PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

RegioneEmiliaRomagna

CONFERENZA DELLE REGIONI E DELLE PROVINCE AUTONOME

Attuazione dell'articolo 11 dalla legge 24 giugno 2009,n.77

MICROZONAZIONE SISMICA

Livello 2

Allegato 2 – Report delle indagini

Regione Emilia-Romagna

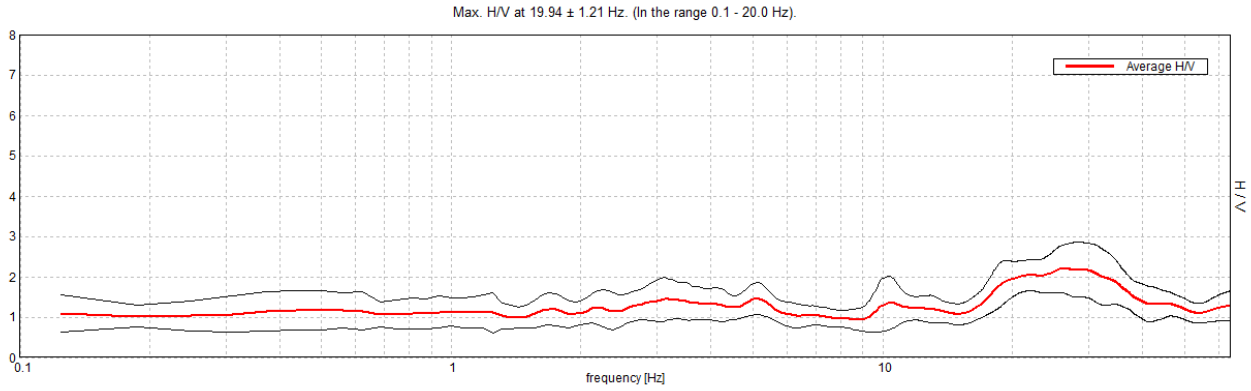
Comune di Grizzana Morandi

Regione	Soggetto realizzatore	Data
EMILIA-ROMAGNA	Raggruppamento temporaneo di professionisti Capogruppo: dott. geol. Samuel Sangiorgi Mandanti: dott. geol. Raffaele Brunaldi, dott. geol. Maurizio Zamboni, dott. geol. Antonio Milioto, ing. Marco Soglia	Luglio 2020

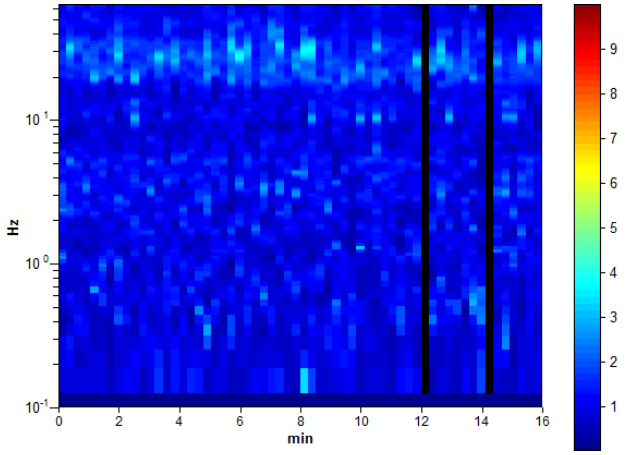
GRIZZANA MORANDI_MS, TR1 PIOPPE SALVARO 1

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 10:00:46 End recording: 23/10/18 10:16:46
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 97% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

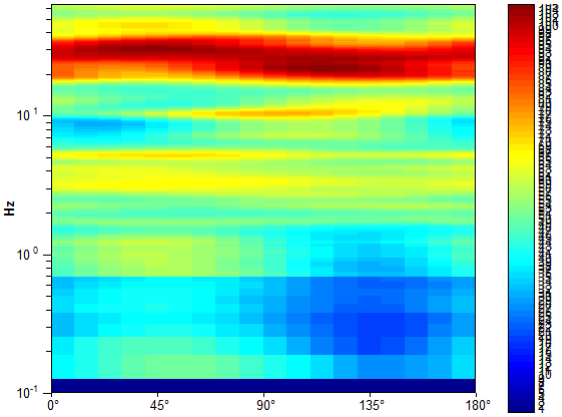
HORIZONTAL TO VERTICAL SPECTRAL RATIO



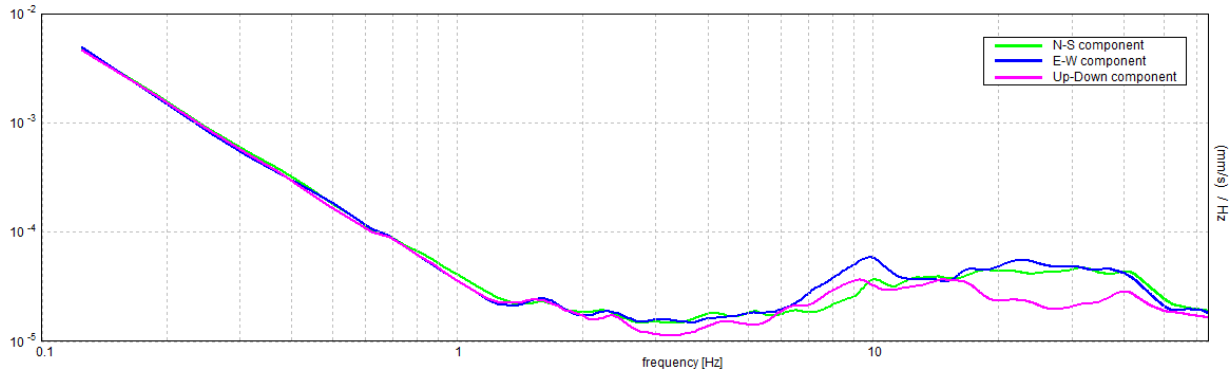
H/V TIME HISTORY



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 19.94 ± 1.21 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.94 > 0.63	OK	
$n_c(f_0) > 200$	18502.0 > 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 480 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	9.125 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.94 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03001| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.59835 < 0.99688	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2197 < 1.58	OK	

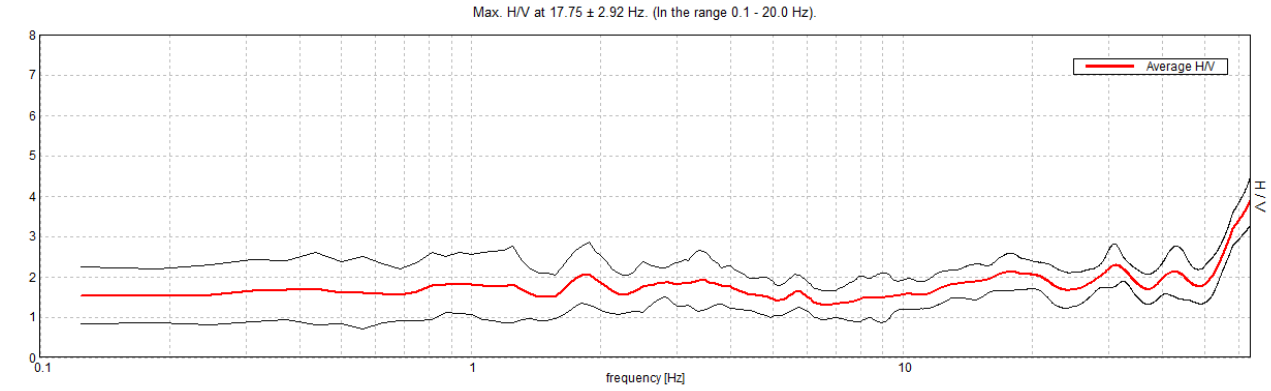
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

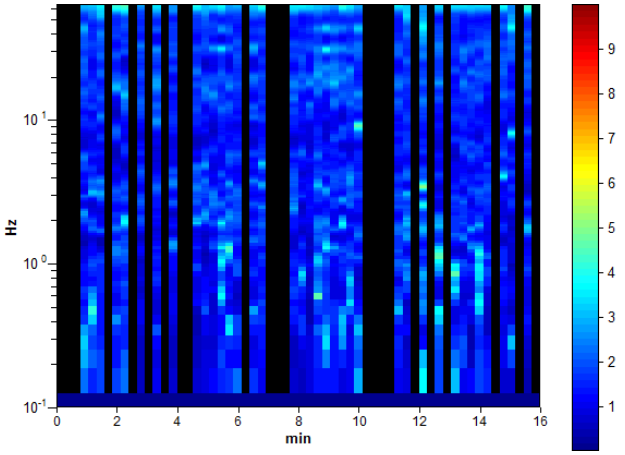
GRIZZANA MORANDI_MS, TR2 PIOPPE SALVARO 2

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 10:24:05 End recording: 23/10/18 10:40:05
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 62% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

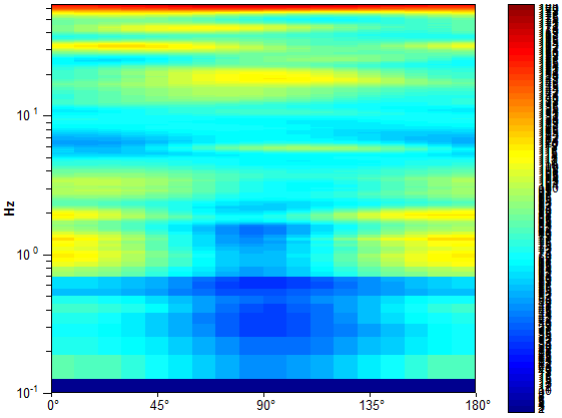
HORIZONTAL TO VERTICAL SPECTRAL RATIO



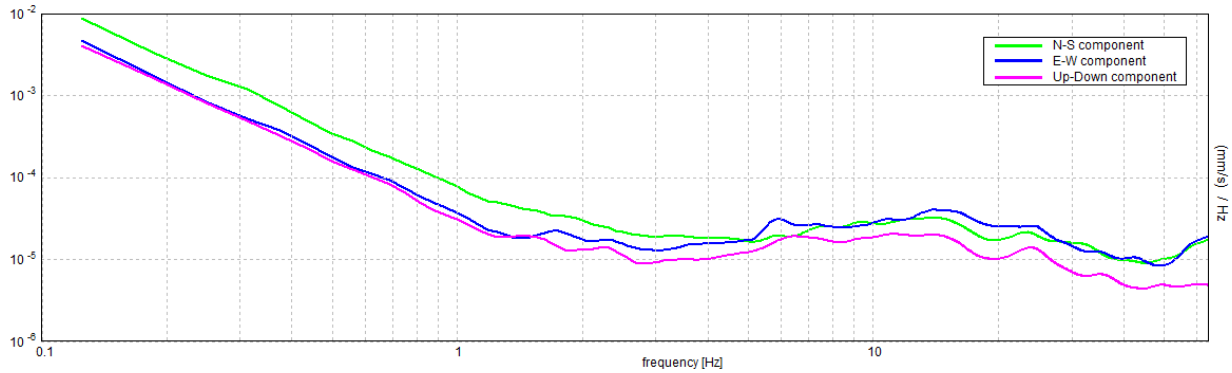
H/V TIME HISTORY



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 17.75 ± 2.92 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	17.75 > 0.63	OK	
$n_c(f_0) > 200$	10508.0 > 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 427 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.12 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.07991| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.41832 < 0.8875		NO
$\sigma_A(f_0) < \theta(f_0)$	0.2239 < 1.58	OK	

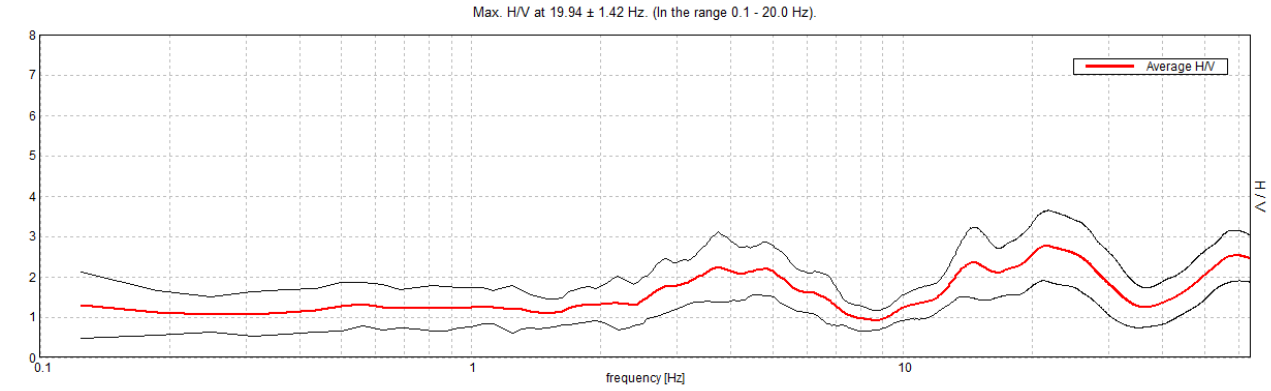
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

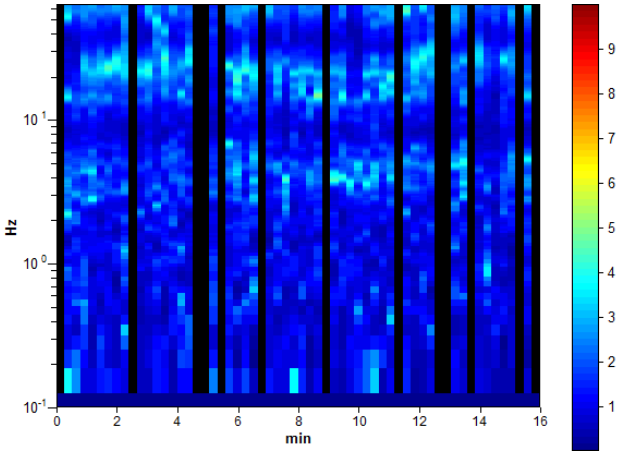
GRIZZANA MORANDI_MS, TR43 PIOPPE CAMPO SPORTIVO

Instrument: TRZ-0108/01-10
Start recording: 05/12/18 09:17:46 End recording: 05/12/18 09:33:47
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 78% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

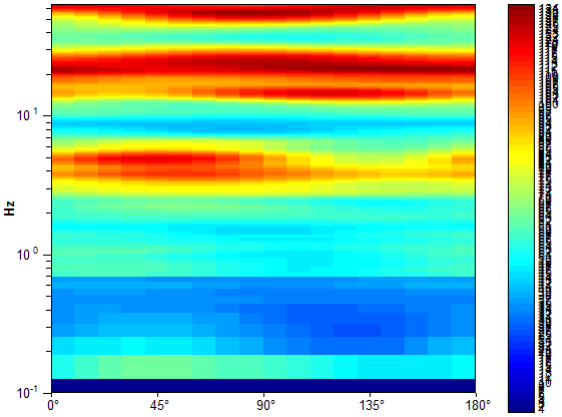
HORIZONTAL TO VERTICAL SPECTRAL RATIO



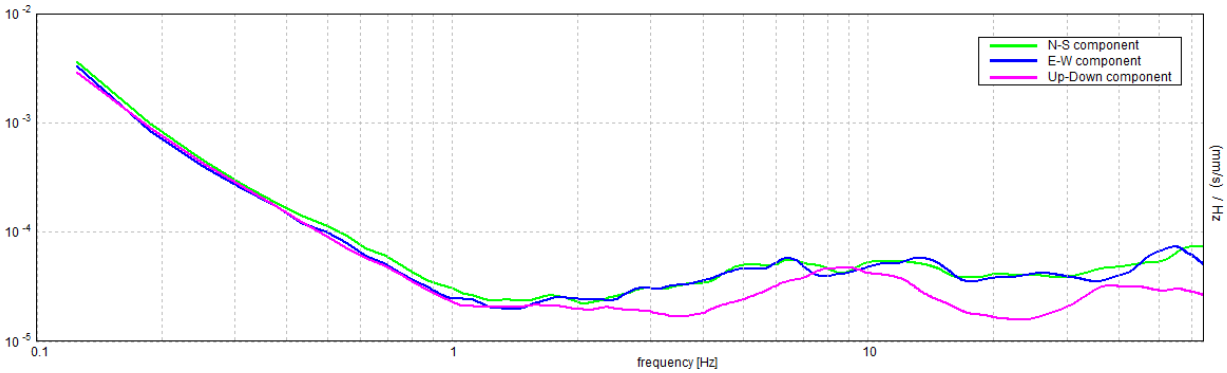
H/V TIME HISTORY



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 19.94 ± 1.42 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.94 > 0.63	OK	
$n_c(f_0) > 200$	14993.0 > 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 480 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	10.25 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	34.938 Hz	OK	
$A_0 > 2$	2.54 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0351| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.69972 < 0.99688	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3831 < 1.58	OK	

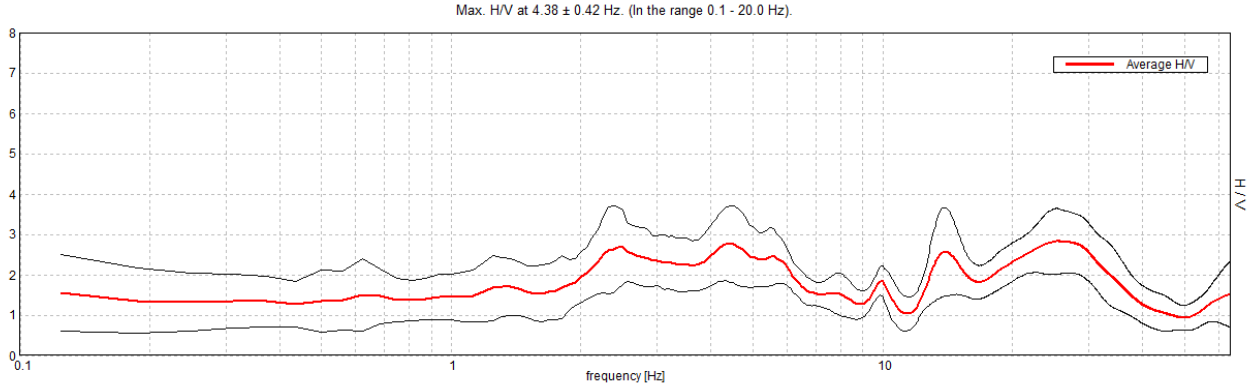
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

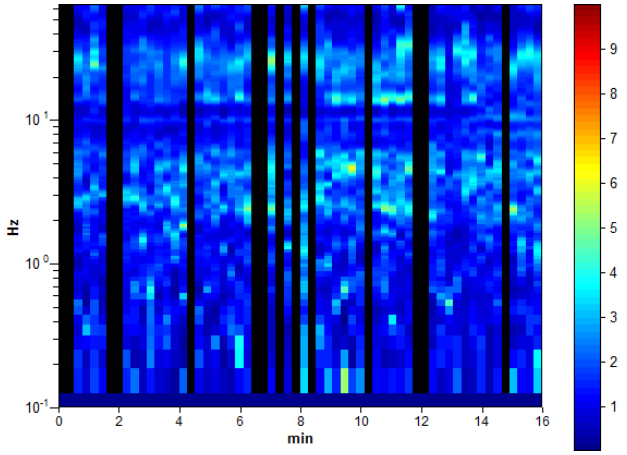
GRIZZANA MORANDI_MS, TR44 PIOPPE LA CASELLA

Instrument: TRZ-0108/01-10
Start recording: 05/12/18 10:59:35 End recording: 05/12/18 11:15:36
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 77% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

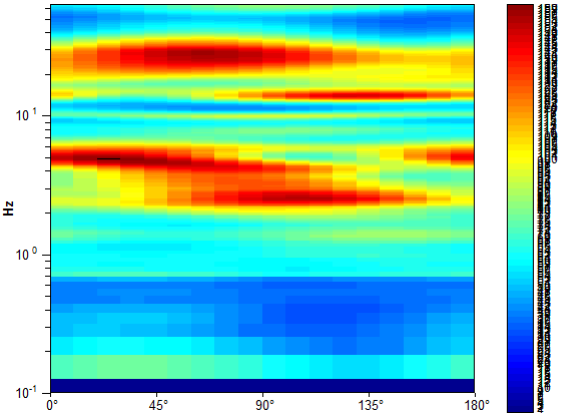
HORIZONTAL TO VERTICAL SPECTRAL RATIO



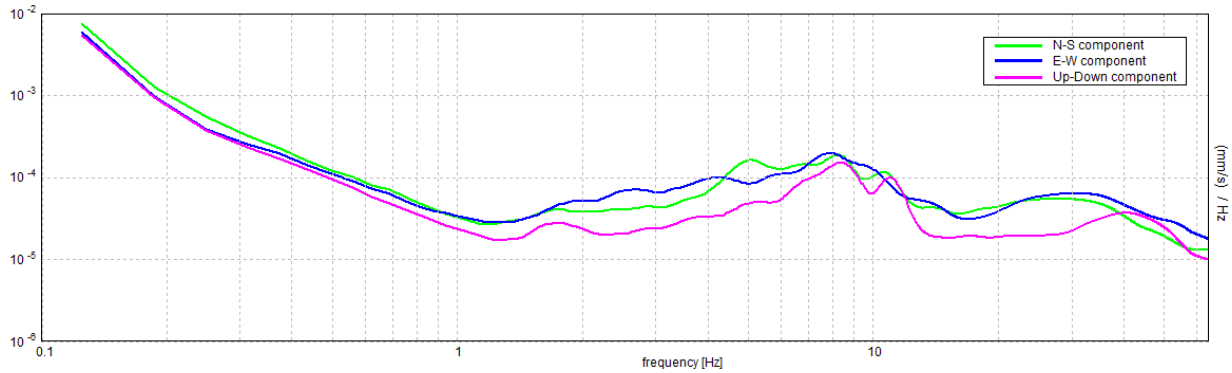
H/V TIME HISTORY



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 4.38 ± 0.42 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.38 > 0.63	OK	
$n_c(f_0) > 200$	3220.0 > 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 106 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	8.438 Hz	OK	
$A_0 > 2$	2.77 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.04683| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.20486 < 0.21875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4519 < 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 $\sigma_A(f) < \theta(f_0)$

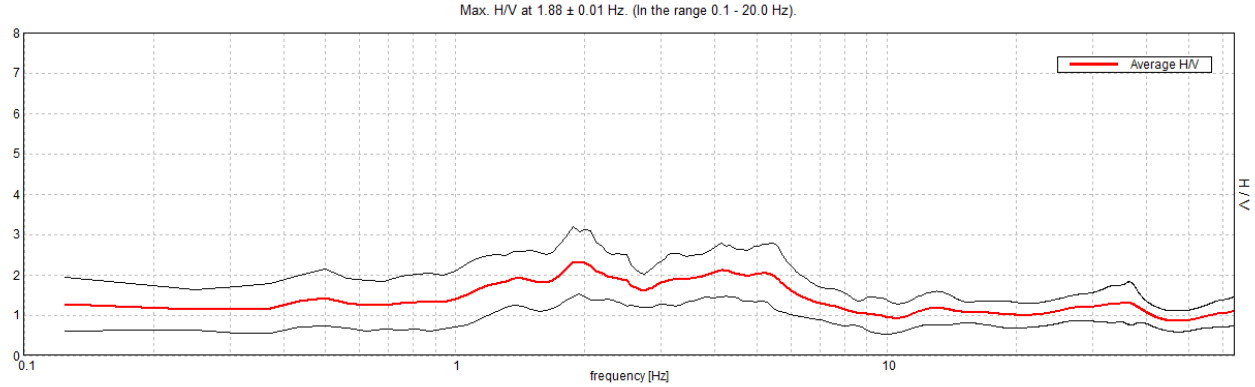
Threshold values for σ_f and $\sigma_A(f_0)$					
Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

GRIZZANA MORANDI_MS, TR46 PIOPPE SOPRA

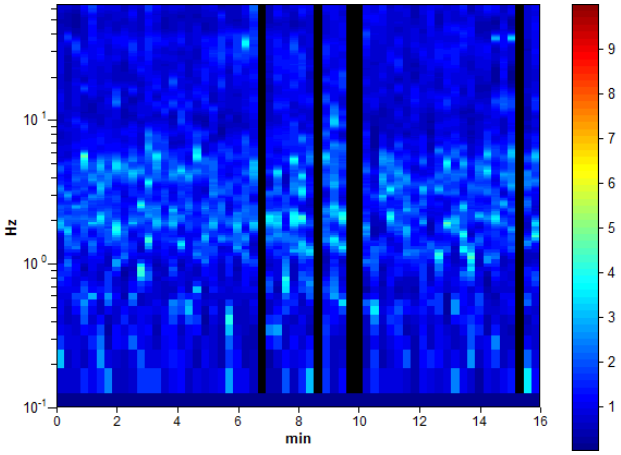
Instrument: TRZ-0108/01-10
Start recording: 05/12/18 16:39:34 End recording: 05/12/18 16:55:35
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
GPS data not available

Trace length: 0h16'00". Analyzed 92% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

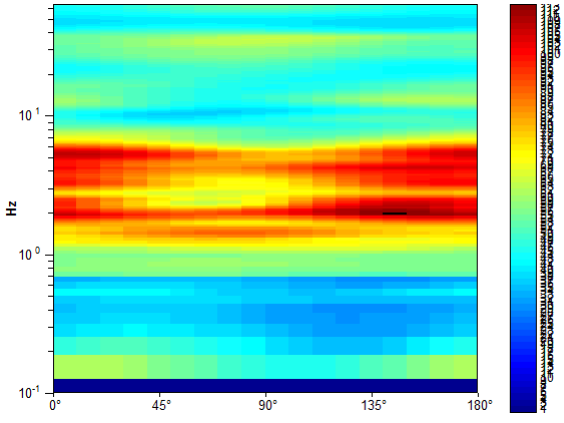
HORIZONTAL TO VERTICAL SPECTRAL RATIO



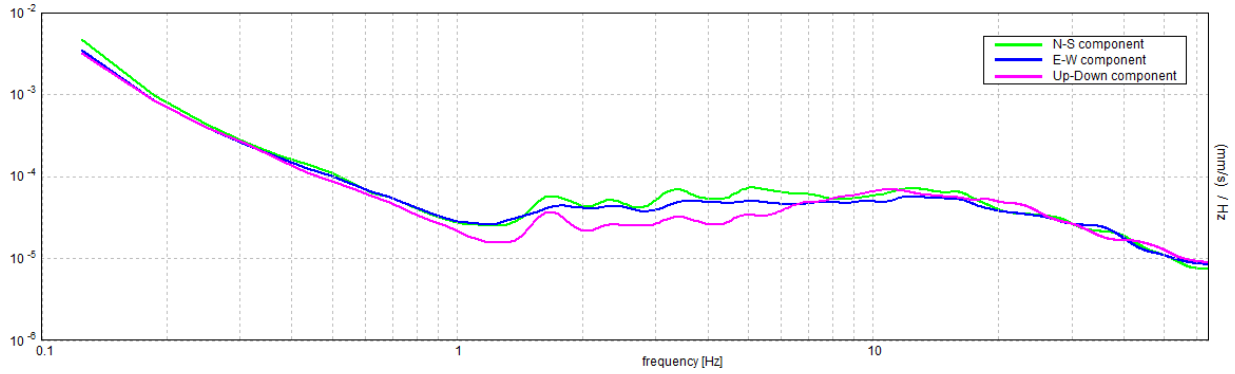
H/V TIME HISTORY



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 1.88 ± 0.01 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.88 > 0.63	OK	
$n_c(f_0) > 200$	1650.0 > 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 46 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.33 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0021| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.00394 < 0.1875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4312 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P32DS35

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	12
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pioppe di Salvaro via Pioppe ´´2´´**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	2		14,90
0,40	1	2		14,90
0,60	2	3		22,35
0,80	2	3		22,35
1,00	2	15		103,57
1,20	2	18		124,28
1,40	2	10		69,05
1,60	3	10		69,05
1,80	3	11		75,95
2,00	3	22		141,56
2,20	3	48		308,85

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

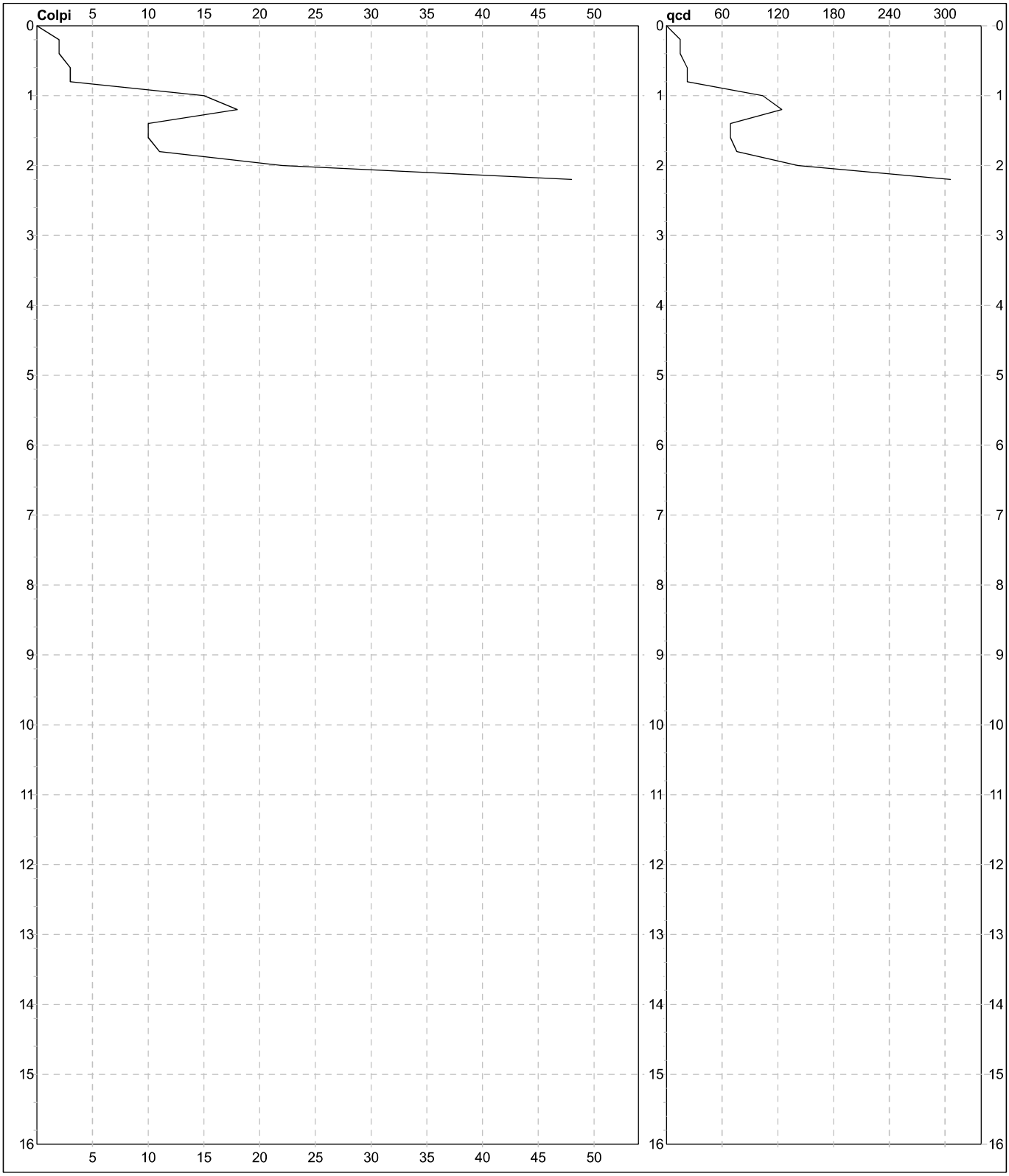
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	12
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pioppe di Salvaro via Pioppe ´´2´´**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P33DS36

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	13
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pioppe di Salvaro via Canale ´´1´´**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda:

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	2		14,90
0,40	1	3		22,35
0,60	2	5		37,24
0,80	2	5		37,24
1,00	2	12		82,85
1,20	2	12		82,85
1,40	2	5		34,52
1,60	3	8		55,24
1,80	3	14		96,66
2,00	3	19		122,25
2,20	3	48		308,85

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

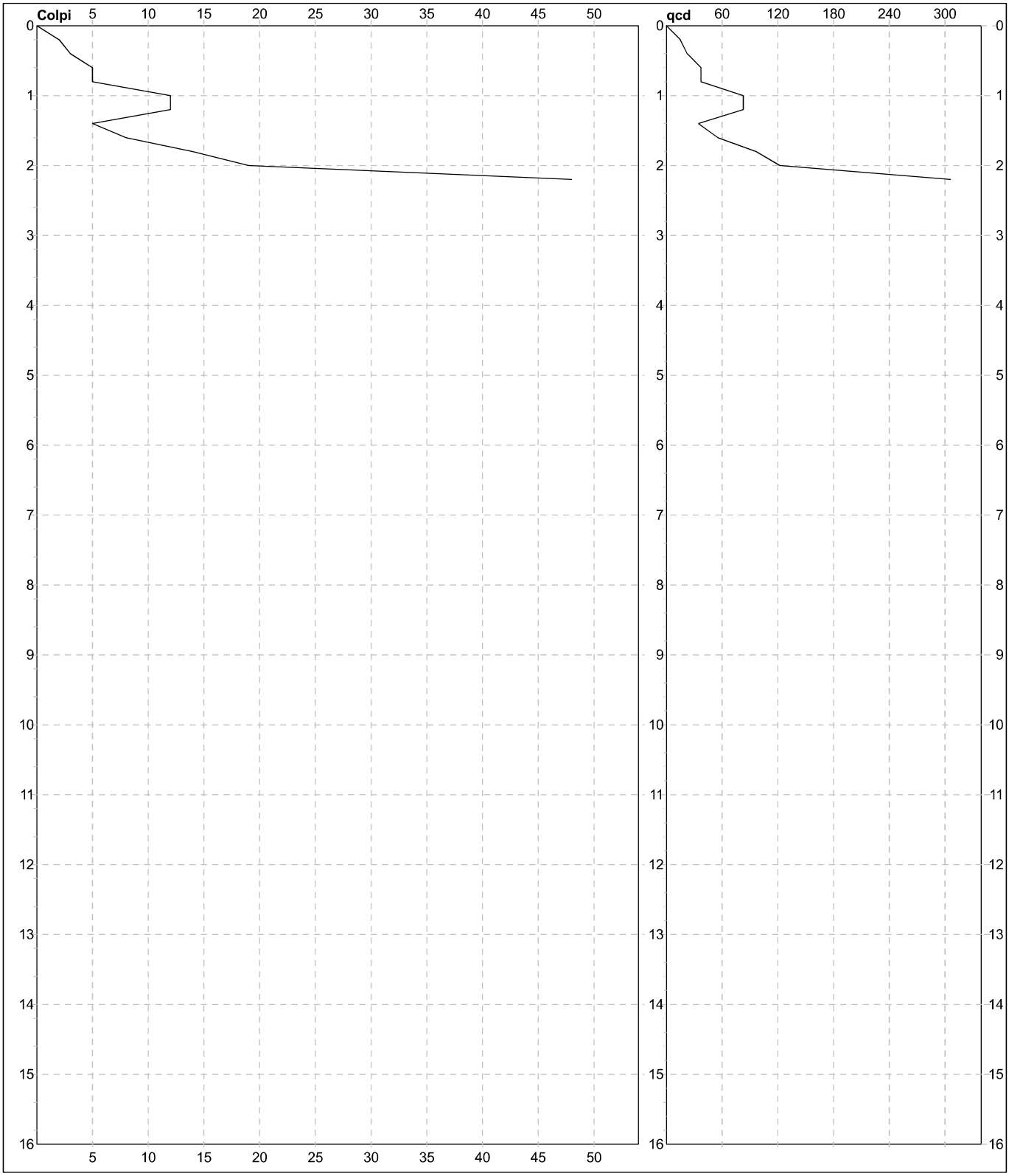
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	13
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pioppe di Salvaro via Canale ´´1´´**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda:



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P34DS37

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	11
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pioppe di Salvaro via Panoramica ´´3´´**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: -3,00 m da quota inizio

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	1		7,45
0,40	1	4		29,80
0,60	2	4		29,80
0,80	2	4		29,80
1,00	2	3		20,71
1,20	2	7		48,33
1,40	2	10		69,05
1,60	3	7		48,33
1,80	3	8		55,24
2,00	3	4		25,74
2,20	3	4		25,74
2,40	3	3		19,30
2,60	4	3		19,30
2,80	4	3		19,30
3,00	4	3		18,07
3,20	4	4		24,10
3,40	4	5		30,12
3,60	5	4		24,10
3,80	5	3		18,07
4,00	5	4		22,65
4,20	5	4		22,65
4,40	5	3		16,99
4,60	6	4		22,65
4,80	6	3		16,99
5,00	6	3		16,03
5,20	6	3		16,03
5,40	6	3		16,03
5,60	7	3		16,03
5,80	7	4		21,37
6,00	7	4		20,23
6,20	7	4		20,23
6,40	7	4		20,23
6,60	8	4		20,23
6,80	8	3		15,17
7,00	8	4		19,20
7,20	8	3		14,40
7,40	8	3		14,40
7,60	9	3		14,40
7,80	9	3		14,40
8,00	9	3		13,70
8,20	9	6		27,41
8,40	9	4		18,27
8,60	10	4		18,27
8,80	10	5		22,84
9,00	10	4		17,43
9,20	10	5		21,79
9,40	10	4		17,43
9,60	11	5		21,79
9,80	11	4		17,43
10,00	11	4		16,66
10,20	11	4		16,66
10,40	11	4		16,66
10,60	12	4		16,66
10,80	12	7		29,16
11,00	12	20		79,79
11,20	12	16		63,84
11,40	12	17		67,82
11,60	13	22		87,77
11,80	13	27		107,72
12,00	13	30		114,84
12,20	13	38		145,47
12,40	13	42		160,78

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

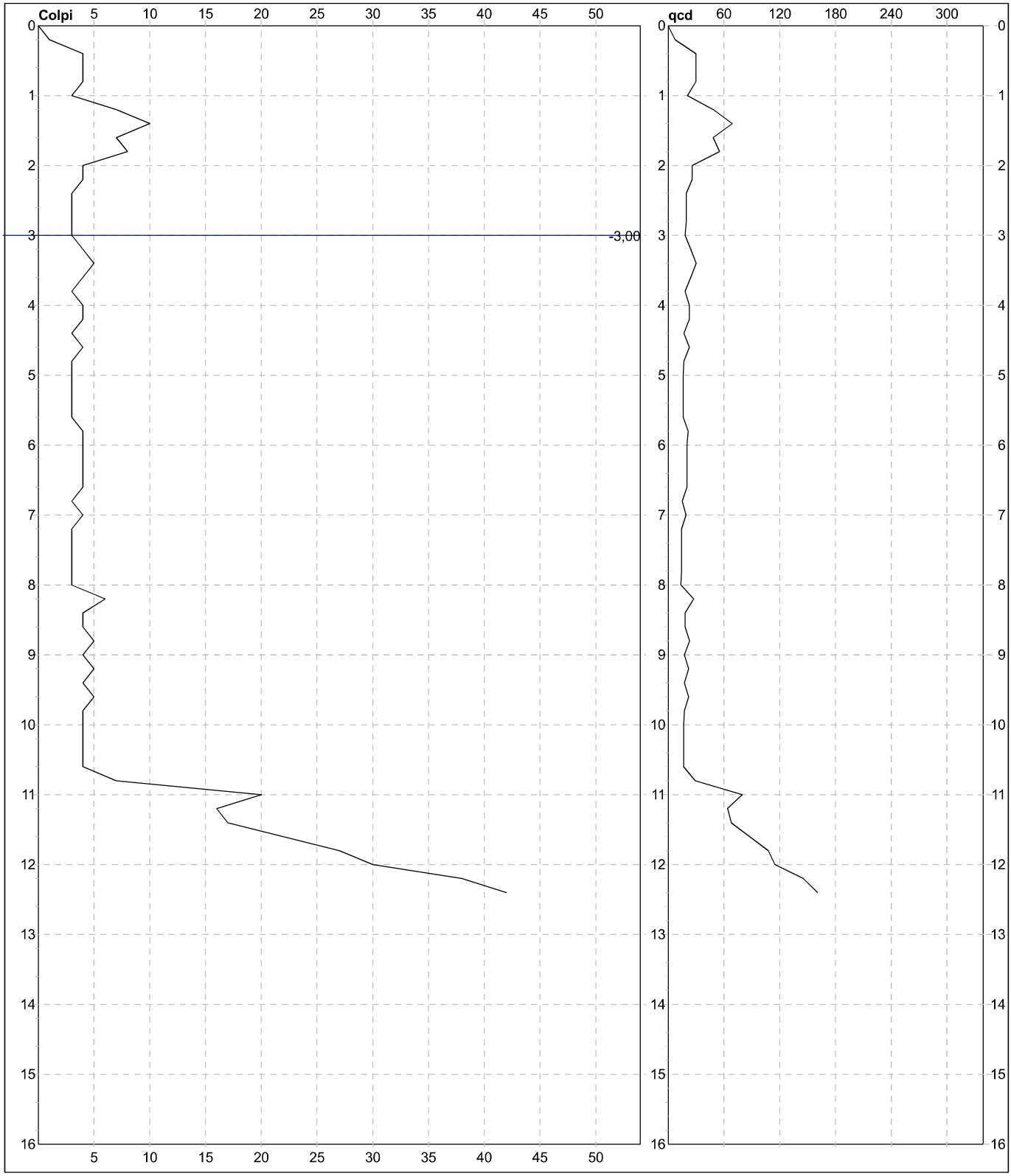
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	11
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pioppe di Salvaro via Panoramica ´´3´´**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: -3,00 m da quota inizio



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

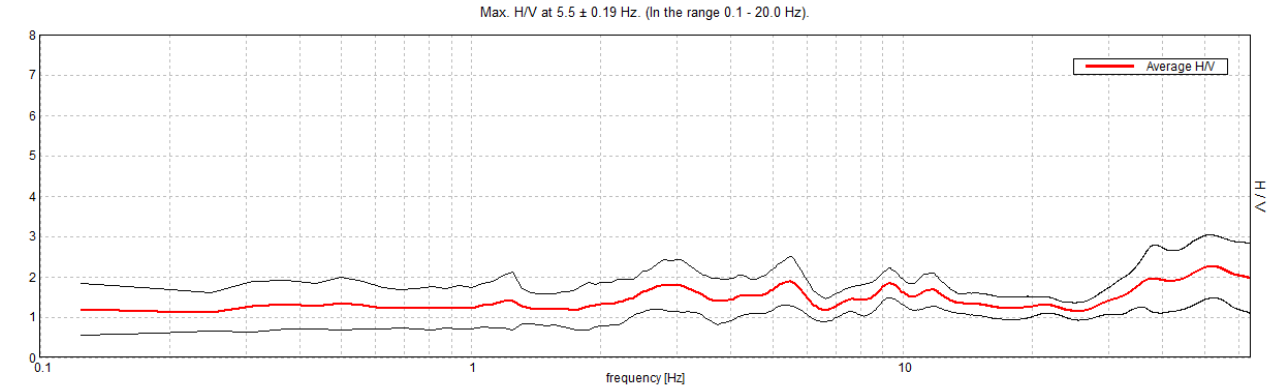
Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

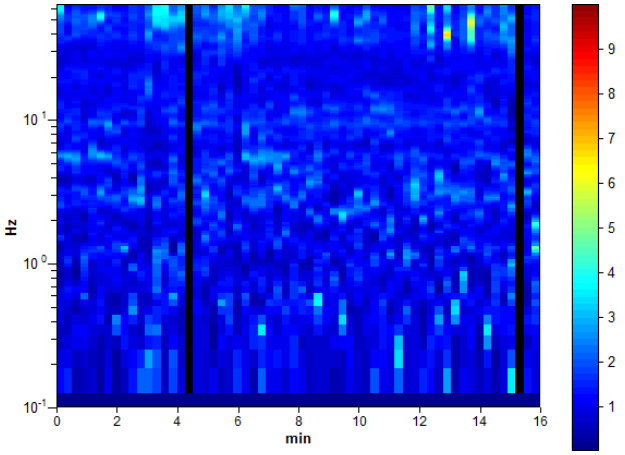
GRIZZANA MORANDI_MS, TR3 CÀ DEL BOSCO

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 11:14:48 End recording: 23/10/18 11:30:48
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 97% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

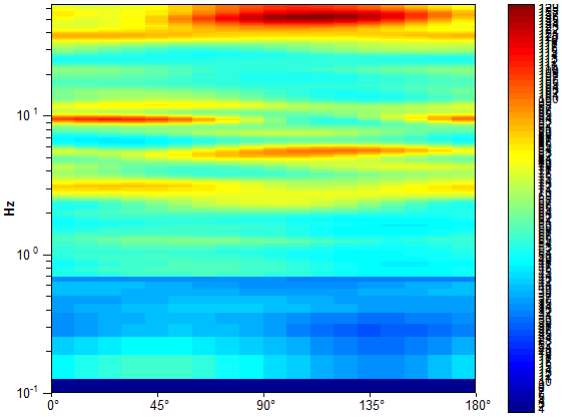
HORIZONTAL TO VERTICAL SPECTRAL RATIO



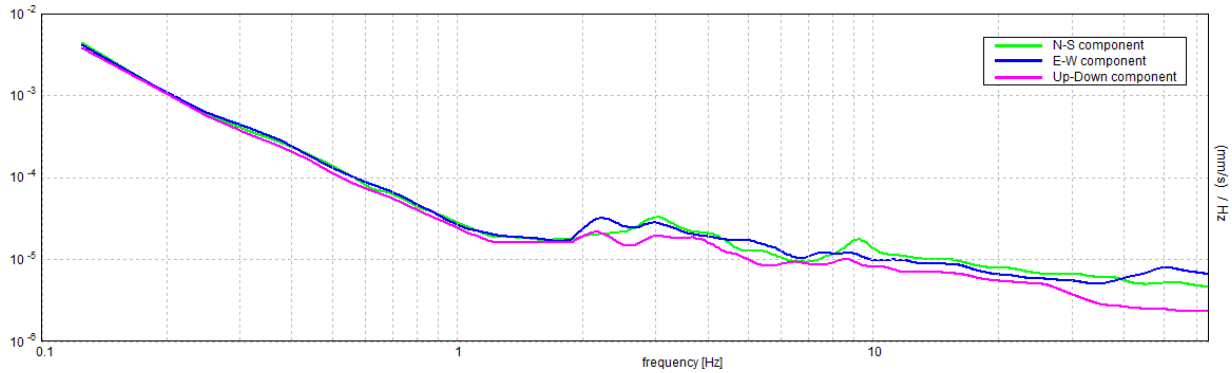
H/V TIME HISTORY



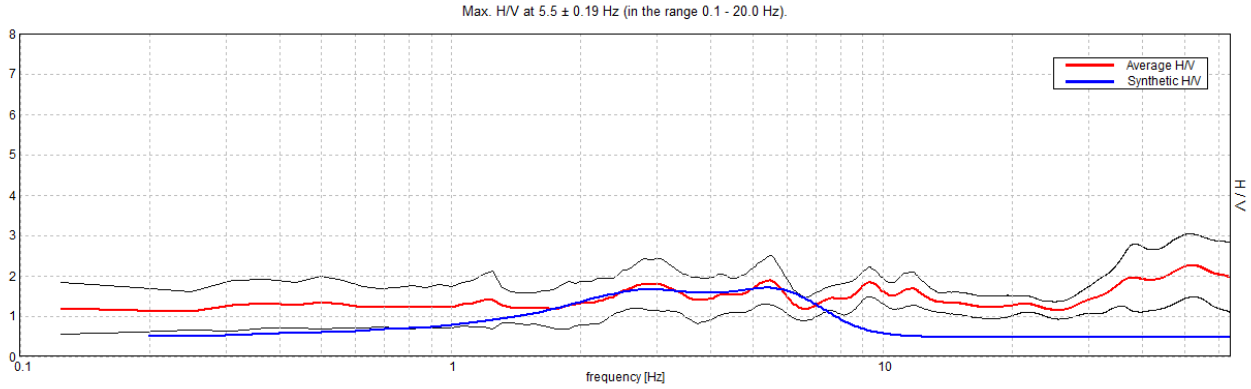
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

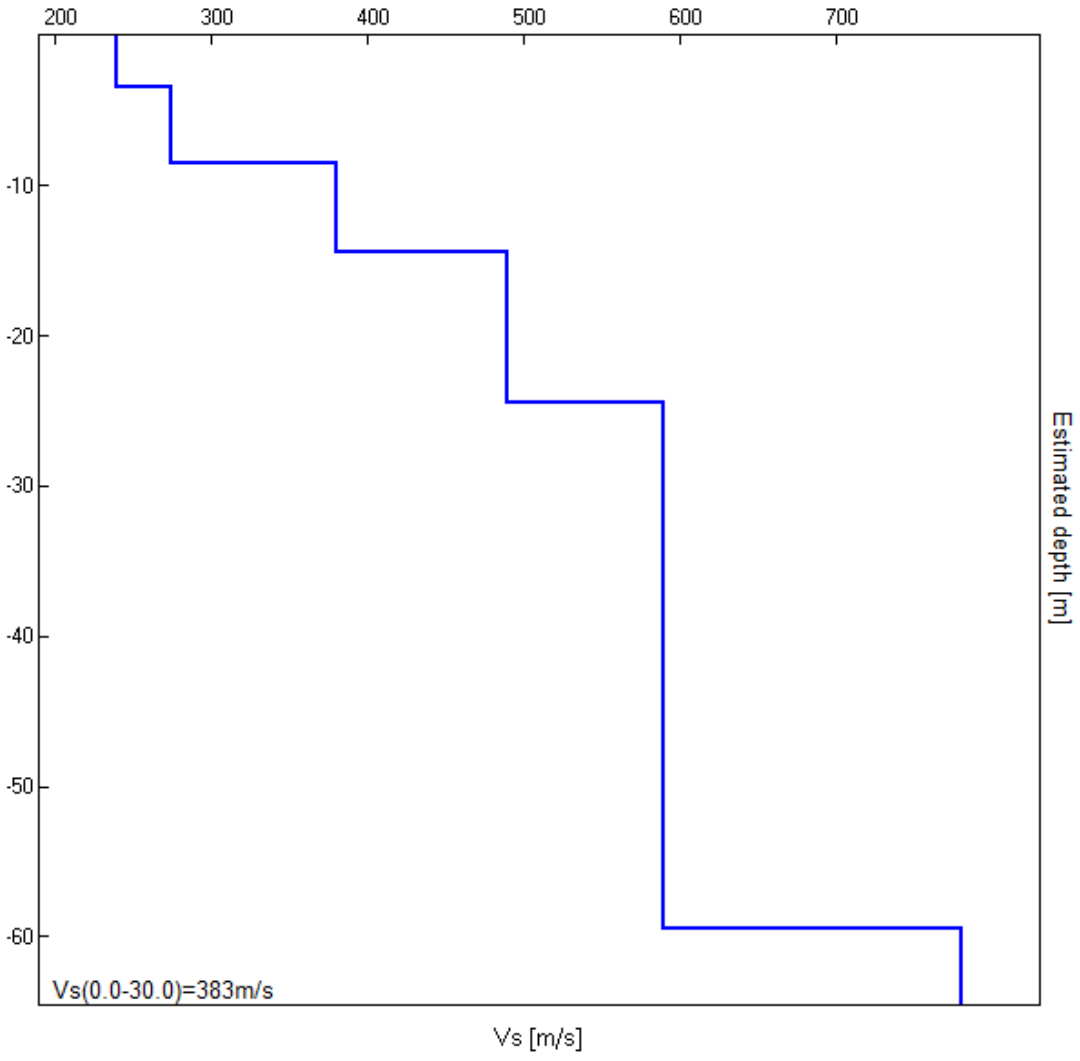


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.50	3.50	240
8.50	5.00	275
14.50	6.00	380
24.50	10.00	490
59.50	35.00	590
inf.	inf.	780

Vs(0.0-30.0)=383m/s



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

Max. H/V at 5.5 ± 0.19 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.50 > 0.63	OK	
$n_c(f_0) > 200$	5104.0 > 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 133 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.88 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01703| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.09364 < 0.275	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3014 < 1.58	OK	

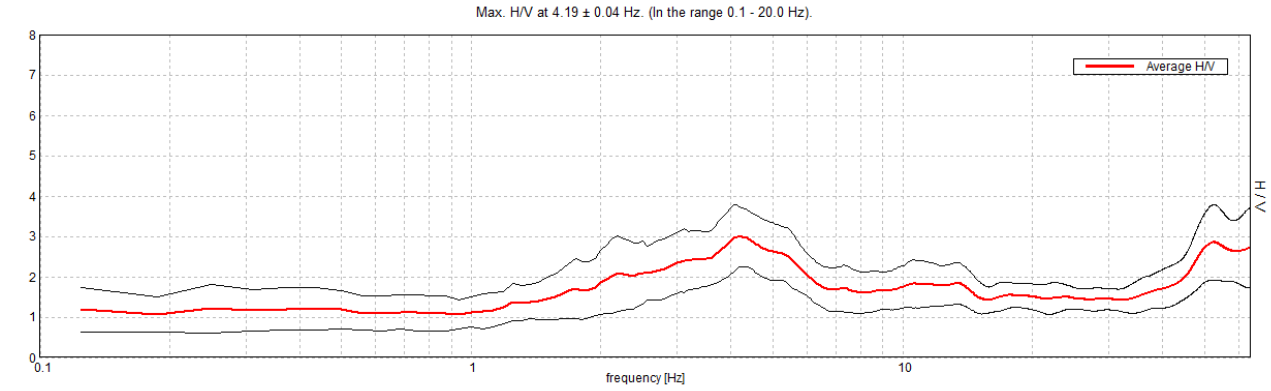
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

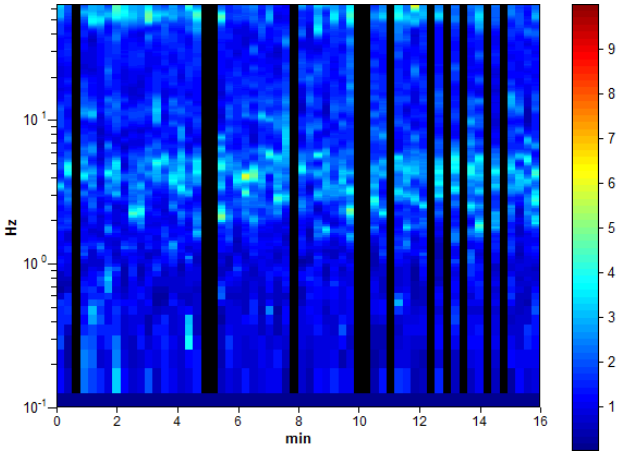
GRIZZANA MORANDI_MS, TR4 AMERICA

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 11:39:53 End recording: 23/10/18 11:55:53
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 80% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

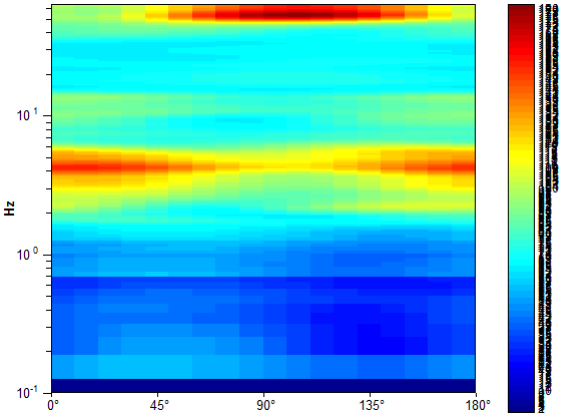
HORIZONTAL TO VERTICAL SPECTRAL RATIO



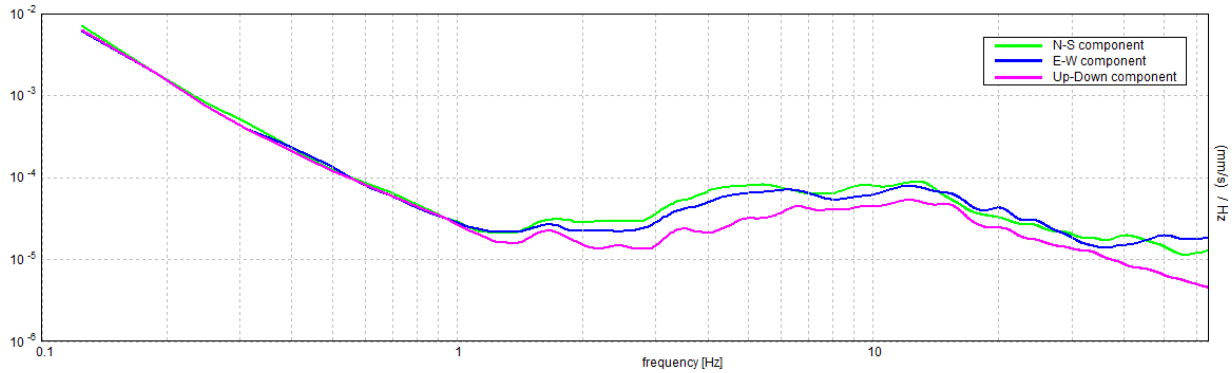
H/V TIME HISTORY



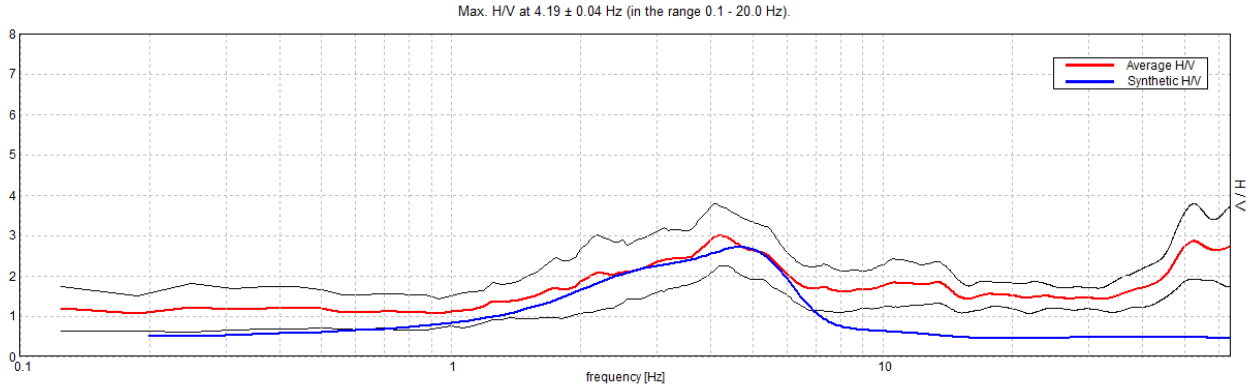
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

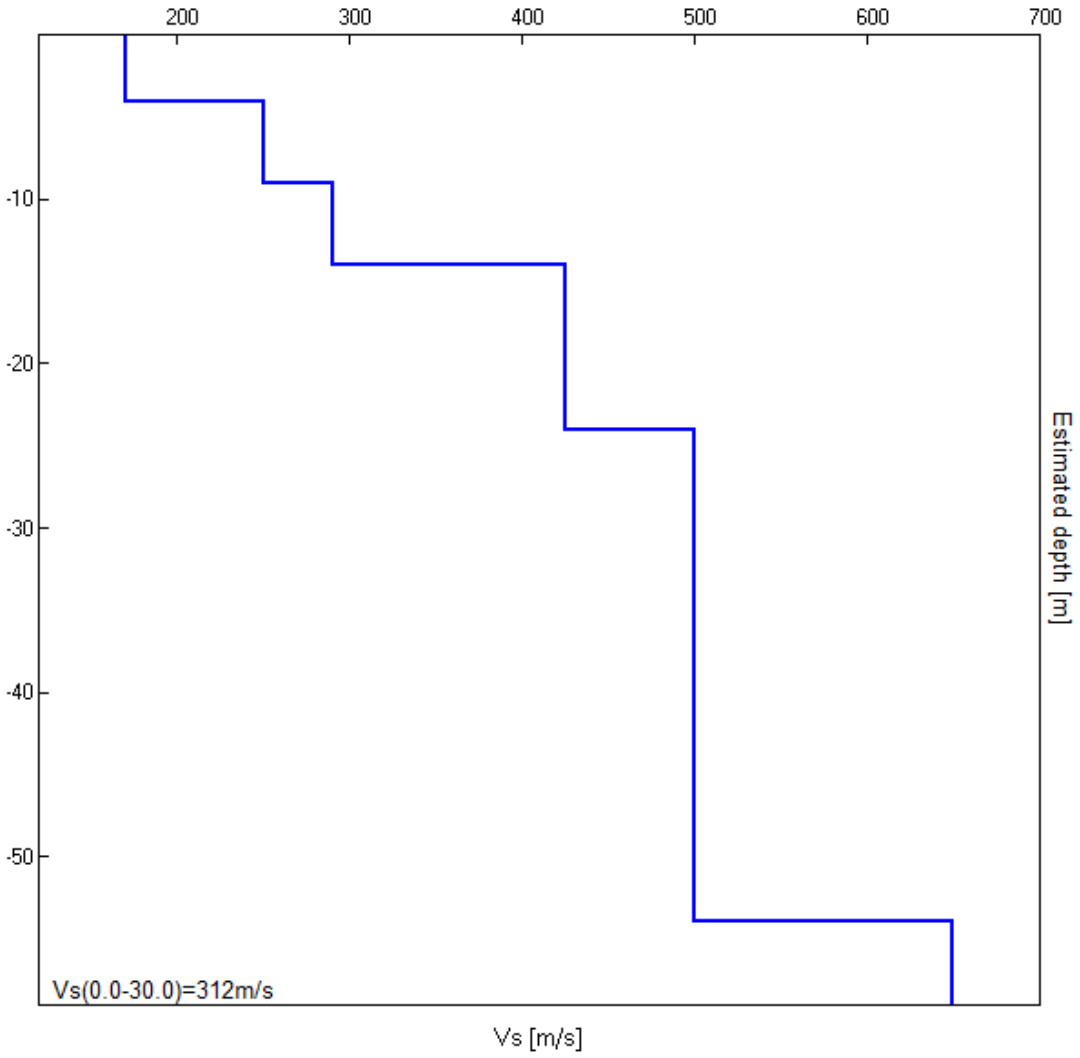


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
4.00	4.00	170	0.37
9.00	5.00	250	0.37
14.00	5.00	290	0.37
24.00	10.00	425	0.37
54.00	30.00	500	0.37
inf.	inf.	650	0.37

Vs(0.0-30.0)=312m/s



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

Max. H/V at 4.19 ± 0.04 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.19 > 0.63	OK	
$n_c(f_0) > 200$	3216.0 > 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 102 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.5 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	14.938 Hz	OK	
$A_0 > 2$	2.99 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0052| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.02179 < 0.20938	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3681 < 1.58	OK	

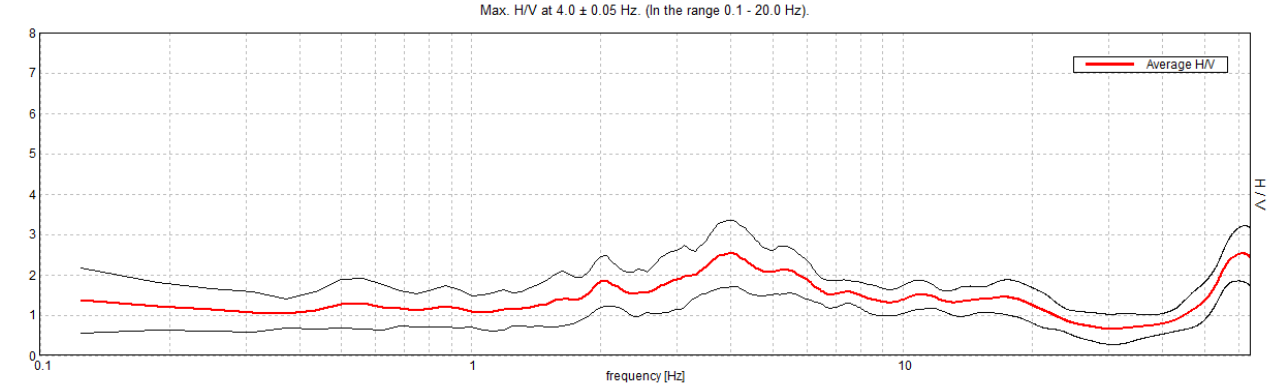
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

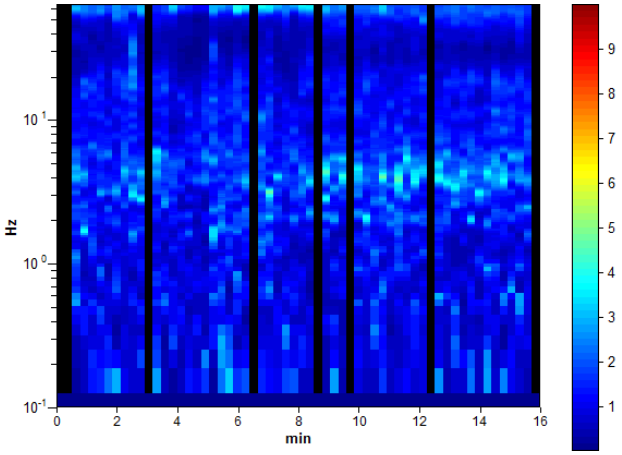
GRIZZANA MORANDI_MS, TR45 CARVIANO-AMERICA

Instrument: TRZ-0108/01-10
Start recording: 05/12/18 12:17:22 End recording: 05/12/18 12:33:23
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 87% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

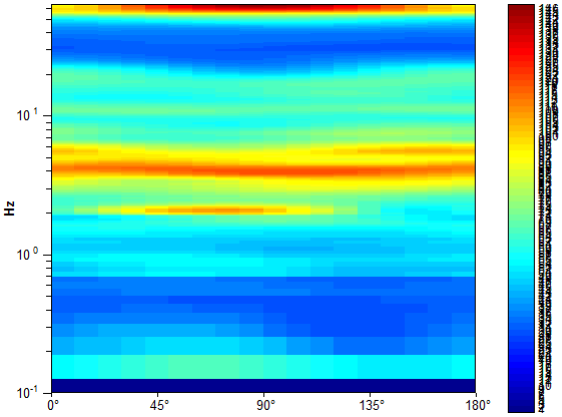
HORIZONTAL TO VERTICAL SPECTRAL RATIO



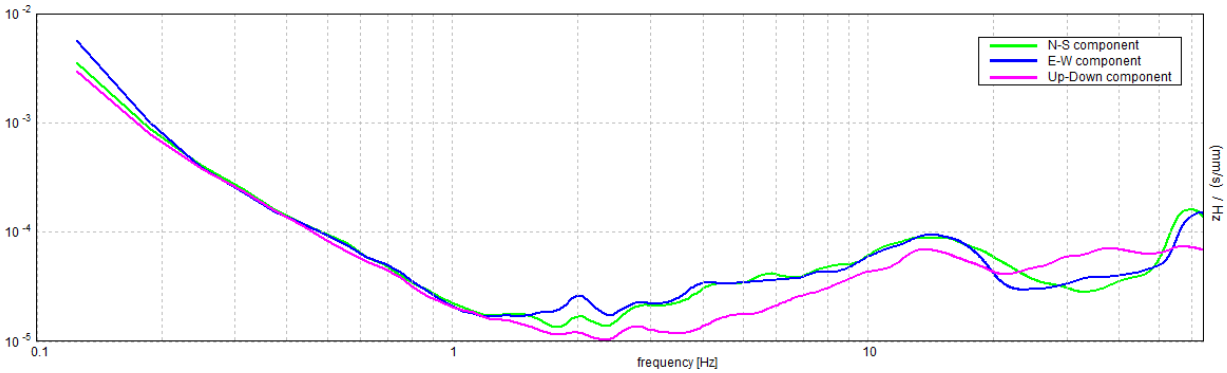
H/V TIME HISTORY



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 4.0 ± 0.05 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.00 > 0.63	OK	
$n_c(f_0) > 200$	3328.0 > 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 97 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.438 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.53 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00649| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.02595 < 0.2	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4023 < 1.58	OK	

