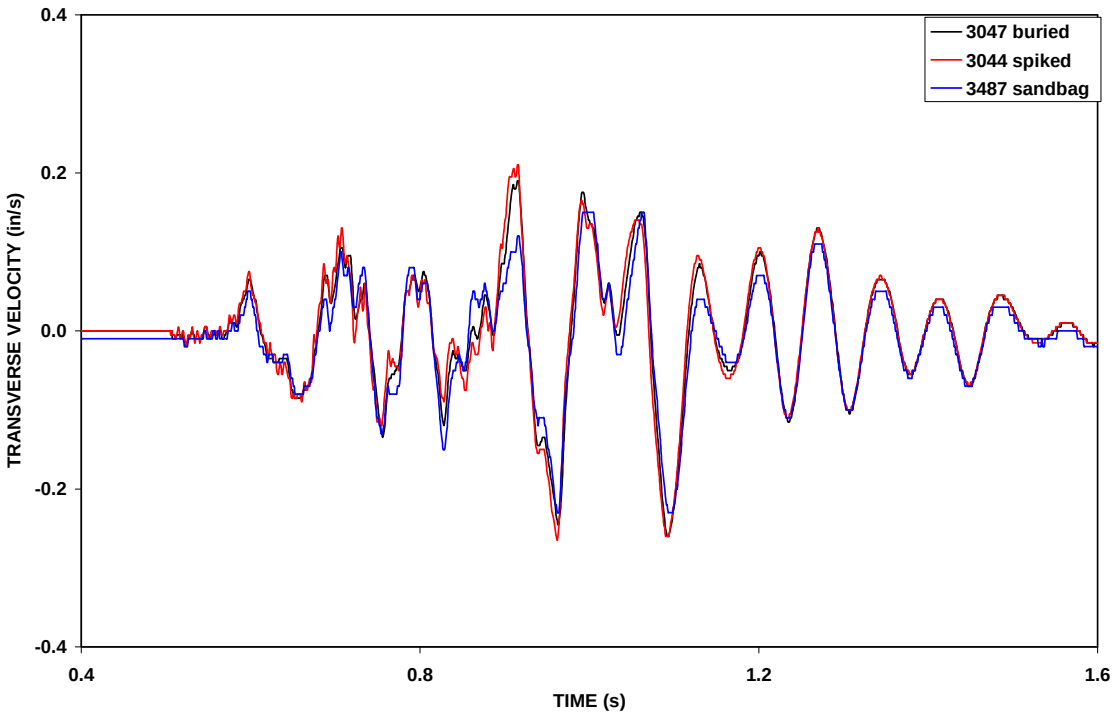
Cluster 2 SD 32.7 ft/lb$^{1/2}$

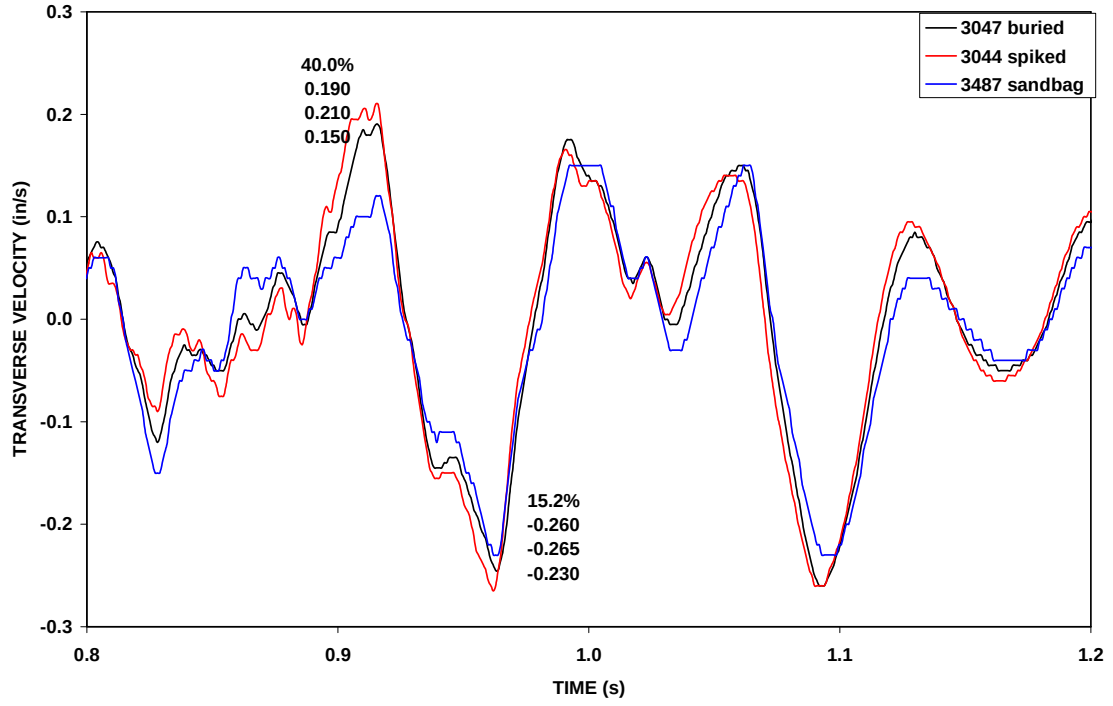

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.5
0.3
0.0
-0.3
-0.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6


3047 buried
3044 spiked
3487 sandbag
5.4%
0.490
0.465
0.470
5.1%
-0.390
-0.400
-0.410
RADIAL VELOCITY (in/s)
TIME (s)
0.50
0.25
0.00
-0.25
-0.50
0.5
0.7
0.9
1.1
1.3


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.8
1.2
1.6

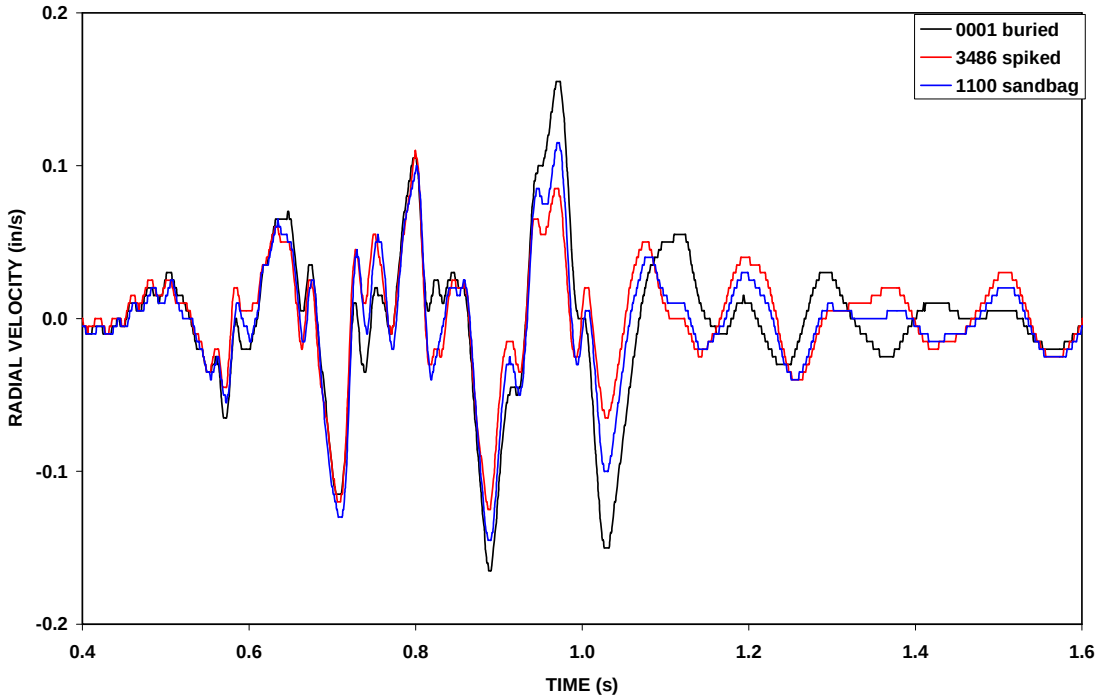

3047 buried
3044 spiked
3487 sandbag
7.5%
0.215
0.210
0.200
5.5%
-0.275
-0.285
-0.290
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.6
0.7
0.8
0.9
1.0
1.1

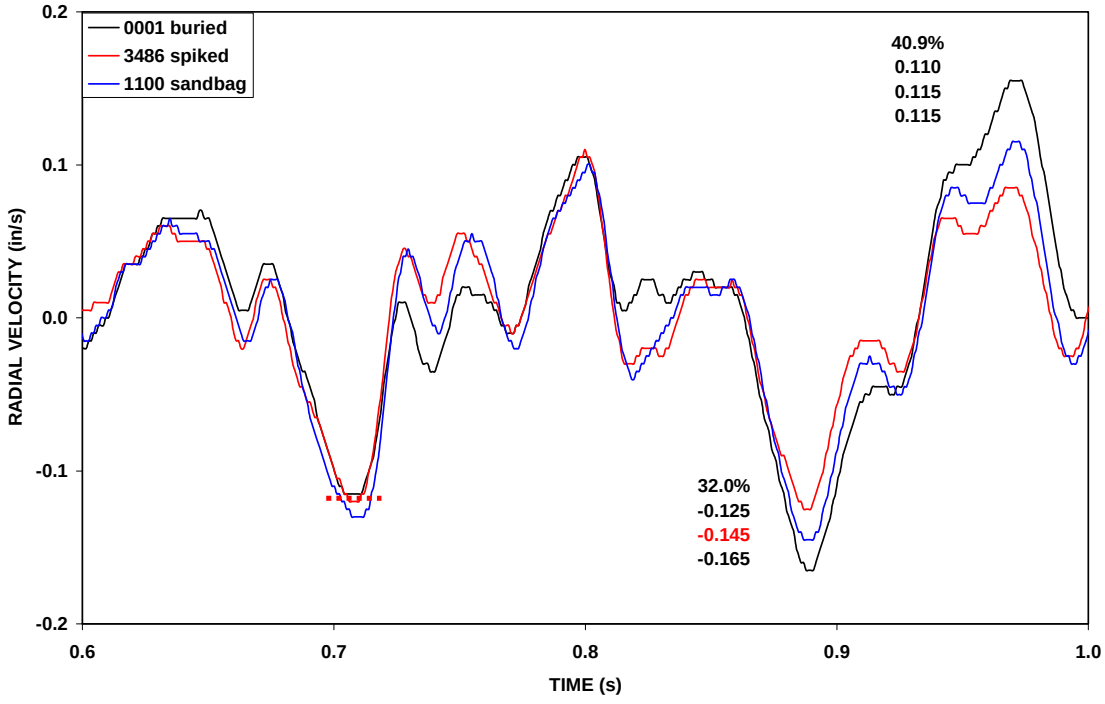

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6

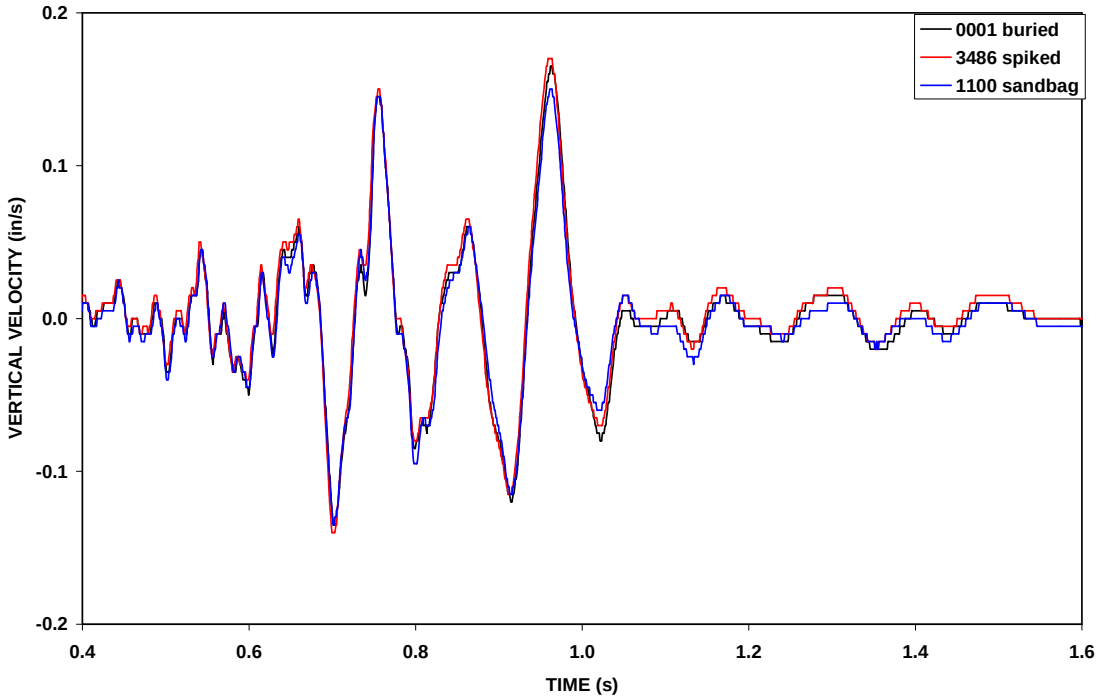

3047 buried
3044 spiked
3487 sandbag
40.0%
0.190
0.210
0.150
15.2%
-0.260
-0.265
-0.230
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.8
0.9
1.0
1.1
1.2

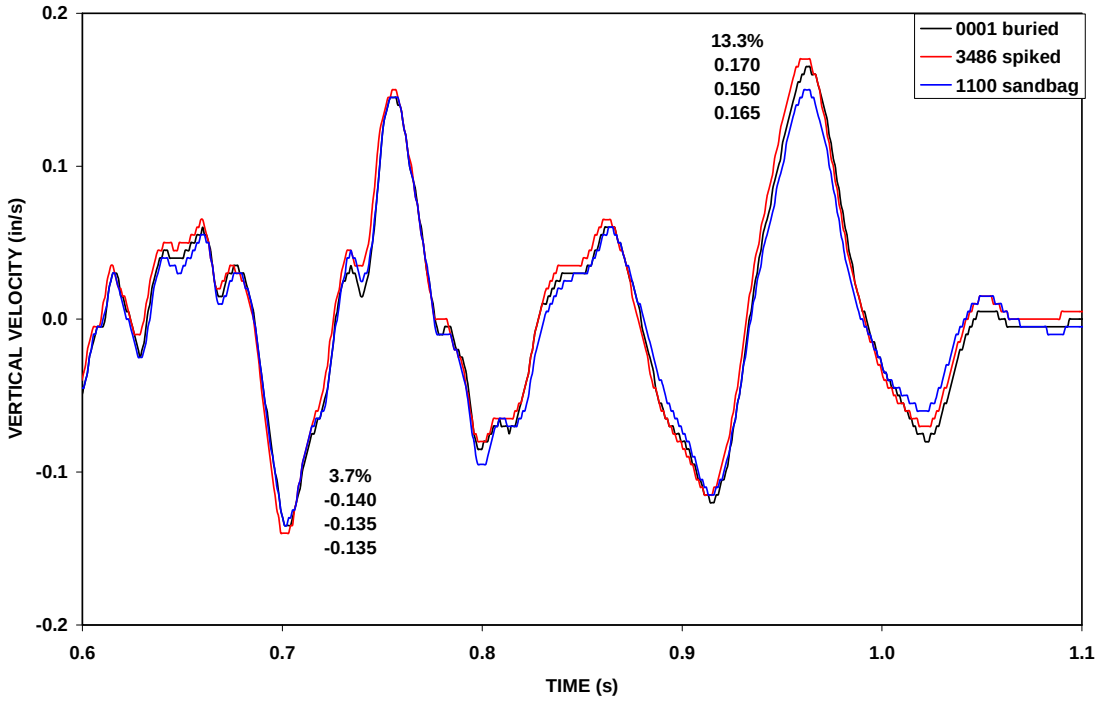
OH-5

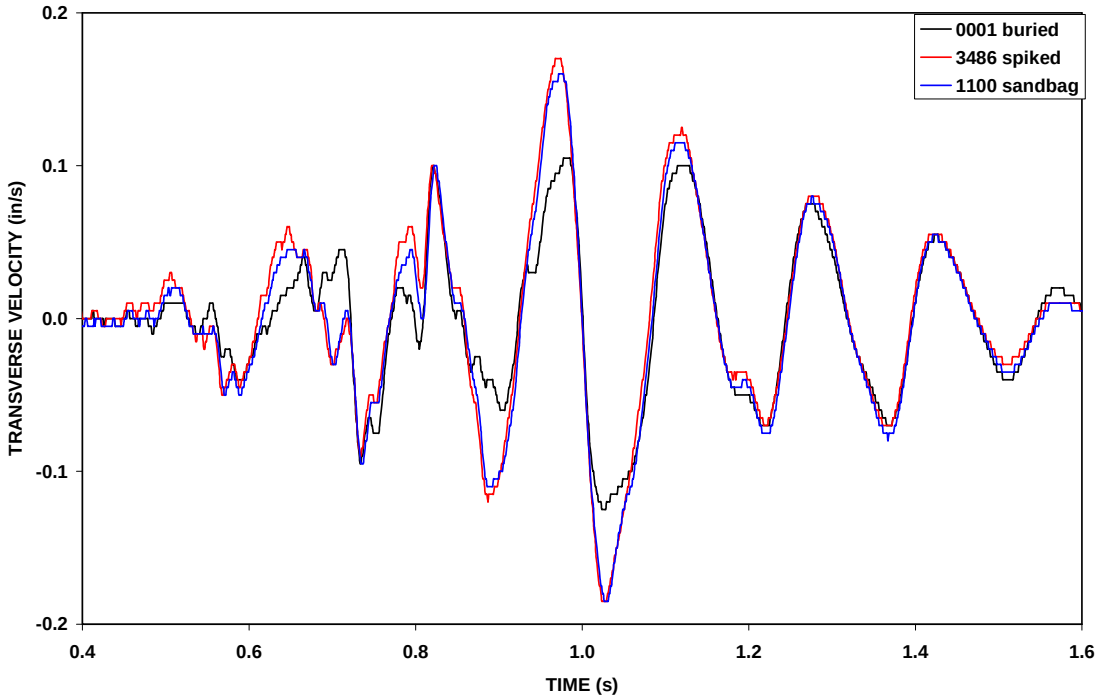
Cluster 3 SD 65.5 ft/lb$^{1/2}$

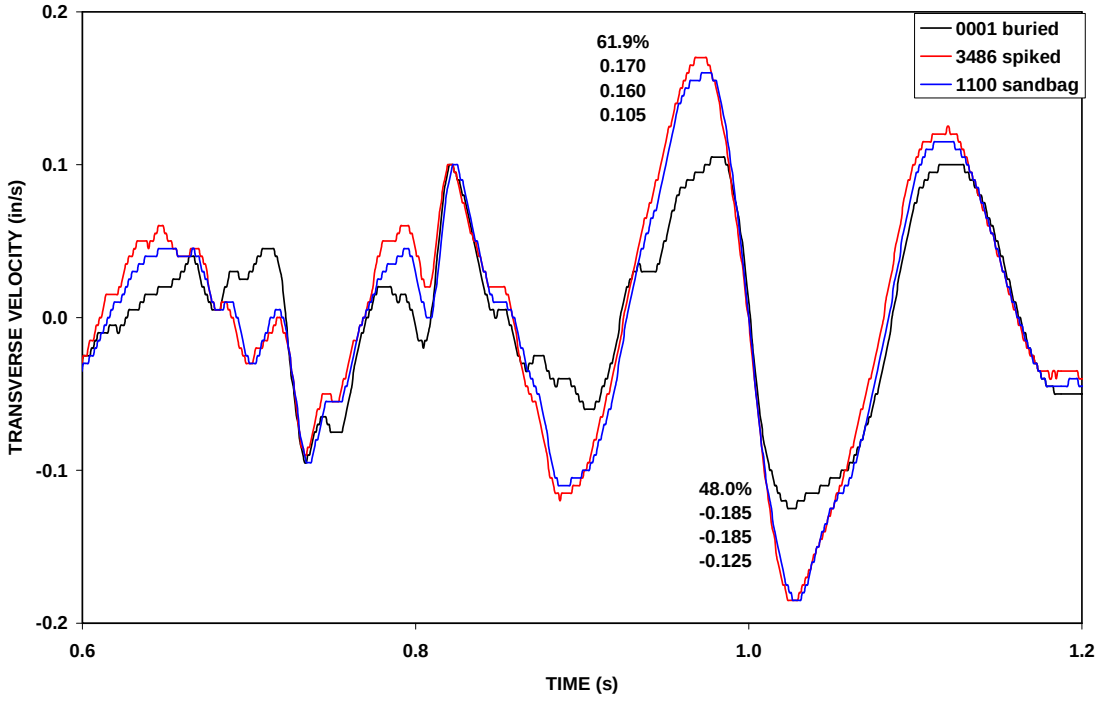

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6


0001 buried
3486 spiked
1100 sandbag
40.9%
0.110
0.115
0.115
32.0%
-0.125
-0.145
-0.165
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.7
0.8
0.9
1.0


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

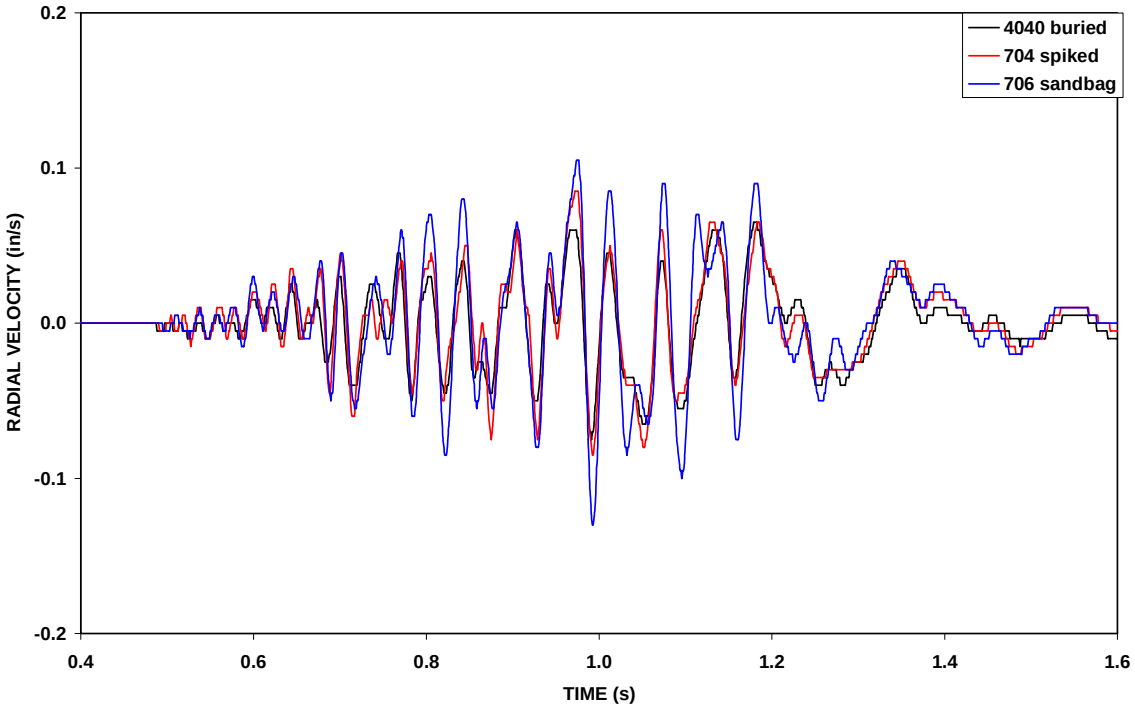

0001 buried
3486 spiked
1100 sandbag
13.3%
0.170
0.150
0.165
3.7%
-0.140
-0.135
-0.135
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.7
0.8
0.9
1.0
1.1

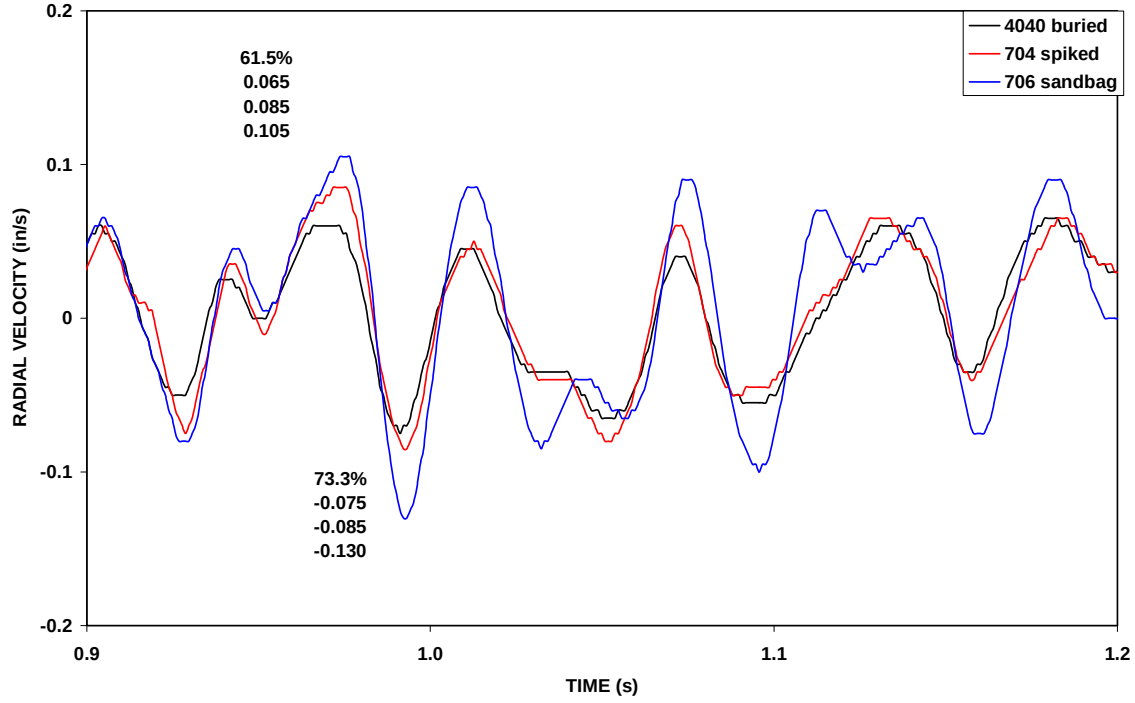

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

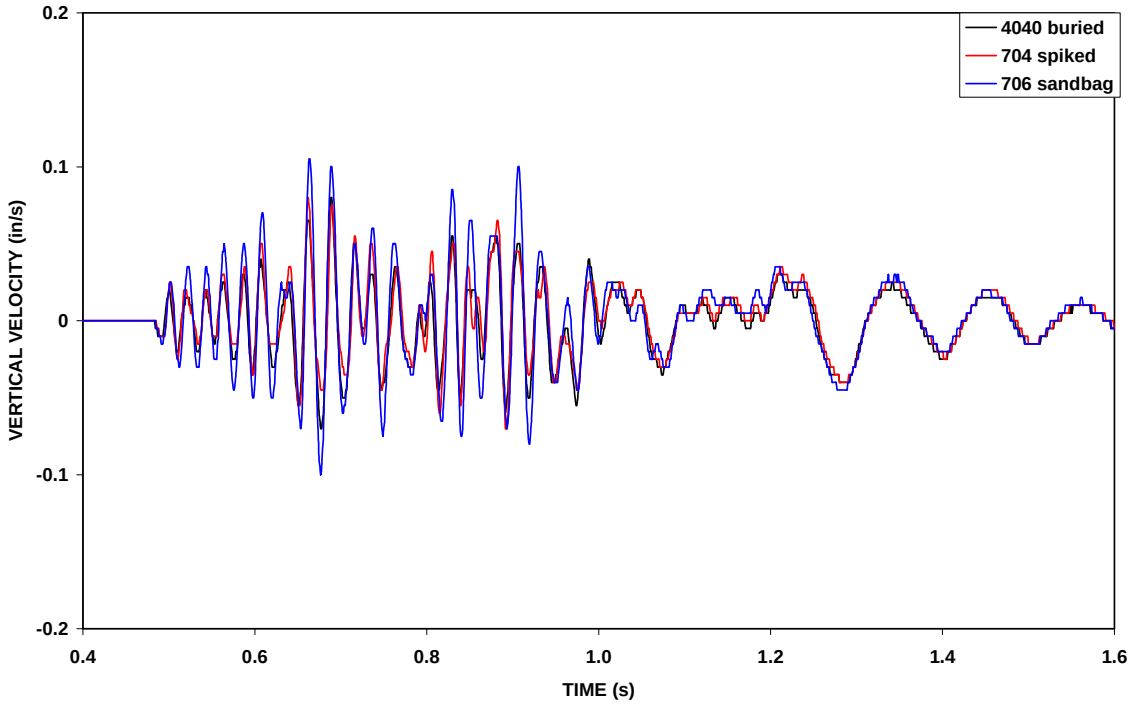

0001 buried
3486 spiked
1100 sandbag
61.9%
0.170
0.160
0.105
48.0%
-0.185
-0.185
-0.125
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.8
1.0
1.2

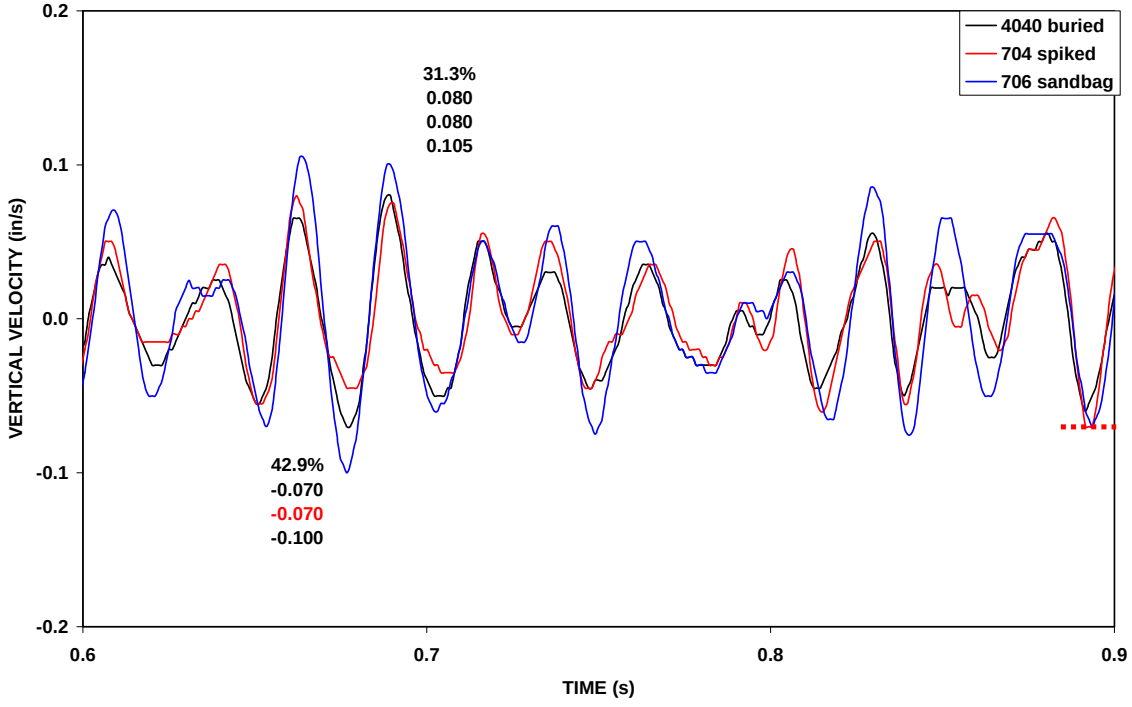
OH-5

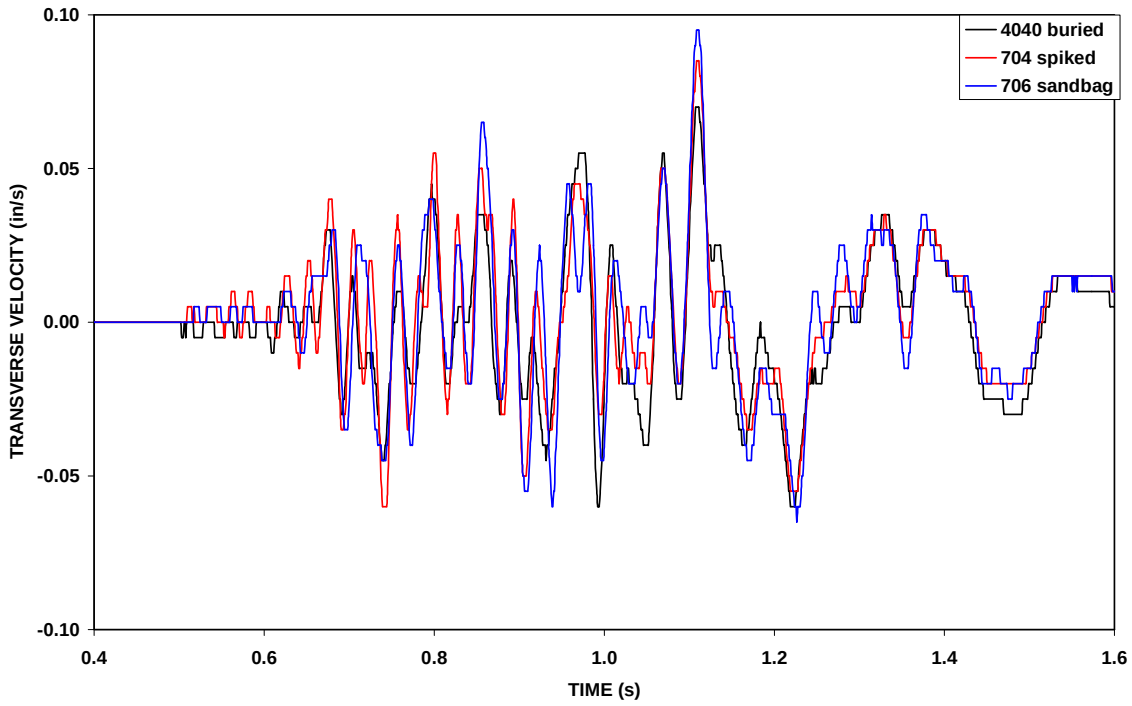
Cluster 4 SD 109.1 ft/lb$^{1/2}$

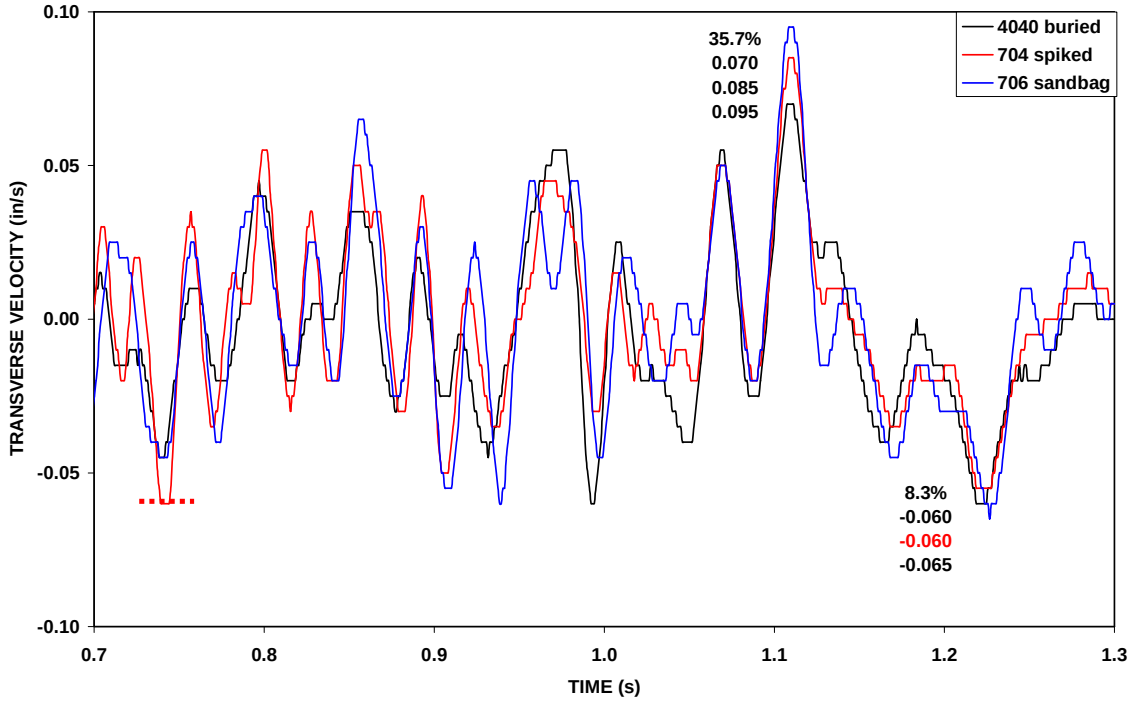

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6


4040 buried
704 spiked
706 sandbag
61.5%
0.065
0.085
0.105
73.3%
-0.075
-0.085
-0.130
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0
-0.1
-0.2
0.9
1.0
1.1
1.2


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

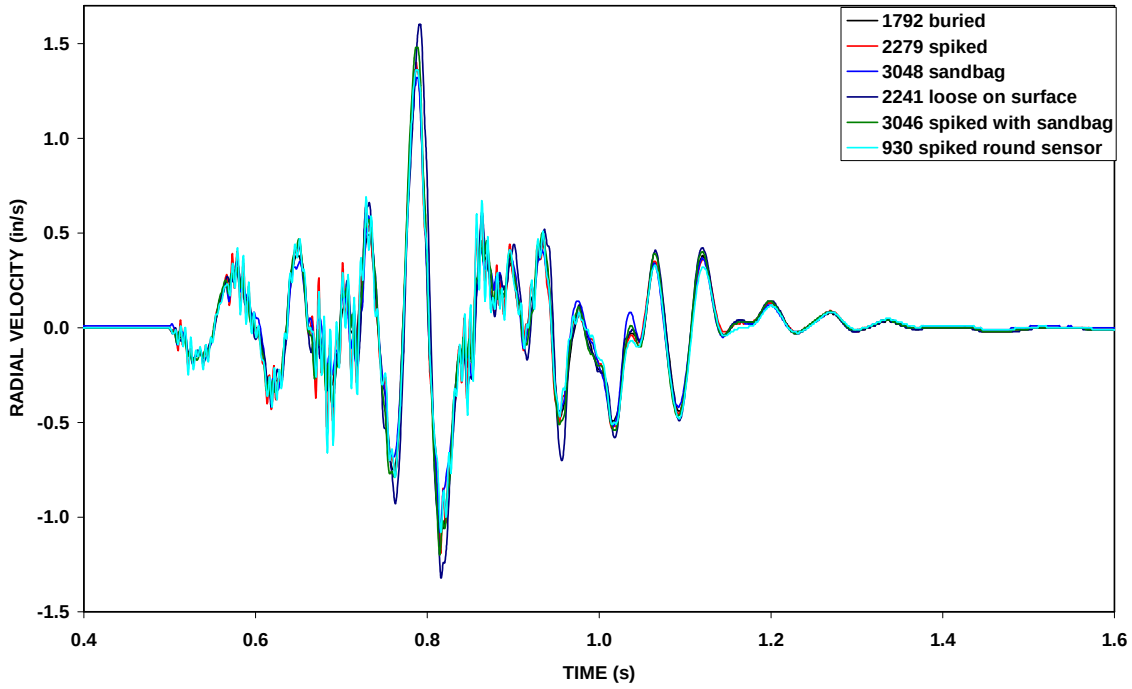

4040 buried
704 spiked
706 sandbag
31.3%
0.080
0.080
0.105
42.9%
-0.070
-0.070
-0.100
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.7
0.8
0.9

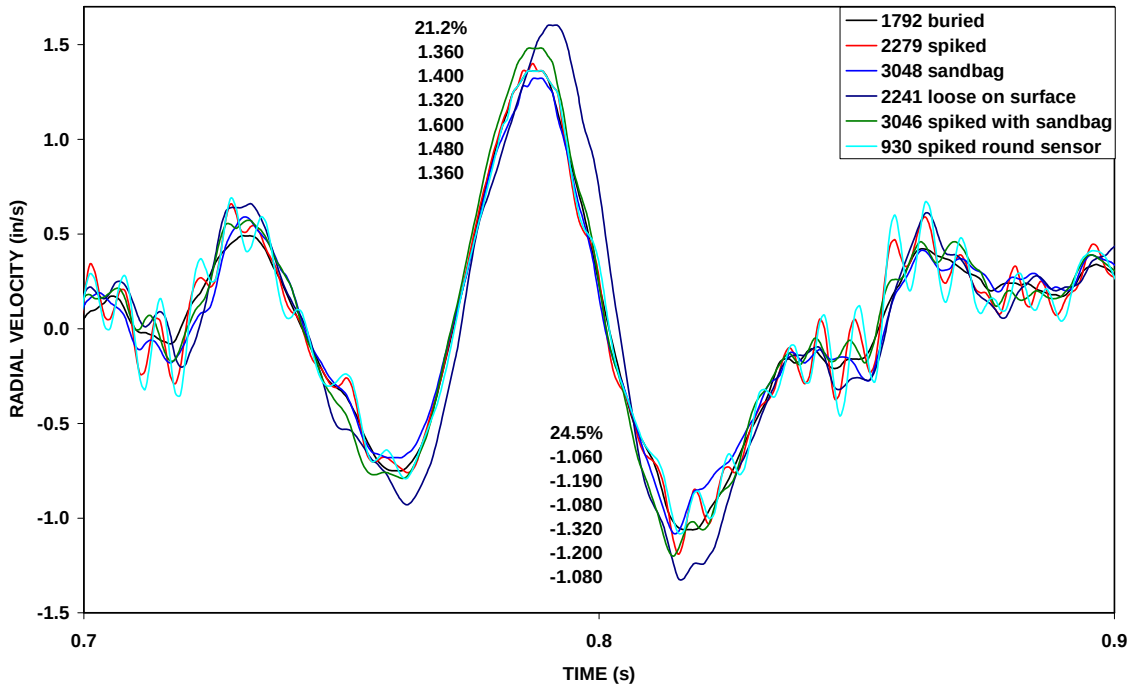

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
0.4
0.6
0.8
1.0
1.2
1.4
1.6

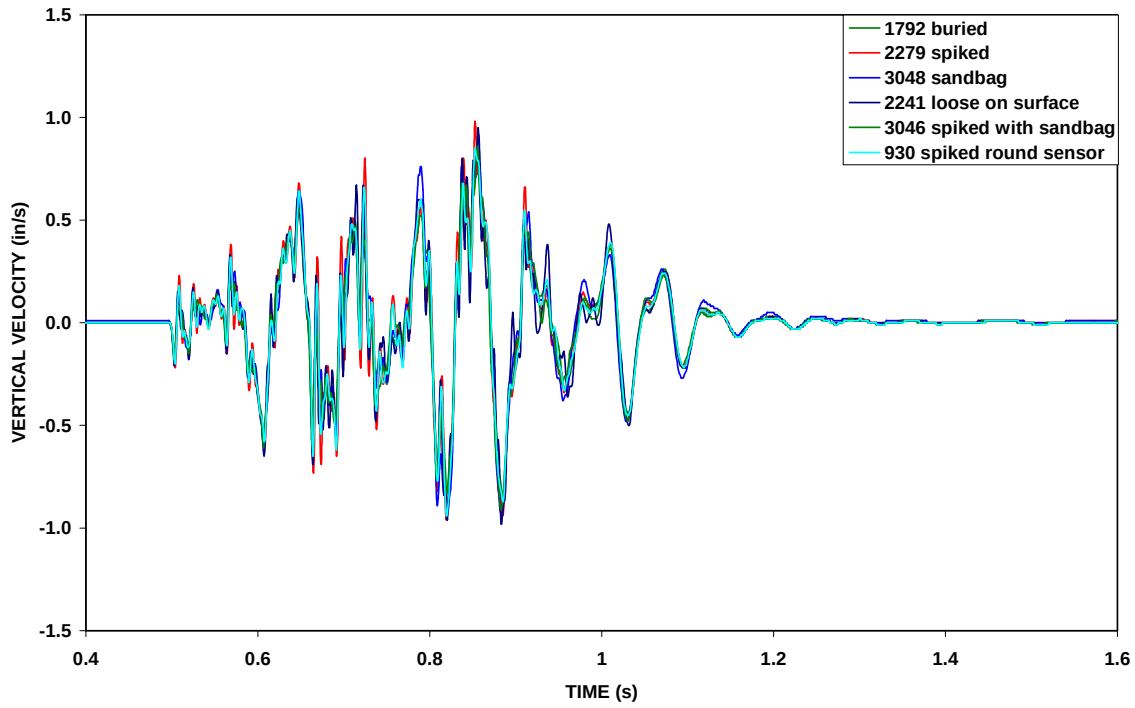

4040 buried
704 spiked
706 sandbag
35.7%
0.070
0.085
0.095
8.3%
-0.060
-0.060
-0.065
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
0.7
0.8
0.9
1.0
1.1
1.2
1.3

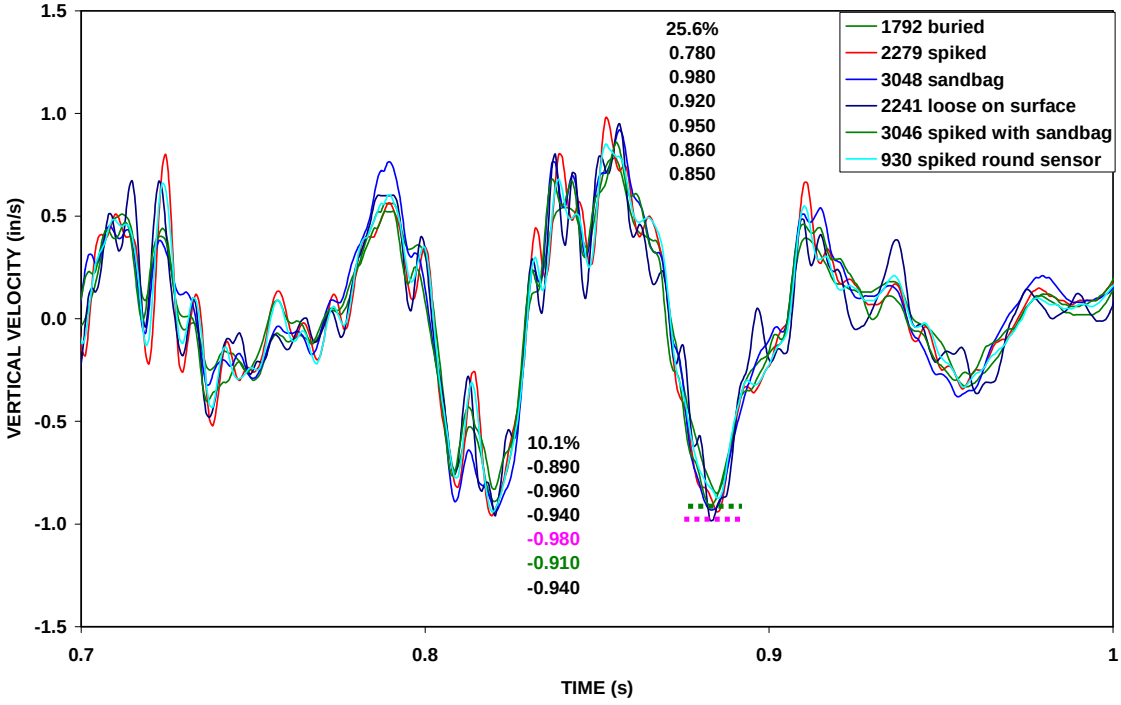
OH-6

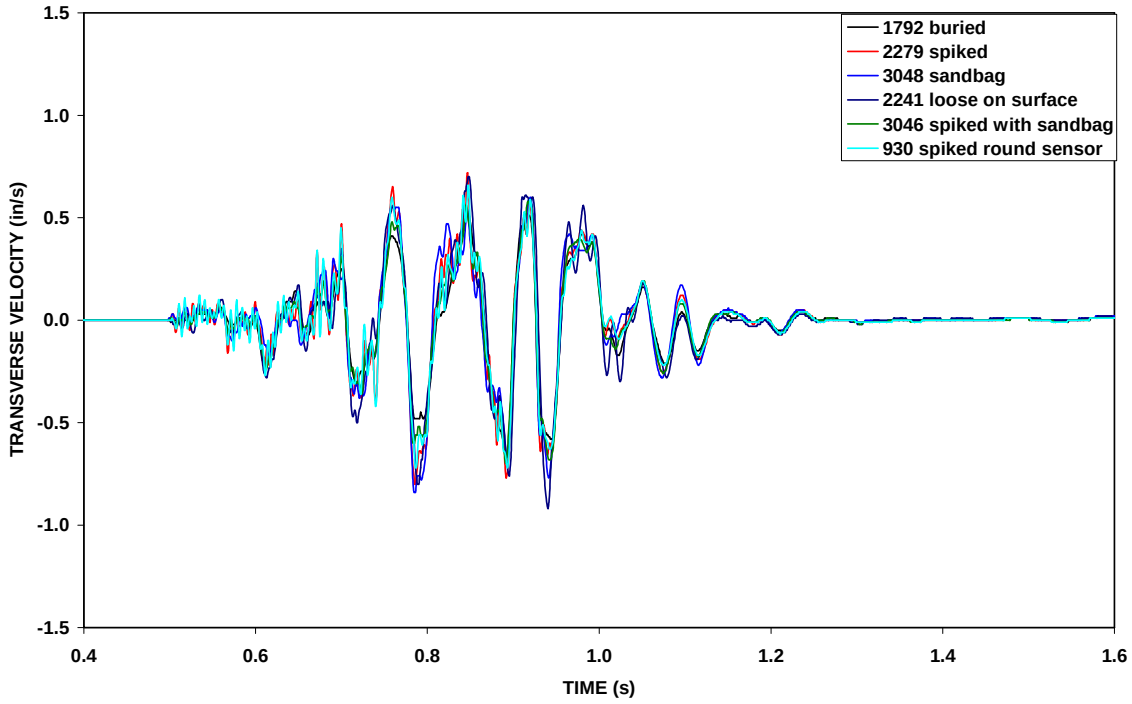
Cluster 1 SD 13.1 ft/lb$^{1/2}$

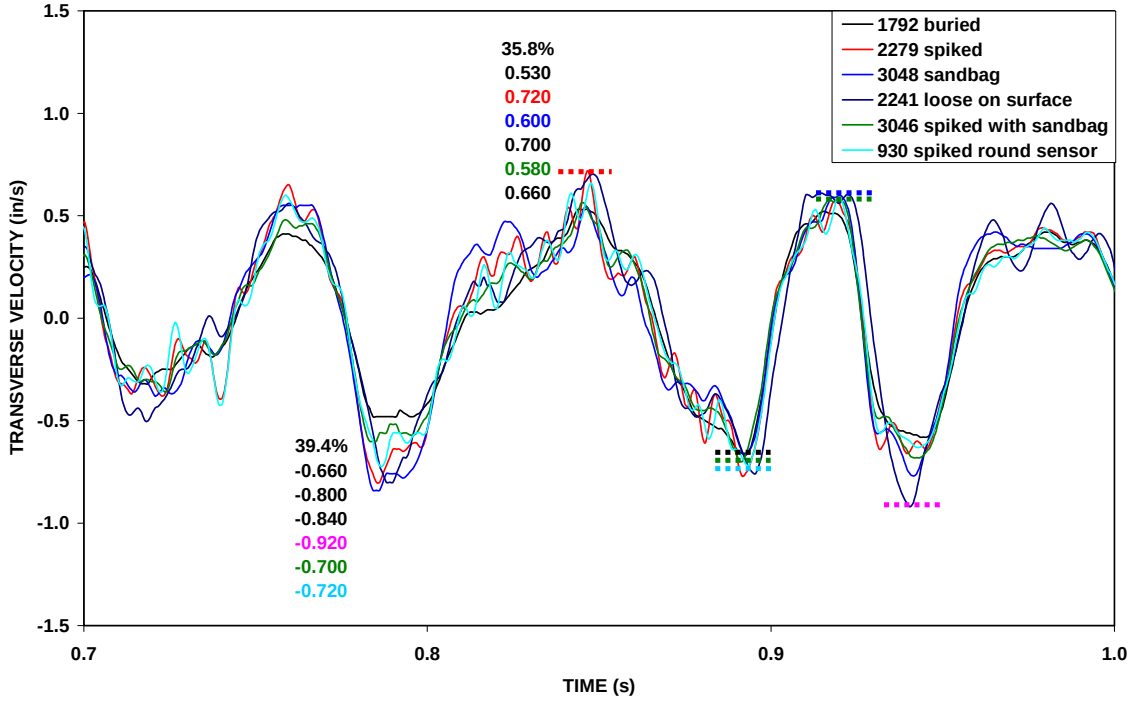

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

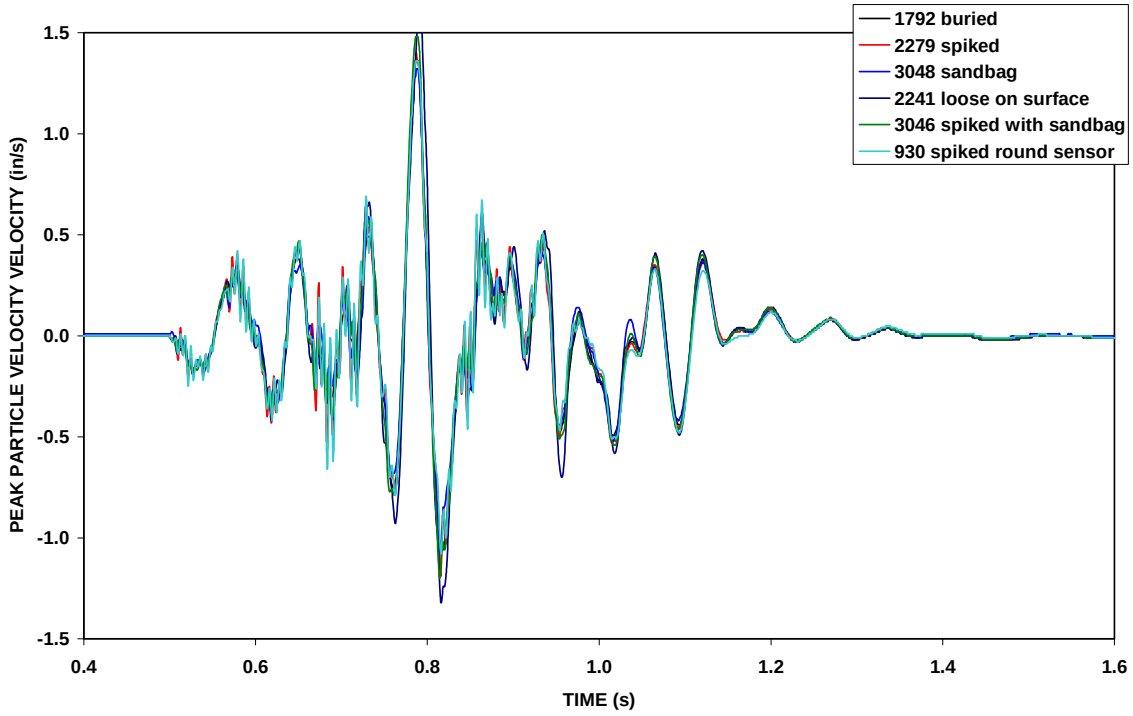

21.2%
1.360
1.400
1.320
1.600
1.480
1.360
24.5%
-1.060
-1.190
-1.080
-1.320
-1.200
-1.080
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.7
0.8
0.9
TIME (s)

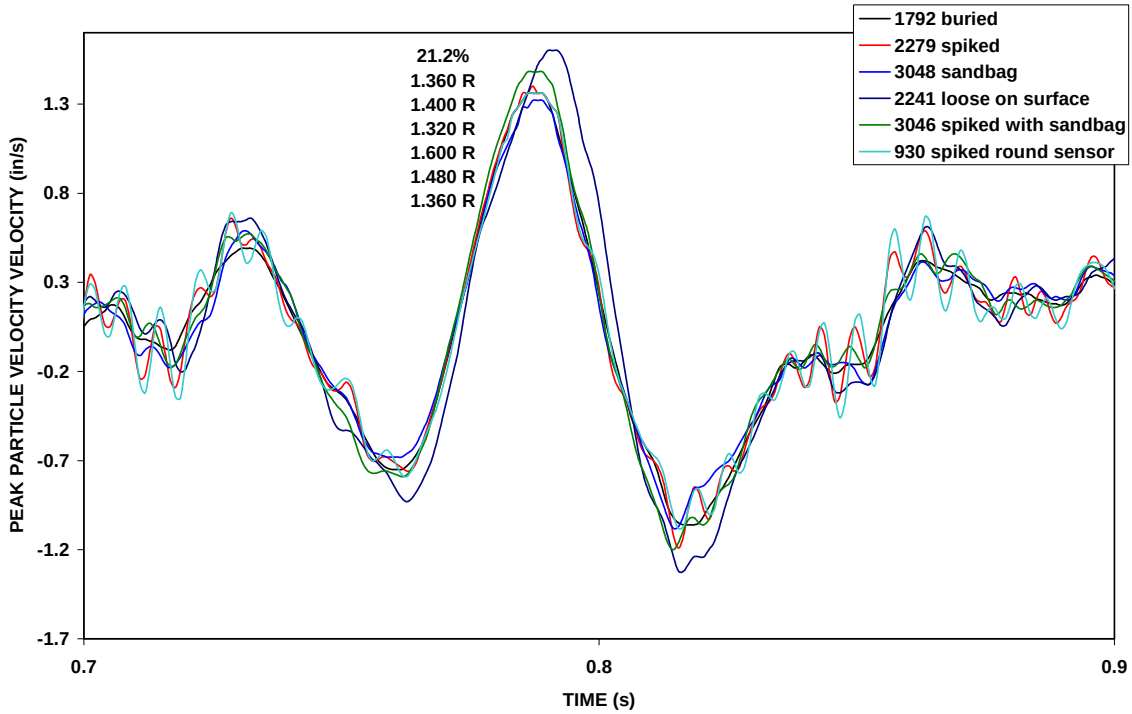

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1
1.2
1.4
1.6


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
25.6%
0.780
0.980
0.920
0.950
0.860
0.850
10.1%
-0.890
-0.960
-0.940
-0.980
-0.910
-0.940
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.7
0.8
0.9
1


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6

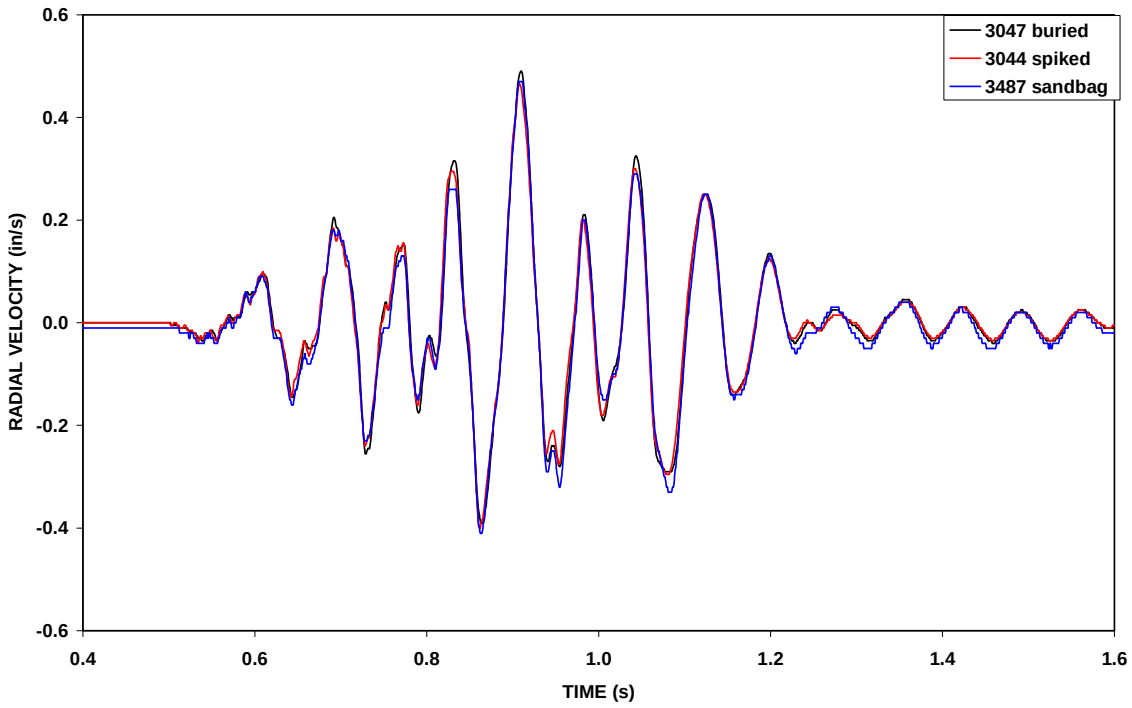

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
35.8%
0.530
0.720
0.600
0.700
0.580
0.660
39.4%
-0.660
-0.800
-0.840
-0.920
-0.700
-0.720
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.7
0.8
0.9
1.0

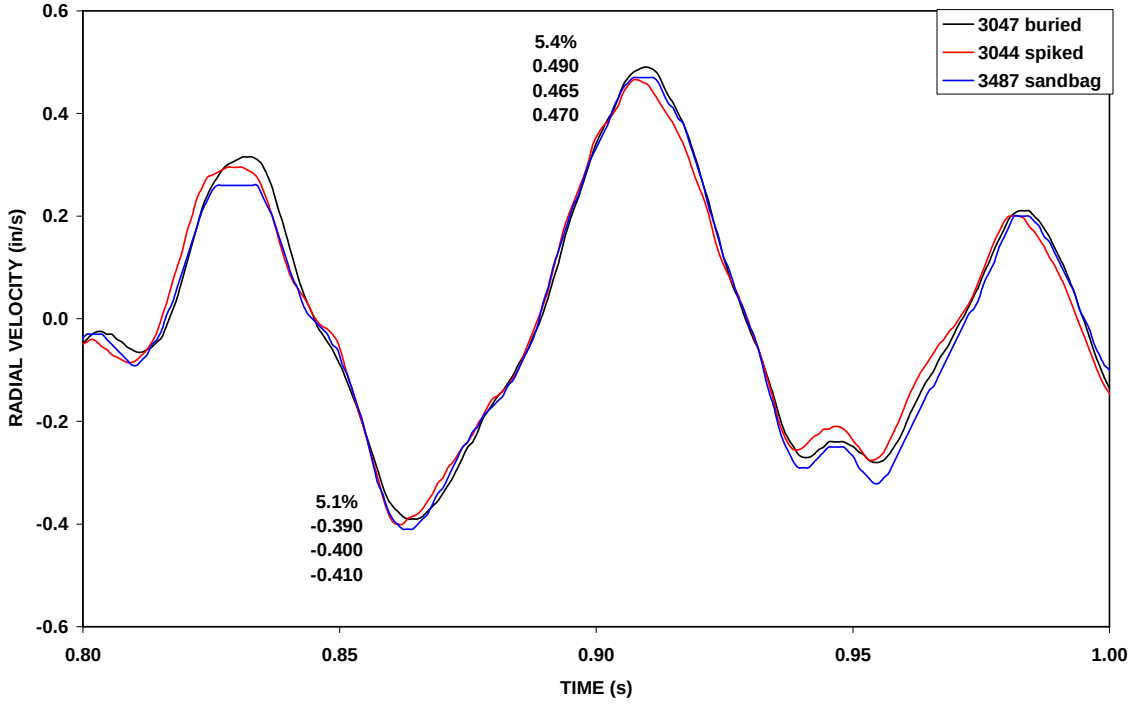

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

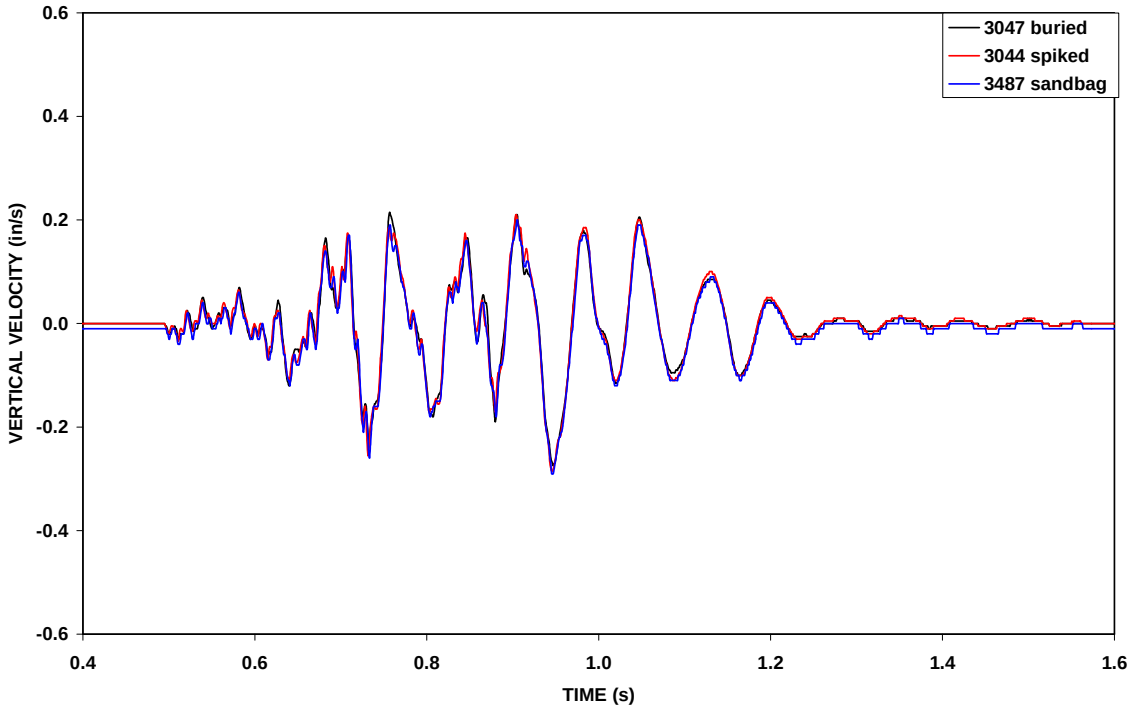

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
21.2%
1.360 R
1.400 R
1.320 R
1.600 R
1.480 R
1.360 R
PEAK PARTICLE VELOCITY VELOCITY (in/s)
1.3
0.8
0.3
-0.2
-0.7
-1.2
-1.7
0.7
0.8
0.9
TIME (s)

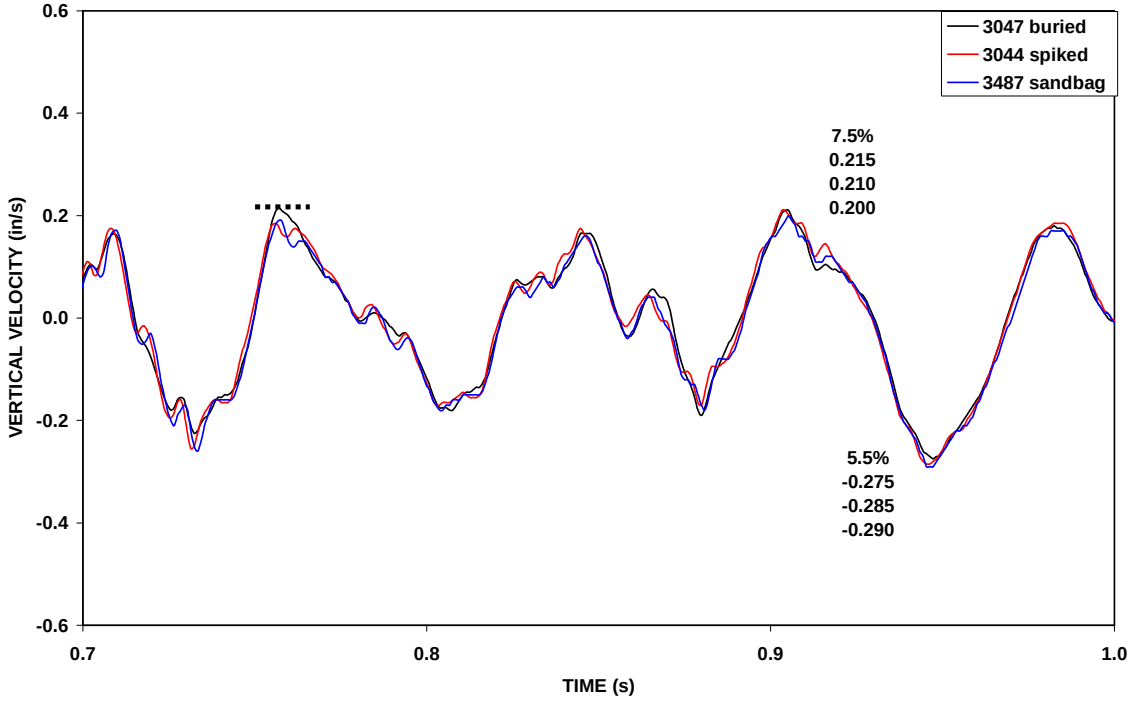
OH-6

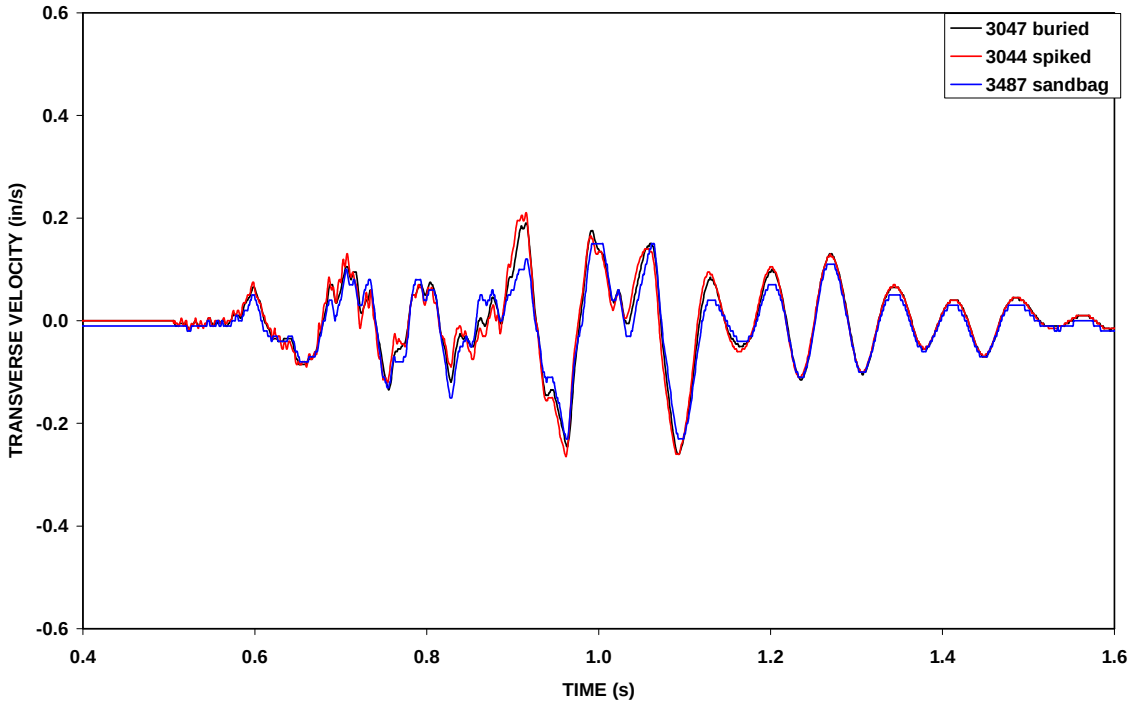
Cluster 2 SD 26.1 ft/lb$^{1/2}$

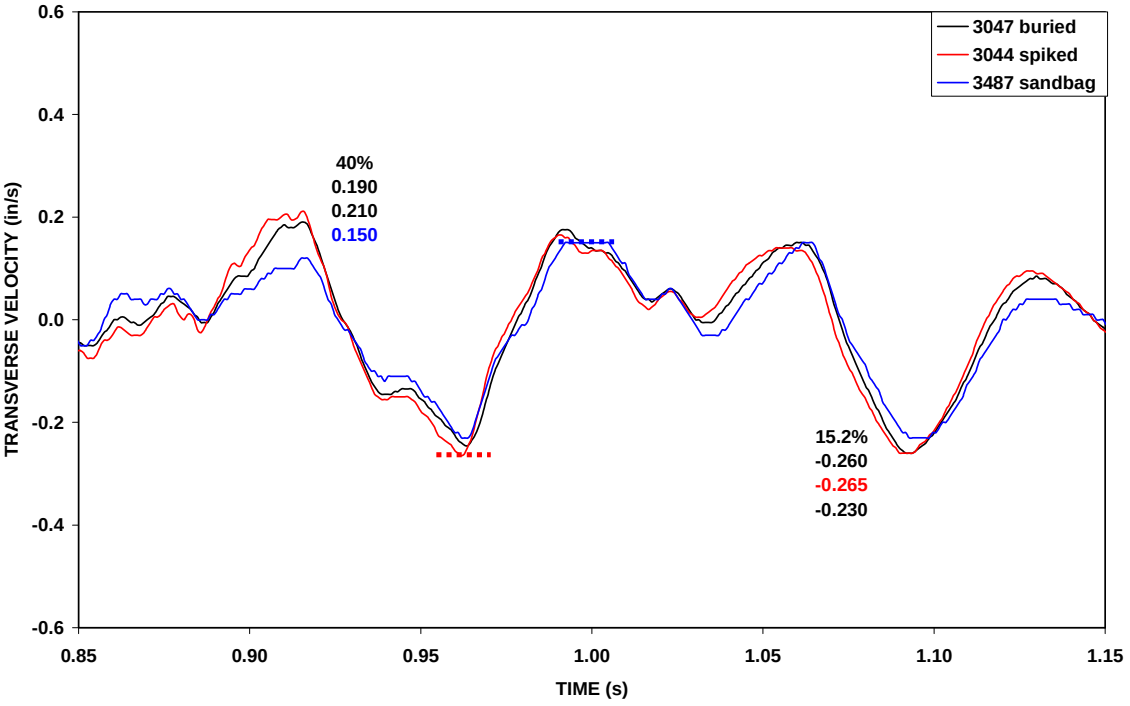

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6


3047 buried
3044 spiked
3487 sandbag
5.4%
0.490
0.465
0.470
5.1%
-0.390
-0.400
-0.410
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.80
0.85
0.90
0.95
1.00


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6

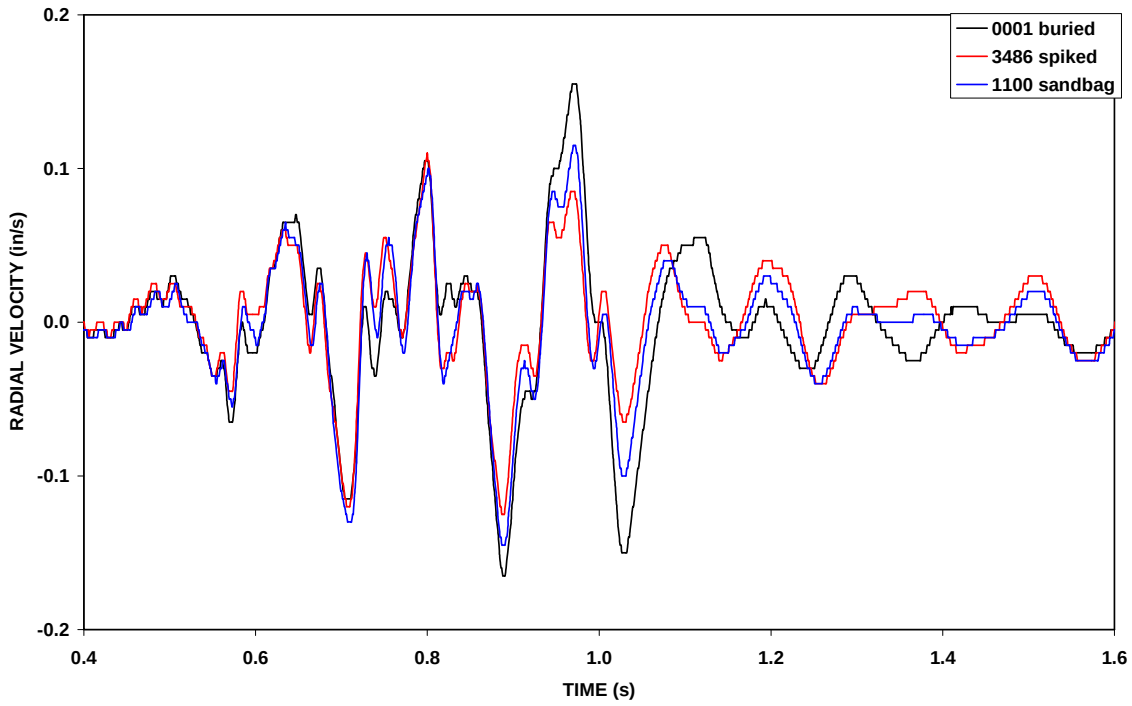

3047 buried
3044 spiked
3487 sandbag
7.5%
0.215
0.210
0.200
5.5%
-0.275
-0.285
-0.290
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.7
0.8
0.9
1.0

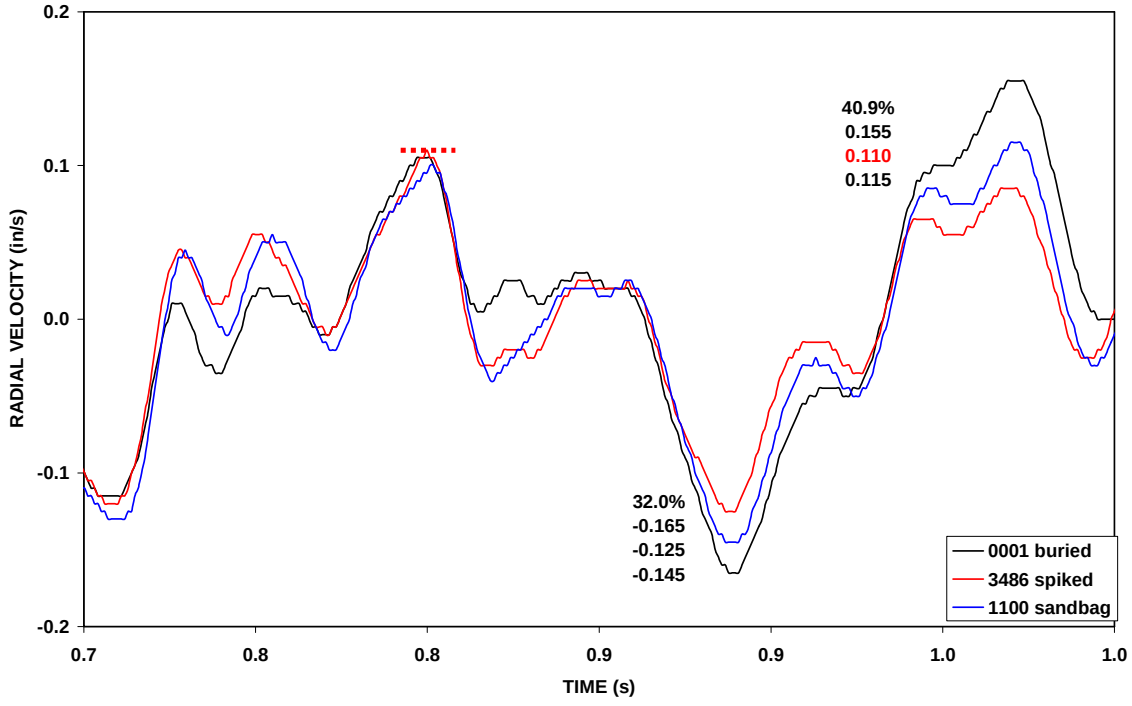

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6

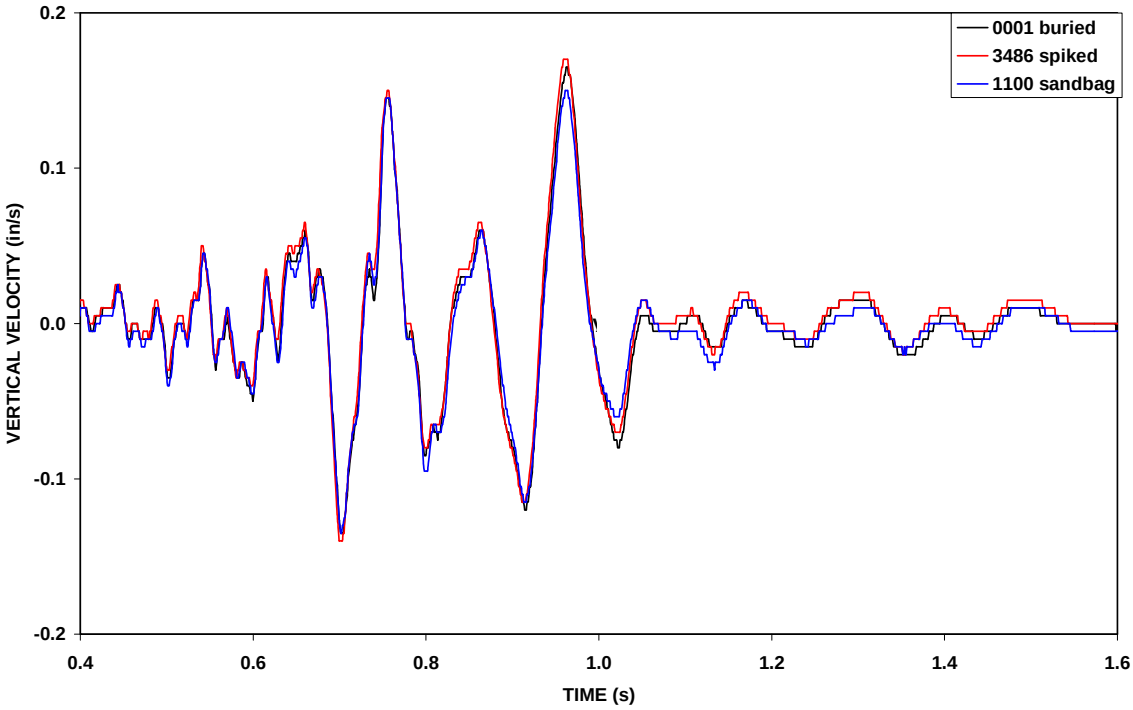

3047 buried
3044 spiked
3487 sandbag
40%
0.190
0.210
0.150
15.2%
-0.260
-0.265
-0.230
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.85
0.90
0.95
1.00
1.05
1.10
1.15

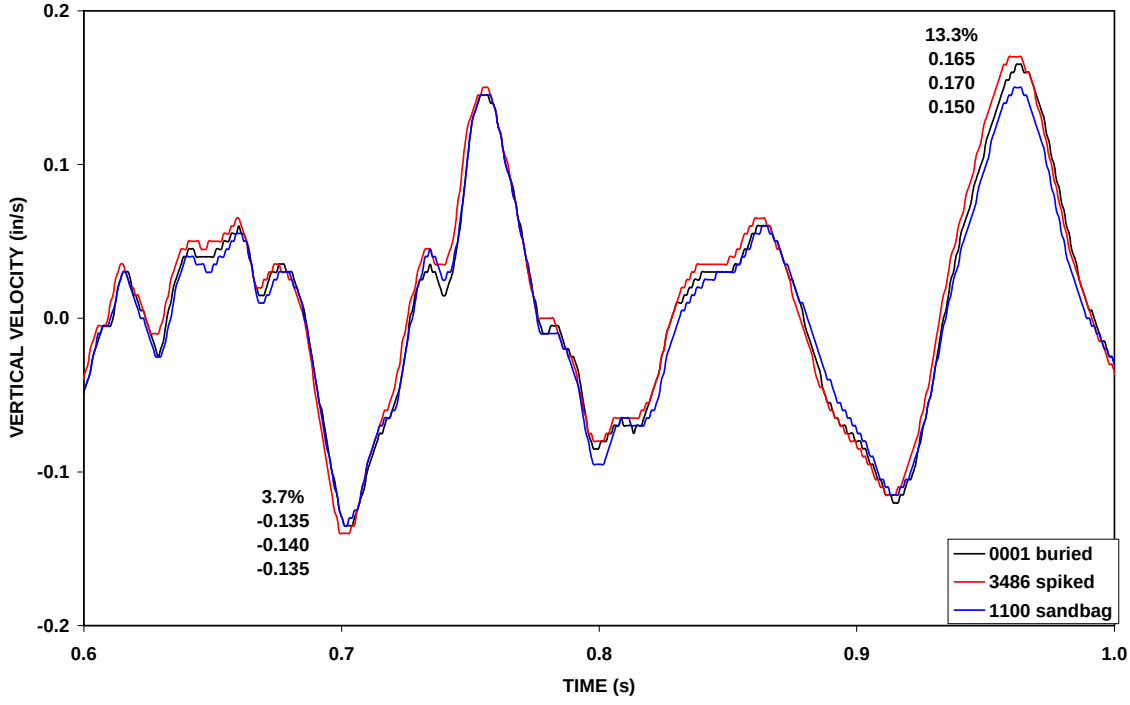
OH-6

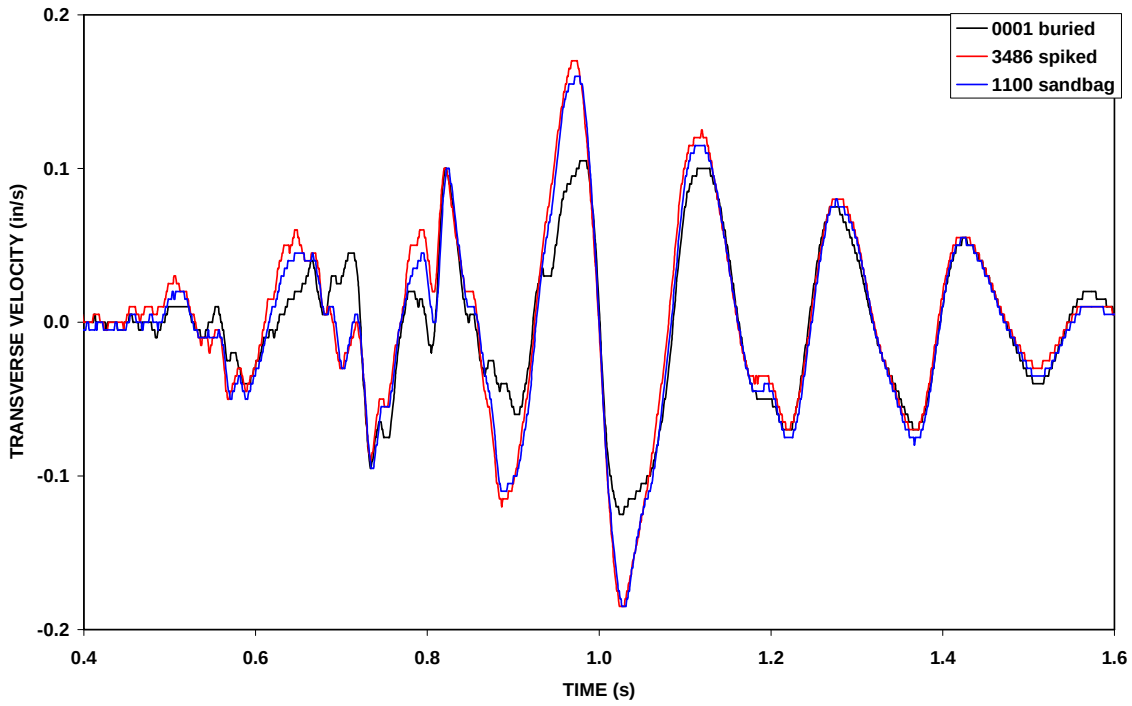
Cluster 3 SD 41.5 ft/lb$^{1/2}$

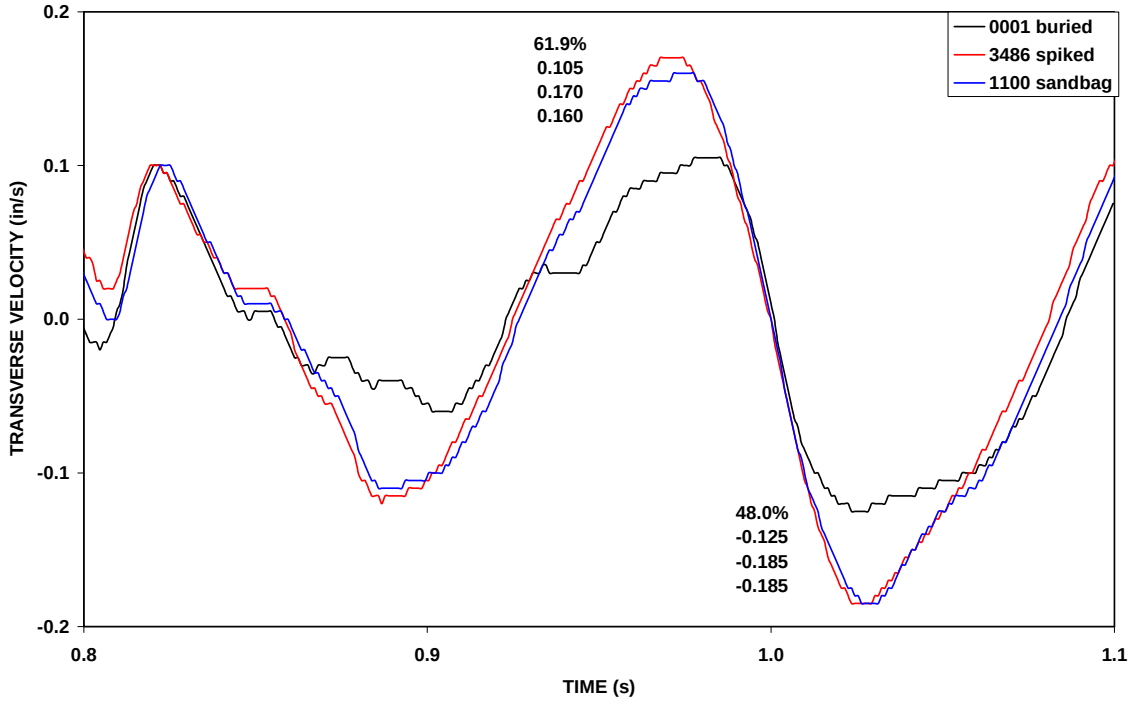

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6


40.9%
0.155
0.110
0.115
32.0%
-0.165
-0.125
-0.145
0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.7
0.8
0.8
0.9
0.9
1.0
1.0


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

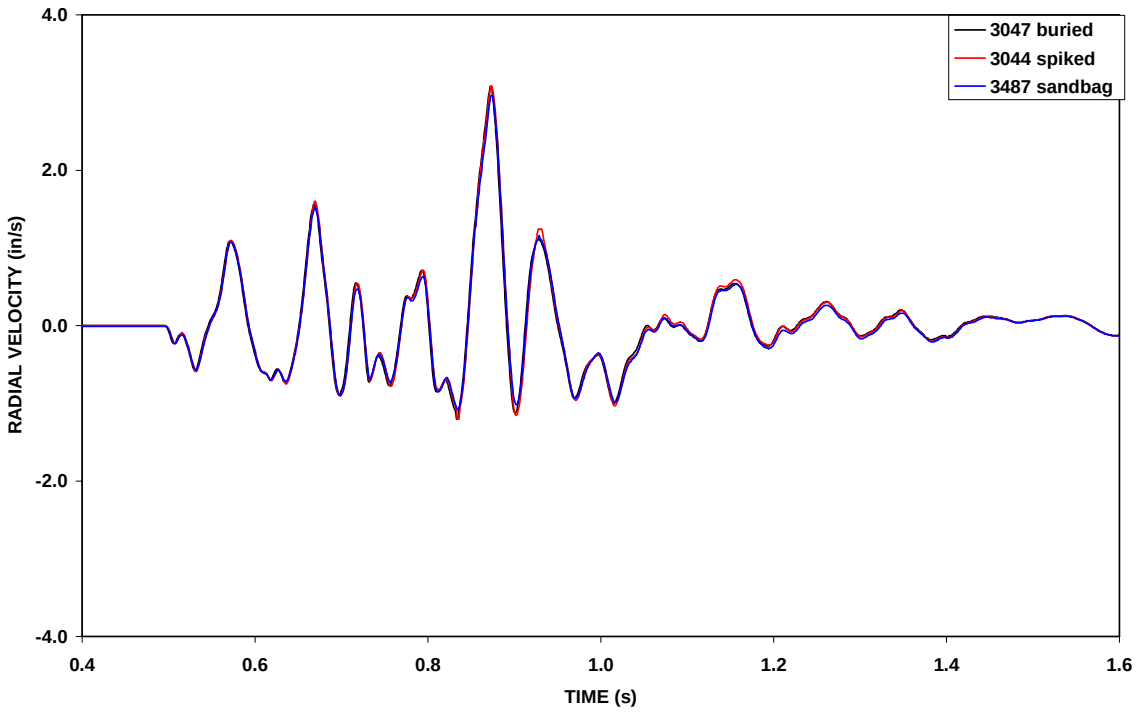

13.3%
0.165
0.170
0.150
3.7%
-0.135
-0.140
-0.135
0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.7
0.8
0.9
1.0

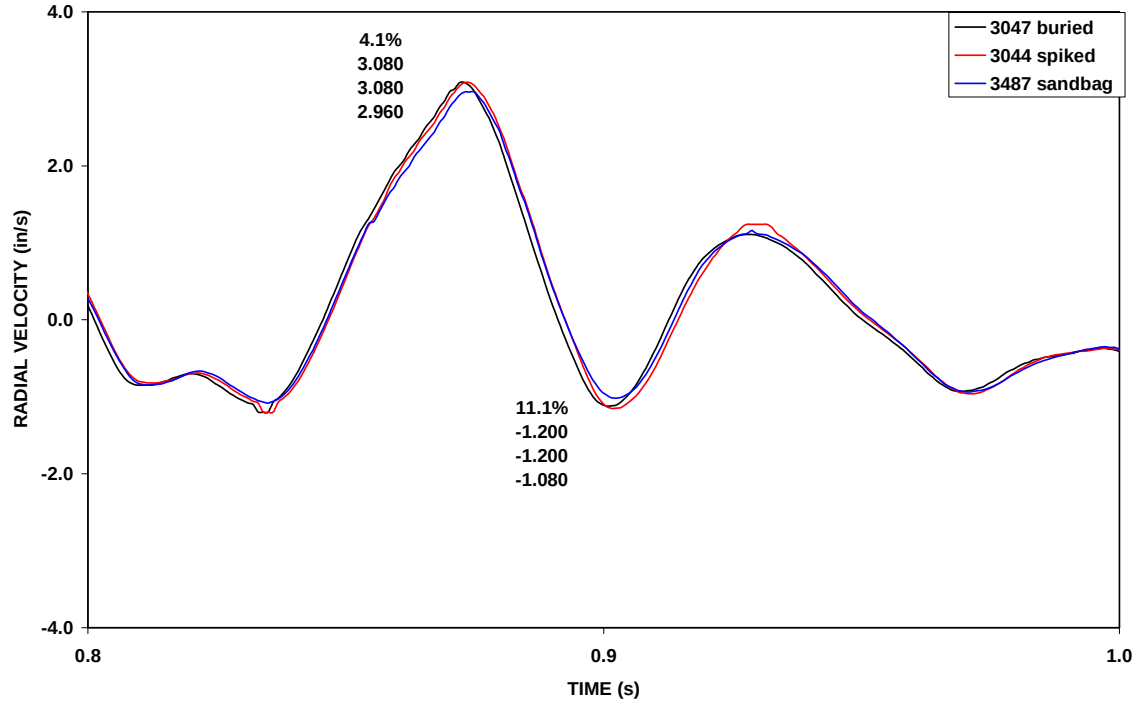

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6

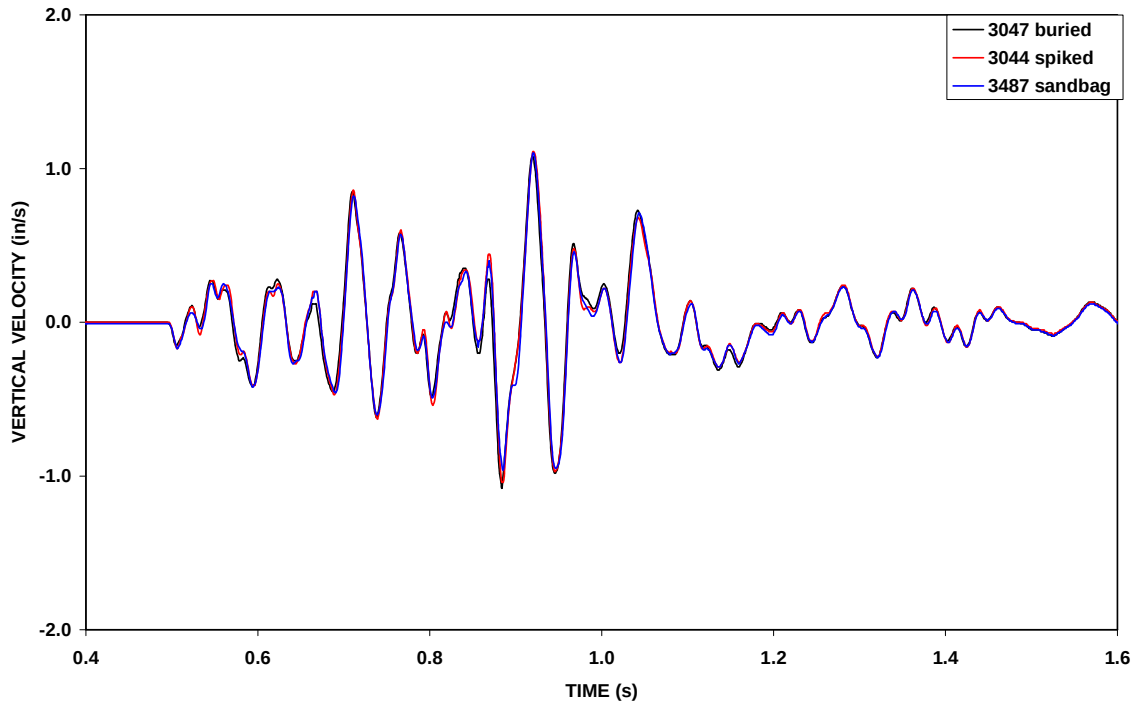

0001 buried
3486 spiked
1100 sandbag
61.9%
0.105
0.170
0.160
48.0%
-0.125
-0.185
-0.185
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.8
0.9
1.0
1.1

