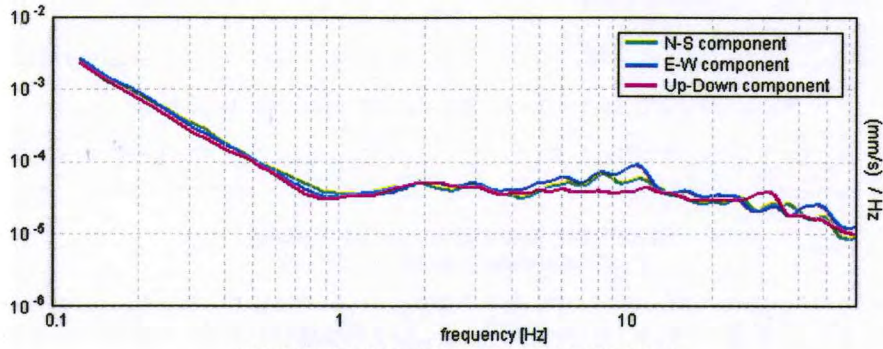
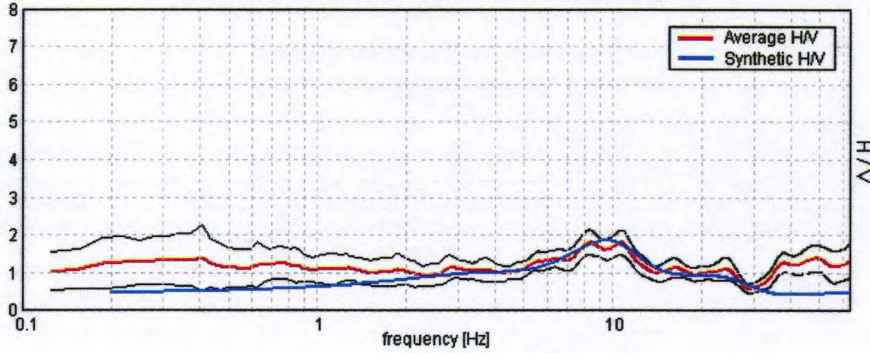


SPETTRI DELLE SINGOLE COMPONENTI



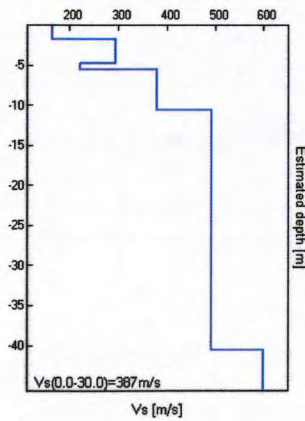
H/V SPERIMENTALE vs. H/V SINTETICO

Picco H/V a  $8.31 \pm 0.85$  Hz (nell'intervallo 0.0 - 64.0 Hz).



Profondità alla base dello strato [m]	Spessore [m]	Vs [m/s]	Rapporto di Poisson
1.80	1.80	162	0.35
4.80	3.00	293	0.35
5.60	0.80	221	0.35
10.60	5.00	379	0.35
40.60	30.00	493	0.35
inf.	inf.	600	0.35

Vs(0.0-30.0)=387m/s





[Secondo le linee guida SESAME, 2005. Si raccomanda di leggere attentamente il manuale di *Grilla* prima di interpretare la tabella seguente].

Picco H/V a  $8.31 \pm 0.85$  Hz (nell'intervallo 0.0 - 64.0 Hz).

**Criteri per una curva H/V affidabile**  
 [Tutti 3 dovrebbero risultare soddisfatti]

$f_0 > 10 / L_w$	$8.31 > 0.50$	OK	
$n_c(f_0) > 200$	$5985.0 > 200$	OK	
$\sigma_A(f) < 2$ per $0.5f_0 < f < 2f_0$ se $f_0 > 0.5$ Hz $\sigma_A(f) < 3$ per $0.5f_0 < f < 2f_0$ se $f_0 < 0.5$ Hz	Superato 0 volte su 400	OK	

**Criteri per un picco H/V chiaro**  
 [Almeno 5 su 6 dovrebbero essere soddisfatti]

Esiste $f^-$ in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$			NO
Esiste $f^+$ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$	26.219 Hz	OK	
$A_0 > 2$	$1.81 > 2$		NO
$f_{\text{picco}} [A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.04943  < 0.05$	OK	
$\sigma_f < \epsilon(f_0)$	$0.41093 < 0.41563$	OK	
$\sigma_A(f_0) < \theta(f_0)$	$0.1635 < 1.58$	OK	

$L_w$	lunghezza della finestra
$n_w$	numero di finestre usate nell'analisi
$n_c = L_w n_w f_0$	numero di cicli significativi
$f$	frequenza attuale
$f_0$	frequenza del picco H/V
$\sigma_f$	deviazione standard della frequenza del picco H/V
$\epsilon(f_0)$	valore di soglia per la condizione di stabilità $\sigma_f < \epsilon(f_0)$
$A_0$	ampiezza della curva H/V alla frequenza $f_0$
$A_{H/V}(f)$	ampiezza della curva H/V alla frequenza $f$
$f^-$	frequenza tra $f_0/4$ e $f_0$ alla quale $A_{H/V}(f^-) < A_0/2$
$f^+$	frequenza tra $f_0$ e $4f_0$ alla quale $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	deviazione standard di $A_{H/V}(f)$ , $\sigma_A(f)$ è il fattore per il quale la curva $A_{H/V}(f)$ media deve essere moltiplicata o divisa
$\sigma_{\log H/V}(f)$	deviazione standard della funzione $\log A_{H/V}(f)$
$\theta(f_0)$	valore di soglia per la condizione di stabilità $\sigma_A(f) < \theta(f_0)$

Intervallo di freq. [Hz]	Valori di soglia per $\sigma_f$ e $\sigma_A(f_0)$				
	< 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0	> 2.0
$\epsilon(f_0)$ [Hz]	$0.25 f_0$	$0.2 f_0$	$0.15 f_0$	$0.10 f_0$	$0.05 f_0$
$\theta(f_0)$ per $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
$\log \theta(f_0)$ per $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