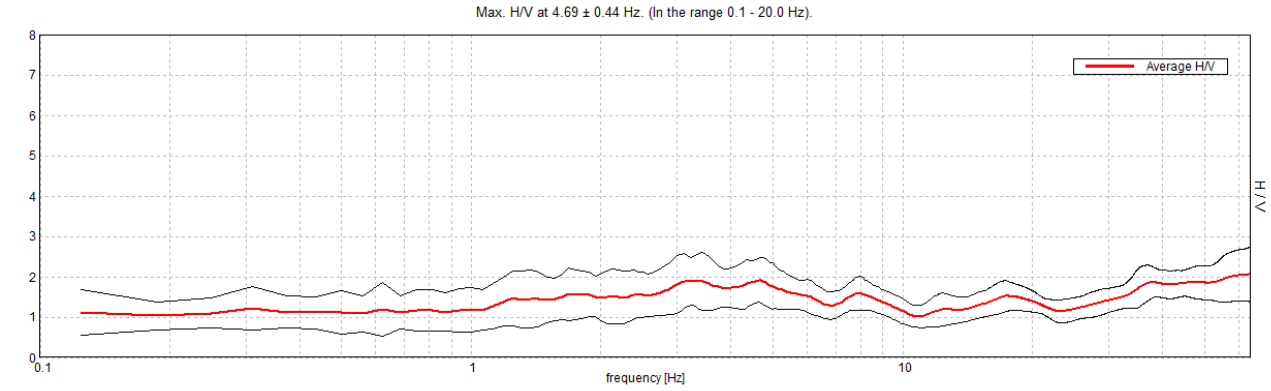
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

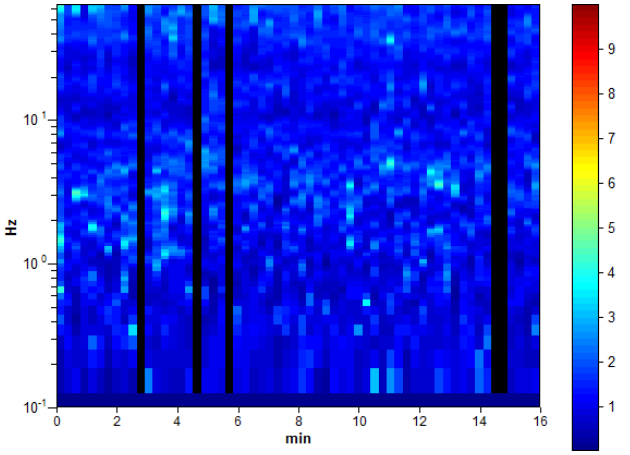
GRIZZANA MORANDI_MS, TR5 EUROPA

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 12:01:46 End recording: 23/10/18 12:17:46
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 92% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

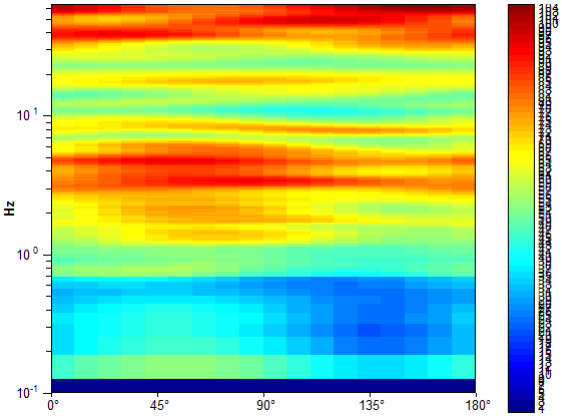
HORIZONTAL TO VERTICAL SPECTRAL RATIO



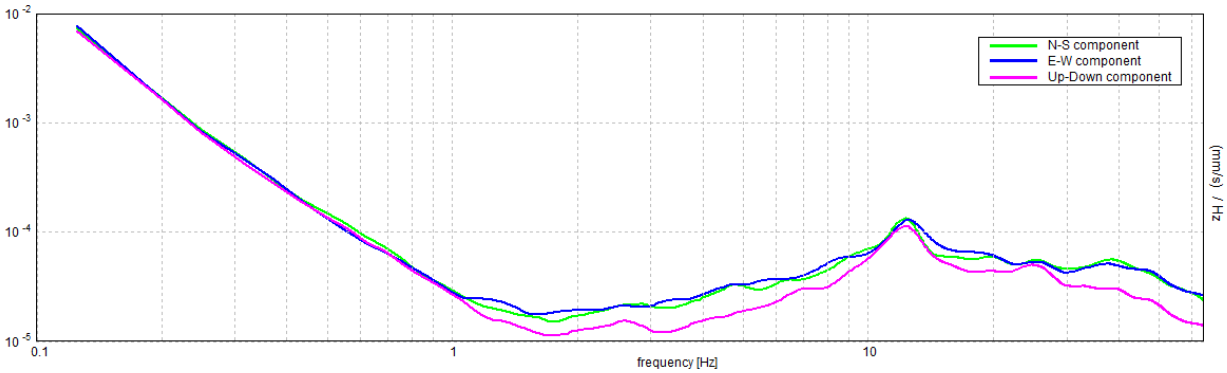
H/V TIME HISTORY



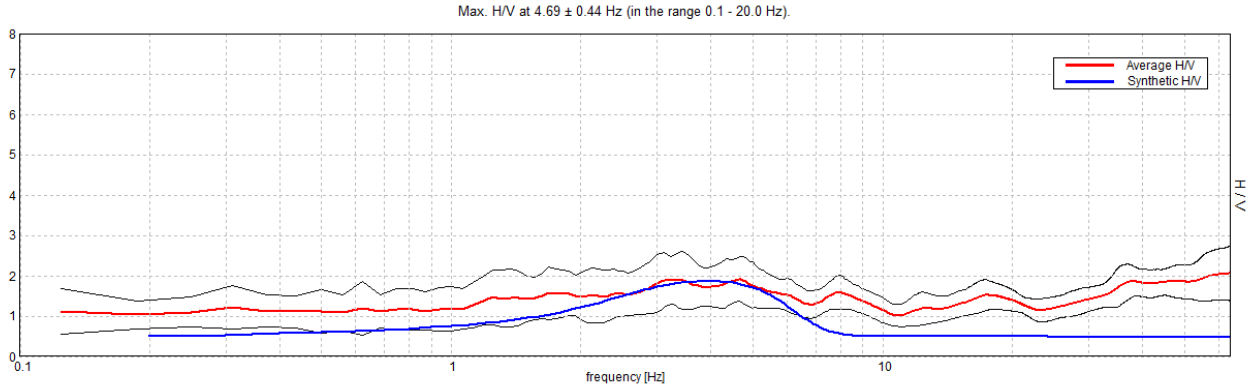
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

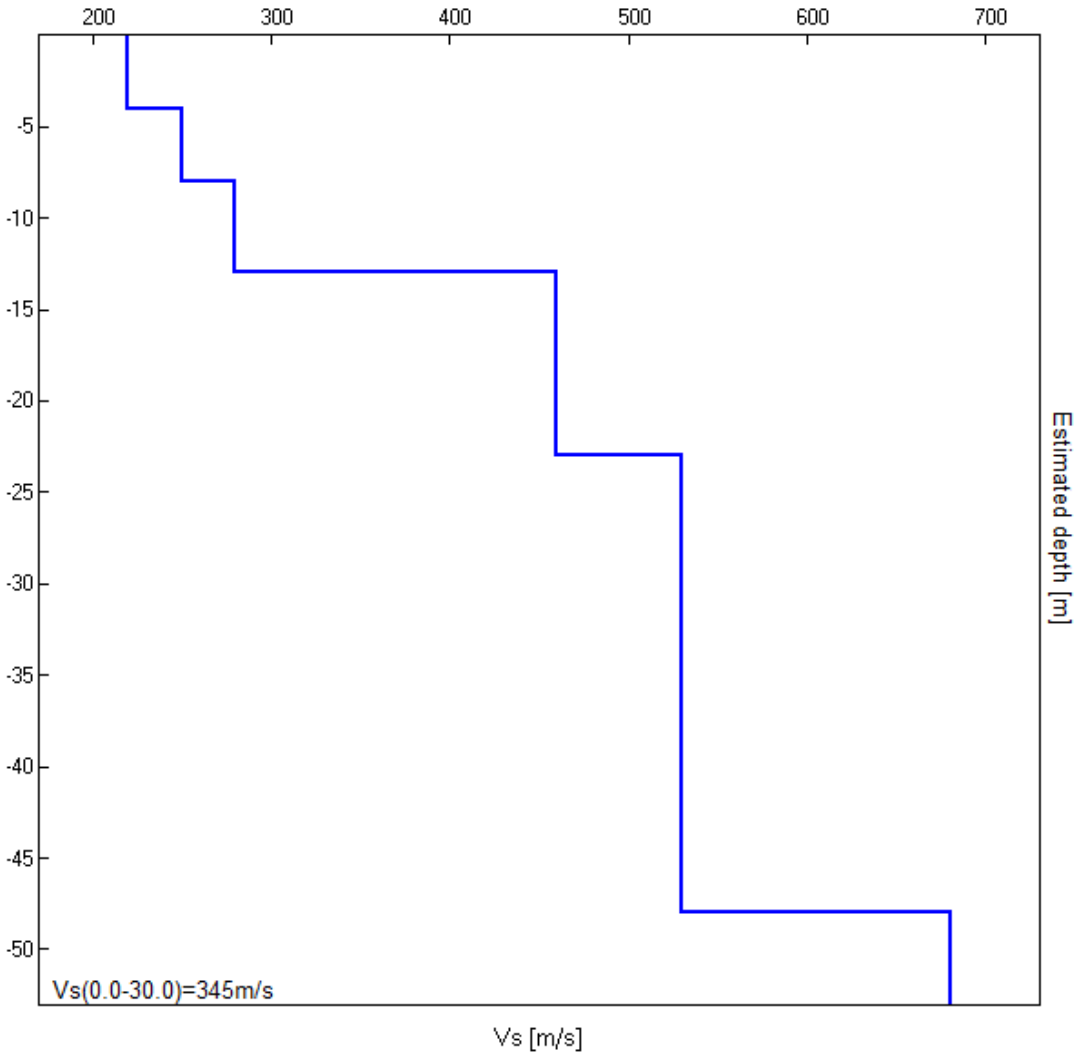


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	220
8.00	4.00	250
13.00	5.00	280
23.00	10.00	460
48.00	25.00	530
inf.	inf.	680

Vs(0.0-30.0)=345m/s



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

Max. H/V at 4.69 ± 0.44 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.69 > 0.63	OK	
$n_c(f_0) > 200$	4125.0 > 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 114 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.91 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.04602| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.21572 < 0.23438	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2775 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P39DS42

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	10
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **America a Vergato tra via Carviano e il fiume**

U.M.: **kg/cm²** | Pagina: 1 | Elaborato:

Data esec.: 10/04/2019

Falda: Foro chiuso

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	1		7,45
0,40	1	3		22,35
0,60	2	8		59,59
0,80	2	11		81,94
1,00	2	10		69,05
1,20	2	9		62,14
1,40	2	9		62,14
1,60	3	13		89,76
1,80	3	14		96,66
2,00	3	14		90,08
2,20	3	8		51,48
2,40	3	7		45,04
2,60	4	5		32,17
2,80	4	8		51,48
3,00	4	5		30,12
3,20	4	5		30,12
3,40	4	4		24,10
3,60	5	5		30,12
3,80	5	6		36,15
4,00	5	5		28,32
4,20	5	4		22,65
4,40	5	2		11,33
4,60	6	2		11,33
4,80	6	4		22,65
5,00	6	4		21,37
5,20	6	4		21,37
5,40	6	20		106,86
5,60	7	13		69,46
5,80	7	5		26,72
6,00	7	4		20,23
6,20	7	6		30,34
6,40	7	5		25,29
6,60	8	5		25,29
6,80	8	5		25,29
7,00	8	4		19,20
7,20	8	8		38,40
7,40	8	7		33,60
7,60	9	6		28,80
7,80	9	5		24,00
8,00	9	5		22,84
8,20	9	5		22,84
8,40	9	5		22,84
8,60	10	7		31,98
8,80	10	12		54,82
9,00	10	8		34,86
9,20	10	6		26,15
9,40	10	8		34,86
9,60	11	7		30,50
9,80	11	6		26,15
10,00	11	12		49,99
10,20	11	9		37,49
10,40	11	7		29,16
10,60	12	6		24,99
10,80	12	6		24,99
11,00	12	6		23,94
11,20	12	7		27,93
11,40	12	6		23,94
11,60	13	8		31,92
11,80	13	17		67,82
12,00	13	24		91,87
12,20	13	25		95,70
12,40	13	12		45,94
12,60	14	10		38,28
12,80	14	11		42,11
13,00	14	10		36,79
13,20	14	13		47,83
13,40	14	25		91,98
13,60	15	24		88,30
13,80	15	33		121,41
14,00	15	34		120,40
14,20	15	28		99,15
14,40	15	26		92,07
14,60	16	25		88,53
14,80	16	27		95,61

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

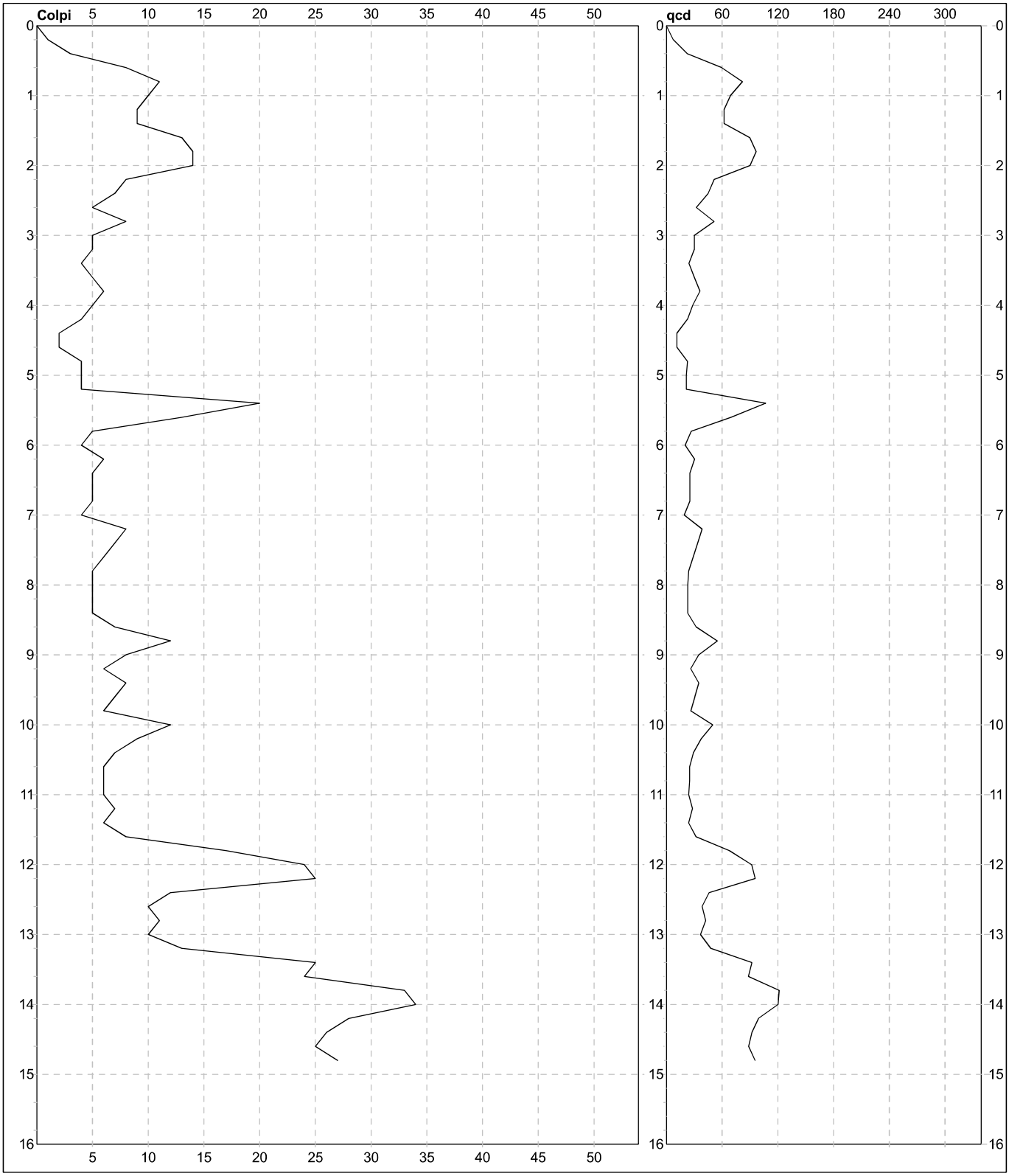
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	10
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **America a Vergato tra via Carviano e il fiume**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Foro chiuso

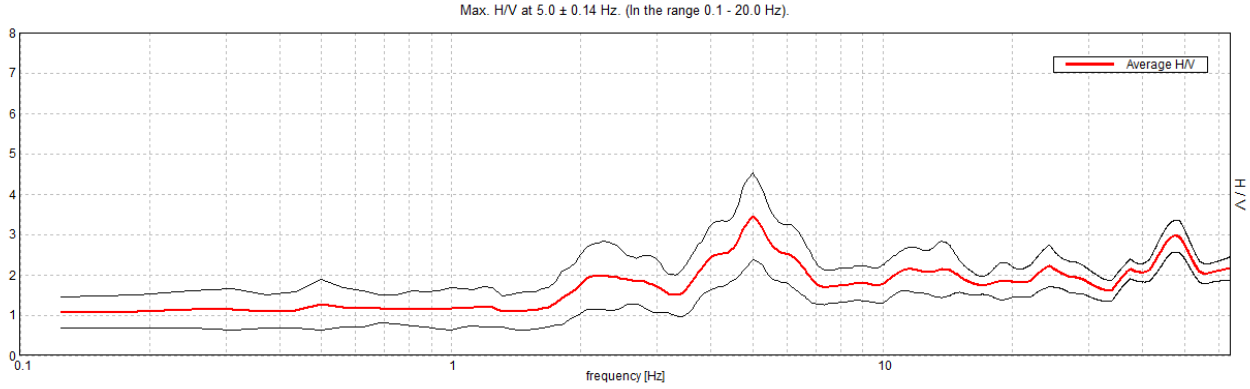


Penetrometro:	DPSH (S. Heavy)	Responsabile:		Preforo:	m
Massa battente:	63,50 m	Assistente:		Corr.astine:	kg/ml
Altezza caduta:	0,75 m			Cod.ISTAT:	0
Avanzamento:	0,20 m				

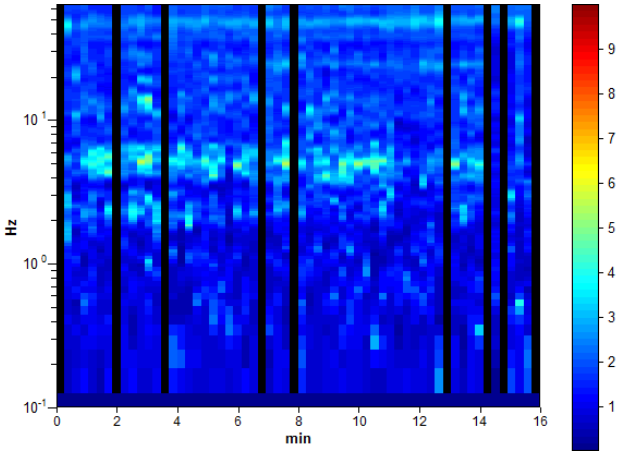
GRIZZANA MORANDI_MS, TR6 LAGO DI POGGIO

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 12:34:12 End recording: 23/10/18 12:50:12
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 85% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

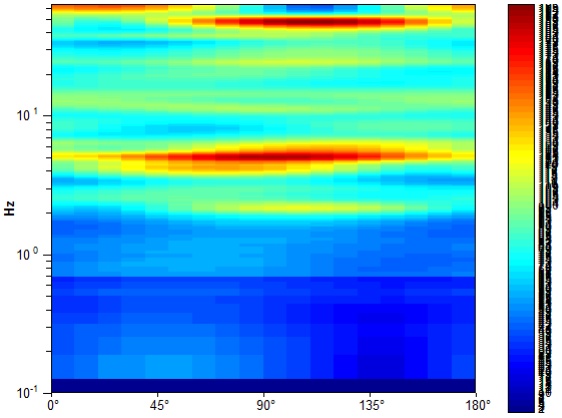
HORIZONTAL TO VERTICAL SPECTRAL RATIO



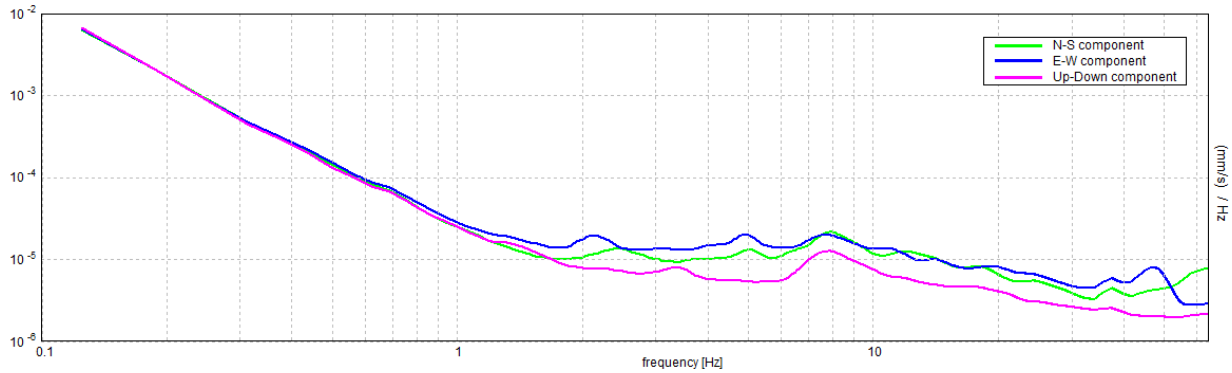
H/V TIME HISTORY



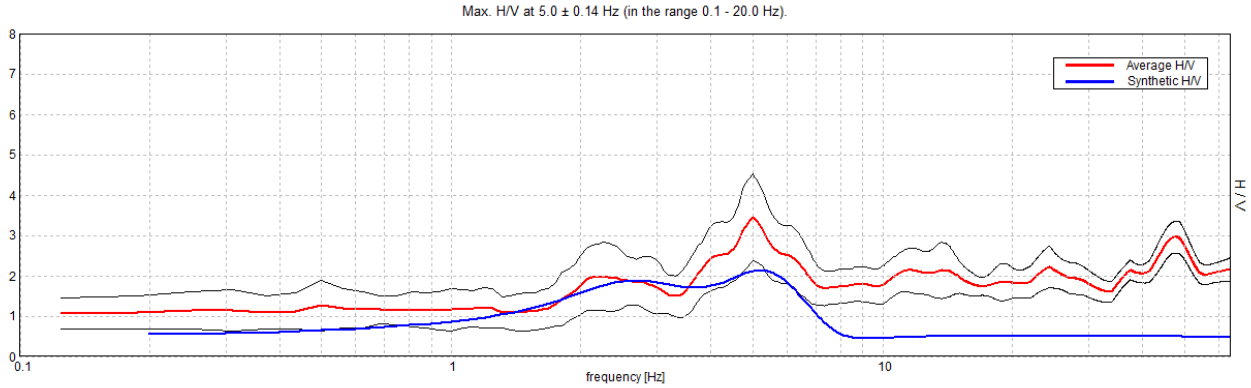
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

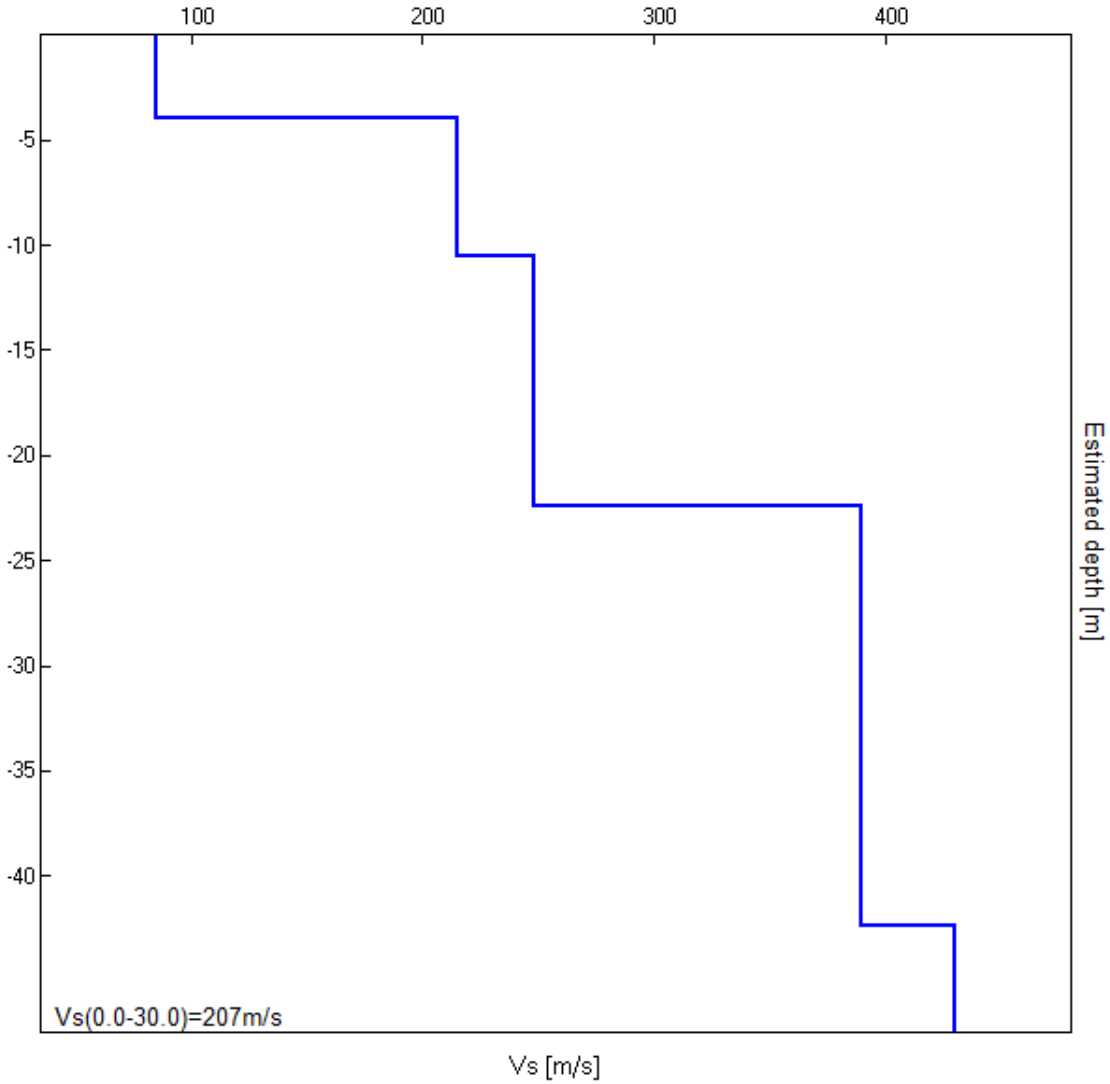


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	85
10.50	6.50	215
22.40	11.90	248
42.40	20.00	390
inf.	inf.	430

Vs(0.0-30.0)=207m/s



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

Max. H/V at 5.0 ± 0.14 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.00 > 0.63	OK	
$n_c(f_0) > 200$	4080.0 > 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 121 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	3.563 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	7.188 Hz	OK	
$A_0 > 2$	3.45 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01407| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.07035 < 0.25	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.5347 < 1.58	OK	

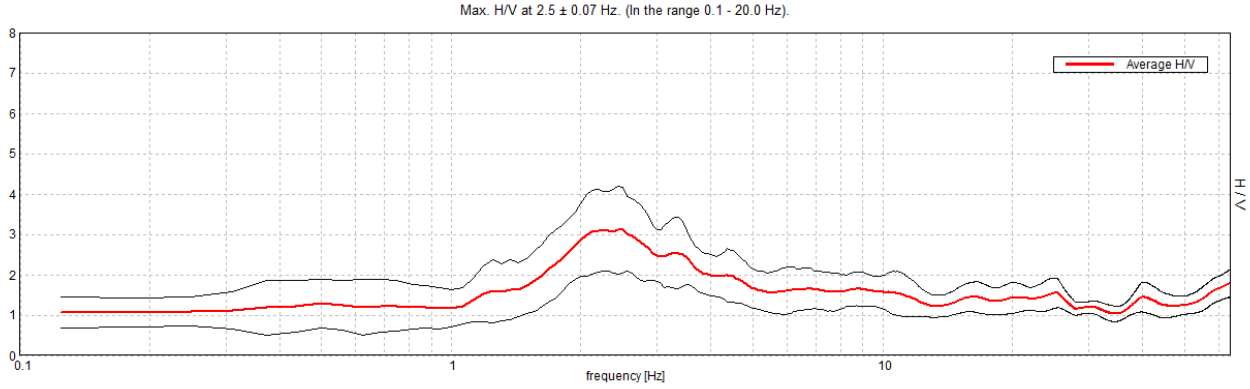
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

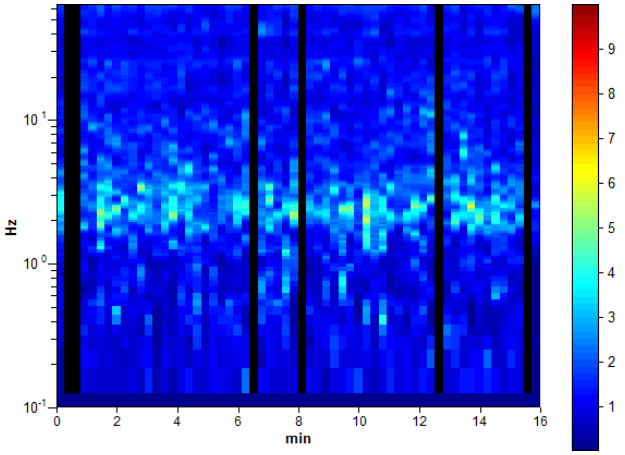
GRIZZANA MORANDI_MS, TR7 Q510

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 12:53:29 End recording: 23/10/18 13:09:29
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 90% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

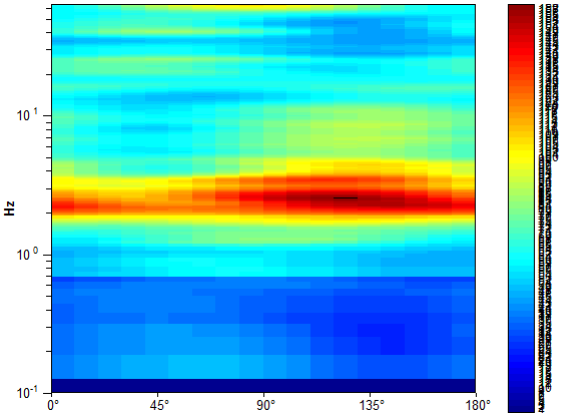
HORIZONTAL TO VERTICAL SPECTRAL RATIO



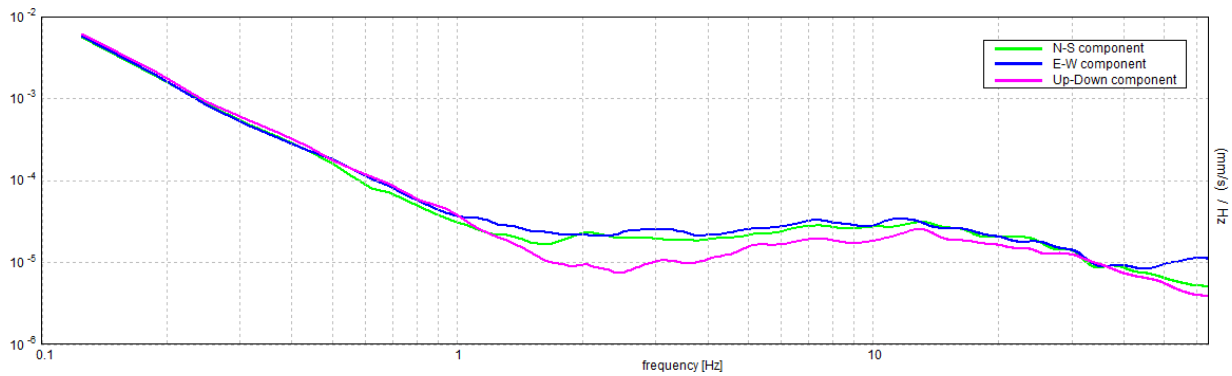
H/V TIME HISTORY



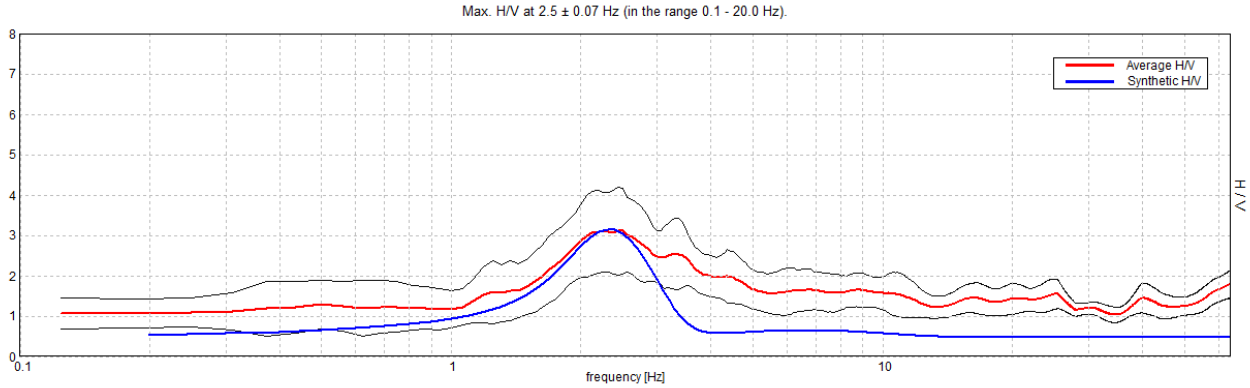
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

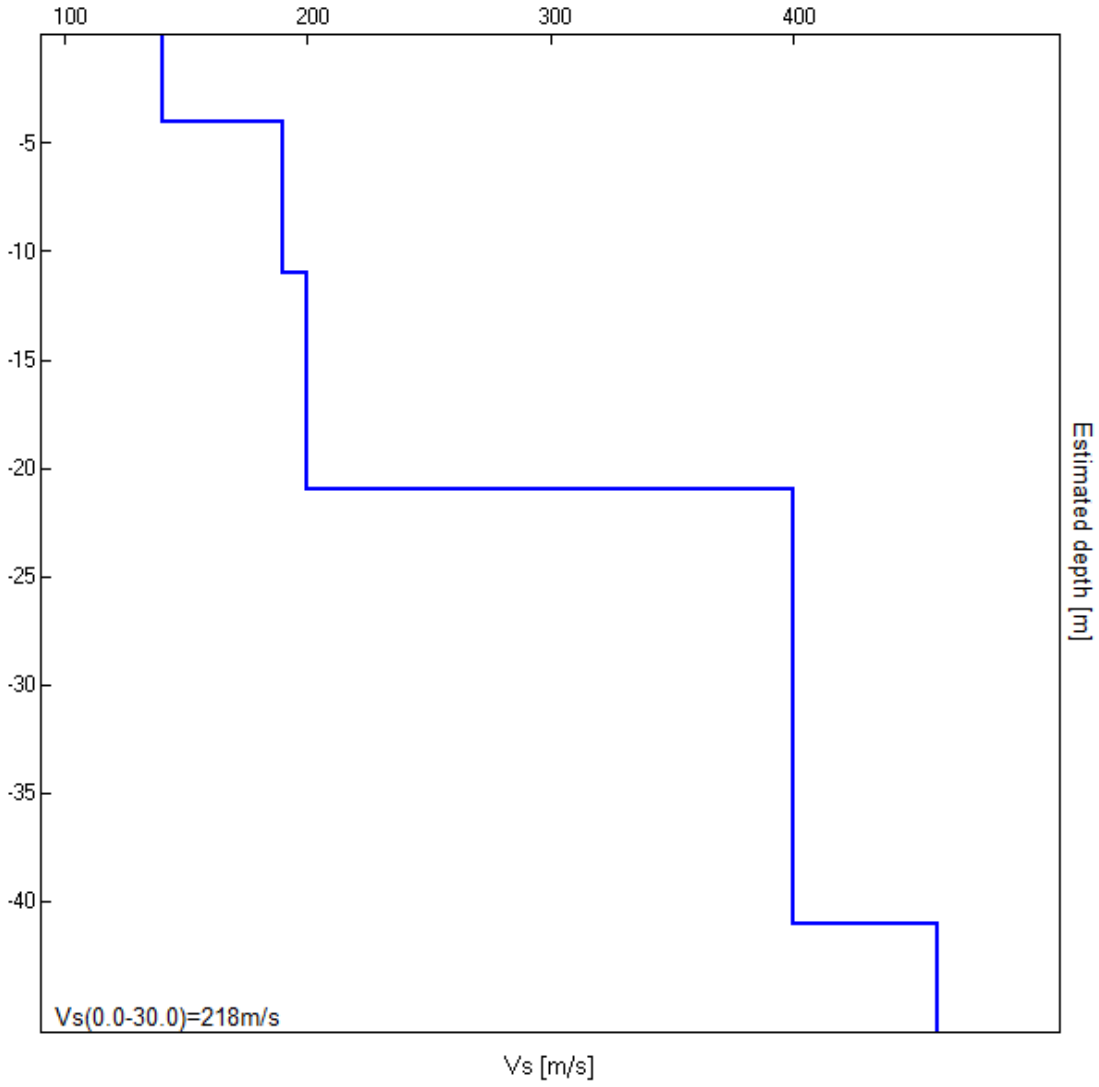


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	140
11.00	7.00	190
21.00	10.00	200
41.00	20.00	400
inf.	inf.	460

Vs(0.0-30.0)=218m/s



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

Max. H/V at 2.5 ± 0.07 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	2.50 > 0.63	OK	
$n_c(f_0) > 200$	2160.0 > 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 61 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.188 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	5.5 Hz	OK	
$A_0 > 2$	3.11 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01326| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.03314 < 0.125	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.5272 < 1.58	OK	

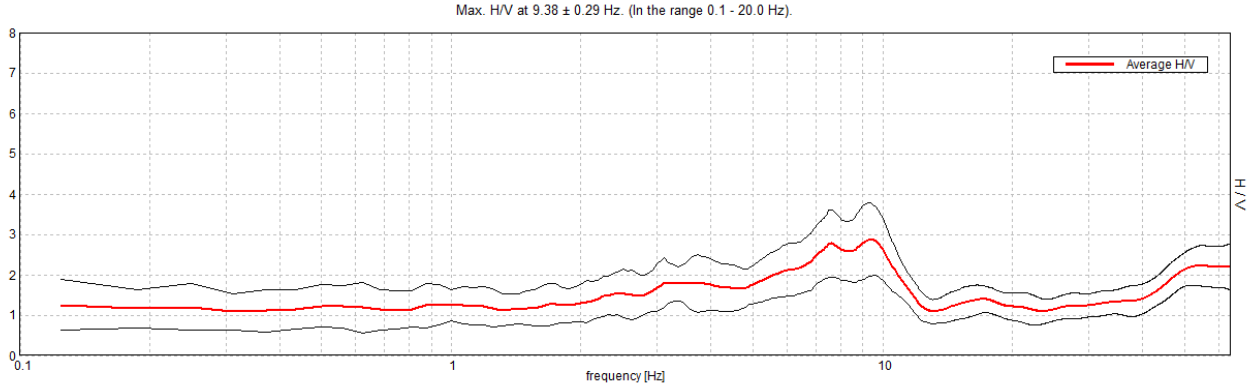
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

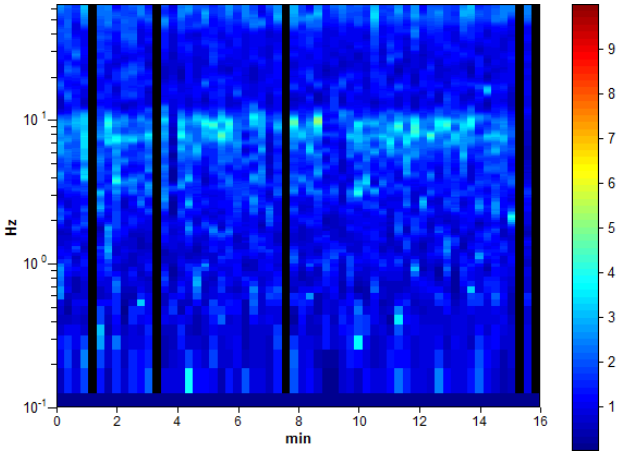
GRIZZANA MORANDI_MS, TR8 SORGENTE DI CASIGNO

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 13:16:14 End recording: 23/10/18 13:32:14
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 92% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

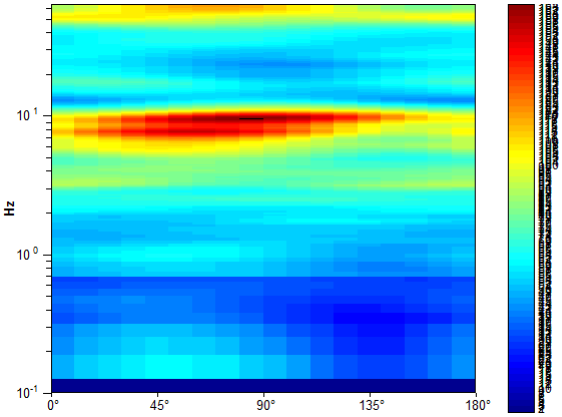
HORIZONTAL TO VERTICAL SPECTRAL RATIO



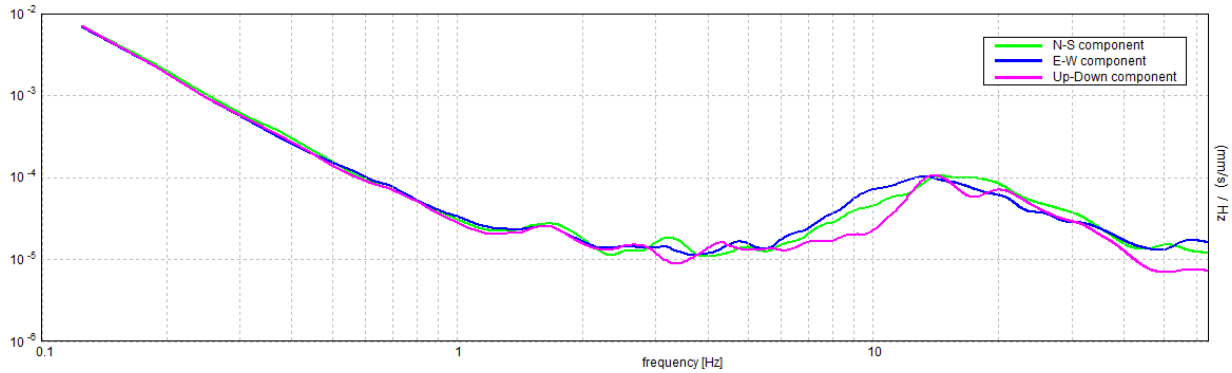
H/V TIME HISTORY



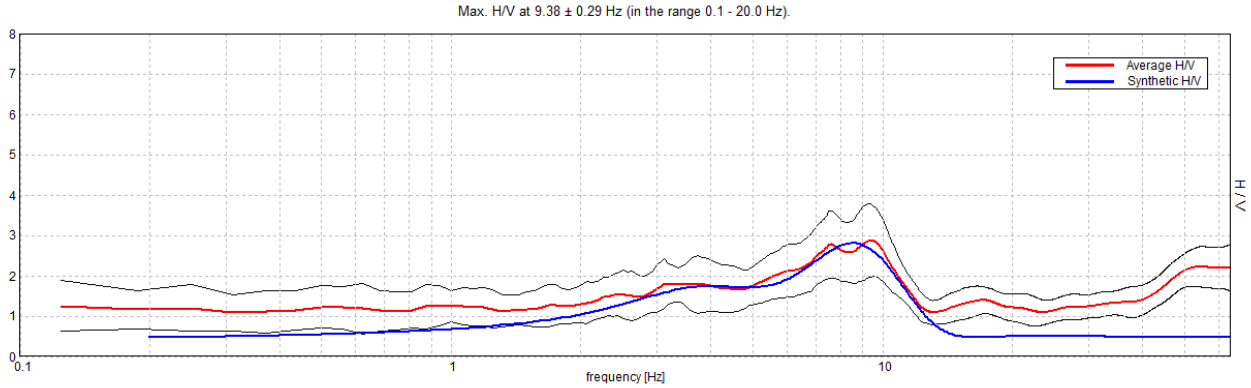
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

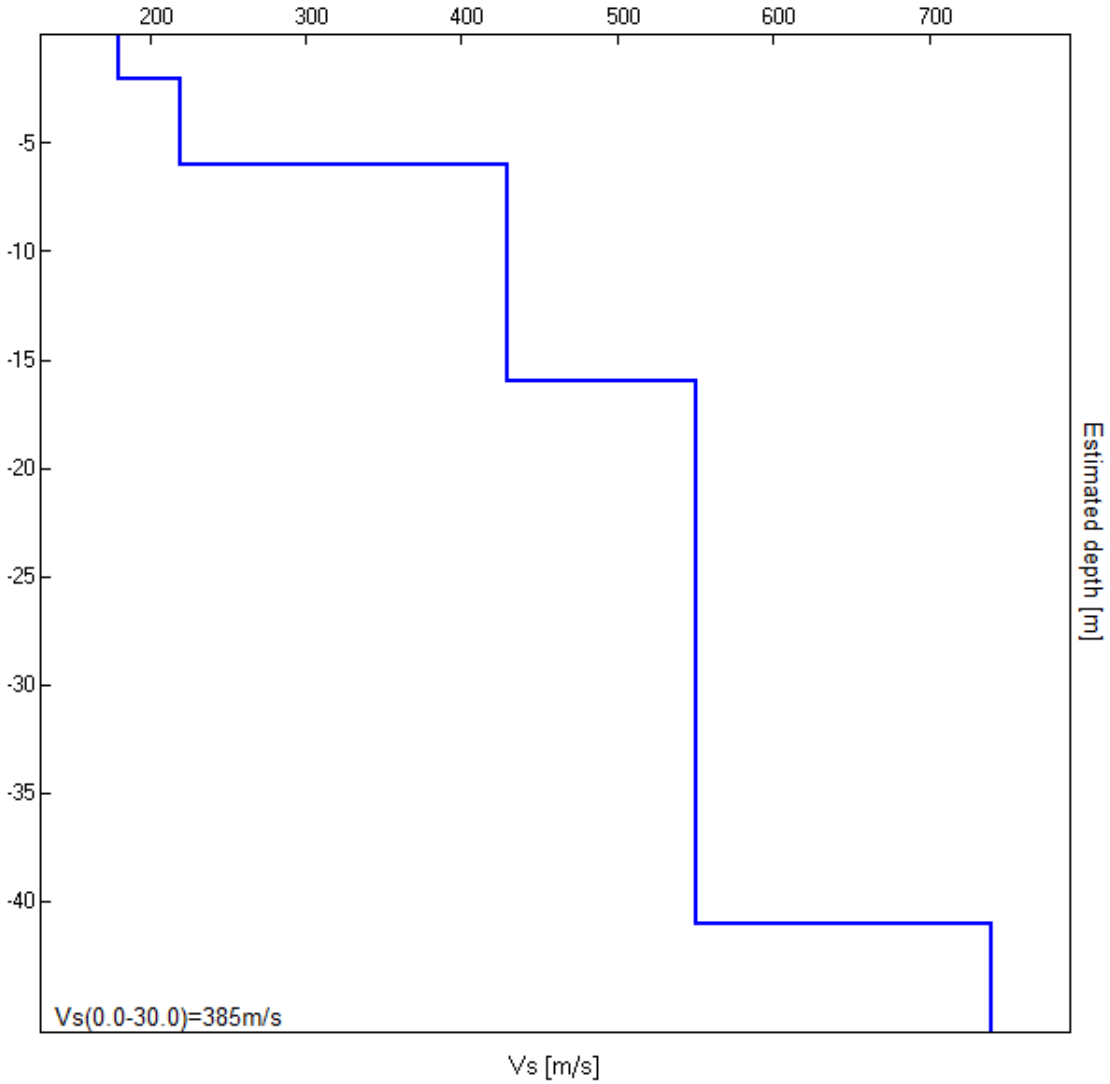


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.00	2.00	180
6.00	4.00	220
16.00	10.00	430
41.00	25.00	550
inf.	inf.	740

Vs(0.0-30.0)=385m/s



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

Max. H/V at 9.38 ± 0.29 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	9.38 > 0.63	OK	
$n_c(f_0) > 200$	8250.0 > 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 226 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	11.875 Hz	OK	
$A_0 > 2$	2.88 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01545| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.14483 < 0.46875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4514 < 1.58	OK	

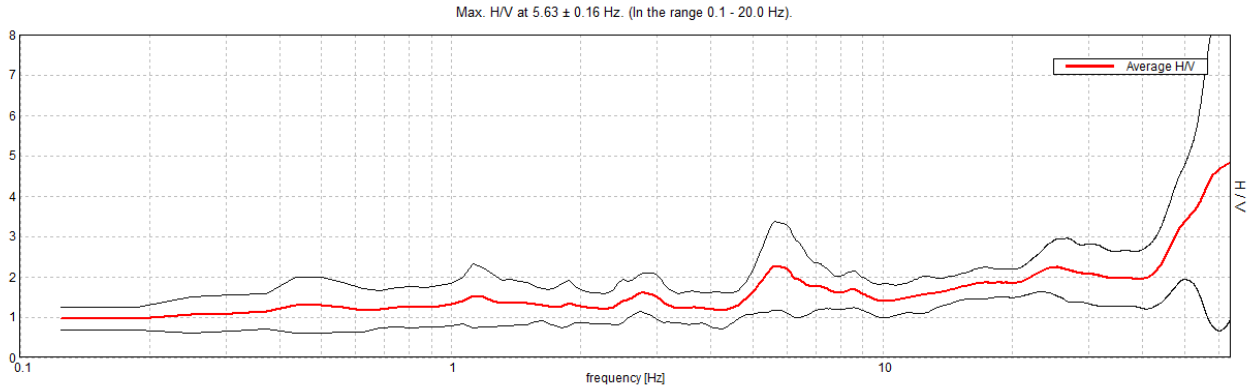
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

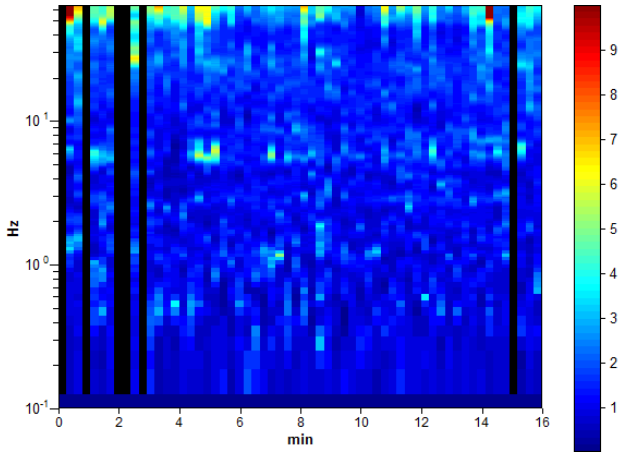
GRIZZANA MORANDI_MS, TR9 CASIGNO Q430

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 13:37:39 End recording: 23/10/18 13:53:39
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 90% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

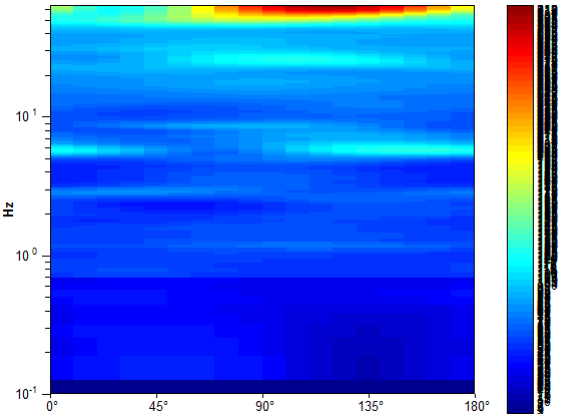
HORIZONTAL TO VERTICAL SPECTRAL RATIO



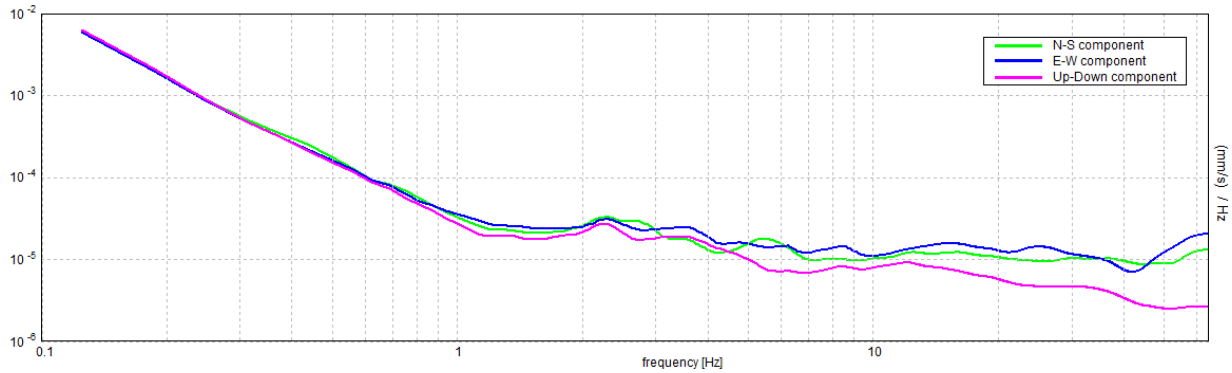
H/V TIME HISTORY



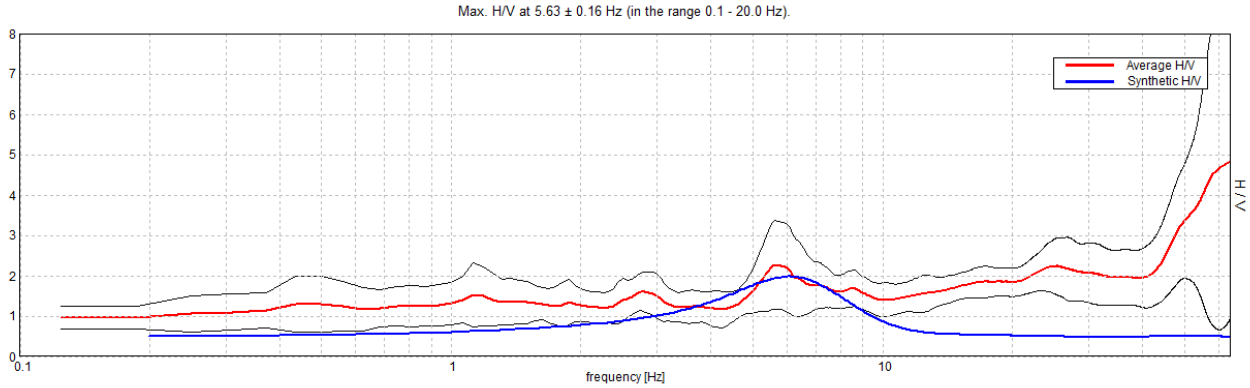
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

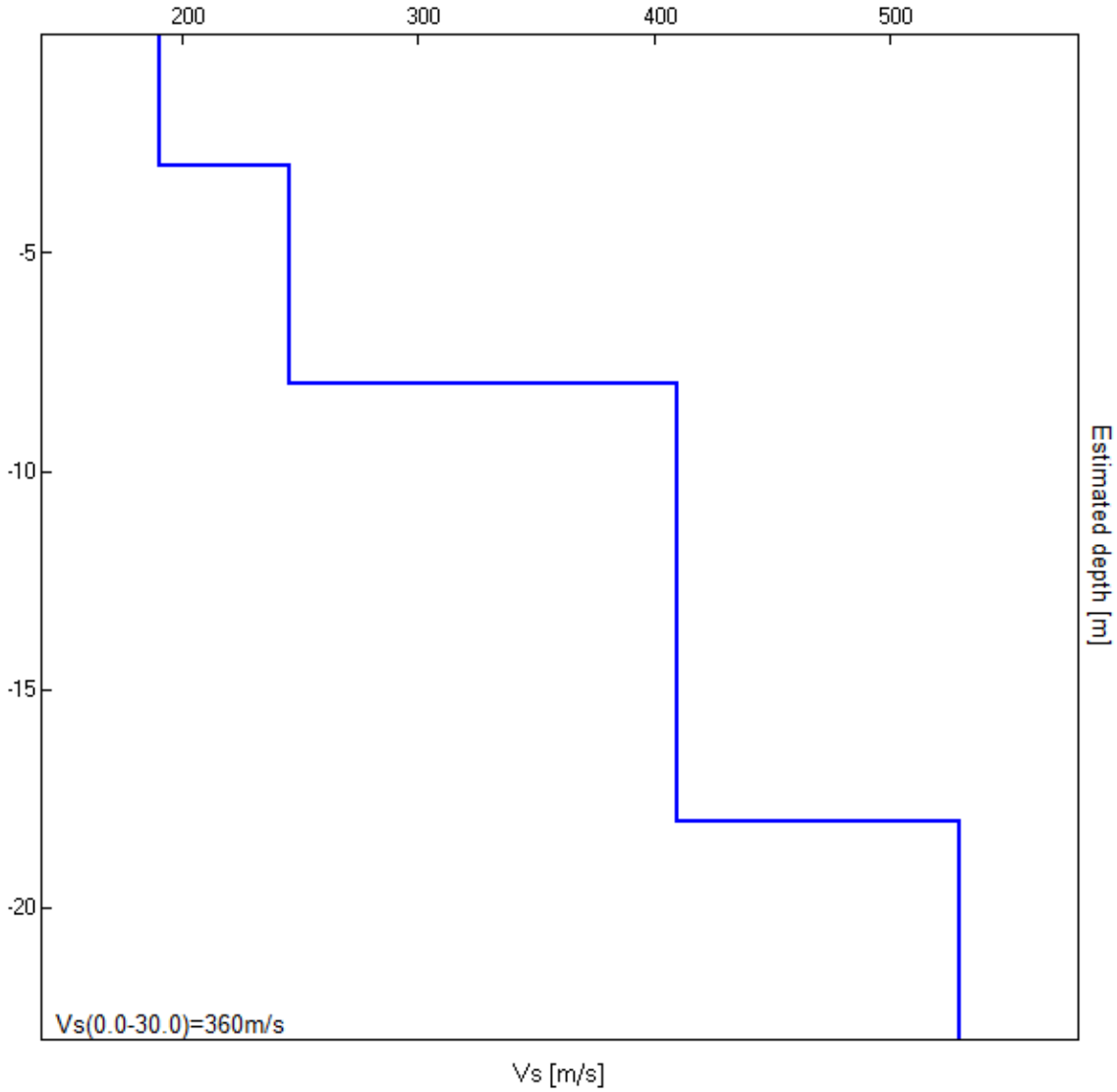


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.00	3.00	190
8.00	5.00	245
18.00	10.00	410
inf.	inf.	530

Vs(0.0-30.0)=360m/s



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

Max. H/V at 5.63 ± 0.16 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.63 > 0.63	OK	
$n_c(f_0) > 200$	4860.0 > 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 136 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.28 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01428| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.08034 < 0.28125	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.5437 < 1.58	OK	

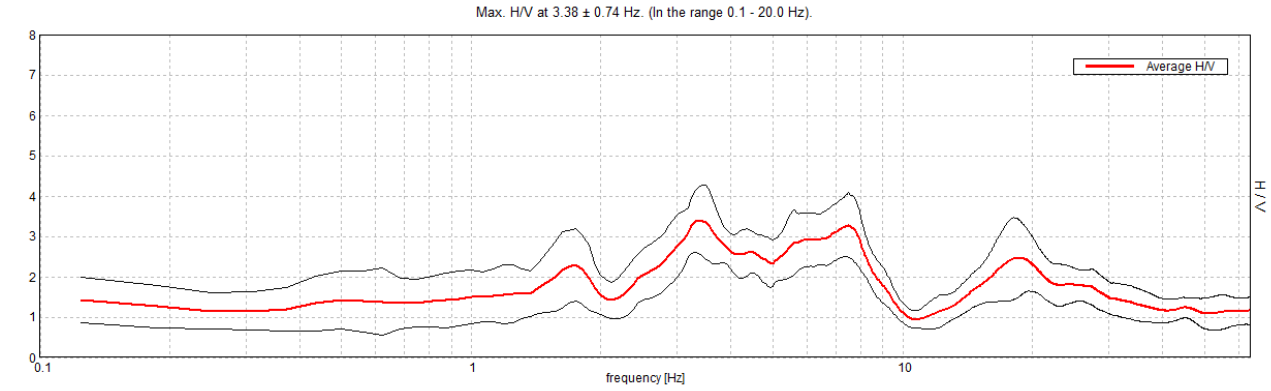
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

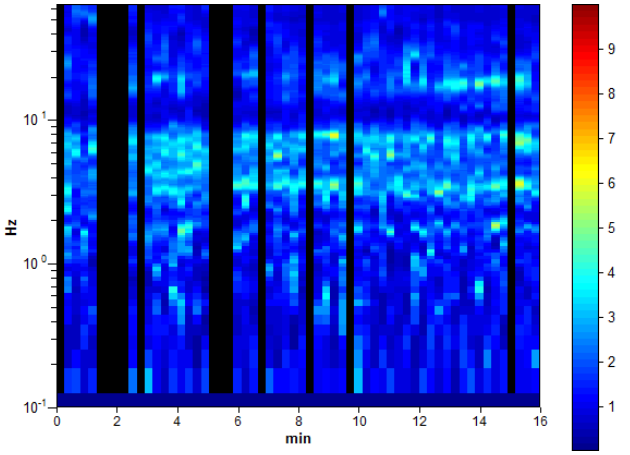
GRIZZANA MORANDI_MS, TR42 GRIZZANA CAMPO SPORTIV

Instrument: TRZ-0108/01-10
Start recording: 28/11/18 16:20:56 End recording: 28/11/18 16:36:57
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 78% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

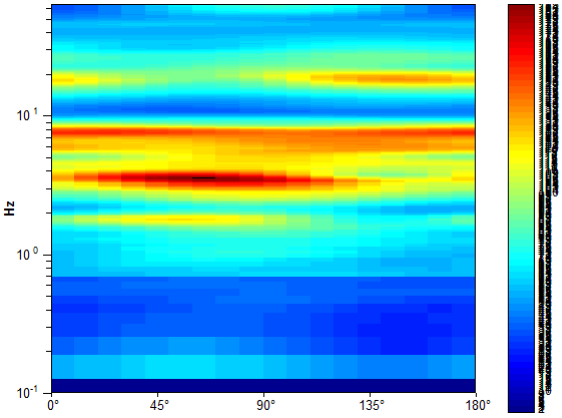
HORIZONTAL TO VERTICAL SPECTRAL RATIO



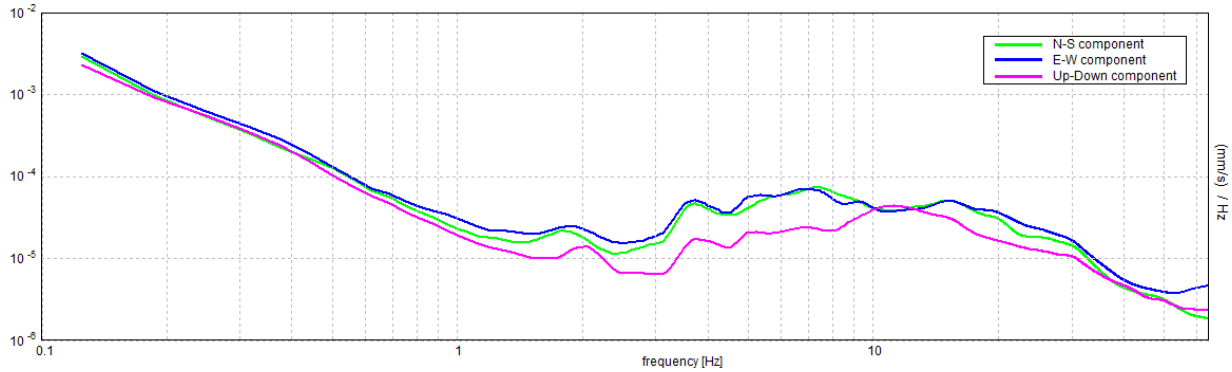
H/V TIME HISTORY



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 3.38 ± 0.74 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.38 > 0.63	OK	
$n_c(f_0) > 200$	2538.0 > 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 82 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	2.313 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	9.188 Hz	OK	
$A_0 > 2$	3.40 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.10704| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.36126 < 0.16875		NO
$\sigma_A(f_0) < \theta(f_0)$	0.4006 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P45DS48

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	9
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **La Torre Campoluzzo vino SP24**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: Foro chiuso

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	5		37,24
0,40	1	5		37,24
0,60	2	5		37,24
0,80	2	5		37,24
1,00	2	4		27,62
1,20	2	2		13,81
1,40	2	2		13,81
1,60	3	2		13,81
1,80	3	2		13,81
2,00	3	2		12,87
2,20	3	1		6,43
2,40	3	1		6,43
2,60	4	1		6,43
2,80	4	1		6,43
3,00	4	1		6,02
3,20	4	1		6,02
3,40	4	1		6,02
3,60	5	2		12,05
3,80	5	2		12,05
4,00	5	2		11,33
4,20	5	3		16,99
4,40	5	2		11,33
4,60	6	3		16,99
4,80	6	3		16,99
5,00	6	3		16,03
5,20	6	4		21,37
5,40	6	4		21,37
5,60	7	3		16,03
5,80	7	4		21,37
6,00	7	5		25,29
6,20	7	7		35,40
6,40	7	7		35,40
6,60	8	9		45,51
6,80	8	12		60,69
7,00	8	13		62,40
7,20	8	15		72,00
7,40	8	15		72,00
7,60	9	15		72,00
7,80	9	16		76,80
8,00	9	17		77,66
8,20	9	13		59,39
8,40	9	15		68,52
8,60	10	14		63,96
8,80	10	15		68,52
9,00	10	18		78,44
9,20	10	17		74,08
9,40	10	22		95,87
9,60	11	56		244,03