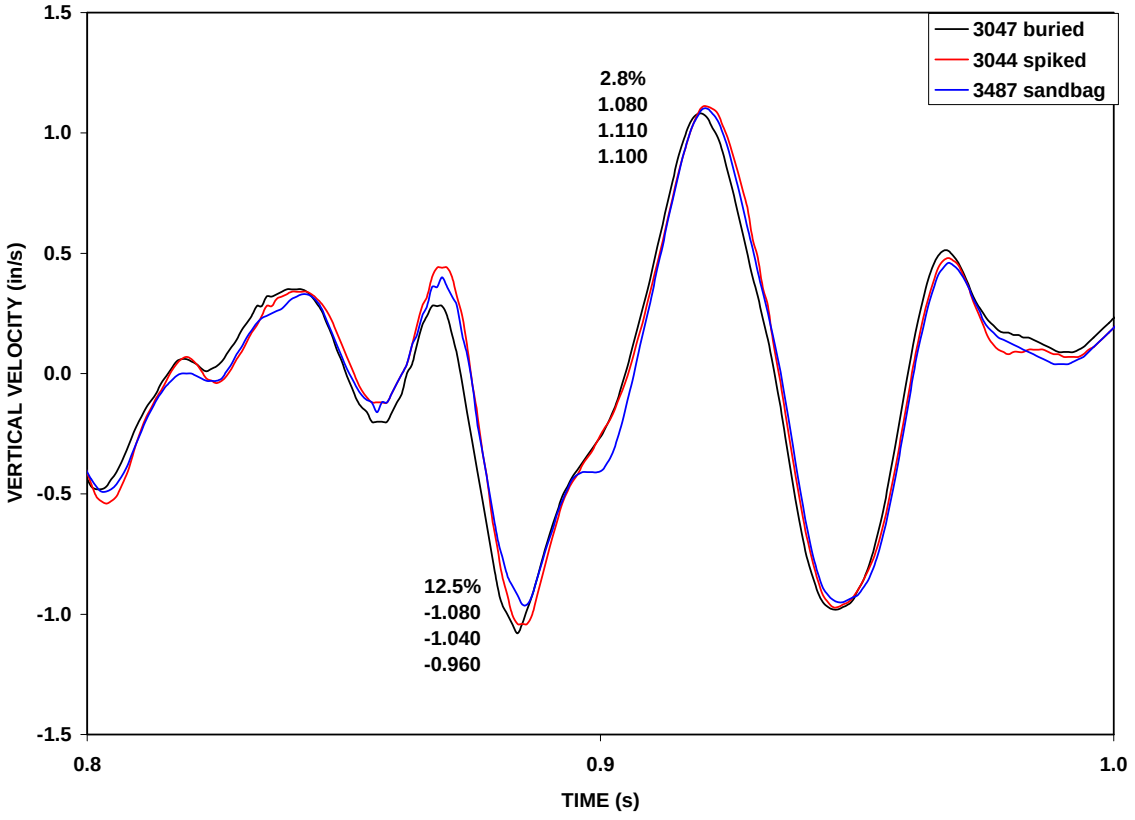
WV-1

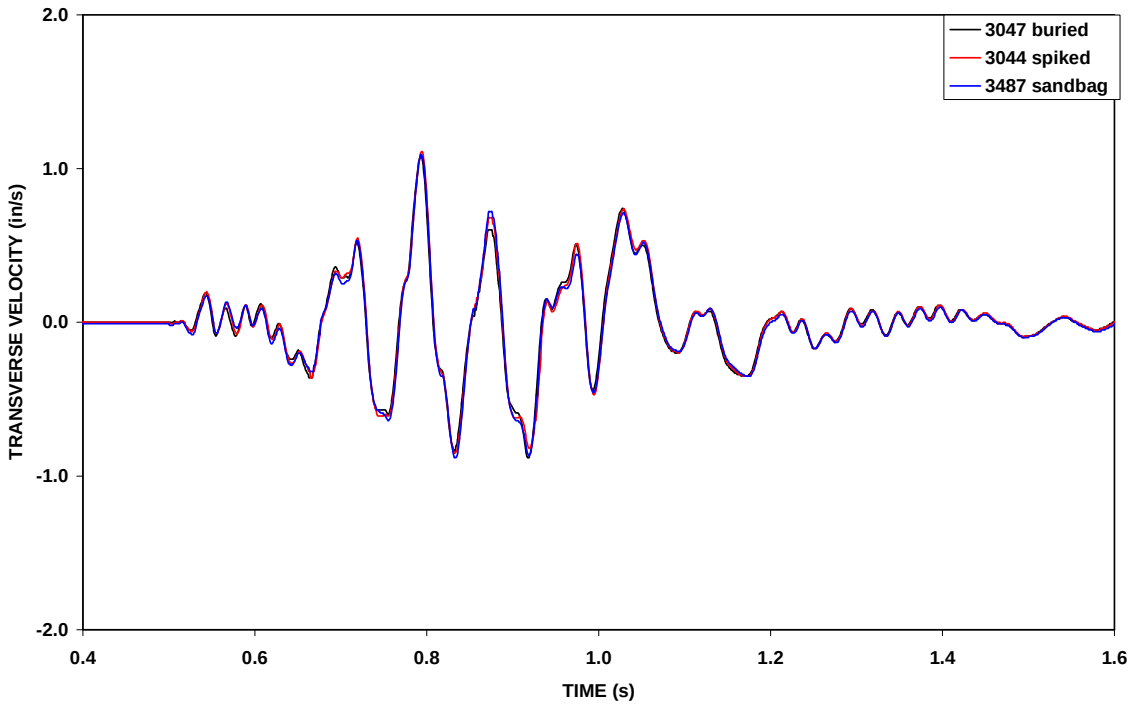
Cluster 1 SD 15.3 ft/lb$^{1/2}$

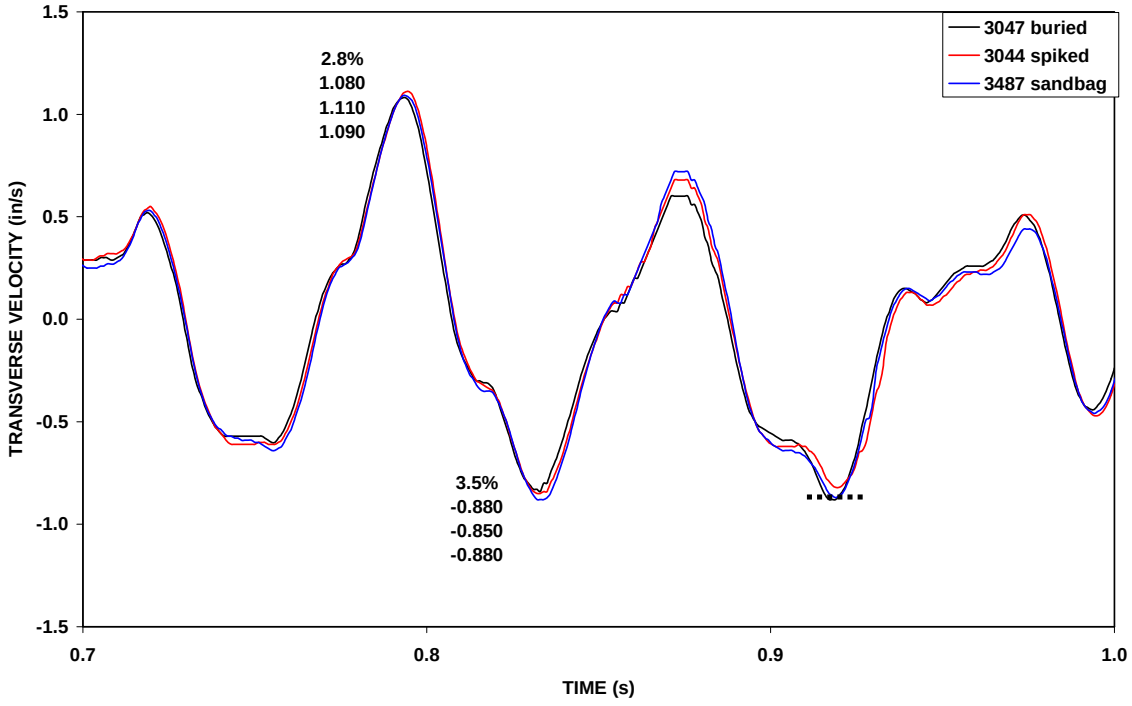

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
4.0
2.0
0.0
-2.0
-4.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6


3047 buried
3044 spiked
3487 sandbag
4.1%
3.080
3.080
2.960
11.1%
-1.200
-1.200
-1.080
RADIAL VELOCITY (in/s)
TIME (s)
4.0
2.0
0.0
-2.0
-4.0
0.8
0.9
1.0


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6

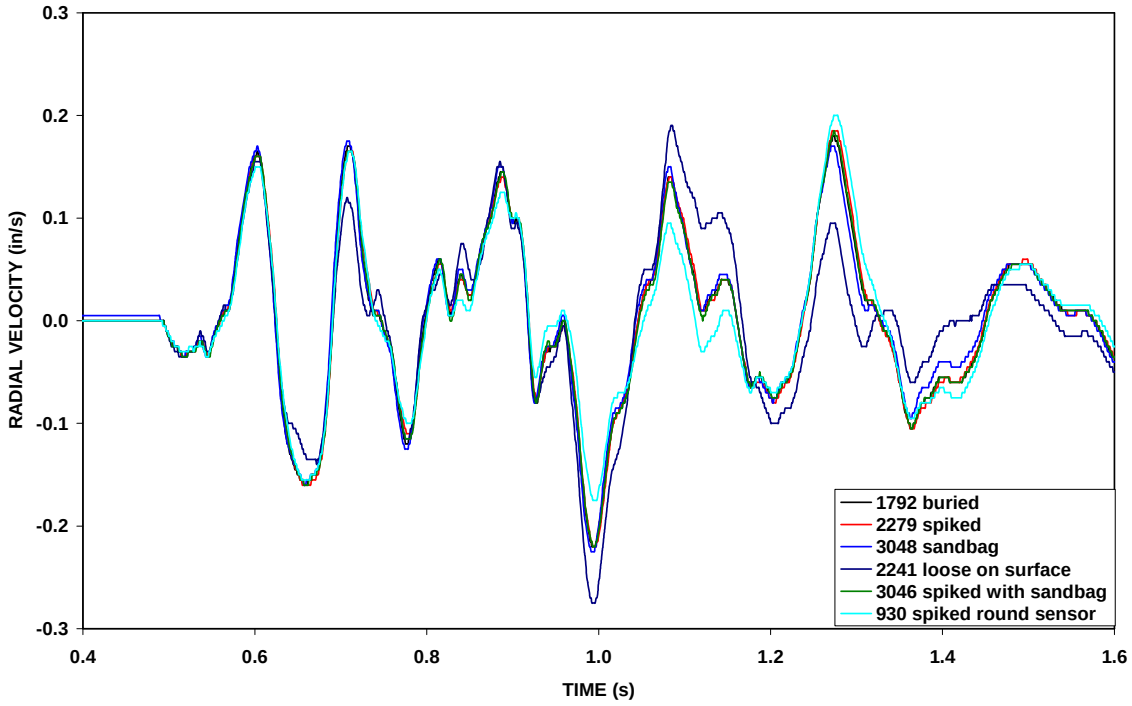

3047 buried
3044 spiked
3487 sandbag
2.8%
1.080
1.110
1.100
12.5%
-1.080
-1.040
-0.960
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.8
0.9
1.0

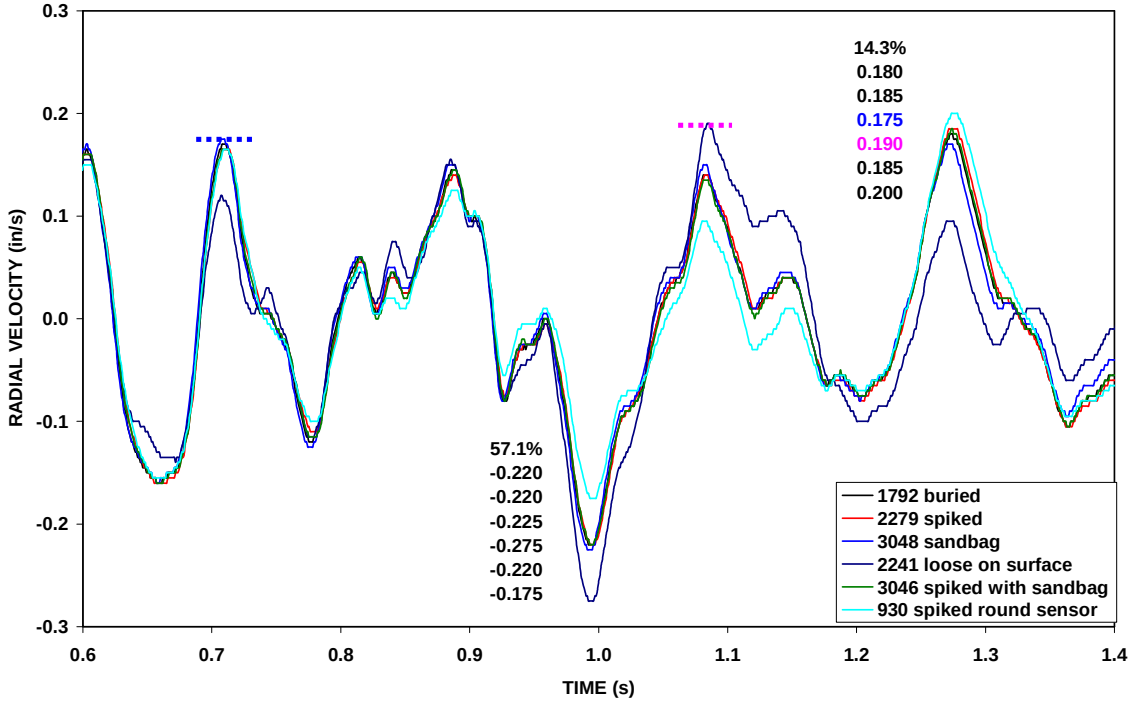

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

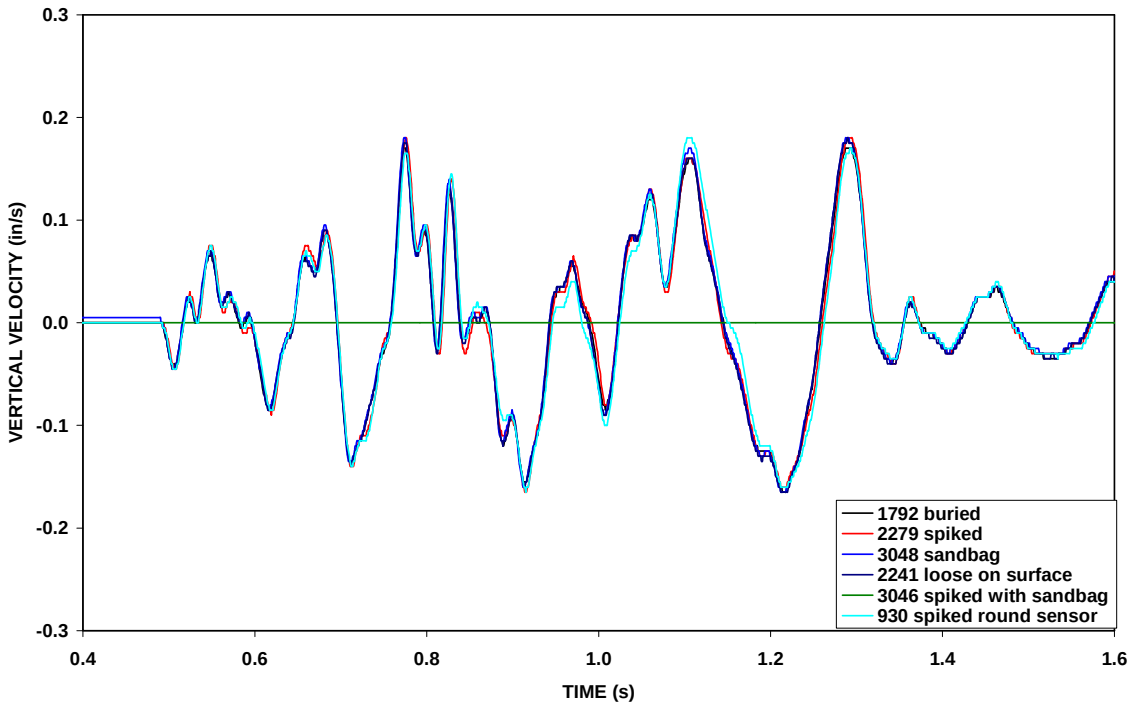

3047 buried
3044 spiked
3487 sandbag
2.8%
1.080
1.110
1.090
3.5%
-0.880
-0.850
-0.880
TRANSVERSE VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.7
0.8
0.9
1.0
TIME (s)

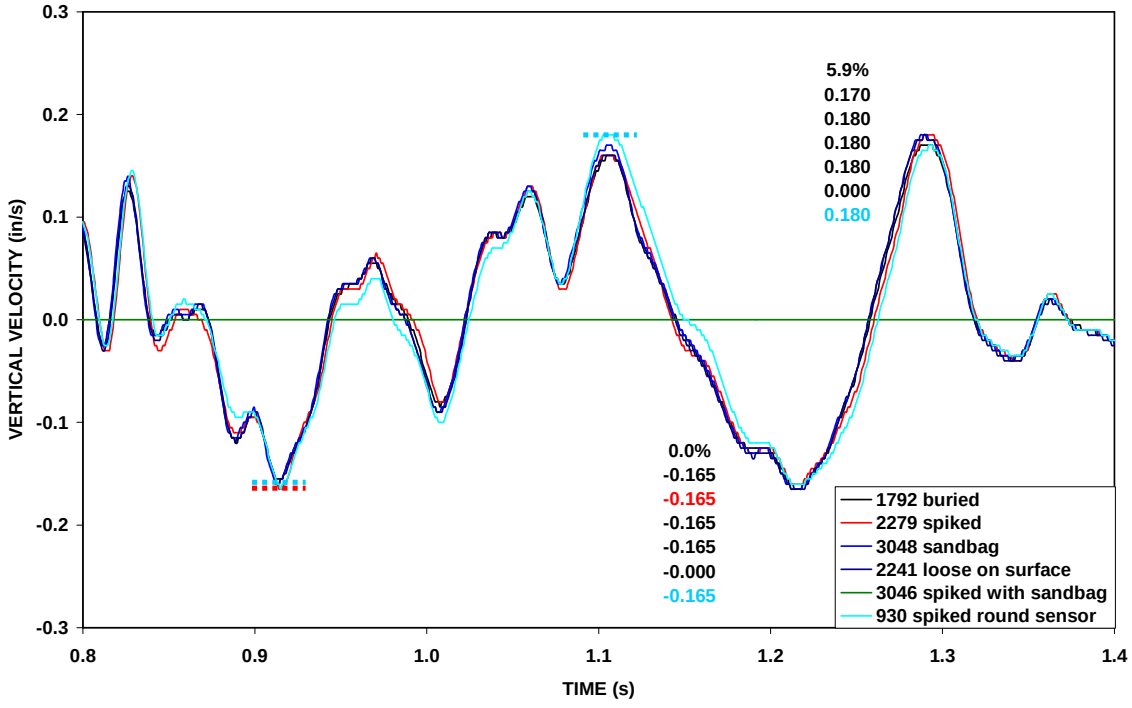
WV-1

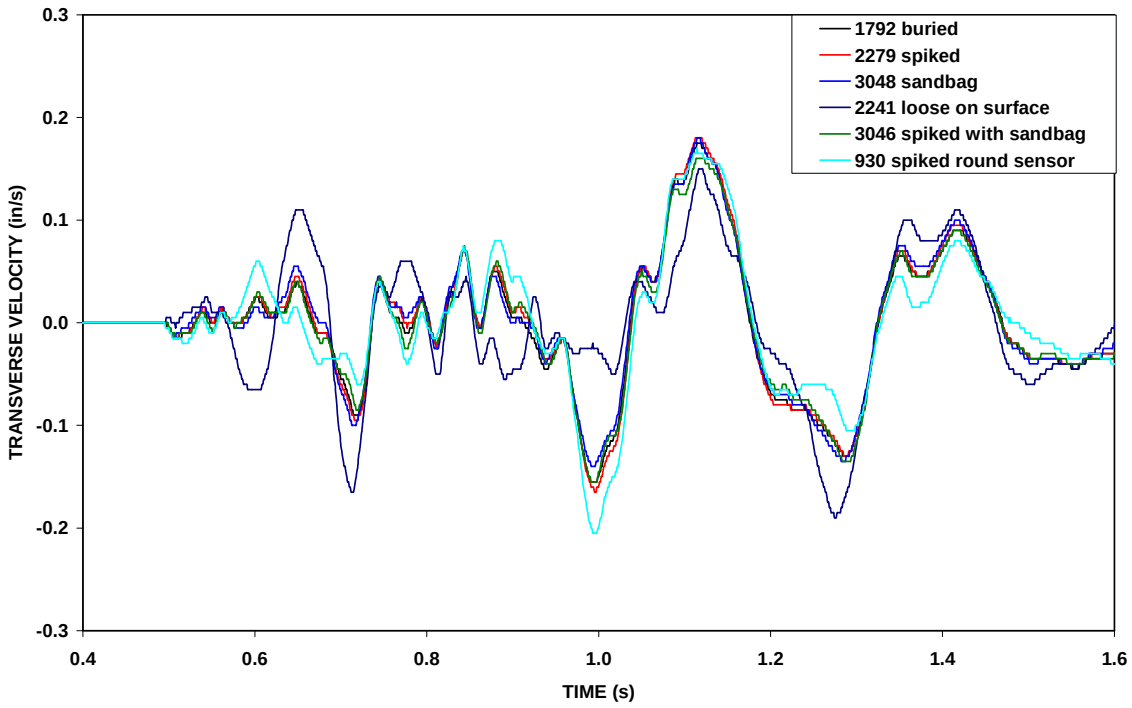
Cluster 2 SD 22.5 ft/lb$^{1/2}$

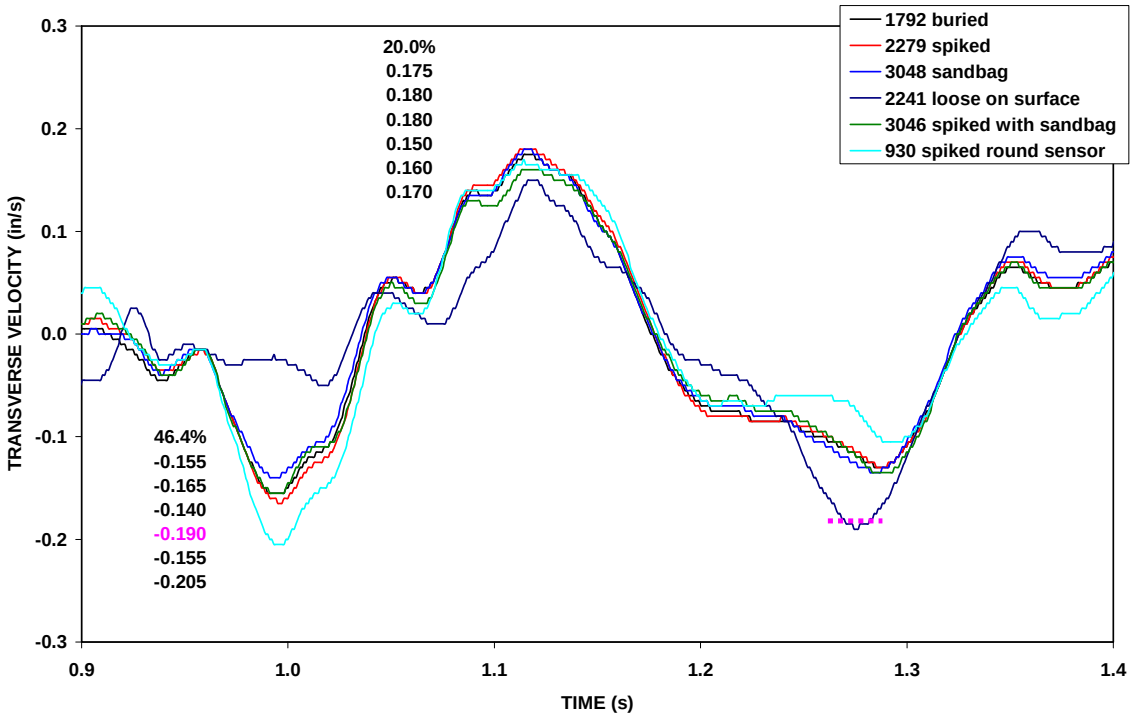

RADIAL VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

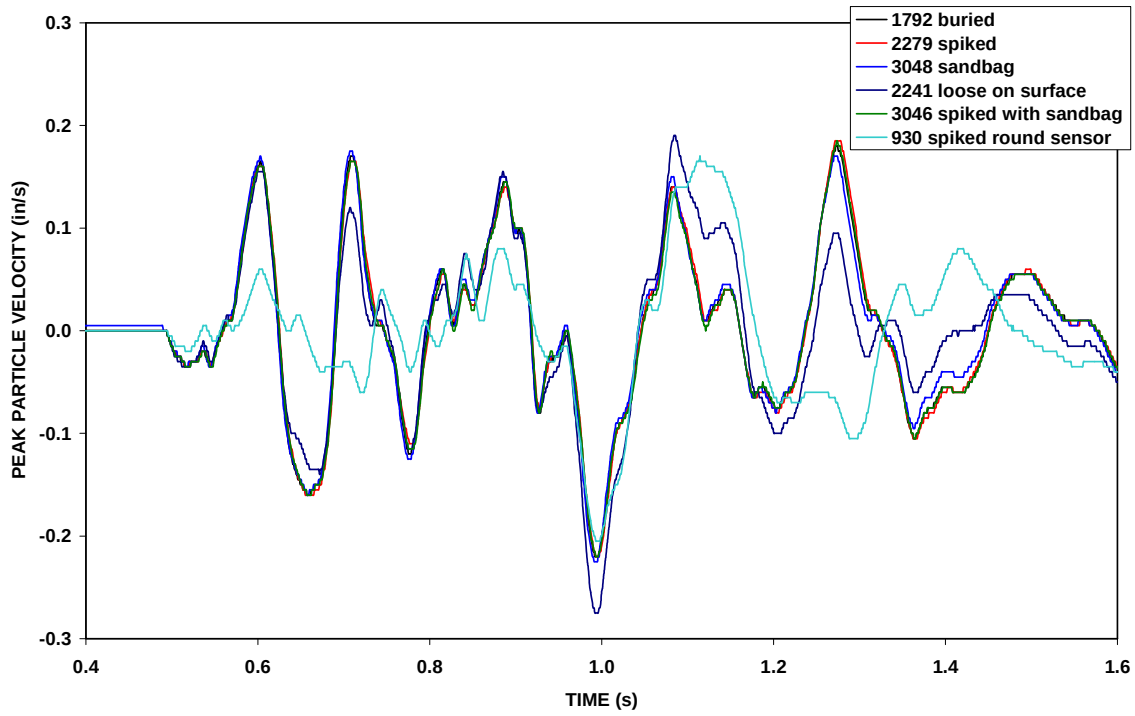

RADIAL VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
TIME (s)
14.3%
0.180
0.185
0.175
0.190
0.185
0.200
57.1%
-0.220
-0.220
-0.225
-0.275
-0.220
-0.175
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor

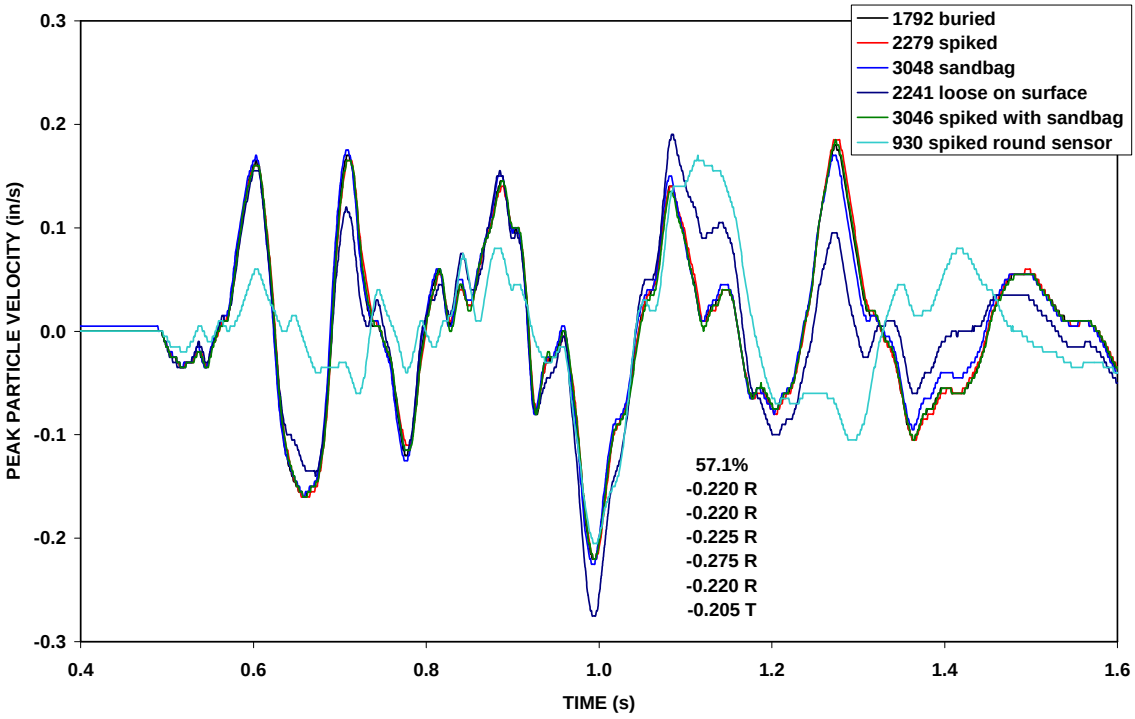

VERTICAL VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor


VERTICAL VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.8
0.9
1.0
1.1
1.2
1.3
1.4
TIME (s)
5.9%
0.170
0.180
0.180
0.180
0.000
0.180
0.0%
-0.165
-0.165
-0.165
-0.165
-0.000
-0.165
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6

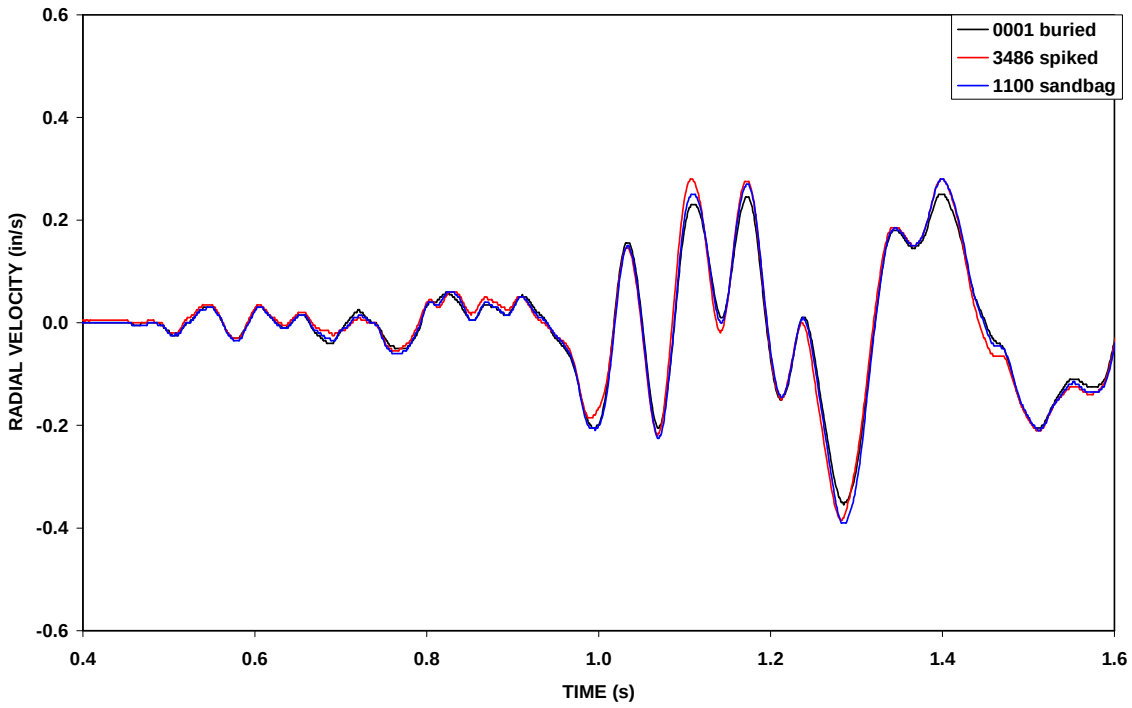

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
20.0%
0.175
0.180
0.180
0.150
0.160
0.170
46.4%
-0.155
-0.165
-0.140
-0.190
-0.155
-0.205
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.9
1.0
1.1
1.2
1.3
1.4

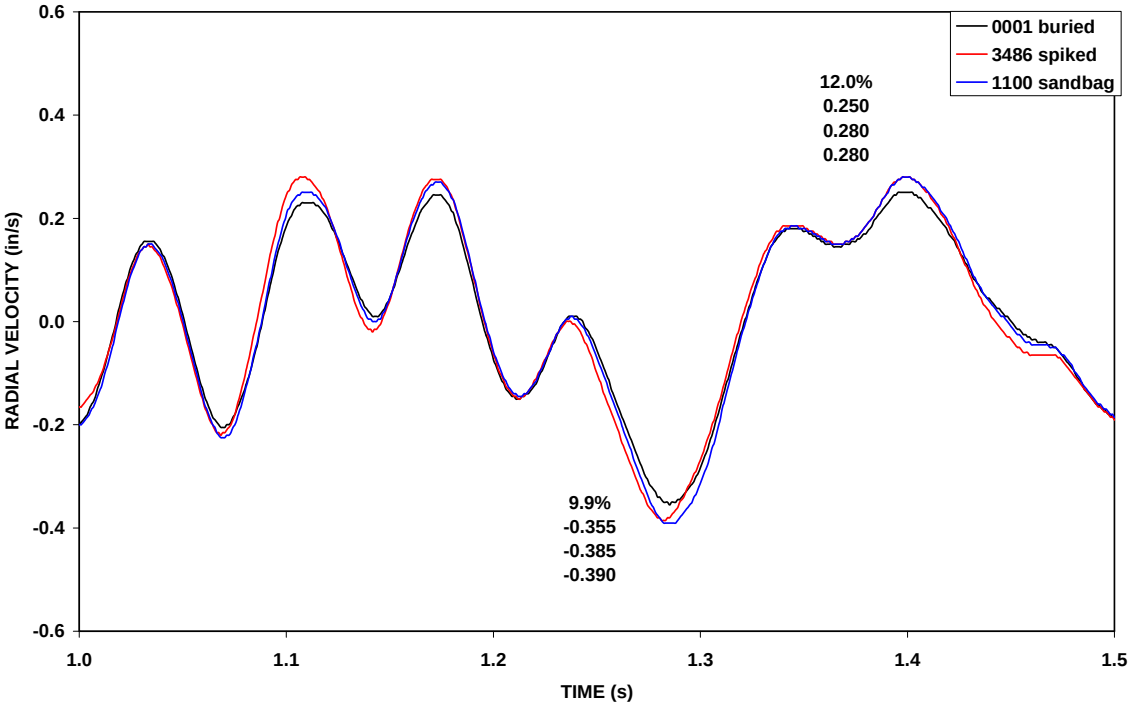

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6

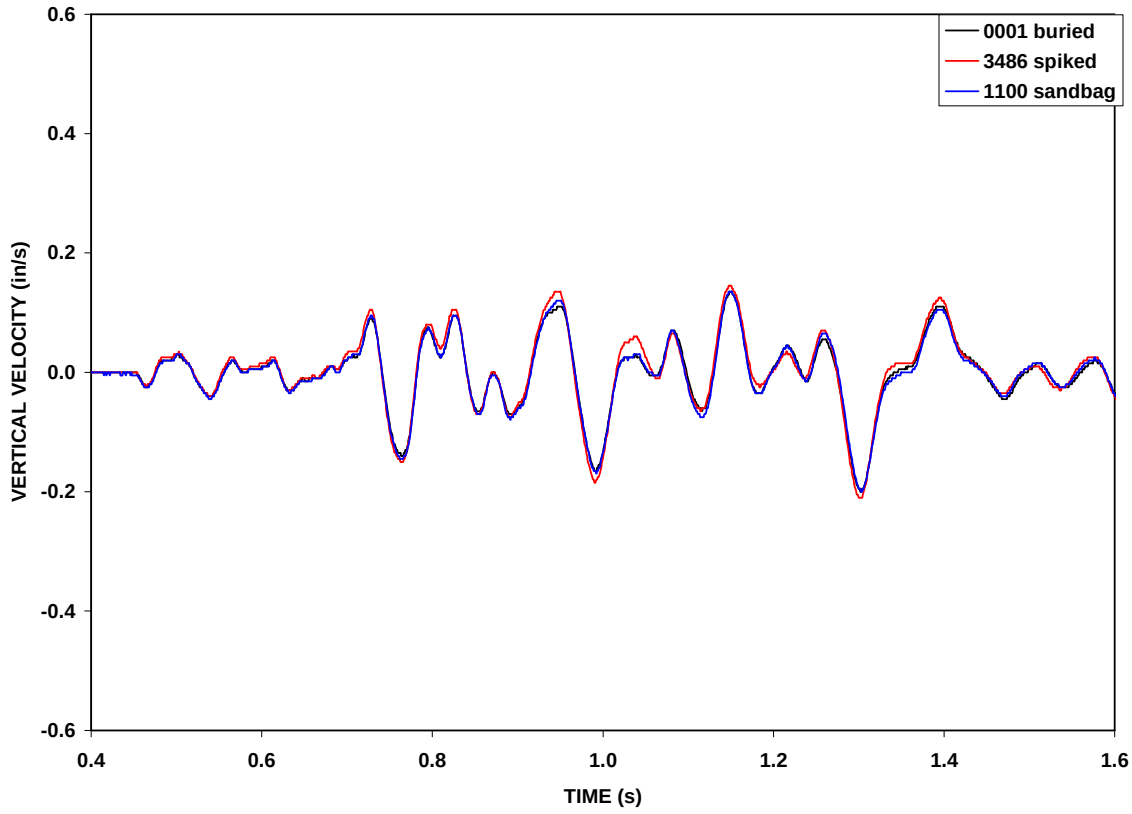

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
57.1%
-0.220 R
-0.220 R
-0.225 R
-0.275 R
-0.220 R
-0.205 T
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6

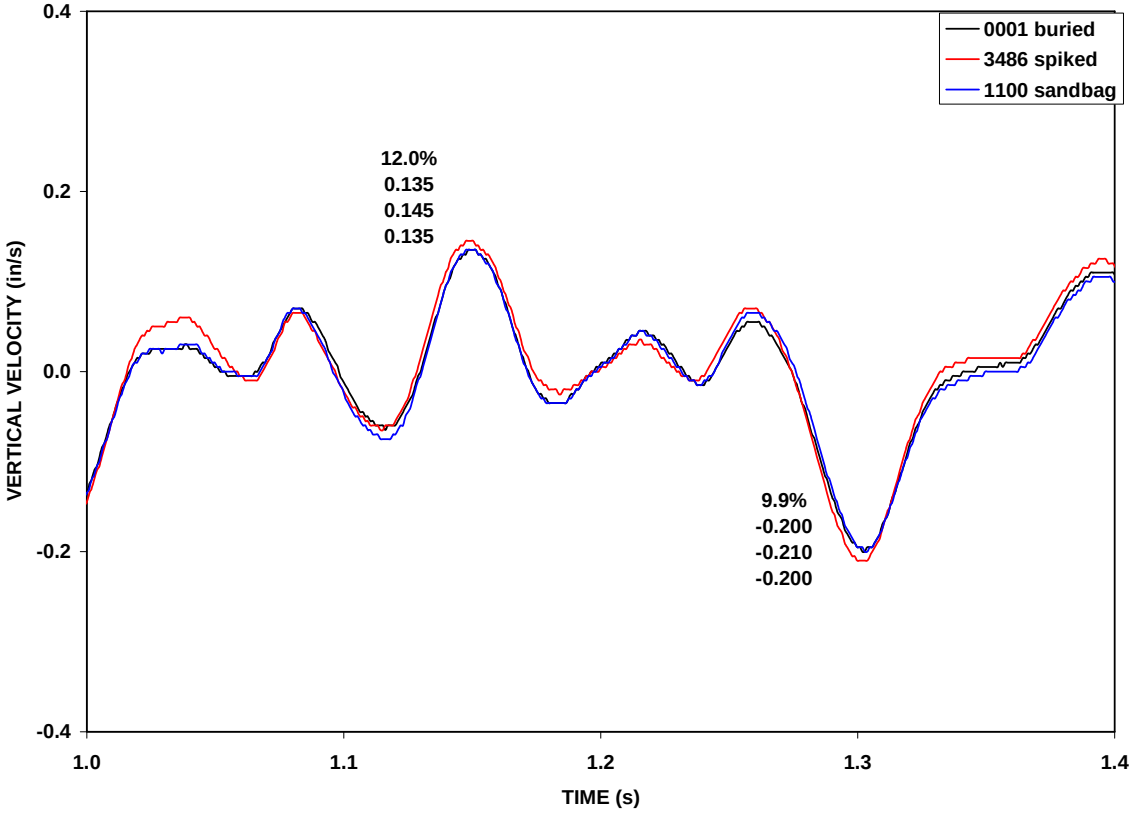
WV-1

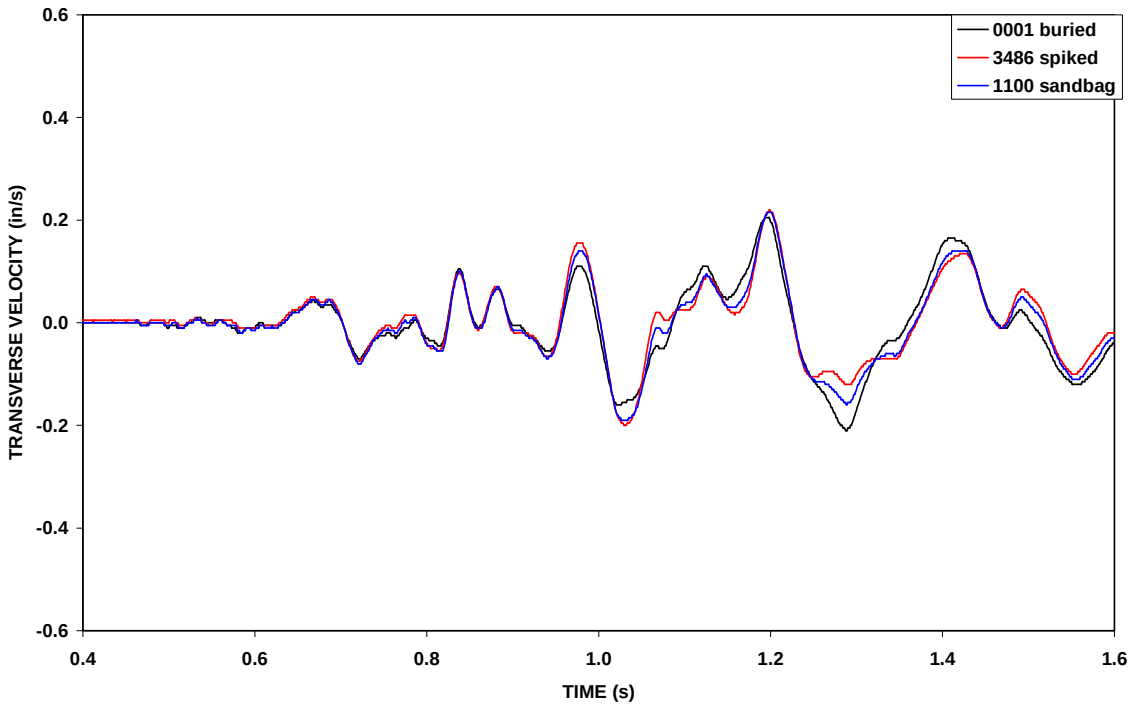
Cluster 3 SD 36.4 ft/lb$^{1/2}$

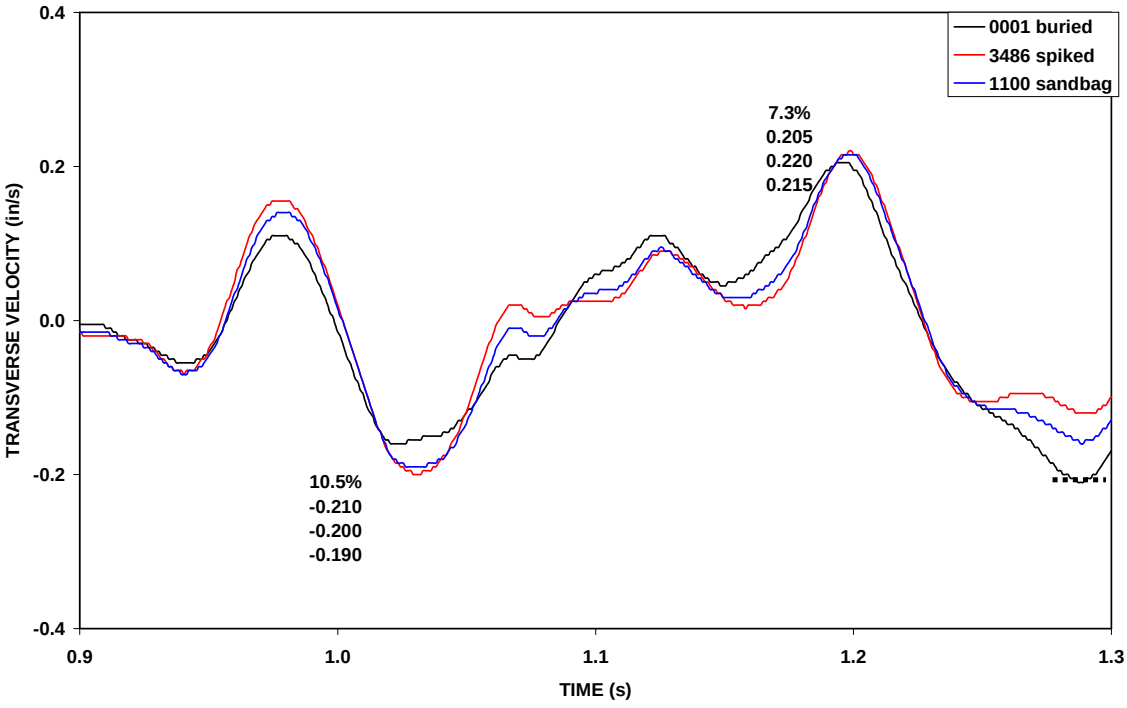

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6


0001 buried
3486 spiked
1100 sandbag
12.0%
0.250
0.280
0.280
9.9%
-0.355
-0.385
-0.390
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1.0
1.1
1.2
1.3
1.4
1.5


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

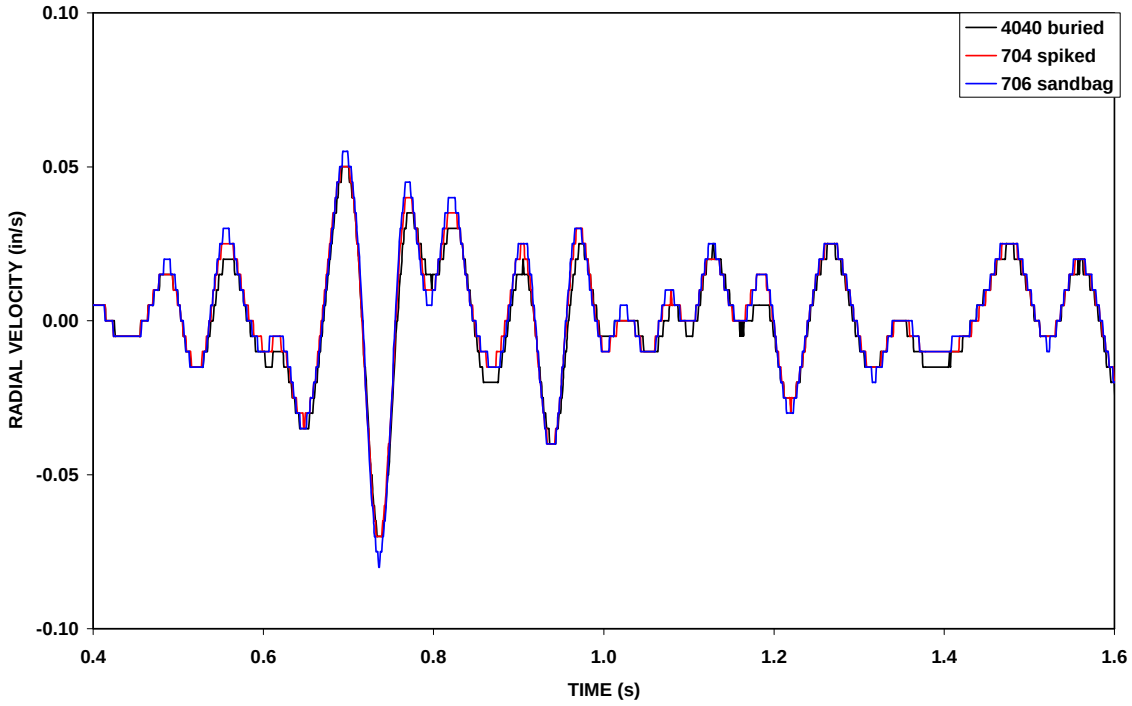

0001 buried
3486 spiked
1100 sandbag
12.0%
0.135
0.145
0.135
9.9%
-0.200
-0.210
-0.200
VERTICAL VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
1.0
1.1
1.2
1.3
1.4
TIME (s)

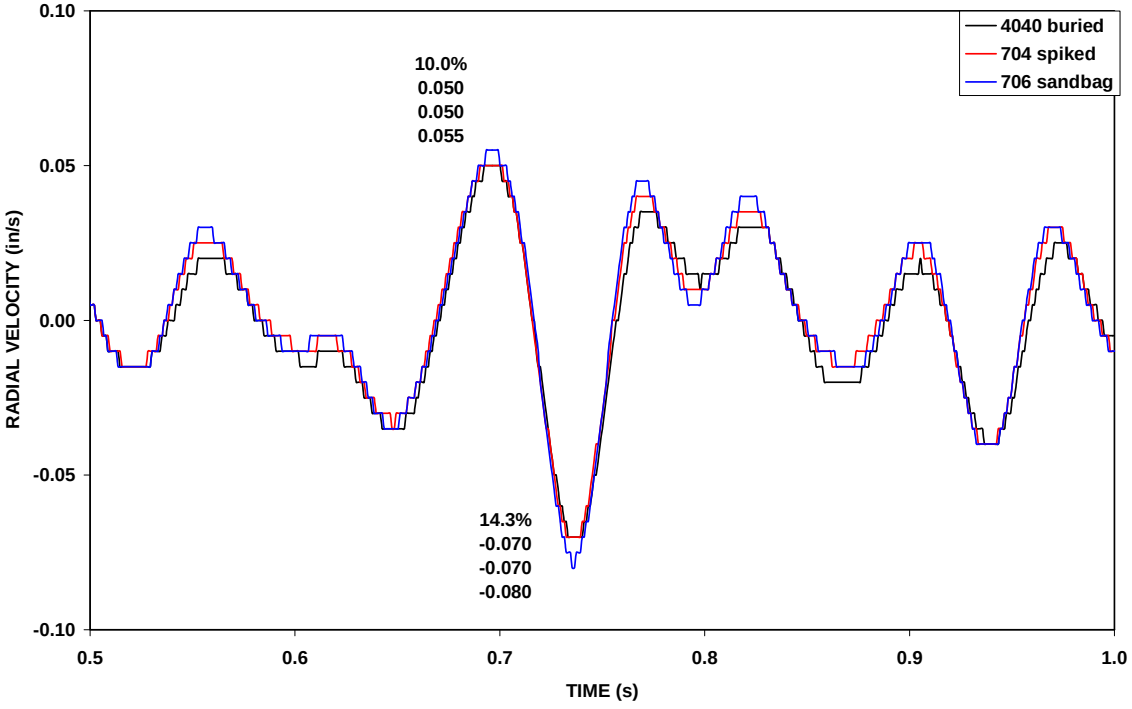

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6

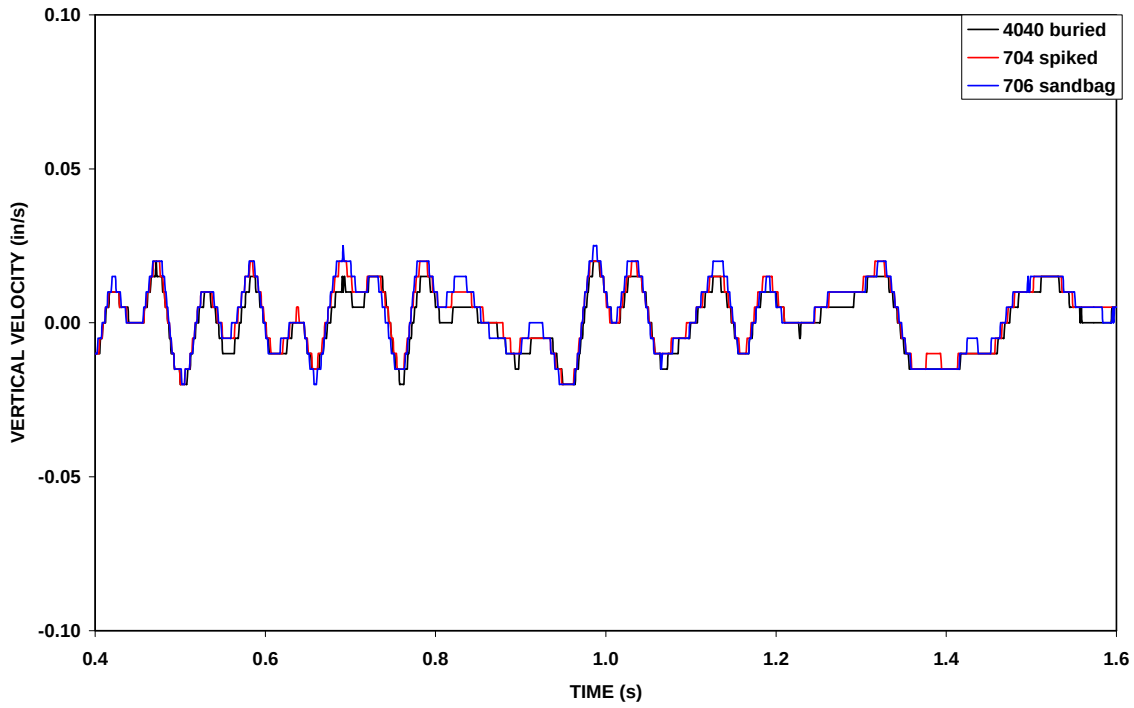

0001 buried
3486 spiked
1100 sandbag
7.3%
0.205
0.220
0.215
10.5%
-0.210
-0.200
-0.190
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.9
1.0
1.1
1.2
1.3

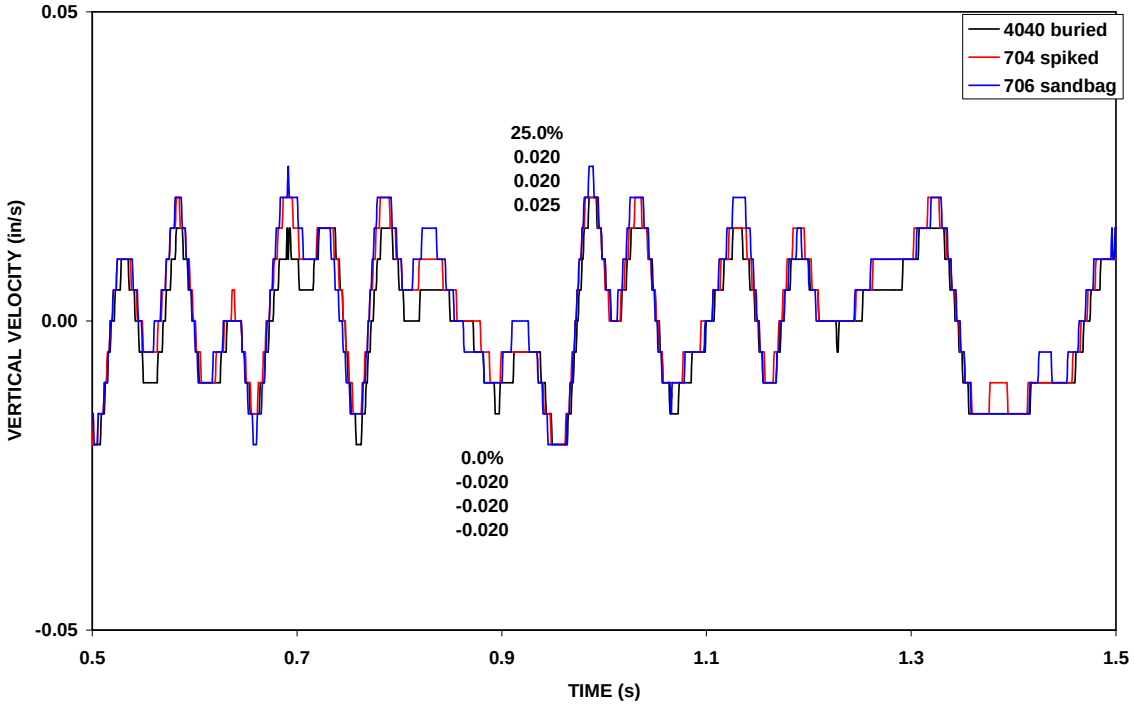
WV-1

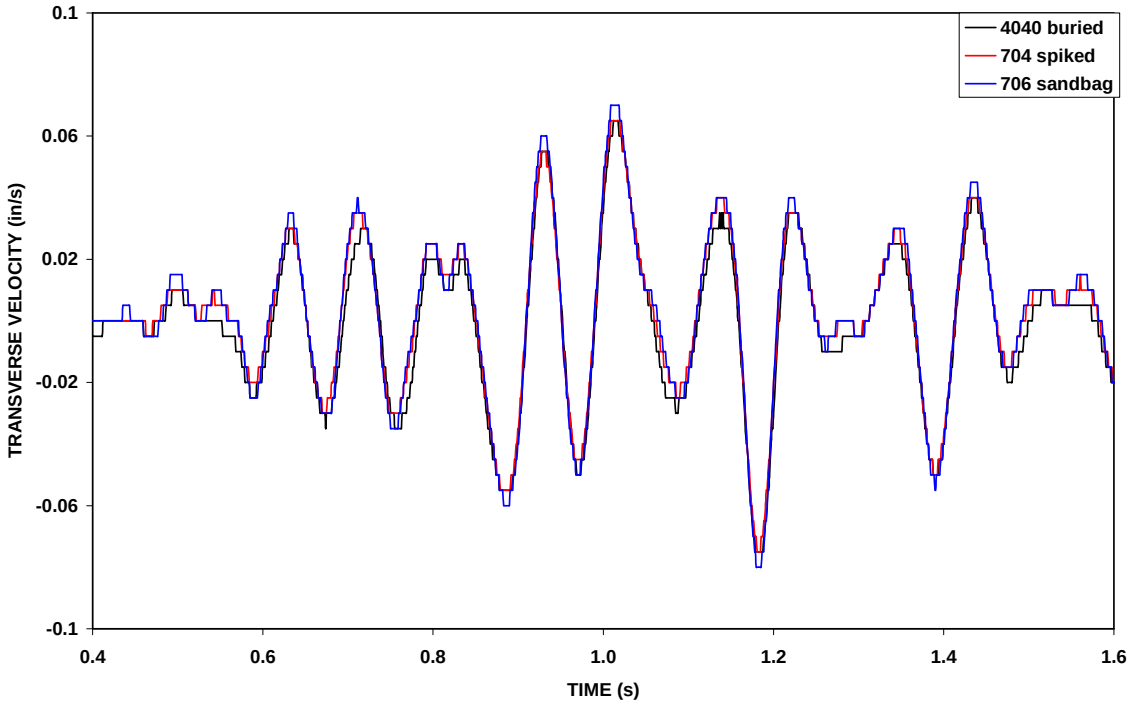
Cluster 4 SD 78.1 ft/lb$^{1/2}$

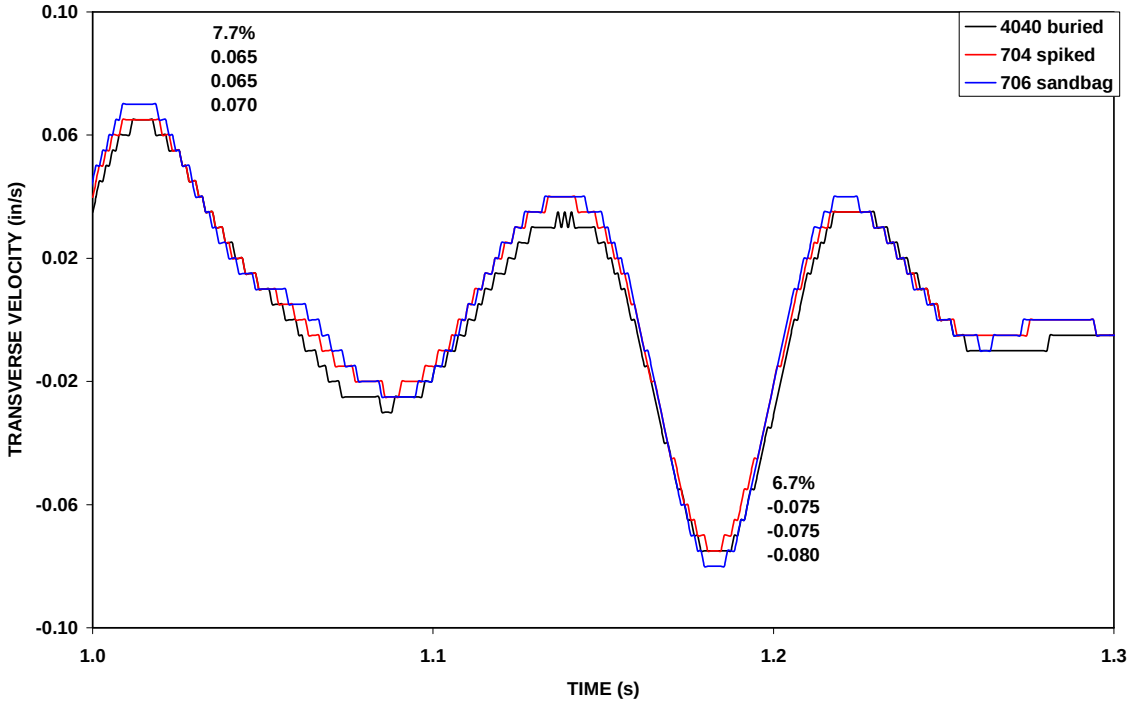

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
0.4
0.6
0.8
1.0
1.2
1.4
1.6


4040 buried
704 spiked
706 sandbag
10.0%
0.050
0.050
0.055
14.3%
-0.070
-0.070
-0.080
RADIAL VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
0.5
0.6
0.7
0.8
0.9
1.0


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
0.10
0.05
0.00
-0.05
-0.10
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

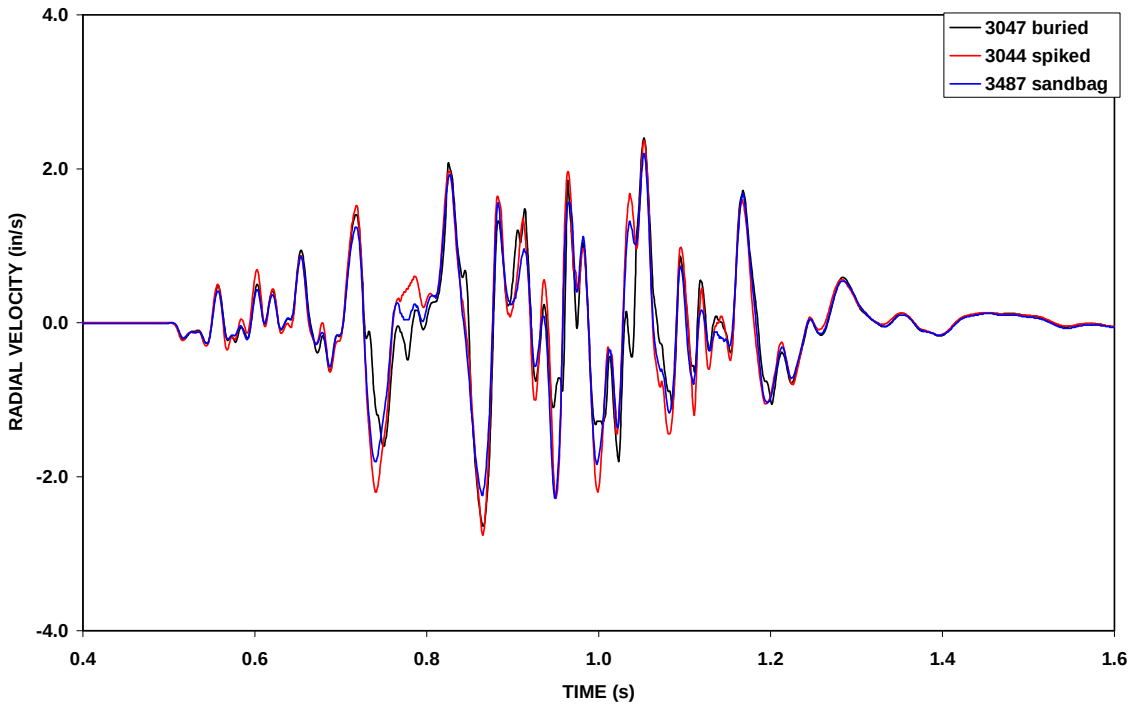

4040 buried
704 spiked
706 sandbag
25.0%
0.020
0.020
0.025
0.0%
-0.020
-0.020
-0.020
VERTICAL VELOCITY (in/s)
0.05
0.00
-0.05
0.5
0.7
0.9
1.1
1.3
1.5
TIME (s)

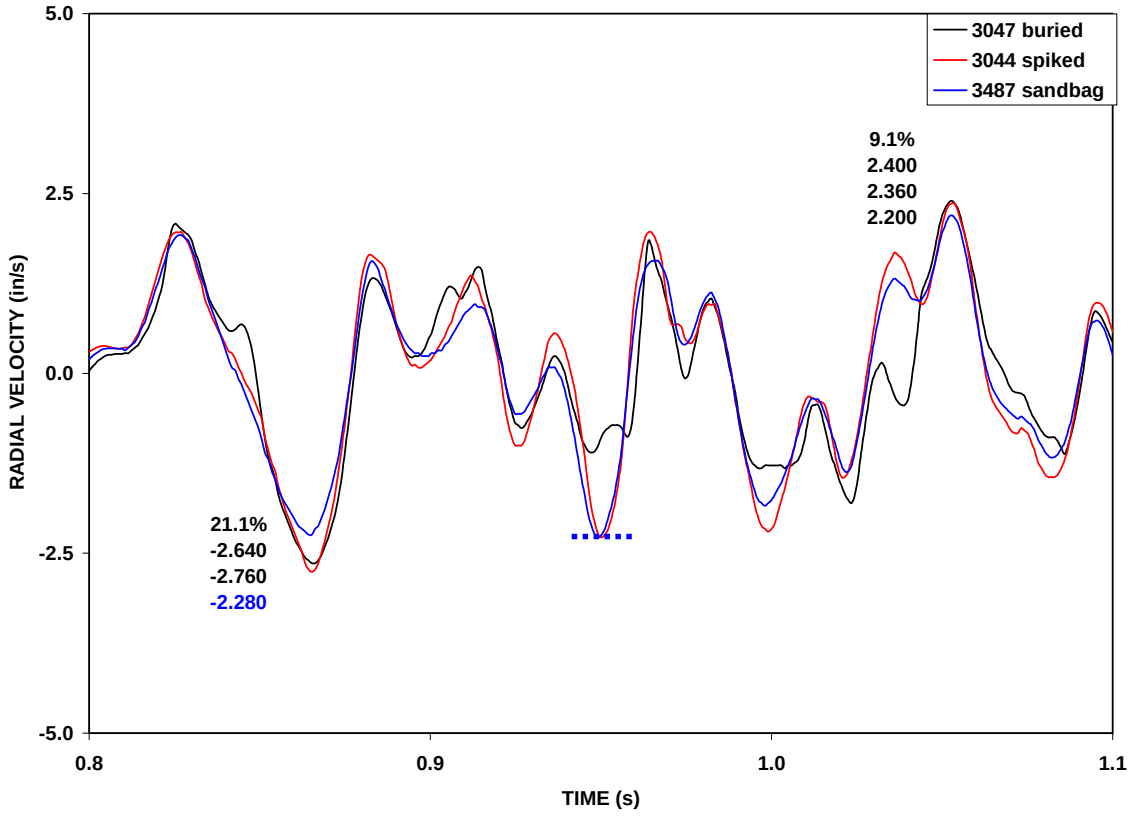

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.1
0.06
0.02
-0.02
-0.06
-0.1
0.4
0.6
0.8
1.0
1.2
1.4
1.6

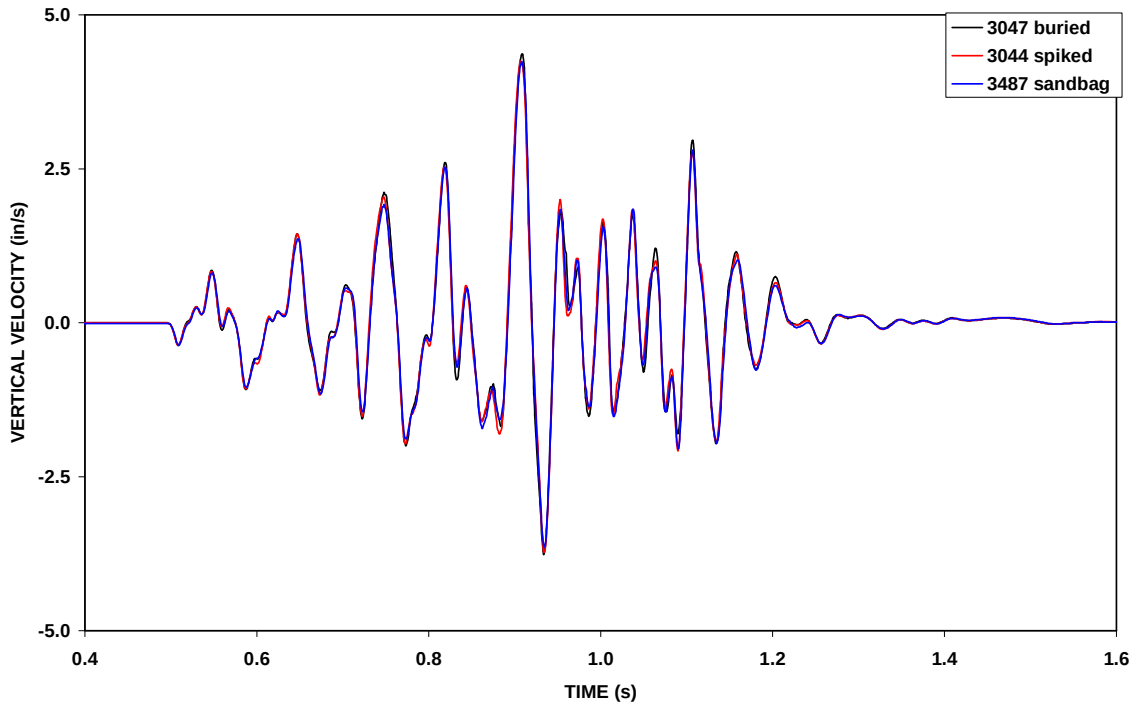

4040 buried
704 spiked
706 sandbag
7.7%
0.065
0.065
0.070
6.7%
-0.075
-0.075
-0.080
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.10
0.06
0.02
-0.02
-0.06
-0.10
1.0
1.1
1.2
1.3

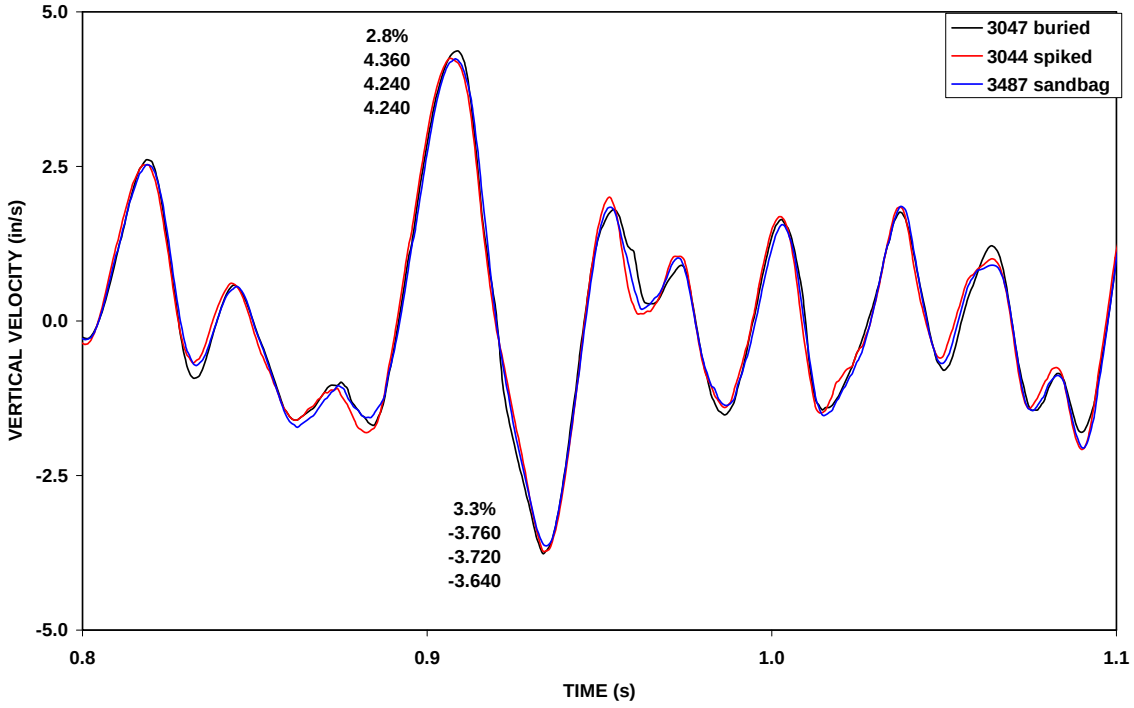
WV-2

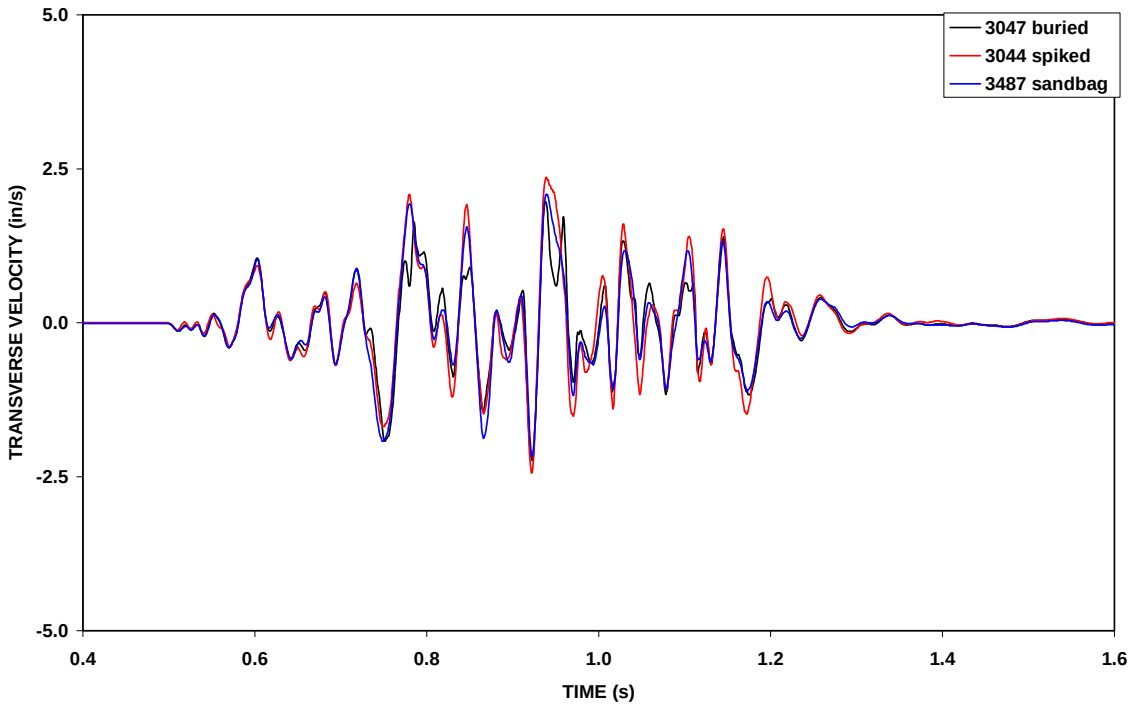
Cluster 1 SD 14.8 ft/lb$^{1/2}$

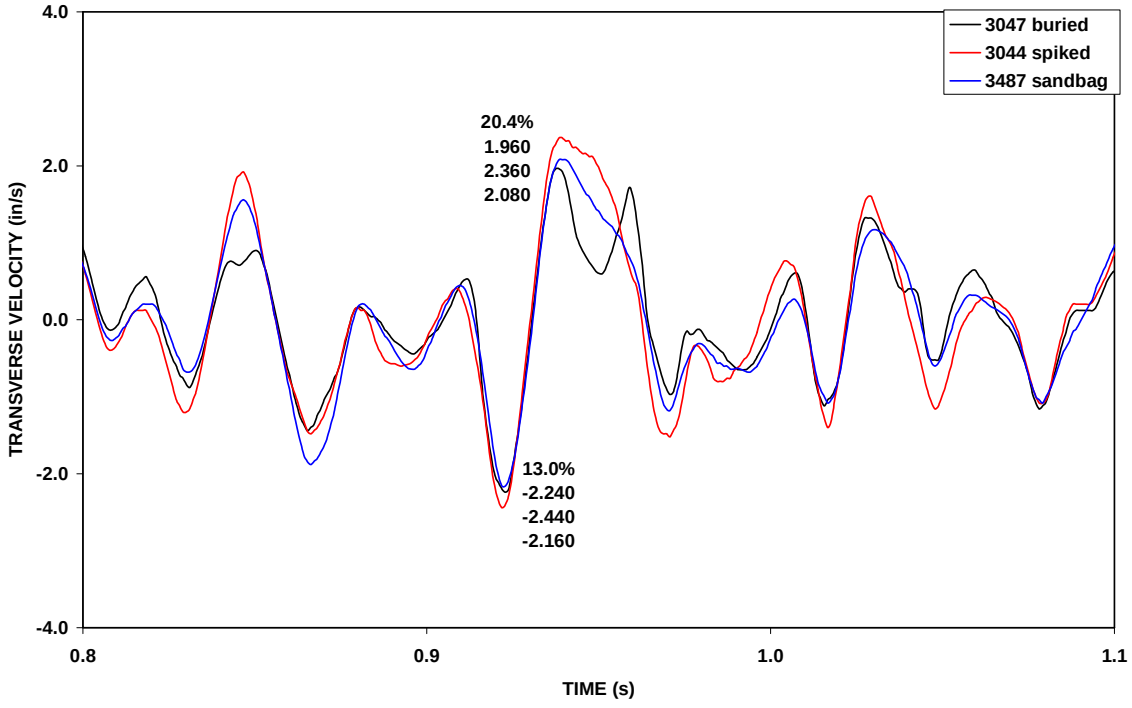

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
4.0
2.0
0.0
-2.0
-4.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6


3047 buried
3044 spiked
3487 sandbag
9.1%
2.400
2.360
2.200
21.1%
-2.640
-2.760
-2.280
RADIAL VELOCITY (in/s)
TIME (s)
5.0
2.5
0.0
-2.5
-5.0
0.8
0.9
1.0
1.1


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
5.0
2.5
0.0
-2.5
-5.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6

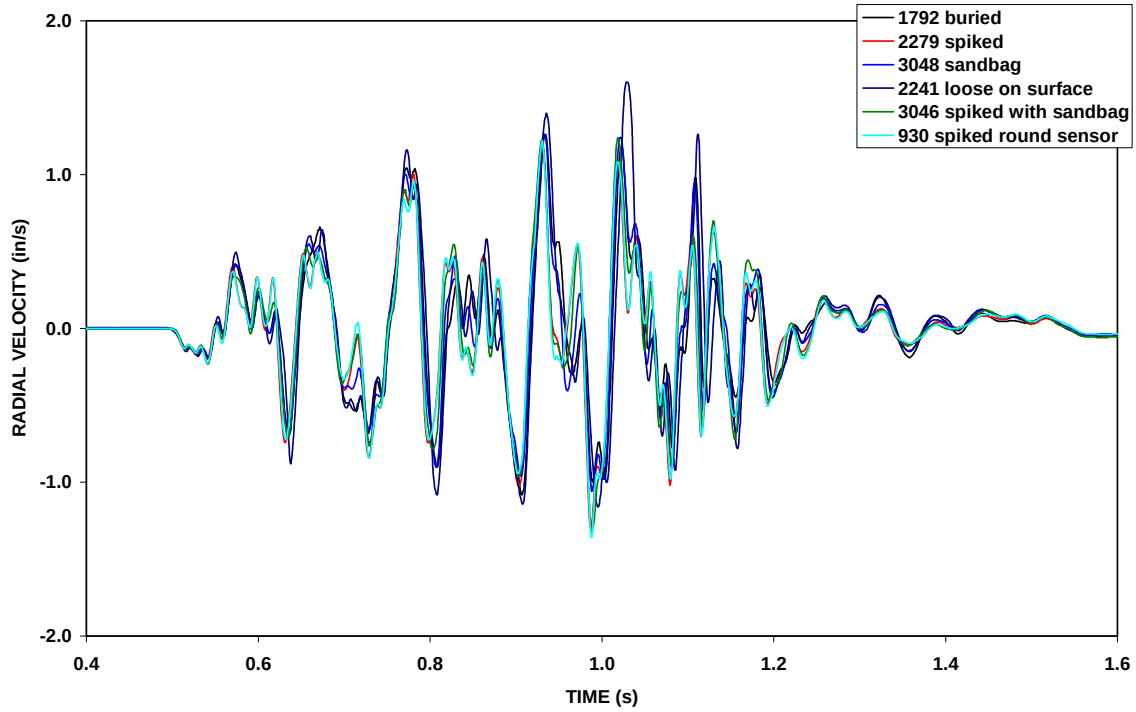

3047 buried
3044 spiked
3487 sandbag
2.8%
4.360
4.240
4.240
3.3%
-3.760
-3.720
-3.640
VERTICAL VELOCITY (in/s)
TIME (s)
5.0
2.5
0.0
-2.5
-5.0
0.8
0.9
1.0
1.1

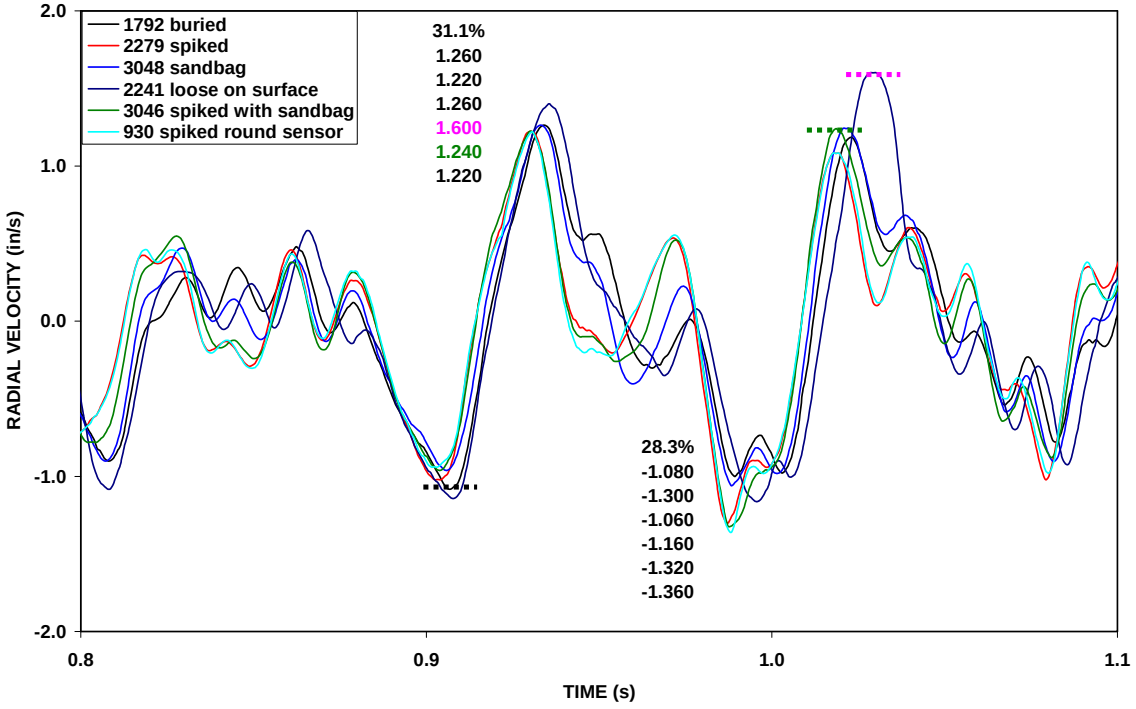

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
5.0
2.5
0.0
-2.5
-5.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

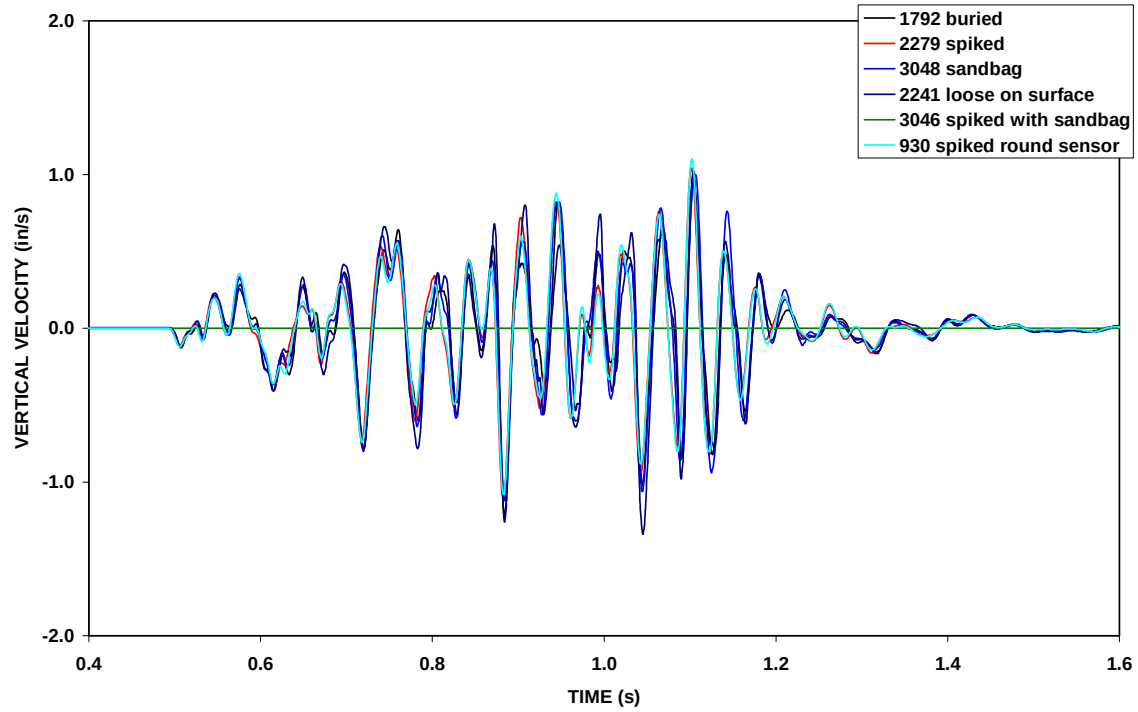

3047 buried
3044 spiked
3487 sandbag
20.4%
1.960
2.360
2.080
13.0%
-2.240
-2.440
-2.160
TRANSVERSE VELOCITY (in/s)
4.0
2.0
0.0
-2.0
-4.0
0.8
0.9
1.0
1.1
TIME (s)

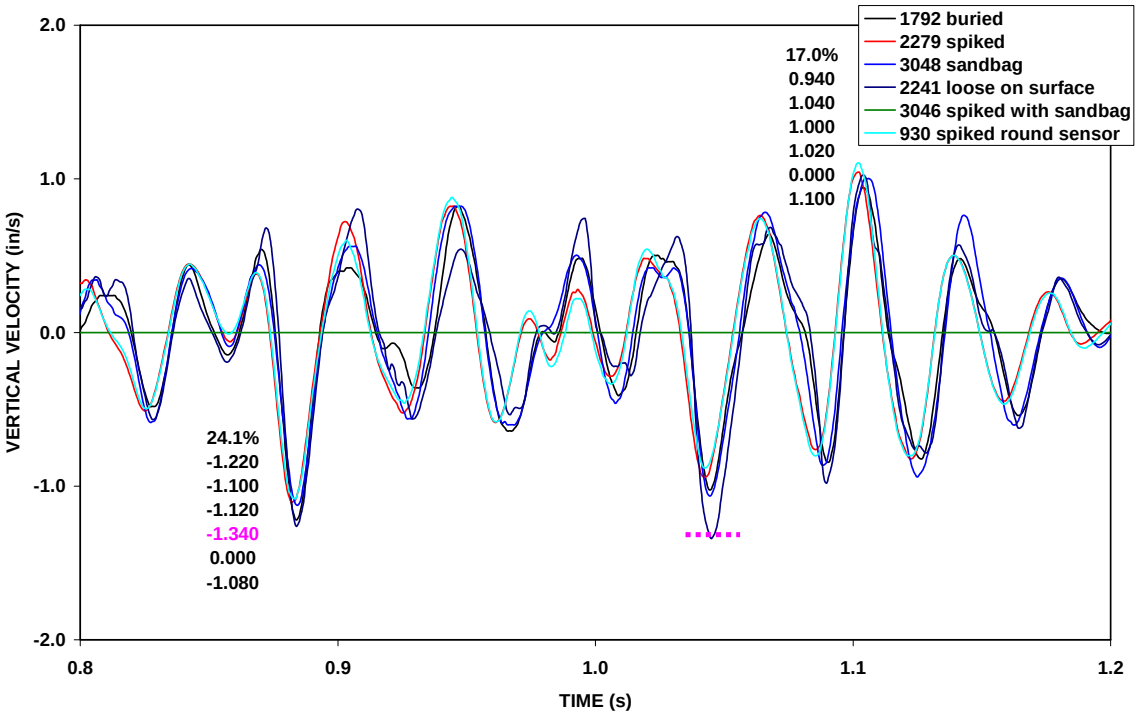
WV-2

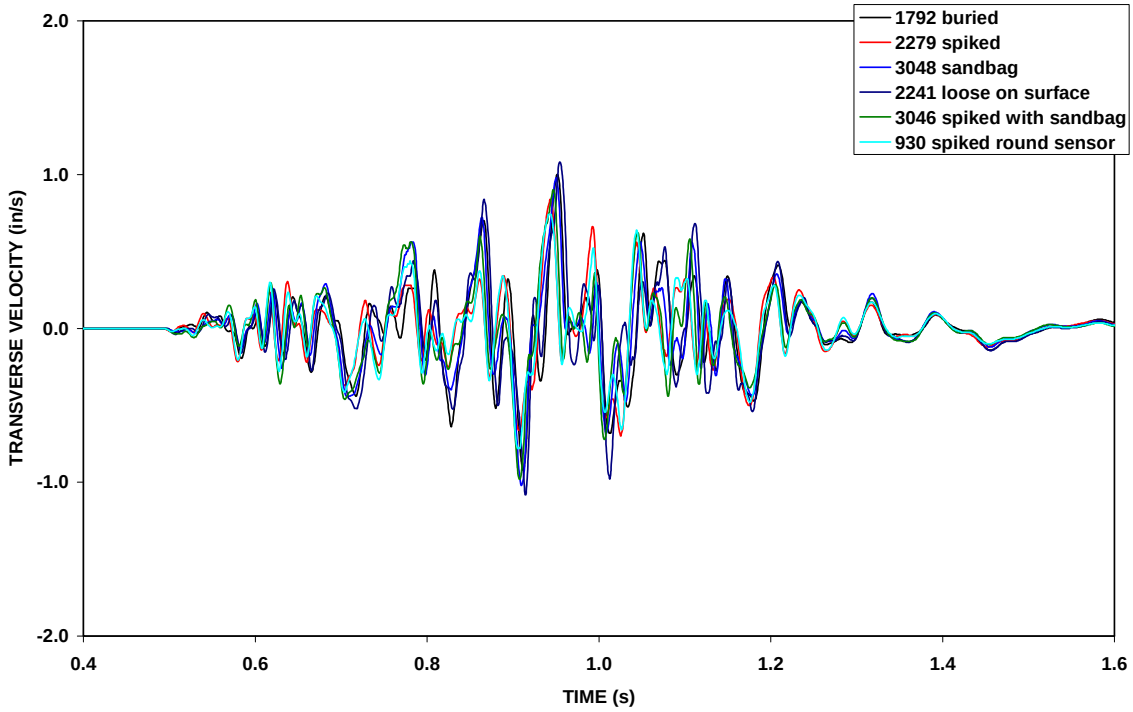
Cluster 2 SD 26.9 ft/lb$^{1/2}$

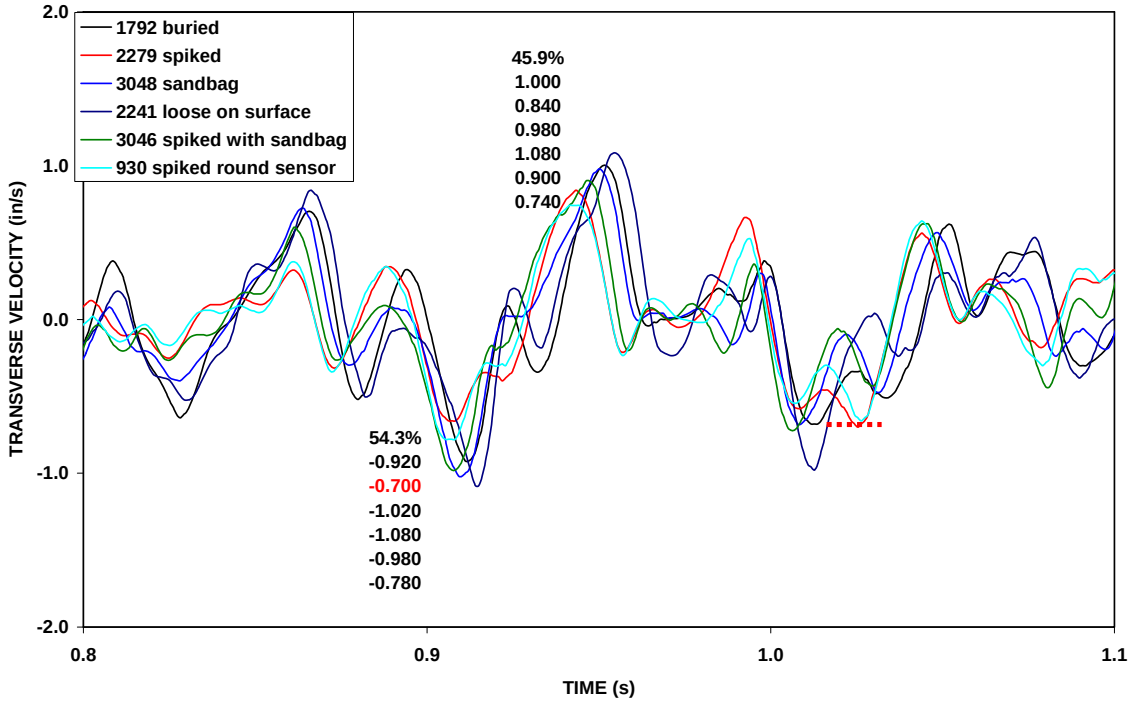

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6

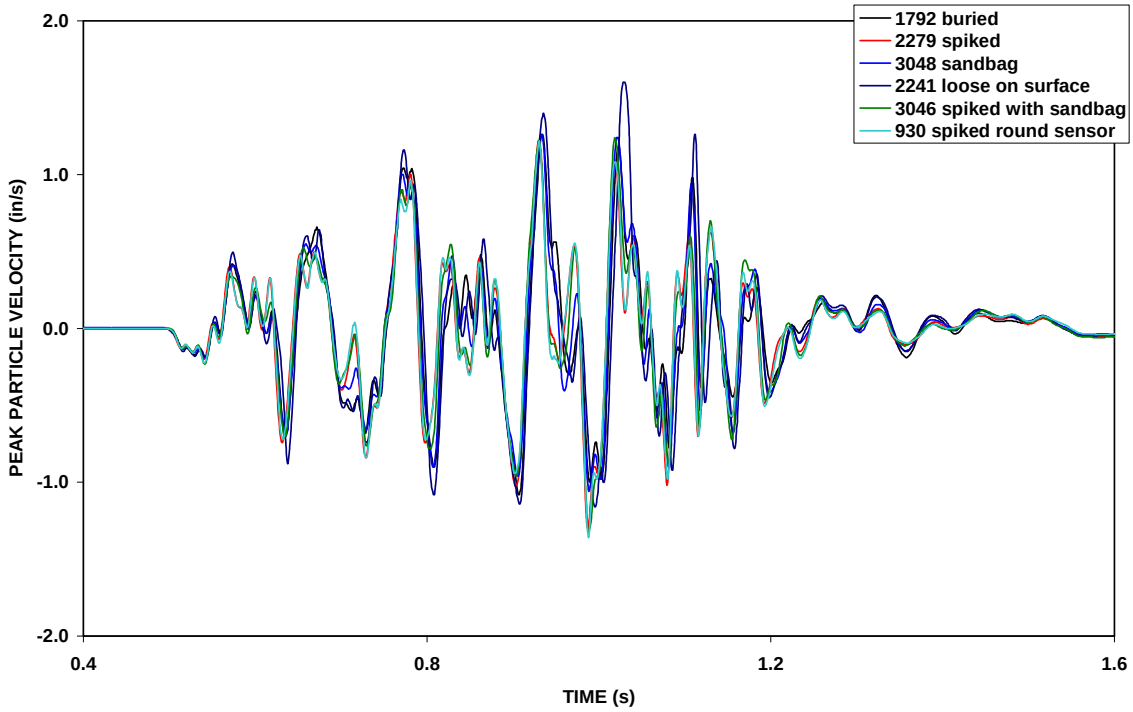

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
31.1%
1.260
1.220
1.260
1.600
1.240
1.220
28.3%
-1.080
-1.300
-1.060
-1.160
-1.320
-1.360
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.8
0.9
1.0
1.1

