

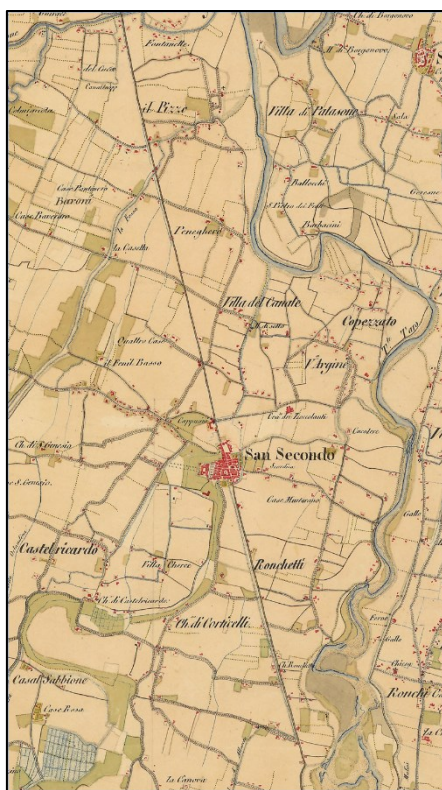


Comune di San Secondo Parmense
Provincia di Parma

PUG

Piano Urbanistico Generale

REPORT PROVE MASW+HVSr



Febbraio 2026

Assunzione

Adozione

Approvazione



PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile



Regione Emilia-Romagna



CONFERENZA DELLE REGIONI E
DELLE PROVINCE AUTONOME

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

MICROZONAZIONE SISMICA

Elaborato 8

Prove MASW – HVSR

Regione Emilia-Romagna

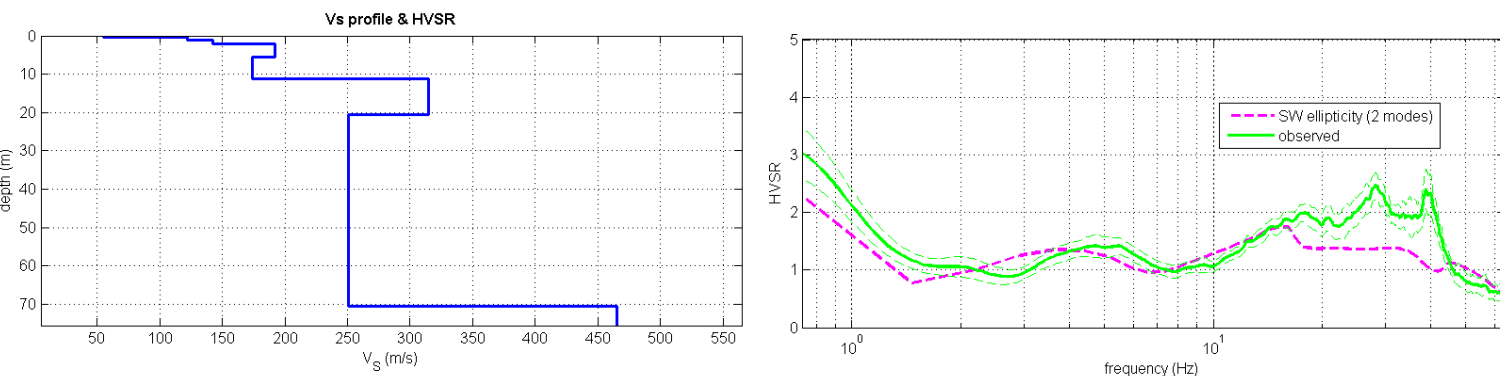
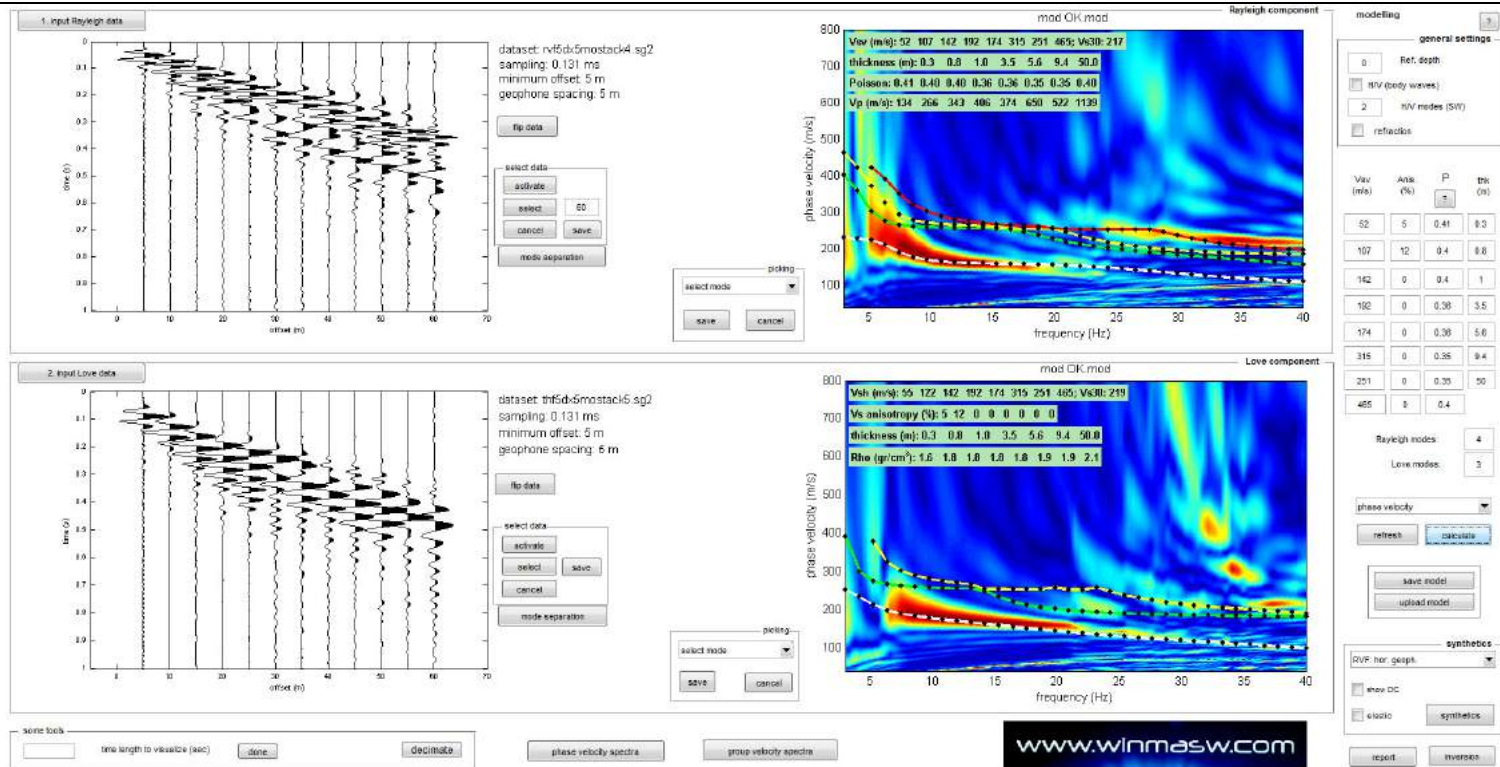
Comune di San Secondo



