

# **ALLEGATO N. 1**

**Prove geognostiche/geofisiche in sito**  
**di nuova realizzazione**



## Company information

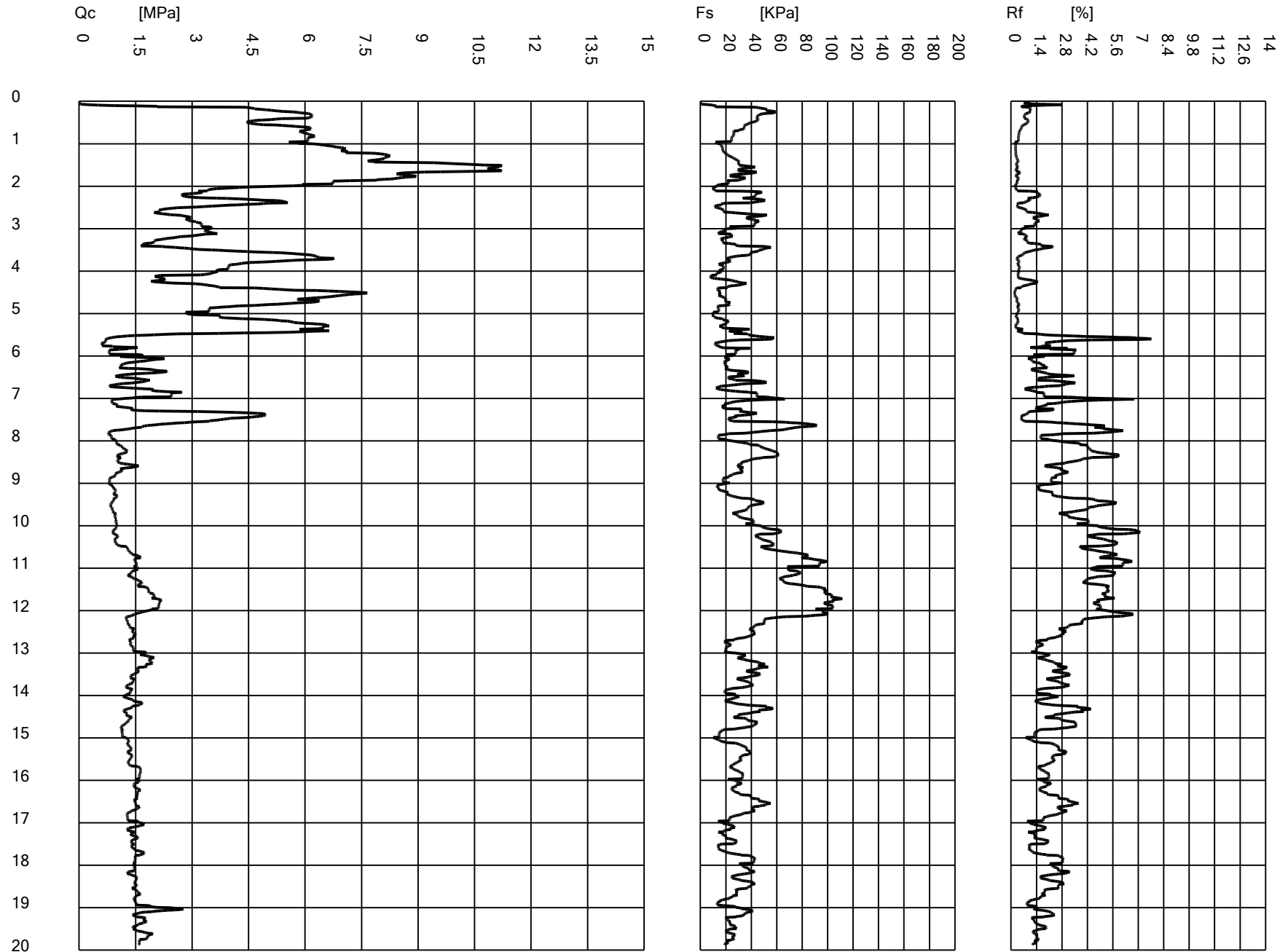
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

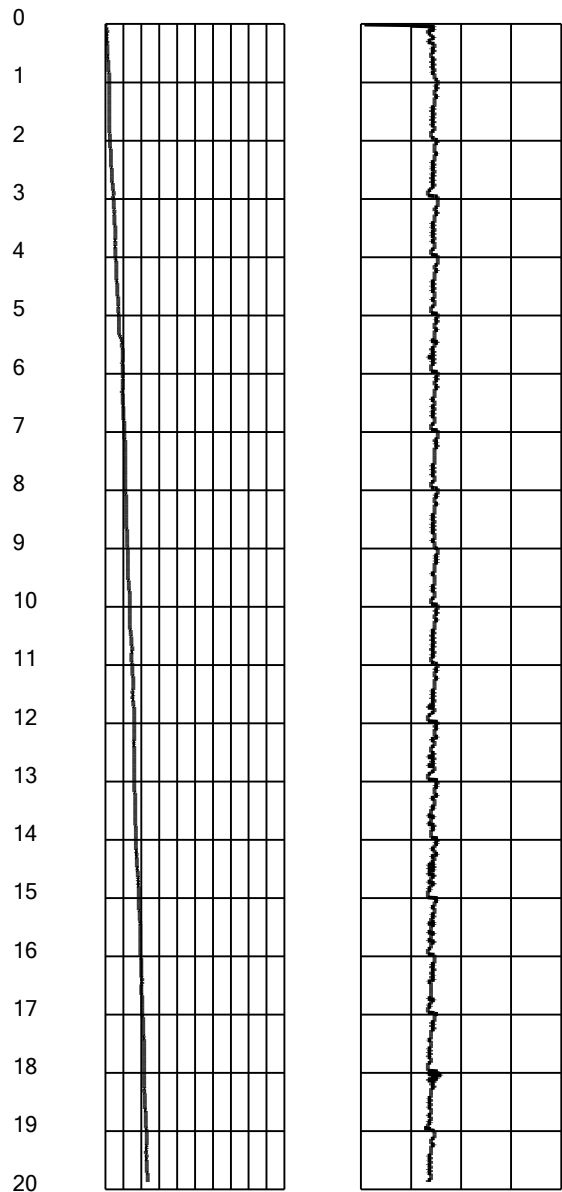
## Test information

Name: CPTE 1  
Location: CPTE 1  
Date: 11/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 70  
Ground level [cm]: 0  
Latitude: 44.111154  
Longitude: 12.501310  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20



Intergeo srl

€JJ€FI ÚFHJÌ



**INTERGEO** s.r.l. - Servizi Geologici  
Strada Acquasalata, 9 47899 Serravalle - RSM  
Codice Operatore Economico - SM21197  
Tel. 333 2208376  
www.intergeosm.com - mail: info@intergeosm.com

Cone Penetration Test (CPTU) - Date: 11/11/2020

Site: Rimini - Microzonazione sismica - Test: CPTE 2

## Company information

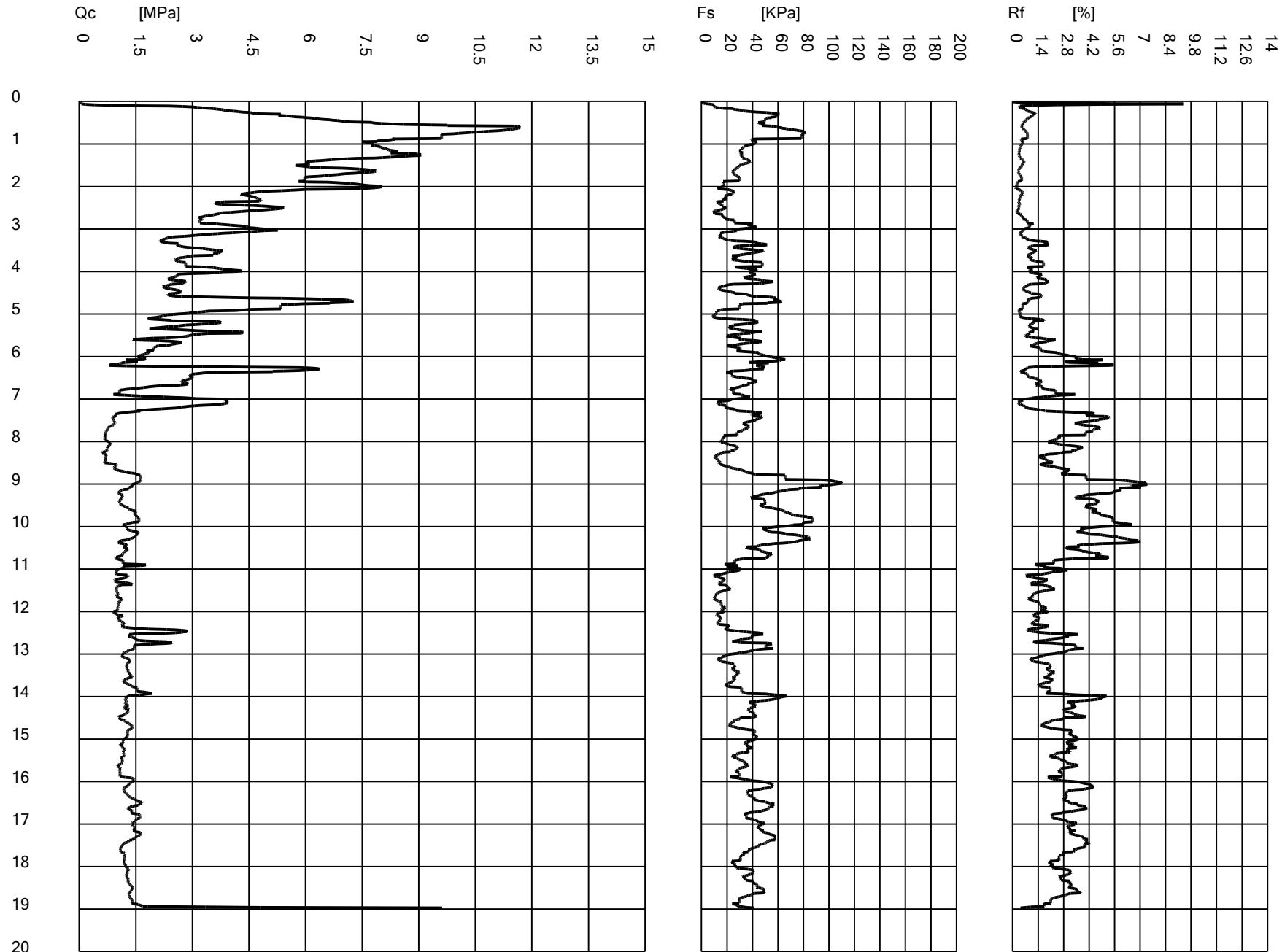
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

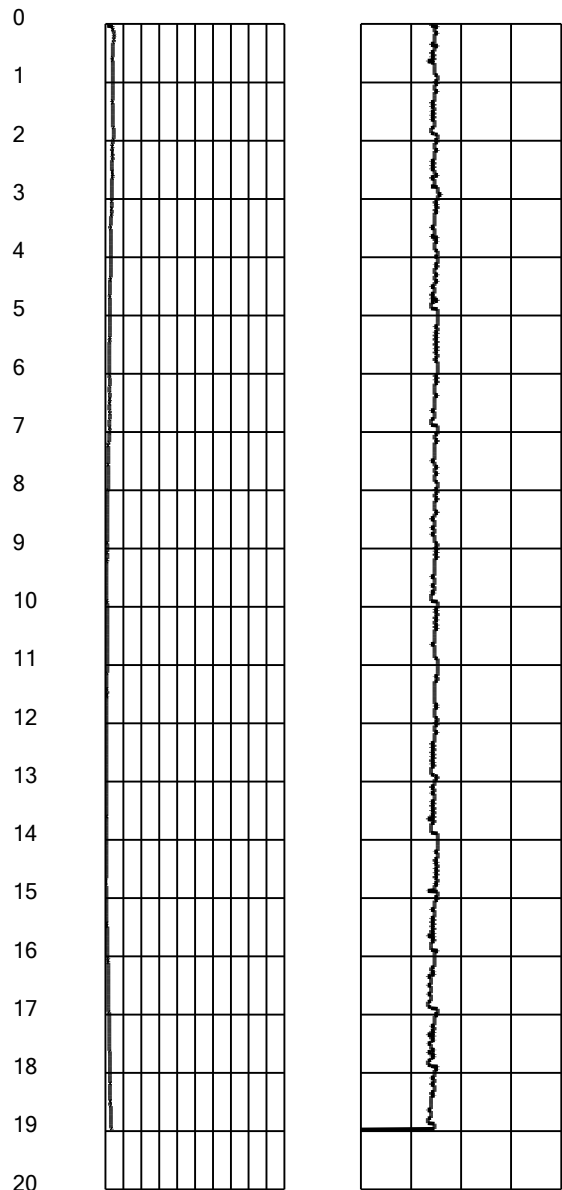
## Test information

Name: CPTE 2  
Location: CPTE 2  
Date: 11/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 130  
Ground level [cm]: 0  
Latitude: 44.110191  
Longitude: 12.506932  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20





Cone Penetration Test (CPTU) - Date: 19/01/2021

Site: Rimini - Microzonazione sismica - Test: CPTE 3

## Company information

Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

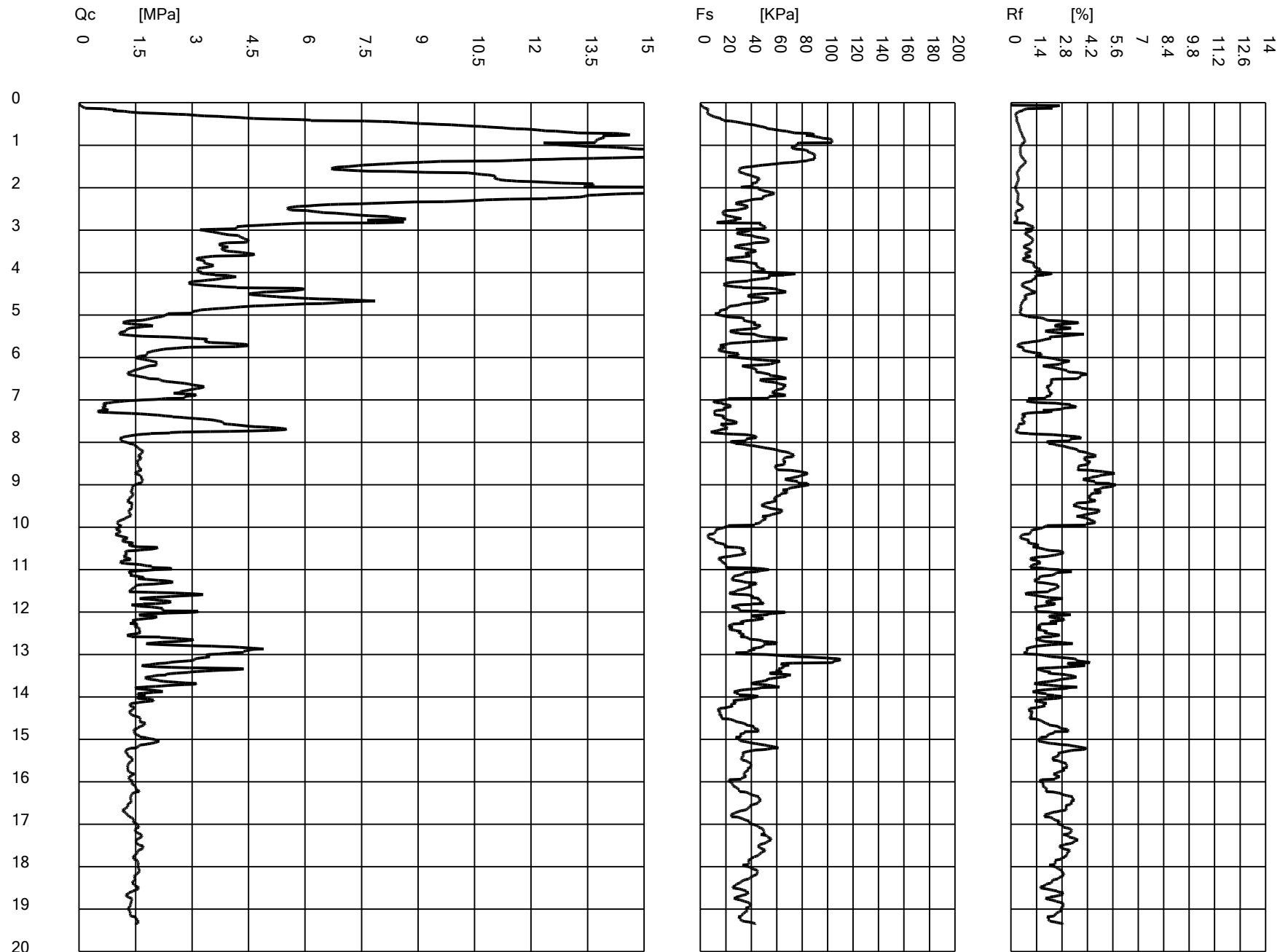
## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

## Test information

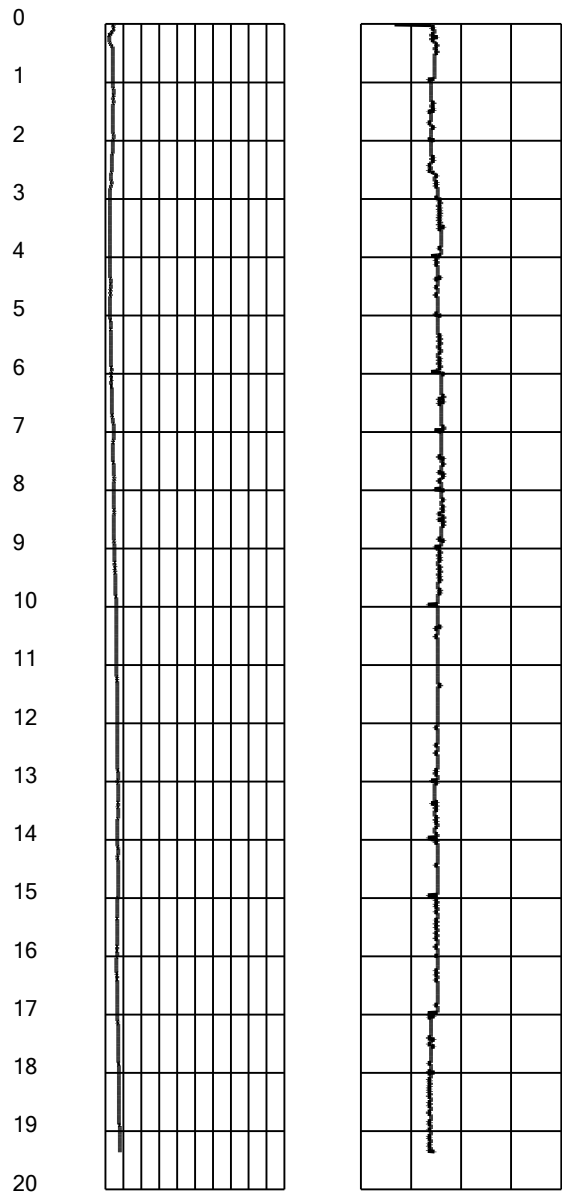
Name: CPTE 3  
Location: CPTE 3  
Date: 19/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 90  
Ground level [cm]: 0  
Latitude: 44.108754  
Longitude: 12.511344  
Operator:  
Comments:  
Probe code: MKS728







Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

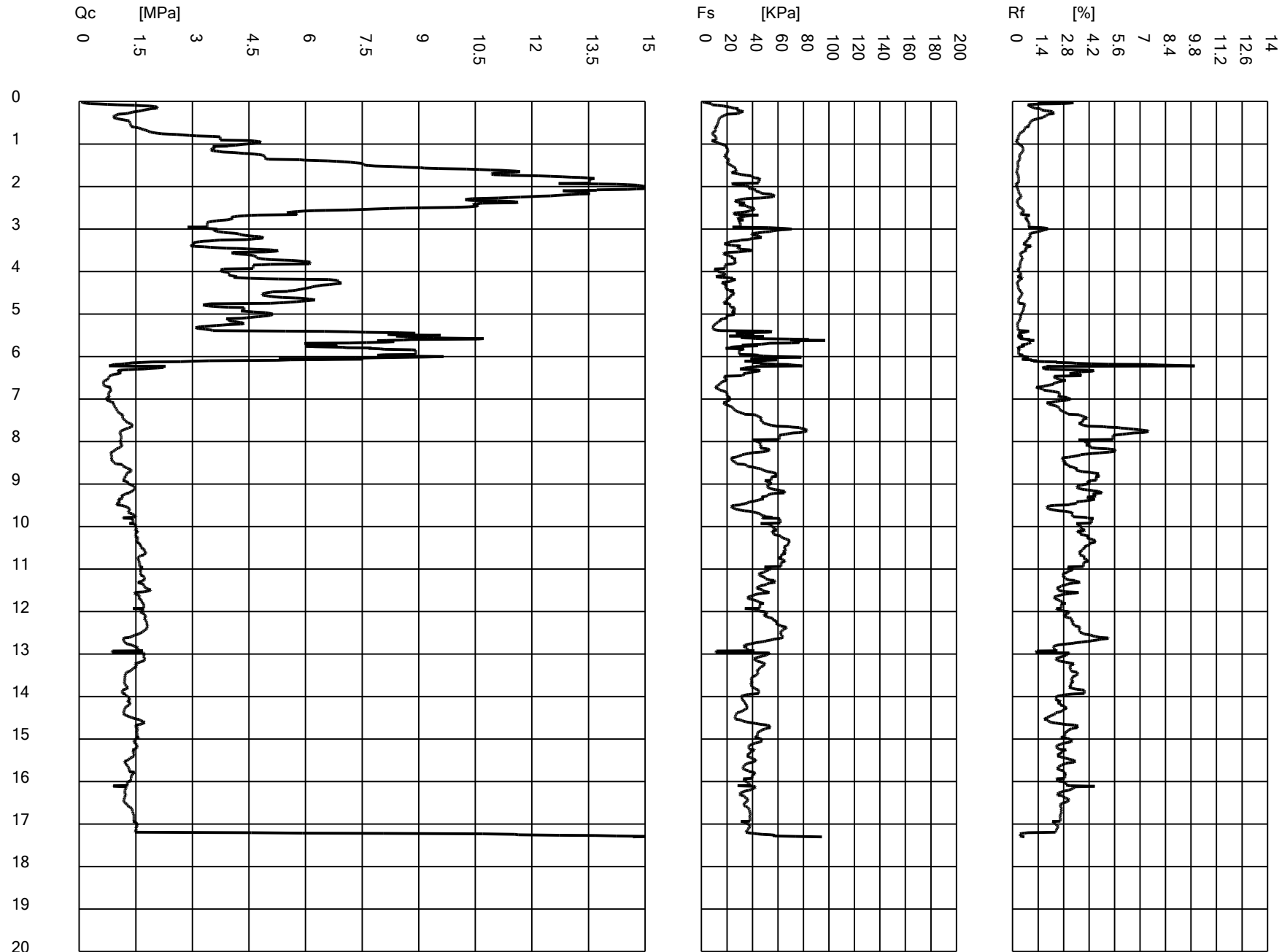
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

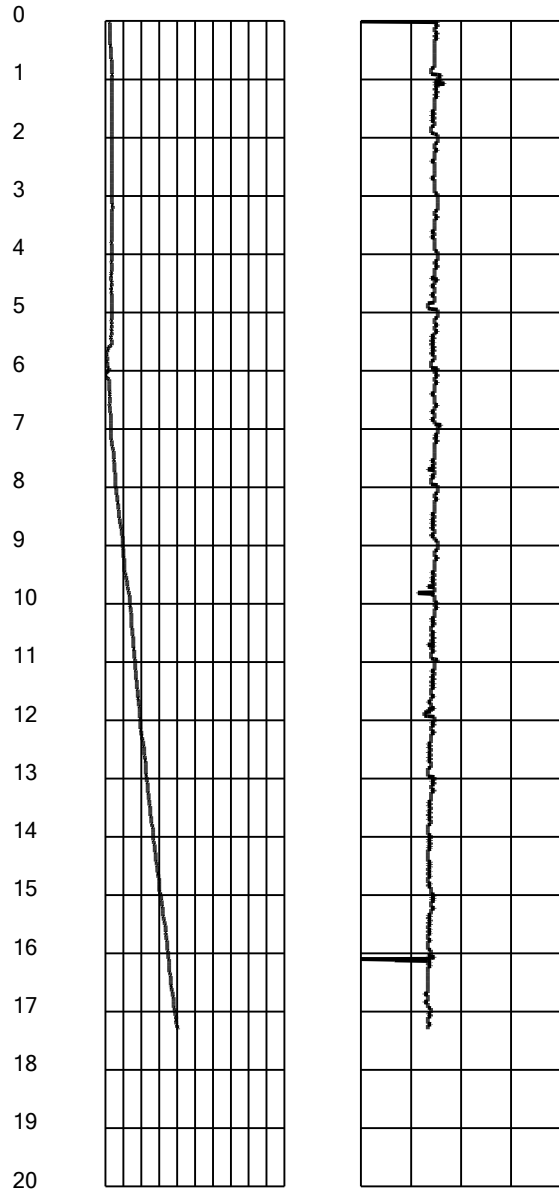
## Test information

Name: CPTE 4  
Location: CPTE 4  
Date: 11/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 70  
Ground level [cm]: 0  
Latitude: 44.106047  
Longitude: 12.507017  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20





## Company information

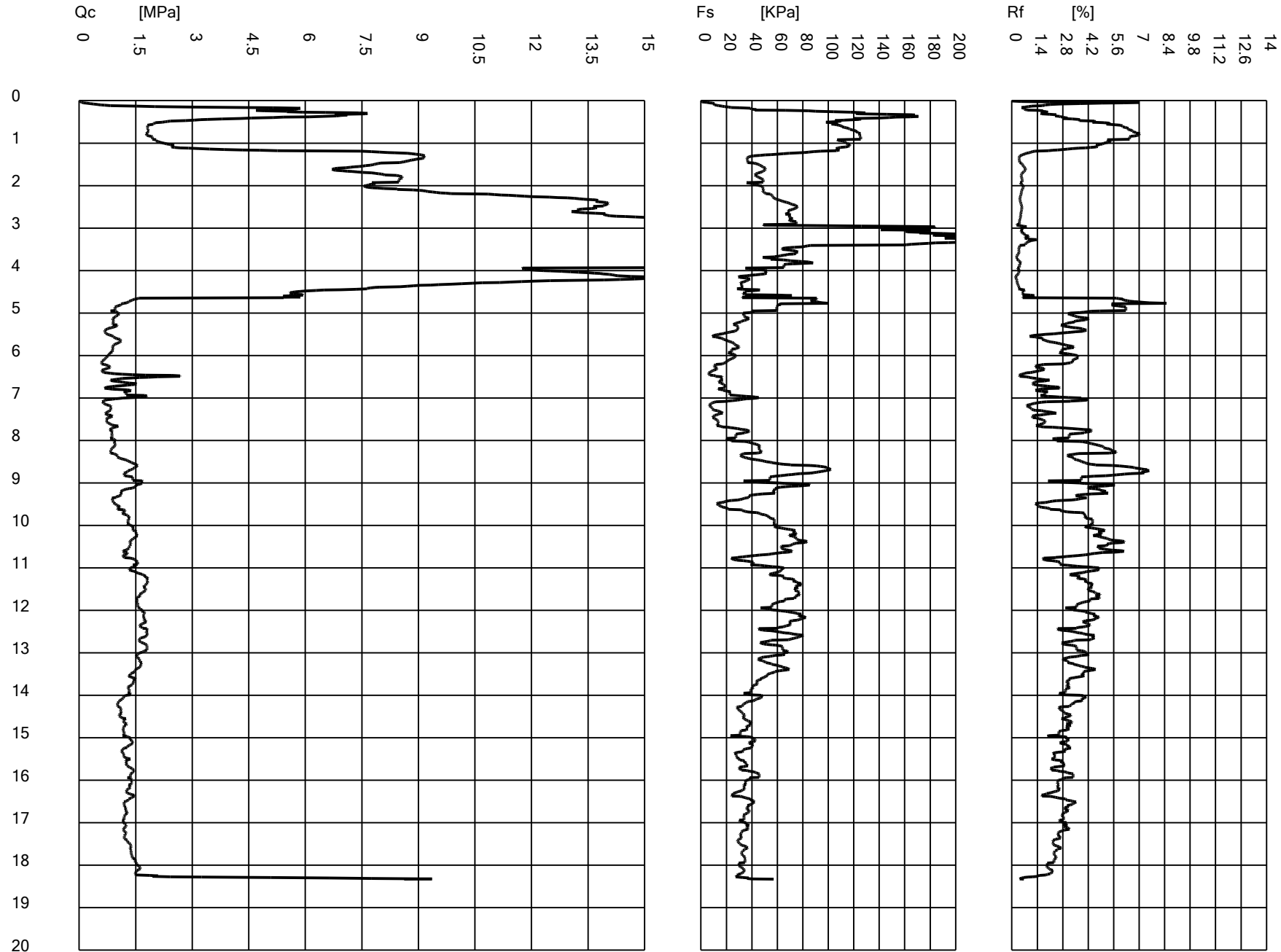
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
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Locality:

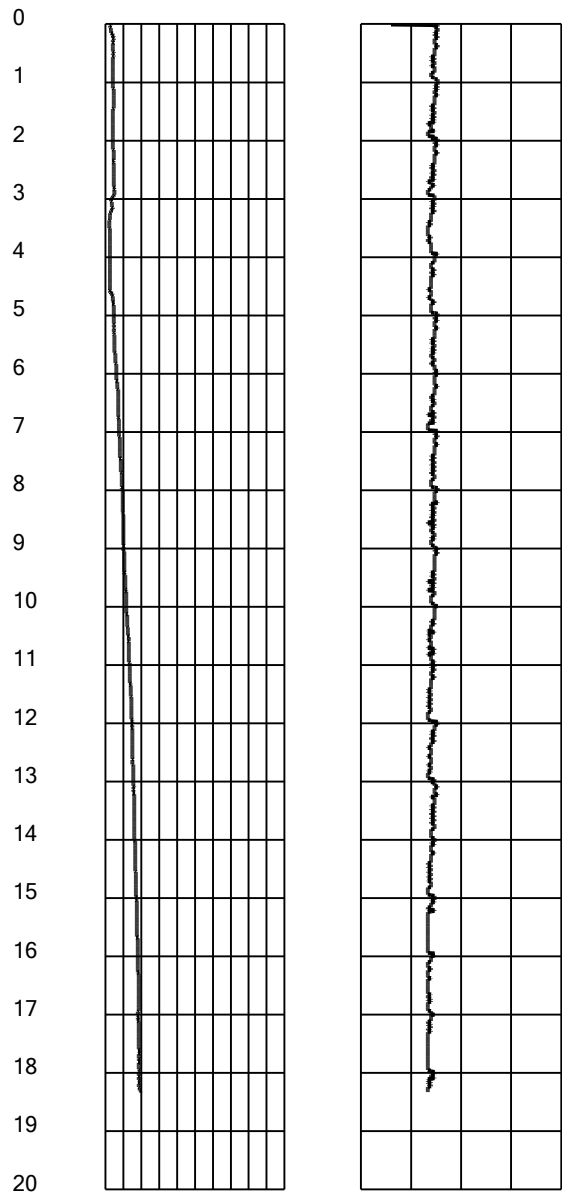
## Test information

Name: CPTE 5  
Location: CPTE 5  
Date: 11/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 100  
Ground level [cm]: 0  
Latitude: 44.105457  
Longitude: 12.506281  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6







Cone Penetration Test (CPTU) - Date: 12/01/2021

Site: Rimini - Microzonazione sismica - Test: CPTE 6

## Company information

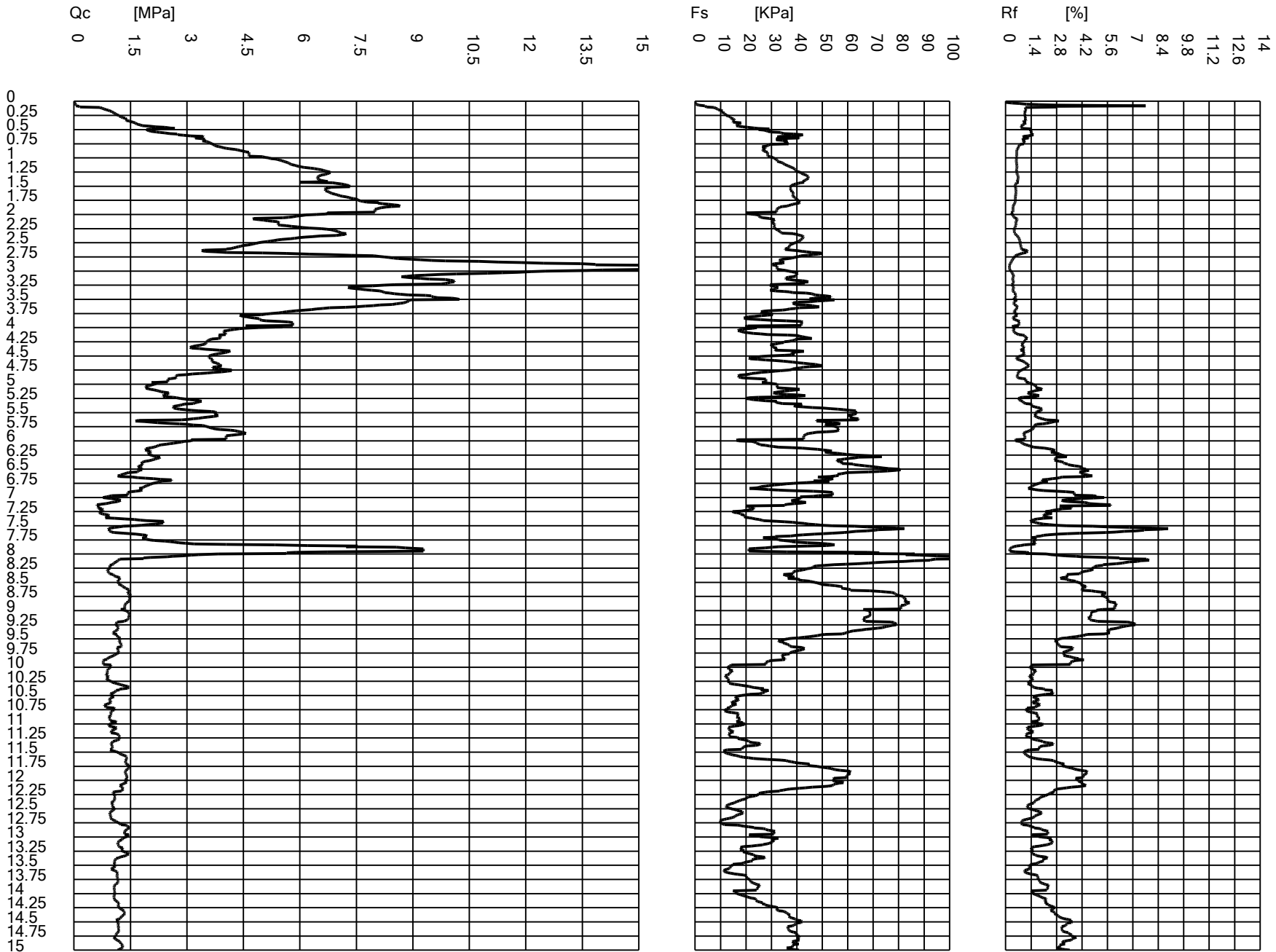
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

## Test information

Name: CPTE 6  
Location: CPTE 6  
Date: 12/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 120  
Ground level [cm]: 0  
Latitude: 44.104872  
Longitude: 12.514962  
Operator:  
Comments:  
Probe code: MKS728

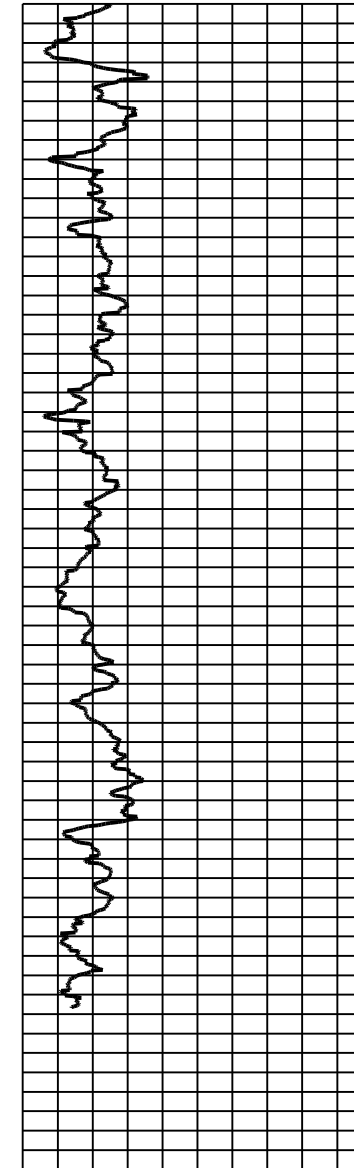
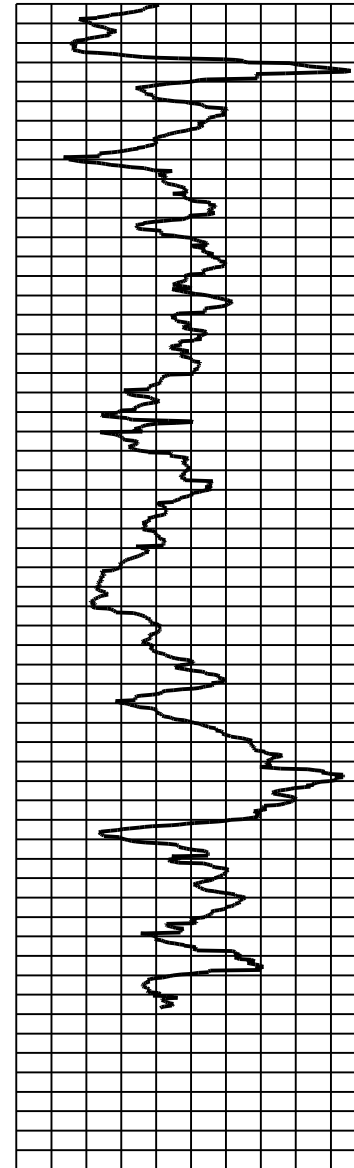
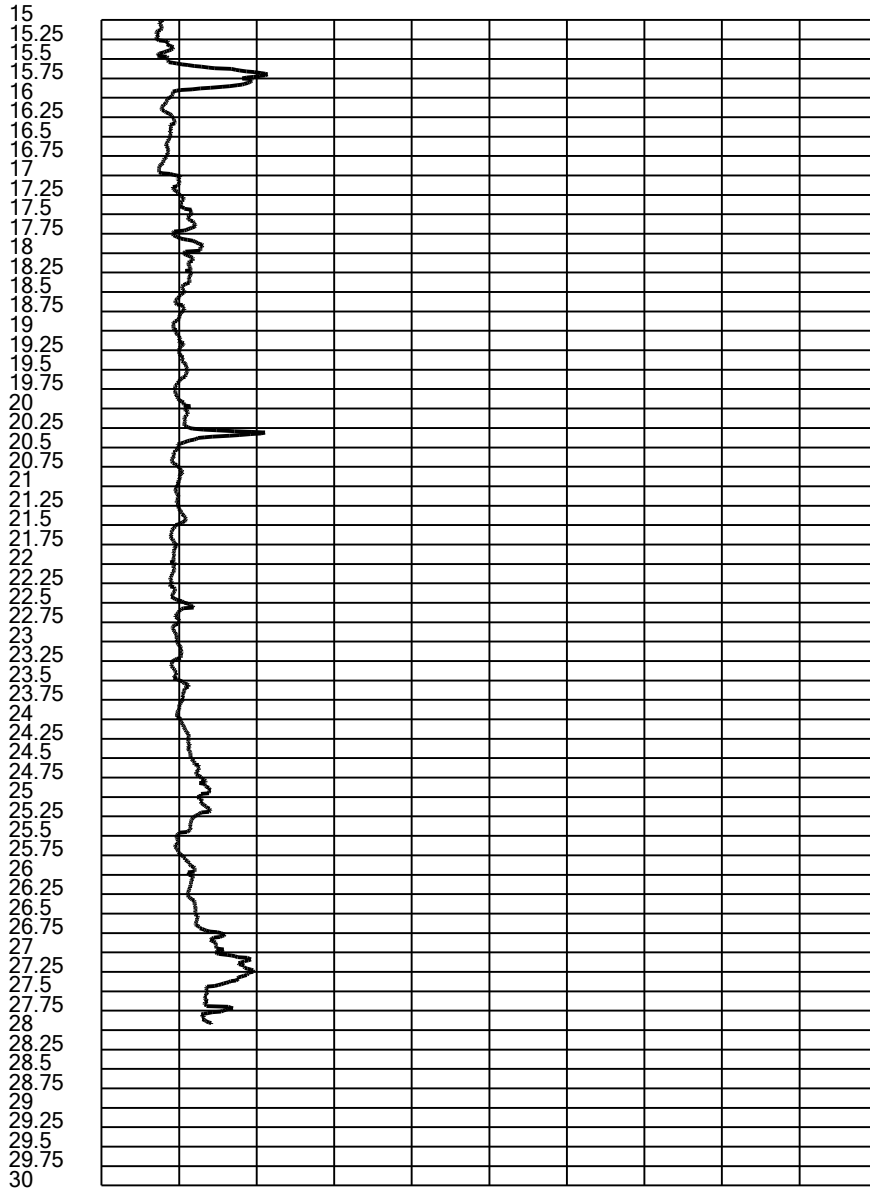