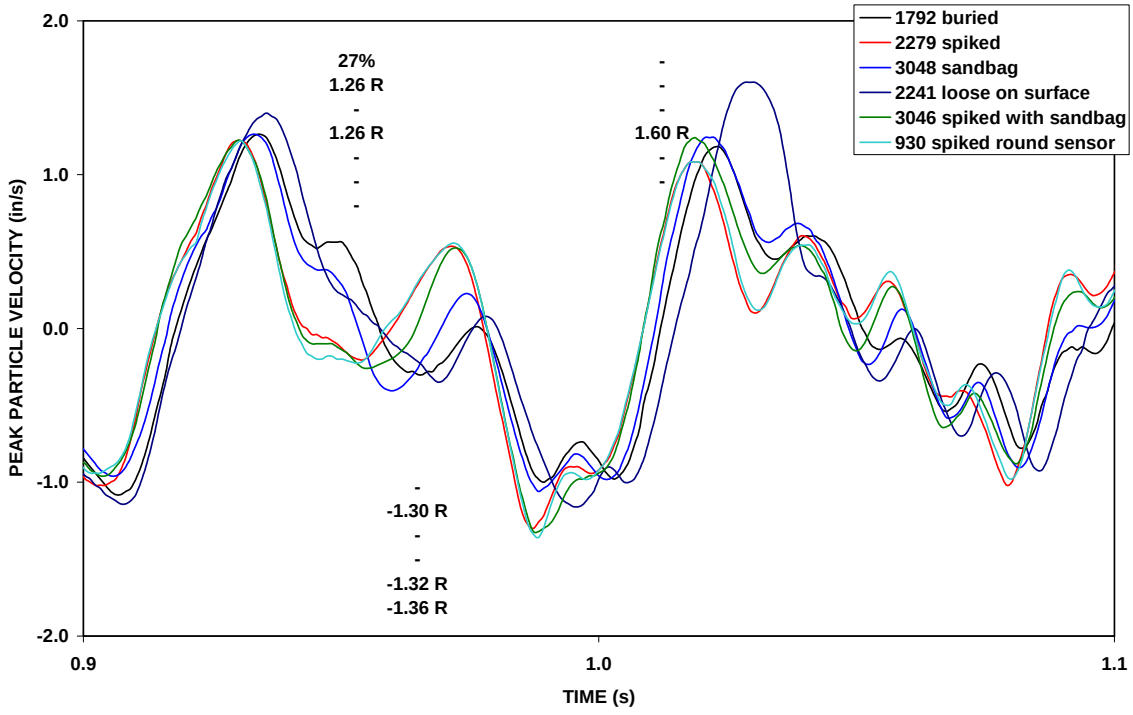

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
17.0%
0.940
1.040
1.000
1.020
0.000
1.100
24.1%
-1.220
-1.100
-1.120
-1.340
0.000
-1.080
VERTICAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.8
0.9
1.0
1.1
1.2


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
TRANSVERSE VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

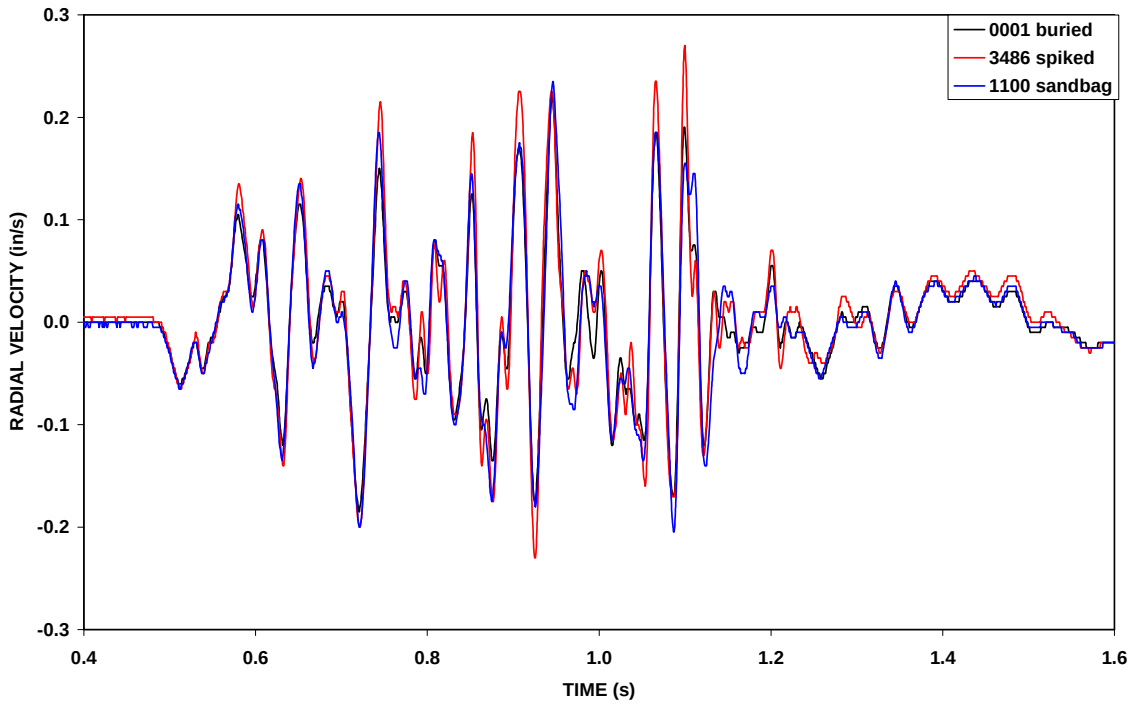

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
45.9%
1.000
0.840
0.980
1.080
0.900
0.740
54.3%
-0.920
-0.700
-1.020
-1.080
-0.980
-0.780
TRANSVERSE VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
0.8
0.9
1.0
1.1
TIME (s)

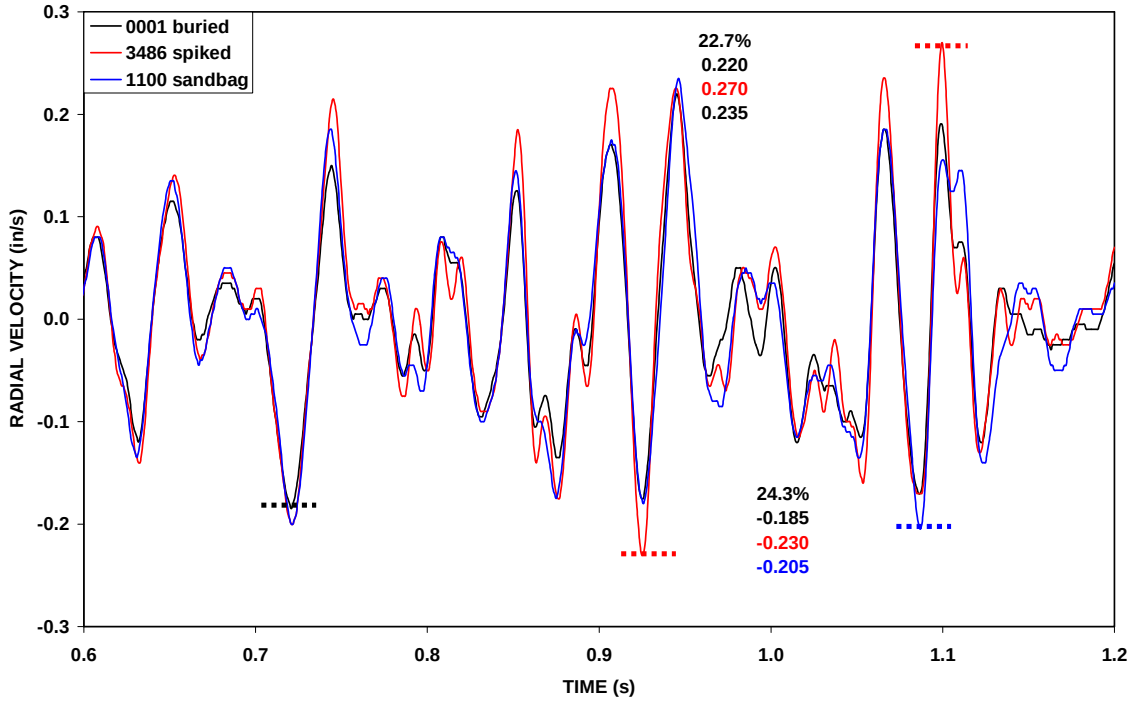

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.8
1.2
1.6
TIME (s)

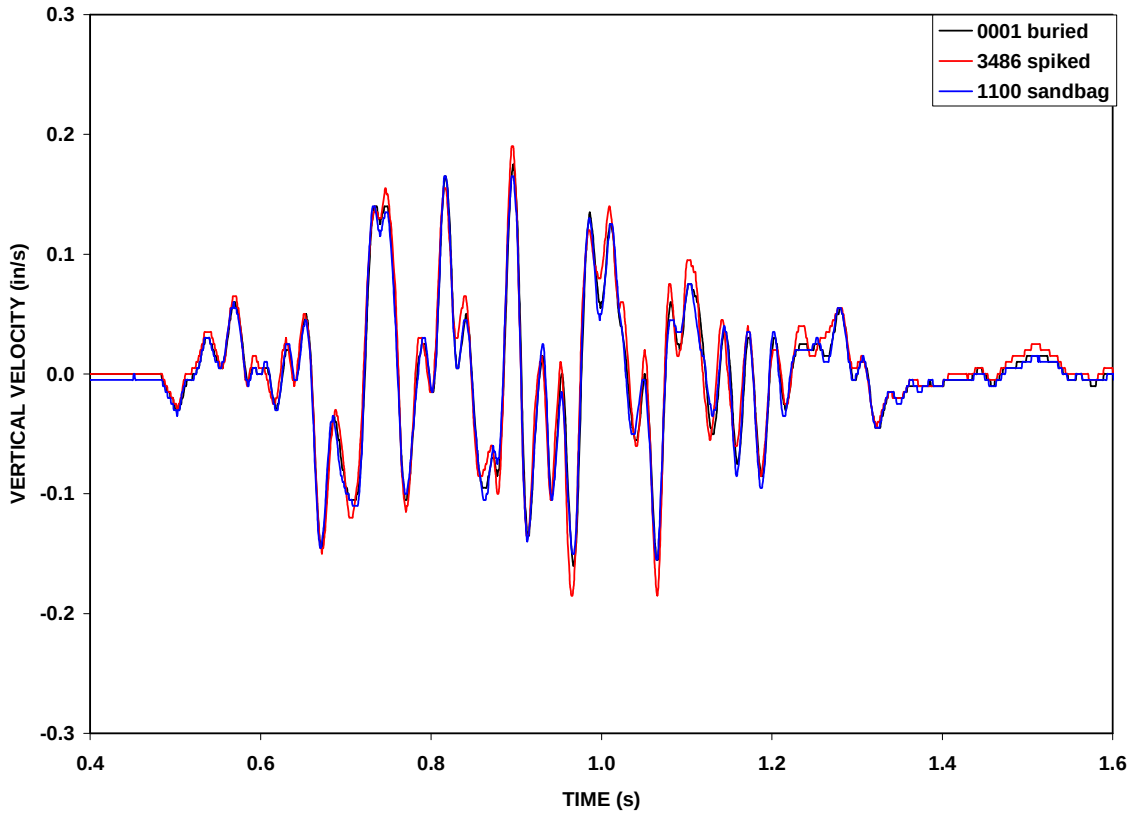

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
930 spiked round sensor
27%
1.26 R
1.26 R
1.60 R
-1.30 R
-1.32 R
-1.36 R
PEAK PARTICLE VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
0.9
1.0
1.1
TIME (s)

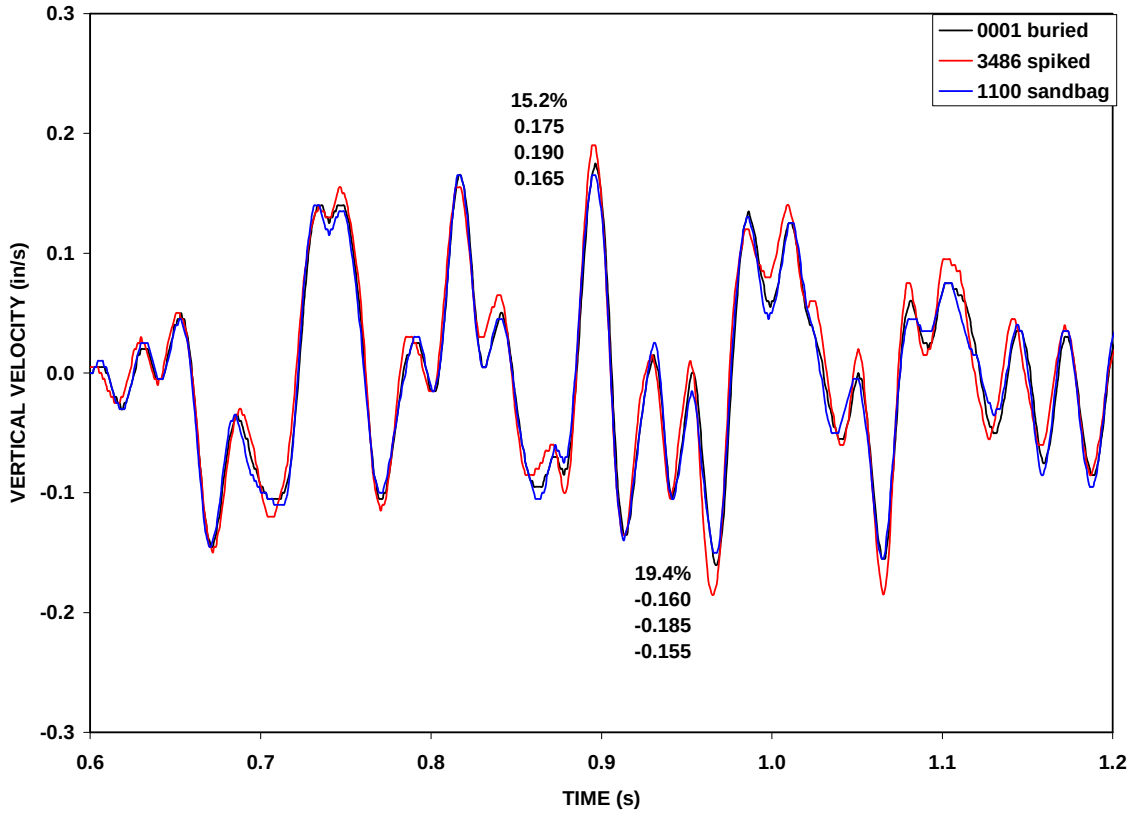
WV-2

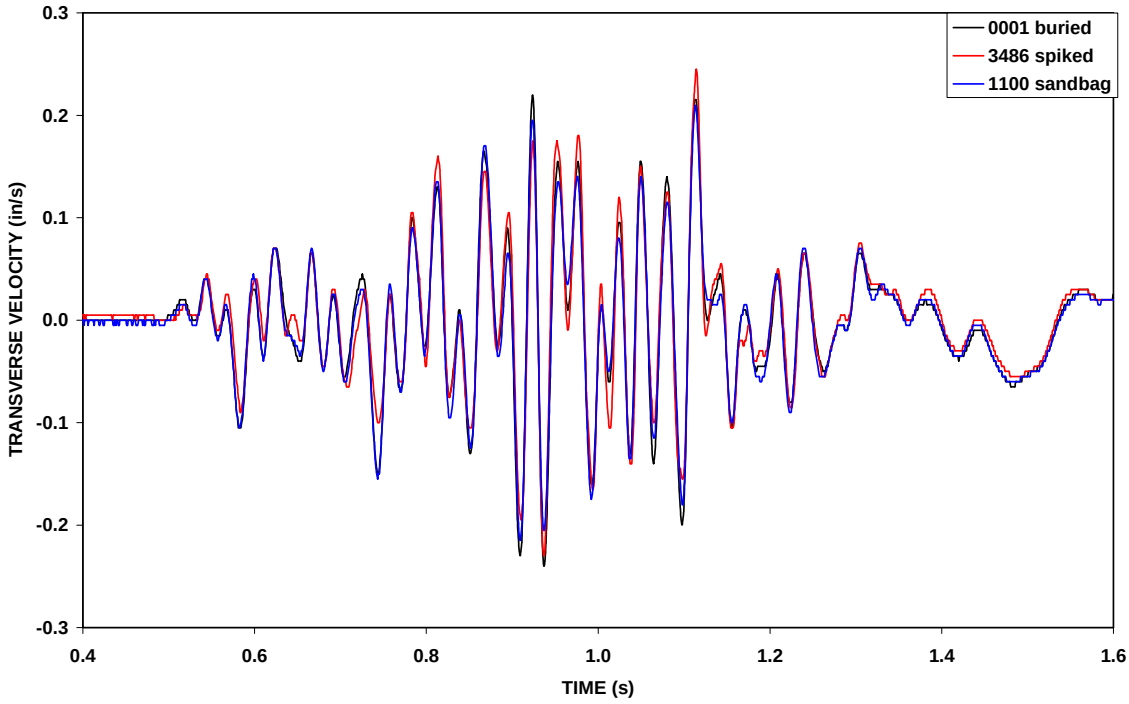
Cluster 3 SD 51.1 ft/lb$^{1/2}$

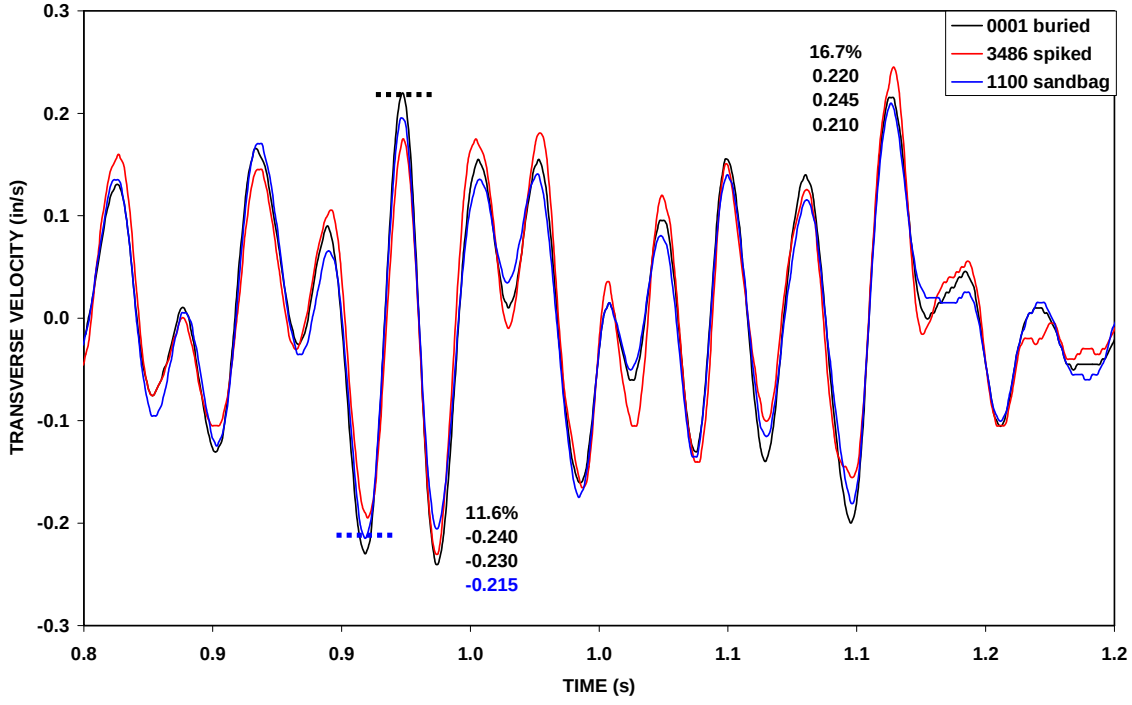

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6


0001 buried
3486 spiked
1100 sandbag
22.7%
0.220
0.270
0.235
24.3%
-0.185
-0.230
-0.205
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.6
0.7
0.8
0.9
1.0
1.1
1.2


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6

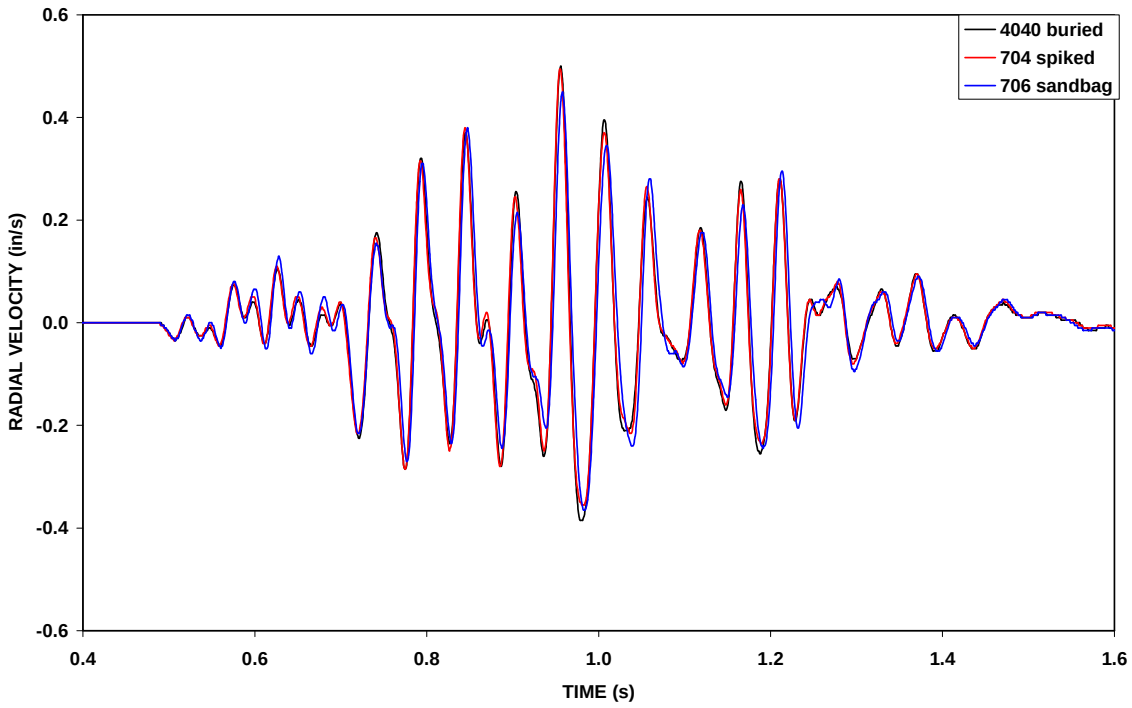

0001 buried
3486 spiked
1100 sandbag
15.2%
0.175
0.190
0.165
19.4%
-0.160
-0.185
-0.155
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.6
0.7
0.8
0.9
1.0
1.1
1.2

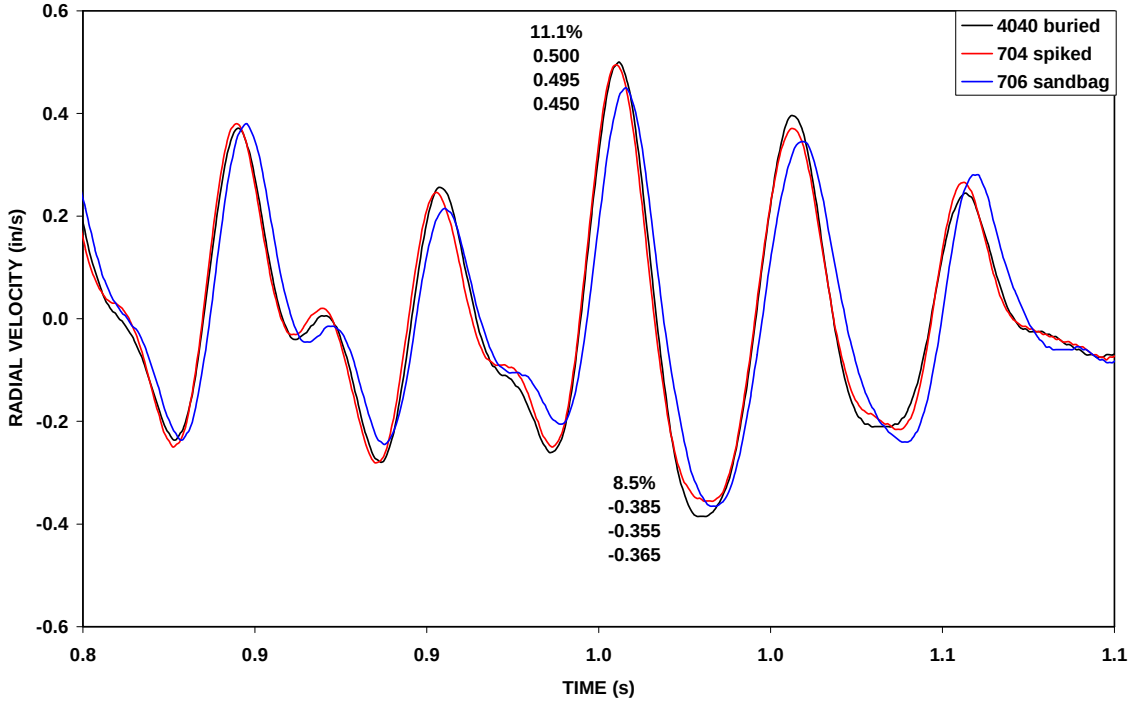

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6

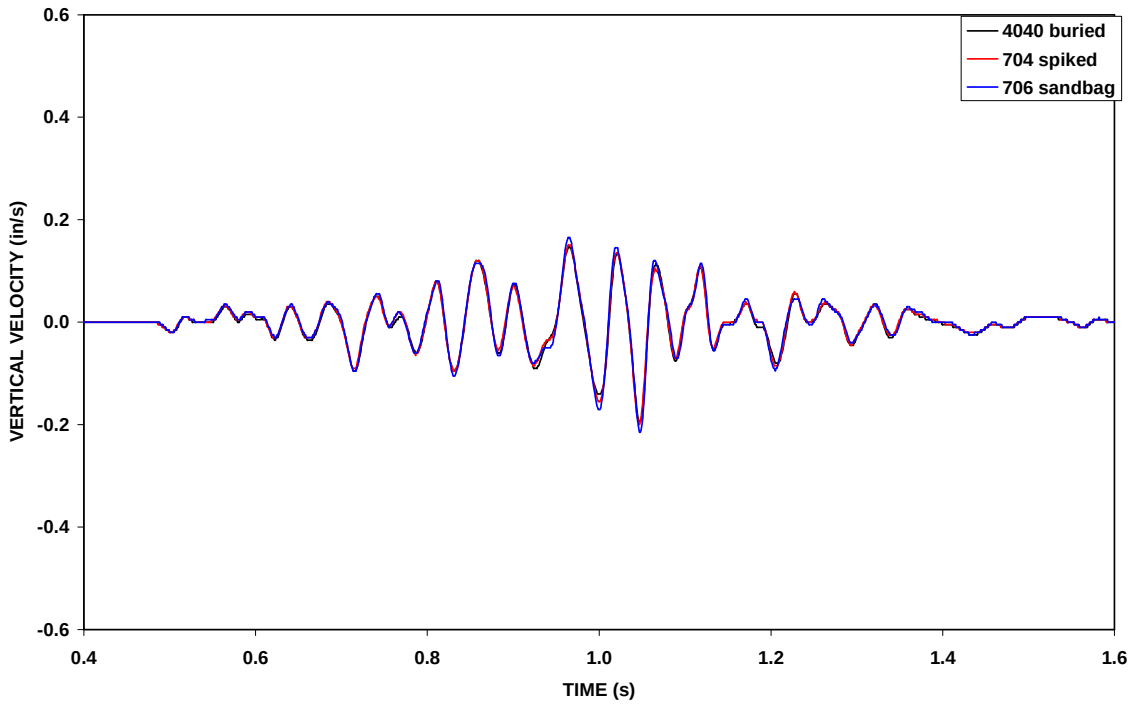

0001 buried
3486 spiked
1100 sandbag
16.7%
0.220
0.245
0.210
11.6%
-0.240
-0.230
-0.215
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.8
0.9
0.9
1.0
1.0
1.1
1.1
1.2
1.2

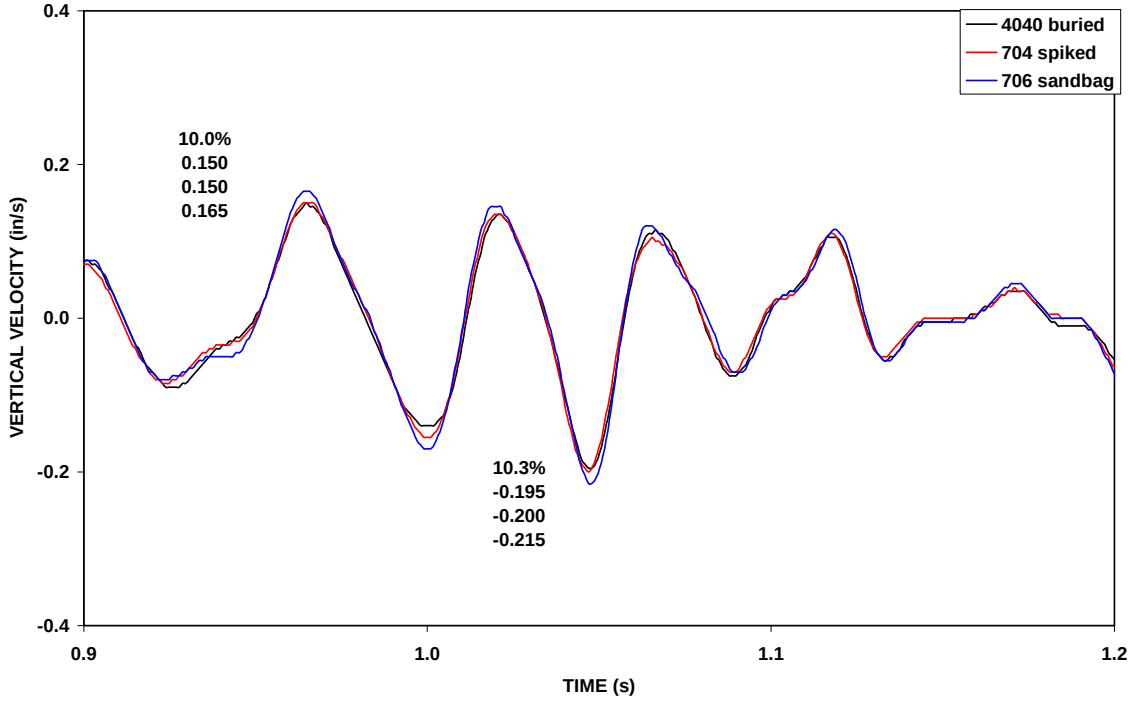
WV-2

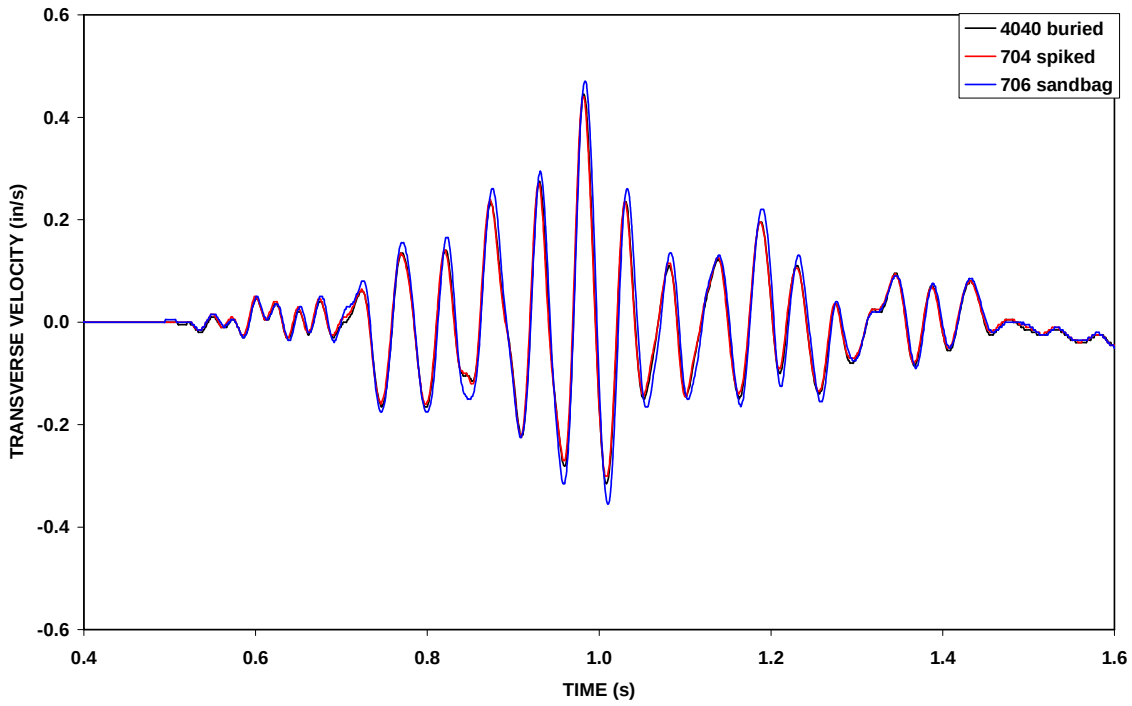
Cluster 4 SD 101.9 ft/lb$^{1/2}$

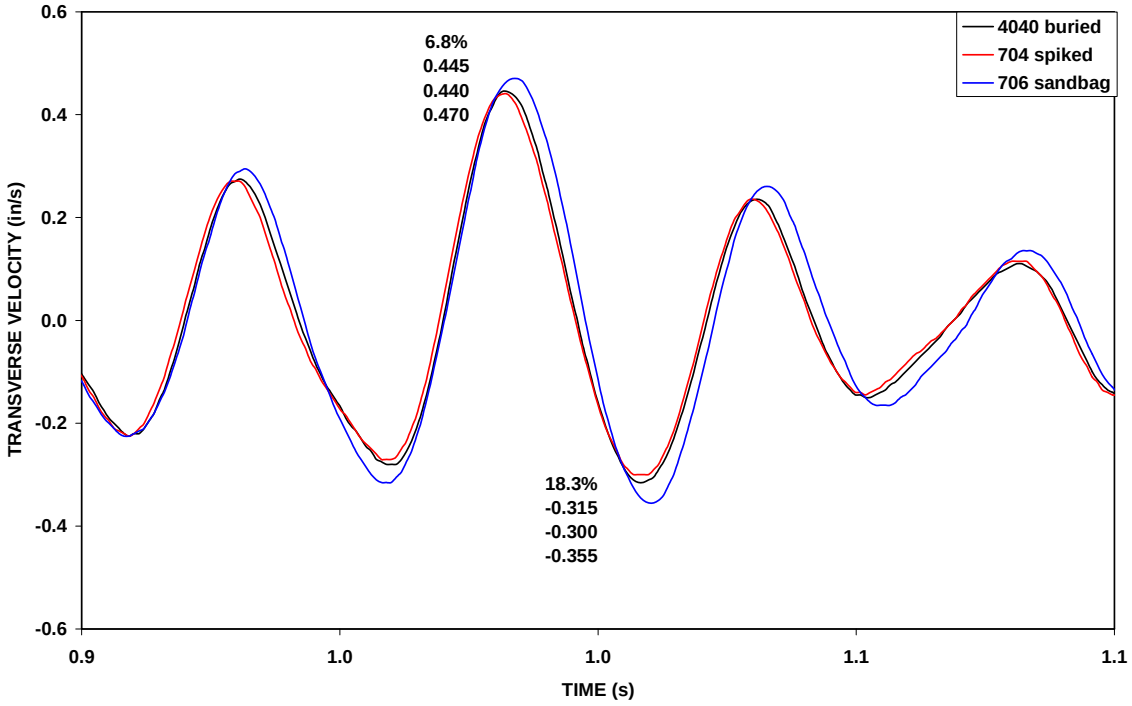

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6


4040 buried
704 spiked
706 sandbag
11.1%
0.500
0.495
0.450
8.5%
-0.385
-0.355
-0.365
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.8
0.9
0.9
1.0
1.0
1.1
1.1


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6

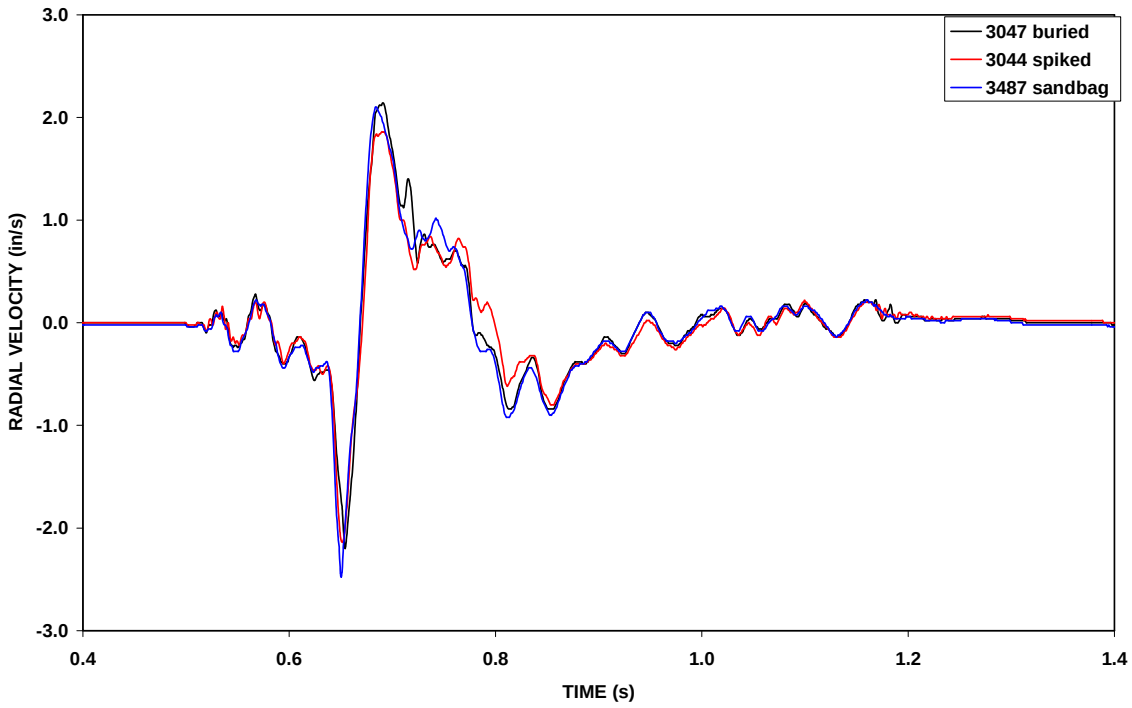

4040 buried
704 spiked
706 sandbag
10.0%
0.150
0.150
0.165
10.3%
-0.195
-0.200
-0.215
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.9
1.0
1.1
1.2

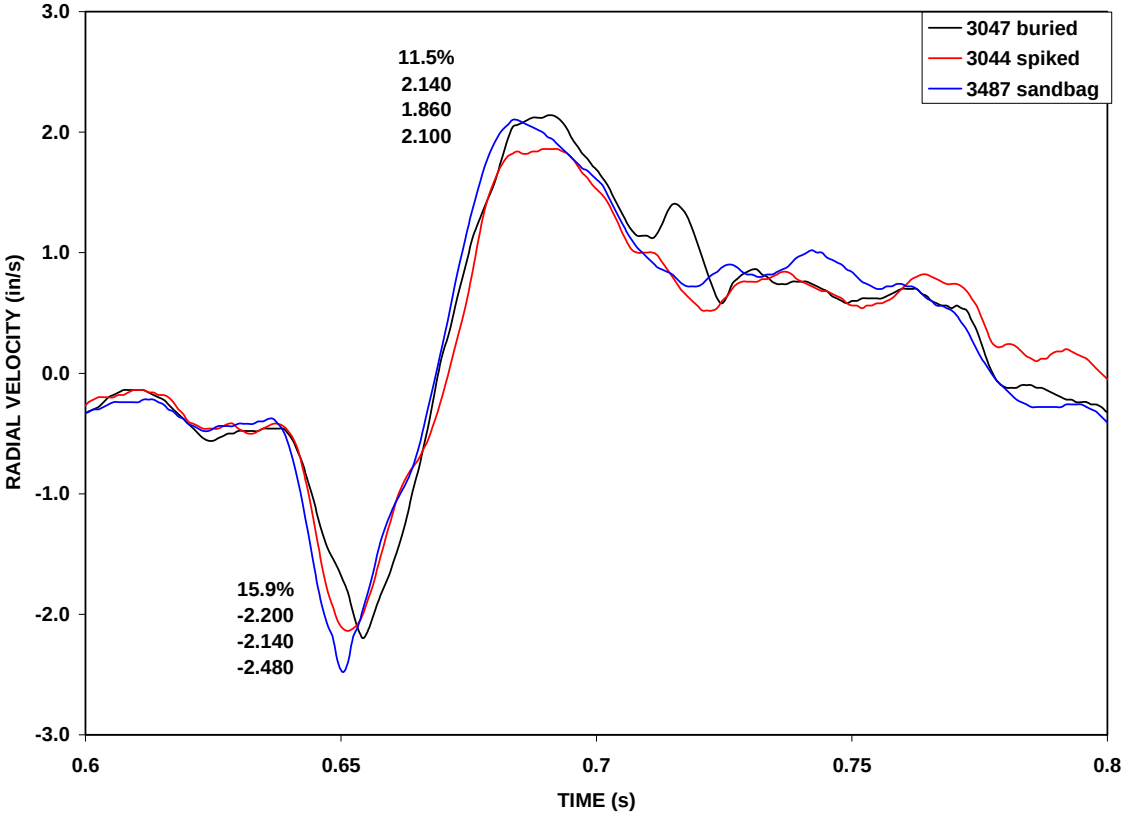

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
0.6
0.8
1.0
1.2
1.4
1.6
TIME (s)

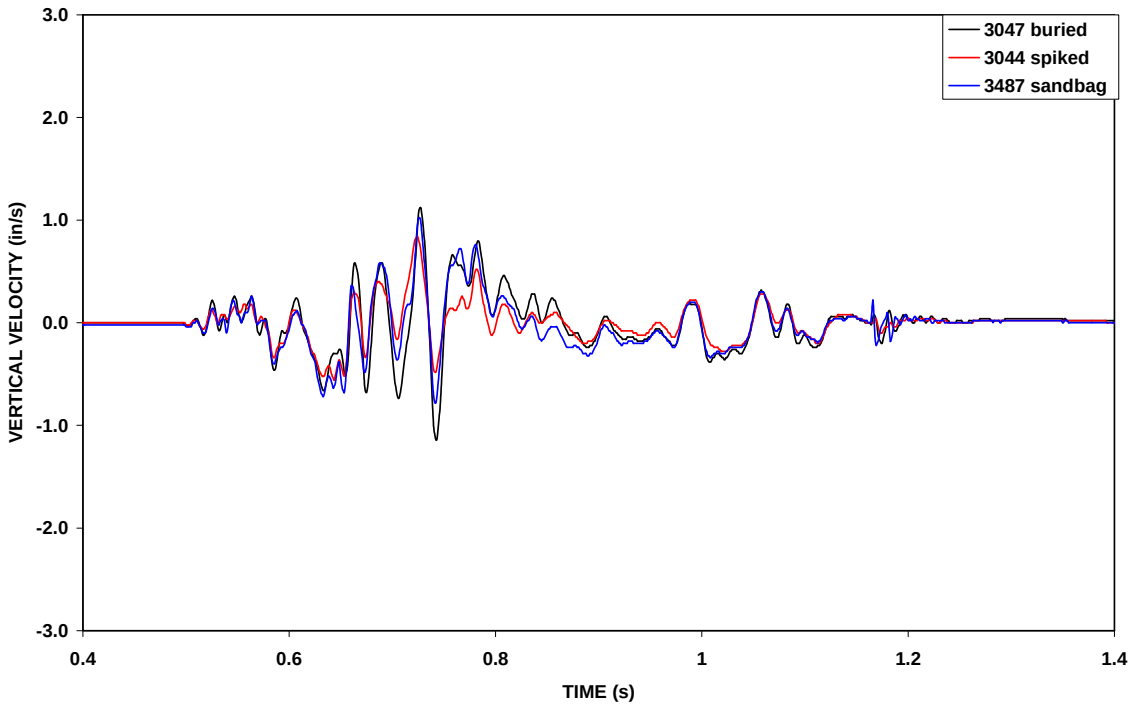

4040 buried
704 spiked
706 sandbag
6.8%
0.445
0.440
0.470
18.3%
-0.315
-0.300
-0.355
TRANSVERSE VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.9
1.0
1.0
1.1
1.1
TIME (s)

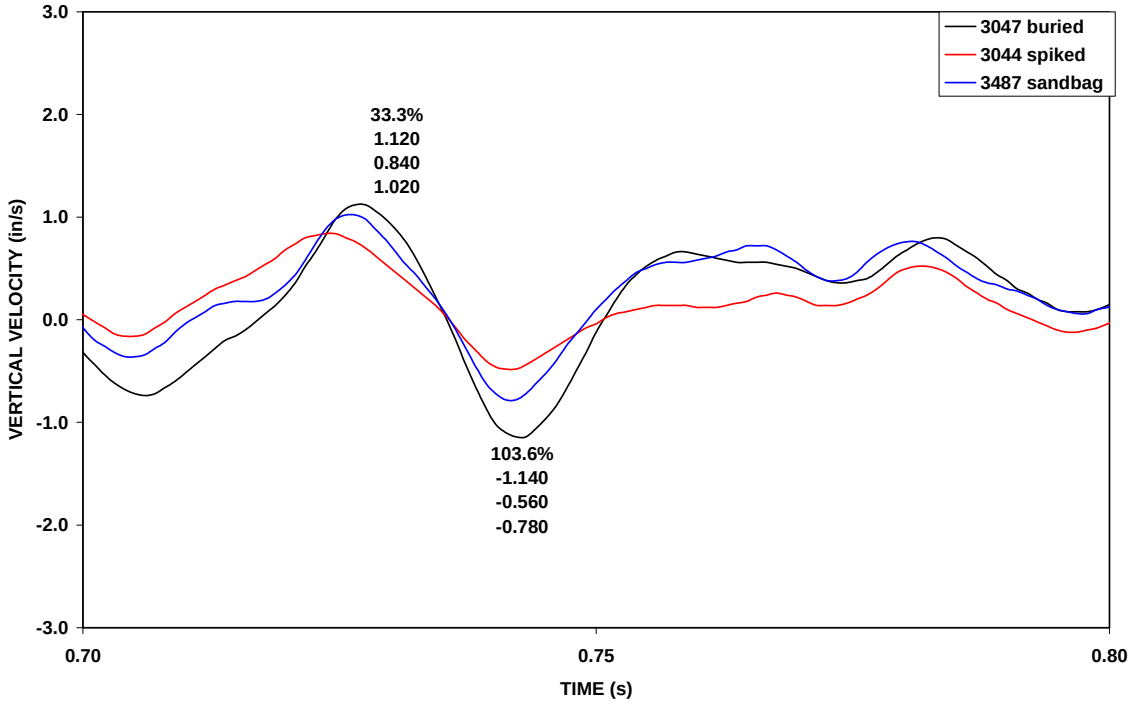
WV-3

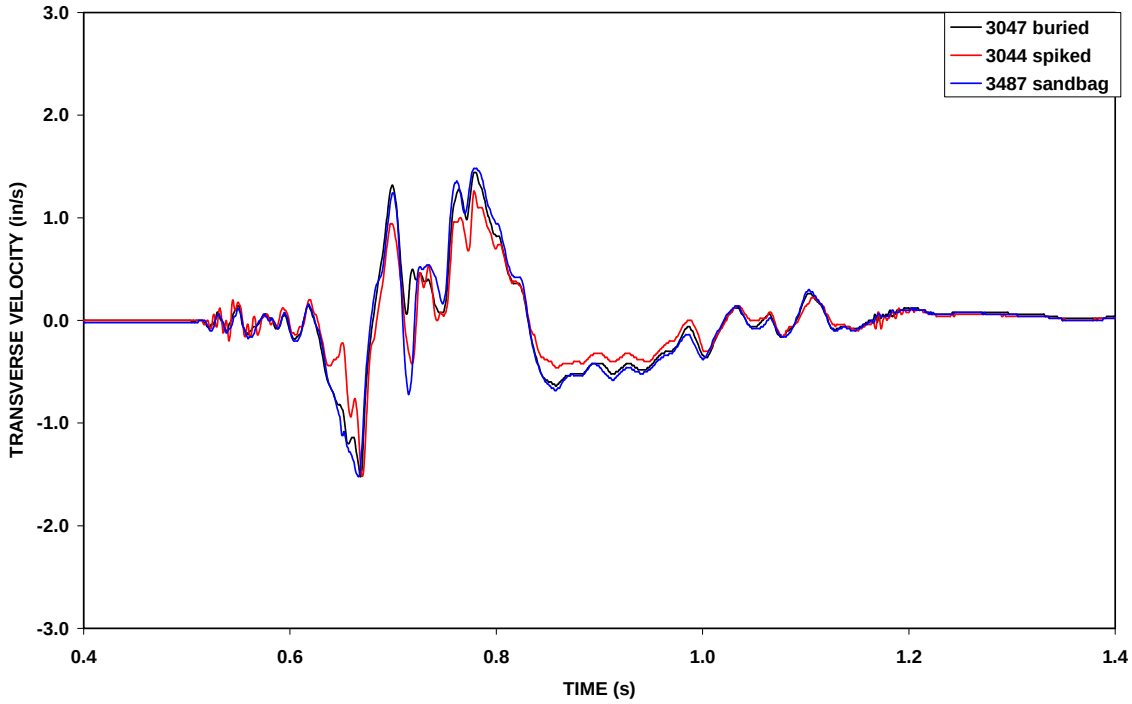
Cluster 1 SD 14.3 ft/lb$^{1/2}$

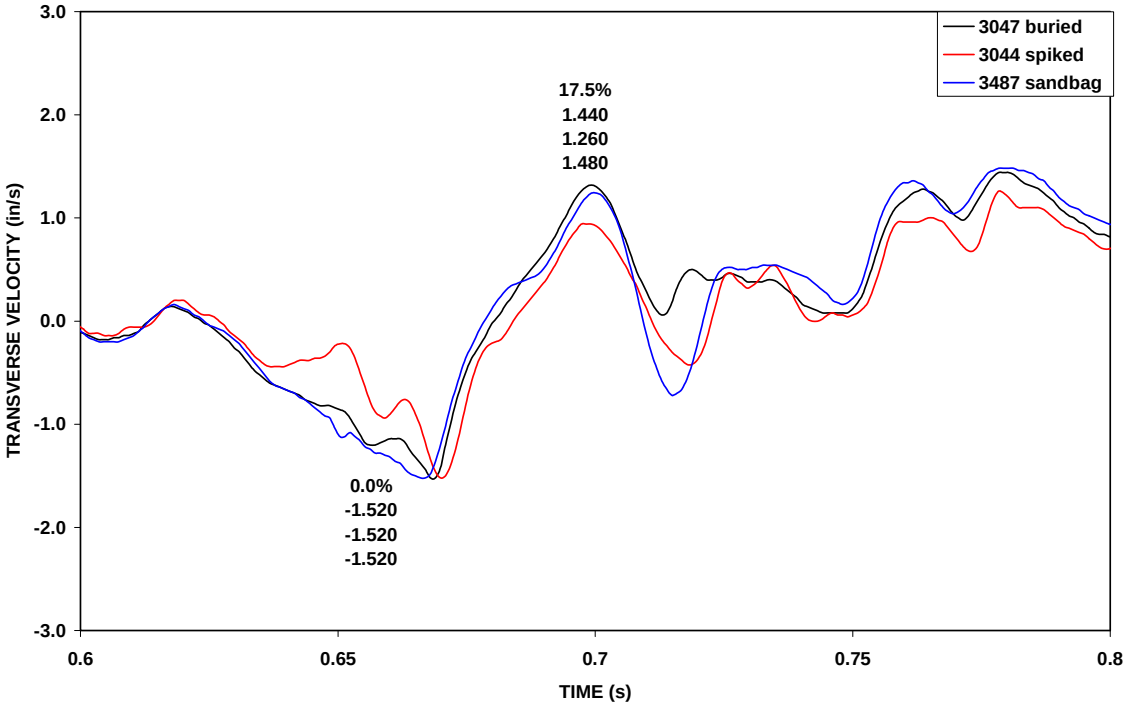

3047 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.6
0.8
1.0
1.2
1.4


3047 buried
3044 spiked
3487 sandbag
11.5%
2.140
1.860
2.100
15.9%
-2.200
-2.140
-2.480
RADIAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.6
0.65
0.7
0.75
0.8


3047 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.6
0.8
1
1.2
1.4

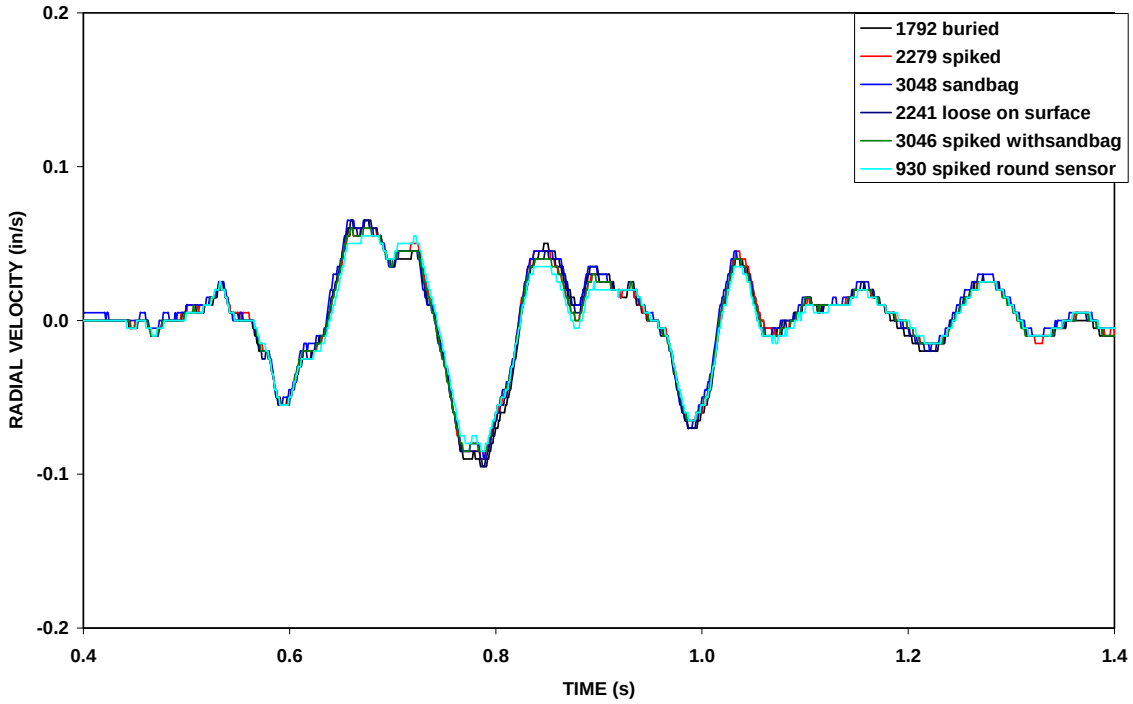

3047 buried
3044 spiked
3487 sandbag
33.3%
1.120
0.840
1.020
103.6%
-1.140
-0.560
-0.780
VERTICAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.70
0.75
0.80

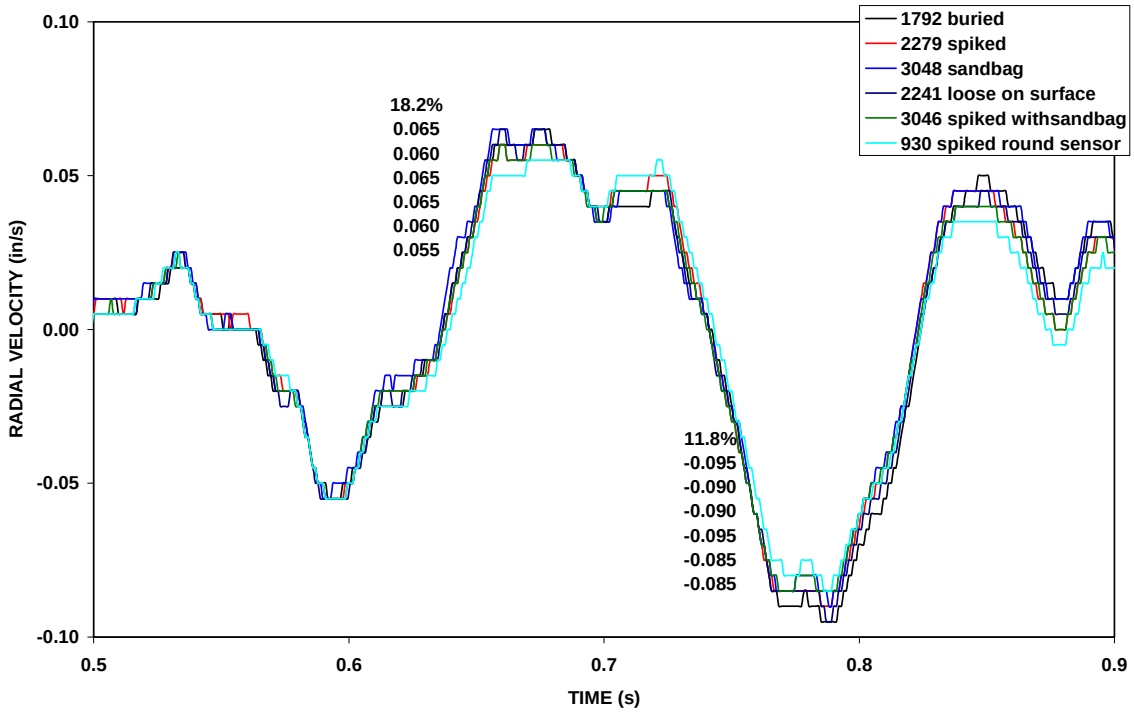

3047 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.6
0.8
1.0
1.2
1.4

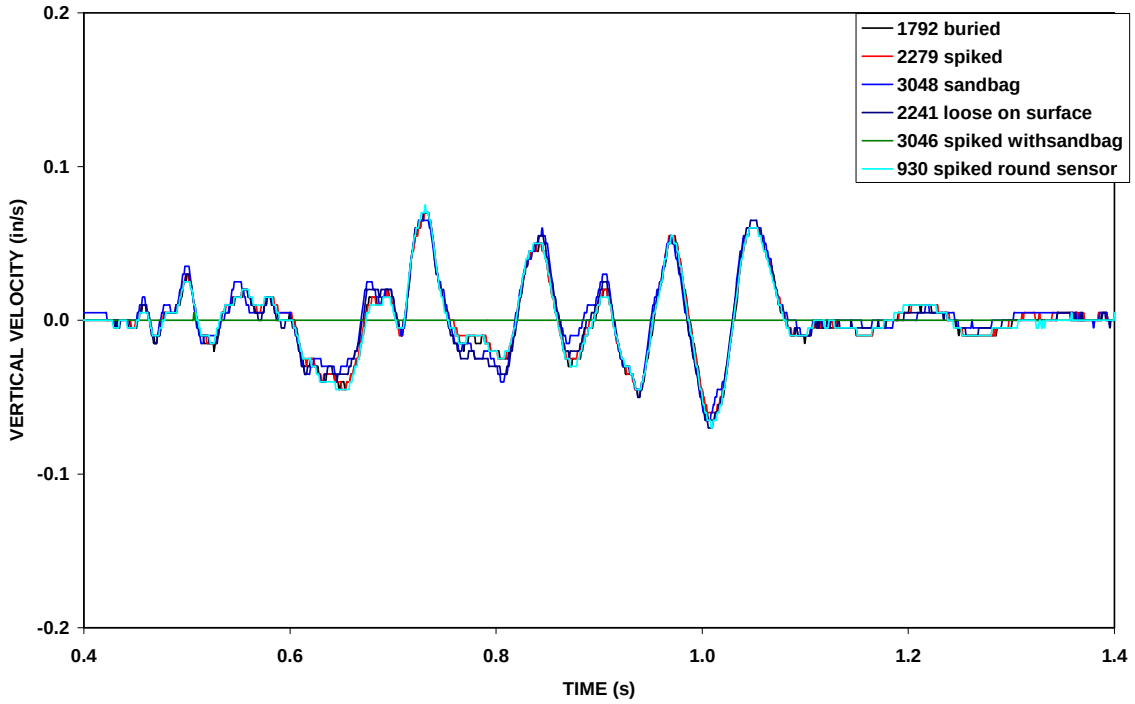

3047 buried
3044 spiked
3487 sandbag
17.5%
1.440
1.260
1.480
0.0%
-1.520
-1.520
-1.520
TRANSVERSE VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.6
0.65
0.7
0.75
0.8

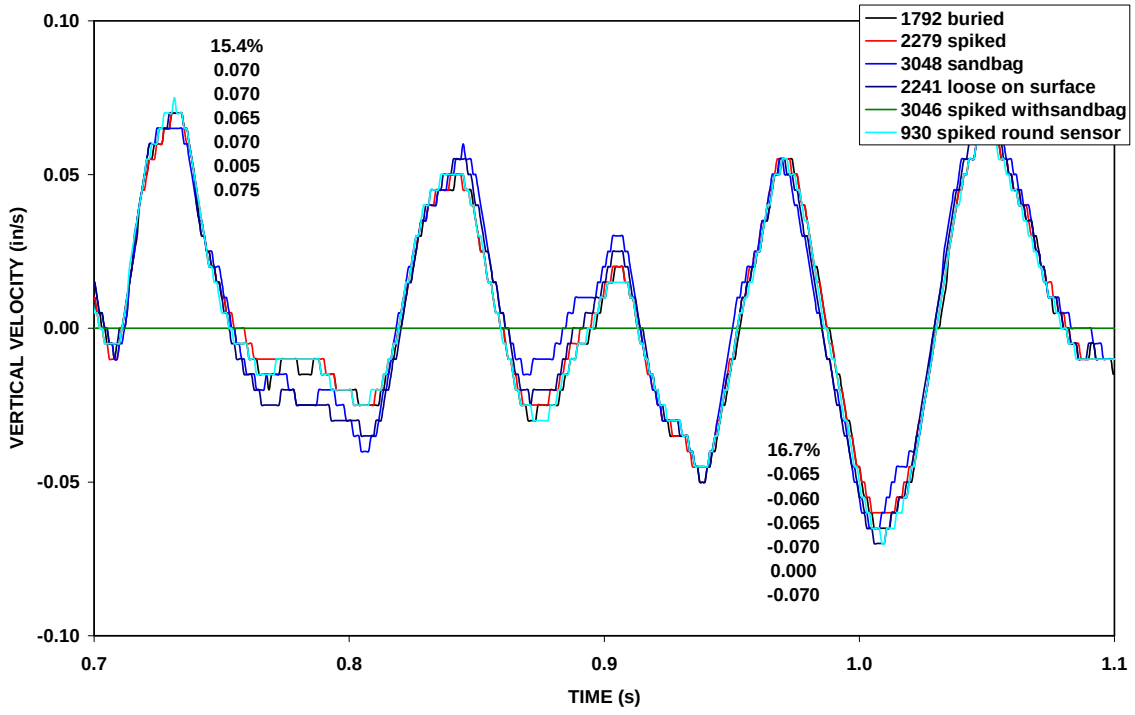
WV-3

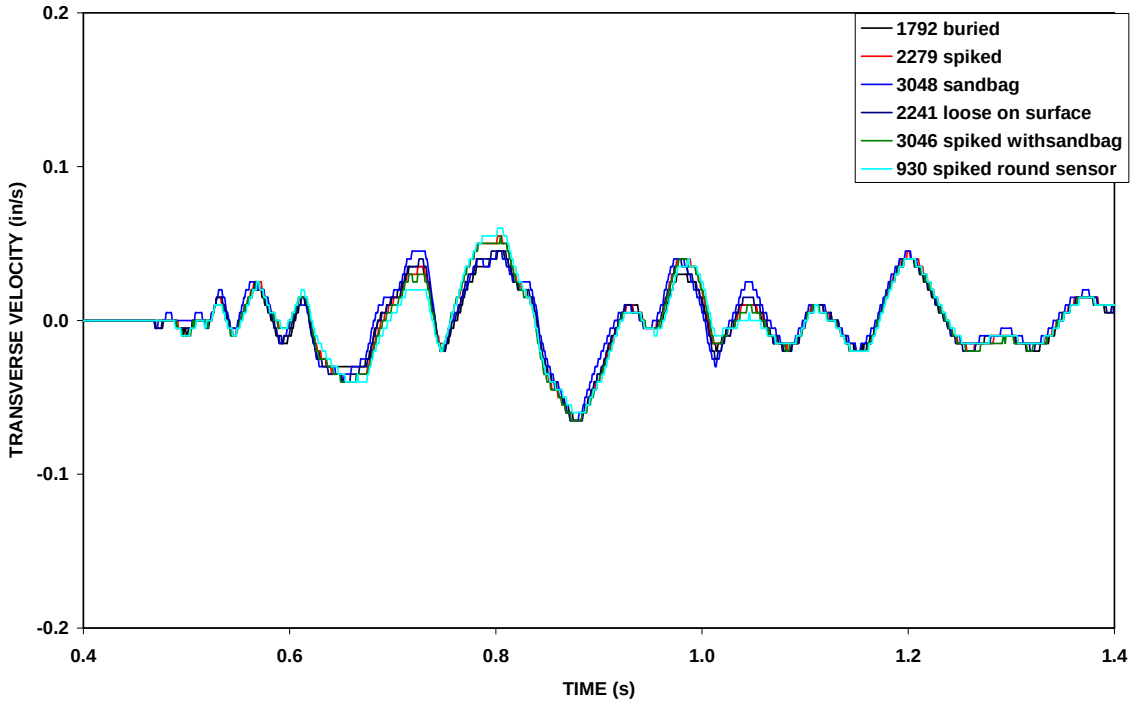
Cluster 2 SD 32.0 ft/lb$^{1/2}$

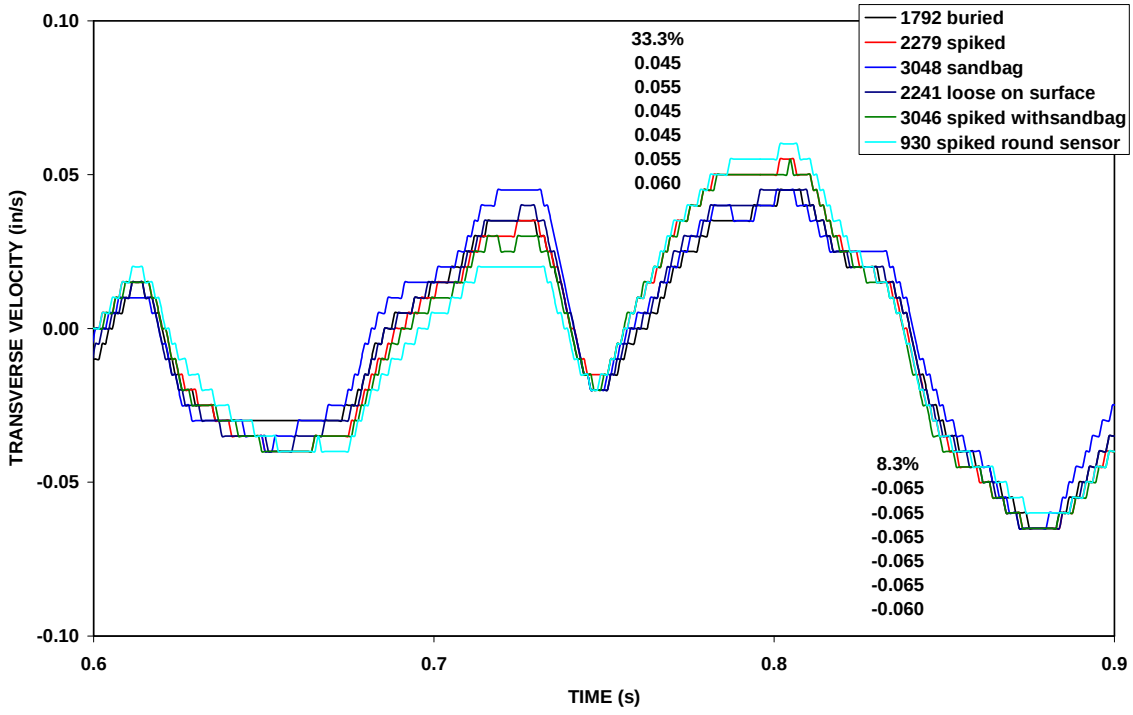

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked withsandbag
930 spiked round sensor
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4

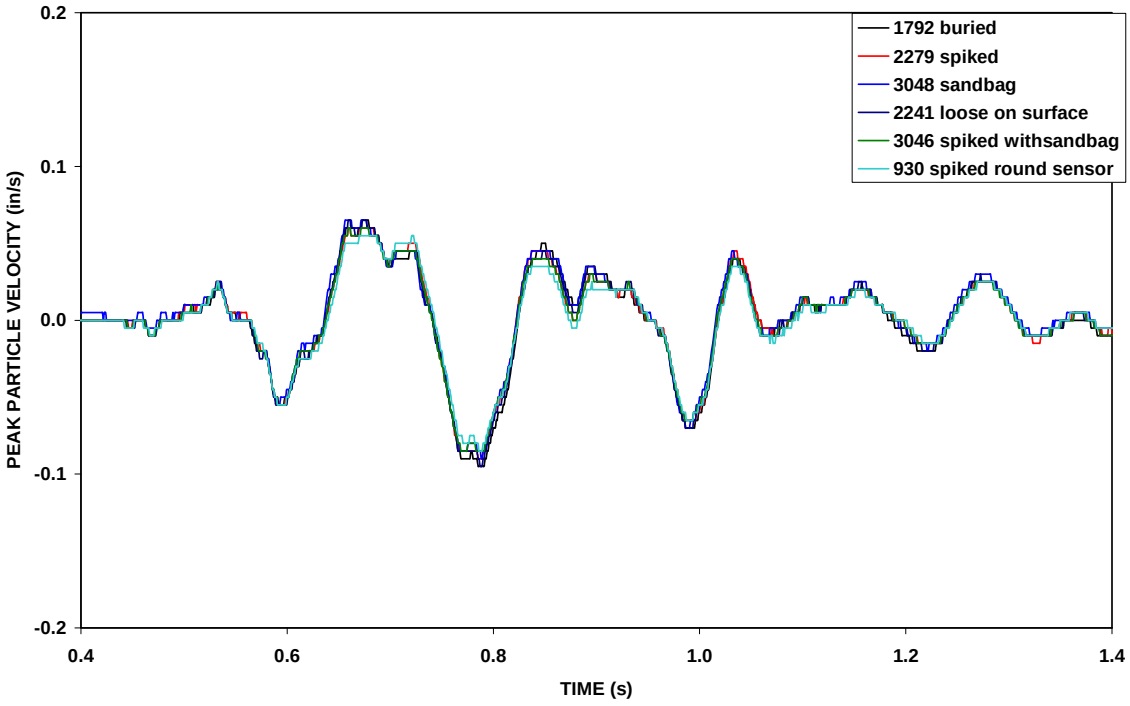

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked withsandbag
930 spiked round sensor
18.2%
0.065
0.060
0.065
0.065
0.060
0.055
11.8%
-0.095
-0.090
-0.090
-0.095
-0.085
-0.085
RADIAL VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
0.5
0.6
0.7
0.8
0.9

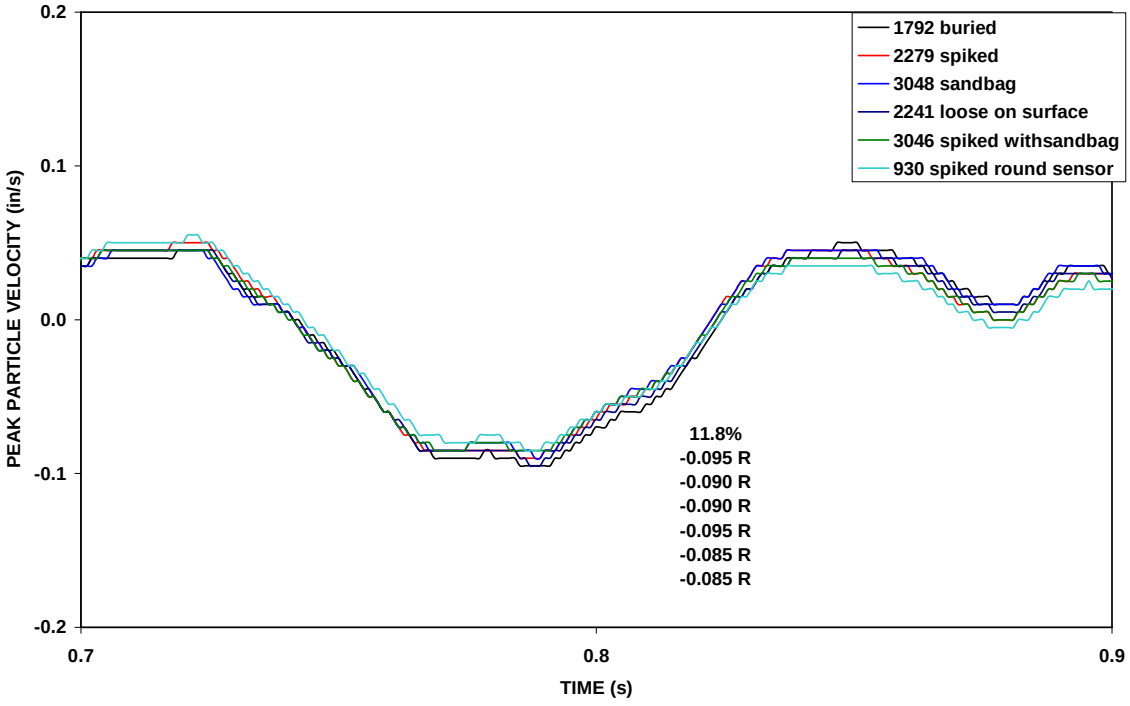

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked withsandbag
930 spiked round sensor
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked withsandbag
930 spiked round sensor
15.4%
0.070
0.070
0.065
0.070
0.005
0.075
16.7%
-0.065
-0.060
-0.065
-0.070
0.000
-0.070
VERTICAL VELOCITY (in/s)
TIME (s)
0.10
0.05
0.00
-0.05
-0.10
0.7
0.8
0.9
1.0
1.1


0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
TRANSVERSE VELOCITY (in/s)
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked withsandbag
930 spiked round sensor

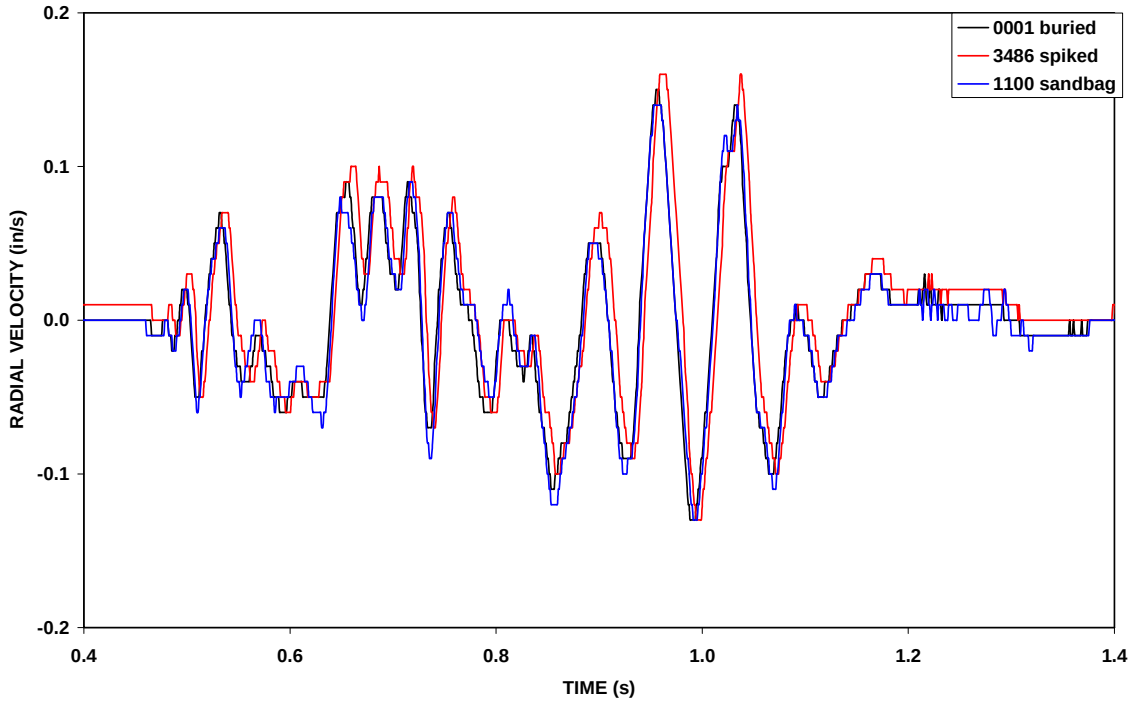

0.10
0.05
0.00
-0.05
-0.10
0.6
0.7
0.8
0.9
TRANSVERSE VELOCITY (in/s)
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked withsandbag
930 spiked round sensor
33.3%
0.045
0.055
0.045
0.045
0.055
0.060
8.3%
-0.065
-0.065
-0.065
-0.065
-0.065
-0.060

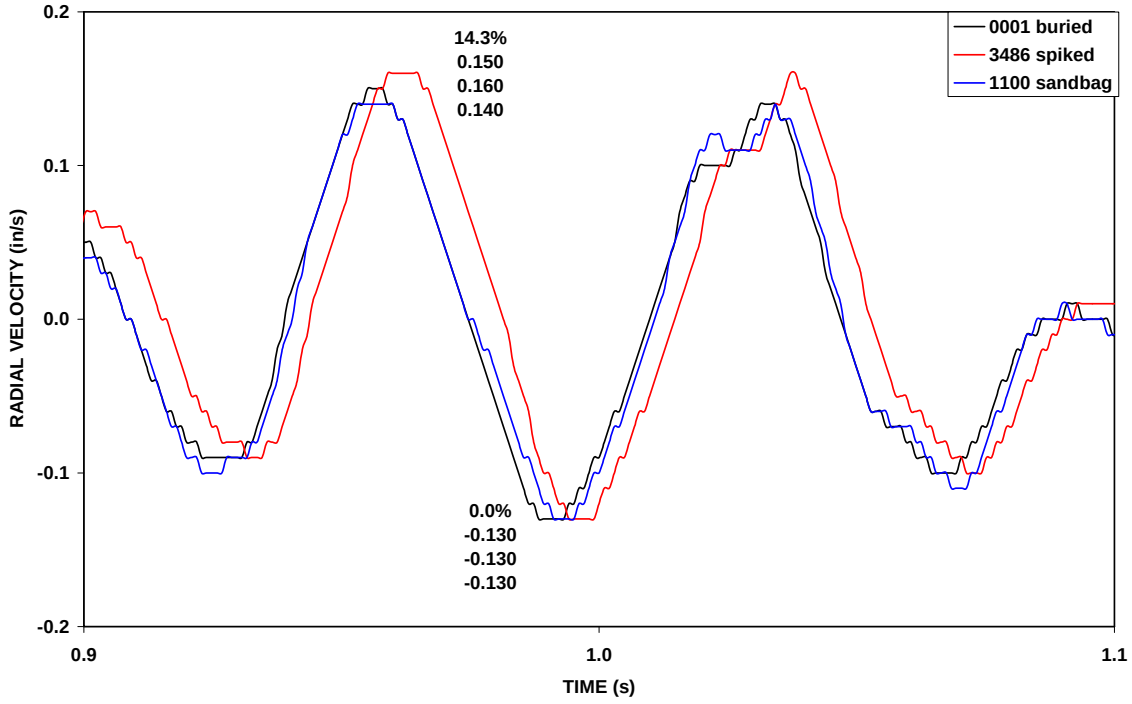

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked withsandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
TIME (s)

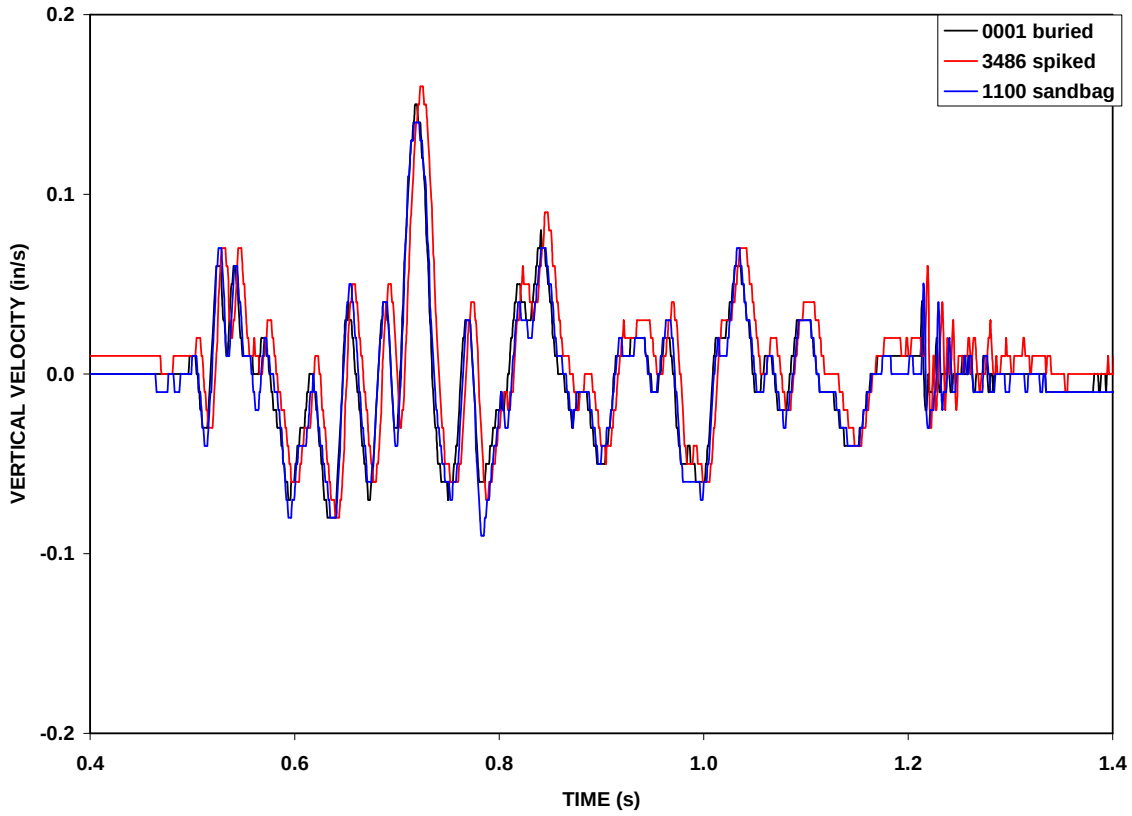

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked withsandbag
930 spiked round sensor
PEAK PARTICLE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.7
0.8
0.9
TIME (s)
11.8%
-0.095 R
-0.090 R
-0.090 R
-0.095 R
-0.085 R
-0.085 R

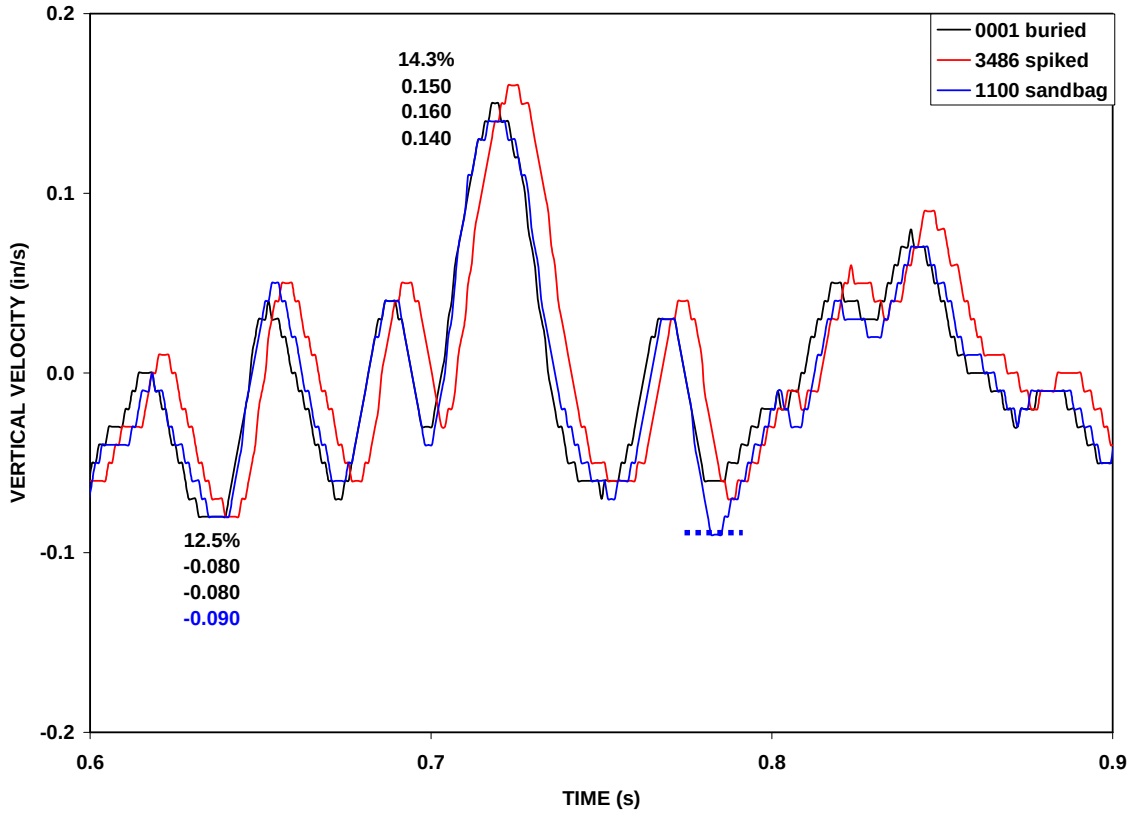
WV-3

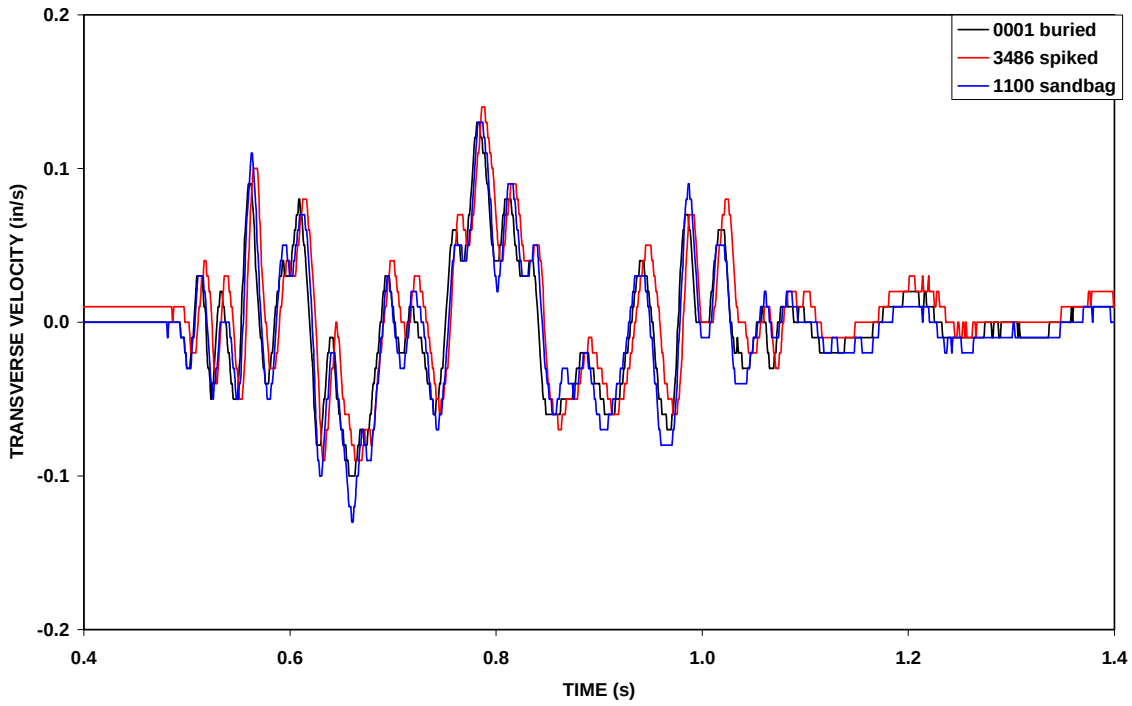
Cluster 3 SD 62.9 ft/lb$^{1/2}$

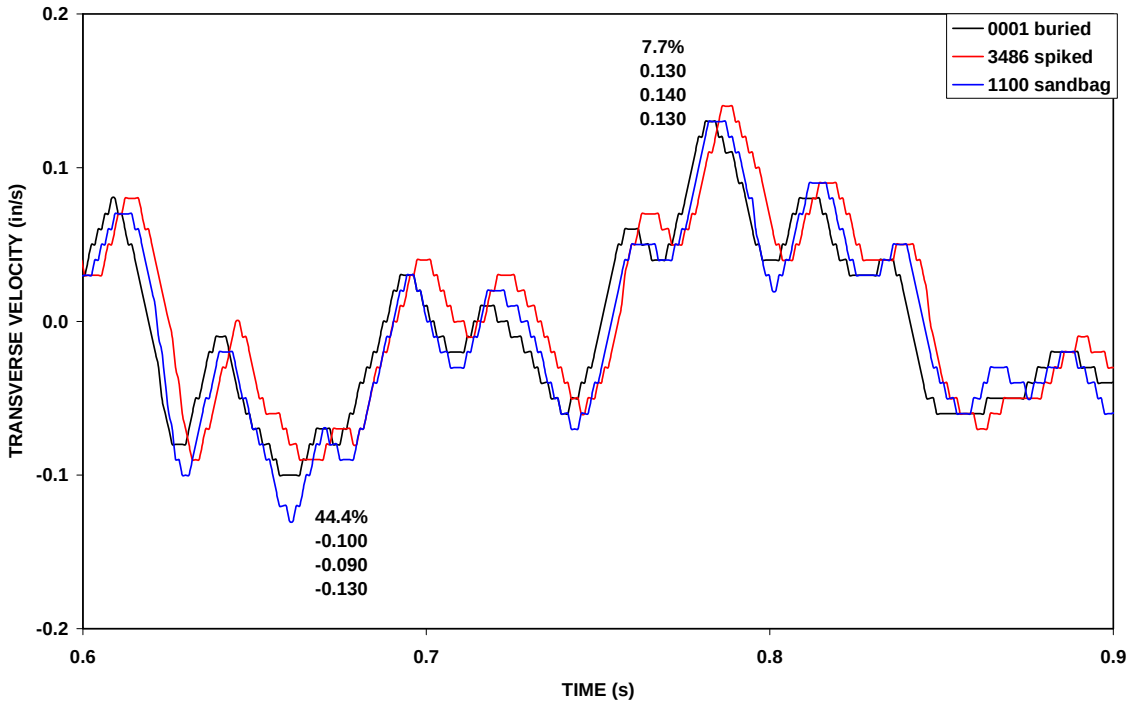

0001 buried
3486 spiked
1100 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4


0001 buried
3486 spiked
1100 sandbag
14.3%
0.150
0.160
0.140
0.0%
-0.130
-0.130
-0.130
RADIAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.9
1.0
1.1


0001 buried
3486 spiked
1100 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4

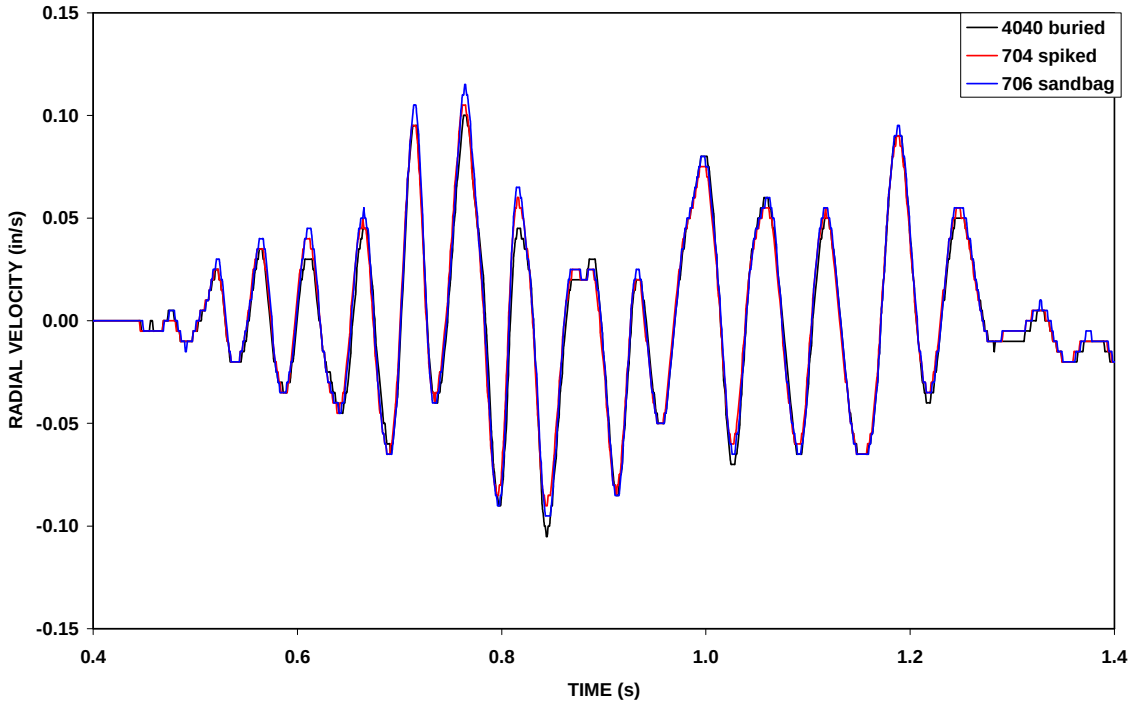

0001 buried
3486 spiked
1100 sandbag
14.3%
0.150
0.160
0.140
12.5%
-0.080
-0.080
-0.090
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.7
0.8
0.9

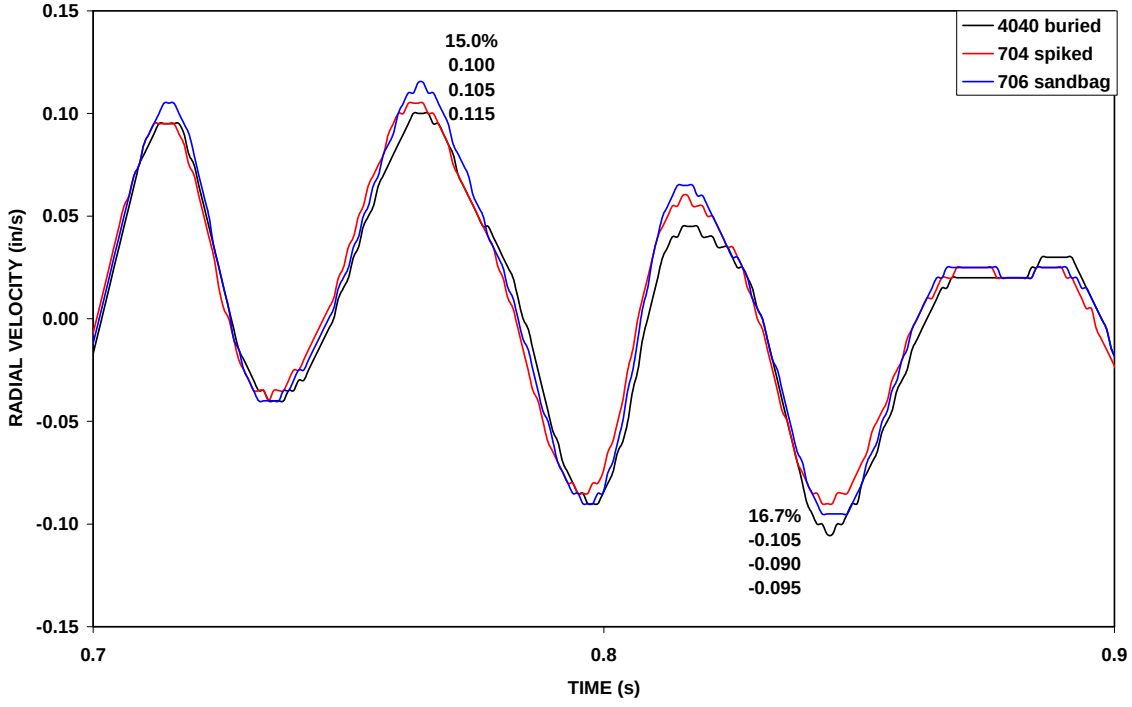

0001 buried
3486 spiked
1100 sandbag
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.6
0.8
1.0
1.2
1.4
TIME (s)