**10\_09\_30\_FUCCCHIO, FUCCCHIO TR1**

Instrument: TEP-0085/01-10

Start recording: 30/09/10 10:08:30 End recording: 30/09/10 10:22:31

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

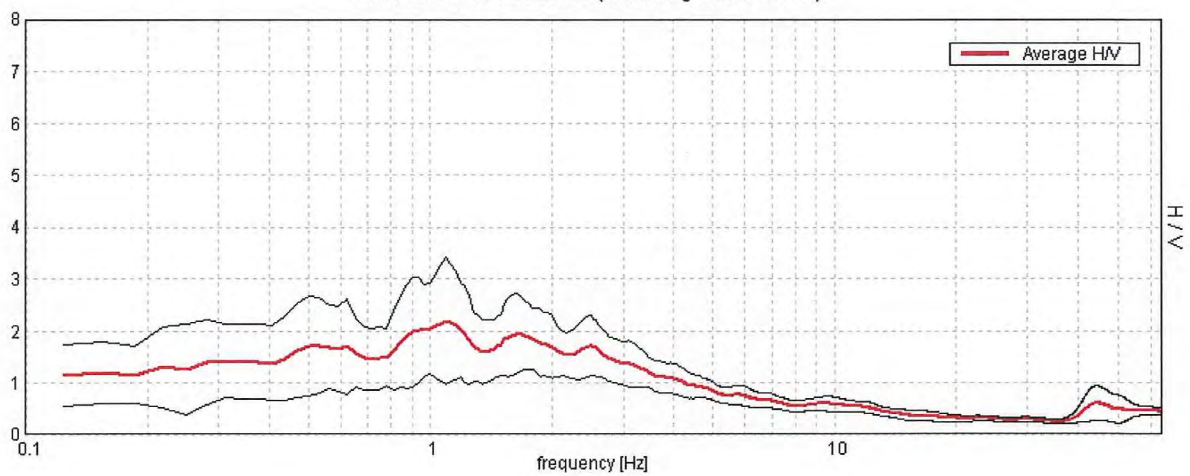
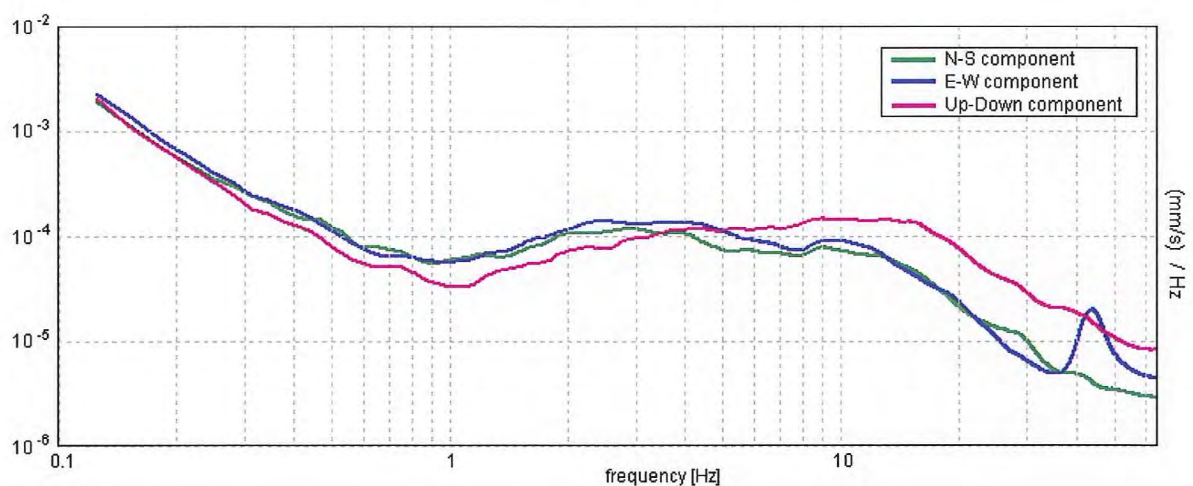
Trace length: 0h14'00". Analysis performed on the entire trace.

Sampling rate: 128 Hz

Window size: 20 s

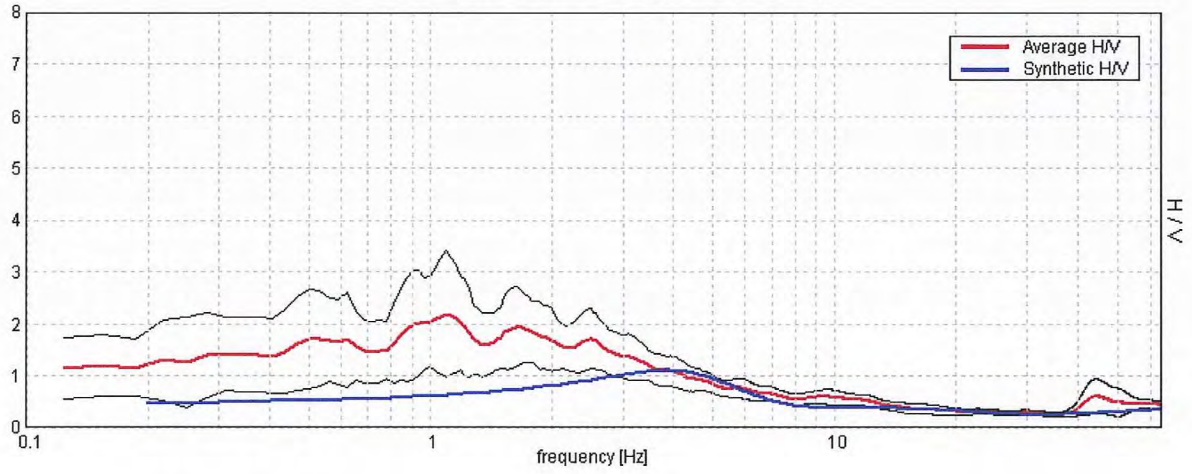
Smoothing type: Triangular window

Smoothing: 10%

**HORIZONTAL TO VERTICAL SPECTRAL RATIO**Max. H/V at  $1.09 \pm 0.05$  Hz (in the range 0.0 - 64.0 Hz).**SINGLE COMPONENT SPECTRA**

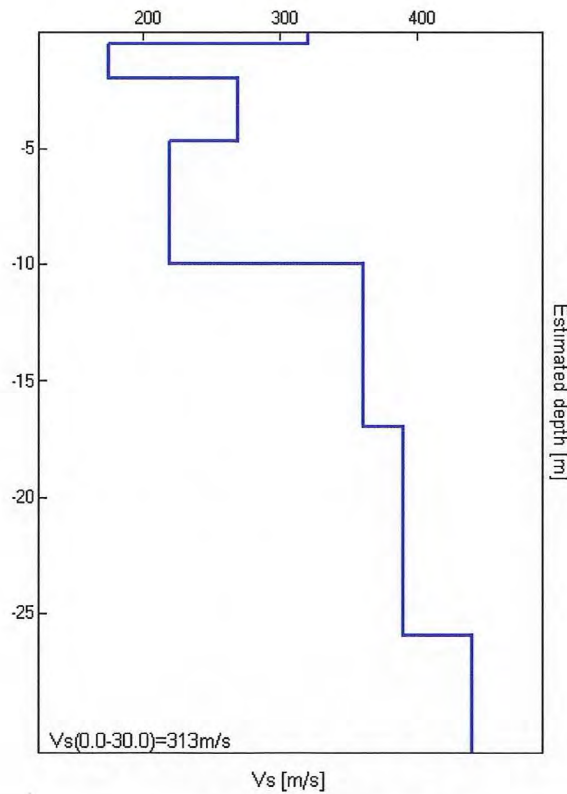
EXPERIMENTAL vs. SYNTHETIC H/V

Max. H/V at  $1.09 \pm 0.05$  Hz (in the range 0.0 - 64.0 Hz).



