CPTU46A

ADOTTATTO con Delibera di C.C. N. 182544/105 del 31/10/2017

Comune	Ravenna
Via	Missiroli
Localita'	Ospedale Civile
Committente	Politecnica
Data	29/03/2010

Falda 0.80 m

Sigla della Punta	Tecnopenta 010104
Azzeramento	Inizio prova
Ultimo taratura guadagno	14-mar-2010
Ultimo taratura per deriva termica	14-mar-2010

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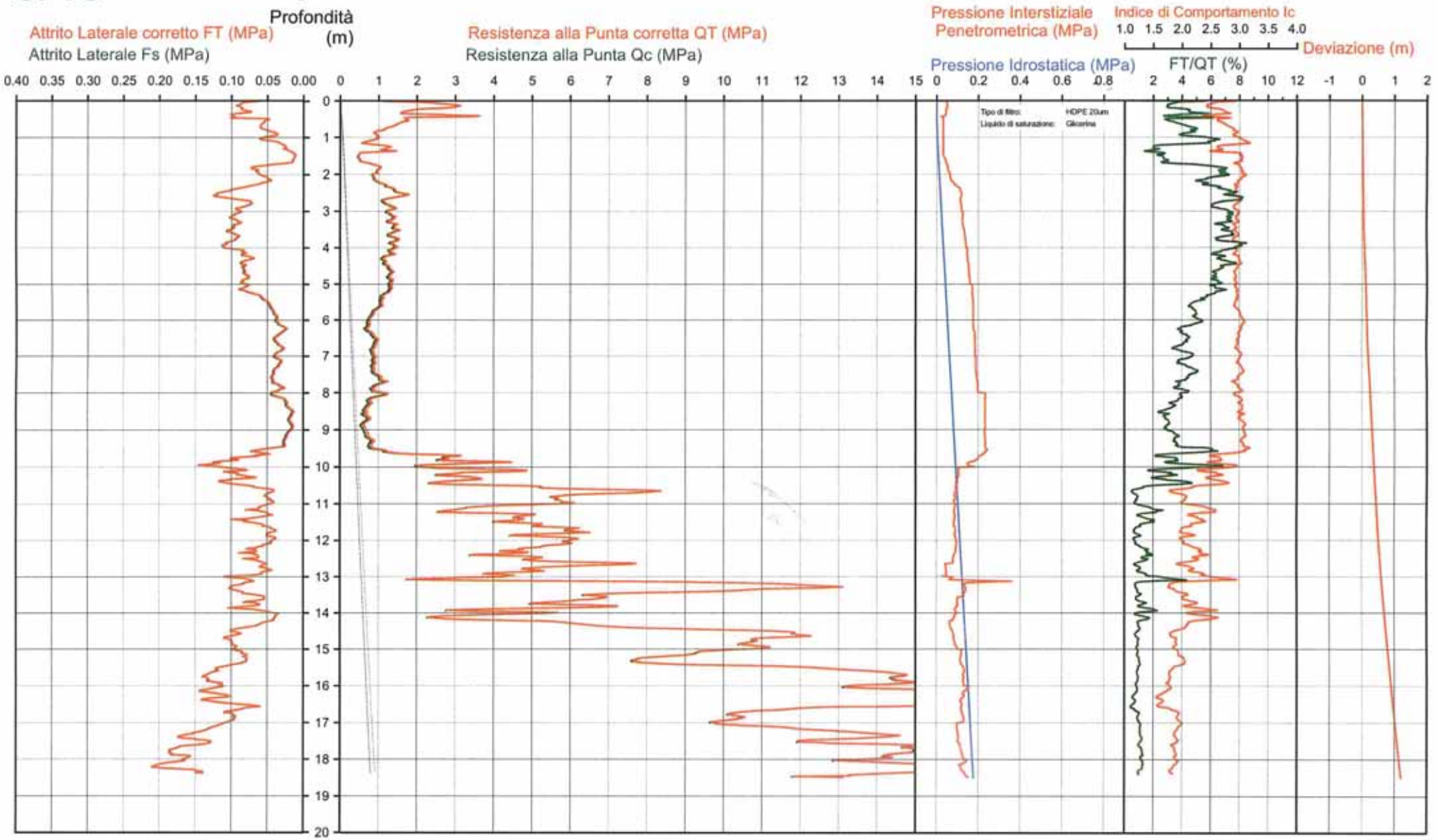
CPTU 1



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CPTU 1

Data 29/03/2010
Cantiere / Via Missiroli
Località Ospedale Civile
Comune Ravenna
Profondità falda idrica m. 0.80

Vs10 168

QT	Qc1N	FT	FT/Qnet	Ic	Litologia Robertson 1990	H	Litologia grafica	Falda idrica	Addensamento (Sabbia) Consistenza (Argilla)	Densità Relativa	Angolo Attrito φ'	Coesione	OCR s.20	Modulo Edometrico	Velocità Vs
(kg/cm²)	(adim.)	(adim.)	%	Robertson	(secondo Ic e Qc1N)	m				Tatsuoka 1986 %	Robertson °	(kg/cm²)	Robertson	(kg/cm²)	Baldi (sabbia), Mayne & Rix (argilla) m/sec
22.1	37.5	0.80	3.6	2.62	limo argilloso-argilla limosa	0.10			Solido-plastica (Duro)			1.14		127.9	218
30.0	51.1	0.89	3.0	2.44	sabbia limosa-limo sabbioso	0.20			Addensata	44.8	51.0			172.5	258
20.0	33.9	0.85	4.4	2.69	limo argilloso-argilla limosa	0.40			Plastica			1.07		114.9	305
24.7	41.9	0.88	3.6	2.39	sabbia limosa-limo sabbioso	0.50			Mediamente Addensata	38.3	45.9			142.8	232
14.7	24.9	0.56	4.0	2.76	limo argilloso-argilla limosa	0.80		H2O	Plastica			0.87		84.9	168
9.6	16.4	0.43	4.5	2.93	limo argilloso-argilla limosa	1.00			Molle-plastica (Soffice)			0.63		55.3	130
7.8	13.5	0.44	5.7	3.07	argilla-argilla limosa	1.20			Molle-plastica (Soffice)			0.54	9.35	44.9	114
12.1	20.8	0.23	2.0	2.63	limo argilloso-argilla limosa	1.40			Plastica			0.76		50.0	150
5.0	8.5	0.13	2.6	3.02	argilla-argilla limosa	1.60			Molle-plastica (Soffice)			0.37	4.98	25.7	99
5.8	9.9	0.19	2.8	2.99	argilla-argilla limosa	1.70			Molle-plastica (Soffice)			0.42	5.34	32.1	95
9.4	15.9	0.56	6.2	3.03	argilla-argilla limosa	2.20			Molle-plastica (Soffice)			0.62	7.65	52.6	128
12.1	20.6	0.72	6.1	2.95	limo argilloso-argilla limosa	2.40			Plastica			0.75		68.0	149
15.8	26.9	1.13	7.4	2.92	limo argilloso-argilla limosa	2.60			Plastica			0.92		86.7	177
12.3	20.9	0.88	7.4	3.00	argilla-argilla limosa	2.80			Plastica			0.76	8.22	67.3	151
13.4	22.6	0.90	7.0	2.96	argilla-argilla limosa	3.30			Plastica			0.81	9.21	74.1	160
14.1	24.0	0.96	7.1	2.84	limo argilloso-argilla limosa	4.20			Plastica			0.85		77.9	168
12.1	20.6	0.80	7.0	2.99	argilla-argilla limosa	4.60			Plastica			0.76	5.45	67.1	150
13.4	22.6	0.90	6.4	2.93	limo argilloso-argilla limosa	5.10			Plastica			0.81		74.7	160
12.3	20.3	0.72	6.3	2.96	argilla-argilla limosa	5.40			Plastica			0.76	4.71	68.8	151
10.8	17.8	0.48	4.9	2.93	limo argilloso-argilla limosa	5.70			Plastica			0.68		61.9	140
8.8	14.4	0.40	5.0	3.01	argilla-argilla limosa	5.90			Molle-plastica (Soffice)			0.60	3.01	50.9	124
7.8	12.4	0.34	5.1	3.08	argilla-argilla limosa	6.20			Molle-plastica (Soffice)			0.53	2.46	44.2	113
8.7	13.3	0.33	4.3	2.99	argilla-argilla limosa	6.70			Molle-plastica (Soffice)			0.59	2.65	50.5	121
8.2	13.1	0.36	4.5	3.01	argilla-argilla limosa	7.80			Molle-plastica (Soffice)			0.61	2.52	52.7	126
11.1	14.9	0.40	4.1	2.94	limo argilloso-argilla limosa	7.80			Plastica			0.71		64.2	142
9.1	12.2	0.32	4.1	3.01	argilla-argilla limosa	8.00			Molle-plastica (Soffice)			0.61	2.27	52.8	126
11.9	15.5	0.42	4.0	2.92	limo argilloso-argilla limosa	8.10			Plastica			0.74		68.7	148
8.1	10.6	0.24	3.7	3.03	argilla-argilla limosa	8.40			Molle-plastica (Soffice)			0.55	1.87	47.0	116
6.9	8.8	0.16	3.1	3.05	argilla-argilla limosa	9.10			Molle-plastica (Soffice)			0.48	1.44	41.2	105
8.8	10.5	0.33	4.5	3.08	argilla-argilla limosa	9.60			Molle-plastica (Soffice)			0.59	1.80	50.5	121
30.3	33.3	0.94	3.6	2.63	limo argilloso-argilla limosa				Semi solida (Molto duro)			1.37		176.1	257

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CPTU 1

Data 29/03/2010
Cantiere / Via Missiroli
Località Ospedale Civile
Comune Ravenna
Profondità falda idrica m. 0.80

Vs10 168

QT	Qc1N	FT	FT/Qnet	Ic	Litologia Robertson 1990	H	Litologia grafica	Falda idrica	Addensamento (Sabbia) Consistenza (Argilla)	Densità Relativa	Angolo Attrito φ'	Coesione	OCR s.20	Modulo Edometrico	Velocità Vs
(kg/cm²)	(adim.)	(adim.)	%	Robertson	(secondo Ic e Qc1N)	m				Tatsuoka 1986 %	Robertson °	(kg/cm²)	Robertson	(kg/cm²)	Baldi (sabbia), Mayne & Rix (argilla) m/sec
						10.50									
59.2	61.9	0.50	0.9	2.05	sabbia limosa-limo sabbioso	11.10			Mediamente Addensata	51.2	38.1			190.3	186
53.5	34.7	0.59	2.0	2.45	sabbia limosa-limo sabbioso	11.30			Sciolta	32.1	34.5			136.5	202
52.2	51.8	0.58	1.2	2.18	sabbia limosa-limo sabbioso	13.00			Mediamente Addensata	45.3	36.7			176.8	224
27.8	28.4	0.90	3.8	2.74	limo argilloso-argilla limosa	13.10			Solido-plastica (Duro)			1.31		161.3	253
105.0	101.8	0.88	0.9	1.89	sabbia-sabbia limosa	13.40			Mediamente Addensata	67.5	40.2			338.4	208
74.5	70.9	0.70	1.0	2.02	sabbia-sabbia limosa	13.60			Mediamente Addensata	55.6	38.2			240.9	199
60.2	56.4	0.72	1.3	2.17	sabbia limosa-limo sabbioso	13.80			Mediamente Addensata	48.1	36.9			206.5	238
35.7	32.5	0.44	1.5	2.40	sabbia limosa-limo sabbioso	14.20			Sciolta	29.9	33.5			127.7	247
59.6	54.6	0.57	1.0	2.13	sabbia limosa-limo sabbioso	14.40			Mediamente Addensata	47.0	36.5			193.4	223
108.3	101.0	0.99	0.9	1.88	sabbia-sabbia limosa	15.00			Mediamente Addensata	67.3	39.8			347.4	214
66.4	61.5	0.63	1.0	1.97	sabbia-sabbia limosa	15.30			Mediamente Addensata	50.2	38.0			268.9	211
78.1	70.1	0.81	1.1	2.05	sabbia limosa-limo sabbioso	15.40			Mediamente Addensata	55.3	37.7			297.2	208
150.1	138.4	1.18	0.8	1.74	sabbia-sabbia limosa	16.60			Addensata	79.0	41.1			474.0	229
104.7	92.2	1.00	1.0	1.93	sabbia-sabbia limosa	17.10			Mediamente Addensata	64.3	38.8			339.8	222
142.0	126.8	1.62	1.2	1.88	sabbia-sabbia limosa				Mediamente Addensata	74.8	40.2			475.8	234

CPTU44A

ADOTTATO con Delibera di C.C. N. 182544/105 del 31/10/2017

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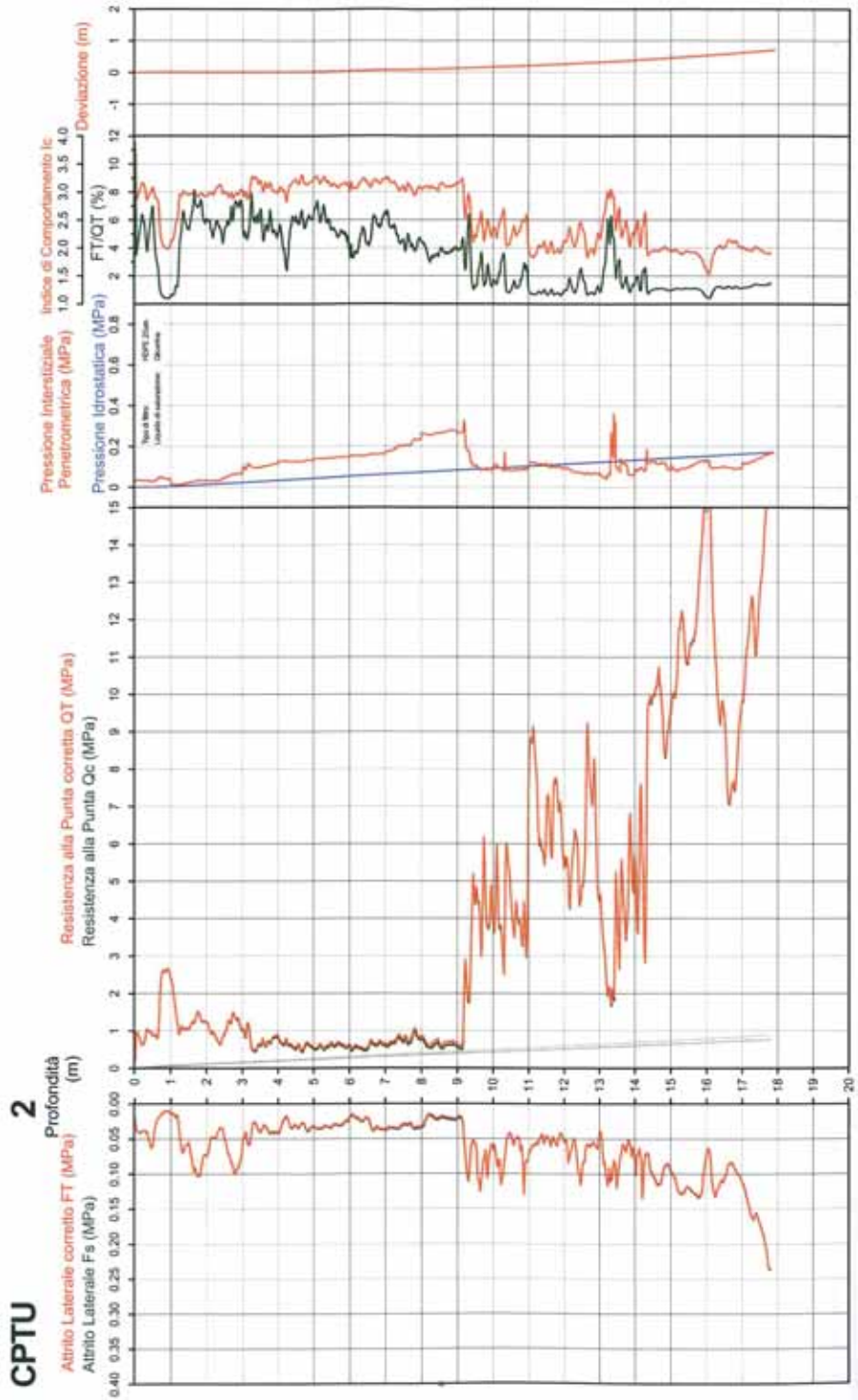
CPTU 2

Comune Ravenna
Via Missiroli
Località Ospedale Civile
Committente Polleccnica
Data 29-mar-10

Falda 0.80 m

Sigla della Punta Tecnopenta 010104
Azzeramento Inizio prova
Ultimo taratura guadagno 14-mar-2010
Ultimo taratura per deriva termica 14-mar-2010



CPTU 2

Data 29 marzo 2010
Cantiere / Via Missiroli
Località Ospedale Civile
Comune Ravenna
Profondità falda idrica m. 0.80

Vs1? 147

QT	Qc1N	FT	FT/Qnet	Ic	Litologia Robertson 1990	H	Litologia grafica	Falda idrica	Addensamento (Sabbia) Consistenza (Argilla)	Densità Relativa	Angolo Attrito φ'	Coesione	OCR	Modulo Edometrico	Velocità Vs
7.1	12.0	0.39	5.6	3.12	argilla-argilla limosa	0.30			Molle-plastica (Soffice)			0.49	50.01	39.8	137
9.8	16.7	0.41	4.3	2.81	limo argilloso-argilla limosa	0.40			Molle-plastica (Soffice)			0.64		56.8	132
9.3	15.8	0.51	5.5	3.00	argilla-argilla limosa	0.60			Molle-plastica (Soffice)			0.62	20.55	52.8	127
9.8	16.7	0.22	2.4	2.75	limo argilloso-argilla limosa	0.70			Molle-plastica (Soffice)			0.64		45.8	132
26.2	42.8	0.12	0.5	2.05	sabbia limosa-limo sabbioso	1.00		H2O	Mediamente Addensata	59.0	43.4			76.8	108
18.4	31.3	0.16	0.9	2.30	sabbia limosa-limo sabbioso	1.20			Mediamente Addensata	28.6	41.1			59.0	139
11.0	18.8	0.65	5.9	2.96	argilla-argilla limosa	1.70			Plastica			0.70	11.26	62.3	141
12.9	22.0	0.83	6.4	2.95	limo argilloso-argilla limosa	2.10			Plastica			0.79		72.0	156
8.3	14.1	0.43	5.4	3.04	argilla-argilla limosa	2.50			Molle-plastica (Soffice)			0.56	6.16	47.2	118
12.4	21.1	0.75	6.2	2.94	limo argilloso-argilla limosa	2.80			Plastica			0.77		69.7	151
11.4	19.4	0.68	6.1	2.96	argilla-argilla limosa	3.20			Plastica			0.73	7.04	64.2	144
6.3	11.0	0.42	7.1	3.20	argilla-argilla limosa	3.30			Molle-plastica (Soffice)			0.48	3.58	47.1	101
4.9	8.3	0.21	5.2	3.20	argilla-argilla limosa	3.40			Molto-plastica (Molto Soffice)			0.36	2.55	34.3	85
7.3	12.3	0.37	5.7	3.08	argilla-argilla limosa	4.00			Molle-plastica (Soffice)			0.50	3.64	41.3	108
6.4	10.8	0.29	5.4	3.11	argilla-argilla limosa	4.80			Molle-plastica (Soffice)			0.45	2.89	42.8	100
6.1	10.4	0.31	6.1	3.17	argilla-argilla limosa	6.00			Molle-plastica (Soffice)			0.44	2.11	42.6	99
5.6	9.6	0.20	4.3	3.13	argilla-argilla limosa	6.50			Molle-plastica (Soffice)			0.40	1.61	35.9	92
6.7	10.1	0.24	5.1	3.16	argilla-argilla limosa	7.30			Molle-plastica (Soffice)			0.47	1.83	46.9	104
6.1	11.0	0.21	4.6	3.06	argilla-argilla limosa	7.80			Molle-plastica (Soffice)			0.55	2.07	48.5	110
6.8	11.8	0.32	4.4	3.04	argilla-argilla limosa	8.10			Molle-plastica (Soffice)			0.55	2.16	50.8	122
5.9	8.8	0.20	3.8	3.10	argilla-argilla limosa	9.20			Molle-plastica (Soffice)			0.48	1.48	42.8	105
23.6	37.5	0.86	4.2	2.73	limo argilloso-argilla limosa	9.40			Sodo-plastica (Duro)			1.19		136.4	229
43.0	66.8	0.74	1.9	2.33	sabbia limosa-limo sabbioso				Mediamente Addensata	41.8	36.6			173.4	246

CPTU45A

ADOTTATTO con Delibera di C.C. N. 182544/105 del 31/10/2017

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CPTU 2

Data 29 marzo 2010
Cantiere / Via Missiroli
Località Ospedale Civile
Comune Ravenna
Profondità falda idrica m. 0.80

Vs17 147

QT	Qc1N	FT	FT/Qsat/Ic	Litologia Robertson 1990	H m	Litologia grafica	Falda idrica	Addensamento (Sabbia) Consistenza (Argilla)	Densità Relativa Tatsuoka 1990 %	Angolo Attrito φ' Robertson °	Coesione Senesi kg/cm²	OCR s.m Robertson	Modulo Edometrico Senesi kg/cm²	Velocità Vs Sabbi (sabbia), Mayne & Rix (argilla) m/sec
					11.00									
70.2	71.4	0.53	0.8	1.97 sabbia-sabbia limosa	12.00			Mediamente Addensata	55.8	38.8			221.2	191
53.2	52.4	0.74	1.5	2.23 sabbia limosa-limo sabbioso	12.60			Mediamente Addensata	45.7	36.8			192.6	340
79.0	75.8	0.59	0.8	1.94 sabbia-sabbia limosa	12.80			Mediamente Addensata	57.9	38.8			245.4	198
47.2	45.2	0.53	1.2	2.23 sabbia limosa-limo sabbioso	13.10			Mediamente Addensata	40.8	35.7			158.3	239
25.6	24.0	0.97	4.5	2.80 limo argilloso-argilla limosa	13.30			Solido-plastica (Duro)			1.25		147.2	236
19.5	18.1	1.02	6.0	2.98 argilla-argilla limosa	13.40			Plastica			1.06	3.08	110.0	202
47.1	43.6	0.77	1.9	2.36 sabbia limosa-limo sabbioso	14.30			Mediamente Addensata	55.6	35.3			190.7	284
95.0	88.1	0.96	1.0	1.97 sabbia-sabbia limosa	15.10			Mediamente Addensata	62.8	39.1			311.4	210
117.8	108.4	1.24	1.1	1.91 sabbia-sabbia limosa	15.90			Mediamente Addensata	69.8	40.0			388.2	220
152.7	142.0	0.77	0.5	1.61 sabbia-sabbia limosa	16.10			Addensata	79.8	41.2			468.9	229
121.8	113.6	1.15	1.0	1.87 sabbia-sabbia limosa	16.30			Mediamente Addensata	70.3	39.9			395.5	223
96.0	84.9	1.13	1.2	2.02 sabbia-sabbia limosa	16.50			Mediamente Addensata	61.8	38.5			325.1	217
78.3	67.3	0.92	1.3	2.10 sabbia limosa-limo sabbioso	16.90			Mediamente Addensata	54.0	37.2			265.4	236
98.1	85.9	1.10	1.2	2.00 sabbia-sabbia limosa	17.10			Mediamente Addensata	61.9	38.5			326.5	220
130.6	116.4	1.74	1.4	1.99 sabbia-sabbia limosa				Mediamente Addensata	72.0	39.9			456.0	230

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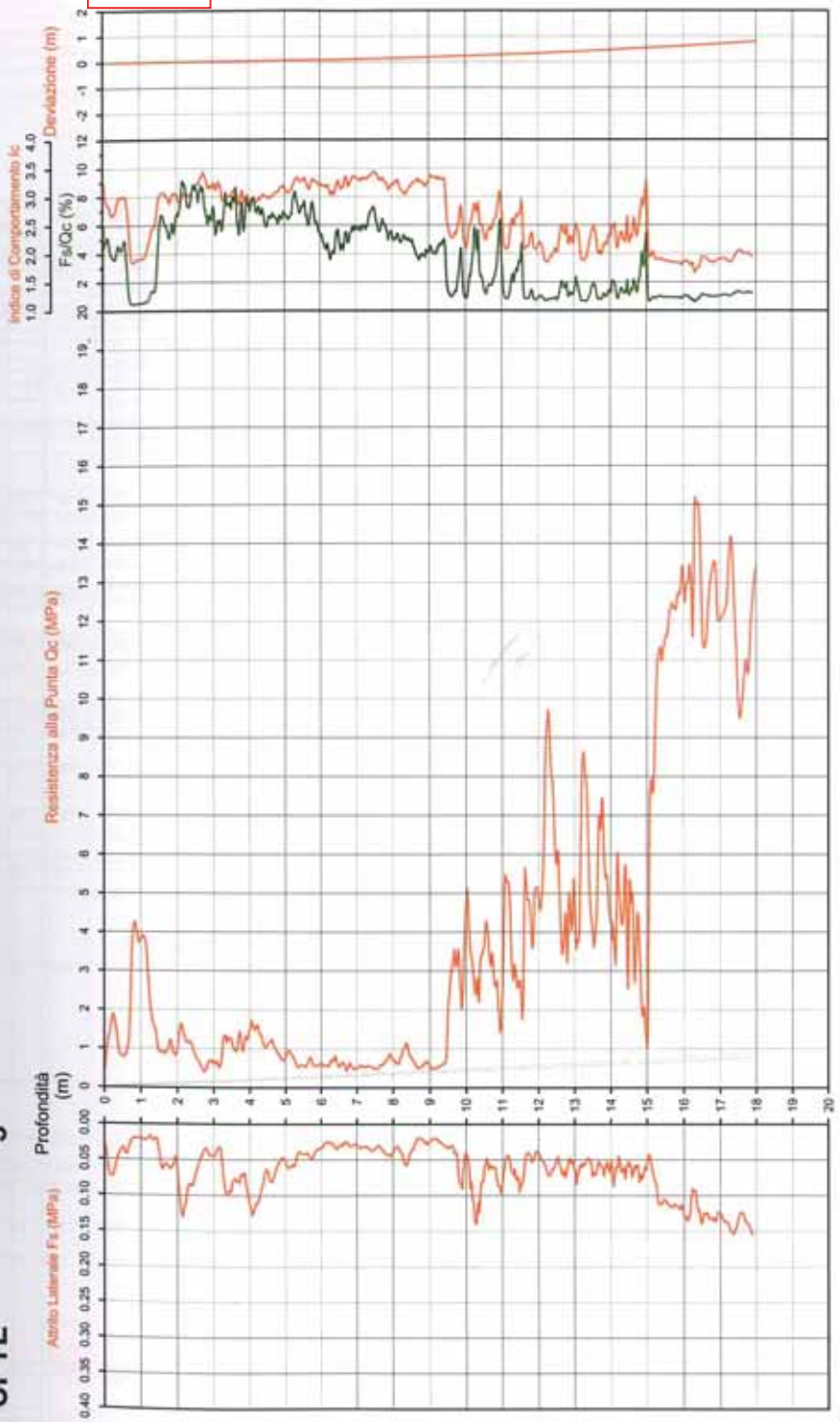
Falda 0.80 m

Sigla della Punta: Tecnopenta 010104
Azzeramento: Inizio prova
Ultimo taratura guadagno: 14-mar-2010
Ultimo taratura per deriva termica: 14-mar-2010

Comune Ravenna
Via Missiroli
Località Ospedale Civile
Committente Politecnica
Data 29-mar-10

CPTE 3



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CPTE **3**

Data	29 marzo 2010
Cantiere / Via	Missiroli
Località	Ospedale Civile
Comune	Ravenna
Profondità falda idrica m.	0.80

Vs10: 148

Qc (kg/cm²)	Qc/N (Kulhawy & Mayne)	Fs (kg/cm²)	Fs/Qnet %	Ic (Robertson)	Litologia Robertson 1986 (modello non-Fr vs Qc-Fs)	H (m)	Litologia grafica	Falda idrica	Addensamento (Sabbia) Consistenza (Argilla)	Densità Relativa (Terzaghi 1996) %	Angolo Attrito φ' (Robertson) °	Coesione (Terzaghi) kg/cm²	OCR s.vo (Robertson)	Modulo Edometrico (Terzaghi) kg/cm²	Velocità Vs (Sabbia (sabbie), Mayne & Rix (argille)) m/sec
9.2	15.7	0.45	5.0	2.99	argilla-argilla limosa	0.10			Molle-plastica (Soffice)			0.61	174.39	52.6	126
15.0	25.6	0.62	4.2	3.77	limo argilloso-argilla limosa	0.40			Plastica			0.88		80.8	170
8.2	13.9	0.37	4.6	2.99	argilla-argilla limosa	0.60			Molle-plastica (Soffice)			0.58	17.99	47.0	117
12.3	20.9	0.35	3.1	2.74	limo argilloso-argilla limosa	0.70			Plastica			0.77		74.3	152
37.3	63.4	0.21	0.8	1.93	sabbia-sabbia limosa	1.20		1(27)	Mediamente Addensata	51.9	45.0			114.5	106
18.7	31.8	0.20	1.1	2.34	sabbia limosa-limo sabbioso	1.40			Mediamente Addensata	29.1	40.7			62.1	148
9.9	16.8	0.52	5.2	2.97	argilla-argilla limosa	2.00			Molle-plastica (Soffice)			0.65	9.02	55.9	131
13.1	22.3	1.02	8.0	3.00	argilla-argilla limosa	2.40			Plastica			0.80	10.16	70.7	157
8.2	13.9	0.69	8.9	3.18	argilla-argilla limosa	2.60			Molle-plastica (Soffice)			0.56	5.67	43.1	116
4.9	8.4	0.40	9.0	3.35	argilla-argilla limosa	2.80			Fluido-plastica (Molto Soffice)			0.38	3.09	38.9	85
6.3	10.7	0.40	8.9	3.20	argilla-argilla limosa	3.00			Molle-plastica (Soffice)			0.48	3.70	48.3	99
11.9	20.2	0.83	7.4	3.01	argilla-argilla limosa	4.00			Plastica			0.74	6.31	65.0	148
15.0	26.4	1.14	7.7	2.94	limo argilloso-argilla limosa	4.30			Plastica			0.90		84.3	175
11.3	19.8	0.75	7.0	3.00	argilla-argilla limosa	4.70			Plastica			0.73	5.05	63.7	145
8.5	14.4	0.56	7.3	3.11	argilla-argilla limosa	5.20			Molle-plastica (Soffice)			0.57	3.32	48.6	120
6.1	10.3	0.43	8.3	3.26	argilla-argilla limosa	6.00			Molle-plastica (Soffice)			0.44	2.03	47.1	99
5.9	9.3	0.28	6.1	3.21	argilla-argilla limosa	7.00			Molle-plastica (Soffice)			0.42	1.66	41.2	95
5.4	7.8	0.33	8.2	3.35	argilla-argilla limosa	7.70			Molle-plastica (Soffice)			0.39	1.27	40.8	90
7.0	9.5	0.39	6.9	3.23	argilla-argilla limosa	8.20			Molle-plastica (Soffice)			0.49	1.64	39.0	106
9.8	12.3	0.48	5.9	3.11	argilla-argilla limosa	8.50			Molle-plastica (Soffice)			0.63	2.26	53.9	129
5.7	7.2	0.24	5.9	3.28	argilla-argilla limosa	9.40			Molle-plastica (Soffice)			0.41	1.09	39.3	93
9.9	11.7	0.32	4.8	3.07	argilla-argilla limosa	9.50			Molle-plastica (Soffice)			0.68	2.05	56.3	132
60.7	94.6	0.40	1.4	2.38	sabbia limosa-limo sabbioso	9.80			Sciolta	31.9	34.8			107.8	221
24.7	27.7	0.86	3.9	2.72	limo argilloso-argilla limosa	9.90			Solido-plastica (Duro)			1.22		142.9	234
34.6	42.2	0.66	2.0	2.39	sabbia limosa-limo sabbioso				Mediamente Addensata	38.5	36.0			159.4	241

CPTE **3**

Data	29 marzo 2010
Cantiere / Via	Missiroli
Località	Ospedale Civile
Comune	Ravenna
Profondità falda idrica m.	0.80

Vs10: 148

Qc (kg/cm²)	Qc/N (Kulhawy & Mayne)	Fs (kg/cm²)	Fs/Qnet %	Ic (Robertson)	Litologia Robertson 1986 (modello non-Fr vs Qc-Fs)	H (m)	Litologia grafica	Falda idrica	Addensamento (Sabbia) Consistenza (Argilla)	Densità Relativa (Terzaghi 1996) %	Angolo Attrito φ' (Robertson) °	Coesione (Terzaghi) kg/cm²	OCR s.vo (Robertson)	Modulo Edometrico (Terzaghi) kg/cm²	Velocità Vs (Sabbia (sabbie), Mayne & Rix (argille)) m/sec
						10.20									
26.2	28.7	1.22	5.1	2.78	limo argilloso-argilla limosa	10.40			Solido-plastica (Duro)			1.27		148.8	244
35.0	37.4	0.63	1.8	2.42	sabbia limosa-limo sabbioso	10.80			Sciolta	34.5	35.1			142.9	248
24.8	26.3	0.79	3.2	2.70	limo argilloso-argilla limosa	10.90			Solido-plastica (Duro)			1.22		144.2	235
17.8	18.9	0.90	5.1	2.96	argilla-argilla limosa	11.00			Plastica			0.98	3.48	100.5	191
44.0	45.6	0.57	1.3	2.28	sabbia limosa-limo sabbioso	11.30			Mediamente Addensata	41.1	36.2			180.9	232
29.5	30.6	0.71	2.4	2.57	sabbia limosa-limo sabbioso	11.40			Sciolta	27.8	33.6			170.2	256
25.5	26.1	0.81	3.2	2.71	limo argilloso-argilla limosa	11.80			Solido-plastica (Duro)			1.24		148.1	239
47.5	47.8	0.45	1.0	2.17	sabbia limosa-limo sabbioso	12.10			Mediamente Addensata	42.8	36.3			154.8	215
76.8	76.1	0.62	0.8	1.96	sabbia-sabbia limosa	12.50			Mediamente Addensata	58.5	38.9			244.2	185
44.4	43.2	0.62	1.5	2.31	sabbia limosa-limo sabbioso	12.80			Mediamente Addensata	39.3	35.5			163.5	243
46.1	44.2	0.60	1.4	2.28	sabbia limosa-limo sabbioso	13.20			Mediamente Addensata	40.0	35.6			164.2	250
77.8	74.6	0.53	0.7	1.93	sabbia-sabbia limosa	13.40			Mediamente Addensata	57.3	38.6			242.5	200
48.2	46.2	0.61	1.4	2.27	sabbia limosa-limo sabbioso	13.70			Mediamente Addensata	40.8	35.6			171.0	246
70.4	66.3	0.61	0.9	2.02	sabbia-sabbia limosa	13.80			Mediamente Addensata	53.4	37.8			224.8	199
45.0	41.0	0.63	1.5	2.33	sabbia limosa-limo sabbioso	14.80			Mediamente Addensata	37.6	34.9			164.7	262
19.2	18.4	0.87	4.5	2.94	limo argilloso-argilla limosa	15.00			Plastica			1.04		109.4	195
77.1	70.1	0.86	1.1	2.07	sabbia limosa-limo sabbioso	15.30			Mediamente Addensata	55.3	37.8			256.5	227
126.8	115.4	1.23	1.0	1.86	sabbia-sabbia limosa	17.40			Mediamente Addensata	71.7	40.1			412.1	226
104.8	90.9	1.34	1.3	2.02	sabbia-sabbia limosa	17.80			Mediamente Addensata	63.9	38.8			362.9	225
116.4	103.4	1.48	1.3	1.97	sabbia-sabbia limosa				Mediamente Addensata	68.1	39.2			407.0	229

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CPTU 4

Data 29 marzo 2010
Cantiere / Via Mosetti
Località Ospedale Civile
Comune Ravenna
Profondità falda idrica m. 0.80

Qt	Quota s.l.m.	FT	FT/Qc	Litologia Robertson 1990	H	Litologia grafica	Falda Idrica	Addensamento (Sabbie) Consistenza (Argille)	Densità Relativa	Angolo Attrito f'	Cedimenti	OCR	Modulo Edometrico	Velocità Vs
	m	kg/cm²	%		m				%	°			kg/cm²	m/s
11.0	25.2	0.61	4.4	2 Argilla limosa	0.70			Argilla			0.75		69.5	148
11.2	26.1	0.74	3.9	2 Limo argilloso-argilla limosa	0.80			Molto plastica (Suffisi)			1.11		123.5	206
14.1	24.0	0.48	3.0	2 Limo argilloso-argilla limosa	0.80			Plastica			0.84		82.8	164
16.8	25.0	0.10	1.1	3 Sabbia limosa limo sabbioso	0.60			Mediamente Addensata	25.5	42.4			55.7	146
20.0	27.2	0.17	0.5	1 Argilla/argilla limosa	0.70			Mediamente Addensata	48.6	44.7			103.1	183
17.8	30.3	0.17	1.1	3 Sabbia limosa/limo sabbioso	1.00			Mediamente Addensata	27.6	40.9			58.7	140
11.0	18.7	0.55	5.1	2 Limo argilloso-argilla limosa	1.20			Plastica			0.76		82.8	141
8.6	14.7	0.50	5.9	3 Argilla-argilla limosa	1.40			Molto plastica (Suffisi)			0.58	6.33	44.7	121
11.6	20.2	0.76	6.7	2 Argilla-argilla limosa	1.60			Plastica			0.75	10.77	86.1	147
13.2	22.5	0.85	6.5	2 Limo argilloso-argilla limosa	1.80			Plastica			0.81		74.2	158
8.5	14.4	0.56	6.6	3 Argilla-argilla limosa	2.00			Molto plastica (Suffisi)			0.57	5.98	46.8	120
11.3	19.2	0.85	6.0	2 Argilla-argilla limosa	2.20			Plastica			0.72	6.92	63.4	143
13.8	23.4	0.41	2.9	3 Argilla-argilla limosa	2.40			Molto plastica (Suffisi)			0.52	4.09	43.1	111
13.0	22.0	0.83	6.4	2 Limo argilloso-argilla limosa	2.60			Plastica			0.82		75.4	160
11.5	19.6	0.75	6.5	3 Argilla-argilla limosa	2.80			Plastica			0.71	5.54	63.9	146
8.9	15.2	0.49	5.5	3 Argilla-argilla limosa	3.00			Molto plastica (Suffisi)			0.60	3.80	36.3	124
8.9	11.8	0.26	4.9	3 Argilla-argilla limosa	3.20			Molto plastica (Suffisi)			0.48	2.64	45.2	108
8.3	10.7	0.20	3.5	3 Argilla-argilla limosa	3.40			Molto plastica (Suffisi)			0.45	2.17	36.3	100
9.4	9.2	0.11	2.5	2 Argilla-argilla limosa	3.60			Molto plastica (Suffisi)			0.39	1.66	26.8	90
7.2	11.1	0.26	4.7	3 Argilla-argilla limosa	3.80			Molto plastica (Suffisi)			0.50	2.11	41.5	128
7.8	11.1	0.27	4.3	3 Argilla-argilla limosa	4.00			Molto plastica (Suffisi)			0.53	2.04	43.0	115
10.4	14.2	0.33	3.6	2 Limo argilloso-argilla limosa	4.20			Plastica			0.67	2.26	60.7	137
9.0	12.2	0.27	3.6	2 Argilla-argilla limosa	4.40			Molto plastica (Suffisi)			0.60	2.26	52.3	125
7.5	9.6	0.16	2.6	2 Argilla-argilla limosa	4.60			Molto plastica (Suffisi)			0.52	1.76	42.3	111
12.6	34.0	0.34	1.1	3 Sabbia limosa limo sabbioso	4.80			Mediamente Addensata	34.0	36.7			108.5	197
20.2	29.1	1.20	6.0	2 Limo argilloso-argilla limosa	5.00			Plastica			1.23		141.7	237
20.4	41.2	0.80	2.6	3 Sabbia limosa limo sabbioso	5.20			Mediamente Addensata	37.7	38.8			201.2	275
44.1	94.1	0.52	1.1	3 Sabbia limosa limo sabbioso	5.40			Mediamente Addensata	47.1	37.7			143.9	263
14.4	59.5	0.50	0.6	3 Sabbia limosa limo sabbioso	5.60			Mediamente Addensata	35.2	39.1			197.5	186
43.6	47.2	0.66	1.5	3 Sabbia limosa limo sabbioso	5.80			Mediamente Addensata	43.2	36.7			156.5	223

VS18 181

Falda 0.80 m

Sigla data Punta
Azzeramento
Ultimo taratura guadagno
Ultimo taratura per deriva termica

Tecnopenta 010104
Inizio prova 14-mar-2010
14-mar-2010
14-mar-2010

Comune Ravenna
Via Messina
Località Ospedale Civile
Committente Polibercica
Data 29-mar-10

SGT Società di Geologia Territoriale
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CPTU43A

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CPTU 4

Data	29 marzo 2010
Cantiere / Via	Missiroli
Località	Ospedale Civile
Comune	Ravenna
Profondità falda idrica m.	0.80

Vs10 191

QT (kPa/cm²)	Qc1N (cinsa & E)	FT (kPa/cm²)	FT/Qnet (%)	Ic (Robertson)	Litologia Robertson 1990 (zone su Ft vs Qc1N)	H (m)	Litologia grafica	Falda idrica	Addensamento (Sabbia) Consistenza (Argilla)	Densità Relativa (Tatsuoka 1990) (%)	Angolo Attrito φ' (Robertson) (°)	Coesione (kPa/cm²)	OCR s.H (Robertson)	Modulo Edometrico (kPa/cm²)	Velocità Vs (kPa/cm²) (kPa/cm²) (sabbia), Mayne & Rix (argilla) (m/sec)
						10.50									
35.7	37.9	0.92	2.8	2.51	sabbia limosa-limo sabbioso	10.80			Mediamente Addensata	35.0	35.2			181.4	274
41.5	43.5	0.73	1.9	2.36	sabbia limosa-limo sabbioso	11.00			Mediamente Addensata	39.5	36.0			186.3	256
75.7	77.5	0.53	0.7	1.92	sabbia-sabbia limosa	11.40			Mediamente Addensata	58.6	39.3			236.8	190
36.0	38.6	0.52	1.5	2.35	sabbia limosa-limo sabbioso	11.70			Mediamente Addensata	35.6	35.1			138.9	240
21.8	21.8	0.76	4.0	2.60	limo argilloso-argilla limosa	11.90			Solido-plastica (Duro)			1.13		125.2	216
40.8	40.5	0.55	1.5	2.32	sabbia limosa-limo sabbioso	12.20			Mediamente Addensata	37.2	35.3			147.5	243
47.7	46.8	0.44	1.0	2.17	sabbia limosa-limo sabbioso	12.50			Mediamente Addensata	41.9	36.1			154.9	216
37.5	36.4	0.68	2.0	2.44	sabbia limosa-limo sabbioso	12.70			Scolta	33.6	34.5			154.9	267
48.7	47.8	0.60	1.4	2.25	sabbia limosa-limo sabbioso	12.90			Mediamente Addensata	42.1	36.0			170.8	239
76.1	72.7	0.60	0.9	1.97	sabbia-sabbia limosa	13.80			Mediamente Addensata	56.5	38.4			341.2	201
52.0	48.2	0.48	1.0	2.15	sabbia limosa-limo sabbioso	14.00			Mediamente Addensata	42.9	30.9			168.0	223
22.8	20.4	0.37	3.0	2.75	limo argilloso-argilla limosa	14.10			Solido-plastica (Duro)			1.16		134.3	223
56.7	52.1	0.70	1.3	2.29	sabbia limosa-limo sabbioso	14.40			Mediamente Addensata	45.5	36.3			203.4	251
84.9	78.7	0.61	0.7	1.91	sabbia-sabbia limosa	14.90			Mediamente Addensata	59.1	38.6			265.7	207
61.2	55.7	0.73	1.4	2.19	sabbia limosa-limo sabbioso	14.70			Mediamente Addensata	47.7	36.6			214.4	243
105.9	97.6	0.97	0.9	1.96	sabbia-sabbia limosa	15.20			Mediamente Addensata	66.2	39.6			330.5	215
140.7	130.4	1.39	1.0	1.83	sabbia-sabbia limosa	15.40			Mediamente Addensata	75.8	40.8			457.4	226
91.7	80.4	0.92	1.0	1.99	sabbia-sabbia limosa	15.60			Mediamente Addensata	59.8	38.2			299.7	217
73.3	62.6	0.86	1.2	2.12	sabbia limosa-limo sabbioso	15.70			Mediamente Addensata	51.7	36.9			248.4	244
133.3	118.6	1.68	1.3	1.92	sabbia-sabbia limosa				Mediamente Addensata	72.7	40.0			455.9	231

RAPPORTO D'INDAGINE IN SITO

COMMITTENTE:	POLITECNICA - INGEGNERIA E ARCHITETTURA Soc. Coop.				
CANTIERE:	Ampliamento DSM - Ospedale di Ravenna - Via Missiroli, RAVENNA				
PERFORAZIONE N.	S1	RESPONSABILE:	Dott. Geol. Davide Lodi	INIZIO SONDAGGIO:	31/03/2010
COORDINATE:Nord	0753931	OPERATORE:	Dott. Geol. Renato Rijillo	FINE SONDAGGIO:	31/03/2010
COORDINATE: Est	4922809	ATTREZZATURA:	Sonda Hydra Joy 2	QUOTA slm:	~ 4.00 metri
Da m: 0.00	A m: 17.00	Profondità Finale m:	17.00		

DOC. 1 PAG. 1 DI 1

DESCRIZIONE STRATIGRAFICA	PROFONDITA' m da p.c.	SIMBOLOGIA STRATIGRAFICA
Terreno vegetale.	0.05	
Limo argilloso debolmente sabbioso marrone chiaro compatto, con frammenti di radici.	0.90	
Alternanza di limo sabbioso compatto e sabbia fine limosa marrone chiaro, con frammenti di radici.	2.00	
Argilla limosa marrone chiaro, mediamente consistente.	5.40	
Argilla limosa grigia, poco consistente, con sparsi resti vegetali, resti di conchiglie e livelli di argilla torbosa	8.00	
Argilla limosa debolmente sabbiosa grigia scura , poco consistente, con inclusi resti vegetali.	8.60	
Sabbia fine e media debolmente limosa grigio scura, mediamente addensata, con inclusi resti vegetali e frammenti di conchiglie (presenza di livelli torbosi tra 8.80-9.00, 9.70-10.20, 12.30-12.40, 13.20-13.30 m da pc).	15.80	
Sabbia fine limosa grigio chiara, molto addensata, con frammenti di conchiglie millimetrici.	17.00	
Fine perforazione.		

STRUMENTAZIONE

PROVE ESEGUITE (N° colpi)
- 7.50 Oersterberg: S1-C1
- 10.50 S1-SPT1 (6,8,14)
- 13.50 Oersterberg: S1-C2

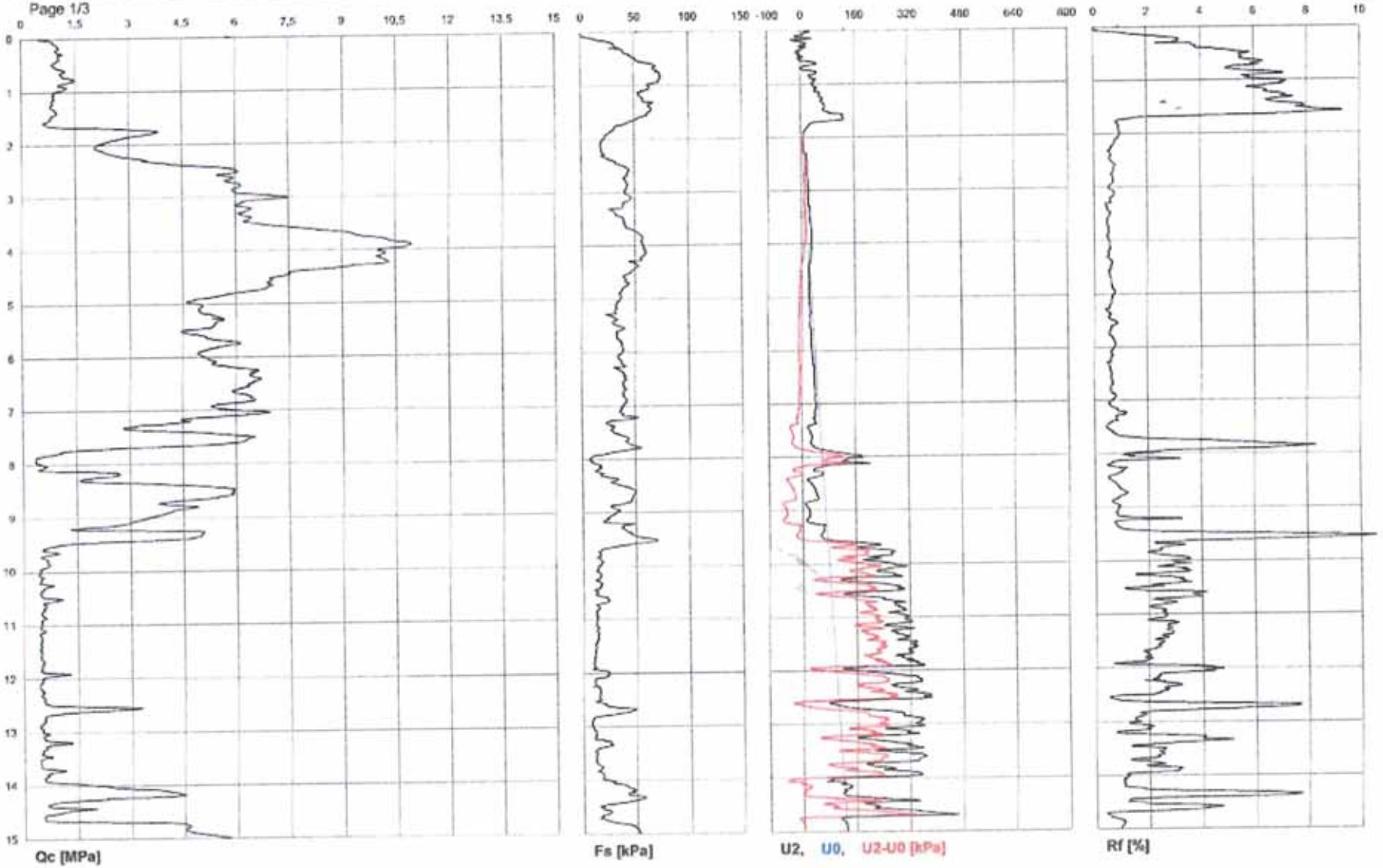
Recupero carota: 100%

POCKET PEMETROMETER Profondità (m da pc)	Misura (Kg/cm²)
0.15	0.1
0.30	0.1
0.45	0.8
0.60	1.7
2.05	1.3
2.20	1.8
2.50	1.8
2.80	2.4
3.00	1.8
3.15	2.0
3.30	1.8
3.45	1.8
3.60	2.0
3.80	2.4
4.10	2.4
4.40	2.4
4.50	2.4
4.65	1.8
4.80	2.0
5.15	1.8
5.35	2.4
5.50	1.8
5.70	1.8
5.90	1.8
6.20	0.8
6.40	0.8
6.60	0.8
6.80	0.8
7.20	1.4
7.45	1.4
8.00	0.8
8.20	0.8
8.40	0.8
8.60	0.8

Manovre

	Profondità m da p.c.
I	1.50
II	3.00
III	4.50
IV	6.00
V	7.50
VI	8.00
VII	9.00
VIII	10.50
IX	10.95
X	12.00
XI	13.50
XII	14.00
XIII	15.50
XIV	17.00

GEOLOG s.r.l.	Commissioner: PROGRA s.r.l.	
Site: Discarica Hera V. Romea N. Locality: Ravenna	Test Location: Discarica CPTU 1 Date: 16/03/2005	Abs. quota [cm]: 0 Prehole [cm]: 0 Hydrostatic Line [cm]: 195



TGSWS3 for Pagani Geotechnical Equipment acquisition systems

GEOLOG s.r.l.	Commissioner: PROGRA s.r.l.	
Site: Discarica Hera V. Romea N. Locality: Ravenna	Test Location: Discarica CPTU 1 Date: 16/03/2005	Abs. quota [cm]: 0 Prehole [cm]: 0 Hydrostatic Line [cm]: 195

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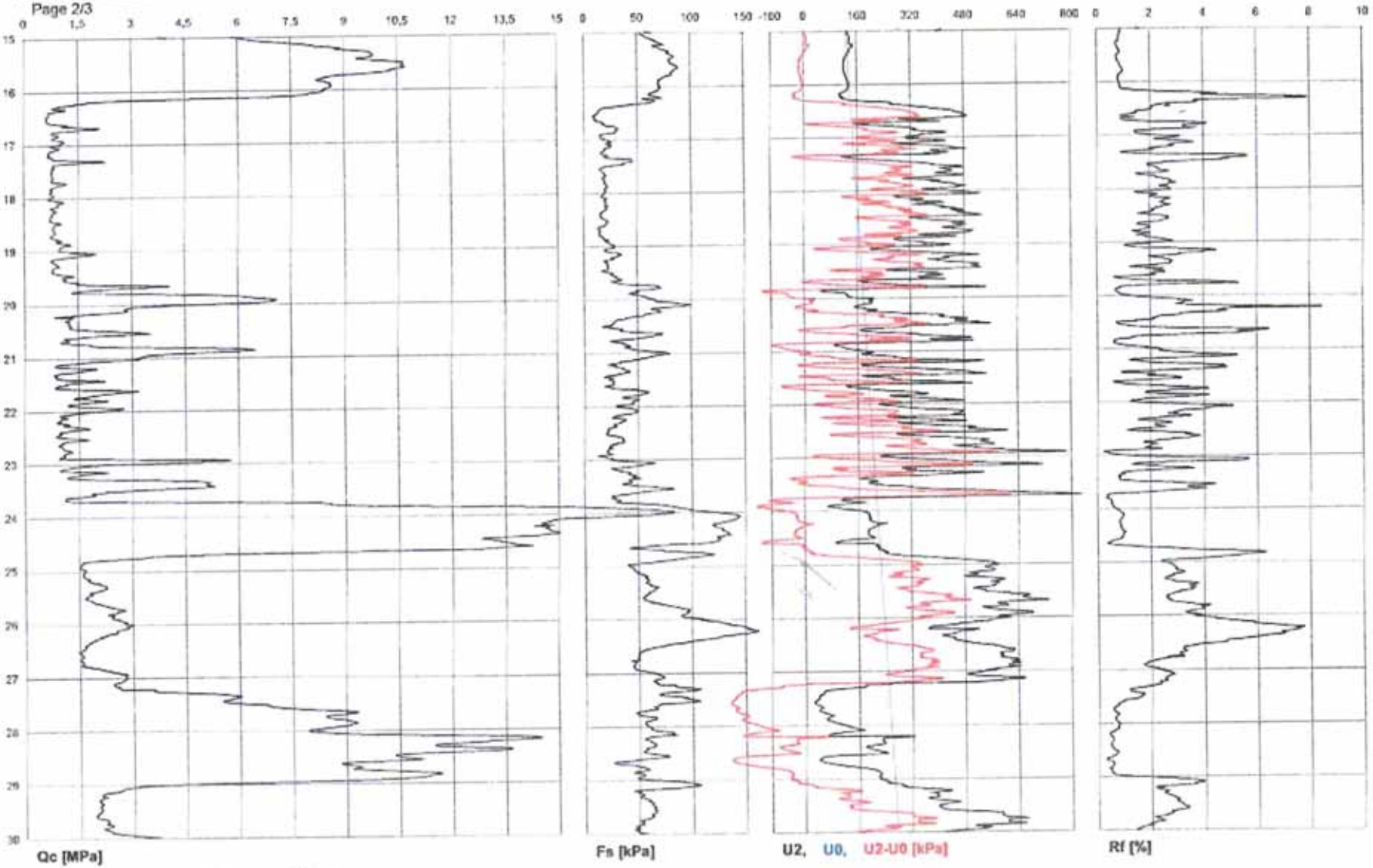

TGSW03 for Pagani Geotechnical Equipment acquisition systems

GEOLOG s.r.l.	Commissioner: PROGRA s.r.l.	
Site: Discarica Hera V. Romea N. Locality: Ravenna	Test Location: Discarica CPTU 1 Date: 16/03/2005	Abs. quota [cm]: 0 Prehole [cm]: 0 Hydrostatic Line [cm]: 195

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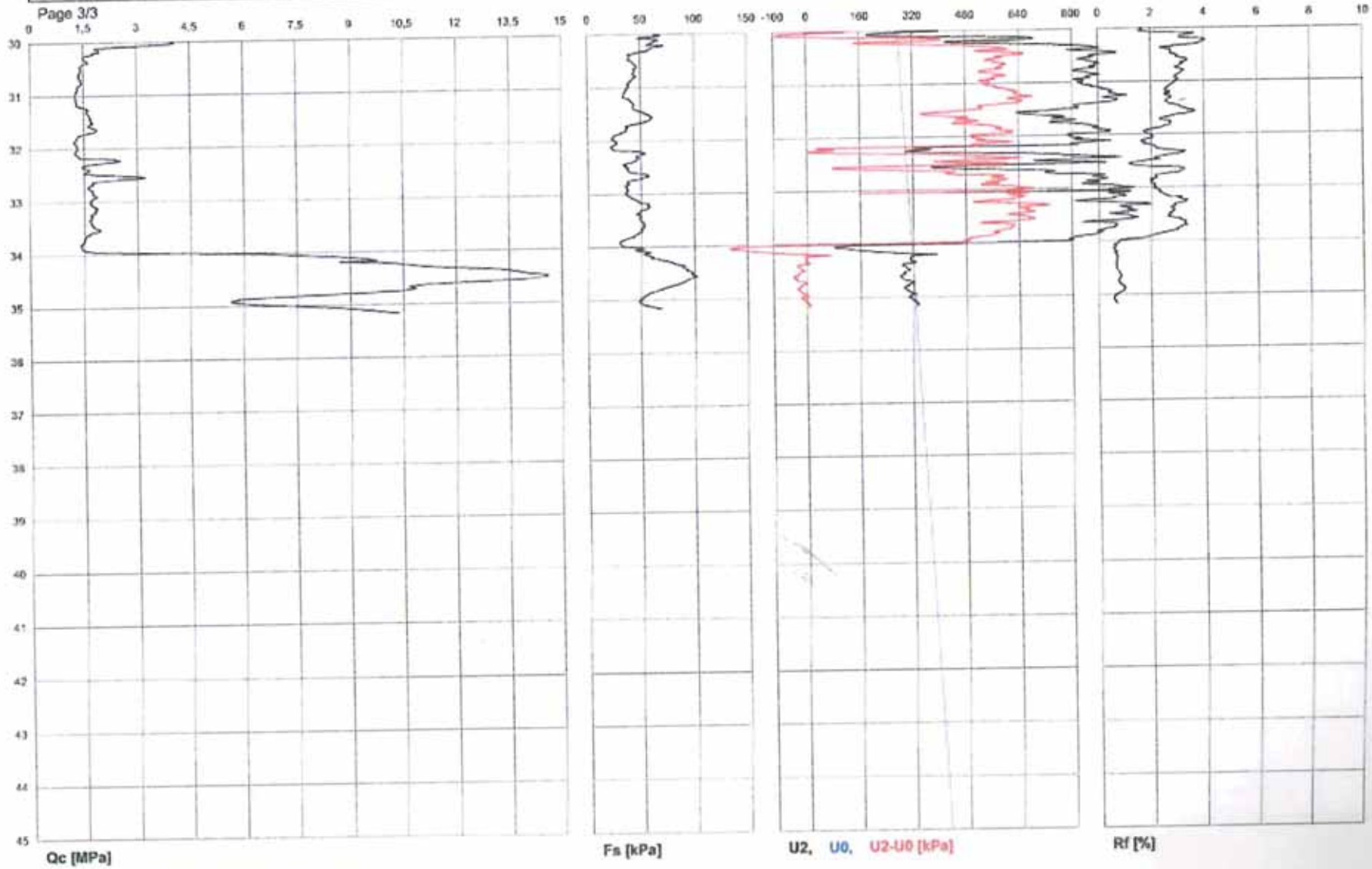

TGSW53 for Pagani Geotechnical Equipment acquisition systems

CPTU48A

elletipi s.r.l.
Sede operativa ed amm.va: Via Annibale Zucchini, 69 - 44100 FERRARA
tel. 0532/56771; fax 0532/56119 e-mail: info@elletipi.it sito: www.elletipi.it
P.IVA e Codice Fiscale n. 00174600387

Laboratorio aut. dal Ministero Infrastrutture e Trasporti D.P.R. n. 380/01 art. 59 circ. n. 34/STC Dirig. n° 57382 del 06/05/2005

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi

CANTIERE Polisportivo Ponte Nuovo - Ravenna

CPT N° CPTU 02 PROF. FALDA (m da p.c.) 1.00

DATA 08/04/10 PREFORO (m da p.c.) TIPO PUNTA piezocono G1 - CPL2IN

COMMESSA 8042/10 C. SITO N°: 573/10 del 28/04/10

prof.	qc	fs	U	incl.
m	Mpa	kPa	kPa	gradi
0.20	2.08	48.17	68.93	1.88
0.40	2.55	95.01	29.50	0.58
0.60	1.95	146.50	34.86	0.70
0.80	1.60	148.27	38.96	0.73
1.00	1.16	110.60	50.21	0.81
1.20	0.76	39.60	60.94	0.96
1.40	0.61	23.59	41.68	0.96
1.60	0.56	12.98	58.11	1.05
1.80	1.13	15.63	35.18	1.10
2.00	0.73	20.49	72.20	1.18
2.20	0.78	20.48	79.81	1.25
2.40	0.92	42.32	45.90	1.37
2.60	0.78	49.22	63.93	1.49
2.80	0.59	38.75	55.17	1.57
3.00	0.54	24.25	71.93	1.64
3.20	0.48	18.68	88.69	1.74
3.40	0.41	18.52	111.77	1.82
3.60	0.40	16.94	112.72	1.91
3.80	0.40	16.00	118.10	2.00
4.00	0.35	14.54	125.48	2.07
4.20	0.31	11.32	132.59	2.15
4.40	0.34	8.85	145.46	2.22
4.60	0.36	9.97	169.72	2.33
4.80	0.29	8.95	178.37	2.35
5.00	0.28	7.87	188.37	2.44
5.20	0.28	8.24	214.76	2.49
5.40	0.30	10.20	241.48	2.59
5.60	0.30	9.82	250.25	2.64
5.80	0.30	9.10	258.74	2.69
6.00	0.37	9.51	265.45	2.78
6.20	1.50	12.37	107.61	2.87
6.40	4.17	26.50	96.96	2.91
6.60	4.34	29.02	114.22	2.99
6.80	4.47	25.05	119.93	3.10
7.00	5.13	29.89	130.26	3.20
7.20	6.26	30.32	100.84	3.30
7.40	9.38	40.35	91.35	3.46
7.60	8.33	54.28	96.24	3.58
7.80	5.54	37.24	64.04	3.69
8.00	5.56	30.06	57.27	3.83
8.20	7.09	33.58	87.97	4.00
8.40	6.59	45.83	111.39	4.17
8.60	5.81	39.50	87.24	4.29
8.80	7.22	34.27	76.03	4.42
9.00	8.07	42.80	78.31	4.57
9.20	6.27	45.98	28.64	4.73
9.40	8.55	41.15	4.88	4.94
9.60	8.56	48.23	38.24	5.12
9.80	7.67	47.74	58.88	5.27
10.00	8.88	50.05	42.62	5.44
10.20	8.59	55.97	83.14	5.58
10.40	6.81	53.26	71.26	5.70
10.60	6.24	42.58	65.10	5.86
10.80	6.71	38.98	64.04	5.99
11.00	6.98	41.49	75.26	6.16
11.20	8.40	47.93	107.50	6.30
11.40	9.32	60.70	106.17	6.46
11.60	9.55	65.83	121.49	6.62
11.80	10.98	64.30	123.37	6.76
12.00	11.05	72.57	119.93	6.93
12.20	10.27	68.82	118.82	7.10
12.40	8.64	64.06	89.13	7.26
12.60	8.49	49.82	70.09	7.40
12.80	10.09	60.09	101.73	7.58
13.00	10.08	64.17	97.28	7.75
13.20	10.25	74.05	100.74	7.90
13.40	7.66	66.29	99.63	8.05
13.60	8.86	60.02	79.92	8.25
13.80	9.97	68.67	74.04	8.42
14.00	10.42	65.98	109.29	8.63
14.20	11.56	70.36	111.44	8.79
14.40	15.54	50.56	62.88	9.01
14.60	13.02	54.09	43.57	9.20
14.80	12.00	65.88	77.25	9.39
15.00	14.08	70.08	78.42	9.55
15.20	14.08	75.55	49.84	9.71
15.40	13.24	78.93	30.80	9.88
15.60	12.84	72.93	50.00	10.07
15.80	11.57	73.96	48.28	10.20
16.00	12.30	67.97	86.08	10.35
16.20	11.33	65.17	37.74	10.52
16.40	12.81	70.16	36.13	10.65
16.60	12.66	72.54	24.92	10.82
16.80	11.93	75.98	26.80	10.95
17.00	11.73	62.84	35.13	11.15
17.20	13.45	75.89	101.34	11.32
17.40	13.52	84.70	89.80	11.53
17.60	13.46	89.53	97.23	11.71
17.80	13.31	73.85	98.95	11.88
18.00	13.74	90.87	115.10	12.07
18.20	14.84	94.07	138.64	12.23
18.40	16.67	101.56	132.37	12.41
18.60	14.22	92.45	95.90	12.57
18.80	16.13	79.74	188.81	12.80
19.00	20.12	73.53	174.88	13.08
19.20	15.52	55.38	139.30	13.30
19.40	16.83	91.54	56.27	13.52
19.60	18.06	112.56	125.32	13.74
19.80	14.15	109.18	97.18	13.94
20.00	7.05	76.91	102.06	14.11
20.20	2.21	66.04	395.10	14.28
20.40	1.70	71.56	347.54	14.42
20.60	0.94	33.09	401.98	14.57
20.80	1.07	10.76	450.94	14.68
21.00	1.38	14.80	529.08	14.85
21.20	1.49	37.99	317.13	14.96
21.40	1.44	18.64	414.86	15.05
21.60	2.09	29.13	392.60	15.16
21.80	2.46	38.02	271.78	15.34
22.00	1.80	31.04	411.75	15.46
22.20	2.42	37.88	430.34	15.63
22.40	6.35	66.24	65.60	15.84
22.60	3.61	83.65	201.96	16.03
22.80	6.15	42.29	61.10	16.24
23.00	3.51	49.12	250.19	16.38
23.20	1.41	38.50	545.01	16.54
23.40	1.33	35.69	481.57	16.65
23.60	1.16	28.75	458.04	16.75
23.80	1.21	14.88	558.55	16.83
24.00	1.48	19.64	506.27	16.92
24.20	1.91	56.17	402.26	17.02
24.40	1.62	74.42	355.98	17.11
24.60	1.21	40.84	386.28	17.22
24.80	1.62	18.38	545.34	17.36
25.00	1.84	63.77	456.43	17.51
25.20	2.08	87.37	355.31	17.64
25.40	2.22	85.09	384.67	17.78
25.60	2.06	75.30	395.60	17.94
25.80	2.03	46.86	484.12	18.07
26.00	2.11	37.60	634.31	18.25
26.20	2.21	52.09	708.57	18.50
26.40	2.22	74.32	655.01	18.73
26.60	2.07	72.37	617.44	18.87
26.80	1.84	68.56	601.12	18.99
27.00	1.74	65.64	584.47	19.06
27.20	1.59	51.10	573.20	19.18
27.40	1.38	35.34	560.33	19.28
27.60	1.65	28.35	628.81	19.37
27.80	1.62	33.48	618.77	19.48
28.00	1.99	25.95	599.56	19.59
28.20	7.76	35.67	179.26	19.67
28.40	3.27	91.25	364.74	19.82
28.60	1.55	48.66	734.15	19.93
28.80	5.02	29.53	444.11	20.04
29.00	5.53	63.78	309.30	20.19
29.20	2.09	64.32	712.62	20.36
29.40	1.85	61.26	609.44	20.45
29.60	1.83	54.06	623.43	20.56
29.80	1.75	58.53	576.31	20.70
30.00	1.94	39.66	666.72	20.80
30.20	2.16	49.05	673.21	20.89
30.40	2.26	61.61	635.42	21.00
30.60	2.53	62.39	649.13	21.08
30.80	4.47	67.67	389.44	21.20

Lo Sperimentatore:
dott. Massimo Romagnoli

Il Direttore Settore Prove in Sito:
dott. geol. Gianluca Ferioli

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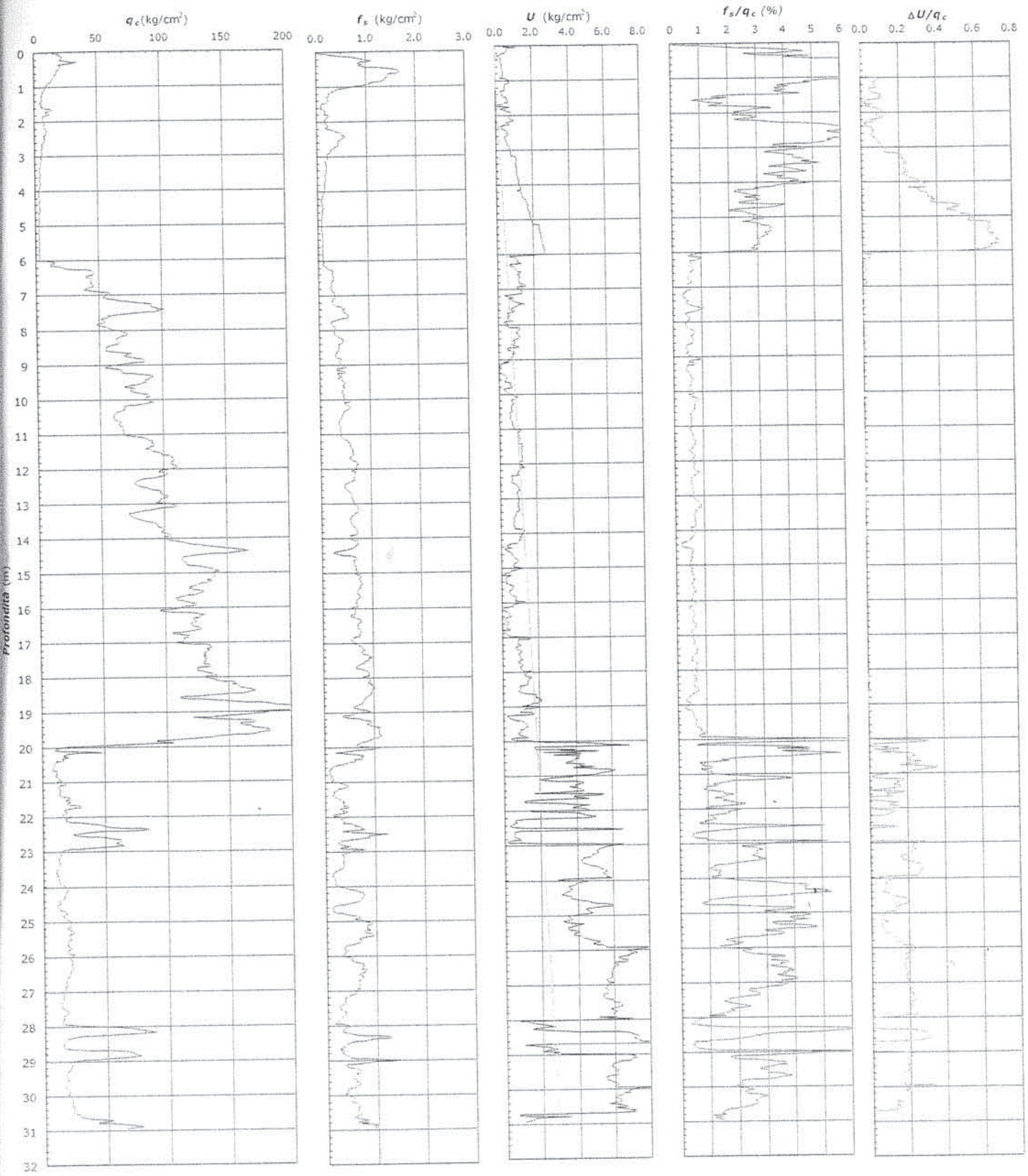
P.IVA e Codice Fiscale n. 00174600387

Laboratorio aut. dal Ministero Infrastrutture e Trasporti P.C.S. Lic. PR. S.T.C. in forza al D.P.R. n. 380/01 art. 59 ver. d. 349/99 Decr. n° 65302 del 06/05/2015

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Ponte Nuovo - Ravenna

CPT N°	CPTU 02	PROF. FALDA (m da p.c.)	1.00		
DATA	08/04/10	PREFORO (m da p.c.)		TIPO PUNTA	piezocono G1 - CPL2IN
COMMESSA	8042/10	C. SITO N°:	573/10 del 28/04/10		



Lo Sperimantatore:
dott. Massimo Romagnoli

Il Direttore Settore Prove in Sito:
dott. geol. Gianluca Ferioli

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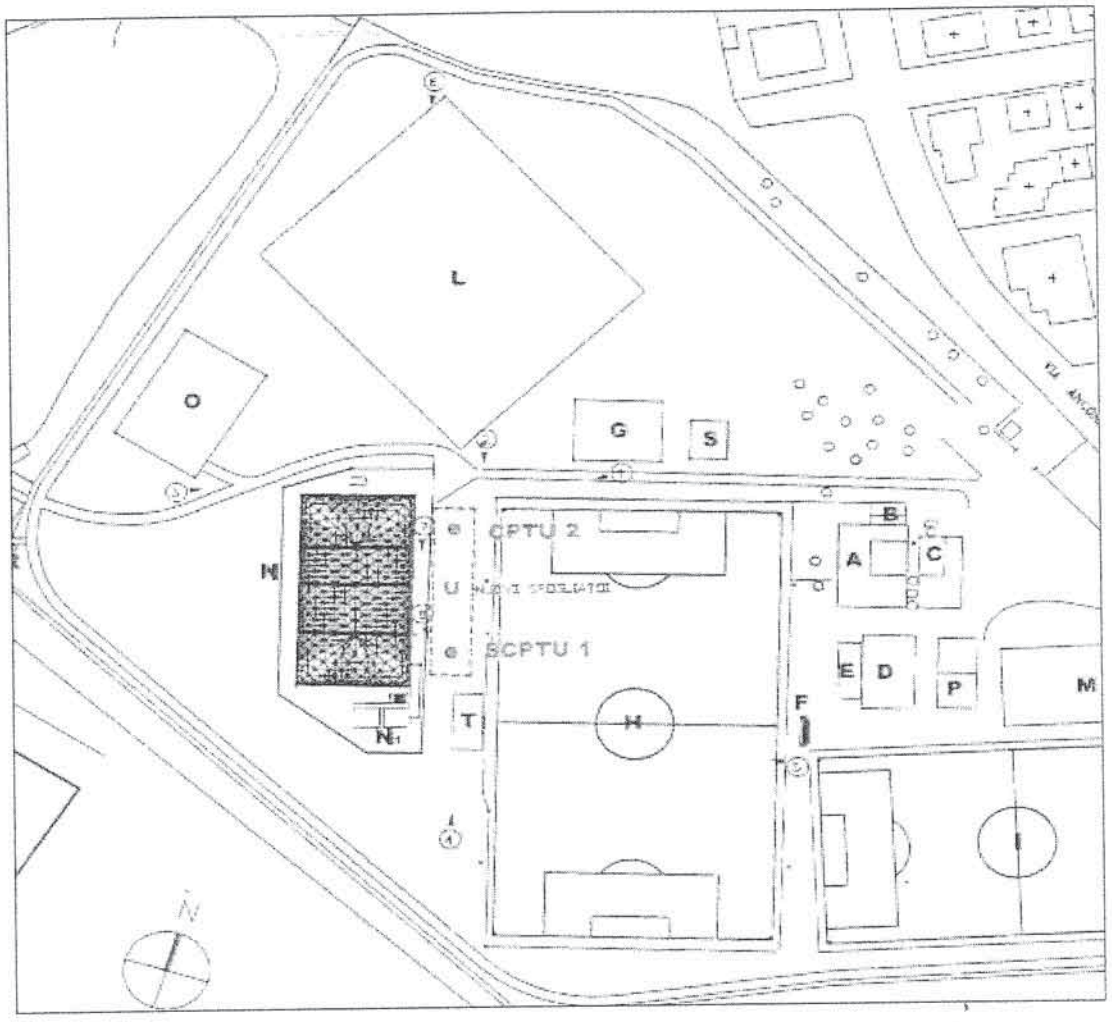
P.IVA e Codice Fiscale n. 00174600387

COMMITTENTE	**Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi**				
CANTIERE	Polisportivo Ponte Nuovo - Ravenna				
CPT N°	CPTU 02	PROF. FALDA (m da p.c.)	1.00		
DATA	08/04/10	PREFORO (m da p.c.)		TIPO PUNTA	piezocono G1 - CPL2IN
COMMESSA	8042/10	C. SITO N°:	573/10 del 28/04/10		

PLANIMETRIA

Località: Polisportivo Ponte Nuovo - Ravenna



Lo Sperimantatore:
dott. Massimo Romagnoli

Il Direttore Settore Prove in Sito:
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COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Ponte Nuovo - Ravenna

CPT N° CPTU 02 PROF. FALDA (m da p.c.) 1.00
DATA 08/04/10 PREFORO (m da p.c.) 0.00 TIPO PUNTA piezocono G1 - CPL2IN
COMMESSA 8042/10

Prof. (m) da	a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{vo} (kg/cm²)	C_u media (kg/cm²)	Φ' (1) (gradi)	Φ (2) (gradi)
0.00	0.06	0.03	0.06	sabbie limose	17.867808	1.3-1.8	0.01	-	>45	50
0.06	0.14	0.10	0.08	limi e limi sabbiosi	21.4	1.3-1.8	0.03	1.4	>45	44
0.14	0.22	0.18	0.08	limi argillosi e argille limose	21.6	1.3-1.8	0.04	1.4	-	-
0.22	0.24	0.23	0.02	argille	20.8	0.7-1.3	0.04	1.4	-	-
0.24	0.28	0.26	0.04	limi argillosi e argille limose	27.4	1.3-1.8	0.05	1.8	-	-
0.28	0.34	0.31	0.06	limi e limi sabbiosi	30.7	1.3-1.8	0.06	2.0	43	40
0.34	0.36	0.35	0.02	argille	19.1	0.7-1.3	0.06	1.3	-	-
0.36	0.42	0.39	0.06	limi argillosi e argille limose	20.8	1.3-1.8	0.07	1.4	-	-
0.42	0.46	0.44	0.04	argille	20.2	0.7-1.3	0.08	1.3	-	-
0.46	1.04	0.75	0.58	torbe	14.4	0.4-0.8	0.16	0.9	-	-
1.04	1.46	1.25	0.42	argille	6.3	0.4-0.8	0.23	0.4	-	-
1.46	1.50	1.48	0.04	limi argillosi e argille limose	5.3	0.8-1.1	0.22	0.3	-	-
1.50	1.54	1.52	0.04	limi e limi sabbiosi	5.9	0.8-1.1	0.22	0.4	<32	25
1.54	1.56	1.55	0.02	limi argillosi e argille limose	5.2	0.8-1.1	0.23	0.3	-	-
1.56	1.80	1.68	0.24	limi e limi sabbiosi	10.3	0.8-1.1	0.26	0.7	<32	27
1.80	2.28	2.04	0.48	limi argillosi e argille limose	7.7	0.8-1.1	0.33	0.5	-	-
2.28	2.38	2.33	0.10	argille	9.0	0.4-0.8	0.32	0.6	-	-
2.38	2.50	2.44	0.12	torbe	7.8	0.4-0.8	0.33	0.5	-	-
2.50	2.58	2.54	0.08	argille	7.7	0.4-0.8	0.33	0.5	-	-
2.58	2.72	2.65	0.14	torbe	6.0	0.4-0.8	0.35	0.4	-	-
2.72	4.18	3.45	1.46	argille	4.1	0.4-0.8	0.53	0.2	-	-
4.18	4.34	4.26	0.16	limi argillosi e argille limose	3.4	0.8-1.1	0.49	0.2	-	-
4.34	4.40	4.37	0.06	argille	3.2	0.4-0.8	0.49	0.2	-	-
4.40	4.42	4.41	0.02	limi argillosi e argille limose	3.8	0.8-1.1	0.49	0.2	-	-
4.42	4.50	4.46	0.08	argille	3.4	0.4-0.8	0.50	0.2	-	-
4.50	4.60	4.55	0.10	limi argillosi e argille limose	3.6	0.8-1.1	0.51	0.2	-	-
4.60	4.74	4.67	0.14	argille	2.7	0.4-0.8	0.52	0.1	-	-
4.74	4.86	4.80	0.12	limi argillosi e argille limose	3.0	0.8-1.1	0.53	0.1	-	-
4.86	5.10	4.98	0.24	argille	2.7	0.4-0.8	0.56	0.1	-	-
5.10	5.14	5.12	0.04	limi argillosi e argille limose	2.9	0.8-1.1	0.56	0.1	-	-
5.14	5.94	5.54	0.80	argille	3.0	0.4-0.8	0.66	0.1	-	-
5.94	5.98	5.96	0.04	limi argillosi e argille limose	3.9	0.8-1.1	0.63	0.2	-	-
5.98	6.02	6.00	0.04	limi e limi sabbiosi	9.6	0.8-1.1	0.63	0.6	<32	20
6.02	6.10	6.06	0.08	sabbie limose	14.3	0.8-1.1	0.64	-	<32	22
6.10	6.16	6.13	0.06	limi e limi sabbiosi	12.5	0.8-1.1	0.65	0.8	<32	21
6.16	6.26	6.21	0.10	sabbie limose	26.3	0.8-1.1	0.66	-	<32	25
6.26	6.42	6.34	0.16	sabbie	45.2	0.8-1.1	0.68	-	<32	28
6.42	6.50	6.46	0.08	sabbie limose	40.8	0.8-1.1	0.69	-	<32	27
6.50	6.78	6.64	0.28	sabbie	44.0	0.8-1.1	0.73	-	<32	28
6.78	6.86	6.82	0.08	sabbie limose	39.6	0.8-1.1	0.73	-	<32	27
6.86	7.56	7.21	0.70	sabbie	74.9	0.8-1.1	0.83	-	33	30
7.56	7.66	7.61	0.10	sabbie limose	56.9	0.8-1.1	0.82	-	<32	28
7.66	9.04	8.35	1.38	sabbie	64.5	0.8-1.1	1.03	-	<32	28
9.04	9.08	9.06	0.04	sabbie limose	55.2	0.8-1.1	0.97	-	<32	27
9.08	19.92	14.50	10.84	sabbie	113.5	0.8-1.1	2.72	-	<32	29
19.92	19.94	19.93	0.02	sabbie limose	54.5	0.8-1.1	2.19	-	<32	23
19.94	19.98	19.96	0.04	limi e limi sabbiosi	28.8	0.8-1.1	2.19	1.6	<32	19
19.98	20.00	19.99	0.02	argille	16.9	0.4-0.8	2.19	0.9	-	-
20.00	20.08	20.04	0.08	torbe	11.1	0.4-0.8	2.20	0.5	-	-
20.08	20.10	20.09	0.02	argille	15.0	0.4-0.8	2.20	0.7	-	-
20.10	20.18	20.14	0.08	sabbie limose	34.5	0.8-1.1	2.21	-	<32	20
20.18	20.20	20.19	0.02	limi e limi sabbiosi	19.3	0.8-1.1	2.21	1.0	<32	17
20.20	20.24	20.22	0.04	limi argillosi e argille limose	18.1	0.8-1.1	2.22	0.9	-	-
20.24	20.26	20.25	0.02	argille	17.1	0.4-0.8	2.22	0.9	-	-

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P.IVA e Codice Fiscale n. 00174600387

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Ponte Nuovo - Ravenna

CPT N°	CPTU 02	PROF. FALDA (m da p.c.)	1.00		
DATA	08/04/10	PREFORO (m da p.c.)	0.00	TIPO PUNTA	piezocono G1 - CPL2IN
COMMESSA	8042/10				

Prof. (m) da	a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{v0} (kg/cm²)	C_u media (kg/cm²)	Φ' (1) (gradi)	Φ (2) (gradi)
20.26	20.30	20.28	0.04	limi argillosi e argille limose	19.1	0.8-1.1	2.22	1.0	-	-
20.30	20.34	20.32	0.04	argille	16.1	0.4-0.8	2.23	0.8	-	-
20.34	20.38	20.36	0.04	limi argillosi e argille limose	15.7	0.8-1.1	2.23	0.8	-	-
20.38	20.50	20.44	0.12	argille	9.9	0.4-0.8	2.25	0.4	-	-
20.50	20.52	20.51	0.02	limi argillosi e argille limose	9.2	0.8-1.1	2.24	0.3	-	-
20.52	20.84	20.68	0.32	limi e limi sabbiosi	10.1	0.8-1.1	2.29	0.4	<32	13
20.84	20.86	20.85	0.02	sabbie limose	13.2	0.8-1.1	2.28	-	<32	15
20.86	21.08	20.97	0.22	limi e limi sabbiosi	15.4	0.8-1.1	2.32	0.7	<32	15
21.08	21.16	21.12	0.08	limi argillosi e argille limose	12.4	0.8-1.1	2.32	0.5	-	-
21.16	21.40	21.28	0.24	limi e limi sabbiosi	14.1	0.8-1.1	2.35	0.6	<32	15
21.40	21.48	21.44	0.08	sabbie limose	21.0	0.8-1.1	2.35	-	<32	17
21.48	21.64	21.56	0.16	limi e limi sabbiosi	20.4	0.8-1.1	2.38	1.1	<32	17
21.64	21.72	21.68	0.08	sabbie limose	29.1	0.8-1.1	2.38	-	<32	19
21.72	21.96	21.84	0.24	limi e limi sabbiosi	18.2	0.8-1.1	2.42	0.9	<32	16
21.96	21.98	21.97	0.02	sabbie limose	16.4	0.8-1.1	2.41	-	<32	15
21.98	22.14	22.06	0.16	limi e limi sabbiosi	20.0	0.8-1.1	2.43	1.0	<32	17
22.14	22.32	22.23	0.18	sabbie limose	45.9	0.8-1.1	2.45	-	<32	21
22.32	22.42	22.37	0.10	sabbie	71.7	0.8-1.1	2.46	-	<32	24
22.42	22.46	22.44	0.04	sabbie limose	34.5	0.8-1.1	2.46	-	<32	20
22.46	22.48	22.47	0.02	limi e limi sabbiosi	27.1	0.8-1.1	2.46	1.5	<32	18
22.48	22.50	22.49	0.02	limi argillosi e argille limose	24.2	0.8-1.1	2.46	1.3	-	-
22.50	22.52	22.51	0.02	argille	24.9	0.4-0.8	2.47	1.4	-	-
22.52	22.54	22.53	0.02	limi argillosi e argille limose	29.7	0.8-1.1	2.47	1.7	-	-
22.54	22.56	22.55	0.02	limi e limi sabbiosi	36.4	0.8-1.1	2.47	2.1	<32	20
22.56	22.64	22.60	0.08	sabbie limose	51.8	0.8-1.1	2.48	-	<32	22
22.64	22.84	22.74	0.20	sabbie	61.9	0.8-1.1	2.51	-	<32	23
22.84	22.90	22.87	0.06	sabbie limose	42.2	0.8-1.1	2.51	-	<32	21
22.90	22.92	22.91	0.02	limi e limi sabbiosi	23.8	0.8-1.1	2.51	1.3	<32	17
22.92	22.94	22.93	0.02	limi argillosi e argille limose	17.5	0.8-1.1	2.51	0.9	-	-
22.94	22.96	22.95	0.02	argille	15.1	0.4-0.8	2.52	0.7	-	-
22.96	23.04	23.00	0.08	limi argillosi e argille limose	15.8	0.8-1.1	2.53	0.7	-	-
23.04	23.12	23.08	0.08	limi e limi sabbiosi	14.2	0.8-1.1	2.54	0.6	<32	14
23.12	23.32	23.22	0.20	limi argillosi e argille limose	12.9	0.8-1.1	2.56	0.5	-	-
23.32	23.38	23.35	0.06	limi e limi sabbiosi	13.5	0.8-1.1	2.56	0.6	<32	14
23.38	23.52	23.45	0.14	limi argillosi e argille limose	12.1	0.8-1.1	2.58	0.5	-	-
23.52	24.10	23.81	0.58	limi e limi sabbiosi	13.9	0.8-1.1	2.67	0.6	<32	14
24.10	24.32	24.21	0.22	limi argillosi e argille limose	17.5	0.8-1.1	2.68	0.8	-	-
24.32	24.46	24.39	0.14	argille	13.8	0.4-0.8	2.68	0.6	-	-
24.46	24.54	24.50	0.08	limi argillosi e argille limose	11.8	0.8-1.1	2.69	0.5	-	-
24.54	24.66	24.60	0.12	limi e limi sabbiosi	11.7	0.8-1.1	2.71	0.4	<32	13
24.66	24.76	24.71	0.10	sabbie limose	17.4	0.8-1.1	2.72	-	<32	15
24.76	24.82	24.79	0.06	limi e limi sabbiosi	16.9	0.8-1.1	2.72	0.8	<32	15
24.82	24.94	24.88	0.12	limi argillosi e argille limose	17.0	0.8-1.1	2.74	0.8	-	-
24.94	24.96	24.95	0.02	limi e limi sabbiosi	18.9	0.8-1.1	2.73	0.9	<32	16
24.96	25.28	25.12	0.32	limi argillosi e argille limose	20.9	0.8-1.1	2.79	1.0	-	-
25.28	25.30	25.29	0.02	limi e limi sabbiosi	23.6	0.8-1.1	2.77	1.2	<32	17
25.30	25.38	25.34	0.08	limi argillosi e argille limose	22.0	0.8-1.1	2.78	1.1	-	-
25.38	25.42	25.40	0.04	argille	19.7	0.4-0.8	2.79	1.0	-	-
25.42	25.48	25.45	0.06	limi argillosi e argille limose	20.9	0.8-1.1	2.79	1.0	-	-
25.48	25.50	25.49	0.02	limi e limi sabbiosi	21.8	0.8-1.1	2.79	1.1	<32	16
25.50	25.64	25.57	0.14	limi argillosi e argille limose	19.4	0.8-1.1	2.82	0.9	-	-
25.64	25.92	25.78	0.28	limi e limi sabbiosi	19.8	0.8-1.1	2.85	1.0	<32	16
25.92	25.94	25.93	0.02	sabbie limose	24.3	0.8-1.1	2.84	-	<32	17
25.94	26.20	26.07	0.26	limi e limi sabbiosi	21.7	0.8-1.1	2.88	1.1	<32	16

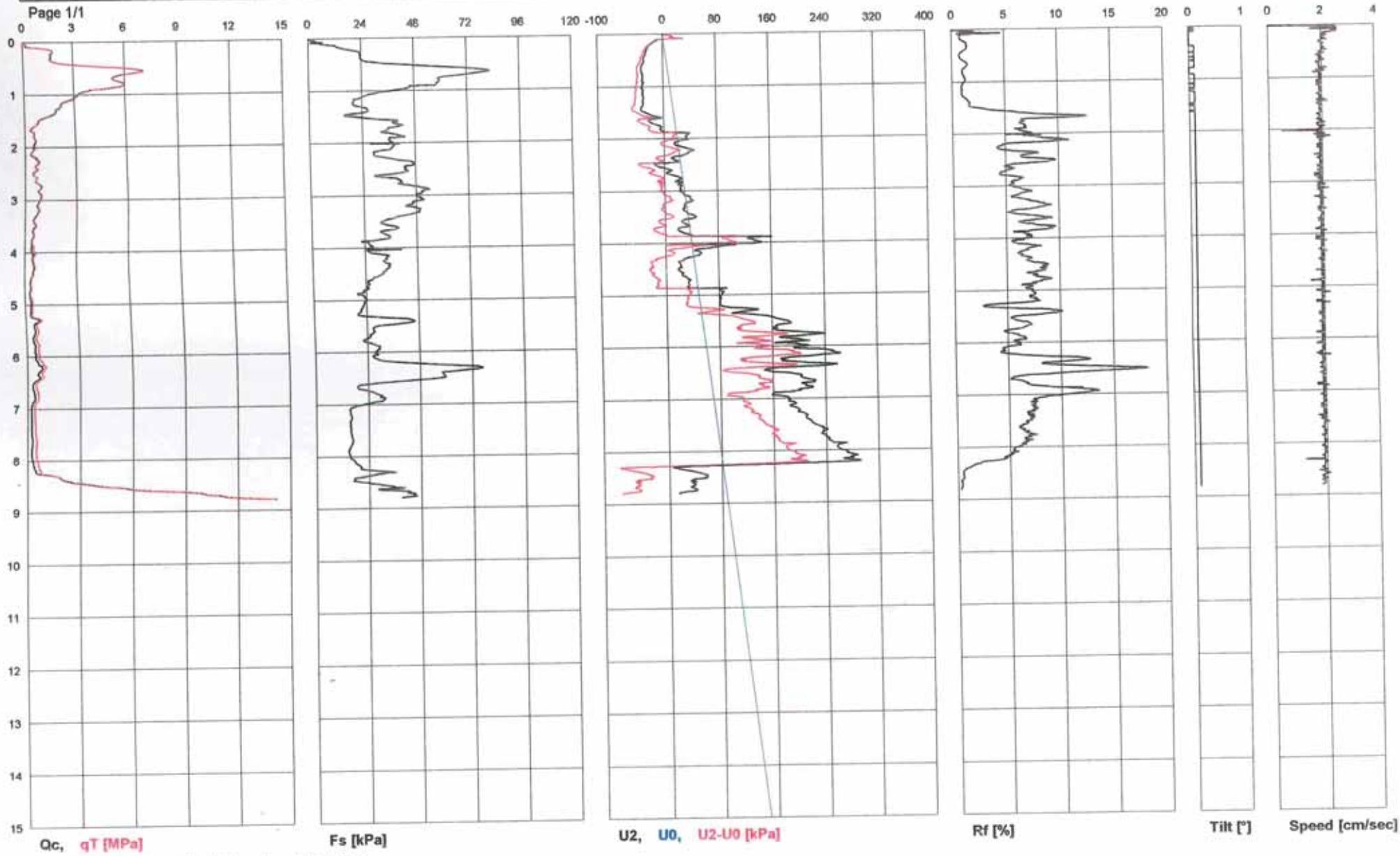
elletipi s.r.l.
Sede operativa ed amm.va: Via Annibale Zucchini, 69 - 44100 FERRARA
tel. 0532/56771; fax 0532/56119 e-mail: info@elletipi.it sito: www.elletipi.it
P.IVA e Codice Fiscale n. 00174600387
Laboratorio aut. dal Ministero Infrastrutture e Trasporti P.F.S.L.L.PP. S.T.C. in base al D.P.R. n. 380/01 art. 59 circ. n. 34/STC Dec. n. 53362 del 06/05/2015

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Ponte Nuovo - Ravenna

CPT N° CPTU 02 PROF. FALDA (m da p.c.) 1.00
DATA 08/04/10 PREFORO (m da p.c.) 0.00 TIPO PUNTA piezocono G1 - CPL2IN
COMMESSA 8042/10

Prof. (m) da	a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{vo} (kg/cm²)	C_u media (kg/cm²)	Φ' (1) (gradi)	Φ (2) (gradi)
26.20	27.16	26.68	0.96	limi argillosi e argille limose	18.7	0.8-1.1	3.03	0.9	-	-
27.16	27.28	27.22	0.12	limi e limi sabbiosi	14.7	0.8-1.1	3.00	0.6	<32	14
27.28	27.38	27.33	0.10	limi argillosi e argille limose	13.0	0.8-1.1	3.01	0.5	-	-
27.38	27.96	27.67	0.58	limi e limi sabbiosi	15.7	0.8-1.1	3.10	0.7	<32	14
27.96	28.00	27.98	0.04	sabbie limose	37.3	0.8-1.1	3.07	-	<32	19
28.00	28.24	28.12	0.24	sabbie	74.3	0.8-1.1	3.11	-	<32	23
28.24	28.26	28.25	0.02	sabbie limose	40.1	0.8-1.1	3.10	-	<32	19
28.26	28.28	28.27	0.02	limi e limi sabbiosi	31.3	0.8-1.1	3.11	1.7	<32	18
28.28	28.30	28.29	0.02	limi argillosi e argille limose	26.7	0.8-1.1	3.11	1.4	-	-
28.30	28.32	28.31	0.02	argille	22.8	0.4-0.8	3.11	1.1	-	-
28.32	28.38	28.35	0.06	torbe	18.1	0.4-0.8	3.12	0.8	-	-
28.38	28.42	28.40	0.04	argille	15.9	0.4-0.8	3.12	0.7	-	-
28.42	28.48	28.45	0.06	limi argillosi e argille limose	15.5	0.8-1.1	3.13	0.6	-	-
28.48	28.50	28.49	0.02	limi e limi sabbiosi	15.2	0.8-1.1	3.13	0.6	<32	14
28.50	28.52	28.51	0.02	limi argillosi e argille limose	14.5	0.8-1.1	3.13	0.6	-	-
28.52	28.64	28.58	0.12	limi e limi sabbiosi	15.5	0.8-1.1	3.15	0.6	<32	14
28.64	28.68	28.66	0.04	sabbie limose	30.1	0.8-1.1	3.15	-	<32	17
28.68	28.90	28.79	0.22	sabbie	69.4	0.8-1.1	3.18	-	<32	22
28.90	28.94	28.92	0.04	sabbie limose	46.0	0.8-1.1	3.18	-	<32	20
28.94	28.96	28.95	0.02	limi e limi sabbiosi	35.9	0.8-1.1	3.18	2.0	<32	18
28.96	28.98	28.97	0.02	limi argillosi e argille limose	27.4	0.8-1.1	3.18	1.4	-	-
28.98	29.02	29.00	0.04	torbe	20.7	0.4-0.8	3.18	1.0	-	-
29.02	29.04	29.03	0.02	argille	19.9	0.4-0.8	3.18	0.9	-	-
29.04	29.08	29.06	0.04	limi argillosi e argille limose	20.0	0.8-1.1	3.19	0.9	-	-
29.08	29.24	29.16	0.16	limi e limi sabbiosi	20.6	0.8-1.1	3.21	1.0	<32	15
29.24	29.44	29.34	0.20	limi argillosi e argille limose	17.7	0.8-1.1	3.24	0.8	-	-
29.44	29.50	29.47	0.06	limi e limi sabbiosi	17.6	0.8-1.1	3.24	0.8	<32	14
29.50	29.56	29.53	0.06	limi argillosi e argille limose	18.0	0.8-1.1	3.25	0.8	-	-
29.56	29.60	29.58	0.04	limi e limi sabbiosi	19.1	0.8-1.1	3.25	0.9	<32	15
29.60	29.76	29.68	0.16	limi argillosi e argille limose	17.1	0.8-1.1	3.27	0.7	-	-
29.76	30.62	30.19	0.86	limi e limi sabbiosi	21.8	0.8-1.1	3.40	1.0	<32	15
30.62	30.86	30.74	0.24	sabbie limose	51.0	0.8-1.1	3.40	-	<32	20
30.86	30.90	30.88	0.04	sabbie	77.9	0.8-1.1	3.39	-	<32	22
30.90	30.94	30.92	0.04	sabbie limose	68.2	0.8-1.1	3.40	-	<32	22

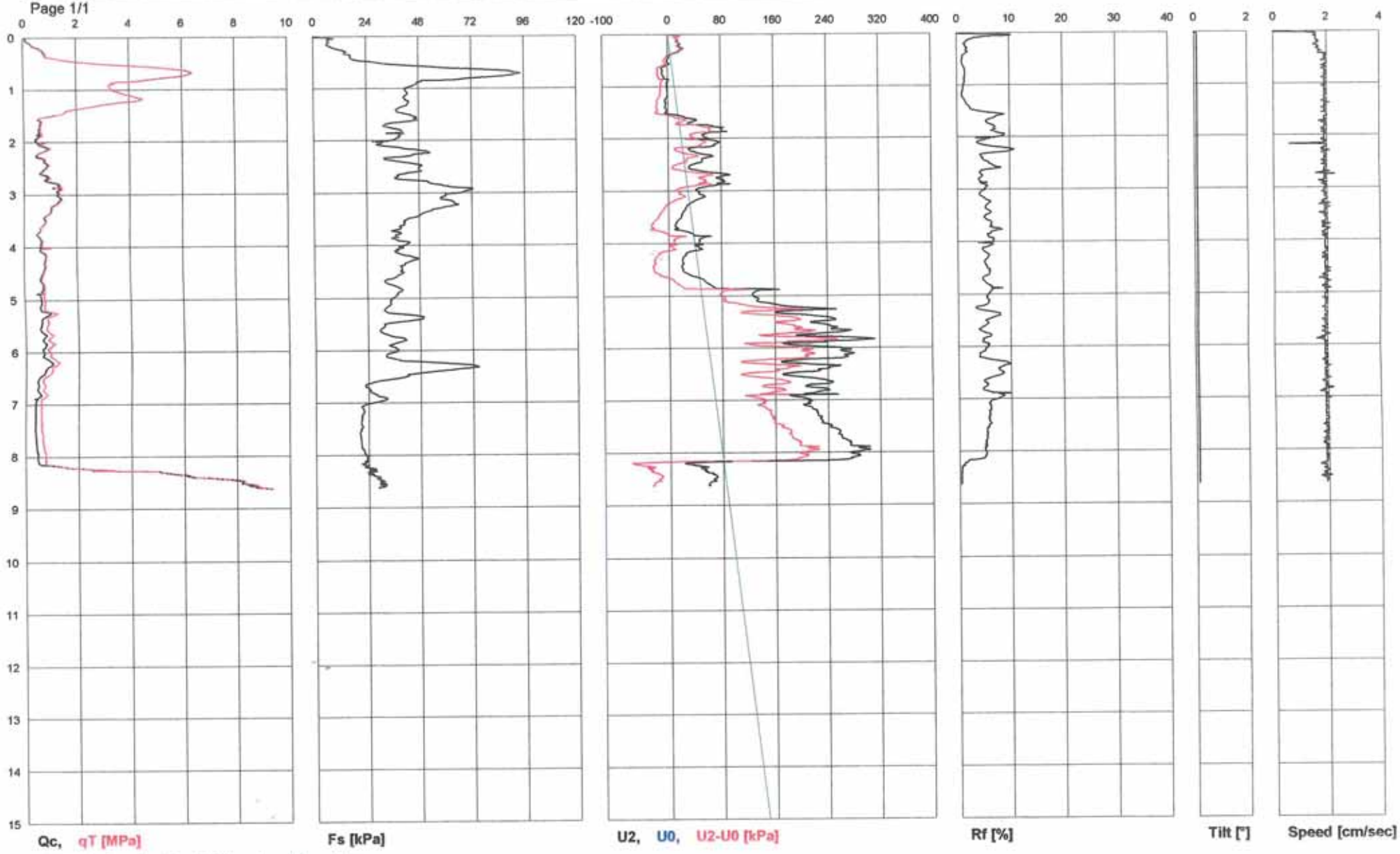
GEOEMME DUE S.a.s	CPTU49A	Commissioner: PROVINCIA RAVENNA
Site: 07031 Locality: RAVENNA	Test Location: 5.cpt Date: 06/02/2007	Abs. quota [cm]: 0 Prehole [cm]: 0 Hydrostatic Line [cm]: 0



TGSW03 for Pagani Geotechnical Equipment acquisition systems

GEOEMME DUE S.a.s	CPTU50A	Commissioner: PROVINCIA RAVENNA
Site: 07031 Locality: RAVENNA	Test Location: 4.cpt Date: 06/02/2007	Abs. quota [cm]: 0 Prehole [cm]: 0 Hydrostatic Line [cm]: 0

Page 1/1



TGSW03 for Pagani Geotechnical Equipment acquisition systems

GEOEMME DUE S.a.s

CPTU51A

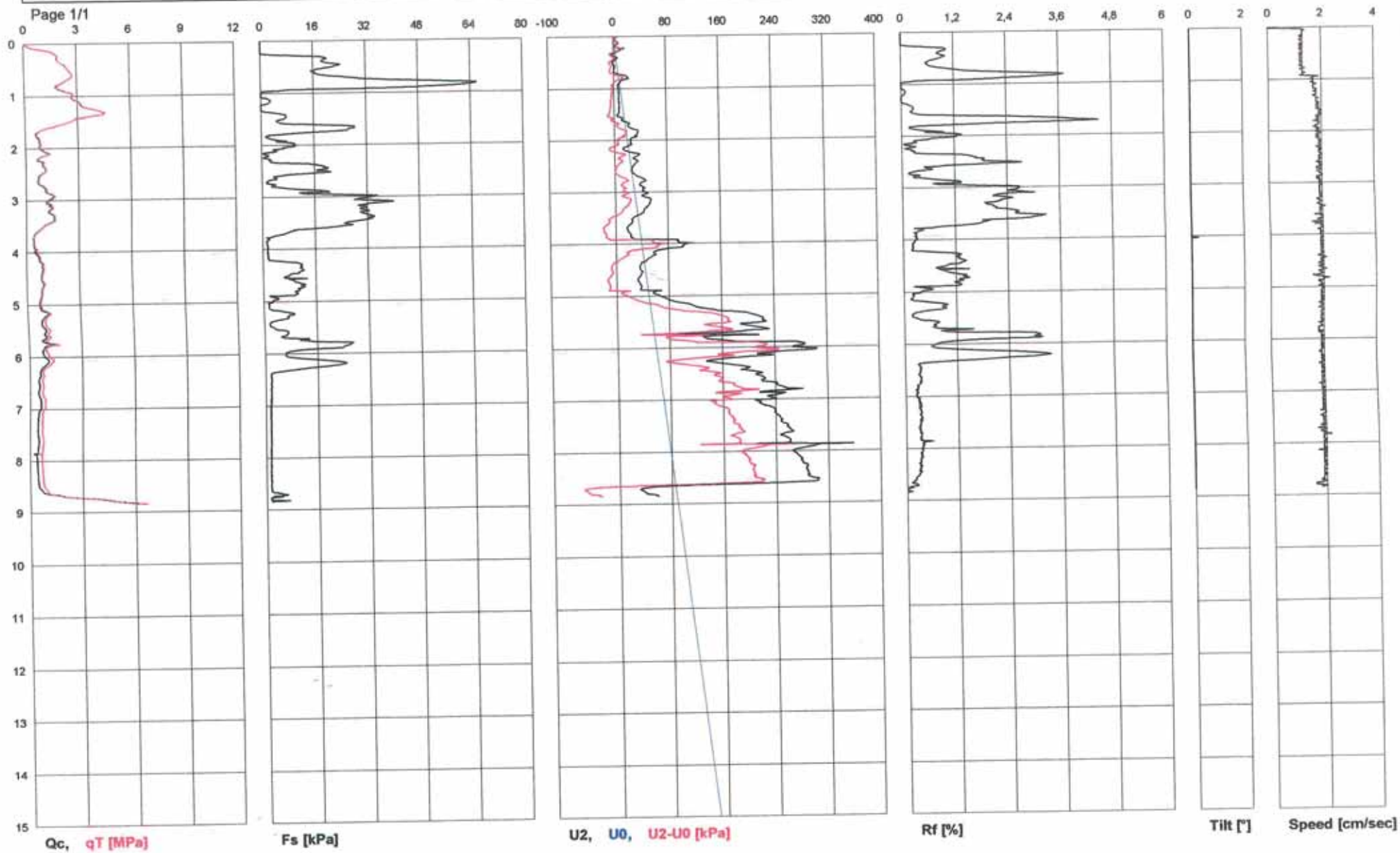
Commissioner: PROVINCIA RAVENNA

Site: 07031
Locality: RAVENNA

Test Location: 1.cpt
Date: 05/02/2007

Abs. quota [cm]: 0
Prehole [cm]: 0
Hydrostatic Line [cm]: 0

Page 1/1



TGSW03 for Pagani Geotechnical Equipment acquisition systems

GEOEMME DUE S.a.s

CPTU52A

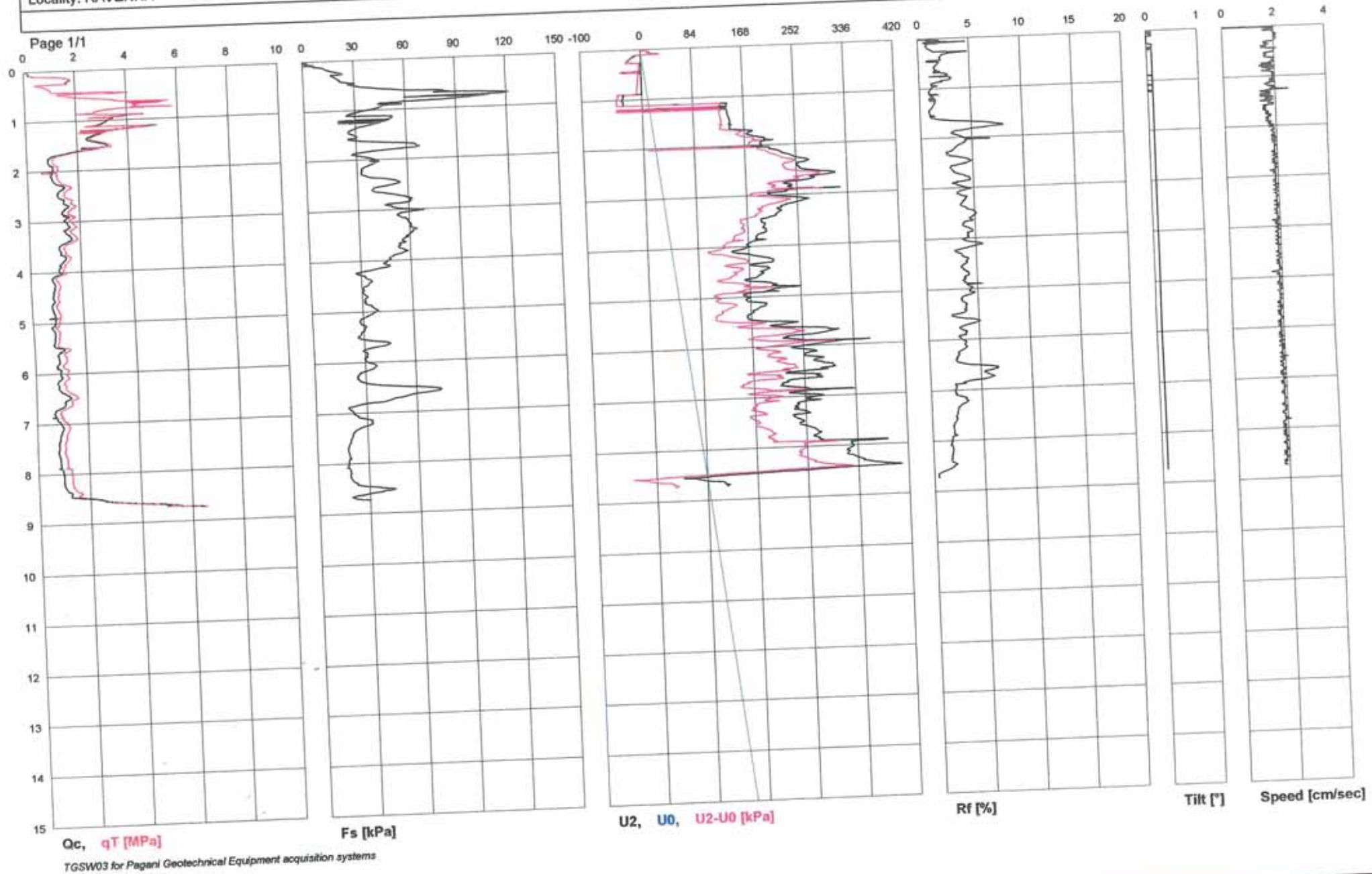
Commissioner: PROVINCIA RAVENNA

Site: 07031
Locality: RAVENNA

Test Location: 6.cpt
Date: 06/02/2007

Abs. quota [cm]: 0
Prehole [cm]: 0
Hydrostatic Line [cm]: 0

Page 1/1



TGSW03 for Pagani Geotechnical Equipment acquisition systems

GEOEMME DUE S.a.s

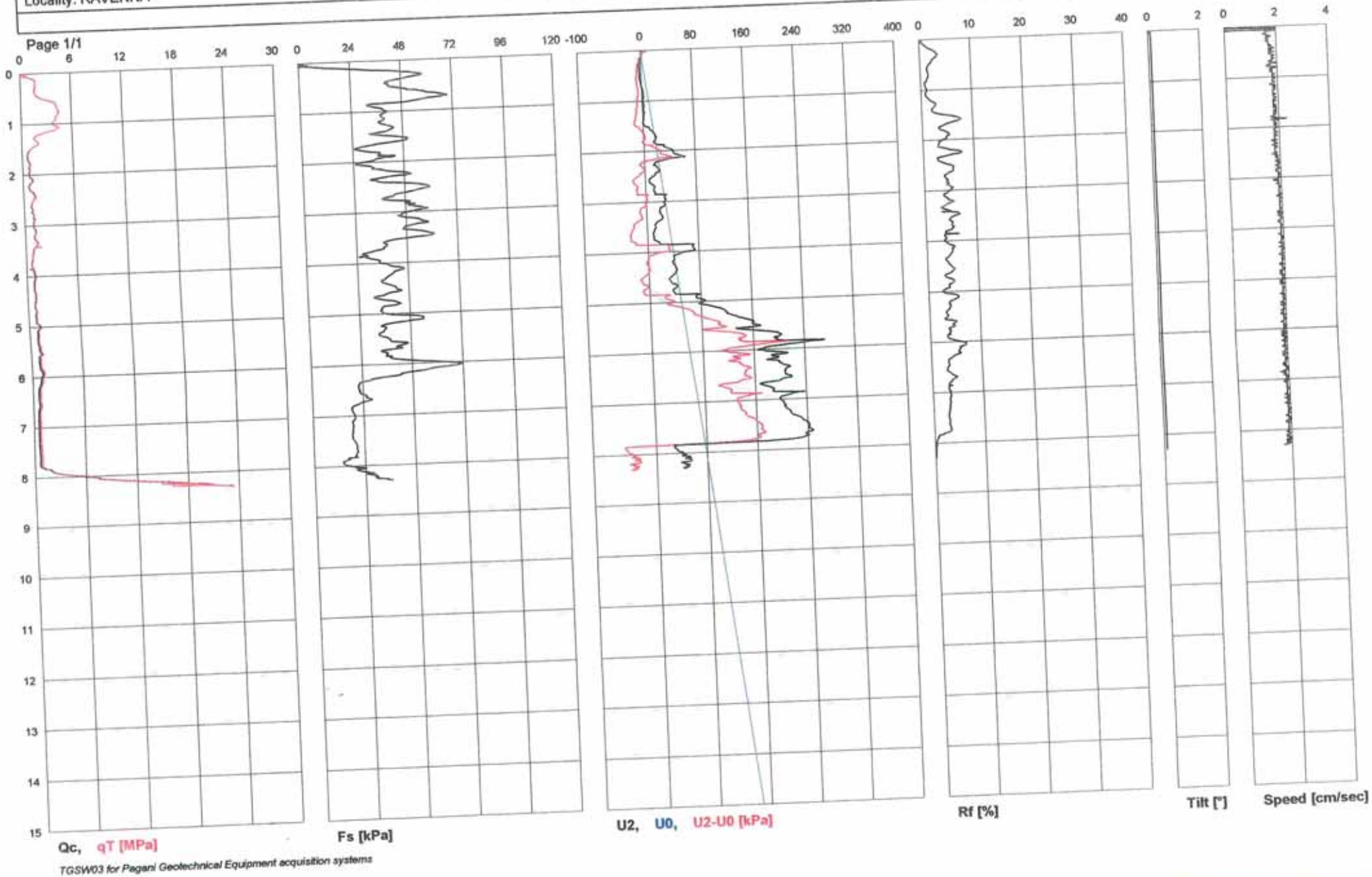
CPTU53A

Site: 07031
Locality: RAVENNA

Test Location: 3.cpt
Date: 05/02/2007

Commissioner: PROVINCIA RAVENNA

Abs. quota [cm]: 0
Prehole [cm]: 0
Hydrostatic Line [cm]: 0



TGSW03 for Pagani Geotechnical Equipment acquisition systems

GEOEMME DUE S.a.s

CPTU54A

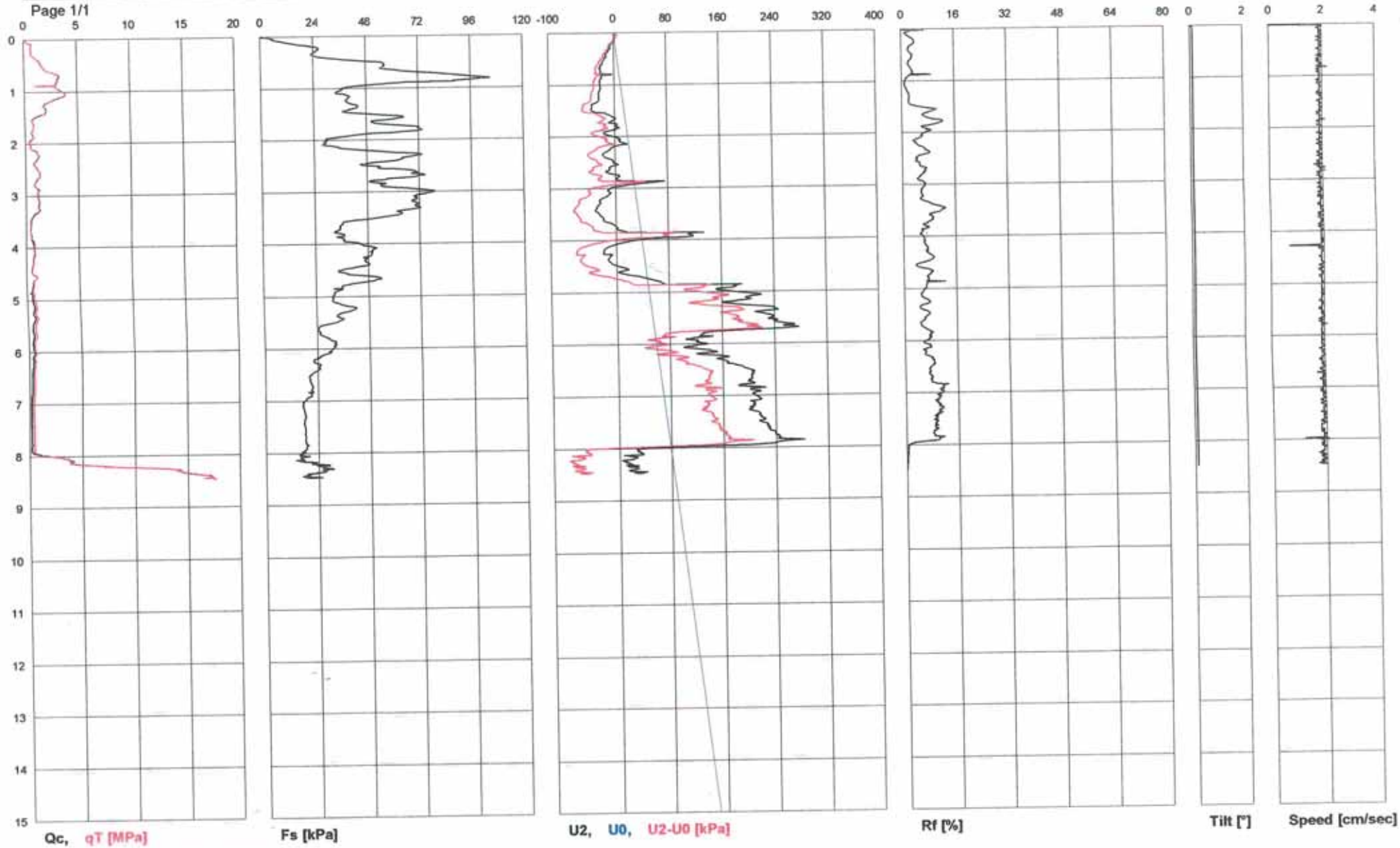
Commissioner: PROVINCIA RAVENNA

Site: 07031
Locality: RAVENNA

Test Location: 2.cpt
Date: 05/02/2007

Abs. quota [cm]: 0
Prehole [cm]: 0
Hydrostatic Line [cm]: 0

Page 1/1



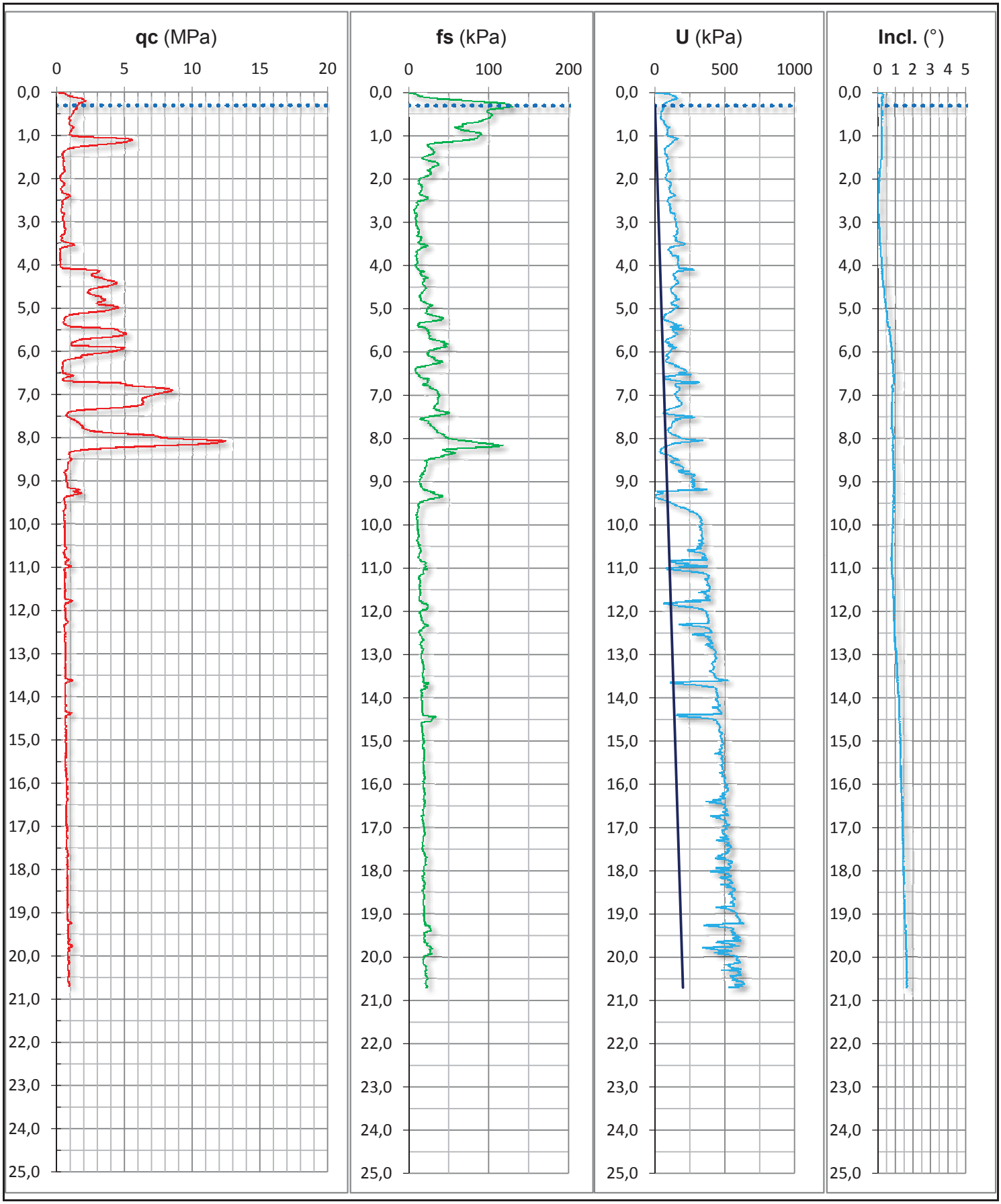
TGSW03 for Pagani Geotechnical Equipment acquisition systems

