PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

RegioneEmiliaRomagna

CONFERENZA DELLE REGIONI E DELLE PROVINCE AUTONOME

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

MICROZONAZIONE SISMICA

Livello 2

Allegato 3 – Report delle indagini

Regione Emilia-Romagna

Comune di Marano sul Panaro

Regione	Soggetto realizzatore	Data
EMILIA-ROMAGNA Studio realizzato con il contributo di cui all'OCPDC 780/2021 recepita con DGR 1885/2021	Dott. geologo Samuel Sangiorgi	Agosto 2022

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

036020P70277DS193

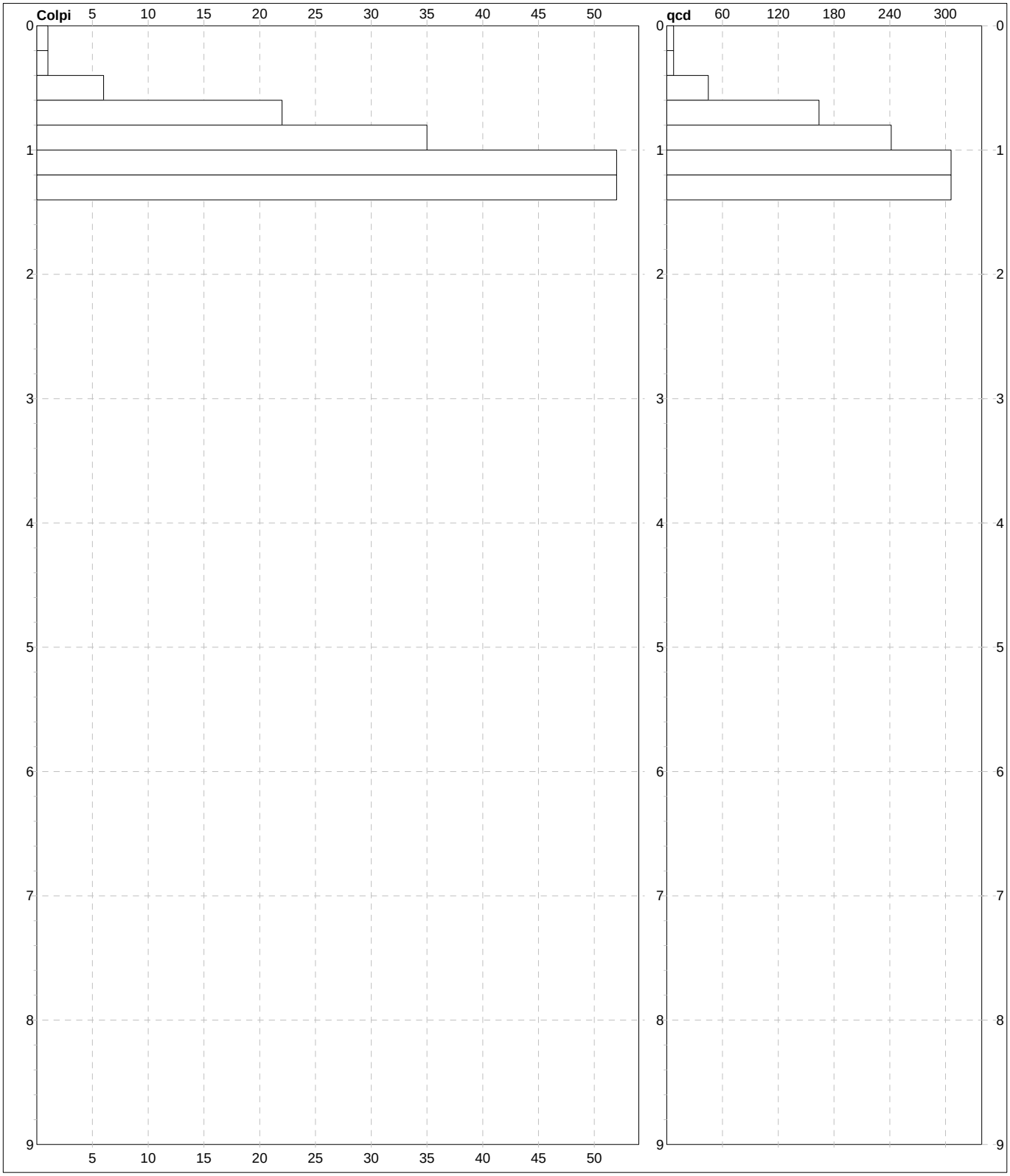
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	1
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **via Fondovalle sp4**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Scala: 1:45
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Quota ass.:
Falda: Assente



Penetrometro: DPSH (S. Heavy)
Massa battente: 63.50 m
Altezza caduta: 0.75 m
Avanzamento: 0.20 m

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

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	1
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **via Fondovalle sp4**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Falda: Assente

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0.20	1	1		7.45
0.40	1	1		7.45
0.60	2	6		44.69
0.80	2	22		163.87
1.00	2	35		241.66
1.20	2	67		462.60
1.40	2	70		483.32

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

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

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

036020P70278DS194

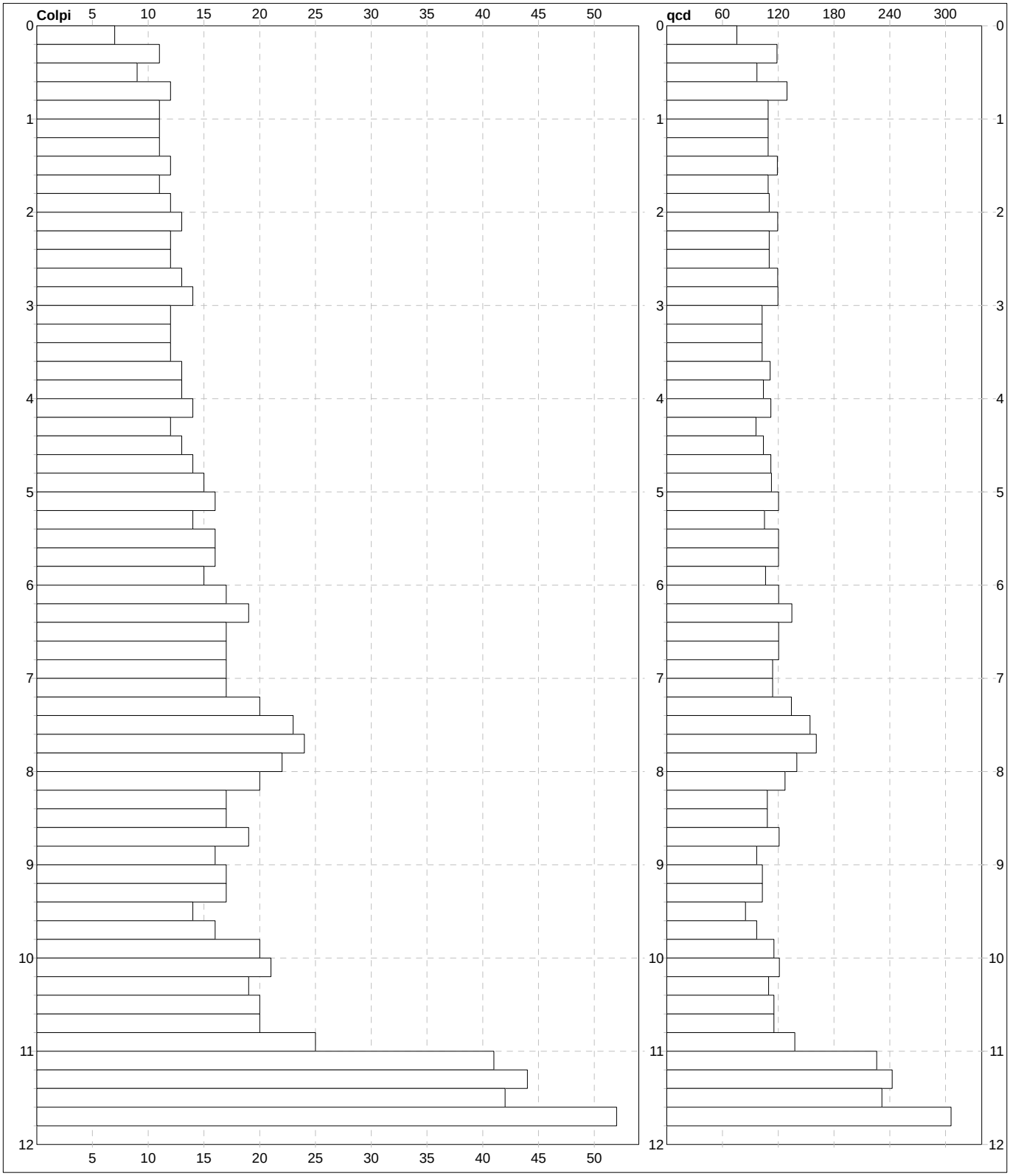
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	2
riferimento	038-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere:
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Scala: 1:60
Pagina: 1
Elaborato:

Data esec.: 15/05/2022
Quota ass.:
Falda: Foro chiuso



Penetrometro: DPSH (S. Heavy)
Massa battente: 63.50 m
Altezza caduta: 0.75 m
Avanzamento: 0.20 m

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

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	2
riferimento	038-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere:
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 15/05/2022
Falda: Foro chiuso

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0.20	1	7		75.50
0.40	1	11		118.64
0.60	2	9		97.07
0.80	2	12		129.42
1.00	2	11		109.15
1.20	2	11		109.15
1.40	2	11		109.15
1.60	3	12		119.07
1.80	3	11		109.15
2.00	3	12		110.25
2.20	3	13		119.44
2.40	3	12		110.25
2.60	4	12		110.25
2.80	4	13		119.44
3.00	4	14		119.75
3.20	4	12		102.65
3.40	4	12		102.65
3.60	5	12		102.65
3.80	5	13		111.20
4.00	5	13		104.03
4.20	5	14		112.03
4.40	5	12		96.02
4.60	6	13		104.03
4.80	6	14		112.03
5.00	6	15		112.76
5.20	6	16		120.27
5.40	6	14		105.24
5.60	7	16		120.27
5.80	7	16		120.27
6.00	7	15		106.31
6.20	7	17		120.49
6.40	7	19		134.66
6.60	8	17		120.49
6.80	8	17		120.49
7.00	8	17		113.97
7.20	8	17		113.97
7.40	8	20		134.09
7.60	9	23		154.20
7.80	9	24		160.91
8.00	9	22		139.93
8.20	9	20		127.21
8.40	9	17		108.13
8.60	10	17		108.13
8.80	10	19		120.85
9.00	10	16		96.80
9.20	10	17		102.86
9.40	10	17		102.86
9.60	11	14		84.70
9.80	11	16		96.80
10.00	11	20		115.38
10.20	11	21		121.15
10.40	11	19		109.61
10.60	12	20		115.38
10.80	12	20		115.38
11.00	12	25		137.81
11.20	12	41		226.01
11.40	12	44		242.55
11.60	13	42		231.53
11.80	13	65		358.31

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

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

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

036020P70279DS195

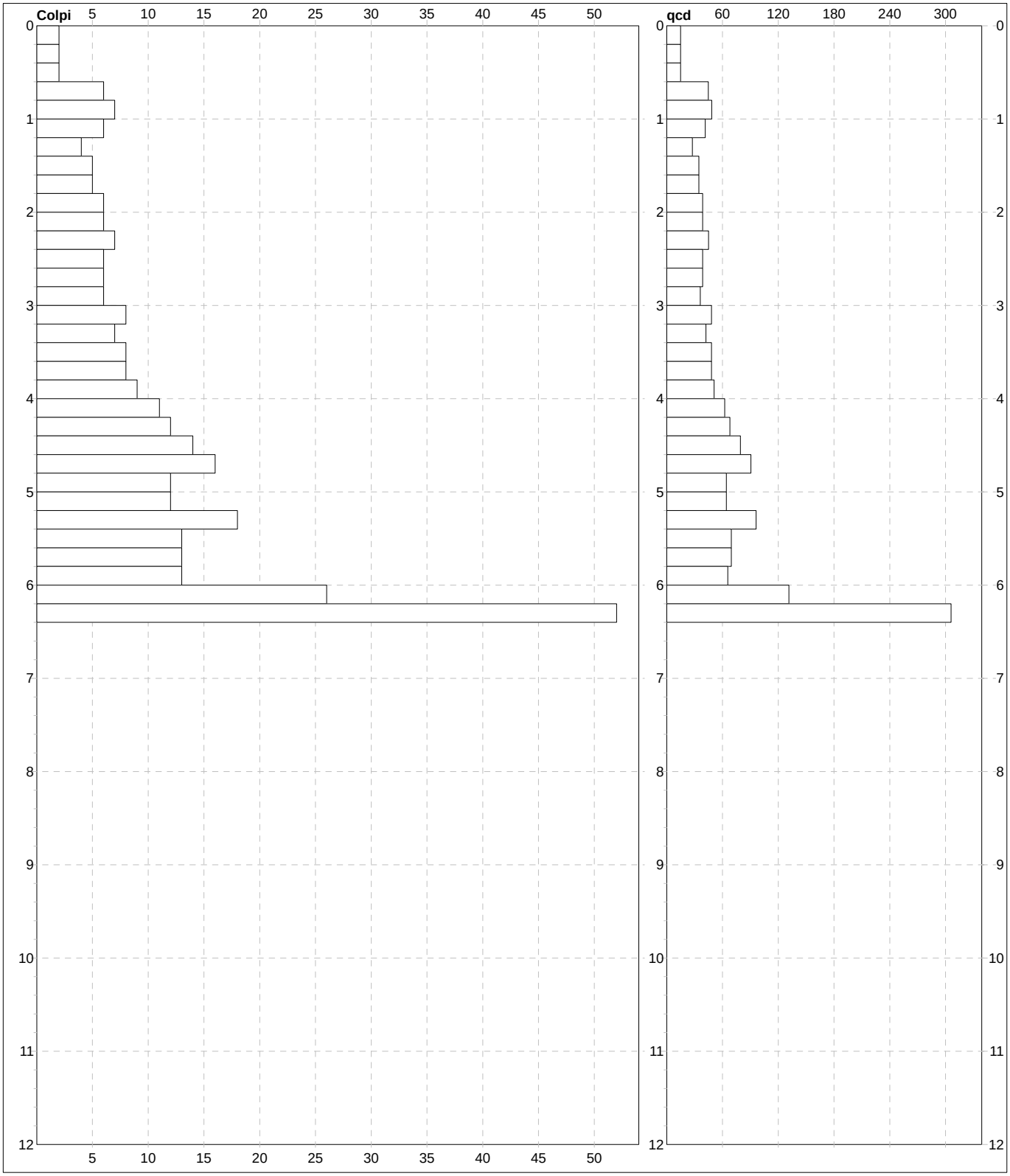
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	3
riferimento	038-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere:
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Scala: 1:60
Pagina: 1
Elaborato:

Data esec.: 15/05/2022
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63.50 m
Altezza caduta: 0.75 m
Avanzamento: 0.20 m

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

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	3
riferimento	038-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere:
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 15/05/2022
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0.20	1	2		14.90
0.40	1	2		14.90
0.60	2	2		14.90
0.80	2	6		44.69
1.00	2	7		48.33
1.20	2	6		41.43
1.40	2	4		27.62
1.60	3	5		34.52
1.80	3	5		34.52
2.00	3	6		38.61
2.20	3	6		38.61
2.40	3	7		45.04
2.60	4	6		38.61
2.80	4	6		38.61
3.00	4	6		36.15
3.20	4	8		48.19
3.40	4	7		42.17
3.60	5	8		48.19
3.80	5	8		48.19
4.00	5	9		50.97
4.20	5	11		62.30
4.40	5	12		67.96
4.60	6	14		79.29
4.80	6	16		90.61
5.00	6	12		64.12
5.20	6	12		64.12
5.40	6	18		96.18
5.60	7	13		69.46
5.80	7	13		69.46
6.00	7	13		65.74
6.20	7	26		131.49
6.40	7	65		328.72