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
0.50	0.50	320
2.00	1.50	175
4.70	2.70	270
10.00	5.30	220
17.00	7.00	360
26.00	9.00	390
inf.	inf.	440

Vs(0.0-30.0)=313m/s



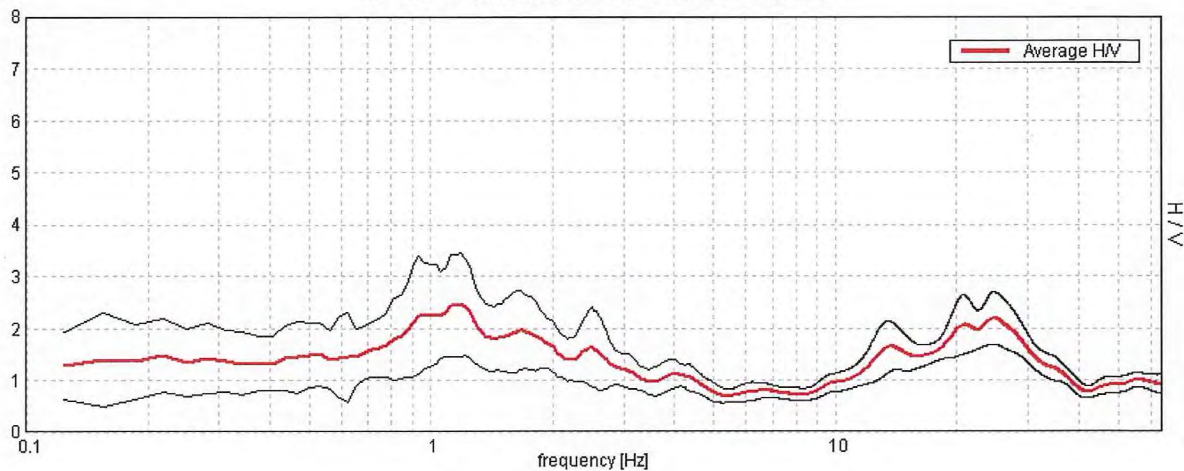
### 10\_09\_30\_FUCCCHIO, FUCCCHIO TR2

Instrument: TEP-0085/01-10  
Start recording: 30/09/10 11:03:58      End recording: 30/09/10 11:17:59  
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
GPS data not available

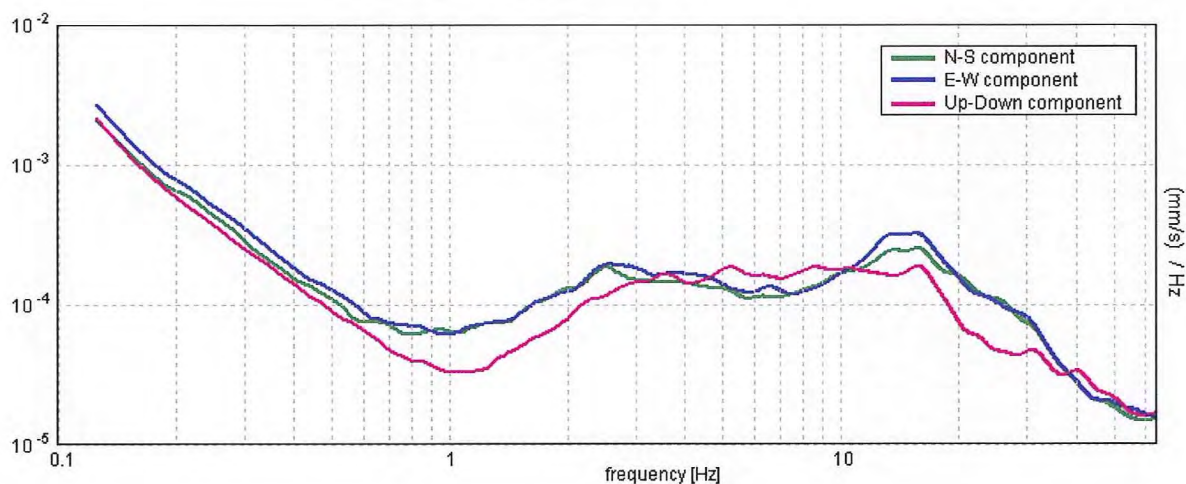
Trace length: 0h14'00".      Analysis performed on the entire trace.  
Sampling rate: 128 Hz  
Window size: 20 s  
Smoothing type: Triangular window  
Smoothing: 10%

#### HORIZONTAL TO VERTICAL SPECTRAL RATIO

Max. H/V at 1.19 ± 0.06 Hz (in the range 0.0 - 64.0 Hz).