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA
DIAGRAMMI DI RESISTENZA

RIF. PROVA:	CPTU n°:
U07-15	RER2

COMMITTENTE: Regione Emilia Romagna
CANTIERE: Casalborsetti (Ra)
DATA: 29/01/2015

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 20,70
PROFONDITA' FALDA (m da p.c.): 0,30
PREFORO (m da p.c.): 0,00



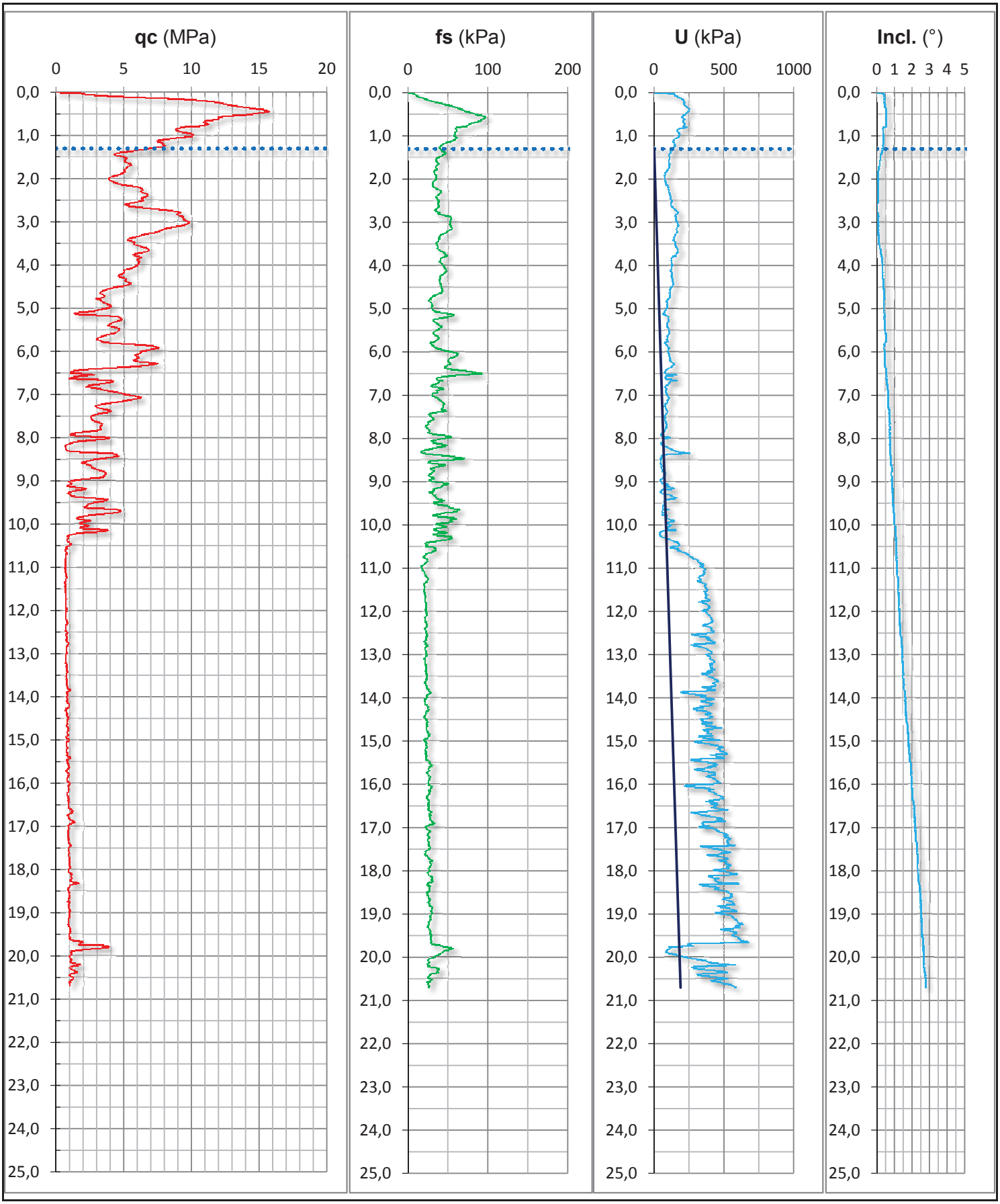
CPTU56A

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA
DIAGRAMMI DI RESISTENZA

RIF. PROVA:	CPTU n°:
U07-15	RER3

COMMITTENTE: Regione Emilia Romagna
CANTIERE: Marina di Ravenna (Ra)
DATA: 28/01/2015

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 20,70
PROFONDITA' FALDA (m da p.c.): 1,30
PREFORO (m da p.c.): 0,00



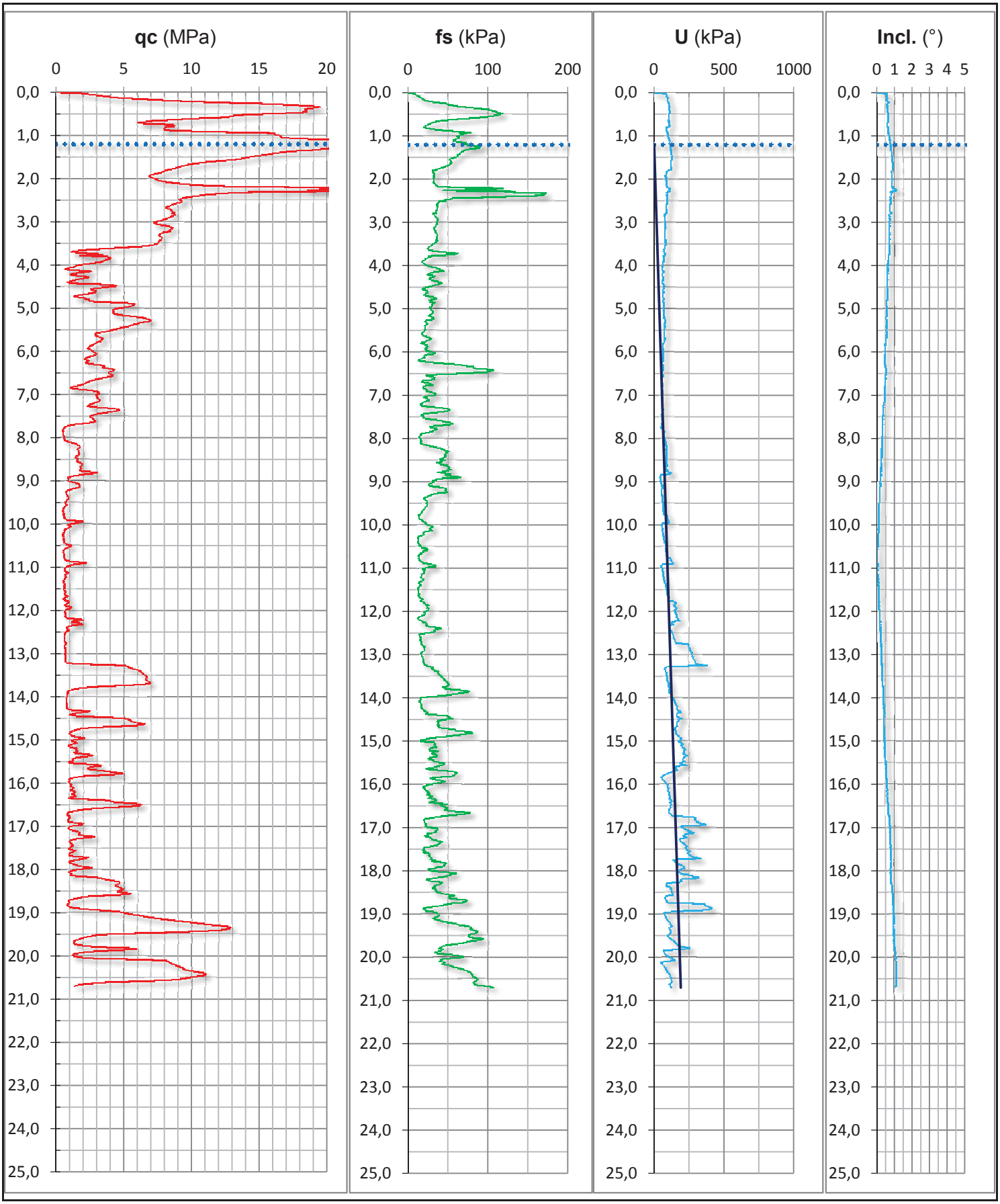
CPTU57A

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA
DIAGRAMMI DI RESISTENZA

RIF. PROVA:	CPTU n°:
U07-15	RER4

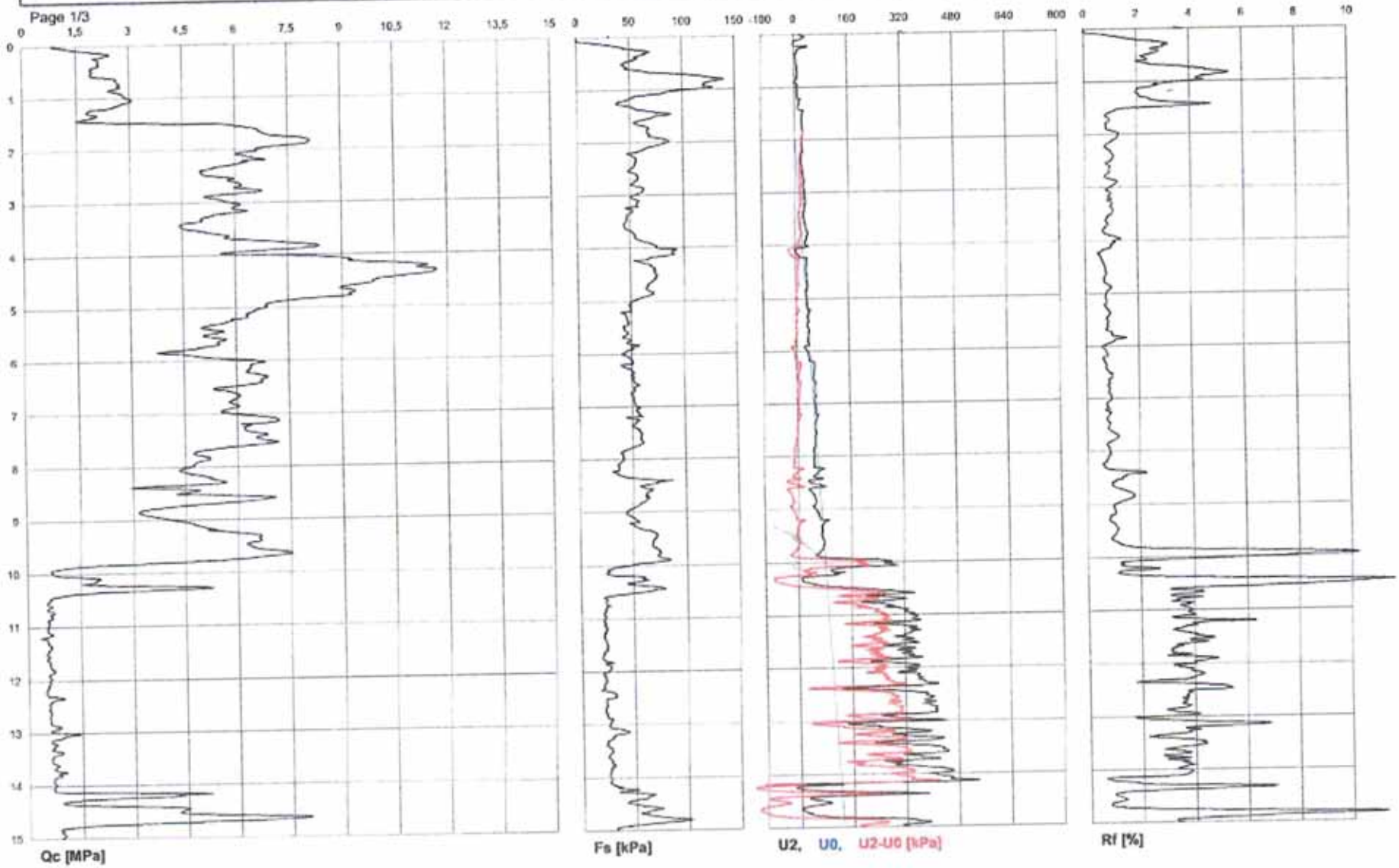
COMMITTENTE: Regione Emilia Romagna
CANTIERE: Lido di Savio (Ra)
DATA: 28/01/2015

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 20,70
PROFONDITA' FALDA (m da p.c.): 1,20
PREFORO (m da p.c.): 0,00

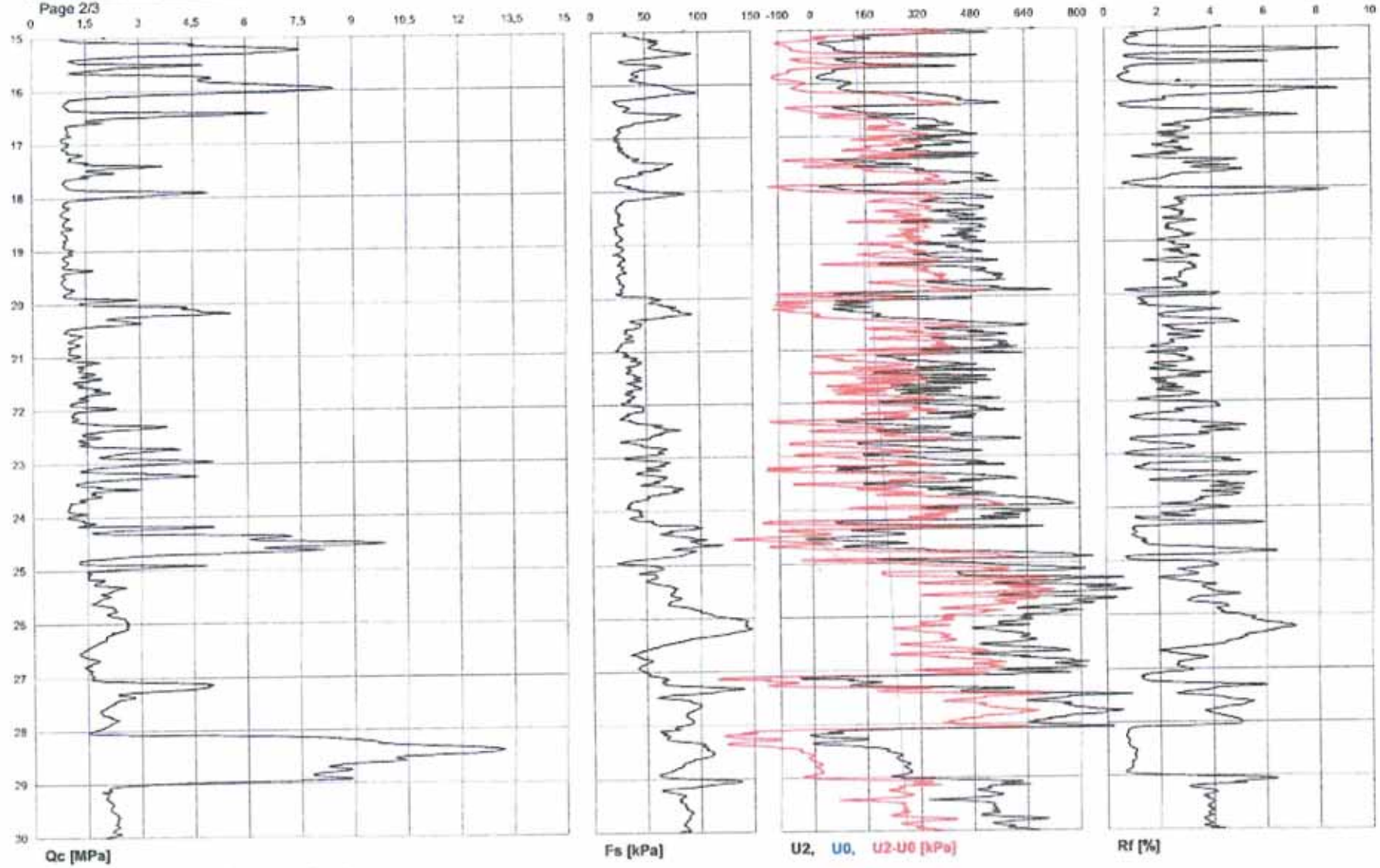


CPTU58A

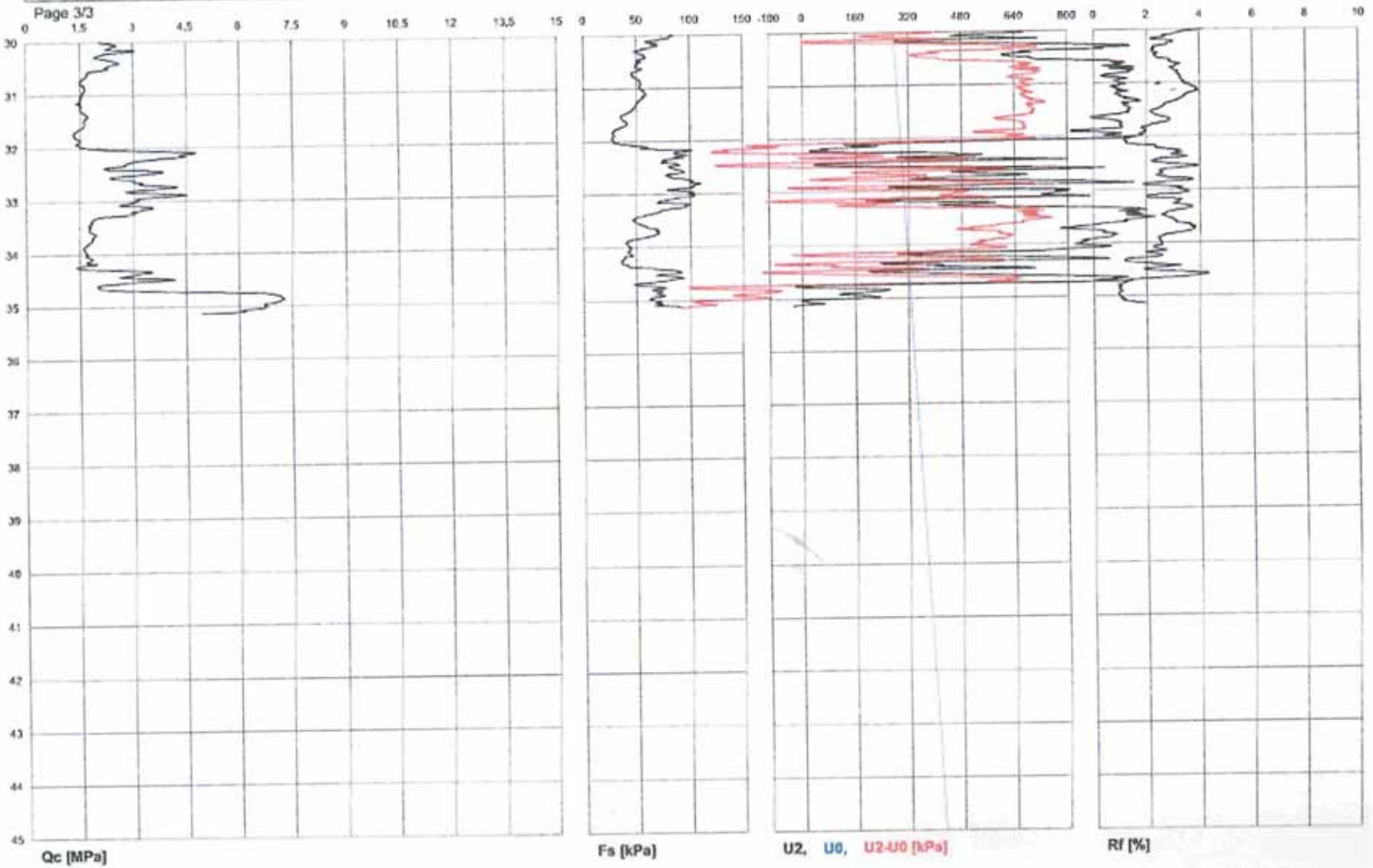
GEOLOG s.r.l.	Commissioner: PROGRA s.r.l.
Site: Discarica Hera V. Romea N. Locality: Ravenna	Test Location: Discarica CPTU 2 Date: 16/03/2005
	Abs. quota [cm]: 0 Prehole [cm]: 0 Hydrostatic Line [cm]: 190



GEOLOG s.r.l.	Commissioner: PROGRA s.r.l.	
Site: Discarica Hera V. Romea N. Locality: Ravenna	Test Location: Discarica CPTU 2 Date: 16/03/2005	Abs. quota [cm]: 0 Prehole [cm]: 0 Hydrostatic Line [cm]: 190



GEOLOG s.r.l.	Commissioner: PROGRA s.r.l.	
Site: Discarica Hera V. Romea N. Locality: Ravenna	Test Location: Discarica CPTU 2 Date: 16/03/2005	Abs. quota [cm]: 0 Prehole [cm]: 0 Hydrostatic Line [cm]: 190



SCPTU1A

www.pergeo.it - info @pergeo.it

SCPTU 3

Prova eseguita da:
Pergeo S.r.l.
via dell'artigianato,2 44130 - Ro Ferrarese
www.pergeo.it - info @pergeo.it
Dir.del Laboratorio: Dr.Geol.M.Condotta
Sperimentatore: Dr.Geol. F. Zanella

Committente: Comune di Ravenna
Cantiere:Piazzale Kennedy (RA)
Data: 22/03/2013

ID Prova: SCPTU 3
Profondita falda: mt 2 da p.c.
Preforo:1,20 mt scavo + fino a mt 7,00 di dpsh

Profondità massima raggiunta: 30,00 mt
Punta sismica: Tecnopenta G1-CPL2IN - SISMI
n° Dissipazioni eseguite: 0

Prof.	RP	RL	PN	Incl.	V.avanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz
metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec
0.020	0.058	0.611	7.570	0.588	1.930	1.660	0.050	1.613	-3.420	0.481	2.160	3.300	0.012	1.172	7.570	1.219	2.160	4.940	0.017	0.254	22.220	0.890	2.190	6.600	0.301	3.280	42.970	1.692	2.150
0.040	0.026	0.060	1.460	0.563	2.560	1.680	0.135	1.058	-2.200	0.608	2.180	3.320	0.012	0.950	7.570	1.202	2.180	4.960	0.017	0.476	22.220	0.806	2.200	6.620	0.354	3.280	44.200	1.638	2.130
0.060	0.006	0.171	1.460	0.856	2.610	1.700	0.050	0.058	-4.640	0.613	2.150	3.340	0.012	0.616	7.570	1.158	2.170	4.980	0.017	0.365	22.220	0.841	2.220	6.640	0.407	3.836	45.420	1.669	2.110
0.080	0.058	0.949	0.240	0.662	2.530	1.720	0.083	1.506	-4.640	0.670	2.190	3.360	0.012	0.505	7.570	1.188	2.100	5.000	0.017	0.365	23.440	0.843	2.250	6.660	0.567	5.391	45.420	1.609	2.040
0.100	0.092	0.953	1.010	0.944	2.560	1.740	0.040	1.062	-4.640	0.659	2.180	3.380	0.034	0.505	7.570	1.181	2.100	5.040	0.034	0.623	30.760	0.819	1.920	6.680	0.684	4.280	46.640	1.596	2.150
0.120	0.067	0.842	0.240	1.451	2.580	1.760	0.051	0.951	-4.640	0.595	2.110	3.400	0.032	0.612	7.570	1.193	2.150	5.060	0.044	0.734	31.990	0.779	2.240	6.700	0.652	5.169	47.860	1.603	2.220
0.140	0.007	0.064	2.680	0.268	2.540	1.780	0.040	0.951	-4.640	0.576	2.180	3.420	0.064	0.612	7.570	1.079	2.120	5.080	0.034	0.623	31.990	0.838	2.230	6.720	0.588	5.503	46.640	1.623	2.190
0.160	0.005	0.282	3.900	0.987	2.500	1.800	0.051	1.062	-4.640	0.686	2.180	3.440	0.011	0.723	6.340	1.083	2.150	5.100	0.032	0.730	31.990	0.805	2.200	6.740	0.641	5.614	47.860	1.558	2.160
0.180	0.047	0.282	0.240	1.017	2.580	1.820	0.083	0.728	-5.870	0.592	2.220	3.460	0.032	0.612	7.570	1.081	2.080	5.120	0.034	0.734	31.990	0.812	2.290	6.760	0.737	4.836	49.080	1.598	2.100
0.200	0.026	0.727	2.680	1.032	2.500	1.840	0.052	2.399	-5.870	0.681	2.270	3.480	0.031	1.608	7.570	1.069	2.100	5.140	0.034	0.623	31.990	0.781	2.180	6.780	0.822	4.614	50.300	1.608	2.070
0.220	0.050	0.842	3.900	0.812	2.510	1.860	0.052	2.177	-7.090	0.673	2.220	3.500	0.031	1.386	6.340	1.160	2.200	5.160	0.043	0.619	31.990	0.905	2.060	6.800	1.043	6.939	51.520	1.557	2.130
0.240	0.010	0.175	2.200	0.636	2.510	1.880	0.084	1.843	-5.870	0.688	2.220	3.520	0.028	0.045	7.570	1.078	2.220	5.180	0.032	0.619	31.990	0.842	2.320	6.820	1.213	10.050	46.640	1.400	2.090
0.260	0.028	0.842	3.900	0.834	2.580	1.900	0.042	2.732	-7.090	0.702	2.280	3.540	0.007	0.823	7.570	1.104	2.190	5.200	0.032	0.619	31.990	0.862	2.280	6.840	0.894	14.606	45.420	1.429	2.170
0.280	0.026	0.162	2.680	1.069	2.630	1.920	0.031	1.843	-7.090	0.632	2.180	3.560	0.081	0.489	7.570	1.102	2.160	5.220	0.032	0.619	31.990	0.872	2.280	6.860	1.181	10.050	47.860	1.434	2.060
0.300	0.006	0.162	2.680	0.945	2.640	1.940	0.042	1.510	-7.090	0.733	2.250	3.580	0.060	0.378	7.570	1.089	2.100	5.240	0.032	0.619	30.760	0.854	2.350	6.880	1.458	10.383	49.080	1.447	2.180
0.320	0.048	0.273	3.900	0.961	2.540	1.960	0.043	1.070	-7.090	0.738	2.230	3.600	0.027	0.596	7.570	1.066	2.090	5.260	0.032	0.619	31.990	0.839	2.290	6.900	1.374	9.800	50.300	1.418	2.120
0.340	0.070	0.171	7.570	0.824	2.530	1.980	0.043	0.736	-7.090	0.754	2.160	3.620	0.059	0.596	5.120	1.190	2.180	5.280	0.032	0.619	31.990	0.800	2.200	6.920	1.054	11.911	47.860	1.437	2.180
0.360	0.016	0.385	3.900	1.507	2.560	2.000	0.043	1.292	-7.090	0.753	2.170	3.640	0.027	2.596	7.570	1.056	2.130	5.300	0.043	0.619	31.990	0.811	2.290	6.940	0.959	13.133	45.420	1.411	2.180
0.380	0.038	0.278	2.320	0.947	2.560	2.020	0.032	0.959	-7.090	0.752	2.250	3.660	0.144	0.485	7.570	0.919	2.100	5.320	0.037	0.603	31.990	1.008	1.930	6.960	1.138	8.018	45.420	1.440	2.130
0.400	0.099	0.397	5.630	1.268	2.560	2.040	0.054	1.070	-7.090	0.771	2.280	3.680	0.004	0.259	7.570	0.986	2.150	5.340	0.037	0.714	31.990	0.905	2.010	6.980	1.074	9.240	45.420	1.447	2.160
0.420	0.060	0.269	1.460	1.171	2.590	2.060	0.039	0.979	-9.530	0.604	2.640	3.700	0.025	0.481	6.340	1.033	2.190	5.360	0.048	0.714	31.990	0.888	2.150	7.000	1.044	9.244	45.420	1.461	2.190
0.440	0.005	0.718	1.460	1.237	2.530	2.080	0.018	0.756	-10.750	0.723	2.110	3.720	0.025	0.370	7.570	1.035	2.200	5.380	0.037	0.714	30.760	1.012	2.090	7.020	0.915	11.574	44.200	1.462	2.130
0.460	0.004	0.603	0.240	1.223	2.580	2.100	0.039	0.756	-9.530	0.726	2.120	3.740	0.003	0.144	6.340	1.069	2.190	5.400	0.069	0.825	31.990	0.966	2.050	7.040	0.872	9.796	42.970	1.428	2.150
0.480	0.208	0.162	3.760	1.357	2.660	2.120	0.039	0.756	-9.530	0.621	2.110	3.760	0.024	0.366	7.570	1.055	2.190	5.420	0.069	0.825	31.990	0.966	2.070	7.060	0.819	7.574	42.970	1.437	2.180
0.500	0.027	0.829	1.460	1.274	2.660	2.140	0.029	0.534	-10.750	0.765	2.050	3.780	0.003	0.477	7.570	1.084	2.160	5.440	0.048	0.825	30.760	1.067	2.120	7.080	0.745	8.018	41.750	1.478	2.180
0.520	0.059	0.940	5.120	1.278	2.660	2.160	0.050	0.534	-9.530	0.686	2.100	3.800	0.000	0.358	7.570	1.047	2.220	5.460	0.069	0.825	31.990	0.991	2.150	7.100	0.670	9.463	40.530	1.456	2.240
0.540	0.006	0.393	3.900	1.295	2.540	2.180	0.050	0.534	-9.530	0.723	2.070	3.820	0.021	0.247	7.570	1.031	2.220	5.480	0.048	0.936	31.990	1.030	2.160	7.120	0.606	11.796	40.530	1.510	2.230
0.560	0.018	0.175	2.680	1.209	2.500	2.200	0.039	0.534	-9.530	0.809	2.080	3.840	0.000	0.247	7.570	1.055	2.170	5.500	0.048	0.825	31.990	0.991	2.120	7.140	0.532	13.574	40.530	1.480	2.220
0.580	0.018	0.175	2.680	1.319	2.590	2.220	0.039	0.756	-9.530	0.789	2.070	3.860	0.021	0.247	7.570	1.050	2.190	5.520	0.048	0.825	31.990	1.038	2.090	7.160	0.488	15.347	39.310	1.521	2.240
0.600	0.018	0.397	1.460	1.311	2.590	2.240	0.061	0.645	-10.750	0.877	2.090	3.880	0.052	0.201	7.570	1.199	2.200	5.540	0.069	0.825	31.990	1.003	2.080	7.180	0.456	16.681	39.310	1.517	2.200
0.620	0.028	0.731	2.680	1.329	2.590	2.260	0.050	1.090	-10.750	0.751	2.150	3.900	0.020	0.243	7.570	1.121	2.220	5.560	0.091	0.936	31.990	1.124	2.120	7.200	0.403	17.792	40.530	1.540	2.220
0.640	0.050	0.064	1.460	1.317	2.540	2.280	0.039	0.756	-10.750	0.836	2.180	3.920	0.020	0.243	7.570	1.080	2.280	5.580	0.132	1.376	34.430	1.075	2.090	7.220	0.392	18.459	40.530	1.543	2.280
0.660	0.028	0.064	1.460	1.323	2.660	2.300	0.029	0.645	-10.750	0.841	2.130	3.940	0.003	0.239	7.570	1.048	2.270	5.600	0.121	2.154	33.210	0.962	2.150	7.240	0.379	19.451	40.530	1.542	2.180
0.680	0.099	0.492	5.120	1.420	2.640	2.320	0.039	0.534	-10.750	0.836	2.080	3.960	0.050	0.128	8.790	1.261	2.240	5.620	0.121	2.154	31.990	0.897	2.030	7.260	0.389	18.673	41.750	1.566	2.130
0.700	0.008	0.401	-7.090	1.591	2.640	2.340	0.061	0.534	-9.530	0.787	2.090	3.980	0.167	0.205	7.570	1.100	2.250	5.640	0.047	4.599	30.760	0.944	2.130	7.280	0.411	16.228	41.750	1.555	2.220
0.720	0.007	0.619	-4.640	1.508	2.640	2.360	0.050	0.645	-9.530	0.761	2.120	4.000	0.049	0.321	7.570	1.175	2.240	5.660	0.089	2.710	31.990	0.928	2.170	7.300	0.336	14.673	44.200	1.564	2.250
0.740	0.007	0.508	-3.420	1.512	1.930	2.380	0.050	0.756	-10.750	0.919	2.110	4.020	0.028	0.791	7.570	1.199	2.250	5.680	0.068	3.376	30.760	0.920	2.200	7.320	0.367	11.891	46.640	1.550	2.290
0.760	0.007	0.175	-3.420	1.558	2.660	2.400	0.050	0.756	-9.530	0.924	2.120	4.040	0.028	0.791	7.570	1.171	2.270	5.700	0.068	2.821	30.760	0.963	2.200	7.340	0.431	10.891	49.080	1.577	2.350
0.780	0.008	0.735	-3.420	1.529	2.680	2.420	0.059	1.086	-9.530	0.890	2.060	4.060	0.016	0.898	7.570	1.191	2.190	5.720	0.045	2.595	30.760	0.977	2.090	7.360	0.494	9.224	50.300	1.602	2.270
0.800	0.019	0.512	-2.200	1.495	2.630	2.440	0.038	0.975	-10.750	0.971	2.100	4.080	0.026	0.120	8.790	1.186	2.190	5.740	0.067	3.706	30.760	1.119	2.110	7.380	0.516	9.002	50.300	1.577	2.230
0.820	0.002	0.401	-4.640	1.578	2.610	2.460	0.049	1.086	-9.530	0.920	2.200	4.100	0.048	0.009	7.570	1.195	2.280	5.760	0.067	3.372	31.990	1.138	2.090	7.400	0.526	7.558	50.300	1.602	2.270
0.840	0.050	0.064	-0.980	1.540	2.660	2.480	0.080	1.197	-9.530	0.890	2.200	4.120	0.013	0.445	8.790	1.164	2.290	5.780	0.067	1.817	30.760	1.162	2.150	7.420	0.613	7.006	49.080	1.657	2.170
0.860	0.019	0.265	-2.200	1.512	2.700	2.500	0.059	1.530	-8.310	0.914	2.220	4.140	0.013	0.556	8.790	1.175	2.330	5.800	0.214	0.146	31.990	1.368	2.150	7.440	0.517	6.339	46.640	1.685	2.100
0.880	0.030	0.265	-2.200	1.496	2.750	2.520	0.058	1.526	-9.530	0.930	2.100	4.160	0.024	0.334	10.010	1.134	2.350	5.820	0.129	3.924	28.320	1.716	2.070	7.460	0.411	7.895	45.420	1.686	2.070
0.900	0.011	0.257	-4.640	1.601	2.750	2.540	0.058	1.748	-8.310	0.923	2.110	4.180	0.024	0.334	10.010	1.138	2.270	5.840	0.120	3.261	23.440	1.321	2.170	7.480	0.336	9.451	45.420	1.687	2.120
0.920	0.058	0.365	-1.750	1.717	2.700	2.560	0.058	1.748	-9.530	0.852	2.120	4.200	0.012	0.219	10.010	1.144	2.290	5.860	0.116	3.916	31.990	1.792	2.180	7.500	0.315	10.562	46.640	1.677	2.150
0.940	0.021	0.409	-4.640	1.495	2.720	2.580	0.058	1.859	-9.530	0.959	2.120	4.220	0.022	0.108	10.010	1.139	2.310	5.880	0.041	3.471	29.540	1.547	2.220	7.520	0.326	10.562	49.080	1.698	2.180
0.960	0.011	0.076	-3.420	1.647	2.720	2.600	0.056	1.967	-9.530	0.948	2.150	4.240	0.015	0.278	18.550	1.145	2.200	5.900	0.062	3.694	30.760	1.569	2.180	7.540	0.634	13.895	55.180	1.692	2.130
0.980	0.022	0.409	-3.420	1.611	2.660	2.620	0.056	2.189	-8.310	0.885	2.110	4.260	0.027	0.282	19.780	1.074	2.150	5.920	0.082	4.356	30.760	1.626	2.160	7.560	0.836	11.673	55.180	1.709	2.100
1.000	0.032	0.298	-3.420	1.698	2.810	2.640	0.043	2.181	-8.310	0.908	2.160	4.280	0.047	0.167	19.780	1.056	2.100	5.940	0.072	4.356	30.760	1.592	2.130	7.580	0.762	8.784	44.200	1.714	2.080
1.020	0.083	0.365	-8.310	1.645	2.660	2.660	0.043	2.292	-8.310	0.911	2.190	4.300	0.058	0.167	19.780	1.064	2.110	5.960	0.114	1.356	30.760	1.640	2.190	7.600	0.687	11.562	36.870	1.687	2.130
1.040	0.025	0.481	-13.190	1.659	2.680	2.680	0.042	2.177	-8.310	0.908	2.200	4.320	0.021	0.056	19.780	1.069	2.080	5.980	0.081	1.797	30.760	1.513	2.170	7.620	0.517	14.673	35.650	1.740	2.130
1.060	0.025	0.259	-13.190	1.679	2.560	2.700	0.042	2.177	-8.310	0.998	2.180	4.340	0.007	0.619	10.010	2.147	2.090	6.000	0.069	1.126	30.760	1.512	2.150	7.640	0.623	18.228	58.850	1.748	2.130
1.080	0.036	0.370	-13.190	1.680	2.580	2.720	0.052	2.177	-8.310	0.945	2.150	4.360	0.079	0.278	19.780	1.124	2.120	6.020	0.069	0.793	31.990	1.521	2.200	7.660	0.794	16.673	72.280	1.718	2.080
1.100	0.049	0.265	-54.710	0.183	2.530	2.740	0.040	1.728	-8.310	0.960	2.160	4.380	0.026	0.834	18.550	1.148	2.110	6.040	0.068	0.789	30.760	1.537	2.180	7.680	0.751	20.339	74.720	1.737	2.090
1.120	0.064	0.223	-66.300	0.691	2.590	2.760	0.040	1.506	-8.310	0.999	2.230	4.400	0.026	0.500	18.550	1.058	2.220	6.060	0.068	0.789	31.990	1.545	2.240	7.700	0.686	24.002	83.270	1.701	2.180
1.140	0.037	0.374	-14.410	1.255	2.580	2.780	0.071	1.169	-7.090	0.992	2.190	4.420	0.026	0.834	18.550	1.082	2.160	6.080	0.076	0.781	31.990	1.560	2.240	7.720	0.696	24.558	91.810	1.726	2.220
1.160	0.027	0.374	-14.410	1.696	2.510	2.800	0.039	1.169	-7.090	0.988	2.150	4.440	0.009	0.715	21.000	0.914	2.110	6.100	0.065	0.781	31.990	1.553	2.240	7.740	0.696	24.558	102.800	1.724	2.190
1.180	0.027	0.263	-14.410	1.679	2.540	2.820	0.038	1.054	-7.090	1.013	2.180	4.460	0.015	0.500	18.550	1.093	2.100	6.120	0.053	0.777	31.990	1.568	2.220	7.760	0.718	24.558	104.020	1.722	2.100
1.200	0.028	0.267	-14.410	0.701	2.510	2.840	0.027	0.943	-7.090	1.036	2.200	4.480	0.012	0.715	19.780	1.063	2.130	6.140	0.074	0.777	33.210	1.552	2.250	7.780	0.739	25.558	110.130	1.755	2.110
1.220	0.003	0.935	5.870	0.557	2.580	2.860	0.024	0.712	-7.090	0.994	2.240	4.500	0.023	0.715	19.780	1.017	2.150	6.160	0.063	1.332	33.210	1.592	2.190	7.800	0.728	28.113	110.130	1.752	2.110
1.240	0.129	0.708	2.680	0.437	2.170	2.880	0.086	0.732	-3.420	1.345	2.250	4.520	0.023	0.381	19.780	1.019	2.150	6.180	0.062	0.773	33.210	1.592	2.270	7.820	0.696	28.335	113.790	1.722	2.150
1.260	0.076	0.375	1.460	0.266	2.130	2.900	0.052	0.177	-9.530	1.175	2.240	4.540	0.023	0.381	19.780	1.034	2.090	6.200	0.062	0.773	34.430	1.608	2.220	7.840	0.674	27.220	115.010	1.734	2.150
1.280	0.044	0.819	3.420	0.217	2.100	2.920	0.012	0.486	-7.090	1.219	2.230	4.560	0.002	0.270	19.780	1.012	2.090	6.220	0.062	0.884	34.430	1.608	2.130	7.860	0.663	28.331	118.680	1.766	2.080
1.300	0.077	1.712	0.240	0.835	2.080	2.940	0.012	0.153	-7.090	1.219	2.280	4.580	0.011	0.266	19.780	1.075	2.160	6.240	0.061	0.880	34.430	1.624	2.190	7.880	0.791	27.665	112.570	1.800	2.190
1.320	0.030	0.181	2.200	0.535	2.110	2.960	0.021	0.593	-5.870	1.206	2.220	4.600	0.021	0.266	21.000	1.048	2.190	6.260	0.061	0.880	34.430	1.632	2.310	7.900	0.599	28.331	99.140	1.798	2.160
1.340	0.077	0.490	2.680	0.860	2.080	2.980	0.021	0.815	-5.870	1.223	2.270	4.620	0.011	0.266	19.780	1.065	2.240	6.280	0.069	0.872	35.650	1.656	2.290	7.920	0.610	29.443	100.360	1.769	2.230
1.360	0.020	0.375	0.980	0.768	2.130	3.000	0.020	0.478	-5.870	1.198	2.230	4.640	0.011	0.266	19.780	1.017	2.160	6.300	0.111	1.094	36.870	1.688	2.320	7.940	0.715	27.661	102.800	1.805	2.180
1.380	0.020	0.597	0.980	0.778	2.060	3.020	0.036	0.180	8.790	1.132	2.650	4.660	0.021	0.266	21.000	0.950	2.110	6.320	0.101	1.316	35.650	1.640	2.320	7.960	0.992	27.439	113.790	1.775	2.170
1.400	0.012	0.375	2.200	0.585	2.080	3.040	0.015	0.180	7.570	1.206	2.110	4.680	0.009	0.373	21.000	1.054	2.100	6.340	0.218	1.094	36.870	1.700	2.270	7.980	1.862	27.105	105.250	1.824	2.130
1.420	0.002	0.042	3.420	0.759	2.200	3.060	0.004	0.735	8.790	1.214	2.110	4.700	0.009	0.373	21.000	0.995	2.160	6.360	0.216	1.201	35.650	1.564	2.270	8.000	2.194	25.327	111.350	1.819	2.190
1.440	0.120	0.935	2.200	0.627	2.180	3.080	0.015	0.402	7.570	1.190	2.130	4.720	0.020	0.373	21.000	1.015	2.130	6.380	0.323	1.535	35.650	1.592	2.200	8.020	2.321	25.327	112.570	1.800	2.190
1.460	0.014	0.601	4.640	0.449	2.180	3.100	0.014	0.620	8.790	1.182	2.120	4.740	0.041	0.373	21.000	0.898	2.150	6.400	0.334	1.507	44.200	1.519	2.530	8.040	2.339	22.792	90.590	1.794	2.420
1.480	0.077	0.712	4.640	0.279	2.150	3.120	0.014	0.509	7.570	1.264	2.110	4.760	0.052	0.373	22.220	0.856	2.150	6.420	0.345	2.062	42.970	1.565	2.090	8.060	2.233	22.792	88.150	1.780	2.080
1.500	0.150	0.597	3.900	0.579	2.080	3.140	0.056	0.398	8.790	1.192	2.120	4.780	0.001	0.373	21.000	0.987	2.180	6.440	0.334	2.951	42.970	1.629	2.090	8.080	2.084	24.125	85.710	1.855	2.110
1.520	0.003	0.379	-7.090	0.384	2.090	3.160	0.046	0.398	8.790	1.228	2.120	4.800	0.019	0.369	22.220	0.882	2.190	6.460	0.313	3.062	42.970	1.660	2.070	8.100	1.562	25.236	78.380	1.801	2.090
1.540	0.120	0.601	-2.200	0.442	2.130	3.180	0.046	0.398	7.570	1.250	2.090	4.820	0.020	0.373	21.000	0.818	2.200	6.480	0.302	3.395	42.970	1.626	2.120	8.120	1.318	25.236	68.620	1.771	2.150
1.560	0.101	0.498	-3.420	0.268	2.100	3.200	0.035	0.620	7.570	1.217	2.090	4.840	0.008	0.258	21.000	0.965	2.190	6.500	0.292	3.951	42.970	1.662	2.170	8.140	1.137	25.792	61.290	1.771	2.160
1.580	0.069	0.498	-3.420	0.397	2.100	3.220	0.035	0.509	7.570	1.209	2.100	4.860	0.019	0.369	22.220	0.841	2.160	6.520	0.270	3.951	42.970	1.677	2.170	8.160	0.562	29.681	51.520	1.762	2.070
1.600	0.069	0.498	-2.200	0.637	2.120	3.240	0.035	0.620	7.570	1.186	2.080	4.880	0.008	0.369	22.220	0.898	2.190	6.540	0.249	3.840	42.970	1.687	2.090	8.180	0.506	28.784	56.410	1.786	2.120
1.620	0.048	0.720	-3.420	0.396	2.160	3.260	0.035	0.954	7.570	1.192	2.070	4.900	0.019	0.369	22.220	1.011	2.230	6.560	0.237	3.614	42.970	1.681	2.090	8.200	0.687	30.562	78.380	1.735	2.090
1.640	0.103	0.503	-2.200	0.333	2.200	3.280	0.035	1.509	7.570	1.162	2.110	4.920	0.017	0.365	22.220	0.882	2.150	6.580	0.269	3.391	42.970	1.650	2.080	8.220	1.159	22.792	62.510	1.718	2.080

Prof.: Profondità RL: - RP: Resistenza di punta - Resistenza all'attrito laterale - Incl.:clinazione - Vavanz: velocità di avanzamento della punta

Pergeo S.r.l. Via Dell'Artigianato, 2 44030 Ro Ferrarese (FE) tel. 0532/426021 fax. 0532/426521

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SCPTU 3

Committente: Comune di Ravenna
Cantiere:Piazzale Kennedy (RA)
Data: 22/03/2013

ID Prova: SCPTU 3
Profondita falda: mt 2 da p.c.
Preforo:1,20 mt scavo + fino a mt 7,00 di dpsh

Profondità massima raggiunta: 30,00 mt
Punta sismica: Tecnopenta G1-CPL2IN - SISMI
n° Dissipazioni eseguite: 0

Prova eseguita da:
Pergeo S.r.l.
via dell'artigianato,2 44130 - Ro Ferrarese
www.pergeo.it - info @pergeo.it
Dir.del Laboratorio: Dr.Geol.M.Condotta
Sperimentatore: Dr.Geol. F. Zanella

Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz
metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec
8.240	1.315	26.562	80.830	1.763	2.130	9.880	1.629	35.133	18.550	1.915	2.120	11.520	2.383	23.129	35.650	2.182	2.210	13.180	4.011	50.272	33.900	2.519	2.150	14.820	5.378	30.034	53.960	2.729	2.060
8.260	0.730	30.562	107.690	1.751	2.090	9.900	1.374	37.578	18.550	1.955	2.070	11.540	2.266	23.574	33.210	2.144	2.040	13.200	3.756	43.606	10.010	2.499	2.180	14.840	5.452	30.590	56.410	2.762	2.050
8.280	0.666	27.784	101.580	1.800	2.100	9.920	1.097	44.800	12.450	1.949	2.160	11.560	2.436	25.351	34.430	2.157	2.050	13.220	3.680	39.602	14.890	2.515	2.170	14.860	5.452	32.145	57.630	2.781	2.030
8.300	0.634	22.784	99.140	1.780	2.150	9.940	0.906	43.800	21.000	1.950	2.160	11.580	2.617	28.129	19.780	2.176	2.080	13.240	3.829	36.824	18.550	2.506	2.240	14.880	5.388	33.145	57.630	2.759	2.110
8.320	0.548	21.669	96.700	1.745	2.080	9.960	0.862	42.907	49.080	1.938	2.190	11.600	2.734	33.018	21.460	2.182	2.130	13.260	4.350	30.268	24.660	2.517	2.190	14.900	5.239	34.034	57.630	2.733	2.160
8.340	0.579	19.113	97.920	1.724	2.120	9.980	0.979	42.574	108.910	1.976	2.180	11.620	2.862	35.463	24.640	2.200	2.160	13.280	4.880	30.598	30.760	2.556	2.180	14.920	5.165	34.479	57.630	2.752	2.120
8.360	0.569	18.002	97.920	1.755	2.130	10.000	1.074	42.463	102.800	1.984	2.150	11.640	2.872	38.129	24.640	2.197	2.070	13.300	5.051	29.709	31.990	2.527	2.220	14.940	5.311	35.026	60.070	2.754	2.090
8.380	0.546	16.998	102.800	1.759	2.070	10.020	1.096	39.240	80.830	1.995	2.150	11.660	2.904	35.129	23.420	2.183	2.080	13.320	5.008	29.153	31.990	2.541	2.150	14.960	5.566	35.804	62.510	2.760	2.060
8.400	0.525	14.665	118.680	1.761	2.080	10.040	1.561	45.042	10.010	1.950	2.360	11.680	2.936	33.129	20.240	2.184	2.080	13.340	4.900	29.038	33.210	2.556	2.240	14.980	5.907	35.693	66.170	2.769	2.030
8.420	0.514	14.887	117.460	1.734	2.090	10.060	1.795	55.487	18.790	1.951	2.130	11.700	3.042	28.907	22.680	2.173	2.070	13.360	4.815	29.927	34.430	2.548	2.220	15.000	6.194	34.471	69.840	2.762	2.090
8.440	0.545	14.327	119.900	1.775	2.070	10.080	2.498	59.487	13.670	1.962	2.120	11.720	2.957	27.463	22.680	2.205	2.090	13.380	4.794	30.149	35.650	2.572	2.120	15.020	6.103	34.070	75.940	2.756	2.650
8.460	0.545	13.439	118.680	1.750	2.070	10.100	3.029	62.598	17.570	1.958	2.150	11.740	2.925	26.463	23.900	2.223	2.070	13.400	4.633	30.367	35.650	2.576	2.160	15.040	6.305	32.626	74.720	2.756	1.990
8.480	0.545	13.661	118.680	1.720	2.120	10.120	3.157	54.264	10.010	1.967	2.170	11.760	2.903	26.236	23.900	2.209	2.060	13.420	4.505	30.034	35.650	2.572	2.240	15.060	6.294	33.959	74.720	2.754	2.070
8.500	0.545	14.216	117.460	1.759	2.110	10.140	3.029	47.264	11.230	1.975	2.270	11.780	2.956	24.459	25.120	2.171	2.110	13.440	4.378	29.367	35.650	2.564	2.250	15.080	6.358	35.292	74.720	2.757	2.100
8.520	0.522	14.657	112.570	1.724	2.190	10.160	2.964	42.038	12.450	1.991	2.220	11.800	3.052	24.792	26.340	2.195	2.180	13.460	4.375	28.359	36.870	2.575	2.290	15.100	6.656	36.848	78.380	2.760	2.160
8.540	0.543	14.990	113.790	1.747	2.150	10.180	2.996	40.371	14.890	1.967	2.190	11.820	3.073	25.903	26.340	2.175	2.150	13.480	4.513	28.915	39.310	2.572	2.290	15.120	7.007	38.848	80.830	2.731	2.120
8.560	0.543	16.546	113.790	1.766	2.110	10.200	3.039	38.260	17.330	1.983	2.230	11.840	3.052	28.792	22.200	2.221	2.170	13.500	4.747	29.582	40.530	2.603	2.200	15.140	7.167	41.959	83.270	2.736	2.110
8.580	0.543	17.101	113.790	1.779	2.080	10.220	3.039	34.816	18.550	2.005	2.190	11.860	2.988	27.236	22.200	2.210	2.090	13.520	4.916	29.689	41.750	2.596	2.240	15.160	7.006	44.733	83.270	2.757	2.080
8.600	0.522	16.990	113.790	1.751	2.120	10.240	2.985	30.705	13.670	1.983	2.180	11.880	3.081	25.895	22.680	2.208	2.040	13.540	5.086	28.133	34.430	2.602	2.230	15.180	6.516	45.955	80.830	2.749	2.160
8.620	0.543	17.212	112.570	1.781	2.120	10.260	2.931	29.367	17.570	1.980	2.280	11.900	2.879	28.451	22.680	2.194	2.120	13.560	5.331	27.022	39.310	2.606	2.220	15.200	6.048	46.733	78.380	2.763	2.160
8.640	0.543	17.323	112.570	1.792	2.150	10.280	2.878	29.034	18.790	1.983	2.200	11.920	2.570	29.117	21.460	2.215	2.110	13.580	5.673	25.137	71.060	2.594	2.180	15.220	5.600	47.951	77.160	2.749	2.110
8.660	0.543	17.435	112.570	1.798	2.080	10.300	2.963	25.923	10.010	1.987	2.150	11.940	2.570	31.451	21.460	2.230	2.150	13.600	5.928	25.026	72.280	2.612	2.040	15.240	5.270	48.507	77.160	2.733	2.120
8.680	0.522	17.768	112.570	1.794	2.080	10.320	3.194	23.582	12.450	1.984	2.200	11.960	2.836	40.006	23.900	2.228	2.060	13.620	6.035	25.248	66.170	2.600	2.030	15.260	5.302	48.395	79.600	2.771	2.160
8.700	0.512	18.212	113.790	1.753	2.180	10.340	3.407	24.359	12.450	1.973	2.240	11.980	2.996	46.895	20.980	2.224	2.180	13.640	6.098	25.915	67.390	2.641	2.090	15.280	5.673	49.614	83.270	2.756	2.160
8.720	0.522	17.990	115.010	1.771	2.220	10.360	3.492	27.026	18.790	1.989	2.320	12.000	2.985	45.228	22.200	2.234	2.150	13.660	6.037	27.812	67.390	2.637	2.130	15.300	6.152	51.391	86.930	2.762	2.220
8.740	0.555	17.883	116.230	1.835	2.200	10.380	3.439	29.137	12.680	2.012	2.290	12.020	2.985	41.562	20.980	2.231	2.180	13.680	5.867	30.812	66.170	2.646	2.100	15.320	6.447	56.606	86.930	2.768	2.190
8.760	0.555	17.883	116.230	1.794	2.130	10.400	3.492	30.804	11.460	2.019	2.270	12.060	2.922	41.705	39.310	2.219	2.130	13.700	5.750	32.701	67.390	2.643	2.060	15.340	6.754	54.268	90.590	2.779	2.150
8.780	0.524	17.772	116.230	1.812	2.100	10.420	3.576	27.467	13.900	2.023	2.230	12.080	2.943	39.816	44.200	2.234	2.160	13.720	5.524	34.248	66.170	2.625	2.030	15.360	6.797	53.379	91.810	2.802	2.190
8.800	0.502	17.439	115.010	1.807	2.090	10.440	3.469	26.022	15.120	2.030	2.280	12.100	2.847	37.483	44.200	2.222	2.180	13.740	5.269	35.693	66.170	2.625	2.070	15.380	6.572	54.598	91.810	2.796	2.160
8.820	0.492	17.439	116.230	1.775	2.160	10.460	3.459	25.355	17.570	2.016	2.270	12.120	2.741	32.483	36.870	2.222	2.160	13.760	5.003	37.026	66.170	2.643	2.080	15.400	6.242	53.931	90.590	2.795	2.220
8.840	0.492	16.772	117.460	1.826	2.120	10.480	3.523	25.244	31.990	2.023	2.100	12.140	2.634	29.705	40.530	2.214	2.150	13.780	4.801	38.471	66.170	2.639	2.050	15.420	5.826	52.705	90.590	2.776	2.240
8.860	0.481	16.216	118.680	1.757	2.120	10.500	3.767	27.467	34.430	2.045	2.060	12.160	2.688	30.816	41.750	2.219	2.180	13.800	4.588	39.359	66.170	2.641	2.080	15.440	5.559	50.590	90.590	2.788	2.150
8.880	0.460	15.883	122.340	1.811	2.130	10.520	3.757	30.355	34.430	2.067	2.040	12.180	2.730	33.371	40.530	2.227	2.150	13.820	4.278	39.800	64.950	2.658	2.050	15.460	5.431	47.701	91.810	2.788	2.110
8.900	0.481	15.216	126.000	1.833	2.180	10.540	3.757	31.244	35.650	2.040	2.100	12.200	2.676	32.701	38.790	2.236	2.230	13.840	4.076	39.578	64.950	2.641	2.110	15.480	5.428	46.248	94.260	2.796	2.190
8.920	0.492	14.772	129.670	1.811	2.220	10.560	3.991	33.244	38.090	2.037	2.150	12.220	2.473	33.367	39.530	2.234	2.250	13.860	4.235	39.467	67.390	2.635	2.120	15.500	5.448	46.467	95.480	2.818	2.230
8.940	0.492	14.105	135.770	1.782	2.200	10.580	4.033	37.578	28.320	2.066	2.170	12.240	2.325	30.923	30.240	2.237	2.190	13.880	4.819	38.796	71.060	2.625	2.170	15.520	5.459	45.578	96.700	2.812	2.290
8.960	0.514	12.887	138.210	1.833	2.170	10.600	4.044	39.133	19.780	2.033	2.130	12.260	2.452	36.479	36.340	2.272	2.220	13.900	5.170	42.796	64.950	2.641	2.130	15.540	5.351	46.018	94.260	2.807	2.290
8.980	0.525	12.331	136.990	1.815	2.130	10.620	3.980	36.911	18.550	2.044	2.080	12.280	2.697	45.479	32.200	2.251	2.220	13.920	5.233	38.681	61.290	2.639	2.060	15.560	5.234	44.463	94.260	2.799	2.190
9.000	0.546	12.665	136.990	1.818	2.200	10.640	3.884	36.244	19.780	2.037	2.070	12.300	3.120	52.137	36.850	2.261	2.180	13.940	5.264	37.236	62.510	2.646	2.020	15.580	5.190	42.903	95.480	2.807	2.230
9.020	0.559	14.812	127.220	1.824	2.710	10.660	3.842	34.800	21.000	2.067	2.130	12.320	3.460	49.804	38.080	2.269	2.290	13.960	5.424	37.570	64.950	2.641	2.090	15.600	5.158	42.570	96.700	2.801	2.250
9.040	0.569	15.812	139.430	1.833	2.060	10.680	3.757	32.578	21.000	2.037	2.090	12.340	3.556	50.248	35.630	2.266	2.180	13.980	5.666	37.006	68.620	2.639	2.080	15.620	5.106	38.574	100.360	2.815	1.830
9.060	0.527	16.145	141.880	1.811	2.160	10.700	3.670	31.574	21.000	2.063	2.120	12.360	3.630	42.582	38.310	2.276	2.150	14.000	5.794	36.895	69.840	2.648	2.090	15.640	5.117	37.018	99.140	2.824	2.040
9.080	0.516	16.590	145.540	1.811	2.180	10.720	3.617	29.907	22.220	2.049	2.040	12.380	3.799	39.244	34.640	2.269	2.220	14.020	5.836	37.006	72.280	2.656	2.030	15.660	5.170	36.351	99.140	2.818	2.060
9.100	0.505	17.034	146.760	1.833	2.190	10.740	3.628	28.463	22.220	2.084	2.080	12.400	3.969	38.911	30.240	2.294	2.230	14.040	5.814	36.002	72.280	2.631	2.150	15.680	5.287	36.796	99.140	2.815	2.010
9.120	0.505	17.034	147.980	1.833	2.240	10.760	3.521	27.907	23.440	2.092	2.180	12.420	3.883	37.463	23.440	2.296	2.370	14.060	5.856	34.891	73.500	2.664	2.100	15.700	5.457	38.240	100.360	2.822	2.080
9.140	0.527	17.256	152.860	1.820	2.240	10.780	3.541	25.903	23.440	2.088	2.200	12.440	3.659	31.240	22.220	2.293	2.350	14.080	5.919	35.665	74.720	2.648	2.160	15.720	5.564	40.574	101.580	2.826	2.110
9.160	0.527	17.145	155.310	1.822	2.200	10.800	3.626	25.792	24.660	2.072	2.170	12.460	3.574	29.685	22.220	2.293	2.270	14.100	6.004	36.776	75.940	2.674	2.120	15.740	5.553	41.574	101.580	2.824	2.130
9.180	0.559	16.812	158.970	1.831	2.250	10.820	3.690	26.236	25.880	2.103	2.120	12.480	3.745	29.907	24.660	2.304	2.220	14.120	5.951	34.840	74.720	2.646	2.730	15.760	5.511	42.463	100.360	2.824	2.060
9.200	0.580	16.479	161.410	1.816	2.150	10.840	3.421	27.673	24.660	2.125	2.070	12.500	3.904	30.907	25.880	2.296	2.280	14.140	5.951	35.284	73.500	2.650	2.110	15.780	5.393	43.463	100.360	2.845	2.060
9.220	0.580	16.812	162.630	1.829	2.250	10.860	3.070	25.895	23.440	2.080	2.100	12.520	3.745	30.351	24.660	2.285	2.230	14.160	5.866	35.840	73.500	2.648	2.150	15.800	5.276	45.351	99.140	2.861	2.070
9.240	0.590	17.256	166.300	1.853	2.230	10.880	2.932	25.784	23.440	2.091	2.120	12.540	3.432	26.816	44.200	2.288	2.670	14.180	5.653	36.840	71.060	2.668	2.120	15.820	5.254	47.125	99.140	2.840	2.050
9.260	0.612	17.479	169.960	1.843	2.160	10.900	2.962	28.447	24.660	2.127	2.120	12.560	3.390	26.483	42.970	2.285	2.050	14.200	5.398	37.507	71.060	2.650	2.100	15.840	5.541	49.236	102.800	2.849	2.060
9.280	0.644	18.034	173.620	1.860	2.160	10.920	3.143	31.335	25.880	2.061	2.060	12.580	3.443	28.371	42.970	2.290	2.040	14.220	5.047	38.284	68.620	2.681	2.150	15.860	6.147	50.792	101.580	2.848	2.080
9.300	0.686	18.367	183.390	1.836	2.250	10.940	3.484	32.335	27.100	2.090	2.160	12.600	3.581	29.705	44.200	2.301	2.110	14.240	4.675	38.618	67.390	2.643	2.150	15.880	7.030	51.125	104.020	2.842	2.010
9.320	0.729	19.256	187.050	1.830	2.250	10.960	3.856	34.558	14.890	2.104	2.130	12.620	3.709	31.149	44.200	2.304	2.120	14.260	4.451	39.395	67.390	2.658	2.200	15.900	7.506	48.117	108.910	2.840	2.060
9.340	0.739	20.145	152.860	1.836	2.330	10.980	3.972	38.887	23.900	2.101	2.180	12.640	3.496	34.483	18.550	2.303	2.170	14.280	4.322	40.058	67.390	2.674	2.200	15.920	7.804	43.673	111.350	2.822	2.130
9.360	0.708	24.145	154.090	1.819	2.270	11.000	4.163	36.331	21.460	2.123	2.180	12.660	3.347	33.371	21.000	2.308	2.110	14.300	4.205	40.614	67.390	2.656	2.170	15.940	7.836	40.562	110.130	2.814	2.150
9.380	0.708	25.923	158.970	1.836	2.240	11.020	4.259	34.331	20.980	2.137	2.160	12.680	3.400	36.260	14.890	2.305	2.070	14.320	4.046	40.169	67.390	2.656	2.200	15.960	7.847	40.673	111.350	2.831	2.120
9.400	0.750	27.034	163.850	1.856	2.250	11.040	4.197	26.812	23.440	2.104	2.680	12.700	3.571	36.260	19.780	2.313	2.060	14.340	3.830	39.495	67.390	2.674	2.180	15.980	7.867	42.335	113.790	2.825	2.070
9.420	0.739	27.923	144.320	1.838	2.280	11.060	4.239	23.923	18.550	2.089	2.160	12.720	3.571	39.371	19.780	2.336	2.090	14.360	3.777	37.383	67.390	2.679	2.160	16.000	7.792	44.224	115.010	2.831	2.030
9.440	0.708	30.367	146.760	1.846	2.220	11.080	4.346	22.812	14.890	2.089	2.160	12.740	3.592	38.594	11.230	2.326	2.090	14.380	3.935	35.713	69.840	2.689	2.250	16.020	7.003	51.503	102.800	2.799	2.630
9.460	0.825	32.812	112.570	1.852	2.510	11.100	4.325	22.923	14.890	2.110	2.160	12.760	3.644	36.145	14.890	2.358	2.130	14.400	4.212	35.491	73.500	2.680	2.160	16.040	7.517	44.391	100.360	2.803	1.940
9.480	0.973	34.367	119.900	1.817	2.070	11.120	4.112	23.812	14.890	2.125	2.150	12.780	3.644	36.034	21.000	2.354	2.030	14.420	4.127	38.157	60.070	2.695	2.090	16.060	7.460	46.503	96.700	2.830	2.090
9.500	1.048	34.812	51.520	1.874	2.060	11.140	3.825	24.812	14.890	2.129	2.170	12.800	3.708	36.923	22.220	2.366	2.060	14.440	3.817	40.153	39.310	2.672	2.160	16.080	7.409	48.395	96.700	2.803	2.010
9.520	0.942	36.034	19.780	1.899	2.120	11.160	3.505	24.034	14.890	2.110	2.220	12.820	3.814	36.812	23.440	2.366	2.170	14.460	3.763	35.598	40.530	2.678	2.250	16.100	7.290	49.614	96.700	2.827	2.120
9.540	0.676	39.367	55.180	1.886	2.130	11.180	3.271	24.367	16.110	2.132	2.220	12.840	3.630	38.137	17.330	2.397	2.180	14.480	3.975	38.483	50.300	2.695	2.250	16.120	7.024	49.614	96.700	2.816	2.120
9.560	0.750	35.256	138.210	1.834	2.170	11.200	3.271	26.256	17.330	2.125	2.200	12.860	3.279	38.693	17.330	2.364	2.160	14.500	4.113	39.927	53.960	2.711	2.270	16.140	6.673	48.725	94.260	2.824	2.150
9.580	0.984	32.701	190.720	1.870	2.080	11.220	3.396	29.359	18.550	2.110	2.200	12.880	3.098	36.026	21.000	2.409	2.100	14.520	4.103	39.260	57.630	2.693	2.250	16.160	6.290	49.169	94.260	2.821	2.120
9.600	1.080	29.145	34.430	1.908	2.090	11.240	3.396	33.026	18.550	2.129	2.230	12.900	3.171	36.467	24.660	2.432	2.070	14.540	3.910	38.145	57.630	2.697	2.220	16.180	5.766	51.606	91.810	2.821	2.130
9.620	1.090	39.367	57.630	1.908	2.070	11.260	3.269	32.026	17.330	2.118	2.170	12.920	3.427	38.133	28.320	2.440	2.070	14.560	3.612	38.923	57.630	2.693	2.250	16.200	4.936	58.272	86.930	2.822	2.130
9.640	1.080	35.479	27.100	1.869	2.090	11.280	3.109	30.915	18.550	2.139	2.280	12.940	3.842	38.244	31.990	2.458	2.100	14.580	3.399	36.812	56.410	2.697	2.230	16.220	4.329	68.824	84.490	2.793	2.170
9.660	0.920	38.145	19.780	1.895	2.110	11.300	3.003	32.582	21.000	2.128	2.200	12.960	4.288	38.578	38.090	2.451	2.110	14.600	3.449	36.359	58.850	2.720	2.220	16.240	4.914	79.824	94.260	2.818	2.120
9.680	0.750	38.256	86.930	1.890	2.100	11.320	3.161	33.911	22.220	2.117	2.150	12.980	4.459	39.911	39.310	2.474	2.070	14.620	3.805	32.705	75.940	2.709	2.760	16.260	6.061	90.820	56.410	2.815	2.080
9.700	0.875	36.471	128.440	1.875	2.060	11.340	3.544	38.467	12.450	2.139	2.150	13.000	4.500	37.685	39.310	2.493	2.120	14.640	4.103	32.038	78.380	2.707	2.020	16.280	6.966	91.153	91.810	2.801	2.120
9.720	0.992	37.915	124.780	1.868	2.130	11.360	3.682	42.578	22.200	2.135	2.270	13.020	3.886	39.280	62.510	2.465	3.500	14.660	4.326	32.594	63.730	2.707	2.060	16.300	6.794	76.927	91.810	2.815	2.150
9.740	1.077	38.582	44.200	1.907	2.180	11.380	3.702	45.240	20.750	2.150	2.250	13.040	3.567	36.836	62.510	2.461	2.100	14.680	4.326	36.927	11.230	2.720	2.090	16.320	6.815	71.149	93.040	2.801	2.170
9.760	1.003	40.137	39.310	1.908	2.180	11.400	3.670	37.240	21.970	2.146	2.290	13.060	3.152	39.280	60.070	2.484	2.130	14.700	4.315	35.038	23.440	2.732	2.120	16.340	7.378	68.701	100.360	2.815	2.200
9.780	1.162	40.359	27.100	1.902	2.160	11.420	3.564	33.018	29.530	2.175	2.290	13.080	3.407	44.169	62.510	2.486	2.160	14.720	4.432	32.038	36.870	2.723	2.090	16.360	7.981	69.026	107.690	2.815	2.150
9.800	1.683	46.248	73.500	1.916	2.070	11.440	3.456	28.792	28.310	2.150	2.240	13.100	4.096	50.383	68.620	2.495	2.100	14.740	4.666	32.371	42.970	2.721	2.040	16.380	8.279	72.026	110.130	2.802	2.190
9.820	2.205	40.026	35.650	1.935	2.060	11.460	3.318	25.347	27.090	2.168	2.250	13.120	4.514	56.391	29.780	2.499	2.170	14.760	4.922	32.483	46.640	2.732	2.040	16.400	8.427	67.022	110.130	2.826	2.180
9.840	2.257	36.800	19.780	1.957	2.120	11.480	3.041	25.236	25.870	2.143	2.240	13.140	4.713	56.495	30.240	2.520	2.130	14.780	5.124	31.371	50.300	2.738	2.060	16.420	8.383	56.351	106.470	2.815	2.160
9.860	1.937	36.244	18.550	1.895	2.100	11.500	2.722	24.459	23.420	2.157	2.200	13.160	4.415	53.717	32.200	2.509	2.100	14.800	5.272	30.917	51.520	2.759	2.040	16.440	8.322	56.705	107.690	2.818	2.230

Pergeo S.r.l. Via Dell'Artigianato, 2 44030 Ro Ferrarese (FE) tel. 0532/426021 fax. 0532/426521

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SCPTU 3

Prova eseguita da:
Pergeo S.r.l.
via dell'artigianato,2 44130 - Ro Ferrarese
www.pergeo.it - info @pergeo.it
Dir.del Laboratorio: Dr.Geol.M.Condotta
Sperimentatore: Dr.Geol. F. Zanella

Committente: Comune di Ravenna
Cantiere:Piazzale Kennedy (RA)
Data: 22/03/2013

ID Prova: SCPTU 3
Profondita falda: mt 2 da p.c.
Preforo:1,20 mt scavo + fino a mt 7,00 di dpsh

Profondità massima raggiunta: 30,00 mt
Punta sismica: Tecnopenta G1-CPL2IN - SISMI
n° Dissipazioni eseguite: 0

Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz
metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec
16.460	8.360	58.236	110.130	2.801	2.150	18.120	10.262	74.260	36.870	2.707	2.050	19.760	13.991	88.981	82.050	2.749	1.980	21.400	10.046	96.338	104.020	2.796	2.100	23.040	10.843	80.947	41.000	2.871	1.830
16.480	8.453	58.562	112.570	2.822	2.120	18.140	10.103	73.816	38.090	2.701	2.060	19.780	14.279	91.537	84.490	2.749	1.940	21.420	8.492	115.445	100.360	2.800	2.050	23.060	11.026	82.951	40.980	2.874	2.020
16.500	8.665	59.558	116.230	2.816	2.130	18.160	9.910	75.145	40.530	2.698	2.070	19.800	14.430	92.545	85.710	2.731	1.940	21.440	7.598	133.778	96.700	2.798	2.090	23.080	11.153	84.395	44.640	2.880	2.000
16.520	8.962	56.558	119.900	2.801	2.220	18.180	9.697	76.590	41.750	2.701	2.100	19.820	14.526	95.100	86.930	2.745	2.030	21.460	7.831	141.441	102.800	2.798	2.070	23.100	11.333	85.503	49.530	2.885	2.030
16.540	9.153	55.443	113.790	2.822	2.250	18.200	9.343	76.582	44.200	2.714	2.150	19.840	14.757	98.870	90.590	2.756	2.030	21.480	9.512	137.885	118.680	2.798	2.110	23.120	11.567	86.614	41.970	2.888	1.970
16.560	9.024	57.216	96.700	2.805	2.280	18.220	8.991	75.467	45.420	2.714	2.110	19.860	14.981	99.537	93.040	2.747	2.060	21.500	11.627	125.548	132.110	2.800	2.130	23.140	11.822	88.614	40.750	2.880	2.060
16.580	8.694	58.994	97.920	2.822	2.280	18.240	8.810	74.800	49.080	2.720	2.100	19.880	14.906	101.759	90.590	2.756	2.020	21.520	12.904	118.103	104.020	2.811	2.080	23.160	12.053	90.828	40.750	2.888	2.100
16.600	8.416	60.323	100.360	2.824	2.180	18.260	8.819	74.685	51.520	2.717	2.100	19.900	14.820	103.866	93.040	2.764	2.000	21.540	13.571	115.762	97.920	2.811	2.090	23.180	12.096	91.939	40.750	2.886	2.110
16.620	8.214	62.212	101.580	2.818	2.240	18.280	8.977	74.238	55.180	2.707	2.120	19.920	14.809	106.199	95.480	2.761	1.950	21.560	13.954	109.540	100.360	2.789	2.120	23.200	12.116	92.157	40.750	2.880	2.080
16.640	8.211	63.315	100.360	2.805	2.190	18.300	9.134	74.451	56.410	2.725	2.130	19.940	14.840	107.973	96.700	2.760	2.000	21.580	14.303	102.199	139.430	2.802	2.480	23.220	12.180	91.602	40.530	2.886	2.030
16.660	8.380	64.423	96.700	2.830	2.200	18.320	9.250	71.780	53.960	2.717	2.050	19.960	14.923	108.414	100.360	2.768	1.990	21.600	14.462	101.643	126.000	2.800	2.120	23.240	12.084	99.459	78.380	2.893	2.900
16.680	8.507	58.867	104.020	2.822	2.480	18.340	9.387	69.998	57.630	2.717	2.110	19.980	15.165	112.406	100.360	2.756	2.000	21.620	14.205	106.639	123.560	2.777	2.110	23.260	12.538	94.117	33.670	2.888	2.060
16.700	8.743	58.315	89.370	2.833	2.020	18.360	9.438	70.105	60.070	2.720	2.110	20.000	15.377	113.513	99.140	2.768	1.950	21.640	13.707	111.310	121.120	2.806	2.050	23.280	12.602	93.562	36.340	2.879	2.030
16.720	8.679	57.649	86.930	2.809	2.010	18.380	9.309	71.435	61.290	2.725	2.150	20.020	15.483	112.846	100.360	2.769	1.980	21.660	13.292	114.532	119.900	2.786	2.090	23.300	12.315	93.117	33.900	2.890	2.080
16.740	8.317	56.982	85.710	2.821	2.090	18.400	9.073	71.760	62.510	2.725	2.180	20.040	14.968	101.351	108.910	2.717	2.480	21.680	13.088	116.861	119.900	2.793	2.170	23.320	11.836	90.451	36.340	2.890	2.010
16.760	8.062	55.315	86.930	2.822	2.120	18.420	8.722	71.204	64.950	2.728	2.170	20.060	14.862	99.351	82.050	2.721	2.050	21.700	12.929	117.417	121.120	2.797	2.180	23.340	11.728	91.002	38.790	2.897	2.110
16.780	7.977	54.649	88.150	2.835	2.100	18.440	8.327	71.423	66.170	2.728	2.150	20.080	14.776	92.240	63.730	2.732	2.040	21.720	12.982	118.306	121.120	2.793	2.220	23.360	11.845	90.891	33.670	2.880	2.100
16.800	7.902	55.204	89.370	2.824	2.050	18.460	8.070	74.307	66.170	2.753	2.180	20.100	14.457	79.796	80.830	2.721	2.010	21.740	13.067	119.639	116.230	2.802	2.170	23.380	12.067	90.887	38.550	2.872	2.100
16.820	7.784	56.534	90.590	2.830	2.030	18.480	8.068	82.859	61.990	2.744	2.120	20.120	14.318	68.236	85.710	2.723	1.980	21.760	13.034	121.079	108.910	2.791	2.130	23.400	12.438	91.327	24.660	2.877	2.100
16.840	7.592	57.867	90.590	2.811	2.080	18.500	7.961	94.299	62.680	2.751	2.200	20.140	13.828	58.236	72.280	2.730	1.960	21.780	13.162	120.079	104.020	2.793	2.160	23.420	13.192	92.212	30.760	2.872	2.070
16.860	7.486	57.756	91.810	2.814	2.080	18.520	7.724	104.291	65.870	2.756	2.160	20.160	13.326	53.006	44.200	2.723	2.040	21.800	13.268	118.413	105.250	2.791	2.160	23.440	13.948	93.101	36.870	2.863	2.090
16.880	7.602	56.863	94.260	2.830	2.050	18.540	7.403	111.287	60.750	2.744	2.090	20.180	12.824	59.558	46.640	2.717	1.980	21.820	13.584	119.071	104.020	2.785	2.100	23.460	14.243	94.315	40.530	2.877	2.100
16.900	7.857	56.085	97.920	2.799	2.040	18.560	6.955	107.617	63.190	2.763	2.150	20.200	12.537	66.113	55.180	2.725	2.020	21.840	13.504	105.925	117.460	2.747	2.770	23.480	14.252	93.867	41.750	2.865	2.070
16.920	8.304	56.085	101.580	2.814	2.030	18.580	6.328	88.617	65.630	2.761	2.220	20.220	12.440	73.776	60.070	2.732	2.010	21.860	14.005	103.040	86.930	2.739	1.930	23.500	14.208	96.196	41.750	2.865	2.070
16.940	8.707	55.303	105.250	2.792	2.110	18.600	5.837	74.057	68.080	2.755	2.230	20.240	12.492	82.883	64.950	2.729	2.060	21.880	14.133	104.596	85.710	2.746	1.950	23.520	14.090	99.303	39.310	2.863	2.110
16.960	8.739	54.859	106.470	2.803	2.150	18.620	6.132	75.049	66.850	2.756	2.270	20.260	12.416	90.657	68.620	2.736	2.070	21.900	14.177	107.155	85.710	2.753	2.030	23.540	13.716	103.299	40.530	2.854	2.110
16.980	8.610	54.744	107.690	2.806	2.160	18.640	7.260	88.494	61.970	2.733	2.230	20.280	12.381	97.093	73.500	2.754	2.070	21.920	14.145	109.933	85.710	2.747	2.040	23.560	13.469	107.403	44.200	2.857	2.150
17.000	8.493	55.188	108.910	2.830	2.110	18.660	8.226	93.267	63.190	2.768	2.160	20.300	12.509	99.871	78.380	2.754	2.050	21.940	14.071	113.489	86.930	2.736	2.070	23.580	13.308	110.510	49.080	2.855	2.170
17.040	8.041	54.824	110.130	2.783	2.000	18.680	8.629	84.486	65.630	2.776	2.190	20.320	12.710	96.978	83.270	2.756	2.020	21.960	14.124	115.822	89.370	2.747	2.000	23.600	13.337	111.502	52.740	2.867	2.090
17.060	7.818	55.935	108.910	2.747	2.080	18.700	8.649	70.958	42.970	2.754	2.610	20.340	12.825	96.307	88.150	2.771	2.090	21.980	14.209	118.378	91.810	2.771	1.960	23.620	13.472	113.383	57.630	2.848	2.120
17.080	7.818	57.379	110.130	2.764	2.040	18.720	8.777	61.736	61.230	2.723	2.050	20.360	12.961	96.966	93.040	2.760	2.070	22.000	12.559	123.596	99.140	2.739	2.420	23.640	13.599	115.379	60.070	2.849	2.130
17.100	7.818	57.824	110.130	2.778	2.070	18.740	8.705	61.299	60.750	2.733	2.000	20.380	12.947	98.958	94.260	2.771	2.010	22.020	14.555	111.772	75.940	2.715	1.920	23.660	13.650	113.597	63.730	2.861	2.080
17.120	7.668	58.264	110.130	2.754	2.060	18.760	8.418	61.411	69.300	2.760	2.030	20.400	12.723	99.176	96.700	2.769	2.060	22.040	14.662	113.327	66.170	2.703	1.980	23.680	13.649	112.482	66.170	2.853	2.180
17.140	7.625	58.264	112.570	2.747	2.110	18.780	8.120	55.411	68.080	2.747	1.990	20.420	12.700	98.728	96.700	2.762	2.090	22.060	14.736	113.661	68.620	2.704	2.030	23.700	13.456	109.033	69.840	2.861	2.060
17.160	7.551	58.820	112.570	2.747	2.110	18.800	7.950	50.188	66.850	2.738	2.070	20.440	12.802	99.160	101.580	2.760	2.080	22.080	14.779	115.550	67.390	2.736	1.920	23.720	13.027	107.910	71.060	2.851	2.070
17.180	7.315	58.371	112.570	2.759	2.100	18.820	7.822	50.744	65.630	2.720	2.100	20.460	12.960	99.823	104.020	2.763	2.120	22.100	14.820	116.435	72.280	2.703	2.000	23.740	12.695	107.128	74.720	2.867	2.170
17.200	6.996	57.705	112.570	2.759	2.120	18.840	7.769	50.411	60.750	2.738	2.090	20.480	13.097	100.041	102.800	2.756	2.100	22.120	14.884	115.990	73.500	2.708	2.060	23.760	12.534	106.124	77.160	2.865	2.180
17.220	6.741	57.260	112.570	2.751	2.100	18.860	7.822	51.744	65.870	2.731	2.030	20.500	13.181	100.482	108.910	2.764	2.090	22.140	14.934	118.315	74.720	2.720	2.080	23.780	12.477	105.557	82.050	2.859	2.190
17.240	6.569	56.701	113.790	2.747	2.110	18.880	7.873	52.403	62.200	2.736	2.030	20.520	13.219	99.581	105.250	2.776	2.100	22.160	14.848	120.311	74.720	2.737	2.070	23.800	12.401	103.553	84.490	2.872	2.190
17.260	6.439	55.804	115.010	2.756	2.160	18.900	7.841	53.291	62.200	2.762	2.050	20.540	13.229	99.132	107.690	2.776	2.090	22.180	14.763	120.534	75.940	2.718	2.010	23.820	12.081	100.993	86.930	2.888	2.170
17.280	6.267	55.244	115.010	2.754	2.080	18.920	7.777	54.069	60.980	2.745	2.040	20.560	13.121	99.795	110.130	2.776	2.120	22.200	14.676	117.752	73.500	2.720	1.990	23.840	11.462	98.656	85.710	2.861	2.160
17.300	5.980	54.578	115.010	2.759	2.110	18.940	7.680	55.287	62.680	2.760	2.030	20.580	13.053	101.339	115.010	2.791	2.120	22.220	14.546	117.855	77.160	2.747	2.000	23.860	10.458	93.311	84.490	2.869	2.190
17.320	5.723	53.018	115.010	2.754	2.150	18.960	7.712	57.510	65.120	2.749	2.060	20.600	13.094	102.446	117.460	2.776	2.030	22.240	14.298	113.291	83.270	2.745	2.040	23.900	7.117	77.339	129.670	2.859	1.980
17.340	5.564	50.796	116.230	2.759	2.150	18.980	7.786	57.843	60.010	2.760	2.010	20.620	13.135	103.775	116.230	2.772	2.070	22.260	14.137	108.621	69.840	2.759	2.030	23.920	4.925	83.894	118.680	2.859	2.000
17.360	5.499	49.347	116.230	2.759	2.180	19.000	7.998	58.283	63.670	2.755	2.080	20.640	13.049	105.104	118.680	2.761	2.170	22.280	13.667	106.279	74.720	2.792	1.990	23.940	3.298	93.339	107.690	2.864	2.010
17.380	5.485	48.451	117.460	2.761	2.200	19.020	8.232	59.061	66.110	2.755	2.120	20.660	12.898	105.989	115.010	2.788	2.160	22.300	13.568	102.938	79.600	2.764	2.060	23.960	2.290	104.458	97.920	2.849	2.050
17.400	5.484	47.335	119.900	2.762	2.170	19.040	8.439	59.391	75.940	2.723	2.330	20.680	12.841	108.755	117.460	2.791	2.190	22.320	13.544	94.708	90.590	2.794	2.040	23.980	1.779	116.791	97.920	2.851	2.070
17.420	5.579	46.224	121.120	2.764	2.200	19.060	8.684	59.503	73.500	2.729	2.070	20.700	12.840	106.751	116.230	2.772	2.200	22.340	13.575	86.259	88.150	2.778	2.070	24.000	1.340	132.116	211.470	2.840	2.110
17.440	5.748	44.665	123.560	2.764	2.150	19.080	8.982	60.280	72.280	2.733	2.020	20.720	12.796	107.303	116.230	2.776	2.130	22.360	13.307	79.589	94.260	2.787	2.070	24.020	1.117	130.005	321.360	2.851	2.080
17.460	5.929	43.998	124.780	2.761	2.170	19.100	9.577	62.169	74.720	2.725	2.000	20.740	12.772	107.295	112.570	2.794	2.130	22.380	12.516	78.688	91.810	2.799	2.070	24.040	1.471	71.836	298.160	2.818	2.420
17.480	6.258	43.550	127.220	2.778	2.220	19.120	10.471	63.725	82.050	2.733	2.060	20.760	12.696	108.068	112.570	2.788	2.170	22.400	11.206	79.239	94.260	2.827	2.050	24.060	1.641	65.836	332.350	2.825	2.000
17.500	6.565	43.768	119.900	2.786	2.130	19.140	11.822	66.169	72.280	2.732	2.030	20.780	12.567	107.398	105.250	2.796	2.100	22.420	9.936	73.561	97.920	2.824	2.130	24.080	1.770	62.173	350.670	2.816	2.030
17.520	7.065	43.212	119.900	2.776	2.090	19.160	13.046	68.391	58.850	2.740	2.040	20.800	12.480	106.283	105.250	2.799	2.190	22.440	9.158	73.668	106.470	2.846	2.080	24.100	2.131	57.280	381.190	2.812	2.030
17.540	7.477	42.760	119.900	2.776	2.180	19.180	13.745	69.939	55.180	2.729	2.010	20.820	12.208	92.183	127.220	2.759	2.040	22.460	8.879	74.771	108.910	2.847	2.040	24.120	1.854	48.503	350.670	2.802	2.040
17.560	8.147	41.871	121.120	2.750	2.220	19.200	13.956	74.157	46.640	2.756	2.090	20.840	12.104	95.525	113.790	2.772	1.960	22.480	9.079	76.100	112.570	2.840	2.100	24.140	1.450	38.169	338.460	2.809	2.030
17.580	8.658	40.427	119.900	2.761	2.220	19.220	14.254	78.157	42.970	2.730	2.100	20.860	12.094	97.858	111.350	2.772	2.010	22.500	7.991	80.537	107.690	2.850	2.090	24.160	1.056	30.725	340.900	2.799	2.020
17.600	9.071	38.645	121.120	2.764	2.250	19.240	15.083	81.931	52.740	2.721	2.070	20.880	12.168	99.747	108.910	2.770	2.020	22.520	5.852	83.866	86.930	2.863	2.160	24.180	1.319	30.606	470.320	2.815	2.110
17.620	9.603	35.423	123.560	2.748	2.190	19.260	15.785	86.153	57.630	2.752	2.070	20.900	12.402	101.858	108.910	2.764	2.060	22.540	4.287	82.751	71.060	2.874	2.190	24.200	2.777	31.495	673.010	2.842	2.110
17.640	10.305	31.311	124.780	2.751	2.180	19.280	16.432	89.483	66.170	2.740	2.050	20.920	12.689	103.858	106.470	2.772	2.020	22.560	3.275	83.525	66.170	2.885	2.160	24.220	4.362	30.161	209.030	2.838	2.080
17.660	10.676	25.196	127.220	2.748	2.230	19.300	16.718	92.256	61.290	2.725	2.090	20.940	12.913	104.303	99.140	2.756	1.980	22.580	2.689	84.414	72.280	2.871	2.160	24.240	4.234	27.495	191.940	2.808	2.060
17.680	10.761	21.641	126.000	2.720	2.170	19.320	16.837	97.475	63.730	2.717	2.100	20.960	12.977	106.636	99.140	2.769	1.980	22.600	2.112	96.406	69.840	2.869	2.160	24.260	3.617	25.383	165.830	2.843	2.040
17.700	10.910	20.974	126.000	2.725	2.220	19.340	16.969	101.244	60.070	2.713	2.040	20.980	13.048	105.517	89.370	2.753	2.000	22.620	1.611	108.291	172.400	2.886	2.170	24.280	2.968	41.606	134.550	2.854	1.990
17.720	11.170	17.907	135.770	2.674	2.270	19.360	17.181	103.240	66.170	2.713	2.060	21.000	12.921	109.183	89.370	2.759	1.980	22.640	1.205	105.398	312.820	2.894	2.180	24.300	2.277	60.161	157.750	2.855	2.090
17.740	11.457	17.240	135.770	2.692	1.990	19.380	17.126	106.792	69.840	2.730	2.090	21.020	13.100	109.179	91.810	2.759	2.030	22.660	1.023	93.727	570.450	2.885	2.180	24.320	1.883	64.161	147.980	2.871	2.030
17.760	11.500	18.463	132.110	2.673	2.040	19.400	16.889	111.673	72.280	2.729	2.100	21.040	12.898	95.402	93.040	2.761	1.970	22.680	1.044	84.171	608.300	2.904	2.090	24.340	2.947	89.939	348.220	2.874	2.050
17.780	11.223	22.018	127.220	2.700	2.090	19.420	16.686	116.780	74.720	2.738	2.170	21.060	12.567	82.953	97.920	2.748	1.990	22.700	1.085	77.723	585.100	2.893	2.150	24.360	8.032	77.606	290.840	2.879	2.010
17.800	10.776	29.129	113.790	2.690	2.110	19.440	16.438	121.105	78.380	2.733	2.120	21.080	12.129	79.505	102.800	2.755	2.090	22.720	1.085	71.279	526.490	2.897	2.200	24.380	11.500	64.383	96.700	2.896	2.030
17.820	10.489	37.240	115.010	2.676	2.070	19.460	16.097	123.323	78.380	2.734	2.100	21.100	11.458	83.390	99.140	2.751	2.100	22.740	1.274	61.937	651.030	2.897	2.220	24.400	13.141	71.280	93.040	2.880	2.050
17.840	10.276	45.907	110.130	2.668	2.030	19.480	15.667	125.756	77.160	2.732	2.150	21.120	11.330	77.279	100.360	2.756	2.070	22.760	2.785	49.604	653.470	2.896	2.250	24.420	13.620	60.614	113.790	2.885	2.050
17.860	10.287	52.796	97.920	2.671	2.040	19.500	15.251	126.863	82.050	2.740	2.120	21.140	11.264	77.604	100.360	2.751	2.010	22.780	5.338	44.271	481.310	2.897	2.180	24.440	14.035	50.947	134.550	2.882	2.050
17.880	10.275	60.014	95.480	2.689	2.060	19.520	15.078	128.522	83.270	2.729	2.120	21.160	11.262	81.378	96.700	2.764	2.000	22.800	6.721	31.382	62.510	2.912	2.130	24.460	14.375	56.614	145.540	2.894	2.020
17.900	10.243	67.014	93.040	2.660	2.010	19.540	14.988	127.176	84.490	2.752	2.180	21.180	11.303	88.818	97.920	2.768	1.990	22.820	7.487	33.159	63.730	2.909	2.160	24.480	14.801	58.169	158.970	2.919	2.080
17.920	10.145	72.006	84.490	2.663	2.080	19.560	14.837	124.391	88.150	2.754	2.070	21.200	11.493	95.370	95.480	2.764	2.020	22.840	8.067	32.601	115.010	2.888	2.470	24.500	15.309	60.828	173.620	2.916	2.070
17.940	10.038	74.451	80.830	2.668	2.010	19.580	14.769	120.490	90.590	2.756	2.050	21.220	11.834	99.703	99.140	2.770	2.030	22.860	8.515	35.494	115.010	2.872	2.020	24.520	15.873	67.606	193.160	2.916	2.020
17.960	9.931	76.224	82.050	2.667	2.040	19.600	14.681	116.704	91.810	2.763	2.160	21.240	12.246	97.251	101.580	2.791	1.990	22.880	9.004	42.494	83.270	2.888	1.950	24.540	16.617	72.939	213.910	2.916	2.030
17.980	9.919	78.998	83.270	2.668	2.110	19.620	14.594	113.255	90.590	2.762	2.180	21.260	12.415	97.913	102.800	2.799	2.040	22.900	9.422	50.057	67.390	2.874	2.010	24.560	17.447	74.939	234.670	2.924	2.070
18.000	9.949	78.994	82.050	2.668	2.150	19.640	14.463	111.243	90.590	2.760	2.200	21.280	12.319	97.247	102.800	2.786	2.050	22.920	9.890	59.502	42.970	2.882	1.980	24.580	18.213	79.383	245.660	2.918	2.060
18.020	9.454	82.149	84.490	2.673	2.770	19.660	14.354	109.791	90.590	2.762	2.190	21.300	12.201	96.576	104.020	2.777	2.090	22.940	10.198	65.279	39.310	2.880	2.040	24.600	18.926	79.161	254.210	2.926	2.100
18.040	9.996	74.260	44.200	2.700	1.980	19.680	14.105	106.668	86.930	2.762	2.180	21.320	12.050	96.239	105.250	2.796	2.070	22.960	10.402	69.950	30.760	2.879	2.070	24.620	19.403	76.268	251.770	2.926	2.110
18.060	10.092	74.816	34.430	2.692	2.020	19.700	14.038	102.549	78.380	2.752	2.160	21.340	11.604	98.127	105.250	2.807	2.050	22.980	10.434	72.506	31.990	2.862	2.080	24.640	19.424	75.713	191.940	2.924	2.080
18.080	10.262	75.038	34.430	2.701	2.040	19.720	13.867	104.211	73.500	2.769	2.170	21.360	11.209	97.346	105.250	2.796	2.050	23.000	10.498	75.395	34.430	2.887	2.000	24.660	19.434	77.264	204.150	2.957	2.130
18.100	10.347	74.705	35.650	2.704	2.070	19.740	13.745	86.644	91.810	2.749	2.220	21.380	10.833	97.277	106.470	2.794	2.100	23.020	7.439	89.503	45.310	2.874	2.210	24.680	19.517	78.816	217.580	2.956	2.110

Pergeo S.r.l. Via Dell'Artigianato, 2 44030 Ro Ferrarese (FE) tel. 0532/426021 fax. 0532/426521

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SCPTU 3

Committente: Comune di Ravenna
Cantiere:Piazzale Kennedy (RA)
Data: 22/03/2013

ID Prova: SCPTU 3
Profondita falda: mt 2 da p.c.
Preforo:1,20 mt scavo + fino a mt 7,00 di dpsh

Profondità massima raggiunta: 30,00 mt
Punta sismica: Tecnopenta G1-CPL2IN - SISMI
n° Dissipazioni eseguite: 0

Prova eseguita da:
Pergeo S.r.l.
via dell'artigianato,2 44130 - Ro Ferrarese
www.pergeo.it - info @pergeo.it
Dir.del Laboratorio: Dr.Geol.M.Condotta
Sperimentatore: Dr.Geol. F. Zanella

Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz	Prof.	RP	RL	PN	Incl.	Vavanz
metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec	metri	Mpa	KPa	KPa	Gradi °	cm/sec
24.700	19.378	85.479	218.800	2.965	2.120	26.340	2.079	37.043	644.930	3.061	2.010	27.980	1.859	57.356	560.680	3.211	2.250	29.640	2.495	62.380	395.840	3.409	2.090
24.720	19.279	90.248	222.460	2.971	2.130	26.360	1.983	42.710	558.240	3.081	2.090	28.020	2.062	62.865	453.230	3.213	2.030	29.660	2.325	60.380	393.400	3.417	2.040
24.740	19.023	98.467	223.680	2.979	2.060	26.380	1.813	43.154	351.890	3.066	2.080	28.040	1.989	65.869	433.690	3.234	2.010	29.680	2.208	56.269	389.740	3.434	2.060
24.760	18.628	105.129	222.460	3.003	2.090	26.400	1.665	47.936	366.540	3.066	2.070	28.060	1.924	68.865	420.260	3.205	2.010	29.700	2.208	53.158	398.290	3.434	2.070
24.780	17.879	113.451	215.140	3.004	2.170	26.420	1.697	46.269	404.390	3.086	2.070	28.080	1.902	71.643	405.610	3.213	2.040	29.720	2.378	59.158	427.590	3.432	2.060
24.800	17.175	115.891	218.800	3.004	2.190	26.440	1.889	40.603	442.240	3.065	2.110	28.100	1.849	75.865	420.260	3.213	2.070	29.740	2.665	61.158	454.450	3.417	2.150
24.820	16.555	117.439	221.240	2.988	2.220	26.460	2.123	38.269	482.530	3.078	2.120	28.120	1.870	77.754	434.920	3.211	2.100	29.760	3.186	66.269	488.640	3.448	2.120
24.840	15.884	115.212	215.140	3.012	2.220	26.480	2.314	40.491	510.620	3.057	2.110	28.140	1.881	78.865	434.920	3.240	2.080	29.780	3.591	74.269	506.950	3.442	2.100
24.860	14.784	113.978	200.480	3.018	2.160	26.500	2.474	43.825	487.420	3.068	2.120	28.160	1.881	78.420	442.240	3.241	2.030	29.800	4.101	86.603	271.300	3.440	2.110
24.880	12.857	112.530	190.720	3.028	2.190	26.520	2.559	49.269	419.040	3.066	2.090	28.180	1.880	77.083	443.460	3.243	2.040	29.820	4.772	88.825	105.250	3.440	2.090
24.900	11.162	96.347	226.120	3.047	3.470	26.540	2.782	51.158	334.790	3.060	2.120	28.200	1.848	76.194	436.140	3.248	2.050	29.840	4.846	83.603	97.920	3.449	2.090
24.920	9.588	102.235	201.700	3.039	2.040	26.560	2.899	60.825	348.220	3.052	2.130	28.220	1.846	74.079	420.260	3.243	2.030	29.860	4.612	68.491	90.590	3.442	2.180
24.940	9.130	112.791	199.260	3.051	2.000	26.580	2.963	72.158	240.780	3.053	2.080	28.240	1.857	74.635	416.600	3.251	2.060	29.880	4.080	58.047	82.050	3.434	2.080
24.960	9.972	122.684	213.910	3.059	1.990	26.600	2.857	68.380	244.440	3.053	2.110	28.260	1.878	75.746	422.710	3.263	2.020	29.900	3.600	57.376	66.170	3.434	2.050
24.980	11.066	131.791	191.940	3.069	1.940	26.620	2.750	59.269	271.300	3.066	2.120	28.280	1.907	72.849	412.940	3.255	2.030	29.920	3.313	61.043	79.600	3.434	2.150
25.000	9.045	145.235	268.620	3.061	2.050	26.640	2.846	59.158	303.050	3.069	2.160	28.300	1.865	73.182	398.290	3.279	2.110	29.940	3.398	63.154	99.140	3.434	2.160
25.020	5.854	153.347	272.450	3.074	2.100	26.660	3.027	59.603	332.350	3.067	2.180	28.320	1.800	76.178	382.410	3.279	2.130	29.960	3.632	64.599	108.910	3.439	2.190
25.040	3.830	147.005	3110.980	3.059	2.130	26.680	3.133	57.491	389.740	3.058	2.180	28.340	1.789	78.956	376.310	3.259	2.110	29.980	4.015	65.376	117.460	3.430	2.170
25.060	2.574	115.783	341.750	3.067	2.060	26.700	3.240	55.603	461.780	3.051	2.120	28.360	1.788	80.063	370.200	3.276	2.080	30.000	4.536	64.043	126.000	3.431	2.130
25.080	1.764	106.223	321.120	3.071	2.040	26.720	3.261	63.825	268.860	3.075	2.190	28.380	1.777	80.841	373.870	3.288	2.030						
25.100	1.454	107.108	337.110	3.063	2.060	26.740	3.378	81.714	262.750	3.067	2.150	28.400	1.744	79.503	366.540	3.292	2.050						
25.120	1.272	100.327	393.400	3.074	2.040	26.760	3.781	83.710	338.460	3.076	2.180	28.420	1.776	78.615	365.320	3.290	2.060						
25.140	1.175	85.989	495.970	3.092	2.040	26.780	4.557	79.265	515.500	3.076	2.190	28.440	1.786	80.059	361.660	3.282	2.080						
25.160	1.172	82.870	519.160	3.071	2.040	26.800	5.334	88.710	162.630	3.097	2.090	28.460	1.753	82.388	357.990	3.290	2.060						
25.180	1.172	81.315	527.710	3.086	1.990	26.820	5.153	107.487	130.890	3.078	2.110	28.480	1.742	81.611	356.770	3.314	2.080						
25.200	1.171	74.866	526.490	3.074	2.050	26.840	4.375	89.595	119.900	3.097	2.200	28.500	1.729	80.380	347.000	3.318	2.090						
25.220	1.170	53.751	521.610	3.099	2.090	26.860	3.747	65.372	126.000	3.114	2.250	28.520	1.697	79.936	342.120	3.314	2.150						
25.240	1.159	34.862	513.060	3.099	2.100	26.880	3.354	65.261	171.180	3.124	2.280	28.540	1.685	79.599	342.120	3.296	2.090						
25.260	1.148	25.751	505.730	3.091	2.090	26.900	3.088	73.928	234.670	3.106	2.240	28.560	1.664	78.376	343.340	3.296	2.100						
25.280	1.147	24.303	498.410	3.094	2.030	26.920	2.906	72.591	284.730	3.106	2.190	28.580	1.653	75.821	340.900	3.326	2.090						
25.300	1.148	24.307	491.080	3.099	2.020	26.940	3.450	110.039	179.730	3.108	2.300	28.600	1.620	75.039	339.680	3.318	2.150						
25.320	1.159	25.418	489.860	3.101	2.030	26.960	3.162	109.595	174.840	3.114	1.970	28.620	1.577	75.039	343.340	3.318	2.120						
25.340	1.180	26.307	487.420	3.102	2.040	26.980	3.184	116.039	205.370	3.124	2.050	28.640	1.556	75.039	357.990	3.328	2.060						
25.360	1.256	27.311	491.080	3.107	2.060	27.000	3.716	128.595	310.370	3.124	1.990	28.660	1.555	73.257	367.760	3.336	2.090						
25.380	1.320	27.977	495.970	3.123	1.990	27.020	4.769	128.372	259.090	3.141	2.000	28.680	1.555	71.257	375.090	3.334	2.120						
25.400	1.364	28.537	493.520	3.134	2.090	27.040	5.152	107.817	124.780	3.124	1.990	28.700	1.555	70.368	378.750	3.342	2.150						
25.420	1.398	28.545	477.650	3.123	2.080	27.060	4.503	100.150	100.360	3.139	2.050	28.720	1.552	70.138	378.750	3.325	2.170						
25.440	1.388	29.211	458.110	3.123	2.100	27.080	3.682	80.368	94.260	3.122	2.100	28.740	1.531	69.916	381.190	3.333	2.170						
25.460	1.357	31.104	445.900	3.131	2.080	27.100	3.012	76.257	108.910	3.139	2.110	28.760	1.541	66.471	390.960	3.358	2.130						
25.480	1.359	32.219	433.690	3.132	2.080	27.120	2.618	71.479	188.270	3.146	2.030	28.780	1.594	63.249	400.730	3.341	2.150						
25.500	1.392	33.112	428.810	3.123	2.090	27.140	2.477	70.583	211.470	3.149	2.020	28.800	1.626	62.027	403.170	3.342	2.090						
25.520	1.478	33.783	425.150	3.139	2.120	27.160	2.328	67.027	229.790	3.146	2.050	28.820	1.657	60.134	378.750	3.336	2.160						
25.540	1.566	34.902	411.720	3.123	2.070	27.180	2.253	66.467	244.440	3.154	2.060	28.840	1.625	63.356	373.870	3.352	2.130						
25.560	1.632	36.351	393.400	3.123	2.080	27.200	2.093	57.023	267.640	3.150	2.050	28.860	1.657	63.134	368.980	3.360	2.060						
25.580	1.654	39.021	322.580	3.122	2.110	27.220	1.976	48.245	326.250	3.149	2.070	28.880	1.667	63.134	362.880	3.360	2.090						
25.600	1.656	44.136	318.920	3.123	2.110	27.240	1.975	47.241	354.330	3.150	2.010	28.900	1.667	64.023	353.110	3.357	2.170						
25.620	1.658	50.033	314.040	3.107	2.150	27.260	1.975	43.130	379.970	3.161	2.080	28.920	1.667	66.023	342.120	3.357	2.160						
25.640	1.617	56.371	283.510	3.093	2.190	27.280	2.145	40.686	427.590	3.169	2.120	28.940	1.625	67.801	323.800	3.368	2.190						
25.660	1.640	60.708	270.080	3.090	2.150	27.300	2.273	42.575	453.230	3.179	2.120	28.960	1.646	68.912	344.560	3.374	2.200						
25.680	1.588	67.934	260.310	3.089	2.180	27.320	2.314	42.904	472.770	3.177	2.110	28.980	1.710	67.023	344.560	3.366	2.120						
25.700	1.526	73.160	261.530	3.101	2.160	27.340	2.824	44.127	532.600	3.174	2.040	29.000	1.721	68.690	336.010	3.398	2.160						
25.720	1.486	73.391	254.210	3.084	2.150	27.360	3.739	49.904	636.380	3.177	2.000	29.020	1.763	68.467	325.030	3.373	2.170						
25.740	1.433	73.724	245.660	3.068	2.220	27.380	4.856	52.126	220.020	3.179	2.050	29.040	1.754	69.170	381.190	3.347	1.850						
25.760	1.370	71.061	239.560	3.065	2.150	27.400	4.601	60.904	63.730	3.188	2.030	29.060	1.808	67.615	224.900	3.363	1.950						
25.780	1.329	65.621	235.890	3.082	2.100	27.420	3.718	51.571	58.850	3.202	2.090	29.080	1.776	72.170	235.890	3.357	2.010						
25.800	1.288	62.958	232.230	3.066	2.200	27.440	2.792	47.459	53.960	3.177	2.040	29.100	1.733	75.837	243.220	3.359	1.980						
25.820	1.245	58.514	226.120	3.065	2.240	27.460	2.026	51.015	102.800	3.174	2.120	29.120	1.659	80.503	237.110	3.365	2.030						
25.840	1.205	53.188	223.680	3.066	2.250	27.480	1.782	54.571	321.360	3.196	2.110	29.140	1.616	82.059	235.890	3.357	2.100						
25.860	1.173	50.077	221.240	3.082	2.310	27.500	1.803	53.793	372.640	3.189	2.120	29.160	1.563	82.059	243.220	3.365	2.060						
25.880	1.154	44.303	220.020	3.081	2.250	27.520	1.835	54.571	399.510	3.171	2.120	29.180	1.584	79.837	261.530	3.357	1.980						
25.900	1.134	39.196	218.800	3.062	2.190	27.540	1.899	52.793	415.380	3.193	2.080	29.200	1.616	75.726	270.080	3.370	2.000						
25.920	1.144	34.863	217.580	3.055	2.220	27.560	1.941	48.015	432.470	3.171	2.110	29.220	1.627	68.837	279.850	3.357	2.030						
25.940	1.237	26.706	459.340	3.053	7.540	27.580	1.973	43.126	450.790	3.189	2.130	29.240	1.659	63.392	282.290	3.357	2.010						
25.960	1.237	28.595	447.130	3.049	2.040	27.600	1.963	37.793	463.000	3.172	2.120	29.260	1.657	61.944	287.170	3.366	2.020						
25.980	1.194	28.817	436.140	3.059	1.980	27.620	1.941	36.348	466.660	3.186	2.100	29.280	1.668	60.833	292.060	3.381	2.010						
26.000	1.162	28.261	442.240	3.057	2.030	27.640	1.846	37.015	470.320	3.189	2.150	29.300	1.679	60.166	298.160	3.373	1.960						
26.020	1.130	27.817	447.130	3.051	2.020	27.660	1.782	36.571	466.660	3.189	2.160	29.320	1.721	60.722	307.930	3.378	2.070						
26.040	1.130	26.483	456.890	3.081	2.090	27.680	1.729	41.904	464.220	3.204	2.200	29.340	1.785	60.944	318.920	3.370	2.060						
26.060	1.120	25.372	463.000	3.055	2.120	27.700	1.686	40.904	476.430	3.189	2.200	29.360	1.849	60.833	332.350	3.378	2.090						
26.080	1.120	24.928	466.660	3.065	2.080	27.720	1.771	35.571	505.730	3.202	2.170	29.380	1.920	61.047	345.780	3.365	2.040						
26.100	1.088	24.150	471.550	3.061	2.030	27.740	1.909	34.571	530.150	3.202	2.190	29.400	2.016	61.936	364.100	3.373	1.990						
26.120	1.120	22.150	486.200	3.081	2.030	27.760	2.026	36.459	550.910	3.210	2.160	29.420	2.186	60.491	386.080	3.382	1.970						
26.140	1.194	21.150	504.510	3.078	2.060	27.780	2.069	38.015	565.560	3.194	2.160	29.440	2.357	60.158	409.270	3.397	2.050						
26.160	1.301	20.595	526.490	3.077	2.040	27.800	2.080	38.793	569.230	3.193	2.230	29.460	2.474	60.380	426.370	3.393	2.010						
26.180	1.375	21.817	543.580	3.076	2.070	27.820	2.080	40.793	560.680	3.211	2.130	29.480	2.399	63.936	408.050	3.378	2.050						
26.200	1.535	23.039	574.110	3.062	2.050	27.840	2.037	44.571	550.910	3.227	2.110	29.500	2.272	66.269	386.080	3.393	1.990						
26.220	1.630	24.150	597.310	3.077	2.020	27.860	1.964	47.575	542.360	3.211	2.160	29.520	2.123	63.491	366.540	3.402	2.060						
26.240	1.694	24.928	605.860	3.076	2.120	27.880	1.879	49.130	528.930	3.197	2.220	29.540	2.089	64.154	377.530	3.410	2.070						
26.260	1.726	27.261	619.290	3.074	2.130	27.900	1.773	50.241	505.730	3.210	2.250	29.560	2.303	63.158	416.600	3.418	2.080						
26.280	1.834	26.710	654.700	3.077	2.110	27.920	1.719	52.575	505.730	3.229	2.310	29.580	2.623	62.603	458.110	3.410	2.070						
26.300	1.919	28.599	658.360	3.077	2.080	27.940	1.730	55.019	517.940	3.235	2.230	29.600	2.867	68.936	461.780	3.409	2.030						
26.320	2.036	32.043	646.150	3.077	2.050	27.960	1.773	57.019	535.040	3.213	2.170	29.620	2.729	68.380	422.710	3.407	2.070						

Pergeo S.r.l. Via Dell'Artigianato, 2 44030 Ro Ferrarese (FE) tel. 0532/426021 fax. 0532/426521

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SCPTU 3

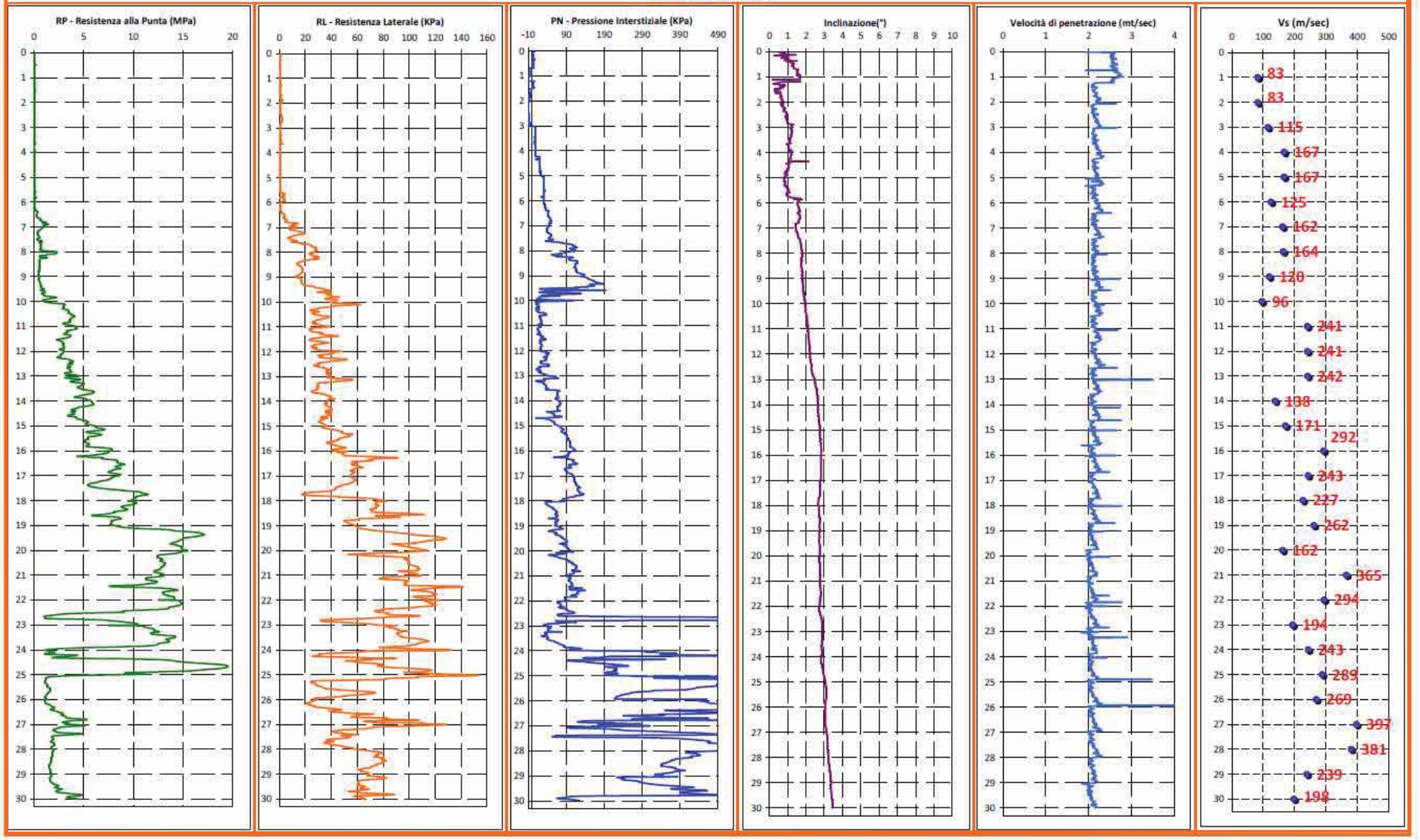
Committente: Comune di Ravenna
Cantiere:Piazzale Kennedy (RA)
Data: 22/03/2013

ID Prova: SCPTU 3
Profondita falda: mt 2 da p.c.
Preforo:1,20 mt scavo + fino a mt 7,00 di dpsh

Profondità massima raggiunta: 30,00 mt
Punta sismica: Tecnopenta G1-CPL2IN - SISMI
n° Dissipazioni eseguite: 0

Prova eseguita da:
Pergeo S.r.l.
via dell'artigianato,2 44130 - Ro Ferrarese
www.pergeo.it - info @pergeo.it
Dir.del Laboratorio: Dr.Geol.M.Condotta
Sperimentatore: Dr.Geol. F. Zanella

GRAFICI PROVA SCPTU 3



Pergeo S.r.l. Via Dell'Artigianato, 2 44030 Ro Ferrarese (FE) tel. 0532/426021 fax. 0532/426521

www.pergeo.it - info @pergeo.it

SCPTU 3

Committente: Comune di Ravenna
Cantiere:Piazzale Kennedy (RA)
Data: 22/03/2013

ID Prova: SCPTU 3
Profondita falda: mt 2 da p.c.
Preforo:1,20 mt scavo + fino a mt 7,00 di dpsh