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

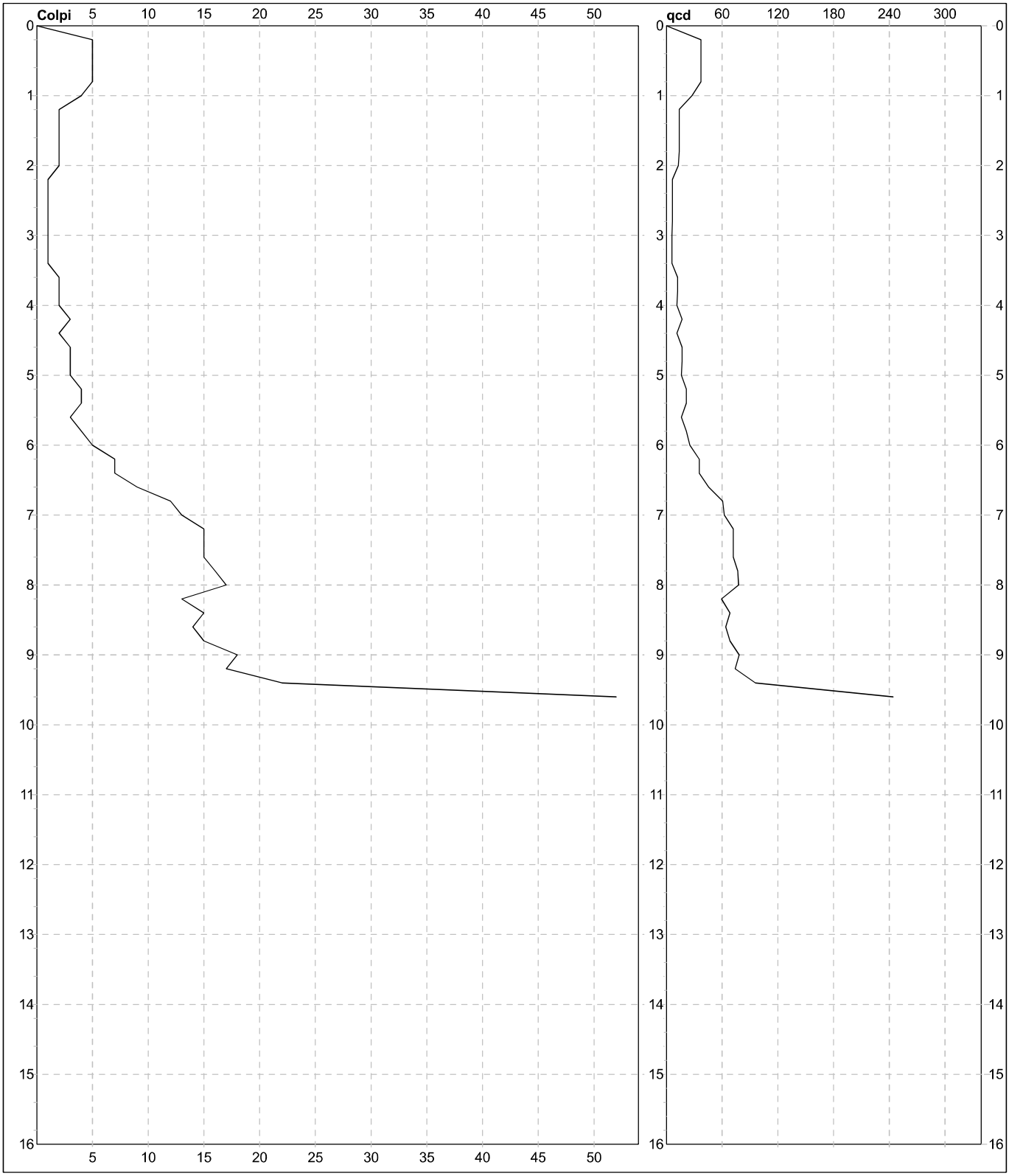
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	9
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **La Torre Campoluzzo vino SP24**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Foro chiuso



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

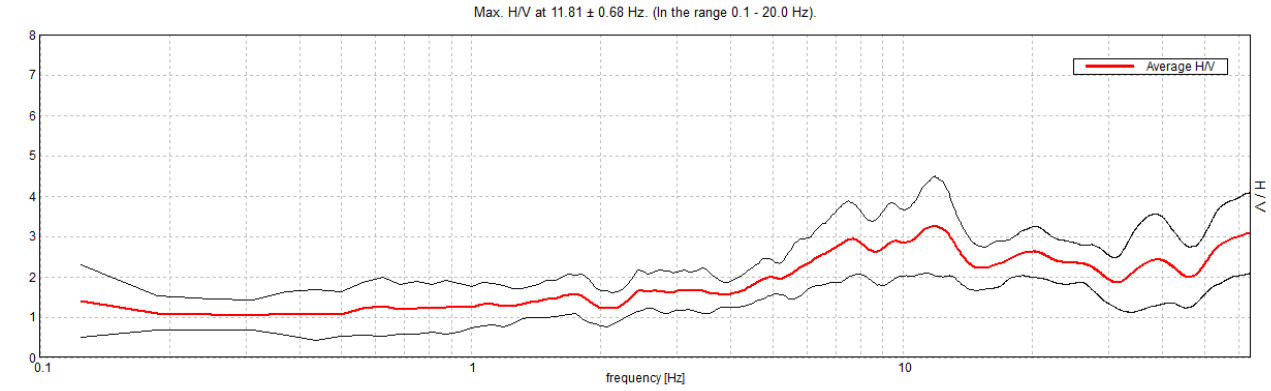
Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

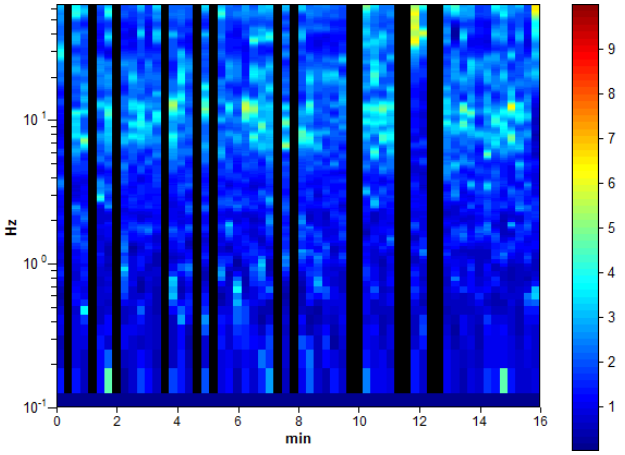
GRIZZANA MORANDI_MS, TR10 CAMPARO MORANDI VEGETT

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 14:45:16 End recording: 23/10/18 15:01:16
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 77% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

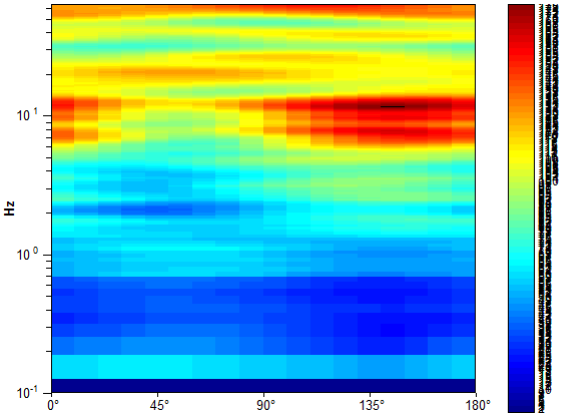
HORIZONTAL TO VERTICAL SPECTRAL RATIO



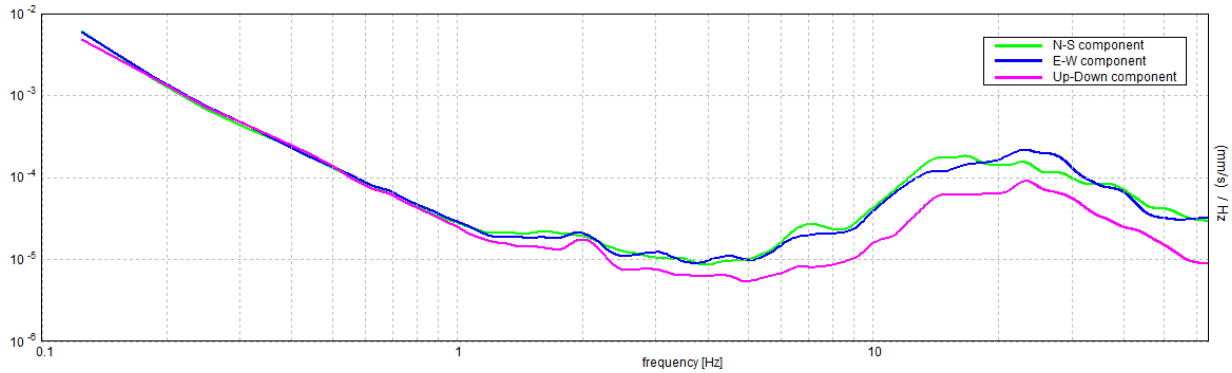
H/V TIME HISTORY



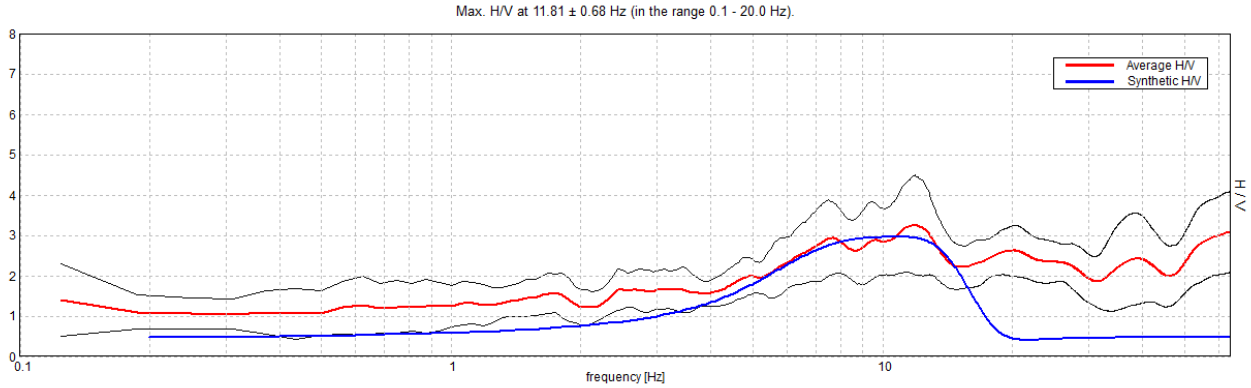
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

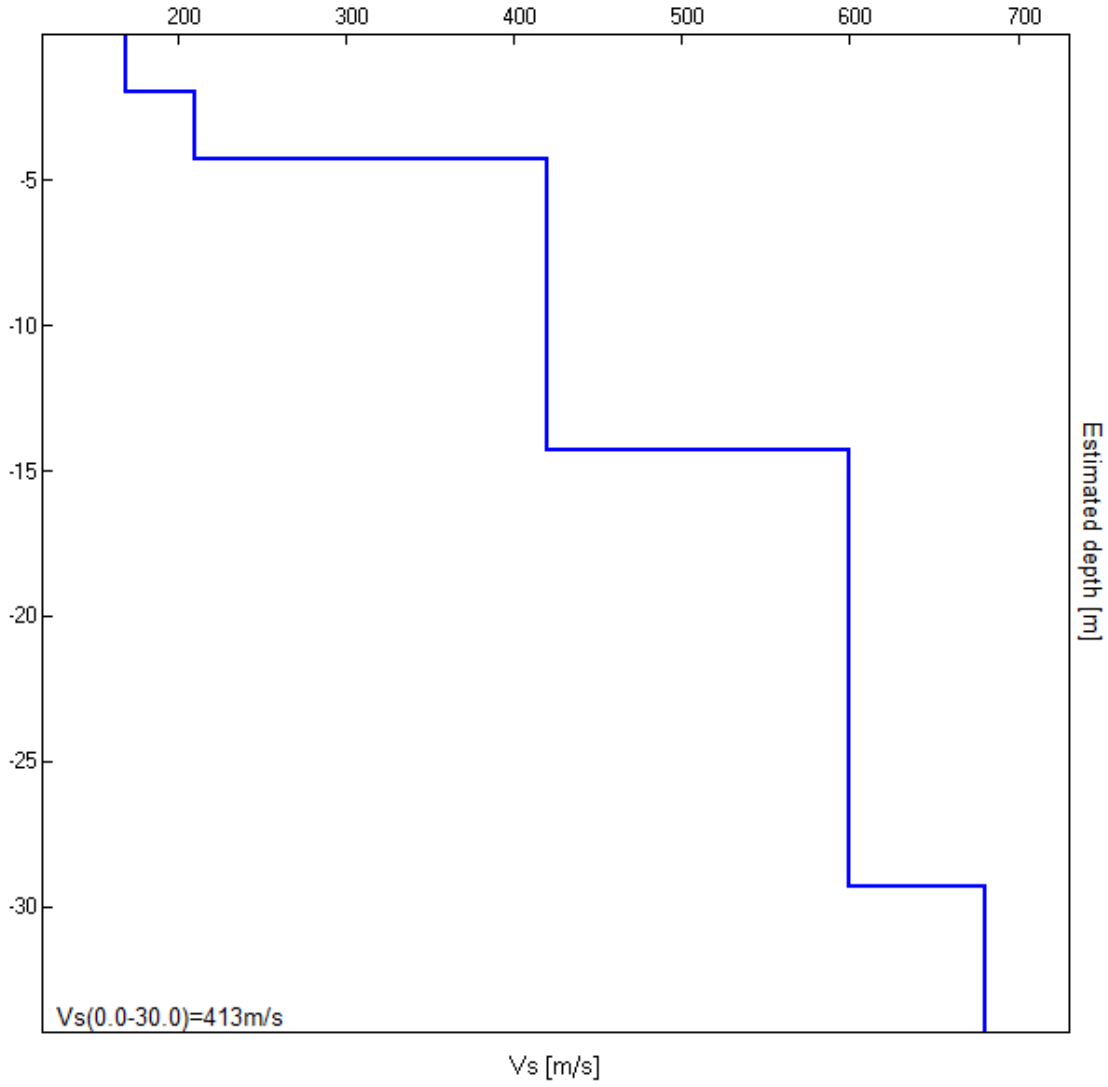


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.00	2.00	170
4.30	2.30	210
14.30	10.00	420
29.30	15.00	600
inf.	inf.	680

Vs(0.0-30.0)=413m/s



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

Max. H/V at 11.81 ± 0.68 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	11.81 > 0.63	OK	
$n_c(f_0) > 200$	8694.0 > 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 284 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	4.188 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	3.25 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0281| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.33187 < 0.59063	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.6003 < 1.58	OK	

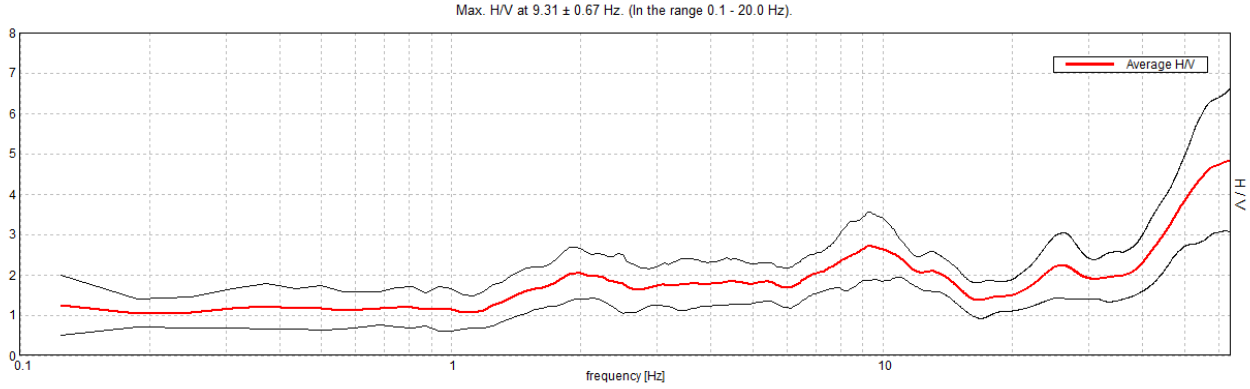
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

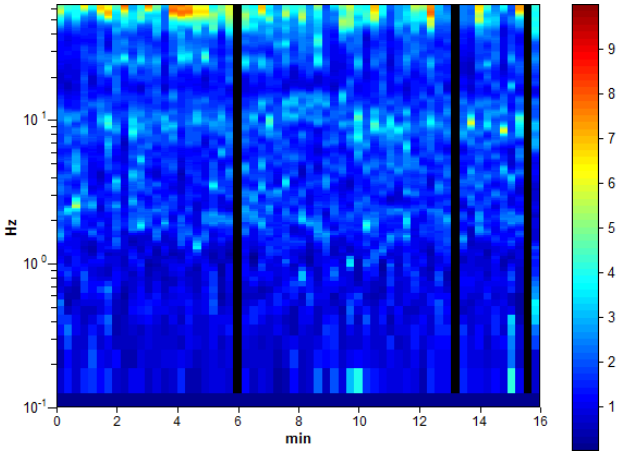
GRIZZANA MORANDI_MS, TR11 CASTELLO GRIZZANA

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 15:08:21 End recording: 23/10/18 15:24:21
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 95% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

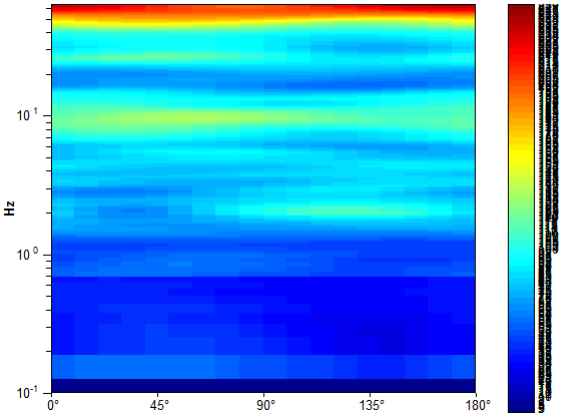
HORIZONTAL TO VERTICAL SPECTRAL RATIO



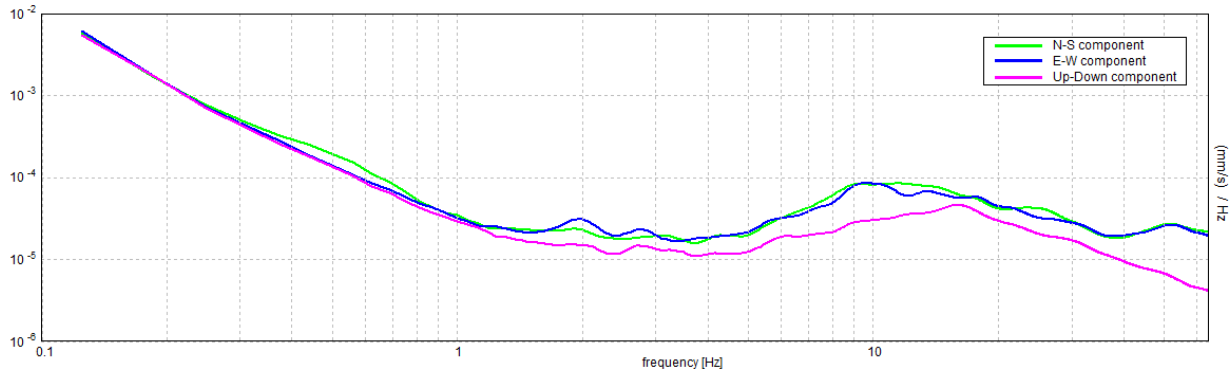
H/V TIME HISTORY



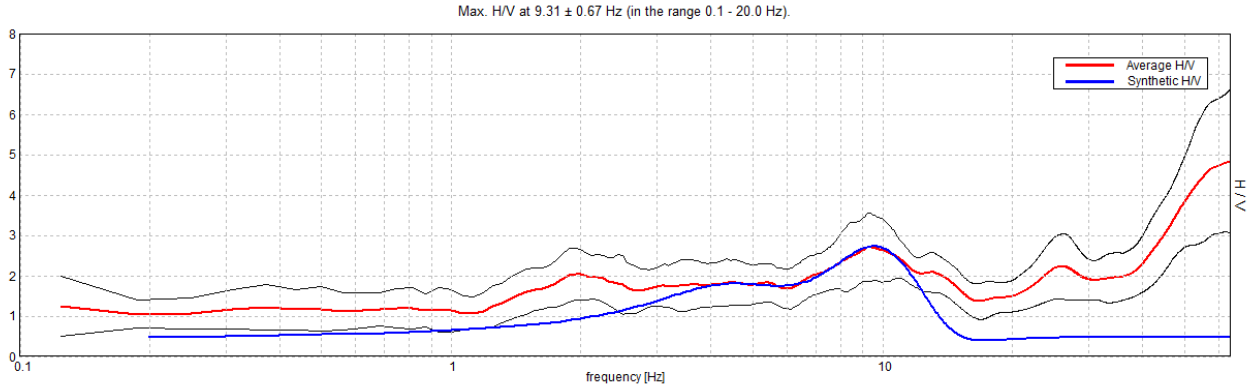
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

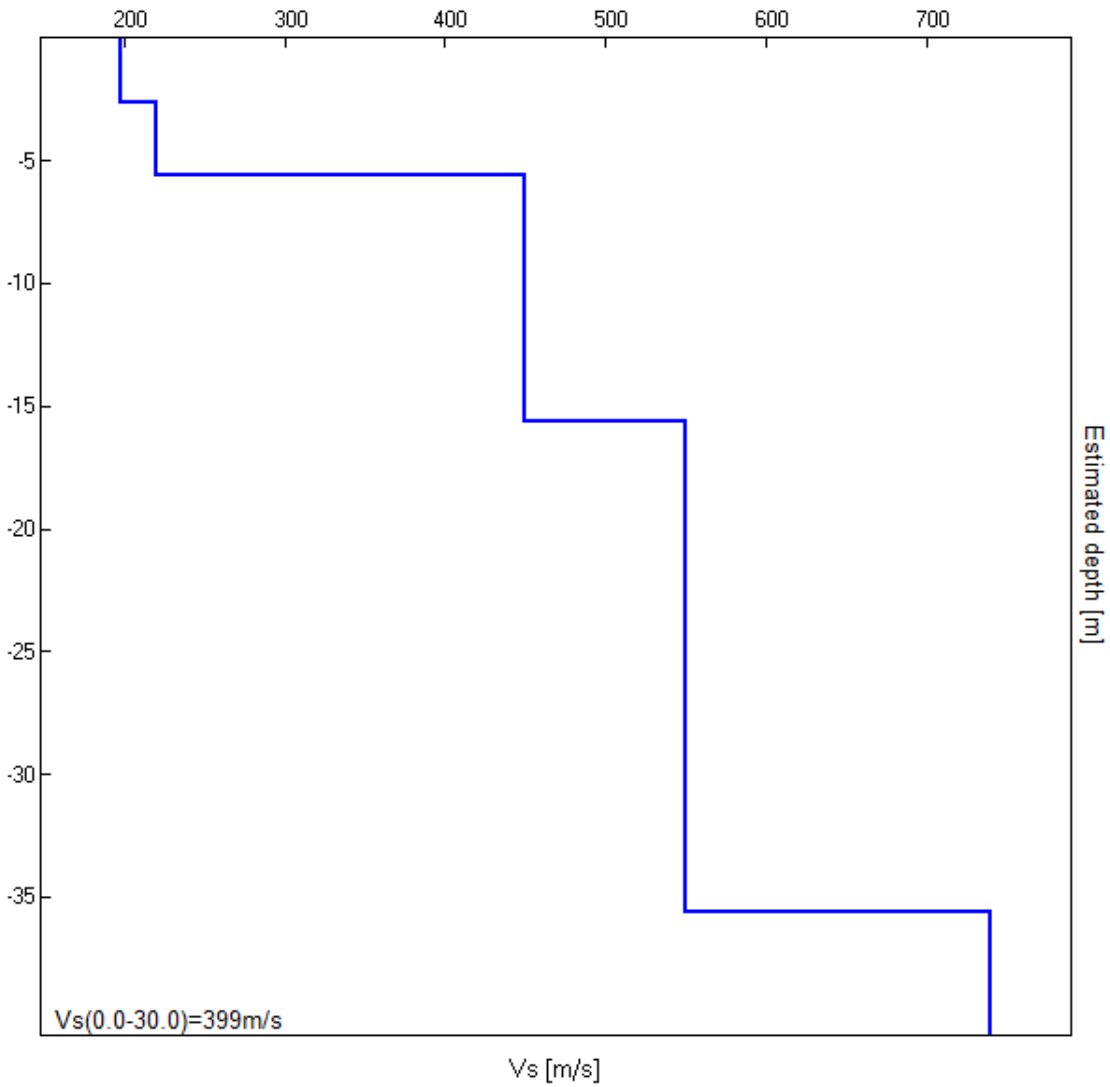


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.60	2.60	198
5.60	3.00	220
15.60	10.00	450
35.60	20.00	550
inf.	inf.	740

Vs(0.0-30.0)=399m/s



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

Max. H/V at 9.31 ± 0.67 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	9.31 > 0.63	OK	
$n_c(f_0) > 200$	8493.0 > 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 224 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.71 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0357| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.33246 < 0.46563	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4173 < 1.58	OK	

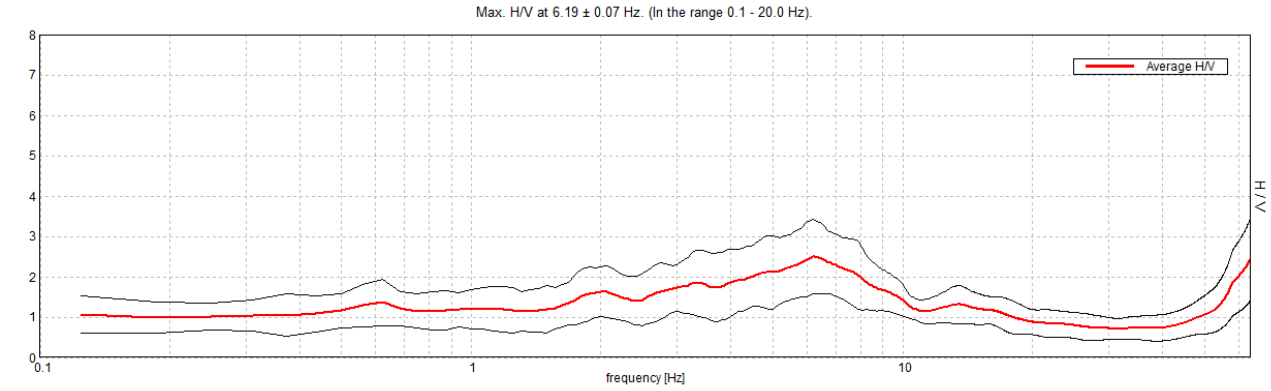
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

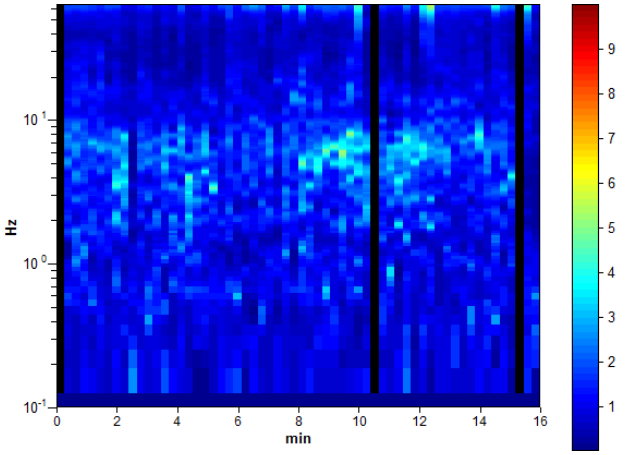
GRIZZANA MORANDI_MS, TR24 GRIZZANA 2

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 16:35:02 End recording: 25/10/18 16:51:02
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 95% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

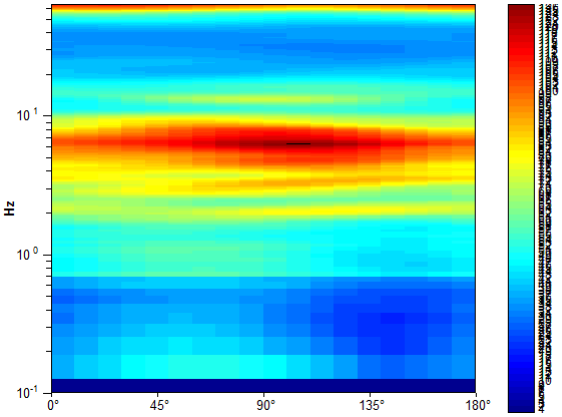
HORIZONTAL TO VERTICAL SPECTRAL RATIO



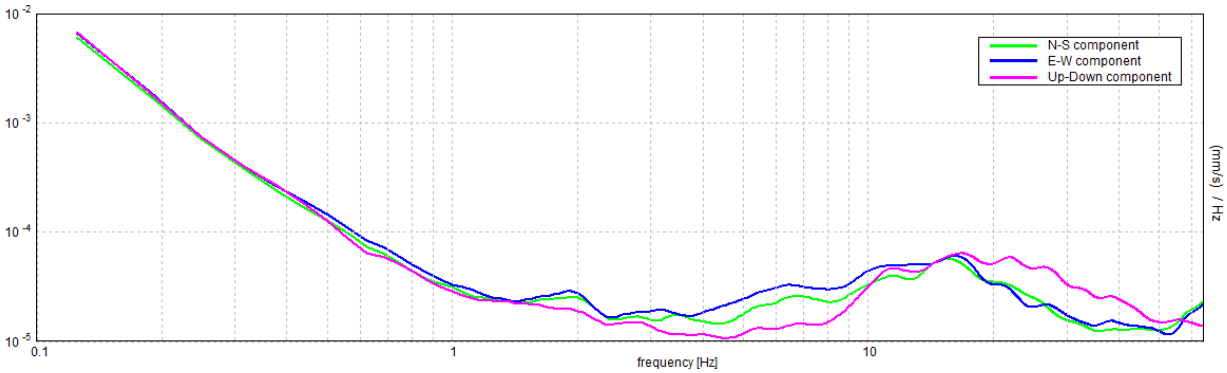
H/V TIME HISTORY



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 6.19 ± 0.07 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	6.19 > 0.63	OK	
$n_c(f_0) > 200$	5643.0 > 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 150 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.563 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	10.5 Hz	OK	
$A_0 > 2$	2.49 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00573| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.03545 < 0.30938	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.457 < 1.58	OK	

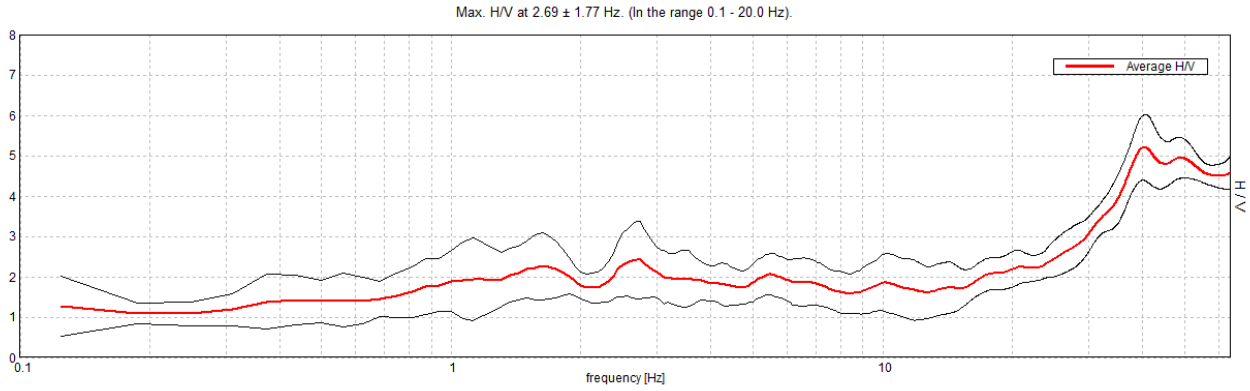
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

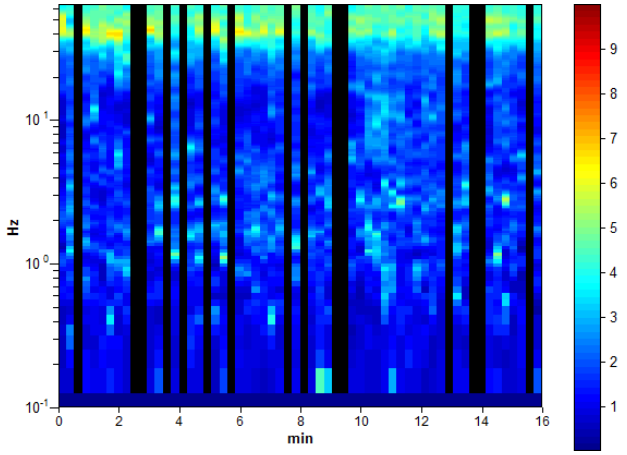
GRIZZANA MORANDI_MS, TR25 GRIZZANA 3

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 17:00:31 End recording: 25/10/18 17:16:31
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 75% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

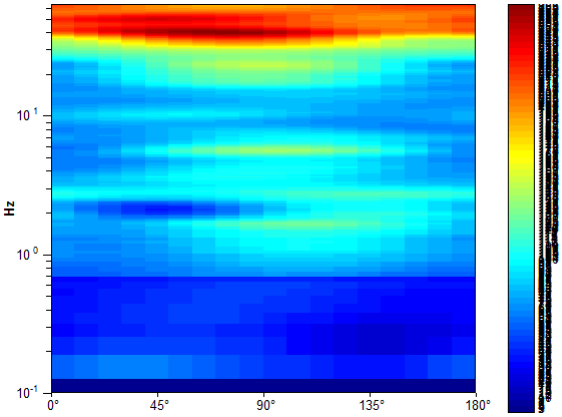
HORIZONTAL TO VERTICAL SPECTRAL RATIO



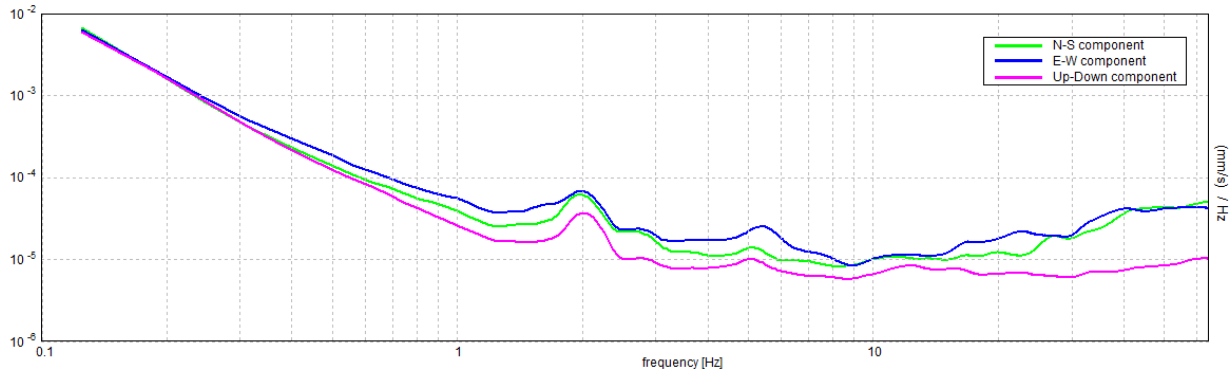
H/V TIME HISTORY



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 2.69 ± 1.77 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	2.69 > 0.63	OK	
$n_c(f_0) > 200$	1935.0 > 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 66 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.42 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.32362| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.86974 < 0.13438		NO
$\sigma_A(f_0) < \theta(f_0)$	0.469 < 1.58	OK	

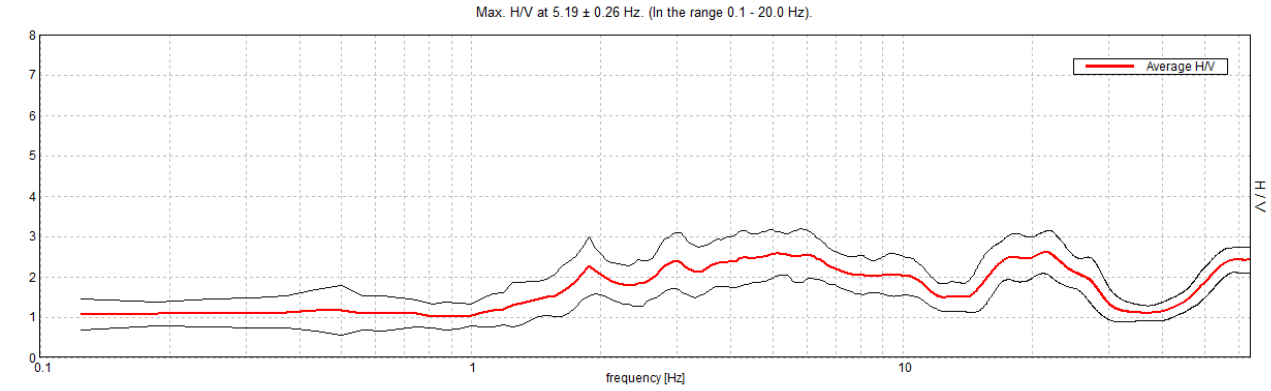
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

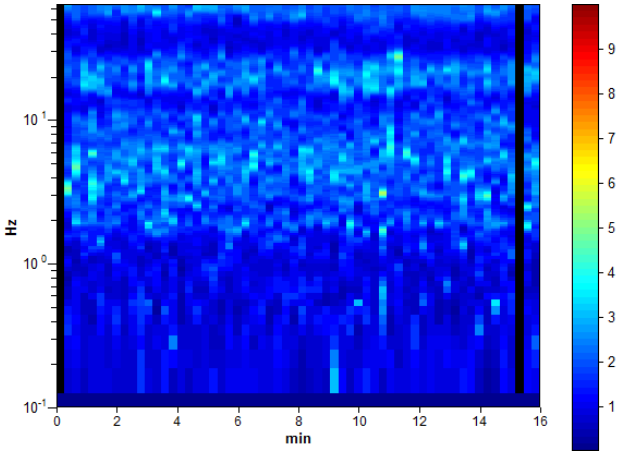
GRIZZANA MORANDI_MS, TR23 GRIZZANA 1

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 16:09:30 End recording: 25/10/18 16:25:30
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 97% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

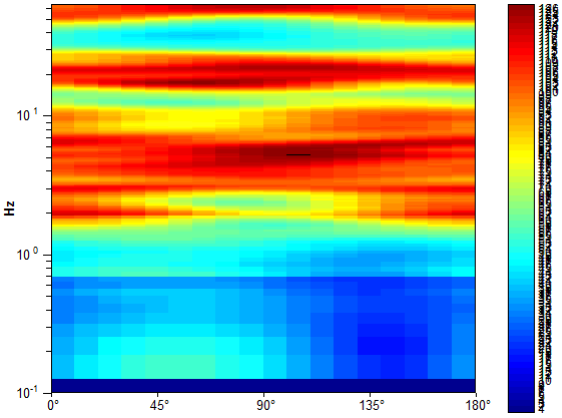
HORIZONTAL TO VERTICAL SPECTRAL RATIO



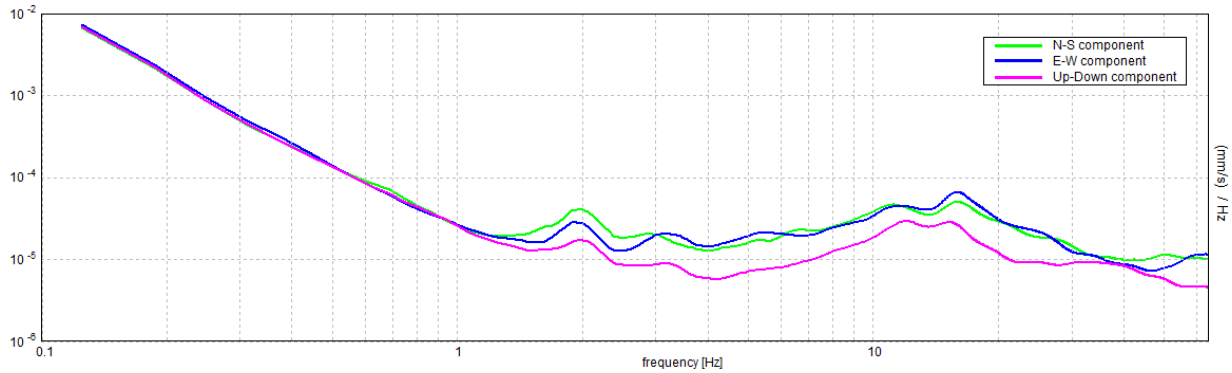
H/V TIME HISTORY



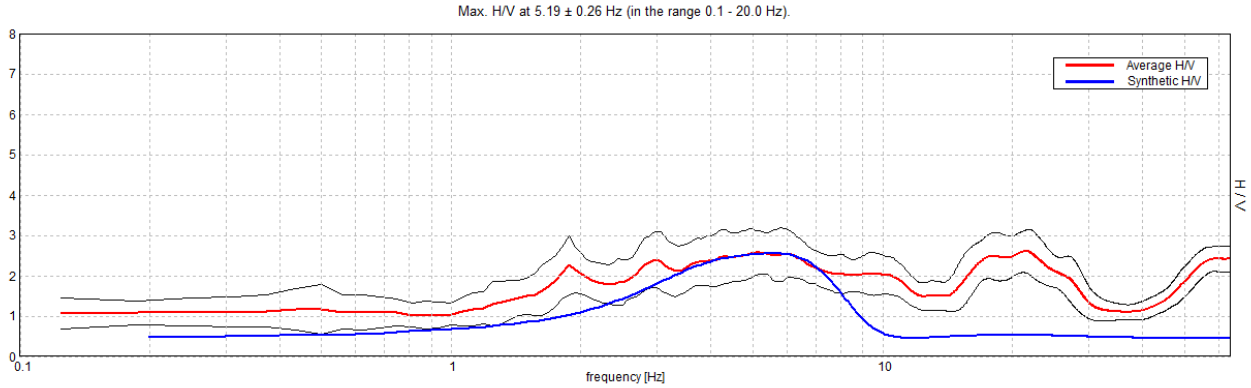
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

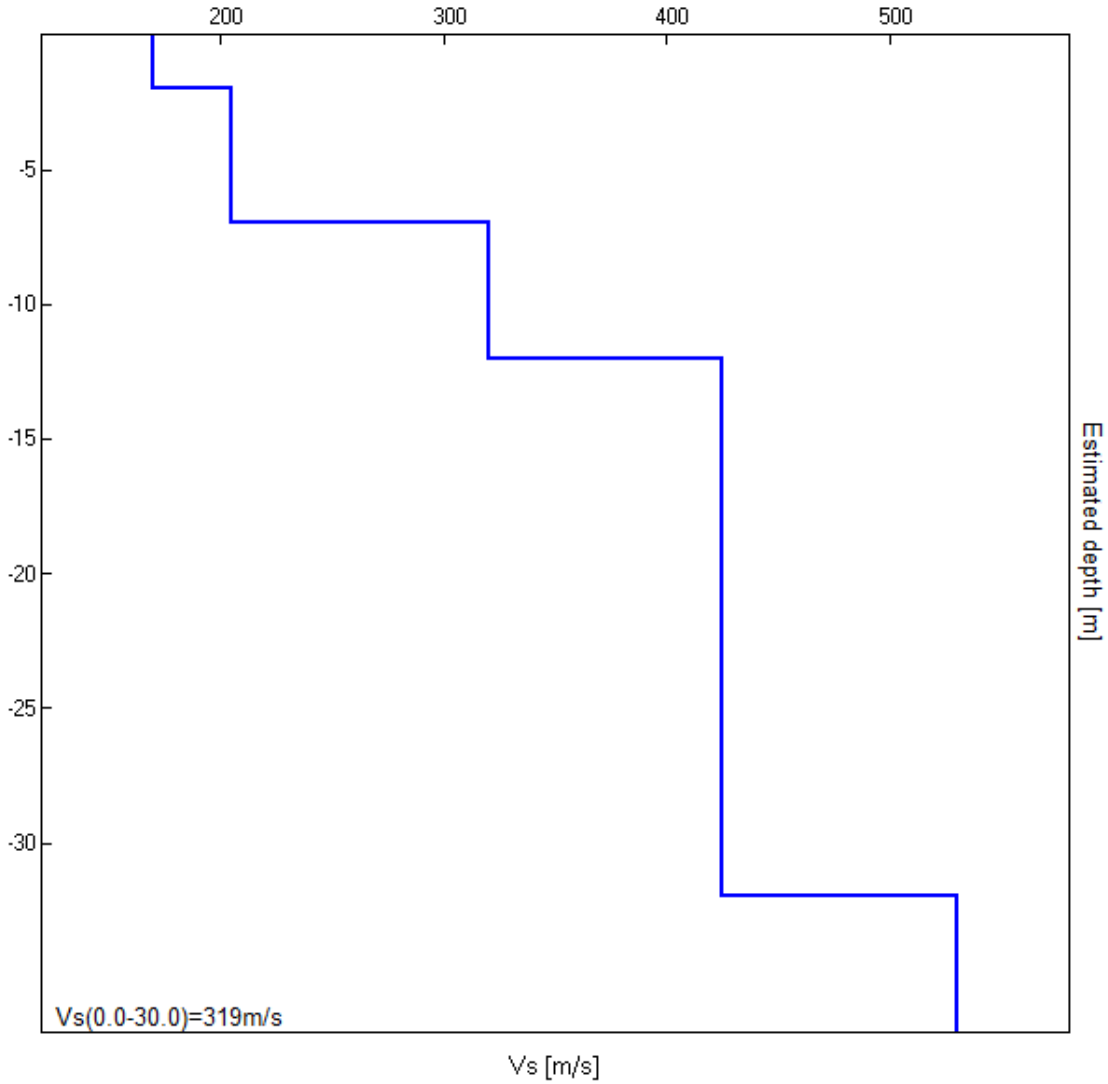


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.00	2.00	170
7.00	5.00	205
12.00	5.00	320
32.00	20.00	425
inf.	inf.	530

Vs(0.0-30.0)=319m/s



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

Max. H/V at 5.19 ± 0.26 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.19 > 0.63	OK	
$n_c(f_0) > 200$	4814.0 > 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 126 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.57 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02484| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.12886 < 0.25938	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2709 < 1.58	OK	

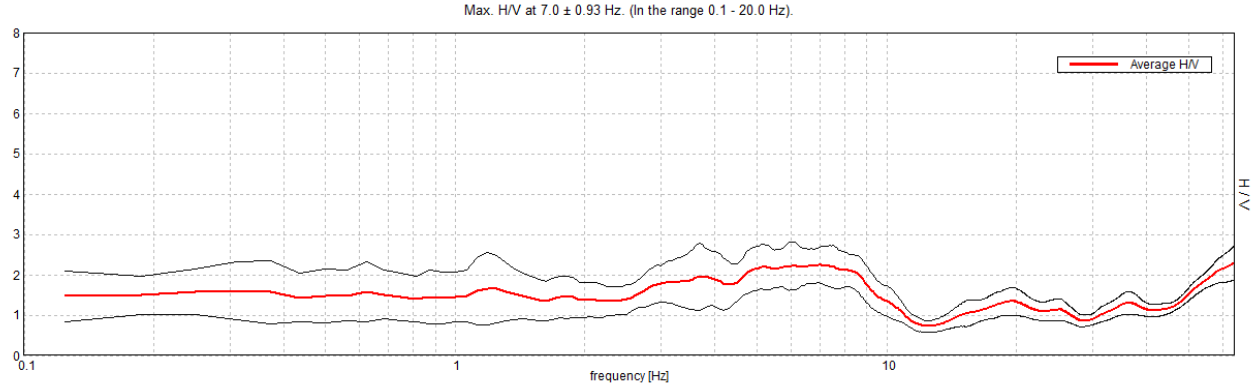
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

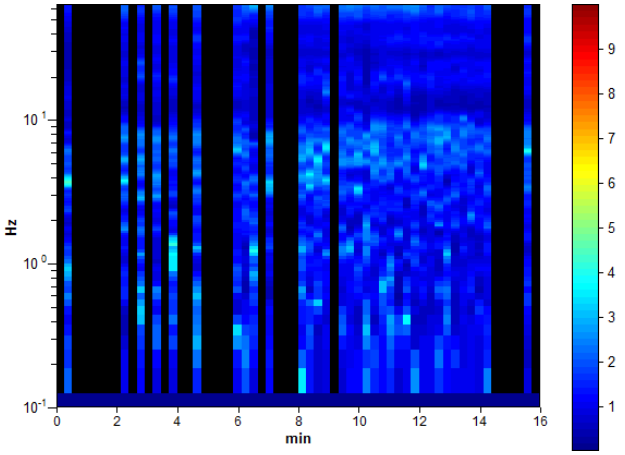
GRIZZANA MORANDI_MS, TR12 CASTAGN. STANCO SOTTO

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 15:34:52 End recording: 23/10/18 15:50:52
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 57% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

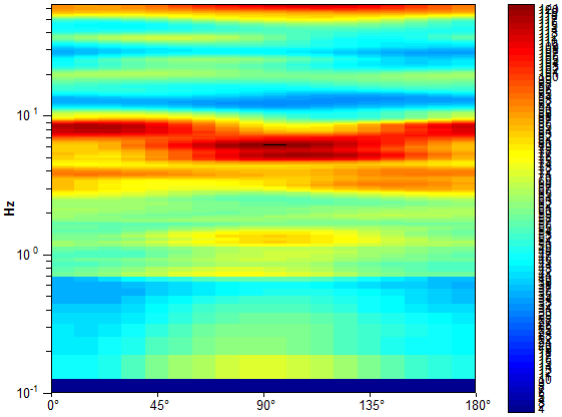
HORIZONTAL TO VERTICAL SPECTRAL RATIO



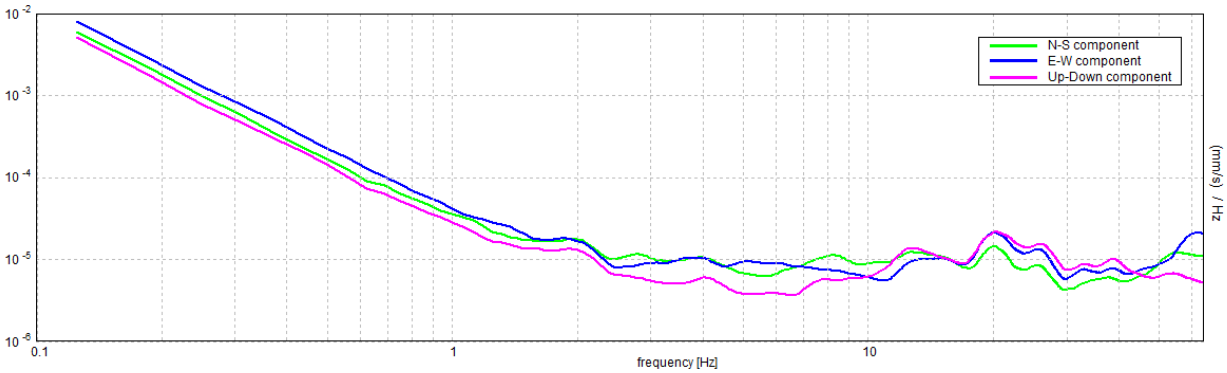
H/V TIME HISTORY



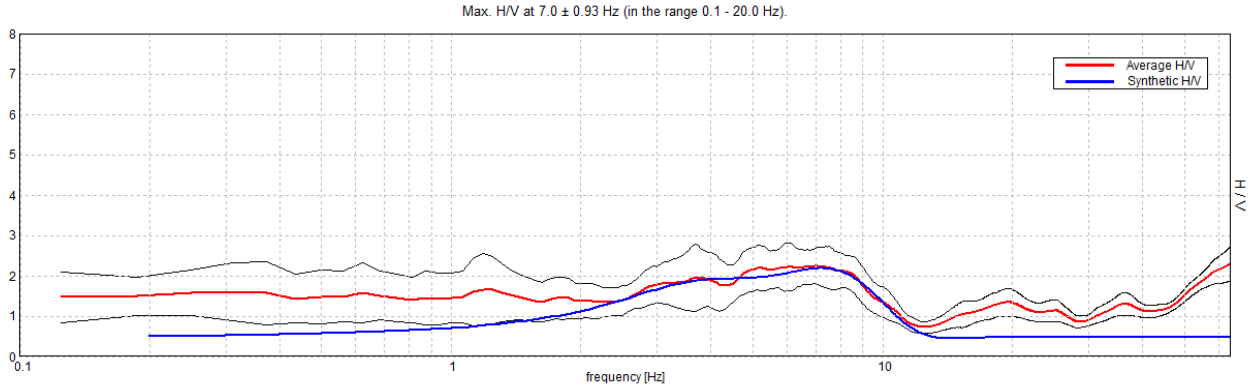
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

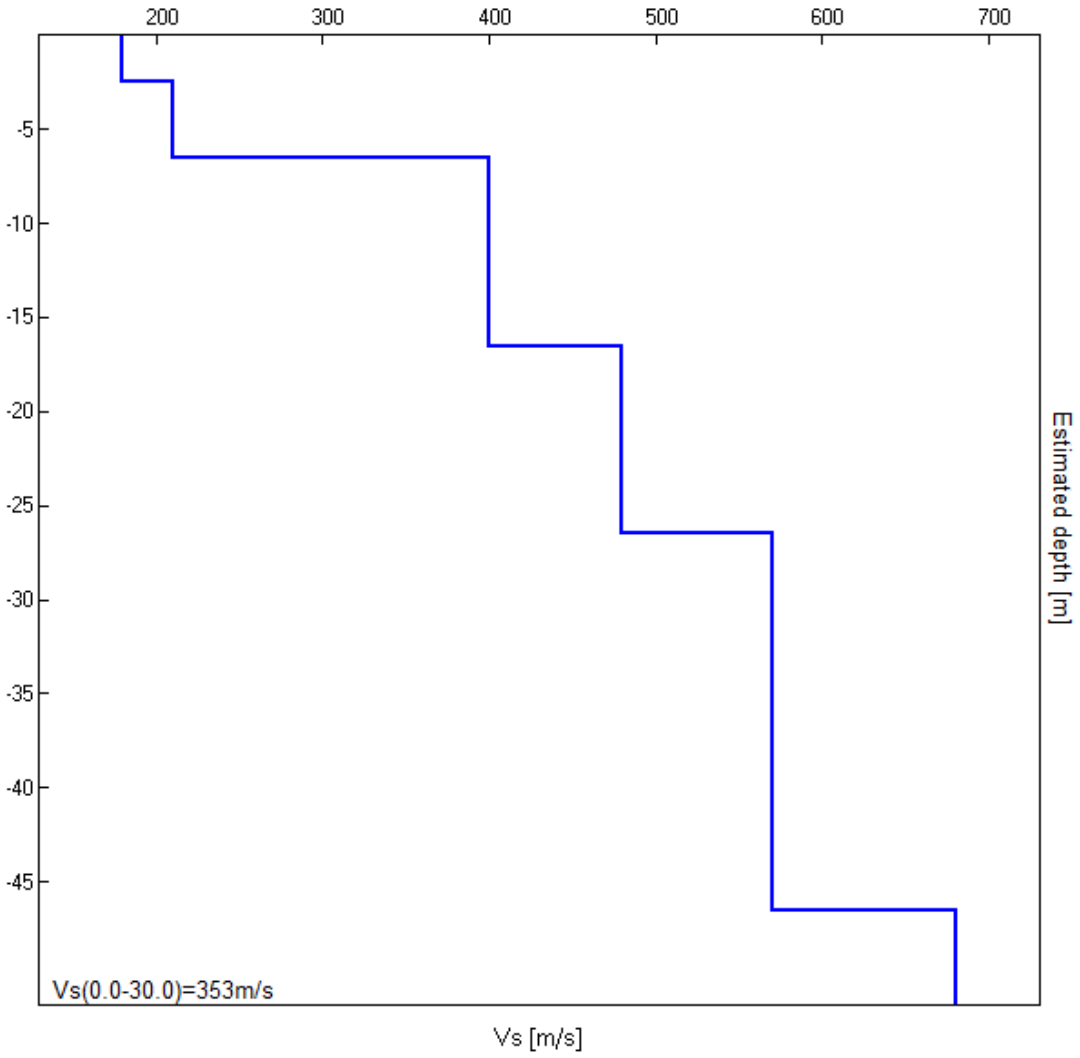


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.50	2.50	180
6.50	4.00	210
16.50	10.00	400
26.50	10.00	480
46.50	20.00	570
inf.	inf.	680

Vs(0.0-30.0)=353m/s



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

Max. H/V at 7.0 ± 0.93 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	7.00 > 0.63	OK	
$n_c(f_0) > 200$	3808.0 > 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 169 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	10.75 Hz	OK	
$A_0 > 2$	2.24 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.06451| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.45154 < 0.35		NO
$\sigma_A(f_0) < \theta(f_0)$	0.2166 < 1.58	OK	

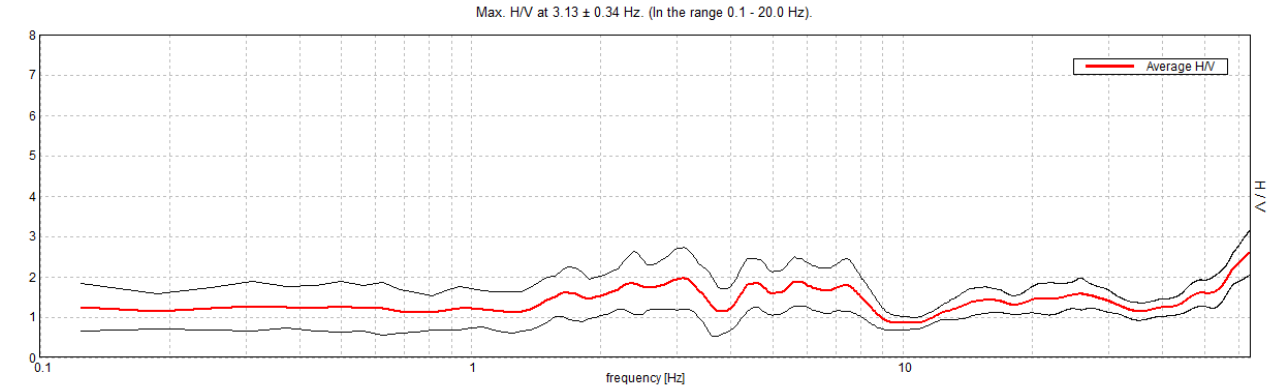
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

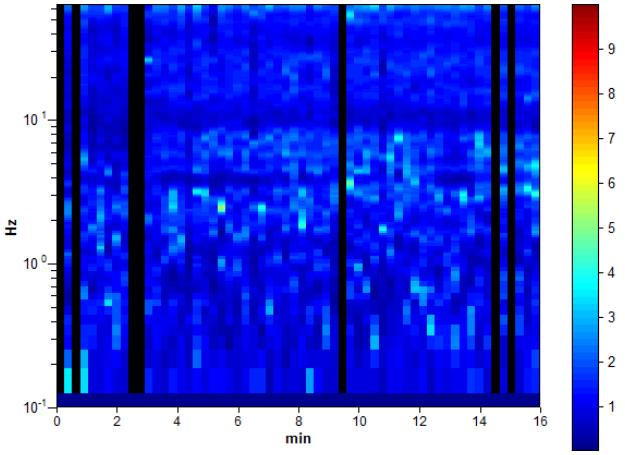
GRIZZANA MORANDI_MS, TR13 MONTE STANCO 2

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 16:00:52 End recording: 23/10/18 16:16:52
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 88% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

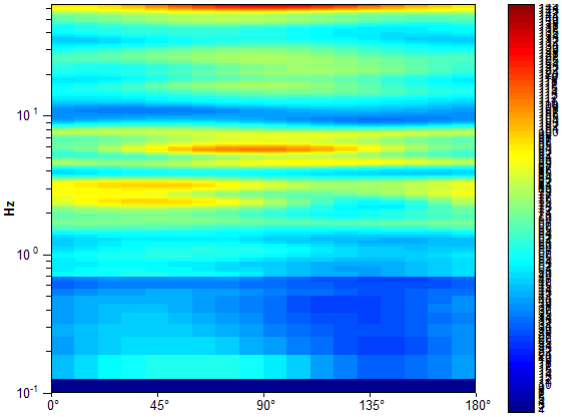
HORIZONTAL TO VERTICAL SPECTRAL RATIO



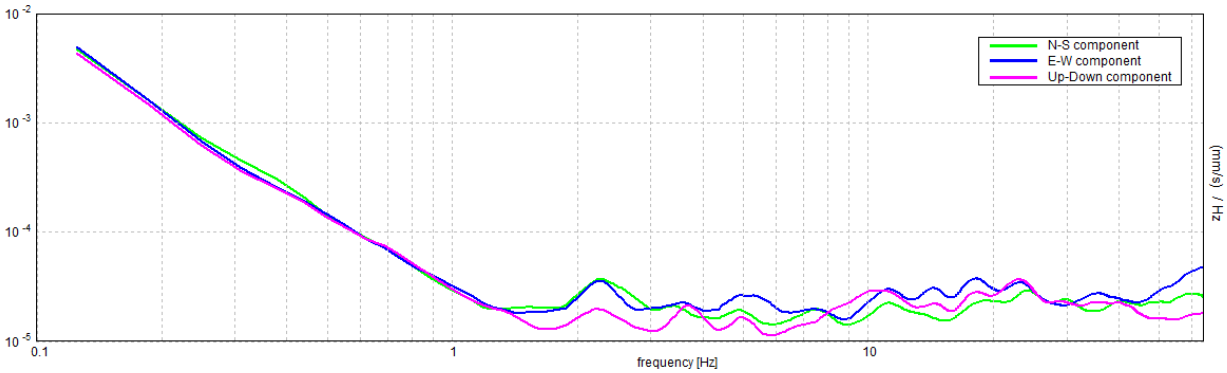
H/V TIME HISTORY



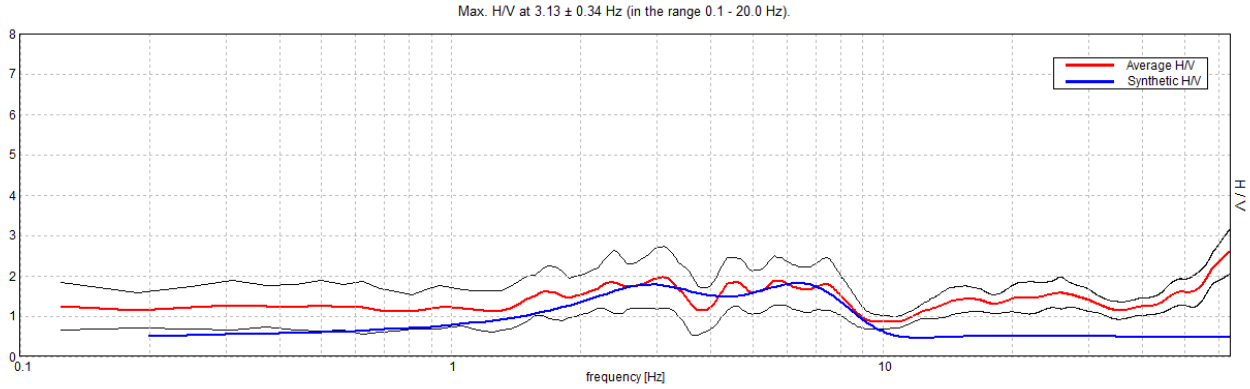
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

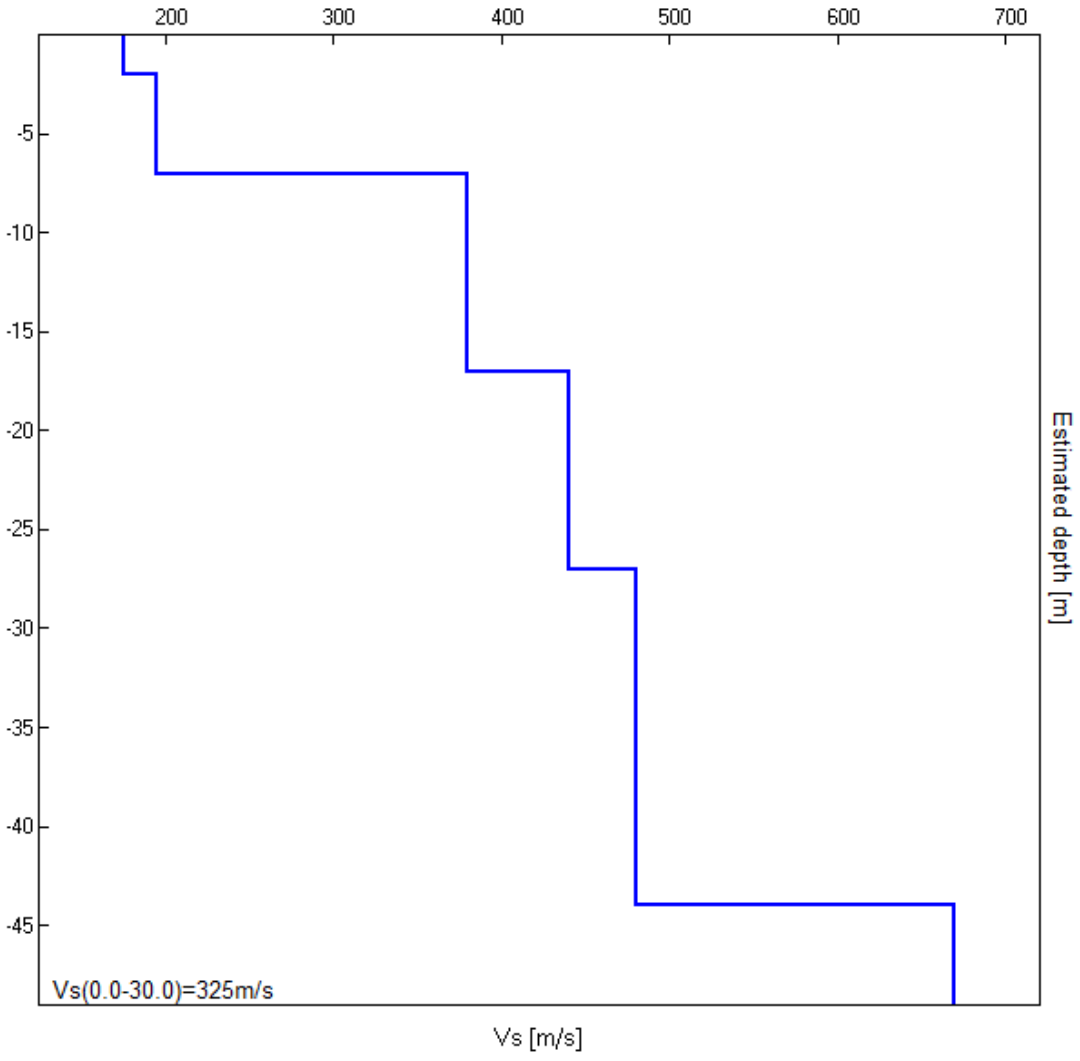


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.00	2.00	175
7.00	5.00	195
17.00	10.00	380
27.00	10.00	440
44.00	17.00	480
inf.	inf.	670