Qc [MPa]  
 0 1.5 3 4.5 6 7.5 9 10.5 12 13.5 15

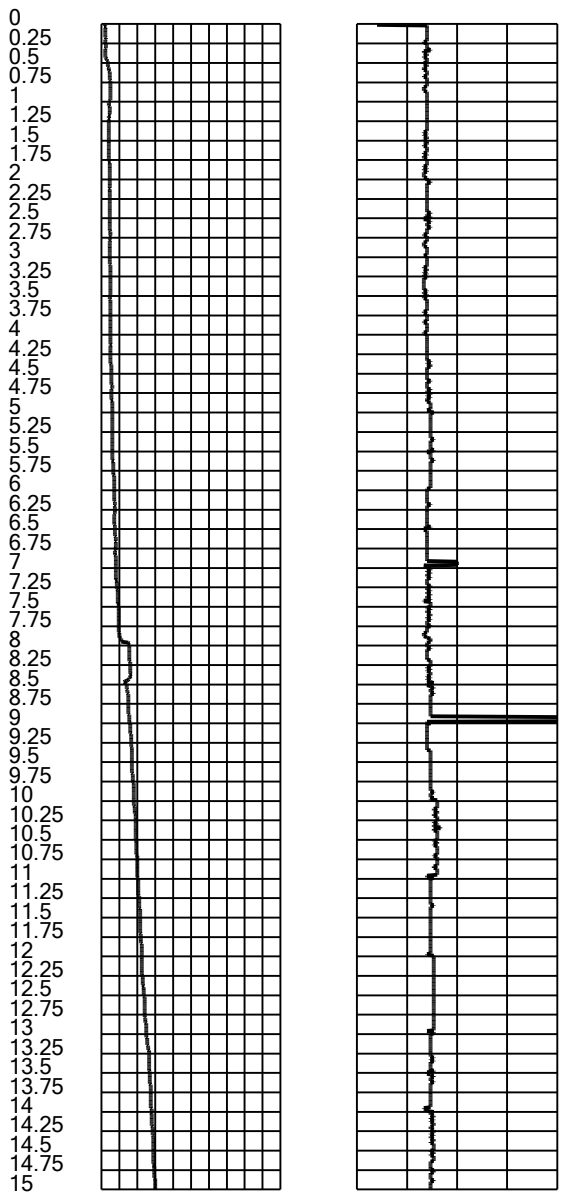
Fs [KPa]  
 0 10 20 30 40 50 60 70 80 90 100

Rf [%]  
 0 1.4 2.8 4.2 5.6 7 8.4 9.8 11.2 12.6 14



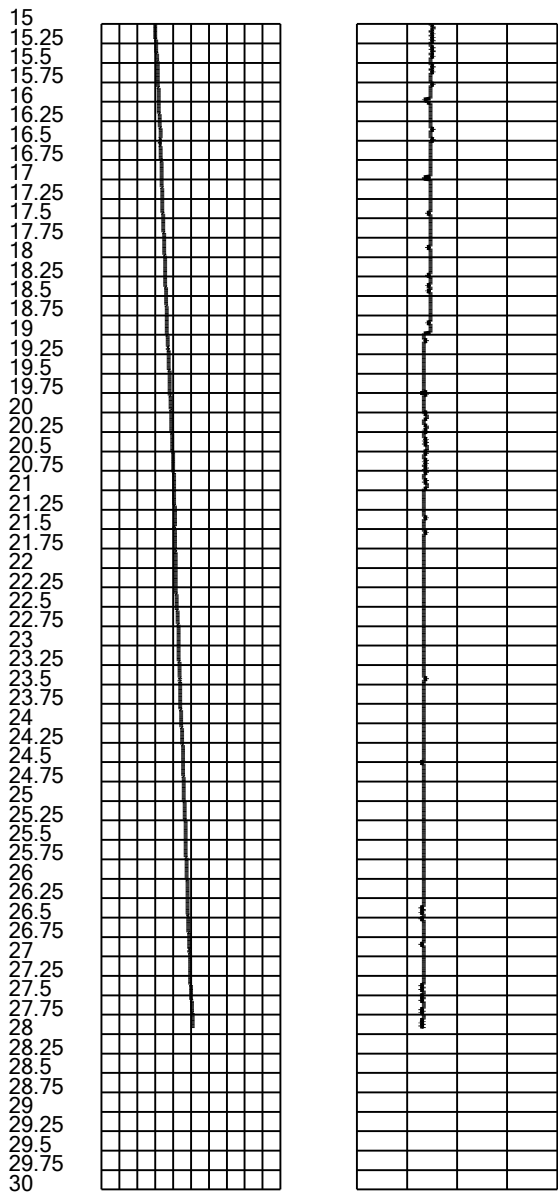


Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

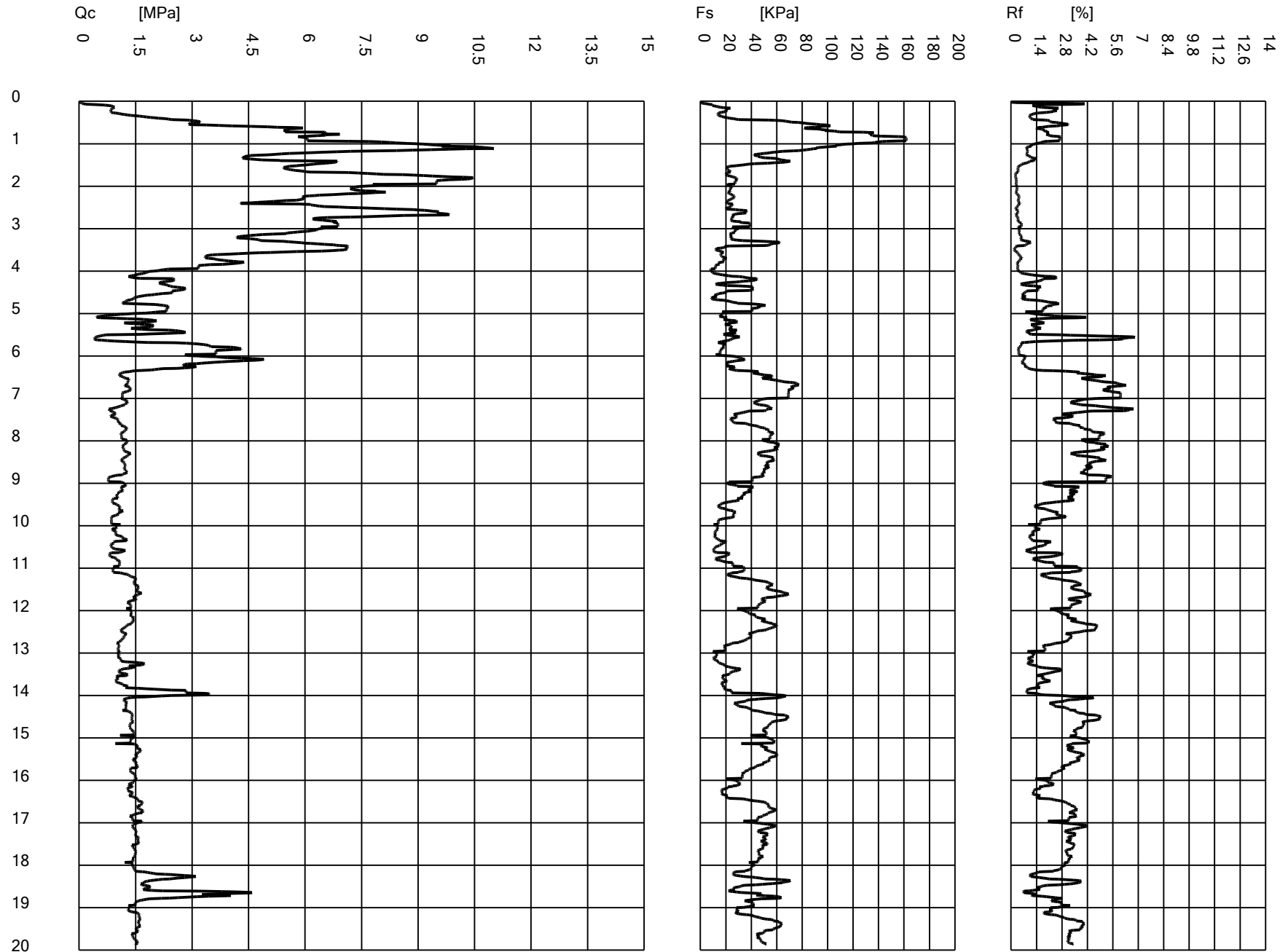
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

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Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

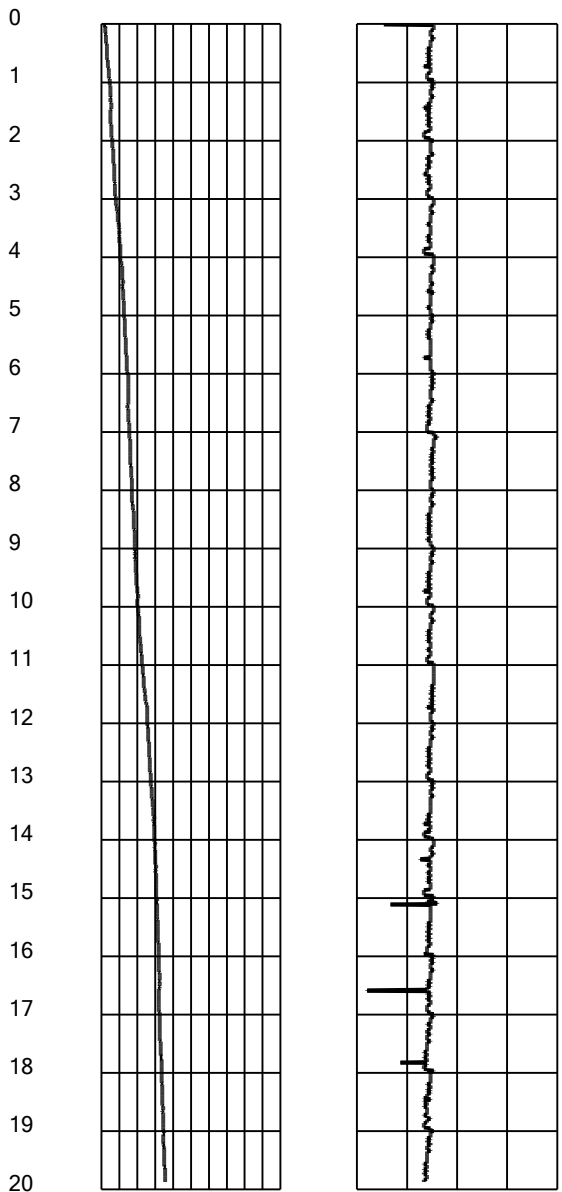
## Test information

Name: CPTE 7  
Location: CPTE 7  
Date: 11/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 100  
Ground level [cm]: 0  
Latitude: 44.102424  
Longitude: 12.513271  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20







Cone Penetration Test (CPTU) - Date: 19/01/2021

Site: Rimini - Microzonazione sismica - Test: CPTE 8

## Company information

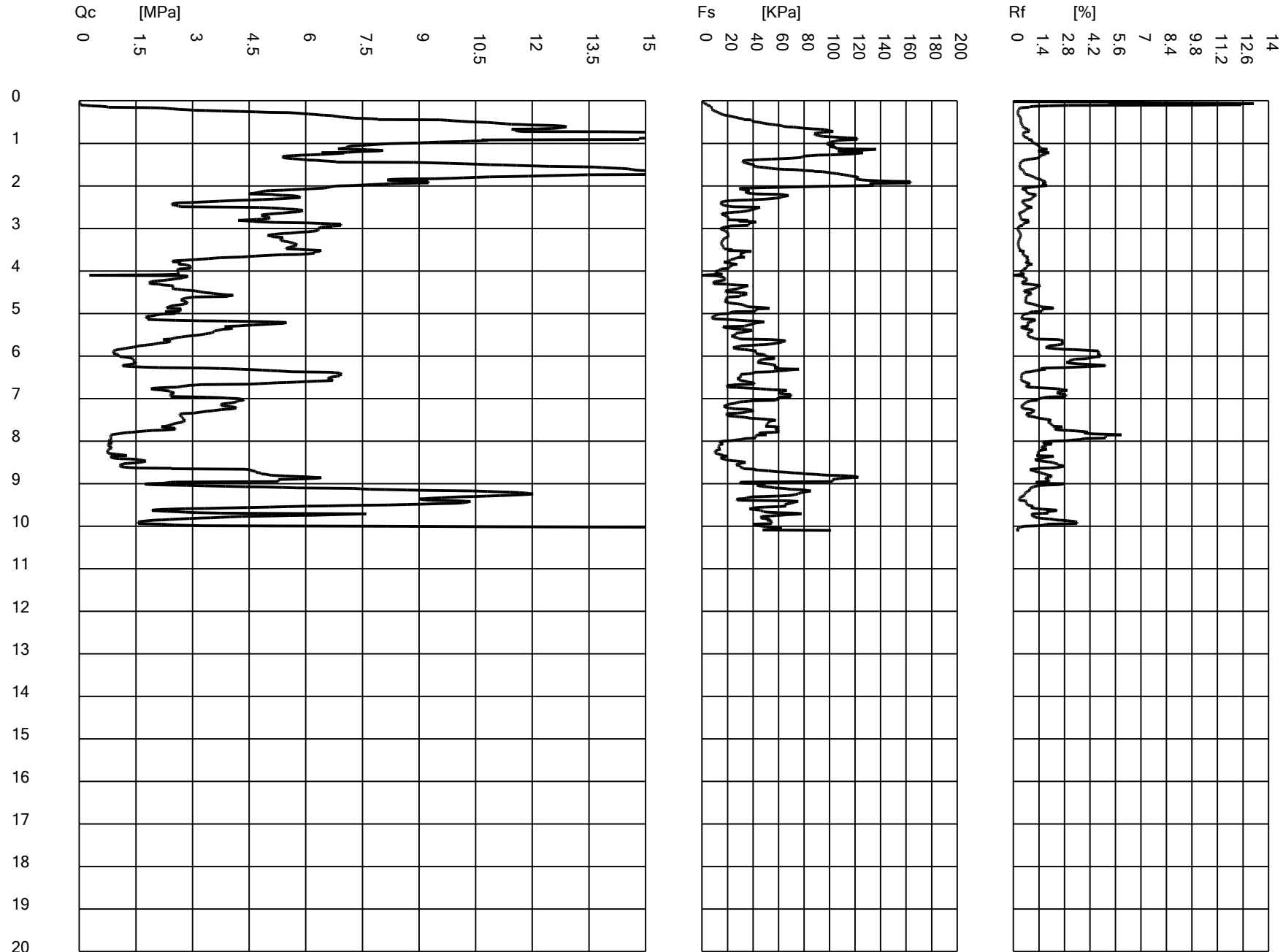
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

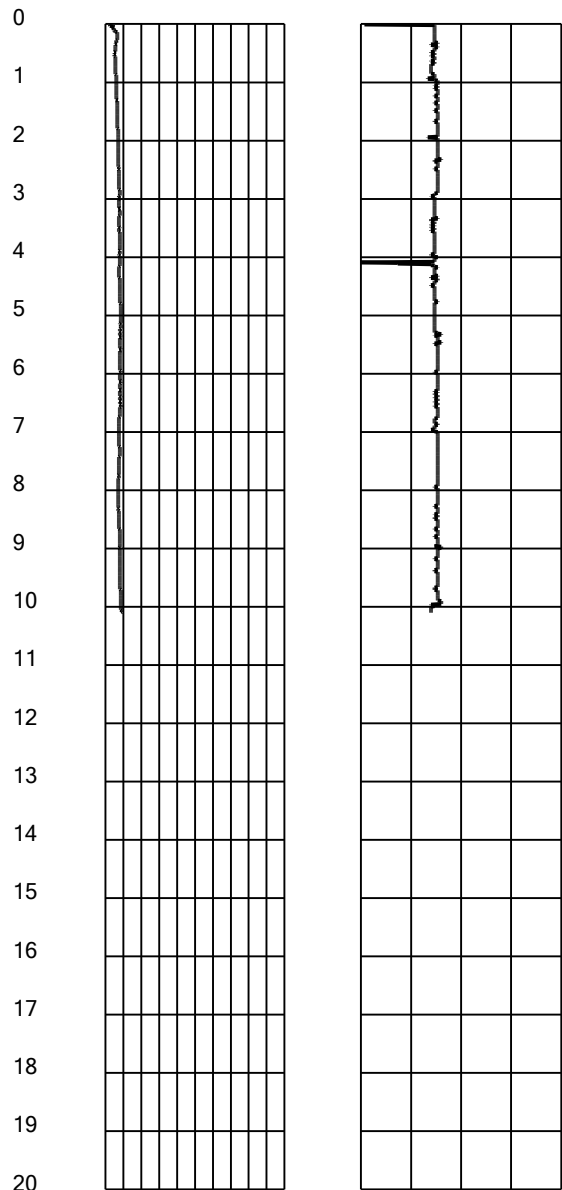
## Test information

Name: CPTE 8  
Location: CPTE 8  
Date: 19/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 100  
Ground level [cm]: 0  
Latitude: 44.091584  
Longitude: 12.533972  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

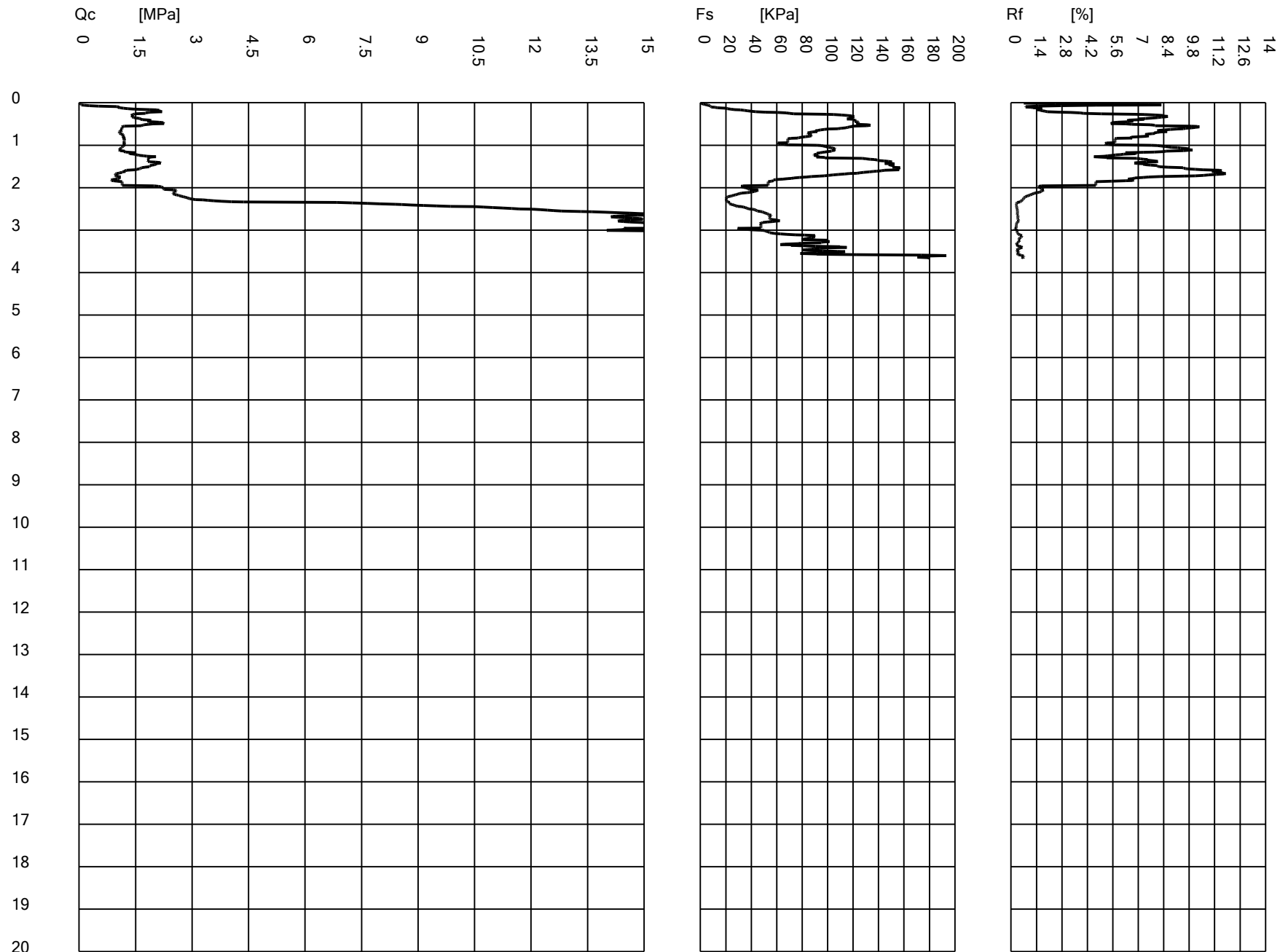
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

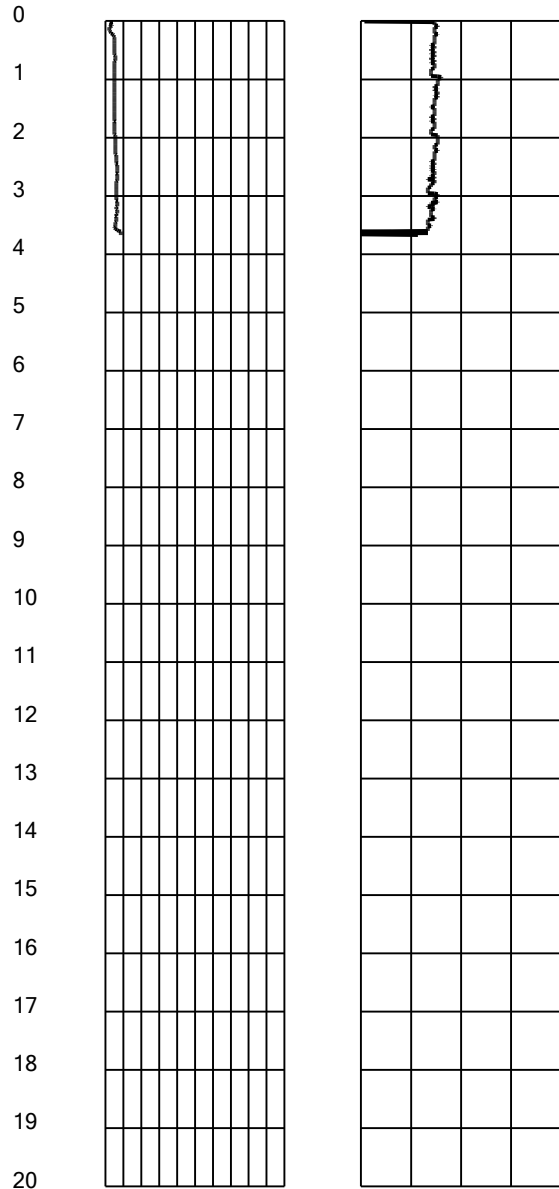
## Test information

Name: CPTE 9  
Location: CPTE 9  
Date: 11/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 160  
Ground level [cm]: 0  
Latitude: 44.087994  
Longitude: 12.530348  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

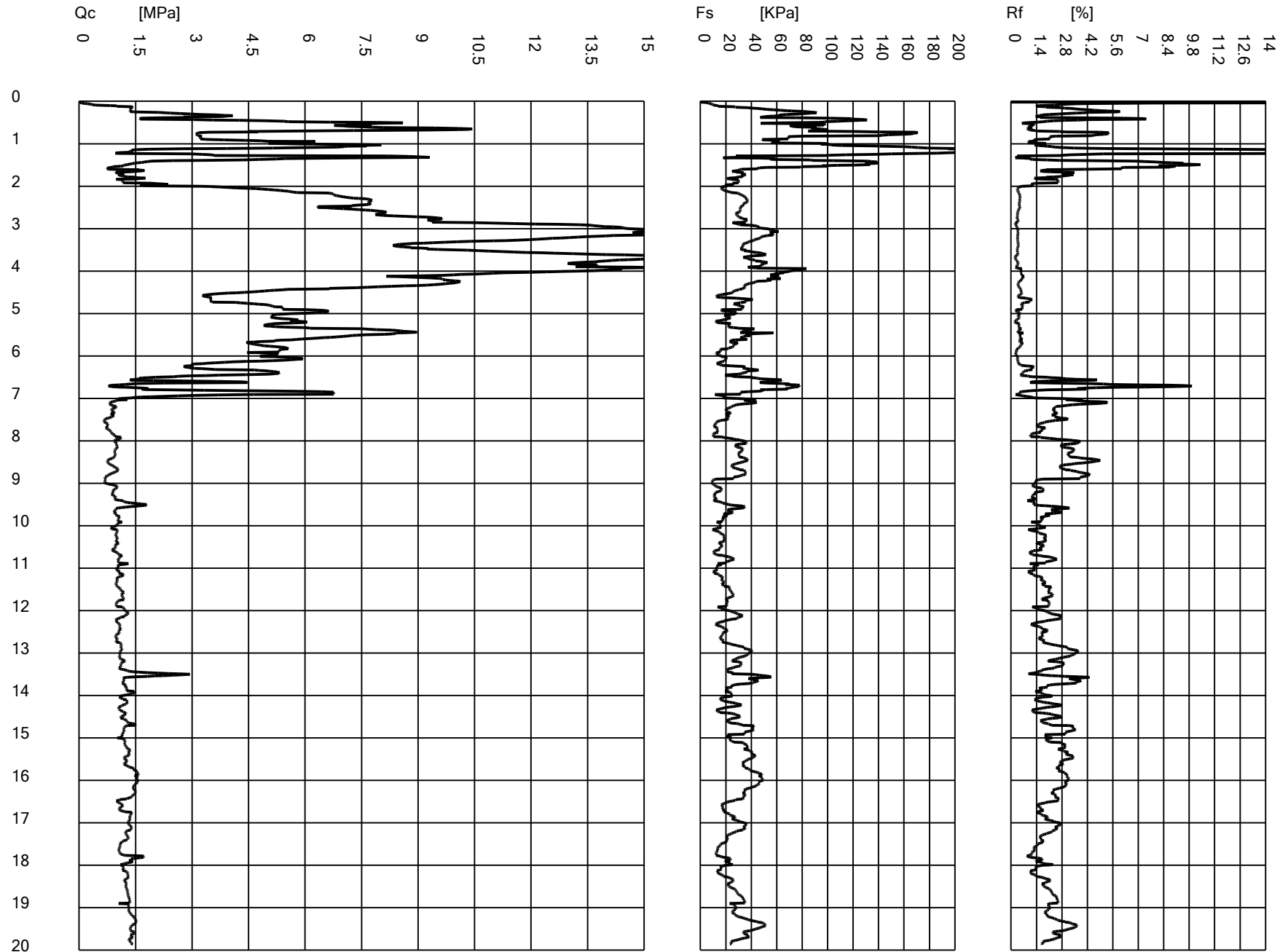
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

## Test information

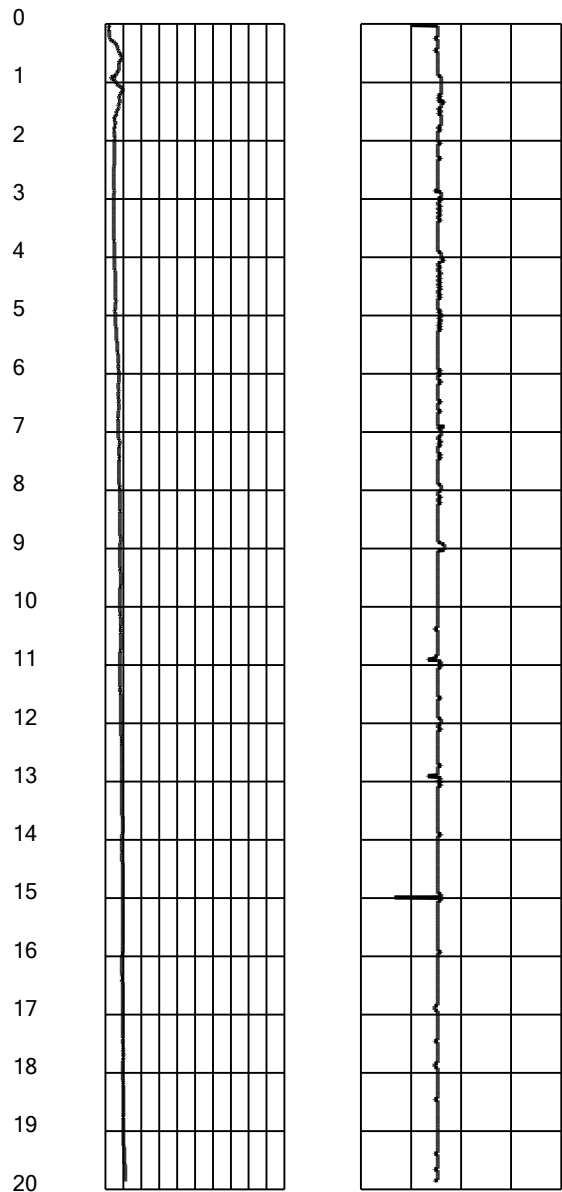
Name: CPTE 10  
Location: CPTE 10  
Date: 26/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 190  
Ground level [cm]: 0  
Latitude: 44.084436  
Longitude: 12.536053  
Operator:  
Comments:  
Probe code: MKS728







Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

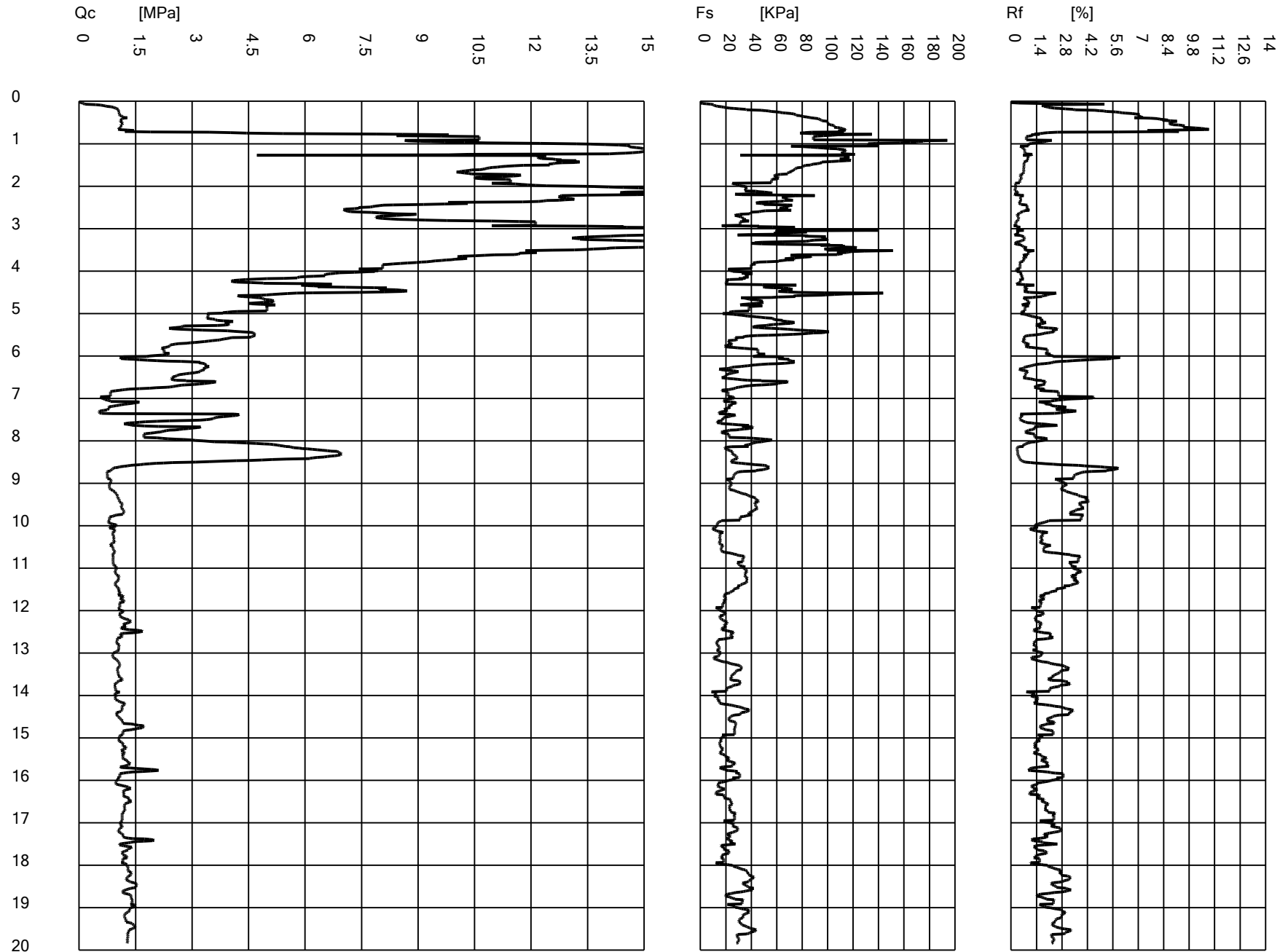
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

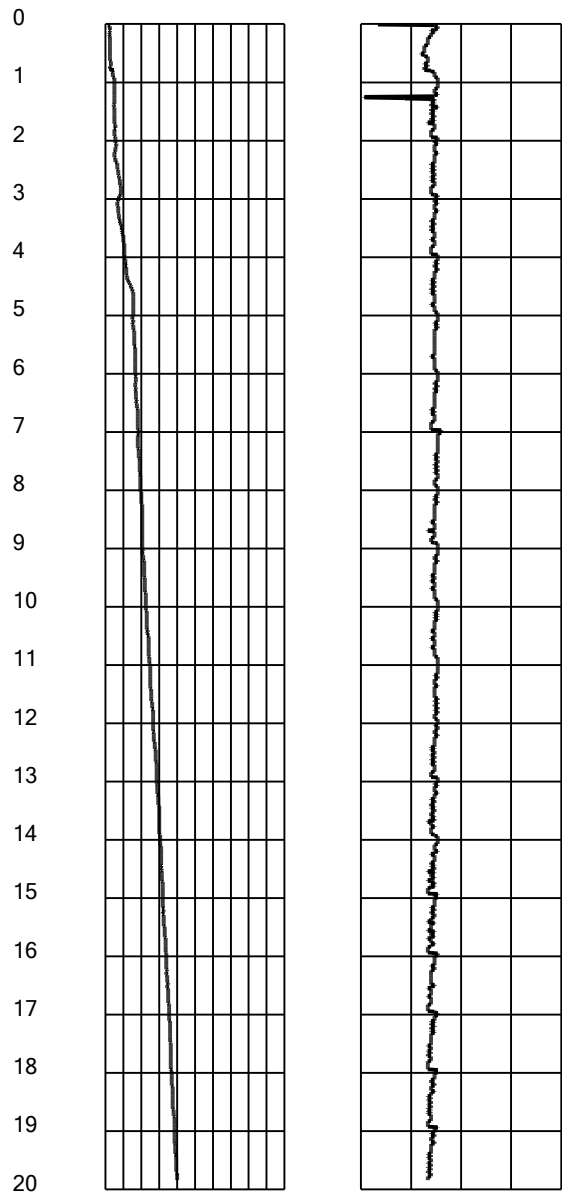
## Test information

Name: CPTE 11  
Location: CPTE 11  
Date: 18/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 180  
Ground level [cm]: 0  
Latitude: 44.084710  
Longitude: 12.543564  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

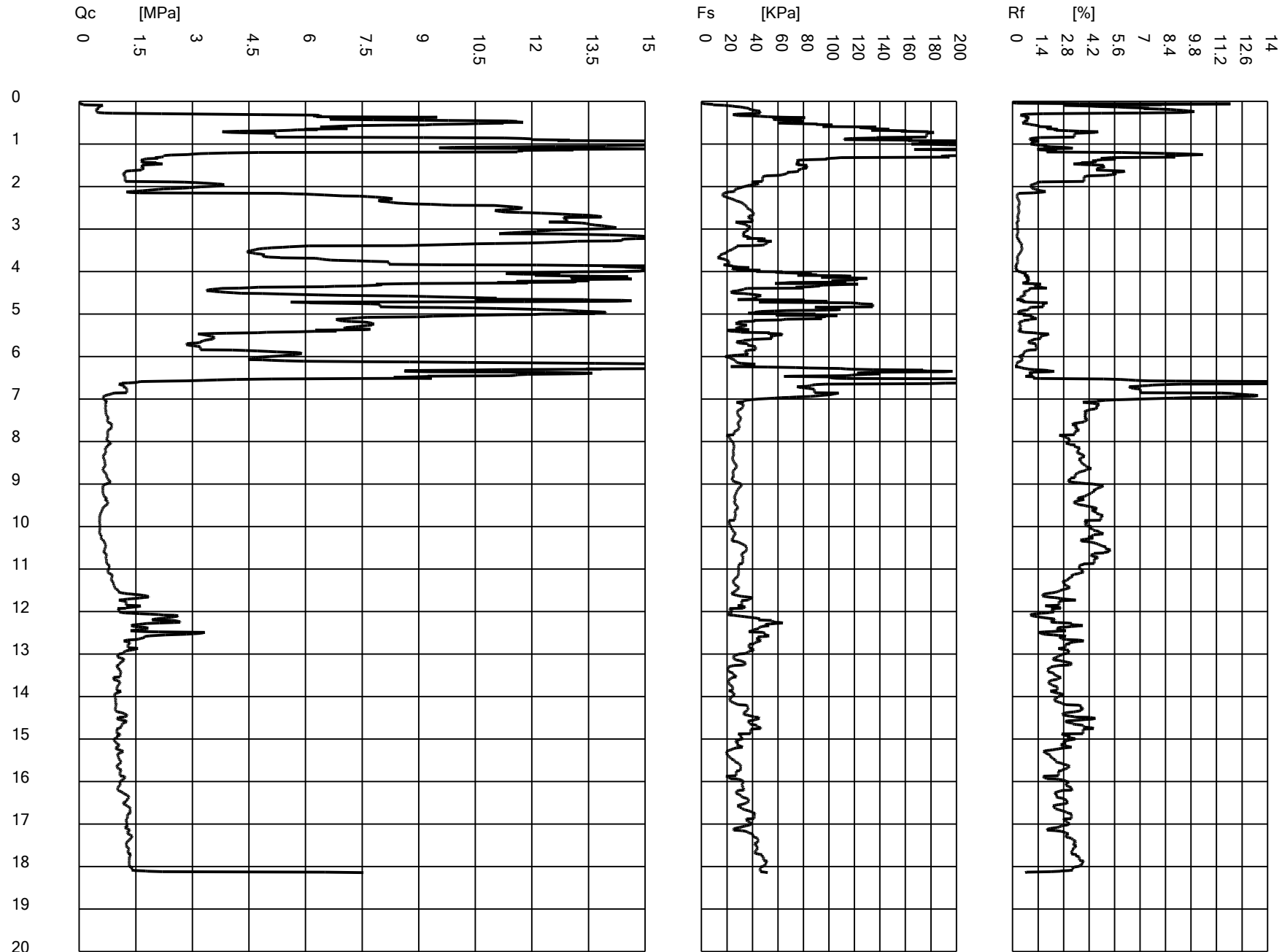
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

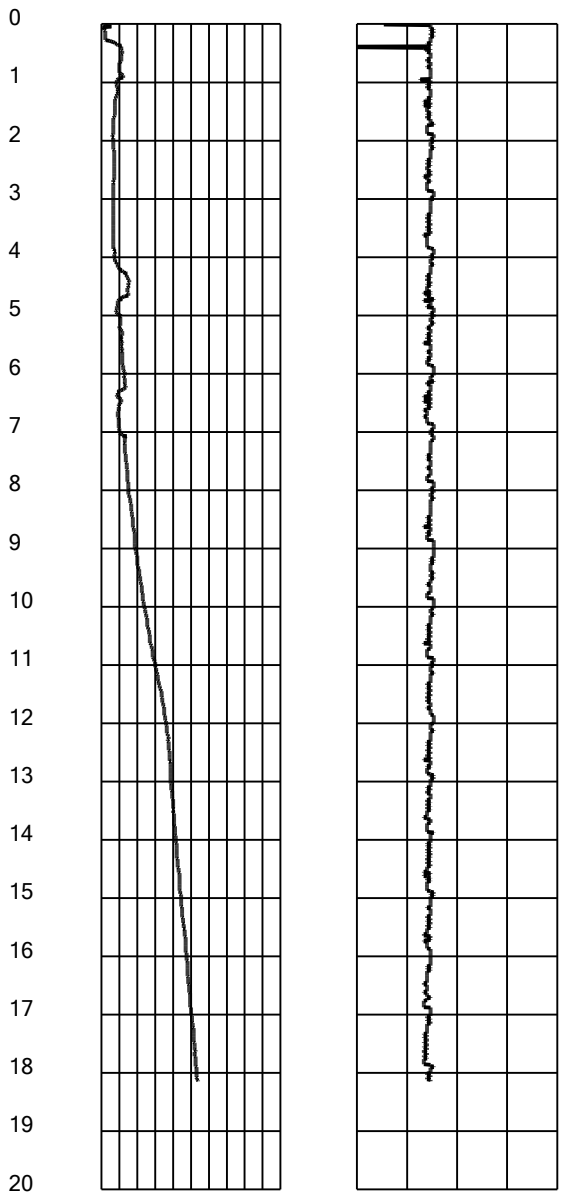
## Test information

Name: CPTE 12  
Location: CPTE 12  
Date: 18/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 170  
Ground level [cm]: 0  
Latitude: 44.075637  
Longitude: 12.548063  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20





## Company information

Name: Intergeo srl

Address: Strada Acquasalata, 9

Zip code:

City: Serravalle

P.IVA: C.O.E: SM 21197

E-Mail: info@intergeosm.com

Phone number:

Fax number:

## Site information

Name: Rimini - Microzonazione sismica

Date: 11/11/2020

Commissioner: Merli Alessandro

Locality:

## Test information

Name: CPTE 13

Location: CPTE 13

Date: 09/02/2021

Prehole mode:

Prehole depth [cm]: 0

Hydrostatic line [cm]: 130

Ground level [cm]: 0

Latitude: 44.074747

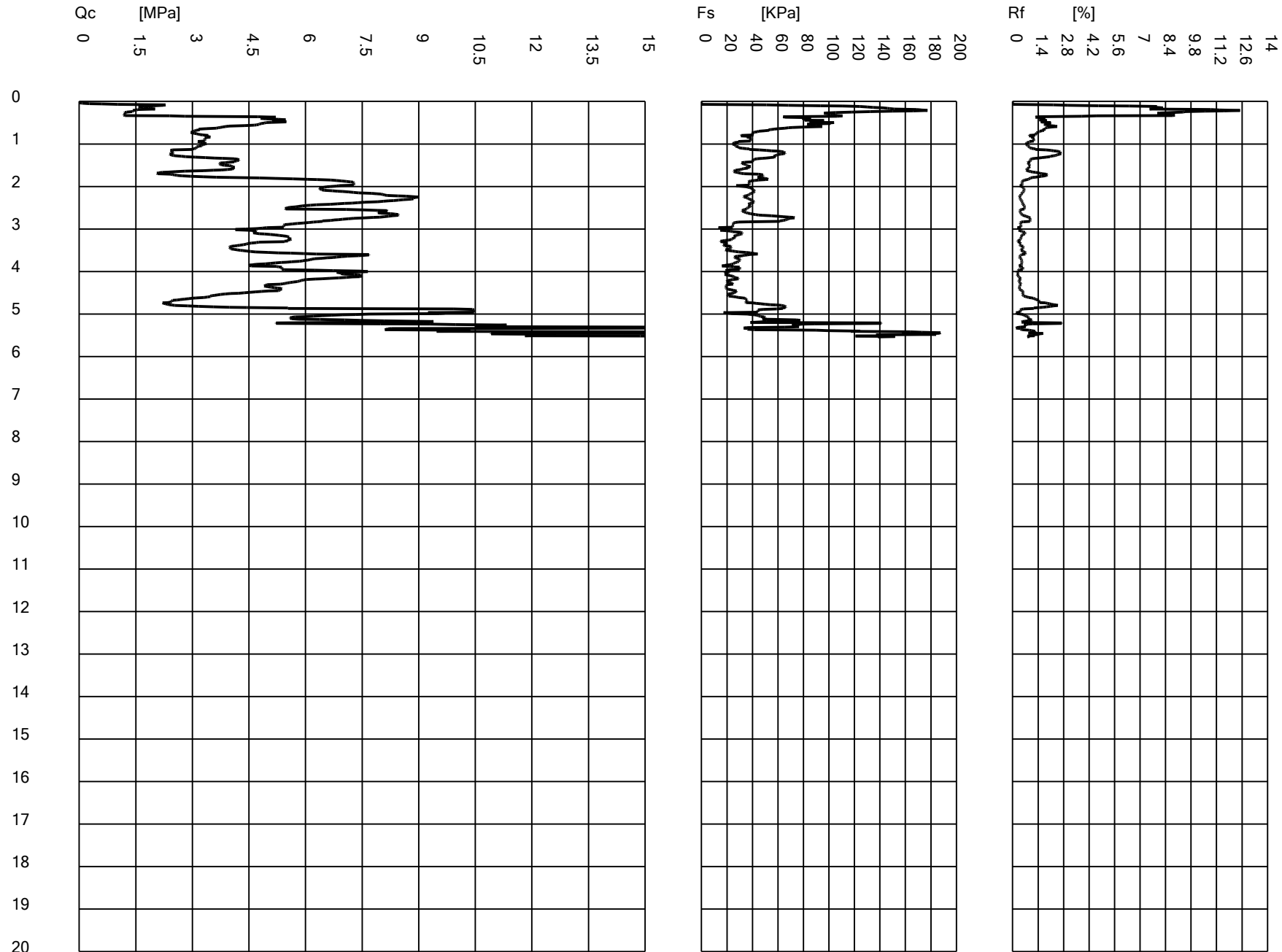
Longitude: 12.574692

Operator:

Comments:

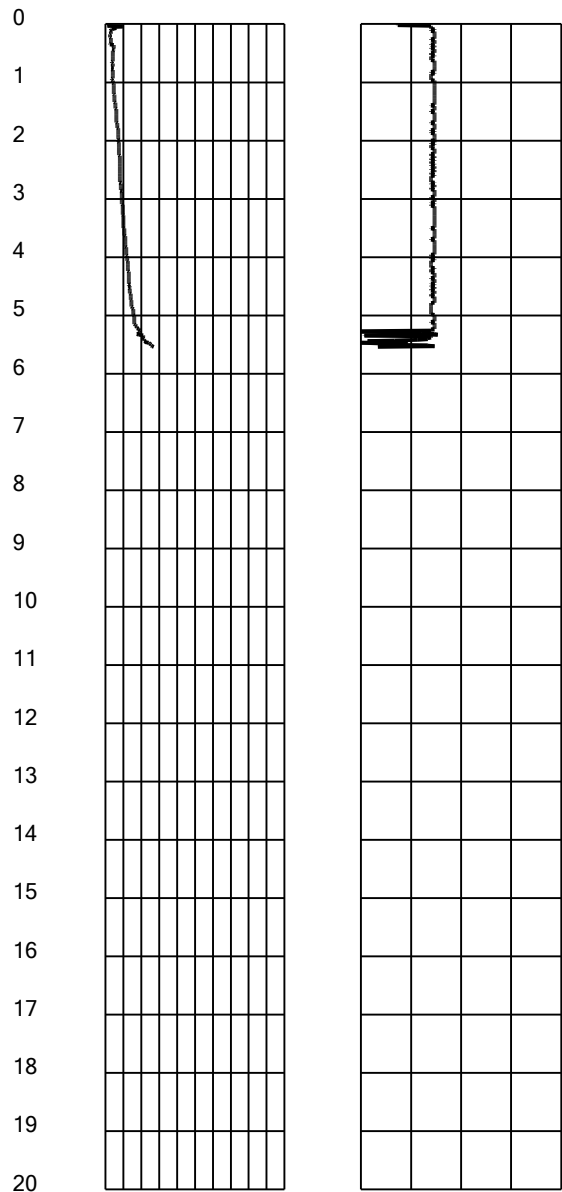
Probe code: MKS728







Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

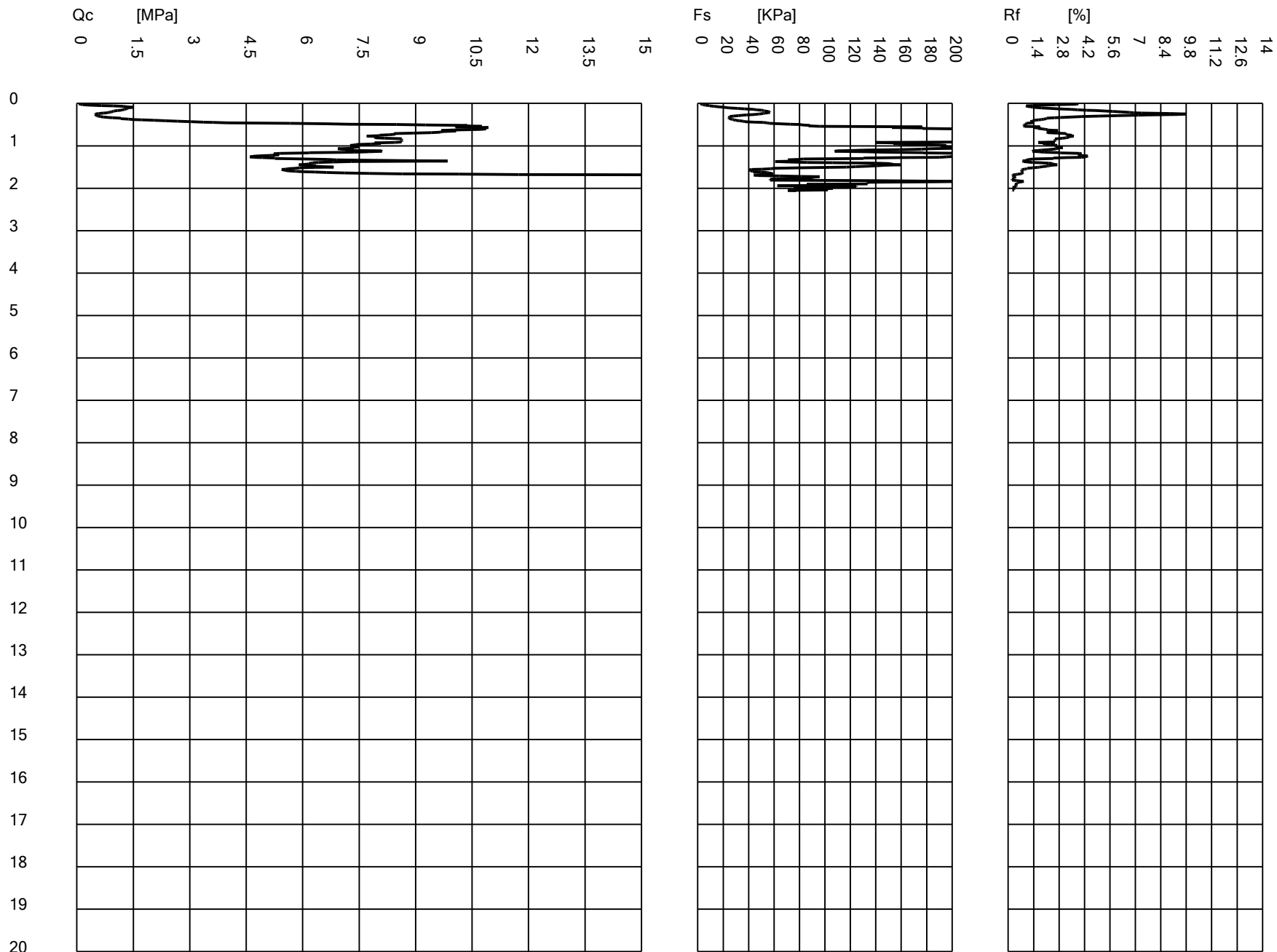
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

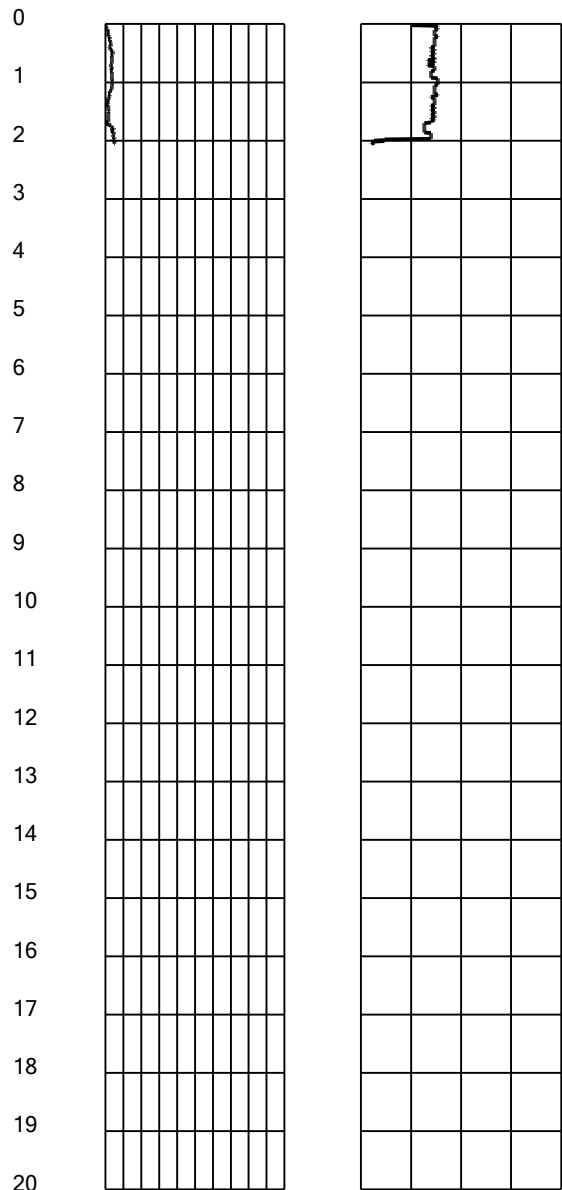
## Test information

Name: CPTE 14  
Location: CPTE 14  
Date: 18/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 120  
Ground level [cm]: 0  
Latitude: 44.078076  
Longitude: 12.553536  
Operator:  
Comments:  
Probe code: MKJ321





Tilt [°]      Speed [cm/sec]  
0 1 2 3 4 5 6  
0 1 2 3 4 5 6





## Company information

Name: Intergeo srl

Address: Strada Acquasalata, 9

Zip code:

City: Serravalle

P.IVA: C.O.E: SM 21197

E-Mail: info@intergeosm.com

Phone number:

Fax number:

## Site information

Name: Rimini - Microzonazione sismica

Date: 11/11/2020

Commissioner: Merli Alessandro

Locality:

## Test information

Name: CPTE 15

Location: CPTE 15

Date: 09/02/2021

Prehole mode:

Prehole depth [cm]: 0

Hydrostatic line [cm]: 110

Ground level [cm]: 0

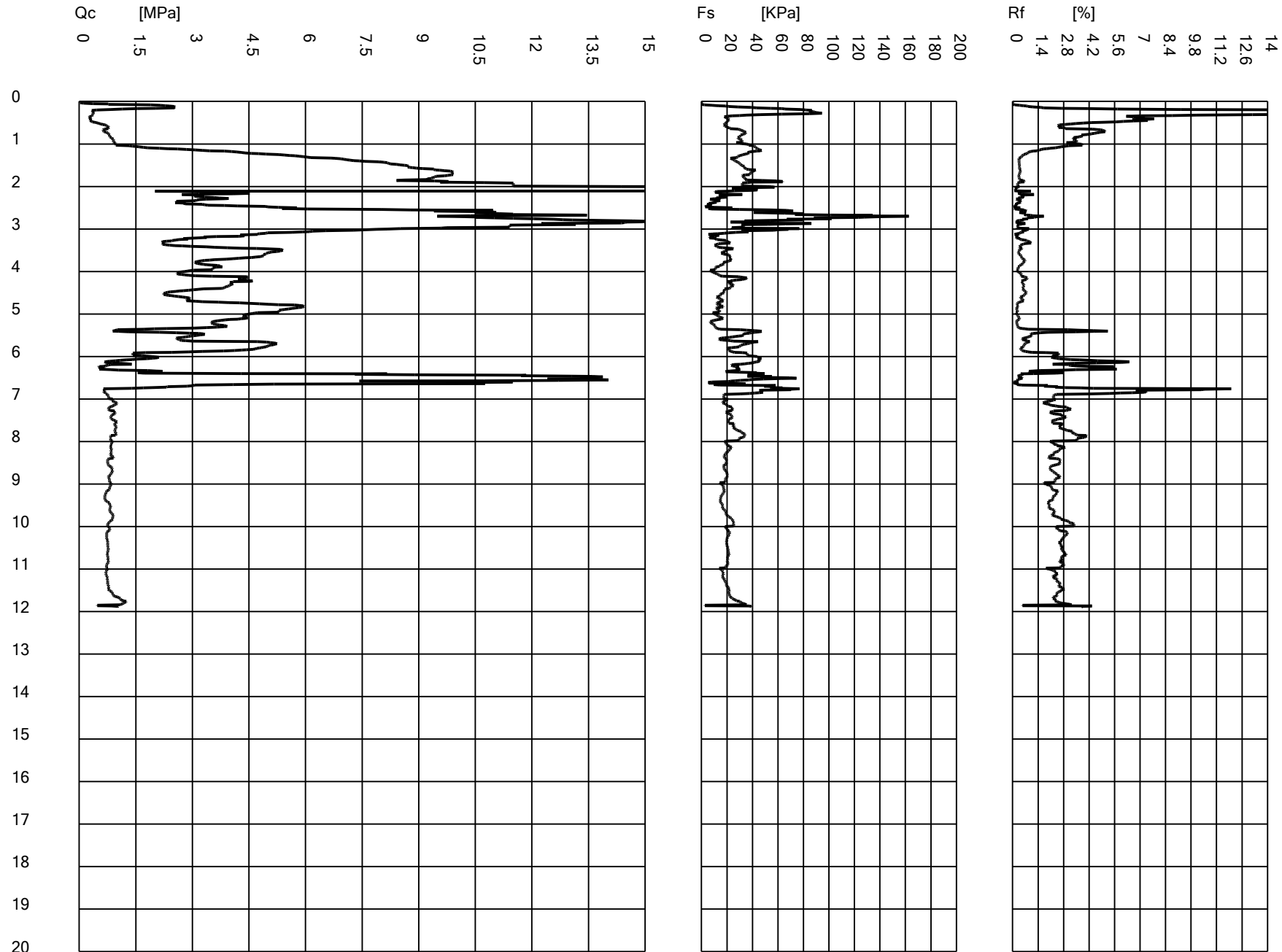
Latitude: 44.072343

Longitude: 12.554488

Operator:

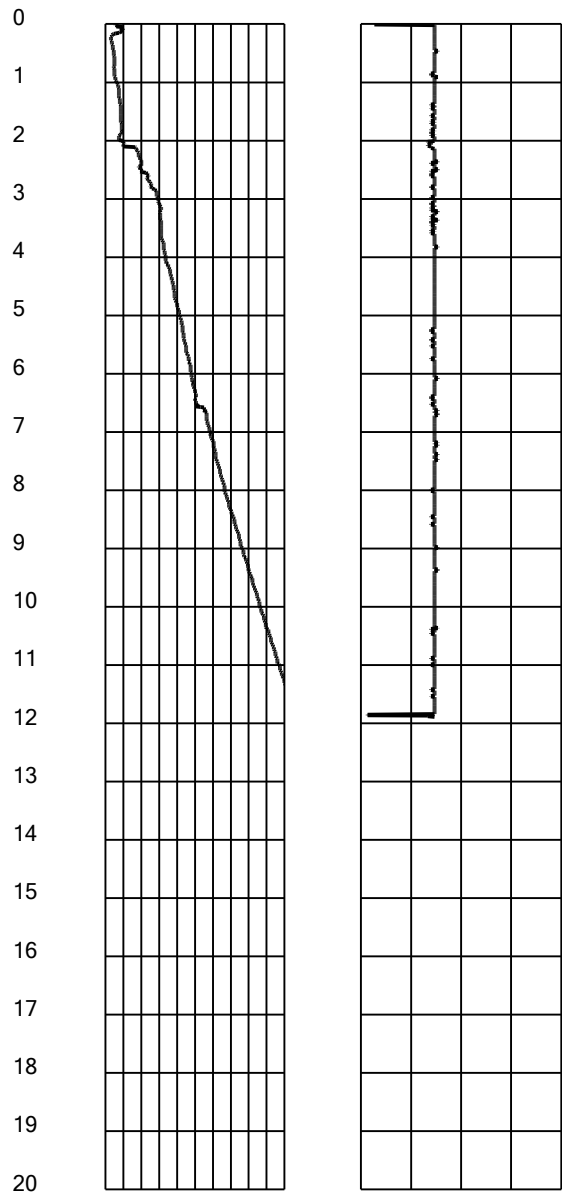
Comments:

Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6







Cone Penetration Test (CPTU) - Date: 09/02/2021

Site: Rimini - Microzonazione sismica - Test: CPTE 15B

## Company information

Name: Intergeo srl

Address: Strada Acquasalata, 9

Zip code:

City: Serravalle

P.IVA: C.O.E: SM 21197

E-Mail: info@intergeosm.com

Phone number:

Fax number:

## Site information

Name: Rimini - Microzonazione sismica

Date: 11/11/2020

Commissioner: Merli Alessandro

Locality:

## Test information

Name: CPTE 15B

Location: CPTE 15B

Date: 09/02/2021

Prehole mode:

Prehole depth [cm]: 0

Hydrostatic line [cm]: 90

Ground level [cm]: 0

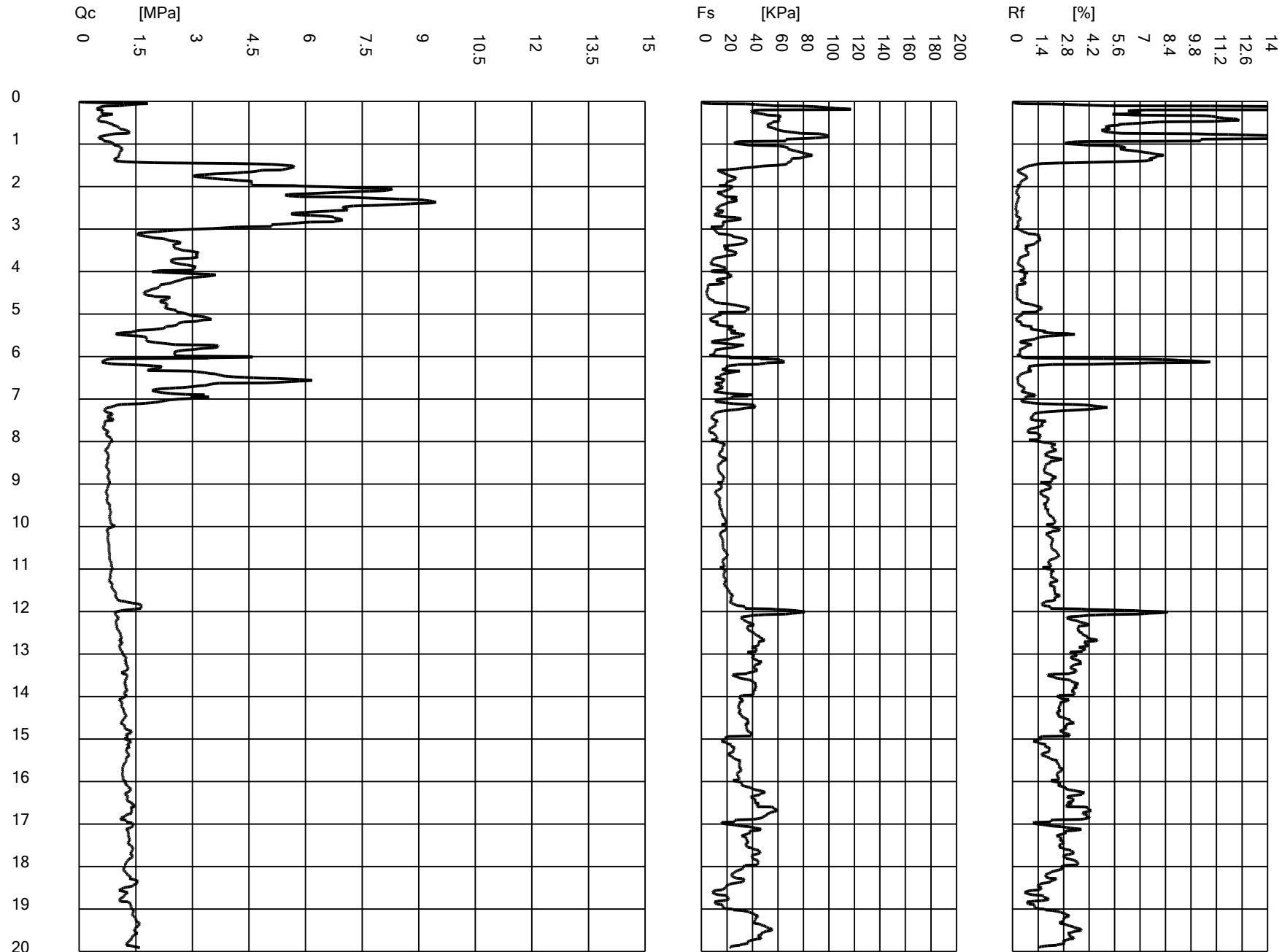
Latitude: 44.073140

Longitude: 12.555468

Operator:

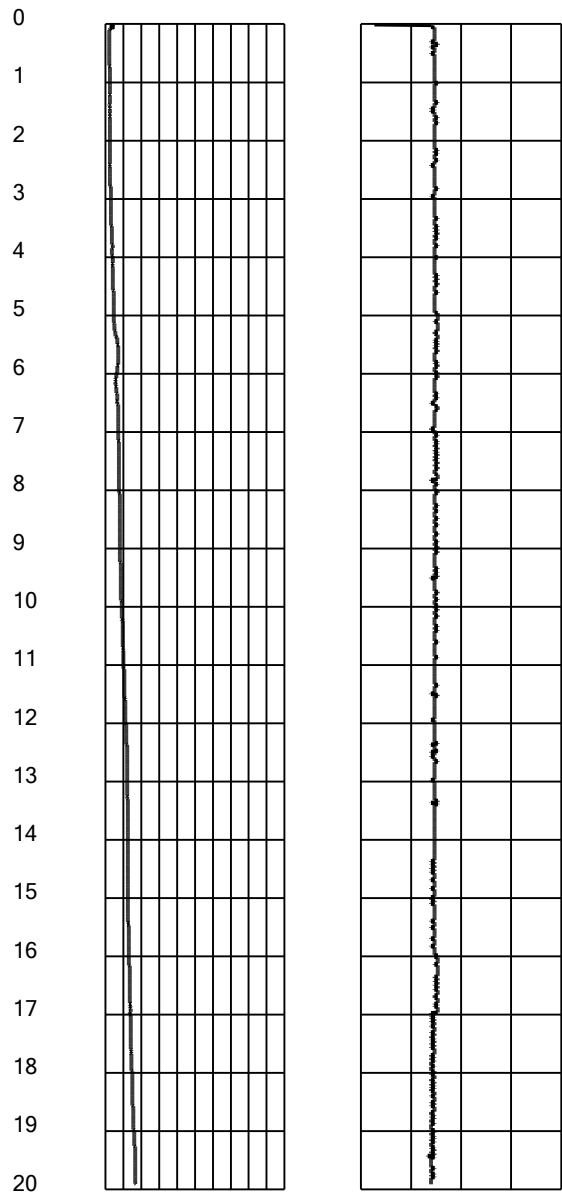
Comments:

Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20





## Company information

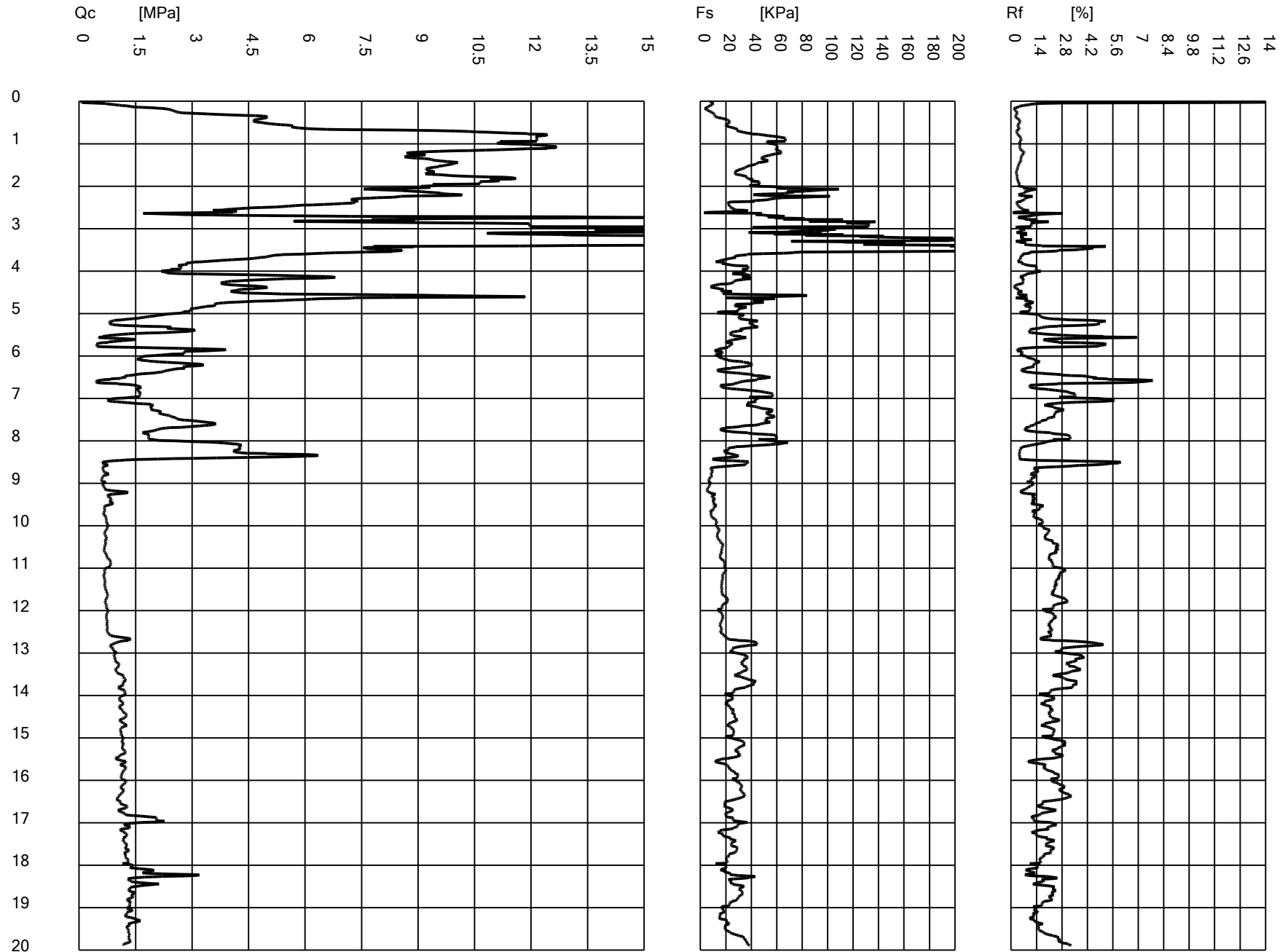
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
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Fax number:

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Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

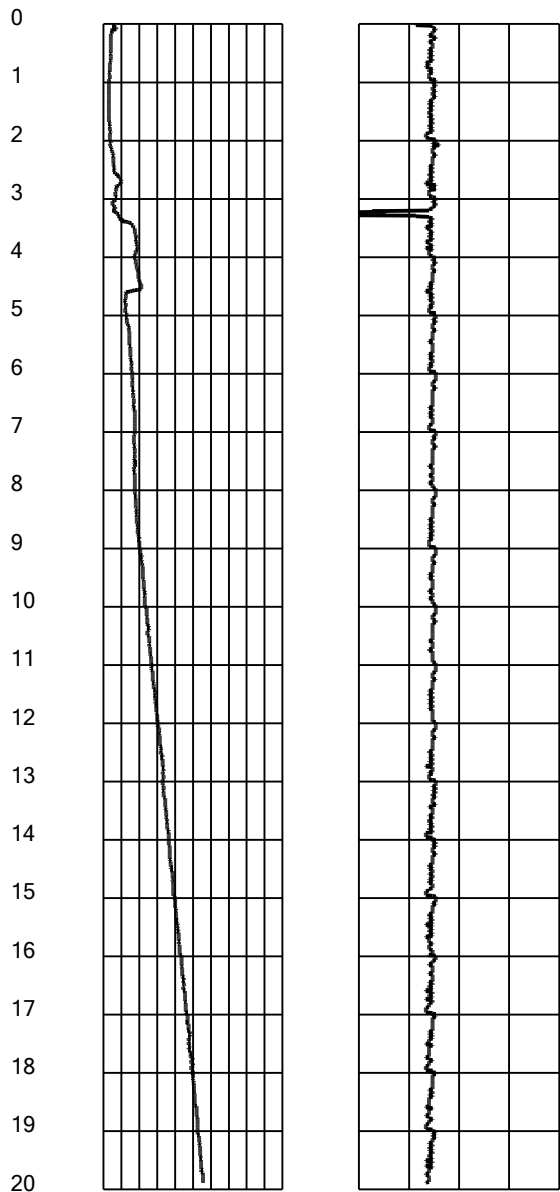
## Test information

Name: CPTE 16  
Location: CPTE 16  
Date: 18/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 150  
Ground level [cm]: 0  
Latitude: 44.076972  
Longitude: 12.557539  
Operator:  
Comments:  
Probe code: MKJ321





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20





## Company information

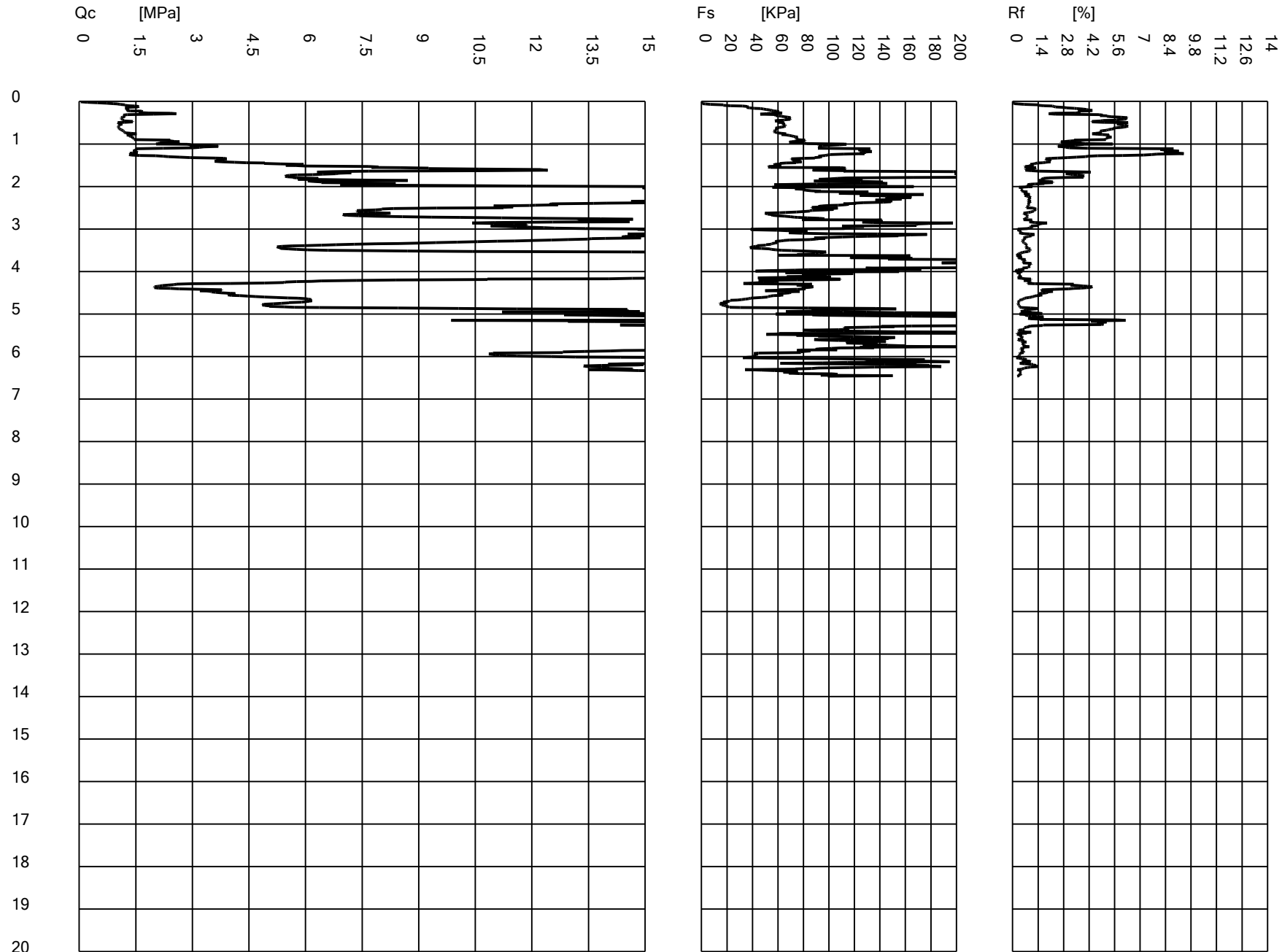
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

## Test information

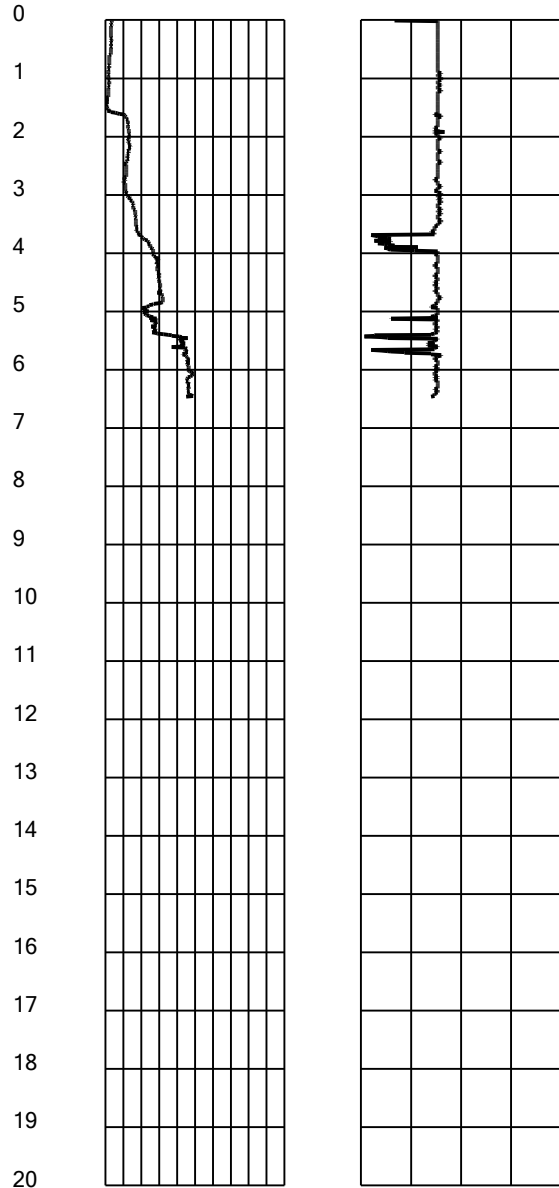
Name: CPTE 17  
Location: CPTE 17  
Date: 03/12/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 200  
Ground level [cm]: 0  
Latitude: 44.066537  
Longitude: 12.564605  
Operator:  
Comments:  
Probe code: MKJ321







Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

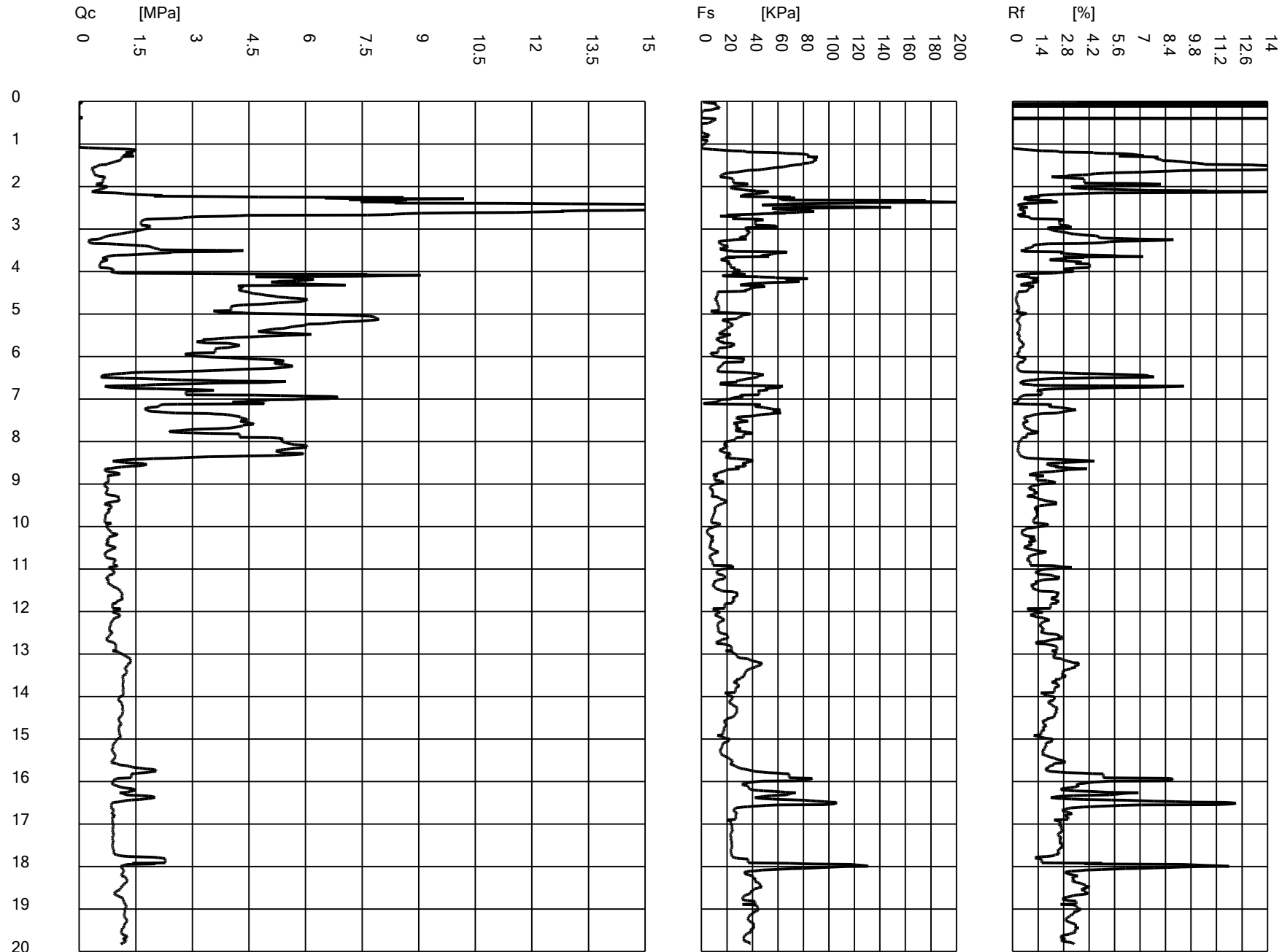
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