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

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

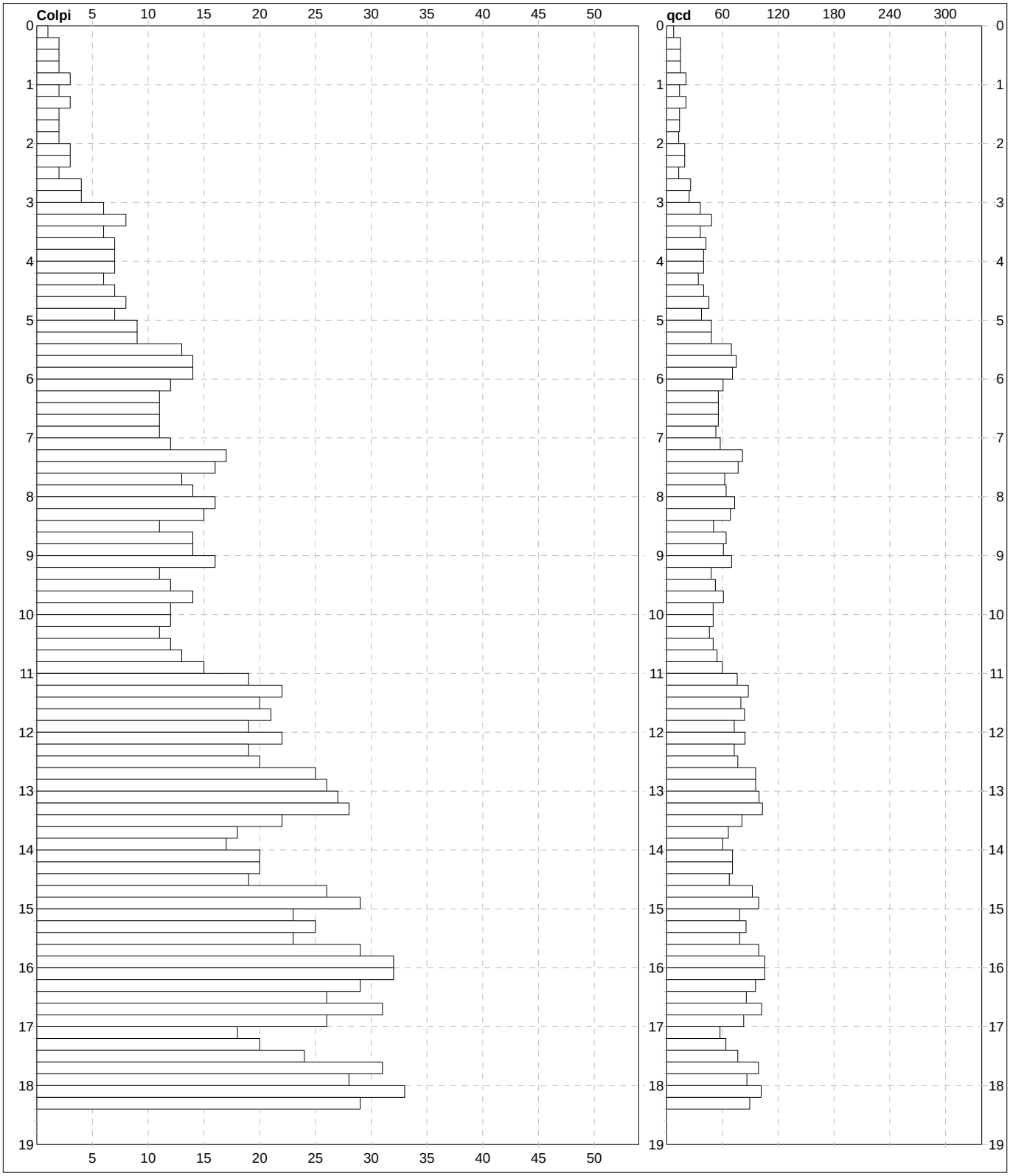
Servizi Geotecnici Raffaele Scircoli
Via Nazionale Toscana, 16 - 40068 S Lazzaro (Bo)

036020P70280DS196

PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	4
riferimento	033-2022

Committente:	**dott geol Samuel Sangiorgi**	U.M.:	**kg/cm²**	Data esec.:	28/04/2022
Cantiere:	**Ospitaletto**	Scala:	1:95	Quota ass.:	
Località:	**Marano sul Panaro**	Pagina:	1		
		Elaborato:		Falda:	Non rilevata



Penetrometro:	DPSH (S. Heavy)		
Massa battente:	63.50 m		
Altezza caduta:	0.75 m		
Avanzamento:	0.20 m		

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

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	4
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **Ospitaletto**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0.20	1	1		7.45
0.40	1	2		14.90
0.60	2	2		14.90
0.80	2	2		14.90
1.00	2	3		20.71
1.20	2	2		13.81
1.40	2	3		20.71
1.60	3	2		13.81
1.80	3	2		13.81
2.00	3	2		12.87
2.20	3	3		19.30
2.40	3	3		19.30
2.60	4	2		12.87
2.80	4	4		25.74
3.00	4	4		24.10
3.20	4	6		36.15
3.40	4	8		48.19
3.60	5	6		36.15
3.80	5	7		42.17
4.00	5	7		39.64
4.20	5	7		39.64
4.40	5	6		33.98
4.60	6	7		39.64
4.80	6	8		45.31
5.00	6	7		37.40
5.20	6	9		48.09
5.40	6	9		48.09
5.60	7	13		69.46
5.80	7	14		74.80
6.00	7	14		70.80
6.20	7	12		60.69
6.40	7	11		55.63
6.60	8	11		55.63
6.80	8	11		55.63
7.00	8	11		52.80
7.20	8	12		57.60
7.40	8	17		81.61
7.60	9	16		76.80
7.80	9	13		62.40
8.00	9	14		63.96
8.20	9	16		73.09
8.40	9	15		68.52
8.60	10	11		50.25
8.80	10	14		63.96
9.00	10	14		61.01
9.20	10	16		69.72
9.40	10	11		47.93
9.60	11	12		52.29
9.80	11	14		61.01
10.00	11	12		49.99
10.20	11	12		49.99
10.40	11	11		45.82
10.60	12	12		49.99
10.80	12	13		54.15
11.00	12	15		59.85
11.20	12	19		75.80
11.40	12	22		87.77
11.60	13	20		79.79
11.80	13	21		83.78
12.00	13	19		72.73
12.20	13	22		84.22
12.40	13	19		72.73
12.60	14	20		76.56
12.80	14	25		95.70
13.00	14	26		95.66
13.20	14	27		99.33
13.40	14	28		103.01
13.60	15	22		80.94
13.80	15	18		66.22
14.00	15	17		60.20
14.20	15	20		70.82
14.40	15	20		70.82
14.60	16	19		67.28
14.80	16	26		92.07
15.00	16	29		98.99
15.20	1	23		78.51
15.40	1	25		85.33
15.60	2	23		78.51
15.80	2	29		98.99
16.00	2	32		105.42
16.20	2	32		105.42
16.40	2	29		95.54
16.60	3	26		85.65
16.80	3	31		102.12
17.00	3	26		82.77
17.20	3	18		57.30
17.40	3	20		63.67
17.60	4	24		76.40
17.80	4	31		98.68
18.00	4	28		86.23
18.20	4	33		101.63
18.40	4	29		89.31

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

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

036020P70281DS197

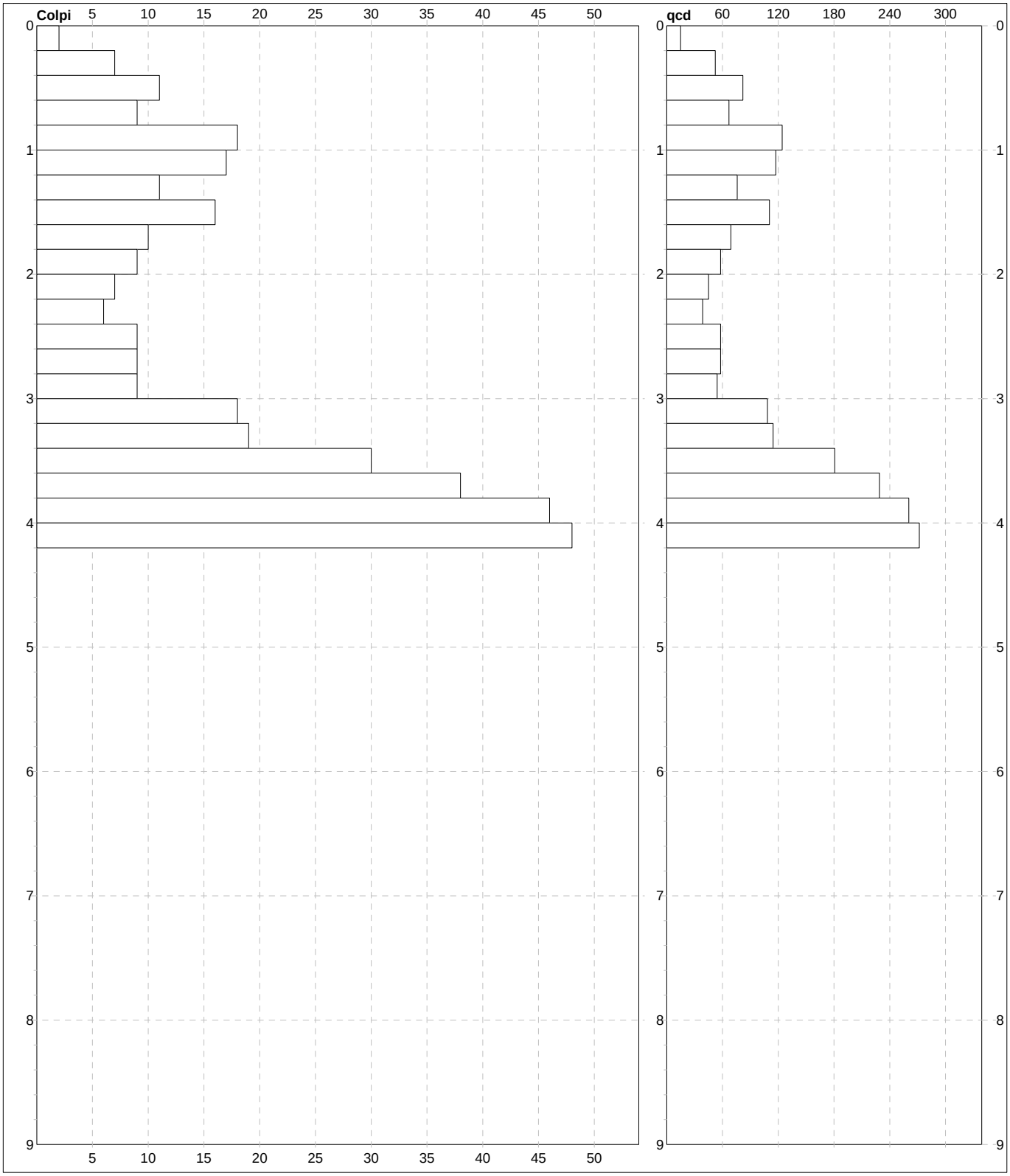
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	5
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **Casona**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Scala: 1:45
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63.50 m
Altezza caduta: 0.75 m
Avanzamento: 0.20 m

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

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	5
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **Casona**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0.20	1	2		14.90
0.40	1	7		52.14
0.60	2	11		81.94
0.80	2	9		67.04
1.00	2	18		124.28
1.20	2	17		117.38
1.40	2	11		75.95
1.60	3	16		110.47
1.80	3	10		69.05
2.00	3	9		57.91
2.20	3	7		45.04
2.40	3	6		38.61
2.60	4	9		57.91
2.80	4	9		57.91
3.00	4	9		54.22
3.20	4	18		108.44
3.40	4	19		114.46
3.60	5	30		180.73
3.80	5	38		228.92
4.00	5	46		260.51
4.20	5	48		271.84

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

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

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

036020P70282DS198

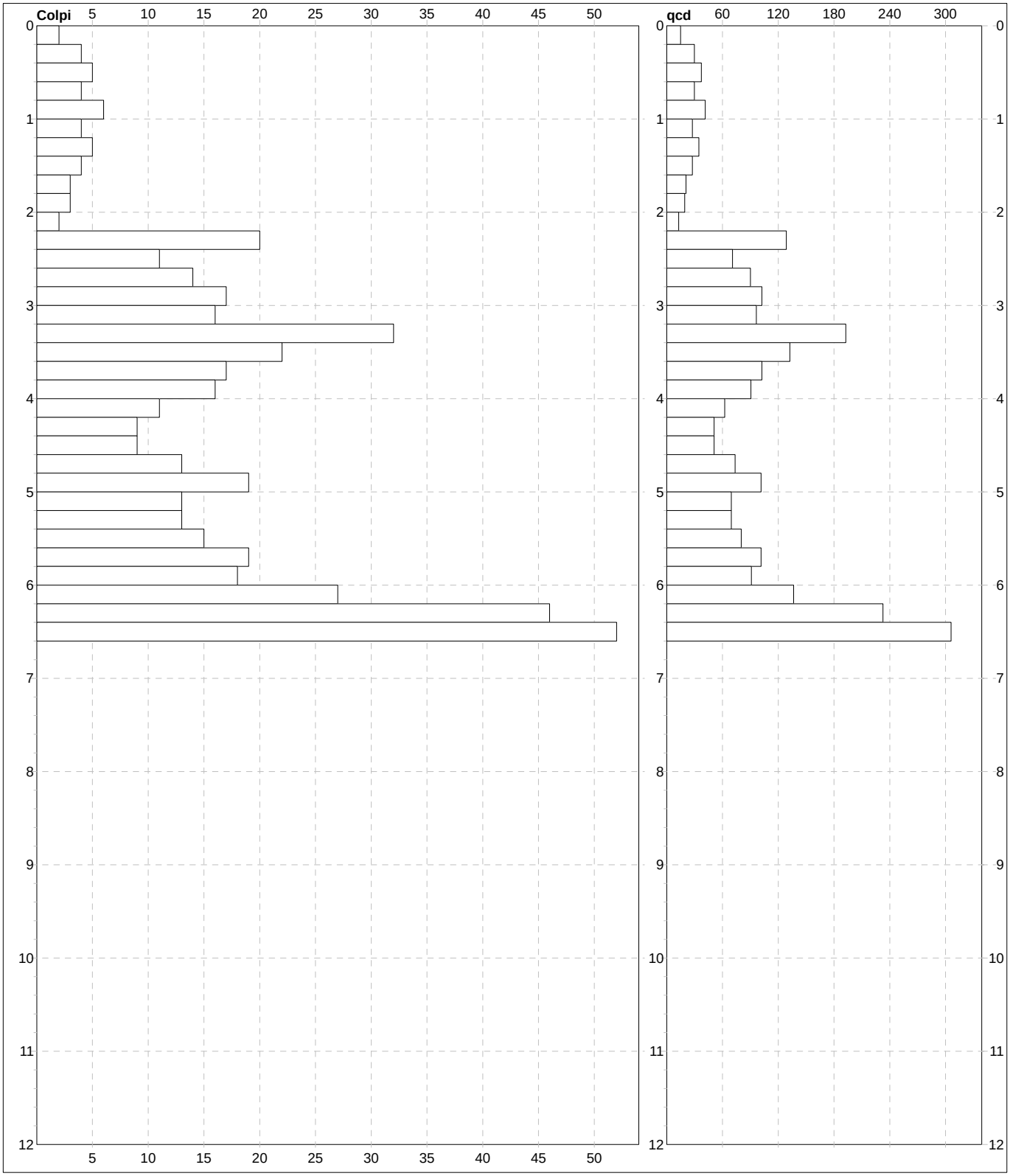
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	6
riferimento	038-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere:
Località: **Marano sul Panaro sp4 Casona/Ost Vecchia**

U.M.: **kg/cm²**
Scala: 1:60
Pagina: 1
Elaborato:

Data esec.: 15/05/2022
Quota ass.:
Falda: Foro chiuso



Penetrometro: DPSH (S. Heavy)
Massa battente: 63.50 m
Altezza caduta: 0.75 m
Avanzamento: 0.20 m

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

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	6
riferimento	038-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere:
Località: **Marano sul Panaro sp4 Casona/Ost Vecchia**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 15/05/2022
Falda: Foro chiuso

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0.20	1	2		14.90
0.40	1	4		29.80
0.60	2	5		37.24
0.80	2	4		29.80
1.00	2	6		41.43
1.20	2	4		27.62
1.40	2	5		34.52
1.60	3	4		27.62
1.80	3	3		20.71
2.00	3	3		19.30
2.20	3	2		12.87
2.40	3	20		128.69
2.60	4	11		70.78
2.80	4	14		90.08
3.00	4	17		102.41
3.20	4	16		96.39
3.40	4	32		192.78
3.60	5	22		132.53
3.80	5	17		102.41
4.00	5	16		90.61
4.20	5	11		62.30
4.40	5	9		50.97
4.60	6	9		50.97
4.80	6	13		73.62
5.00	6	19		101.52
5.20	6	13		69.46
5.40	6	13		69.46
5.60	7	15		80.15
5.80	7	19		101.52
6.00	7	18		91.03
6.20	7	27		136.54
6.40	7	46		232.63
6.60	8	65		328.72