Regione Emilia-Romagna	Soggetto realizzatore Dott. Geol. Fabio Picinotti	Data Marzo 2020
		MS3

PROVE MASW + HVSR

034033L11 + 034033P197



Profondità		Velocità	Spessore
(m da p.c.)		(m/s)	(m)
0,0	0,3	52	0,3
0,3	1,1	107	0,8
1,1	2,1	142	1,0
2,1	5,6	192	3,5
5,6	11,2	174	5,6
11,2	20,6	315	9,4
20,6	70,6	251	50,0
70,6	inf.	465	-

show data reset show location

step1 (optional) - electrode

12Hz new frequency resume

step2 - HV computation

remove events (each fac. & T) clean area

22 window length (s)

10 tapering (%)

2% spectral smoothing (triangular window)

show particle motion (raw data)

full input

compute

step3a (optional) - directivity analysis

compute

max freq: 22 Hz

step3b (optional) - directivity over time

directivity in time

save - optional1: save HVSR as file

save HV file 0.7 18 04 H2

save HV curve (as file)

pick HV curve

save picked HV

compute SAME for picked curve

quick analysis (H/V ratio)

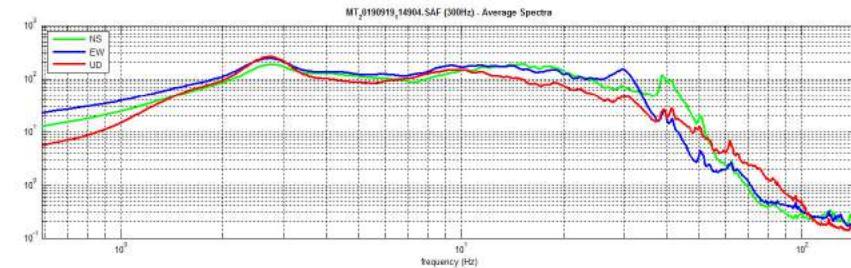
average Vs (m/s)

150 (from surface to bedrock)

22 depth of the bedrock (m)

1000 Vs of the bedrock

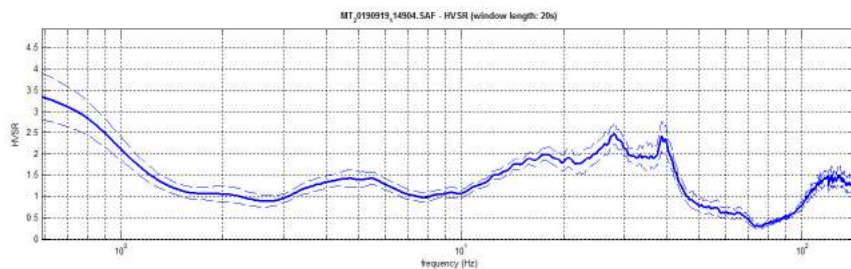
clean compute



Peak frequency (Hz): 4.8 (±1.8)
Peak HVSR value: 1.4 (±0.2)

Criteria for a reliable H/V curve

#1. [f0 > 10/Lw]: 4.8 > 0.5 (OK)
#2. [nc > 200]: 11238 > 200 (OK)
#3. [f0 > 0.5Hz; sigmaA(f) < 2 for 0.5f0 < f < 2f0] (OK)



Criteria for a clear H/V peak (at least 5 should be fulfilled)

#1. [exists f- in the range [f0/4, f0] | AH/V(f-) < A0/2]: (NO)
#2. [exists f+ in the range [f0, 4f0] | AH/V(f+) < A0/2]: (NO)
#3. [A0 > 2]: 1.4 < 2 (NO)
#4. [fpeak[Ah/v(f) ± sigmaA(f)] = f0 ± 5%]: (NO)
#5. [sigmaA(f) < epsilon(f0)]: 1.820 > 0.238 (NO)
#6. [sigmaA(f0) < theta(f0)]: 0.199 < 1.58 (OK)

Peak frequency (Hz): 18.1 (±3.7)
Peak HVSR value: 2.0 (±0.2)

Criteria for a reliable H/V curve

#1. [f0 > 10/Lw]: 18.1 > 0.5 (OK)
#2. [nc > 200]: 42618 > 200 (OK)
#3. [f0 > 0.5Hz; sigmaA(f) < 2 for 0.5f0 < f < 2f0] (OK)

Criteria for a clear H/V peak (at least 5 should be fulfilled)

#1. [exists f- in the range [f0/4, f0] | AH/V(f-) < A0/2]: yes, at frequency 8.1Hz (OK)
#2. [exists f+ in the range [f0, 4f0] | AH/V(f+) < A0/2]: (NO)
#3. [A0 > 2]: 2.0 < 2 (NO)
#4. [fpeak[Ah/v(f) ± sigmaA(f)] = f0 ± 5%]: (OK)
#5. [sigmaA(f) < epsilon(f0)]: 3.653 > 0.903 (NO)
#6. [sigmaA(f0) < theta(f0)]: 0.173 < 1.58 (OK)

