

2023

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F11
ALLEGATO A

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Piano di Governo del Territorio

COMUNE DI TREVIGLIO
PROVINCIA DI BERGAMO



COMUNE DI TREVIGLIO

Provincia di Bergamo



data:
20.01.2023

agg.to:
///

archivio:
R02/23_c77



Antonio Galizzi Geologo

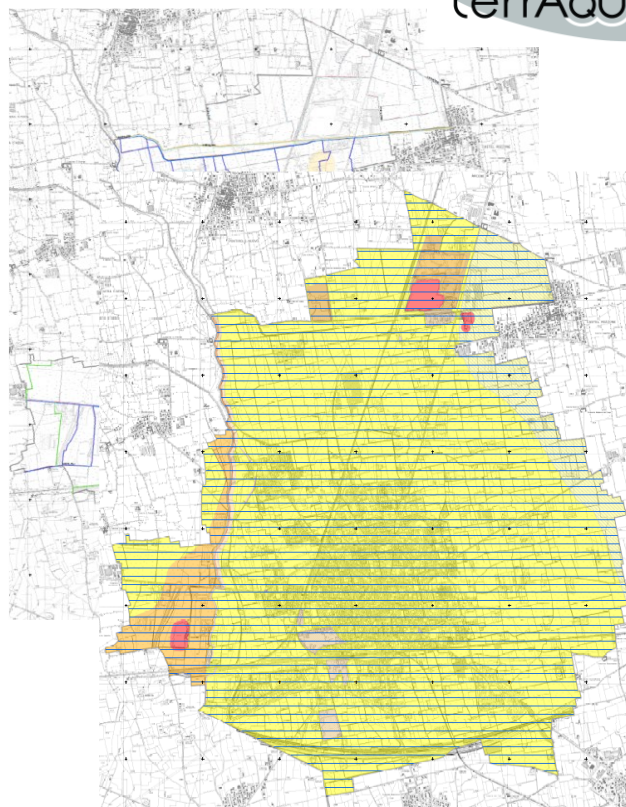
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PIANO DI GOVERNO DEL TERRITORIO

**AGGIORNAMENTO DELLO STUDIO
GEOLOGICO, IDROGEOLOGICO E
SISMICO DEL TERRITORIO
COMUNALE DI TREVIGLIO**

**ALLEGATO A
INDAGINI SISMICHE**

TREVIGLIO2, VIA DEI CAPPUCCINI 1

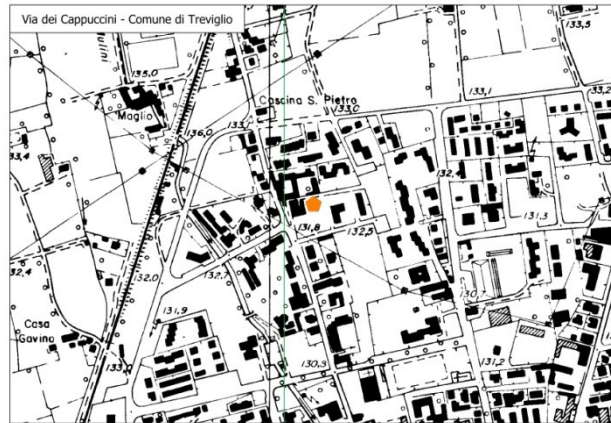
Start recording: 20/02/20 09:31:37 End recording: 20/02/20 09:51:38
Trace length: 0h20'00". Analyzed 75% trace (manual window selection)
Sampling rate: 128 Hz

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

Array geometry (x): 0.0 3.0 6.0 9.0 12.0 15.0 18.0 21.0 24.0 27.0 30.0 33.0 36.0 39.0 42.0 45.0 48.0 m.

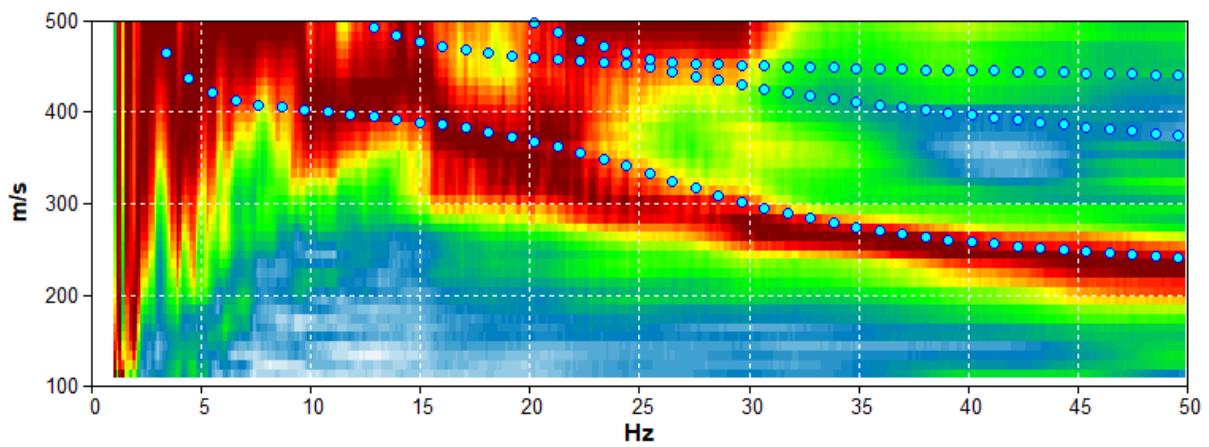


Foto



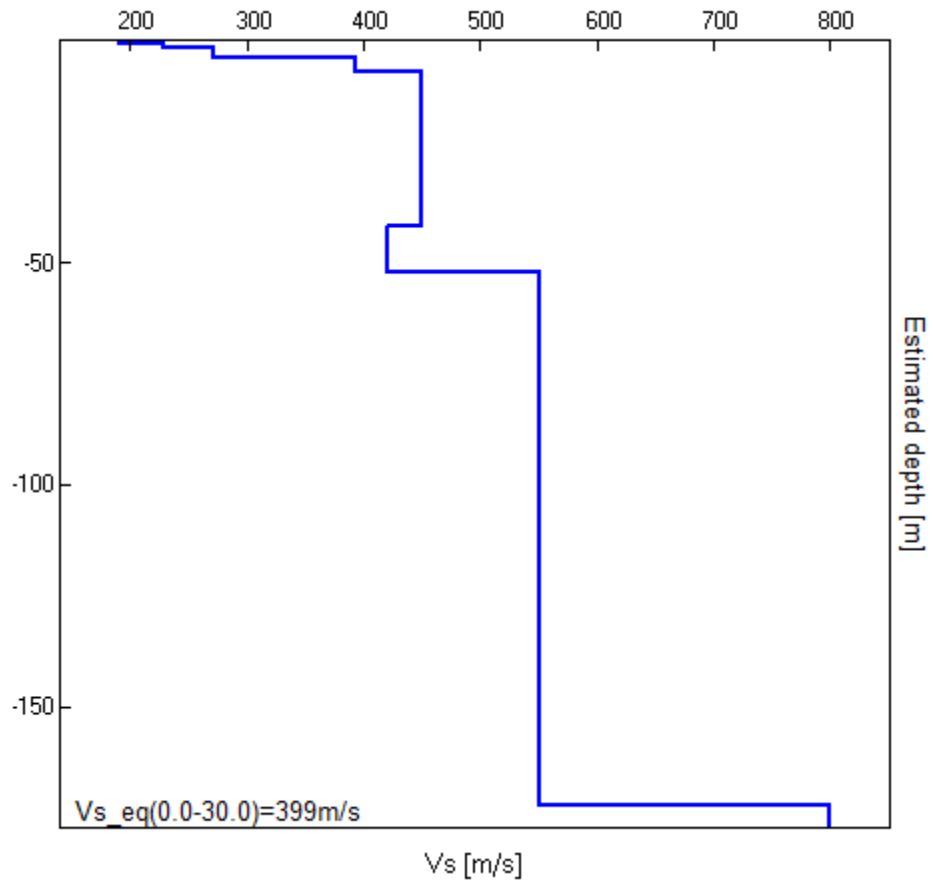
Estratto mappa

MODELLED RAYLEIGH WAVE PHASE VELOCITY DISPERSION CURVE



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.80	0.80	190	0.45
1.50	0.70	228	0.42
4.00	2.50	272	0.42
7.00	3.00	393	0.42
42.00	35.00	450	0.45
52.00	10.00	420	0.46
172.00	120.00	550	0.45
inf.	inf.	800	0.45

Vs_eq(0.0-30.0)=399m/s



TREVIGLIO2, VIA DEI CAPPUCCINI 1

Instrument: TEN-0031/01-07

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 20/02/20 09:31:37 End recording: 20/02/20 09:51:38

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h20'00". Analyzed 75% trace (manual window selection)

Sampling rate: 128 Hz

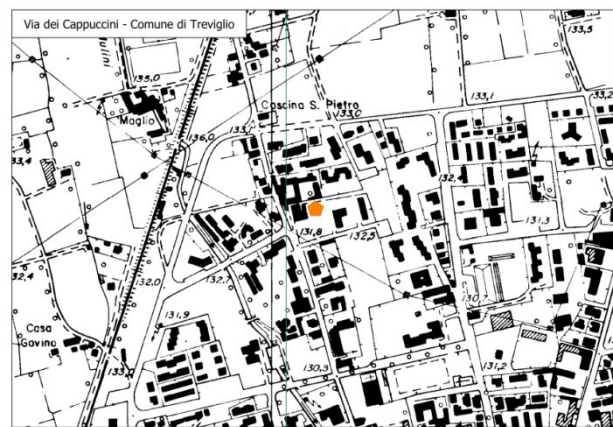
Window size: 20 s

Smoothing type: Triangular window

Smoothing: 10%



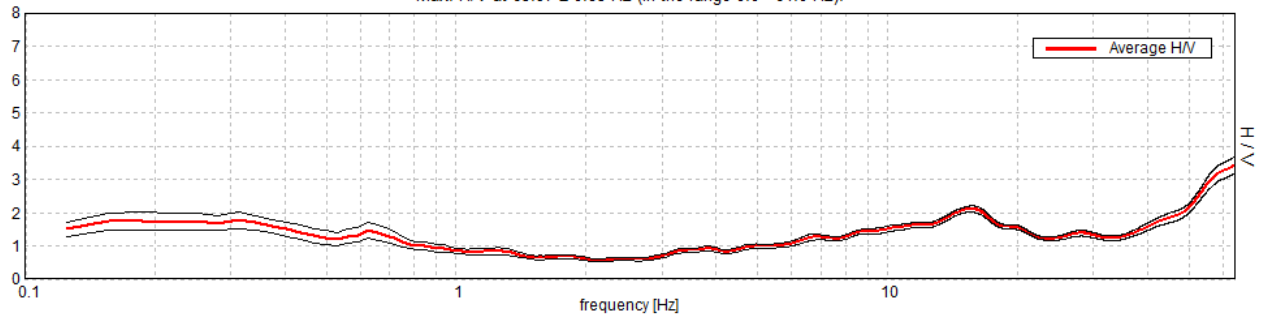
Foto



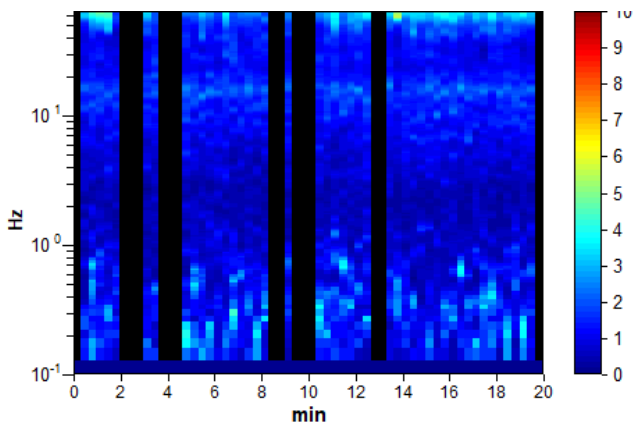
Estratto mappa

HORIZONTAL TO VERTICAL SPECTRAL RATIO

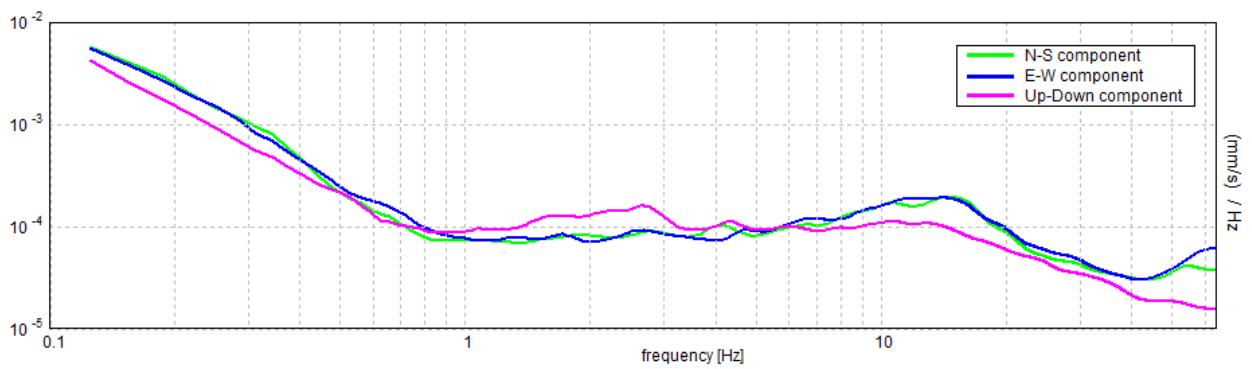
Max. H/V at 63.97 ± 0.83 Hz (in the range 0.0 - 64.0 Hz).



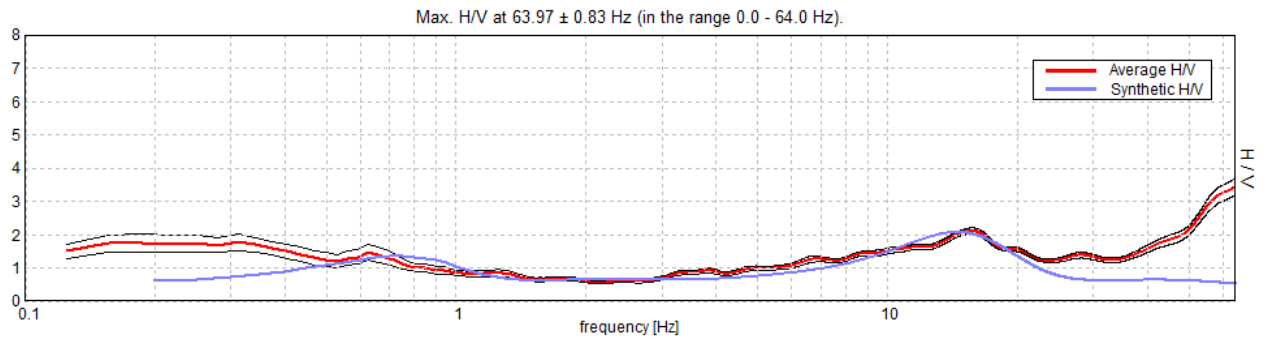
H/V TIME HISTORY



SINGLE COMPONENT SPECTRA

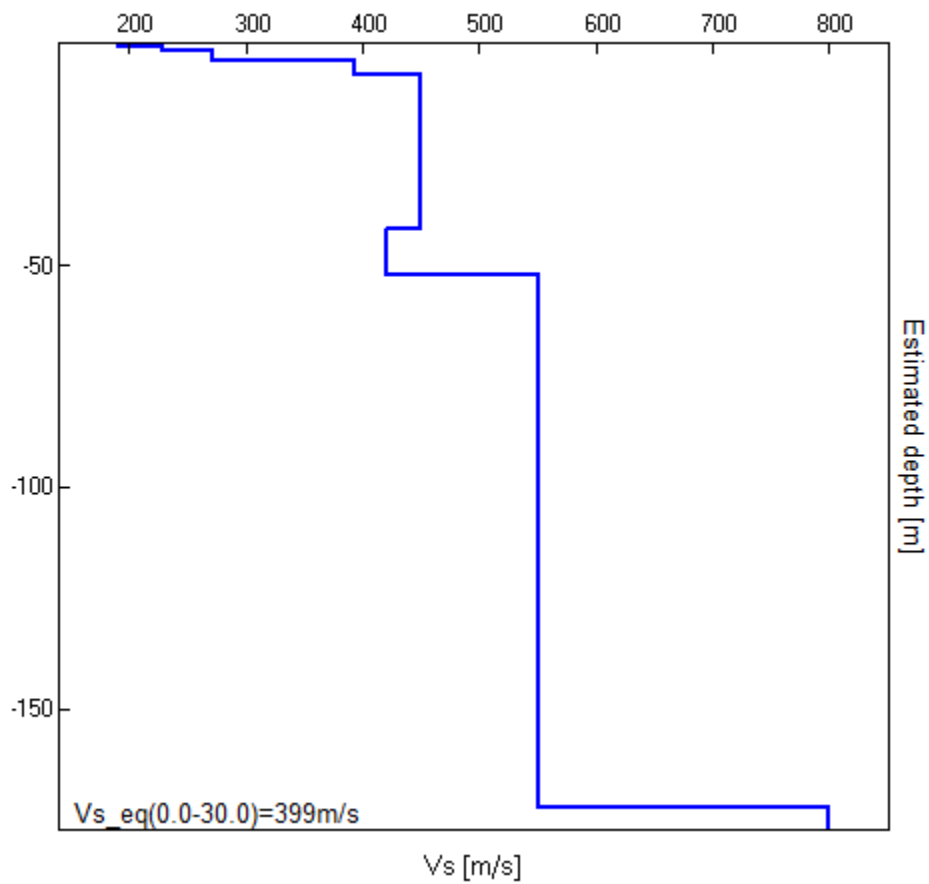


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.80	0.80	190	0.45
1.50	0.70	228	0.42
4.00	2.50	272	0.42
7.00	3.00	393	0.42
42.00	35.00	450	0.45
52.00	10.00	420	0.46
172.00	120.00	550	0.45
inf.	inf.	800	0.45

Vs_eq(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 63.97 ± 0.83 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	$63.97 > 0.50$	OK	
$n_c(f_0) > 200$	$57571.9 > 200$	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 1026 times	OK	

Criteria for a clear H/V peak

[At least 5 out of 6 should be fulfilled]

Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$	42.281 Hz	OK	
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	$3.44 > 2$	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.01301 < 0.05$	OK	
$\sigma_f < \varepsilon(f_0)$	$0.83255 < 3.19844$	OK	
$\sigma_A(f_0) < \theta(f_0)$	$0.2595 < 1.58$	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
$\sigma_{\log H/V}(f)$	standard deviation of $\log A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for 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 $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

TREVIGLIO2, VIA GIUSSANI 1

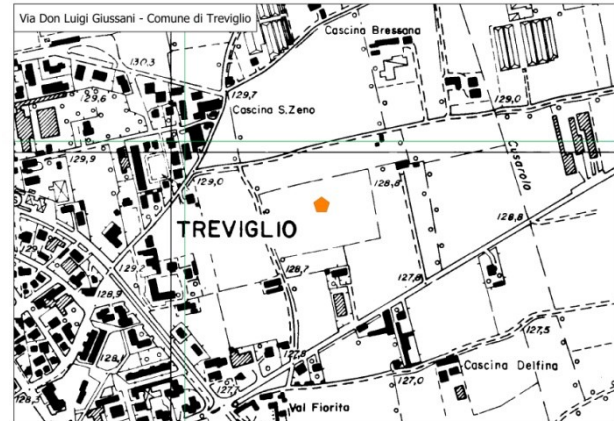
Start recording: 20/02/20 10:23:36 End recording: 20/02/20 10:43:37
Trace length: 0h20'00". Analyzed 85% trace (manual window selection)
Sampling rate: 128 Hz

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

Array geometry (x): 0.0 3.0 6.0 9.0 12.0 15.0 18.0 21.0 24.0 27.0 30.0 33.0 36.0 39.0 42.0 45.0 48.0 m.

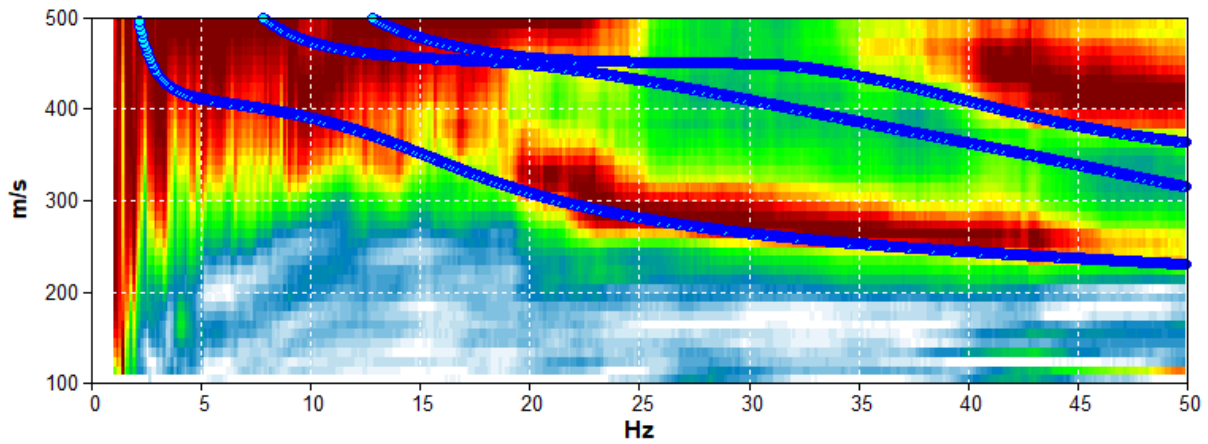


Foto



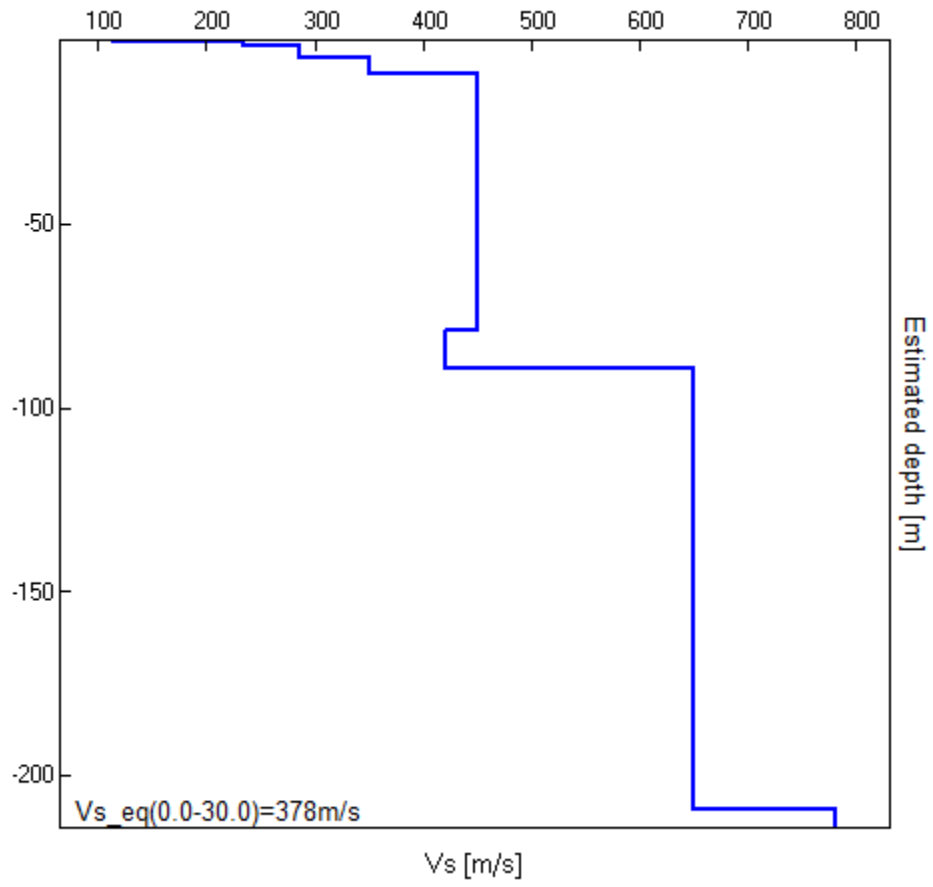
Estratto mappa

MODELLED RAYLEIGH WAVE PHASE VELOCITY DISPERSION CURVE



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.60	0.60	115	0.42
1.60	1.00	235	0.42
4.60	3.00	286	0.42
9.10	4.50	350	0.45
19.10	10.00	450	0.45
79.10	60.00	450	0.45
89.10	10.00	420	0.45
209.10	120.00	650	0.42
inf.	inf.	780	0.42

$V_{s_eq}(0.0-30.0)=378\text{m/s}$



TREVIGLIO2, VIA GIUSSANI 1

Instrument: TEN-0031/01-07

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 20/02/20 10:23:36 End recording: 20/02/20 10:43:37

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h20'00". Analyzed 85% trace (manual window selection)

Sampling rate: 128 Hz

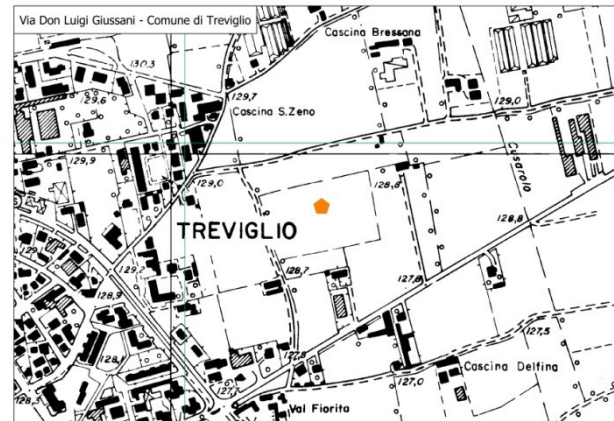
Window size: 20 s

Smoothing type: Triangular window

Smoothing: 10%



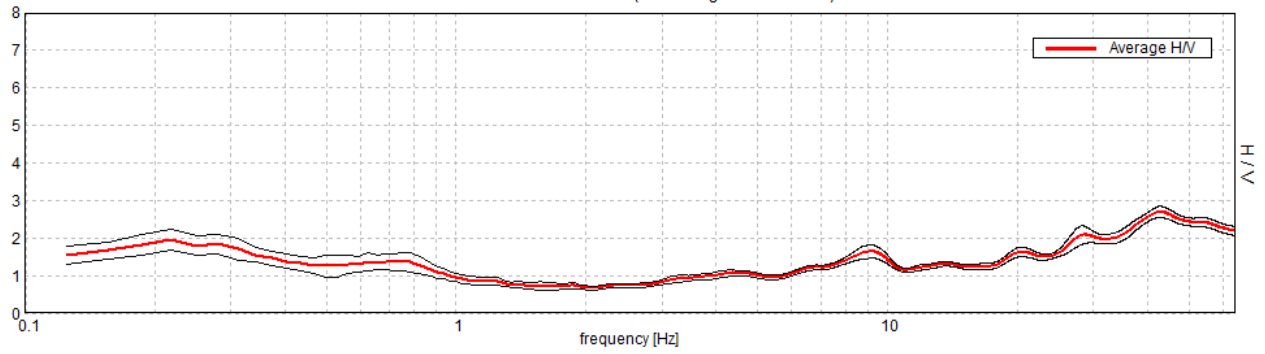
Foto



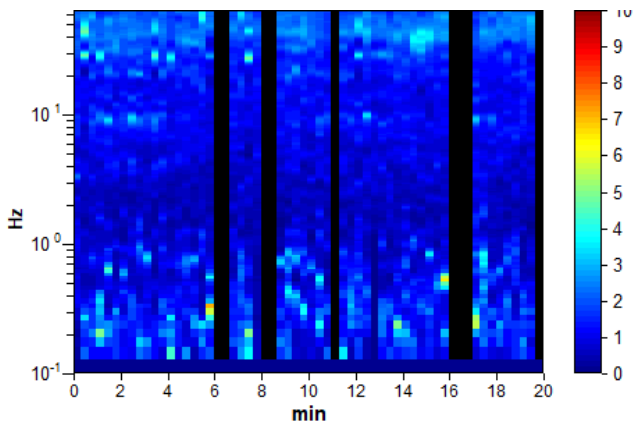
Estratto mappa

HORIZONTAL TO VERTICAL SPECTRAL RATIO

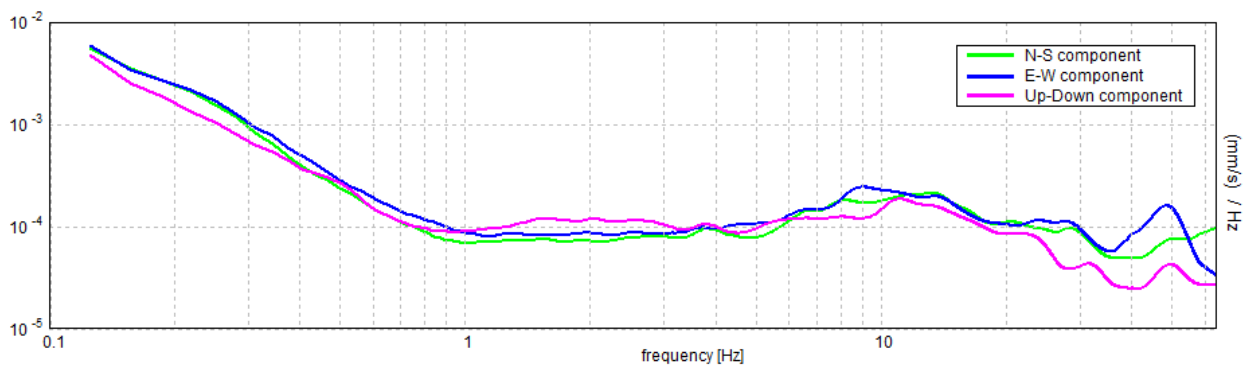
Max. H/V at 42.81 ± 2.8 Hz (in the range 0.0 - 64.0 Hz).



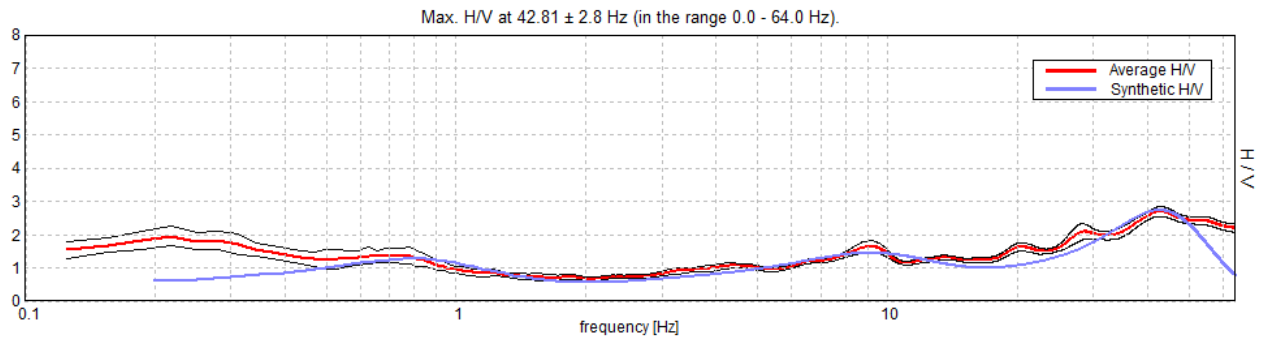
H/V TIME HISTORY



SINGLE COMPONENT SPECTRA

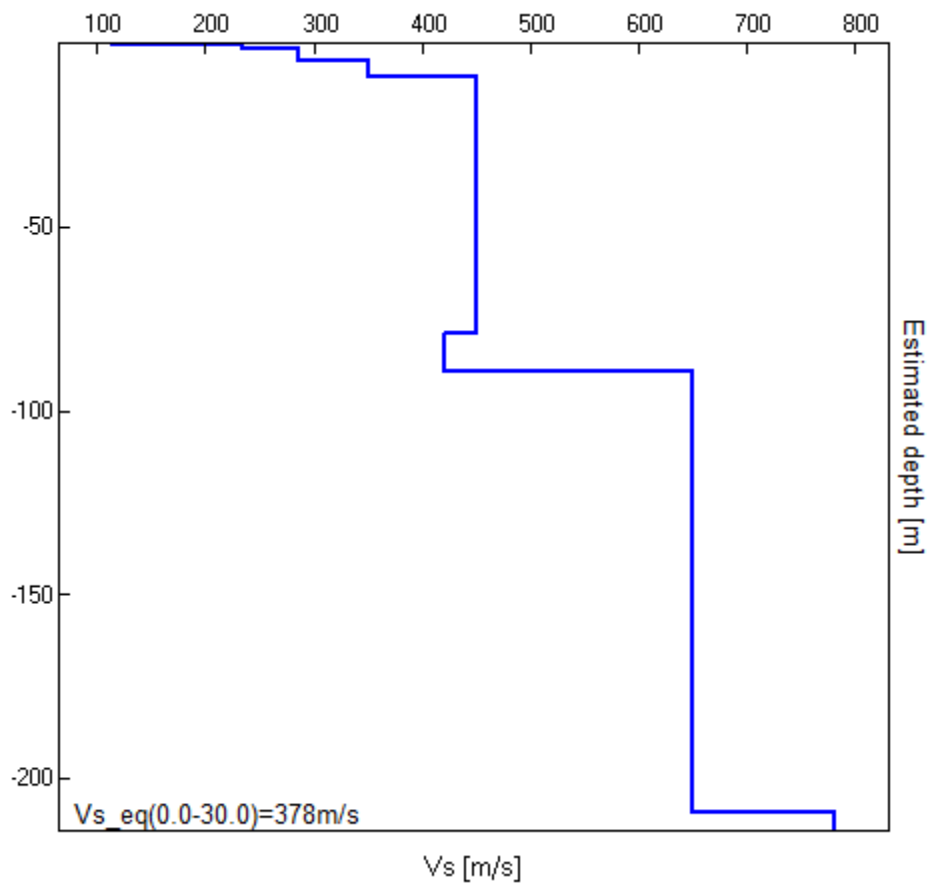


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.60	0.60	115	0.42
1.60	1.00	235	0.42
4.60	3.00	286	0.42
9.10	4.50	350	0.45
19.10	10.00	450	0.45
79.10	60.00	450	0.45
89.10	10.00	420	0.45
209.10	120.00	650	0.42
inf.	inf.	780	0.42

Vs_eq(0.0-30.0)=378m/s



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

Max. H/V at 42.81 ± 2.8 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	42.81 > 0.50	OK	
$n_c(f_0) > 200$	43668.8 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 1364 times	OK	

Criteria for a clear H/V peak

[At least 5 out of 6 should be fulfilled]

Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$	18.313 Hz	OK	
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.70 > 2	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.0653 < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	2.79553 < 2.14063		NO
$\sigma_A(f_0) < \theta(f_0)$	0.1516 < 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
$\sigma_{\log H/V}(f)$	standard deviation of $\log A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for 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 $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

TREVIGLIO2, CIMITERO 1

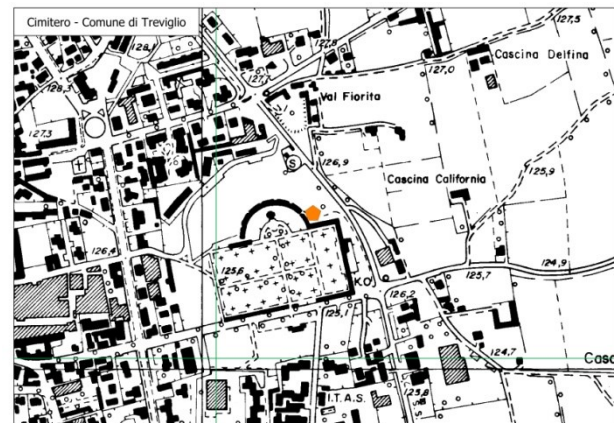
Start recording: 20/02/20 11:08:37 End recording: 20/02/20 11:28:37
Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling rate: 128 Hz

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

Array geometry (x): 0.0 3.0 6.0 9.0 12.0 15.0 18.0 21.0 24.0 27.0 30.0 33.0 36.0 39.0 42.0 45.0 48.0 m.

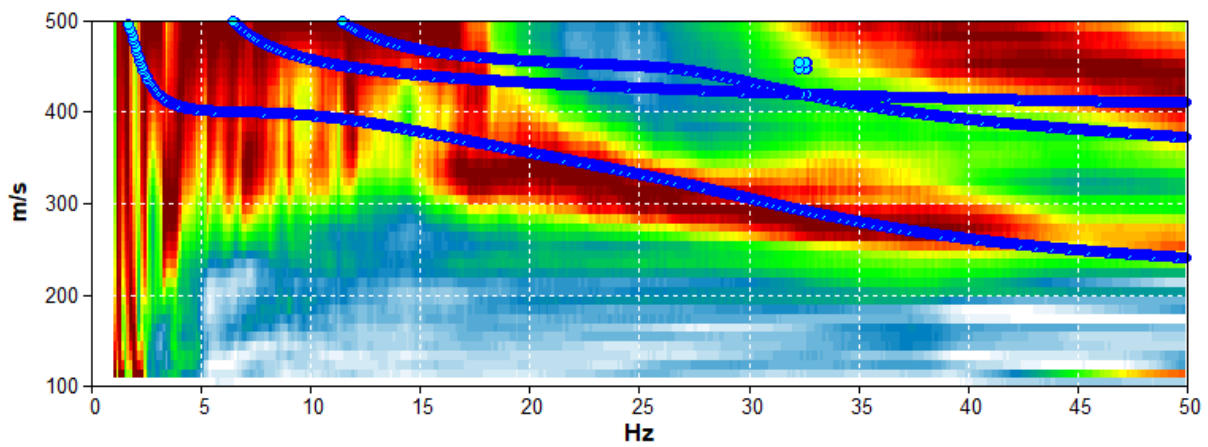


Foto



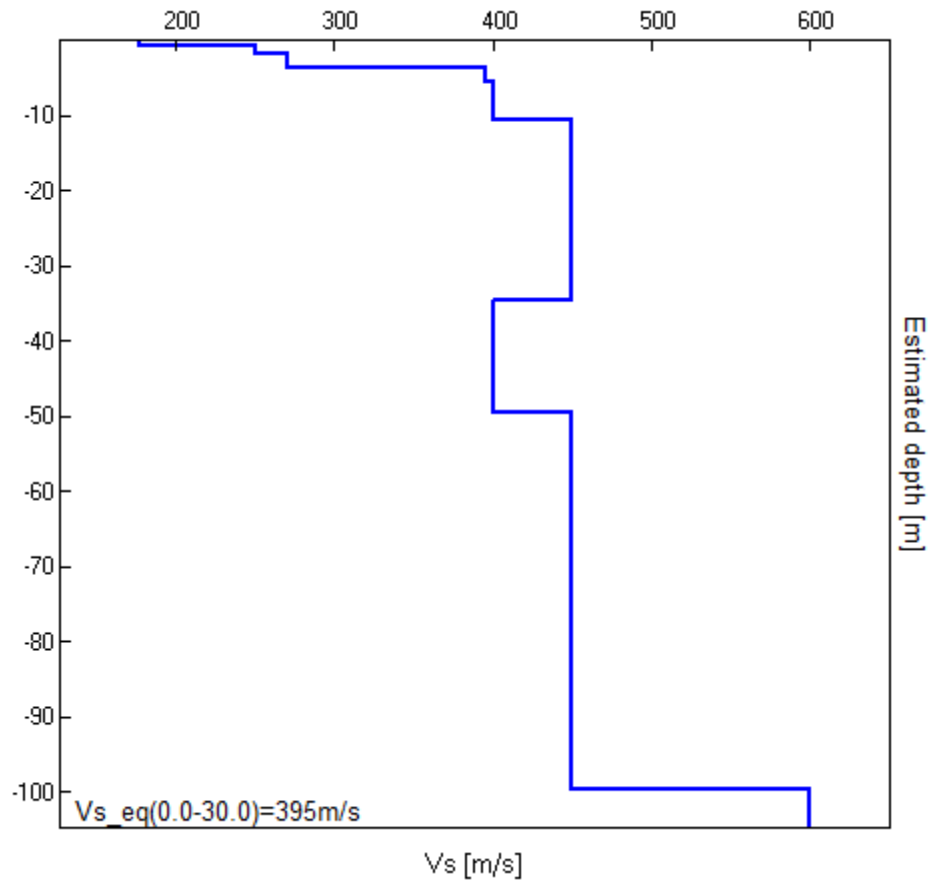
Estratto mappa

MODELLED RAYLEIGH WAVE PHASE VELOCITY DISPERSION CURVE



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.80	0.80	177	0.42
1.80	1.00	250	0.42
3.60	1.80	270	0.42
5.60	2.00	395	0.45
10.60	5.00	400	0.44
34.60	24.00	450	0.46
49.60	15.00	400	0.46
99.60	50.00	450	0.46
inf.	inf.	600	0.42

Vs_eq(0.0-30.0)=395m/s



TREVIGLIO2, CIMITERO 1

Instrument: TEN-0031/01-07

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 20/02/20 11:08:37 End recording: 20/02/20 11:28:37

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.

Sampling rate: 128 Hz

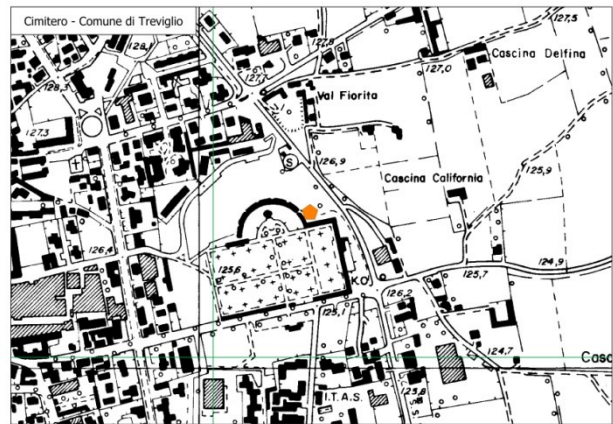
Window size: 20 s

Smoothing type: Triangular window

Smoothing: 10%



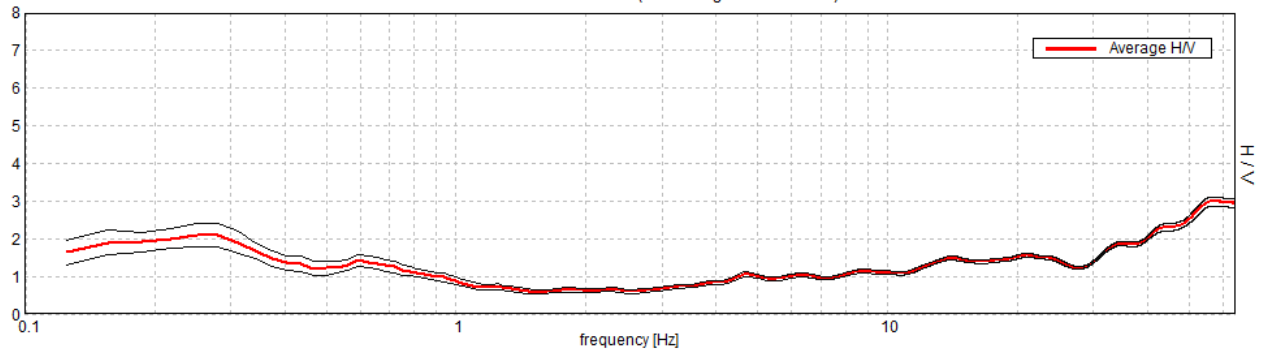
Foto



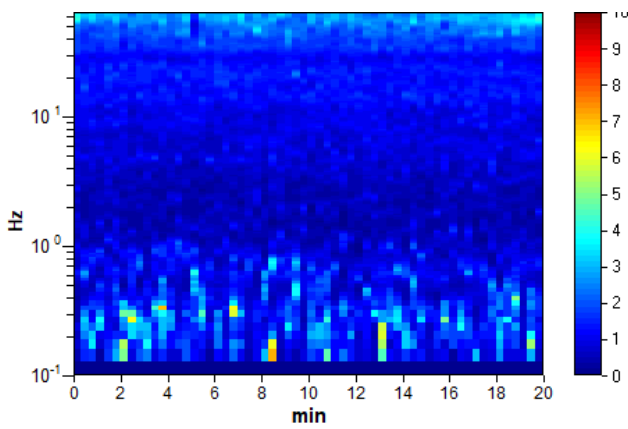
Estratto mappa

HORIZONTAL TO VERTICAL SPECTRAL RATIO

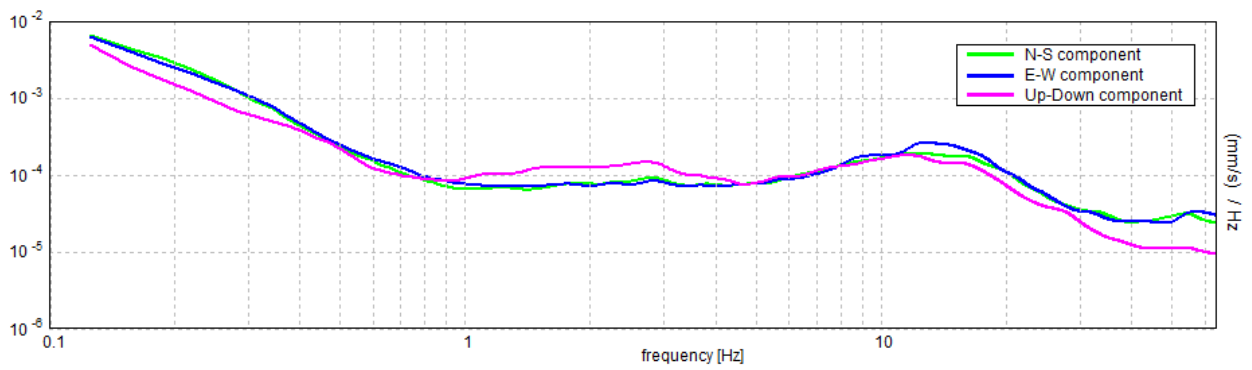
Max. H/V at 56.88 ± 3.78 Hz (in the range 0.0 - 64.0 Hz).



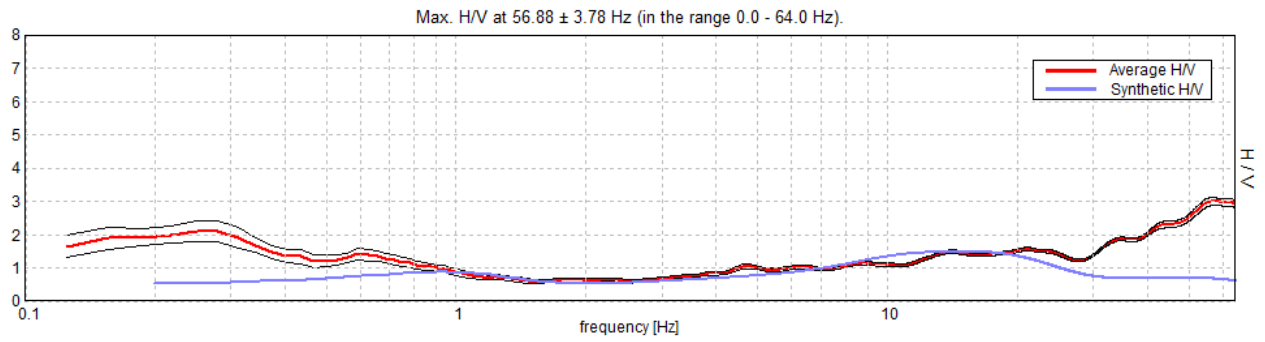
H/V TIME HISTORY



SINGLE COMPONENT SPECTRA

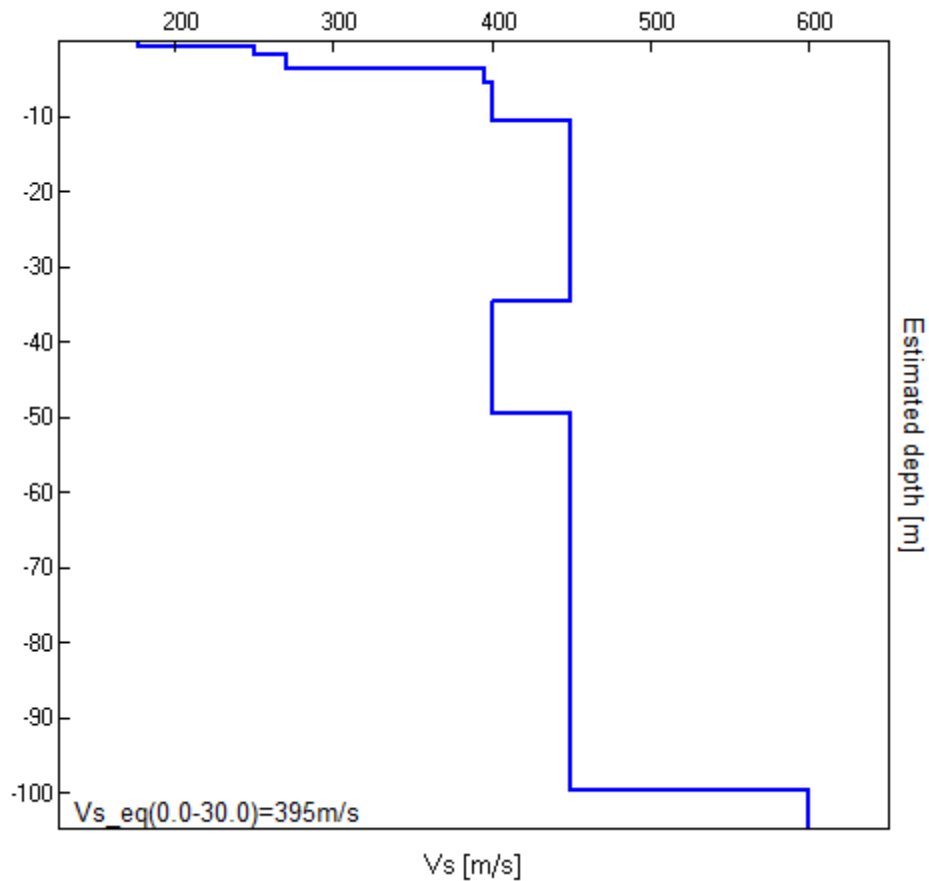


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.80	0.80	177	0.42
1.80	1.00	250	0.42
3.60	1.80	270	0.42
5.60	2.00	395	0.45
10.60	5.00	400	0.44
34.60	24.00	450	0.46
49.60	15.00	400	0.46
99.60	50.00	450	0.46
inf.	inf.	600	0.42

Vs_eq(0.0-30.0)=395m/s



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

Max. H/V at 56.88 ± 3.78 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	56.88 > 0.50	OK	
$n_c(f_0) > 200$	68250.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 1139 times	OK	

Criteria for a clear H/V peak

[At least 5 out of 6 should be fulfilled]

Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$	30.75 Hz	OK	
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.99 > 2	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.06649 < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	$3.78171 < 2.84375$		NO
$\sigma_A(f_0) < \theta(f_0)$	$0.1184 < 1.58$	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
$\sigma_{\log H/V}(f)$	standard deviation of $\log A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for 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 $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

TREVIGLIO, T04 – Via Vesture (Fondazione Anni Sereni)

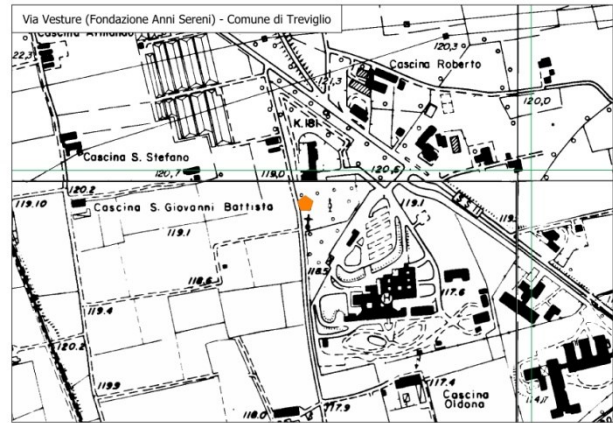
Start recording: 20/02/2012:23:06 End recording: 20/02/20 12:43:06
Trace length: 0h20'00". Analyzed 83% trace (manual window selection)
Sampling rate: 128 Hz

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

Array geometry (x): 0.0 3.0 6.0 9.0 12.0 15.0 18.0 21.0 24.0 27.0 30.0 33.0 36.0 39.0 42.0 45.0 48.0 m.

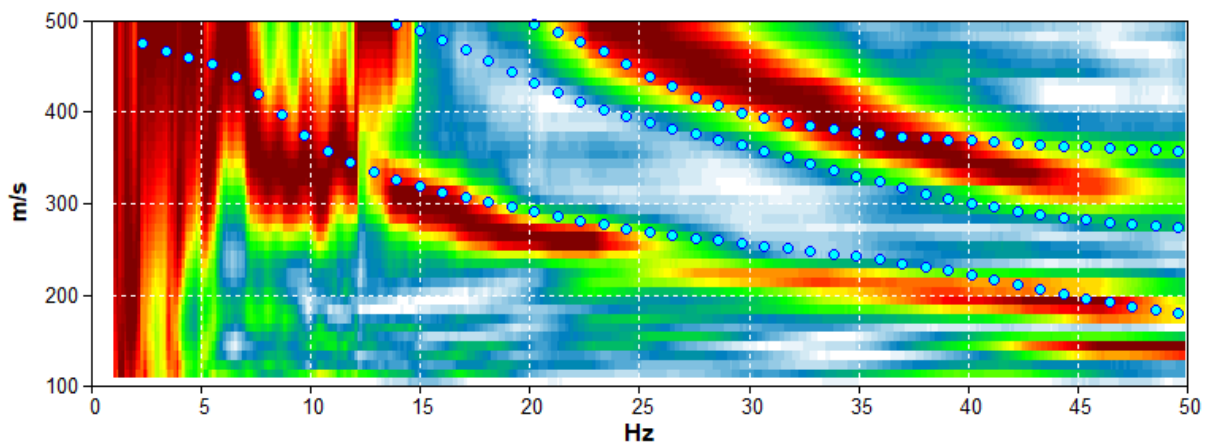


Foto



Estratto mappa

MODELLED RAYLEIGH WAVE PHASE VELOCITY DISPERSION CURVE



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
1.50	1.50	153	0.42
6.00	4.50	290	0.42
18.00	12.00	370	0.46
21.00	3.00	479	0.44
71.00	50.00	520	0.44
91.00	20.00	490	0.44
211.00	120.00	510	0.42
inf.	inf.	850	0.42

Vs_eq(0.0-30.0)=369m/s

TREVIGLIO, T04 - Via Vesture (Fondazione Anni Sereni)

Instrument: TEN-0031/01-07

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 20/02/2012:03:06 End recording: 20/02/20 12:23:06

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h20'00". Analyzed 83% trace (manual window selection)

Sampling rate: 128 Hz

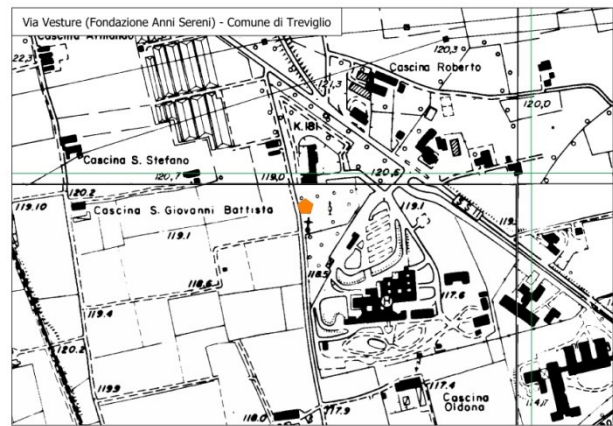
Window size: 20 s

Smoothingtype: Triangularwindow

Smoothing: 10%



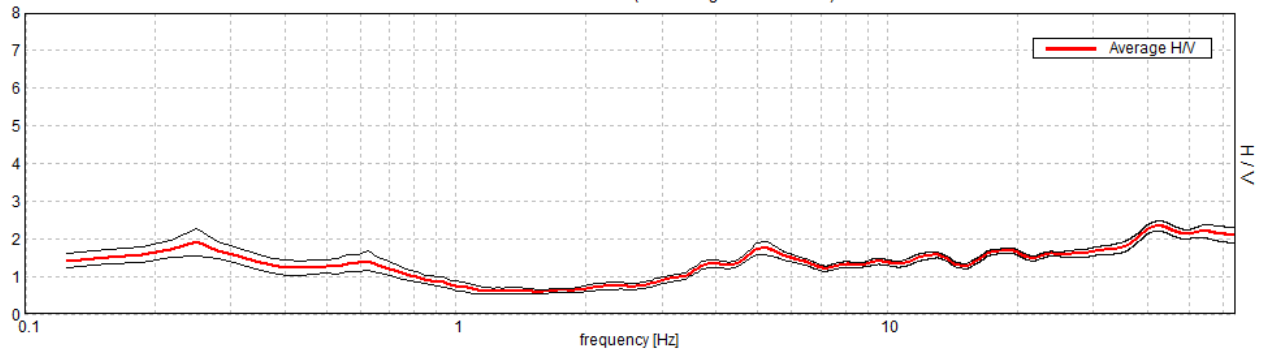
Foto



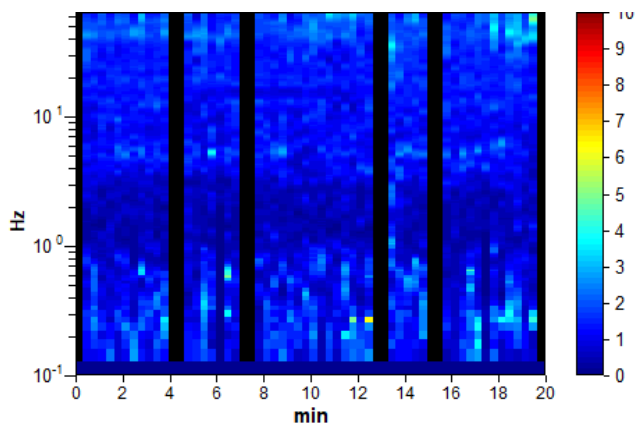
Estratto mappa

HORIZONTAL TO VERTICAL SPECTRAL RATIO

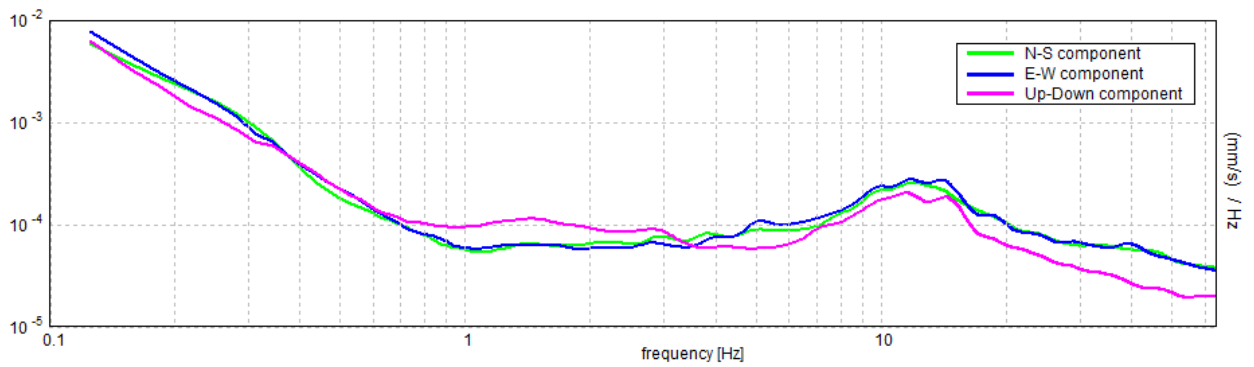
Max. H/V at 42.5 ± 0.33 Hz (in the range 0.0 - 64.0 Hz).



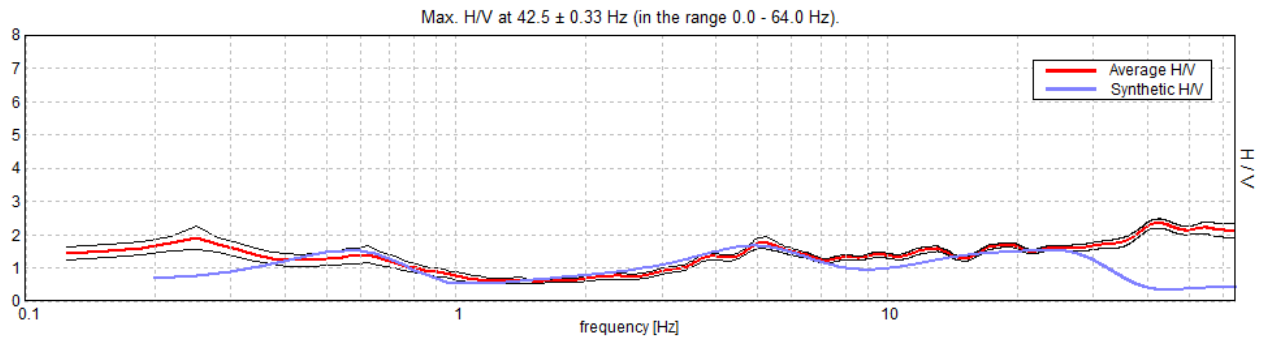
H/V TIME HISTORY



SINGLE COMPONENT SPECTRA

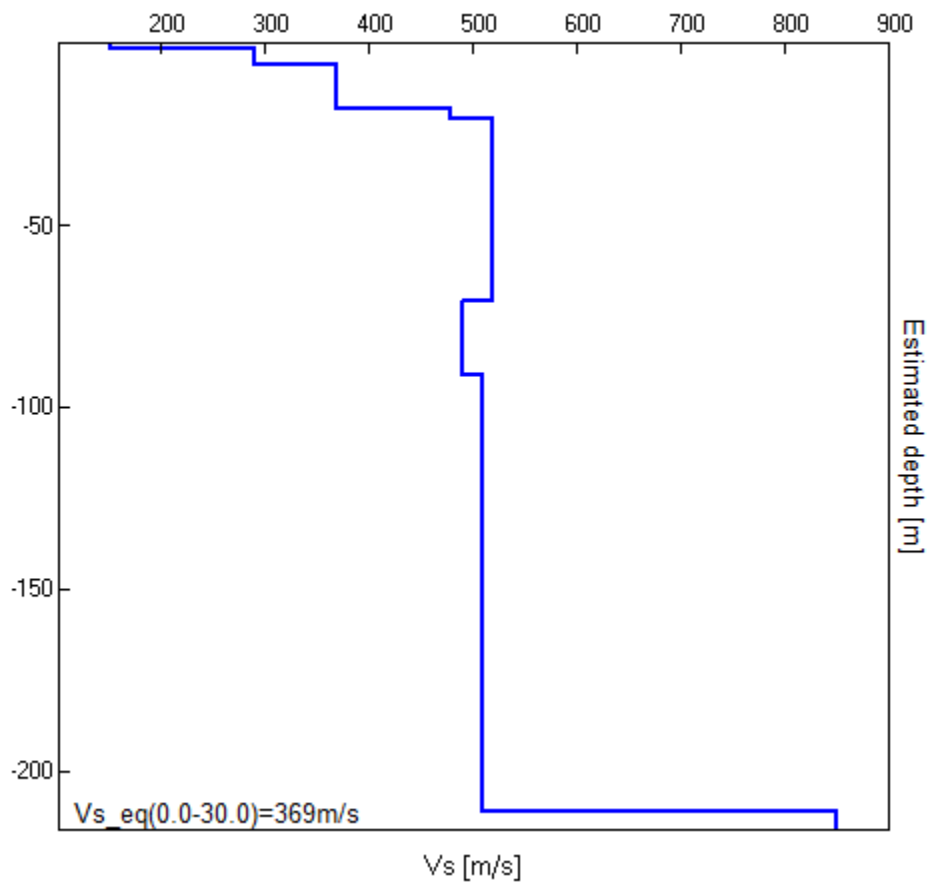


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
1.50	1.50	153	0.42
6.00	4.50	290	0.42
18.00	12.00	370	0.46
21.00	3.00	479	0.44
71.00	50.00	520	0.44
91.00	20.00	490	0.44
211.00	120.00	510	0.42
inf.	inf.	850	0.42

Vs_eq(0.0-30.0)=369m/s



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

Max. H/V at 42.5 ± 0.33 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	$42.50 > 0.50$	OK	
$n_c(f_0) > 200$	$42500.0 > 200$	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 1369 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	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.00772 < 0.05$	OK	
$\sigma_f < \varepsilon(f_0)$	$0.32802 < 2.125$	OK	
$\sigma_A(f_0) < \theta(f_0)$	$0.1378 < 1.58$	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
$\sigma_{\log H/V}(f)$	standard deviation of $\log A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for 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 $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

TREVIGLIO, T05_FIERA

Instrument: TEN-0031/01-07

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 20/02/20 14:13:51 End recording: 20/02/20 14:33:51

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h20'00". Analyzed 93% trace (manual window selection)

Sampling rate: 128 Hz

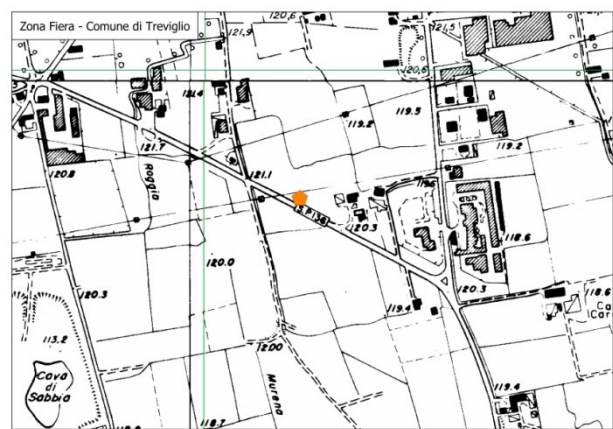
Window size: 20 s

Smoothing type: Triangular window

Smoothing: 10%



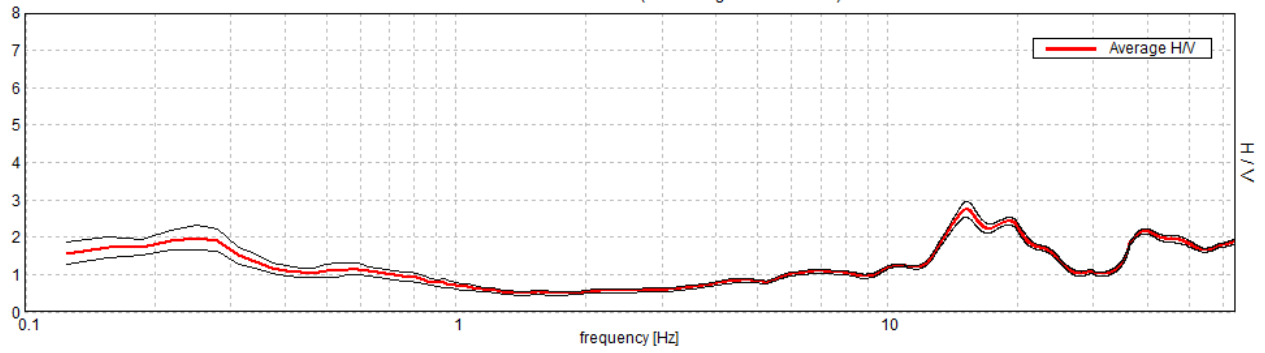
Foto



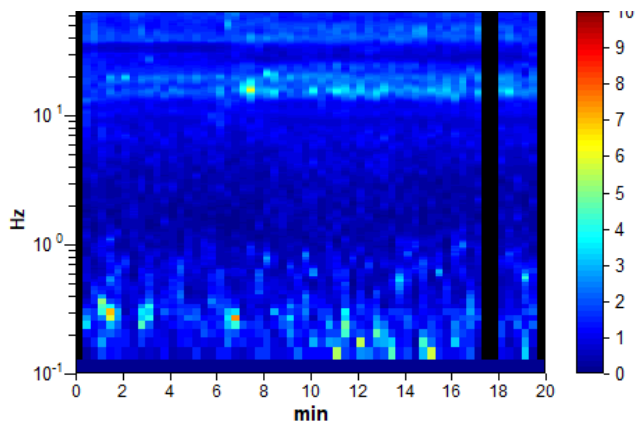
Estratto mappa

HORIZONTAL TO VERTICAL SPECTRAL RATIO

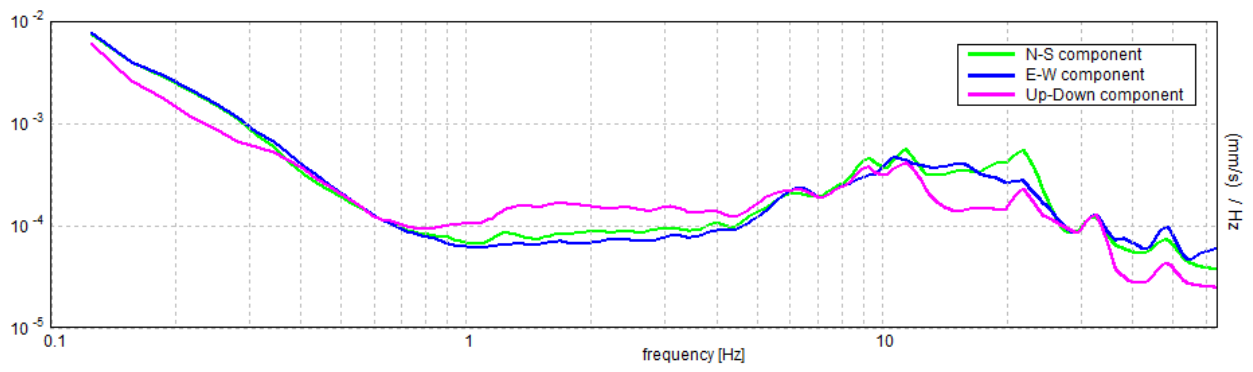
Max. H/V at 15.25 ± 9.17 Hz. (In the range 0.0 - 64.0 Hz).



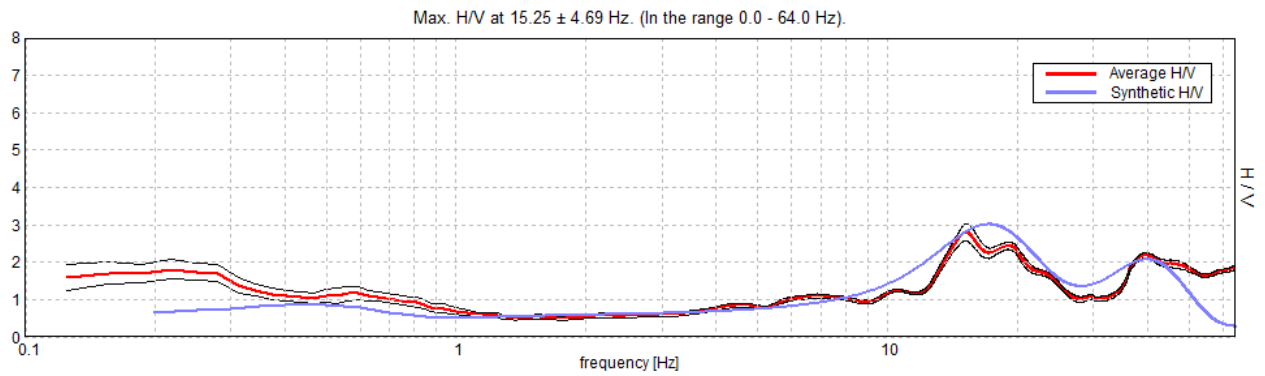
H/V TIME HISTORY



SINGLE COMPONENT SPECTRA

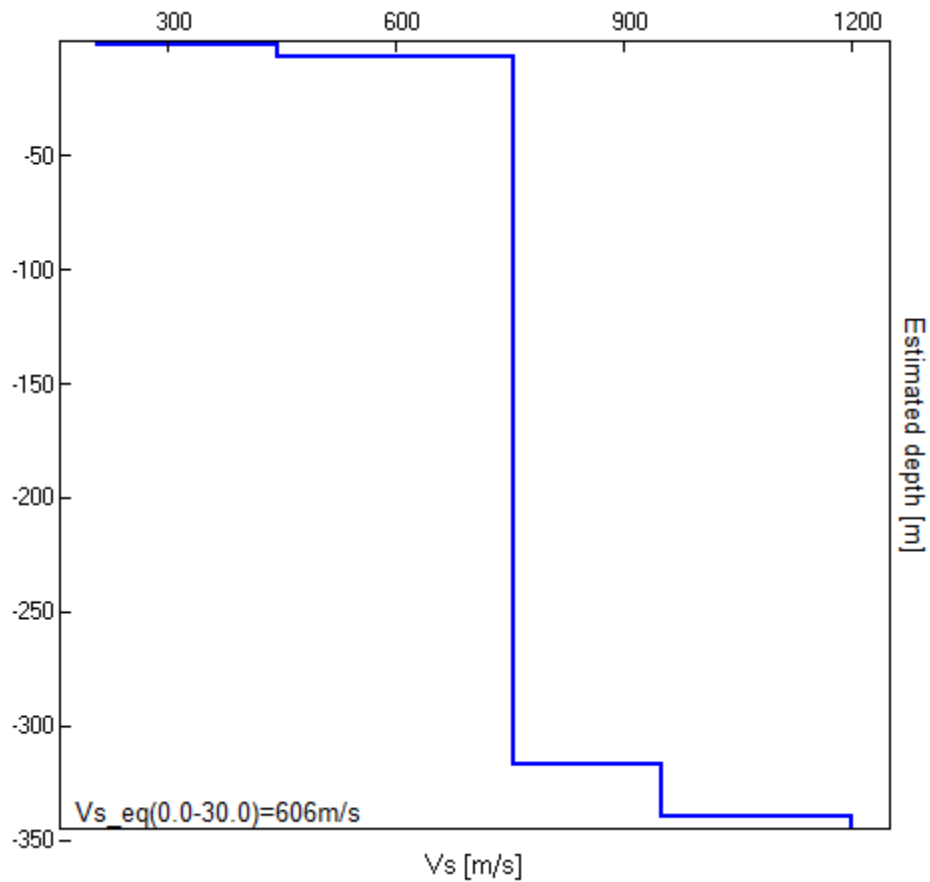


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
1.40	1.40	210	0.42
6.80	5.40	446	0.42
316.80	310.00	755	0.30
339.80	23.00	950	0.10
inf.	inf.	1200	0.40

$V_{s_eq}(0.0-30.0)=606\text{m/s}$



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

Max. H/V at 15.25 ± 9.17 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	15.25 > 0.50	OK	
$n_c(f_0) > 200$	17080.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 733 times	OK	

Criteria for a clear H/V peak

[At least 5 out of 6 should be fulfilled]

Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$	12.469 Hz	OK	
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$	25.094 Hz	OK	
$A_0 > 2$	2.75 > 2	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.60144 < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	9.17195 < 0.7625		NO
$\sigma_A(f_0) < \theta(f_0)$	0.2107 < 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
$\sigma_{\log H/V}(f)$	standard deviation of $\log A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for 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 $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

TREVIGLIO, T06 - PALAFACCHETTI

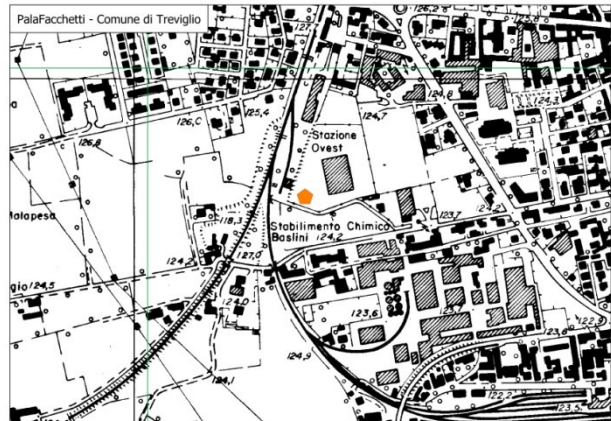
Start recording: 20/02/20 14:20:50 End recording: 20/02/2014:40:50
Trace length: 0h20'00". Analysis performed on the entire trace.
Sampling rate: 128 Hz

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

Array geometry (x): 0.0 3.0 6.0 9.0 12.0 15.0 18.0 21.0 24.0 27.0 30.0 33.0 36.0 39.0 42.0 45.0 48.0 m.

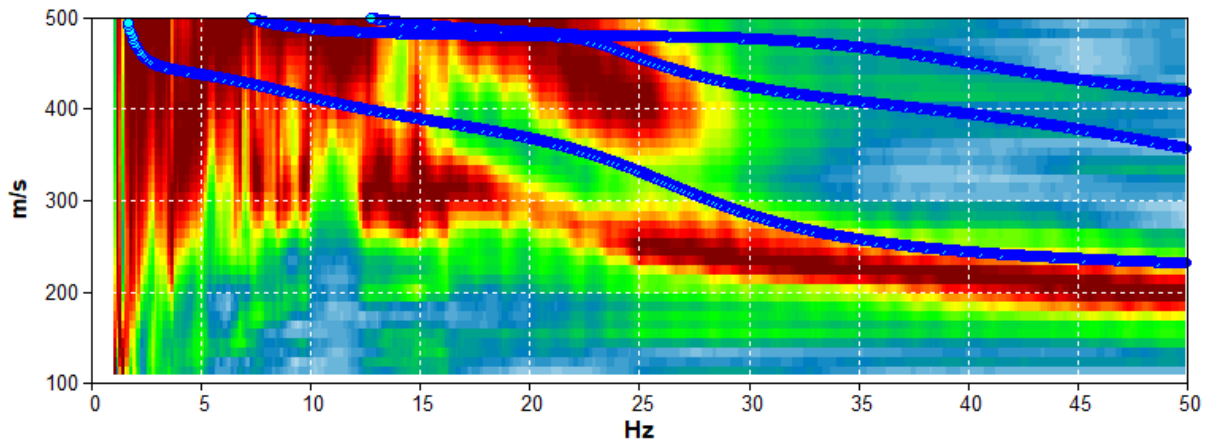


Foto



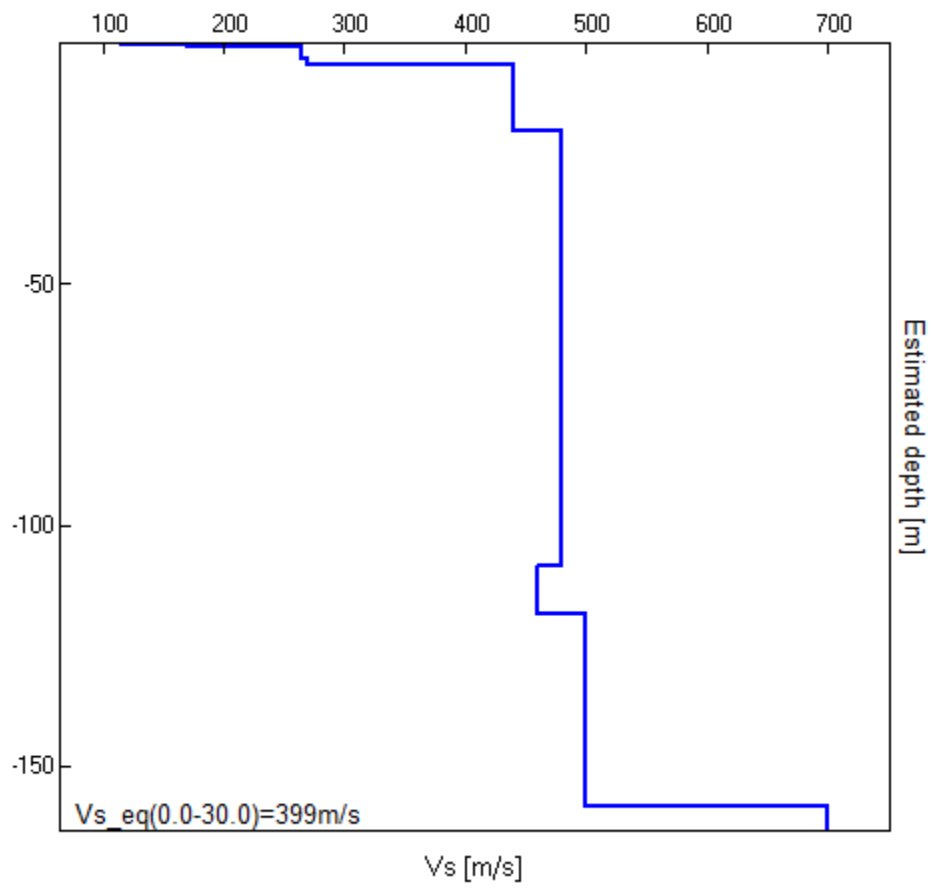
Estratto mappa

MODELLED RAYLEIGH WAVE PHASE VELOCITY DISPERSION CURVE



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.40	0.40	115	0.42
0.80	0.40	170	0.42
3.30	2.50	265	0.42
4.30	1.00	270	0.45
18.30	14.00	440	0.45
108.30	90.00	480	0.45
118.30	10.00	460	0.45
158.30	40.00	500	0.44
inf.	inf.	700	0.43

$Vs_{eq}(0.0-30.0)=399\text{m/s}$



TREVIGLIO, T06 - PALAFACCHETTI

Instrument: TEN-0031/01-07

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 20/02/2014:55:50 End recording: 20/02/20 15:15:50

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h20'00". Analysis performed on the entire trace.

Sampling rate: 128 Hz

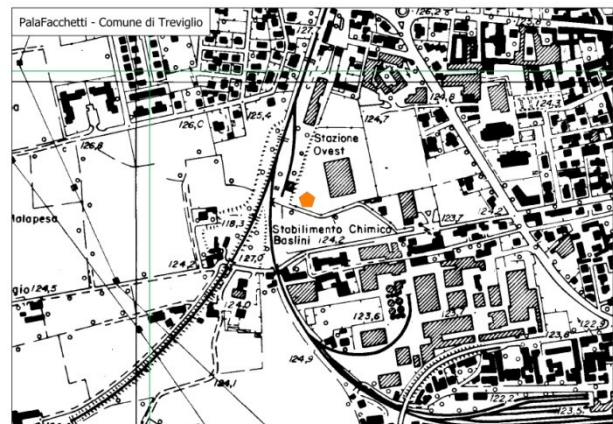
Window size: 20 s

Smoothing type: Triangular window

Smoothing: 10%



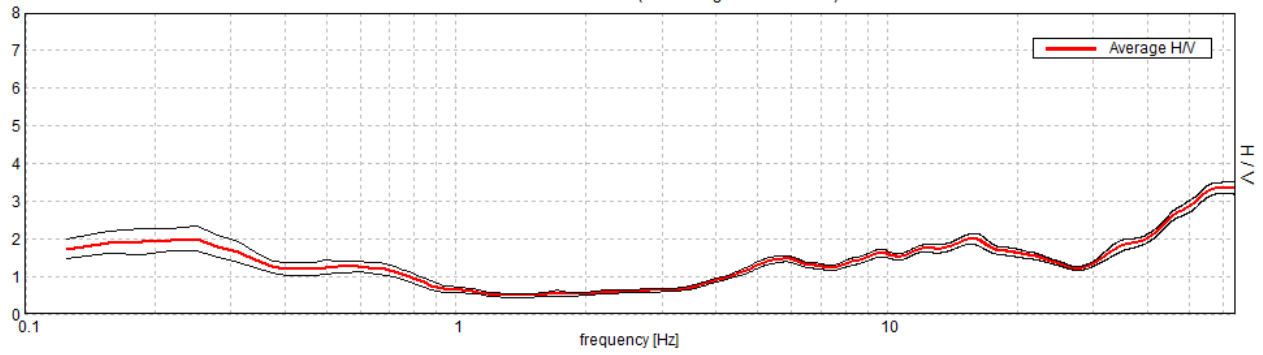
Foto



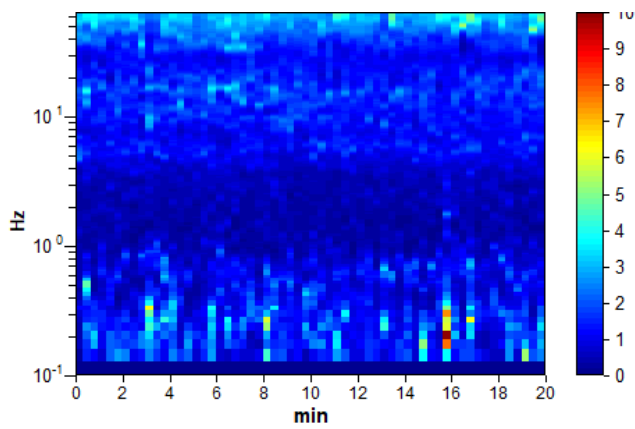
Estratto mappa

HORIZONTAL TO VERTICAL SPECTRAL RATIO

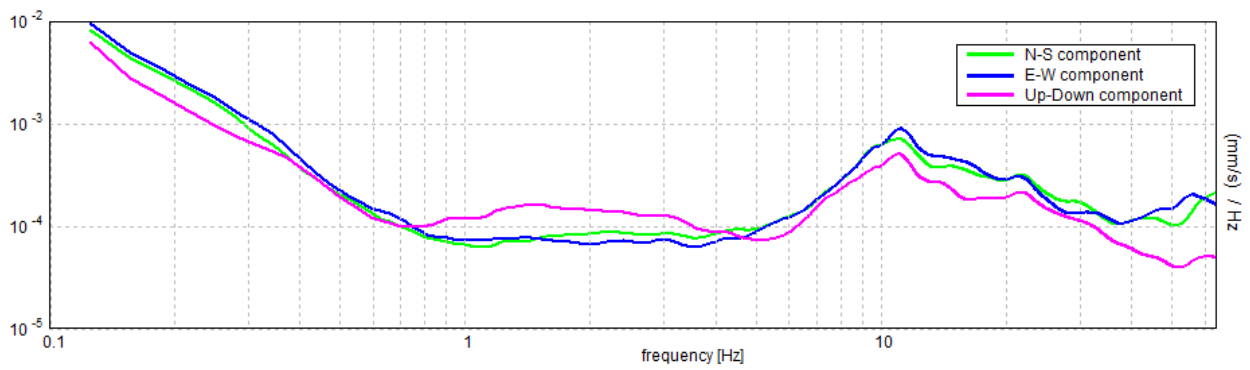
Max. H/V at 15.63 ± 5.08 Hz (in the range 0.0 - 30.0 Hz).



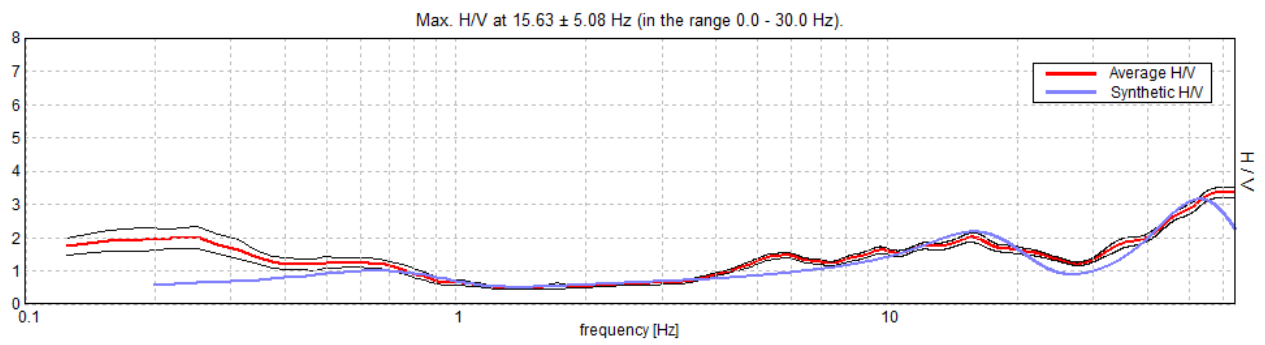
H/V TIME HISTORY



SINGLE COMPONENT SPECTRA

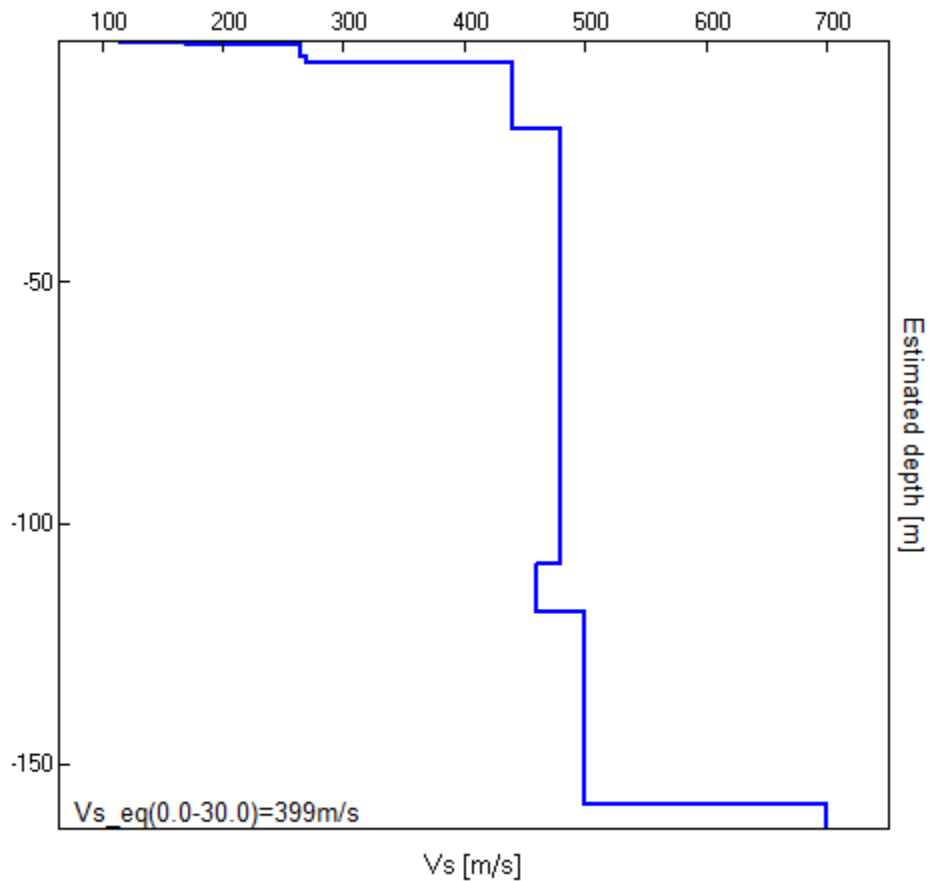


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
0.40	0.40	115	0.42
0.80	0.40	170	0.42
3.30	2.50	265	0.42
4.30	1.00	270	0.45
18.30	14.00	440	0.45
108.30	90.00	480	0.45
118.30	10.00	460	0.45
158.30	40.00	500	0.44
inf.	inf.	700	0.43

Vs_eq(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 15.63 ± 5.08 Hz (in the range 0.0 - 30.0 Hz).

Criteria for a reliable H/V curve

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	15.63 > 0.50	OK	
$n_c(f_0) > 200$	18750.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 751 times	OK	

Criteria for a clear H/V peak

[At least 5 out of 6 should be fulfilled]

Exists f^- in $[f_0/4, f_0] \mid A_{H/V}(f^-) < A_0 / 2$	4.313 Hz	OK	
Exists f^+ in $[f_0, 4f_0] \mid A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.00 > 2	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.3249 < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	$5.07651 < 0.78125$		NO
$\sigma_A(f_0) < \theta(f_0)$	$0.137 < 1.58$	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
$\sigma_{\log H/V}(f)$	standard deviation of $\log A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for 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 $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20