Vs(0.0-30.0)=325m/s



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

Max. H/V at 3.13 ± 0.34 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.13 > 0.63	OK	
$n_c(f_0) > 200$	2650.0 > 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 76 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	9.0 Hz	OK	
$A_0 > 2$	1.96 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.05337| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.16679 < 0.15625		NO
$\sigma_A(f_0) < \theta(f_0)$	0.3819 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P53DS56

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	8
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Montestanco Castagneto SP73**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: -2,40 m da quota inizio

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	1		7,45
0,40	1	2		14,90
0,60	2	2		14,90
0,80	2	1		7,45
1,00	2	2		13,81
1,20	2	2		13,81
1,40	2	1		6,90
1,60	3	1		6,90
1,80	3	1		6,90
2,00	3	11		70,78
2,20	3	6		38,61
2,40	3	2		12,87
2,60	4	24		154,43
2,80	4	8		51,48
3,00	4	7		42,17
3,20	4	6		36,15
3,40	4	8		48,19
3,60	5	9		54,22
3,80	5	3		18,07
4,00	5	4		22,65
4,20	5	5		28,32
4,40	5	55		311,48

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

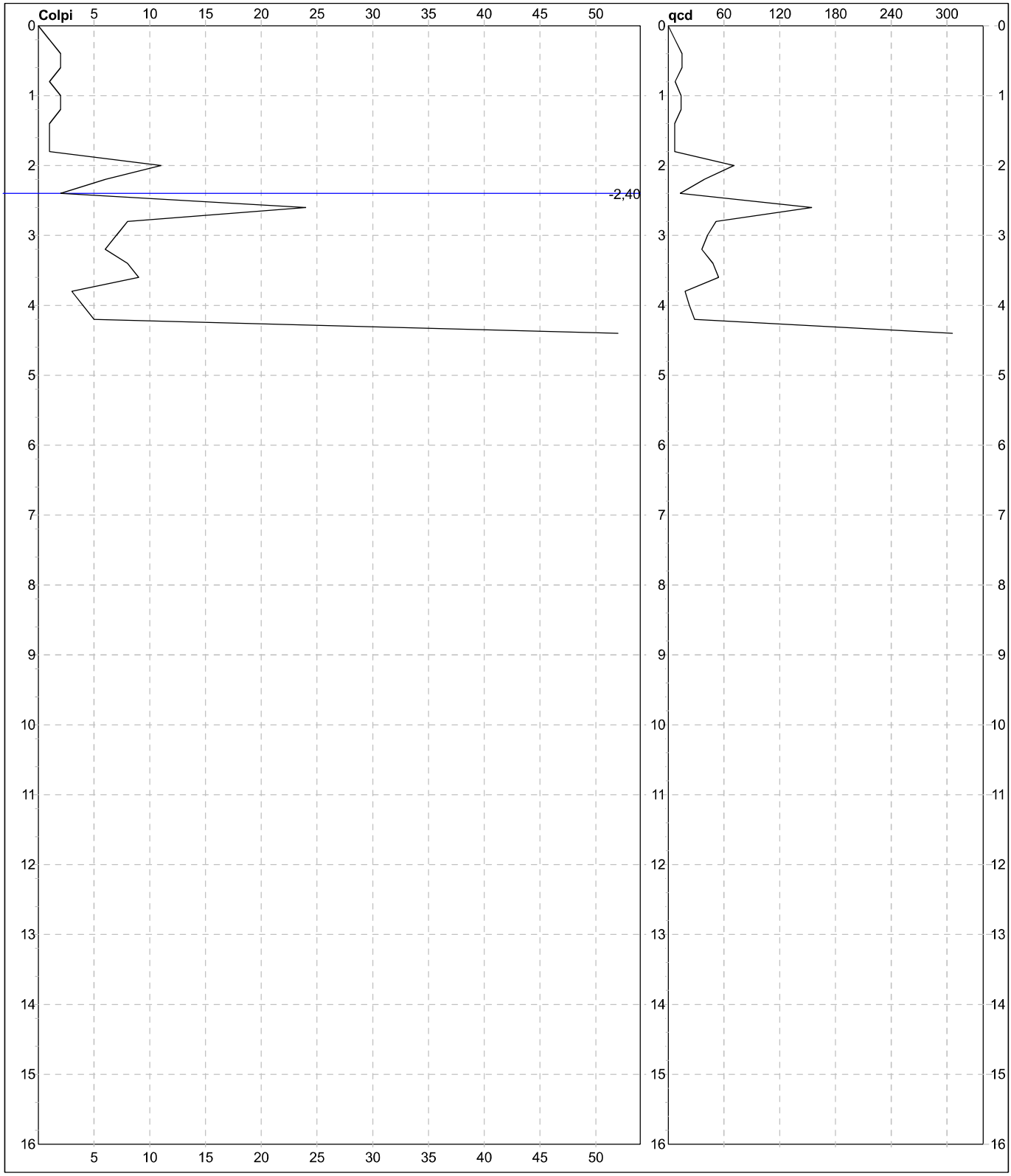
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	8
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Montestanco Castagneto SP73**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: -2,40 m da quota inizio

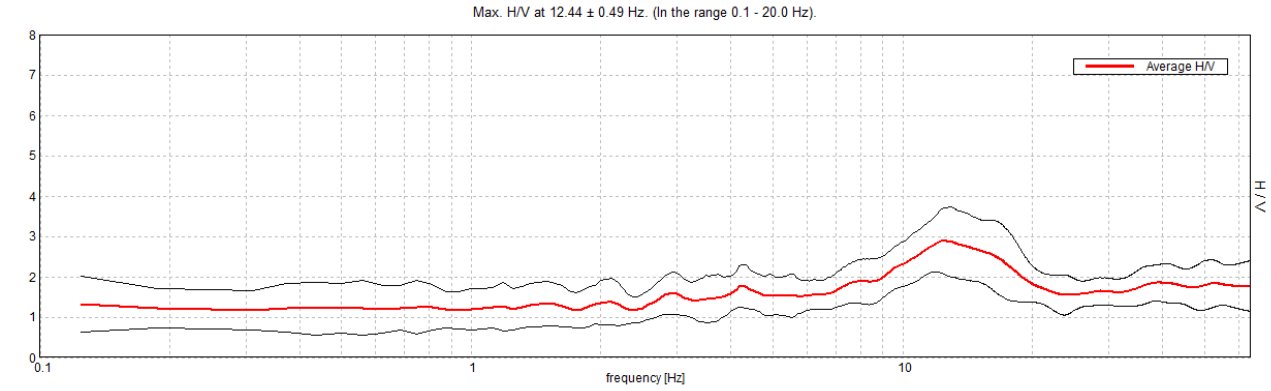


Penetrometro:	DPSH (S. Heavy)	Responsabile:		Preforo:	m
Massa battente:	63,50 m	Assistente:		Corr.astine:	kg/ml
Altezza caduta:	0,75 m			Cod.ISTAT:	0
Avanzamento:	0,20 m				

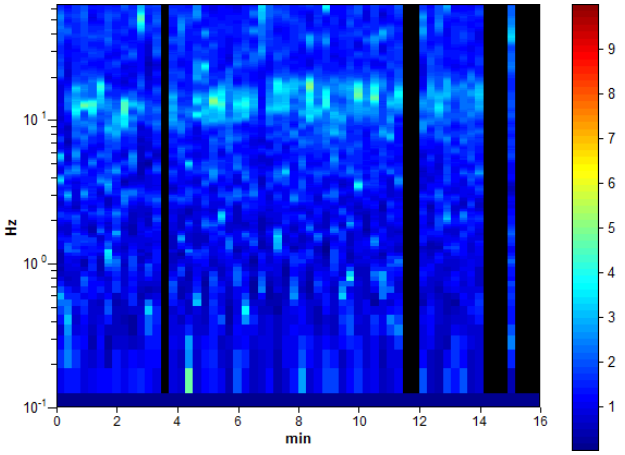
GRIZZANA MORANDI_MS, TR14 STANCO SOTTO

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 16:37:05 End recording: 23/10/18 16:53:05
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 85% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

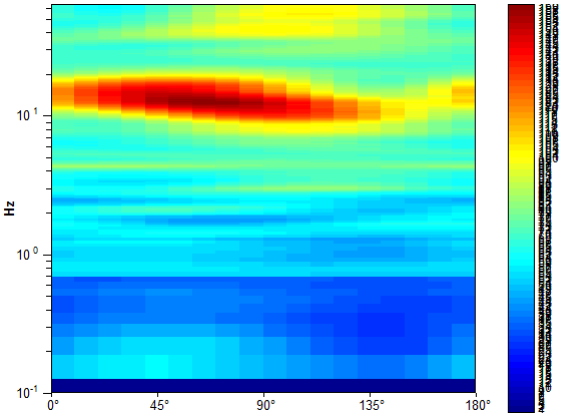
HORIZONTAL TO VERTICAL SPECTRAL RATIO



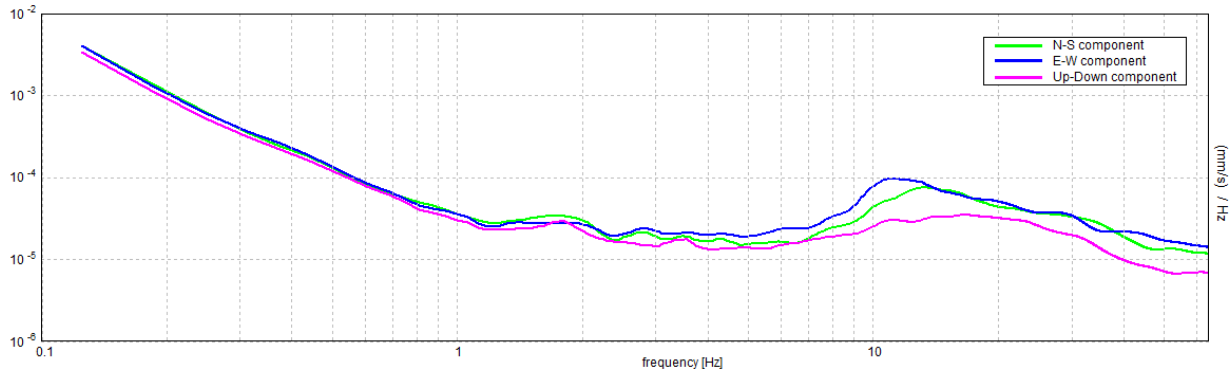
H/V TIME HISTORY



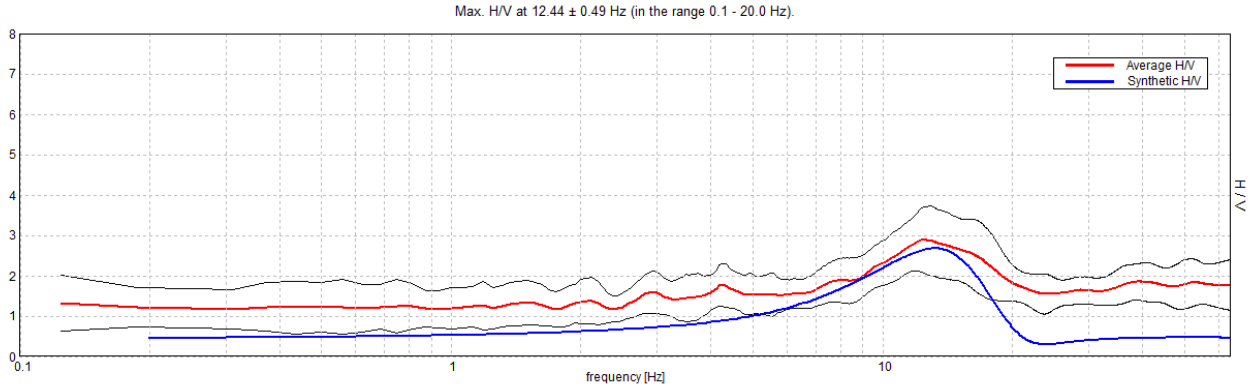
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

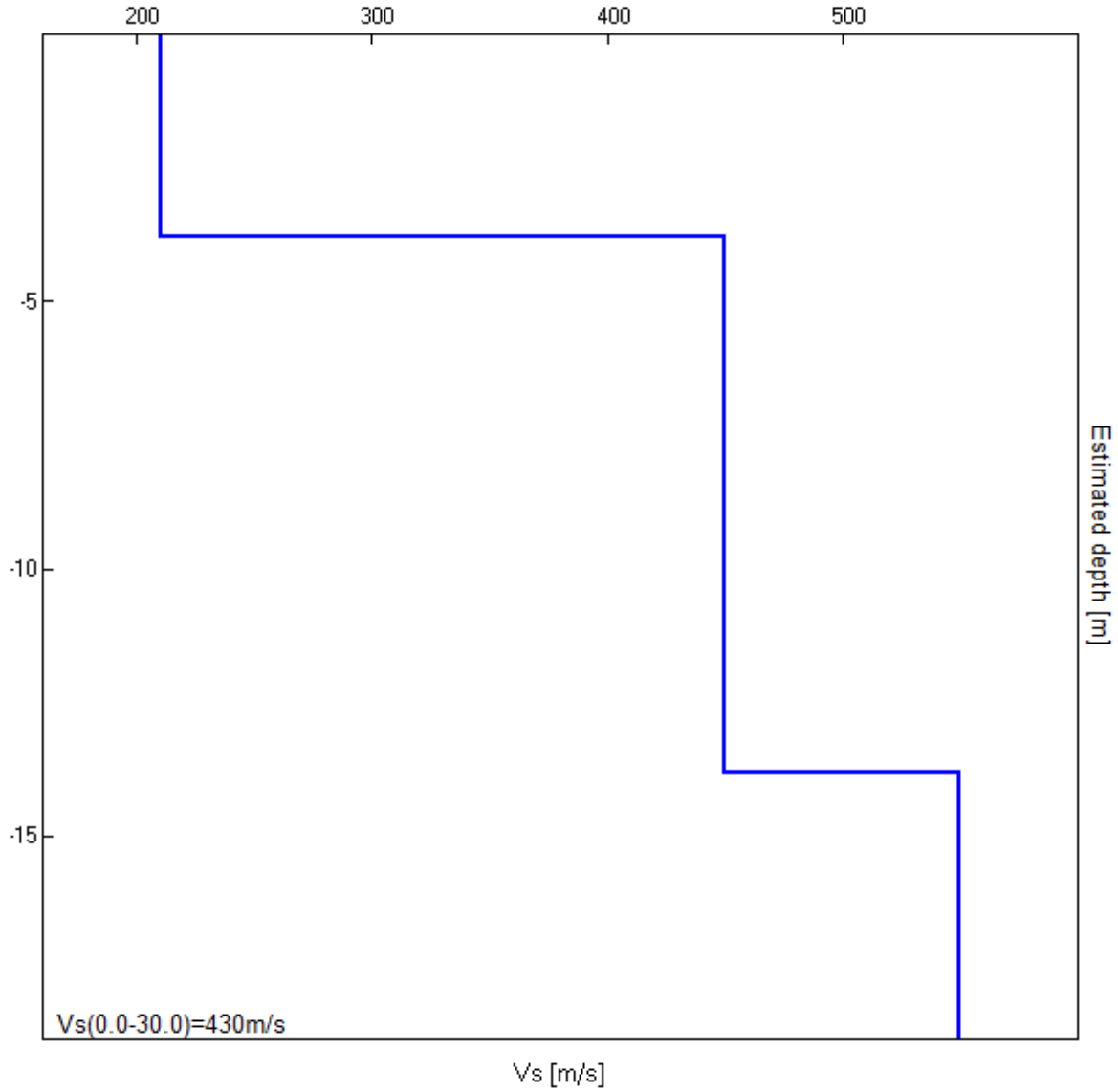


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.80	3.80	210
13.80	10.00	450
inf.	inf.	550

Vs(0.0-30.0)=430m/s



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

Max. H/V at 12.44 ± 0.49 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	12.44 > 0.63	OK	
$n_c(f_0) > 200$	10149.0 > 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 300 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	3.5 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.89 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01941| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.24137 < 0.62188	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4035 < 1.58	OK	

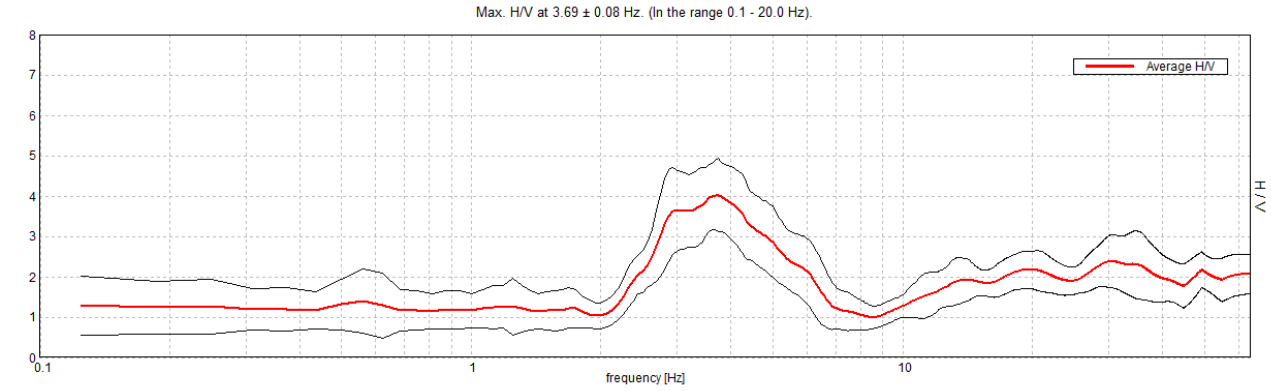
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

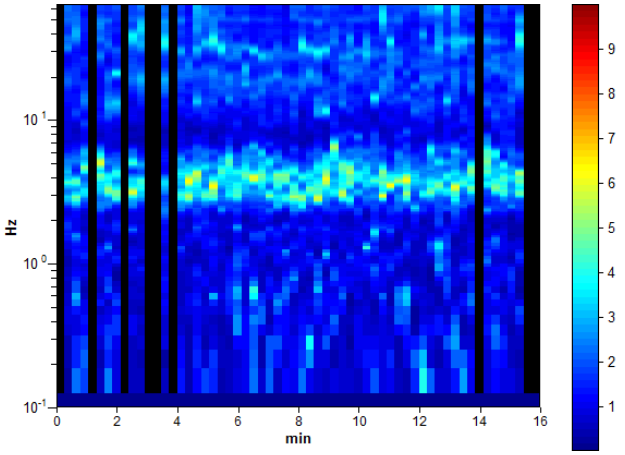
GRIZZANA MORANDI_MS, TR15 STANCO SOPRA 2

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 17:02:49 End recording: 23/10/18 17:18:49
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 85% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

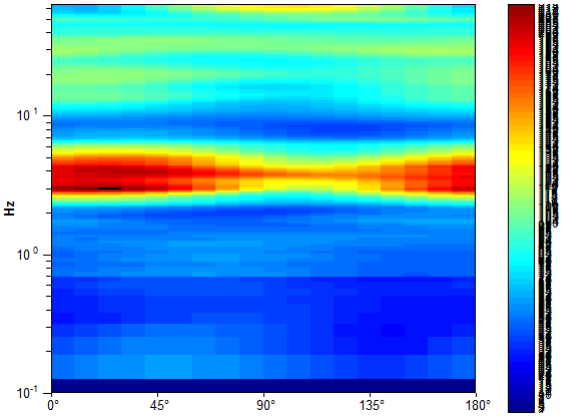
HORIZONTAL TO VERTICAL SPECTRAL RATIO



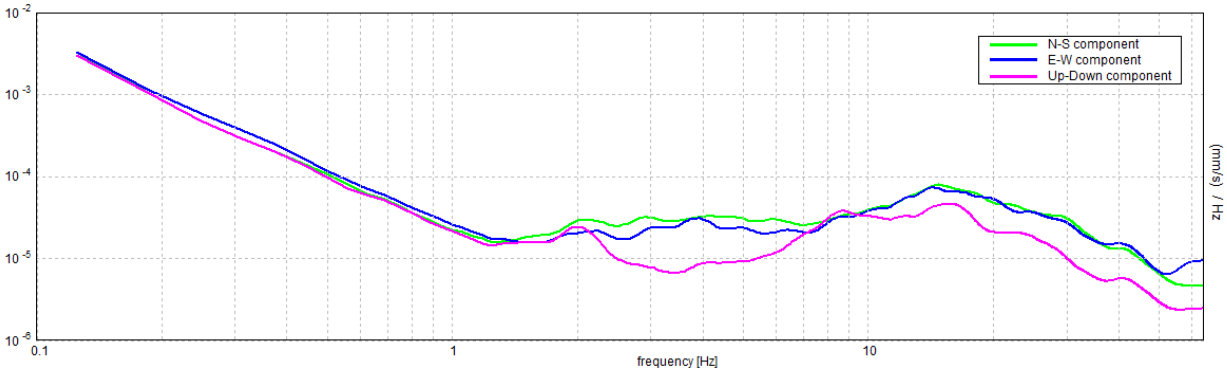
H/V TIME HISTORY



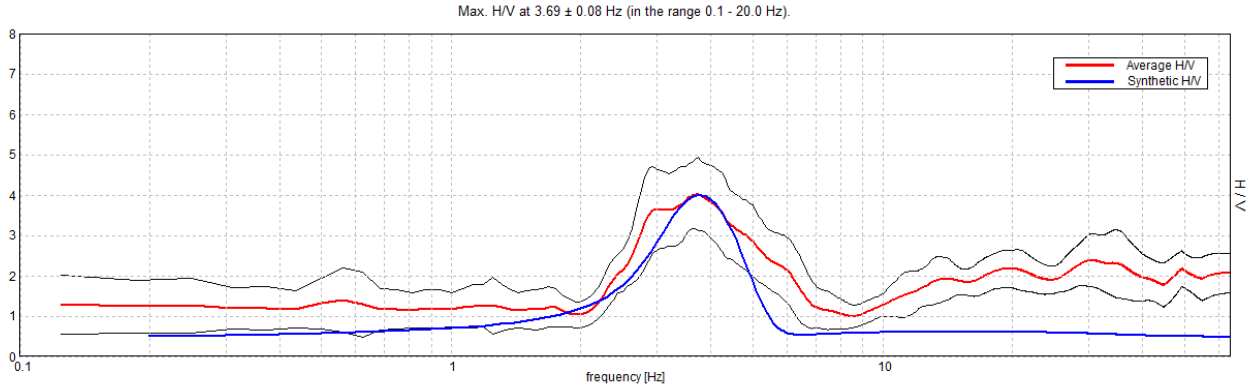
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

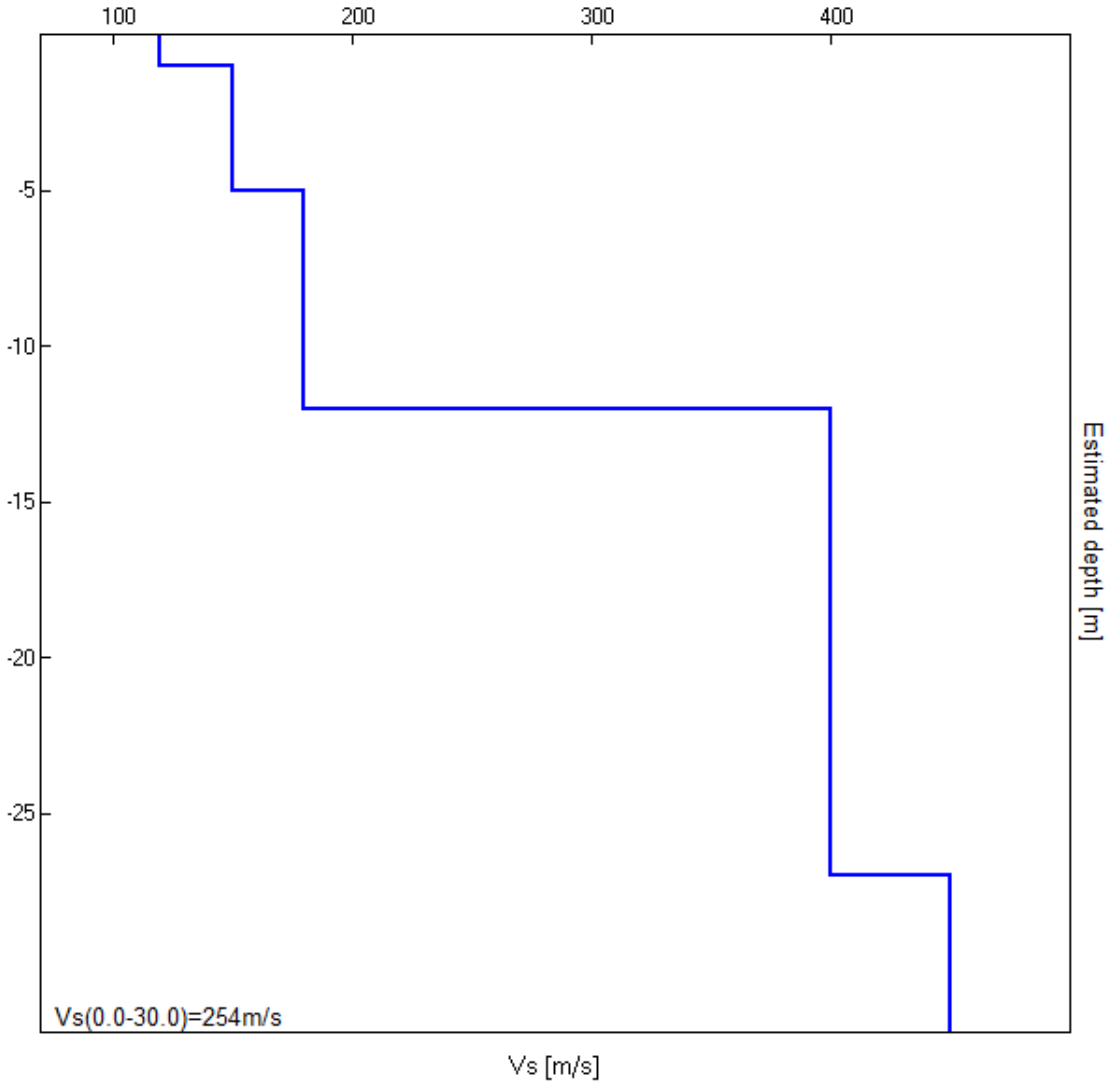


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
1.00	1.00	120
5.00	4.00	150
12.00	7.00	180
27.00	15.00	400
inf.	inf.	450

Vs(0.0-30.0)=254m/s



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

Max. H/V at 3.69 ± 0.08 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.69 > 0.63	OK	
$n_c(f_0) > 200$	3009.0 > 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 90 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	2.375 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	6.188 Hz	OK	
$A_0 > 2$	4.03 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0102| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.03761 < 0.18438	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4269 < 1.58	OK	

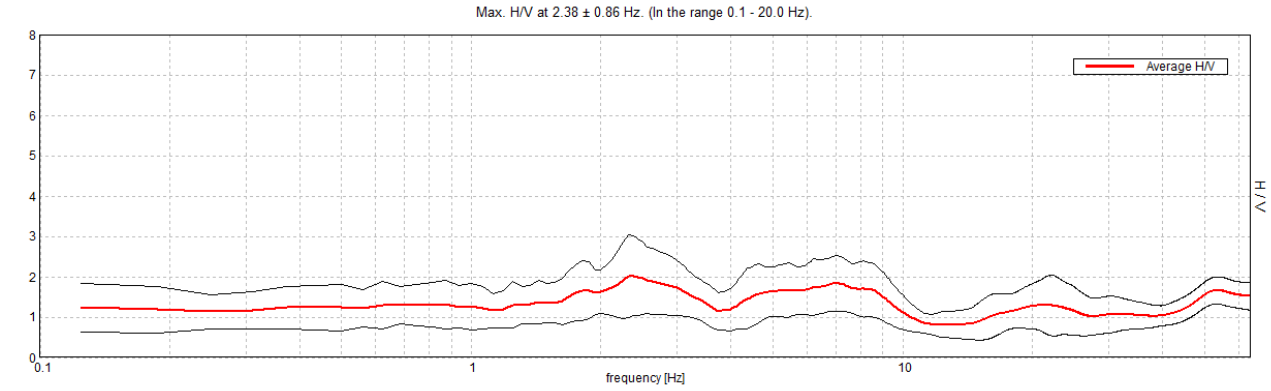
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

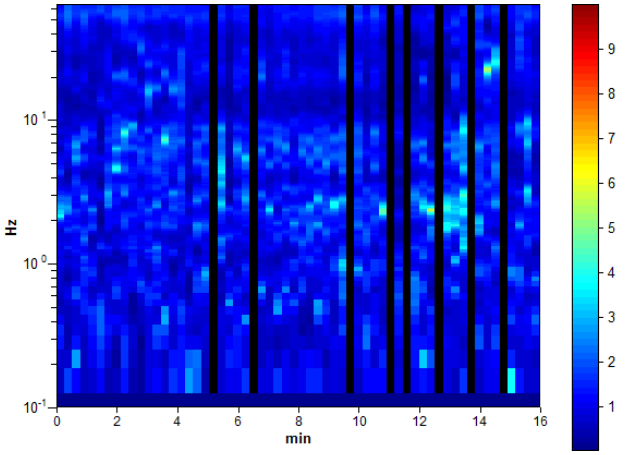
GRIZZANA MORANDI_MS, TR16 STANCO SOPRA 1

Instrument: TRZ-0009/01-09
Start recording: 23/10/18 17:24:23 End recording: 23/10/18 17:40:23
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 87% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

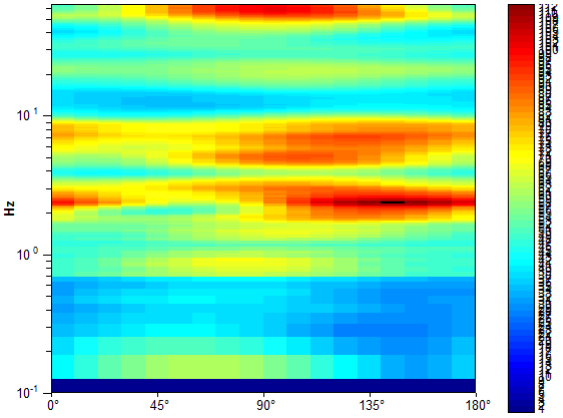
HORIZONTAL TO VERTICAL SPECTRAL RATIO



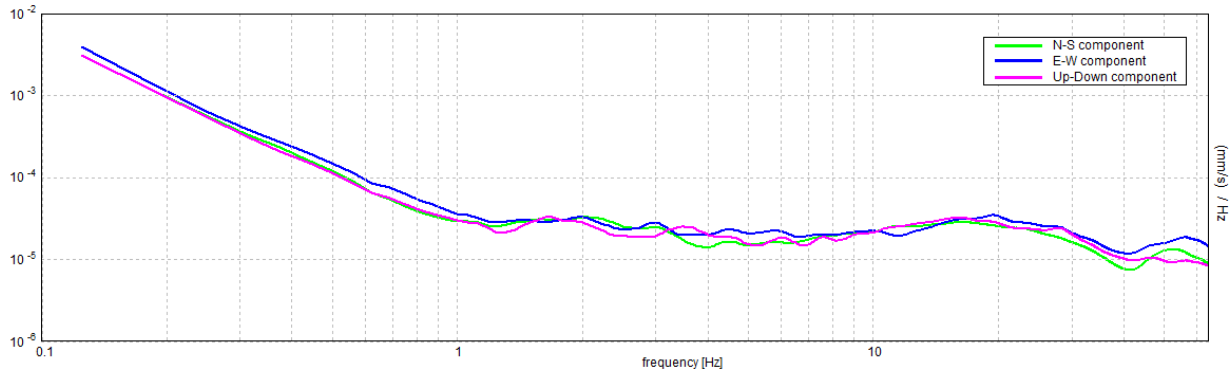
H/V TIME HISTORY



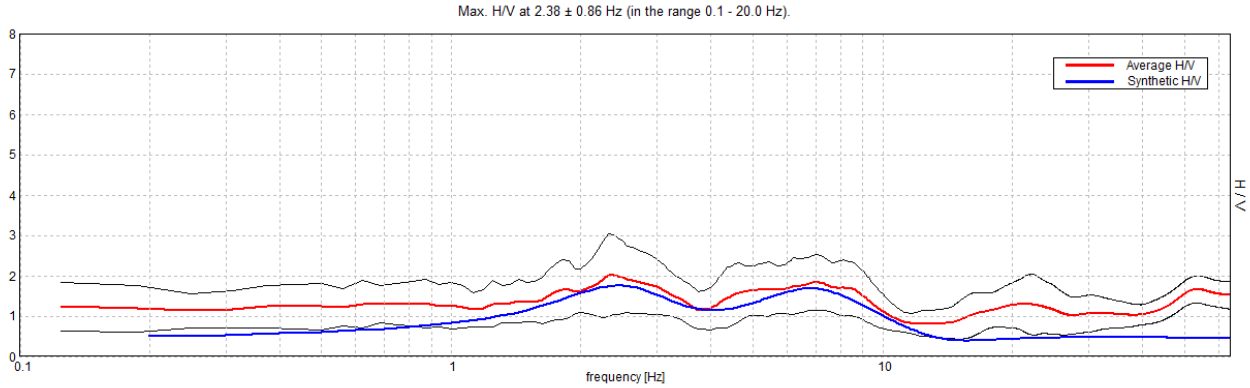
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

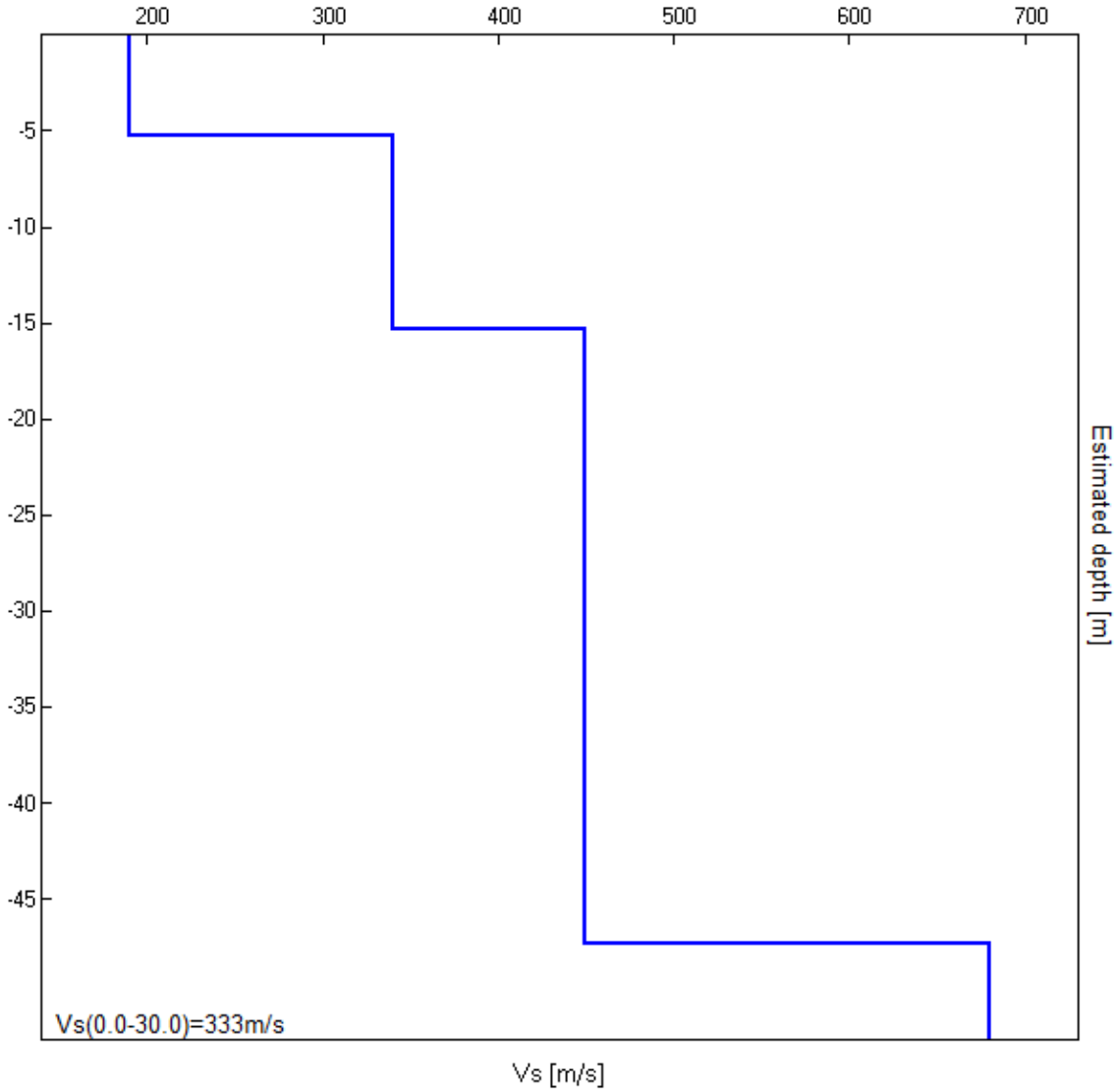


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
5.30	5.30	190
15.30	10.00	340
47.30	32.00	450
inf.	inf.	680

Vs(0.0-30.0)=333m/s



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

Max. H/V at 2.38 ± 0.86 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	2.38 > 0.63	OK	
$n_c(f_0) > 200$	1976.0 > 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 58 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.02 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.17824| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.42331 < 0.11875		NO
$\sigma_A(f_0) < \theta(f_0)$	0.4897 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P57DS60

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	2
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pian di Setta ´´3´´ incrocio vicino ponte ferrovia**

U.M.: **kg/cm²** | Pagina: 1 | Elaborato:

Data esec.: 10/04/2019

Falda: Foro chiuso

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	1		7,45
0,40	1	1		7,45
0,60	2	0		0,00
0,80	2	1		7,45
1,00	2	3		20,71
1,20	2	2		13,81
1,40	2	3		20,71
1,60	3	3		20,71
1,80	3	1		6,90
2,00	3	4		25,74
2,20	3	5		32,17
2,40	3	4		25,74
2,60	4	6		38,61
2,80	4	10		64,34
3,00	4	10		60,24
3,20	4	16		96,39
3,40	4	6		36,15
3,60	5	5		30,12
3,80	5	10		60,24
4,00	5	17		96,28
4,20	5	14		79,29
4,40	5	26		147,25
4,60	6	31		175,56
4,80	6	23		130,26
5,00	6	24		128,23
5,20	6	36		192,35
5,40	6	58		309,90

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

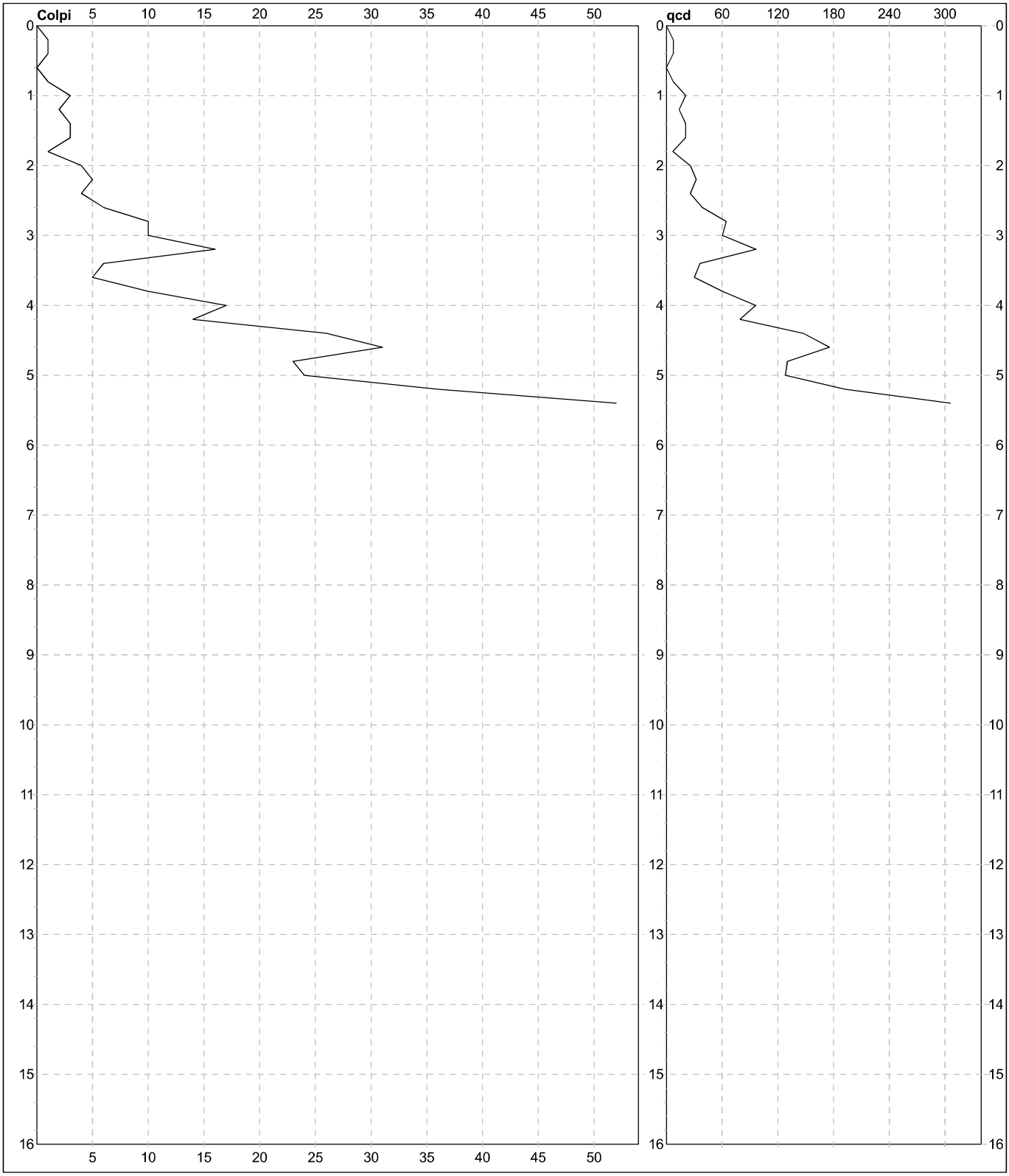
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	2
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pian di Setta ´´3´´ incrocio vicino ponte ferrovia**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Foro chiuso



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

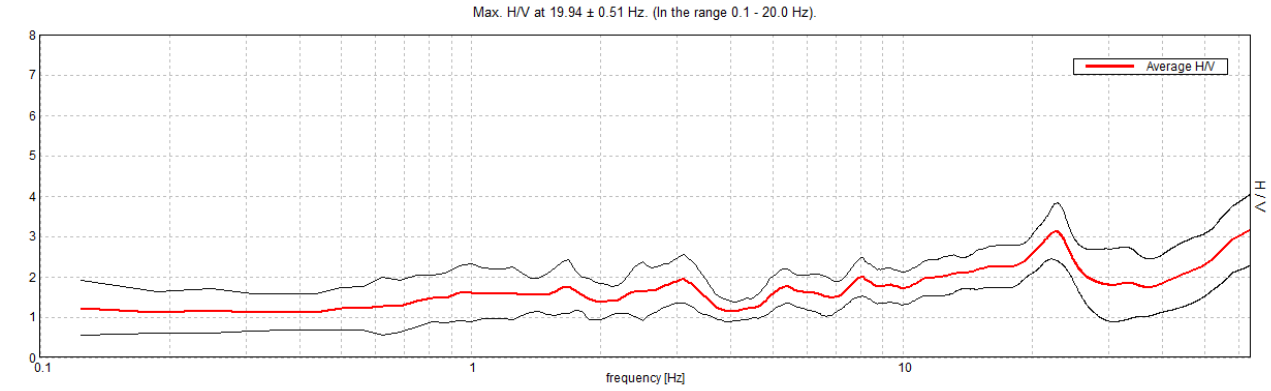
Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

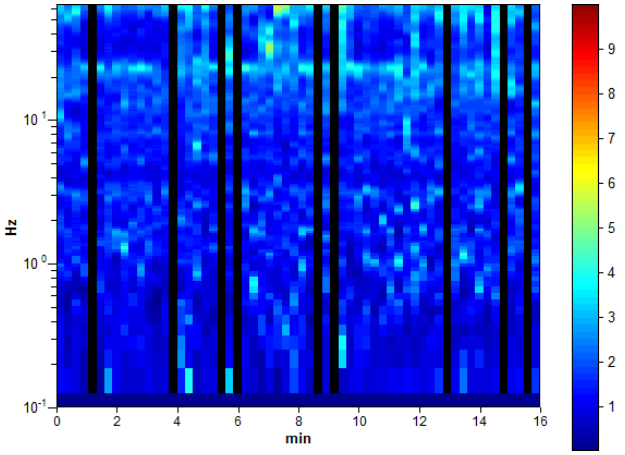
GRIZZANA MORANDI_MS, TR18 CÀ DEI CINELLI

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 14:10:52 End recording: 25/10/18 14:26:52
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 85% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

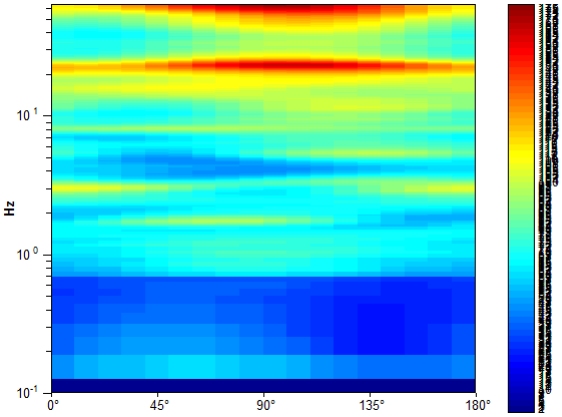
HORIZONTAL TO VERTICAL SPECTRAL RATIO



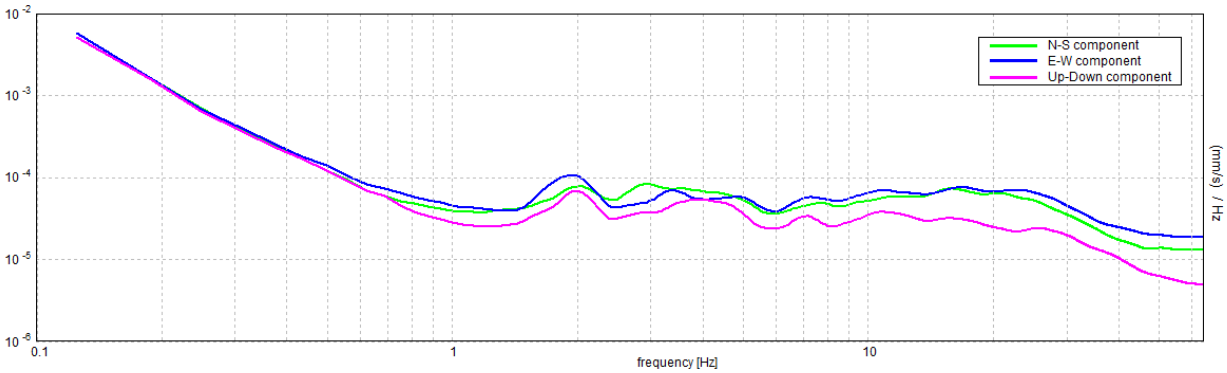
H/V TIME HISTORY



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 19.94 ± 0.51 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.94 > 0.63	OK	
$n_c(f_0) > 200$	16269.0 > 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 480 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.56 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0127| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.25323 < 0.99688	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2349 < 1.58	OK	

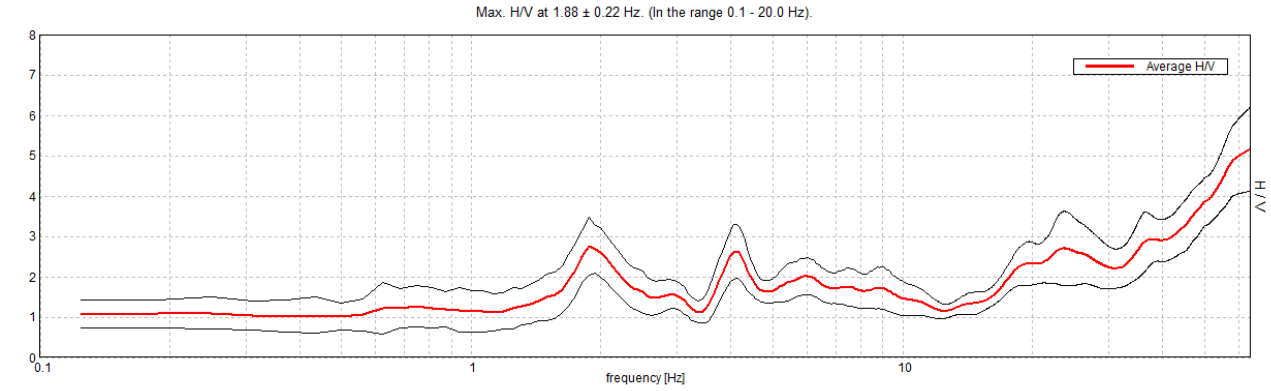
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

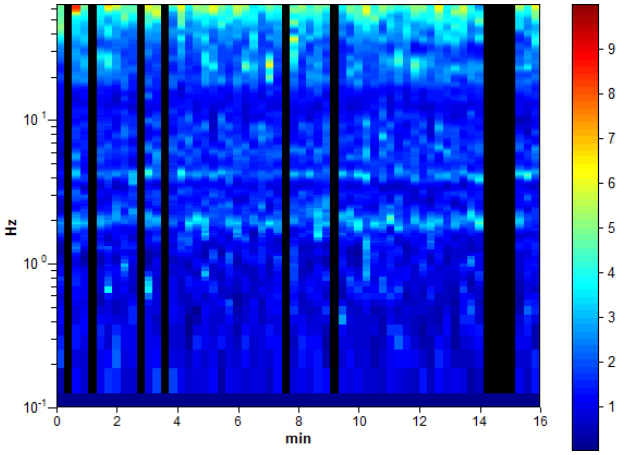
GRIZZANA MORANDI_MS, TR17 STAZIONE GRIZZANA

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 13:38:00 End recording: 25/10/18 13:54:00
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 83% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

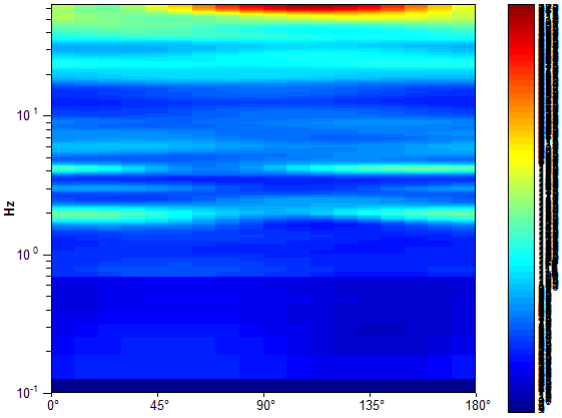
HORIZONTAL TO VERTICAL SPECTRAL RATIO



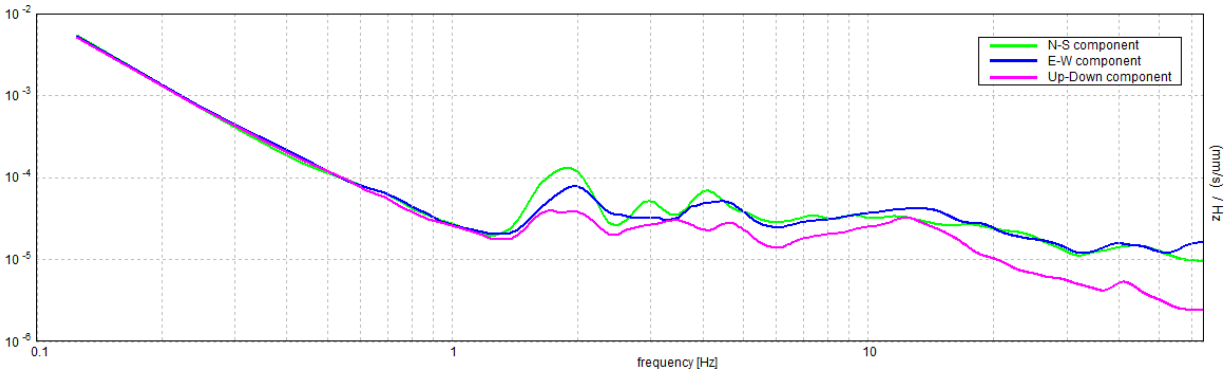
H/V TIME HISTORY



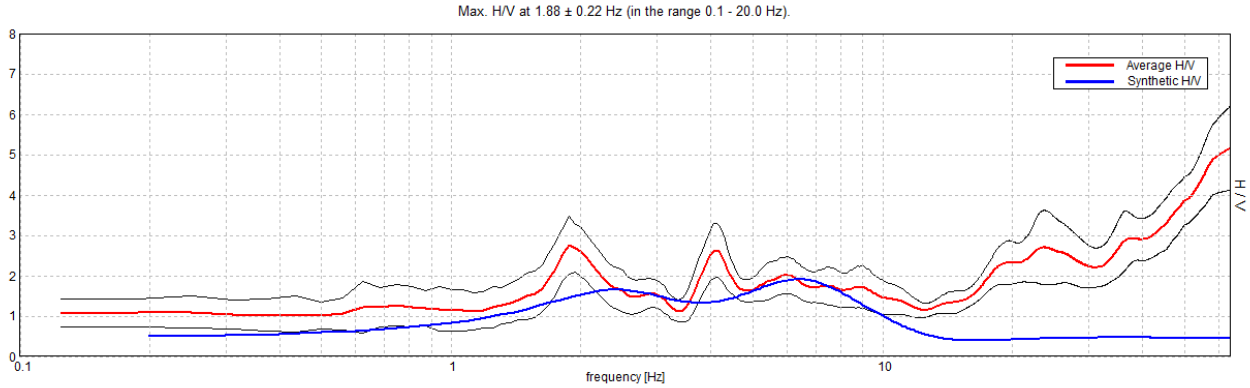
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

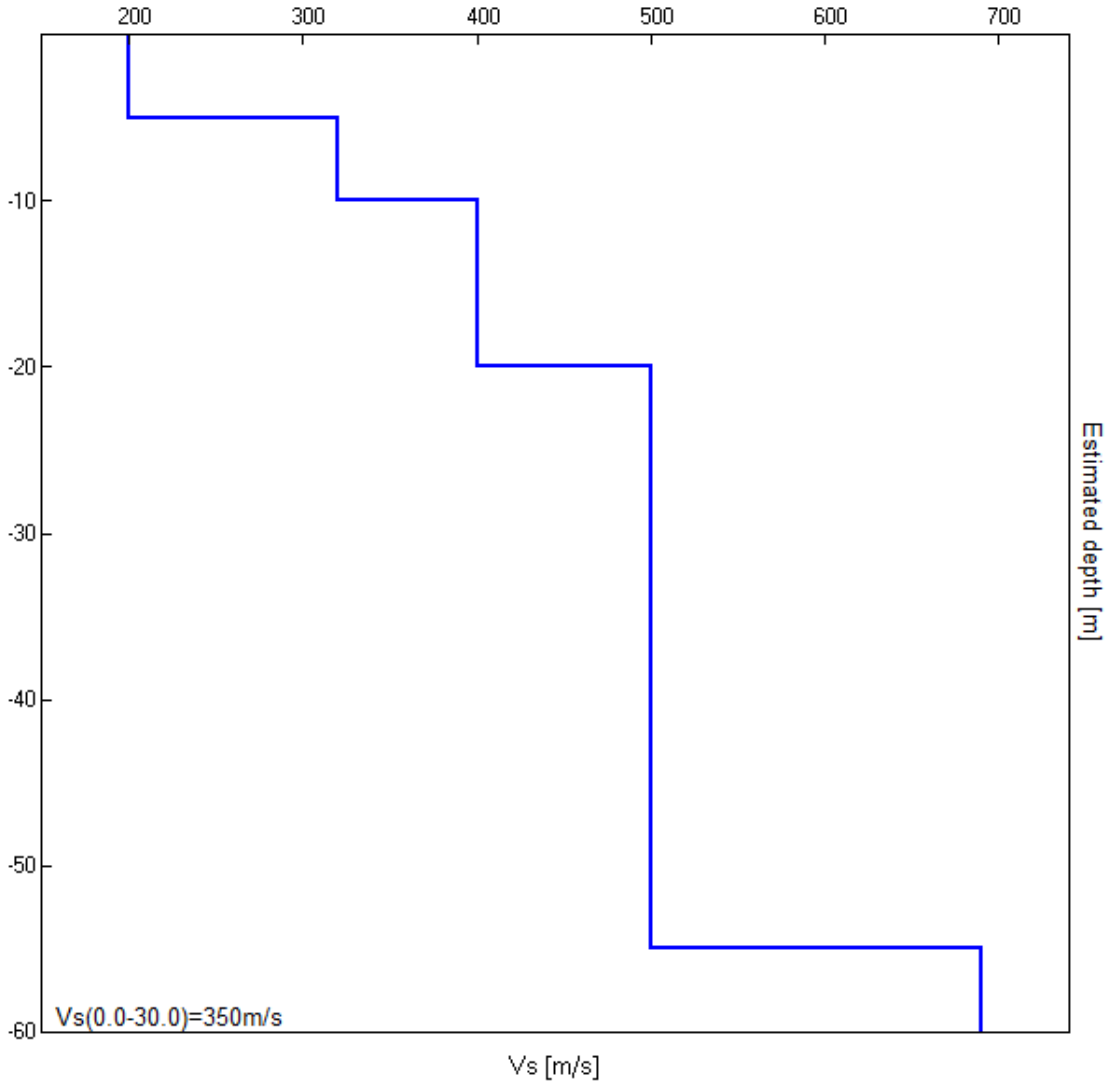


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
5.00	5.00	200
10.00	5.00	320
20.00	10.00	400
55.00	35.00	500
inf.	inf.	690

Vs(0.0-30.0)=350m/s



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

Max. H/V at 1.88 ± 0.22 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.88 > 0.63	OK	
$n_c(f_0) > 200$	1500.0 > 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 46 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.375 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	3.188 Hz	OK	
$A_0 > 2$	2.76 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.05907| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.11075 < 0.1875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3493 < 1.78	OK	

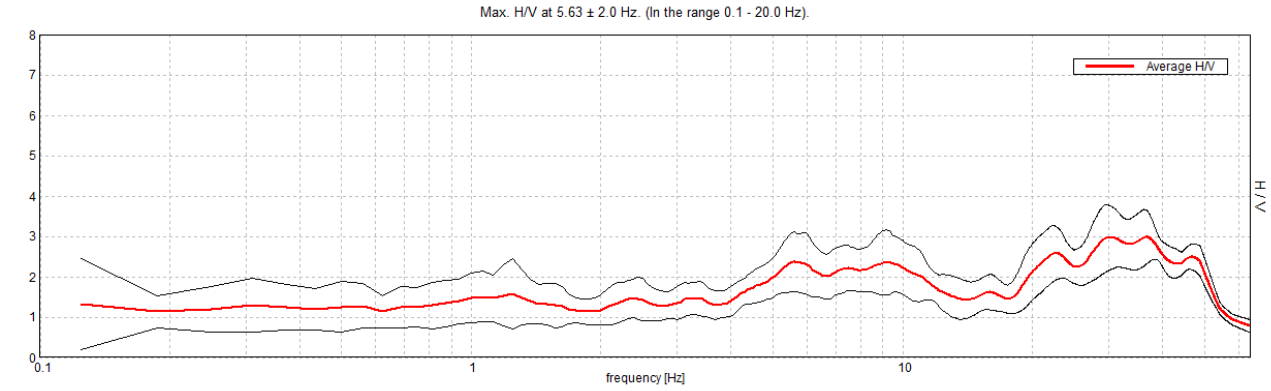
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

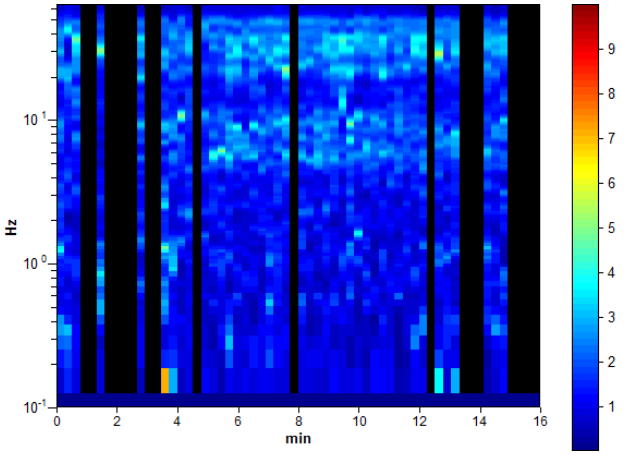
GRIZZANA MORANDI_MS, TR19 PONTE FANEDOLA

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 14:31:25 End recording: 25/10/18 14:47:25
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 70% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

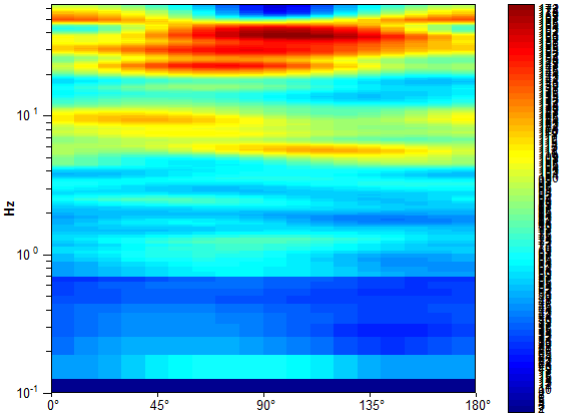
HORIZONTAL TO VERTICAL SPECTRAL RATIO



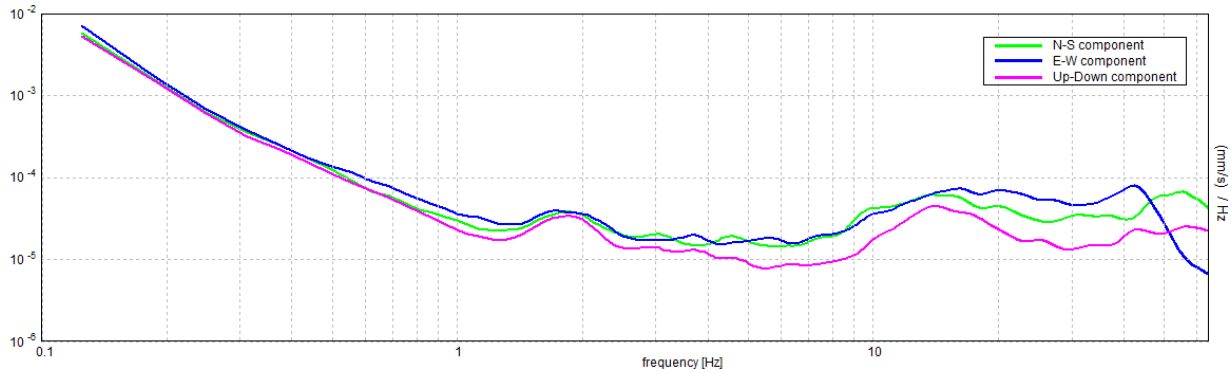
H/V TIME HISTORY



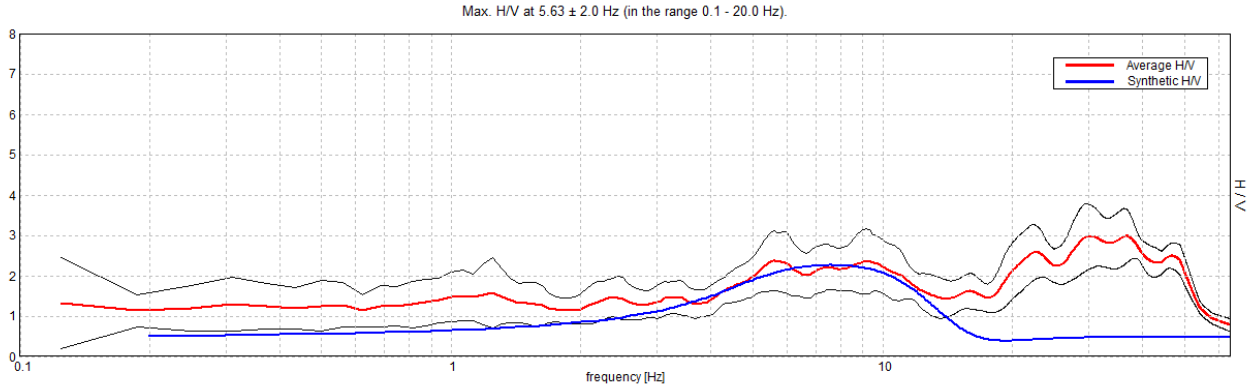
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