STRUMENTAZIONE

Sismografo 24 canali (Echo 2002)
Geofoni orizzontali 4.5 Hz

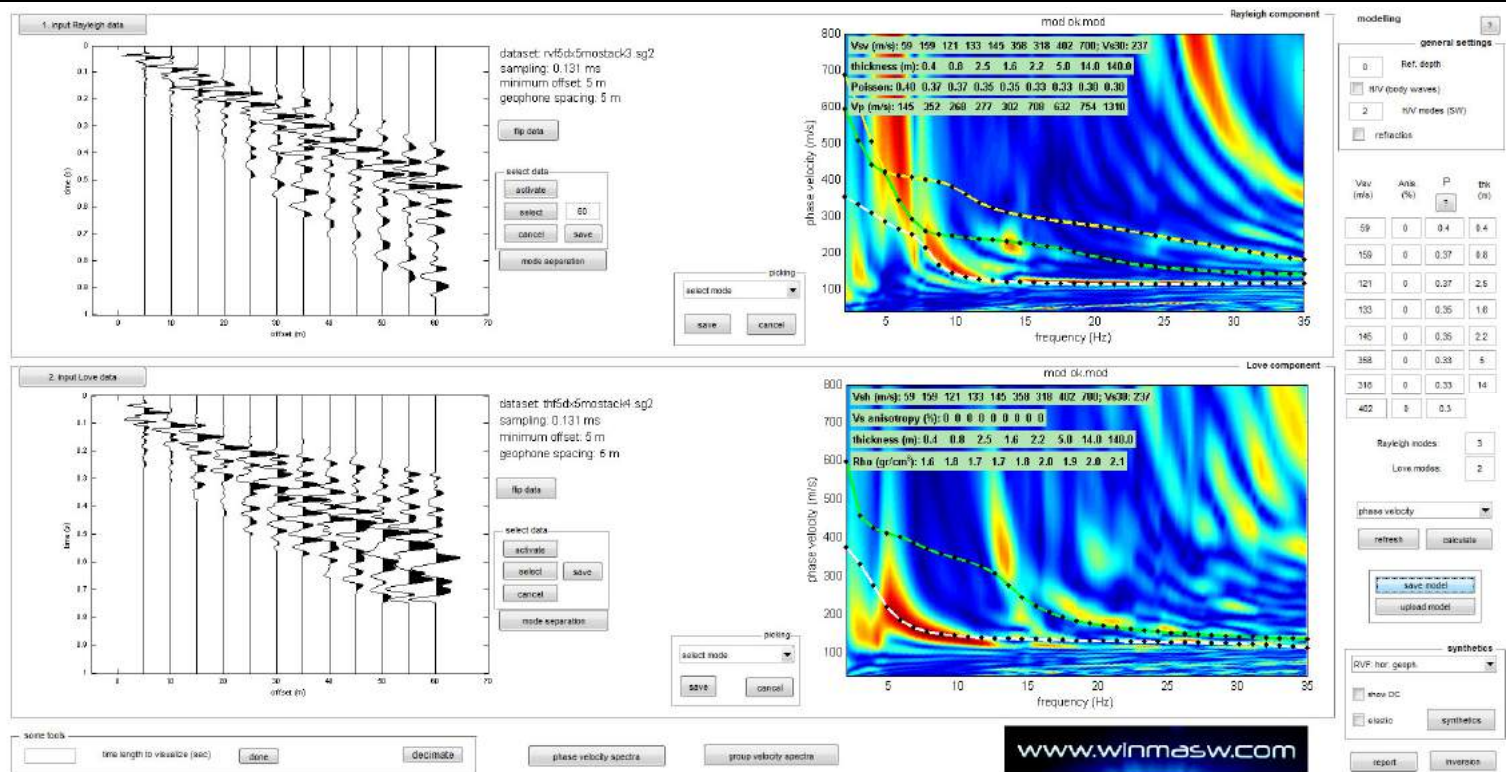
Sismografo SR04-GEOBOX
Sensore 2.0 Hz

Località
"Cimitero" di
San
Secondo
Parmense

COMMITTENTE:
Geol. Fabio Picinotti

ESECUZIONE (12-
19/09/2019):
Geol. Filippo Segalini
Geol. Davide Zucchi

034033L12 + 034033P198



Profondità		Velocità	Spessore
(m da p.c.)		(m/s)	(m)
0,0	0,4	59	0,4
0,4	1,2	159	0,8
1,2	3,7	121	2,5
3,7	5,3	133	1,6
5,3	7,5	145	2,2
7,5	12,5	358	5,0
12,5	26,5	318	14,0
26,5	166,5	402	140,0
26,5	inf.	700	-

allow data | reset | show location

step1 (optional) - decrease 150Hz | new frequency | recompute

step2 - HV computation

remove events | both Rad & Tr | clean axis

20 | window length (s) | 10 | tapering (%) | 10% | spectral smoothing (triangular window)

show particle motion (raw data) | ☒ full output | compute

step3a (optional) - directivity analysis

compute | max freq: 32 Hz

step3b (optional) - directivity over time

directivity in time | time step: 00 %

save - optional: save HVSR as it is

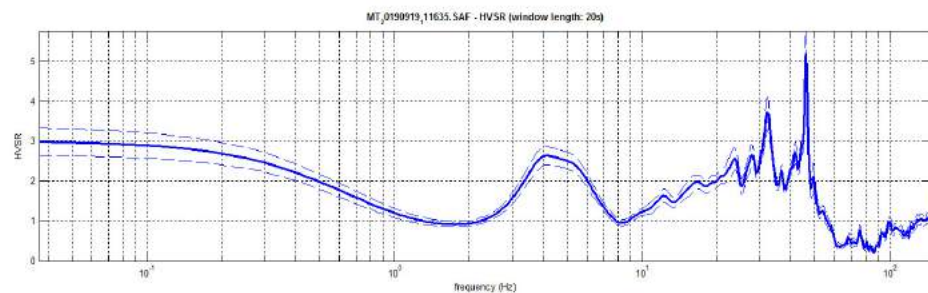
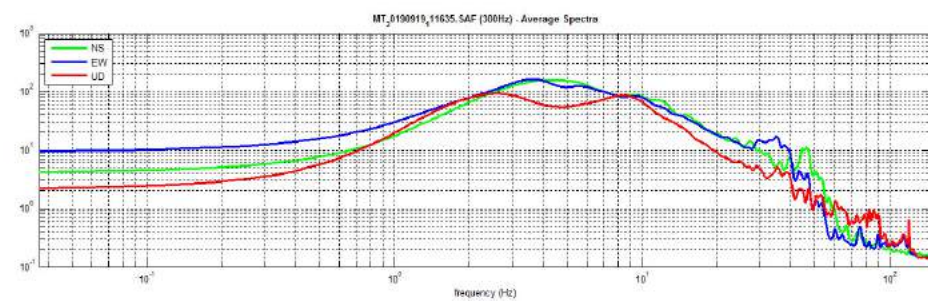
Save HV from: 0.45 to 04 Hz | save HV curve (as it is)

save - optional2: picking HV curve

pick HV curve | save picked HV | compute SE SAMT for picked curve

quick analysis (V/V_{10H})

average V_{10H} (m/s) | 100 | depth of the bedrock (m) | 20 | V_{10H} of the bedrock | 1000 |



Peak frequency (Hz): 4.2 (±3.9)

Peak HVSR value: 2.6 (±0.2)

== Criteria for a reliable H/V curve ==

- #1. [f₀ > 10/Lw]: 4.2 > 0.5 (OK)
- #2. [nc > 200]: 8519 > 200 (OK)
- #3. [f₀ > 0.5Hz; sigmaA(f) < 2 for 0.5f₀ < f < 2f₀] (OK)

== Criteria for a clear H/V peak (at least 5 should be fulfilled) ==

- #1. [exists f- in the range [f₀/4, f₀] | AH/V(f-) < A0/2]: yes, at frequency 2.8Hz (OK)
- #2. [exists f+ in the range [f₀, 4f₀] | AH/V(f+) < A0/2]: yes, at frequency 7.1Hz (OK)
- #3. [A0 > 2]: 2.6 > 2 (OK)
- #4. [fpeak[Ah/v(f) ± sigmaA(f)] = f₀ ± 5%]: (OK)
- #5. [sigmaA < epsilon(f₀)]: 3.913 > 0.209 (NO)
- #6. [sigmaA(f₀) < theta(f₀)]: 0.229 < 1.58 (OK)