Profondità massima raggiunta: 30,00 mt
Punta sismica: Tecnopenta G1-CPL2IN - SISMI
n° Dissipazioni eseguite: 0

Prova eseguita da:
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Dir.del Laboratorio: Dr.Geol.M.Condotta
Sperimentatore: Dr.Geol. F. Zanella

Vs 30 e ANAGRAFICA PROVA SCPTU 3

prof. (p)	prof.(cs)	Dist (L)	Tempo (t)	VsP	L2-L1	t2-t1	VsL			Vs30
m	m	m	sec	m/sec	m	sec	m/sec			
0.00										
1.00		Vs ricavata con Nspt - N_{10} - (DPSH)					83	1.00	0.01205	
2.00		Vs ricavata con Nspt - N_{10} - (DPSH)					83	1.00	0.01205	
3.00		Vs ricavata con Nspt - N_{10} - (DPSH)					115	1.00	0.00870	
4.00		Vs ricavata con Nspt - N_{10} - (DPSH)					167	1.00	0.00599	
5.00		Vs ricavata con Nspt - N_{10} - (DPSH)					167	1.00	0.00599	
6.00		Vs ricavata con Nspt - N_{10} - (DPSH)					125	1.00	0.00800	
7.00		Vs ricavata con Nspt - N_{10} - (DPSH)					162	1.00	0.00617	
8.00	7.70	7.87	0.0482	164	7.87	0.0482	164	1.00	0.00612	
9.00	8.70	8.86	0.0564	157	0.98	0.0082	120	1.00	0.00836	
10.00	9.70	9.84	0.0666	148	0.98	0.0102	96	1.00	0.01041	
11.00	10.70	10.83	0.0707	153	0.99	0.0041	241	1.00	0.00415	
12.00	11.70	11.82	0.0748	158	0.99	0.0041	241	1.00	0.00414	
13.00	12.70	12.81	0.0789	162	0.99	0.0041	242	1.00	0.00414	
14.00	13.70	13.80	0.0861	160	0.99	0.0072	138	1.00	0.00724	
15.00	14.70	14.79	0.0919	161	0.99	0.0058	171	1.00	0.00585	
16.00	15.70	15.79	0.0953	166	0.99	0.0034	292	1.00	0.00342	
17.00	16.70	16.78	0.0994	169	0.99	0.0041	243	1.00	0.00412	
18.00	17.70	17.78	0.1038	171	1.00	0.0044	227	1.00	0.00441	
19.00	18.70	18.77	0.1076	174	1.00	0.0038	262	1.00	0.00382	
20.00	19.70	19.77	0.1137	174	1.00	0.0061	162	1.00	0.00617	
21.00	20.70	20.77	0.1165	178	1.00	0.0027	365	1.00	0.00274	
22.00	21.70	21.76	0.1199	182	1.00	0.0034	294	1.00	0.00340	
23.00	22.70	22.76	0.1250	182	1.00	0.0051	194	1.00	0.00516	
24.00	23.70	23.76	0.1291	184	1.00	0.0041	243	1.00	0.00411	
25.00	24.70	24.76	0.1326	187	1.00	0.0035	289	1.00	0.00347	
26.00	25.70	25.75	0.1363	189	1.00	0.0037	269	1.00	0.00371	
27.00	26.70	26.75	0.1388	193	1.00	0.0025	397	1.00	0.00252	
28.00	27.70	27.75	0.1414	196	1.00	0.0026	381	1.00	0.00263	
29.00	28.70	28.75	0.1456	197	1.00	0.0042	239	1.00	0.00418	
30.00	29.70	29.75	0.1506	197	1.00	0.0050	198	1.00	0.00505	
								30.00	0.16826	178

prof. (p): profondità piezocono

prof.(cs): profondità cono sismico

D1: distanza fra la sorgente del rumore S - geofono triassiale (L)

Tempo (t): tempo d'arrivo dell'onda a S

VsP: velocità del suono nel percorso fra S ed L - Vs puntuale alla profondità

Vsi: velocità del suono nel percorso fra S ed L

VsL: Vs per ogni livello (L2 - L1)/(t2 - t1)

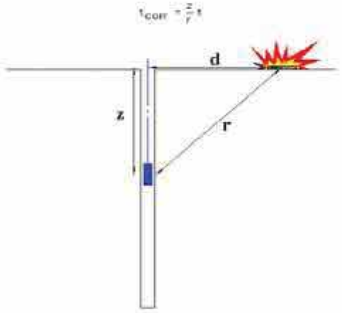

Figura 1 – Schema di down hole con metodo diretto

Coordinate geografiche:
Latitudine: 44.416860°
Longitudine: 12.197474°
Elevazione: 4-5 m

elletipi s.r.l.
Sede operativa ed amm.va: Via Annibale Zucchini, 69 - 44100
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P IVA e Codice Fiscale n. 00174600387

SCPTU2A

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Darsena - via Marani, Ravenna

PROT N° SCPTU 01 — PROF. FALDA (m da p.c.) 2.30 — TIPO PUNTA piezocono G1 - CPL2IN
DATA 30/06/11 — PREFORO (m da p.c.) 0.90 — Lat. 44.415157°
COMMESSA 9405/11 — C. SITO N°: S110092 — Long. 12.211598°

qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi
0.19	51.56	9.89	0.46	2.92	0.86	23.42	92.31	1.28	4.92	0.40	6.53	127.72	2.49	6.92	11.35	73.21	64.84	4.54	8.92	7.55	27.32	114.29	5.77
0.15	59.12	8.67	0.49	2.94	0.86	25.86	91.09	1.29	4.94	0.41	6.42	130.16	2.49	6.94	12.31	70.54	67.28	4.55	8.94	7.73	32.54	114.90	5.79
0.20	60.56	12.33	0.52	2.96	0.89	27.19	101.47	1.31	4.96	0.44	6.75	132.60	2.49	6.96	13.66	69.09	70.33	4.59	8.96	7.94	38.88	115.51	5.80
0.38	65.34	12.33	0.53	2.98	0.91	29.42	117.34	1.30	4.98	0.45	7.42	134.43	2.56	6.98	14.39	70.20	63.00	4.56	8.98	8.20	42.43	116.73	5.83
0.40	75.79	10.50	0.52	3.00	0.95	27.09	121.00	1.30	5.00	0.64	7.53	139.93	2.56	7.00	14.58	68.98	41.64	4.63	9.00	8.42	46.21	118.56	5.83
0.44	78.79	9.28	0.47	3.02	0.99	24.53	119.17	1.37	5.02	2.21	7.64	155.19	2.55	7.02	14.48	70.31	34.31	4.62	9.02	8.49	49.10	119.78	5.85
4.24	44.95	0.73	0.48	3.04	0.99	25.64	117.95	1.32	5.04	4.81	9.64	133.21	2.57	7.04	14.12	68.08	36.75	4.63	9.04	8.46	50.99	120.39	5.85
4.04	54.61	0.73	0.42	3.06	0.94	23.53	116.12	1.34	5.06	5.90	10.08	115.51	2.57	7.06	13.58	67.64	38.58	4.63	9.06	8.28	53.54	119.78	5.86
3.95	58.50	1.95	0.52	3.08	0.87	25.76	110.01	1.37	5.08	6.11	9.53	113.68	2.58	7.08	12.80	71.41	40.42	4.66	9.08	8.06	56.10	119.17	5.86
4.18	53.17	1.95	0.48	3.10	0.86	31.20	106.96	1.40	5.10	6.05	8.97	111.23	2.57	7.10	11.83	79.30	41.03	4.67	9.10	7.78	58.54	118.56	5.86
4.45	55.50	3.17	0.49	3.12	0.84	36.65	105.74	1.38	5.12	5.97	11.08	109.40	2.58	7.12	11.22	84.63	42.86	4.71	9.12	7.53	59.54	117.95	5.90
4.46	54.95	1.95	0.53	3.14	0.84	41.54	106.96	1.39	5.14	5.90	13.08	107.57	2.59	7.14	10.75	91.51	44.08	4.71	9.14	7.24	60.43	117.34	5.91
4.47	54.39	0.73	0.56	3.16	0.83	44.88	106.96	1.41	5.16	5.40	16.86	102.08	2.60	7.16	9.68	82.68	55.68	4.72	9.16	6.80	51.53	114.90	5.92
4.07	84.94	3.17	0.42	3.18	0.79	45.55	106.96	1.45	5.18	4.57	19.75	91.09	2.60	7.18	9.46	86.13	53.85	4.73	9.18	6.68	51.64	111.84	5.92
4.20	96.28	3.17	0.48	3.20	0.73	38.04	89.26	1.42	5.20	4.00	27.31	84.37	2.62	7.20	9.03	87.02	53.24	4.76	9.20	6.43	52.19	109.40	5.93
4.33	107.61	3.17	0.54	3.22	0.73	35.26	89.87	1.41	5.22	3.63	33.75	79.49	2.63	7.22	8.59	87.79	52.63	4.72	9.22	6.11	53.08	106.96	5.91
4.46	118.94	3.17	0.60	3.24	0.73	32.82	91.09	1.45	5.24	3.37	38.42	75.82	2.63	7.24	8.55	84.13	52.63	4.76	9.24	5.80	52.42	104.52	5.96
4.48	130.05	3.79	0.53	3.26	0.71	31.48	95.36	1.45	5.26	3.80	45.20	77.66	2.66	7.26	8.93	80.68	53.85	4.79	9.26	5.54	51.64	103.91	5.97
4.58	150.39	3.79	0.59	3.28	0.71	30.59	103.30	1.46	5.28	4.41	55.31	79.49	2.66	7.28	10.01	72.46	55.68	4.80	9.28	5.30	49.97	102.08	5.98
4.49	168.50	3.79	0.57	3.30	0.71	29.15	122.22	1.47	5.30	5.33	53.53	73.99	2.68	7.30	10.78	65.24	56.90	4.80	9.30	4.92	49.31	100.24	5.98
4.35	175.94	3.79	0.55	3.32	0.74	26.93	128.33	1.47	5.32	5.92	45.64	70.94	2.70	7.32	10.97	60.12	56.90	4.80	9.32	4.52	49.19	98.41	5.98
4.46	189.49	3.79	0.57	3.34	0.71	24.82	124.66	1.49	5.34	6.27	41.31	72.16	2.69	7.34	10.61	59.34	55.68	4.80	9.34	4.29	49.08	97.19	6.02
4.62	217.72	1.34	0.60	3.36	0.69	22.94	118.56	1.48	5.36	6.51	35.31	73.38	2.71	7.36	10.02	60.01	55.07	4.81	9.36	4.34	48.53	99.02	6.02
4.49	217.05	1.10	0.56	3.38	0.63	22.82	116.12	1.51	5.38	6.52	30.97	73.99	2.69	7.38	9.86	57.34	55.07	4.85	9.38	4.65	47.97	102.69	6.00
4.51	233.71	2.32	0.57	3.40	0.58	23.27	111.84	1.55	5.40	6.55	29.31	72.16	2.71	7.40	9.97	56.90	55.68	4.87	9.40	4.86	46.53	103.91	6.03
4.53	250.38	3.55	0.58	3.42	0.62	23.82	111.23	1.51	5.42	6.21	27.86	72.16	2.69	7.42	10.03	59.11	57.51	4.88	9.42	4.81	45.53	91.09	6.04
4.50	255.60	3.55	0.62	3.44	0.60	25.83	110.62	1.55	5.44	6.21	31.63	72.77	2.69	7.44	9.89	62.11	56.29	4.87	9.44	4.71	42.86	61.78	6.04
4.39	260.15	3.55	0.58	3.46	0.58	27.61	113.68	1.56	5.46	5.96	30.96	71.55	2.62	7.46	9.81	64.45	53.24	4.88	9.46	4.54	39.53	33.70	6.09
4.42	273.93	4.77	0.58	3.48	0.59	27.94	115.51	1.54	5.48	6.32	30.19	69.11	2.67	7.48	9.75	64.56	54.46	4.90	9.48	4.07	35.52	36.75	6.08
4.25	278.26	5.99	0.63	3.50	0.58	27.16	117.95	1.54	5.50	6.04	28.96	70.33	2.66	7.50	9.37	62.55	53.85	4.91	9.50	3.30	23.52	36.75	6.05
4.04	282.92	7.21	0.64	3.52	0.60	24.61	122.22	1.61	5.52	5.39	42.41	68.50	2.67	7.52	9.03	60.55	53.24	4.92	9.52	2.46	25.08	36.75	6.08
3.89	272.25	7.21	0.61	3.54	0.64	22.72	127.72	1.56	5.54	5.15	36.96	68.50	2.66	7.54	8.62	61.22	52.63	4.94	9.54	1.89	31.19	36.75	6.10
3.75	272.02	7.21	0.62	3.56	0.69	22.72	129.55	1.60	5.56	5.02	33.85	68.50	2.67	7.56	8.10	61.44	51.40	4.94	9.56	2.12	42.63	40.42	6.10
3.64	285.57	7.21	0.63	3.58	0.70	23.28	130.16	1.59	5.58	4.97	30.30	68.50	2.66	7.58	7.61	61.88	50.79	4.96	9.58	3.17	52.74	51.40	6.13
3.56	283.79	7.21	0.66	3.60	0.65	24.05	131.38	1.58	5.60	4.98	27.85	69.11	2.70	7.60	7.12	63.88	50.18	4.98	9.60	3.33	56.08	16.00	6.13
3.50	294.90	7.21	0.69	3.62	0.63	24.39	129.55	1.61	5.62	5.08	20.40	69.72	2.70	7.62	6.60	65.10	48.96	4.98	9.62	2.66	56.19	7.45	6.14
3.41	287.56	6.60	0.65	3.64	0.64	24.84	128.94	1.62	5.64	4.86	21.51	69.11	2.73	7.64	6.08	63.22	48.35	4.99	9.64	2.46	60.30	17.22	6.15
3.33	289.44	3.55	0.68	3.66	0.65	25.95	128.33	1.67	5.66	4.95	14.85	69.72	2.76	7.66	5.72	60.66	47.74	5.03	9.66	3.04	68.07	20.88	6.16
3.28	291.33	1.95	0.67	3.68	0.66	27.51	125.89	1.68	5.68	5.43	13.74	70.33	2.82	7.68	5.14	58.22	46.52	5.03	9.68	3.99	81.74	23.93	6.18
3.21	288.21	5.62	0.71	3.70	0.69	27.84	122.83	1.67	5.70	6.01	19.40	70.94	2.83	7.70	4.34	54.77	44.69	5.00	9.70	4.86	74.29	6.84	6.20
3.19	286.55	6.23	0.73	3.72	0.66	28.40	121.00	1.72	5.72	6.01	16.07	69.72	2.86	7.72	3.51	52.32	42.25	5.02	9.72	5.41	70.29	5.62	6.22
3.11	277.65	5.62	0.73	3.74	0.64	28.29	120.39	1.73	5.74	6.08	23.73	67.28	2.87	7.74	2.76	48.66	39.80	5.03	9.74	5.93	69.07	8.67	6.22
3.05	259.54	5.01	0.73	3.76	0.63	27.84	114.90	1.70	5.76	6.11	31.40	66.67	2.91	7.76	2.33	47.10	38.58	5.06	9.76	6.54	57.07	11.11	6.22
2.97	246.87	3.79	0.76	3.78	0.63	28.40	112.45	1.69	5.78	7.61	94.73	177.78	3.08	7.78	2.19	47.21	38.58	5.06	9.78	6.76	52.73	8.67	6.27
2.91	240.99	3.17	0.77	3.80	0.59	30.18	111.23	1.74	5.80	13.69	173.06	64.22	3.61	7.80	2.36	47.21	39.19	5.06	9.80	6.54	49.07	5.62	6.27
2.79	232.32	4.40	0.78	3.82	0.58	30.96	110.62	1.76	5.82	12.54	150.72	26.37	3.74	7.82	2.62	47.43	38.58	5.09	9.82	6.19	39.84	6.23	6.28
2.70	220.65	6.84	0.80	3.84	0.55	30.85	110.01	1.72	5.84	10.89	132.61	2.56	3.79	7.84	2.80	44.65	23.32	5.09	9.84	5.97	28.40	8.06	6.30
2.61	211.65	5.62	0.78	3.86	0.54	30.96	110.01	1.81	5.86	8.43	148.26	5.01	3.83	7.86	2.33	42.32	12.33	5.09	9.86	5.87	25.18	9.28	6.30
2.52	196.32	4.40	0.81	3.88	0.53	30.40	110.01	1.78	5.88	7.48	165.15	6.84	3.88	7.88	1.90	40.07	8.06	5.12	9.88	5.62	24.84	9.89	6.33
2.39	193.65	3.79	0.87	3.90	0.52	29.85	110.01	1.76	5.90	6.68	168.15	8.06	3.94	7.90	1.50	35.65	8.06	5.12	9.90	5.25	26.28	10.50	6.33
2.23	190.77	1.95	0.84	3.92	0.41	23.01	93.52	1.78	5.92	6.33	161.82	9.89	3.95	7.92	1.32	28.99	9.28	5.12	9.92	5.01	31.28	11.72	6.35
2.09	185.88	1.34	0.84	3.94	0.41	20.57	94.75	1.79	5.94	6.08	129.71	11.72	3.97	7.94	1.13	32.32	9.28	5.16	9.94	4.92	33.17	12.33	6.35
1.98	175.77	1.34	0.89	3.96	0.41	18.12	95.97	1.80	5.96	5.90	97.70	14.16	4.01	7.96	0.93	32.65	10.50	5.17	9.96	4.97	32.17	14.16	6.34
1.87	165.55	2.56	0.87	3.98	0.39	16.23	97.80	1.83	5.98	5.79	61.36	16.00	3.99	7.98	0.79	31.21	18.44	5.15	9.98	5.22	33.84	16.00	6.35
1.75	156.00	4.40	0.90	4.00	0.39	15.12	98.41	1.84	6.00	5.72	34.70	17.22	4.01	8.00	0.67	33.32	34.31	5.18	10.00	5.56	34.28	17.83	6.34
1.65	128.48	12.33	0.81	4.02	0.37	9.29	81.93	1.88	6.02	5.16	14.93	9.28	3.94	8.02	0.62	34.54	62.39	5.20	10.02	5.47	30.00	58.12	6.35
1.60	121.25	7.45	0.81	4.04	0.37	7.74	81.93	1.89	6.04	5.14	14.70	9.89	3.94	8.04	0.66	33.33	58.73	5.17	10.04	5.77	32.00	58.12	6.35
1.49	113.25	5.62	0.82	4.06	0.38	7.07	82.54	1.93	6.06	5.31	14.81	11.72	3.98	8.06	0.70	32.78	83.15	5.18	10.06	5.95	33.34	58.73	6.38
1.42	108.81	5.62	0.84	4.08	0.40	6.40	83.15	1.98	6.08	5.31	15.04	11.72	3.99	8.08	0.84	31.44	94.14	5.20	10.08	5.73	34.45	58.73	6.35
1.36	108.70	5.62	0.86	4.10	0.61	8.29	84.98	1.90	6.10	5.38	19.15	12.33	3.98	8.10	0.96	31.55	103.91	5.22	10.10	5.61	34.45	59.34	6.40
1.31	104.92	5.62	0.88	4.12	0.59	8.62	75.82	1.89	6.12	5.68	24.26	13.55	3.98	8.12	1.00	32.55	56.90	5.22	10.12	5.27	37.11	59.95	6.39
1.29	98.92	6.23	0.84	4.14	0.51	9.18	70.94	1.94	6.14	5.74	24.70	14.16	3.97	8.14	0.85	31.89	44.69	5.22	10.14	5.58	38.34	62.39	6.42
1.25	95.81	15.38	0.89	4.16	0.44	11.40	72.16	1.94	6.16	5.83	30.14	15.38	3.96	8.16	0.77	32.44	9.89	5.24	10.16	6.09	41.11	64.84	6.40
1.19	87.92	18.44	0.88	4.18	0.45	9.18	78.88	1.91	6.18	6.21	30.25	17.22	3.95	8.18	0.73	34.89	3.79	5.24	10.18	7.04	44.89	67.28	6.42
1.14	76.81	18.44	0.92	4.20	0.50	8.29	83.76	1.99	6.20	6.78	38.59	19.05	3.98	8.20	0.85	34.89	102.08	5.24	10.20	7.87	51.56	64.22	6.42
1.11	73.14	17.83	0.89	4.22	0.58	7.62	88.64	1.96	6.22	8.97	44.48	19.66	4.02	8.22	1.38	33.66	130.77	5.26	10.22	8.09	54.78	16.61	6.45
1.01	70.47	18.44	0.94	4.24	0.98	7.51	94.75	2.00	6.24	10.43	32.59	24.54	4.01	8.24	1.97	31.22	100.24	5.27	10.24	7.93	52.56	8.67	6.46
0.94	69.36	25.15	0.93	4.26	1.37	8.74	80.10	1.99	6.26	10.08	22.15	28.82	4.05	8.26	2.08	32.55	31.87	5.29	10.26	7.46	49.44	13.55	6.46
0.96	95.59	23.32	0.95	4.28	1.05	7.63	63.61	2.00	6.28	9.73	28.37	26.37	4.06	8.28	1.55	28.33	20.27	5.30	10.28	7.12	46.89	16.00	6.48
0.90	105.48	23.32	0.96	4.30	0.79	6.74	59.95	2.01	6.30	9.86	34.71	29.43	4.10	8.30	1.18	26.00	18.44	5.32	10.30	7.04	45.00	19.05	6.50
0.83	98.14	23.93	0.99	4.32	0.62	8.85	58.73	2.03	6.32	9.21	35.70	27.59	4.16	8.32	0.97	27.00	16.00	5.32	10.32	7.02	43.11	21.49	6.52
0.70	72.48	25.15	0.99	4.34	0.56	12.85	61.17	2.07	6.34	8.00	36.26	25.76	4.19	8.34	1.18	24.22	47.74	5.33	10.34	7.08	41.22	23.93	6.52
0.64	64.48	28.82	0.99	4.36	0.64	14.29	72.77	2.10	6.36	7.25	35.70	26.37	4.19	8.36	1.30	25.33	33.09	5.35	10.36	7.00	41.66	26.37	6.54
0.66	68.70	36.14	1.00	4.38	0.86	12.96	81.32	2.11	6.38	7.32	40.47	28.21	4.23	8.38	1.14	31.55	23.32	5.39	10.38	7.00	39.89	28.21	6.54
0.67	63.70	50.79	1.01	4.40	0.96	12.29	77.66	2.10	6.40	7.54	39.91	30.04	4.25	8.40	1.03	31.33	18.44	5.41	10.40	6.99	43.33	30.04	6.54
0.67	55.04	52.01	1.03	4.42	0.81	14.52	67.89	2.10	6.42	7.79	33.25	32.48	4.20	8.42	0.94	28.44	25.15	5.40	10.42	6.93	45.11	31.87	6.58
0.67	46.15	50.18	1.04	4.44	0.62	13.29	66.06	2.16	6.44	8.01	35.14	33.70	4.25	8.44	0.94	24.44	74.60	5.41	10.44	6.93	47.22	33.09	6.59
0.62	41.04	50.18	1.00	4.46	0.51	11.74	66.06	2.13	6.46	8.15	38.03	35.53	4.28	8.46	1.23	19.88	56.29	5.44	10.46	6.84	48.55	34.92	6.60
0.58	31.48	49.57	1.05	4.48	0.45	12.52	72.16	2.15	6.48	8.62	42.36	37.36	4.27	8.48	1.41	22.99	26.37	5.45	10.48	6.80	49.77	36.14	6.60
0.54	23.15	48.96	1.06	4.50	0.52	10.41	84.98	2.18	6.50	8.83	38.58	39.19	4.31	8.50	1.12	25.22	6.23	5.48	10.50	6.76	49.88	37.36	6.60
0.54	20.93	52.01	1.07	4.52	0.71	10.41	90.48	2.25	6.52	8.78	46.02	41.03	4.29	8.52	0.75	25.77	2.32	5.49	10.52	6.85	48.43	39.19	6.63
0.67	16.59	60.56	1.08	4.54	0.69	9.96	86.81	2.23	6.54	8.88	53.47	42.25	4.29	8.54	0.49	29.66	26.37	5.48	10.54	6.94	47.87	41.03	6.63
0.76	12.04	58.73	1.07	4.56	0.62	7.74	69.11	2.26	6.56	9.48	59.58	44.69	4.31	8.56	0.49	25.99	94.14	5.51	10.56	7.02	48.21	42.25	6.65
0.73	9.93	55.68	1.07	4.58	0.46	11.41	59.95	2.28	6.58	10.47	60.91	47.74	4.31	8.58	0.66	22.77	111.23	5.54	10.58	7.02	50.21	43.47	6.69
0.69	8.71	53.85	1.12	4.60	0.40	14.30	68.50	2.27	6.60	11.37	66.68	48.96	4.30	8.60	0.78	20.21	117.95	5.54	10.60	7.12	49.87	44.08	6.67
0.74	7.71	56.90	1.11	4.62	0.40	14.08	80.10	2.28	6.62	11.75	70.68	47.13	4.32	8.62	0.88	18.99	103.30	5.57	10.62	7.27	48.65	41.03	6.69
0.72	5.04	39.80	1.16	4.64	0.40	13.30	88.03	2.31	6.64	12.03	68.35	46.52	4.32	8.64	1.13	21.66	118.56	5.57	10.64	7.31	47.76	39.80	6.72
0.49	6.15	31.87	1.16	4.66	0.40	13.19	92.31	2.31	6.66	12.51	67.23	47.13	4.35	8.66	1.50	17.77	74.60	5.58	10.66	7.27	47.53	41.64	6.72
0.47	16.16	30.65	1.11	4.68	0.40	13.19	96.58	2.33	6.68	13.24	67.79	48.96	4.36	8.68	1.38	18.10	53.24	5.59	10.68	7.23	46.76	42.86	6.72
0.48	16.50	50.79	1.19	4.70	0.39	11.19	99.63	2.33	6.70	13.93	68.68	52.01	4.39	8.70	1.03	18.10	29.43	5.60	10.70	7.13	46.08	42.25	6.76
0.50	15.50	62.39	1.18	4.72	0.39	7.97	102.69	2.37	6.72	13.96	69.90	54.46	4.39	8.72	0.73	19.10	23.32	5.60	10.72	7.03	44.53	44.08	6.76
0.50	14.84	61.78	1.18	4.74	0.38	5.74	105.13	2.39	6.74	13.18	71.56	55.07	4.41	8.74	1.07	17.77	113.06	5.65	10.74	6.88	45.08	45.91	6.77
0.57	14.18	62.39	1.17	4.76	0.39	5.19	106.35	2.38	6.76	12.13	77.56	55.07	4.43	8.76	3.12	16.54	150.31	5.68	10.76	6.81	48.08	47.13	6.78
0.60	11.40	70.94	1.19	4.78	0.40	5.19	109.40	2.40	6.78	11.36	85.67	55.07	4.43	8.78	4.84	13.66	119.17	5.68	10.78	6.76	50.97	48.35	6.81
0.71	8.96	78.88	1.17	4.80	0.39	5.62	112.45	2.41	6.80	10.95	89.67	56.29	4.46	8.80	5.42	13.54	116.73	5.70	10.80	6.71	49.97	49.57	6.81
0.77	8.41	81.32	1.19	4.82	0.43	5.75	114.90	2.43	6.82	10.84	89.67	58.12	4.48	8.82	5.75	15.88	109.40	5.71	10.82	6.65	48.52	50.18	6.81
0.78	8.19	79.49	1.22	4.84	0.45	6.74	119.78	2.44	6.84	11.04	88.77	59.95	4.49	8.84	5.99	17.88	110.62	5.72	10.84	6.48	47.19	51.40	6.85
0.80	10.63	77.66	1.22	4.86	0.44	6.97	122.83	2.44	6.86	11.37	86.66	63.00	4.50	8.86	6.35	20.21	112.45	5.72	10.86	6.40	44.74	52.01	6.85
0.86	15.41	80.71	1.28	4.88	0.41	7.19	123.44	2.44	6.88	11.47	83.11	64.22	4.49	8.88	6.89	23.54	114.90	5.73	10.88	6.29	41.63	53.24	6.88
0.87	20.86	92.31	1.25	4.90	0.41	7.08	125.89	2.48	6.90	11.22	78.66	64.84	4.53	8.90	7.29	25.43	115.51	5.76	10.90	5.95	40.85	53.85	6.88

Lo Sperimentatore:
dott. Massimo Romagnoli

Il Direttore Settore Prove in Sito:
dott. geol. Gianluca Ferioli

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P IVA e Codice Fiscale n. 00174600387

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Darsena - via Marani, Ravenna

CPT N° SCPTU 01 | PROF. FALDA (m da p.c.) 2.30 | TIPO PUNTA piezocono G1 - CPL2IN
DATA 30/06/11 | PREFORO (m da p.c.) 0.90 | Lat. 44.415157°
COMMESSA 9405/11 | C. SITO N°: S110092 | Long. 12.211598°

prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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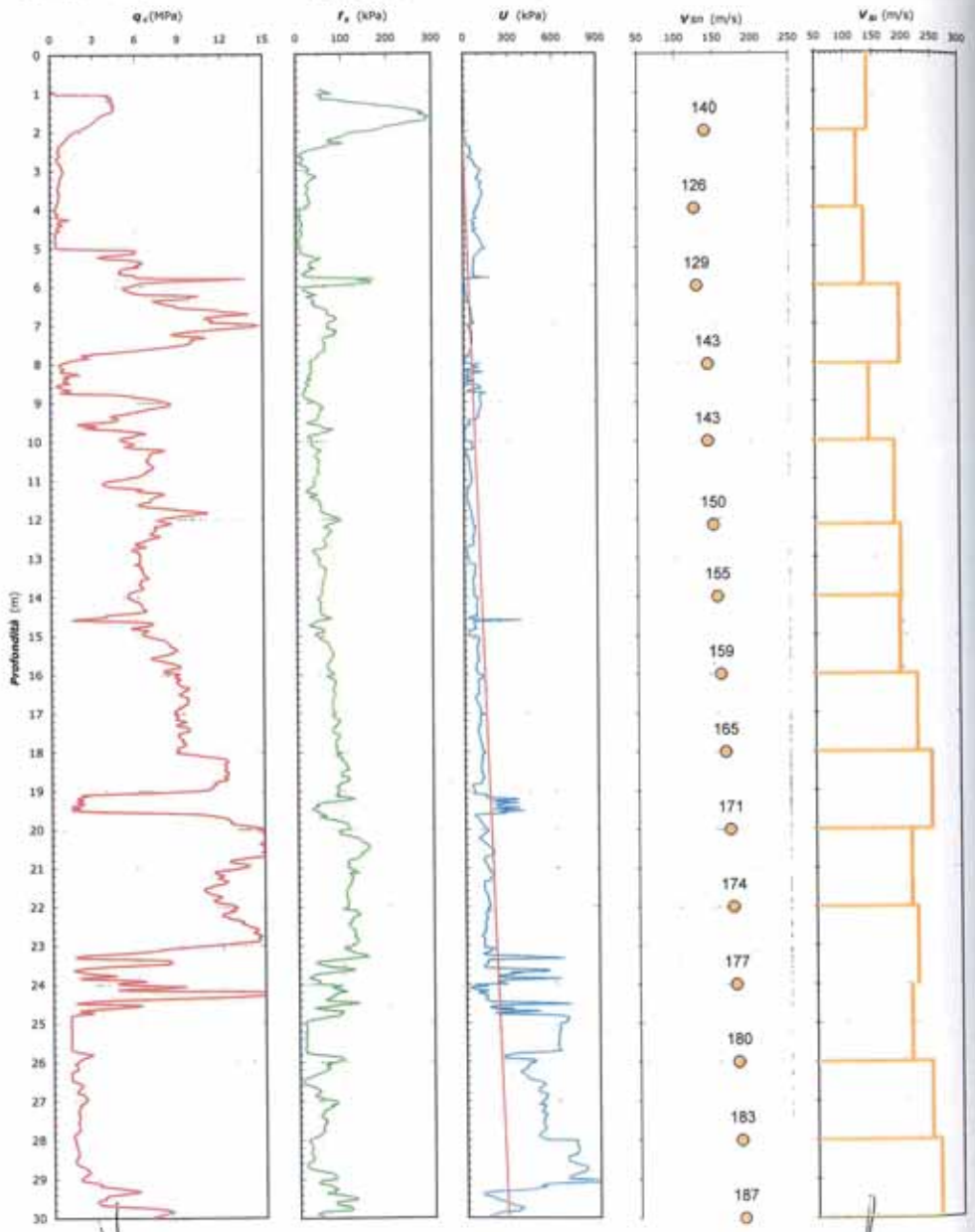
DATA	30/06/11	PREFORO (m da p.c.)	0.90	Lat.	44.415157°
COMMESSA	9405/11	C. SITO N°:	S110092	Long.	12.211598°



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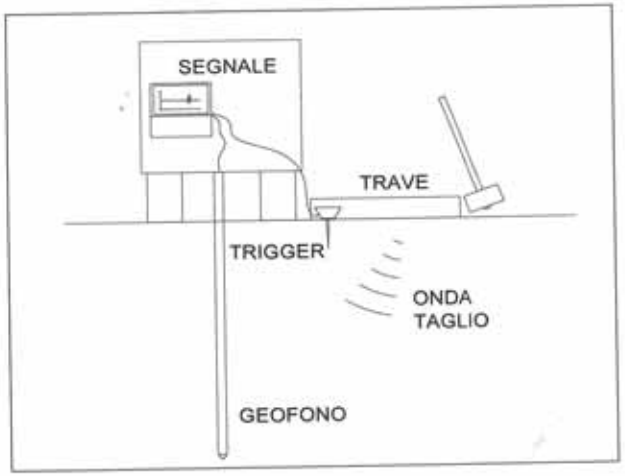
AZIENDA CON SISTEMA DI GESTIONE INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001:2000
UNI EN ISO 14001

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Darsena - via Marani, Ravenna

CPT N°	SCPTU 01	PROF. FALDA (m da p.c.)	2.30	TIPO PUNTA	piezocono G1 - CPL2IN
DATA	30/06/11	PREFORO (m da p.c.)	0.90	Lat.	44.415157°
COMMESSA	9405/11	C. SITO N°:	S110092	Long.	12.211598°



Profondità (m)	Ts (s)	L (m)	Vs (m/s)	Vis (m/s)
1.02	T0	1.43	-	-
2.00	5.77	2.23	140	140
4.00	21.31	4.11	126	121
6.00	35.96	6.06	129	133
8.02	46.18	8.05	143	194
10.00	59.94	10.00	143	142
12.16	71.48	12.13	150	185
14.00	80.81	13.95	155	195
16.00	91.02	15.92	159	193
18.00	99.90	17.89	165	222
20.00	107.89	19.86	171	246
22.00	117.22	21.83	174	211
24.00	126.10	23.79	177	221
26.00	135.42	25.75	180	210
28.00	143.41	27.70	183	245
30.00	150.96	29.66	187	259

CATEGORIA SOTTOSUOLO
C
$V_{s,30}$ = 187 m/s

D = Distanza centro trave generatrice ond
Profondità = Profondità punta da piano campagna
Ts = Tempo percorrenza onda di taglio
L = Lunghezza percorso onda di taglio
Vs = Velocità onde di taglio da piano campagna alla profondità indi = 1.00 m
Vis = Velocità onde di taglio nello strato di terreno compreso fra le due profondità indicate

Lo Sperimentatore:
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CANTIERE Polisportivo Darsena - via Marani, Ravenna

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DATA	30/06/11	PREFORO (m da p.c.)	0.90	Lat.	44.415157°
COMMESSA	9405/11	C. SITO N°:	S110092	Long.	12.211598°

UBICAZIONE

Località: Polisportivo Darsena - via Marani, Ravenna

Lo Sperimentatore:
dott. Massimo Romagnoli

Il Direttore Settore Prove in Sito:
dott. geol. Gianluca Ferioli

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COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Darsena - via Marani, Ravenna

CPT N°	SCPTU 01	PROF. FALDA (m da p.c.)	2.30	TIPO PUNTA	piezocono G1 - CPL2IN
DATA	30/06/11	PREFORO (m da p.c.)	0.90	Lat.	44.415157°
COMMESSA	9405/11			Long.	12.211598°

Prof. (m) da	a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{v0} (kg/cm²)	C_u media (kg/cm²)	ϕ' (1) (gradi)	ϕ (2) (gradi)
0.00	1.02	0.51	1.02	torbe	2.8751901	0.7-1.3	0.13	0.2	-	-
1.02	1.16	1.09	0.14	sabbie limose	41.7	1.3-1.8	0.16	-	41	35
1.16	1.30	1.23	0.14	limi e limi sabbiosi	42.9	1.3-1.8	0.18	2.8	41	34
1.30	1.40	1.35	0.10	limi argillosi e argille limose	44.0	1.3-1.8	0.20	2.9	-	-
1.40	1.46	1.43	0.06	argille	43.9	0.7-1.3	0.21	2.9	-	-
1.46	2.46	1.96	1.00	torbe	20.9	0.4-0.8	0.39	1.4	-	-
2.46	2.52	2.49	0.06	argille	5.4	0.4-0.8	0.38	0.3	-	-
2.52	2.54	2.53	0.02	limi argillosi e argille limose	6.6	0.8-1.1	0.38	0.4	-	-
2.54	2.66	2.60	0.12	limi e limi sabbiosi	6.7	0.8-1.1	0.40	0.4	<32	22
2.66	2.70	2.68	0.04	argille	4.7	0.4-0.8	0.40	0.3	-	-
2.70	2.78	2.74	0.08	limi argillosi e argille limose	5.3	0.8-1.1	0.41	0.3	-	-
2.78	2.88	2.83	0.10	limi e limi sabbiosi	7.7	0.8-1.1	0.42	0.5	<32	23
2.88	3.10	2.99	0.22	limi argillosi e argille limose	8.9	0.8-1.1	0.45	0.6	-	-
3.10	3.30	3.20	0.20	argille	7.5	0.4-0.8	0.47	0.5	-	-
3.30	3.36	3.33	0.06	limi argillosi e argille limose	7.0	0.8-1.1	0.47	0.4	-	-
3.36	3.54	3.45	0.18	argille	5.9	0.4-0.8	0.49	0.4	-	-
3.54	3.58	3.56	0.04	limi argillosi e argille limose	6.9	0.8-1.1	0.49	0.4	-	-
3.58	4.00	3.79	0.42	argille	5.5	0.4-0.8	0.54	0.3	-	-
4.00	4.08	4.04	0.08	limi argillosi e argille limose	3.7	0.8-1.1	0.53	0.2	-	-
4.08	4.12	4.10	0.04	limi e limi sabbiosi	5.9	0.8-1.1	0.53	0.3	<32	19
4.12	4.20	4.16	0.08	limi argillosi e argille limose	4.7	0.8-1.1	0.54	0.3	-	-
4.20	4.24	4.22	0.04	limi e limi sabbiosi	7.6	0.8-1.1	0.55	0.5	<32	20
4.24	4.26	4.25	0.02	sabbie limose	13.5	0.8-1.1	0.55	-	<32	24
4.26	4.32	4.29	0.06	limi e limi sabbiosi	8.0	0.8-1.1	0.56	0.5	<32	21
4.32	4.36	4.34	0.04	limi argillosi e argille limose	5.9	0.8-1.1	0.56	0.3	-	-
4.36	4.42	4.39	0.06	limi e limi sabbiosi	8.6	0.8-1.1	0.57	0.5	<32	21
4.42	4.50	4.46	0.08	limi argillosi e argille limose	5.2	0.8-1.1	0.58	0.3	-	-
4.50	4.56	4.53	0.06	limi e limi sabbiosi	6.6	0.8-1.1	0.58	0.4	<32	19
4.56	4.58	4.57	0.02	limi argillosi e argille limose	4.5	0.8-1.1	0.58	0.2	-	-
4.58	4.68	4.63	0.10	argille	3.9	0.4-0.8	0.60	0.2	-	-
4.68	4.76	4.72	0.08	limi argillosi e argille limose	3.8	0.8-1.1	0.60	0.2	-	-
4.76	4.78	4.77	0.02	limi e limi sabbiosi	3.9	0.8-1.1	0.60	0.2	<32	16
4.78	4.80	4.79	0.02	limi argillosi e argille limose	3.8	0.8-1.1	0.61	0.2	-	-
4.80	4.82	4.81	0.02	limi e limi sabbiosi	4.2	0.8-1.1	0.61	0.2	<32	16
4.82	4.98	4.90	0.16	limi argillosi e argille limose	4.2	0.8-1.1	0.63	0.2	-	-
4.98	5.00	4.99	0.02	limi e limi sabbiosi	5.3	0.8-1.1	0.63	0.4	<32	18
5.00	5.02	5.01	0.02	sabbie limose	21.7	0.8-1.1	0.63	-	<32	25
5.02	5.18	5.10	0.16	sabbie	54.8	0.8-1.1	0.66	-	34	30
5.18	5.30	5.24	0.12	sabbie limose	40.1	0.8-1.1	0.67	-	32	28
5.30	5.76	5.53	0.46	sabbie	58.5	0.8-1.1	0.74	-	33	30
5.76	5.78	5.77	0.02	sabbie limose	74.6	0.8-1.1	0.72	-	35	31
5.78	5.84	5.81	0.06	sabbie	121.3	0.8-1.1	0.72	-	37	34
5.84	5.98	5.91	0.14	sabbie limose	65.4	0.8-1.1	0.74	-	34	30
5.98	7.62	6.80	1.64	sabbie	95.6	0.8-1.1	1.00	-	34	32
7.62	7.72	7.67	0.10	sabbie limose	48.6	0.8-1.1	0.94	-	<32	27
7.72	7.82	7.77	0.10	limi e limi sabbiosi	24.1	0.8-1.1	0.95	1.5	<32	23
7.82	7.84	7.83	0.02	sabbie limose	27.5	0.8-1.1	0.95	-	<32	24
7.84	7.92	7.88	0.08	limi e limi sabbiosi	17.3	0.8-1.1	0.96	1.1	<32	21
7.92	7.96	7.94	0.04	limi argillosi e argille limose	10.1	0.8-1.1	0.96	0.6	-	-
7.96	8.06	8.01	0.10	argille	6.7	0.4-0.8	0.97	0.3	-	-
8.06	8.14	8.10	0.08	limi argillosi e argille limose	8.9	0.8-1.1	0.98	0.5	-	-
8.14	8.20	8.17	0.06	argille	7.7	0.4-0.8	0.98	0.4	-	-
8.20	8.30	8.25	0.10	limi e limi sabbiosi	16.0	0.8-1.1	1.00	1.0	<32	21
8.30	8.32	8.31	0.02	limi argillosi e argille limose	9.5	0.8-1.1	1.00	0.5	-	-
8.32	8.36	8.34	0.04	limi e limi sabbiosi	12.1	0.8-1.1	1.00	0.7	<32	19

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P.IVA e Codice Fiscale n. 00174600387

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Darsena - via Marani, Ravenna

CPT N° SCPTU 01
DATA 30/06/11
COMMESSA 9405/11

PROF. FALDA (m da p.c.) 2.30
PREFORO (m da p.c.) 0.90

TIPO PUNTA piezocono G1 - CPL2IN
Lat. 44.415157°
Long. 12.211598°

Prof. (m) da	Prof. (m) a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{vo} (kg/cm²)	C_u media (kg/cm²)	Φ' (1) (gradi)	Φ (2) (gradi)
8.36	8.44	8.40	0.08	limi argillosi e argille limose	9.9	0.8-1.1	1.01	0.6	-	-
8.44	8.50	8.47	0.06	limi e limi sabbiosi	12.3	0.8-1.1	1.02	0.7	<32	15
8.50	8.52	8.51	0.02	limi argillosi e argille limose	7.4	0.8-1.1	1.02	0.4	-	-
8.52	8.54	8.53	0.02	torbe	4.8	0.4-0.8	1.02	0.2	-	-
8.54	8.56	8.55	0.02	argille	4.8	0.4-0.8	1.02	0.2	-	-
8.56	8.60	8.58	0.04	limi argillosi e argille limose	7.1	0.8-1.1	1.03	0.4	-	-
8.60	8.70	8.65	0.10	limi e limi sabbiosi	11.6	0.8-1.1	1.04	0.7	<32	19
8.70	8.72	8.71	0.02	limi argillosi e argille limose	7.2	0.8-1.1	1.04	0.4	-	-
8.72	8.74	8.73	0.02	limi e limi sabbiosi	10.5	0.8-1.1	1.04	0.6	<32	18
8.74	8.76	8.75	0.02	sabbie limose	30.6	0.8-1.1	1.04	-	<32	24
8.76	9.24	9.00	0.48	sabbie	69.5	0.8-1.1	1.12	-	<32	28
9.24	9.52	9.38	0.28	sabbie limose	43.7	0.8-1.1	1.14	-	<32	26
9.52	9.56	9.54	0.04	limi e limi sabbiosi	19.7	0.8-1.1	1.13	1.2	<32	21
9.56	9.60	9.58	0.04	sabbie limose	31.9	0.8-1.1	1.14	-	<32	24
9.60	9.68	9.64	0.08	limi e limi sabbiosi	29.8	0.8-1.1	1.15	1.9	<32	23
9.68	9.74	9.71	0.06	sabbie limose	53.0	0.8-1.1	1.16	-	<32	27
9.74	10.96	10.35	1.22	sabbie	63.6	0.8-1.1	1.35	-	<32	27
10.96	11.16	11.06	0.20	sabbie limose	39.7	0.8-1.1	1.32	-	<32	24
11.16	11.98	11.57	0.82	sabbie	75.9	0.8-1.1	1.44	-	<32	28
11.98	12.02	12.00	0.04	sabbie limose	74.3	0.8-1.1	1.41	-	<32	27
12.02	12.58	12.30	0.56	sabbie	72.7	0.8-1.1	1.50	-	<32	27
12.58	12.66	12.62	0.08	sabbie limose	59.4	0.8-1.1	1.48	-	<32	26
12.66	13.86	13.26	1.20	sabbie	62.3	0.8-1.1	1.67	-	<32	26
13.86	14.00	13.93	0.14	sabbie limose	54.2	0.8-1.1	1.64	-	<32	25
14.00	14.40	14.20	0.40	sabbie	61.6	0.8-1.1	1.69	-	<32	25
14.40	14.52	14.46	0.12	sabbie limose	42.0	0.8-1.1	1.69	-	<32	23
14.52	14.54	14.53	0.02	limi e limi sabbiosi	27.6	0.8-1.1	1.69	1.6	<32	21
14.54	14.58	14.56	0.04	limi argillosi e argille limose	17.4	0.8-1.1	1.70	1.0	-	-
14.58	14.60	14.59	0.02	limi e limi sabbiosi	25.5	0.8-1.1	1.70	1.5	<32	20
14.60	19.04	16.82	4.44	sabbie	91.1	0.8-1.1	2.41	-	<32	27
19.04	19.08	19.06	0.04	sabbie limose	52.1	0.8-1.1	2.20	-	<32	23
19.08	19.10	19.09	0.02	limi argillosi e argille limose	21.0	0.8-1.1	2.20	1.1	-	-
19.10	19.12	19.11	0.02	limi e limi sabbiosi	26.0	0.8-1.1	2.20	1.5	<32	19
19.12	19.14	19.13	0.02	limi argillosi e argille limose	22.8	0.8-1.1	2.21	1.3	-	-
19.14	19.16	19.15	0.02	argille	20.1	0.4-0.8	2.21	1.1	-	-
19.16	19.20	19.18	0.04	torbe	17.7	0.4-0.8	2.21	0.9	-	-
19.20	19.22	19.21	0.02	argille	21.2	0.4-0.8	2.21	1.2	-	-
19.22	19.28	19.25	0.06	limi argillosi e argille limose	19.7	0.8-1.1	2.22	1.1	-	-
19.28	19.36	19.32	0.08	limi e limi sabbiosi	20.3	0.8-1.1	2.23	1.1	<32	17
19.36	19.40	19.38	0.04	limi argillosi e argille limose	14.7	0.8-1.1	2.23	0.7	-	-
19.40	19.48	19.44	0.08	limi e limi sabbiosi	17.0	0.8-1.1	2.24	0.9	<32	16
19.48	19.50	19.49	0.02	limi argillosi e argille limose	14.3	0.8-1.1	2.24	0.7	-	-
19.50	19.52	19.51	0.02	limi e limi sabbiosi	23.7	0.8-1.1	2.25	1.3	<32	18
19.52	19.56	19.54	0.04	sabbie limose	42.4	0.8-1.1	2.25	-	<32	21
19.56	23.08	21.32	3.52	sabbie	128.1	0.8-1.1	2.82	-	<32	27
23.08	23.18	23.13	0.10	sabbie limose	66.6	0.8-1.1	2.66	-	<32	23
23.18	23.22	23.20	0.04	limi e limi sabbiosi	45.3	0.8-1.1	2.66	2.7	<32	21
23.22	23.24	23.23	0.02	argille	27.7	0.4-0.8	2.66	1.5	-	-
23.24	23.32	23.28	0.08	torbe	18.1	0.4-0.8	2.67	0.9	-	-
23.32	23.34	23.33	0.02	limi e limi sabbiosi	38.4	0.8-1.1	2.67	2.2	<32	20
23.34	23.36	23.35	0.02	sabbie limose	64.6	0.8-1.1	2.67	-	<32	23
23.36	23.50	23.43	0.14	sabbie	78.0	0.8-1.1	2.69	-	<32	24
23.50	23.54	23.52	0.04	sabbie limose	43.9	0.8-1.1	2.69	-	<32	21
23.54	23.56	23.55	0.02	limi e limi sabbiosi	28.1	0.8-1.1	2.70	1.6	<32	18
23.56	23.58	23.57	0.02	limi argillosi e argille limose	22.3	0.8-1.1	2.70	1.2	-	-

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P.IVA e Codice Fiscale n. 00174600387

AZIENDA CON SISTEMA DI GESTIONE INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Darsena - via Marani, Ravenna

CPT N° SCPTU 01
DATA 30/06/11
COMMESSA 9405/11

PROF. FALDA (m da p.c.) 2.30
PREFORO (m da p.c.) 0.90

TIPO PUNTA piezocono G1 - CPL2IN
Lat. 44.415157°
Long. 12.211598°

Prof. (m) da	Prof. (m) a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{vo} (kg/cm²)	C_u media (kg/cm²)	Φ' (1) (gradi)	Φ (2) (gradi)
23.58	23.64	23.61	0.06	torbe	15.9	0.4-0.8	2.70	0.7	-	-
23.64	23.66	23.65	0.02	argille	16.7	0.4-0.8	2.70	0.8	-	-
23.66	23.68	23.67	0.02	limi argillosi e argille limose	20.3	0.8-1.1	2.71	1.0	-	-
23.68	23.72	23.70	0.04	limi e limi sabbiosi	24.2	0.8-1.1	2.71	1.3	<32	17
23.72	23.82	23.77	0.10	sabbie limose	34.7	0.8-1.1	2.73	-	<32	19
23.82	23.84	23.83	0.02	limi e limi sabbiosi	18.3	0.8-1.1	2.72	0.9	<32	16
23.84	23.88	23.86	0.04	sabbie limose	34.8	0.8-1.1	2.73	-	<32	19
23.88	23.94	23.91	0.06	sabbie	61.4	0.8-1.1	2.74	-	<32	22
23.94	24.02	23.98	0.08	sabbie limose	49.9	0.8-1.1	2.75	-	<32	21
24.02	24.10	24.06	0.08	sabbie	81.7	0.8-1.1	2.76	-	<32	24
24.10	24.16	24.13	0.06	sabbie limose	52.0	0.8-1.1	2.76	-	<32	21
24.16	24.38	24.27	0.22	sabbie	129.5	0.8-1.1	2.79	-	<32	26
24.38	24.40	24.39	0.02	sabbie limose	48.8	0.8-1.1	2.79	-	<32	21
24.40	24.44	24.42	0.04	limi e limi sabbiosi	30.0	0.8-1.1	2.79	1.7	<32	18
24.44	24.46	24.45	0.02	argille	19.6	0.4-0.8	2.79	1.0	-	-
24.46	24.48	24.47	0.02	torbe	15.6	0.4-0.8	2.79	0.7	-	-
24.48	24.50	24.49	0.02	argille	23.6	0.4-0.8	2.80	1.2	-	-
24.50	24.62	24.56	0.12	sabbie limose	51.0	0.8-1.1	2.81	-	<32	21
24.62	24.66	24.64	0.04	limi e limi sabbiosi	25.1	0.8-1.1	2.82	1.3	<32	17
24.66	24.70	24.68	0.04	limi argillosi e argille limose	19.3	0.8-1.1	2.82	1.0	-	-
24.70	24.72	24.71	0.02	limi e limi sabbiosi	28.0	0.8-1.1	2.82	1.5	<32	18
24.72	24.76	24.74	0.04	limi argillosi e argille limose	22.9	0.8-1.1	2.83	1.2	-	-
24.76	24.78	24.77	0.02	argille	15.2	0.4-0.8	2.83	0.7	-	-
24.78	24.82	24.80	0.04	torbe	12.3	0.4-0.8	2.83	0.5	-	-
24.82	24.86	24.84	0.04	argille	12.2	0.4-0.8	2.83	0.5	-	-
24.86	24.90	24.88	0.04	limi argillosi e argille limose	12.5	0.8-1.1	2.84	0.5	-	-
24.90	25.70	25.30	0.80	limi e limi sabbiosi	12.3	0.8-1.1	2.97	0.5	<32	13
25.70	25.80	25.75	0.10	sabbie limose	20.8	0.8-1.1	2.94	-	<32	16
25.80	25.84	25.82	0.04	limi e limi sabbiosi	25.6	0.8-1.1	2.94	1.4	<32	17
25.84	25.90	25.87	0.06	limi argillosi e argille limose	21.8	0.8-1.1	2.95	1.1	-	-
25.90	26.00	25.95	0.10	argille	17.5	0.4-0.8	2.96	0.8	-	-
26.00	26.32	26.16	0.32	limi argillosi e argille limose	14.7	0.8-1.1	3.01	0.6	-	-
26.32	26.44	26.38	0.12	limi e limi sabbiosi	12.4	0.8-1.1	3.01	0.5	<32	13
26.44	26.60	26.52	0.16	sabbie limose	16.6	0.8-1.1	3.03	-	<32	14
26.60	26.74	26.67	0.14	limi e limi sabbiosi	17.8	0.8-1.1	3.05	0.8	<32	15
26.74	26.76	26.75	0.02	limi argillosi e argille limose	15.5	0.8-1.1	3.04	0.7	-	-
26.76	26.98	26.87	0.22	limi e limi sabbiosi	20.7	0.8-1.1	3.08	1.0	<32	15
26.98	27.30	27.14	0.32	limi argillosi e argille limose	18.5	0.8-1.1	3.12	0.9	-	-
27.30	27.44	27.37	0.14	limi e limi sabbiosi	17.6	0.8-1.1	3.13	0.8	<32	15
27.44	27.66	27.55	0.22	limi argillosi e argille limose	17.0	0.8-1.1	3.15	0.8	-	-
27.66	27.74	27.70	0.08	limi e limi sabbiosi	17.8	0.8-1.1	3.16	0.8	<32	15
27.74	27.92	27.83	0.18	limi argillosi e argille limose	14.9	0.8-1.1	3.18	0.6	-	-
27.92	28.58	28.25	0.66	limi e limi sabbiosi	15.4	0.8-1.1	3.28	0.6	<32	14
28.58	28.76	28.67	0.18	sabbie limose	19.3	0.8-1.1	3.27	-	<32	15
28.76	28.88	28.82	0.12	limi e limi sabbiosi	23.8	0.8-1.1	3.29	1.2	<32	16
28.88	29.02	28.95	0.14	limi argillosi e argille limose	19.9	0.8-1.1	3.30	0.9	-	-
29.02	29.08	29.05	0.06	limi e limi sabbiosi	22.3	0.8-1.1	3.30	1.1	<32	16
29.08	29.14	29.11	0.06	sabbie limose	31.4	0.8-1.1	3.31	-	<32	18
29.14	29.20	29.17	0.06	limi e limi sabbiosi	32.6	0.8-1.1	3.32	1.8	<32	18
29.20	29.40	29.30	0.20	sabbie limose	50.8	0.8-1.1	3.35	-	<32	20
29.40	29.70	29.55	0.30	limi e limi sabbiosi	34.3	0.8-1.1	3.39	1.9	<32	18
29.70	29.80	29.75	0.10	sabbie limose	68.1	0.8-1.1	3.39	-	<32	22
29.80	30.00	29.90	0.20	sabbie	75.1	0.8-1.1	3.41	-	<32	22

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P.IVA e Codice Fiscale n. 00174600387

Laboratorio aut. dal Ministero Infrastrutture e Trasporti D.P.R. n. 380/01 art. 59 com. 1 lett. a) Decr. n° 83362 del 06/06/2001

MMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
NTIERE Polisportivo Ponte Nuovo - Ravenna
' N° SCPTU 01 PROF. FALDA (m da p.c.) 1.20
TA 08/04/10 PREFORO (m da p.c.) TIPO PUNTA piezocono G1 - CPL2IN
MMESSA 8042/10 C. SITO N°: 572/10 del 28/04/10

qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.
Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi
0.29	14.17	31.26	0.83	15.20	14.70	89.41	85.70	10.16					
1.20	84.04	21.49	1.18	15.40	14.05	87.72	76.32	10.29					
1.57	147.45	32.26	1.61	15.60	13.13	84.61	76.49	10.47					
1.18	133.41	33.59	1.65	15.80	12.27	76.67	73.99	10.65					
0.68	82.37	35.31	1.66	16.00	10.25	68.80	114.06	10.78					
0.70	59.93	57.40	1.64	16.20	12.32	73.20	74.27	10.92					
0.81	55.01	73.61	1.64	16.40	13.24	81.48	58.56	11.12					
0.62	45.09	58.68	1.70	16.60	13.29	84.14	67.83	11.27					
0.47	28.31	65.56	1.76	16.80	12.26	94.06	92.97	11.45					
0.68	27.35	80.21	1.81	17.00	11.42	78.46	152.80	11.63					
0.62	44.70	69.33	1.87	17.20	12.39	90.33	149.58	11.82					
0.61	28.31	79.38	1.86	17.40	12.50	88.88	128.33	11.98					
0.87	14.89	72.50	1.91	17.60	11.24	87.33	122.94	12.20					
0.91	11.79	82.15	1.92	17.80	14.22	89.84	139.54	12.37					
0.58	11.27	86.20	1.98	18.00	15.59	92.58	119.56	12.55					
0.49	8.63	93.70	2.04	18.20	16.34	114.15	93.92	12.73					
0.37	10.60	106.18	2.10	18.40	16.90	117.56	110.23	12.92					
0.43	11.22	101.63	2.16	18.60	17.51	125.63	123.89	13.11					
0.24	9.21	112.62	2.18	18.80	20.16	106.47	116.73	13.33					
0.26	11.30	129.38	2.21	19.00	20.61	64.92	144.87	13.62					
0.31	11.21	137.71	2.25	19.20	19.09	109.58	144.81	13.84					
0.34	11.32	140.48	2.32	19.40	15.53	98.02	81.26	14.04					
0.38	12.59	144.26	3.15	19.60	15.41	110.17	92.97	14.26					
0.44	8.44	153.25	2.47	19.80	18.98	107.23	75.38	14.43					
1.79	10.97	125.94	2.58	20.00	19.13	122.33	93.70	14.67					
3.58	16.14	64.34	2.66	20.20	16.59	128.51	84.21	14.91					
4.63	25.33	40.25	2.83	20.40	13.10	114.45	146.70	15.11					
3.48	25.28	25.21	2.89	20.60	6.21	123.86	41.92	15.28					
3.60	46.11	24.32	2.97	20.80	1.41	75.45	533.85	15.42					
4.53	41.48	46.63	3.12	21.00	0.99	34.45	404.93	15.51					
4.57	32.36	59.01	3.22	21.20	1.18	32.96	464.20	15.66					
3.85	32.42	56.34	3.37	21.40	1.11	53.15	350.48	15.78					
4.64	34.10	38.97	3.46	21.60	1.24	31.06	372.19	15.90					
5.49	35.29	57.23	3.59	21.80	1.68	43.15	276.25	16.02					
5.76	35.30	72.33	3.73	22.00	2.17	52.92	203.47	16.03					
6.33	35.80	53.40	3.81	22.20	1.85	42.03	487.29	16.14					
7.18	37.90	49.52	3.92	22.40	2.11	49.18	436.84	16.23					
7.72	41.87	55.85	4.07	22.60	1.39	38.36	486.63	16.36					
6.26	45.13	69.22	4.21	22.80	5.05	37.09	355.12	16.52					
6.02	37.43	101.69	4.34	23.00	8.11	37.15	202.53	16.66					
6.09	38.28	107.40	4.47	23.20	2.61	88.26	328.93	16.83					
6.23	38.97	77.32	4.60	23.40	1.22	42.36	614.77	16.95					
6.03	37.56	73.49	4.73	23.60	1.19	39.54	588.52	17.04					
9.37	43.57	50.19	4.96	23.80	1.09	30.25	590.19	17.16					
8.85	57.21	75.10	5.11	24.00	1.07	39.66	429.18	17.28					
6.38	51.95	60.40	5.23	24.20	1.21	47.06	441.50	17.37					
8.21	48.50	20.33	5.39	24.40	1.15	67.45	322.23	17.46					
9.58	49.03	35.64	5.55	24.60	0.97	68.68	332.33	17.58					
9.25	55.62	56.12	5.75	24.80	0.93	35.24	477.02	17.64					
7.97	54.70	92.36	5.90	25.00	1.28	55.75	388.66	17.75					
7.57	54.49	115.01	6.08	25.20	1.40	76.36	316.63	17.86					
7.50	55.11	115.45	6.21	25.40	1.65	74.05	366.91	17.94					
6.64	48.52	99.02	6.38	25.60	1.59	80.61	350.48	18.06					
6.14	46.90	91.14	6.53	25.80	1.43	64.41	417.91	18.14					
6.44	42.33	92.42	6.74	26.00	1.98	41.64	578.62	18.28					
7.55	52.37	80.32	6.92	26.20	2.08	56.45	655.37	18.38					
8.58	63.37	97.30	7.12	26.40	2.07	78.40	599.40	18.49					
8.89	67.35	91.03	7.26	26.60	1.93	76.29	563.87	18.58					
9.34	68.29	67.67	7.44	26.80	1.74	72.88	546.48	18.68					
8.53	50.86	101.41	7.60	27.00	1.67	69.81	527.30	18.79					
8.62	66.73	108.46	7.76	27.20	1.49	55.18	518.69	18.88					
8.94	63.57	112.46	7.93	27.40	1.27	39.29	506.11	18.99					
9.61	62.74	82.71	8.12	27.60	1.51	32.37	575.54	19.09					
8.53	62.38	101.19	8.25	27.80	1.52	37.58	564.60	19.19					
10.06	58.37	108.24	8.35	28.00	1.68	39.42	523.25	19.30					
10.24	73.63	109.74	8.48	28.20	5.03	43.70	102.47	19.38					
7.64	65.85	108.63	8.62	28.40	4.46	68.18	116.06	19.50					
8.85	59.54	88.92	8.77	28.60	1.62	77.76	718.17	19.66					
9.96	68.10	83.04	8.95	28.80	1.64	52.15	681.65	19.75					
10.39	66.53	118.45	9.15	29.00	2.23	53.40	383.72	19.86					
11.99	61.32	110.07	9.29	29.20	1.74	40.38	585.13	20.00					
11.67	76.37	110.90	9.44	29.40	1.84	57.93	599.84	20.12					
14.20	67.85	115.18	9.61	29.60	1.93	69.90	581.64	20.23					
15.40	88.39	105.07	9.80	29.80	1.78	73.20	569.54	20.35					
15.25	90.35	92.44	9.94	30.00	1.66	46.38	679.76	20.43					

Lo Sperimantatore:
dott. Massimo Romagnoli

Il Direttore Settore Prove in Sito:
dott. geol. Gianluca Ferioli

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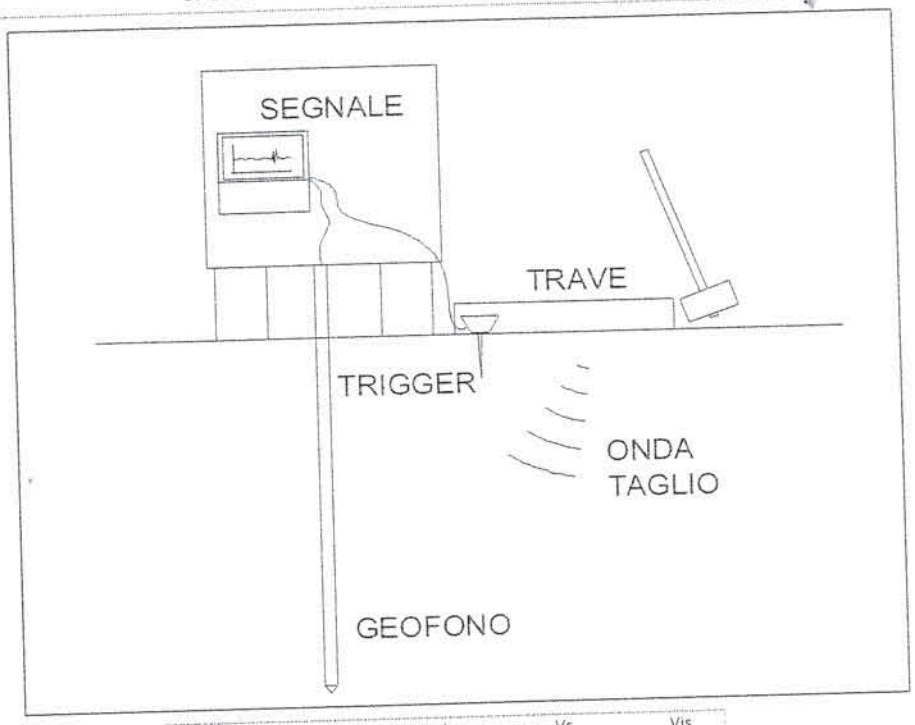
P.IVA e Codice Fiscale n. 00174600387

MMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
NTIERE Polisportivo Ponte Nuovo - Ravenna

N°	SCPTU 01	PROF. FALDA (m da p.c.)	1.20		
TA	08/04/10	PREFORO (m da p.c.)		TIPO PUNTA	piezocono G1 - CPL2IN
MMESSA	8042/10	C. SITO N°:	572/10 del 28/04/10		



Profondità (m)	Ts (s)	L (m)	Vs (m/s)	Vis (m/s)
0.3	T0	1.19	-	-
2	0.0071	2.31	158	158
4	0.0222	4.16	134	123
5	0.0306	5.13	129	115
7	0.0435	7.09	136	153
9	0.0555	9.07	142	164
11	0.0648	11.06	152	213
13	0.0741	13.05	160	213
15	0.0821	15.04	169	249
16	0.0860	16.04	173	256
18	0.0959	18.04	176	202
20	0.1021	20.03	185	321
22	0.1094	22.03	190	273
24	0.1181	24.03	193	231
26	0.1256	26.03	198	265
28	0.1341	28.02	200	237
30	0.1425	30.02	202	237

$V_{s,30}$ = 202 m/s

D = Distanza centro trave generatrice onde di taglio - verticale di prova = 1.15 m
Profondità = Profondità punta da piano campagna
Ts = Tempo percorrenza onda di taglio
L = Lunghezza percorso onda di taglio
Vs = Velocità onde di taglio da piano campagna alla profondità indicata
Vis = Velocità onde di taglio nello strato di terreno compreso fra le due profondità indicate

Lo Sperimentatore:
dott. Massimo Romagnoli

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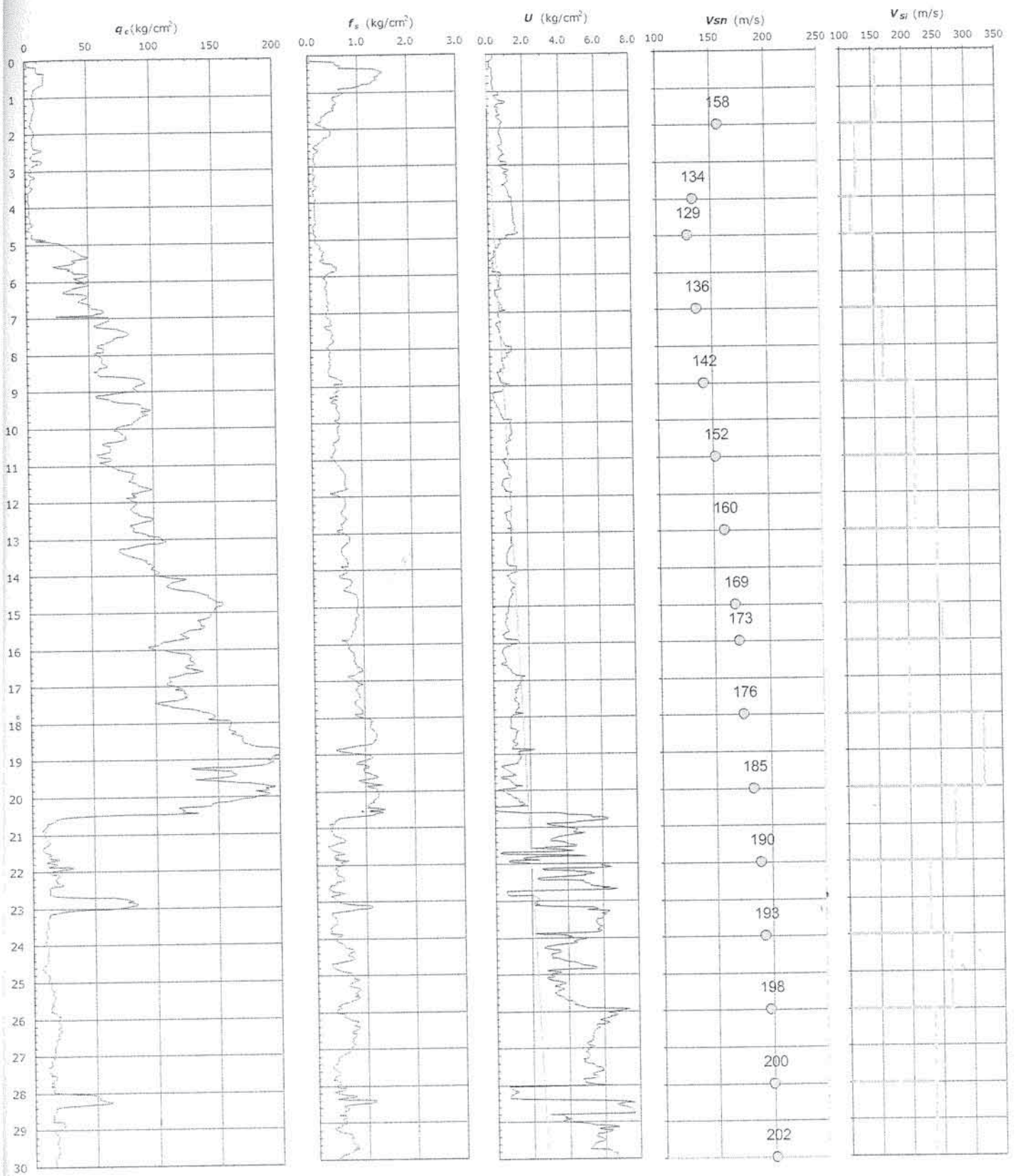
COMMITTENTE **Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi**
CANTIERE Polisportivo Ponte Nuovo - Ravenna
PT N° SCPTU 01 PROF. FALDA (m da p.c.) 1.20
DATA 08/04/10 PREFORO (m da p.c.) TIPO PUNTA piezocono G1 - CPL2IN
COMMESSA 8042/10 C. SITO N°: 572/10 del 28/04/10



Lo Sperimantatore:
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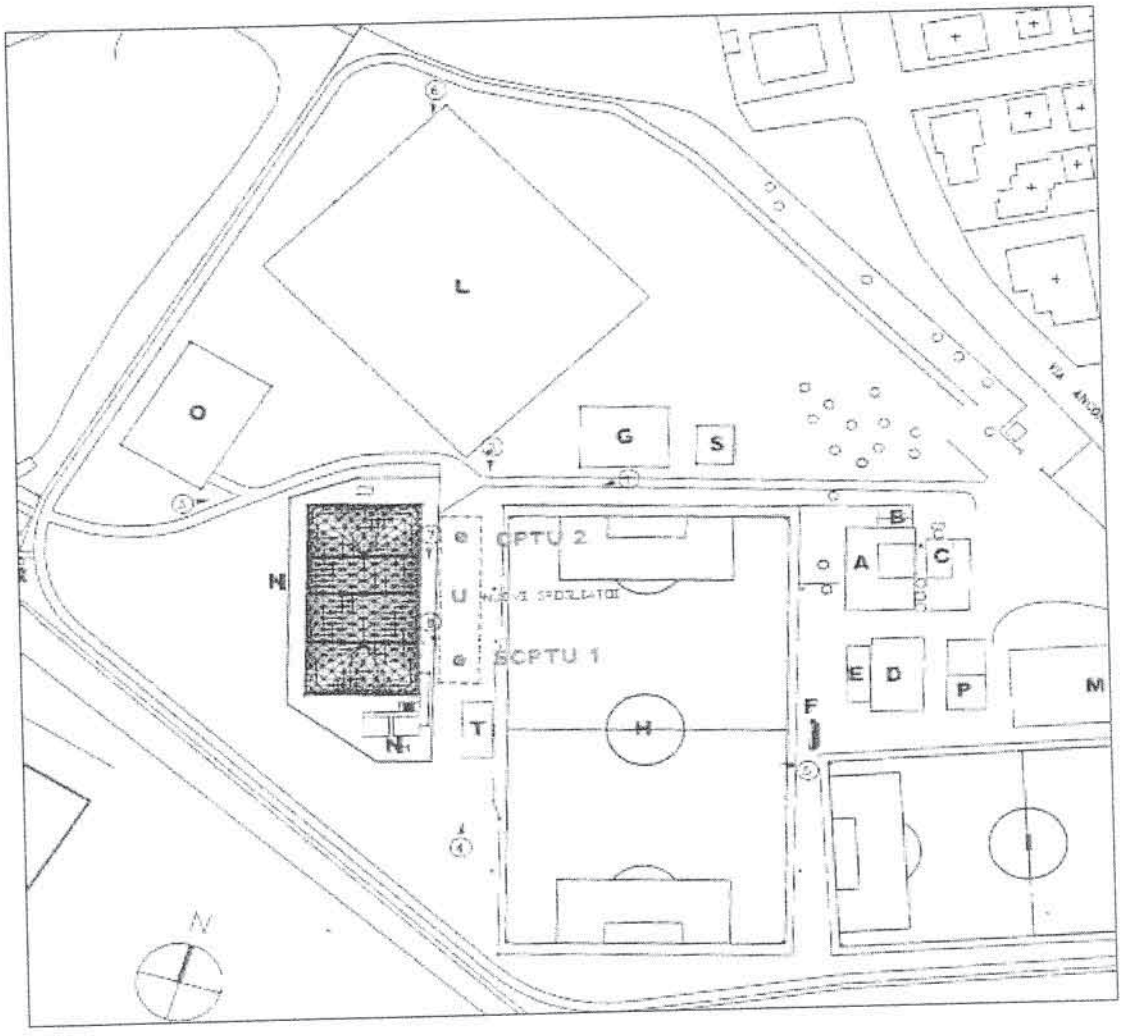
MMITTENTE **Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi**
NTIERE Polisportivo Ponte Nuovo - Ravenna

T N°	SCPTU 01	PROF. FALDA (m da p.c.)	1.20		
TA	08/04/10	PREFORO (m da p.c.)		TIPO PUNTA	piezocono G1 - CPL2IN
MMESSA	8042/10	C. SITO N°:	572/10 del 28/04/10		

PLANIMETRIA

Località: Polisportivo Ponte Nuovo - Ravenna



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COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Ponte Nuovo - Ravenna

PROVA N° SCPTU 01 PROF. FALDA (m da p.c.) 1.20
DATA 08/04/10 PREFORO (m da p.c.) 0.00 TIPO PUNTA piezocono G1 - CPL2IN
COMMESSA 8042/10

Prof. (m) da	a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{vo} (kg/cm²)	C_u media (kg/cm²)	Φ' (1) (gradi)	Φ (2) (gradi)
00	0.16	0.08	0.16	argille	1.2	0.7-1.3	0.02	0.1	-	-
16	0.18	0.17	0.02	torbe	8.3	0.7-1.3	0.02	0.5	-	-
18	0.24	0.21	0.06	argille	10.0	0.7-1.3	0.03	0.7	-	-
24	0.32	0.28	0.08	torbe	9.5	0.7-1.3	0.04	0.6	-	-
32	0.34	0.33	0.02	argille	10.7	0.7-1.3	0.04	0.7	-	-
34	1.56	0.95	1.22	torbe	9.5	0.4-0.8	0.26	0.6	-	-
56	1.60	1.58	0.04	argille	5.8	0.4-0.8	0.23	0.4	-	-
60	1.62	1.61	0.02	torbe	5.4	0.4-0.8	0.23	0.3	-	-
62	1.68	1.65	0.06	argille	5.2	0.4-0.8	0.24	0.3	-	-
68	1.78	1.73	0.10	torbe	4.2	0.4-0.8	0.25	0.3	-	-
78	1.82	1.80	0.04	argille	4.9	0.4-0.8	0.25	0.3	-	-
82	1.88	1.85	0.06	limi argillosi e argille limose	6.1	0.8-1.1	0.26	0.4	-	-
88	2.02	1.95	0.14	argille	7.1	0.4-0.8	0.27	0.5	-	-
02	2.22	2.12	0.20	torbe	5.9	0.4-0.8	0.29	0.4	-	-
22	2.36	2.29	0.14	argille	5.8	0.4-0.8	0.30	0.4	-	-
36	2.40	2.38	0.04	limi argillosi e argille limose	6.7	0.8-1.1	0.30	0.4	-	-
40	2.52	2.46	0.12	limi e limi sabbiosi	10.4	0.8-1.1	0.32	0.7	<32	25
52	2.54	2.53	0.02	limi argillosi e argille limose	6.4	0.8-1.1	0.32	0.4	-	-
54	2.58	2.56	0.04	argille	5.6	0.4-0.8	0.32	0.3	-	-
58	2.60	2.59	0.02	limi argillosi e argille limose	4.9	0.8-1.1	0.32	0.3	-	-
60	2.62	2.61	0.02	argille	4.3	0.4-0.8	0.32	0.3	-	-
62	2.68	2.65	0.06	limi argillosi e argille limose	5.0	0.8-1.1	0.33	0.3	-	-
68	2.72	2.70	0.04	limi e limi sabbiosi	8.8	0.8-1.1	0.34	0.6	<32	24
72	2.78	2.75	0.06	sabbie limose	13.4	0.8-1.1	0.34	-	<32	26
78	2.86	2.82	0.08	limi e limi sabbiosi	9.0	0.8-1.1	0.35	0.6	<32	24
86	2.90	2.88	0.04	limi argillosi e argille limose	5.0	0.8-1.1	0.36	0.3	-	-
90	2.94	2.92	0.04	argille	3.8	0.4-0.8	0.36	0.2	-	-
94	3.04	2.99	0.10	limi argillosi e argille limose	4.5	0.8-1.1	0.37	0.3	-	-
04	3.06	3.05	0.02	argille	2.9	0.4-0.8	0.37	0.2	-	-
06	3.12	3.09	0.06	limi argillosi e argille limose	3.5	0.8-1.1	0.38	0.2	-	-
12	3.20	3.16	0.08	limi e limi sabbiosi	6.8	0.8-1.1	0.39	0.4	<32	21
20	3.24	3.22	0.04	limi argillosi e argille limose	4.0	0.8-1.1	0.39	0.2	-	-
24	3.28	3.26	0.04	argille	3.5	0.4-0.8	0.40	0.2	-	-
28	3.32	3.30	0.04	limi argillosi e argille limose	4.0	0.8-1.1	0.40	0.2	-	-
32	3.38	3.35	0.06	argille	3.1	0.4-0.8	0.41	0.2	-	-
38	3.44	3.41	0.06	limi argillosi e argille limose	3.9	0.8-1.1	0.41	0.2	-	-
44	3.48	3.46	0.04	limi e limi sabbiosi	5.9	0.8-1.1	0.42	0.3	<32	20
48	3.52	3.50	0.04	limi argillosi e argille limose	4.9	0.8-1.1	0.42	0.3	-	-
52	4.30	3.91	0.78	argille	2.8	0.4-0.8	0.52	0.1	-	-
30	4.32	4.31	0.02	limi argillosi e argille limose	3.7	0.8-1.1	0.49	0.2	-	-
32	4.40	4.36	0.08	argille	3.4	0.4-0.8	0.50	0.2	-	-
40	4.44	4.42	0.04	limi argillosi e argille limose	5.3	0.8-1.1	0.50	0.3	-	-
44	4.46	4.45	0.02	limi e limi sabbiosi	6.6	0.8-1.1	0.50	0.4	<32	19
46	4.48	4.47	0.02	limi argillosi e argille limose	5.3	0.8-1.1	0.50	0.3	-	-
48	4.52	4.50	0.04	argille	3.1	0.4-0.8	0.51	0.2	-	-
52	4.54	4.53	0.02	torbe	2.2	0.4-0.8	0.51	0.1	-	-
54	4.64	4.59	0.10	argille	2.4	0.4-0.8	0.52	0.1	-	-
64	4.66	4.65	0.02	limi argillosi e argille limose	3.6	0.8-1.1	0.52	0.2	-	-
66	4.72	4.69	0.06	limi e limi sabbiosi	5.1	0.8-1.1	0.53	0.3	<32	18
72	4.80	4.76	0.08	limi argillosi e argille limose	4.8	0.8-1.1	0.54	0.3	-	-
80	4.86	4.83	0.06	limi e limi sabbiosi	9.2	0.8-1.1	0.54	0.6	<32	21
86	4.88	4.87	0.02	sabbie limose	16.8	0.8-1.1	0.54	-	<32	24
88	4.90	4.89	0.02	limi e limi sabbiosi	8.3	0.8-1.1	0.54	0.5	<32	20
90	5.06	4.98	0.16	sabbie limose	27.1	0.8-1.1	0.57	-	<32	27

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OMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
ANTIERE Polisportivo Ponte Nuovo - Ravenna

PT N° SCPTU 01 PROF. FALDA (m da p.c.) 1.20
ATA 08/04/10 PREFORO (m da p.c.) 0.00 TIPO PUNTA piezocono G1 - CPL2IN
OMMESSA 8042/10

Prof. (m) da	a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{v0} (kg/cm²)	C_u media (kg/cm²)	Φ' (1) (gradi)	Φ (2) (gradi)
.06	5.10	5.08	0.04	sabbie	33.7	0.8-1.1	0.57	-	<32	28
.10	5.12	5.11	0.02	sabbie limose	35.4	0.8-1.1	0.57	-	<32	28
.12	5.14	5.13	0.02	sabbie	36.9	0.8-1.1	0.57	-	<32	28
.14	5.16	5.15	0.02	sabbie limose	37.5	0.8-1.1	0.57	-	<32	28
.16	5.40	5.28	0.24	sabbie	44.5	0.8-1.1	0.61	-	32	29
.40	5.98	5.69	0.58	sabbie limose	37.7	0.8-1.1	0.69	-	<32	28
.98	6.02	6.00	0.04	sabbie	46.6	0.8-1.1	0.67	-	32	29
.02	6.04	6.03	0.02	sabbie limose	39.4	0.8-1.1	0.67	-	<32	28
.04	6.12	6.08	0.08	sabbie	49.7	0.8-1.1	0.68	-	32	29
.12	6.36	6.24	0.24	sabbie limose	36.9	0.8-1.1	0.72	-	<32	27
.36	6.46	6.41	0.10	sabbie	48.7	0.8-1.1	0.72	-	<32	28
.46	6.58	6.52	0.12	sabbie limose	43.4	0.8-1.1	0.74	-	<32	28
.58	6.92	6.75	0.34	sabbie	55.0	0.8-1.1	0.79	-	32	29
.92	6.94	6.93	0.02	sabbie limose	23.5	0.8-1.1	0.77	-	<32	24
.94	9.08	8.01	2.14	sabbie	68.6	0.8-1.1	1.12	-	<32	29
.08	9.14	9.11	0.06	sabbie limose	55.5	0.8-1.1	1.02	-	<32	27
.14	20.46	14.80	11.32	sabbie	118.1	0.8-1.1	2.84	-	<32	29
20.46	20.48	20.47	0.02	sabbie limose	75.9	0.8-1.1	2.29	-	<32	24
20.48	20.52	20.50	0.04	limi e limi sabbiosi	43.7	0.8-1.1	2.29	2.6	<32	21
20.52	20.54	20.53	0.02	limi argillosi e argille limose	25.4	0.8-1.1	2.30	1.4	-	-
20.54	20.56	20.55	0.02	argille	21.7	0.4-0.8	2.30	1.2	-	-
20.56	20.60	20.58	0.04	torbe	19.0	0.4-0.8	2.30	1.0	-	-
20.60	20.62	20.61	0.02	argille	19.7	0.4-0.8	2.30	1.0	-	-
20.62	20.68	20.65	0.06	torbe	16.1	0.4-0.8	2.31	0.8	-	-
20.68	20.72	20.70	0.04	argille	12.2	0.4-0.8	2.31	0.5	-	-
20.72	20.82	20.77	0.10	limi argillosi e argille limose	11.3	0.8-1.1	2.32	0.5	-	-
20.82	20.88	20.85	0.06	argille	8.5	0.4-0.8	2.33	0.3	-	-
20.88	20.90	20.89	0.02	limi e limi sabbiosi	10.5	0.8-1.1	2.33	0.4	<32	13
20.90	21.16	21.03	0.26	limi argillosi e argille limose	10.7	0.8-1.1	2.37	0.4	-	-
21.16	21.20	21.18	0.04	limi e limi sabbiosi	13.6	0.8-1.1	2.36	0.6	<32	15
21.20	21.26	21.23	0.06	limi argillosi e argille limose	13.5	0.8-1.1	2.37	0.6	-	-
21.26	21.32	21.29	0.06	argille	11.3	0.4-0.8	2.38	0.5	-	-
21.32	21.40	21.36	0.08	torbe	8.6	0.4-0.8	2.38	0.3	-	-
21.40	21.44	21.42	0.04	argille	9.1	0.4-0.8	2.38	0.3	-	-
21.44	21.46	21.45	0.02	limi argillosi e argille limose	9.6	0.8-1.1	2.39	0.3	-	-
21.46	21.58	21.52	0.12	limi e limi sabbiosi	13.6	0.8-1.1	2.40	0.6	<32	15
21.58	21.62	21.60	0.04	limi argillosi e argille limose	12.9	0.8-1.1	2.40	0.6	-	-
21.62	21.68	21.65	0.06	limi e limi sabbiosi	20.0	0.8-1.1	2.41	1.0	<32	17
21.68	21.76	21.72	0.08	limi argillosi e argille limose	13.7	0.8-1.1	2.42	0.6	-	-
21.76	21.82	21.79	0.06	limi e limi sabbiosi	18.3	0.8-1.1	2.43	0.9	<32	16
21.82	21.86	21.84	0.04	limi argillosi e argille limose	14.0	0.8-1.1	2.43	0.6	-	-
21.86	21.88	21.87	0.02	limi e limi sabbiosi	30.0	0.8-1.1	2.43	1.7	<32	19
21.88	21.90	21.89	0.02	sabbie limose	33.3	0.8-1.1	2.43	-	<32	19
21.90	21.96	21.93	0.06	limi e limi sabbiosi	23.8	0.8-1.1	2.44	1.3	<32	18
21.96	22.04	22.00	0.08	limi argillosi e argille limose	15.0	0.8-1.1	2.45	0.7	-	-
22.04	22.38	22.21	0.34	limi e limi sabbiosi	20.1	0.8-1.1	2.50	1.0	<32	17
22.38	22.52	22.45	0.14	limi argillosi e argille limose	14.5	0.8-1.1	2.51	0.7	-	-
22.52	22.66	22.59	0.14	limi e limi sabbiosi	14.7	0.8-1.1	2.53	0.7	<32	15
22.66	22.68	22.67	0.02	sabbie limose	29.0	0.8-1.1	2.52	-	<32	18
22.68	23.02	22.85	0.34	sabbie	74.8	0.8-1.1	2.58	-	<32	24
23.02	23.04	23.03	0.02	sabbie limose	44.2	0.8-1.1	2.58	-	<32	21
23.04	23.06	23.05	0.02	limi e limi sabbiosi	32.2	0.8-1.1	2.58	1.8	<32	19
23.06	23.08	23.07	0.02	limi argillosi e argille limose	25.0	0.8-1.1	2.57	1.4	-	-
23.08	23.12	23.10	0.04	argille	19.8	0.4-0.8	2.57	1.0	-	-

elletipi s.r.l.
Sede operativa ed amm.va: Via Annibale Zucchini, 69 - 44100 FERRARA
tel. 0532/56771; fax 0532/56119 e-mail: info@elletipi.it sito: www.elletipi.it
P.IVA e Codice Fiscale n. 00174600367

COMMITTENTE Comune di Ravenna - Area Infrastrutture Civili - Servizio Edilizia U. O. Impianti Sportivi
CANTIERE Polisportivo Ponte Nuovo - Ravenna

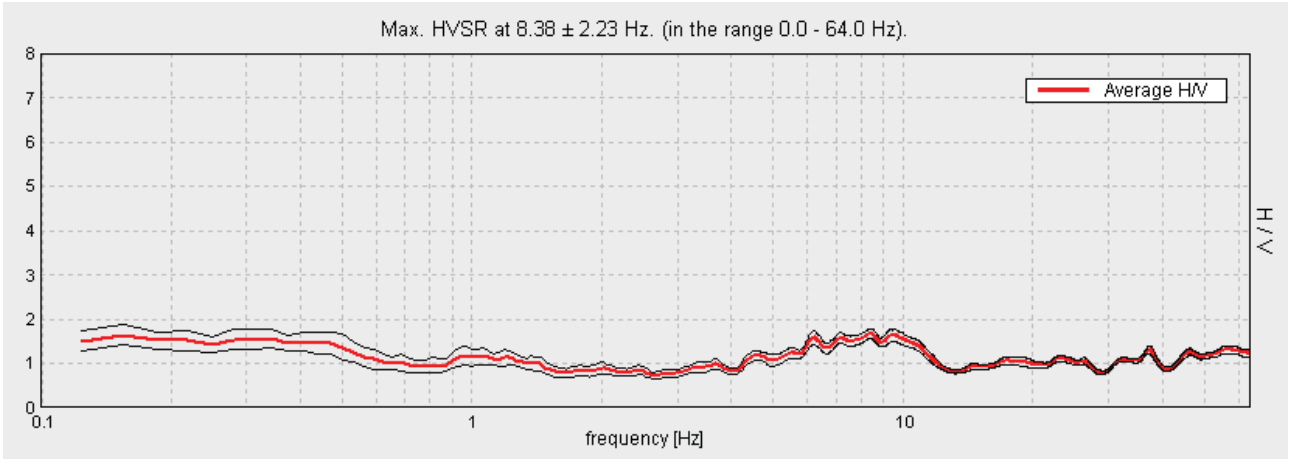
PROVA CPT N°	SCPTU 01	PROF. FALDA (m da p.c.)	1.20		
DATA	08/04/10	PREFORO (m da p.c.)	0.00	TIPO PUNTA	piezocono G1 - CPL2IN
COMMESSA	8042/10				

Prof. (m) da	a	Prof. media (m)	Pot. strato (m)	Litologia	q_c media (kg/cm²)	γ' (t/m³)	σ'_{vo} (kg/cm²)	C_u media (kg/cm²)	Φ' (1) (gradi)	Φ (2) (gradi)
23.12	23.20	23.16	0.08	torbe	13.9	0.4-0.8	2.58	0.6	-	-
23.20	23.26	23.23	0.06	argille	12.6	0.4-0.8	2.58	0.5	-	-
23.26	23.28	23.27	0.02	limi argillosi e argille limose	12.1	0.8-1.1	2.58	0.5	-	-
23.28	23.32	23.30	0.04	limi e limi sabbiosi	11.8	0.8-1.1	2.59	0.5	<32	13
23.32	23.70	23.51	0.38	limi argillosi e argille limose	11.3	0.8-1.1	2.65	0.4	-	-
23.70	23.76	23.73	0.06	limi e limi sabbiosi	11.0	0.8-1.1	2.64	0.4	<32	13
23.76	23.80	23.78	0.04	limi argillosi e argille limose	11.0	0.8-1.1	2.64	0.4	-	-
23.80	23.84	23.82	0.04	limi e limi sabbiosi	11.6	0.8-1.1	2.65	0.5	<32	13
23.84	23.86	23.85	0.02	limi argillosi e argille limose	10.7	0.8-1.1	2.65	0.4	-	-
23.86	23.96	23.91	0.10	argille	10.0	0.4-0.8	2.66	0.3	-	-
23.96	24.10	24.03	0.14	limi argillosi e argille limose	11.4	0.8-1.1	2.68	0.4	-	-
24.10	24.28	24.19	0.18	argille	11.7	0.4-0.8	2.70	0.5	-	-
24.28	24.36	24.32	0.08	torbe	10.9	0.4-0.8	2.70	0.4	-	-
24.36	24.46	24.41	0.10	argille	11.6	0.4-0.8	2.71	0.4	-	-
24.46	24.64	24.55	0.18	torbe	8.3	0.4-0.8	2.72	0.2	-	-
24.64	24.66	24.65	0.02	argille	7.9	0.4-0.8	2.72	0.2	-	-
24.66	24.90	24.78	0.24	limi argillosi e argille limose	11.0	0.8-1.1	2.76	0.4	-	-
24.90	25.10	25.00	0.20	argille	13.3	0.4-0.8	2.77	0.5	-	-
25.10	25.14	25.12	0.04	torbe	12.7	0.4-0.8	2.77	0.5	-	-
25.14	25.20	25.17	0.06	argille	13.7	0.4-0.8	2.77	0.6	-	-
25.20	25.30	25.25	0.10	limi argillosi e argille limose	16.1	0.8-1.1	2.79	0.7	-	-
25.30	25.72	25.51	0.42	argille	15.3	0.4-0.8	2.84	0.7	-	-
25.72	25.80	25.76	0.08	limi argillosi e argille limose	13.8	0.8-1.1	2.83	0.6	-	-
25.80	26.20	26.00	0.40	limi e limi sabbiosi	19.9	0.8-1.1	2.89	1.0	<32	16
26.20	26.56	26.38	0.36	limi argillosi e argille limose	19.9	0.8-1.1	2.93	1.0	-	-
26.56	26.58	26.57	0.02	argille	17.0	0.4-0.8	2.91	0.8	-	-
26.58	26.84	26.71	0.26	limi argillosi e argille limose	17.0	0.8-1.1	2.95	0.8	-	-
26.84	26.88	26.86	0.04	argille	15.7	0.4-0.8	2.94	0.7	-	-
26.88	27.44	27.16	0.56	limi argillosi e argille limose	14.1	0.8-1.1	3.03	0.6	-	-
27.44	27.64	27.54	0.20	limi e limi sabbiosi	15.8	0.8-1.1	3.04	0.7	<32	14
27.64	27.66	27.65	0.02	limi argillosi e argille limose	14.7	0.8-1.1	3.03	0.6	-	-
27.66	27.68	27.67	0.02	limi e limi sabbiosi	15.2	0.8-1.1	3.03	0.6	<32	14
27.68	27.70	27.69	0.02	limi argillosi e argille limose	13.2	0.8-1.1	3.04	0.5	-	-
27.70	27.90	27.80	0.20	limi e limi sabbiosi	15.3	0.8-1.1	3.07	0.6	<32	14
27.90	27.96	27.93	0.06	limi argillosi e argille limose	14.3	0.8-1.1	3.07	0.6	-	-
27.96	27.98	27.97	0.02	limi e limi sabbiosi	16.4	0.8-1.1	3.07	0.7	<32	14
27.98	28.12	28.05	0.14	sabbie limose	44.0	0.8-1.1	3.09	-	<32	20
28.12	28.24	28.18	0.12	sabbie	54.4	0.8-1.1	3.10	-	<32	21
28.24	28.34	28.29	0.10	sabbie limose	50.8	0.8-1.1	3.11	-	<32	20
28.34	28.36	28.35	0.02	limi e limi sabbiosi	26.8	0.8-1.1	3.11	1.4	<32	17
28.36	28.38	28.37	0.02	limi argillosi e argille limose	21.3	0.8-1.1	3.11	1.0	-	-
28.38	28.46	28.42	0.08	torbe	17.0	0.4-0.8	3.12	0.7	-	-
28.46	28.50	28.48	0.04	argille	16.5	0.4-0.8	3.12	0.7	-	-
28.50	28.76	28.63	0.26	limi argillosi e argille limose	14.8	0.8-1.1	3.16	0.6	-	-
28.76	28.98	28.87	0.22	limi e limi sabbiosi	22.4	0.8-1.1	3.19	1.1	<32	16
28.98	29.04	29.01	0.06	limi argillosi e argille limose	16.2	0.8-1.1	3.18	0.7	-	-
29.04	29.06	29.05	0.02	limi e limi sabbiosi	15.7	0.8-1.1	3.18	0.7	<32	14
29.06	29.10	29.08	0.04	limi argillosi e argille limose	15.3	0.8-1.1	3.19	0.6	-	-
29.10	29.26	29.18	0.16	limi e limi sabbiosi	16.5	0.8-1.1	3.21	0.8	<32	15
29.26	29.88	29.57	0.62	limi argillosi e argille limose	17.8	0.8-1.1	3.31	0.8	-	-
29.88	30.00	29.94	0.12	limi e limi sabbiosi	16.4	0.8-1.1	3.29	0.7	<32	14

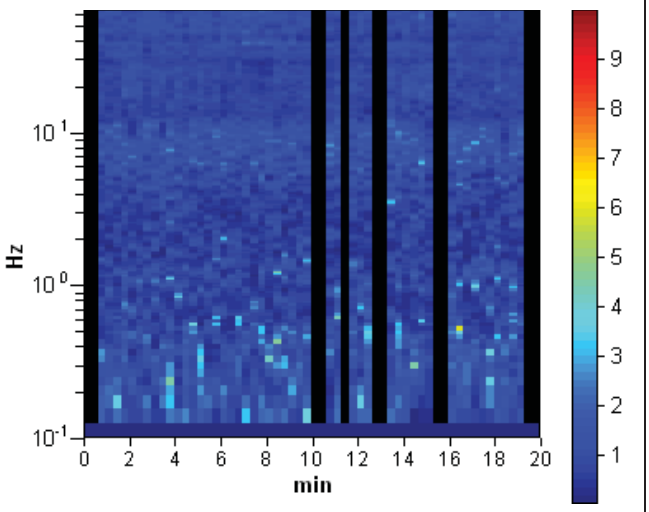
CLASSE (RAVENNA) – SCUOLA ELEMENTARE - VIA ROMEA S. 247

Start recording: 10/03/08 13:10:40 End recording: 10/03/08 13:30:41
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h20'00". Analyzed 82% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window, Smoothing: 5%

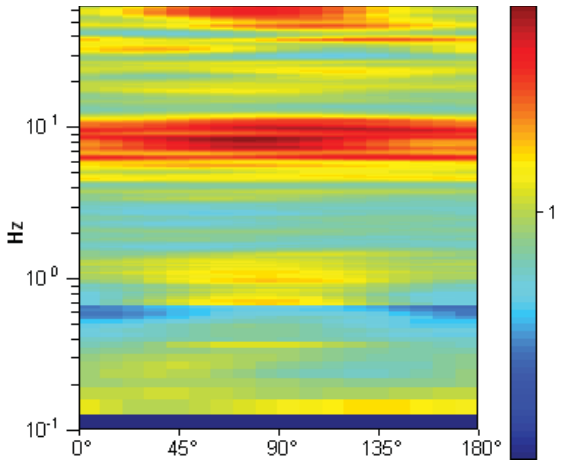
HORIZONTAL TO VERTICAL SPECTRAL RATIO



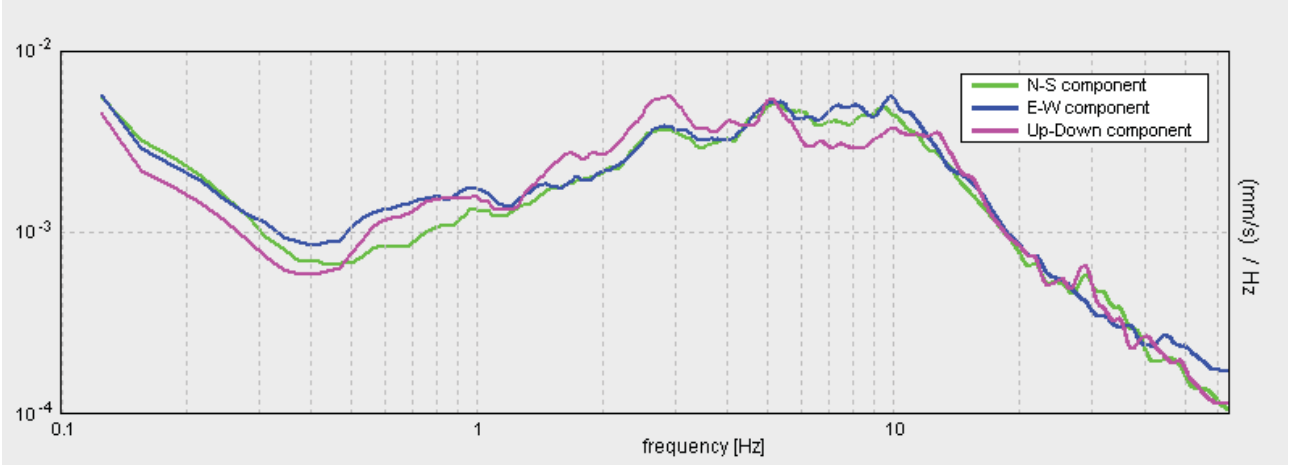
H/V TIME HISTORY



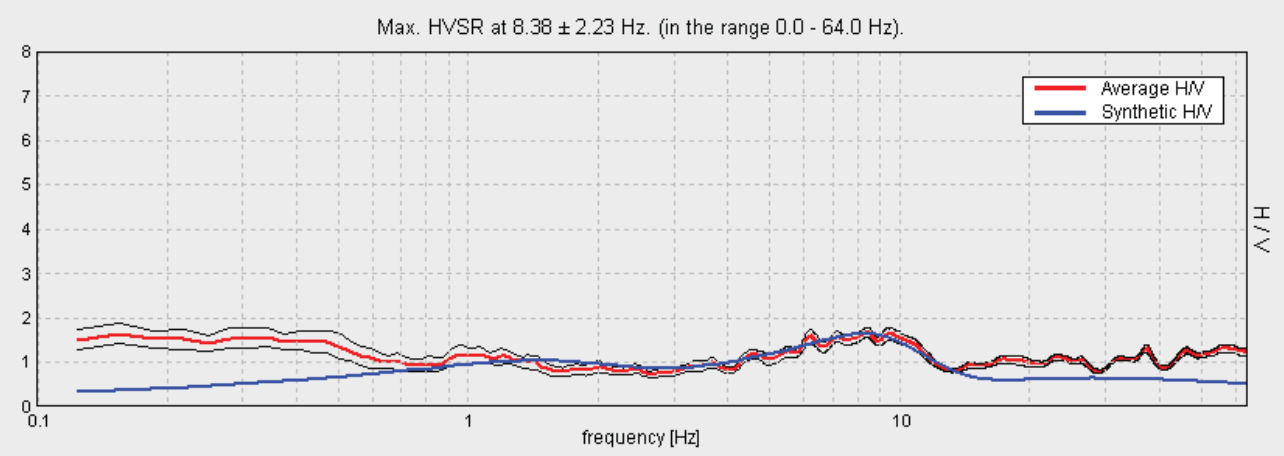
DIRECTIONAL H/V



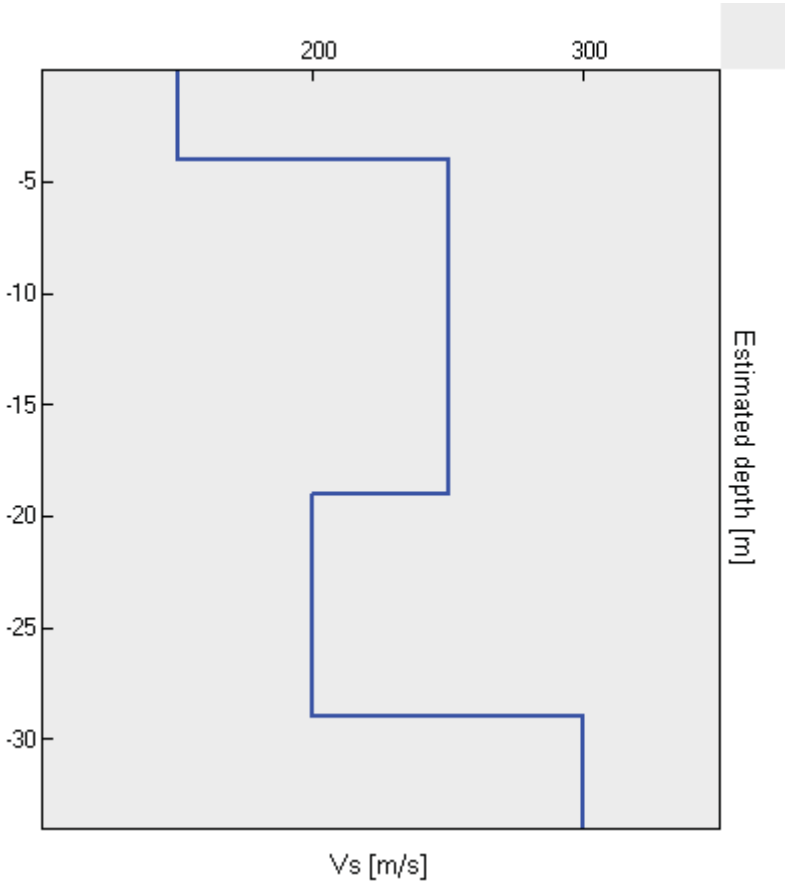
SINGLE COMPONENT SPECTRA



EXPERIMENTAL VS. SYNTHETIC H/V



Profondità base del livello [m]	Spessore [m]	Vs [m/s]
4.00	4.00	150
19.00	15.00	250
29.00	10.00	200
inf.	inf.	300



[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables**.]

Max. HVSR at 8.38 ± 2.23 Hz. (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	8.38 > 0.50	OK	
$n_c(f_0) > 200$	8207.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 403 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	4.125 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	12.844 Hz	OK	
$A_0 > 2$	1.67 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.13119| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.09872 < 0.41875		NO
$\sigma_A(f_0) < \varepsilon(f_0)$	0.0563 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_A(f) < \varepsilon(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\varepsilon(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\varepsilon(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

ADOTATTO con Delibera di C.C. N. 182544/105 del 31/10/2017

TROMINO® Grilla
www.tromino.it

RAVENNA - VIA DEI PINI, VIA DEI PINI TR01

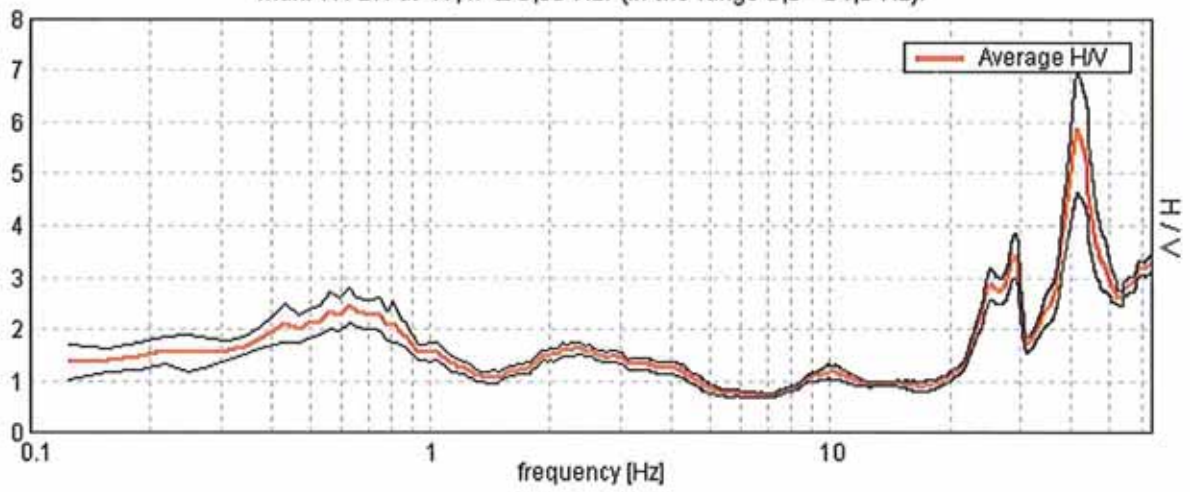
Start recording: 08/04/09 14:21:47 End recording: 08/04/09 14:41:48

GPS data not available

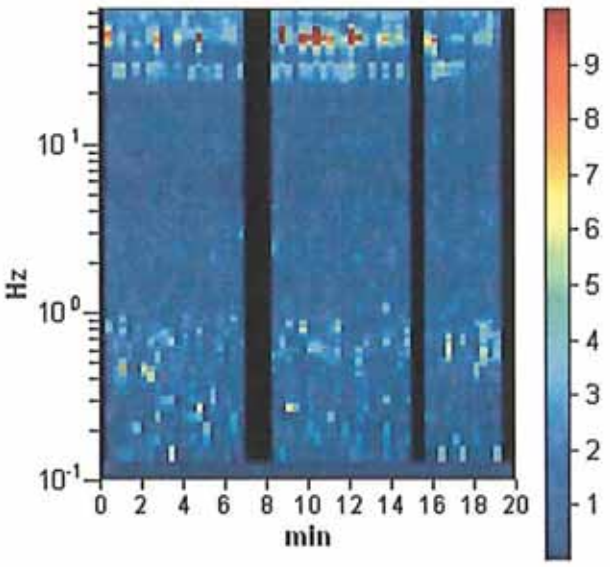
Trace length: 0h20'00". Analyzed 85% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

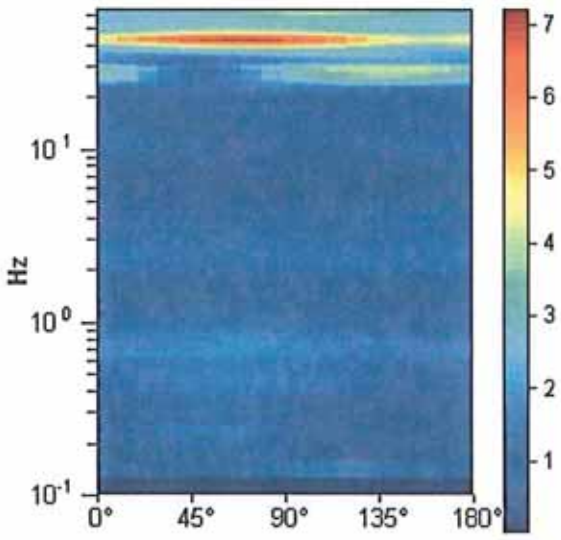
Max. HVSR at 41,47 ± 0,33 Hz. (in the range 0,0 - 64,0 Hz).



H/V TIME HISTORY



DIRECTIONAL H/V



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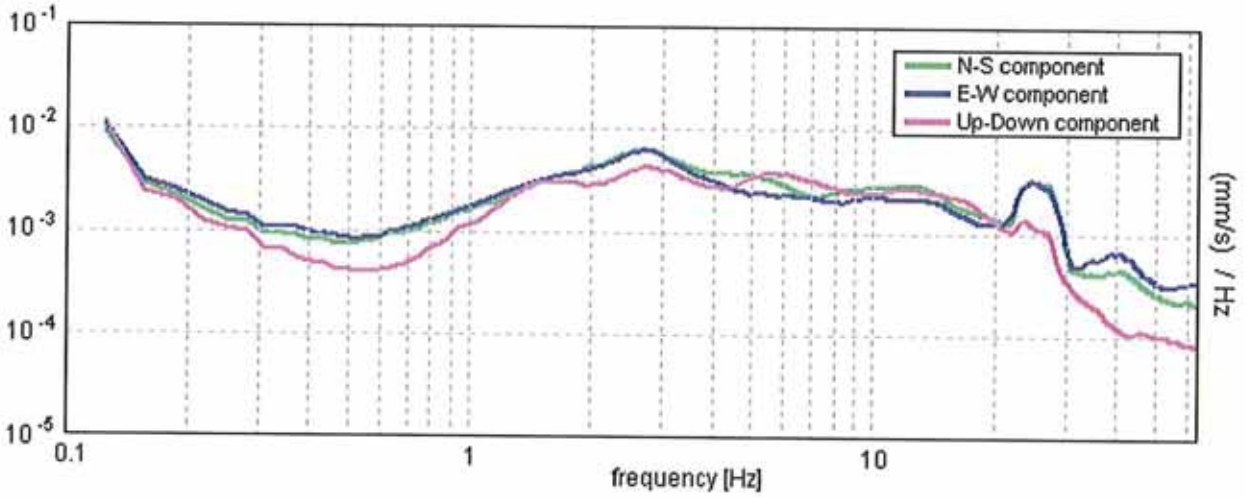
SINGLE COMPONENT SPECTRA



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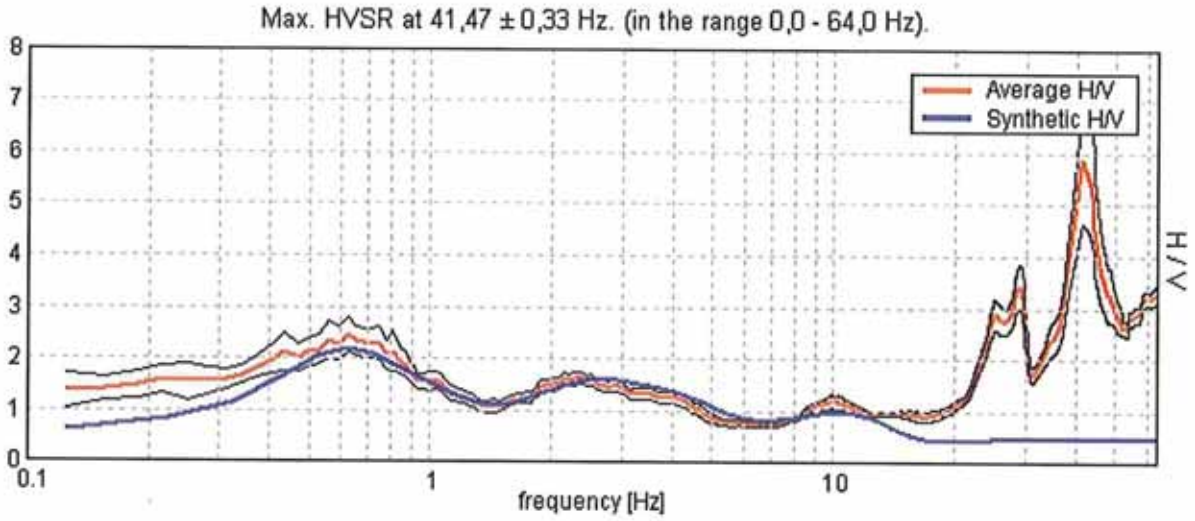
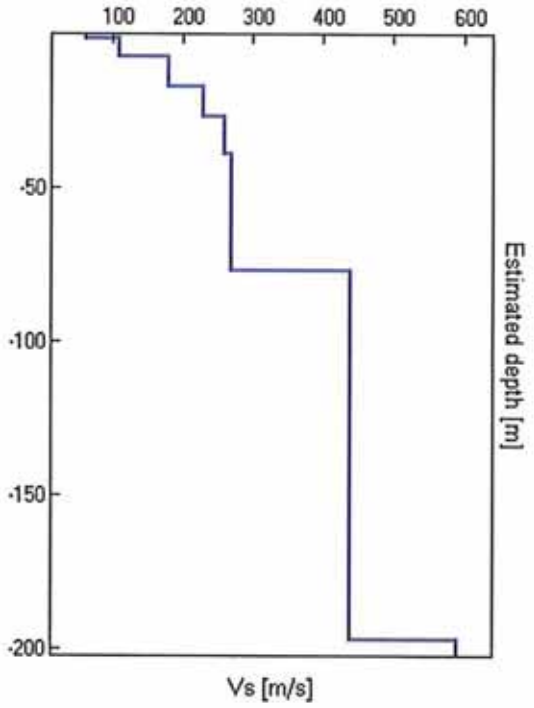
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
1.50	1.50	65
7.00	5.50	110
17.00	10.00	180
27.00	10.00	230
39.00	12.00	260
77.00	38.00	270
197.00	120.00	440
inf.	inf.	590

Vs(0.0-30.0)=163m/s



[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

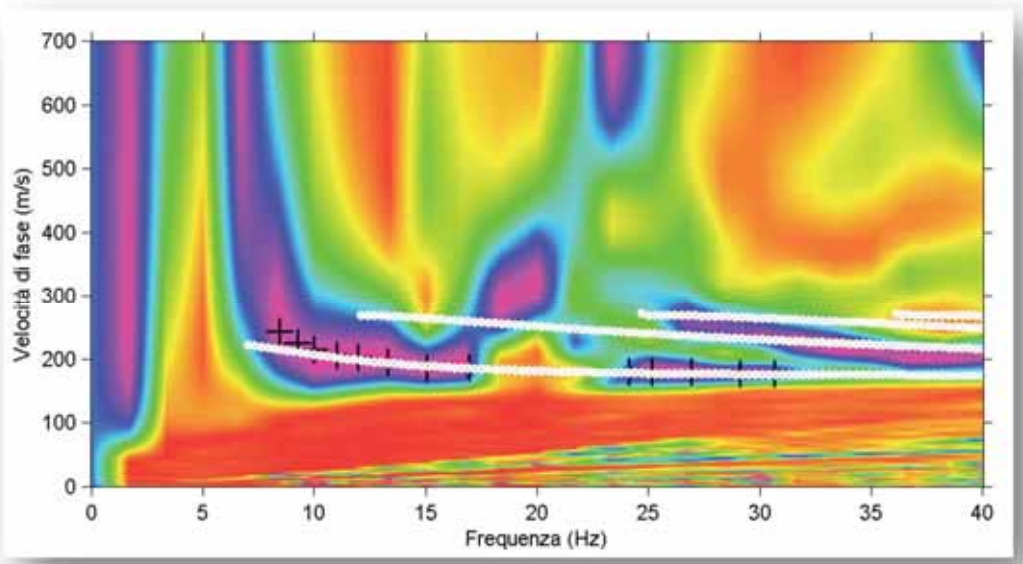
Max. HVSR at 41,47 ± 0,33 Hz. (in the range 0,0 - 64,0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	41.47 > 0.50	OK	
$n_c(f_0) > 200$	42298.1 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1386 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	37.031 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	50.25 Hz	OK	
$A_0 > 2$	5.86 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00394| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.16319 < 2.07344	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.6008 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

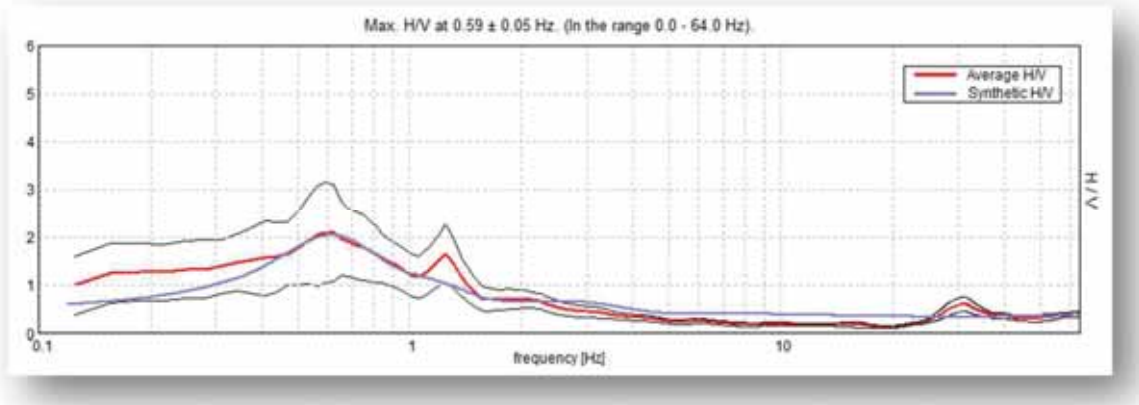
Allegato 3 – Spettro di dispersione



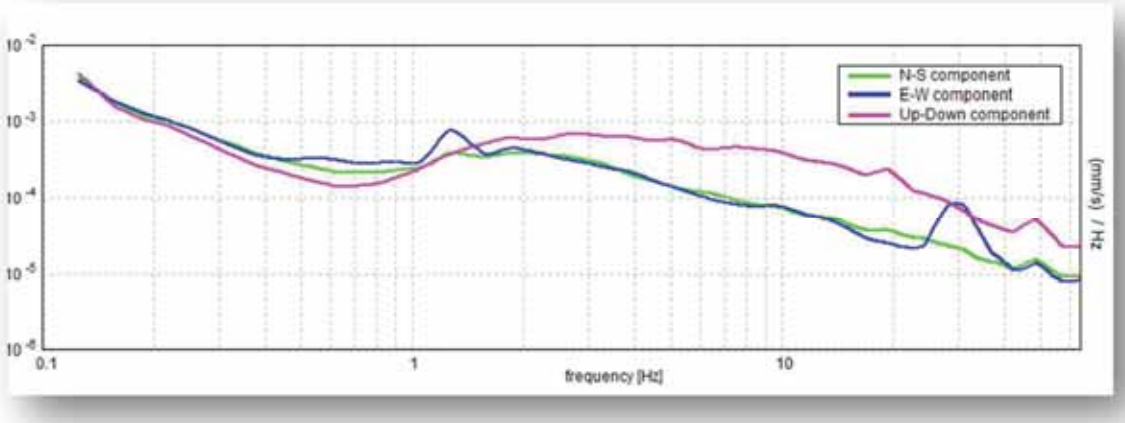
in alto: Spettro frequenza-velocità di fase dei dati acquisiti durante l'indagine. Sovrimposti allo spettro sono il picking del modo fondamentale (crocette nere) e le curve di dispersione sintetiche del modo fondamentale e di alcuni modi superiori (pallini bianchi).
in basso: Curva H/V **(A)** e andamento delle tre componenti velocimetriche (N-S, E-W, Up-Down) **(B)**

HVSR3A

A

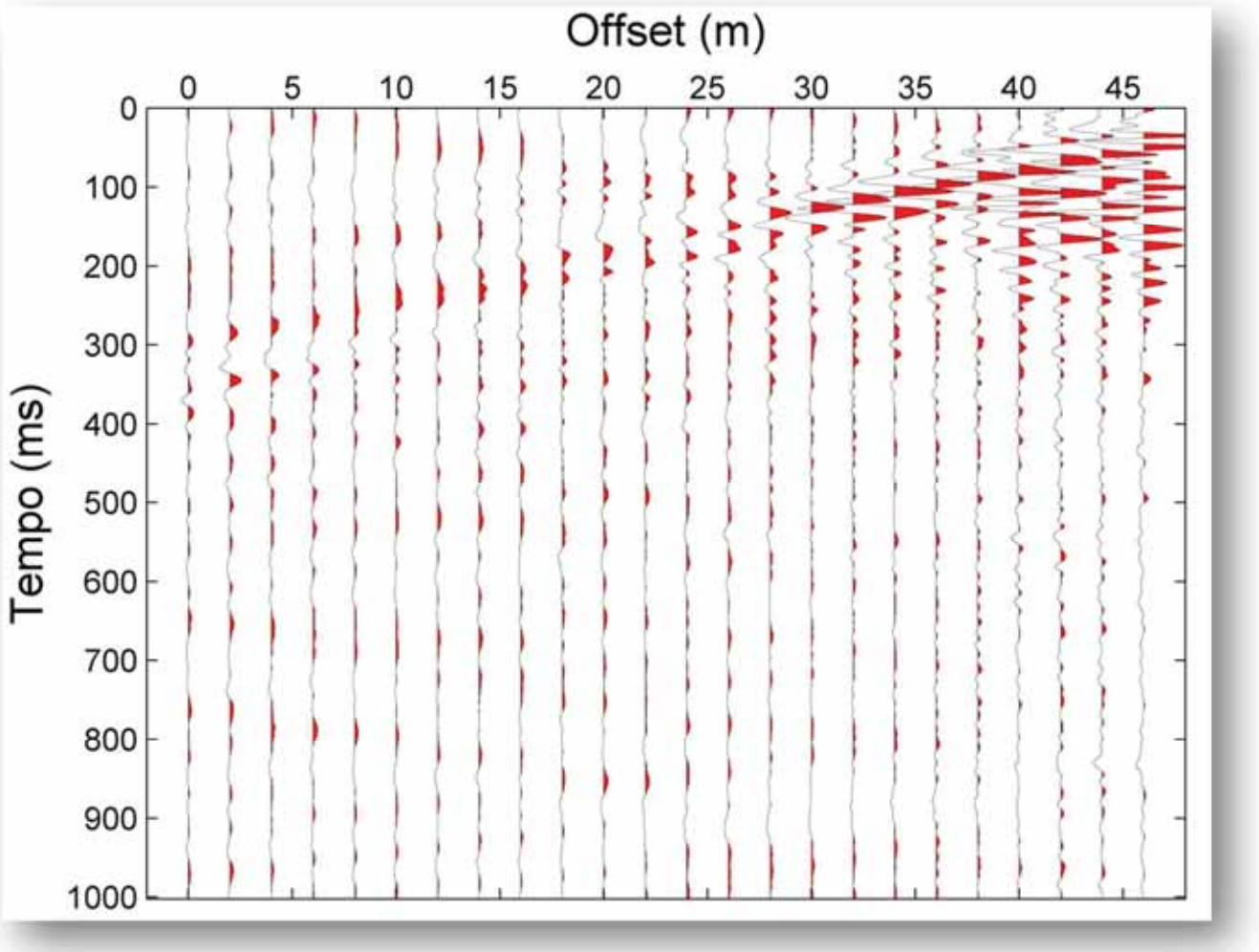


B



MASW3A

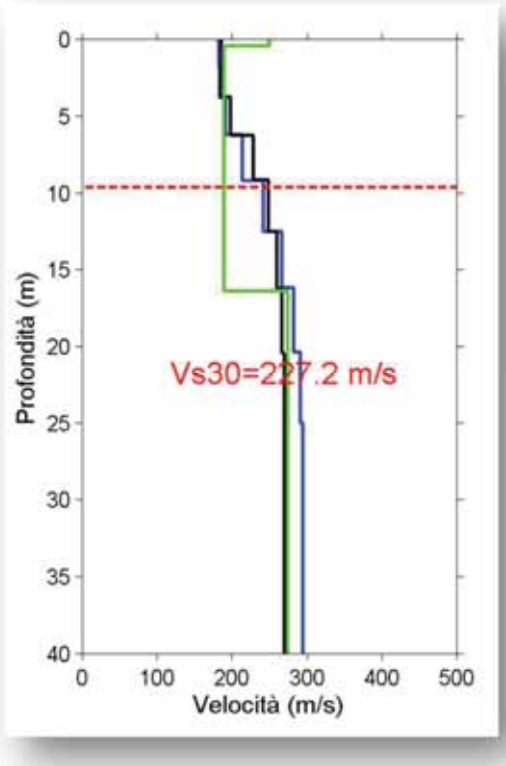
Allegato 2 – Sismogrammi



Sismogrammi acquisiti dai 24 geofoni durante l'indagine. La sorgente è posta ad una distanza di 8 m dal geofono 24. La spaziatura tra i geofoni è di 2 m.