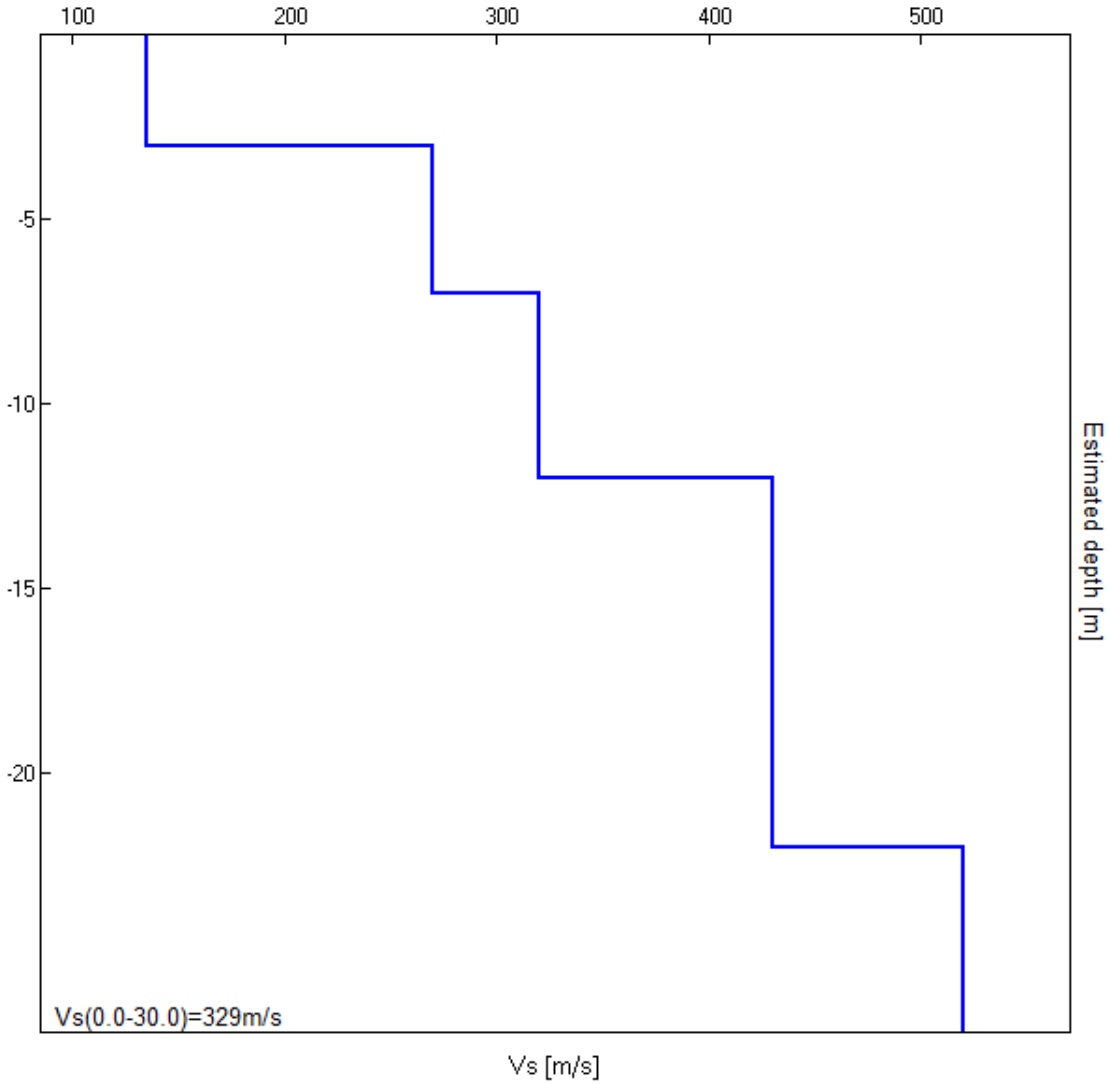


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.00	3.00	135
7.00	4.00	270
12.00	5.00	320
22.00	10.00	430
inf.	inf.	520

Vs(0.0-30.0)=329m/s



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

Max. H/V at 5.63 ± 2.0 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.63 > 0.63	OK	
$n_c(f_0) > 200$	3780.0 > 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 136 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	2.0 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.37 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.17359| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.97646 < 0.28125		NO
$\sigma_A(f_0) < \theta(f_0)$	0.3649 < 1.58	OK	

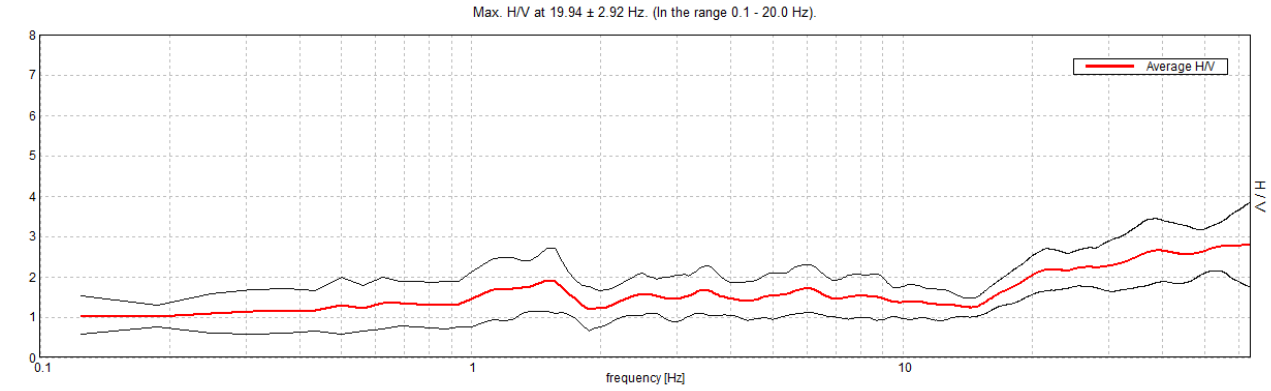
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

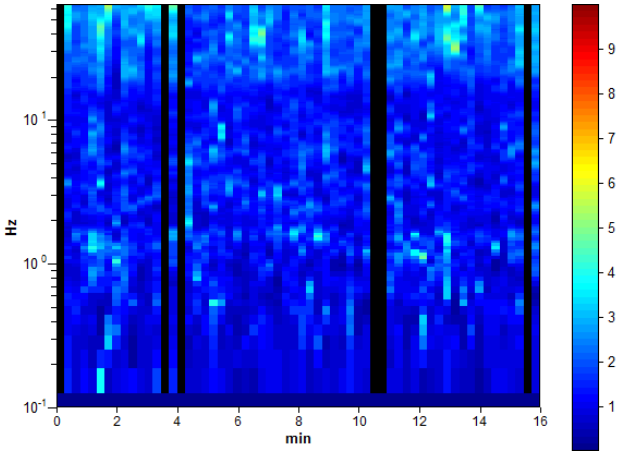
GRIZZANA MORANDI_MS, TR20 PIAN DI SETTA CIMITERO

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 14:51:14 End recording: 25/10/18 15:07:14
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 90% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

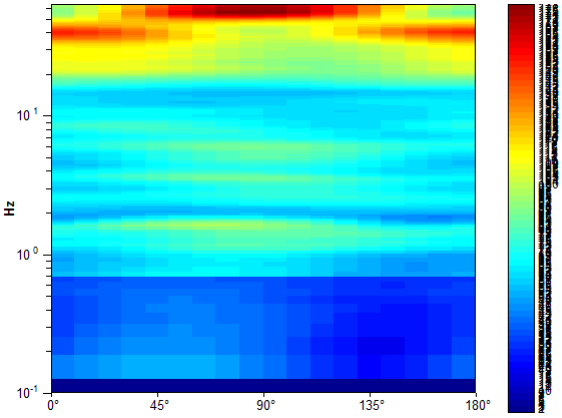
HORIZONTAL TO VERTICAL SPECTRAL RATIO



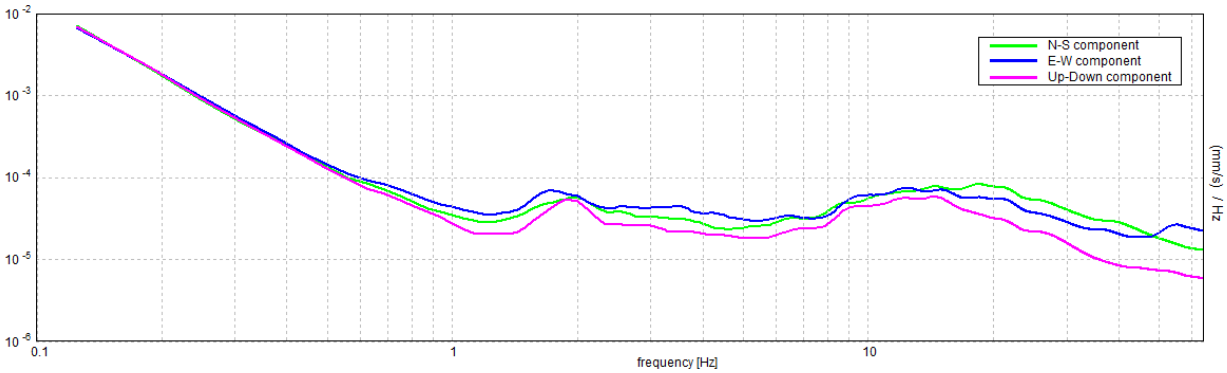
H/V TIME HISTORY



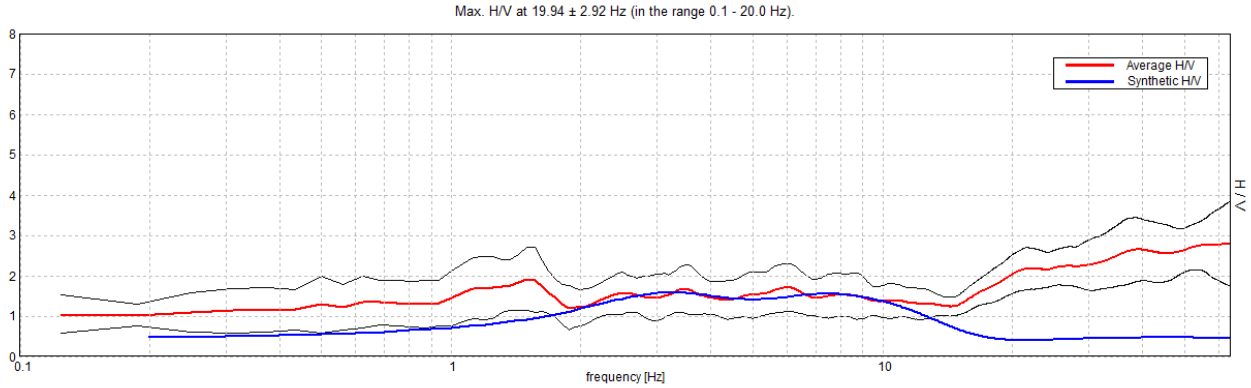
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

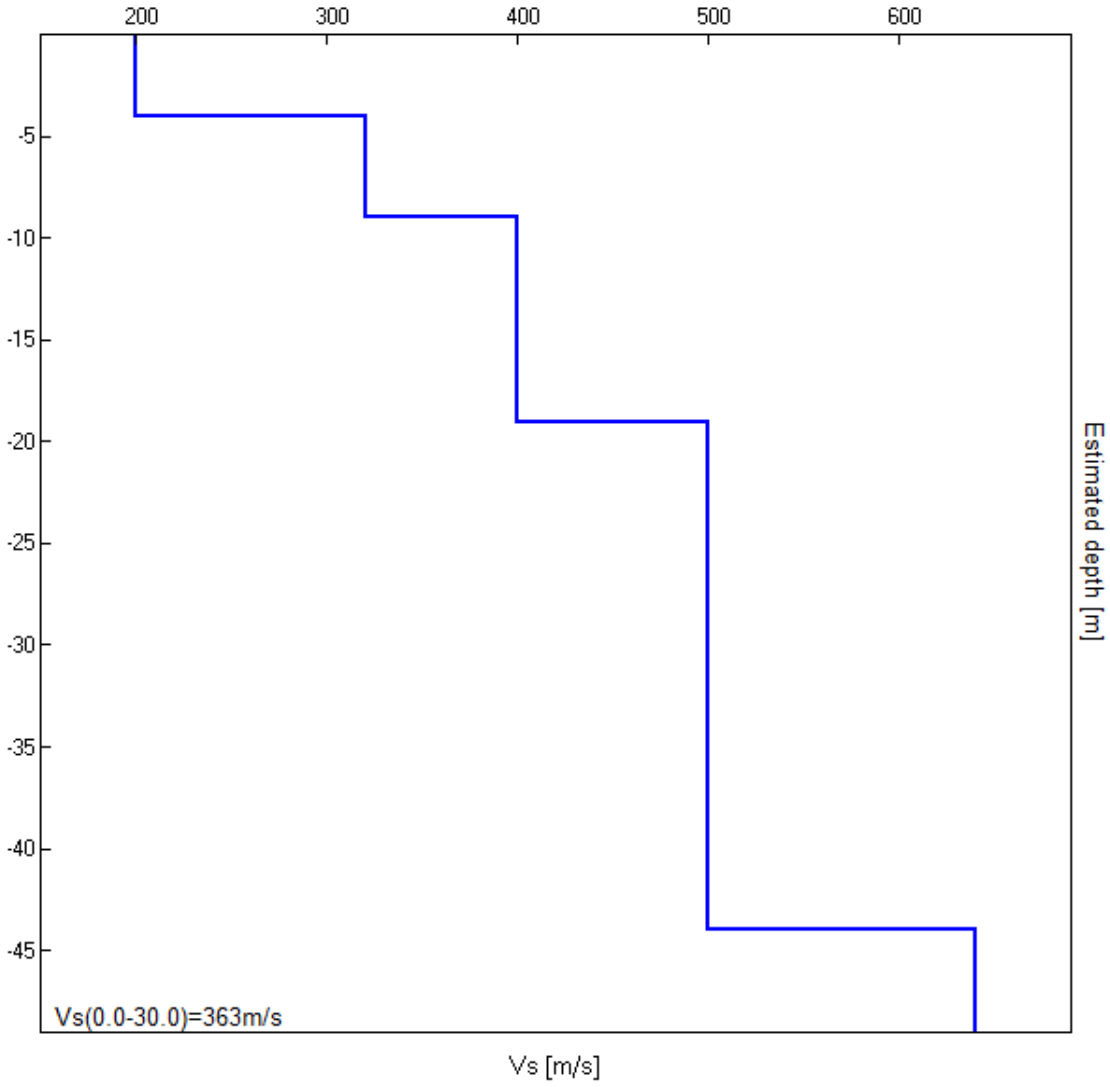


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	200
9.00	5.00	320
19.00	10.00	400
44.00	25.00	500
inf.	inf.	640

Vs(0.0-30.0)=363m/s



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

Max. H/V at 19.94 ± 2.92 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.94 > 0.63	OK	
$n_c(f_0) > 200$	17226.0 > 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 480 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.03 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.07223| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.44005 < 0.99688		NO
$\sigma_A(f_0) < \theta(f_0)$	0.2377 < 1.58	OK	

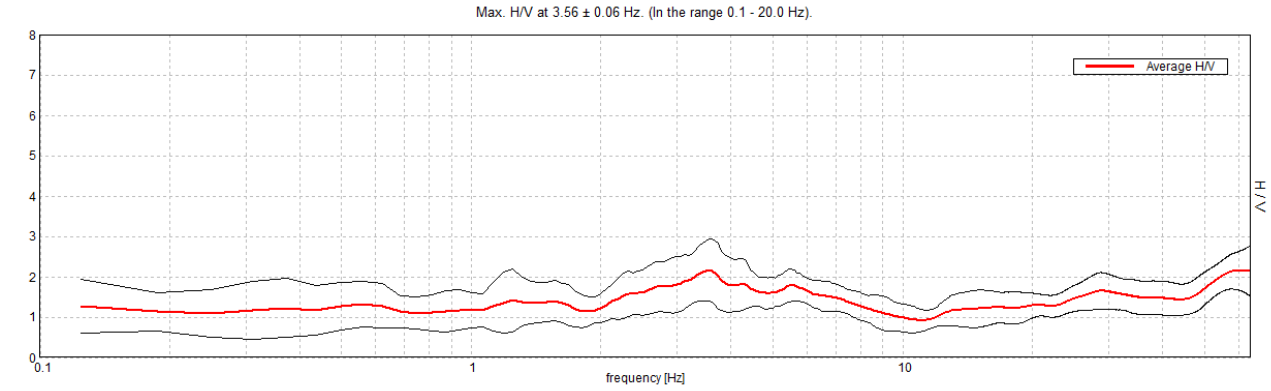
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

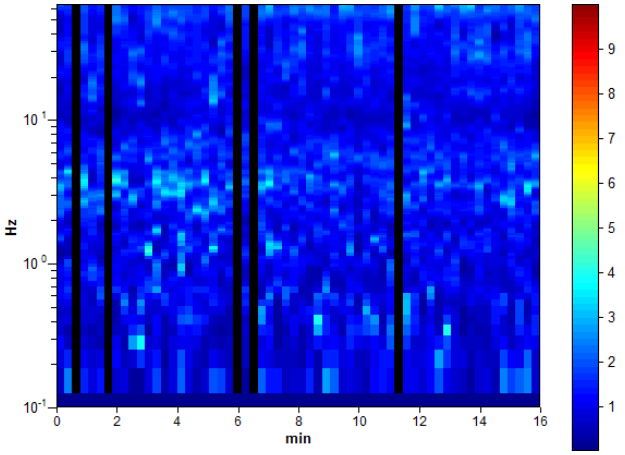
GRIZZANA MORANDI_MS, TR47 PIAN DI SETTA CAMPO SP

Instrument: TRZ-0108/01-10
Start recording: 18/01/19 10:49:23 End recording: 18/01/19 11:05:24
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 92% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

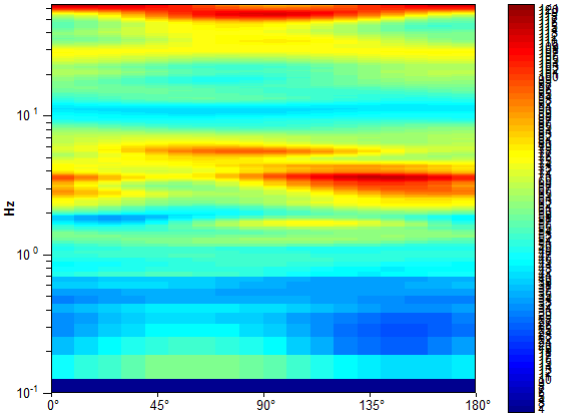
HORIZONTAL TO VERTICAL SPECTRAL RATIO



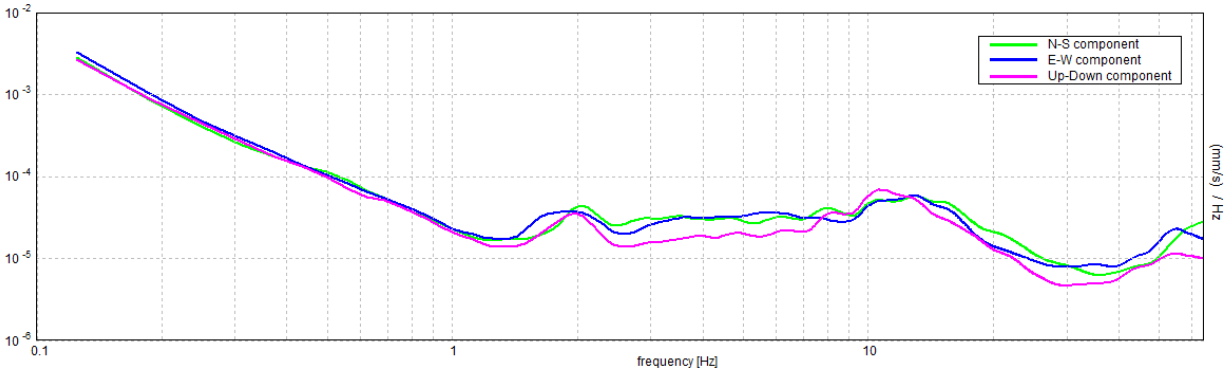
H/V TIME HISTORY



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 3.56 ± 0.06 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.56 > 0.63	OK	
$n_c(f_0) > 200$	3135.0 > 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 86 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	9.125 Hz	OK	
$A_0 > 2$	2.17 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00802| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.02857 < 0.17813	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3834 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P63DS66

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	1
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Marzolaro SP24**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: Foro chiuso

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	1		7,45
0,40	1	2		14,90
0,60	2	3		22,35
0,80	2	3		22,35
1,00	2	4		27,62
1,20	2	7		48,33
1,40	2	11		75,95
1,60	3	20		138,09
1,80	3	54		372,85
2,00	3	19		122,25
2,20	3	37		238,07
2,40	3	22		141,56
2,60	4	11		70,78
2,80	4	32		205,90
3,00	4	38		228,92
3,20	4	60		361,46

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

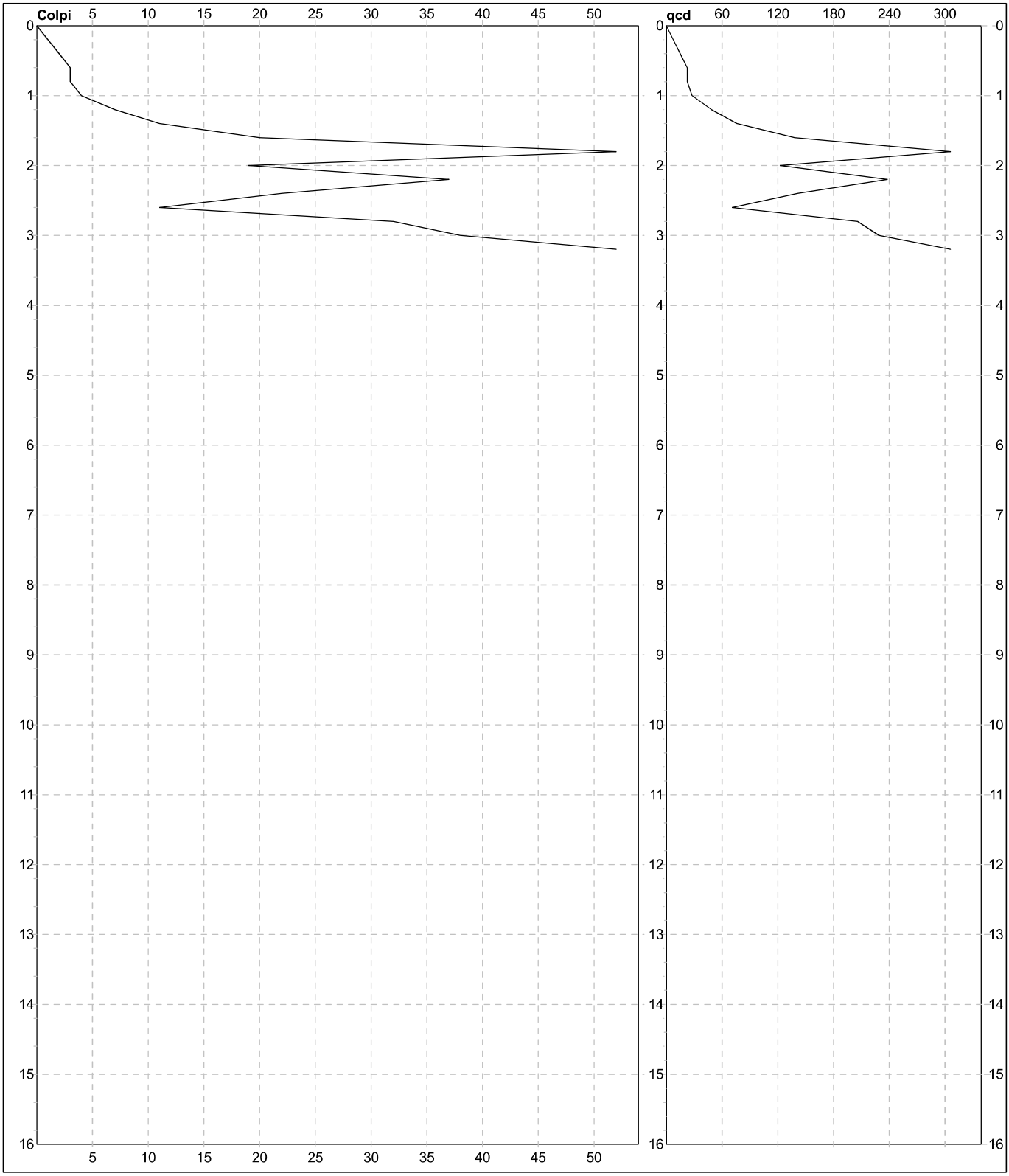
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	1
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Marzolaro SP24**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Foro chiuso



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

Responsabile:
Assistente:

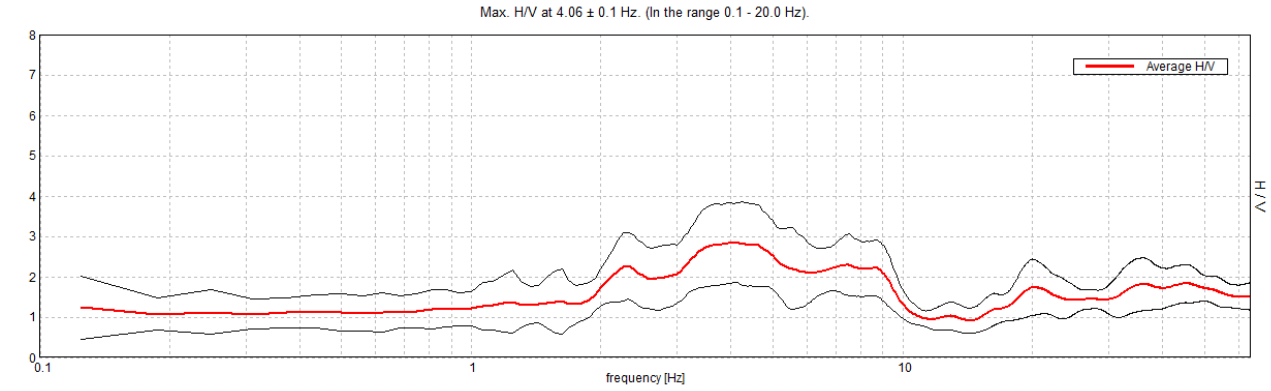
Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

037031P64HVSR67

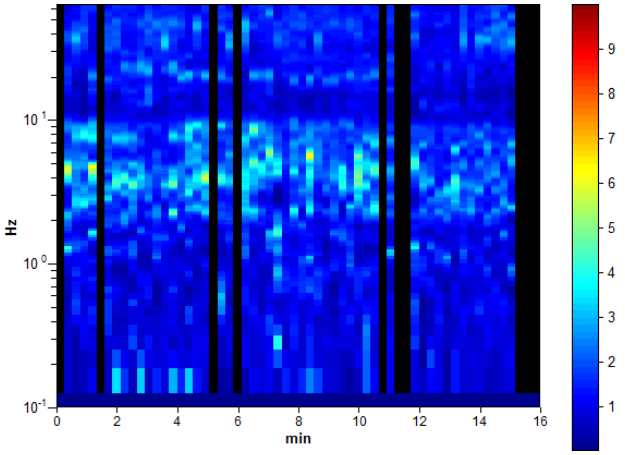
GRIZZANA MORANDI_MS, TR22 LAGARO

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 15:36:12 End recording: 25/10/18 15:52:12
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 83% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

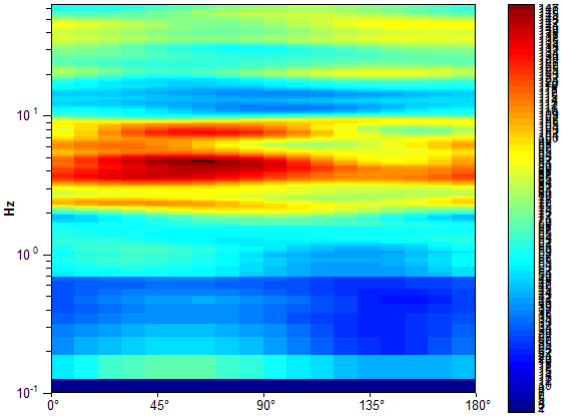
HORIZONTAL TO VERTICAL SPECTRAL RATIO



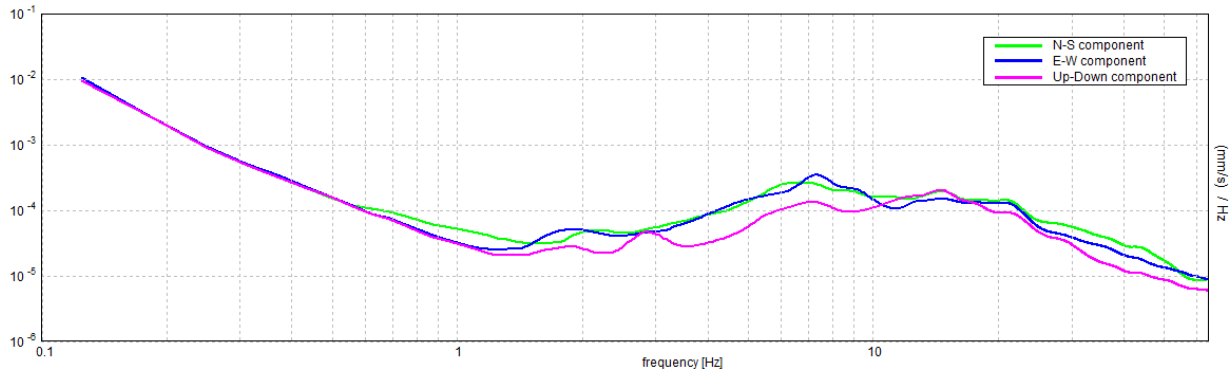
H/V TIME HISTORY



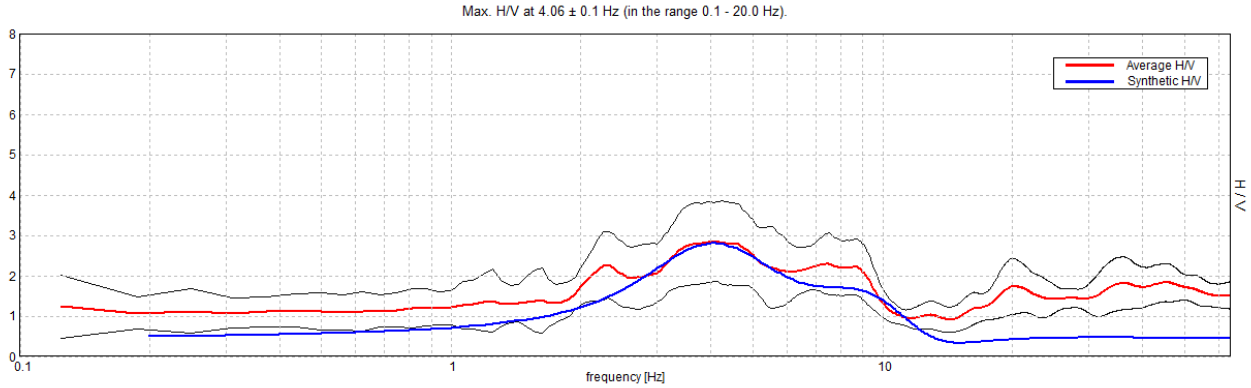
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

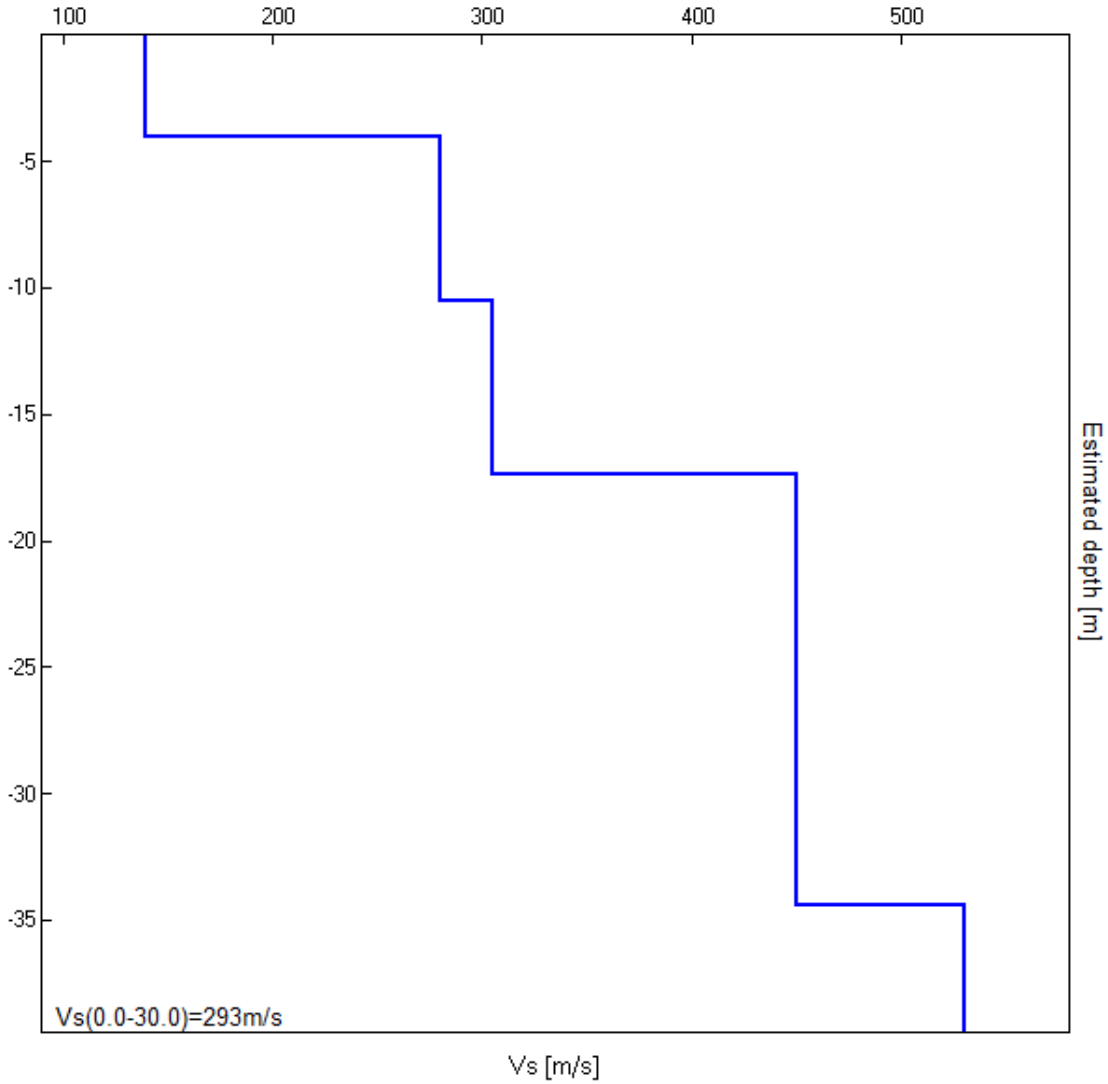


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	140
10.50	6.50	280
17.40	6.90	305
34.40	17.00	450
inf.	inf.	530

Vs(0.0-30.0)=293m/s



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

Max. H/V at 4.06 ± 0.1 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.06 > 0.63	OK	
$n_c(f_0) > 200$	3250.0 > 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 98 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.813 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	9.875 Hz	OK	
$A_0 > 2$	2.84 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01158| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.04705 < 0.20313	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4793 < 1.58	OK	

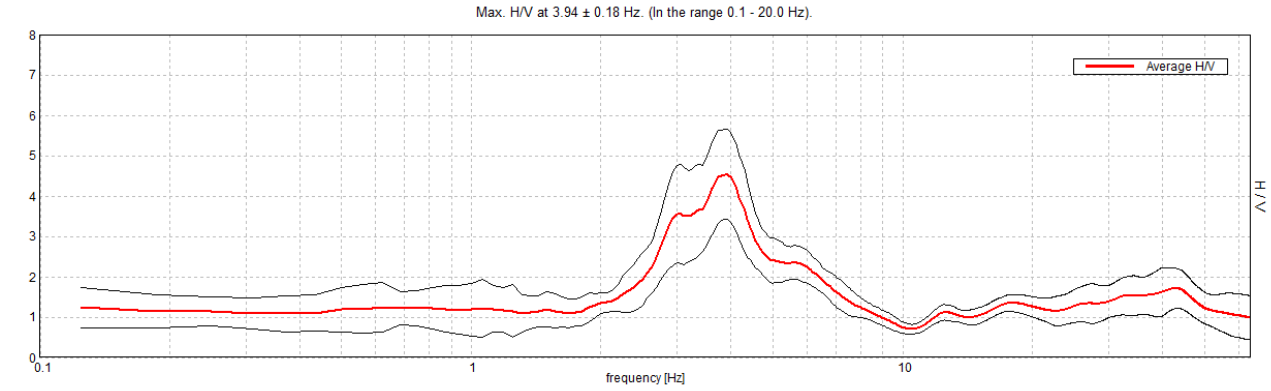
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

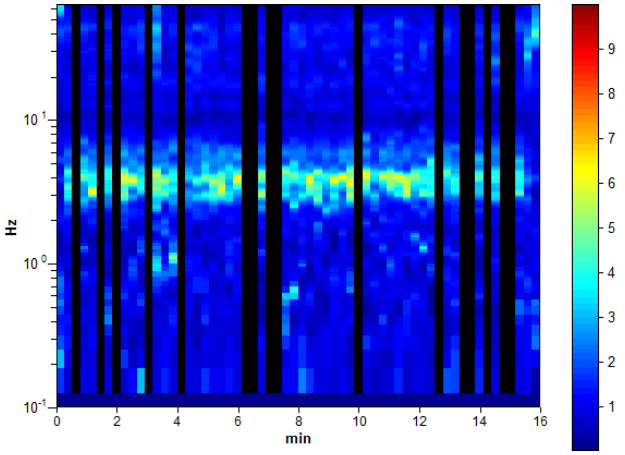
GRIZZANA MORANDI_MS, TR21 CÀ DI LAGARO

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 15:15:18 End recording: 25/10/18 15:31:18
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 73% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

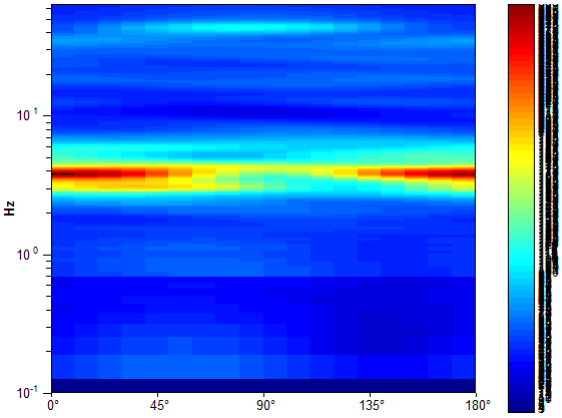
HORIZONTAL TO VERTICAL SPECTRAL RATIO



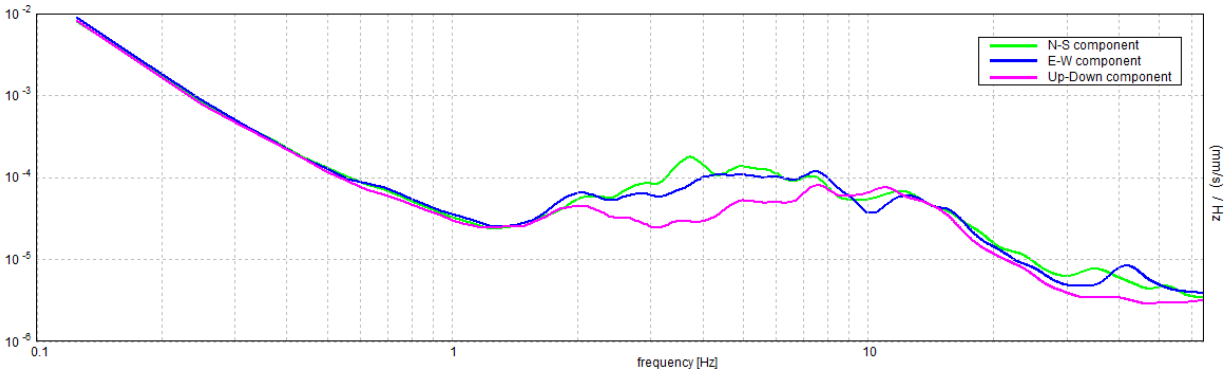
H/V TIME HISTORY



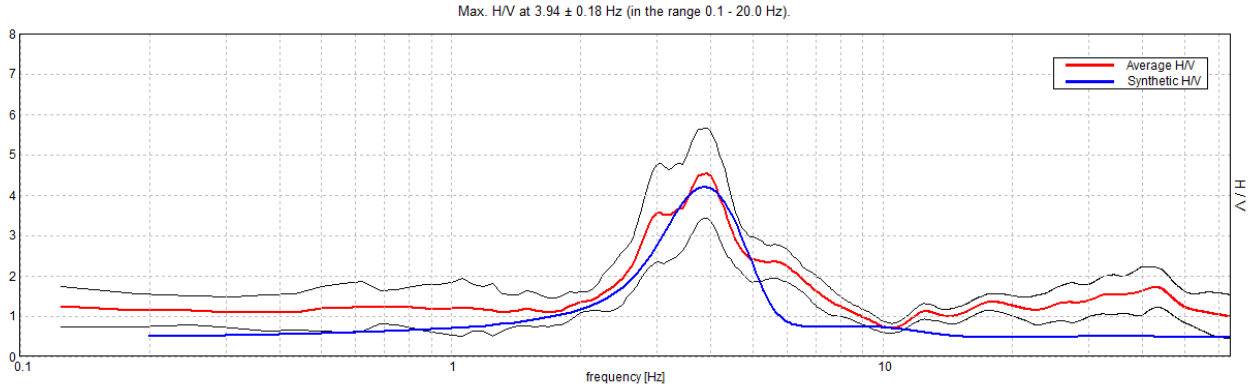
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

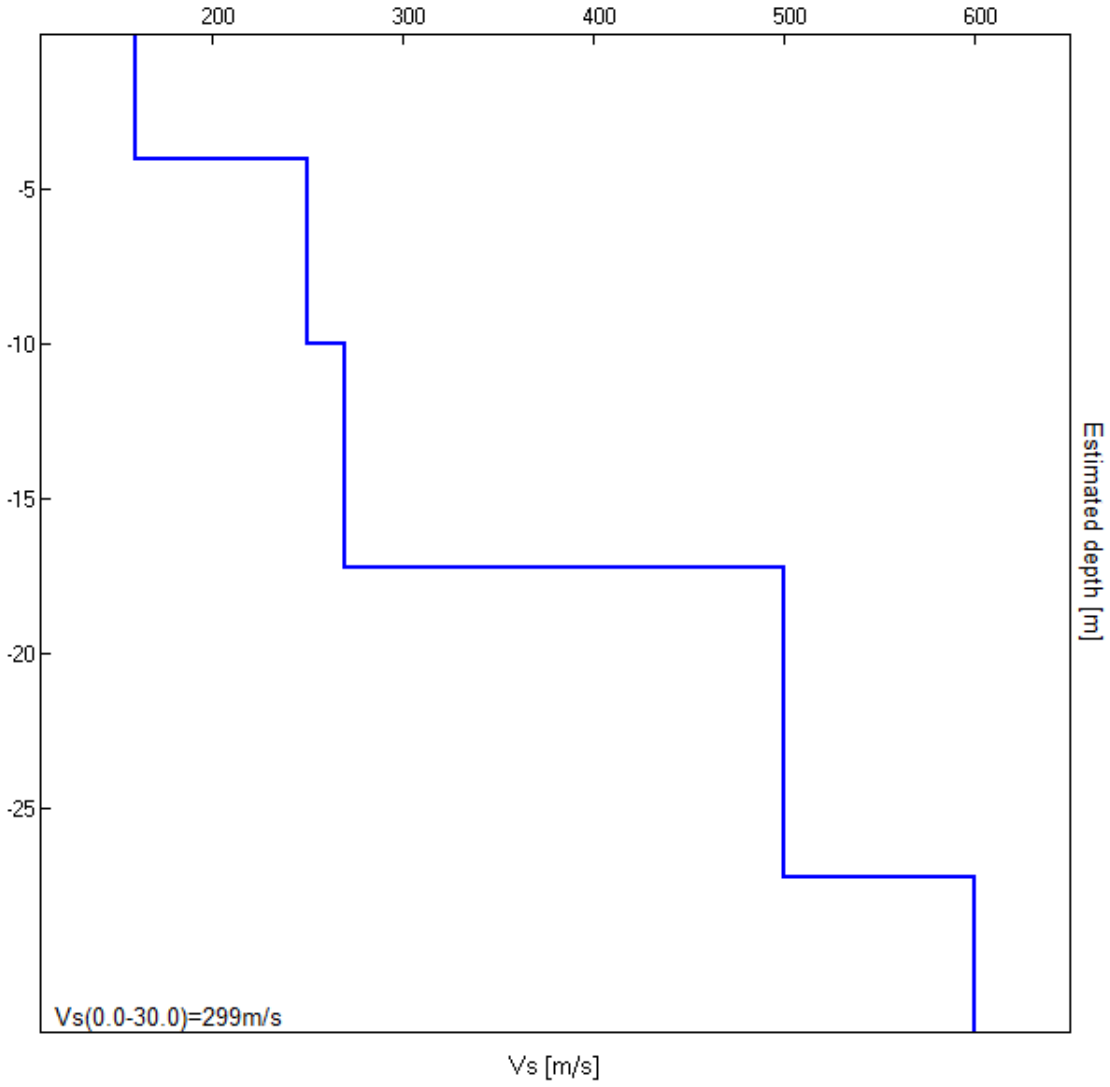


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	160
10.00	6.00	250
17.20	7.20	270
27.20	10.00	500
inf.	inf.	600

Vs(0.0-30.0)=299m/s



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

Max. H/V at 3.94 ± 0.18 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.94 > 0.63	OK	
$n_c(f_0) > 200$	2772.0 > 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 96 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	2.625 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	5.938 Hz	OK	
$A_0 > 2$	4.54 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02215| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.08722 < 0.19688	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.5432 < 1.58	OK	

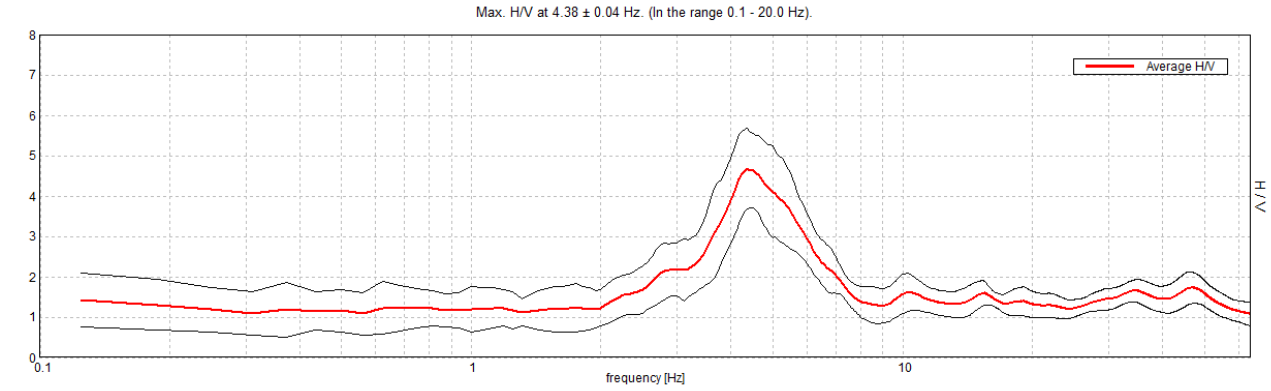
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

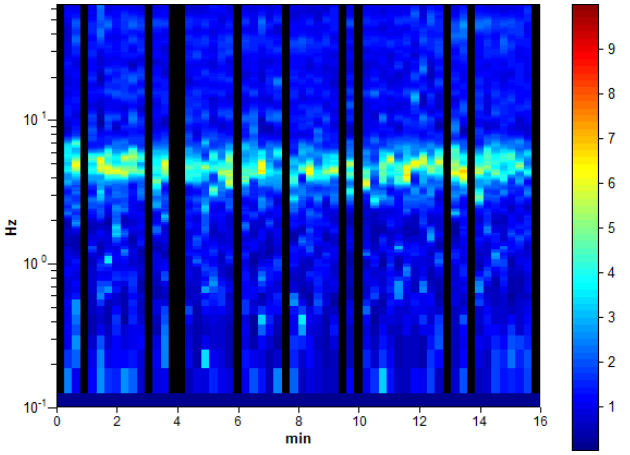
GRIZZANA MORANDI_MS, TR39 PONTE DI RIOLA CHIESA

Instrument: TRZ-0108/01-10
Start recording: 28/11/18 10:11:42 End recording: 28/11/18 10:27:43
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 80% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

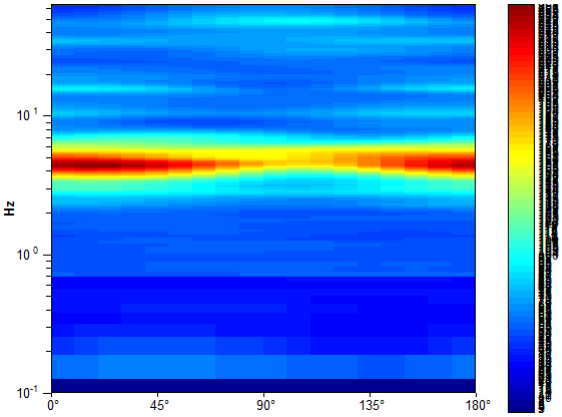
HORIZONTAL TO VERTICAL SPECTRAL RATIO



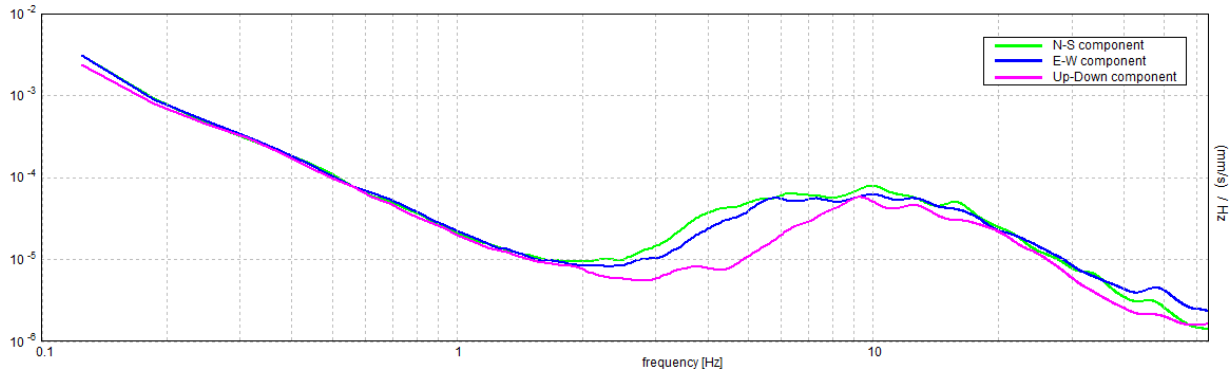
H/V TIME HISTORY



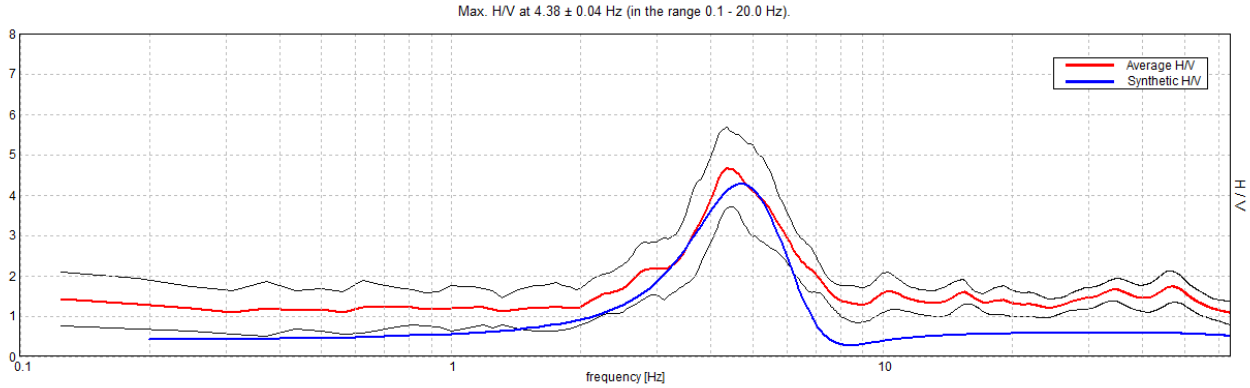
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

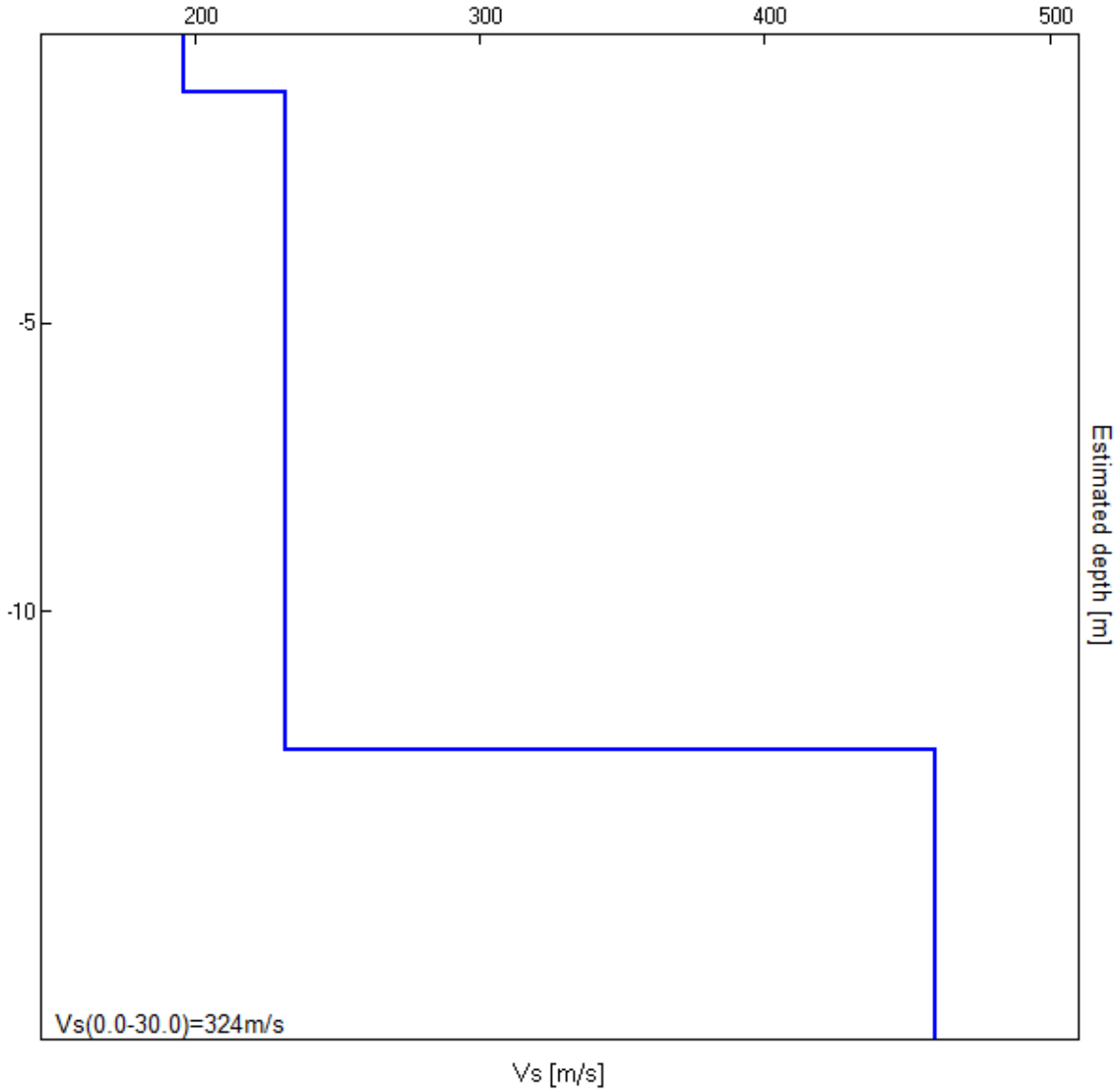


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
1.00	1.00	196
12.40	11.40	232
inf.	inf.	460

Vs(0.0-30.0)=324m/s



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

Max. H/V at 4.38 ± 0.04 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.38 > 0.63	OK	
$n_c(f_0) > 200$	3360.0 > 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 106 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	3.313 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	6.563 Hz	OK	
$A_0 > 2$	4.68 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00481| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.02104 < 0.21875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.494 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P67DS70

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	7
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pontecerio Vergato Ponte 1**

U.M.: **kg/cm²** | Pagina: 1 | Elaborato:

Data esec.: 10/04/2019
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	1		7,45
0,40	1	3		22,35
0,60	2	3		22,35
0,80	2	2		14,90
1,00	2	3		20,71
1,20	2	3		20,71
1,40	2	18		124,28
1,60	3	9		62,14
1,80	3	14		96,66
2,00	3	7		45,04
2,20	3	9		57,91
2,40	3	6		38,61
2,60	4	5		32,17
2,80	4	6		38,61
3,00	4	5		30,12
3,20	4	6		36,15
3,40	4	12		72,29
3,60	5	6		36,15
3,80	5	6		36,15
4,00	5	6		33,98
4,20	5	5		28,32
4,40	5	5		28,32
4,60	6	5		28,32
4,80	6	5		28,32
5,00	6	7		37,40
5,20	6	5		26,72
5,40	6	5		26,72
5,60	7	4		21,37
5,80	7	6		32,06
6,00	7	6		30,34
6,20	7	7		35,40
6,40	7	15		75,86
6,60	8	13		65,74
6,80	8	10		50,57
7,00	8	14		67,20
7,20	8	19		91,21
7,40	8	11		52,80
7,60	9	11		52,80
7,80	9	8		38,40
8,00	9	11		50,25
8,20	9	10		45,68
8,40	9	10		45,68
8,60	10	10		45,68
8,80	10	11		50,25
9,00	10	68		296,32
9,20	10	98		427,05

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

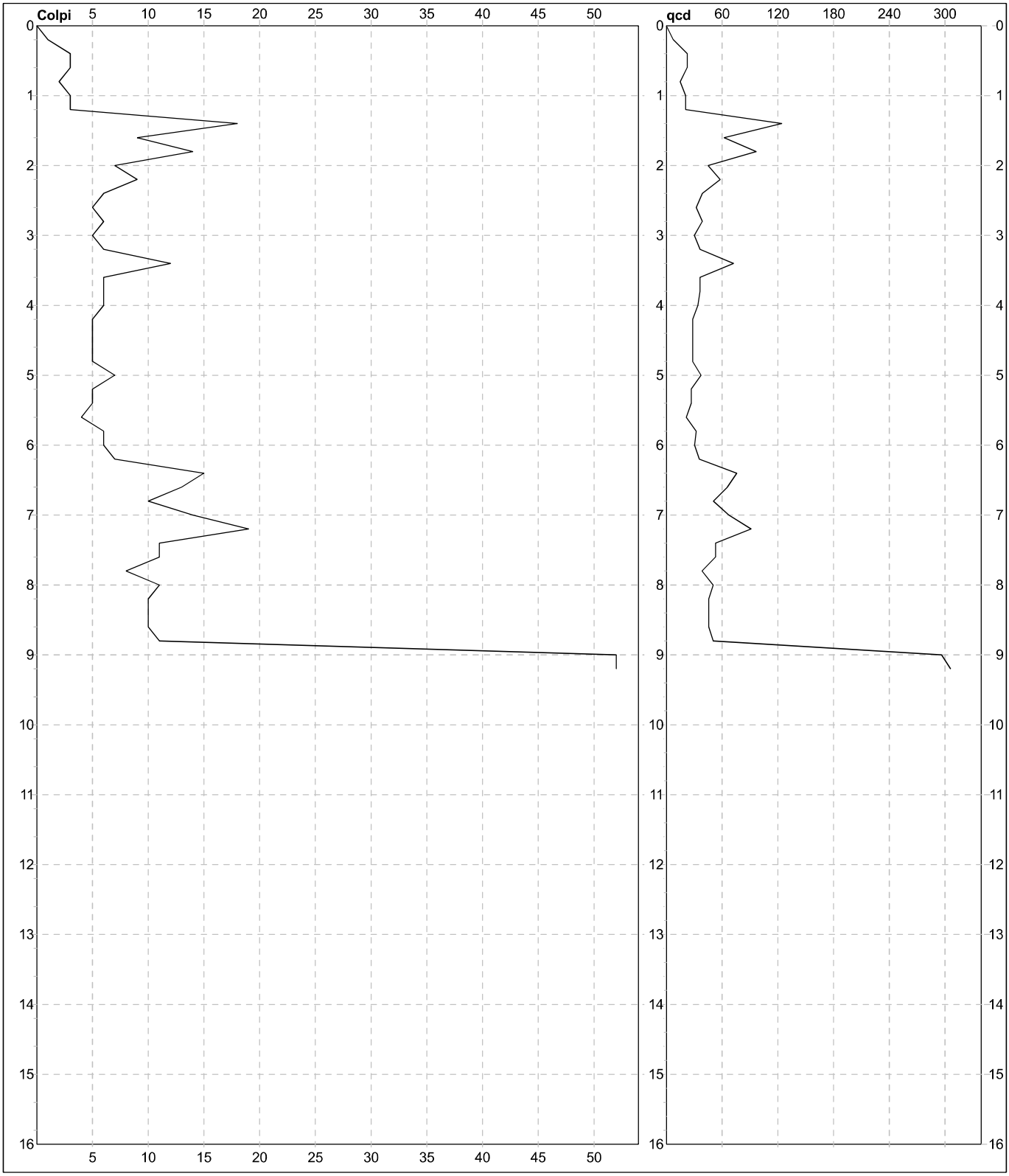
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	7
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pontecerio Vergato Ponte 1**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

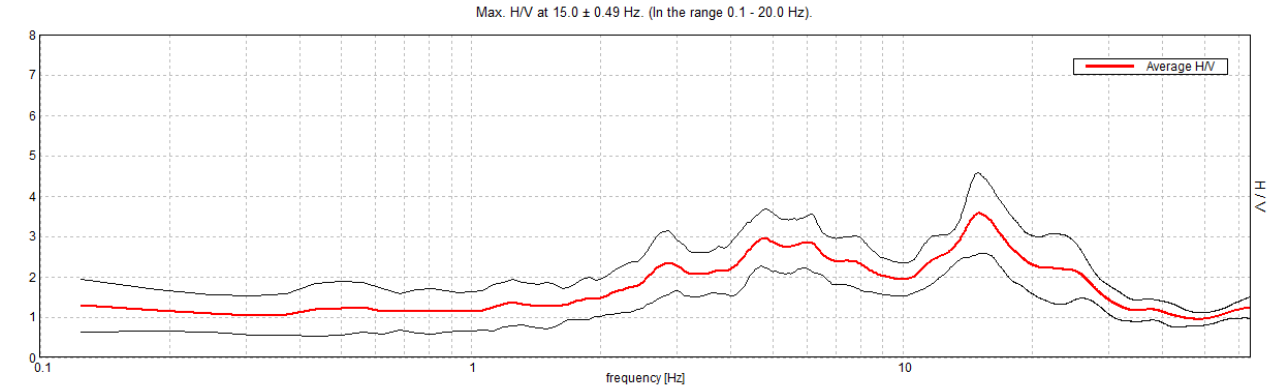
Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

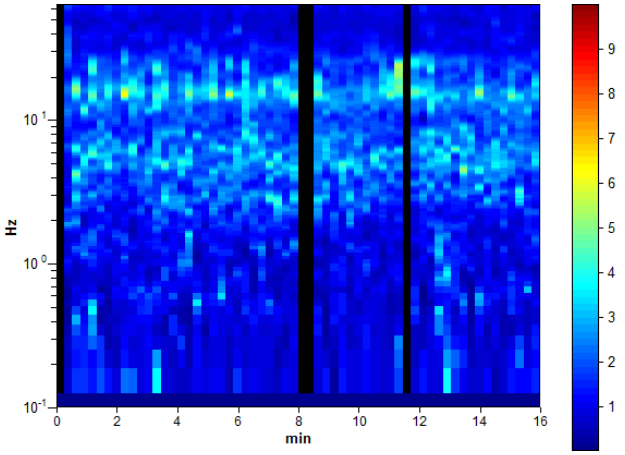
GRIZZANA MORANDI_MS, TR37 PONTE 2

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 12:18:39 End recording: 26/10/18 12:34:39
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 93% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

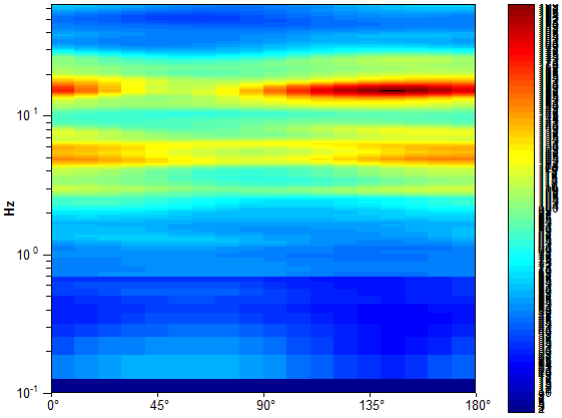
HORIZONTAL TO VERTICAL SPECTRAL RATIO



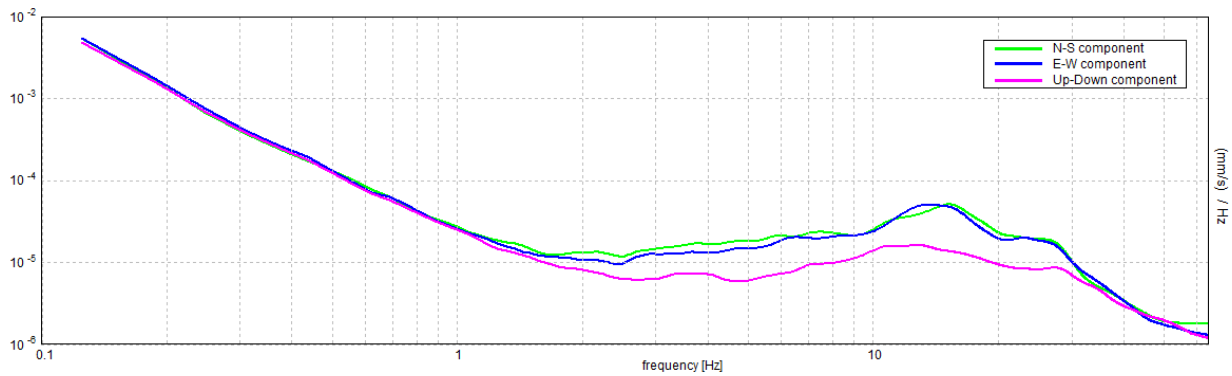
H/V TIME HISTORY



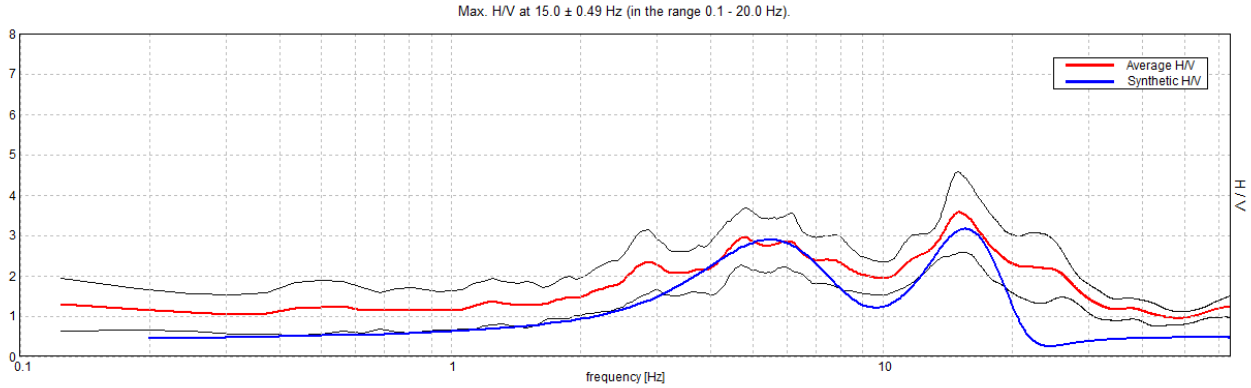
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