STRUMENTAZIONE

Sismografo 24 canali (Echo 2002)
Geofoni orizzontali 4.5 Hz

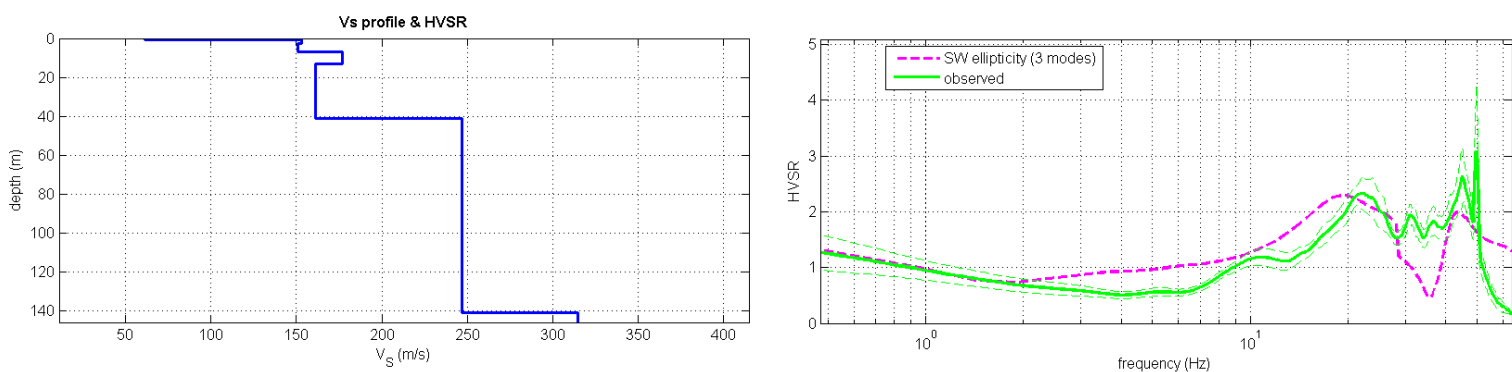
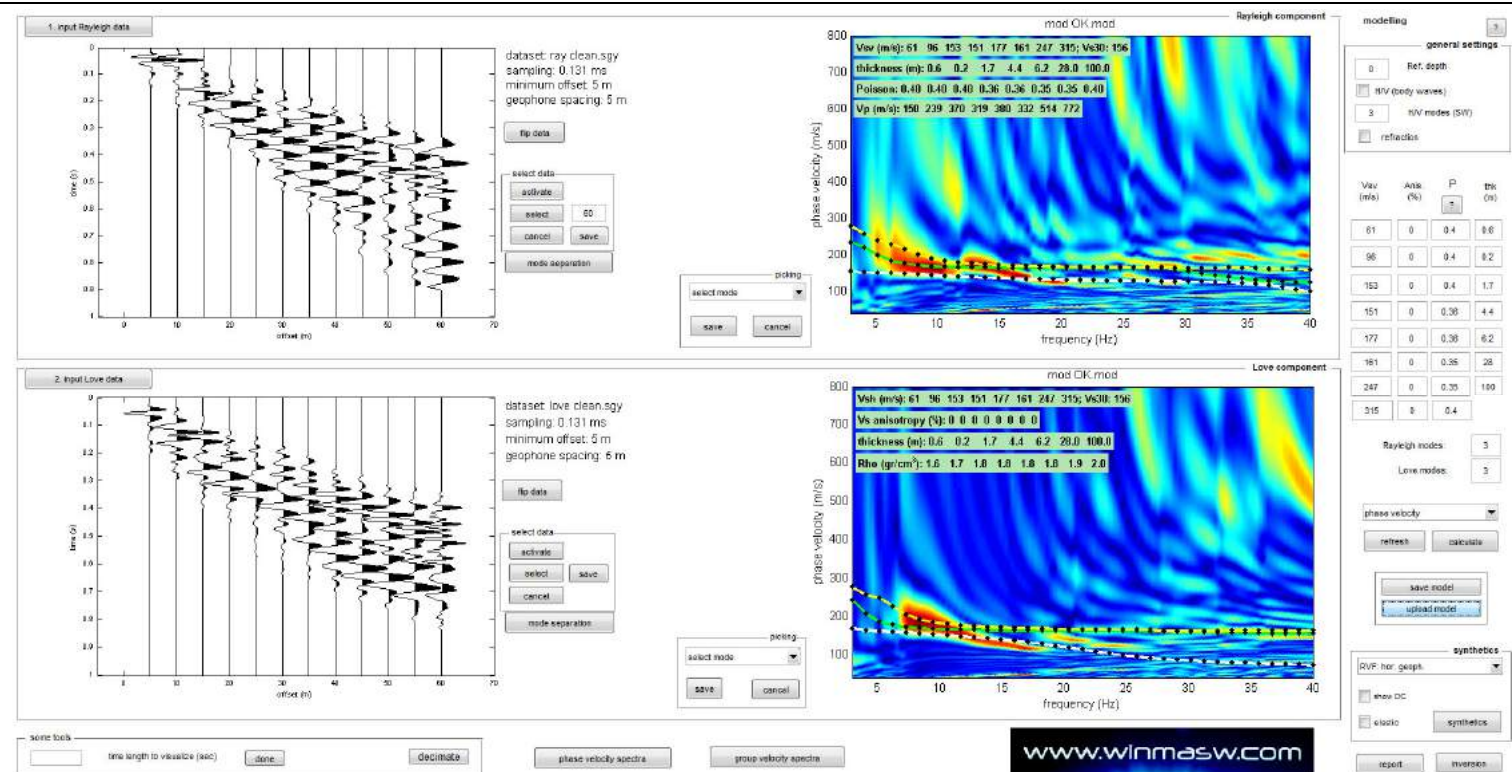
Sismografo SR04-GEOBOX
Sensore 2.0 Hz

Località
"Elisoccorso"
di San
Secondo
Parmense

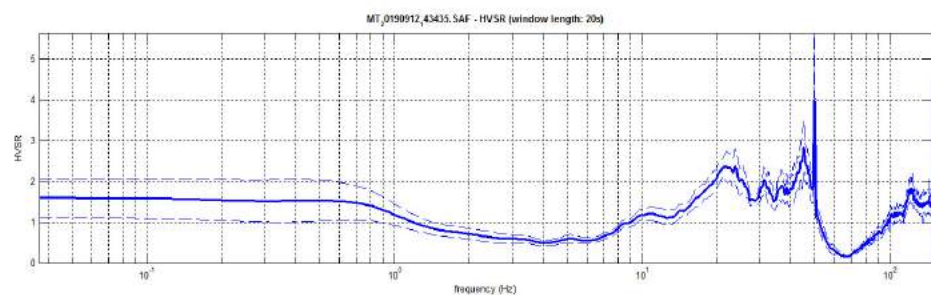
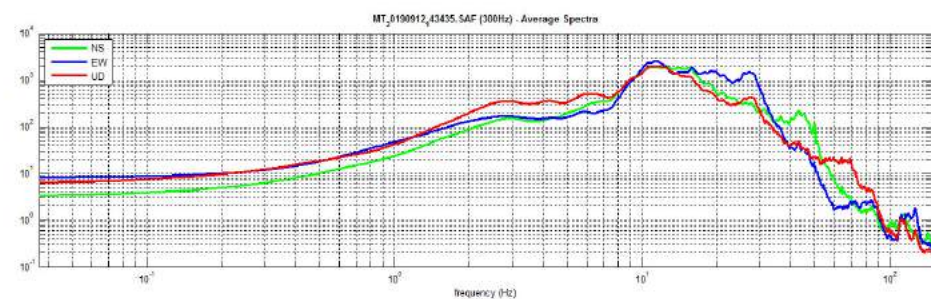
COMMITTENTE:
Geol. Fabio Picinotti

ESECUZIONE (19/09/2019):
Geol. Filippo Segalini
Geol. Davide Zucchi

034033L13 + 034033P199



Software interface for data processing, including steps for 'step1 (optional) - decrease', 'step2 - RV computation', 'step3a (optional) - directionality analysis', and 'step3b (optional) - directionality over time'. It includes various input fields and buttons for computation and saving.



Profondità		Velocità	Spessore
(m da p.c.)		(m/s)	(m)
0,0	0,6	61	0,6
0,6	0,8	96	0,2
0,8	2,5	153	1,7
2,5	6,9	151	4,4
6,9	13,1	177	6,2
13,1	41,1	161	28,0
41,1	141,1	247	100,0
141,1	inf.	315	-

STRUMENTAZIONE
Sismografo 24 canali (Echo 2002)
Geofoni orizzontali 4.5 Hz

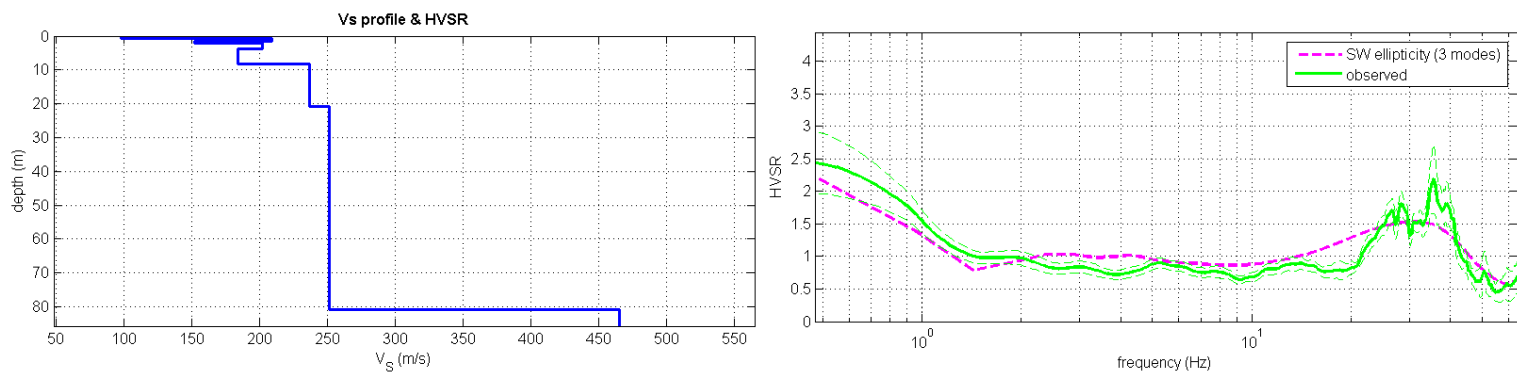
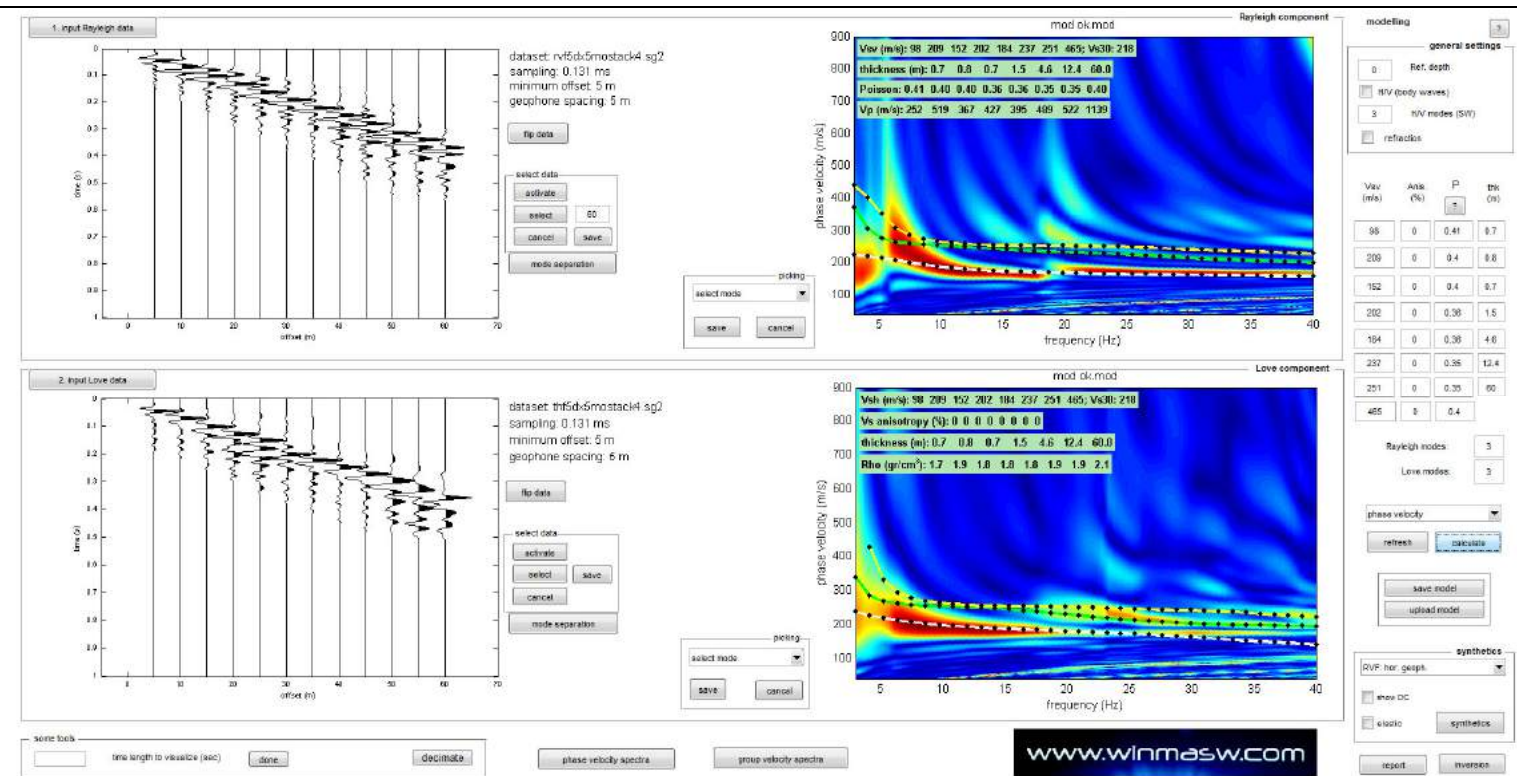
Sismografo SR04-GEOBOX
Sensore 2.0 Hz

Località
"Pizzo" di San
Secondo
Parmense

COMMITTENTE:
Geol. Fabio Picinotti

ESECUZIONE (12/09/2019):
Geol. Filippo Segalini
Geol. Davide Zucchi

034033L14 + 034033P200



Profondità		Velocità	Spessore
(m da p.c.)		(m/s)	(m)
0,0	0,7	98	0,7
0,7	1,5	209	0,8
1,5	2,2	152	0,7
2,2	3,7	202	1,5
3,7	8,3	184	4,6
8,3	20,7	237	12,4
20,7	80,7	251	60,0
80,7	inf.	465	-

show data reset show location

step1 (optional) - decimate

step2 - HV computation

step3a (optional) - directivity analysis

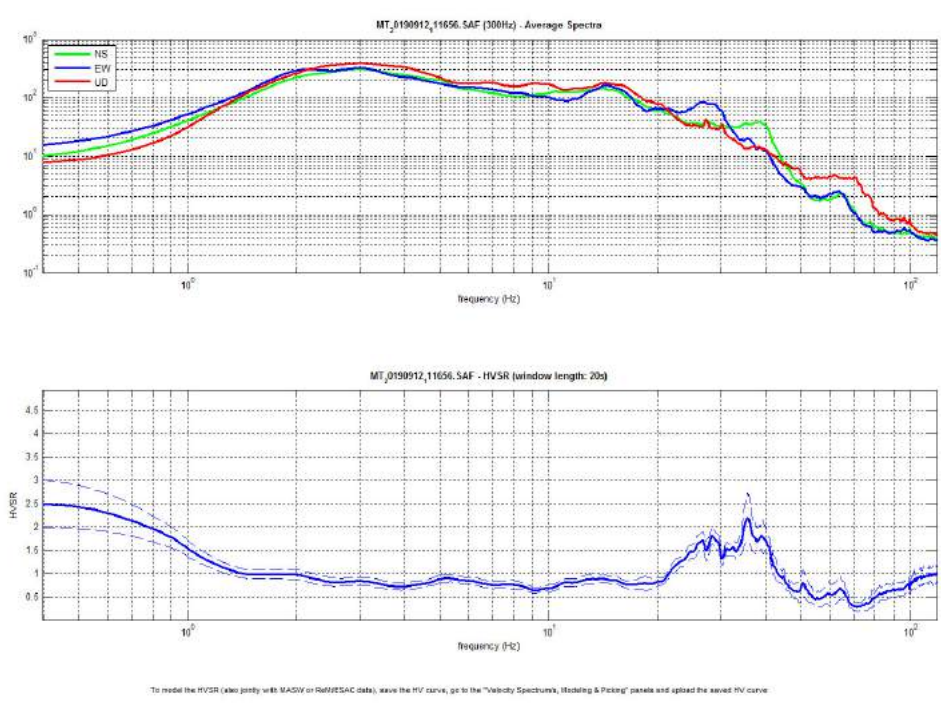
step3b (optional) - directivity over time

save - option1: save HVSR as it is

save - option2: picking HV curve

quick analysis (H-V/LH)

www.winmasw.com



STRUMENTAZIONE

Sismografo 24 canali (Echo 2002)

Geofoni orizzontali 4.5 Hz

Sismografo SR04-GEOBOX

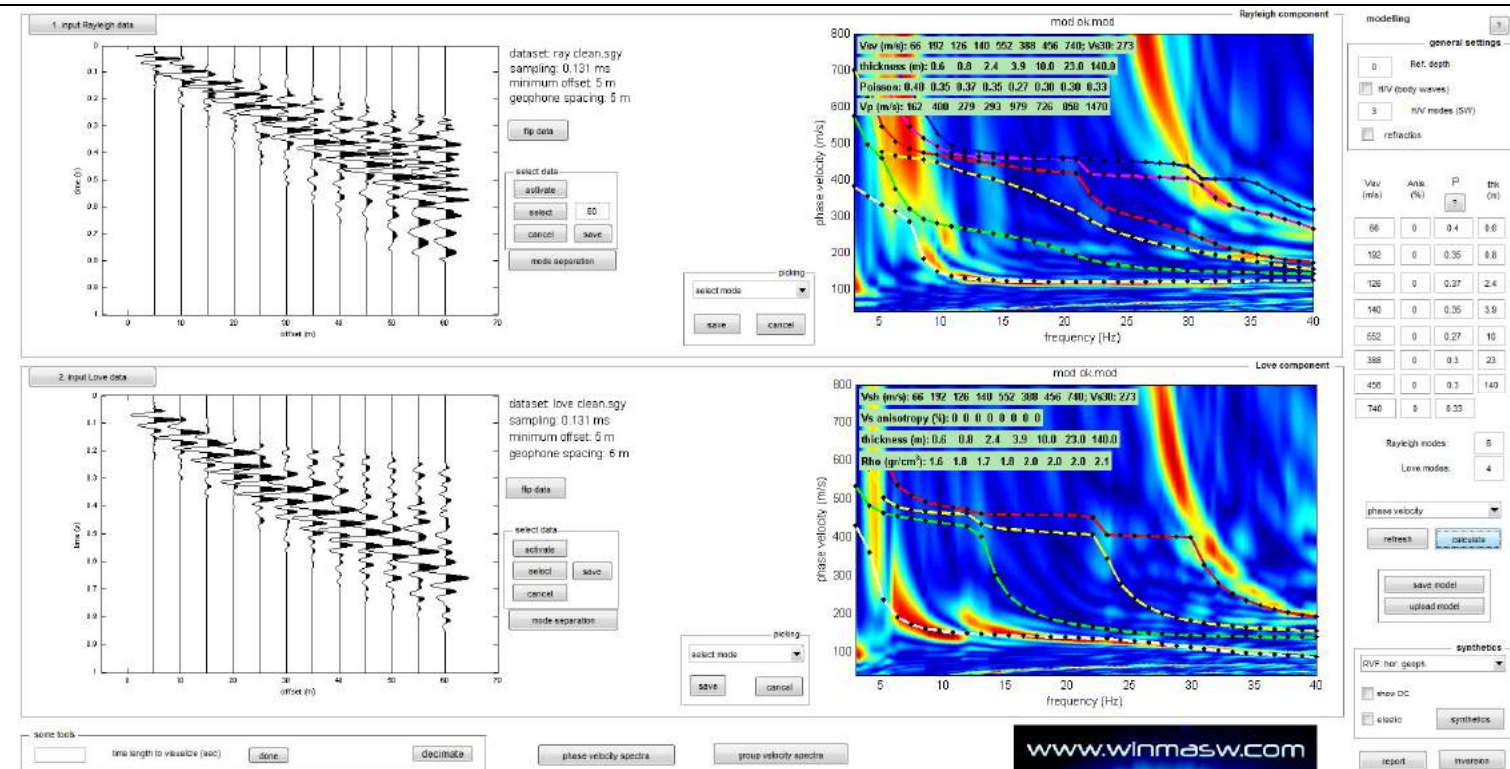
Sensore 2.0 Hz

Località "Ponte
su Taro" di San
Secondo
Parmense

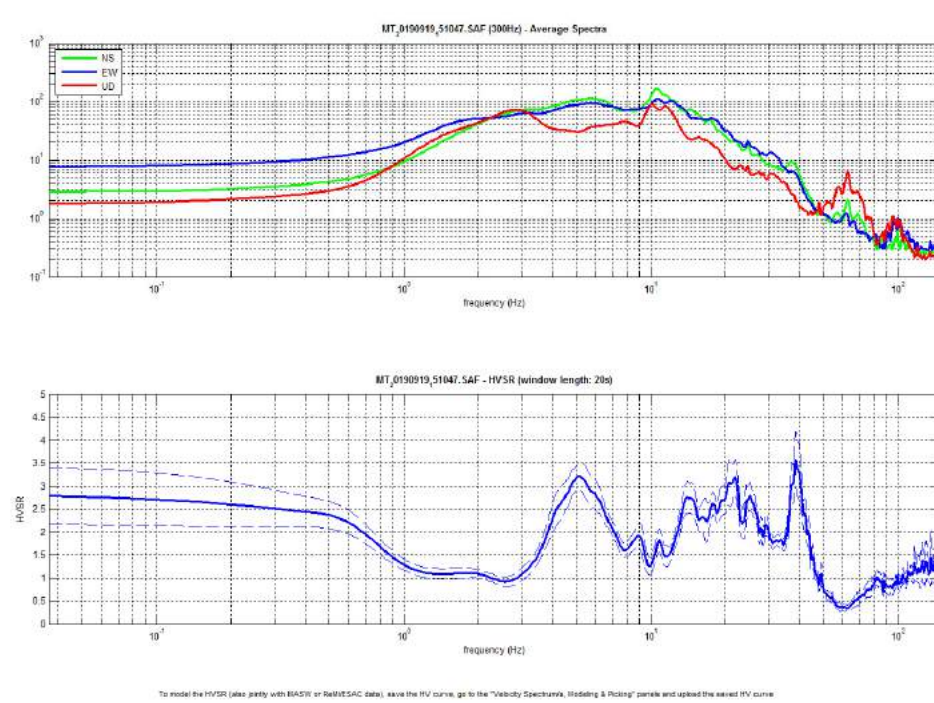
COMMITTENTE:
Geol. Fabio Picinotti

ESECUZIONE (12/09/2019):
Geol. Filippo Segalini
Geol. Davide Zucchi

034033L15 + 034033P201



Profondità		Velocità	Spessore
(m da p.c.)		(m/s)	(m)
0,0	0,6	66	0,6
0,6	1,4	192	0,8
1,4	3,8	126	2,4
3,8	7,7	140	3,9
7,7	17,7	552	10,0
17,7	40,7	388	23,0
40,7	180,7	456	140,0
180,7	inf.	740	-



Peak frequency (Hz): 5.2 (± 6.1)
Peak HVSR value: 3.2 (± 0.3)

Criteria for a reliable H/V curve

- #1. $[f_0 > 10/L.w]: 5.2 > 0.5$ (OK)
- #2. $[n_c > 200]: 9297 > 200$ (OK)
- #3. $[f_0 > 0.5\text{Hz}; \sigma_{\text{H/V}}(f) < 2 \text{ for } 0.5f_0 < f < 2f_0]$ (OK)

Criteria for a clear H/V peak (at least 5 should be fulfilled)

- #1. [exists f^- in the range $[f_0/4, f_0]$ | $AH/V(f^-) < A_0/2$]: yes, at frequency 3.6Hz (OK)
- #2. [exists f^+ in the range $[f_0, 4f_0]$ | $AH/V(f^+) < A_0/2$]: yes, at frequency 7.8Hz (OK)
- #3. $[A_0 > 2]: 3.2 > 2$ (OK)
- #4. $[f_{\text{peak}}[AH/V(f) \pm \sigma_{\text{H/V}}(f)] = f_0 \pm 5\%]$: (OK)
- #5. $[\sigma_{\text{H/V}} < \epsilon_{\text{H/V}}(f_0)]: 6.065 > 0.258$ (NO)
- #6. $[\sigma_{\text{H/V}}(f_0) < \theta_{\text{H/V}}(f_0)]: 0.265 < 1.58$ (OK)

STRUMENTAZIONE
Sismografo 24 canali (Echo 2002)
Geofoni orizzontali 4.5 Hz

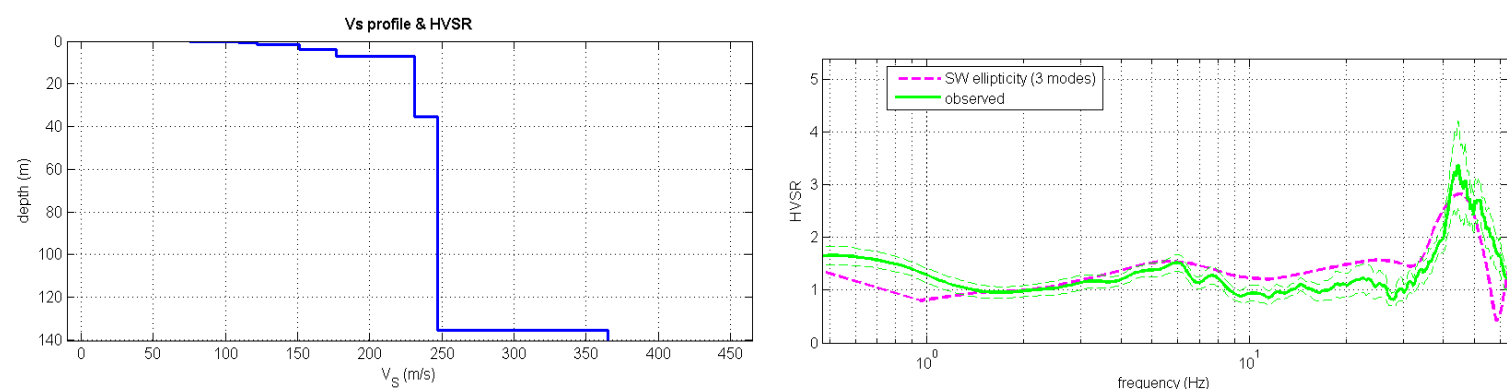
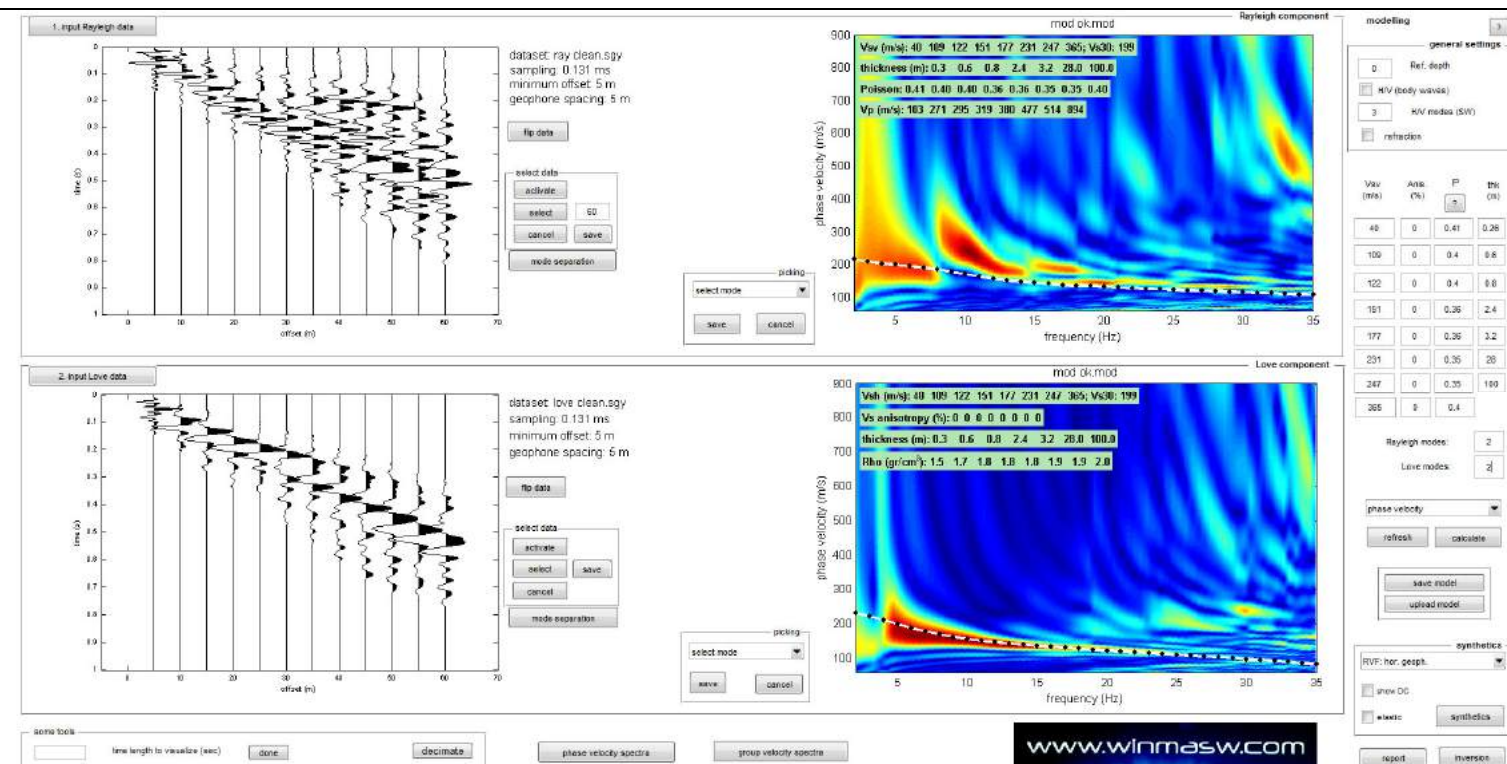
Sismografo SR04-GEOBOX
Sensore 2.0 Hz

Località
"Castellaicardi"
di San Secondo
Parmense

COMMITTENTE:
Geol. Fabio Picinotti

ESECUZIONE (19/09/2019):
Geol. Filippo Segalini
Geol. Davide Zucchi

034033L16 + 034033P202



Profondità		Velocità	Spessore
(m da p.c.)		(m/s)	(m)
0,0	0,3	40	0,3
0,3	0,9	109	0,6
0,9	1,7	122	0,8
1,7	4,1	151	2,4
4,1	7,3	177	3,2
7,3	35,3	231	28,0
35,3	135,3	247	100,0
135,3	inf.	365	-

show data reset show location

step01 (optional) - decimate

120Hz new frequency resample

step02 - HV computation

remove events both flat & 1% clean axis

20 window length (s)

10 tapering (%)

5% spectral smoothing (triangular window)

show particle motion (raw data)

full output compute

step03a (optional) - directivity analysis

complete main freq: 32 Hz

step03b (optional) - directivity over time

directivity in time data skip: 60 %

save - optional: save HV/SR as it is

Save HV from 0.40 to 64 Hz

save HV curve (as it is)

save - optional: picking HV curve

pick HV curve save picked HV

complete SESAME for picked curve

quick analysis (H-Vs/HR)

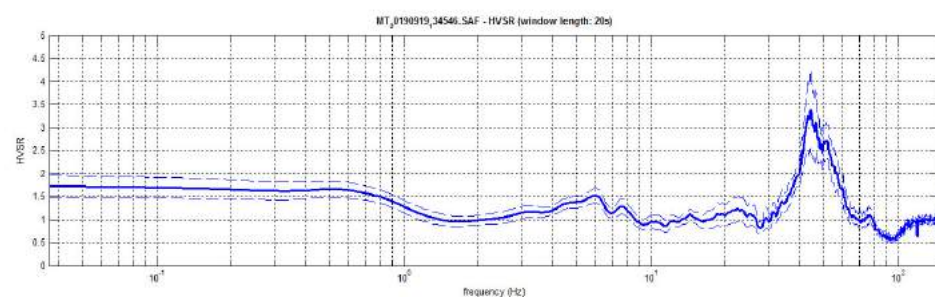
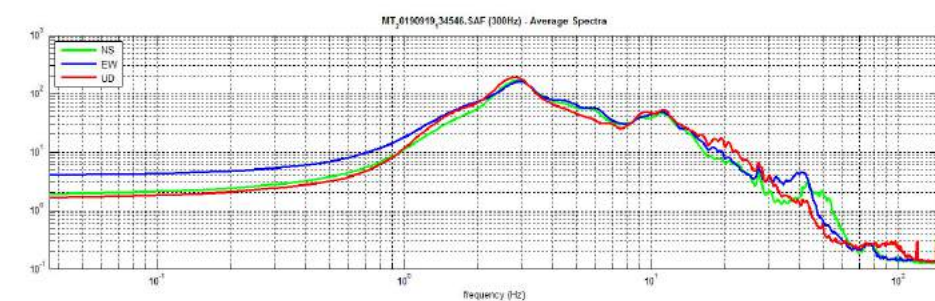
average Vs (m/s) (from surface to bedrock)

100

20 depth of the bedrock (m)

1000 1/3 of the bedrock

plot compute



Peak frequency (Hz): 5.9 (±6.1)

Peak HVSR value: 1.5 (±0.2)

== Criteria for a reliable H/V curve ==

- #1. $[f_0 > 10/Lw]: 5.9 > 0.5$ (OK)
- #2. $[nc > 200]: 14004 > 200$ (OK)
- #3. $[f_0 > 0.5\text{Hz}; \sigma_A(f) < 2 \text{ for } 0.5f_0 < f < 2f_0]$ (OK)

== Criteria for a clear H/V peak (at least 5 should be fulfilled) ==

- #1. $[\text{exists } f^- \text{ in the range } [f_0/4, f_0] \mid AH/V(f^-) < A_0/2]:$ (NO)
- #2. $[\text{exists } f^+ \text{ in the range } [f_0, 4f_0] \mid AH/V(f^+) < A_0/2]:$ (NO)
- #3. $[A_0 > 2]: 1.5 < 2$ (NO)
- #4. $[f_{\text{peak}}[Ah/v(f) \pm \sigma_A(f)] = f_0 \pm 5\%]:$ (OK)
- #5. $[\sigma_A(f) < \epsilon(f_0)]: 6.145 > 0.297$ (NO)
- #6. $[\sigma_A(f_0) < \theta(f_0)]: 0.158 < 1.58$ (OK)

STRUMENTAZIONE

Sismografo 24 canali (Echo 2002)
Geofoni orizzontali 4.5 Hz

Sismografo SR04-GEOBOX
Sensore 2.0 Hz

Località "La
Valle" di San
Secondo
Parmense

COMMITTENTE:
Geol. Fabio Picinotti

ESECUZIONE (19/09/2019):
Geol. Filippo Segalini
Geol. Davide Zucchi