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

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

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

036020P70283DS199

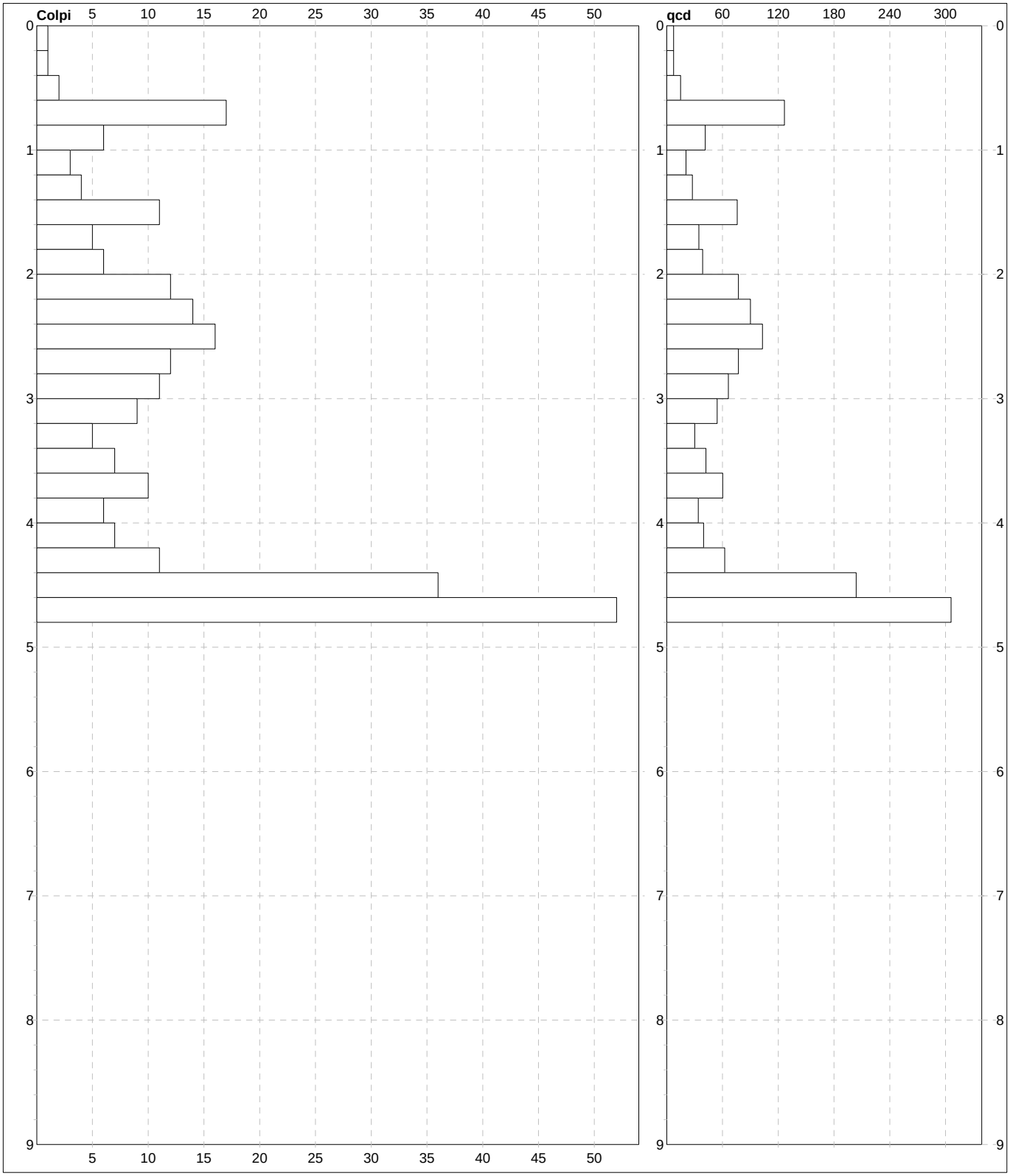
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	7
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **Festà cimitero**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Scala: 1:45
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63.50 m
Altezza caduta: 0.75 m
Avanzamento: 0.20 m

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

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	7
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **Festà cimitero**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0.20	1	1		7.45
0.40	1	1		7.45
0.60	2	2		14.90
0.80	2	17		126.63
1.00	2	6		41.43
1.20	2	3		20.71
1.40	2	4		27.62
1.60	3	11		75.95
1.80	3	5		34.52
2.00	3	6		38.61
2.20	3	12		77.21
2.40	3	14		90.08
2.60	4	16		102.95
2.80	4	12		77.21
3.00	4	11		66.27
3.20	4	9		54.22
3.40	4	5		30.12
3.60	5	7		42.17
3.80	5	10		60.24
4.00	5	6		33.98
4.20	5	7		39.64
4.40	5	11		62.30
4.60	6	36		203.88
4.80	6	60		339.80

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

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

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

036020P70284DS200

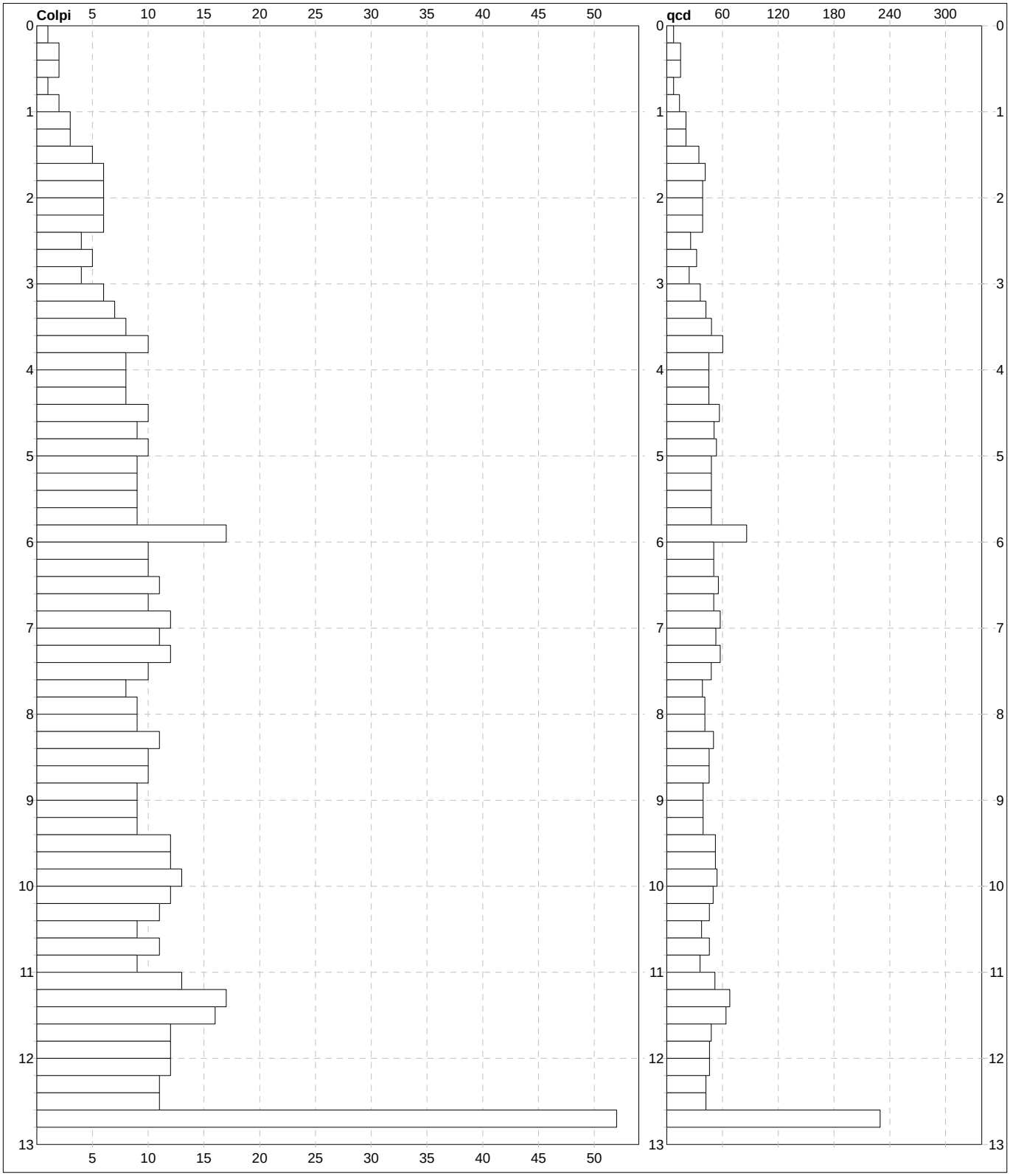
PROVA PENETROMETRICA DINAMICA
DIAGRAMMI COLPI / RESISTENZA

DIN	8
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **Puzzole**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Scala: 1:65
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Quota ass.:
Falda: Non rilevata



Penetrometro: DPSH (S. Heavy)
Massa battente: 63.50 m
Altezza caduta: 0.75 m
Avanzamento: 0.20 m

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

PROVA PENETROMETRICA DINAMICA
LETTURE DI CAMPAGNA PUNTA E/O TOTALE

DIN	8
riferimento	033-2022

Committente: **dott geol Samuel Sangiorgi**
Cantiere: **Puzzole**
Località: **Marano sul Panaro**

U.M.: **kg/cm²**
Pagina: 1
Elaborato:

Data esec.: 28/04/2022
Falda: Non rilevata

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²
0.20	1	1		7.45
0.40	1	2		14.90
0.60	2	2		14.90
0.80	2	1		7.45
1.00	2	2		13.81
1.20	2	3		20.71
1.40	2	3		20.71
1.60	3	5		34.52
1.80	3	6		41.43
2.00	3	6		38.61
2.20	3	6		38.61
2.40	3	6		38.61
2.60	4	4		25.74
2.80	4	5		32.17
3.00	4	4		24.10
3.20	4	6		36.15
3.40	4	7		42.17
3.60	5	8		48.19
3.80	5	10		60.24
4.00	5	8		45.31
4.20	5	8		45.31
4.40	5	8		45.31
4.60	6	10		56.63
4.80	6	9		50.97
5.00	6	10		53.43
5.20	6	9		48.09
5.40	6	9		48.09
5.60	7	9		48.09
5.80	7	9		48.09
6.00	7	17		85.97
6.20	7	10		50.57
6.40	7	10		50.57
6.60	8	11		55.63
6.80	8	10		50.57
7.00	8	12		57.60
7.20	8	11		52.80
7.40	8	12		57.60
7.60	9	10		48.00
7.80	9	8		38.40
8.00	9	9		41.11
8.20	9	9		41.11
8.40	9	11		50.25
8.60	10	10		45.68
8.80	10	10		45.68
9.00	10	9		39.22
9.20	10	9		39.22
9.40	10	9		39.22
9.60	11	12		52.29
9.80	11	12		52.29
10.00	11	13		54.15
10.20	11	12		49.99
10.40	11	11		45.82
10.60	12	9		37.49
10.80	12	11		45.82
11.00	12	9		35.91
11.20	12	13		51.87
11.40	12	17		67.82
11.60	13	16		63.84
11.80	13	12		47.88
12.00	13	12		45.94
12.20	13	12		45.94
12.40	13	11		42.11
12.60	14	11		42.11
12.80	14	60		229.69

H m	Asta n°	L1 n°	L2 n°	qcd kg/cm²

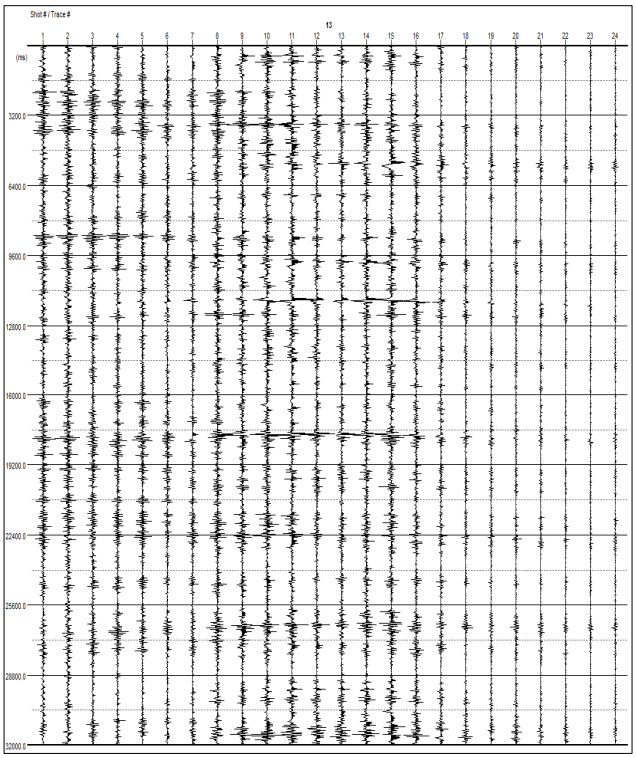
H = profondità
L1 = prima lettura (colpi punta)
L2 = seconda lettura (colpi rivestimento)
qcd = resistenza dinamica punta
Asta = numero di asta impiegata

PROSPEZIONE SISMICA CON METODOLOGIA ESAC

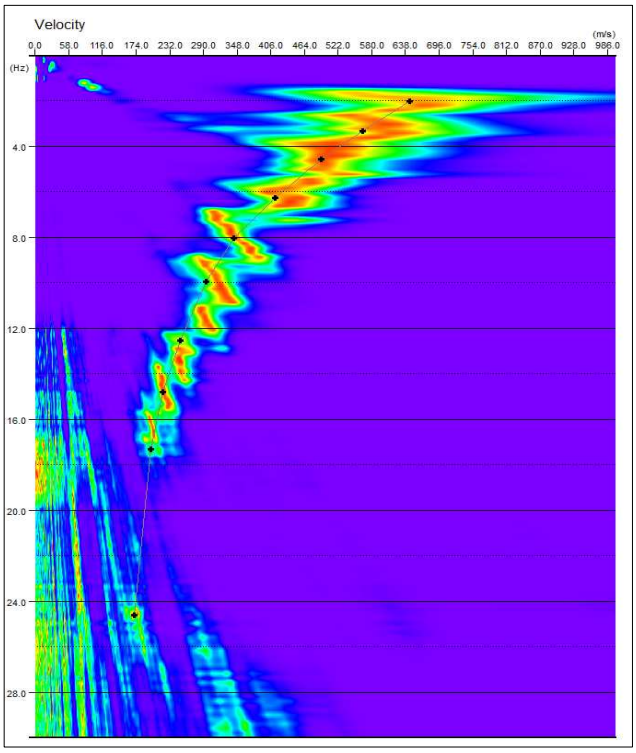
Via Gramsci, Comune di Marano sul Panaro (BO) – 036020P70285ESAC_SPAC201

n° tracce	Δt (ms)	T (s)
25	2,0	32,0

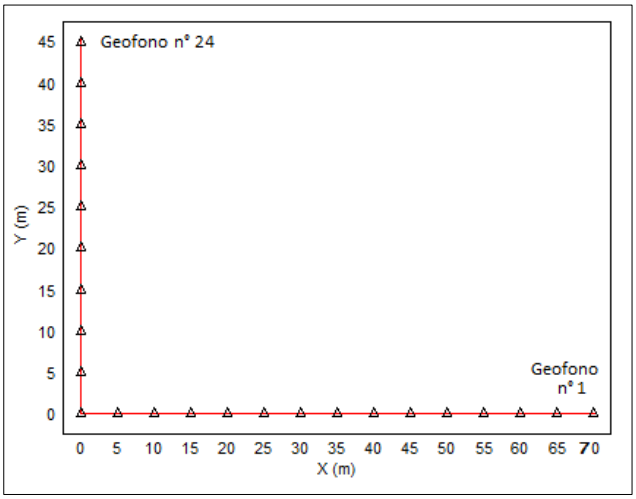
Δt: passo di campionamento; T: durata registrazione.



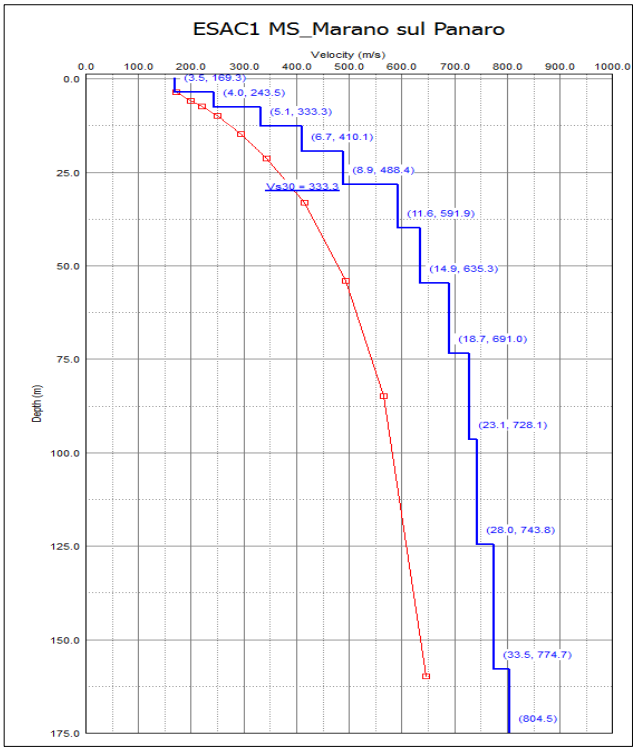
Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



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



Geometria dello stendimento sismico bidimensionale.