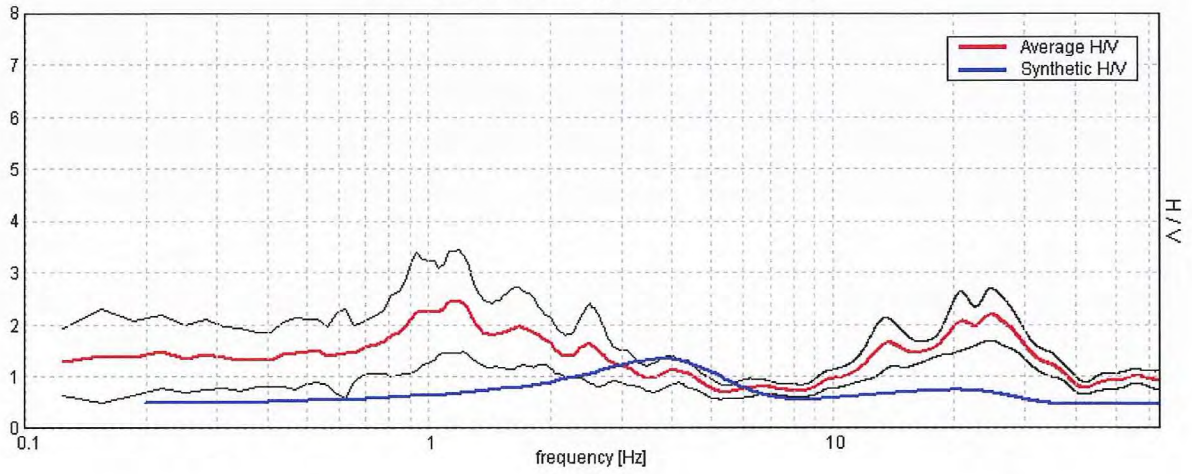


#### SINGLE COMPONENT SPECTRA



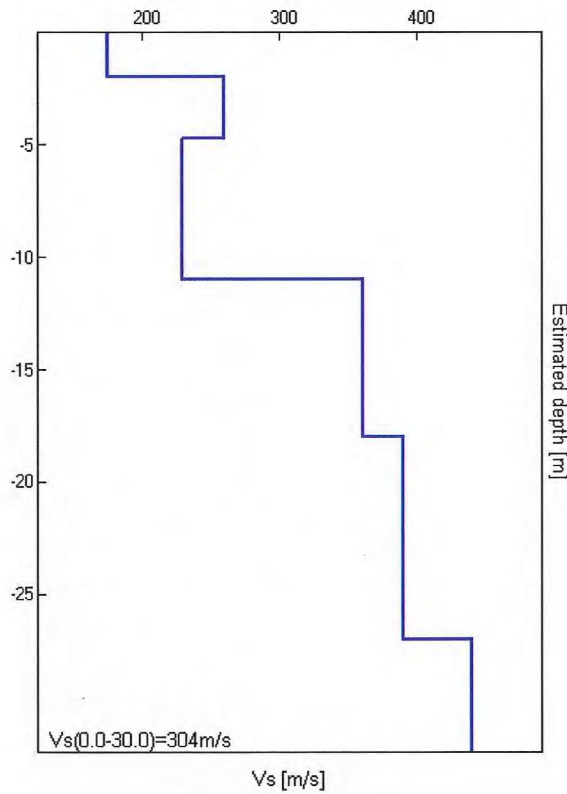
EXPERIMENTAL vs. SYNTHETIC H/V

Max. H/V at  $1.19 \pm 0.06$  Hz (in the range 0.0 - 64.0 Hz).



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.00	2.00	175
4.70	2.70	260
11.00	6.30	230
18.00	7.00	360
27.00	9.00	390
inf.	inf.	440

$V_s(0.0-30.0)=304\text{m/s}$



## Dati misure down hole

Registrazione Nr.	Z (m)	Tp (msec)	Ts (msec)
1	1,00	3,40	6,40
2	2,00	4,50	14,90
3	3,00	5,30	25,00
4	4,00	6,50	31,00
5	5,00	7,20	35,40
6	6,00	7,90	39,10
7	7,00	8,10	44,80
8	8,00	8,50	49,00
9	9,00	8,70	52,80
10	10,00	9,00	57,30
11	11,00	9,50	60,50
12	12,00	9,90	64,60
13	13,00	10,50	70,00
14	14,00	11,20	75,10
15	15,00	11,40	77,70
16	16,00	12,00	84,50
17	17,00	12,40	90,20
18	18,00	12,70	96,00
19	19,00	13,00	102,70
20	20,00	13,40	105,30
21	21,00	13,70	108,00
22	22,00	13,90	114,20
23	23,00	14,30	118,30
24	24,00	14,80	123,70
25	25,00	15,60	125,60
26	26,00	16,20	130,80
27	27,00	16,70	134,50
28	28,00	17,50	137,10
29	29,00	17,80	139,20
30	30,00	18,50	142,10
31	31,00	19,10	144,50
32	32,00	19,60	149,50

Tabella 3

## Risultati

SR (m)	Tpcorr (msec)	Tscorr (msec)
1,8028	1,886	3,5501
2,50	3,60	11,92
3,3541	4,7405	22,3607
4,272	6,0861	29,0262
5,2202	6,8963	33,9071
6,1847	7,6641	37,9326
7,1589	7,9202	43,8056
8,1394	8,3544	48,1607
9,1241	8,5816	52,0816
10,1119	8,9004	56,6661
11,1018	9,4129	59,9452
12,0934	9,8236	64,1012
13,0863	10,4308	69,5386
14,0801	11,1363	74,6726

15,0748	11,3434	77,3144
16,0702	11,9476	84,1311
17,0661	12,352	89,8509
18,0624	12,6561	95,6684
19,0591	12,9597	102,3814
20,0562	13,3625	105,0051
21,0535	13,6652	107,7255
22,0511	13,8678	113,9355
23,0489	14,2697	118,0492
24,0468	14,7712	123,4591
25,045	15,572	125,3745
26,0432	16,1731	130,5829
27,0416	16,6743	134,2929
28,0402	17,4749	136,9037
29,0388	17,7762	139,0142
30,0375	18,4769	141,9227
31,0363	19,0777	144,3311
32,0351	19,5785	149,336

Tabella 4

**Metodo diretto**

**Profondità di riferimento:** 30 m  
**VS30:** 213,39 m/s

**Sismostrati con metodo diretto**

Descrizione (-)	Profondità (m)
limi sabbiosi	3,05
argilla limosa	32

Tabella 5

**Valori medi**

Vp medio (m/s)	Vs medio (m/s)	g medio (kN/mc)	ni medio	G medio (MPa)	Ed medio (MPa)	E medio (MPa)	Ev medio (MPa)
634,1	134,42	17,33	0,48	31,93	710,5	94,28	667,93
1960,05	228,58	17,53	0,49	93,37	6865,56	278,83	6741,06

Tabella 6



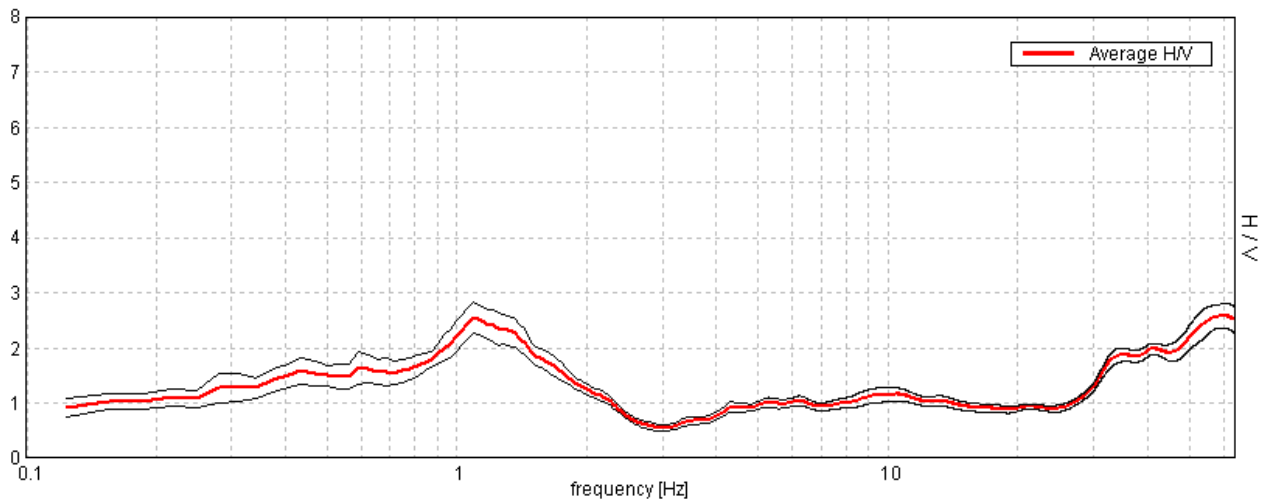
**10\_06\_03\_FUCCCHIO, SAN PIERINO TR1**