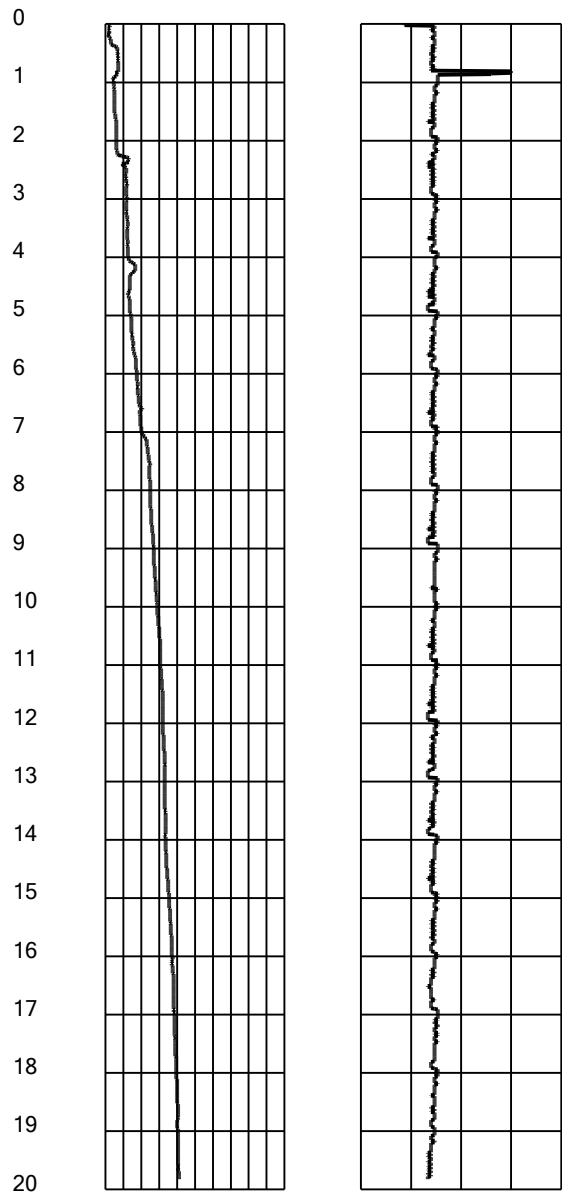
## Test information

Name: CPTE 18  
Location: CPTE 18  
Date: 18/11/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 120  
Ground level [cm]: 0  
Latitude: 44.068693  
Longitude: 12.565137  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

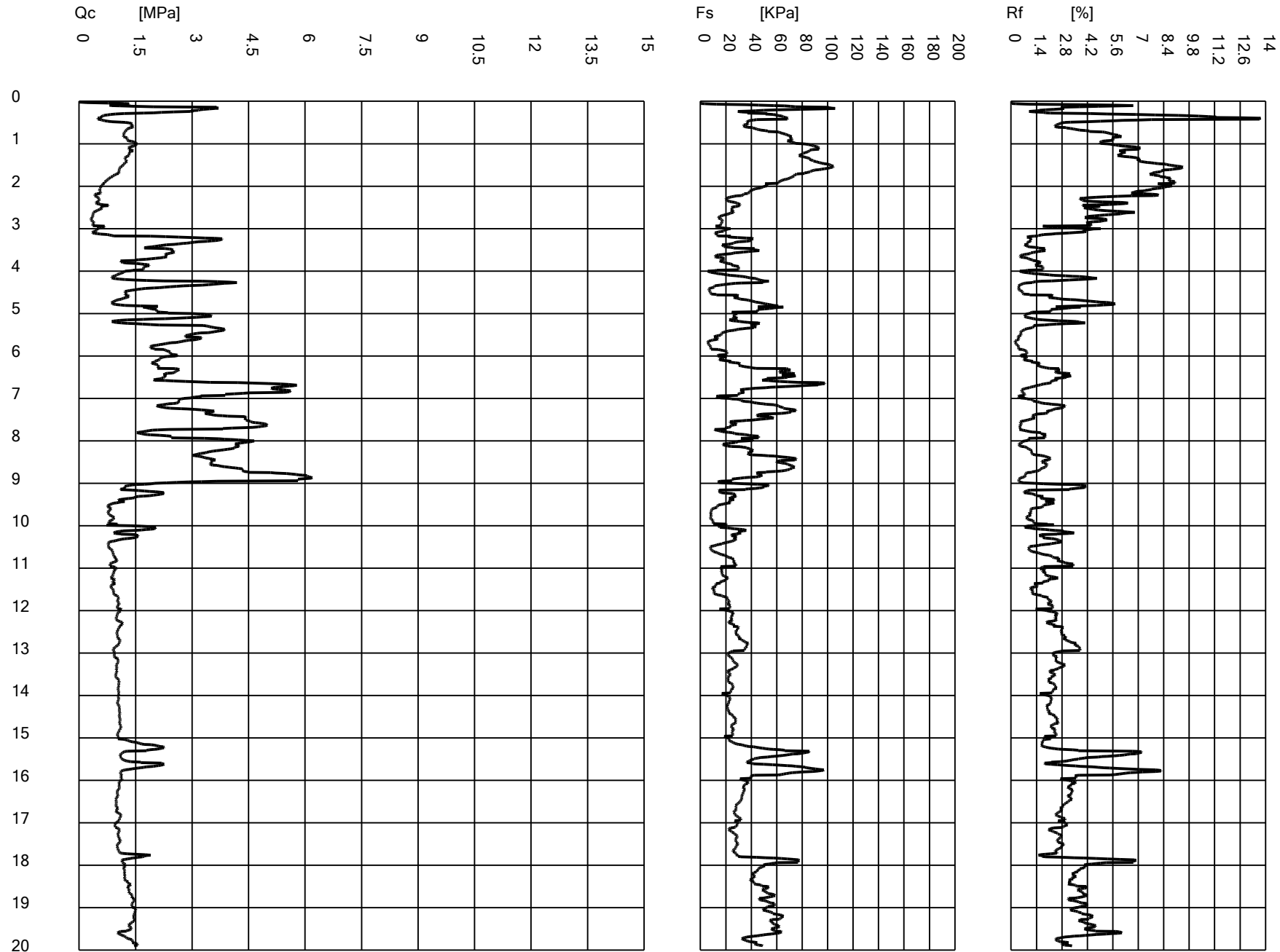
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

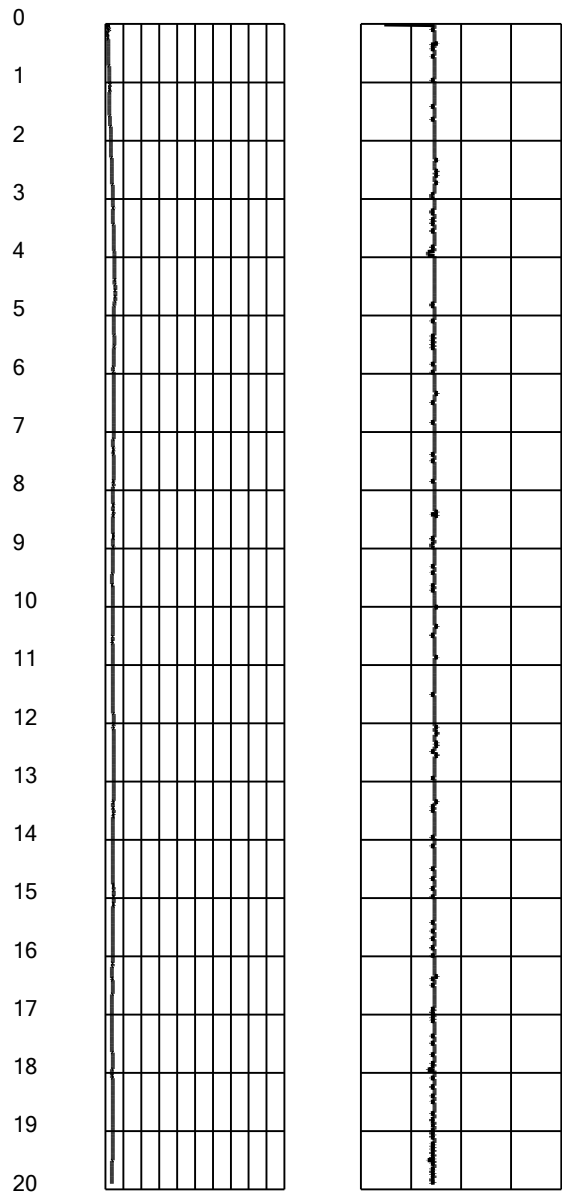
## Test information

Name: CPTE 19  
Location: CPTE 19  
Date: 09/02/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 140  
Ground level [cm]: 0  
Latitude: 44.071507  
Longitude: 12.564648  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

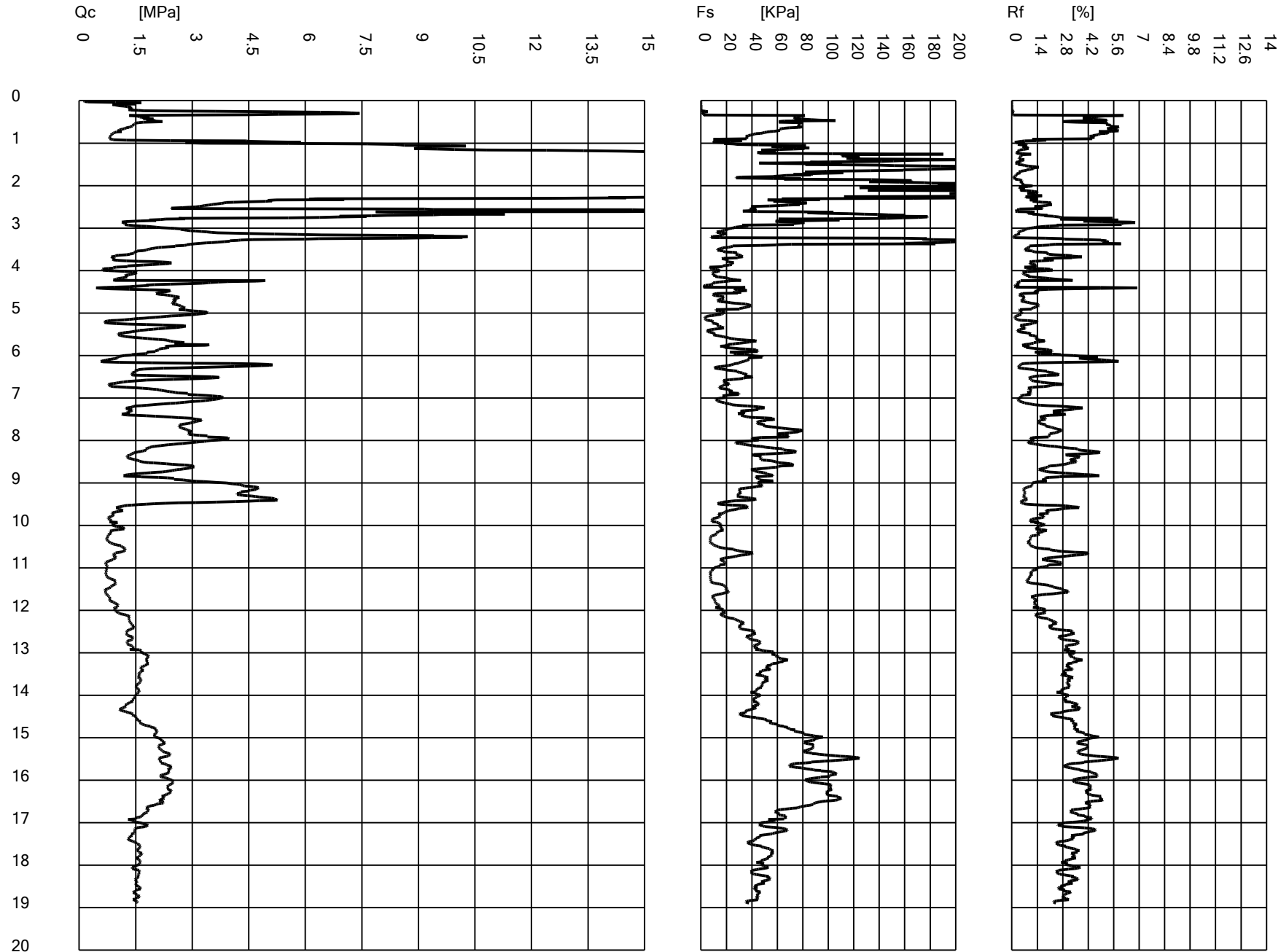
## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

## Test information

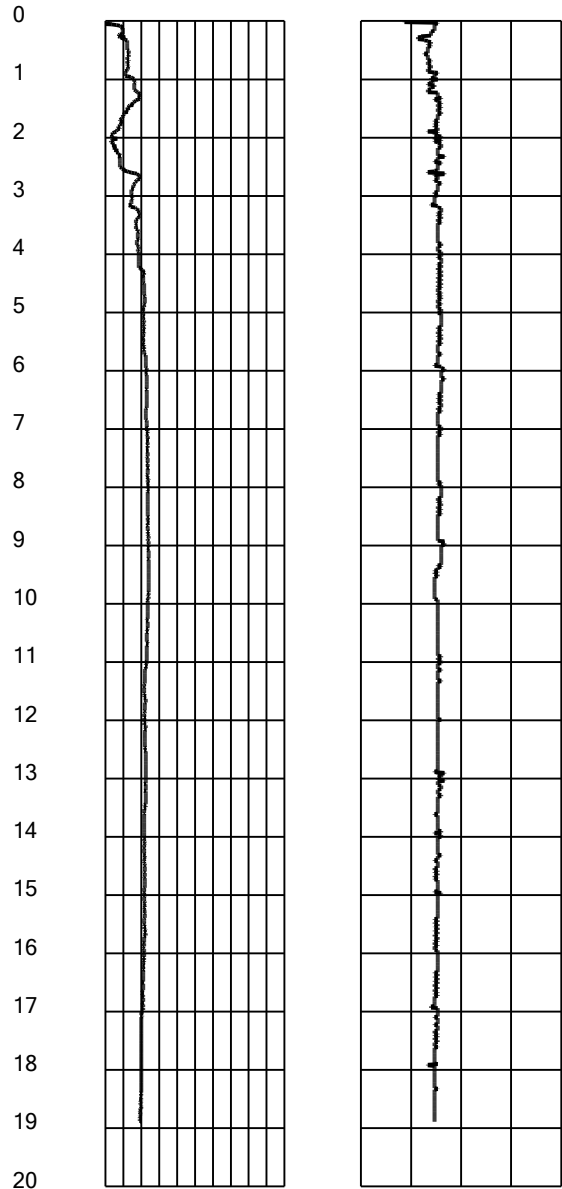
Name: CPTE 20  
Location: CPTE 20  
Date: 03/12/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 80  
Ground level [cm]: 0  
Latitude: 44.074179  
Longitude: 12.569197  
Operator:  
Comments:  
Probe code: MKJ321







Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

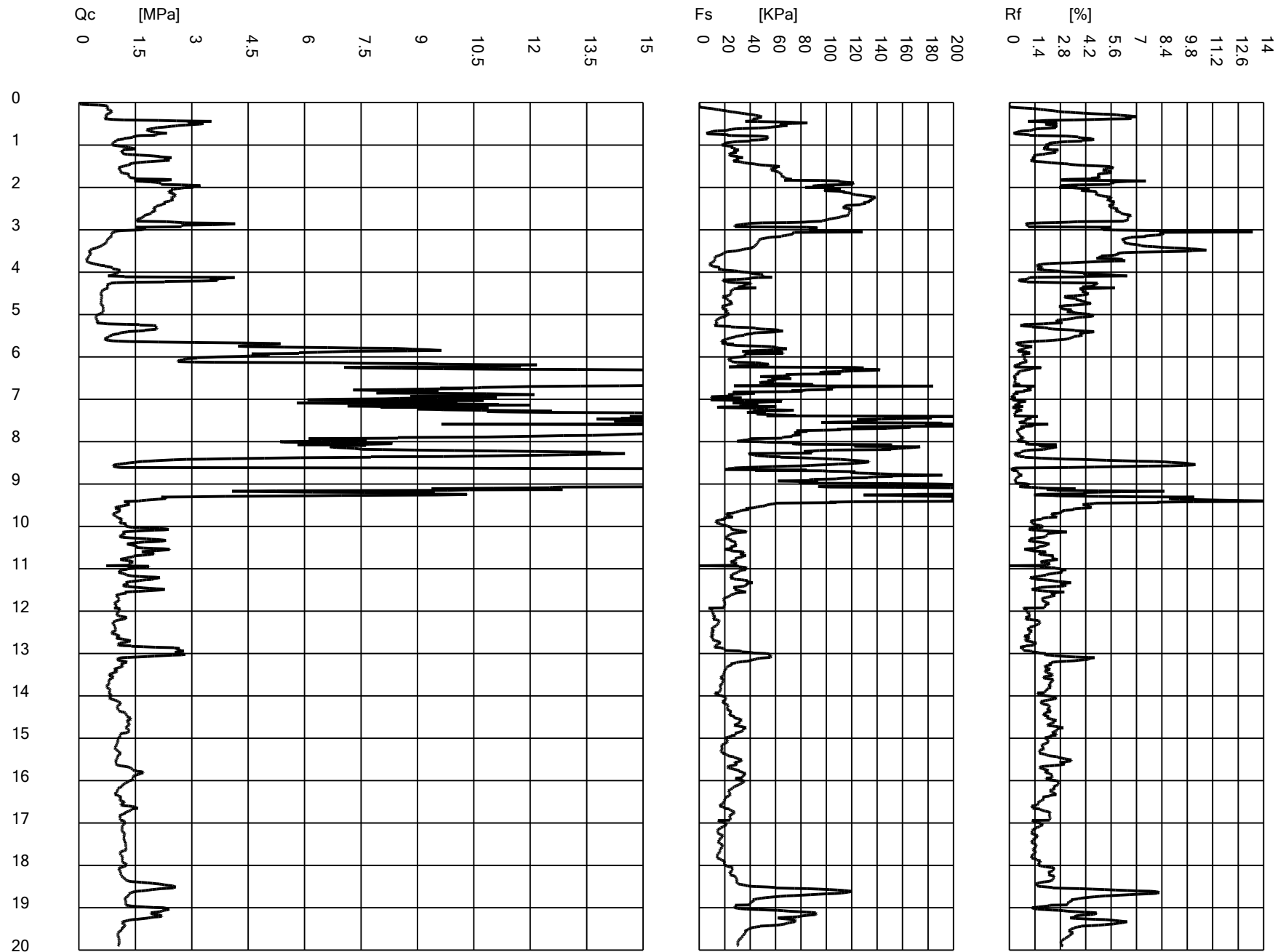
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

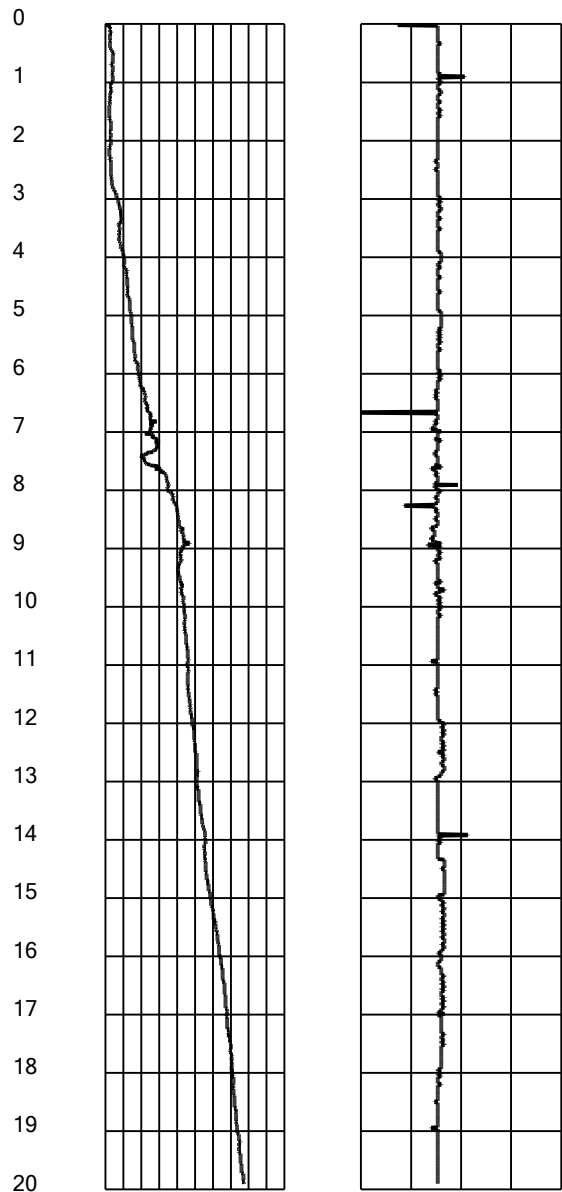
## Test information

Name: CPTE 21  
Location: CPTE 21  
Date: 03/12/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 350  
Ground level [cm]: 0  
Latitude: 44.064629  
Longitude: 12.567329  
Operator:  
Comments:  
Probe code: MKJ321





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

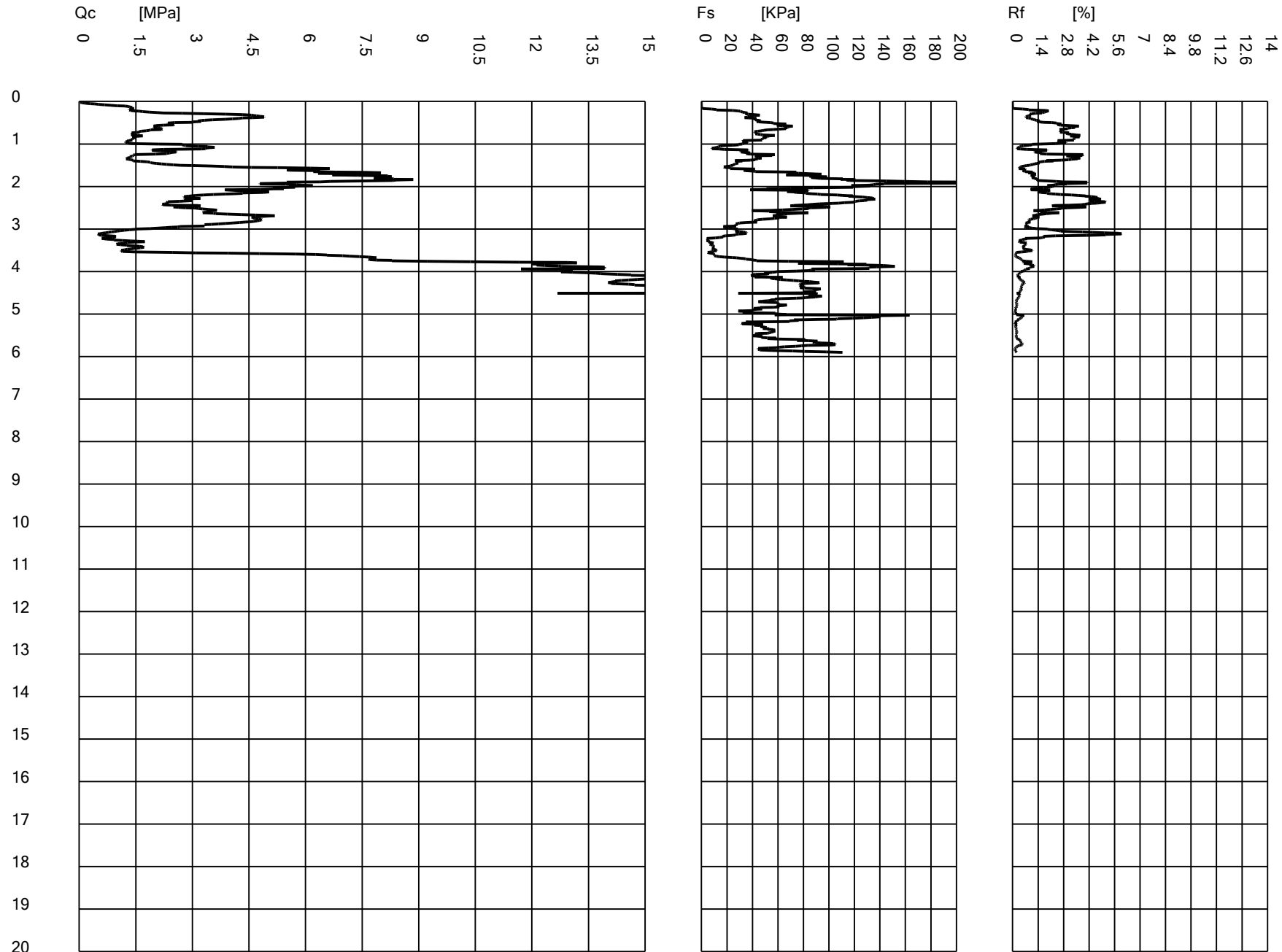
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

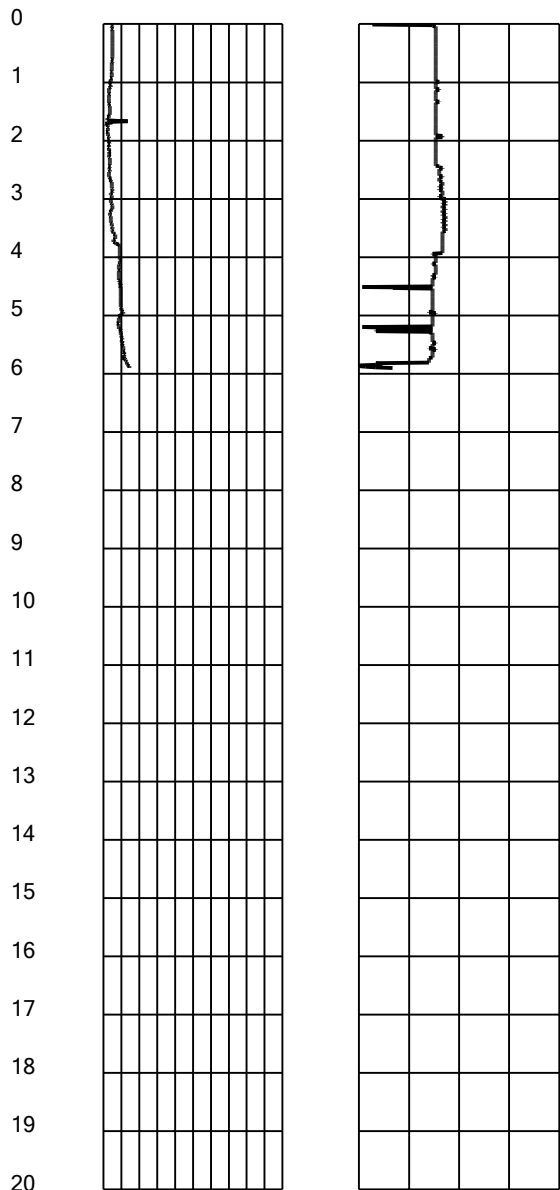
## Test information

Name: CPTE 22  
Location: CPTE 22  
Date: 03/12/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 330  
Ground level [cm]: 0  
Latitude: 44.065272  
Longitude: 12.571189  
Operator:  
Comments:  
Probe code: MKJ321





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6







## Company information

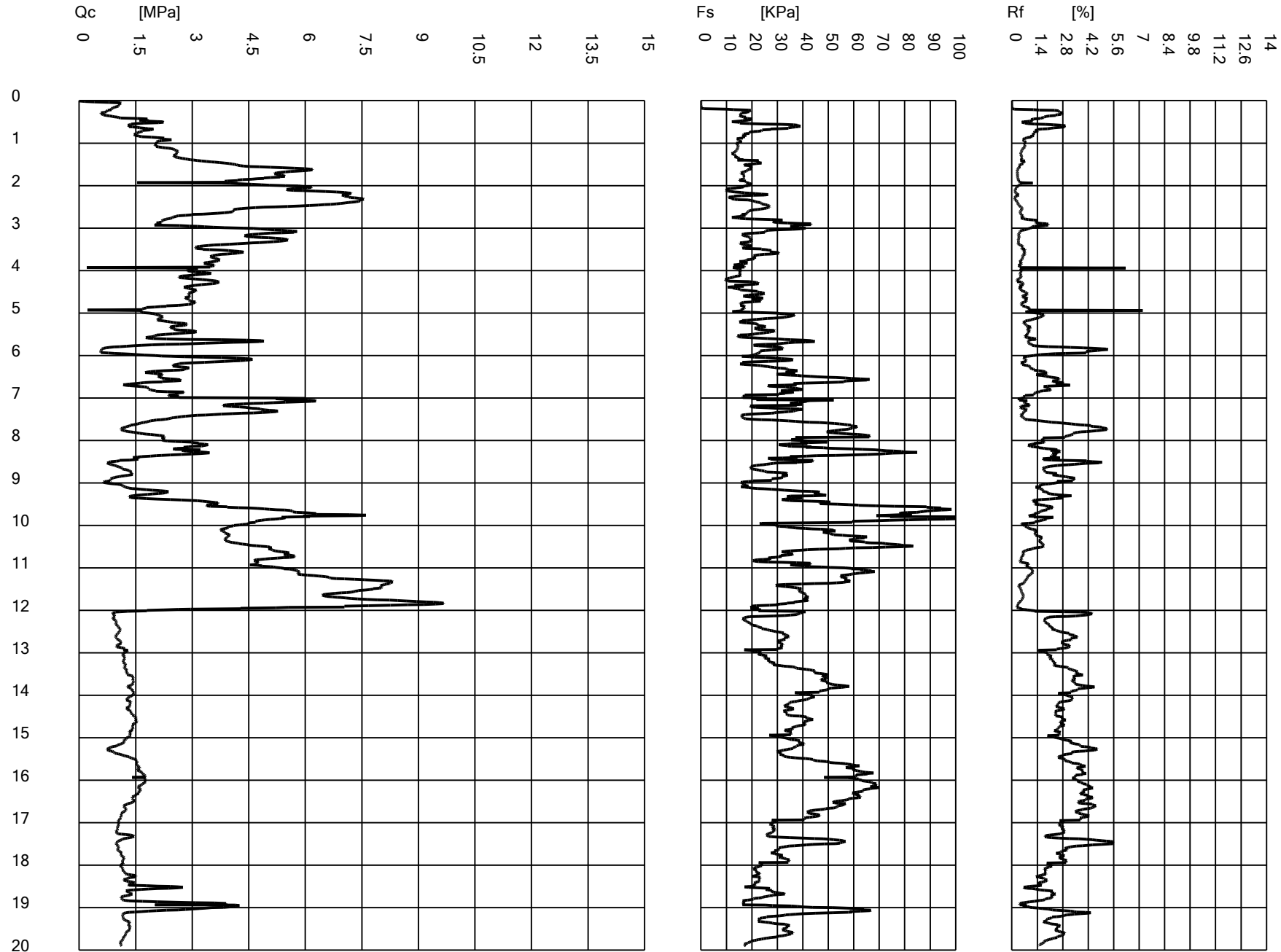
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

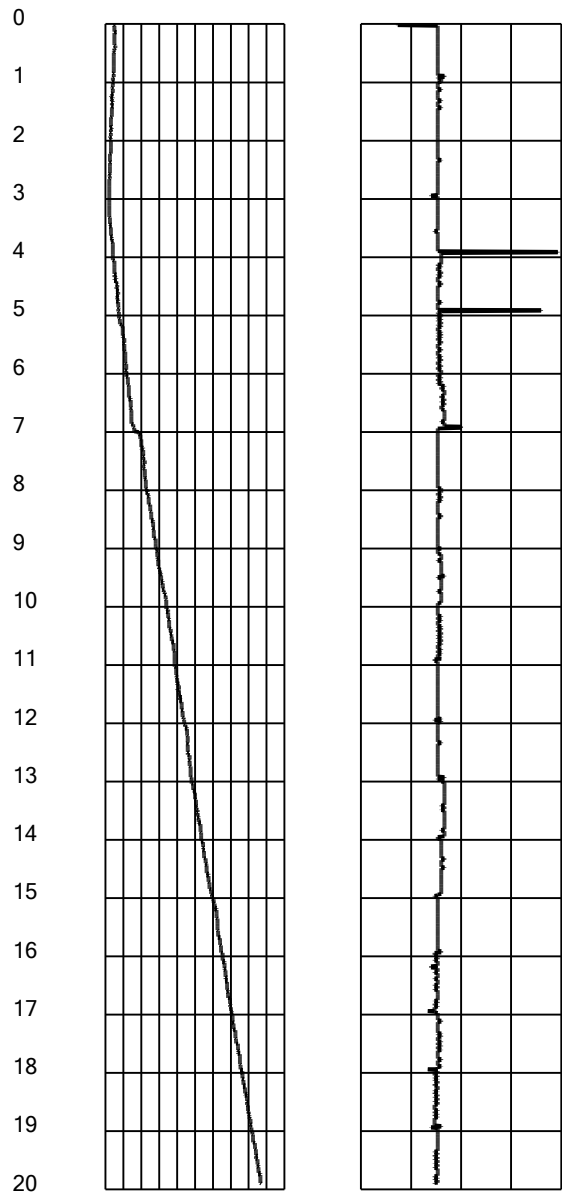
## Test information

Name: CPTE 23  
Location: CPTE 23  
Date: 03/12/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 150  
Ground level [cm]: 0  
Latitude: 44.071224  
Longitude: 12.575962  
Operator:  
Comments:  
Probe code: MKJ321





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

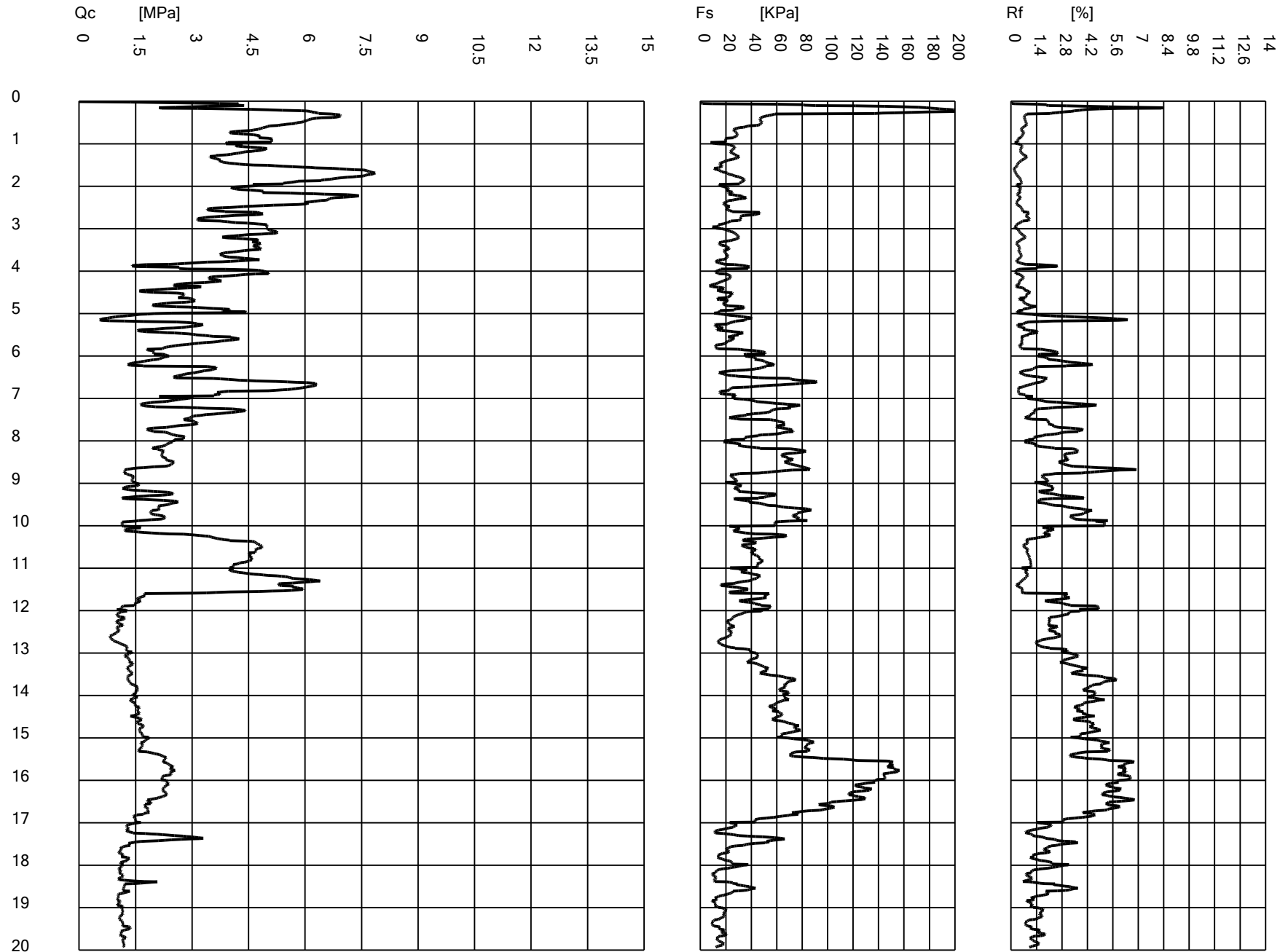
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

## Test information

Name: CPTE 24  
Location: CPTE 24  
Date: 09/02/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 50  
Ground level [cm]: 0  
Latitude: 44.074087  
Longitude: 12.578093  
Operator:  
Comments:  
Probe code: MKS728







## Company information

Name: Intergeo srl

Address: Strada Acquasalata, 9

Zip code:

City: Serravalle

P.IVA: C.O.E: SM 21197

E-Mail: info@intergeosm.com

Phone number:

Fax number:

## Site information

Name: Rimini - Microzonazione sismica

Date: 11/11/2020

Commissioner: Merli Alessandro

Locality:

## Test information

Name: CPTE 25

Location: CPTE 25

Date: 03/12/2020

Prehole mode:

Prehole depth [cm]: 0

Hydrostatic line [cm]: 130

Ground level [cm]: 0

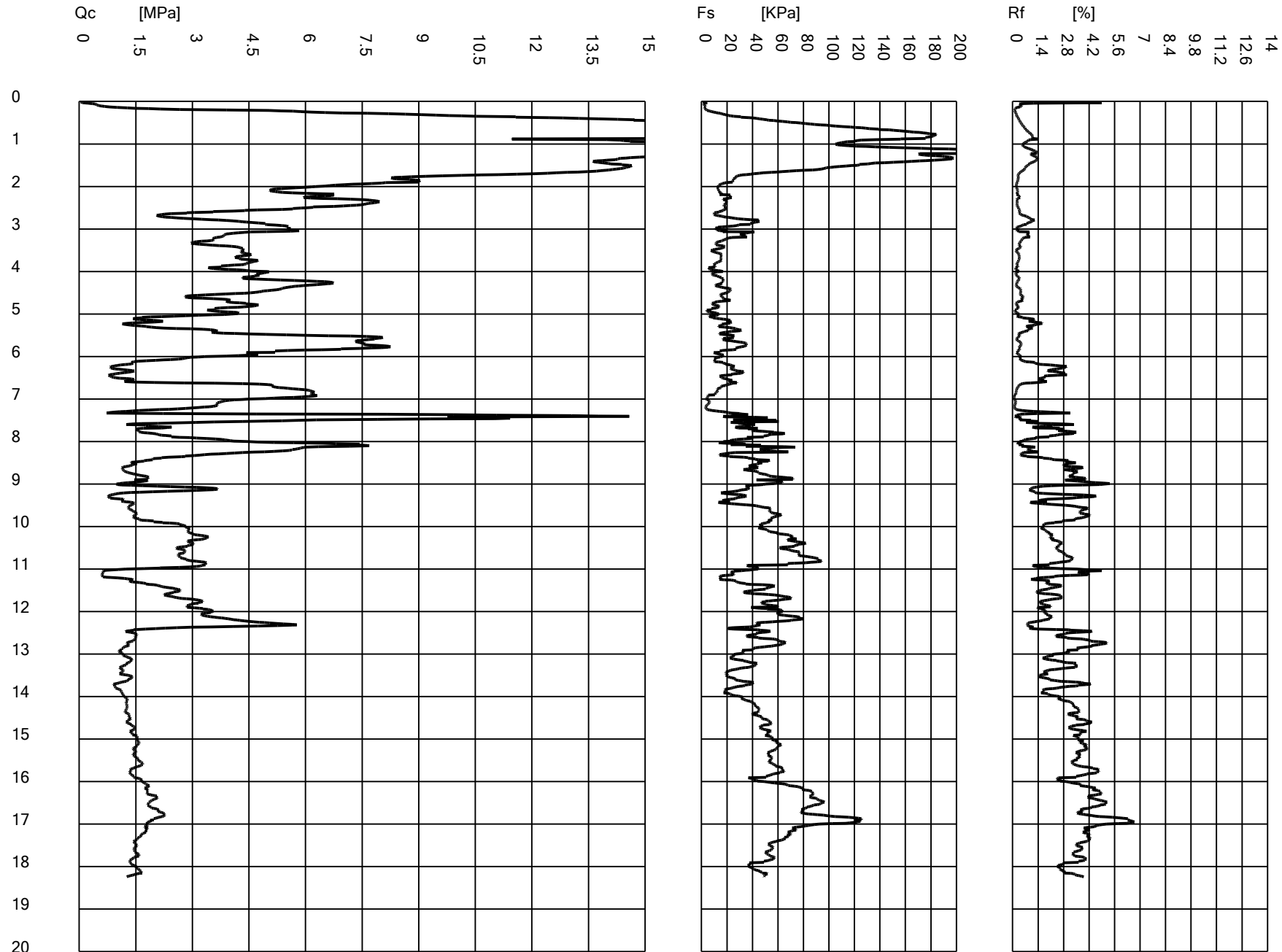
Latitude: 44.077063

Longitude: 12.575682

Operator:

Comments:

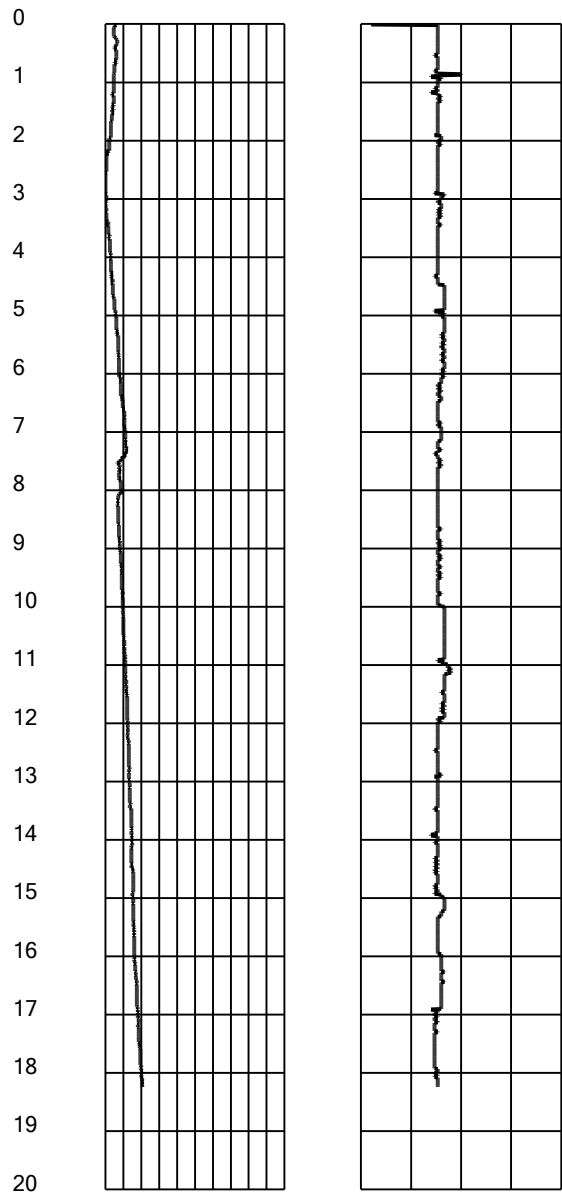
Probe code: MKJ321







Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

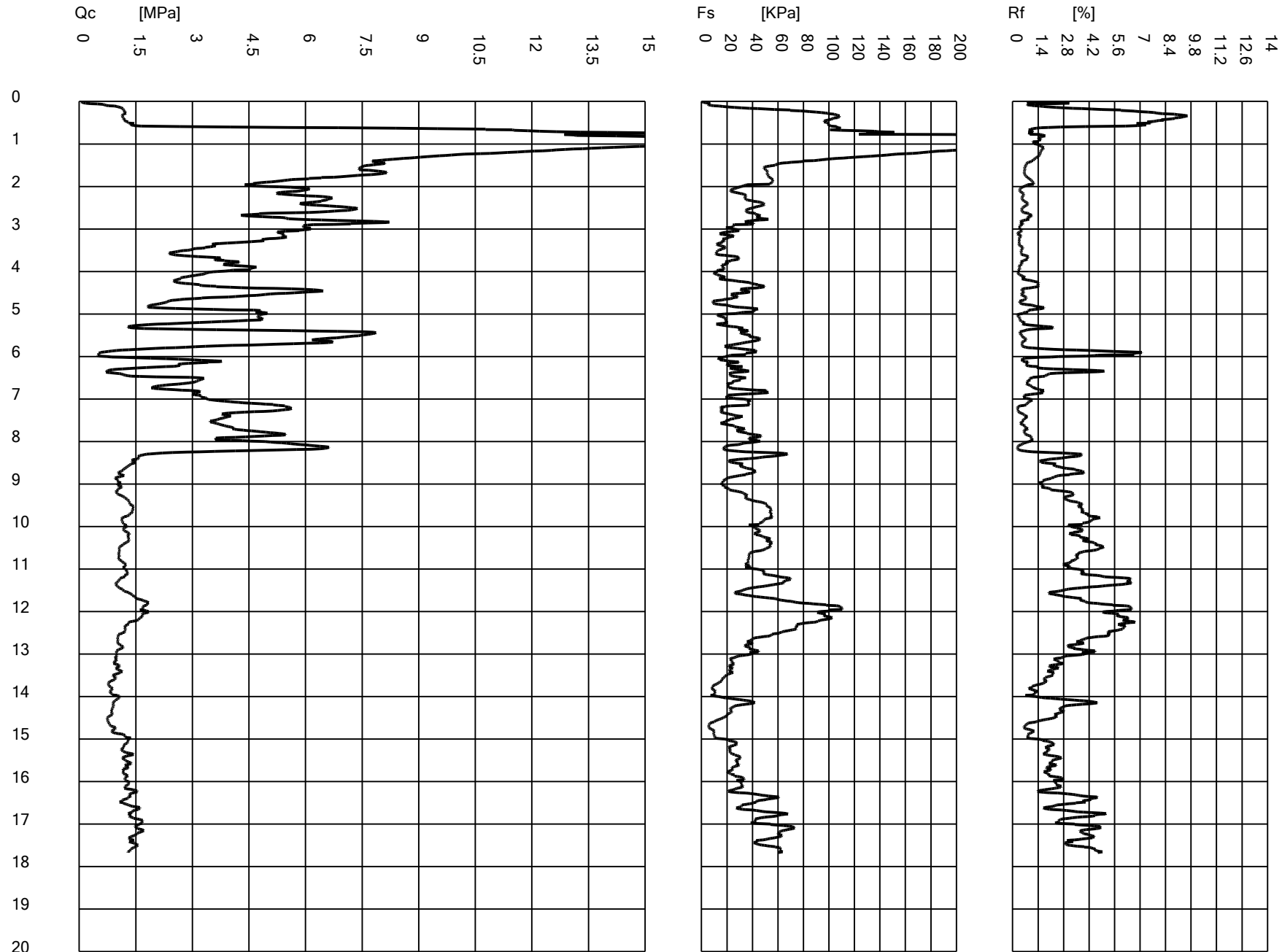
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

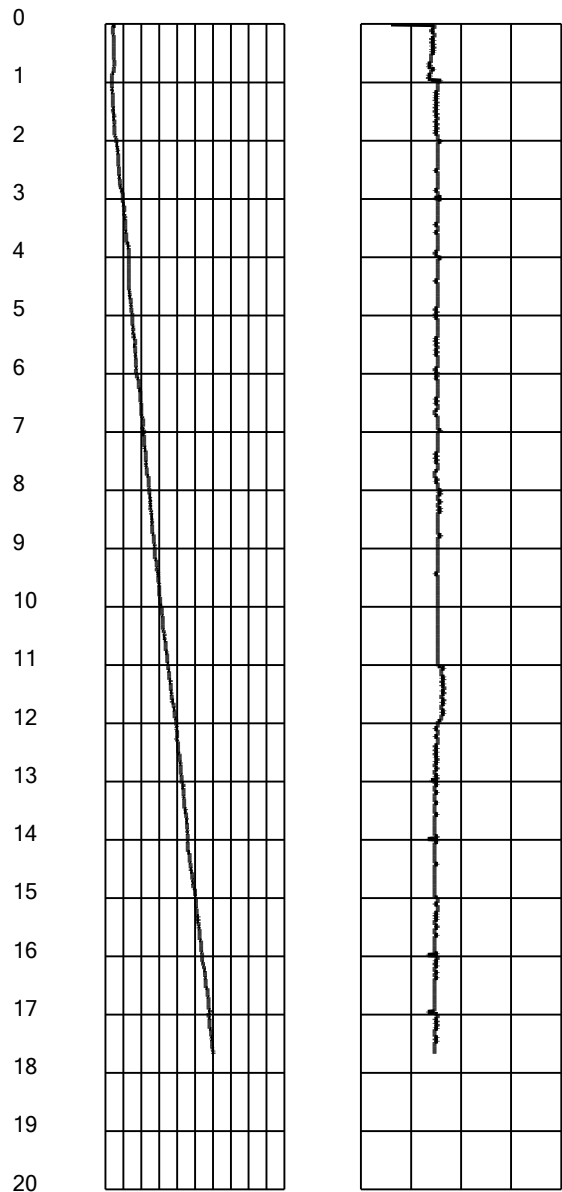
## Test information

Name: CPTE 26  
Location: CPTE 26  
Date: 03/12/2020  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 120  
Ground level [cm]: 0  
Latitude: 44.057922  
Longitude: 12.586477  
Operator:  
Comments:  
Probe code: MKJ321





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

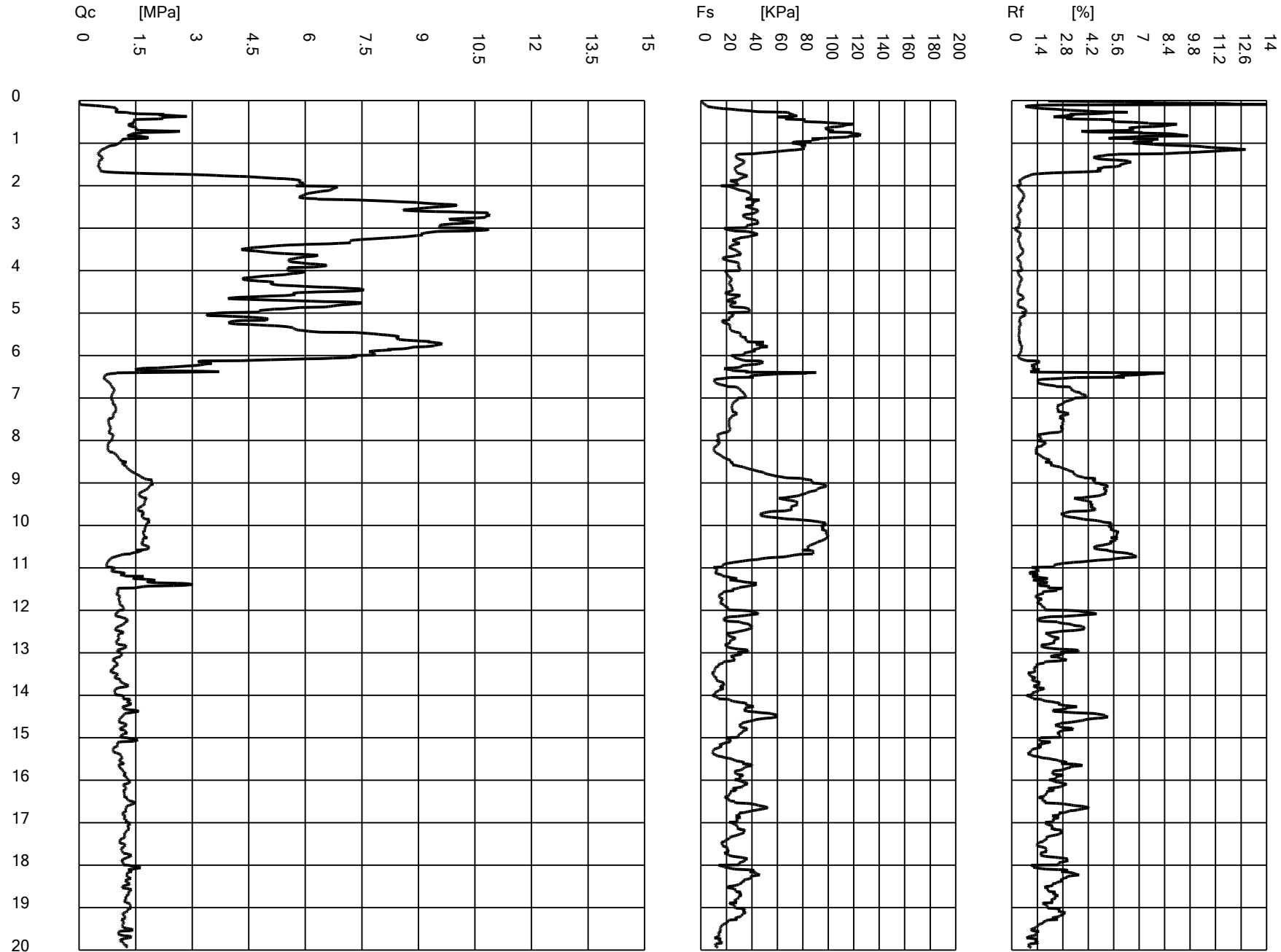
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

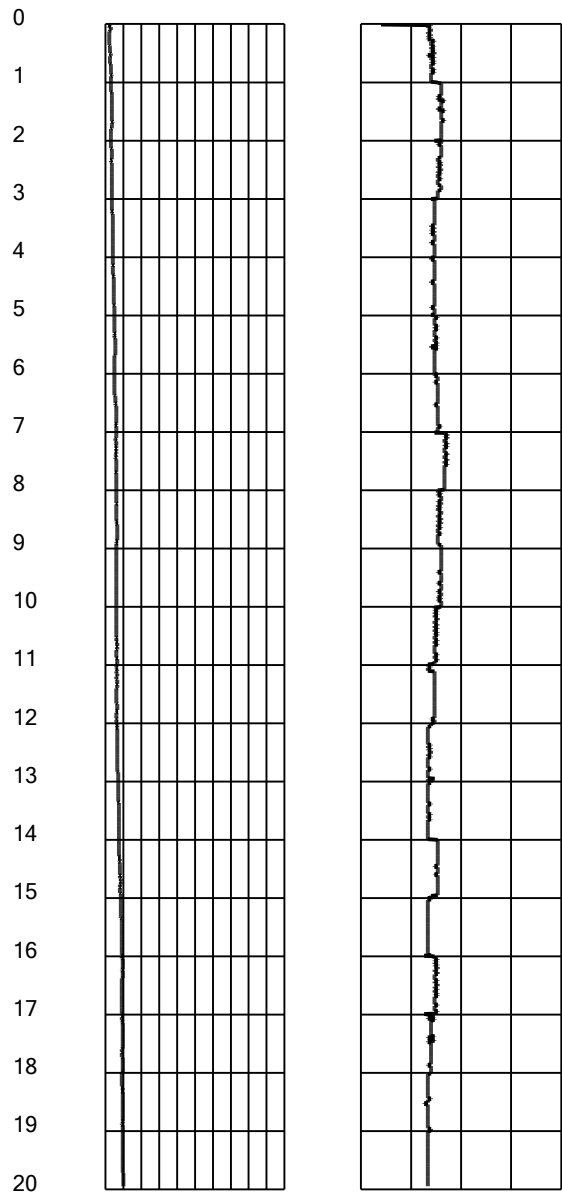
## Test information

Name: CPTE 27  
Location: CPTE 27  
Date: 14/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 150  
Ground level [cm]: 0  
Latitude: 44.045493  
Longitude: 12.596686  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

## Test information

Name: CPTE 28  
Location: CPTE 28  
Date: 14/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 140  
Ground level [cm]: 0  
Latitude: 44.039971  
Longitude: 12.604473  
Operator:  
Comments:  
Probe code: MKS728

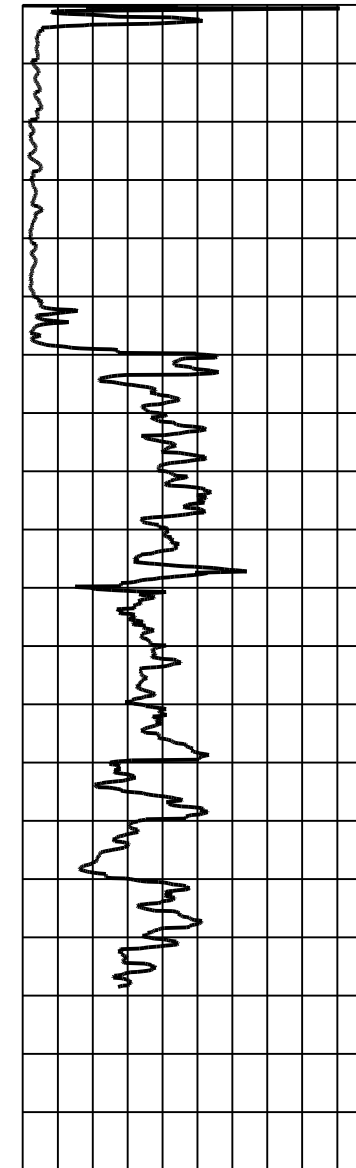
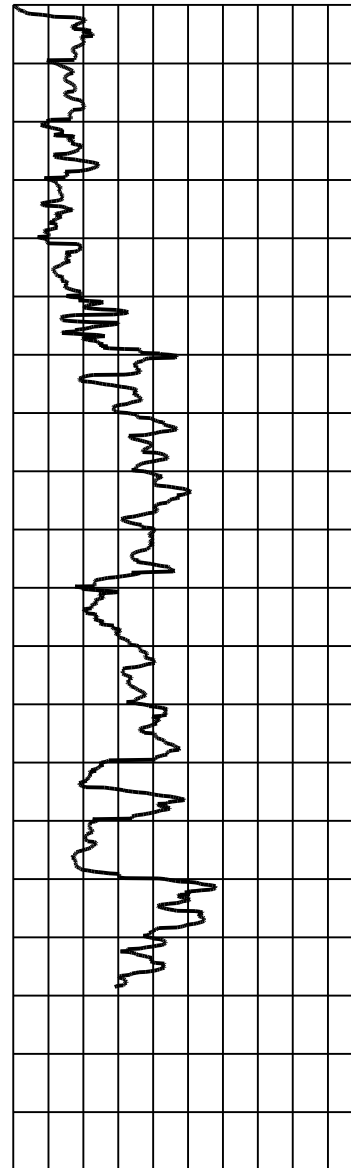
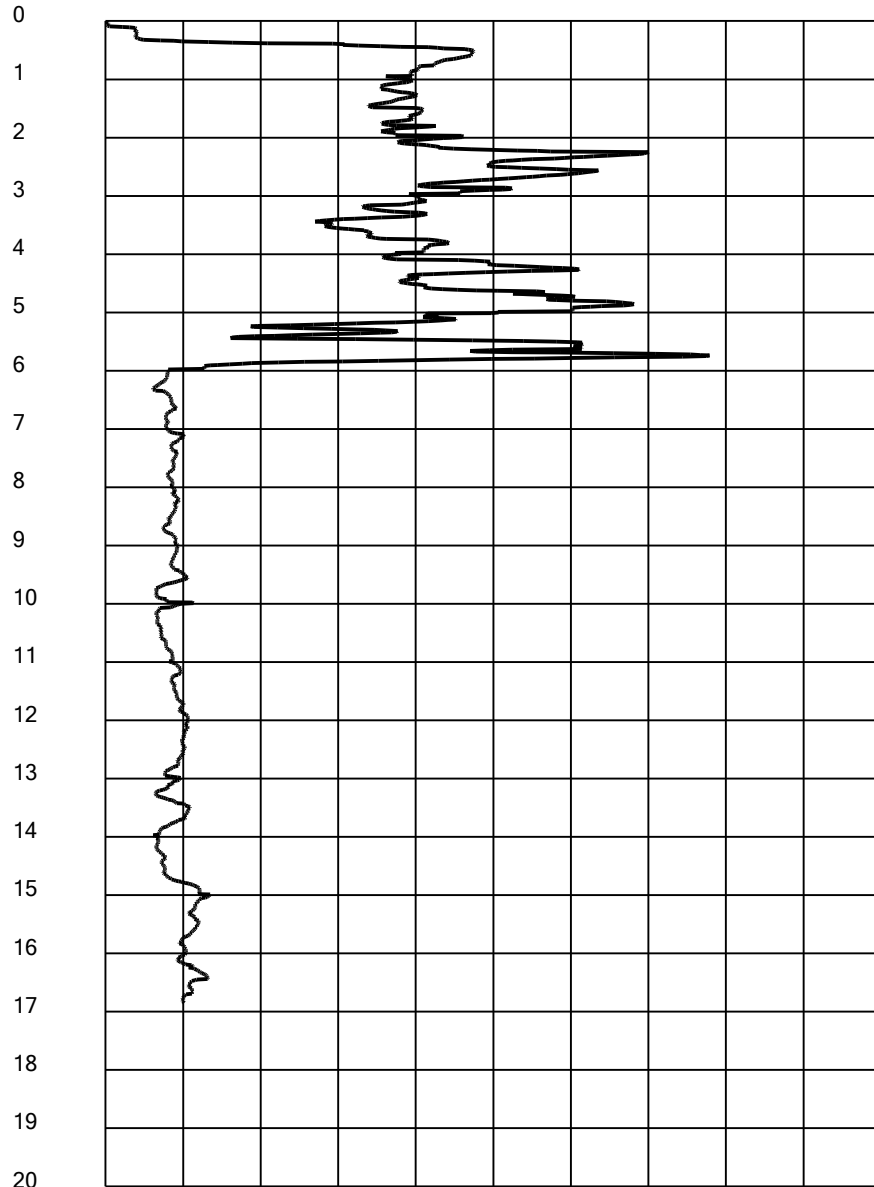




Qc [MPa]  
 0 1.5 3 4.5 6 7.5 9 10.5 12 13.5 15

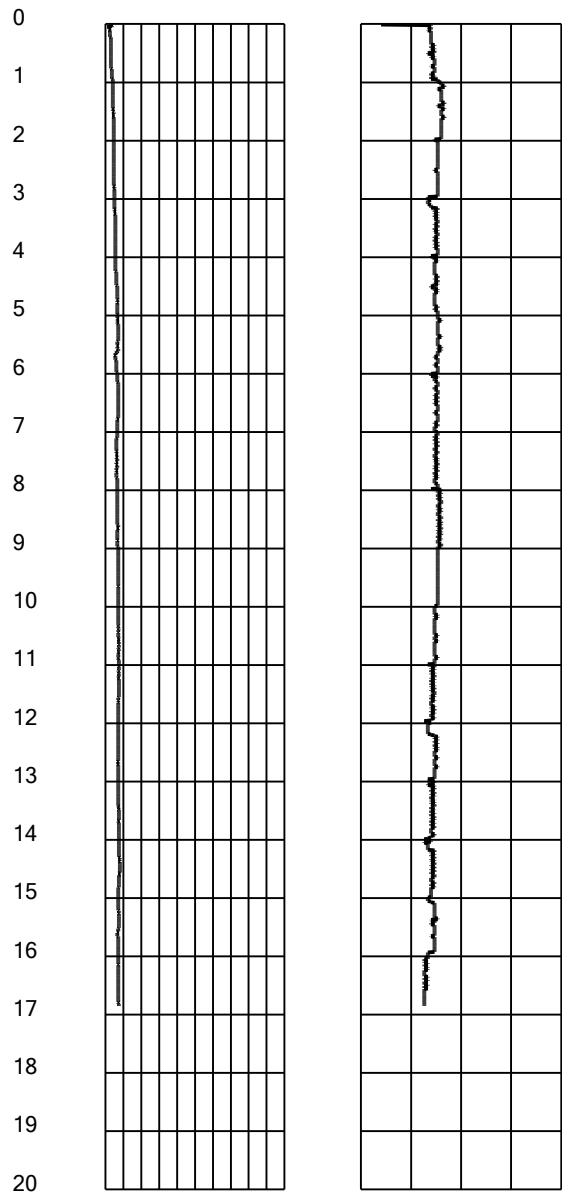
Fs [KPa]  
 0 20 40 60 80 100 120 140 160 180 200

Rf [%]  
 0 1.4 2.8 4.2 5.6 7 8.4 9.8 11.2 12.6 14





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

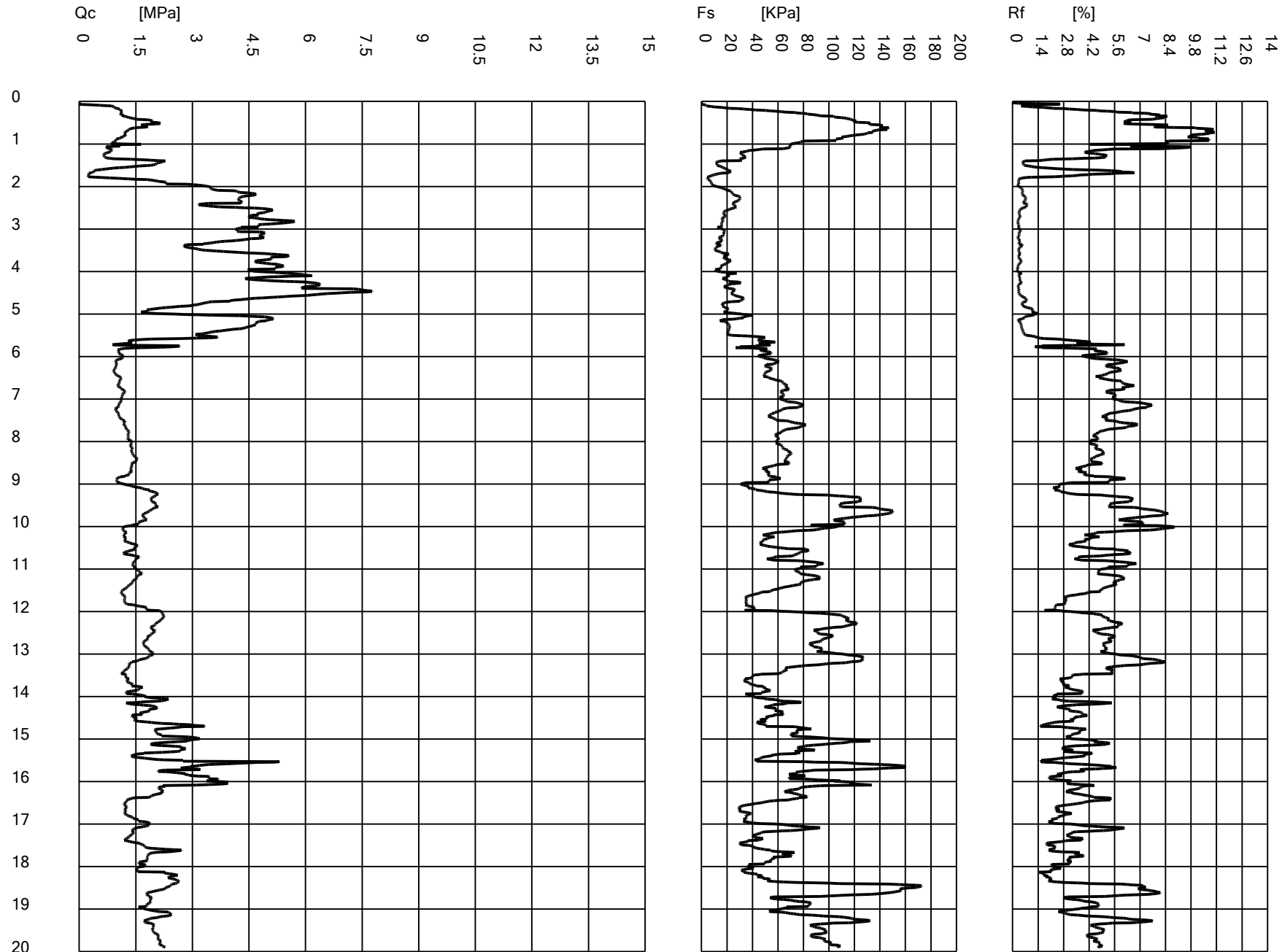
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

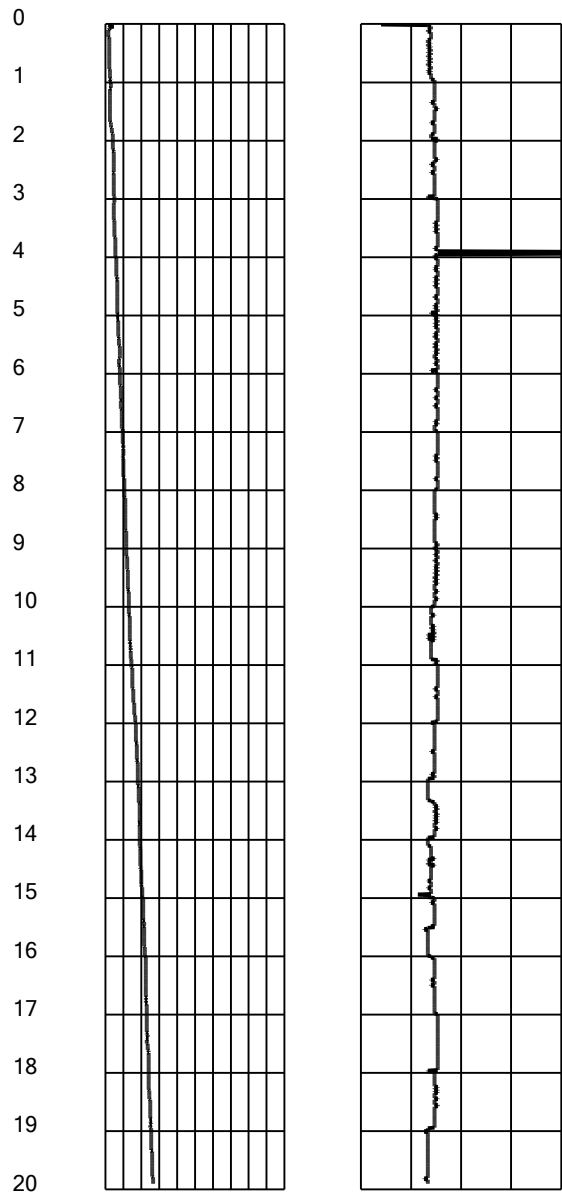
## Test information

Name: CPTE 29  
Location: CPTE 29  
Date: 14/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 160  
Ground level [cm]: 0  
Latitude: 44.034476  
Longitude: 12.612015  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6





## Company information

Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

## Test information

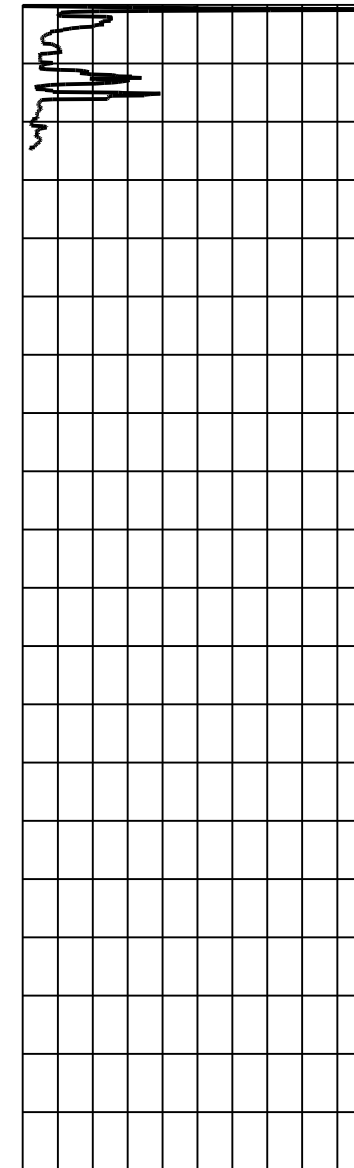
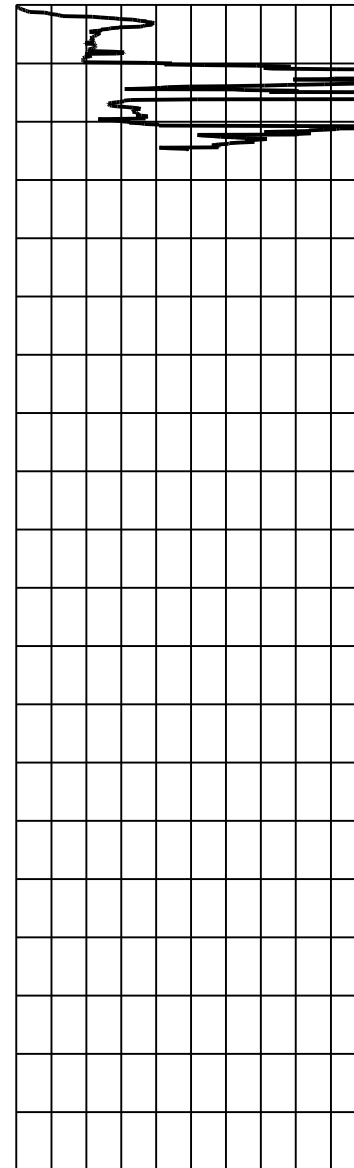
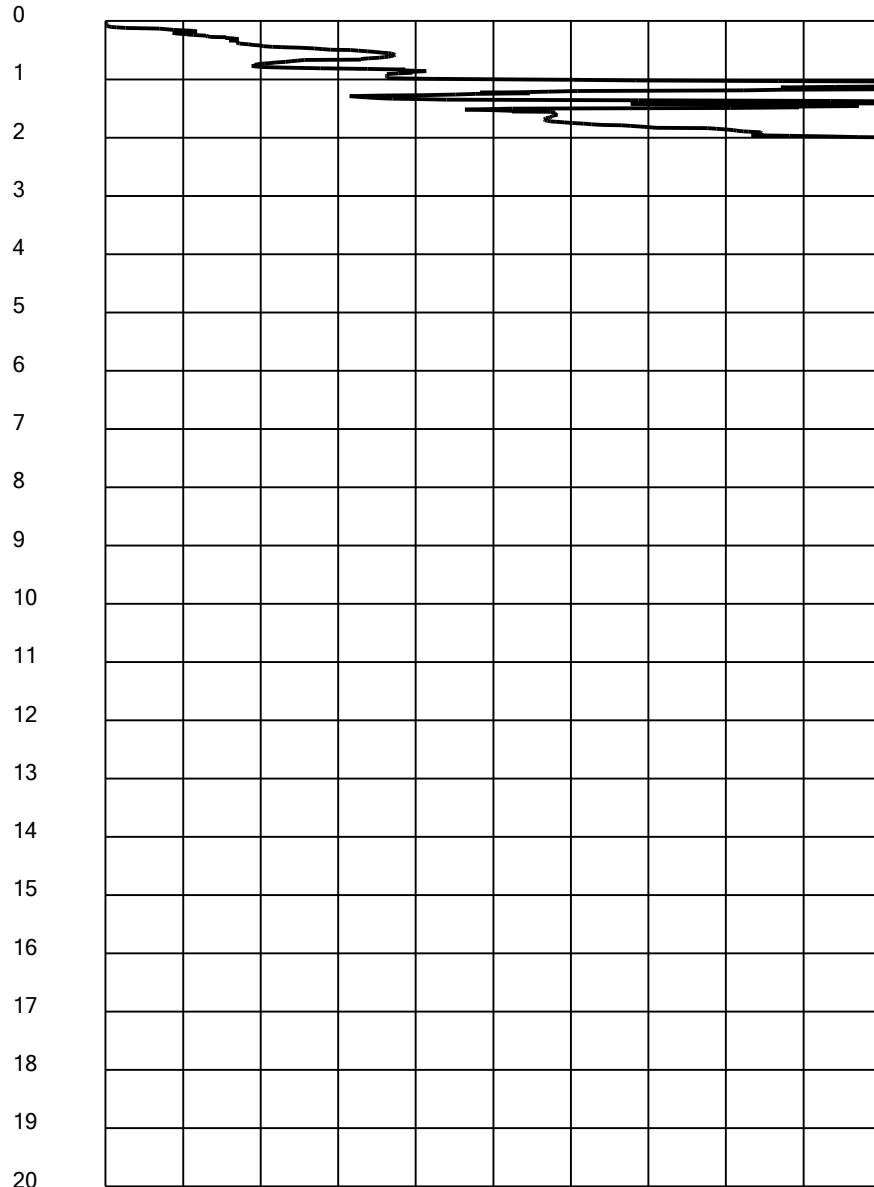
Name: CPTE 30  
Location: CPTE 30  
Date: 14/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 150  
Ground level [cm]: 0  
Latitude: 44.030368  
Longitude: 12.613594  
Operator:  
Comments:  
Probe code: MKS728



Qc [MPa]  
0 1.5 3 4.5 6 7.5 9 10.5 12 13.5 15

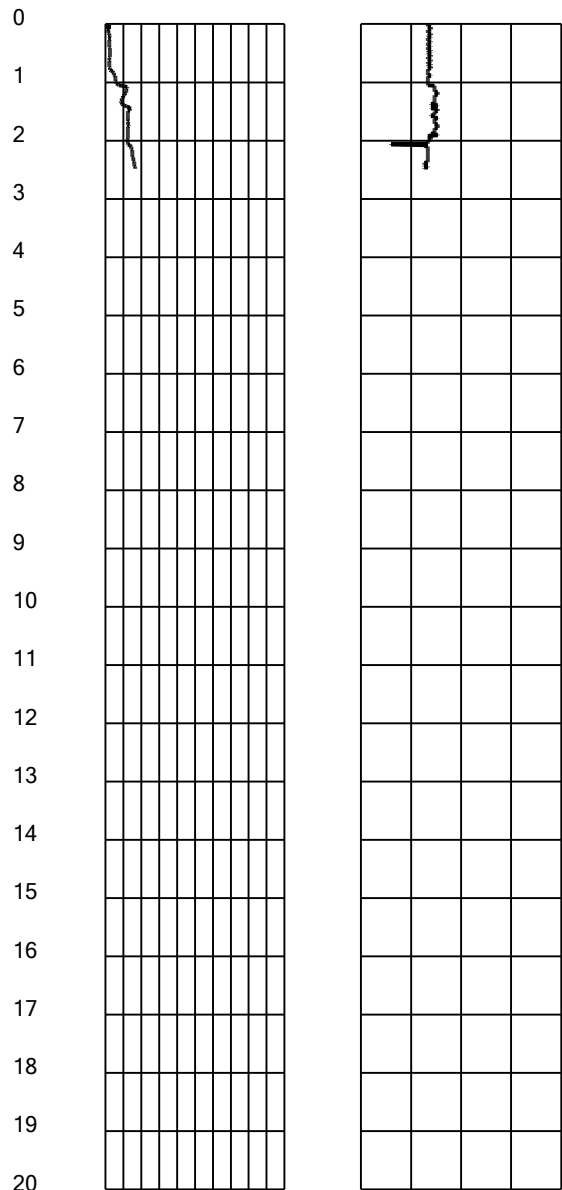
Fs [KPa]  
0 20 40 60 80 100 120 140 160 180 200

Rf [%]  
0 1.4 2.8 4.2 5.6 7 8.4 9.8 11.2 12.6 14





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6







## Company information

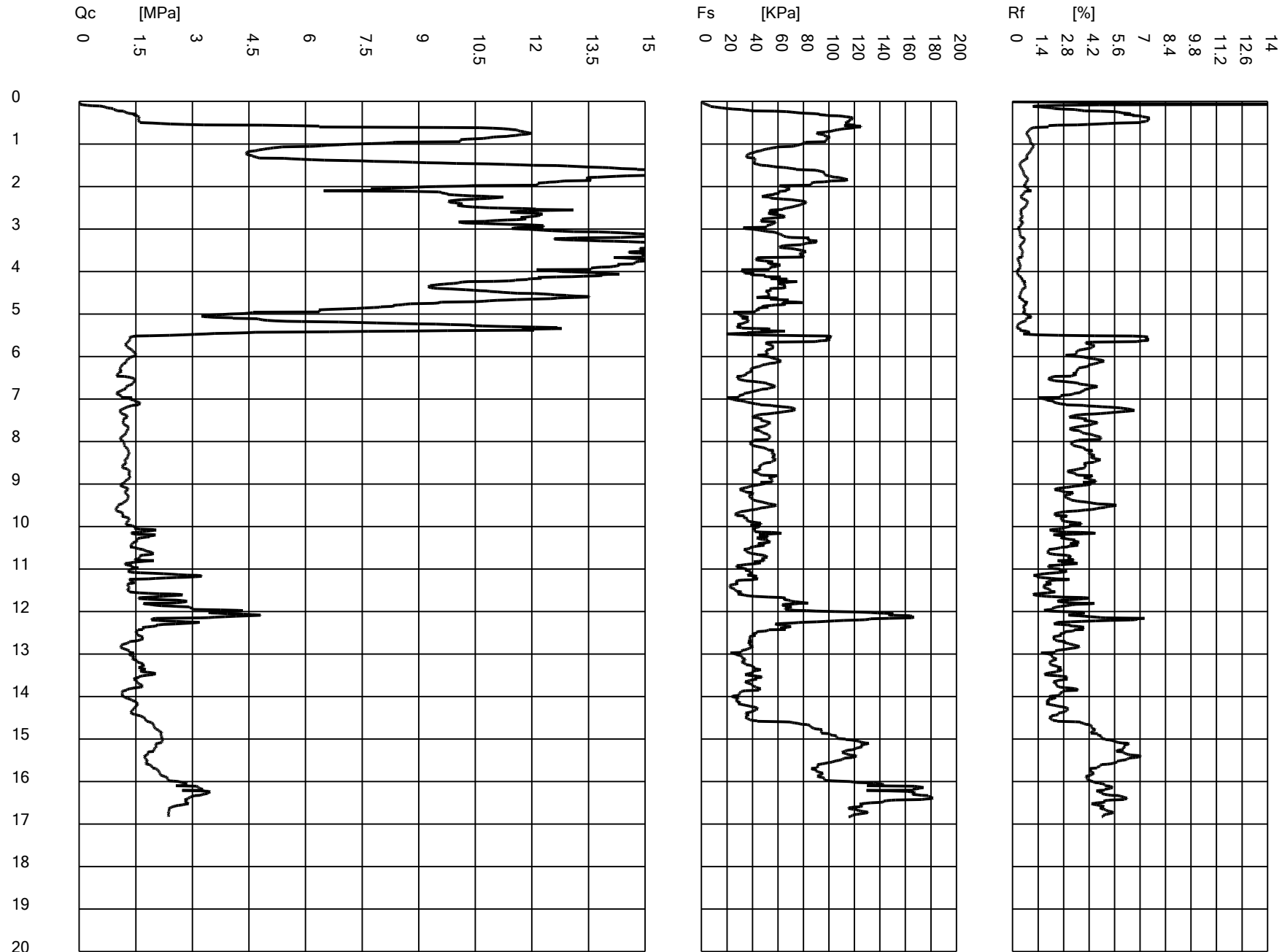
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