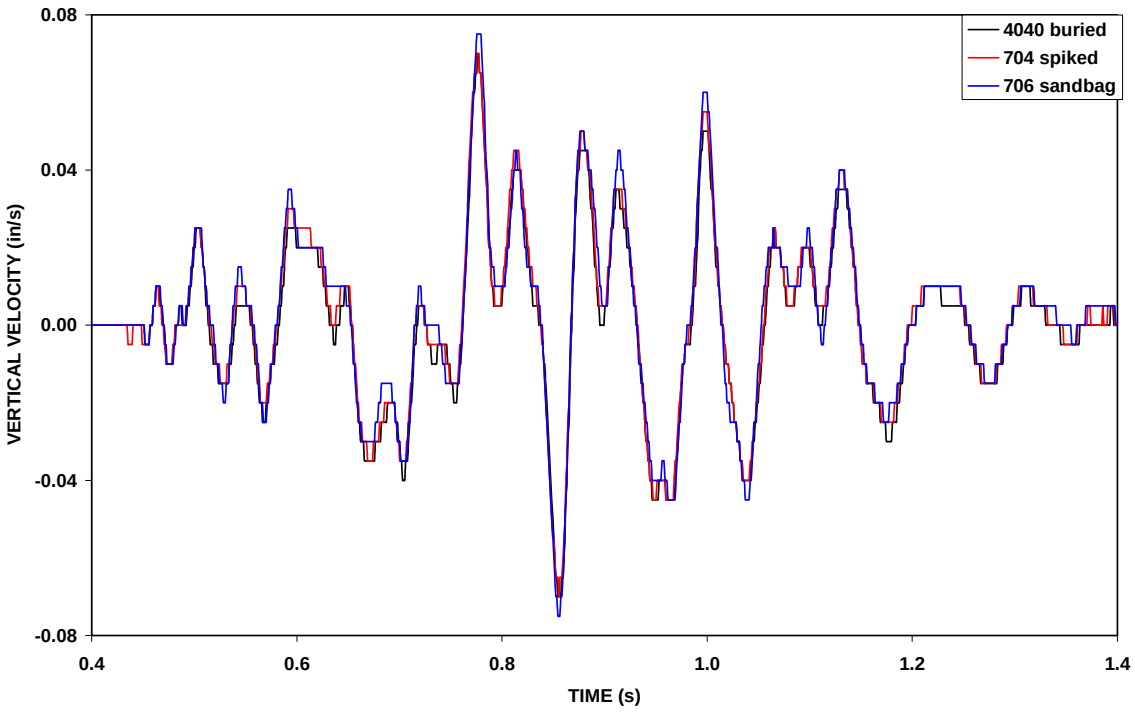

0001 buried
3486 spiked
1100 sandbag
7.7%
0.130
0.140
0.130
44.4%
-0.100
-0.090
-0.130
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.6
0.7
0.8
0.9
TIME (s)

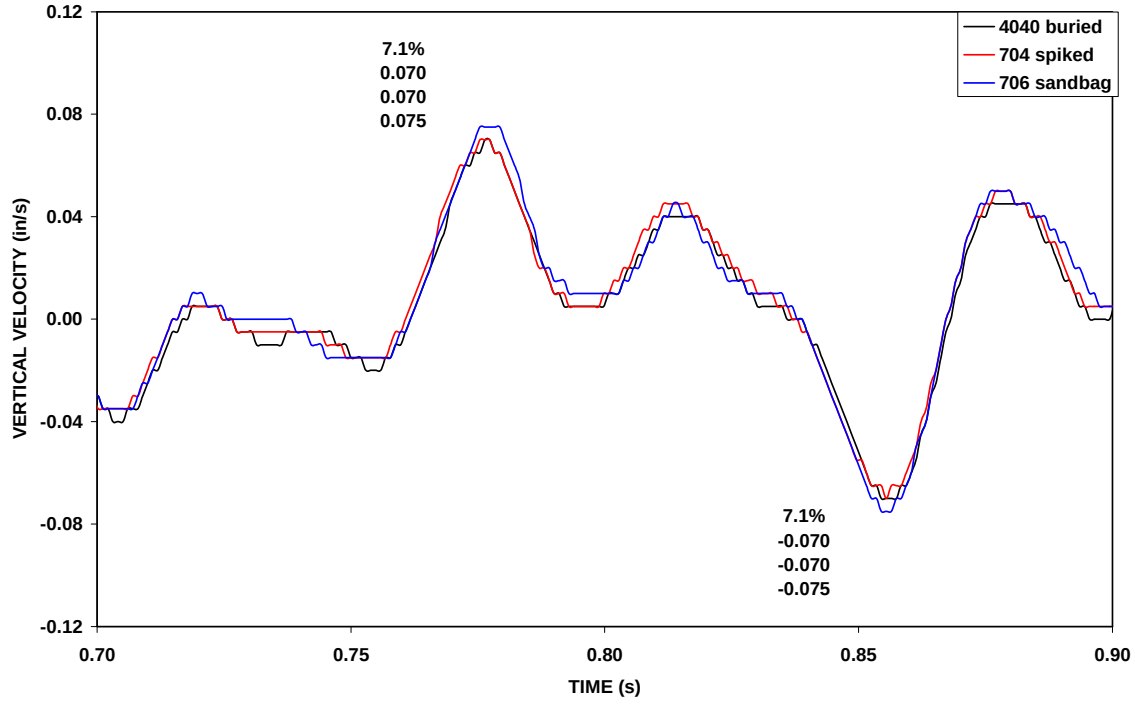
WV-3

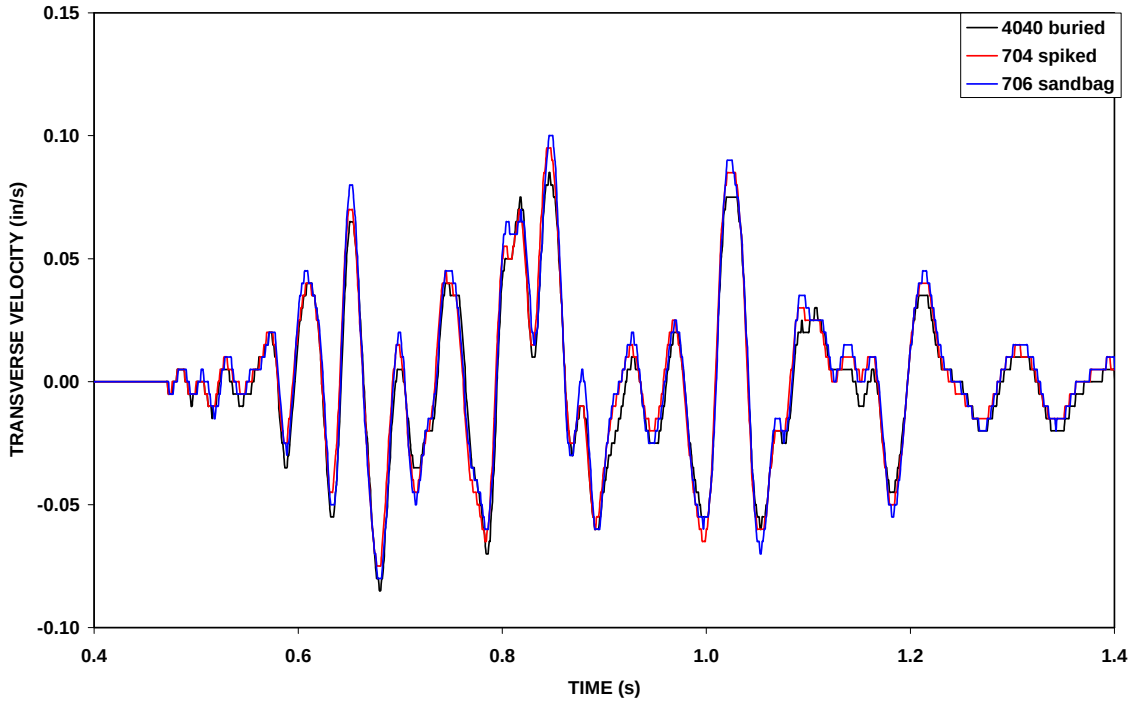
Cluster 4 SD 93.1 ft/lb$^{1/2}$

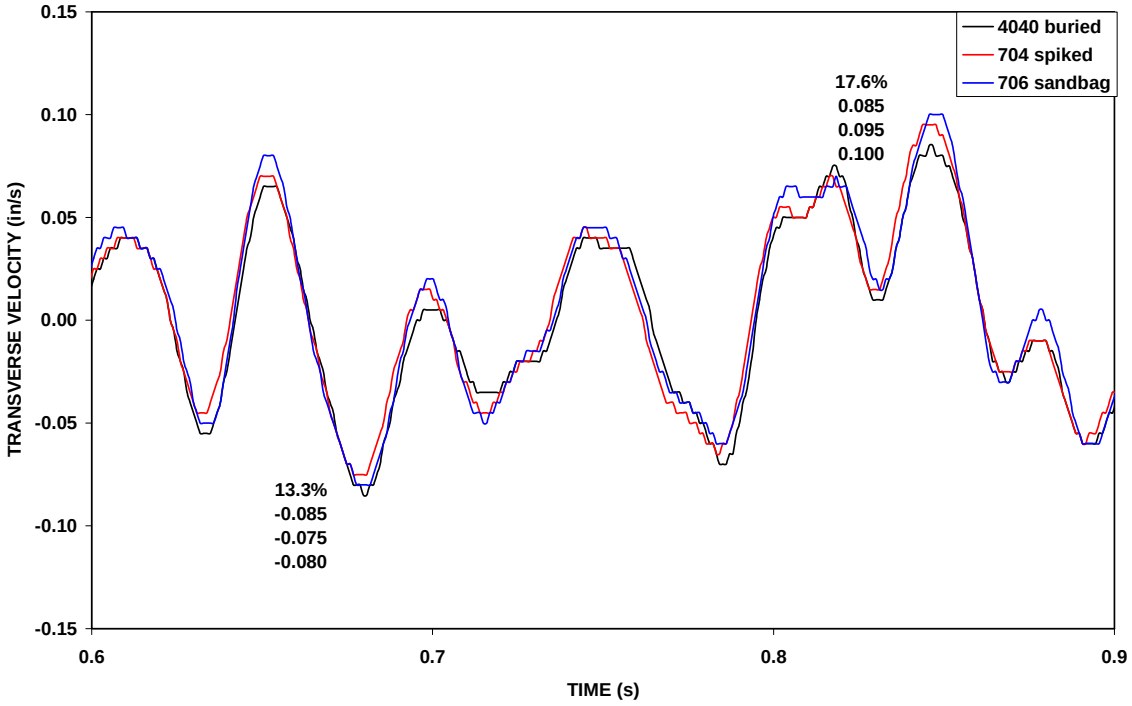

4040 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
0.6
0.8
1.0
1.2
1.4


4040 buried
704 spiked
706 sandbag
15.0%
0.100
0.105
0.115
16.7%
-0.105
-0.090
-0.095
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.7
0.8
0.9


4040 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.08
0.04
0.00
-0.04
-0.08
0.4
0.6
0.8
1.0
1.2
1.4

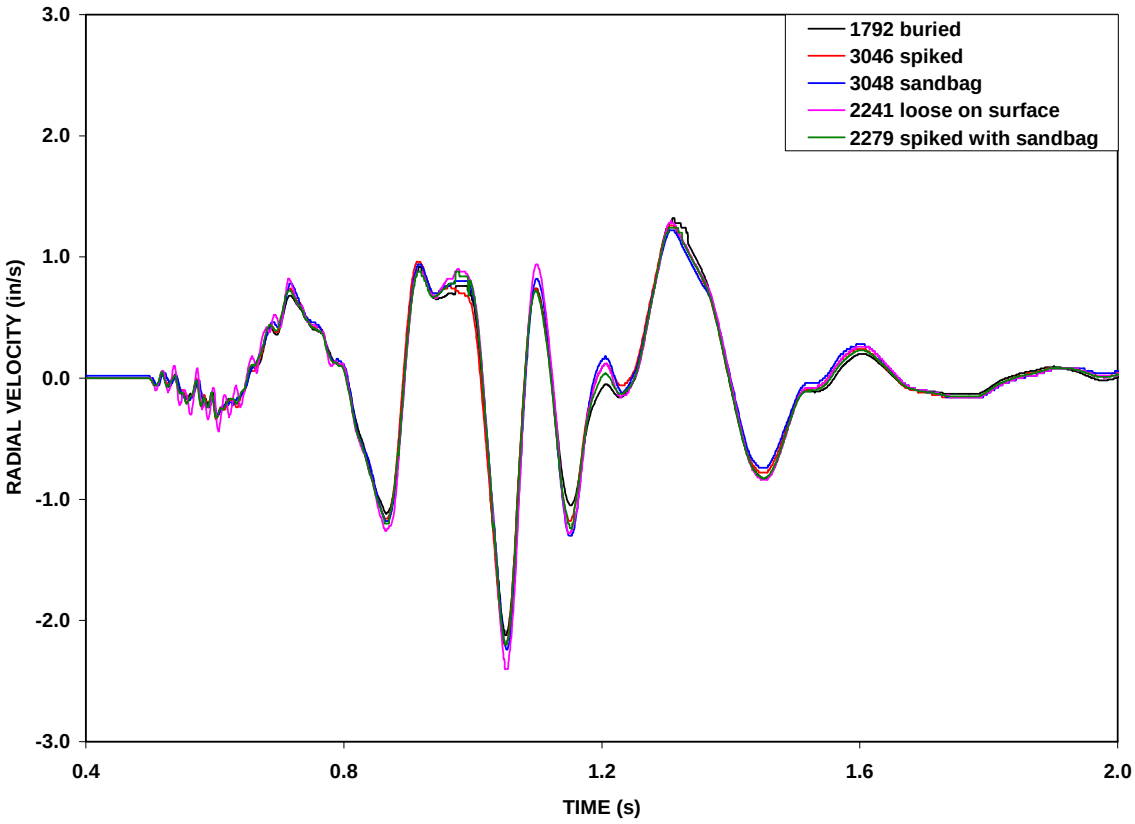

4040 buried
704 spiked
706 sandbag
7.1%
0.070
0.070
0.075
7.1%
-0.070
-0.070
-0.075
VERTICAL VELOCITY (in/s)
TIME (s)
0.12
0.08
0.04
0.00
-0.04
-0.08
-0.12
0.70
0.75
0.80
0.85
0.90

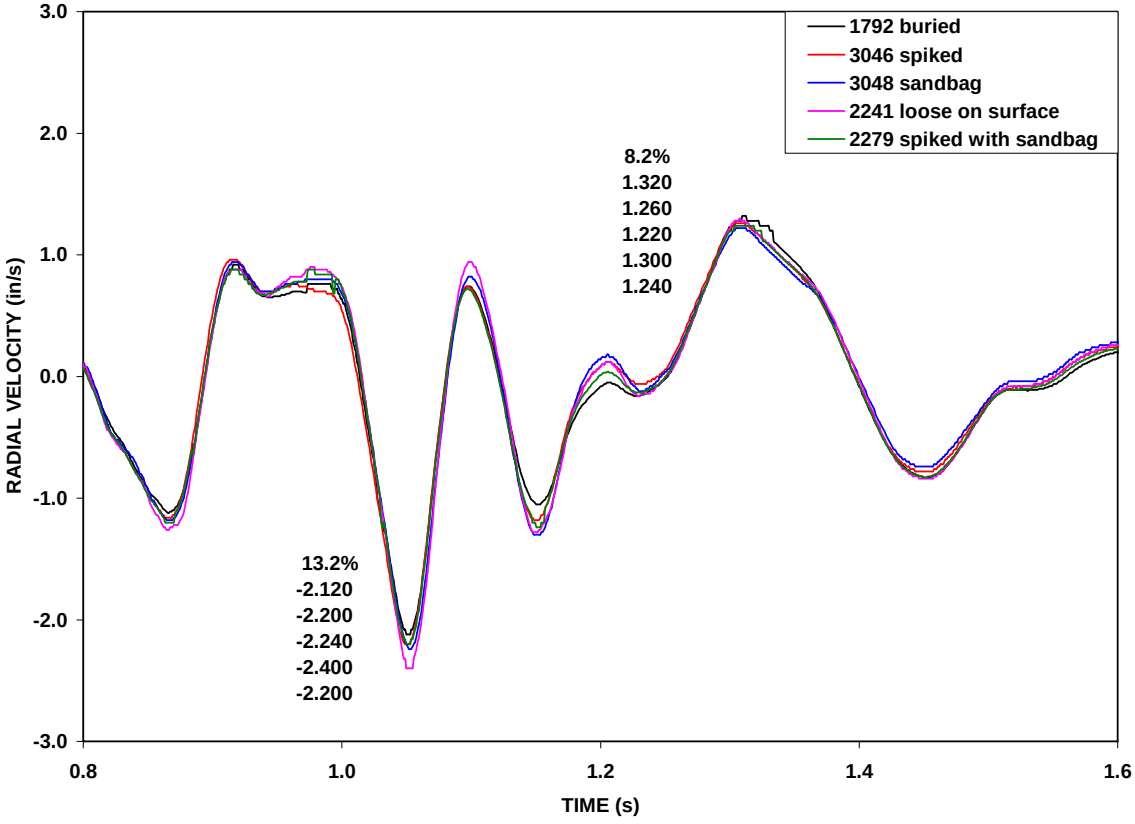

4040 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
0.4
0.6
0.8
1.0
1.2
1.4

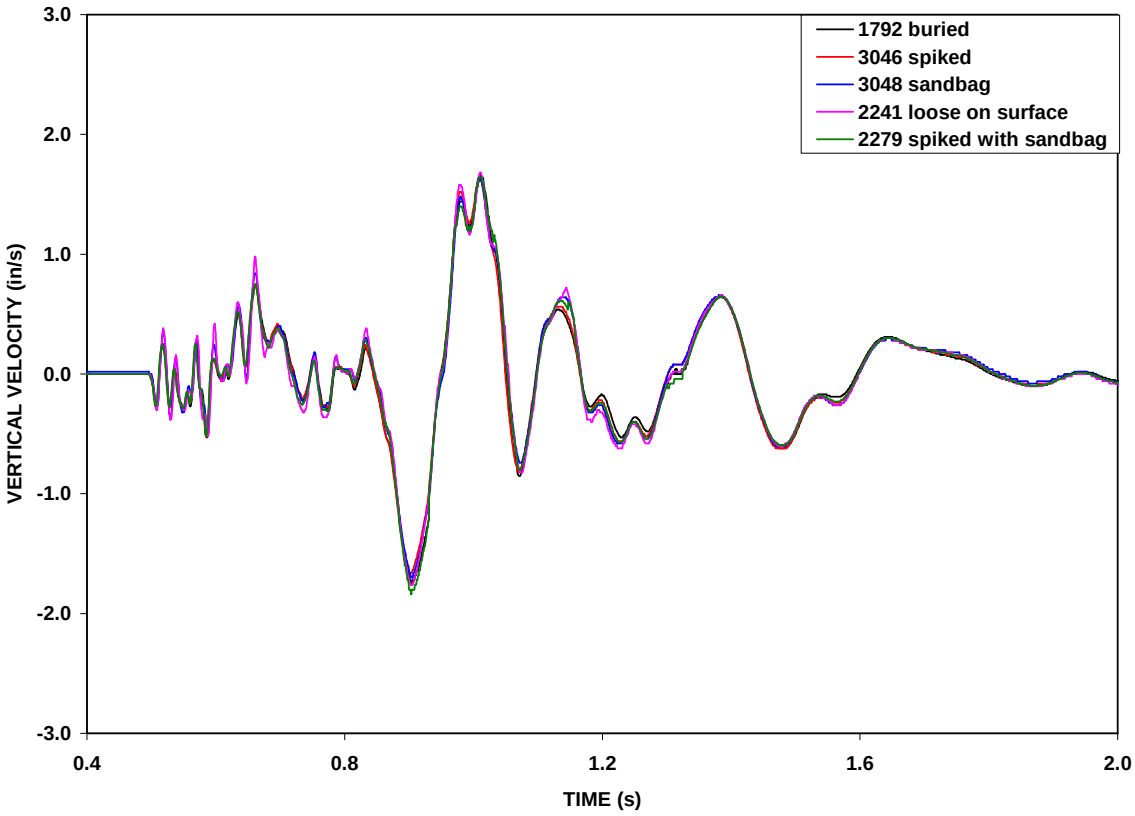

4040 buried
704 spiked
706 sandbag
17.6%
0.085
0.095
0.100
13.3%
-0.085
-0.075
-0.080
TRANSVERSE VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.6
0.7
0.8
0.9

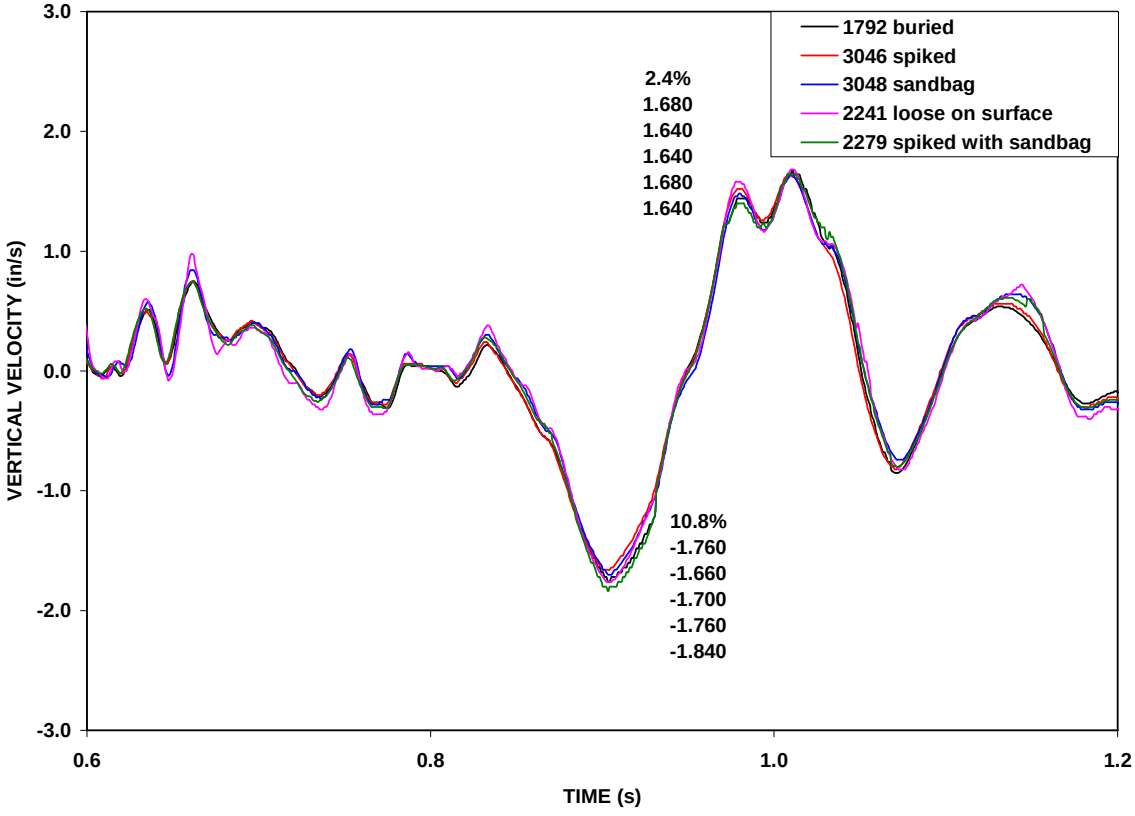
WY-1

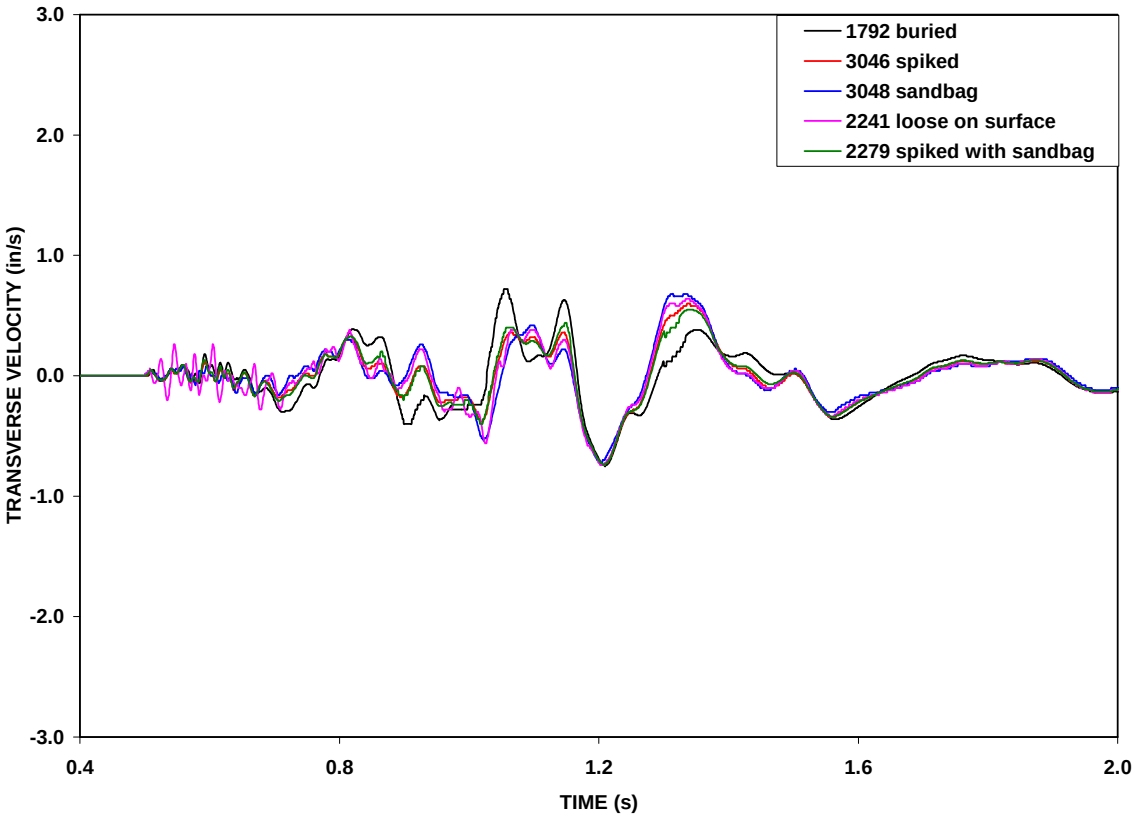
Cluster 1 SD 16.8 ft/lb$^{1/2}$

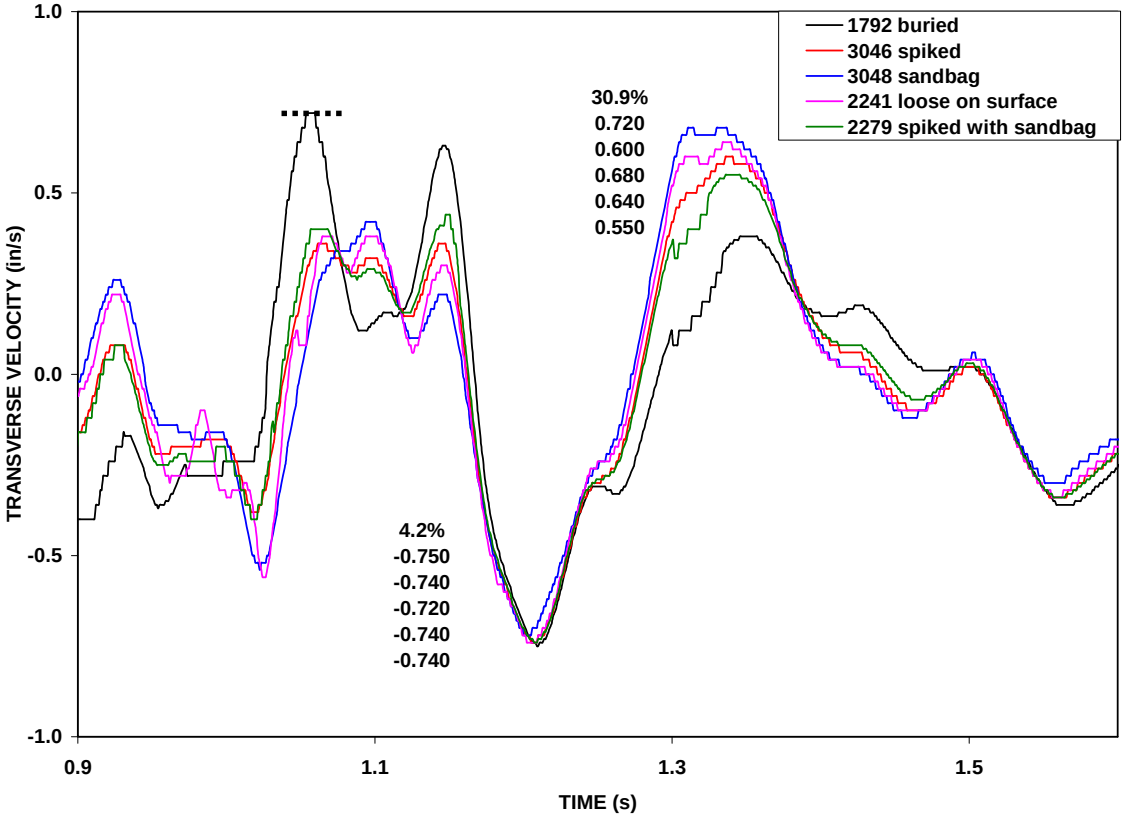

1792 buried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
RADIAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6
2.0

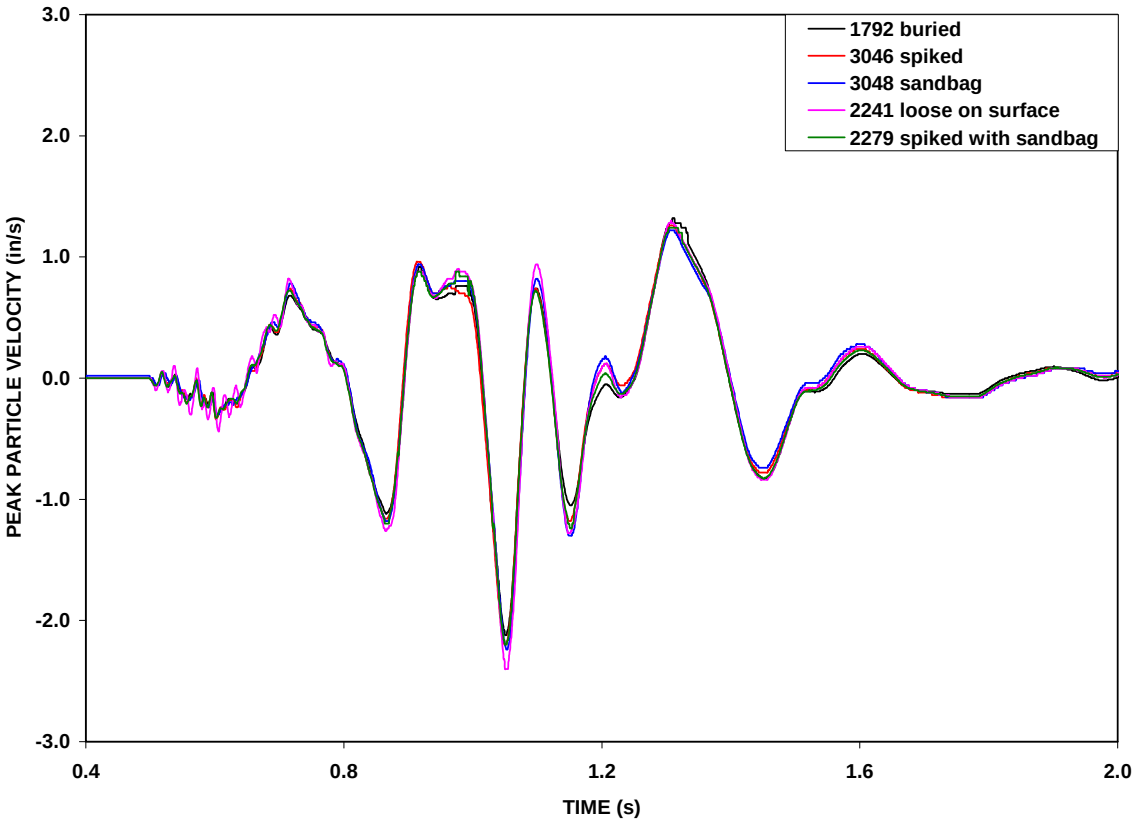

1792 buried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
8.2%
1.320
1.260
1.220
1.300
1.240
13.2%
-2.120
-2.200
-2.240
-2.400
-2.200
RADIAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.8
1.0
1.2
1.4
1.6

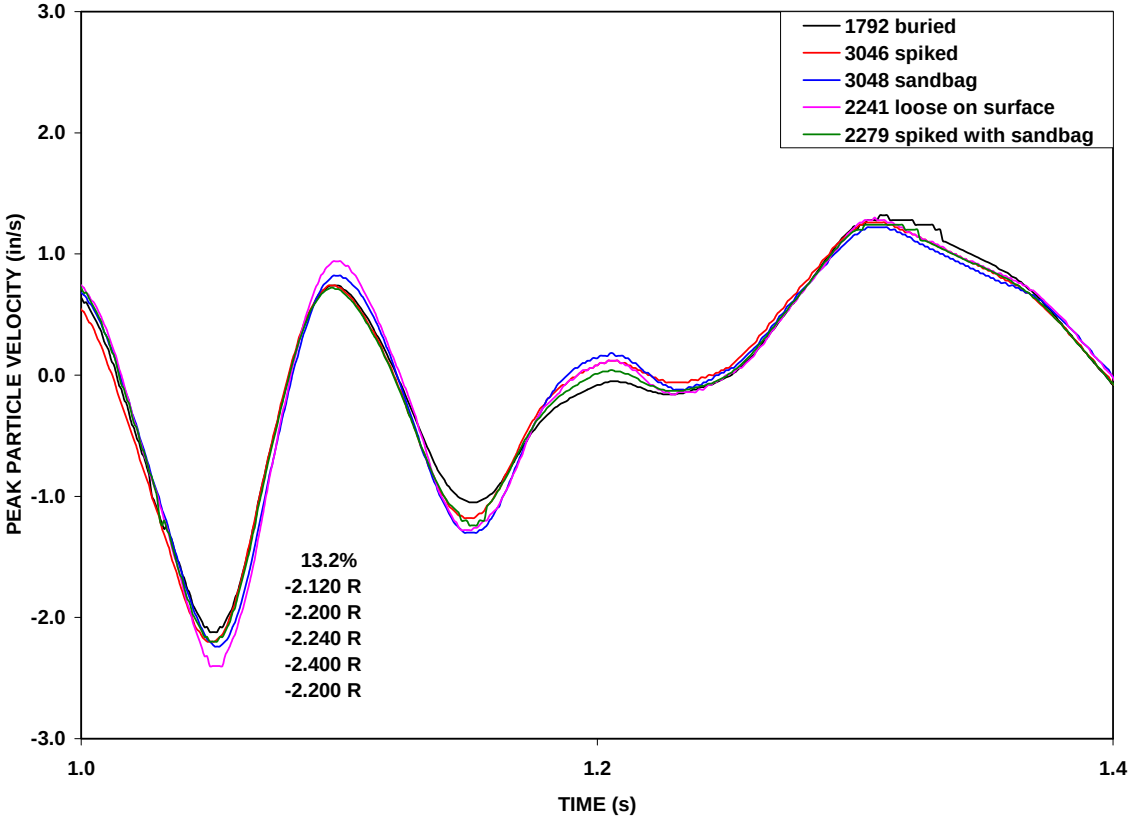

1792 buried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6
2.0


1792 buried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
2.4%
1.680
1.640
1.640
1.680
1.640
10.8%
-1.760
-1.660
-1.700
-1.760
-1.840
VERTICAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.6
0.8
1.0
1.2


1792 buried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
TRANSVERSE VELOCITY (in/s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6
2.0
TIME (s)

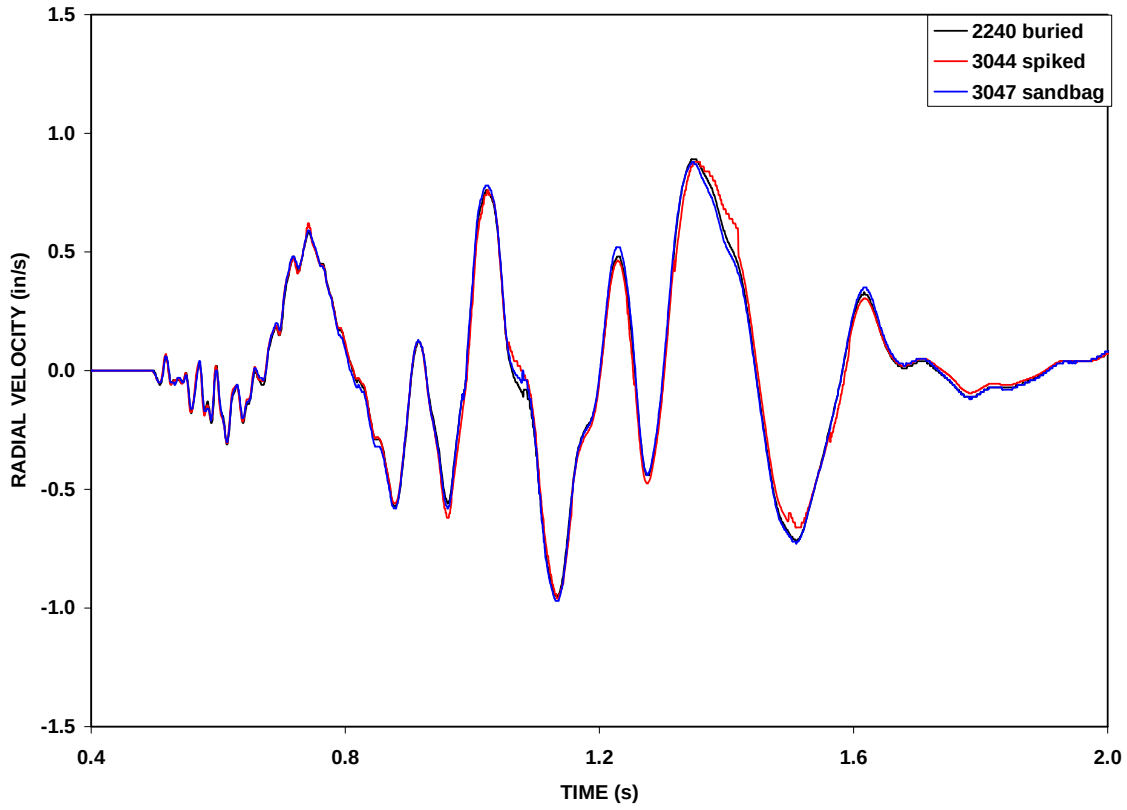

1792 buried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
30.9%
0.720
0.600
0.680
0.640
0.550
4.2%
-0.750
-0.740
-0.720
-0.740
-0.740
TRANSVERSE VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.9
1.1
1.3
1.5
TIME (s)

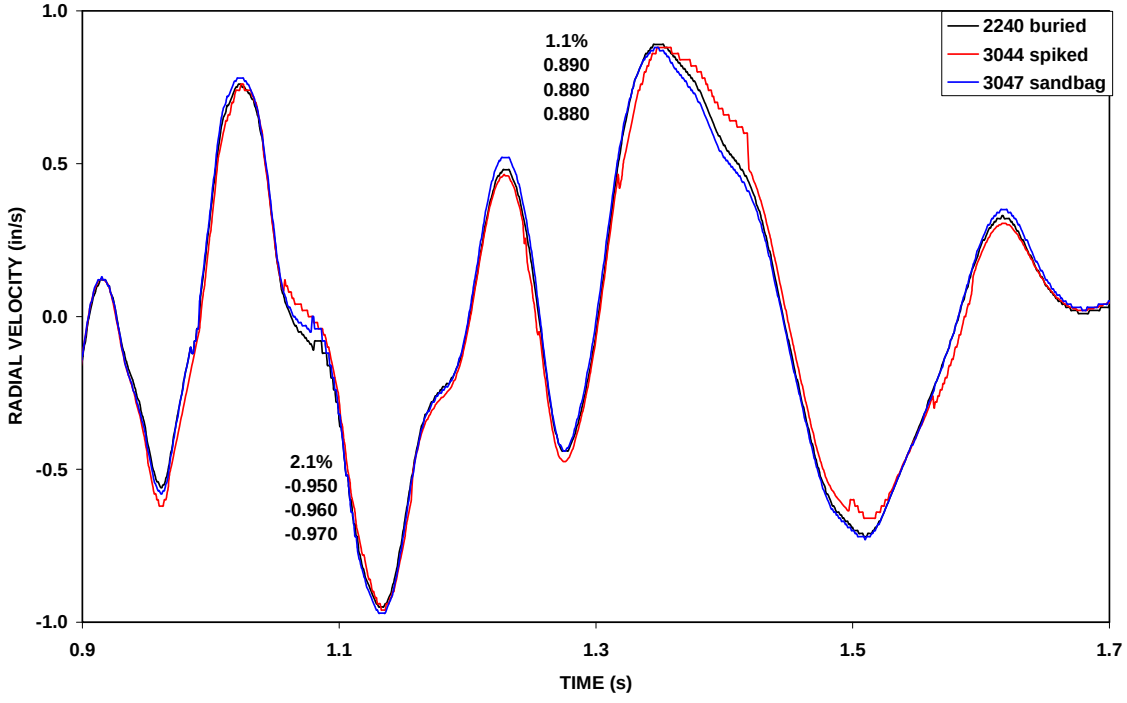

1792 buried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
PEAK PARTICLE VELOCITY (in/s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
0.8
1.2
1.6
2.0
TIME (s)

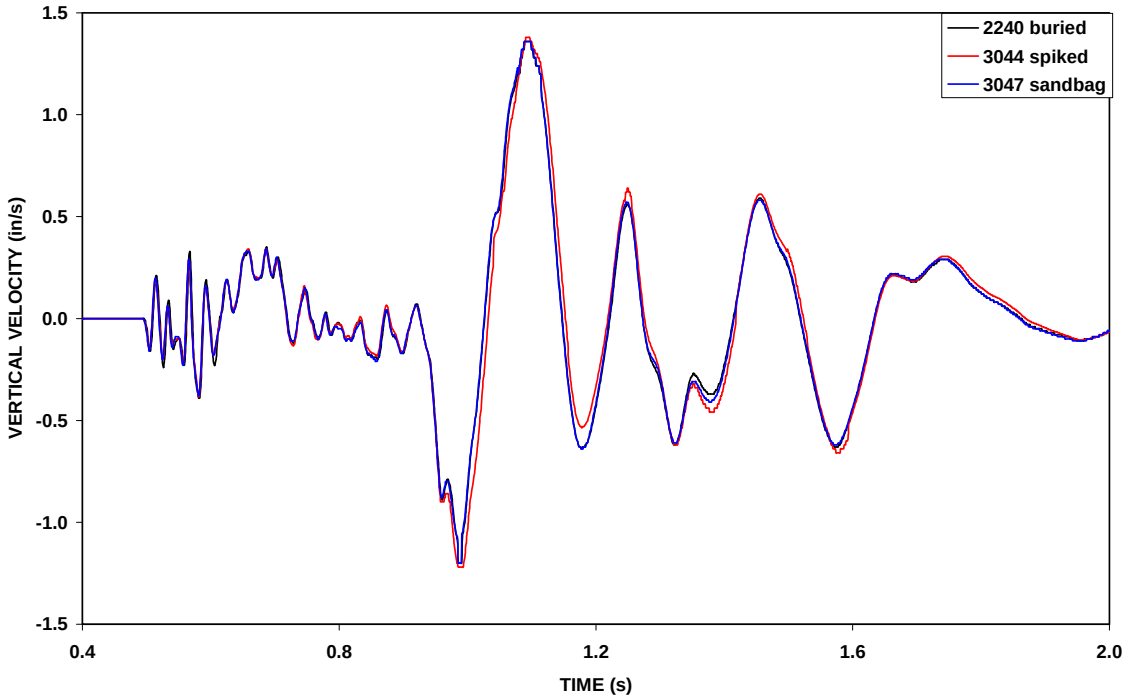

1792 buried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
PEAK PARTICLE VELOCITY (in/s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
13.2%
-2.120 R
-2.200 R
-2.240 R
-2.400 R
-2.200 R
1.0
1.2
1.4
TIME (s)

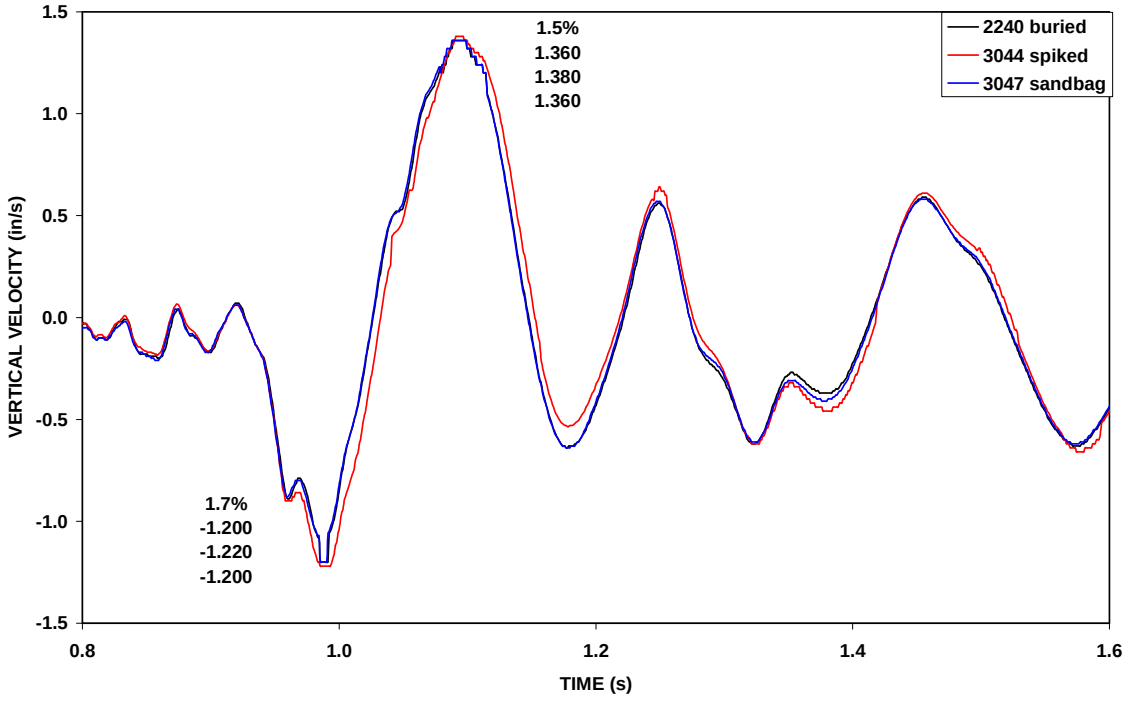
WY-1

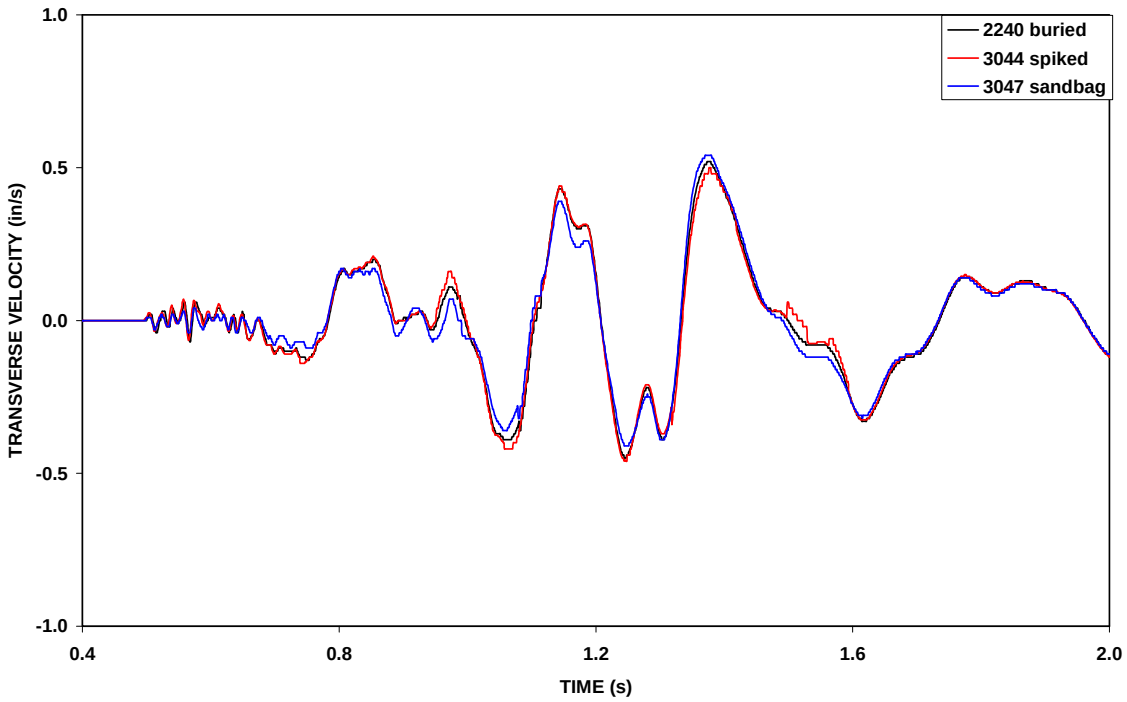
Cluster 2 SD 21.1 ft/lb$^{1/2}$

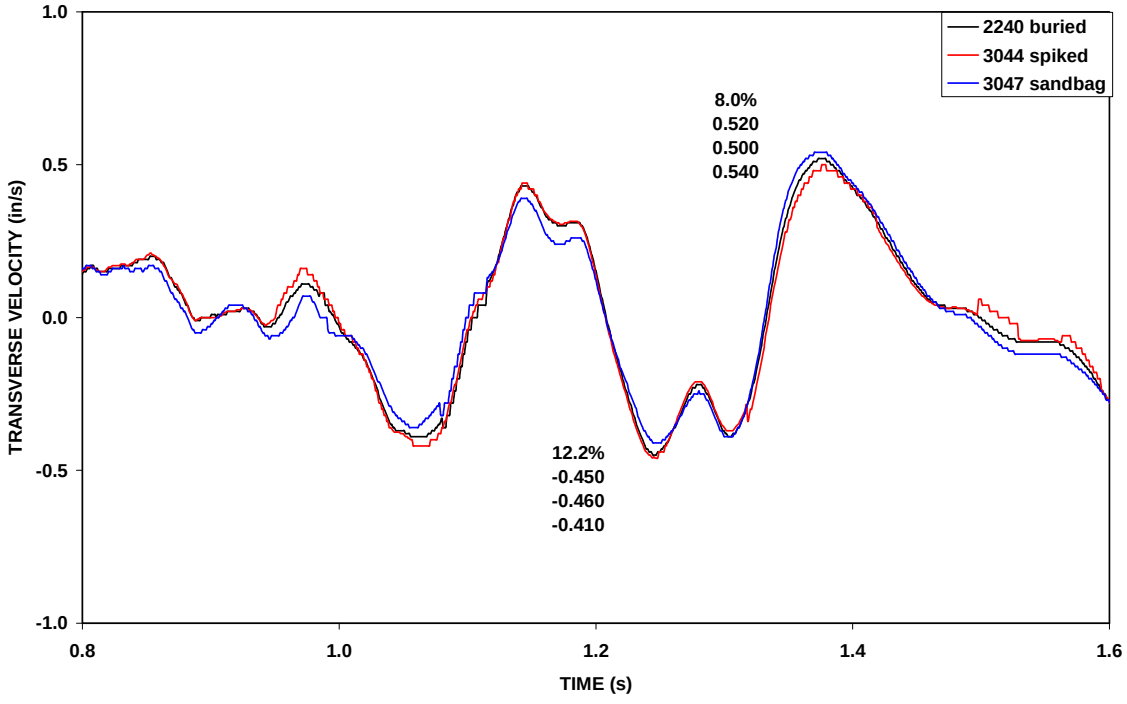

2240 buried
3044 spiked
3047 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.8
1.2
1.6
2.0


2240 buried
3044 spiked
3047 sandbag
1.1%
0.890
0.880
0.880
2.1%
-0.950
-0.960
-0.970
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.9
1.1
1.3
1.5
1.7


2240 buried
3044 spiked
3047 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
0.8
1.2
1.6
2.0

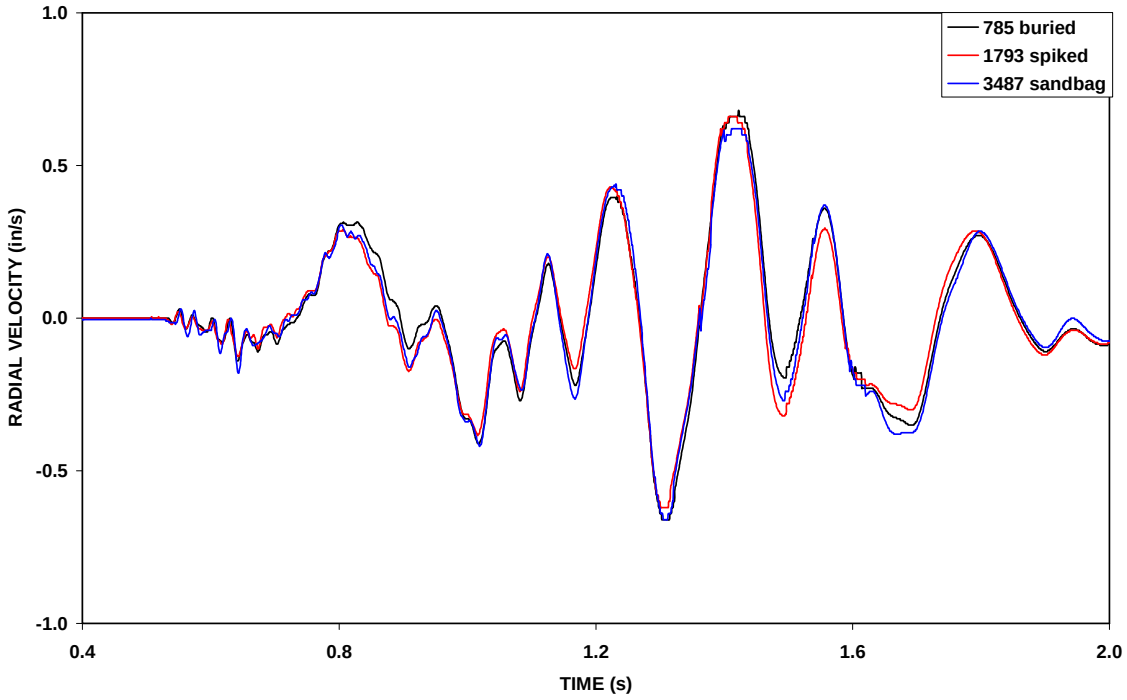

2240 buried
3044 spiked
3047 sandbag
1.5%
1.360
1.380
1.360
1.7%
-1.200
-1.220
-1.200
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.8
1.0
1.2
1.4
1.6

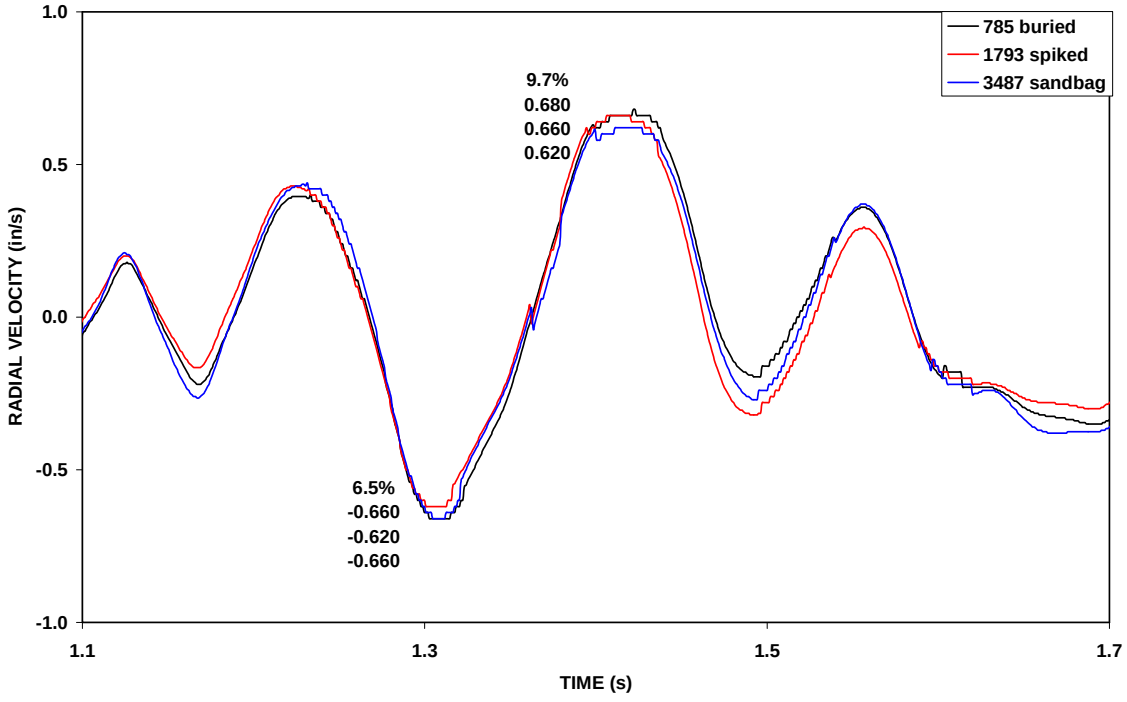

2240 buried
3044 spiked
3047 sandbag
TRANSVERSE VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.8
1.2
1.6
2.0
TIME (s)

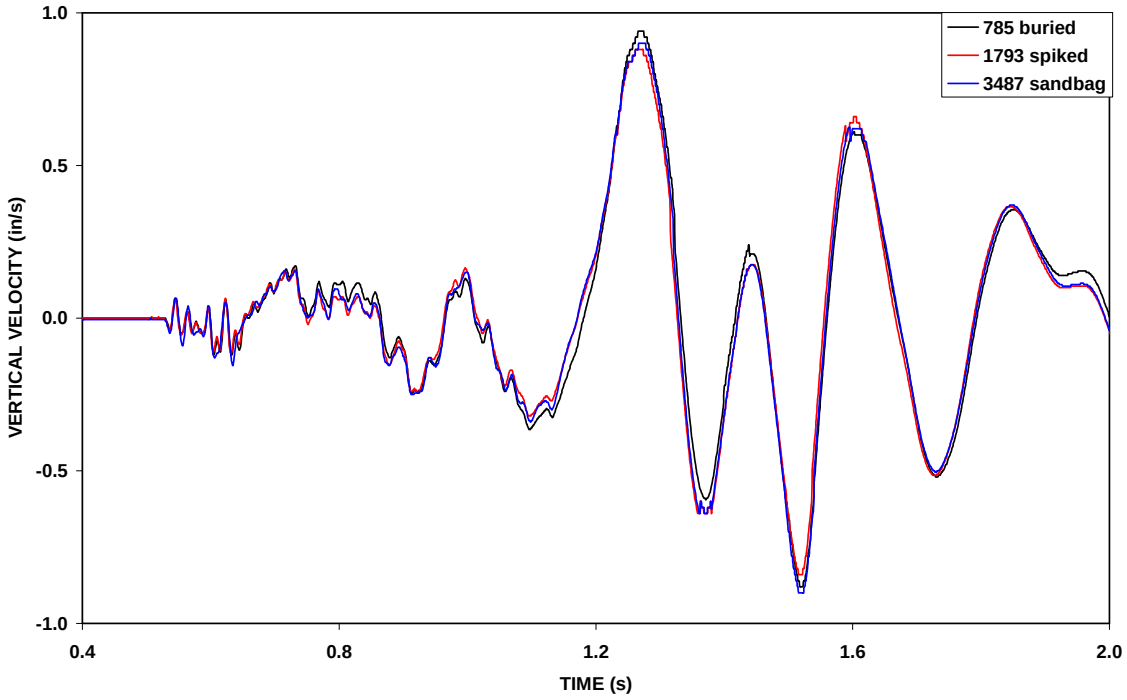

2240 buried
3044 spiked
3047 sandbag
8.0%
0.520
0.500
0.540
12.2%
-0.450
-0.460
-0.410
TRANSVERSE VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
0.8
1.0
1.2
1.4
1.6
TIME (s)

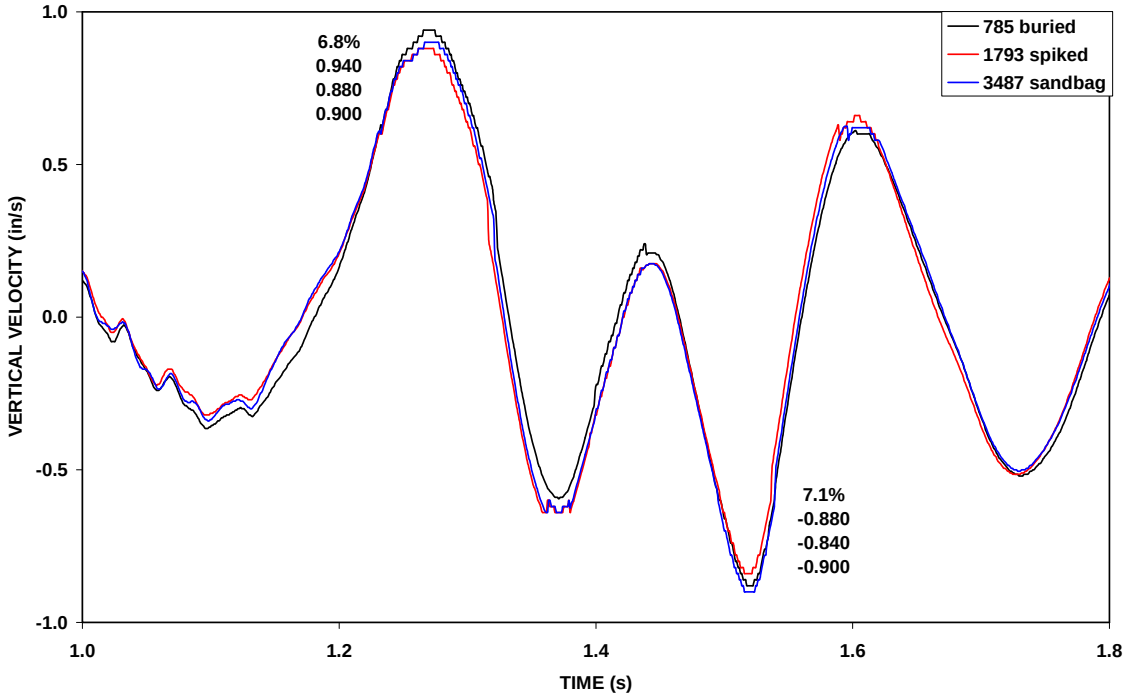
WY-1

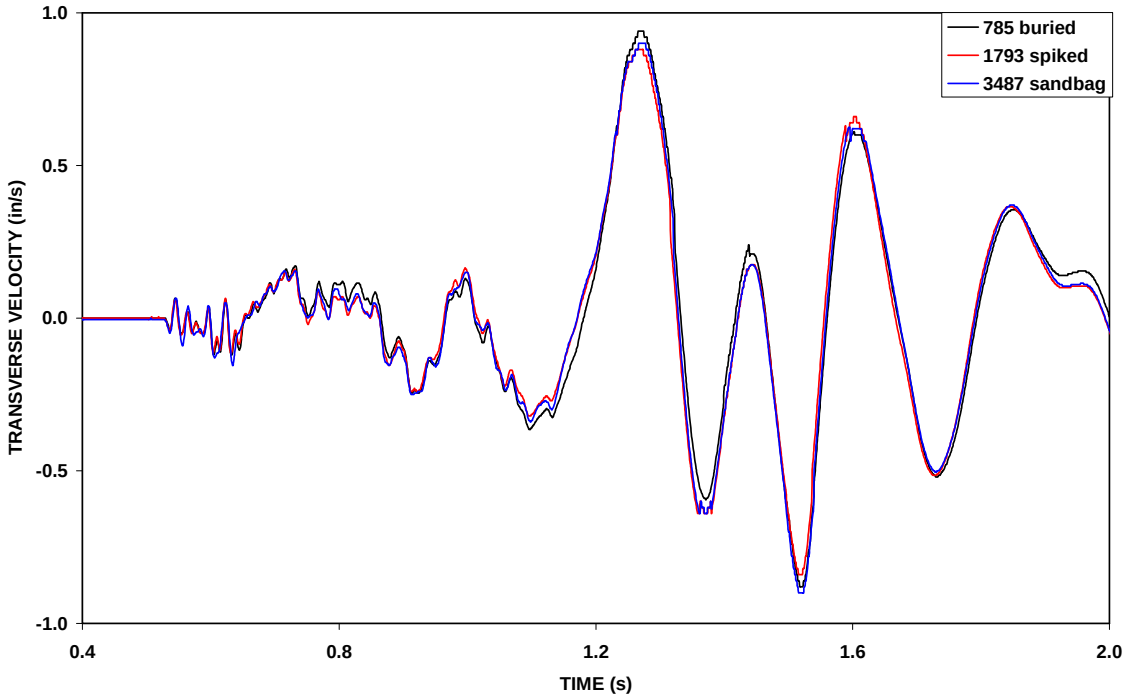
Cluster 3 SD 28.1 ft/lb$^{1/2}$

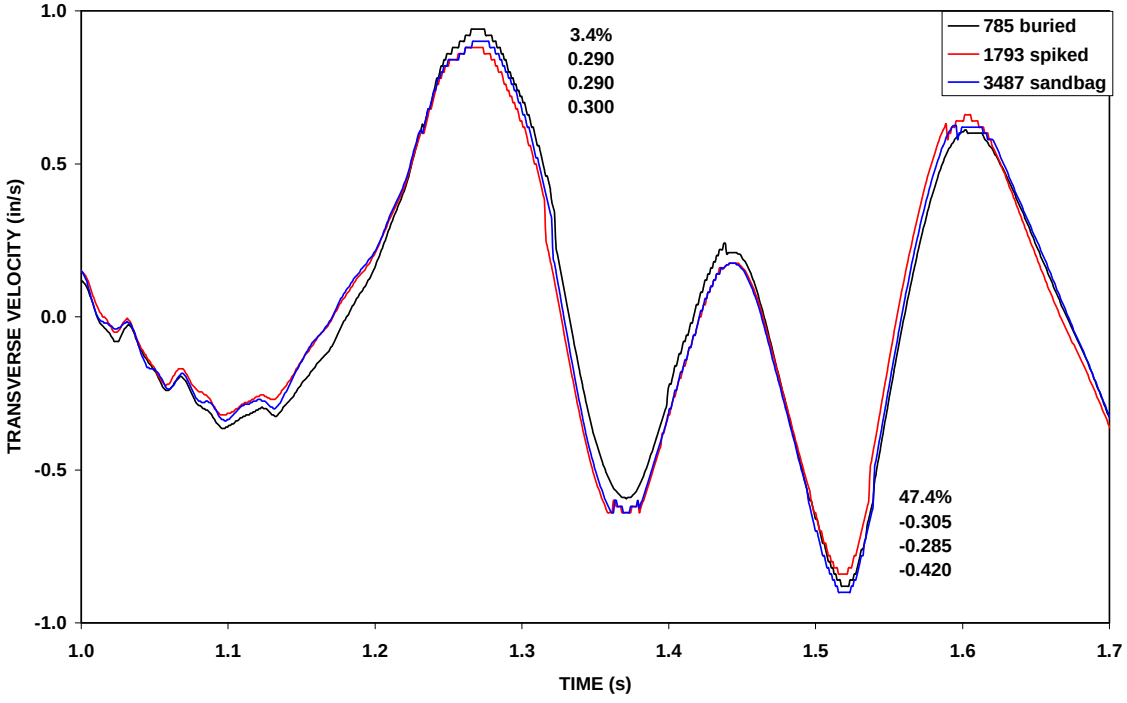

785 buried
1793 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.8
1.2
1.6
2.0


785 buried
1793 spiked
3487 sandbag
9.7%
0.680
0.660
0.620
6.5%
-0.660
-0.620
-0.660
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
1.1
1.3
1.5
1.7


785 buried
1793 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.8
1.2
1.6
2.0

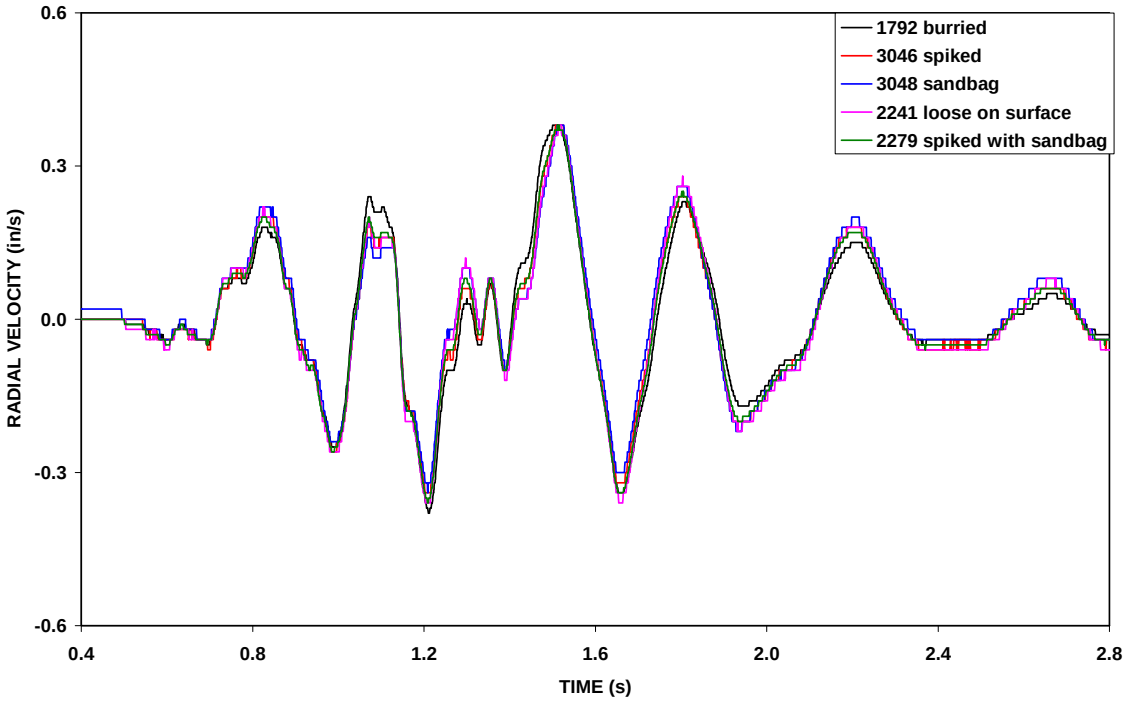

785 buried
1793 spiked
3487 sandbag
6.8%
0.940
0.880
0.900
7.1%
-0.880
-0.840
-0.900
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
1.0
1.2
1.4
1.6
1.8

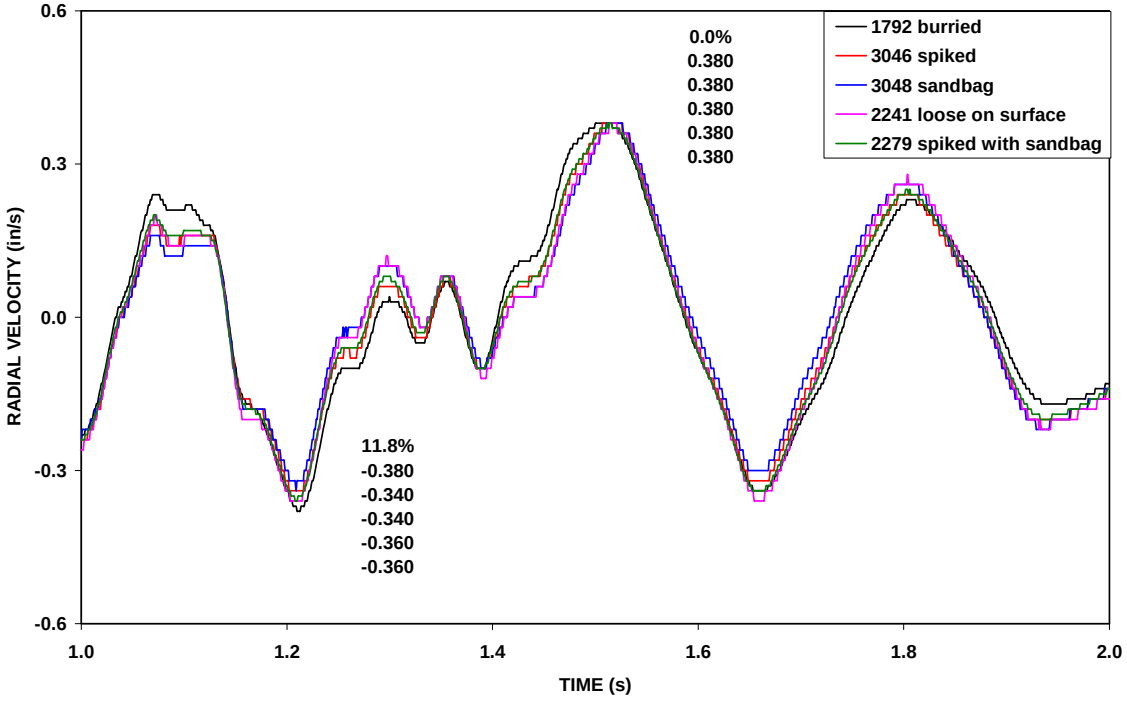

785 buried
1793 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
0.4
0.8
1.2
1.6
2.0

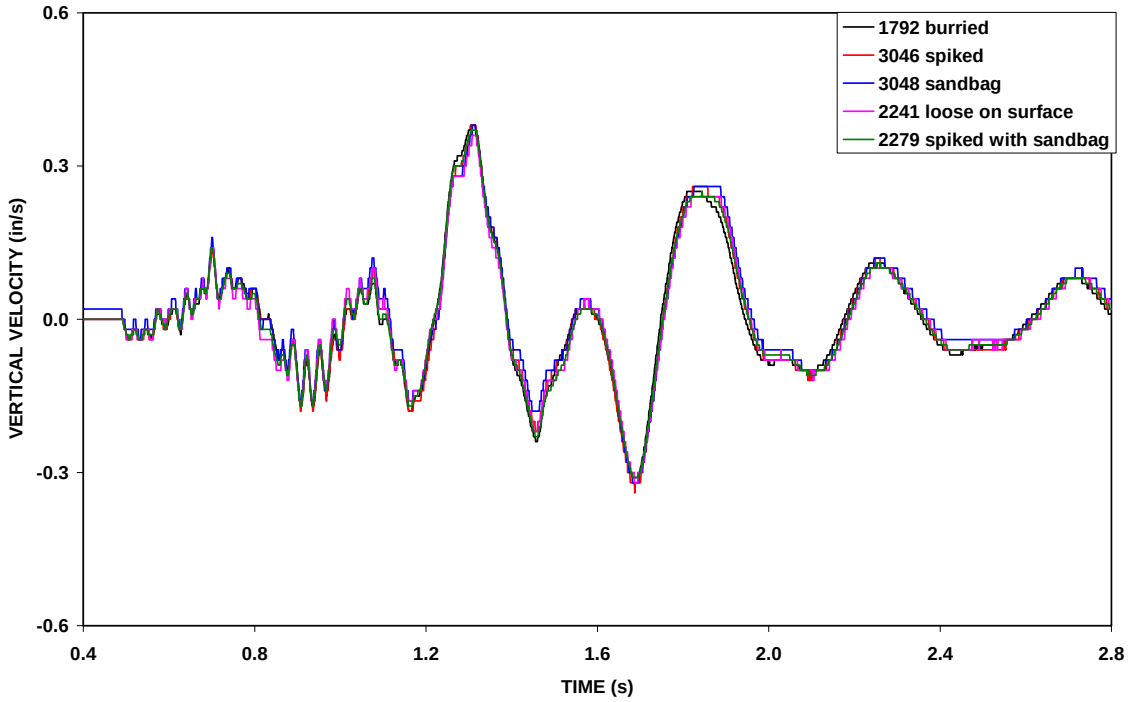

785 buried
1793 spiked
3487 sandbag
3.4%
0.290
0.290
0.300
47.4%
-0.305
-0.285
-0.420
TRANSVERSE VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7

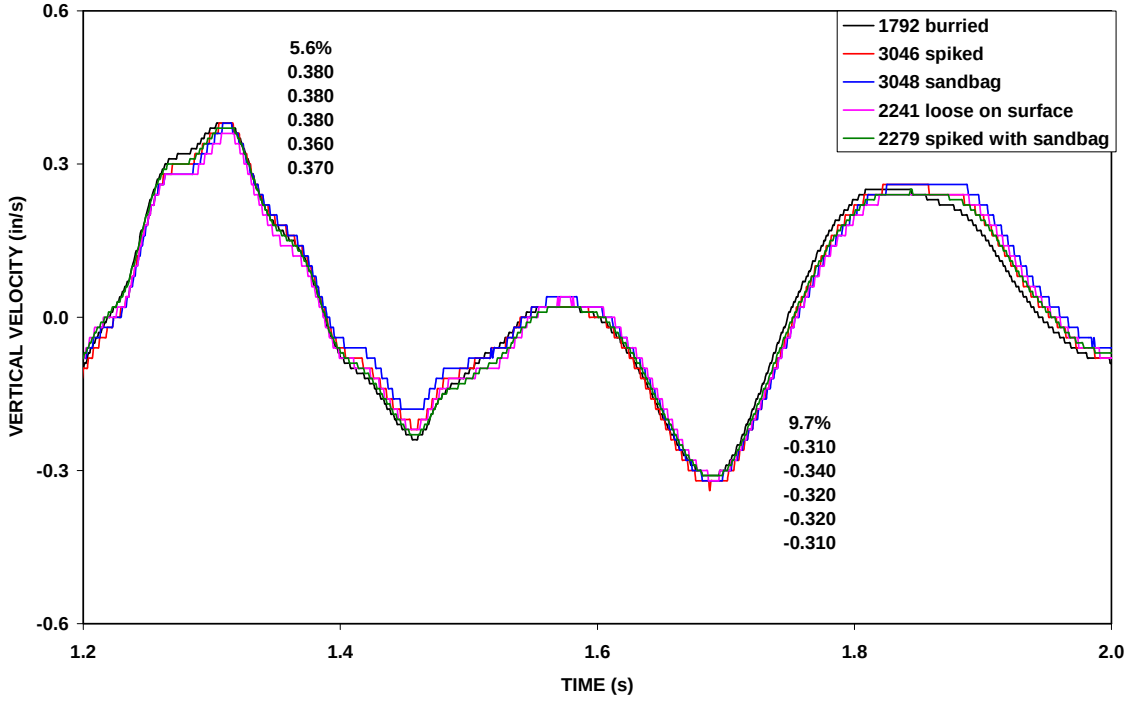
WY-2

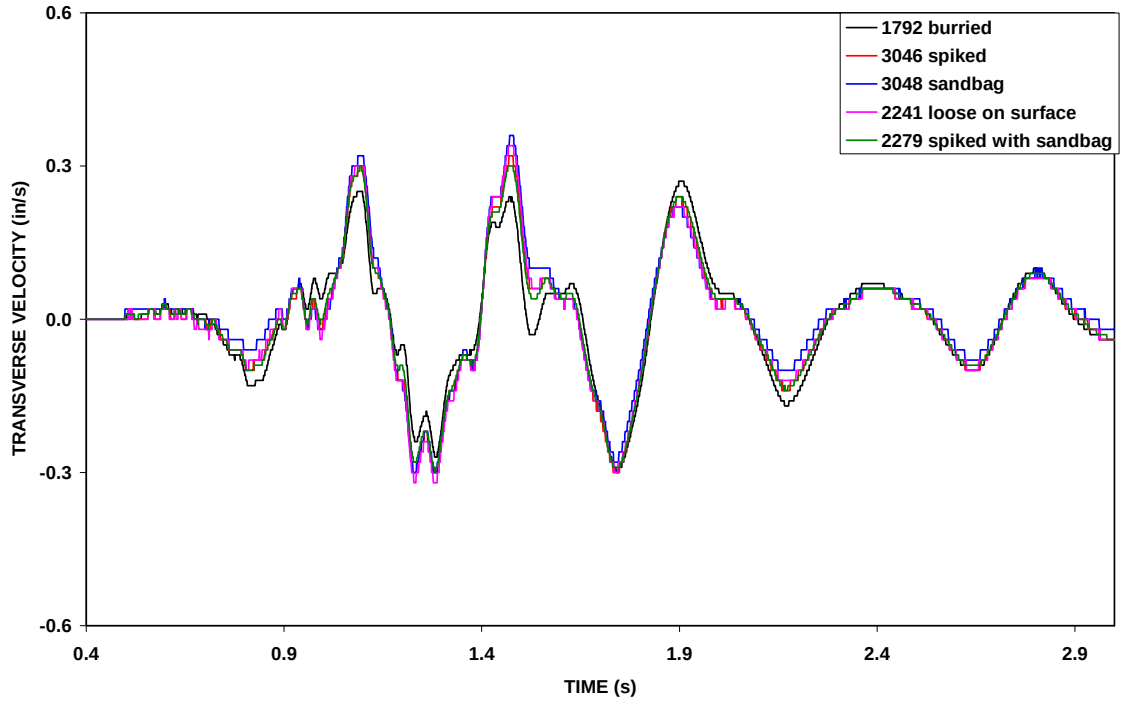
Cluster 1 SD 29.1 ft/lb$^{1/2}$

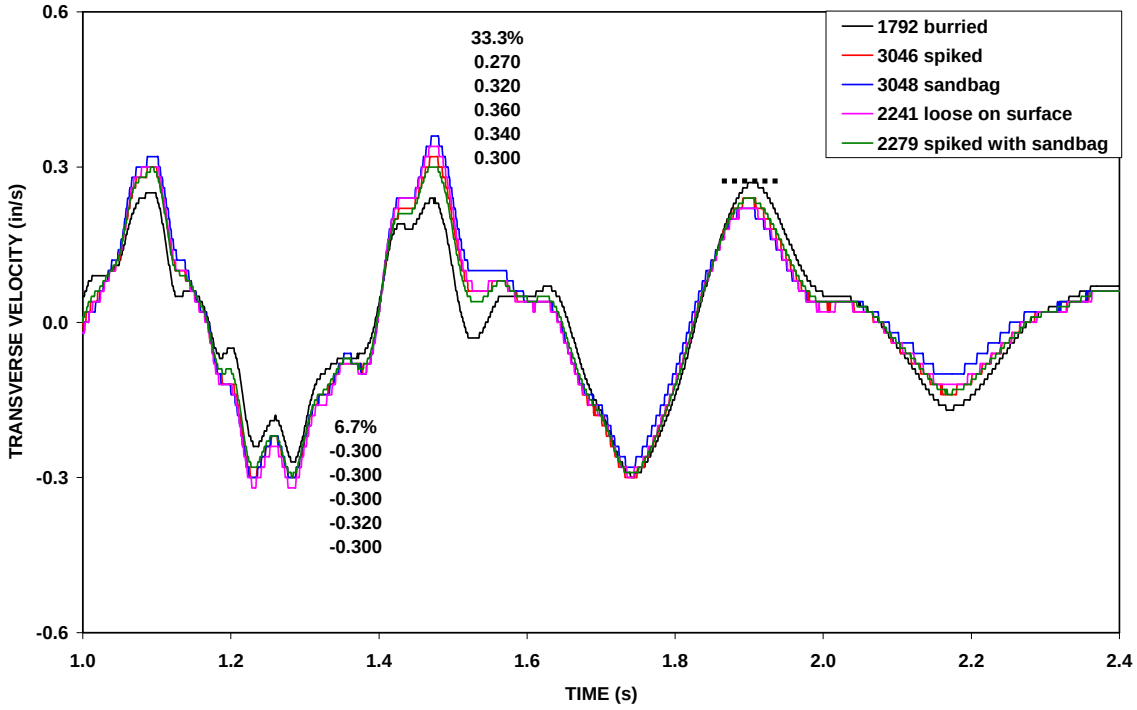

1792 burried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.3
0.0
-0.3
-0.6
0.4
0.8
1.2
1.6
2.0
2.4
2.8

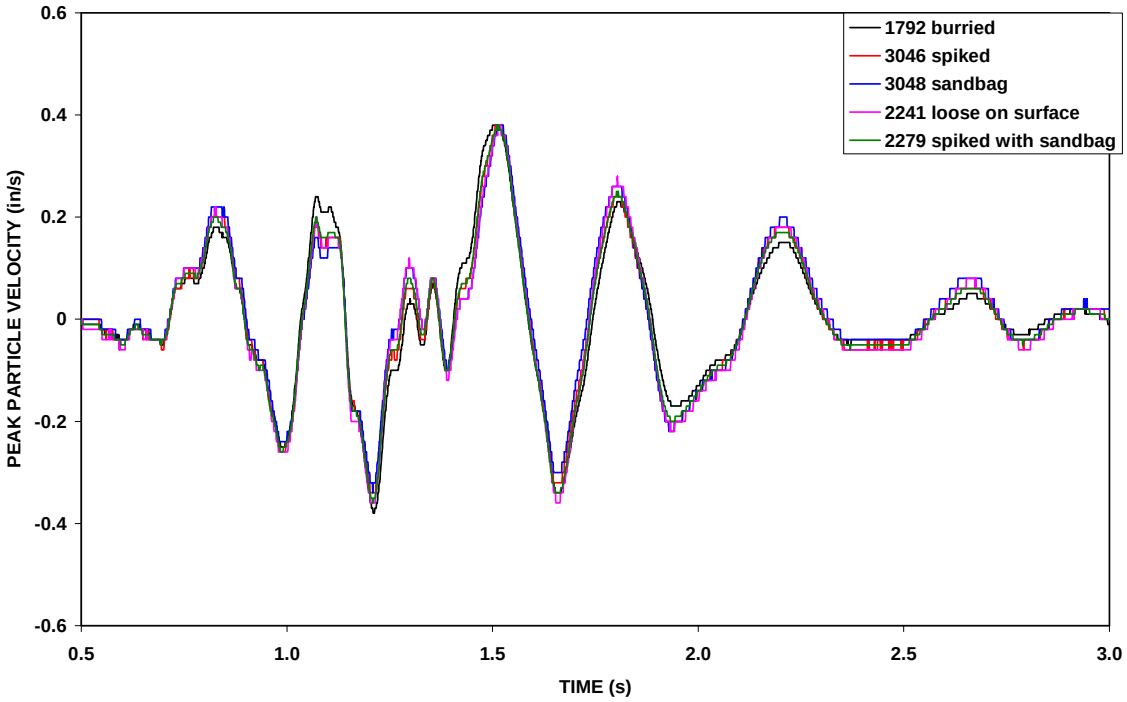

1792 burried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
0.0%
0.380
0.380
0.380
0.380
0.380
11.8%
-0.380
-0.340
-0.340
-0.360
-0.360
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.3
0.0
-0.3
-0.6
1.0
1.2
1.4
1.6
1.8
2.0

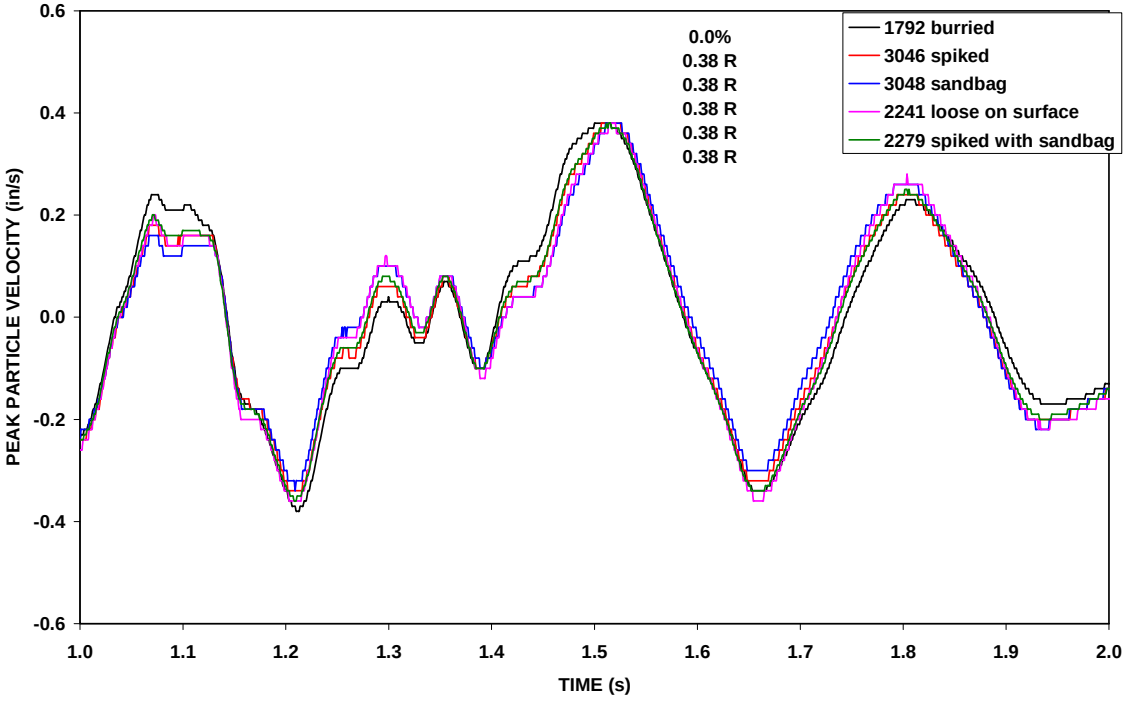

1792 burried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
VERTICAL VELOCITY (in/s)
0.6
0.3
0.0
-0.3
-0.6
0.4
0.8
1.2
1.6
2.0
2.4
2.8
TIME (s)


1792 burried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
5.6%
0.380
0.380
0.380
0.360
0.370
9.7%
-0.310
-0.340
-0.320
-0.320
-0.310
VERTICAL VELOCITY (in/s)
0.6
0.3
0.0
-0.3
-0.6
1.2
1.4
1.6
1.8
2.0
TIME (s)


1792 burried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
TRANSVERSE VELOCITY (in/s)
0.6
0.3
0.0
-0.3
-0.6
0.4
0.9
1.4
1.9
2.4
2.9
TIME (s)

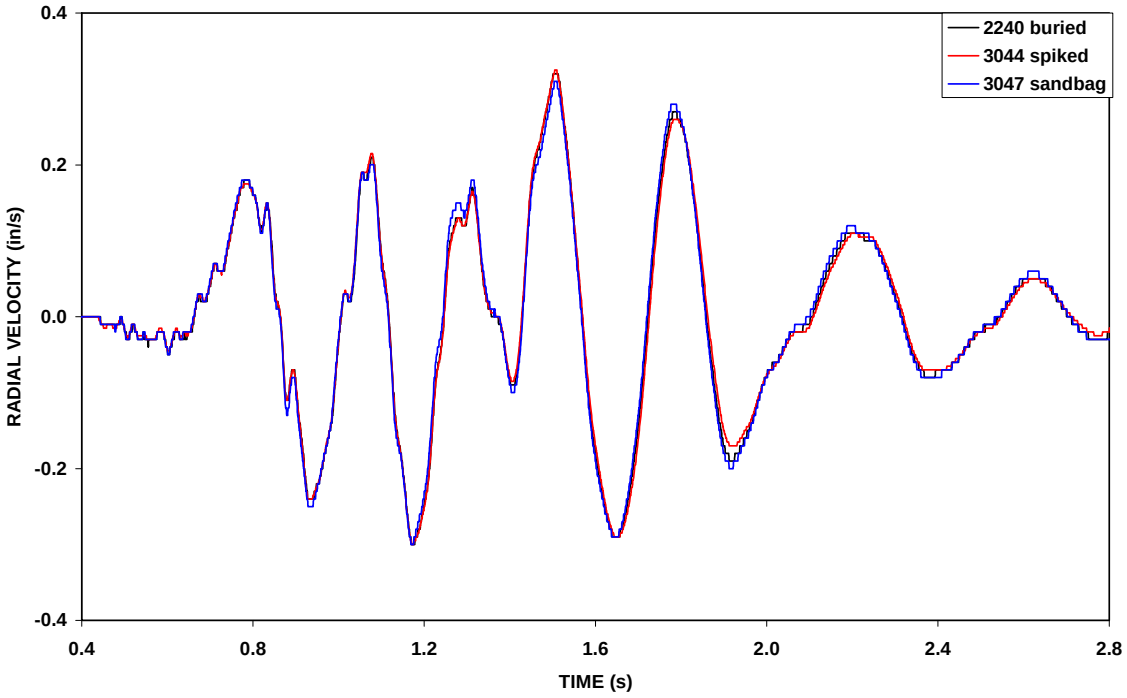

1792 burried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
33.3%
0.270
0.320
0.360
0.340
0.300
6.7%
-0.300
-0.300
-0.300
-0.320
-0.300
TRANSVERSE VELOCITY (in/s)
0.6
0.3
0.0
-0.3
-0.6
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
TIME (s)

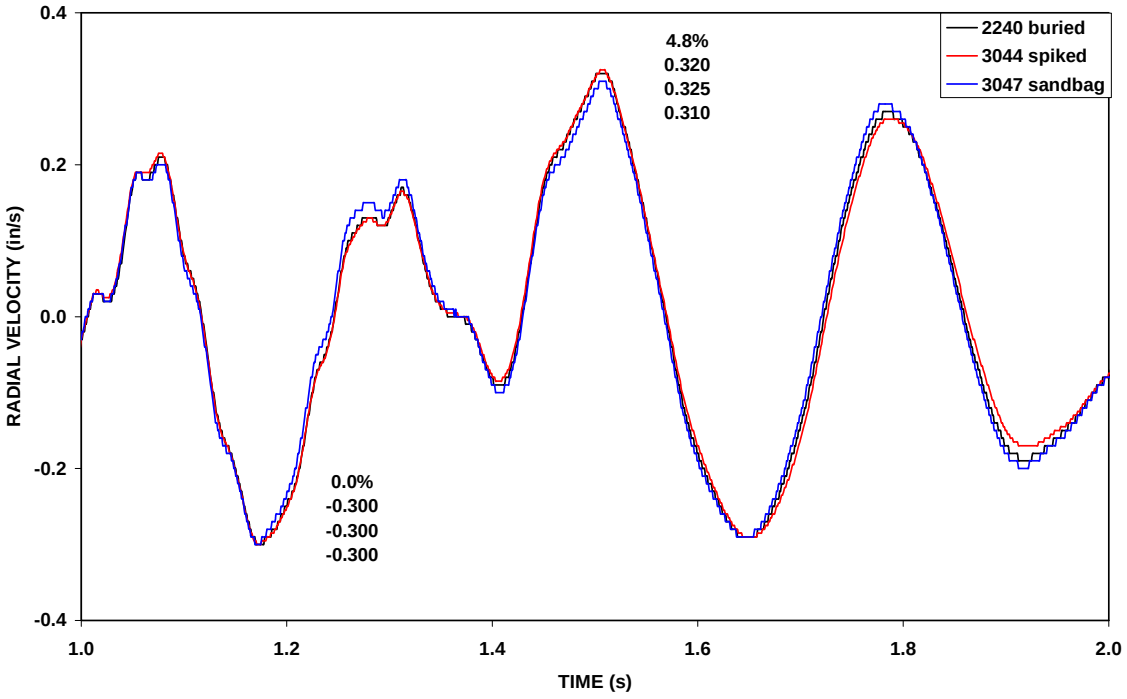

1792 burried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
0.5
1.0
1.5
2.0
2.5
3.0

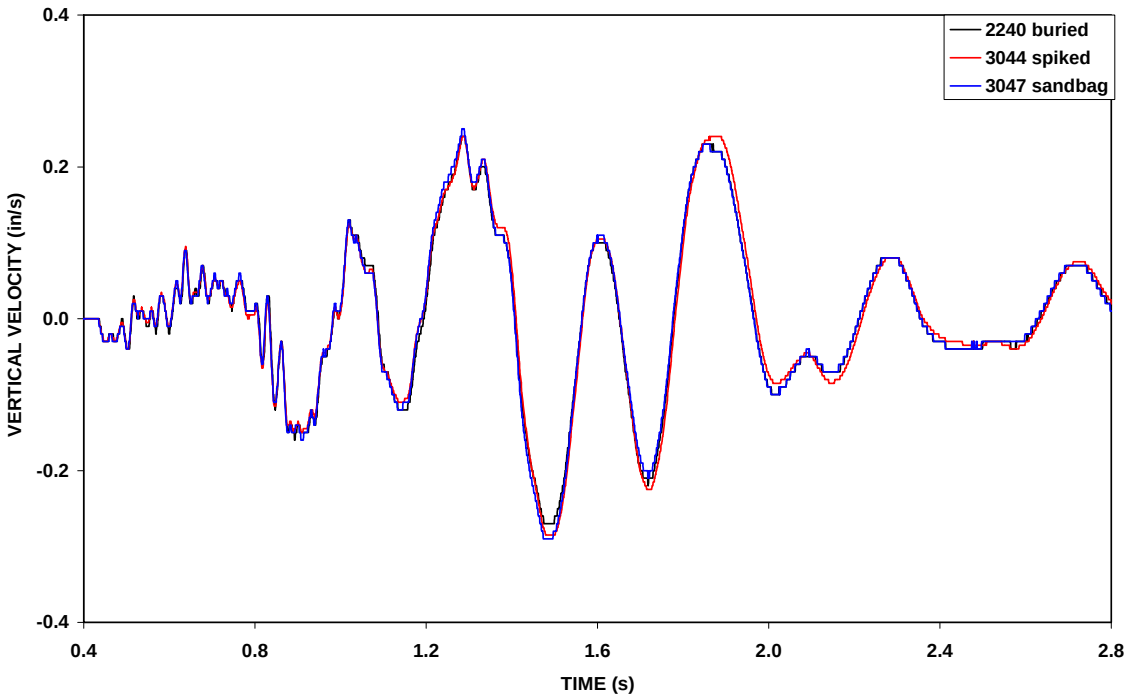

0.0%
0.38 R
0.38 R
0.38 R
0.38 R
0.38 R
1792 burried
3046 spiked
3048 sandbag
2241 loose on surface
2279 spiked with sandbag
PEAK PARTICLE VELOCITY (in/s)
TIME (s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0