Allegato 4 – Velocità onde S in funzione della profondità

A



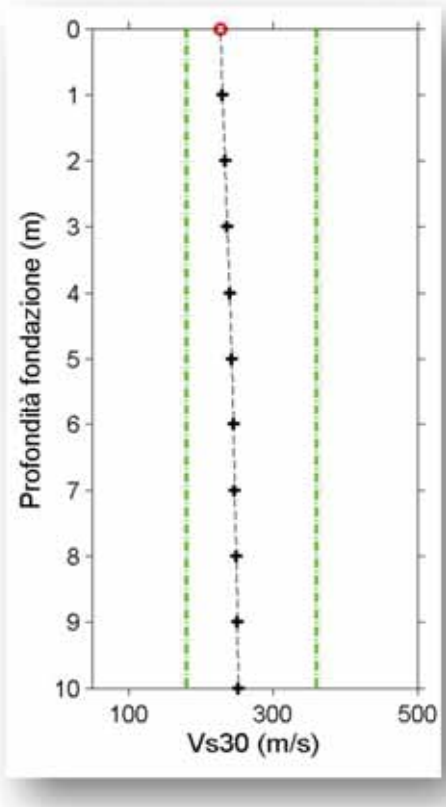
B

Spessore (m)	Vs WaveEq (m/s)	Spessore (m)	Vs SWAMI (m/s)	Spessore (m)	Vs HVSR (m/s)
1.7	185.9	1.7	183.3	0.4	250.0
2.1	185.4	2.1	184.3	16.0	190.0
2.5	198.4	2.4	191.8	50.0	275.0
2.9	228.5	3.0	213.7	125.0	445.0
3.3	248.4	3.3	242.7	inf	670.0
3.7	260.5	3.7	267.3		
4.2	267.1	4.2	283.0		
4.6	269.3	4.6	291.2		
15.0	269.5	15.0	294.8		
inf	269.5	inf	295.0		

(A) Andamento della velocità delle onde S in funzione della profondità. Vengono riportati in nero i valori ottenuti con il programma WaveEq (Geometrics) e in blu i valori derivati con il programma SWAMI (Georgia Institute of Technology), relativamente all'indagine MASW; in verde viene indicato l'andamento ottenuto mediante inversione della curva *H/V,* vincolata nella parte superficiale attraverso i valori ottenuti dall'indagine *MASW*. La linea tratteggiata in rosso rappresenta la profondità stimata per la frequenza più bassa scelta durante l'operazione di *picking*. A profondità maggiori l'andamento delle velocità delle onde S è stimato mediante *fit* della curva H/V.

(B) La prima, terza e quinta colonna riportano gli spessori degli strati dei modelli ottenuti dall'indagine MASW (colonne 1 e 3) e dall'indagine *HVSR* (colonna 5). La seconda e la quarta colonna contengono le velocità stimate attraverso la tecnica *MASW* utilizzando i programmi WaveEq e SWAMI; la sesta colonna riporta le velocità stimate mediante inversione della curva H/V. Sono evidenziati in azzurro i valori di velocità e i relativi spessori utilizzati per il calcolo del parametro Vs_{30};

C



(C) andamento del parametro Vs_{30} in funzione della variazione della profondità del piano fondale della struttura in progetto. Le linee in tratteggio di colore verde indicano i limiti 180 m/s e 360 m/s rispetto alla tabella 1 (cfr. §2).

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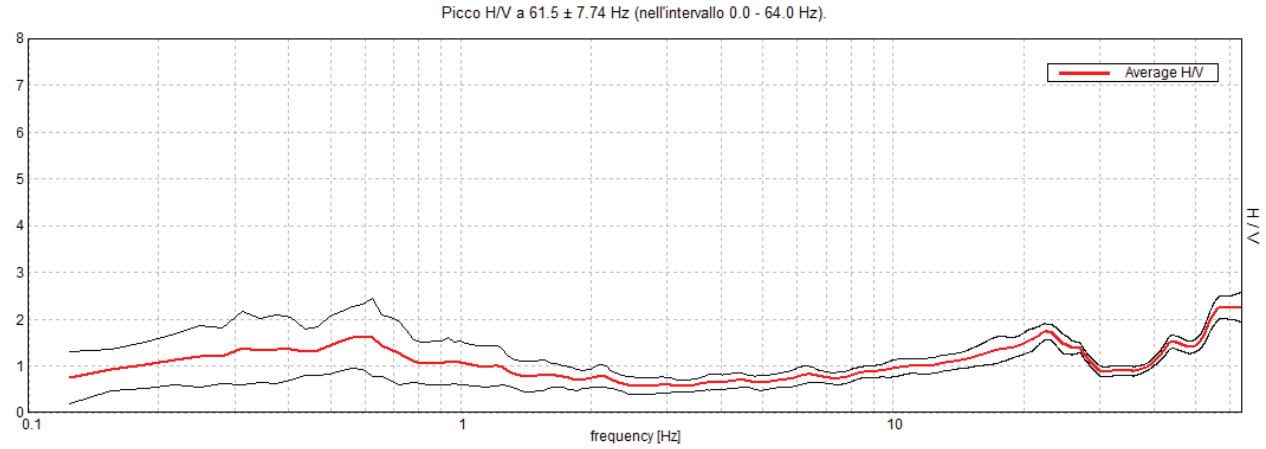
RILEVAZIONE TROMOGRAFICA – RAPPORTO DI PROVA 13.025-1.TR1

13025 RAVENNA, TEATRO RASI TR1

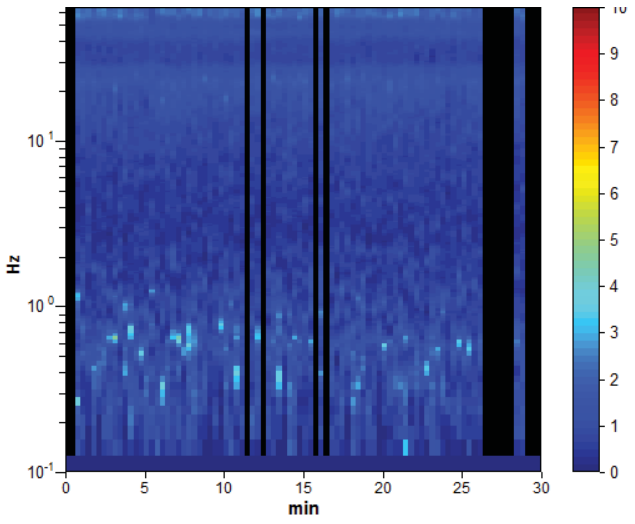
Strumento: TEN-0006/01-07
Inizio registrazione: 10/10/13 11:00:52
Fine registrazione: 10/10/13 11:30:53
Nomi canali: NORTH SOUTH; EAST WEST ; UP DOWN

Durata registrazione: 0h30'00".
Analizzato 83% tracciato (selezione manuale)
Freq. campionamento: 128 Hz
Lunghezza finestre: 20 s
Tipo di lisciamento: Triangular window
Lisciamento: 10%

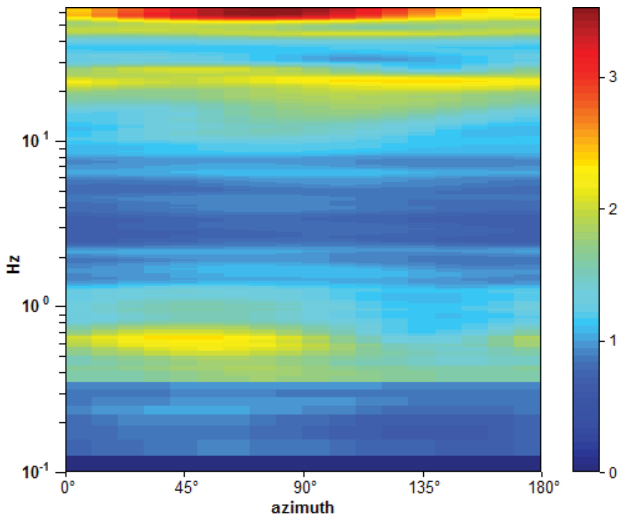
RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE



SERIE TEMPORALE H/V



DIREZIONALITA' H/V



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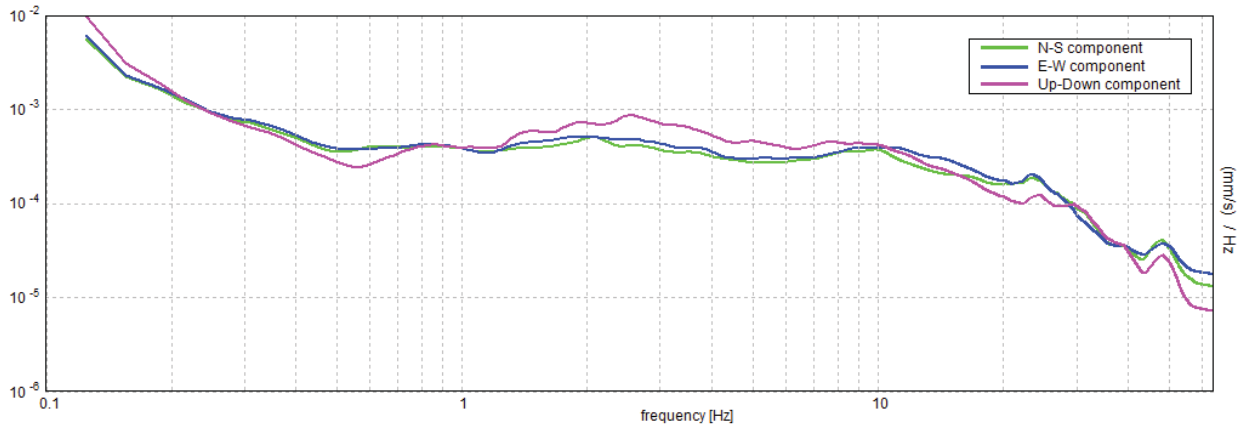
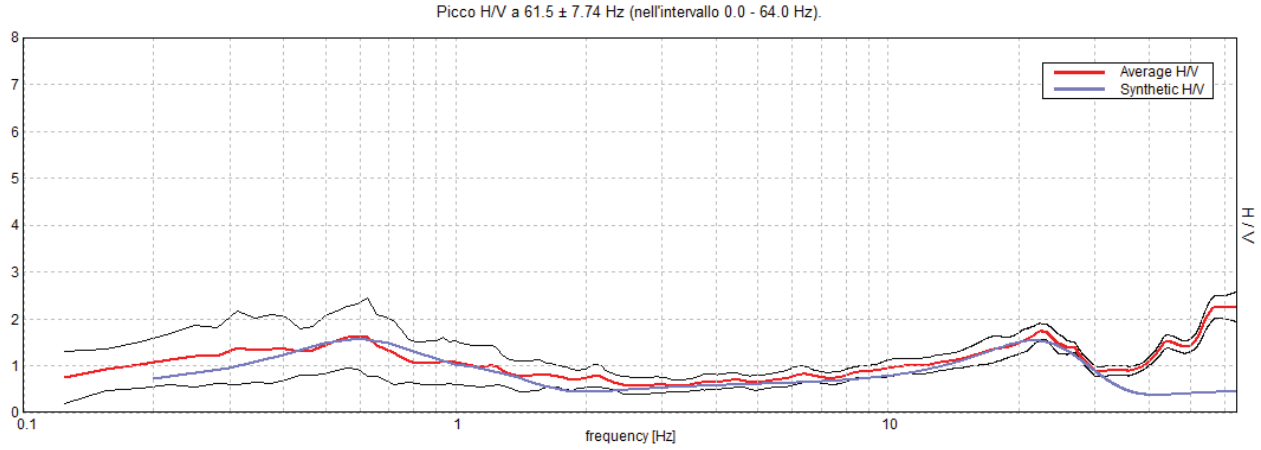
SPETTRI DELLE SINGOLE COMPONENTI

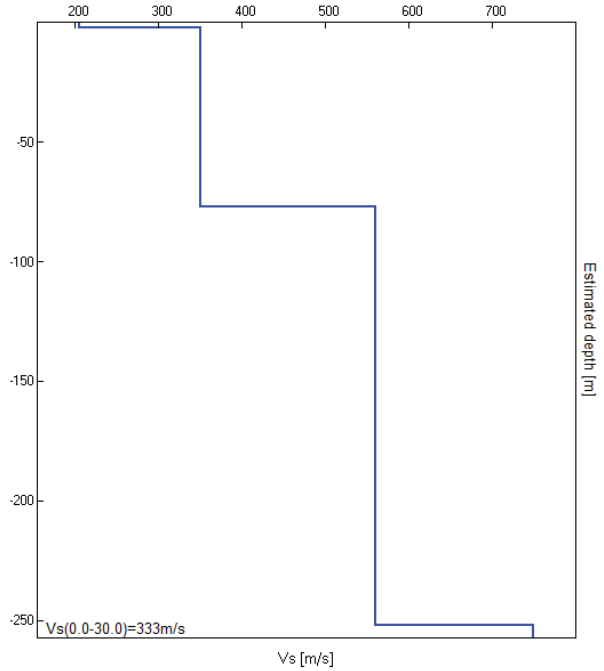


H/V SPERIMENTALE vs. H/V SINTETICO



Profondità alla base dello strato [m]	Spessore [m]	Vs [m/s]
2.20	2.20	205
77.20	75.00	350
252.20	175.00	560
inf.	inf.	750

Vs(0.0-30.0)=333m/s



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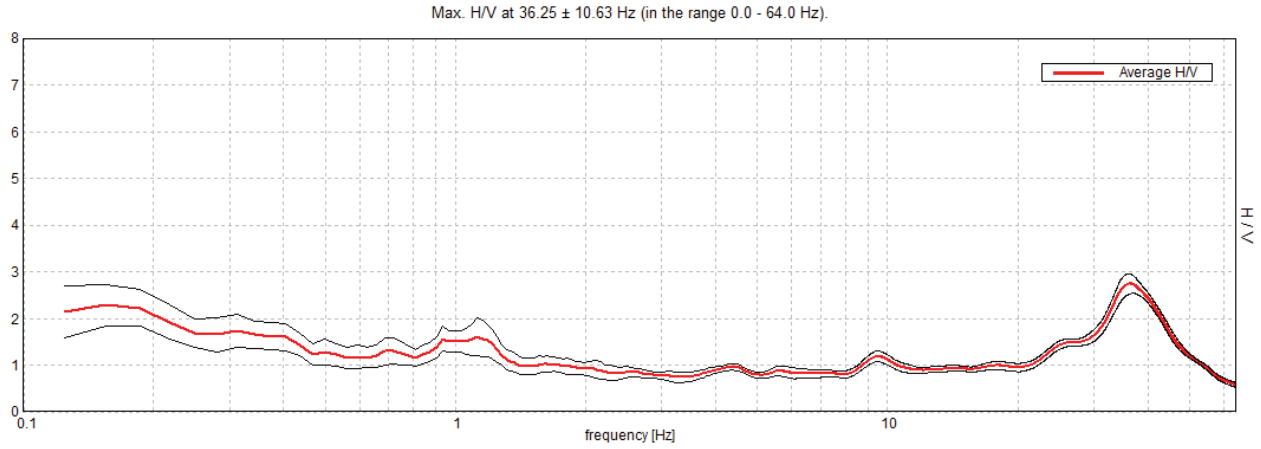
RILEVAZIONE TROMOGRAFICA – RAPPORTO DI PROVA 13.025-7.TR1

13025 RAVENNA, TEATRO ALIGHIERI TR1

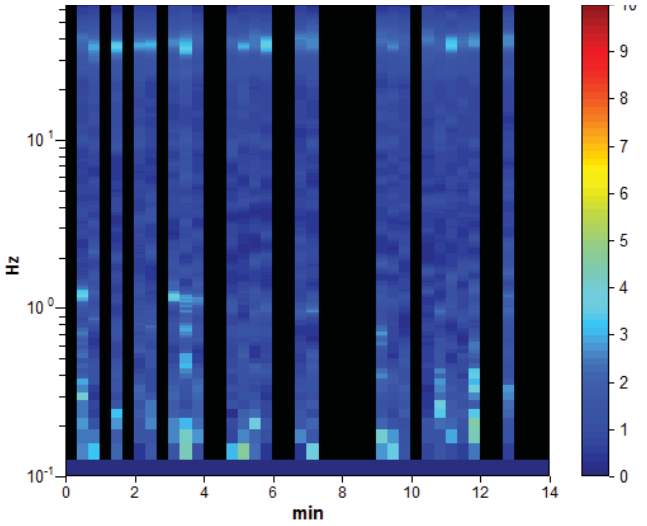
Instrument: TEN-0006/01-07
Start recording: 12/02/14 12:23:00
End recording: 12/02/14 12:37:01
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h14'00''.
Analyzed 55% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 20 s
Smoothing type: Triangular window
Smoothing: 10%

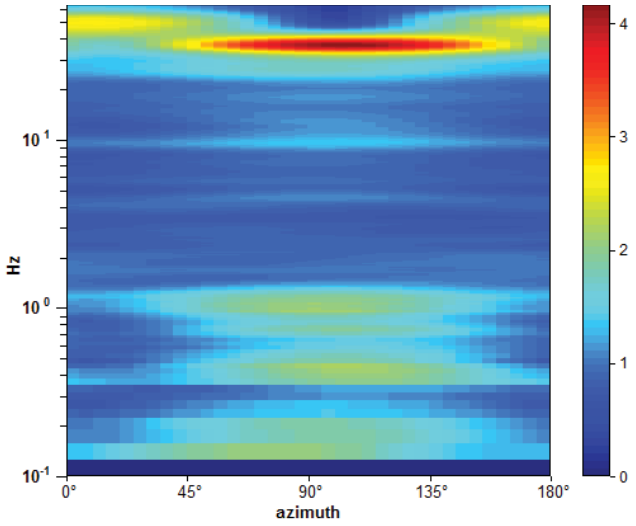
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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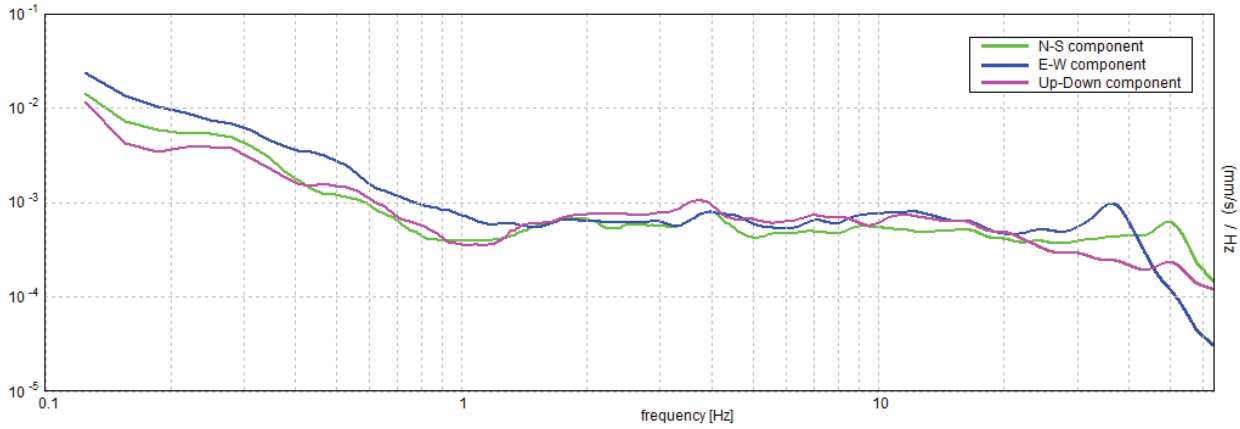
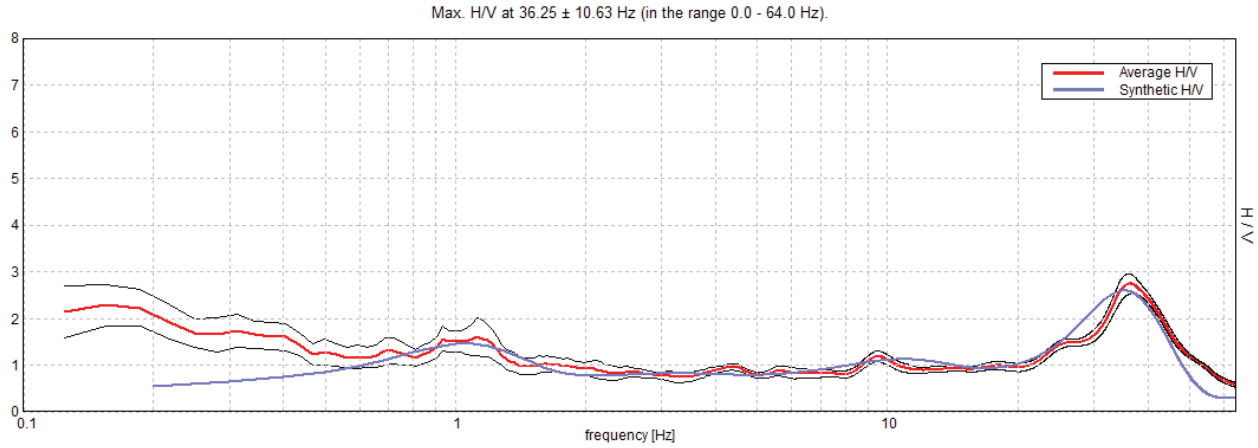
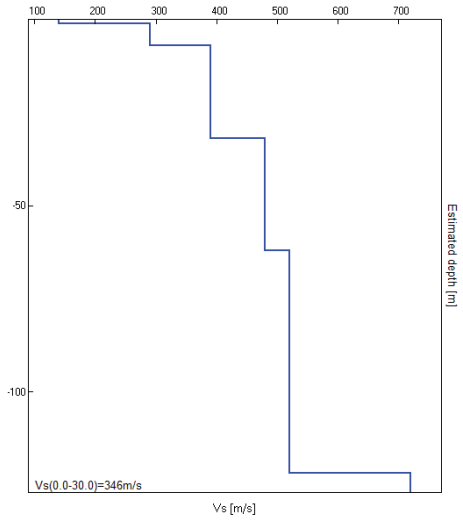


SINGLE COMPONENT SPECTRA



EXPERIMENTAL vs. SYNTHETIC H/V

Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
1.00	1.00	140	0.43
7.00	6.00	290	0.45
32.00	25.00	390	0.43
62.00	30.00	480	0.42
122.00	60.00	520	0.42
inf.	inf.	720	0.42



Vs(0.0-30.0)=346m/s

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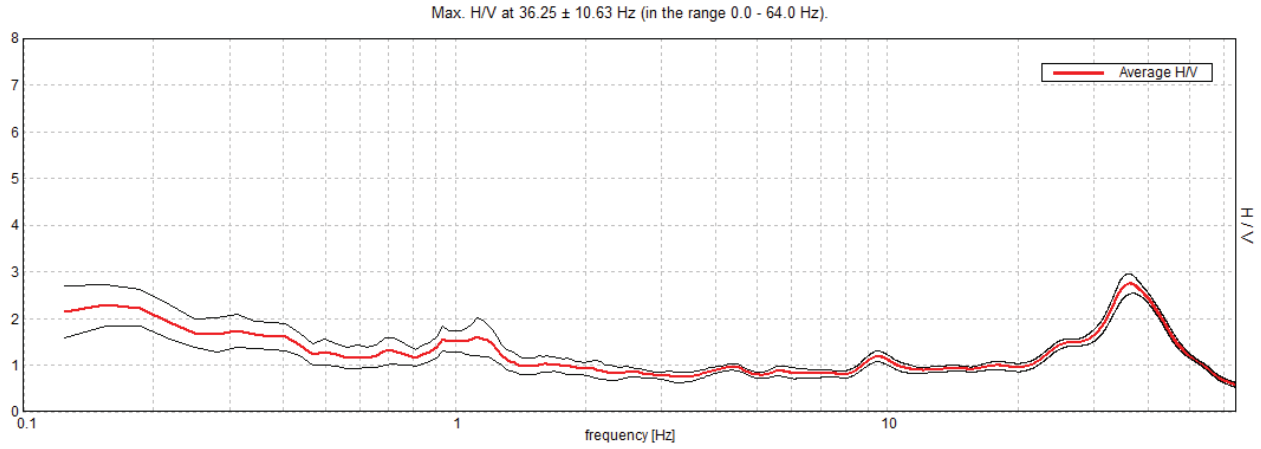
RILEVAZIONE TROMOGRAFICA – RAPPORTO DI PROVA 13.025-5.TR1

13025 RAVENNA, SAN NICOLO' TR1

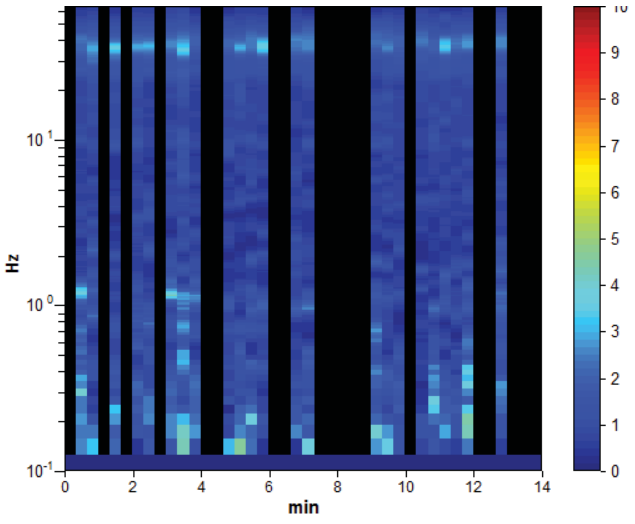
Instrument: TEN-0006/01-07
Start recording: 13/02/14 13:23:00
End recording: 13/02/14 13:37:01
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

Trace length: 0h14'00".
Analyzed 55% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 20 s
Smoothing type: Triangular window
Smoothing: 10%

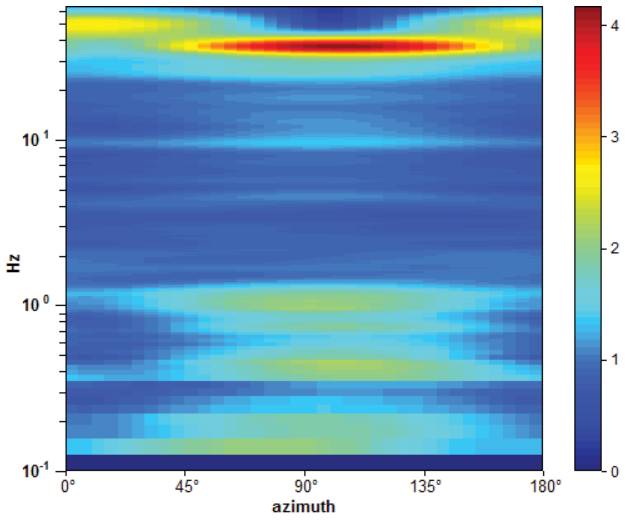
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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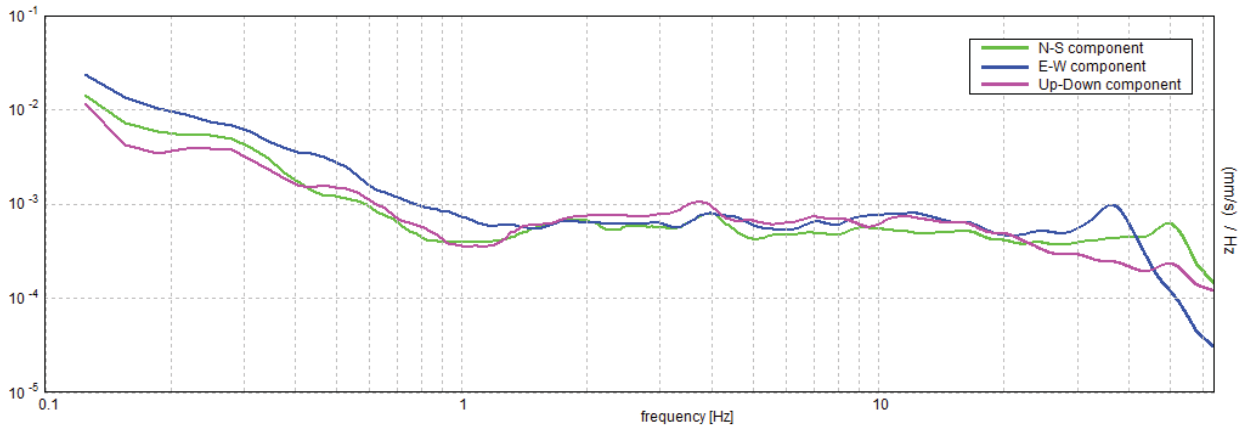
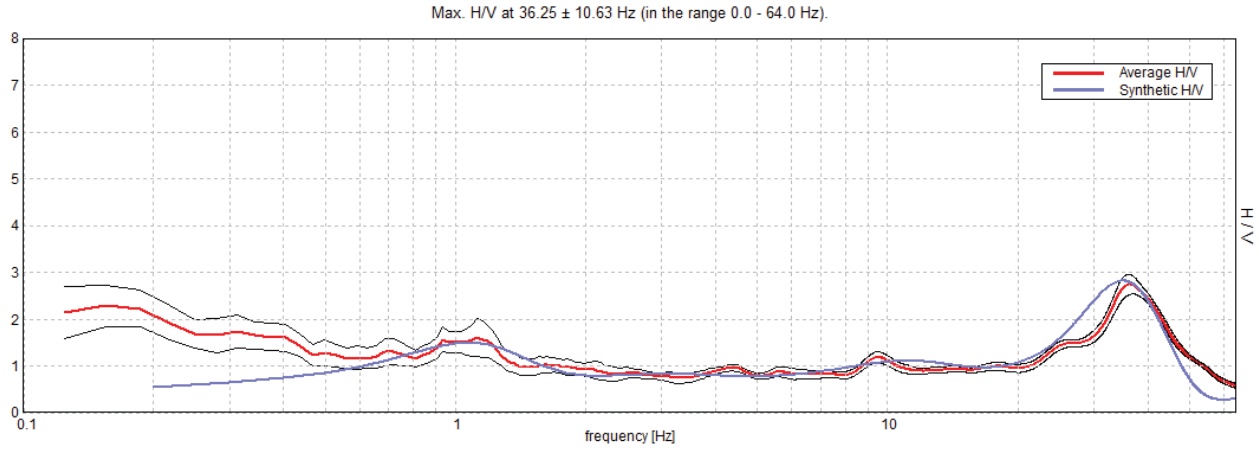
SINGLE COMPONENT SPECTRA

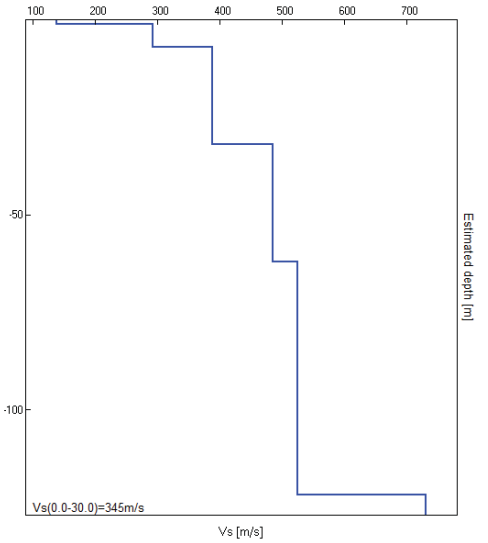


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
1.00	1.00	138
7.00	6.00	292
32.00	25.00	388
62.00	30.00	485
122.00	60.00	525
inf.	inf.	730

Vs(0.0-30.0)=345m/s



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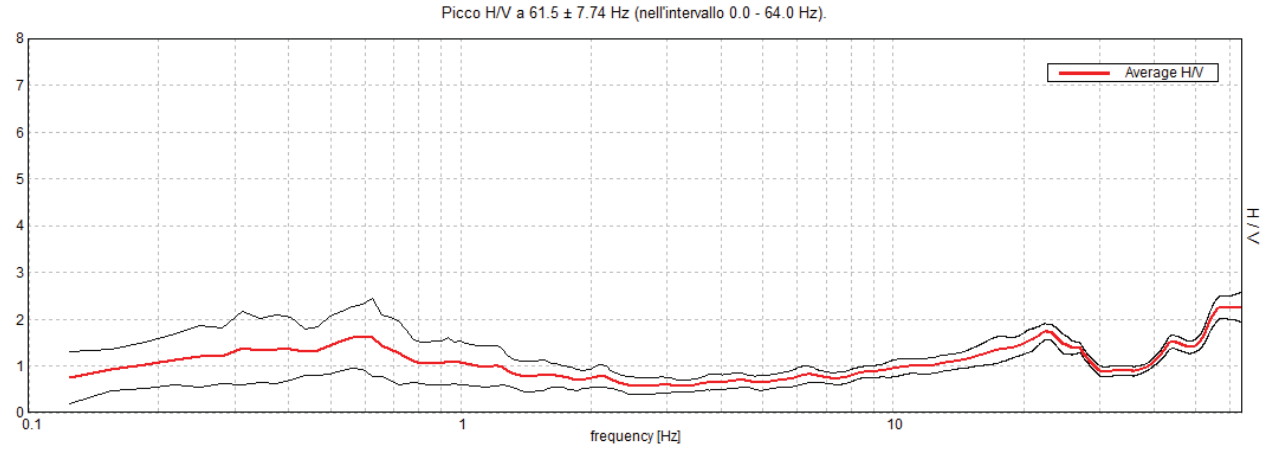
RILEVAZIONE TROMOGRAFICA – RAPPORTO DI PROVA 13.025-1.TR1

13025 RAVENNA, TEATRO RASI TR1

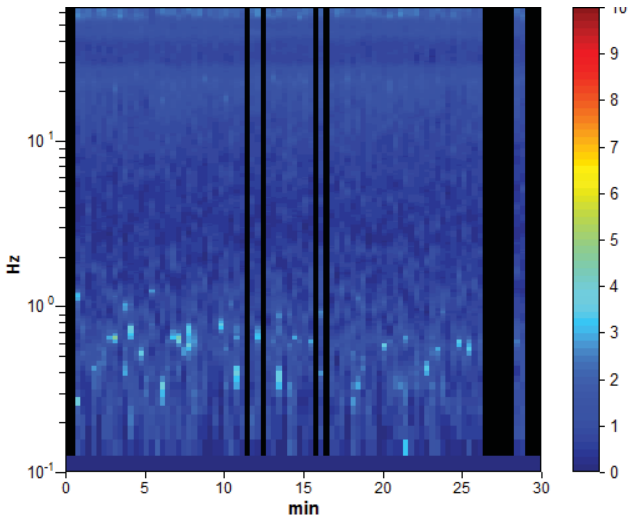
Strumento: TEN-0006/01-07
Inizio registrazione: 10/10/13 11:00:52
Fine registrazione: 10/10/13 11:30:53
Nomi canali: NORTH SOUTH; EAST WEST ; UP DOWN

Durata registrazione: 0h30'00".
Analizzato 83% tracciato (selezione manuale)
Freq. campionamento: 128 Hz
Lunghezza finestre: 20 s
Tipo di lisciamento: Triangular window
Lisciamento: 10%

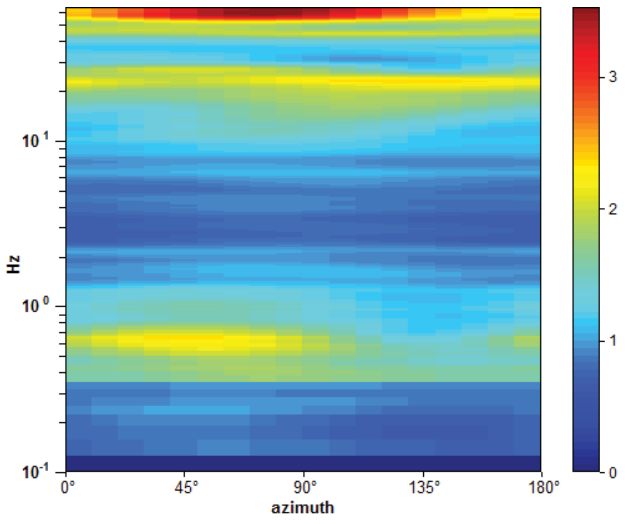
RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE



SERIE TEMPORALE H/V



DIREZIONALITA' H/V



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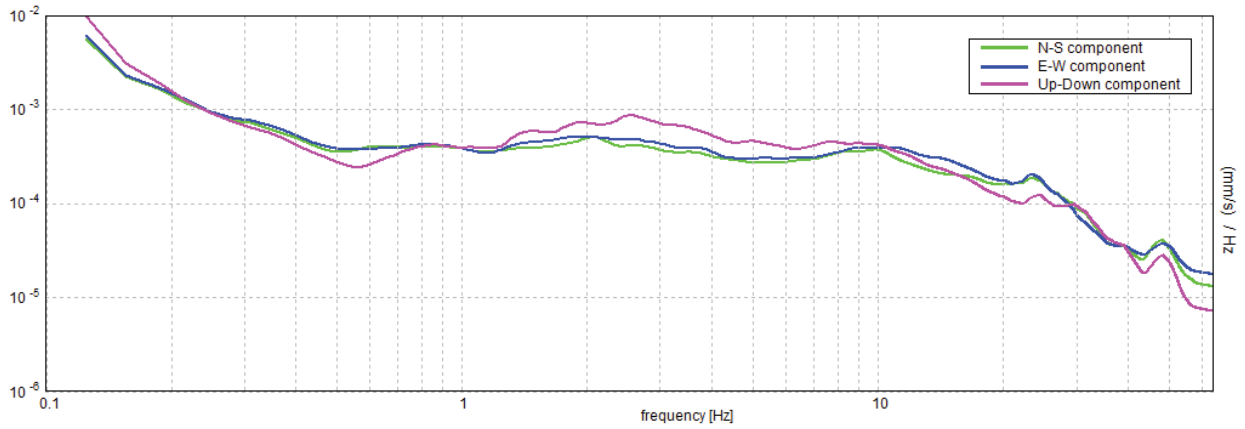
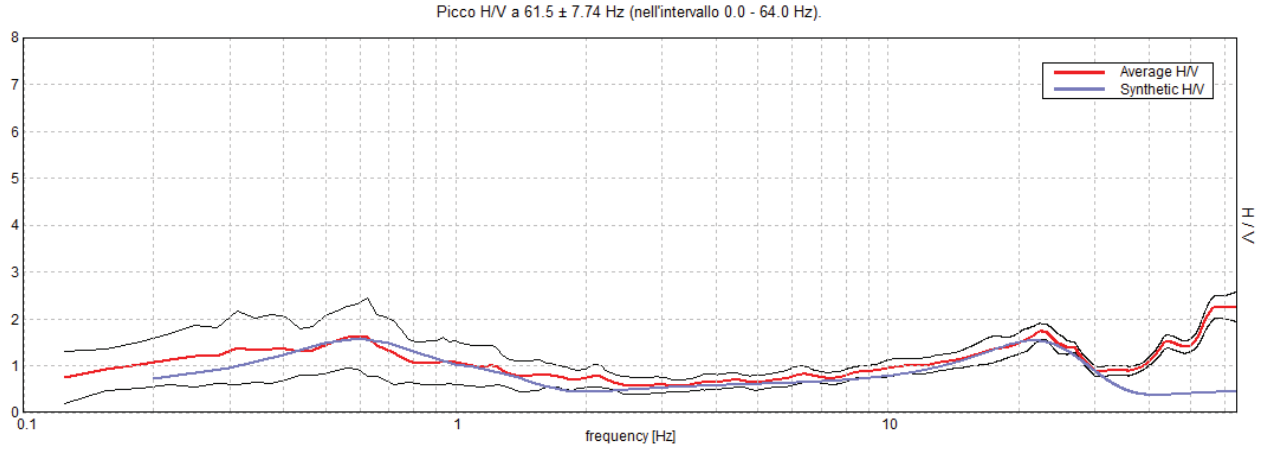
SPETTRI DELLE SINGOLE COMPONENTI

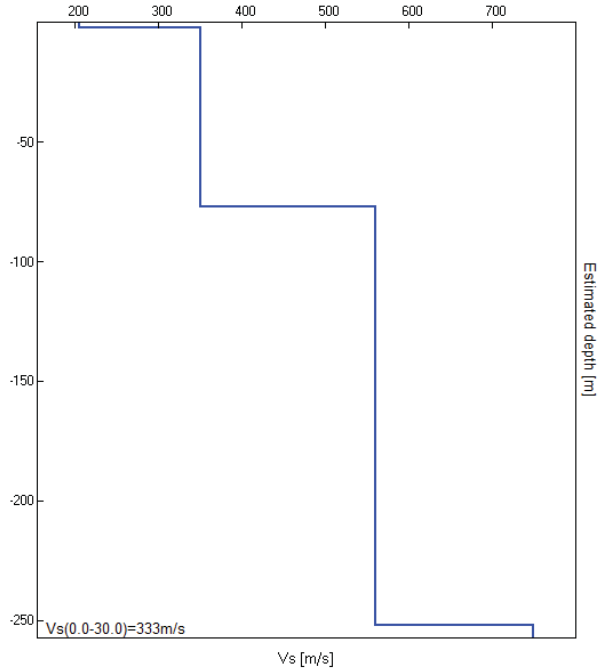


H/V SPERIMENTALE vs. H/V SINTETICO



Profondità alla base dello strato [m]	Spessore [m]	Vs [m/s]
2.20	2.20	205
77.20	75.00	350
252.20	175.00	560
inf.	inf.	750

Vs(0.0-30.0)=333m/s



HVSR8A

TROMINO® Grilla
www.tromino.it

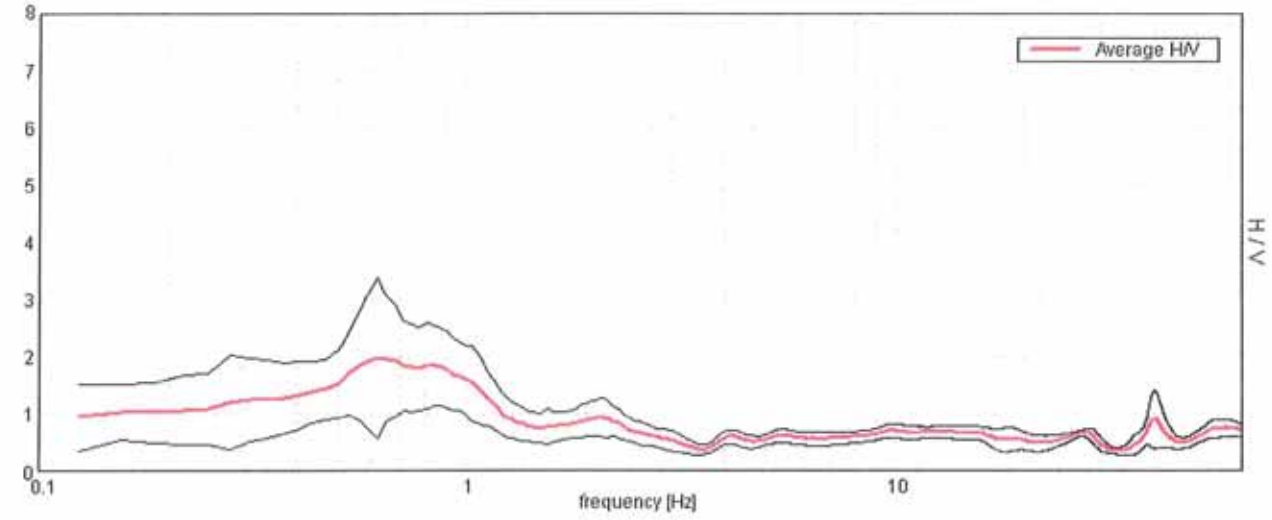
AUREAPROGETTI, VIA CAVOUR-VIA MORIGIA 2

Instrument: TRZ-0117/01-11
Start recording: 20/06/12 11:12:22 End recording: 20/06/12 11:32:22
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

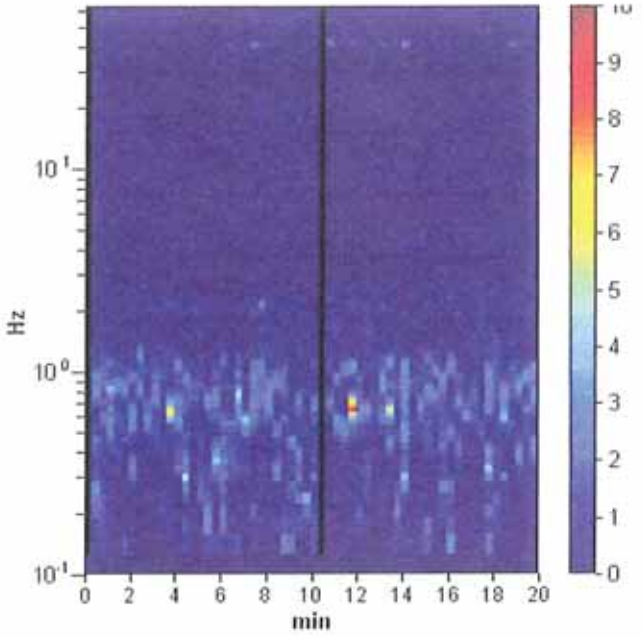
Trace length: 0h20'00". Analyzed 97% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 20 s
Smoothing type: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

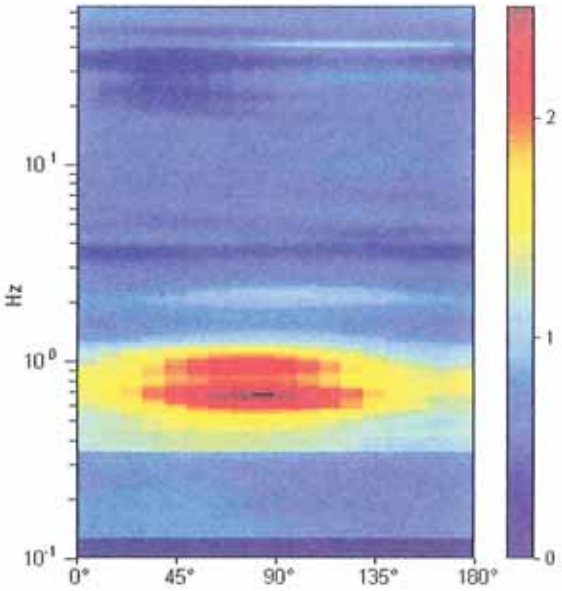
Max. H/V at 0.63 ± 0.04 Hz. (In the range 0.0 - 64.0 Hz).



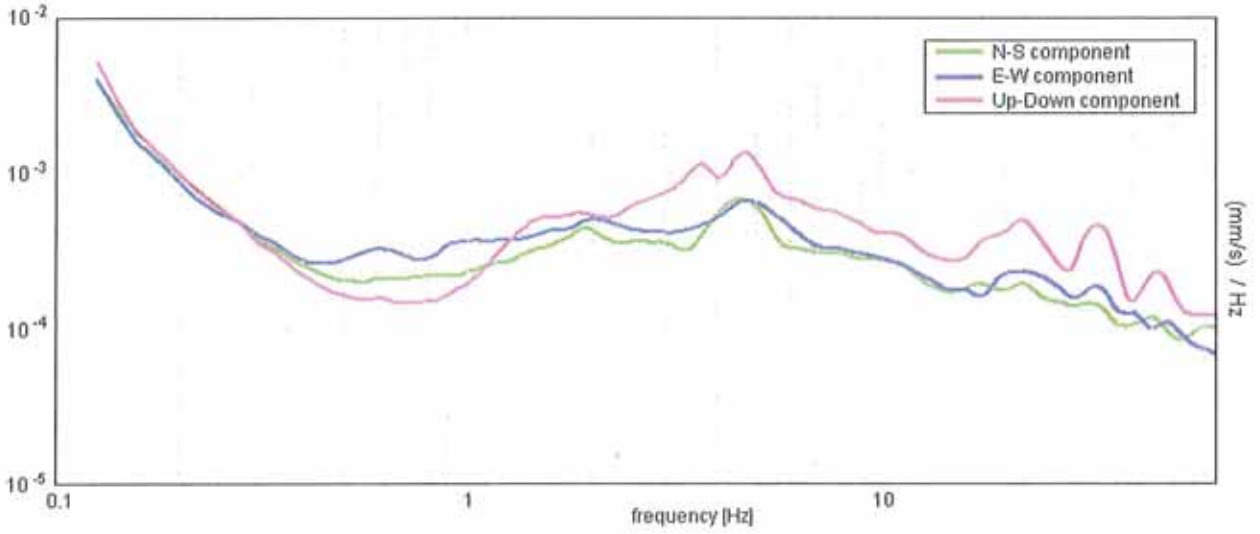
H/V TIME HISTORY



DIRECTIONAL H/V

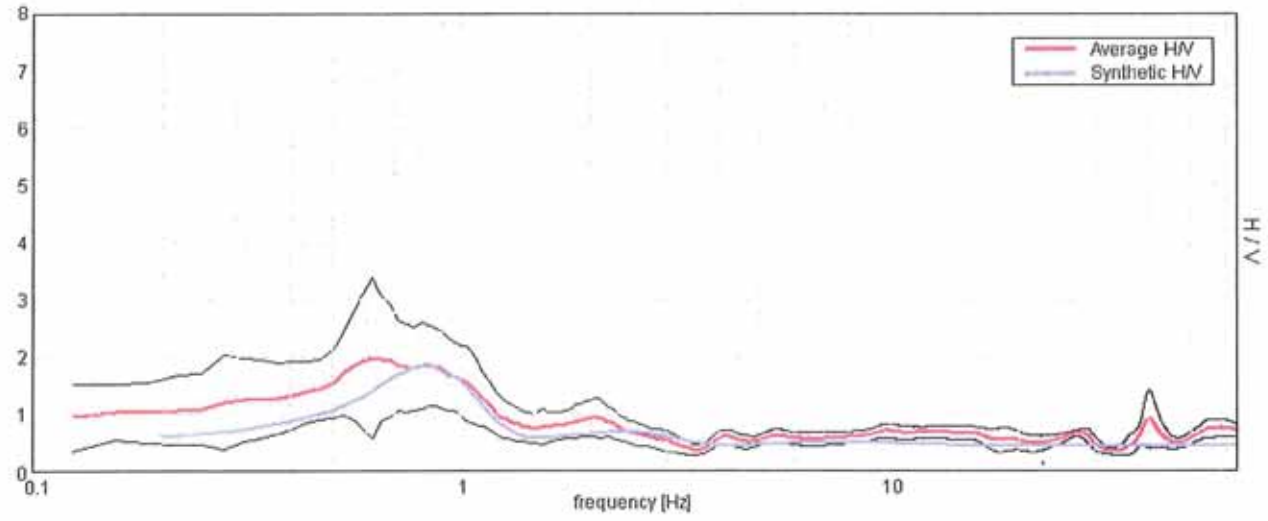


SINGLE COMPONENT SPECTRA



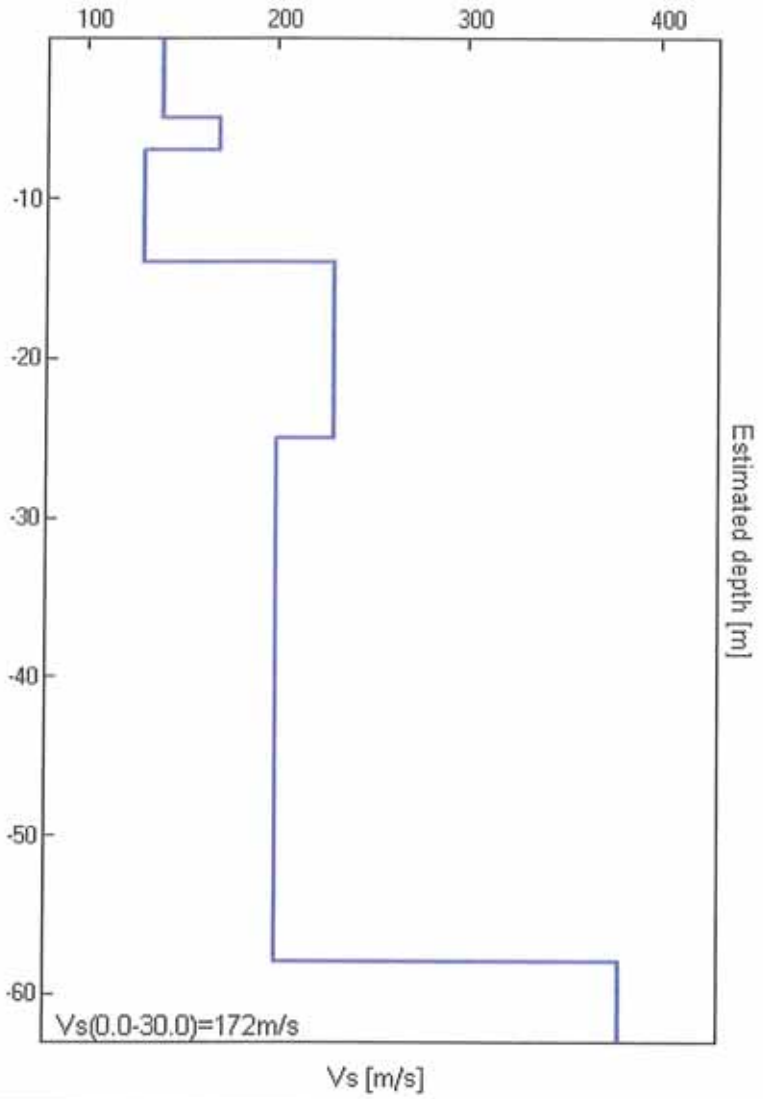
EXPERIMENTAL vs. SYNTHETIC H/V

Max. H/V at 0.63 ± 0.04 Hz. (In the range 0.0 - 64.0 Hz).



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
5.00	5.00	140	0.35
7.00	2.00	170	0.35
14.00	7.00	130	0.35
25.00	11.00	230	0.35
58.00	33.00	200	0.35
inf.	inf.	380	0.35

Vs(0.0-30.0)=172m/s



Max. H/V at 0.63 ± 0.04 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.63 > 0.50	OK	
$n_c(f_0) > 200$	725.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 31 times	OK	
Criteria for a clear H/V peak			
Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$	1.25 Hz	OK	
$A_0 > 2$	1.98 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03009| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.0188 < 0.09375	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.6976 < 2.0	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

studio CP
DOTT. GEOL. PAOLO TRENTI
DOTT. GEOL. MARIA CRISTINA VERRECCHIA

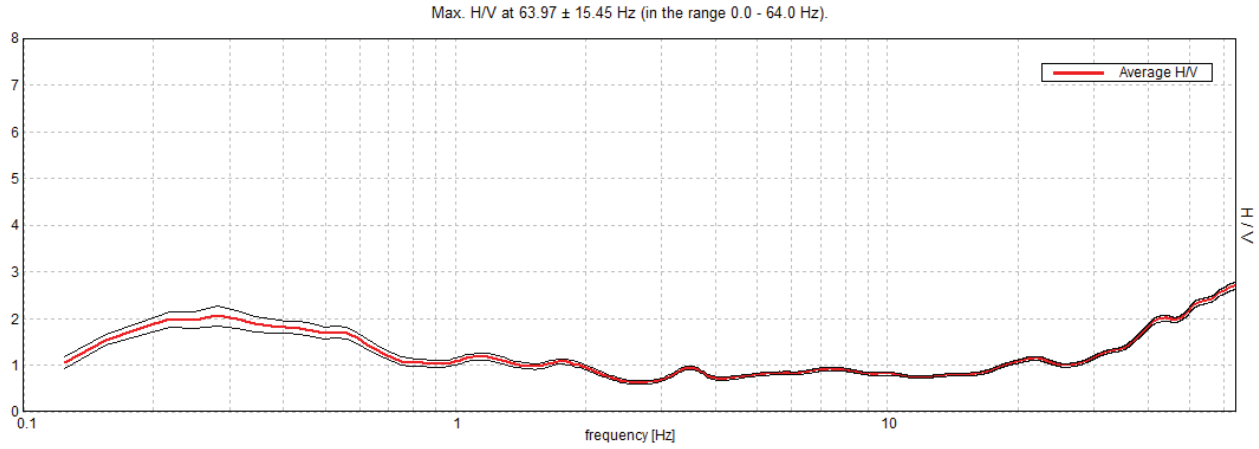
RILEVAZIONE TROMOGRAFICA – RAPPORTO DI PROVA 13.025-4.TR1

13025 RAVENNA, ALMAGIA' TR1

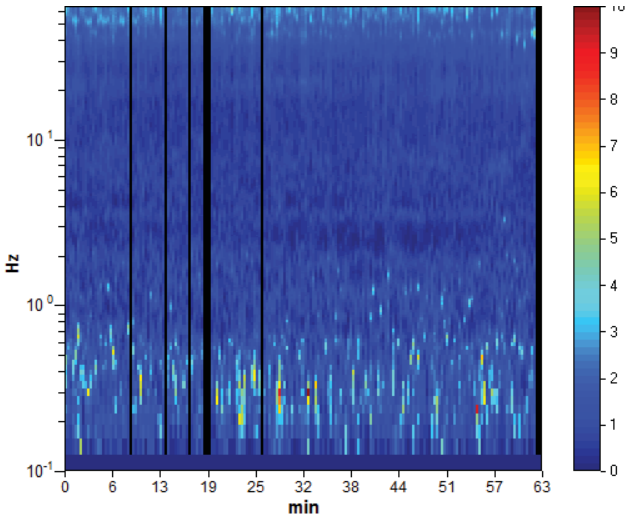
Instrument: TEN-0006/01-07
Start recording: 13/02/14 14:08:07
End recording: 13/02/14 15:11:26
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

Trace length: 1h03'12".
Analyzed 96% trace (automatic window selection)
Sampling rate: 128 Hz
Window size: 20 s
Smoothing type: Triangular window
Smoothing: 10%

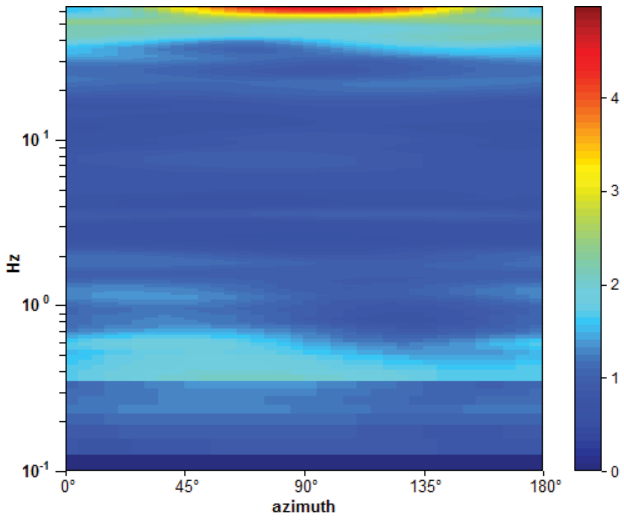
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY

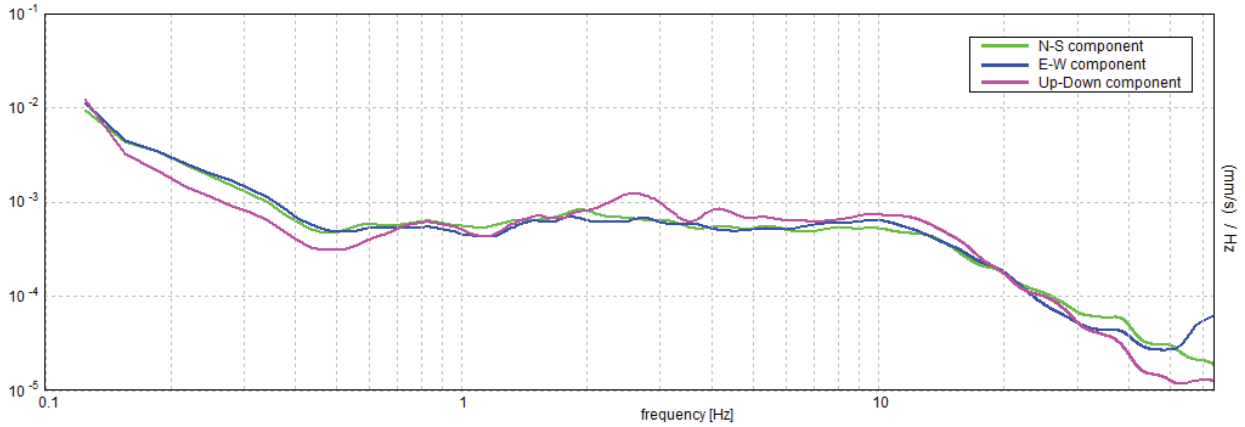


DIRECTIONAL H/V

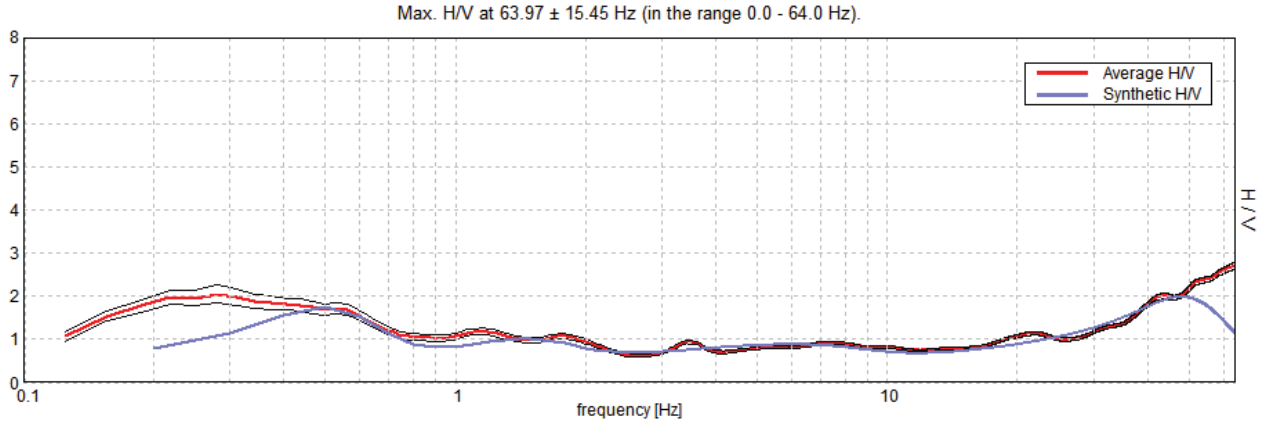


DOTT. GEOL. PAOLO TRENTI
DOTT. GEOL. MARIA CRISTINA VERRECCHIA

SINGLE COMPONENT SPECTRA

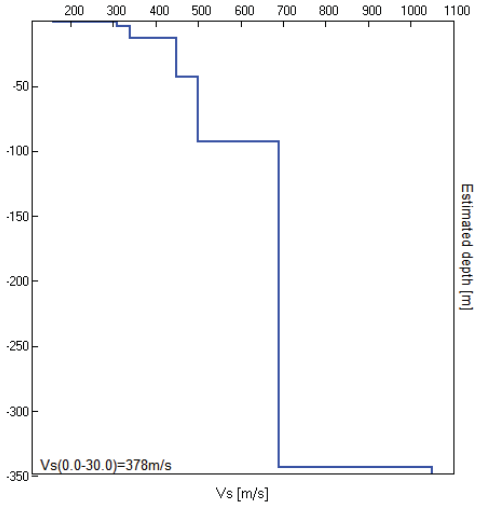


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.80	0.80	160
3.80	3.00	310
12.80	9.00	340
42.80	30.00	450
92.80	50.00	500
342.80	250.00	690
inf.	inf.	1050

Vs(0.0-30.0)=378m/s



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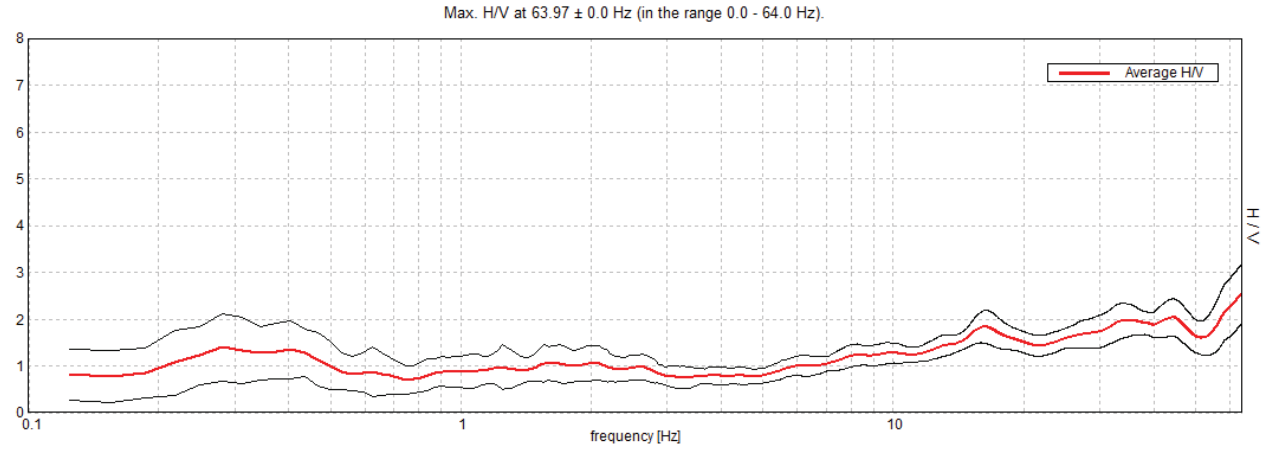
RILEVAZIONE TROMOGRAFICA – RAPPORTO DI PROVA 13.025-7.TR1

13025 RAVENNA, IPPODROMO TR1

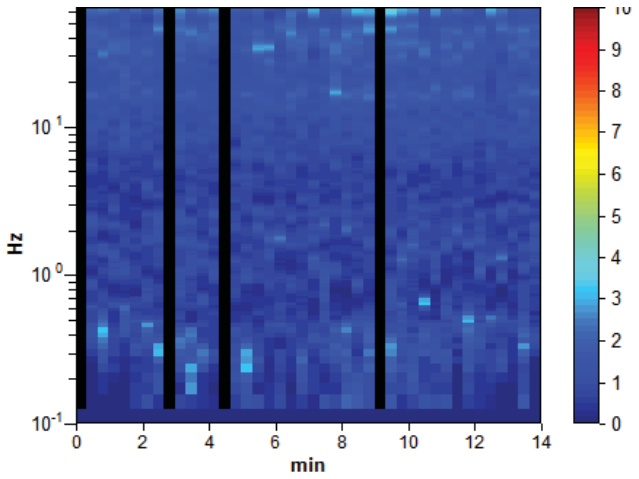
Instrument: TEN-0006/01-07
Start recording: 10/10/13 13:17:19
End recording: 10/10/13 13:31:20
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

Trace length: 0h14'00".
Analyzed 90% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 20 s
Smoothing type: Triangular window
Smoothing: 10%

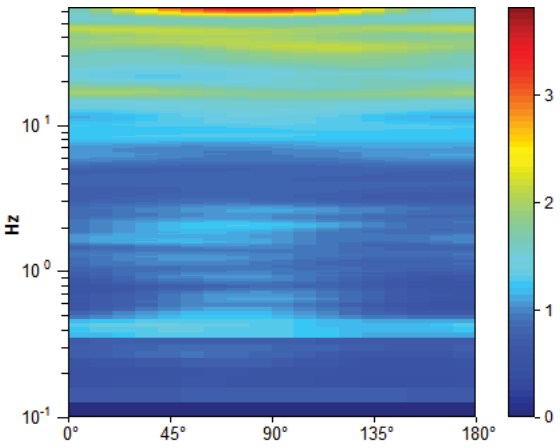
RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE



SERIE TEMPORALE H/V



DIREZIONALITA' H/V



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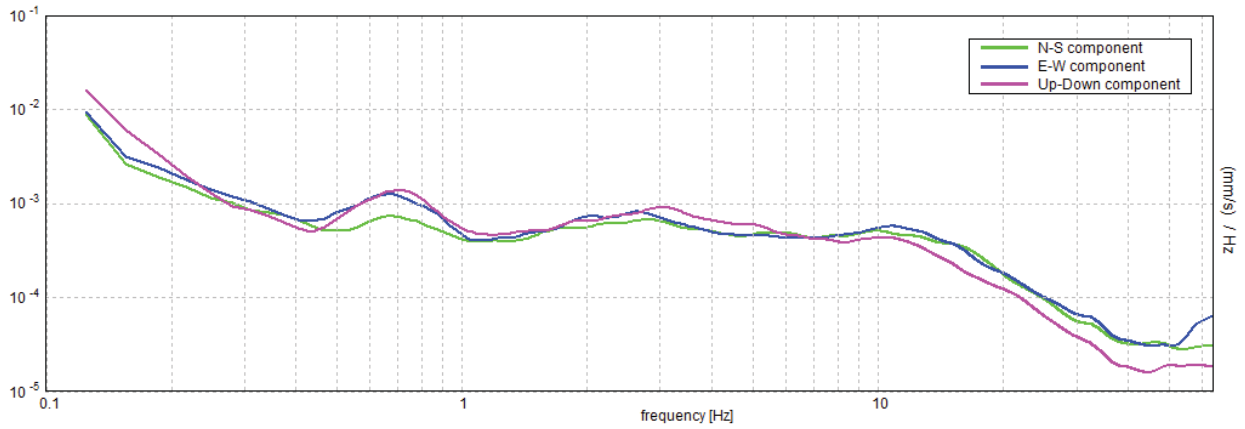
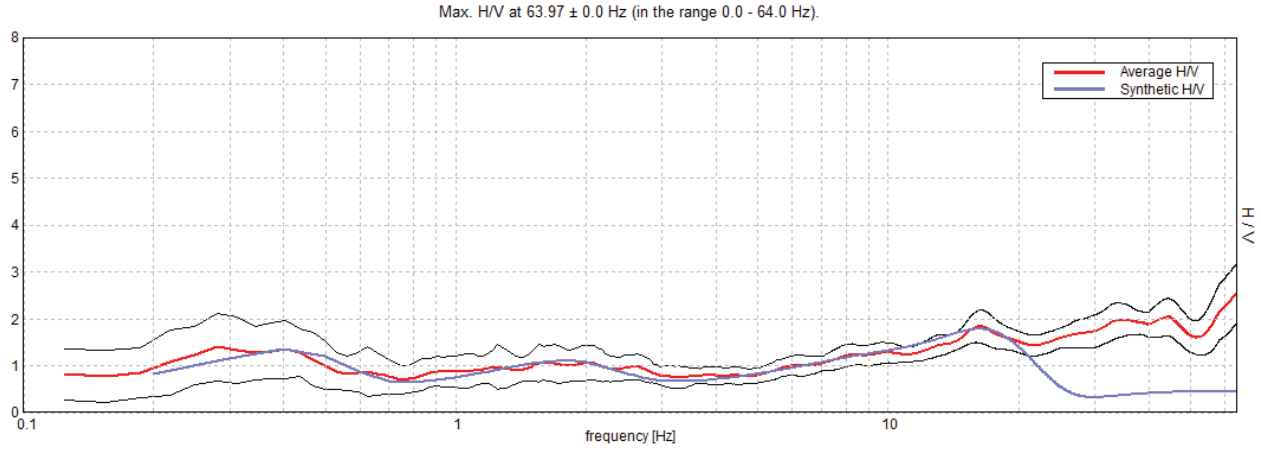
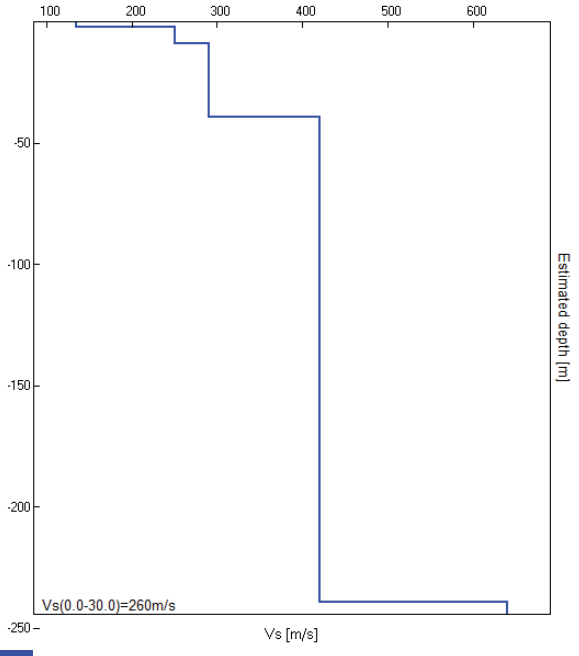
SPETTRI DELLE SINGOLE COMPONENTI



H/V SPERIMENTALE vs. H/V SINTETICO



Profondità alla base dello strato [m]	Spessore [m]	Vs [m/s]
2.00	2.00	135
9.00	7.00	250
39.00	30.00	290
239.00	200.00	420
inf.	inf.	640



Vs(0.0-30.0)=260m/s

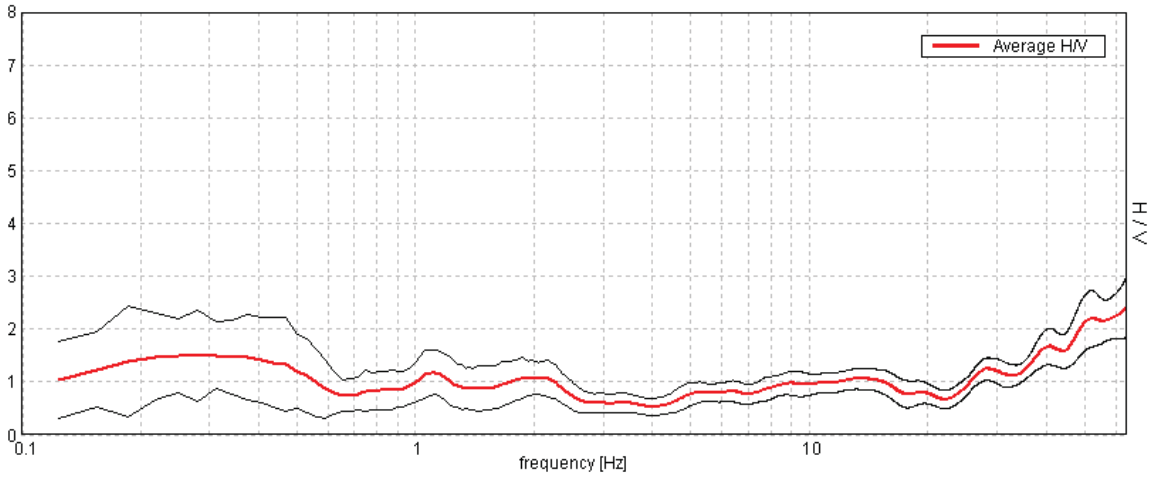
CLASSE, EXZUCCHERIFICIO 1

Instrument: TRZ-0117/01-11
Start recording: 20/01/16 09:55:37 End recording: 20/01/16 10:15:37
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

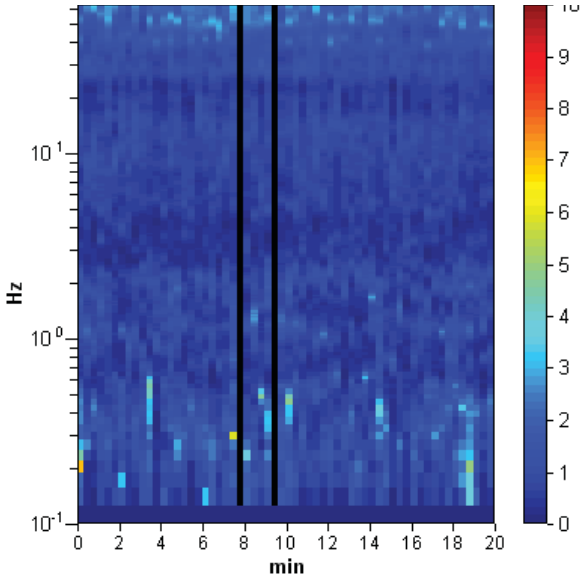
Trace length: 0h20'00". Analyzed 97% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 20 s
Smoothing type: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

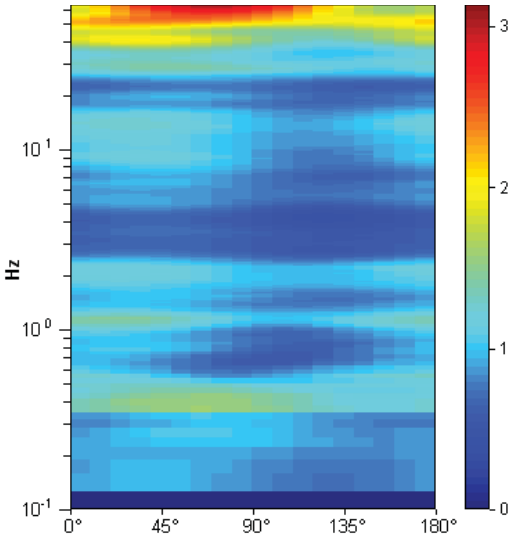
Max. H/V at 63.97 ± 3.14 Hz. (In the range 0.0 - 64.0 Hz).



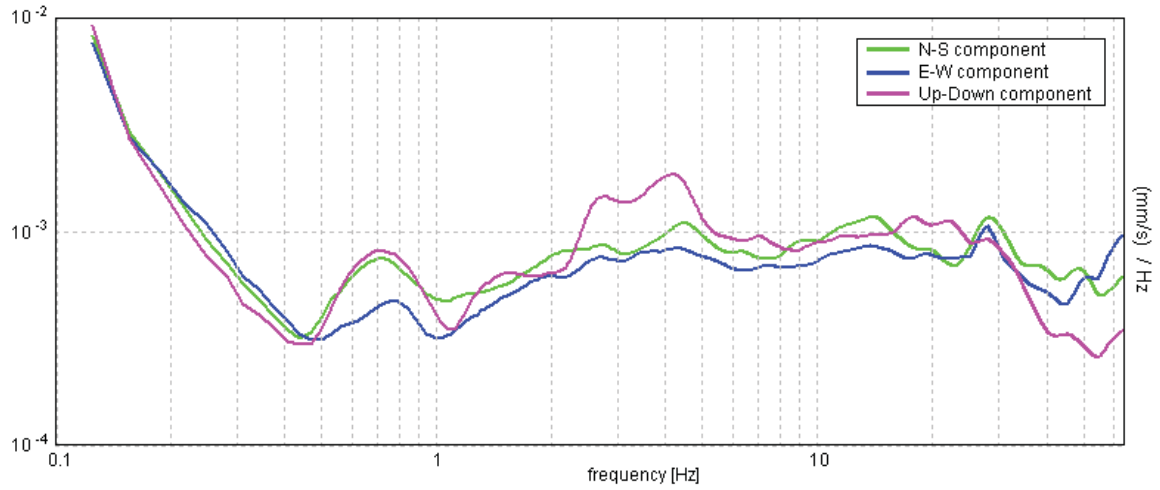
H/V TIME HISTORY



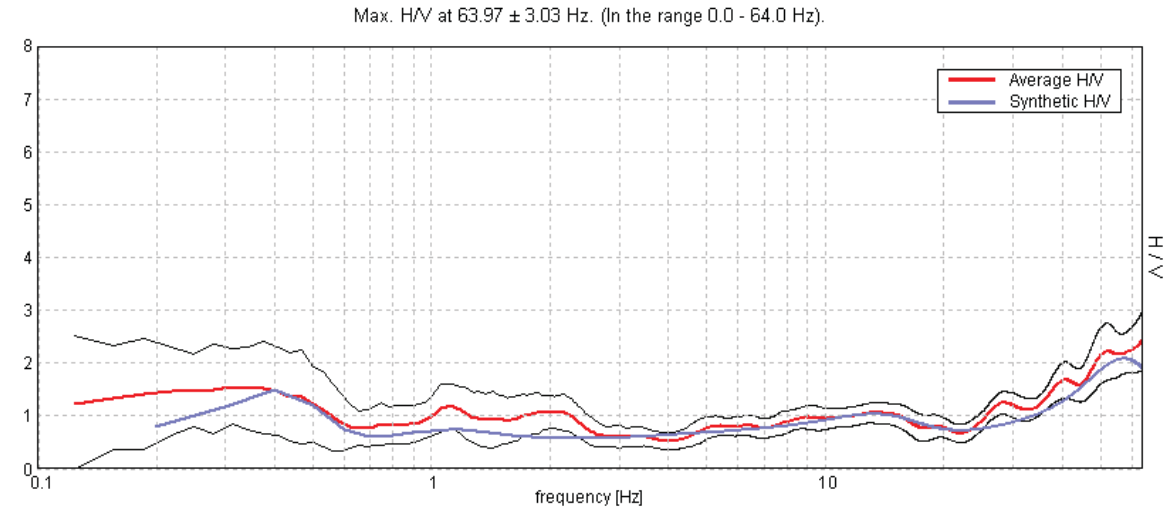
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

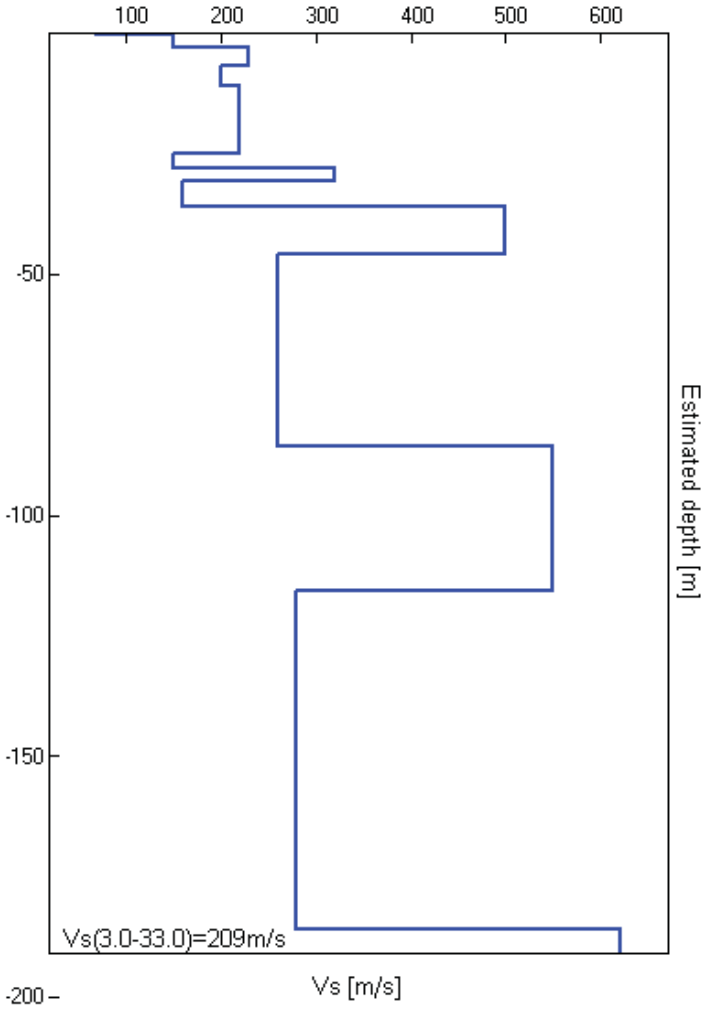


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.30	0.30	70	0.35
2.80	2.50	150	0.35
6.80	4.00	230	0.35
10.80	4.00	200	0.35
24.80	14.00	220	0.35
27.80	3.00	150	0.35
30.80	3.00	320	0.35
35.80	5.00	160	0.35
45.80	10.00	500	0.35
85.80	40.00	260	0.35
115.80	30.00	550	0.35
185.80	70.00	280	0.35
inf.	inf.	620	0.35

Vs(0.0-30.0)=202m/s
Vs(3.0-33.0)=209m/s



Max. H/V at 63.97 ± 3.14 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	63.97 > 0.50	OK	
$n_c(f_0) > 200$	74203.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1026 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	35.031 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.41 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02431| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	1.55518 < 3.19844	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2815 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR12A

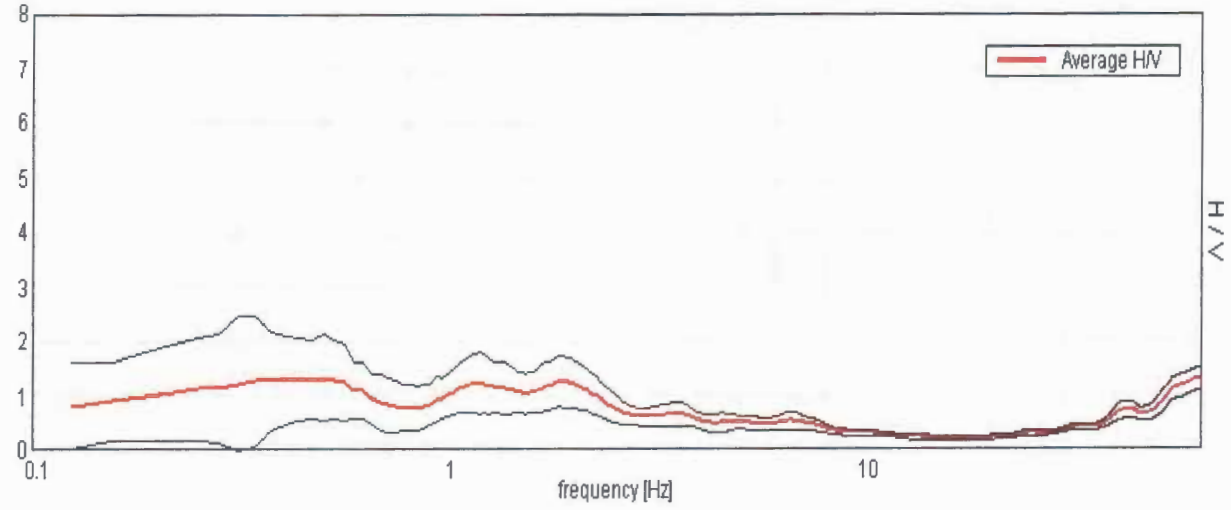
Committente: MARTINI ALIMENTARI S. P. A.
Lavoro: Ristrutturazione e ampliamento di servizi igienici e spogliatoti
Località: Via Bevano, Castiglione di Ravenna

Instrument: TRZ-0112/01-10
Start recording: 10/07/12 09:28:31 End recording: 10/07/12 09:48:32
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

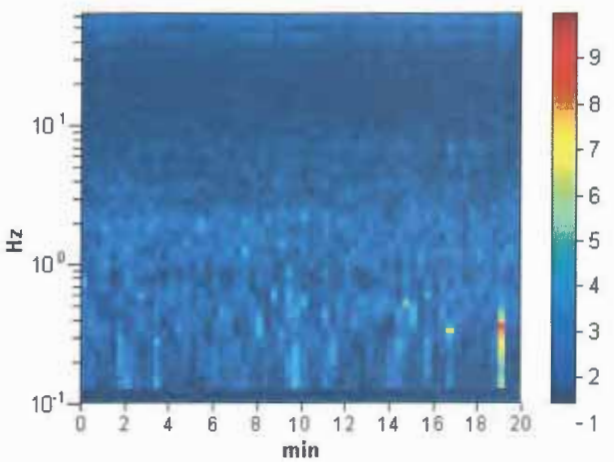
Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling rate: 128 Hz
Window size: 20 s
Smoothing type: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

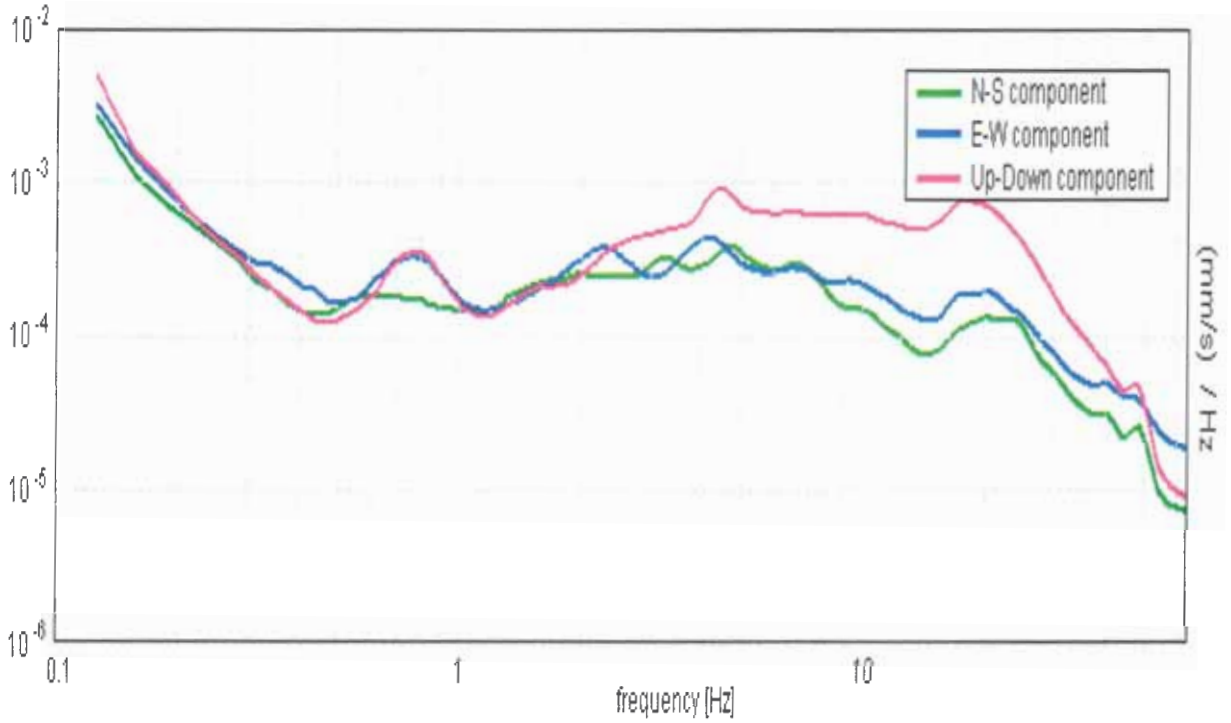
Max. H/V at 0.5 ± 0.3 Hz. (In the range 0.0 - 2.0 Hz).



H/V TIME HISTORY

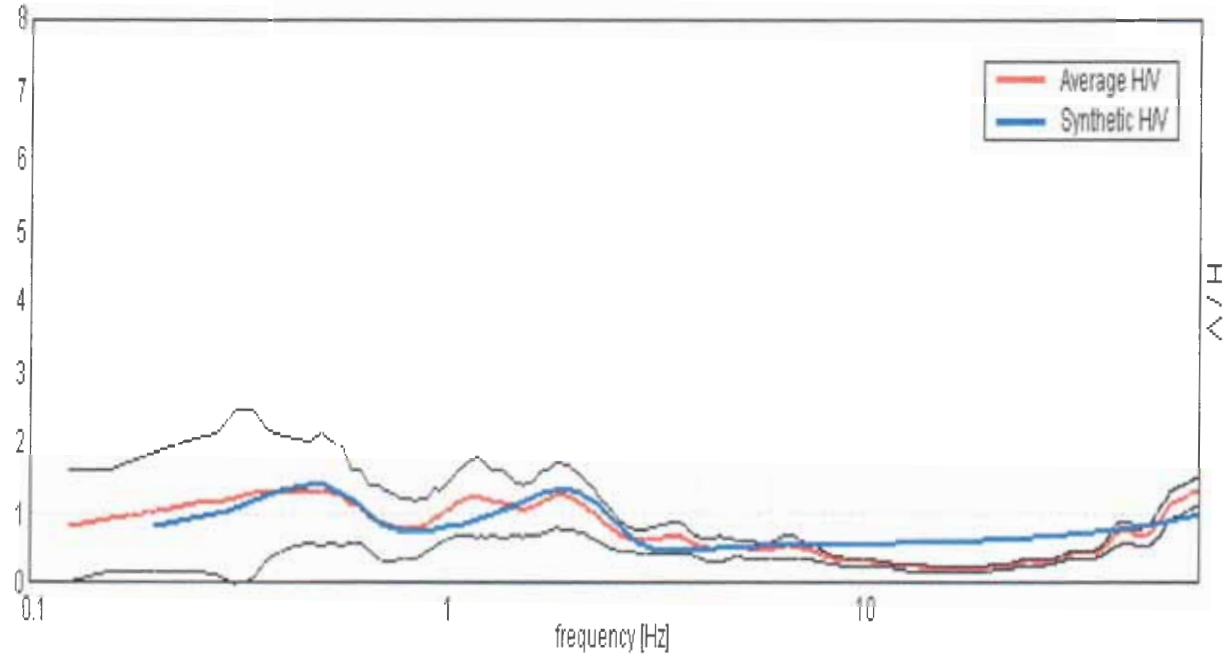


SINGLE COMPONENT SPECTRA

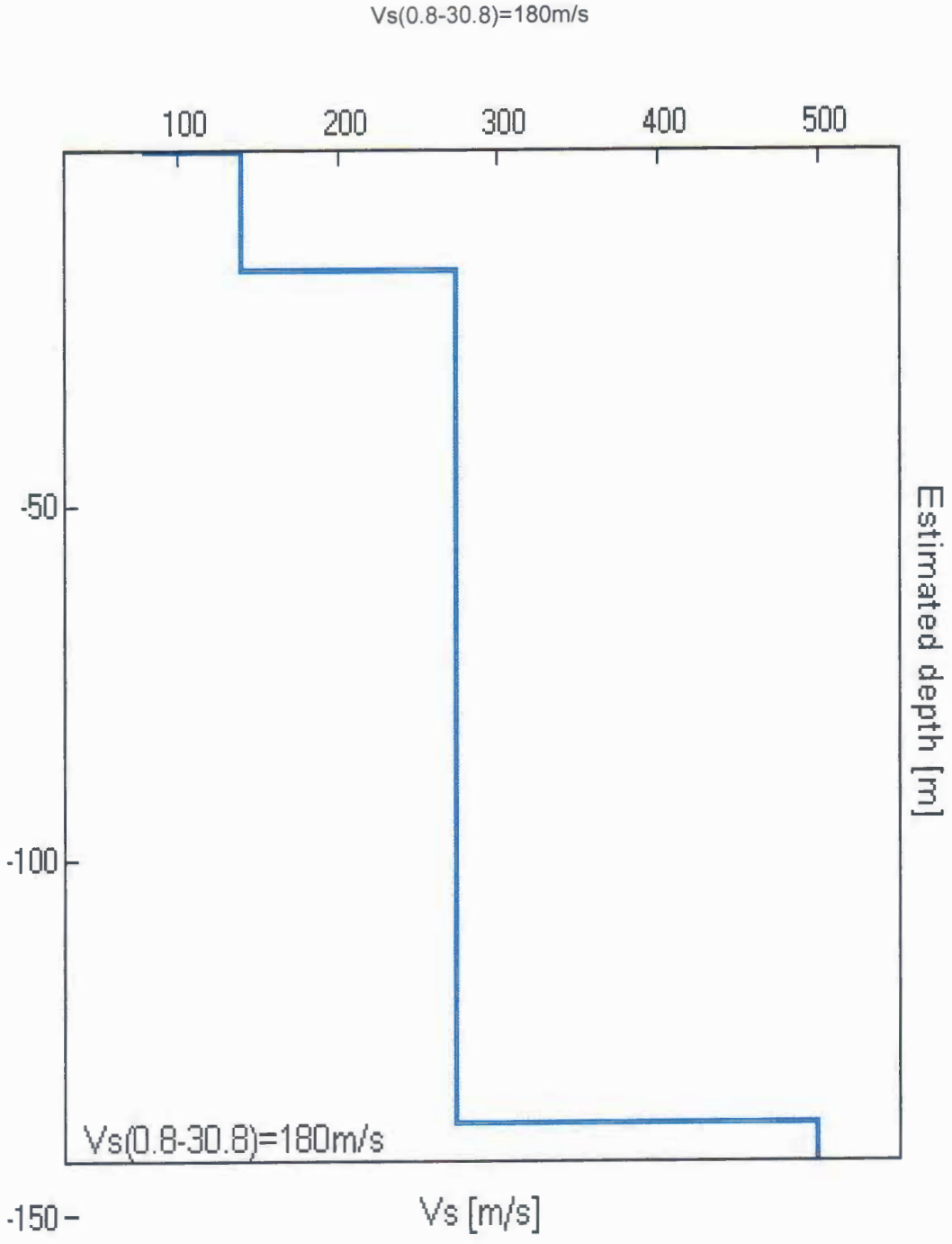


EXPERIMENTAL vs. SYNTHETIC H/V

Max. H/V at 0.5 ± 0.3 Hz. (In the range 0.0 - 2.0 Hz).



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.20	0.20	80	0.35
17.20	17.00	140	0.30
137.20	120.00	275	0.30
inf.	inf.	500	0.27



(According to the SESAME, 2005 guidelines)

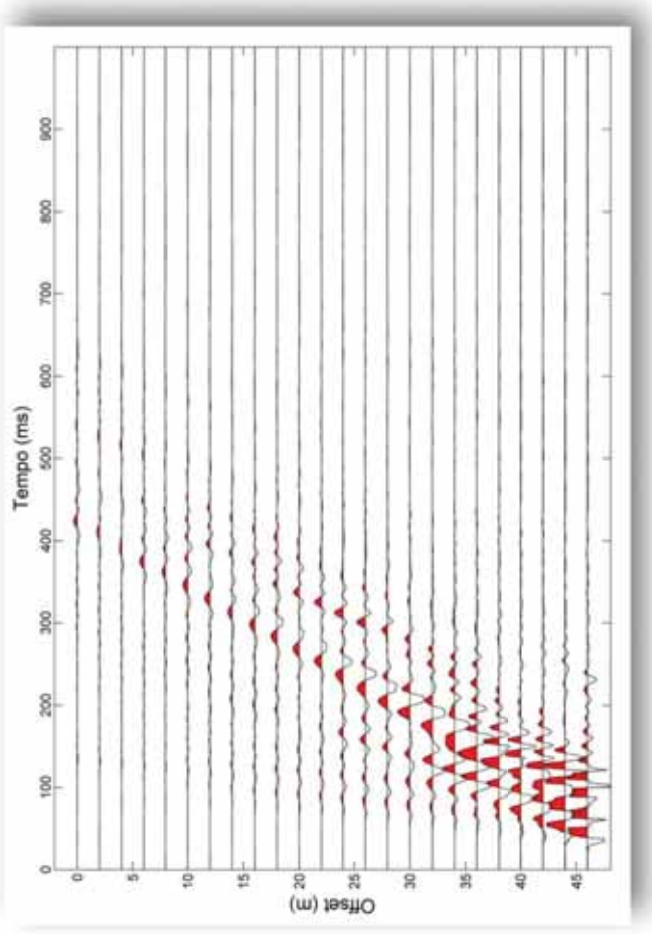
Max. H/V at 0.5 ± 0.3 Hz (in the range 0.0 - 2.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.60 > 0.50	OK	
$n_c(f_0) > 200$	600.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 25 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	3.754 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.32 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03355| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.06686 < 0.075	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3958 < 2.0	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

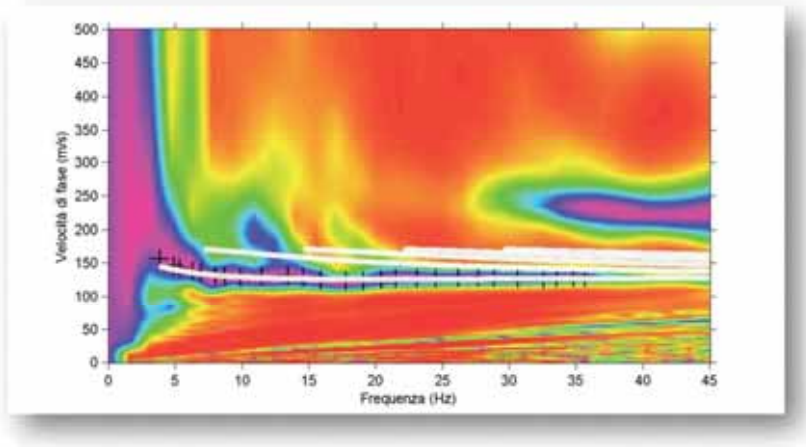
MASW5A



Sismogrammi acquisiti dai 24 geofoni durante l'indagine. La sorgente è posta ad una distanza di 8 m dal geofono 24. La spaziatura tra i geofoni è di 2 m.

Allegato 6 – Sismogrammi – MASW2

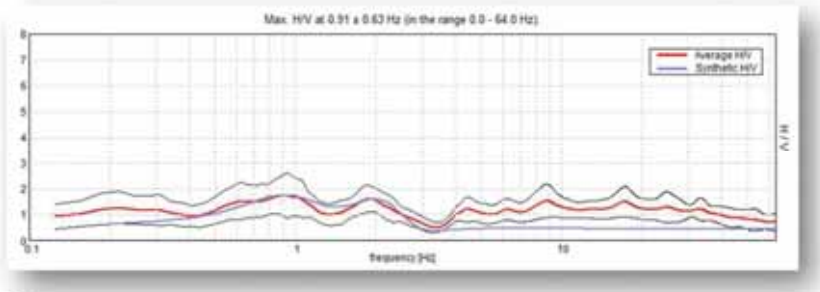
Allegato 7 – Spettro di dispersione – MASW2



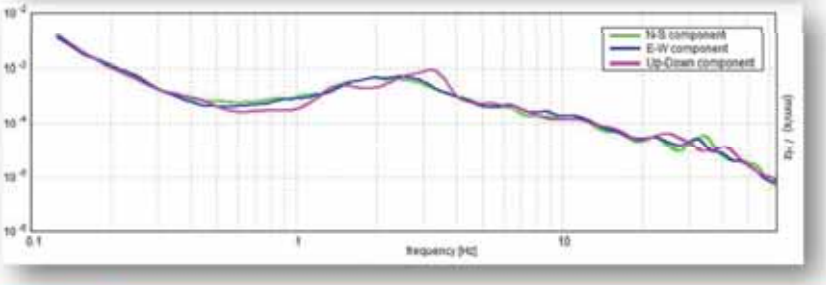
in alto: Spettro frequenza-velocità di fase dei dati acquisiti durante l'indagine. Sovrimposti allo spettro sono il picking del modo fondamentale (crocette nere) e le curve di dispersione sintetiche del modo fondamentale e di alcuni modi superiori (pallini bianchi).
in basso: Curva H/V **(A)** e andamento delle componenti velocimetriche (N-S, E-W, Up-Down) **(B)**

HVSR14A

A

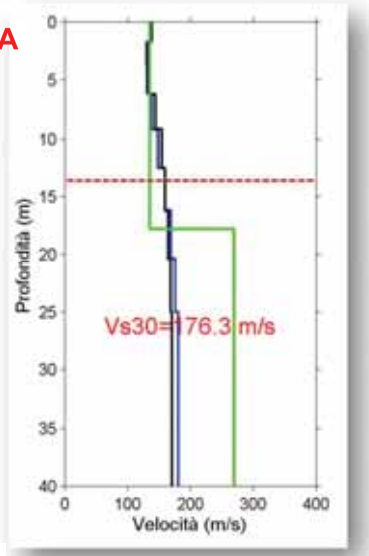


B



Allegato 8 – Velocità onde S in funzione della profondità – MASW2

A



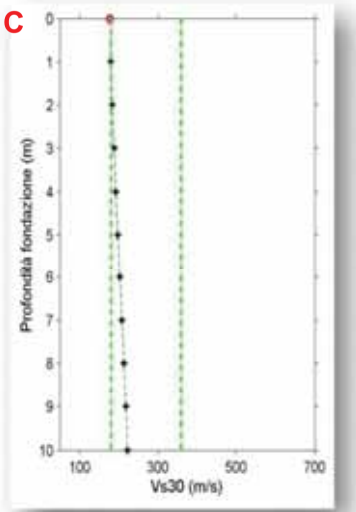
(A) Andamento della velocità delle onde S in funzione della profondità. Vengono riportati in nero i valori ottenuti con il programma WaveEq (Geometrics) e in blu i valori derivati con il programma SWAMI (Georgia Institute of Technology), relativamente all'indagine MASW; in verde viene indicato l'andamento ottenuto mediante inversione della curva *H/V*, vincolata nella parte superficiale attraverso i valori ottenuti dall'indagine *MASW*. La linea tratteggiata in rosso rappresenta la profondità stimata per la frequenza più bassa scelta durante l'operazione di *picking*. A profondità maggiori l'andamento delle velocità delle onde S è stimato mediante *fit* della curva H/V.

B

Spessore (m)	Vs WaveEq (m/s)	Spessore (m)	Vs SWAMI (m/s)	Spessore (m)	Vs HVSR (m/s)
1.7	138.4	1.7	137.1	17.8	135.0
2.1	132.2	2.1	130.8	62.0	260.0
2.5	133.6	2.4	131.1	inf	366.0
2.9	144.3	3.0	138.5		
3.3	154.2	3.3	148.5		
3.7	159.7	3.7	159.3		
4.2	164.7	4.2	169.0		
4.6	168.3	4.6	176.2		
15.0	170.4	15.0	181.0		
inf	170.4	inf	182.0		

(B) La prima, terza e quinta colonna riportano gli spessori degli strati dei modelli ottenuti dall'indagine MASW (colonne 1 e 3) e dall'indagine *HVSR* (colonna 5). La seconda e la quarta colonna contengono le velocità stimate attraverso la tecnica *MASW* utilizzando i programmi WaveEq e SWAMI; la sesta colonna riporta le velocità stimate mediante inversione della curva H/V. Sono evidenziati in azzurro i valori di velocità e i relativi spessori utilizzati per il calcolo del parametro Vs_{30};

C



(C) andamento del parametro Vs_{30} in funzione della variazione della profondità del piano fondale della struttura in progetto. Le linee in tratteggio di colore verde indicano i limiti 180 m/s e 360 m/s rispetto alla tabella 1 (crf. §2).

Allegato 2 – Sismogrammi – MASW1

MASW4A

Sismogrammi acquisiti dai 24 geofoni durante l'indagine. La sorgente è posta ad una distanza di 8 m dal geofono 24. La spaziatura tra i geofoni è di 2 m.

Studio Associato di Geologia e Geofisica
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ADOTATTO con Delibera di C.C. N. 182544/105 del 31/10/2017

Allegato 3 – Spettro di dispersione – MASW1

in alto: Spettro frequenza-velocità di fase dei dati acquisiti durante l'indagine. Sovrimposti allo spettro sono il picking del modo fondamentale (crocette nere) e le curve di dispersione sintetiche del modo fondamentale e di alcuni modi (pallini bianchi).
in basso: Curva H/V **(A)** e andamento delle tre componenti velocimetriche (N-S, E-W, Up-Down) **(B)**

HVSR15A

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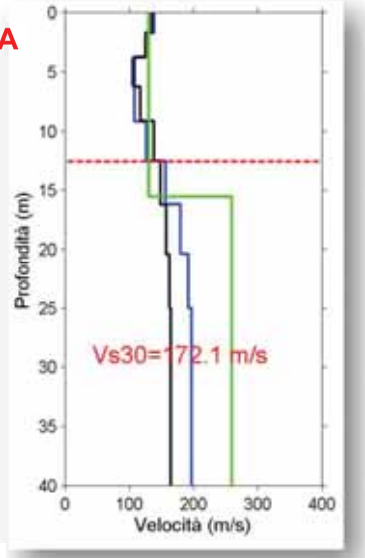
Allegato 4 – Velocità onde S in funzione della profondità – MASW1

A



(A) Andamento della velocità delle onde S in funzione della profondità. Vengono riportati in nero i valori ottenuti con il programma WaveEq (Geometrics) e in blu i valori derivati con il programma SWAMI (Georgia Institute of Technology), relativamente all'indagine MASW; in verde viene indicato l'andamento ottenuto mediante inversione della curva *H/V*, vincolata nella parte superficiale attraverso i valori ottenuti dall'indagine *MASW*. La linea tratteggiata in rosso rappresenta la profondità stimata per la frequenza più bassa scelta durante l'operazione di *picking*. A profondità maggiori l'andamento delle velocità delle onde S è stimato mediante *fit* della curva H/V.

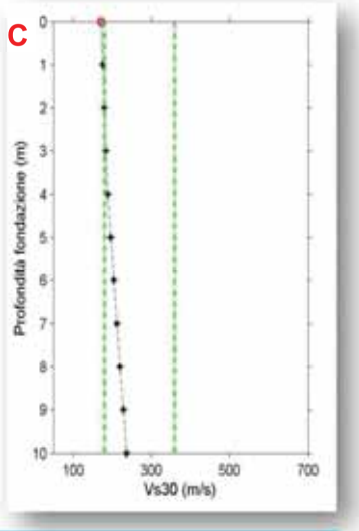
B

Spessore (m)	Vs WaveEq (m/s)	Spessore (m)	Vs SWAMI (m/s)	Spessore (m)	Vs HVSR (m/s)
1.7	135.3	1.7	138.5	15.5	130.0
2.1	125.2	2.1	125.7	57.0	260.0
2.5	108.0	2.4	104.9	inf	365.0
2.9	117.7	3.0	108.0		
3.3	138.2	3.3	126.3		
3.7	148.7	3.7	156.4		
4.2	157.3	4.2	179.6		
4.6	162.5	4.6	191.8		
15.0	165.0	15.0	196.9		
inf	165.0	inf	197.1		

(B) La prima, terza e quinta colonna riportano gli spessori degli strati dei modelli ottenuti dall'indagine MASW (colonne 1 e 3) e dall'indagine *HVSR* (colonna 5). La seconda e la quarta colonna contengono le velocità stimate attraverso la tecnica *MASW* utilizzando i programmi WaveEq e SWAMI; la sesta colonna riporta le velocità stimate mediante inversione della curva H/V. Sono evidenziati in azzurro i valori di velocità e i relativi spessori utilizzati per il calcolo del parametro Vs_{30};

(C) andamento del parametro Vs_{30} in funzione della variazione della profondità del piano fondale della struttura in progetto. Le linee in tratteggio di colore verde indicano i limiti 180 m/s e 360 m/s rispetto alla tabella 1 (crf. §2).