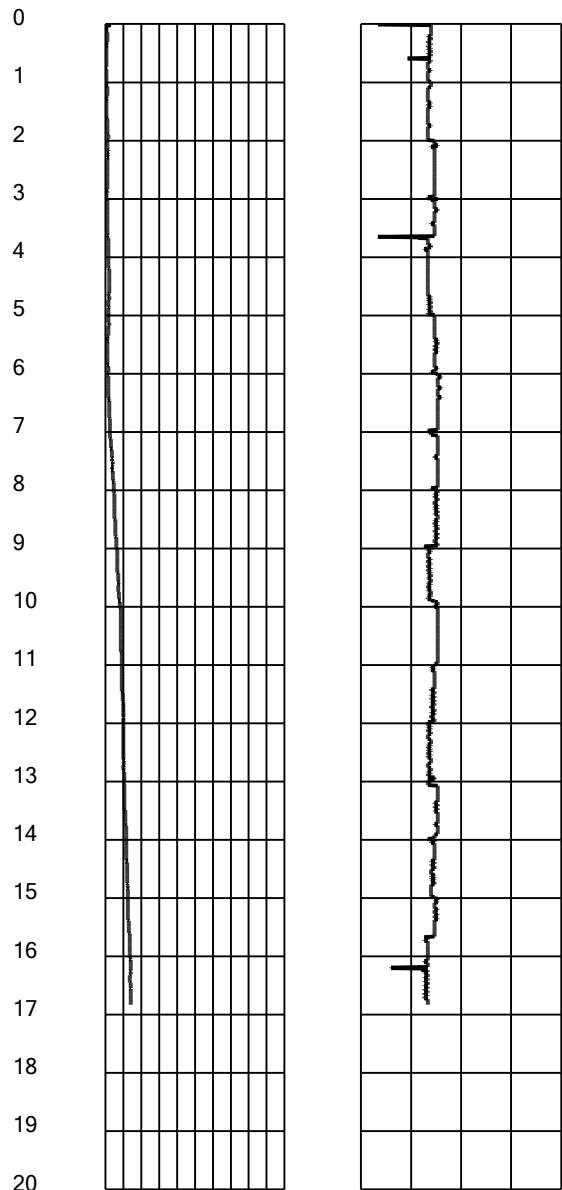
## Test information

Name: CPTE 31  
Location: CPTE 31  
Date: 14/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 150  
Ground level [cm]: 0  
Latitude: 44.026042  
Longitude: 12.620447  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6  
0 0.4 0.8 1.2 1.6 2.0 2.4 2.8 3.2 3.6 4.0 4.4 4.8 5.2 5.6 6.0





## Company information

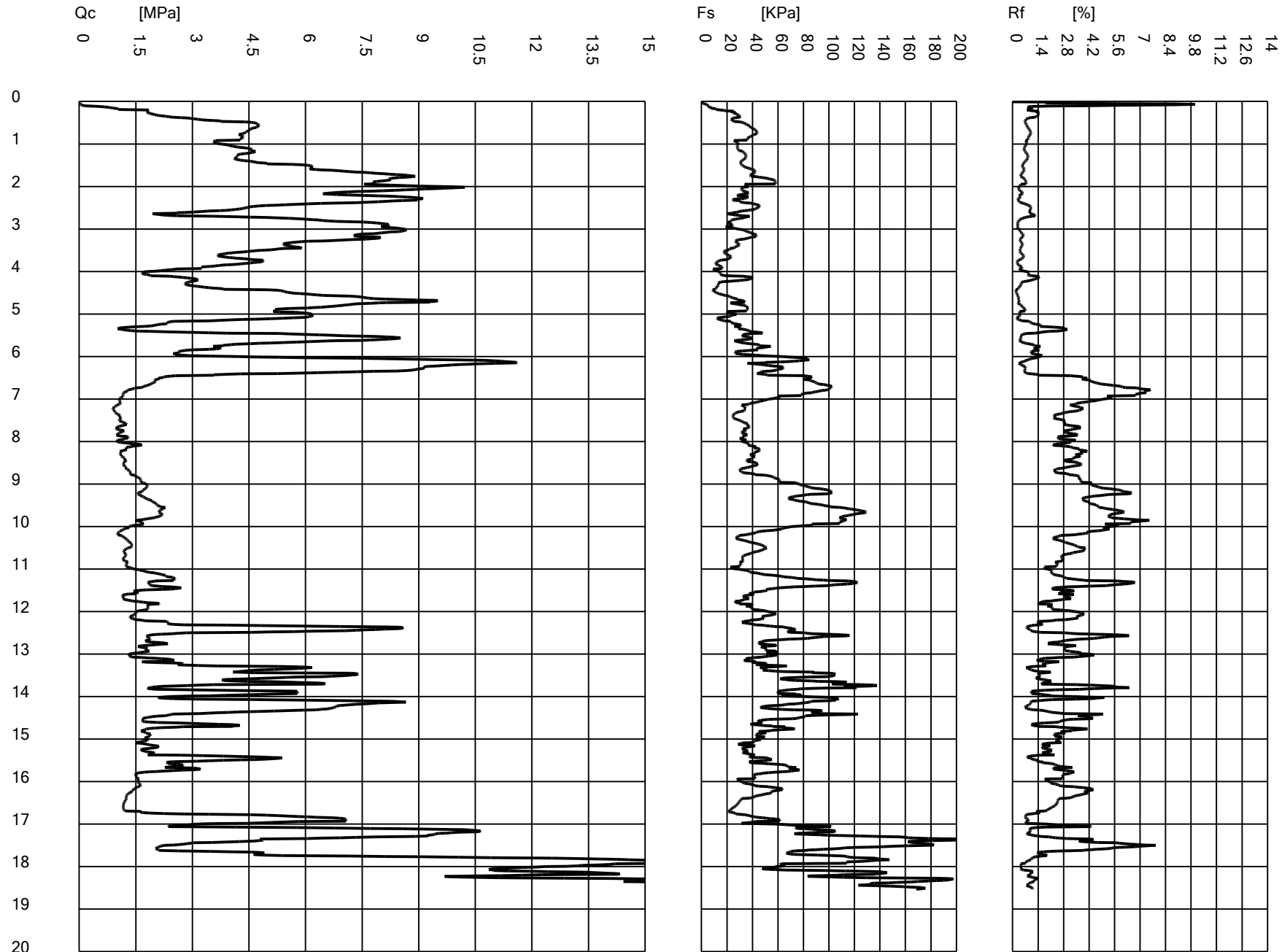
Name: Intergeo srl  
Address: Strada Acquasalata, 9  
Zip code:  
City: Serravalle  
P.IVA: C.O.E: SM 21197  
E-Mail: info@intergeosm.com  
Phone number:  
Fax number:

## Site information

Name: Rimini - Microzonazione sismica  
Date: 11/11/2020  
Commissioner: Merli Alessandro  
Locality:

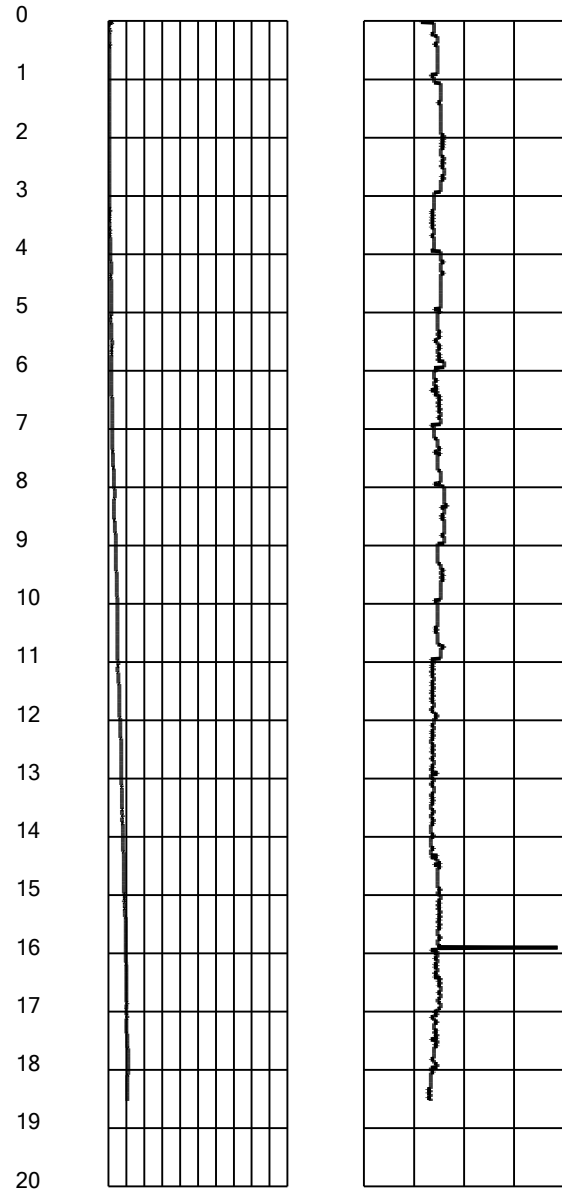
## Test information

Name: CPTE 32  
Location: CPTE 32  
Date: 14/01/2021  
Prehole mode:  
Prehole depth [cm]: 0  
Hydrostatic line [cm]: 100  
Ground level [cm]: 0  
Latitude: 44.024162  
Longitude: 12.628516  
Operator:  
Comments:  
Probe code: MKS728





Tilt [°]      Speed [cm/sec]  
0 1.5 3 4.5 6



**SONDAGGIO: S1**

DA METRI: 0.0 A METRI: 23.0

Responsabile: Mondaini Emanuel

COMMITTENTE: Merli Alessandro  
CANTIERE: Rimini - Bagno numero 8

LOCALITA':

DATA INIZIO: 12-1-2021 DATA FINE: 18-1-2021

QUOTA BOCCAFORO (m s.l.m.):

LUNGHEZZA (m): 46.5

Sonda tipo: IPC Drill 830L

Operatore: Mario Gabrielli



**LEGENDA:**

PROVE S.P.T.: PA Punta aperta - PC Punta chiusa  
CAMPIONI: S Pareti sottili - O Osterberg - M Mazier  
R Rimaneggiato - Rs Rimaneggiato da S.P.T.  
PIEZOMETRI: A Aperto - C Casagrande - E Elettrico  
PERFORAZIONE: CS Carotiere semplice - CD Carotiere doppio - EC Elica continua  
STABILIZZAZIONE: RM Rivestimento metallico  
FB Fanghi bentonitici

% CAROTAGGIO ——— R.Q.D. ———

S.P.T. Prof. Tipo Valori	CAMPIONI		STRATIGRAFIA E DESCRIZIONE	Prof. (m)	Carot. (%) RQD (%) 20 40 60 80	Pocket Test kg/cmq	Vane Test kg/cmq	FALDA		Piezo- metri	Diam. (mm)	Metodo Perf.ne	Metodo Stab.ne	
	Prof.	Tipo						Rinv	Stab					
1			sabbia ossidata colore marrone chiaro	1.2				0.2 (1)	0.0 (4) 0.5 (2)					
2	2.0-2.5	O	sabbie grigio fini laminate con livelli limosi, presenti frustoli carboniosi in lieve entità.	6.5										
3	2.5-3.0	O												
4														
5														
6	5.5-6.0	O												
7	6.0-6.5	O	sabbie grigio fini laminate con livelli più limosi marroncini. In base allo strato presente livello conchigliare.	11.6										
8														
9														
10														
11														
12	14.0-14.5	O	argille limose grigio plastiche, picchettati e laminati da argilla limosa di color ocra.	15.9										
13														
14														
15														
16														
17			argille limose grige con presenza di 2 livelli torbosi agli apici dello strato.	16.6										
18			limini sabbiosi di color grigio, saturi in acqua.	18.0										
19														
20														
21														
22														
23														

**SONDAGGIO: S1**

DA METRI: 23.0 A METRI: 32.0

Responsabile: Mondaini Emanuel

COMMITTENTE: Merli Alessandro

CANTIERE: Rimini - Bagno numero 8

LOCALITA':

DATA INIZIO: 12-1-2021 DATA FINE: 18-1-2021

QUOTA BOCCAFORO (m s.l.m.):

LUNGHEZZA (m): 46.5

Sonda tipo: IPC Drill 830L

Operatore: Mario Gabrielli

**LEGENDA:**

PROVE S.P.T.: PA Punta aperta - PC Punta chiusa  
 CAMPIONI: S Pareti sottili - O Osterberg - M Mazier  
 R Rimaneggiato - Rs Rimaneggiato da S.P.T.  
 PIEZOMETRI: A Aperto - C Casagrande - E Elettrico  
 PERFORAZIONE: CS Carotiere semplice - CD Carotiere doppio - EC Elica continua  
 STABILIZZAZIONE: RM Rivestimento metallico  
 FB Fanghi bentonitici

% CAROTAGGIO ——— R.Q.D. ———

S.P.T. Prof. Tipo Valori	CAMPIONI		STRATIGRAFIA E DESCRIZIONE	Prof. (m)	Carot. (%)		Pocket Test kg/cmq	Vane Test	FALDA Rinv Stab	Piezo- metri	Diam. (mm)	Metodo Perf.ne	Metodo Stab.ne
	Prof.	Tipo			RQD (%)	20 40 60 80							
24	24.0-245.00		Argille limose grige con livelli sabbiosi saturi in acqua, molto comprimibili. Livello falda in pressione +0.90mt. c.p.	23.5			1.2	1.0					
			Argille limose con presenza di frustoli vegetali. presenza di livello carbonioso laminato posto alla base dello strato.			1.3	0.7						
25				25.1			1.3	0.6					
								0.6					
26			limi argillosi di color grigio scuro con presenza di livelli carboniosi laminati	26.1			1.0	0.7					
							1.4	1.2					
27			Ghiaiello in matrice limo-argilloso di color ocra. Falda in pressione +0.3 mt. p.c.	27.0			2.1	1.4					
							2.4	1.4					
28			Ghiaie e sabbie in matrice limosa di color ocra.	27.0			2.7	1.4					
							1.7	0.9					
29				27.0									
30				27.0									
31				31.2									
32			Argille di color grigio con ghiaiello.	31.4									
			Sabbie medie, laminate con livelli limosi più chiari.	31.5									



**SONDAGGIO: S1**

DA METRI: 32.0 A METRI: 46.5

Responsabile: Mondaini Emanuel

COMMITTENTE: Merli Alessandro  
CANTIERE: Rimini - Bagno numero 8  
LOCALITA':

DATA INIZIO: 12-1-2021 DATA FINE: 18-1-2021

QUOTA BOCCAFORO (m s.l.m.):

LUNGHEZZA (m): 46.5

Sonda tipo: IPC Drill 830L

Operatore: Mario Gabrielli

**LEGENDA:**

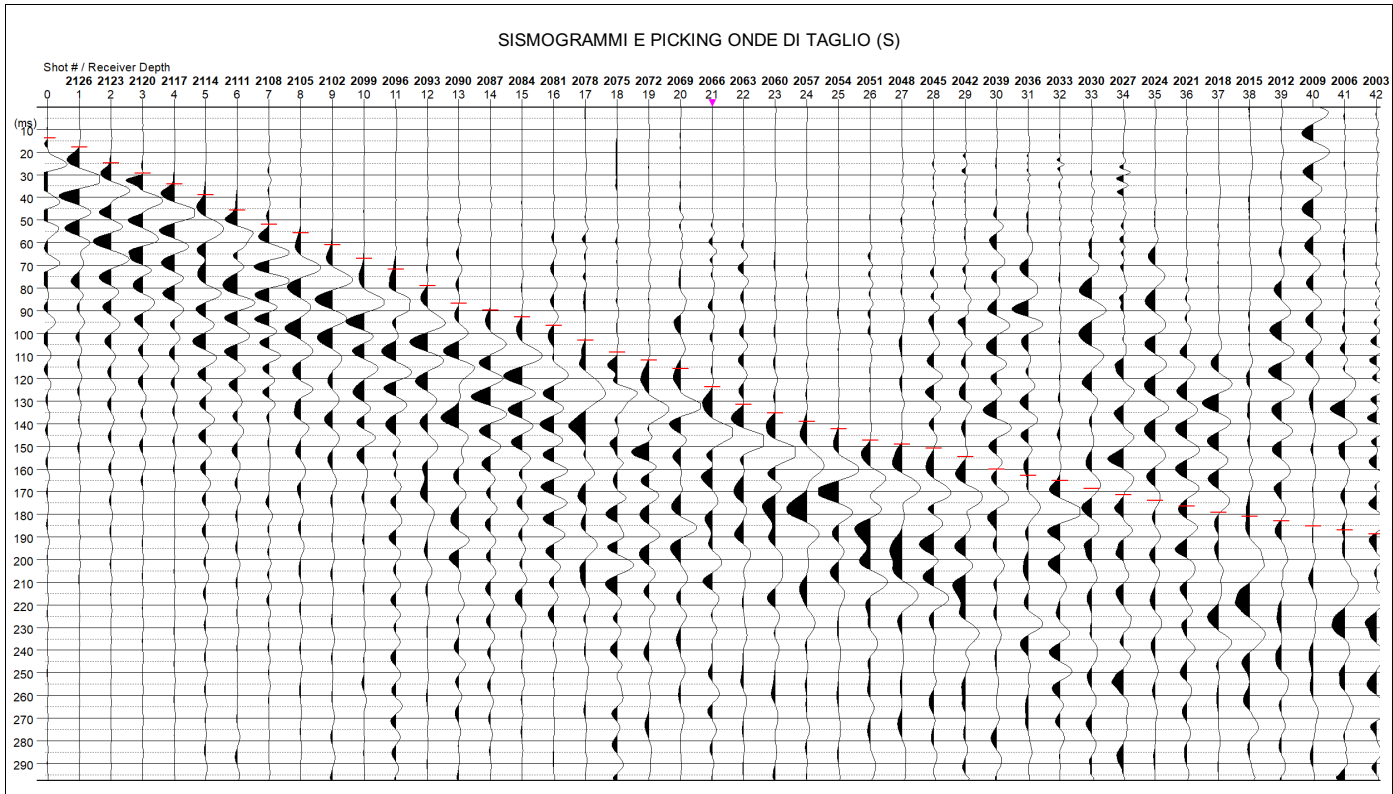
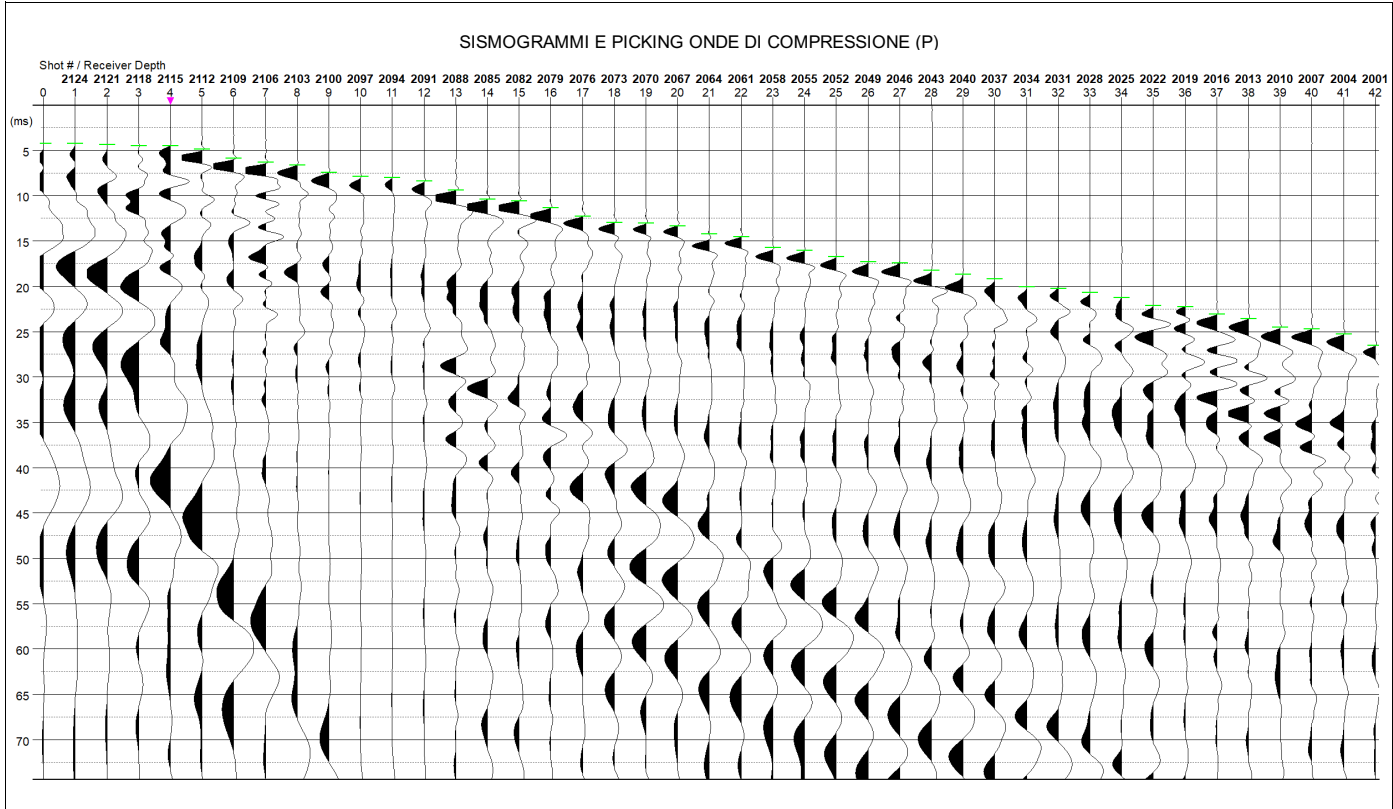
PROVE S.P.T.: PA Punta aperta - PC Punta chiusa  
CAMPIONI: S Pareti sottili - O Osterberg - M Mazier  
R Rimaneggiato - Rs Rimaneggiato da S.P.T.  
PIEZOMETRI: A Aperto - C Casagrande - E Elettrico  
PERFORAZIONE: CS Carotiere semplice - CD Carotiere doppio - EC Elica continua  
STABILIZZAZIONE: RM Rivestimento metallico  
FB Fanghi bentonitici

% CAROTAGGIO ——— R.Q.D. ———

S.P.T. Prof. Tipo Valori	CAMPIONI		STRATIGRAFIA E DESCRIZIONE	Prof. (m)	Carot. (%)				Pocket Test kg/cmq	Vane Test kg/cmq	FALDA Rinv Stab	Piezo- metri	Diam. (mm)	Metodo Perf.ne	Metodo Stab.ne
	Prof.	Tipo			RQD (%)	20	40	60							
33			Sabbie prevalenti con ghiaietto.	32.5					2.2						
			Argille grige laminate con frustoli vegetali alla base sabbiosa.	33.1					2.2 1.2						
34			Sabbie prevalenti grige con ghiaietto fine.	34.0					2.3 1.3						
			Ghiaietto prevalente con ghiaia e sabbia oca in matrice limosa.	35.0					2.5 1.0						
35			Ghiaia grossolana, diametro max ciottoli 70 mm., in matrice limosa oca.	36.0											
			Argilla mediamente plastica di color grigio con ghiaietto.	36.5					1.6 0.7						
37			Argilla limosa plastica grigia.	37.2					1.7 0.8						
			Argilla grigia con venature nerastre passanti ad argilla ossidata laminata.	38.8					1.2 0.5						
38			Limi sabbiosi ossidati.	39.0					1.4 0.6						
			Argille ossidate laminate con alternanza di limi maggiormente sabbiosi.	39.9					1.5 0.8						
39			Argille ossidate e laminate.	41.7					2.1 1.2						
			Limi Sabbiosi grigio scuro, con presenza di frustoli vegetali, laminati con livelli limosi chiari saturi in acqua.	42.8					2.2 1.4						
40			Limi argillosi nerastri laminati con livelli limosi sabbiosi.	43.3					0.7 0.3						
			Livello argilloso nerastro torboso.	43.4					0.7 0.3						
41			Alternanza decimetrica di livelli ghiaiosi in matrice argillo-limosa nerastra.	43.7					0.6 0.3						
			Ghiaie grossolane aventi diametro max 150 mm. in matrice limosa chiara. Falda piezometrica in pressione rilevante. (maggiore di 2.0 mt. sopra al p.c.)	45.0					0.6 0.3						
42			Ghiaie e sabbie grossolane, fini portati in maniera rilevante a bocca foro dal forte acquifero presente. (carotaggio a distruzione, utensile tricono)	46.5											

<b>COMMITTENTE</b>	<b>Geol. Alessandro Merli</b>
<b>Prova DOWNHOLE</b>	<b>DH-S1</b>
<b>Cantiere</b>	<b>Bagno Luciano - Rimini (RN)</b>
<b>Data acquisizione</b>	<b>12/02/21</b>

**ALLEGATO 1**

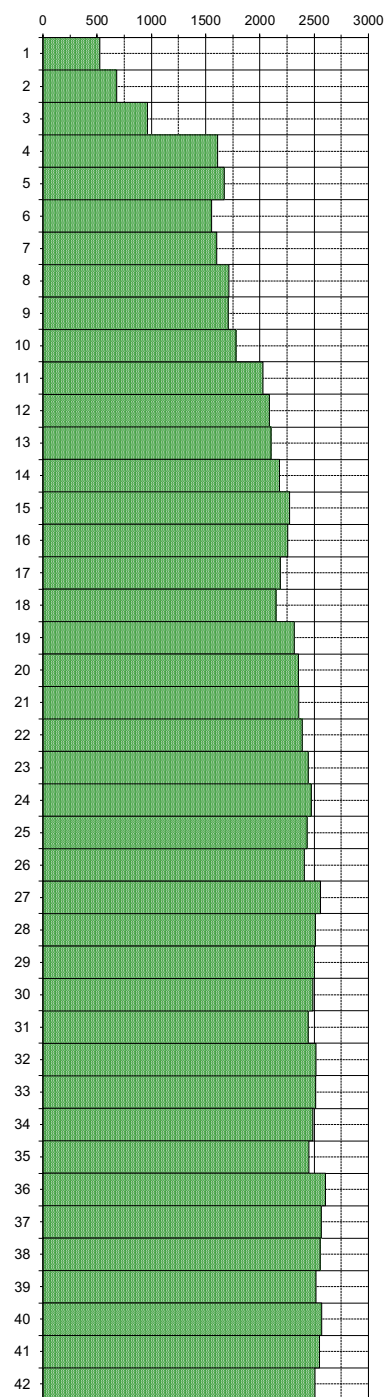


<b>COMMITTENTE</b>	Geol. Alessandro Merli
<b>Prova DOWNHOLE</b>	DH-S1
<b>Cantiere</b>	Bagno Luciano - Rimini (RN)
<b>Data acquisizione</b>	12/02/21

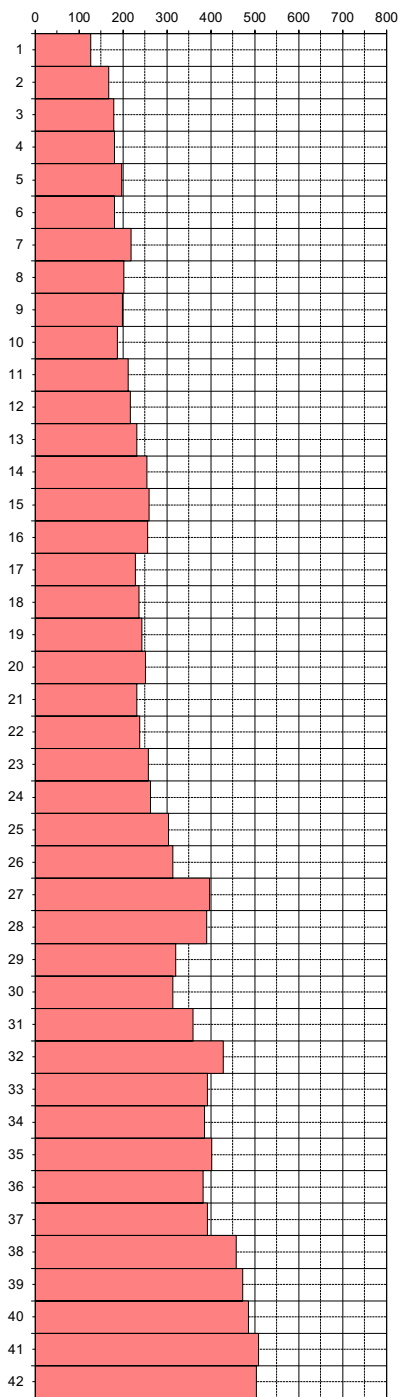
**ALLEGATO 2**

Prof. (m)	Vp m/sec.	Vs m/sec.	$\gamma$ T/m <sup>3</sup>	$\nu$	Edin Kg/cm <sup>2</sup>	Gdin Kg/cm <sup>2</sup>	Kdin Kg/cm <sup>2</sup>
1	524	126	1.68	0.47	2180	742	11912
2	680	167	1.76	0.47	3839	1308	19875
3	963	178	1.88	0.48	4535	1530	42715
4	1610	181	2.07	0.49	4831	1617	125742
5	1670	197	2.09	0.49	5712	1913	134926
6	1554	181	2.06	0.49	4835	1619	116985
7	1602	218	2.07	0.49	6950	2331	122727
8	1714	201	2.10	0.49	5948	1992	142151
9	1708	198	2.10	0.49	5774	1933	141264
10	1780	187	2.11	0.49	5167	1729	154276
11	2028	211	2.17	0.49	6575	2200	200397
12	2087	216	2.18	0.49	6910	2312	212292
13	2102	231	2.18	0.49	7867	2633	214753
14	2180	254	2.20	0.49	9500	3181	230086
15	2273	260	2.21	0.49	9954	3333	250461
16	2256	256	2.21	0.49	9630	3224	246892
17	2188	228	2.20	0.49	7704	2577	233187
18	2148	236	2.19	0.49	8219	2751	224252
19	2316	244	2.22	0.49	8762	2931	261240
20	2355	251	2.23	0.49	9320	3119	269904
21	2358	232	2.23	0.50	7955	2660	271678
22	2389	238	2.24	0.49	8369	2799	278826
23	2445	258	2.25	0.49	9843	3293	291215
24	2473	263	2.25	0.49	10179	3406	297859
25	2434	304	2.24	0.49	13527	4533	285593
26	2409	313	2.24	0.49	14387	4823	278668
27	2558	396	2.27	0.49	22779	7656	308919
28	2511	391	2.26	0.49	22166	7450	297442
29	2502	319	2.26	0.49	14929	5004	301231
30	2488	313	2.25	0.49	14409	4829	298132
31	2445	359	2.25	0.49	18727	6288	283897
32	2516	427	2.26	0.49	26323	8862	295392
33	2514	392	2.26	0.49	22332	7507	298009
34	2488	385	2.25	0.49	21489	7222	292268
35	2451	401	2.25	0.49	23264	7827	281714
36	2604	382	2.27	0.49	21283	7147	322043
37	2565	393	2.27	0.49	22374	7518	311152
38	2555	457	2.26	0.48	30008	10114	302032
39	2516	473	2.26	0.48	31936	10777	290648
40	2569	486	2.27	0.48	33719	11380	302581
41	2549	508	2.26	0.48	36583	12365	294901
42	2507	504	2.26	0.48	35932	12148	284892

**VELOCITA' ONDE DI COMPRESIONE (Vp)**  
m/sec



**VELOCITA' ONDE DI TAGLIO (Vs)**  
m/sec



**Legenda parametri dinamici**

<b>Vp</b>	Velocità onde P	(m/s)	<b><math>\nu</math></b>	Coefficiente di Poisson
<b>Vs</b>	Velocità onde S	(m/s)	<b>Edin</b>	Modulo di Elasticità Kg/cm <sup>2</sup>
<b><math>\gamma</math></b>	Peso di volume	T/m <sup>3</sup>	<b>Gdin</b>	Modulo di Taglio Kg/cm <sup>2</sup>
			<b>Kdin</b>	Modulo di Compressibilità Kg/cm <sup>2</sup>

**CLASSIFICAZIONE SISMICA DEI SUOLI (NTC 2018)**

$$Vs_{30} = \frac{30}{\sum_{i=1,N} \frac{h_i}{V_i}}$$

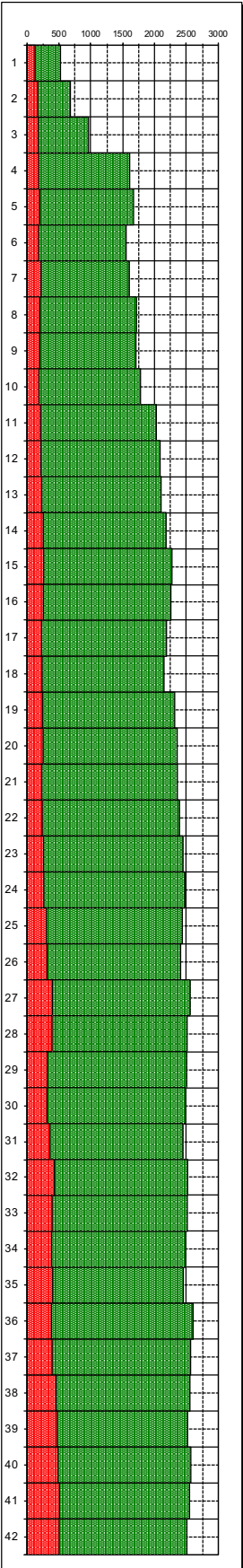
**Vs30** = **228** m/sec

**CATEGORIA SUOLO**

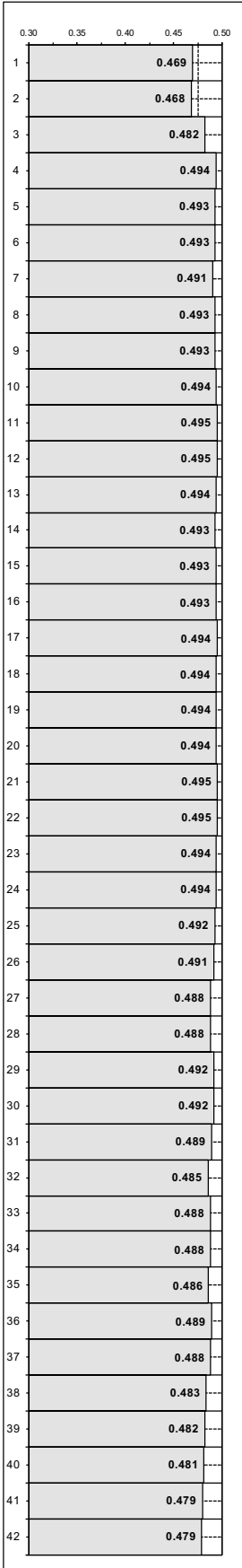
= **C**

### ALLEGATO 3 - GRAFICI DEI PARAMETRI ELASTICI DINAMICI

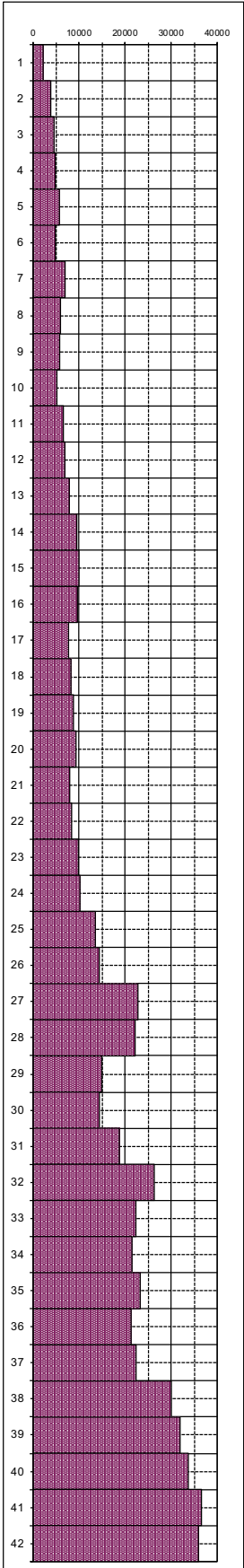
**VELOCITA' - Vp e Vs (m/sec)**



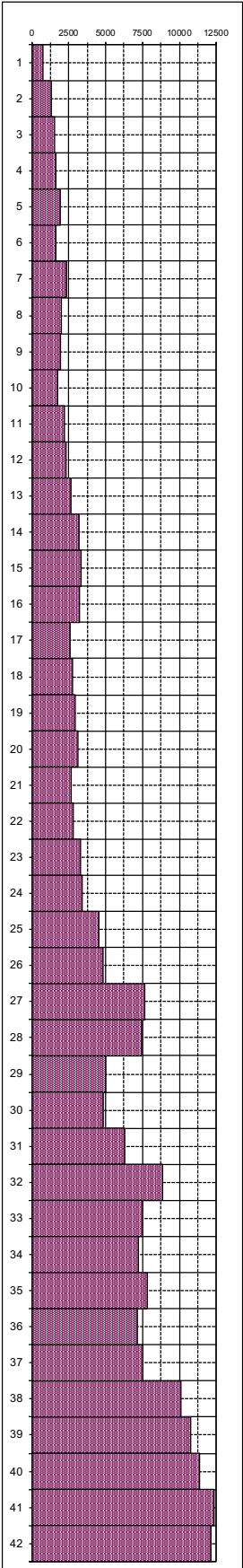
**COEFFICIENTE DI POISSON  $\nu$**



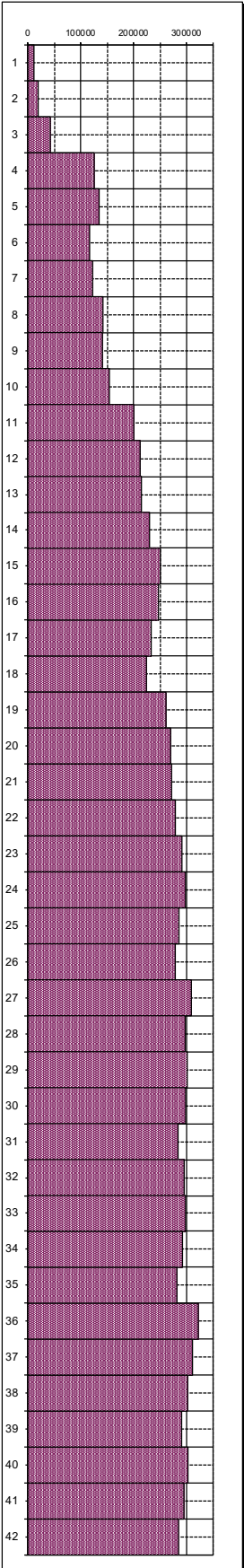
**MODULO DI ELASTICITA' Edin (kg/cm<sup>2</sup>)**



**MODULO DI TAGLIO Gdin (kg/cm<sup>2</sup>)**



**MODULO DI COMPRESSIBILITA' Kdin (kg/cm<sup>2</sup>)**



profondità (m)

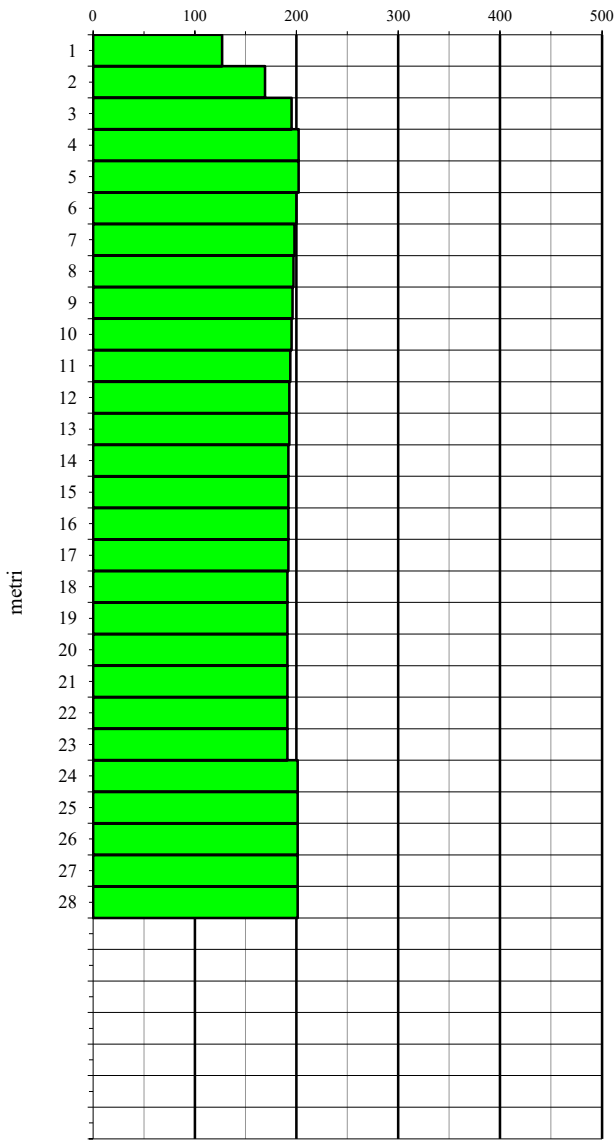
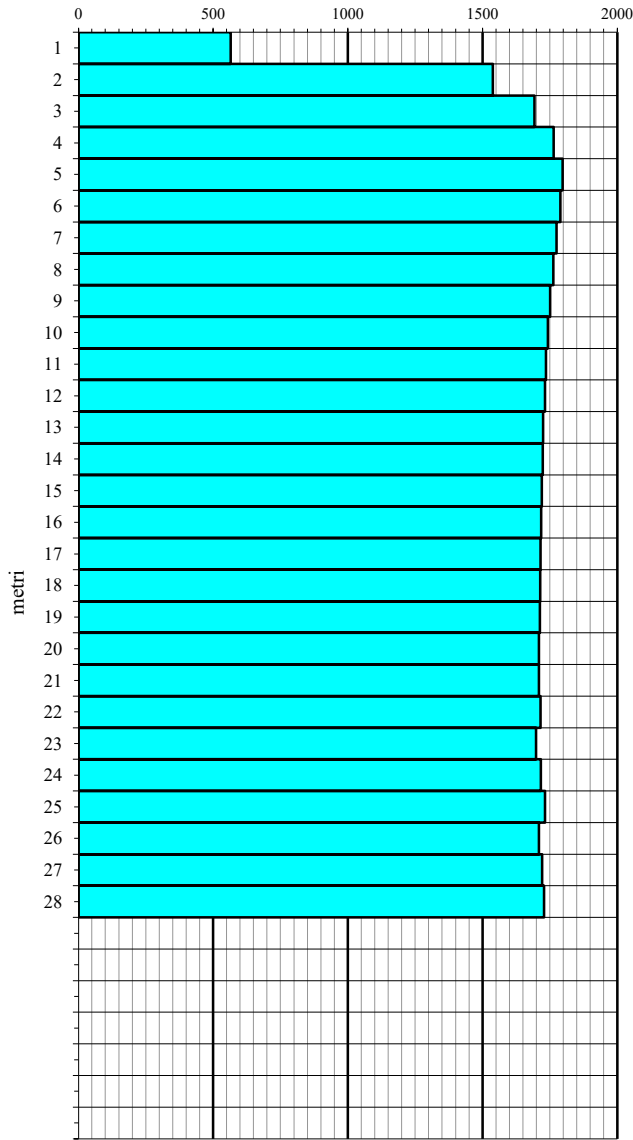


Cantiere: Torre Pedrera - Viale San Salvador
Data: 12/01/2021
Sismocono n.: 1

**INTERGEO** s.r.l. - Servizi Geologici  
 www.intergeosm.com - mail: info@intergeosm.com

Velocità onde P (m/sec.) - onde di compressione

Velocità onde S (m/sec.) - onde di taglio



$$V_{S30} = \frac{30}{\sum_{i=1,N} h_i / V_i}$$

dove  $h_i$  e  $V_i$  indicano lo spessore (in m) e la velocità delle onde di taglio (m/s) dello strato i-esimo, per un totale di N strati presenti nei 30m superiori.