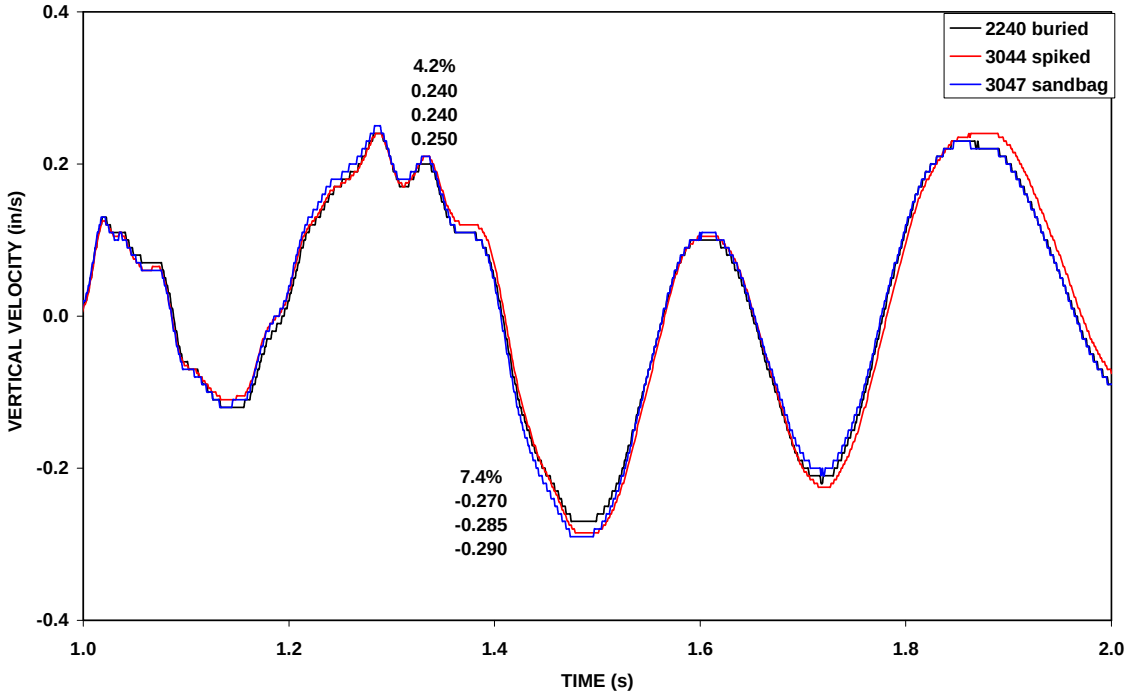
WY-2

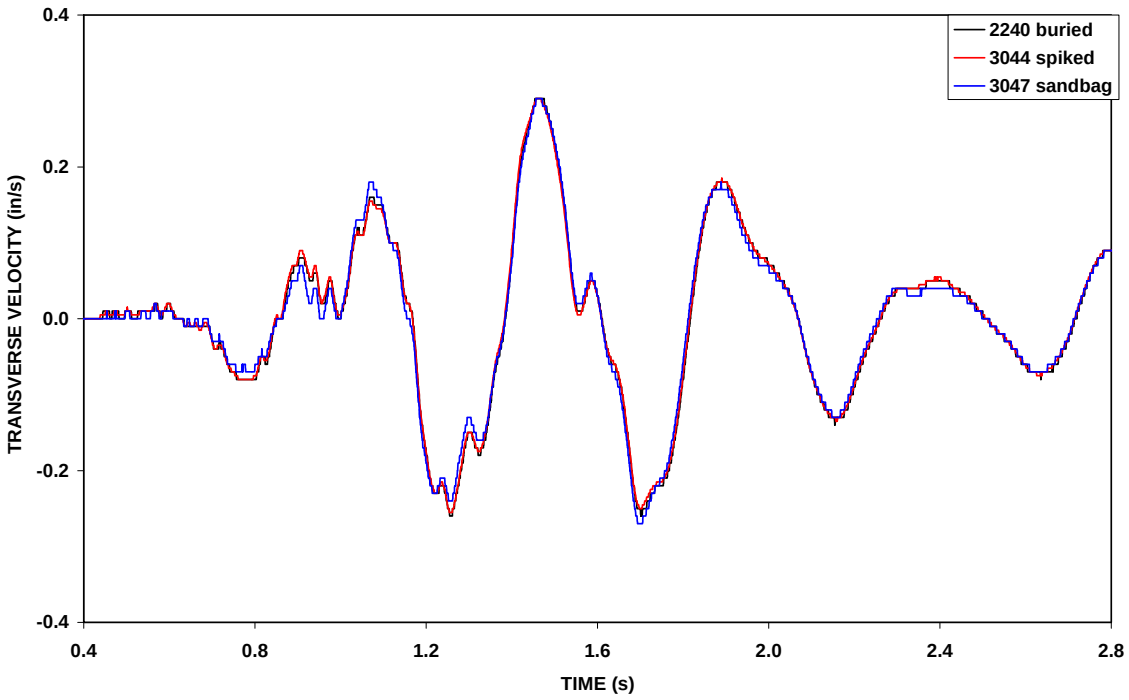
Cluster 2 SD 32.4 ft/lb$^{1/2}$

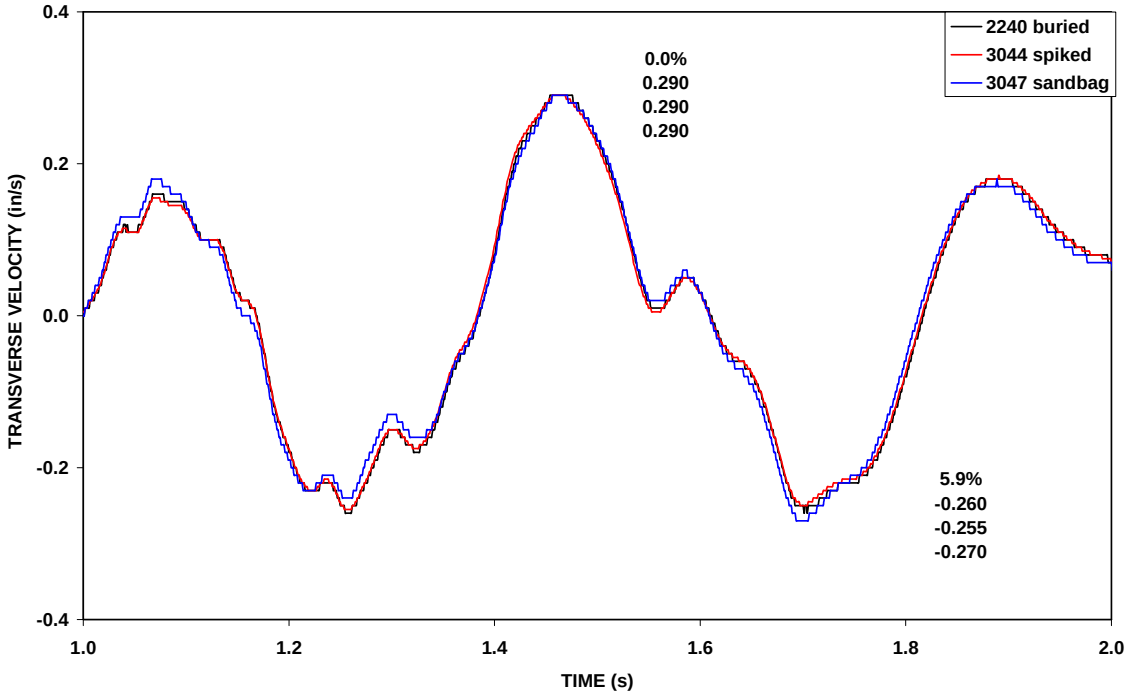

2240 buried
3044 spiked
3047 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6
2.0
2.4
2.8


2240 buried
3044 spiked
3047 sandbag
4.8%
0.320
0.325
0.310
0.0%
-0.300
-0.300
-0.300
RADIAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
1.0
1.2
1.4
1.6
1.8
2.0


2240 buried
3044 spiked
3047 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6
2.0
2.4
2.8

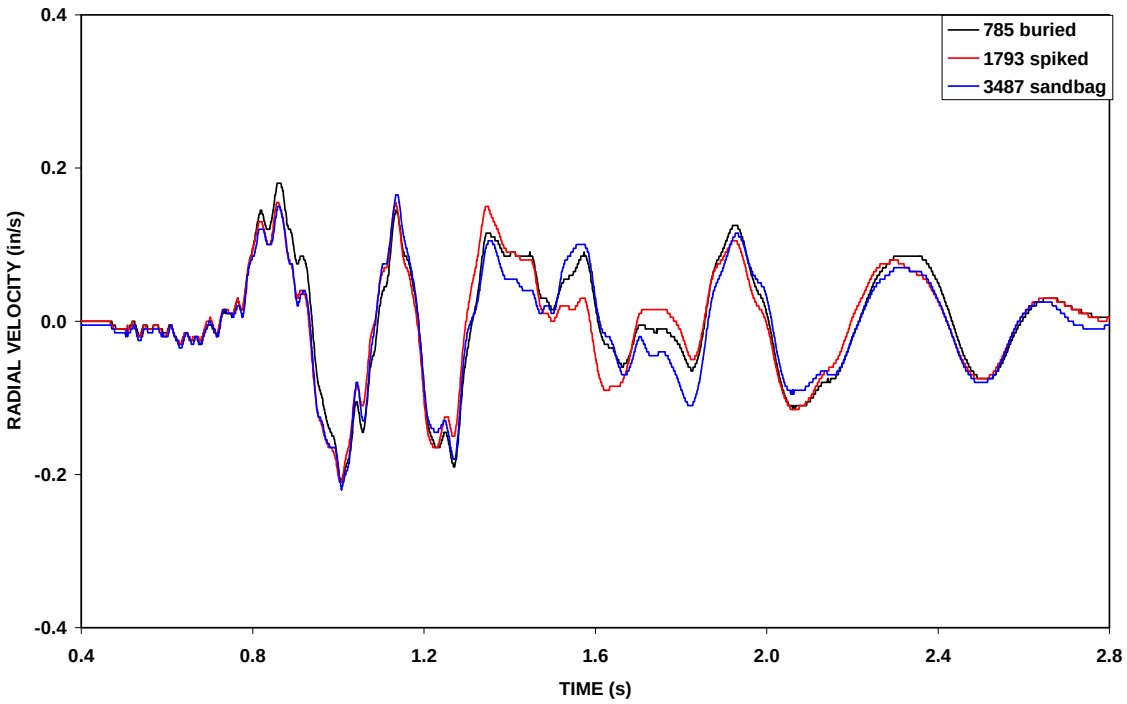

2240 buried
3044 spiked
3047 sandbag
4.2%
0.240
0.240
0.250
7.4%
-0.270
-0.285
-0.290
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
1.0
1.2
1.4
1.6
1.8
2.0

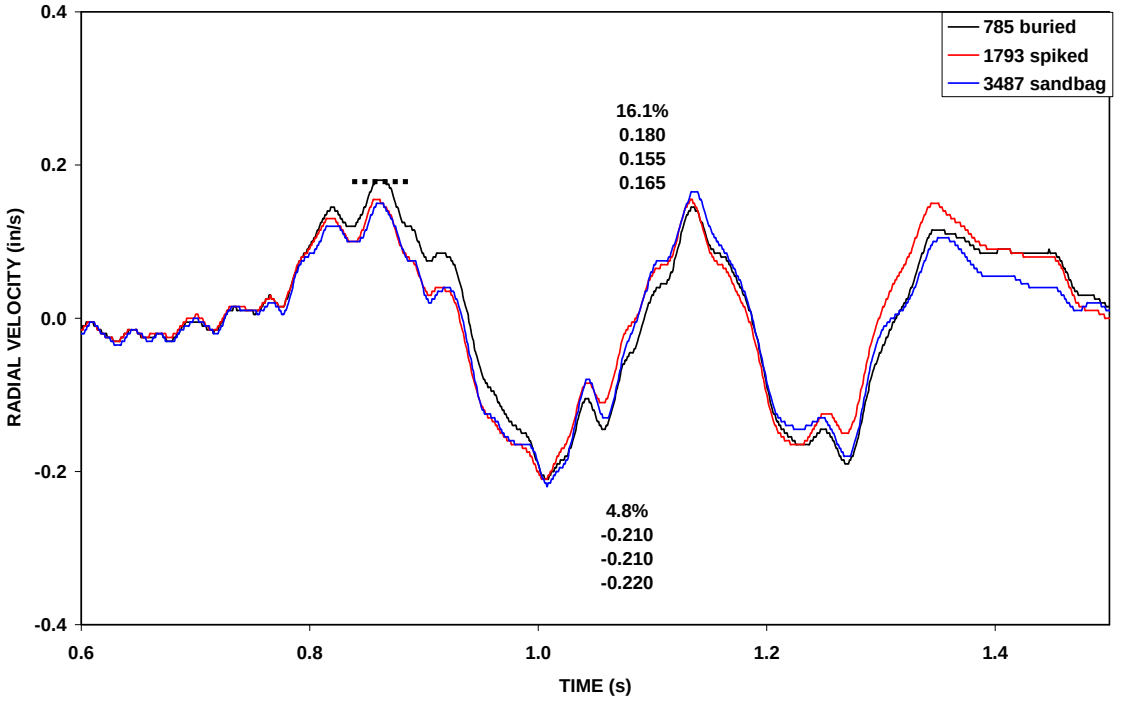

2240 buried
3044 spiked
3047 sandbag
TRANSVERSE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6
2.0
2.4
2.8
TIME (s)

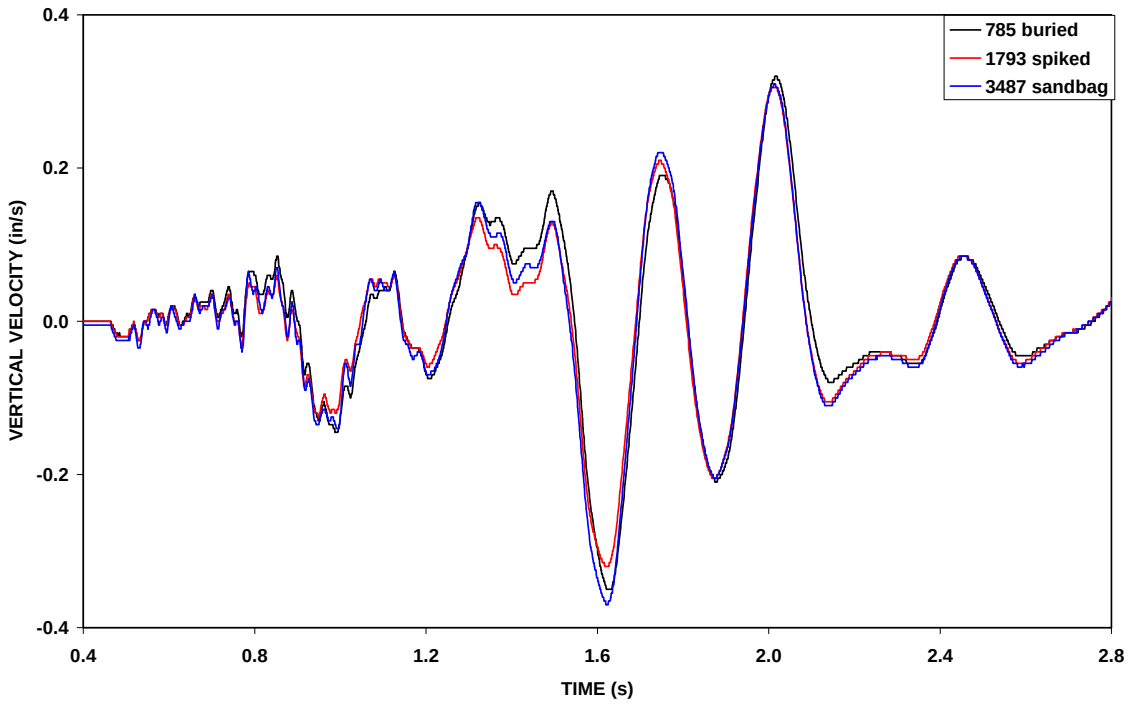

2240 buried
3044 spiked
3047 sandbag
0.0%
0.290
0.290
0.290
5.9%
-0.260
-0.255
-0.270
TRANSVERSE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
1.0
1.2
1.4
1.6
1.8
2.0
TIME (s)

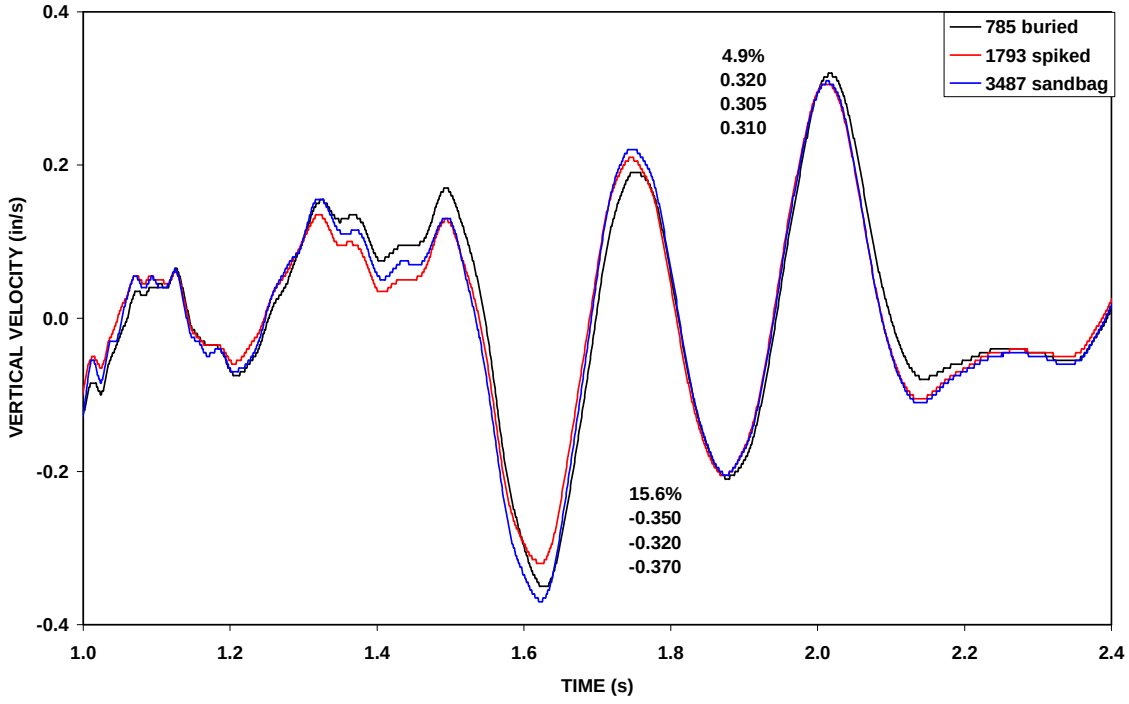
WY-2

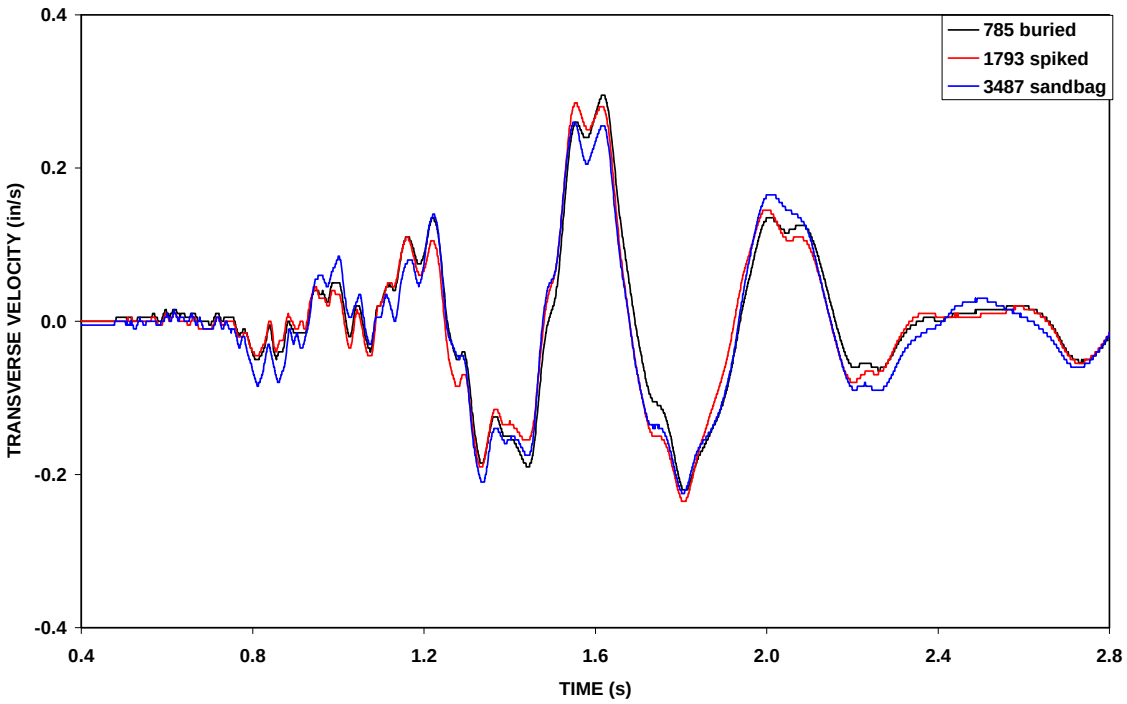
Cluster 3 SD 37.8 ft/lb$^{1/2}$

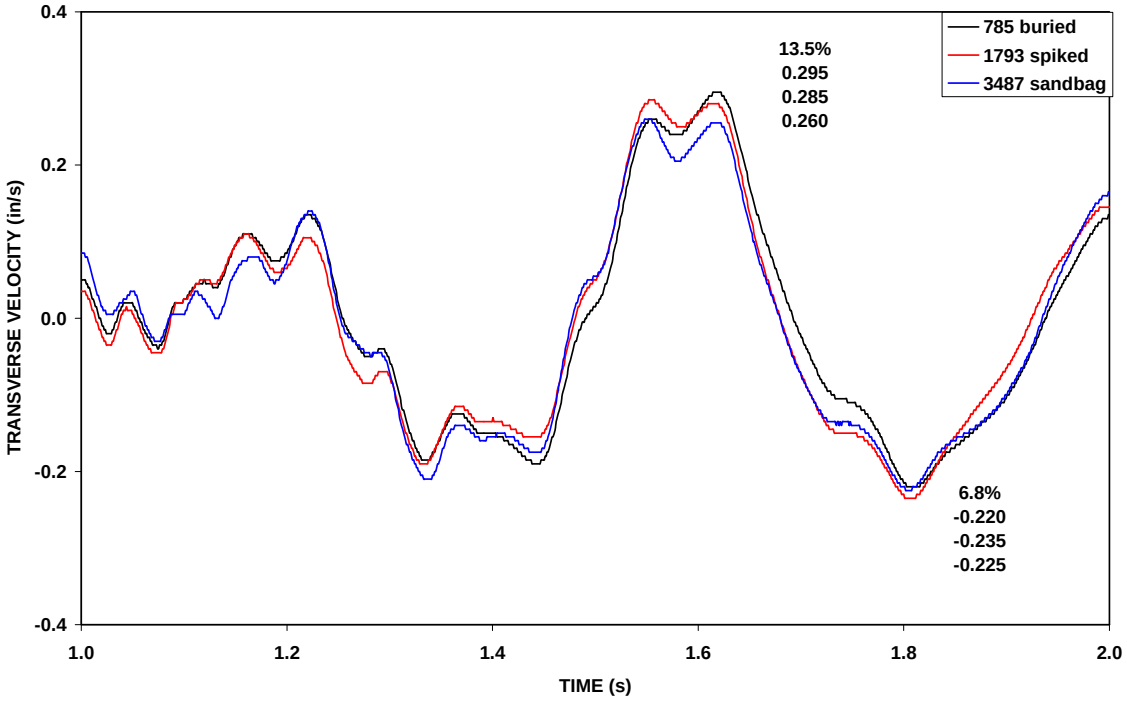

785 buried
1793 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6
2.0
2.4
2.8


785 buried
1793 spiked
3487 sandbag
16.1%
0.180
0.155
0.165
4.8%
-0.210
-0.210
-0.220
RADIAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.6
0.8
1.0
1.2
1.4


785 buried
1793 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6
2.0
2.4
2.8

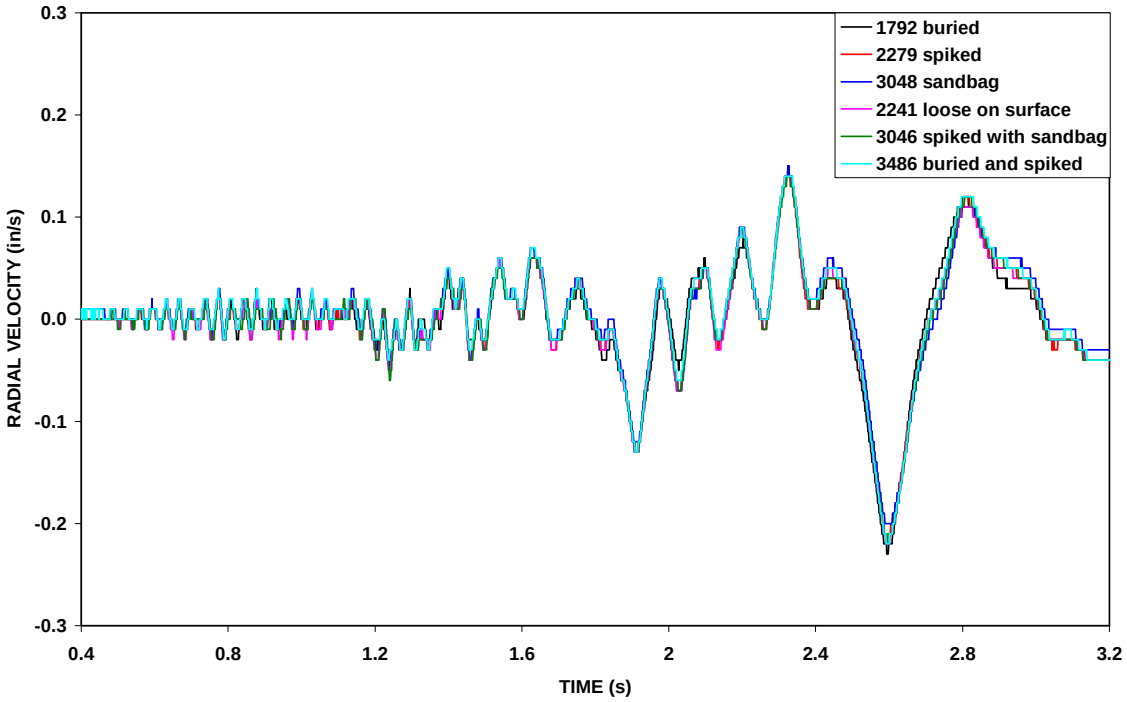

785 buried
1793 spiked
3487 sandbag
4.9%
0.320
0.305
0.310
15.6%
-0.350
-0.320
-0.370
VERTICAL VELOCITY (in/s)
TIME (s)
0.4
0.2
0.0
-0.2
-0.4
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4

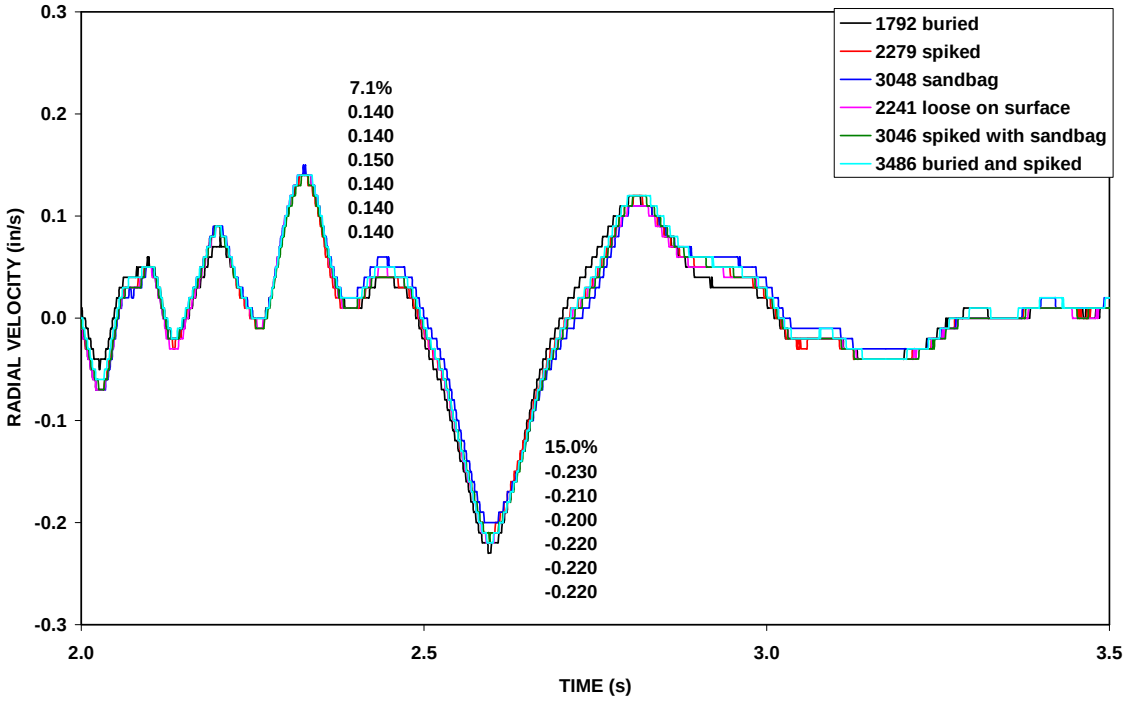

785 buried
1793 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.4
0.8
1.2
1.6
2.0
2.4
2.8
TIME (s)

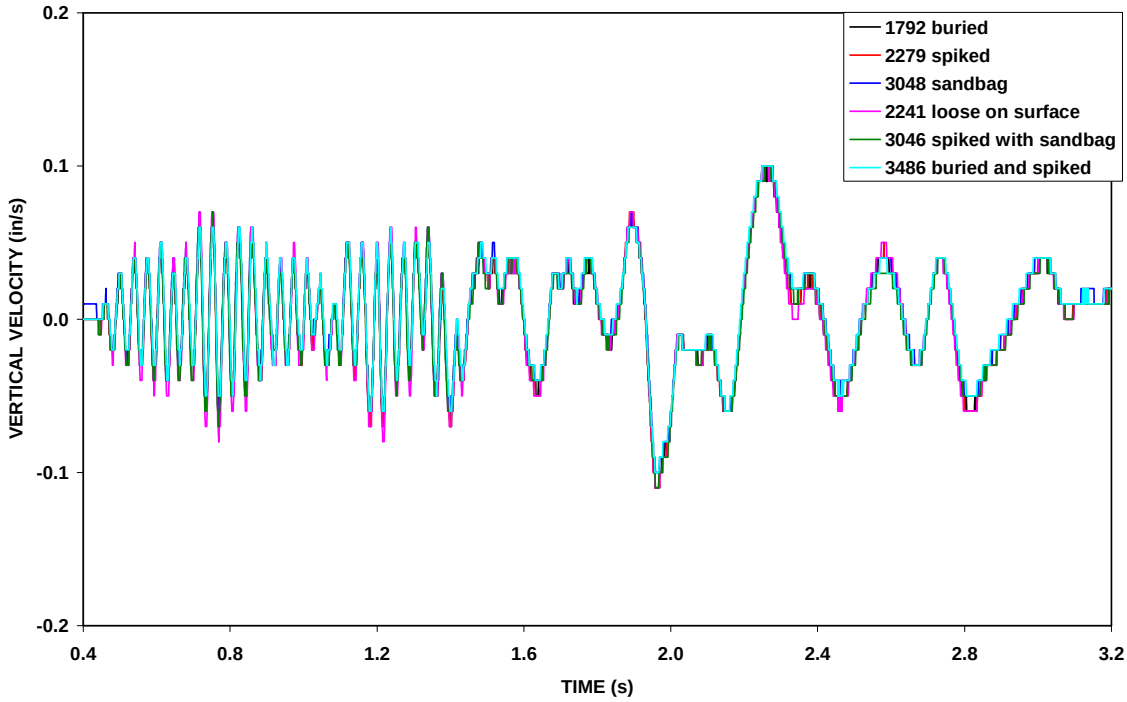

785 buried
1793 spiked
3487 sandbag
13.5%
0.295
0.285
0.260
6.8%
-0.220
-0.235
-0.225
TRANSVERSE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
1.0
1.2
1.4
1.6
1.8
2.0
TIME (s)

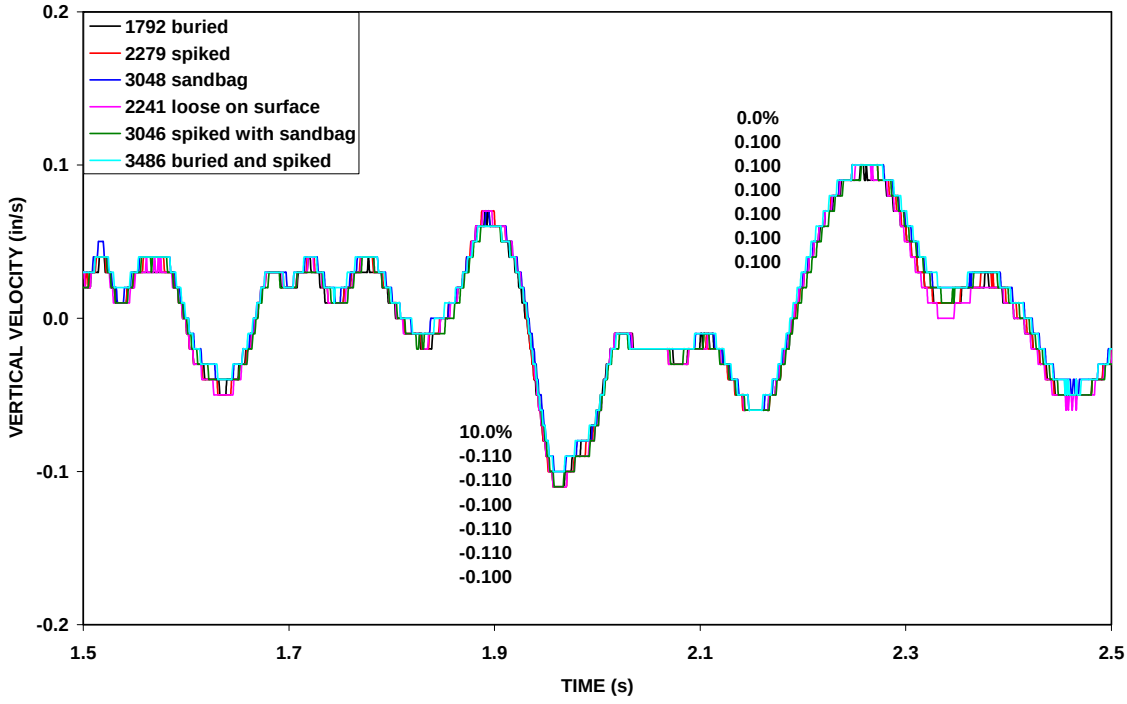
WY-3

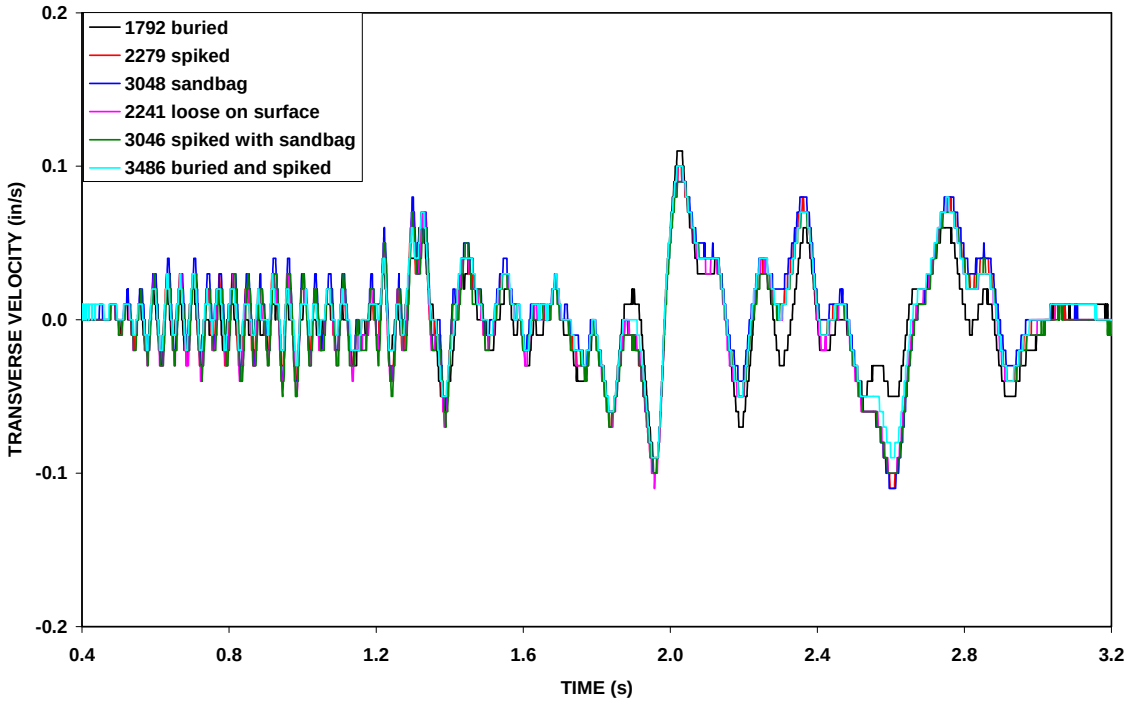
Cluster 1 SD 51.3 ft/lb$^{1/2}$

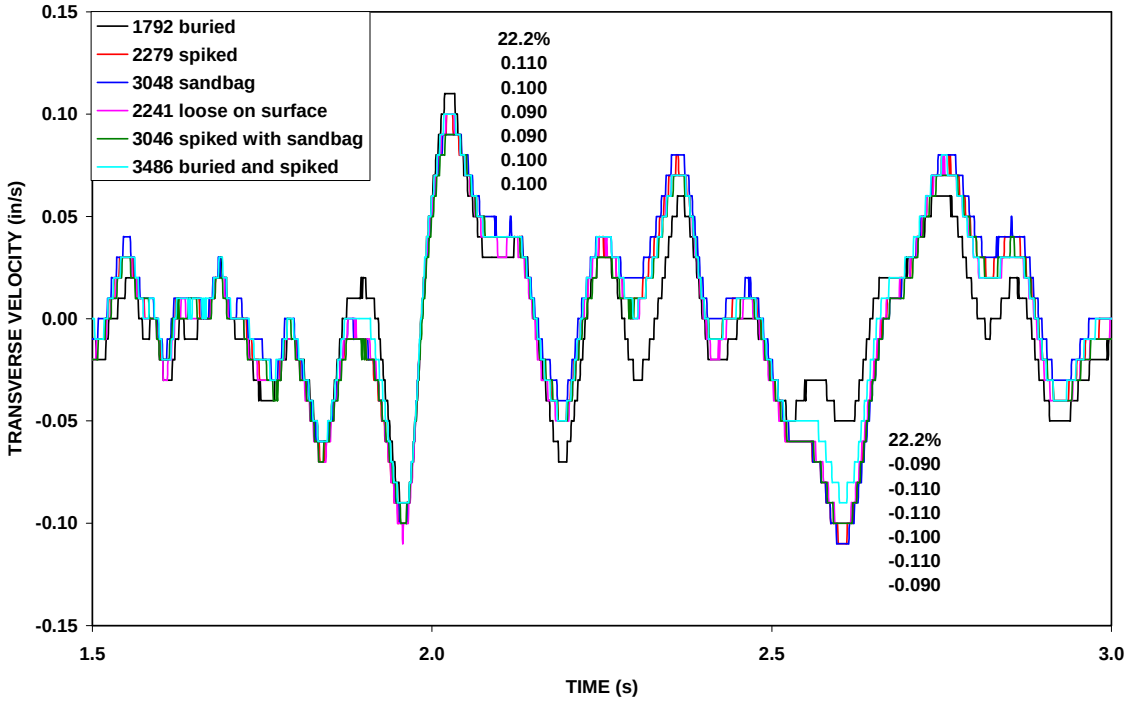

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
0.8
1.2
1.6
2
2.4
2.8
3.2

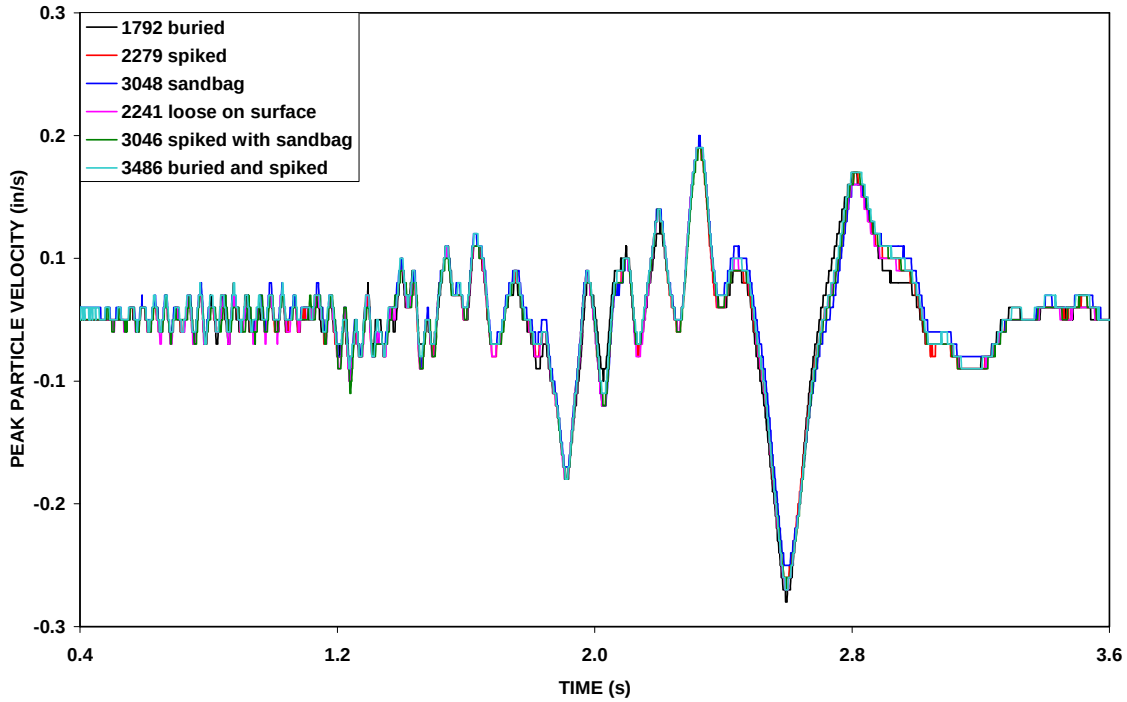

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
7.1%
0.140
0.140
0.150
0.140
0.140
0.140
15.0%
-0.230
-0.210
-0.200
-0.220
-0.220
-0.220
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
2.0
2.5
3.0
3.5

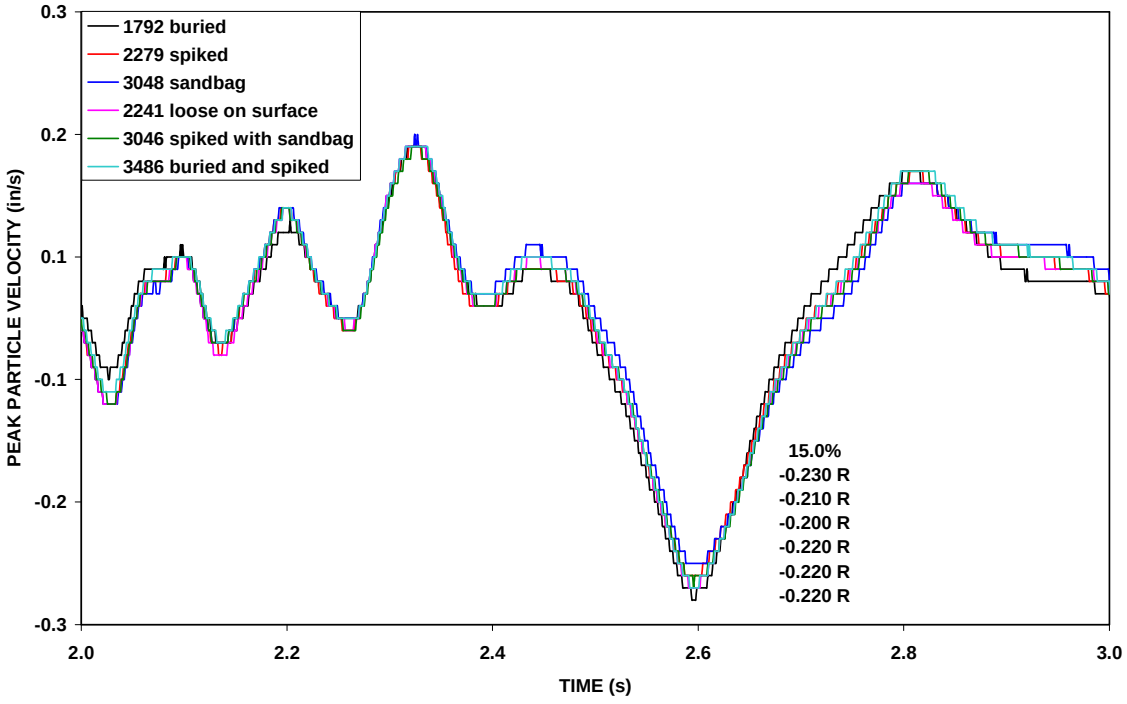

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
0.0%
0.100
0.100
0.100
0.100
0.100
0.100
10.0%
-0.110
-0.110
-0.100
-0.110
-0.110
-0.100
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
1.5
1.7
1.9
2.1
2.3
2.5


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
TIME (s)

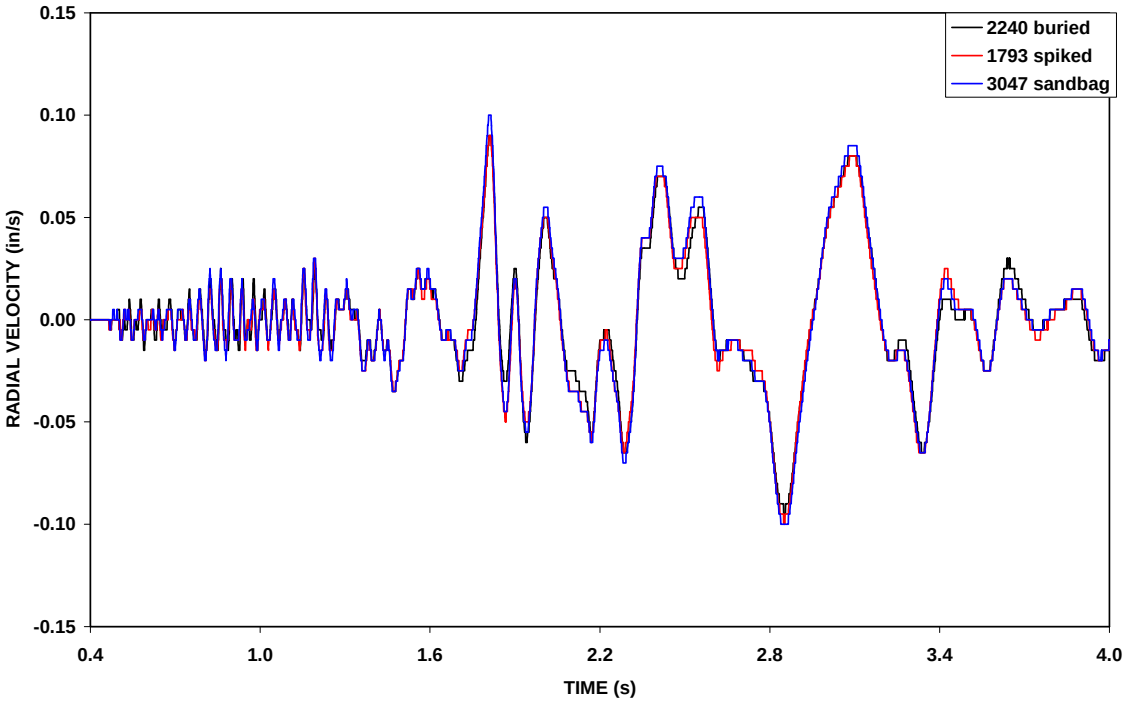

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
22.2%
0.110
0.100
0.090
0.090
0.100
0.100
22.2%
-0.090
-0.110
-0.110
-0.100
-0.110
-0.090
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1.5
2.0
2.5
3.0
TIME (s)

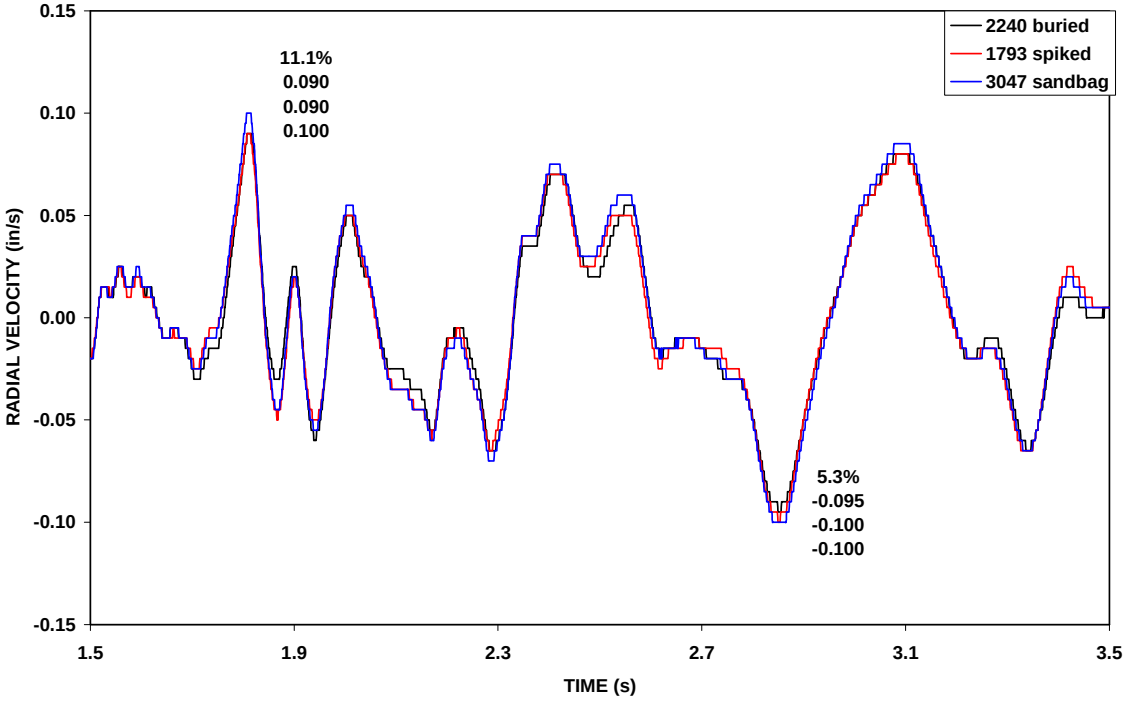

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
PEAK PARTICLE VELOCITY (in/s)
0.3
0.2
0.1
-0.1
-0.2
-0.3
0.4
1.2
2.0
2.8
3.6
TIME (s)

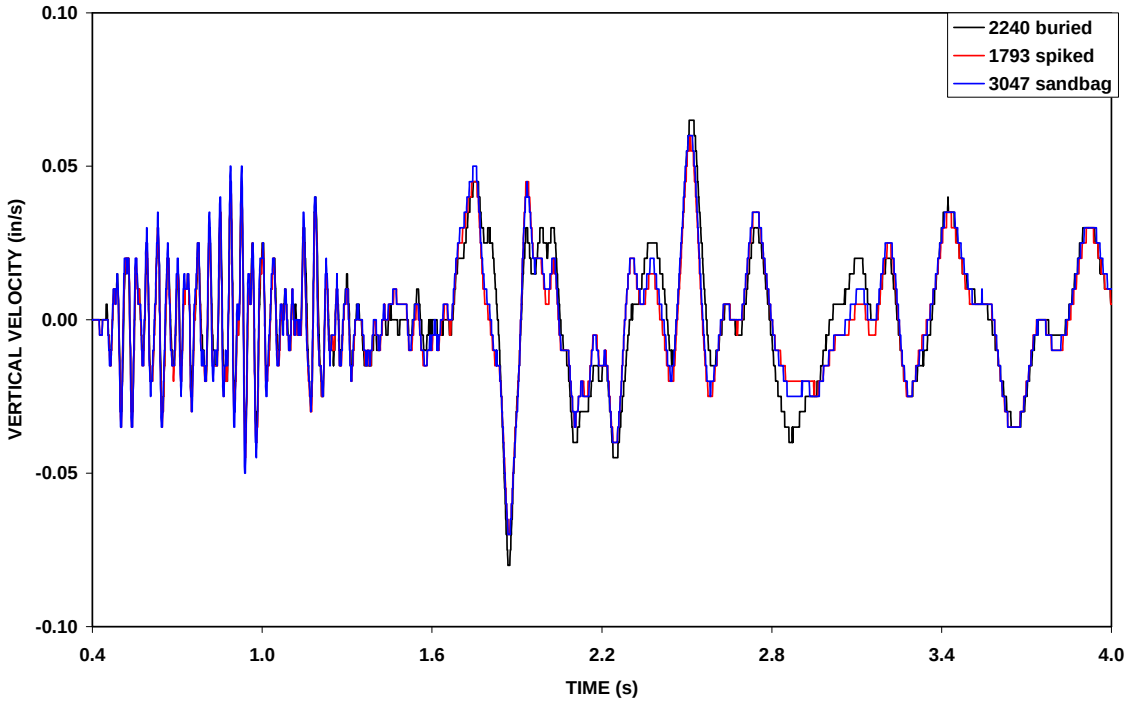

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
PEAK PARTICLE VELOCITY (in/s)
0.3
0.2
0.1
-0.1
-0.2
-0.3
2.0
2.2
2.4
2.6
2.8
3.0
TIME (s)
15.0%
-0.230 R
-0.210 R
-0.200 R
-0.220 R
-0.220 R
-0.220 R

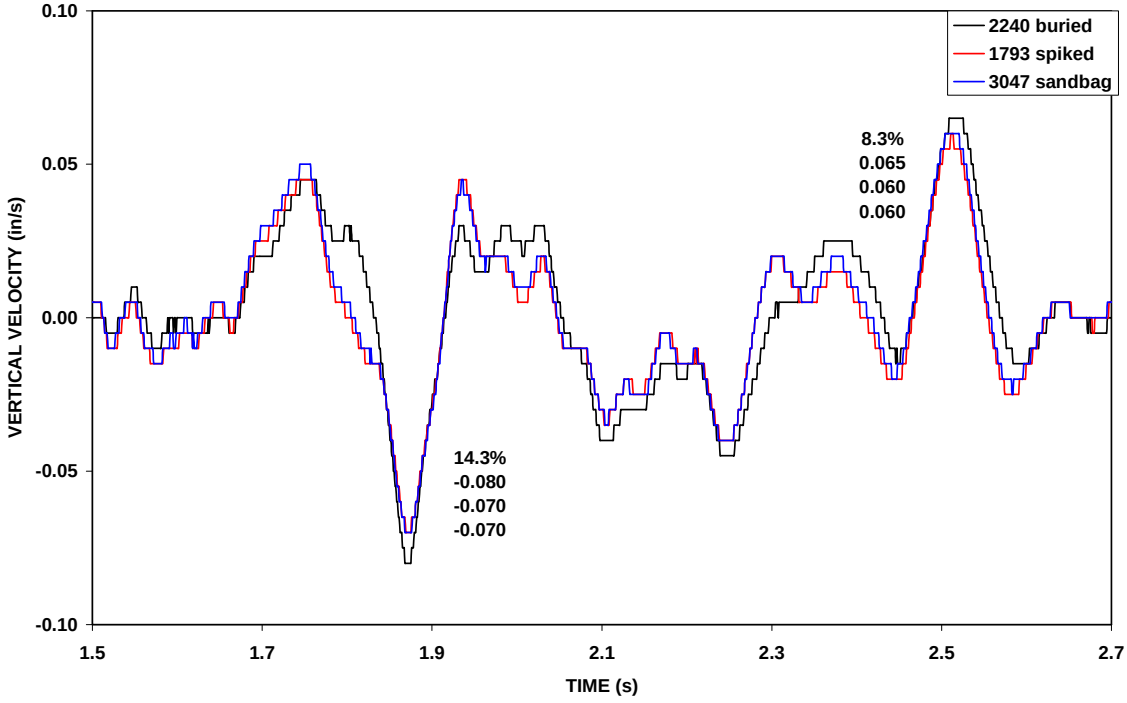
WY-3

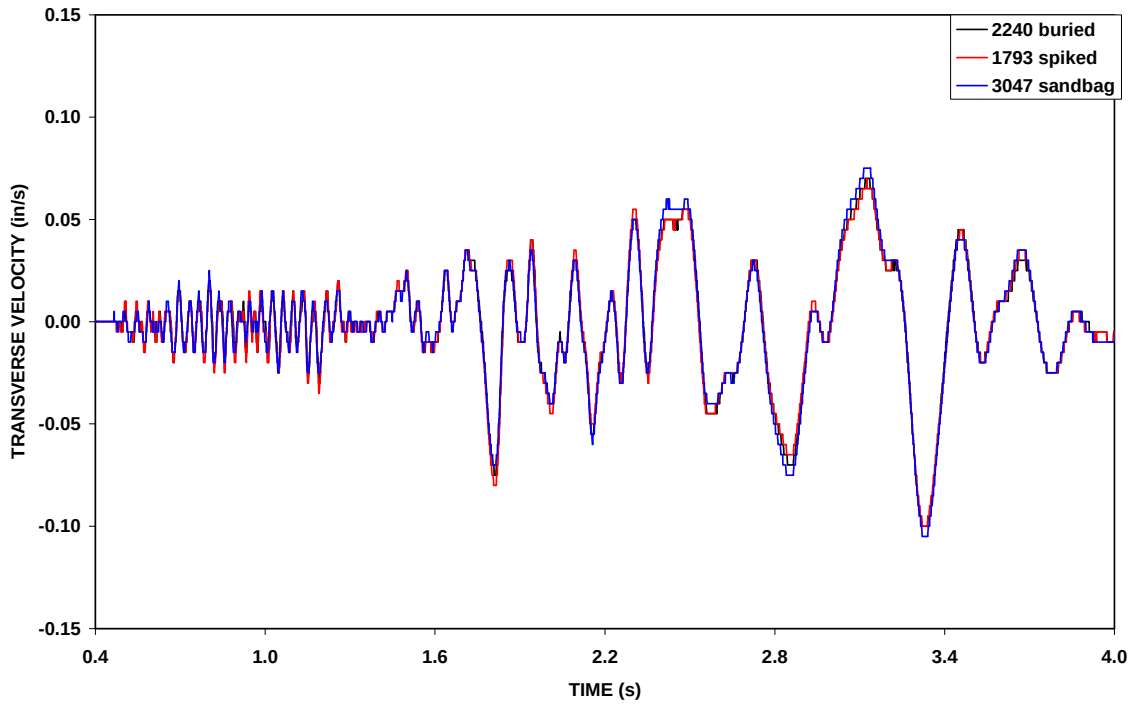
Cluster 2 SD 66.0 ft/lb$^{1/2}$

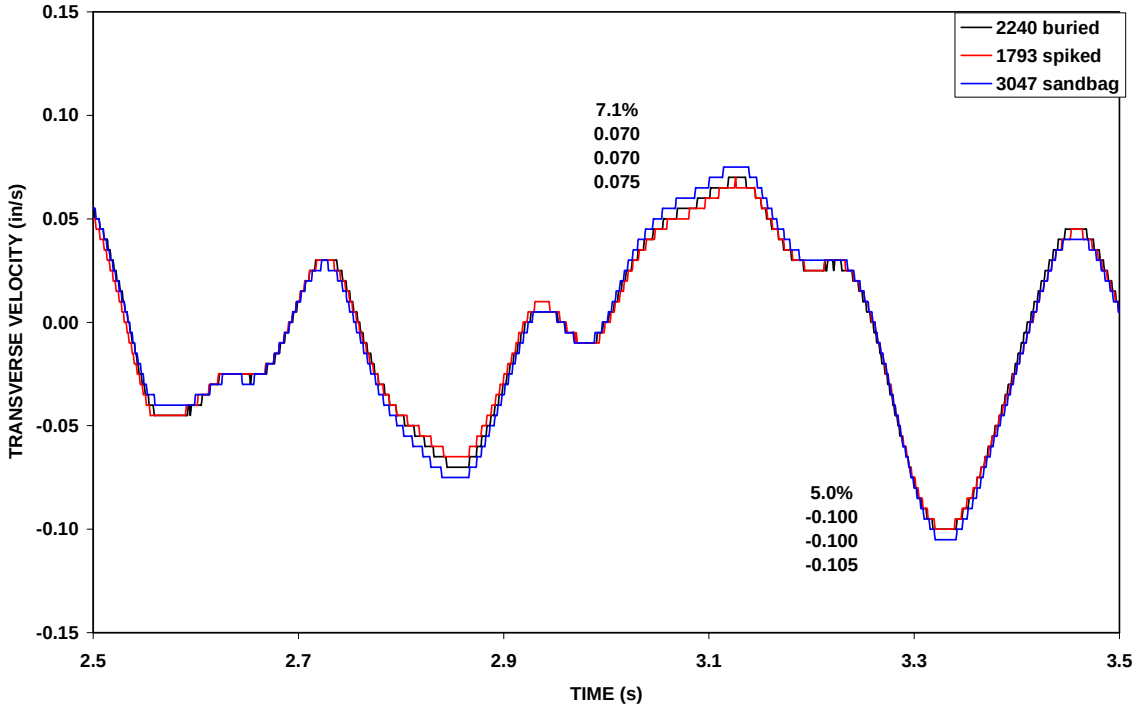

2240 buried
1793 spiked
3047 sandbag
RADIAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
1.0
1.6
2.2
2.8
3.4
4.0
TIME (s)


2240 buried
1793 spiked
3047 sandbag
11.1%
0.090
0.090
0.100
5.3%
-0.095
-0.100
-0.100
RADIAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1.5
1.9
2.3
2.7
3.1
3.5
TIME (s)


2240 buried
1793 spiked
3047 sandbag
VERTICAL VELOCITY (in/s)
0.10
0.05
0.00
-0.05
-0.10
0.4
1.0
1.6
2.2
2.8
3.4
4.0
TIME (s)

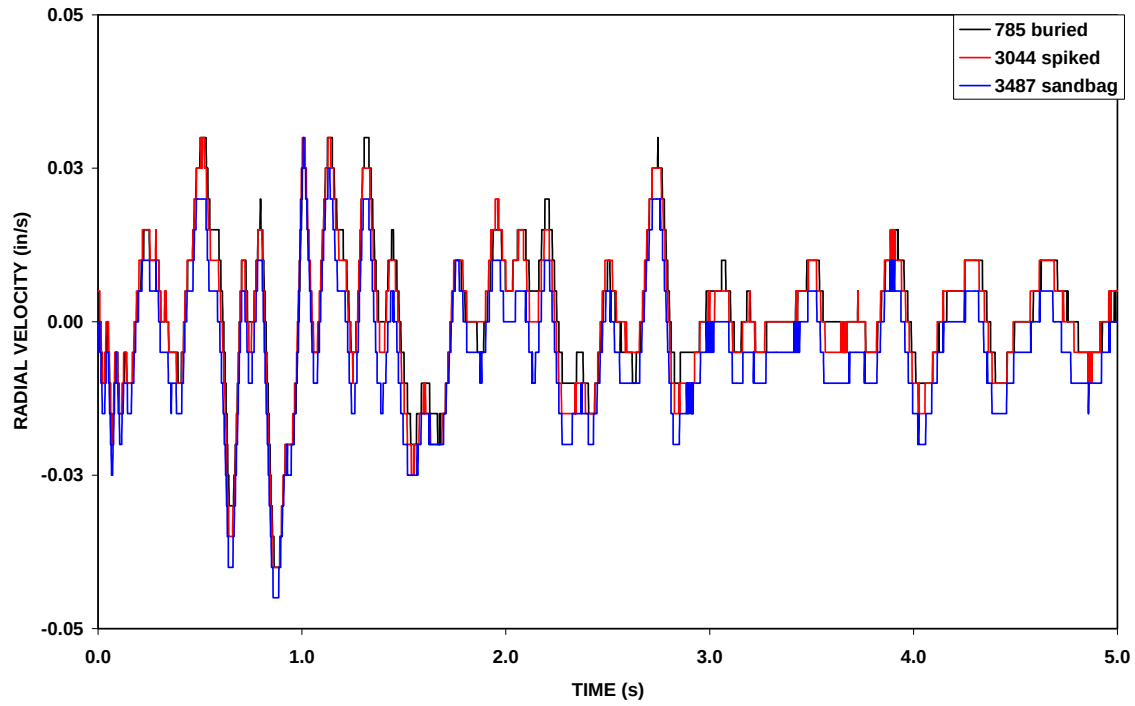

2240 buried
1793 spiked
3047 sandbag
8.3%
0.065
0.060
0.060
14.3%
-0.080
-0.070
-0.070
VERTICAL VELOCITY (in/s)
0.10
0.05
0.00
-0.05
-0.10
1.5
1.7
1.9
2.1
2.3
2.5
2.7
TIME (s)

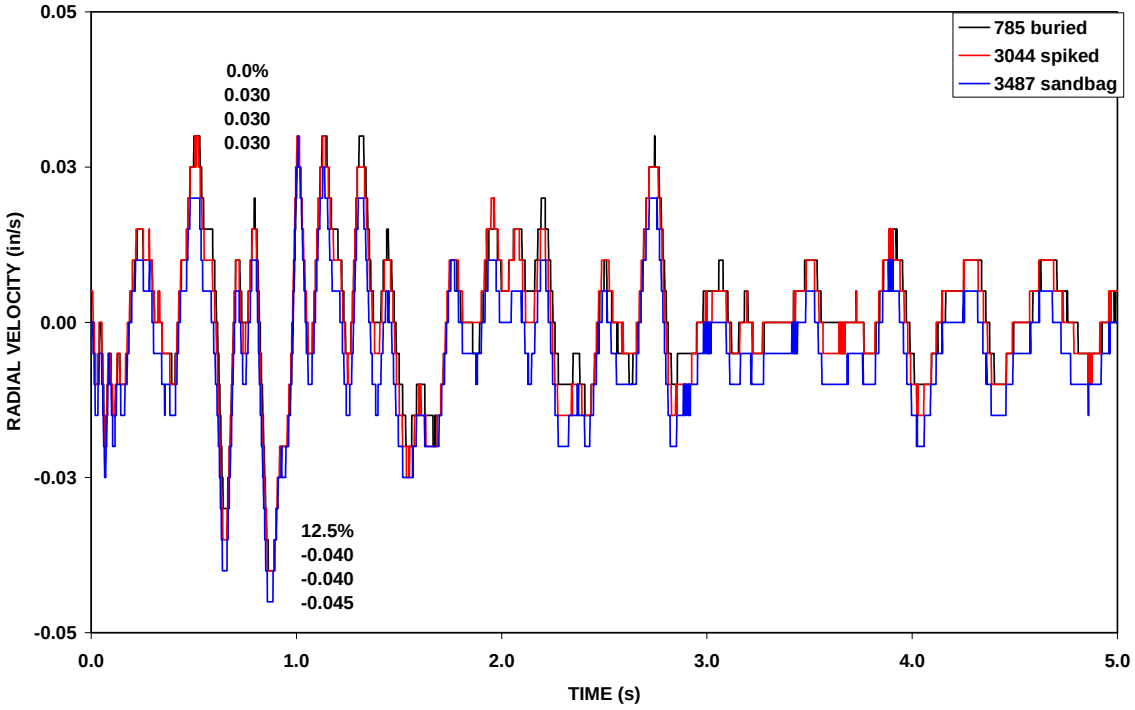

2240 buried
1793 spiked
3047 sandbag
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
1.0
1.6
2.2
2.8
3.4
4.0
TIME (s)

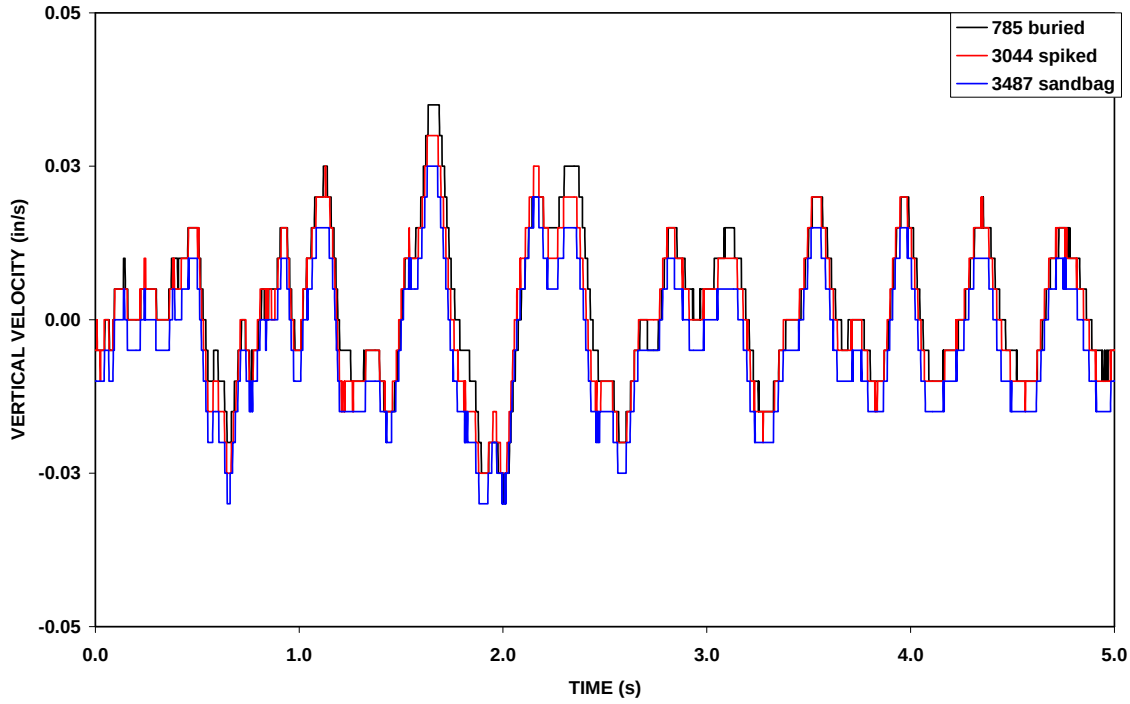

2240 buried
1793 spiked
3047 sandbag
7.1%
0.070
0.070
0.075
5.0%
-0.100
-0.100
-0.105
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
2.5
2.7
2.9
3.1
3.3
3.5
TIME (s)

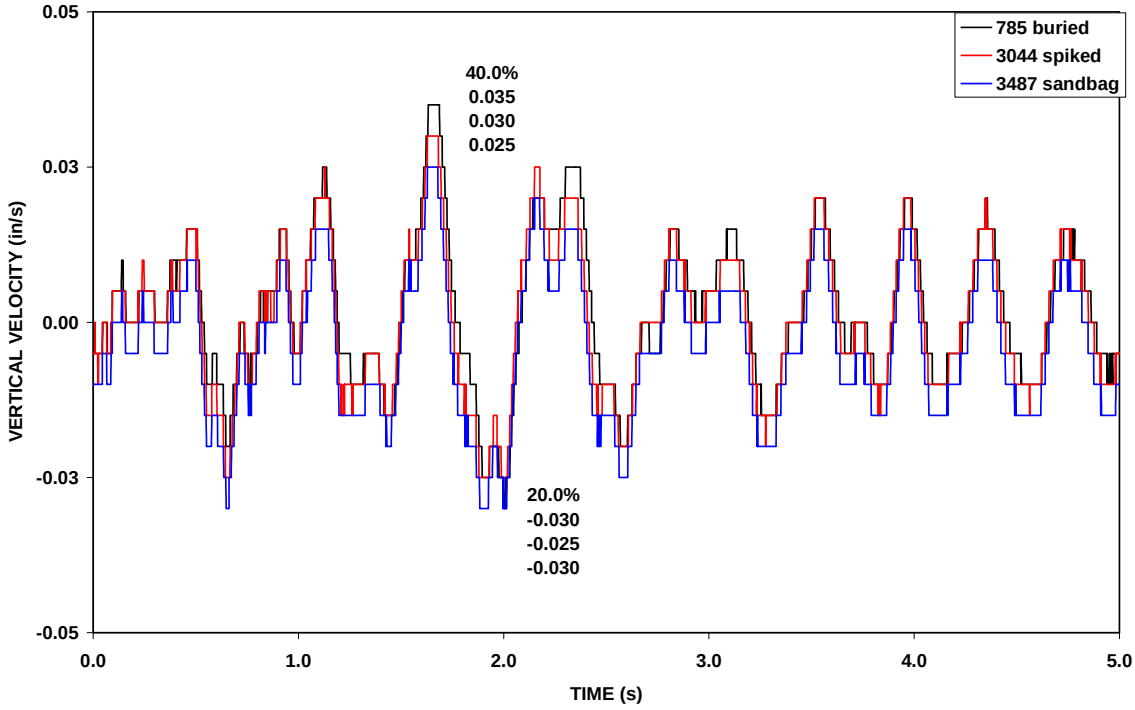
WY-3

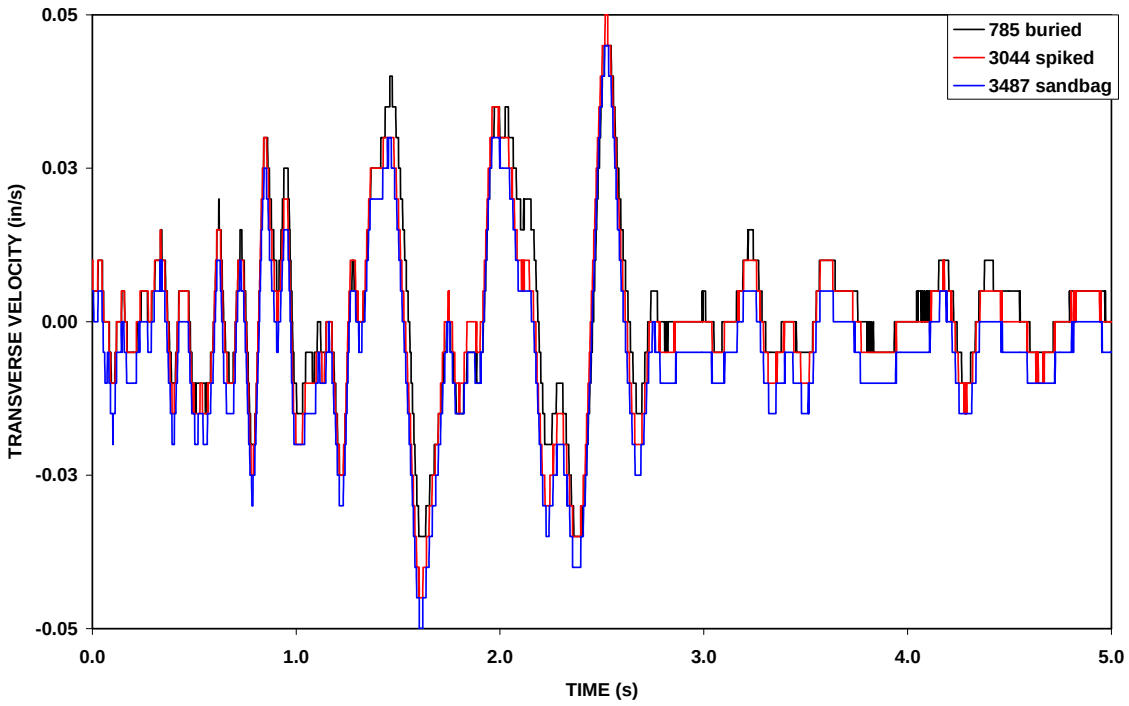
Cluster 3 SD 97.6 ft/lb$^{1/2}$

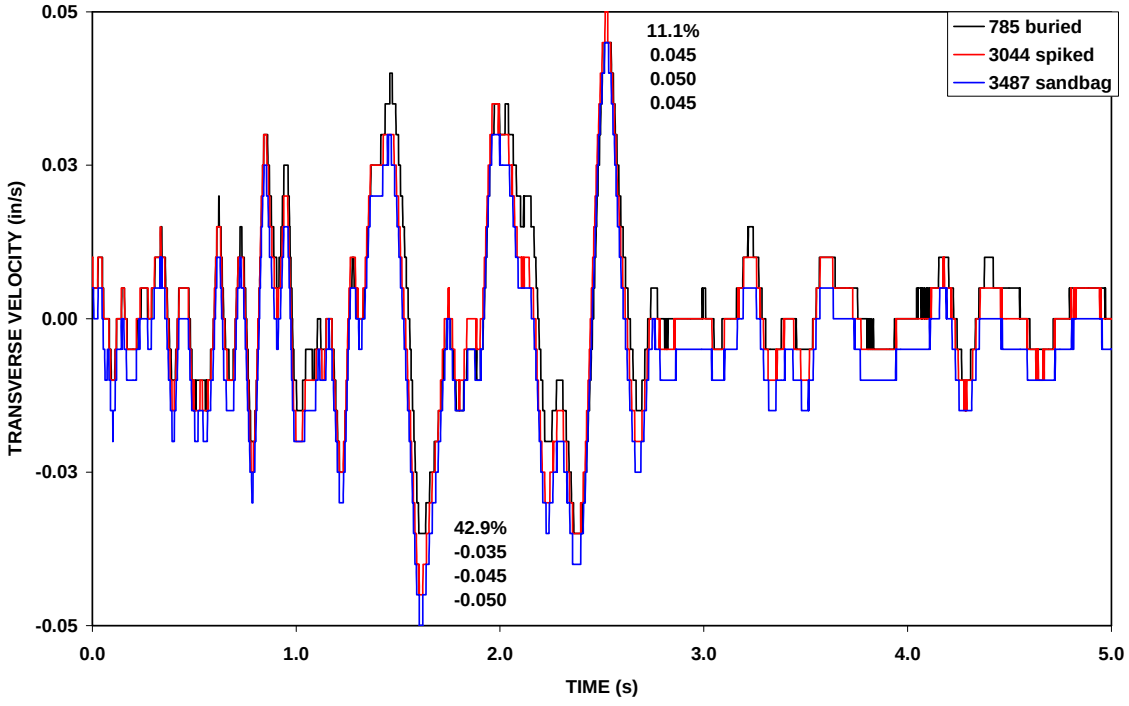

785 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.05
0.03
0.00
-0.03
-0.05
0.0
1.0
2.0
3.0
4.0
5.0


785 buried
3044 spiked
3487 sandbag
0.0%
0.030
0.030
0.030
12.5%
-0.040
-0.040
-0.045
RADIAL VELOCITY (in/s)
TIME (s)
0.05
0.03
0.00
-0.03
-0.05
0.0
1.0
2.0
3.0
4.0
5.0


785 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.05
0.03
0.00
-0.03
-0.05
0.0
1.0
2.0
3.0
4.0
5.0

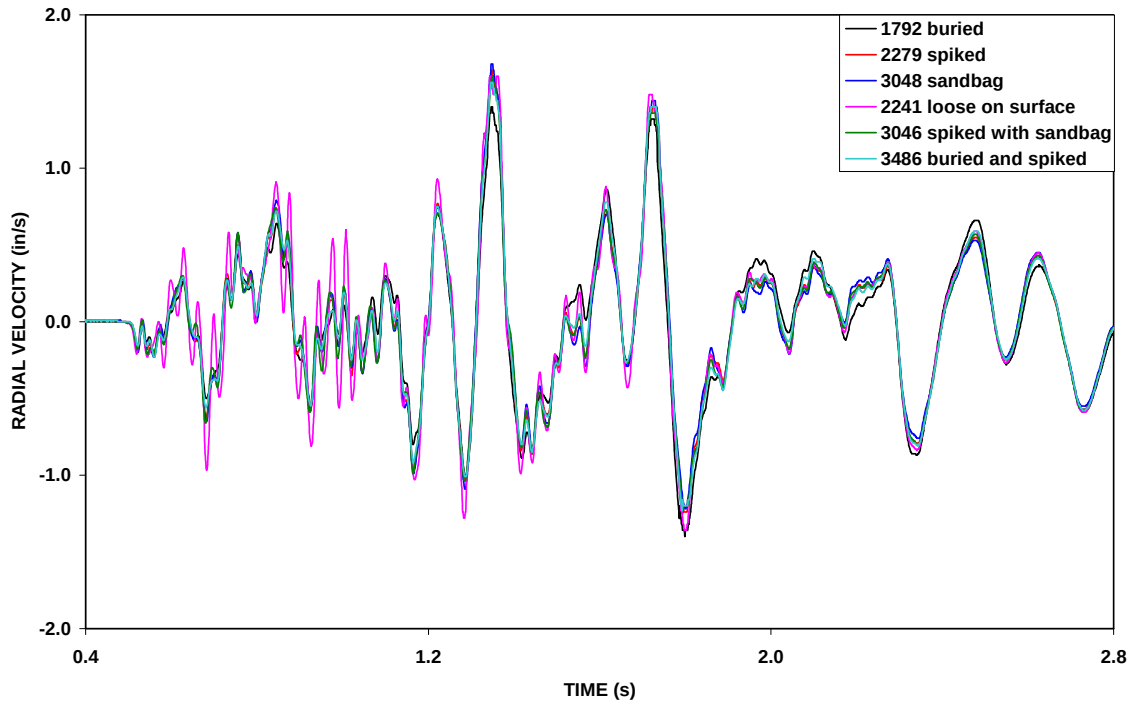

785 buried
3044 spiked
3487 sandbag
40.0%
0.035
0.030
0.025
20.0%
-0.030
-0.025
-0.030
VERTICAL VELOCITY (in/s)
TIME (s)
0.05
0.03
0.00
-0.03
-0.05
0.0
1.0
2.0
3.0
4.0
5.0

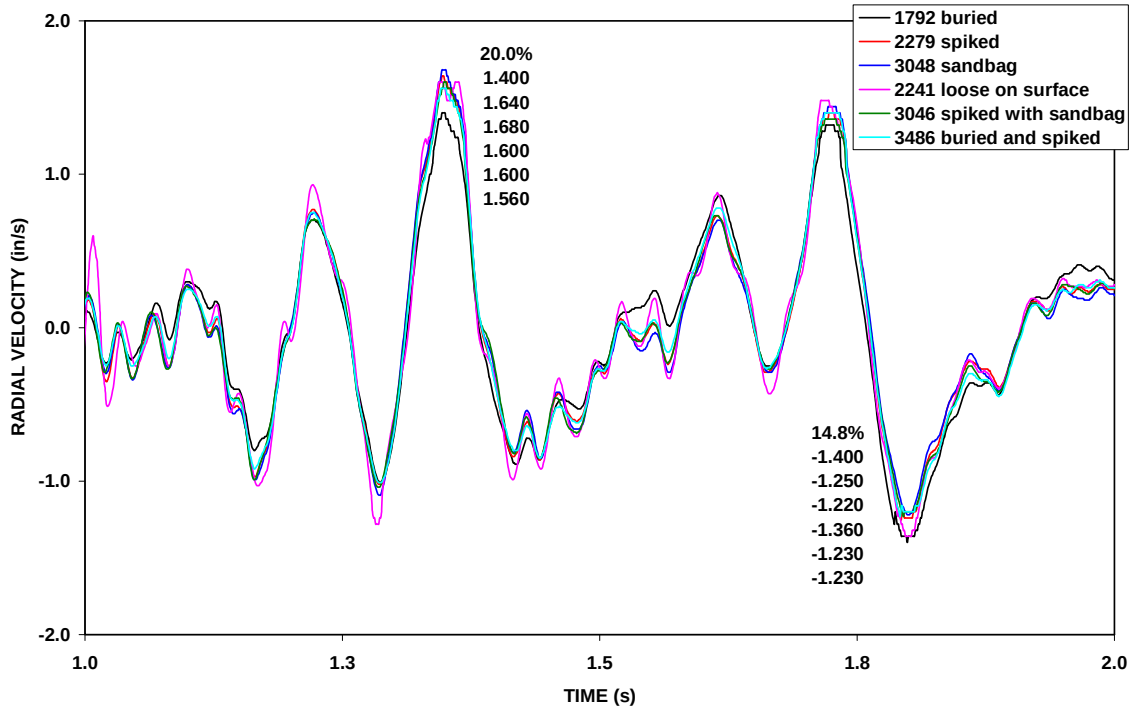

785 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
0.05
0.03
0.00
-0.03
-0.05
0.0
1.0
2.0
3.0
4.0
5.0
TIME (s)

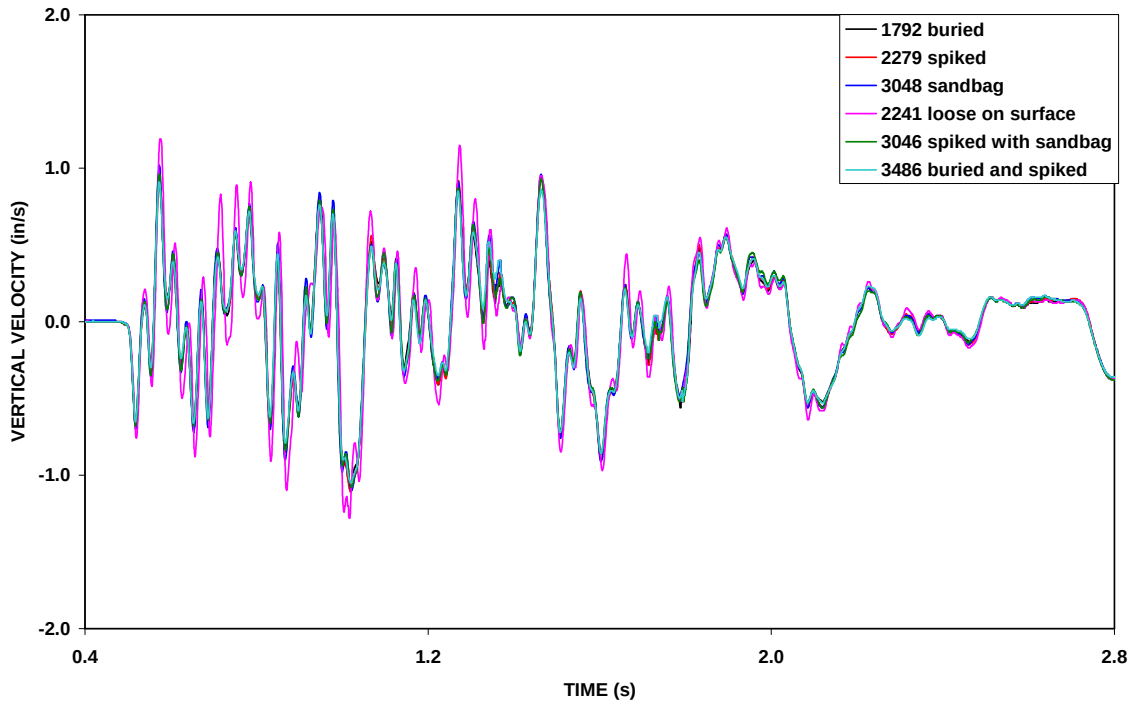

785 buried
3044 spiked
3487 sandbag
11.1%
0.045
0.050
0.045
42.9%
-0.035
-0.045
-0.050
TRANSVERSE VELOCITY (in/s)
0.05
0.03
0.00
-0.03
-0.05
0.0
1.0
2.0
3.0
4.0
5.0
TIME (s)

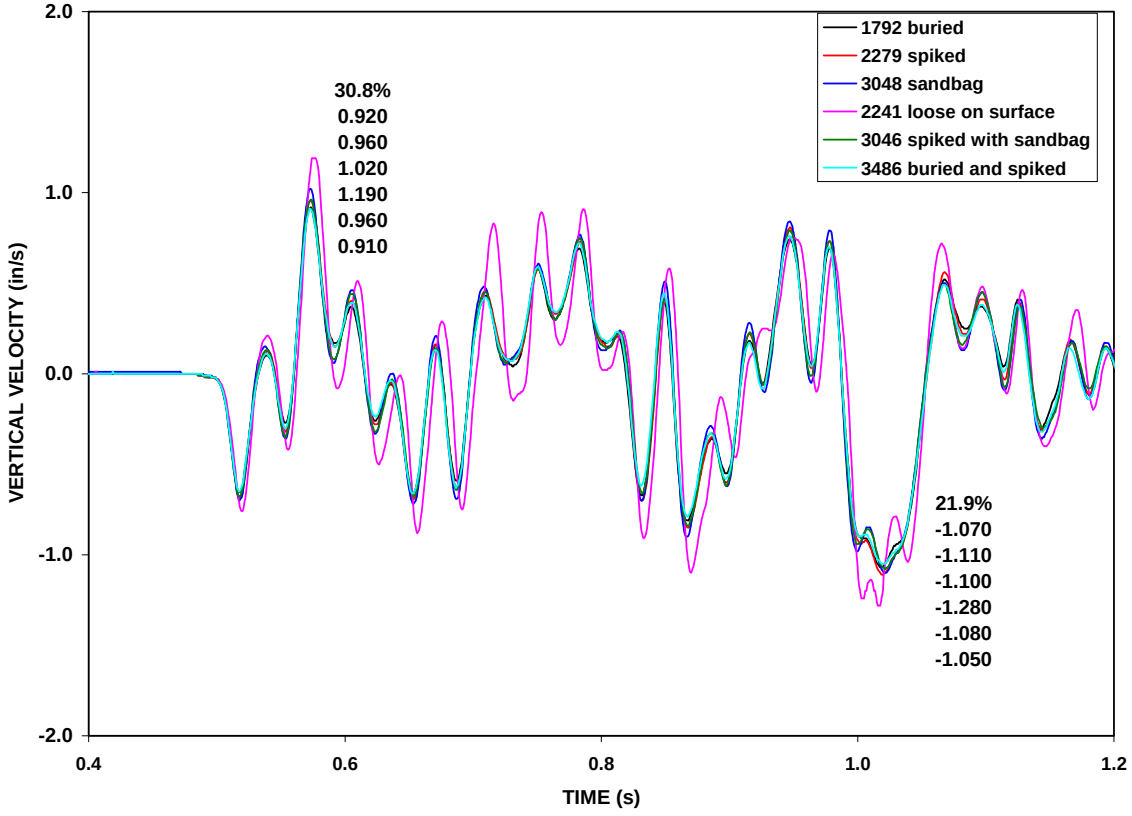
WY-4

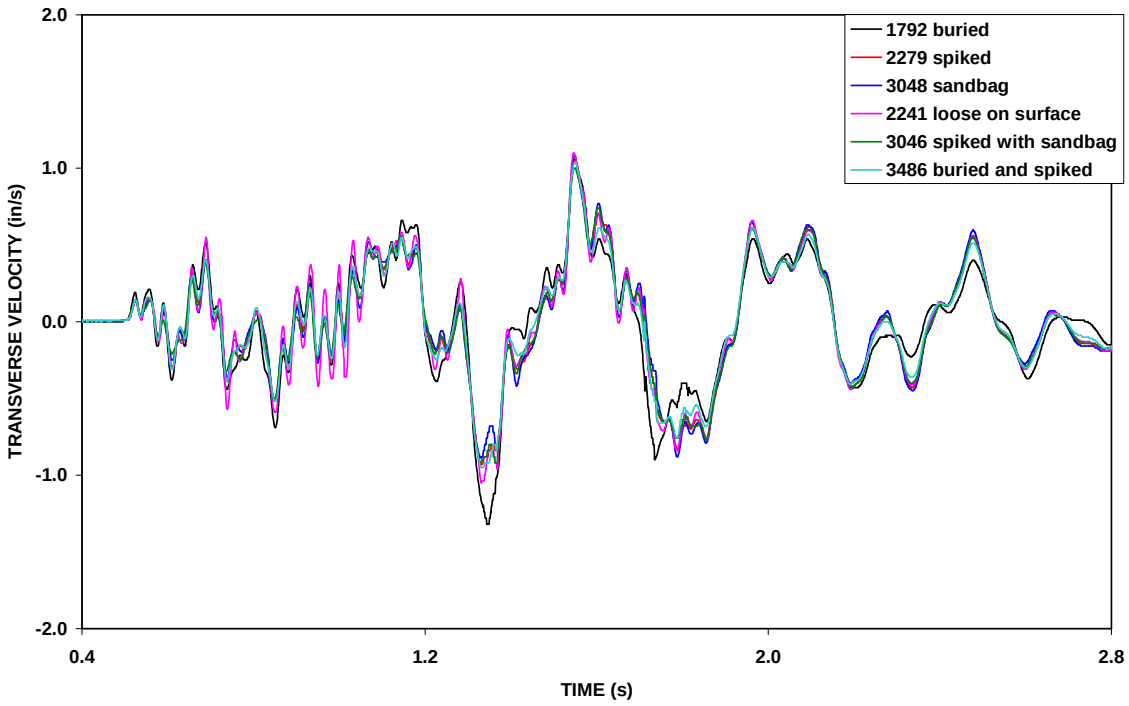
Cluster 1 SD 9.7 ft/lb$^{1/2}$

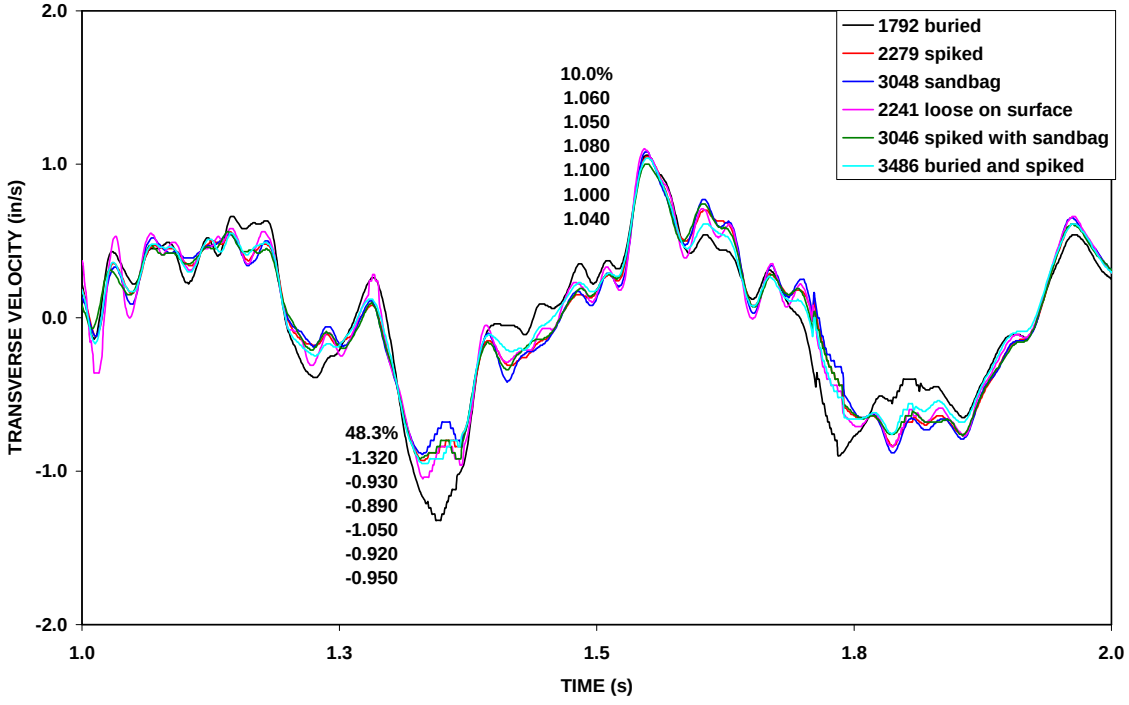

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
0.4
1.2
2.0
2.8

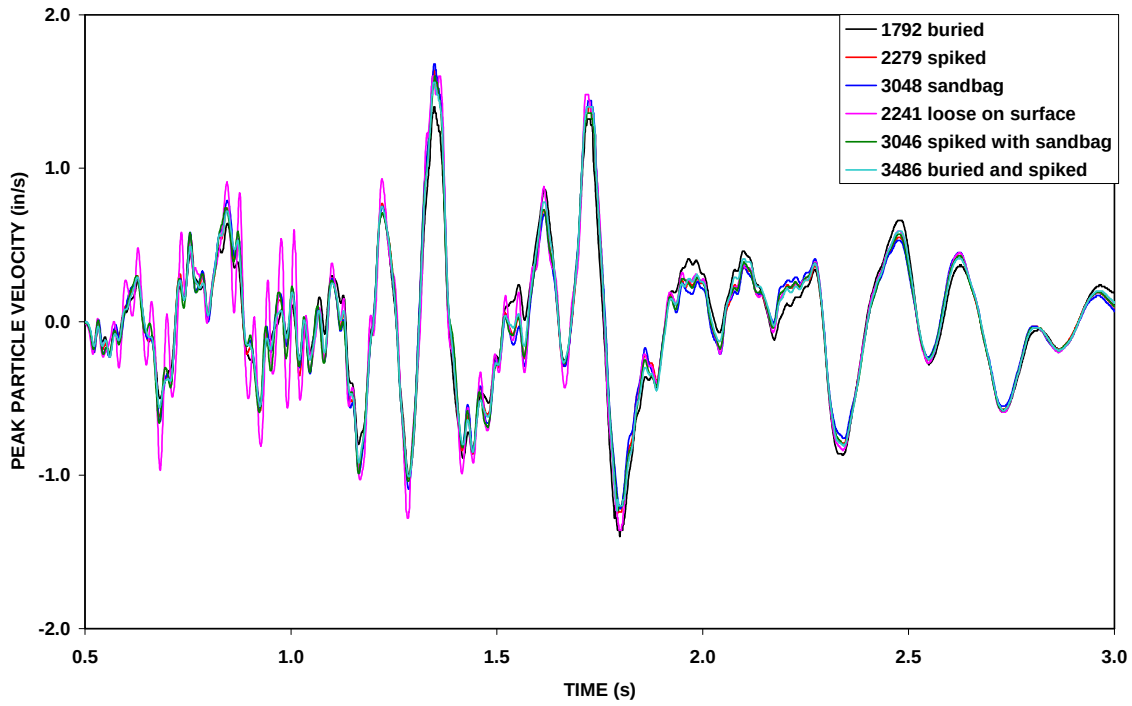

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
20.0%
1.400
1.640
1.680
1.600
1.600
1.560
14.8%
-1.400
-1.250
-1.220
-1.360
-1.230
-1.230
RADIAL VELOCITY (in/s)
TIME (s)
2.0
1.0
0.0
-1.0
-2.0
1.0
1.3
1.5
1.8
2.0