C



Allegato 5 – Documentazione fotografica – MASW2

Foto 1 – Ubicazione misura *HVSR*

studio CP
DOTT. GEOL. PAOLO TRENTI
DOTT. GEOL. MARIA CRISTINA VERRECCHIA

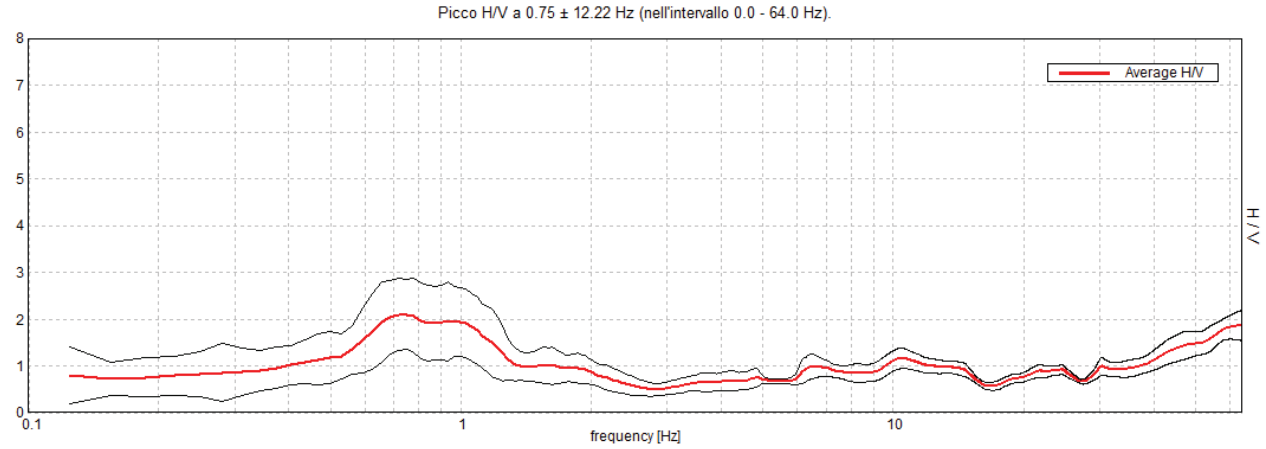
RILEVAZIONE TROMOGRAFICA – RAPPORTO DI PROVA 13.025-6.TR1

13025 RAVENNA, CIMITERO TR1

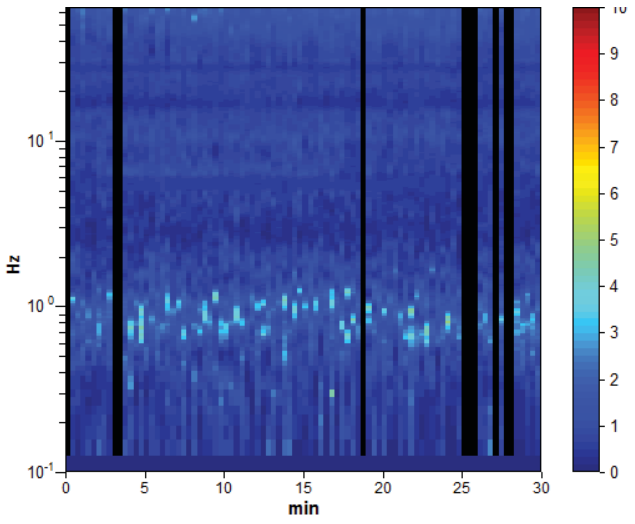
Strumento: TEN-0006/01-07
Inizio registrazione: 27/09/13 16:34:11
Fine registrazione: 27/09/13 17:04:12
Nomi canali: NORTH SOUTH; EAST WEST ; UP DOWN

Durata registrazione: 0h30'00".
Analizzato 89% tracciato (selezione manuale)
Freq. campionamento: 128 Hz
Lunghezza finestre: 20 s
Tipo di lisciamento: Triangular window
Lisciamento: 10%

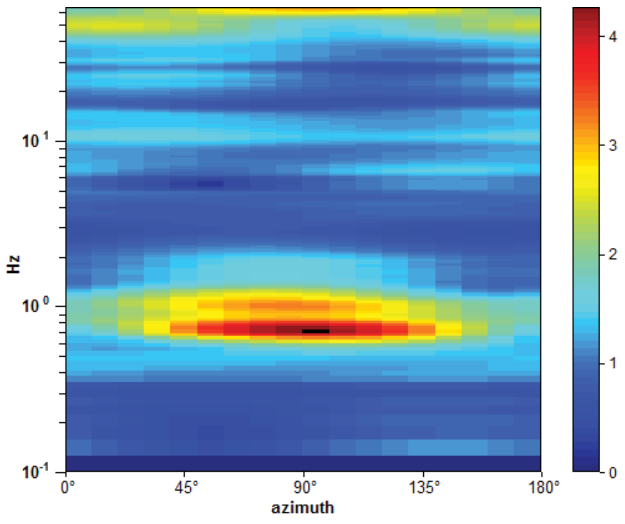
RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE



SERIE TEMPORALE H/V



DIREZIONALITA' H/V



studio CP
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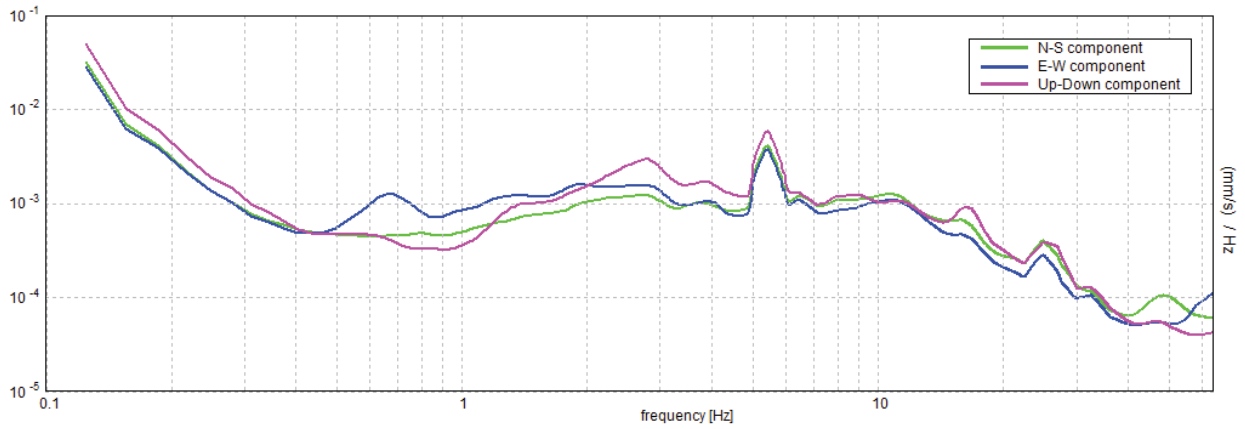
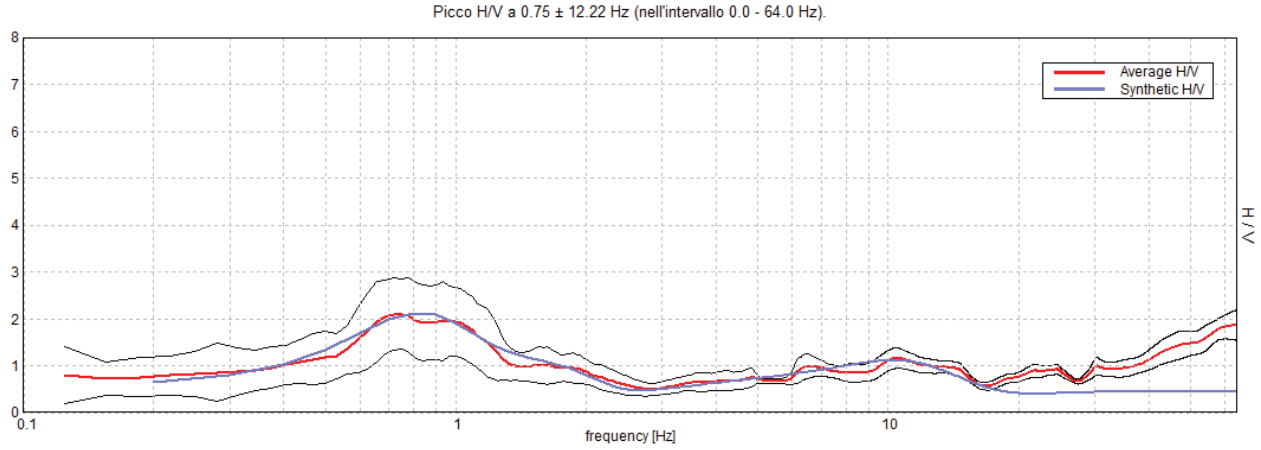
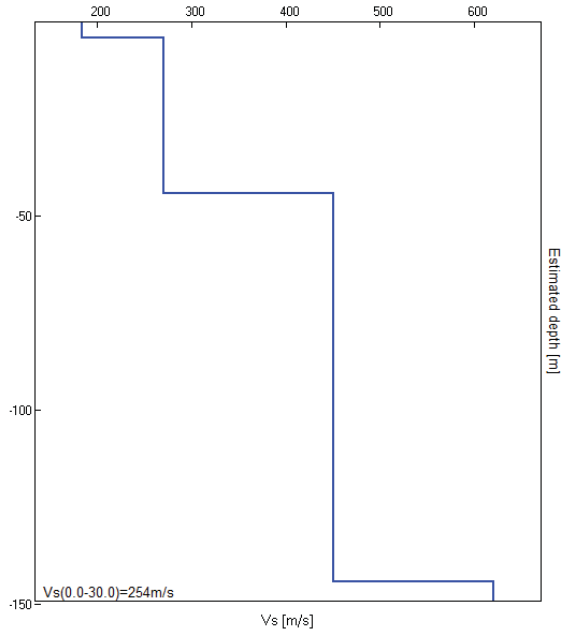
SPETTRI DELLE SINGOLE COMPONENTI



H/V SPERIMENTALE vs. H/V SINTETICO



Profondità alla base dello strato [m]	Spessore [m]	Vs [m/s]
4.00	4.00	184
44.00	40.00	270
144.00	100.00	450
inf.	inf.	620



Vs(0.0-30.0)=254m/s

HVSR17A

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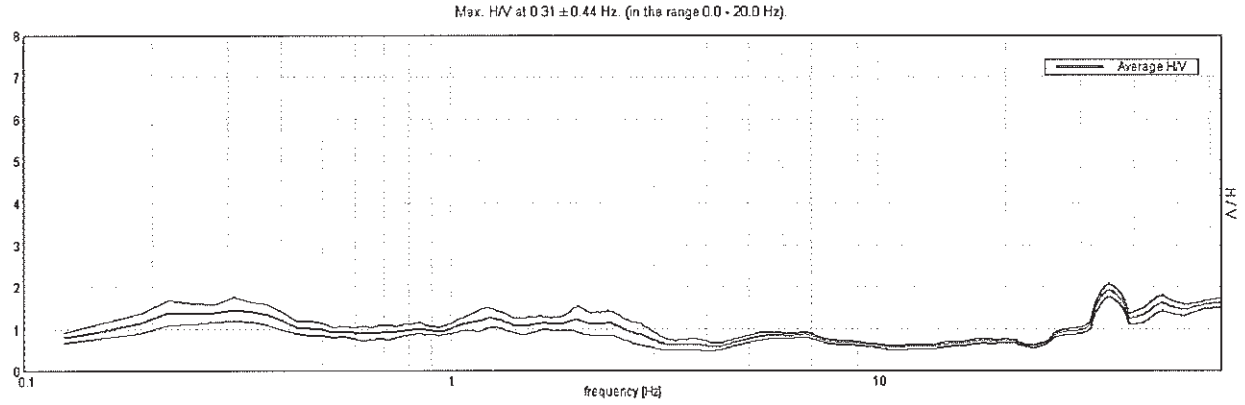
CASALBORSETTI - VIA DELLE ROSE 18-20, BROGNARA TR 1

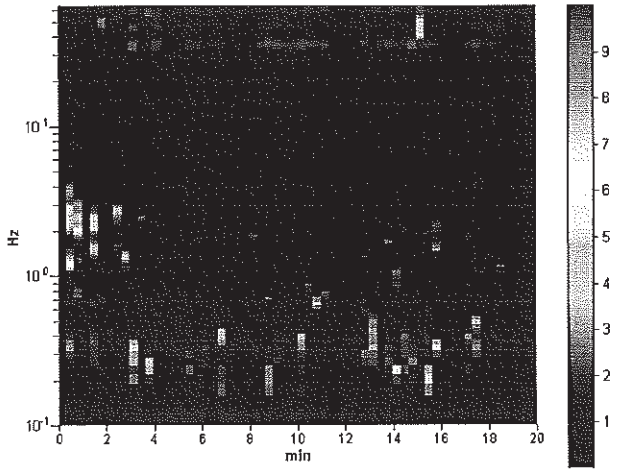
Start recording: 18/11/09 16:09:18 End recording: 18/11/09 16:29:19
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 72% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

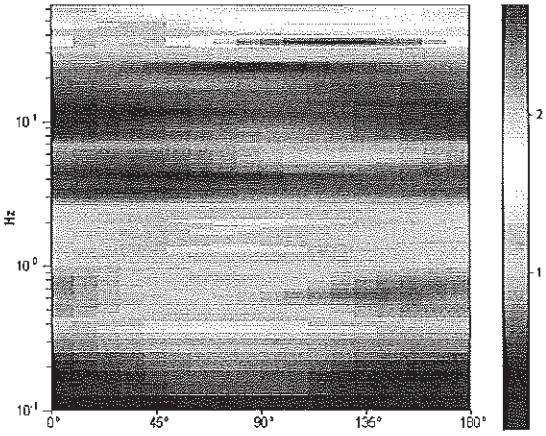
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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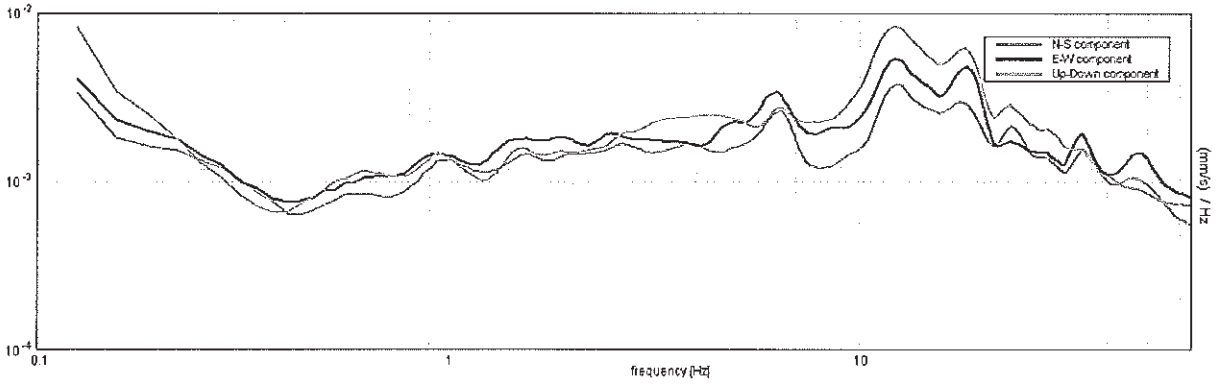
SINGLE COMPONENT SPECTRA



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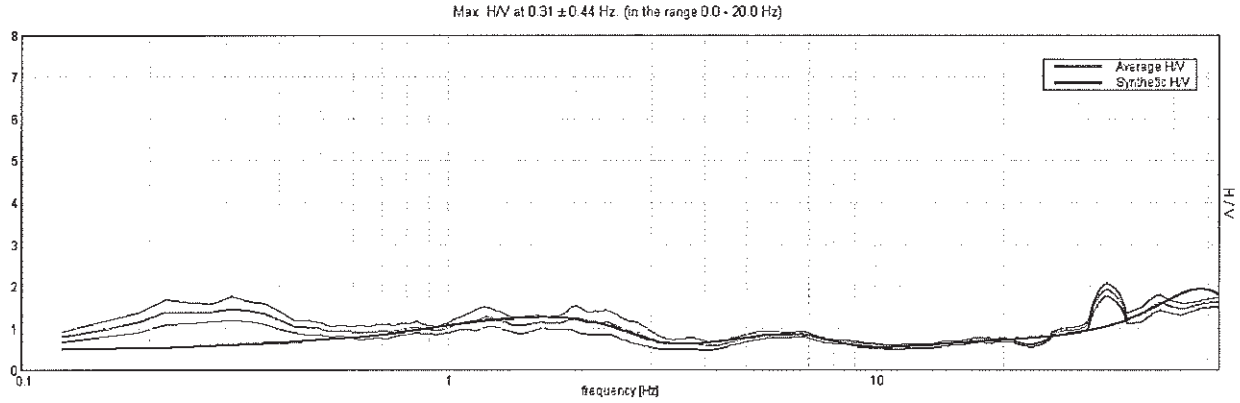
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.20	0.20	48
4.60	4.40	100
8.60	4.00	180
12.60	4.00	110
15.60	3.00	150
50.60	35.00	240
inf.	inf.	290

Vs(0.0-30.0)=161m/s

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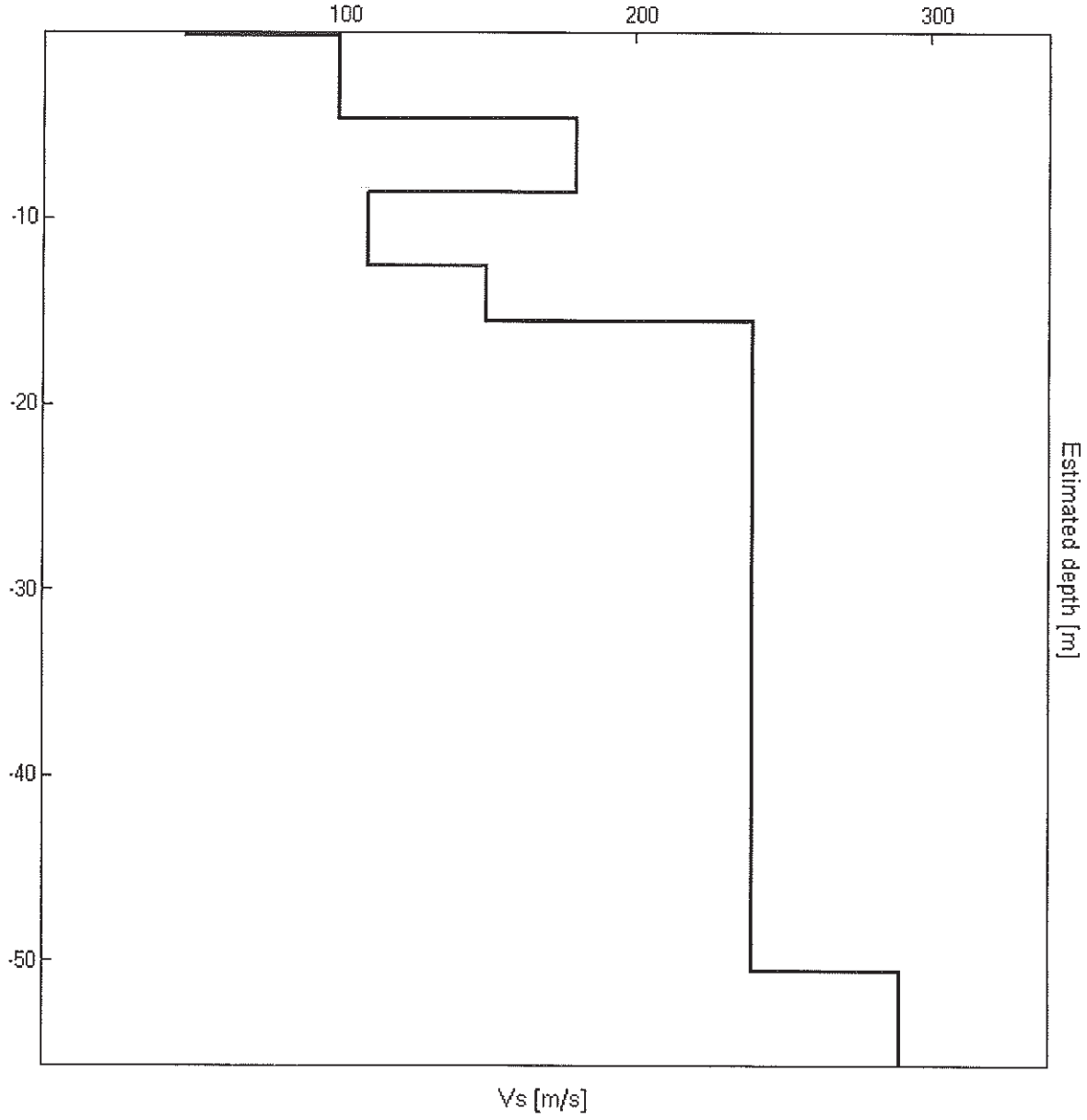

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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 0.31 ± 0.44 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.31 > 0.50		NO
$n_c(f_0) > 200$	268.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 16 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.47 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.6878| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.21494 < 0.0625		NO
$\sigma_A(f_0) < \theta(f_0)$	0.1401 < 2.5	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR18A

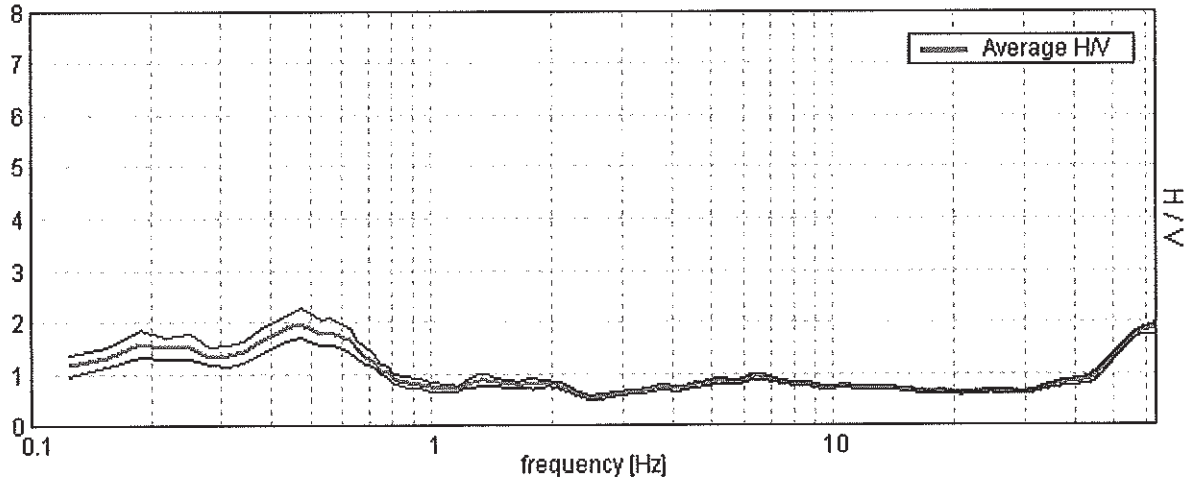
RAVENNA – n. 4

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

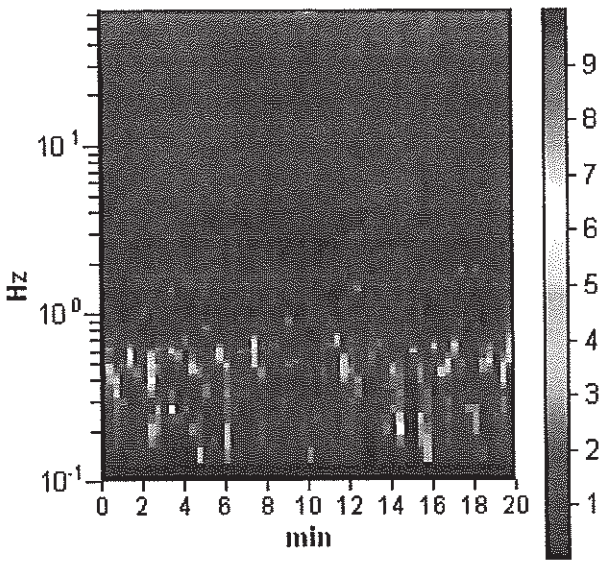
Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

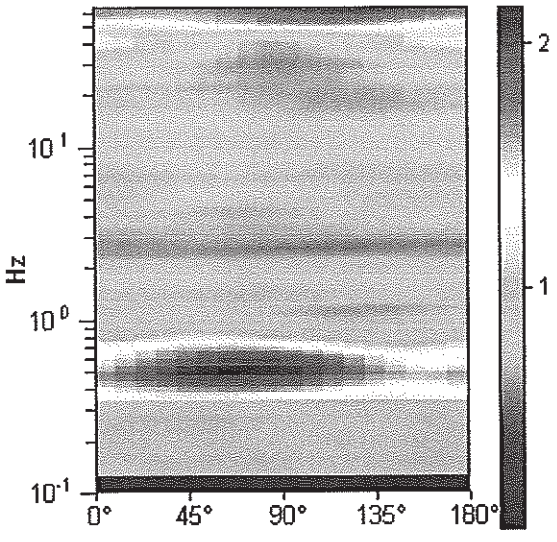
Max. H/V at 0.47 ± 0.01 Hz. (in the range 0.0 - 30.0 Hz).



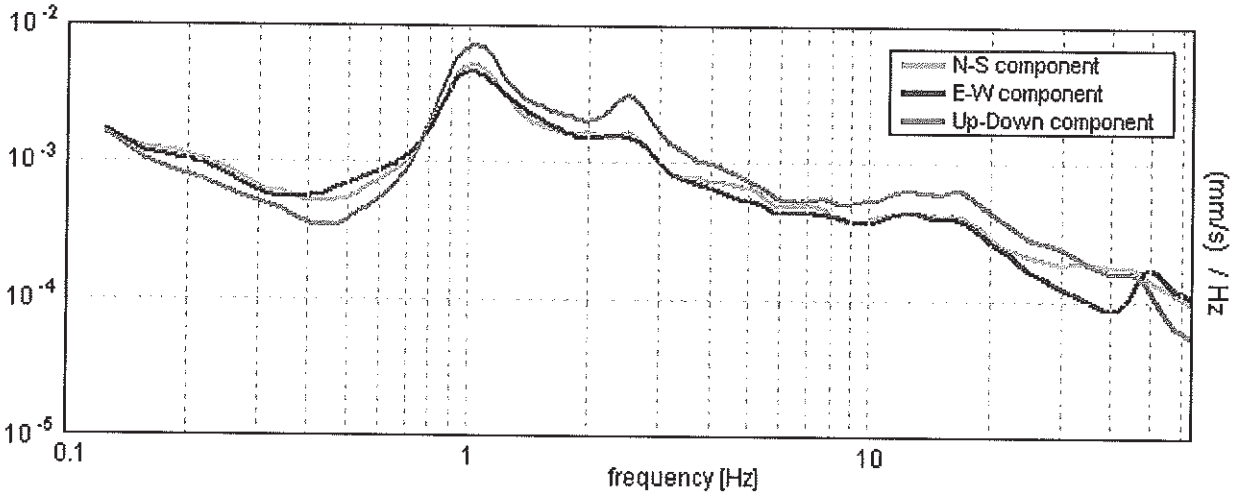
H/V TIME HISTORY



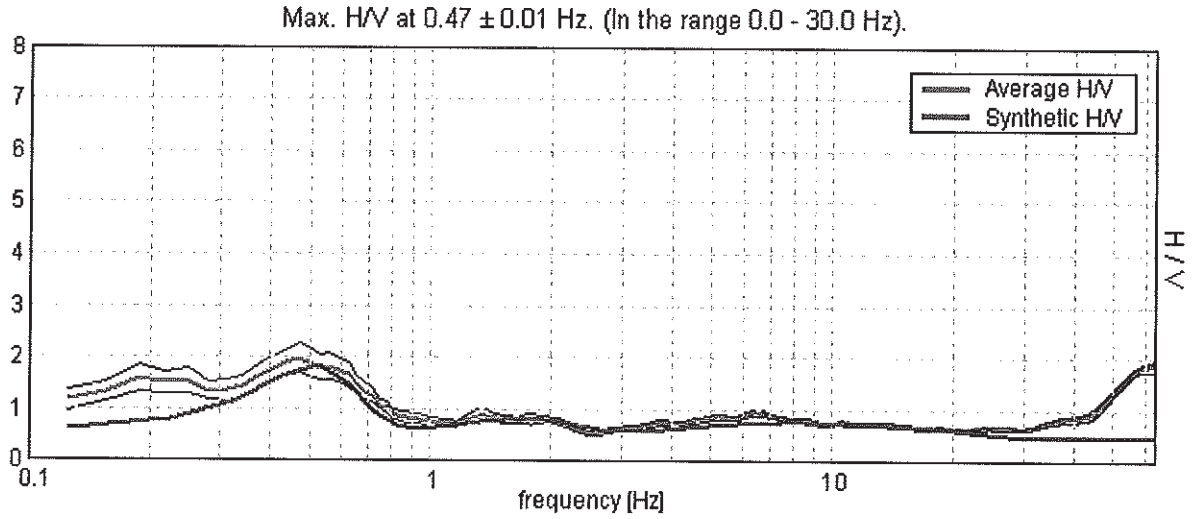
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

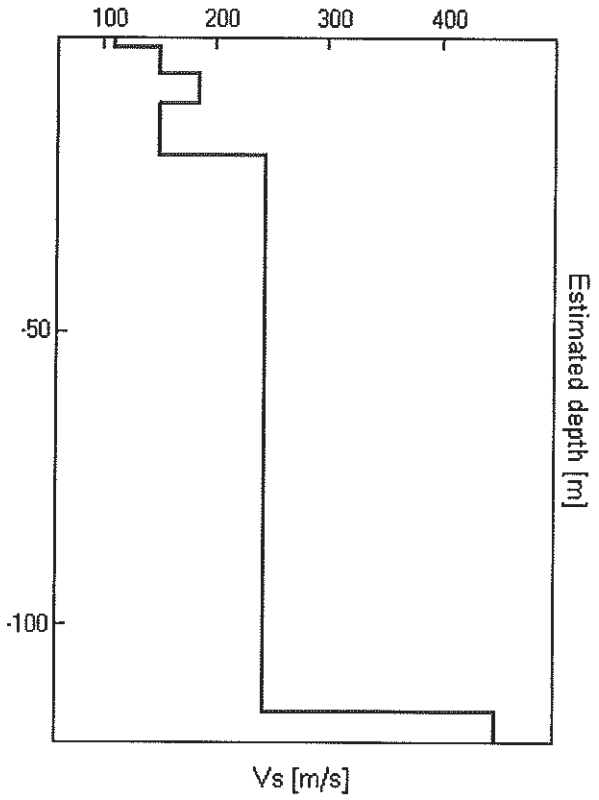


EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
1.50	1.50	110
6.00	4.50	150
11.00	5.00	185
20.00	9.00	150
115.00	95.00	245
inf.	inf.	450

Vs(0.0-30.0)=175m/s


100
200
300
400
-50
-100
Estimated depth [m]
Vs [m/s]

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 0.47 ± 0.01 Hz. (in the range 0.0 - 30.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.47 > 0.50		NO
$n_c(f_0) > 200$	562.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 24 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	0.813 Hz	OK	
$A_0 > 2$	1.99 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00629| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.00295 < 0.09375	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1386 < 2.5	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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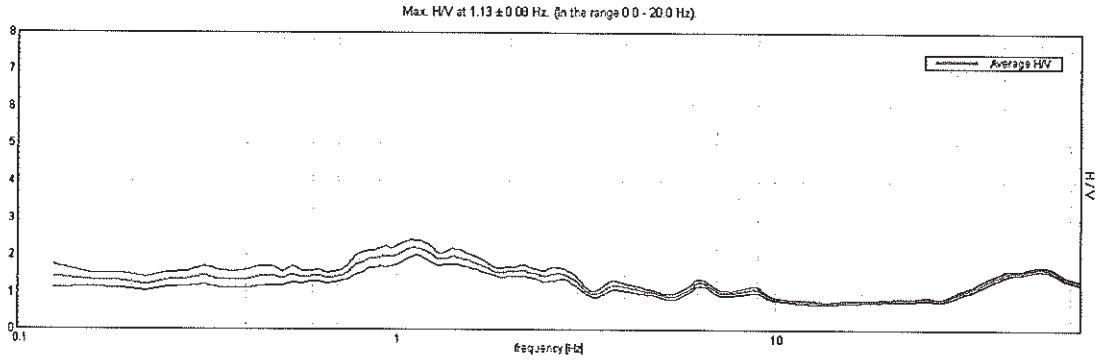
HVSR19A

RAVENNA – n. 5

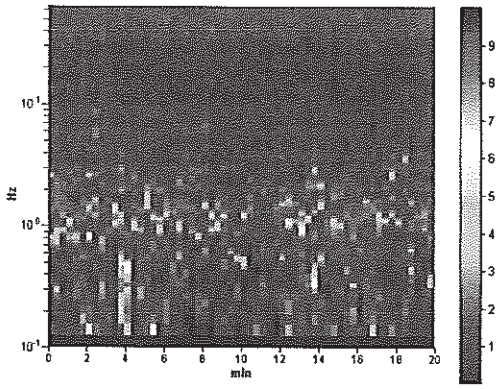
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

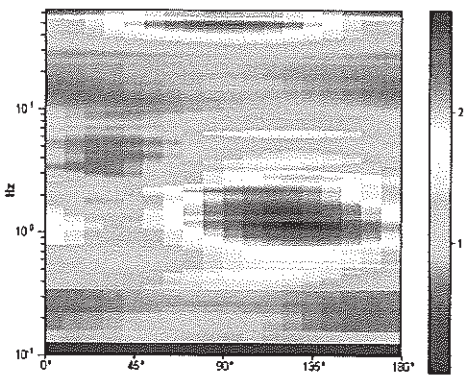
HORIZONTAL TO VERTICAL SPECTRAL RATIO



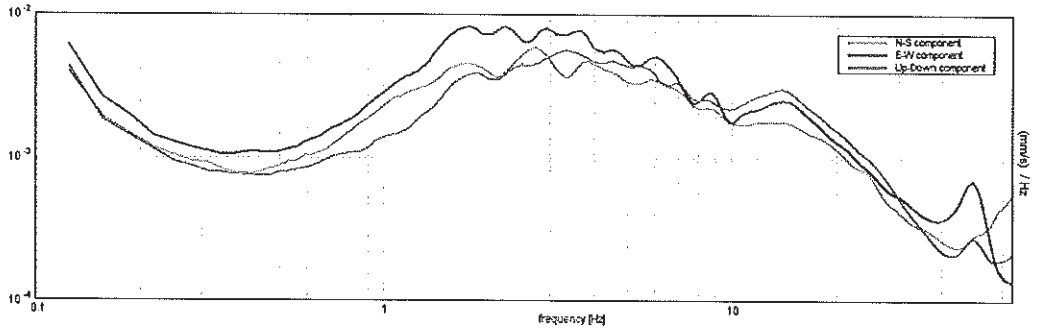
H/V TIME HISTORY



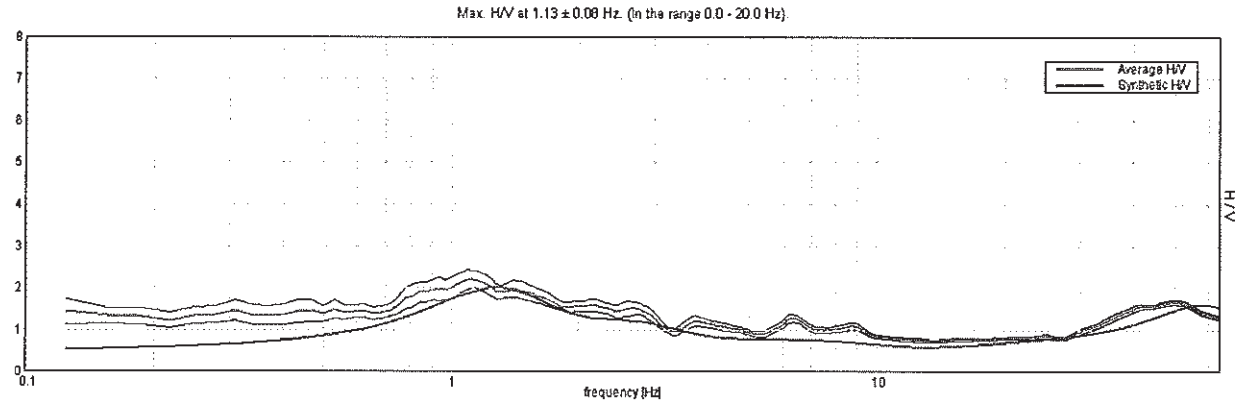
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

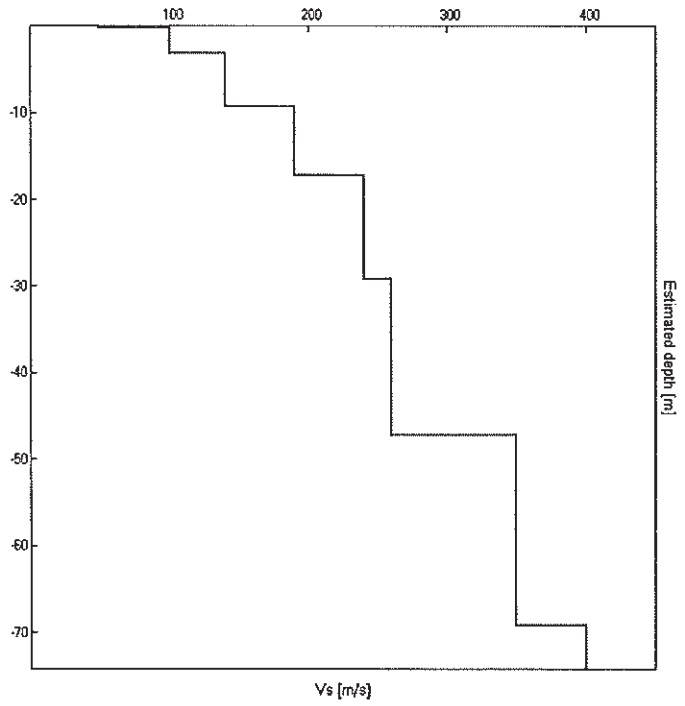


EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.20	0.20	50
3.20	3.00	100
9.20	6.00	140
17.20	8.00	190
29.20	12.00	240
47.20	18.00	260
69.20	22.00	350
inf.	inf.	400

Vs(0.0-30.0)=174m/s



[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 1.13 ± 0.08 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.13 > 0.50	OK	
$n_c(f_0) > 200$	1350.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 55 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$	3.156 Hz	OK	
$A_0 > 2$	2.20 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03432| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.0386 < 0.1125	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1015 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR20A

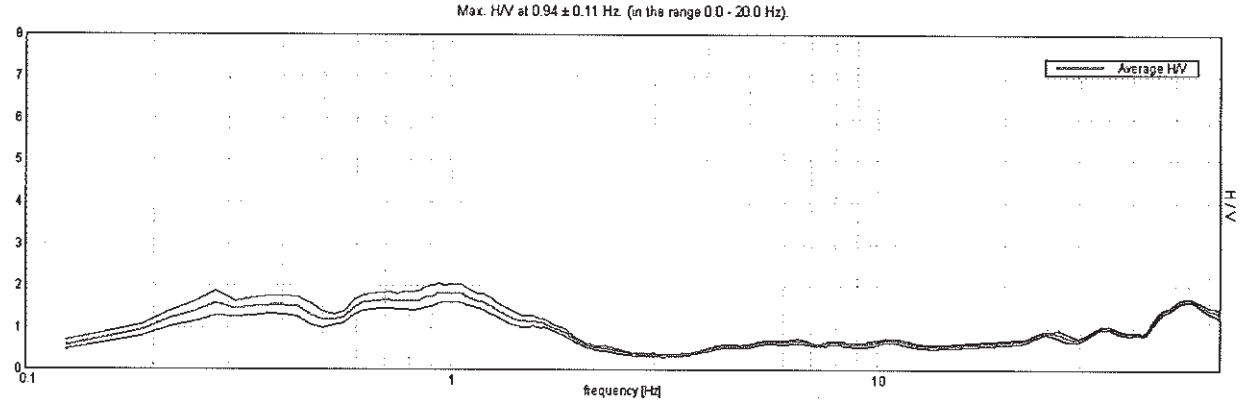
TROMINO® Grilla

RAVENNA – n. 6

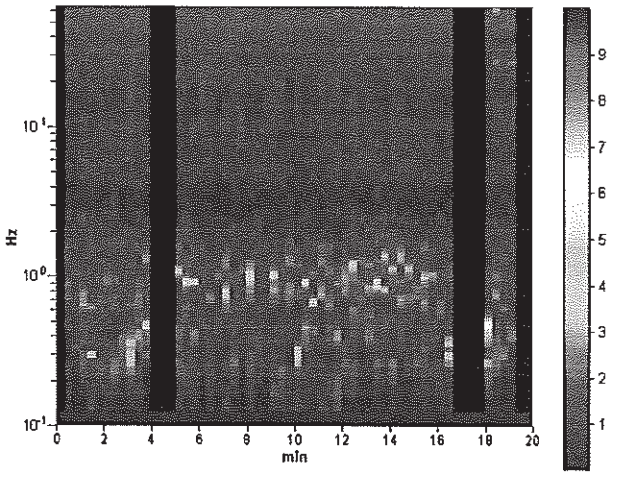
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 83% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

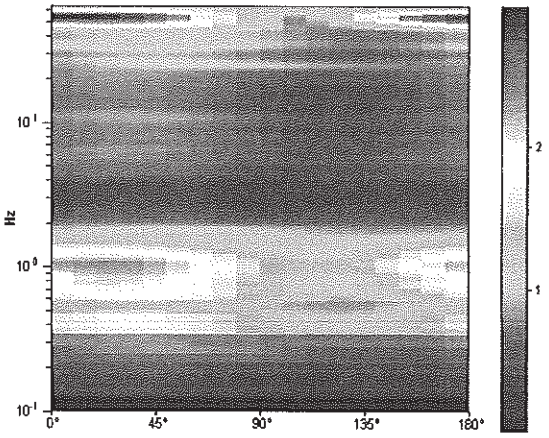
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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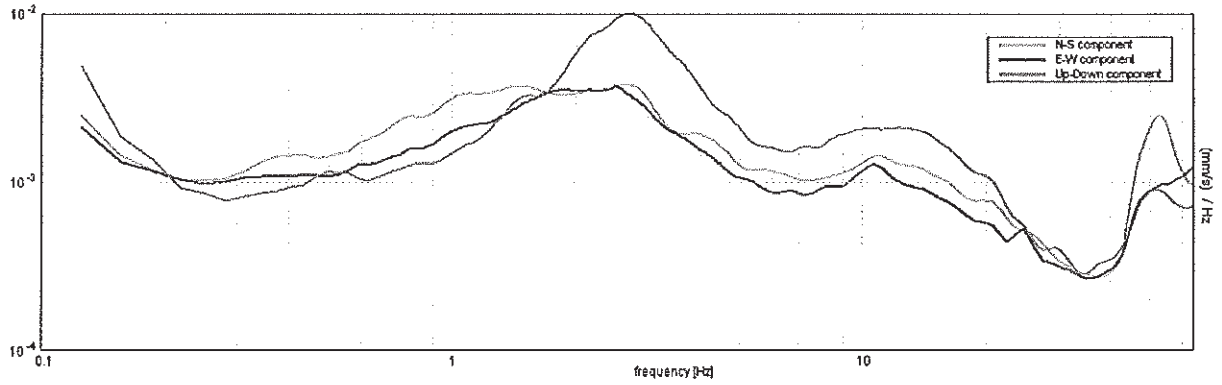
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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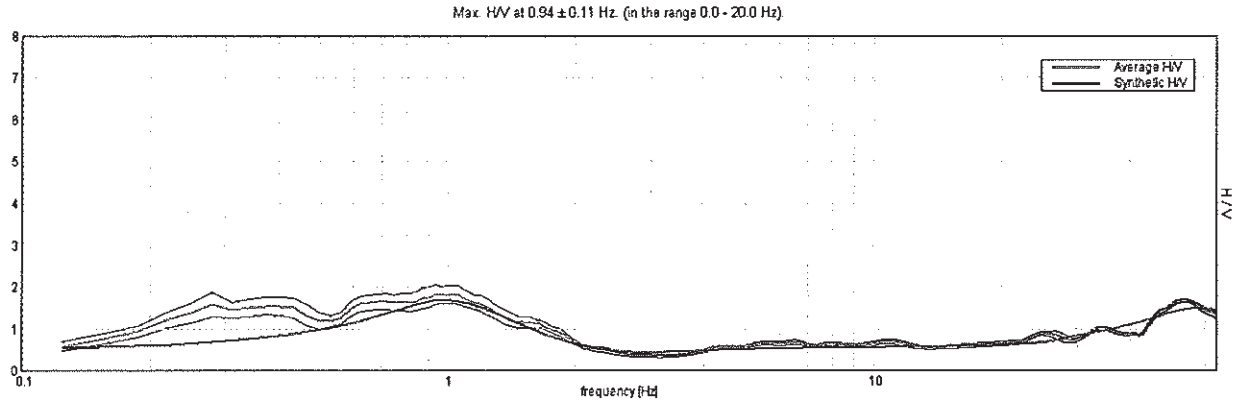
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.40	0.40	100
10.40	10.00	195
24.40	14.00	185
29.40	5.00	250
53.40	24.00	290
95.40	42.00	360
inf.	inf.	450

Vs(0.0-30.0)=196m/s

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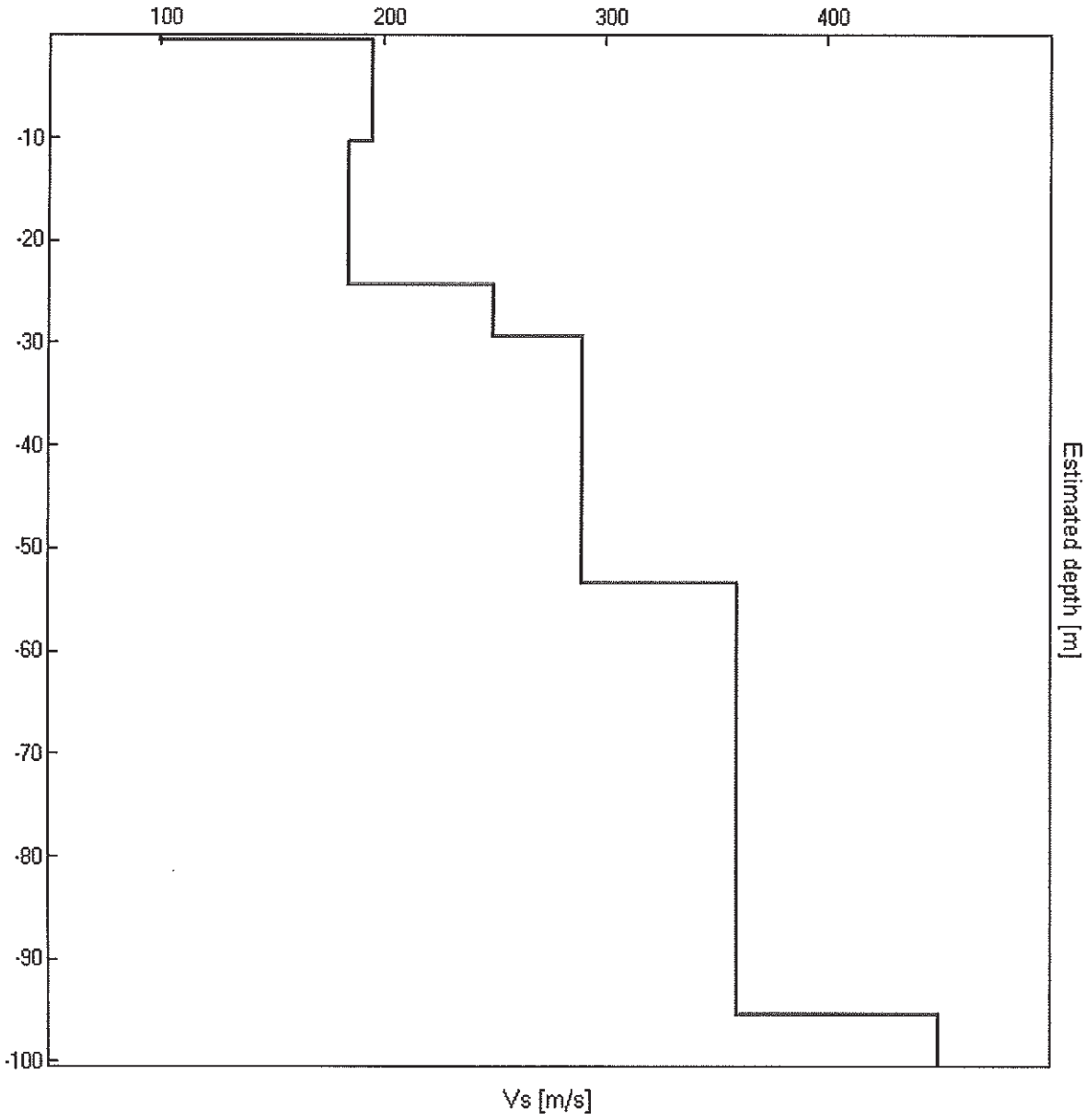

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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 0.94 ± 0.11 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.94 > 0.50	OK	
$n_c(f_0) > 200$	937.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 46 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	1.844 Hz	OK	
$A_0 > 2$	1.83 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.06033| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.05656 < 0.14063	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1158 < 2.0	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR21A

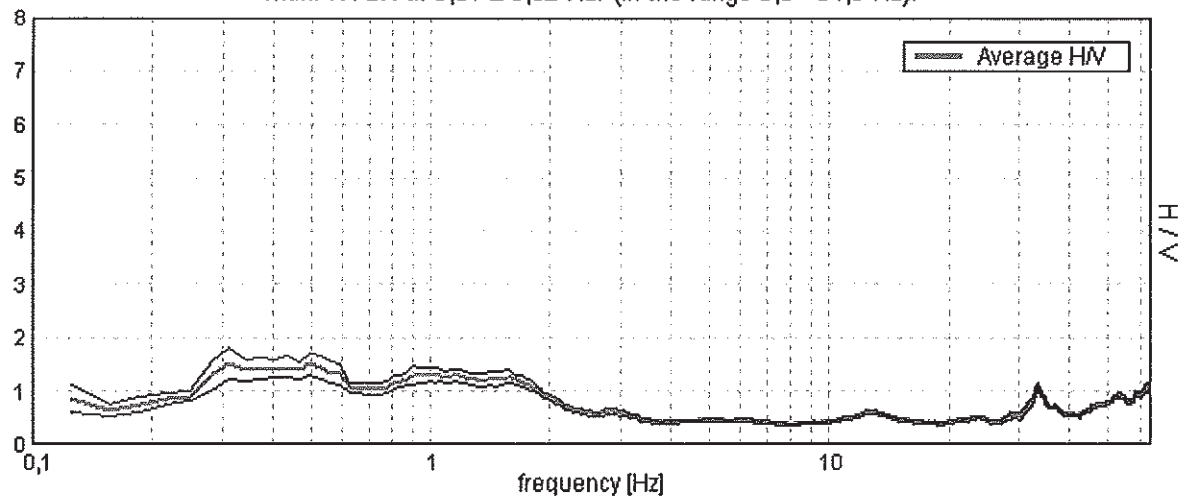
RAVENNA – n. 7

GPS data not available

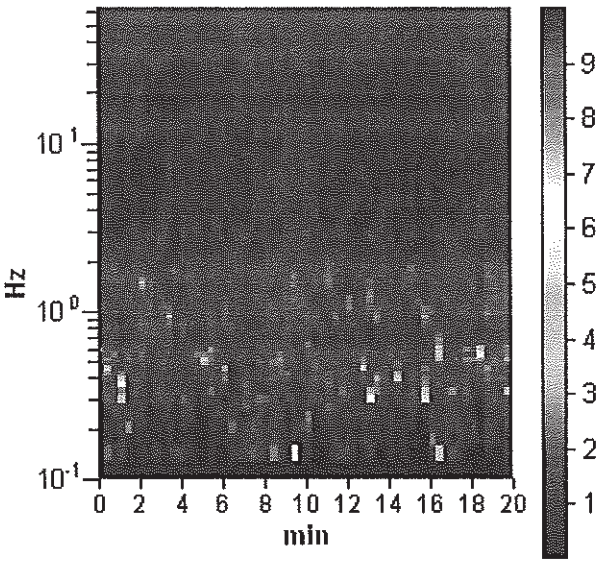
Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

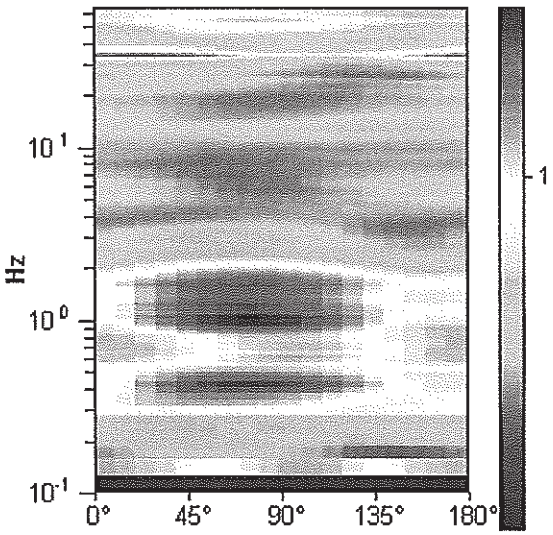
Max. HVSR at 0,31 ± 0,02 Hz. (in the range 0,0 - 64,0 Hz).



H/V TIME HISTORY



DIRECTIONAL H/V



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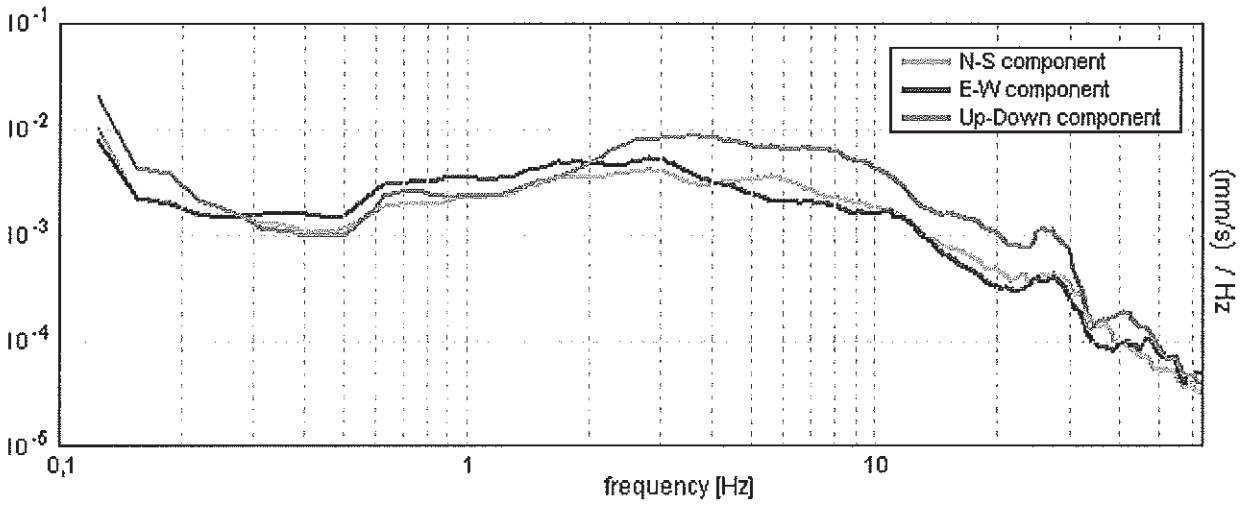
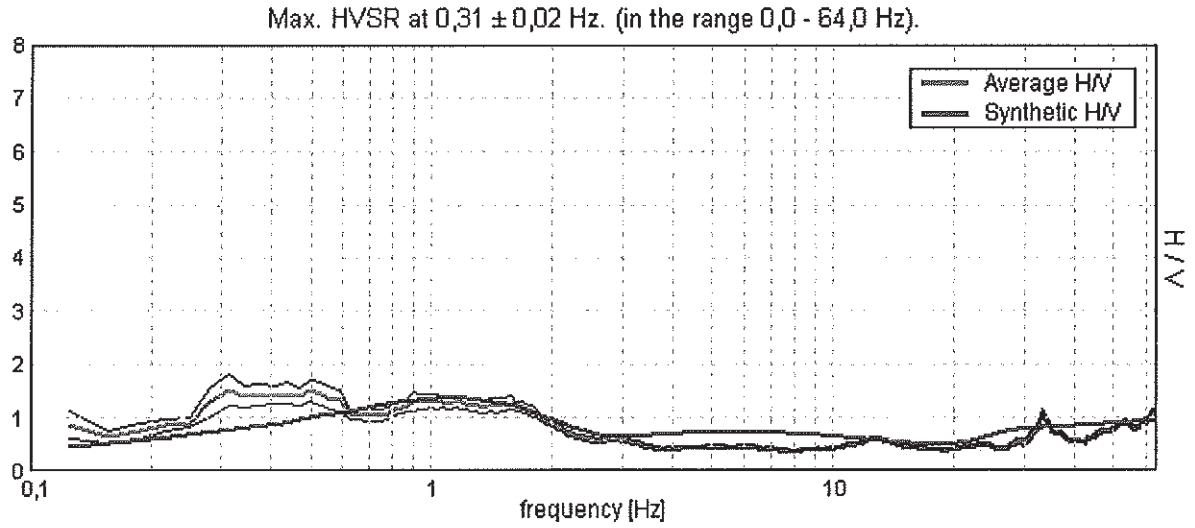
SINGLE COMPONENT SPECTRA

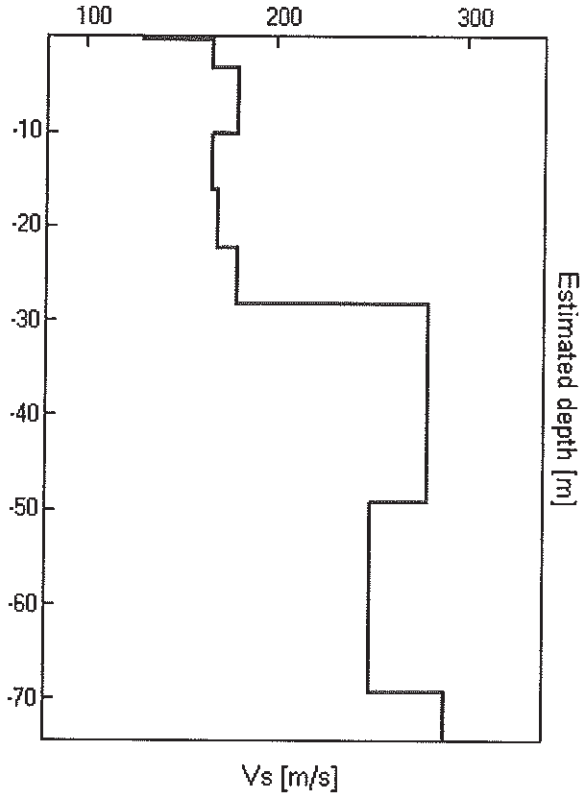


EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0,30	0,30	130
3,30	3,00	167
10,30	7,00	180
16,30	6,00	167
22,30	6,00	170
28,30	6,00	180
49,30	21,00	280
69,30	20,00	250
inf.	inf.	290

Vs30=177 m/s


100
200
300
-10
-20
-30
-40
-50
-60
-70
Estimated depth [m]
Vs [m/s]

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. HVSR at 0,31 ± 0,02 Hz. (in the range 0,0 - 64,0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0,31 > 0,50		NO
$n_c(f_0) > 200$	375,0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 16 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$	0,188 Hz	OK	
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1,51 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0,03902| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0,01219 < 0,0625	OK	
$\sigma_A(f_0) < \theta(f_0)$	0,1474 < 2,5	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR22A

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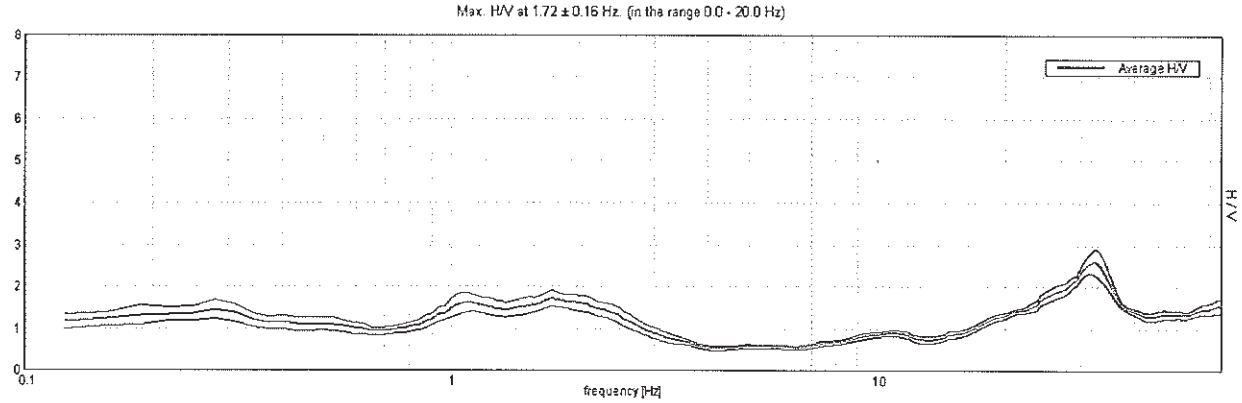
RAVENNA – n. 32

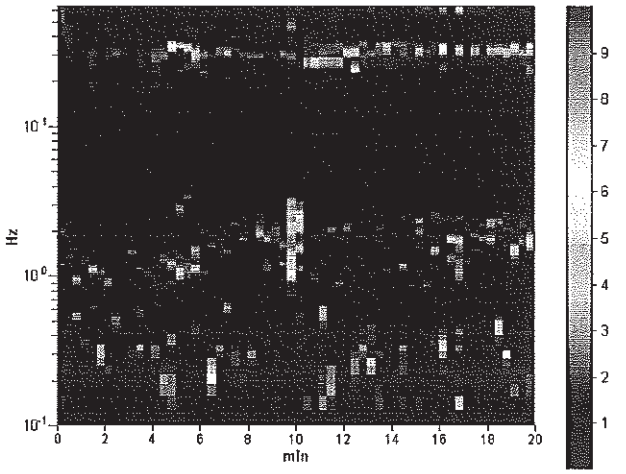
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

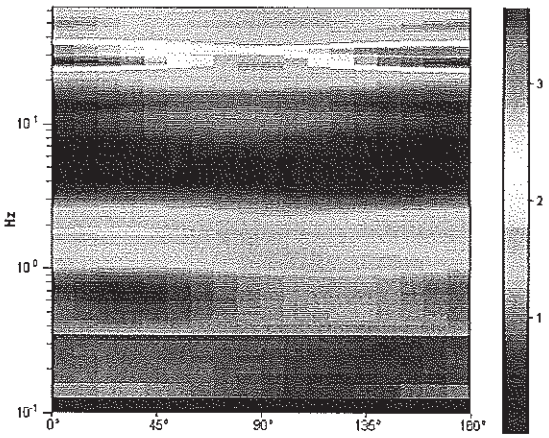
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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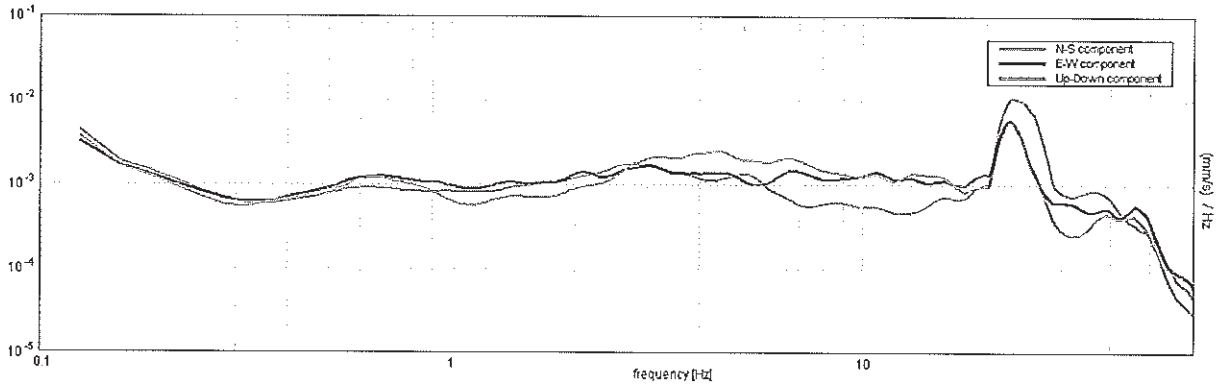
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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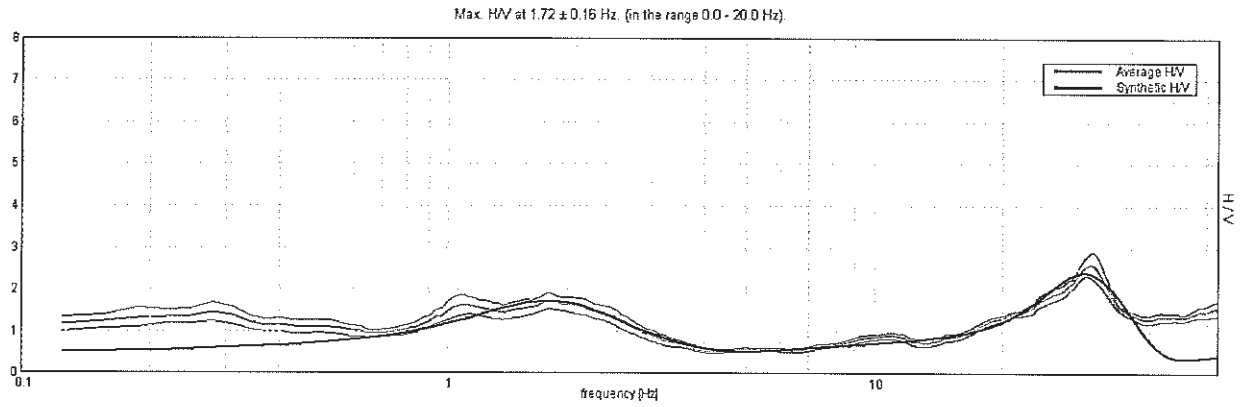
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.40	0.40	50
9.00	8.60	109
24.00	15.00	185
49.00	25.00	260
inf.	inf.	290

Vs(0.0-30.0)=157m/s

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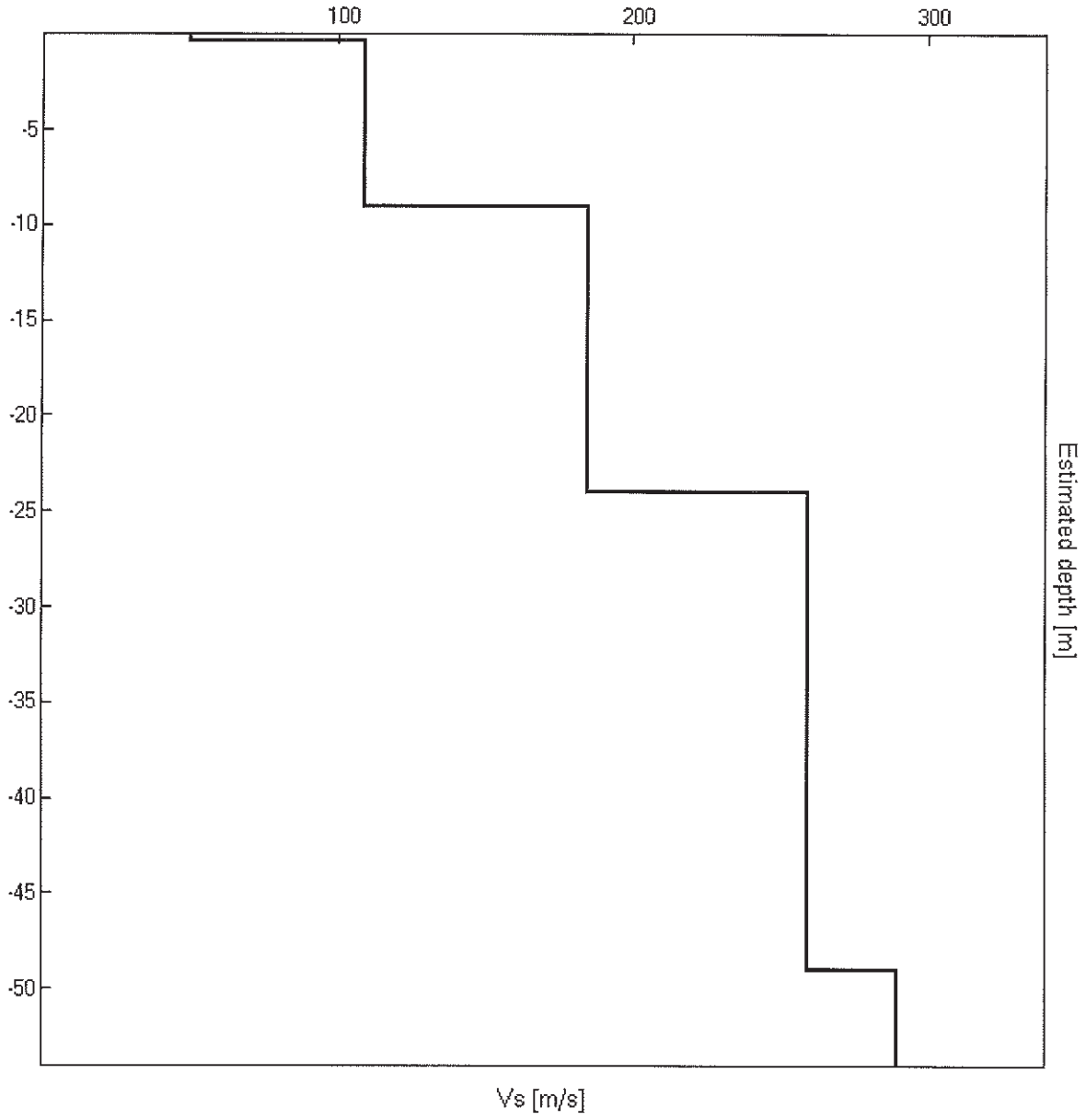

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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 1.72 ± 0.16 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.72 > 0.50	OK	
$n_c(f_0) > 200$	2062.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 84 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	3.094 Hz	OK	
$A_0 > 2$	1.72 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0451| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.07752 < 0.17188	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0957 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR23A

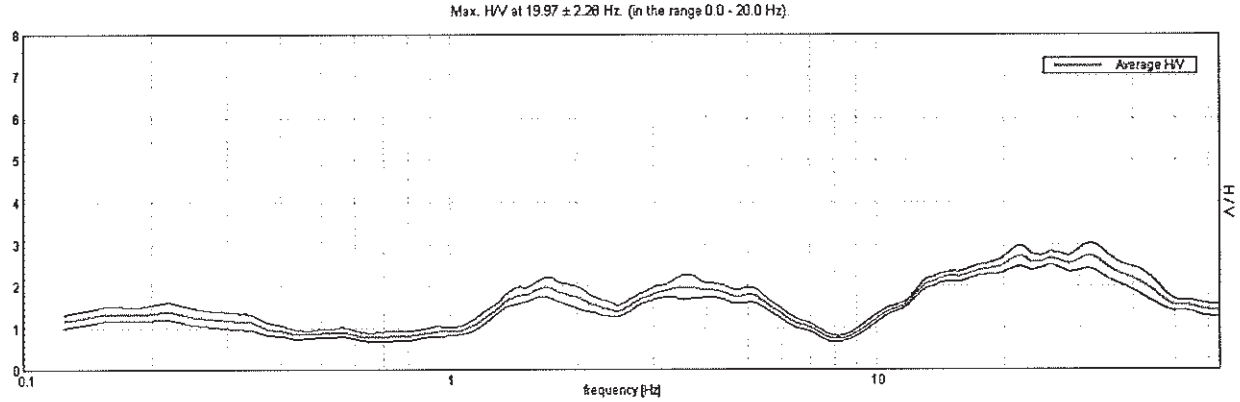
TROMINO® Grilla

RAVENNA – n. 2

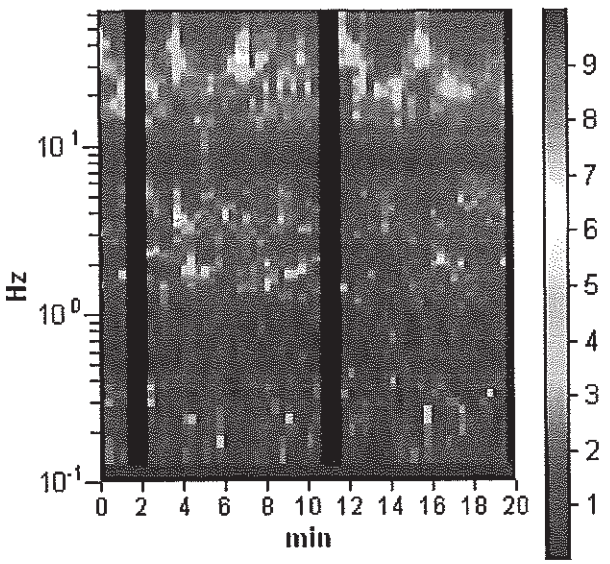
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 88% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

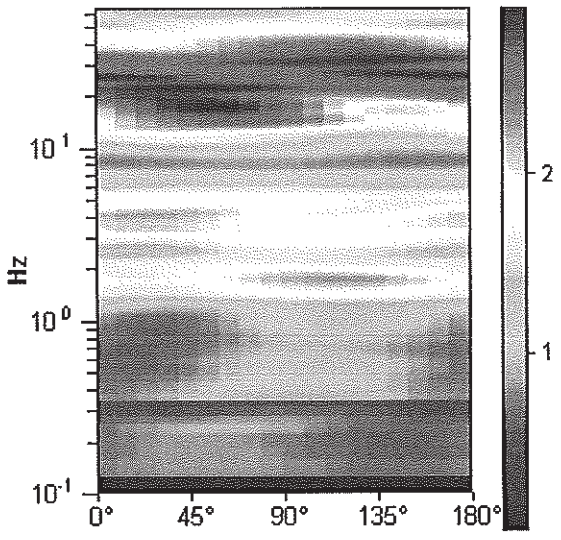
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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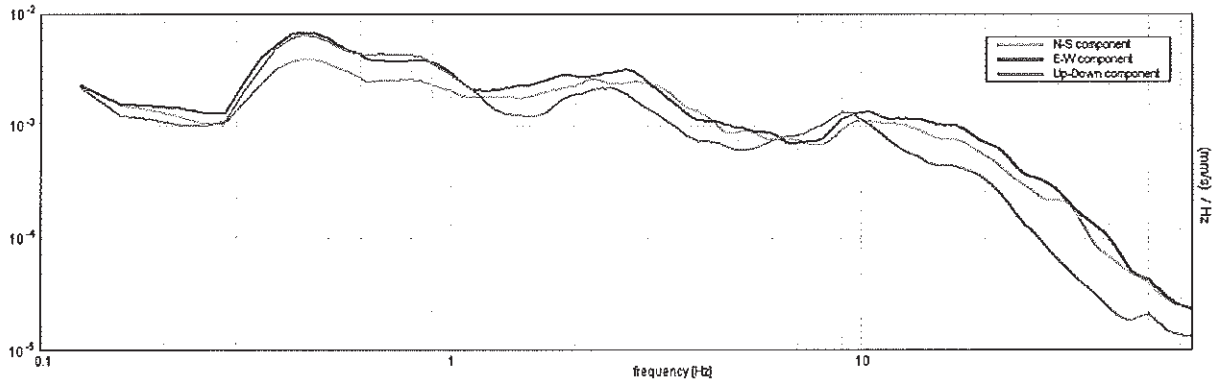
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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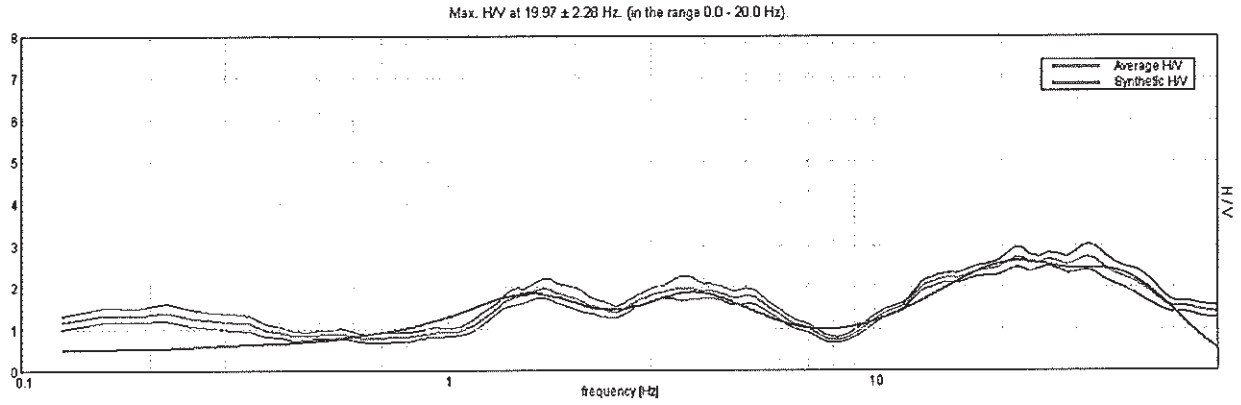
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.18	0.18	32
0.58	0.40	68
1.38	0.80	100
3.38	2.00	145
8.38	5.00	170
14.38	6.00	245
24.38	10.00	290
61.38	37.00	370
inf.	inf.	550

Vs(0.0-30.0)=219m/s

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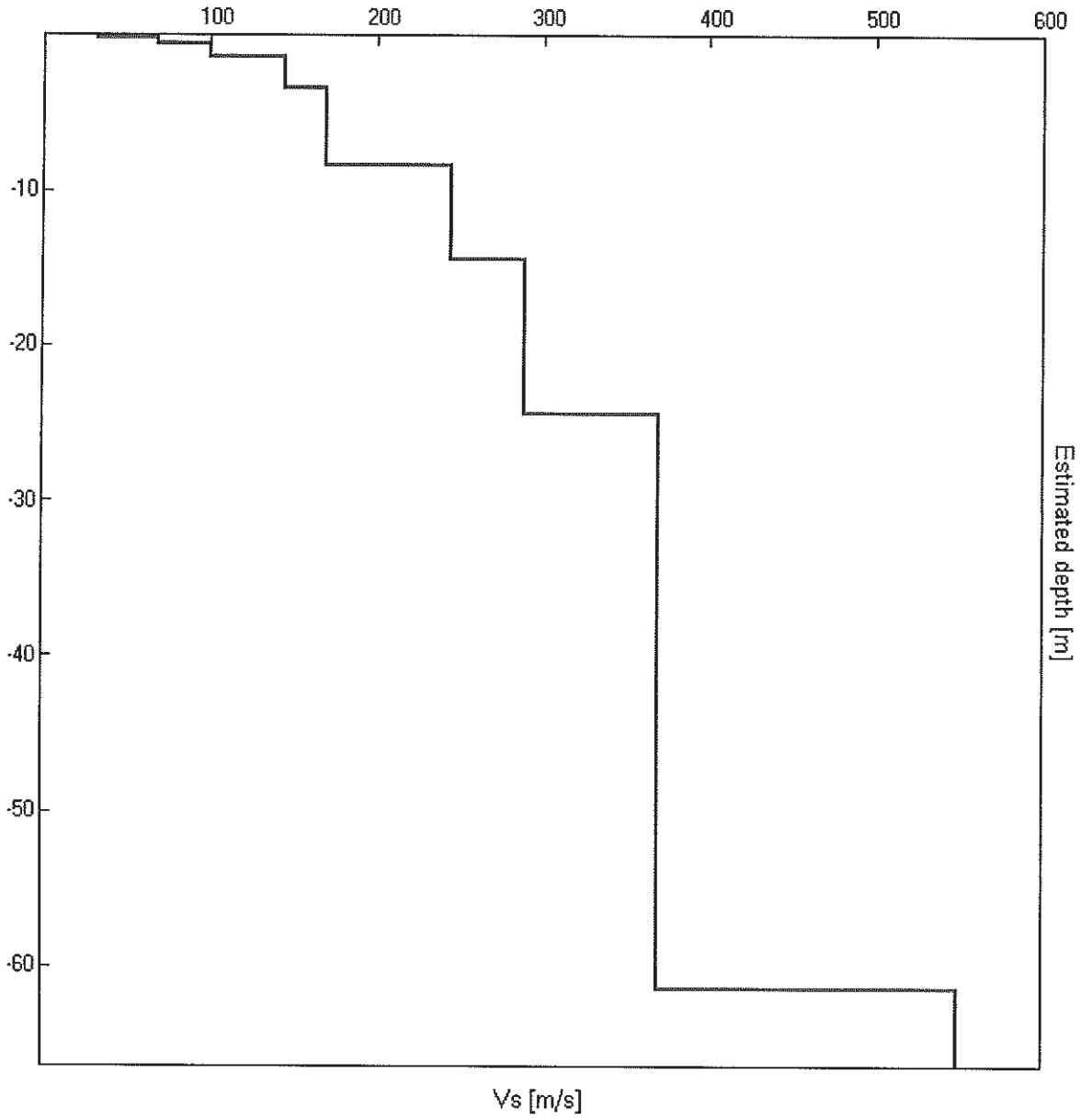

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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 19.97 ± 2.28 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	OK	
$n_c(f_0) > 200$	21166.9 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 960 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	10.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.51 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.05637| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.12564 < 0.99844		NO
$\sigma_A(f_0) < \theta(f_0)$	0.0916 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR24A

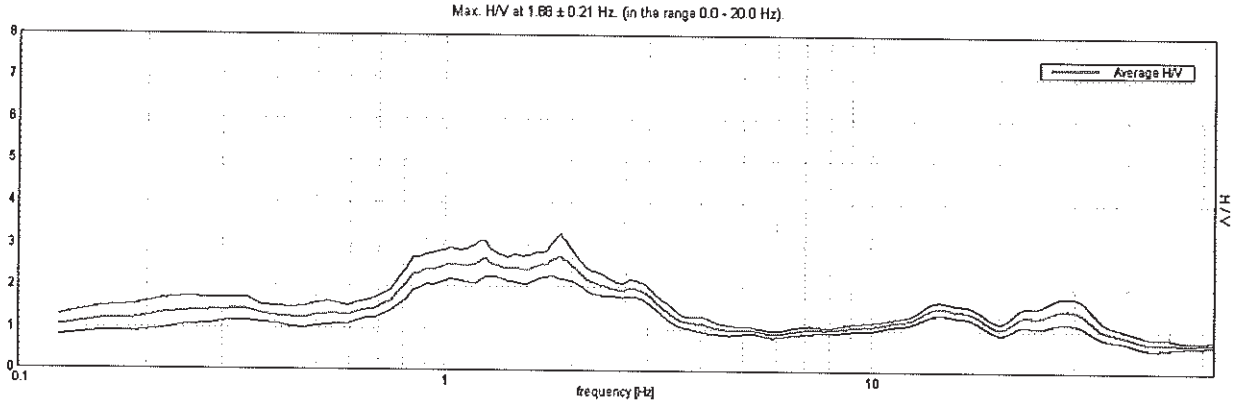
TROMINO® Grilla

RAVENNA – N. 1

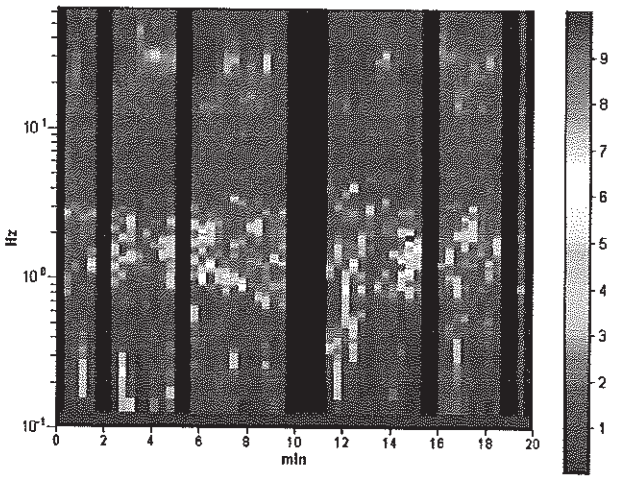
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 75% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

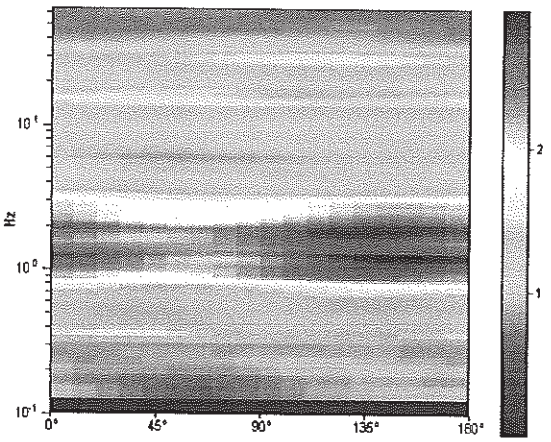
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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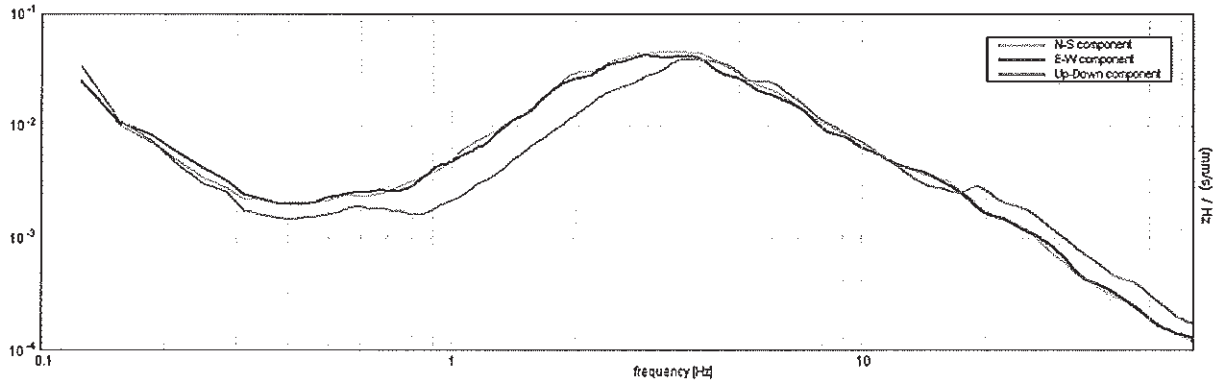
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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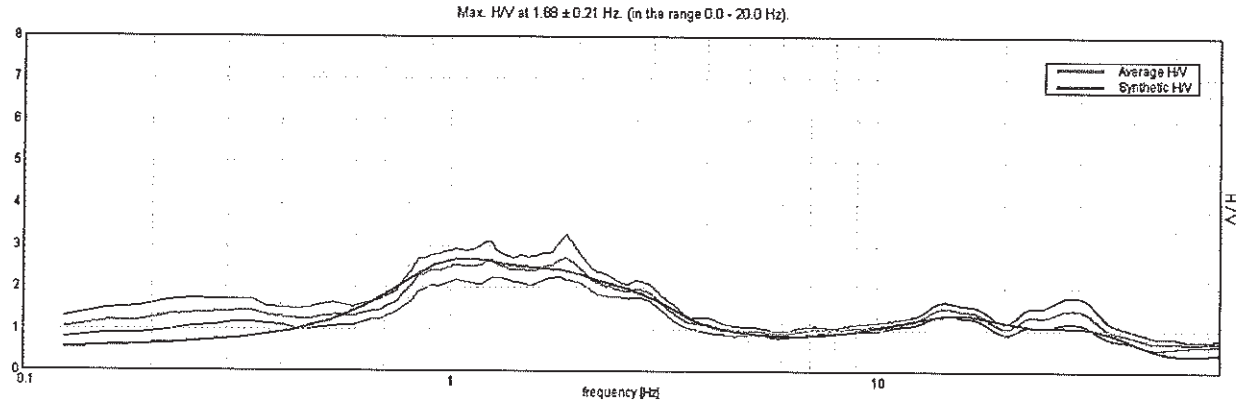
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.40	0.40	50
1.60	1.20	93
6.10	4.50	133
12.10	6.00	170
25.10	13.00	240
57.10	32.00	350
69.10	12.00	470
132.10	63.00	520
154.10	22.00	630
inf.	inf.	720

Vs(0.0-30.0)=190m/s

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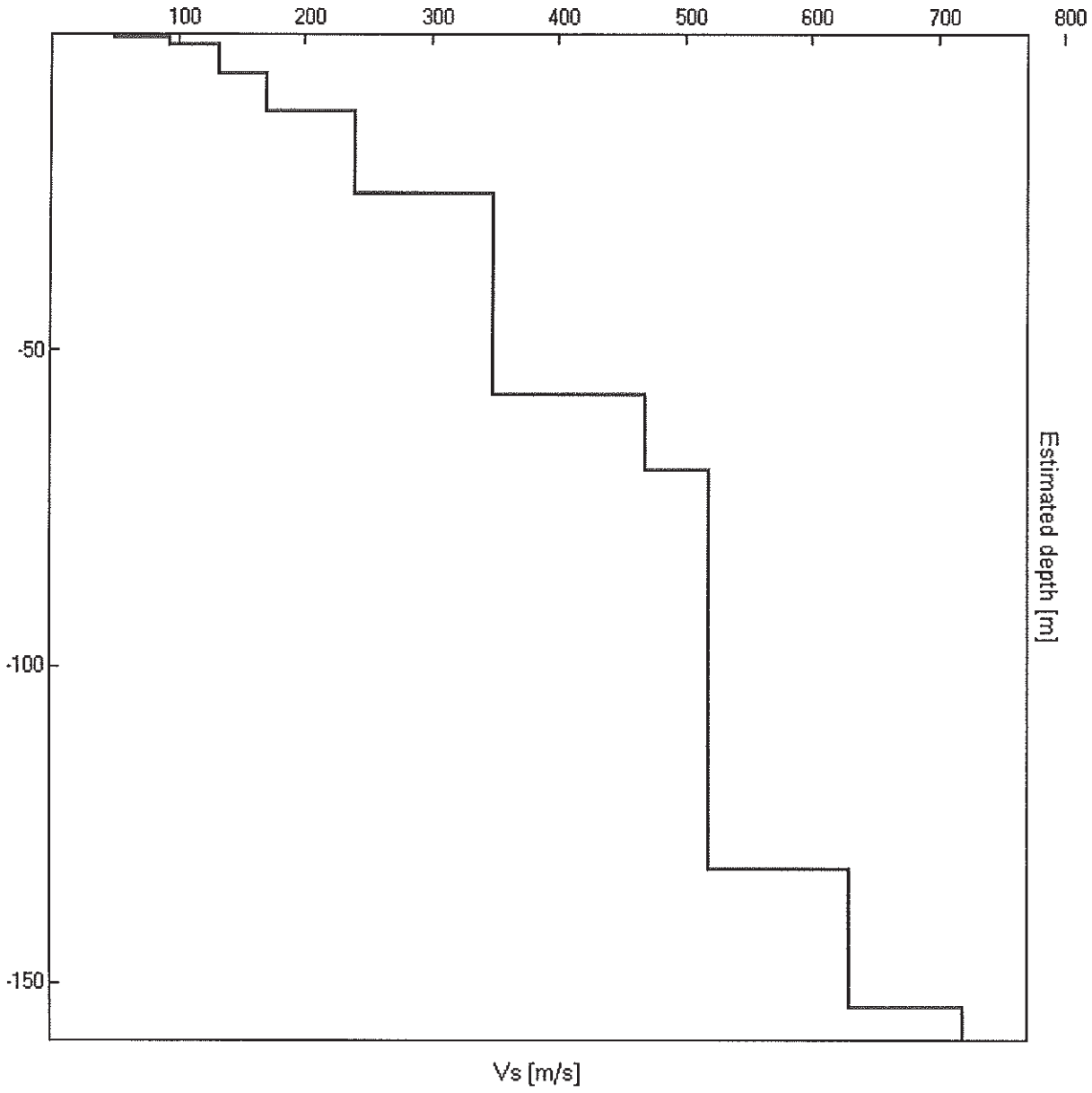

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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 1.88 ± 0.21 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.88 > 0.50	OK	
$n_c(f_0) > 200$	1687.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 91 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.594 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	3.406 Hz	OK	
$A_0 > 2$	2.73 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.05398| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.10121 < 0.1875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2633 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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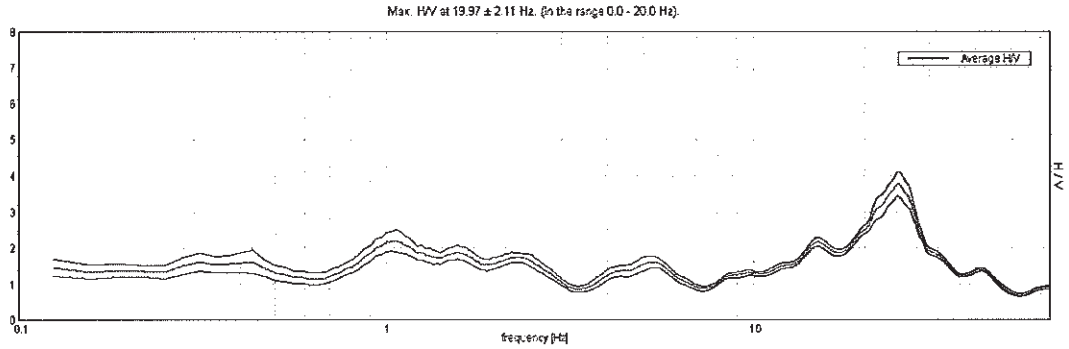
HVSR25A

RAVENNA – n. 3

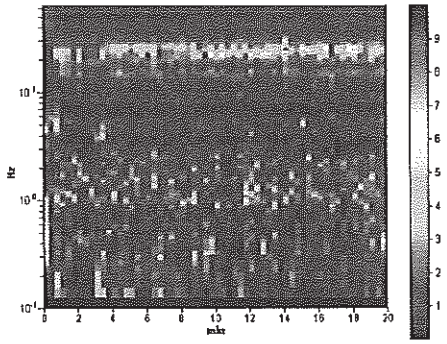
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

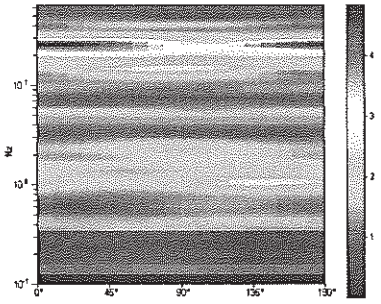
HORIZONTAL TO VERTICAL SPECTRAL RATIO



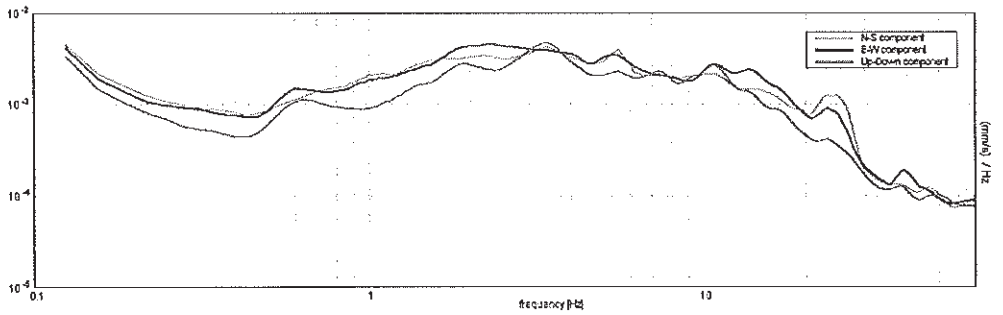
H/V TIME HISTORY



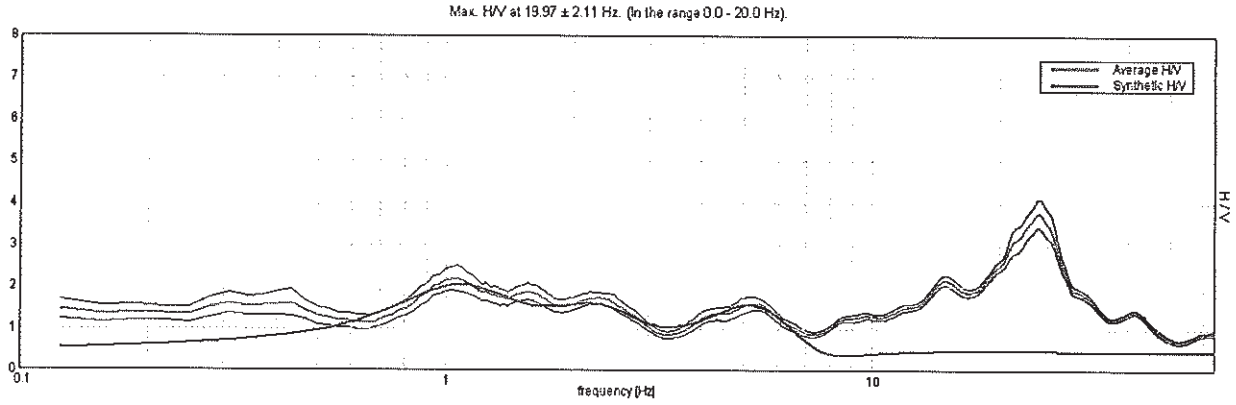
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

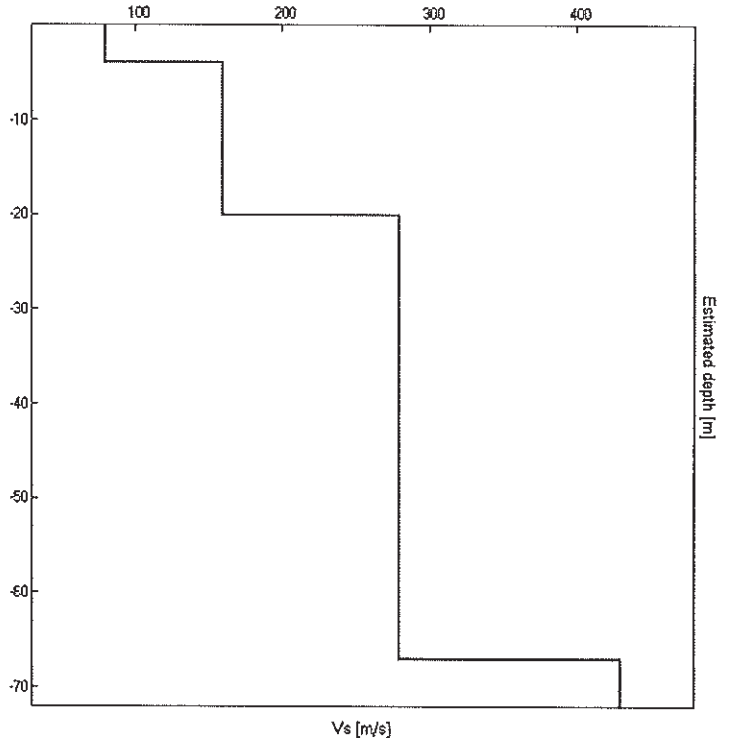


EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	80
20.00	16.00	160
67.00	47.00	280
inf.	inf.	430

Vs(0.0-30.0)=162m/s



[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 19.97 ± 2.11 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	OK	
$n_c(f_0) > 200$	23962.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 960 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	9.0 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	35.906 Hz	OK	
$A_0 > 2$	2.50 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.05226| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.04364 < 0.99844		NO
$\sigma_A(f_0) < \theta(f_0)$	0.0587 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR26A

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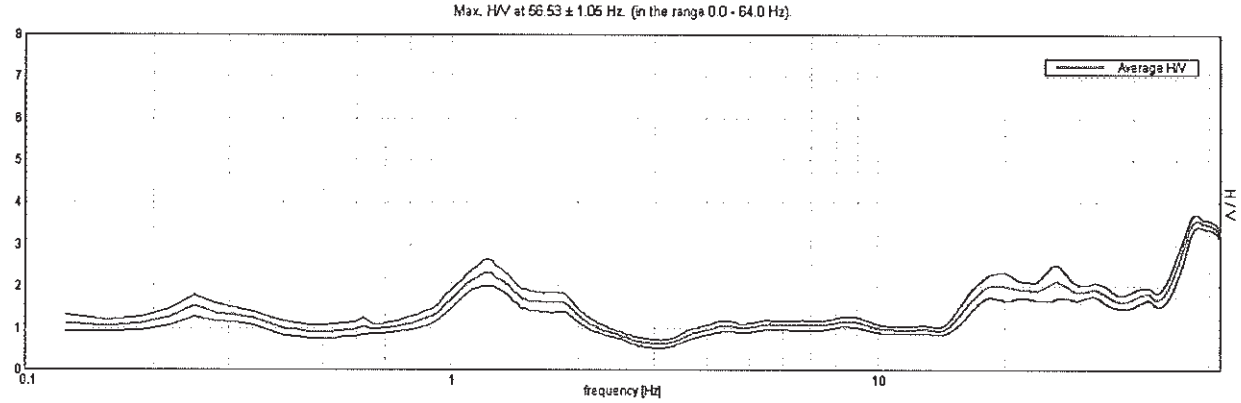
RAVENNA – n. 8

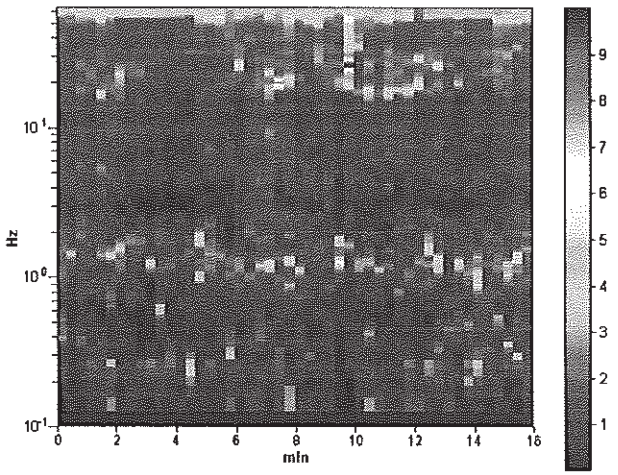
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h16'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

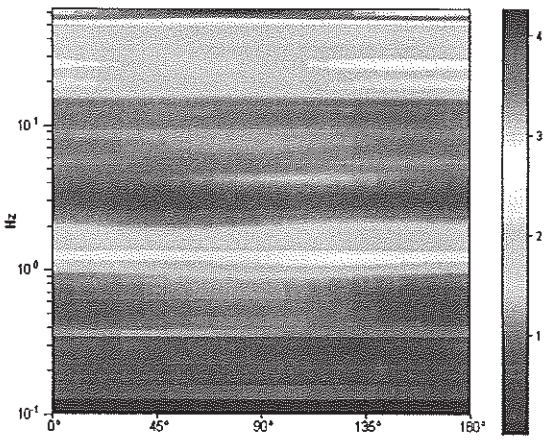
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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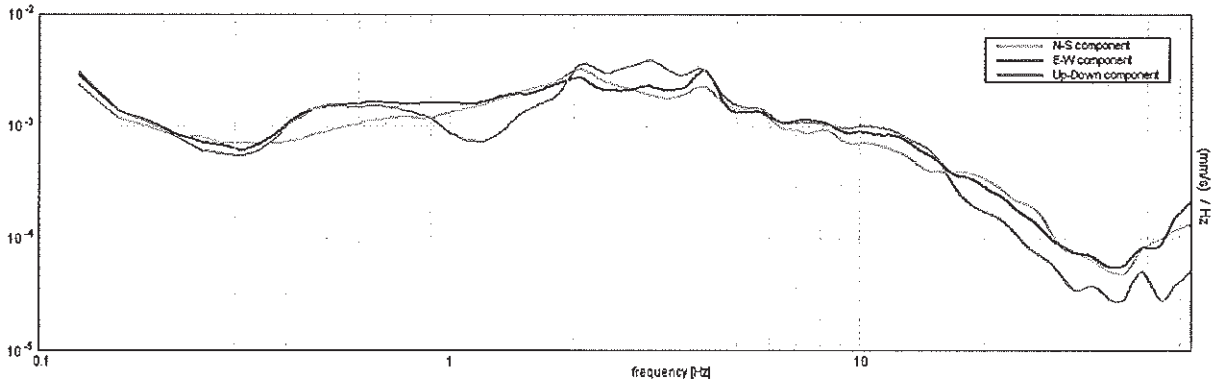
SINGLE COMPONENT SPECTRA



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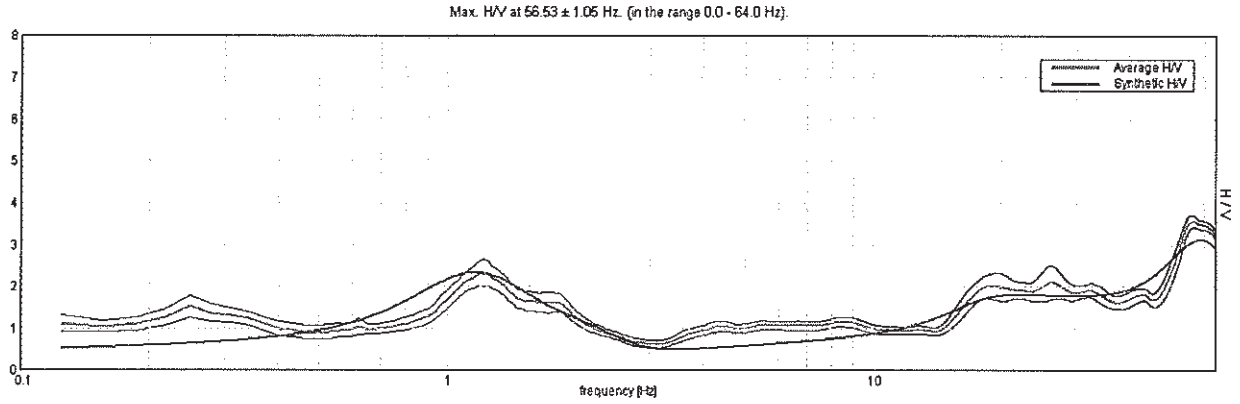
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.23	0.23	50
1.03	0.80	123
1.53	0.50	175
2.53	1.00	189
7.53	5.00	230
11.53	4.00	180
27.53	16.00	220
45.53	18.00	370
57.53	12.00	400
99.53	42.00	440
inf.	inf.	630

Vs(0.0-30.0)=210m/s

TROMINO® Grilla

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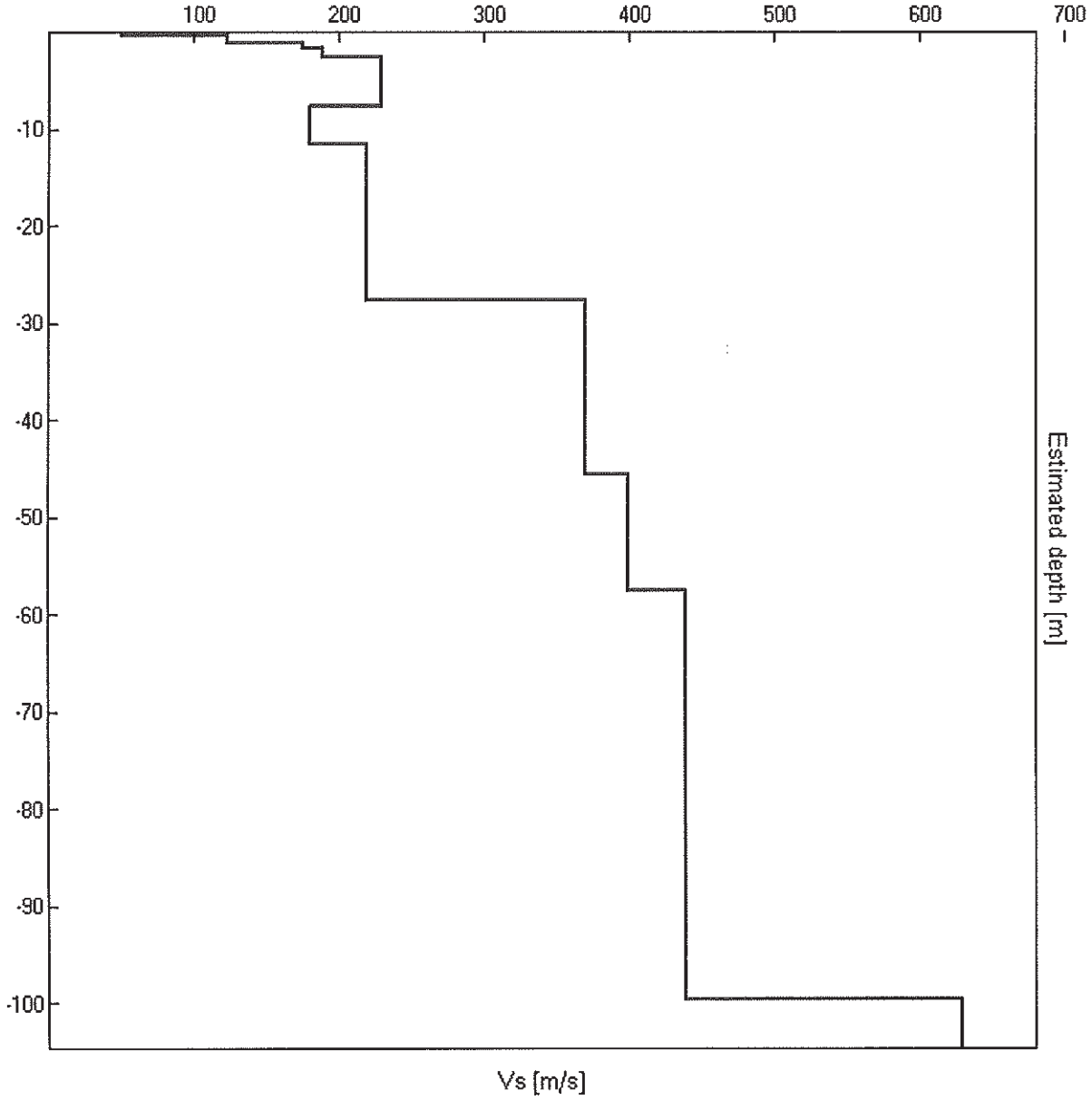

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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 56.53 ± 1.05 Hz. (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	56.53 > 0.50	OK	
$n_c(f_0) > 200$	54270.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1144 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$	47.156 Hz	OK	
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	3.56 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00911| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.51472 < 2.82656	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0706 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR27A

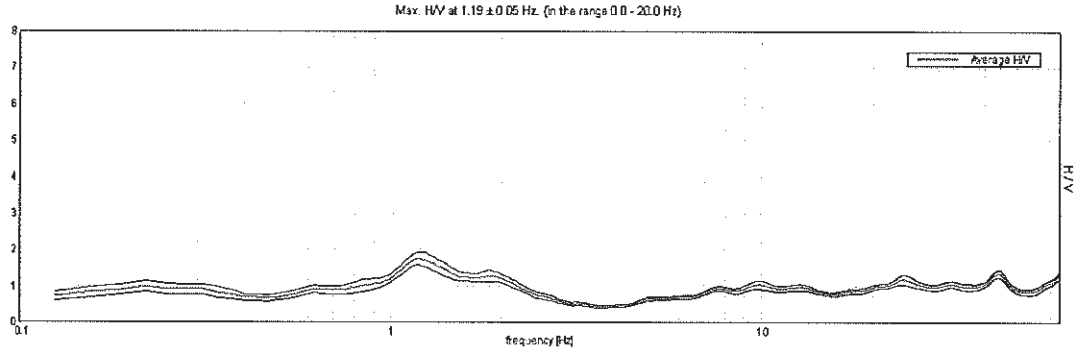
TROMINO® Grilla

RAVENNA – n. 9

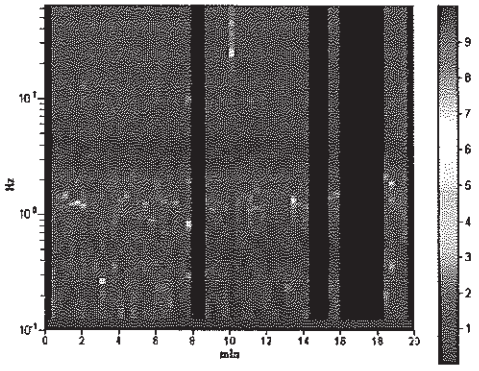
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 77% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

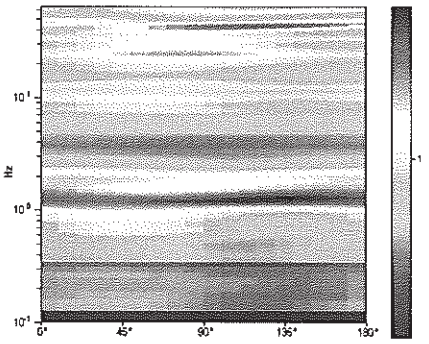
HORIZONTAL TO VERTICAL SPECTRAL RATIO



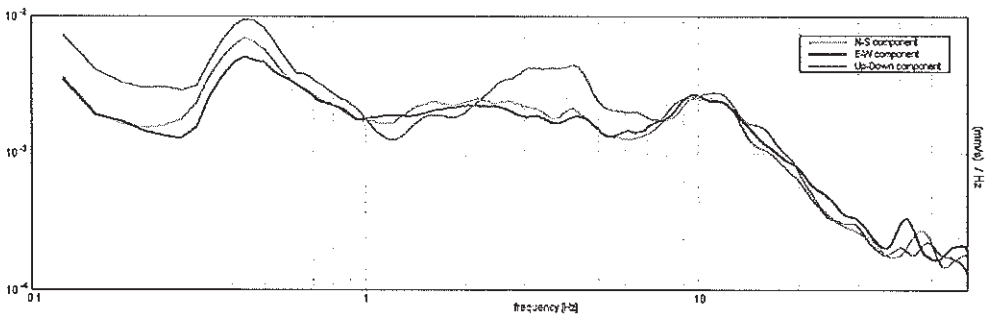
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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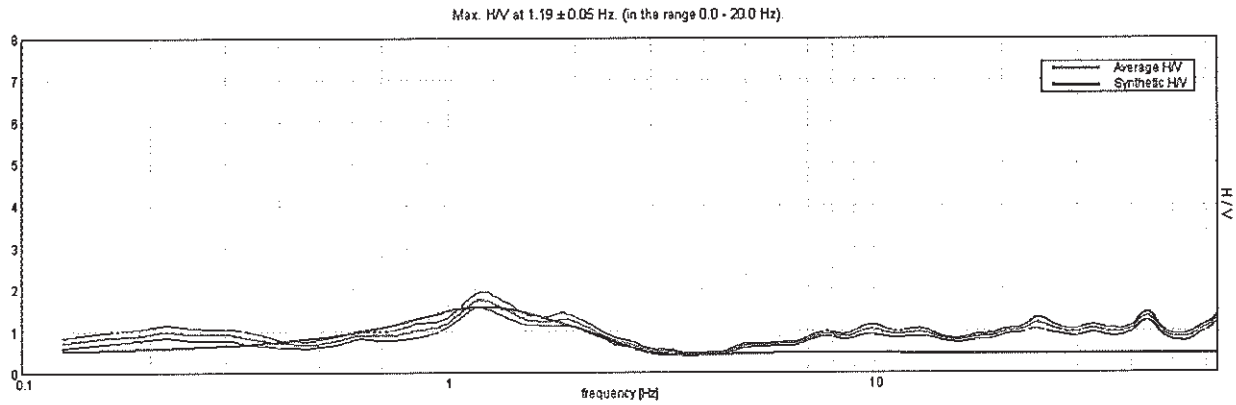
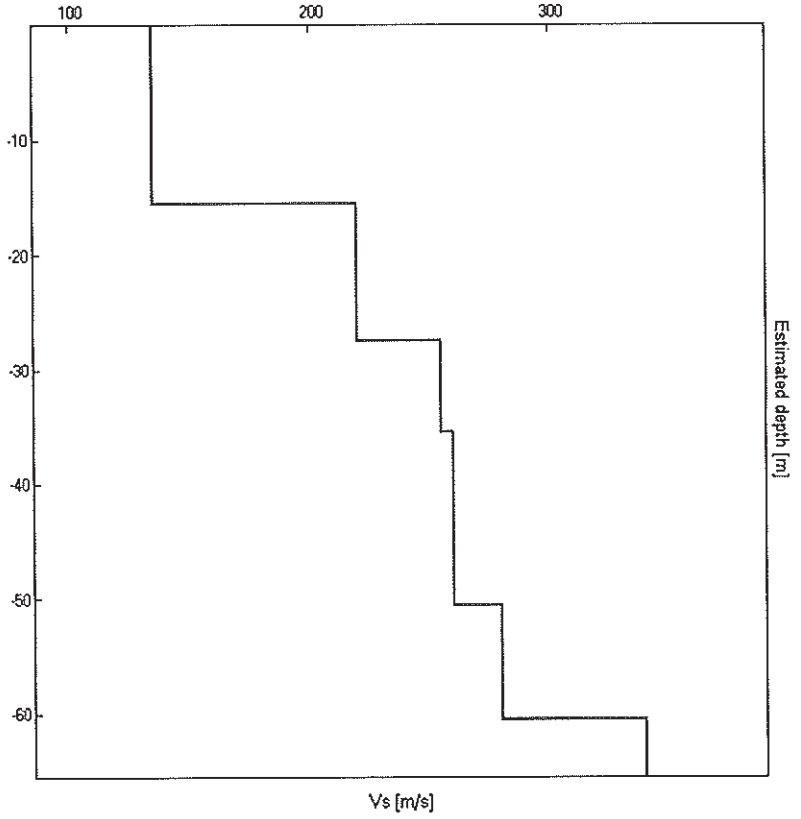
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
15.50	15.50	135
27.50	12.00	220
35.50	8.00	255
50.50	15.00	260
60.50	10.00	280
inf.	inf.	340

Vs(0.0-30.0)=167m/s



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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 1.19 ± 0.05 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.19 > 0.50	OK	
$n_c(f_0) > 200$	1092.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 58 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.594 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	2.344 Hz	OK	
$A_0 > 2$	1.75 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01946| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.02311 < 0.11875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0856 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR28A

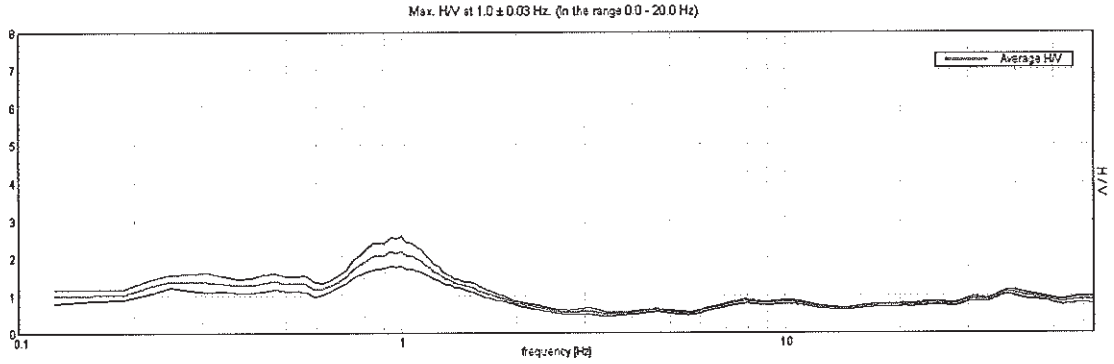
TROMINO® Grilla

RAVENNA – n. 10

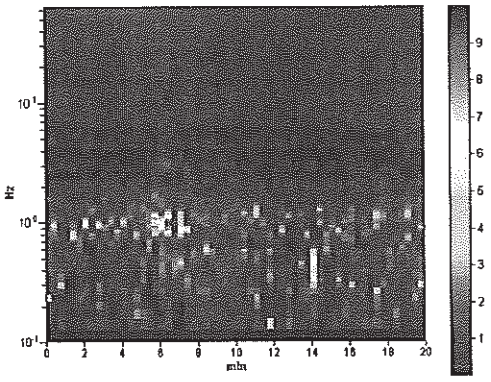
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

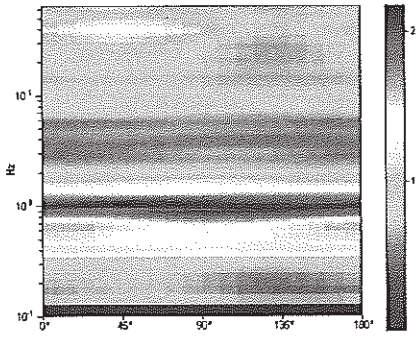
HORIZONTAL TO VERTICAL SPECTRAL RATIO



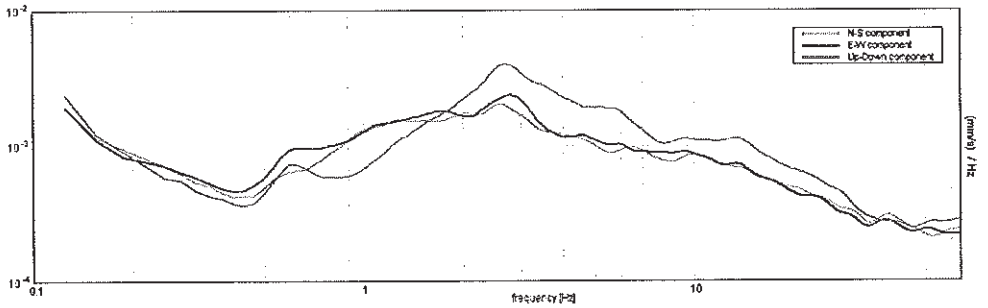
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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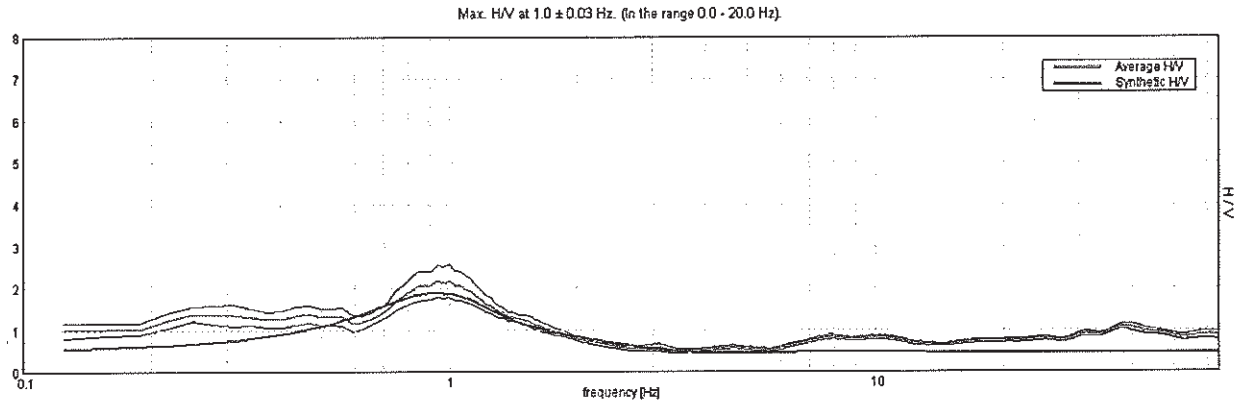
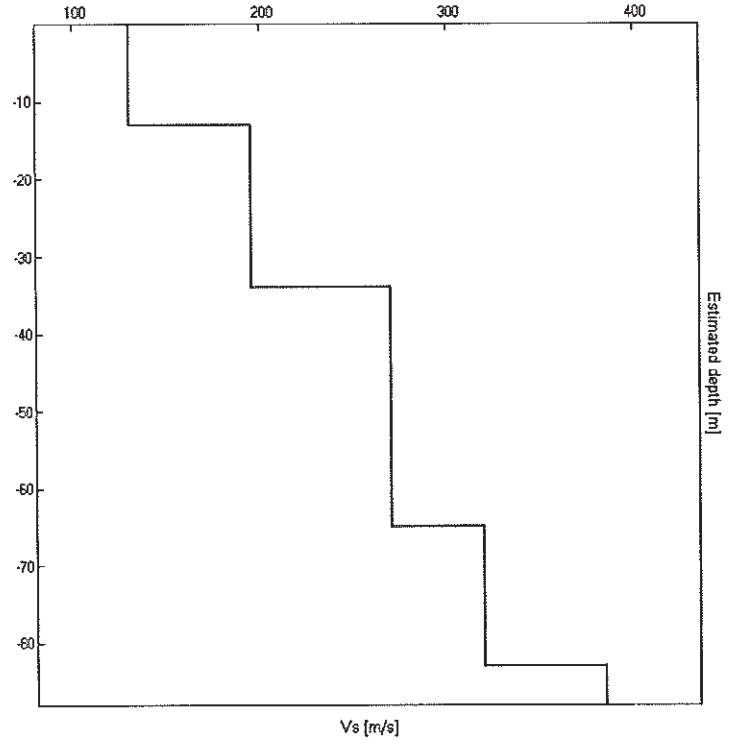
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
13.00	13.00	130
34.00	21.00	195
65.00	31.00	270
83.00	18.00	320
inf.	inf.	385

Vs(0.0-30.0)=160m/s



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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 1.0 ± 0.03 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.00 > 0.50	OK	
$n_c(f_0) > 200$	1200.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 49 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$	1.656 Hz	OK	
$A_0 > 2$	2.17 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01618| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.01618 < 0.1	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1968 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR29A

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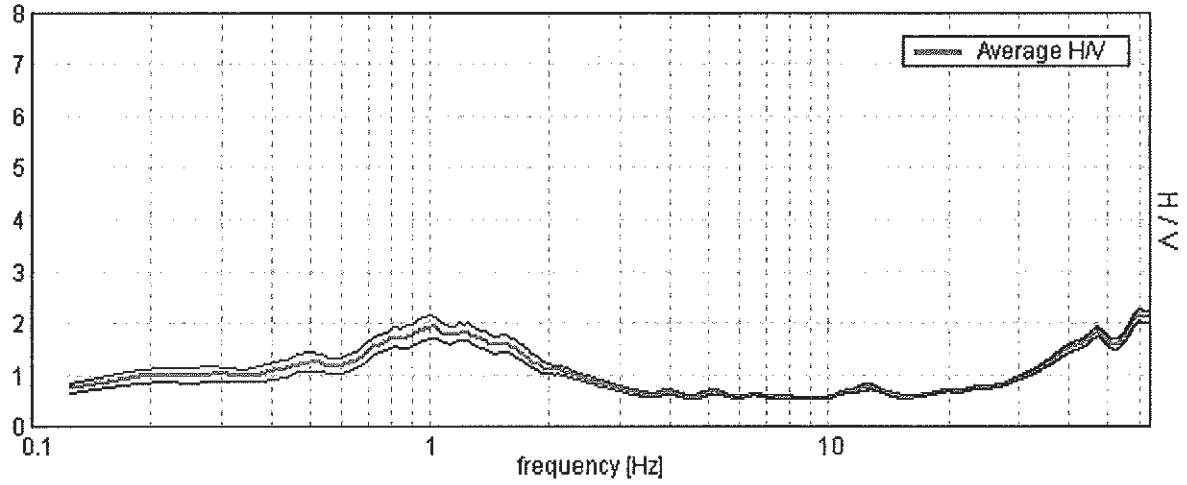
RAVENNA - n. 11

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

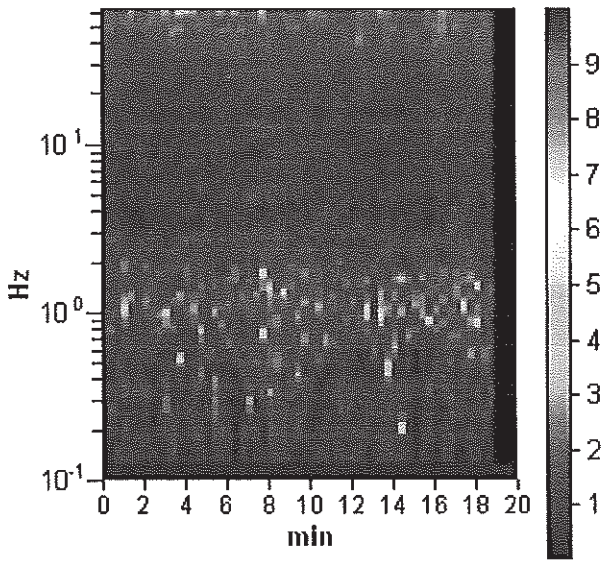
Trace length: 0h20'00". Analyzed 95% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

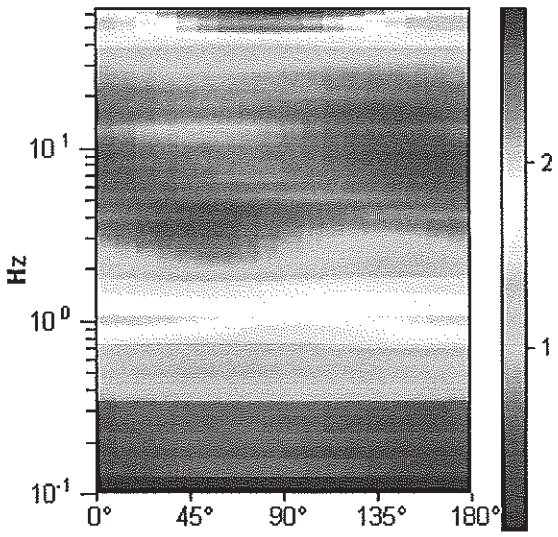
Max. H/V at 1.0 ± 0.02 Hz. (in the range 0.0 - 20.0 Hz).