**$V_{s28} = 191$  m/sec.**



# ARRAY BIDIMENSIONALE (ESAC/SPAC)

## Ambient Vibrations

Committente: Comune di Rimini

Codice prova: ESAC\_01

<p><b>LOCALITA':</b> Torre Pedrera – Rimini</p> <p><b>DATA PROVA:</b> gennaio 2021</p> <p><b>Coordinata Est:</b> 12.515860° (WGS 84 – Google Earth)</p> <p><b>Coordinata Nord:</b> 44.105487° (WGS 84 – Google Earth)</p> <p><b>QUOTA (m.s.l.m.):</b> 1</p> <p><b>ENERGIZZAZIONE:</b> Ambient Vibrations</p> <p><b>STRUMENTAZIONE:</b> Sara</p> <p><b>NUMERO CANALI:</b> 48</p>	<p><b>GEOMETRIA:</b> Configurazione ad L</p> <p><b>SPAZIATURA/ILUNGHEZZA X:</b> 5-10 m / 305</p> <p><b>SPAZIATURA/LUNGHEZZA Y:</b> 5 m / 55 m</p> <p><b>SAMPLING Freq :</b> 62.5 Hz</p> <p><b>FREQUENCY Range:</b> 0.4 – 30 Hz</p> <p><b>TIME Acquisition:</b> 35 min</p> <p><b>CONDIZIONI METEO:</b> Sole</p> <p><b>SOFTWARE:</b> Geopsy-Dinver-Spac2disp-Max2curve</p>
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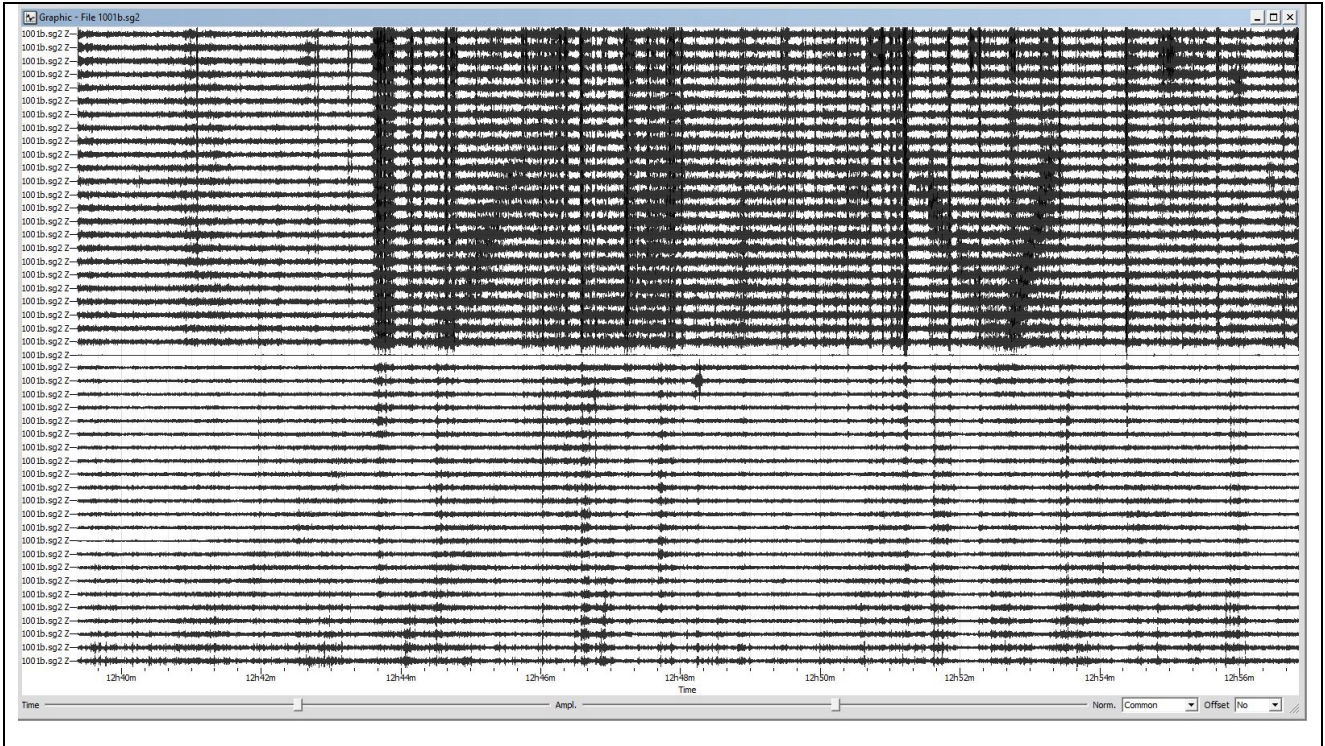
Immagine Google Earth



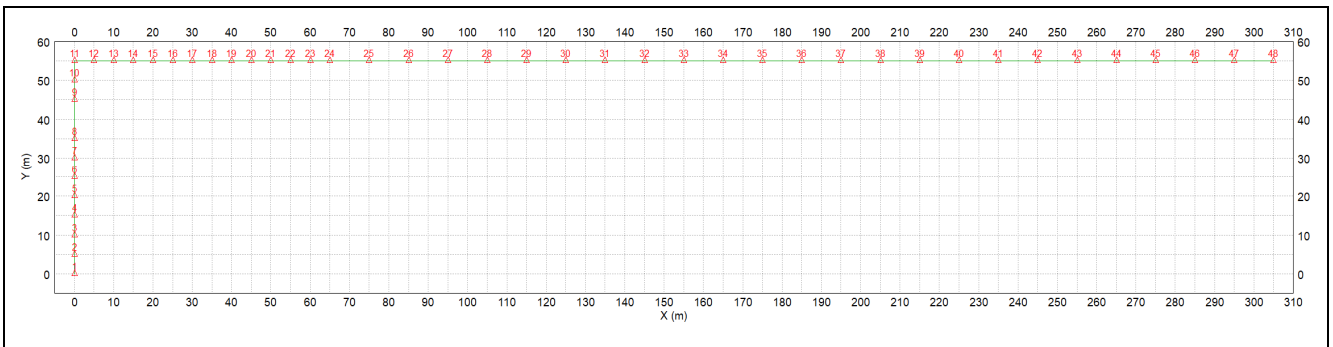
Foto area di indagine



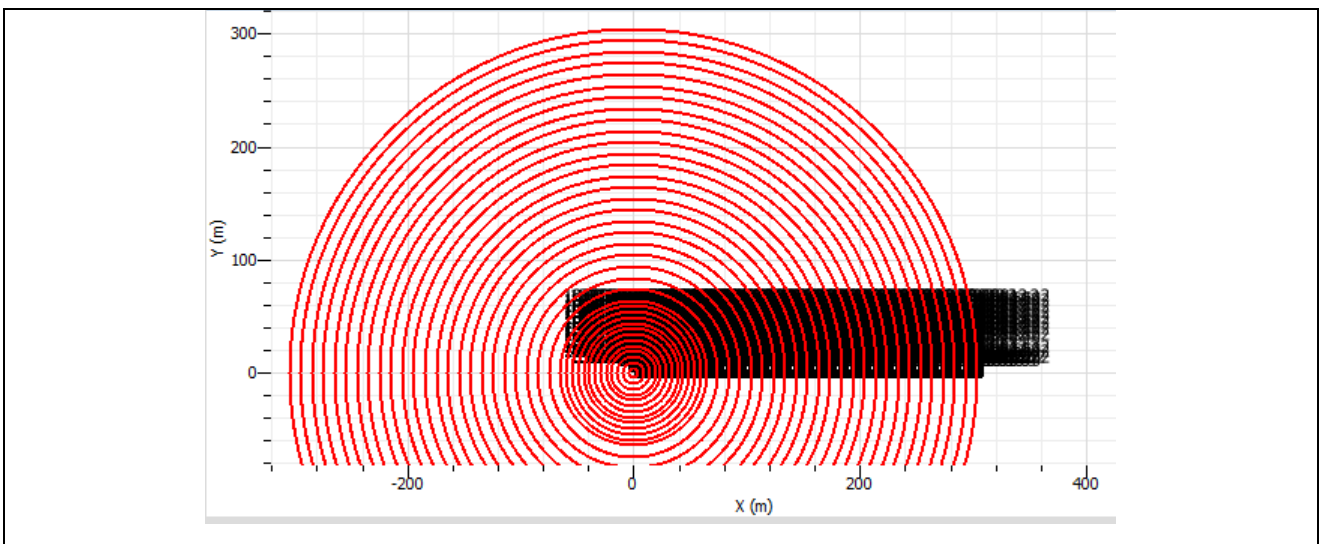
# Segnali registrazione



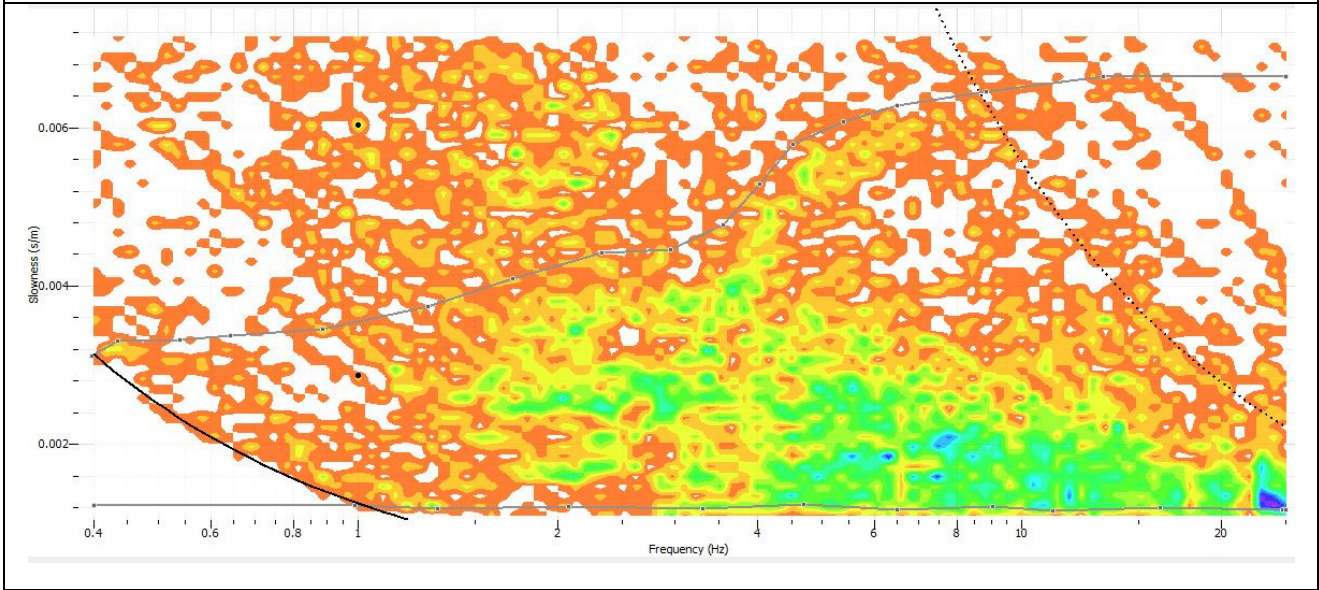
# Planimetria Array



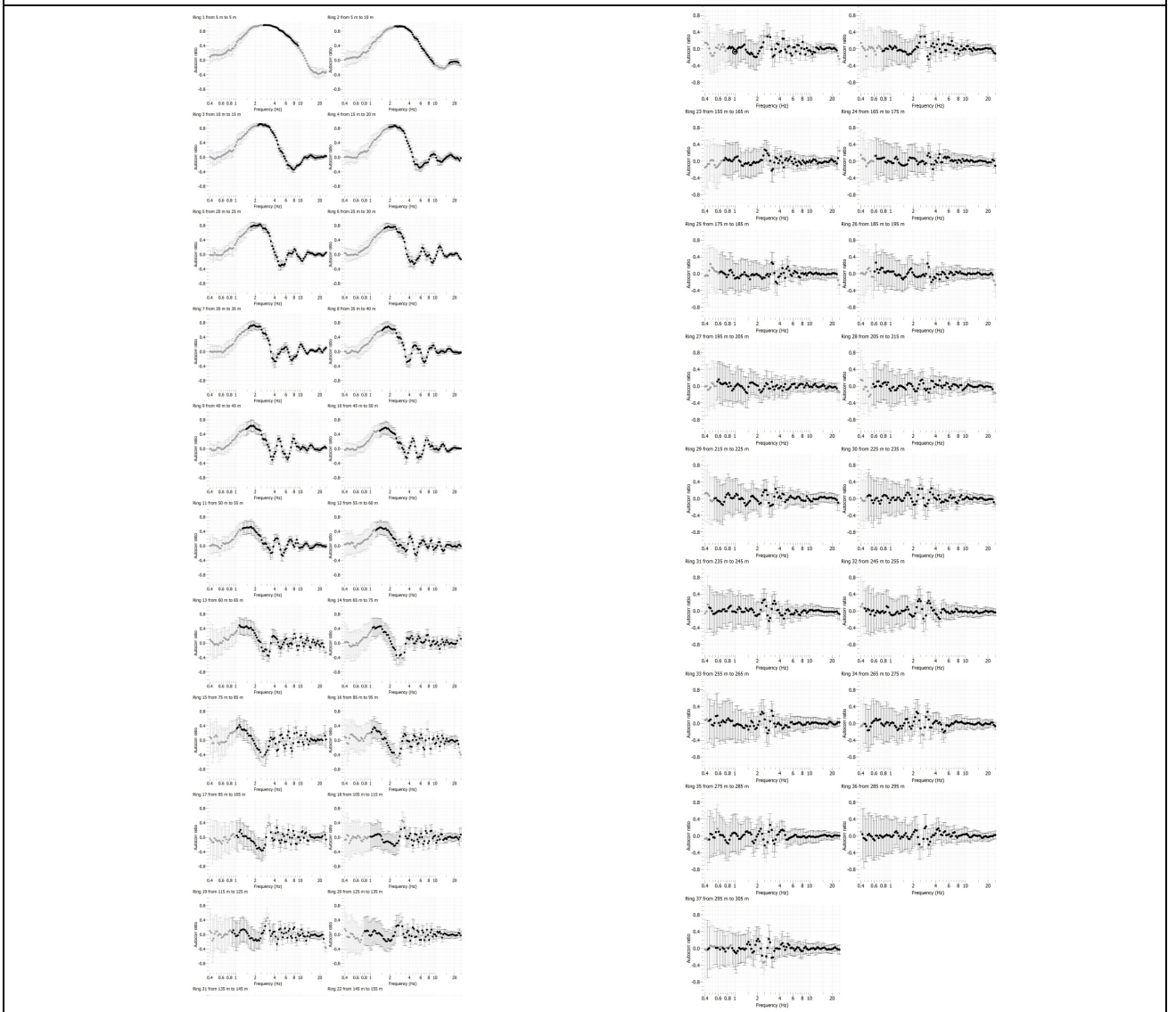
# Co-Array / Rings



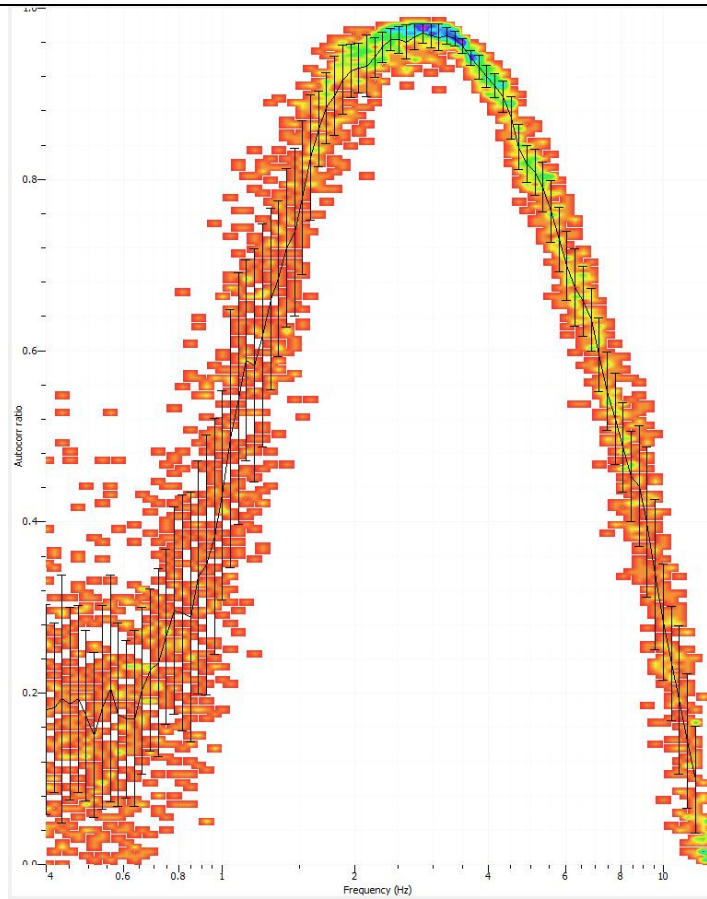
**SPETTRO DI DISPERSIONE CUMULATIVO DEI RINGS E RELATIVO PICKING, CON INDIVIDUAZIONE DEI CAMPI DI FREQUENZA/VELOCITA' SIGNIFICATIVI**



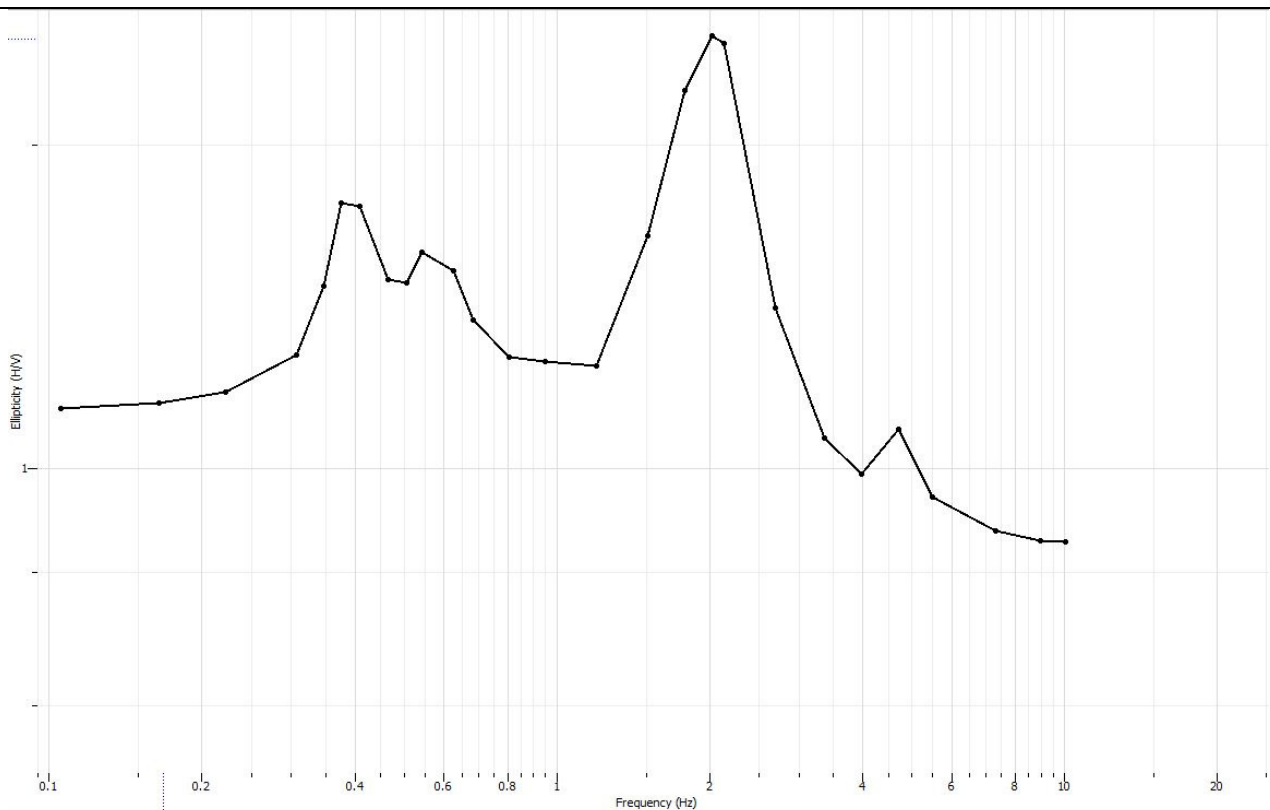
**CURVE DI DISPERSIONE CORRISPONDENTI AD OGNI RING**



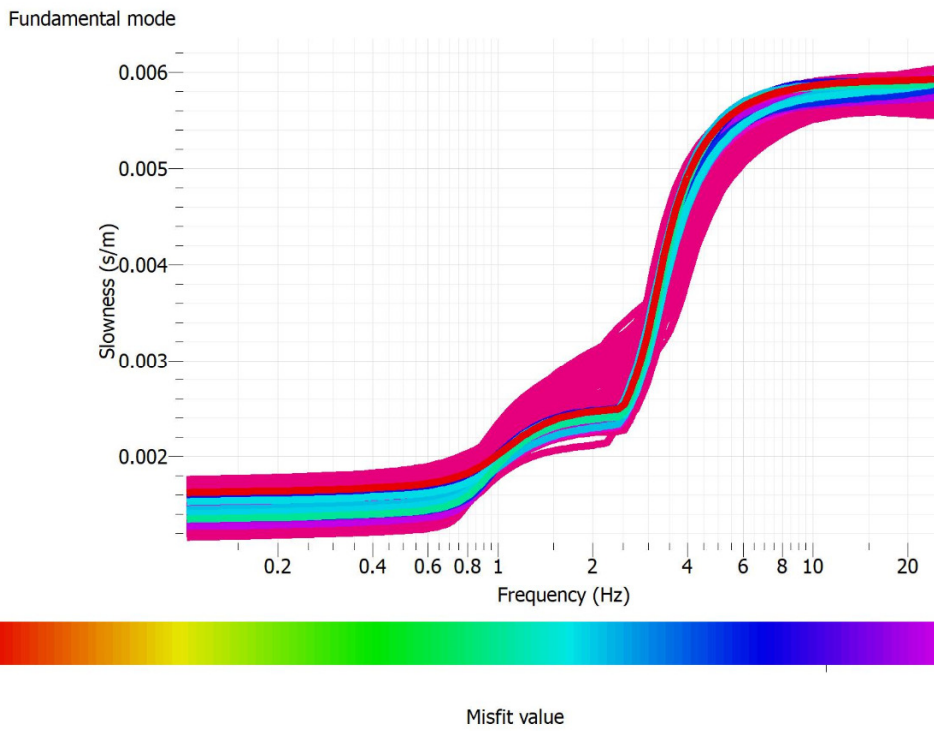
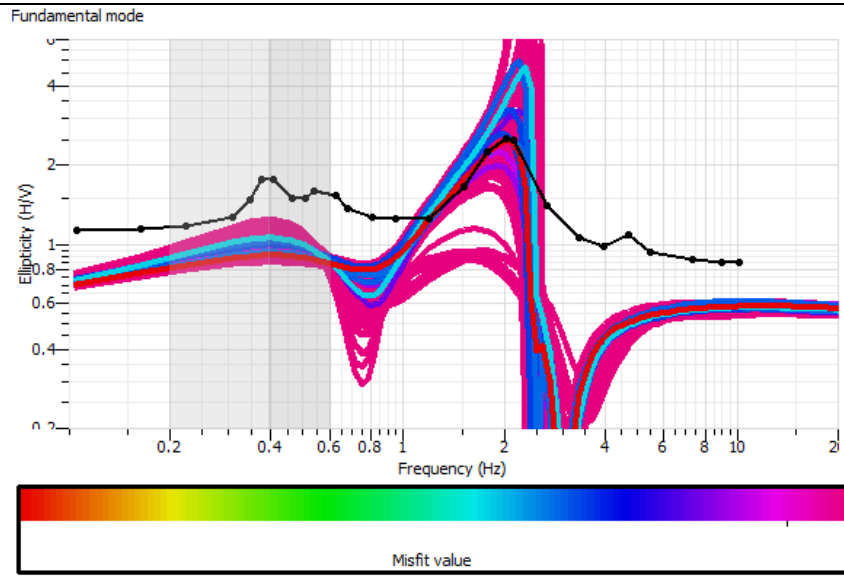
### SPETTRO CUMULATIVO CON RAPPORTO DI AUTOCORRELAZIONE/FREQUENZA



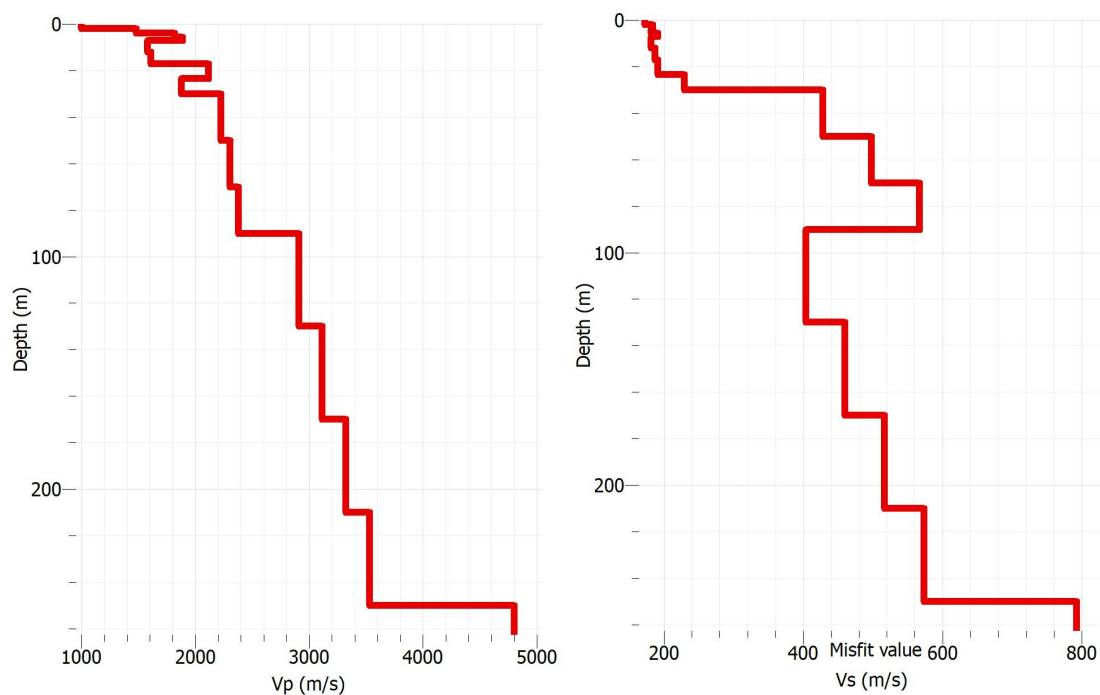
### Ellipticity curve semplificato – modello curva media H/V



### Inversione congiunta – selezione curve a minor MISFIT



PROFILO SPERIMENTALE DI VS MAGGIORMENTE RAPPRESENTATIVO (MISFIT MIN)



Dati di sintesi profilo di velocità

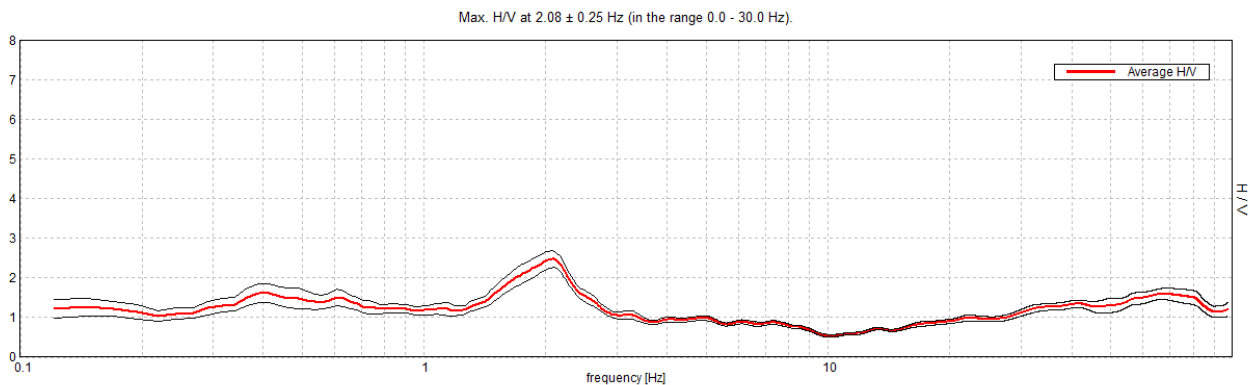
Spessore (m)	Vp (m/s)	Vs (m/s)	gamma (kg/mc)
2	998.2871	172.1679	1800
2	1477.377	183.5105	1800
1.5	1816.587	181.5297	1850
1.5	1887.961	190.7836	1850
5	1576.751	181.4197	1900
5	1608.44	186.9156	1900
6.5	2114.689	191.0108	2000
6.5	1877.475	229.6324	2000
20	2225.512	428.2085	2100
20	2301.794	497.7367	2100
20	2378.077	567.2649	2100
40	2908.684	403.5291	2100
40	3115.744	460.0925	2100
40	3322.804	516.6559	2100
40	3529.863	573.2193	2100
bottom	4800.77	792.7746	2200

**VS 30 = 193 m/s**

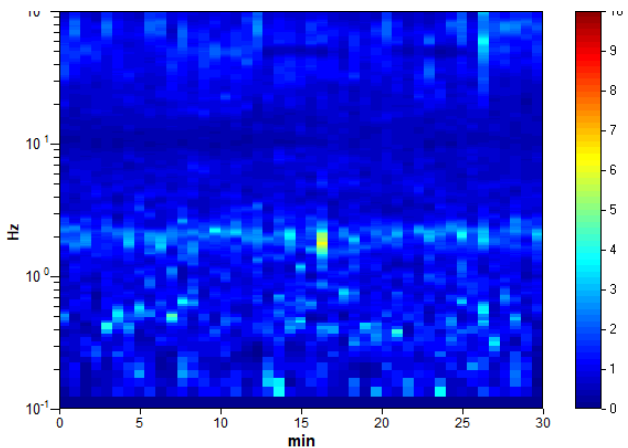
**MS3\_RIMINI, HVSR\_01**

Instrument: EXT- 24 bit USB  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 27/01/21 11:12:09 End recording: 27/01/21 11:42:09  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h30'00". Analysis performed on the entire trace.  
 Sampling rate: 200 Hz  
 Window size: 40 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

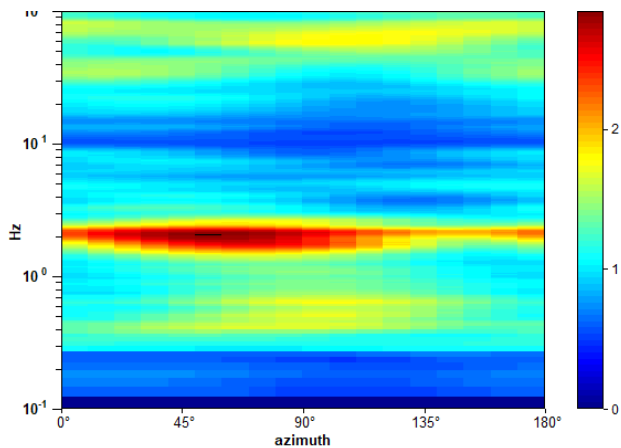
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



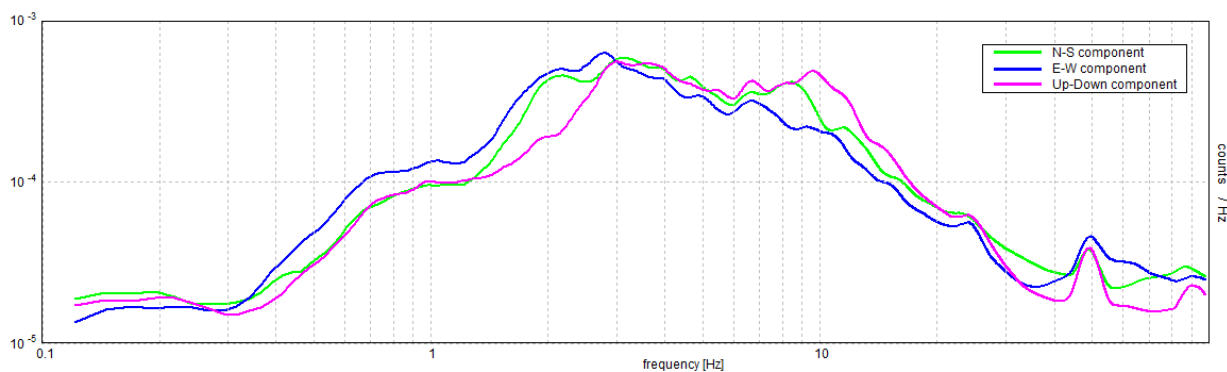
**H/V TIME HISTORY**



**DIRECTIONAL H/V**



**SINGLE COMPONENT SPECTRA**



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

**Max. H/V at  $2.08 \pm 0.25$  Hz (in the range 0.0 - 30.0 Hz).**

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

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	$2.08 > 0.25$	OK	
$n_c(f_0) > 200$	$3735.4 > 200$	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 128 times	OK	

**Criteria for a clear H/V peak**

[At least 5 out of 6 should be fulfilled]

Exists $f^-$ in $[f_0/4, f_0]$   $A_{H/V}(f^-) < A_0 / 2$	1.27 Hz	OK	
Exists $f^+$ in $[f_0, 4f_0]$   $A_{H/V}(f^+) < A_0 / 2$	2.759 Hz	OK	
$A_0 > 2$	$2.47 > 2$	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.12058  < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	$0.25022 < 0.10376$		NO
$\sigma_A(f_0) < \theta(f_0)$	$0.2145 < 1.58$	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
$\sigma_f$	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

# ARRAY BIDIMENSIONALE (ESAC/SPAC) Ambient Vibrations

Committente: Comune di Rimini

Codice prova: ESAC\_02

<b>LOCALITA':</b> Marina centro – Rimini	<b>GEOMETRIA:</b> Configurazione ad L
<b>DATA PROVA:</b> gennaio 2021	<b>SPAZIATURA/ILUNGHEZZA X:</b> 5-10 m / 200
<b>Coordinata Est:</b> 12.578531° (WGS 84 – Google Earth)	<b>SPAZIATURA/LUNGHEZZA Y:</b> 5-10 m / 135 m
<b>Coordinata Nord:</b> 44.074277° (WGS 84 – Google Earth)	<b>SAMPLING Freq :</b> 62.5 Hz
<b>QUOTA (m.s.l.m.):</b> 1	<b>FREQUENCY Range:</b> 0.4 – 30 Hz
<b>ENERGIZZAZIONE:</b> Ambient Vibrations	<b>TIME Acquisition:</b> 35 min
<b>STRUMENTAZIONE:</b> Sara	<b>CONDIZIONI METEO:</b> Sole
<b>NUMERO CANALI:</b> 48	<b>SOFTWARE:</b> Geopsy-Dinver-Spac2disp-Max2curve