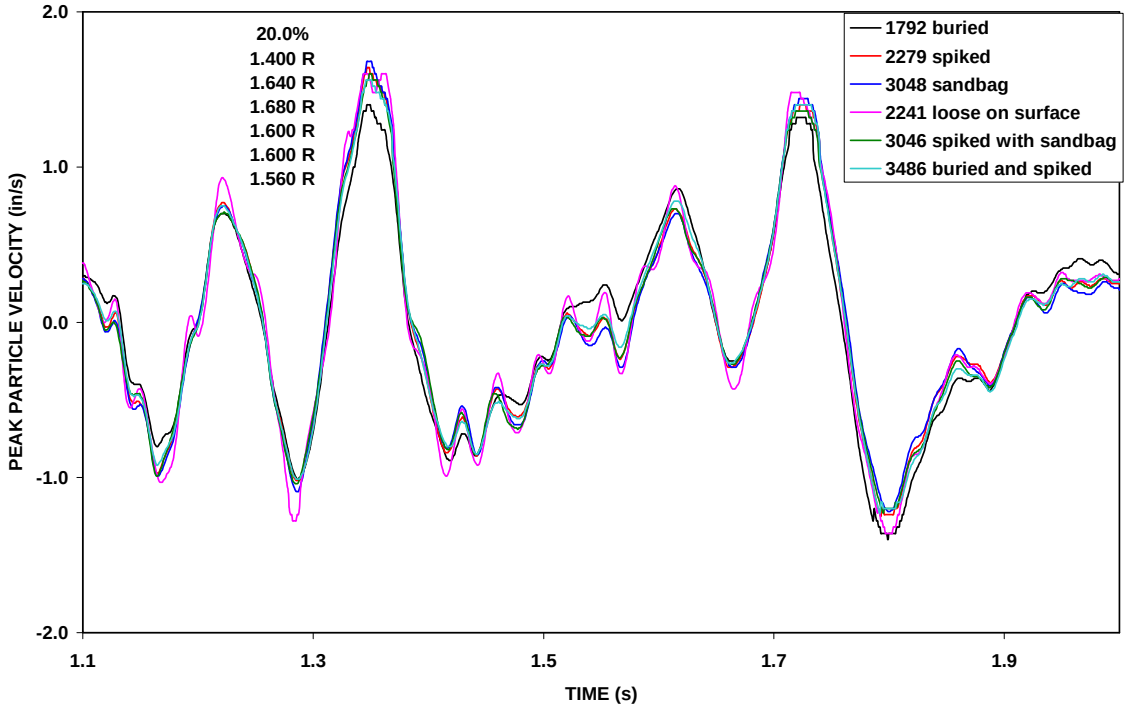

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
VERTICAL VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
0.4
1.2
2.0
2.8
TIME (s)


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
30.8%
0.920
0.960
1.020
1.190
0.960
0.910
21.9%
-1.070
-1.110
-1.100
-1.280
-1.080
-1.050
VERTICAL VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
0.4
0.6
0.8
1.0
1.2
TIME (s)


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
TRANSVERSE VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
0.4
1.2
2.0
2.8
TIME (s)

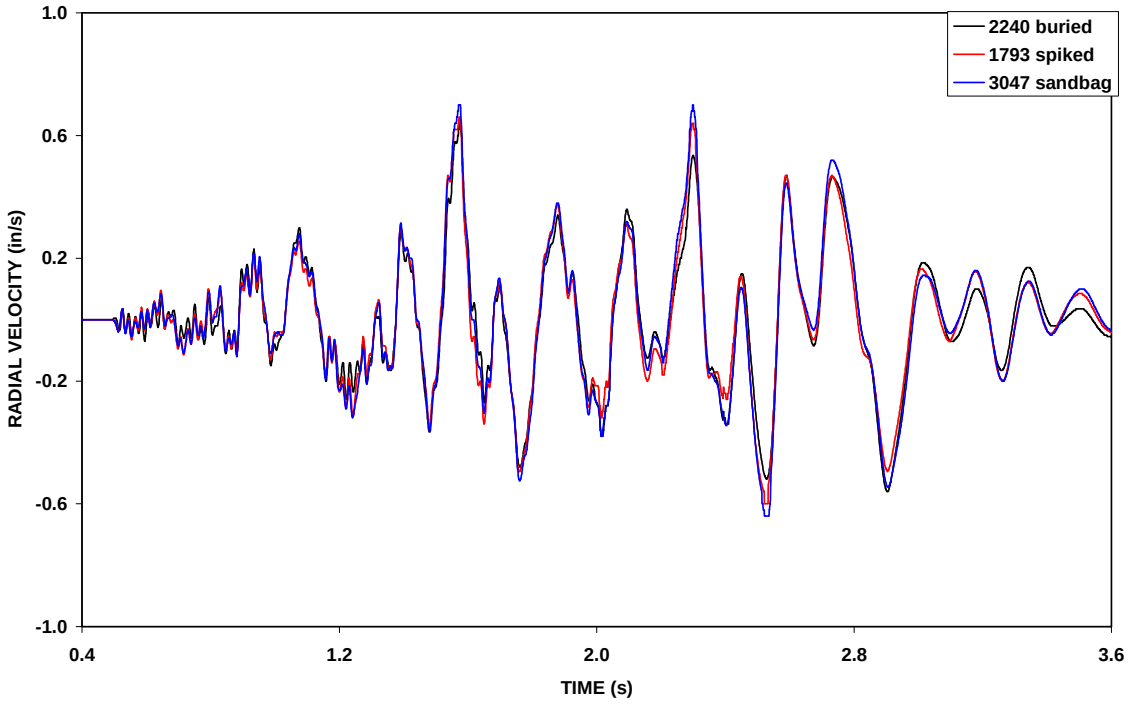

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
10.0%
1.060
1.050
1.080
1.100
1.000
1.040
48.3%
-1.320
-0.930
-0.890
-1.050
-0.920
-0.950
TRANSVERSE VELOCITY (in/s)
2.0
1.0
0.0
-1.0
-2.0
1.0
1.3
1.5
1.8
2.0
TIME (s)

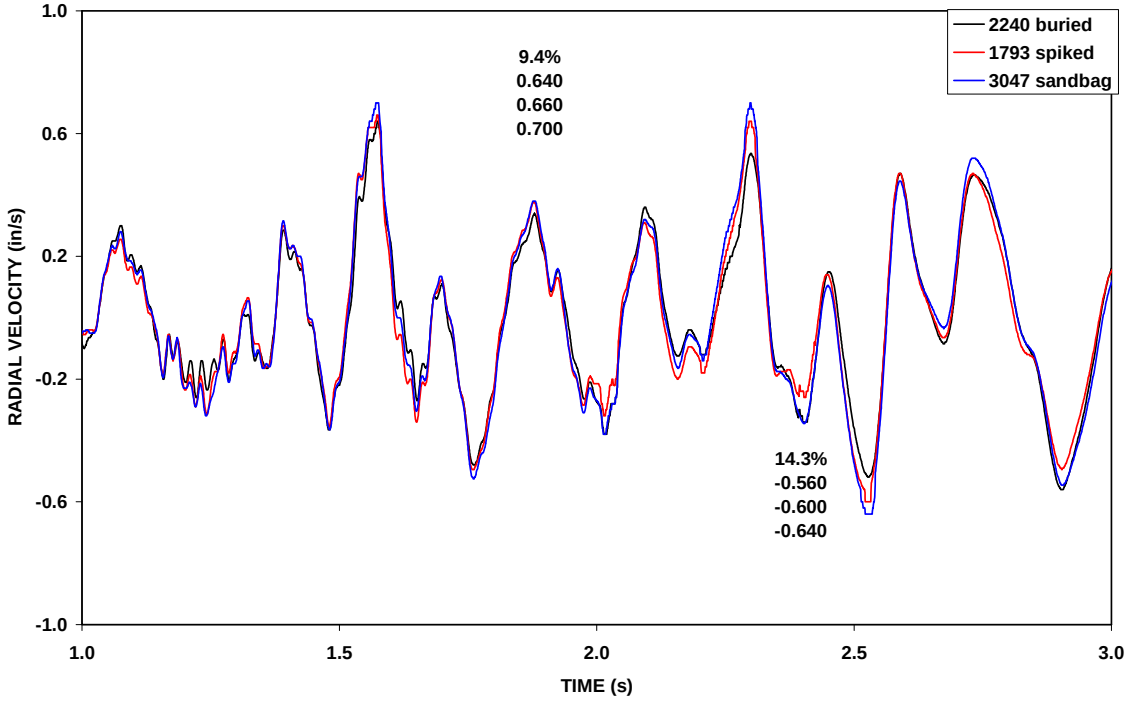

2.0
1.0
0.0
-1.0
-2.0
PEAK PARTICLE VELOCITY (in/s)
0.5
1.0
1.5
2.0
2.5
3.0
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked

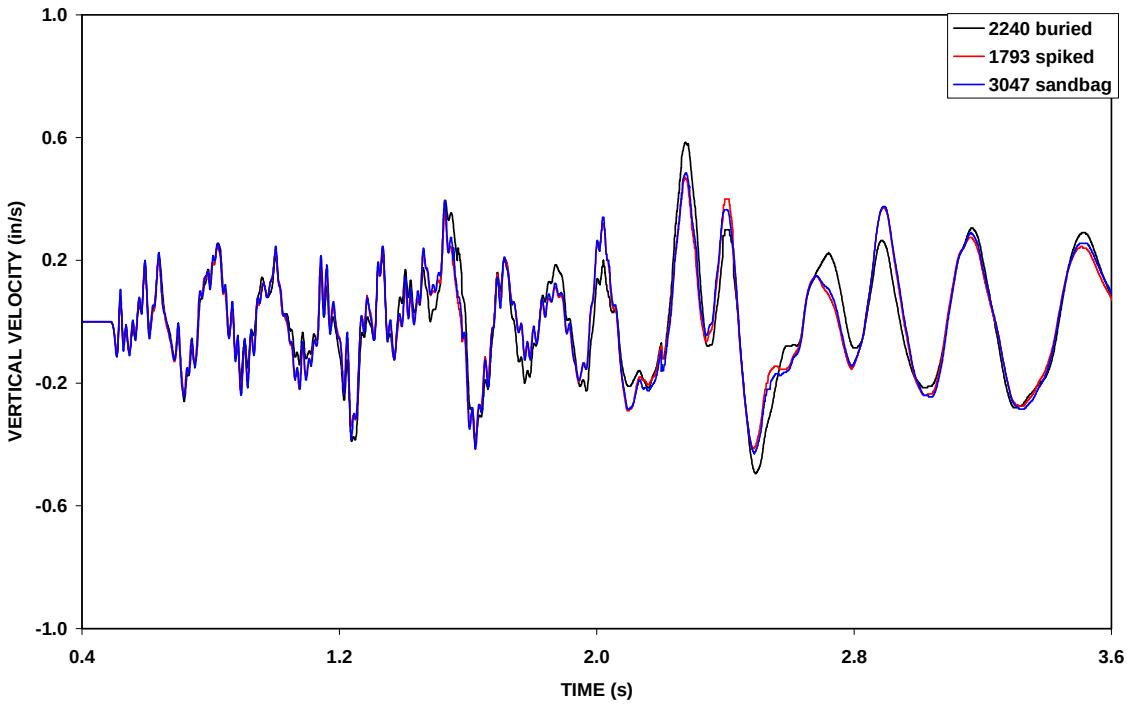

20.0%
1.400 R
1.640 R
1.680 R
1.600 R
1.600 R
1.560 R
2.0
1.0
0.0
-1.0
-2.0
PEAK PARTICLE VELOCITY (in/s)
1.1
1.3
1.5
1.7
1.9
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked

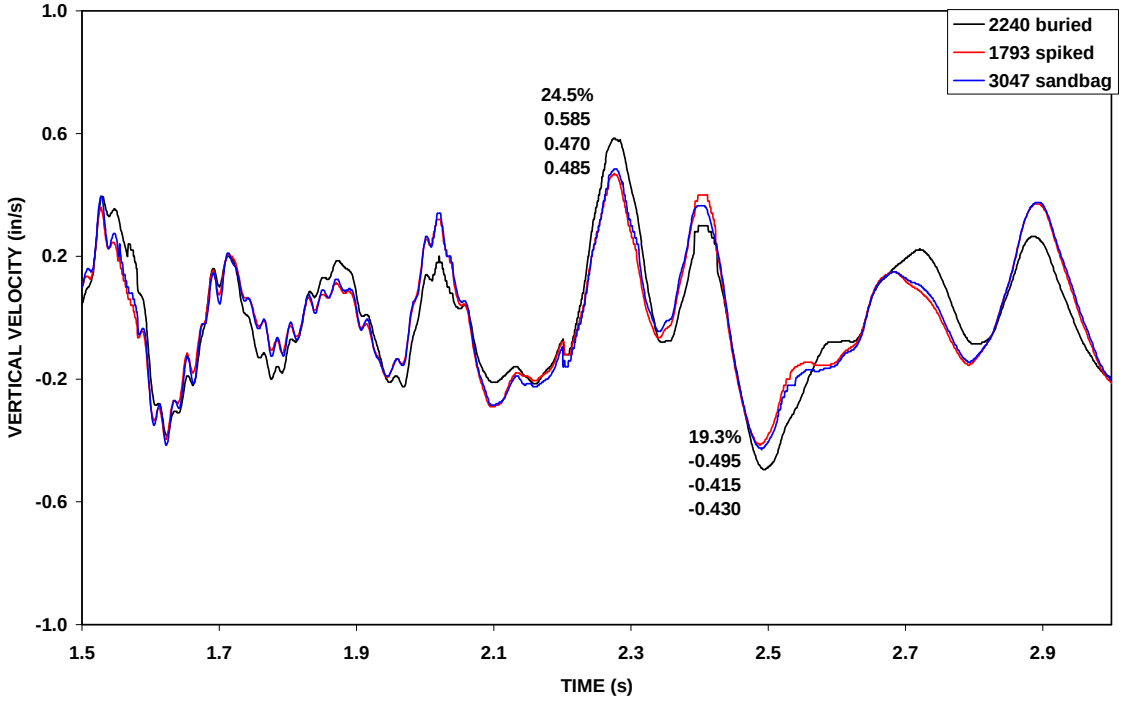
WY-4

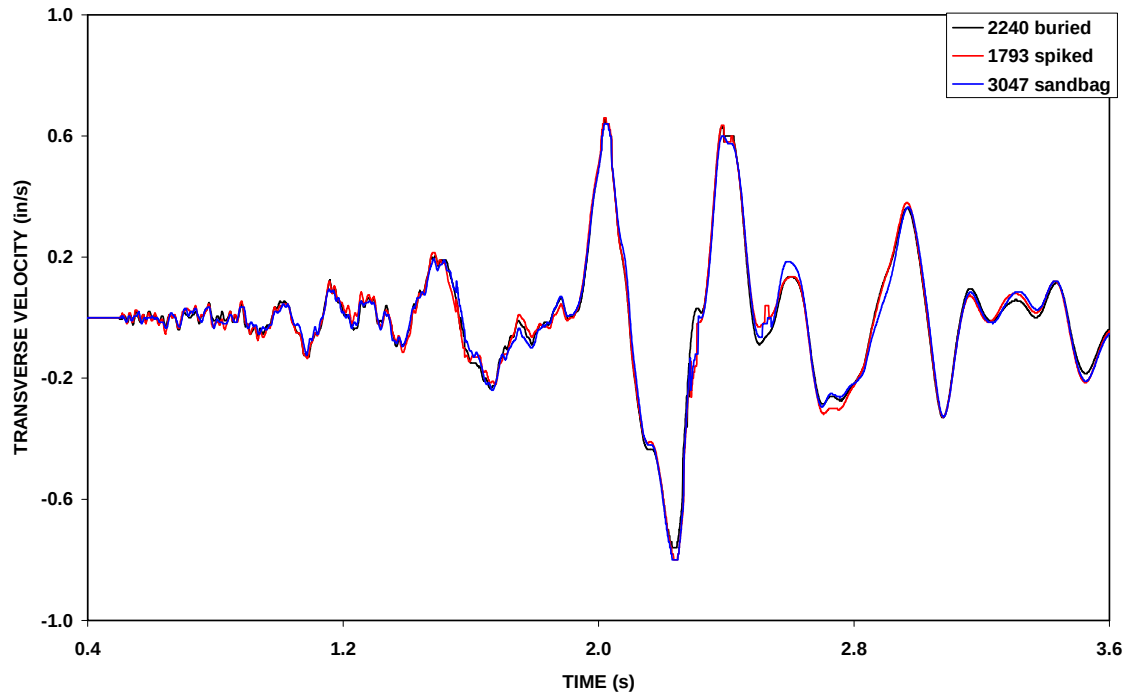
Cluster 2 SD 20.2 ft/lb$^{1/2}$

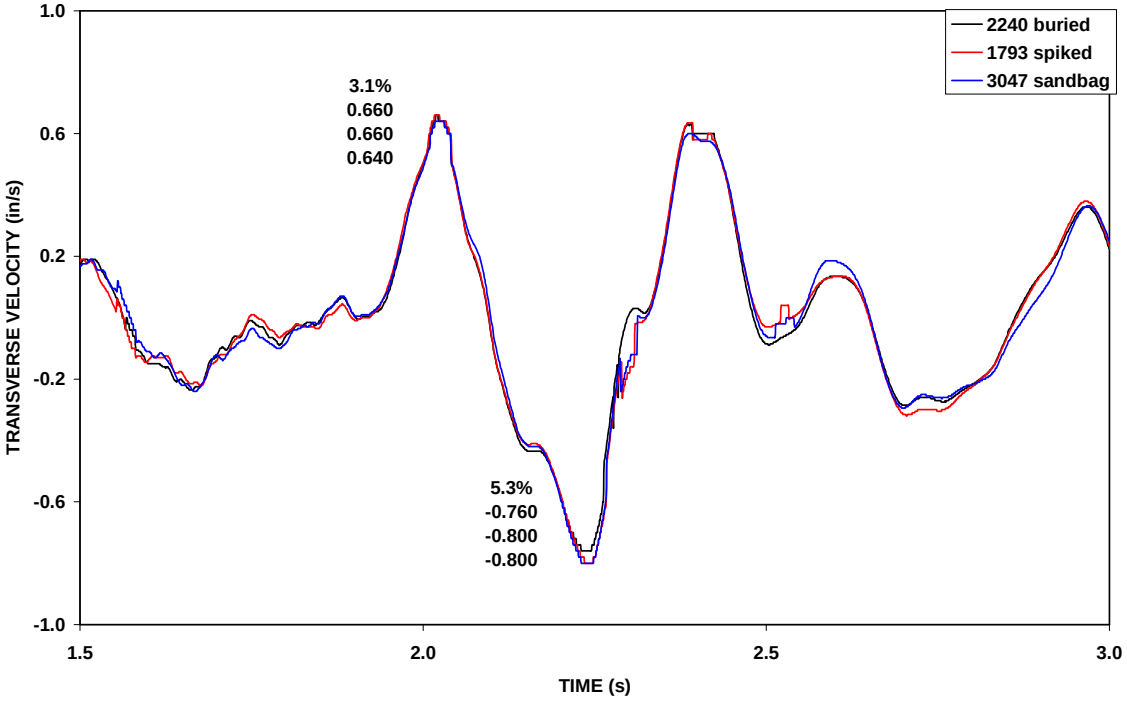

2240 buried
1793 spiked
3047 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
0.4
1.2
2.0
2.8
3.6


2240 buried
1793 spiked
3047 sandbag
9.4%
0.640
0.660
0.700
14.3%
-0.560
-0.600
-0.640
RADIAL VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
1.0
1.5
2.0
2.5
3.0


2240 buried
1793 spiked
3047 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
0.4
1.2
2.0
2.8
3.6

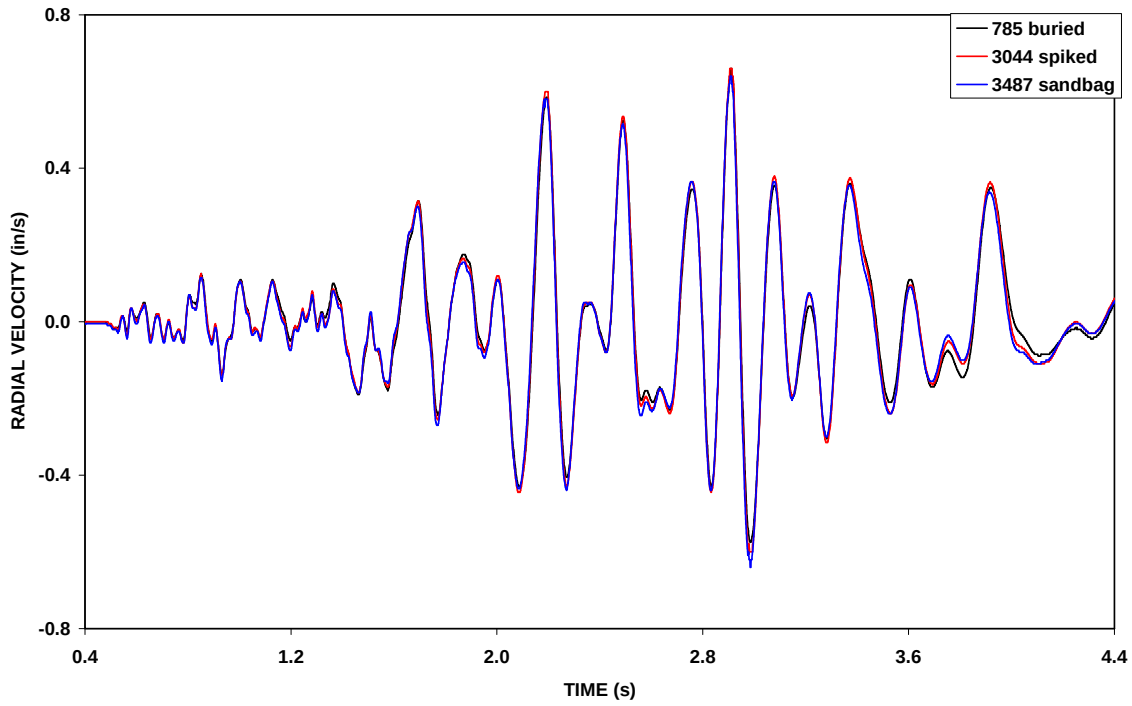

2240 buried
1793 spiked
3047 sandbag
24.5%
0.585
0.470
0.485
19.3%
-0.495
-0.415
-0.430
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
1.5
1.7
1.9
2.1
2.3
2.5
2.7
2.9

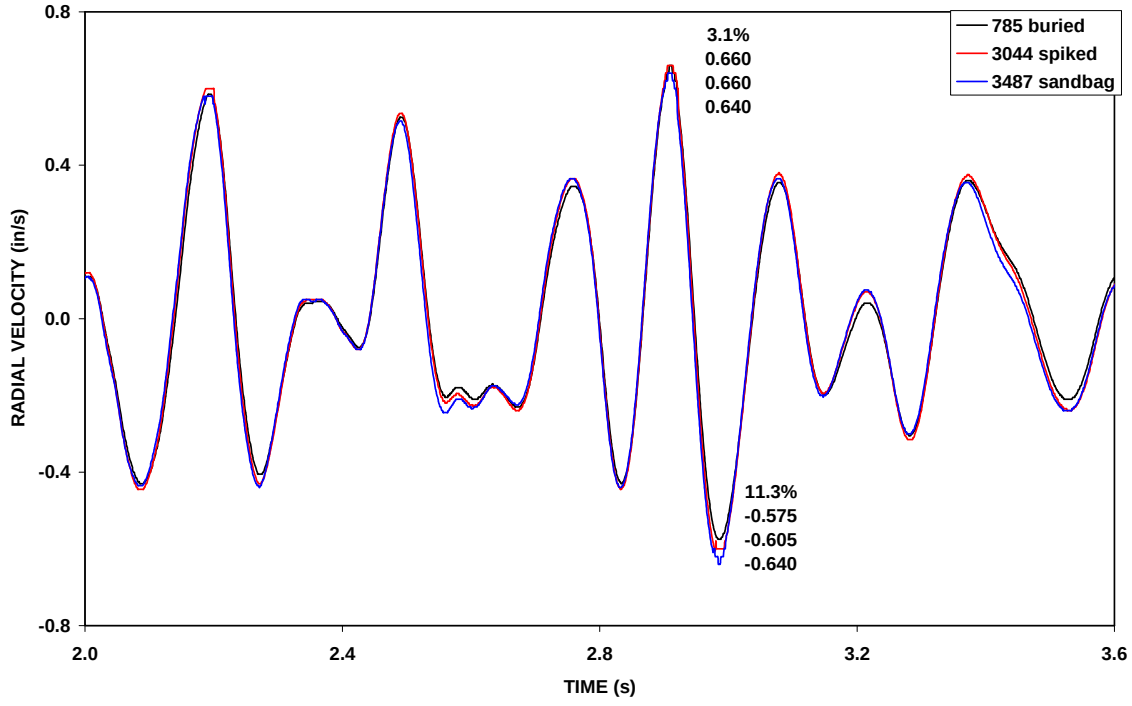

2240 buried
1793 spiked
3047 sandbag
TRANSVERSE VELOCITY (in/s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
0.4
1.2
2.0
2.8
3.6
TIME (s)

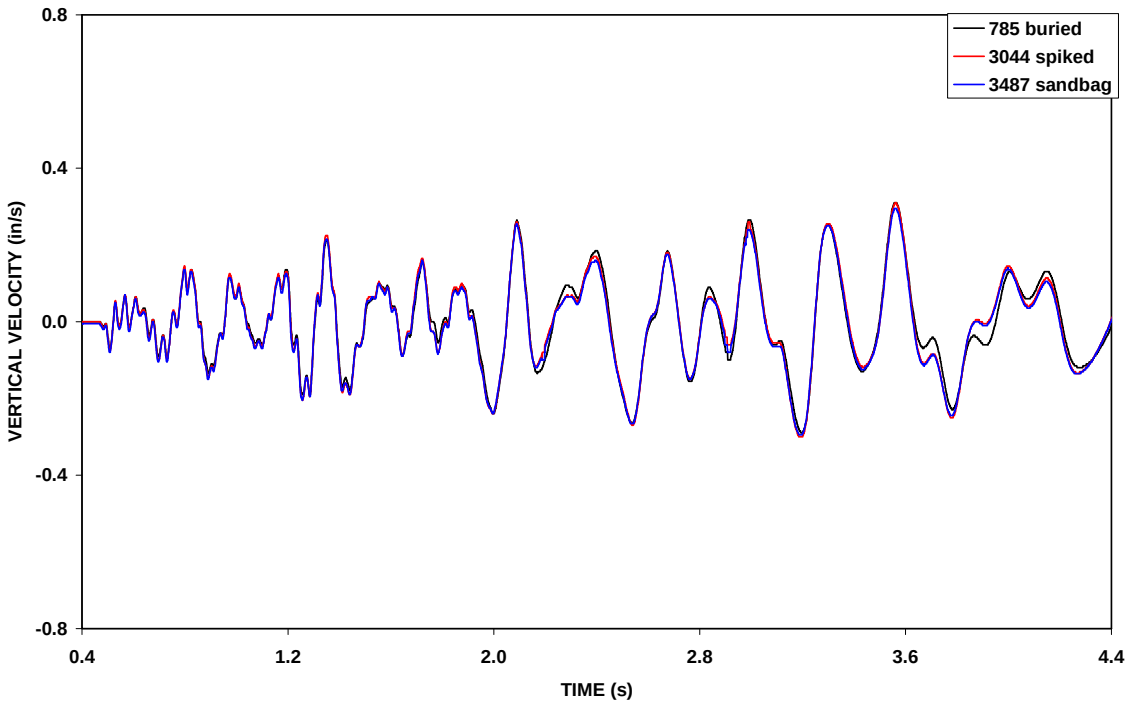

2240 buried
1793 spiked
3047 sandbag
3.1%
0.660
0.660
0.640
5.3%
-0.760
-0.800
-0.800
TRANSVERSE VELOCITY (in/s)
1.0
0.6
0.2
-0.2
-0.6
-1.0
1.5
2.0
2.5
3.0
TIME (s)

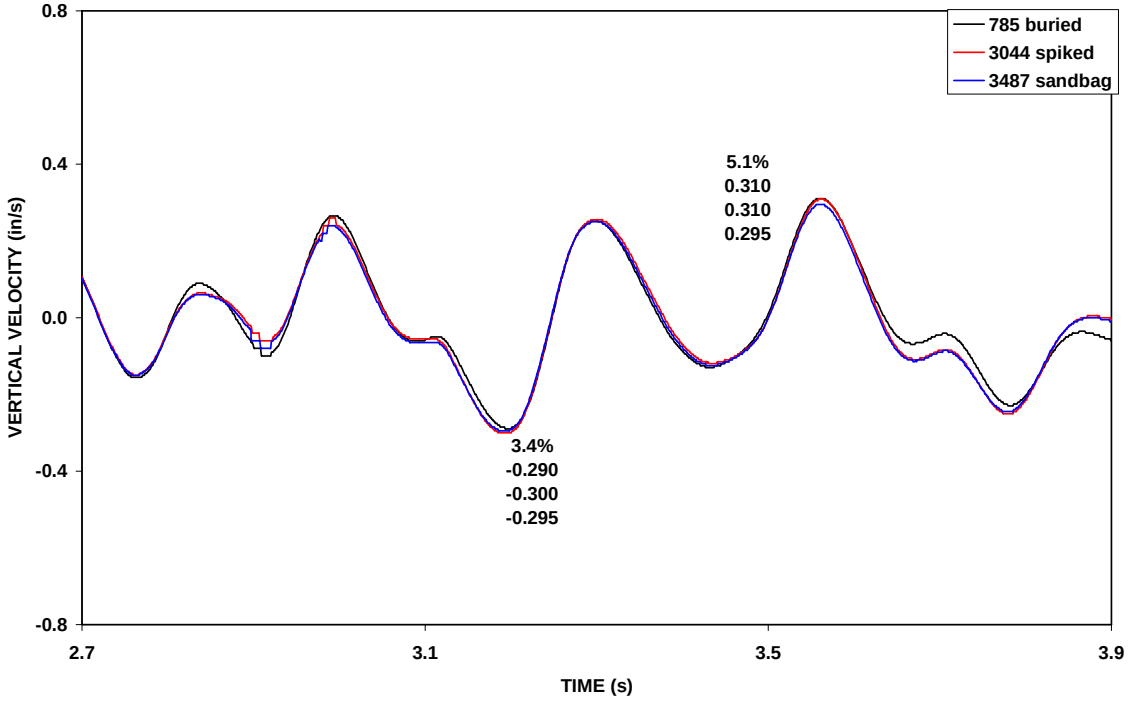
WY-4

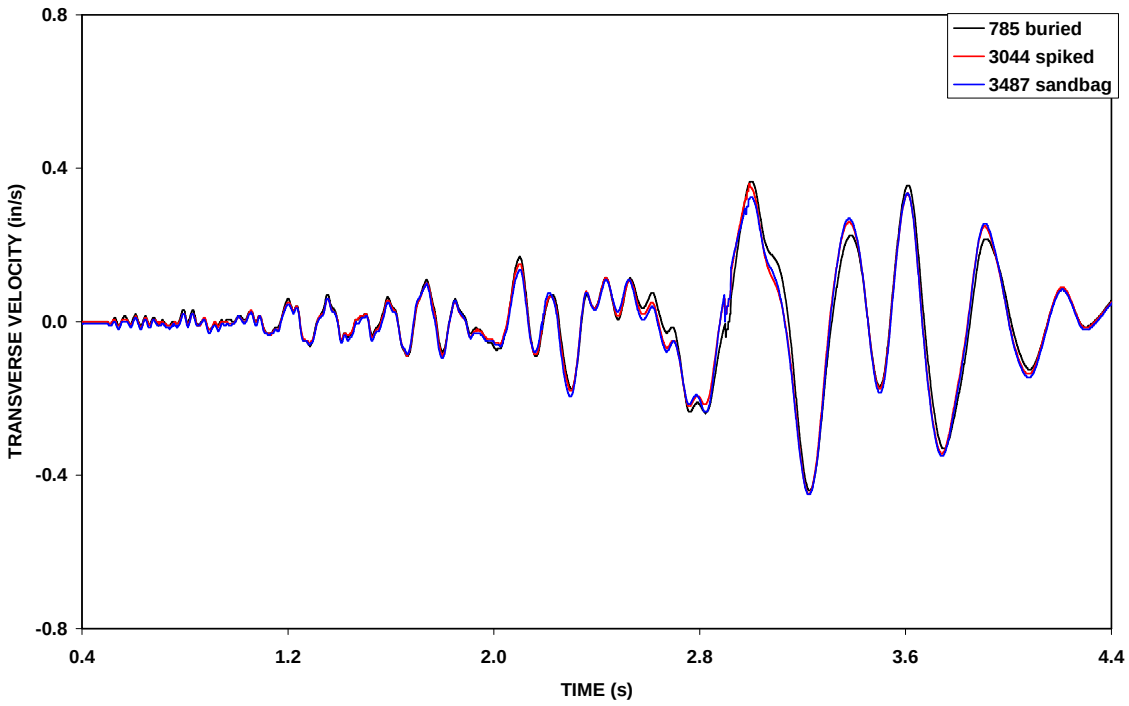
Cluster 3 SD 37.0 ft/lb$^{1/2}$

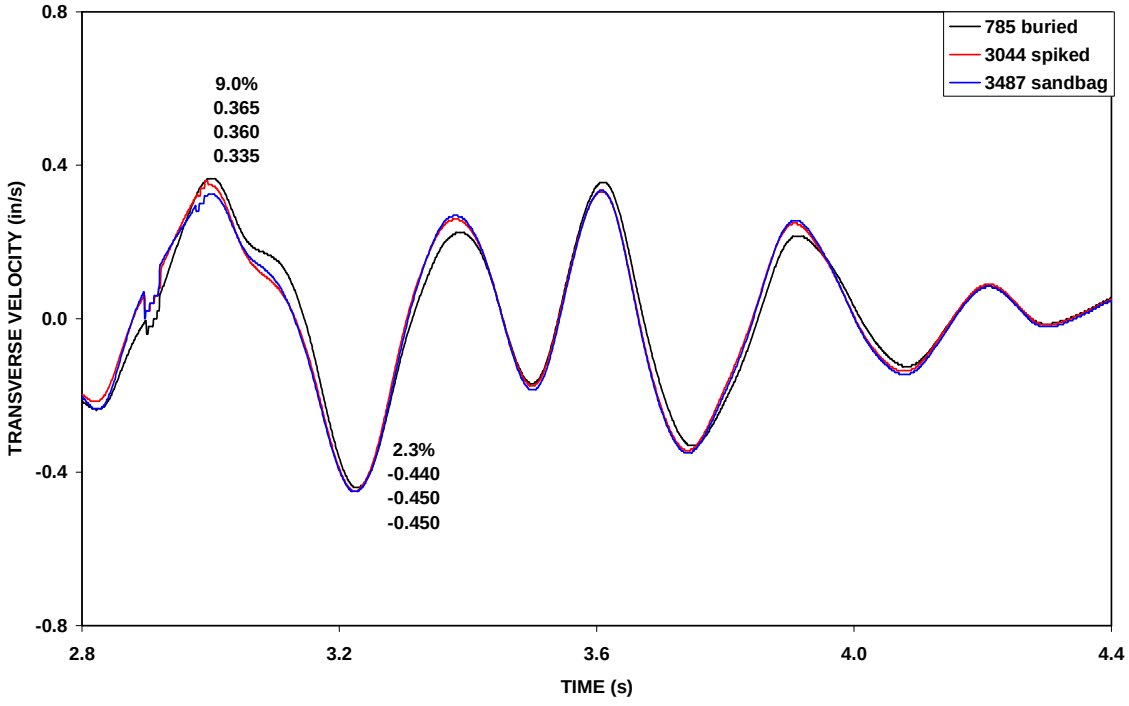

785 buried
3044 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)


785 buried
3044 spiked
3487 sandbag
3.1%
0.660
0.660
0.640
11.3%
-0.575
-0.605
-0.640
RADIAL VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
2.0
2.4
2.8
3.2
3.6
TIME (s)


785 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)

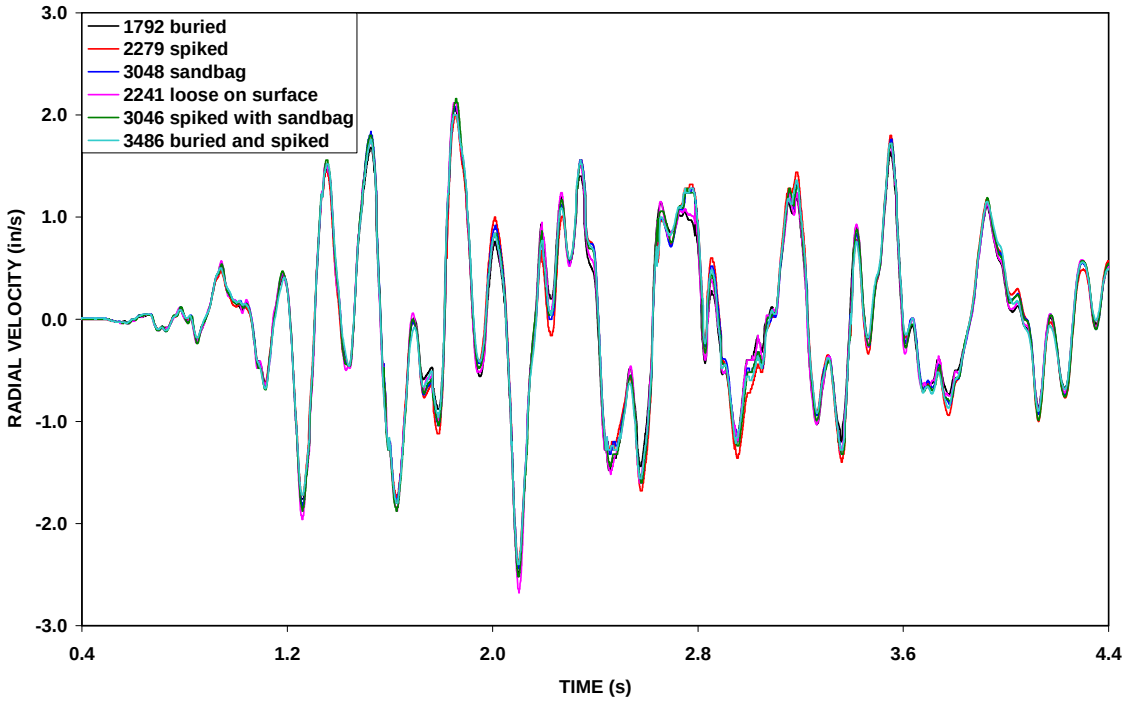

785 buried
3044 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
5.1%
0.310
0.310
0.295
3.4%
-0.290
-0.300
-0.295
2.7
3.1
3.5
3.9
TIME (s)

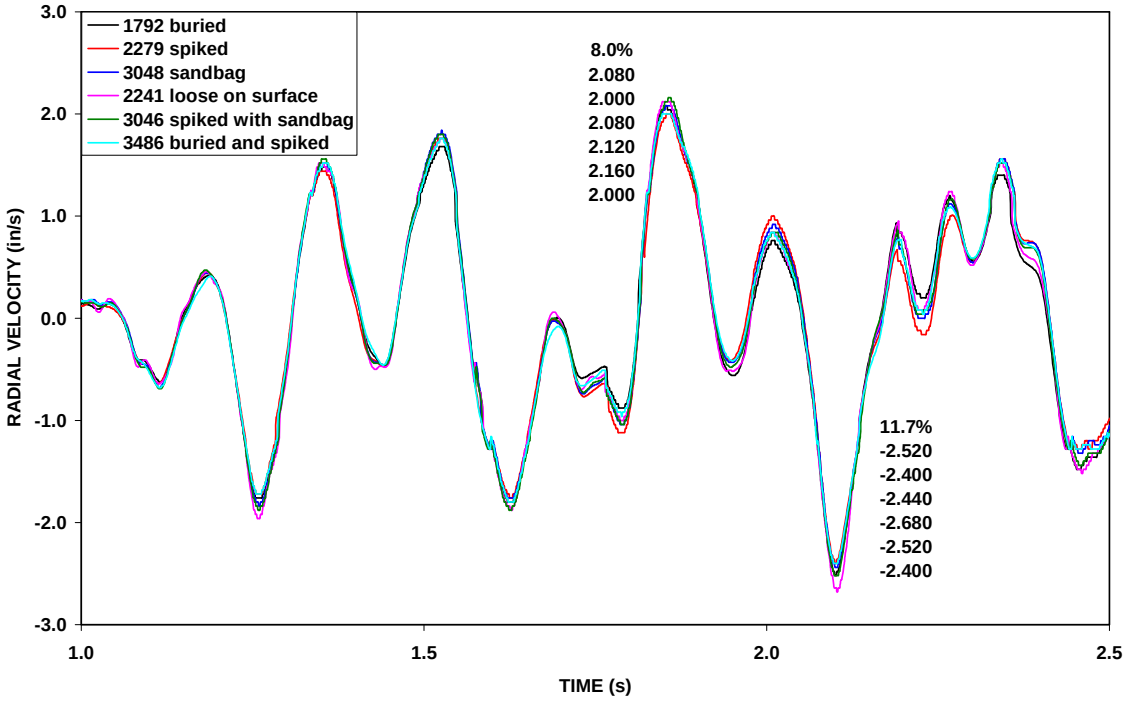

785 buried
3044 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)

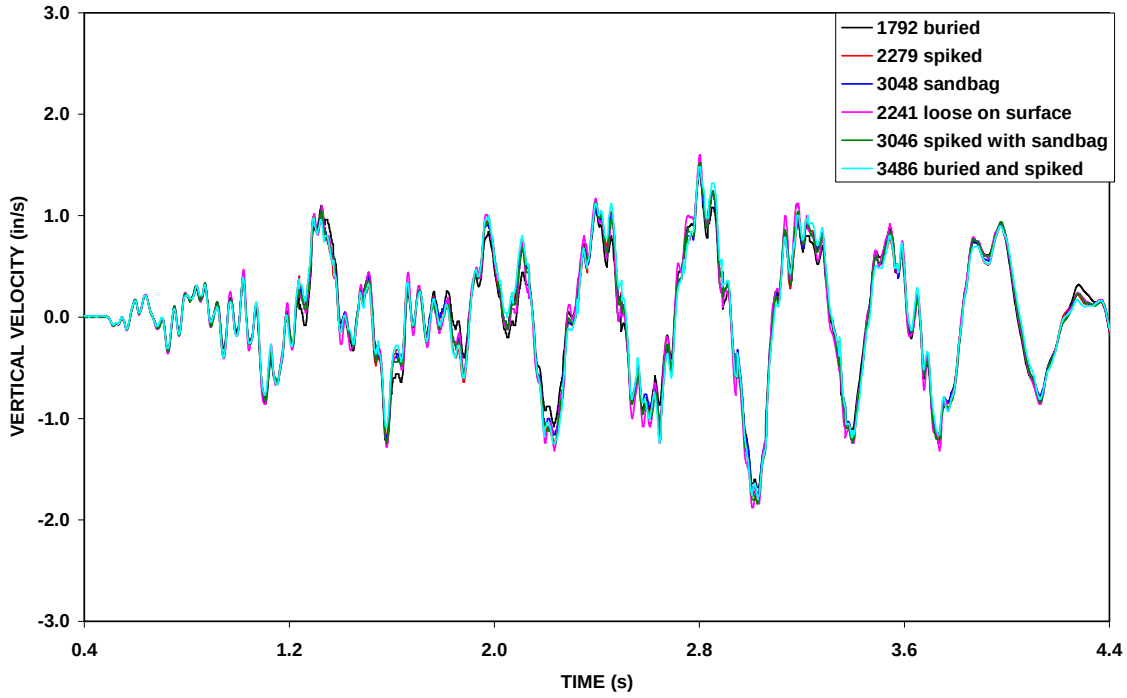

785 buried
3044 spiked
3487 sandbag
9.0%
0.365
0.360
0.335
2.3%
-0.440
-0.450
-0.450
TRANSVERSE VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
2.8
3.2
3.6
4.0
4.4
TIME (s)

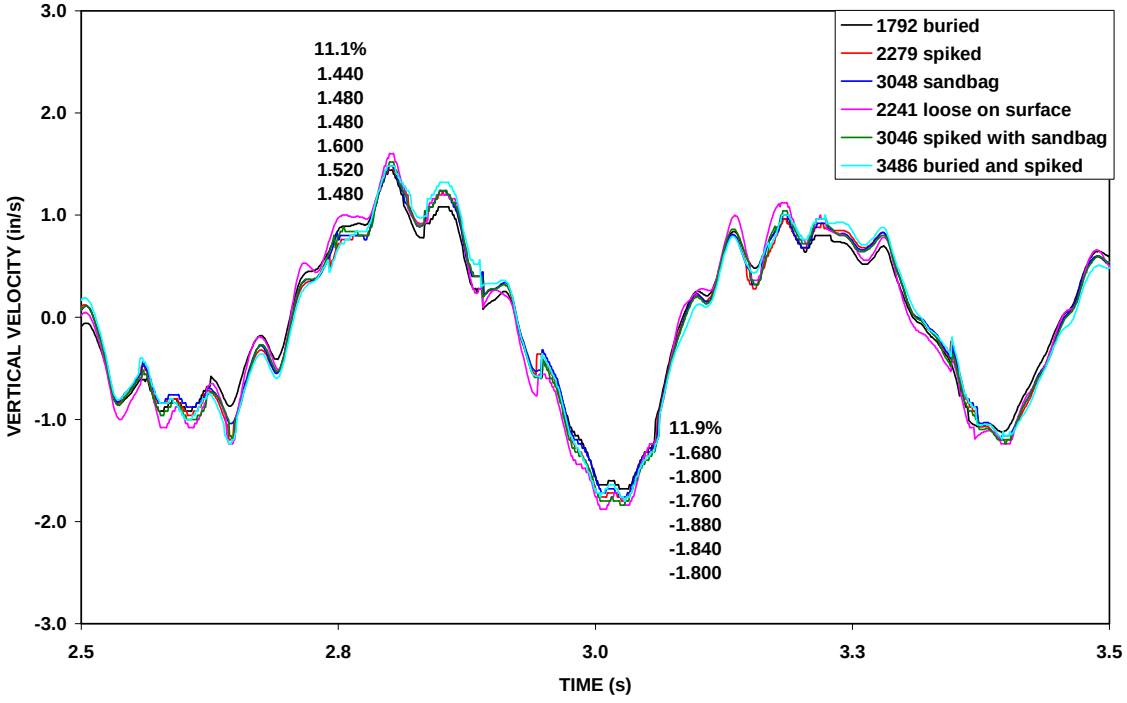
WY-5

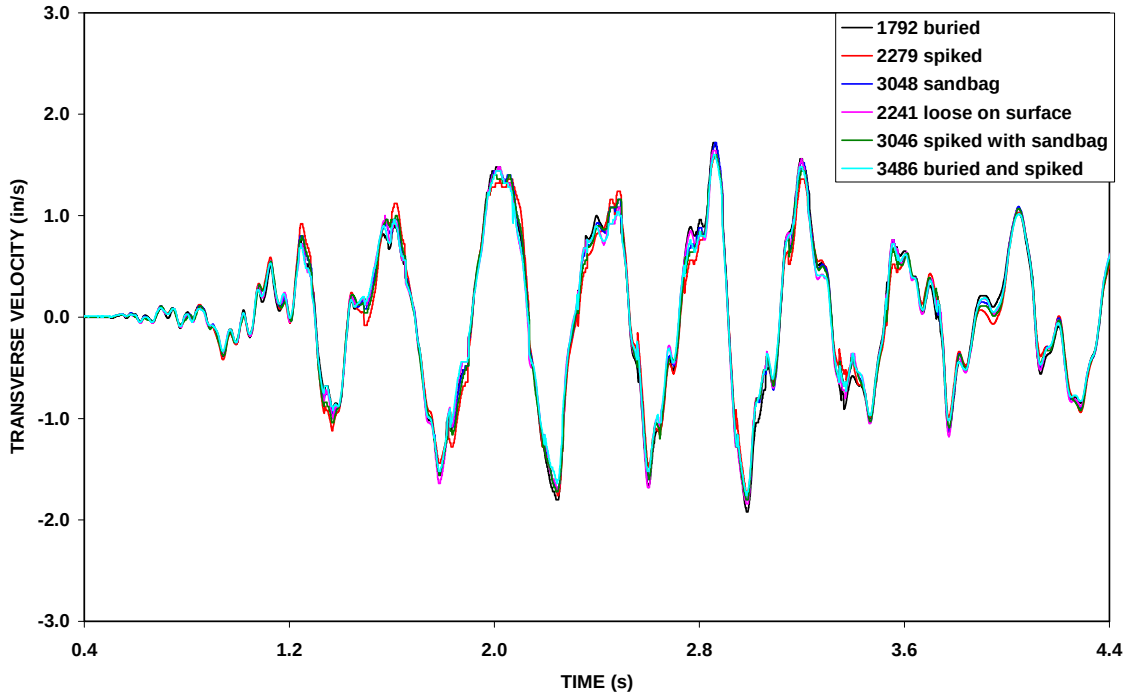
Cluster 1 SD 12.9 ft/lb$^{1/2}$

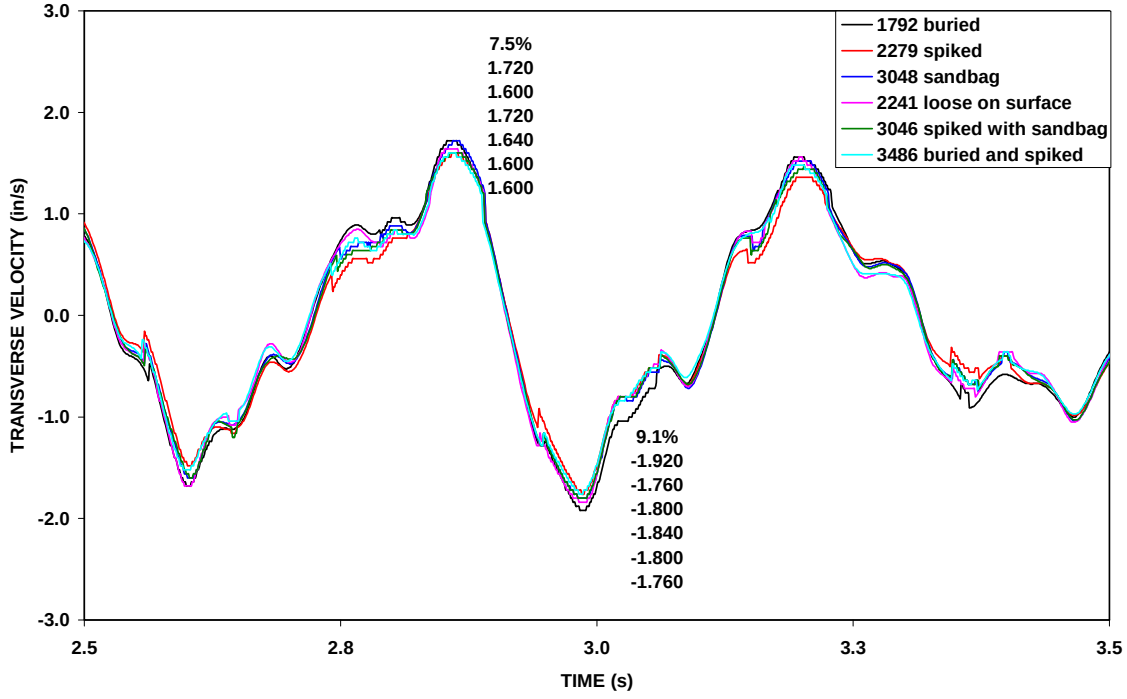

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
RADIAL VELOCITY (in/s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)

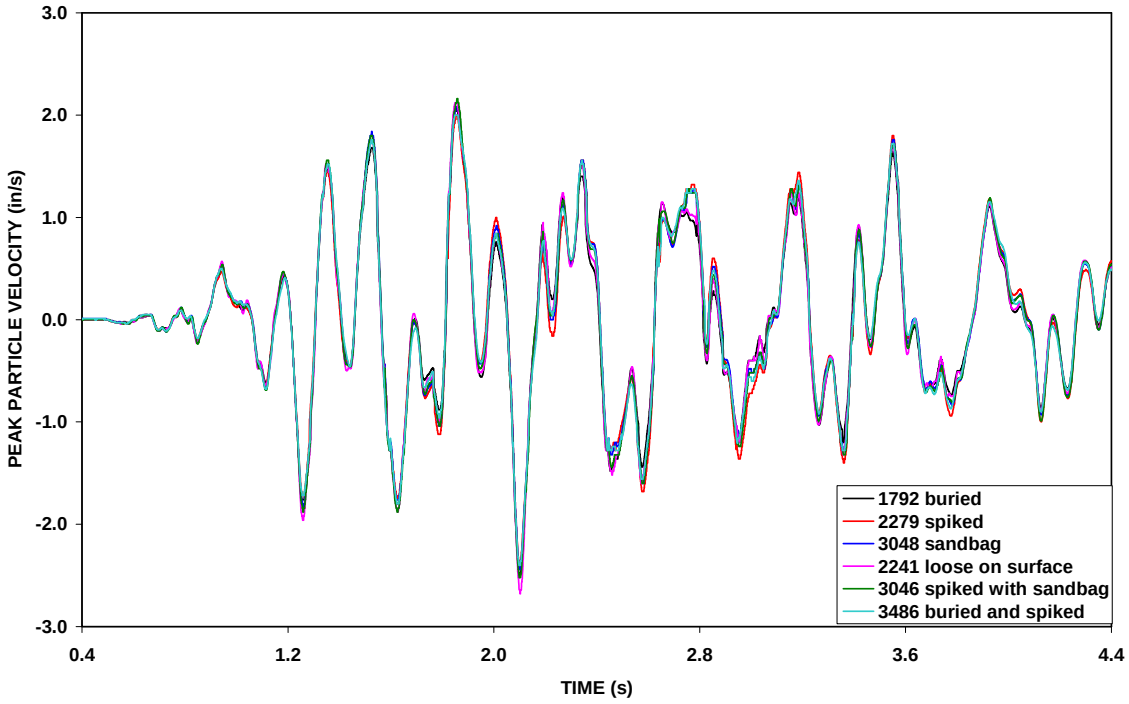

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
8.0%
2.080
2.000
2.080
2.120
2.160
2.000
11.7%
-2.520
-2.400
-2.440
-2.680
-2.520
-2.400
RADIAL VELOCITY (in/s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
1.0
1.5
2.0
2.5
TIME (s)

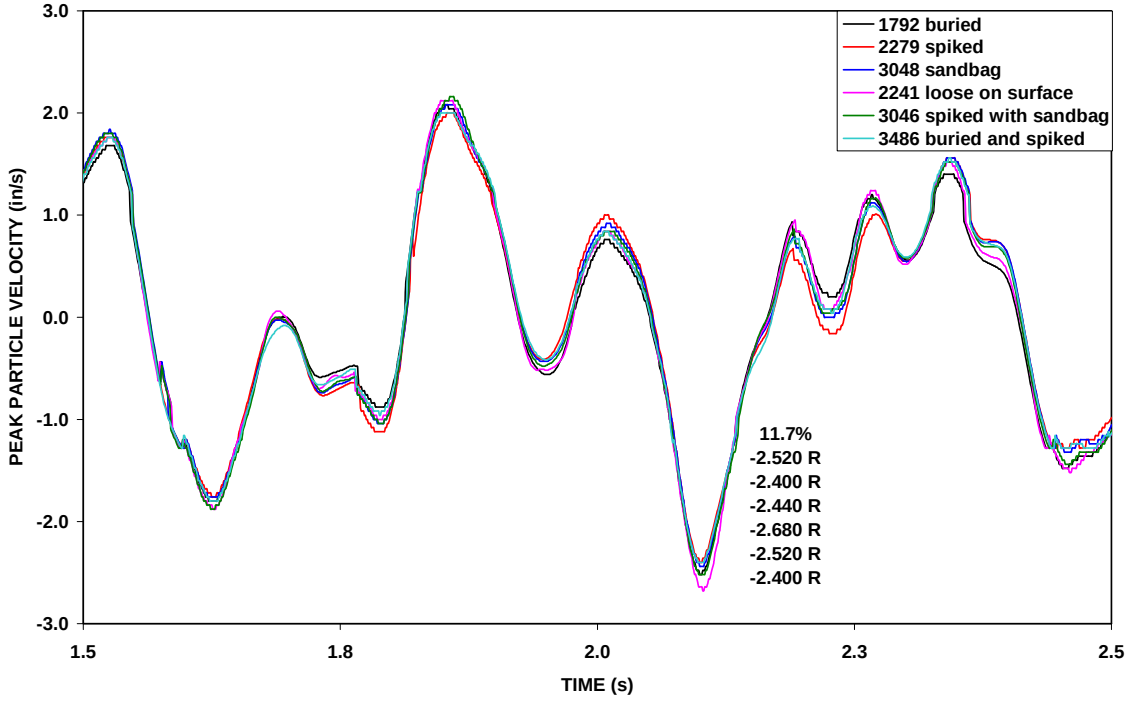

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
VERTICAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
1.2
2.0
2.8
3.6
4.4


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
11.1%
1.440
1.480
1.480
1.600
1.520
1.480
11.9%
-1.680
-1.800
-1.760
-1.880
-1.840
-1.800
VERTICAL VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
2.5
2.8
3.0
3.3
3.5


1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
TRANSVERSE VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.4
1.2
2.0
2.8
3.6
4.4

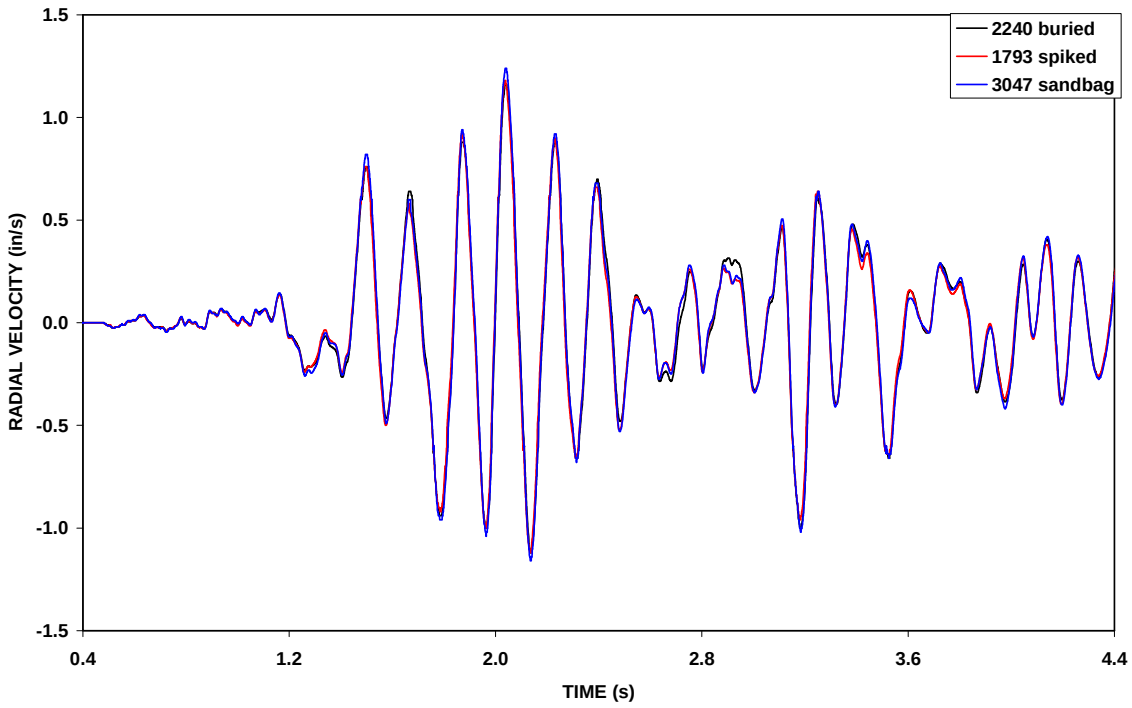

1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
7.5%
1.720
1.600
1.720
1.640
1.600
1.600
9.1%
-1.920
-1.760
-1.800
-1.840
-1.800
-1.760
TRANSVERSE VELOCITY (in/s)
TIME (s)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
2.5
2.8
3.0
3.3
3.5

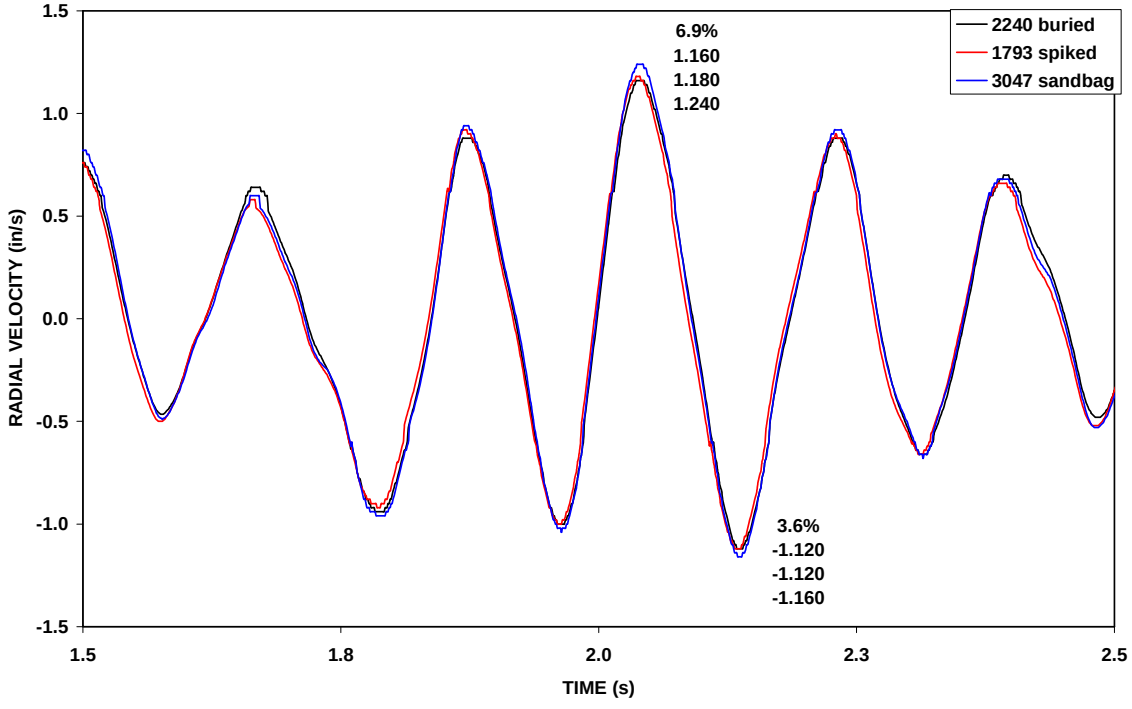

3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
PEAK PARTICLE VELOCITY (in/s)
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked

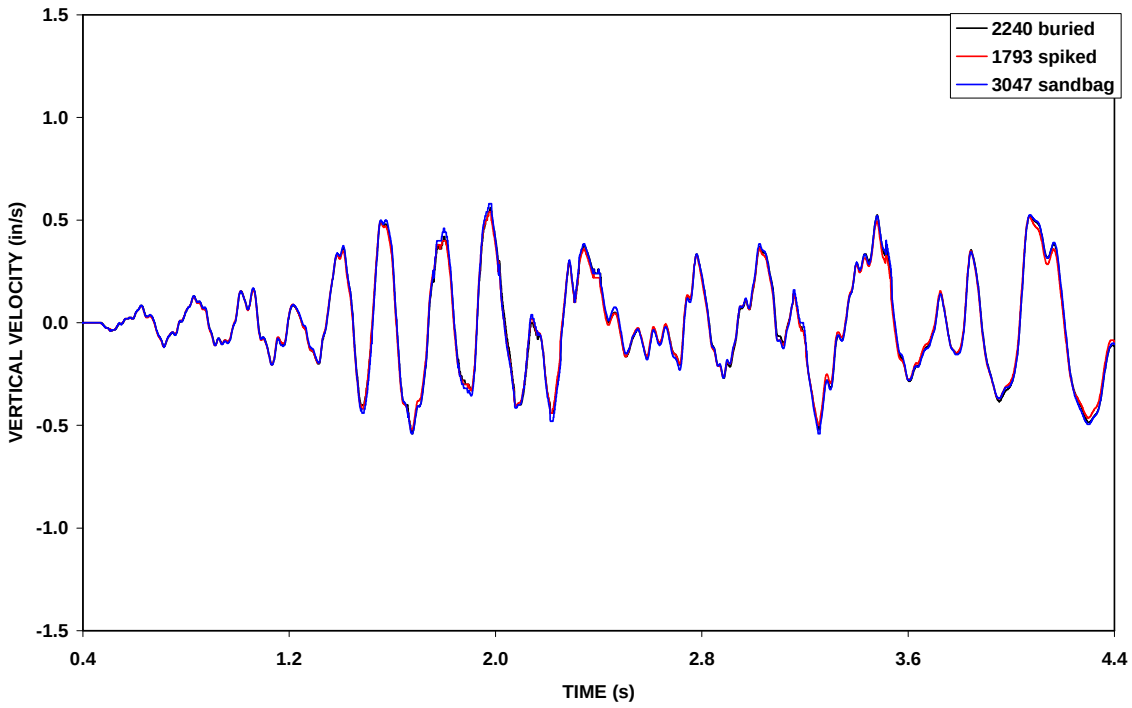

3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
PEAK PARTICLE VELOCITY (in/s)
1.5
1.8
2.0
2.3
2.5
TIME (s)
1792 buried
2279 spiked
3048 sandbag
2241 loose on surface
3046 spiked with sandbag
3486 buried and spiked
11.7%
-2.520 R
-2.400 R
-2.440 R
-2.680 R
-2.520 R
-2.400 R

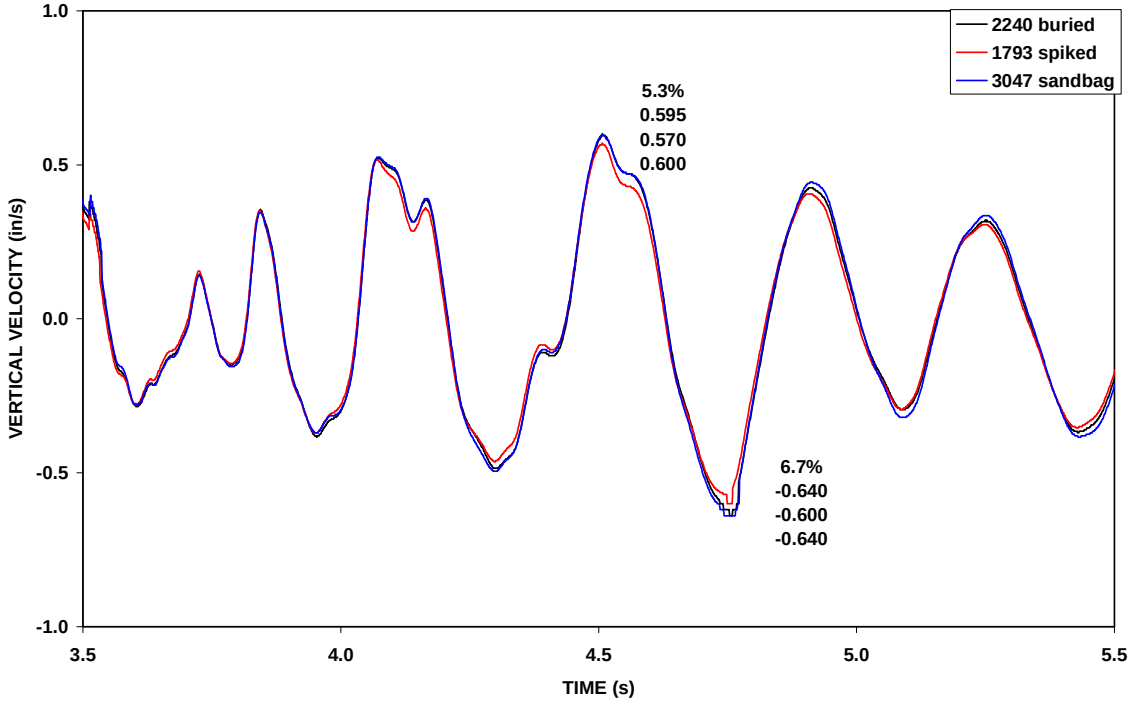
WY-5

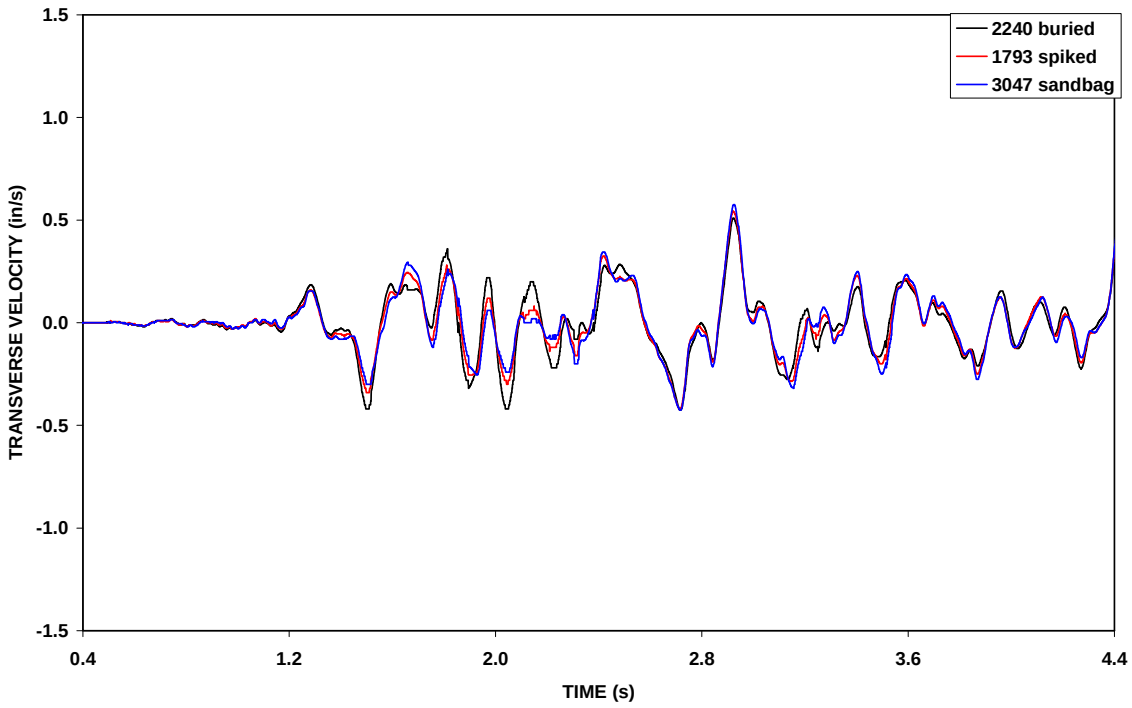
Cluster 2 SD 26.0 ft/lb$^{1/2}$

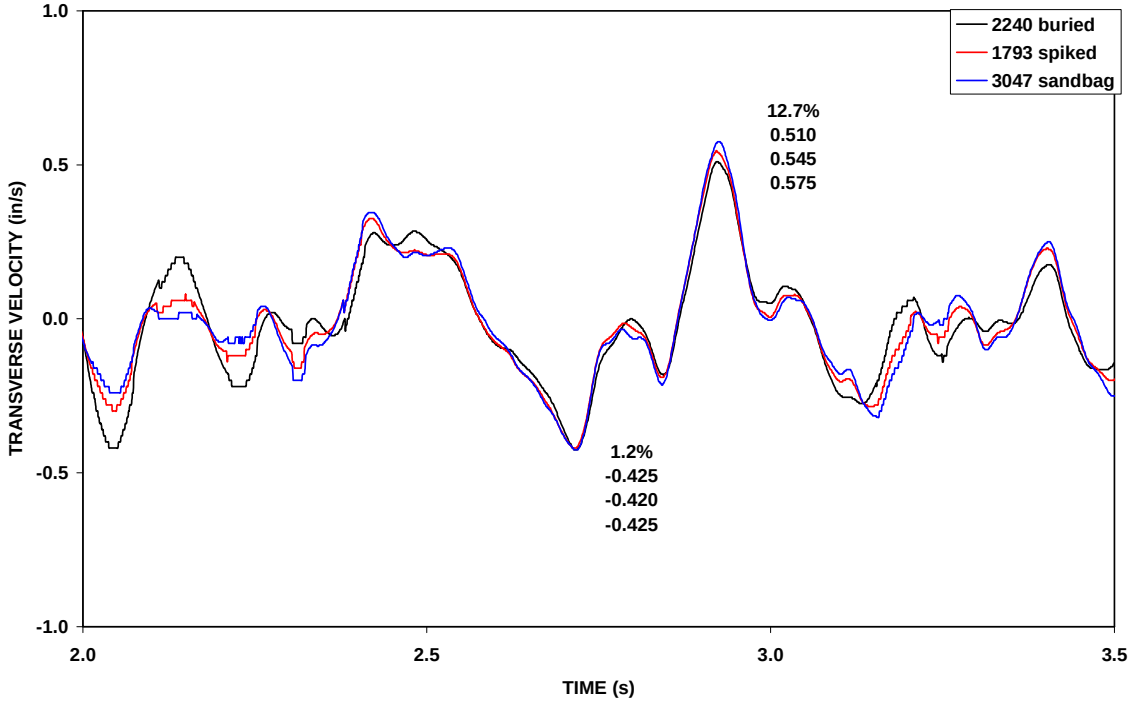

2240 buried
1793 spiked
3047 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
1.2
2.0
2.8
3.6
4.4


2240 buried
1793 spiked
3047 sandbag
6.9%
1.160
1.180
1.240
3.6%
-1.120
-1.120
-1.160
RADIAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1.5
1.8
2.0
2.3
2.5


2240 buried
1793 spiked
3047 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
1.2
2.0
2.8
3.6
4.4

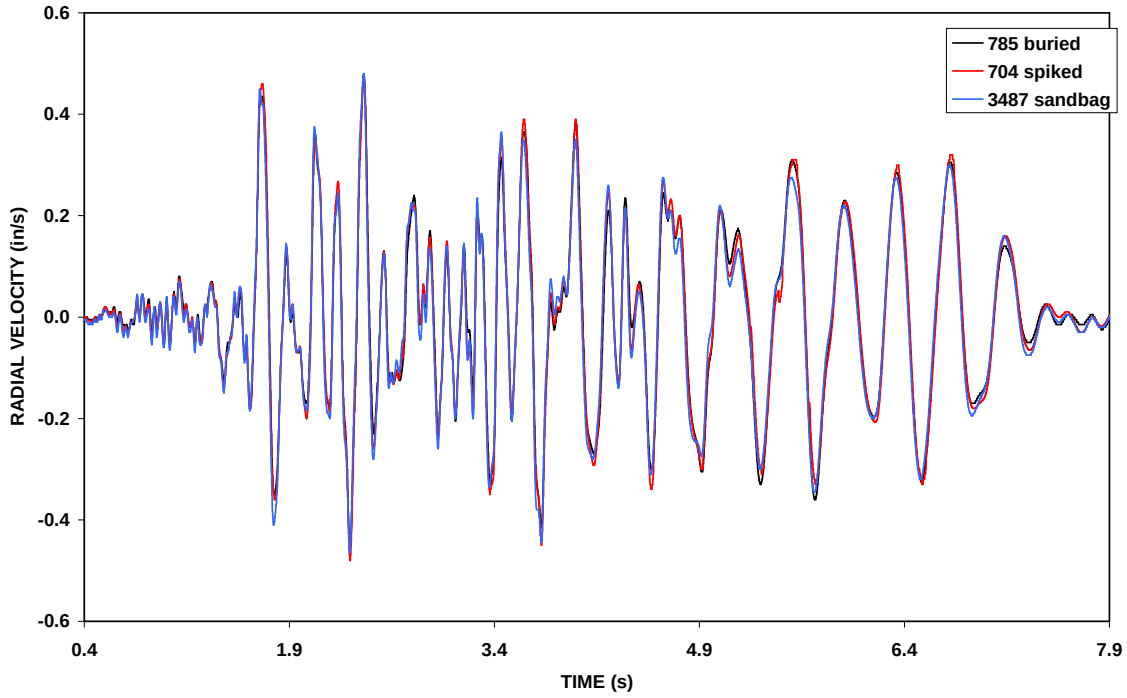

2240 buried
1793 spiked
3047 sandbag
5.3%
0.595
0.570
0.600
6.7%
-0.640
-0.600
-0.640
VERTICAL VELOCITY (in/s)
TIME (s)
1.0
0.5
0.0
-0.5
-1.0
3.5
4.0
4.5
5.0
5.5

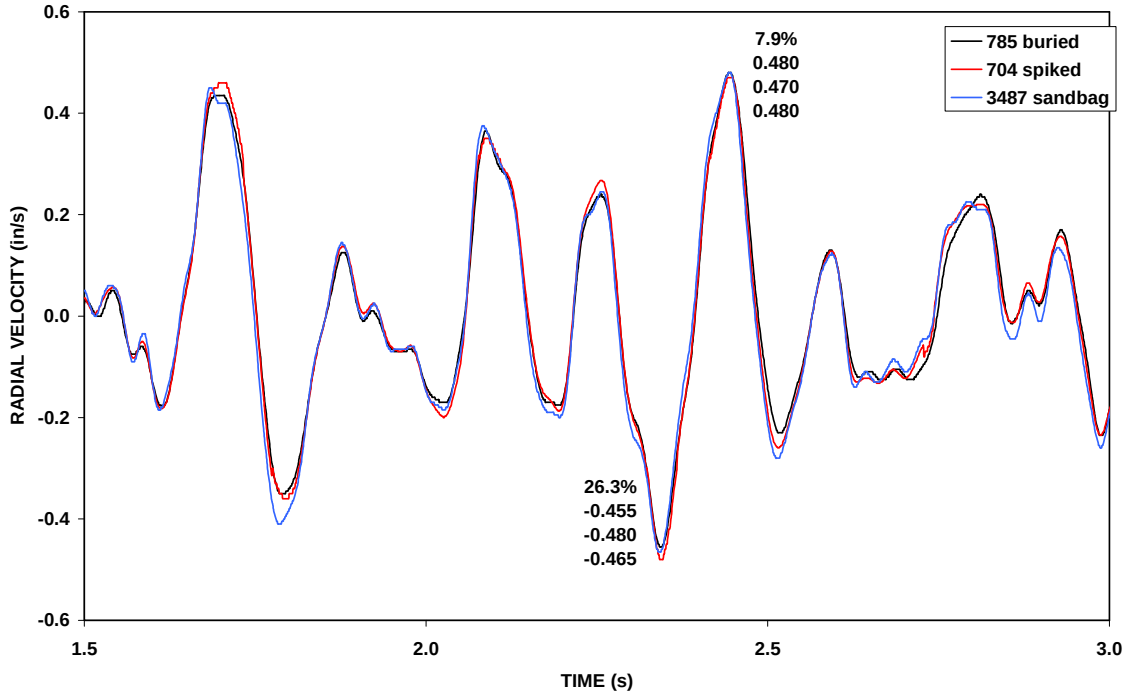

2240 buried
1793 spiked
3047 sandbag
TRANSVERSE VELOCITY (in/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)

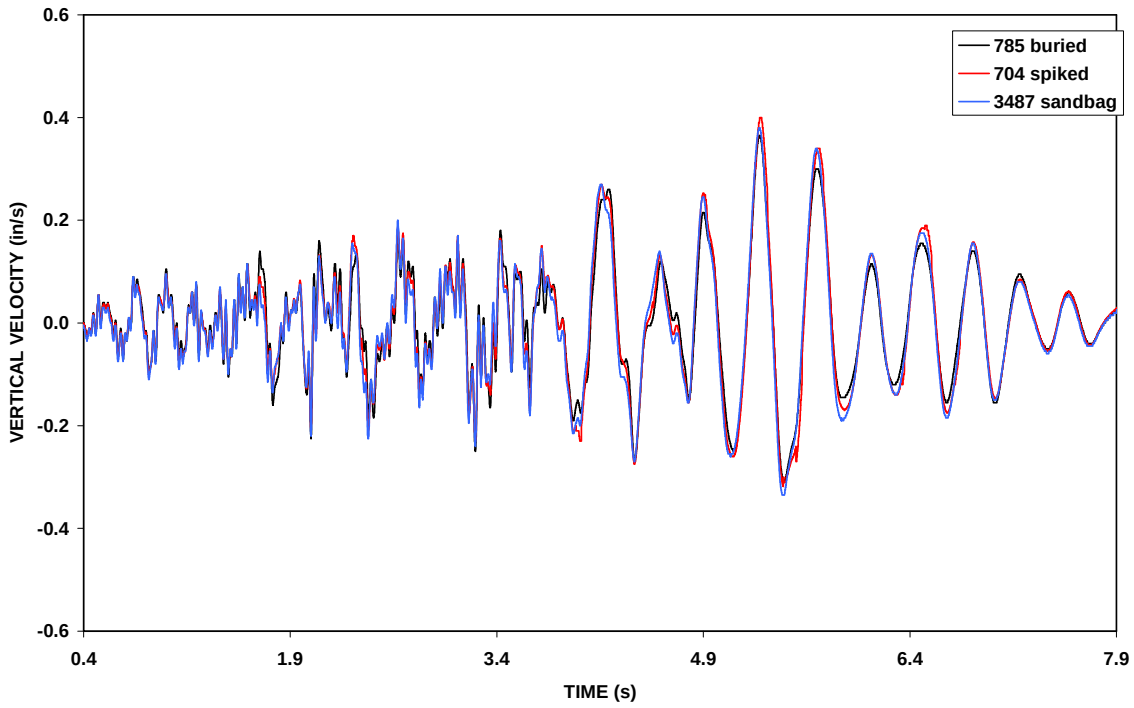

2240 buried
1793 spiked
3047 sandbag
12.7%
0.510
0.545
0.575
1.2%
-0.425
-0.420
-0.425
TRANSVERSE VELOCITY (in/s)
1.0
0.5
0.0
-0.5
-1.0
2.0
2.5
3.0
3.5
TIME (s)

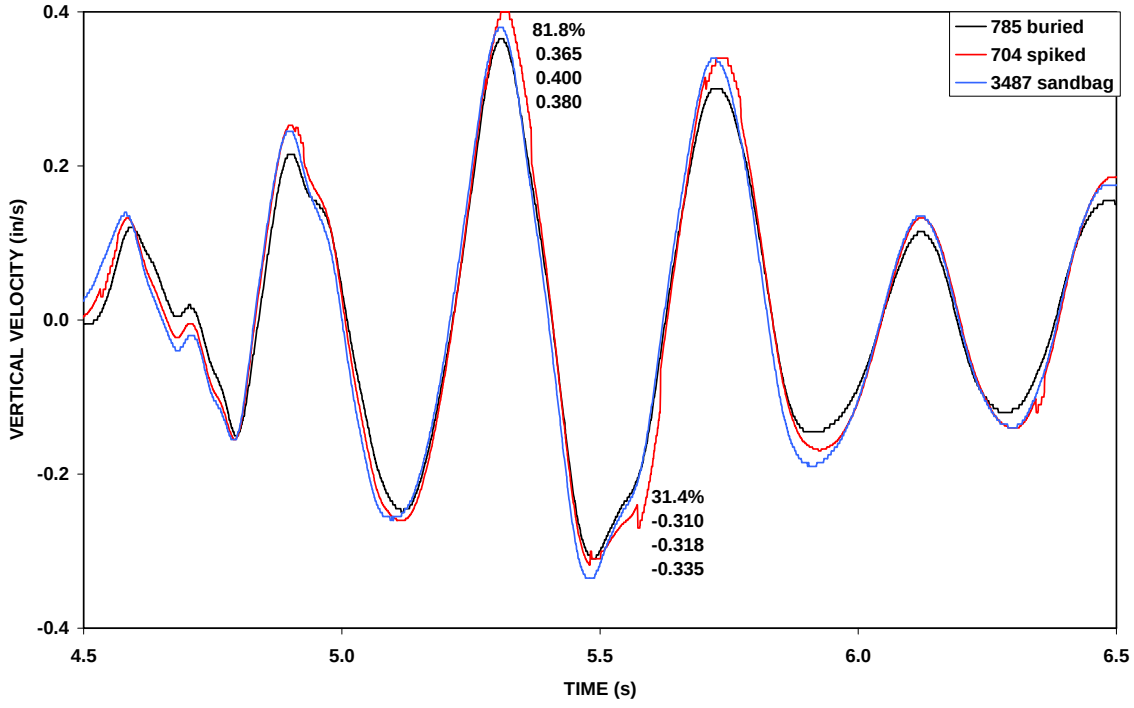
WY-5

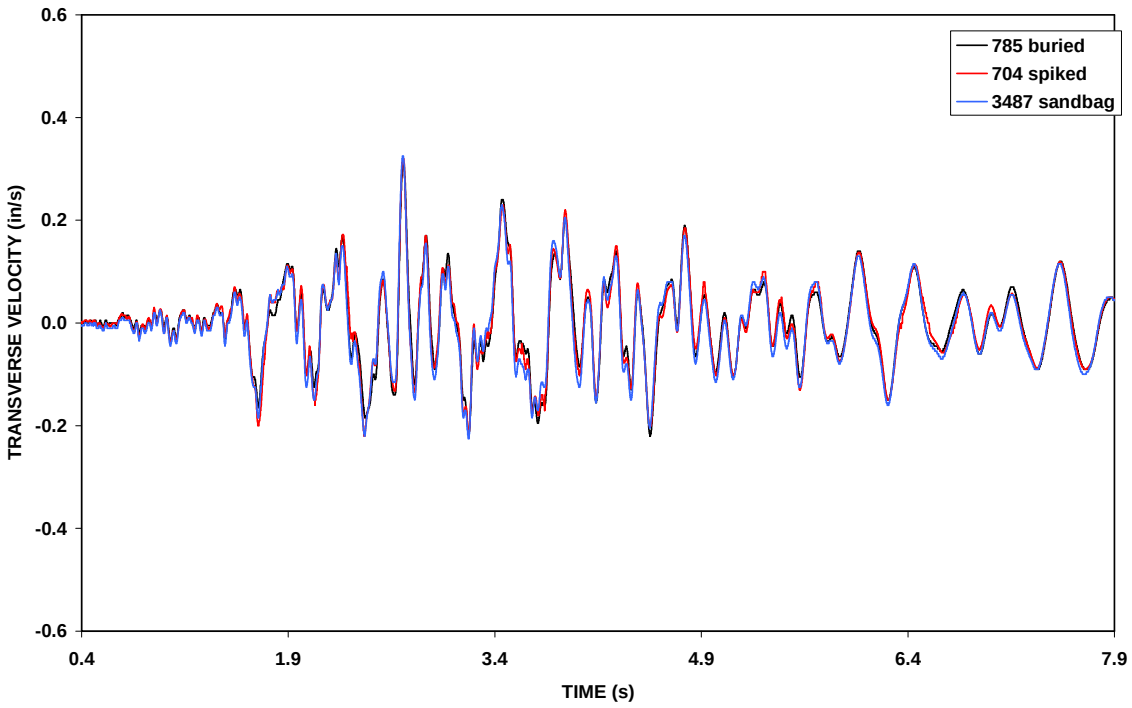
Cluster 3 SD 44.2 ft/lb$^{1/2}$

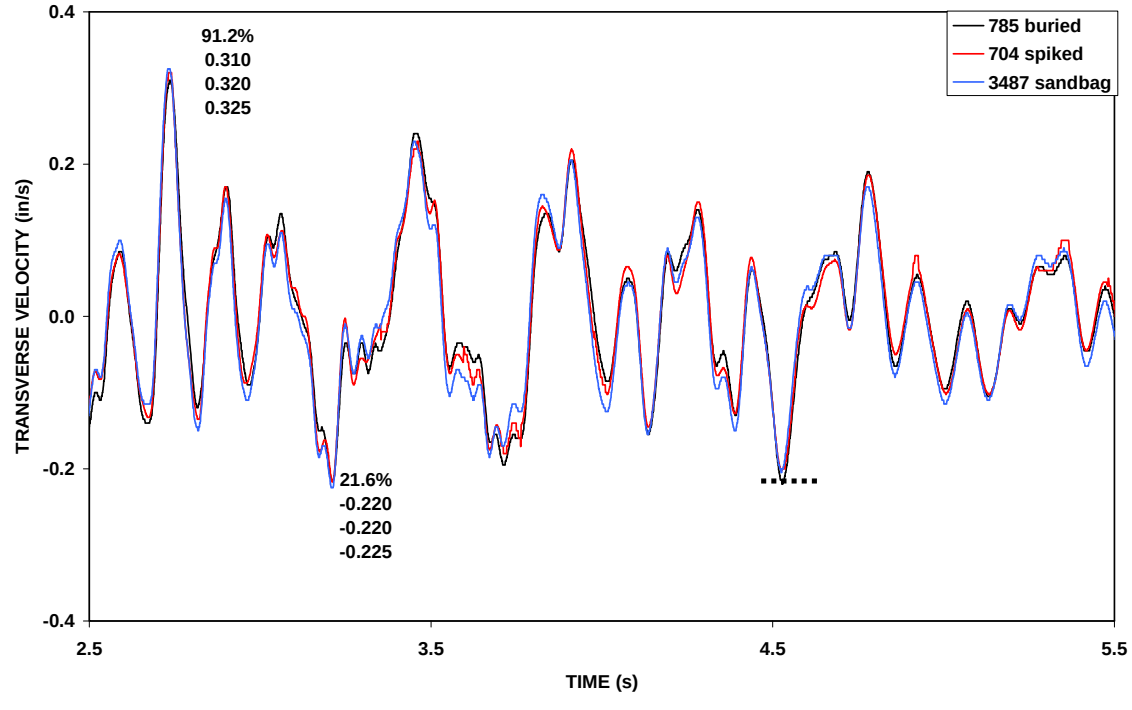

785 buried
704 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
1.9
3.4
4.9
6.4
7.9
TIME (s)


785 buried
704 spiked
3487 sandbag
7.9%
0.480
0.470
0.480
26.3%
-0.455
-0.480
-0.465
RADIAL VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1.5
2.0
2.5
3.0
TIME (s)


785 buried
704 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
1.9
3.4
4.9
6.4
7.9
TIME (s)

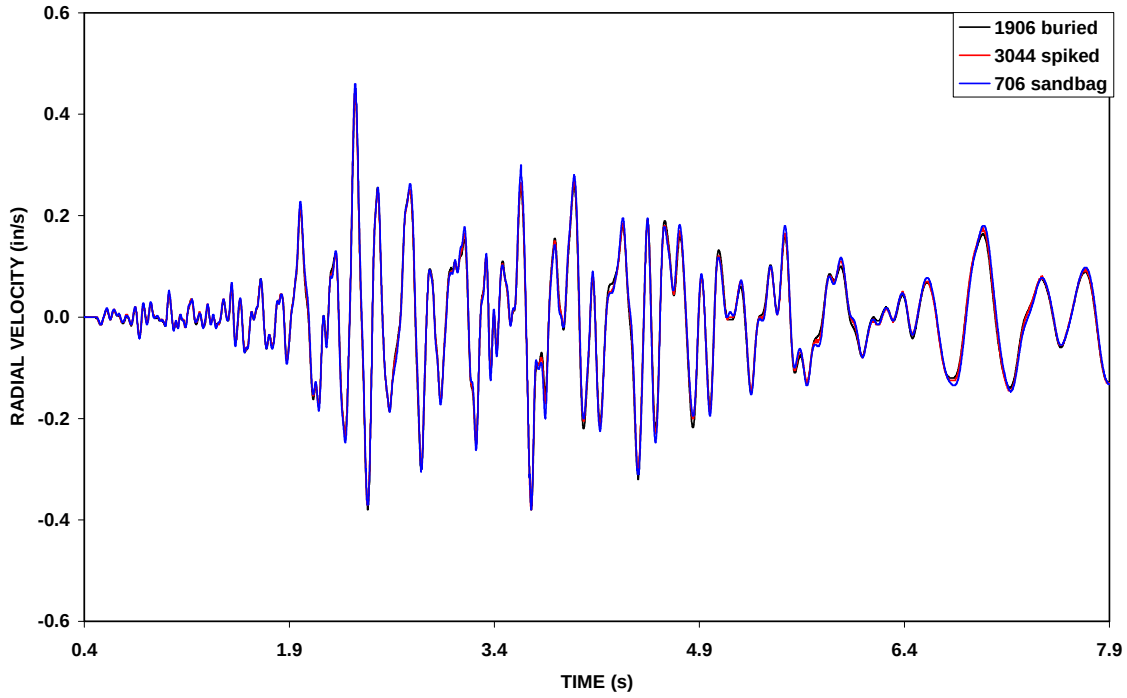

785 buried
704 spiked
3487 sandbag
81.8%
0.365
0.400
0.380
31.4%
-0.310
-0.318
-0.335
VERTICAL VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
4.5
5.0
5.5
6.0
6.5
TIME (s)

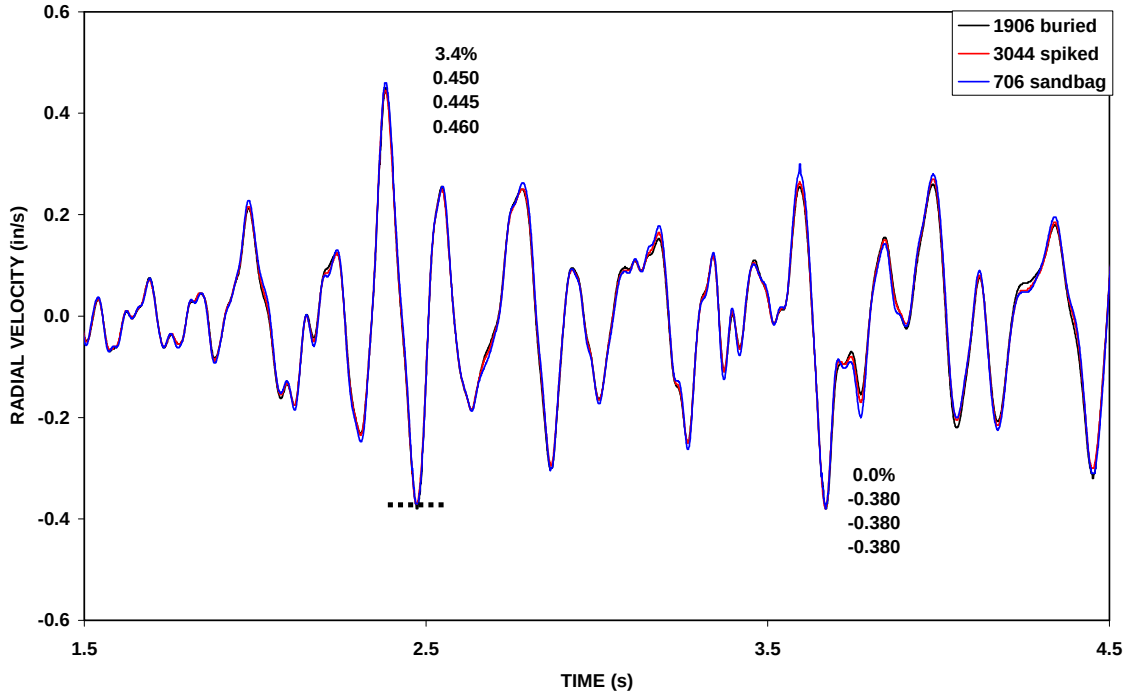

785 buried
704 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
1.9
3.4
4.9
6.4
7.9
TIME (s)

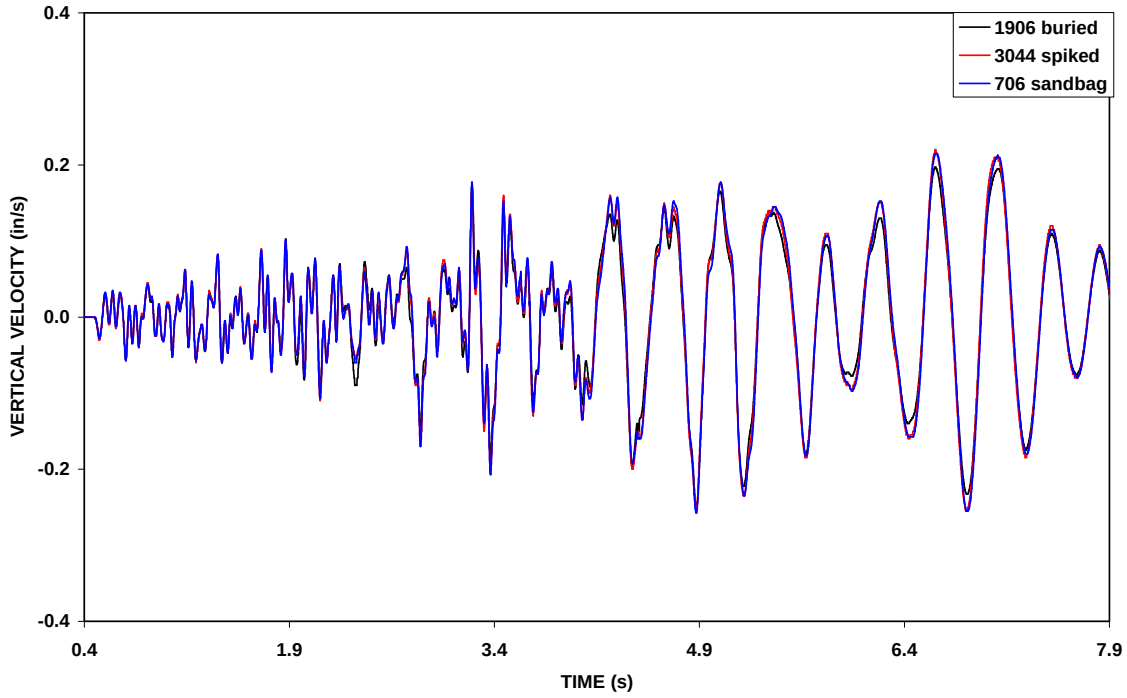

785 buried
704 spiked
3487 sandbag
91.2%
0.310
0.320
0.325
21.6%
-0.220
-0.220
-0.225
TRANSVERSE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
2.5
3.5
4.5
5.5
TIME (s)