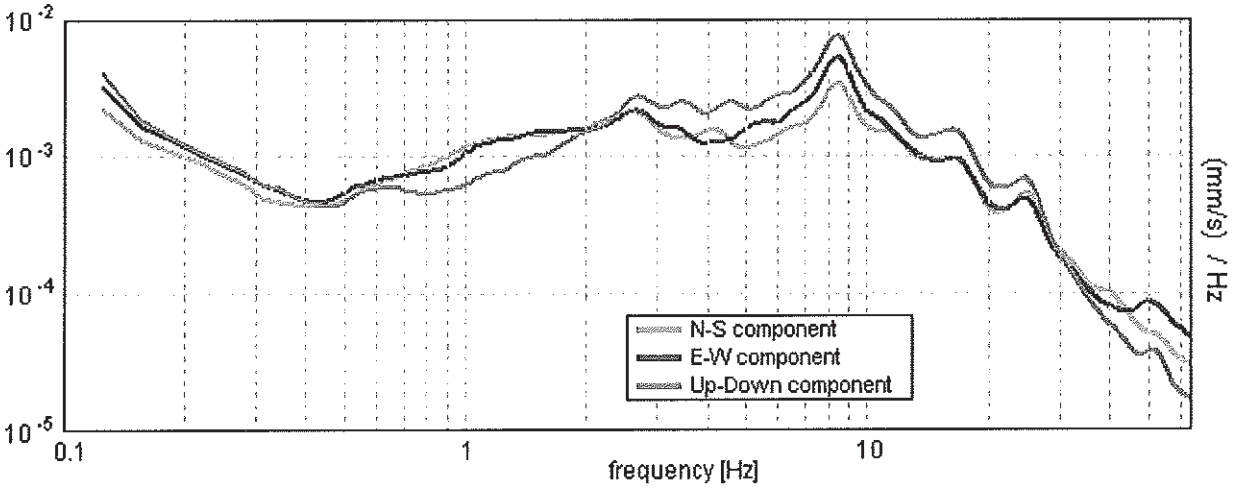
H/V TIME HISTORY



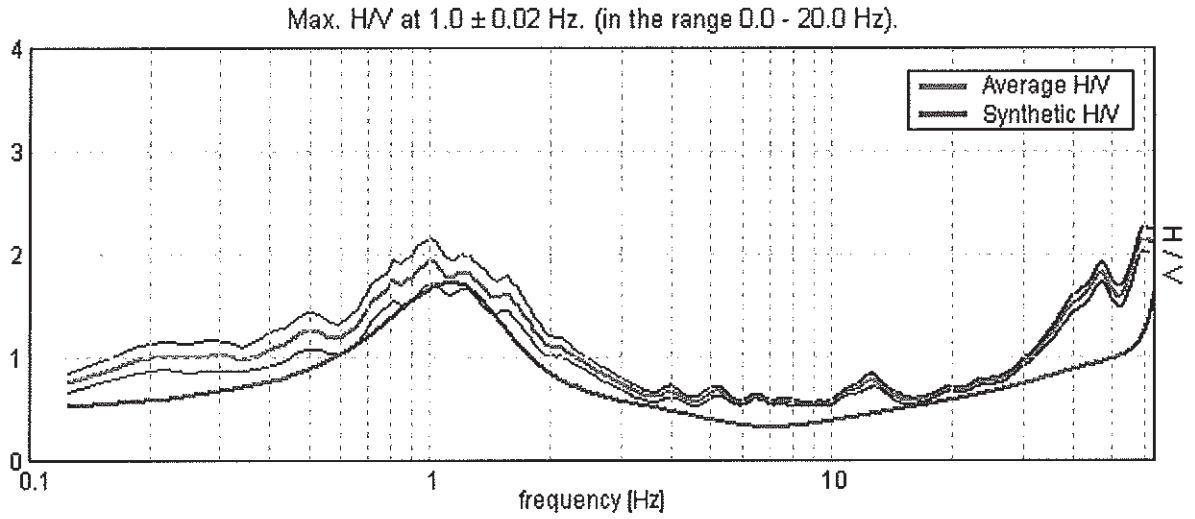
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

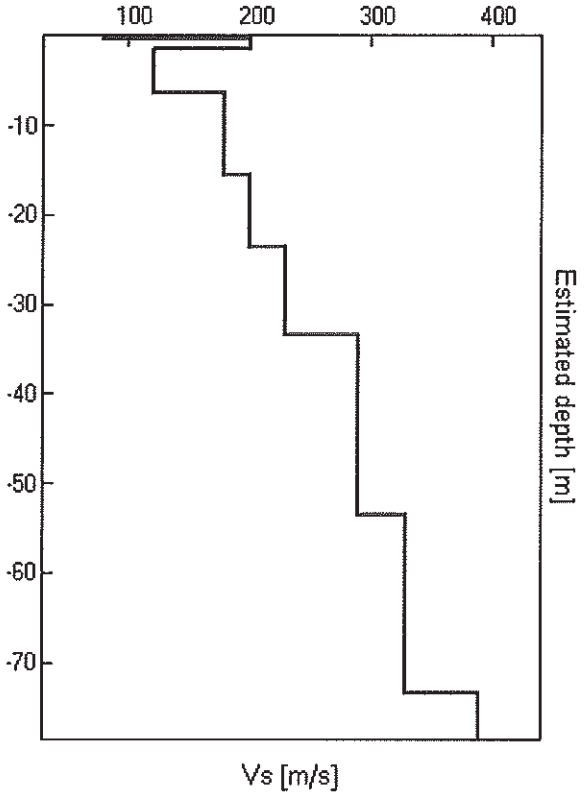


EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.30	0.30	80
1.50	1.20	200
6.50	5.00	120
15.50	9.00	180
23.50	8.00	200
33.50	10.00	230
53.50	20.00	290
73.50	20.00	330
inf.	inf.	390

Vs(0.0-30.0)=177m/s


100
200
300
400
-10
-20
-30
-40
-50
-60
-70
Estimated depth [m]
Vs [m/s]

[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 1.0 ± 0.02 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.00 > 0.50	OK	
$n_c(f_0) > 200$	1140.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 49 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$	2.406 Hz	OK	
$A_0 > 2$	1.94 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01057| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.01057 < 0.1	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1074 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR30A

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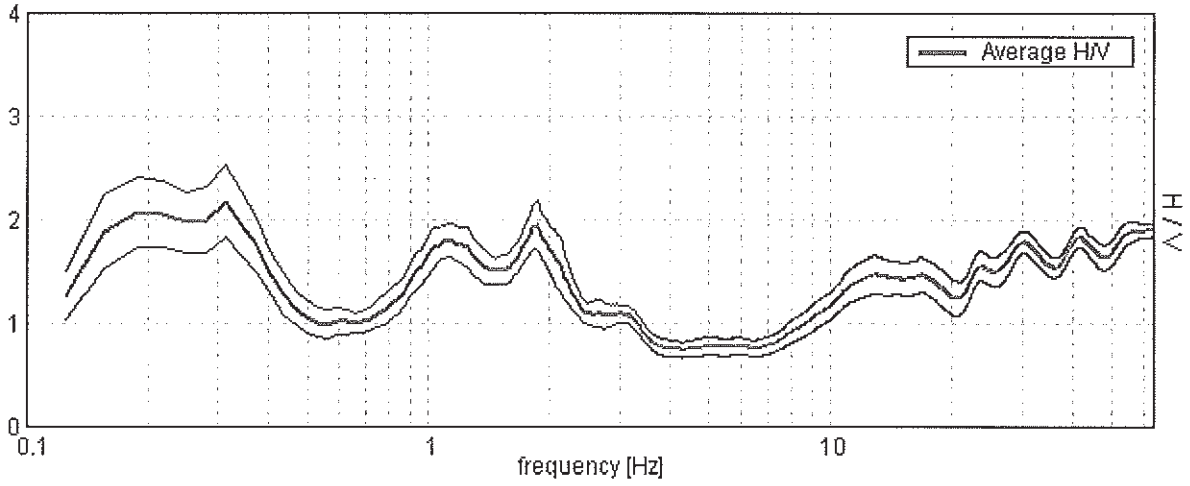
RAVENNA - n. 33

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

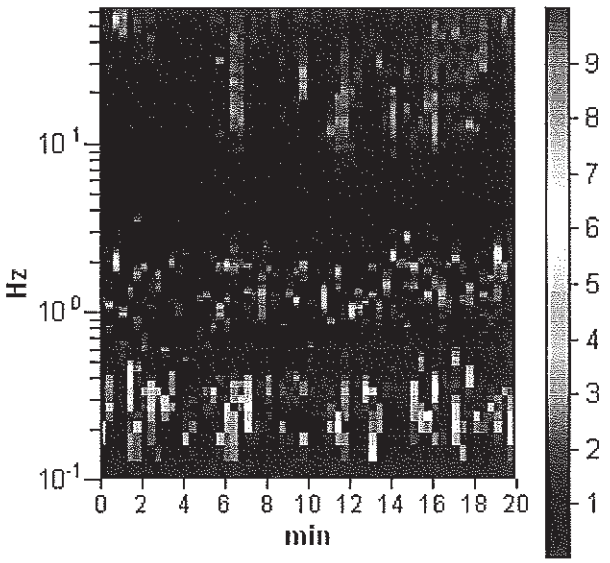
Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

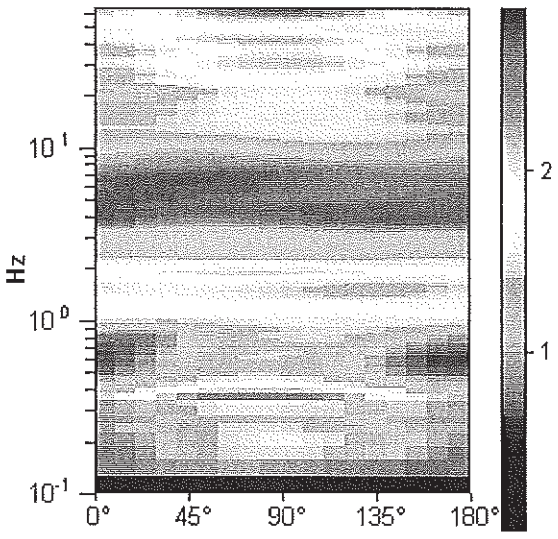
Max. H/V at 0.31 ± 0.08 Hz. (in the range 0.0 - 20.0 Hz).



H/V TIME HISTORY



DIRECTIONAL H/V



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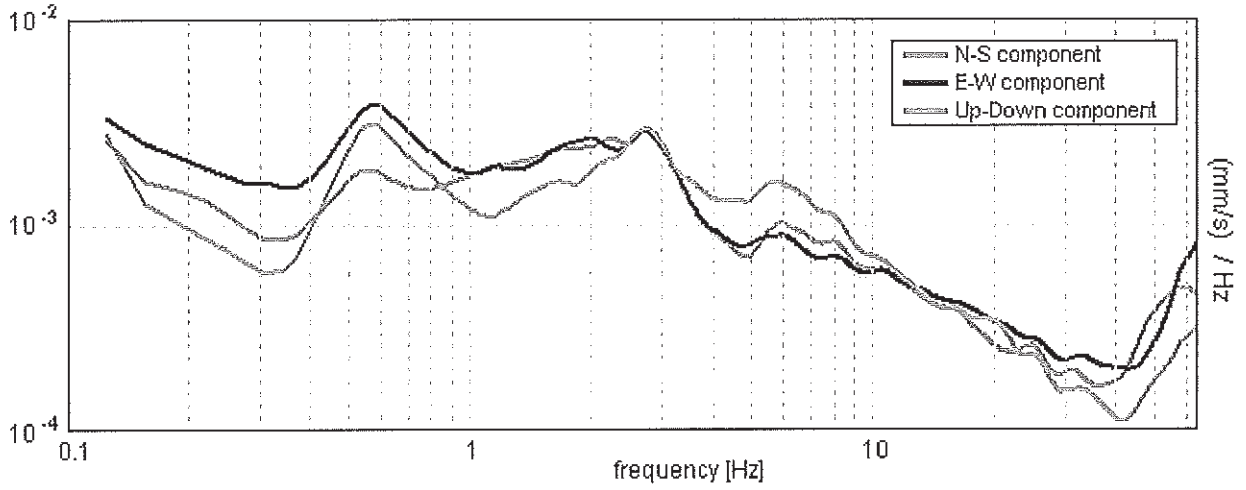
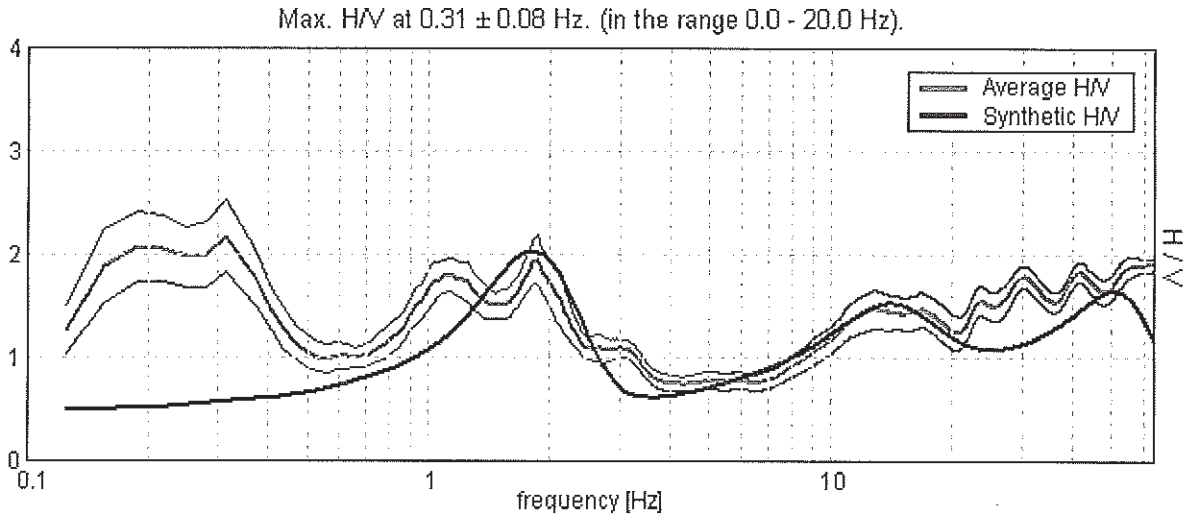
SINGLE COMPONENT SPECTRA

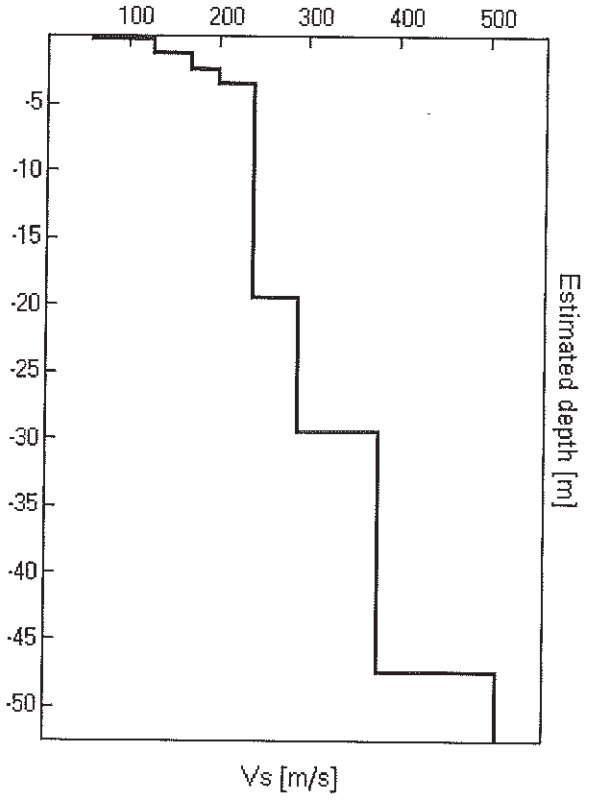


EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.30	0.30	62
1.30	1.00	130
2.50	1.20	170
3.50	1.00	200
19.50	16.00	240
29.50	10.00	290
47.50	18.00	380
inf.	inf.	510

Vs(0.0-30.0)=236m/s


100
200
300
400
500
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Estimated depth [m]
Vs [m/s]

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 0.31 ± 0.08 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.31 > 0.50		NO
$n_c(f_0) > 200$	375.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 16 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	0.5 Hz	OK	
$A_0 > 2$	2.18 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.12496| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.03905 < 0.0625	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1743 < 2.5	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR31A

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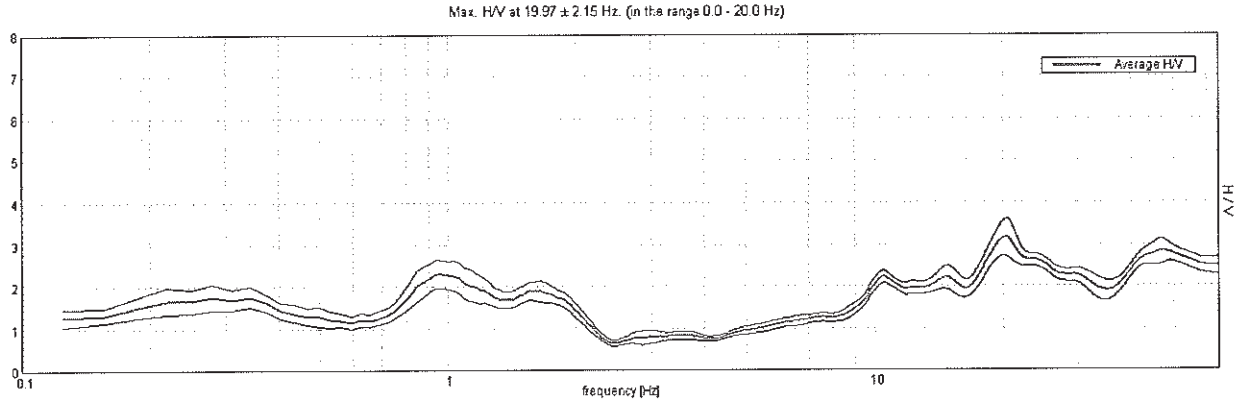
TROMINO® Grilla

RAVENNA – n. 36

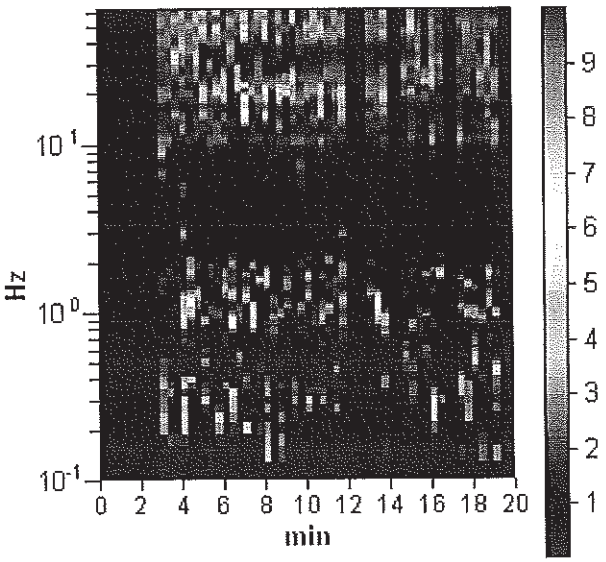
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 70% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

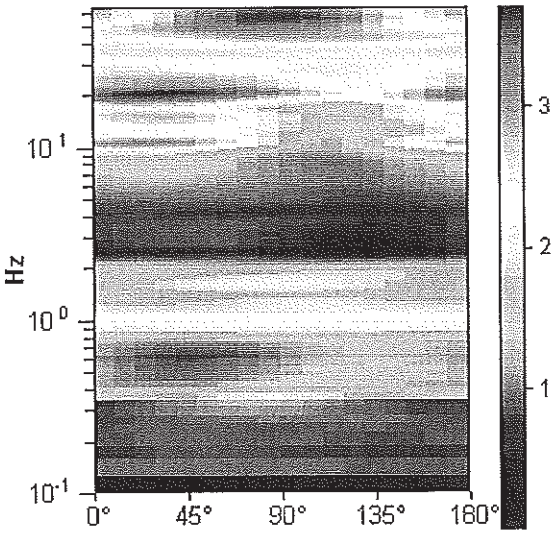
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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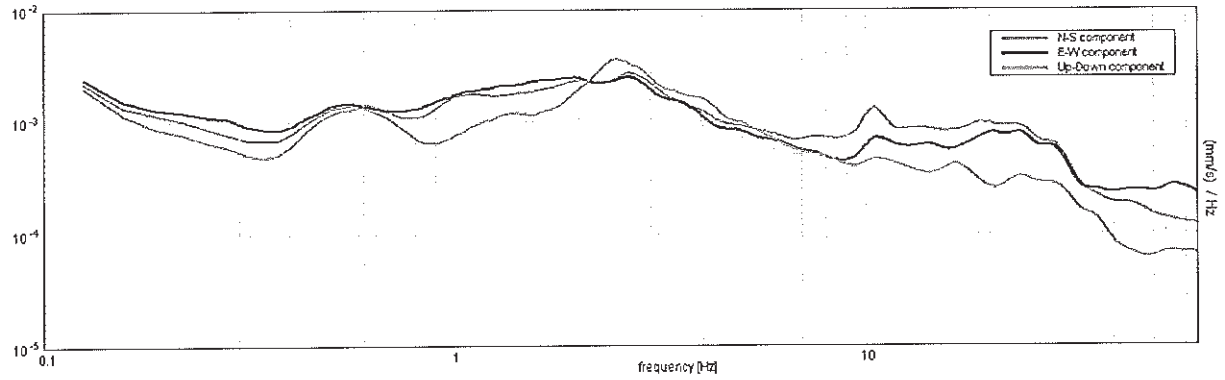
SINGLE COMPONENT SPECTRA



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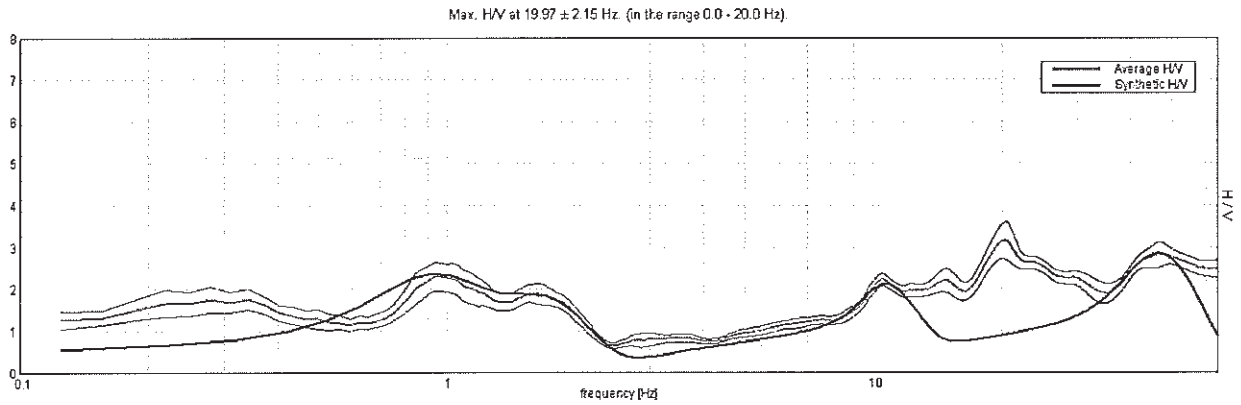
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.24	0.24	43
1.44	1.20	105
3.94	2.50	130
6.94	3.00	275
15.44	8.50	130
18.44	3.00	190
31.44	13.00	240
49.44	18.00	360
113.44	64.00	390
inf.	inf.	600

Vs(0.0-30.0)=170m/s

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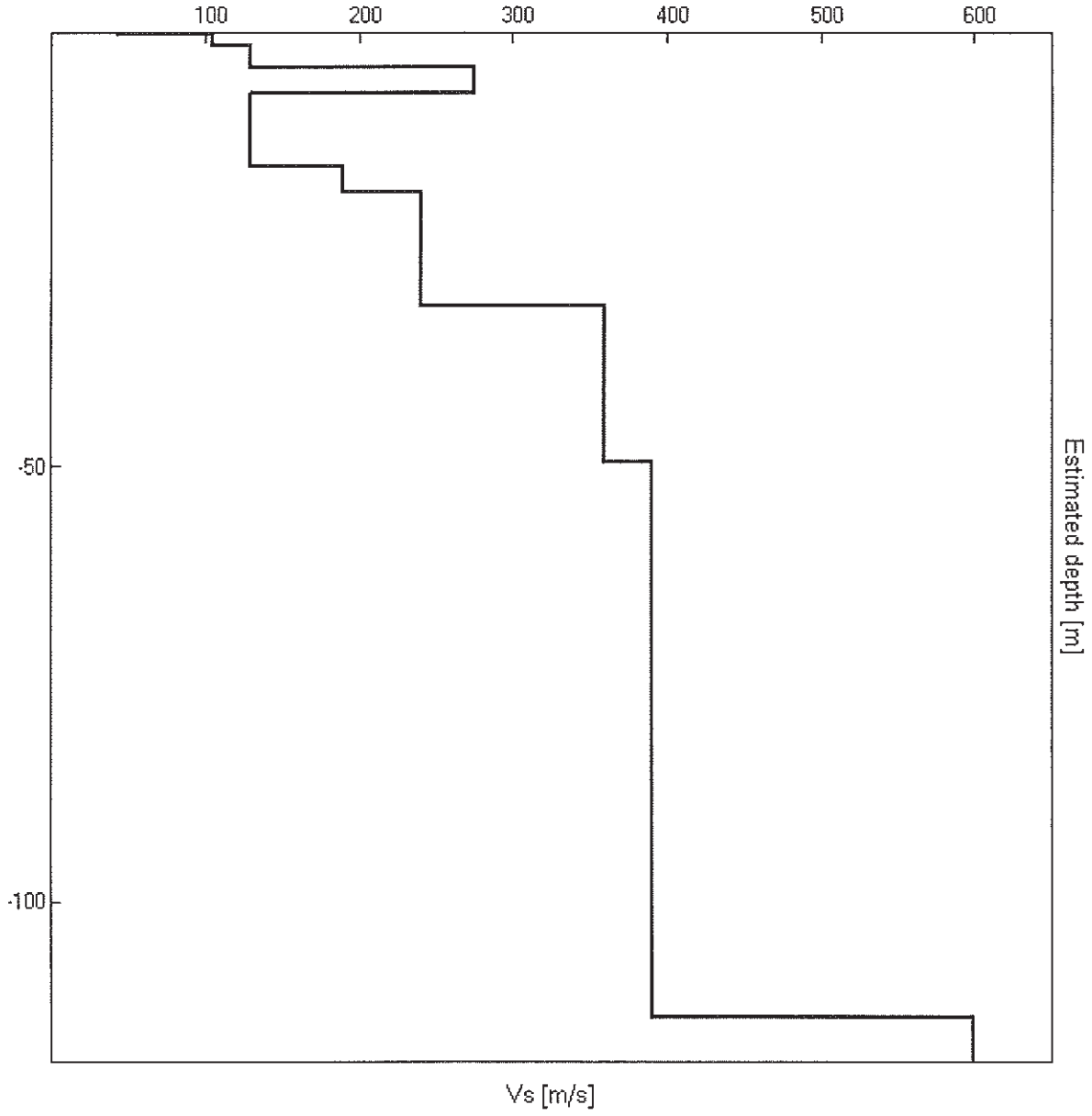

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TROMINO® Grilla

[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 19.97 ± 2.15 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	OK	
$n_c(f_0) > 200$	16773.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 960 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	9.219 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	3.13 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.05262| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.05066 < 0.99844		NO
$\sigma_A(f_0) < \theta(f_0)$	0.2038 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR32A

TROMINO® Grilla

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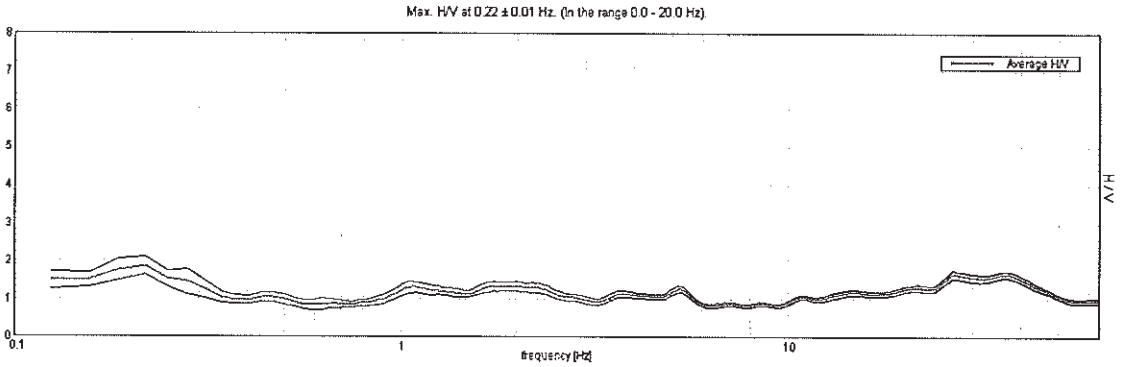
RAVENNA - n. 16

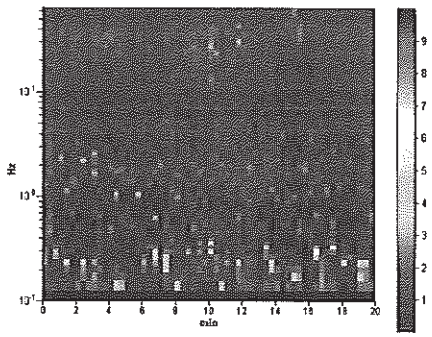
Start recording: 19/10/10 16:21:55 End recording: 19/10/10 16:41:55
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

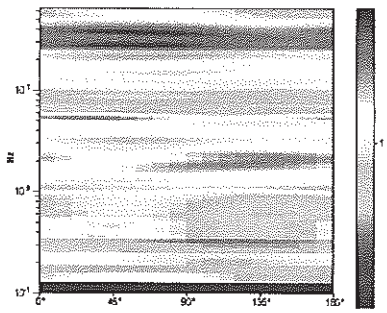
HORIZONTAL TO VERTICAL SPECTRAL RATIO



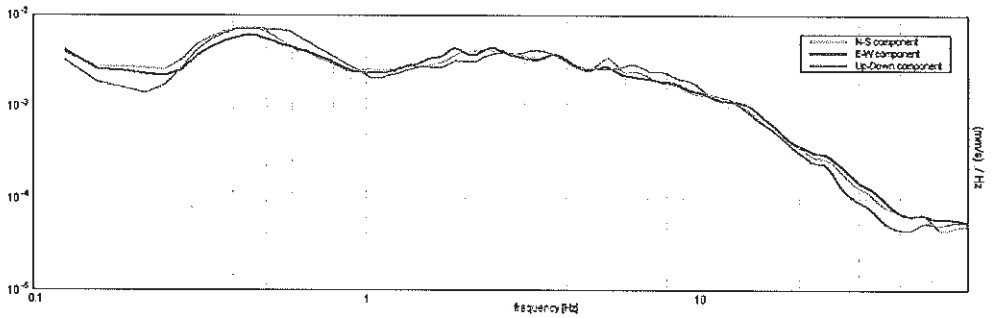
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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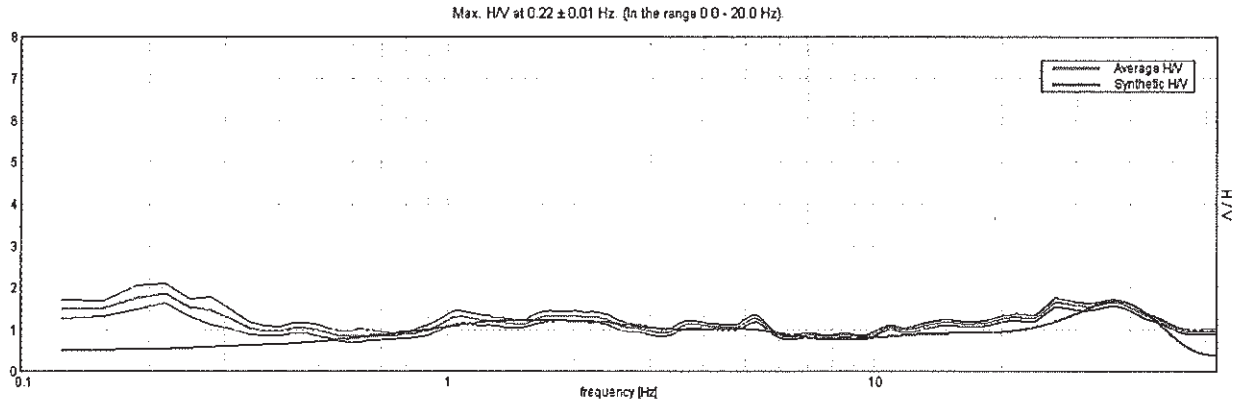
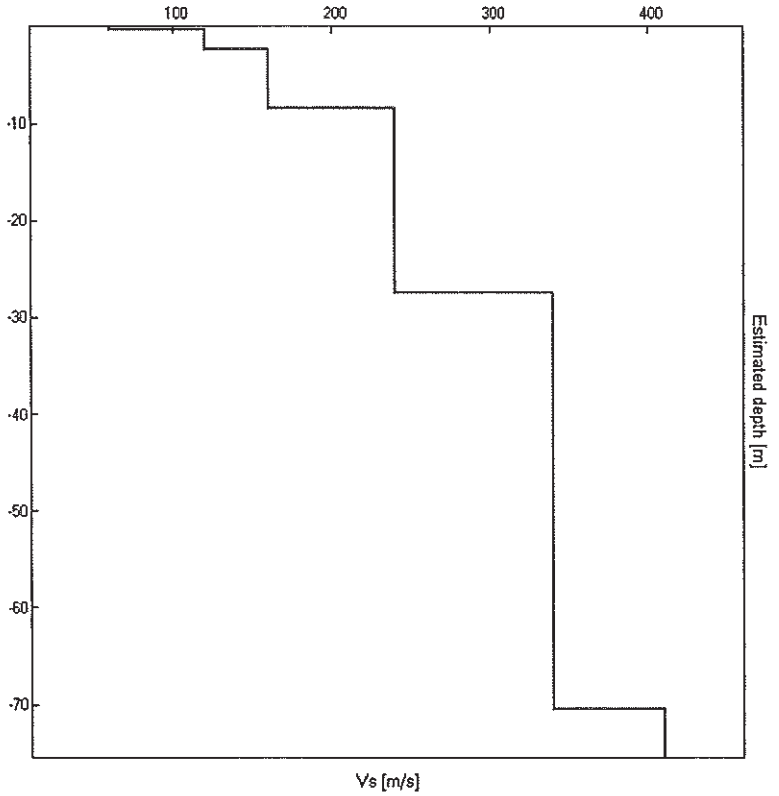
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.40	0.40	60
2.40	2.00	120
8.40	6.00	160
27.40	19.00	240
70.40	43.00	340
inf.	inf.	410

Vs(0.0-30.0)=203m/s



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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 0.22 ± 0.01 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.22 > 0.50		NO
$n_c(f_0) > 200$	262.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 12 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$	0.531 Hz	OK	
$A_0 > 2$	1.86 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02662| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.00582 < 0.04375	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1155 < 2.5	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR33A

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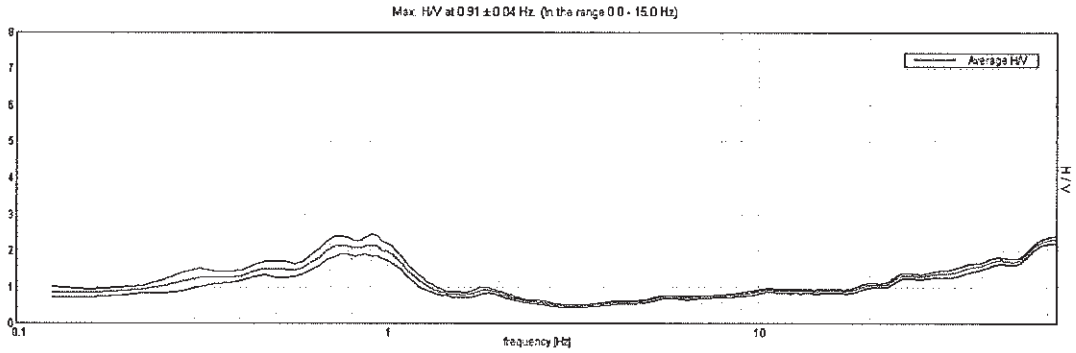
RAVENNA – n. 15

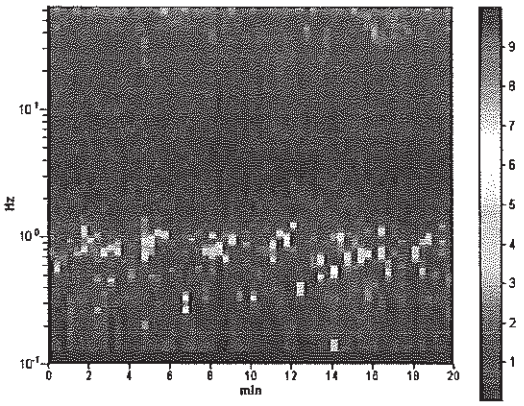
Start recording: 22/06/10 16:53:55 End recording: 22/06/10 17:13:56
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

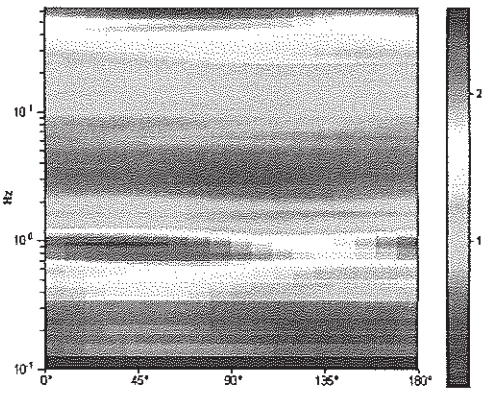
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

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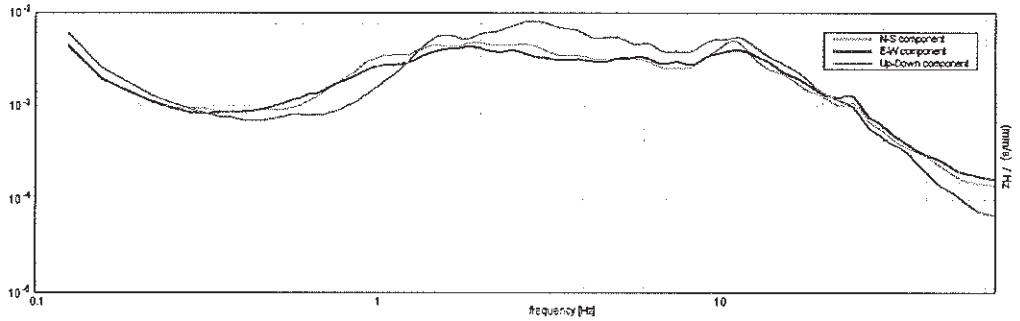

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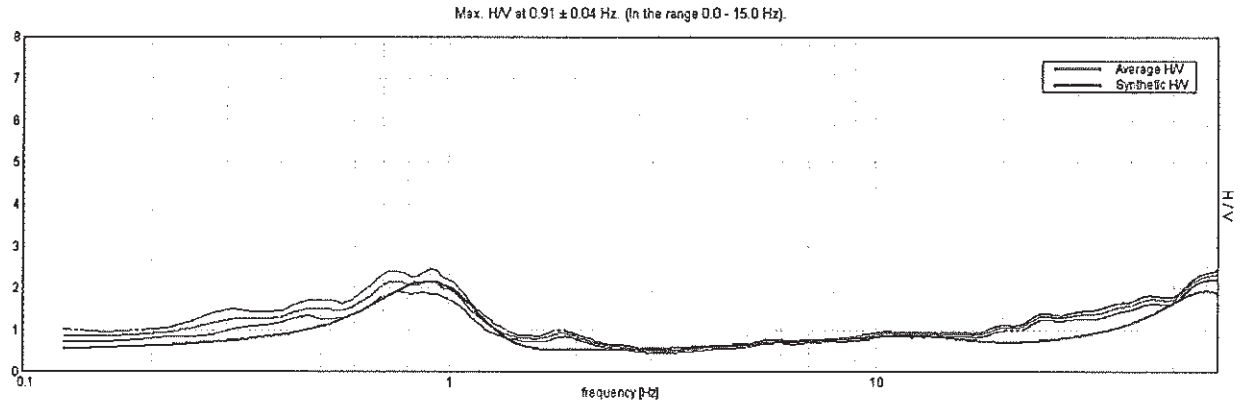
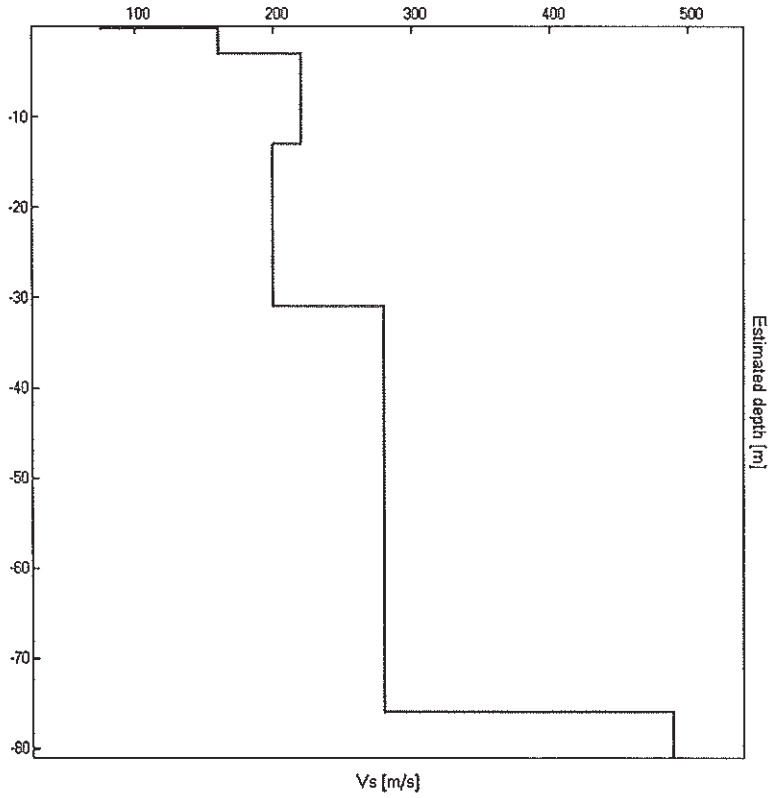
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.30	0.30	75
3.00	2.70	160
13.00	10.00	220
31.00	18.00	200
76.00	45.00	280
inf.	inf.	490

Vs(0.0-30.0)=198m/s



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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 0.91 ± 0.04 Hz. (in the range 0.0 - 15.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.91 > 0.50	OK	
$n_c(f_0) > 200$	1087.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 44 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.25 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	1.281 Hz	OK	
$A_0 > 2$	2.15 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02048| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.01856 < 0.13594	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.148 < 2.0	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR34A

TROMINO® Grilla

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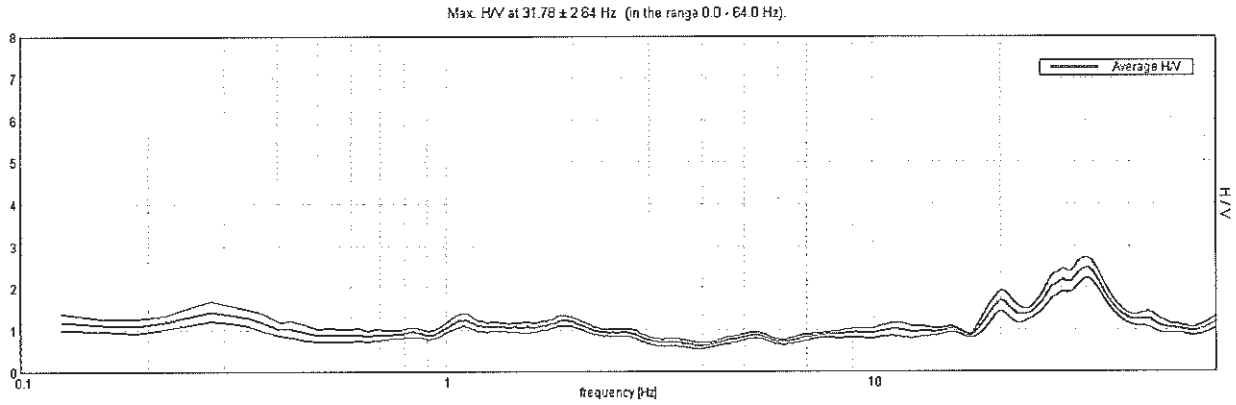
RAVENNA – n. 19

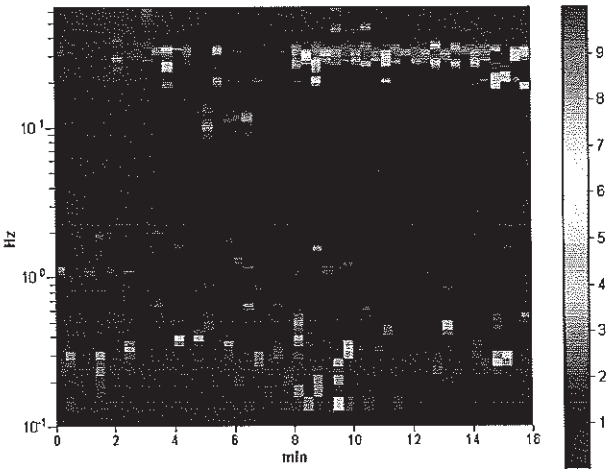
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h16'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

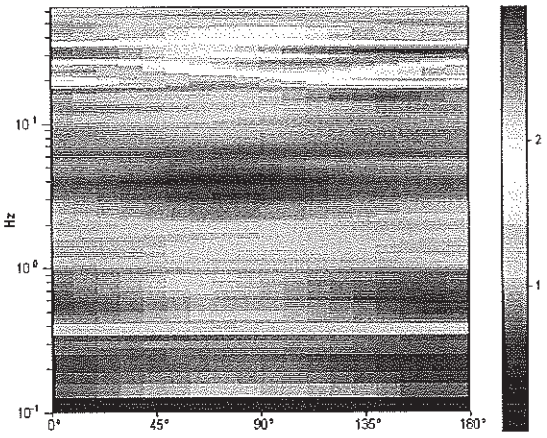
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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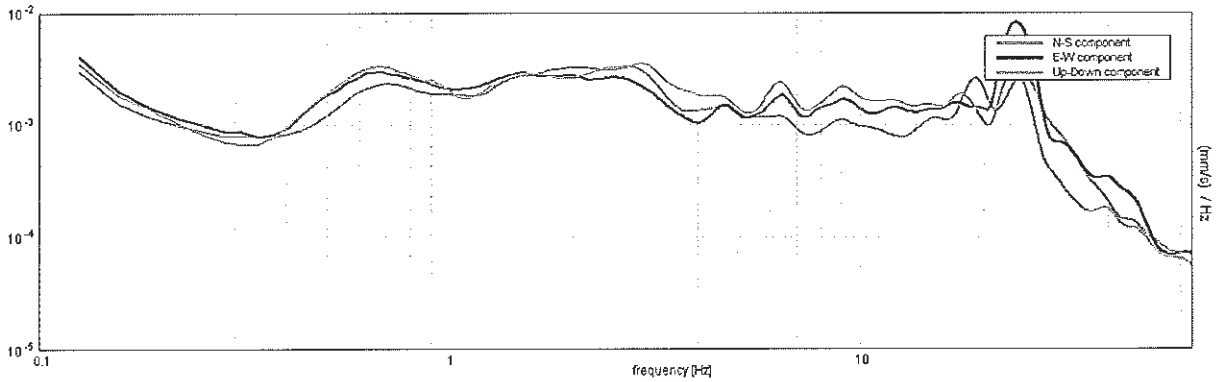
SINGLE COMPONENT SPECTRA



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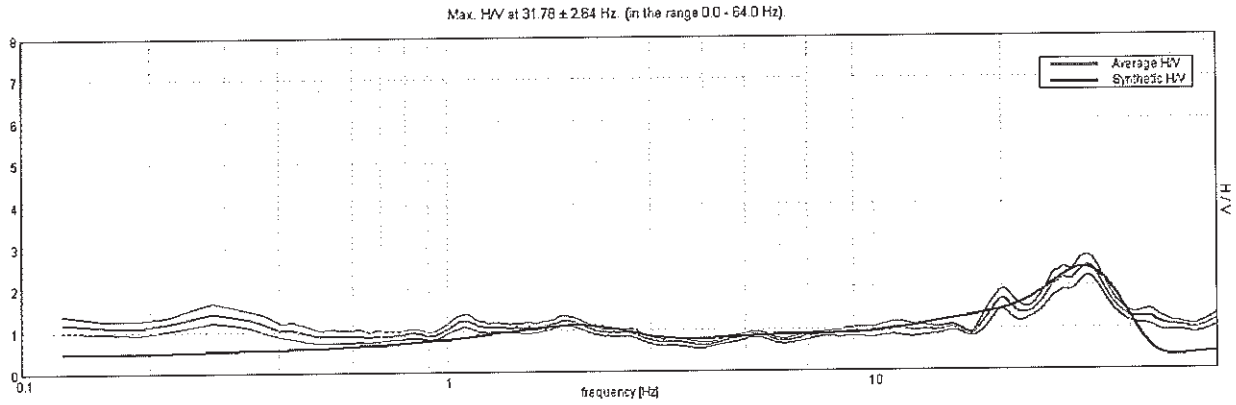
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.50	0.50	60
2.50	2.00	140
8.50	6.00	180
26.50	18.00	230
inf.	inf.	330

Vs(0.0-30.0)=207m/s

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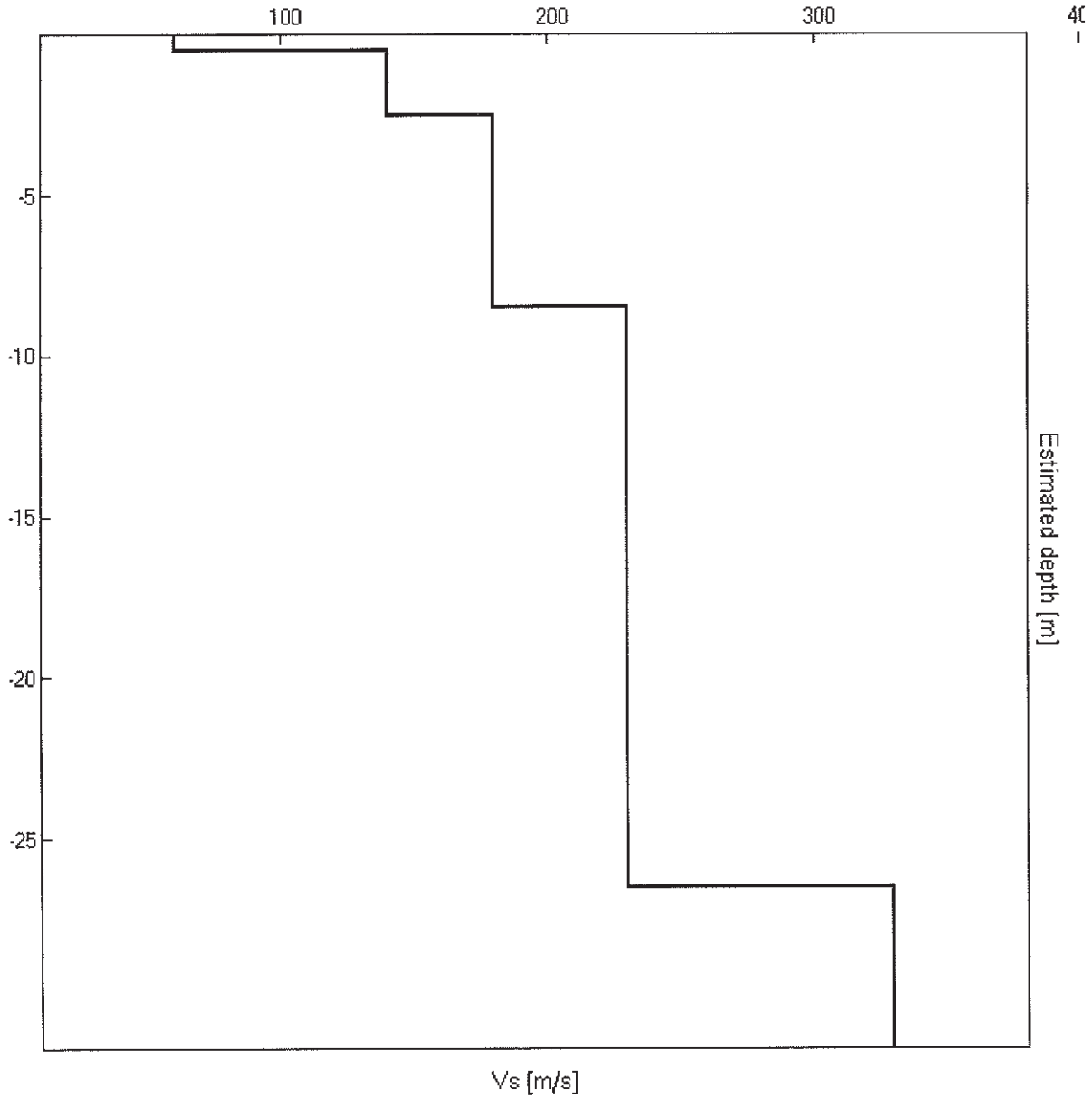
TROMINO® Grilla



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TROMINO® Grilla

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 31.78 ± 2.64 Hz. (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	31.78 > 0.50	OK	
$n_c(f_0) > 200$	30510.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1526 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	18.375 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	41.188 Hz	OK	
$A_0 > 2$	2.48 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.04092| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	1.30049 < 1.58906	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.122 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR35A

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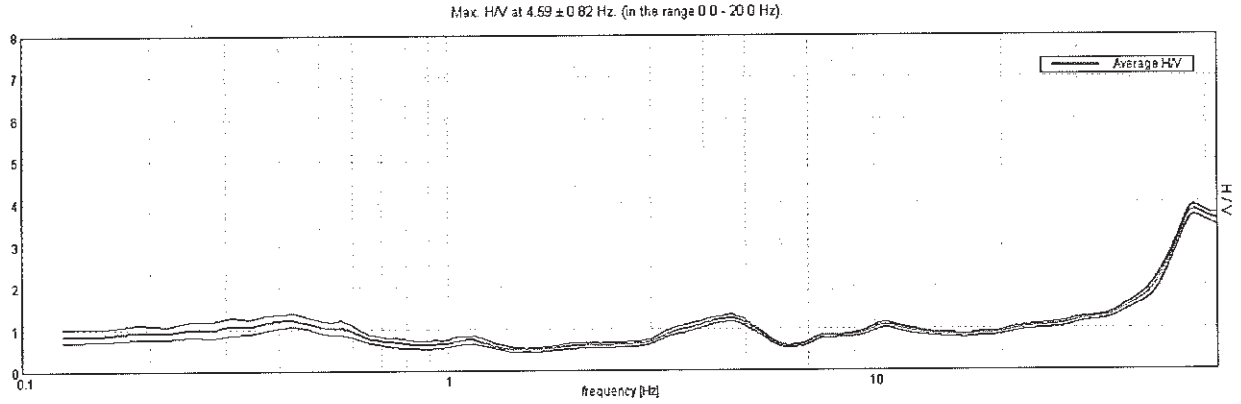
RAVENNA – n. 21

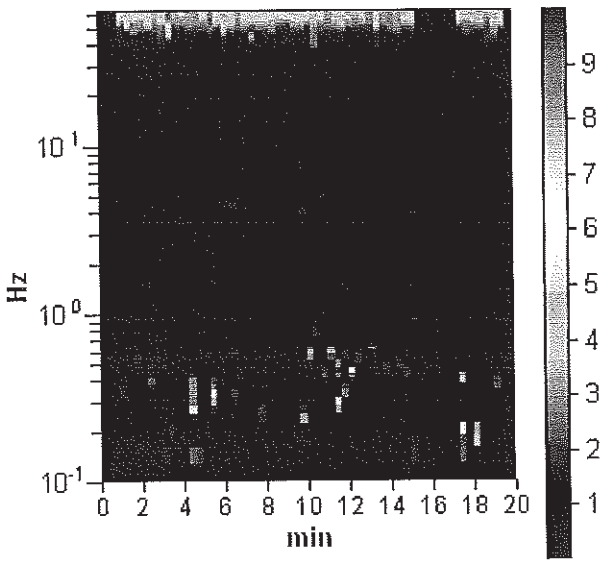
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 83% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

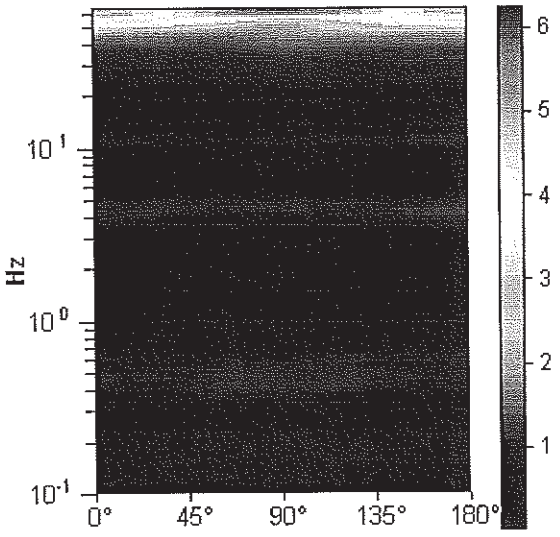
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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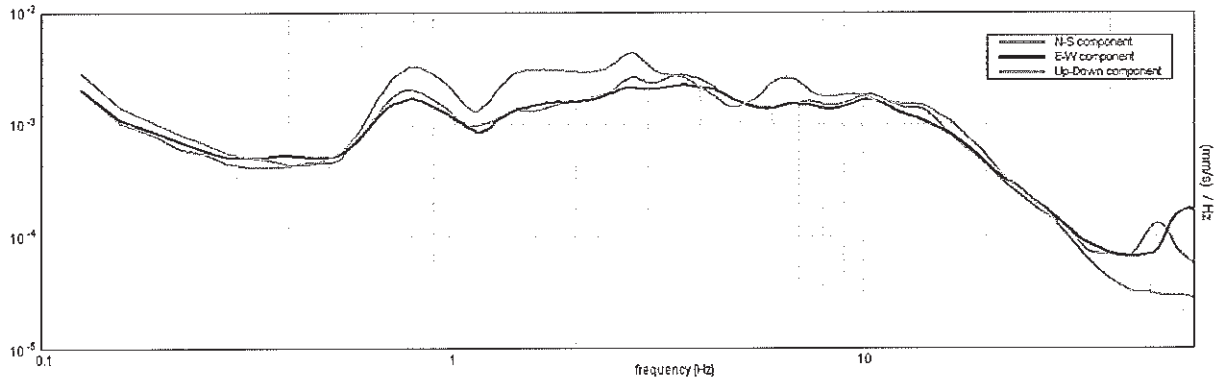
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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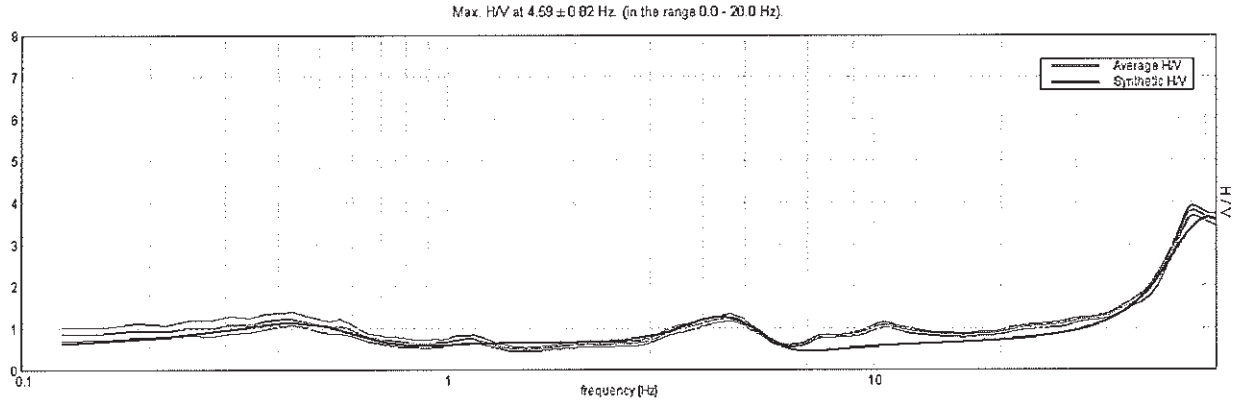
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.22	0.22	52
8.62	8.40	130
12.62	4.00	390
32.62	20.00	210
147.62	115.00	290
inf.	inf.	460

Vs(0.0-30.0)=185m/s

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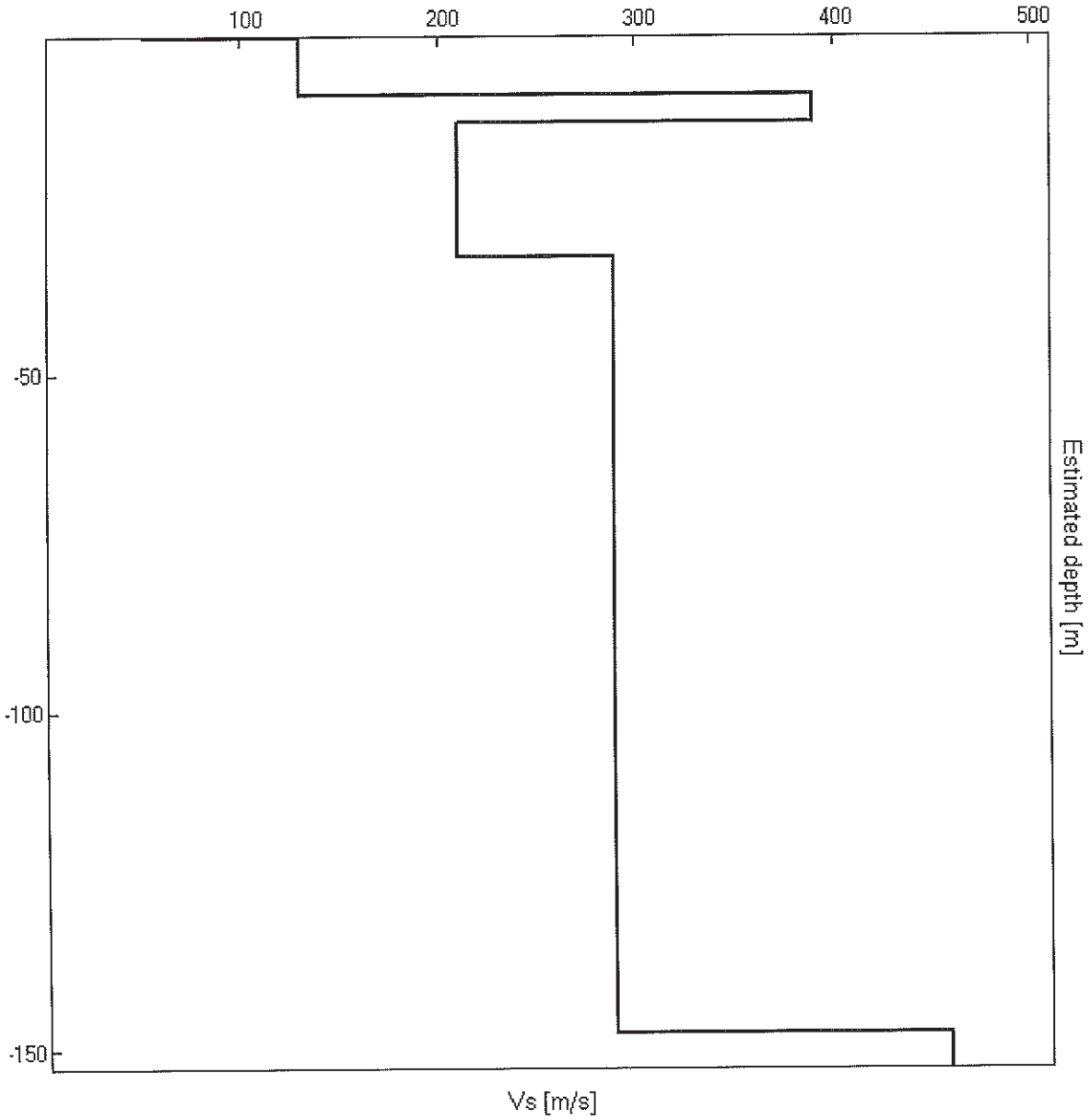

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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 4.59 ± 0.82 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.59 > 0.50	OK	
$n_c(f_0) > 200$	4593.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 222 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	2.563 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	5.969 Hz	OK	
$A_0 > 2$	1.25 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	[0.08754] < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.40213 < 0.22969		NO
$\sigma_A(f_0) < \theta(f_0)$	0.0389 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR36A

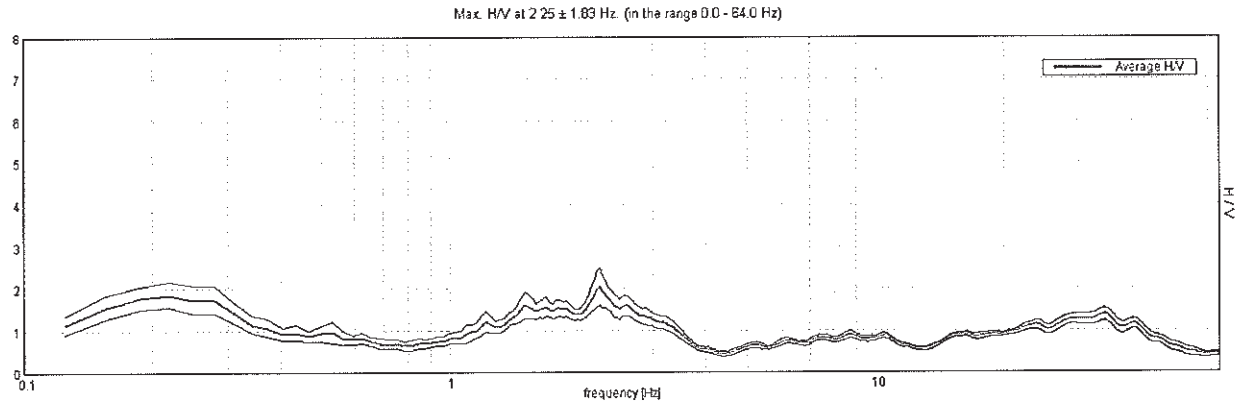
TROMINO® Grilla

RAVENNA – n. 20

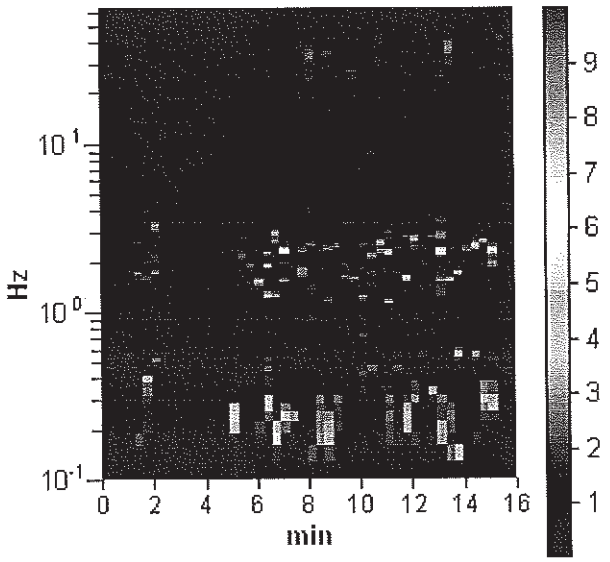
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h16'00". Analyzed 75% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 5%

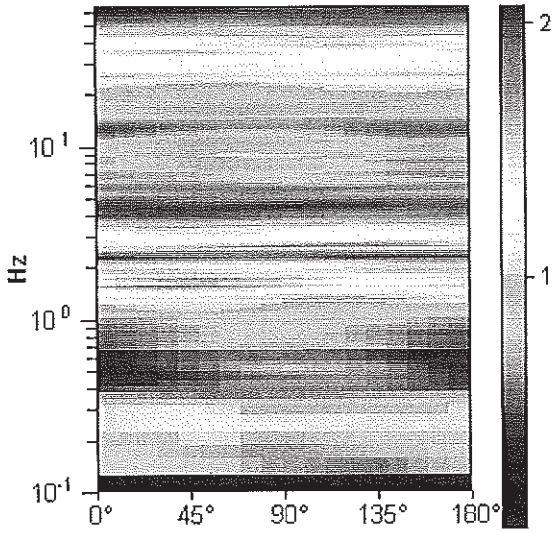
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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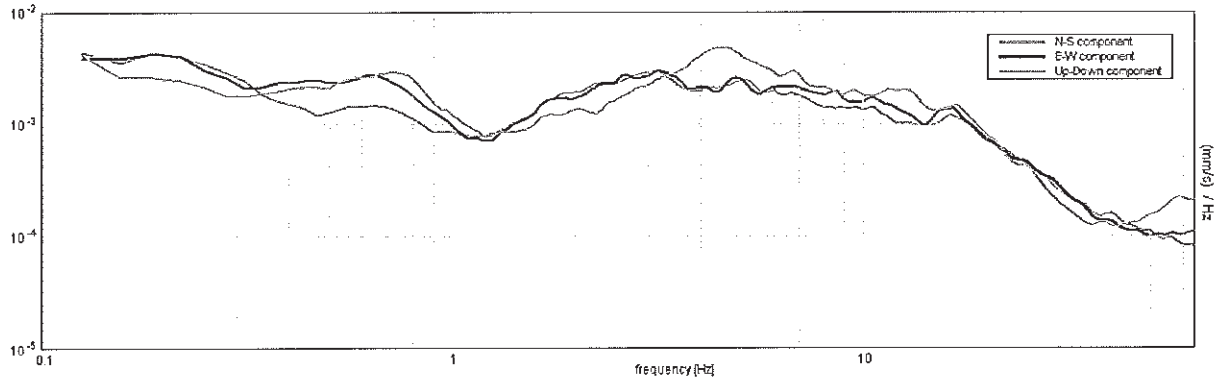
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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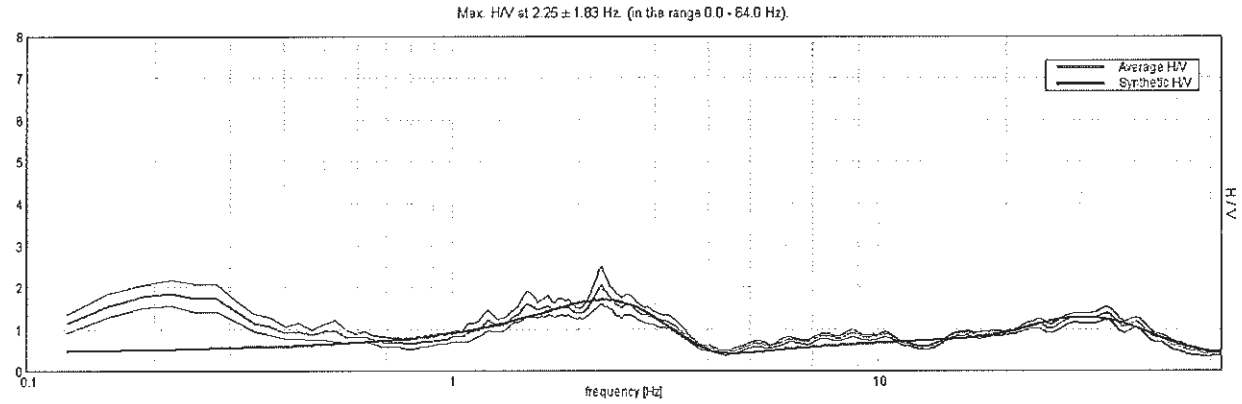
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.45	0.45	75
0.95	0.50	125
3.95	3.00	145
11.95	8.00	130
21.95	10.00	255
36.95	15.00	260
inf.	inf.	310

Vs(2.0-32.0)=196m/s

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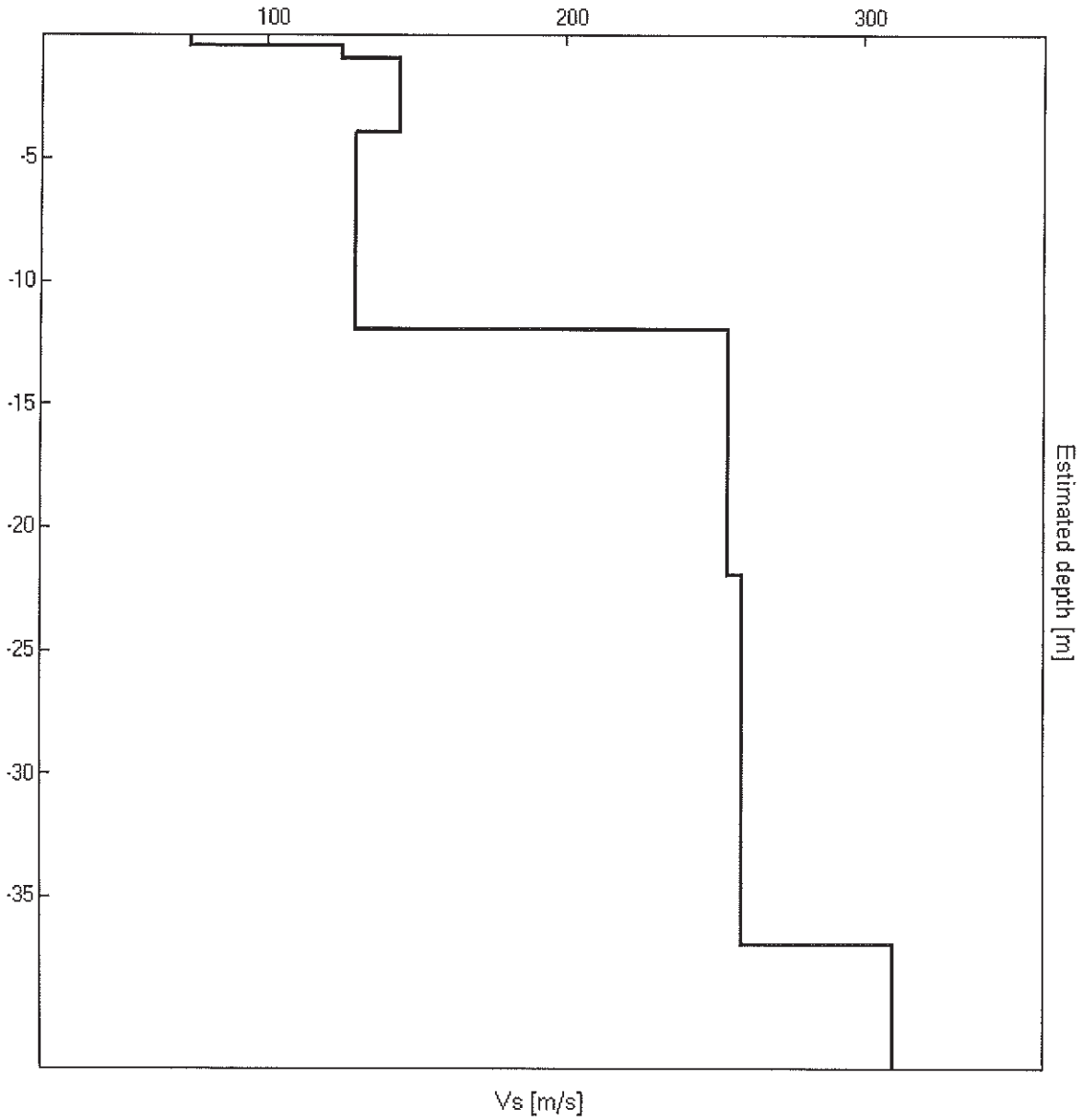

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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 2.25 ± 1.83 Hz. (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	2.25 > 0.50	OK	
$n_c(f_0) > 200$	1620.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 109 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.156 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	3.406 Hz	OK	
$A_0 > 2$	2.06 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	[0.39422] < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.887 < 0.1125		NO
$\sigma_A(f_0) < \theta(f_0)$	0.2135 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR37A

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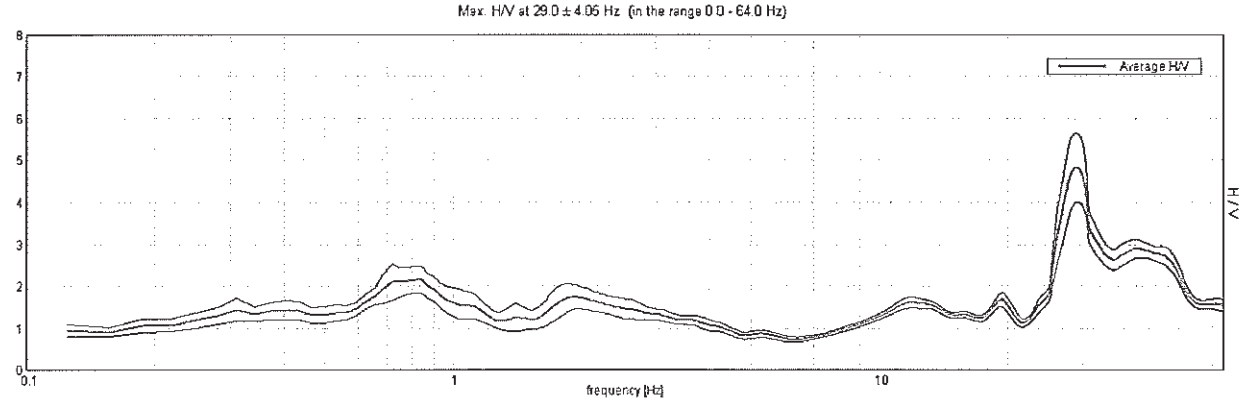
RAVENNA – n. 34

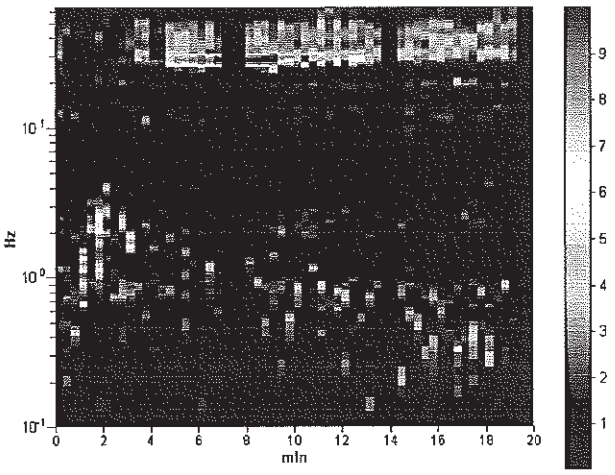
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 88% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

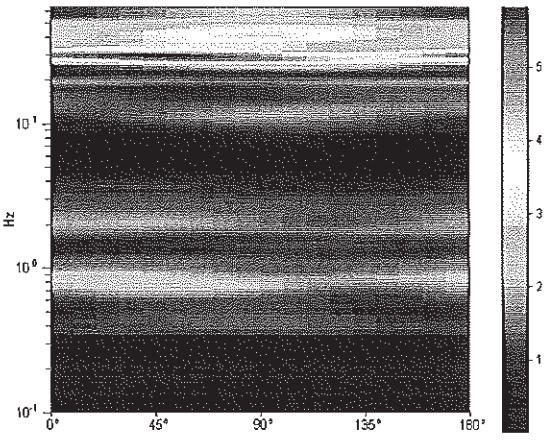
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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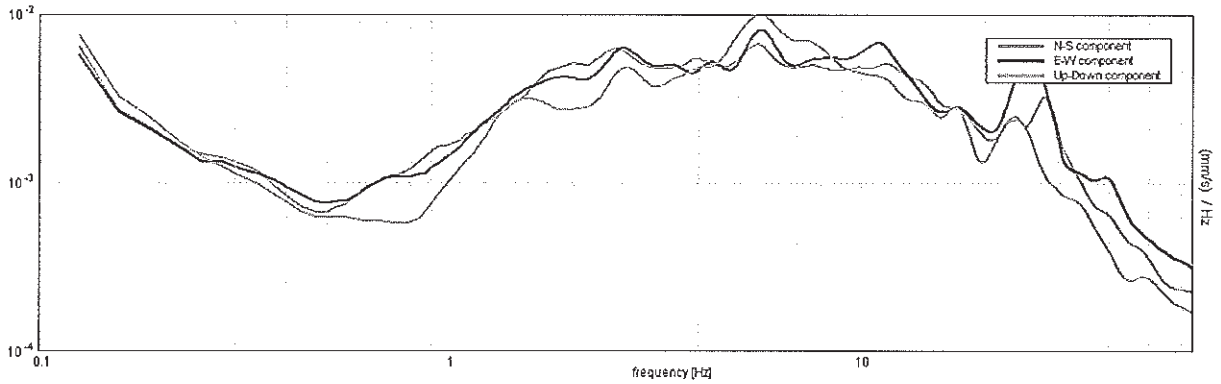
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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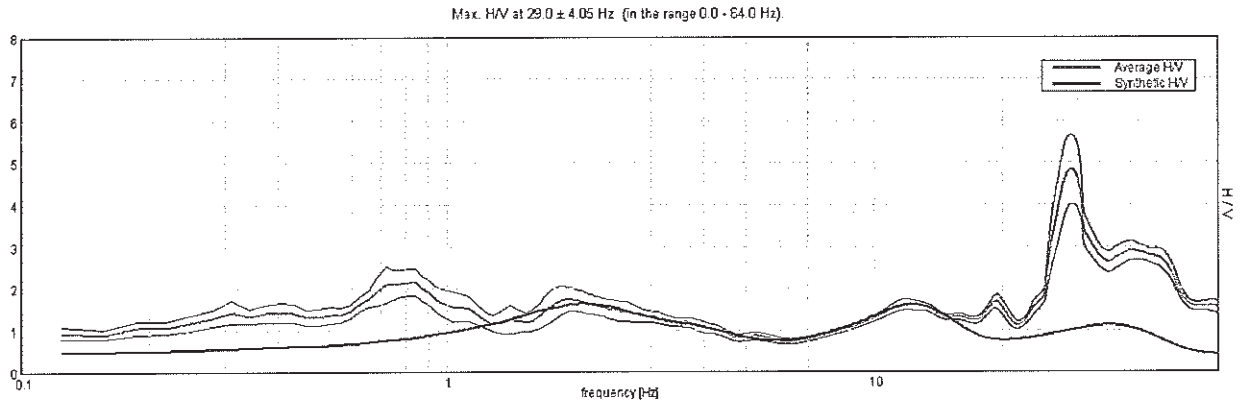
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.30	0.30	45
1.70	1.40	80
4.60	2.90	140
8.10	3.50	120
20.10	12.00	205
29.10	9.00	230
inf.	inf.	300

Vs(0.0-30.0)=172m/s

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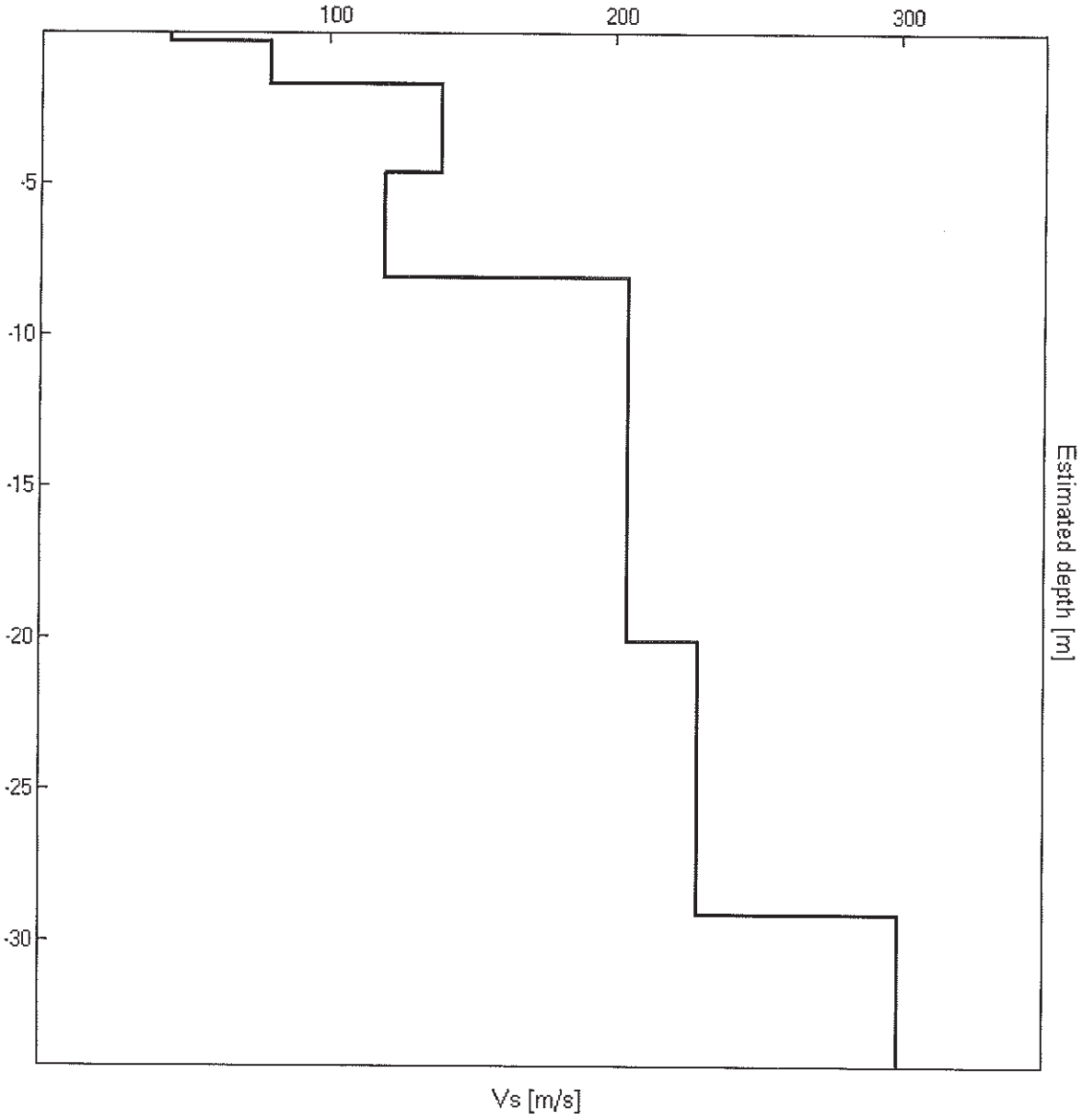

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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 29.0 ± 4.05 Hz. (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	29.00 > 0.50	OK	
$n_c(f_0) > 200$	30740.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1393 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	25.469 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	49.531 Hz	OK	
$A_0 > 2$	4.83 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.06886| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.99686 < 1.45		NO
$\sigma_A(f_0) < \theta(f_0)$	0.4047 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR38A

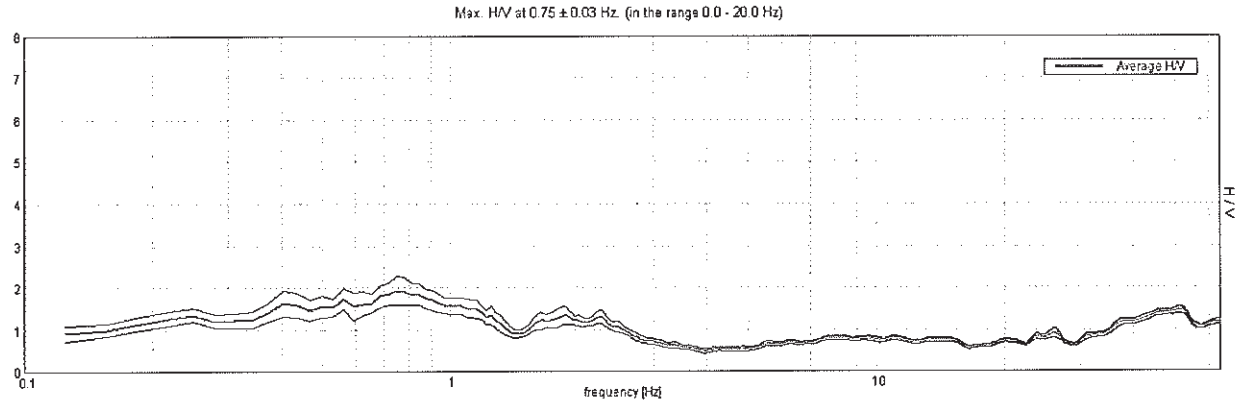
TROMINO® Grilla

RAVENNA – n. 18

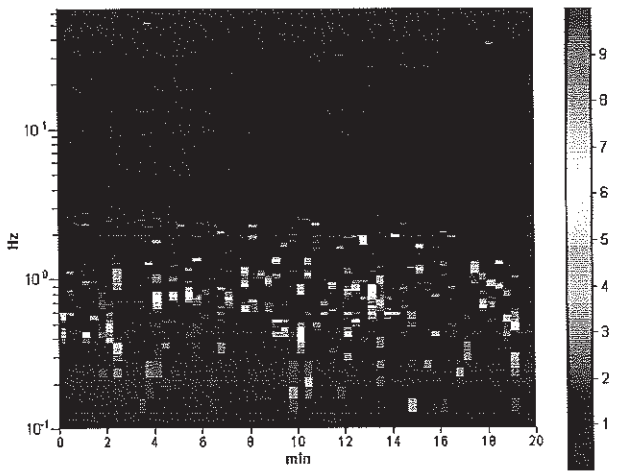
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 92% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 5%

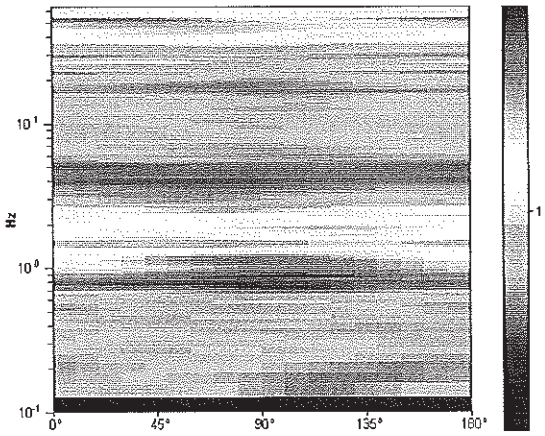
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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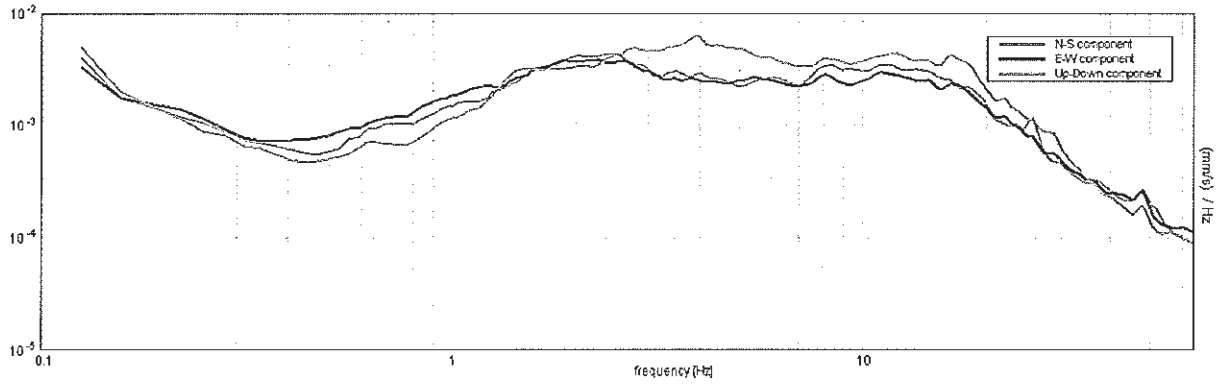
SINGLE COMPONENT SPECTRA



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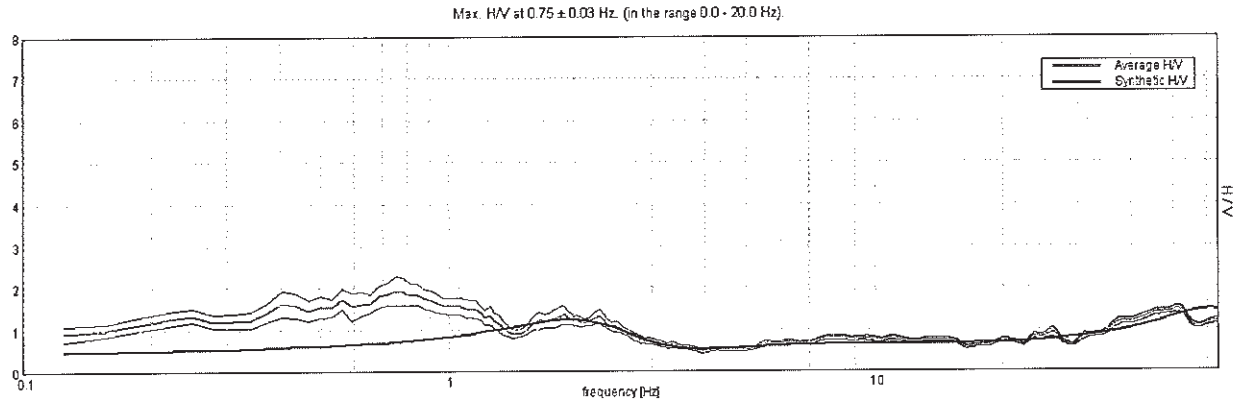
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.30	0.30	80
3.30	3.00	155
19.30	16.00	180
31.30	12.00	270
inf.	inf.	305

Vs(0.0-30.0)=198m/s

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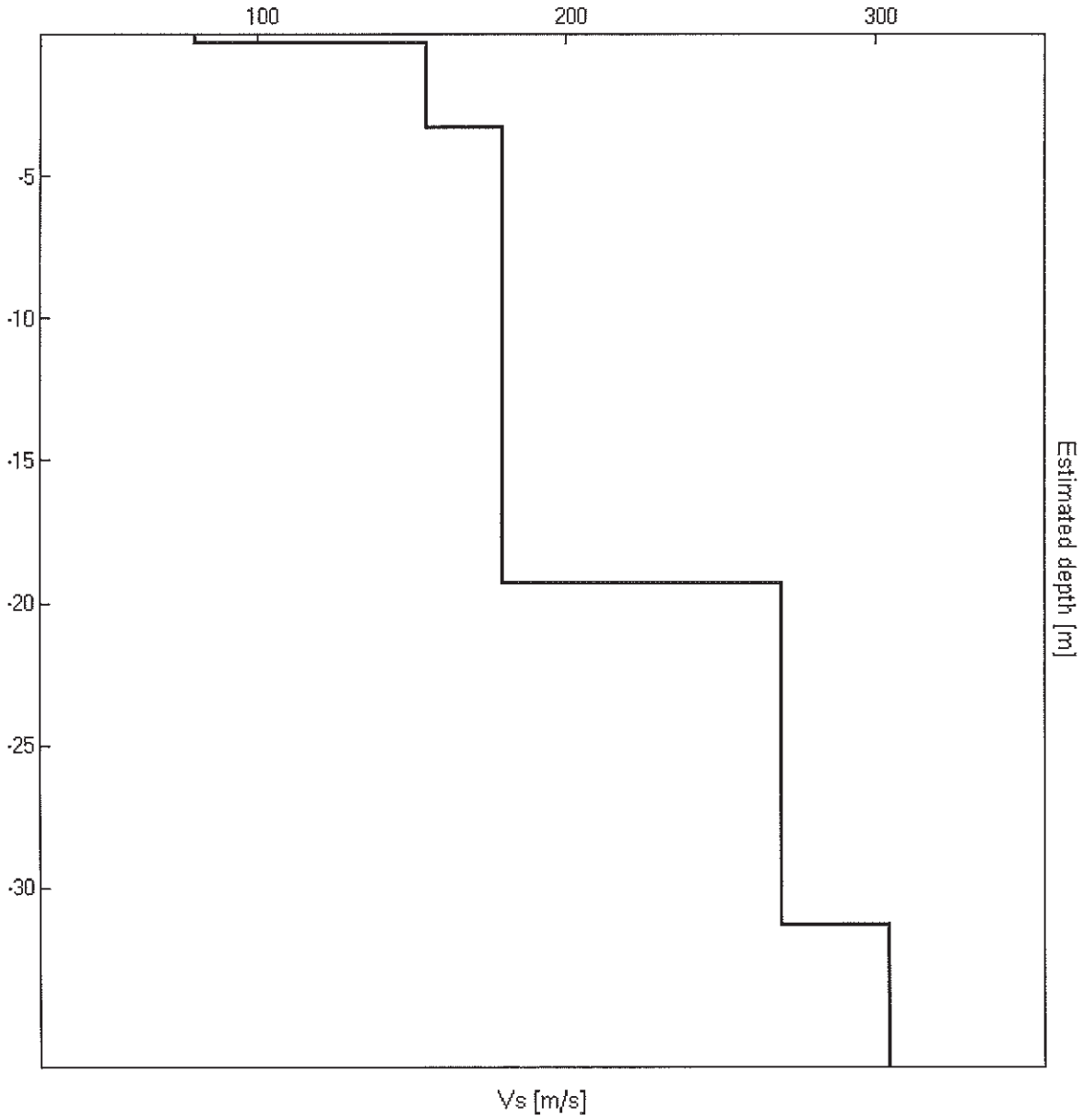
TROMINO® Grilla



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TROMINO® Grilla

[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 0.75 ± 0.03 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.75 > 0.50	OK	
$n_c(f_0) > 200$	825.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 37 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	1.406 Hz	OK	
$A_0 > 2$	1.93 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02299| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.01724 < 0.1125	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1696 < 2.0	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR39A

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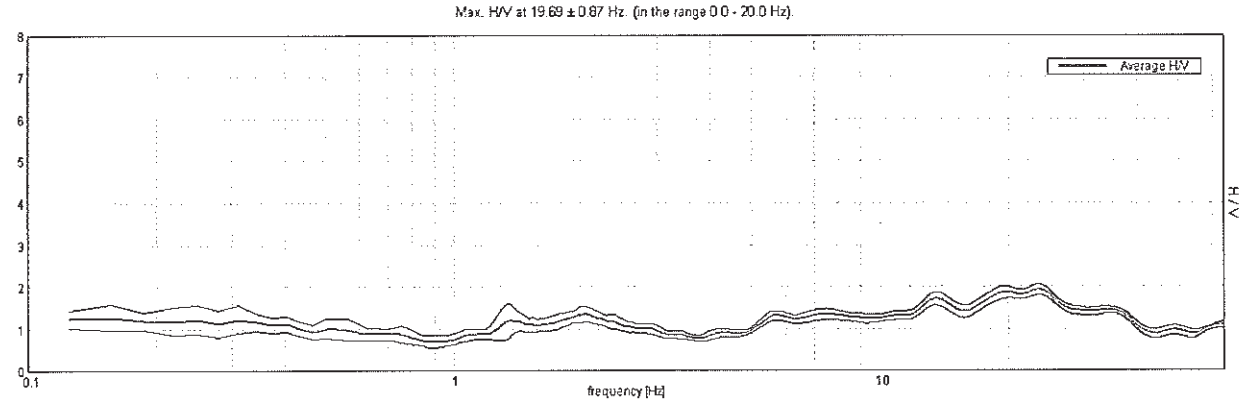
TROMINO® Grilla

RAVENNA – n. 23

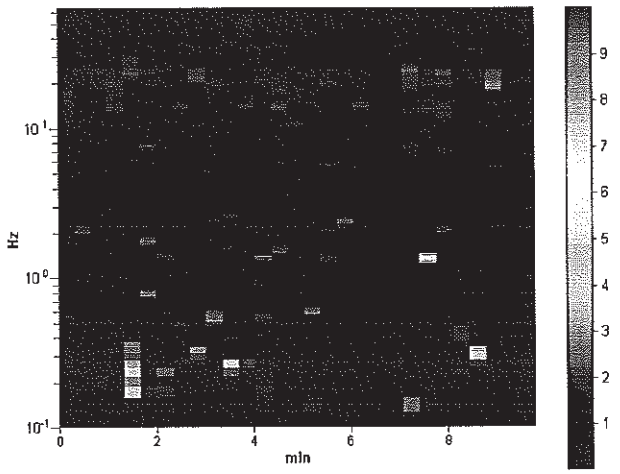
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h09'48". Analyzed 86% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

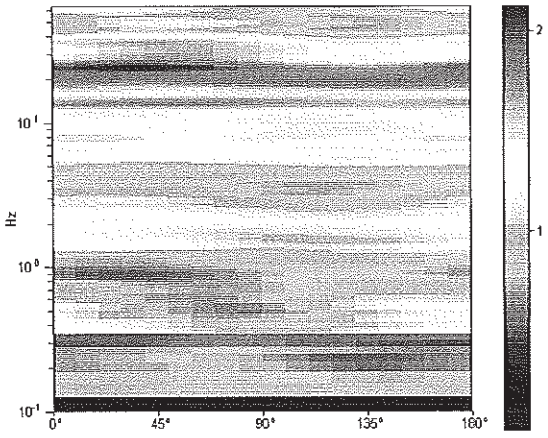
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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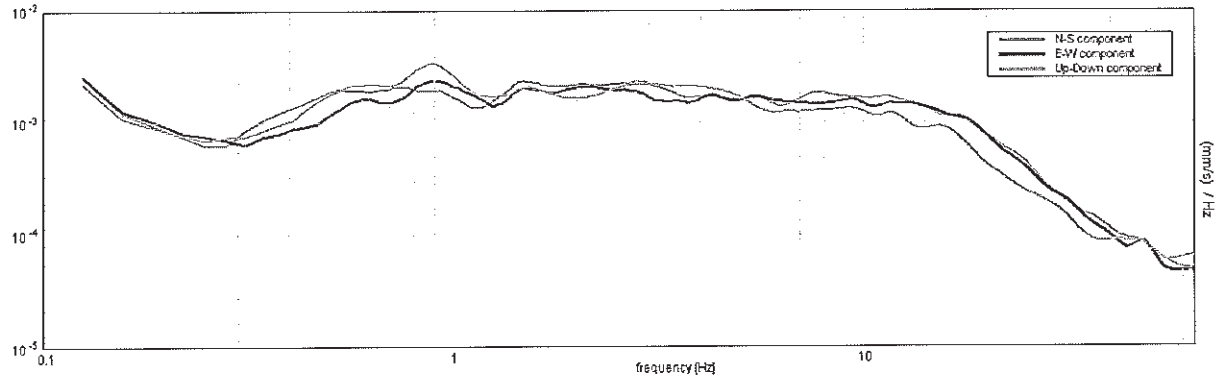
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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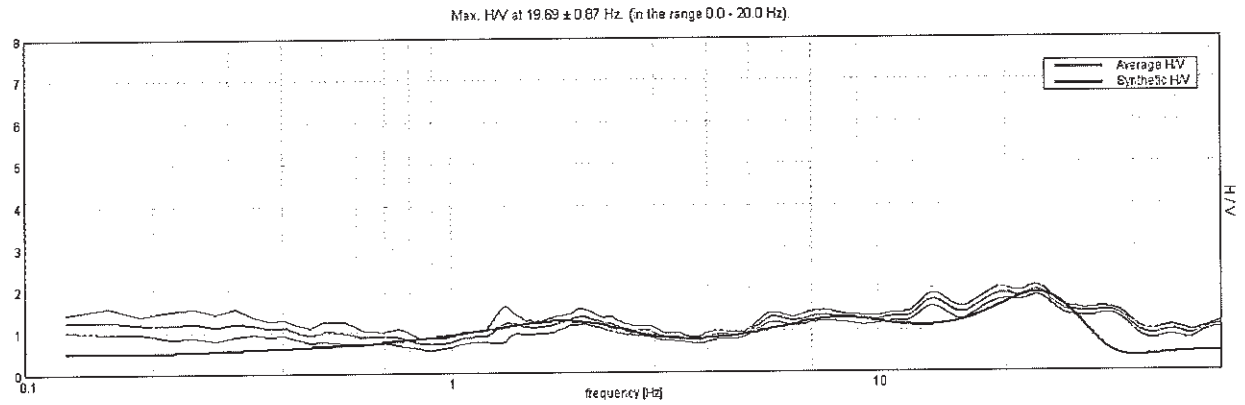
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.55	0.55	52
2.55	2.00	115
4.55	2.00	145
19.55	15.00	185
39.55	20.00	260
inf.	inf.	300

Vs(0.0-30.0)=184m/s

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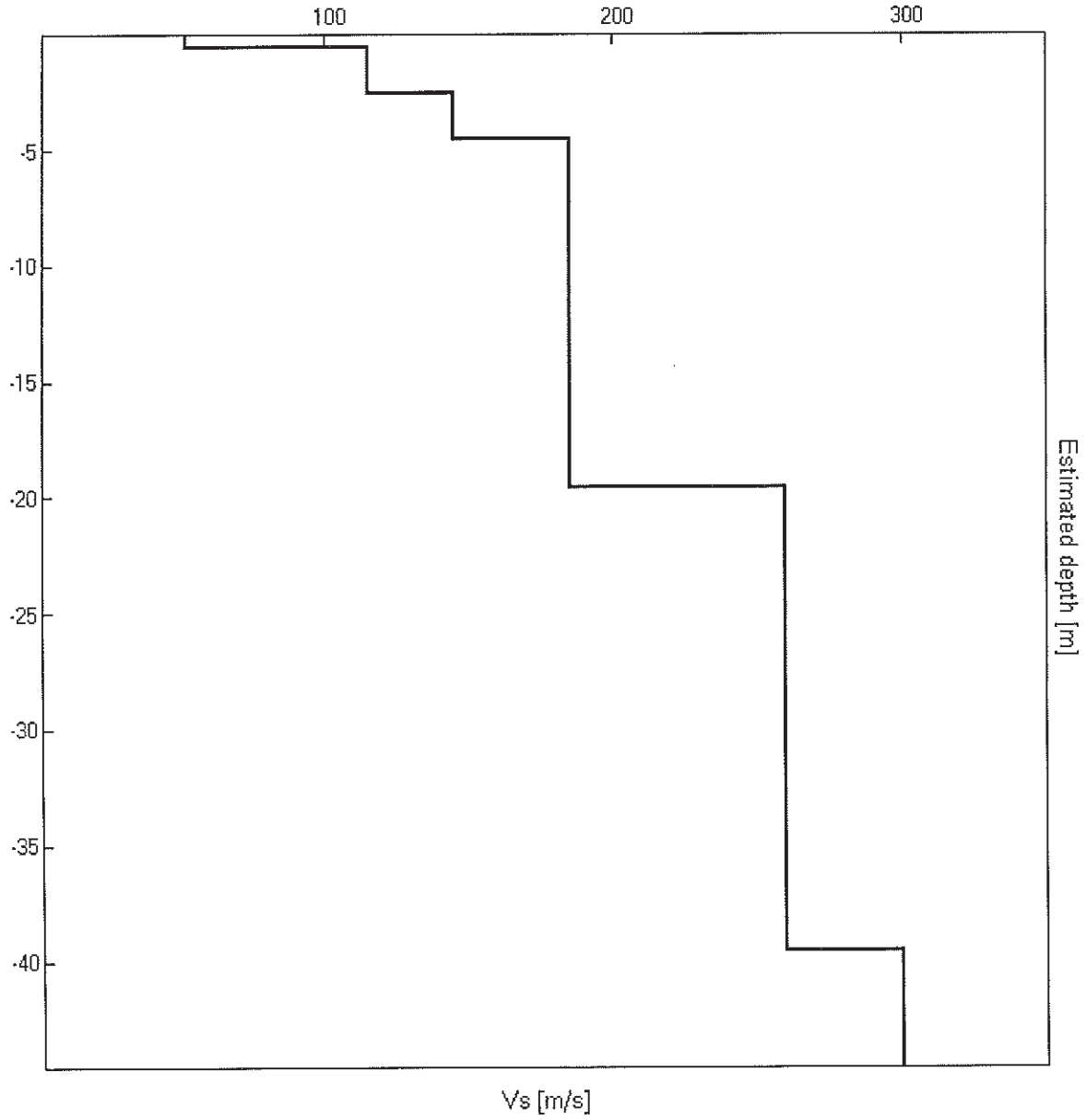
TROMINO® Grilla



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TROMINO® Grilla

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 19.69 ± 0.87 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.69 > 0.50	OK	
$n_c(f_0) > 200$	9843.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 946 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	41.813 Hz	OK	
$A_0 > 2$	1.87 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02105| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.41434 < 0.98438	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0685 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR40A

TROMINO® Grilla
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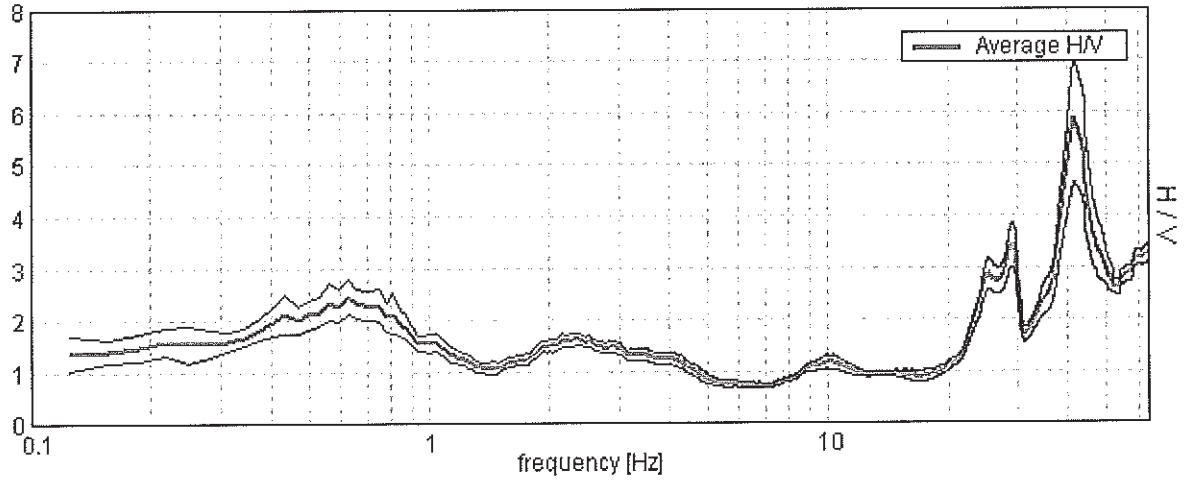
RAVENNA – n. 23

GPS data not available

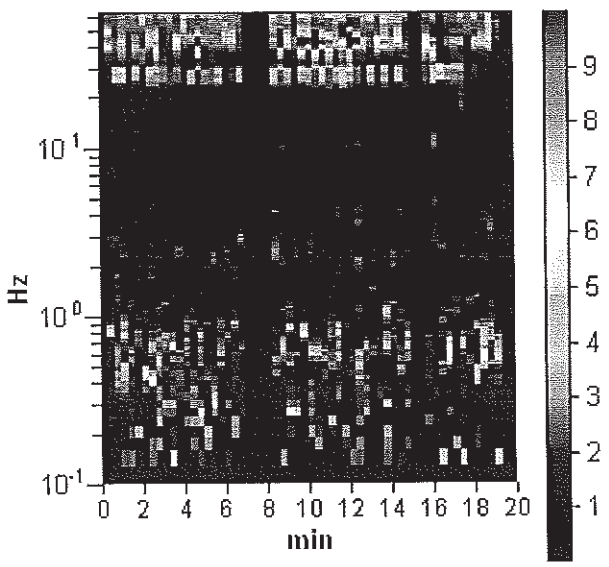
Trace length: 0h20'00". Analyzed 85% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

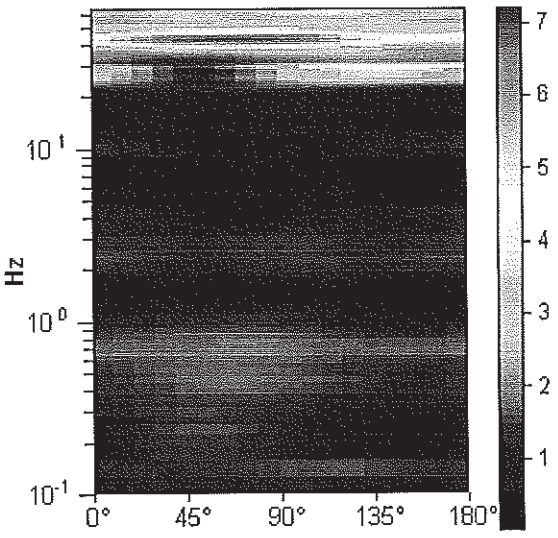
Max. HVSR at 41,47 ± 0,33 Hz. (in the range 0,0 - 64,0 Hz).