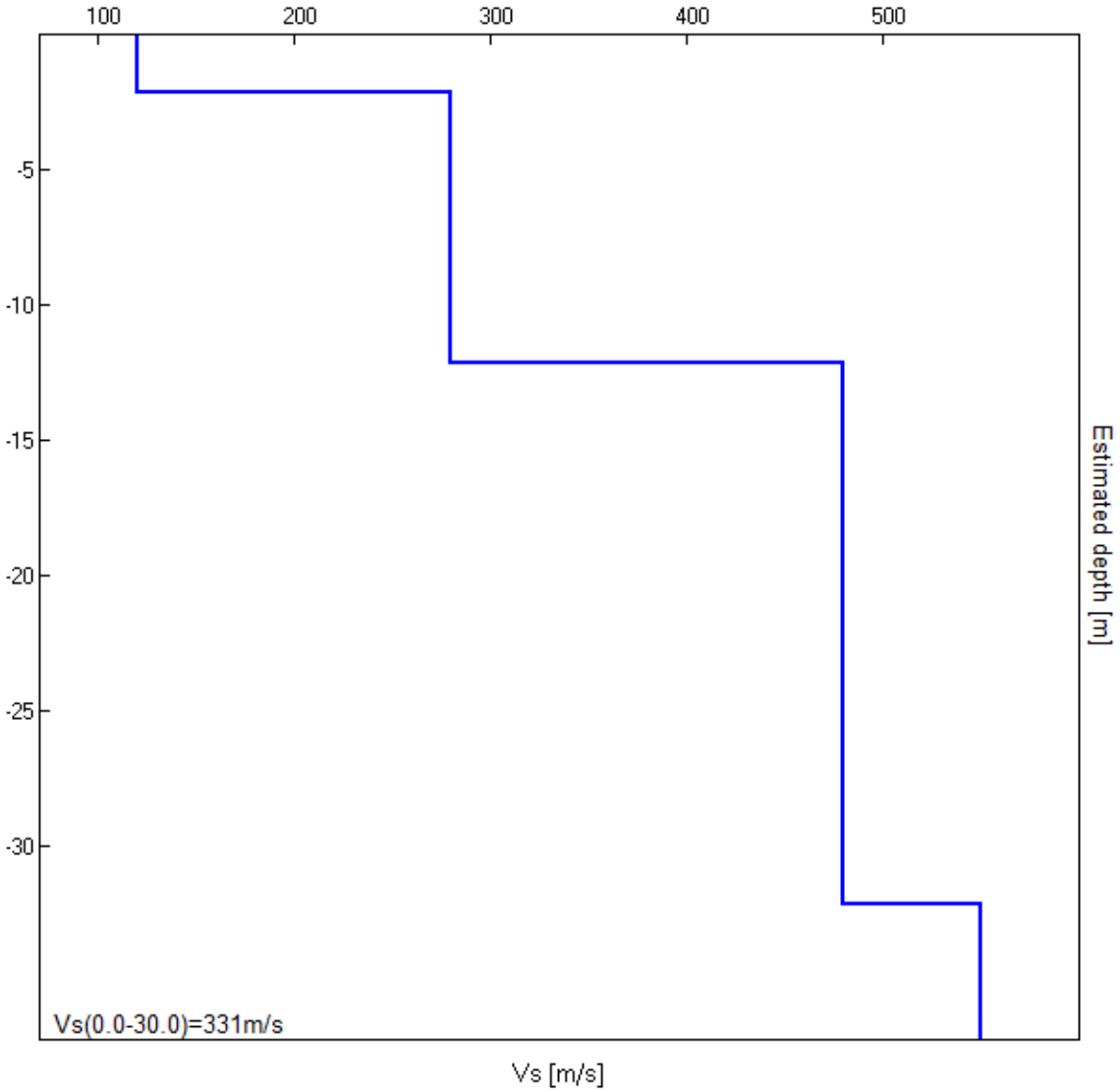


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.10	2.10	120
12.10	10.00	280
32.10	20.00	480
inf.	inf.	550

Vs(0.0-30.0)=331m/s



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

Max. H/V at 15.0 ± 0.49 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	15.00 > 0.63	OK	
$n_c(f_0) > 200$	13440.0 > 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 361 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	27.5 Hz	OK	
$A_0 > 2$	3.58 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0161| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.24153 < 0.75	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4981 < 1.58	OK	

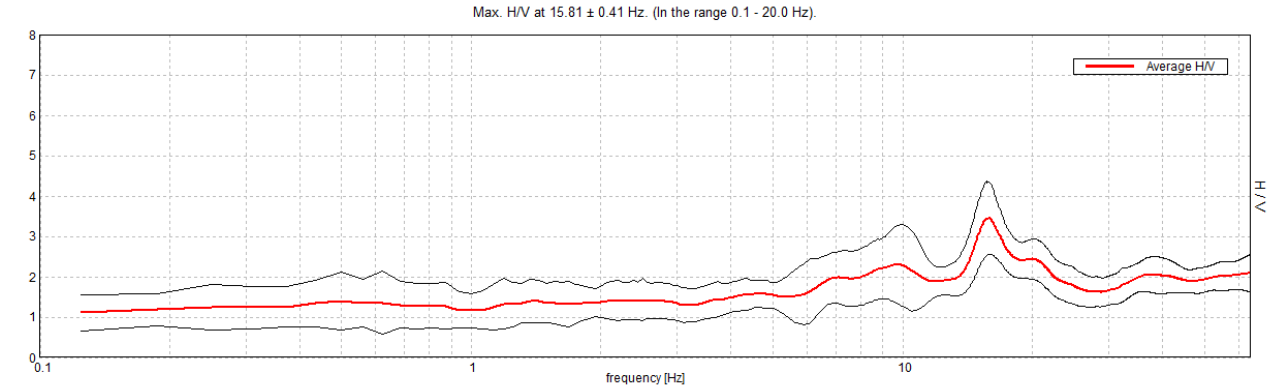
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

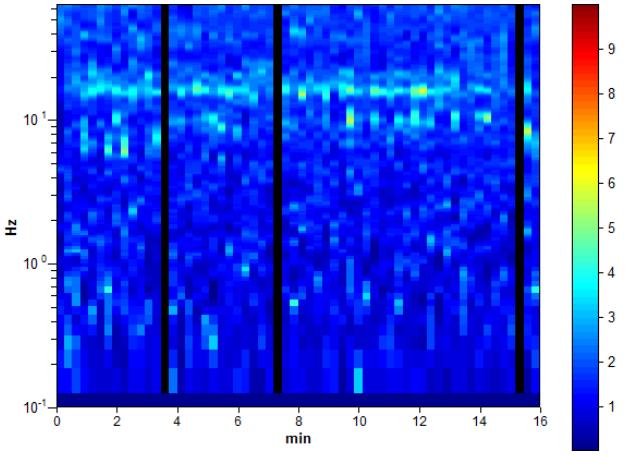
GRIZZANA MORANDI_MS, TR36 PONTE 1

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 11:46:29 End recording: 26/10/18 12:02:29
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 95% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

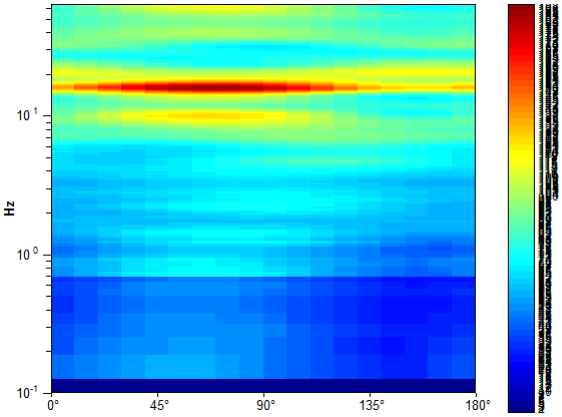
HORIZONTAL TO VERTICAL SPECTRAL RATIO



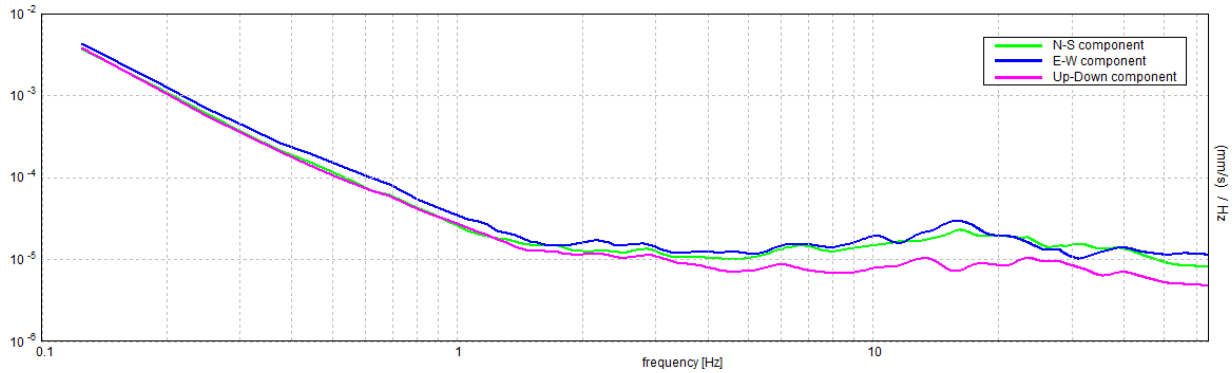
H/V TIME HISTORY



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 15.81 ± 0.41 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	15.81 > 0.63	OK	
$n_c(f_0) > 200$	14421.0 > 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 380 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	6.25 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	25.375 Hz	OK	
$A_0 > 2$	3.45 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01285| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.20311 < 0.79063	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4453 < 1.58	OK	

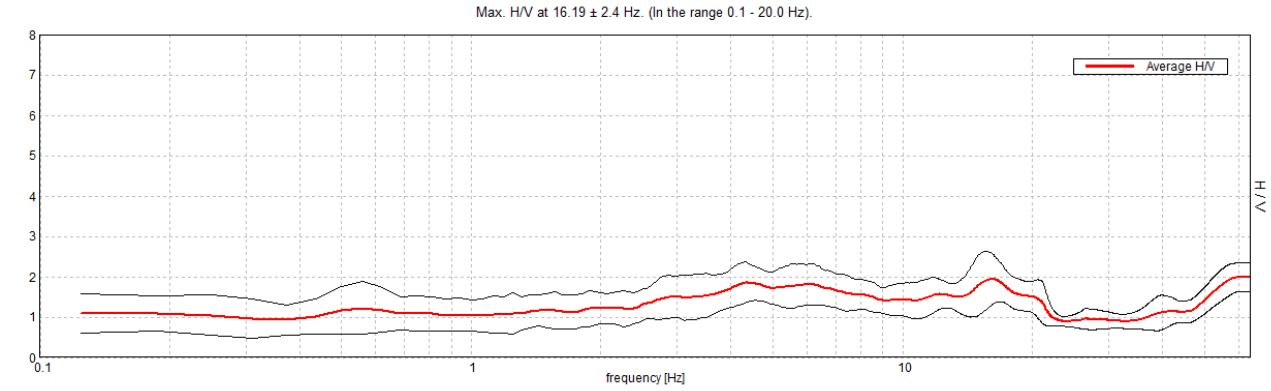
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

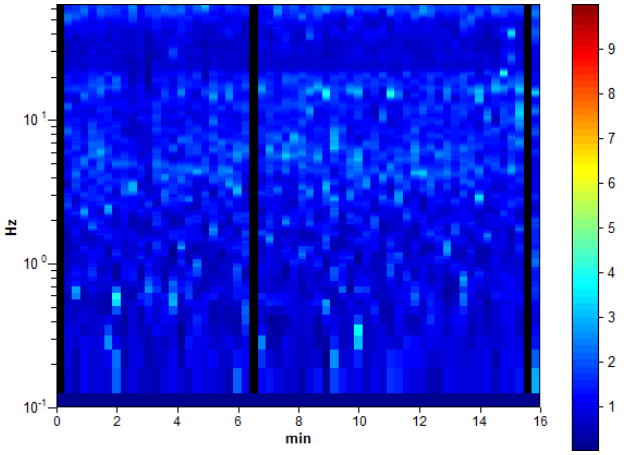
GRIZZANA MORANDI_MS, TR38 PONTE 3

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 12:43:21 End recording: 26/10/18 12:59:21
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 95% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

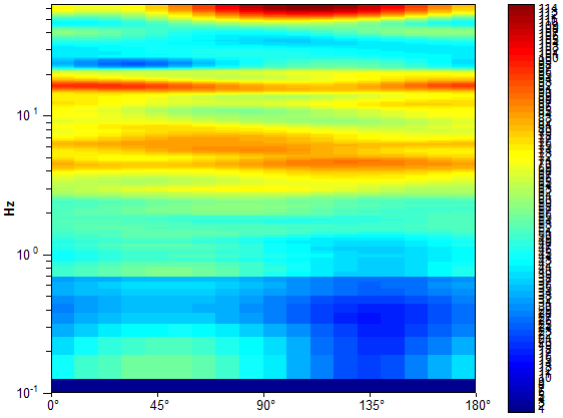
HORIZONTAL TO VERTICAL SPECTRAL RATIO



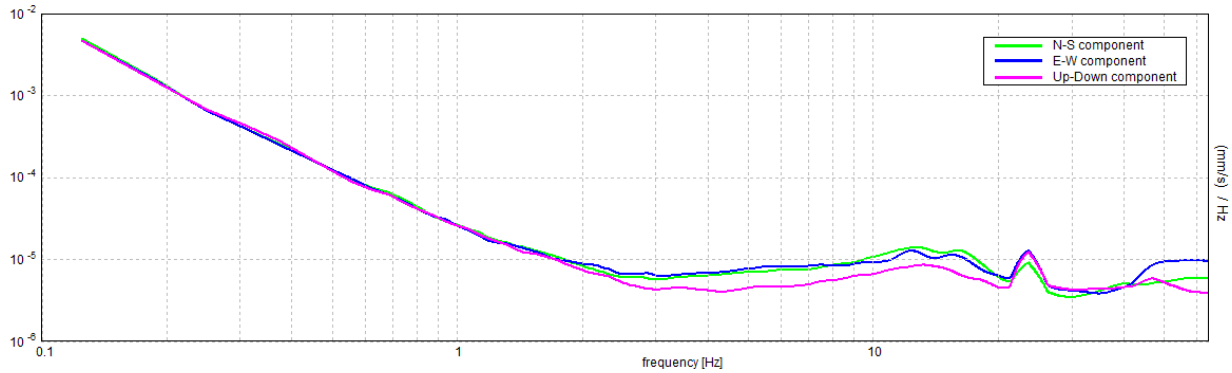
H/V TIME HISTORY



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 16.19 ± 2.4 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	16.19 > 0.63	OK	
$n_c(f_0) > 200$	14763.0 > 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 390 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	22.438 Hz	OK	
$A_0 > 2$	1.94 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0733| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.18656 < 0.80938		NO
$\sigma_A(f_0) < \theta(f_0)$	0.3048 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P71DS74

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	6
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pontecerio posiz Ponte2 vicino SP62**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	2		14,90
0,40	1	8		59,59
0,60	2	9		67,04
0,80	2	6		44,69
1,00	2	50		345,23

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

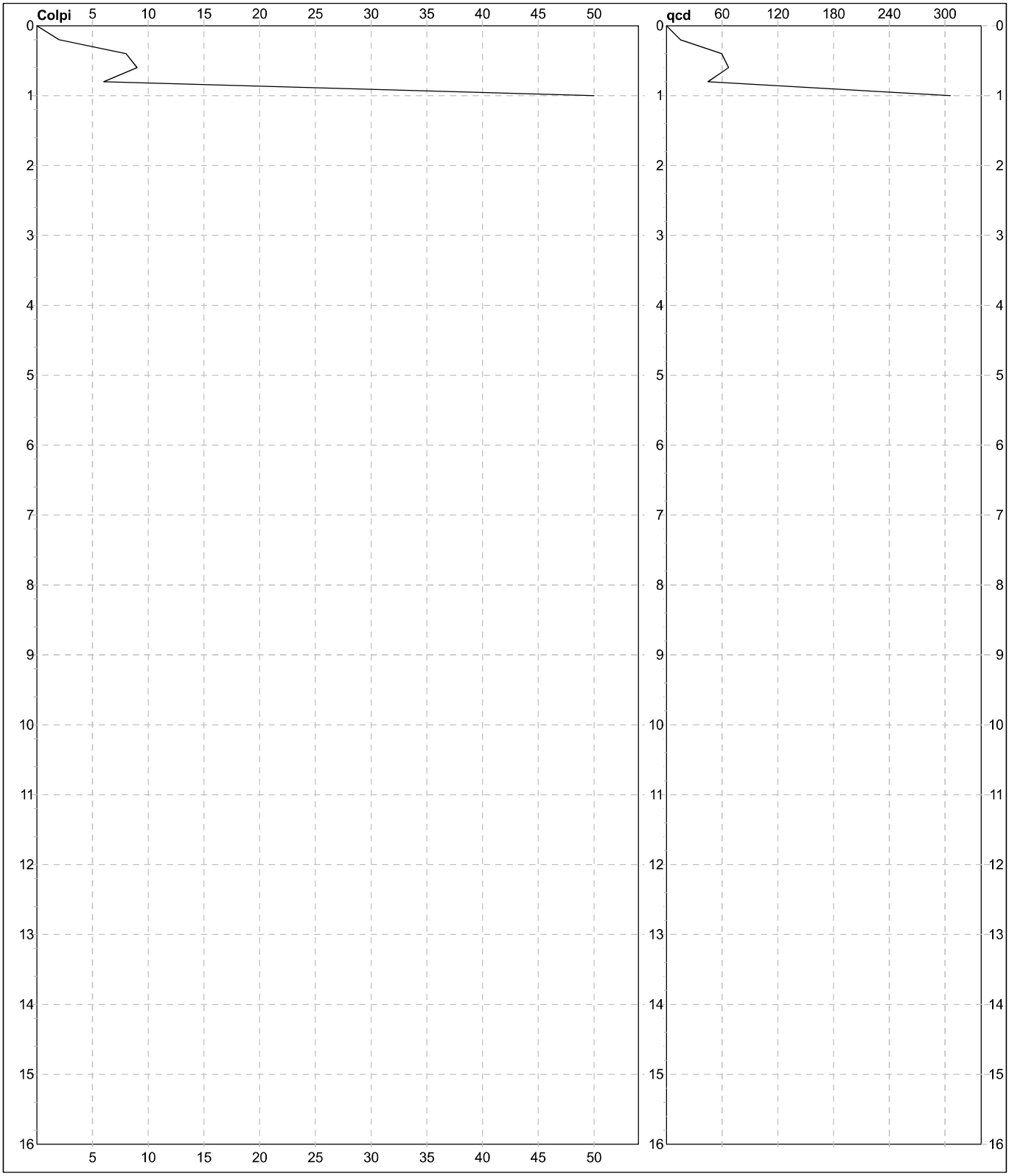
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	6
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Pontecerio posiz Ponte2 vicino SP62**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

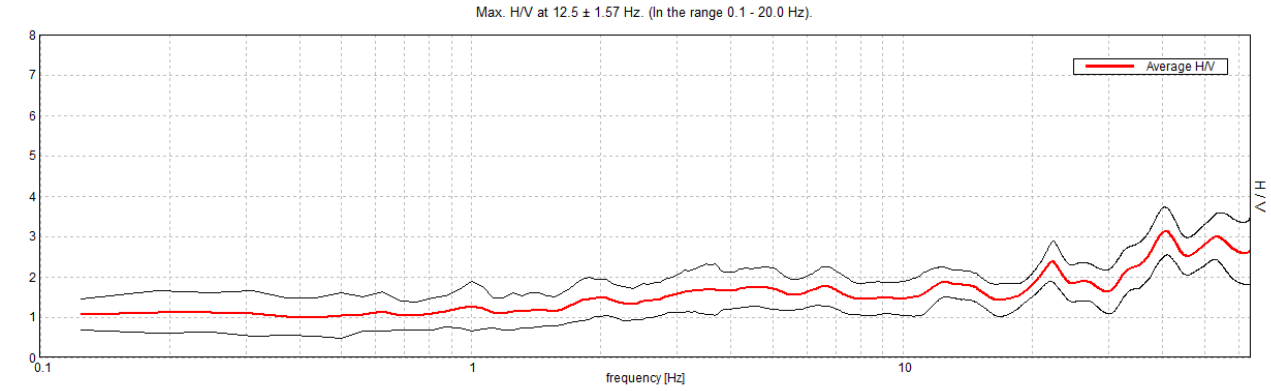
Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

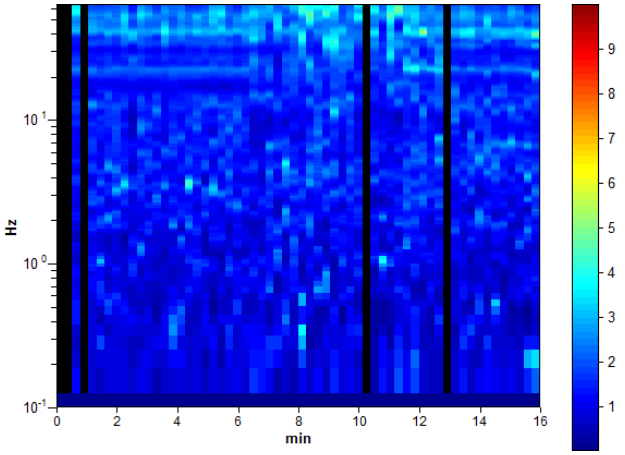
GRIZZANA MORANDI_MS, TR35 SAVIGNANO

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 11:09:18 End recording: 26/10/18 11:25:18
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 92% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

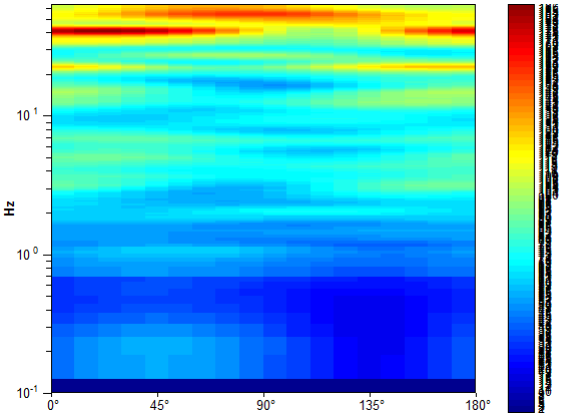
HORIZONTAL TO VERTICAL SPECTRAL RATIO



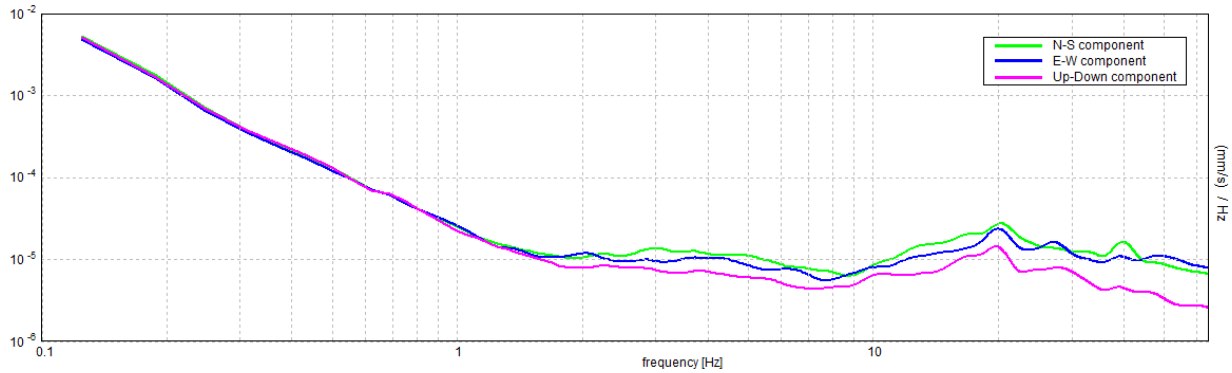
H/V TIME HISTORY



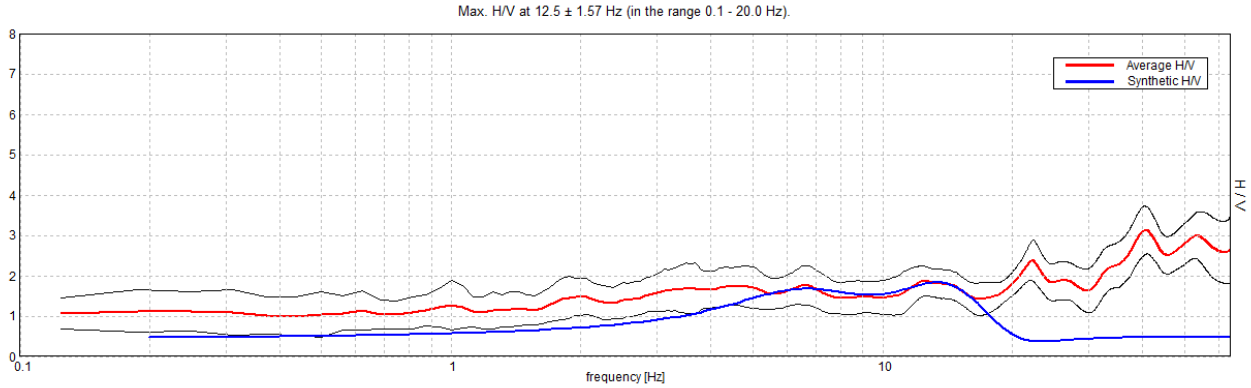
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

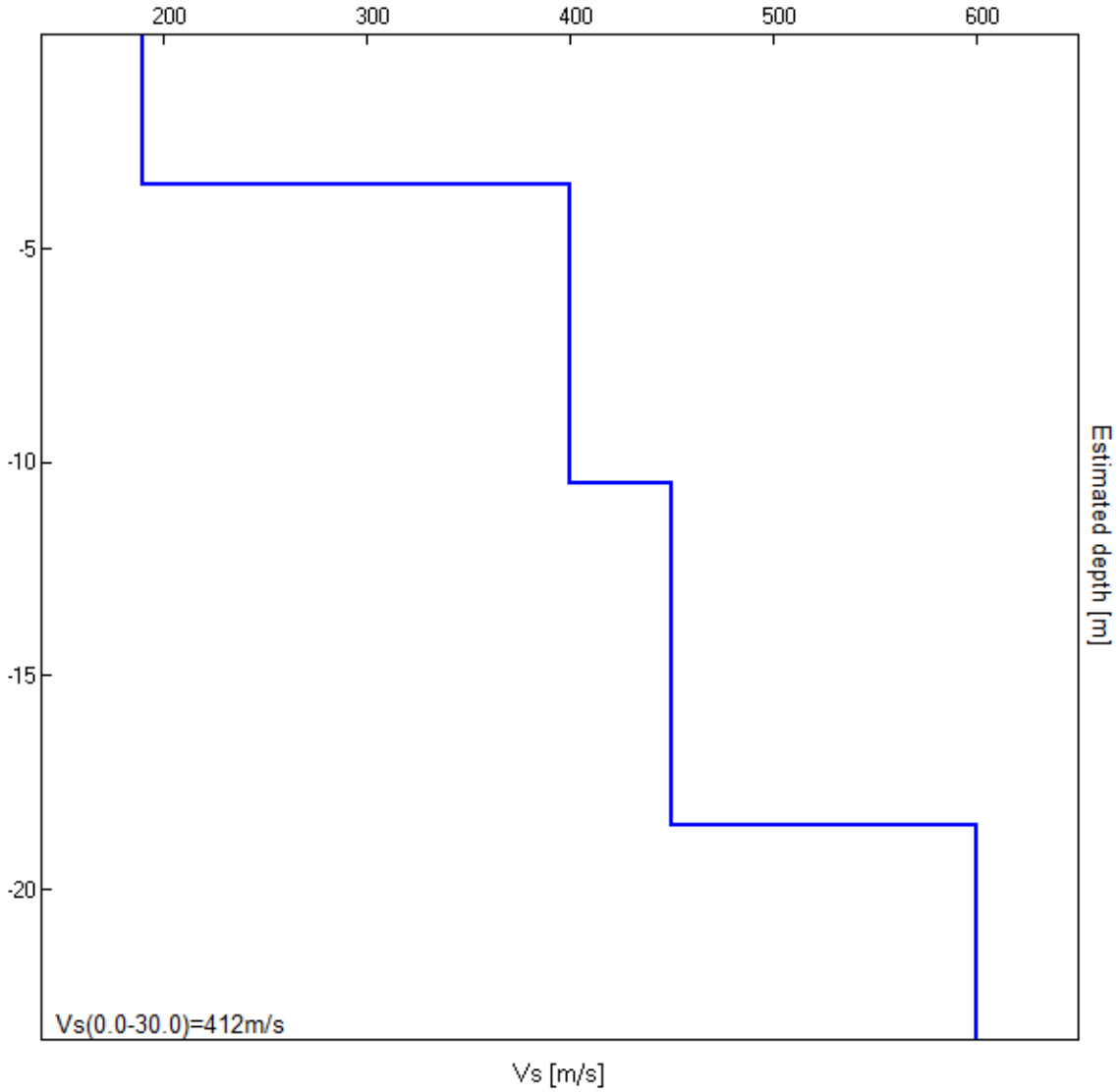


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.50	3.50	190
10.50	7.00	400
18.50	8.00	450
inf.	inf.	600

Vs(0.0-30.0)=412m/s



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

Max. H/V at 12.5 ± 1.57 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	12.50 > 0.63	OK	
$n_c(f_0) > 200$	11000.0 > 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 301 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.87 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.06214| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.77676 < 0.625		NO
$\sigma_A(f_0) < \theta(f_0)$	0.1841 < 1.58	OK	

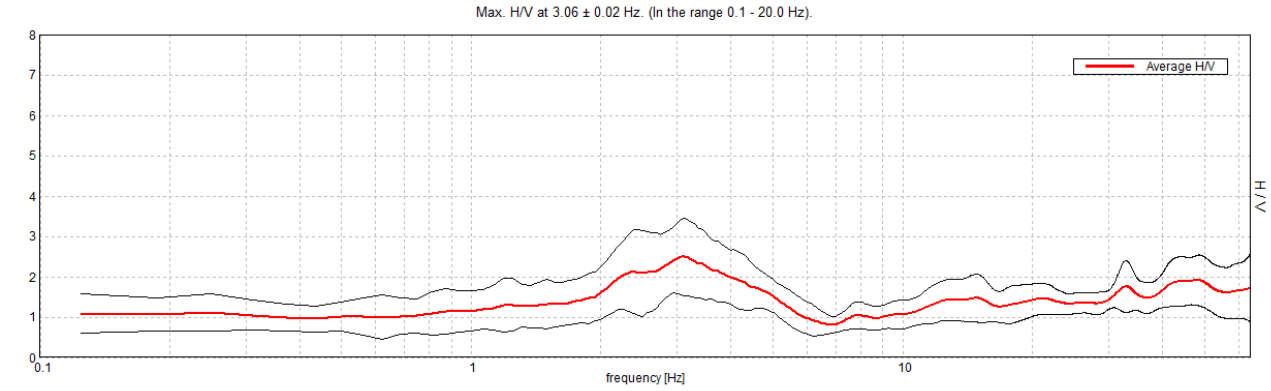
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

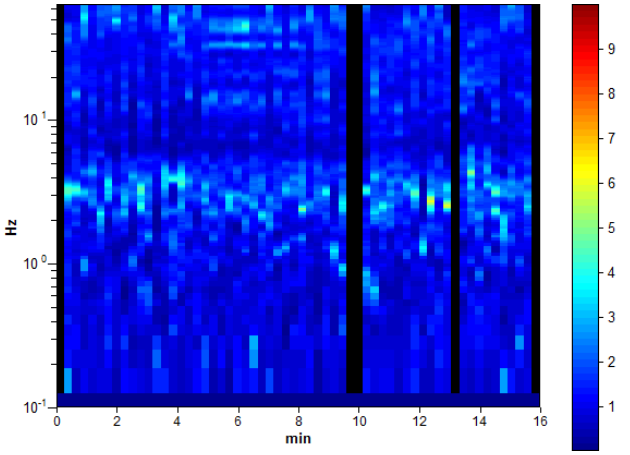
GRIZZANA MORANDI_MS, TR34 ARPIATTAROI 2

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 10:35:39 End recording: 26/10/18 10:51:39
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 92% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

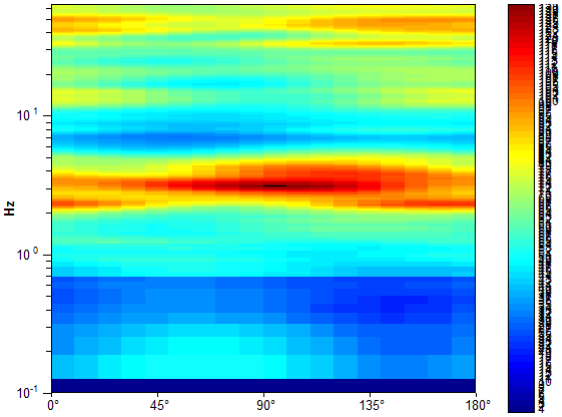
HORIZONTAL TO VERTICAL SPECTRAL RATIO



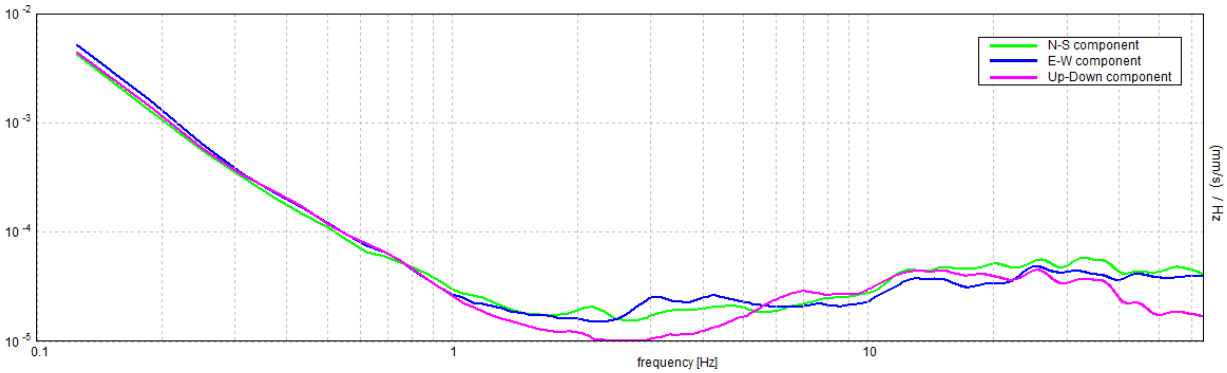
H/V TIME HISTORY



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 3.06 ± 0.02 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.06 > 0.63	OK	
$n_c(f_0) > 200$	2695.0 > 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 74 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.125 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	5.438 Hz	OK	
$A_0 > 2$	2.50 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00348| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.01066 < 0.15313	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4637 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P74DS77

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	4
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Ginepri SP62 Arpiattarola**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	0		0,00
0,40	1	15		111,73
0,60	2	2		14,90
0,80	2	3		22,35
1,00	2	6		41,43
1,20	2	8		55,24
1,40	2	8		55,24
1,60	3	10		69,05
1,80	3	7		48,33
2,00	3	7		45,04
2,20	3	4		25,74
2,40	3	4		25,74
2,60	4	4		25,74
2,80	4	4		25,74
3,00	4	4		24,10
3,20	4	6		36,15
3,40	4	6		36,15
3,60	5	7		42,17
3,80	5	8		48,19
4,00	5	8		45,31
4,20	5	9		50,97
4,40	5	12		67,96
4,60	6	9		50,97
4,80	6	11		62,30
5,00	6	7		37,40
5,20	6	7		37,40
5,40	6	9		48,09
5,60	7	9		48,09
5,80	7	10		53,43
6,00	7	10		50,57
6,20	7	17		85,97
6,40	7	56		283,20

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

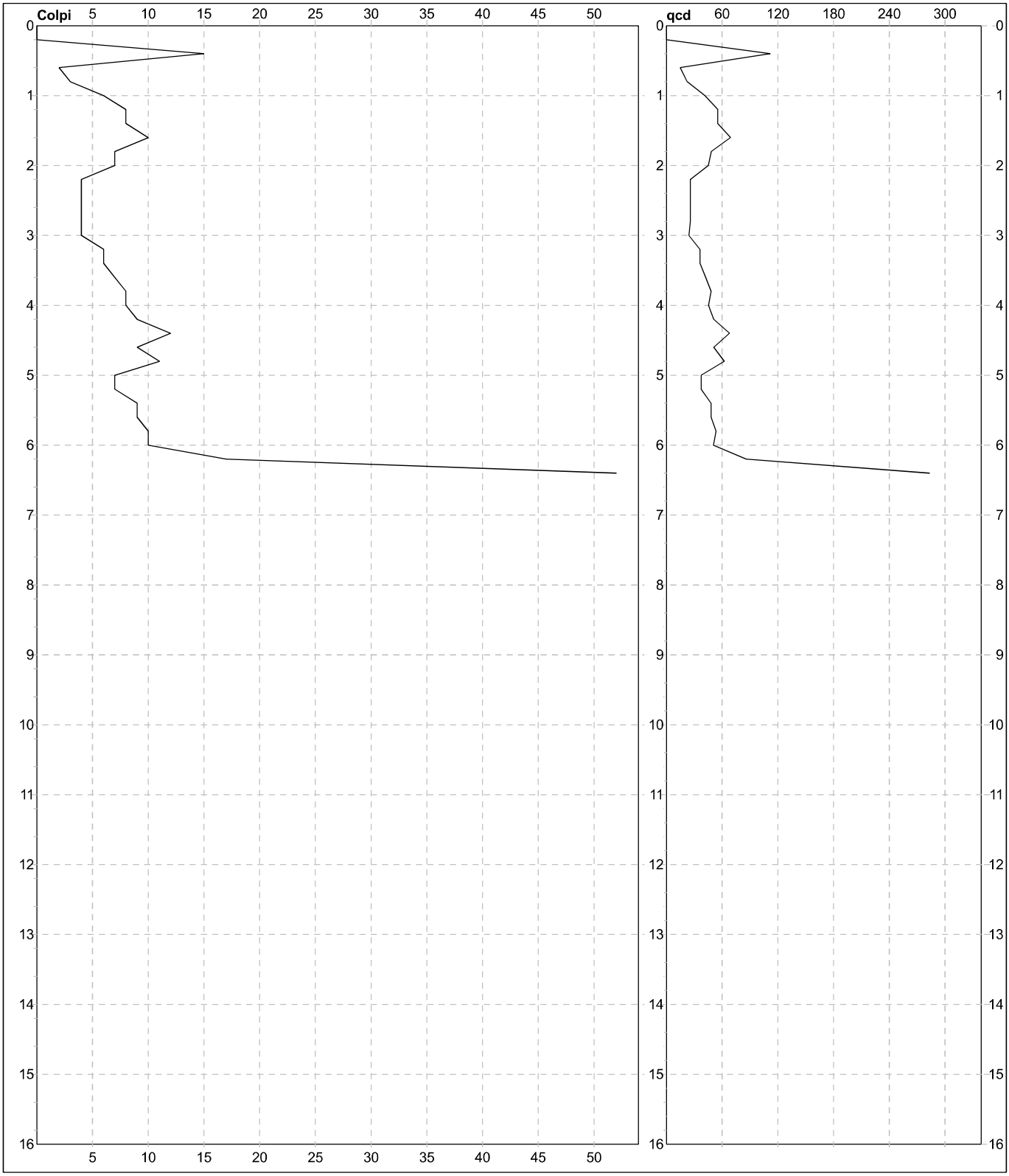
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	4
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Ginepri SP62 Arpiattarola**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

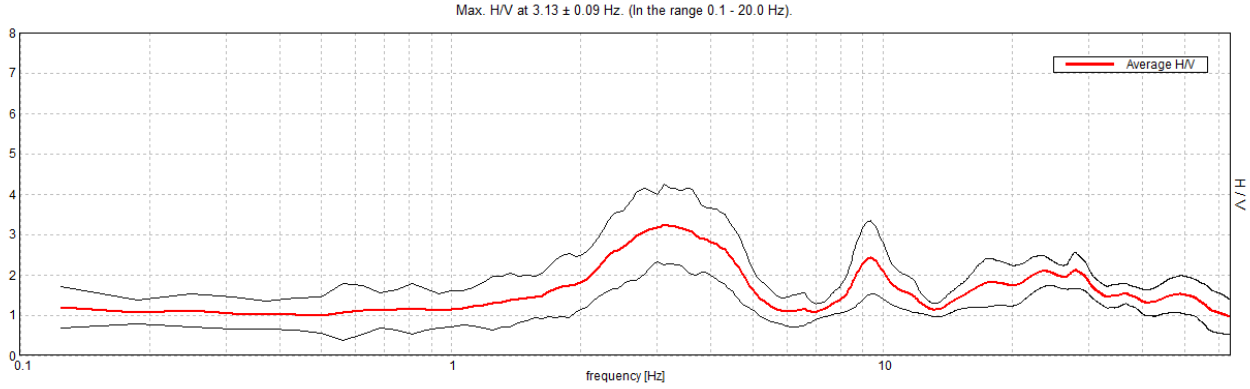
Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

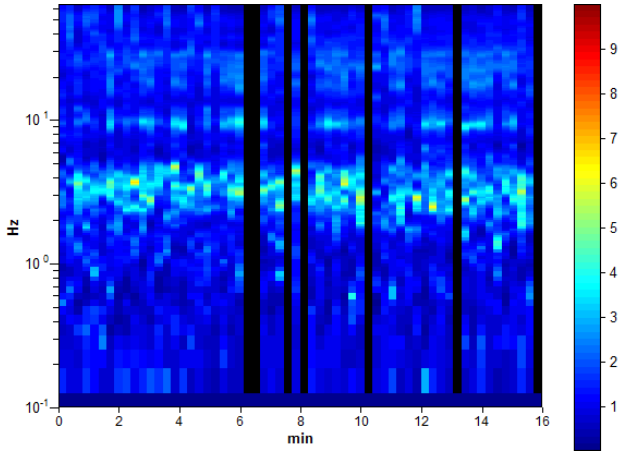
GRIZZANA MORANDI_MS, TR33 ARPIATTAROI 1

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 10:16:03 End recording: 26/10/18 10:32:03
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 88% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

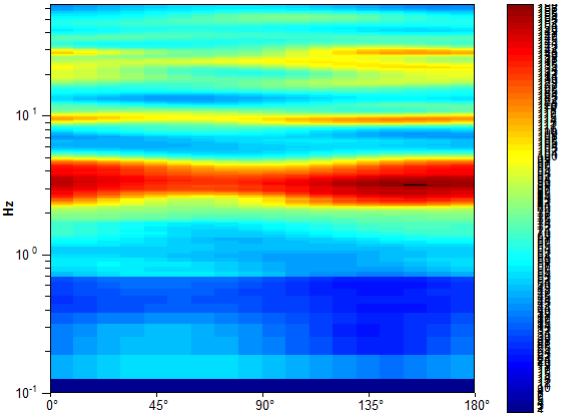
HORIZONTAL TO VERTICAL SPECTRAL RATIO



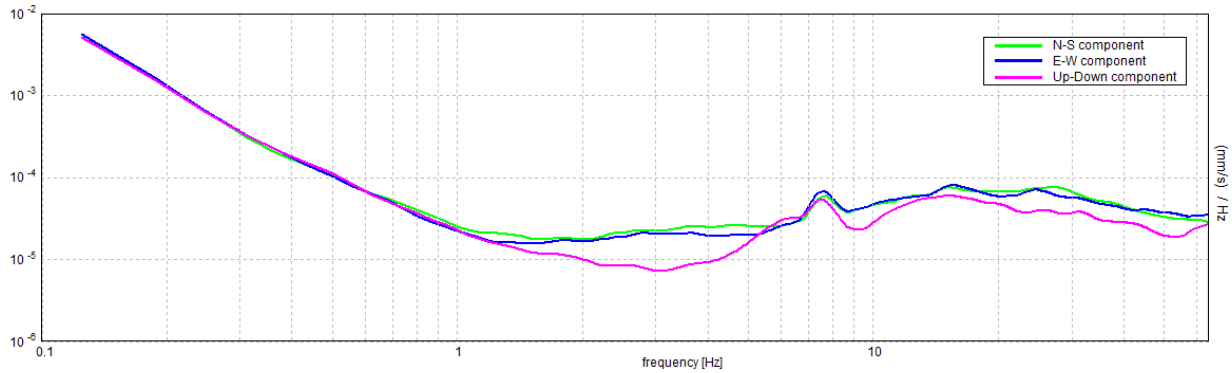
H/V TIME HISTORY



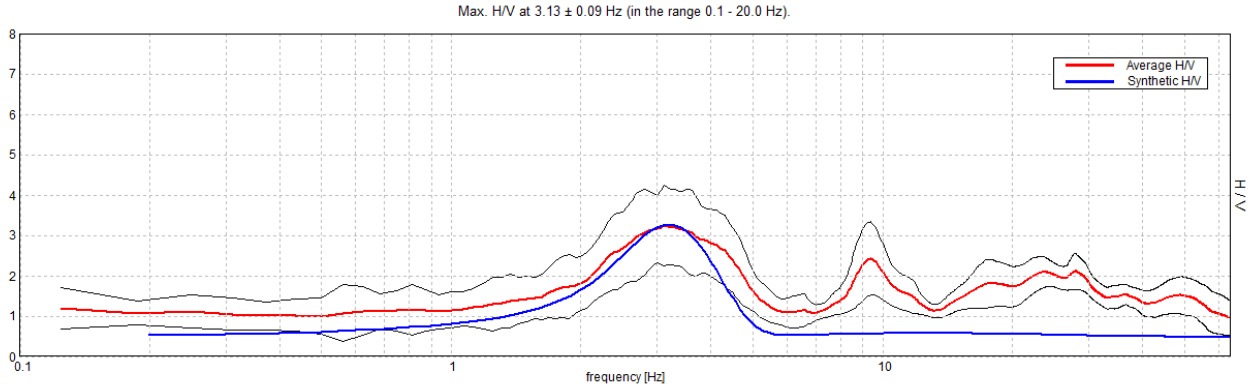
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

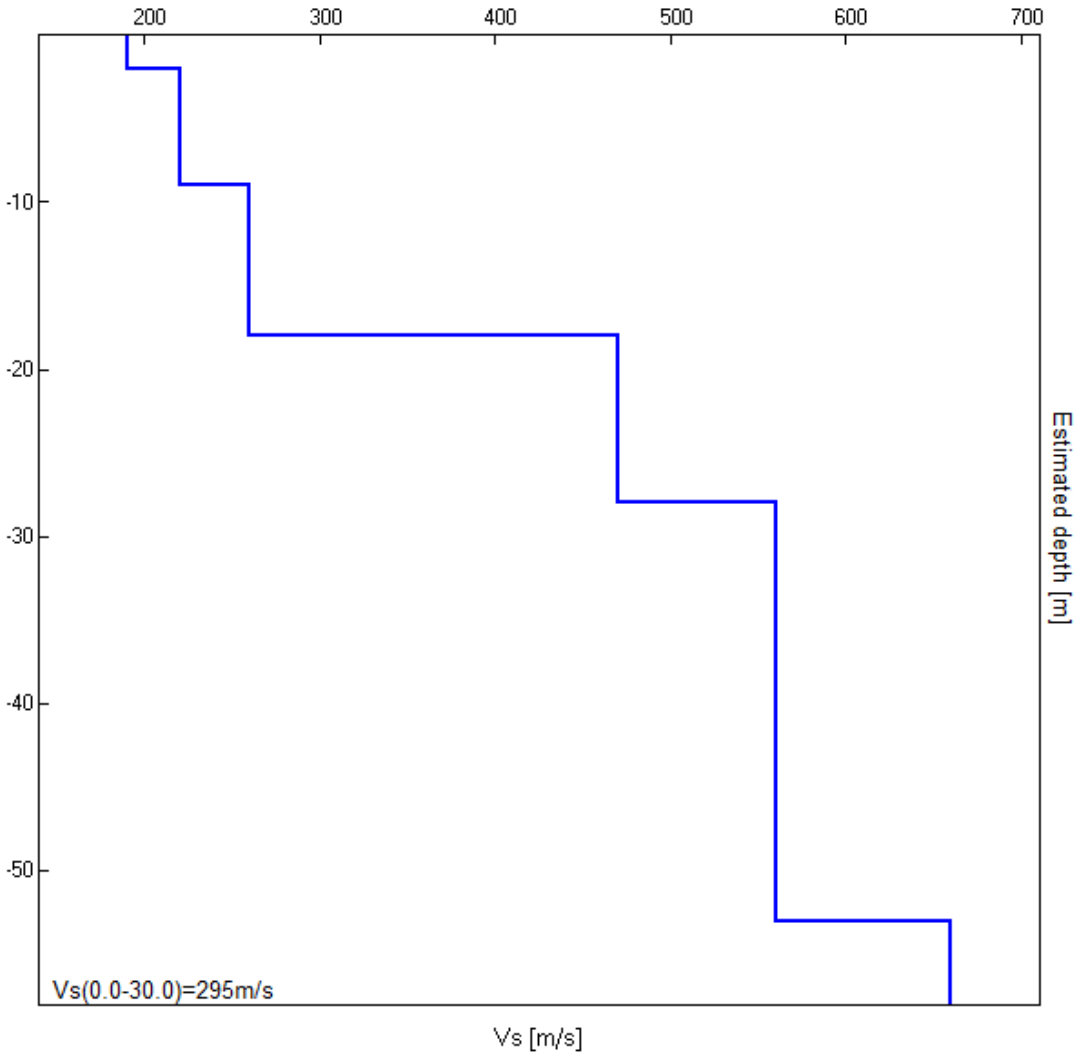


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
2.00	2.00	190
9.00	7.00	220
18.00	9.00	260
28.00	10.00	470
53.00	25.00	560
inf.	inf.	660

Vs(0.0-30.0)=295m/s



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

Max. H/V at 3.13 ± 0.09 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.13 > 0.63	OK	
$n_c(f_0) > 200$	2650.0 > 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 76 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.688 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	5.063 Hz	OK	
$A_0 > 2$	3.24 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.01423| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.04448 < 0.15625	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4921 < 1.58	OK	

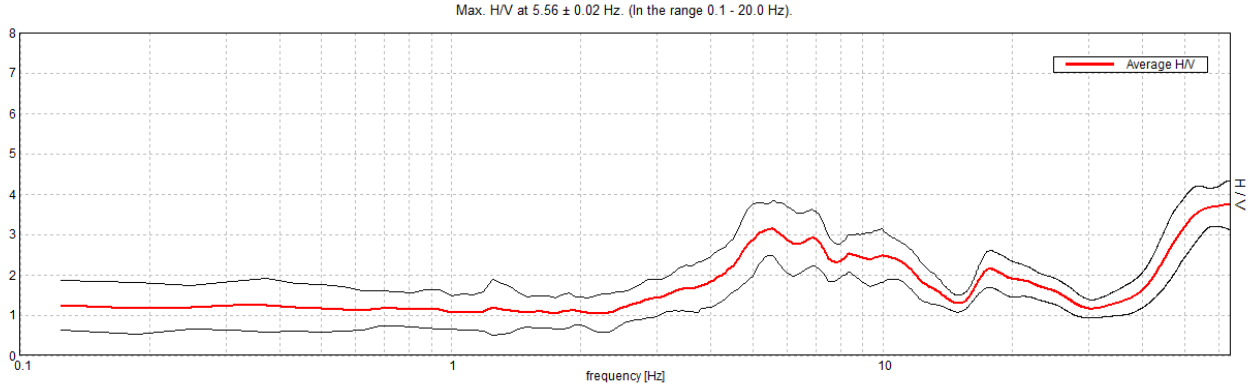
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

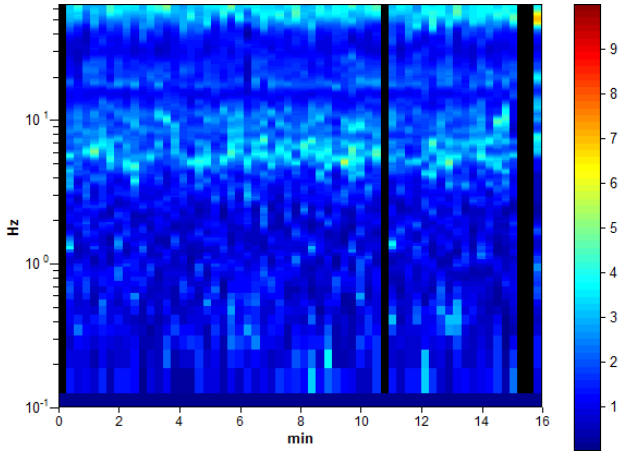
GRIZZANA MORANDI_MS, TR40 PONTE VERZUNO CAMPO SP

Instrument: TRZ-0108/01-10
Start recording: 28/11/18 11:22:30 End recording: 28/11/18 11:38:31
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 93% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

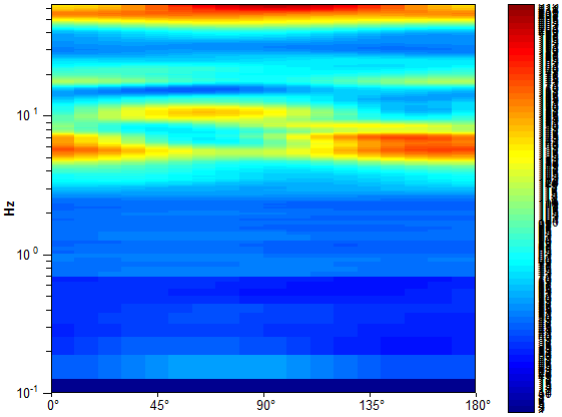
HORIZONTAL TO VERTICAL SPECTRAL RATIO



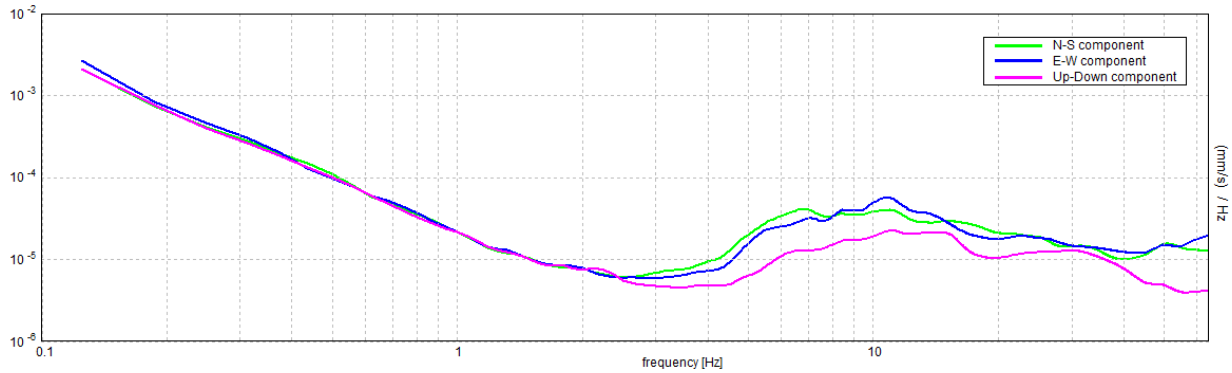
H/V TIME HISTORY



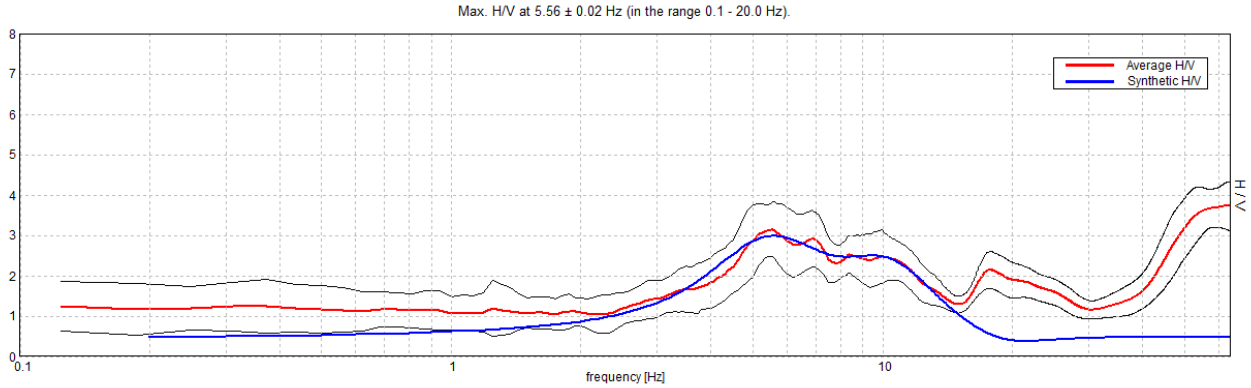
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

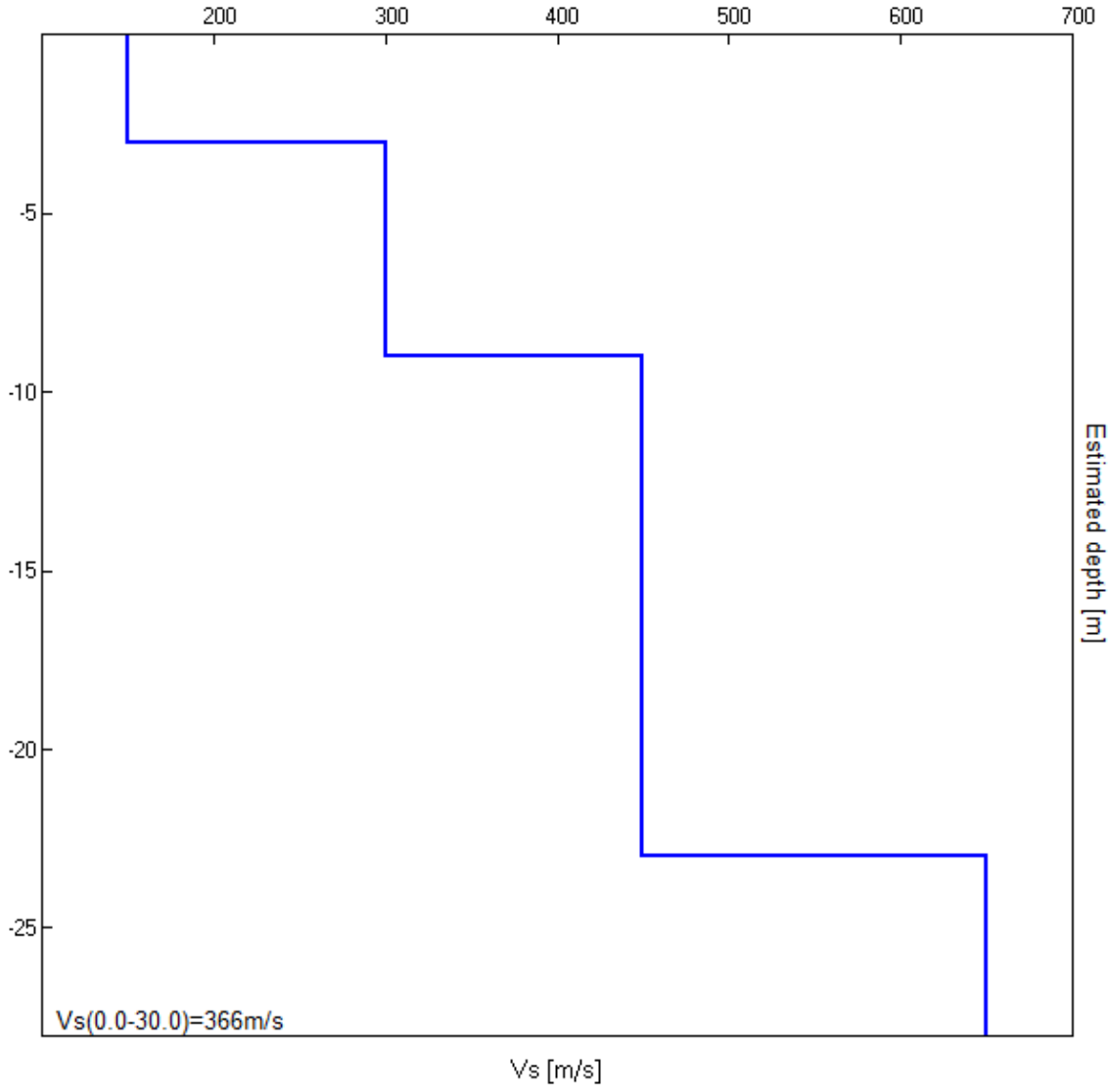


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.00	3.00	150
9.00	6.00	300
23.00	14.00	450
inf.	inf.	650

Vs(0.0-30.0)=366m/s



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

Max. H/V at 5.56 ± 0.02 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.56 > 0.63	OK	
$n_c(f_0) > 200$	4984.0 > 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 134 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	3.25 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	13.5 Hz	OK	
$A_0 > 2$	3.14 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.002| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.0111 < 0.27813	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3361 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo) 037031P77DS80

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	5
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Ponte di Verzuno incrocio SP23 SP62**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	1		7,45
0,40	1	9		67,04
0,60	2	11		81,94
0,80	2	14		104,28
1,00	2	18		124,28
1,20	2	18		124,28
1,40	2	18		124,28
1,60	3	18		124,28
1,80	3	10		69,05
2,00	3	14		90,08
2,20	3	14		90,08
2,40	3	14		90,08
2,60	4	6		38,61
2,80	4	13		83,65
3,00	4	11		66,27
3,20	4	16		96,39
3,40	4	18		108,44
3,60	5	27		162,66
3,80	5	32		192,78
4,00	5	34		192,55
4,20	5	35		198,21
4,40	5	37		209,54
4,60	6	40		226,53

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

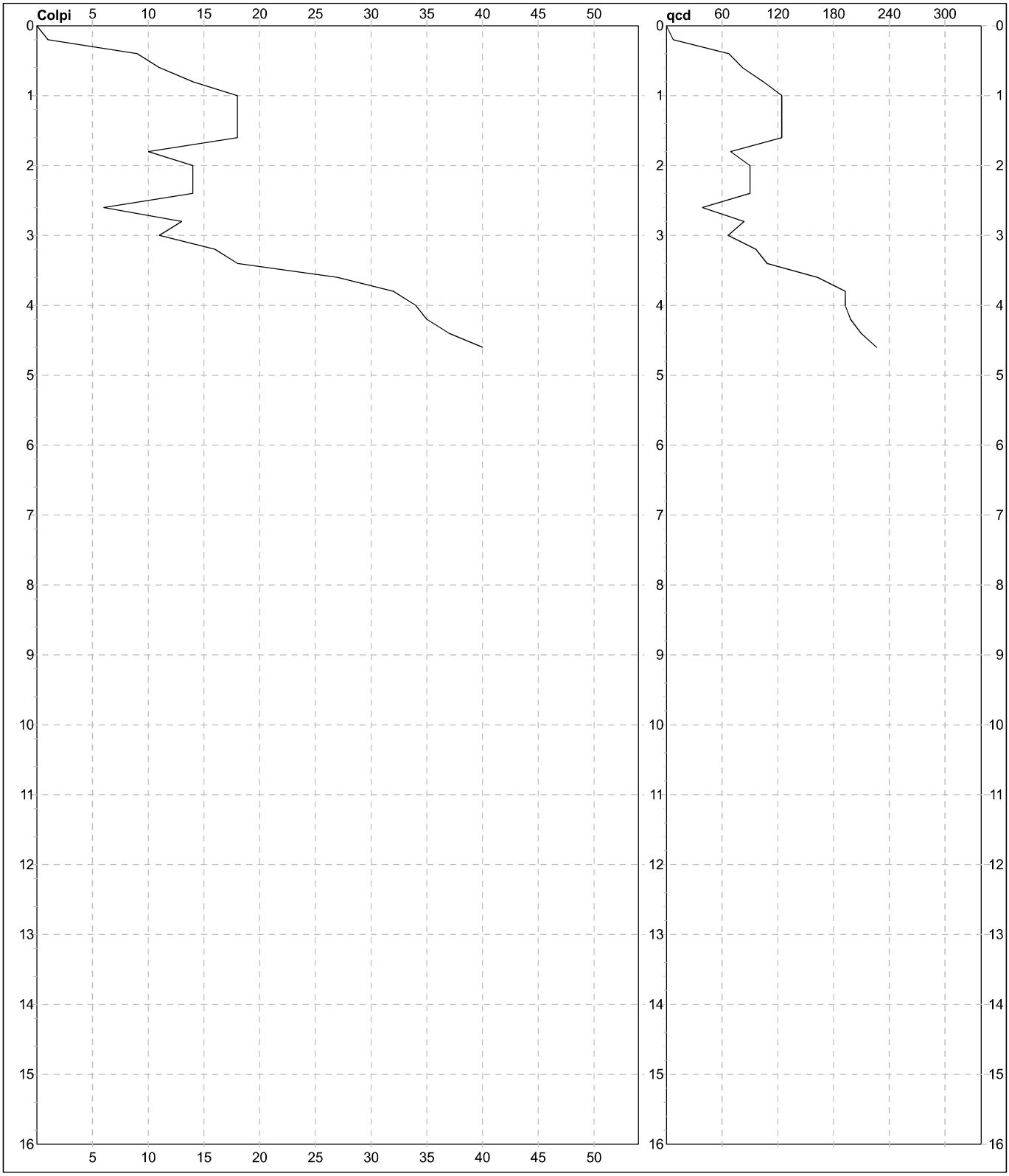
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	5
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Ponte di Verzuno incrocio SP23 SP62**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

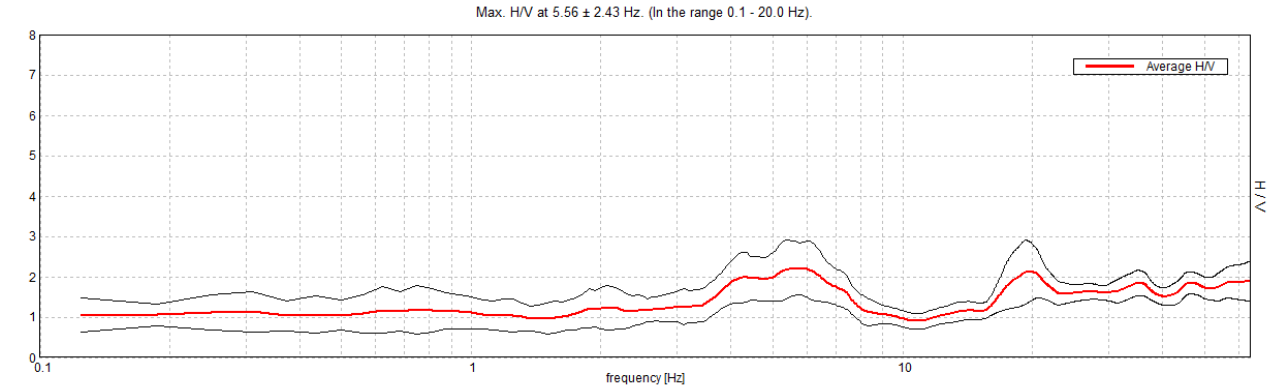
Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

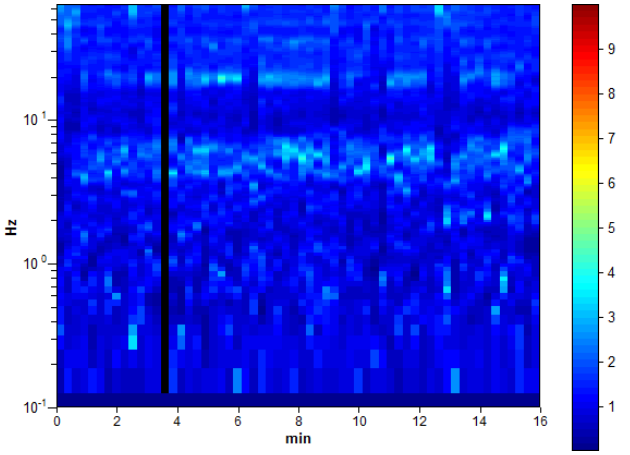
GRIZZANA MORANDI_MS, TR32 P.VERZUNO-PIANACCIA

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 09:51:48 End recording: 26/10/18 10:07:48
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 98% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

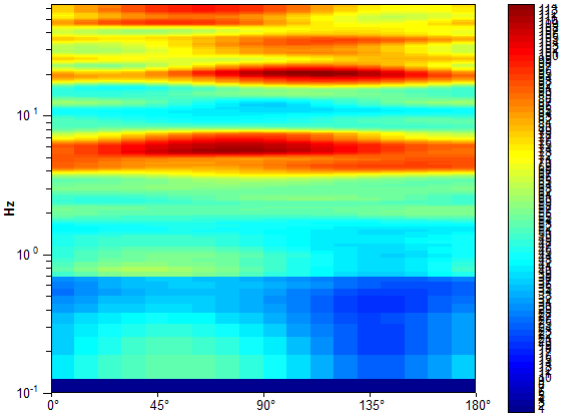
HORIZONTAL TO VERTICAL SPECTRAL RATIO



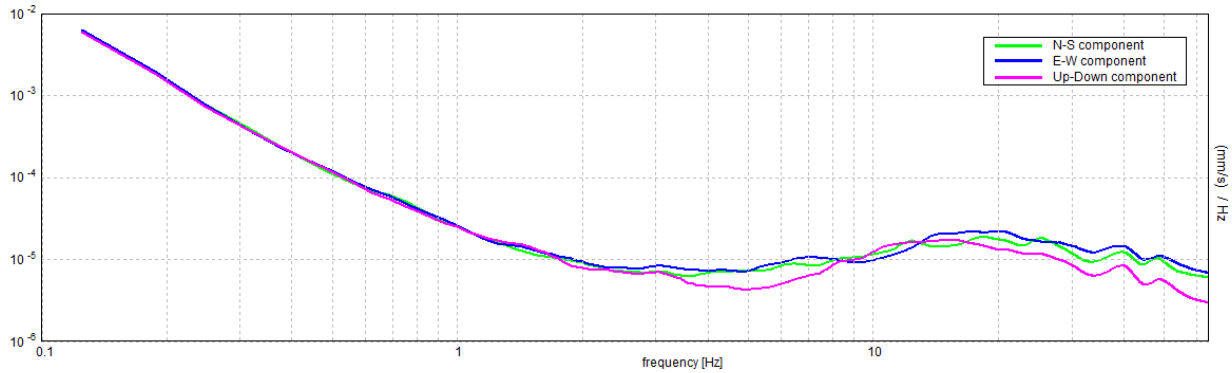
H/V TIME HISTORY



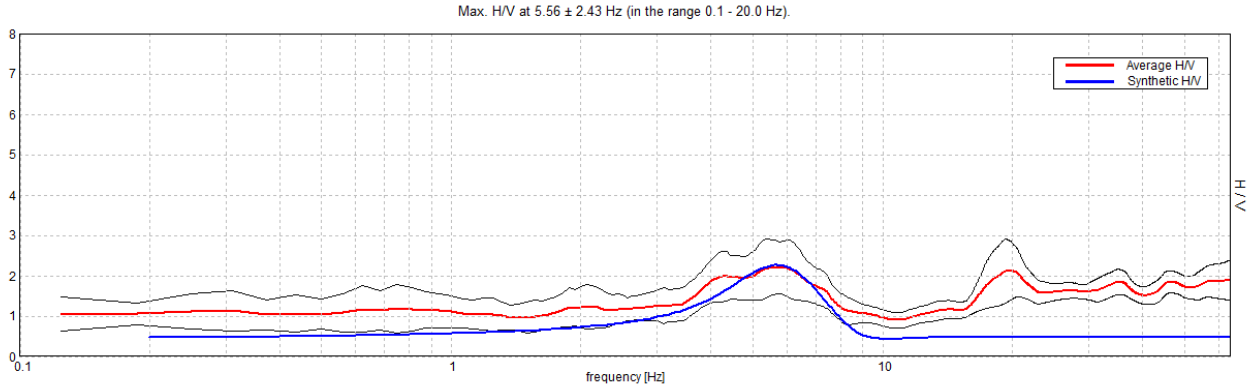
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

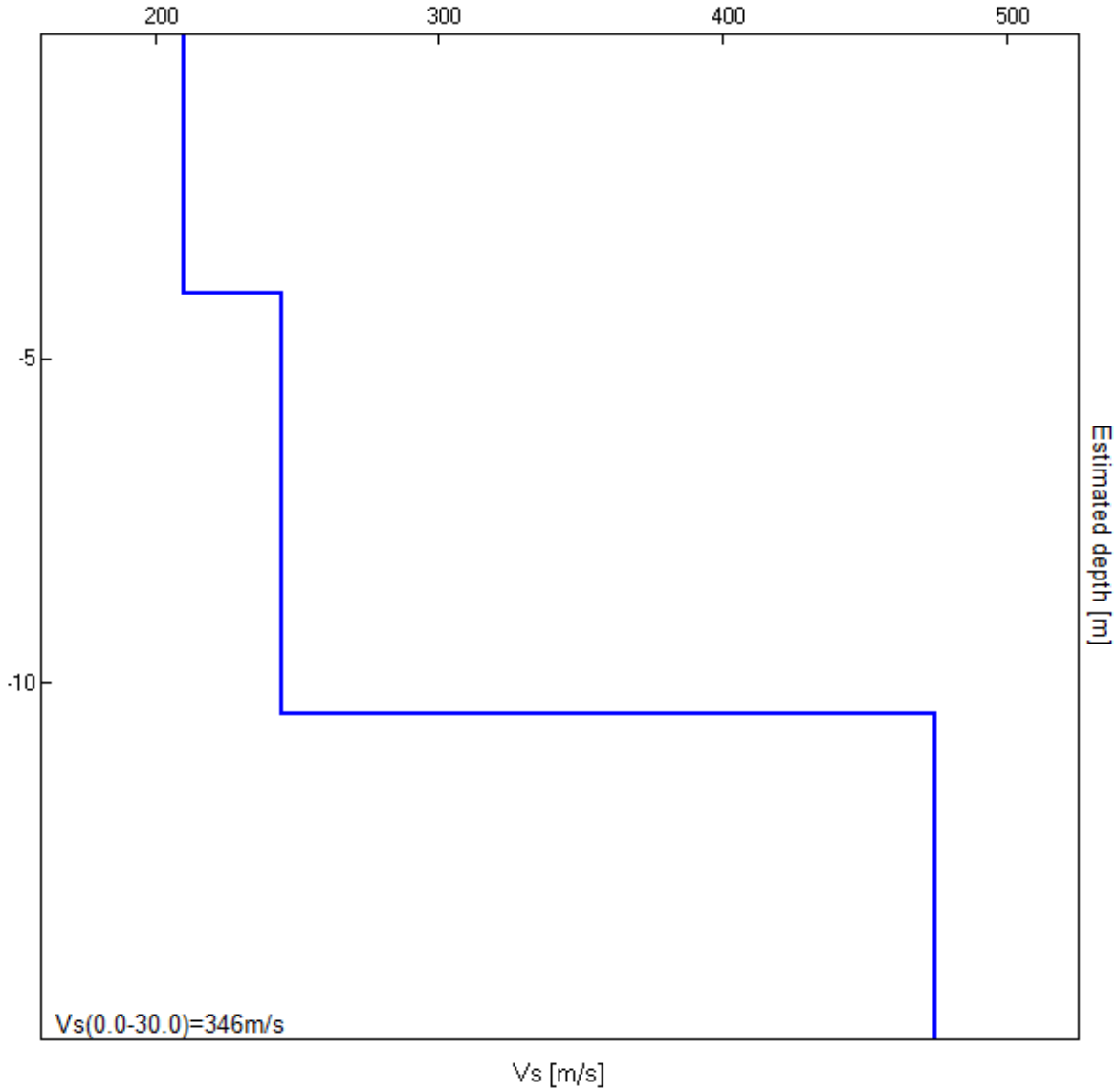


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	210
10.50	6.50	245
inf.	inf.	475

Vs(0.0-30.0)=346m/s



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

Max. H/V at 5.56 ± 2.43 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.56 > 0.63	OK	
$n_c(f_0) > 200$	5251.0 > 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 134 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.75 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	8.563 Hz	OK	
$A_0 > 2$	2.21 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.21636| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.20348 < 0.27813		NO
$\sigma_A(f_0) < \theta(f_0)$	0.3359 < 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

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

037031P79DS82

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	3
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Campolo via Montovolo**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0,20	1	2		21,57
0,40	1	7		75,50
0,60	2	8		86,28
0,80	2	3		32,36
1,00	2	3		29,77
1,20	2	1		9,92
1,40	2	4		39,69
1,60	3	5		49,61
1,80	3	8		79,38
2,00	3	9		82,69
2,20	3	10		91,88
2,40	3	7		64,31
2,60	4	2		18,38
2,80	4	5		45,94
3,00	4	12		102,65
3,20	4	13		111,20
3,40	4	11		94,09
3,60	5	12		102,65
3,80	5	17		145,42
4,00	5	12		96,02
4,20	5	14		112,03
4,40	5	16		128,03
4,60	6	12		96,02
4,80	6	10		80,02
5,00	6	17		127,79
5,20	6	8		60,14
5,40	6	10		75,17
5,60	7	8		60,14
5,80	7	12		90,20
6,00	7	7		49,61
6,20	7	10		70,88
6,40	7	12		85,05
6,60	8	14		99,23
6,80	8	19		134,66
7,00	8	8		53,64
7,20	8	8		53,64
7,40	8	9		60,34
7,60	9	3		20,11
7,80	9	17		113,97
8,00	9	10		63,61
8,20	9	13		82,69
8,40	9	15		95,41
8,60	10	16		101,77
8,80	10	15		95,41
9,00	10	13		78,65
9,20	10	10		60,50
9,40	10	9		54,45
9,60	11	9		54,45
9,80	11	11		66,55
10,00	11	14		80,76
10,20	11	15		86,53
10,40	11	19		109,61
10,60	12	24		138,45
10,80	12	25		144,22
11,00	12	30		165,38
11,20	12	23		126,79
11,40	12	14		77,18
11,60	13	17		93,71
11,80	13	12		66,15
12,00	13	9		47,50
12,20	13	7		36,95
12,40	13	9		47,50
12,60	14	9		47,50
12,80	14	9		47,50
13,00	14	7		35,44
13,20	14	7		35,44
13,40	14	8		40,50
13,60	15	21		106,31
13,80	15	18		91,13
14,00	15	20		97,28
14,20	15	19		92,42
14,40	15	13		63,23
14,60	16	28		136,19
14,80	16	26		126,46
15,00	16	30		140,41
15,20	1	27		126,37
15,40	1	32		149,77

H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

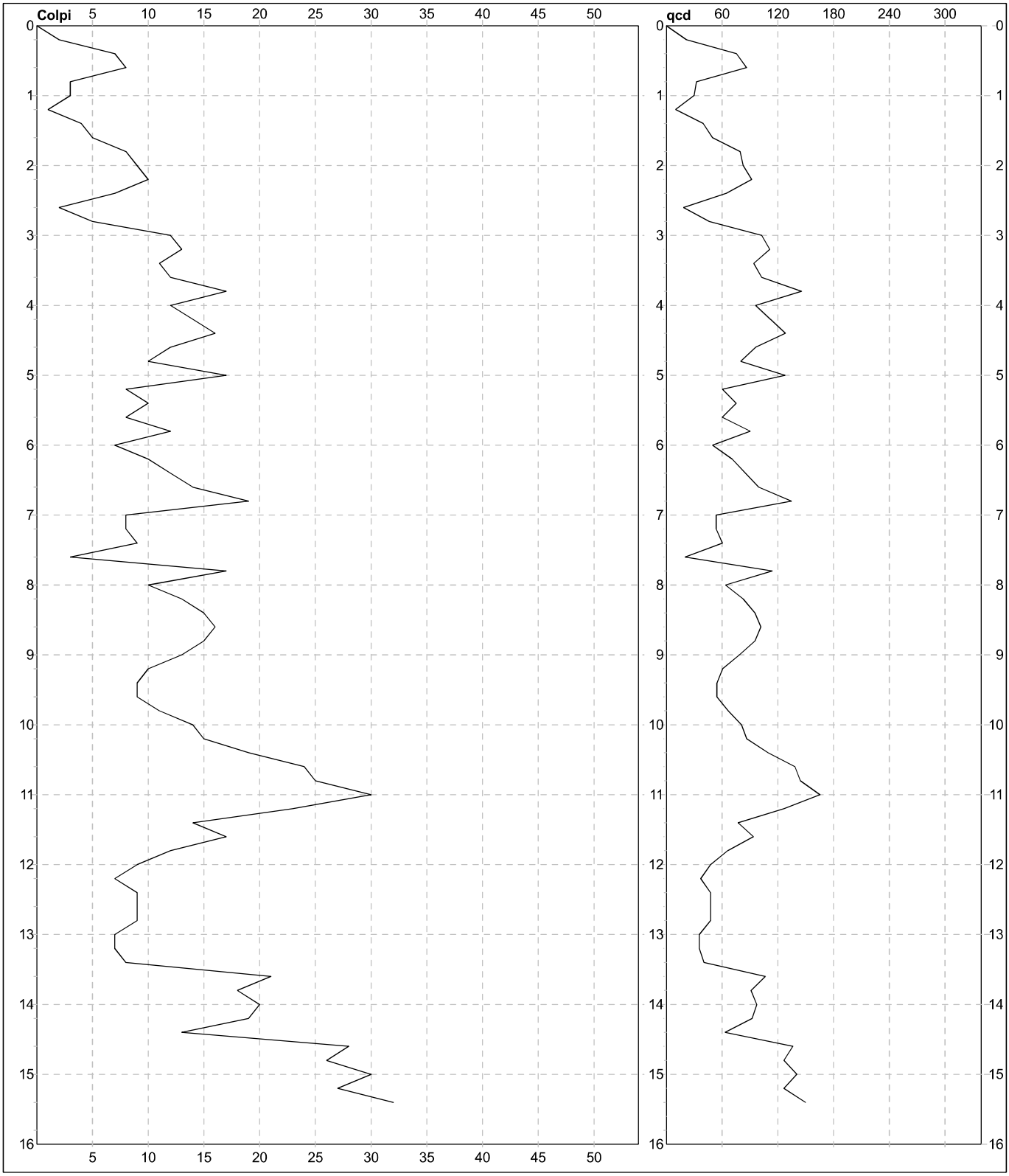
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	3
riferimento	017-2019

Committente: **dott geol Raffaele Brunaldi**
Cantiere:
Località: **Campolo via Montovolo**

U.M.: **kg/cm²**
Scala: 1:80
Pagina: 1
Elaborato:

Data esec.: 10/04/2019
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63,50 m
Altezza caduta: 0,75 m
Avanzamento: 0,20 m

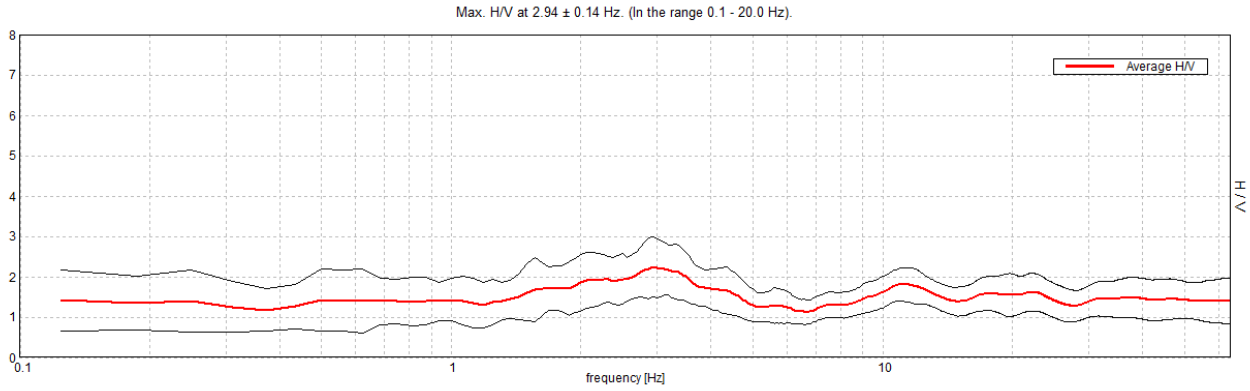
Responsabile:
Assistente:

Preforo: m
Corr.astine: kg/ml
Cod.ISTAT: 0

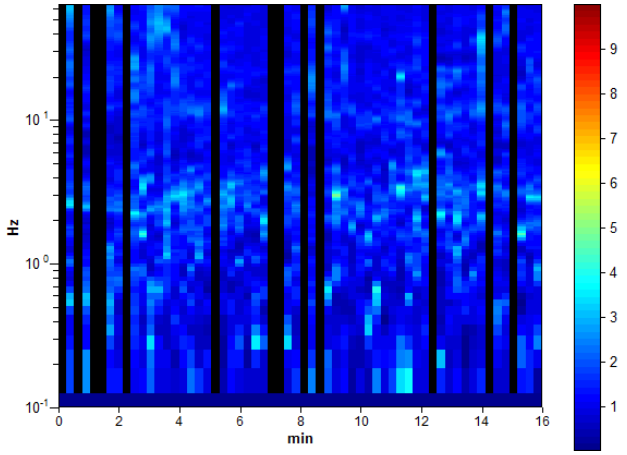
GRIZZANA MORANDI_MS, TR41 CAMPOLO CAMPO SPORTIVO

Instrument: TRZ-0108/01-10
Start recording: 28/11/18 12:37:33 End recording: 28/11/18 12:53:34
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 78% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

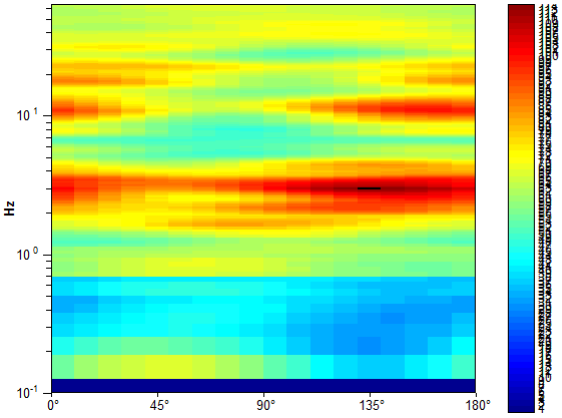
HORIZONTAL TO VERTICAL SPECTRAL RATIO



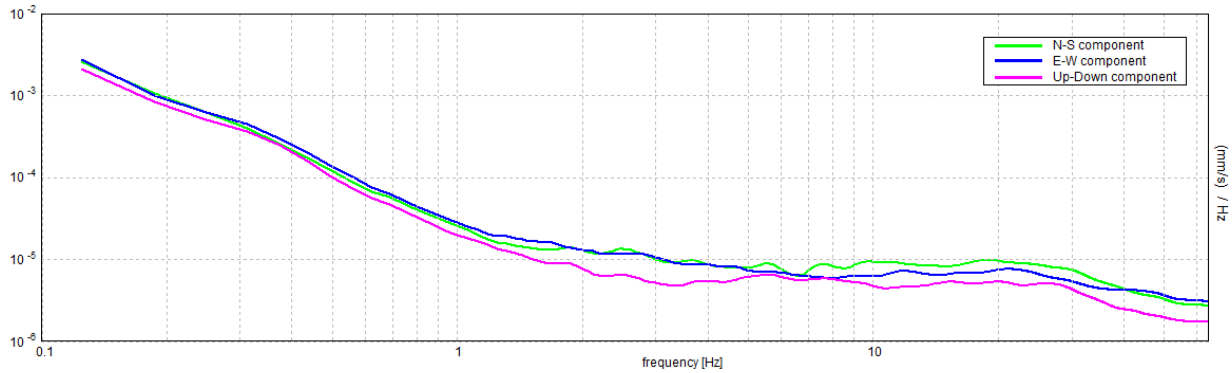
H/V TIME HISTORY



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 2.94 ± 0.14 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	2.94 > 0.63	OK	
$n_c(f_0) > 200$	2209.0 > 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 72 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.24 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02369| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.06958 < 0.14688	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3698 < 1.58	OK	

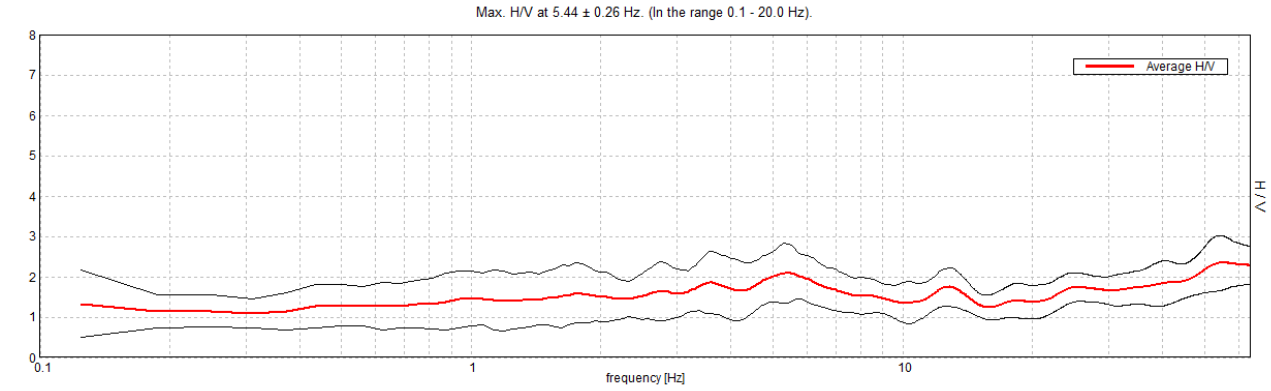
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

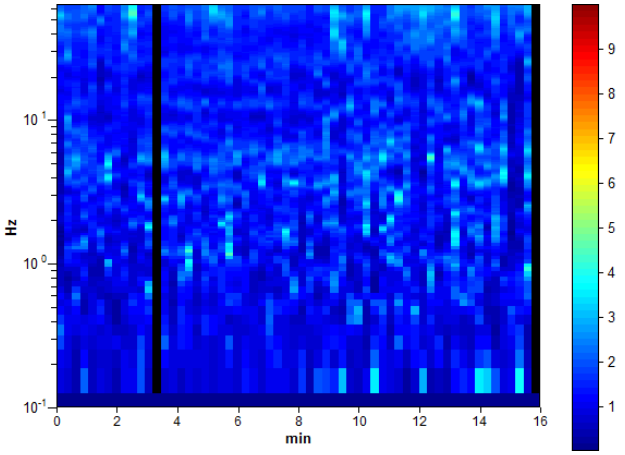
GRIZZANA MORANDI_MS, TR30 CAMPOLO

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 08:51:50 End recording: 26/10/18 09:07:50
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 97% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

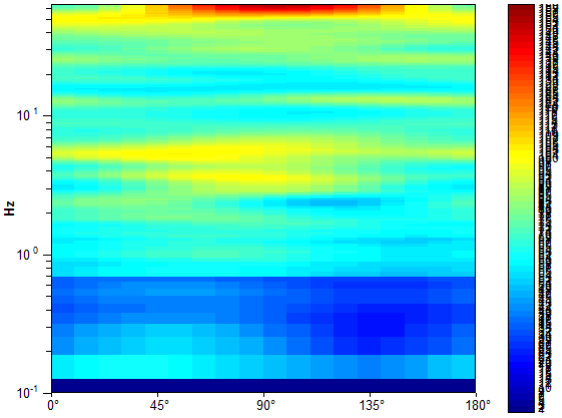
HORIZONTAL TO VERTICAL SPECTRAL RATIO



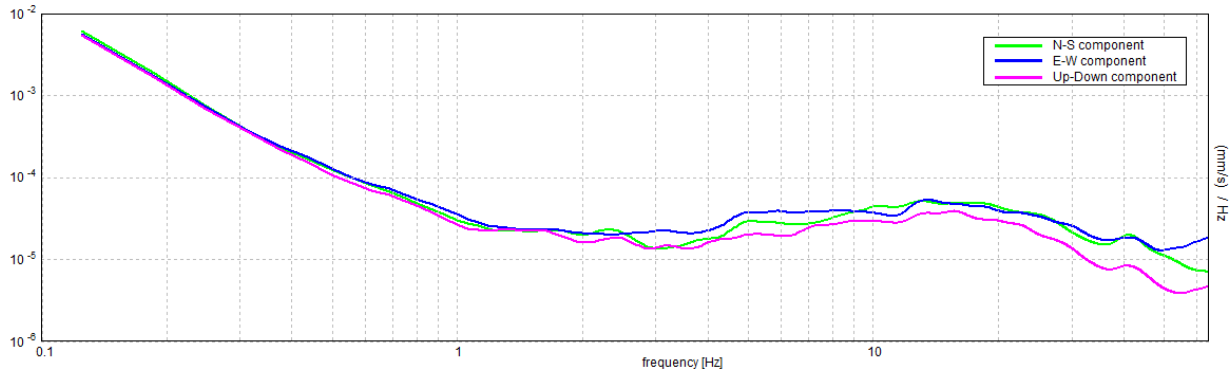
H/V TIME HISTORY



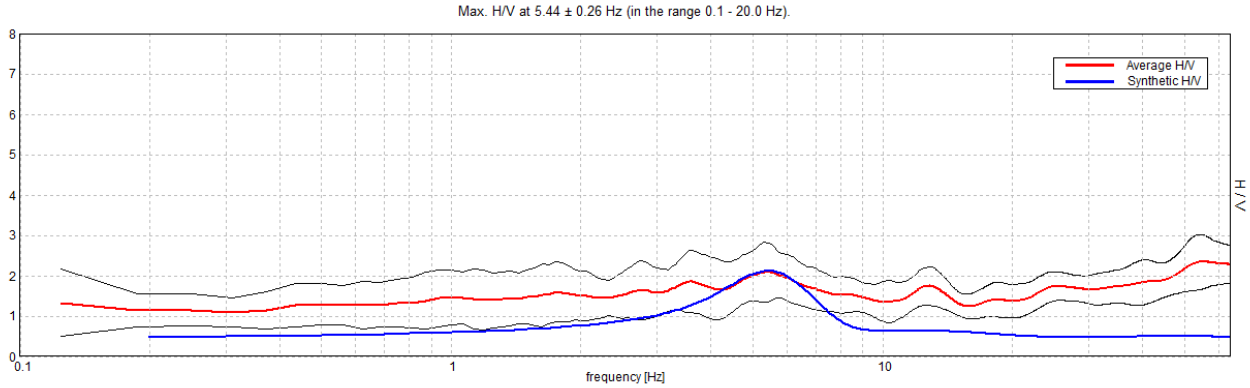
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

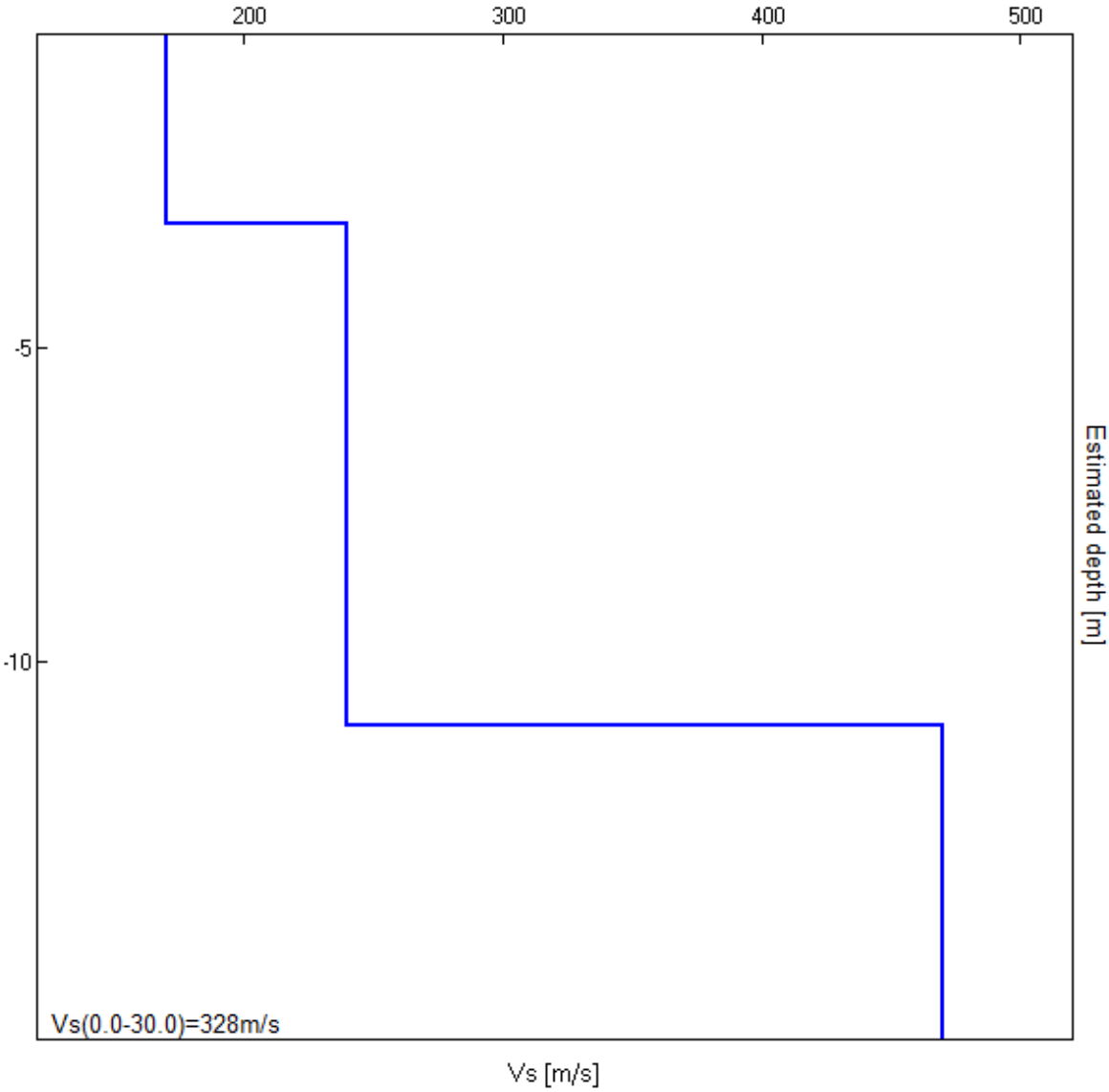


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.00	3.00	170
11.00	8.00	240
inf.	inf.	470

Vs(0.0-30.0)=328m/s



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

Max. H/V at 5.44 ± 0.26 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.44 > 0.63	OK	
$n_c(f_0) > 200$	5046.0 > 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 132 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.08 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02331| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.12676 < 0.27188	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3627 < 1.58	OK	

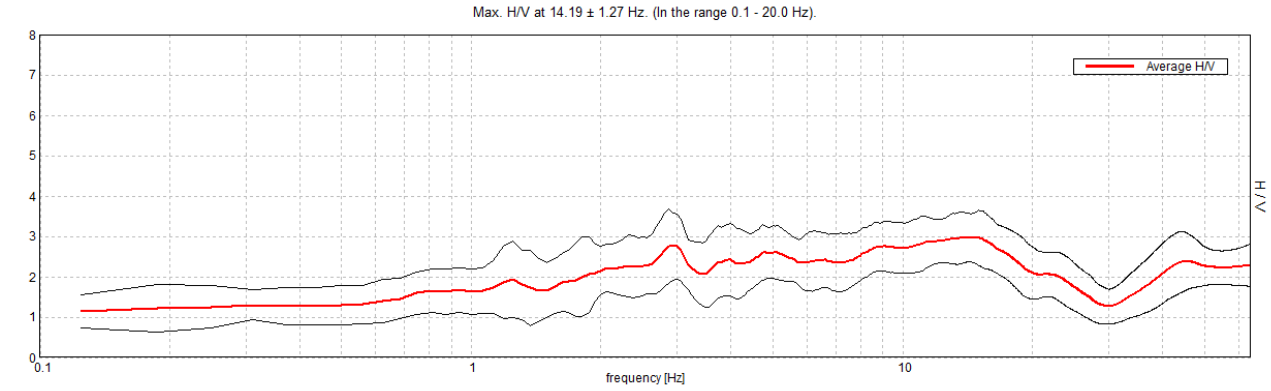
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

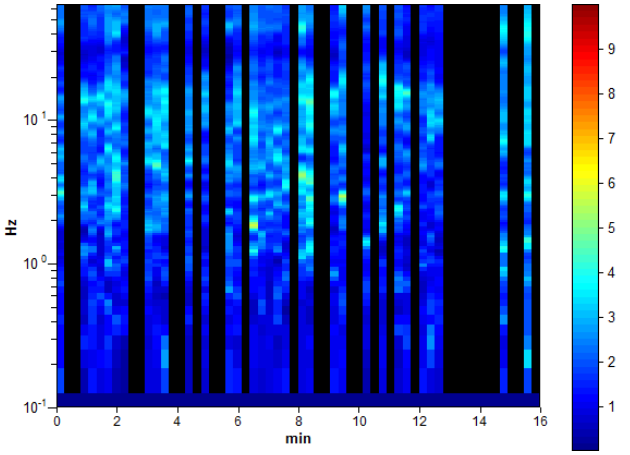
GRIZZANA MORANDI_MS, TR31 CAVALLINO

Instrument: TRZ-0009/01-09
Start recording: 26/10/18 09:19:32 End recording: 26/10/18 09:35:32
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 53% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

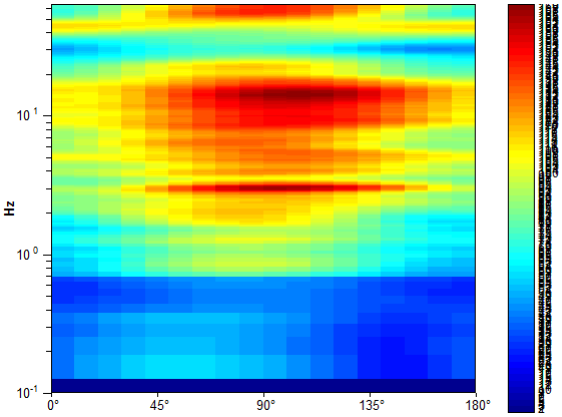
HORIZONTAL TO VERTICAL SPECTRAL RATIO



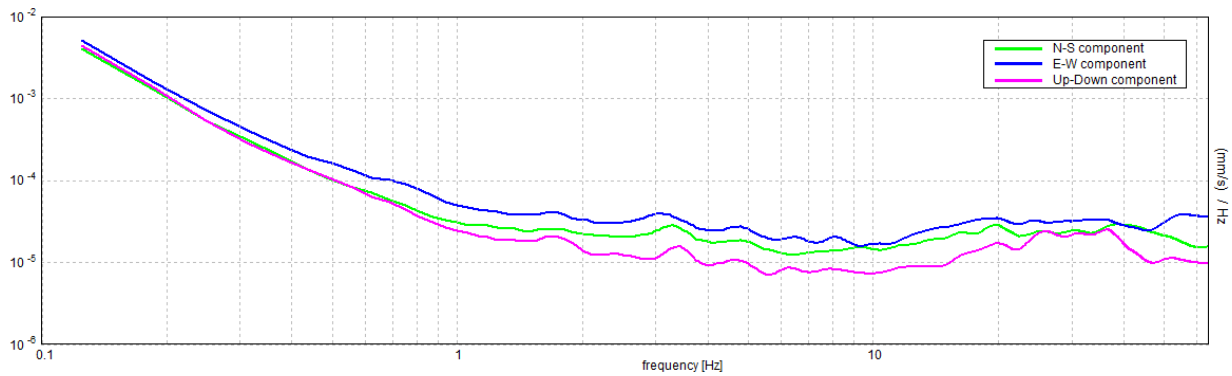
H/V TIME HISTORY



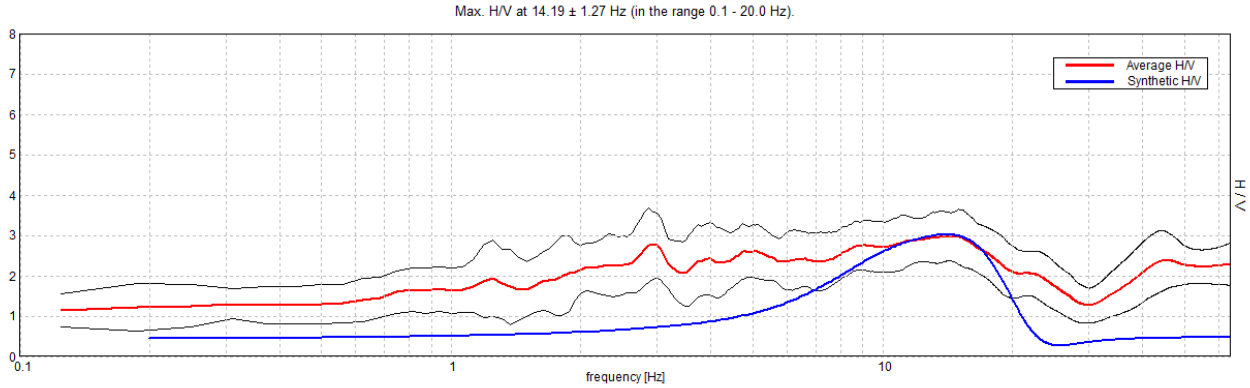
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

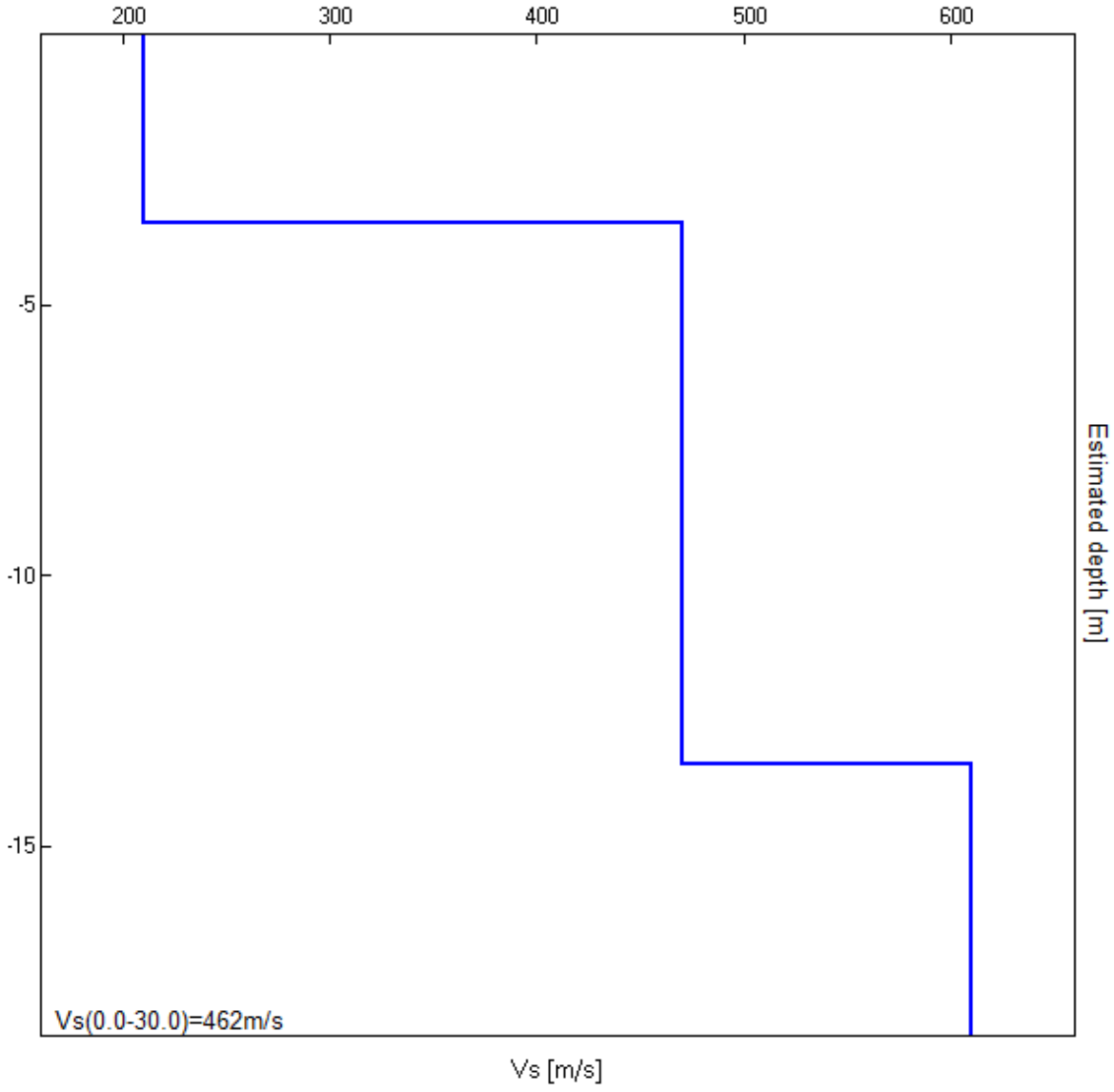


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.50	3.50	210
13.50	10.00	470
inf.	inf.	610

Vs(0.0-30.0)=462m/s



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

Max. H/V at 14.19 ± 1.27 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	14.19 > 0.63	OK	
$n_c(f_0) > 200$	7264.0 > 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 342 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	27.188 Hz	OK	
$A_0 > 2$	2.97 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0433| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.61435 < 0.70938	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2907 < 1.58	OK	

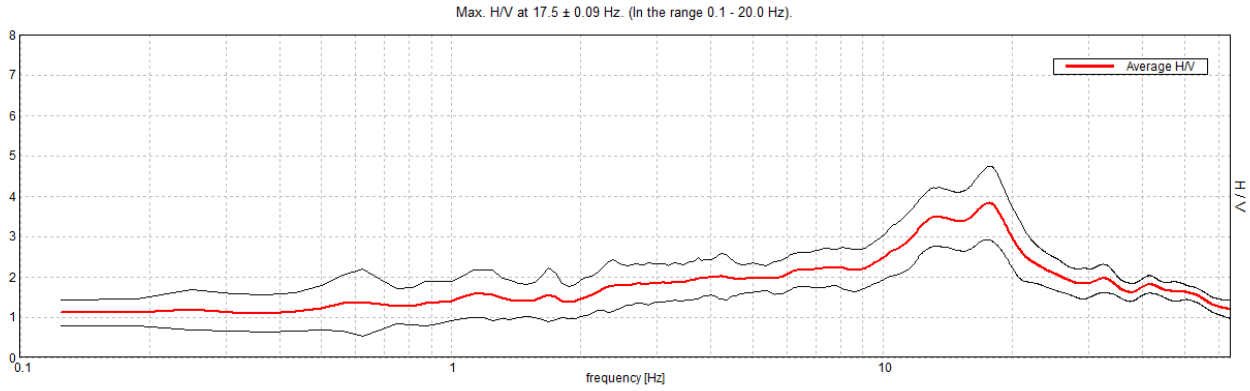
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

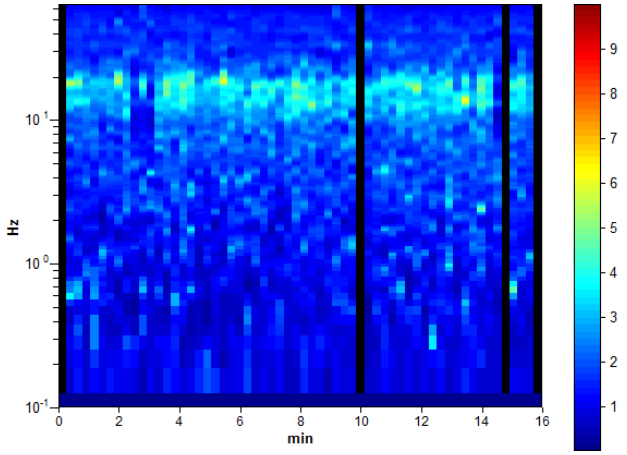
GRIZZANA MORANDI_MS, TR29 COLLINA

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 18:38:25 End recording: 25/10/18 18:54:25
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 93% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

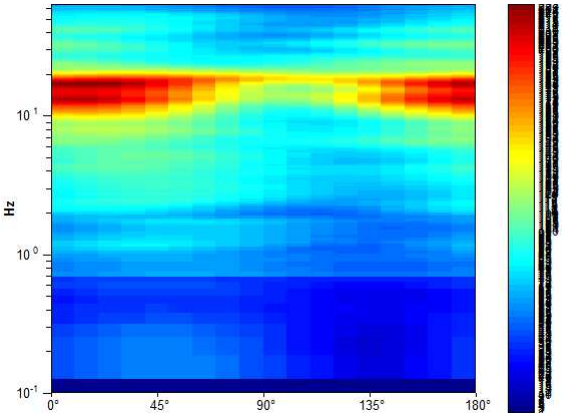
HORIZONTAL TO VERTICAL SPECTRAL RATIO



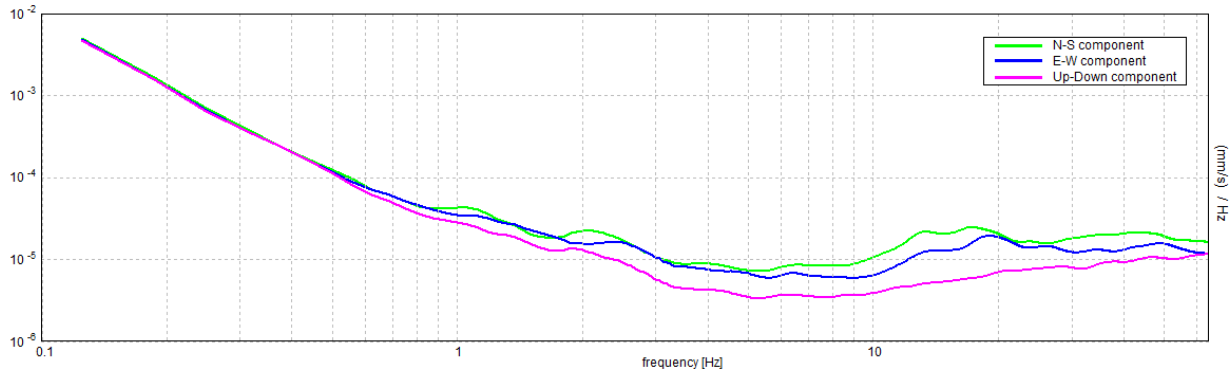
H/V TIME HISTORY



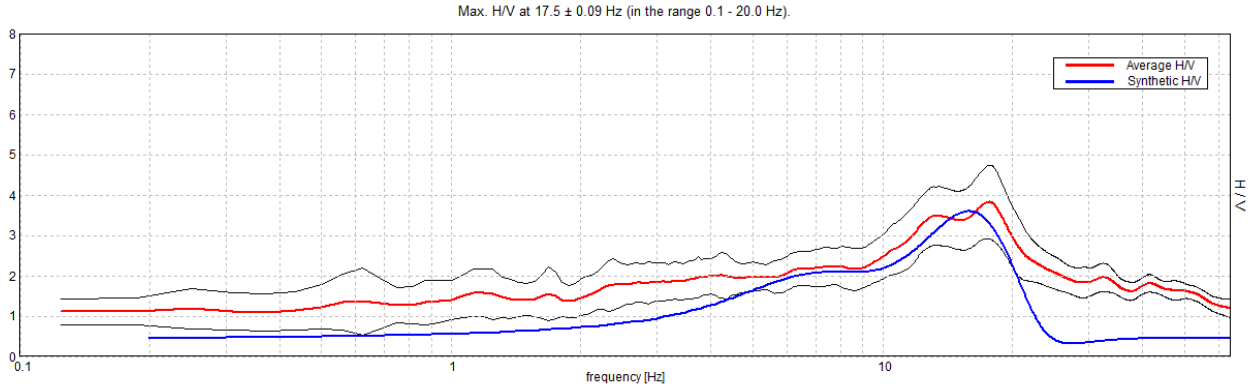
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

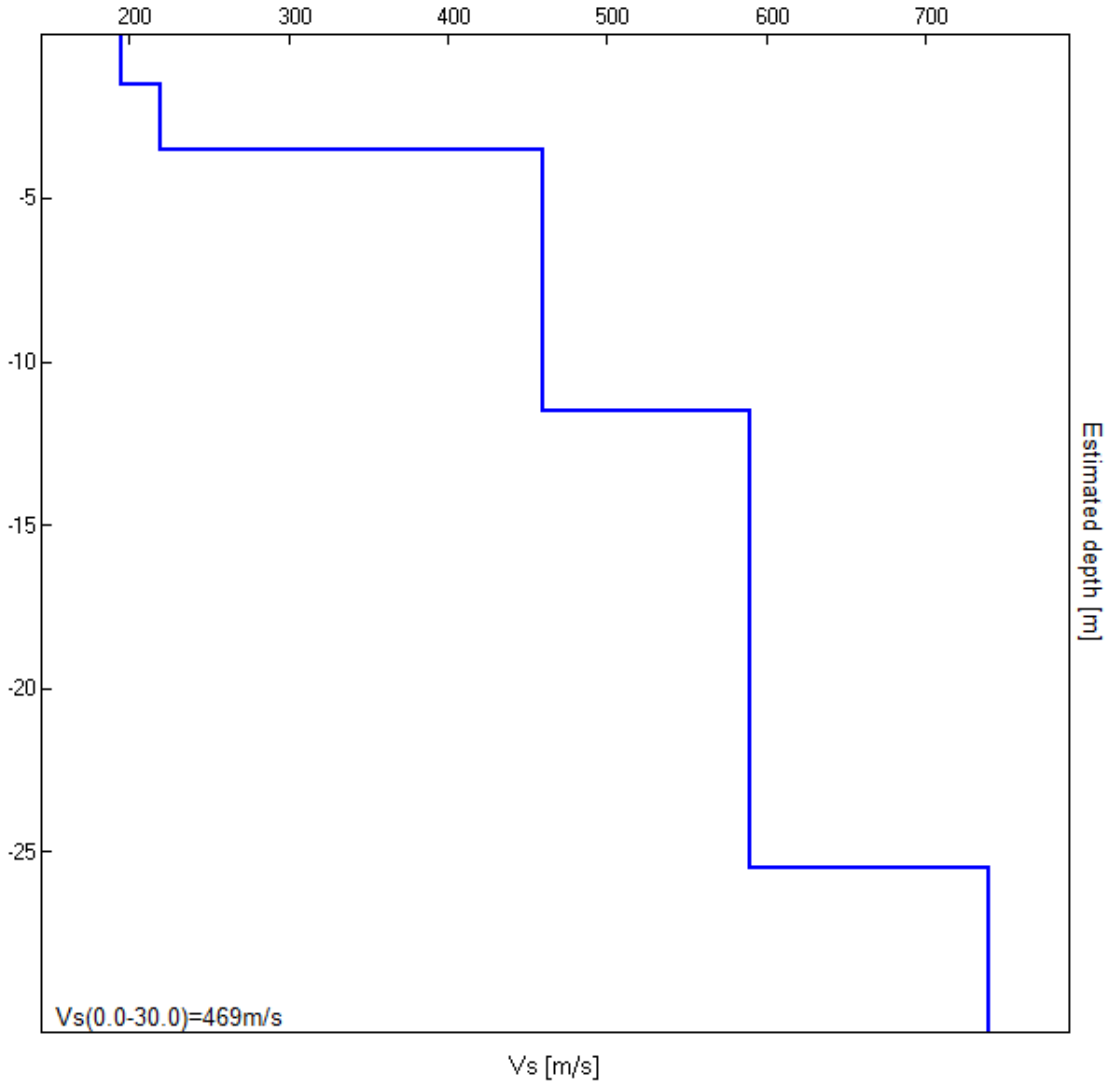


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
1.50	1.50	195
3.50	2.00	220
11.50	8.00	460
25.50	14.00	590
inf.	inf.	740

Vs(0.0-30.0)=469m/s



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

Max. H/V at 17.5 ± 0.09 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	17.50 > 0.63	OK	
$n_c(f_0) > 200$	15680.0 > 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 421 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	26.938 Hz	OK	
$A_0 > 2$	3.82 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00252| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.04407 < 0.875	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4461 < 1.58	OK	

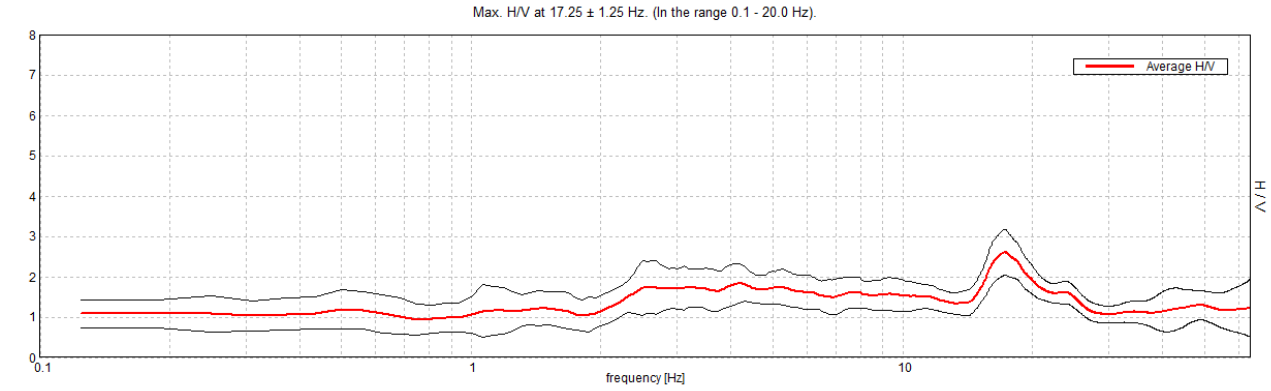
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

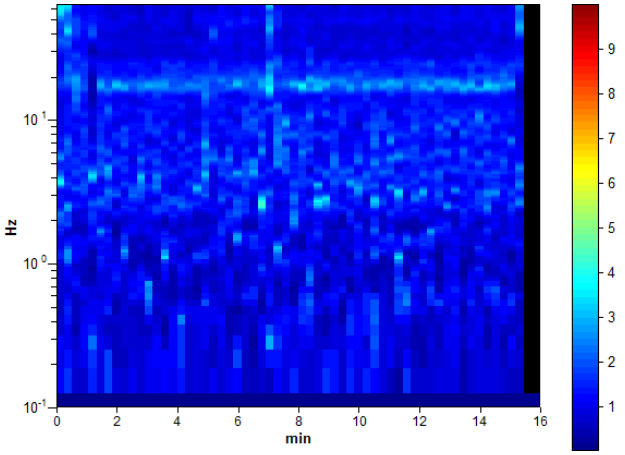
GRIZZANA MORANDI_MS, TR28 CAVANELLA

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 18:13:20 End recording: 25/10/18 18:29:20
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 97% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

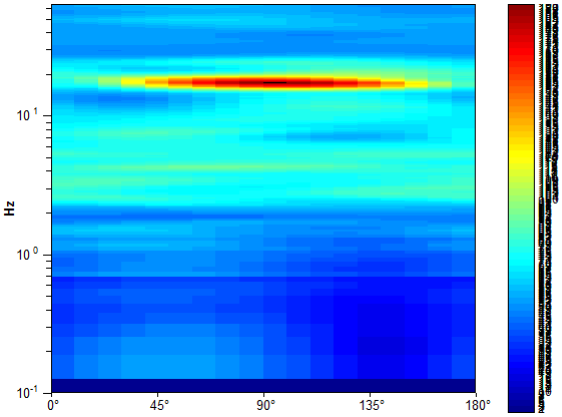
HORIZONTAL TO VERTICAL SPECTRAL RATIO



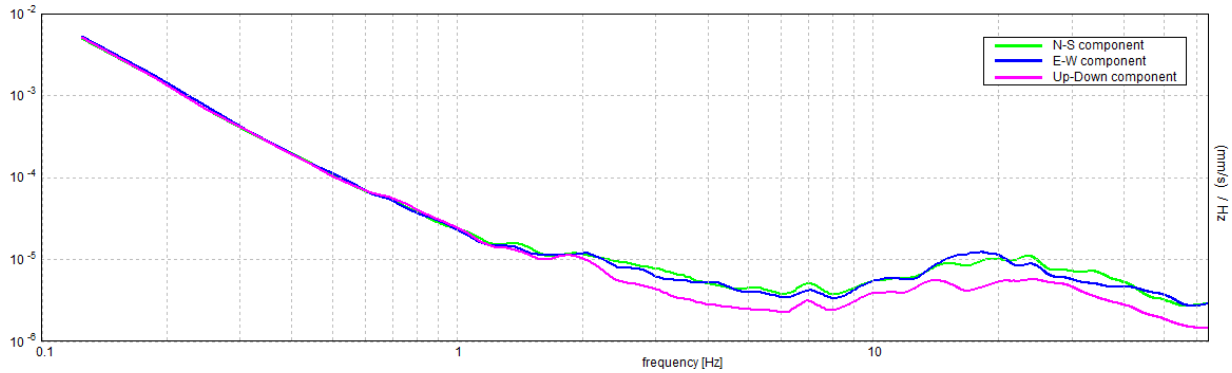
H/V TIME HISTORY



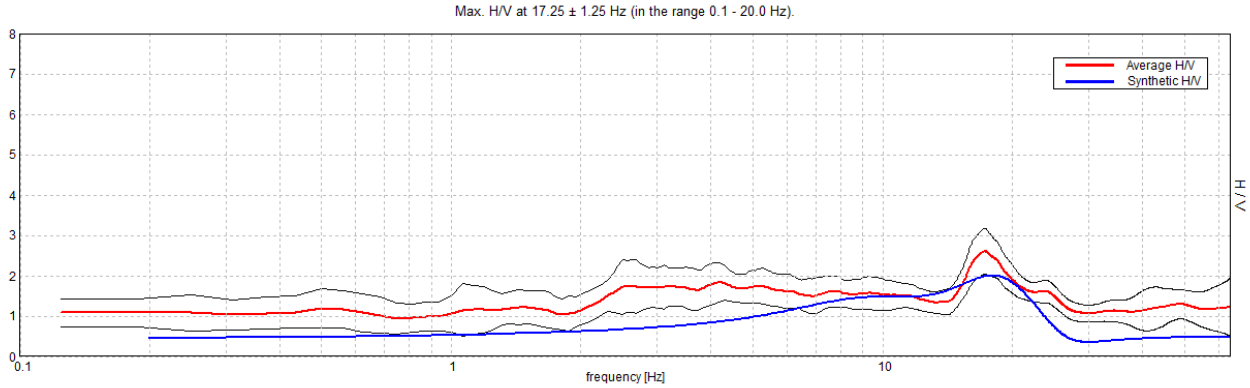
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

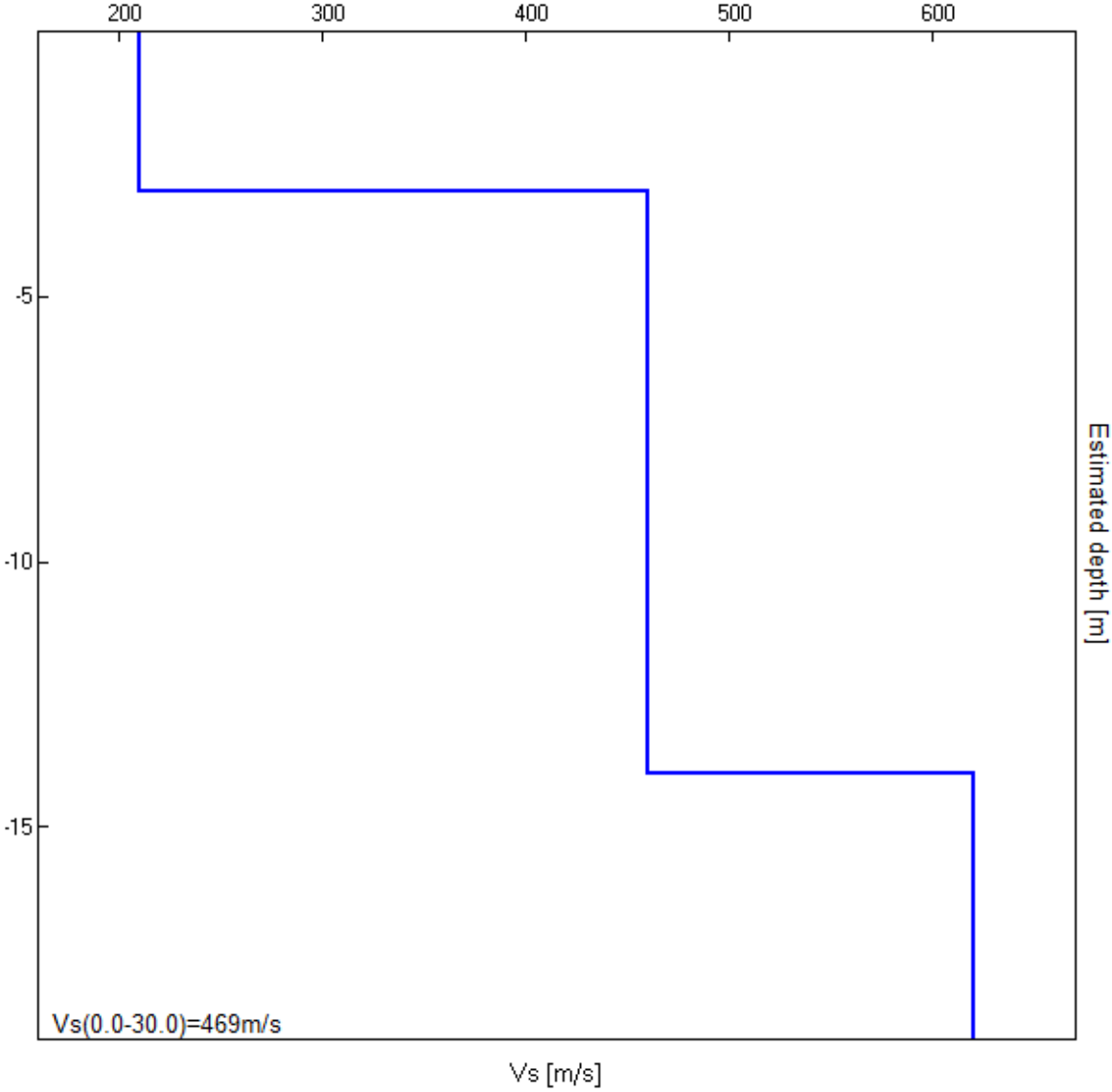


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.00	3.00	210
14.00	11.00	460
inf.	inf.	620

Vs(0.0-30.0)=469m/s



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

Max. H/V at 17.25 ± 1.25 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	17.25 > 0.63	OK	
$n_c(f_0) > 200$	16008.0 > 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 415 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	26.063 Hz	OK	
$A_0 > 2$	2.61 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.0358| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.61759 < 0.8625	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2801 < 1.58	OK	

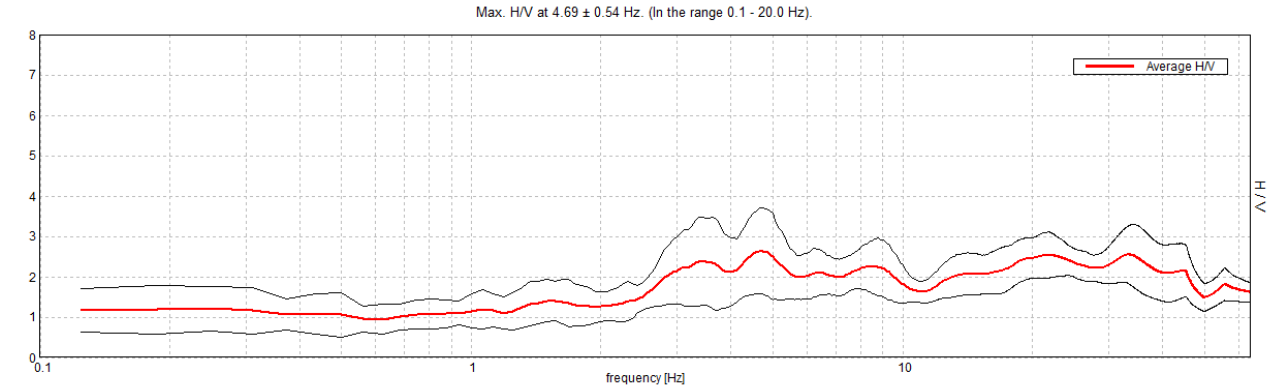
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

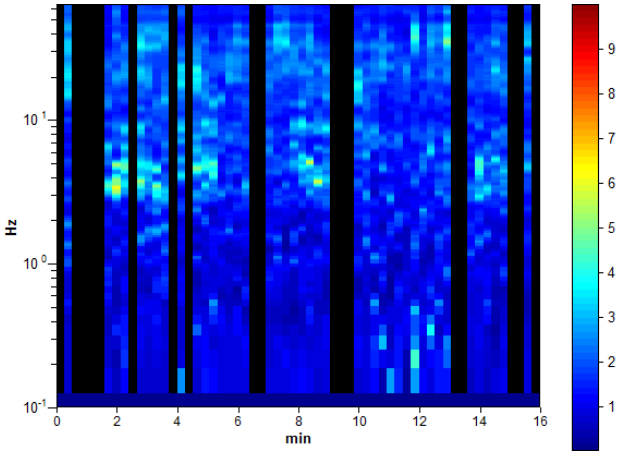
GRIZZANA MORANDI_MS, TR26 MARZOLARO

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 17:31:27 End recording: 25/10/18 17:47:27
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 70% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