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

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	3.5	3.5	169.3
2	7.5	4.0	243.5
3	12.6	5.1	333.3
4	19.3	6.7	410.1
5	28.2	8.9	488.4
6	39.8	11.6	591.9
7	54.7	14.9	635.3
8	73.4	18.7	691.0
9	96.5	23.1	728.1
10	124.5	28.0	743.8
11	158.0	33.5	774.7
12	∞	∞	804.5

$V_{S30} = 333.3 \pm 10\%$ [m/s]

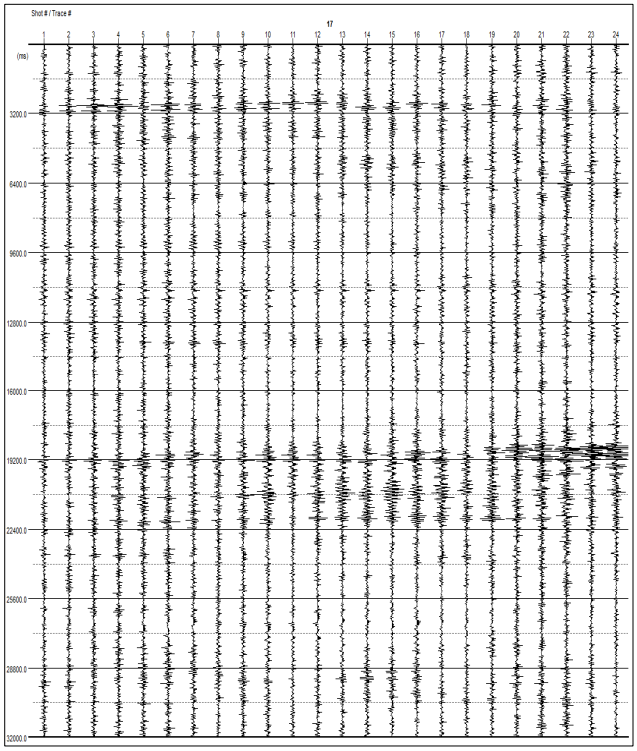
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ESAC

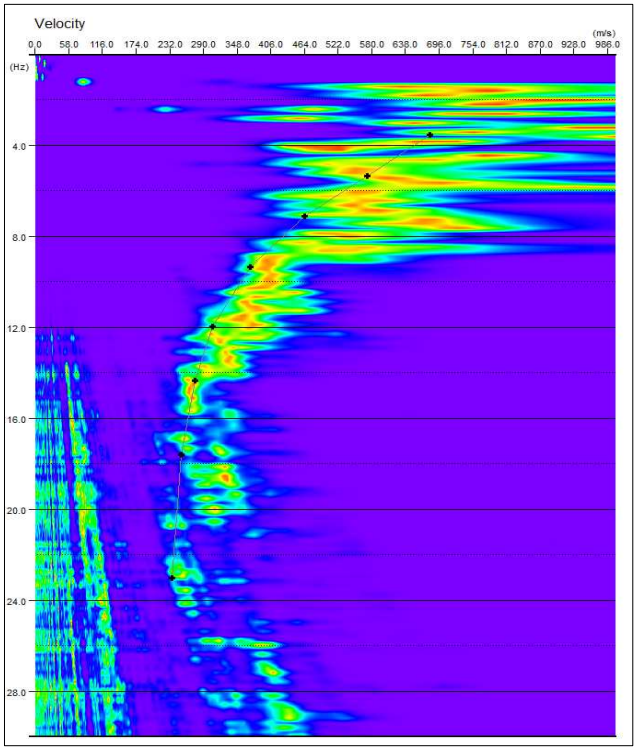
Loc. Osteria Vecchia, Comune di Marano sul Panaro (BO) – 036020P70286ESAC_SPAC202

n° tracce	Δt (ms)	T (s)
25	2,0	32,0

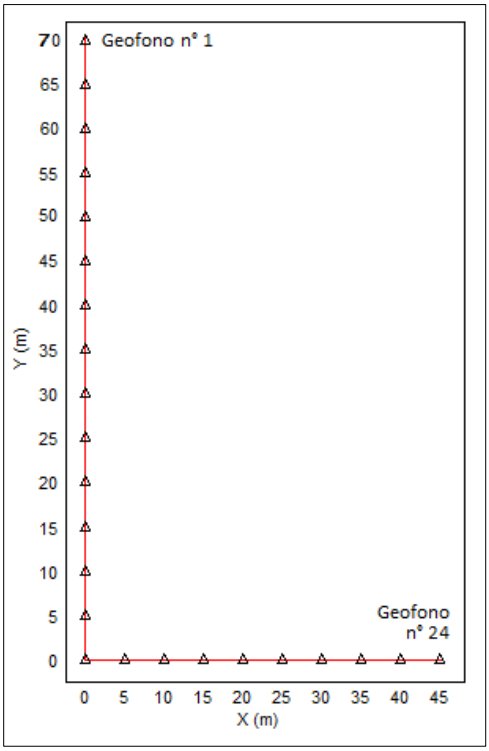
Δt: passo di campionamento; T: durata registrazione.



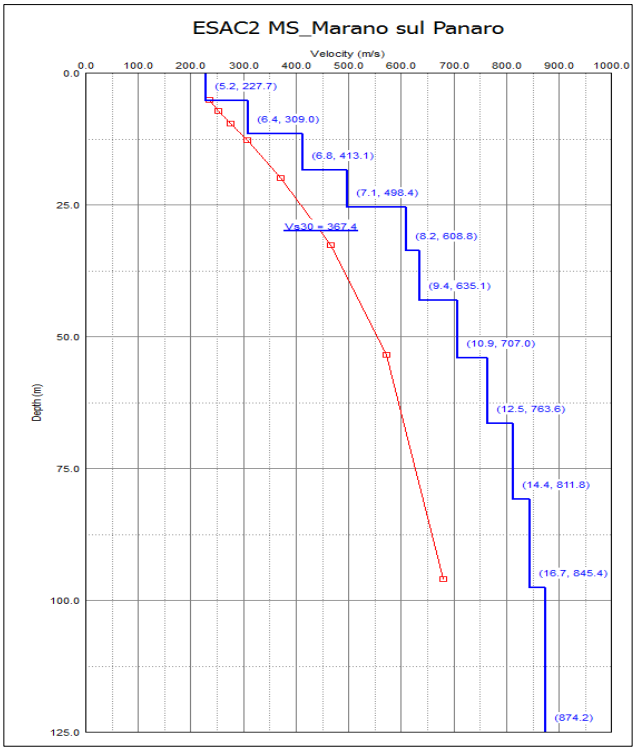
Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



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



Geometria dello stendimento sismico bidimensionale.



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

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	5.2	5.2	227.7
2	11.6	6.4	309.0
3	18.4	6.8	413.1
4	25.5	7.1	498.4
5	33.7	8.2	608.8
6	43.1	9.4	635.1
7	54.0	10.9	707.0
8	66.5	12.5	763.6
9	80.9	14.4	811.8
10	97.6	16.7	845.4
11	∞	∞	874.2

$V_{S30} = 367.4 \pm 10\%$ [m/s]

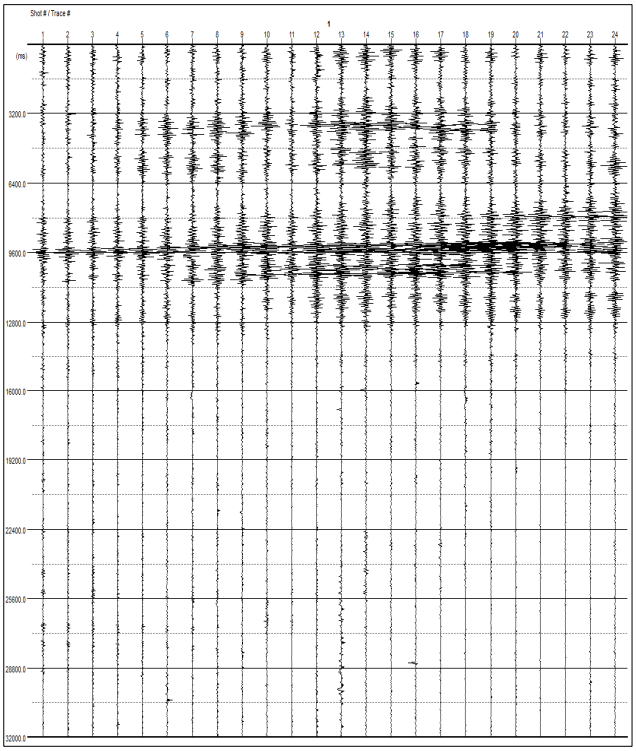
Sintesi dei parametri del modello di sottosuolo ottenuto e Valore di Vs30 calcolato.

PROSPEZIONE SISMICA CON METODOLOGIA ESAC

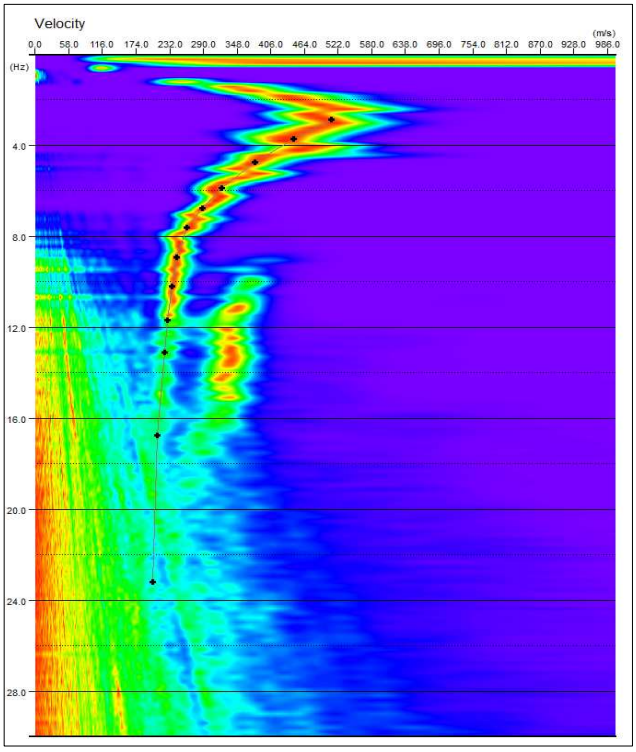
Loc. Puzzole, Comune di Marano sul Panaro (BO) – 036020P70287ESAC_SPAC203

n° tracce	Δt (ms)	T (s)
25	2,0	32,0

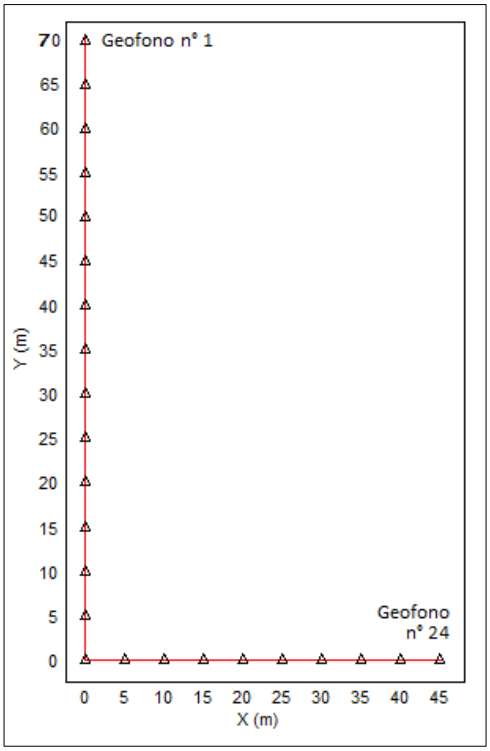
Δt: passo di campionamento; T: durata registrazione.



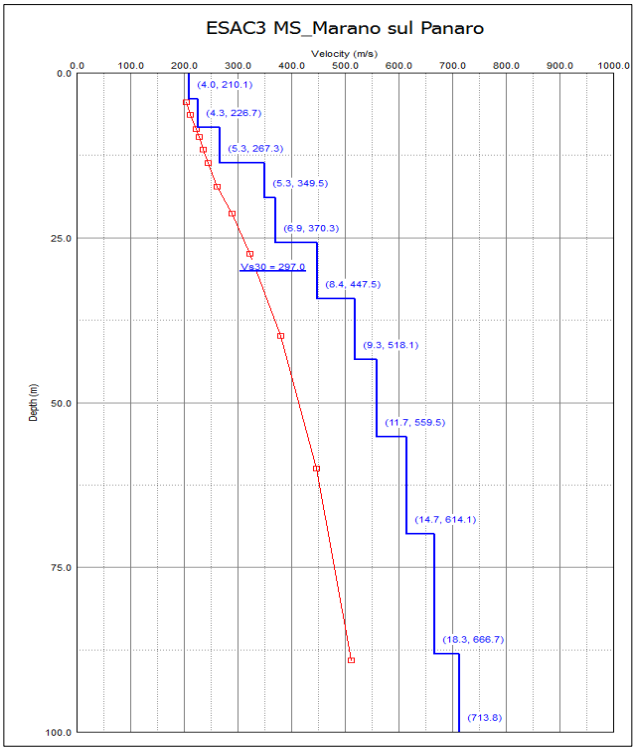
Sismogramma registrato durante le acquisizioni di microtremore sismico. In ascissa il numero dei geofoni, in ordinata il tempo (ms).



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



Geometria dello stendimento sismico bidimensionale.



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

Tabella di sintesi

n. Strato	Profondità letto (m dal p.c.)	Spessore (m)	V_S (m/s)
1	4.0	4.0	210.1
2	8.3	4.3	226.7
3	13.6	5.3	267.3
4	18.9	5.3	349.5
5	25.8	6.9	370.3
6	34.2	8.4	447.5
7	43.5	9.3	518.1
8	55.2	11.7	559.5
9	69.9	14.7	614.1
10	88.2	18.3	666.7
11	∞	∞	713.8

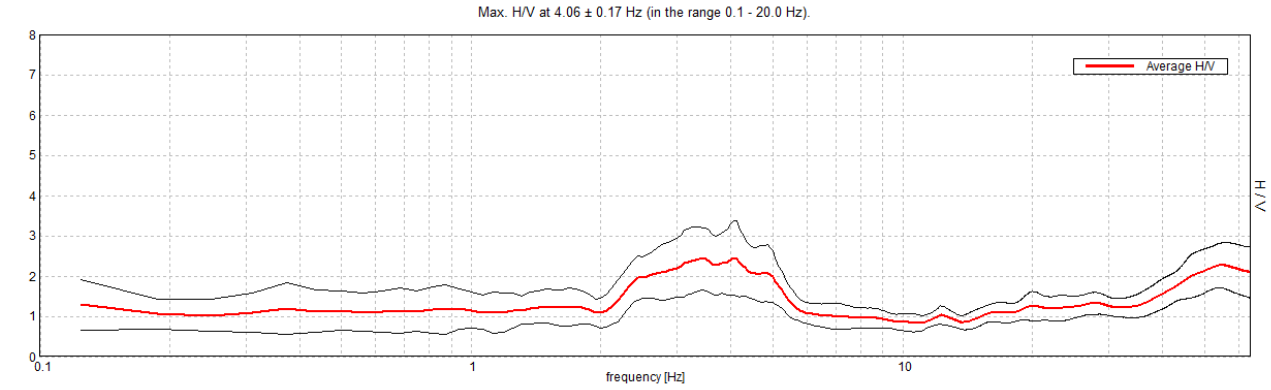
$V_{S30} = 297.0 \pm 10\%$ [m/s]

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

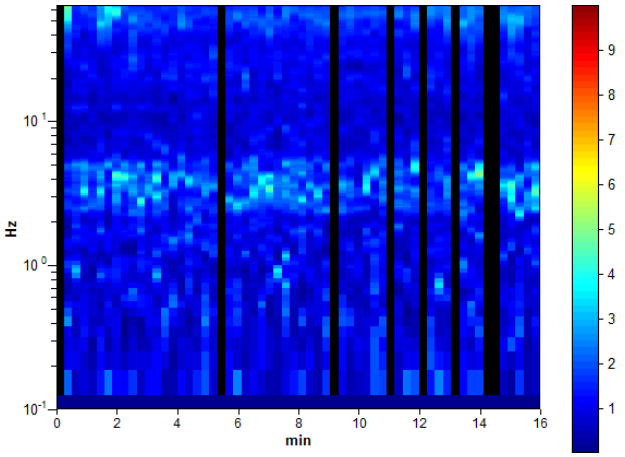
MARANO SUL PANARO_MS, HVSR1 **036020P70288HVSR204**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 09:35:25 End recording: 03/05/02 09:51:26
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 87% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