H/V TIME HISTORY



DIRECTIONAL H/V



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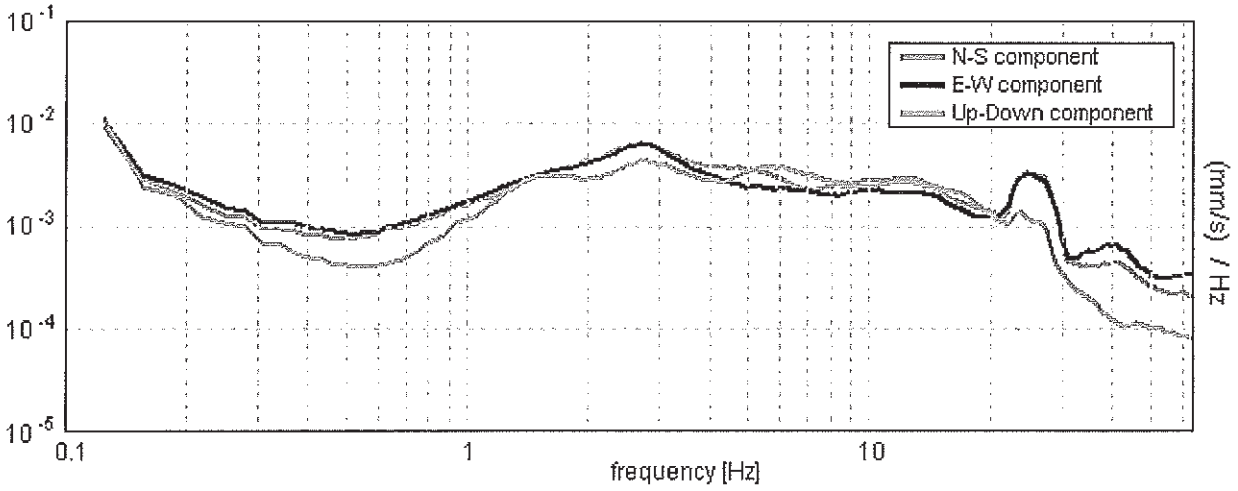
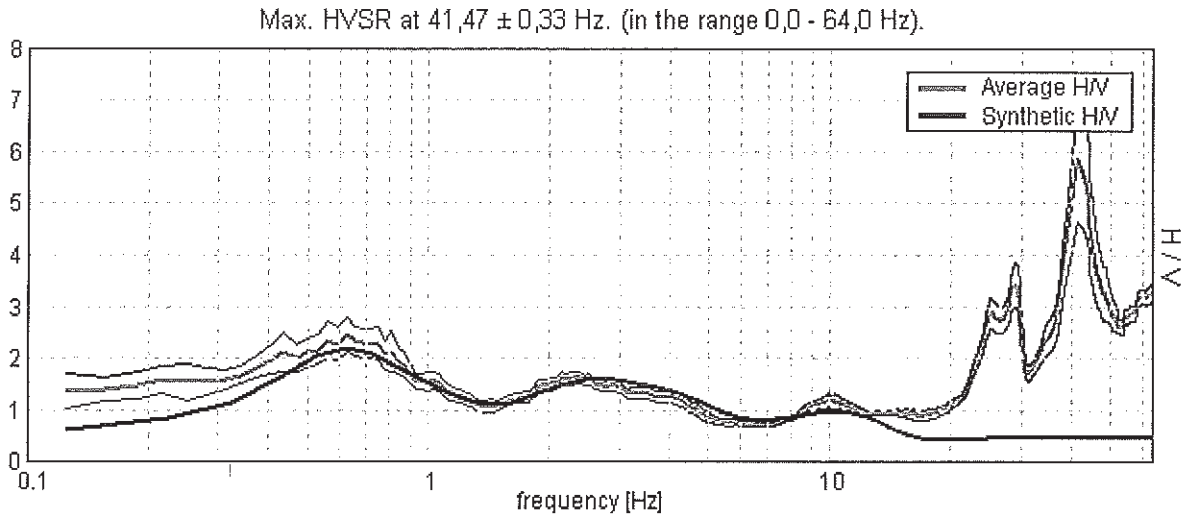
SINGLE COMPONENT SPECTRA

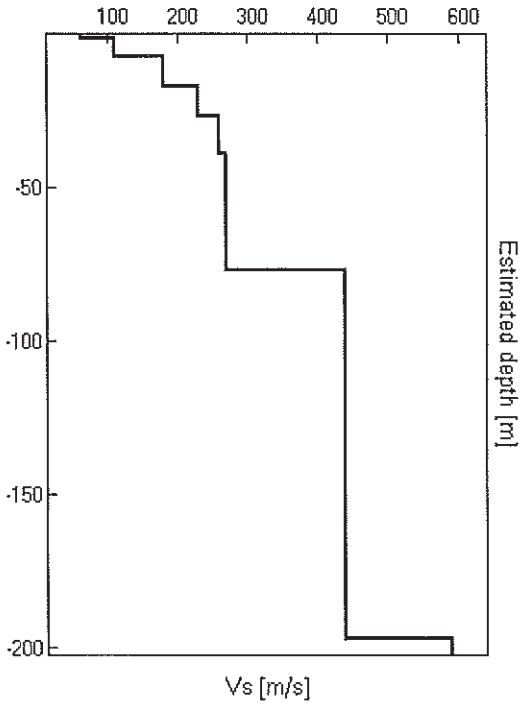


EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
1.50	1.50	65
7.00	5.50	110
17.00	10.00	180
27.00	10.00	230
39.00	12.00	260
77.00	38.00	270
197.00	120.00	440
inf.	inf.	590

Vs(0.0-30.0)=163m/s



[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. HVSR at 41,47 ± 0,33 Hz. (in the range 0,0 - 64,0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	41.47 > 0.50	OK	
$n_c(f_0) > 200$	42298.1 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1386 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	37.031 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	50.25 Hz	OK	
$A_0 > 2$	5.86 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00394| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.16319 < 2.07344	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.6008 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR41A

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TROMINO® Grilla

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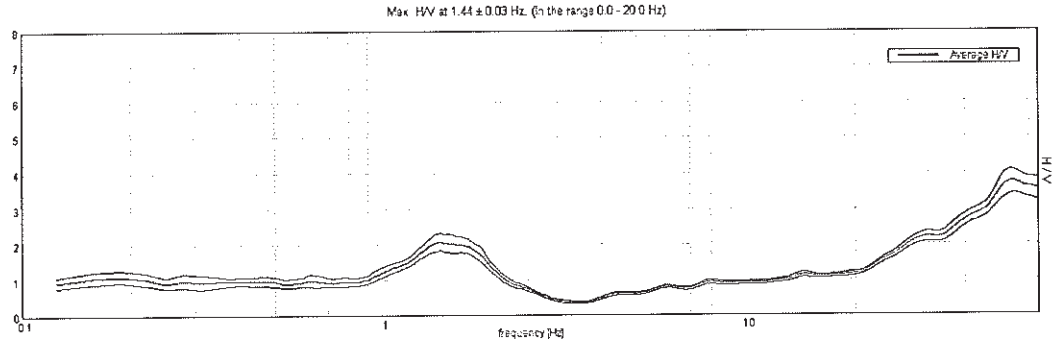
RAVENNA – n. 25

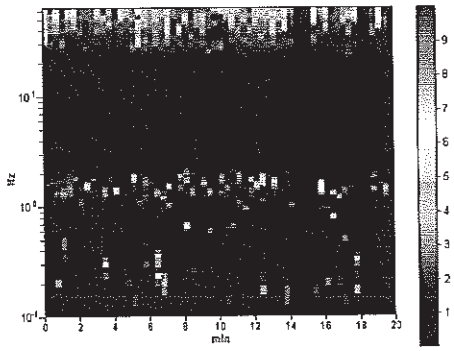
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 90% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

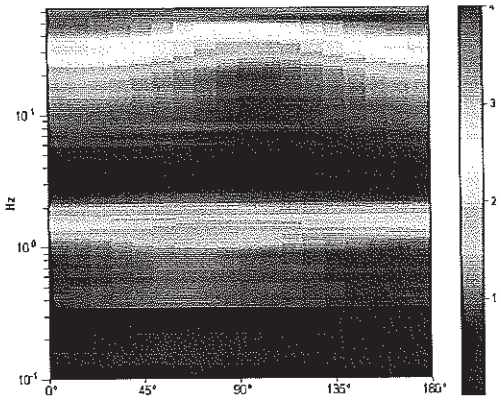
HORIZONTAL TO VERTICAL SPECTRAL RATIO



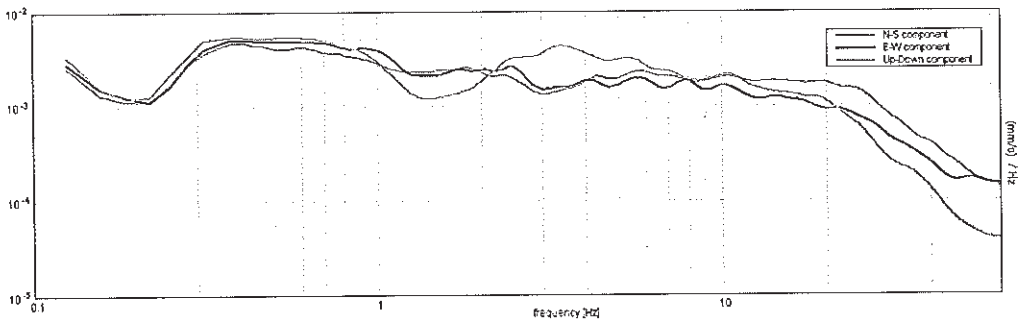
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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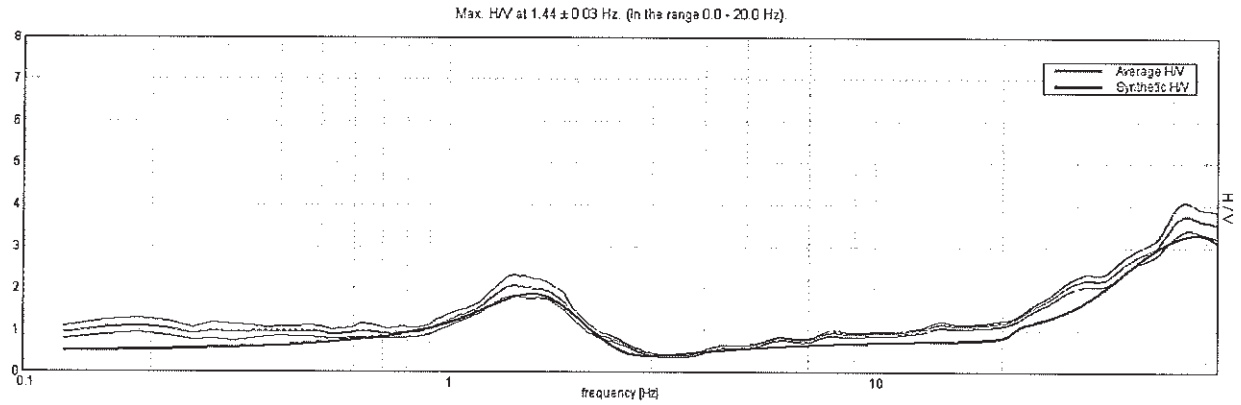
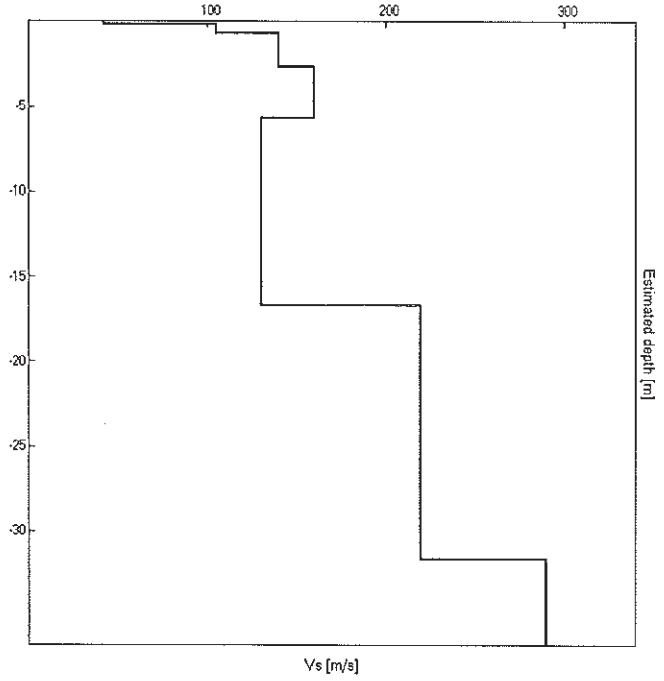
TROMINO® Grilla

EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.18	0.18	42
0.68	0.50	105
2.68	2.00	140
5.68	3.00	160
16.68	11.00	130
31.68	15.00	220
inf.	inf.	290

Vs(0.0-30.0)=160m/s



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TROMINO® Grilla

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 1.44 ± 0.03 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.44 > 0.50	OK	
$n_c(f_0) > 200$	1552.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 70 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.906 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	2.156 Hz	OK	
$A_0 > 2$	2.07 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01165| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.01675 < 0.14375	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1203 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR42A

TROMINO® Grilla

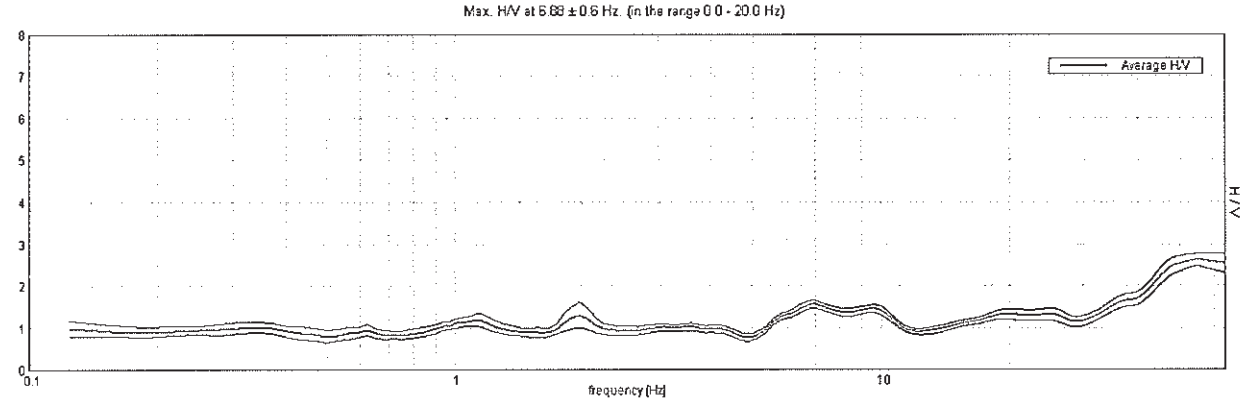
www.tromino.it

RAVENNA – n. 24

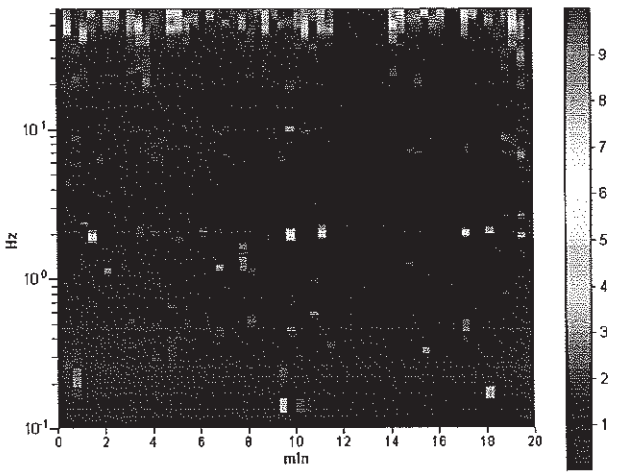
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 82% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

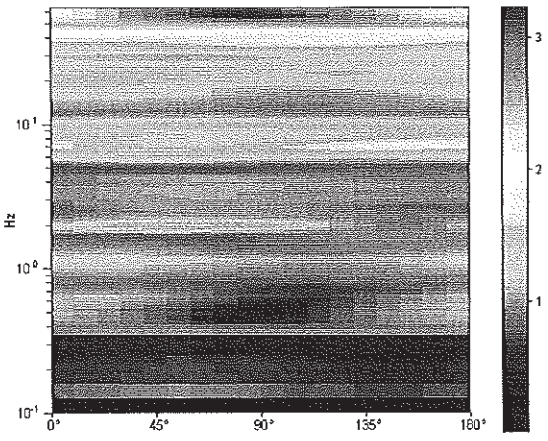
HORIZONTAL TO VERTICAL SPECTRAL RATIO



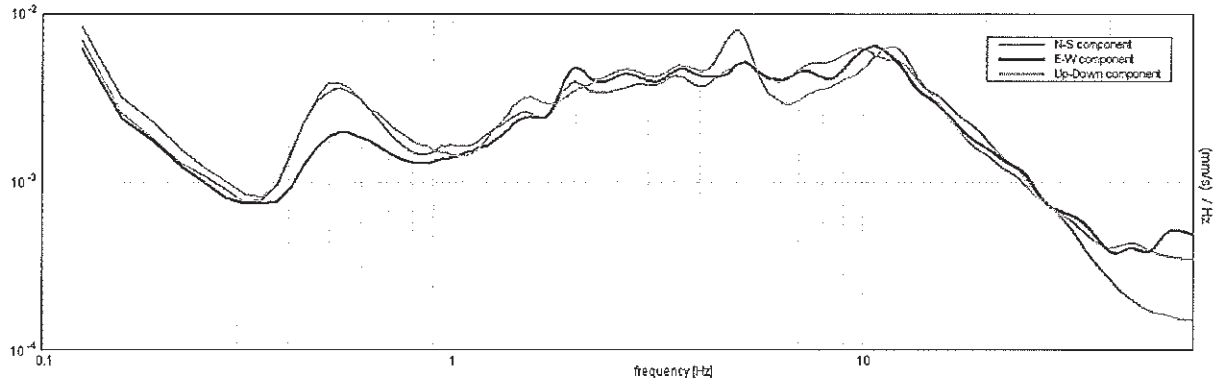
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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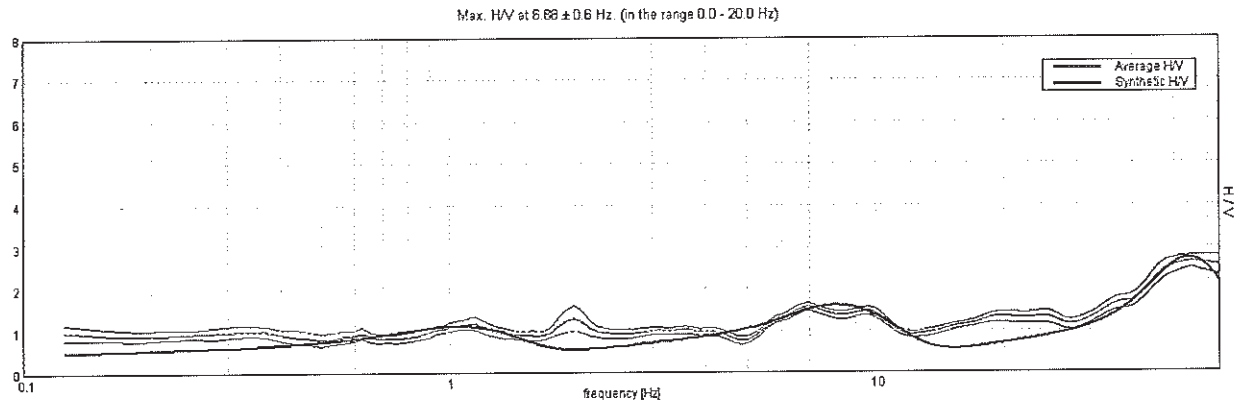
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.23	0.23	50
3.23	3.00	118
10.23	7.00	220
22.23	12.00	230
28.23	6.00	200
46.23	18.00	220
inf.	inf.	360

Vs(0.0-30.0)=197m/s

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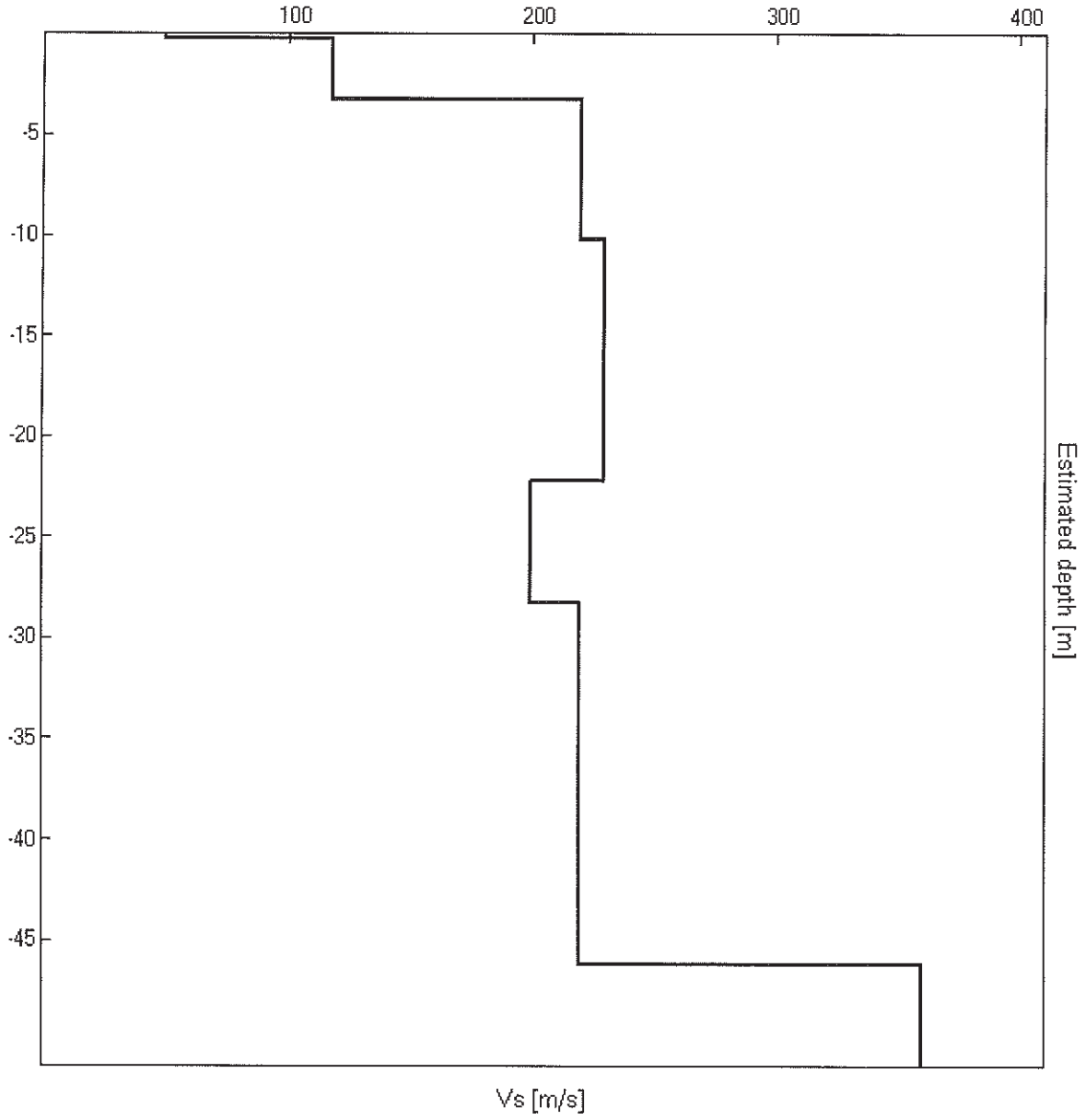

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 6.88 ± 0.6 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	6.88 > 0.50	OK	
$n_c(f_0) > 200$	6737.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 331 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	4.969 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.56 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.04274| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.29383 < 0.34375	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0469 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR43A

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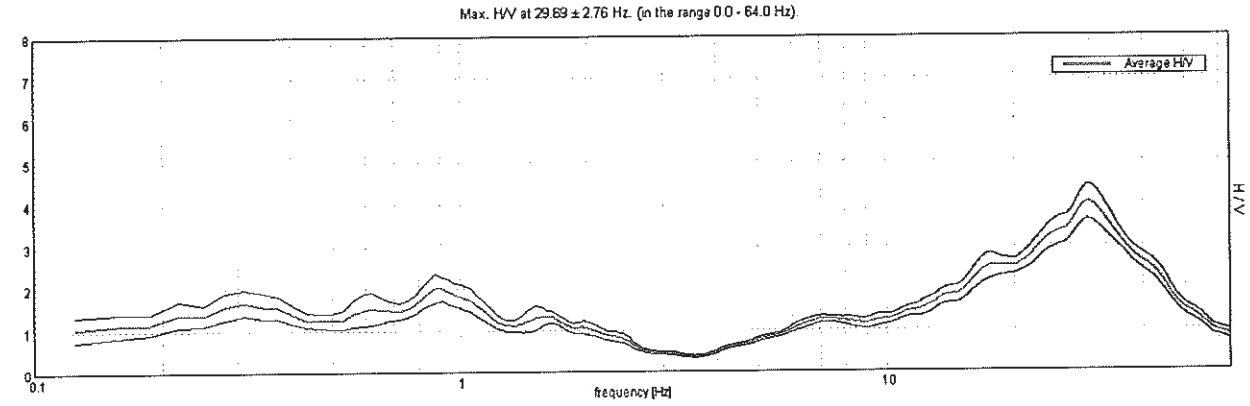
RAVENNA – n. 13

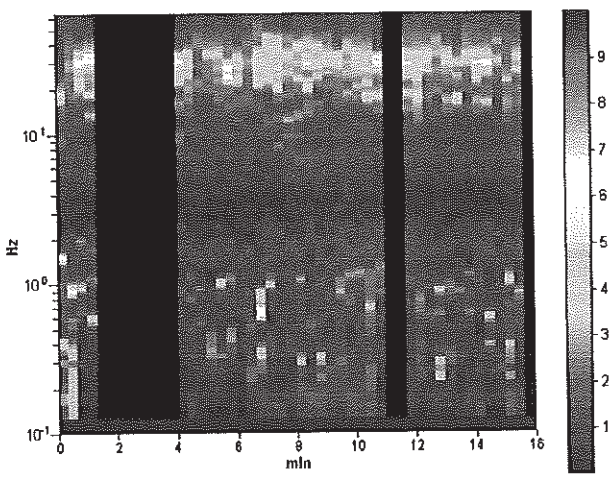
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h16'00''. Analyzed 77% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

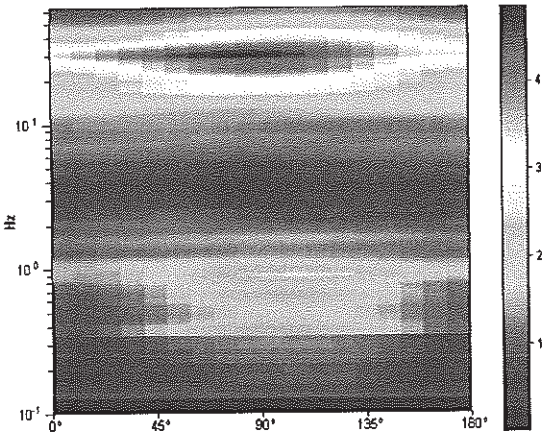
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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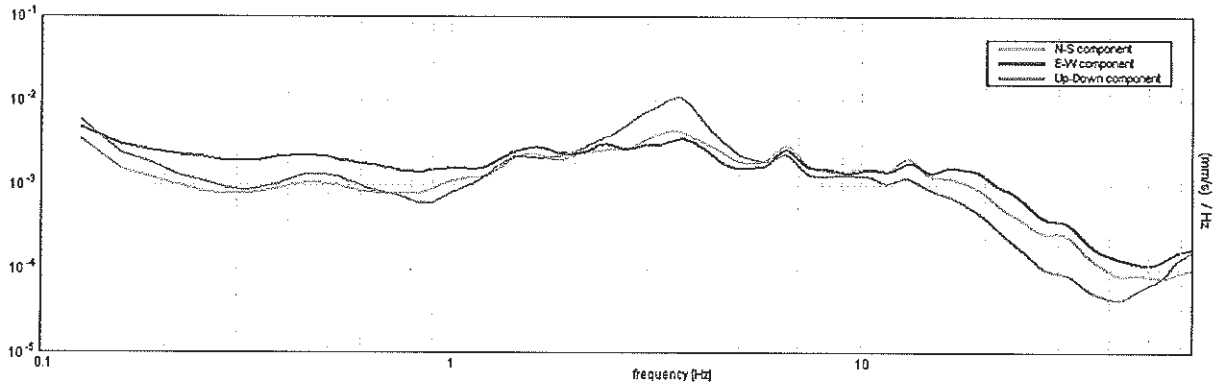
SINGLE COMPONENT SPECTRA



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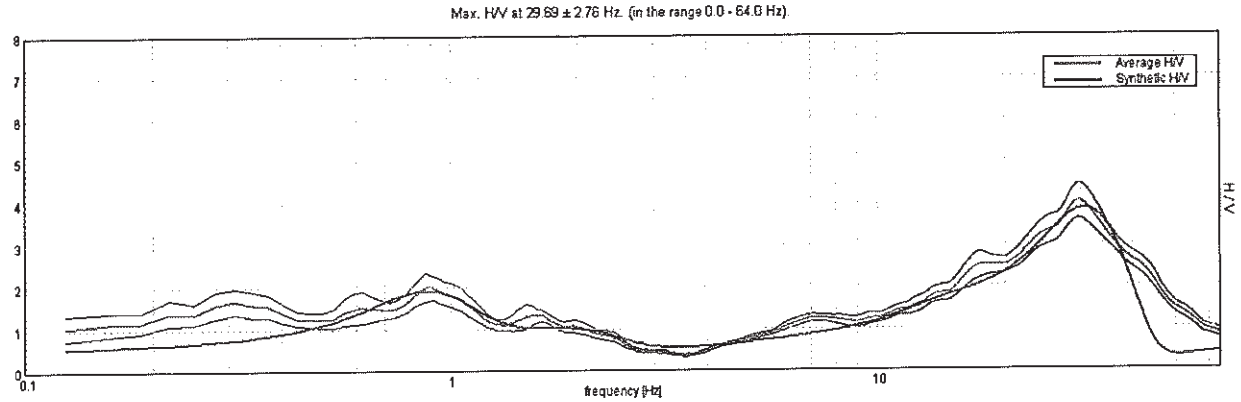
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.47	0.47	60
0.77	0.30	120
1.57	0.80	145
2.07	0.50	150
4.07	2.00	190
8.07	4.00	210
10.07	2.00	220
17.07	7.00	180
32.07	15.00	250
102.07	70.00	360
inf.	inf.	570

Vs(0.0-30.0)=202m/s

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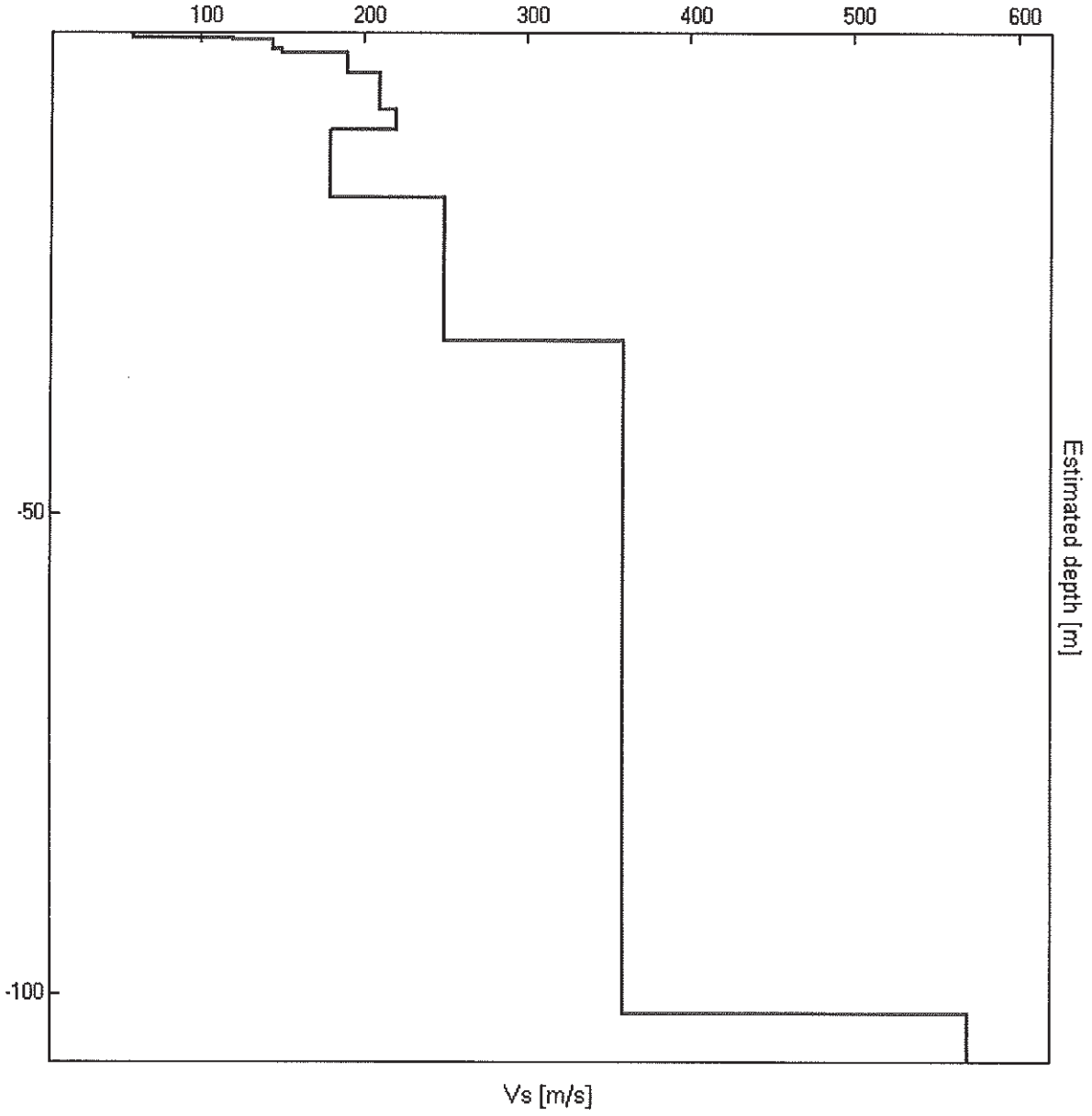

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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 29.69 ± 2.76 Hz. (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	29.69 > 0.50	OK	
$n_c(f_0) > 200$	21968.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1426 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	15.375 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	45.594 Hz	OK	
$A_0 > 2$	4.01 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.04516| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	1.34074 < 1.48438	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2003 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR44A

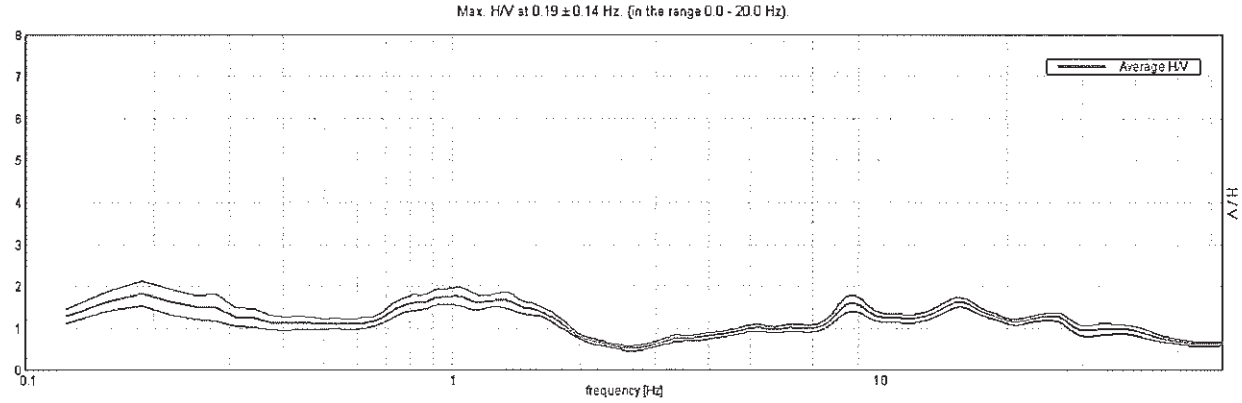
TROMINO® Grilla

RAVENNA - n. 35

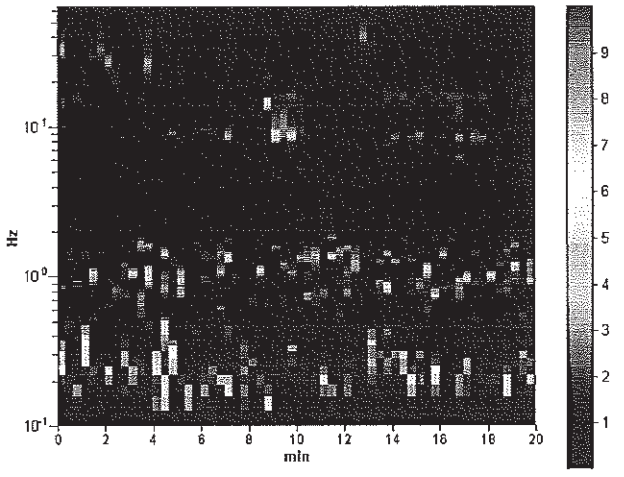
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

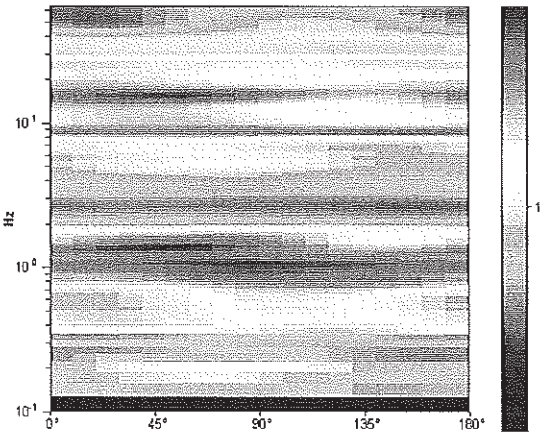
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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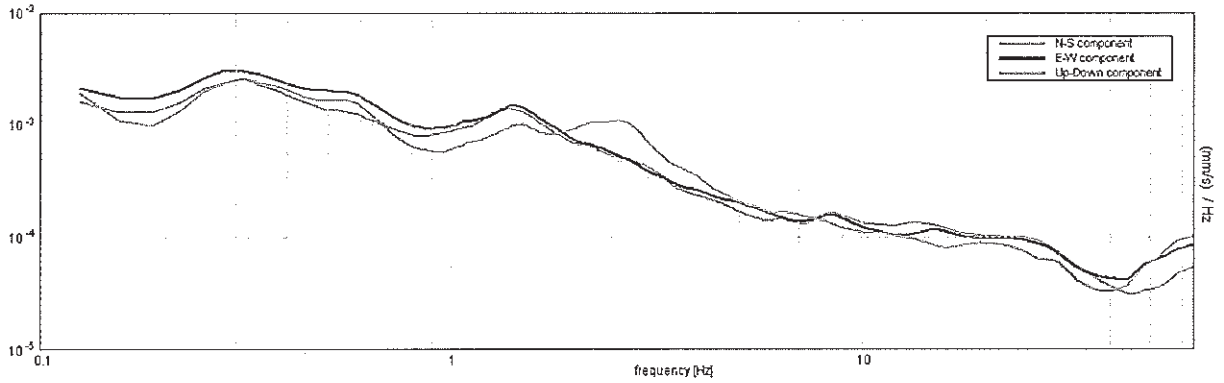
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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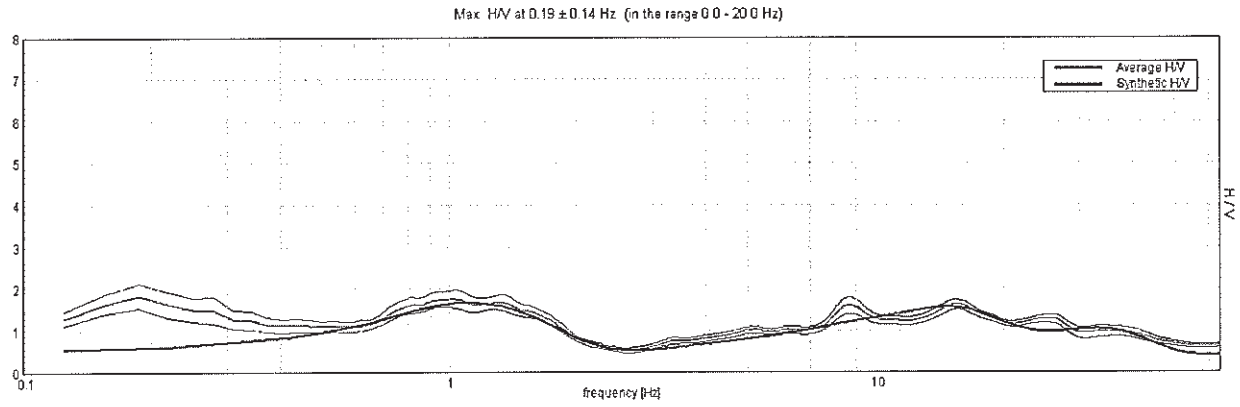
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.40	0.40	55
1.70	1.30	100
6.70	5.00	160
10.70	4.00	190
20.70	10.00	155
41.70	21.00	250
69.70	28.00	325
101.70	32.00	350
inf.	inf.	400

Vs(0.0-30.0)=172m/s

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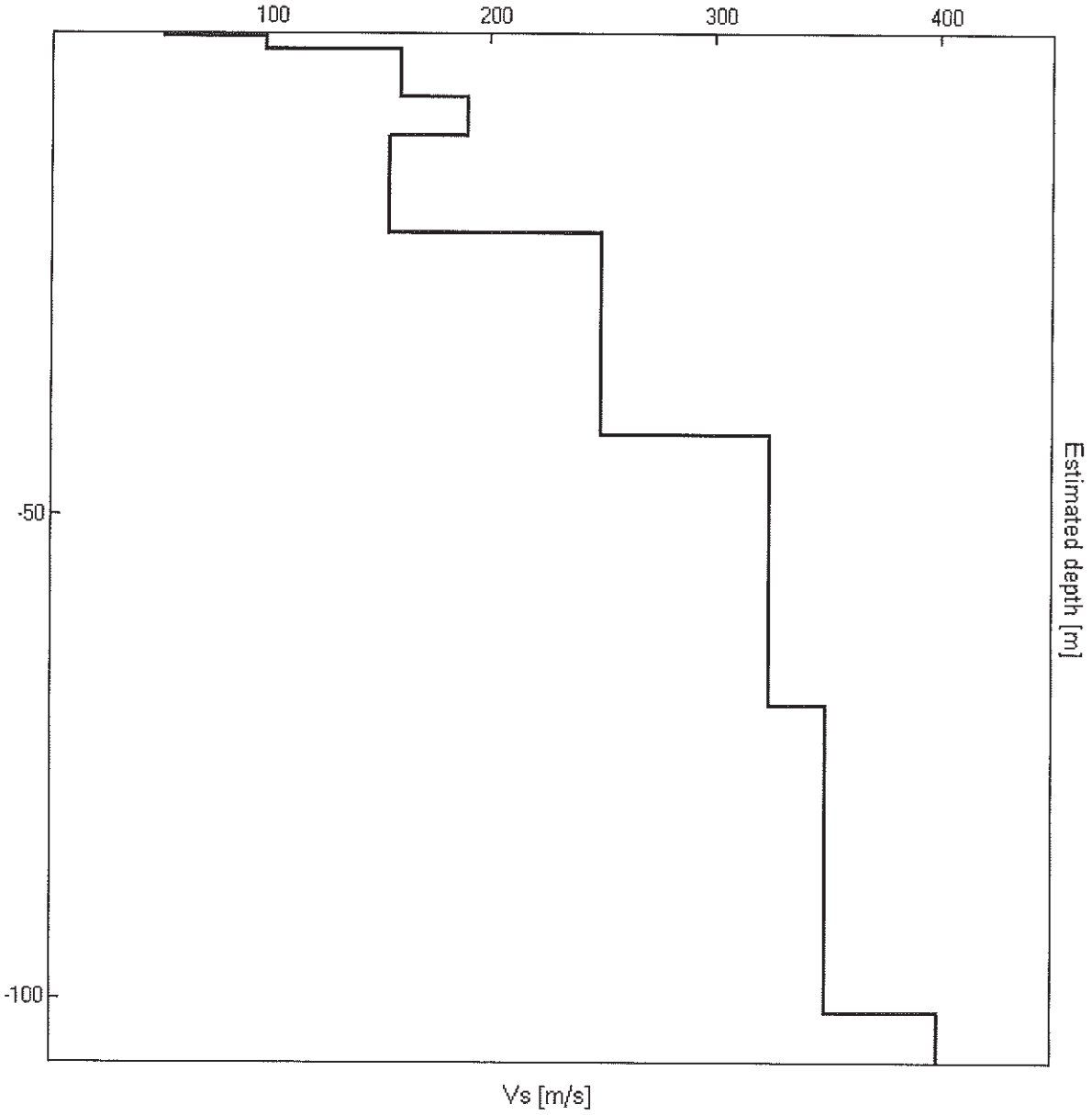

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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 0.19 ± 0.14 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.19 > 0.50		NO
$n_c(f_0) > 200$	225.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 10 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.83 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.36701| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.06882 < 0.04688		NO
$\sigma_A(f_0) < \theta(f_0)$	0.142 < 3.0	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR45A

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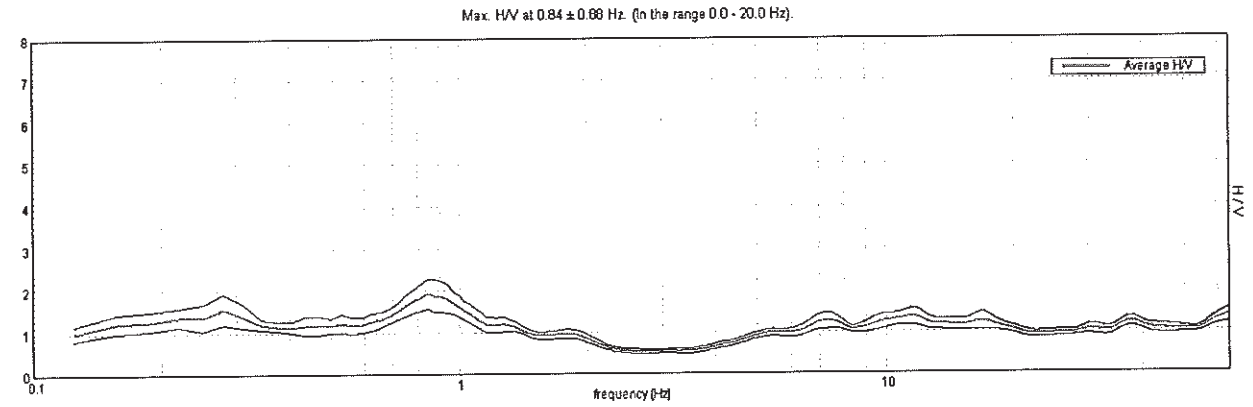
RAVENNA – n. 12

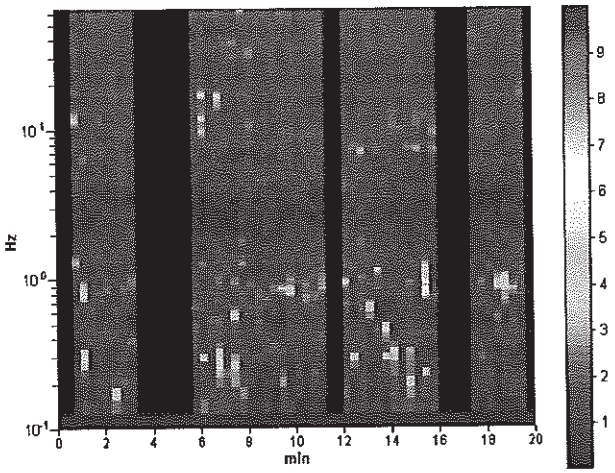
Start recording: 23/09/10 16:06:14 End recording: 23/09/10 16:26:15
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 73% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

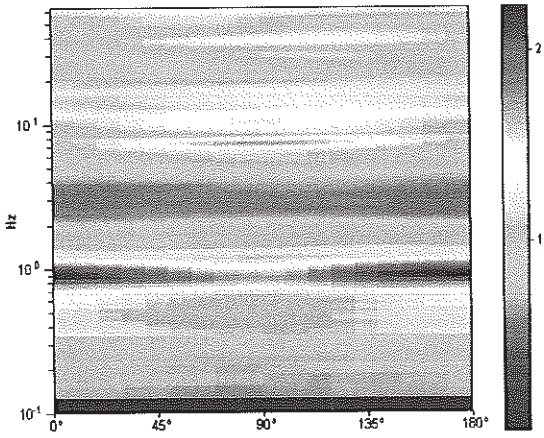
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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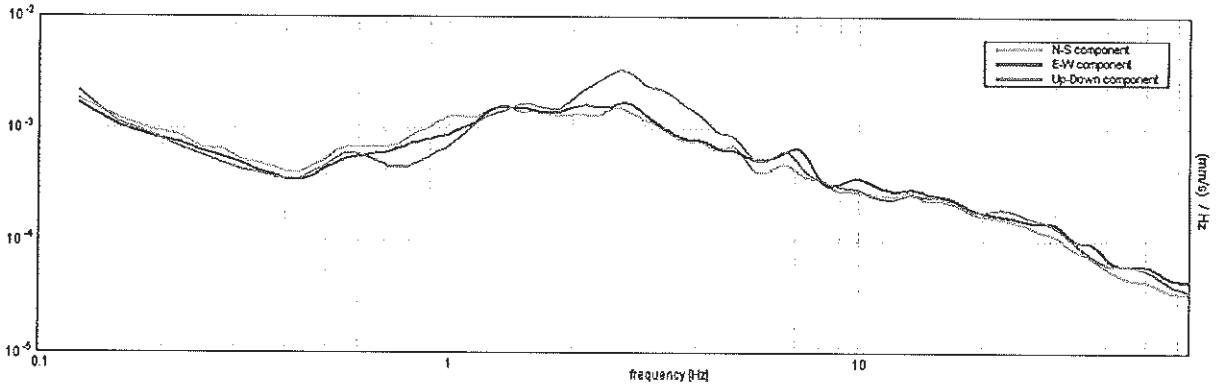
SINGLE COMPONENT SPECTRA



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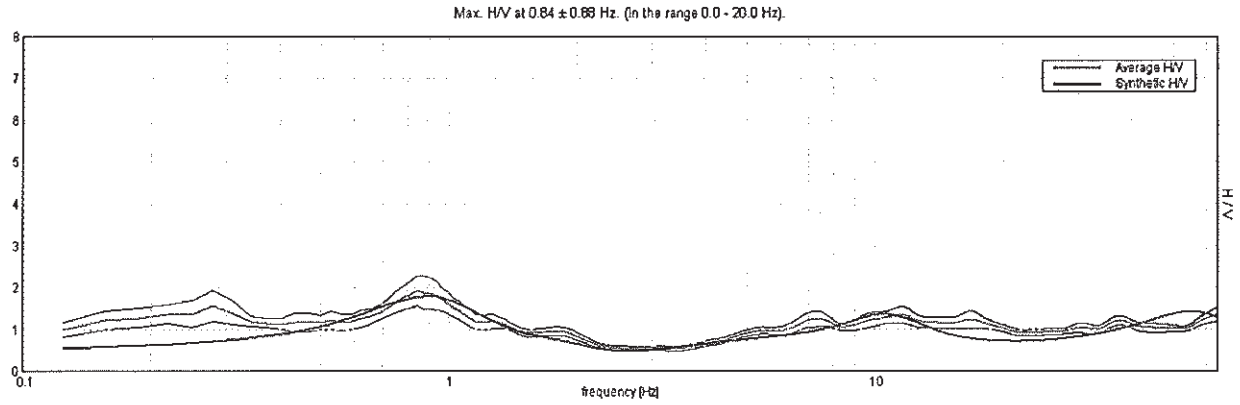
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.30	0.30	70
2.30	2.00	130
5.30	3.00	190
10.30	5.00	240
28.30	18.00	185
93.30	65.00	340
inf.	inf.	520

Vs(0.0-30.0)=189m/s

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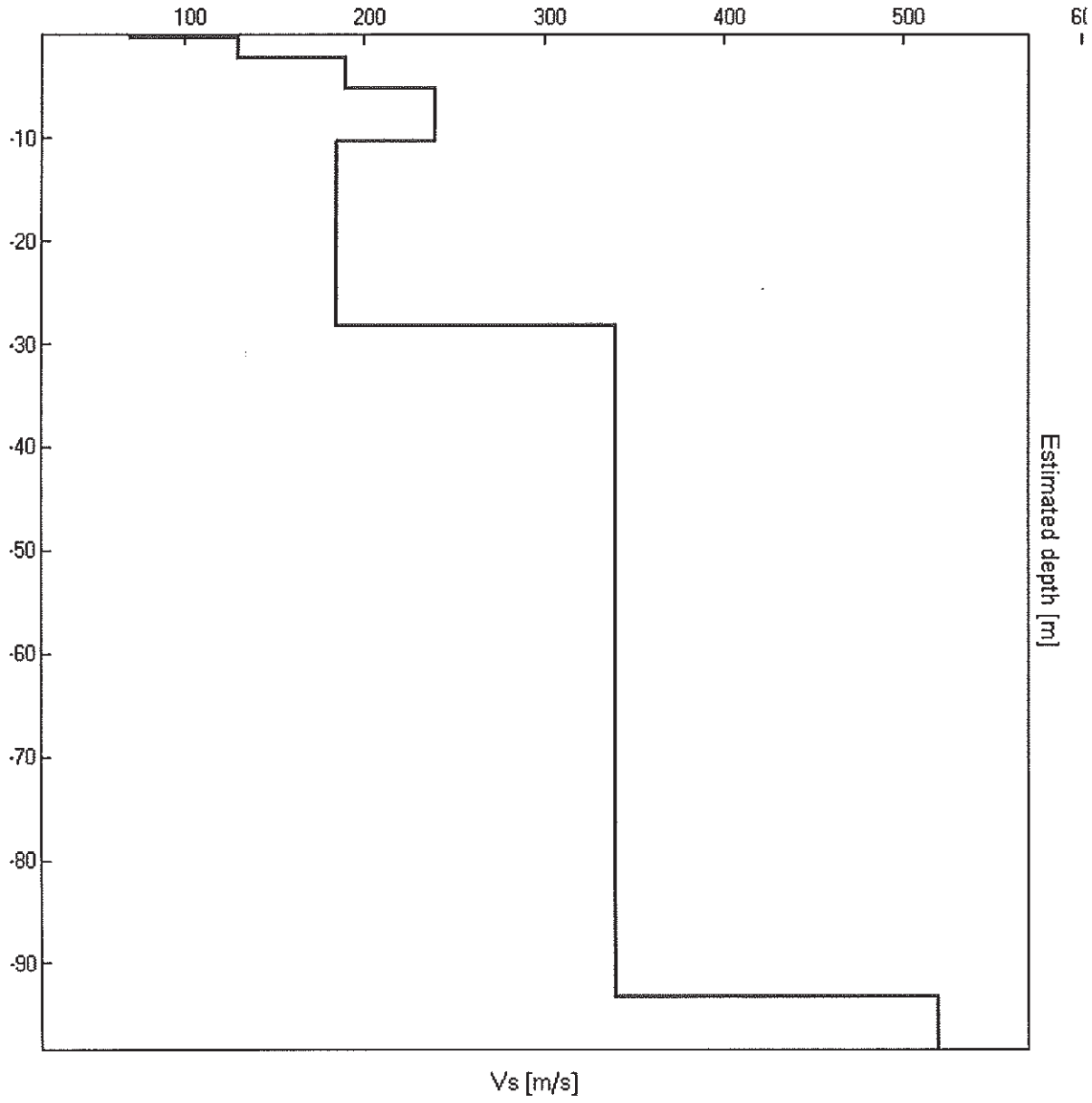

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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 0.84 ± 0.88 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.84 > 0.50	OK	
$n_c(f_0) > 200$	742.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 42 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	1.5 Hz	OK	
$A_0 > 2$	1.92 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.50947| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.42987 < 0.12656		NO
$\sigma_A(f_0) < \theta(f_0)$	0.1784 < 2.0	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR46A

TROMINO® Grilla

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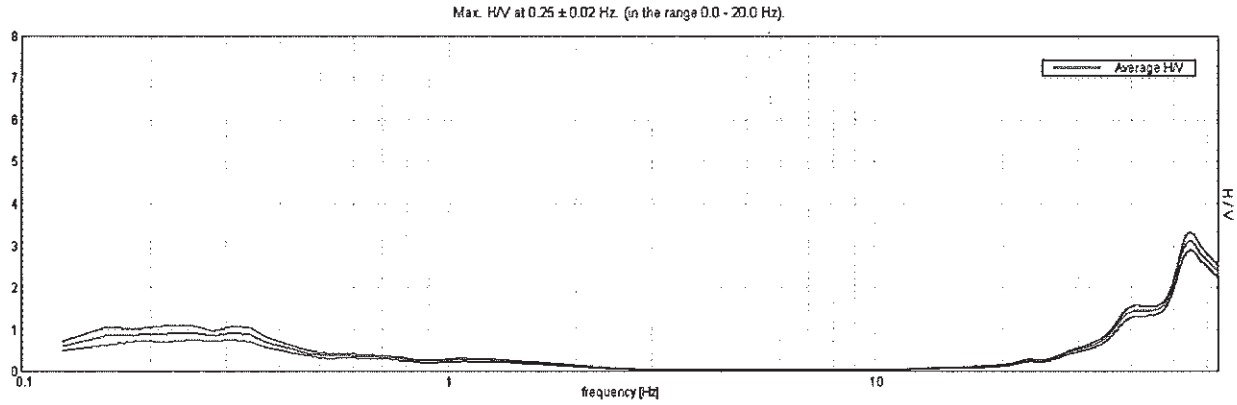
RAVENNA – n. 17

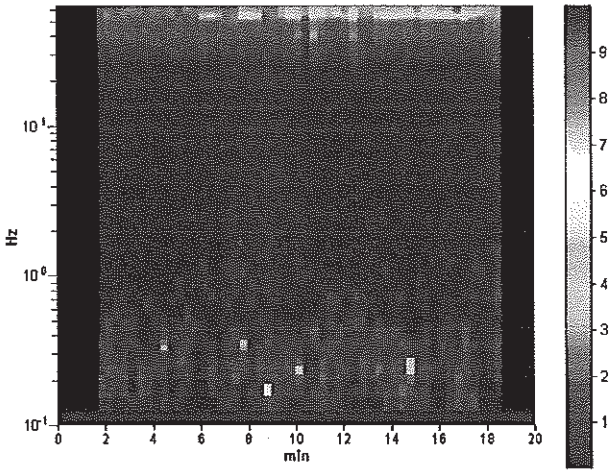
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 85% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

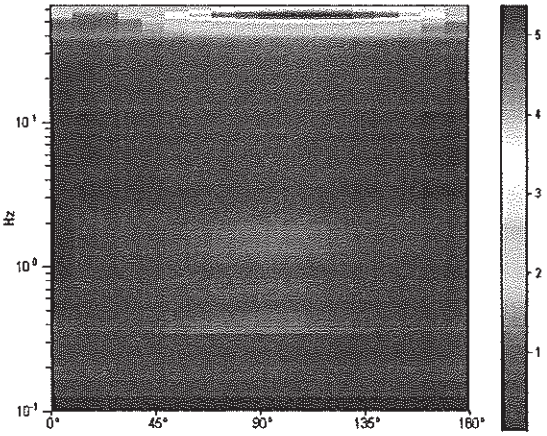
HORIZONTAL TO VERTICAL SPECTRAL RATIO



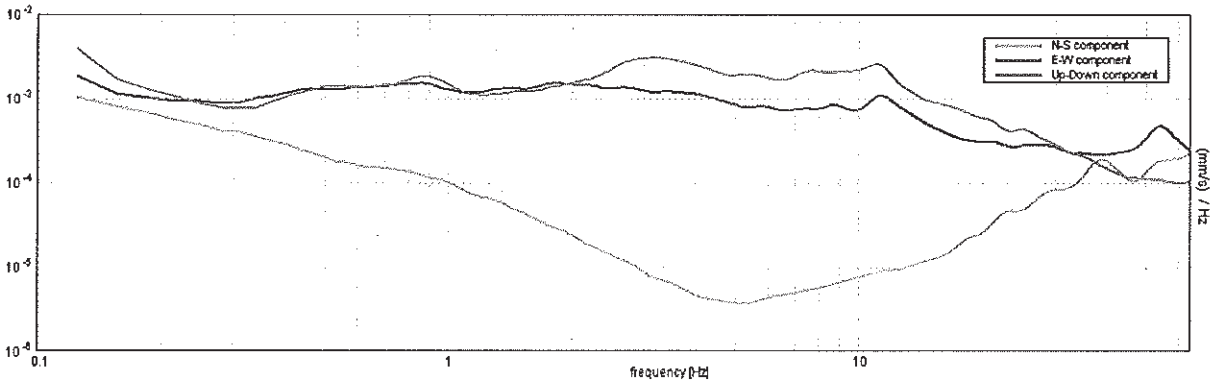
H/V TIME HISTORY



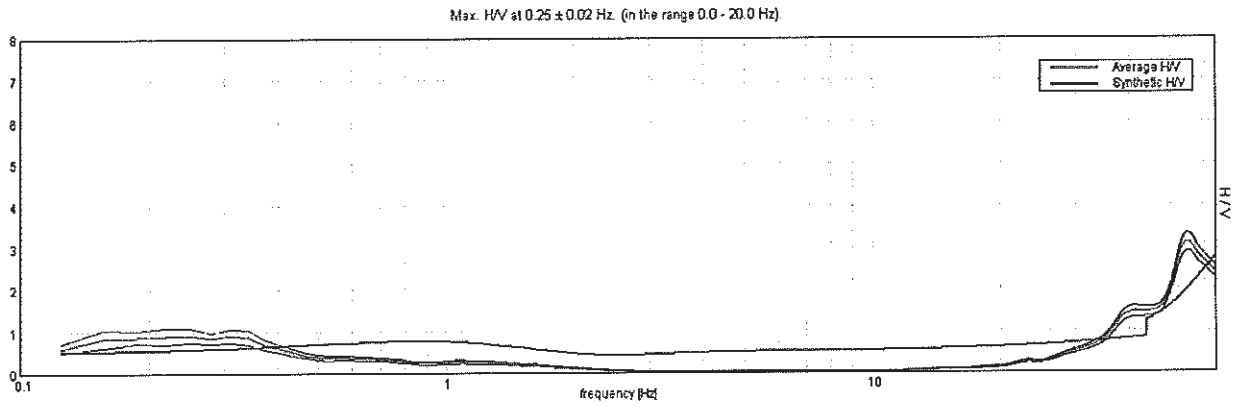
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

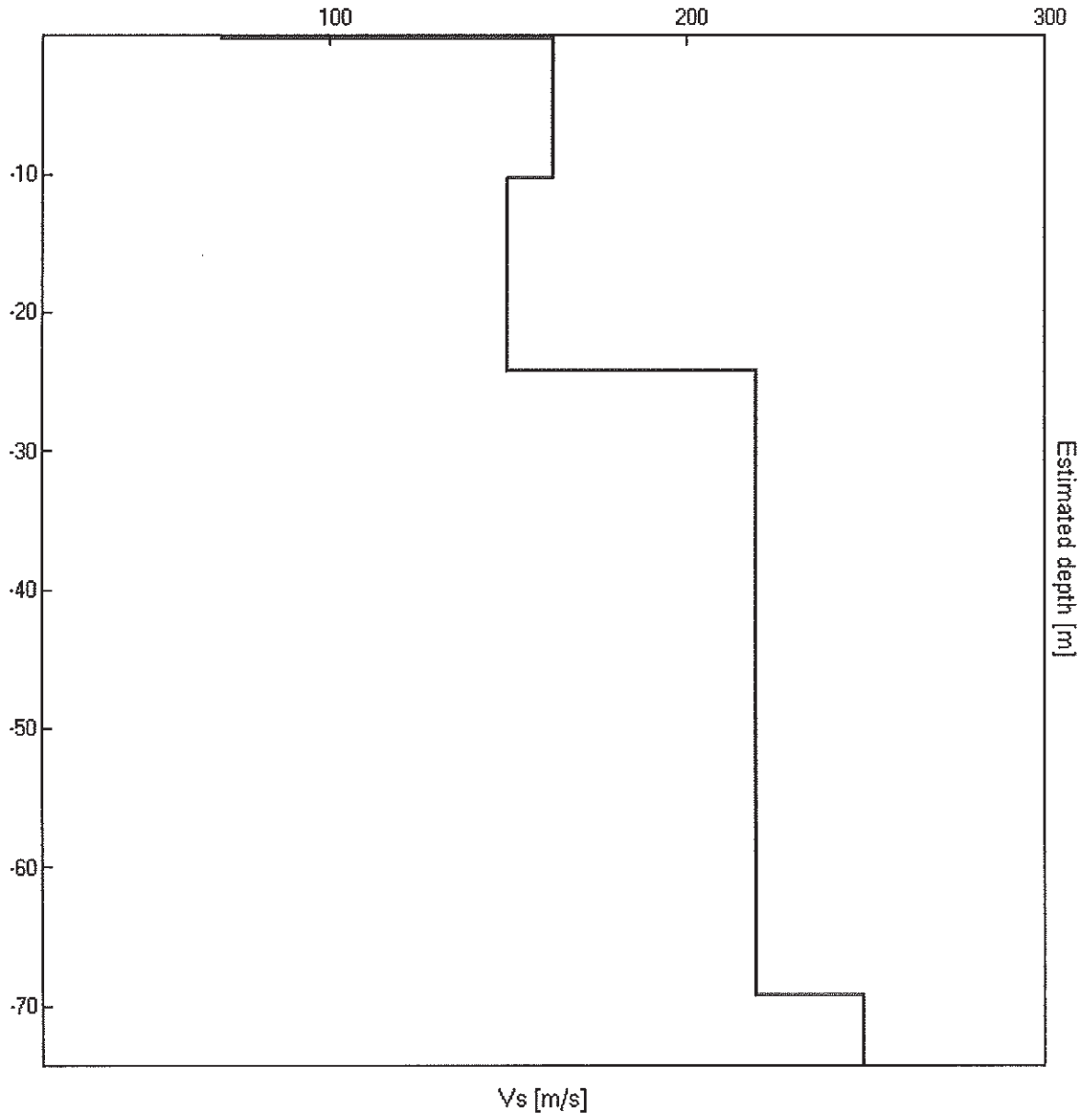


EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.25	0.25	70
10.25	10.00	163
24.25	14.00	150
69.25	45.00	220
inf.	inf.	250

Vs(0.0-30.0)=163m/s


100
200
300
-10
-20
-30
-40
-50
-60
-70
Estimated depth [m]
Vs [m/s]

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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 0.25 ± 0.02 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.25 > 0.50		NO
$n_c(f_0) > 200$	255.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 13 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	0.469 Hz	OK	
$A_0 > 2$	0.92 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03279| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.0082 < 0.05	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0854 < 2.5	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR47A

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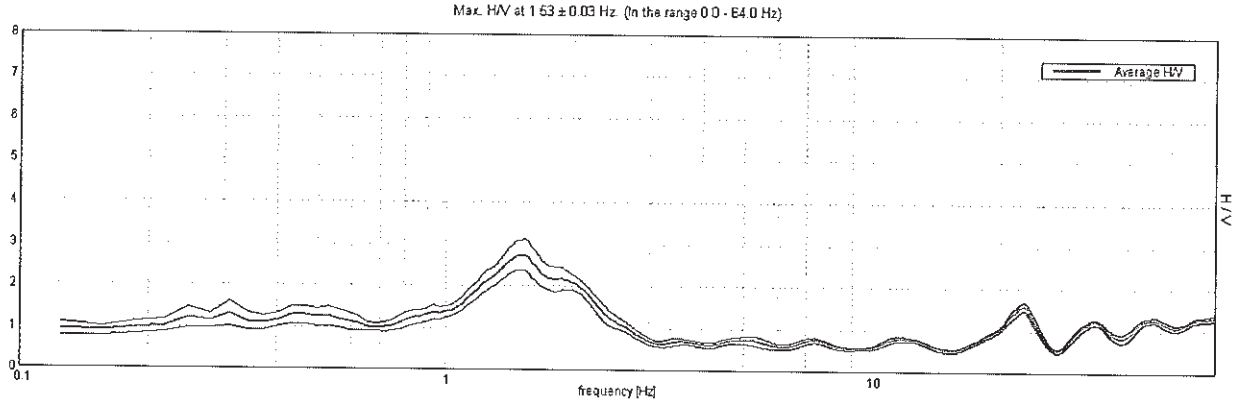
TROMINO® Grilla

RAVENNA – n. 28

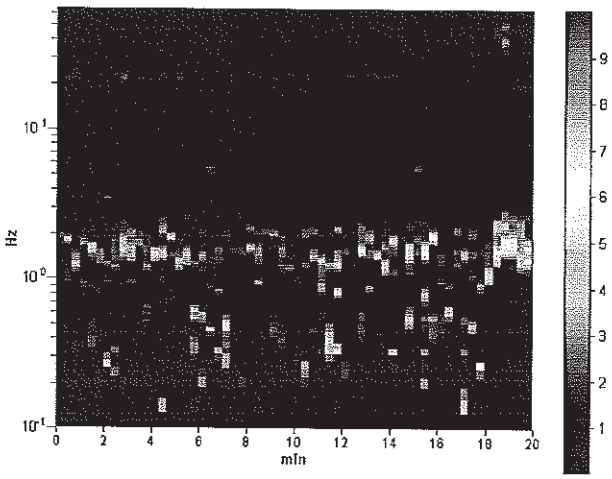
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

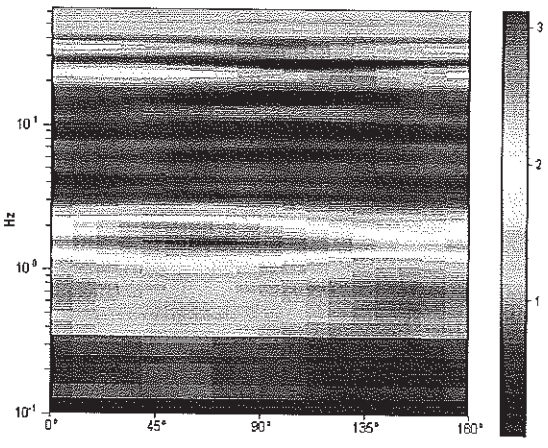
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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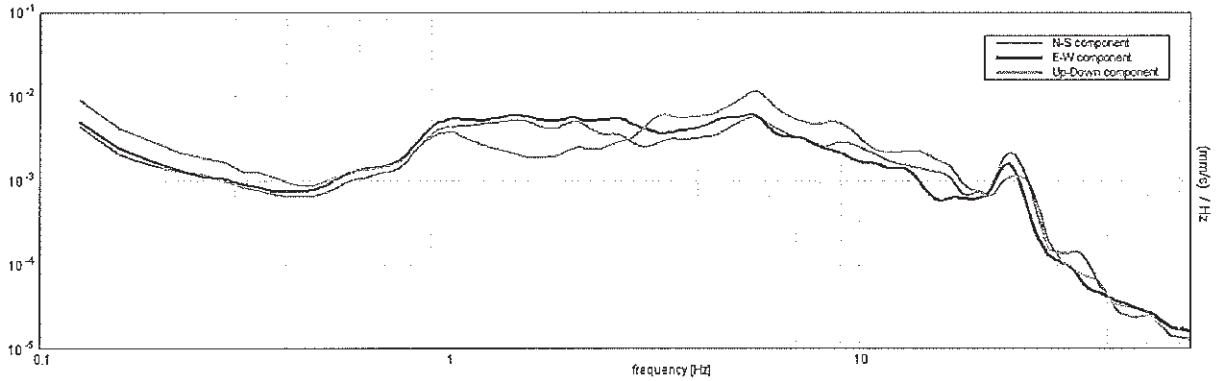
SINGLE COMPONENT SPECTRA



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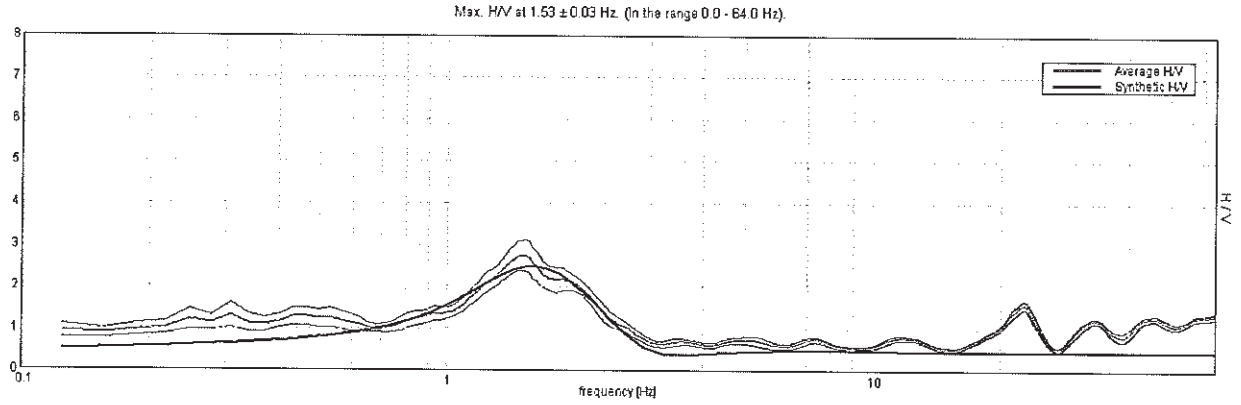
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
16.00	16.00	135
19.00	3.00	250
37.00	18.00	265
51.00	14.00	305
59.00	8.00	340
inf.	inf.	380

Vs(0.0-30.0)=174m/s

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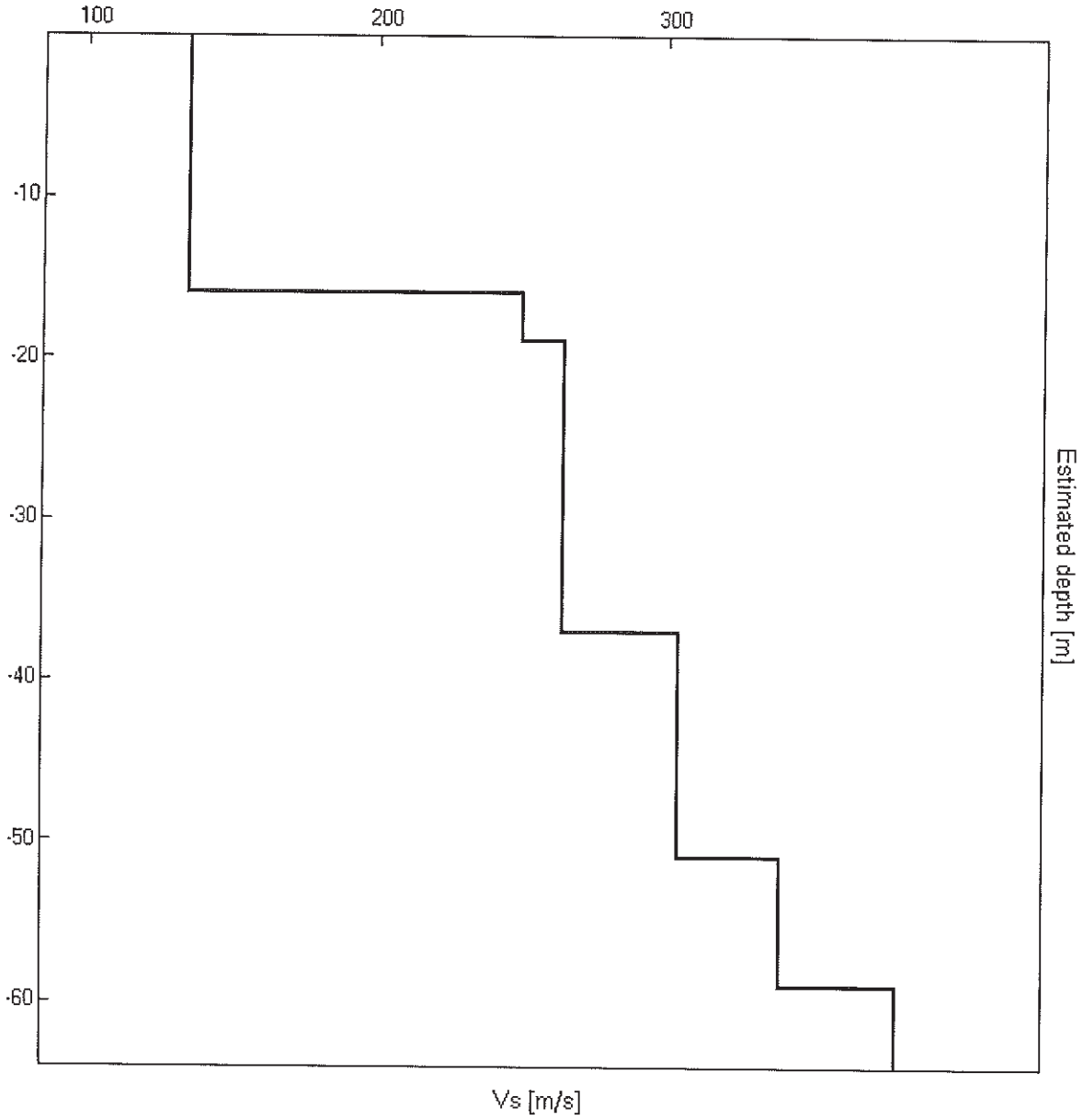

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[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 1.53 ± 0.03 Hz. (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.53 > 0.50	OK	
$n_c(f_0) > 200$	1837.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 74 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.969 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	2.344 Hz	OK	
$A_0 > 2$	2.74 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01024| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.01568 < 0.15313	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1856 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR48A

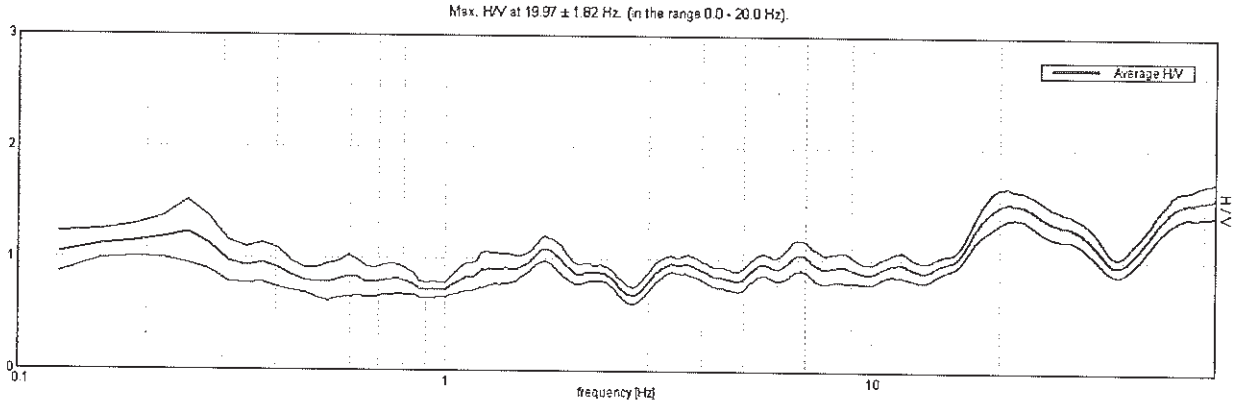
TROMINO® Grilla

RAVENNA – n. 29

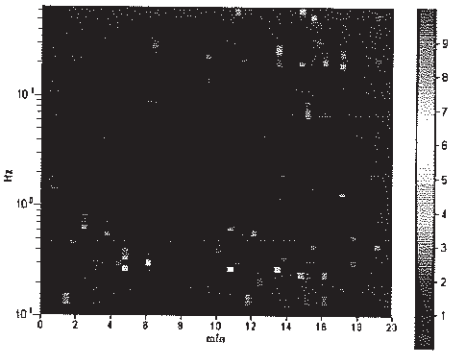
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 63% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

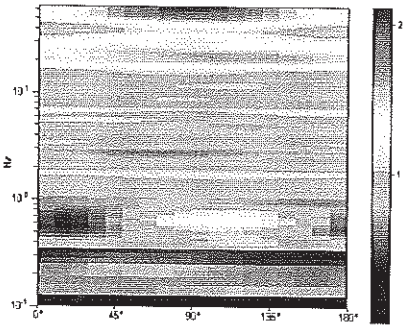
HORIZONTAL TO VERTICAL SPECTRAL RATIO



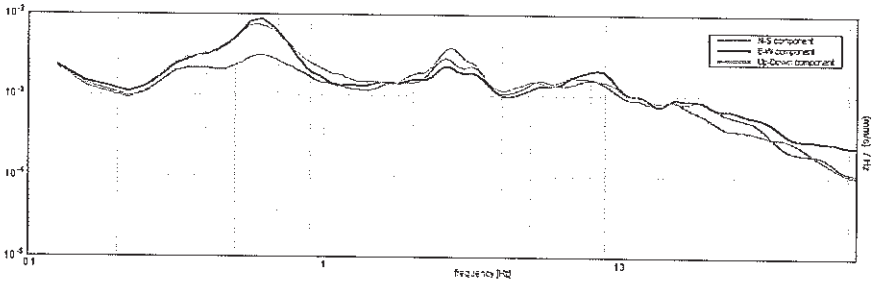
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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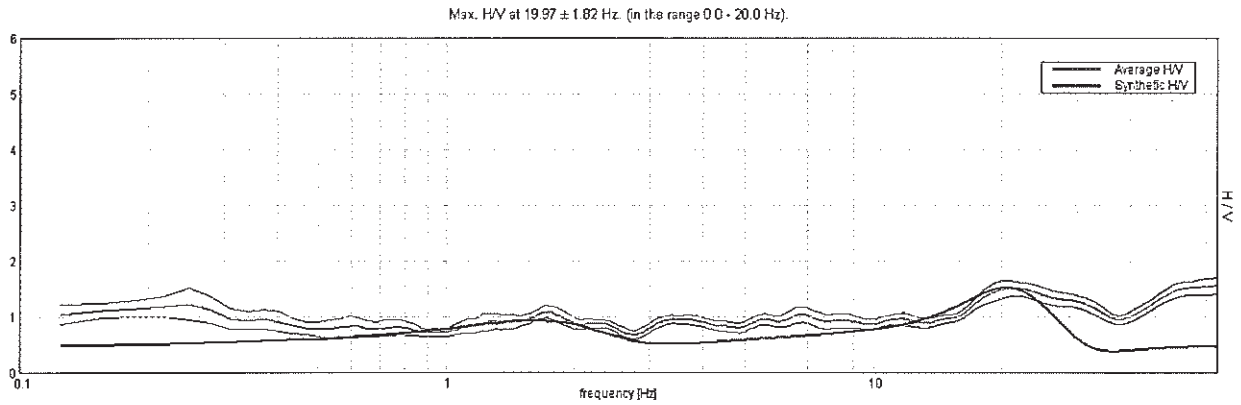
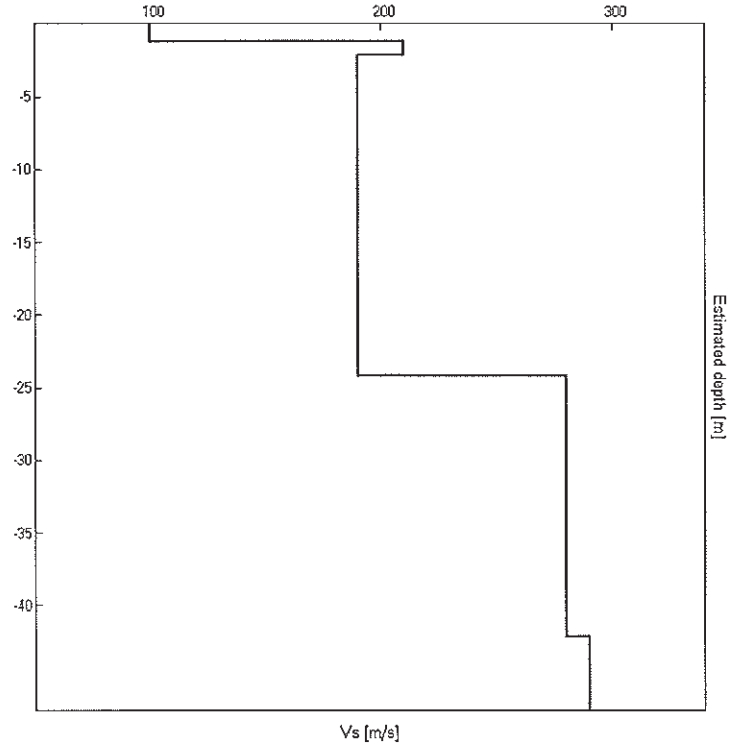
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
1.20	1.20	100
2.20	1.00	210
24.20	22.00	190
42.20	18.00	280
inf.	inf.	290

Vs(0.0-30.0)=196m/s



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TROMINO® Grilla

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 19.97 ± 1.82 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	OK	
$n_c(f_0) > 200$	15176.3 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 960 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.49 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.04427| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.88398 < 0.99844	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0761 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR49A

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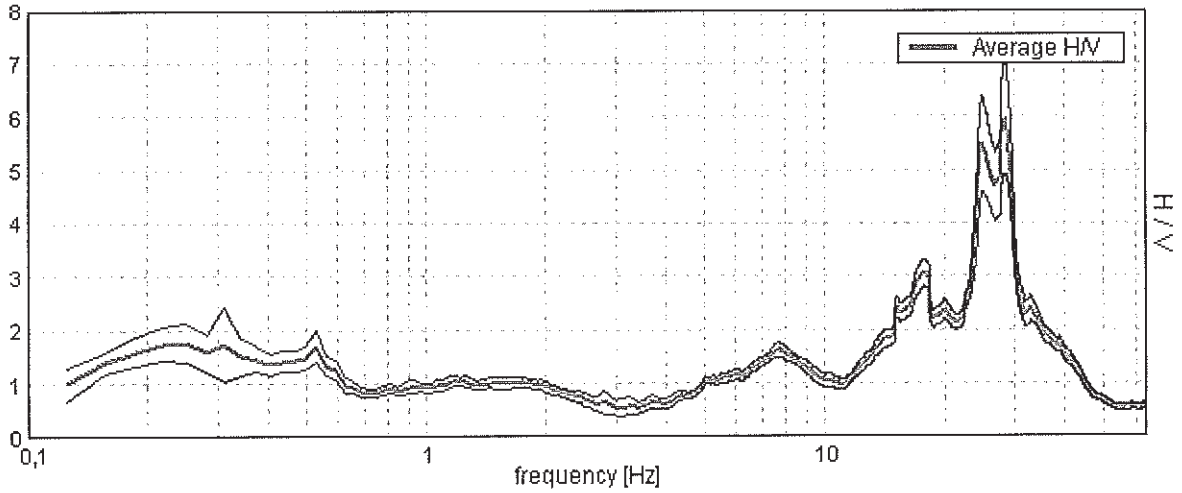
RAVENNA – n. 27

GPS data not available

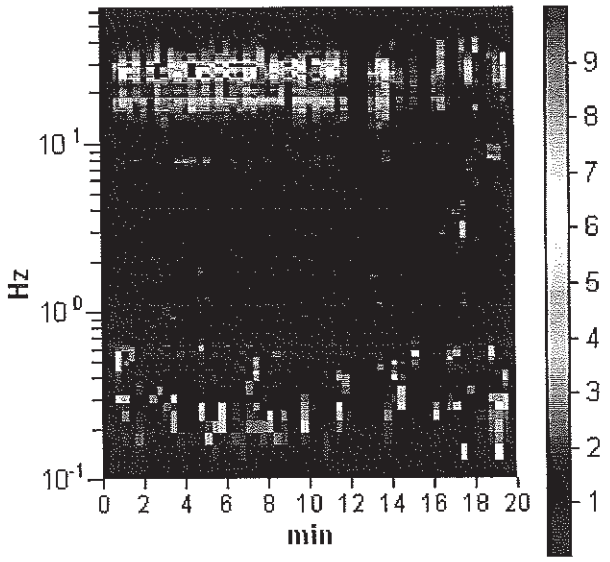
Trace length: 0h20'00". Analyzed 87% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

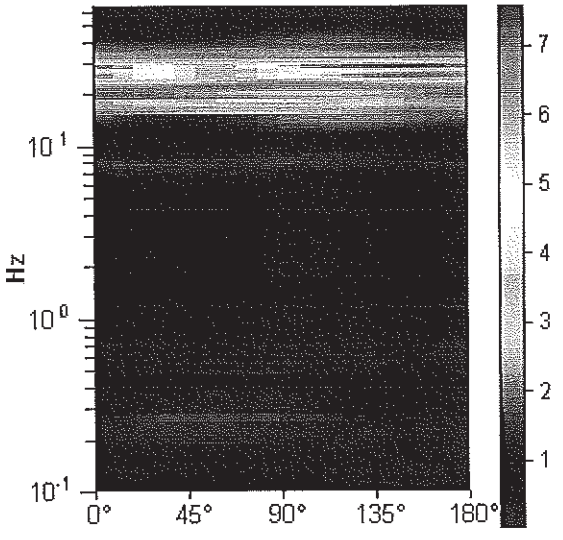
Max. HVSR at 28,28 ± 1,09 Hz. (in the range 0,0 - 64,0 Hz).



H/V TIME HISTORY



DIRECTIONAL H/V



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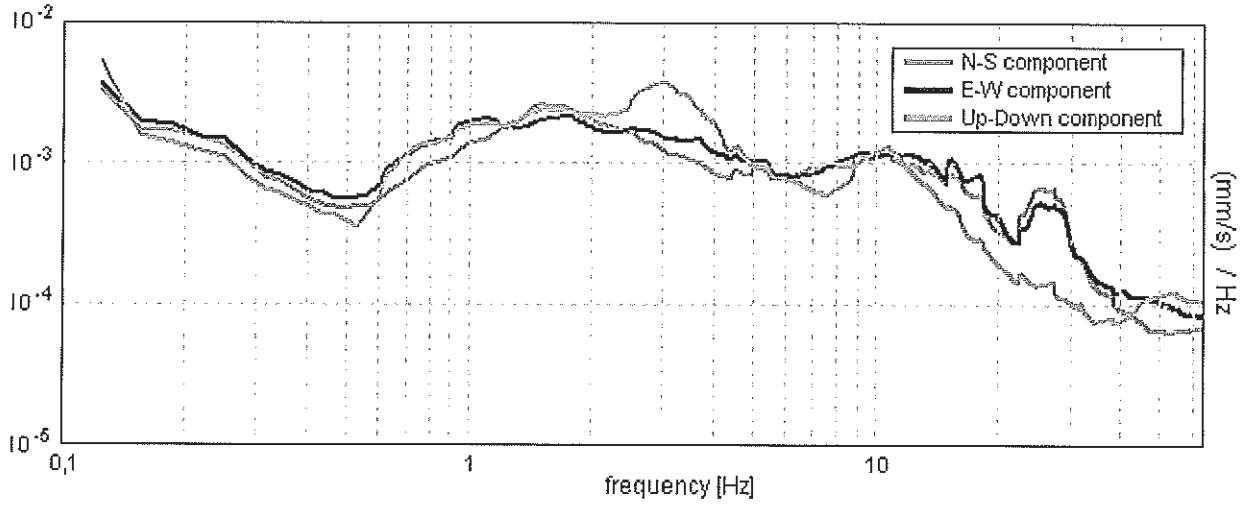
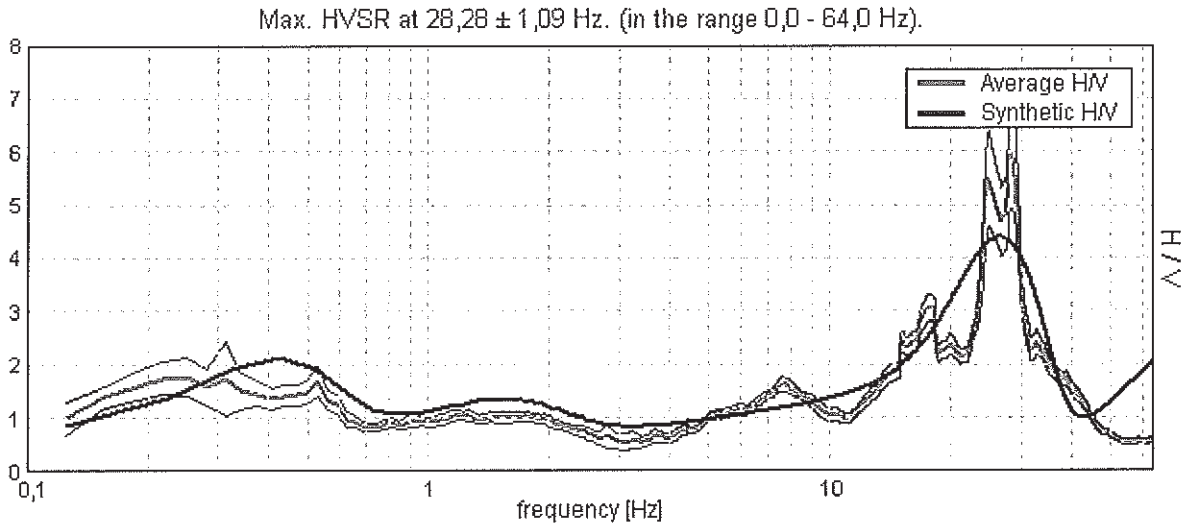
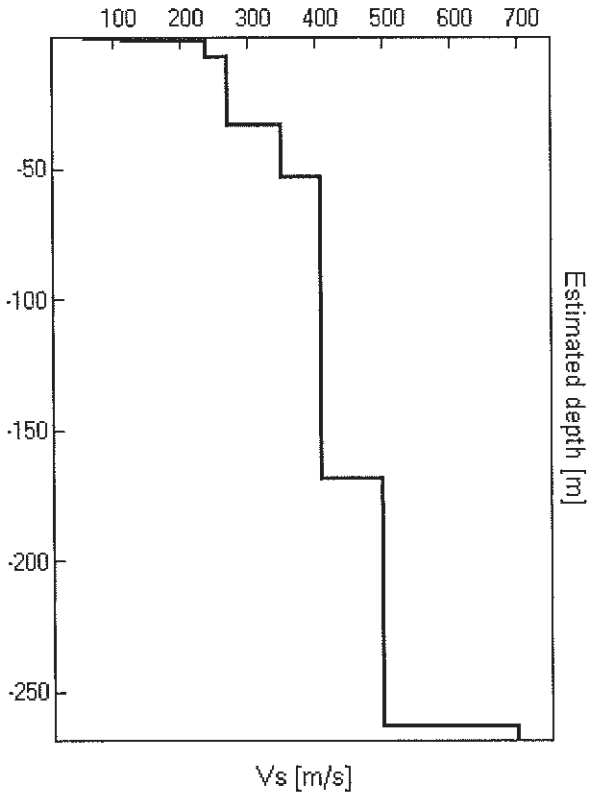
SINGLE COMPONENT SPECTRA



EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0,20	0,20	60
1,20	1,00	115
7,20	6,00	240
33,20	26,00	270
53,20	20,00	350
168,20	115,00	410
263,20	95,00	500
inf.	inf.	700
		Vs30 = 247 m/s



[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. HVSR at 28,28 ± 1,09 Hz. (in the range 0,0 - 64,0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	28,28 > 0,50	OK	
$n_c(f_0) > 200$	29412,5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1358 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	23,313 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	30,406 Hz	OK	
$A_0 > 2$	5,95 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0,01905| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0,53879 < 1,41406	OK	
$\sigma_A(f_0) < \theta(f_0)$	0,5099 < 1,58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR50A

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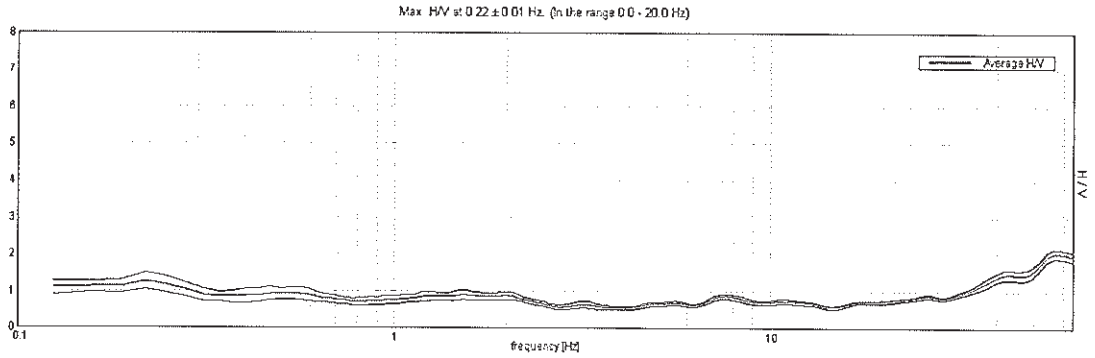
RAVENNA – n. 30

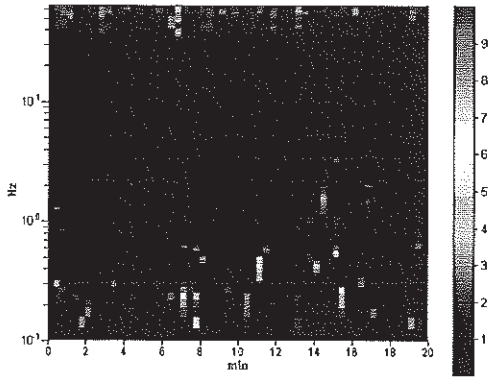
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 83% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

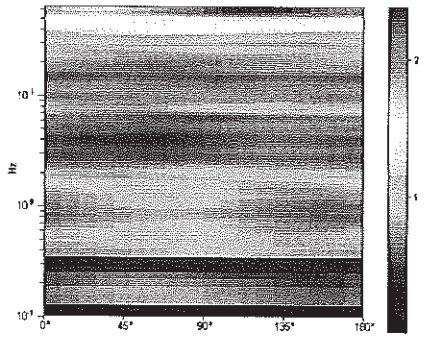
HORIZONTAL TO VERTICAL SPECTRAL RATIO



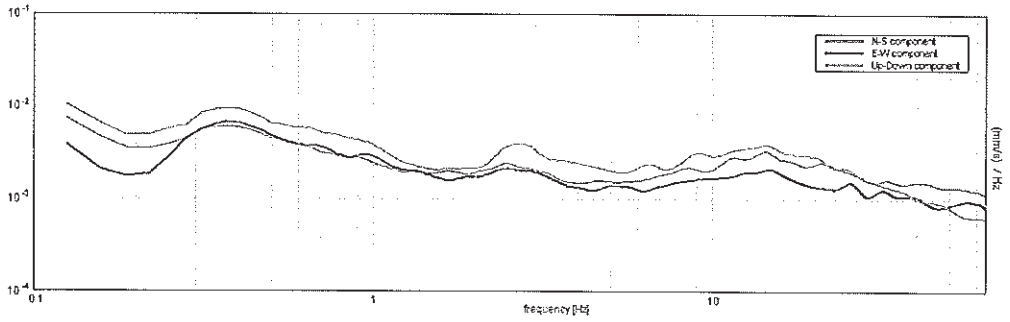
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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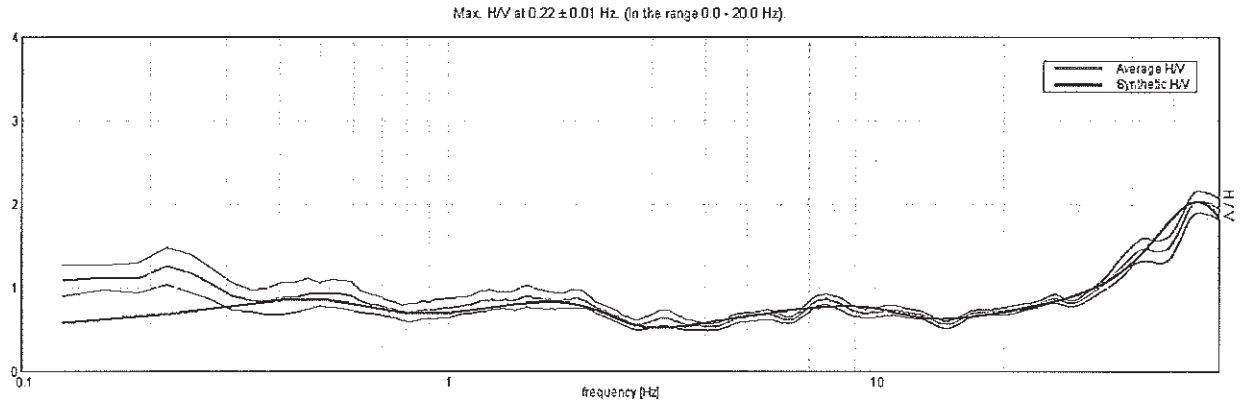
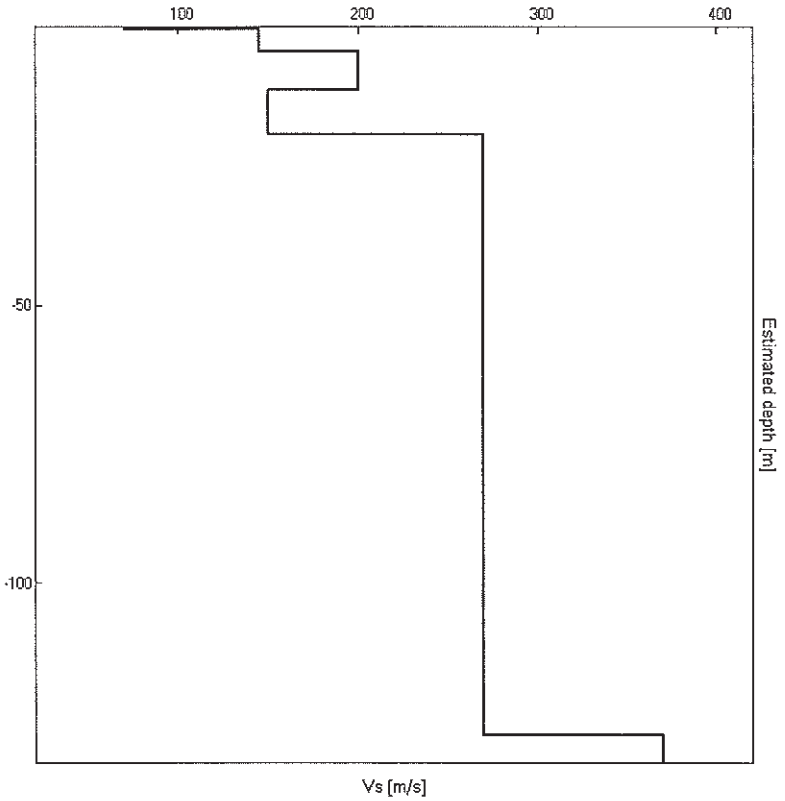
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.30	0.30	70
4.30	4.00	145
11.30	7.00	200
19.30	8.00	150
127.30	108.00	270
inf.	inf.	370

Vs(0.0-30.0)=188m/s



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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 0.22 ± 0.01 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.22 > 0.50		NO
$n_c(f_0) > 200$	218.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 12 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.26 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01178| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.00258 < 0.04375	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1103 < 2.5	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR51A

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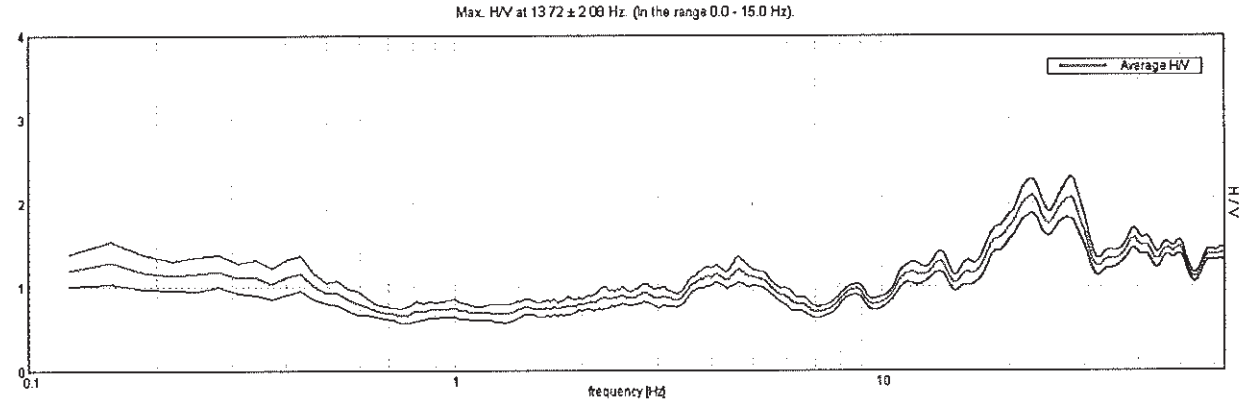
RAVENNA – n. 14

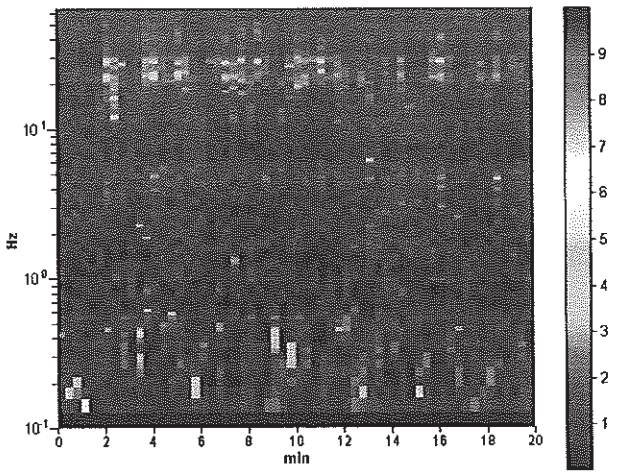
Start recording: 19/02/10 18:14:42 End recording: 19/02/10 18:34:43
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 5%

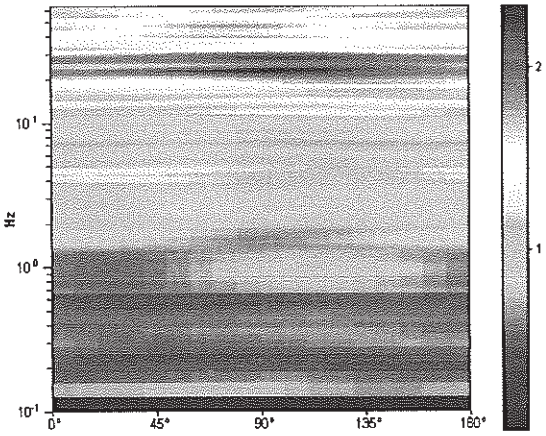
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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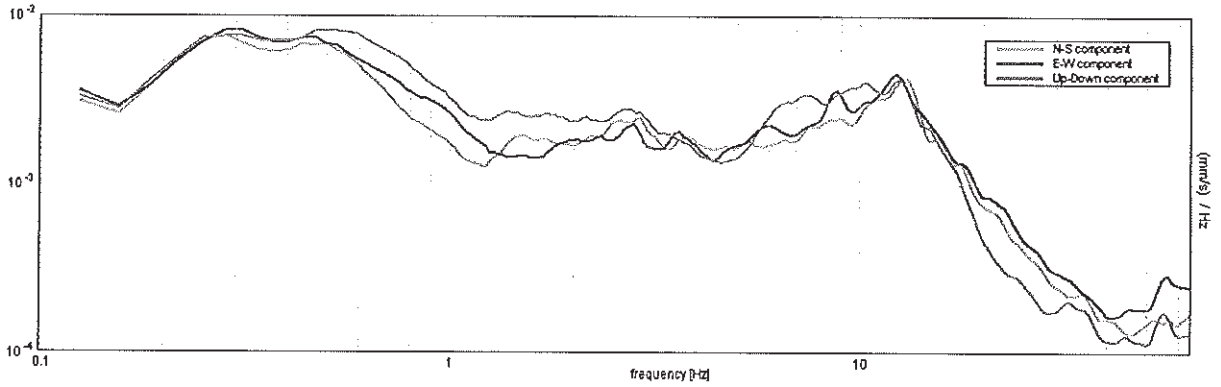
SINGLE COMPONENT SPECTRA



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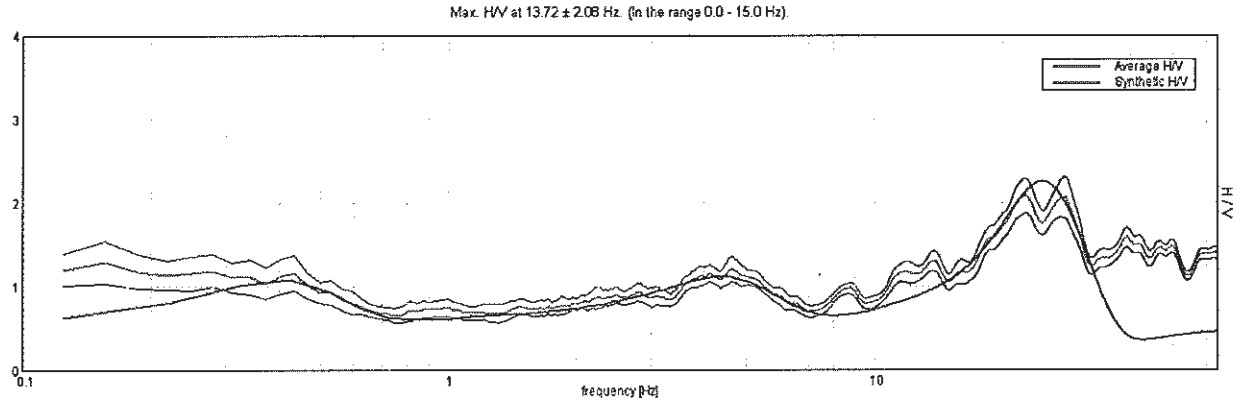
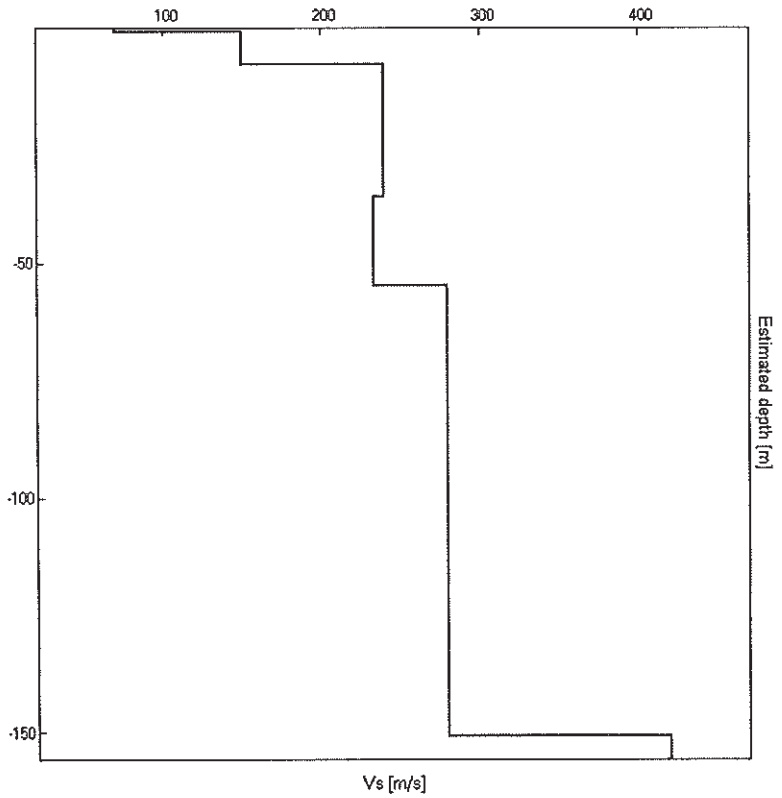
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.70	0.70	70
7.70	7.00	150
35.70	28.00	240
54.70	19.00	233
150.70	96.00	280
inf.	inf.	420

Vs(0.0-30.0)=201m/s



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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 13.72 ± 2.08 Hz. (in the range 0.0 - 15.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	13.72 > 0.50	OK	
$n_c(f_0) > 200$	16462.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 660 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.30 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.07505| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.02954 < 0.68594		NO
$\sigma_A(f_0) < \theta(f_0)$	0.0598 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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HVSR52A

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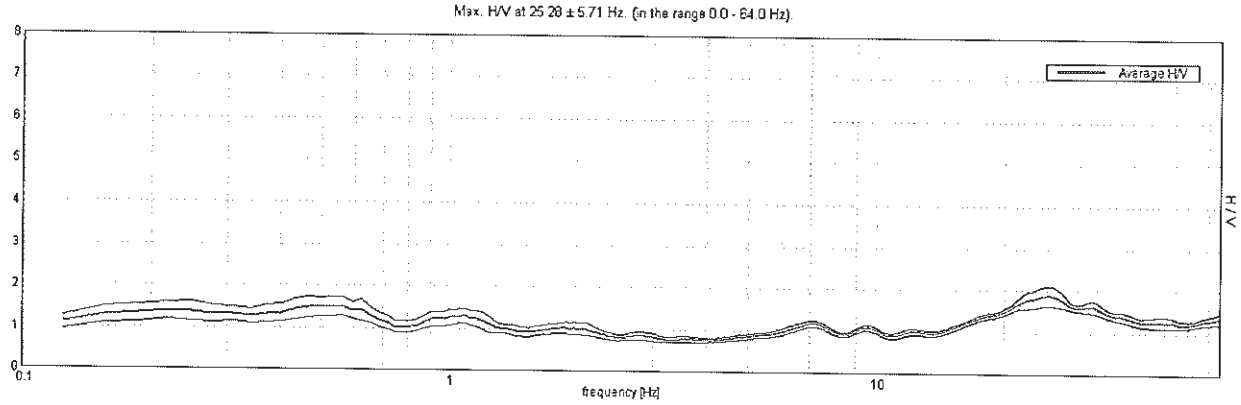
RAVENNA – n. 31

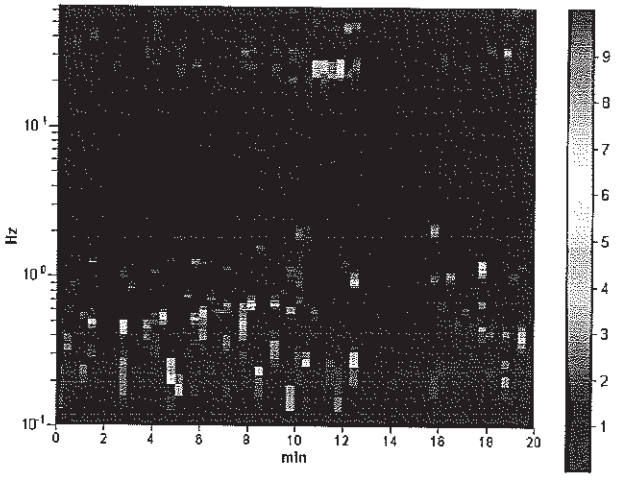
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 80% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

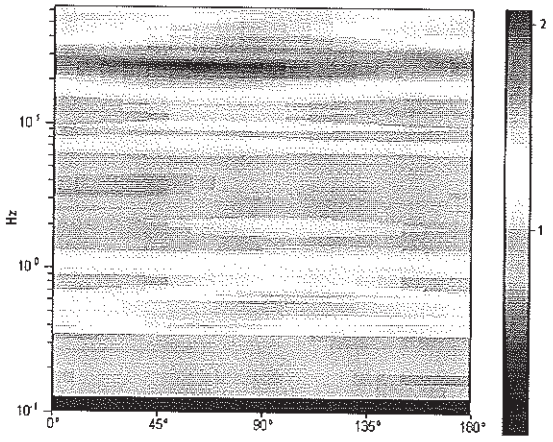
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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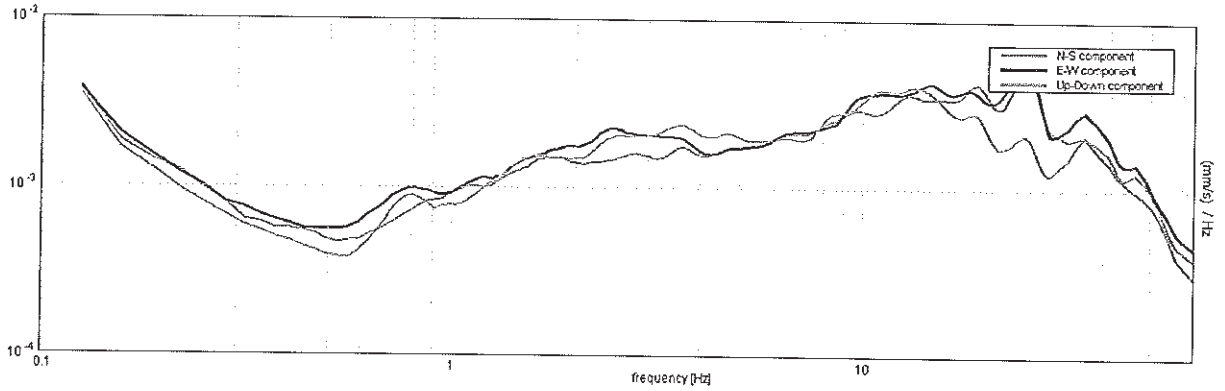
TROMINO® Grilla

SINGLE COMPONENT SPECTRA



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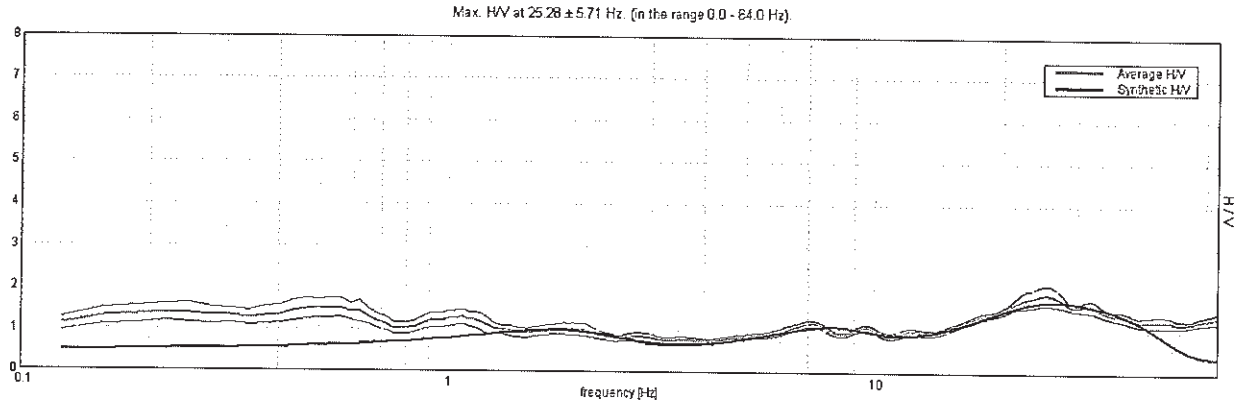
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.40	0.40	60
1.40	1.00	120
6.40	5.00	155
10.40	4.00	260
16.40	6.00	170
20.40	4.00	190
50.40	30.00	300
inf.	inf.	320