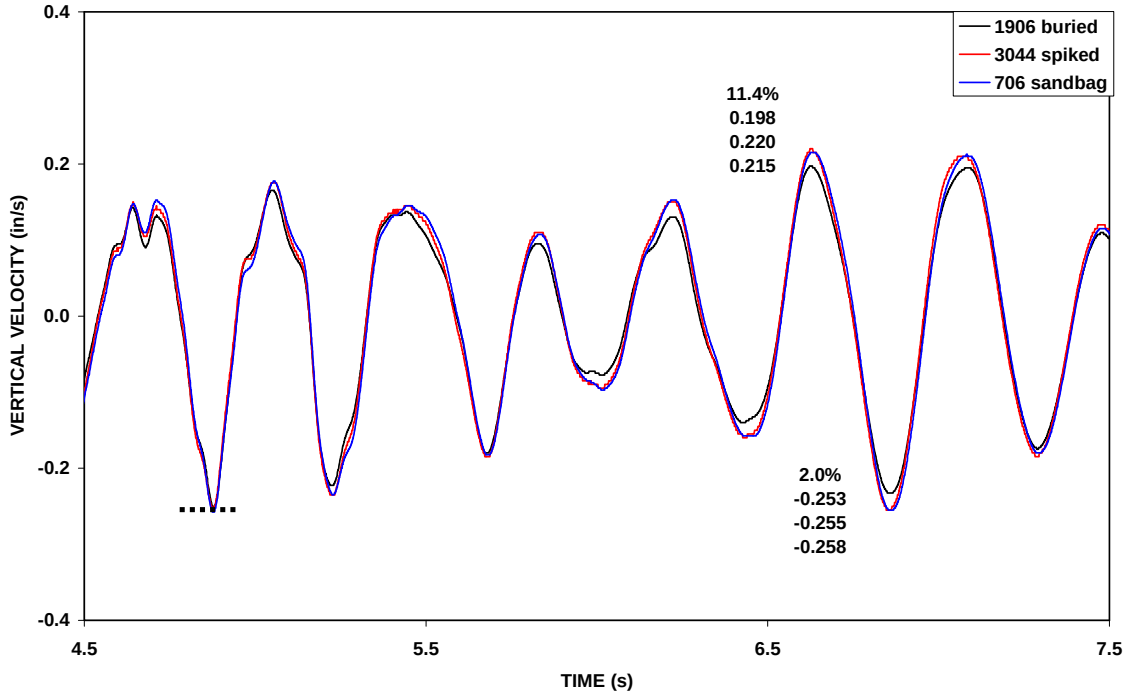
WY-5

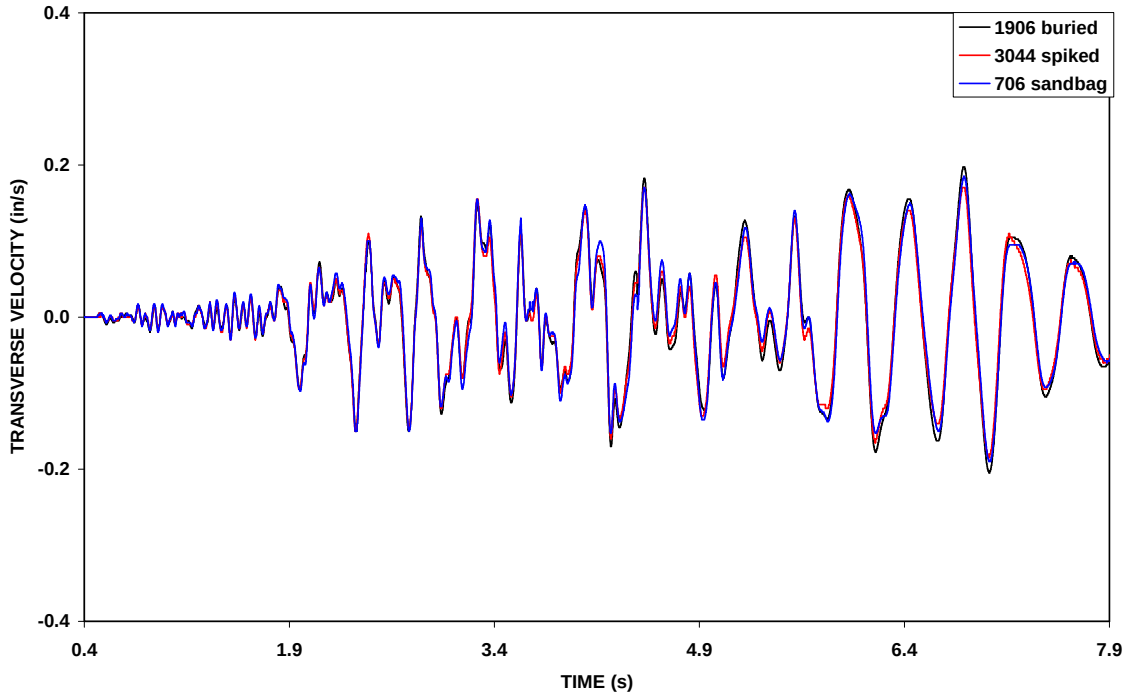
Cluster 4 SD 61.2 ft/lb$^{1/2}$

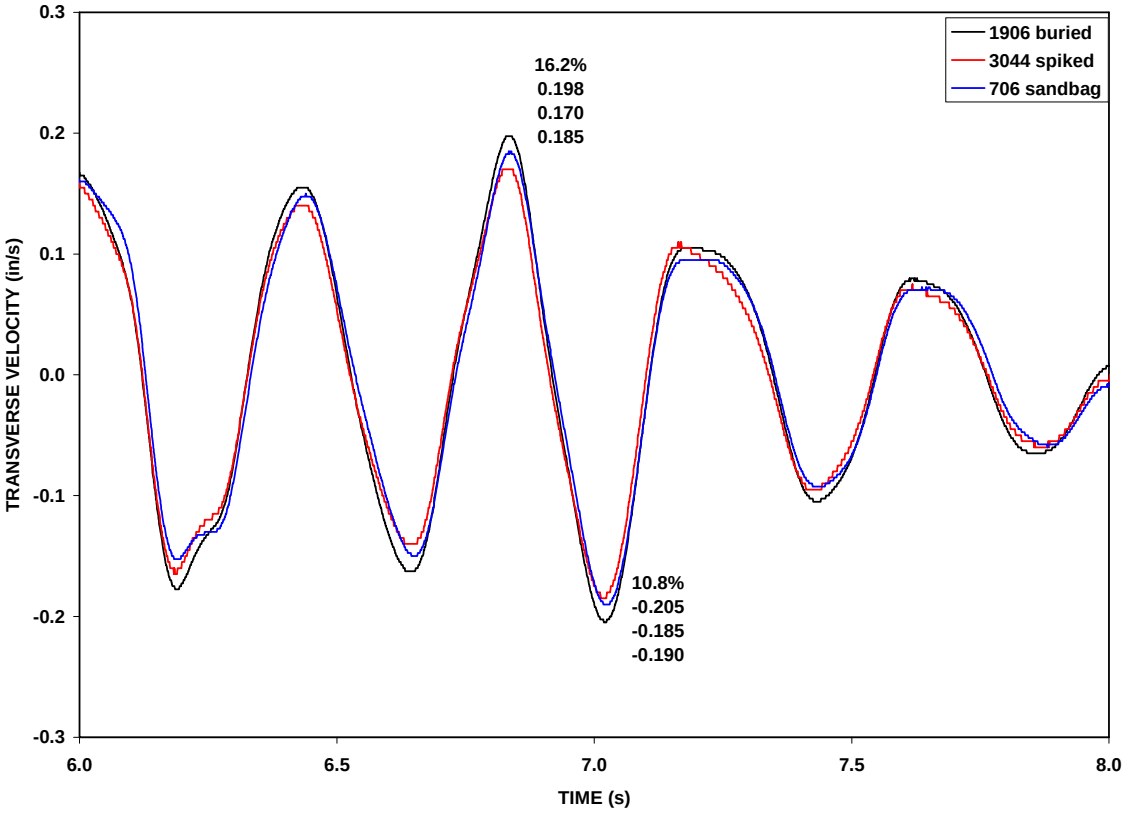

1906 buried
3044 spiked
706 sandbag
RADIAL VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
0.4
1.9
3.4
4.9
6.4
7.9
TIME (s)


1906 buried
3044 spiked
706 sandbag
3.4%
0.450
0.445
0.460
0.0%
-0.380
-0.380
-0.380
RADIAL VELOCITY (in/s)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1.5
2.5
3.5
4.5
TIME (s)


1906 buried
3044 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.4
1.9
3.4
4.9
6.4
7.9
TIME (s)

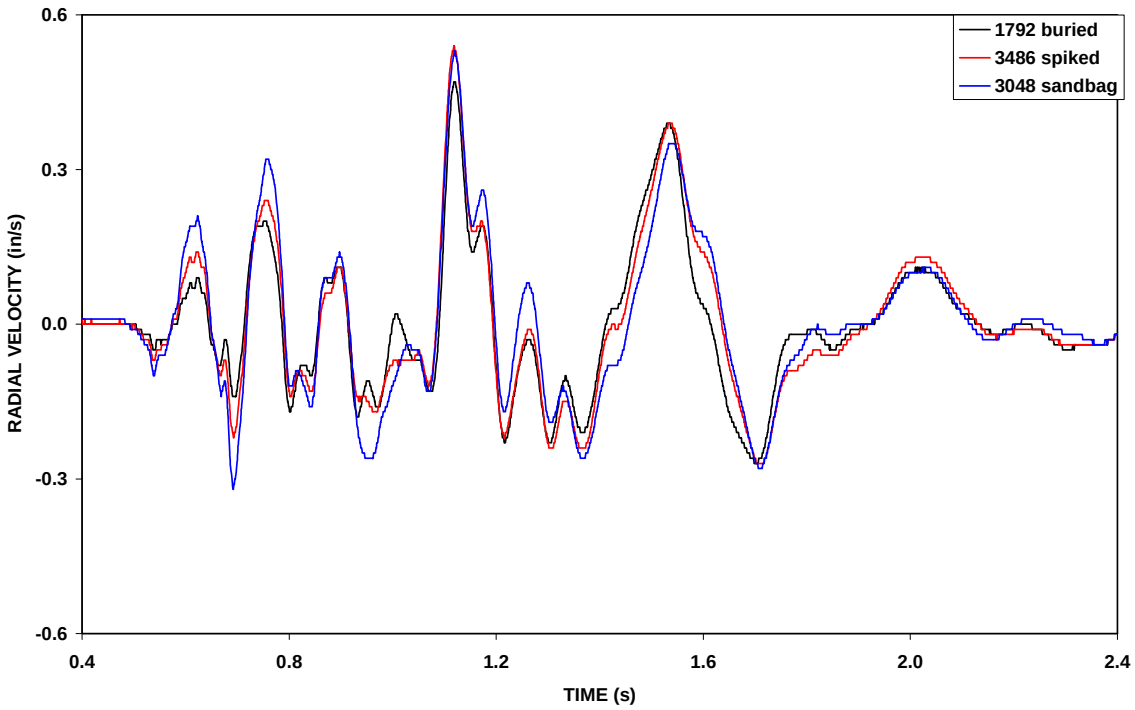

1906 buried
3044 spiked
706 sandbag
11.4%
0.198
0.220
0.215
2.0%
-0.253
-0.255
-0.258
VERTICAL VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
4.5
5.5
6.5
7.5
TIME (s)

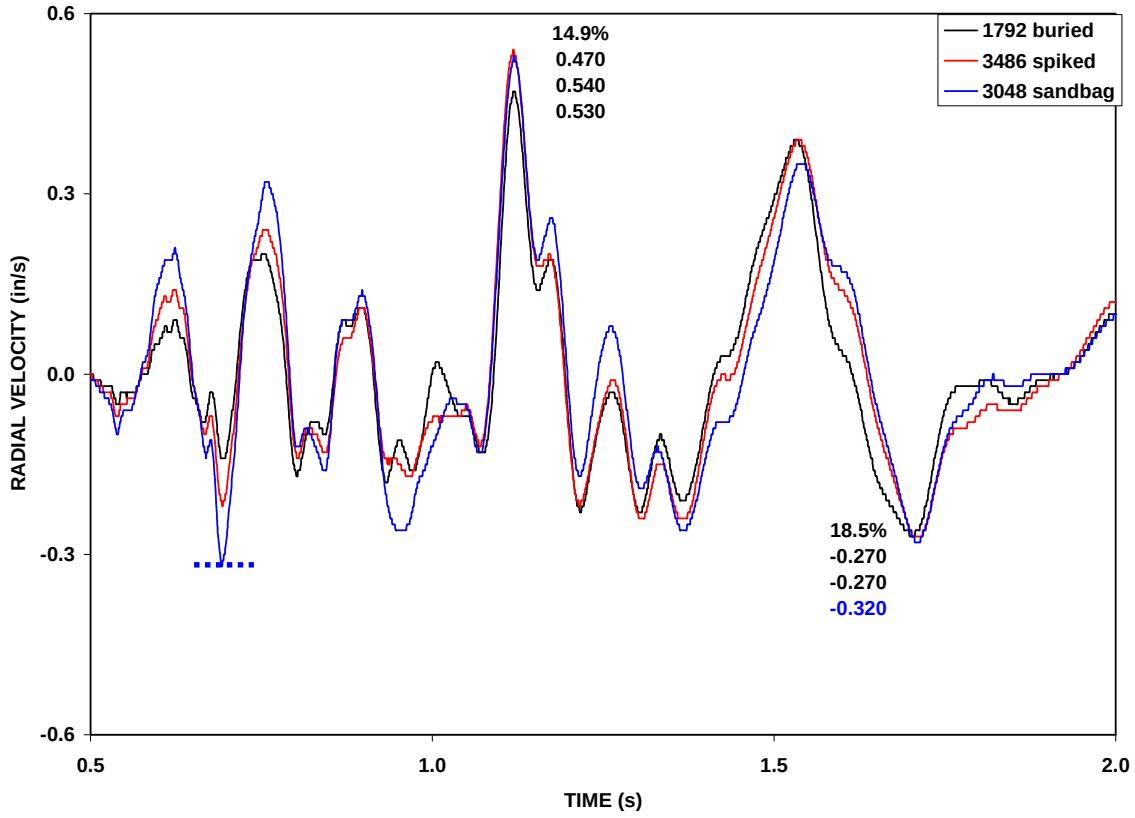

1906 buried
3044 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.4
1.9
3.4
4.9
6.4
7.9
TIME (s)

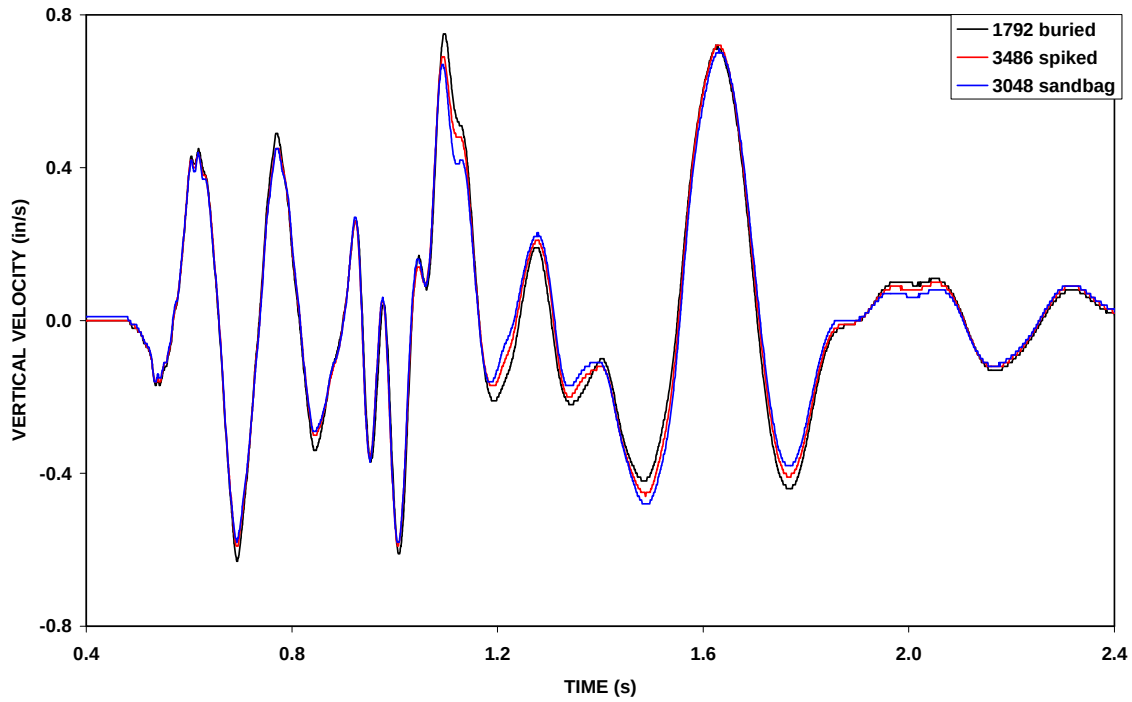

1906 buried
3044 spiked
706 sandbag
16.2%
0.198
0.170
0.185
10.8%
-0.205
-0.185
-0.190
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
6.0
6.5
7.0
7.5
8.0
TIME (s)

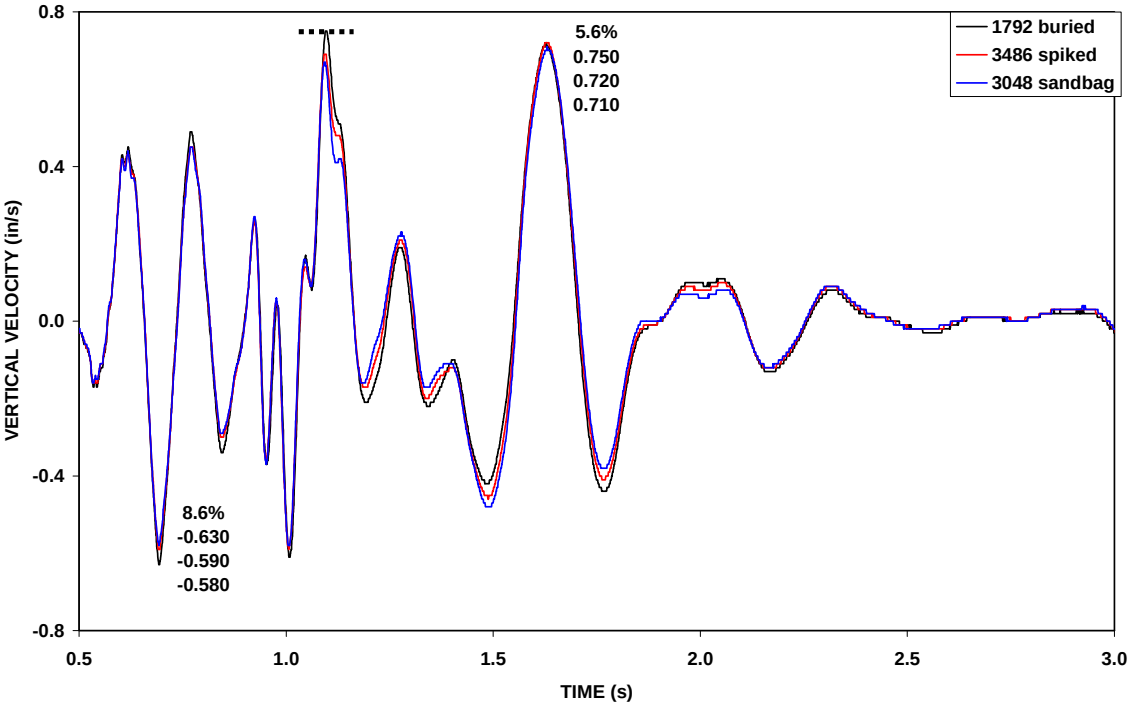
WY-6

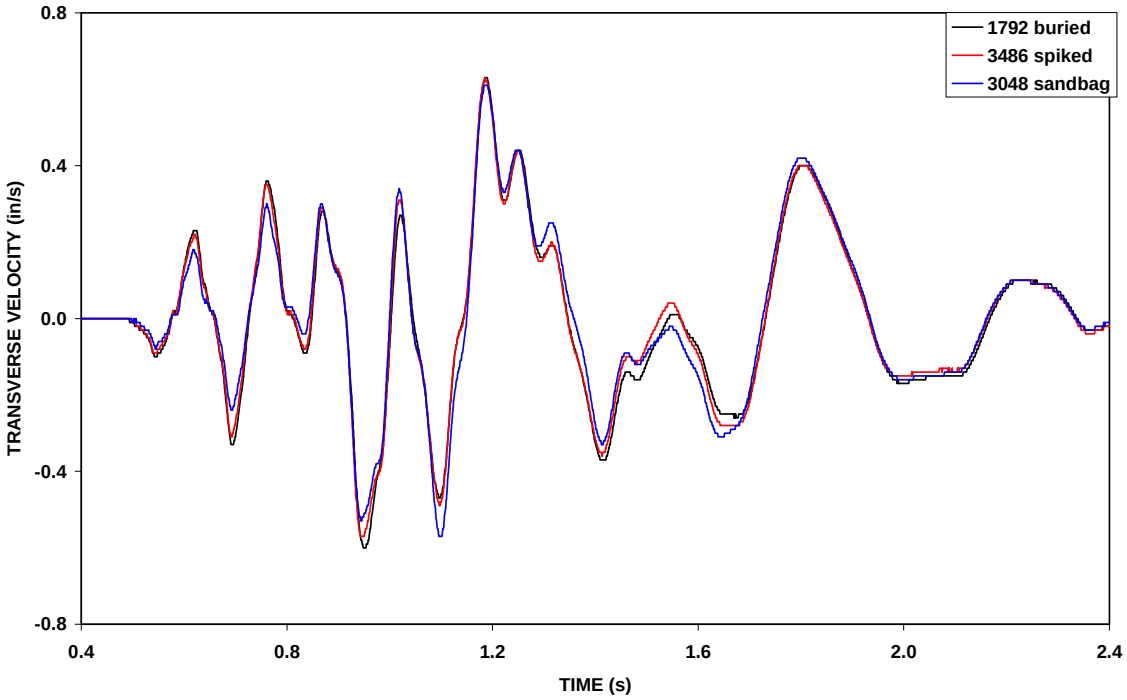
Cluster 1 SD 19.1 ft/lb$^{1/2}$

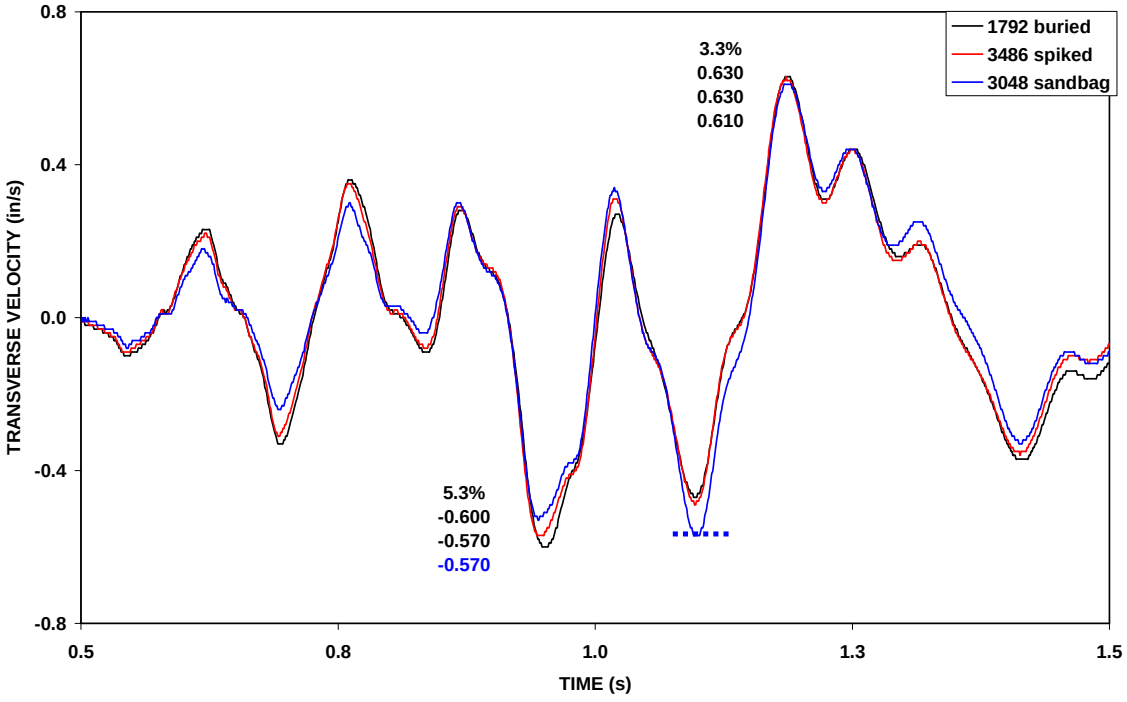

1792 buried
3486 spiked
3048 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.3
0.0
-0.3
-0.6
0.4
0.8
1.2
1.6
2.0
2.4


1792 buried
3486 spiked
3048 sandbag
14.9%
0.470
0.540
0.530
18.5%
-0.270
-0.270
-0.320
RADIAL VELOCITY (in/s)
TIME (s)
0.6
0.3
0.0
-0.3
-0.6
0.5
1.0
1.5
2.0


1792 buried
3486 spiked
3048 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
0.4
0.8
1.2
1.6
2.0
2.4

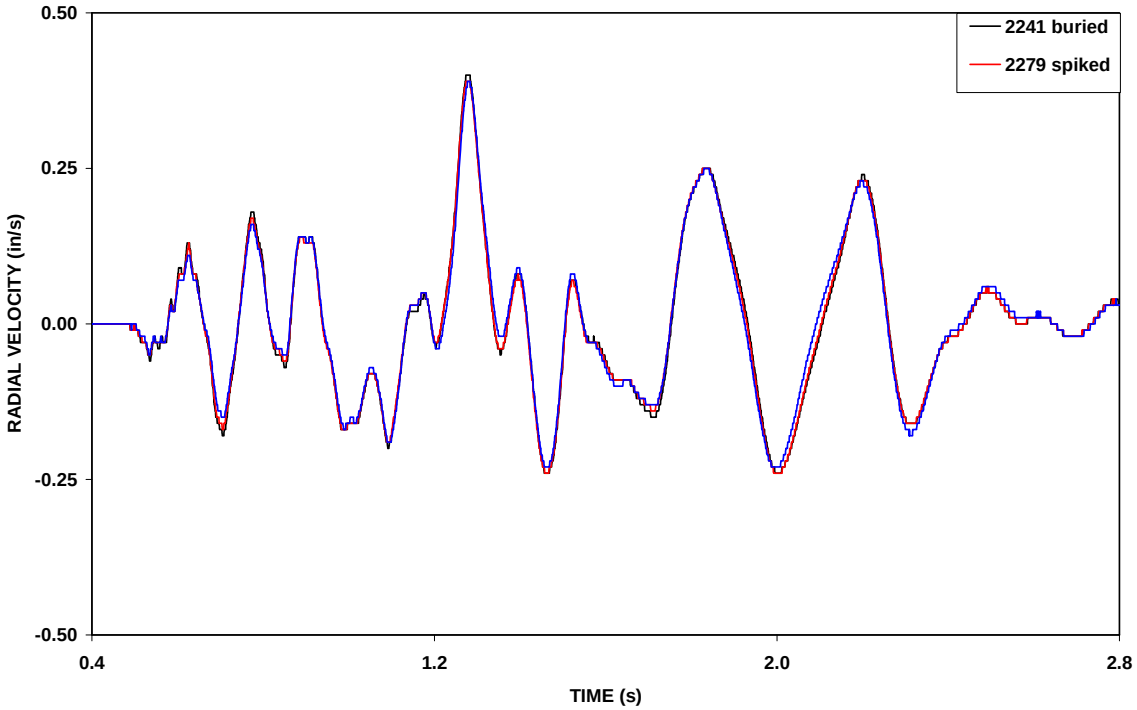

1792 buried
3486 spiked
3048 sandbag
5.6%
0.750
0.720
0.710
8.6%
-0.630
-0.590
-0.580
VERTICAL VELOCITY (in/s)
TIME (s)
0.8
0.4
0.0
-0.4
-0.8
0.5
1.0
1.5
2.0
2.5
3.0

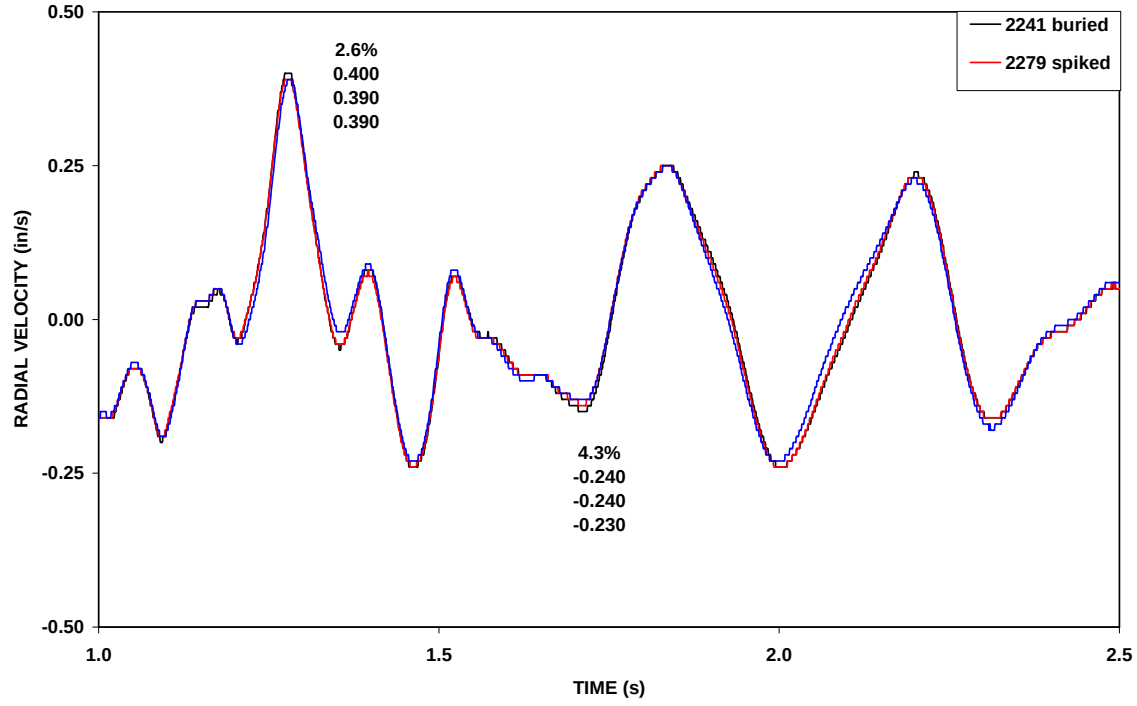

1792 buried
3486 spiked
3048 sandbag
TRANSVERSE VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.4
0.8
1.2
1.6
2.0
2.4
TIME (s)

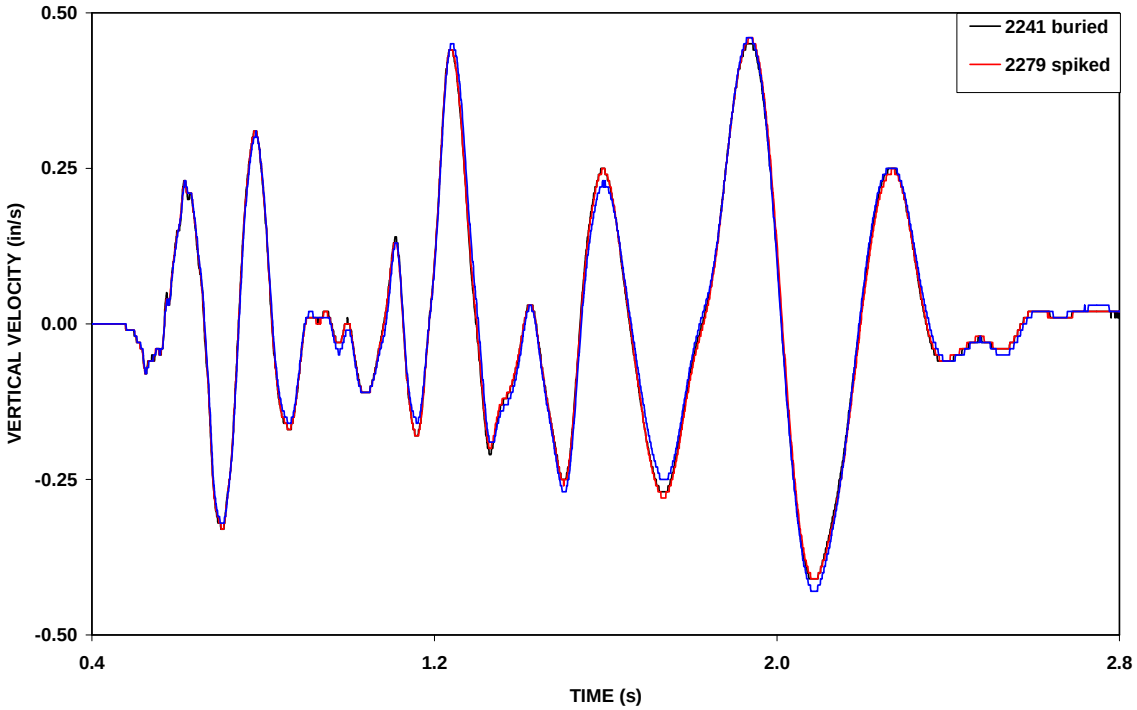

1792 buried
3486 spiked
3048 sandbag
3.3%
0.630
0.630
0.610
5.3%
-0.600
-0.570
-0.570
TRANSVERSE VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.5
0.8
1.0
1.3
1.5
TIME (s)

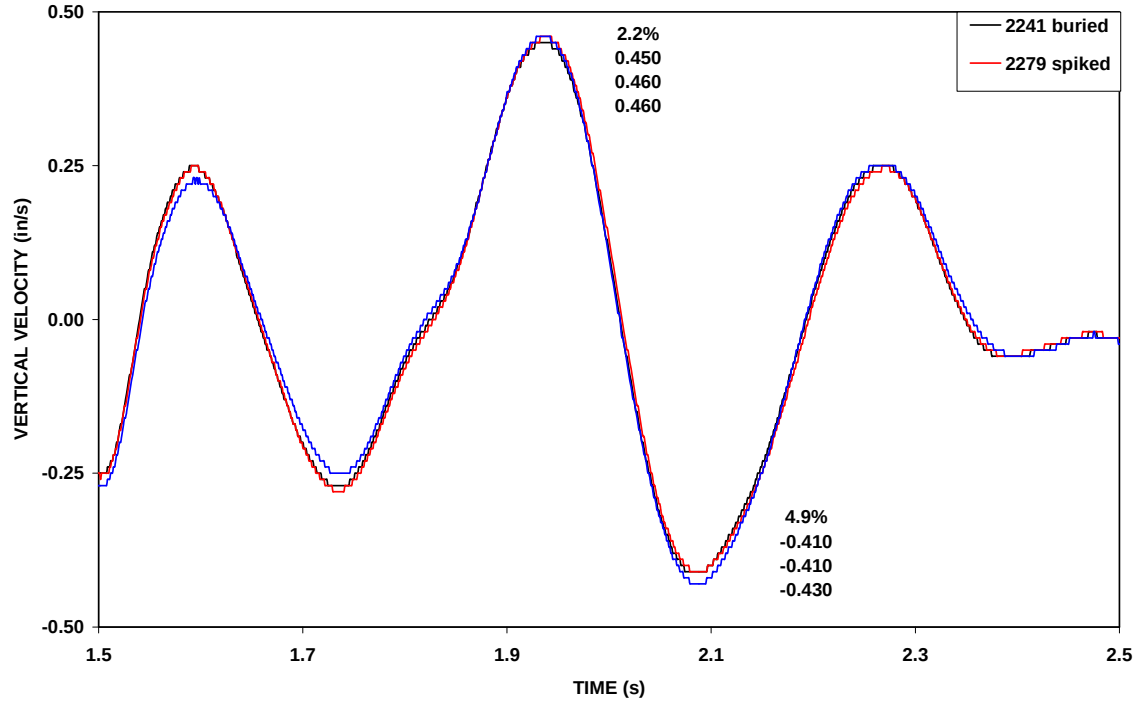
WY-6

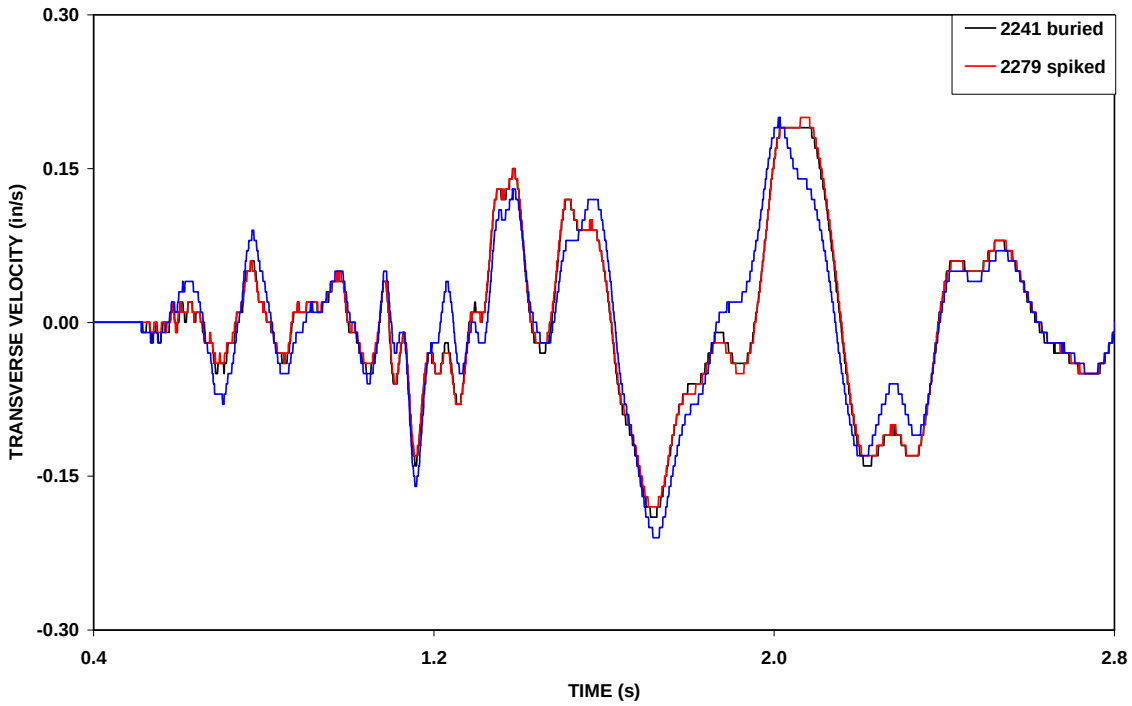
Cluster 2 SD 25.1 ft/lb$^{1/2}$

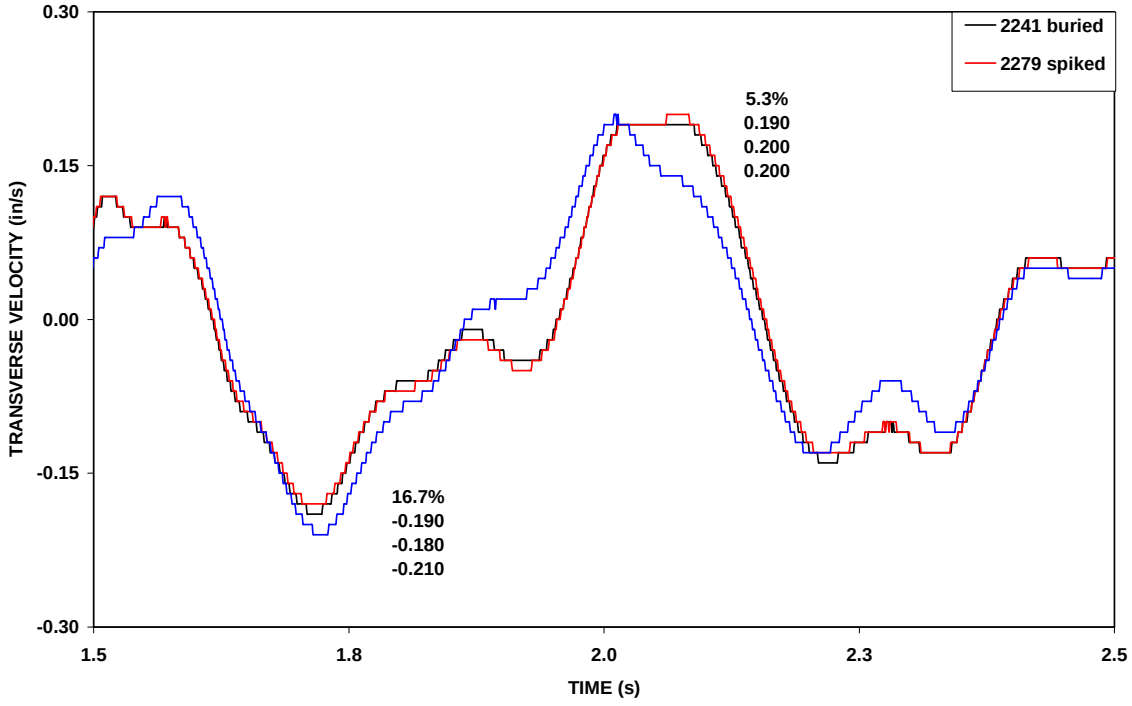

0.50
0.25
0.00
-0.25
-0.50
RADIAL VELOCITY (in/s)
0.4
1.2
2.0
2.8
TIME (s)
2241 buried
2279 spiked

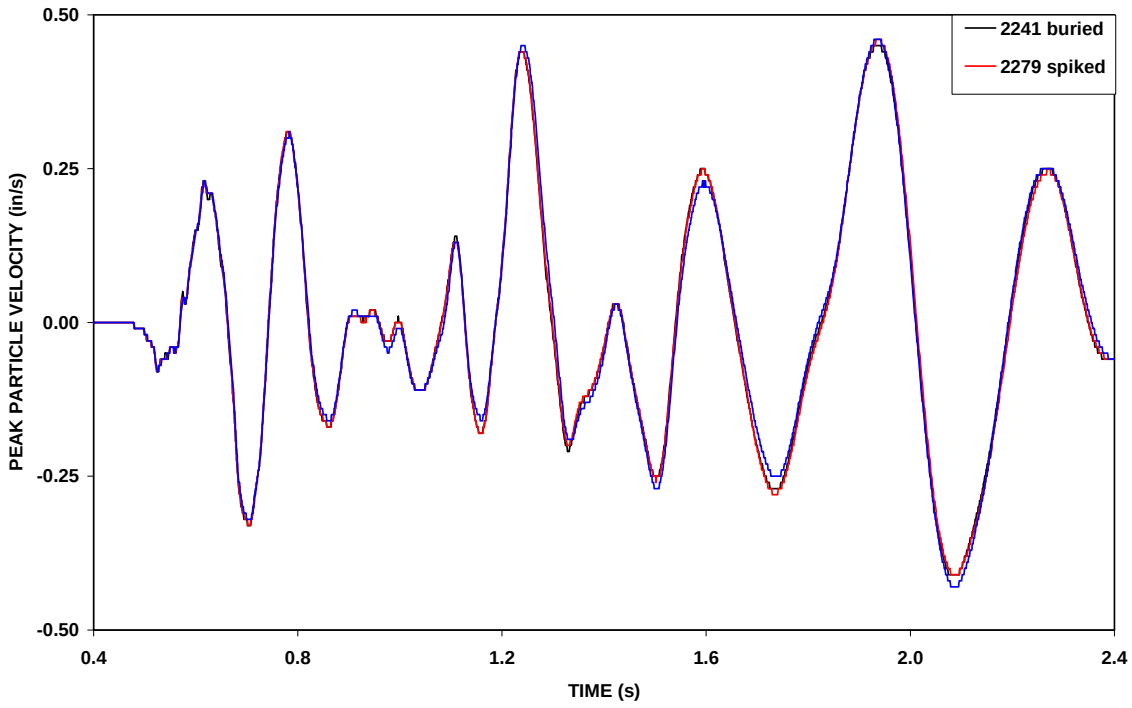

0.50
0.25
0.00
-0.25
-0.50
RADIAL VELOCITY (in/s)
1.0
1.5
2.0
2.5
TIME (s)
2241 buried
2279 spiked
2.6%
0.400
0.390
0.390
4.3%
-0.240
-0.240
-0.230

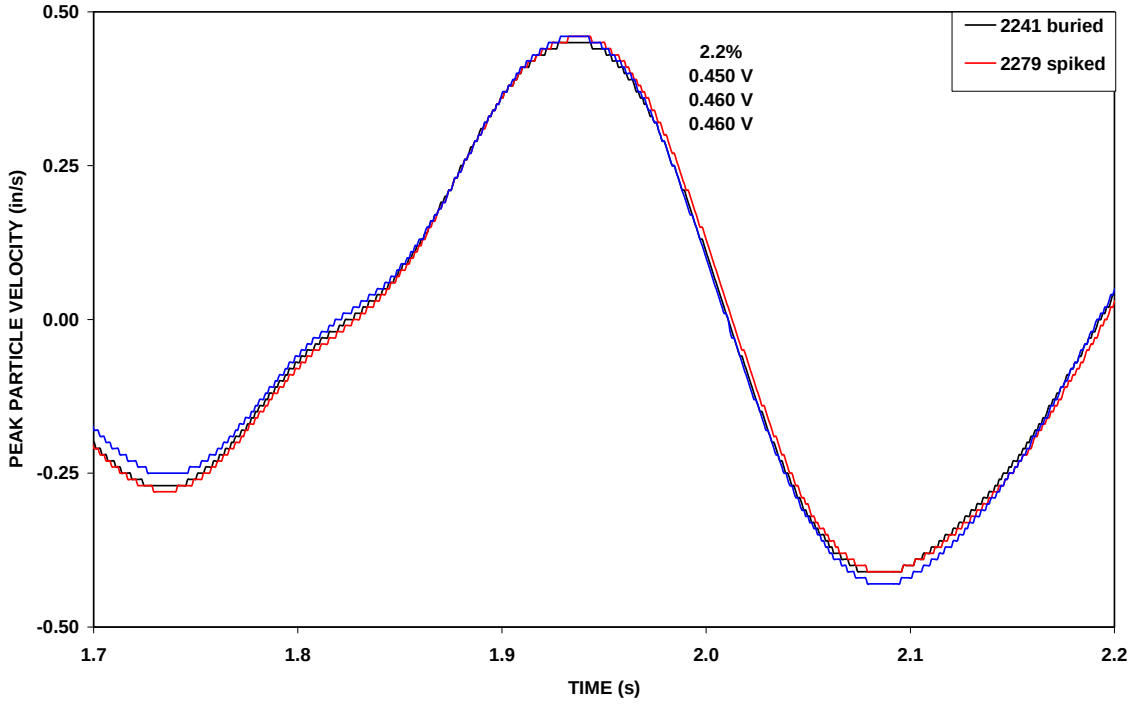

0.50
0.25
0.00
-0.25
-0.50
VERTICAL VELOCITY (in/s)
0.4
1.2
2.0
2.8
TIME (s)
2241 buried
2279 spiked


0.50
0.25
0.00
-0.25
-0.50
VERTICAL VELOCITY (in/s)
1.5
1.7
1.9
2.1
2.3
2.5
TIME (s)
2241 buried
2279 spiked
2.2%
0.450
0.460
0.460
4.9%
-0.410
-0.410
-0.430


2241 buried
2279 spiked
TRANSVERSE VELOCITY (in/s)
0.30
0.15
0.00
-0.15
-0.30
0.4
1.2
2.0
2.8
TIME (s)

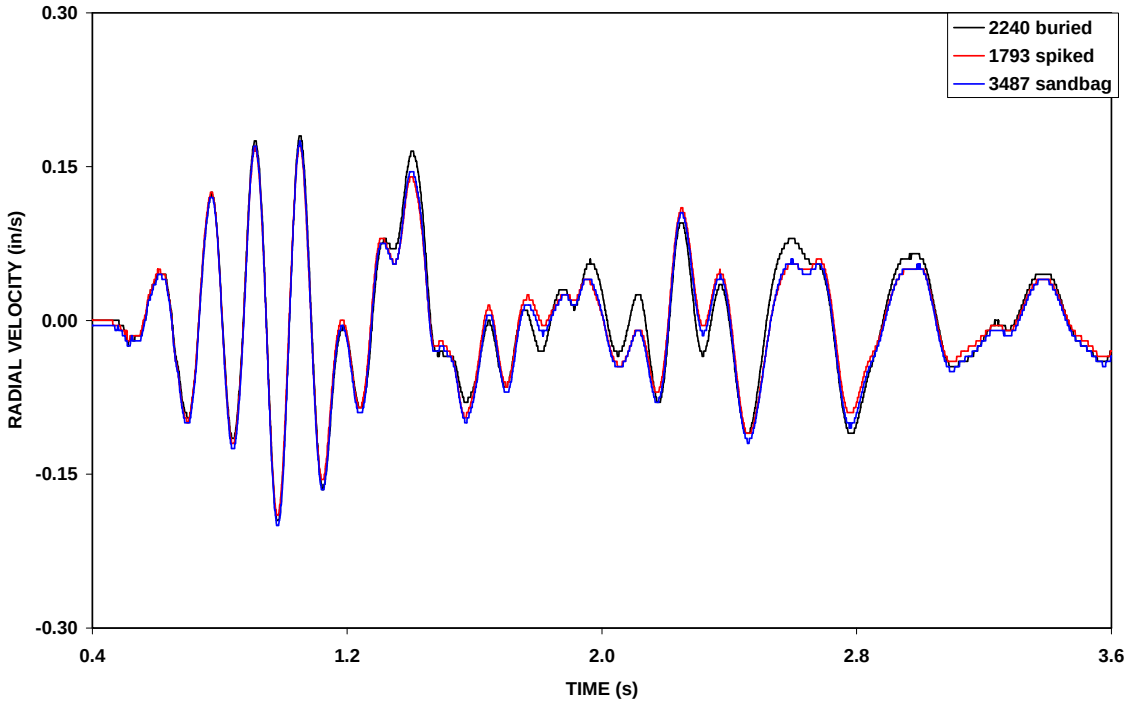

2241 buried
2279 spiked
5.3%
0.190
0.200
0.200
16.7%
-0.190
-0.180
-0.210
TRANSVERSE VELOCITY (in/s)
0.30
0.15
0.00
-0.15
-0.30
1.5
1.8
2.0
2.3
2.5
TIME (s)

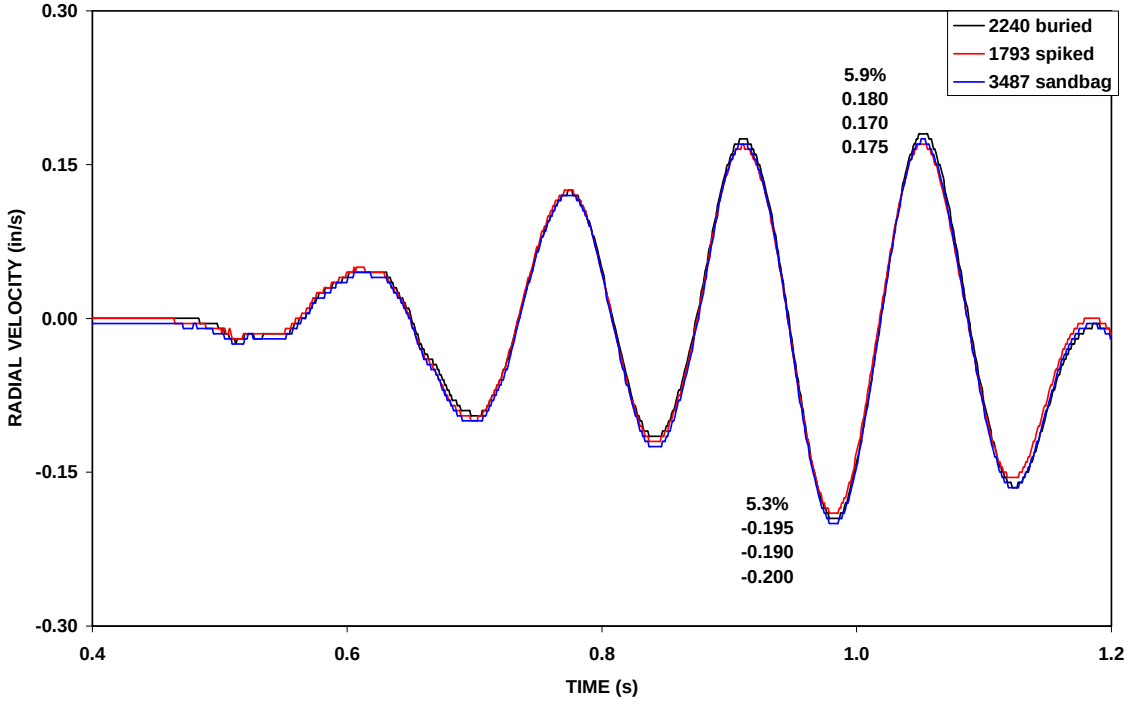

2241 buried
2279 spiked
PEAK PARTICLE VELOCITY (in/s)
0.50
0.25
0.00
-0.25
-0.50
0.4
0.8
1.2
1.6
2.0
2.4
TIME (s)

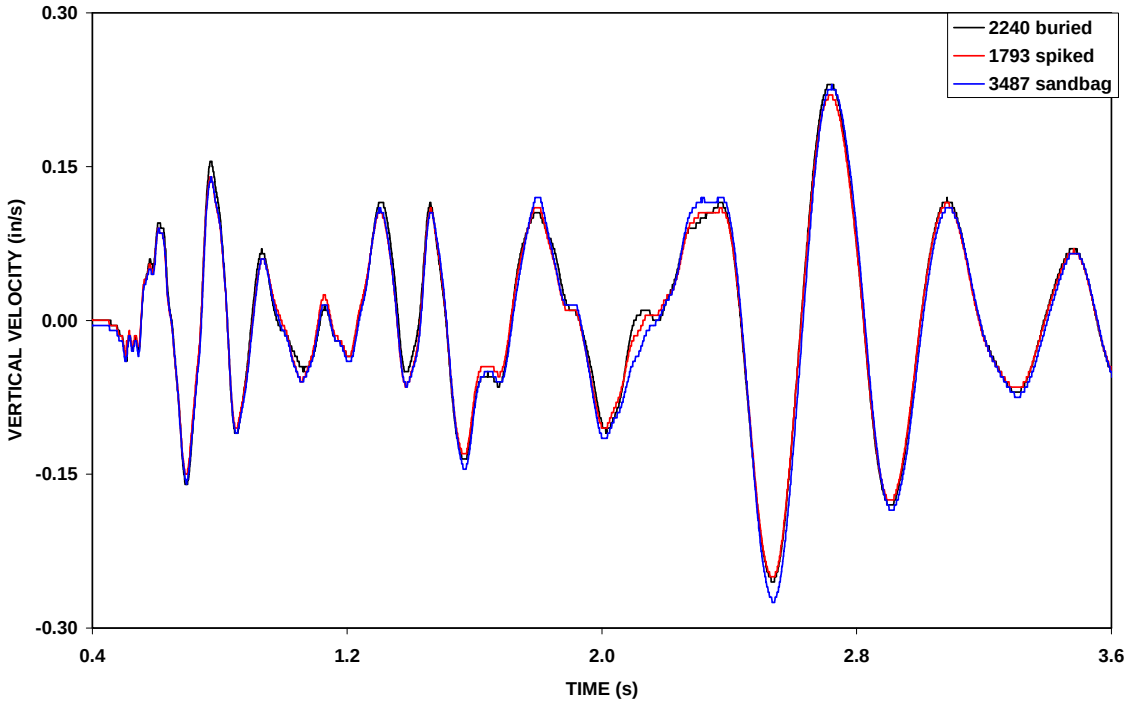

2241 buried
2279 spiked
2.2%
0.450 V
0.460 V
0.460 V
PEAK PARTICLE VELOCITY (in/s)
0.50
0.25
0.00
-0.25
-0.50
1.7
1.8
1.9
2.0
2.1
2.2
TIME (s)

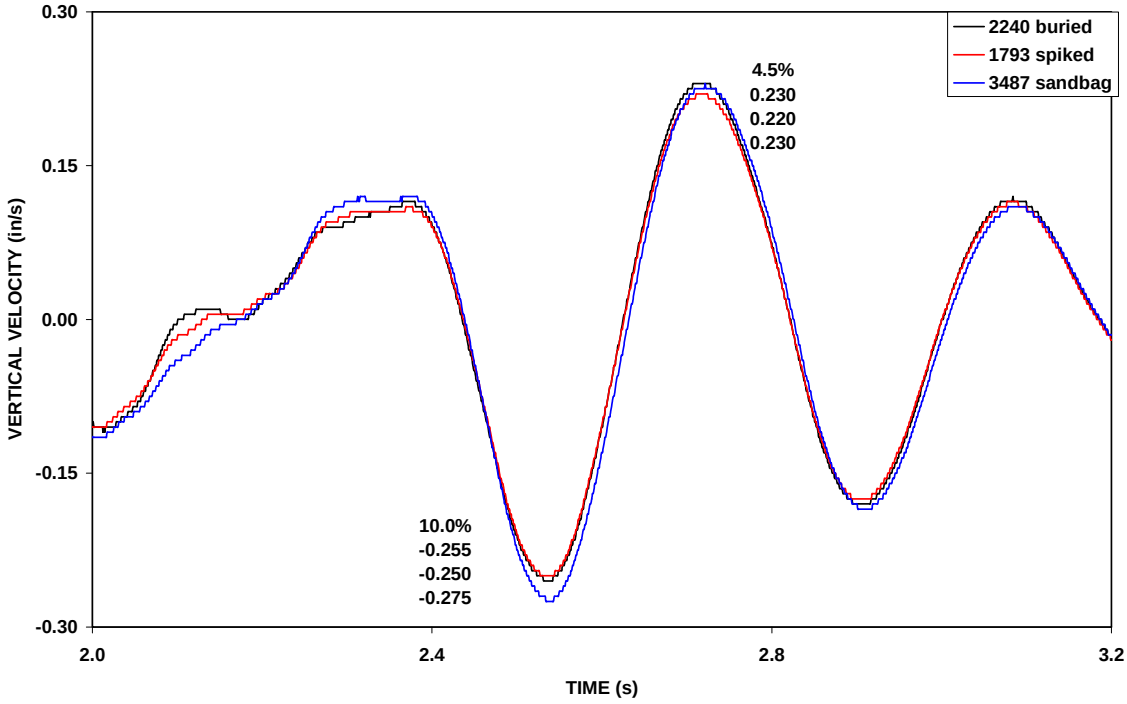
WY-6

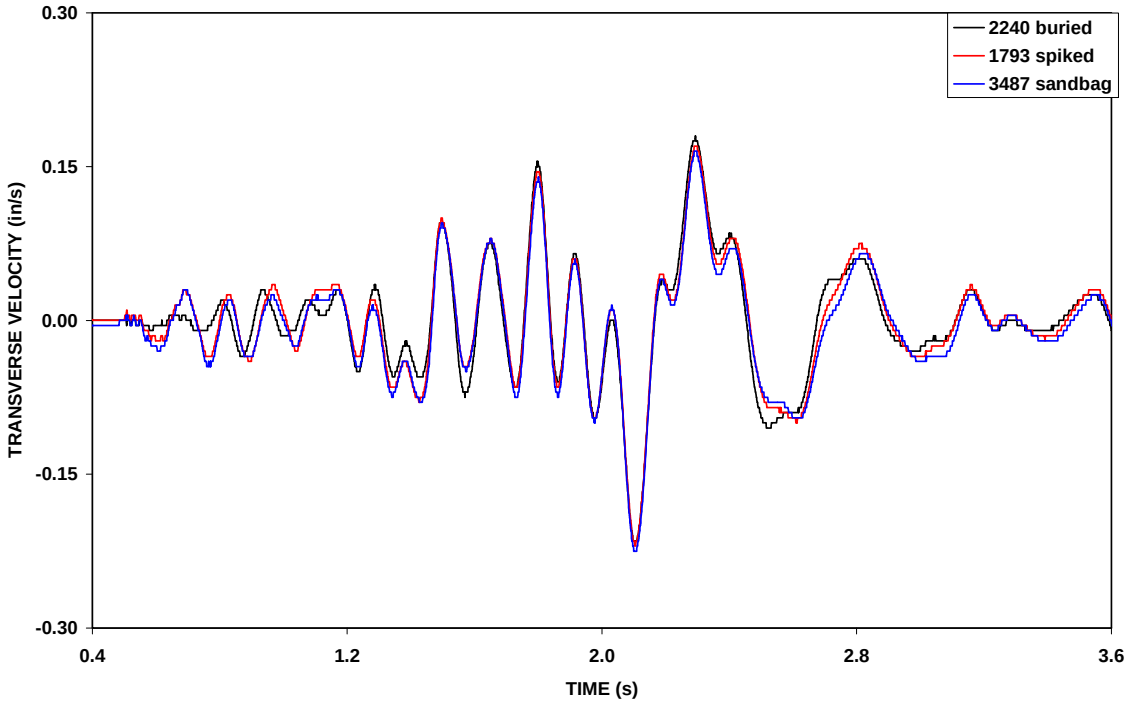
Cluster 3 SD 36.7 ft/lb$^{1/2}$

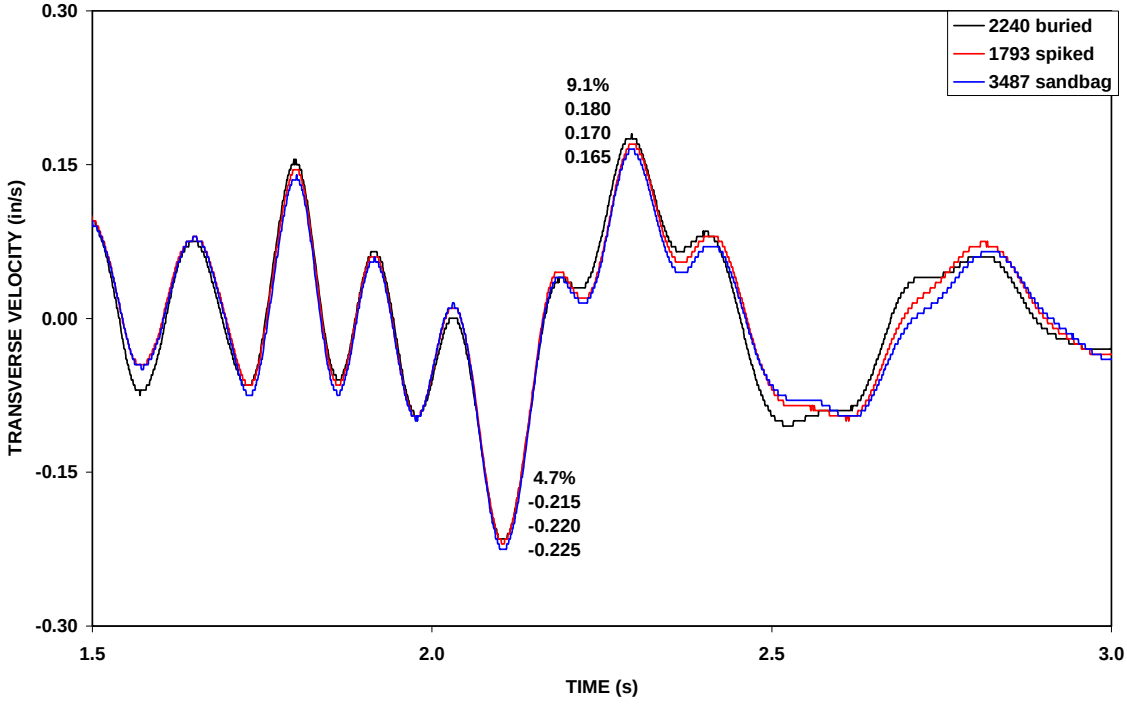

2240 buried
1793 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
0.30
0.15
0.00
-0.15
-0.30
0.4
1.2
2.0
2.8
3.6
TIME (s)


2240 buried
1793 spiked
3487 sandbag
5.9%
0.180
0.170
0.175
5.3%
-0.195
-0.190
-0.200
RADIAL VELOCITY (in/s)
0.30
0.15
0.00
-0.15
-0.30
0.4
0.6
0.8
1.0
1.2
TIME (s)


2240 buried
1793 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
0.30
0.15
0.00
-0.15
-0.30
0.4
1.2
2.0
2.8
3.6
TIME (s)

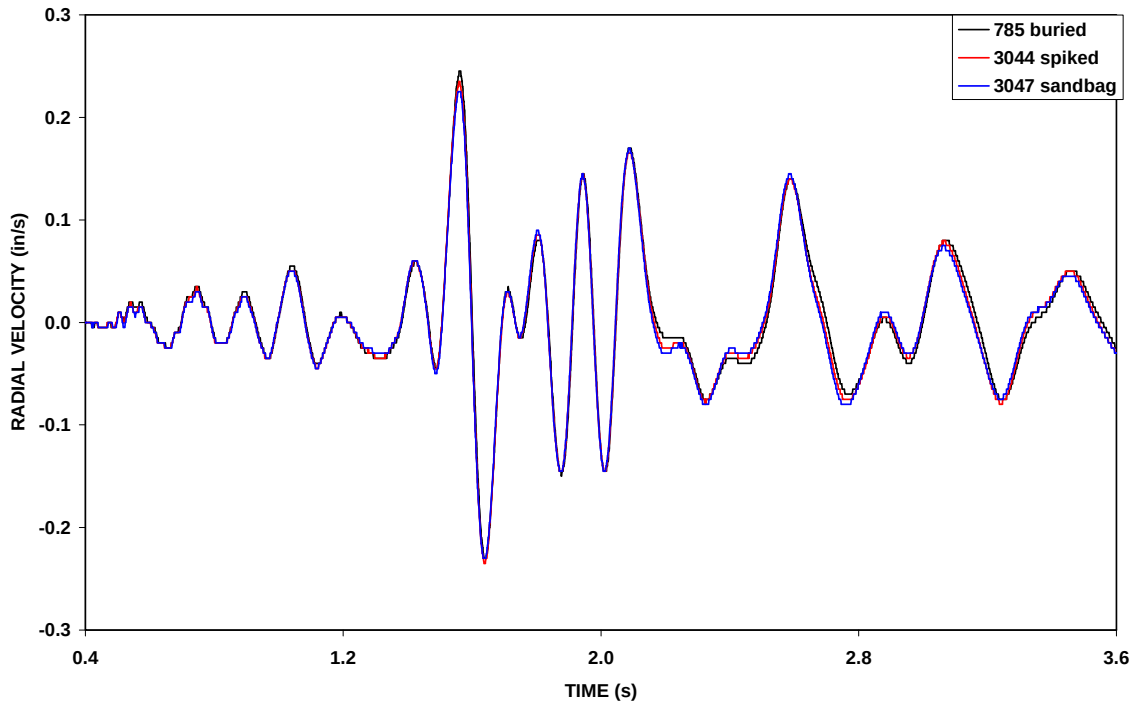

2240 buried
1793 spiked
3487 sandbag
4.5%
0.230
0.220
0.230
10.0%
-0.255
-0.250
-0.275
VERTICAL VELOCITY (in/s)
0.30
0.15
0.00
-0.15
-0.30
2.0
2.4
2.8
3.2
TIME (s)

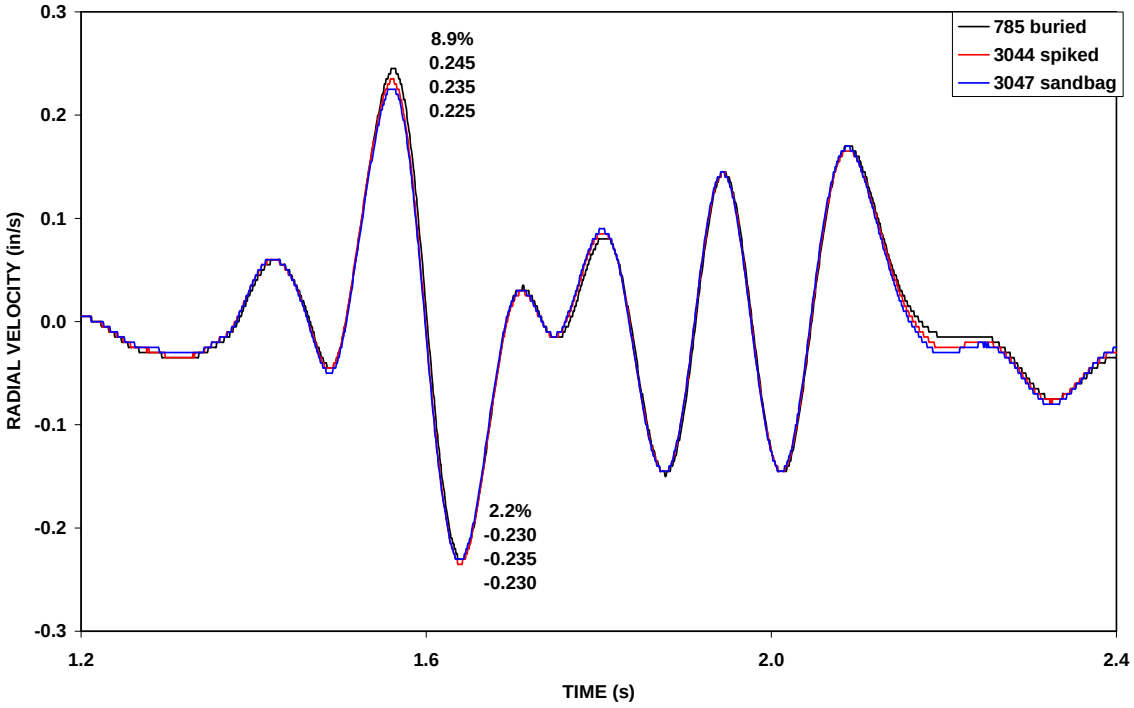

2240 buried
1793 spiked
3487 sandbag
0.30
0.15
0.00
-0.15
-0.30
TRANSVERSE VELOCITY (in/s)
0.4
1.2
2.0
2.8
3.6
TIME (s)

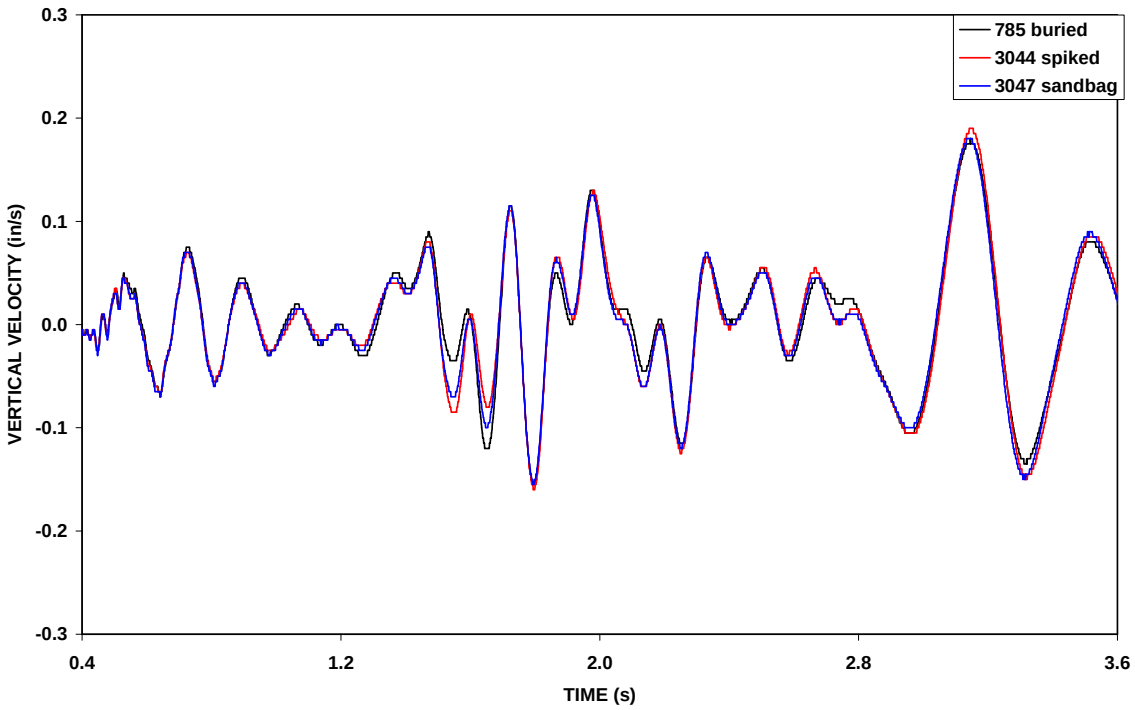

2240 buried
1793 spiked
3487 sandbag
9.1%
0.180
0.170
0.165
4.7%
-0.215
-0.220
-0.225
0.30
0.15
0.00
-0.15
-0.30
TRANSVERSE VELOCITY (in/s)
1.5
2.0
2.5
3.0
TIME (s)

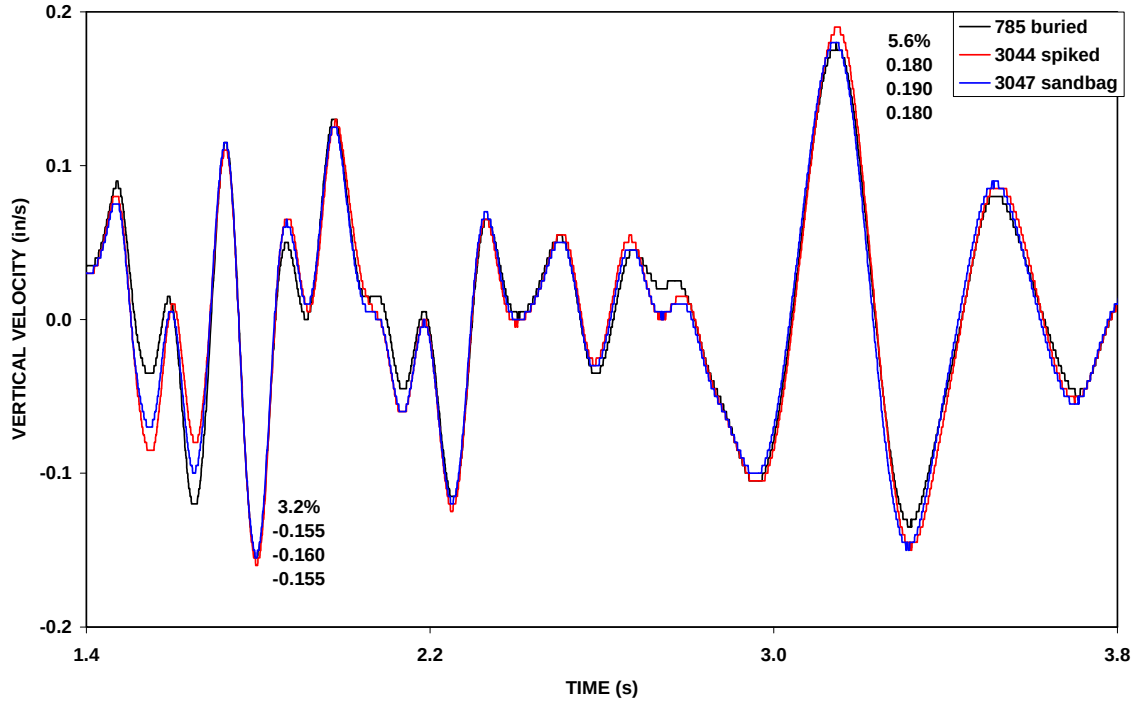
WY-6

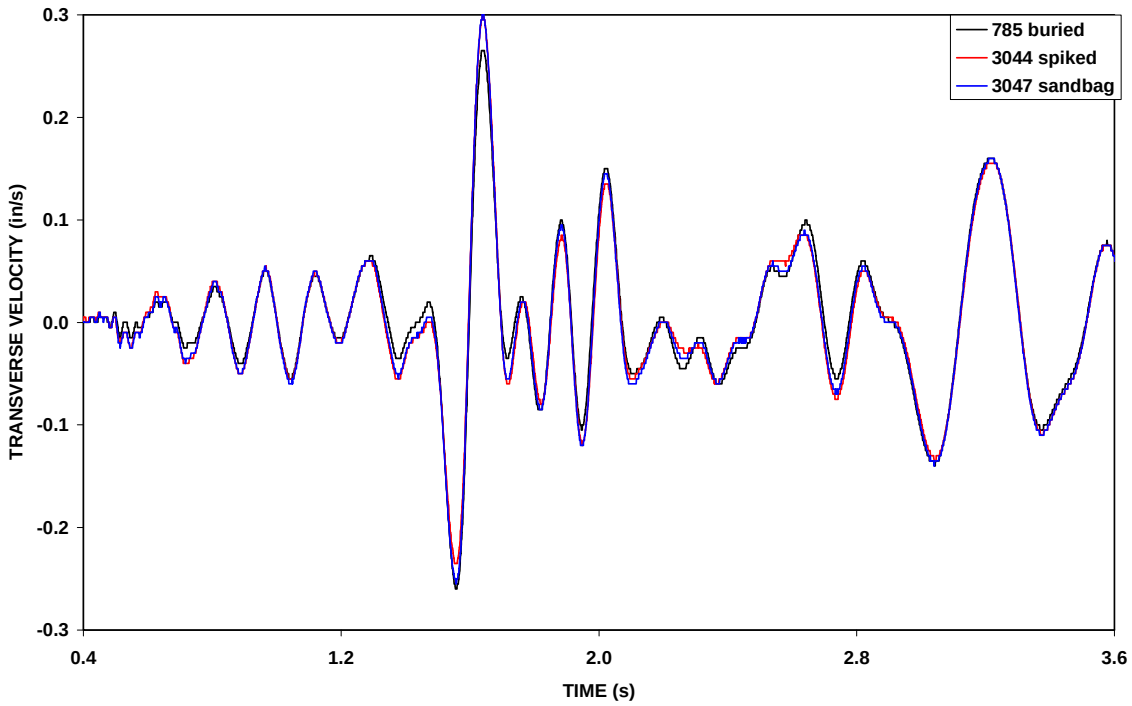
Cluster 4 SD 49.6 ft/lb$^{1/2}$

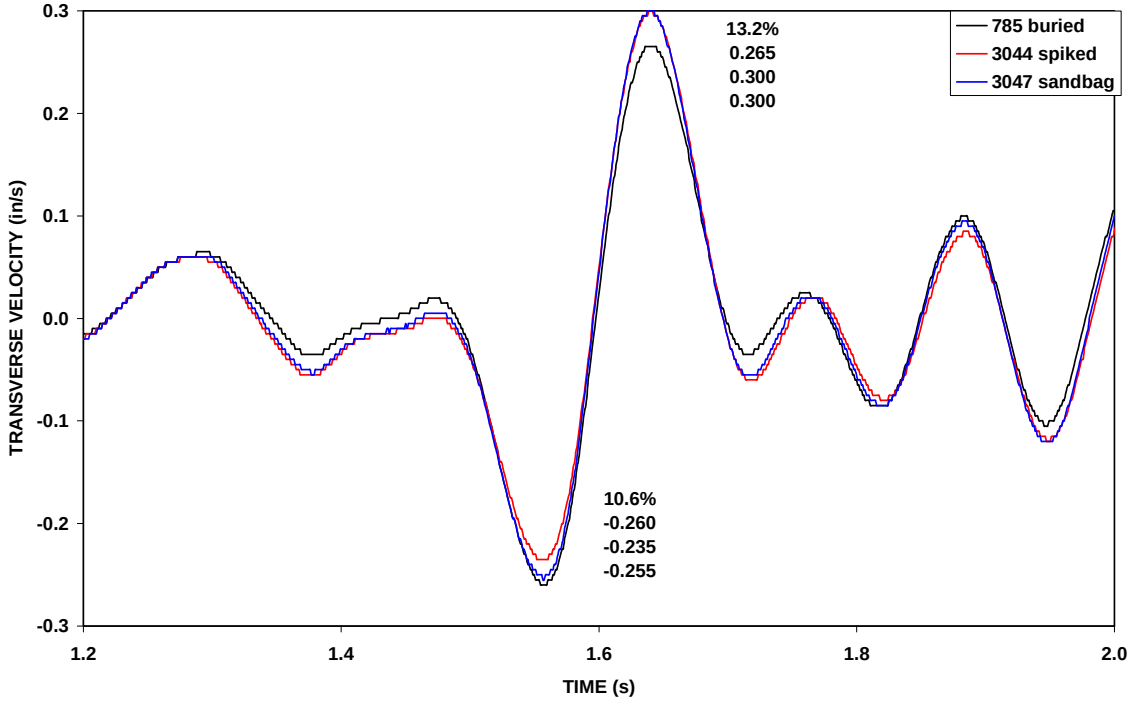

785 buried
3044 spiked
3047 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
1.2
2.0
2.8
3.6


785 buried
3044 spiked
3047 sandbag
8.9%
0.245
0.235
0.225
2.2%
-0.230
-0.235
-0.230
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
1.2
1.6
2.0
2.4


785 buried
3044 spiked
3047 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
1.2
2.0
2.8
3.6

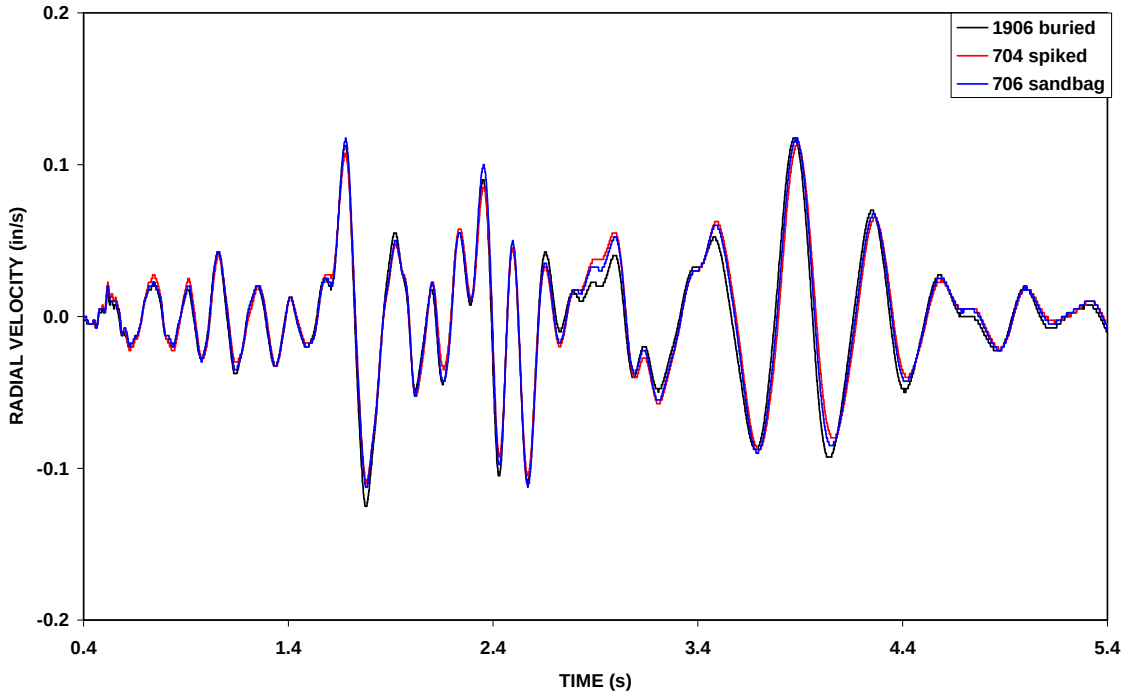

785 buried
3044 spiked
3047 sandbag
5.6%
0.180
0.190
0.180
3.2%
-0.155
-0.160
-0.155
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
1.4
2.2
3.0
3.8

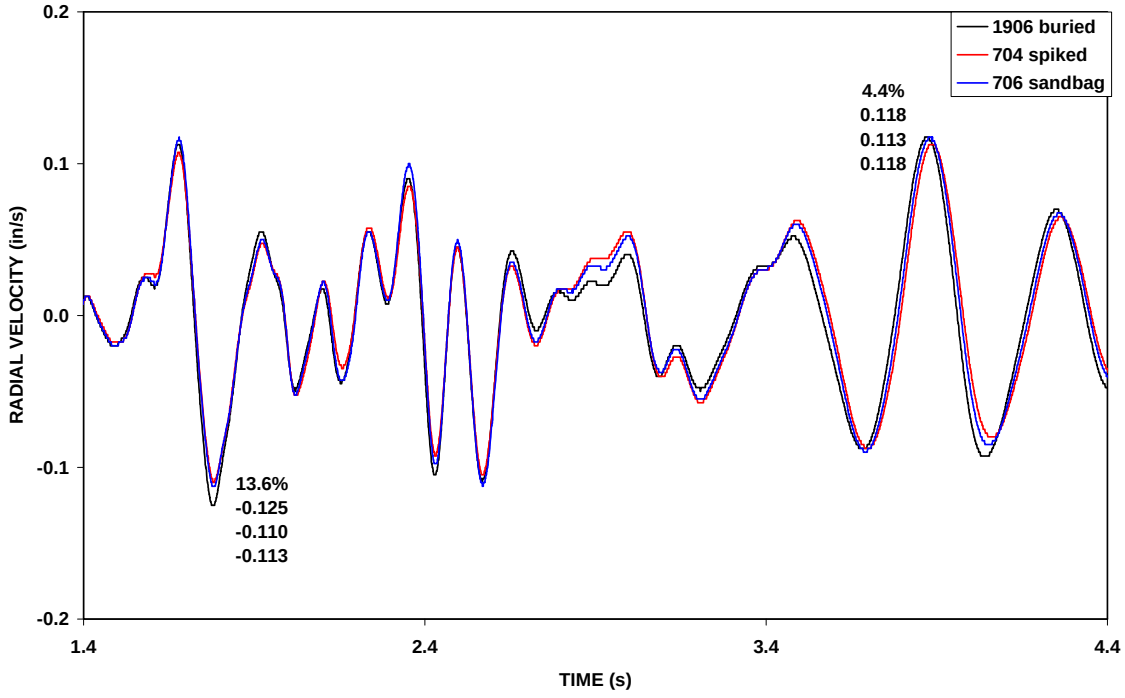

785 buried
3044 spiked
3047 sandbag
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
1.2
2.0
2.8
3.6
TIME (s)

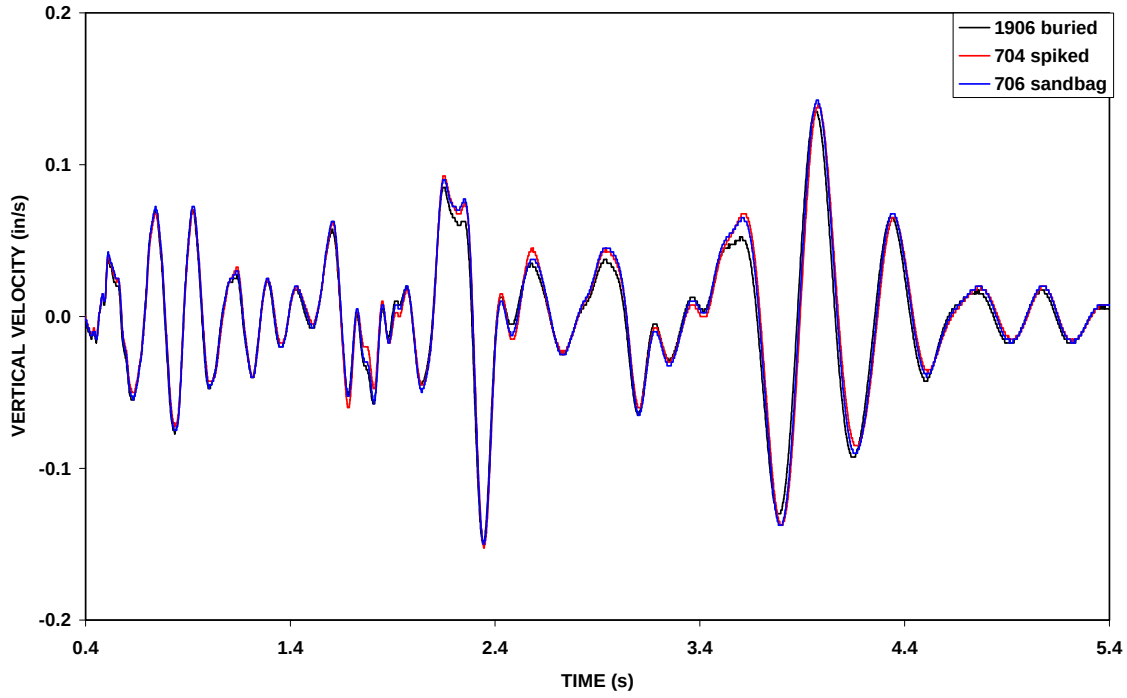

785 buried
3044 spiked
3047 sandbag
13.2%
0.265
0.300
0.300
10.6%
-0.260
-0.235
-0.255
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
1.2
1.4
1.6
1.8
2.0
TIME (s)

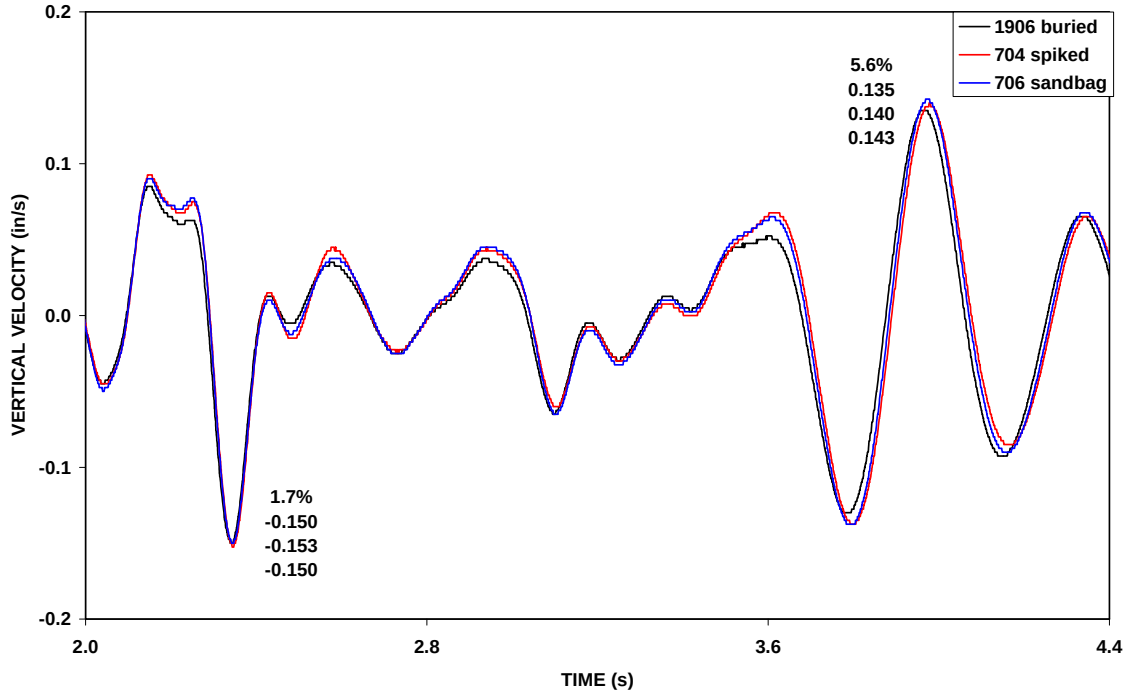
WY-6

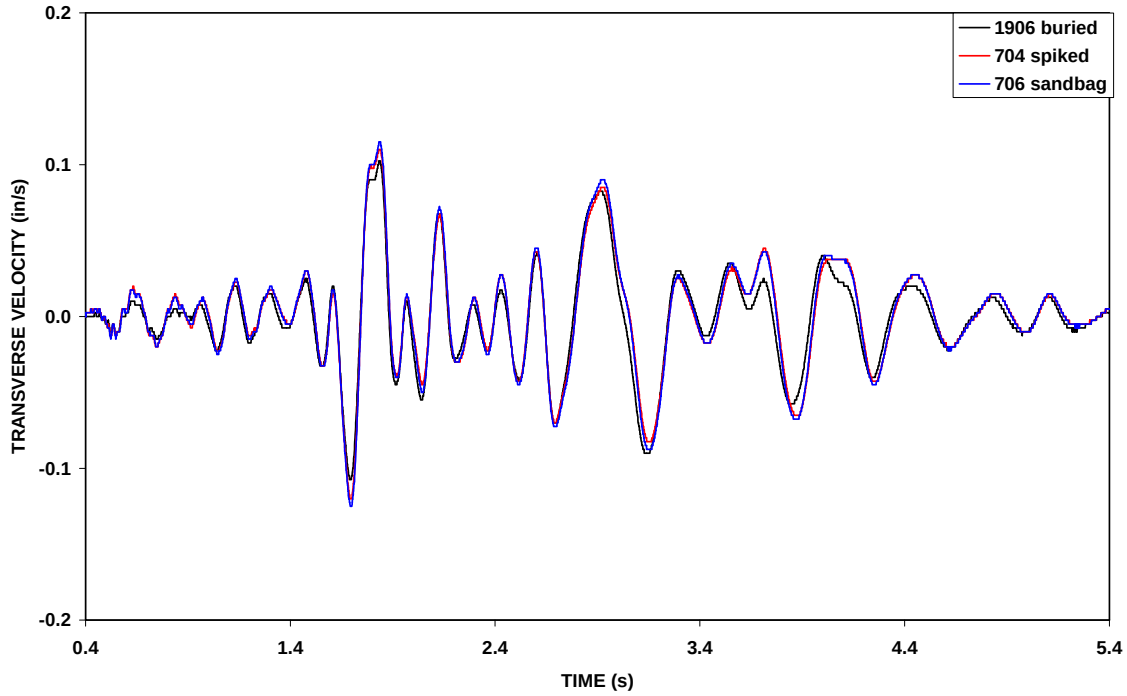
Cluster 5 SD 61.9 ft/lb$^{1/2}$

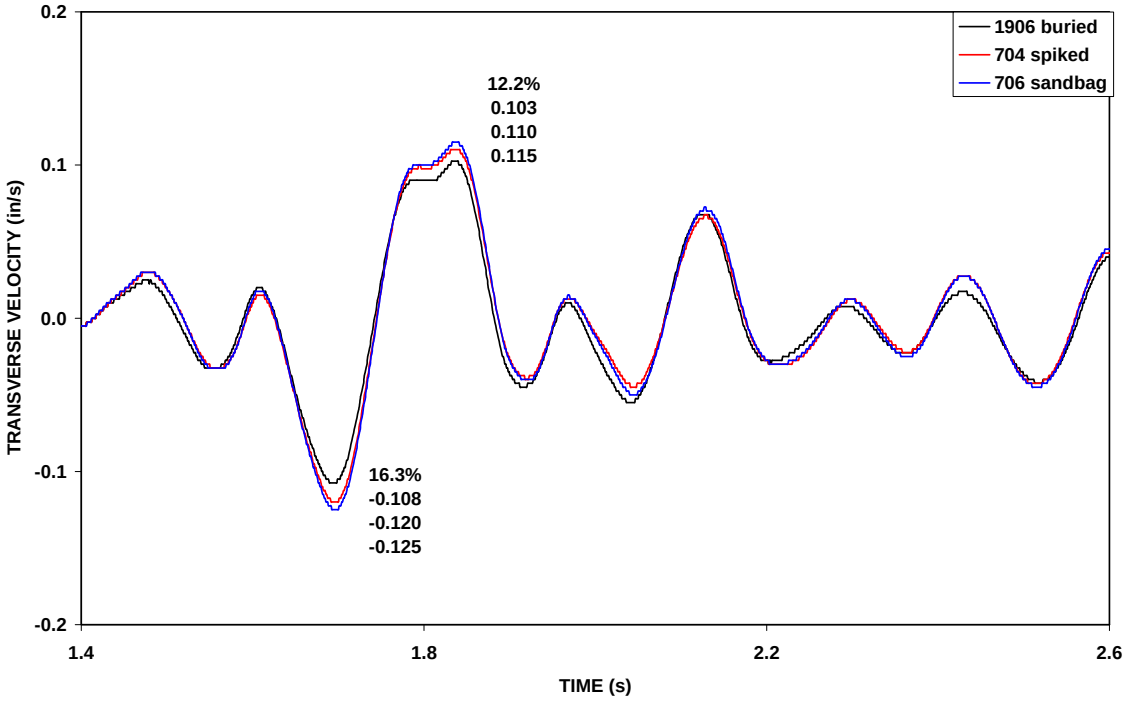

1906 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
1.4
2.4
3.4
4.4
5.4
TIME (s)


1906 buried
704 spiked
706 sandbag
4.4%
0.118
0.113
0.118
13.6%
-0.125
-0.110
-0.113
RADIAL VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
1.4
2.4
3.4
4.4
TIME (s)


1906 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
0.4
1.4
2.4
3.4
4.4
5.4

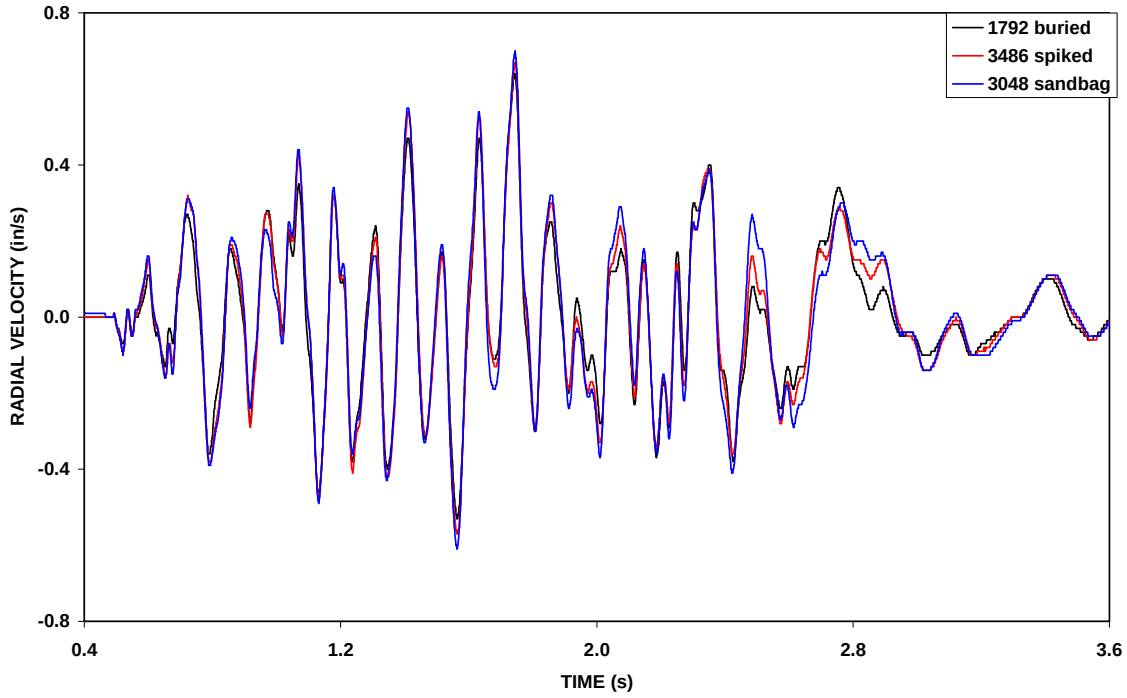

1906 buried
704 spiked
706 sandbag
5.6%
0.135
0.140
0.143
1.7%
-0.150
-0.153
-0.150
VERTICAL VELOCITY (in/s)
TIME (s)
0.2
0.1
0.0
-0.1
-0.2
2.0
2.8
3.6
4.4