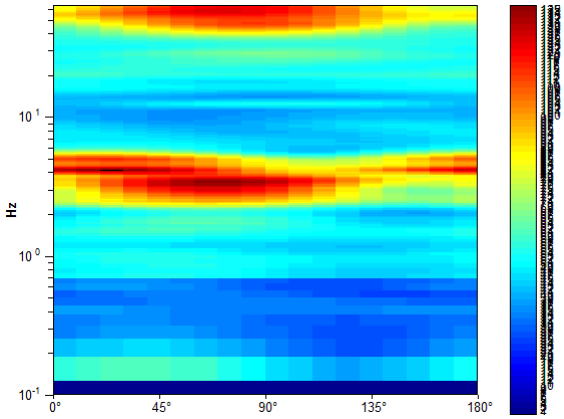
HORIZONTAL TO VERTICAL SPECTRAL RATIO



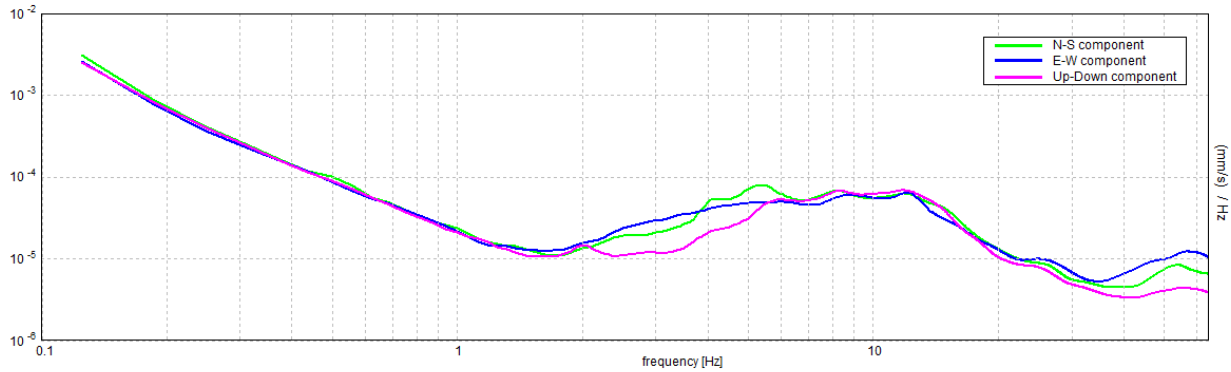
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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

Max. H/V at 4.06 ± 0.17 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	4.06 > 0.63	OK	
$n_c(f_0) > 200$	3380.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 98 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	2.063 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	5.688 Hz	OK	
$A_0 > 2$	2.46 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02009| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.08162 < 0.20313	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.4552 < 1.58	OK	

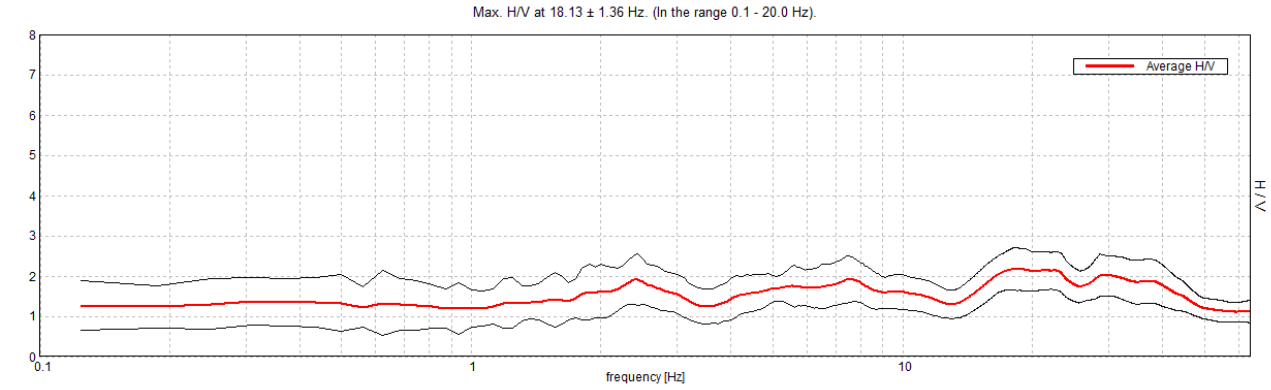
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

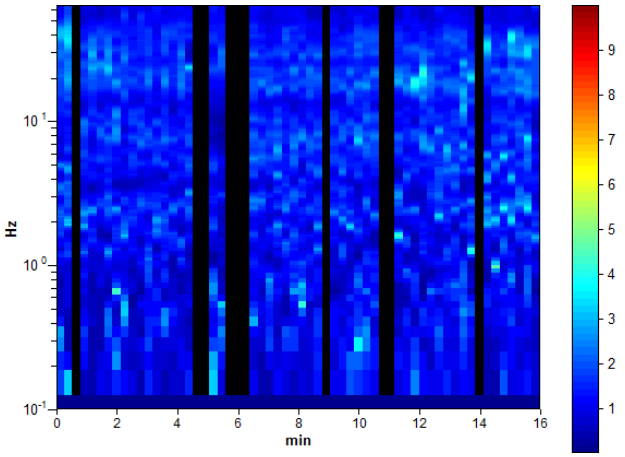
MARANO SUL PANARO_MS, HVSR2 **036020P70289HVSR205**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 10:44:35 End recording: 03/05/02 11:00:36
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 83% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

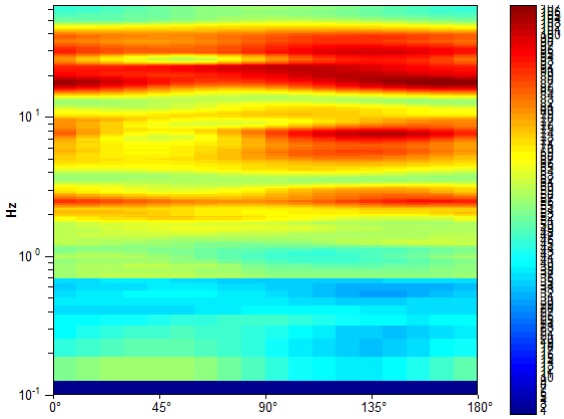
HORIZONTAL TO VERTICAL SPECTRAL RATIO



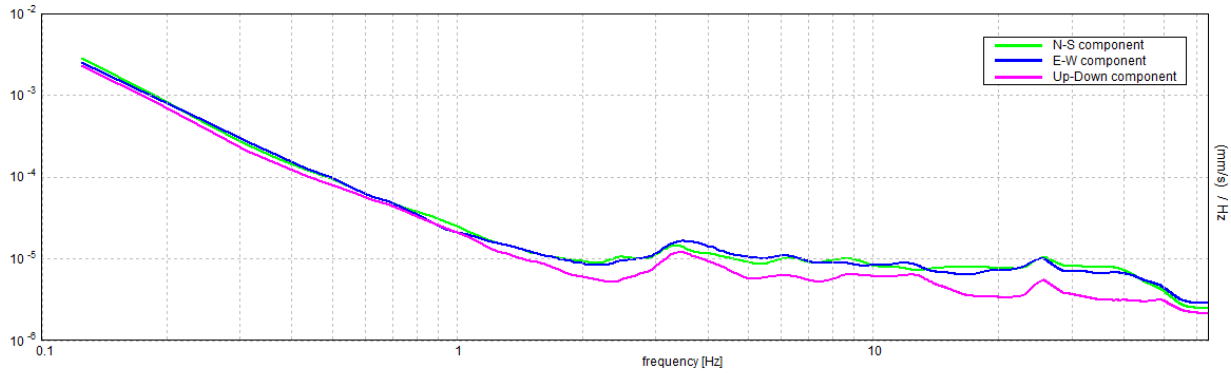
H/V TIME HISTORY



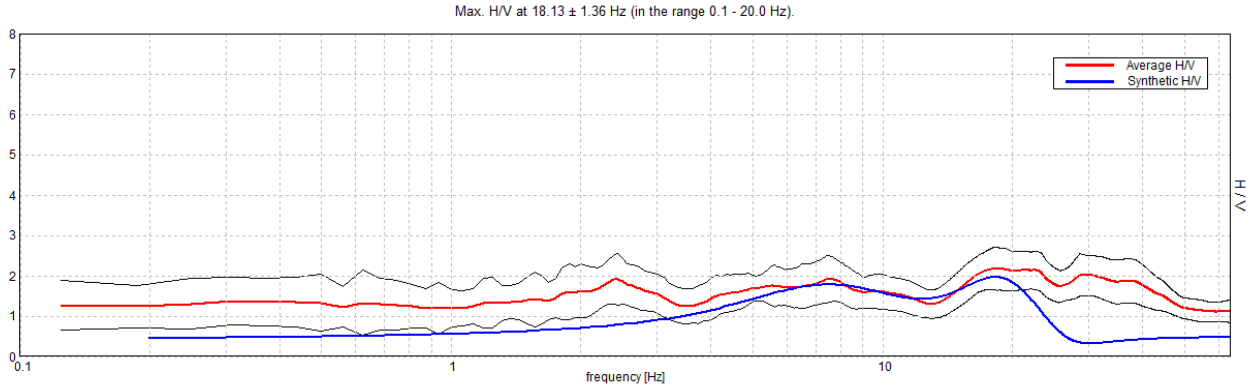
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

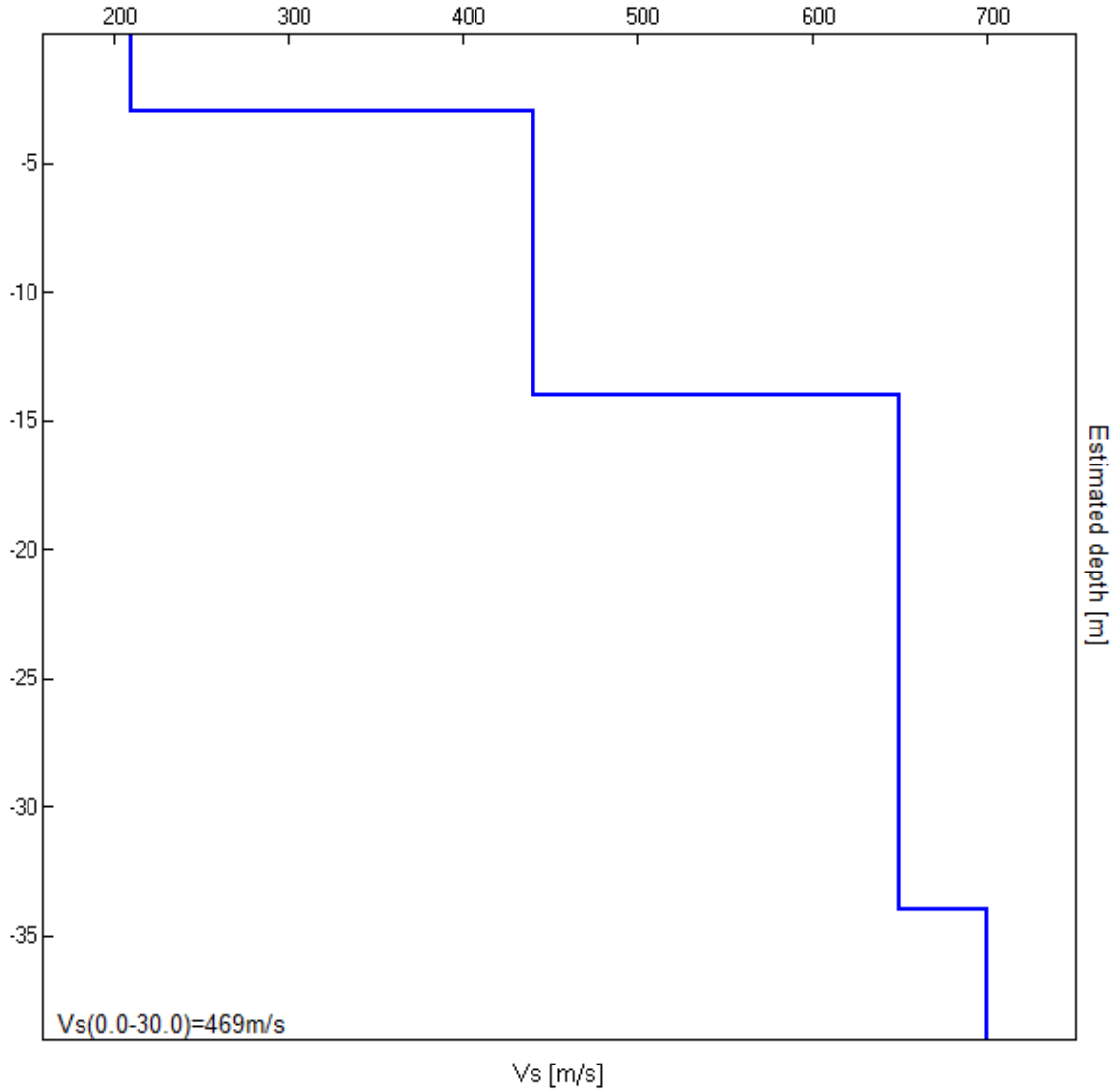


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.00	3.00	210
14.00	11.00	440
34.00	20.00	650
inf.	inf.	700

Vs(0.0-30.0)=469m/s



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

Max. H/V at 18.13 ± 1.36 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	18.13 > 0.63	OK	
$n_c(f_0) > 200$	14500.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 436 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.18 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03702| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.67104 < 0.90625	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2612 < 1.58	OK	

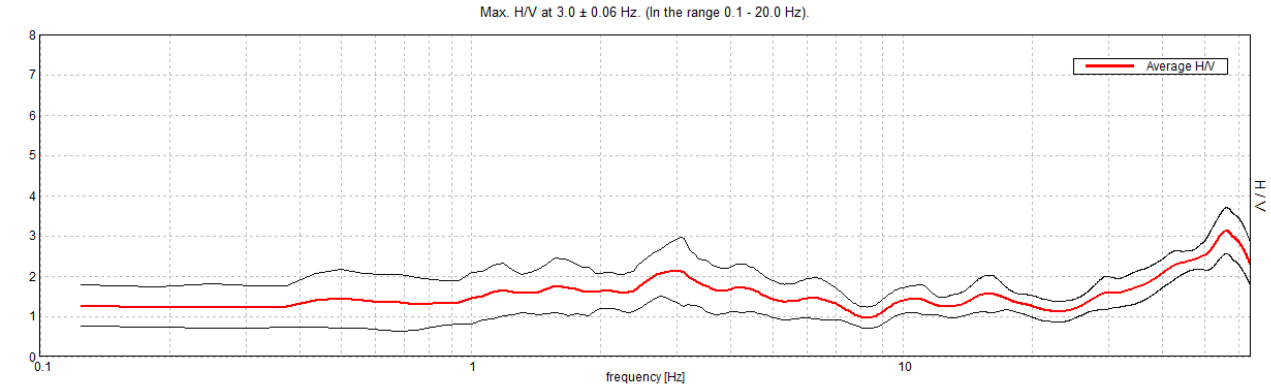
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

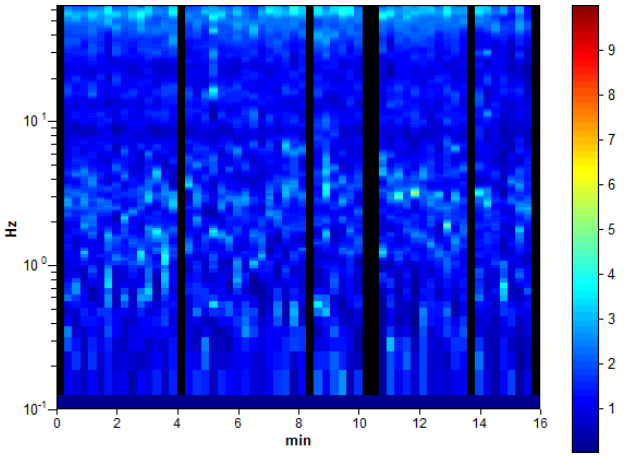
MARANO SUL PANARO_MS, HVSR3 **036020P70290HVSR206**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 11:36:56 End recording: 03/05/02 11:52:57
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 88% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

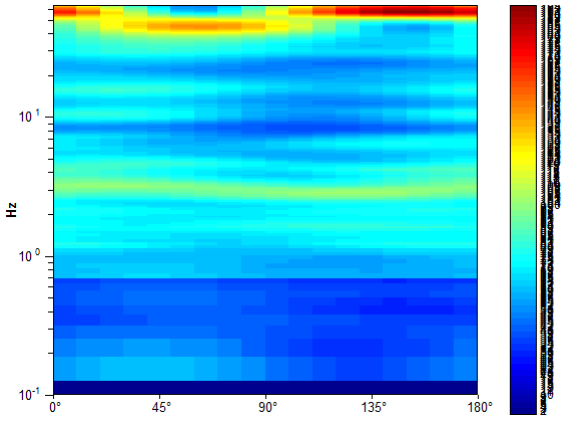
HORIZONTAL TO VERTICAL SPECTRAL RATIO



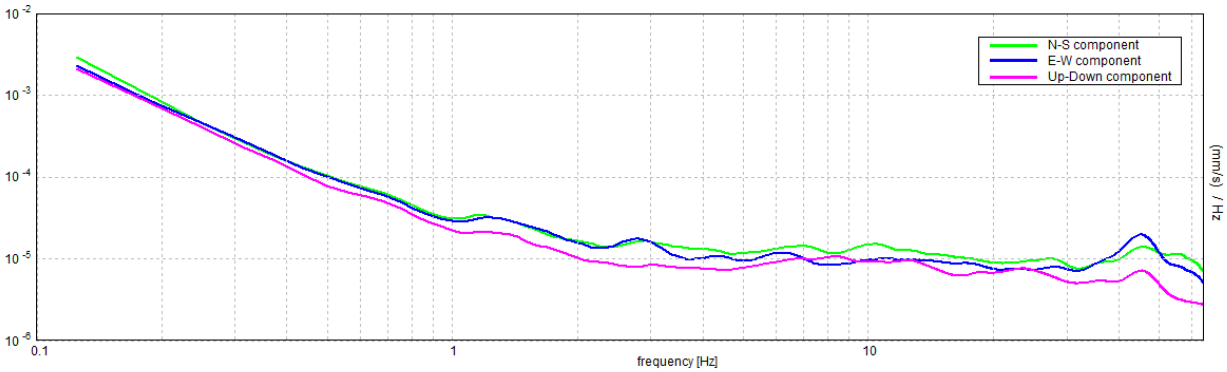
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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

Max. H/V at 3.0 ± 0.06 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.00 > 0.63	OK	
$n_c(f_0) > 200$	2544.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 73 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	7.688 Hz	OK	
$A_0 > 2$	2.13 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.00972| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.02917 < 0.15	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.3888 < 1.58	OK	

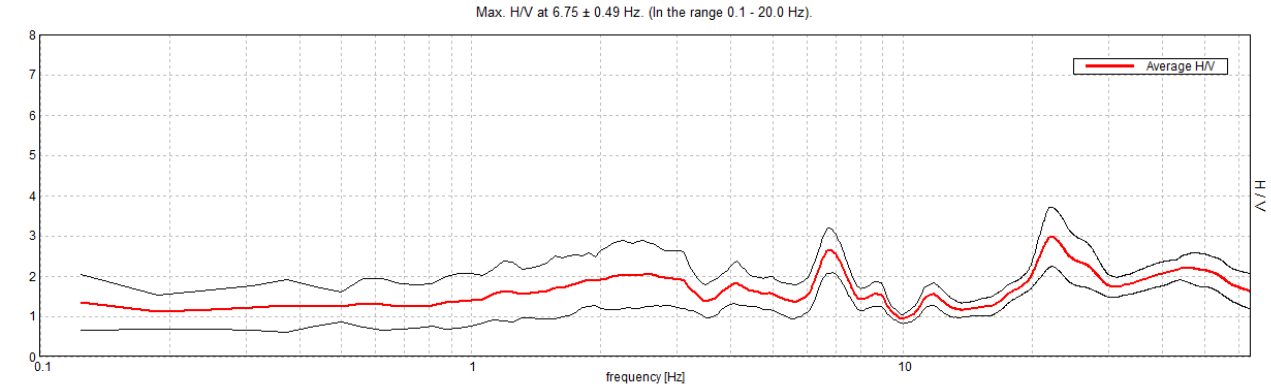
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

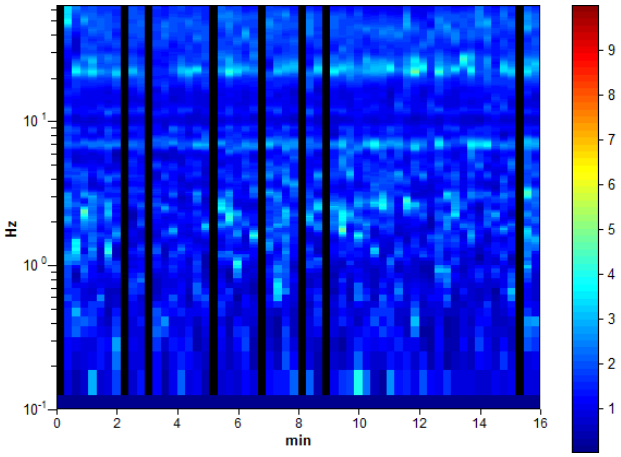
MARANO SUL PANARO_MS, HVSR4 **036020P70291HVSR207**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 12:16:16 End recording: 03/05/02 12:32:17
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 87% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

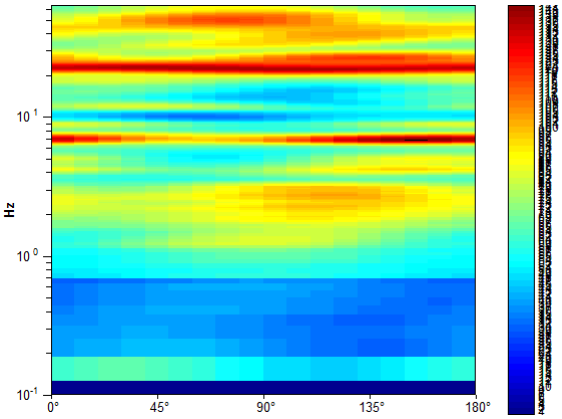
HORIZONTAL TO VERTICAL SPECTRAL RATIO



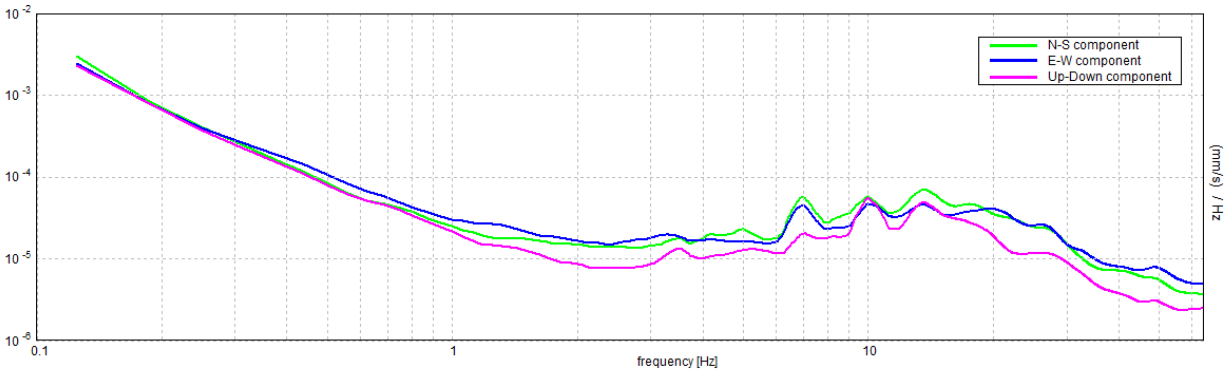
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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

Max. H/V at 6.75 ± 0.49 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	6.75 > 0.63	OK	
$n_c(f_0) > 200$	5616.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 163 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	9.188 Hz	OK	
$A_0 > 2$	2.63 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.03593| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.24249 < 0.3375	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2733 < 1.58	OK	

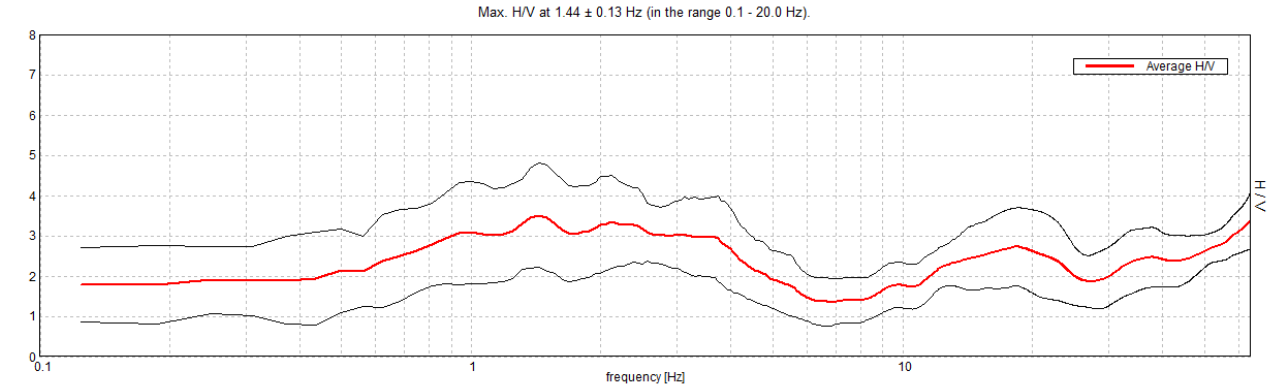
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

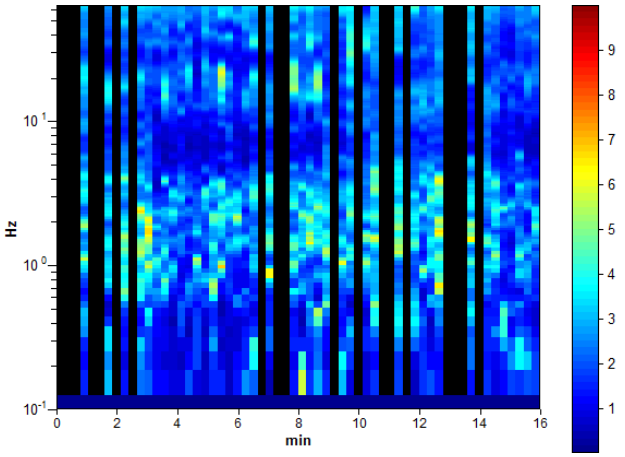
MARANO SUL PANARO_MS, HVSR5 **036020P70292HVSR208**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 13:01:30 End recording: 03/05/02 13:17:31
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00". Analyzed 68% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

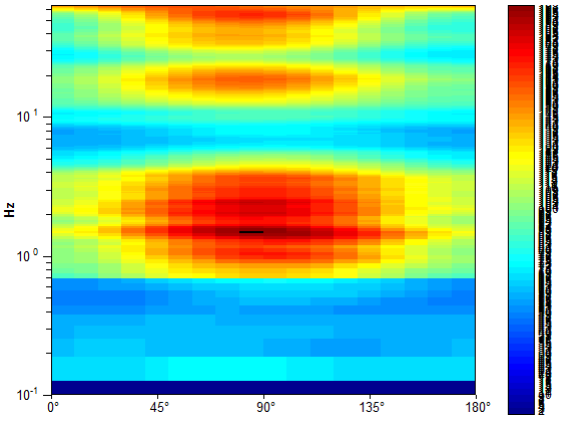
HORIZONTAL TO VERTICAL SPECTRAL RATIO



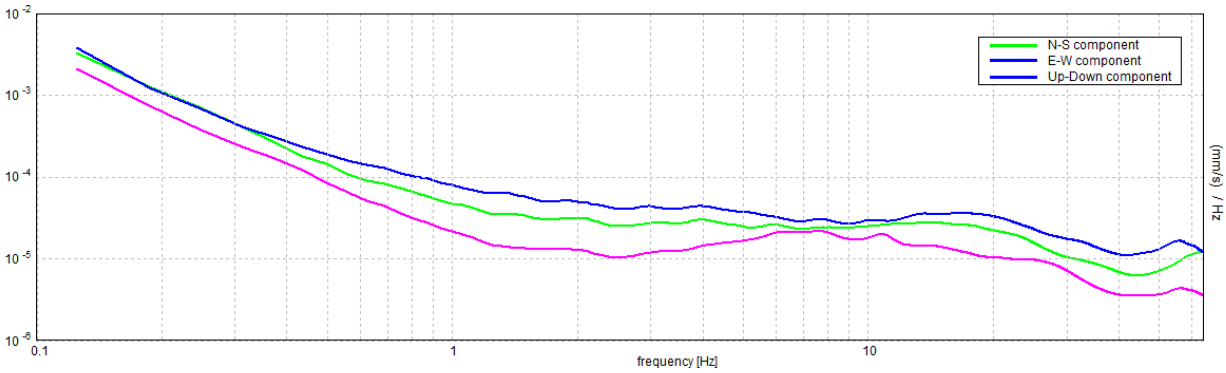
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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

Max. H/V at 1.44 ± 0.13 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	1.44 > 0.63	OK	
$n_c(f_0) > 200$	943.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 36 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	5.563 Hz	OK	
$A_0 > 2$	3.50 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.04298| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.06179 < 0.14375	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.6333 < 1.78	OK	

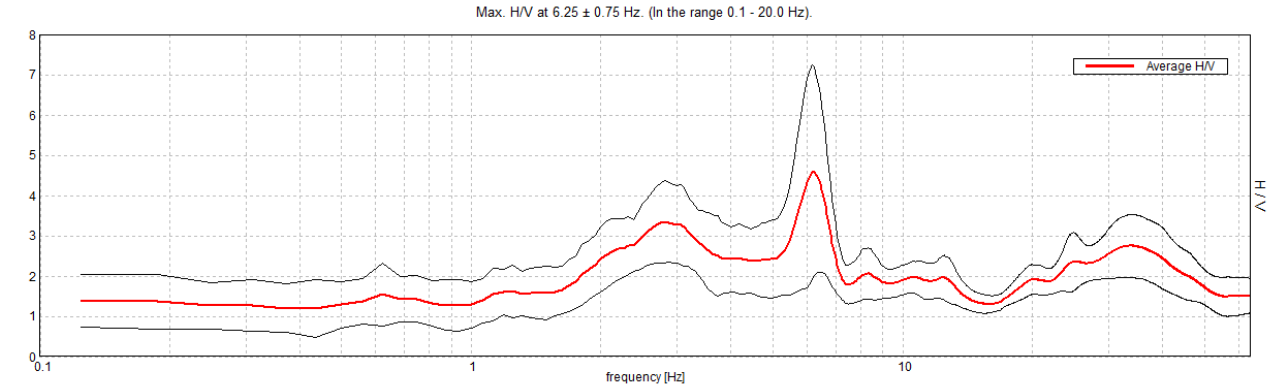
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

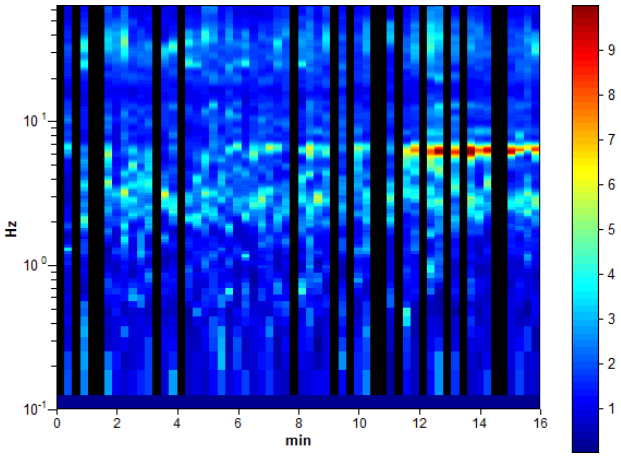
MARANO SUL PANARO_MS, HVSR6 **036020P70293HVSR209**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 14:27:20 End recording: 03/05/02 14:43:21
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 72% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

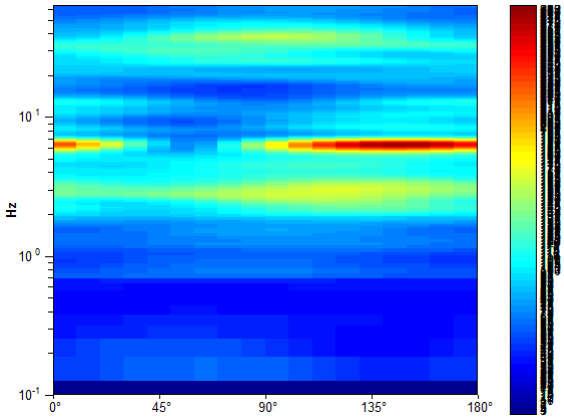
HORIZONTAL TO VERTICAL SPECTRAL RATIO



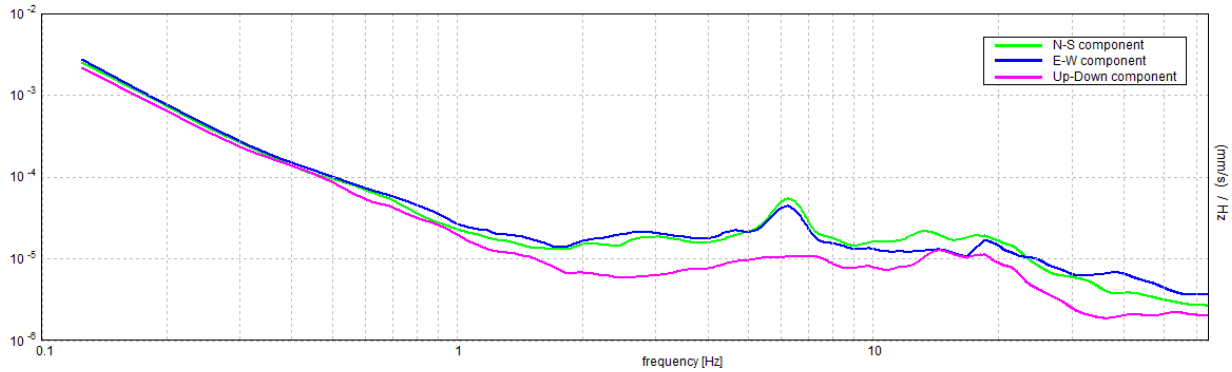
H/V TIME HISTORY



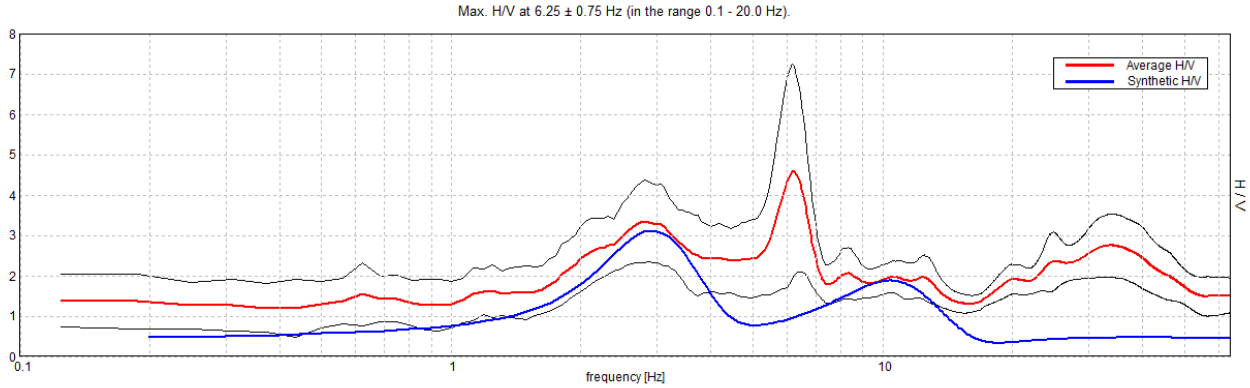
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