Vs(0.0-30.0)=199m/s

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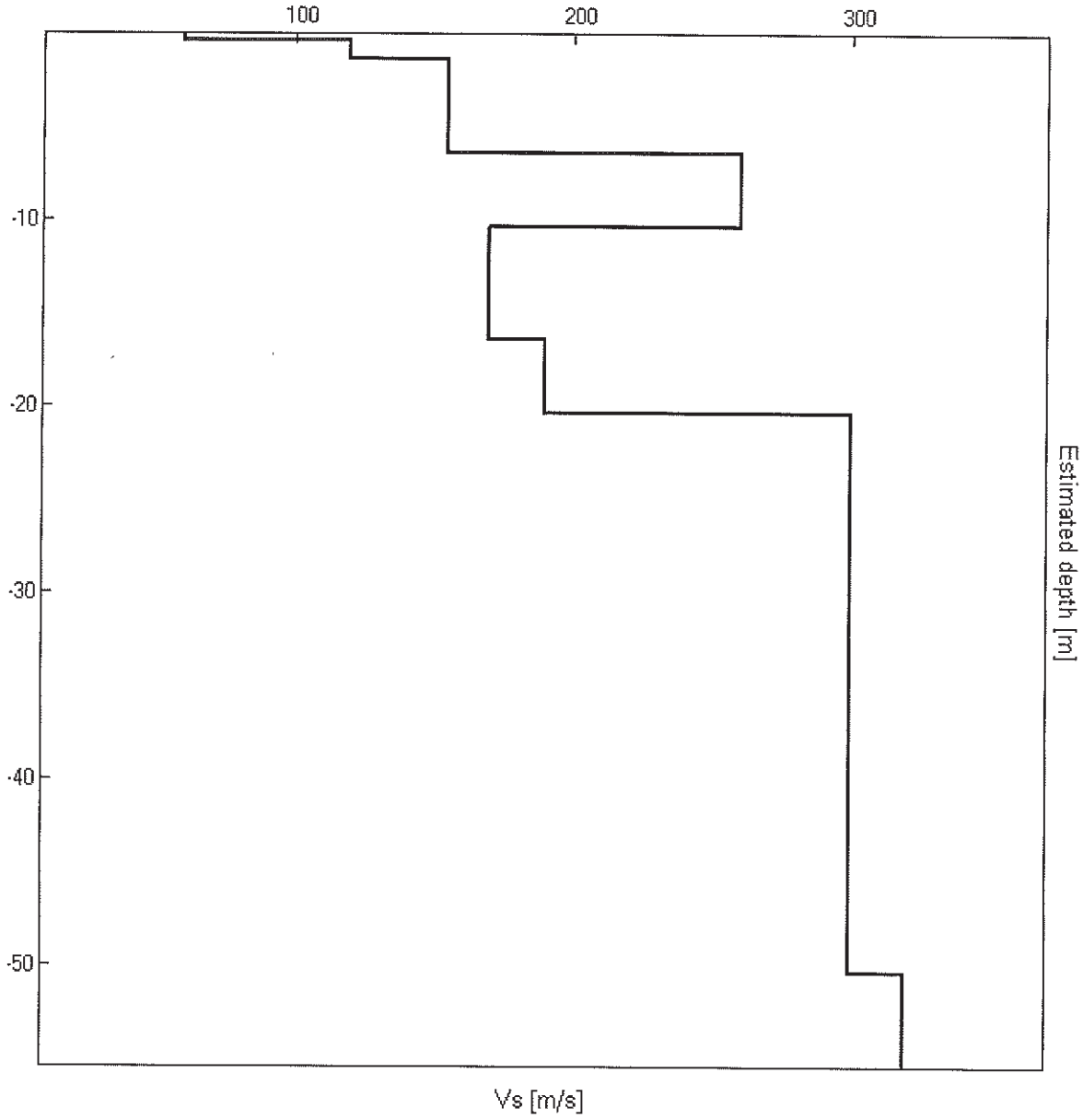

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[According to the Sesame, 2005 guidelines. **Please read carefully the Grilla manual before interpreting the following tables.**]

Max. H/V at 25.28 ± 5.71 Hz. (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	25.28 > 0.50	OK	
$n_c(f_0) > 200$	24270.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1214 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	11.469 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.88 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.11101| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	2.80654 < 1.26406		NO
$\sigma_A(f_0) < \theta(f_0)$	0.1155 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR53A

TROMINO® Grilla

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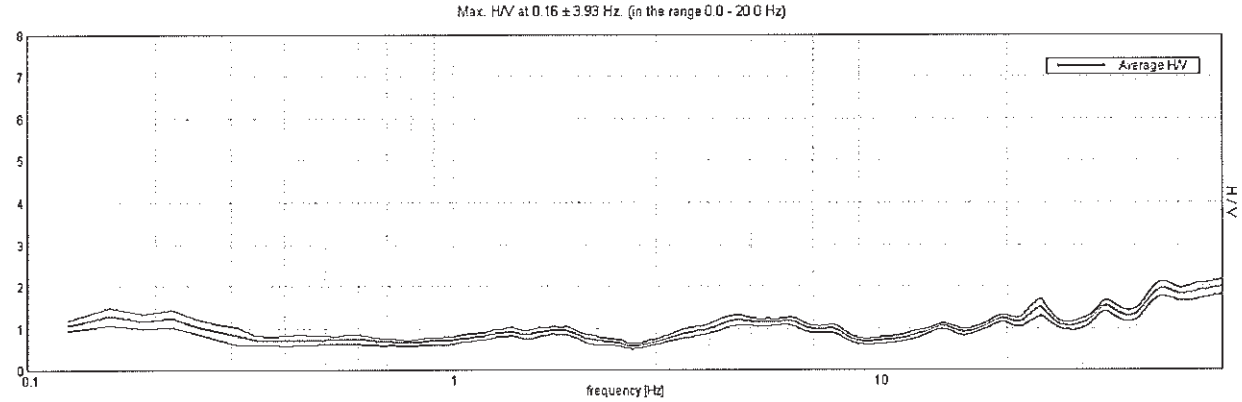
RAVENNA – n. 26

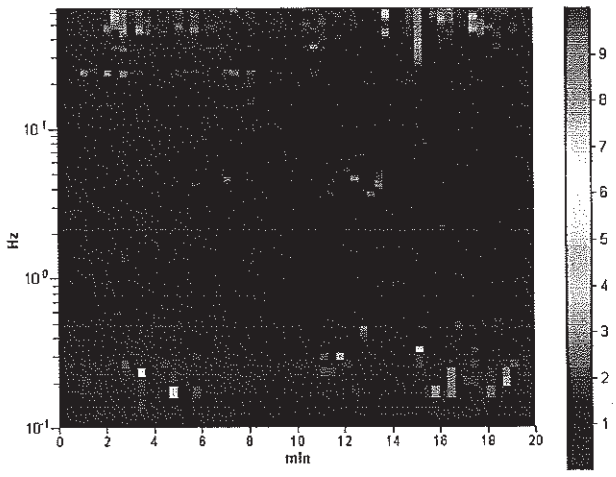
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 78% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

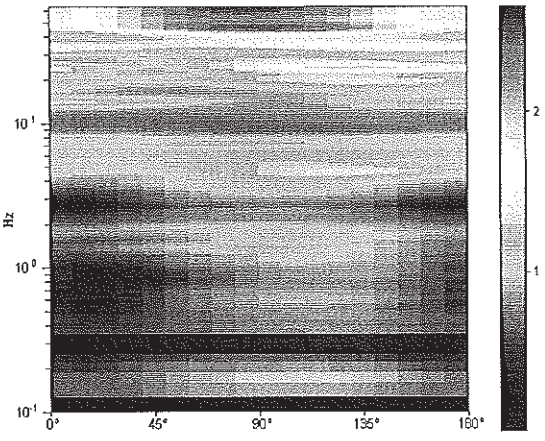
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



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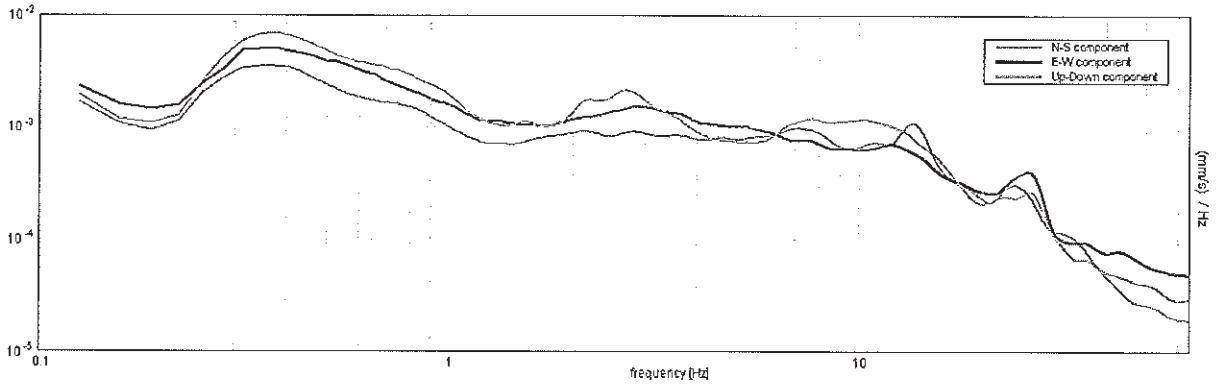
SINGLE COMPONENT SPECTRA



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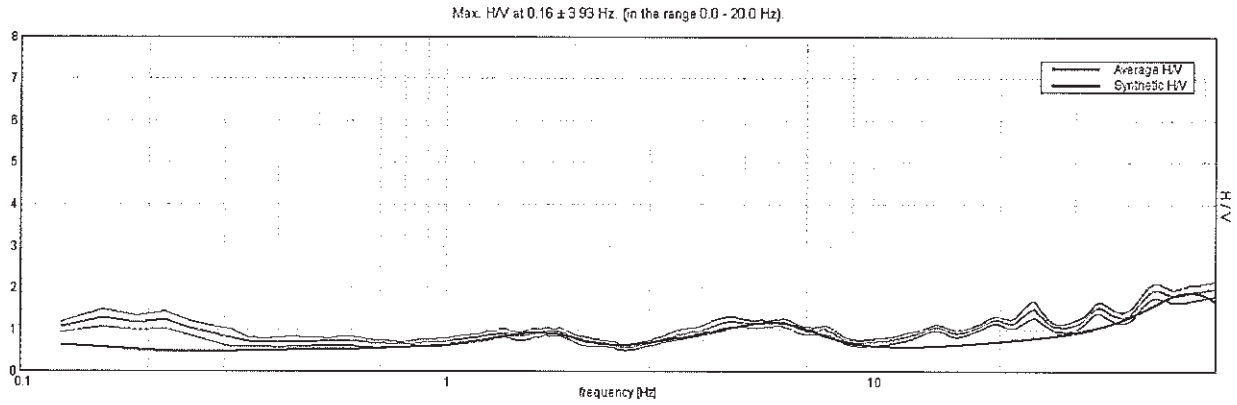
EXPERIMENTAL VS. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.25	0.25	58
3.85	3.60	120
8.85	5.00	170
15.85	7.00	230
27.85	12.00	160
47.85	20.00	330
inf.	inf.	260

Vs(0.0-30.0)=171m/s

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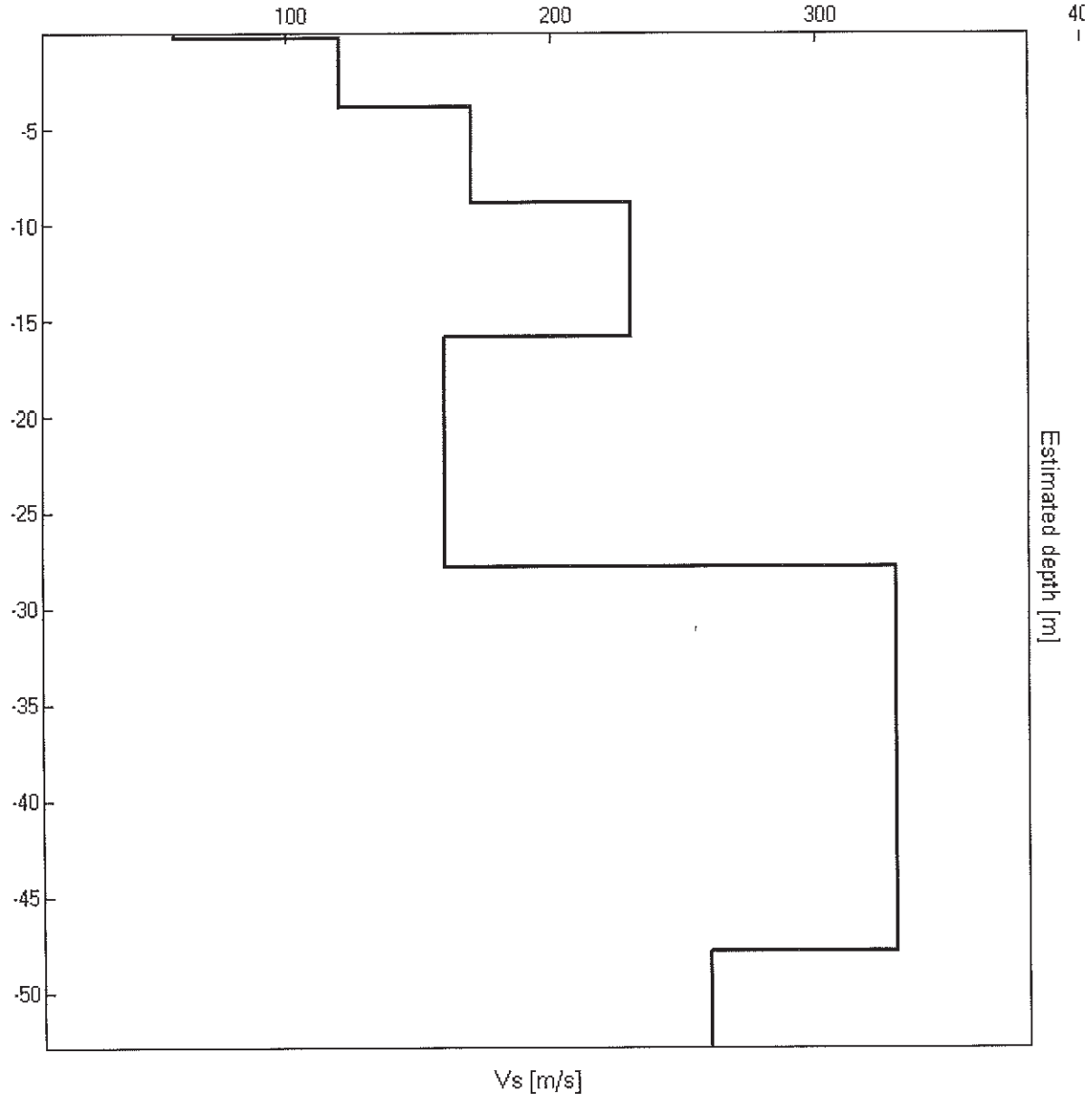

SGT Società di Geologia Territoriale
www.tromino.it
www.geo55.com

TROMINO® Grilla

[According to the Sesame, 2005 guidelines. **Please read carefully the** Grilla **manual before interpreting the following tables.**]

Max. H/V at 0.16 ± 3.93 Hz. (in the range 0.0 - 20.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.16 > 0.50		NO
$n_c(f_0) > 200$	146.9 > 200		NO
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 8 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.28 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|12.35853| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.93102 < 0.03906		NO
$\sigma_A(f_0) < \theta(f_0)$	0.1055 < 3.0	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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C.F. SFR SMN 64M05 L216A - P. IVA 01859390542

COMUNE DI RAVENNA

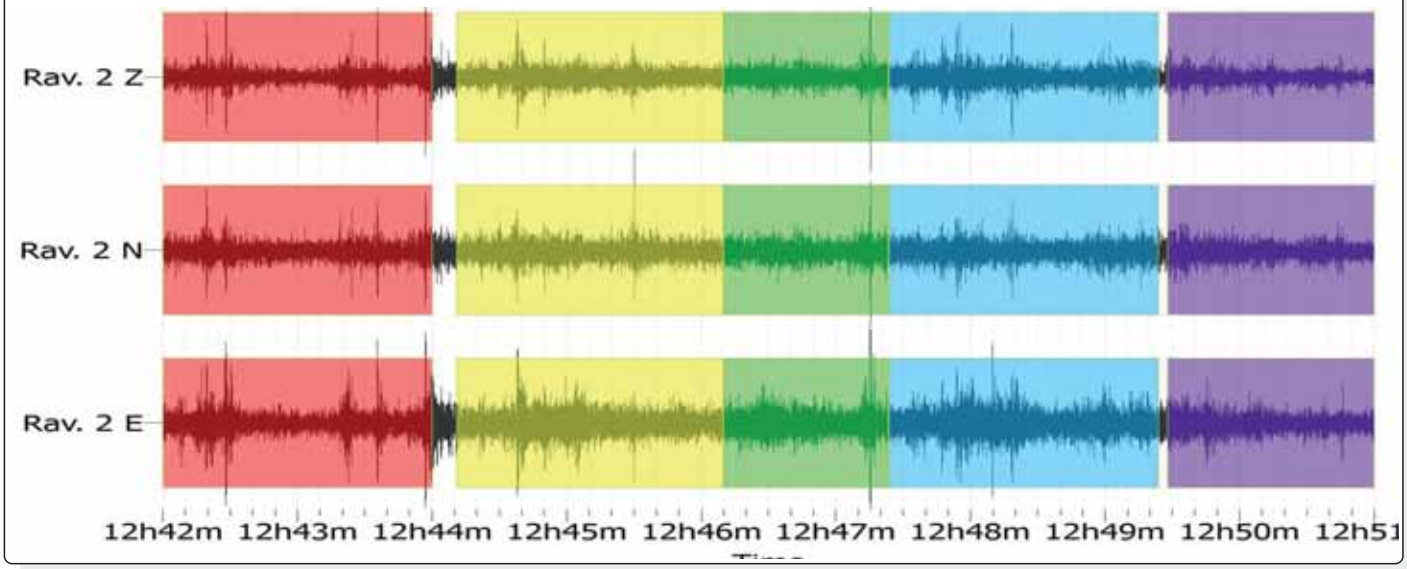
VERIFICHE TECNICHE SU EDIFICI COMPRESI NEL PROGRAMMA Ex ART. 2 COMMA 3 O.P.C.M. 3274/2003 E SS.MM.II.
LOTTO N. 6

INDAGINE SISMICA HVSR

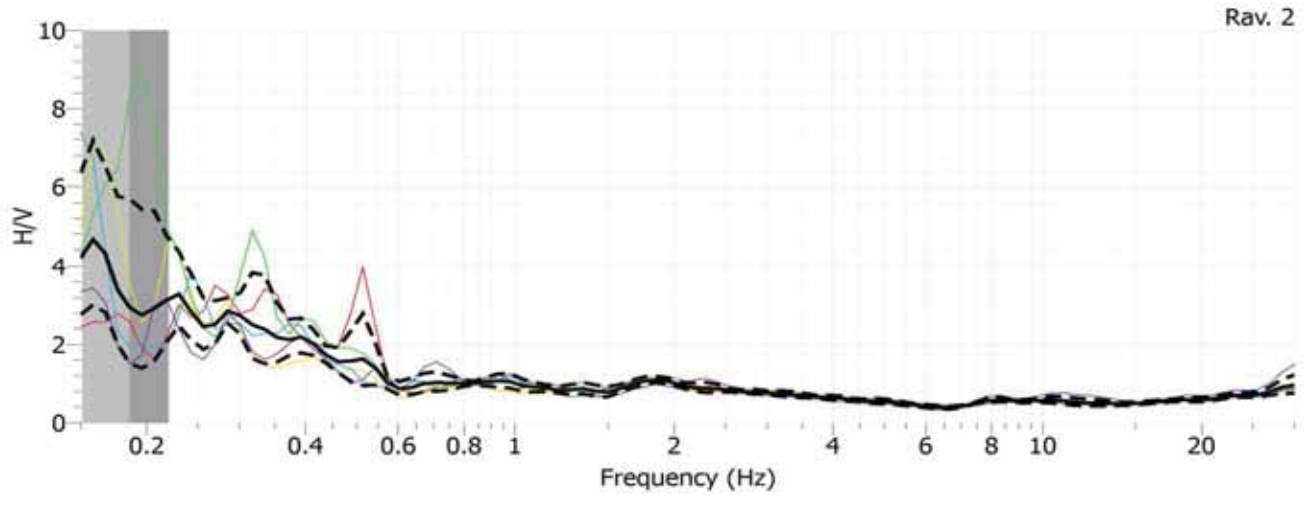
Stadio Com. «B. BENELLI» — *Dr. Geol. Simone SFORNA*

DOCUMENTAZIONE FOTOGRAFICA

ACQUISIZIONE - 20 minuti



RAPPORTO H/V - Frequenza di sito = 0,185 Hz - Dev. standard = 0,03 Hz



PRESIDENZA DEL CONSIGLIO DEI MINISTRI

DIPARTIMENTO DELLA PROTEZIONE CIVILE

UFFICIO SERVIZIO SISMICO NAZIONALE

SCHEDA DI SINTESI DELLA VERIFICA SISMICA DI "LIVELLO 1" O DI "LIVELLO 2" PER GLI EDIFICI STRATEGICI AI FINI DELLA PROTEZIONE CIVILE O RILEVANTI IN CASO DI COLLASSO A SEGUITO DI EVENTO SISMICO

(Ordinanza n. 3274/2003 – Articolo 2, commi 3 e 4)

PARTE GEOLOGICO TECNICA

(Sezz. nn° 1/parte - 5 - 9 - 18 - 19)

Denominazione edificio	STADIO COMUNALE «G. BENELLI»

Coordinate geografiche ED50		
Lat	44,407127	
Lon	12,195796	

5) Dati geomorfologici					
Morfologia del sito				***Fenomeni franosi***	
A ○ Cresta/Dirupo	B ○ Pendio Forte	C ○ Pendio leggero	D ☒ Pianura	E ☒ Assenti	F ○ Presenti

9) Perimetrazione ai sensi del D.L. 180/1998		
SI ○ 0 – NO ☒ 1 **NB:** *In caso affermativo compilare la matrice sottostante*		
	Area R4	Area R3
1) Frana	❑	❑
2) Alluvione	❑	❑

18) Classificazione sismica	
1) Zona sismica:	1 ○ 2 ○ 3 X 4 ○
2) Valore dell'accelerazione orizzontale massima di ancoraggio spettro risposta elastico (suolo A) dedotto da:	0.223
2.1) Allegato 1 all'Ordinanza n. 3274/2003	X
2.2) Delibera di Giunta Regionale	○
2.3) Studio più approfondito:	
2.3.1) Mappa di riferimento nazionale (*INGV, 2004*)	○
2.3.2) Studio regionale	○
2.3.3) Studio di letteratura	○
2.3.4) Studio effettuato direttamente	○

19) Categoria di suolo di fondazione			
1	Metodologia per l'attribuzione della categoria di suolo di fondazione	1) Sulla base di carte geologiche disponibili	❑
		2) Sulla base di indagini esistenti	❑
		3) Sulla base di prove in situ effettuate appositamente	X
2	Descrizione indagini effettuate o già disponibili	1) Sondaggi geognostici a distruzione o a carotaggio continuo	❑
		2) Prova Standard Penetration Test (SPT) o Cone Penetration Test (CPT)	X
		3) Prospezione sismica in foro (Down-Hole o Cross-Hole)	❑
		4) Prova sismica superficiale a rifrazione	❑
		5) Analisi granulometrica	❑
		6) Prove triassiali	❑
		7) Prove di taglio diretto	❑
		8) Altro PROVA SISMICA MASW	X

3	Eventuali anomalie	1) Presenza di cavità					SI ○ – NO X
		2) Presenza di terreni di fondazione di natura significativamente diversa					SI ○ – NO X
4	Velocità media onde di taglio V_{s30} 246 m/s	5	Resistenza Penetrometrica media N_{SPT} __ colpi	6	Resistenza media alla punta q_c __ kPa	7	Coesione non drenata media c_u __ kPa
8	Suscettibilità alla liquefazione SI ○ – NO X **NB:** *In caso affermativo compilare la parte destra*	1) Profondità della falda da piano di campagna					Z_w __.__
		2) Profondità della fondazione rispetto al piano di campagna					Z_g __.__
		3) Presenza di terreni a grana grossa sotto la quota di falda entro i primi 15 m di profondità:					SI ○ – NO ○
		Spessore \ densità		sciolte		medie	dense
		3.1) Sabbie fini m __		○		○	○
		3.2) Sabbie medie m __		○		○	○
		3.3) Sabbie grosse m __		○		○	○
9	Categoria di suolo di fondazione C (par 3.1 Ord3274/03)	10	1) Fattore S di amplificazione per profilo stratigrafico 1.37 2) Periodo T_B dello spettro di risposta 0.095 3) Periodo T_c dello spettro di risposta 0.287 a) Valore di Norma X b) Valore desunto in letteratura ○ c) Valore desunto da analisi specifiche ○				
11	Coefficiente di amplificazione topografica S_T	1.00					

Dr. Geol. Simone Sforna
(O.R.G.U. N° 112)

Perugia, novembre 2013

Studio di geologia
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C.F. SFR SMN 64M05 L216A - P. IVA 01859390542

COMUNE DI RAVENNA

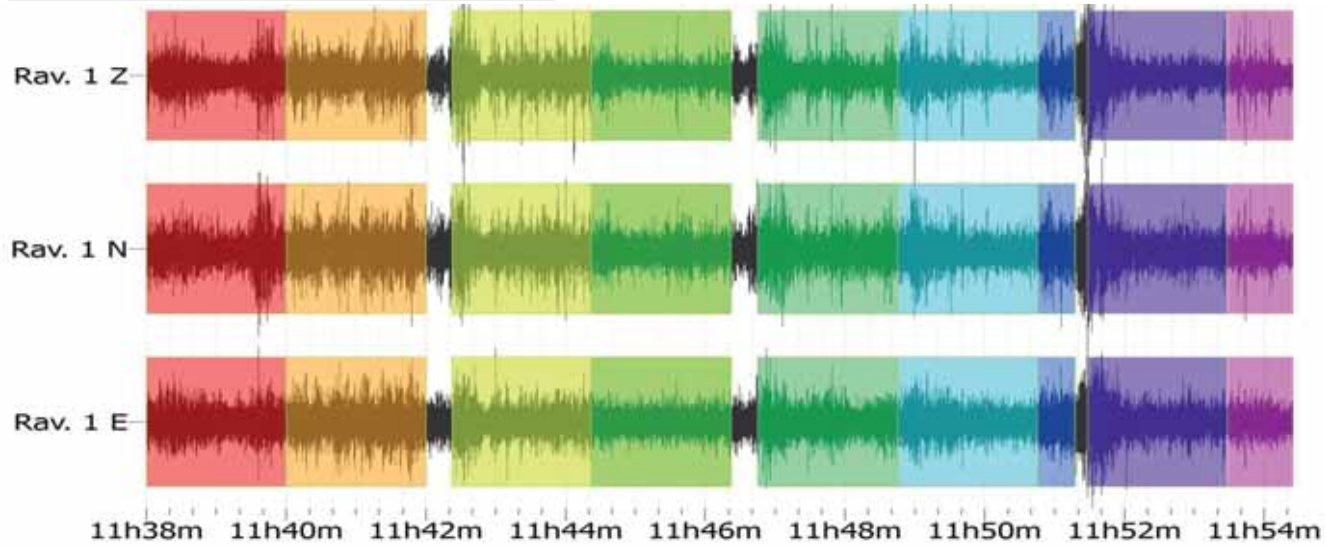
VERIFICHE TECNICHE SU EDIFICI COMPRESI NEL PROGRAMMA Ex ART. 2 COMMA 3 O.P.C.M. 3274/2003 E SS.MM.II.
LOTTO N. 6

INDAGINE SISMICA HVSR

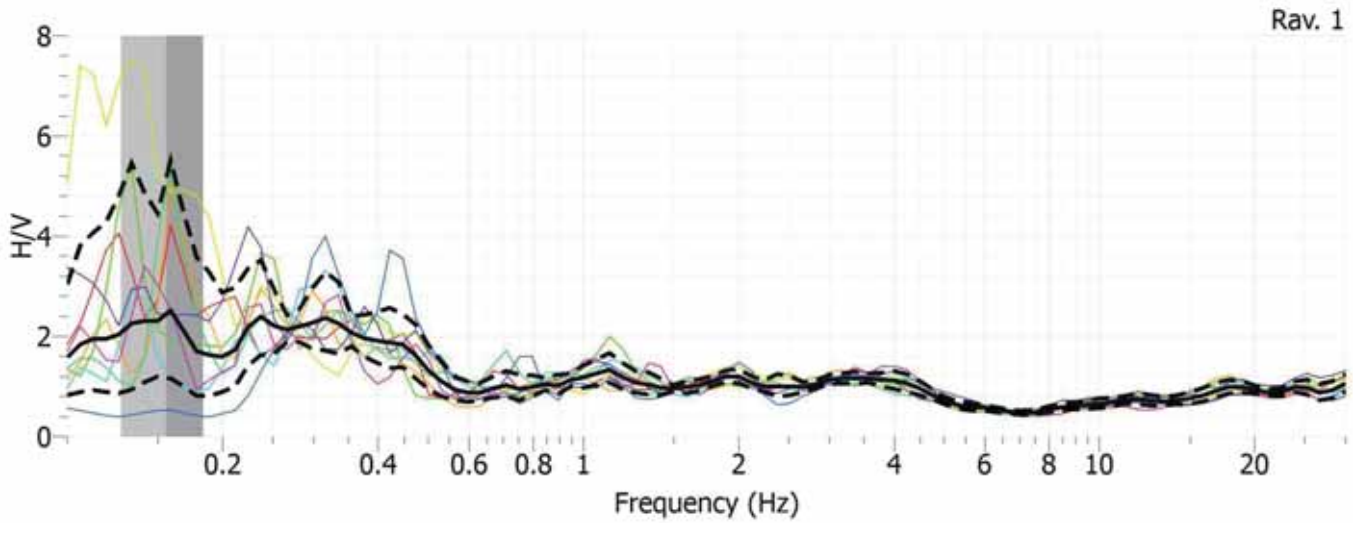
Campo di Atletica E. Marfoglia — *Dr. Geol. Simone SFORNA*

DOCUMENTAZIONE FOTOGRAFICA

ACQUISIZIONE - 20 minuti



RAPPORTO H/V - Frequenza di sito = 0,155 Hz - Dev. standard = 0,01 Hz



PRESIDENZA DEL CONSIGLIO DEI MINISTRI

DIPARTIMENTO DELLA PROTEZIONE CIVILE

UFFICIO SERVIZIO SISMICO NAZIONALE

SCHEDA DI SINTESI DELLA VERIFICA SISMICA DI "LIVELLO 1" O DI "LIVELLO 2" PER GLI EDIFICI STRATEGICI AI FINI DELLA PROTEZIONE CIVILE O RILEVANTI IN CASO DI COLLASSO A SEGUITO DI EVENTO SISMICO

(Ordinanza n. 3274/2003 – Articolo 2, commi 3 e 4)

PARTE GEOLOGICO TECNICA

(Sezz. nn° 1/parte - 5 - 9 - 18 - 19)

Denominazione edificio	CAMPO DI ATLETICA «E.MARFOGLIA»

Coordinate geografiche ED50		
Lat	44,400014	
Lon	12,204311	

5) Dati geomorfologici					
Morfologia del sito				***Fenomeni franosi***	
A ○ Cresta/Dirupo	B ○ Pendio Forte	C ○ Pendio leggero	D ☒ Pianura	E ☒ Assenti	F ○ Presenti

9) Perimetrazione ai sensi del D.L. 180/1998		
SI ○ 0 – NO ☒ 1 **NB:** *In caso affermativo compilare la matrice sottostante*		
	Area R4	Area R3
1) Frana	❑	❑
2) Alluvione	❑	❑

18) Classificazione sismica	
1) Zona sismica:	1 ❍ 2 ❍ 3 ☒ 4 ❍
2) Valore dell'accelerazione orizzontale massima di ancoraggio spettro risposta elastico (suolo A) dedotto da:	0.224
2.1) Allegato 1 all'Ordinanza n. 3274/2003	☒
2.2) Delibera di Giunta Regionale	❍
2.3) Studio più approfondito:	
2.3.1) Mappa di riferimento nazionale (*INGV, 2004*)	❍
2.3.2) Studio regionale	❍
2.3.3) Studio di letteratura	❍
2.3.4) Studio effettuato direttamente	❍

19) Categoria di suolo di fondazione			
1	Metodologia per l'attribuzione della categoria di suolo di fondazione	1) Sulla base di carte geologiche disponibili	❑
		2) Sulla base di indagini esistenti	❑
		3) Sulla base di prove in situ effettuate appositamente	☒
2	Descrizione indagini effettuate o già disponibili	1) Sondaggi geognostici a distruzione o a carotaggio continuo	❑
		2) Prova Standard Penetration Test (SPT) o Cone Penetration Test (CPT)	☒
		3) Prospezione sismica in foro (Down-Hole o Cross-Hole)	❑
		4) Prova sismica superficiale a rifrazione	❑
		5) Analisi granulometrica	❑
		6) Prove triassiali	❑
		7) Prove di taglio diretto	❑
		8) Altro ***PROVA SISMICA MASW***	☒

3	Eventuali anomalie	1) Presenza di cavità				SI ❍ – NO ☒	
		2) Presenza di terreni di fondazione di natura significativamente diversa				SI ❍ – NO ☒	
4	Velocità media onde di taglio V_{s30} 223 m/s	5	Resistenza Penetrometrica media N_{SPT} colpi	6	Resistenza media alla punta q_c kPa	7	Coesione non drenata media c_u kPa
8	Suscettibilità alla liquefazione SI ❍ – NO ☒ **NB:** *In caso affermativo compilare la parte destra*	1) Profondità della falda da piano di campagna				Z_w	
		2) Profondità della fondazione rispetto al piano di campagna				Z_g	
		3) Presenza di terreni a grana grossa sotto la quota di falda entro i primi 15 m di profondità:				SI ❍ – NO ❍	
		Spessore \ densità	sciolte		medie		dense
		3.1) Sabbie fini m	❍		❍		❍
		3.2) Sabbie medie m	❍		❍		❍
		3.3) Sabbie grosse m	❍		❍		❍
9	Categoria di suolo di fondazione C (par 3.1 Ord3274/03)	10	1) Fattore S di amplificazione per profilo stratigrafico 1.37 2) Periodo T_B dello spettro di risposta 0.093 3) Periodo T_c dello spettro di risposta 0.288 a) Valore di Norma ☒ b) Valore desunto in letteratura ❍ c) Valore desunto da analisi specifiche ❍				
11	Coefficiente di amplificazione topografica S_T	1.00					

Dr. Geol. Simone Sforna
(O.R.G.U. N° 112)

Perugia, novembre 2013

ADOTTATTO con Delibera di C.C. N. 182544/105 del 31/10/2017

Studio di geologia
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C.F. SFR SMN 64M05 L216A - P. IVA 01859390542

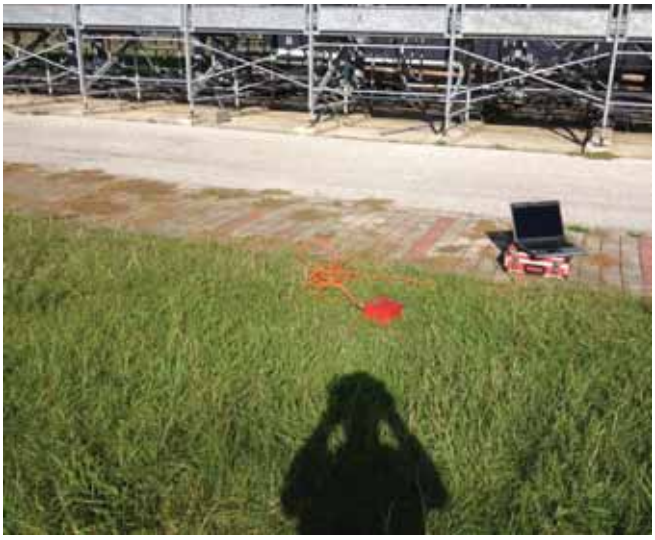
COMUNE DI RAVENNA

VERIFICHE TECNICHE SU EDIFICI COMPRESI NEL PROGRAMMA Ex ART. 2 COMMA 3 O.P.C.M. 3274/2003 E SS.MM.II.
LOTTO N. 6

INDAGINE SISMICA HVSR

Bacino di Canottaggio Standiana — *Dr. Geol. Simone SFORNA*

DOCUMENTAZIONE FOTOGRAFICA



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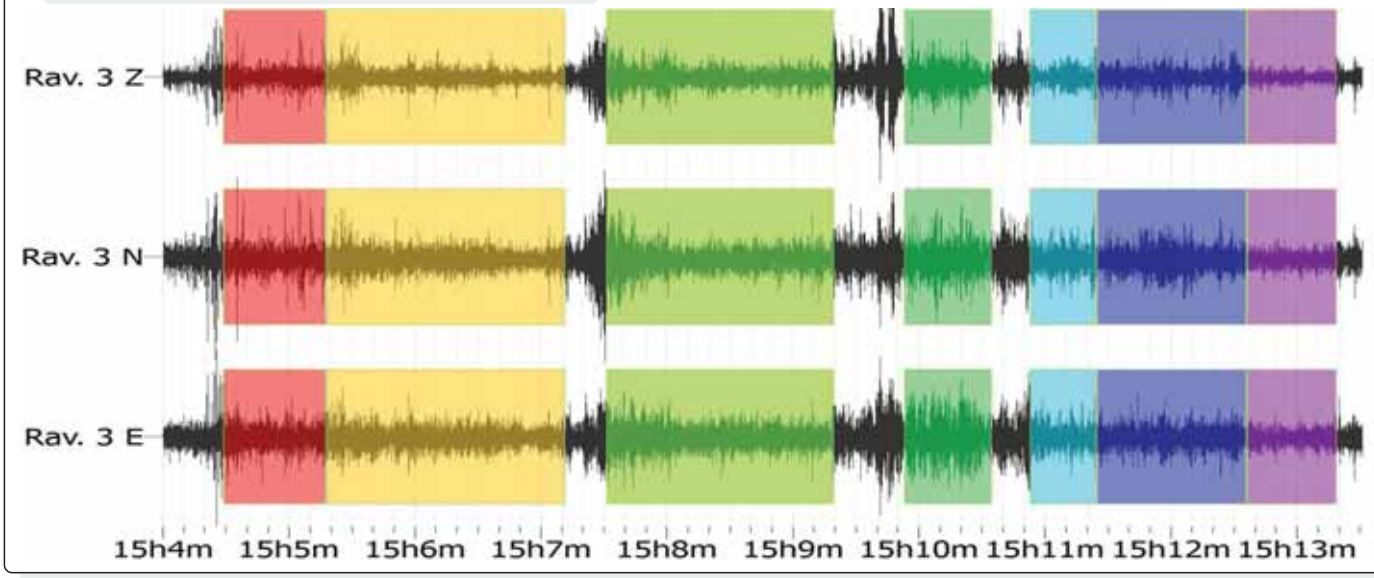
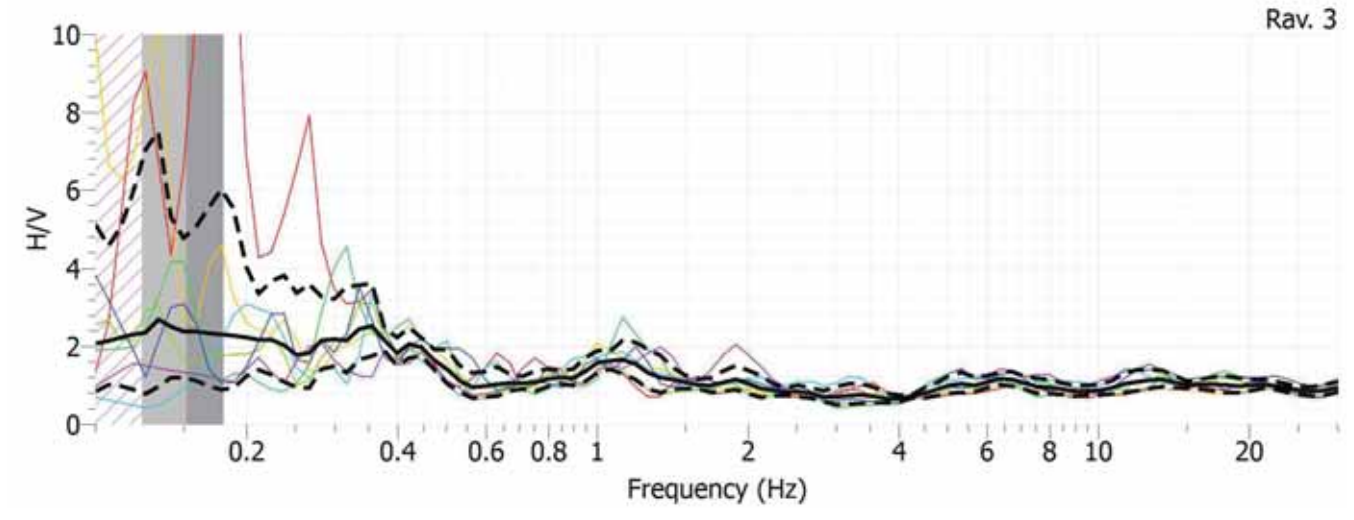


RAPPORTO H/V - Frequenza di sito = 0,151 Hz - Dev. standard = 0,02 Hz



PRESIDENZA DEL CONSIGLIO DEI MINISTRI

DIPARTIMENTO DELLA PROTEZIONE CIVILE

UFFICIO SERVIZIO SISMICO NAZIONALE

SCHEDA DI SINTESI DELLA VERIFICA SISMICA DI "LIVELLO 1" O DI "LIVELLO 2" PER GLI EDIFICI STRATEGICI AI FINI DELLA PROTEZIONE CIVILE O RILEVANTI IN CASO DI COLLASSO A SEGUITO DI EVENTO SISMICO

(Ordinanza n. 3274/2003 – Articolo 2, commi 3 e 4)

PARTE GEOLOGICO TECNICA

(Sezz. nn° 1/parte - 5 - 9 - 18 - 19)

Denominazione edificio	BACINO DI CANOTTAGGIO «STANDIANA»

Coordinate geografiche ED50		
Lat	44,333931	
Lon	12,263599	

5) Dati geomorfologici					
Morfologia del sito				*Fenomeni franosi*	
A ○ Cresta/Dirupo	B ○ Pendio Forte	C ○ Pendio leggero	D X Pianura	E X Assenti	F ○ Presenti

9) Perimetrazione ai sensi del D.L. 180/1998		
SI ○ 0 – NO X 1 **NB:** *In caso affermativo compilare la matrice sottostante*		
	Area R4	Area R3
1) Frana	❑	❑
2) Alluvione	❑	❑

18) Classificazione sismica	
1) Zona sismica:	1 ○ 2 ○ 3 X 4 ○
2) Valore dell'accelerazione orizzontale massima di ancoraggio spettro risposta elastico (suolo A) dedotto da:	0.228
2.1) Allegato 1 all'Ordinanza n. 3274/2003	X
2.2) Delibera di Giunta Regionale	○
2.3) Studio più approfondito:	
2.3.1) Mappa di riferimento nazionale (*INGV, 2004*)	○
2.3.2) Studio regionale	○
2.3.3) Studio di letteratura	○
2.3.4) Studio effettuato direttamente	○

19) Categoria di suolo di fondazione			
1	Metodologia per l'attribuzione della categoria di suolo di fondazione	1) Sulla base di carte geologiche disponibili	❑
		2) Sulla base di indagini esistenti	X
		3) Sulla base di prove in situ effettuate appositamente	X
2	Descrizione indagini effettuate o già disponibili	1) Sondaggi geognostici a distruzione o a carotaggio continuo	❑
		2) Prova Standard Penetration Test (SPT) o Cone Penetration Test (CPT)	X
		3) Prospezione sismica in foro (Down-Hole o Cross-Hole)	❑
		4) Prova sismica superficiale a rifrazione	❑
		5) Analisi granulometrica	❑
		6) Prove triassiali	❑
		7) Prove di taglio diretto	❑
		8) Altro ***PROVA SISMICA MASW***	X

3	Eventuali anomalie	1) Presenza di cavità				SI ○ 0 – NO X 1	
		2) Presenza di terreni di fondazione di natura significativamente diversa				SI ○ 0 – NO X 1	
4	Velocità media onde di taglio V_{s30} 186 m/s	5	Resistenza Penetrometrica media N_{SPT} ___ colpi	6	Resistenza media alla punta q_c ___ kPa	7	Coesione non drenata media c_u ___ kPa
8	Suscettibilità alla liquefazione SI ○ 0 – NO X 1 **NB:** *In caso affermativo compilare la parte destra*	1) Profondità della falda da piano di campagna				Z_w __.__	
		2) Profondità della fondazione rispetto al piano di campagna				Z_g __.__	
		3) Presenza di terreni a grana grossa sotto la quota di falda entro i primi 15 m di profondità:				SI ○ 0 – NO ○ 1	
		Spessore \ densità	sciolte		medie		dense
		3.1) Sabbie fini m __	○		○		○
		3.2) Sabbie medie m __	○		○		○
		3.3) Sabbie grosse m __	○		○		○
9	Categoria di suolo di fondazione C (par 3.1 Ord3274/03)	10	1) Fattore S di amplificazione per profilo stratigrafico 1.37 2) Periodo T_B dello spettro di risposta 0.097 3) Periodo T_c dello spettro di risposta 0.290 a) Valore di Norma X b) Valore desunto in letteratura ○ c) Valore desunto da analisi specifiche ○				
11	Coefficiente di amplificazione topografica S_T	1.00					

Dr. Geol. Simone Sforna
(O.R.G.U. N° 112)

Perugia, novembre 2013

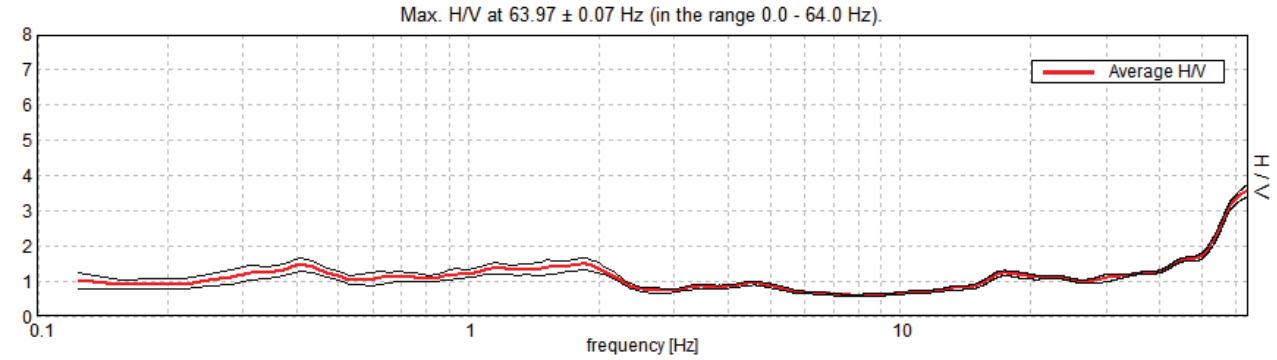
HVSR57A

T50

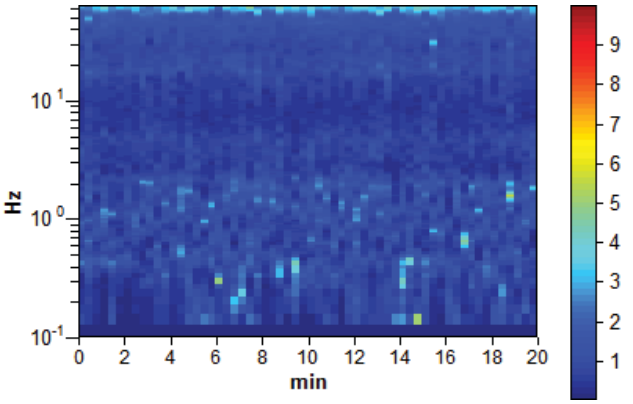
Instrument: TR-0007-01-05
Start recording: 22/08/14 09:46:33 End recording: 22/08/14 10:06:34
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

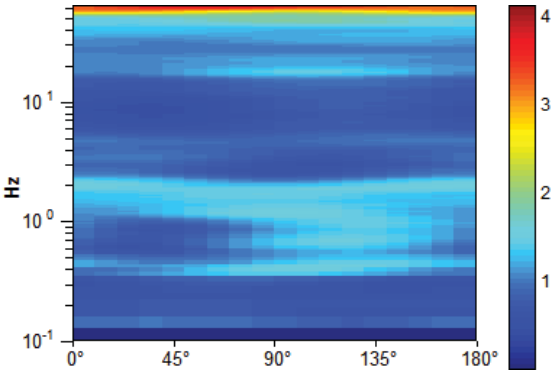
HORIZONTAL TO VERTICAL SPECTRAL RATIO



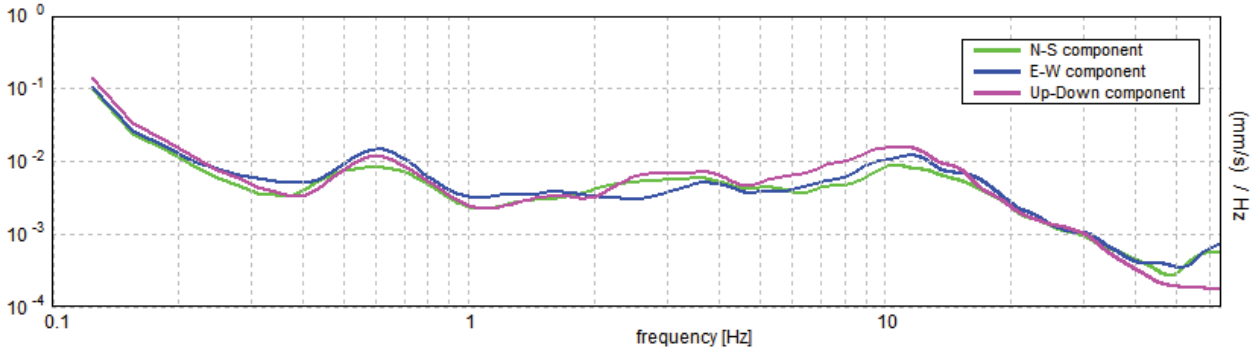
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 63.97 ± 0.07 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	63.97 > 0.50	OK	
$n_c(f_0) > 200$	76762.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1026 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	50.625 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	3.56 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00051| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.03235 < 3.19844	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0862 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

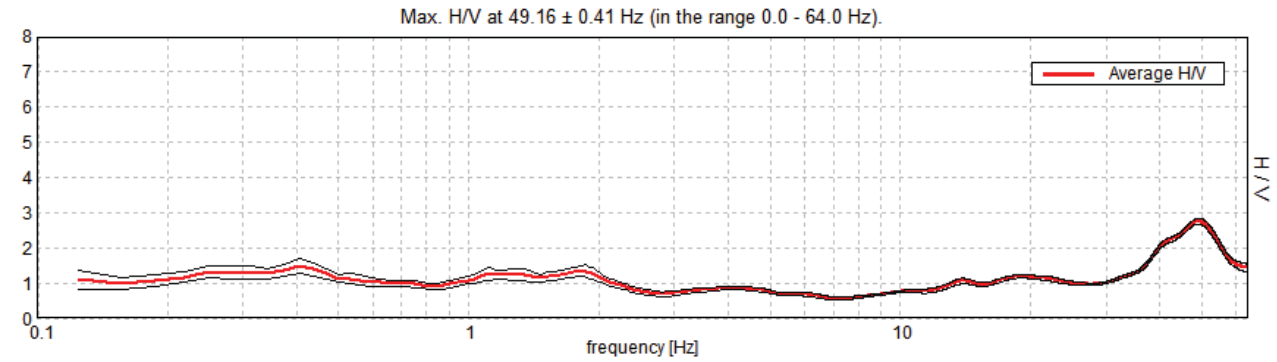
Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

HVSR58A

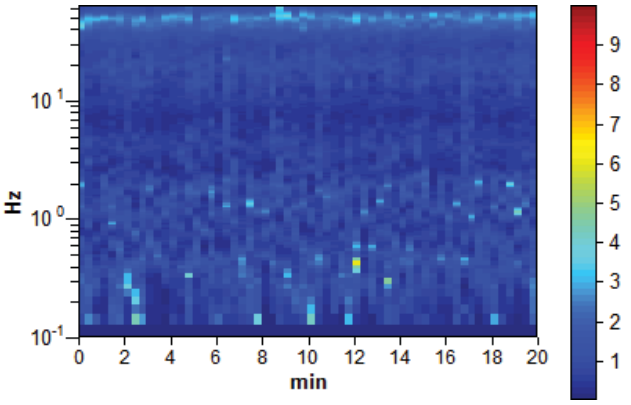
T51
Instrument: TRS-0004/00-06
Start recording: 22/08/14 09:58:45 End recording: 22/08/14 10:18:46
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

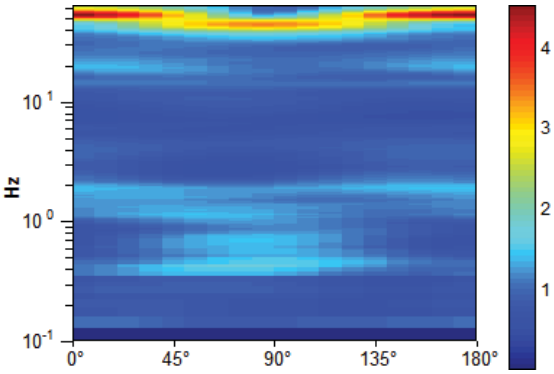
HORIZONTAL TO VERTICAL SPECTRAL RATIO



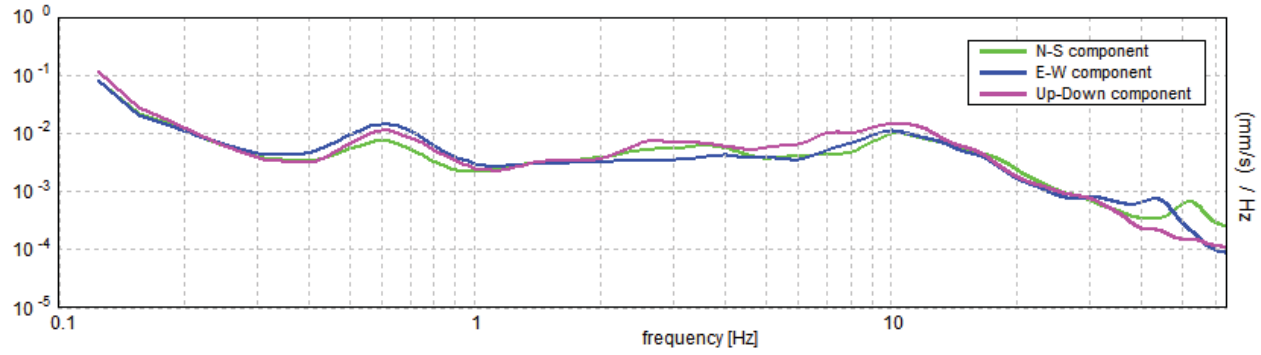
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 49.16 ± 0.41 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	49.16 > 0.50	OK	
$n_c(f_0) > 200$	58987.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1262 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	36.0 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.75 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00413| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.20312 < 2.45781	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0388 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

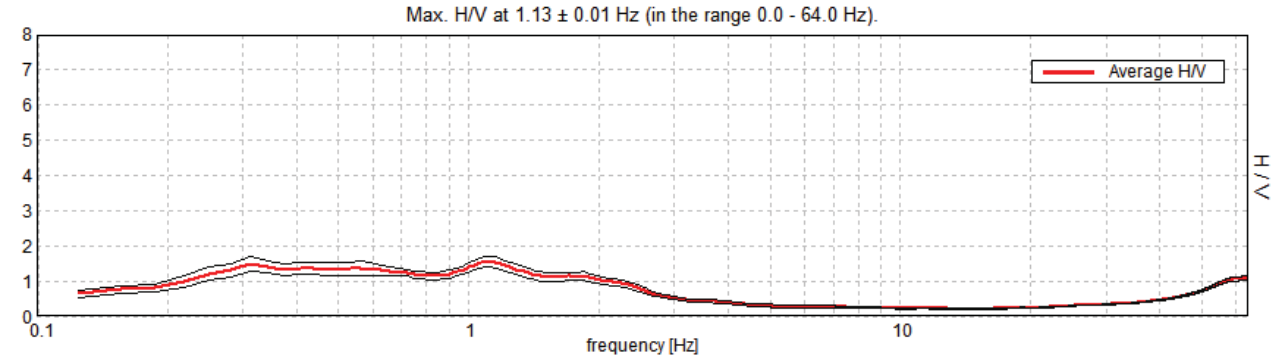
HVSR59A

T52

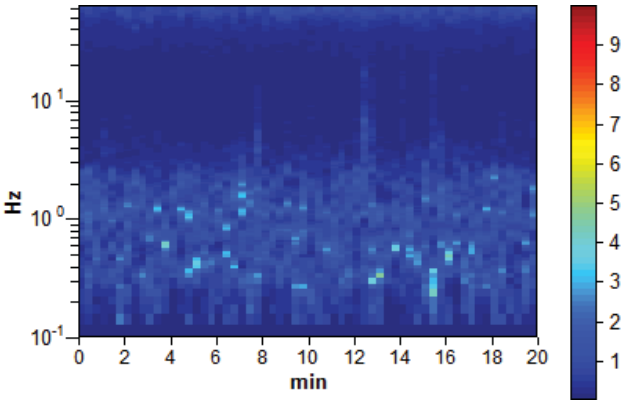
Instrument: TR-0007-01-05
Start recording: 22/08/14 10:21:32 End recording: 22/08/14 10:41:33
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

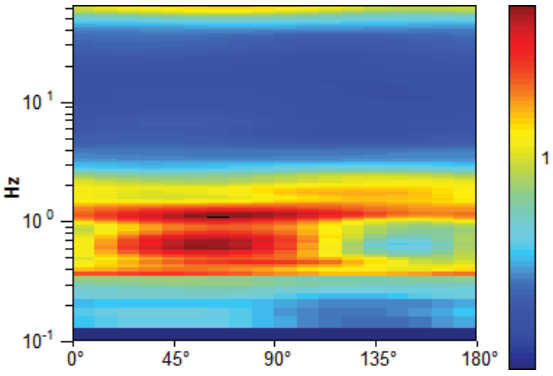
HORIZONTAL TO VERTICAL SPECTRAL RATIO



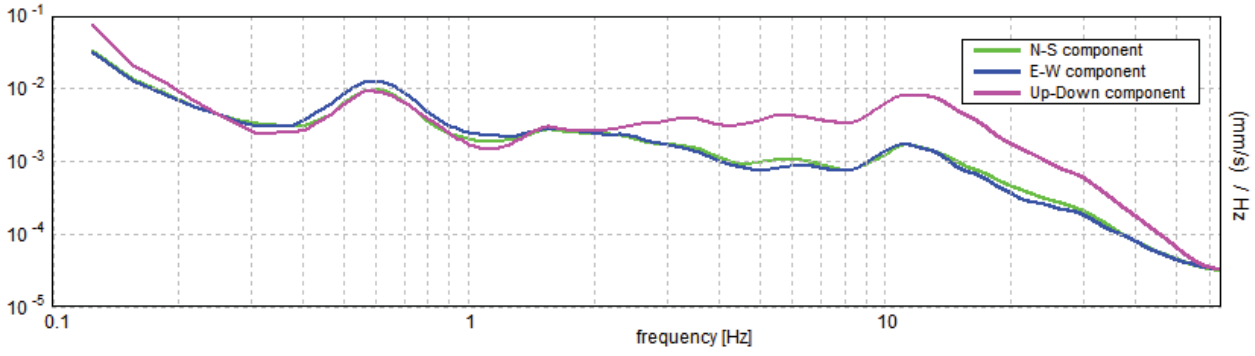
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 1.13 ± 0.01 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.13 > 0.50	OK	
$n_c(f_0) > 200$	1350.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 55 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	2.531 Hz	OK	
$A_0 > 2$	1.54 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00595| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.00669 < 0.1125	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0748 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

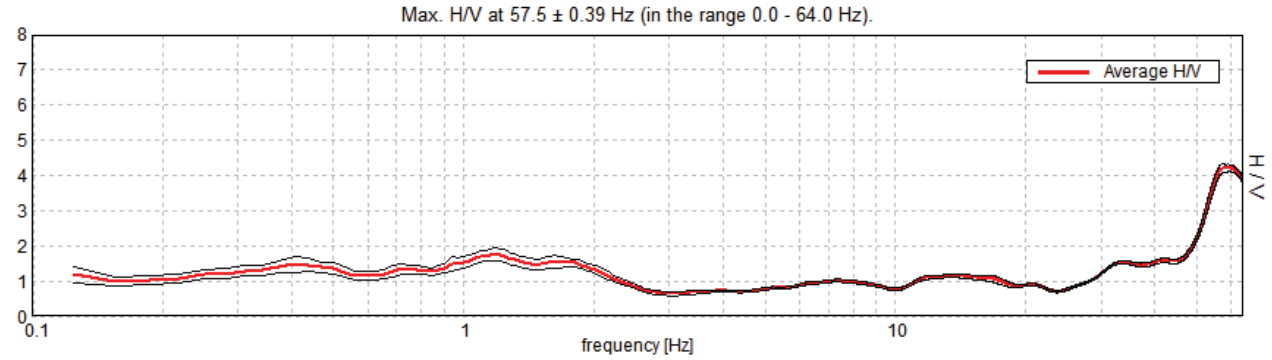
HVSR60A

T53

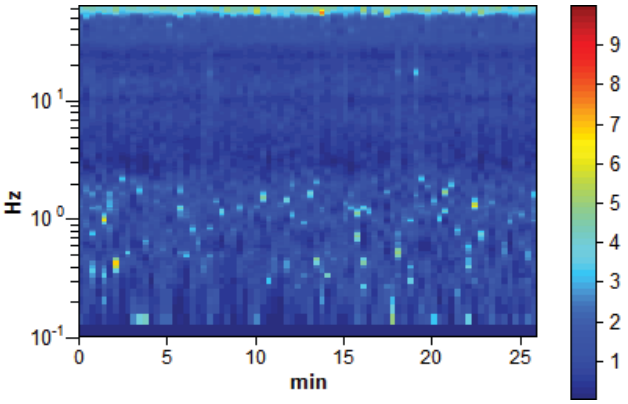
Instrument: TRS-0004/00-06
Start recording: 22/08/14 10:30:45 End recording: 22/08/14 10:56:46
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h26'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

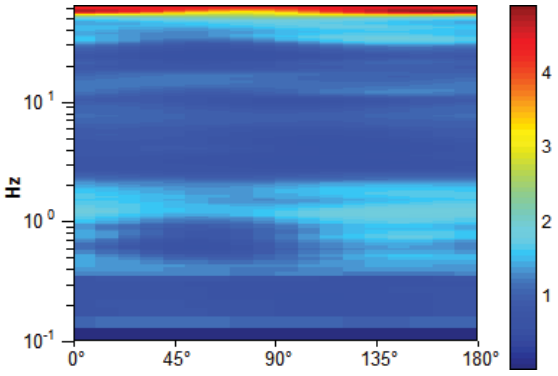
HORIZONTAL TO VERTICAL SPECTRAL RATIO



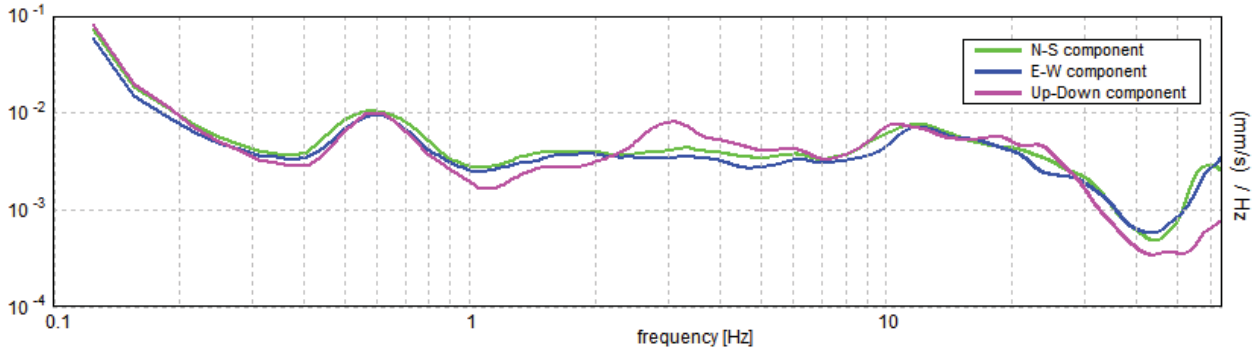
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 57.5 ± 0.39 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	57.50 > 0.50	OK	
$n_c(f_0) > 200$	89700.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1129 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	49.438 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	4.22 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00338| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.19419 < 2.875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0592 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

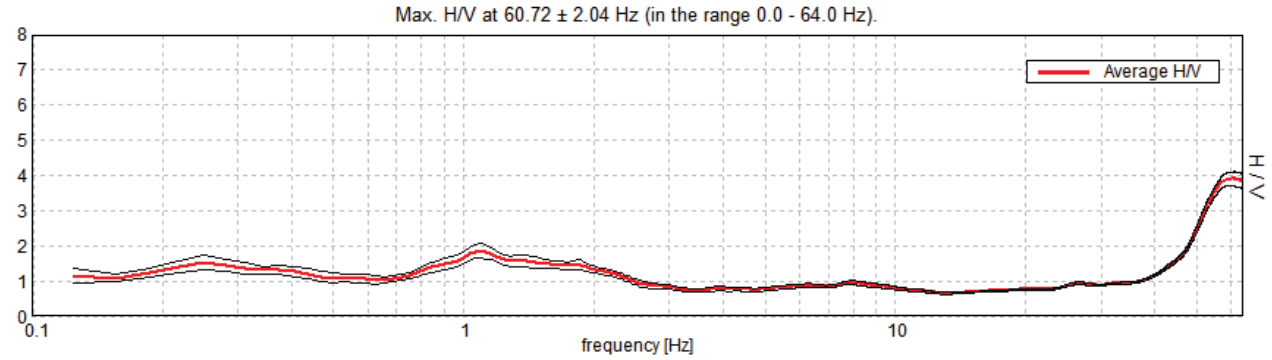
HVSR61A

T55

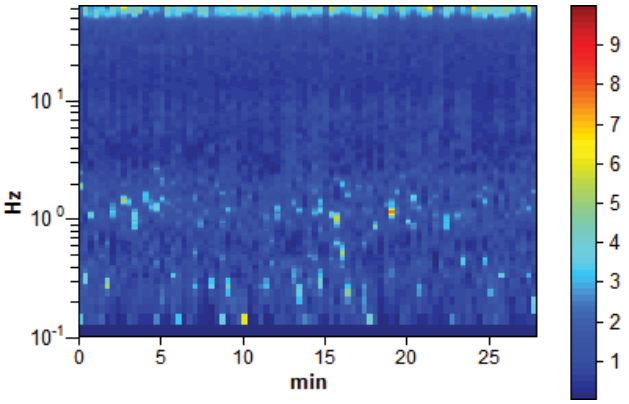
Instrument: TRS-0004/00-06
Start recording: 22/08/14 11:08:24 End recording: 22/08/14 11:36:25
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h28'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

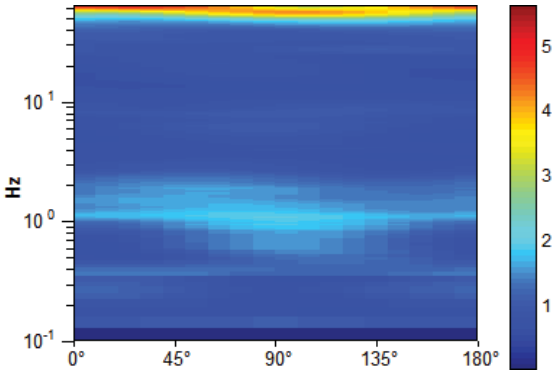
HORIZONTAL TO VERTICAL SPECTRAL RATIO



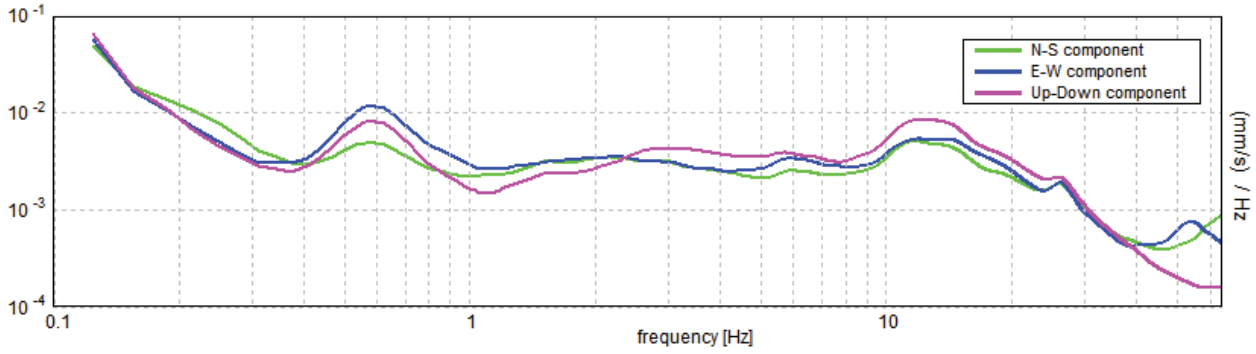
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 60.72 ± 2.04 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	60.72 > 0.50	OK	
$n_c(f_0) > 200$	102007.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1078 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	47.563 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	3.90 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01683| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	1.02169 < 3.03594	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1026 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

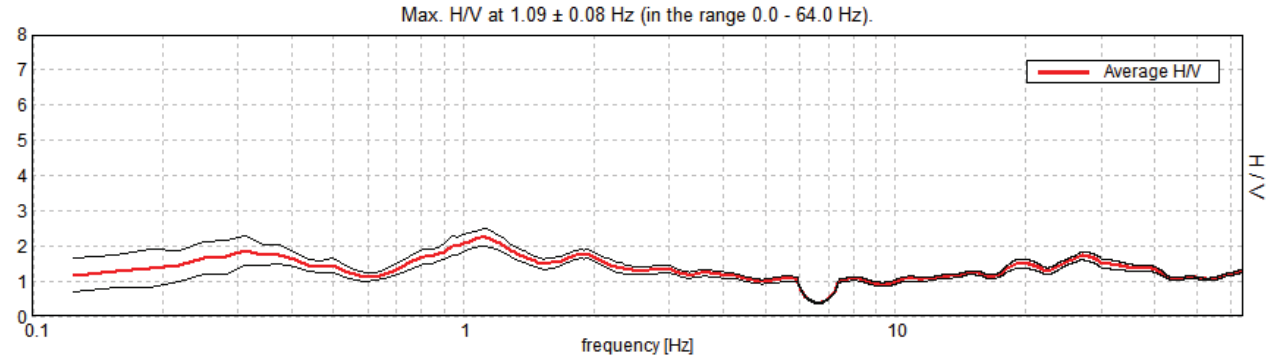
HVSR62A

T54

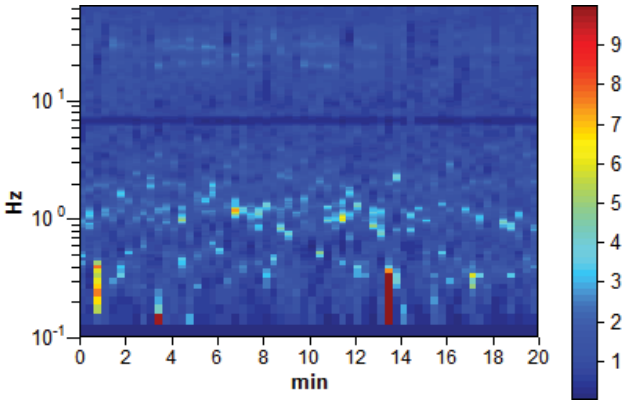
Instrument: TR-0007-01-05
Start recording: 22/08/14 10:59:06 End recording: 22/08/14 11:19:07
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

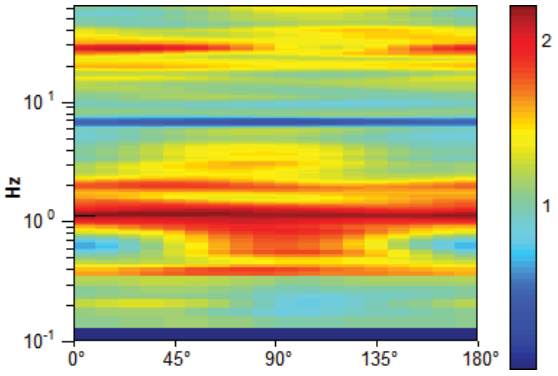
HORIZONTAL TO VERTICAL SPECTRAL RATIO



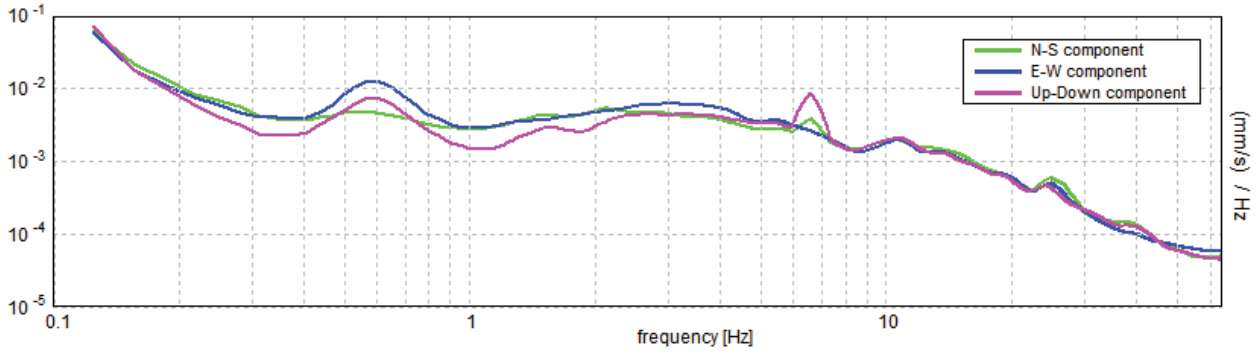
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 1.09 ± 0.08 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.09 > 0.50	OK	
$n_c(f_0) > 200$	1312.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 54 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	4.344 Hz	OK	
$A_0 > 2$	2.23 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03497| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.03825 < 0.10938	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1173 < 1.78	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

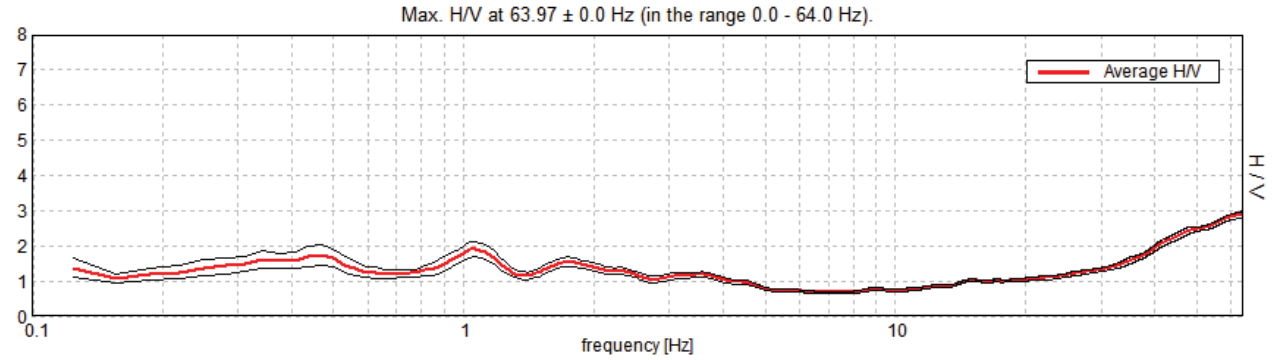
HVSR63A

T56

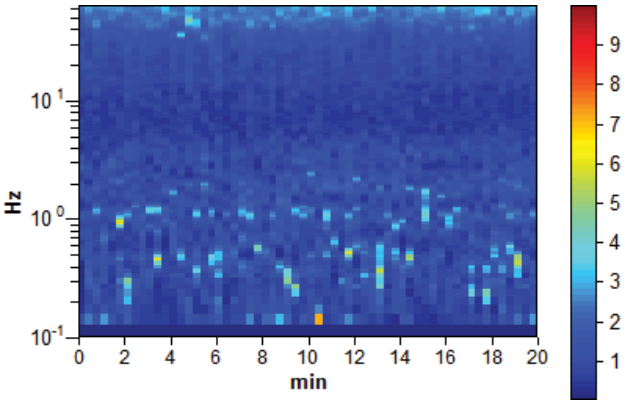
Instrument: TR-0007-01-05
Start recording: 22/08/14 11:40:49 End recording: 22/08/14 12:00:50
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

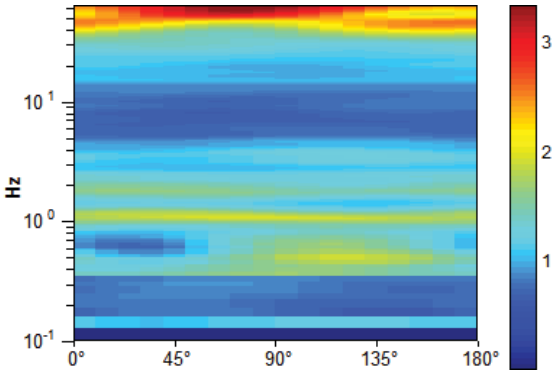
HORIZONTAL TO VERTICAL SPECTRAL RATIO



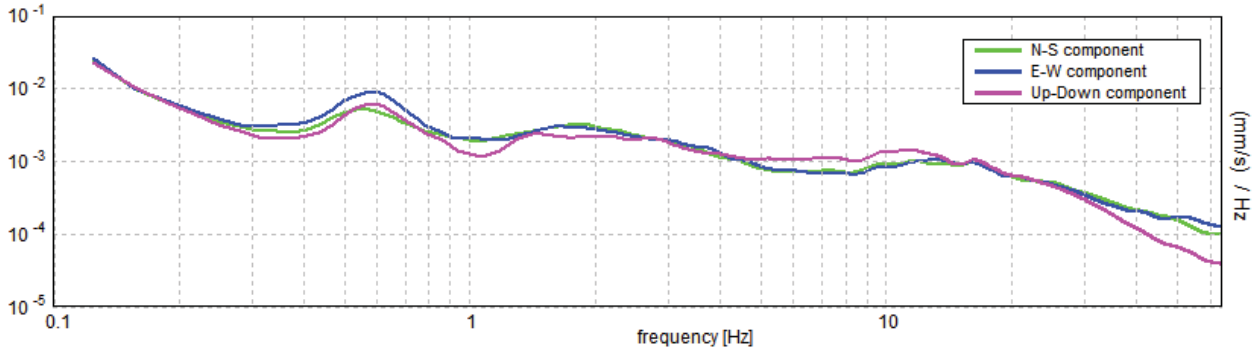
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 63.97 ± 0.0 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	63.97 > 0.50	OK	
$n_c(f_0) > 200$	76762.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1026 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	33.0 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.90 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.0 < 3.19844	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0477 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

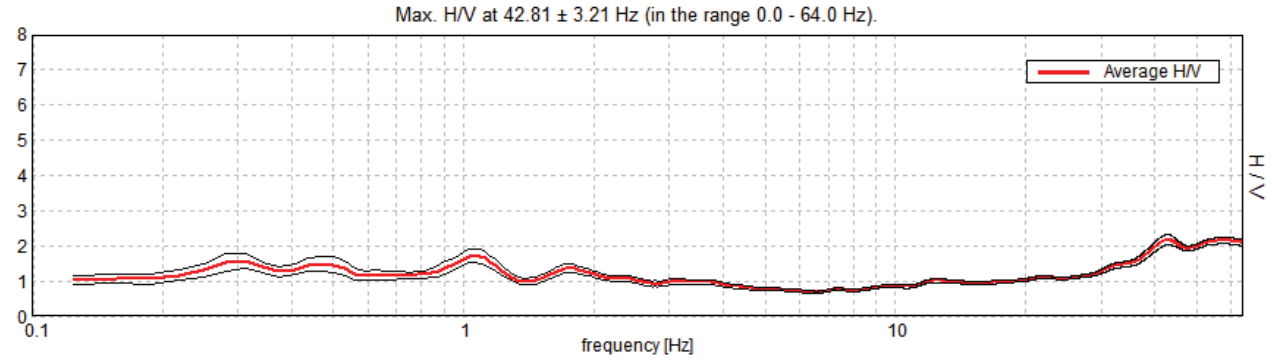
HVSR64A

T57

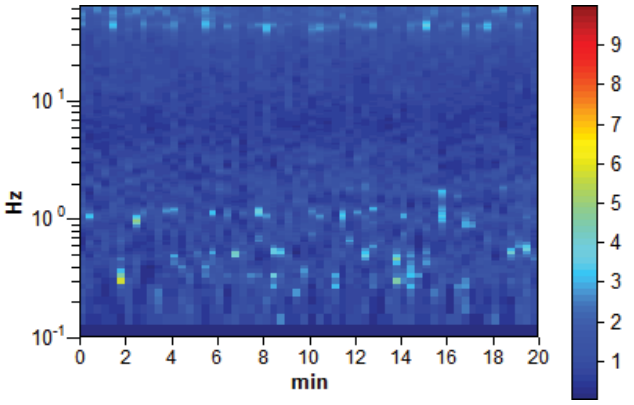
Instrument: TRS-0004/00-06
Start recording: 22/08/14 11:54:10 End recording: 22/08/14 12:14:11
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

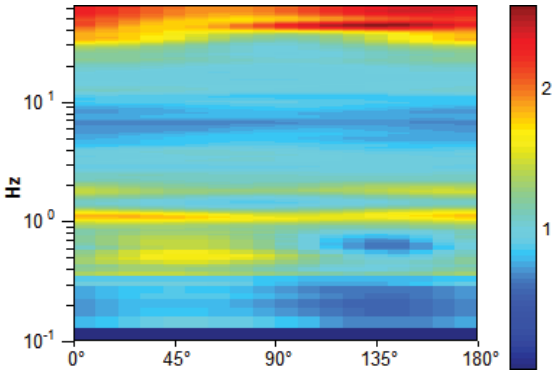
HORIZONTAL TO VERTICAL SPECTRAL RATIO



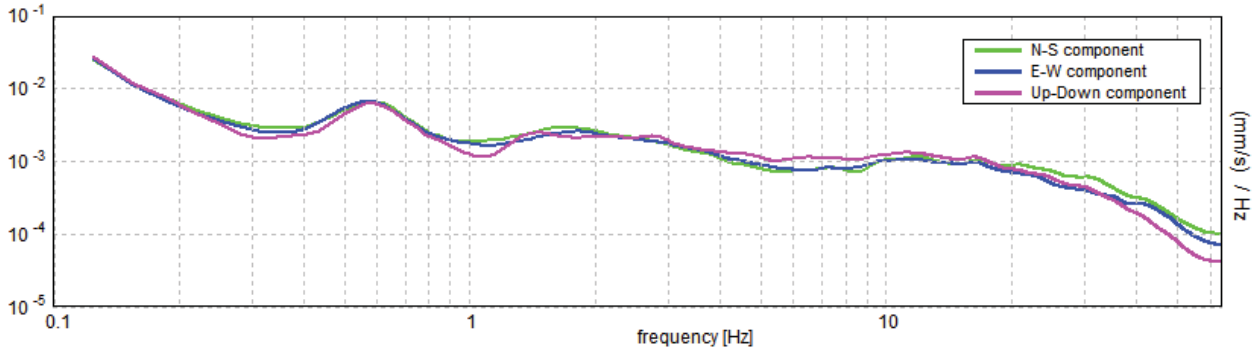
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 42.81 ± 3.21 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	42.81 > 0.50	OK	
$n_c(f_0) > 200$	51375.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1364 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	25.344 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.18 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03716| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	1.59096 < 2.14063	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0726 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

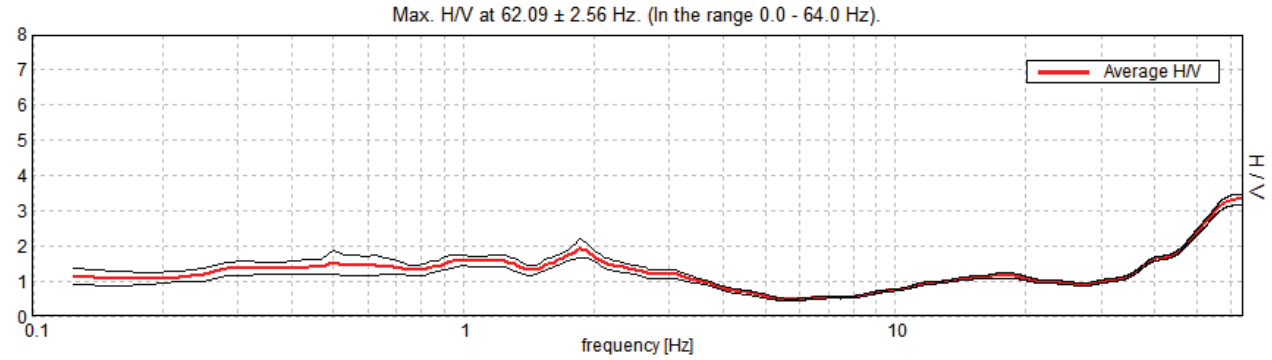
HVSR65A

T58

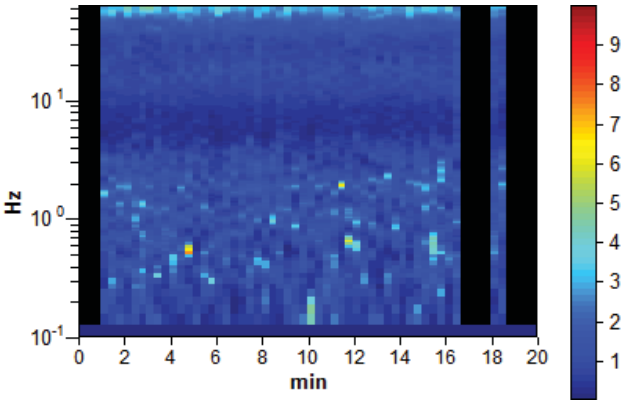
Instrument: TR-0007-01-05
Start recording: 22/08/14 12:25:09 End recording: 22/08/14 12:45:10
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 82% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

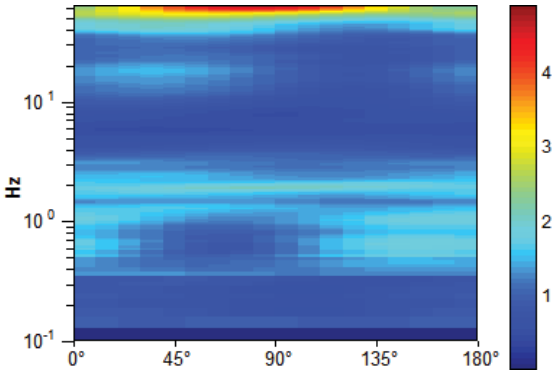
HORIZONTAL TO VERTICAL SPECTRAL RATIO



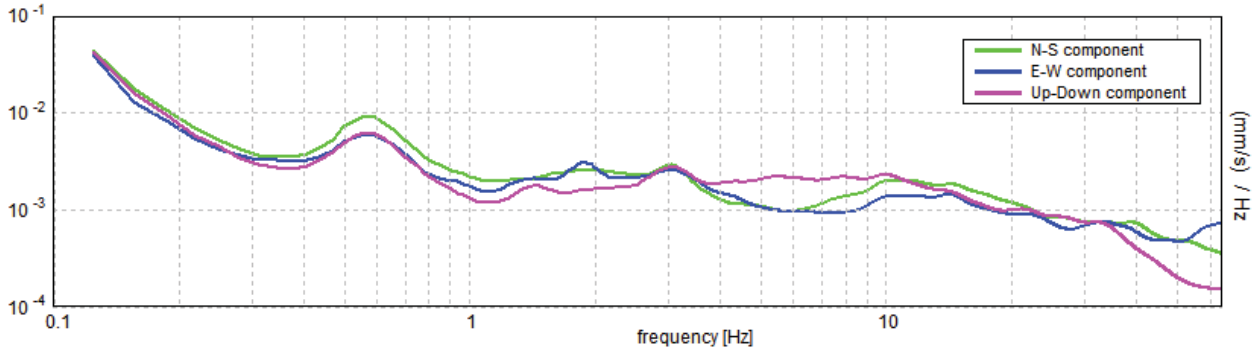
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 62.09 ± 2.56 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	62.09 > 0.50	OK	
$n_c(f_0) > 200$	60851.9 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1056 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	41.281 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	3.32 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02025| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	1.25753 < 3.10469	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0729 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

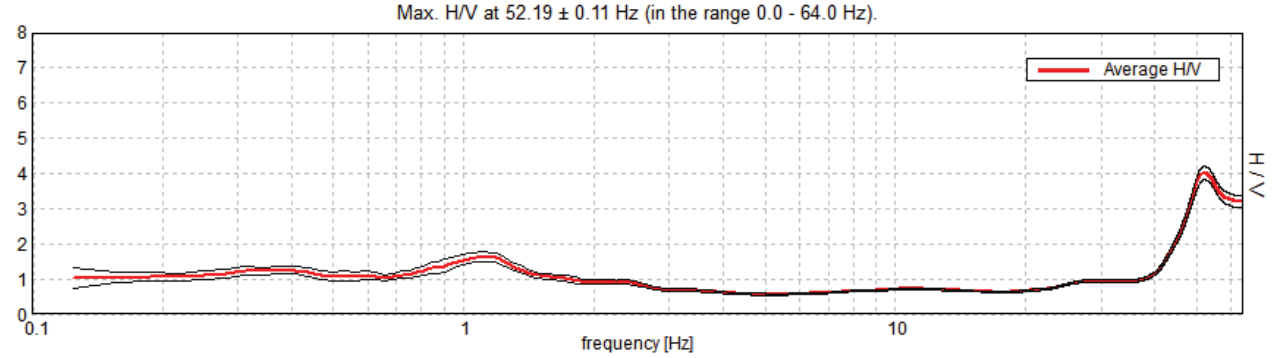
HVSR66A

T59

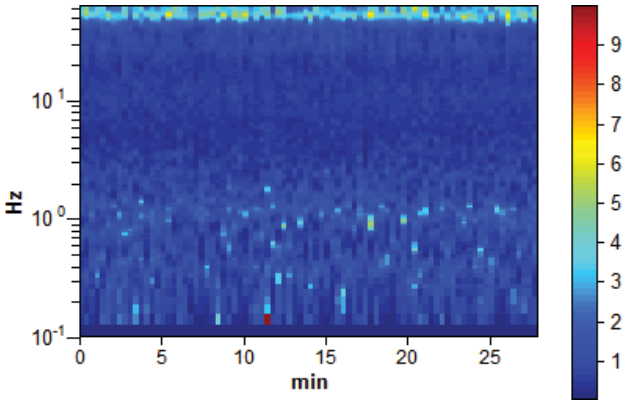
Instrument: TRS-0004/00-06
Start recording: 22/08/14 12:28:49 End recording: 22/08/14 12:56:50
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h28'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

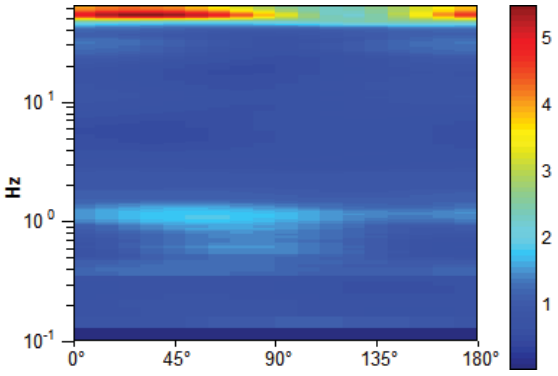
HORIZONTAL TO VERTICAL SPECTRAL RATIO



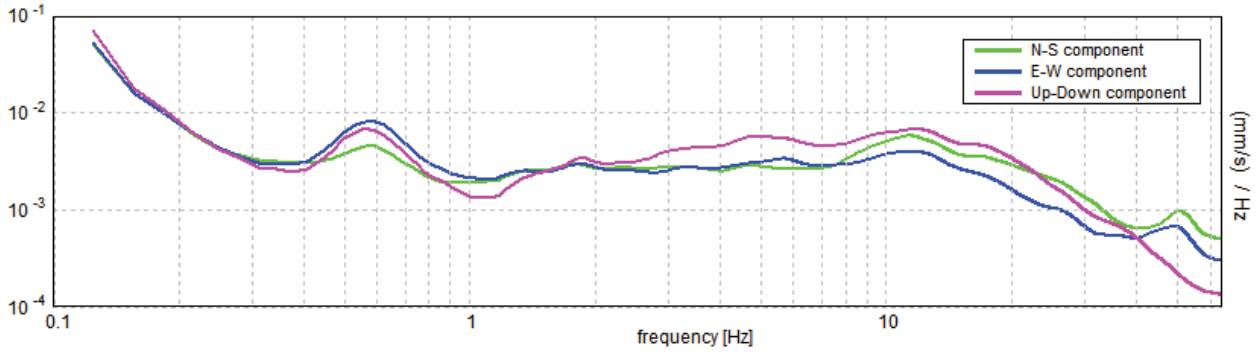
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 52.19 ± 0.11 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	52.19 > 0.50	OK	
$n_c(f_0) > 200$	87675.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1214 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	44.375 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	4.01 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00108| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.05618 < 2.60938	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0961 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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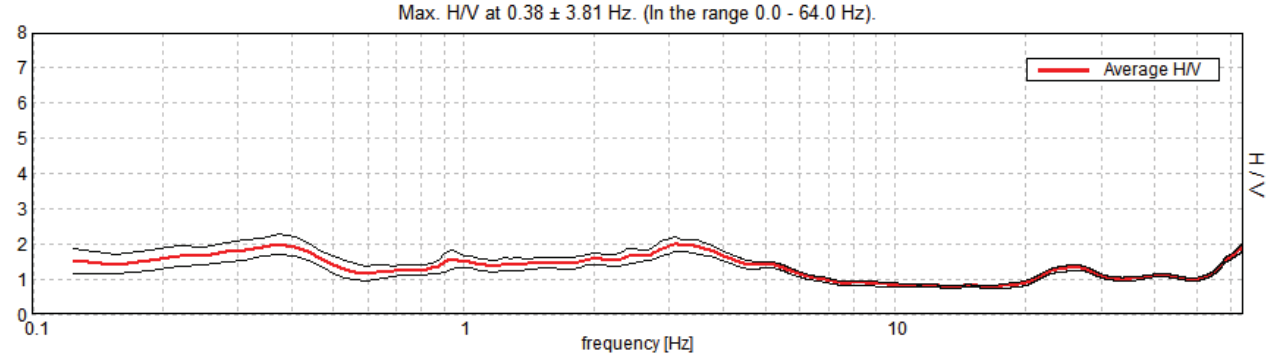
HVSR67A

T60

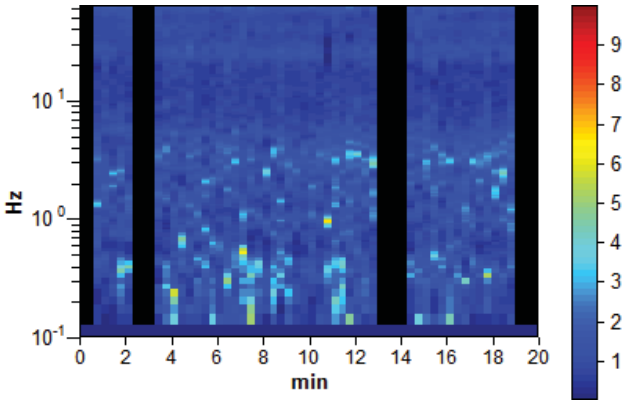
Instrument: TR-0007-01-05
Start recording: 22/08/14 13:13:35 End recording: 22/08/14 13:33:36
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analyzed 80% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

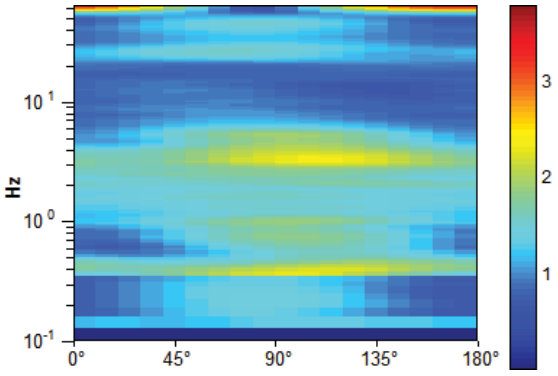
HORIZONTAL TO VERTICAL SPECTRAL RATIO



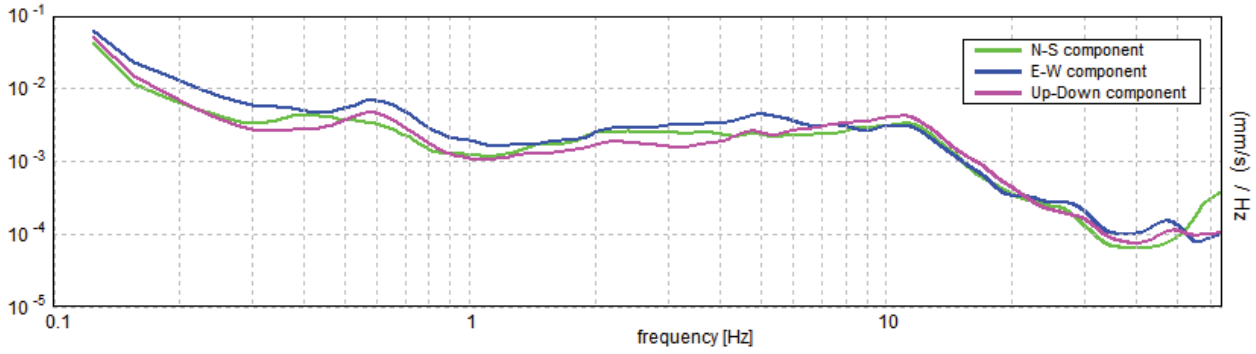
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 0.38 ± 3.81 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.38 > 0.50		NO
$n_c(f_0) > 200$	360.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 19 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.98 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|5.0017| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.87564 < 0.075		NO
$\sigma_A(f_0) < \theta(f_0)$	0.1462 < 2.5	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

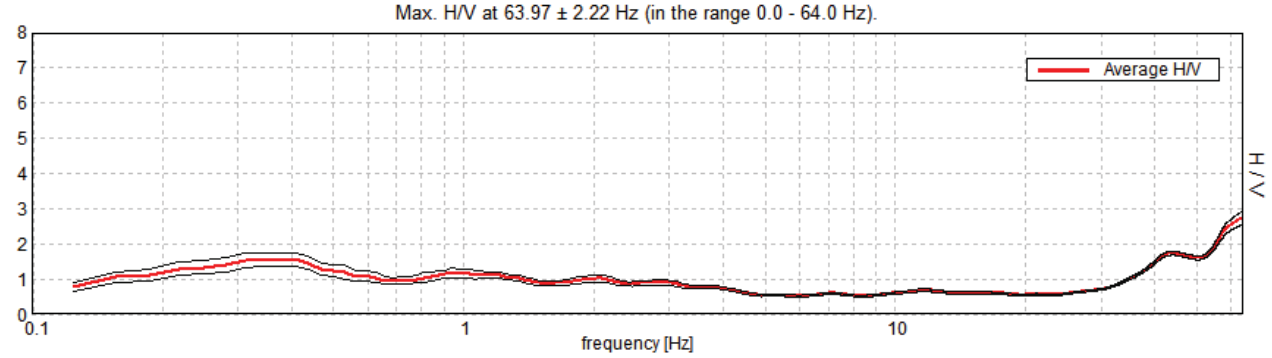
HVSR68A

T61

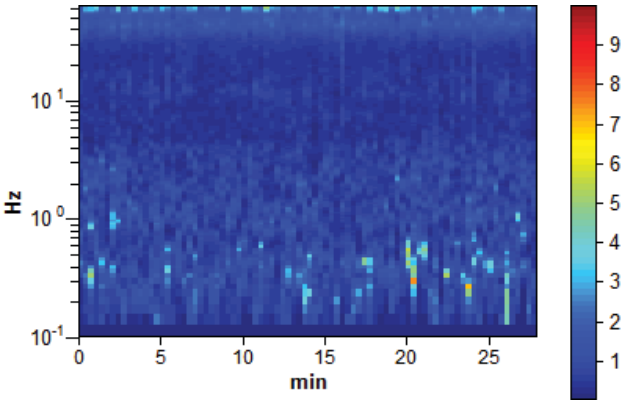
Instrument: TRS-0004/00-06
Start recording: 22/08/14 13:18:04 End recording: 22/08/14 13:46:05
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h28'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

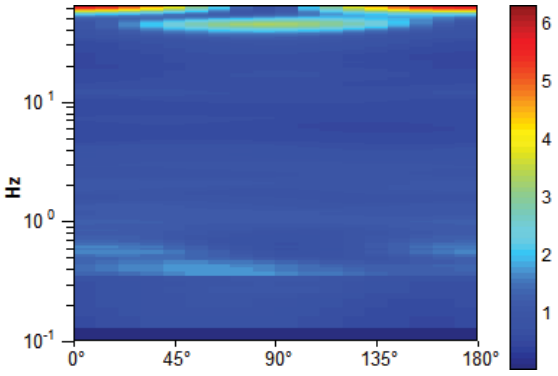
HORIZONTAL TO VERTICAL SPECTRAL RATIO



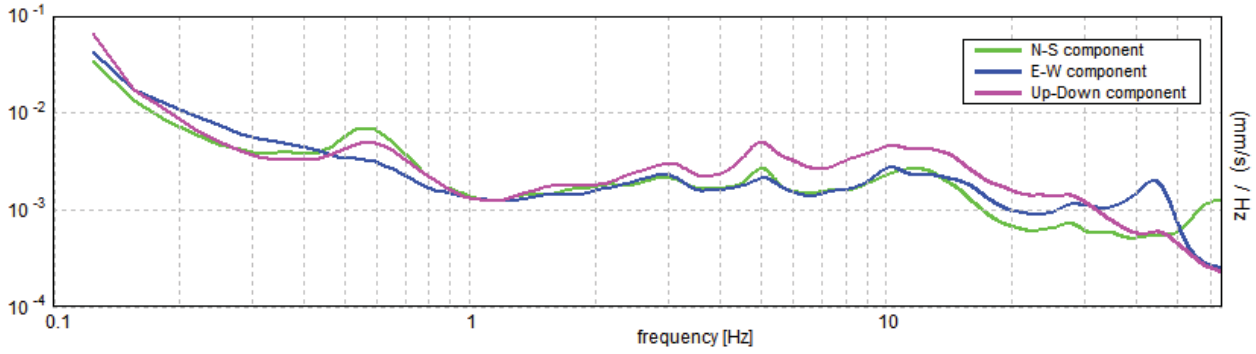
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the** *Grilla* **manual before interpreting the following tables**.]

Max. H/V at 63.97 ± 2.22 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	63.97 > 0.50	OK	
$n_c(f_0) > 200$	107467.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1026 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	38.938 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.73 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01735| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	1.10963 < 3.19844	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0945 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

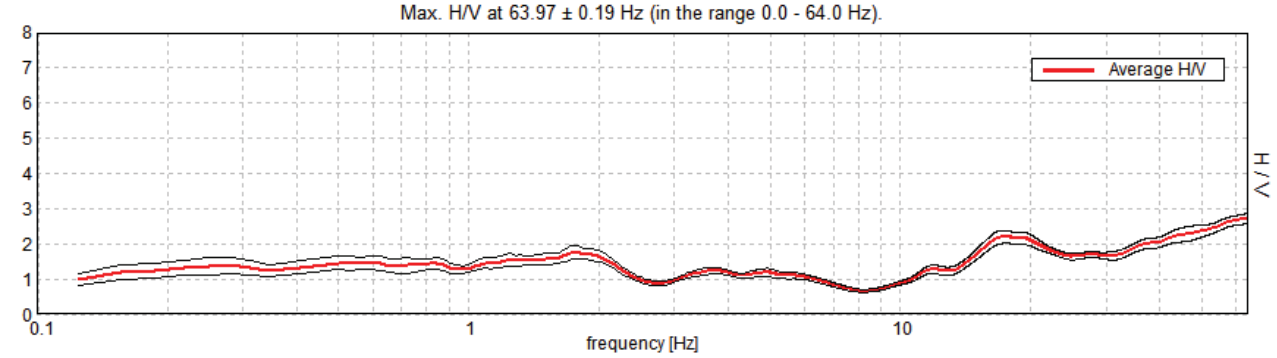
HVSR69A

T62

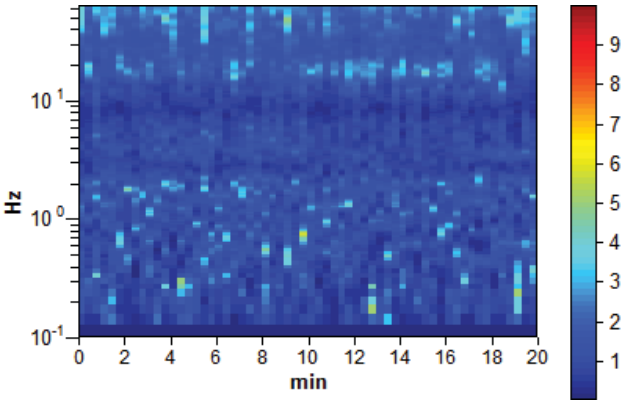
Instrument: TR-0007-01-05
Start recording: 22/08/14 15:15:31 End recording: 22/08/14 15:35:32
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

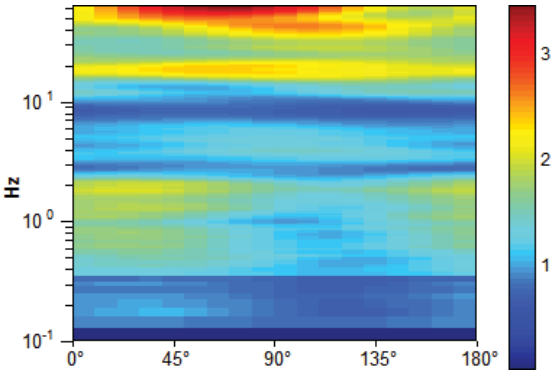
HORIZONTAL TO VERTICAL SPECTRAL RATIO



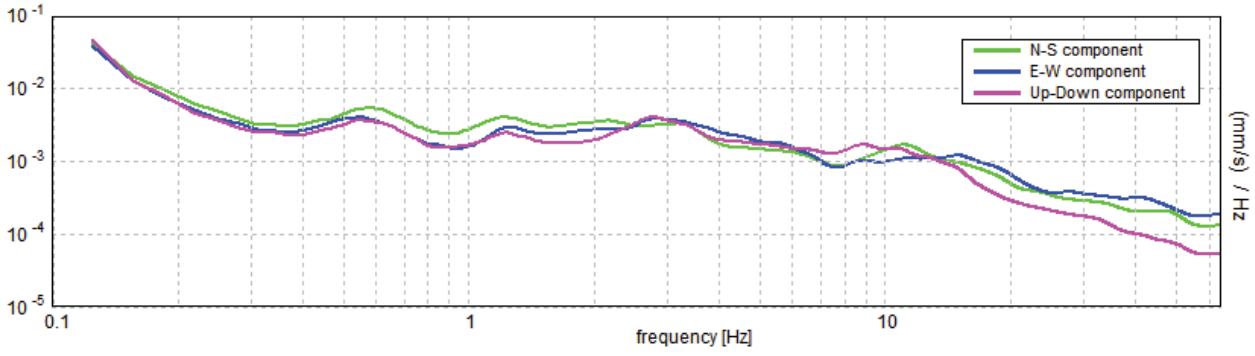
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the *Grilla* manual before interpreting the following tables**.]

Max. H/V at 63.97 ± 0.19 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	63.97 > 0.50	OK	
$n_c(f_0) > 200$	76762.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 1026 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.71 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00145| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.09249 < 3.19844	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0739 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

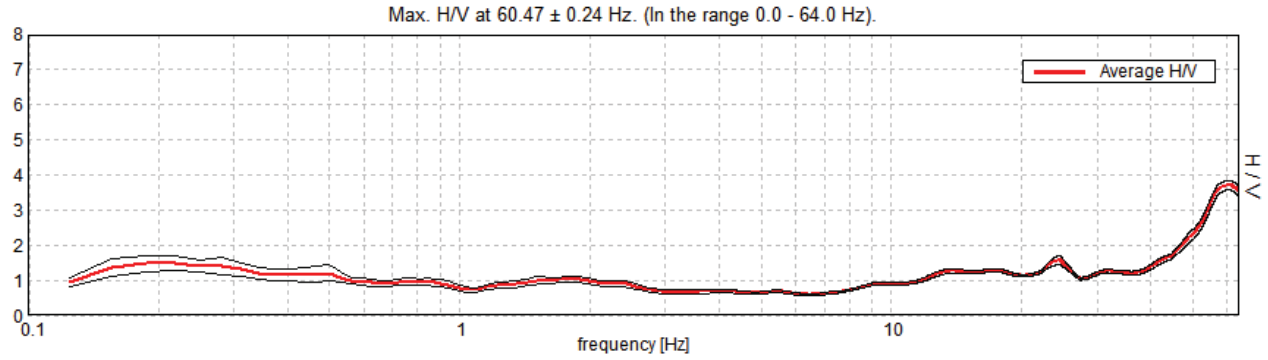
HVSR70A

T79

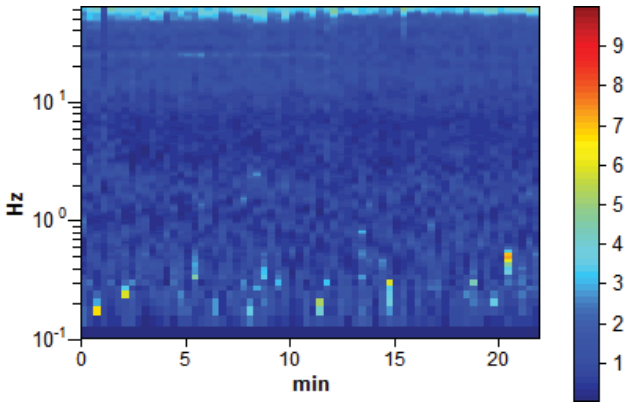
Instrument: TRS-0004/00-06
Start recording: 15/04/14 18:09:55 End recording: 15/04/14 18:31:55
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h22'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

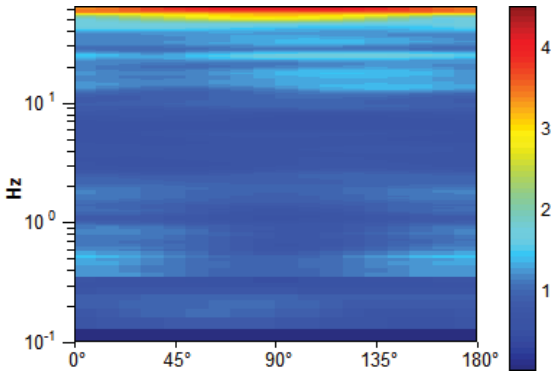
HORIZONTAL TO VERTICAL SPECTRAL RATIO



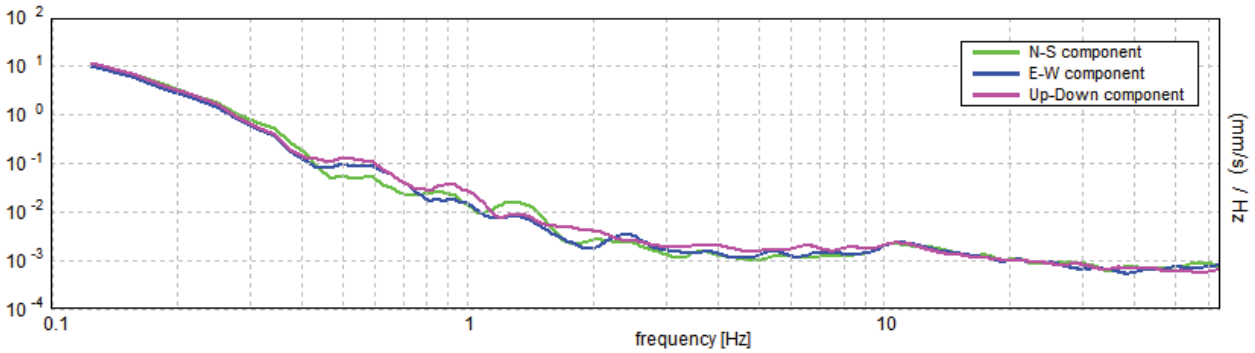
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the *Grilla* manual before interpreting the following tables**.]

Max. H/V at 60.47 ± 0.24 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	60.47 > 0.50	OK	
$n_c(f_0) > 200$	79818.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1082 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	46.0 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	3.70 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00193| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.117 < 3.02344	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.0665 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

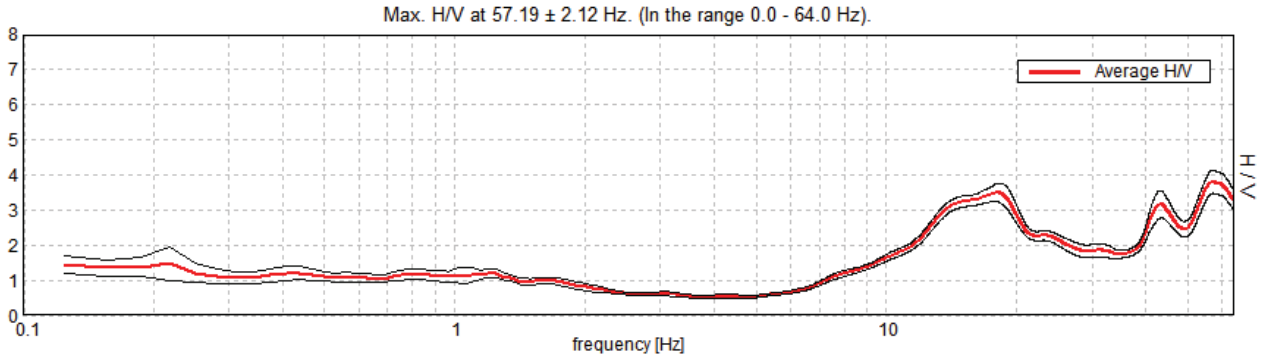
HVSR71A

T78

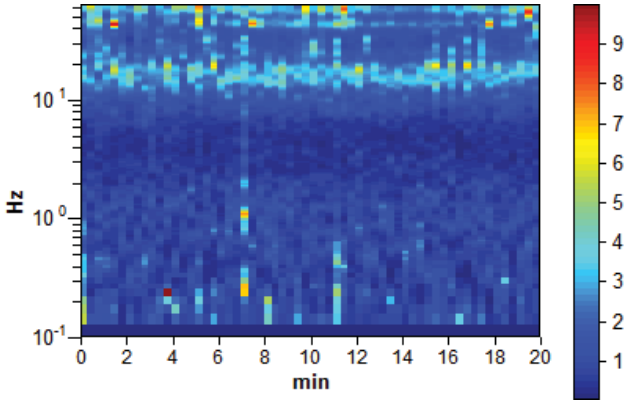
Instrument: TRS-0004/00-06
Start recording: 12/07/13 08:13:13 End recording: 12/07/13 08:33:14
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling frequency: 128 Hz
Window size: 20 s
Smoothing window: Triangular window
Smoothing: 10%

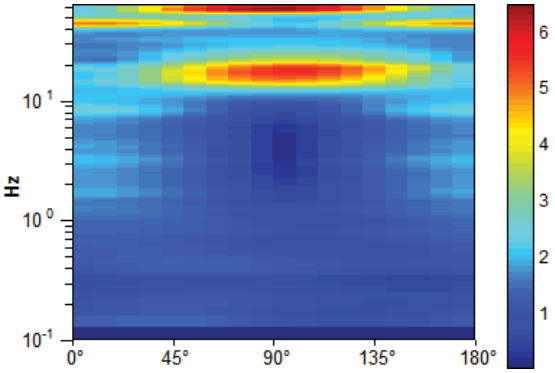
HORIZONTAL TO VERTICAL SPECTRAL RATIO



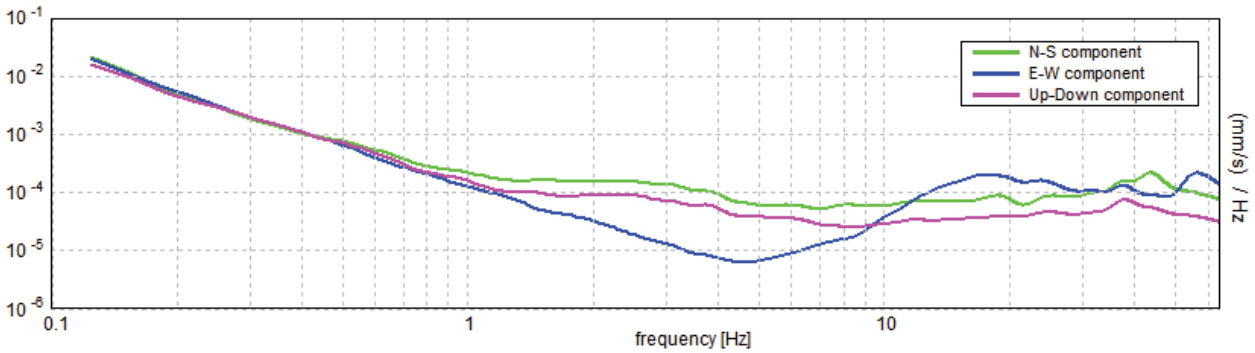
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



[According to the Sesame, 2005 guidelines. **Please read carefully the *Grilla* manual before interpreting the following tables**.]

Max. H/V at 57.19 ± 2.12 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable HVSR curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	57.19 > 0.50	OK	
$n_c(f_0) > 200$	68625.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 1134 times	OK	
Criteria for a clear HVSR peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	38.125 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	3.80 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01834| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	1.04897 < 2.85938	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1625 < 1.58	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{logH/V}(f)$	standard deviation of log $A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$					
Freq.range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
Log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

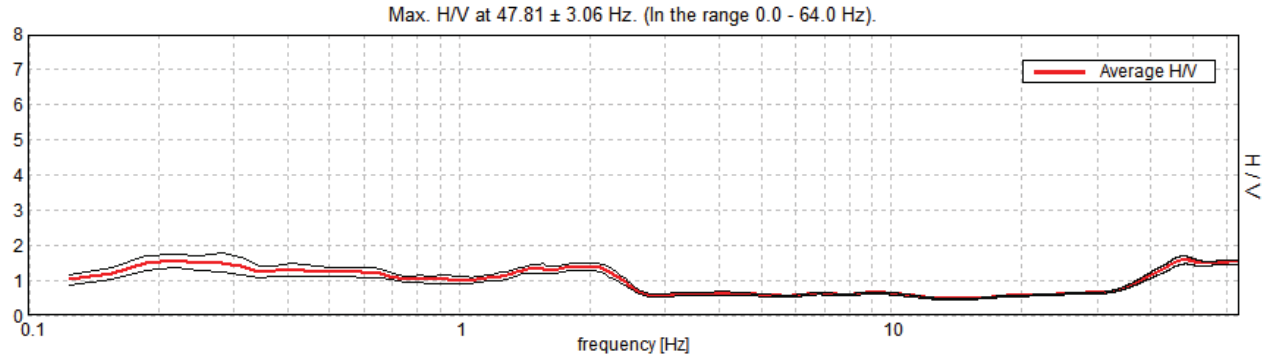
HVSR72A

T77

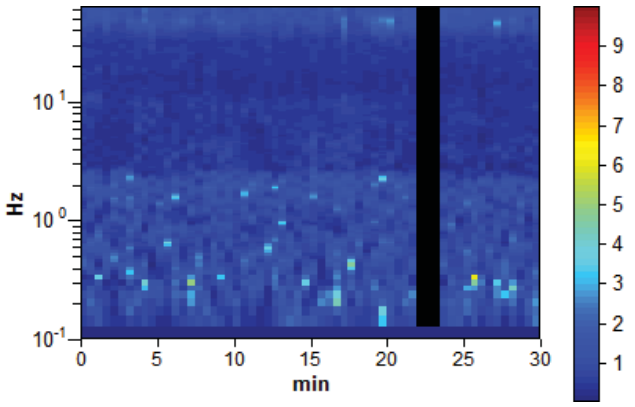
Instrument: TRS-0004/00-06
Start recording: 15/04/14 15:46:28 End recording: 15/04/14 16:16:29
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h30'00". Analyzed 95% trace (manual window selection)
Sampling frequency: 128 Hz
Window size: 30 s
Smoothing window: Triangular window
Smoothing: 10%

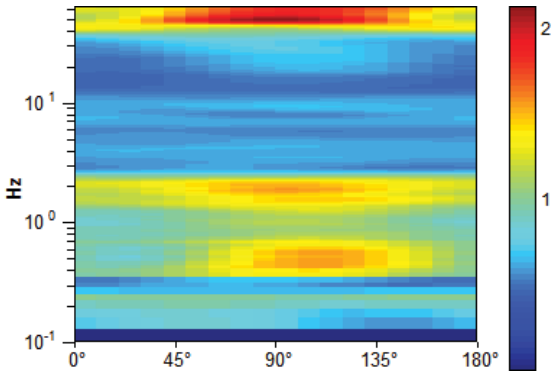
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA