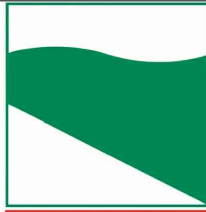




PROTEZIONE CIVILE  
Presidenza del Consiglio dei Ministri  
Dipartimento della Protezione Civile



Regione Emilia-Romagna



CONFERENZA DELLE REGIONI E  
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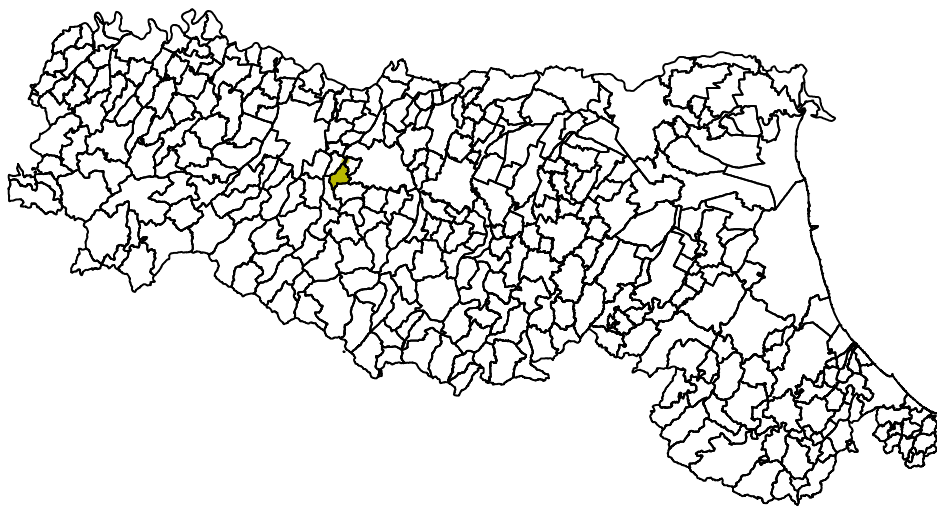
Attuazione dell'articolo 11 della legge 24 giugno 2009, n. 77

# MICROZONAZIONE SISMICA

## Nuove indagini

Regione Emilia-Romagna

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<p>Regione Emilia-Romagna</p>	<p>Soggetto realizzatore RAGGRUPPAMENTO TEMPORANEO DI PROFESSIONISTI Mandataria:  EN GEO Srl. INGENIERING GEOLOGY www.engeo.it Direttori tecnici: Dr. Geol. Carlo Caleffi Dr. Geol. Francesco Cerutti Mandanti: Dr. Geol. Stefano Castagnetti Dr. Geol. Matteo Collareda POLARIS – Studio associato Dr. Geol. Claudia Tomassoli</p>	<p>Data Luglio 2020</p> <p><b>MS2</b></p>
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REGIONE EMILIA ROMAGNA

Provincia di Lucca



**STUDIO DI MICROZONAZIONE SISMICA DI LIVELLO 2**  
**RELAZIONE TECNICA DELLE INDAGINI SISMICHE ed ELETTRICHE**  
**(Re.Mi. – M.A.S.W. – H.V.S.R. - ERT)**

**Comuni di studio: BIBBIANO (RE)**

**Data: Dicembre 2019**

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## 1. Premesse

A supporto dello Studio di Microzonazione Sismica di Livello 2, condotto per alcuni comuni della Val d'Enza, sono state effettuate alcune misure geofisiche.

Al fine di ottenere informazioni più dettagliate sulla risposta sismica locale, necessarie per definire con maggior cura lo studio di MS, sono state condotte nel territorio comunale di Bibbiano

N° 40 misure sismiche di tipo passivo a stazione singola (H.V.S.R.)
N° 40 misure sismiche di tipo attivo in array (M.A.S.W.)
N° 40 misure sismiche di tipo passivo in array (Re.Mi.)
N° 3 stendimenti geo-elettrici 2D (ELE)

## 2. Indagine sismica di tipo passivo a stazione singola (H.V.S.R.)

### Cenni teorici sulla strumentazione utilizzata

La tecnica sismica passiva (tecnica dei rapporti spettrali o H.V.S.R., Horizontal to Vertical Spectral Ratio) è totalmente non invasiva, molto rapida, si può applicare ovunque e non richiede nessun tipo di perforazione, né di stendimenti di cavi, né di energizzazione esterne diverse dal rumore ambientale che in natura esiste ovunque. I risultati che si possono ottenere da una registrazione di questo tipo sono:

- la frequenza caratteristica di risonanza del sito che rappresenta un parametro fondamentale per il corretto dimensionamento degli edifici in termini di risposta sismica locale. Si dovranno adottare adeguate precauzioni nel costruire edifici aventi la stessa frequenza di vibrazione del terreno per evitare l'effetto di "doppia risonanza" estremamente pericolosi per la stabilità degli stessi;
- la frequenza fondamentale di risonanza di un edificio, qualora la misura venga effettuata all'interno dello stesso. In seguito sarà possibile confrontarla con quella caratteristica del sito (free field) e capire se in caso di sisma la struttura potrà essere o meno a rischio;
- la velocità media delle onde di taglio  $V_s$  calcolata tramite un apposito codice di calcolo. È necessario, per l'affidabilità del risultato, conoscere la profondità di un riflettore noto dalla stratigrafia (prova penetrometrica, sondaggio, ecc.) e riconoscibile nella curva H/V. Sarà quindi possibile calcolare la  $V_{s,30}$  e la relativa categoria di sottosuolo come esplicitamente richiesto dalle Norme Tecniche per le Costruzioni del 14 gennaio 2008;
- la stratigrafia del sottosuolo con un range di indagine compreso tra 0,5 e 700 m di profondità anche se il dettaglio maggiore si ha nei primi 100 metri. Il principio su cui si basa la presente tecnica, in termini di stratigrafia del sottosuolo, è rappresentato dalla definizione di strato inteso come unità distinta da quelle sopra e sottostante per un contrasto d'impedenza, ossia per il rapporto tra i prodotti di velocità delle onde sismiche nel mezzo e densità del mezzo stesso.

Le basi teoriche della tecnica HVSR si rifanno in parte alla sismica tradizionale (riflessione, rifrazione, diffrazione) e in parte alla teoria dei microtremori. La forma di un'onda registrata in un sito x da uno strumento dipende:

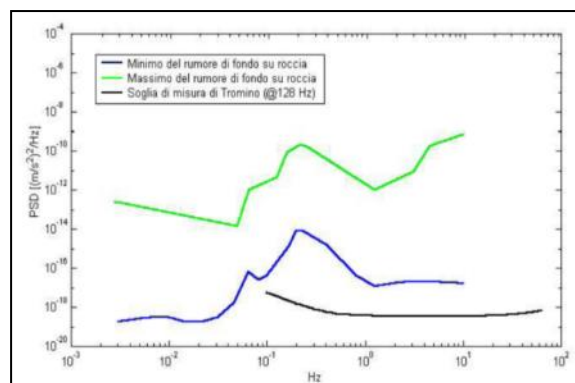
- dalla forma dell'onda prodotta dalla sorgente s;
- dal percorso dell'onda dalla sorgente s al sito x (attenuazioni, riflessioni, rifrazioni, incanalamenti per guide d'onda);
- dalla risposta dello strumento.

Possiamo scrivere questo come:

$$\text{segnale registrazione al sito } x = \text{sorgente} * \text{effetti di percorso} * \text{funzione trasferimento strumento}$$

Il rumore sismico ambientale, presente ovunque sulla superficie terrestre, è generato dai fenomeni atmosferici (onde oceaniche, vento) e dall'attività antropica oltre che, ovviamente, dall'attività dinamica terrestre. Si chiama anche microtremore poiché riguarda oscillazioni molto piccole, molto più piccole di quelle indotte dai terremoti. I metodi che si basano sulla sua acquisizione si dicono passivi poiché il rumore non è generato ad hoc, come ad esempio le esplosioni della sismica attiva. Nel tragitto dalla sorgente  $s$  al sito  $x$  le onde elastiche (sia di terremoto che microtremore) subiscono riflessioni, rifrazioni, intrappolamenti per fenomeni di guida d'onda, attenuazioni che dipendono dalla natura del sottosuolo attraversato. Questo significa che se da un lato l'informazione riguardante la sorgente è persa e non sono più applicabili le tecniche della sismica classica, è presente comunque una parte debolmente correlata nel segnale che può essere estratta e che contiene le informazioni concernenti il percorso del segnale e, in particolare, relative alla struttura locale vicino al sensore. Dunque, anche il debole rumore sismico, che tradizionalmente costituisce la parte di segnale scartata dalla sismologia classica, contiene informazioni. Questa informazione è però "sepolta" all'interno del rumore casuale e può essere estratta attraverso tecniche opportune. Una di queste tecniche è la teoria dei rapporti spettrali o, semplicemente, HVSR che è in grado di fornire stime affidabili delle frequenze principali del sottosuolo; informazione di notevole importanza nell'ingegneria sismica.

Per l'acquisizione dei dati è stato utilizzato un tromometro digitale della ditta Moho S.r.l. modello "Tromino - engy-plus" che rappresenta la nuova generazione di strumenti ultra - leggeri e ultra - compatti in alta risoluzione adatti a tali misurazioni. Lo strumento racchiude al suo interno tre terne velocimetriche con i sensori ortogonali tra loro e con intervallo di frequenza compreso tra 0.1 e 256 Hz. Nella figura a fianco si riporta la curva di rumore di "Tromino" a confronto con i modelli standard di rumore sismico massimo (in verde) e minimo (in blu) per la Terra. Gli spettri di potenza sono espressi in termini di accelerazione e sono relativi alla componente verticale del moto.



### 3. Indagini sismiche in array

#### **Indagine sismica di tipo passivo in array (Re.Mi.) - Cenni teorici sulla strumentazione utilizzata**

È noto che la propagazione delle onde, nel caso di mezzi stratificati e trasversalmente isotropi, avviene in maniera diversa rispetto al caso di mezzi omogenei; non esiste più un'unica velocità, ma ogni frequenza è caratterizzata da una diversa velocità di propagazione a sua volta legata alle varie lunghezze d'onda. Queste lunghezze d'onda interessano il terreno a diverse profondità e risultano influenzate dalle caratteristiche elastiche che sono variabili, appunto, con la profondità. Questo comportamento viene definito *dispersione in frequenza* ed è fondamentale nello sviluppo dei metodi sismici che utilizzano le onde di superficie. Ovviamente, le lunghezze d'onda più grandi corrispondono alle frequenze più basse e vanno ad interessare il terreno più in profondità; al contrario, le lunghezze d'onda più piccole, poiché sono associate alle frequenze più alte, rimangono nelle immediate vicinanze della superficie. I metodi di prospezione sismica che utilizzano le onde di superficie si basano su modelli fisico-matematici nei quali il sottosuolo viene schematizzato come una serie di strati con caratteristiche elastiche lineari.

La procedura Re.Mi. è un metodo di prospezione sismica sviluppato presso l'Università di Reno in Nevada (Louie, 2001) e viene classificato come *metodo passivo* in quanto utilizza il rumore ambientale. I vantaggi derivanti da questo metodo sono molteplici poiché è veloce e semplice da usare in fase di acquisizione, raggiunge una buona profondità e risoluzione d'indagine ma, soprattutto, permette di ottenere migliori risultati in ambienti particolarmente urbanizzati. La fase di acquisizione deve essere effettuata con una serie di accorgimenti e precauzioni da adottare in sito e nella pianificazione della registrazione. Tutto è

finalizzato alla registrazione di dati contenenti la miglior informazione possibile riguardo alla propagazione delle onde di Rayleigh con buon rapporto segnale-rumore.

Il rumore incoerente, cioè di tipo casuale, rappresenta nel caso Re.Mi. la fonte del segnale utile che si vuole registrare. I microtremori generati dall'ambiente si propagano nel suolo e di questi si cerca di distinguere il modo fondamentale di vibrazione dell'onda di Rayleigh dai modi superiori e dall'*aliasing* spaziale: risulta quindi necessario soddisfare la condizione di *omnidirezionalità* delle sorgenti, cioè si suppone che il rumore ambientale provenga sostanzialmente da tutte le direzioni.

I tempi di registrazione dei microtremori sono decisamente più elevati rispetto alle indagini di tipo attivo. La registrazione viene analizzata in finestre temporali che variano dai 10 ai 30 secondi. Sono da considerare la lunghezza dello stendimento  $L$  e la distanza intergeofonica  $\Delta x$ , che agisce sul segnale come una specie di filtro in frequenza; supponendo, infatti, che il segnale arrivi da tutte le direzioni, maggiore è la spaziatura, minore sarà la frequenza del segnale utile campionabile e viceversa: se la frequenza è più bassa, aumenta la profondità d'indagine. La fase più delicata è quella del *data processing*, che consiste nel trattamento dei dati acquisiti con l'obiettivo di stimare la velocità di fase delle onde di Rayleigh ( $V_r$ ), che sono correlabili con le velocità  $V_s$  di propagazione delle onde S ( $V_s \approx 1,1 V_r$ ). Le varie tecniche di processing trasformano l'informazione registrata nel dominio x-t (spazio tempo), in un dominio dove l'energia associata all'evento è funzione della frequenza e di altre variabili. Tutto questo allo scopo di localizzare attraverso lo spettro la densità di energia maggiore, alla quale sono di solito associate le onde di Rayleigh. Con procedura manuale vengono selezionati dei punti sullo spettro, che andranno a formare la curva di dispersione sperimentale.

La scelta di questi valori, denominata *picking*, è condizionata da alcune indicazioni ma è imprescindibile dall'abilità e dall'esperienza dell'interprete anche in base ad altre conoscenze in merito al sito in esame. Per ottenere un elevato dettaglio del segnale, il *sampling rate* utilizzato è stato di 512 Hz. La durata (lunghezza temporale) del segnale registrato per ogni misura è stato di circa 6 minuti. Il software utilizzato per l'analisi spettrale è Grilla v.7.4 - 2018.



### **Indagine sismica di tipo attivo in array (M.A.S.W) - Cenni teorici sulla strumentazione utilizzata**

La procedura M.A.S.W. viene presentata nel 1999 in seguito agli studi effettuati dal Kansas Geological Survey (Park et al., 1999). L'acquisizione simultanea di molti canali, che aumentano la ridondanza statistica, insieme alla semplicità delle operazioni, permettono al M.A.S.W. di superare pienamente le limitazioni incontrate con precedenti metodi. La strumentazione necessaria è composta da uno stendimento sismico di 12 o più geofoni verticali e dal sismografo. L'energizzazione viene effettuata ad hoc a varie distanze e con varie ripetizioni (tecnica stacking) per sommare algebricamente i segnali ottenuti rendendo in tal modo la potenza del segnale superiore a quella del rumore di fondo.

Una particolare analisi spettrale permette di distinguere il modo fondamentale da quelli superiori per ricavare la curva di dispersione ed il profilo delle  $V_s$  per successiva inversione 1-D. La teoria sviluppata suggerisce di caratterizzare tale fenomeno mediante una funzione detta curva di dispersione, che associa ad ogni frequenza la velocità di propagazione dell'onda. Tale curva è estraibile dallo spettro del segnale poiché essa approssimativamente posa sui massimi del valore assoluto dello spettro.

A questo punto la curva di dispersione sperimentale deve essere confrontata con quella relativa ad un modello sintetico che verrà successivamente alterato in base alle differenze riscontrate tra le due curve, fino ad ottenere un modello sintetico a cui è associata una curva di dispersione teorica approssimativamente coincidente con la curva sperimentale. Questa delicata fase di interpretazione è comunemente detta fase di inversione e può avvenire in maniera automatica e/o manuale.

**Procedure operative di acquisizione**

Data la necessità di analizzare le onde di Rayleigh, con elevato dettaglio alle basse frequenze (tipicamente anche al di sotto dei 20 Hz), sono stati utilizzati massimo n° 16 geofoni a 4,5 Hz ad asse verticale uniti in un *array* lineare totalmente digitale (*SoilSpy Rosina*), con un'inter distanza compresa tra 2 e 5 m. Ogni geofono è munito di un digitalizzatore che converte il segnale e lo trasmette al sismografo tramite un'interfaccia USB. Tale sistema permette di avere elevati rapporti di rumore, un perfetto sincronismo e una estrema leggerezza; in tutti i canali non è stato utilizzato né filtraggio né guadagno automatico.

Non sono presenti sostanziali variazioni di quota e quindi i siti possono essere considerati orizzontali. Nel caso delle misure di tipo attivo, l'energizzazione è stata effettuata tramite una mazza su piastra battente di circa 5 Kg, a varie distanze dai geofoni e in entrambi gli estremi del profilo. Il *sampling* rate utilizzato è stato di 512 Hz in modo da ottenere un elevato dettaglio del segnale. La durata (lunghezza temporale) del segnale registrato deve essere sufficiente per consentire all'impulso emesso dalla sorgente di propagarsi da un estremo all'altro dell'*array*, ed inoltre consentire la naturale attenuazione su tutti i ricevitori. Nei casi in questione, dopo aver osservato nel monitor del ricevitore la prima acquisizione, è stato deciso di assumere una lunghezza temporale di circa 1 s, più che sufficiente per il nostro scopo.

Per quanto riguarda l'interpretazione delle misure si precisa che le indagini di tipo Re.Mi. sono state interpretate congiuntamente alle misure H.V.S.R., al fine di poter individuare i contrasti di rigidità profondi ed il probabile passaggio al *bedrock* geofisico. Per quanto riguarda, invece, le indagini di tipo MASW, l'elevata rigidità dei depositi non ha consentito una buona penetrazione e propagazione delle onde, pertanto il modo fondamentale non è sempre visibile in tutto il range di frequenze e ciò ha reso difficile la loro interpretazione. Pertanto, si è proceduto all'elaborazione delle misure tarandole con le rispettive Re.Mi. e senza utilizzare le indagini H.V.S.R.

Per una corretta ricostruzione sismica del sottosuolo e una buona stima delle onde Vs è necessario adottare una modellizzazione numerica che può essere rappresentata dalla seguente equazione:

$$\hat{v}_s = \frac{H}{\sum_{i=1}^n \frac{h_i}{v_i}} \quad [3.1]$$

- Vs = valore di velocità delle onde di taglio [m/s];  
 H = profondità alla quale si desidera stimare Vs [m] (30 m in caso di Vs30);  
 hi = spessore dello strato i - esimo [m];  
 vi = velocità delle onde Vs all'interno dello strato i - esimo [m/s].

**In via puramente indicativa**, al fine di correlare le velocità delle onde di taglio ad un tipo di suolo, si riportano i valori tabulati da Borchardt (1992; 1994) assieme a quelli ottenuti sperimentalmente in diversi ambienti sedimentari da altri autori (Budny, 1984; Ibs von Seht e Wohlenberg, 1999; Delgado et al., 2000 a, b; Parolai et al., 2002; Scherbaum et al., 2003; D'Amico et al., 2004, 2006; Hinzen et al., 2004).

TIPO DI SUOLO	Vs min [m/s]	Vs media [m/s]	Vs max [m/s]
<b>ROCCE MOLTO DURE</b> (es. rocce metamorfiche molto - poco fratturate)	1400	1620	-
<b>ROCCE DURE</b> (es. graniti, rocce ignee, conglomerati, arenarie e argilliti, da mediamente a poco fratturate).	700	1050	1400
<b>SUOLI GHIAIOSI e ROCCE DA TENERE A DURE</b> (es. rocce sedimentarie ignee tenere, arenarie, argilliti, ghiaie e suoli con > 20% di ghiaia).	375	540	700



<b>ARGILLE COMPATTE e SUOLI SABBIOSI - GHIAIOSI</b> (es. ghiaie e suoli con < 20% di ghiaia, sabbie da sciolte a molto compatte, limi e argille sabbiose, argille da medie a compatte e argille limose).	200	290	375
<b>TERRENI TENERI</b> (es. terreni di riempimento sotto falda, argille da tenere a molto tenere).	100	150	200

## 4. Indagine geo-elettrica con inversione tomografica

### Basi teoriche di tomografia elettrica

La tecnica dell'*imaging* elettrico (o tomografia elettrica) adotta una procedura automatizzata sia per l'acquisizione che per l'elaborazione e consente di raccogliere dati elettrici del sottosuolo con una densità elevata impiegando cavi *multicore* con spaziatura interelettrodica variabile (generalmente da 1-2 m a 10).

L'unità di misura è costituita da un geo-resistivimetro assistito da un *computer* che mediante un *software* dedicato gestisce la configurazione geometrica e la sequenza del grande numero di letture che vengono effettuate. Gli elettrodi da controllare sono molte decine, spesso qualche centinaio, ed i vari cavi impiegati vengono tra loro connessi e collegati all'unità di misura.

In pratica, il rilievo consiste dapprima nel posizionare gli elettrodi nel terreno secondo *arrays* 2D o 3D, quindi nell'effettuare il collegamento ai *take-out* dei cavi che portano il segnale (di input ed output) all'unità di misura. Dal *software* viene poi impostata la configurazione prescelta (Wenner, Schlumberger, dipolo-dipolo o polo-polo) ed i relativi parametri geometrici (passo di misura, numero di misure, ecc.).

Le misure sono ciclicamente ripetute fino ad un massimo di 4-6 volte qualora non si raggiunga prima una stabilizzazione della lettura (indicata da un basso scarto percentuale tra il 2-6%) e in corrente alternata con periodo di misura che può essere compreso tra 0,8s e 0,12s con cicli di alcuni secondi; i voltaggi variano da un minimo di 0,2mV a massimi di 400V mentre l'intensità di corrente varia da minimi di 0,001mA a massimi di 50mA. Le misure non soddisfacenti, comunque salvate nel *data set*, potranno essere eliminate in sede di analisi. Per ottenere una densità di valori idonea alla costruzione di una pseudosezione di resistività è necessario che il passo di misura non superi la distanza interelettrodica. Il primo risultato dell'analisi è costituito da una pseudosezione che è solo rappresentativa della sezione reale. Ritrae, infatti, l'andamento della resistività apparente, una specie di valore mediato, con la pseudopropfondità, calcolata con semplici considerazioni geometriche. Ogni misura viene posta convenzionalmente al centro del quadripolo attivo ed alla pseudopropfondità che gli compete.

I dati acquisiti in campagna sono rappresentati secondo pseudosezioni (2D) o pseudopiani (3D) e vengono successivamente elaborati per risalire alla elettro-stratigrafia reale (resistività vera) del volume indagato che si ottiene utilizzando la tecnica di inversione.

Nelle indagini geo-elettriche è possibile scegliere diversi tipi di configurazioni in base a criteri che considerano, ad esempio, il tipo di *target* da individuare, la profondità massima da raggiungere o la sensibilità delle misurazioni condotte. Le configurazioni si distinguono in base alla distribuzione geometrica della programmazione di attivazione delle coppie di elettrodi attivati per l'acquisizione.

### Strumentazione, acquisizione ed elaborazioni

Nel caso in questione è stato utilizzato il nuovo geo-resistivimetro della MoHo Srl modello **ELECTRA** in configurazione Wenner e con un *array* geometrico come riportato nella tabella seguente.

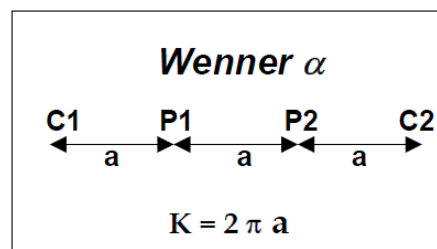


Nome Linea	N° elettrodi	Interdistanza degli elettrodi [m]	Lunghezza [m]
ELE 1	24	3,0 m	69 m
ELE 2	24	3,0 m	69 m
ELE 3	24	3,0 m	69 m

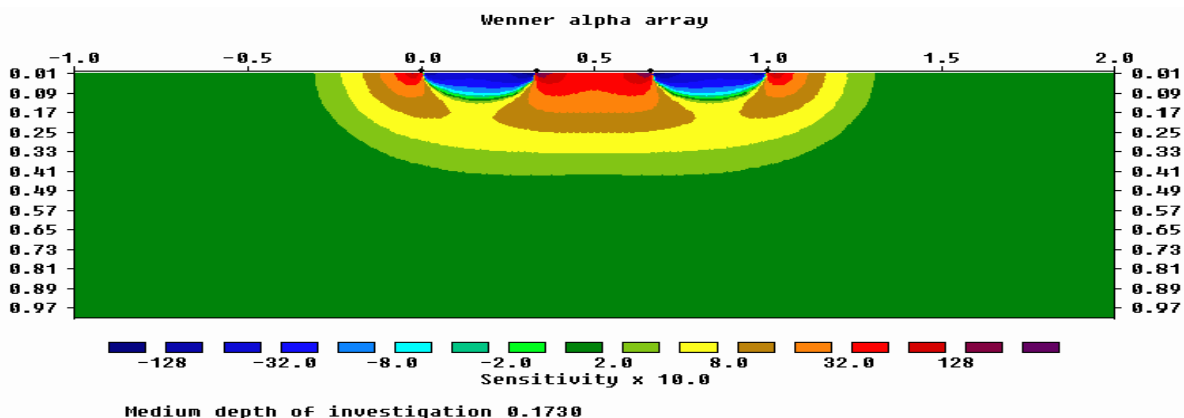
### Array Wenner

Questo tipo di arrangiamento è caratterizzato dal fatto che gli elettrodi di potenziale sono posti al centro degli elettrodi di corrente e la distanza tra i vari elettrodi (distanza interelettrodo) è sempre la stessa ed è pari ad  $a$ .

Il valore del fattore geometrico relativo a tale dispositivo è pari a  $2\pi a$  e quindi il fattore geometrico del Wenner, risulta essere, il più basso tra i dispositivi più comunemente utilizzati. Pertanto è il tipo di *array* che consente di ottenere la massima intensità del segnale e i dati che si misurano con questo dispositivo risultano essere poco rumorosi.



La funzione *sensitivity* per un dispositivo Wenner presenta un andamento quasi orizzontale al disotto del centro del dispositivo (figura seguente); ne consegue che questa tipologia di *array* è relativamente sensibile ai cambiamenti verticali di resistività al di sotto del centro dello stendimento, ma è meno sensibile alle variazioni orizzontali della resistività.



La pseudo-sezione di resistività (o tomografia di prima specie) fornisce un'immagine approssimativa ed immediata della distribuzione di resistività lungo la sezione verticale di sottosuolo sottesa al profilo di misura; può essere quindi considerata come un'immagine sfocata della configurazione elettrica del sottosuolo. La tomografia geoelettrica vera e propria si ottiene mettendo a fuoco l'immagine di resistività apparente in modo da definire meglio le geometrie dei corpi sepolti. È possibile risolvere questo problema (cioè passare da una pseudo-sezione a una tomografia) applicando la tecnica d'inversione di *Loke & Barker* implementata nel software *Res2Dinv v4.01* prodotto dalla Geotomo (Malesia) e impiegato nel presente lavoro. Di seguito viene esposto il procedimento utilizzato comunemente per l'analisi.

- Il procedimento di calcolo prevede la suddivisione iniziale del volume in una griglia di regolarizzazione (analoga a quella impiegata nelle computazioni ad elementi finiti). Ad ogni cella della griglia viene attribuito un valore di resistività sulla base dei dati misurati ed a quelle di confine viene impostata una resistività pari alla media delle letture eseguite.
- Il modello iniziale viene quindi sottoposto ad un processo di inversione che utilizza una *routine* conosciuta con il nome di *smoothness-constrained least-square method* (De Groot-Hedlin e Constable 1990, Sasaki 1992) implementata con una tecnica di ottimizzazione quasi-Newtoniana (Loke e Barker 1996) che la velocizza notevolmente. Le elaborazioni considerano in blocco tutti

i dati acquisiti ed ottimizzano un modello a celle di resistività. Questo modello è meno viziato dalla assunzione di una elettrostratigrafia piana valida per il monodimensionale e risulta, quindi, più adattabile alle complesse geometrie che si incontrano nella realtà.

- L'inversione ha termine al momento in cui si ottiene una buona coincidenza, in senso statistico (scarto quadratico medio), tra i dati sperimentali e quelli teorici (confronto tra pseudosezioni misurate e calcolate).
- Disponendo di una taratura (sondaggio meccanico o dati desunti da scavi) il modello geoelettrico del sottosuolo proposto al termine dell'analisi può essere ricondotto a quello geolitologico.



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*Indagini sismiche di tipo passivo a stazione singola  
(H.V.S.R.)*

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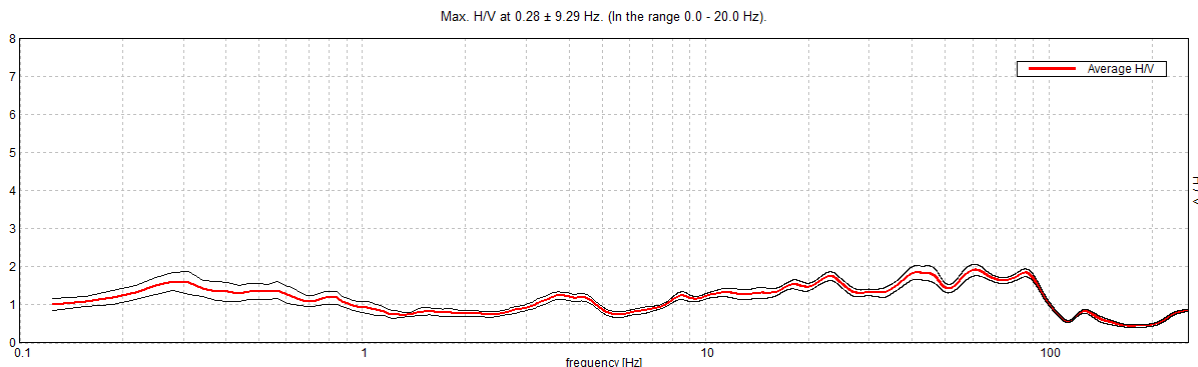




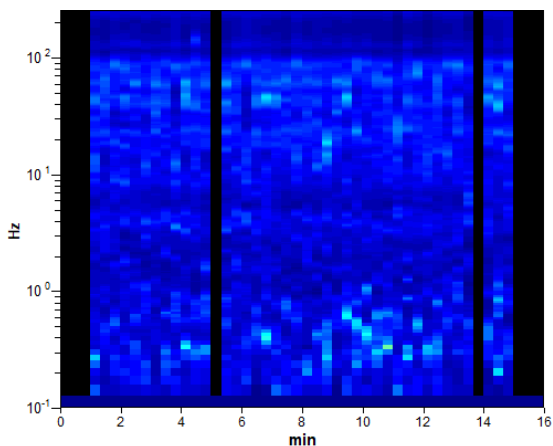
**BIBBIANO, P1**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 10/05/01 12:06:21 End recording: 10/05/01 12:22:22  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 83% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

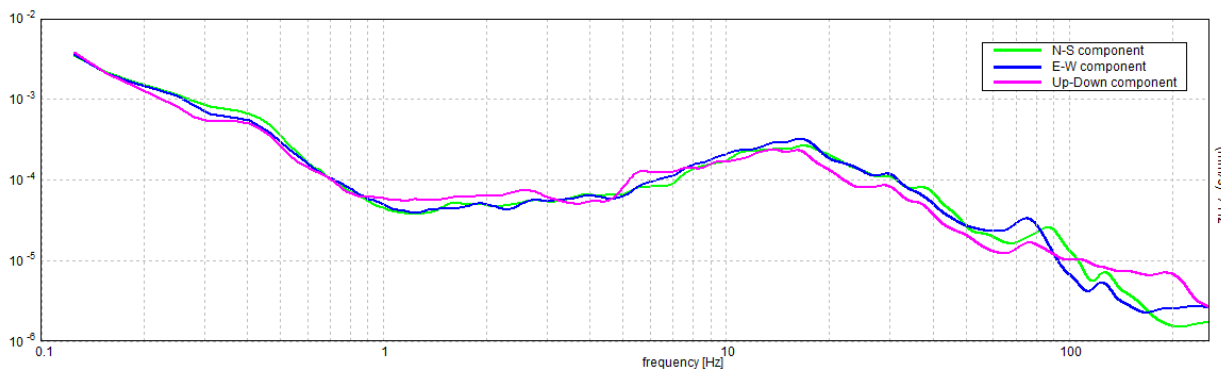
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 0.28 ± 9.29 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$0.28 > 0.50$		<b>NO</b>
$n_c(f_0) > 200$	$225.0 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 14 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	0.094 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	$1.61 > 2$		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 33.03306  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	$9.29055 < 0.05625$		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	$0.2362 < 2.5$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
Nessun picco (np)	/



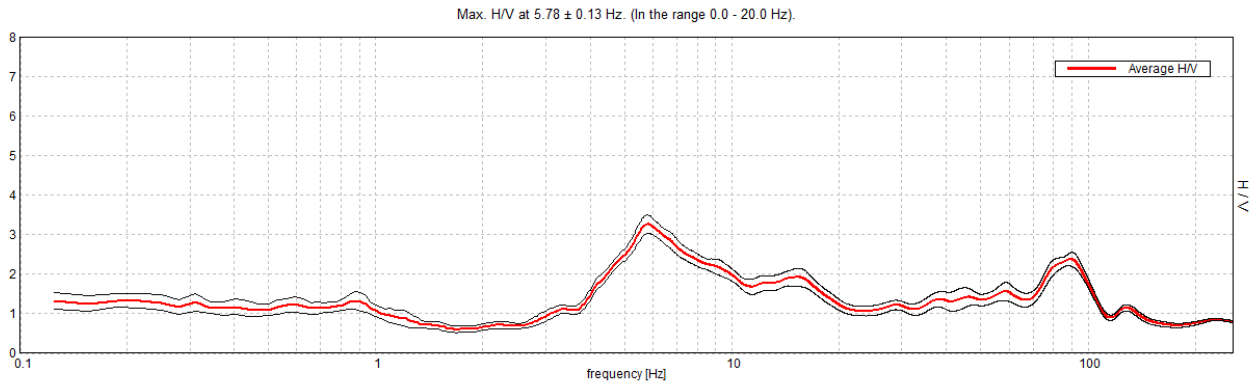
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4955630	141921
	



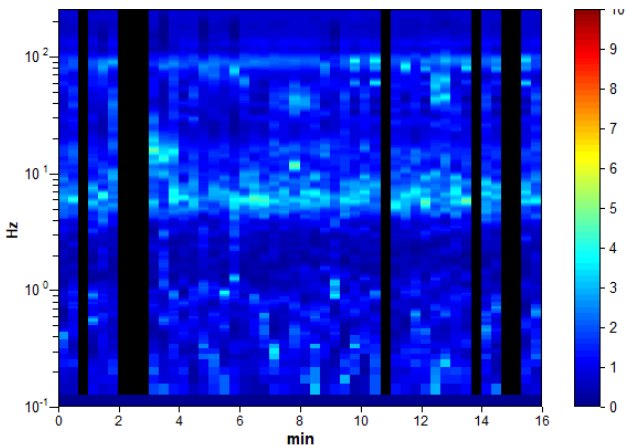
### BIBBIANO, P2

Instrument: TEP-0124/01-10  
Data format: 16 byte  
Full scale [mV]: n.a.  
Start recording: 10/05/01 12:44:07      End recording: 10/05/01 13:00:08  
Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
Y+ Y- ; X+ X- ; Z+ Z-  
GPS data not available  
Trace length: 0h16'00".      Analyzed 83% trace (manual window selection)  
Sampling rate: 512 Hz  
Window size: 20 s  
Smoothing type: Triangular window  
Smoothing: 10%

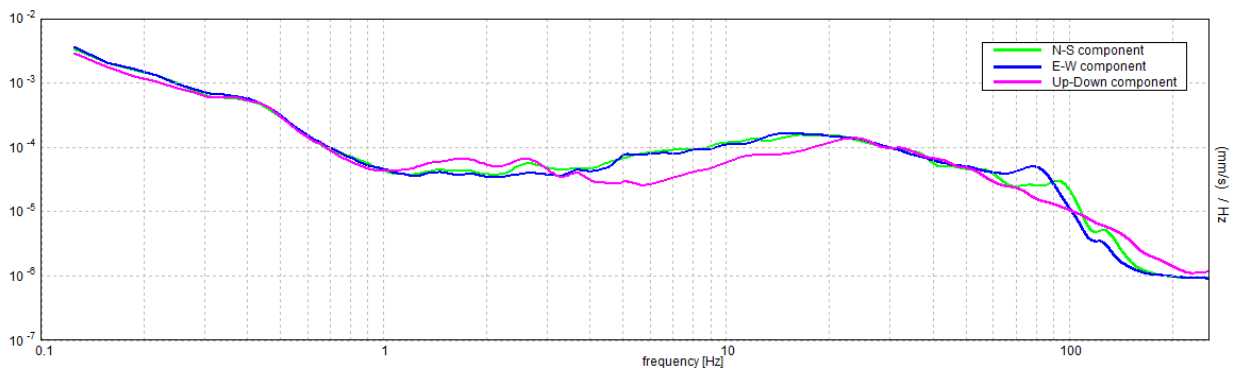
#### HORIZONTAL TO VERTICAL SPECTRAL RATIO



#### H/V TIME HISTORY



#### SINGLE COMPONENT SPECTRA





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

**Max. H/V at 5.78 ± 0.13 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$5.78 > 0.50$	<b>OK</b>	
$n_c(f_0) > 200$	$4625.0 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 278 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	4.094 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	17.313 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	$3.26 > 2$	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.02229  < 0.05$	<b>OK</b>	
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.12885 < 0.28906$	<b>OK</b>	
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.2366 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
5,78 Hz	Alta



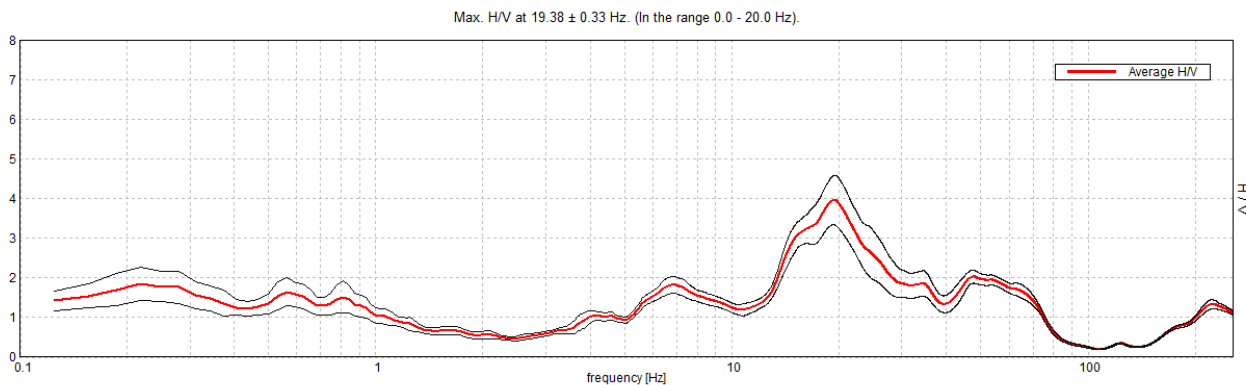
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4955667	141465
	



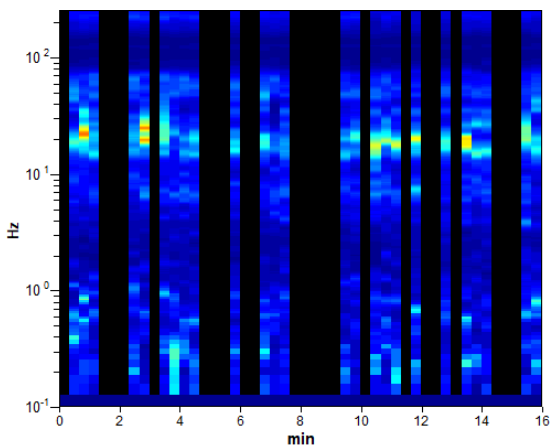
**BIBBIANO, P3**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 10/05/01 13:15:42 End recording: 10/05/01 13:31:43  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 52% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

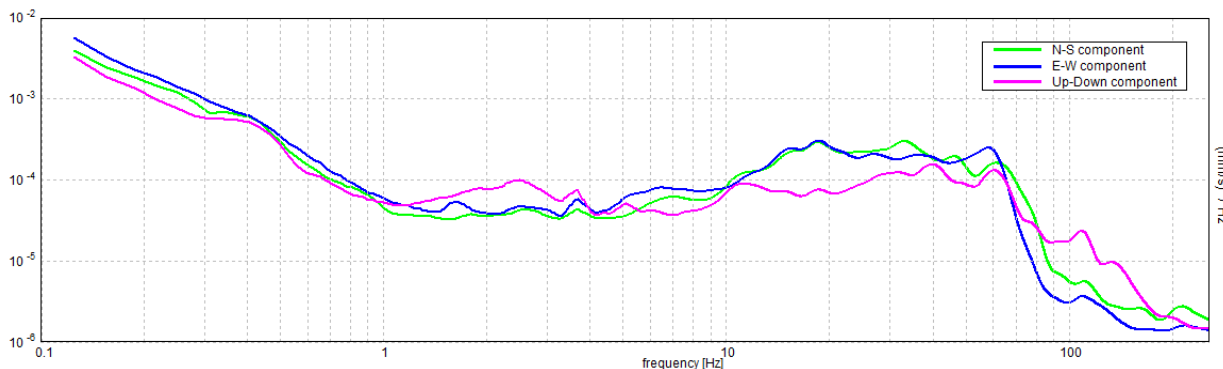
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 19.38 ± 0.33 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.38 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	9687.5 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 931 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	13.438 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	28.375 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	3.96 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.01687  < 0.05$	<b>OK</b>	
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.32686 < 0.96875$	<b>OK</b>	
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.6248 < 1.58$	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
19,38 Hz	Alta





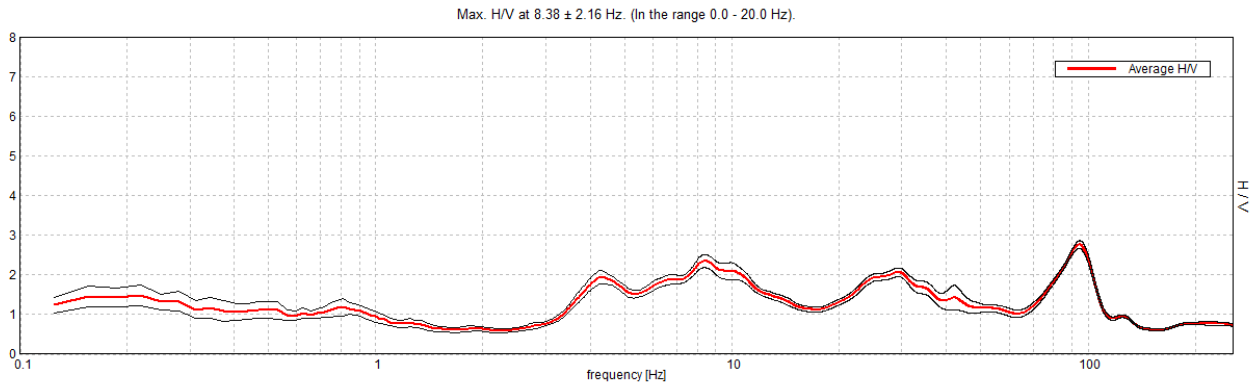
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4955863	140547



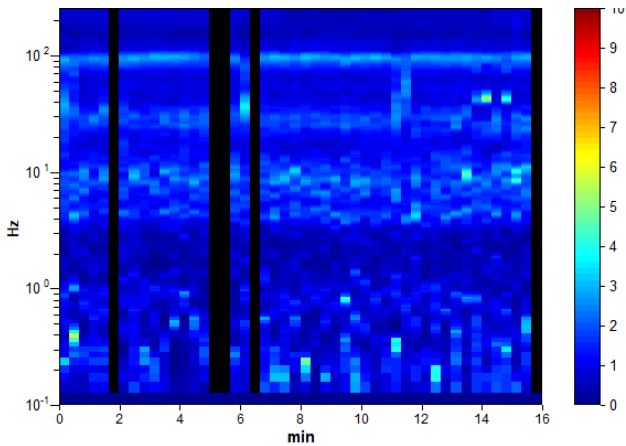
### BIBBIANO, P4

Instrument: TEP-0124/01-10  
Data format: 16 byte  
Full scale [mV]: n.a.  
Start recording: 10/05/01 13:44:35      End recording: 10/05/01 14:00:35  
Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
Y+ Y- ; X+ X- ; Z+ Z-  
GPS data not available  
Trace length: 0h16'00".      Analyzed 90% trace (manual window selection)  
Sampling rate: 512 Hz  
Window size: 20 s  
Smoothing type: Triangular window  
Smoothing: 10%

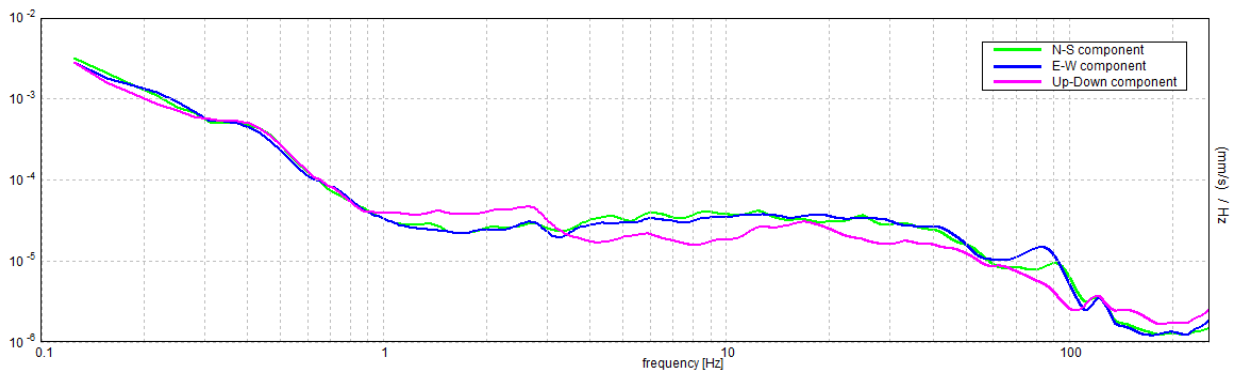
#### HORIZONTAL TO VERTICAL SPECTRAL RATIO



#### H/V TIME HISTORY



#### SINGLE COMPONENT SPECTRA



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

**Max. H/V at 8.38 ± 2.16 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	8.38 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	7202.5 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 403 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	3.5 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	15.594 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	2.35 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.25765  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	2.15785 < 0.41875		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.1664 < 1.58	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
8,38 Hz	Media





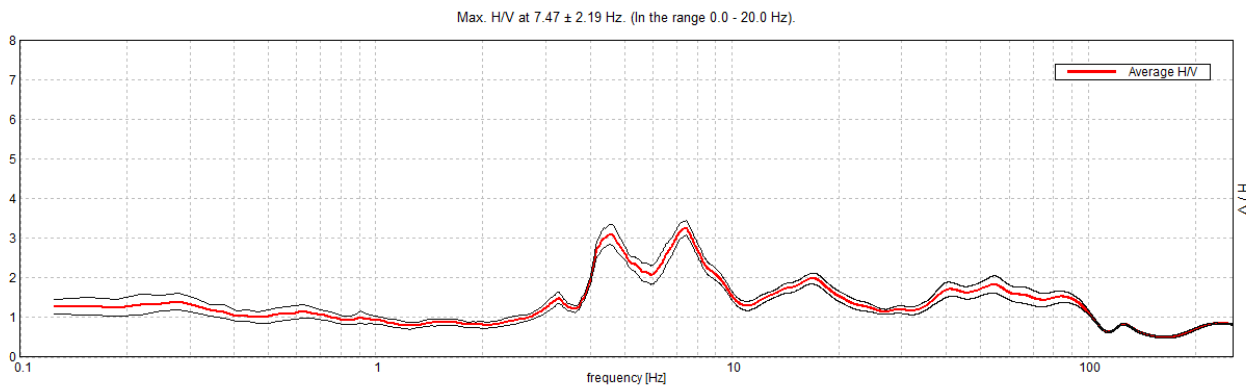
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4955198	140980

An aerial satellite photograph of a residential neighborhood. The houses have reddish-brown roofs and are arranged in a grid-like pattern. In the center of the image, there is a large green field or park area. A red location pin with a white outline and the label 'P4' is placed on the field. The surrounding area includes streets, trees, and other buildings.

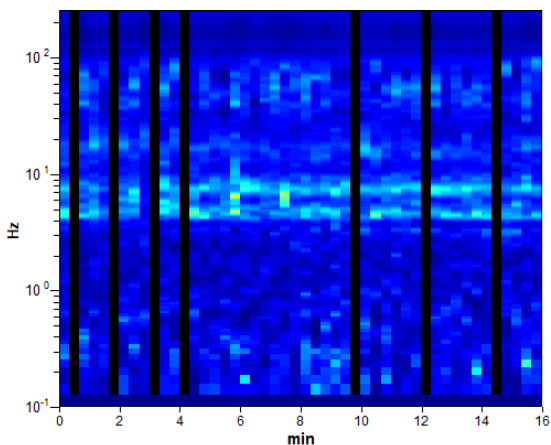
**BIBBIANO, P5**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 10/05/01 14:26:31 End recording: 10/05/01 14:42:31  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 85% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

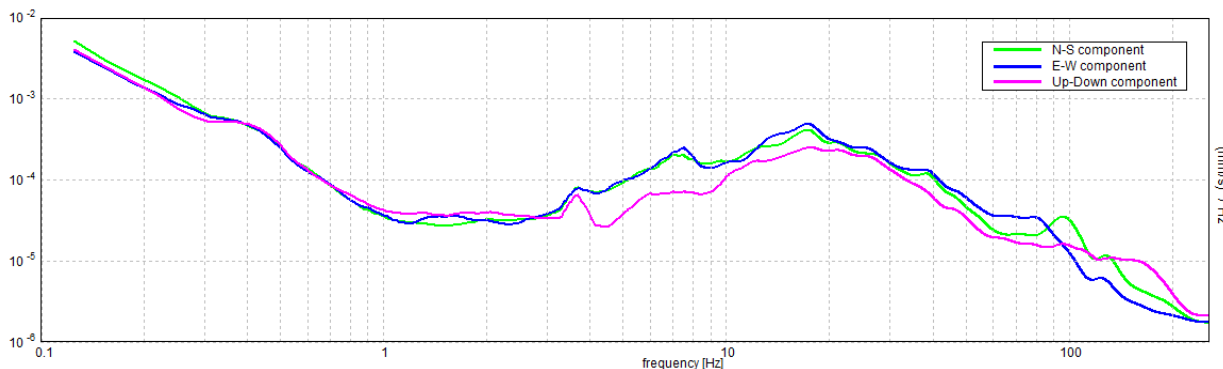
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**





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

**Max. H/V at 7.47 ± 2.19 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$7.47 > 0.50$	<b>OK</b>	
$n_c(f_0) > 200$	$6124.4 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 360 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	3.875 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	9.875 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	$3.26 > 2$	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.29357  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$2.19259 < 0.37344$		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.1822 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
7,47 Hz	Media



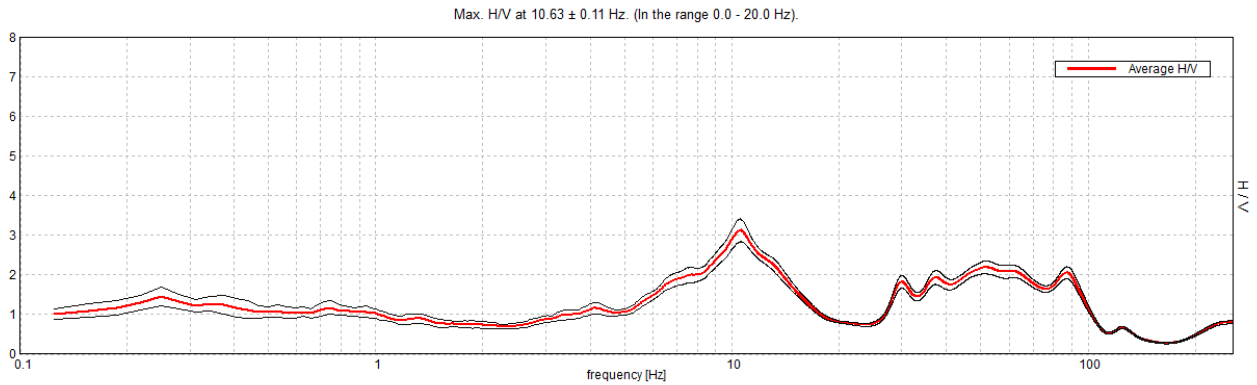
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4954988	140806
	



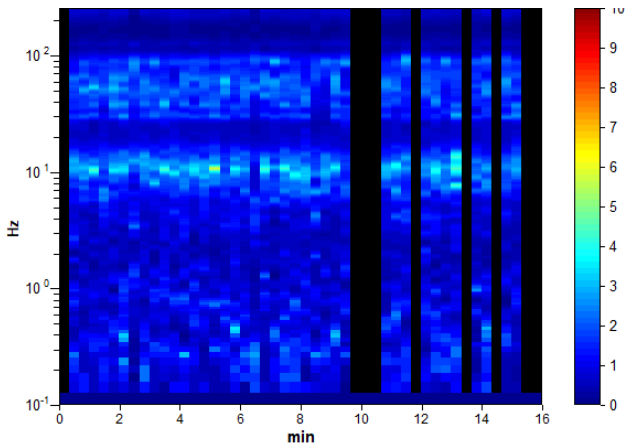
**BIBBIANO, P6**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 10/05/01 16:32:18 End recording: 10/05/01 16:48:18  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 81% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

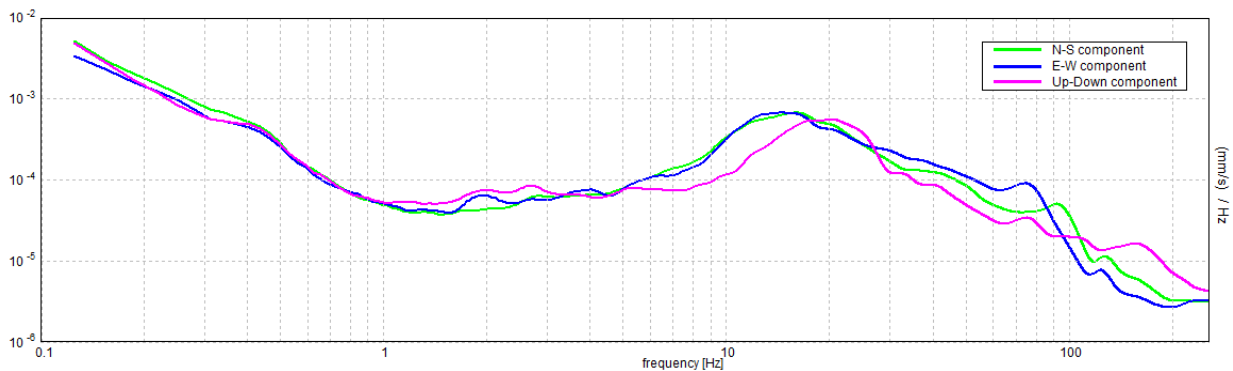
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 10.63 ± 0.11 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	10.63 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	8287.5 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 511 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	6.188 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	15.281 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	3.12 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.01072  < 0.05$	<b>OK</b>	
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.11389 < 0.53125$	<b>OK</b>	
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.286 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
10,63 Hz	Alta





UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4955121	141394
	

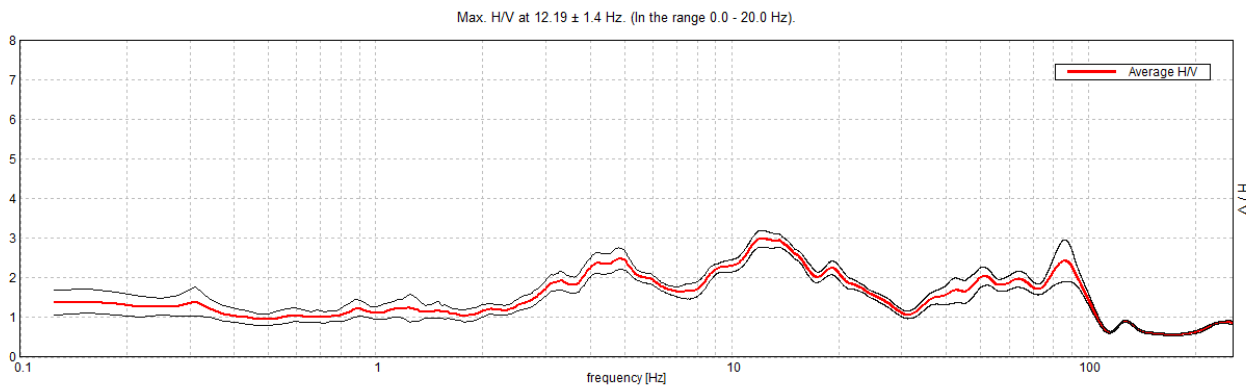




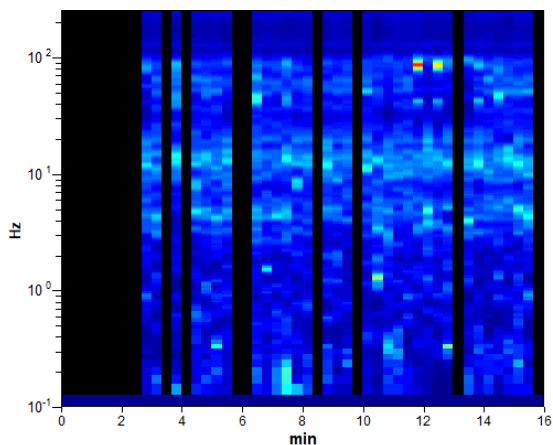
**BIBBIANO, P7**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 10/05/01 17:08:09 End recording: 10/05/01 17:24:09  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 67% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

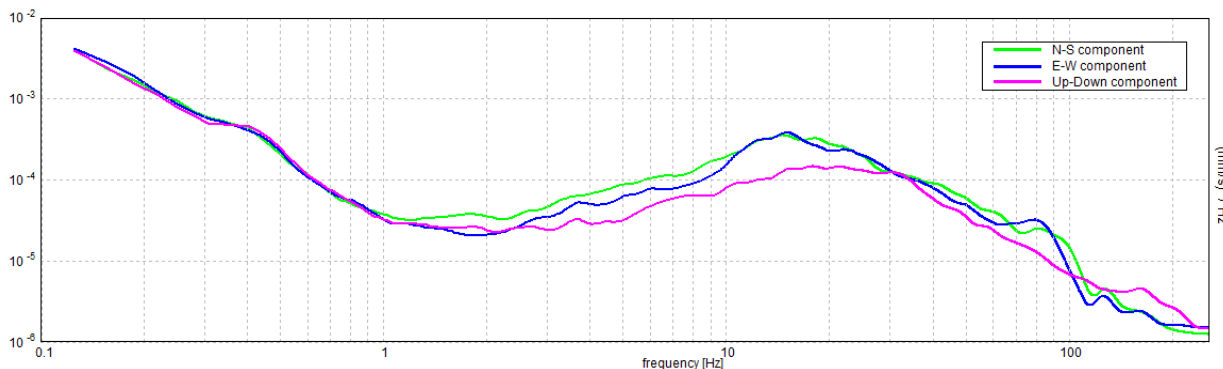
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 12.19 ± 1.4 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	12.19 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	7800.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 586 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>			<b>NO</b>
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	25.813 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	2.99 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.11494  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	1.40083 < 0.60938		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.2114 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
12,19 Hz	Alta



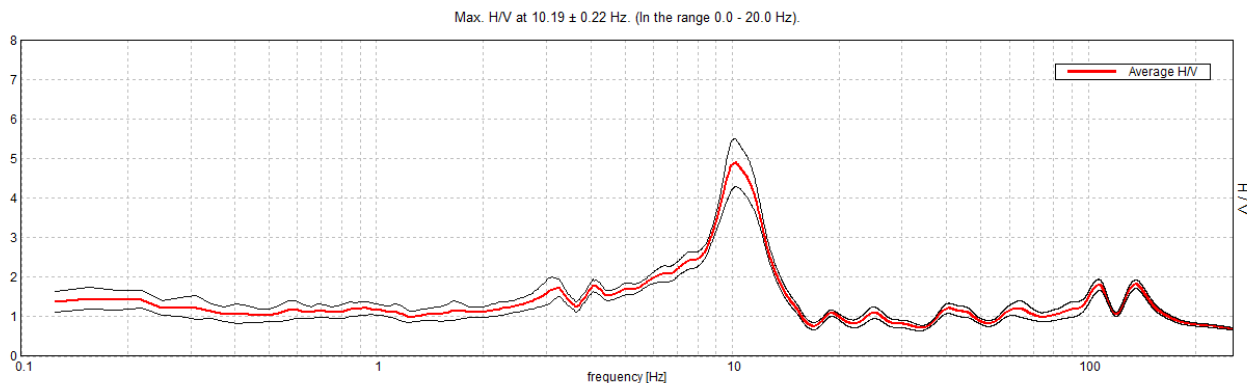
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4954943	140272
	



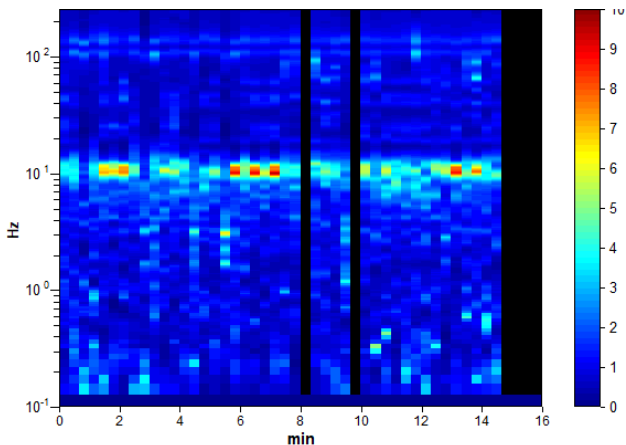
**BIBBIANO, P8**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 10/05/01 18:02:59 End recording: 10/05/01 18:18:59  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 88% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

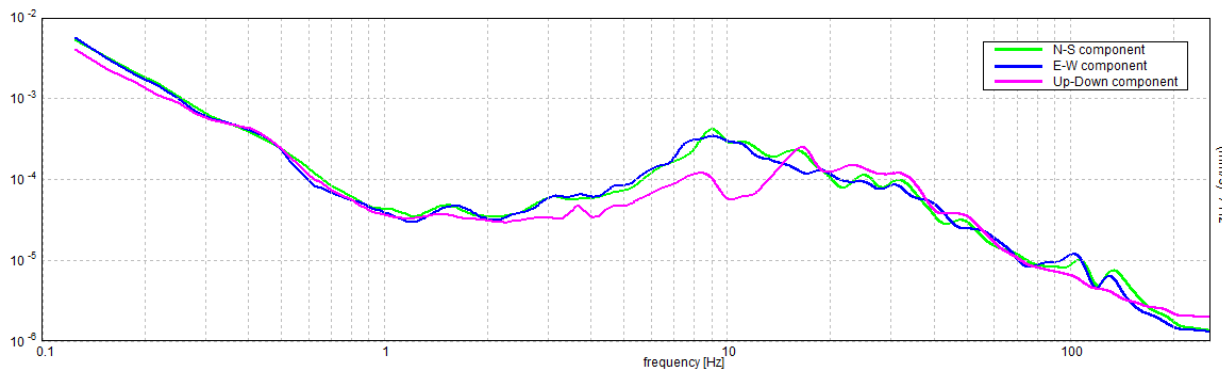
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 10.19 ± 0.22 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	10.19 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	8557.5 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 490 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	7.906 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	12.875 Hz	<b>OK</b>	
$A_0 > 2$	4.89 > 2	<b>OK</b>	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.02197  < 0.05$	<b>OK</b>	
$\sigma_f < \varepsilon(f_0)$	$0.22379 < 0.50938$	<b>OK</b>	
$\sigma_A(f_0) < \theta(f_0)$	$0.6046 < 1.58$	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
10,19 Hz	Alta





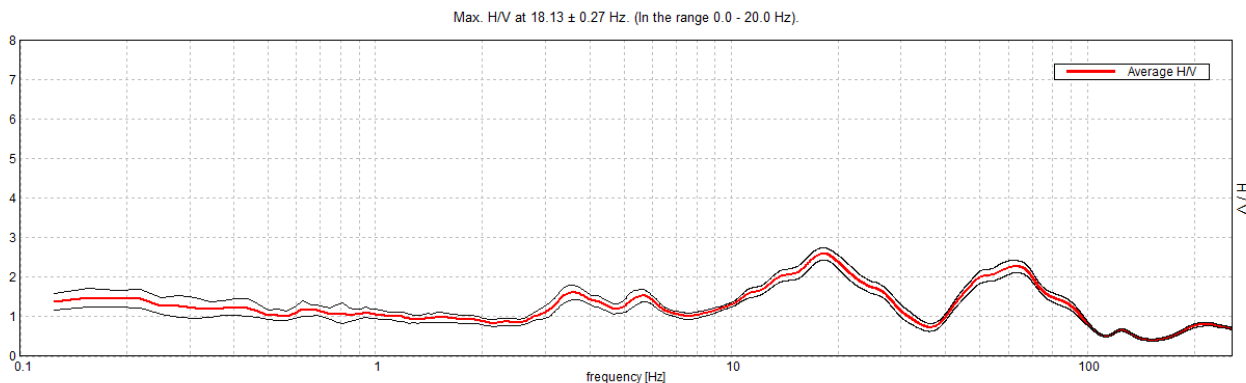
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4954414	140235
	



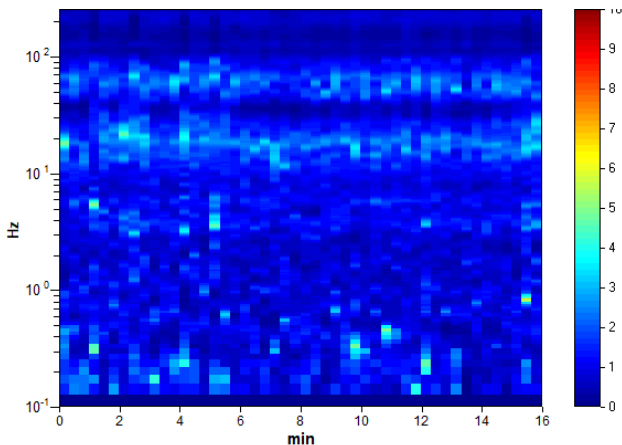
**BIBBIANO, P9**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 10/05/01 18:37:01 End recording: 10/05/01 18:53:02  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analysis performed on the entire trace.  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

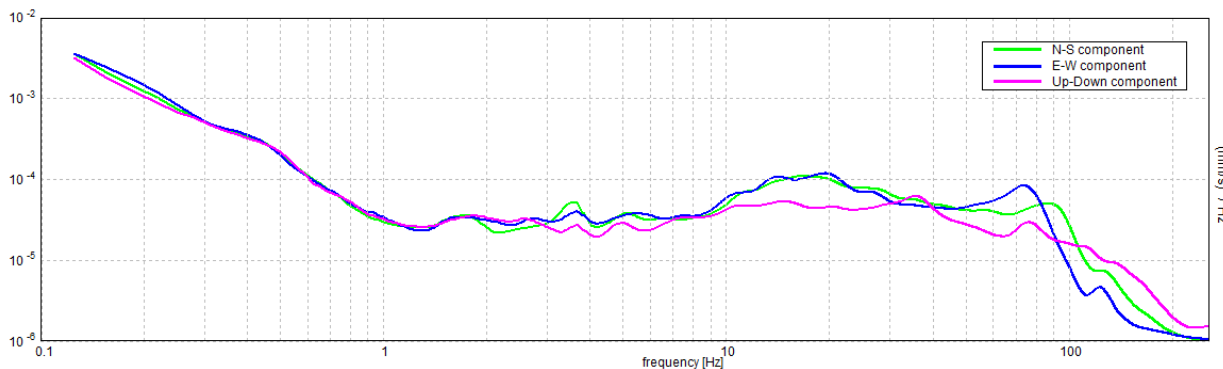
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 18.13 ± 0.27 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	18.13 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	17400.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 871 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	9.938 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	28.938 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	2.59 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.01474  < 0.05$	<b>OK</b>	
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	0.26719 < 0.90625	<b>OK</b>	
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.1571 < 1.58	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
18,13 Hz	Alta





UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4954293	139751
	



### BIBBIANO, P10

Instrument: TEP-0124/01-10

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 10/05/01 19:27:48 End recording: 10/05/01 19:43:49

Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down; Y+ Y-; X+ X-; Z+ Z-

GPS data not available

Trace length: 0h16'00". Analyzed 85% trace (manual window selection)

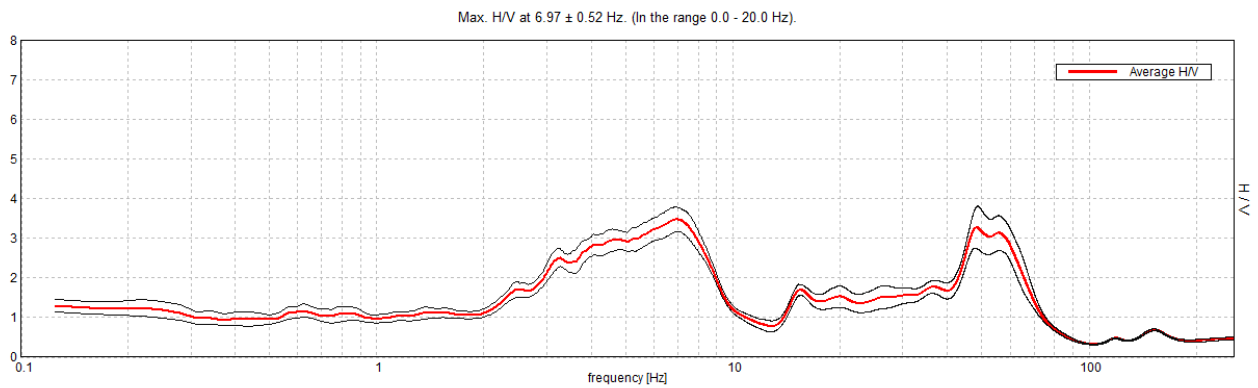
Sampling rate: 512 Hz

Window size: 20 s

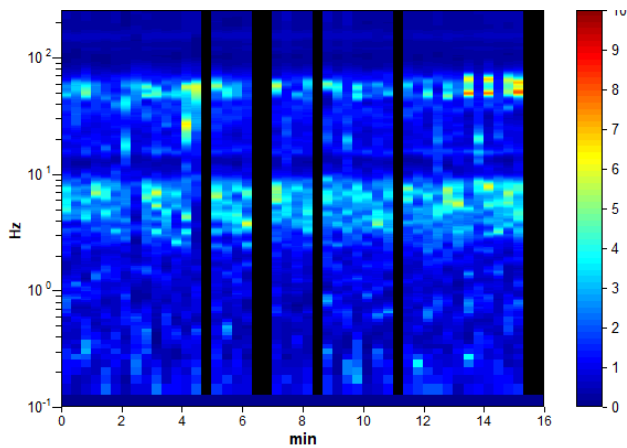
Smoothing type: Triangular window

Smoothing: 10%

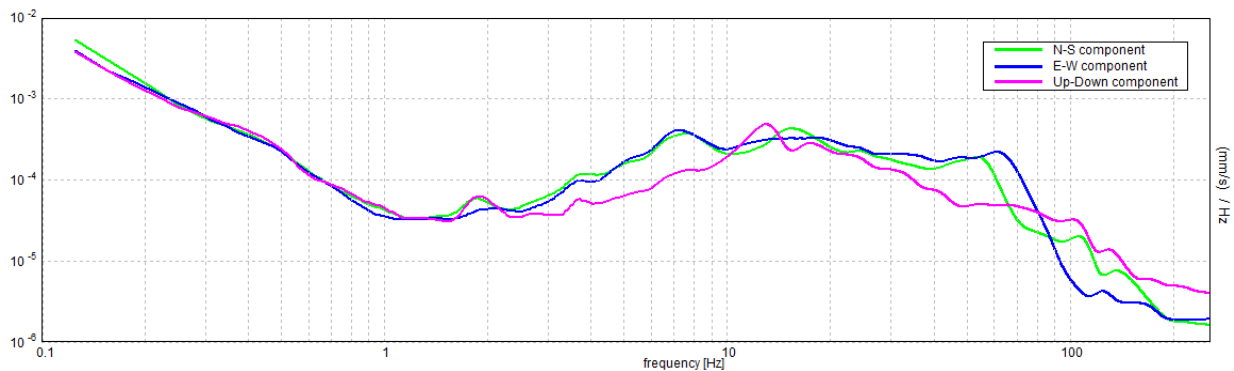
#### HORIZONTAL TO VERTICAL SPECTRAL RATIO



#### H/V TIME HISTORY



#### SINGLE COMPONENT SPECTRA





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

**Max. H/V at 6.97 ± 0.52 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	6.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	5714.4 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 336 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	2.75 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	9.25 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	3.47 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.07414  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.51663 < 0.34844$		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.3109 < 1.58$	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
6,97 Hz	Alta

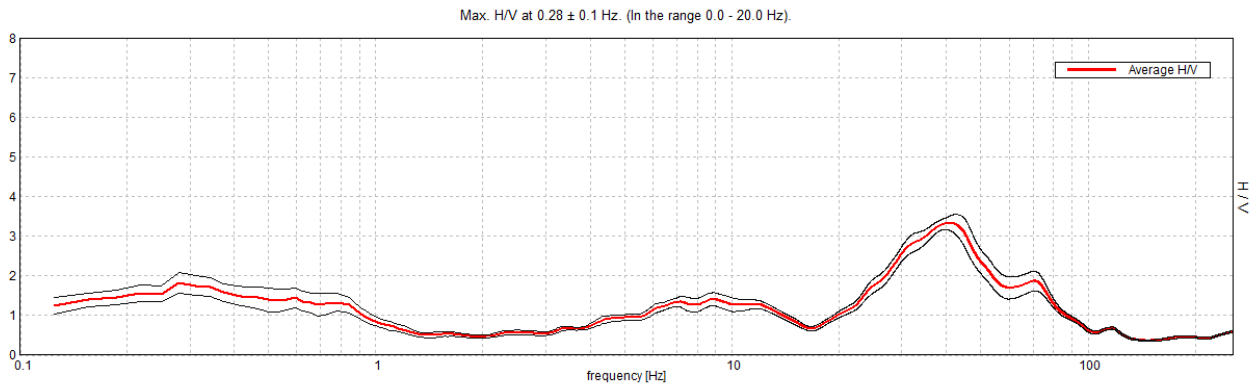


UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4954490	140657
	

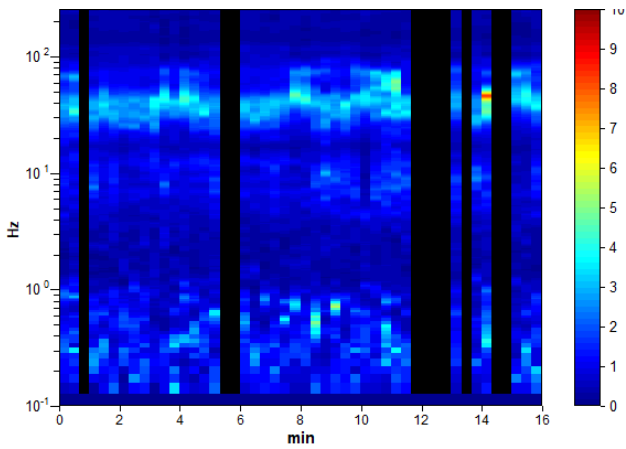
**BIBBIANO, P11**

Instrument: TRZ-0156/01-11  
Data format: 16 byte  
Full scale [mV]: n.a.  
Start recording: 05/12/19 10:58:11      End recording: 05/12/19 11:14:11  
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
GPS data not available  
Trace length: 0h16'00".      Analyzed 79% trace (manual window selection)  
Sampling rate: 512 Hz  
Window size: 20 s  
Smoothing type: Triangular window  
Smoothing: 10%

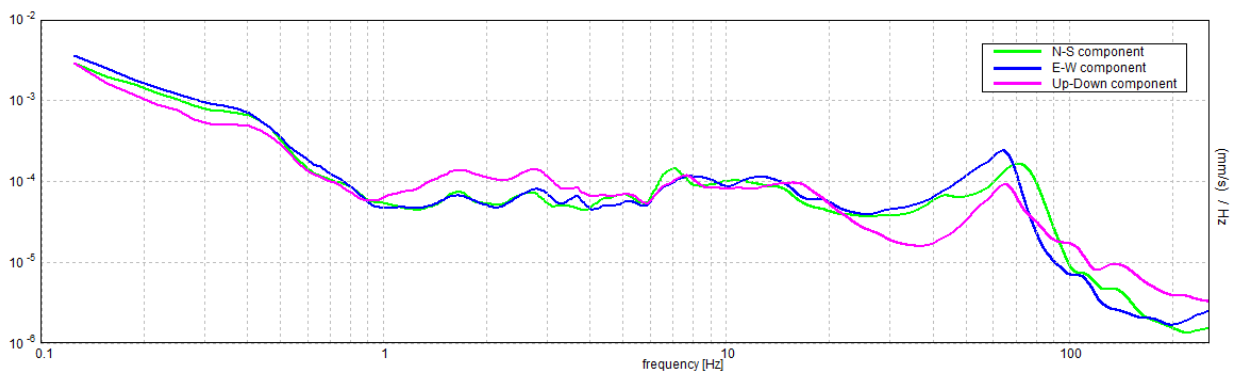
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 0.28 ± 0.1 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.28 > 0.50		<b>NO</b>
$n_c(f_0) > 200$	213.8 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 14 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	0.094 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	0.969 Hz	<b>OK</b>	
$A_0 > 2$	1.83 > 2		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.34436  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	$0.09685 < 0.05625$		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	$0.268 < 2.5$	<b>OK</b>	


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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
Nessun picco (np)	/





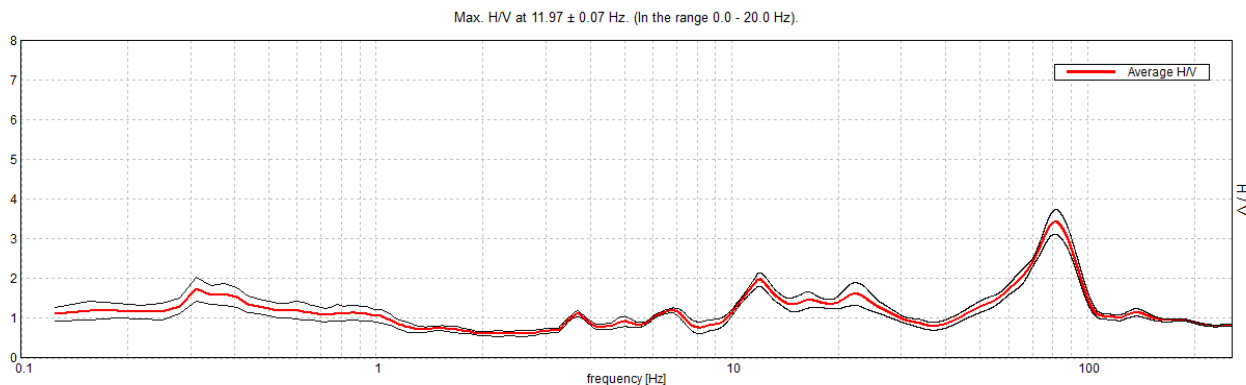
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4957250	142288
	



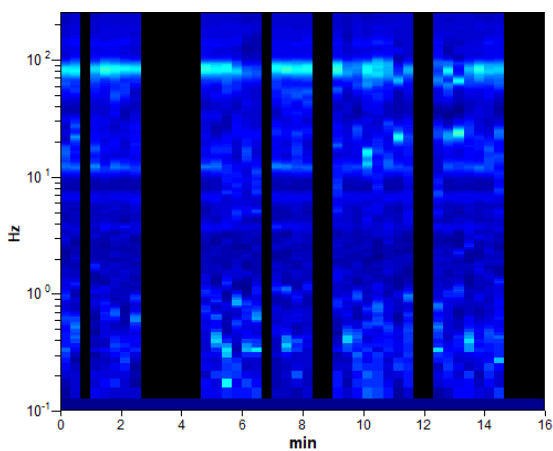
**BIBBIANO, P12**

Instrument: TRZ-0156/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 05/12/19 11:33:03      End recording: 05/12/19 11:49:03  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 67% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

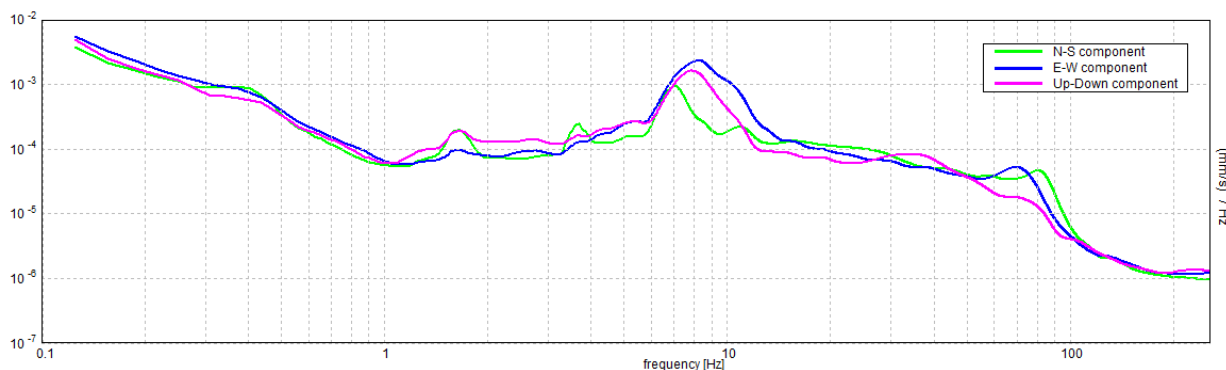
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 11.97 ± 0.07 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	11.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	7660.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 576 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	9.625 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	30.094 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	1.97 > 2		<b>NO</b>
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.00595  < 0.05$	<b>OK</b>	
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.07118 < 0.59844$	<b>OK</b>	
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.171 < 1.58$	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
Nessun picco (np)	/





UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4957673	142874
	

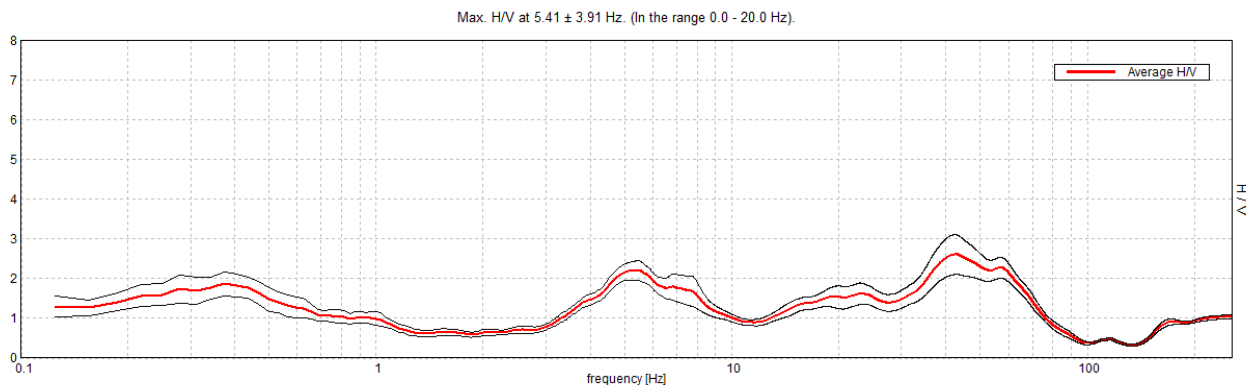




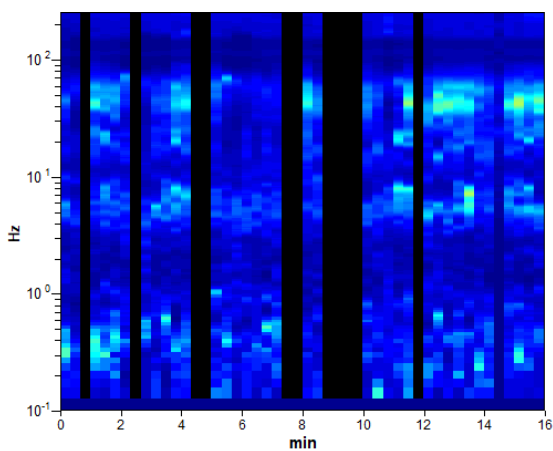
**BIBBIANO, P13**

Instrument: TRZ-0156/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 05/12/19 12:07:20      End recording: 05/12/19 12:23:20  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 77% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

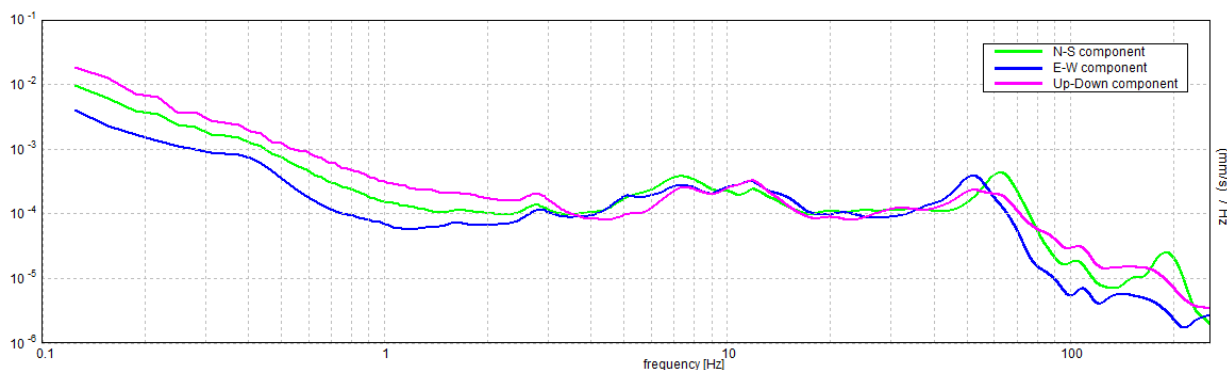
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 5.41 ± 3.91 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.41 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	4000.6 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 260 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	3.438 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	9.438 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	2.20 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.72284  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	3.90785 < 0.27031		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.246 < 1.58	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
5,41	Alta



UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4958066	142542
	

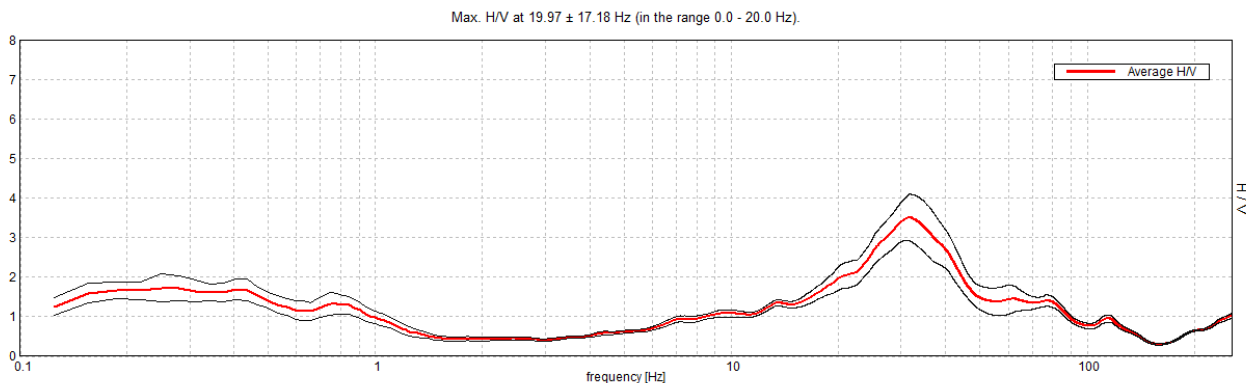




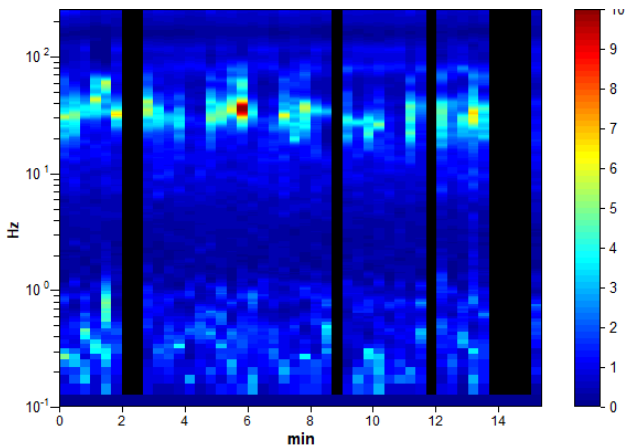
**BIBBIANO, P14**

Instrument: TRZ-0156/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 05/12/19 13:02:59 End recording: 05/12/19 13:18:29  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h15'24". Analyzed 83% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

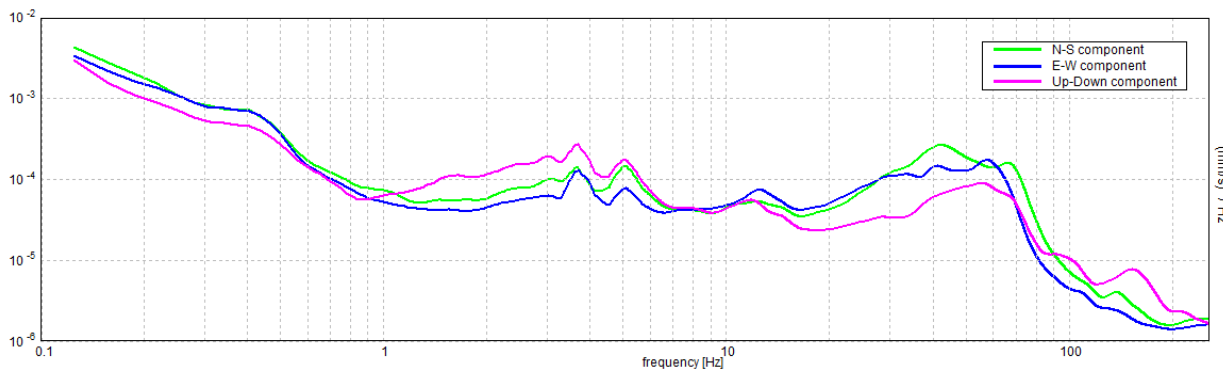
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**





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

**Max. H/V at 19.97 ± 17.18 Hz (in the range 0.0 - 20.0 Hz).**

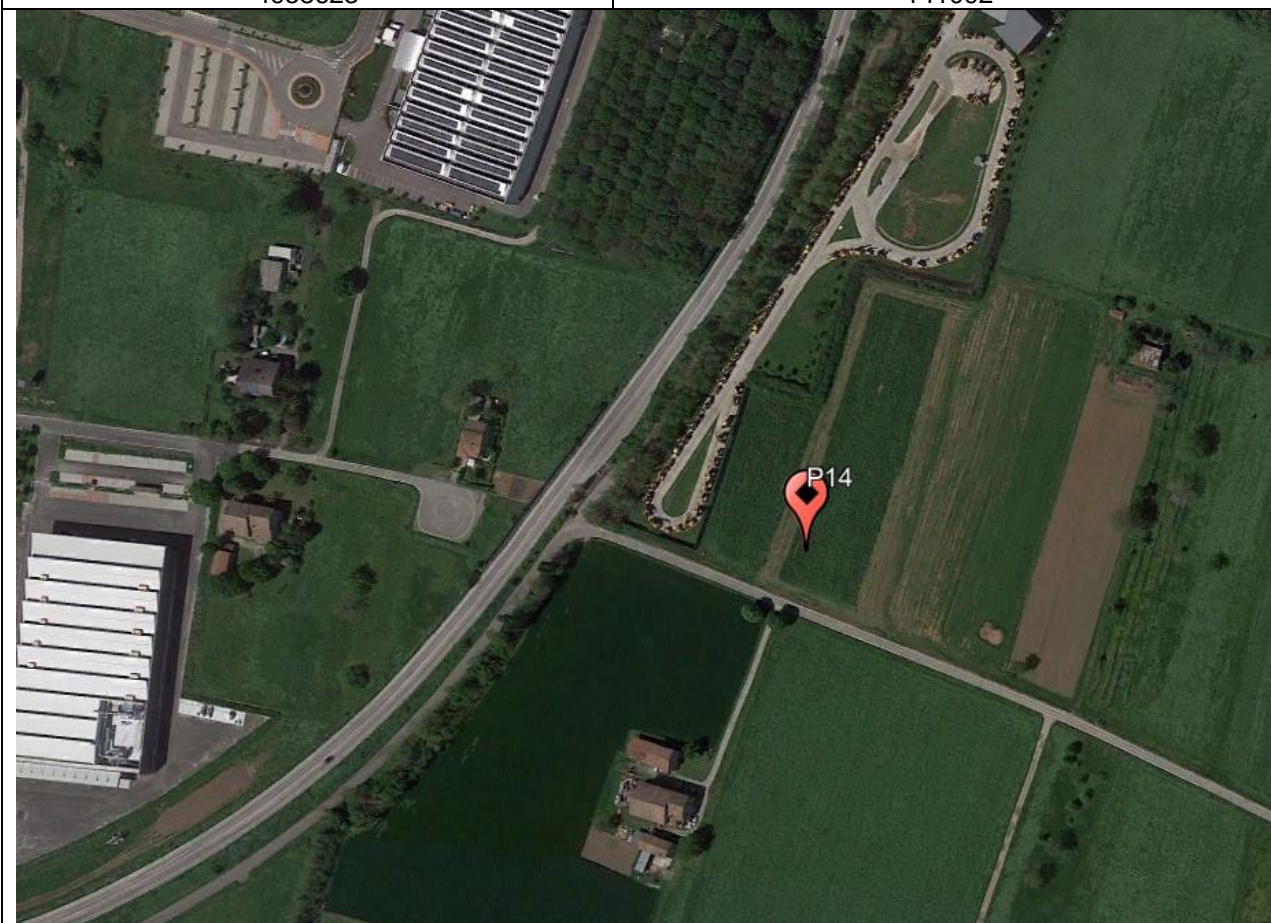
<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	15176.3 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 960 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	8.281 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	1.96 > 2		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.86035  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	17.18006 < 0.99844		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.2922 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
Nessun picco (np)	/



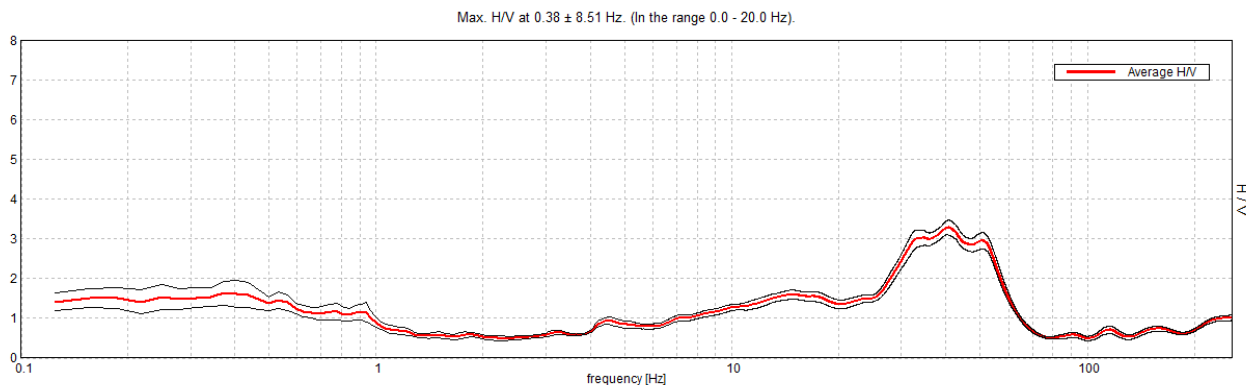
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4958623	141092
	



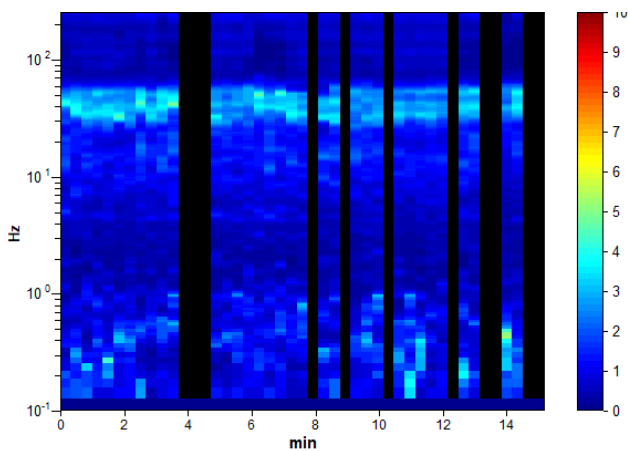
**BIBBIANO, P15**

Instrument: TRZ-0156/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 05/12/19 14:54:04      End recording: 05/12/19 15:09:26  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h15'12".      Analyzed 76% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

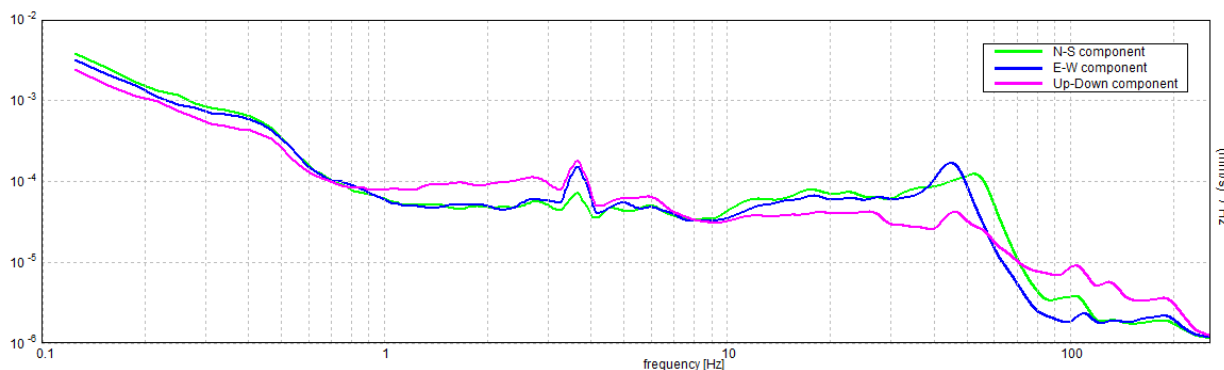
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 0.38 ± 8.51 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	0.38 > 0.50		<b>NO</b>
$n_c(f_0) > 200$	255.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 19 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	0.094 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	1.031 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	1.63 > 2		<b>NO</b>
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 22.69355  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	8.51008 < 0.075		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.3006 < 2.5	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
Nessun picco (np)	/





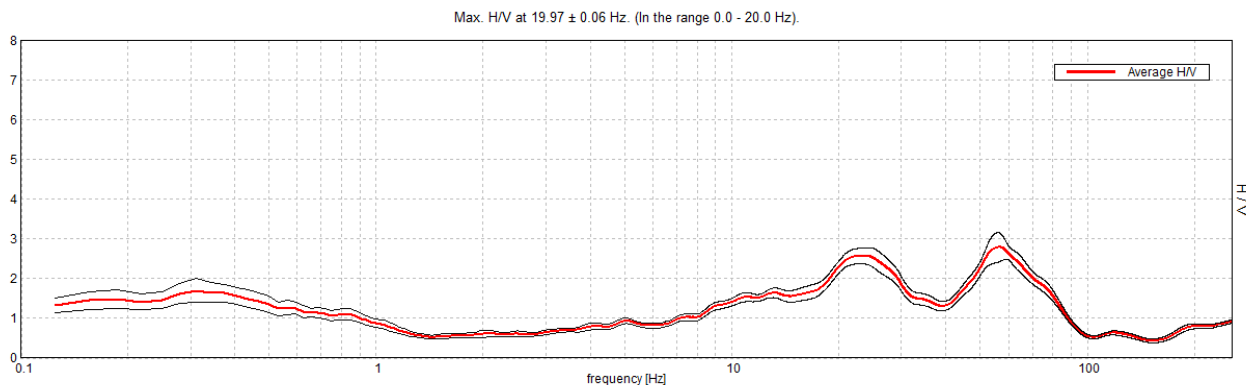
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4957812	142648
	



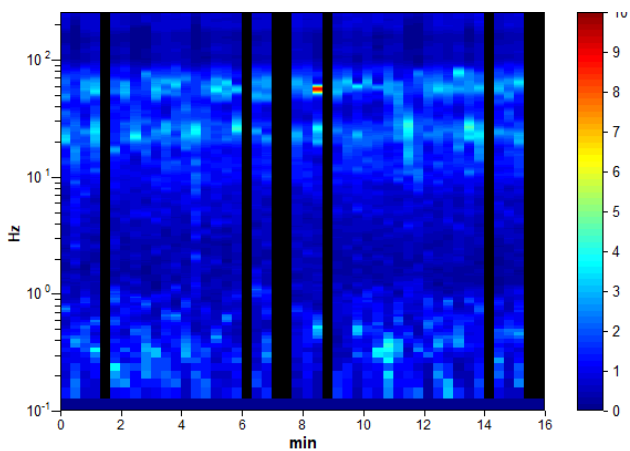
**BIBBIANO, P16**

Instrument: TRZ-0156/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 05/12/19 15:13:39 End recording: 05/12/19 15:29:39  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 83% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

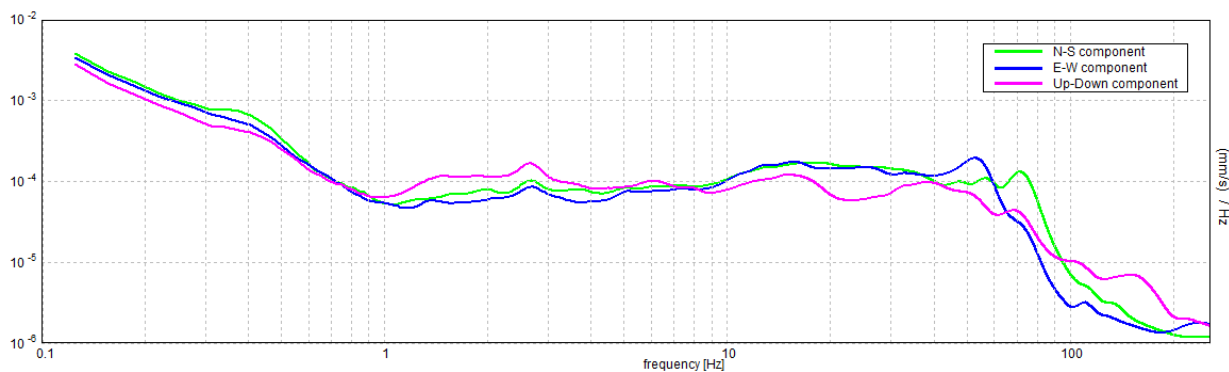
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 19.97 ± 0.06 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	15975.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 960 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	8.406 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	2.28 > 2	<b>OK</b>	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.00292  < 0.05$	<b>OK</b>	
$\sigma_f < \varepsilon(f_0)$	0.05825 < 0.99844	<b>OK</b>	
$\sigma_A(f_0) < \theta(f_0)$	0.1519 < 1.58	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
Nessun picco (np)	/





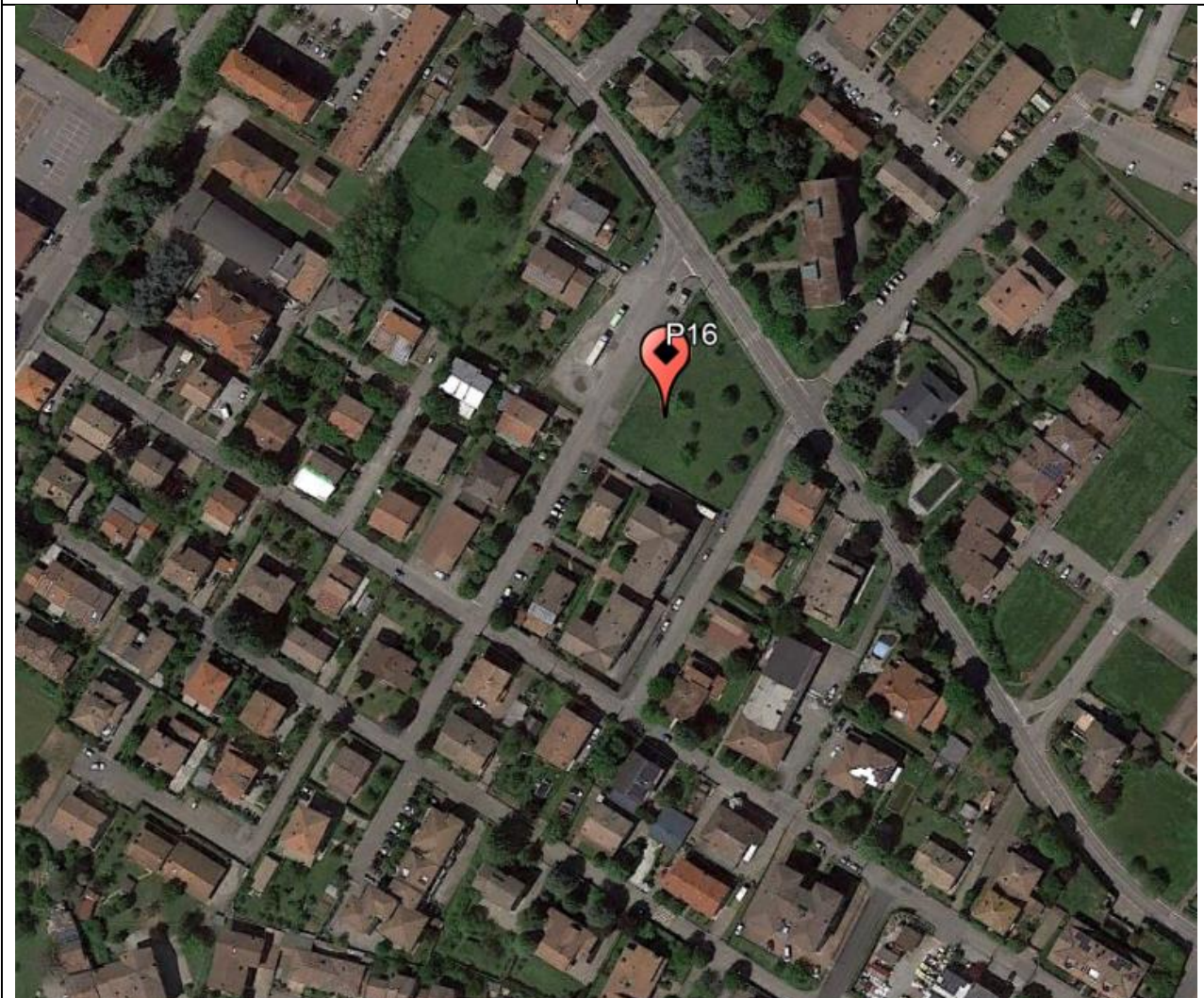
**UBICAZIONE INDAGINI**

**Latitudine (m)**

4958086

**Longitudine (m)**

143040

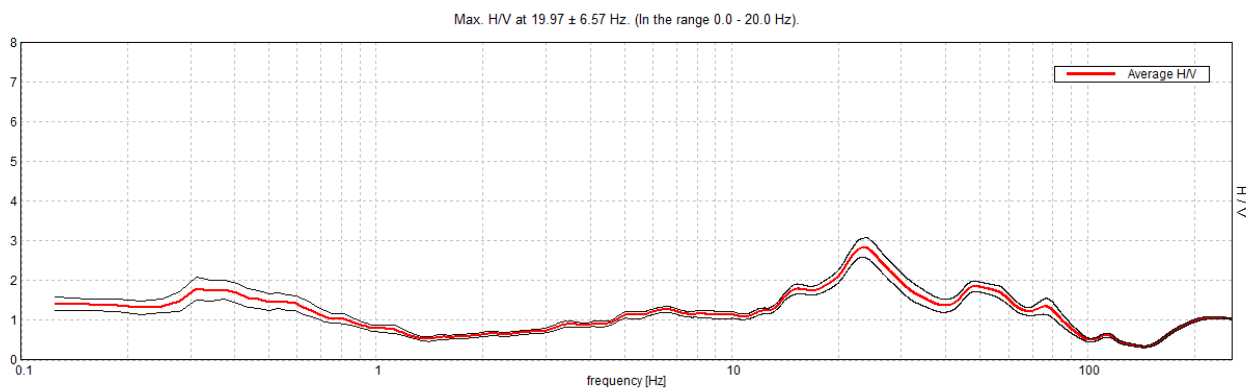




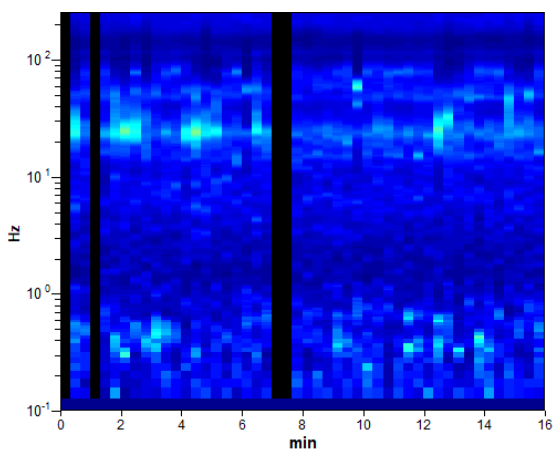
**BIBBIANO, P17**

Instrument: TRZ-0156/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 05/12/19 15:34:26 End recording: 05/12/19 15:50:26  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 92% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

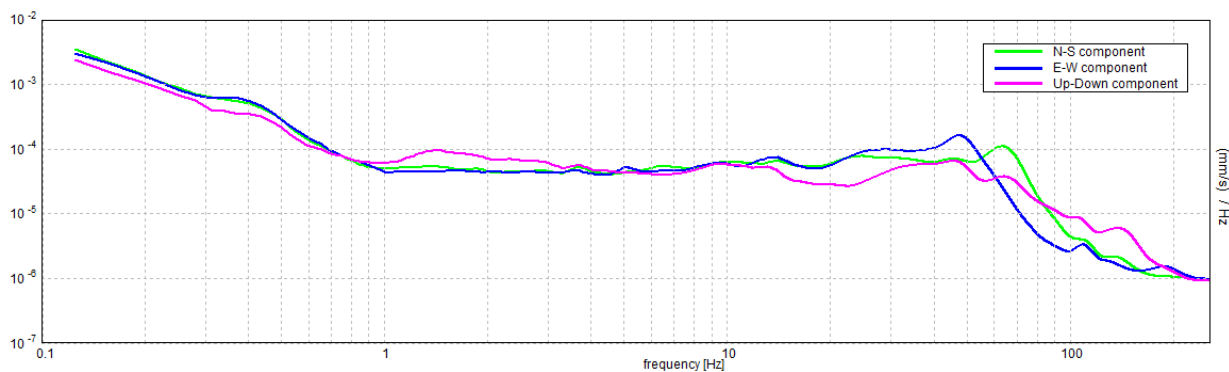
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 19.97 ± 6.57 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	17572.5 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 960 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>			<b>NO</b>
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	2.11 > 2	<b>OK</b>	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.32898  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	6.56931 < 0.99844		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.1597 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
Nessun picco (np)	/



UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4958105	143246
	

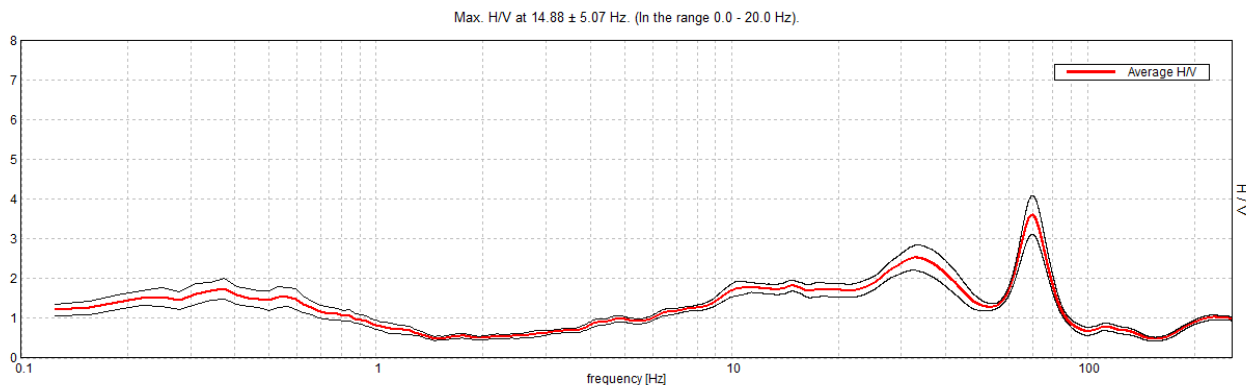




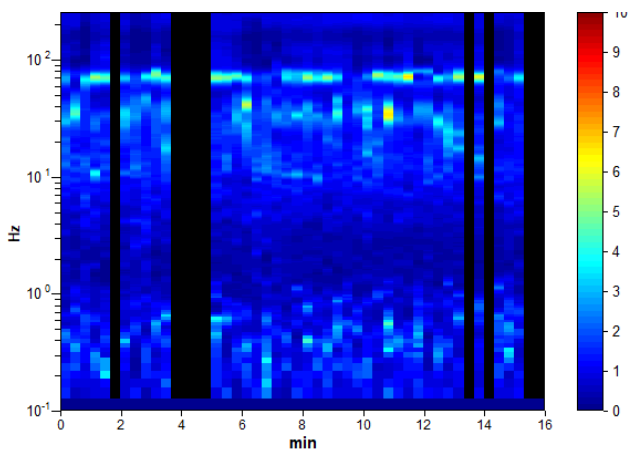
**BIBBIANO, P18**

Instrument: TRZ-0156/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 05/12/19 15:57:58      End recording: 05/12/19 16:13:58  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 81% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

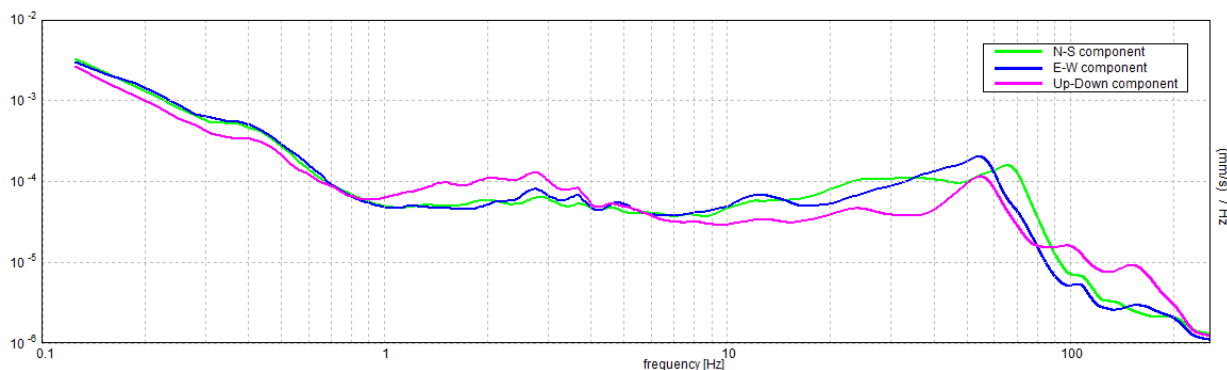
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**





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

**Max. H/V at 14.88 ± 5.07 Hz (in the range 0.0 - 20.0 Hz).**

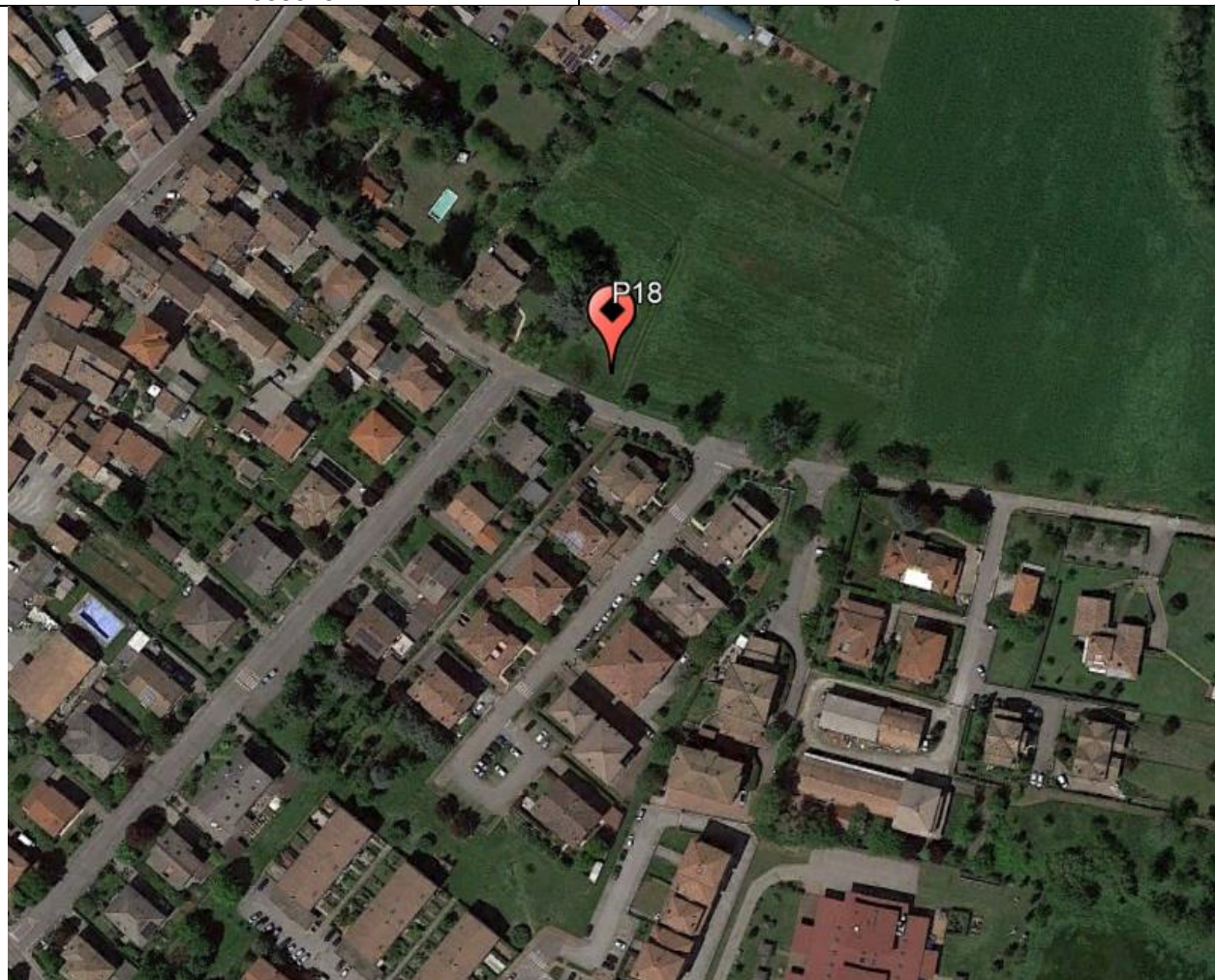
<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	14.88 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	11602.5 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 715 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	4.375 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	1.82 > 2		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.34071  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	5.06812 < 0.74375		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.1378 < 1.58	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
14,88 Hz	Bassa



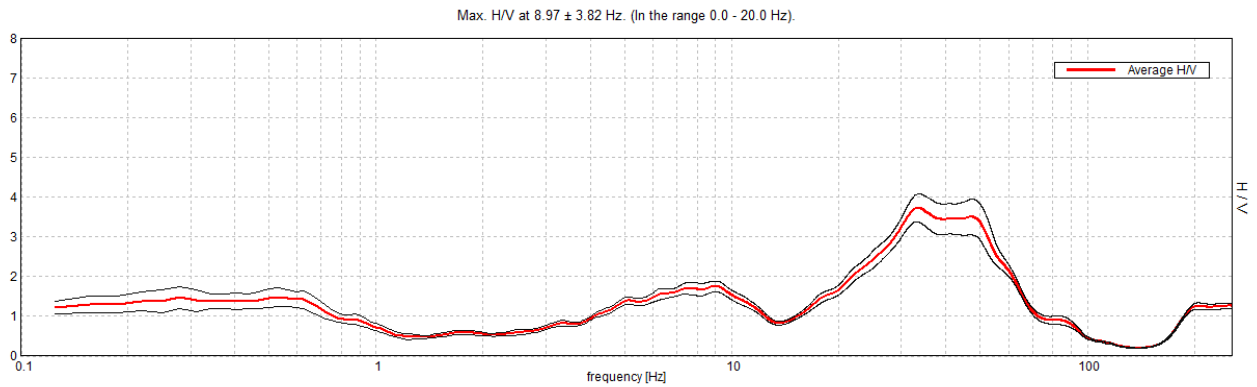
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4958375	143222
	



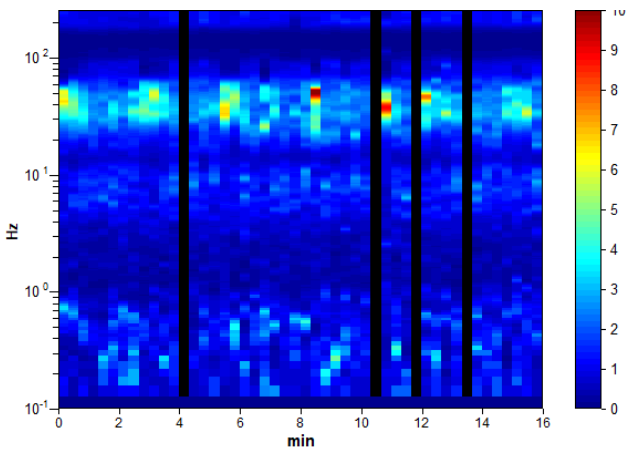
**BIBBIANO, P19**

Instrument: TRZ-0156/01-11  
Data format: 16 byte  
Full scale [mV]: n.a.  
Start recording: 05/12/19 16:25:04 End recording: 05/12/19 16:41:04  
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
GPS data not available  
Trace length: 0h16'00". Analyzed 92% trace (manual window selection)  
Sampling rate: 512 Hz  
Window size: 20 s  
Smoothing type: Triangular window  
Smoothing: 10%

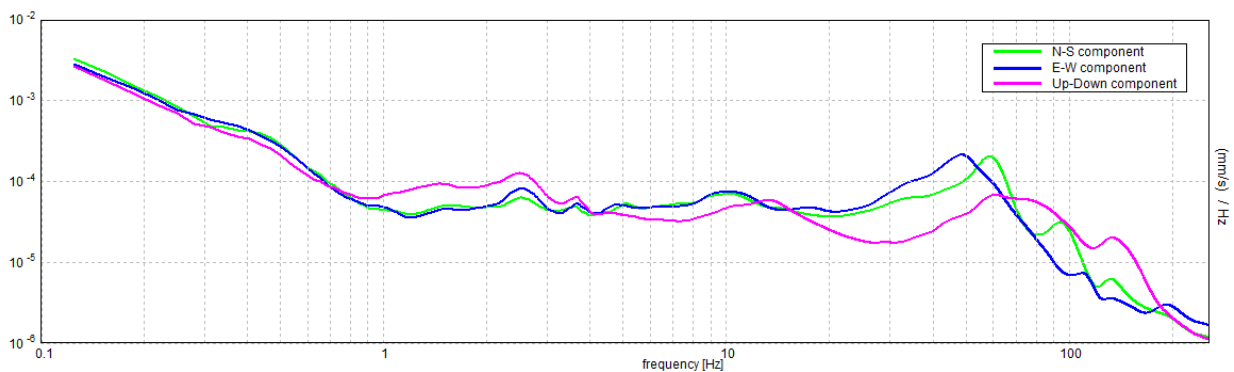
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 8.97 ± 3.82 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	8.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	7892.5 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 432 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	3.875 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	12.969 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	1.75 > 2		<b>NO</b>
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.42542  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	3.81544 < 0.44844		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.1364 < 1.58	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
14,88 Hz	Bassa





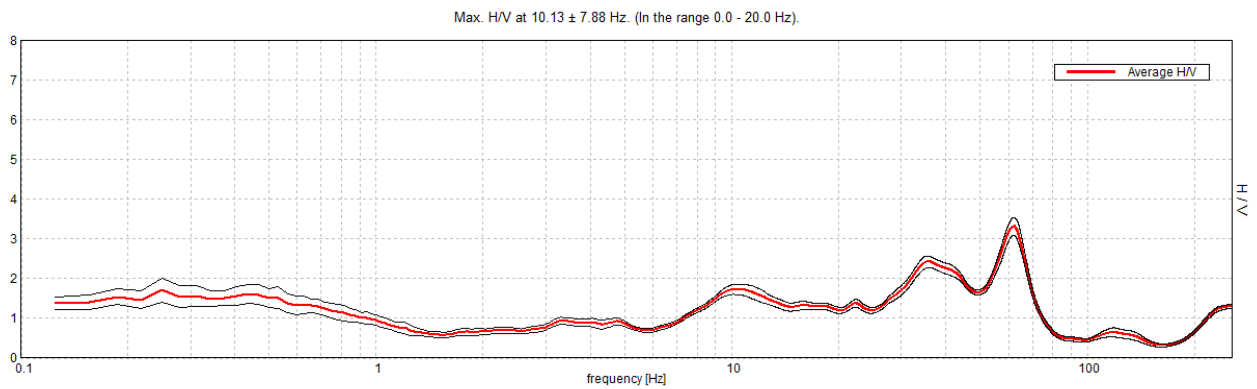
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4958537	143536
	



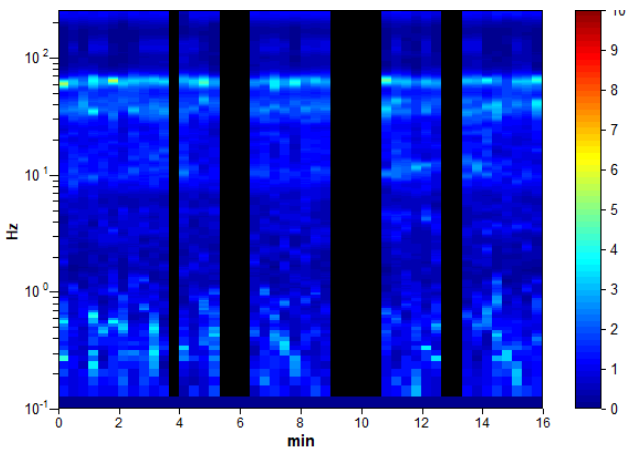
**BIBBIANO, P20**

Instrument: TRZ-0156/01-11  
Data format: 16 byte  
Full scale [mV]: n.a.  
Start recording: 05/12/19 16:47:38 End recording: 05/12/19 17:03:38  
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
GPS data not available  
Trace length: 0h16'00". Analyzed 77% trace (manual window selection)  
Sampling rate: 512 Hz  
Window size: 20 s  
Smoothing type: Triangular window  
Smoothing: 10%

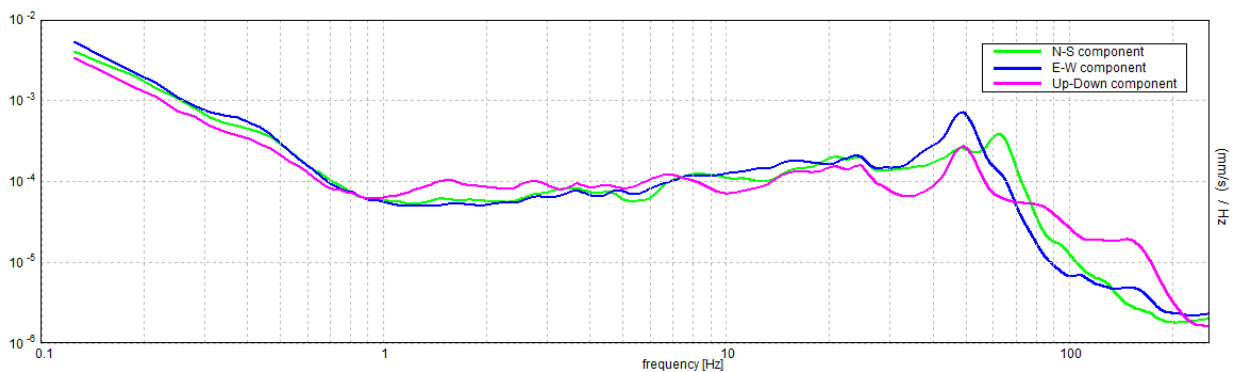
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 10.13 ± 7.88 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	10.13 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	7492.5 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 487 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	6.844 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	1.72 > 2		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.77845  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	7.8818 < 0.50625		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.1211 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
10,13 Hz	Media





UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4958290	143942
	

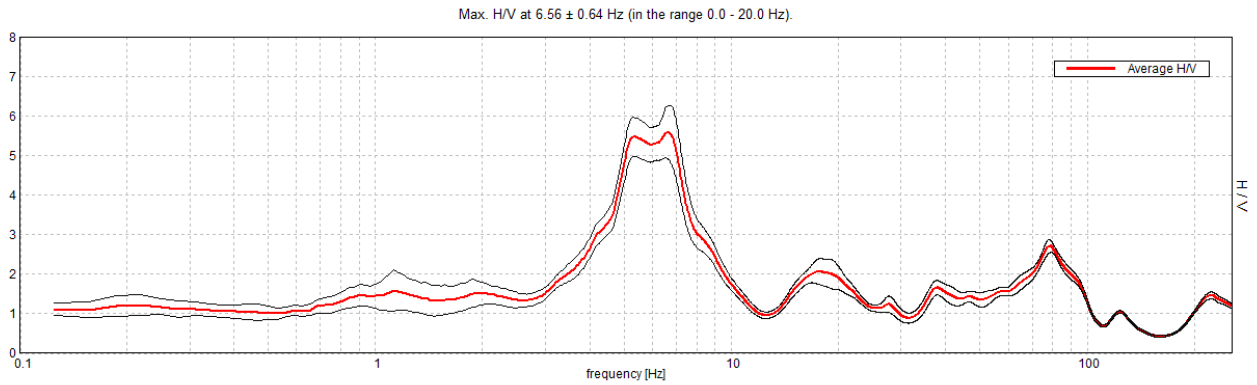




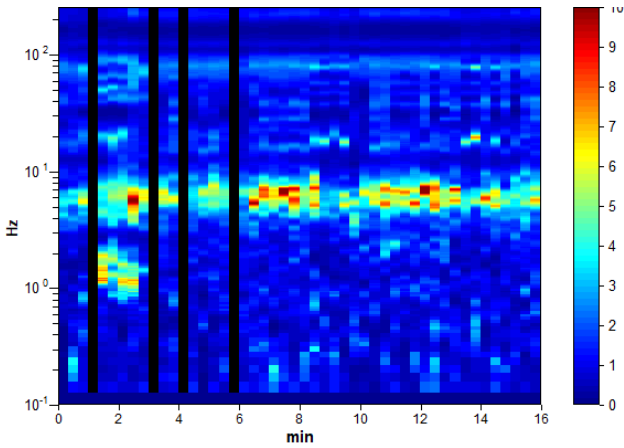
**BIBBIANO, P21**

Instrument: TEP-0124/01-10  
Data format: 16 byte  
Full scale [mV]: n.a.  
Start recording: 11/05/01 10:51:28 End recording: 11/05/01 11:07:28  
Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down; Y+ Y-; X+ X-; Z+ Z-  
GPS data not available  
Trace length: 0h16'00". Analyzed 92% trace (manual window selection)  
Sampling rate: 512 Hz  
Window size: 20 s  
Smoothing type: Triangular window  
Smoothing: 10%

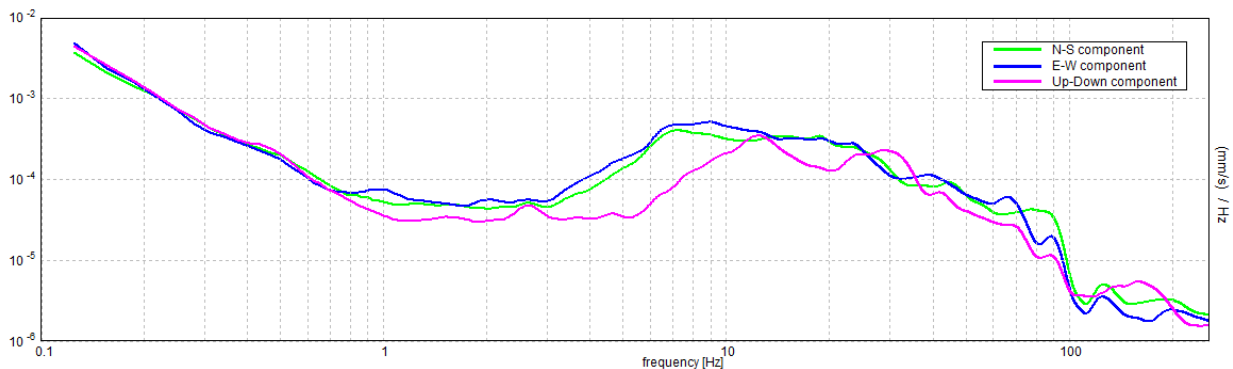
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 6.56 ± 0.64 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	6.56 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	5775.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 316 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	4.063 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	8.5 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	5.58 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.09678  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.63514 < 0.32813$		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.6369 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
6,56 Hz	Alta



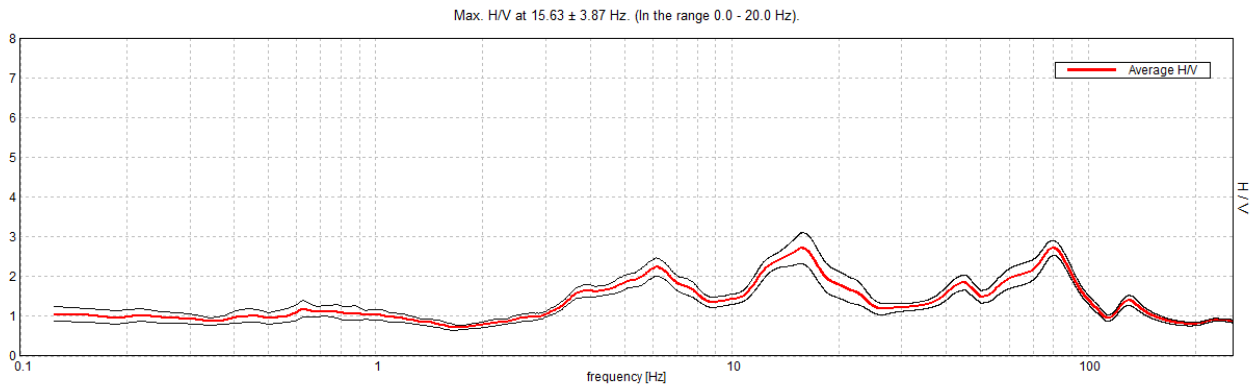
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4953212	139328



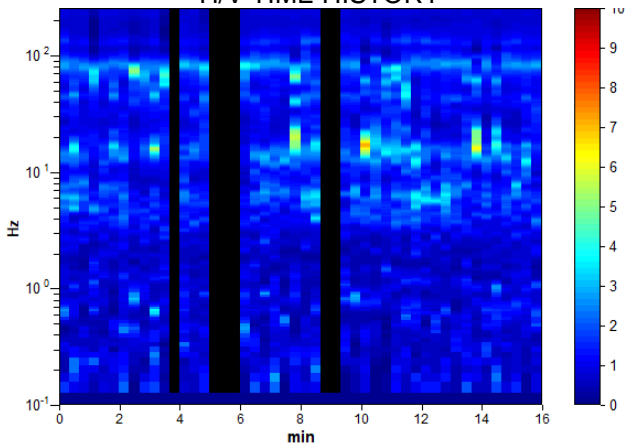
**BIBBIANO, P22**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 11:23:36 End recording: 11/05/01 11:39:36  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z- 15.63 > 0.50OK13125.0 > 200OKExceeded 0 out of 751 timesOK  
 GPS data not available  
 8.969 HzOK24.219 HzOK2.71 > 2OK|0.24799| < 0.05NO3.87487 < 0.78125NO0.385 < 1.58OK  
 Trace length: 0h16'00". Analyzed 88% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

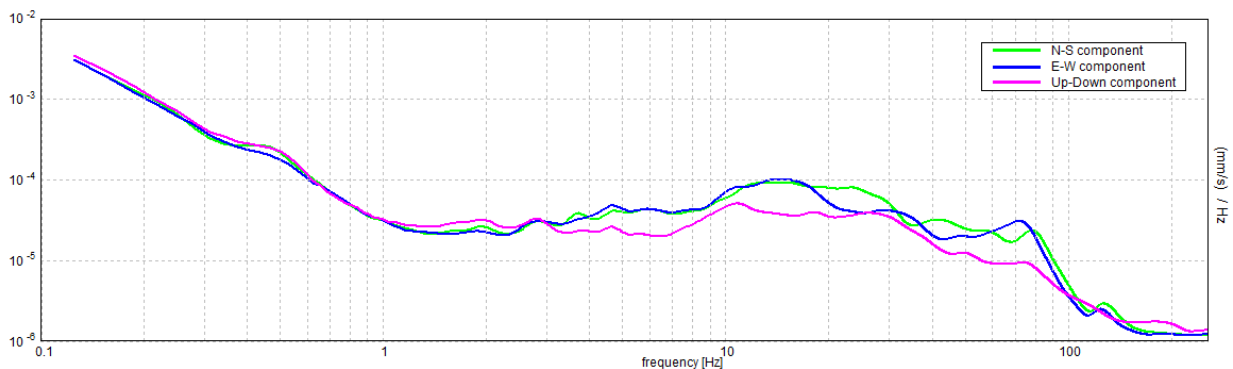
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**





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

**Max. H/V at 15.63 ± 3.87 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	15.63 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	13125.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	8.969 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	24.219 Hz	<b>OK</b>	
$A_0 > 2$	2.71 > 2	<b>OK</b>	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.24799  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	3.87487 < 0.78125		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.385 < 1.58	<b>OK</b>	


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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
15,63 Hz	Alta



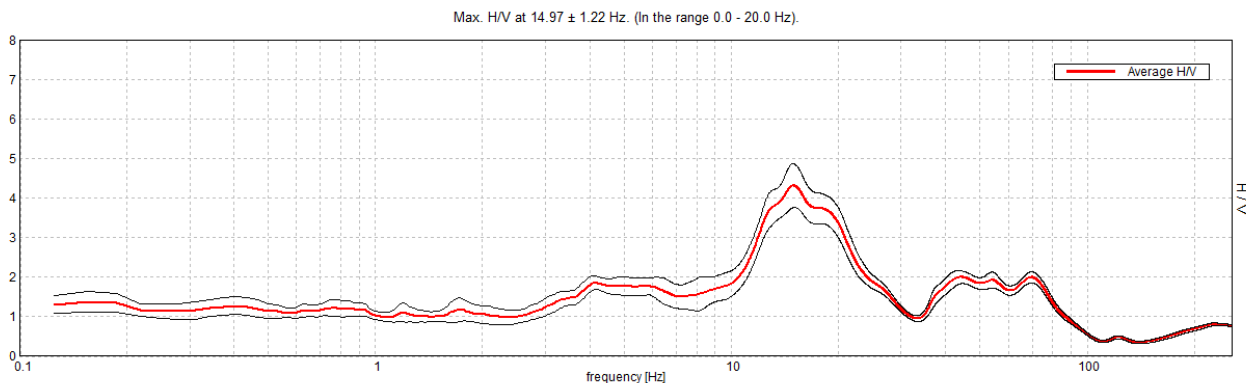
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4953545	139071



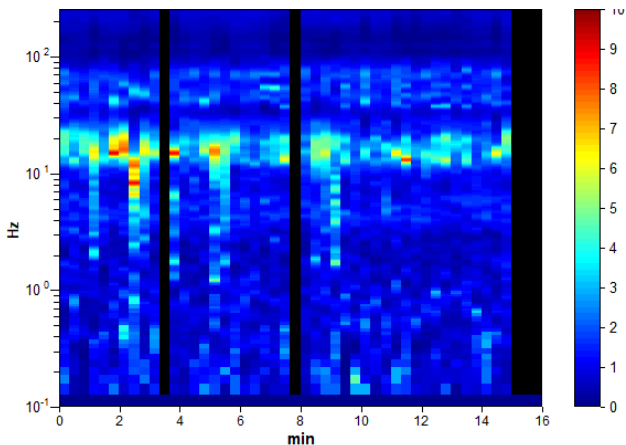
**BIBBIANO, P23**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 11:52:22 End recording: 11/05/01 12:08:22  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 90% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

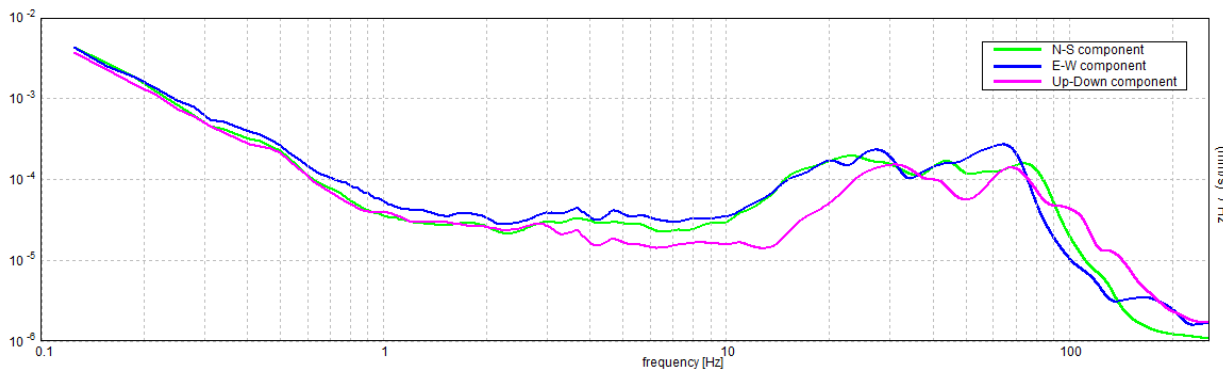
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 14.97 ± 1.22 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	14.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	12873.1 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 720 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	10.813 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	23.344 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	4.32 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.08146  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	1.21928 < 0.74844		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.5572 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
14,97 Hz	Alta





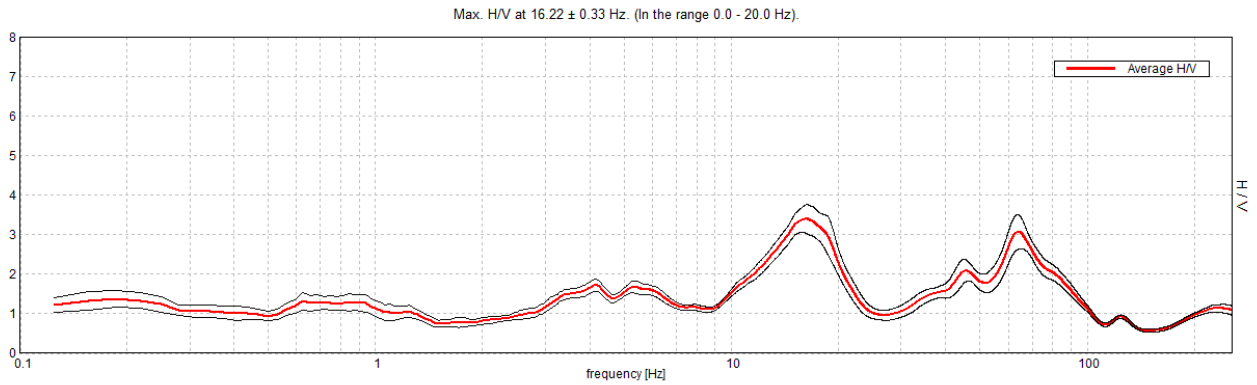
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4953388	138967



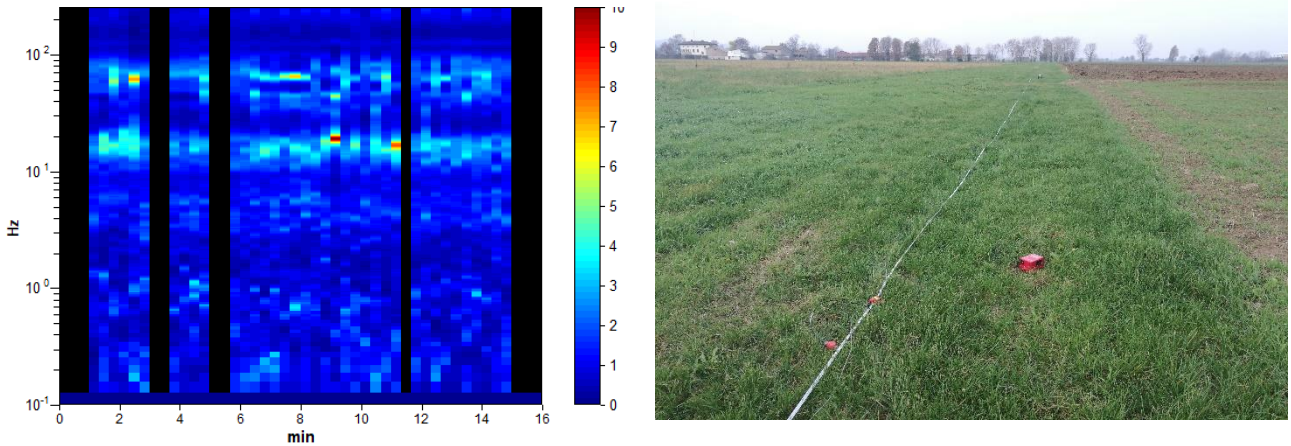
**BIBBIANO, P24**

Instrument: TEP-0124/01-10  
Data format: 16 byte  
Full scale [mV]: n.a.  
Start recording: 11/05/01 12:24:08 End recording: 11/05/01 12:40:08  
Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
Y+ Y- ; X+ X- ; Z+ Z-  
GPS data not available  
Trace length: 0h16'00". Analyzed 77% trace (manual window selection)  
Sampling rate: 512 Hz  
Window size: 20 s  
Smoothing type: Triangular window  
Smoothing: 10%

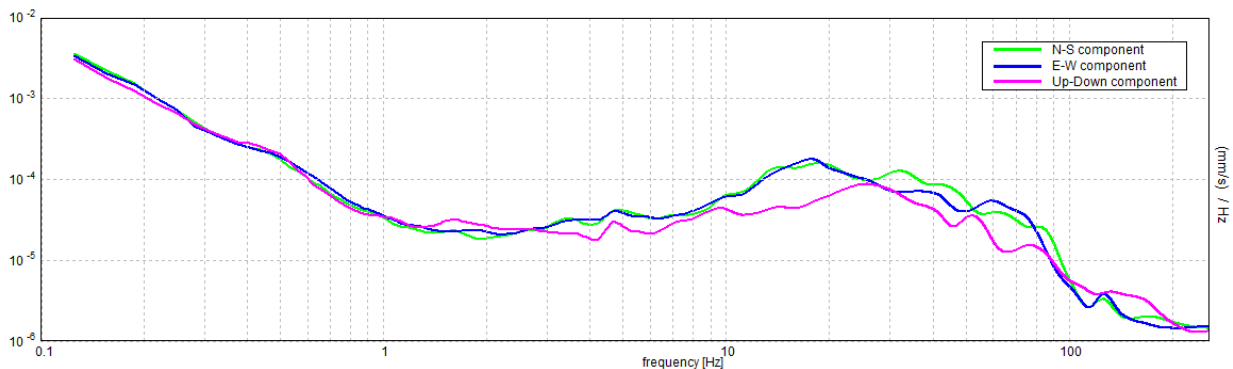
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 16.22 ± 0.33 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	16.22 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	12001.9 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 780 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	10.438 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	21.594 Hz	<b>OK</b>	
$A_0 > 2$	3.40 > 2	<b>OK</b>	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.02044  < 0.05$	<b>OK</b>	
$\sigma_f < \varepsilon(f_0)$	$0.33144 < 0.81094$	<b>OK</b>	
$\sigma_A(f_0) < \theta(f_0)$	$0.3599 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
16,22 Hz	Alta





UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4953687	139298

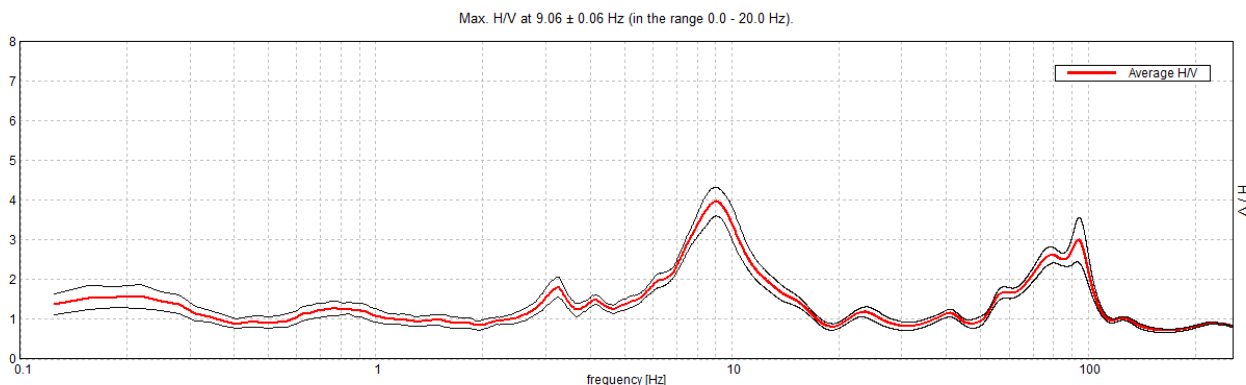




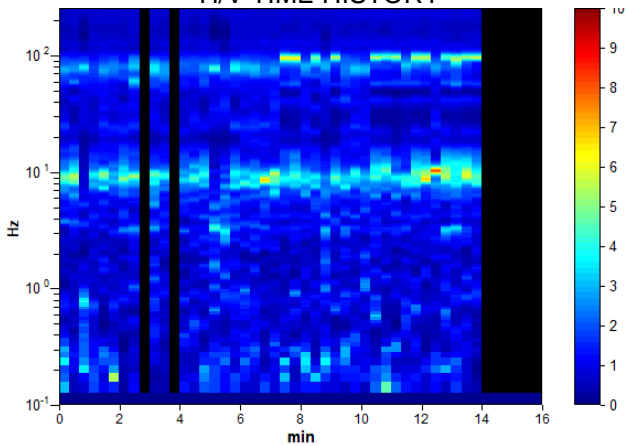
**BIBBIANO, P25**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 12:51:38 End recording: 11/05/01 13:07:38  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z- 9.06 > 0.50OK7250.0 > 200OKExceeded 0 out of 436 timesOK  
 GPS data not available  
 6.313 HzOK12.531 HzOK3.96 > 2OK|0.00711| < 0.05OK0.06442 < 0.45313OK0.3627 < 1.58OK  
 Trace length: 0h16'00". Analyzed 83% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

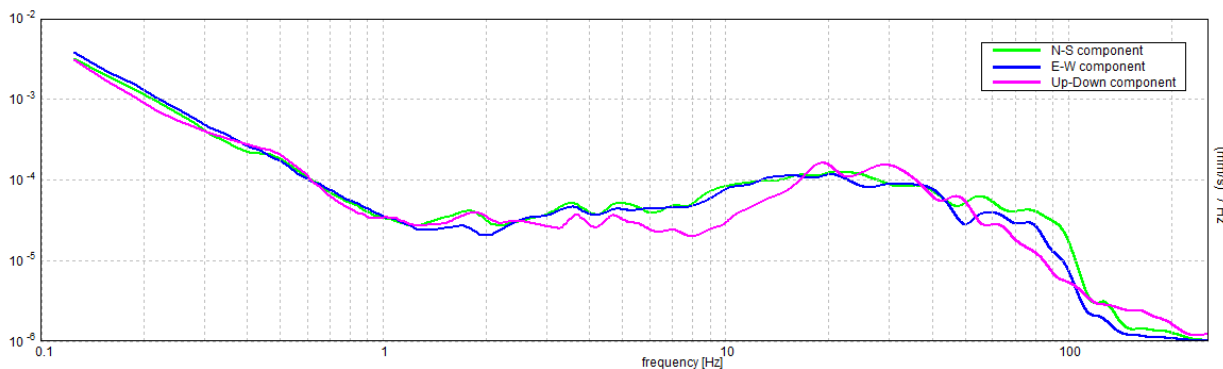
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 9.06 ± 0.06 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	9.06 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	7250.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 436 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	6.313 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	12.531 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	3.96 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	0.00711  < 0.05	<b>OK</b>	
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	0.06442 < 0.45313	<b>OK</b>	
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.3627 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
9,06 Hz	Alta



UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4954011	139884

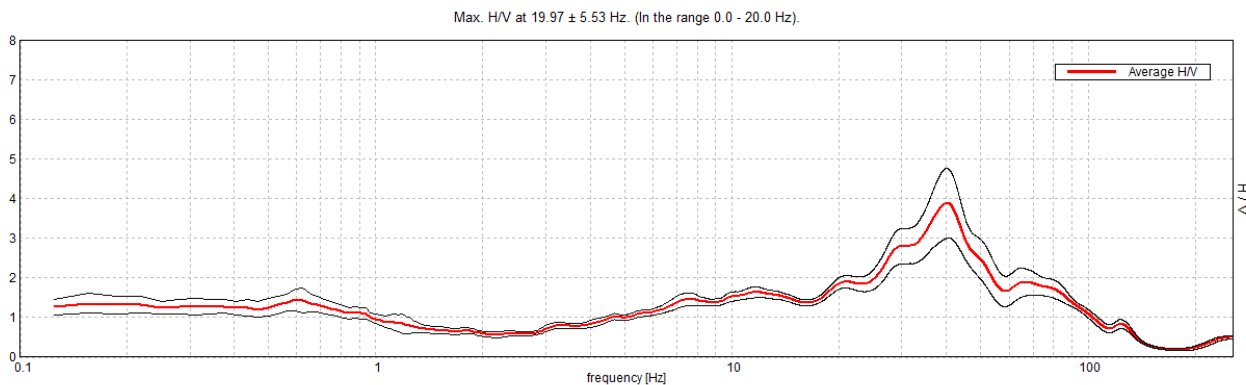
An aerial satellite photograph showing a residential neighborhood on the left and a large green field on the right. A red location pin with the label 'P25' is placed on the boundary between the houses and the field. A road runs vertically through the houses, and a railway track runs horizontally across the bottom right of the field.



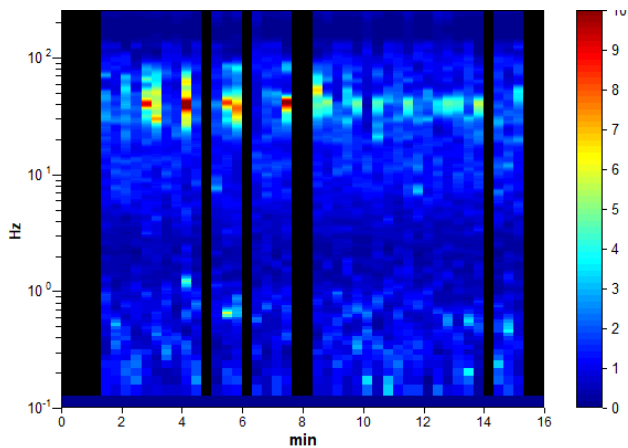
**BIBBIANO, P26**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 13:38:49 End recording: 11/05/01 13:54:50  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 77% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

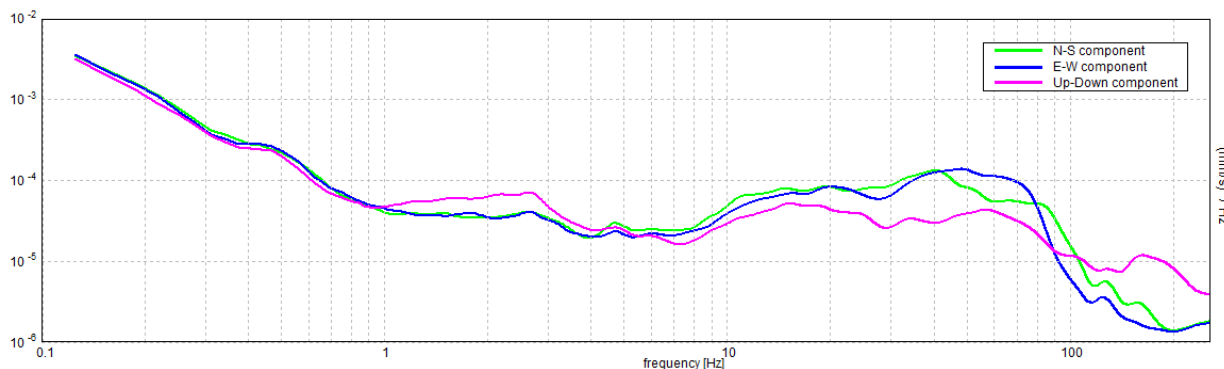
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**





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

**Max. H/V at 19.97 ± 5.53 Hz (in the range 0.0 - 20.0 Hz).**


<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$19.97 > 0.50$	<b>OK</b>	
$n_c(f_0) > 200$	$14776.9 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 960 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>			<b>NO</b>
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	$1.86 > 2$		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.27706  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	$5.53247 < 0.99844$		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	$0.1462 < 1.58$	<b>OK</b>	

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

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

<b>Frequenza caratteristica di sito</b>	<b>Precisione della stima della frequenza</b>
Nessun picco (np)	/



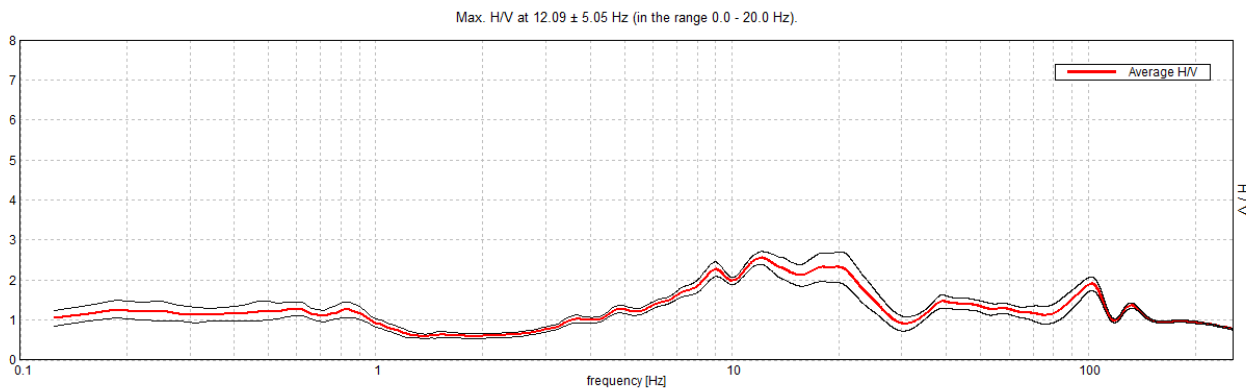
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4956192	141094
	



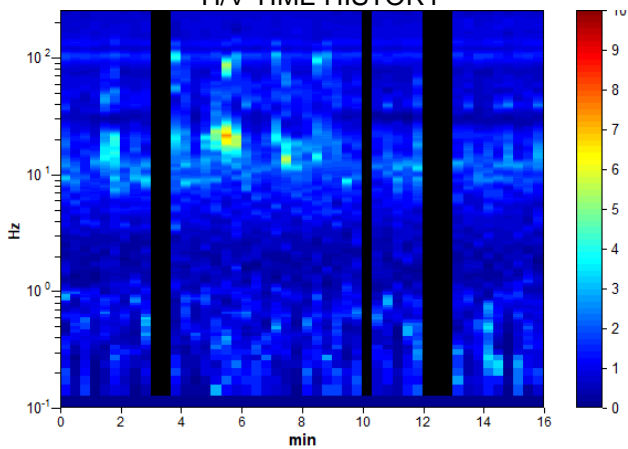
**BIBBIANO, P27**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 14:11:54 End recording: 11/05/01 14:27:55  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 88% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

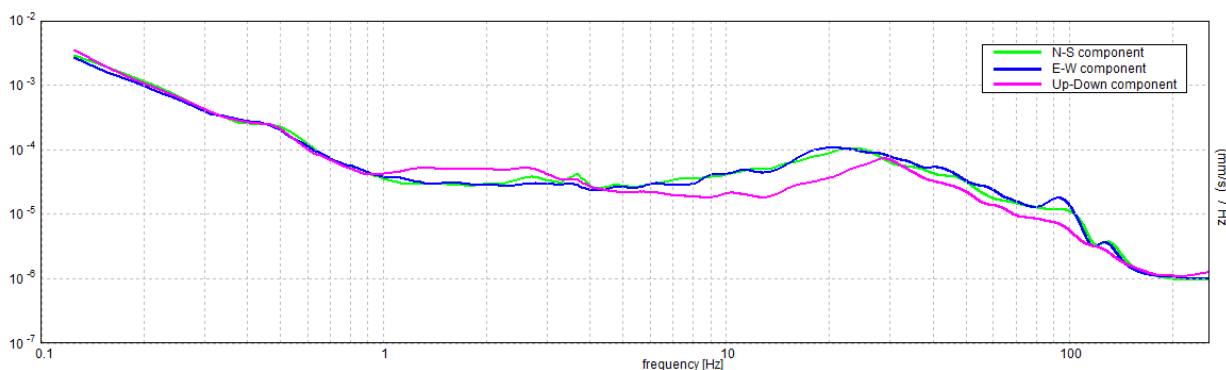
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 12.09 ± 5.05 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	12.09 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	10158.8 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 582 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
Exists $f^-$ in $[f_0/4, f_0]$   $A_{H/V}(f^-) < A_0 / 2$	5.719 Hz	<b>OK</b>	
Exists $f^+$ in $[f_0, 4f_0]$   $A_{H/V}(f^+) < A_0 / 2$	26.438 Hz	<b>OK</b>	
$A_0 > 2$	2.55 > 2	<b>OK</b>	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.41796  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	5.05472 < 0.60469		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.1589 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
12.09	Media





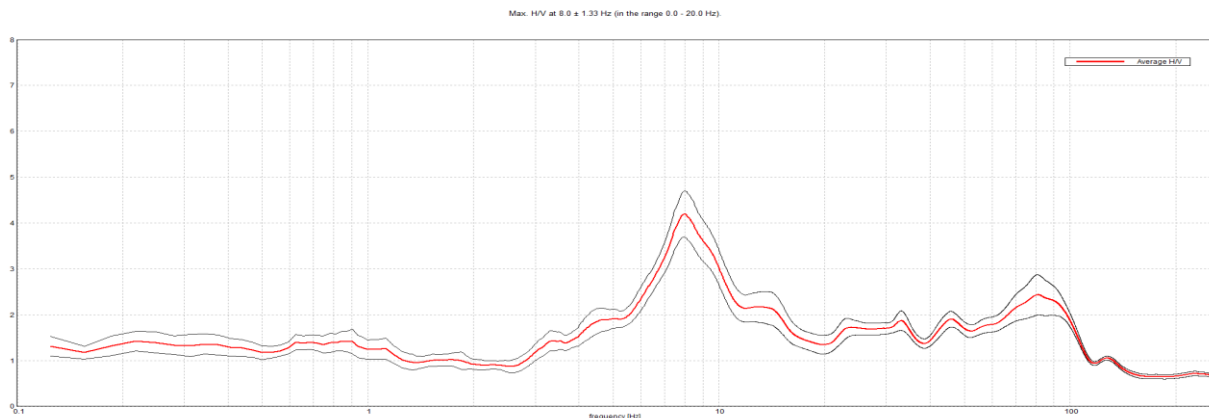
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4955337	142202



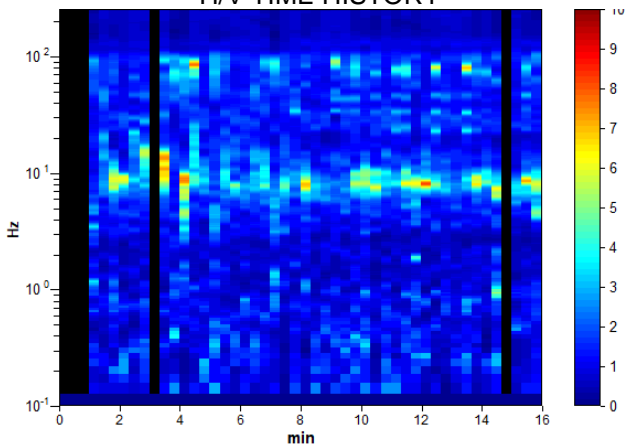
**BIBBIANO, P28**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 15:28:01 End recording: 11/05/01 15:44:01  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN ; north south; east west ; up down ;  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 90% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

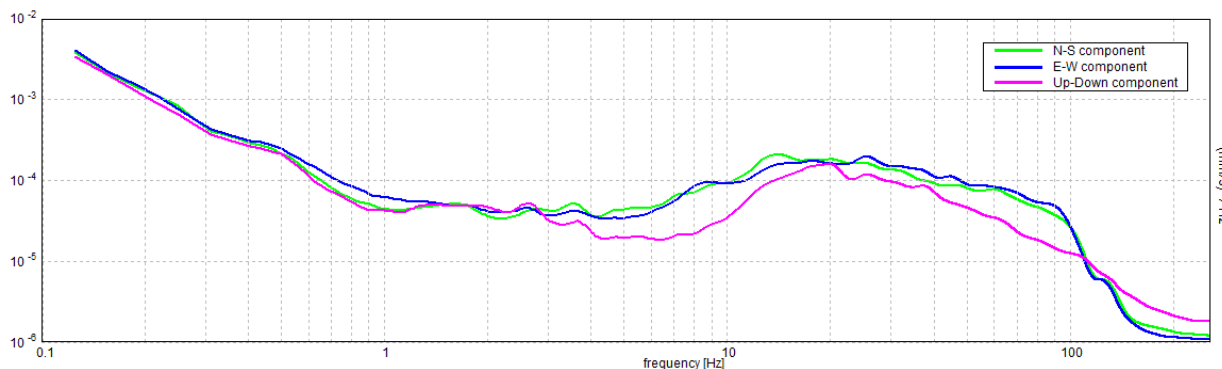
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 8.0 ± 1.33 Hz (in the range 0.0 - 20.0 Hz).**


<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	8.00 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	6880.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 385 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	5.688 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	14.406 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	4.20 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.16616  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	1.32926 < 0.4		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.5053 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
8,00 Hz	Alta



UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4955147	143029
	

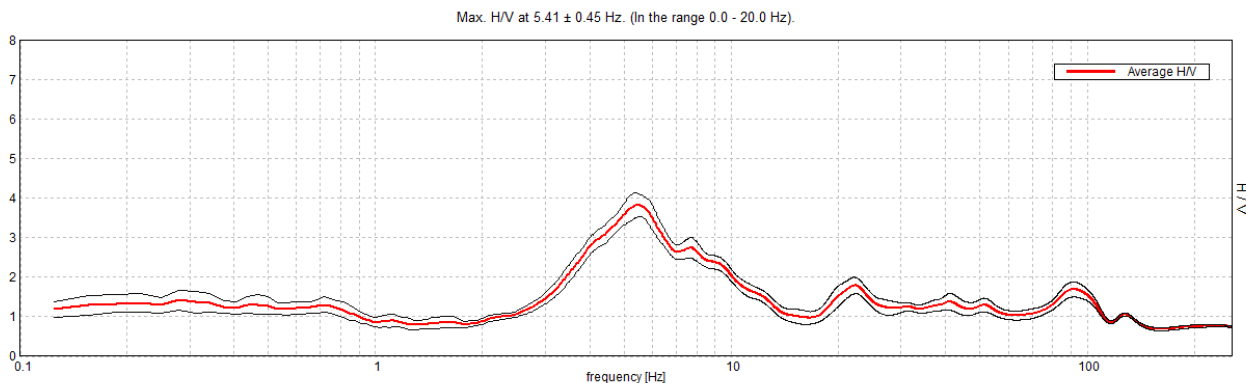




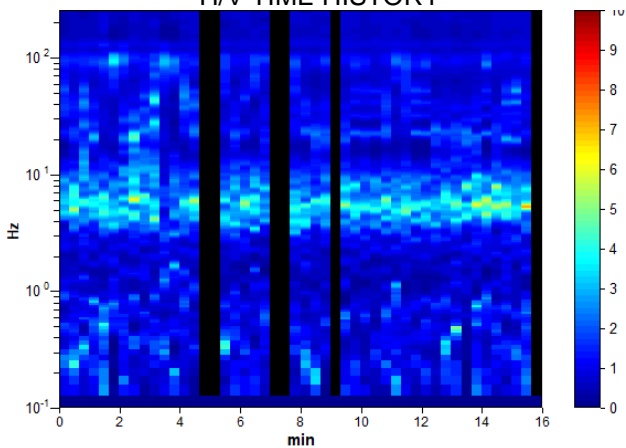
**BIBBIANO, P29**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 16:01:51 End recording: 11/05/01 16:17:51  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 88% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

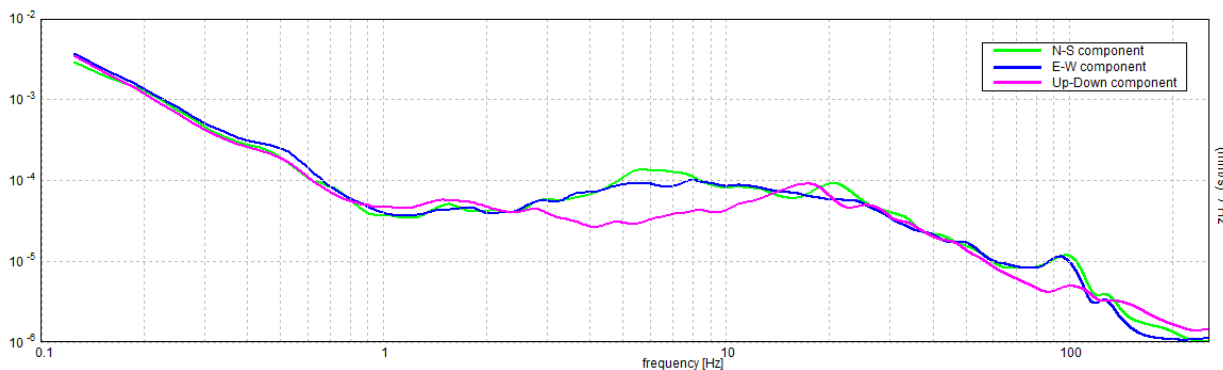
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 5.41 ± 0.45 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.41 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	4541.3 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 260 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	3.344 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	10.313 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	3.82 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.08278  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.44754 < 0.27031$		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.3116 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
5,41 Hz	Alta



UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4955502	143454
	

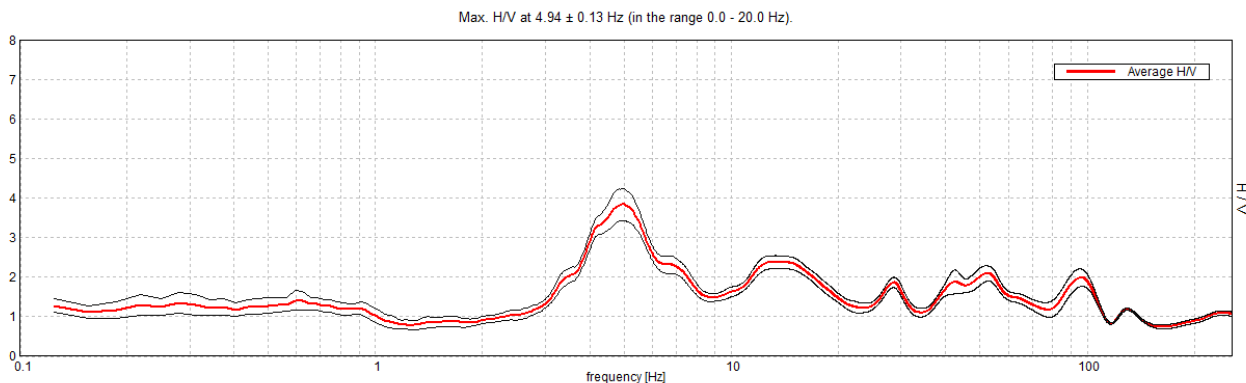




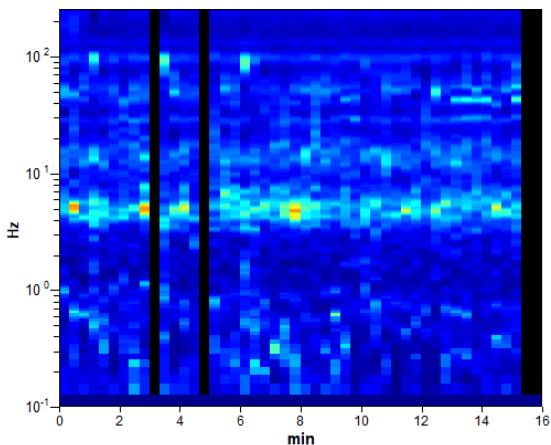
**BIBBIANO, P30**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 16:36:23      End recording: 11/05/01 16:52:23  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN ; north south; east west ; up down ;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 92% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

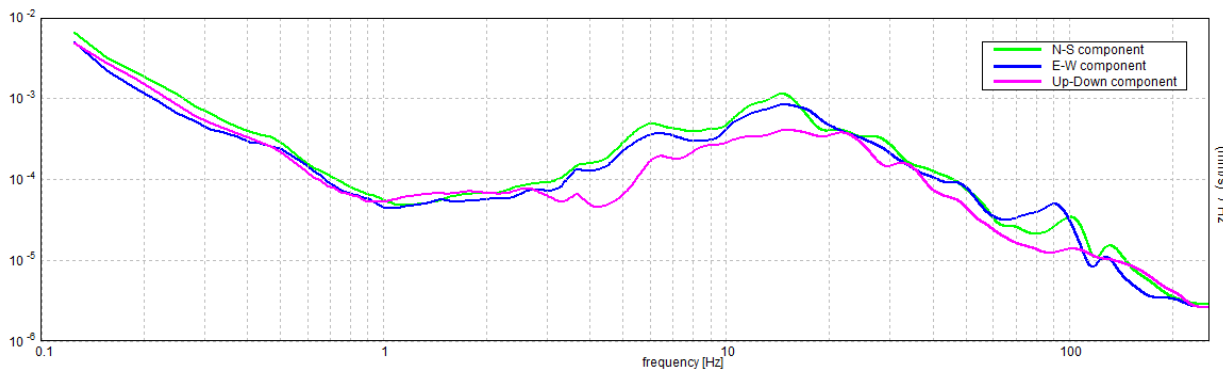
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**





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

**Max. H/V at 4.94 ± 0.13 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.94 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	4345.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 238 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	3.344 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	7.656 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	3.83 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.02562  < 0.05$	<b>OK</b>	
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	0.1265 < 0.24688	<b>OK</b>	
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.3985 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
4,94 Hz	Alta



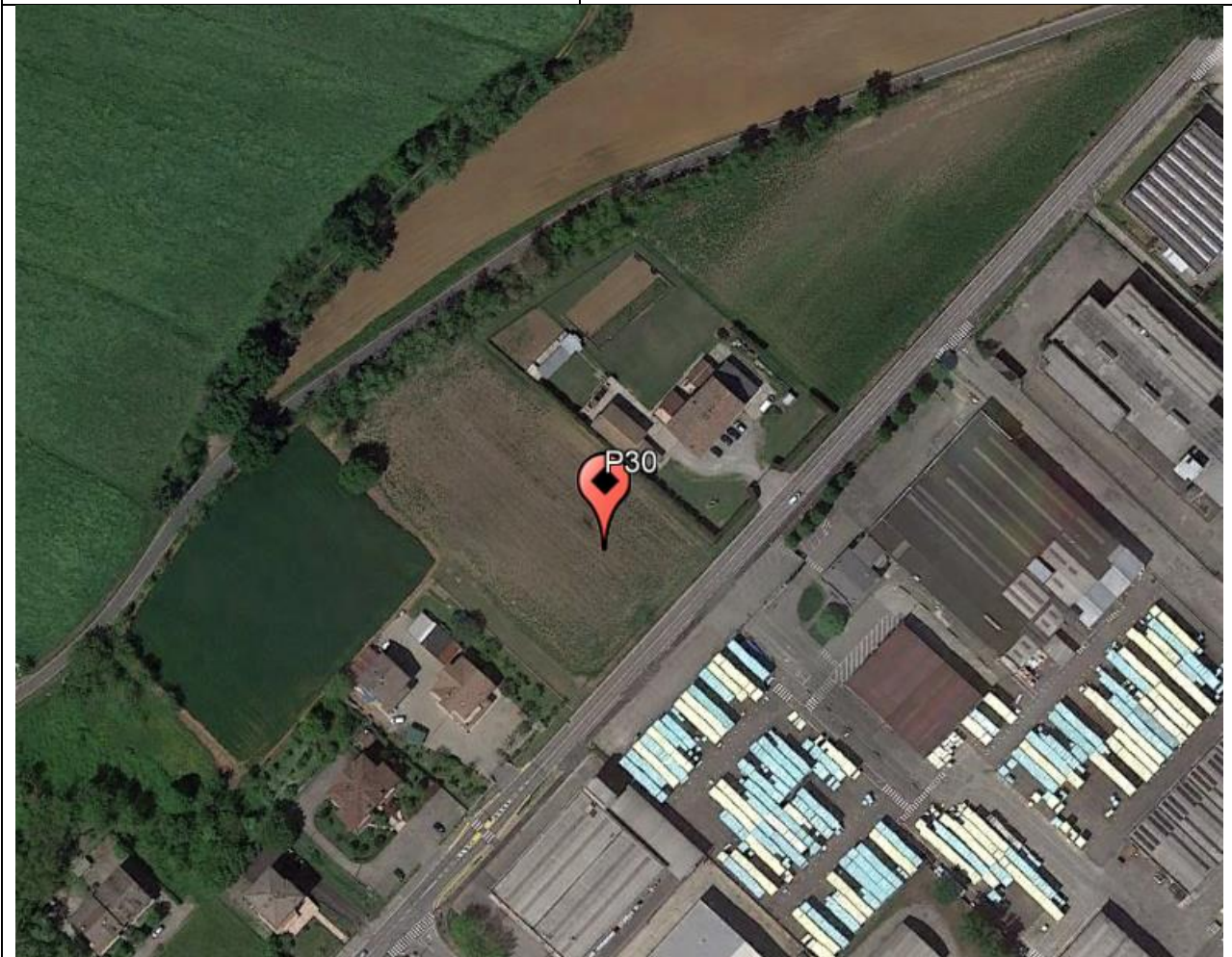
**UBICAZIONE INDAGINI**

**Latitudine (m)**

4956027

**Longitudine (m)**

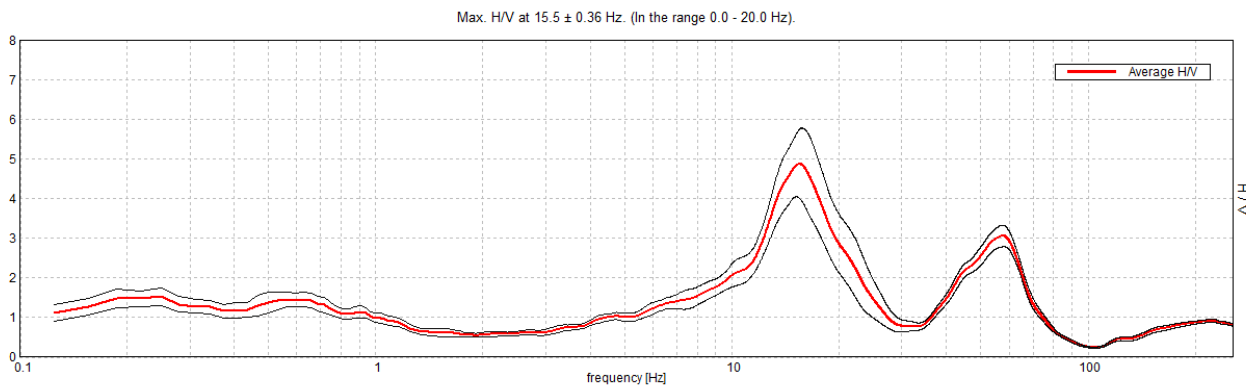
143653



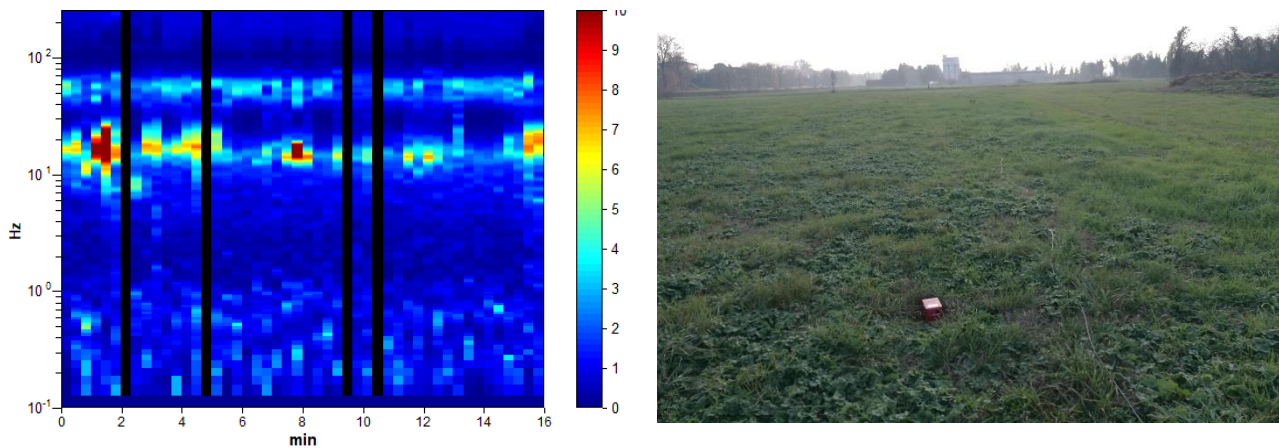
**BIBBIANO, P31**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 17:20:00      End recording: 11/05/01 17:36:00  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN ; north south; east west ; up down ; Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 92% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

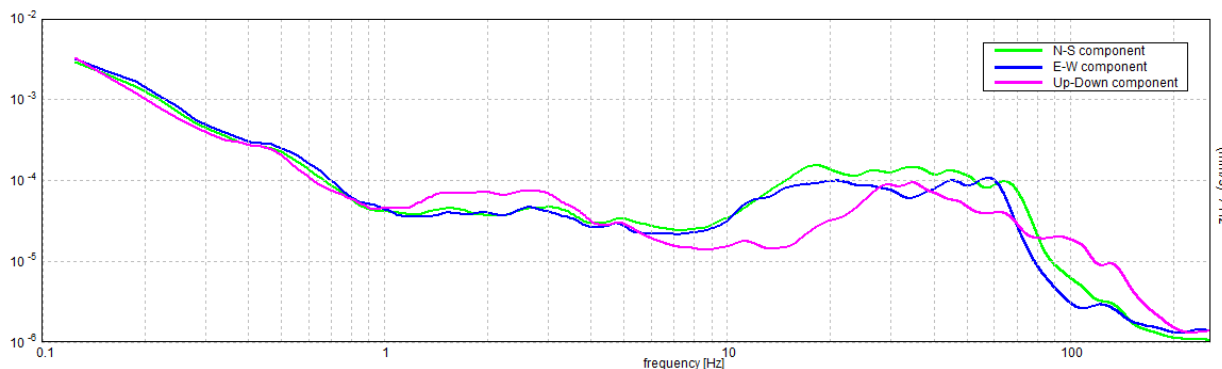
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 15.5 ± 0.36 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$15.50 > 0.50$	<b>OK</b>	
$n_c(f_0) > 200$	$13640.0 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 745 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	11.5 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	21.625 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	$4.87 > 2$	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.02353  < 0.05$	<b>OK</b>	
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.36471 < 0.775$	<b>OK</b>	
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.8749 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
15,5 Hz	Alta





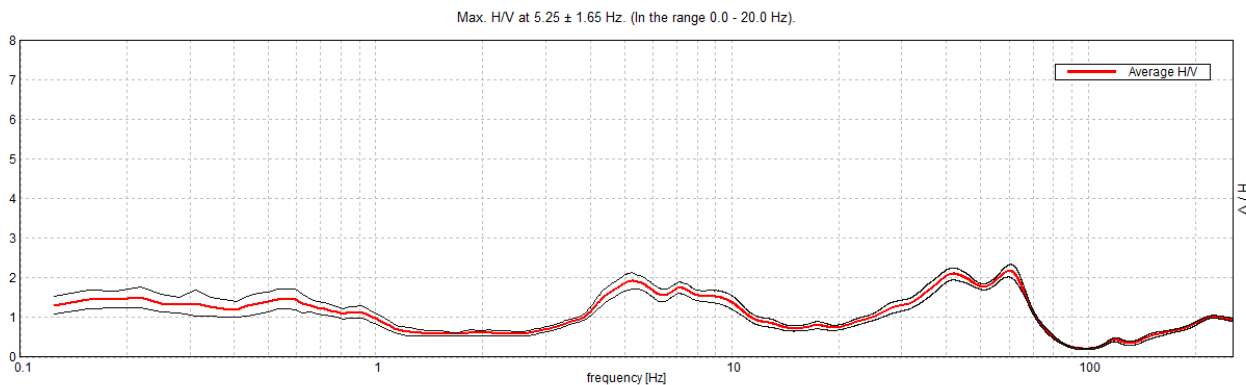
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4956512	141463
	



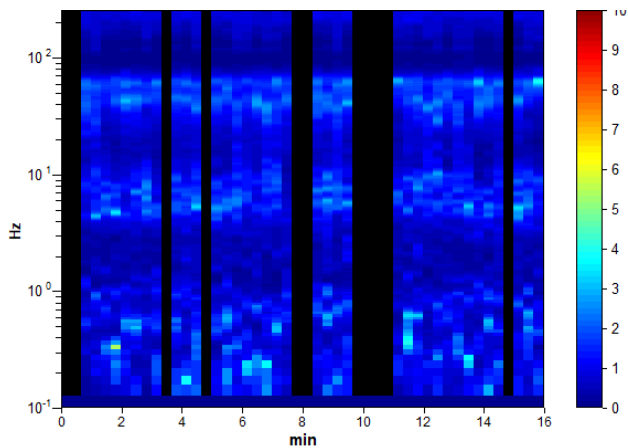
**BIBBIANO, P32**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 11/05/01 17:53:34      End recording: 11/05/01 18:09:35  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 77% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

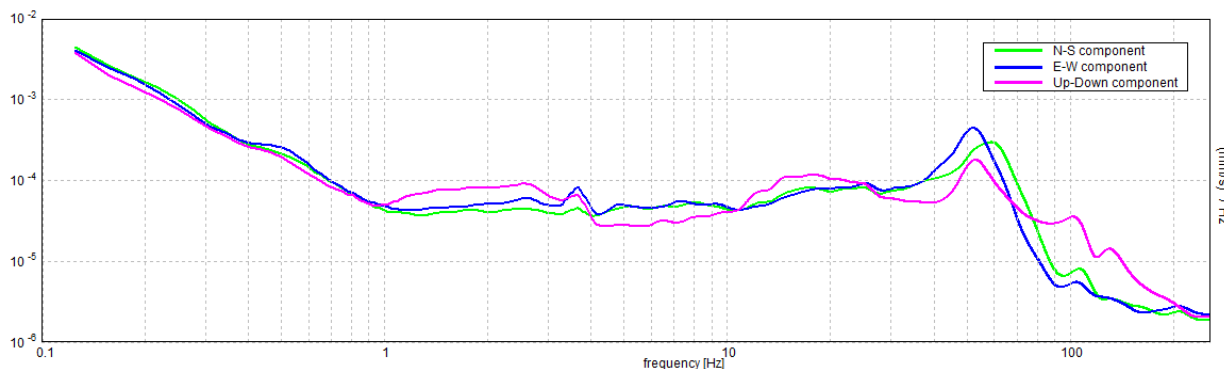
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 5.25 ± 1.65 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.25 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	3885.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 253 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	3.719 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	11.531 Hz	<b>OK</b>	
$A_0 > 2$	1.92 > 2		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.31356  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	1.6462 < 0.2625		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.2075 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
5,25 Hz	Media





UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4956442	142339

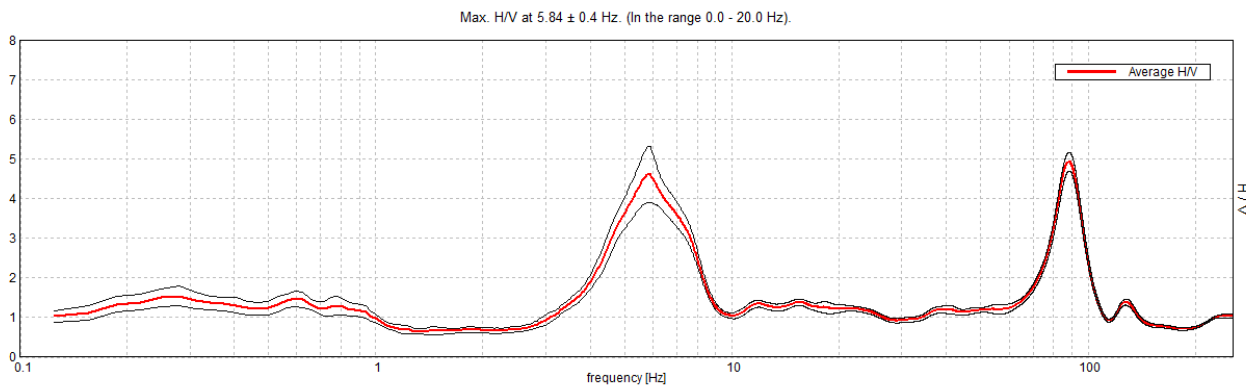




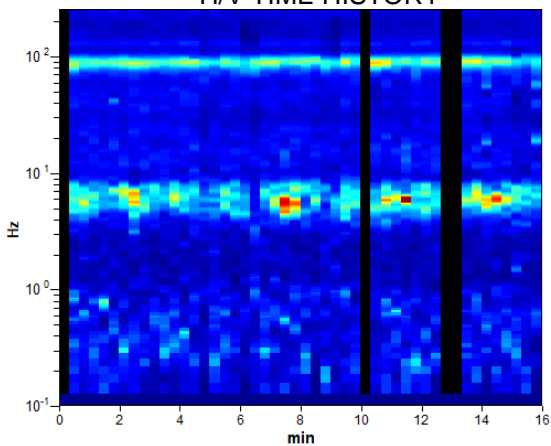
**BIBBIANO, P33**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 21/05/01 12:28:28      End recording: 21/05/01 12:44:28  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN ; north south; east west ; up down ;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 92% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

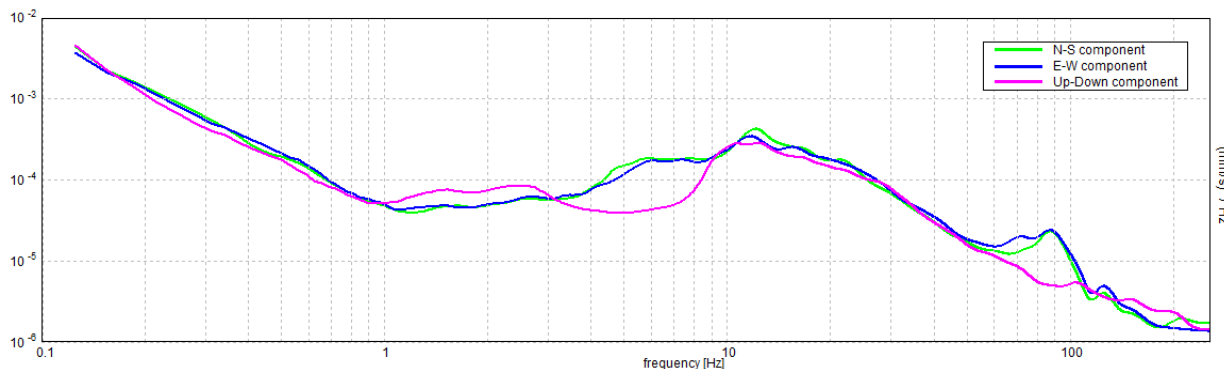
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 5.84 ± 0.4 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$5.84 > 0.50$	<b>OK</b>	
$n_c(f_0) > 200$	$5142.5 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 282 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	4.25 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	8.125 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	$4.61 > 2$	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.06894  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	$0.40288 < 0.29219$		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	$0.709 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
5,84 Hz	Alta



UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4956418	141818
	

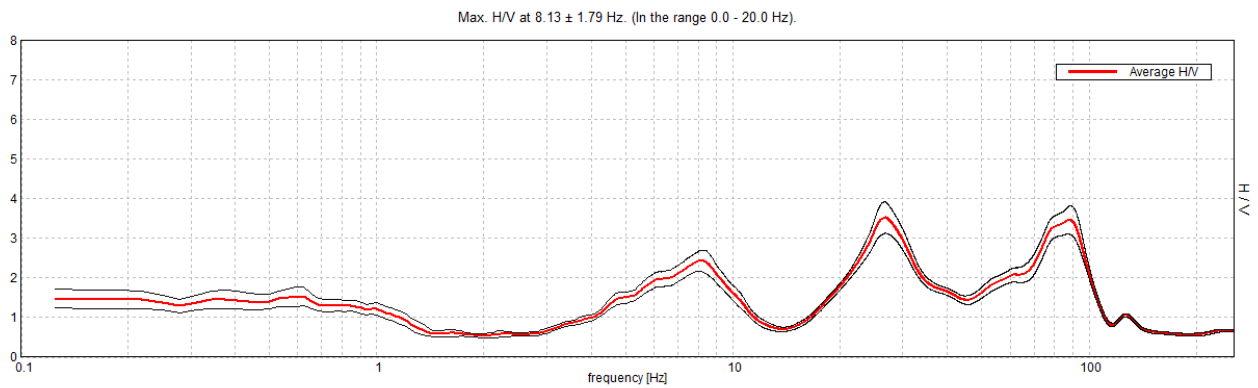




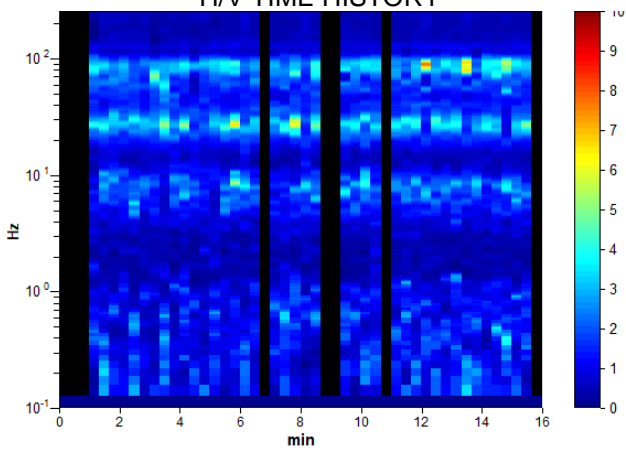
**BIBBIANO, P34**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 21/05/01 13:10:05      End recording: 21/05/01 13:26:06  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN ; north south; east west ; up down ;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 83% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

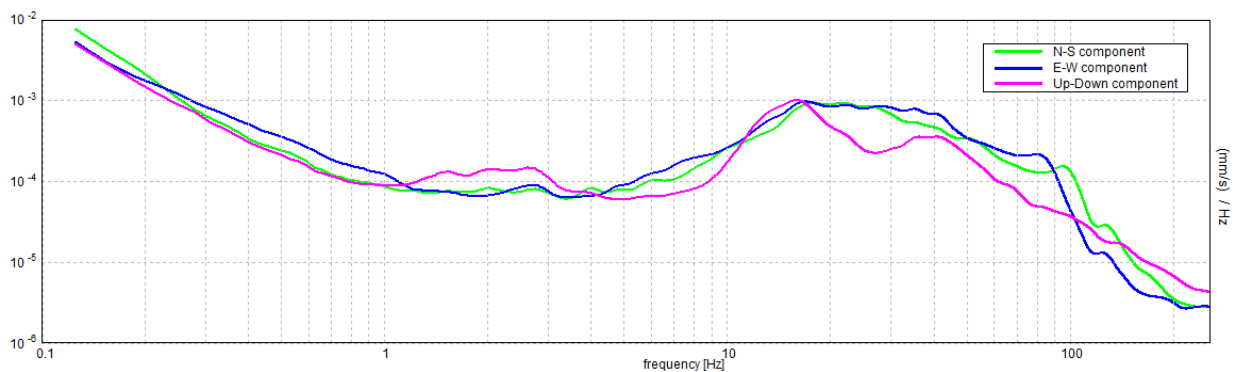
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**





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

**Max. H/V at 8.13 ± 1.79 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	8.13 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	6500.0 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 391 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	4.344 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	10.969 Hz	<b>OK</b>	
<b><math>A_0 &gt; 2</math></b>	2.43 > 2	<b>OK</b>	
<b><math>f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%</math></b>	$ 0.21983  < 0.05$		<b>NO</b>
<b><math>\sigma_f &lt; \varepsilon(f_0)</math></b>	1.78612 < 0.40625		<b>NO</b>
<b><math>\sigma_A(f_0) &lt; \theta(f_0)</math></b>	0.2615 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
8,13 Hz	Alta



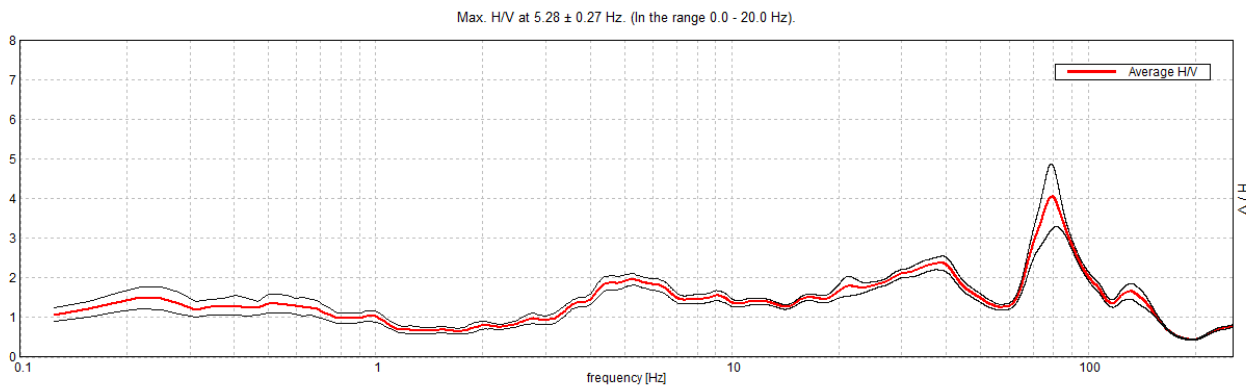
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4957013	142026



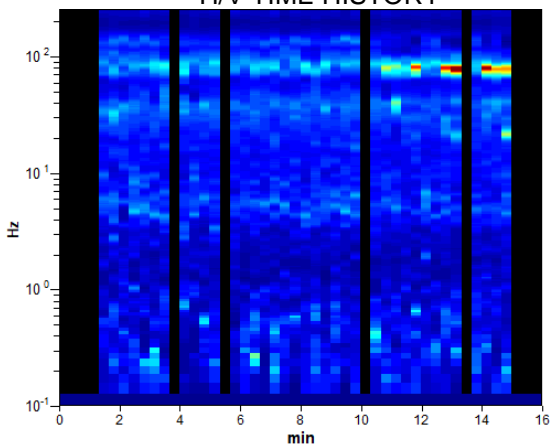
**BIBBIANO, P35**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 21/05/01 13:45:05      End recording: 21/05/01 14:01:06  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN ; north south; east west ; up down ;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 77% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

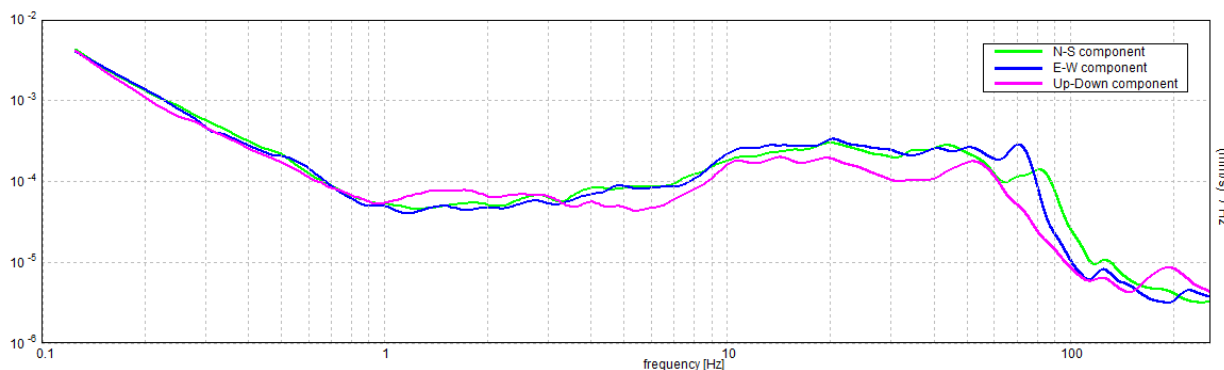
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 5.28 ± 0.27 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$5.28 > 0.50$	<b>OK</b>	
$n_c(f_0) > 200$	$3908.1 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 254 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	3.156 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	$1.96 > 2$		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.0507  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	$0.26774 < 0.26406$		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	$0.1452 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
5,28 Hz	Media





**UBICAZIONE INDAGINI**

**Latitudine (m)**

4958801

**Longitudine (m)**

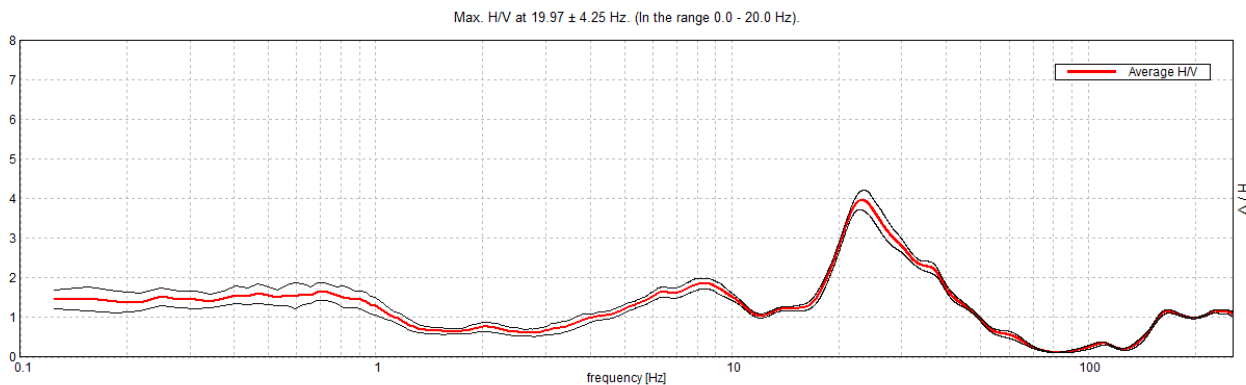
143639



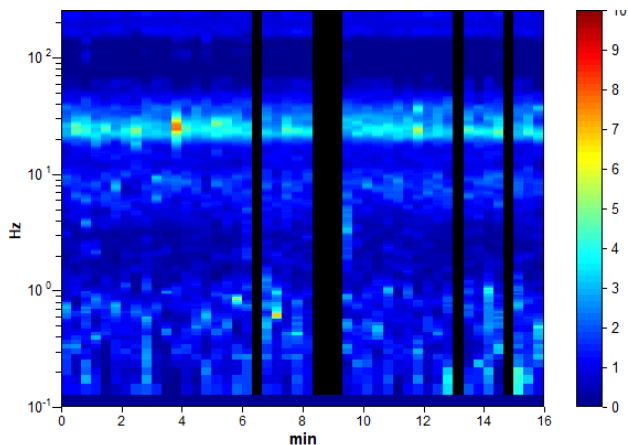
**BIBBIANO, P36**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 21/05/01 14:25:20 End recording: 21/05/01 14:41:21  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 88% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

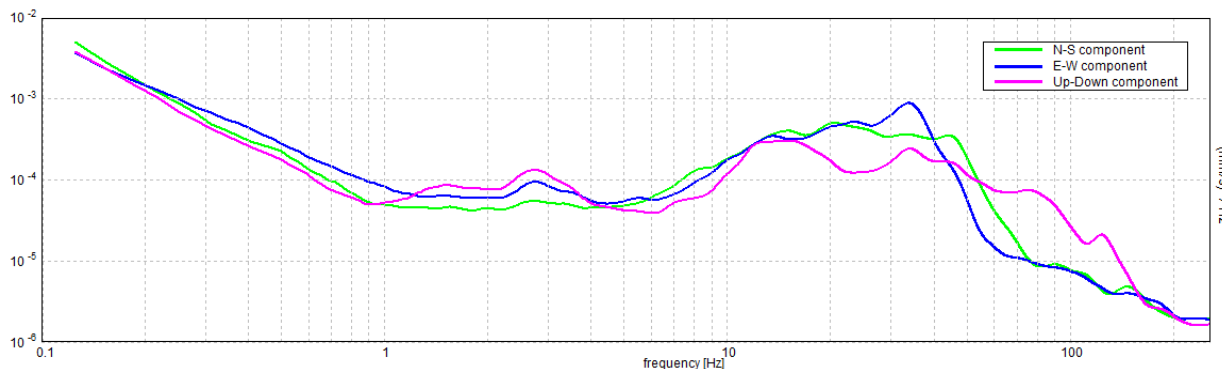
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 19.97 ± 4.25 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$19.97 > 0.50$	<b>OK</b>	
$n_c(f_0) > 200$	$16773.8 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 960 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	16.875 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	43.625 Hz	<b>OK</b>	
$A_0 > 2$	$2.77 > 2$	<b>OK</b>	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.21277  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	$4.24874 < 0.99844$		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	$0.1196 < 1.58$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
8,5 Hz	Media





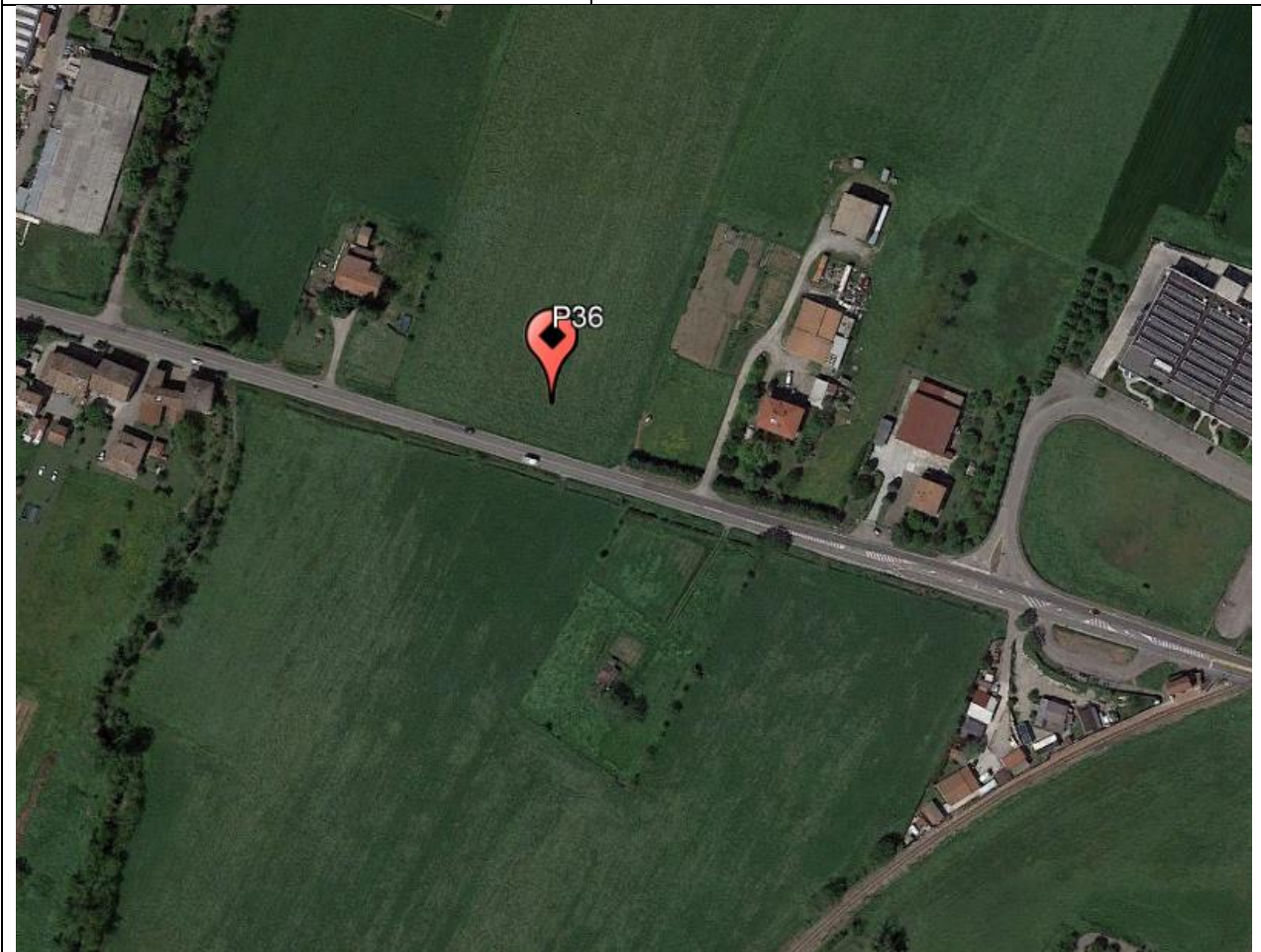
**UBICAZIONE INDAGINI**

**Latitudine (m)**

4959029

**Longitudine (m)**

143068

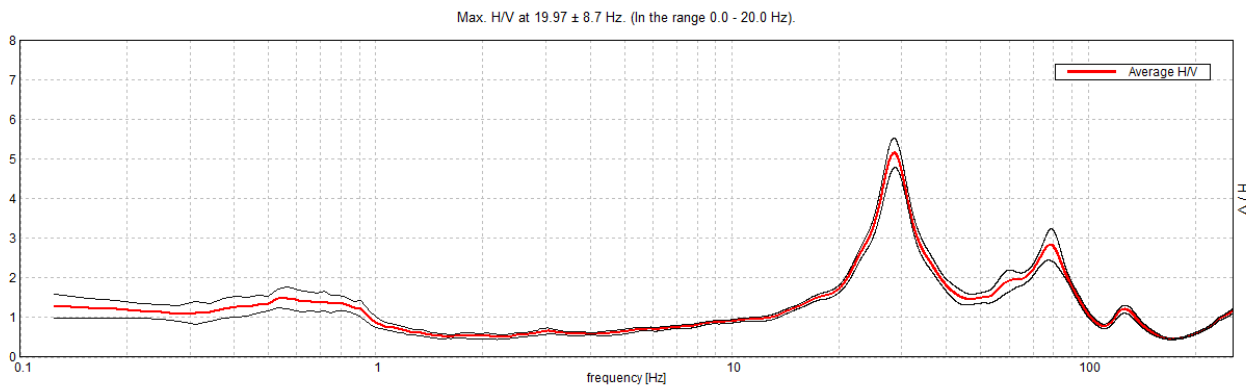




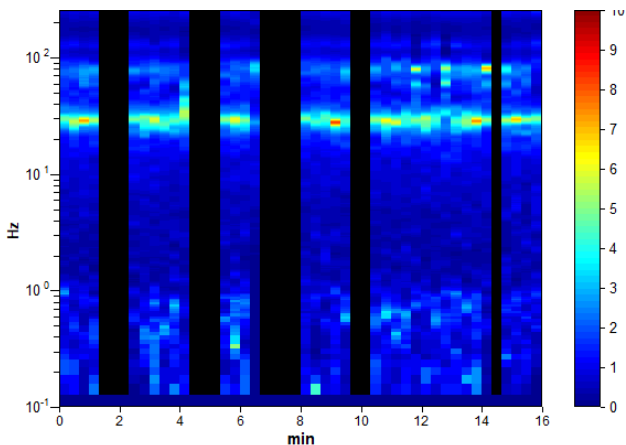
**BIBBIANO, P37**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 21/05/01 15:11:55      End recording: 21/05/01 15:27:56  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 73% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

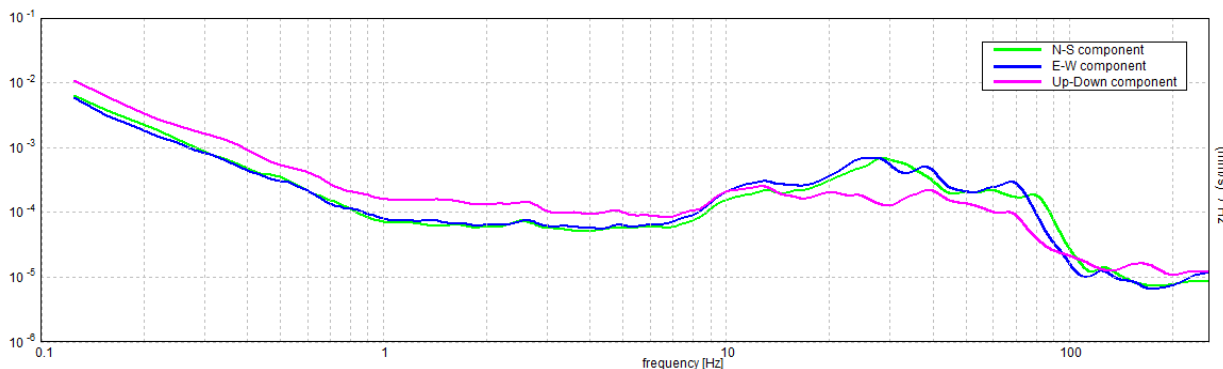
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 19.97 ± 8.7 Hz (in the range 0.0 - 20.0 Hz).**

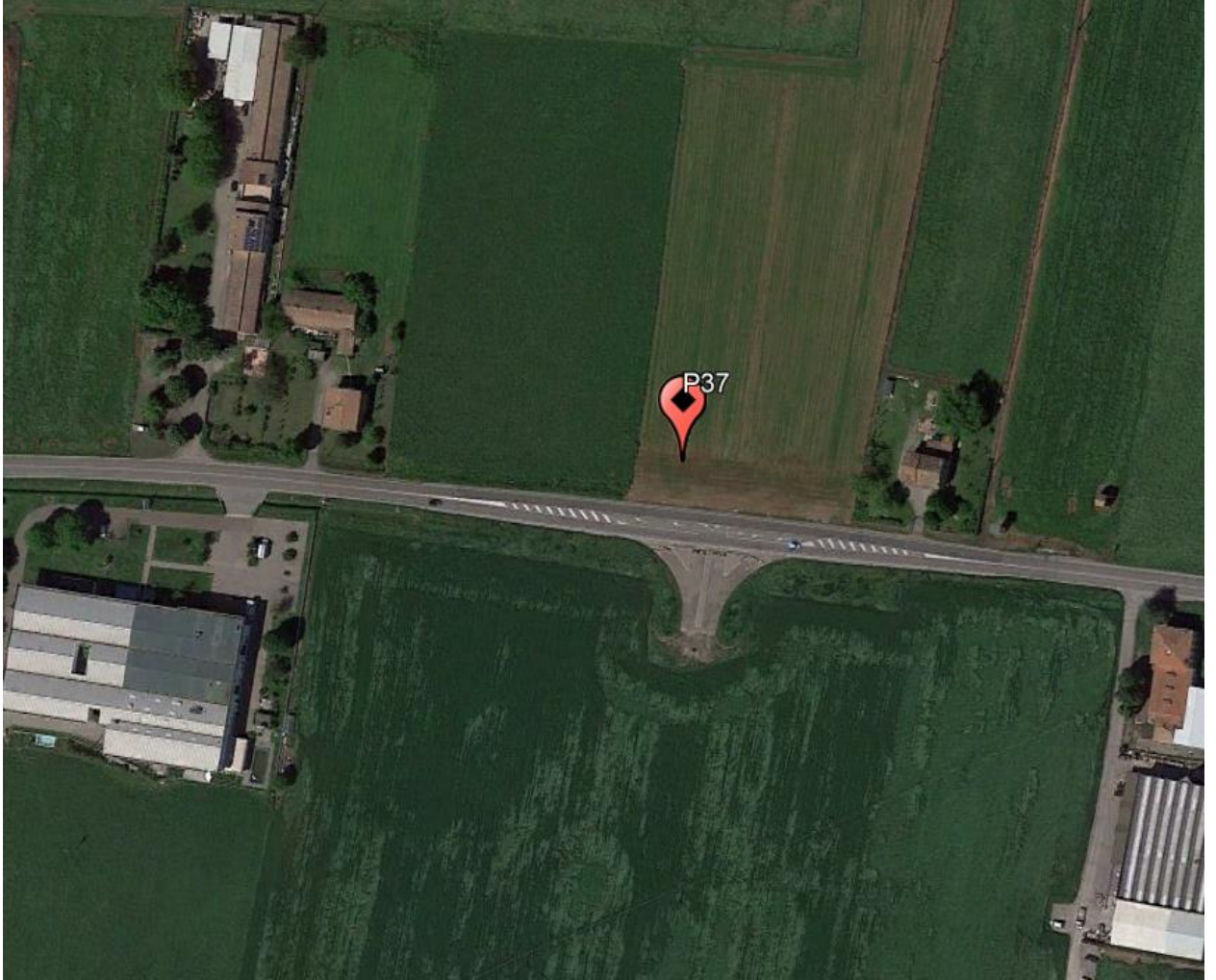
<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	13978.1 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 960 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	8.5 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	1.72 > 2		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.43586  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	8.70352 < 0.99844		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.0925 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
Nessun picco (np)	/



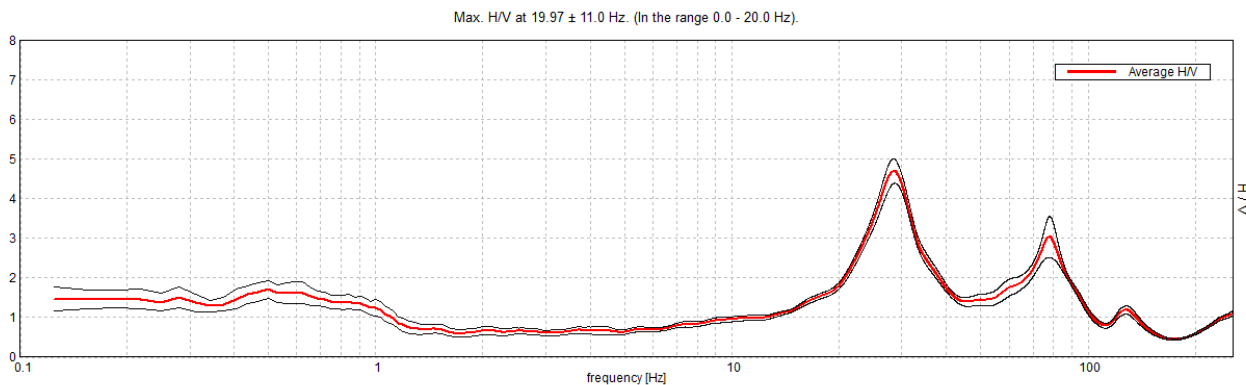
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4959284	142145
	



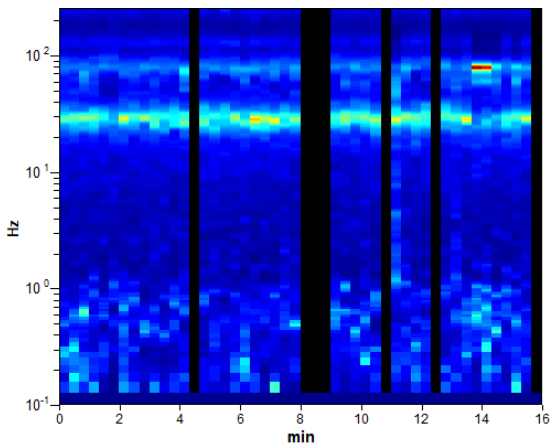
**BIBBIANO, P38**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 21/05/01 15:36:40 End recording: 21/05/01 15:52:40  
 Channel labels: NORTH SOUTH; EAST WEST; UP DOWN; north south; east west; up down;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 85% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

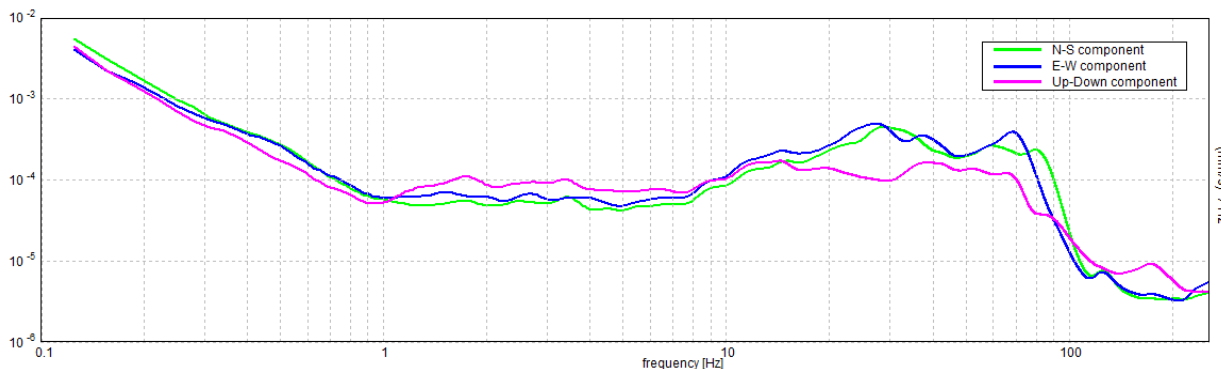
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**





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

**Max. H/V at 19.97 ± 11.0 Hz (in the range 0.0 - 20.0 Hz).**


<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	19.97 > 0.50	<b>OK</b>	
$n_c(f_0) > 200$	16374.4 > 200	<b>OK</b>	
$\sigma_A(f) < 2$ 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 960 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	8.656 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>			<b>NO</b>
$A_0 > 2$	1.79 > 2		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.55071  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	10.99708 < 0.99844		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	0.0812 < 1.58	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
Nessun picco (np)	/



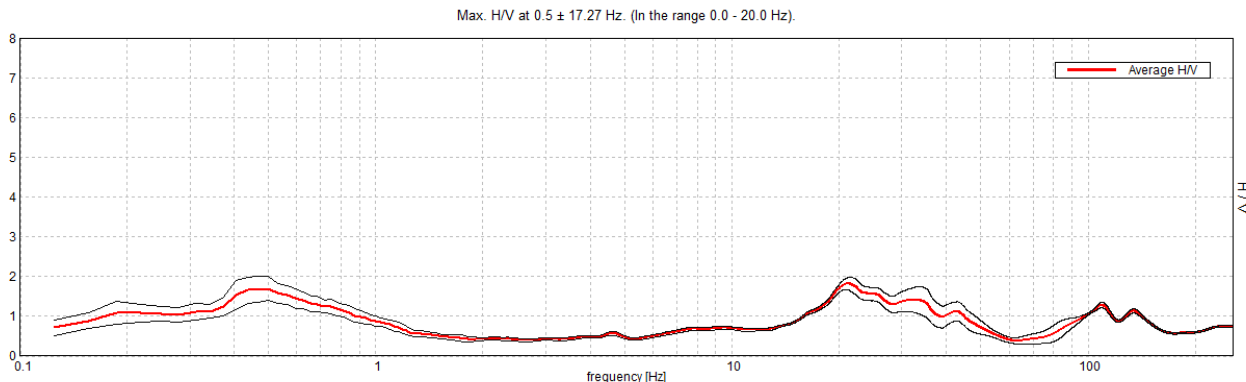
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4959049	142236
	



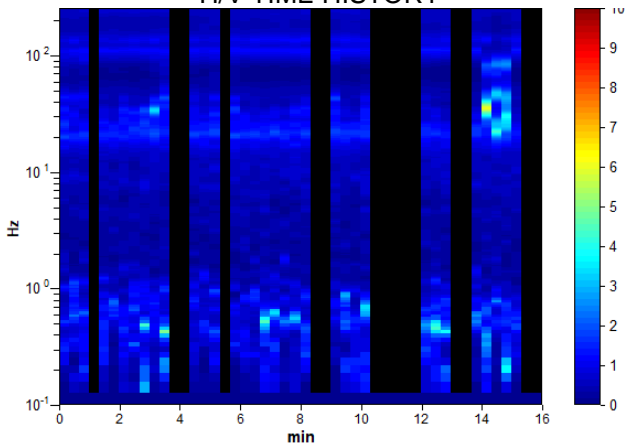
**BIBBIANO, P39**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 21/05/01 16:56:43 End recording: 21/05/01 17:12:43  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN ; north south; east west ; up down ;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00". Analyzed 69% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

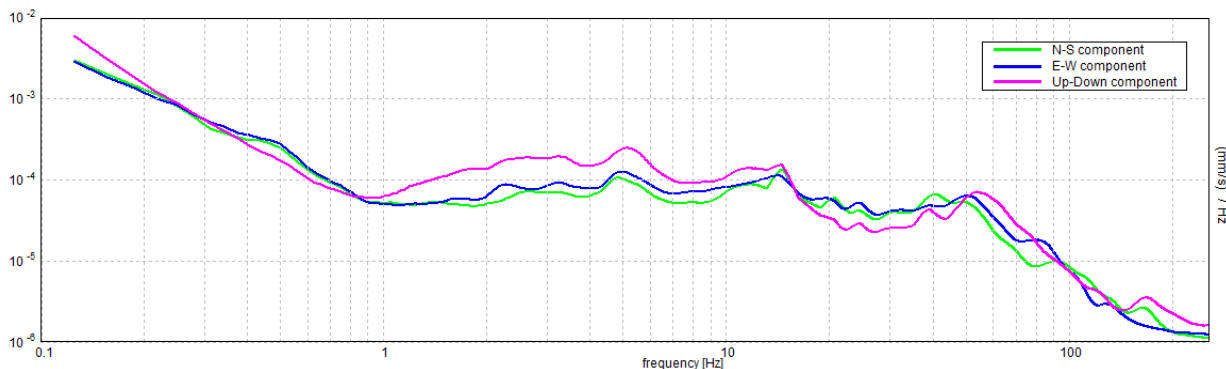
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 0.5 ± 17.27 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$0.50 > 0.50$		<b>NO</b>
$n_c(f_0) > 200$	$330.0 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 25 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>	0.125 Hz	<b>OK</b>	
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	1.031 Hz	<b>OK</b>	
$A_0 > 2$	$1.70 > 2$		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 34.54753  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	$17.27376 < 0.075$		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	$0.3004 < 2.0$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
Nessun picco (np)	/





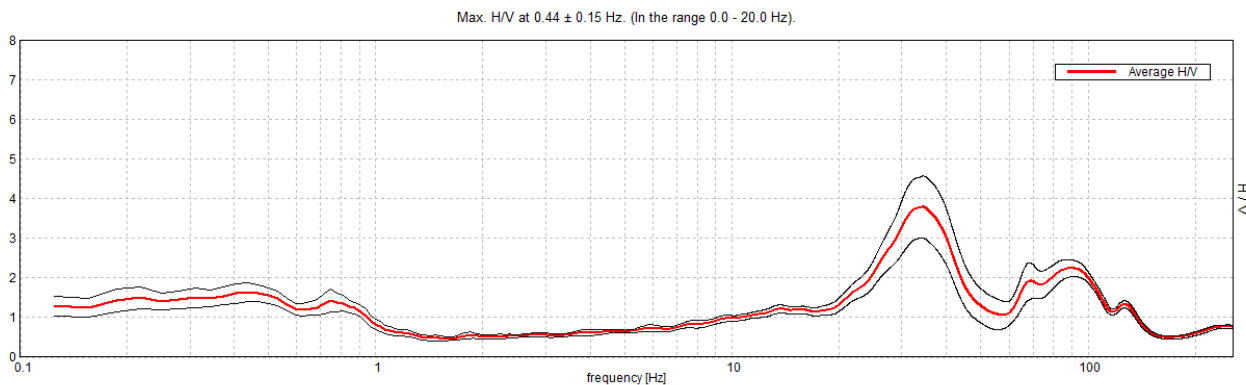
UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4958767	141401



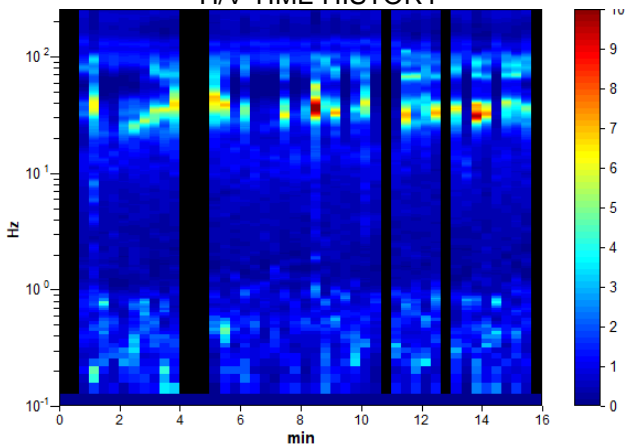
**BIBBIANO, P40**

Instrument: TEP-0124/01-10  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 21/05/01 17:37:31      End recording: 21/05/01 17:53:32  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN ; north south; east west ; up down ;  
 Y+ Y- ; X+ X- ; Z+ Z-  
 GPS data not available  
 Trace length: 0h16'00".      Analyzed 83% trace (manual window selection)  
 Sampling rate: 512 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

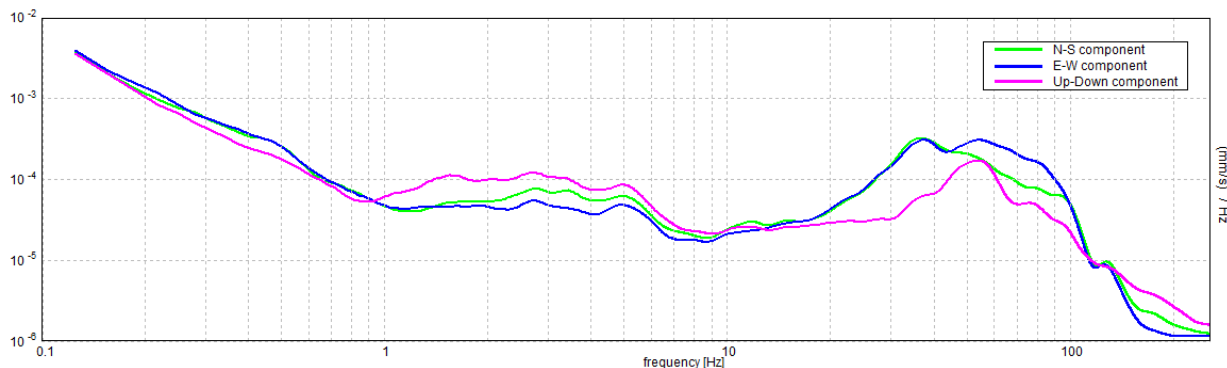
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



**H/V TIME HISTORY**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at 0.44 ± 0.15 Hz (in the range 0.0 - 20.0 Hz).**

<b>Criteria for a reliable H/V curve</b> [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	$0.44 > 0.50$		<b>NO</b>
$n_c(f_0) > 200$	$350.0 > 200$	<b>OK</b>	
$\sigma_A(f) < 2$ 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 22 times	<b>OK</b>	
<b>Criteria for a clear H/V peak</b> [At least 5 out of 6 should be fulfilled]			
<b>Exists <math>f^-</math> in <math>[f_0/4, f_0]</math>   <math>A_{H/V}(f^-) &lt; A_0 / 2</math></b>			<b>NO</b>
<b>Exists <math>f^+</math> in <math>[f_0, 4f_0]</math>   <math>A_{H/V}(f^+) &lt; A_0 / 2</math></b>	1.031 Hz	<b>OK</b>	
$A_0 > 2$	$1.64 > 2$		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.35229  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	$0.15413 < 0.0875$		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	$0.2355 < 2.5$	<b>OK</b>	

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

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

Frequenza caratteristica di sito	Precisione della stima della frequenza
Nessun picco (np)	/





UBICAZIONE INDAGINI	
Latitudine (m)	Longitudine (m)
4958267	141990
	





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*Indagini sismiche di tipo attivo in array  
(M.A.S.W.)*

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Misura sismica MASW n°1 (L1) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

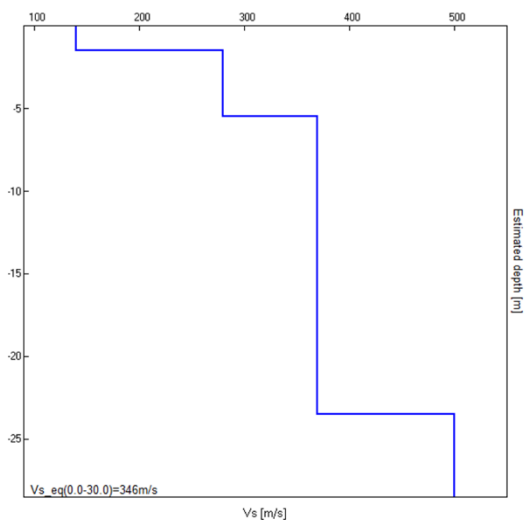
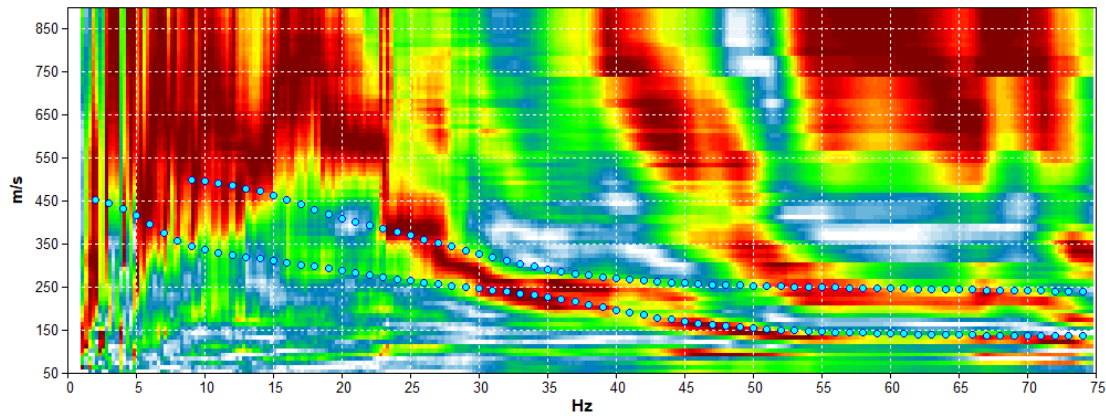
Latitudine: 4955618

Longitudine: 141920

Fine Linea

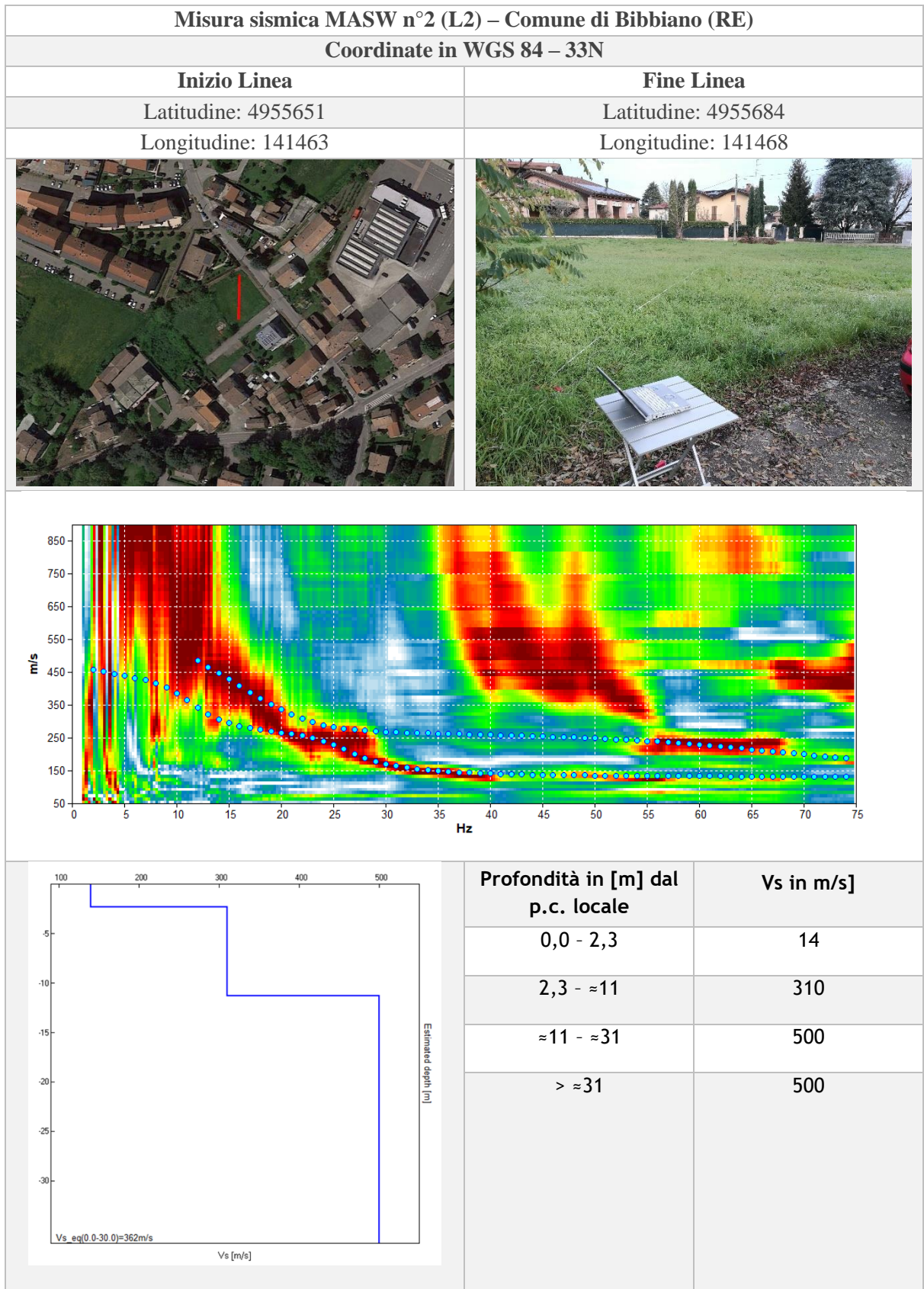
Latitudine: 4955658

Longitudine: 141923



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,5	140
1,5 - 7,0	280
7,0 - ≈24	370
> ≈24	500







Misura sismica MASW n°3 (L3) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

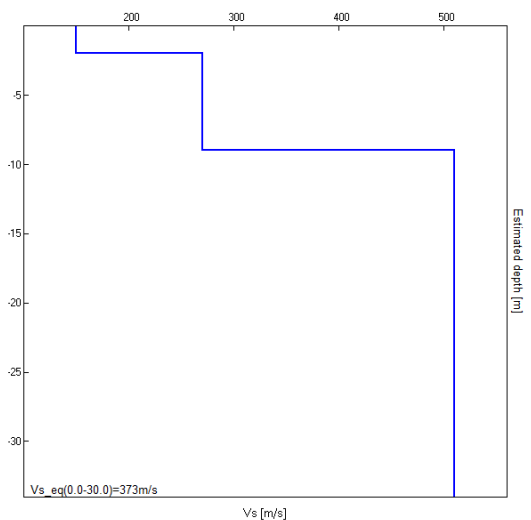
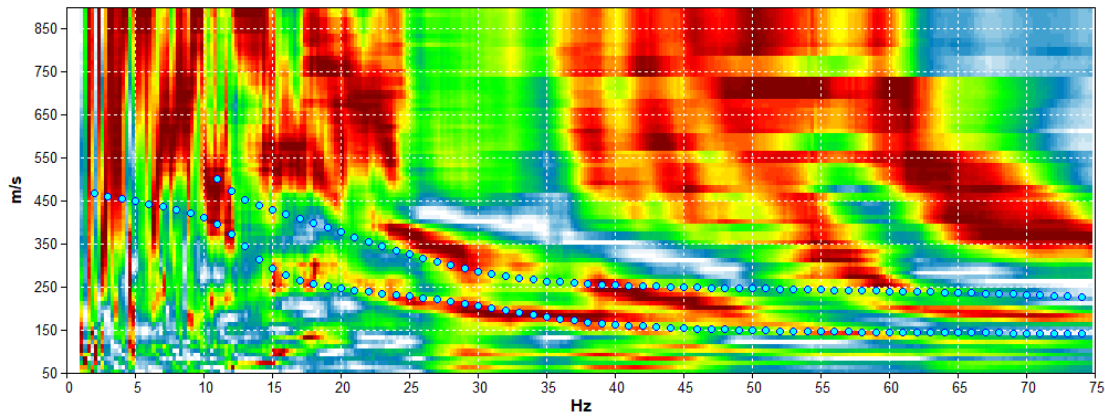
Latitudine: 4955845

Longitudine: 140540

Fine Linea

Latitudine: 4955884

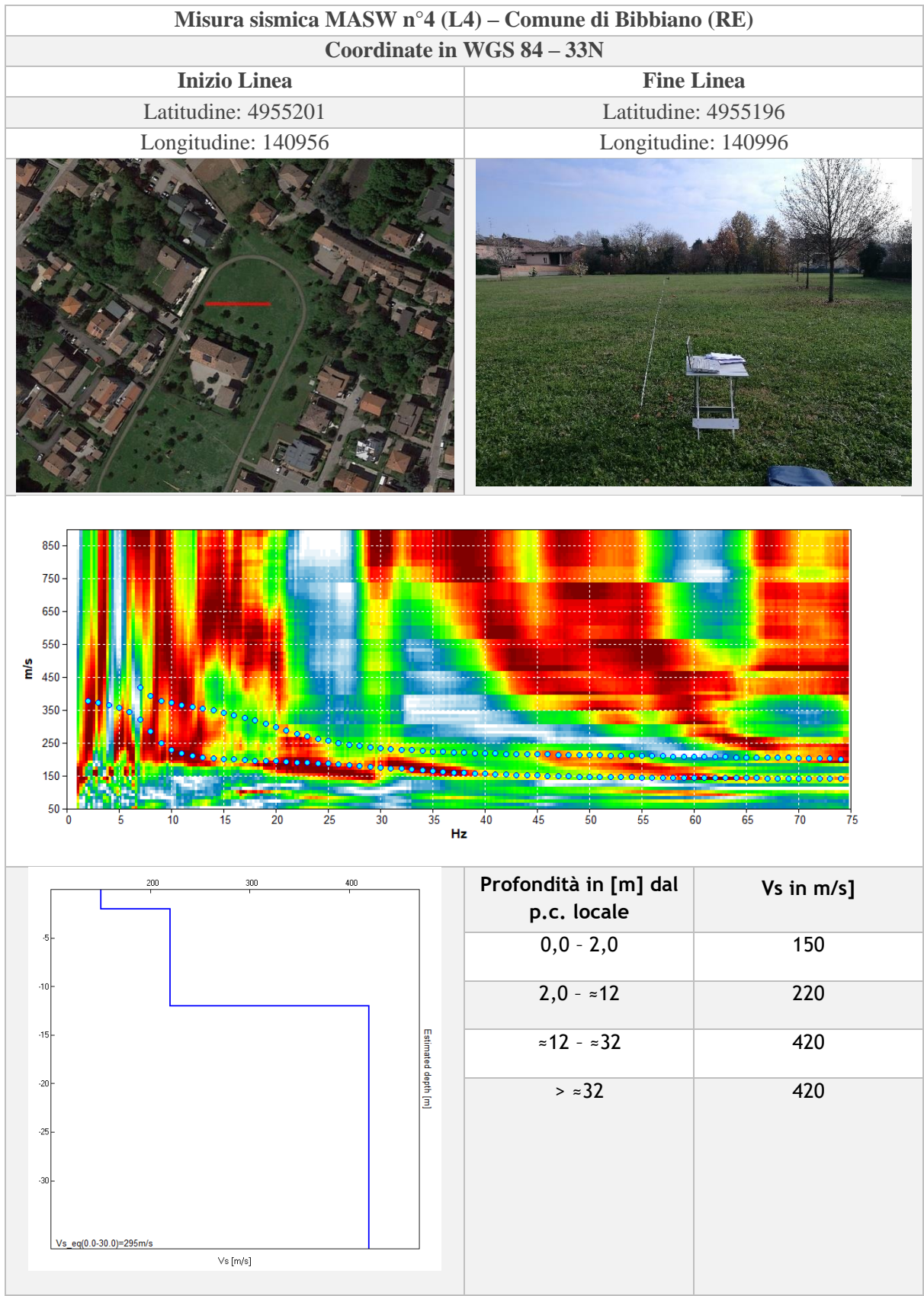
Longitudine: 140547



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,0	150
2,0 - 9,0	270
9,0 - ≈29	510
> ≈29	510







Misura sismica MASW n°5 (L5) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

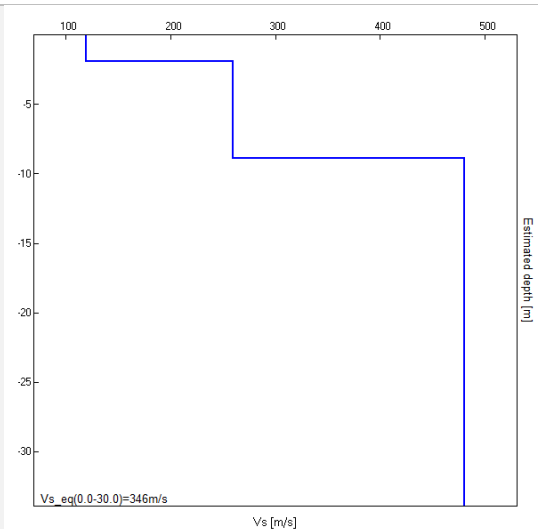
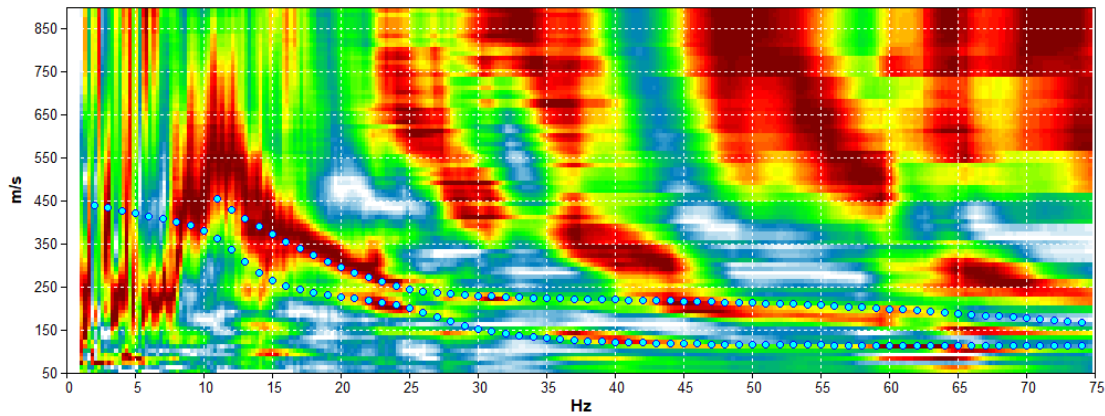
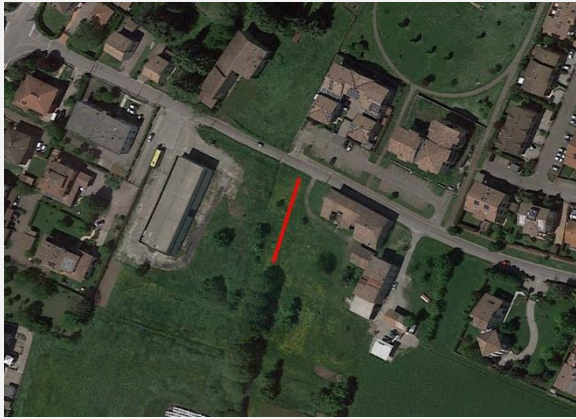
Latitudine: 4955003

Longitudine: 140813

Fine Linea

Latitudine: 4954966

Longitudine: 140797



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,9	120
1,9 - 8,9	260
8,9 - ≈29	480
> ≈29	480



Misura sismica MASW n°6 (L6) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

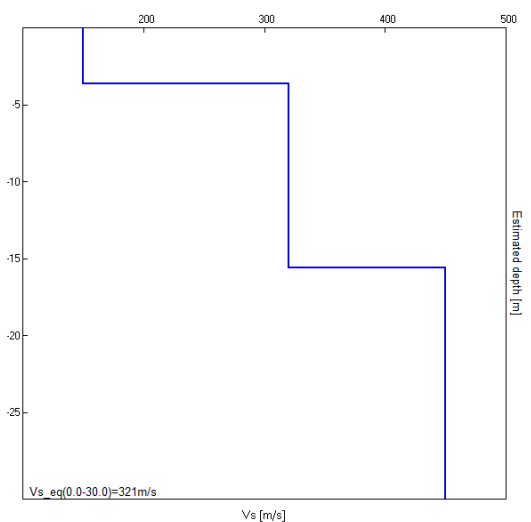
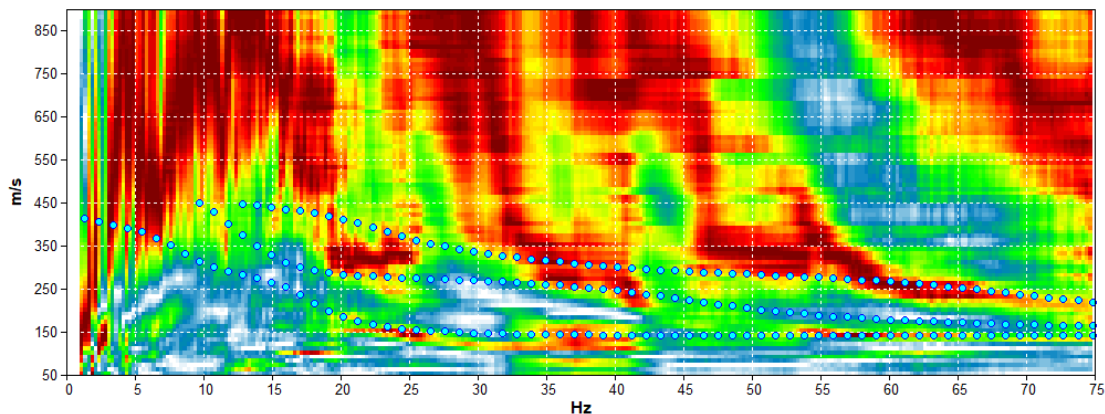
Latitudine: 4955102

Longitudine: 141384

Fine Linea

Latitudine: 4955141

Longitudine: 141391



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 3,6	150
3,6 - ≈16	320
≈16 - ≈26	450
> ≈26	450





Misura sismica MASW n°7 (L7) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

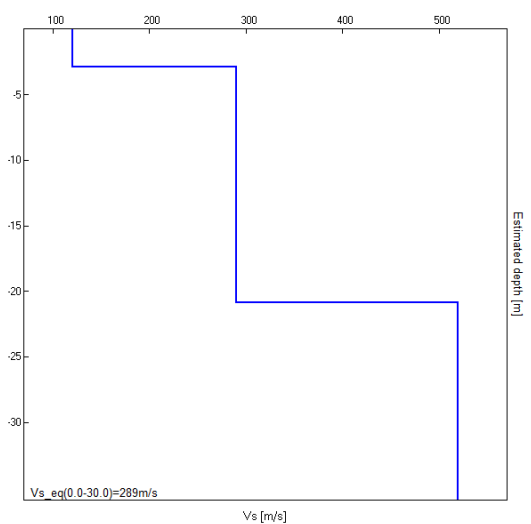
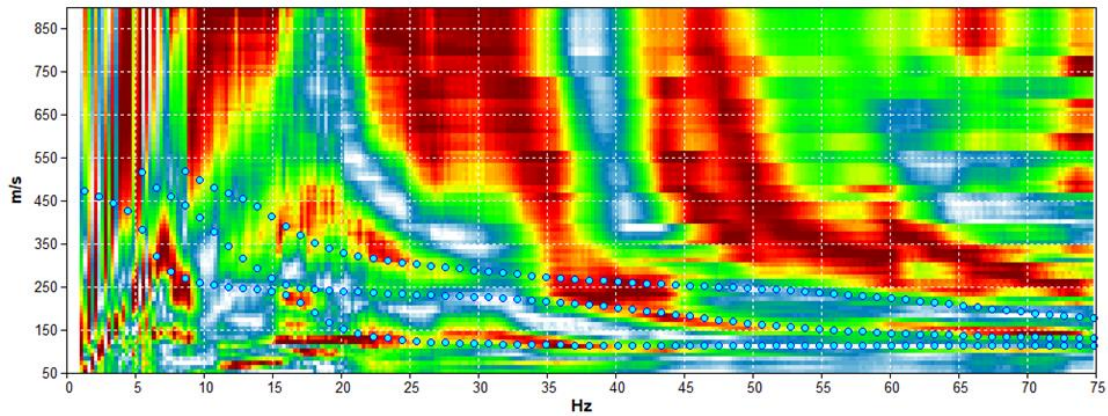
Latitudine: 4954903

Longitudine: 140275

Fine Linea

Latitudine: 4954942

Longitudine: 140268



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,9	120
2,9 - ≈21	290
≈21 - ≈31	520
> ≈31	520





Misura sismica MASW n°8 (L8) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

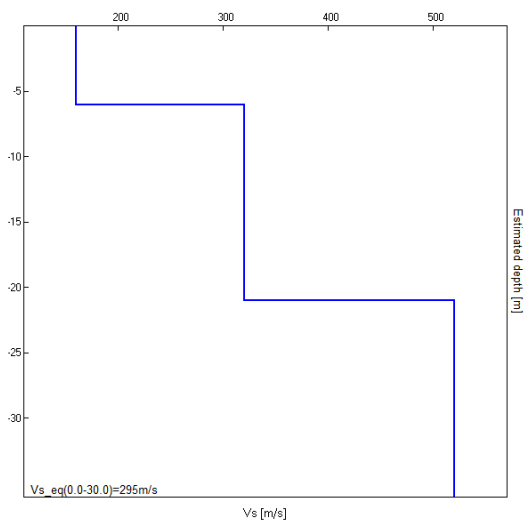
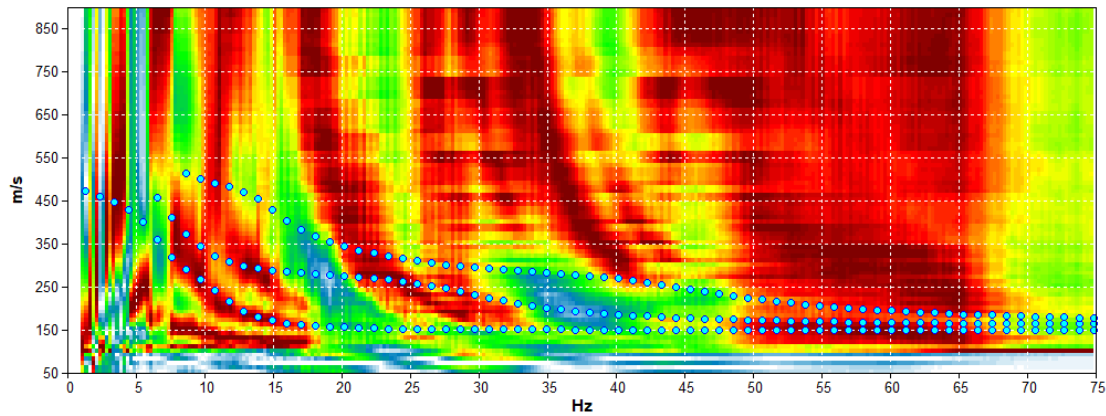
Latitudine: 4954390

Longitudine: 140232

Fine Linea

Latitudine: 4954425

Longitudine: 140236



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 6,0	160
6,0 - ≈21	320
≈21 - ≈31	520
> ≈31	520



Misura sismica MASW n°9 (L9) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

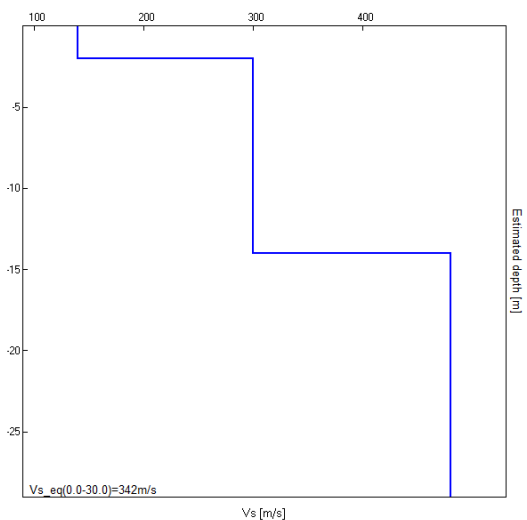
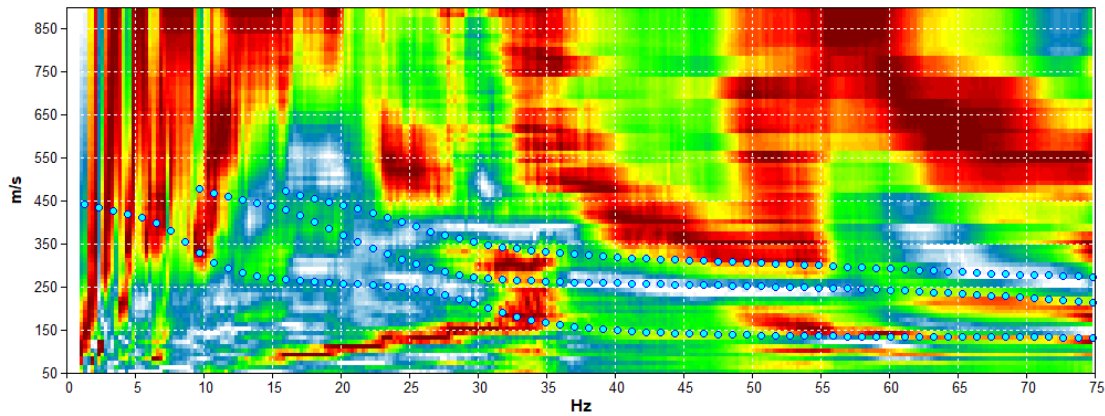
Latitudine: 4954288

Longitudine: 139734

Fine Linea

Latitudine: 4954303

Longitudine: 139766



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,0	140
2,0 - ≈14	300
≈14 - ≈24	480
> ≈24	480



Misura sismica MASW n°10 (L10) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

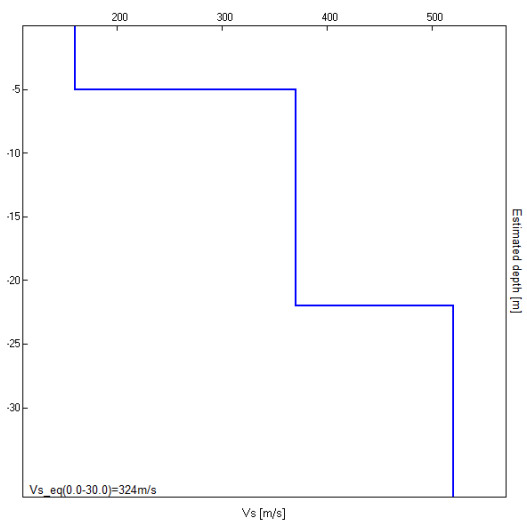
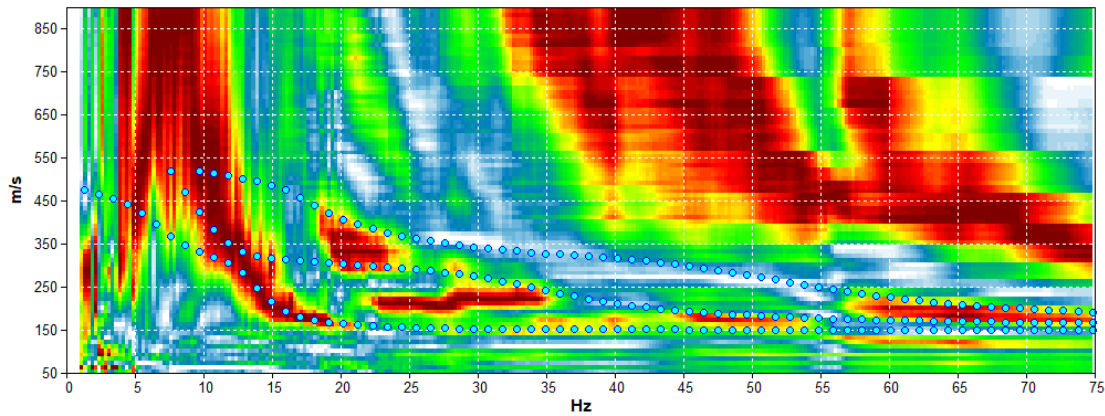
Latitudine: 4954505

Longitudine: 140646

Fine Linea

Latitudine: 4954479



Longitudine: 140677



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 5,0	160
5,0 - ≈22	370
≈22 - ≈32	520
> ≈32	520





<b>Misura sismica MASW n°11 (L11) – Comune di Bibbiano (RE)</b>	
<b>Coordinate in WGS 84 – 33N</b>	
<b>Inizio Linea</b>	<b>Fine Linea</b>
Latitudine: 4957283	Latitudine: 4957267
Longitudine: 142243	Longitudine: 142268
	
<b>MISURA NON INTERPRETABILE</b>	





Misura sismica MASW n°12 (L12) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

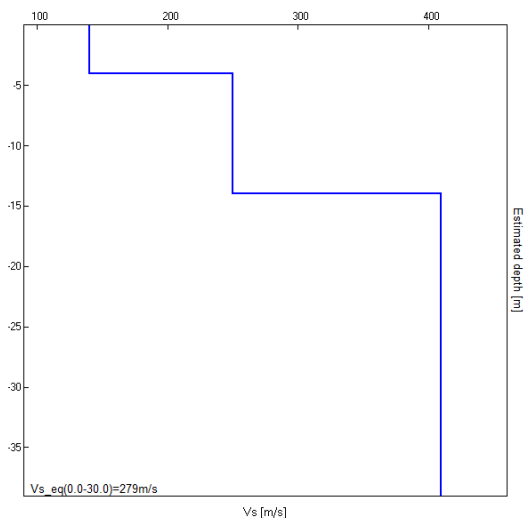
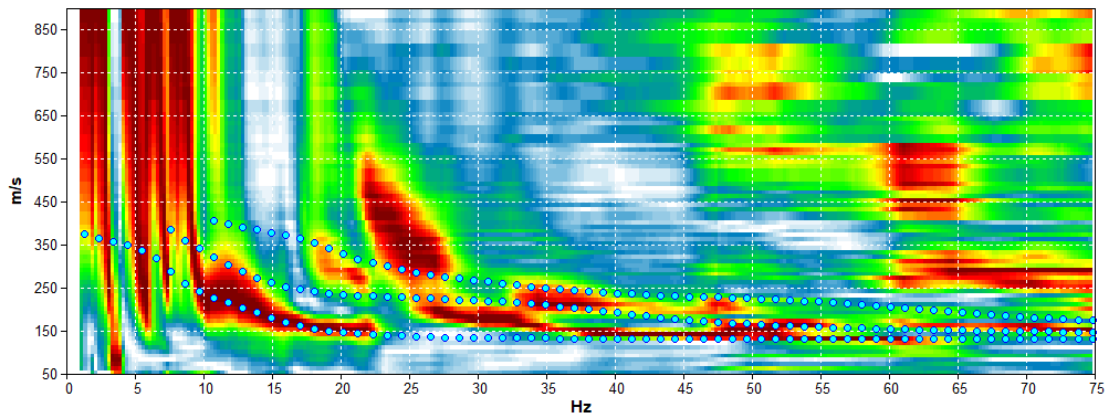
Latitudine: 4957652

Longitudine: 142872

Fine Linea

Latitudine: 4957680

Longitudine: 142885



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 4,0	140
4,0 - ≈14	250
≈14 - ≈34	410
> ≈34	410



Misura sismica MASW n°13 (L13) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

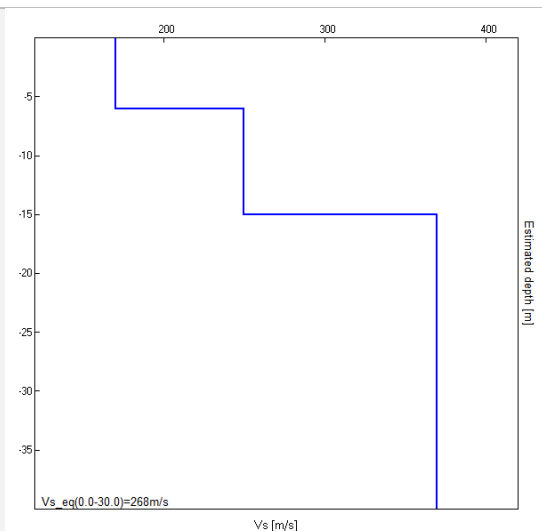
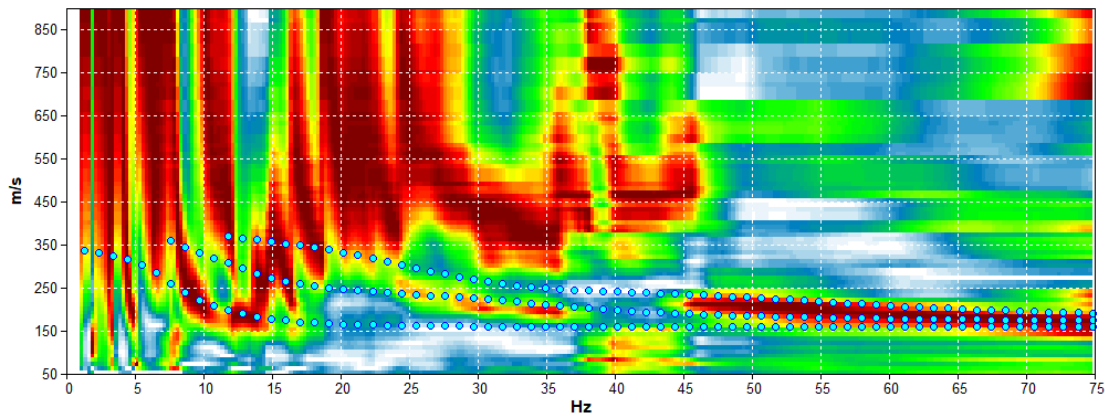
Latitudine: 4958053

Longitudine: 142532

Fine Linea

Latitudine: 4958077

Longitudine: 142550



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 6,0	170
6,0 - ≈15	250
≈15 - ≈35	370
> ≈35	370



Misura sismica MASW n°14 (L14) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

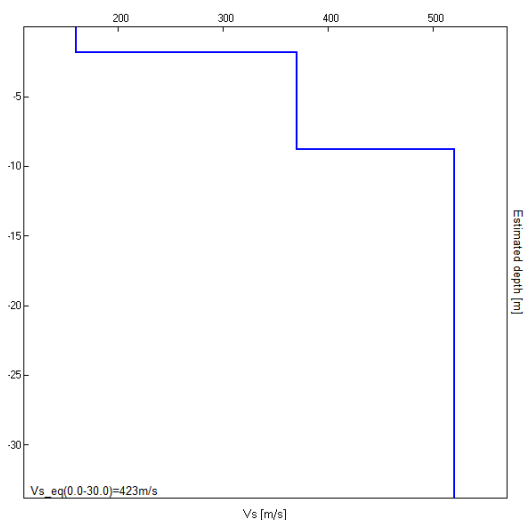
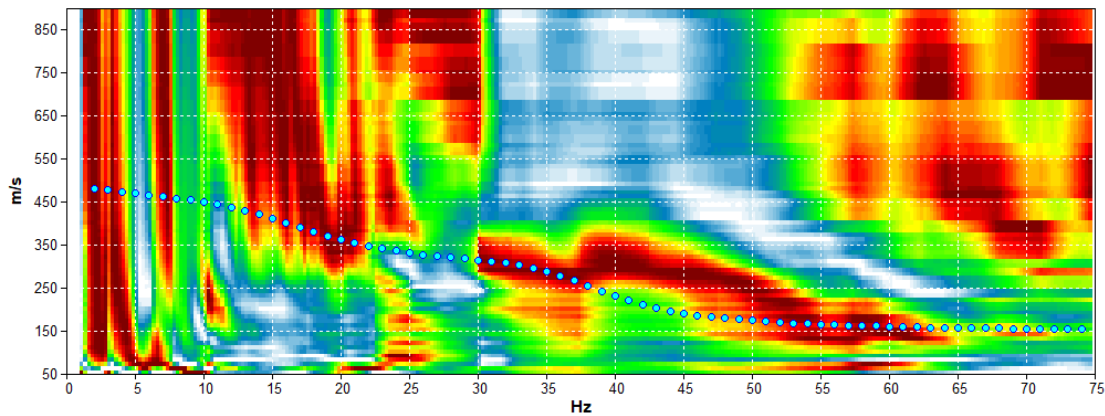
Latitudine: 4958608

Longitudine: 141092

Fine Linea

Latitudine: 4958649

Longitudine: 141111



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,8	160
1,8 - 8,8	370
8,8 - ≈29	520
> ≈29	520





Misura sismica MASW n°15 (L15) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

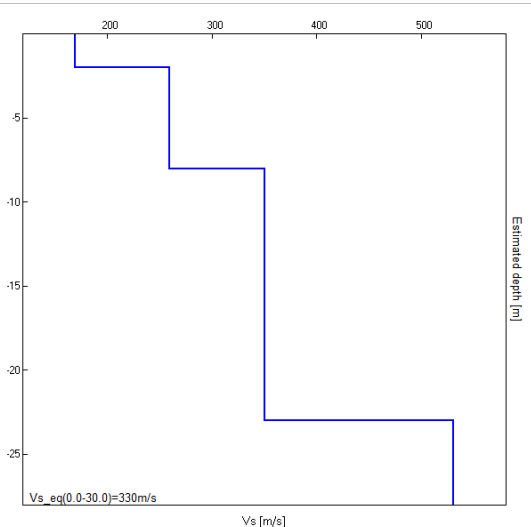
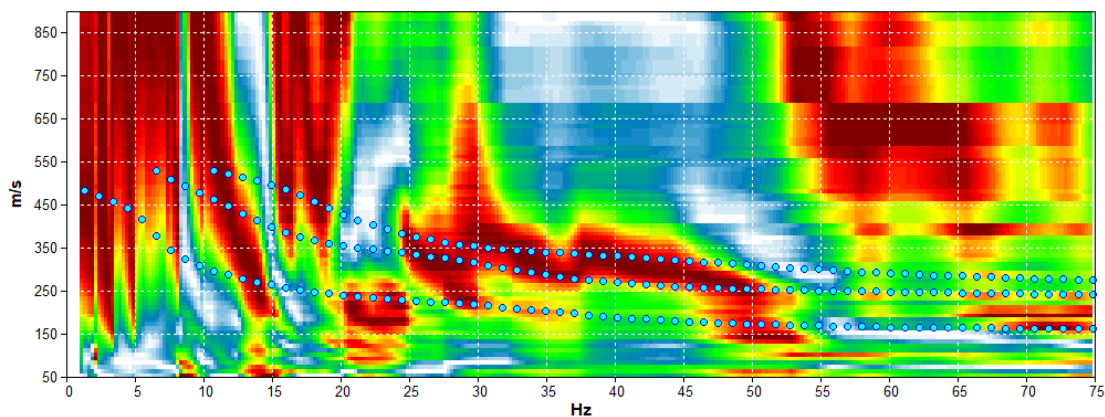
Latitudine: 4957822

Longitudine: 142641

Fine Linea

Latitudine: 4957798

Longitudine: 142658



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,0	170
2,0 - 8,0	260
8,0 - ≈23	380
> ≈23	530





Misura sismica MASW n°16 (L16) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

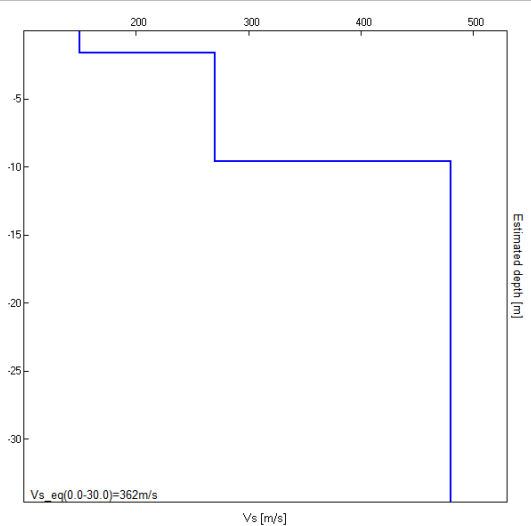
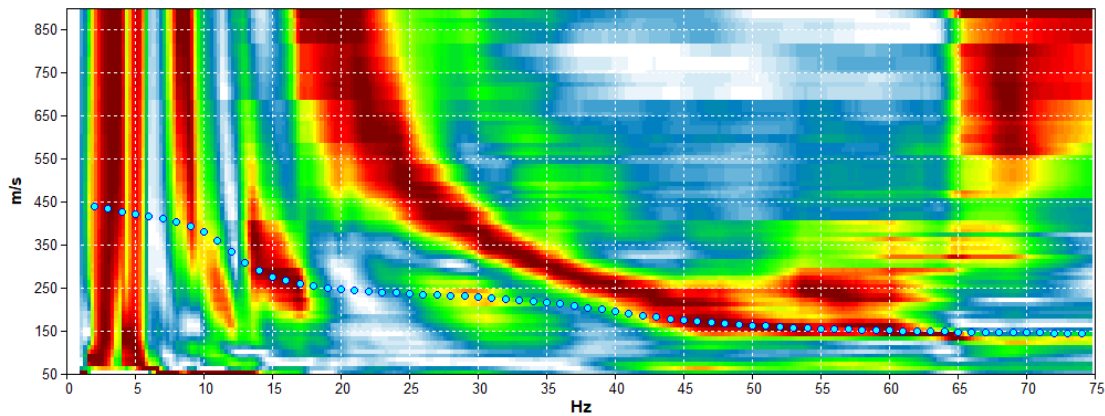
Latitudine: 4958091

Longitudine: 143031

Fine Linea

Latitudine: 4958074

Longitudine: 143055



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,6	150
1,6 - 9,6	270
9,6 - ≈30	480
> ≈30	480



Misura sismica MASW n°17 (L17) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

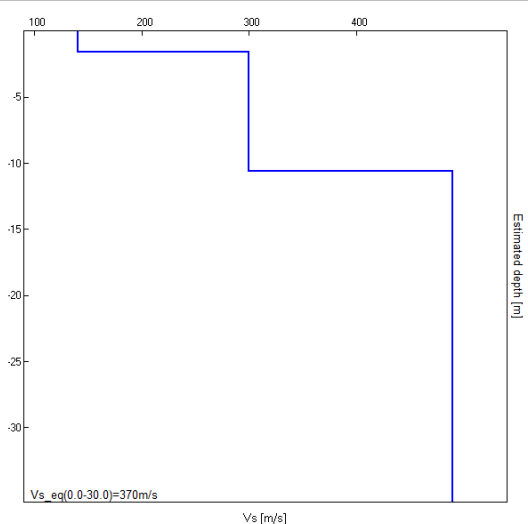
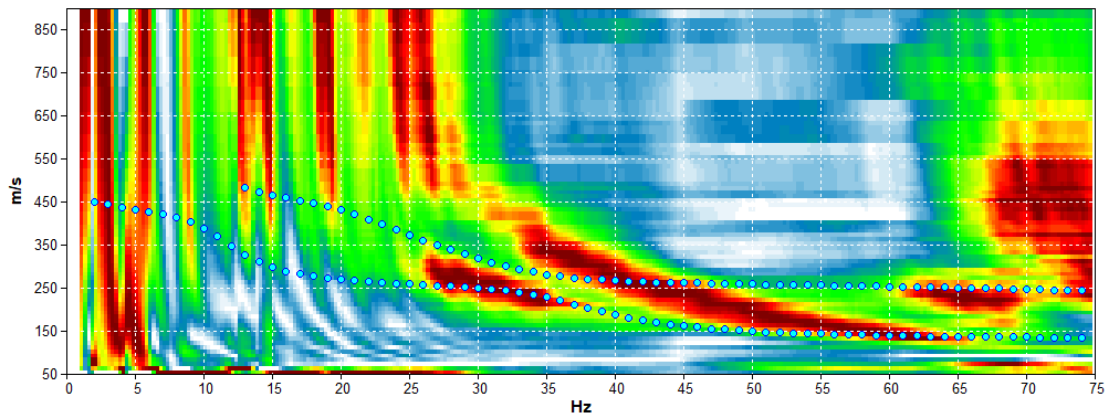
Latitudine: 4958092

Longitudine: 143240

Fine Linea

Latitudine: 4958113

Longitudine: 143261



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,6	140
1,6 - ≈11	300
≈11 - ≈31	490
> ≈31	490



Misura sismica MASW n°18 (L18) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

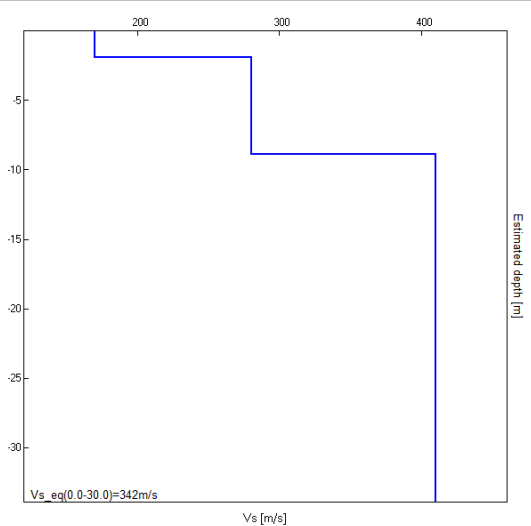
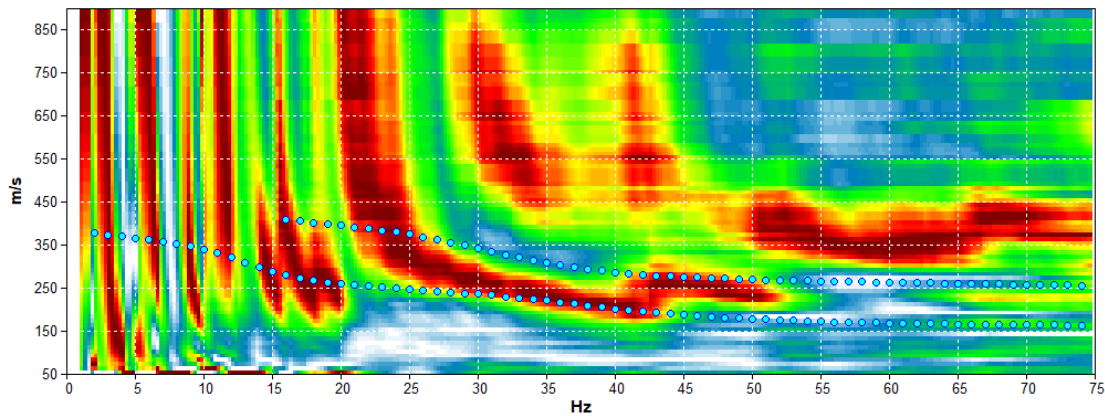
Latitudine: 4958373

Longitudine: 143221

Fine Linea

Latitudine: 4958400

Longitudine: 143235



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,9	170
1,9 - 8,9	280
8,9 - ≈29	410
> ≈29	410





Misura sismica MASW n°19 (L19) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

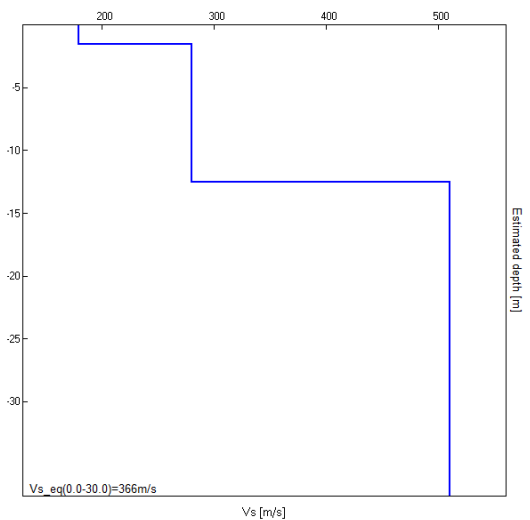
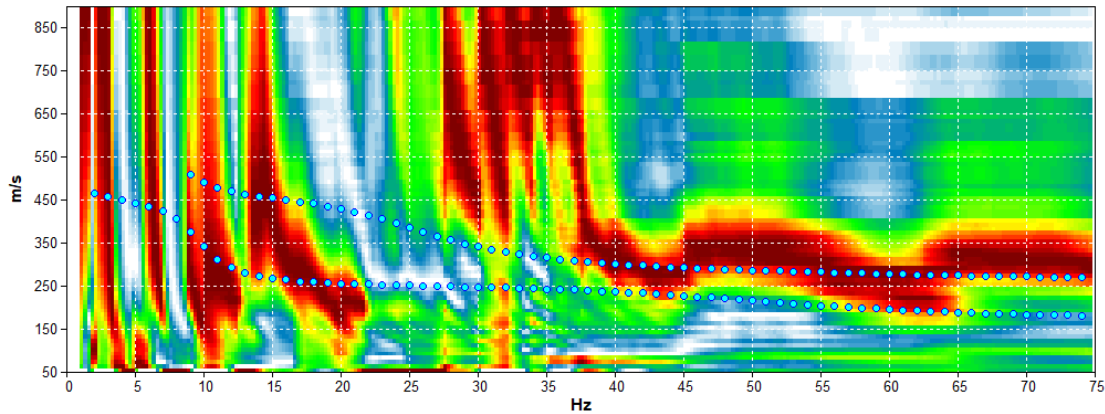
Latitudine: 4958534

Longitudine: 143527

Fine Linea

Latitudine: 4958513

Longitudine: 143549



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,5	180
1,5 - ≈13	280
≈13 - ≈33	510
> ≈33	510





Misura sismica MASW n°20 (L20) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

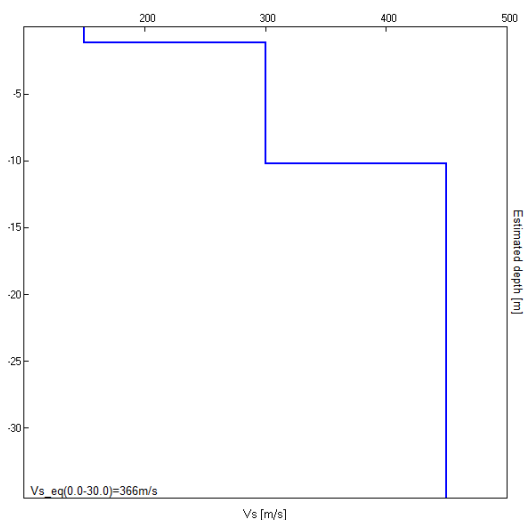
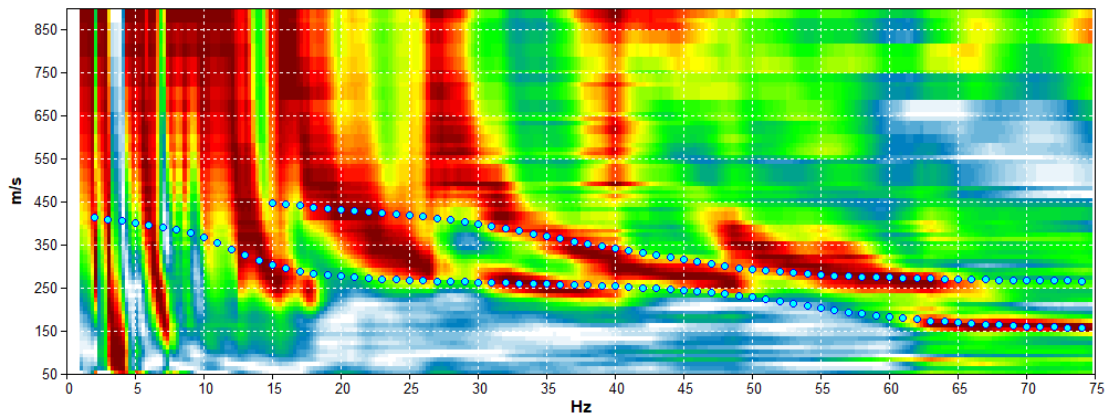
Latitudine: 4958291

Longitudine: 143934

Fine Linea

Latitudine: 4958306

Longitudine: 143908



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,2	150
1,2 - ≈10	300
≈10 - ≈30	450
> ≈30	450



Misura sismica MASW n°21 (L21) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

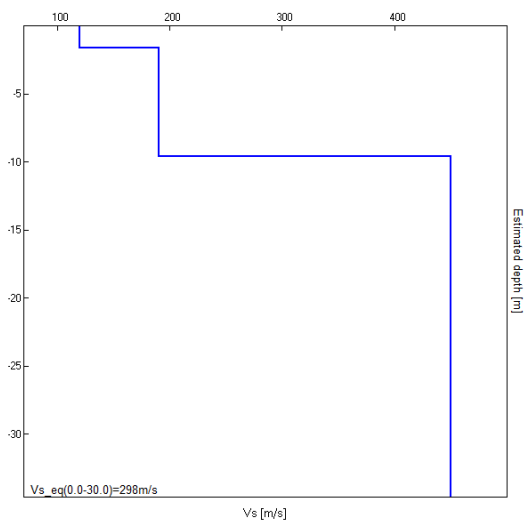
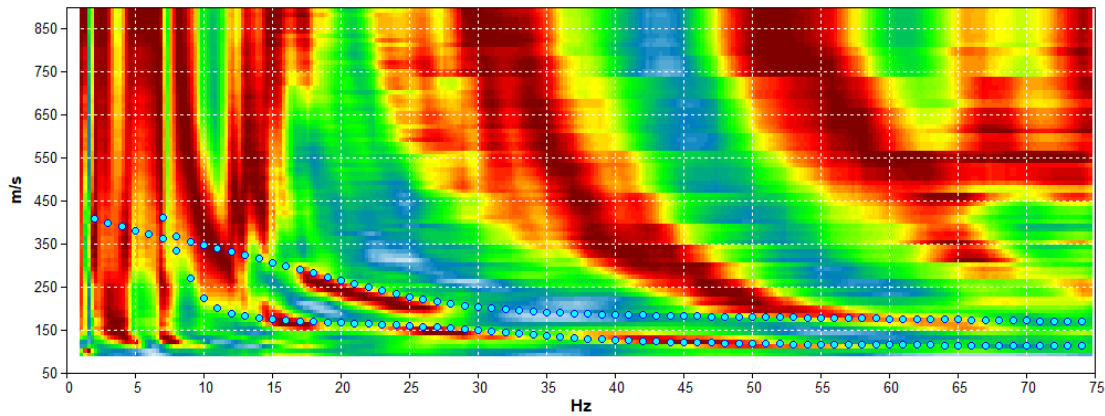
Latitudine: 4953232

Longitudine: 139315

Fine Linea

Latitudine: 4953201

Longitudine: 139340



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,6	120
1,6 - 9,6	190
9,6 - ≈30	450
> ≈30	450



Misura sismica MASW n°22 (L22) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

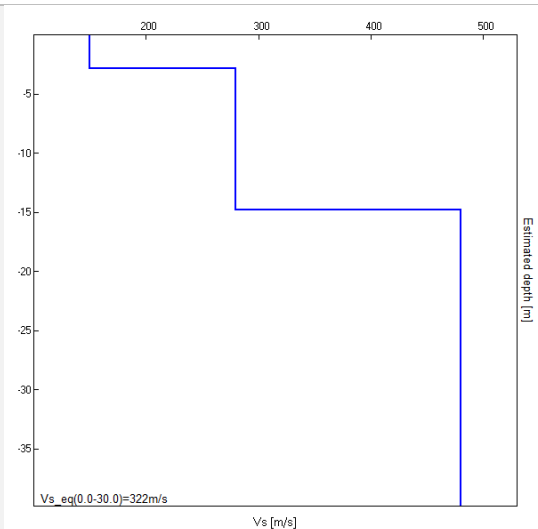
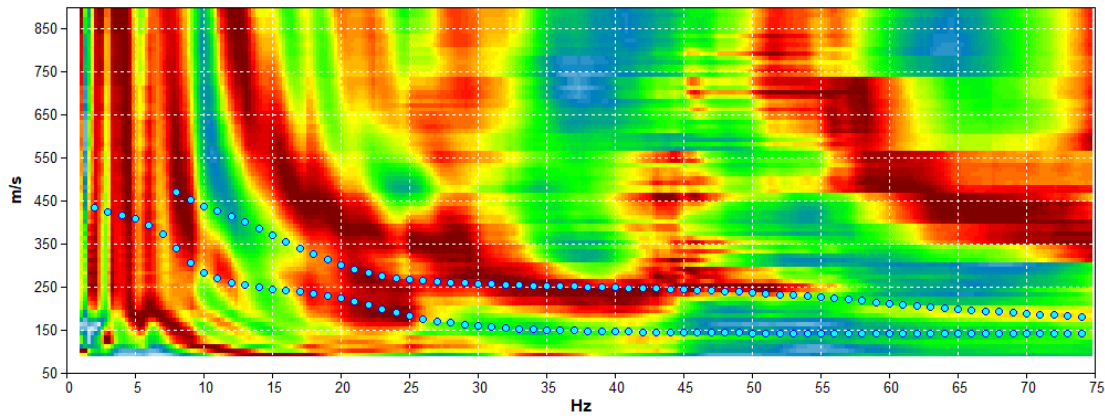
Latitudine: 4953528

Longitudine: 139061

Fine Linea

Latitudine: 4953565

Longitudine: 139076



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,8	150
2,8 - ≈15	280
≈15 - ≈35	480
> ≈35	480





Misura sismica MASW n°23 (L23) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

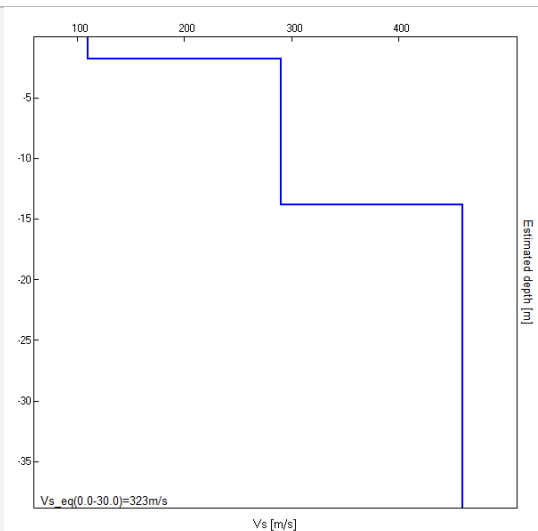
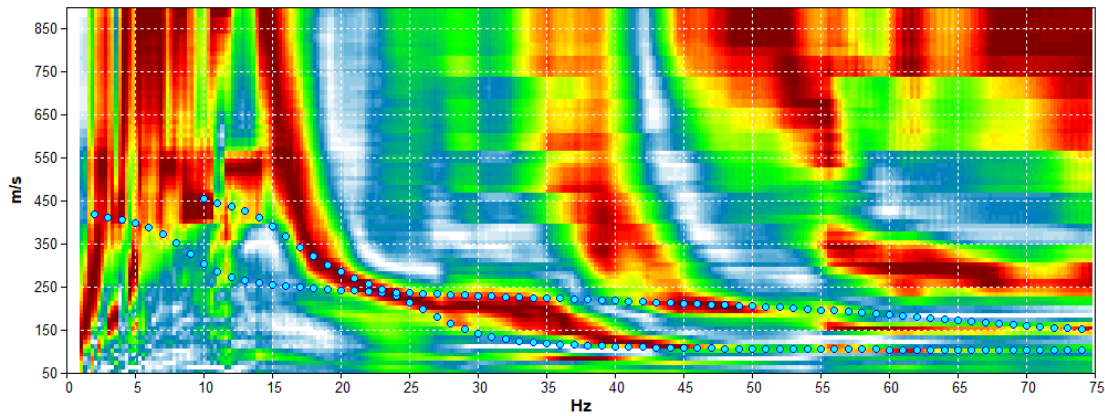
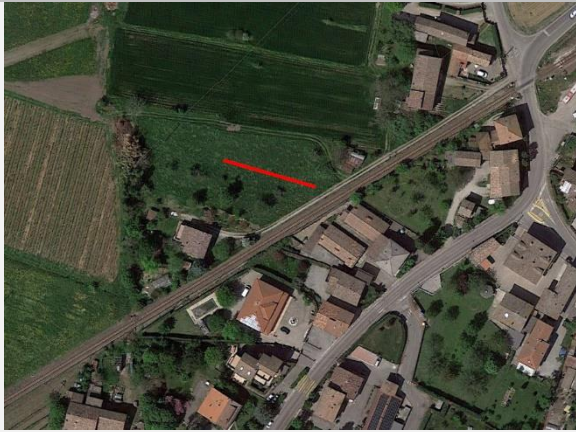
Latitudine: 4953388

Longitudine: 138980

Fine Linea

Latitudine: 4943401

Longitudine: 138942



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,8	110
1,8 - ≈14	290
≈14 - ≈34	460
> ≈34	460



Misura sismica MASW n°24 (L24) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

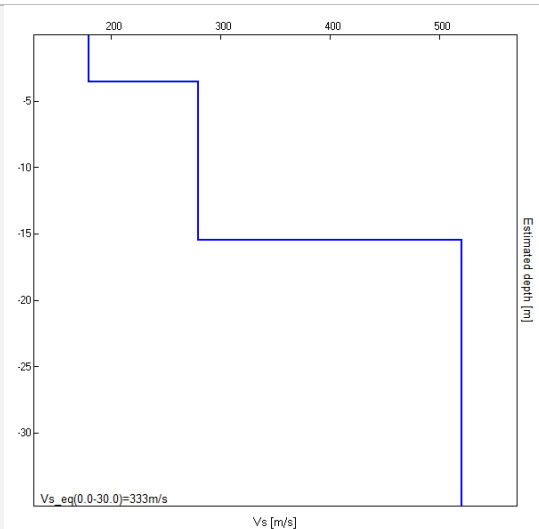
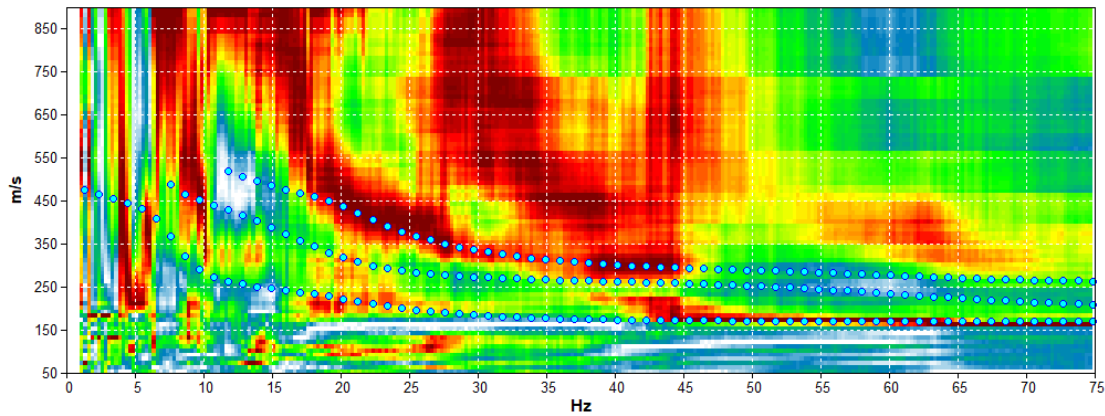
Latitudine: 4953681

Longitudine: 139319

Fine Linea

Latitudine: 4953693

Longitudine: 139280



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 3,5	180
3,5 - ≈16	280
≈16 - ≈31	520
> ≈31	520



Misura sismica MASW n°25 (L25) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

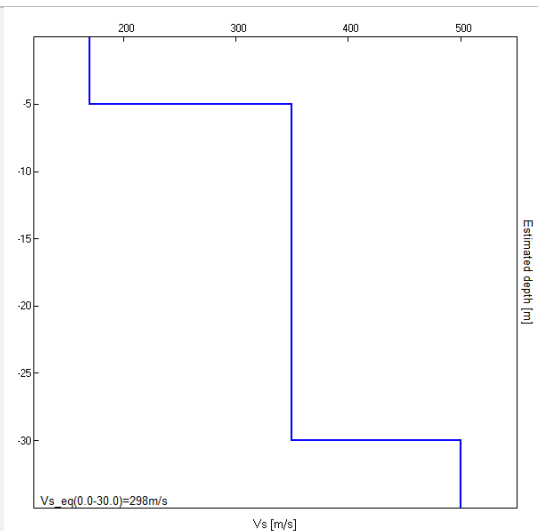
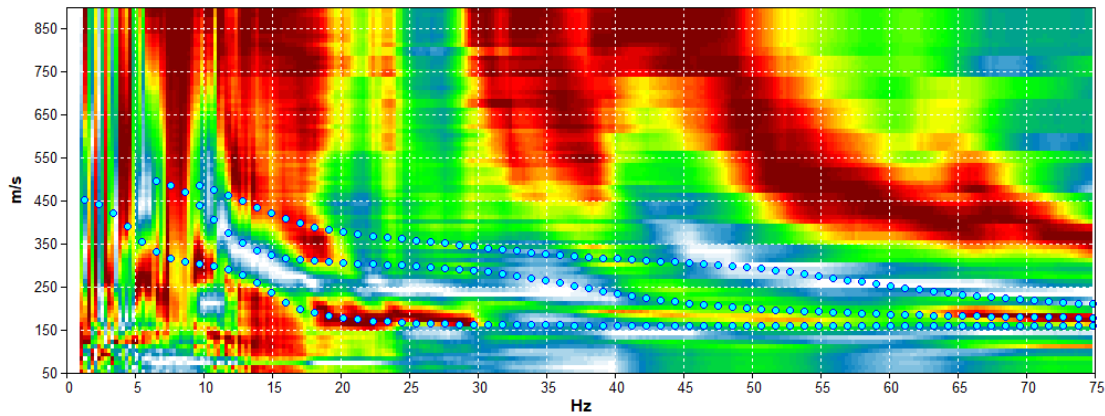
Latitudine: 4954001

Longitudine: 139877

Fine Linea

Latitudine: 4954032

Longitudine: 139900



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 5,0	170
5,0 - ≈30	350
> ≈30	500





Misura sismica MASW n°26 (L26) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

**Inizio Linea**

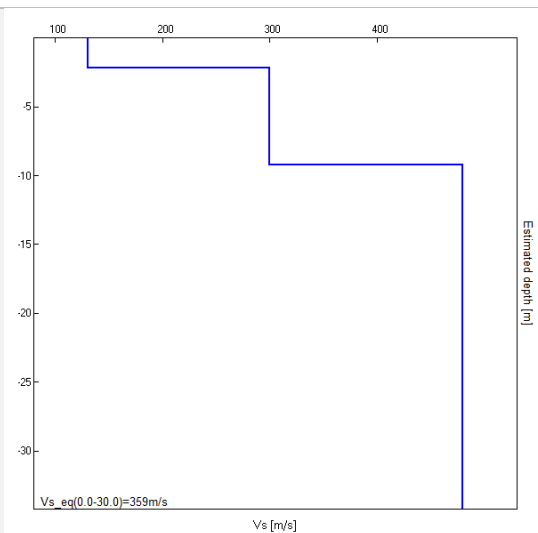
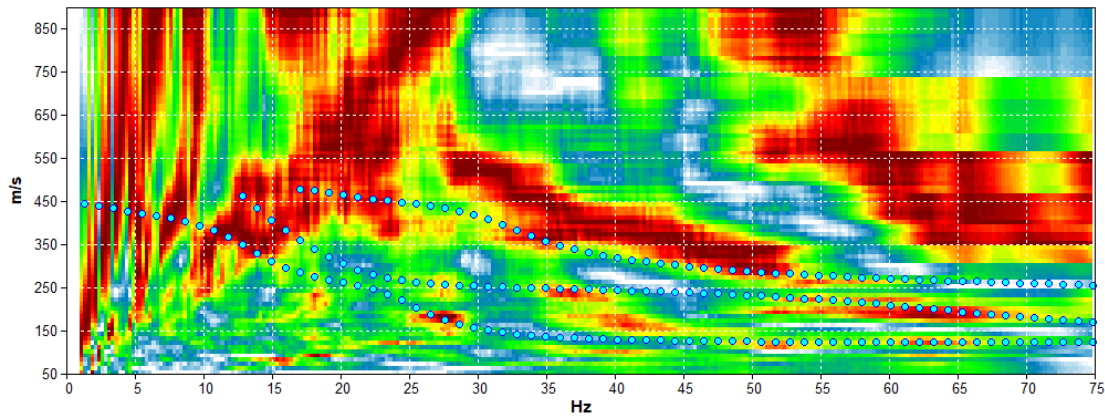
Latitudine: 4956179

Longitudine: 141088

**Fine Linea**

Latitudine: 4956216

Longitudine: 141104



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,2	130
2,2 - 9,2	300
9,2 - ≈29	480
> ≈29	480



Misura sismica MASW n°27 (L27) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

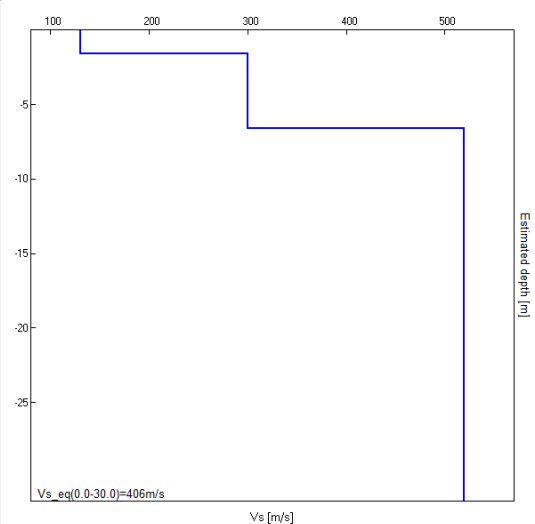
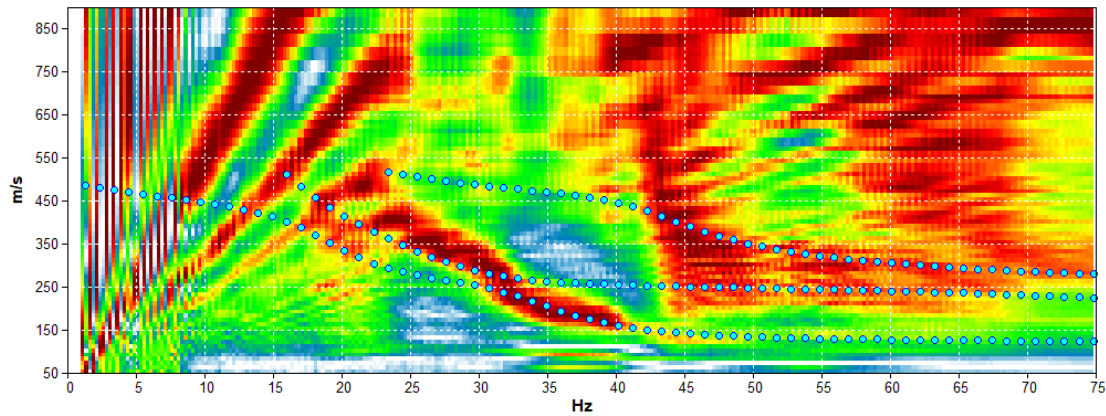
Latitudine: 4955356

Longitudine: 142211

Fine Linea

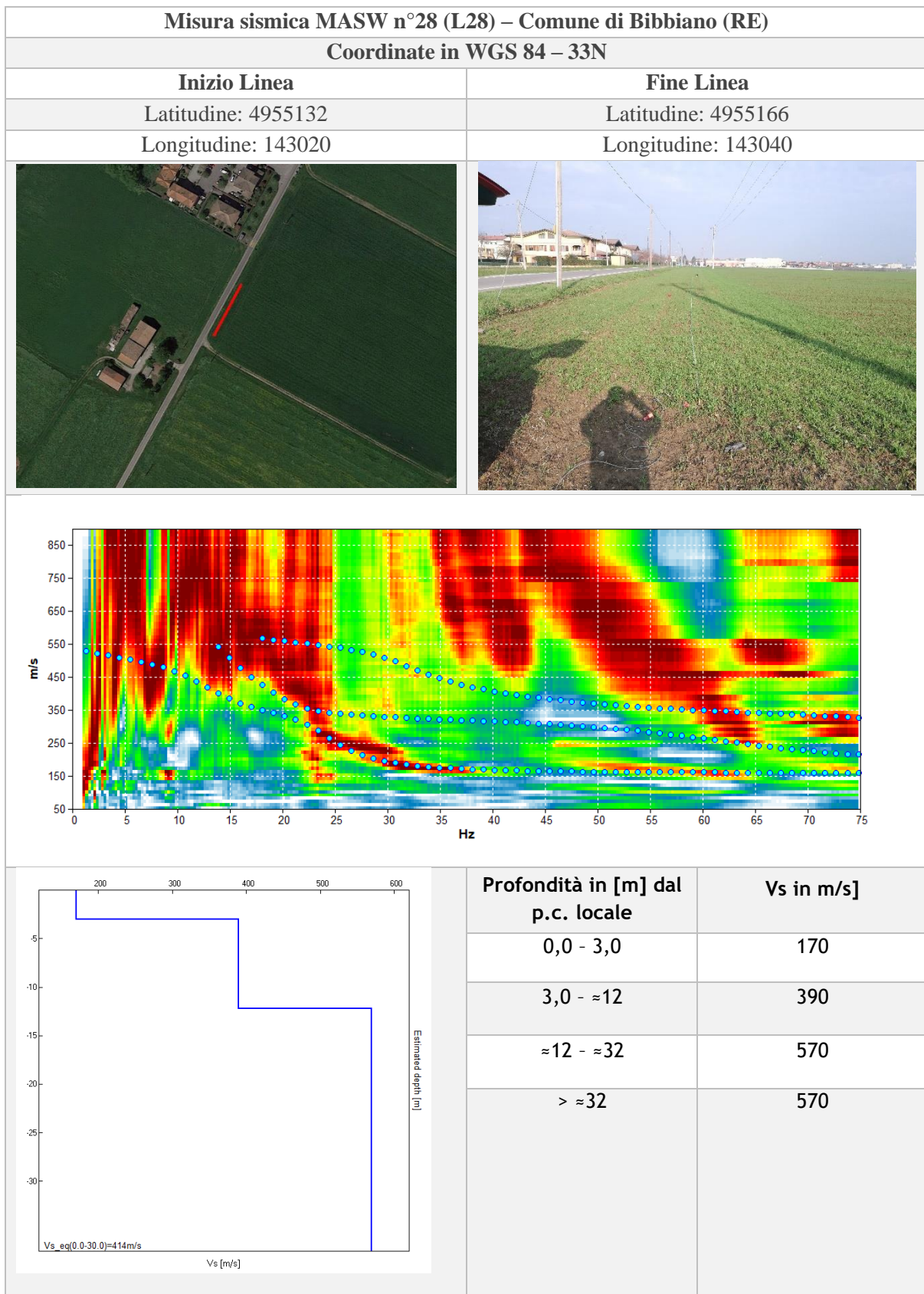
Latitudine: 4955321

Longitudine: 142192



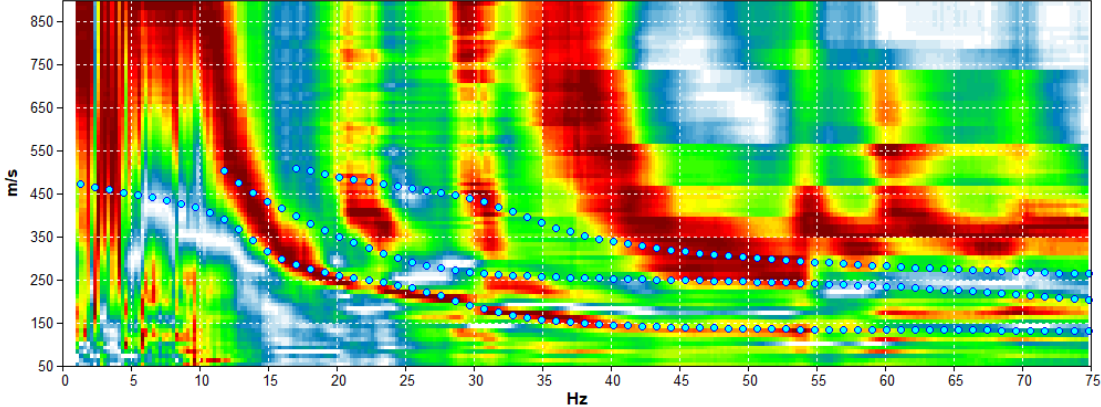
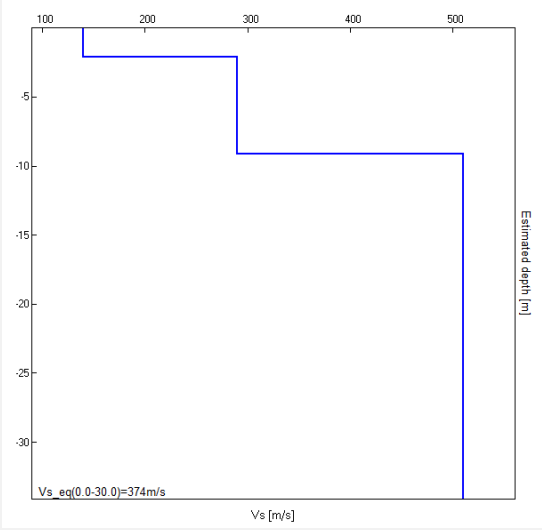


Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,6	130
1,6 - 6,6	300
6,6 - ≈27	520
> ≈27	520







Misura sismica MASW n°29 (L29) – Comune di Bibbiano (RE)											
Coordinate in WGS 84 – 33N											
Inizio Linea	Fine Linea										
Latitudine: 4955486	Latitudine: 4955526										
Longitudine: 143452	Longitudine: 143458										
											
											
 <p>Vs_eq(0.0-30.0)=374m/s</p>	<table border="1"> <thead> <tr> <th>Profondità in [m] dal p.c. locale</th> <th>Vs in m/s]</th> </tr> </thead> <tbody> <tr> <td>0,0 - 2,1</td> <td>140</td> </tr> <tr> <td>2,1 - 9,1</td> <td>290</td> </tr> <tr> <td>9,1 - ≈29</td> <td>510</td> </tr> <tr> <td>&gt; ≈29</td> <td>510</td> </tr> </tbody> </table>	Profondità in [m] dal p.c. locale	Vs in m/s]	0,0 - 2,1	140	2,1 - 9,1	290	9,1 - ≈29	510	> ≈29	510
Profondità in [m] dal p.c. locale	Vs in m/s]										
0,0 - 2,1	140										
2,1 - 9,1	290										
9,1 - ≈29	510										
> ≈29	510										



Misura sismica MASW n°30 (L30) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

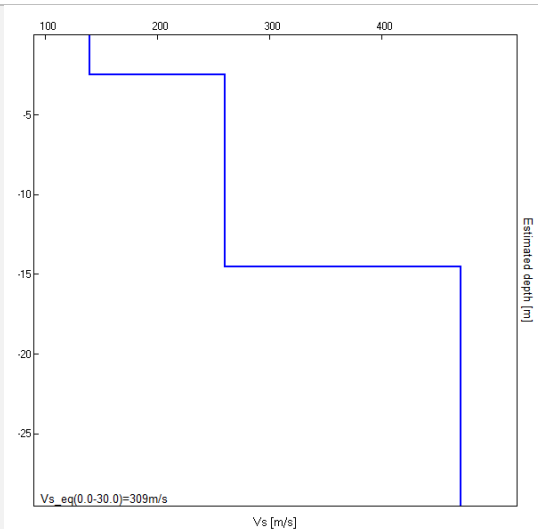
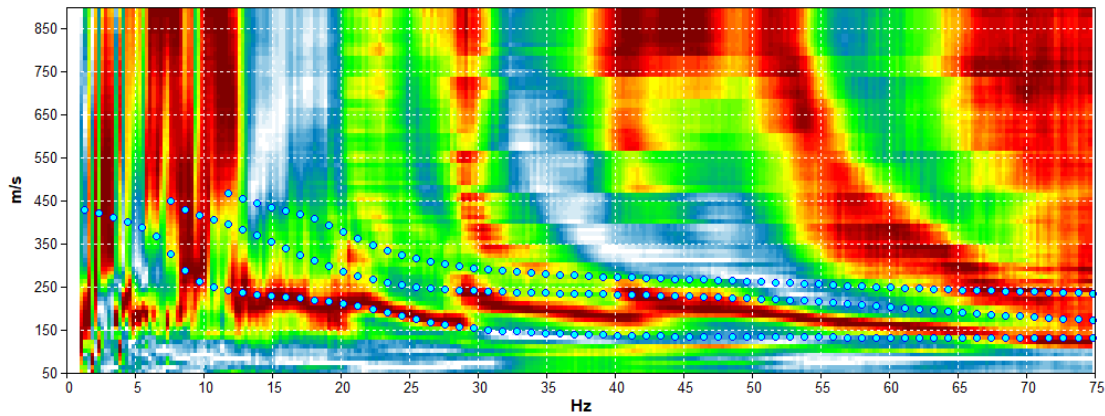
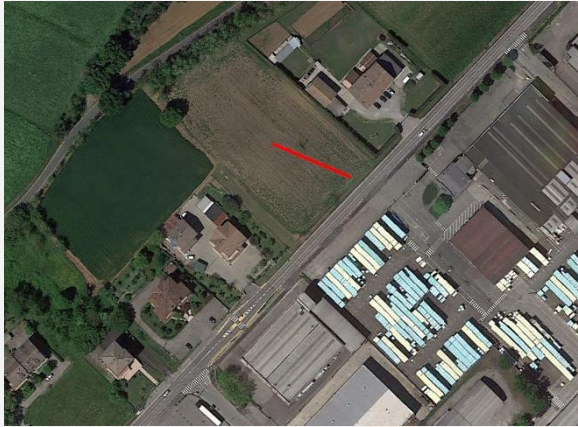
Latitudine: 4956018

Longitudine: 143674

Fine Linea

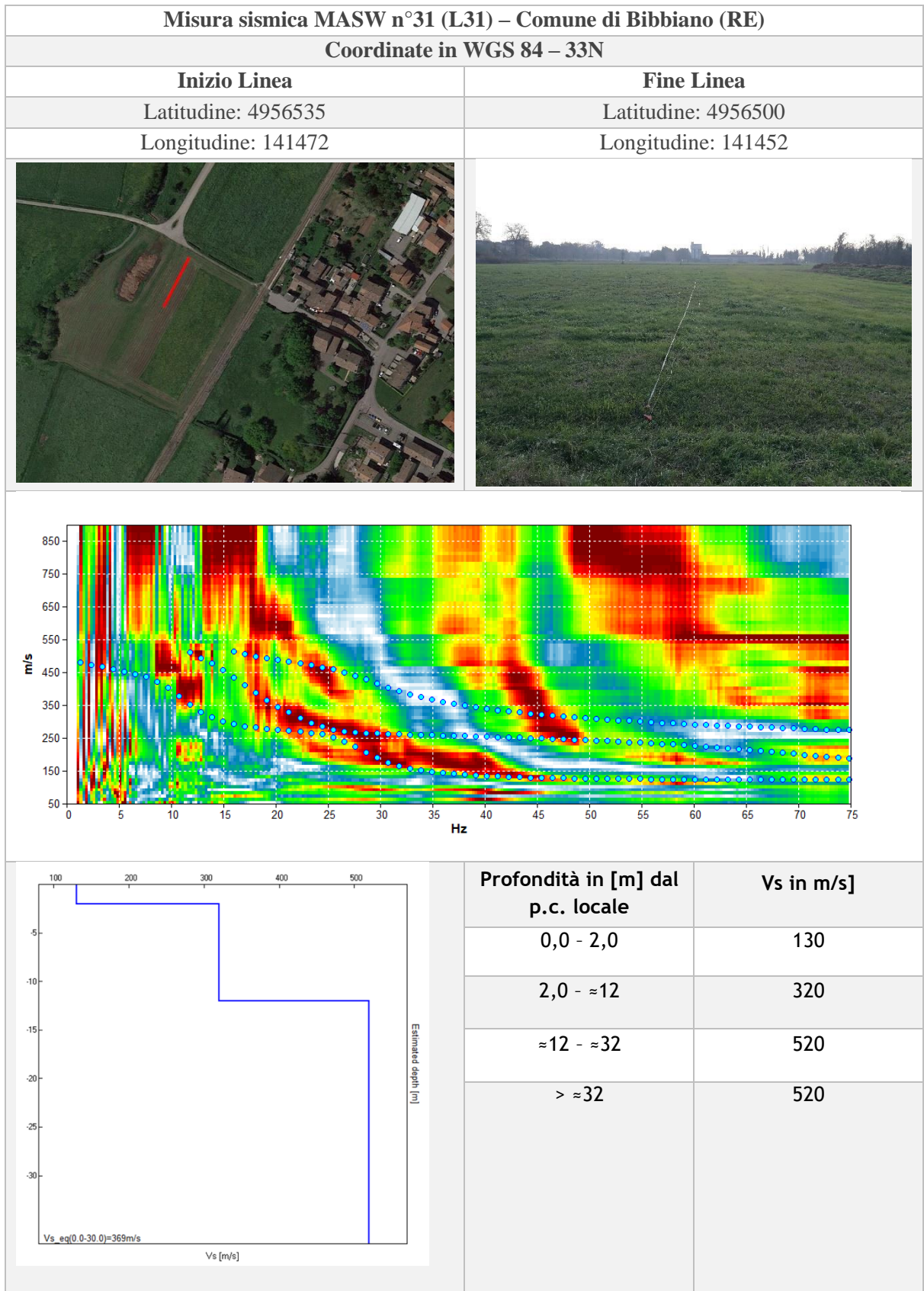
Latitudine: 4956035

Longitudine: 143638



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,5	140
2,5 - ≈15	260
≈15 - ≈25	470
> ≈25	470







Misura sismica MASW n°32 (L32) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

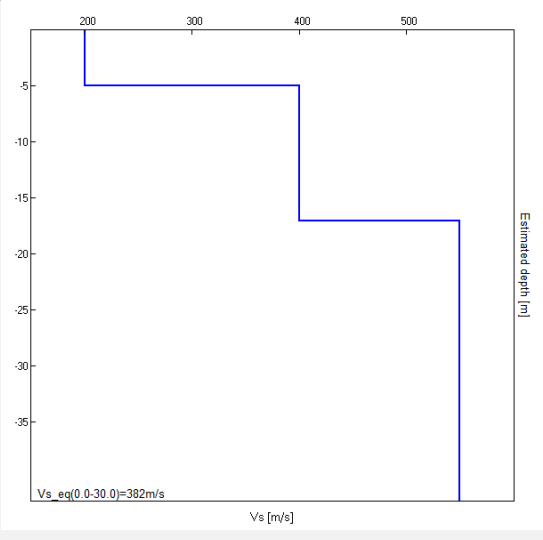
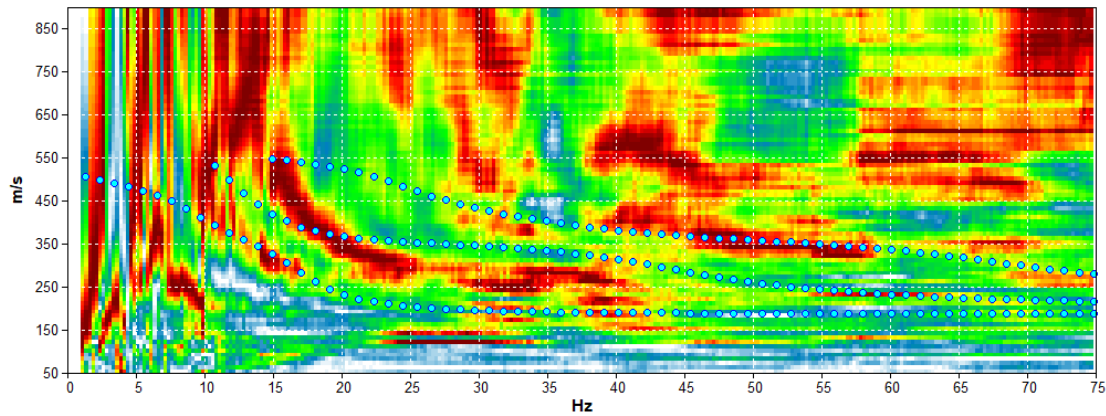
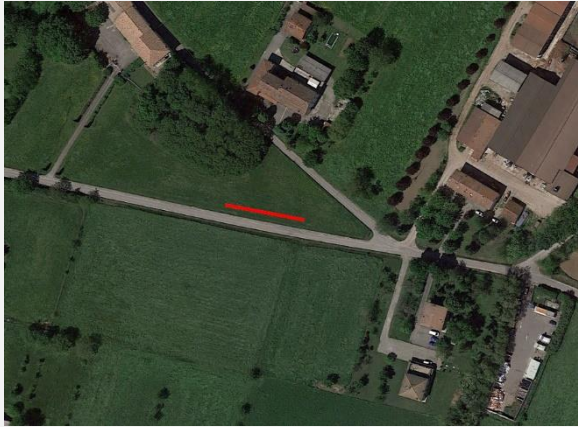
Latitudine: 4956439

Longitudine: 142359

Fine Linea

Latitudine: 4956448

Longitudine: 142320



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 5,0	200
5,0 - ≈17	400
≈17 - ≈37	550
> ≈37	550



Misura sismica MASW n°33 (L33) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

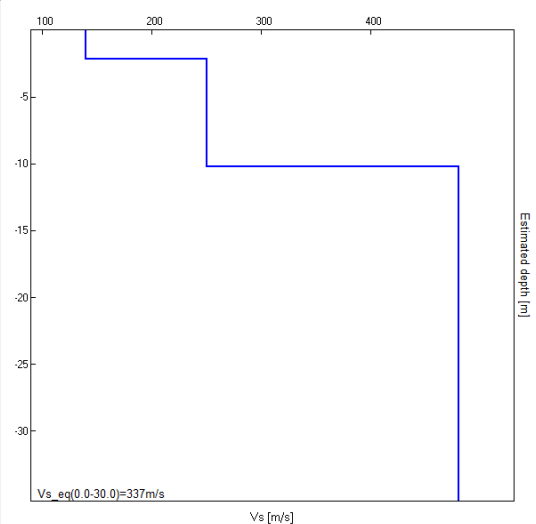
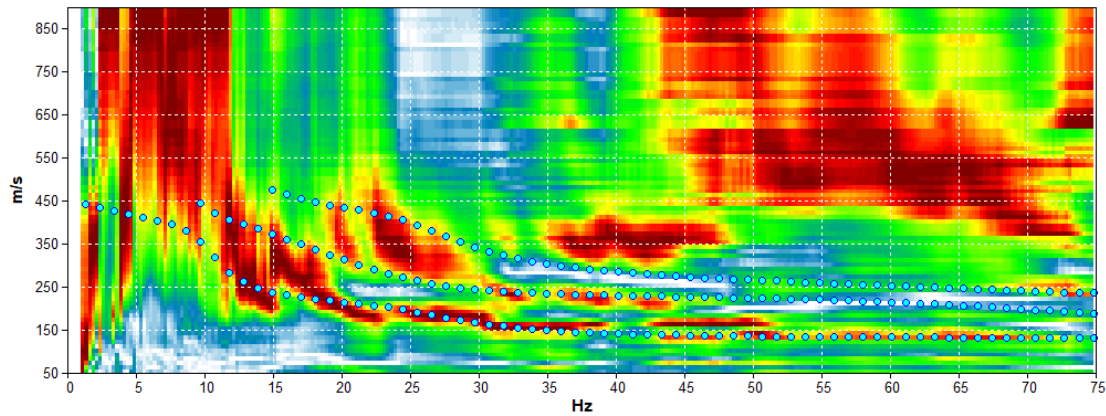
Latitudine: 4956401

Longitudine: 141825

Fine Linea

Latitudine: 4956445

Longitudine: 141814



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,2	140
2,2 - ≈10	250
≈10 - ≈30	480
> ≈30	480



Misura sismica MASW n°34 (L34) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

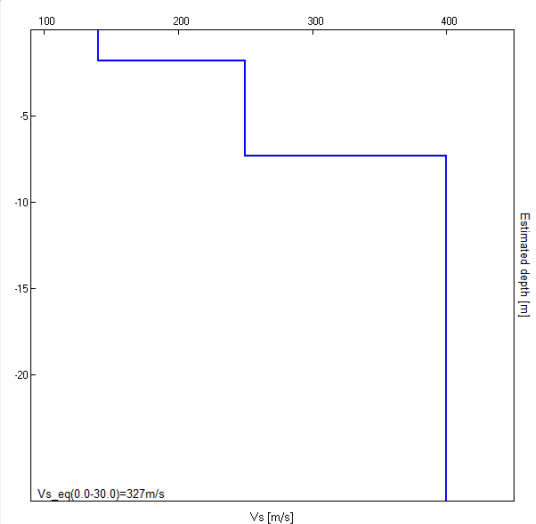
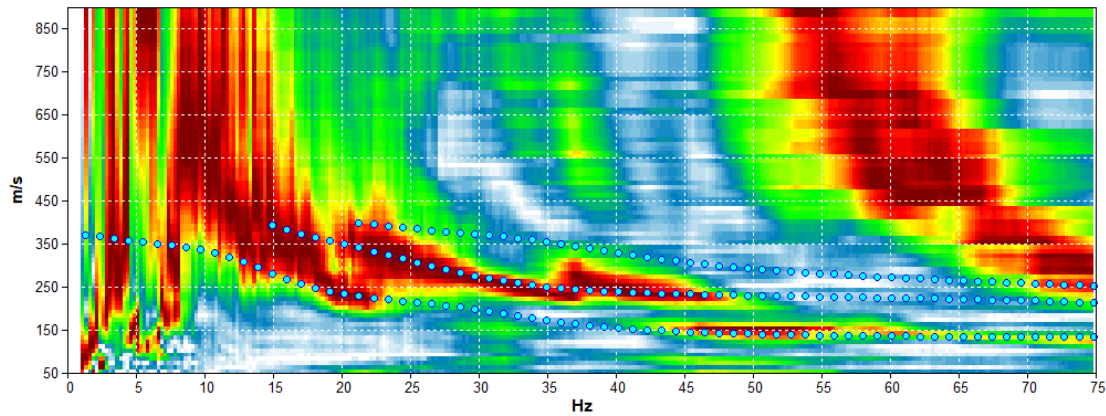
Latitudine: 4956992

Longitudine: 142013

Fine Linea

Latitudine: 4957030

Longitudine: 142036



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,8	140
1,8 - 7,3	250
7,3 - ≈22	400
> ≈22	400





Misura sismica MASW n°35 (L35) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

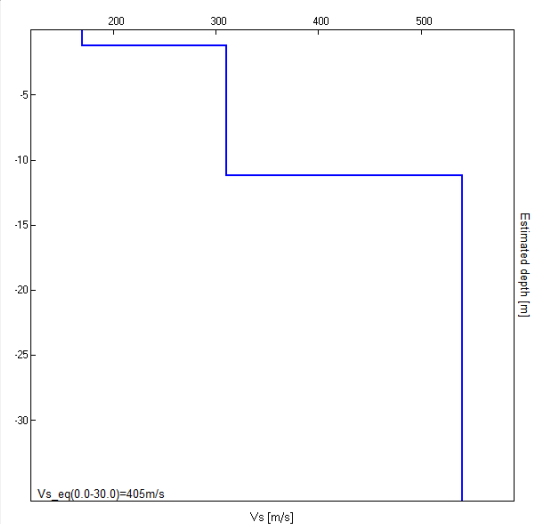
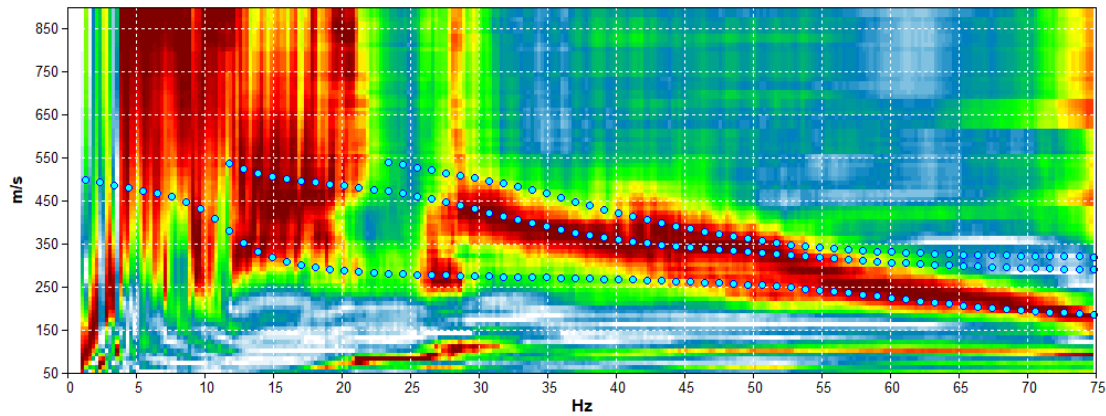
Latitudine: 4958788

Longitudine: 143662

Fine Linea

Latitudine: 4958806

Longitudine: 143621



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,2	170
1,2 - ≈11	310
≈11 - ≈31	540
> ≈31	540



Misura sismica MASW n°36 (L36) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

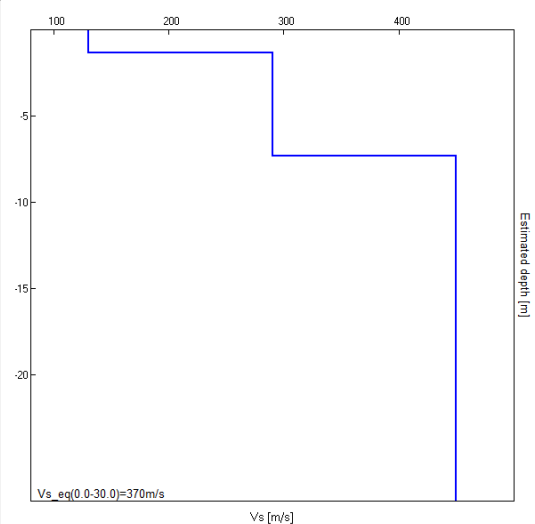
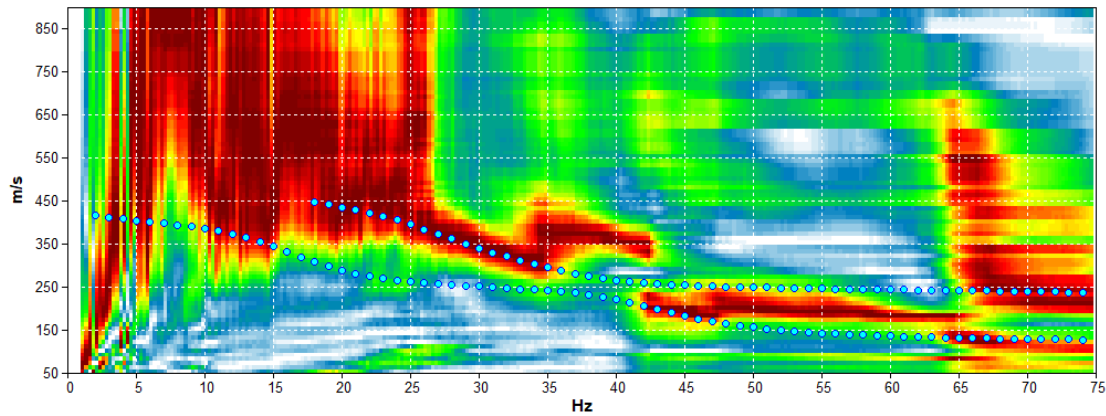
Latitudine: 4959028

Longitudine: 143099

Fine Linea

Latitudine: 4959041

Longitudine: 143056



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,3	130
1,3 - 7,3	290
7,3 - ≈22	450
> ≈22	450



Misura sismica MASW n°37 (L37) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

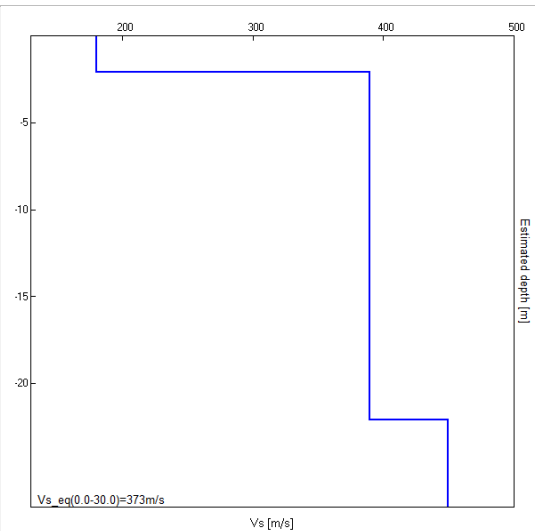
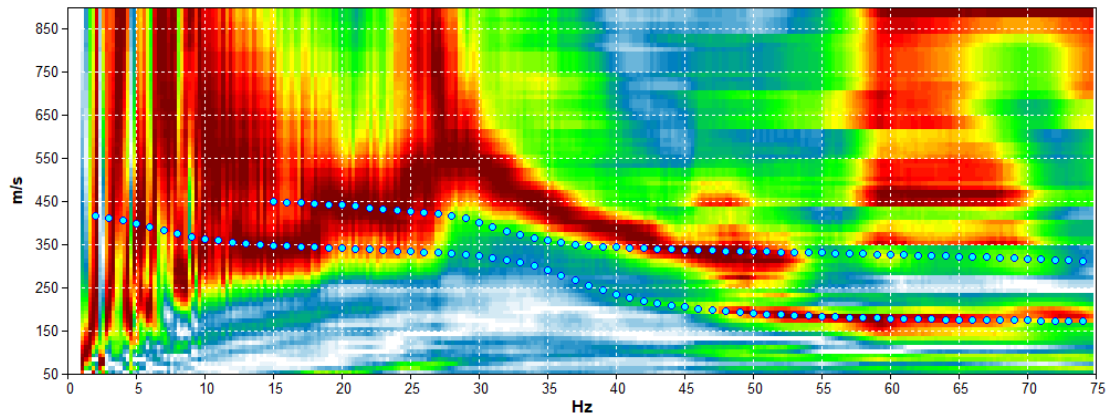
Latitudine: 4959282

Longitudine: 142185

Fine Linea

Latitudine: 4959289

Longitudine: 142141



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,1	180
2,1 - ≈22	390
> ≈22	450





Misura sismica MASW n°38 (L38) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

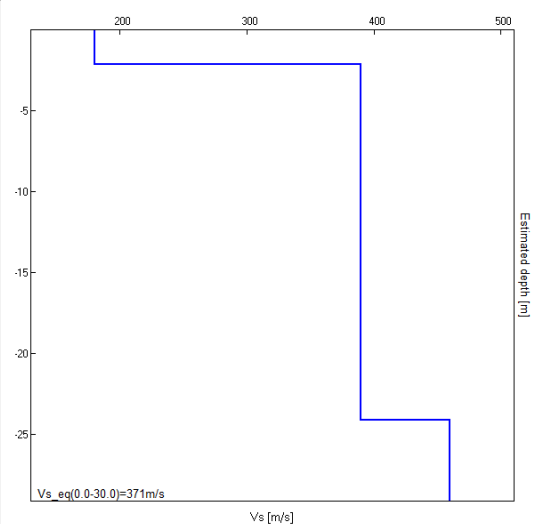
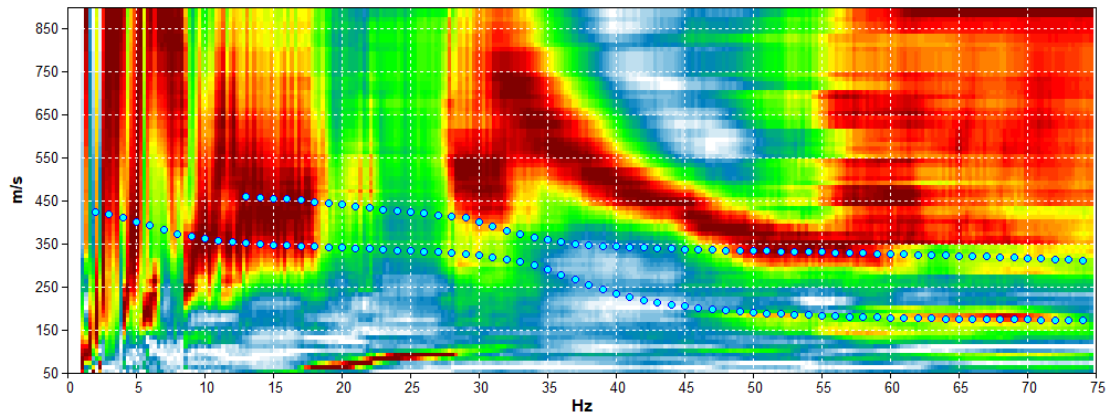
Latitudine: 4959048

Longitudine: 142254

Fine Linea

Latitudine: 4959057

Longitudine: 142210



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,1	180
2,1 - ≈24	390
> ≈24	460



Misura sismica MASW n°39 (L39) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

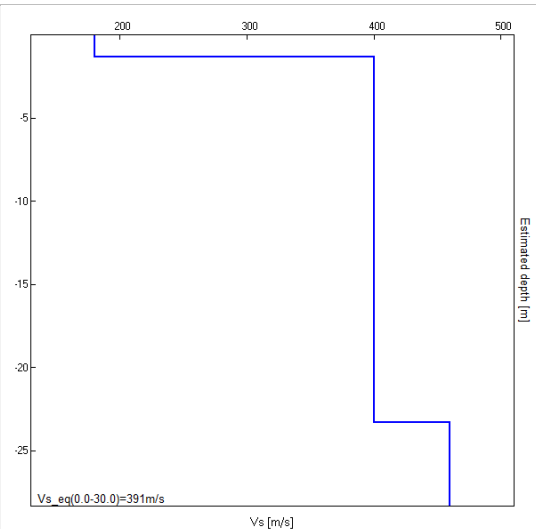
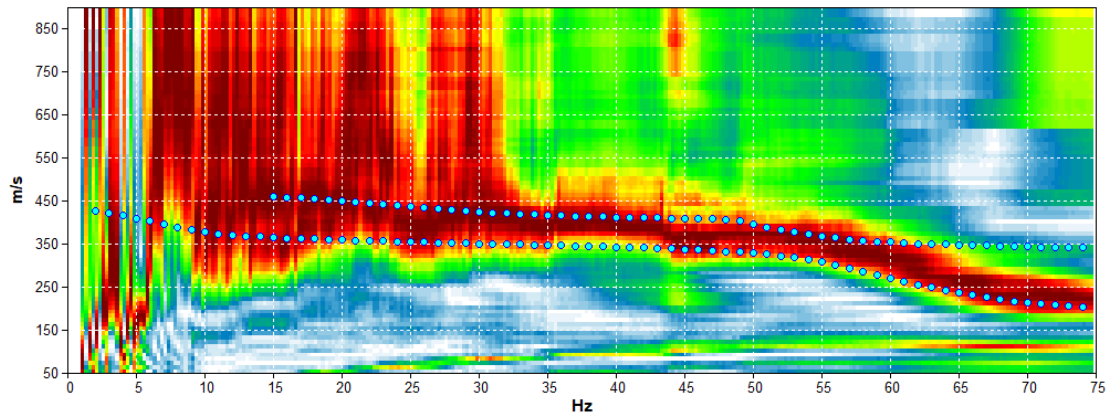
Latitudine: 4958796

Longitudine: 141407

Fine Linea

Latitudine: 4958753

Longitudine: 141394



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,3	180
1,3 - ≈23	400
> ≈23	4600



Misura sismica MASW n°40 (L40) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

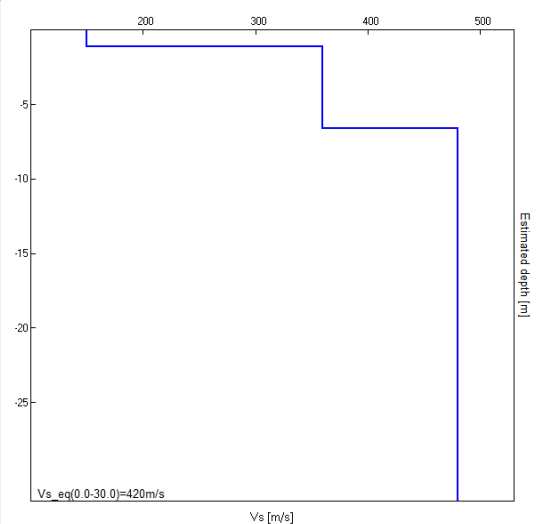
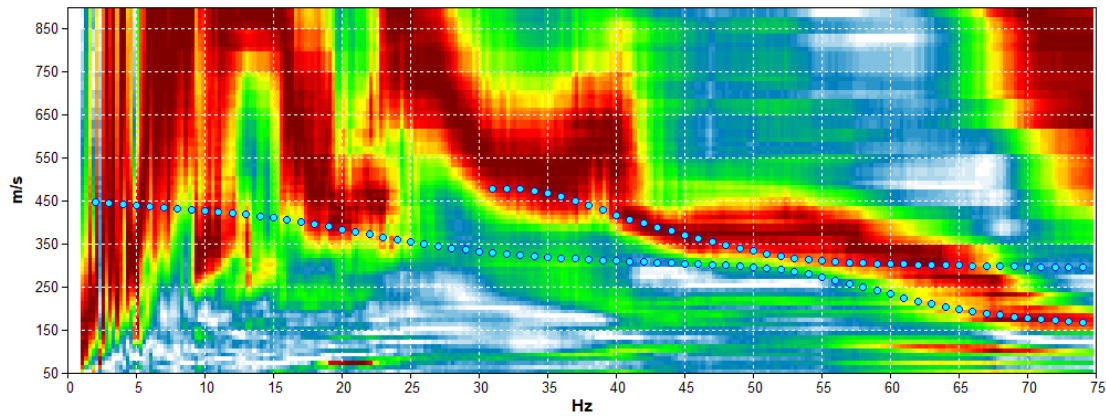
Latitudine: 4958246

Longitudine: 141981

Fine Linea

Latitudine: 4958289

Longitudine: 141993



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,1	150
1,1 - 6,6	360
6,6 - ≈27	480
> ≈27	480



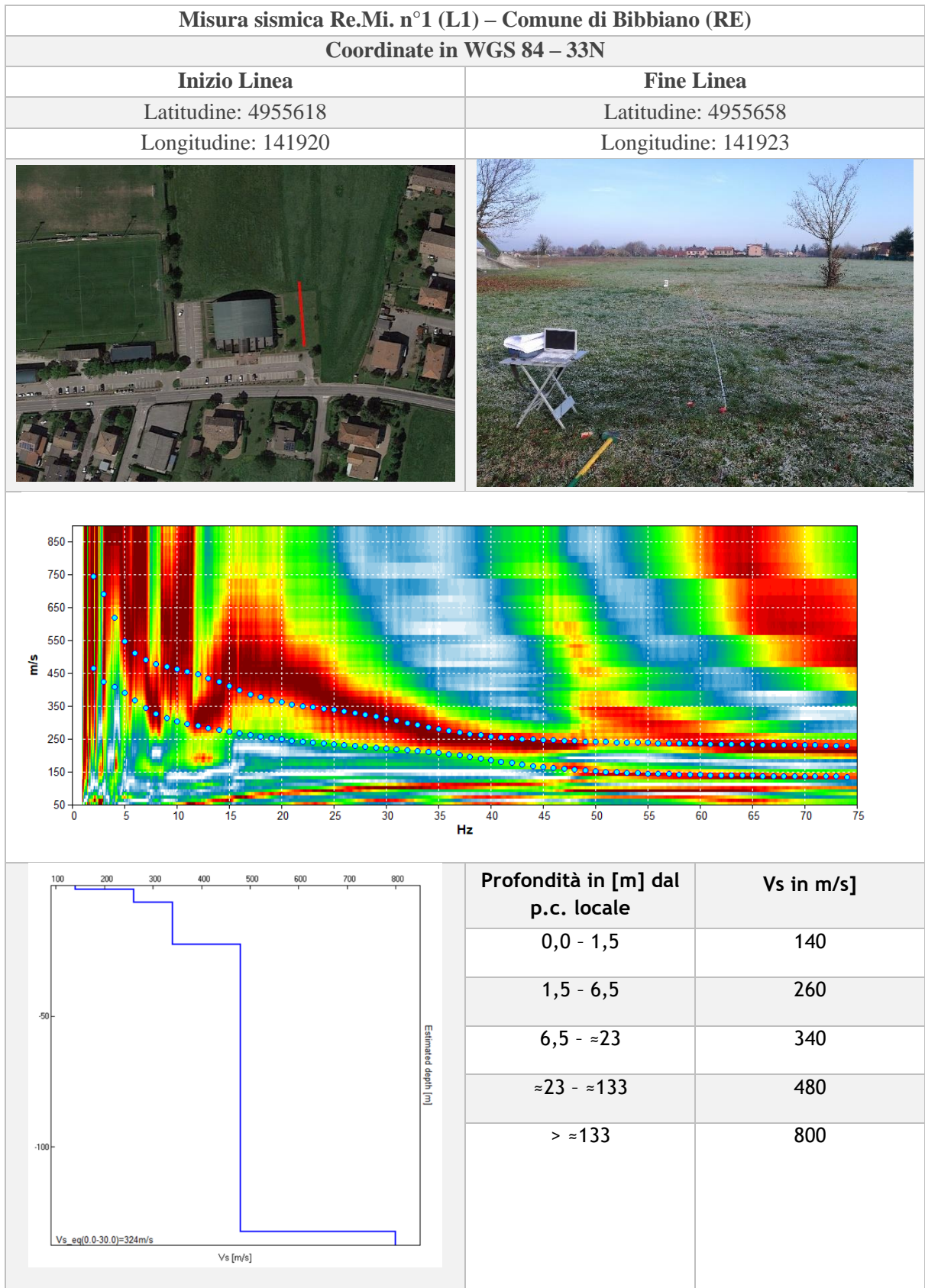


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*Indagini sismiche di tipo passivo in array  
(Re.Mi.)*

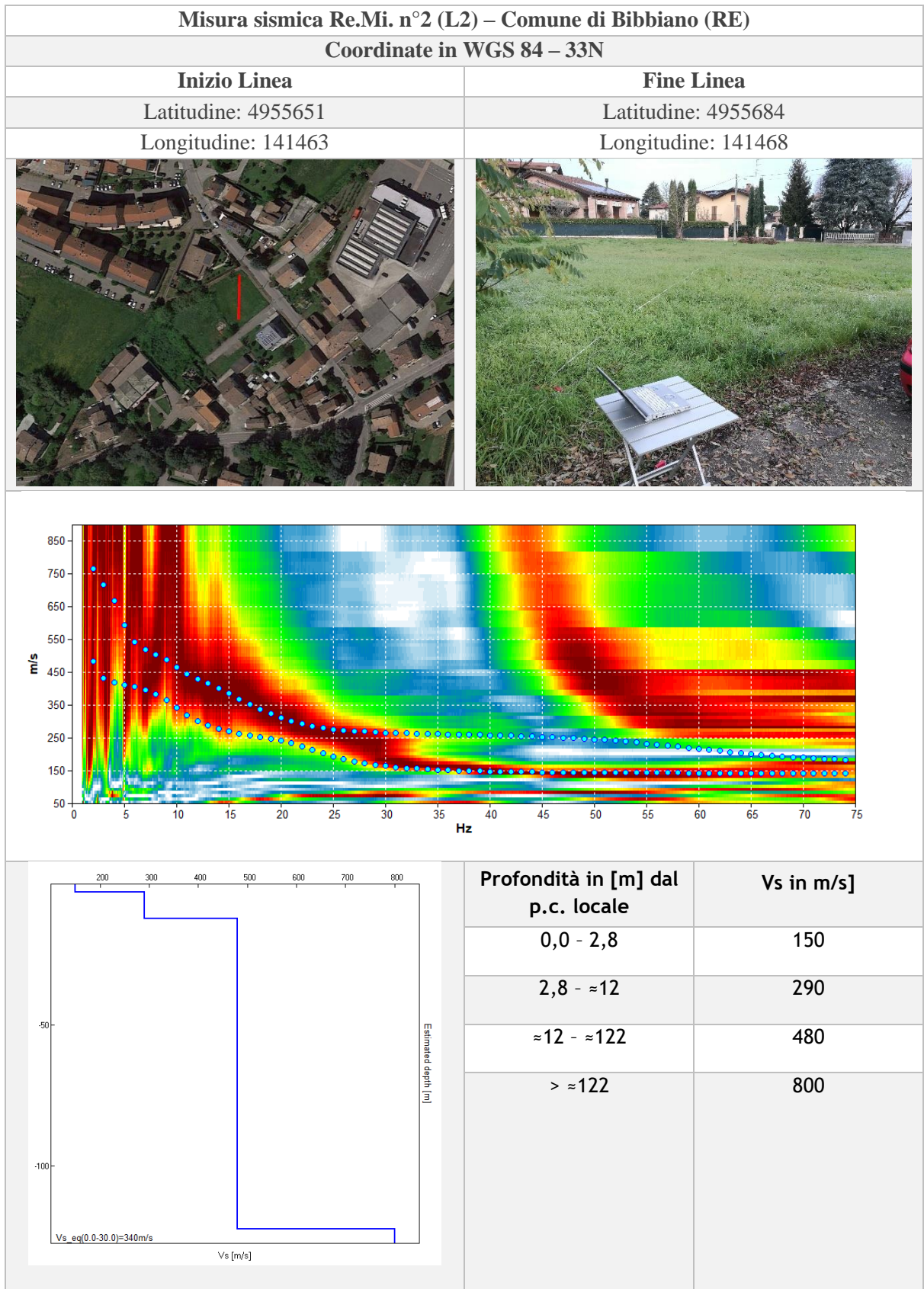
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<b>Vs,30</b>	<b>324 m/s</b>
<b>Profondità bedrock</b>	<b>133 m</b>





<b>Vs,30</b>	<b>340 m/s</b>
<b>Profondità bedrock</b>	<b>122 m</b>





Misura sismica Re.Mi. n°3 (L3) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

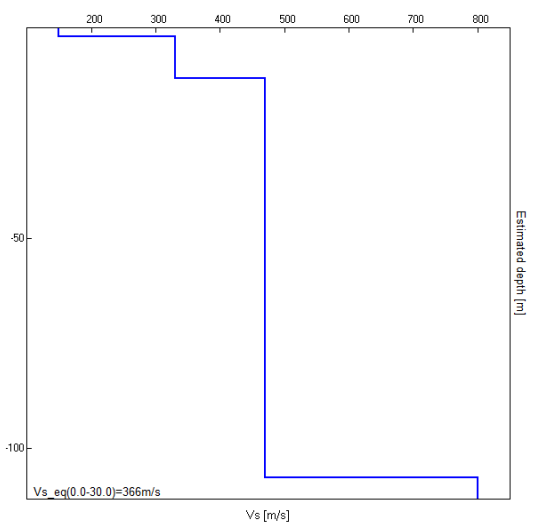
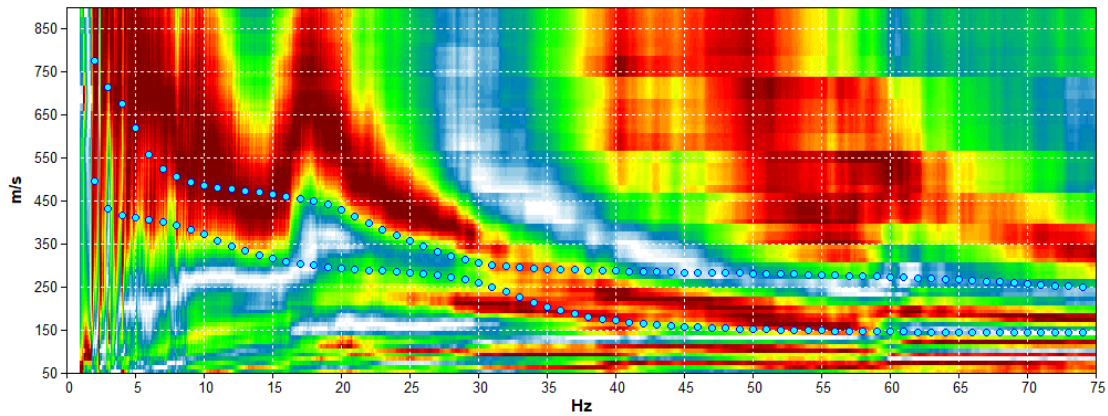
Latitudine: 4955845

Longitudine: 140540

Fine Linea

Latitudine: 4955884

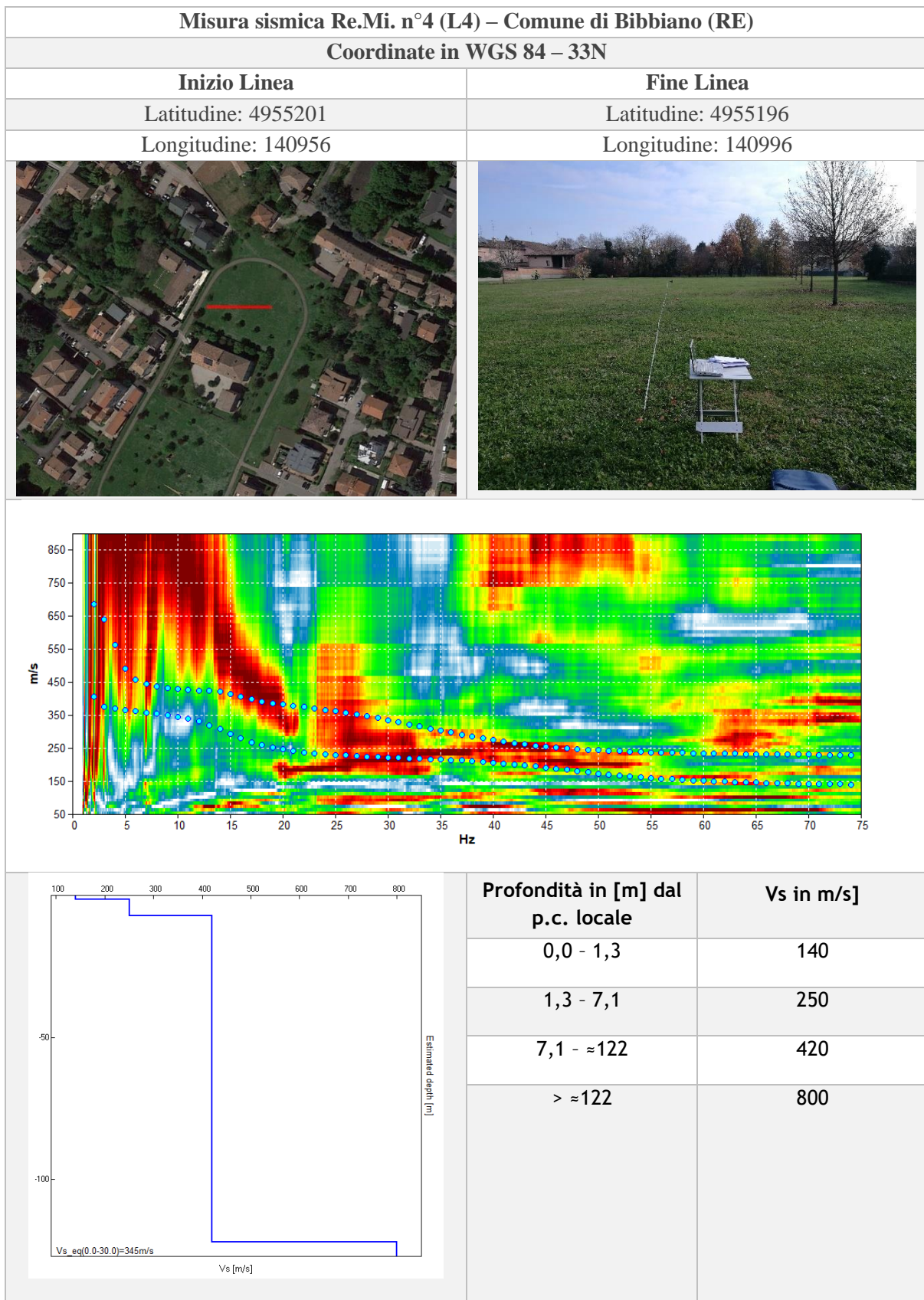
Longitudine: 140547



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,0	150
2,0 - ≈12	330
≈12 - ≈107	470
> ≈107	800

<b>Vs,30</b>	<b>366 m/s</b>
<b>Profondità bedrock</b>	<b>107 m</b>

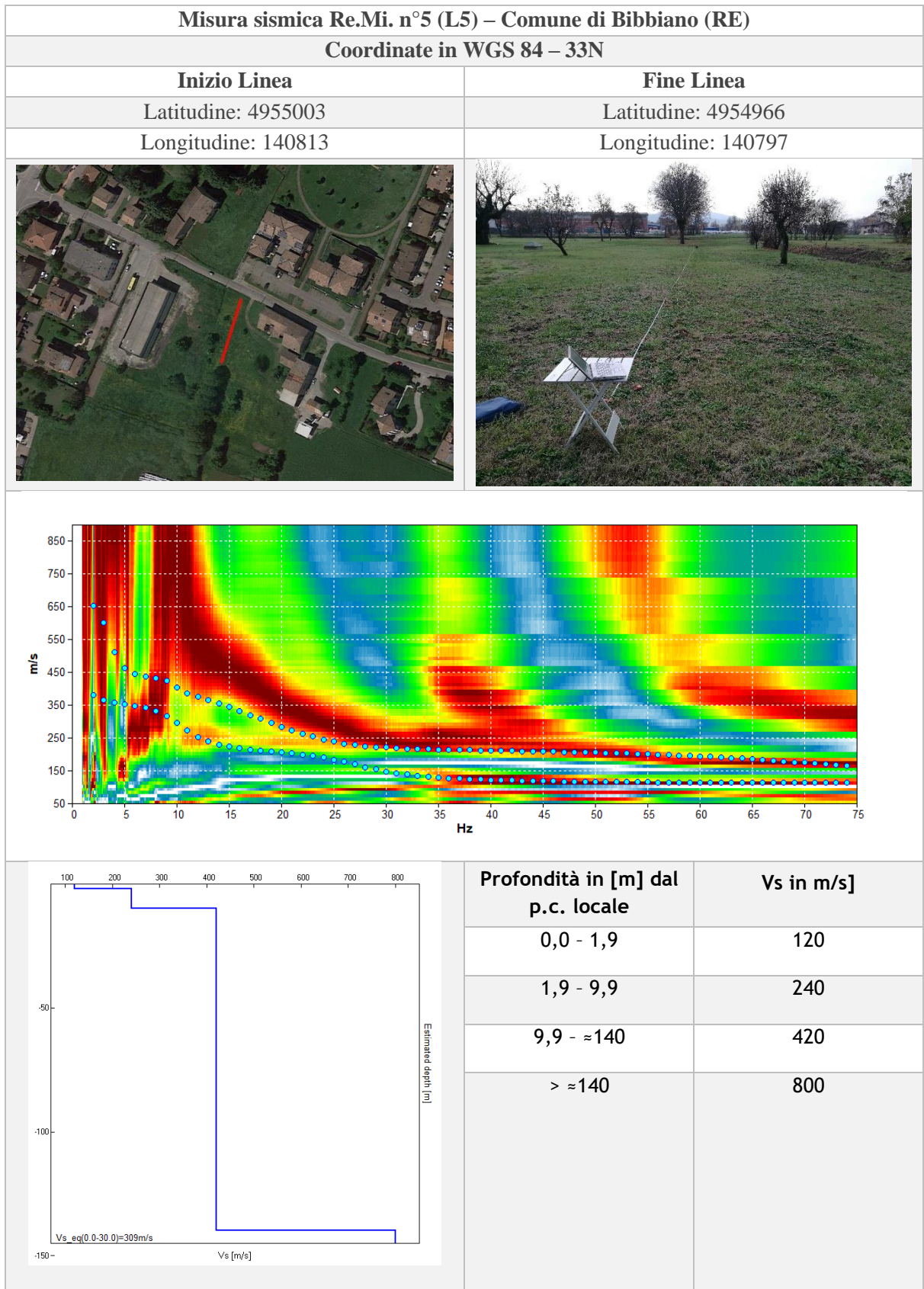




<b>Vs,30</b>	<b>345 m/s</b>
<b>Profondità bedrock</b>	<b>122 m</b>







<b>Vs,30</b>	<b>309 m/s</b>
<b>Profondità bedrock</b>	<b>140 m</b>





Misura sismica Re.Mi. n°6 (L6) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

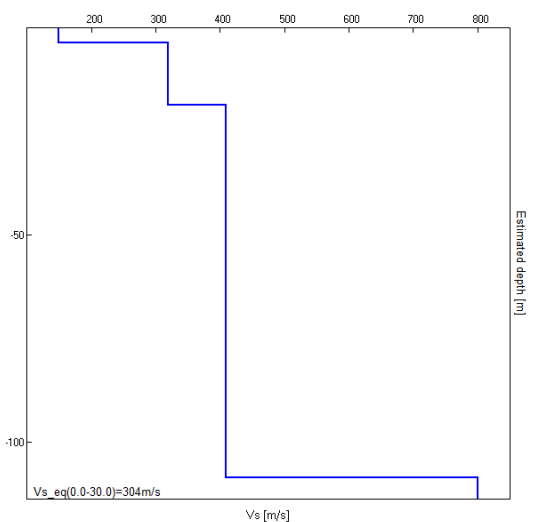
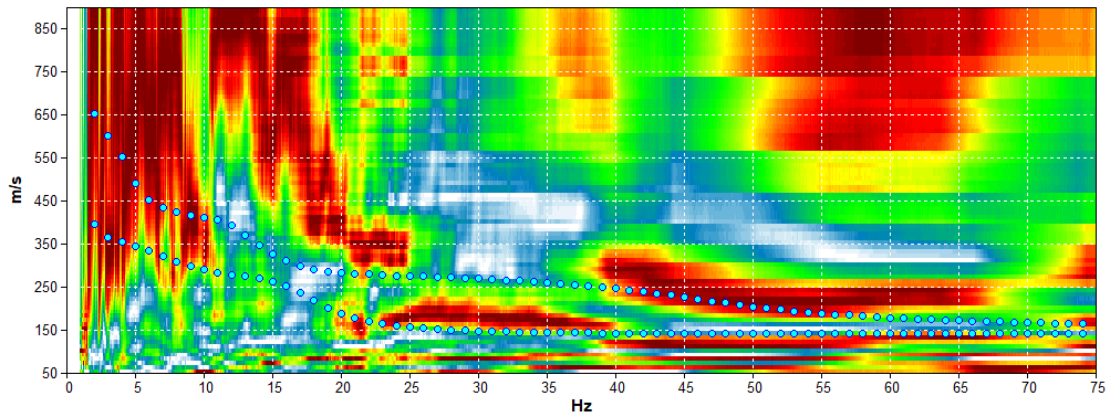
Latitudine: 4955102

Longitudine: 141384

Fine Linea

Latitudine: 4955141



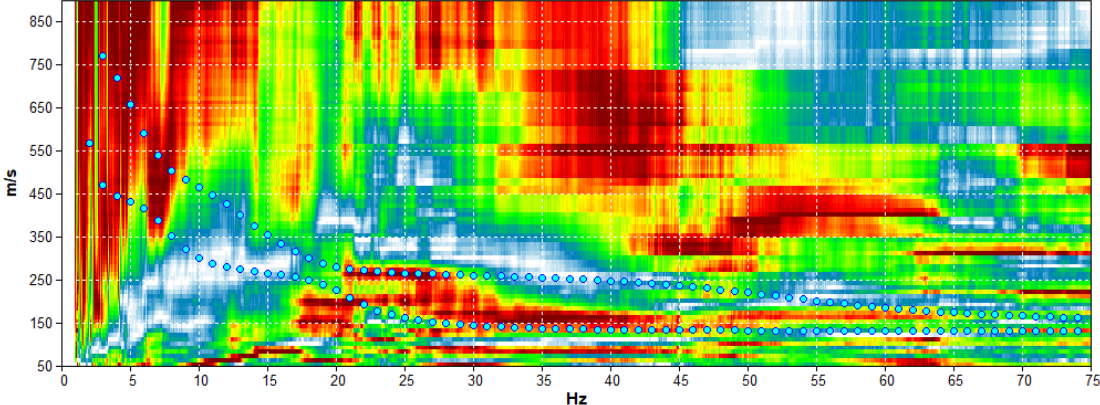
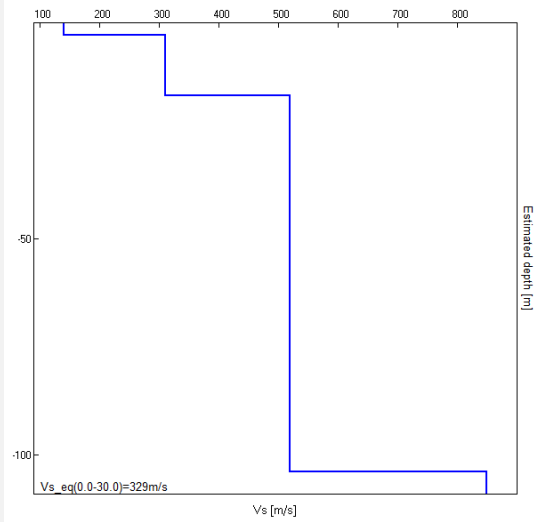
Longitudine: 141391





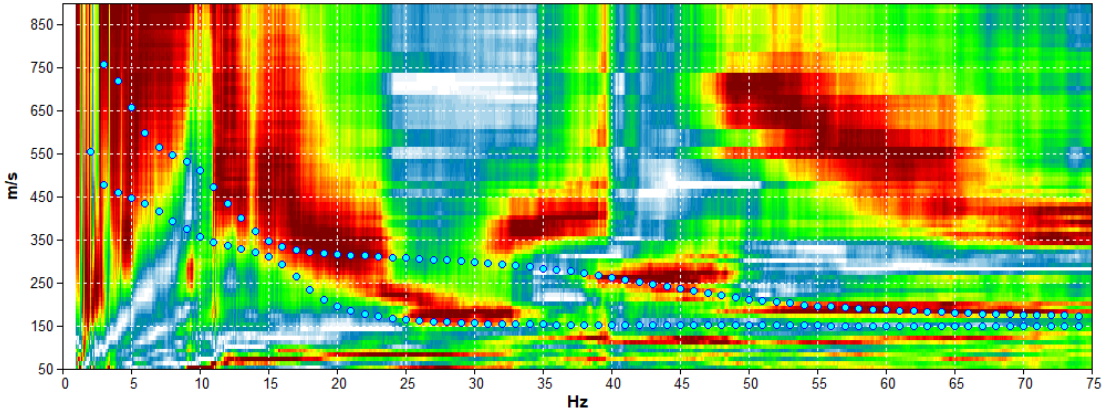
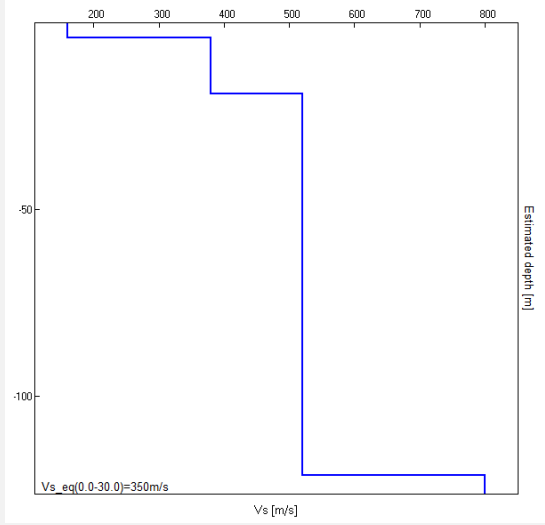
Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 3,6	150
3,6 - ≈19	320
≈19 - ≈109	410
> ≈109	800

<b>Vs,30</b>	<b>304 m/s</b>
<b>Profondità bedrock</b>	<b>109 m</b>



Misura sismica Re.Mi. n°7 (L7) – Comune di Bibbiano (RE)											
Coordinate in WGS 84 – 33N											
Inizio Linea	Fine Linea										
Latitudine: 4954903	Latitudine: 4954942										
Longitudine: 140275	Longitudine: 140268										
											
											
	<table border="1"> <thead> <tr> <th>Profondità in [m] dal p.c. locale</th> <th>Vs in m/s]</th> </tr> </thead> <tbody> <tr> <td>0,0 - 2,9</td> <td>140</td> </tr> <tr> <td>2,9 - ≈17</td> <td>310</td> </tr> <tr> <td>≈17 - ≈104</td> <td>520</td> </tr> <tr> <td>&gt; ≈104</td> <td>850</td> </tr> </tbody> </table>	Profondità in [m] dal p.c. locale	Vs in m/s]	0,0 - 2,9	140	2,9 - ≈17	310	≈17 - ≈104	520	> ≈104	850
Profondità in [m] dal p.c. locale	Vs in m/s]										
0,0 - 2,9	140										
2,9 - ≈17	310										
≈17 - ≈104	520										
> ≈104	850										
<table border="1"> <tbody> <tr> <td><b>Vs,30</b></td> <td><b>329 m/s</b></td> </tr> <tr> <td><b>Profondità bedrock</b></td> <td><b>104 m</b></td> </tr> </tbody> </table>		<b>Vs,30</b>	<b>329 m/s</b>	<b>Profondità bedrock</b>	<b>104 m</b>						
<b>Vs,30</b>	<b>329 m/s</b>										
<b>Profondità bedrock</b>	<b>104 m</b>										

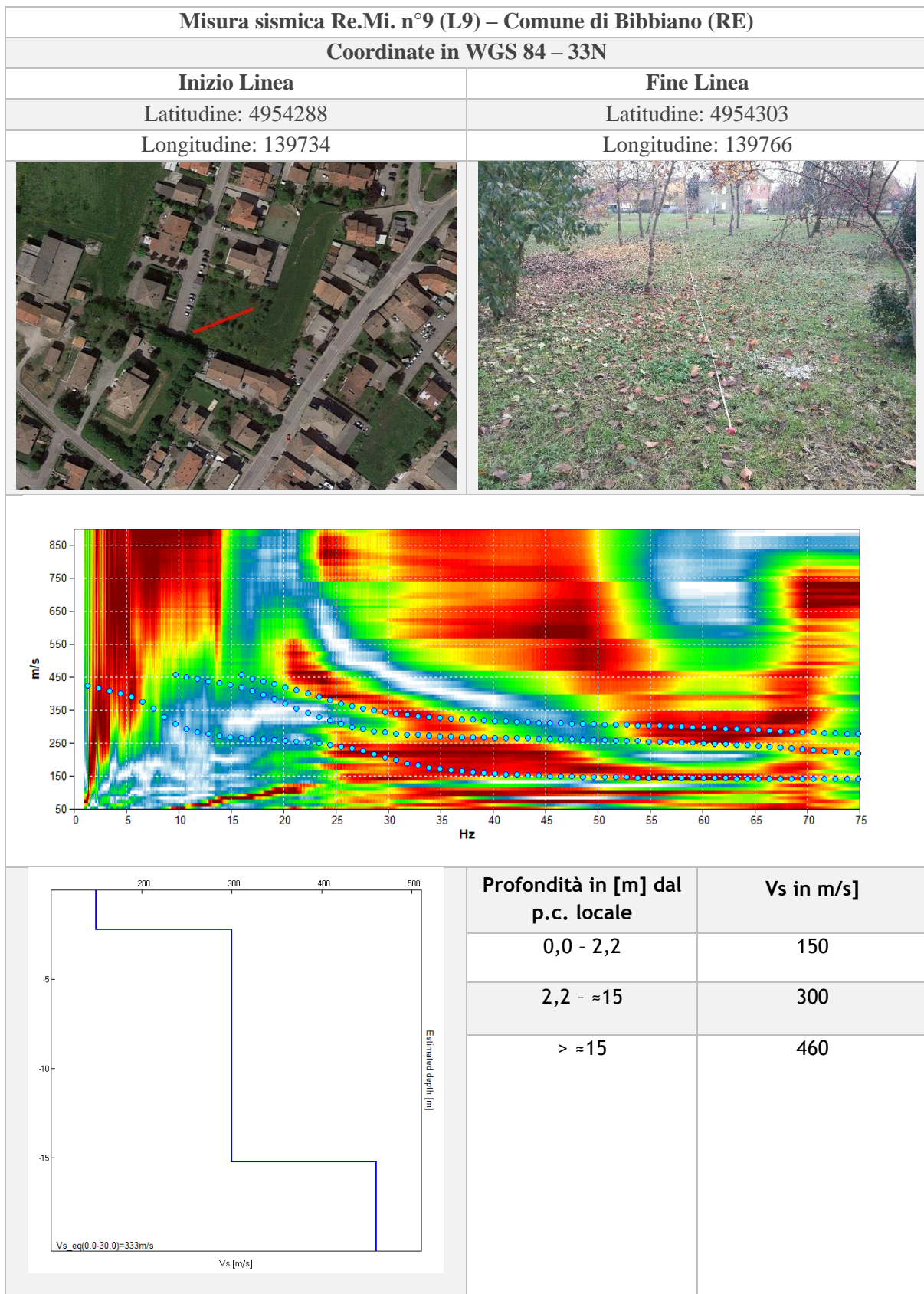


Misura sismica Re.Mi. n°8 (L8) – Comune di Bibbiano (RE)											
Coordinate in WGS 84 – 33N											
Inizio Linea	Fine Linea										
Latitudine: 4954390	Latitudine: 4954425										
Longitudine: 140232	Longitudine: 140236										
											
											
	<table border="1"> <thead> <tr> <th>Profondità in [m] dal p.c. locale</th> <th>Vs in m/s]</th> </tr> </thead> <tbody> <tr> <td>0,0 - 4,0</td> <td>160</td> </tr> <tr> <td>4,0 - ≈19</td> <td>380</td> </tr> <tr> <td>≈19 - ≈121</td> <td>520</td> </tr> <tr> <td>&gt; ≈121</td> <td>800</td> </tr> </tbody> </table>	Profondità in [m] dal p.c. locale	Vs in m/s]	0,0 - 4,0	160	4,0 - ≈19	380	≈19 - ≈121	520	> ≈121	800
Profondità in [m] dal p.c. locale	Vs in m/s]										
0,0 - 4,0	160										
4,0 - ≈19	380										
≈19 - ≈121	520										
> ≈121	800										

<b>Vs,30</b>	<b>350 m/s</b>
<b>Profondità bedrock</b>	<b>121 m</b>

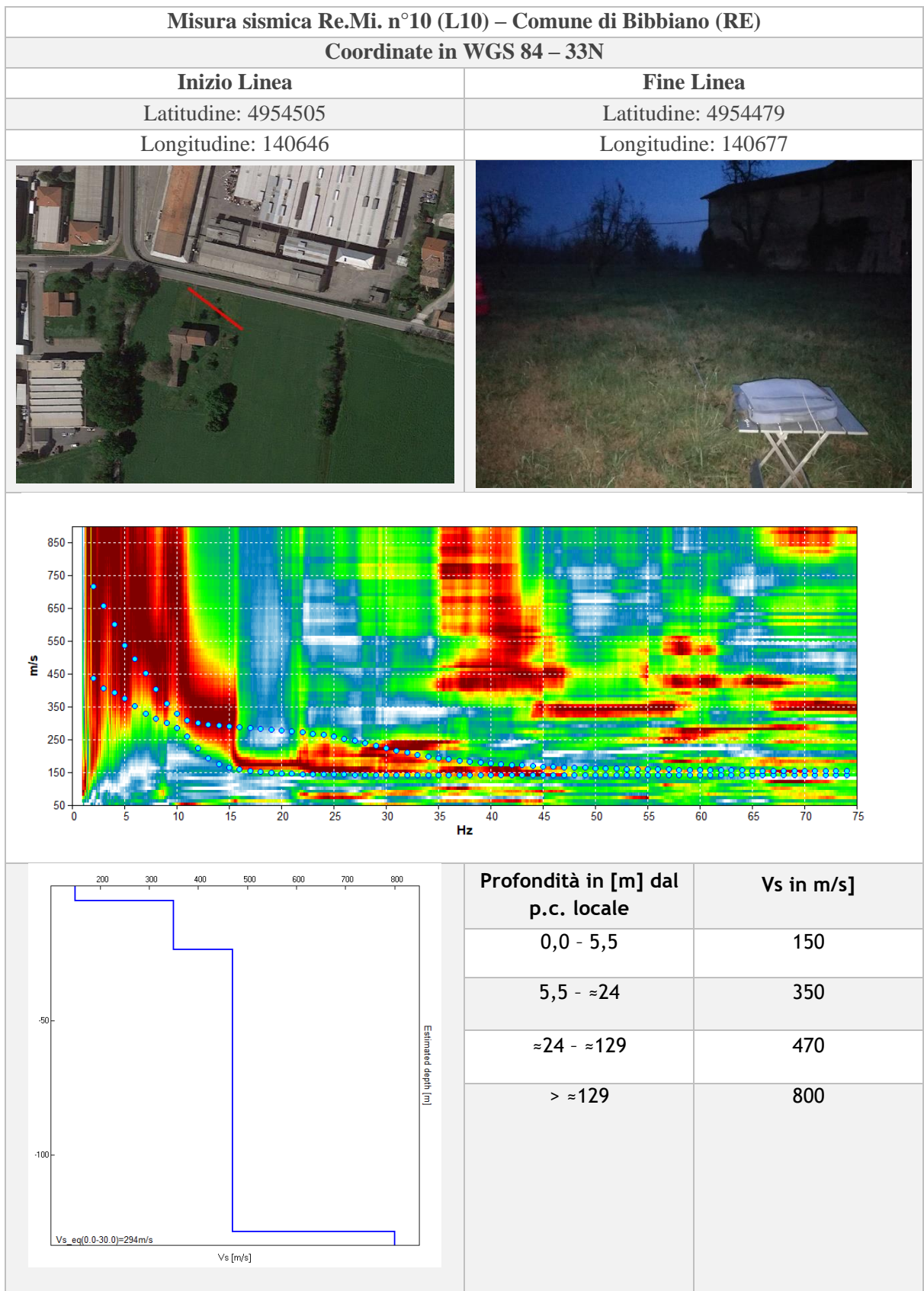






<b>Vs,30</b>	<b>333 m/s</b>
<b>Profondità bedrock</b>	<b>/</b>





<b>Vs,30</b>	<b>294 m/s</b>
<b>Profondità bedrock</b>	<b>129 m</b>



Misura sismica Re.Mi. n°11 (L11) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

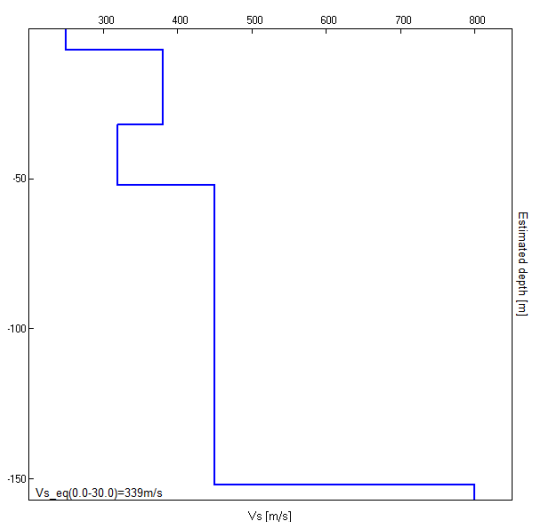
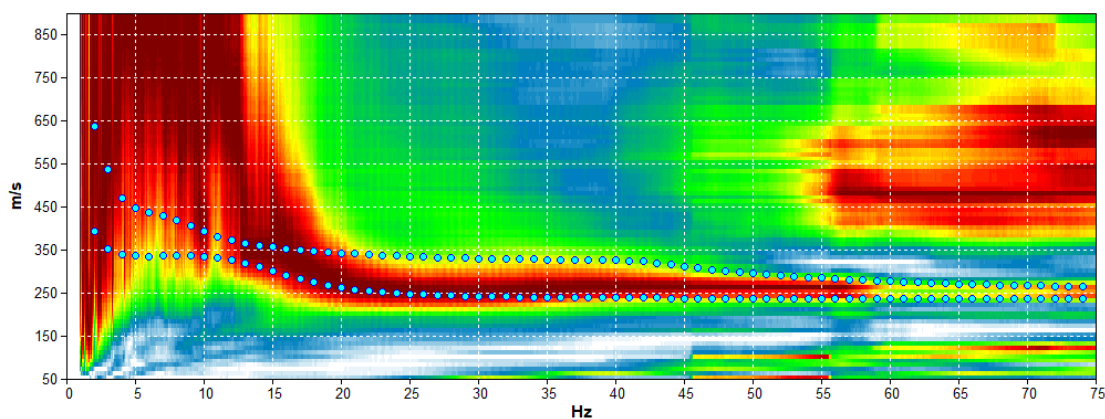
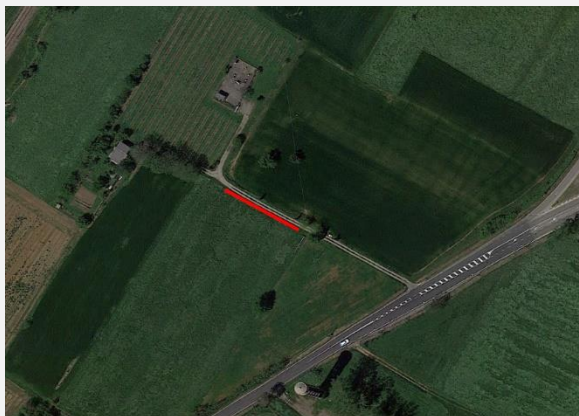
Latitudine: 4957283

Longitudine: 142243

Fine Linea

Latitudine: 4957267

Longitudine: 142268

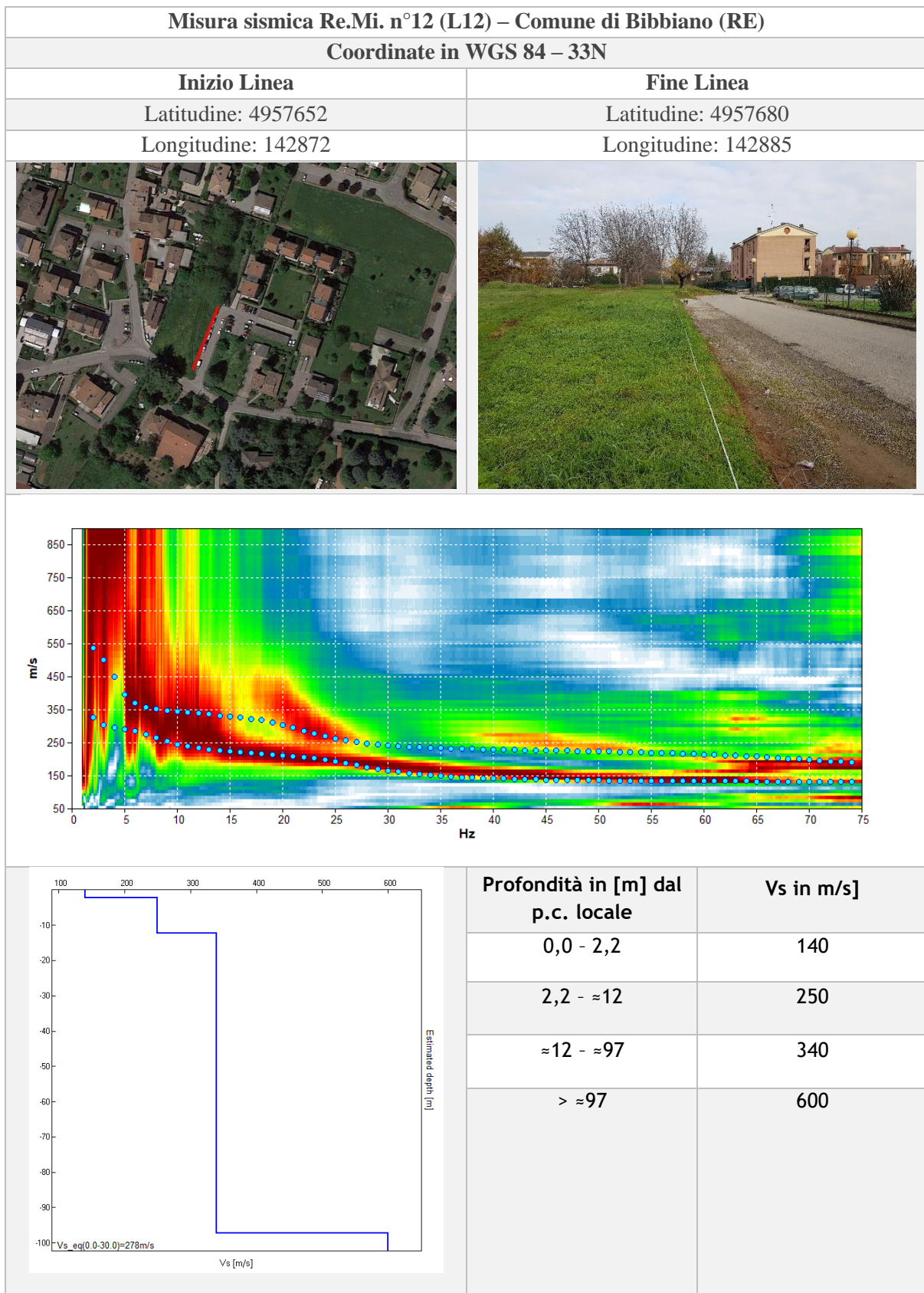


Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 7,0	250
7,0 - ≈32	380
≈32 - ≈52	320
≈52 - ≈152	450
> ≈152	800

<b>Vs,30</b>	<b>339 m/s</b>
<b>Profondità bedrock</b>	<b>152 m</b>







<b>Vs,30</b>	<b>278 m/s</b>
<b>Profondità bedrock</b>	<b>97 m</b>



Misura sismica Re.Mi. n°13 (L13) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

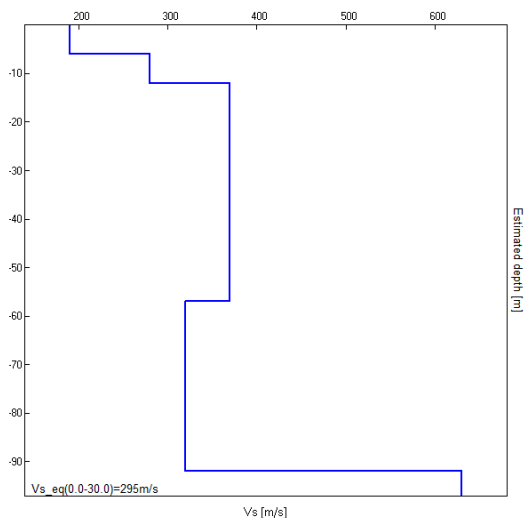
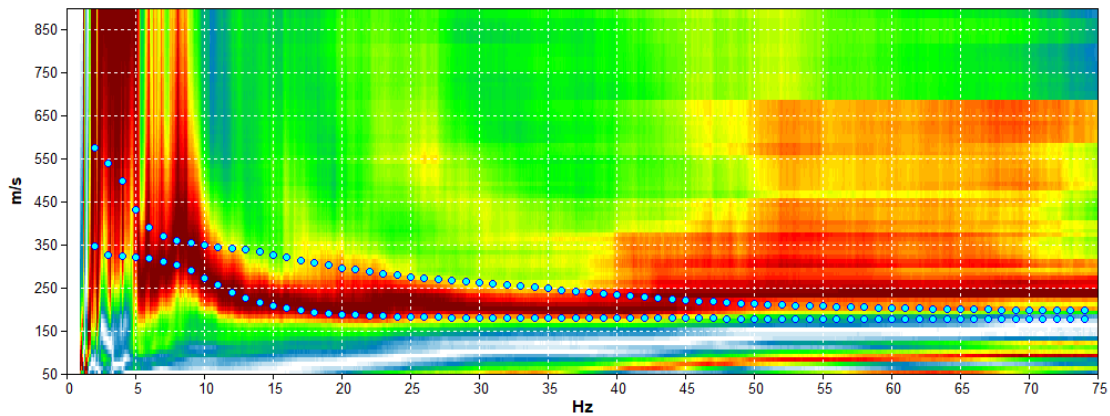
Latitudine: 4958053

Longitudine: 142532

Fine Linea

Latitudine: 4958077

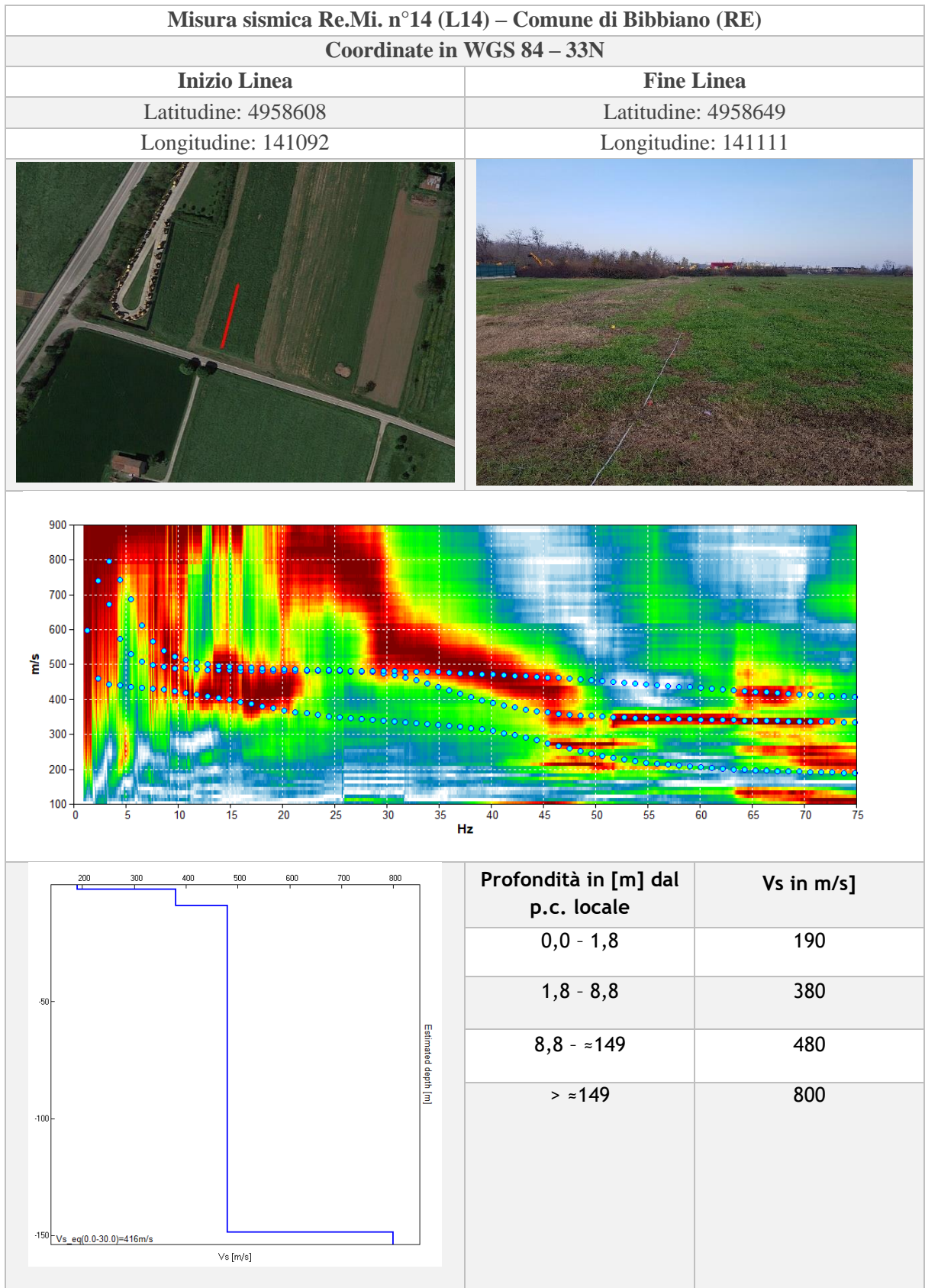
Longitudine: 142550



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 6,0	190
6,0 - ≈12	280
≈12 - ≈57	370
≈57 - ≈92	320
> ≈92	630

<b>Vs,30</b>	<b>295 m/s</b>
<b>Profondità bedrock</b>	<b>/</b>





<b>Vs,30</b>	<b>416 m/s</b>
<b>Profondità bedrock</b>	<b>149 m</b>





Misura sismica Re.Mi. n°15 (L15) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

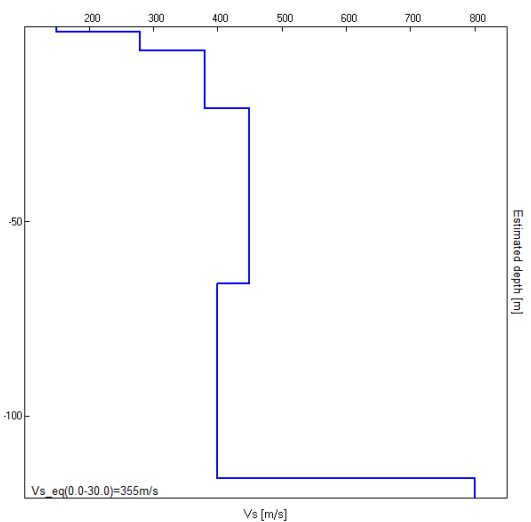
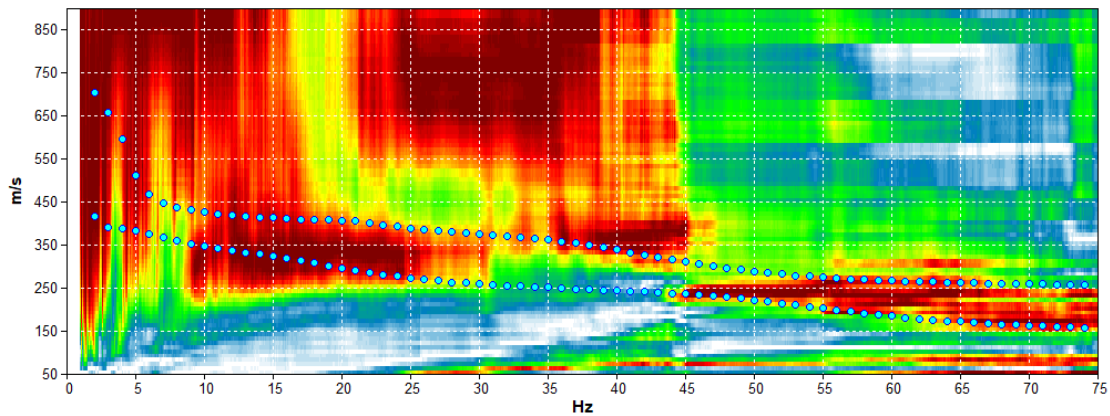
Latitudine: 4957822

Longitudine: 142641

Fine Linea

Latitudine: 4957798

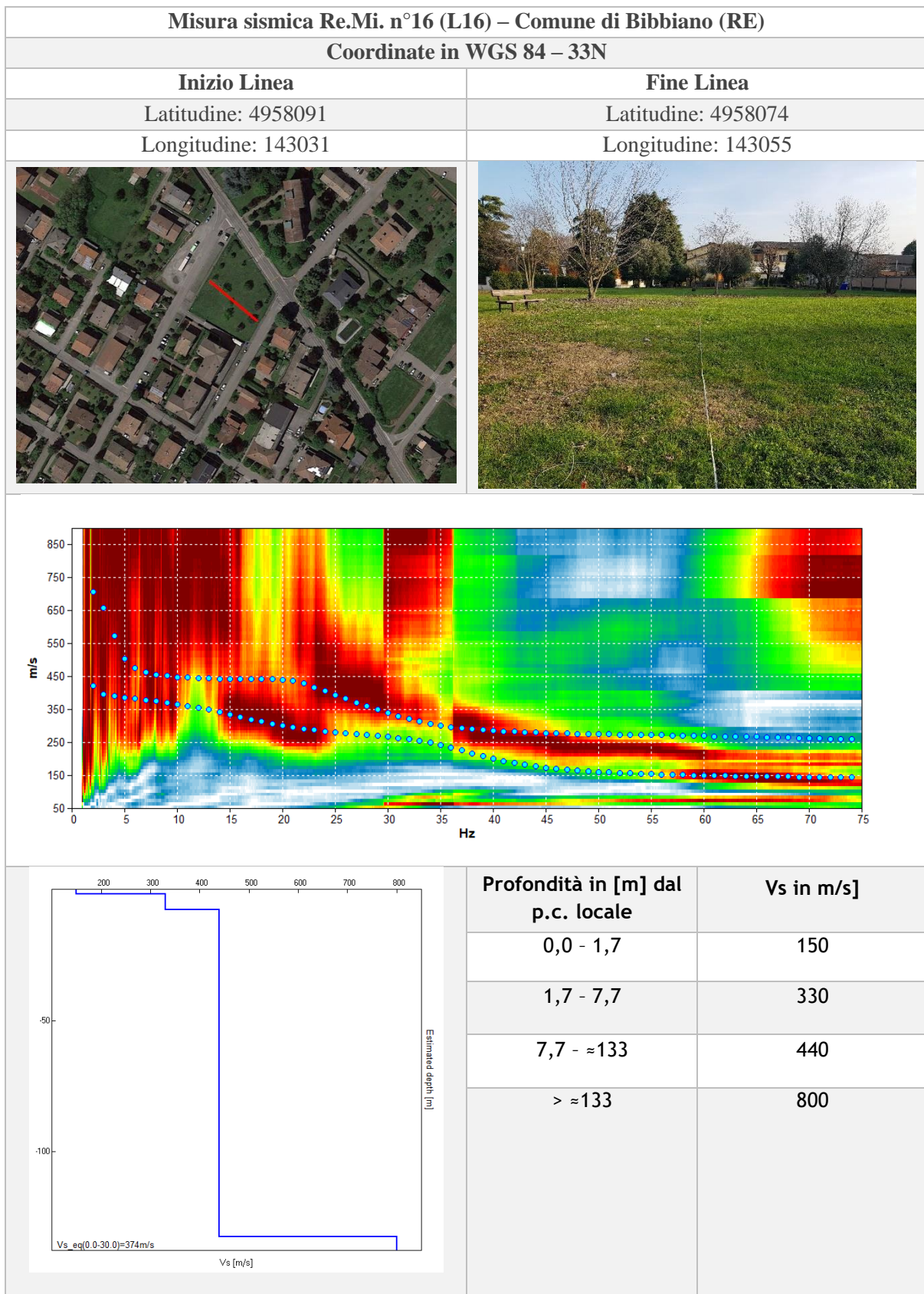
Longitudine: 142658



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,2	150
1,2 - 6,0	280
6,0 - ≈21	380
≈21 - ≈66	450
≈66 - ≈116	400
> ≈116	800

<b>Vs,30</b>	<b>355 m/s</b>
<b>Profondità bedrock</b>	<b>116 m</b>





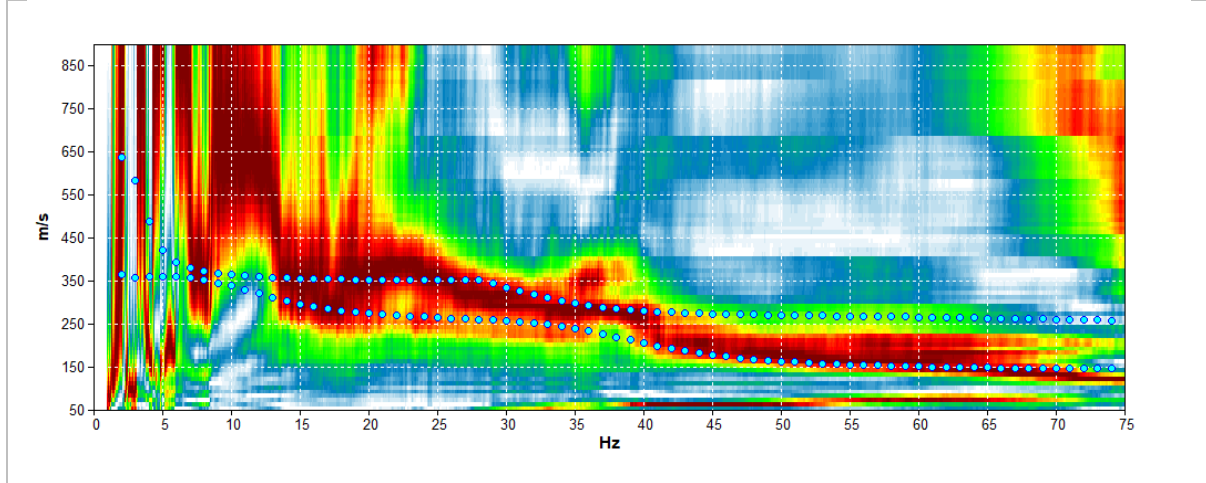


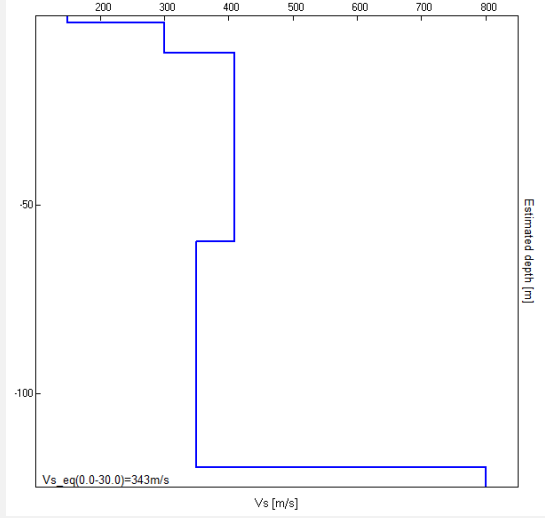
<b>Vs,30</b>	<b>374 m/s</b>
<b>Profondità bedrock</b>	<b>133 m</b>





Misura sismica Re.Mi. n°17 (L17) – Comune di Bibbiano (RE)	
Coordinate in WGS 84 – 33N	
Inizio Linea	Fine Linea
Latitudine: 4958092	Latitudine: 4958113
Longitudine: 143240	Longitudine: 143261
	



	Profondità in [m] dal p.c. locale	Vs in m/s]
	0,0 - 1,7	150
	1,7 - 9,7	300
	9,7 - ≈60	410
	≈60 - ≈120	350
> ≈120	800	

<b>Vs,30</b>	<b>343 m/s</b>
<b>Profondità bedrock</b>	<b>120 m</b>





Misura sismica Re.Mi. n°18 (L18) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

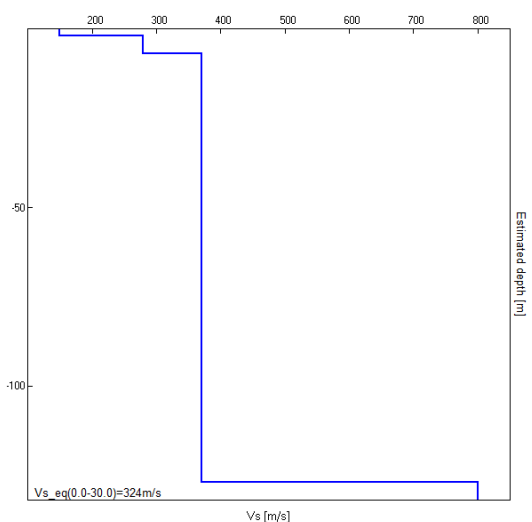
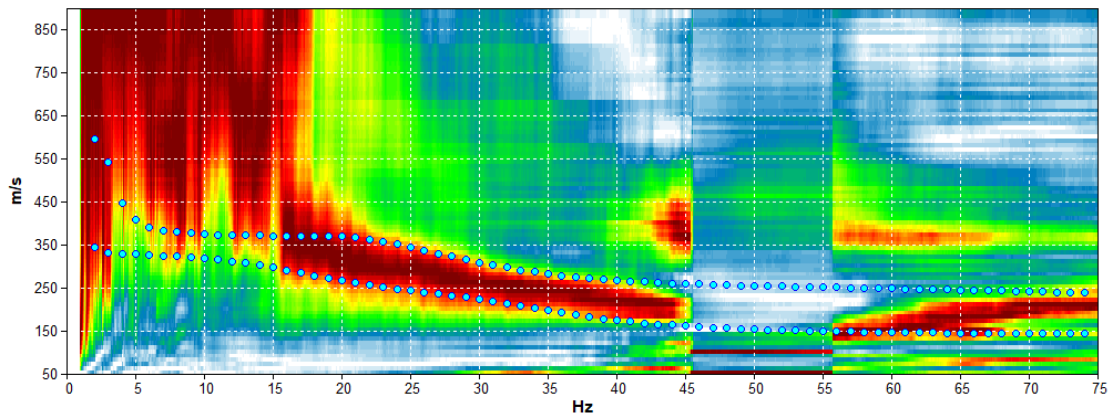
Latitudine: 4958373

Longitudine: 143221

Fine Linea

Latitudine: 4958400

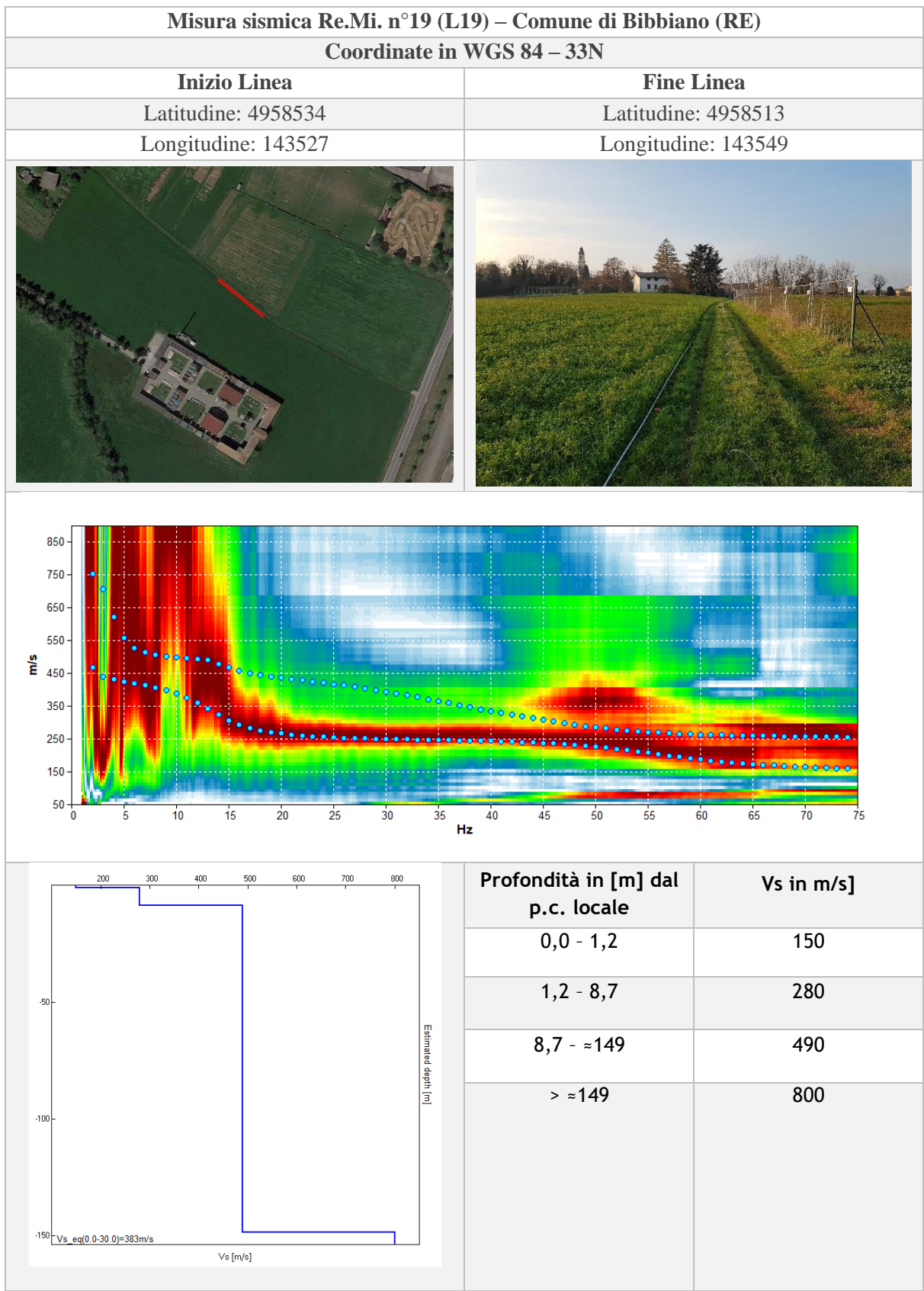
Longitudine: 143235



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,8	150
1,8 - 6,8	280
6,8 - ≈127	370
> ≈127	800



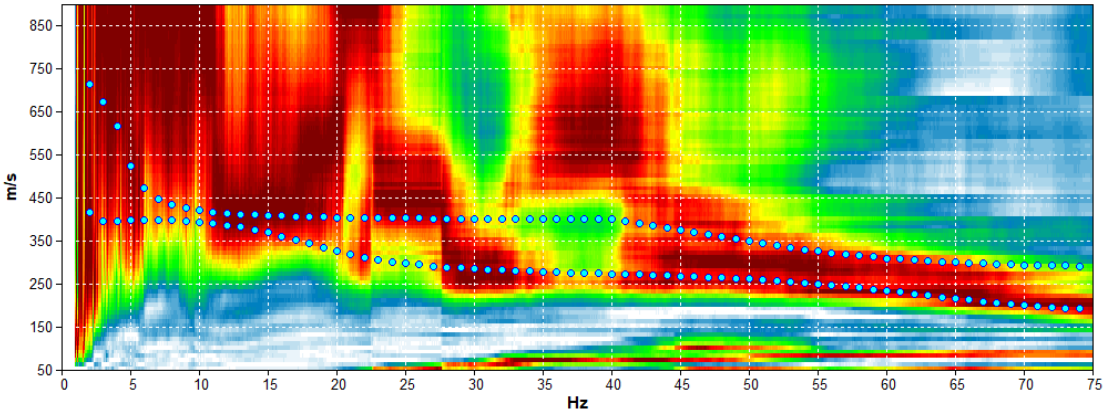
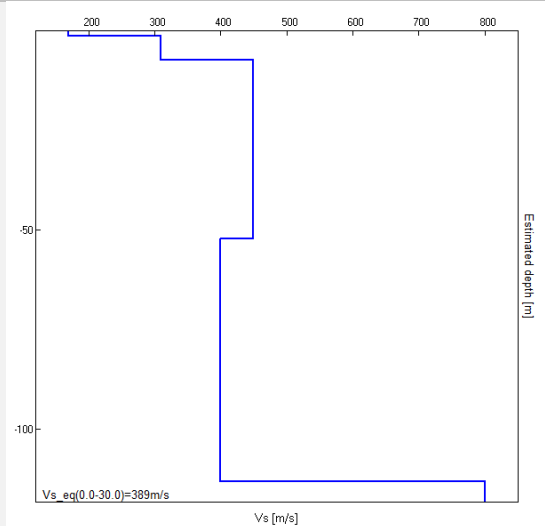
<b>Vs,30</b>	<b>324 m/s</b>
<b>Profondità bedrock</b>	<b>127 m</b>





<b>Vs,30</b>	<b>383 m/s</b>
<b>Profondità bedrock</b>	<b>149 m</b>

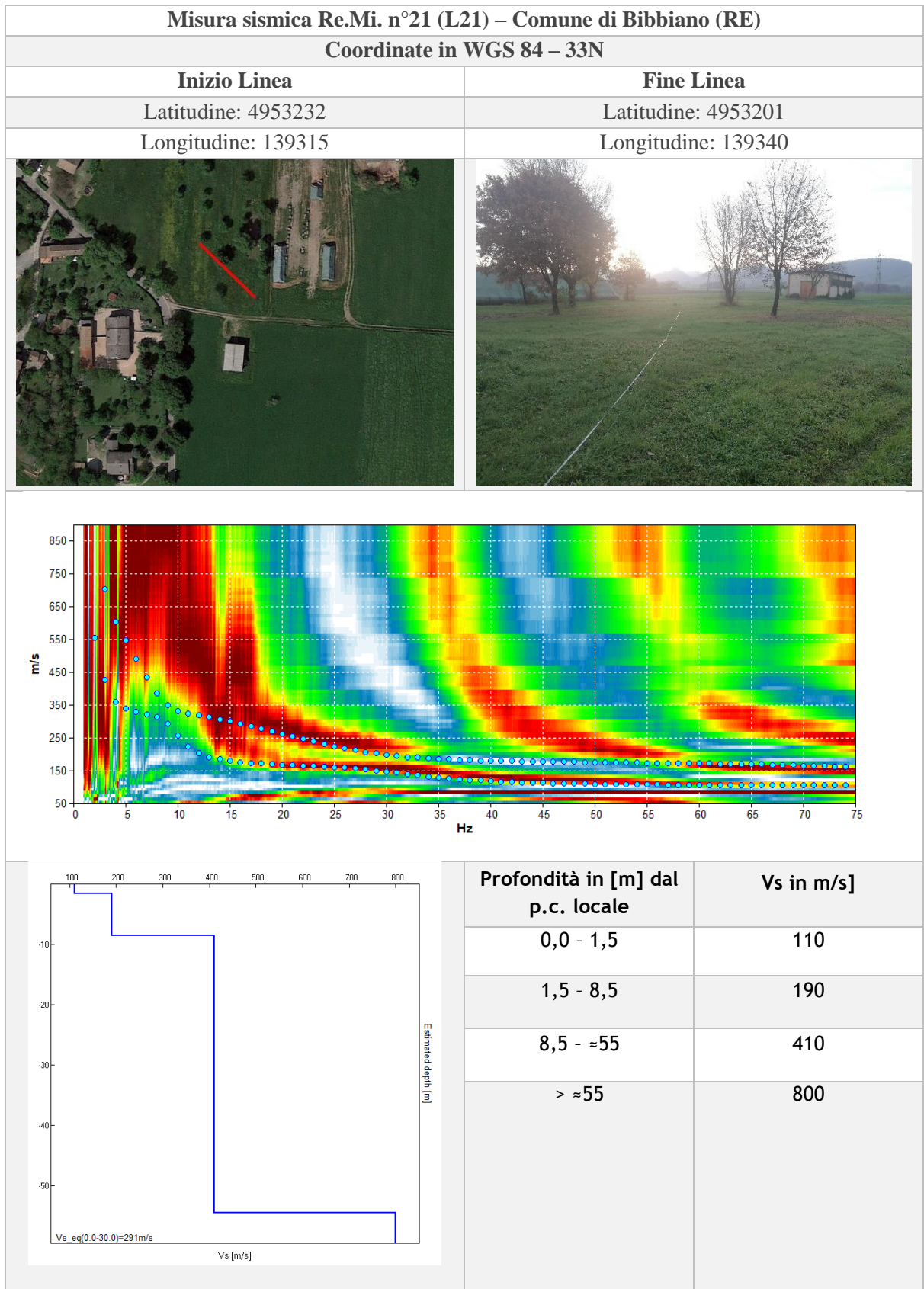


Misura sismica Re.Mi. n°20 (L20) – Comune di Bibbiano (RE)													
Coordinate in WGS 84 – 33N													
Inizio Linea	Fine Linea												
Latitudine: 4958291	Latitudine: 4958306												
Longitudine: 143934	Longitudine: 143908												
													
													
	<table border="1"> <thead> <tr> <th>Profondità in [m] dal p.c. locale</th> <th>Vs in m/s]</th> </tr> </thead> <tbody> <tr> <td>0,0 - 1,2</td> <td>170</td> </tr> <tr> <td>1,2 - 7,2</td> <td>310</td> </tr> <tr> <td>7,2 - ≈52</td> <td>450</td> </tr> <tr> <td>≈52 - ≈113</td> <td>400</td> </tr> <tr> <td>&gt; ≈113</td> <td>800</td> </tr> </tbody> </table>	Profondità in [m] dal p.c. locale	Vs in m/s]	0,0 - 1,2	170	1,2 - 7,2	310	7,2 - ≈52	450	≈52 - ≈113	400	> ≈113	800
Profondità in [m] dal p.c. locale	Vs in m/s]												
0,0 - 1,2	170												
1,2 - 7,2	310												
7,2 - ≈52	450												
≈52 - ≈113	400												
> ≈113	800												

<b>Vs,30</b>	<b>389 m/s</b>
<b>Profondità bedrock</b>	<b>113 m</b>







<b>Vs,30</b>	<b>291 m/s</b>
<b>Profondità bedrock</b>	<b>55 m</b>



Misura sismica Re.Mi. n°22 (L22) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

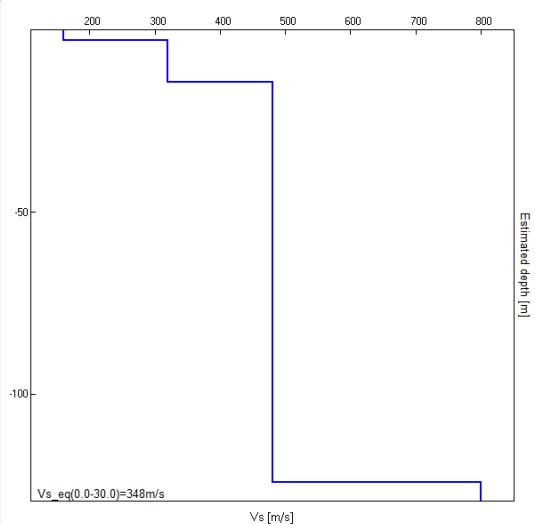
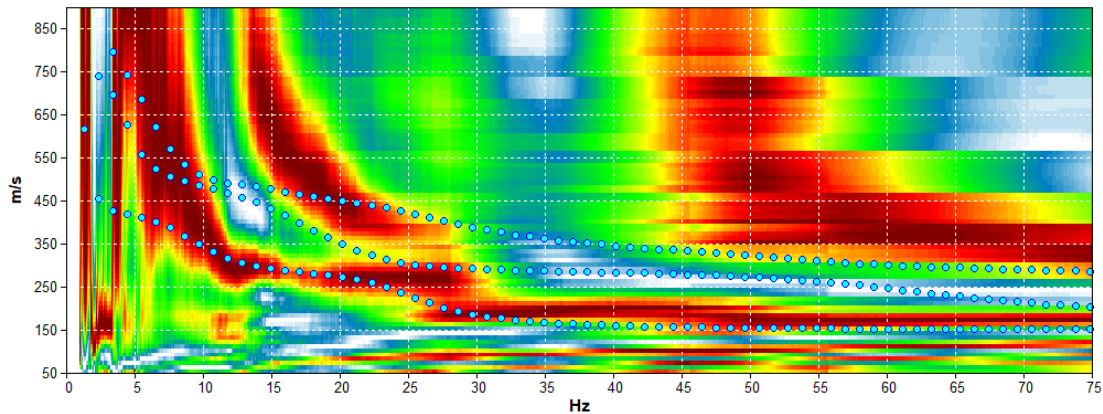
Latitudine: 4953528

Longitudine: 139061

Fine Linea

Latitudine: 4953565

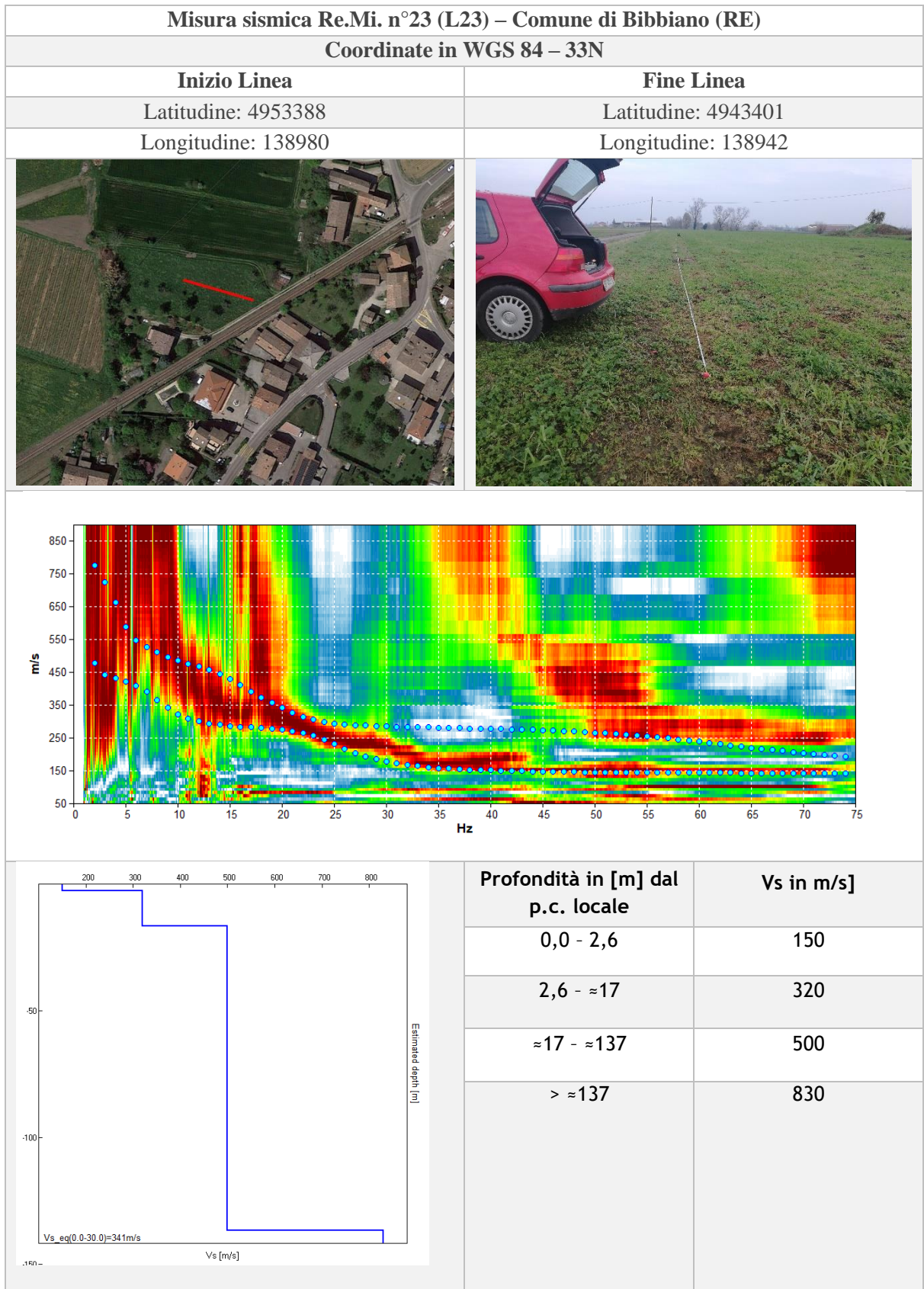
Longitudine: 139076



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,8	160
2,8 - ≈14	320
≈14 - ≈124	480
> ≈124	800

<b>Vs,30</b>	<b>348 m/s</b>
<b>Profondità bedrock</b>	<b>124 m</b>

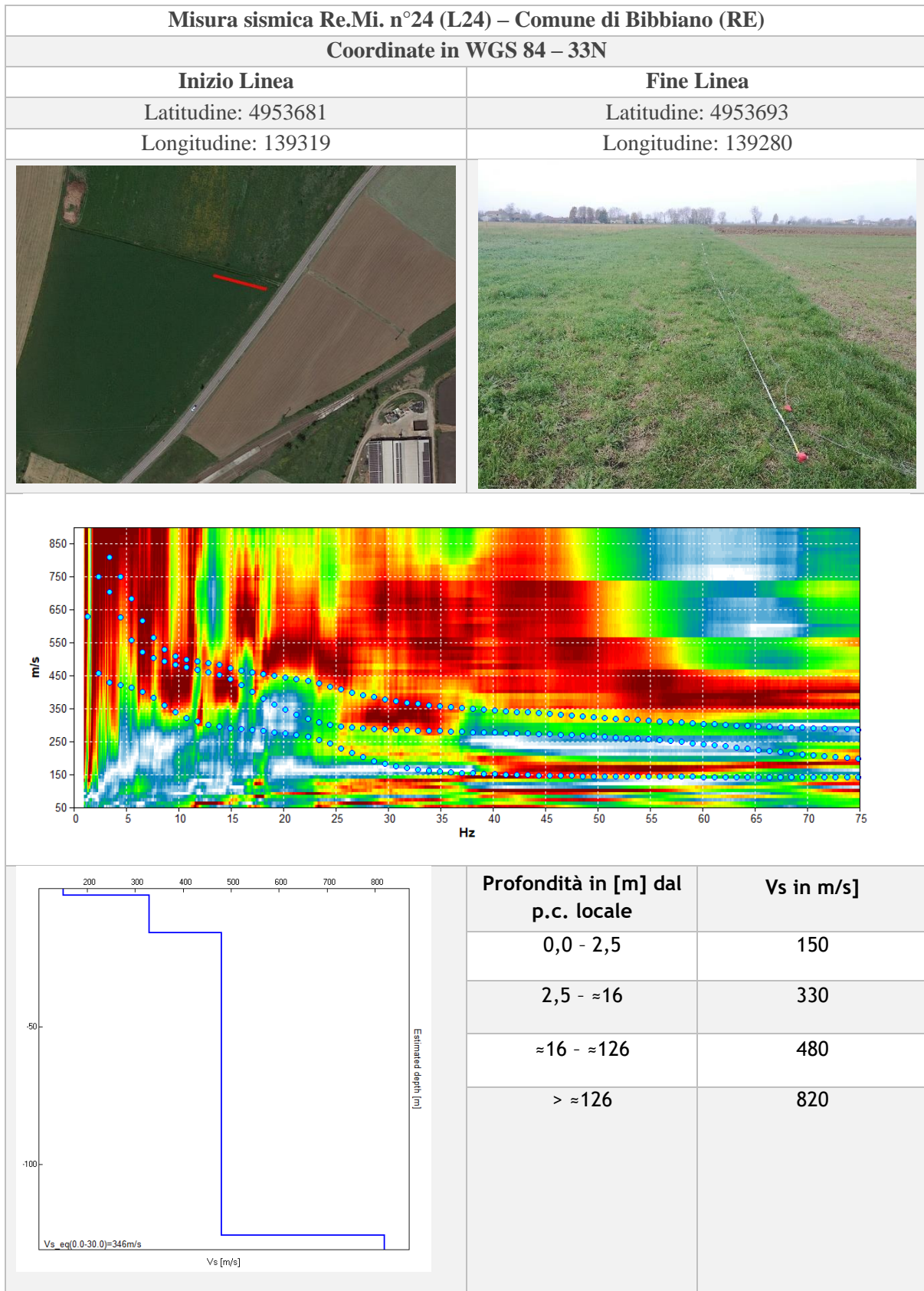




<b>Vs,30</b>	<b>341 m/s</b>
<b>Profondità bedrock</b>	<b>137 m</b>







<b>Vs,30</b>	<b>346 m/s</b>
<b>Profondità bedrock</b>	<b>126 m</b>



Misura sismica Re.Mi. n°25 (L25) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

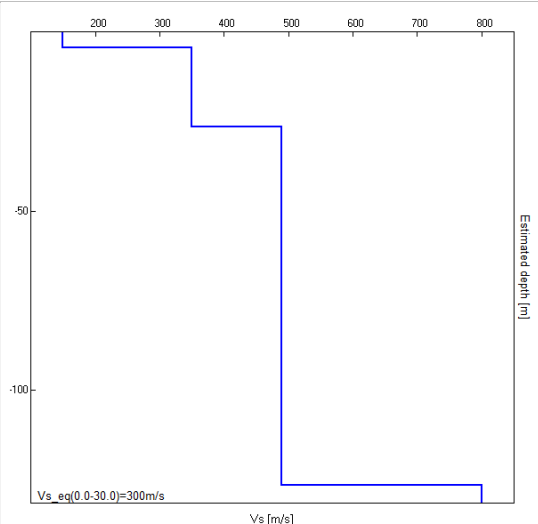
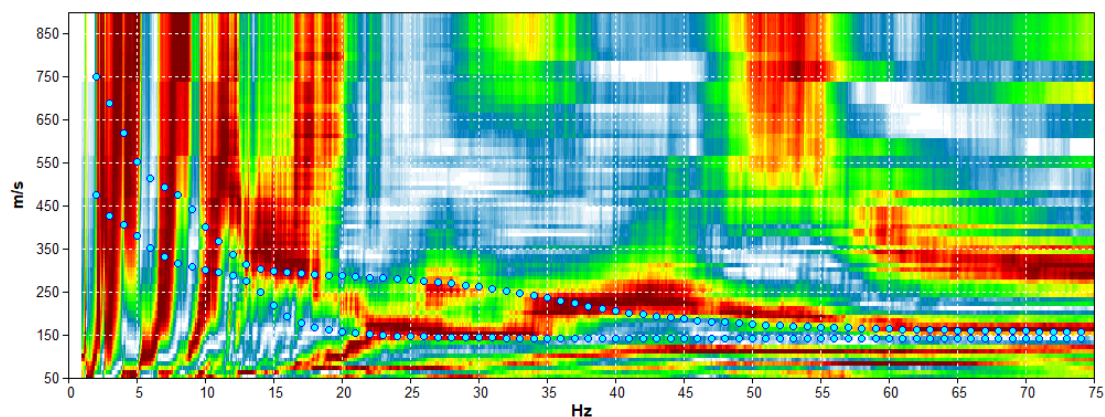
Latitudine: 4954001

Longitudine: 139877

Fine Linea



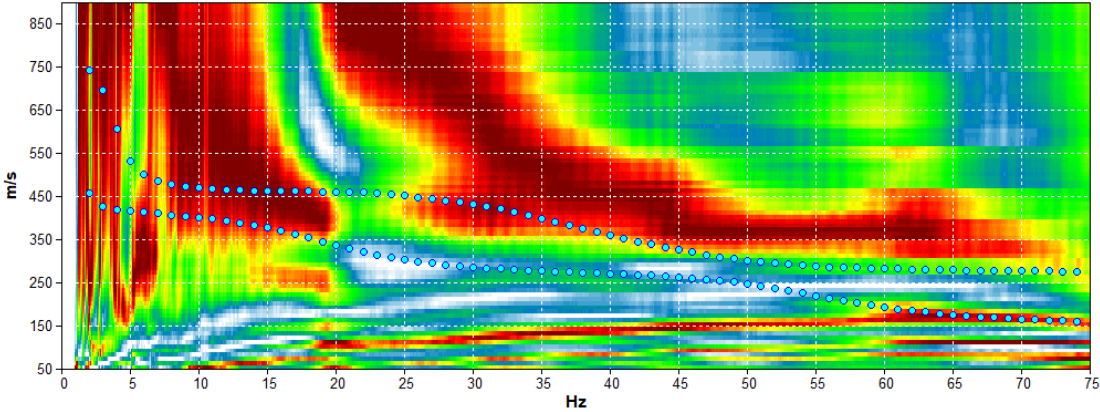
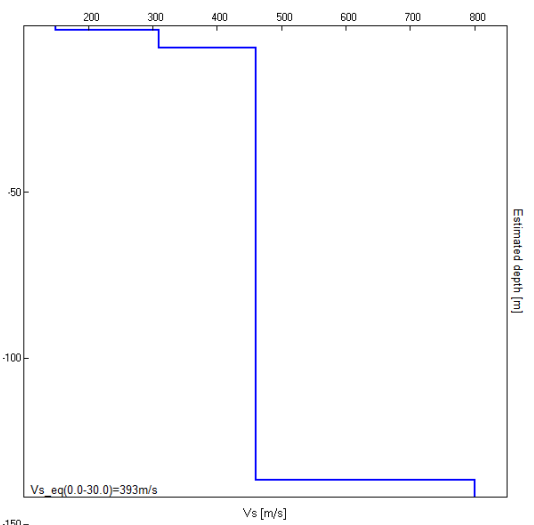
Latitudine: 4954032

Longitudine: 139900



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 4,5	150
4,5 - ≈27	350
≈27 - ≈127	490
> ≈127	800

<b>Vs,30</b>	<b>300 m/s</b>
<b>Profondità bedrock</b>	<b>127 m</b>

Misura sismica Re.Mi. n°26 (L26) – Comune di Bibbiano (RE)											
Coordinate in WGS 84 – 33N											
Inizio Linea	Fine Linea										
Latitudine: 4956179	Latitudine: 4956216										
Longitudine: 141088	Longitudine: 141104										
											
											
	<table border="1"> <thead> <tr> <th>Profondità in [m] dal p.c. locale</th> <th>Vs in m/s]</th> </tr> </thead> <tbody> <tr> <td>0,0 - 1,2</td> <td>150</td> </tr> <tr> <td>1,2 - 6,7</td> <td>310</td> </tr> <tr> <td>6,7 - ≈137</td> <td>460</td> </tr> <tr> <td>&gt; ≈137</td> <td>800</td> </tr> </tbody> </table>	Profondità in [m] dal p.c. locale	Vs in m/s]	0,0 - 1,2	150	1,2 - 6,7	310	6,7 - ≈137	460	> ≈137	800
Profondità in [m] dal p.c. locale	Vs in m/s]										
0,0 - 1,2	150										
1,2 - 6,7	310										
6,7 - ≈137	460										
> ≈137	800										
<table border="1"> <tbody> <tr> <td><b>Vs,30</b></td> <td><b>393 m/s</b></td> </tr> <tr> <td><b>Profondità bedrock</b></td> <td><b>137 m</b></td> </tr> </tbody> </table>		<b>Vs,30</b>	<b>393 m/s</b>	<b>Profondità bedrock</b>	<b>137 m</b>						
<b>Vs,30</b>	<b>393 m/s</b>										
<b>Profondità bedrock</b>	<b>137 m</b>										





Misura sismica Re.Mi. n°27 (L27) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

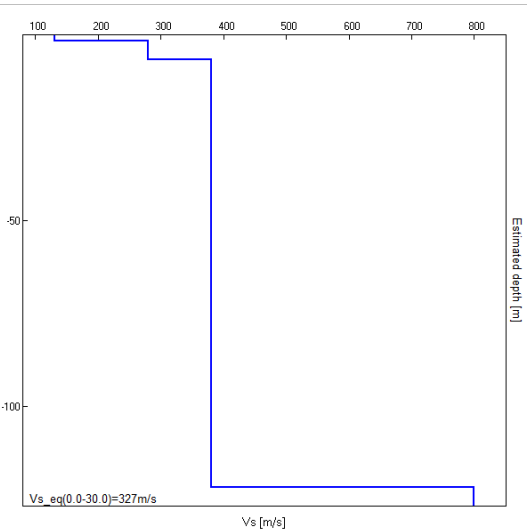
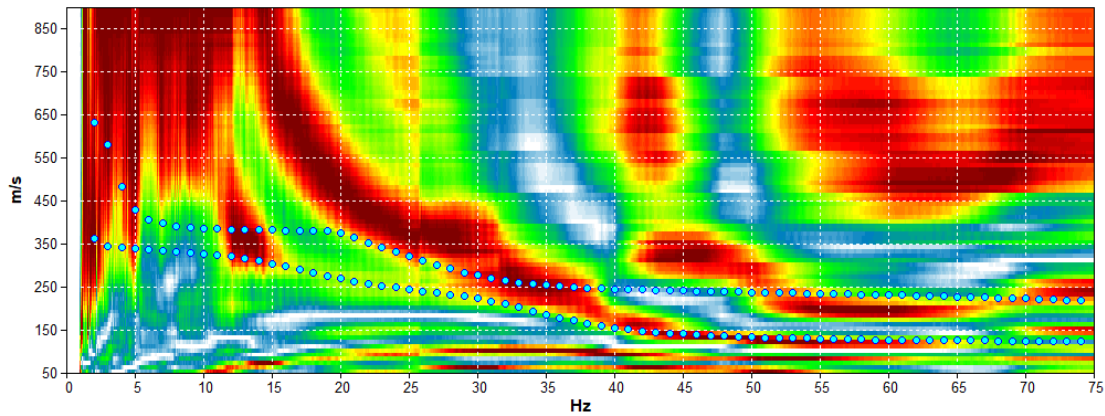
Latitudine: 4955356

Longitudine: 142211

Fine Linea

Latitudine: 4955321

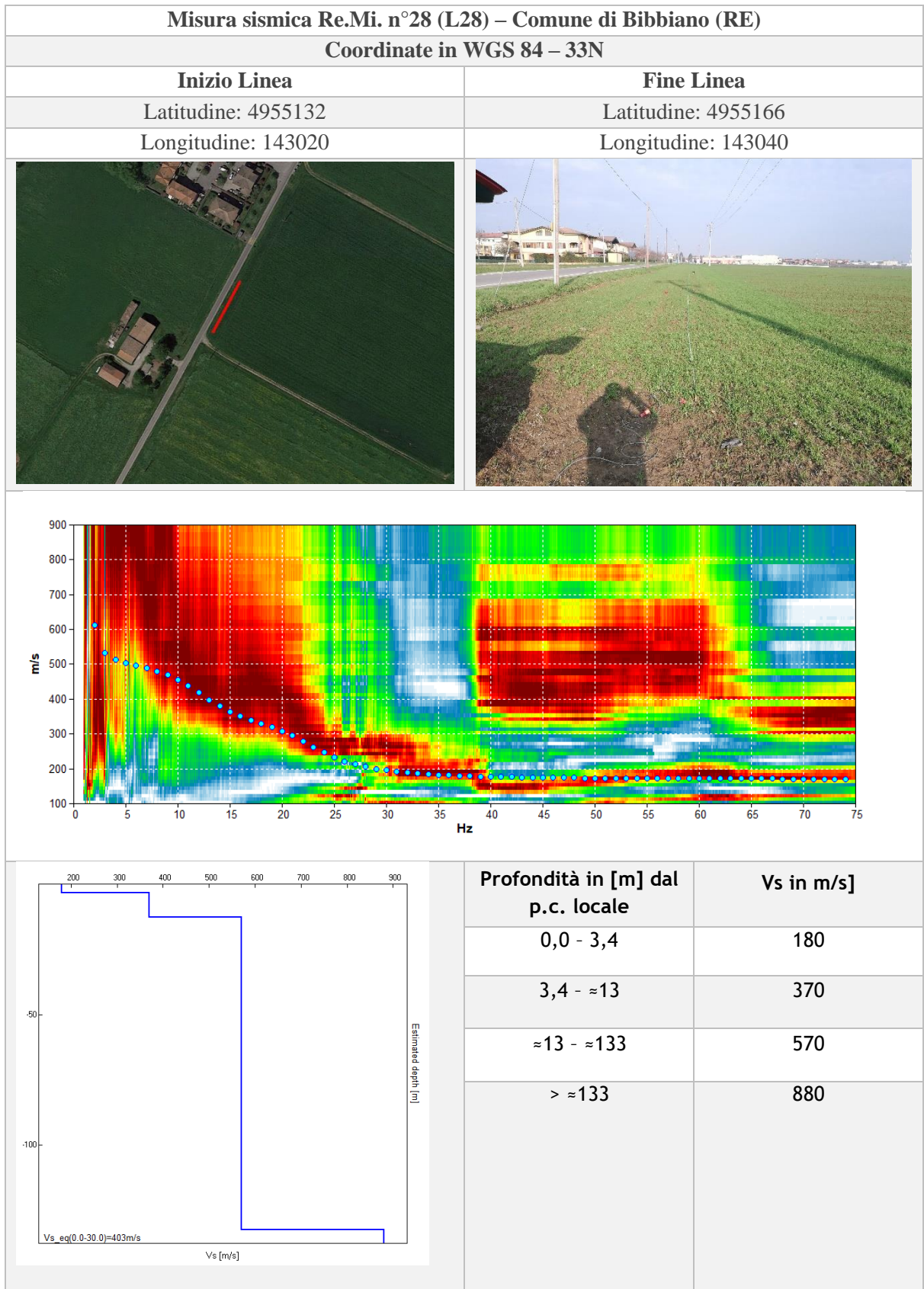
Longitudine: 142192



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 1,6	130
1,6 - 6,6	280
6,6 - ≈122	380
> ≈122	800

<b>Vs,30</b>	<b>327 m/s</b>
<b>Profondità bedrock</b>	<b>122 m</b>





<b>Vs,30</b>	<b>403 m/s</b>
<b>Profondità bedrock</b>	<b>133 m</b>



Misura sismica Re.Mi. n°29 (L29) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

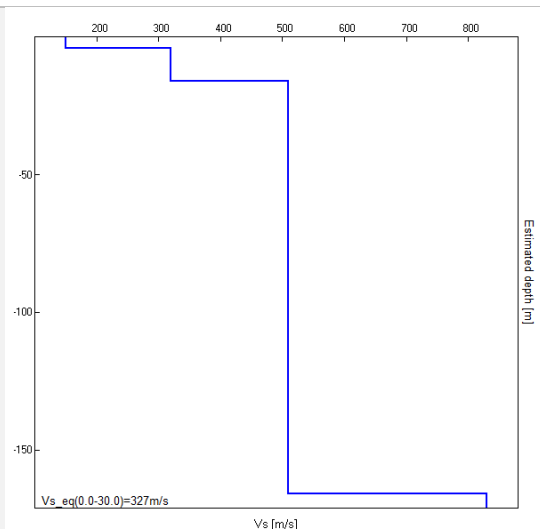
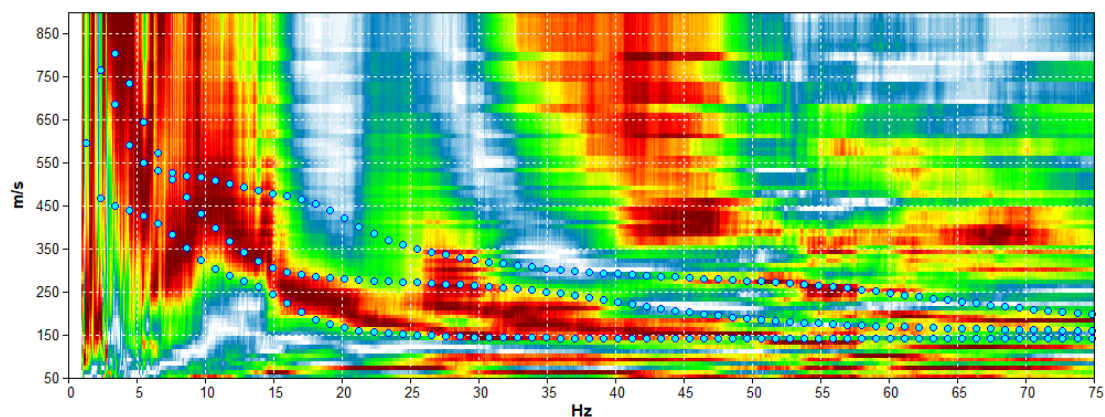
Latitudine: 4955486

Longitudine: 143452

Fine Linea

Latitudine: 4955526

Longitudine: 143458



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 4,0	150
4,0 - ≈16	320
≈ 16 - ≈166	510
> ≈ 166	830

<b>Vs,30</b>	<b>327 m/s</b>
<b>Profondità bedrock</b>	<b>166 m</b>





Misura sismica Re.Mi. n°30 (L30) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

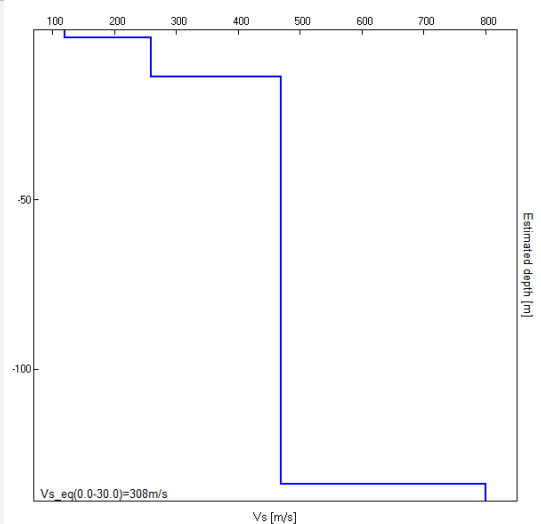
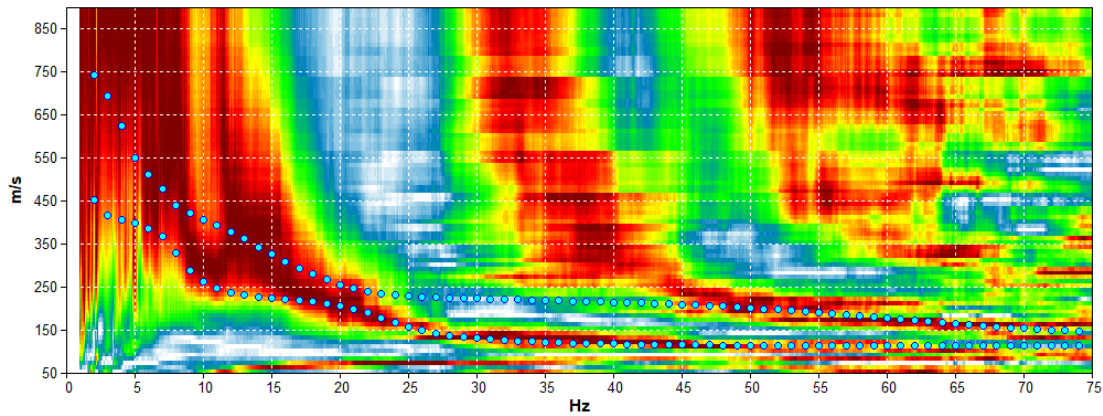
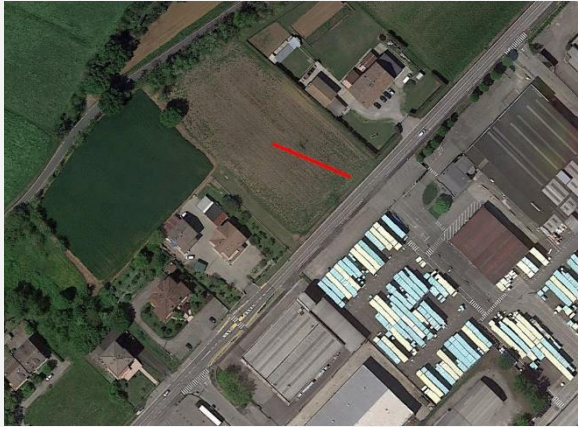
Latitudine: 4956018

Longitudine: 143674

Fine Linea

Latitudine: 4956035

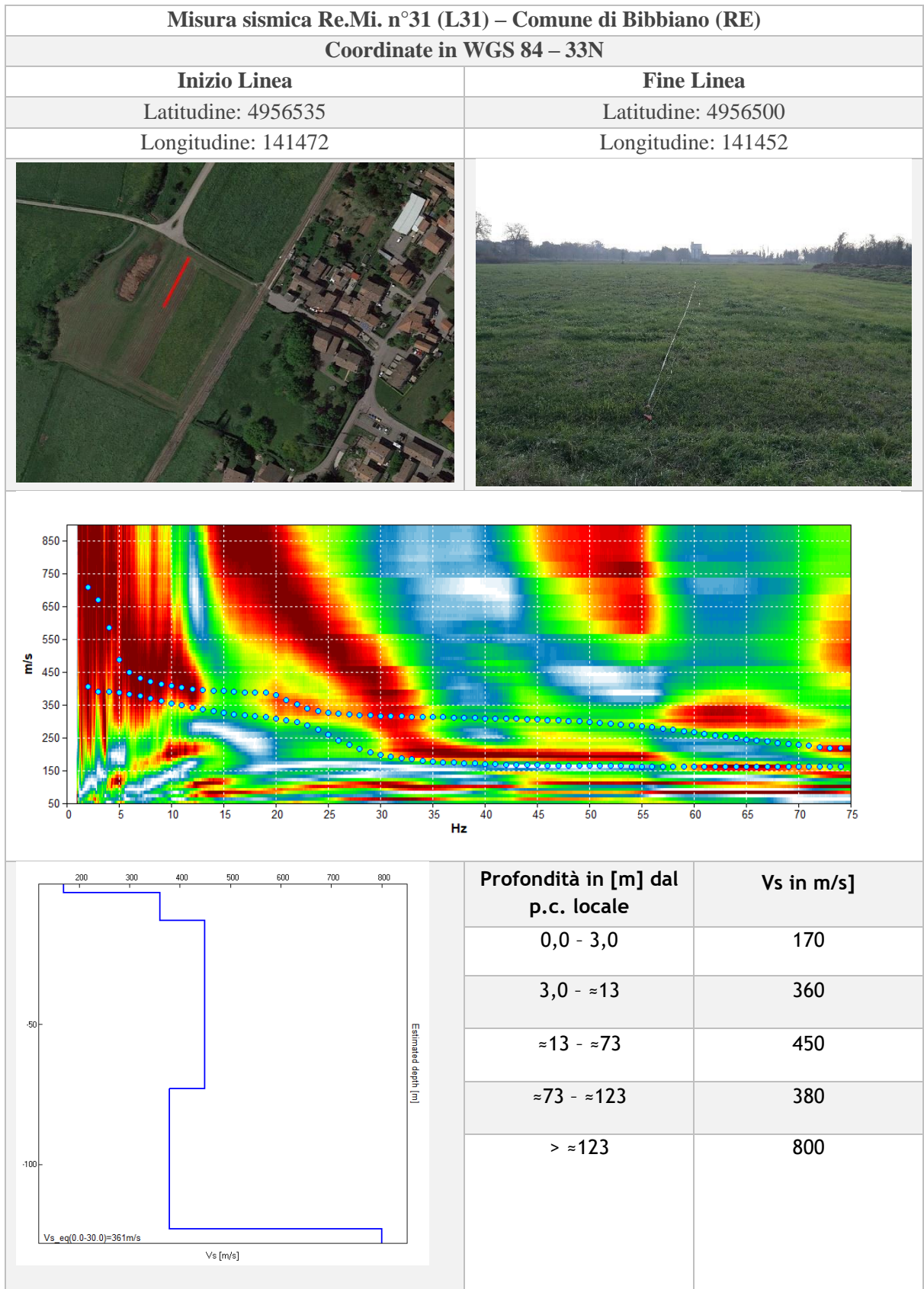
Longitudine: 143638



Profondità in [m] dal p.c. locale	Vs in m/s]
0,0 - 2,2	120
2,2 - ≈14	260
≈14 - ≈134	470
> ≈134	800

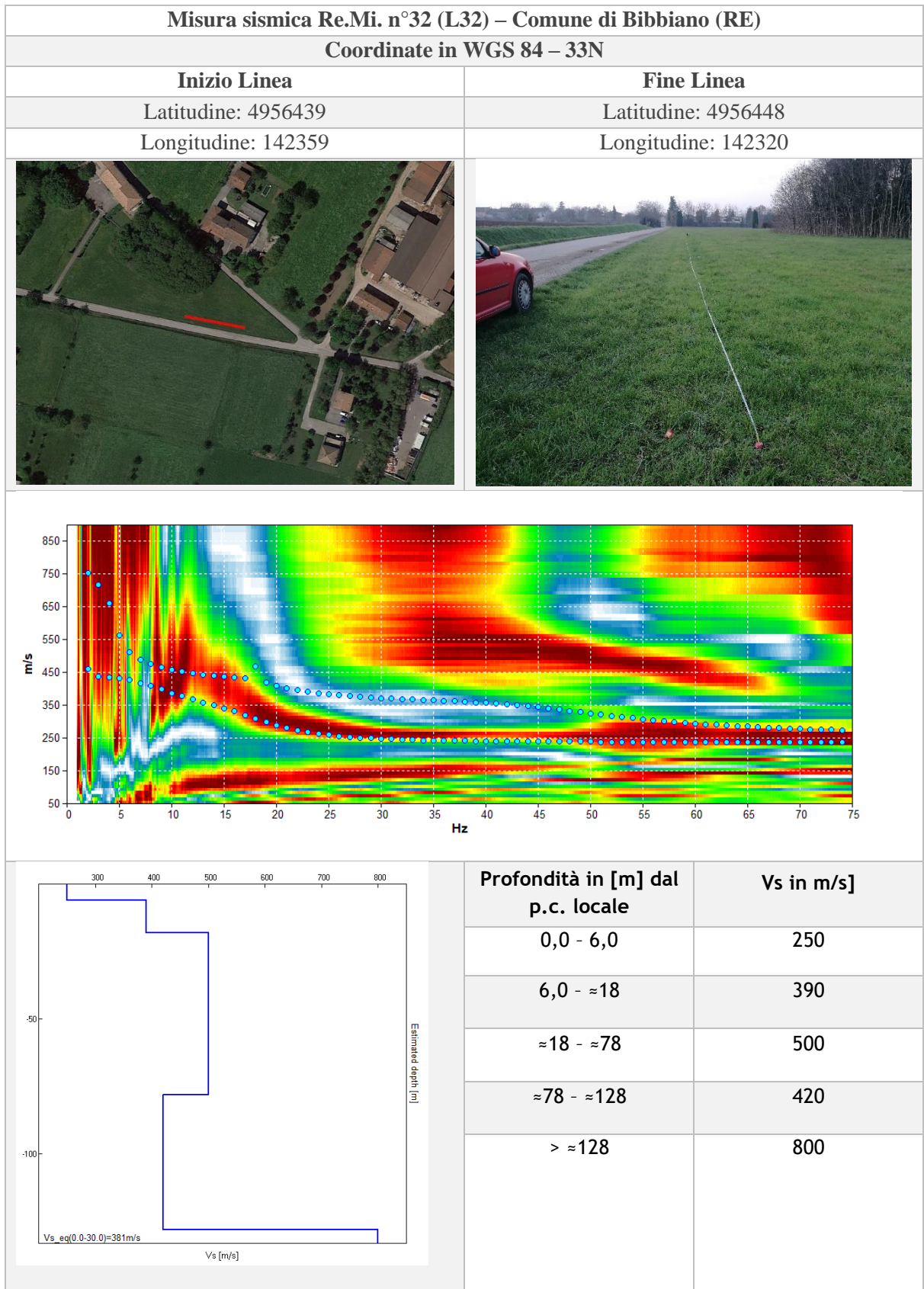
<b>Vs,30</b>	<b>308 m/s</b>
<b>Profondità bedrock</b>	<b>134 m</b>





<b>Vs,30</b>	<b>361 m/s</b>
<b>Profondità bedrock</b>	<b>123 m</b>

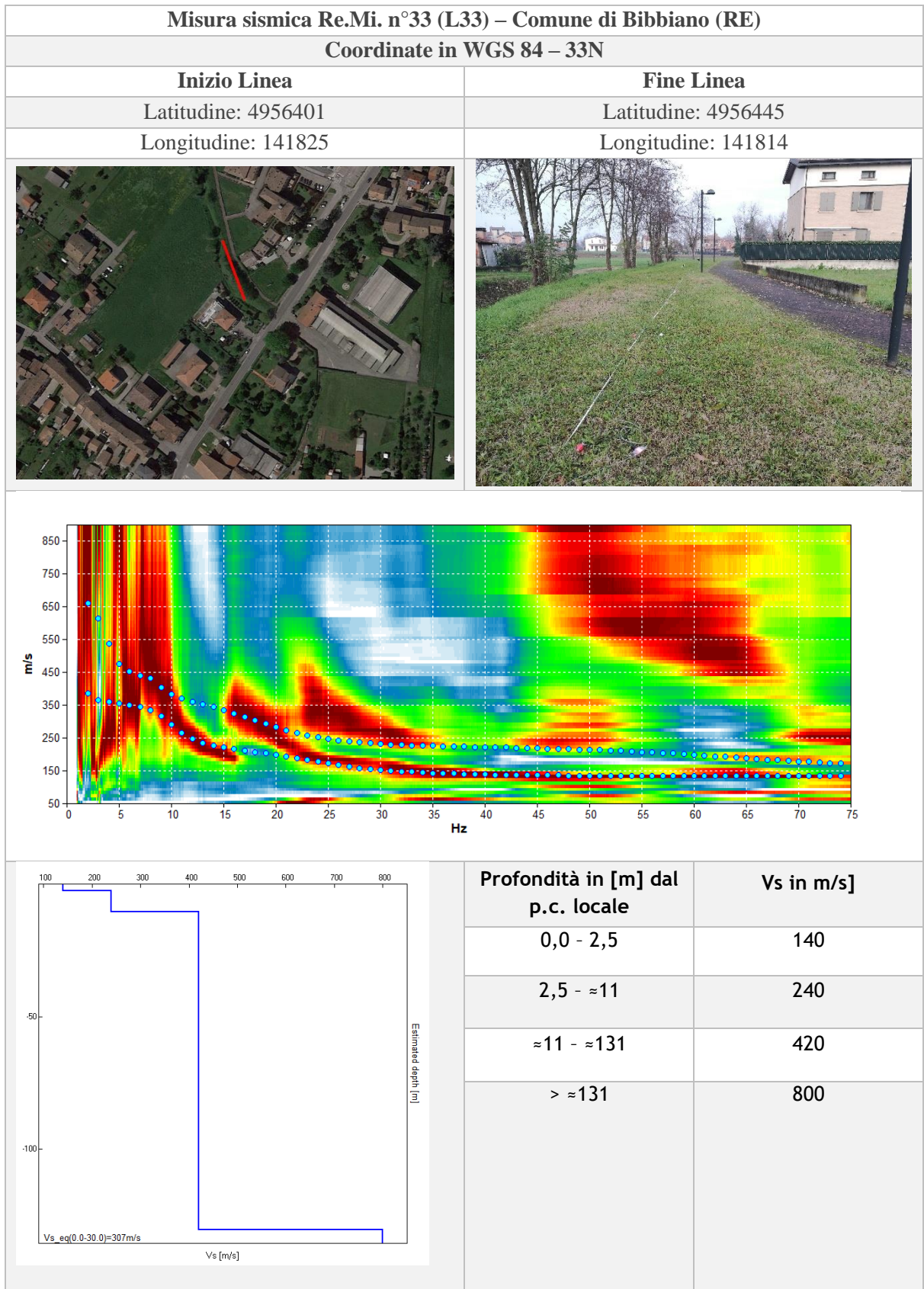




<b>Vs,30</b>	<b>381 m/s</b>
<b>Profondità bedrock</b>	<b>128 m</b>

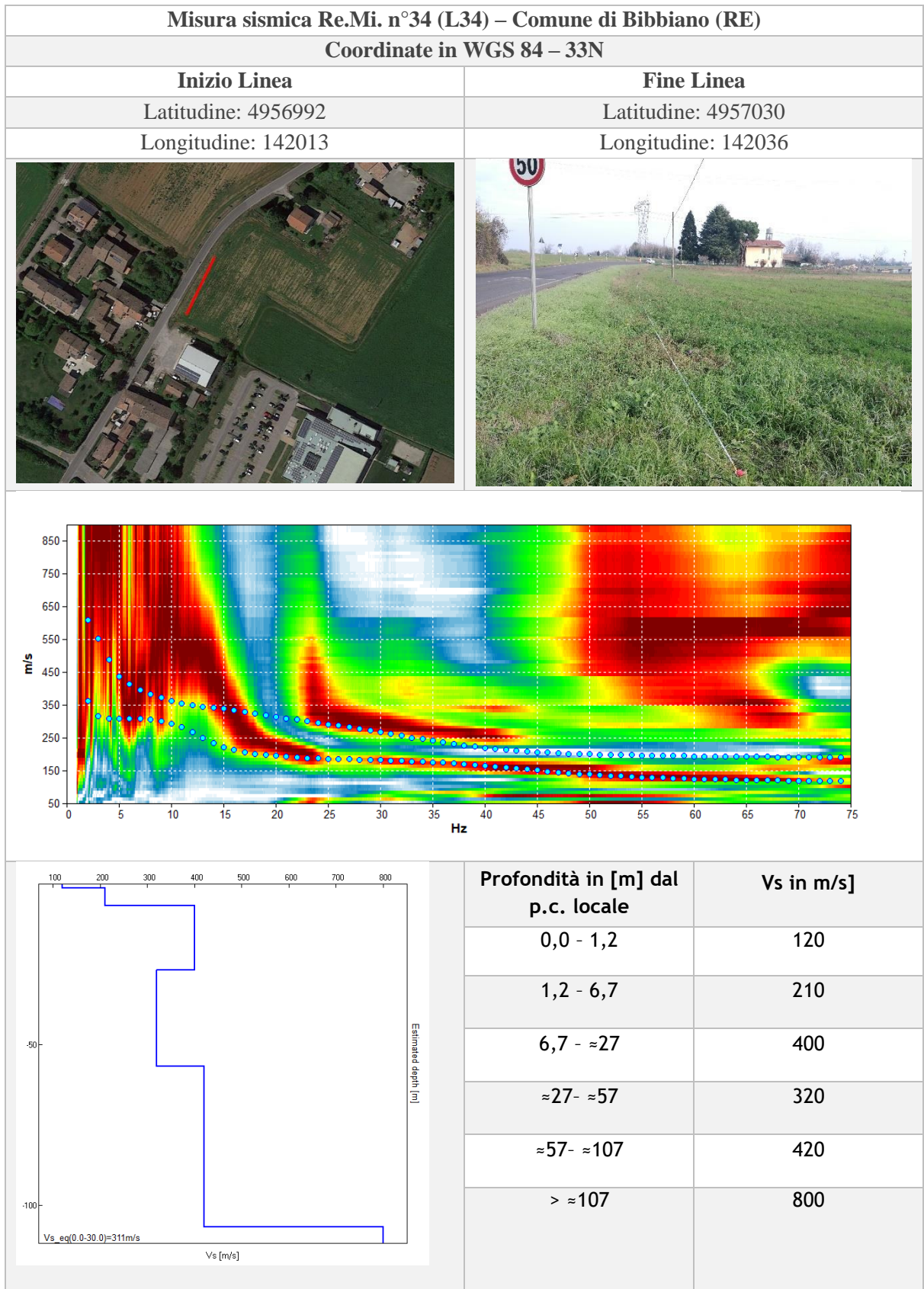






<b>Vs,30</b>	<b>307 m/s</b>
<b>Profondità bedrock</b>	<b>131 m</b>

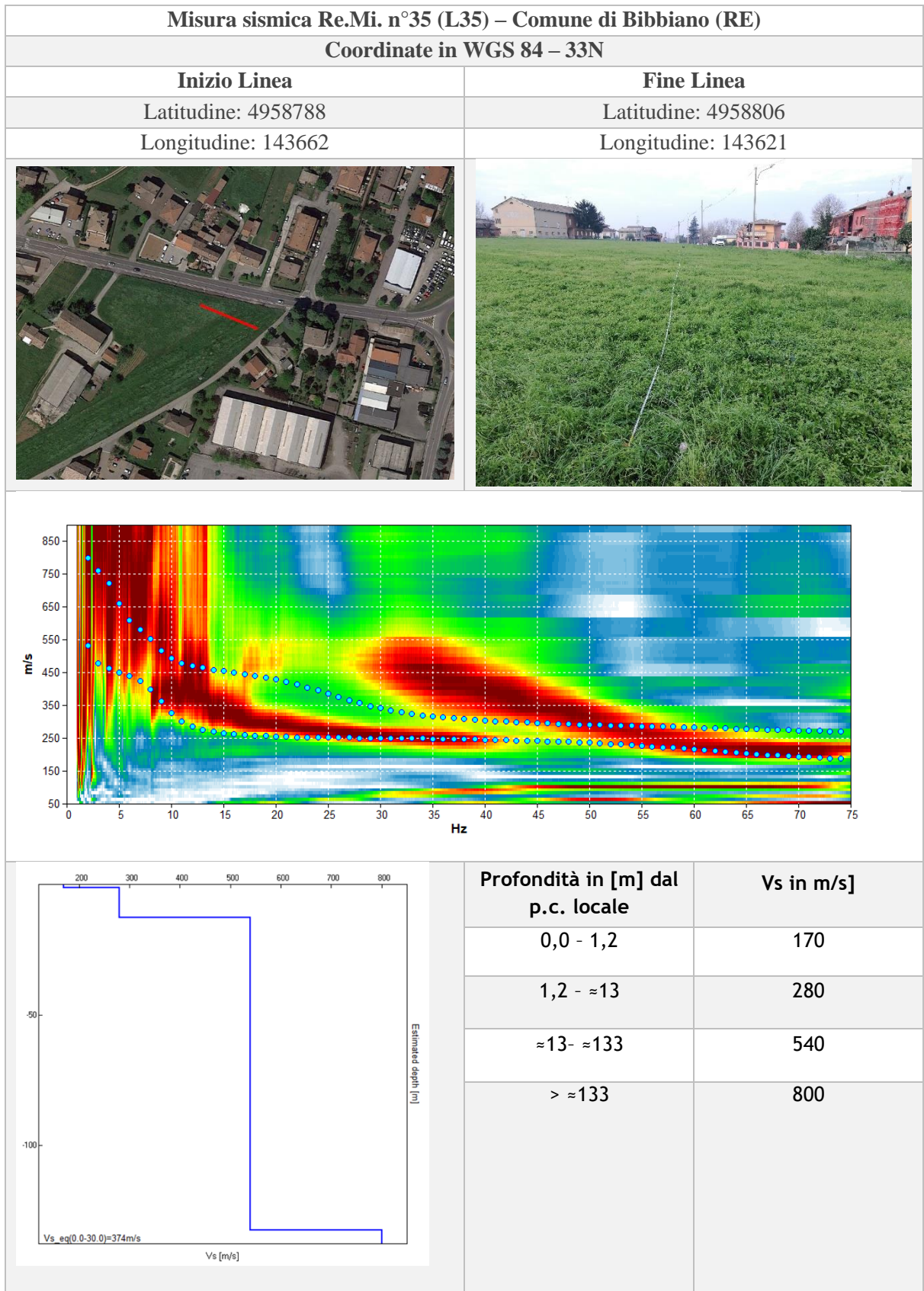




<b>Vs,30</b>	<b>311 m/s</b>
<b>Profondità bedrock</b>	<b>107 m</b>



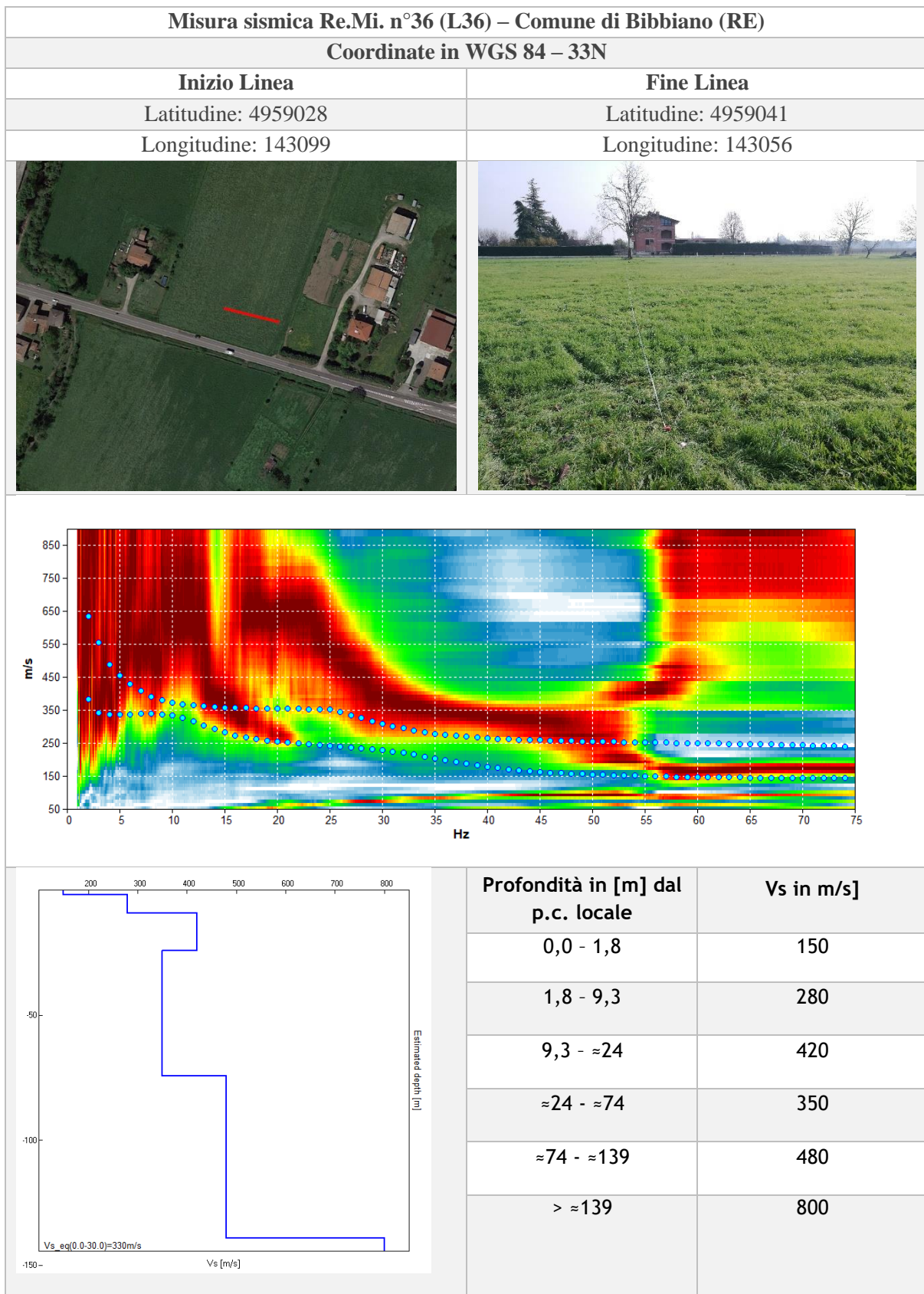




<b>Vs,30</b>	<b>374 m/s</b>
<b>Profondità bedrock</b>	<b>133 m</b>

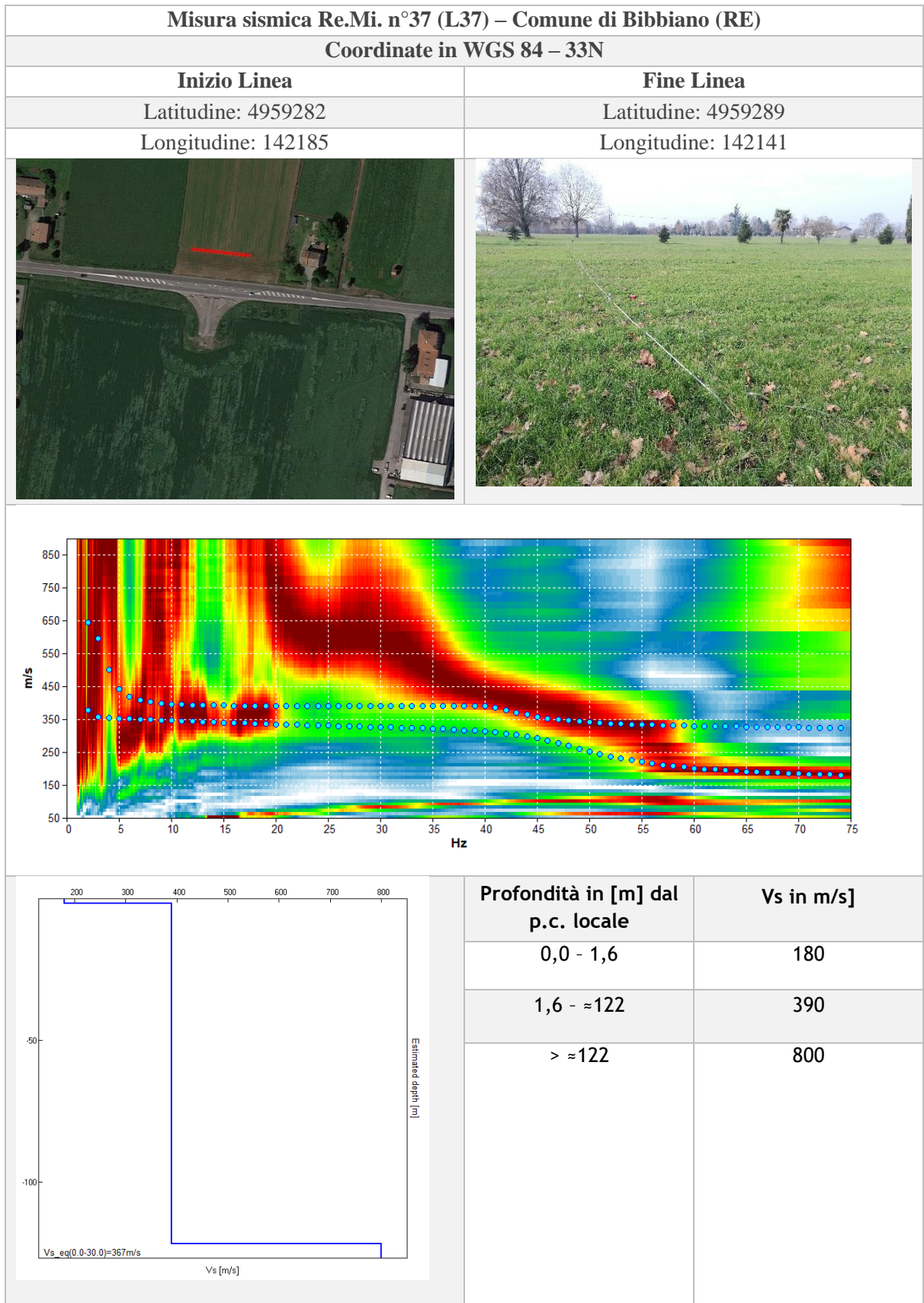






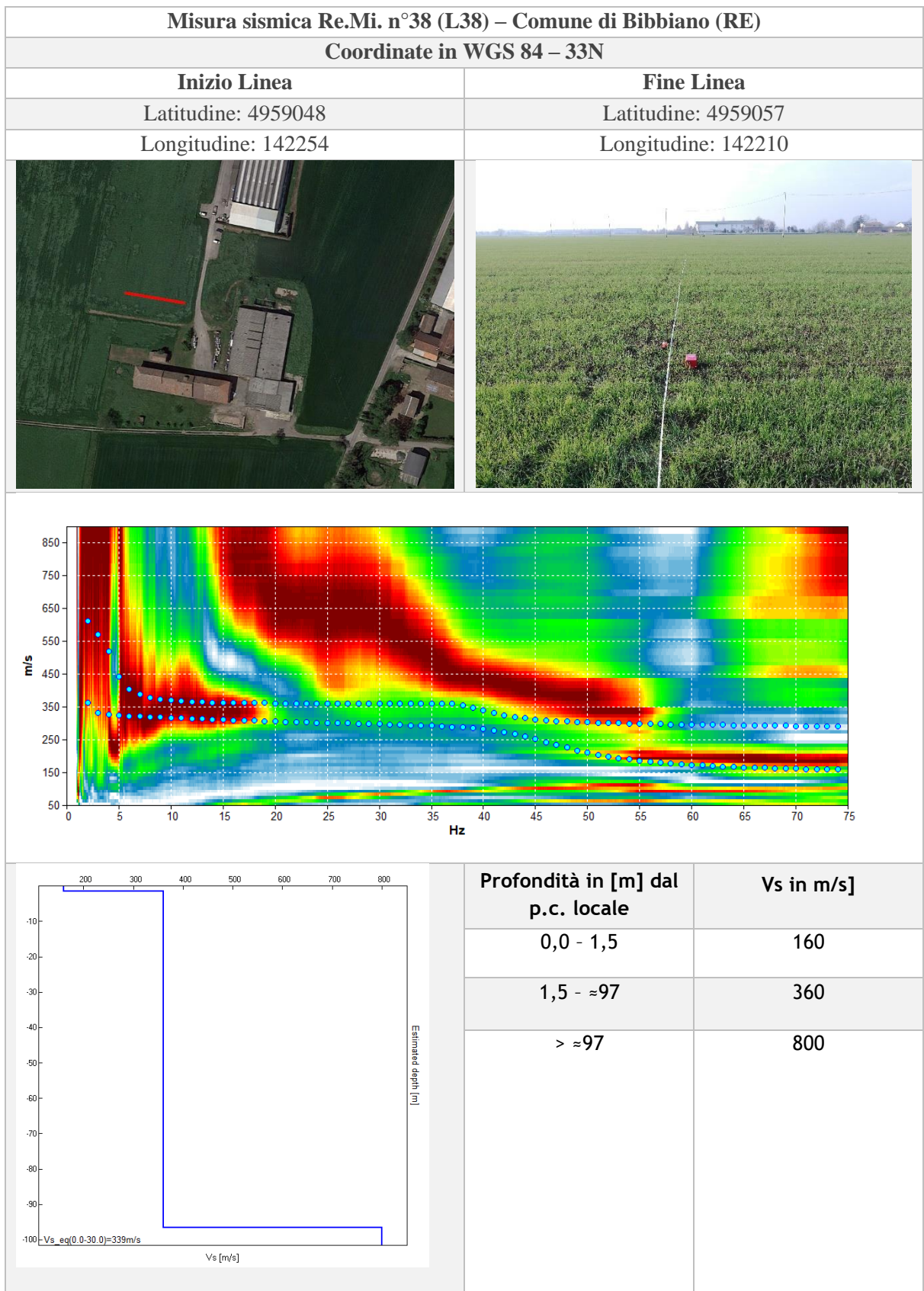
<b>Vs,30</b>	<b>330 m/s</b>
<b>Profondità bedrock</b>	<b>139 m</b>





<b>Vs,30</b>	<b>367 m/s</b>
<b>Profondità bedrock</b>	<b>122 m</b>

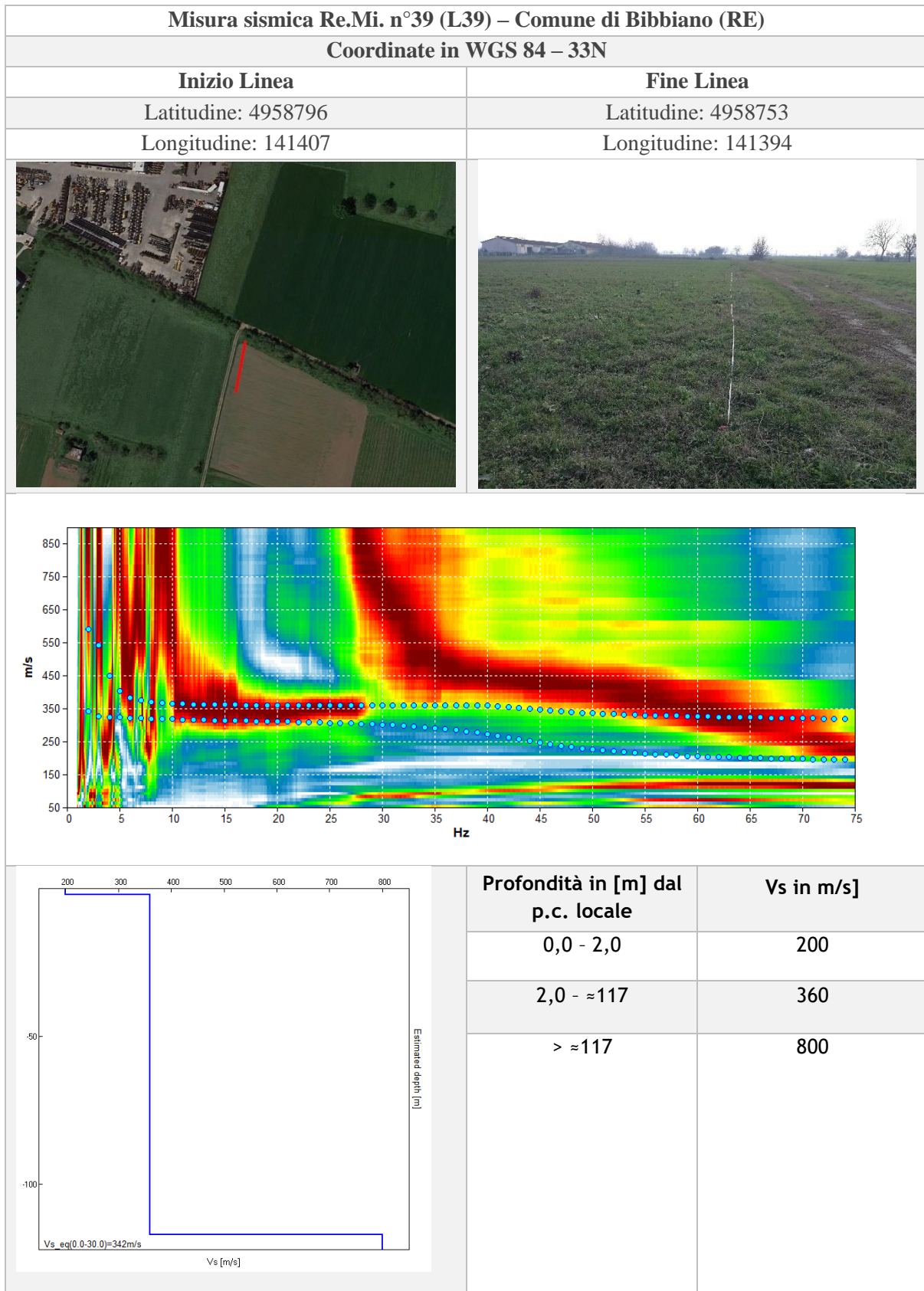




<b>Vs,30</b>	<b>339 m/s</b>
<b>Profondità bedrock</b>	<b>97 m</b>

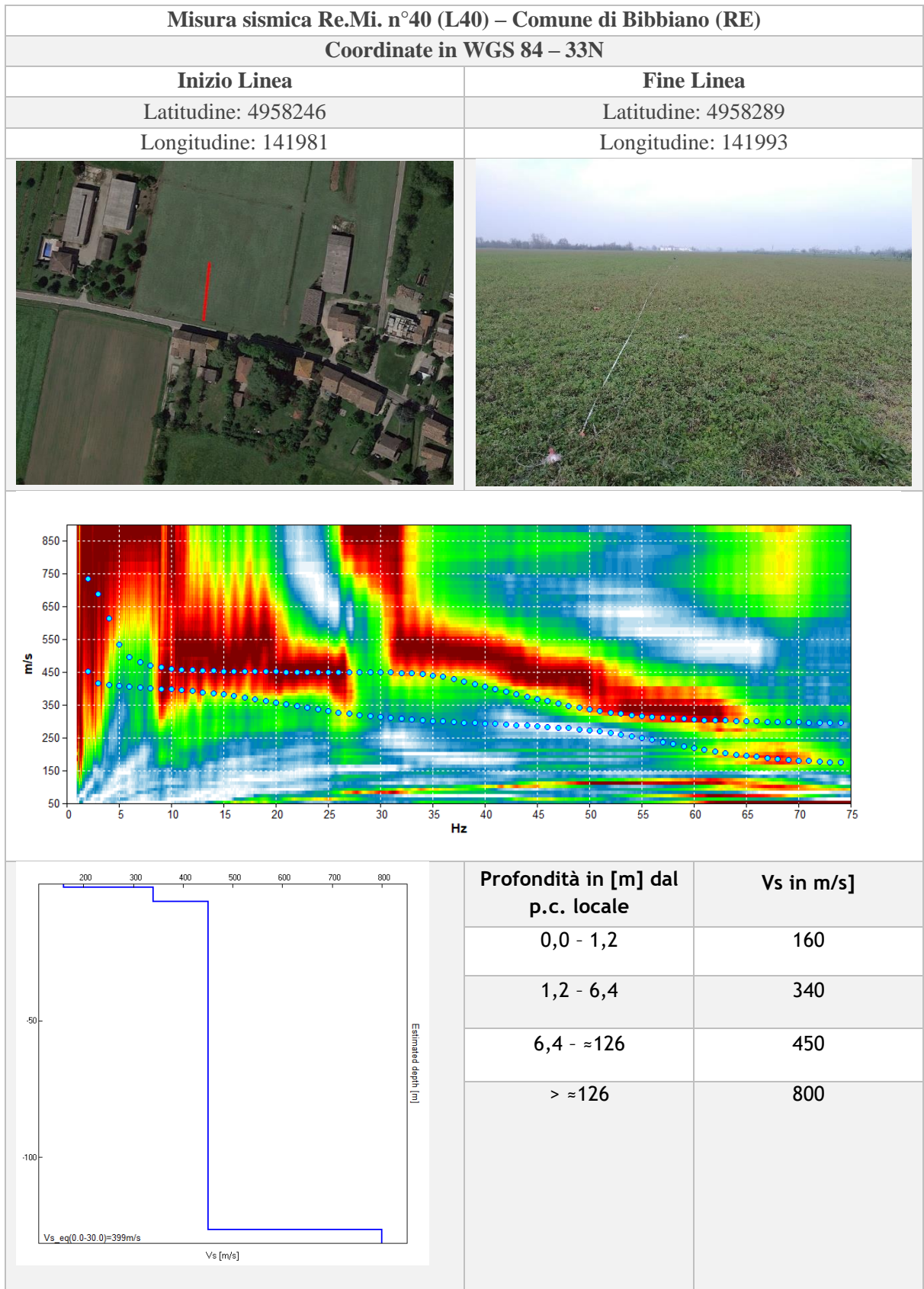






<b>Vs,30</b>	<b>342m/s</b>
<b>Profondità bedrock</b>	<b>117 m</b>





<b>Vs,30</b>	<b>399m/s</b>
<b>Profondità bedrock</b>	<b>126 m</b>



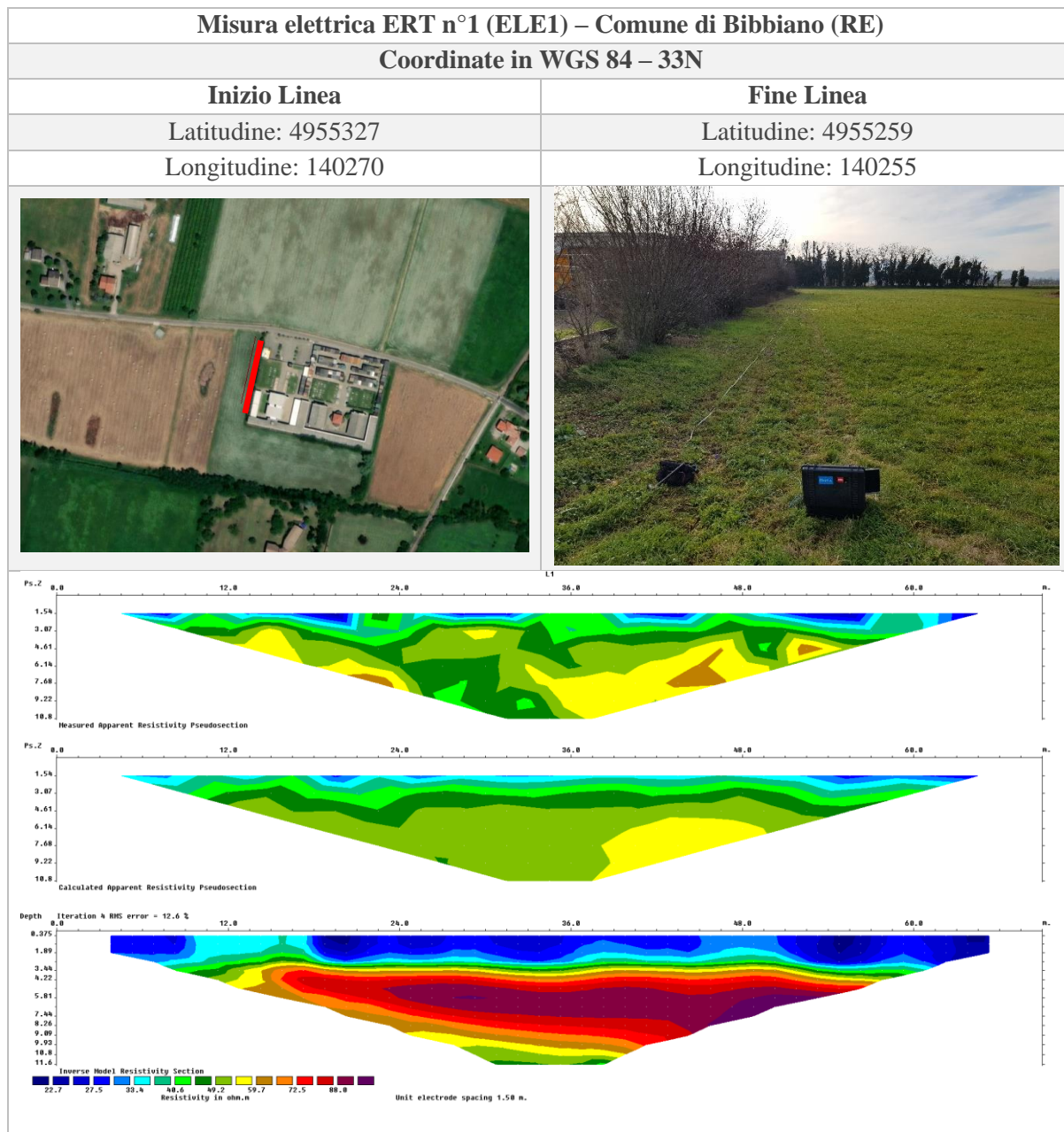
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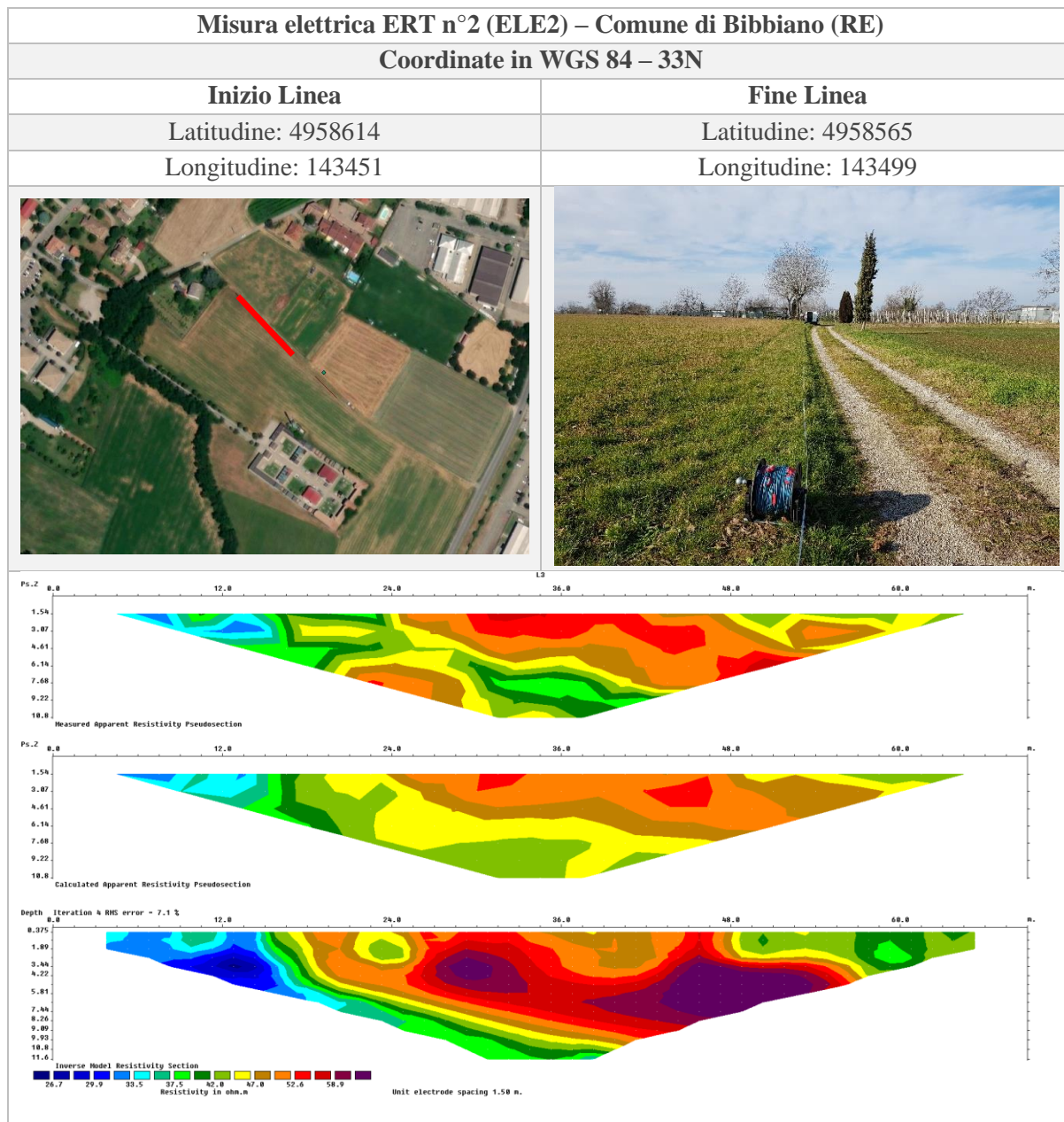
***Analisi geoelettrica: misure di resistività nel  
sottosuolo (ELE)***

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Misura elettrica ERT n°3 (ELE3) – Comune di Bibbiano (RE)

Coordinate in WGS 84 – 33N

Inizio Linea

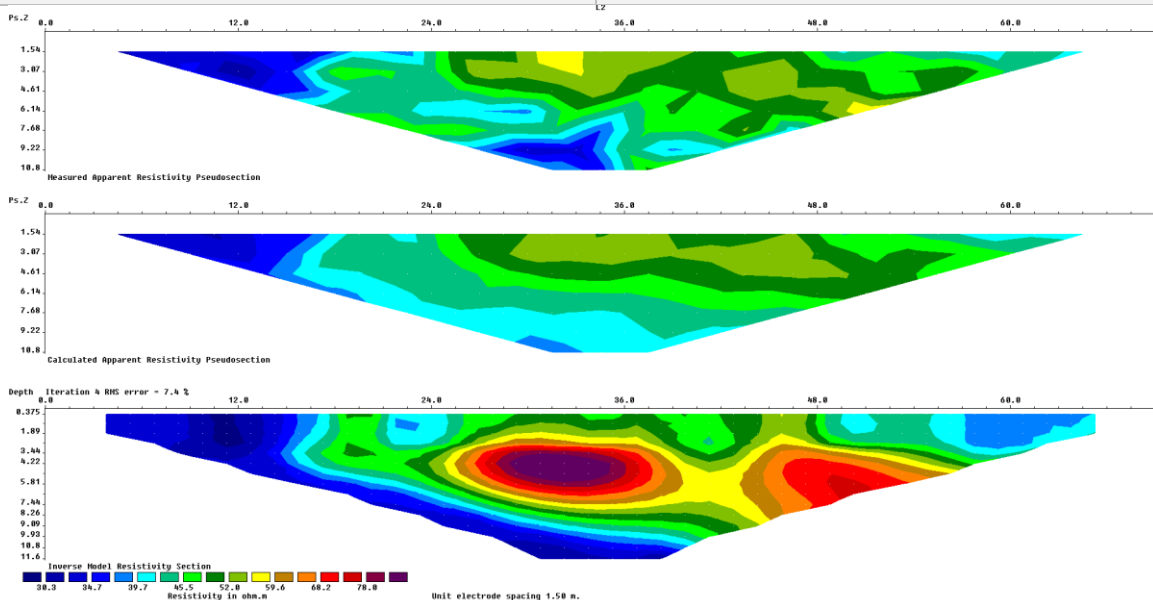
Latitudine: 4957182

Longitudine: 142158

Fine Linea

Latitudine: 4957238

Longitudine: 142198





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## *Prove penetrometriche*

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***Prove penetrometriche statiche***

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**FERRARA DEPARTMENT**

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[www.socotec.it](http://www.socotec.it)

COMMITTENTE: **ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE: **Strada Provinciale 28 - Bibbiano (RE)**

PROVA: **CPT 1** del **18-12-19** FALDA: **n.r.** m da p.c.

COMMESSA: **20844FE/19** C. SITO N°: **SF191055/19 del 30/12/19**



PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>
0.20											
0.40	1.97	143.79	8.89								
0.60	3.35	222.22	23.28								
0.80	5.50	143.79	19.14								
1.00	2.58	287.58	8.96								
1.20	37.09	993.46	37.33								

Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli



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COMMITTENTE:

**ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE:

**Strada Provinciale 28 - Bibbiano (RE)**

PROVA:

**CPT 1**

del

**18-12-19**

FALDA:

**n.r.**

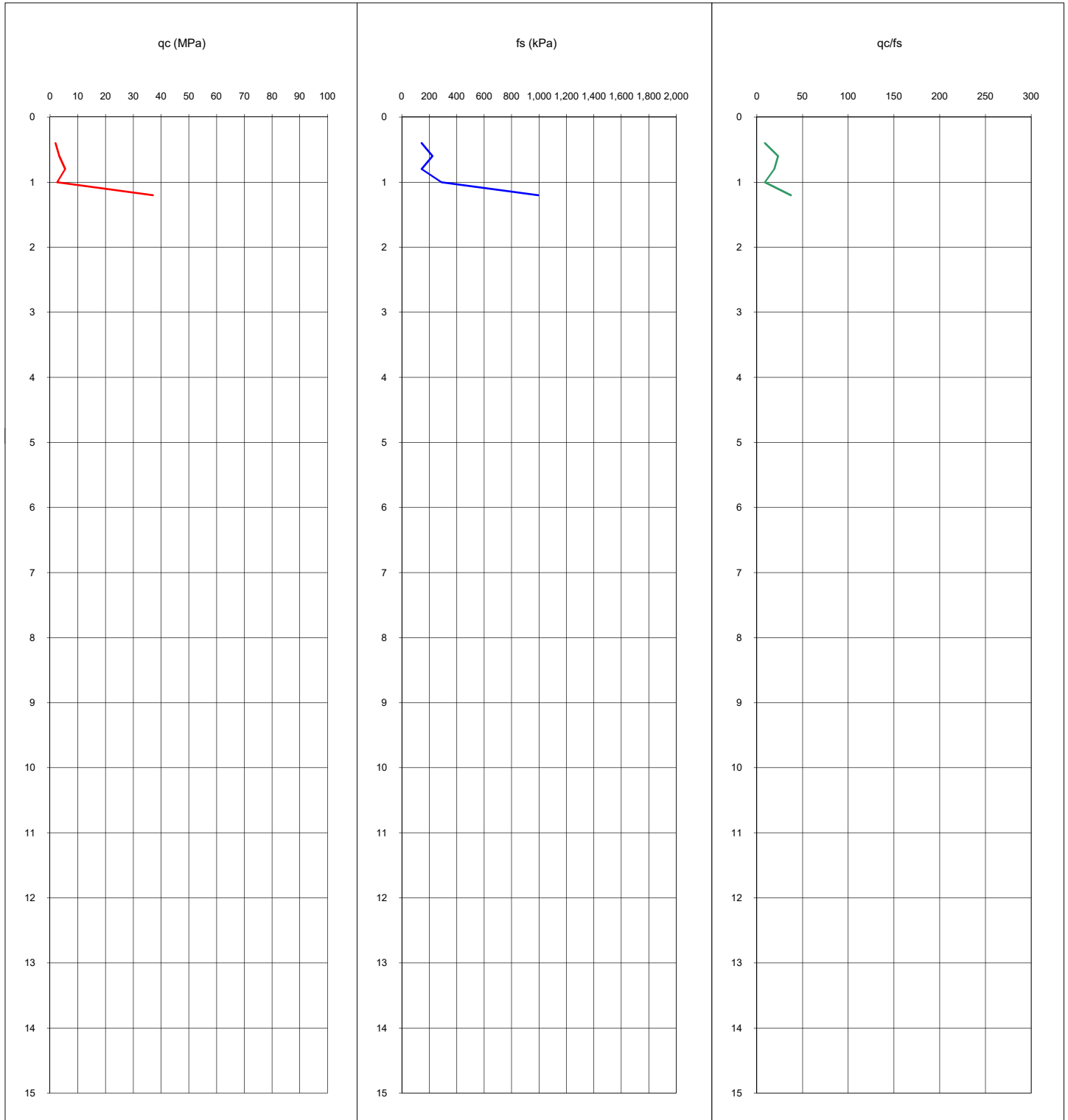
**m da p.c.**

COMMESSA:

**20844FE/19**

C. SITO N°:

**SF191055/19 del 30/12/19**



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
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CANTIERE: **Strada Provinciale 28 - Bibbiano (RE)**

PROVA: **CPT 1** del **18-12-19**

FALDA: **n.r.** m da p.c.

COMMESSA: **20844FE/19** C. SITO N°: **SF191055/19 del 30/12/19**



PLANIMETRIA

Località: Strada Provinciale 28 - Bibbiano (RE)

LAT. (WGS 84): 44.696825°

LONG. (WGS 84): 10.483331°



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
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[www.socotec.it](http://www.socotec.it)COMMITTENTE: **ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**CANTIERE: **Via Montefiorino - Loc. Ghiardo - Bibbiano (RE)**PROVA: **CPT 2** del **19-12-19** FALDA: **n.r.** **m da p.c.**COMMESSA: **20844FE/19** C. SITO N°: **SF191056/19 del 30/12/19**

PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>
0.20				10.20	3.68	326.80	16.56				
0.40	2.17	169.93	16.61	10.40	3.29	222.22	19.35				
0.60	2.17	130.72	5.73	10.60	2.70	169.93	15.89				
0.80	3.15	379.08	12.05	10.80	3.88	169.93	37.07				
1.00	4.73	261.44	18.11	11.00	3.30	104.58	14.86				
1.20	3.95	379.08	10.42	11.20	3.89	222.22	33.07				
1.20	3.95	366.01	10.79	11.40	5.26	117.65	28.76				
1.60	6.30	366.01	20.09	11.60	4.09	183.01	19.54				
1.80	7.87	313.73	25.09	11.80	3.50	209.15	15.74				
2.00	8.67	483.66	13.82	12.00	3.32	222.22	16.91				
2.20	9.06	627.45	16.91	12.20	3.90	196.08	22.97				
2.40	7.69	535.95	14.35	12.40	3.90	169.93	33.18				
2.20	7.30	535.95	11.16	12.60	3.71	117.65	23.64				
2.80	7.30	653.59	10.34	12.80	2.34	156.86	9.93				
3.00	6.72	705.88	10.08	13.00	5.09	235.29	14.43				
3.20	7.11	666.67	10.88	13.20	8.04	352.94	17.56				
3.40	7.51	653.59	10.07	13.40	8.62	457.52	21.28				
3.60	6.92	745.10	8.82	13.60	10.58	405.23	21.31				
3.20	7.11	784.31	10.88	13.80	11.96	496.73	19.88				
4.00	7.52	653.59	11.51	14.00	14.52	601.31	16.10				
4.20	7.52	653.59	11.51	14.20	17.85	901.96	19.51				
4.40	6.54	653.59	11.37	14.40	11.19	915.03	21.94				
4.60	6.34	575.16	9.71	14.60	15.30	509.80	30.02				
4.80	7.13	653.59	11.60	14.80	10.79	509.80	28.47				
4.20	7.53	614.38	11.76	15.00	9.24	379.08	24.37				
5.20	8.32	640.52	13.26								
5.40	9.69	627.45	15.77								
5.60	9.69	614.38	11.77								
5.80	9.69	823.53	11.96								
6.00	8.53	810.46	14.83								
5.20	9.31	575.16	17.37								
6.40	10.68	535.95	17.77								
6.60	13.63	601.31	20.44								
6.80	12.06	666.67	15.12								
7.00	8.74	797.39	11.94								
7.20	6.19	732.03	10.52								
6.20	8.74	588.24	15.19								
7.60	12.46	575.16	19.07								
7.80	9.72	653.59	12.82								
8.00	9.34	758.17	14.01								
8.20	11.89	666.67	15.68								
8.40	11.30	758.17	13.10								
7.20	12.08	862.75	15.94								
8.80	10.71	758.17	13.66								
9.00	10.73	784.31	16.75								
9.20	11.31	640.52	19.67								
9.40	11.12	575.16	18.49								
9.60	9.35	601.31	15.90								
8.20	8.57	588.24	15.99								
10.00	5.64	535.95	17.26								

Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De IasiIl Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli



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COMMITTENTE:

**ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE:

**Via Montefiorino - Loc. Ghiardo - Bibbiano (RE)**

PROVA:

**CPT 2**

del

**19-12-19**

FALDA:

**n.r.**

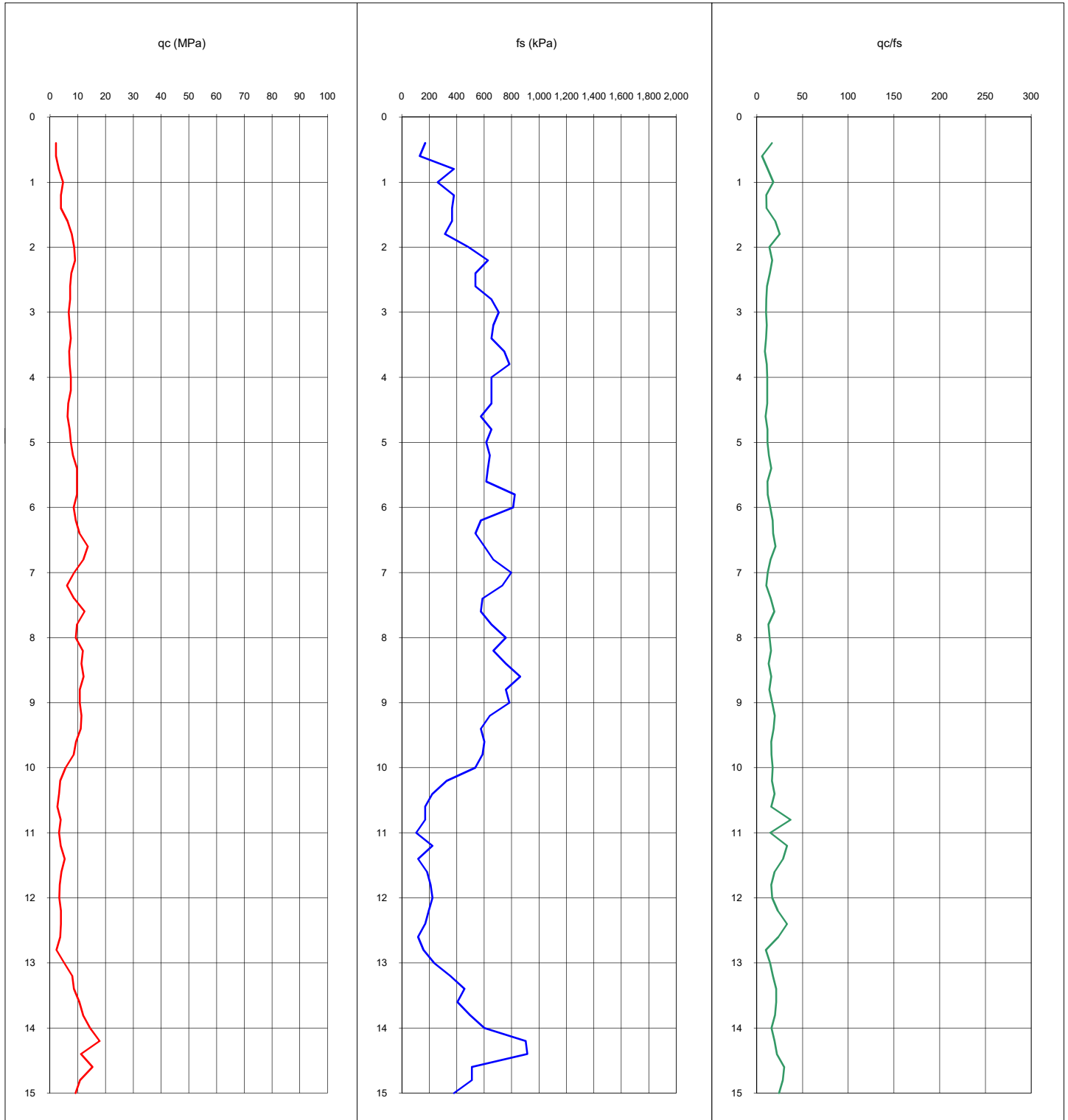
**m da p.c.**

COMMESSA:

**20844FE/19**

C. SITO N°:

**SF191056/19 del 30/12/19**



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli

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CANTIERE: **Via Montefiorino - Loc. Ghiardo - Bibbiano (RE)**

PROVA: **CPT 2** del **19-12-19** FALDA: **n.r.** m da p.c.  
COMMESSA: **20844FE/19** C. SITO N°: **SF191056/19 del 30/12/19**



PLANIMETRIA

Località: Strada Provinciale N° 28 - Bibbiano (RE)

LAT. (WGS 84): 44.665043°

LONG. (WGS 84): 10.502357°



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

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COMMITTENTE: **ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE: **Via A. Secchi - Bibbiano (RE)**

PROVA: **CPT 3** del **20-12-19** FALDA: **3.65** m da p.c.

COMMESSA: **20844FE/19** C. SITO N°: **SF191057/19 del 30/12/19**



PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>
0.20											
0.40	12.00	22.00	2.37	130.72	12.93						
0.60	14.00	28.00	2.76	183.01	17.59						
0.80	13.00	25.00	2.56	156.86	11.53						
1.00	11.00	28.00	2.18	222.22	9.83						
1.20	12.00	25.00	2.38	169.93	14.01						
1.40	14.00	27.00	2.77	169.93	19.28						
1.60	15.00	26.00	2.97	143.79	18.93						
1.80	16.00	28.00	3.16	156.86	20.18						
2.00	23.00	39.00	4.55	209.15	19.34						
2.20	28.00	46.00	5.53	235.29	16.28						
2.40	29.00	55.00	5.73	339.87	17.53						
2.60	31.00	56.00	6.12	326.80	18.73						
2.80	35.00	60.00	6.90	326.80	22.96						
3.00	33.00	56.00	6.53	300.65	31.20						
3.20	45.00	61.00	8.88	209.15	13.32						
3.40	36.00	87.00	7.11	666.67	12.96						
3.60	73.00	115.00	14.37	549.02	14.85						
3.80	48.00	122.00	9.47	967.32	20.12						
4.00	42.00	78.00	8.30	470.59	8.36						
4.20	83.00	159.00	16.34	993.46	36.77						
4.40	38.00	72.00	7.52	444.44	26.15						
4.60	24.00	46.00	4.77	287.58	9.37						
4.80	74.00	113.00	14.58	509.80	50.69						
5.00	158.00	180.00	31.06	287.58	27.63						
5.20	52.00	138.00	10.28	1124.18	19.18						
5.40	44.00	85.00	8.71	535.95	33.32						
5.60	31.00	51.00	6.16	261.44	23.57						
5.80	26.00	46.00	5.18	261.44	22.02						
6.00	25.00	43.00	5.00	235.29	20.12						
6.20	26.00	45.00	5.19	248.37	7.95						
6.40	101.00	151.00	19.90	653.59	30.45						
6.60	62.00	112.00	12.25	653.59	33.48						
6.80	50.00	78.00	9.90	366.01	12.62						
7.00	51.00	111.00	10.11	784.31	13.81						
7.20	56.00	112.00	11.09	732.03	19.28						
7.40	268.00	312.00	52.66	575.16	41.96						
7.60	121.00	217.00	23.84	1254.90	14.03						
7.80	138.00	268.00	27.17	1699.35	15.75						
8.00	140.00	272.00	27.57	1725.49	11.22						
8.20	212.00	400.00	41.69	2457.52	17.52						
8.40	282.00	464.00	55.42	2379.08	23.29						

Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli



**FERRARA DEPARTMENT**

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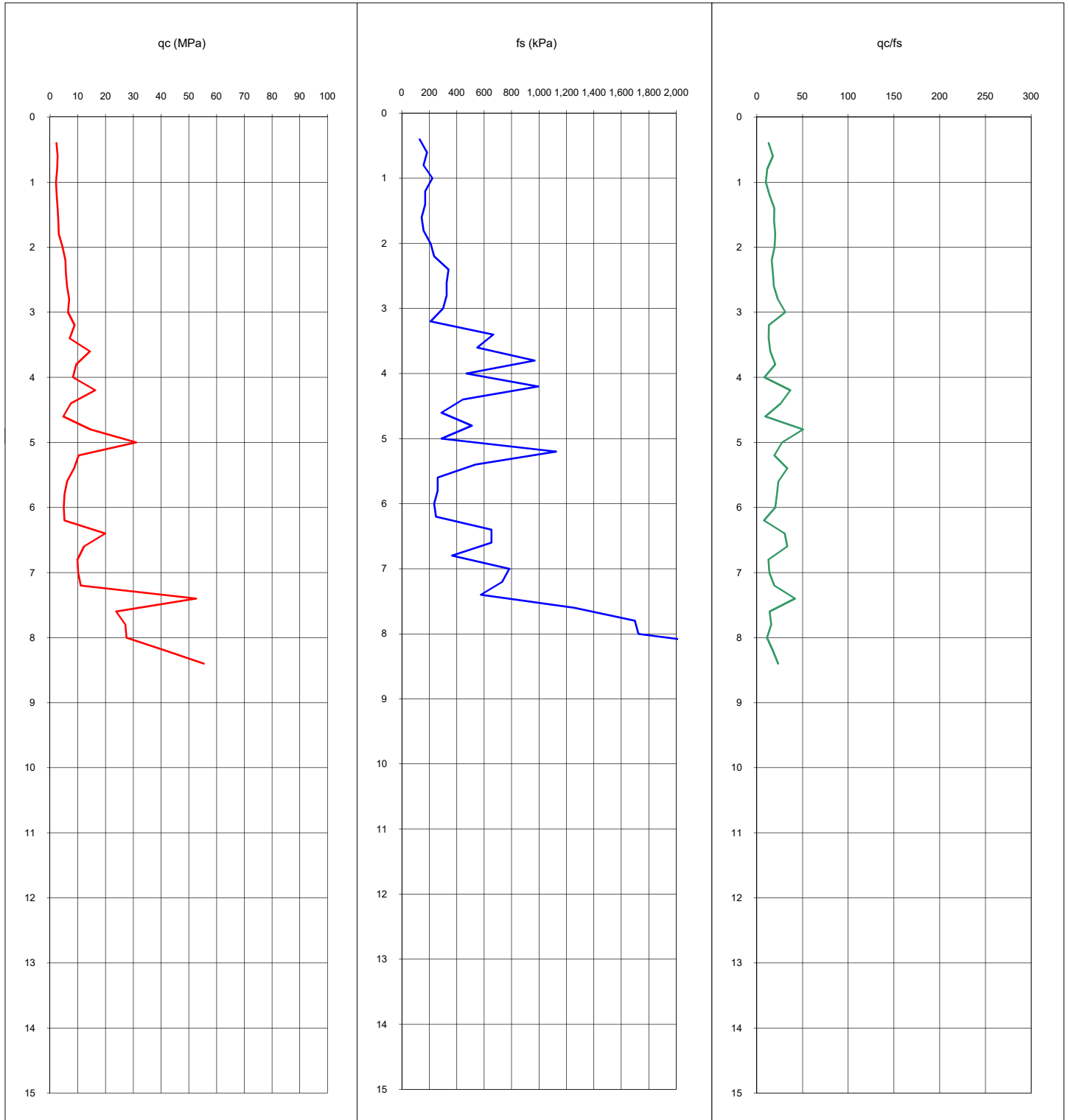
COMMITTENTE: **ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE: **Via A. Secchi - Bibbiano (RE)**

PROVA: **CPT 3** del **20-12-19**

FALDA: **3.65** m da p.c.

COMMESSA: **20844FE/19** C. SITO N°: **SF191057/19 del 30/12/19**



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli

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CANTIERE: **Via A. Secchi - Bibbiano (RE)**

PROVA: **CPT 3** del **20-12-19** FALDA: **3.65** m da p.c.

COMMESSA: **20844FE/19** C. SITO N°: **SF191057/19 del 30/12/19**



PLANIMETRIA

Località: Via A. Secchi - Bibbiano (RE)

LAT. (WGS 84): 44.657346°

LONG. (WGS 84): 10.462845°



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli

**FERRARA DEPARTMENT**

Via Annibale Zucchini, 69 – 44122 Ferrara (FE)  
Tel.: +39 0532 56771 - Fax.: +39 0532 56119

SOCOTEC ITALIA Srl – P.Iva 01872430648  
Headquarters: Via Bariola, 101-103 - 20020 Lainate (MI)  
Tel.: +39 02 9375 0000 - Fax: +39 02 9375 0099

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COMMITTENTE: **ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**  
CANTIERE: **Via Menozzi - Bibbiano (RE)**

PROVA: **CPT 4** del **20-12-19** FALDA: **n.r.** m da p.c.  
COMMESSA: **20844FE/19** C. SITO N°: **SF191058/19 del 30/12/19**



PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>
0.20											
0.40	2.37	130.72	12.93								
0.60	2.76	183.01	17.59								
0.80	2.56	156.86	11.53								
1.00	2.18	222.22	9.83								
1.20	2.38	169.93	14.01								
1.40	2.77	169.93	19.28								
1.60	2.97	143.79	18.93								
1.80	3.16	156.86	20.18								
2.00	4.55	209.15	19.34								
2.20	5.53	235.29	16.28								
2.40	5.73	339.87	17.53								
2.60	6.12	326.80	18.73								
2.80	6.90	326.80	22.96								
3.00	6.53	300.65	31.20								
3.20	8.88	209.15	13.32								
3.40	7.11	666.67	12.96								
3.60	14.37	549.02	14.85								
3.80	9.47	967.32	20.12								
4.00	8.30	470.59	24.43								
4.20	16.34	339.87	36.77								
4.40	7.52	444.44	26.15								
4.60	4.77	287.58	12.59								
4.80	14.58	379.08	24.78								
5.00	31.06	588.24	27.63								
5.20	10.28	1124.18	19.18								
5.40	8.71	535.95	33.32								
5.60	6.16	261.44	23.57								
5.80	5.18	261.44	22.02								
6.00	5.00	235.29	20.12								
6.20	5.19	248.37	7.95								
6.40	19.90	653.59	43.50								
6.60	12.25	457.52	33.48								
6.80	9.90	366.01	12.62								
7.00	10.11	784.31	13.81								
7.20	11.09	732.03	15.15								
7.40	52.66	732.03	41.96								
7.60	23.84	1254.90	14.03								
7.80	27.17	1699.35	15.75								
8.00	27.57	1725.49	11.10								
8.20	41.30	2483.66	17.36								
8.40	55.42	2379.08	23.29								

Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli



**FERRARA DEPARTMENT**

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COMMITTENTE:

**ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE:

**Via Menozzi - Bibbiano (RE)**

PROVA:

**CPT 4**

del

**20-12-19**

FALDA:

**n.r.**

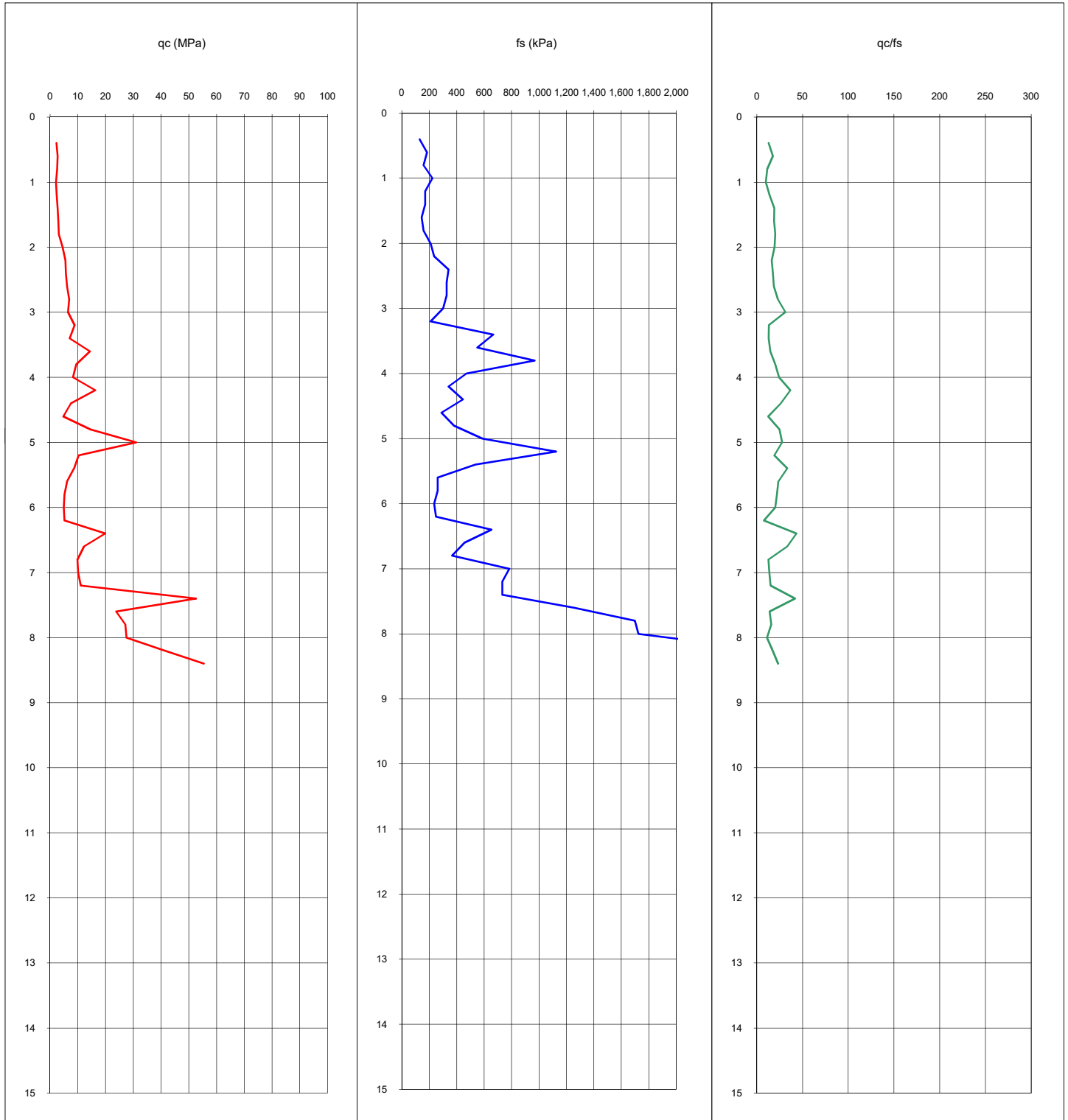
**m da p.c.**

COMMESSA:

**20844FE/19**

C. SITO N°:

**SF191058/19 del 30/12/19**



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli

**FERRARA DEPARTMENT**

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COMMITTENTE: **ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**  
CANTIERE: **Via Menozzi - Bibbiano (RE)**

PROVA: **CPT 4** del **20-12-19** FALDA: **n.r.** m da p.c.  
COMMESSA: **20844FE/19** C. SITO N°: **SF191058/19 del 30/12/19**



PLANIMETRIA

Località: Via Menozzi - Bibbiano (RE)

LAT. (WGS 84): 44.660331°

LONG. (WGS 84): 10.471281°



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli

**FERRARA DEPARTMENT**

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COMMITTENTE: **ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE: **Strada provinciale N° 22 - Cimitero di Barco - Bibbiano (RE)**

PROVA: **CPT5** del **20-12-19** FALDA: **n.r.** m da p.c.

COMMESSA: **20844FE/19** C. SITO N°: **SF191059/19 del 30/12/19**



PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>	PROFONDITA'	q <sub>c</sub> (MPa)	f <sub>s</sub> (kPa)	q <sub>c</sub> /f <sub>s</sub>
0.20											
0.40	1.58	104.58	11.00								
0.60	2.76	143.79	6.21								
0.80	4.92	444.44	3.16								
1.00	39.24	1555.56	25.23								
1.20	20.81	509.80	40.82								
1.40	24.93	1464.05	38.92								
1.60	11.40	640.52	37.92								
1.80	10.22	300.65	34.00								
2.00	3.37	457.52	8.33								
2.20	4.55	405.23	14.51								
2.40	5.14	313.73	32.76								
2.60	3.37	156.86	23.47								
2.80	6.12	143.79	29.26								
3.00	6.33	209.15	24.21								
3.20	3.00	261.44	10.91								
3.40	9.27	274.51	30.83								
3.60	4.37	300.65	23.87								
3.80	9.07	183.01	138.84								
4.00	5.36	65.36	13.68								
4.20	3.01	392.16	38.38								
4.40	5.17	78.43	21.96								
4.60	2.81	235.29	5.98								
4.80	8.89	470.59	28.34								
5.00	4.79	313.73	10.18								
5.20	15.77	470.59	24.13								
5.40	7.14	653.59	5.94								
5.60	63.61	1202.61	52.89								

Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli



**FERRARA DEPARTMENT**

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COMMITTENTE:

**ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE:

**Strada provinciale N° 22 - Cimitero di Barco - Bibbiano (RE)**

PROVA:

**CPT5**

del

**20-12-19**

FALDA:

**n.r.**

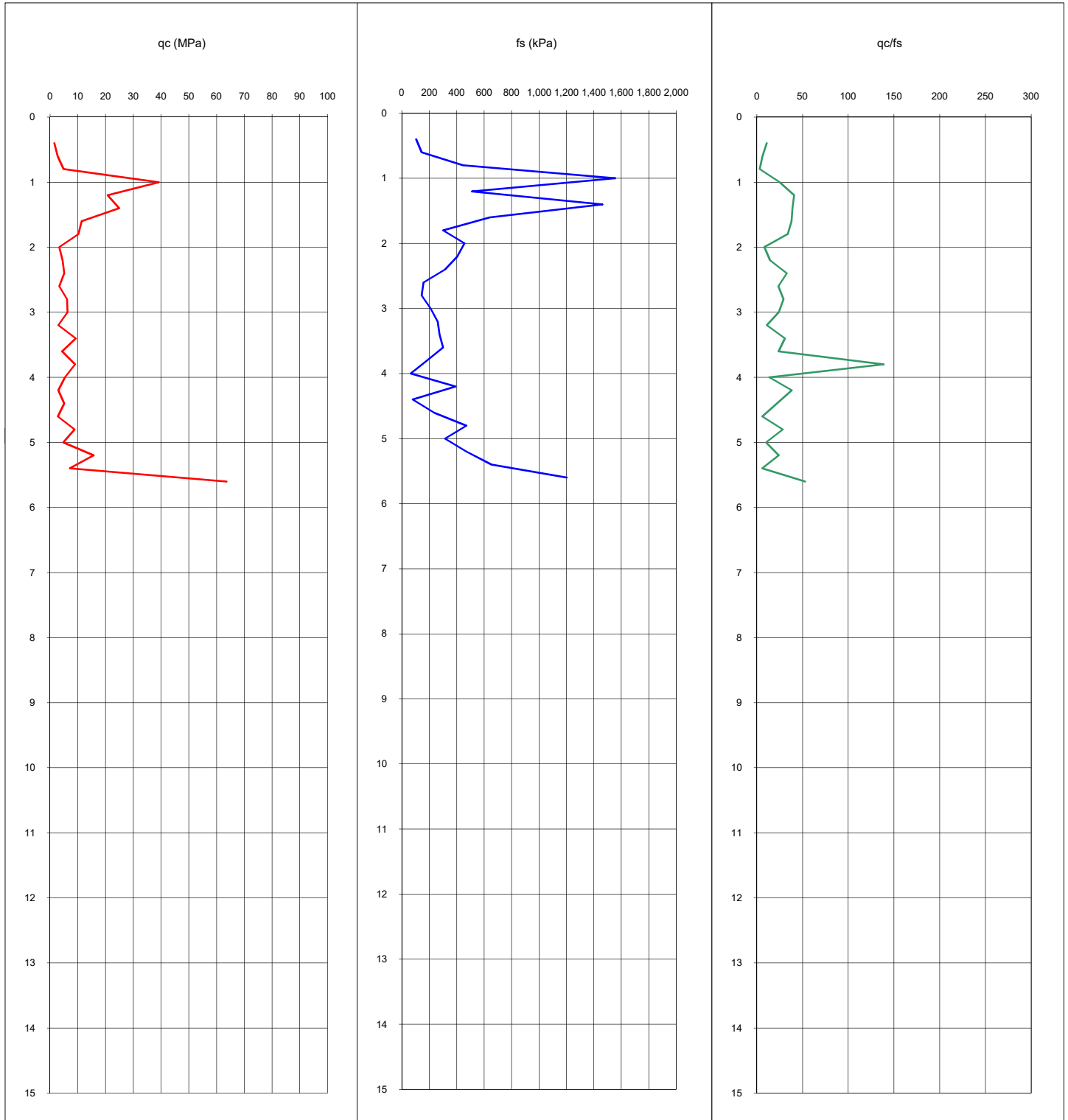
**m da p.c.**

COMMESSA:

**20844FE/19**

C. SITO N°:

**SF191059/19 del 30/12/19**



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli

**FERRARA DEPARTMENT**

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COMMITTENTE:

**ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma**

CANTIERE:

**Strada provinciale N° 22 - Cimitero di Barco - Bibbiano (RE)**

PROVA:

**CPT5**

del

**20-12-19**

FALDA:

**n.r.**

**m da p.c.**

COMMESSA:

**20844FE/19**

C. SITO N°:

**SF191059/19 del 30/12/19**



PLANIMETRIA

Località: Strada provinciale N° 22 - Cimitero di Barco - Bibbiano (RE)

LAT. (WGS 84): 44.690752°

LONG. (WGS 84): 10.500346°



Il Direttore Tecnico SOA OS 20B:  
ing. Massimo De Iasi

Il Direttore del settore Prove in Situ:  
dott.geol. Massimo Romagnoli

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***Prove penetrometriche dinamiche***

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**FERRARA DEPARTMENT**

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Tel.: +39 0532 56771 - Fax.: +39 0532 56119

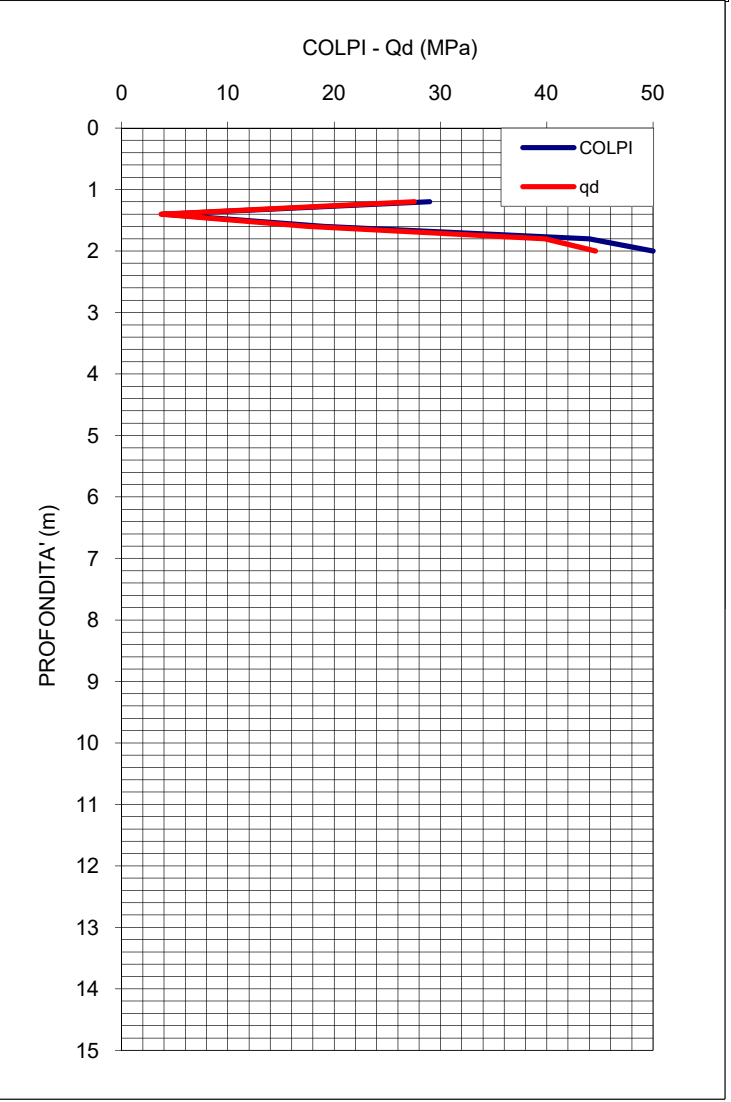
SOCOTEC ITALIA Srl – P.Iva 01872430648  
Headquarters: Via Bariola, 101-103 - 20020 Lainate (MI)  
Tel.: +39 02 9375 0000 - Fax: +39 02 9375 0099  
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COMMITTENTE:	<b>ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma</b>		
CANTIERE:	<b>Strada Provinciale 28 - Bibbiano (RE)</b>		
PROVA:	DPSH1	DATA:	18-12-2019
COMMESSA:	20844FE/19	C. SITO N°:	SF191070
		Rev. 00 DEL:	30/12/19

PROFONDITA'	COLPI	q <sub>d</sub> *	PROFONDITA'	COLPI	q <sub>d</sub> *
0.20	<b>C P T 1</b>				
0.40					
0.60					
0.80					
1.00					
1.20		29	27.5		
1.40		4	3.7		
1.60		19	17.5		
1.80		44	39.8		
2.00		50	44.6		



**CARATTERISTICHE PENETROMETRO**

MARCA e MODELLO:	Pagani DPH		
MAGLIO:	63.5	kg	(M)
ALTEZZA CADUTA:	0.75	m	(H)
PESO TESTA:	0.5	kg	(M')
LUNGHEZZA ASTE:	1.0	m	
PESO ASTE:	6.35	kg	(M')
DIAMETRO ASTE:	32	mm	
DIAMETRO PUNTA:	50.5	mm	(A)
ANGOLO PUNTA:	60	°	

\* q<sub>d</sub> = (M/(M+M')) \* MgH/Ae) = MPa

Il Responsabile Prove in Sito:  
dott. Massimo Romagnoli

Il Direttore Tecnico SOA:  
ing. Massimo de Iasi

**FERRARA DEPARTMENT**

Via Annibale Zucchini, 69 – 44122 Ferrara (FE)  
Tel.: +39 0532 56771 - Fax.: +39 0532 56119

SOCOTEC ITALIA Srl – P.Iva 01872430648  
Headquarters: Via Bariola, 101-103 - 20020 Lainate (MI)  
Tel.: +39 02 9375 0000 - Fax: +39 02 9375 0099  
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COMMITTENTE:	<b>ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma</b>		
CANTIERE:	<b>Strada Provinciale 28 - Bibbiano (RE)</b>		
PROVA:	DPSH1	DATA: 18-12-2019	FALDA: n.r.
COMMESSA:	20844FE/19	C. SITO N°: SF191070	Rev. 00 DEL: 30/12/19

**LAT. (WGS 84):** 44.696825°  
**LONG. (WGS 84):** 10.483331°

UBICAZIONE



Il Responsabile Prove in Sito:  
dott. Massimo Romagnoli

Il Direttore Tecnico SOA:  
ing. Massimo De Iasi

**FERRARA DEPARTMENT**

Via Annibale Zucchini, 69 – 44122 Ferrara (FE)  
Tel.: +39 0532 56771 - Fax.: +39 0532 56119

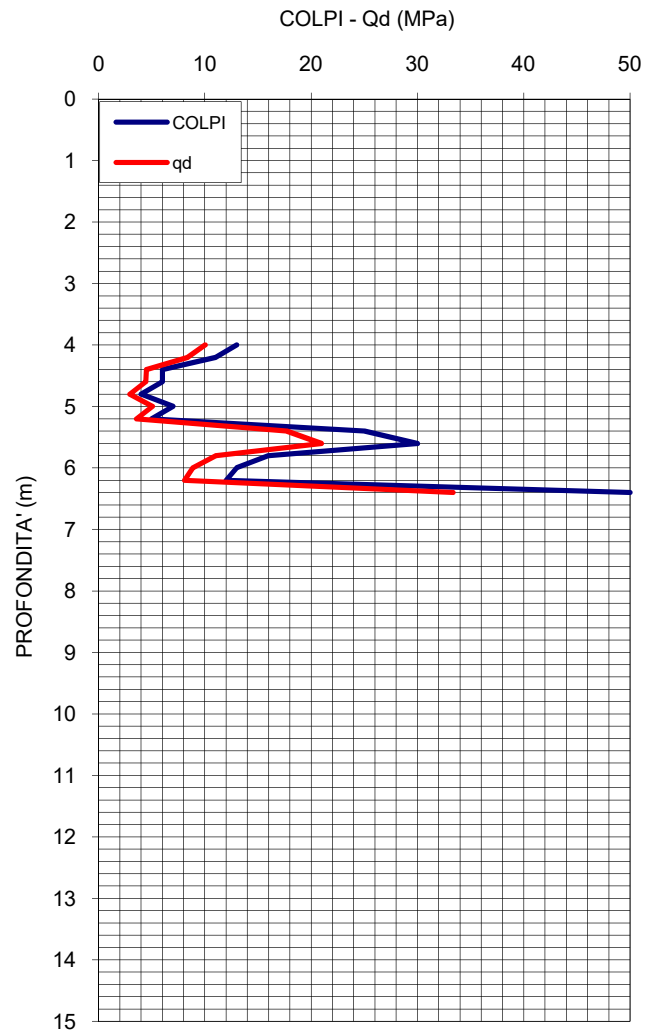
SOCOTEC ITALIA Srl – P.Iva 01872430648  
Headquarters: Via Bariola, 101-103 - 20020 Lainate (MI)  
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COMMITTENTE:	<b>ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma</b>		
CANTIERE:	<b>Via A. Secchi - Bibbiano (RE)</b>		
PROVA:	DPSH1	DATA:	11-12-2019
COMMESSA:	20844FE/19	C. SITO N°:	SF191071
		Rev. 00 DEL:	n.r. 02/01/20

PROFONDITA'	COLPI	q <sub>d</sub> *	PROFONDITA'	COLPI	q <sub>d</sub> *
0.20					
0.40					
0.60					
0.80					
1.00					
1.20					
1.40					
1.60					
1.80					
2.00					
2.20					
2.40					
2.60					
2.80					
3.00					
3.20					
3.40					
3.60					
3.80					
4.00	13	10.1			
4.20	11	8.4			
4.40	6	4.5			
4.60	6	4.5			
4.80	4	2.9			
5.00	7	5.1			
5.20	5	3.6			
5.40	25	17.7			
5.60	30	21.0			
5.80	16	11.1			
6.00	13	8.9			
6.20	12	8.1			
6.40	50	33.4			



**CARATTERISTICHE PENETROMETRO**

MARCA e MODELLO:	Pagani DPH		
MAGLIO:	63.5	kg	(M)
ALTEZZA CADUTA:	0.75	m	(H)
PESO TESTA:	0.5	kg	(M')
LUNGHEZZA ASTE:	1.0	m	
PESO ASTE:	6.35	kg	(M')
DIAMETRO ASTE:	32	mm	
DIAMETRO PUNTA:	50.5	mm	(A)
ANGOLO PUNTA:	60	°	

\* q<sub>d</sub> = (M/(M+M')) \* MgH/Ae = MPa

Il Responsabile Prove in Sito:  
dott. Massimo Romagnoli

Il Direttore Tecnico SOA:  
ing. Massimo de Iasi



**FERRARA DEPARTMENT**

Via Annibale Zucchini, 69 – 44122 Ferrara (FE)  
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SOCOTEC ITALIA Srl – P.Iva 01872430648  
Headquarters: Via Bariola, 101-103 - 20020 Lainate (MI)  
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COMMITTENTE:	<b>ENGEO S.r.l. - Via Suor Maria Adorni, 2 - 43121 Parma</b>		
CANTIERE:	<b>Via A. Secchi - Bibbiano (RE)</b>		
PROVA:	DPSH1	DATA: 11-12-2019	FALDA: n.r.
COMMESSA:	20844FE/19	C. SITO N°: SF191071	Rev. 00 DEL: 02/01/20

**LAT. (WGS 84):** 44.657346°  
**LONG. (WGS 84):** 10.462845°

UBICAZIONE



Il Responsabile Prove in Sito:  
dott. Massimo Romagnoli

Il Direttore Tecnico SOA:  
ing. Massimo De Iasi