Start recording: 03/06/10 17:06:18      End recording: 03/06/10 17:20:19  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available

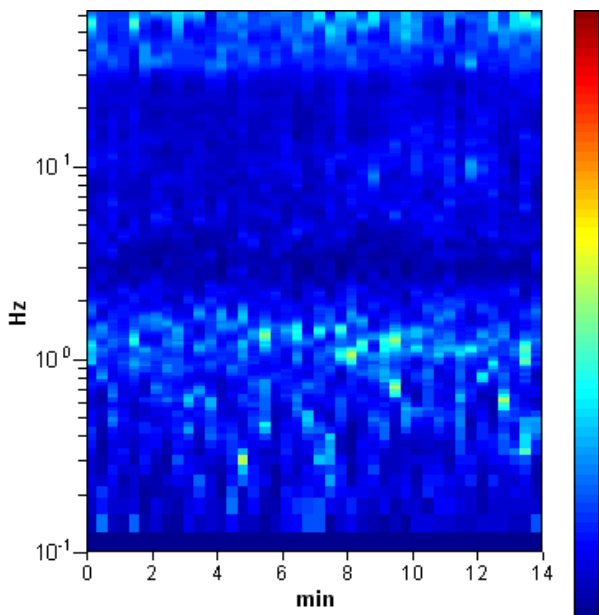
Trace length: 0h14'00".      Analysis performed on the entire trace.  
 Sampling frequency: 128 Hz  
 Window size: 20 s  
 Smoothing window: Triangular window  
 Smoothing: 10%

**HORIZONTAL TO VERTICAL SPECTRAL RATIO**

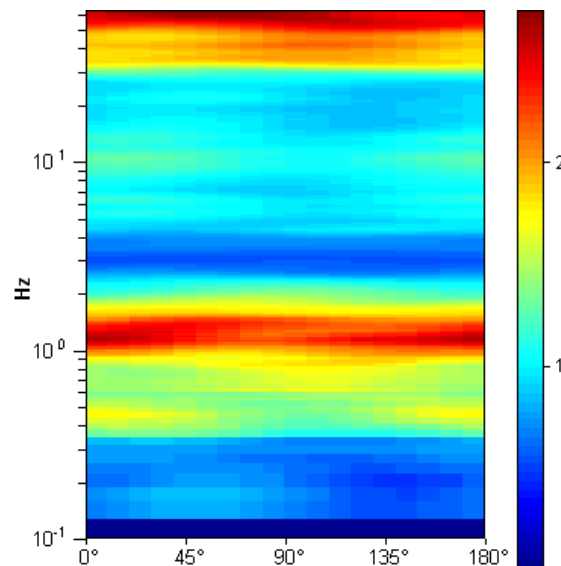
Max. H/V at  $60.47 \pm 5.82$  Hz. (in the range 0.0 - 64.0 Hz).



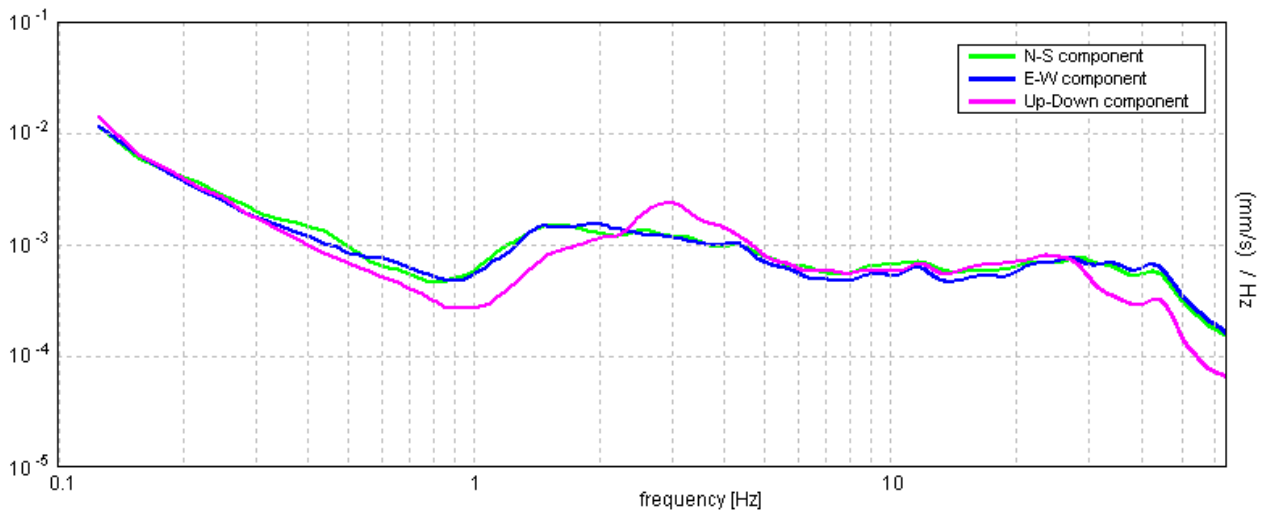
**H/V TIME HISTORY**



**DIRECTIONAL H/V**

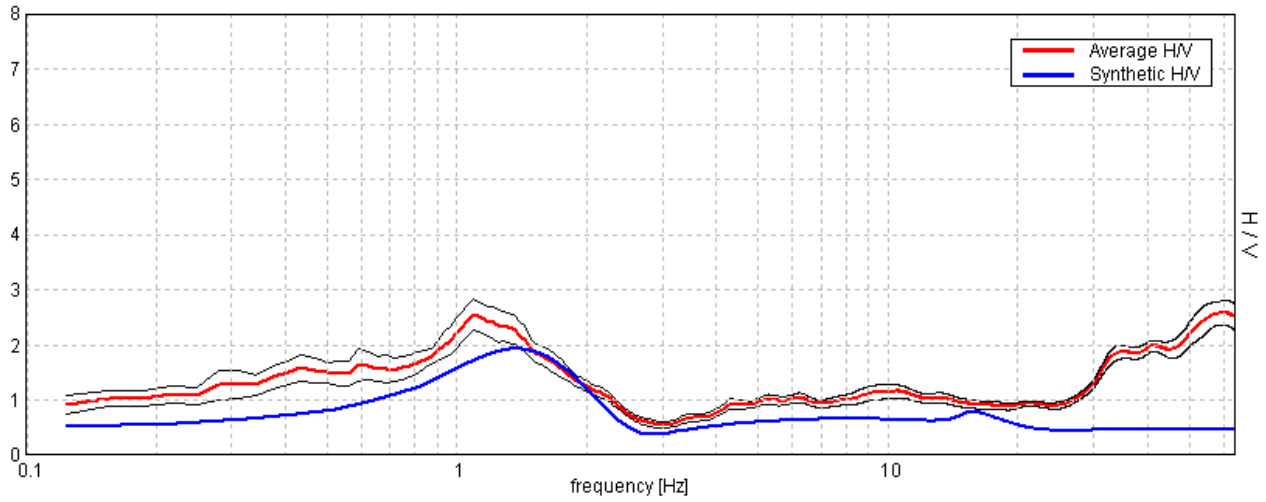


### SINGLE COMPONENT SPECTRA



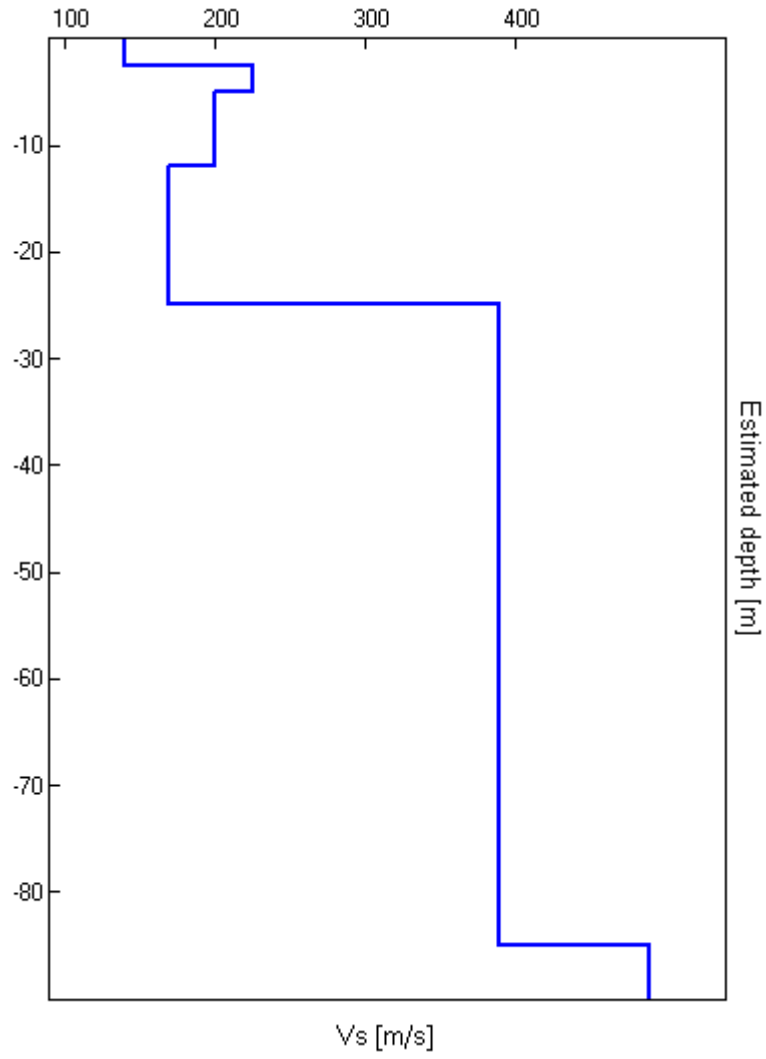
EXPERIMENTAL VS. SYNTHETIC H/V

Max. H/V at 60.47 ± 5.82 Hz. (in the range 0.0 - 64.0 Hz).



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.50	2.50	140
5.00	2.50	225
12.00	7.00	200
25.00	13.00	170
85.00	60.00	390
inf.	inf.	490

Vs(0.0-30.0)=196m/s



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

**Max. H/V at 60.47 ± 5.82 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	
$n_c(f_0) > 200$	50793.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	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 $[f_0/4, f_0]$   $A_{H/V}(f^-) < A_0 / 2$	29.969 Hz	OK	
Exists $f^+$ in $[f_0, 4f_0]$   $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.58 > 2	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.0471  < 0.05$	OK	
$\sigma_f < \varepsilon(f_0)$	2.84815 < 3.02344	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.1094 < 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
$\sigma_f$	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
$\sigma_{\log H/V}(f)$	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 $\sigma_f$ 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 $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

**J11\_063\_03\_25\_FUCECCHIO\_TR, SAN PIERINO TR1**

Strumento: TEP-0085/01-10

Inizio registrazione: 25/03/11 11:24:13 Fine registrazione: 25/03/11 11:38:14

Nomi canali: NORTH SOUTH; EAST WEST; UP DOWN

Dato GPS non disponibile

Durata registrazione: 0h14'00".

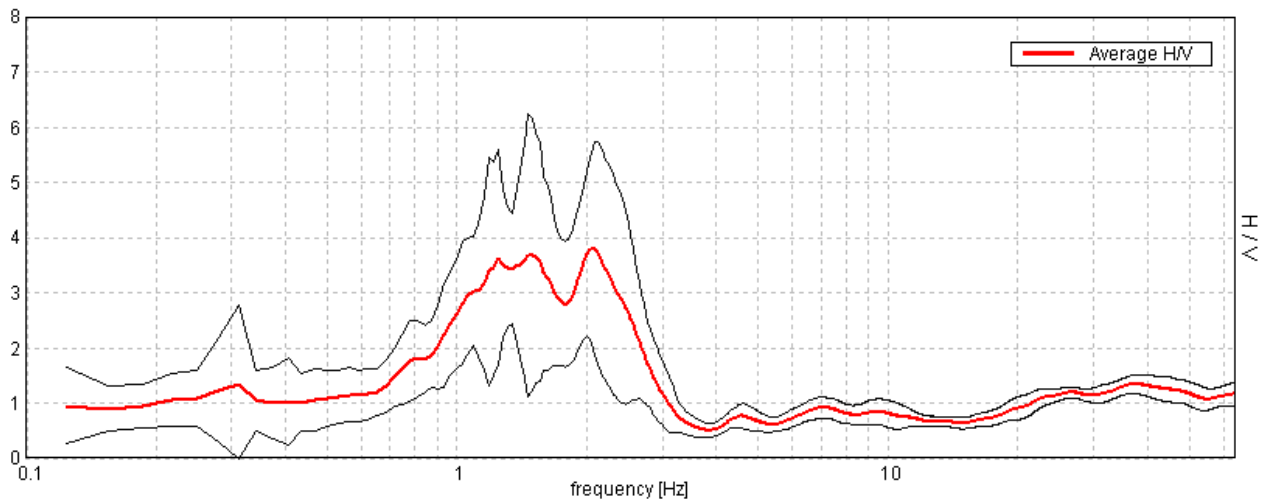
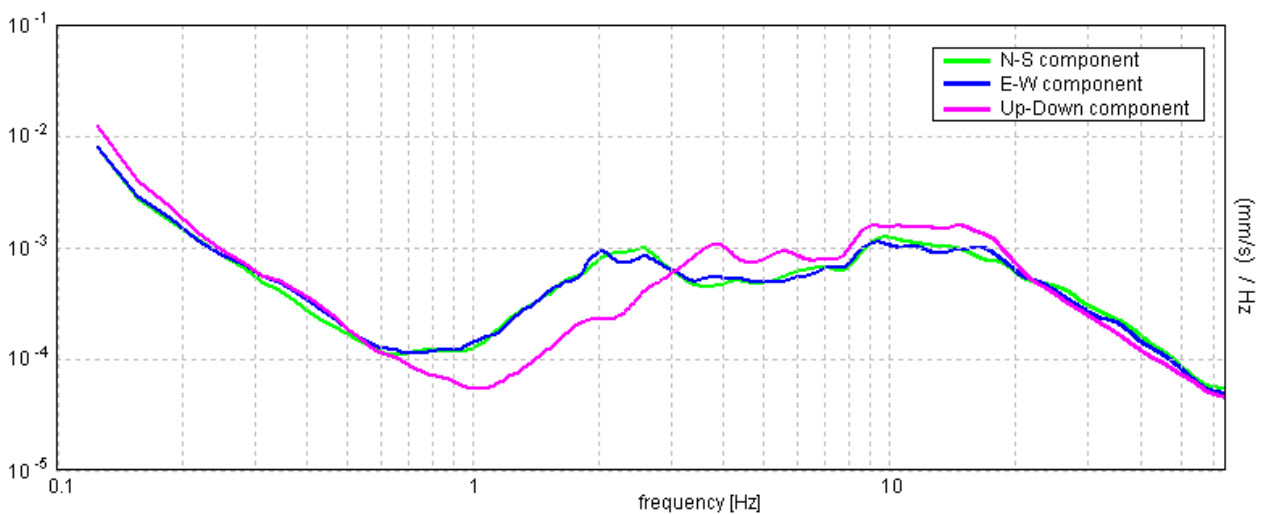
Analisi effettuata sull'intera traccia.