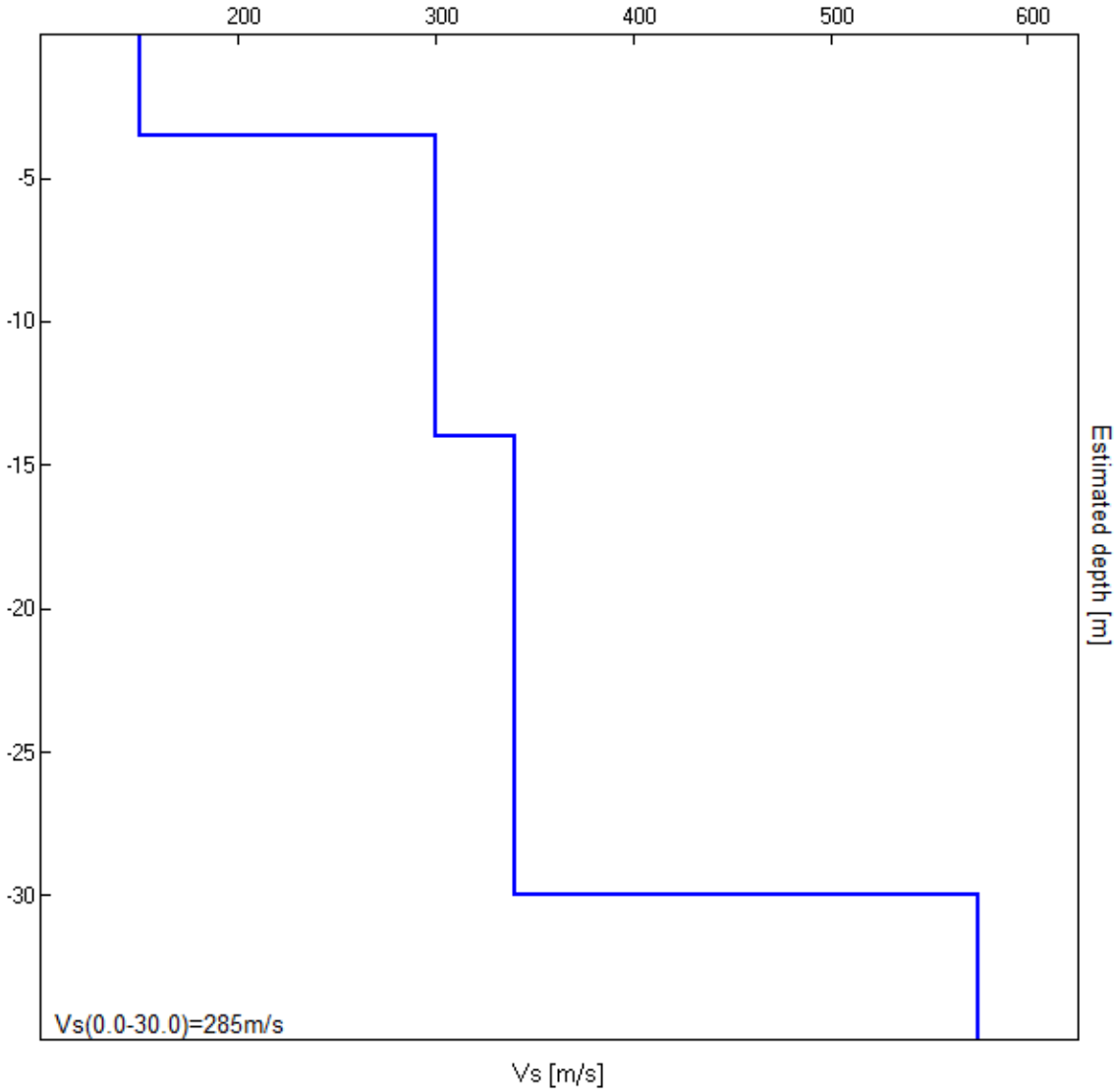


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
3.50	3.50	150
14.00	10.50	300
30.00	16.00	340
inf.	inf.	575

Vs(0.0-30.0)=285m/s



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

Max. H/V at 6.25 ± 0.75 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	6.25 > 0.63	OK	
$n_c(f_0) > 200$	4300.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 13 out of 151 times		NO
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.938 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	7.063 Hz	OK	
$A_0 > 2$	4.60 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.05895| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.36846 < 0.3125		NO
$\sigma_A(f_0) < \theta(f_0)$	1.2621 < 1.58	OK	

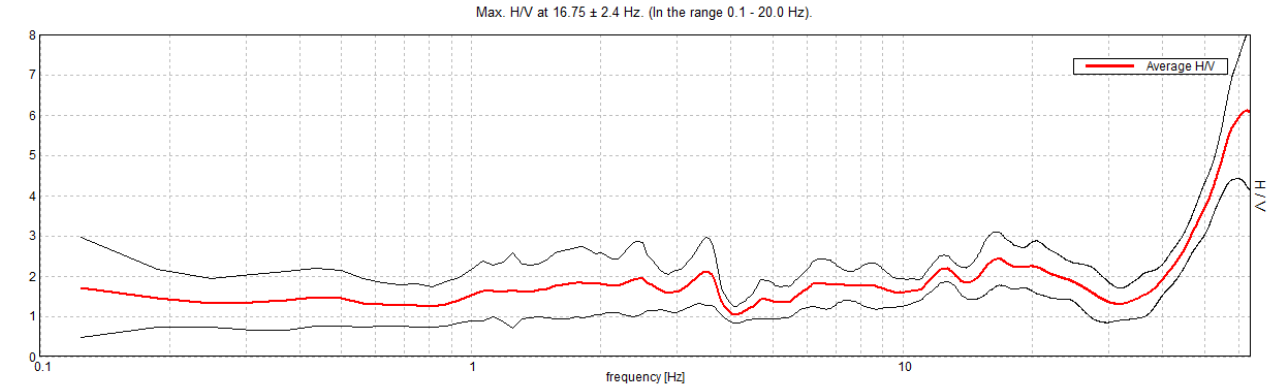
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

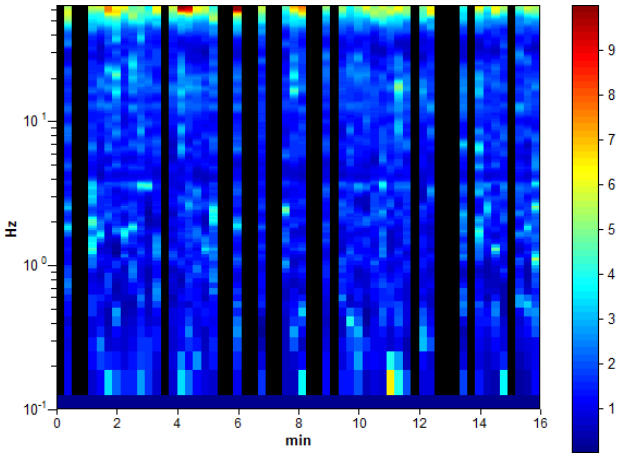
MARANO SUL PANARO_MS, HVSR7 **036020P70294HVSR210**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 14:57:04 End recording: 03/05/02 15:13:05
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 68% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

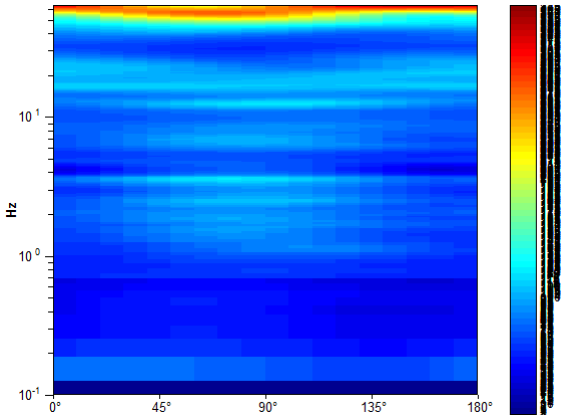
HORIZONTAL TO VERTICAL SPECTRAL RATIO



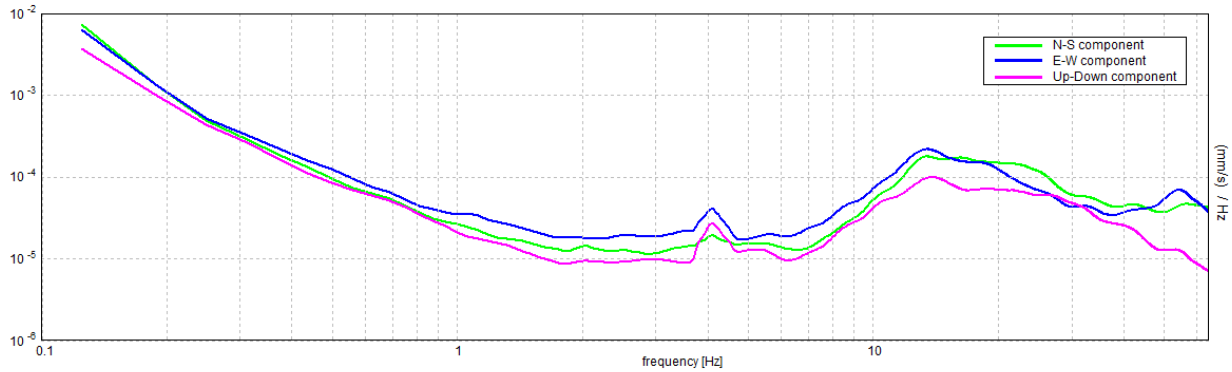
H/V TIME HISTORY



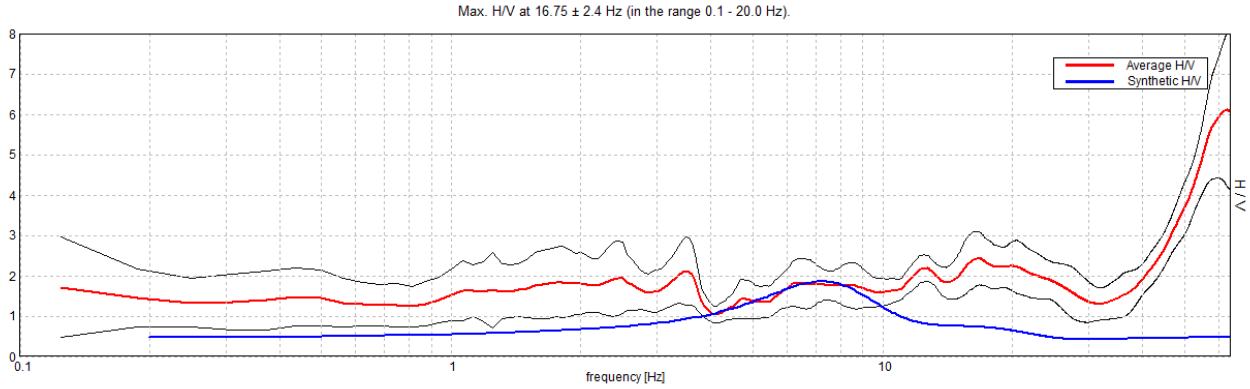
DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA

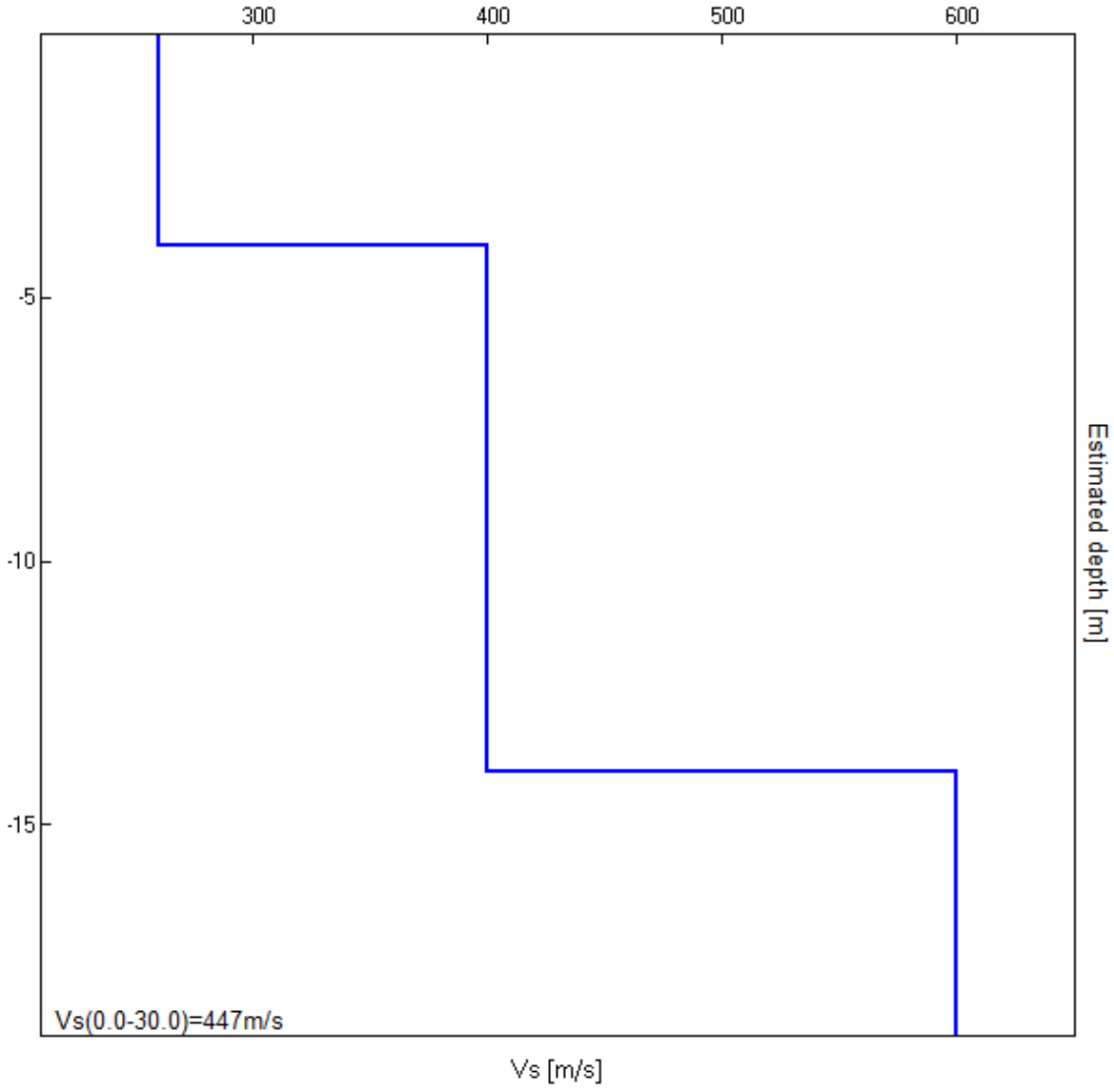


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]
4.00	4.00	260
14.00	10.00	400
inf.	inf.	600

Vs(0.0-30.0)=447m/s



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

Max. H/V at 16.75 ± 2.4 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	16.75 > 0.63	OK	
$n_c(f_0) > 200$	10988.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 403 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	4.438 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	2.42 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.06992| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	1.17114 < 0.8375		NO
$\sigma_A(f_0) < \theta(f_0)$	0.3199 < 1.58	OK	

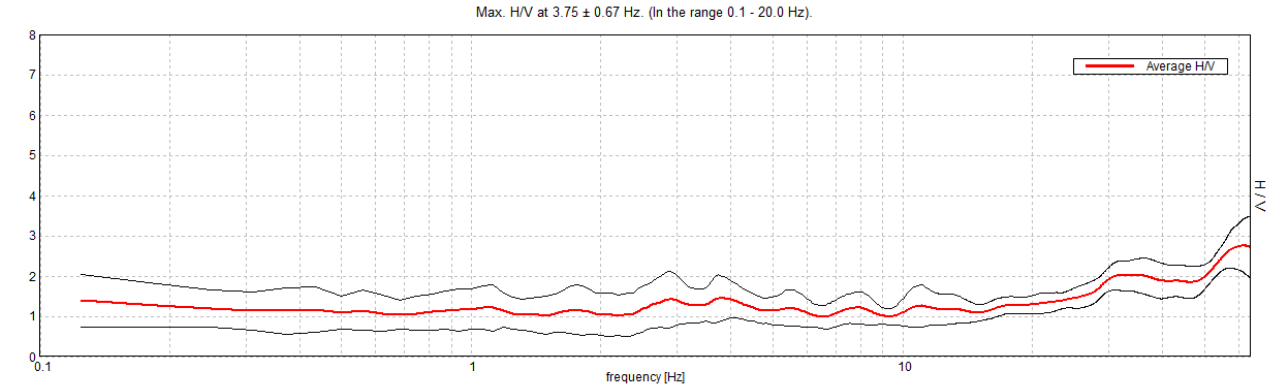
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

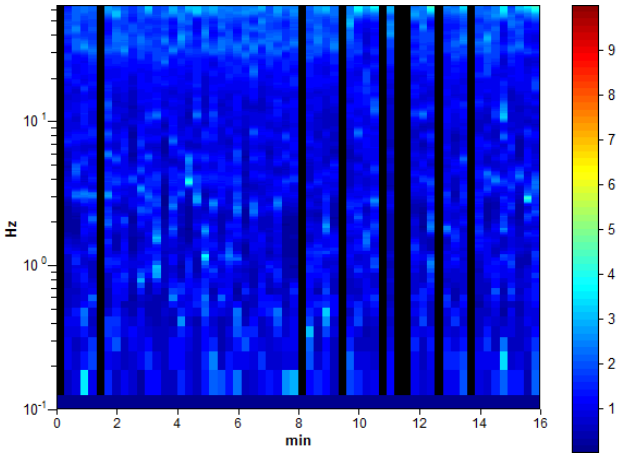
MARANO SUL PANARO_MS, HVSR8 **036020P70295HVSR211**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 15:23:01 End recording: 03/05/02 15:39:02
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 85% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

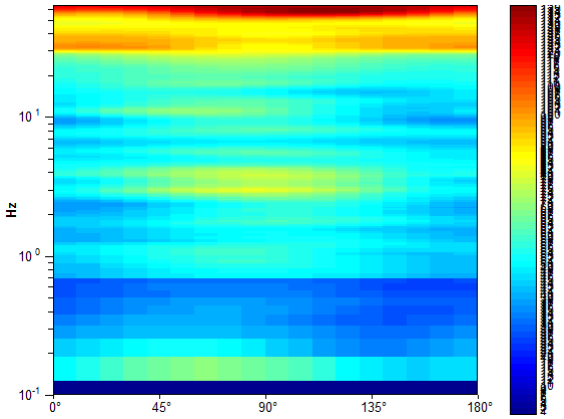
HORIZONTAL TO VERTICAL SPECTRAL RATIO



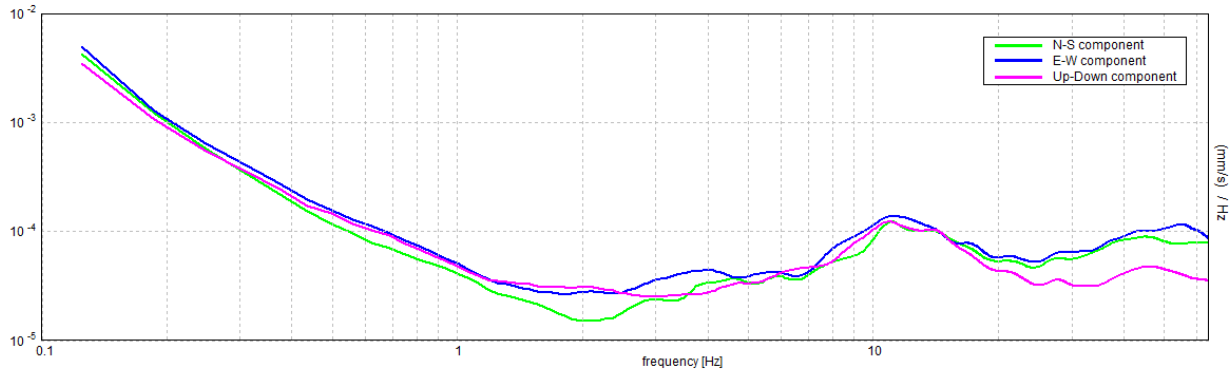
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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

Max. H/V at 3.75 ± 0.67 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	3.75 > 0.63	OK	
$n_c(f_0) > 200$	3060.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 91 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$			NO
$A_0 > 2$	1.45 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.08752| < 0.05		NO
$\sigma_f < \varepsilon(f_0)$	0.3282 < 0.1875		NO
$\sigma_A(f_0) < \theta(f_0)$	0.2916 < 1.58	OK	

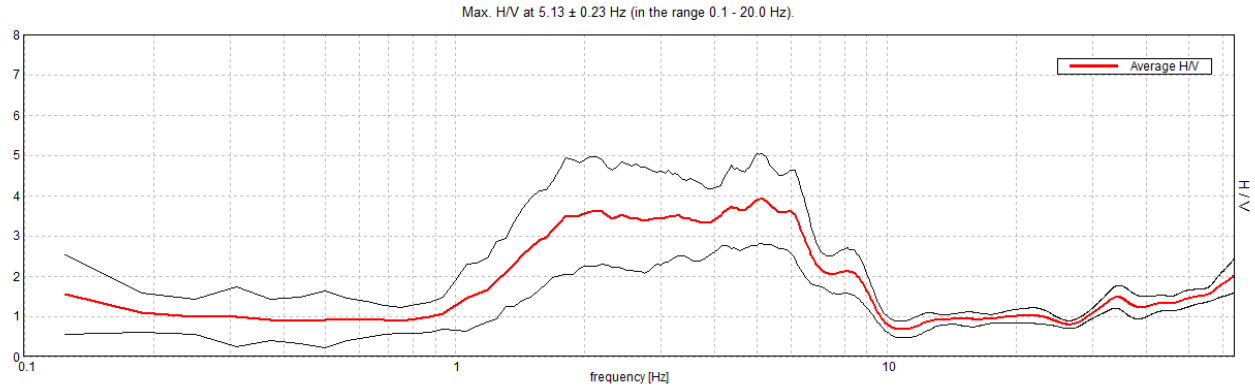
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

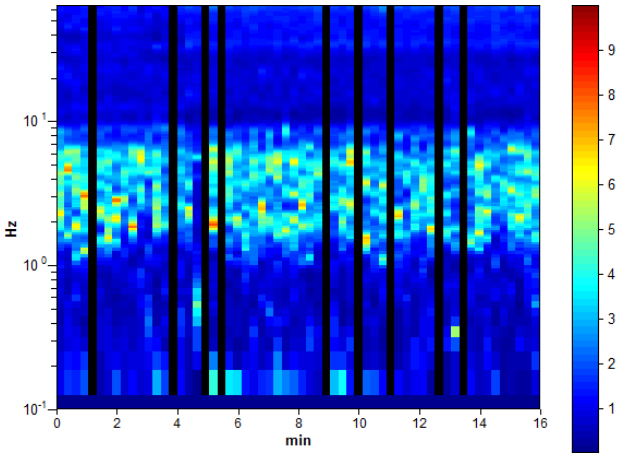
MARANO SUL PANARO_MS, HVSR9 **036020P70296HVSR212**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 15:54:47 End recording: 03/05/02 16:10:48
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 85% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

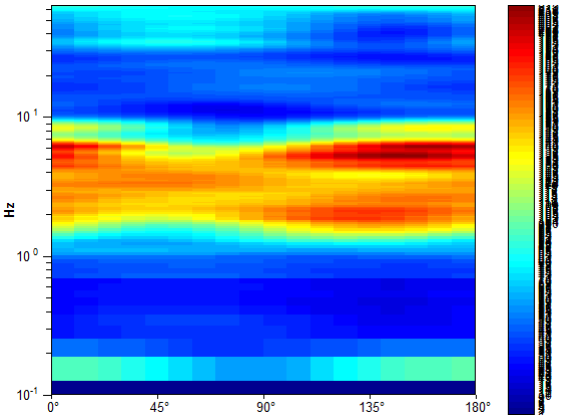
HORIZONTAL TO VERTICAL SPECTRAL RATIO



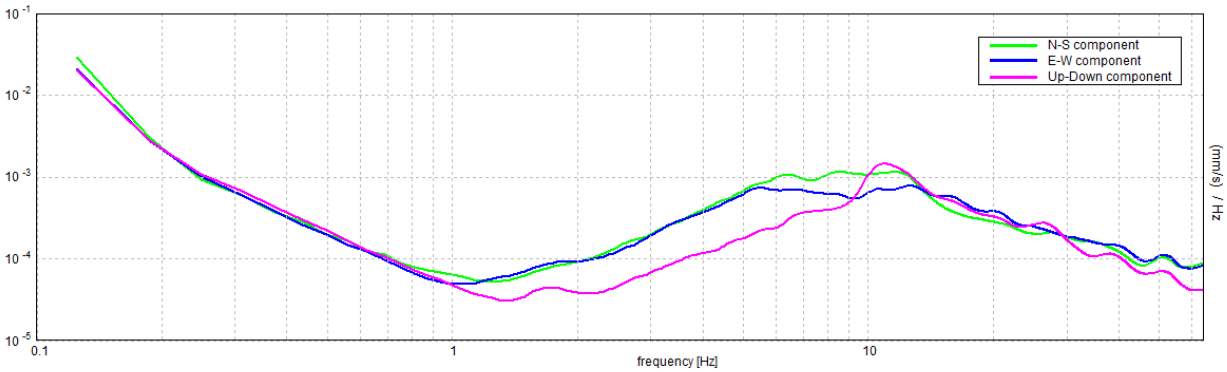
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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

Max. H/V at 5.13 ± 0.23 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	5.13 > 0.63	OK	
$n_c(f_0) > 200$	4182.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz **$\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz**	Exceeded 0 out of 124 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	1.25 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	8.625 Hz	OK	
$A_0 > 2$	3.92 > 2	OK	
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.02213| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.11343 < 0.25625	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.5509 < 1.58	OK	

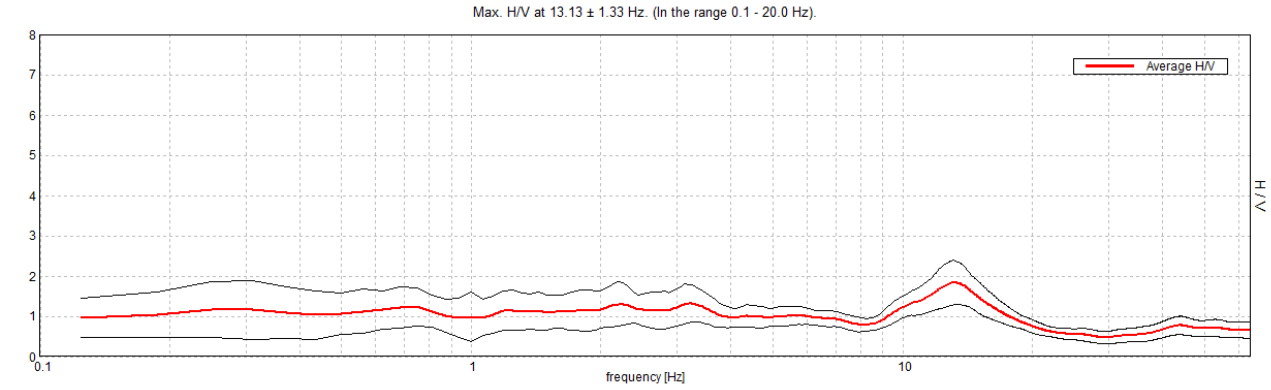
L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak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

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

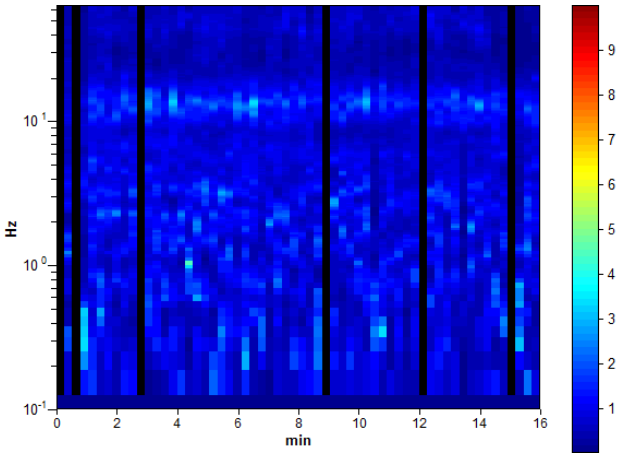
MARANO SUL PANARO_MS, HVSR10 **036020P70297HVSR213**

Instrument: TRZ-0108/01-10
Start recording: 03/05/02 16:27:27 End recording: 03/05/02 16:43:28
Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN
Trace length: 0h16'00''. Analyzed 90% trace (manual window selection)
Sampling rate: 128 Hz
Window size: 16 s
Smoothing type: Triangular window
Smoothing: 10%

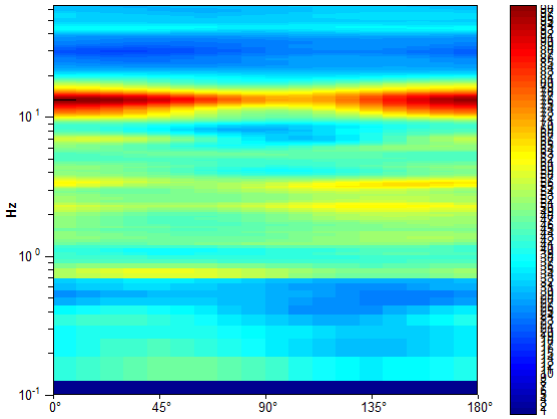
HORIZONTAL TO VERTICAL SPECTRAL RATIO



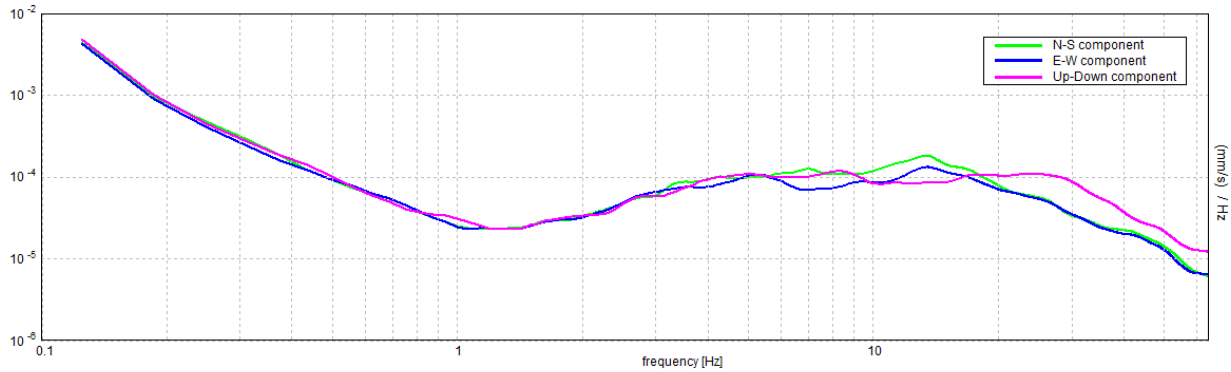
H/V TIME HISTORY



DIRECTIONAL H/V



SINGLE COMPONENT SPECTRA



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

Max. H/V at 13.13 ± 1.33 Hz (in the range 0.1 - 20.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]			
$f_0 > 10 / L_w$	13.13 > 0.63	OK	
$n_c(f_0) > 200$	11340.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5$Hz $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5$Hz	Exceeded 0 out of 316 times	OK	
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]			
Exists f^- in $[f_0/4, f_0]$ | $A_{H/V}(f^-) < A_0 / 2$	8.938 Hz	OK	
Exists f^+ in $[f_0, 4f_0]$ | $A_{H/V}(f^+) < A_0 / 2$	18.313 Hz	OK	
$A_0 > 2$	1.84 > 2		NO
$f_{peak}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	|0.04999| < 0.05	OK	
$\sigma_f < \varepsilon(f_0)$	0.65608 < 0.65625	OK	
$\sigma_A(f_0) < \theta(f_0)$	0.2724 < 1.58	OK	

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

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