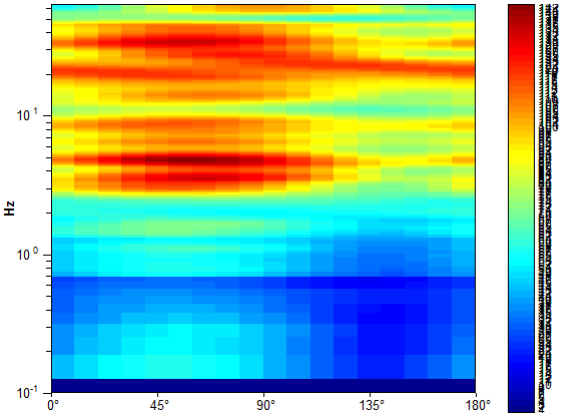
HORIZONTAL TO VERTICAL SPECTRAL RATIO



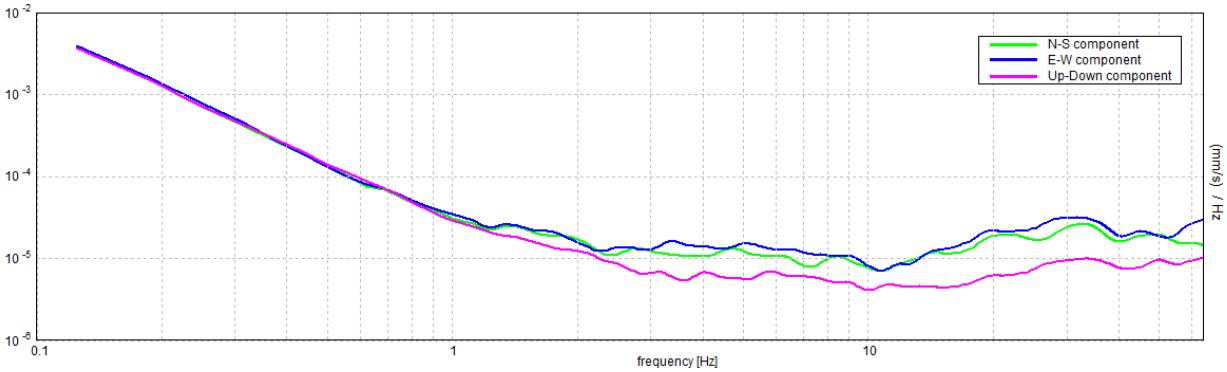
H/V TIME HISTORY



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 4.69 ± 0.54 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.69 > 0.63	OK	
$n_c(f_0) > 200$	3150.0 > 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 114 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	2.188 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.64 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.05601| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.26253 < 0.23438		NO
$\sigma_A(f_0) < \theta(f_0)$	0.5223 < 1.58	OK	

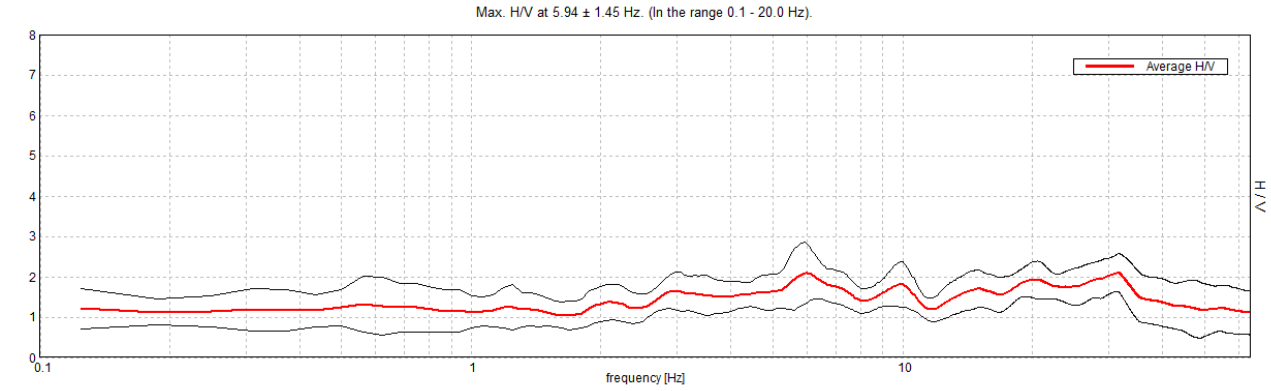
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak 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

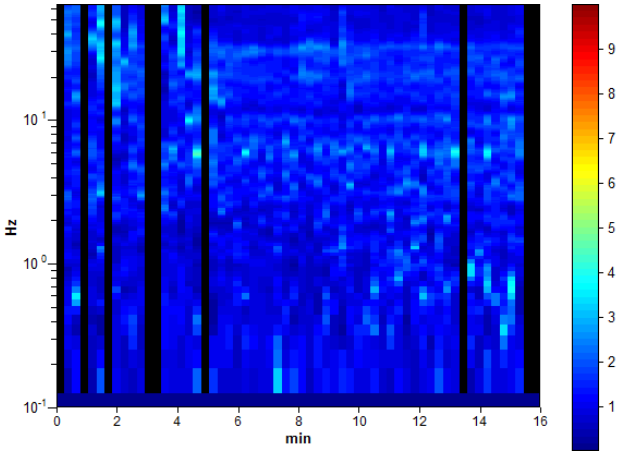
GRIZZANA MORANDI_MS, TR27 POGGIO MARTINO

Instrument: TRZ-0009/01-09
Start recording: 25/10/18 17:52:03 End recording: 25/10/18 18:08:03
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 85% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

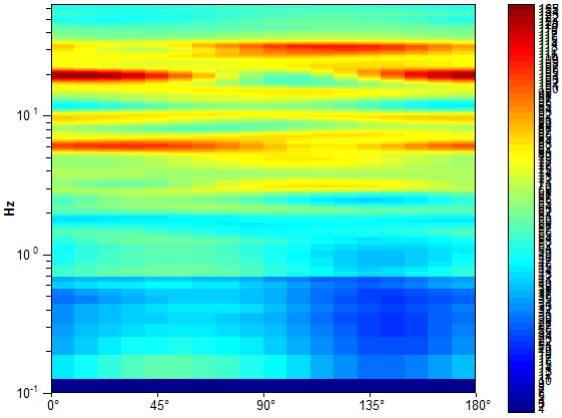
HORIZONTAL TO VERTICAL SPECTRAL RATIO



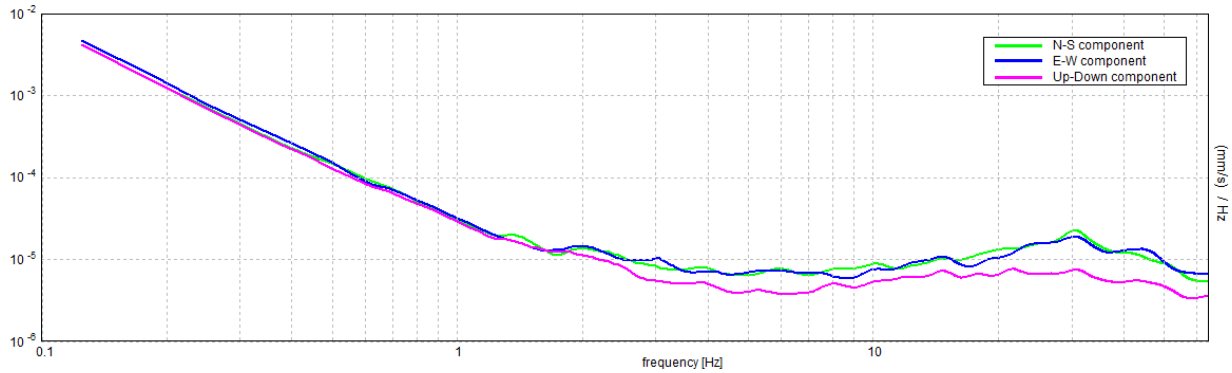
H/V TIME HISTORY



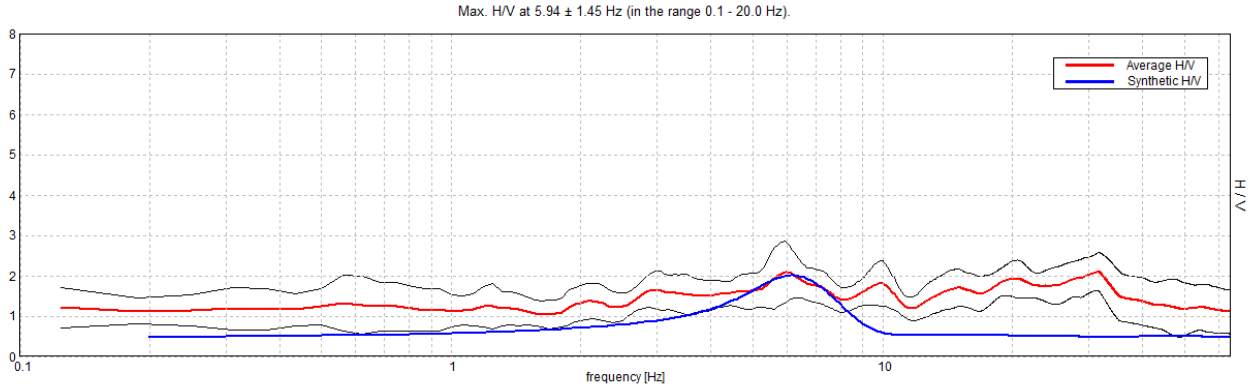
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

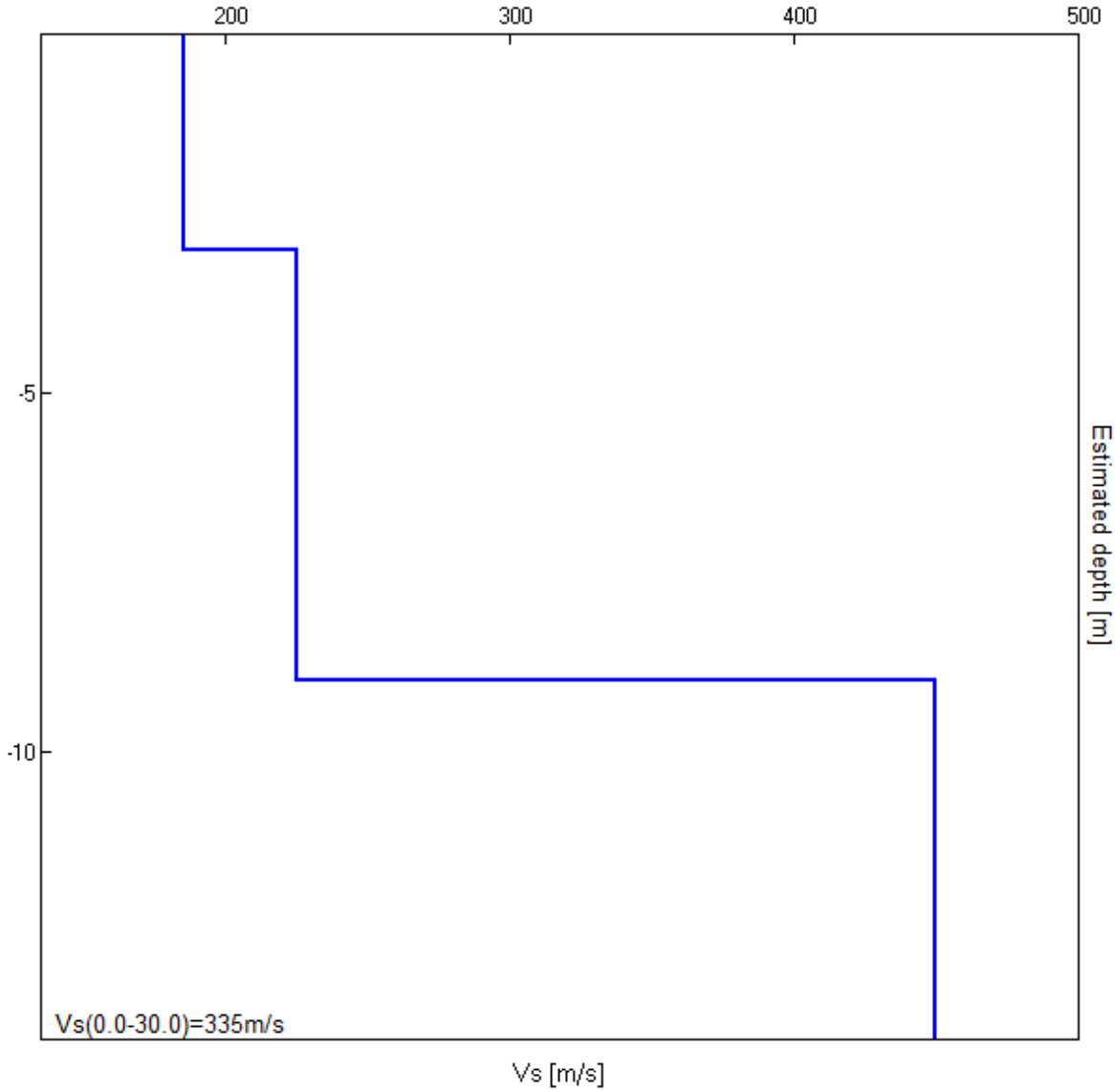


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.00	3.00	185
9.00	6.00	225
inf.	inf.	450

Vs(0.0-30.0)=335m/s



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

Max. H/V at 5.94 ± 1.45 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.94 > 0.63	OK	
$n_c(f_0) > 200$	4845.0 > 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 144 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.688 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.08 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.12019| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.7136 < 0.29688		NO
$\sigma_A(f_0) < \theta(f_0)$	0.3775 < 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 $\sigma_A(f) < \theta(f_0)$

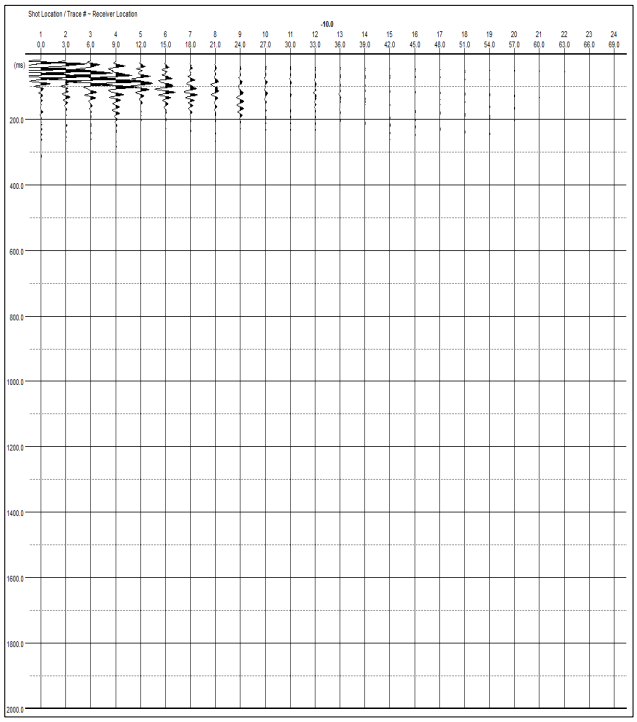
Threshold values for σ_f and $\sigma_A(f_0)$					
Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 f_0	0.2 f_0	0.15 f_0	0.10 f_0	0.05 f_0
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
log $\theta(f_0)$ for $\sigma_{logH/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

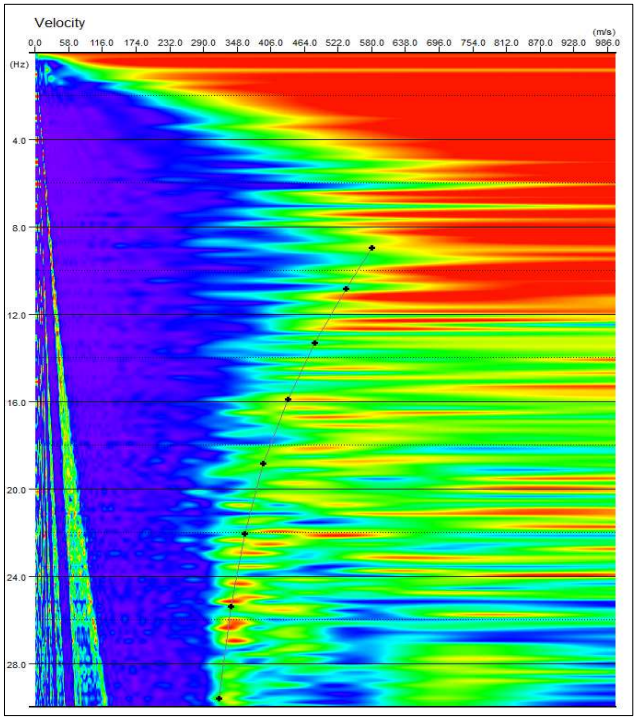
Ponte, Comune di Grizzana Morandi (BO) – 037031L1MASW1

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	3,0	69,0	0,5/2,0	2,0/32,0

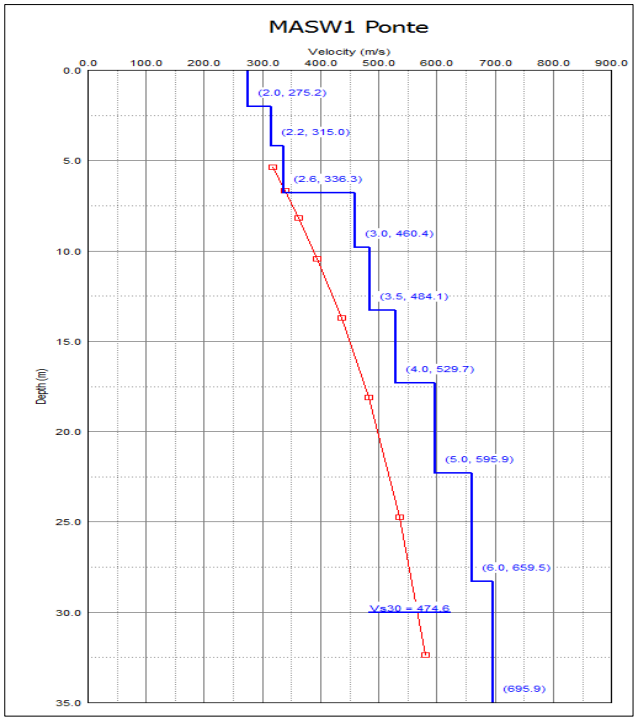
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	2.0	2.0	275.2
2	4.2	2.2	315.0
3	6.8	2.6	336.3
4	9.8	3.0	460.4
5	13.3	3.5	484.1
6	17.3	4.0	529.7
7	22.3	5.0	595.9
8	28.3	6.0	659.5
9	∞	∞	695.9

V_{S30} = 474.6 ± 10% [m/s]

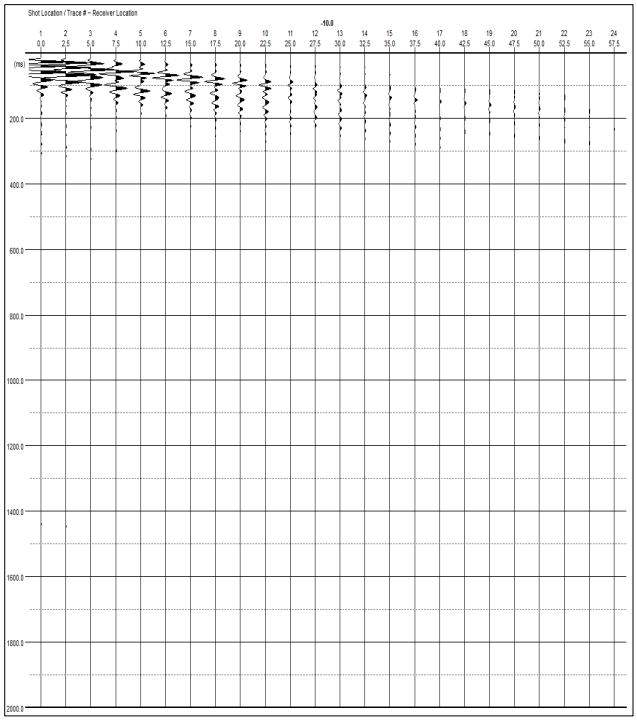
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

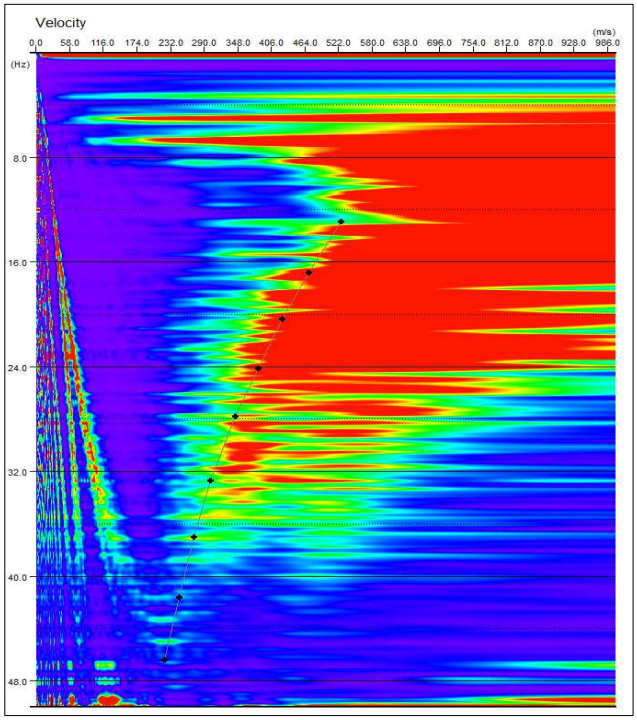
Pianaccia, Comune di Grizzana Morandi (BO) – 037031L2MASW2

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	2,5	57,5	0,5/2,0	2,0/32,0

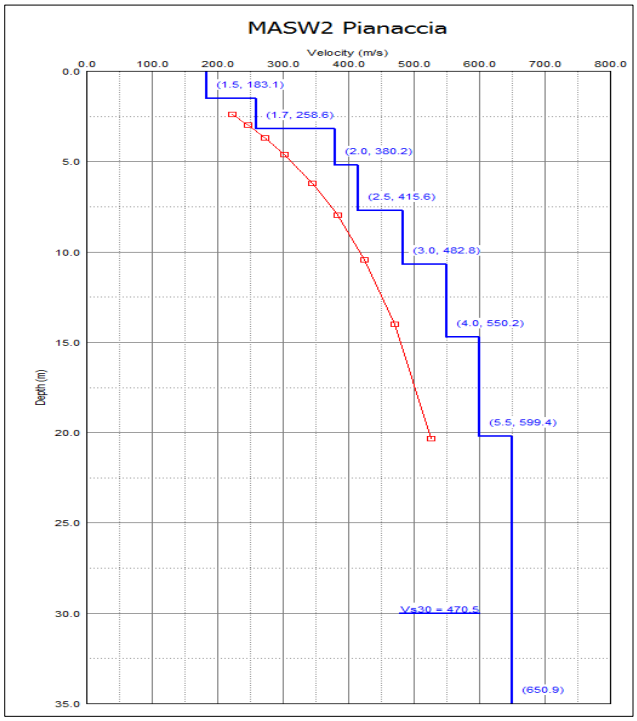
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.5	1.5	183.1
2	3.2	1.7	258.6
3	5.2	2.0	380.2
4	7.7	2.5	415.6
5	10.7	3.0	482.8
6	14.7	4.0	550.2
7	20.2	5.5	599.4
8	∞	∞	650.9

V_{S30} = 470.5 ± 10% [m/s]

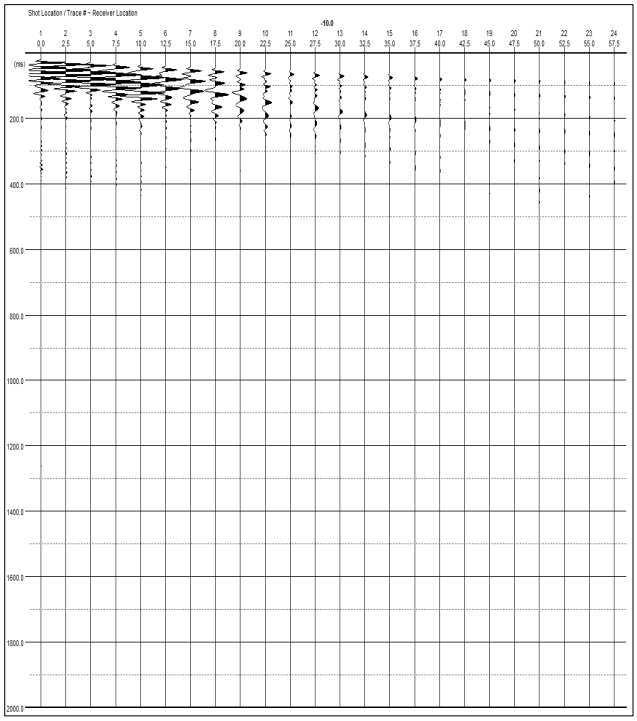
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

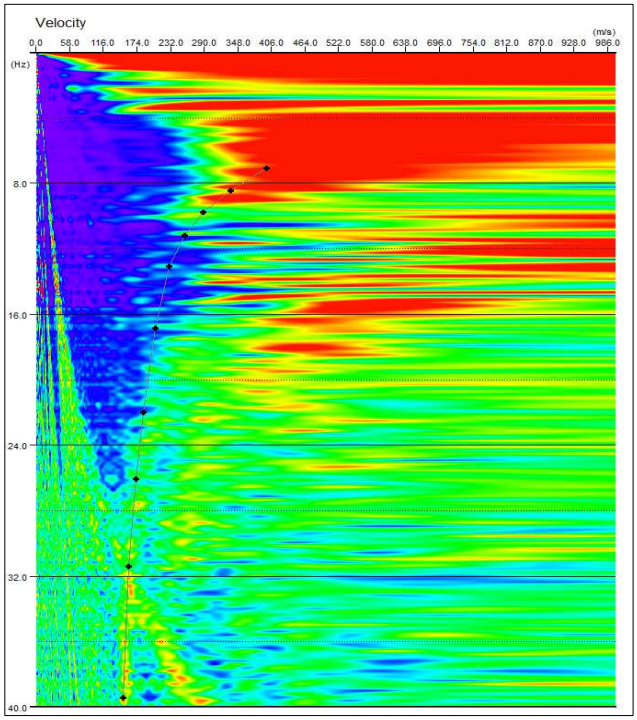
Campolo, Comune di Grizzana Morandi (BO) – 037031L3MASW3

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	2,5	57,5	0,5/2,0	2,0/32,0

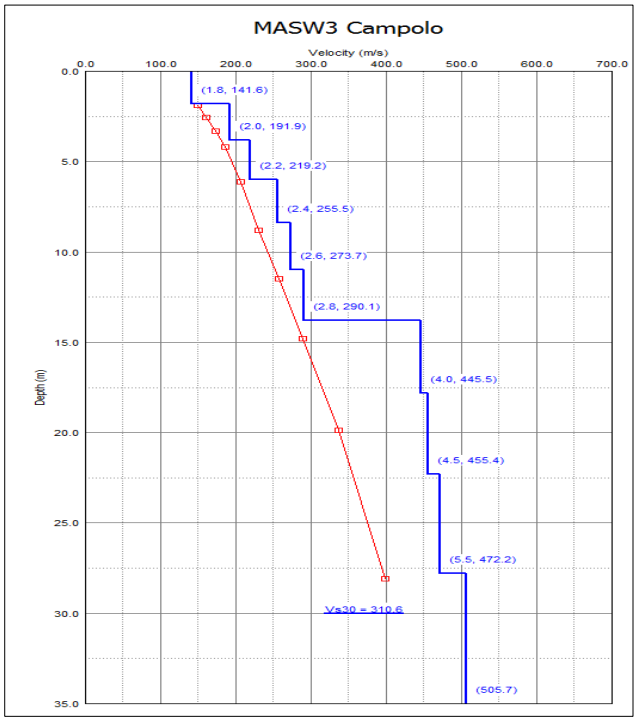
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f*–*v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.8	1.8	141.6
2	3.8	2.0	191.9
3	6.0	2.2	219.2
4	8.4	2.4	255.5
5	11.0	2.6	273.7
6	13.8	2.8	290.1
7	17.8	4.0	445.5
8	22.3	4.5	455.4
9	27.8	5.5	472.2
10	∞	∞	505.7

V_{S30} = 310.6 ± 10% [m/s]

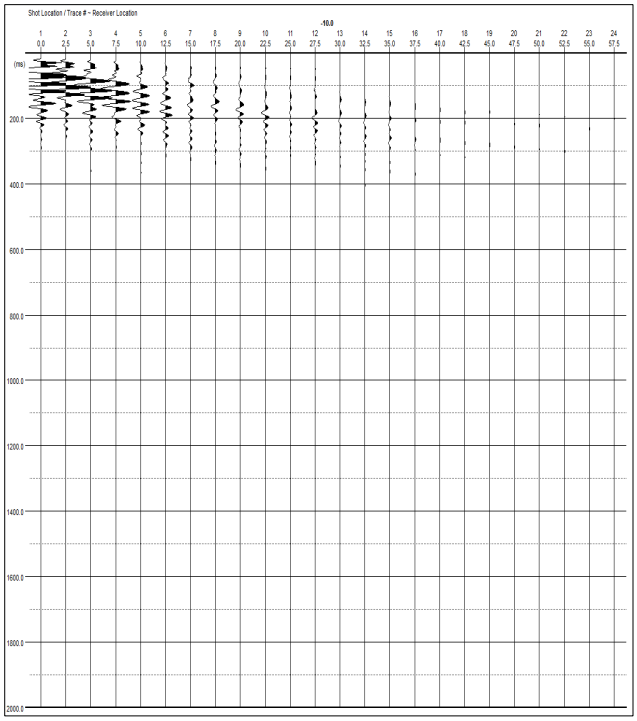
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

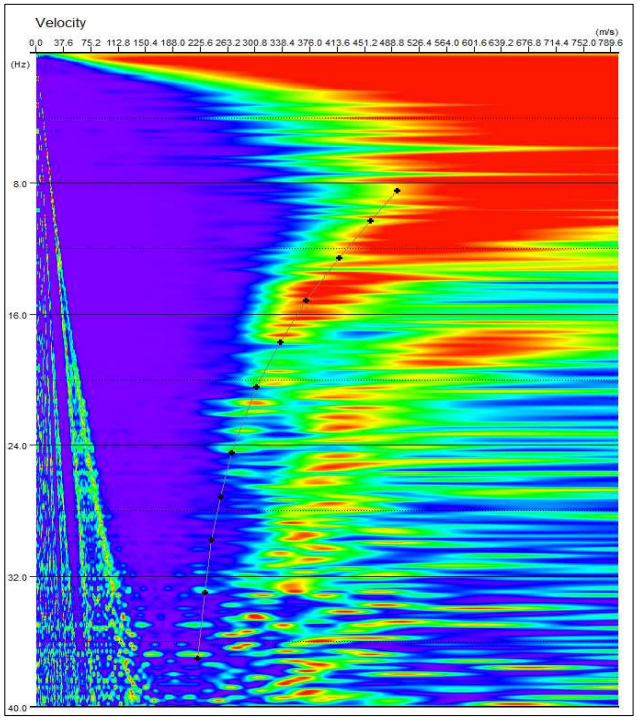
Via Pietrafitta – Grizzana Morandi (BO) – 037031L4MASW4

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	2,5	57,5	0,5/2,0	2,0/32,0

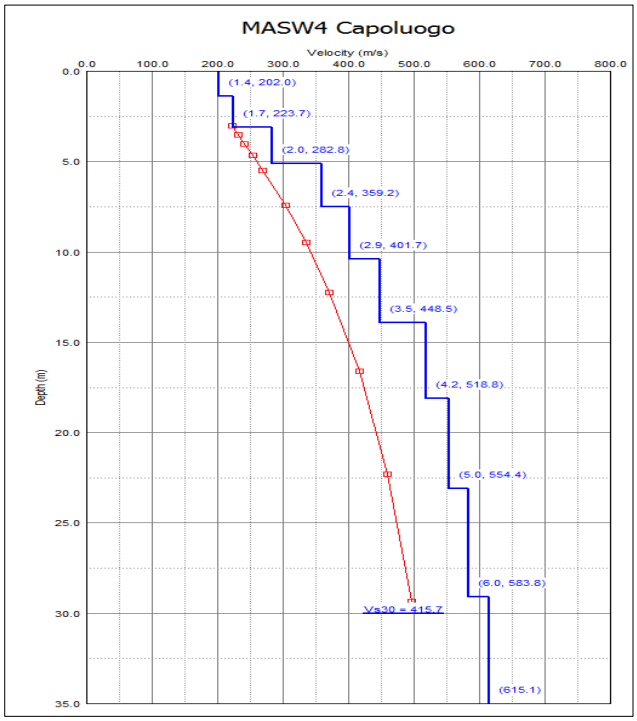
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.4	1.4	202.0
2	3.1	1.7	223.7
3	5.1	2.0	282.8
4	7.5	2.4	359.2
5	10.4	2.9	401.7
6	13.9	3.5	448.5
7	18.1	4.2	518.8
8	23.3	5.2	554.4
9	29.3	6.0	583.8
10	∞	∞	615.1

V_{S30} = 415.7 ± 10% [m/s]

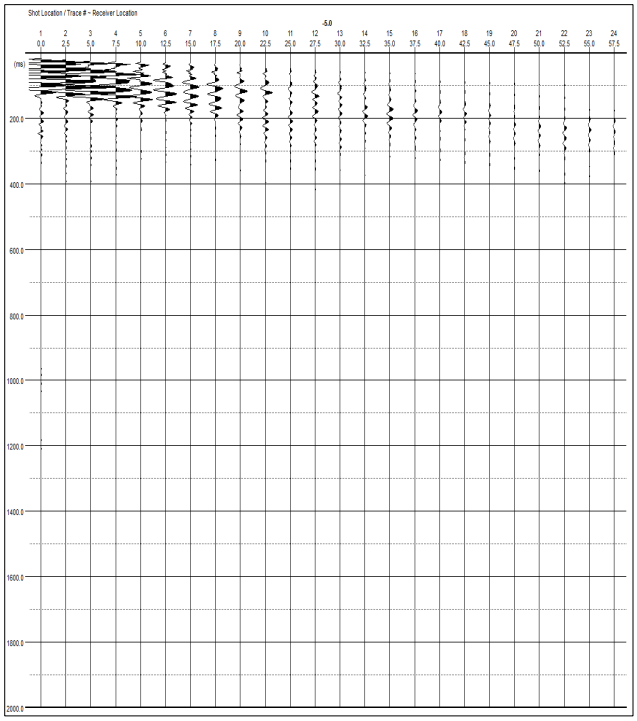
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

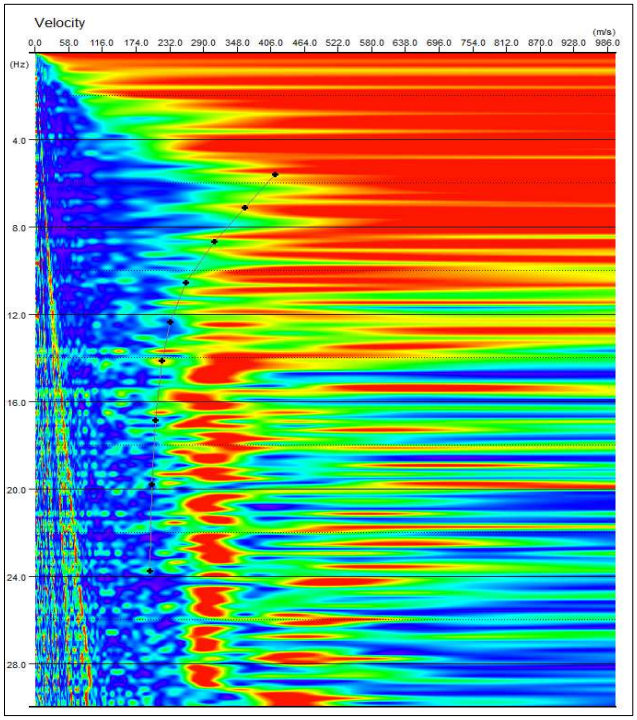
Campo sportivo Pioppe di Salvaro – Comune di Grizzana Morandi (BO) – 037031L5MASW5

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	2,5	57,5	0,5/2,0	2,0/32,0

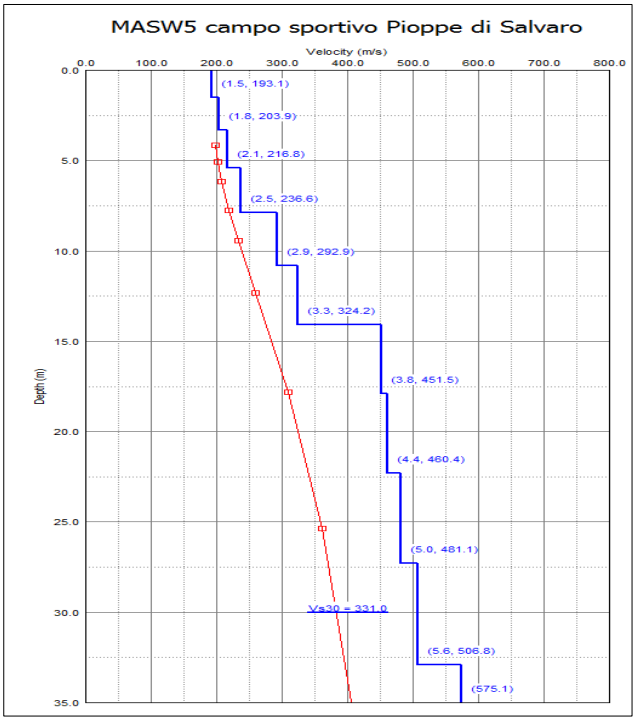
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.5	1.5	193.1
2	3.3	1.8	203.9
3	5.4	2.1	216.8
4	7.9	2.5	236.6
5	10.8	2.9	292.9
6	14.1	3.3	324.2
7	17.9	3.8	451.5
8	22.3	4.4	460.4
9	27.3	5.0	481.1
10	32.9	5.6	506.8
11	∞	∞	575.1

V_{S30} = 331.0 ± 10% [m/s]

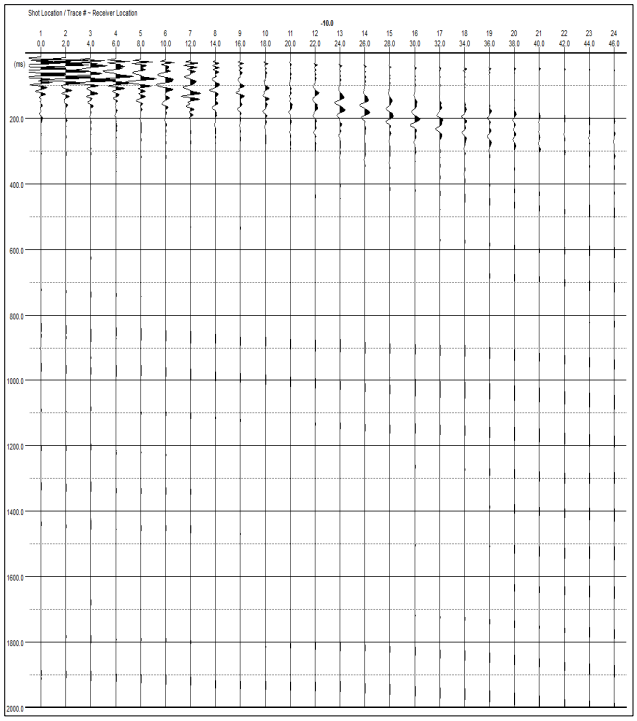
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

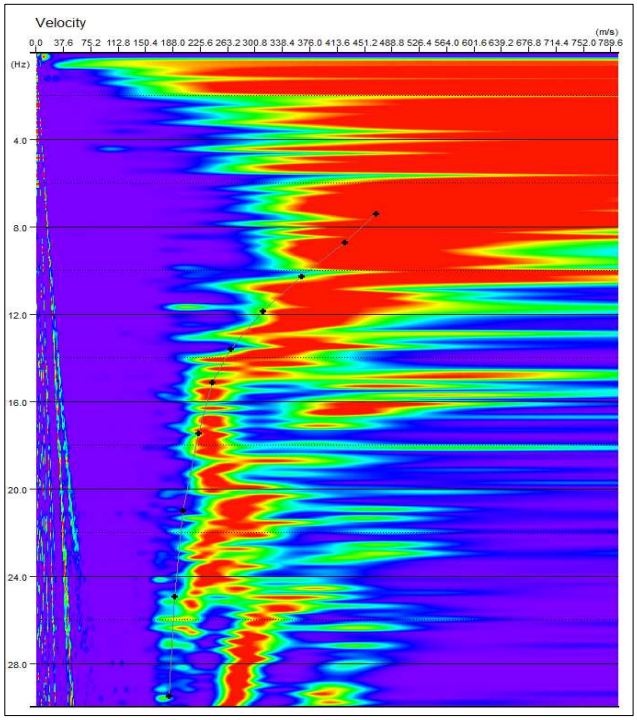
La Casella Pioppe di Salvaro – Comune di Grizzana Morandi (BO) – 037031L6MASW6

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	2,0	46,0	0,5/2,0	2,0/32,0

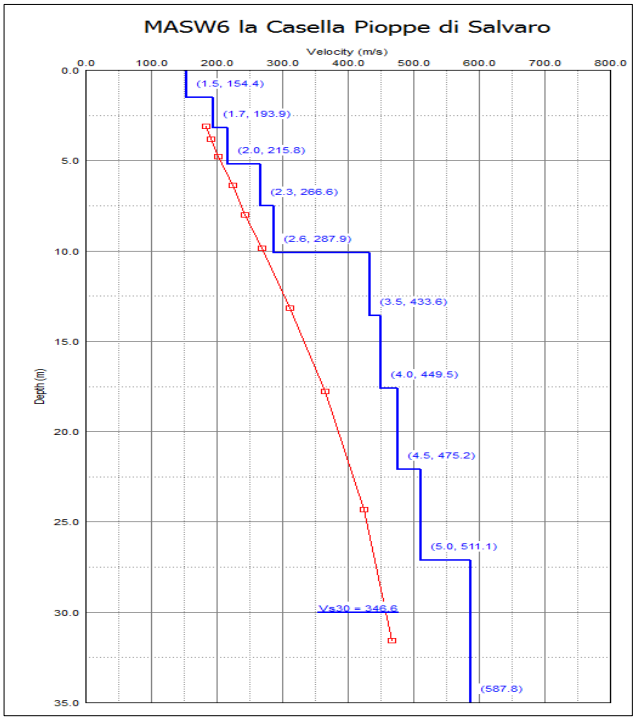
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.5	1.5	154.4
2	3.2	1.7	193.9
3	5.2	2.0	215.8
4	7.5	2.3	266.6
5	10.1	2.6	287.9
6	13.6	3.5	433.6
7	17.6	4.0	449.5
8	22.1	4.5	475.2
9	27.1	5.0	511.1
10	∞	∞	587.8

V_{S30} = 346.6 ± 10% [m/s]

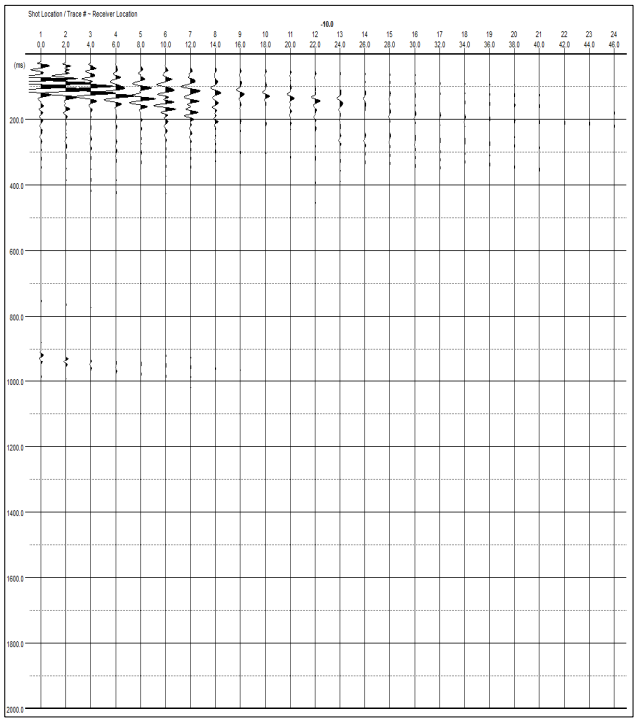
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

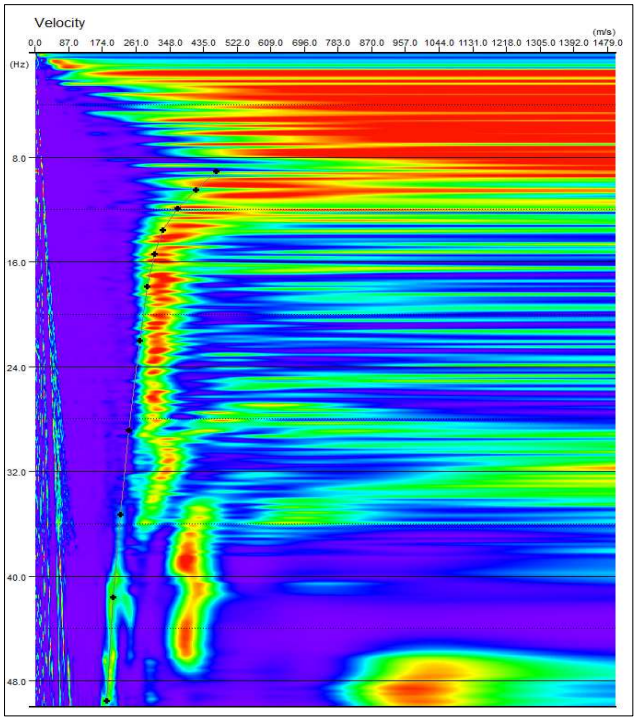
America – Comune di Grizzana Morandi (BO) – 037031L7MASW7

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	2,0	46,0	0,5/2,0	2,0/32,0

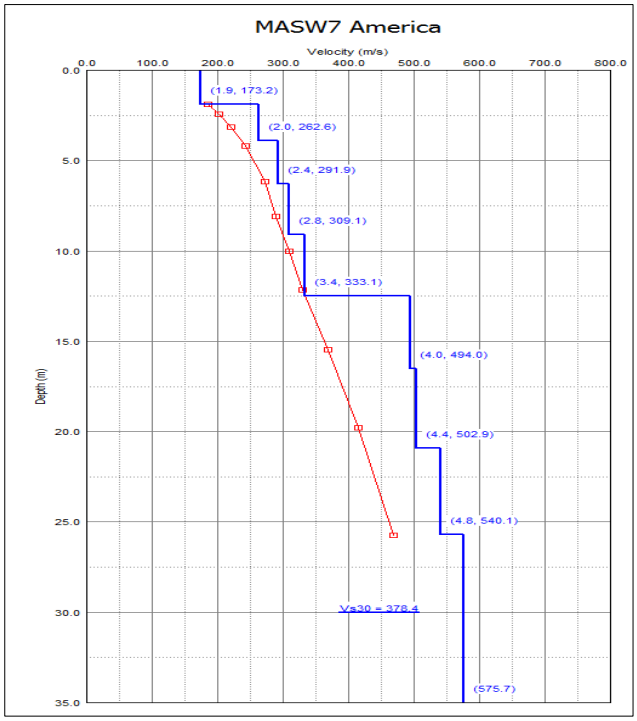
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.9	1.9	173.2
2	3.9	2.0	262.6
3	6.3	2.4	291.9
4	9.1	2.8	309.1
5	12.5	3.4	333.1
6	16.5	4.0	494.0
7	20.9	4.4	502.9
8	25.7	4.8	540.1
9	∞	∞	575.7

V_{S30} = 378.4 ± 10% [m/s]

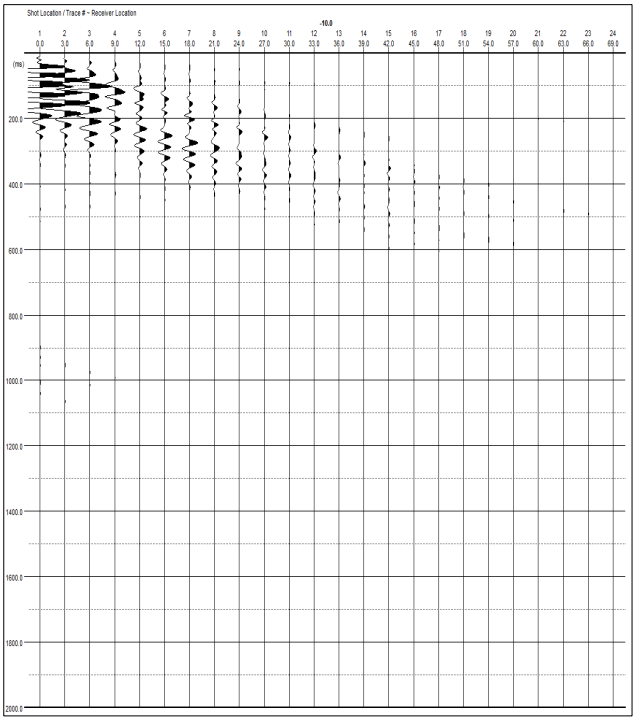
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

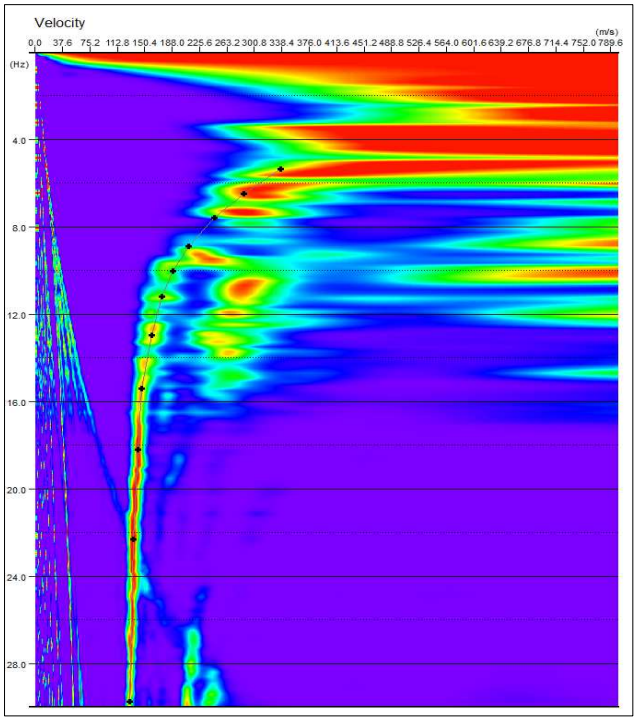
Campo sportivo Grizzana Morandi (BO) – 037031L8MASW8

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	3,0	69,0	0,5/2,0	2,0/32,0

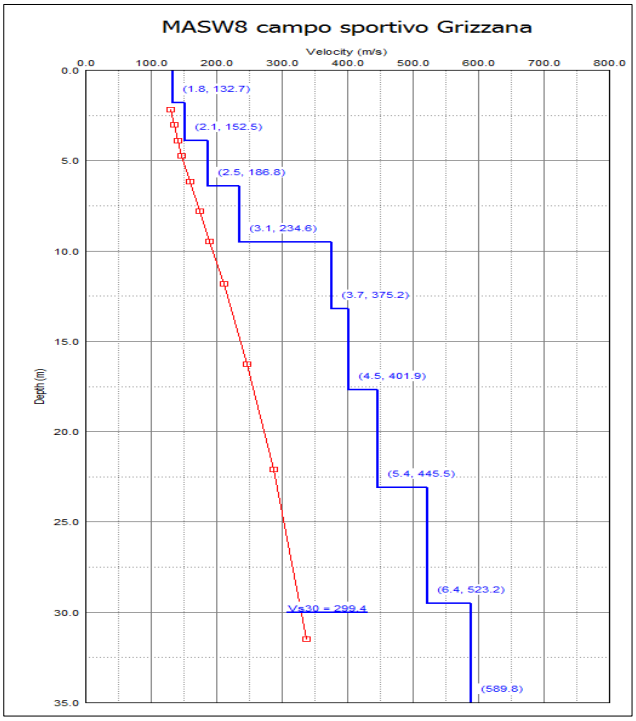
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.8	1.8	132.7
2	3.9	2.1	152.5
3	6.4	2.5	186.8
4	9.5	3.1	234.6
5	13.2	3.7	375.2
6	17.7	4.5	401.9
7	23.1	5.4	445.5
8	29.5	6.4	523.2
9	∞	∞	589.8

V_{S30} = 299.4 ± 10% [m/s]

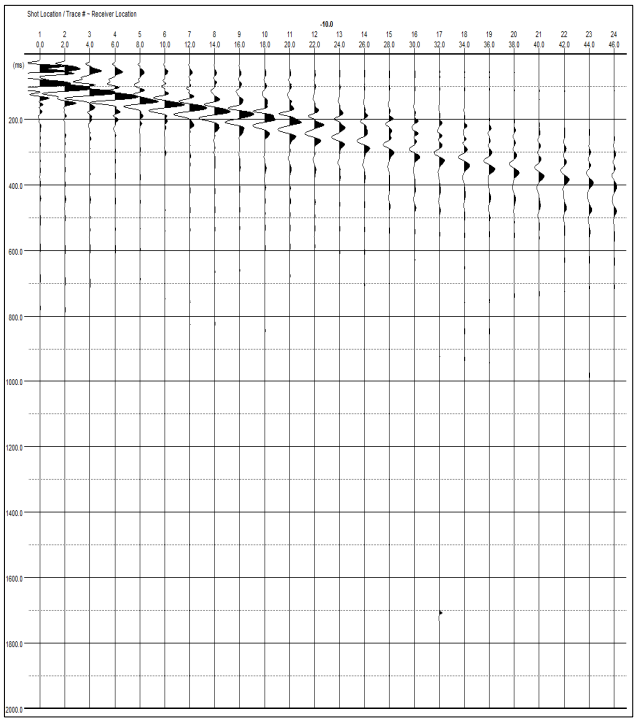
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

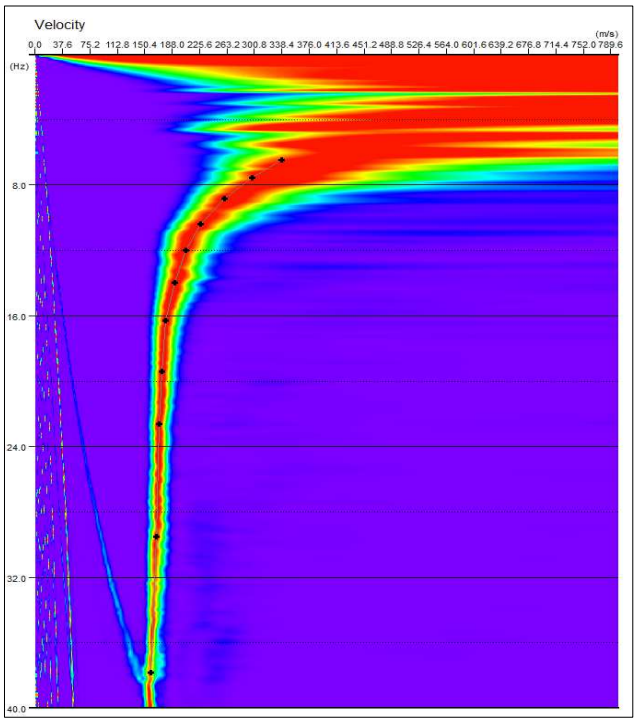
Via Panoramica Pioppe di Salvaro – Comune di Grizzana Morandi (BO) – 037031L9MASW9

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	2,0	46,0	0,5/2,0	2,0/32,0

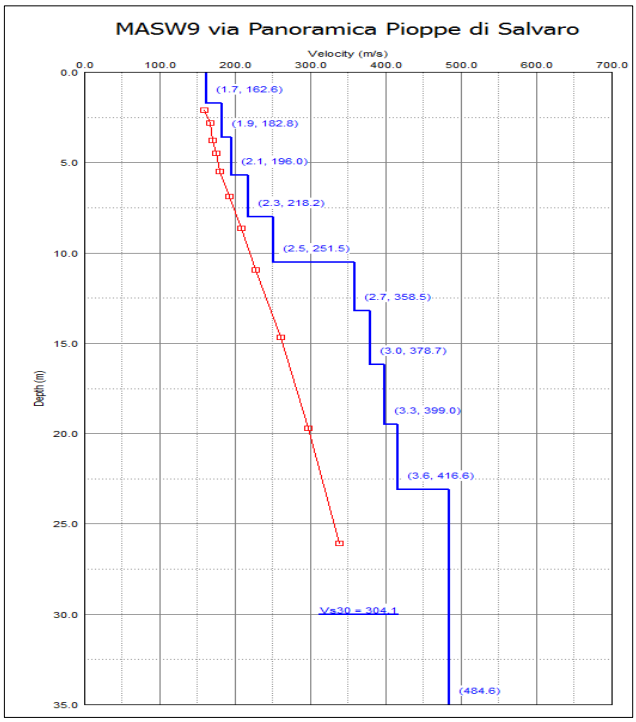
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.7	1.7	162.6
2	3.6	1.9	182.8
3	5.7	2.1	196.0
4	8.0	2.3	218.2
5	10.5	2.5	251.5
6	13.2	2.7	358.5
7	16.2	3.0	378.7
8	19.5	3.3	399.0
9	23.1	3.6	416.6
10	∞	∞	484.6

V_{S30} = 304.1 ± 10% [m/s]

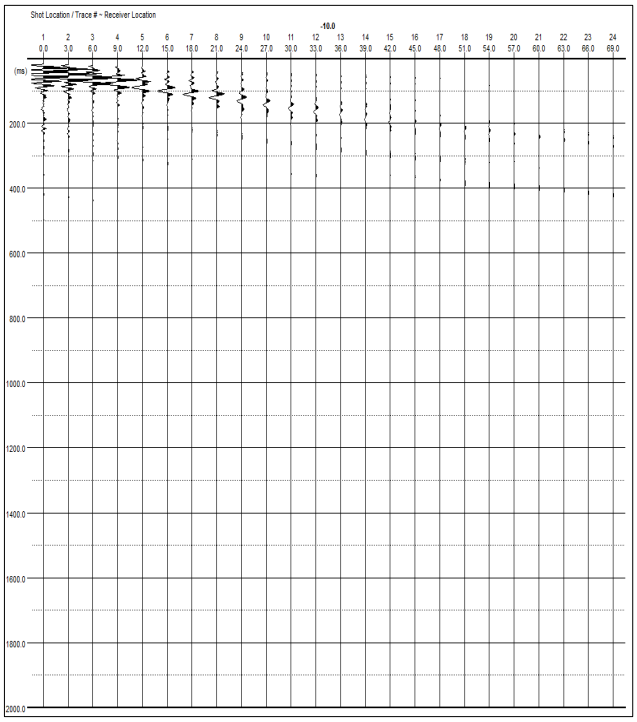
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ATTIVA/PASSIVA MASW/Re.Mi.

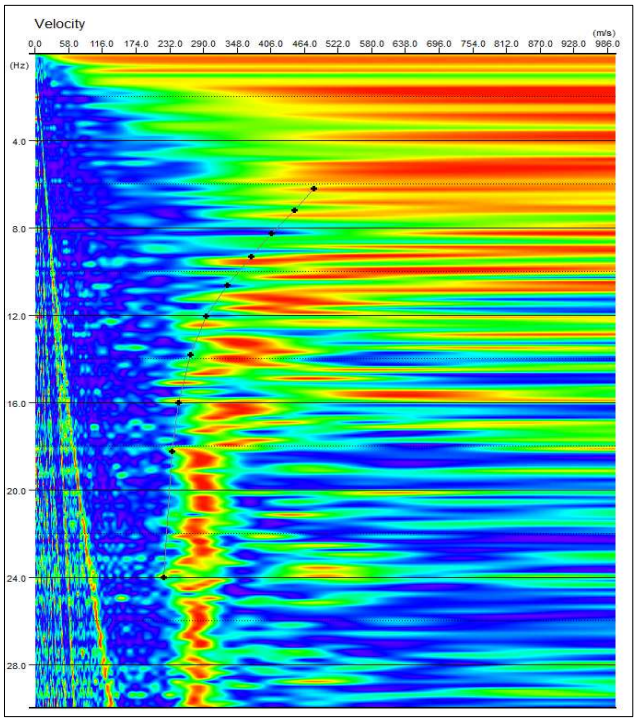
Pian di Setta – Comune di Grizzana Morandi (BO) – 037031L10MASW10

n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	3,0	69,0	0,5/2,0	2,0/32,0

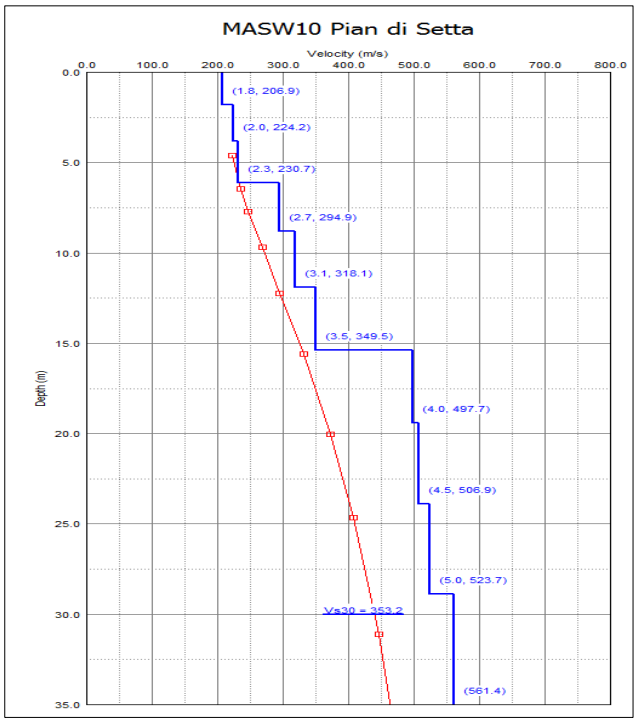
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.8	1.8	206.9
2	3.8	2.0	224.2
3	6.1	2.3	230.7
4	8.8	2.7	294.9
5	11.9	3.1	318.1
6	15.4	3.5	349.5
7	19.4	4.0	497.7
8	23.9	4.5	506.9
9	28.9	5.0	523.7
10	∞	∞	561.4

V_{S30} = 353.2 ± 10% [m/s]

Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

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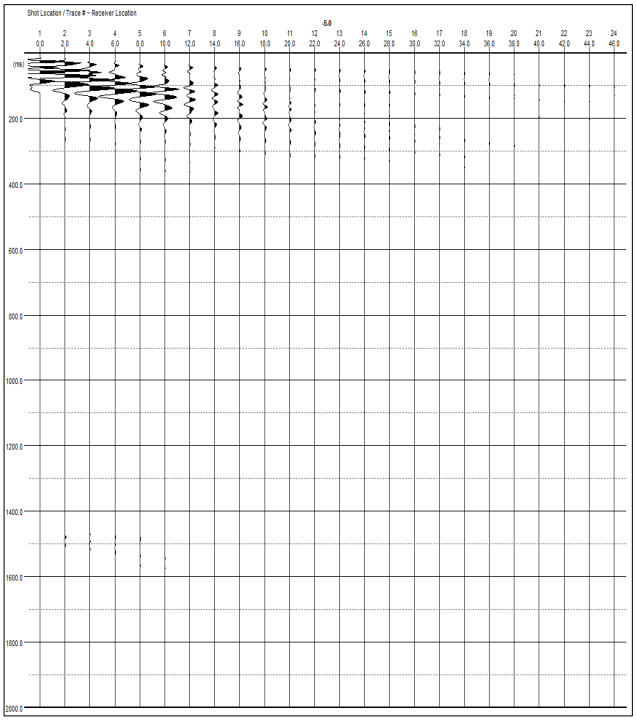
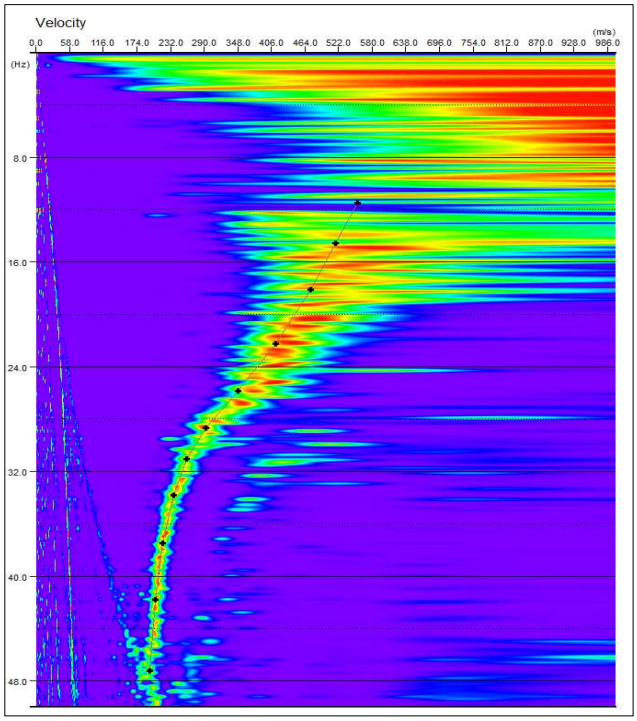
n° tracce	Δx (m)	L tot (m)	Δt (ms)	T (s)
15	2,0	46,0	0,5/2,0	2,0/32,0

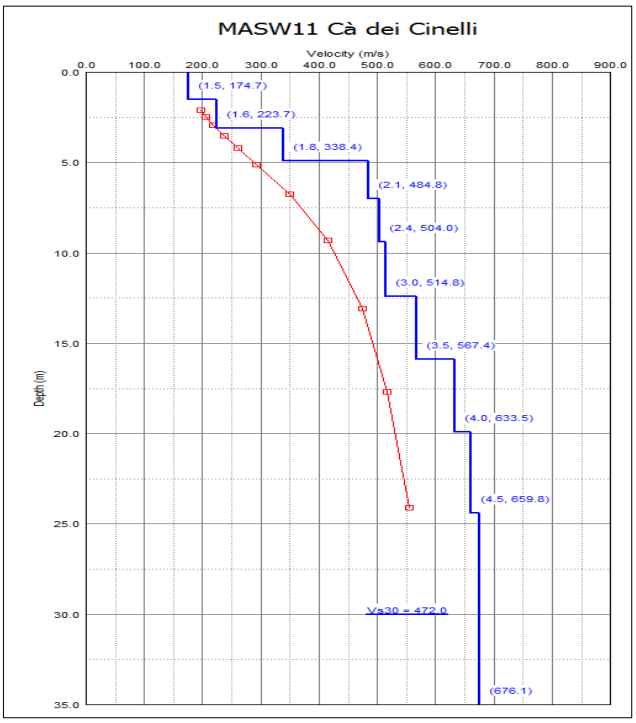
Δx: interdistanza geofonica; L tot: lunghezza profilo; Δt: passo di campionamento; T: durata registrazione.



Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



Spettro di potenza nel dominio *f–v* e Picking della curva sperimentali delle onde R (croci nere).



Modello di sottosuolo (1D) descritti in termini di Vs e spessore dei sismostrati (spezzata blu) e curva di dispersione sperimentale delle onde R (curva rossa).

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	1.5	1.5	174.7
2	3.1	1.6	223.7
3	4.9	1.8	338.4
4	7.0	2.1	484.8
5	9.4	2.4	504.0
6	12.4	3.0	514.8
7	15.9	3.5	567.4
8	19.9	4.0	633.5
9	24.4	4.5	659.8
10	∞	∞	676.1

V_{S30} = 472.0 ± 10% [m/s]

Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.