Freq. campionamento: 128 Hz

Lunghezza finestre: 20 s

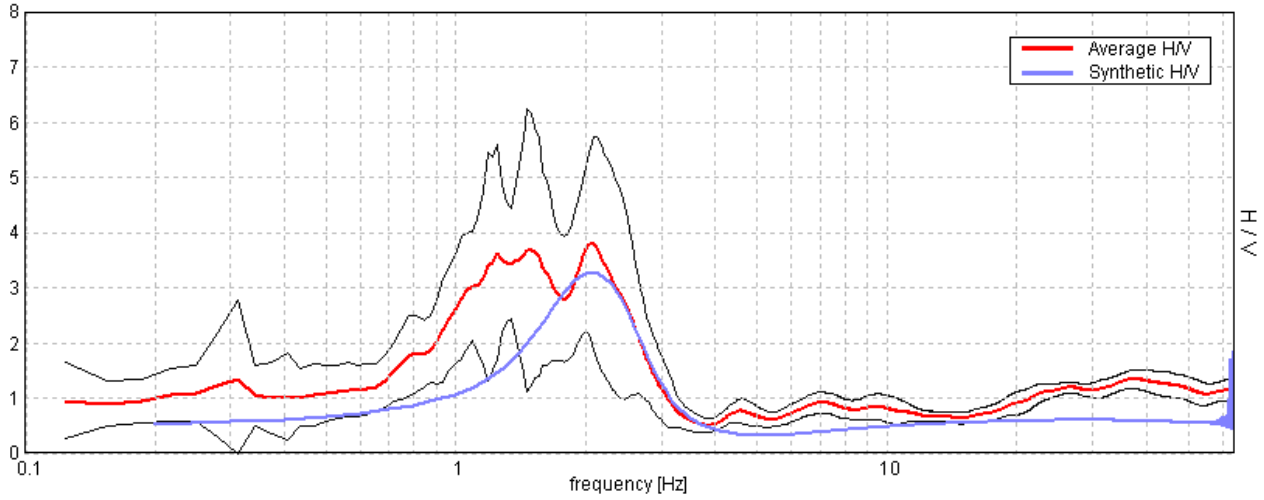
Tipo di lisciamento: Triangular window

Lisciamento: 10%

**RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE**Picco H/V a  $2.09 \pm 0.18$  Hz (nell'intervallo 0.0 - 64.0 Hz).**SPETTRI DELLE SINGOLE COMPONENTI**

H/V SPERIMENTALE vs. H/V SINTETICO

Picco H/V a  $2.09 \pm 0.18$  Hz (nell'intervallo 0.0 - 64.0 Hz).



Profondità alla base dello strato

[m]

1.00  
3.00  
7.50  
15.50  
36.50  
inf.

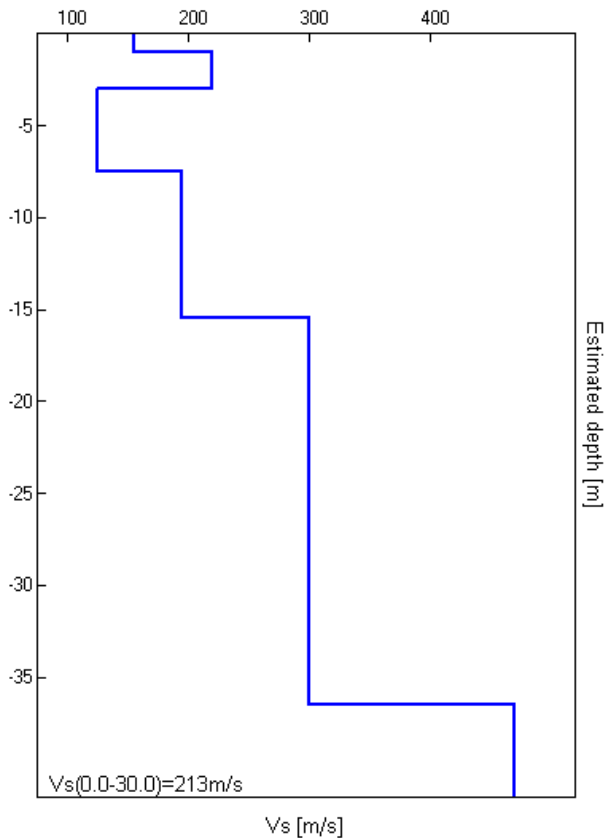
Spessore [m]

1.00  
2.00  
4.50  
8.00  
21.00  
inf.

Vs [m/s]

155  
220  
125  
195  
300  
470

$V_s(0.0-30.0)=213\text{m/s}$



Rif.: j11.063.03.25\_fcc.doc

**J11\_063\_03\_25\_FUCECCHIO\_TR, SAN PIERINO TR2**

Strumento: TEP-0085/01-10

Inizio registrazione: 25/03/11 12:13:15 Fine registrazione: 25/03/11 12:27:16

Nomi canali: NORTH SOUTH; EAST WEST; UP DOWN

Dato GPS non disponibile

Durata registrazione: 0h14'00".