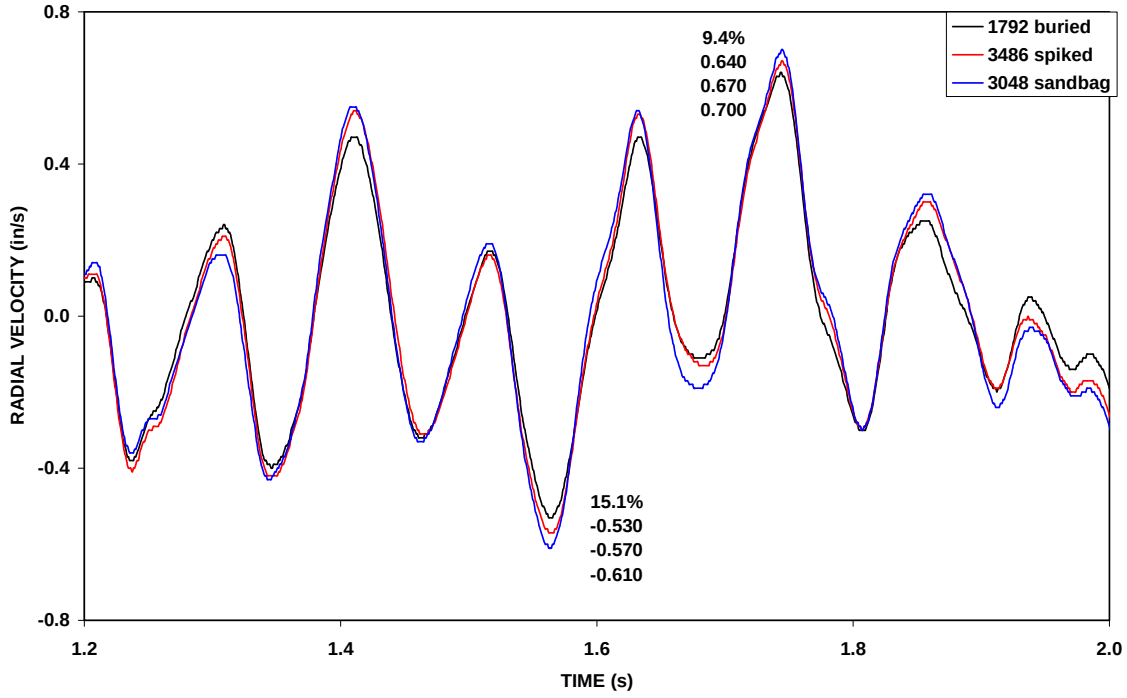

1906 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
1.4
2.4
3.4
4.4
5.4
TIME (s)

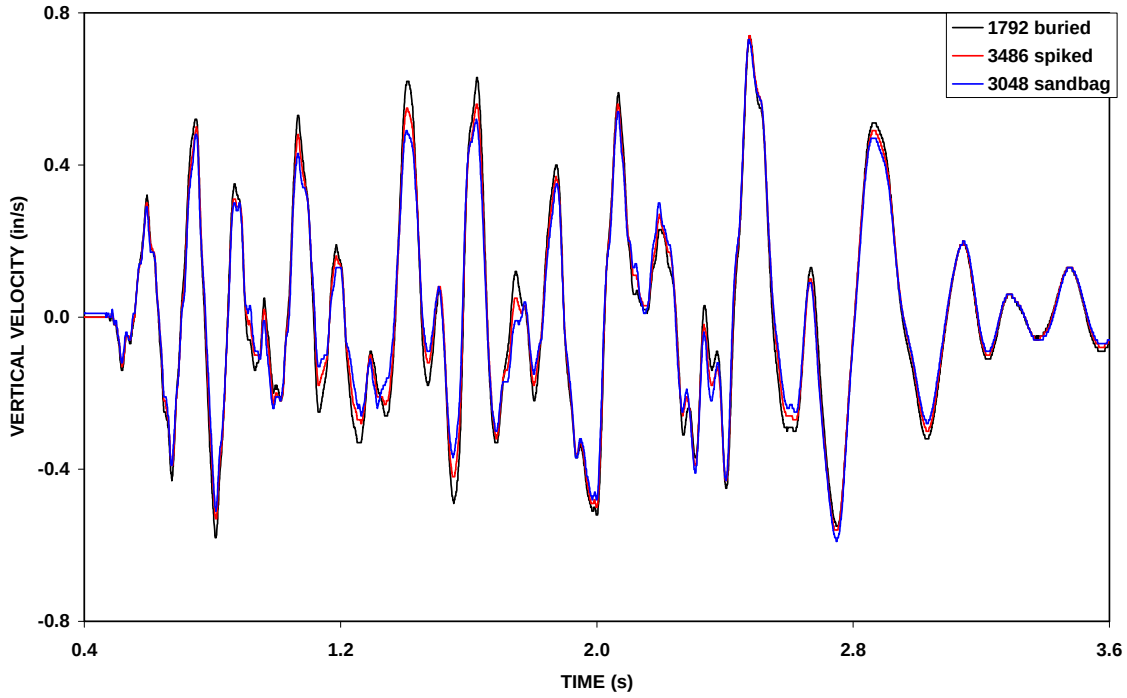

1906 buried
704 spiked
706 sandbag
12.2%
0.103
0.110
0.115
16.3%
-0.108
-0.120
-0.125
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
1.4
1.8
2.2
2.6
TIME (s)

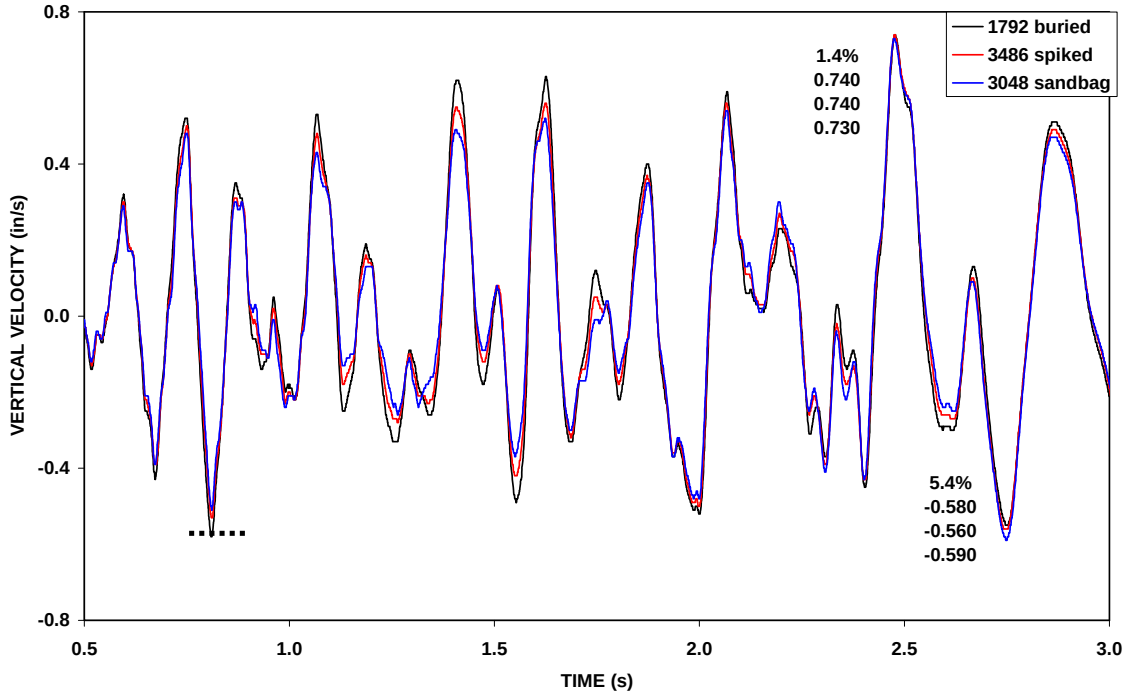
WY-7

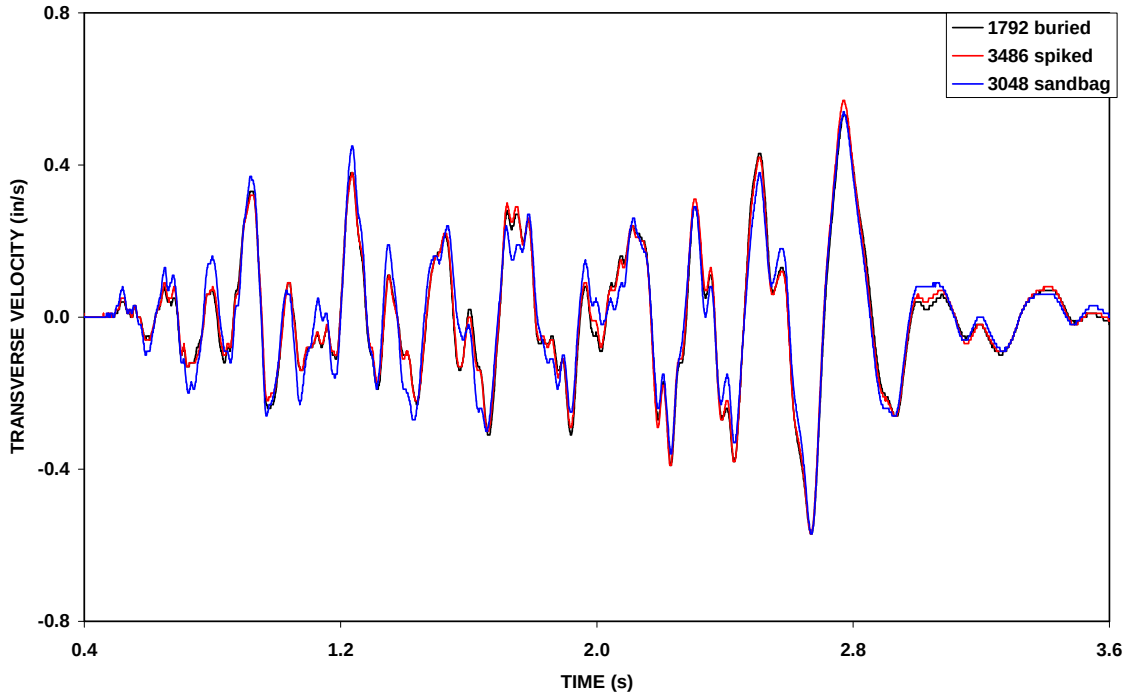
Cluster 1 SD 13.9 ft/lb$^{1/2}$

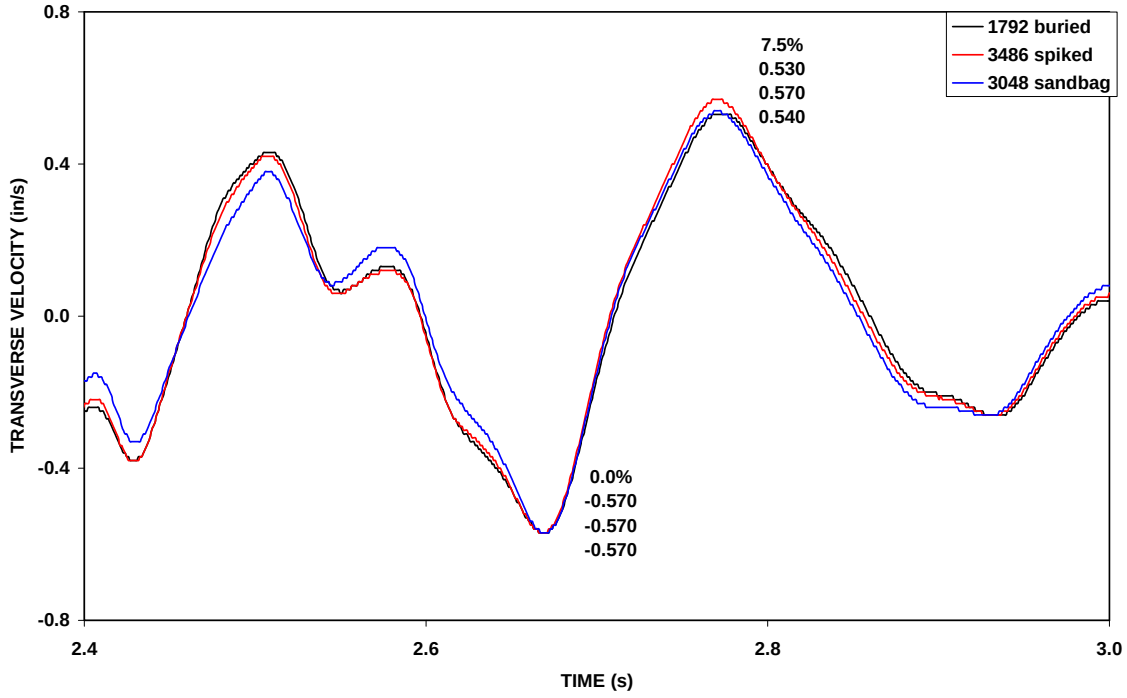

1792 buried
3486 spiked
3048 sandbag
RADIAL VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.4
1.2
2.0
2.8
3.6
TIME (s)


1792 buried
3486 spiked
3048 sandbag
9.4%
0.640
0.670
0.700
15.1%
-0.530
-0.570
-0.610
RADIAL VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
1.2
1.4
1.6
1.8
2.0
TIME (s)


1792 buried
3486 spiked
3048 sandbag
VERTICAL VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.4
1.2
2.0
2.8
3.6
TIME (s)

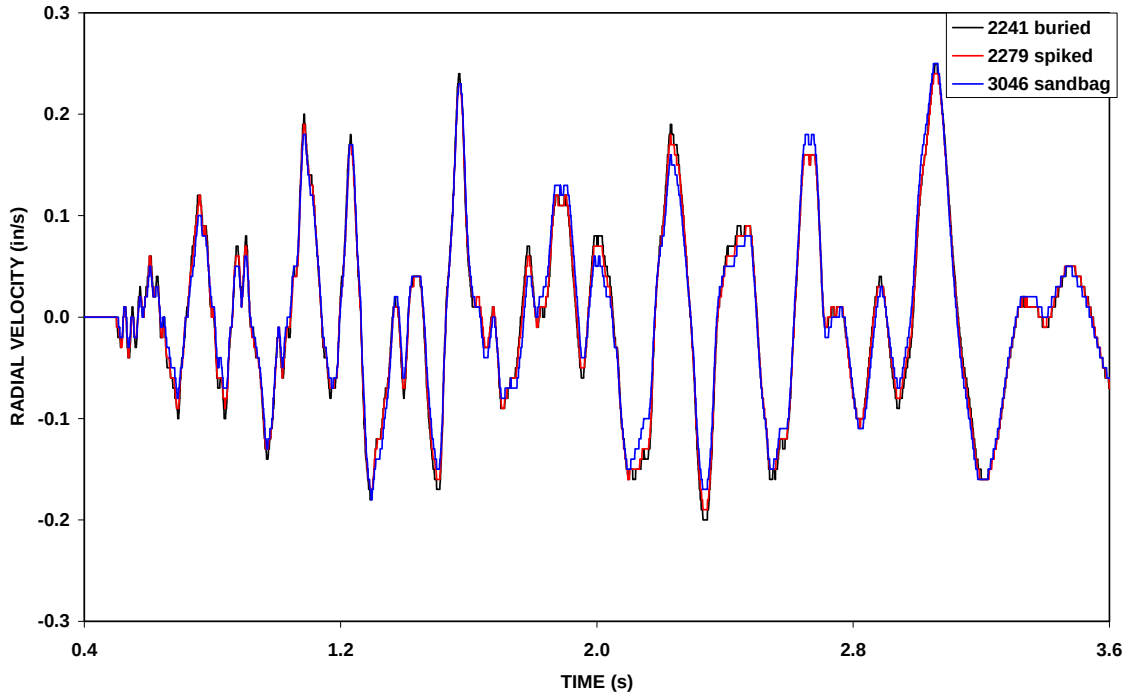

1792 buried
3486 spiked
3048 sandbag
1.4%
0.740
0.740
0.730
5.4%
-0.580
-0.560
-0.590
VERTICAL VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.5
1.0
1.5
2.0
2.5
3.0
TIME (s)

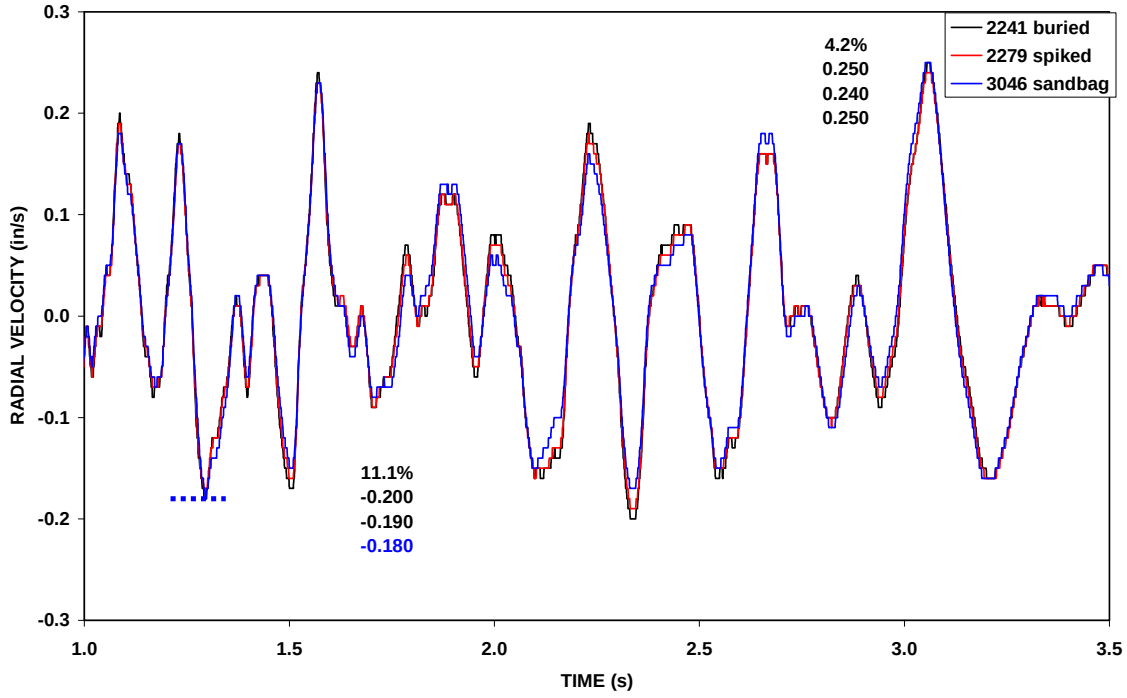

1792 buried
3486 spiked
3048 sandbag
TRANSVERSE VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
0.4
1.2
2.0
2.8
3.6
TIME (s)

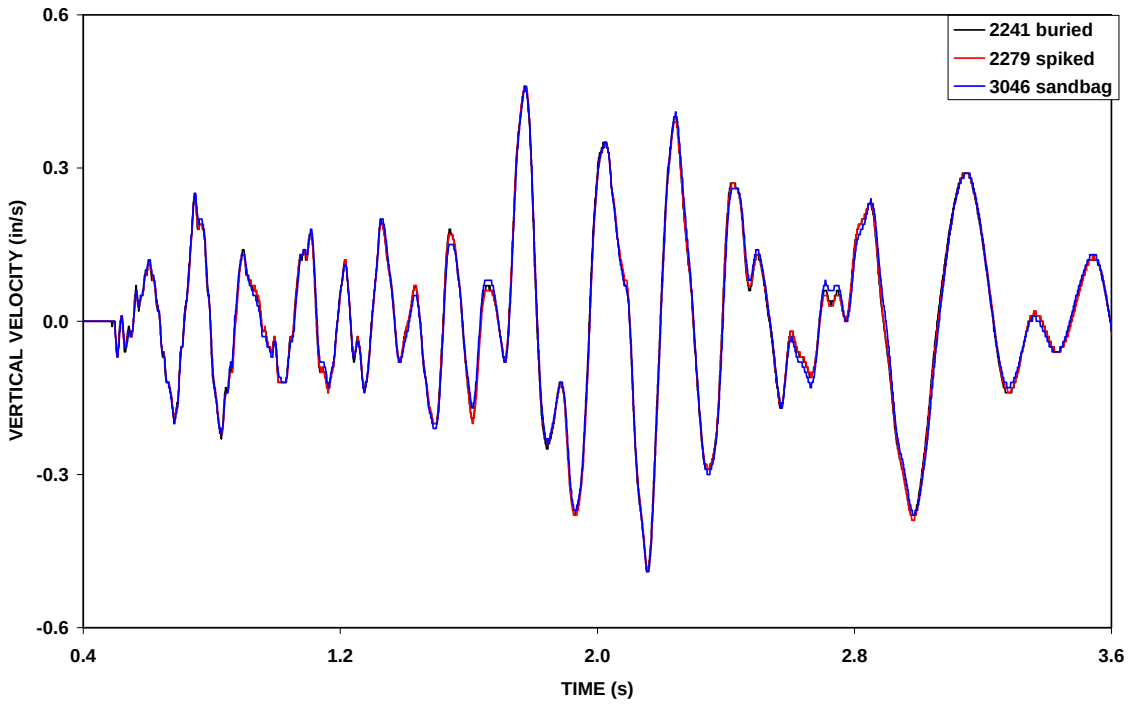

1792 buried
3486 spiked
3048 sandbag
7.5%
0.530
0.570
0.540
0.0%
-0.570
-0.570
-0.570
TRANSVERSE VELOCITY (in/s)
0.8
0.4
0.0
-0.4
-0.8
2.4
2.6
2.8
3.0
TIME (s)

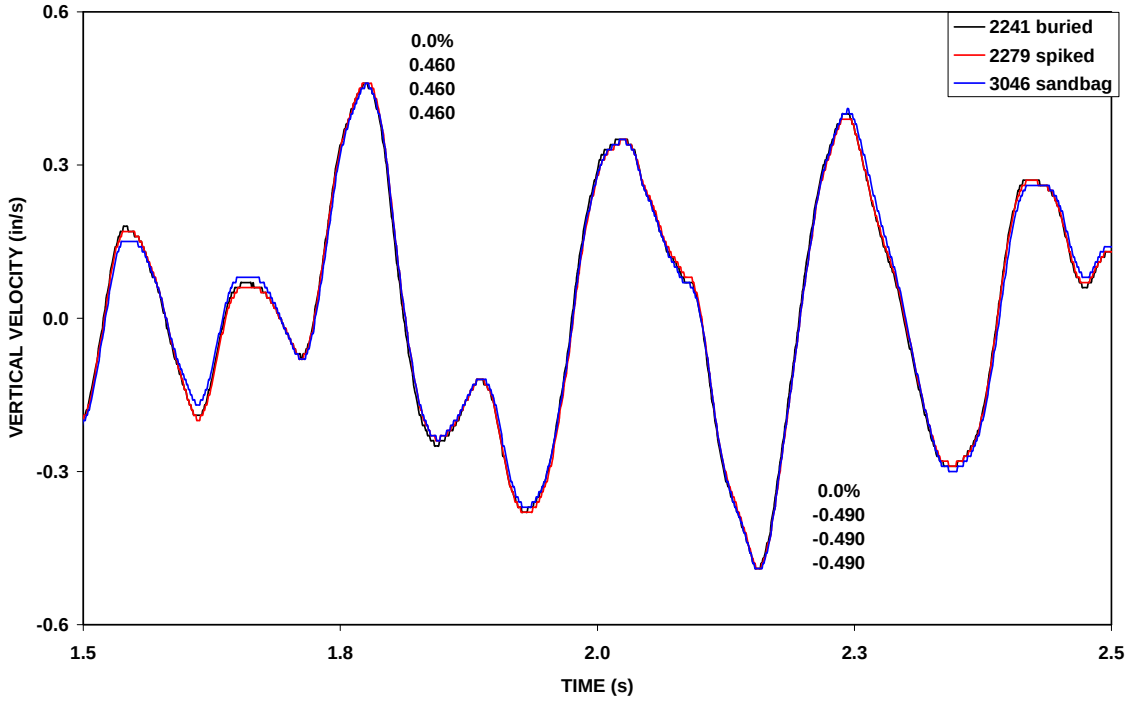
WY-7

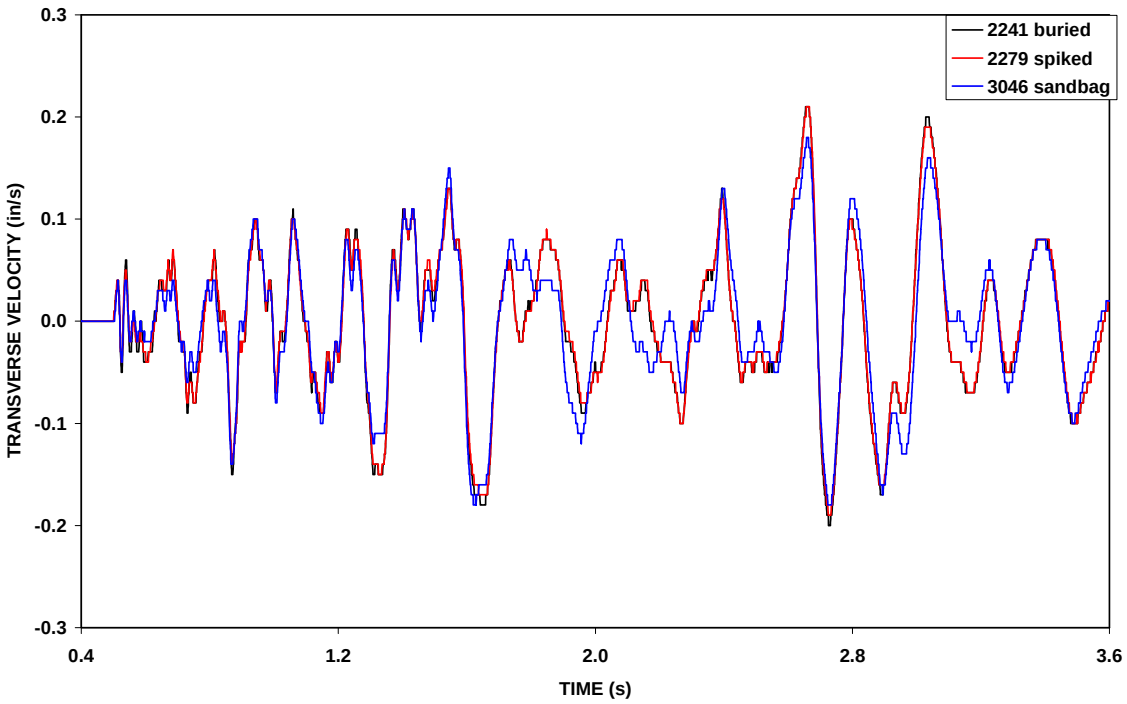
Cluster 2 SD 25.2 ft/lb$^{1/2}$

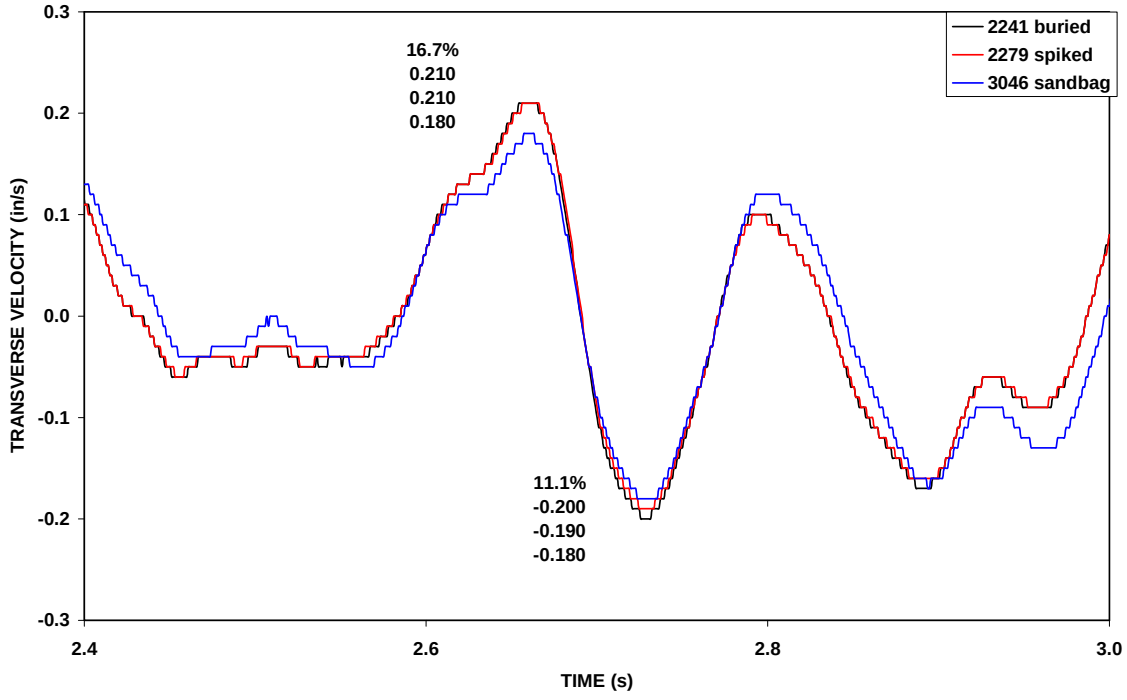

2241 buried
2279 spiked
3046 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
1.2
2.0
2.8
3.6

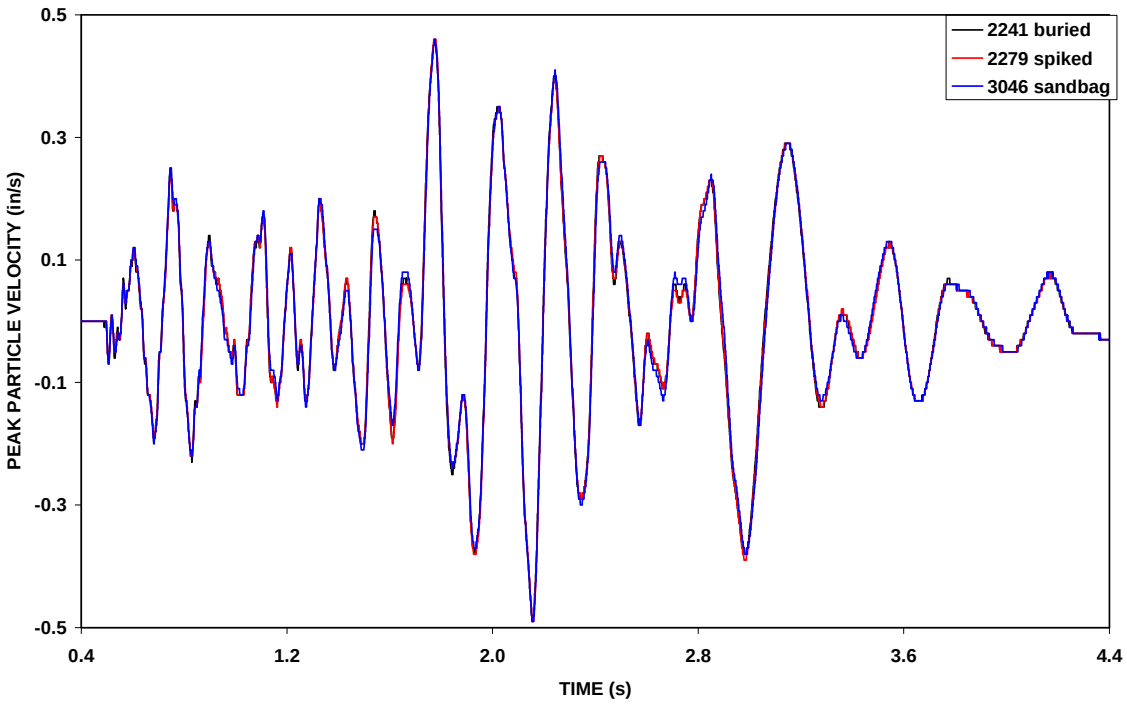

2241 buried
2279 spiked
3046 sandbag
4.2%
0.250
0.240
0.250
11.1%
-0.200
-0.190
-0.180
RADIAL VELOCITY (in/s)
TIME (s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
1.0
1.5
2.0
2.5
3.0
3.5

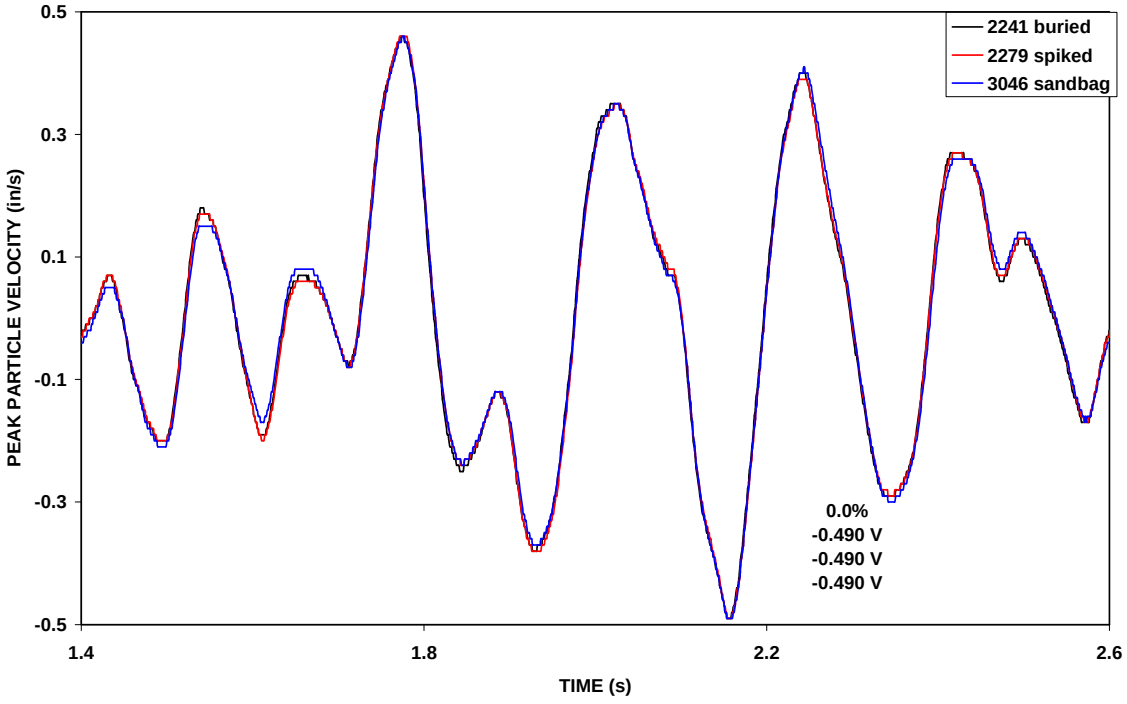

2241 buried
2279 spiked
3046 sandbag
VERTICAL VELOCITY (in/s)
0.6
0.3
0.0
-0.3
-0.6
0.4
1.2
2.0
2.8
3.6
TIME (s)


2241 buried
2279 spiked
3046 sandbag
0.0%
0.460
0.460
0.460
0.0%
-0.490
-0.490
-0.490
VERTICAL VELOCITY (in/s)
0.6
0.3
0.0
-0.3
-0.6
1.5
1.8
2.0
2.3
2.5
TIME (s)


2241 buried
2279 spiked
3046 sandbag
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
0.4
1.2
2.0
2.8
3.6
TIME (s)

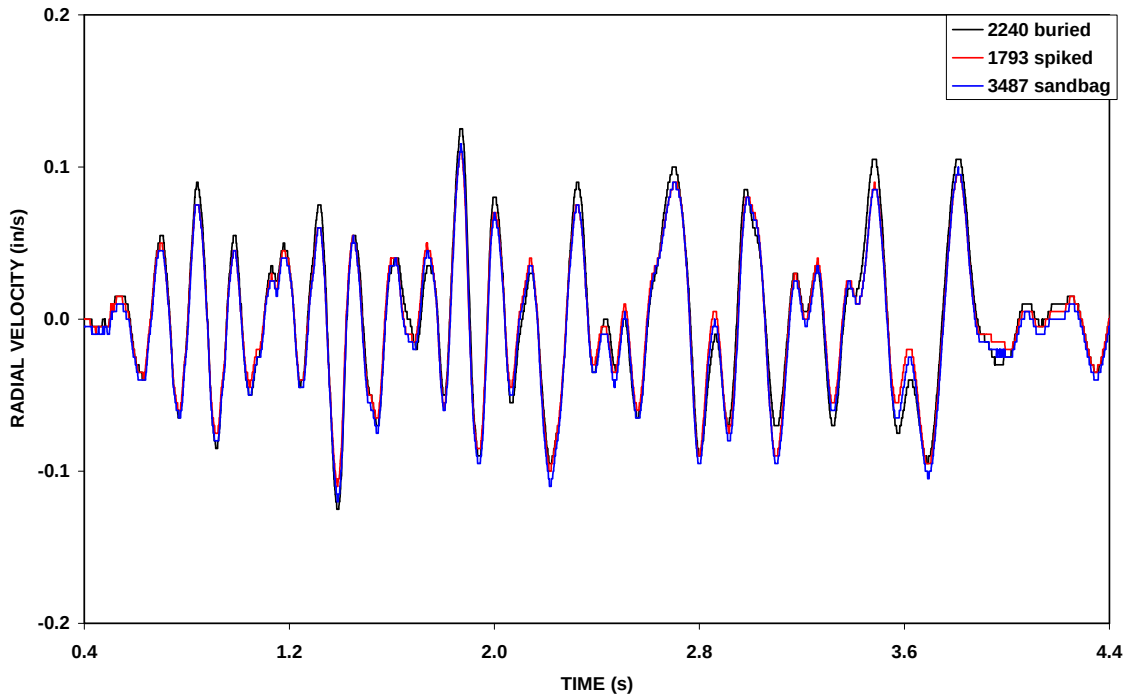

2241 buried
2279 spiked
3046 sandbag
16.7%
0.210
0.210
0.180
11.1%
-0.200
-0.190
-0.180
TRANSVERSE VELOCITY (in/s)
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
2.4
2.6
2.8
3.0
TIME (s)

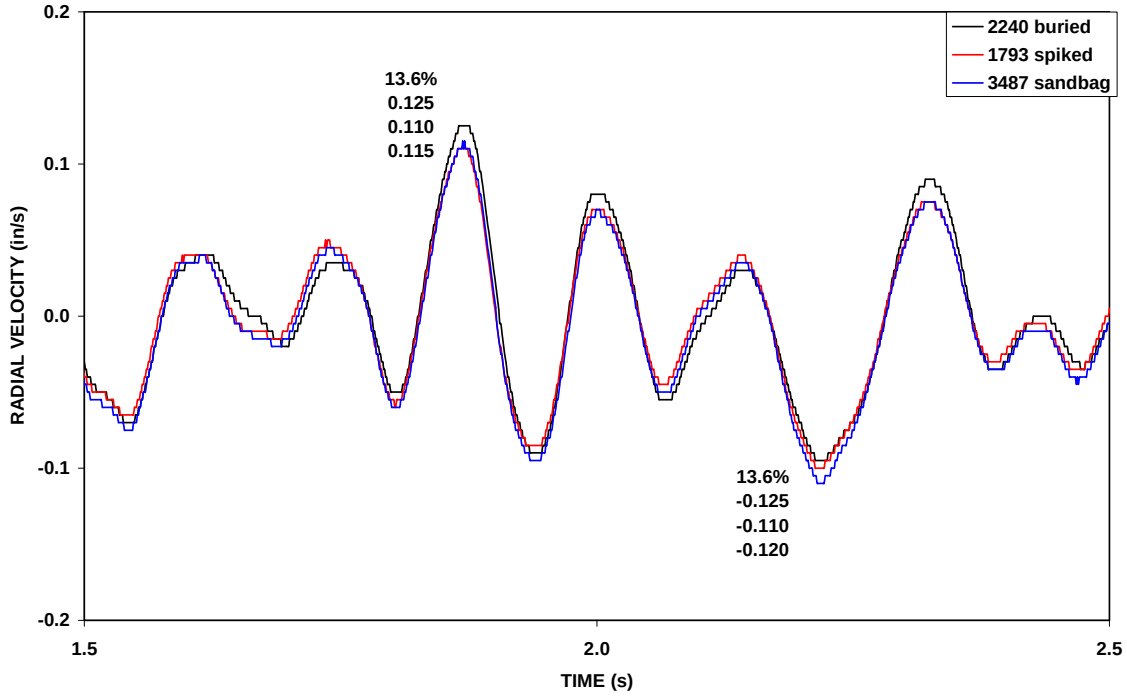

2241 buried
2279 spiked
3046 sandbag
PEAK PARTICLE VELOCITY (in/s)
0.5
0.3
0.1
-0.1
-0.3
-0.5
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)

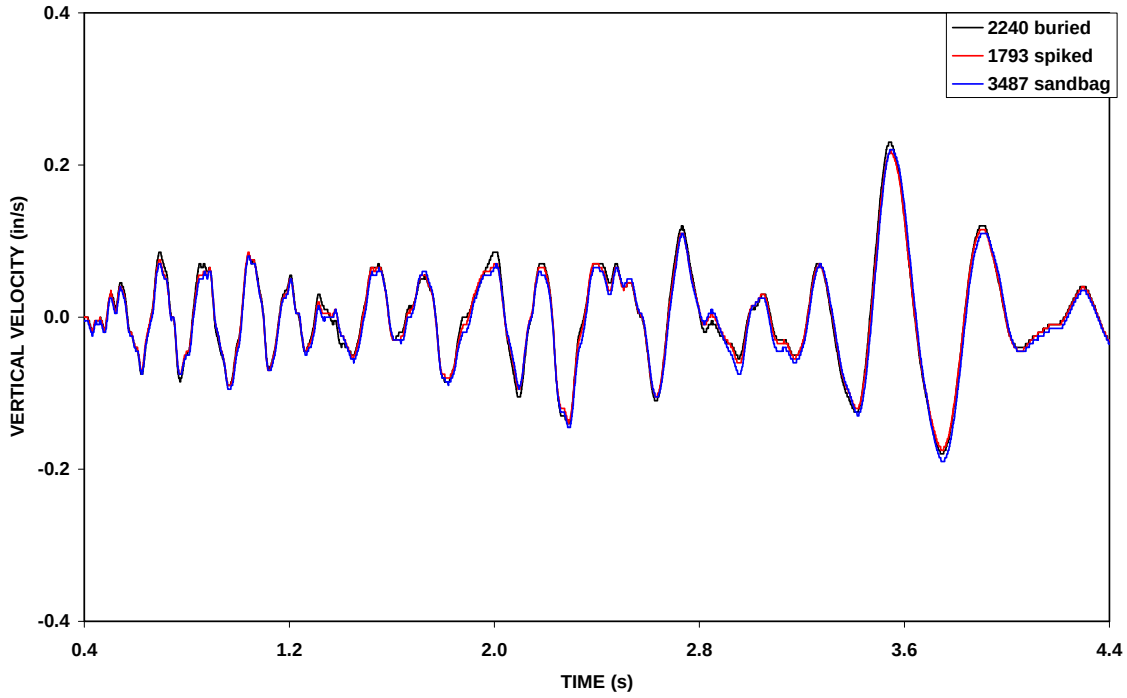

2241 buried
2279 spiked
3046 sandbag
PEAK PARTICLE VELOCITY (in/s)
0.5
0.3
0.1
-0.1
-0.3
-0.5
0.0%
-0.490 V
-0.490 V
-0.490 V
1.4
1.8
2.2
2.6
TIME (s)

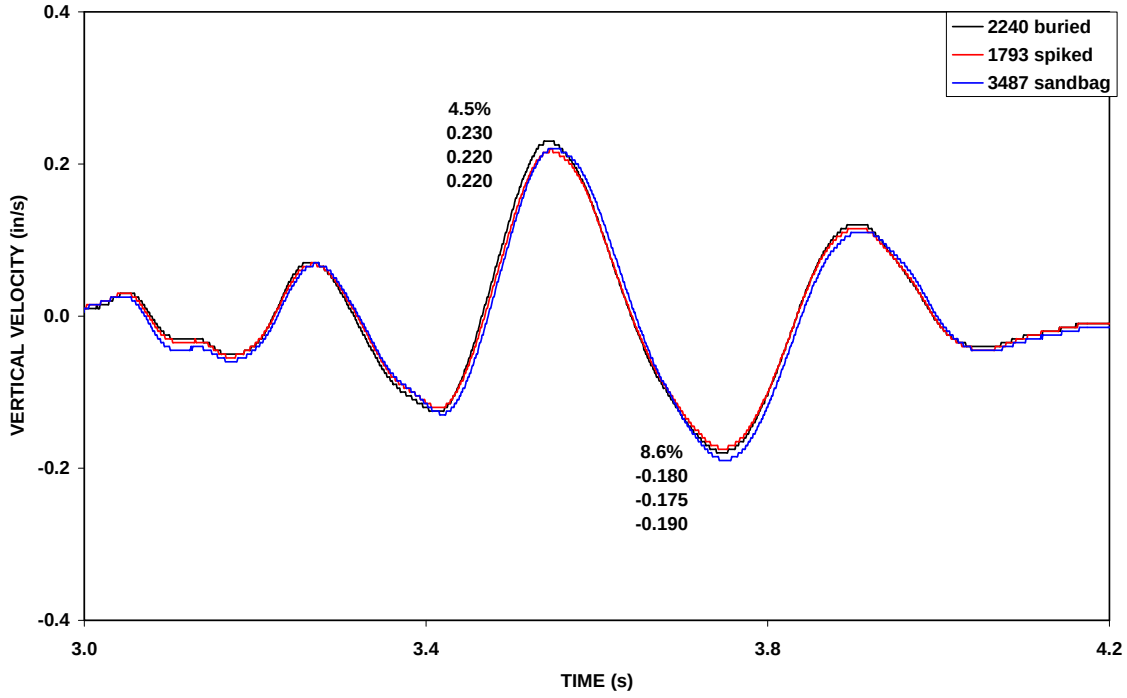
WY-7

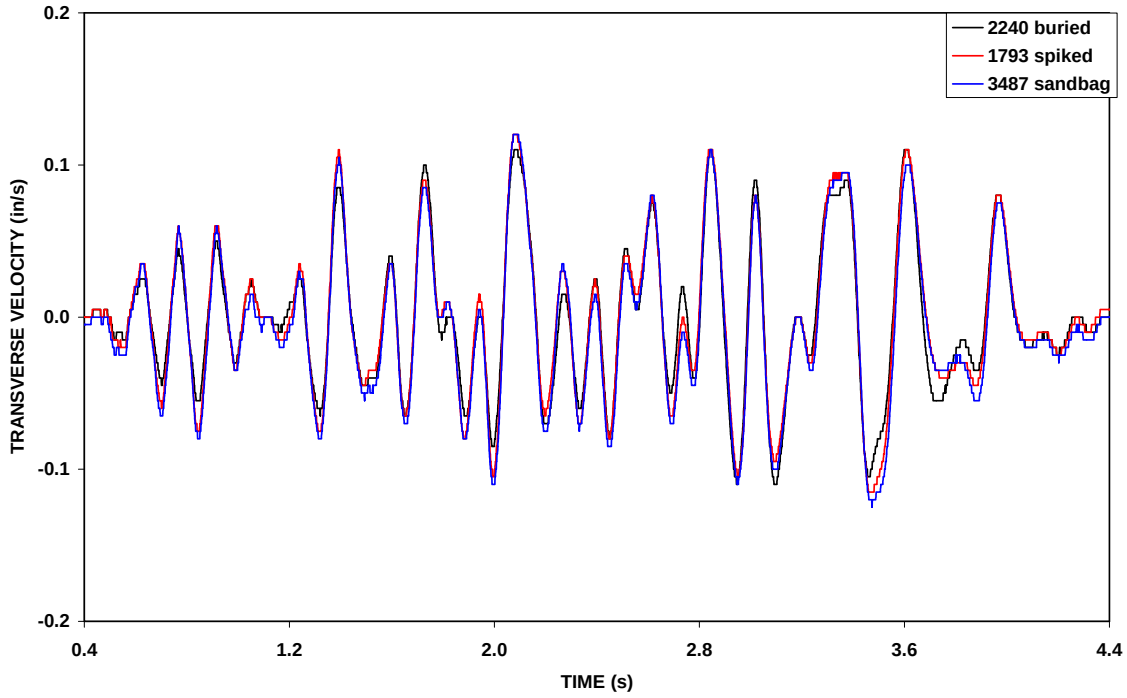
Cluster 3 SD 43.0 ft/lb$^{1/2}$

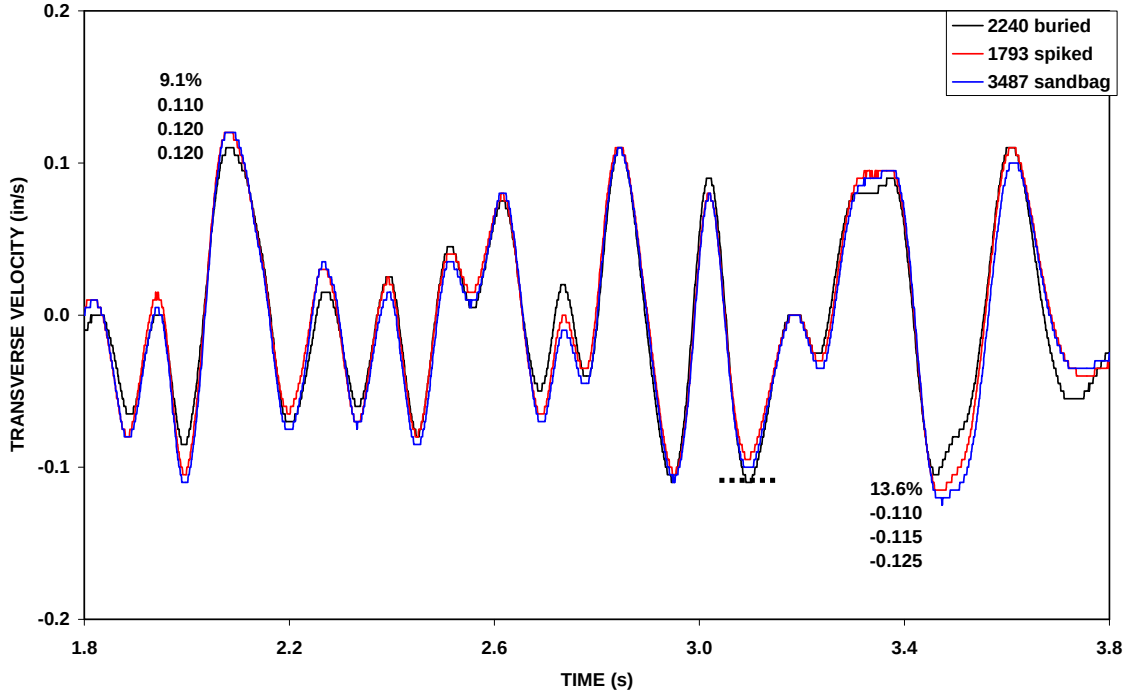

2240 buried
1793 spiked
3487 sandbag
RADIAL VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)


2240 buried
1793 spiked
3487 sandbag
13.6%
0.125
0.110
0.115
13.6%
-0.125
-0.110
-0.120
RADIAL VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
1.5
2.0
2.5
TIME (s)


2240 buried
1793 spiked
3487 sandbag
VERTICAL VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)

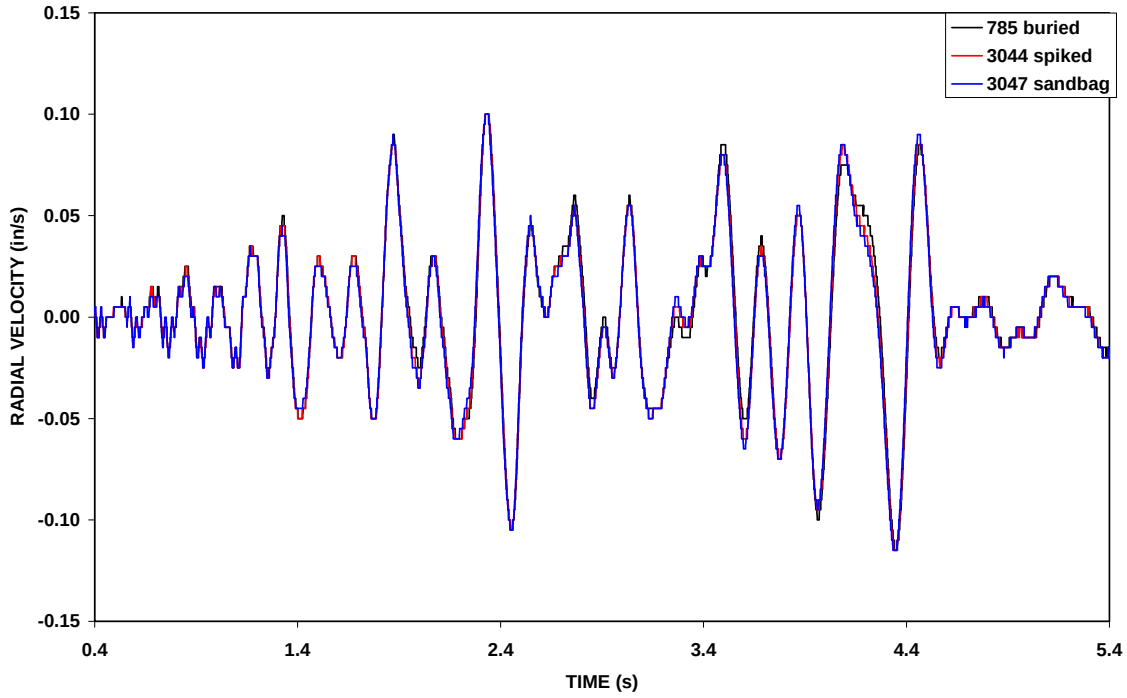

2240 buried
1793 spiked
3487 sandbag
4.5%
0.230
0.220
0.220
8.6%
-0.180
-0.175
-0.190
VERTICAL VELOCITY (in/s)
0.4
0.2
0.0
-0.2
-0.4
3.0
3.4
3.8
4.2
TIME (s)

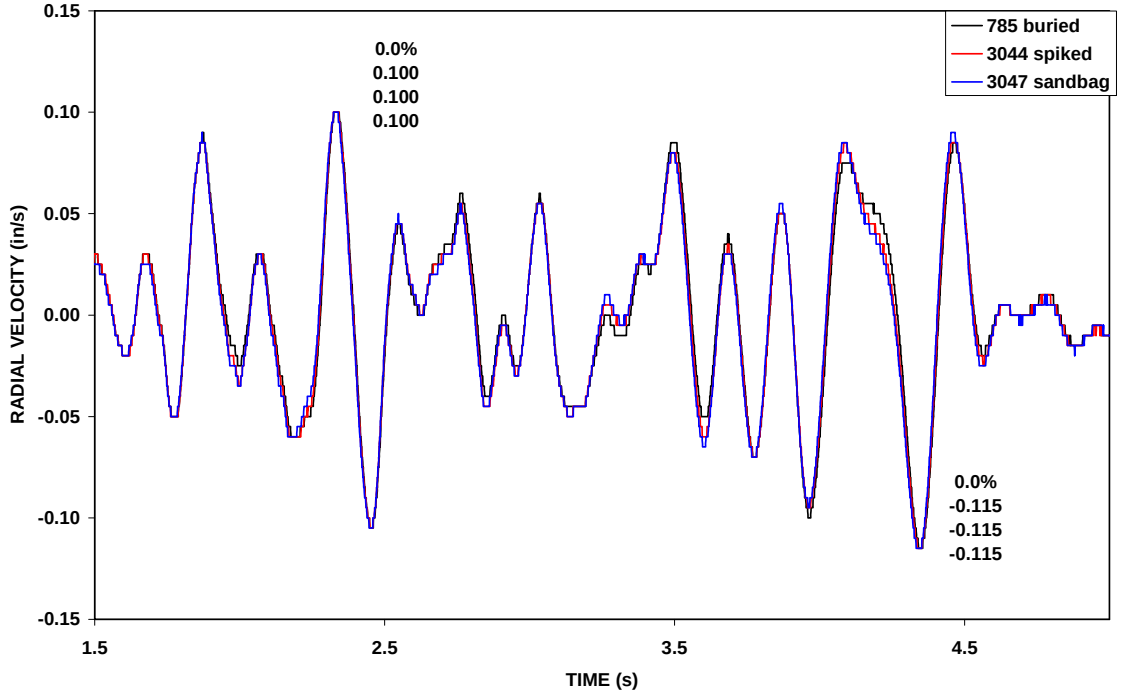

2240 buried
1793 spiked
3487 sandbag
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
0.4
1.2
2.0
2.8
3.6
4.4
TIME (s)

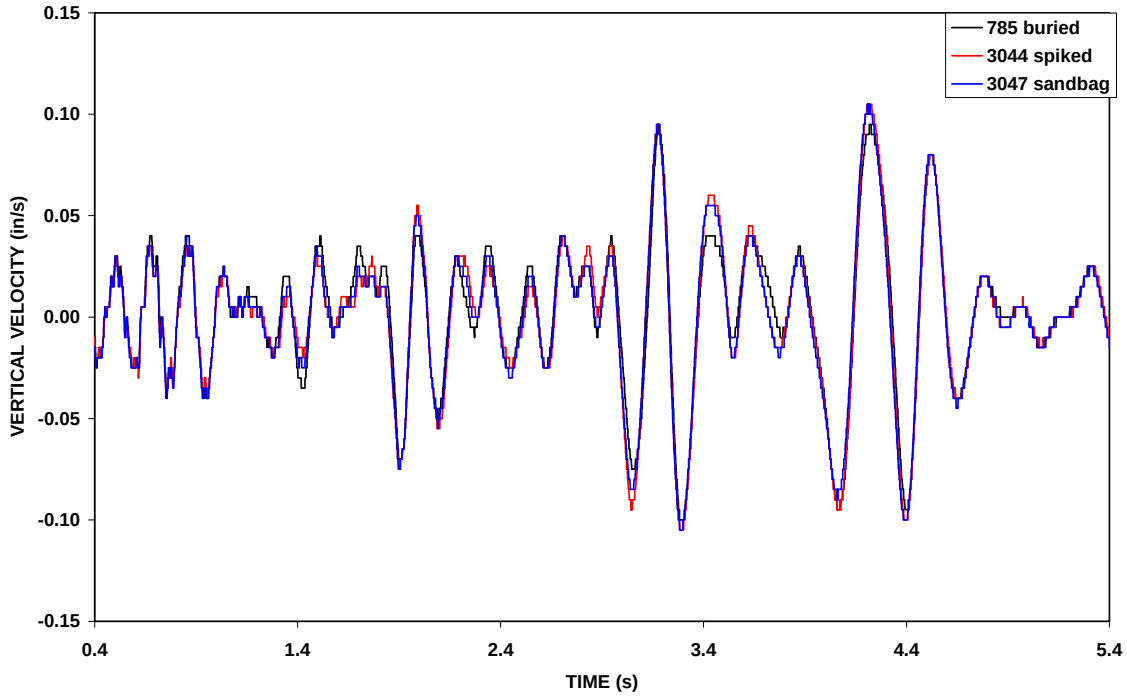

2240 buried
1793 spiked
3487 sandbag
9.1%
0.110
0.120
0.120
13.6%
-0.110
-0.115
-0.125
TRANSVERSE VELOCITY (in/s)
0.2
0.1
0.0
-0.1
-0.2
1.8
2.2
2.6
3.0
3.4
3.8
TIME (s)

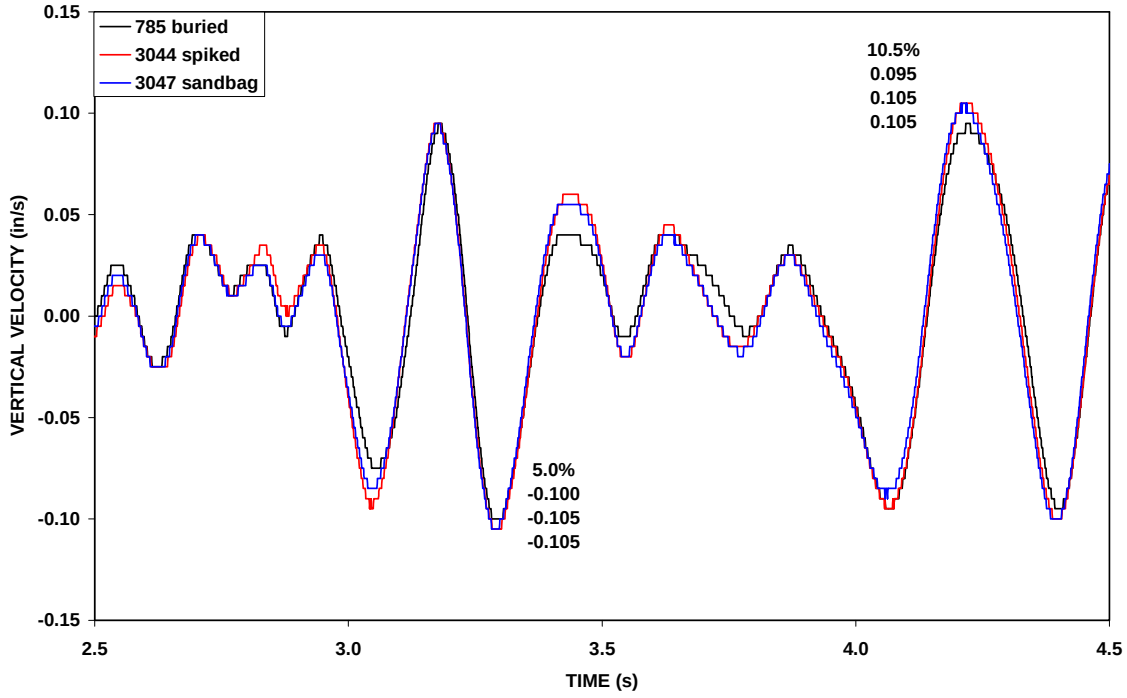
WY-7

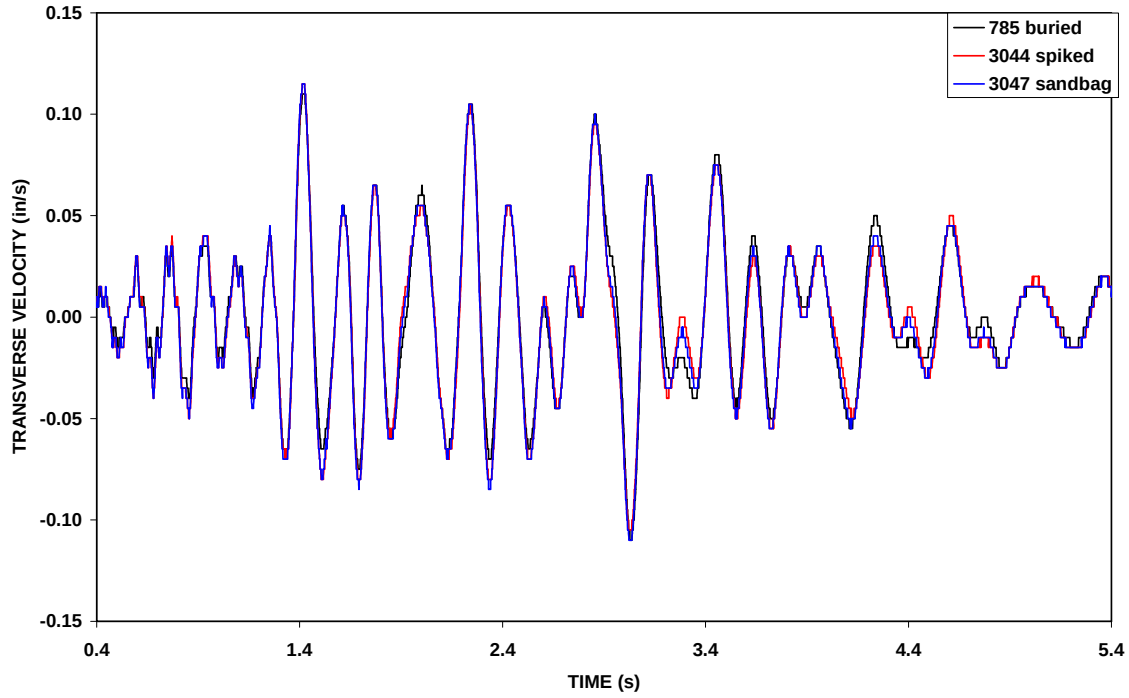
Cluster 4 SD 63.7 ft/lb$^{1/2}$

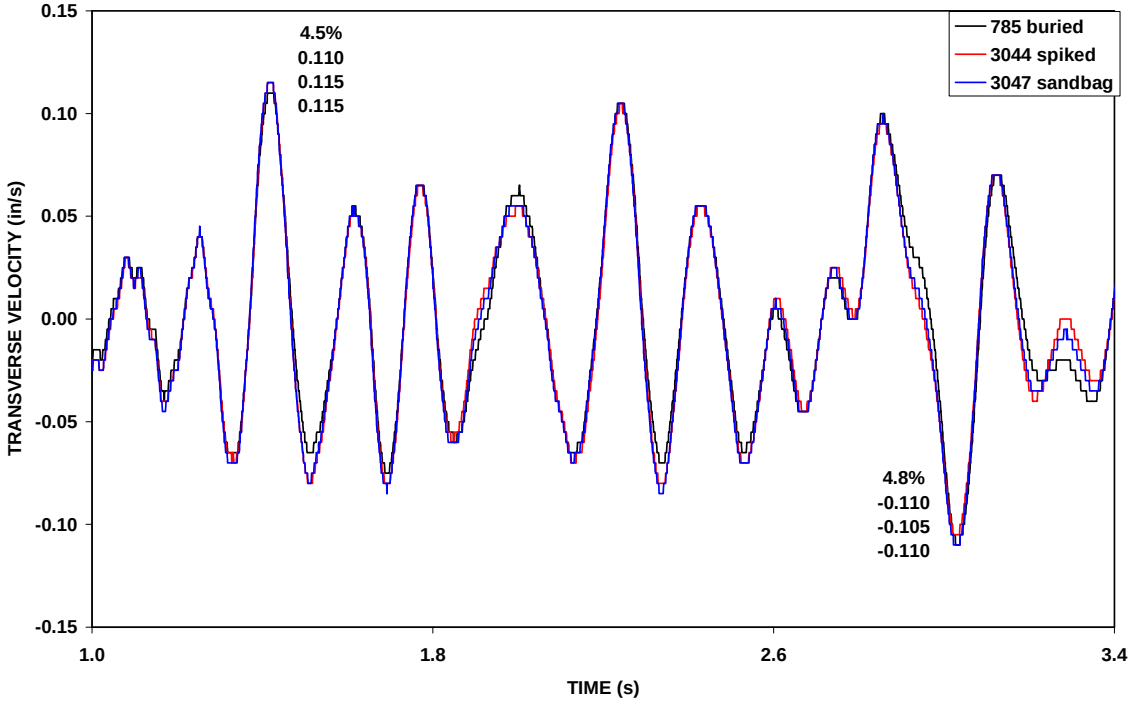

785 buried
3044 spiked
3047 sandbag
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
1.4
2.4
3.4
4.4
5.4


785 buried
3044 spiked
3047 sandbag
0.0%
0.100
0.100
0.100
0.0%
-0.115
-0.115
-0.115
RADIAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1.5
2.5
3.5
4.5


785 buried
3044 spiked
3047 sandbag
VERTICAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
1.4
2.4
3.4
4.4
5.4

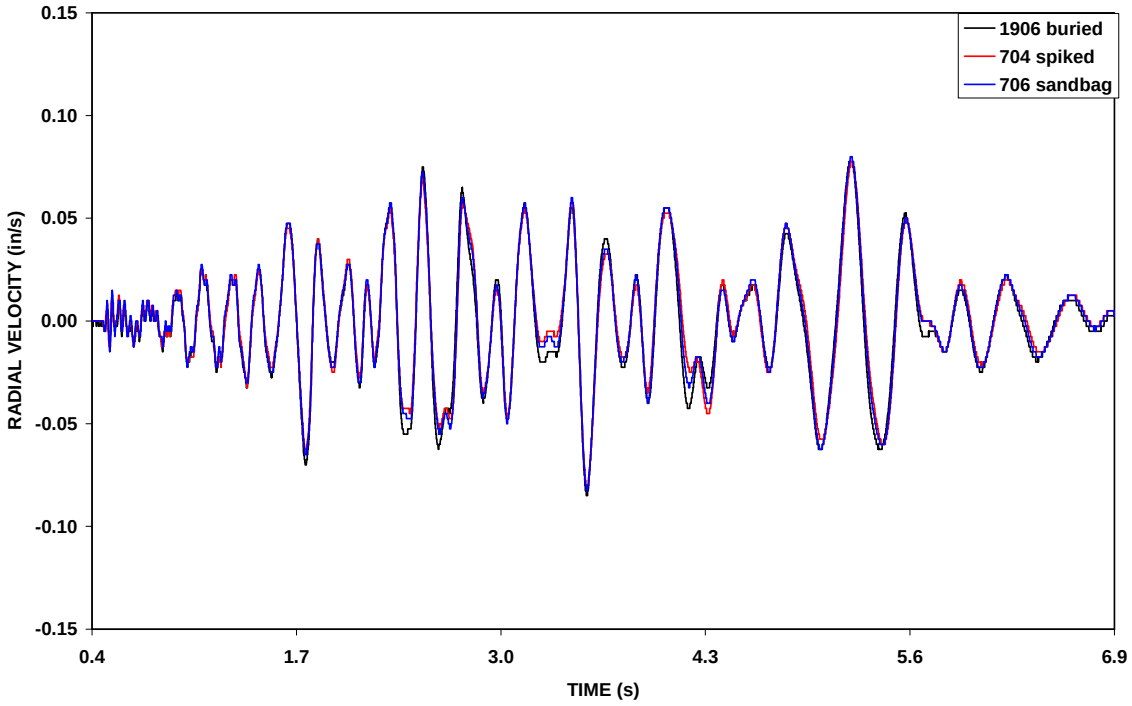

785 buried
3044 spiked
3047 sandbag
10.5%
0.095
0.105
0.105
5.0%
-0.100
-0.105
-0.105
VERTICAL VELOCITY (in/s)
TIME (s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
2.5
3.0
3.5
4.0
4.5

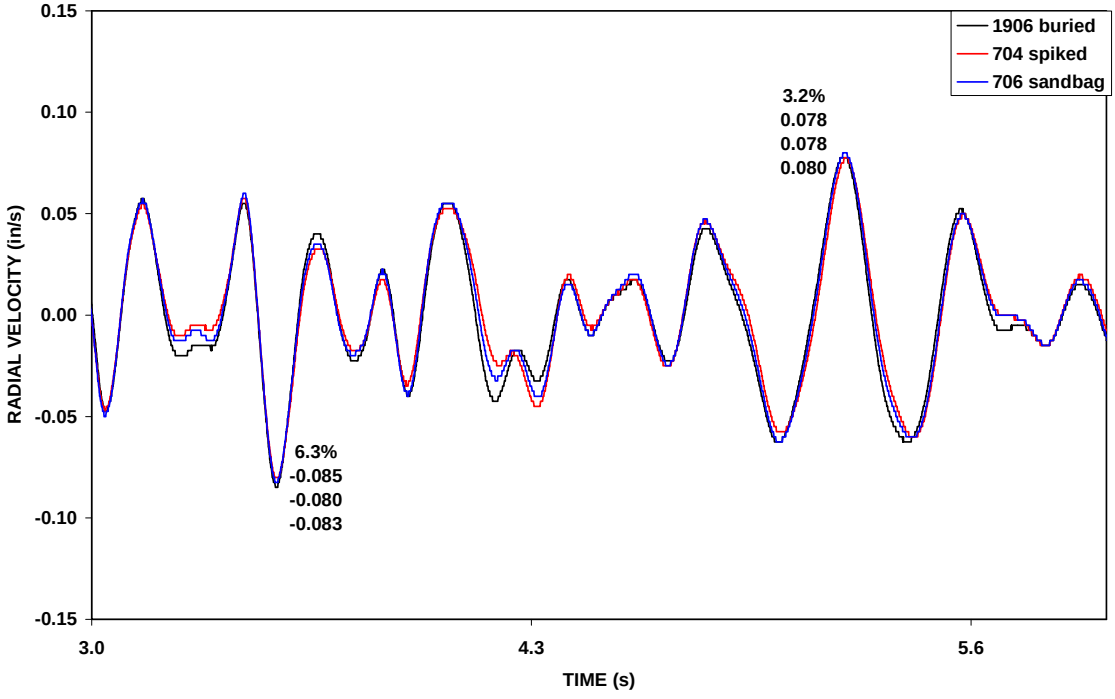

785 buried
3044 spiked
3047 sandbag
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
1.4
2.4
3.4
4.4
5.4
TIME (s)

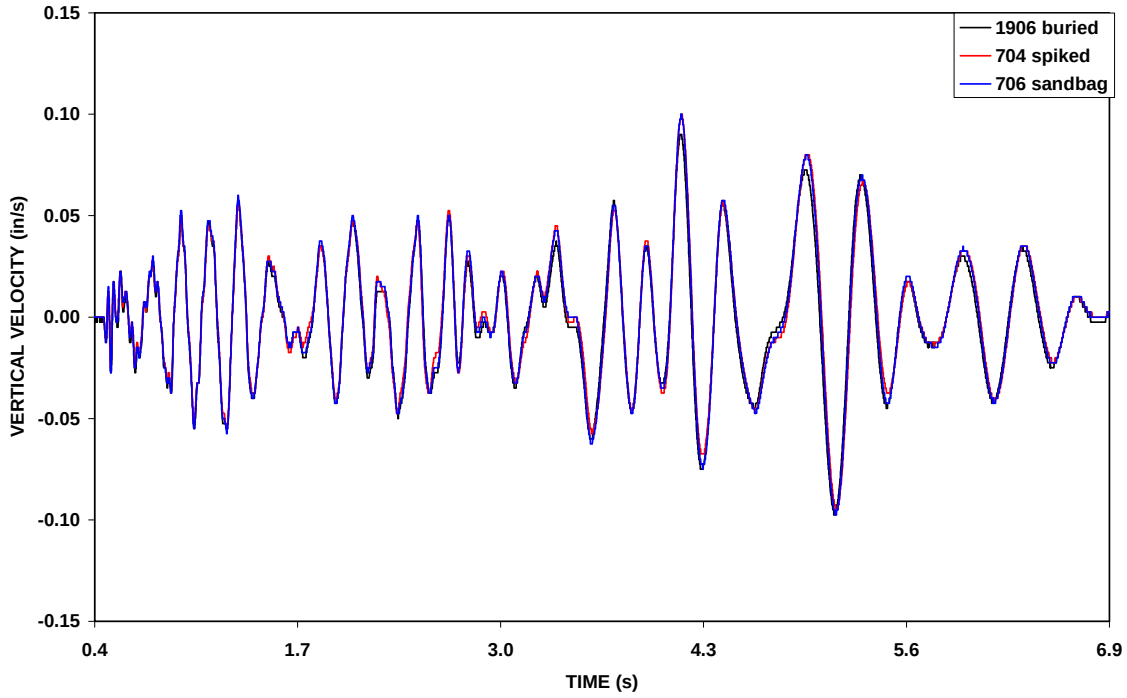

785 buried
3044 spiked
3047 sandbag
4.5%
0.110
0.115
0.115
4.8%
-0.110
-0.105
-0.110
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1.0
1.8
2.6
3.4
TIME (s)

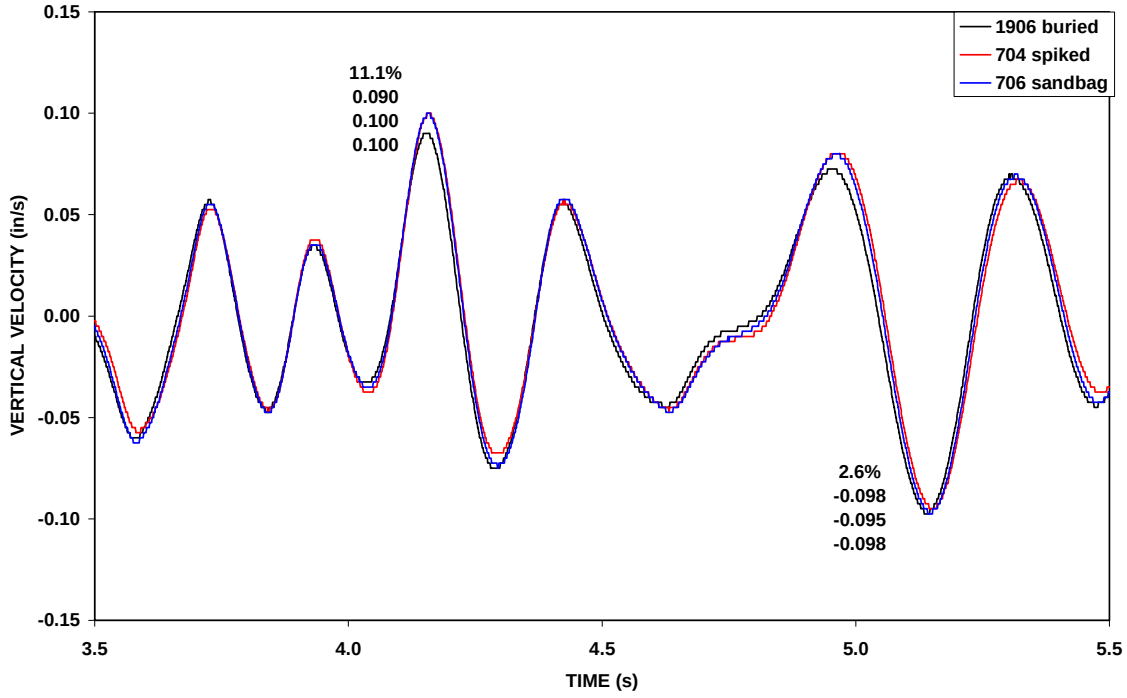
WY-7

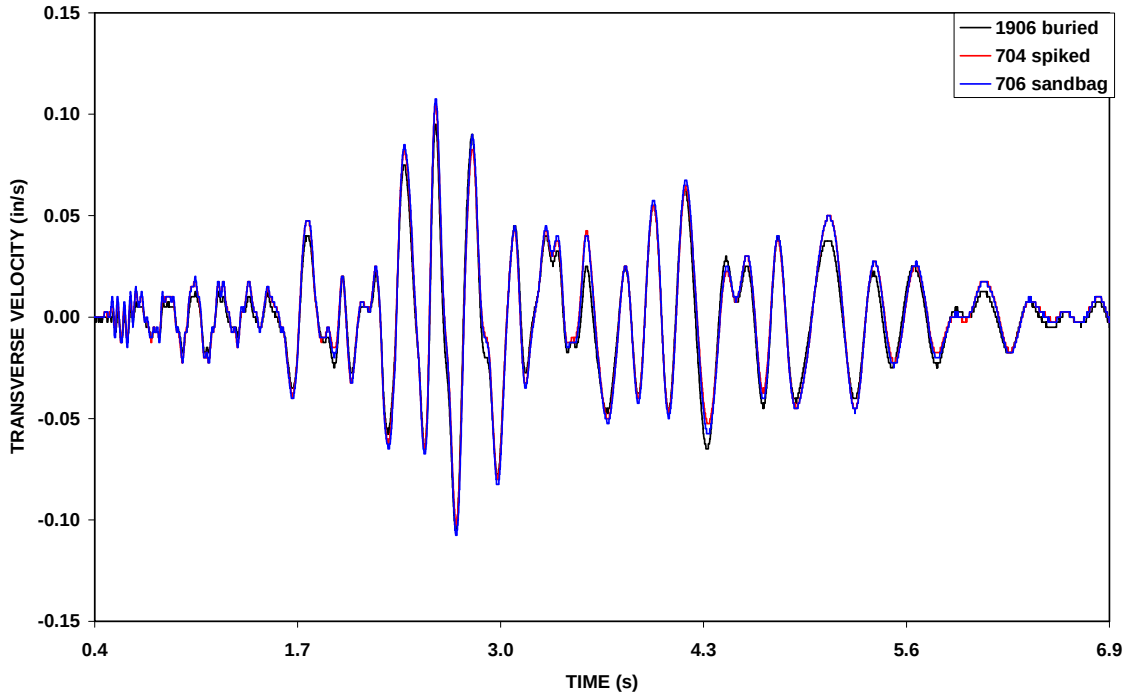
Cluster 5 SD 78.3 ft/lb$^{1/2}$

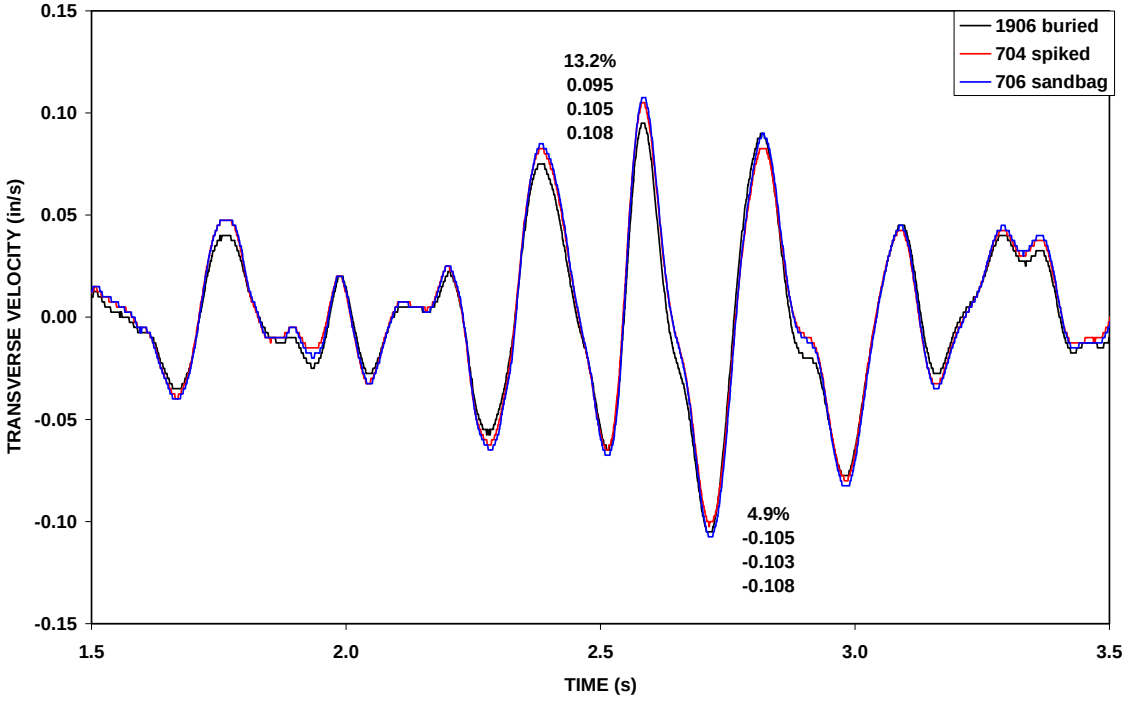

1906 buried
704 spiked
706 sandbag
RADIAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
1.7
3.0
4.3
5.6
6.9
TIME (s)


1906 buried
704 spiked
706 sandbag
3.2%
0.078
0.078
0.080
6.3%
-0.085
-0.080
-0.083
RADIAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
3.0
4.3
5.6
TIME (s)


1906 buried
704 spiked
706 sandbag
VERTICAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
1.7
3.0
4.3
5.6
6.9
TIME (s)


1906 buried
704 spiked
706 sandbag
11.1%
0.090
0.100
0.100
2.6%
-0.098
-0.095
-0.098
VERTICAL VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
3.5
4.0
4.5
5.0
5.5
TIME (s)


1906 buried
704 spiked
706 sandbag
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
0.4
1.7
3.0
4.3
5.6
6.9
TIME (s)


1906 buried
704 spiked
706 sandbag
13.2%
0.095
0.105
0.108
4.9%
-0.105
-0.103
-0.108
TRANSVERSE VELOCITY (in/s)
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1.5
2.0
2.5
3.0
3.5
TIME (s)

APPENDIX C

Blast site data for regression analysis

Geophones placed loose on the ground surface and buried

Site	Scaled distance	Loose on surface			Buried			Component
		Peak particle velocity	Peak frequency	Acceleration	Peak particle velocity	Peak frequency	Acceleration	
ID	SD	(in/s)	(Hz)	(g)	(in/s)	(Hz)	(g)	
KY-2	49	0.70	32.0	0.49	0.49	9.3	0.23	V/R
IN-1	23.6	0.63	8.8	0.17	0.59	7.4	0.13	T
KY-3	66.2	0.11	16.5	0.06	0.07	23.2	0.03	R
IL-2	116.2	0.15	30.1	0.08	0.07	18.2	0.03	T
OH-2	26.8	0.82	6.1	0.27	0.66	6.2	0.19	R
OH-3	30.8	0.88	14.2	0.28	0.98	7.8	0.25	T
OH-4	24.5	0.90	26.9	0.59	0.66	16.0	0.21	R
OH-5	16.4	1.60	16.0	0.52	1.36	16.5	0.33	R
OH-6	13.1	1.03	9.4	0.28	0.90	9.3	0.20	R
KY-6	33.8	0.32	12.4	0.07	0.26	13.1	0.05	R
KY-7	28.6	0.78	10.2	0.14	0.78	9.4	0.13	T
KY-8	27.3	0.28	24.3	0.13	0.21	13.1	0.08	R
WV-1	22.5	0.28	6.1	0.04	0.22	6.0	0.04	R
WV-2	26.9	1.60	15.0	0.56	1.26	12.4	0.57	R
WV-3	21	0.10	6.2	0.03	0.10	6.9	0.02	R
WY-1	16.8	2.40	7.6	0.32	2.12	7.5	0.30	R
WY-2	29.1	0.38	3.0	0.05	0.38	2.9	0.04	R
WY-3	51.3	0.22	2.4	0.03	0.23	2.4	0.03	R
WY-4	9.7	1.60	7.5	0.37	1.40	7.2	0.28	R
WY-5	12.9	2.68	4.4	0.52	2.52	4.3	0.49	R
MI-2	38.2	0.28	46.5	0.30	0.23	36.5	0.13	V
OH-1	22.4	1.26	10.4	0.86	0.92	8.5	0.52	R
Mean		0.86	14.36	0.28	0.75	11.09	0.19	
Standard deviation		0.73	11.16	0.23	0.66	7.66	0.17	
Standard deviation		84.8%	77.7%	81.8%	88.4%	69.0%	86.1%	

Spiked geophones of square and round shapes

Site	Scaled Distance	Spiked square sensor			Spiked round sensor			Component
		Peak particle velocity	Peak frequency	Acceleration	Peak particle velocity	Peak frequency	Acceleration	
ID	SD	(in/s)	(Hz)	(g)	(in/s)	(Hz)	(g)	
KY-1	52.9	0.62	21.3	0.40	0.66	56.8	0.61	T/R
KY-2	49	0.54	14.6	0.41	0.98	56.8	1.01	R
IL-1	19.4	1.62	15.0	0.85	1.66	13.8	0.66	T
IL-2	116.2	0.09	20.4	0.03	0.10	20.4	0.03	T
IN-1	23.6	0.65	7.6	0.24	0.70	7.5	0.27	T
OH-2	26.8	0.68	6.3	0.19	0.64	6.1	0.18	R
OH-3	30.8	0.92	15.0	0.26	0.84	16.0	0.23	T
OH-4	24.5	0.64	16.5	0.32	0.68	36.5	0.40	R/V
OH-6	13.1	1.06	9.3	0.25	0.98	9.4	0.25	R
KY-6	33.8	0.31	12.4	0.07	0.31	12.4	0.07	R
KY-7	28.6	0.82	9.4	0.13	0.76	9.3	0.13	T
WV-1	22.5	0.22	5.8	0.04	0.21	4.3	0.03	R/T
WV-2	26.9	1.30	16.5	0.49	1.36	16.5	0.46	R
WV-3	21	0.09	6.4	0.03	0.09	6.4	0.03	R
NM-4	14.4	1.62	22.2	0.82	1.58	24.3	0.80	R
NM-5	29.1	0.30	13.1	0.07	0.29	8.0	0.11	T
Mean		0.72	13.24	0.29	0.74	19.03	0.33	
Standard deviation		0.49	5.41	0.26	0.49	16.85	0.30	
Standard deviation		68.1%	40.9%	89.9%	66.4%	88.6%	91.8%	

Buried, spiked and combined spiked and buried geophones

Site	Scaled distance	Spiked and buried			Buried			Spiked			Component
		Peak particle velocity	Peak frequency	Acceleration	Peak particle velocity	Peak frequency	Acceleration	Peak particle velocity	Peak frequency	Acceleration	
ID	($ft/lb^{1/2}$)	(in/s)	(Hz)	(g)	(in/s)	(Hz)	(g)				
KY-4	134.2	0.78	7.4	0.23	0.78	7.4	0.29	0.84	64.0	0.88	T
KY-5	51.5	0.74	22.2	0.27	0.74	21.3	0.27	1.08	42.6	0.81	T/T/R
IL-1	19.4	1.14	21.3	0.44	1.22	30.1	0.62	1.62	15.0	0.85	T/V/T
IL-2	116.2	0.07	18.2	0.03	0.07	18.2	0.03	0.09	20.4	0.03	T
IN-1	23.6	0.58	5.8	0.15	0.59	7.4	0.13	0.65	7.6	0.24	R/T/T
WY-3	51.3	0.22	2.4	0.03	0.23	2.4	0.03	0.21	2.4	0.01	R
WY-4	9.7	1.56	6.8	0.30	1.40	7.2	0.28	1.64	6.8	0.30	R
WY-5	12.9	2.40	4.2	0.52	2.52	4.3	0.49	2.40	4.3	0.56	R
Mean		0.94	11.04	0.25	0.94	12.29	0.27	1.07	20.39	0.46	
Standard deviation		0.76	8.12	0.18	0.78	9.77	0.21	0.79	21.89	0.36	
Standard deviation		81.1%	73.5%	72.0%	82.6%	79.5%	78.8%	73.7%	107.4%	78.9%	

Buried, spiked, sandbag, and combined spiked and sandbag geophones

Site	Scaled Distance	buried			spiked and sand bagged			spiked			sand bagged			Component
		Peak particle velocity	Peak frequency	Acceleration	Peak particle velocity	Peak frequency	Acceleration	Peak particle velocity	Peak frequency	Acceleration	Peak particle velocity	Peak frequency	Acceleration	
ID	($ft/lb^{1/2}$)	(in/s)	(Hz)	(g)	(in/s)	(Hz)	(g)	(in/s)	(Hz)	(g)	(in/s)	(Hz)	(g)	
KY-1	52.9	0.52	19.6	0.25	0.54	36.5	0.25	0.62	21.3	0.40	0.58	30.1	0.29	T/V/T/V
KY-2	49	0.49	9.3	0.23	0.56	15.0	0.27	0.54	14.6	0.41	0.57	10.2	0.25	R
IL-1	19.4	1.22	30.1	0.62	1.80	13.1	0.53	1.62	15.0	0.85	1.88	11.6	0.45	V/T/T/T
IL-2	116.2	0.07	18.2	0.03	0.12	20.4	0.05	0.09	20.4	0.03	0.12	20.4	0.05	T
IN-1	23.6	0.59	7.4	0.08	0.60	6.0	0.21	0.65	7.6	0.24	0.60	8.5	0.17	T/R/T/T
OH-1	22.4	0.92	8.5	0.29	1.00	12.4	0.33	1.00	12.4	0.33	1.06	13.1	0.33	R/T/T/T
OH-2	26.8	0.66	6.2	0.19	0.78	6.2	0.22	0.68	6.3	0.19	0.80	6.1	0.21	R
OH-3	30.8	0.98	7.8	0.25	0.88	10.4	0.24	0.92	15.0	0.26	1.08	15.0	0.28	T/R/T/T
OH-4	24.5	0.66	16.0	0.21	0.76	21.3	0.34	0.64	16.5	0.32	0.68	14.6	0.27	R
OH-5	16.4	1.36	16.5	0.33	1.48	16.5	0.45	1.40	17.0	0.72	1.32	17.0	0.41	R
OH-6	13.1	0.90	9.3	0.20	1.05	9.4	0.25	1.06	9.3	0.25	1.02	9.6	0.24	R
KY-6	33.8	0.26	13.1	0.05	0.32	12.4	0.07	0.31	12.4	0.07	0.32	13.4	0.07	R
KY-7	28.6	0.78	9.4	0.13	0.78	9.4	0.14	0.82	9.4	0.13	0.78	10	0.13	T
KY-8	27.3	0.21	13.1	0.08	0.28	13.4	0.11	0.27	23.2	0.11	0.28	16.0	0.10	R
WV-1	22.5	0.22	6.0	0.04	0.22	5.9	0.04	0.22	5.8	0.04	0.23	6.2	0.04	R
WV-2	26.9	1.26	12.4	0.57	1.32	16.5	0.51	1.30	16.5	0.49	1.26	13.4	0.59	R
WV-3	21.0	0.10	6.9	0.02	0.09	6.2	0.01	0.09	6.4	0.03	0.09	6.4	0.01	R
WY-1	16.8	2.12	7.5	0.30	2.20	7.6	0.33	2.20	7.3	0.27	2.24	7.5	0.27	R
WY-2	29.1	0.38	2.9	0.04	0.38	2.8	0.04	0.38	2.8	0.05	0.38	2.9	0.05	R
WY-3	51.3	0.23	2.4	0.03	0.22	2.4	0.03	0.21	2.4	0.01	0.20	2.4	0.03	R
WY-4	9.7	1.40	7.2	0.28	1.60	6.6	0.29	1.64	6.8	0.30	1.68	6.7	0.32	R
WY-5	12.9	2.52	4.3	0.49	2.52	4.4	0.53	2.40	4.3	0.56	2.44	4.4	0.53	R
NM-4	14.4	1.40	12.1	0.58	1.44	13.1	0.66	1.62	22.2	0.82	1.38	21.3	0.74	T/R/T/R
NM-5	29.1	0.27	12.8	0.10	0.30	8.1	0.13	0.30	13.1	0.07	0.30	8.2	0.13	R/R/R/V
NM-7	40.8	0.90	34.1	0.56	not performed			1.24	32.0	0.74	0.94	34.1	0.57	R/ - /R/R
Mean		0.83	10.41	0.22	0.90	10.41	0.25	0.88	11.60	0.28	0.90	10.65	0.25	
Standard deviation		0.64	6.00	0.19	0.68	5.26	0.19	0.67	6.06	0.25	0.68	5.21	0.19	
Standard deviation		78.1%	57.7%	85.0%	76.0%	50.5%	74.8%	75.9%	52.3%	89.0%	75.6%	48.9%	79.0%	

APPENDIX D

Summary statistics for human-induced error tests

Summary statistics for three series of small-scale, single holes blasts

Test Date	Method	Series	Scaled Distance	Statistic	Radial	Peak Frequency	FFT Frequency	Vertical	Peak Frequency	FFT Frequency	Transverse	Peak Frequency	FFT Frequency	PPV	Peak Frequency
			(ft/lbs$^{1/2}$)		(in/s)	(Hz)	(Hz)	(in/s)	(Hz)	(Hz)	(in/s)	(Hz)	(Hz)	(in/s)	(Hz)
2008	buried	1	122	$\bar{x}$	0.036	14.8	11.8	0.074	17.5	15.6	0.048	15.7	16.0	0.074	17.5
				s	0.0017	0.7	0.8	0.0041	3.0	0.7	0.0063	1.1	0.9	0.0041	3.0
		2	120	$\bar{x}$	0.037	14.5	12.6	0.083	16.9	15.3	0.057	15.6	15.8	0.083	16.9
				s	0.0025	0.6	0.6	0.0044	0.5	0.6	0.0047	1.4	0.8	0.0044	0.5
	sandbag	1	106	$\bar{x}$	0.055	15.0	13.7	0.082	18.1	16.9	0.082	17.9	15.9	0.085	18.0
				s	0.0032	0.6	0.6	0.0044	0.5	0.7	0.0044	0.6	3.4	0.0032	0.5
		2	110	$\bar{x}$	0.064	15.4	13.4	0.078	16.8	15.2	0.093	16.4	11.1	0.094	16.4
				s	0.0041	0.8	0.2	0.0047	0.7	1.5	0.0076	0.6	2.3	0.0063	0.7
	spiked	1	118	$\bar{x}$	0.043	14.5	12.0	0.077	18.3	16.5	0.021	35.8	14.5	0.077	18.3
				s	0.0035	4.3	0.5	0.0030	2.3	2.5	0.0033	7.2	4.6	0.0030	2.3
		2	111	$\bar{x}$	0.043	19.0	18.0	0.081	16.9	16.0	0.033	15.8	12.6	0.081	16.9
				s	0.0025	3.3	2.3	0.0025	0.8	0.2	0.0030	1.8	1.0	0.0025	0.8
	sandbag and spiked	1	108	$\bar{x}$	0.048	19.6	18.6	0.096	18.2	16.6	0.047	15.0	12.4	0.096	18.2
				s	0.0036	2.7	2.2	0.0040	0.3	0.6	0.0121	4.1	3.4	0.0040	0.3
		2	106	$\bar{x}$	0.052	15.2	14.5	0.089	17.9	17.2	0.060	14.9	11.6	0.089	17.9
				s	0.0025	0.9	0.1	0.0057	0.4	0.1	0.0160	4.0	3.0	0.0057	0.4
2010	buried	3	20.6	$\bar{x}$	1.24	32.6	27.6	0.895	28.9	23.0	0.347	32.9	28.5	1.26	34.3
				s	0.118	7.9	4.0	0.148	4.4	1.6	0.260	11.7	14.0	0.087	1.3
	sandbag		22.4	$\bar{x}$	1.02	30.9	25.2	1.040	33.7	21.2	0.372	38.4	25.5	1.12	34.0
				s	0.503	2.3	4.5	0.442	6.7	2.3	0.157	11.3	9.1	0.474	5.2
	spiked		28.4	$\bar{x}$	0.371	24.9	21.9	1.176	22.1	16.7	0.168	41.8	26.7	0.401	23.2
				s	0.083	2.5	2.4	0.049	3.6	0.8	0.060	11.3	5.6	0.064	3.4
	sandbag and spiked		29.5	$\bar{x}$	0.366	24.8	21.3	0.396	22.4	16.3	0.165	35.4	26.6	0.414	23.1
				s	0.097	2.3	1.6	0.107	3.3	1.1	0.113	15.5	7.1	0.114	3.7