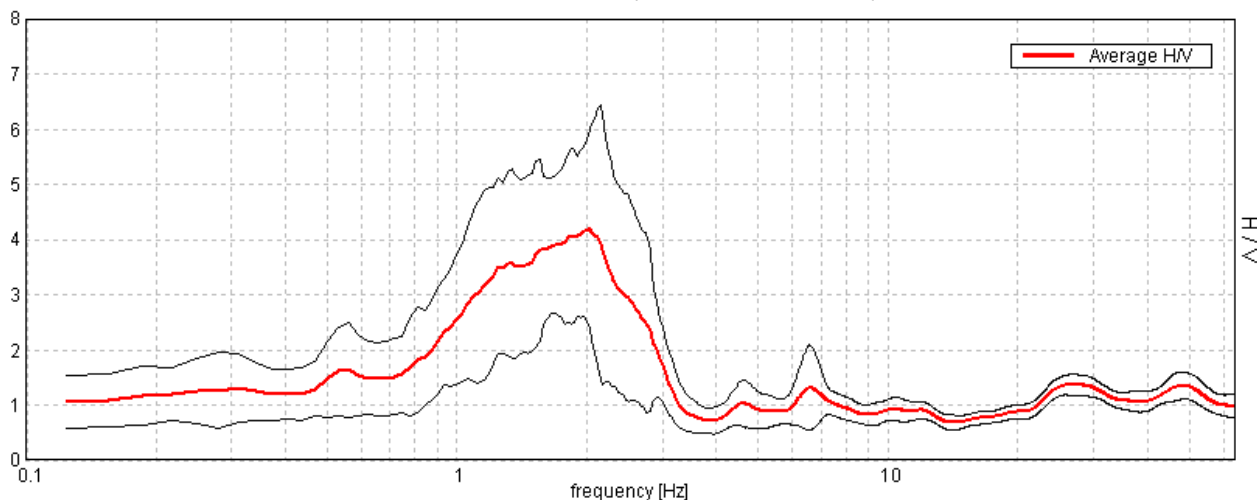
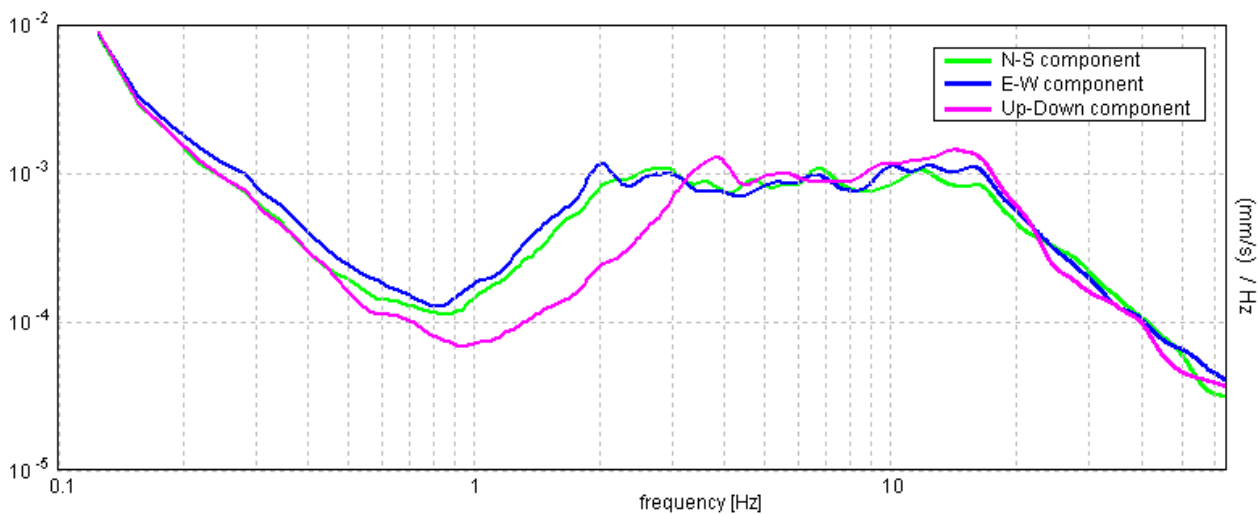
Analizzato 88% tracciato (selezione manuale)

Freq. campionamento: 128 Hz

Lunghezza finestre: 20 s

Tipo di lisciamento: Triangular window

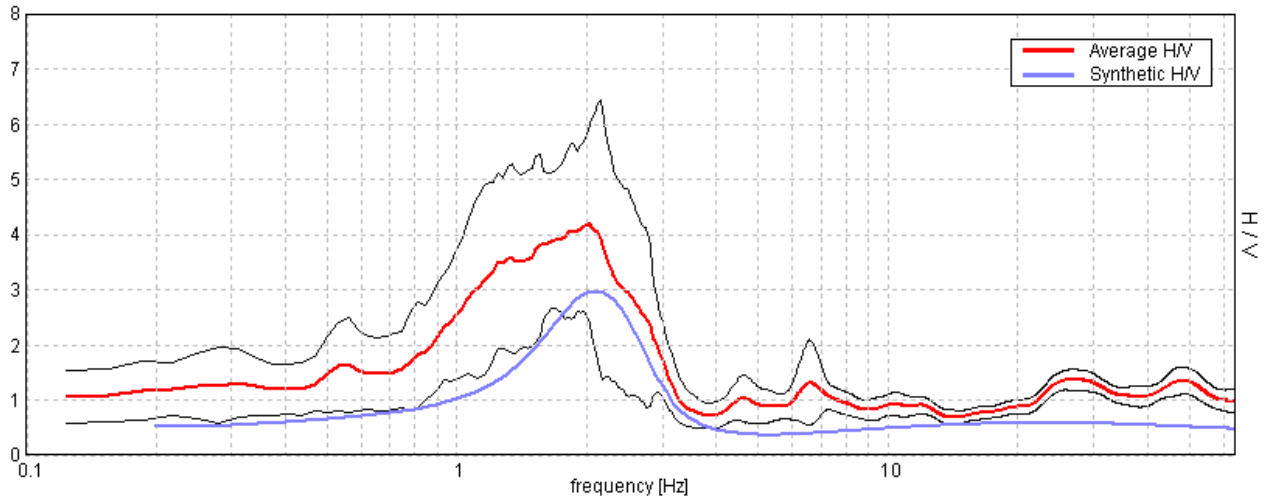
Lisciamento: 10%

**RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE**Picco H/V a  $2.03 \pm 0.13$  Hz (nell'intervallo 0.0 - 64.0 Hz).**SPETTRI DELLE SINGOLE COMPONENTI**



H/V SPERIMENTALE vs. H/V SINTETICO

Picco H/V a  $2.03 \pm 0.13$  Hz (nell'intervallo 0.0 - 64.0 Hz).



Profondità alla base dello strato

[m]

1.00  
3.00  
7.50  
15.50  
35.50  
inf.

Spessore [m]

1.00  
2.00  
4.50  
8.00  
20.00  
inf.

Vs [m/s]

155  
220  
145  
195  
300  
470

Vs(0.0-30.0)=221m/s