Immagine Google Earth

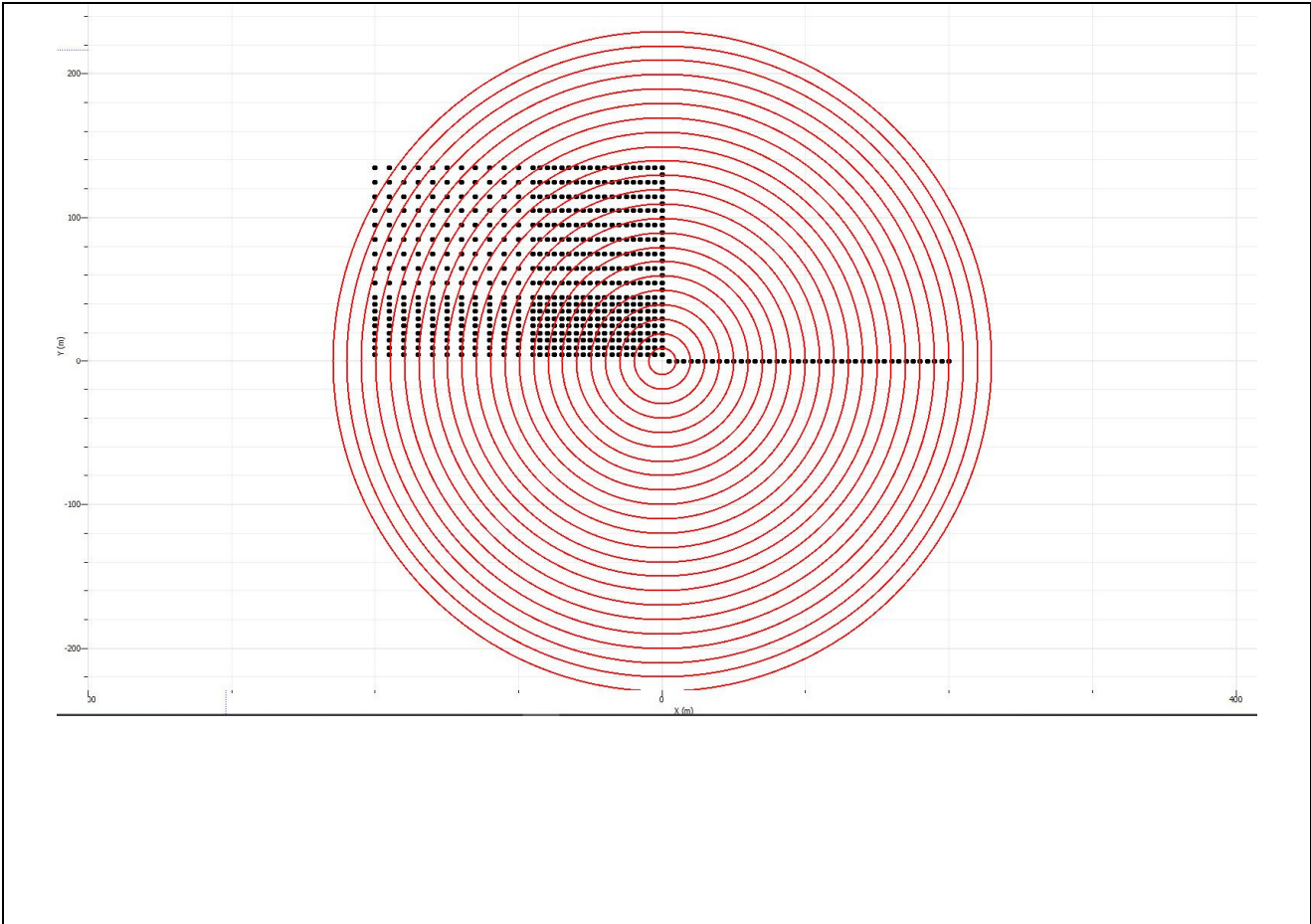


Foto area di indagine

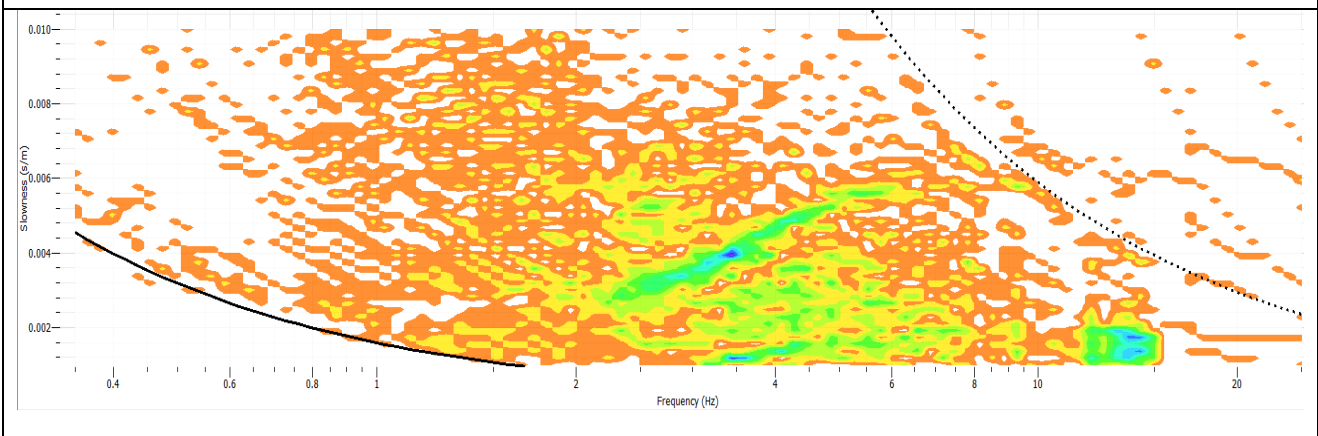




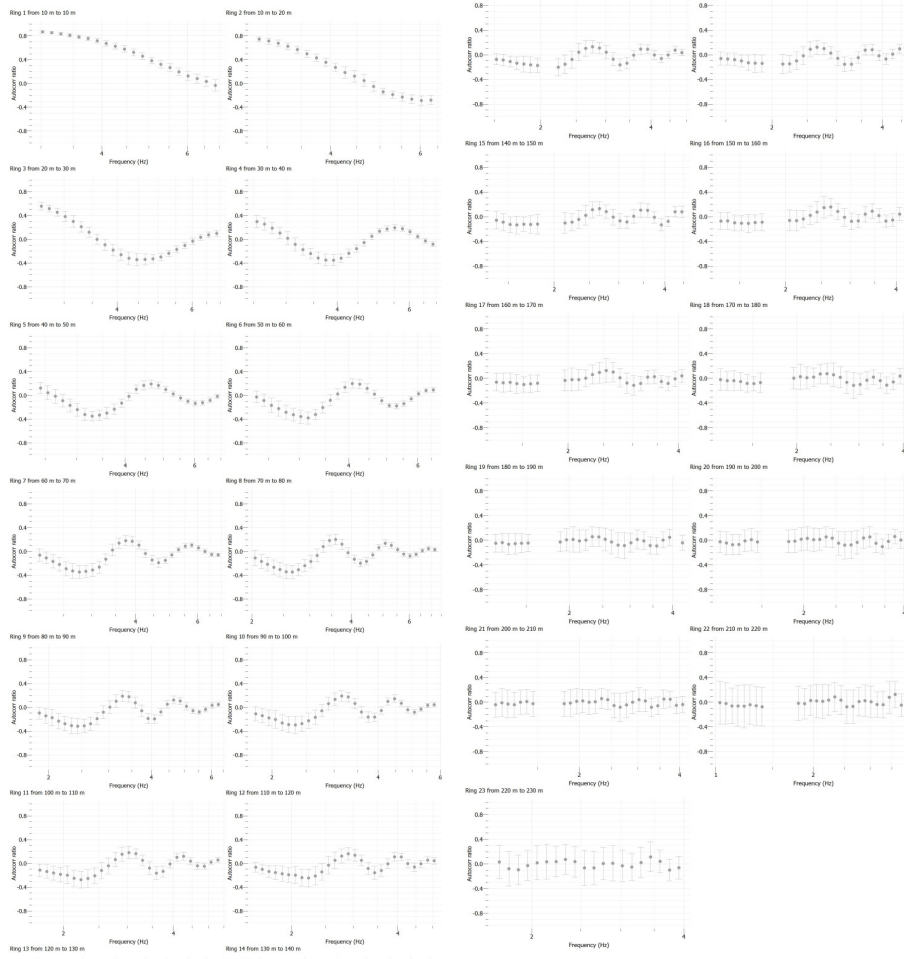
# Co-Array / Rings



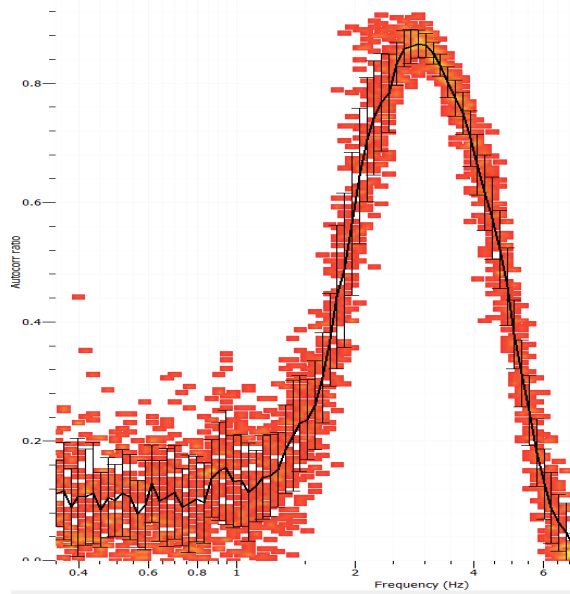
**SPETTRO DI DISPERSIONE CUMULATIVO DEI RINGS CON INDIVIDUAZIONE DEI CAMPI DI FREQUENZA/VELOCITA' SIGNIFICATIVI**



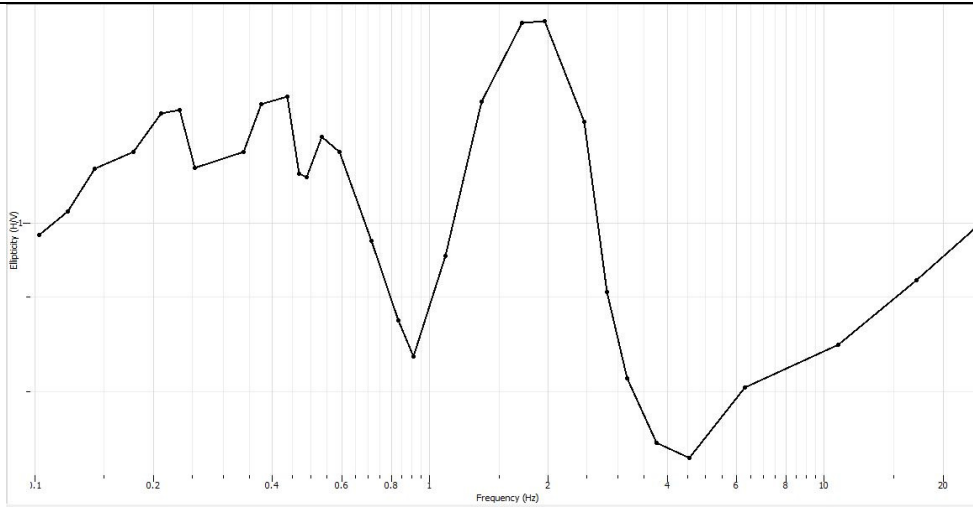
### CURVE DI DISPERSIONE CORRISPONDENTI AD OGNI RING



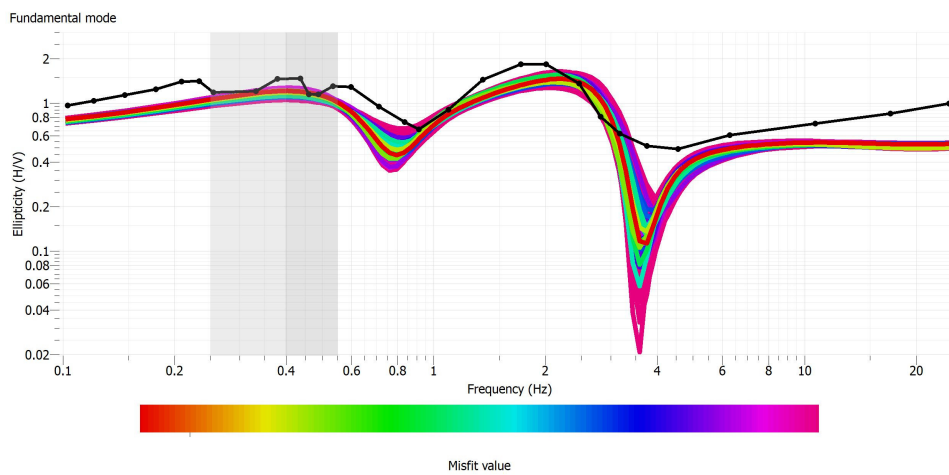
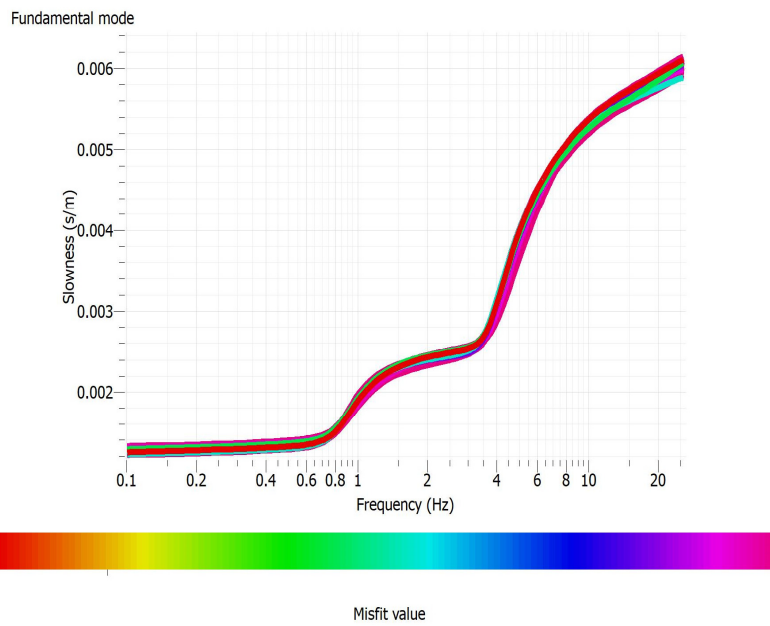
### SPETTRO CUMULATIVO CON RAPPORTO DI AUTOCORRELAZIONE/FREQUENZA



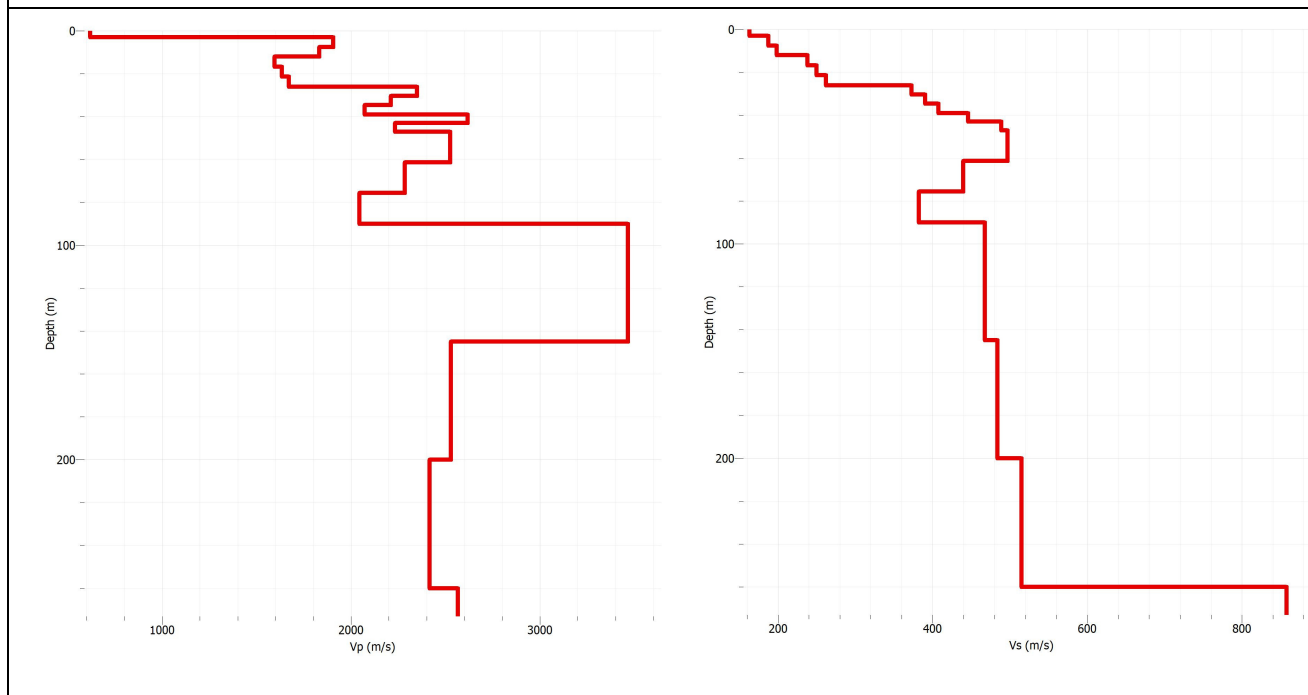
### Ellipticity curve semplificato – modello curva media H/V



### Inversione congiunta – selezione curve a minor MISFIT



PROFILO SPERIMENTALE DI VS MAGGIORMENTE RAPPRESENTATIVO (MISFIT MIN)



Dati di sintesi profilo di velocità

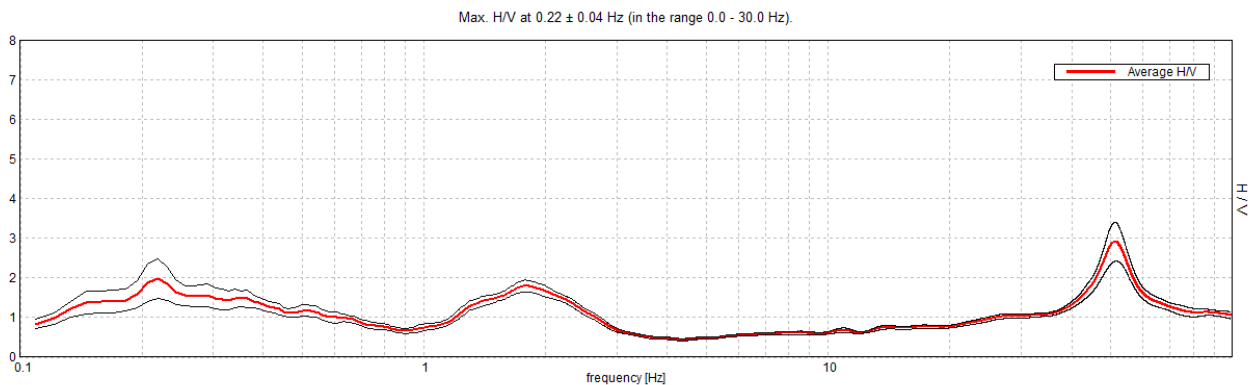
Spessore (m)	Vp (m/s)	Vs (m/s)	gamma (kg/mc)
3.0	618.1806	163.216	1800
4.5	1905.719	187.355	1850
4.5	1831.387	198.465	1850
4.7	1595.469	238.2297	1900
4.7	1633.376	250.0891	1900
4.7	1671.284	261.9486	1900
4.3	2348.909	372.8831	2000
4.3	2210.047	390.2265	2000
4.3	2071.186	407.5699	2000
4.0	2616.21	445.9685	2100
4.0	2233.397	488.6895	2100
14.3	2524.693	496.8375	2100
14.3	2284.275	439.5025	2100
14.3	2043.857	382.1675	2100
55.0	3465.984	467.3233	2200
55.0	2529.063	483.88	2200
60.0	2416.218	515.1505	2200
bottom	2564.864	857.7083	2300

**VS 30 = 228 m/s**

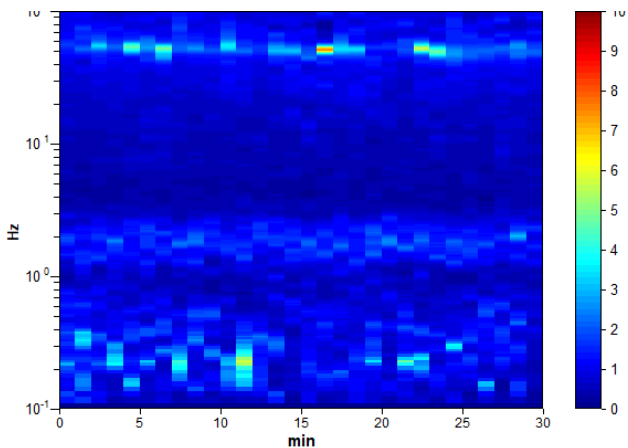
**MS3\_RIMINI, HVSR\_02**

Instrument: EXT- 24 bit USB  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 27/01/21 13:58:52 End recording: 27/01/21 14:28:52  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h30'00". Analysis performed on the entire trace.  
 Sampling rate: 200 Hz  
 Window size: 60 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

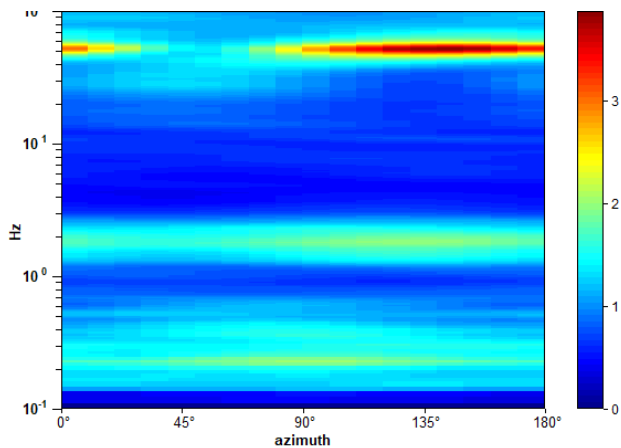
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



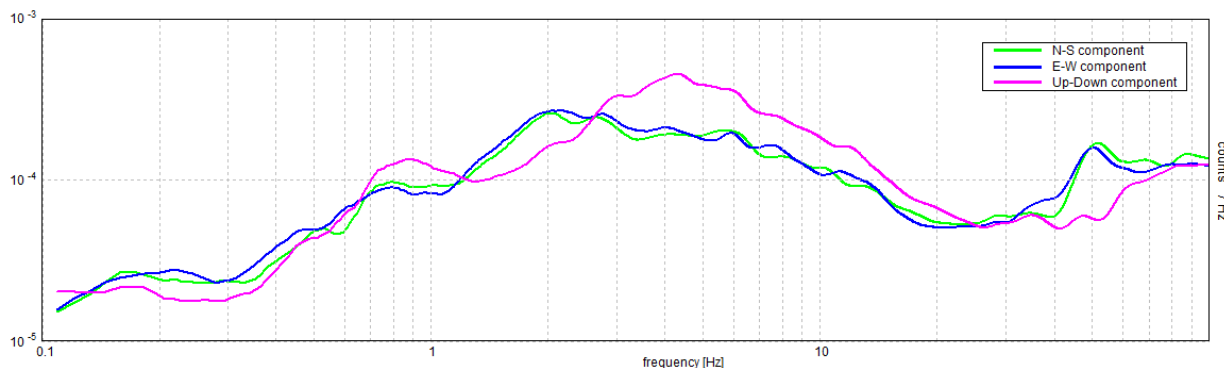
**H/V TIME HISTORY**



**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  $0.22 \pm 0.04$  Hz (in the range 0.0 - 30.0 Hz).**

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

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	$0.22 > 0.17$	OK	
$n_c(f_0) > 200$	$395.5 > 200$	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 28 times	OK	

**Criteria for a clear H/V peak**

[At least 5 out of 6 should be fulfilled]

Exists $f^-$ in $[f_0/4, f_0]$   $A_{H/V}(f^-) < A_0 / 2$	0.122 Hz	OK	
Exists $f^+$ in $[f_0, 4f_0]$   $A_{H/V}(f^+) < A_0 / 2$	0.623 Hz	OK	
$A_0 > 2$	$1.99 > 2$		NO
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.17362  < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	$0.03815 < 0.04395$	OK	
$\sigma_A(f_0) < \theta(f_0)$	$0.5033 < 2.5$	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
$\sigma_f$	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  $\sigma_A(f_0)$

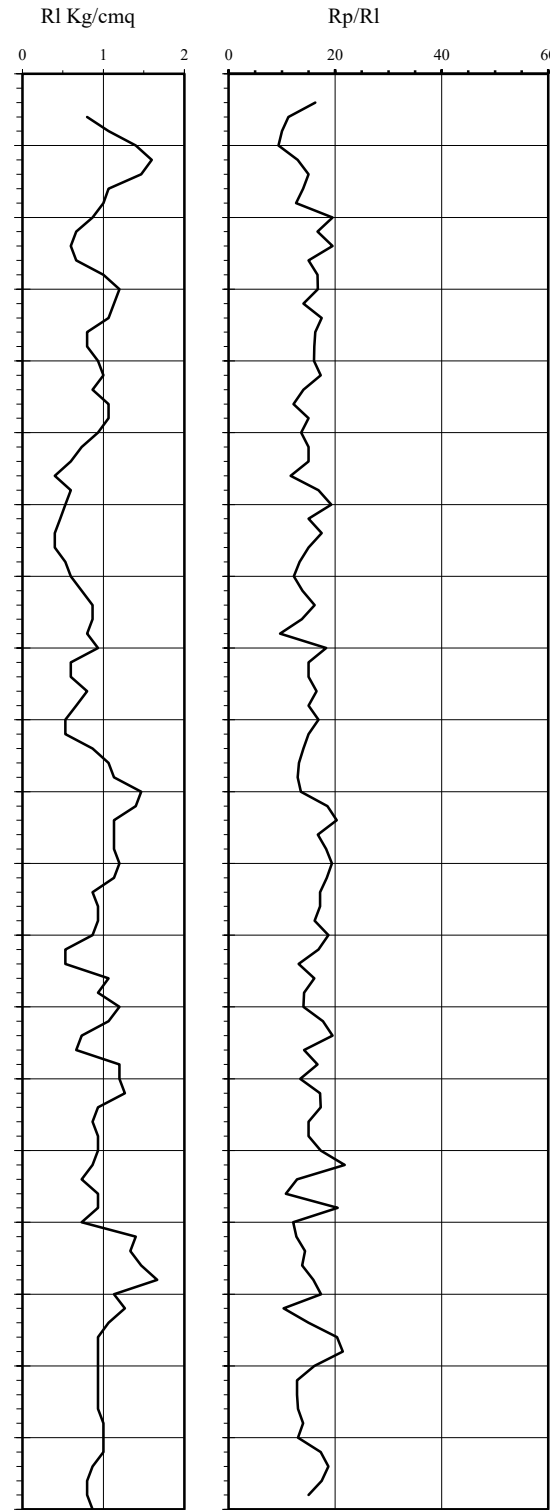
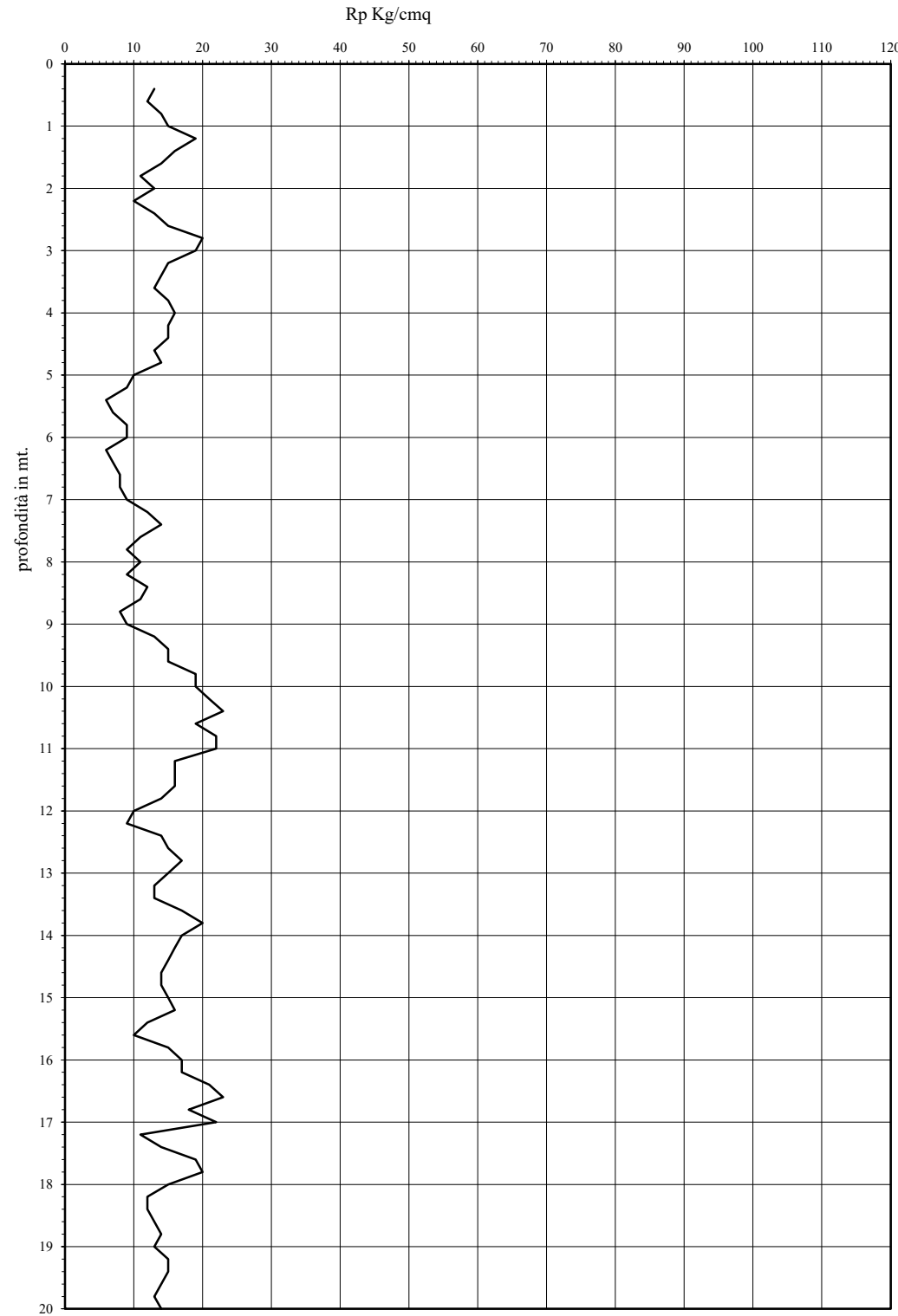
Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	$0.25 f_0$	$0.2 f_0$	$0.15 f_0$	$0.10 f_0$	$0.05 f_0$
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
$\log \theta(f_0)$ for $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

# Prova Penetrometrica Statica

Prova n.: CPT 1  
 Cantiere: Rimini (RN) - Microzonazione sismica  
 Data: Novembre 2020

Quota inizio: piano campagna  
 Liv.falda: -2,20 mt.  
 Note:

Classificazione orientativa dei terreni (Schmertmann - 1978)



mt.	Rp	Rl	Rp/Rl
0.2	13		16.25
0.4	12	0.80	11.25
0.6	14	1.07	10.00
0.8	15	1.40	9.38
1.2	19	1.60	12.95
1.4	16	1.47	15.00
1.6	14	1.07	14.00
1.8	11	1.00	12.69
2.2	13	0.87	19.50
2.4	10	0.67	16.67
2.6	13	0.60	19.50
2.8	15	0.67	15.00
3.2	20	1.00	16.67
3.4	19	1.20	16.76
3.6	15	1.13	14.06
3.8	14	1.07	17.50
4.2	13	0.80	16.25
4.4	15	0.80	16.07
4.6	16	0.93	16.00
4.8	15	1.00	17.31
5.2	14	0.87	14.06
5.4	13	1.07	12.19
5.6	10	0.93	13.64
5.8	9	0.73	15.00
6.2	6	0.40	15.00
6.4	7	0.40	17.50
6.6	8	0.40	15.00
6.8	8	0.53	13.33
7.2	9	0.60	12.27
7.4	12	0.73	13.85
7.6	14	0.87	16.15
7.8	11	0.87	13.75
8.2	9	0.80	9.64
8.4	11	0.93	18.33
8.6	9	0.60	15.00
8.8	12	0.60	15.00
9.2	8	0.67	15.00
9.4	8	0.53	16.88
9.6	9	0.53	15.00
9.8	13	0.53	15.00
10.2	15	0.87	14.06
10.4	15	1.07	13.24
10.6	19	1.13	12.95
10.8	19	1.47	13.57
11.2	21	1.40	18.53
11.4	23	1.13	20.29
11.6	19	1.13	16.76
11.8	22	1.13	18.33
12.2	11	1.20	19.41
12.4	16	1.13	18.46
12.6	16	0.87	17.14
12.8	16	0.93	17.14
13.2	14	0.93	16.15
13.4	10	0.87	18.75
13.6	9	0.53	16.88
13.8	14	0.53	13.13
14.2	15	1.07	16.07
14.4	17	0.93	14.17
14.6	13	1.20	14.06
14.8	13	1.07	17.73
15.2	13	0.73	19.50
15.4	17	0.67	14.17
15.6	20	1.20	16.67
15.8	17	1.20	13.42
16.2	16	1.27	17.14
16.4	15	0.93	17.31
16.6	14	0.87	15.00
16.8	14	0.93	15.00
17.2	15	0.93	17.31
17.4	16	0.87	21.82
17.6	12	0.73	12.86
17.8	10	0.93	10.71
18.2	15	0.93	20.45
18.4	17	0.73	12.14
18.6	17	1.40	12.75
18.8	21	1.33	14.32
19.2	23	1.47	13.80
19.4	18	1.67	15.88
19.6	17	1.13	17.37
19.8	11	1.27	10.31
20.0	14	1.07	15.00

Legenda:

- argilla
- sabbia limoso argillosa
- sabbia
- AO argilla organica e terreni misti; AMT argilla molto tenera;
- AT argilla tenera; AM argilla media; AC argilla compatta
- AMC argilla molto compatta; ASL argilla sabbiosa limosa;
- SL sabbia e limo; SLA sabbia limoso argillosa
- SS sabbia sciolta; S sabbia; SD sabbia densa

Angolo d'attrito interno, densità  
relativa e coesione

φ °	Dr	Cu Kg/cmq	Nspt
/	/	0.65	/
/	/	0.6	/
/	/	0.7	/
/	/	0.75	/
/	/	0.95	/
/	/	0.85	/
/	/	0.7	/
/	/	0.55	/
/	/	0.65	/
/	/	0.75	/
/	/	1	/
/	/	0.95	/
/	/	0.75	/
/	/	0.7	/
/	/	0.65	/
/	/	0.7	/
/	/	0.65	/
/	/	0.7	/
/	/	0.45	/
/	/	0.3	/
/	/	0.35	/
/	/	0.45	/
/	/	0.45	/
/	/	0.3	/
/	/	0.35	/
/	/	0.4	/
/	/	0.45	/
/	/	0.6	/
/	/	0.7	/
/	/	0.55	/
/	/	0.45	/
/	/	0.55	/
/	/	0.4	/
/	/	0.45	/
/	/	0.65	/
/	/	0.75	/
/	/	0.75	/
/	/	0.95	/
/	/	0.95	/
/	/	1.05	/
/	/	1.15	/
/	/	0.95	/
/	/	1.1	/
/	/	1.1	/
/	/	0.8	/
/	/	0.8	/
/	/	0.8	/
/	/	0.7	/
/	/	0.5	/
/	/	0.45	/
/	/	0.7	/
/	/	0.75	/
/	/	0.85	/
/	/	0.65	/
/	/	0.85	/
/	/	1	/
/	/	0.85	/
/	/	0.8	/
/	/	0.75	/
/	/	0.7	/
/	/	0.7	/
/	/	0.75	/
/	/	0.9	/
/	/	1.1	/
/	/	0.55	/
/	/	0.7	/
/	/	0.95	/
/	/	1	/
/	/	0.75	/
/	/	0.6	/
/	/	0.65	/
/	/	0.7	/
/	/	0.65	/
/	/	0.75	/
/	/	0.75	/
/	/	0.7	/
/	/	0.65	/

Verifica alla liquefazione  
magnitudo di 6 g  
accelerazione massima al suolo 0,25 g  
(Seed et al. 1985)

coefficiente di sicurezza

Caratteristiche strumento: penetrometro statico semovente, 200kN spinta  
 Punta meccanica tipo Begemann - manicotto laterale superficie 150 cmq

Cu media Kg/cmq 0.70561 0 Nspt media n. colpi

n.l. non liquefacibile







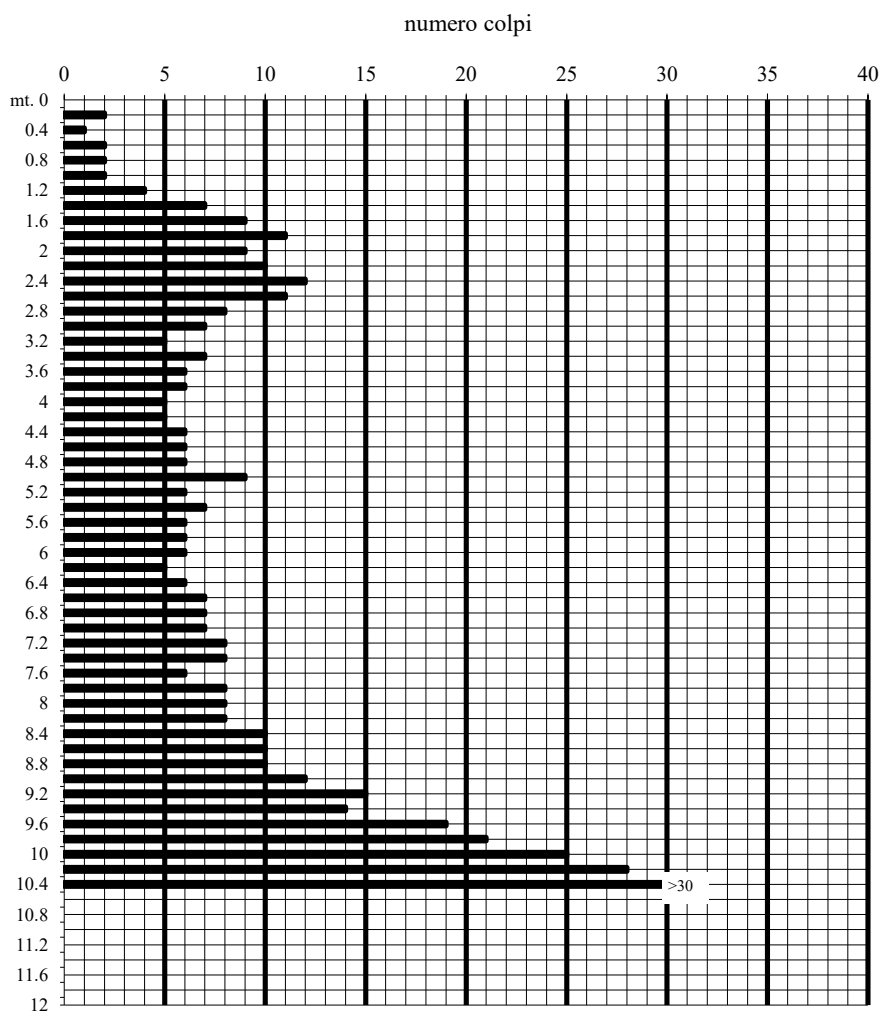
Intergeo s.r.l. - Servizi Geologici - info@intergeosm.com

cantiere: Rimini - Microzonazione sismica  
quota inizio: piano campagna data: Novembre 2020  
prof. falda: -6.70 mt

**PROVA PENETROMETRICA DINAMICA PESANTE DPSH 3**

Penetrometro dinamico pesante tipo "Emilia" :

Peso maglio:63.50 Kg. Caduta maglio:75cm. Sezione punta:20cmq. Peso aste:6.20Kg/ml.

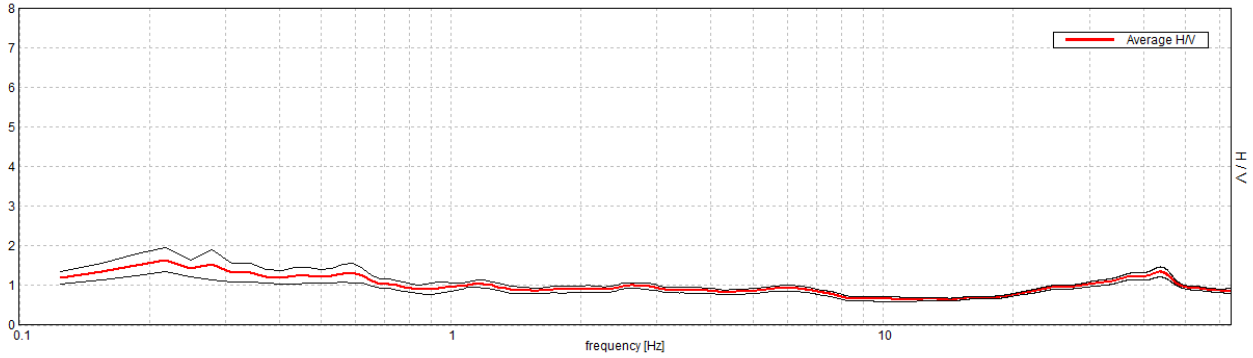


**MS3\_RIMINI, HV 0001**

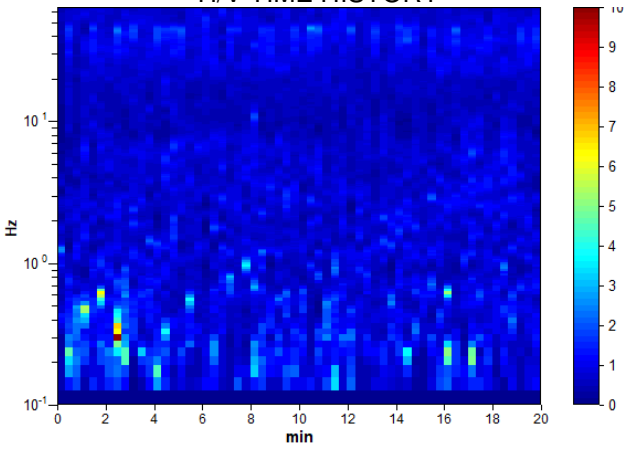
Instrument: TRZ-0144/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 23/11/20 12:31:03      End recording: 23/11/20 12:51:02  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h20'00".      Analysis performed on the entire trace.  
 Sampling rate: 128 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

**HORIZONTAL TO VERTICAL SPECTRAL RATIO**

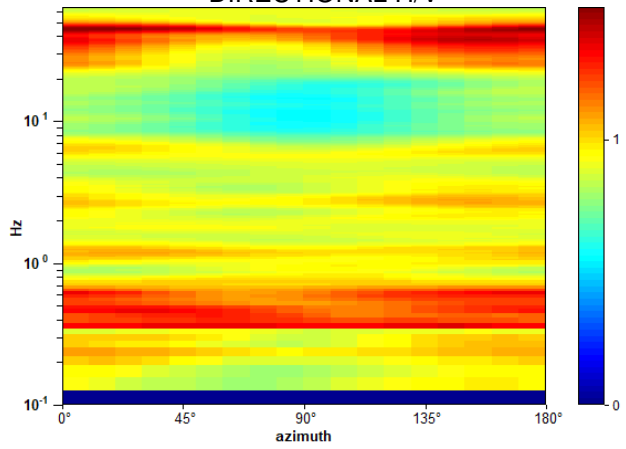
Max. H/V at 0.22 ± 0.15 Hz (in the range 0.0 - 64.0 Hz).



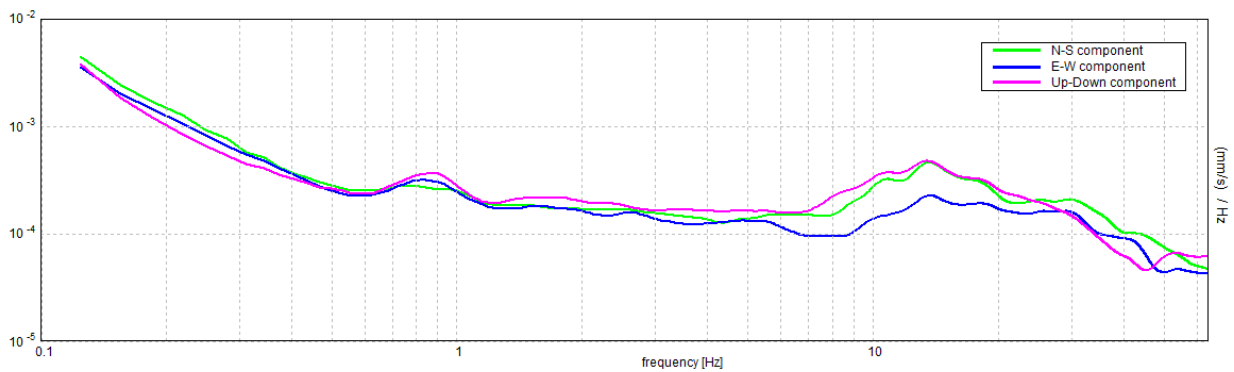
**H/V TIME HISTORY**



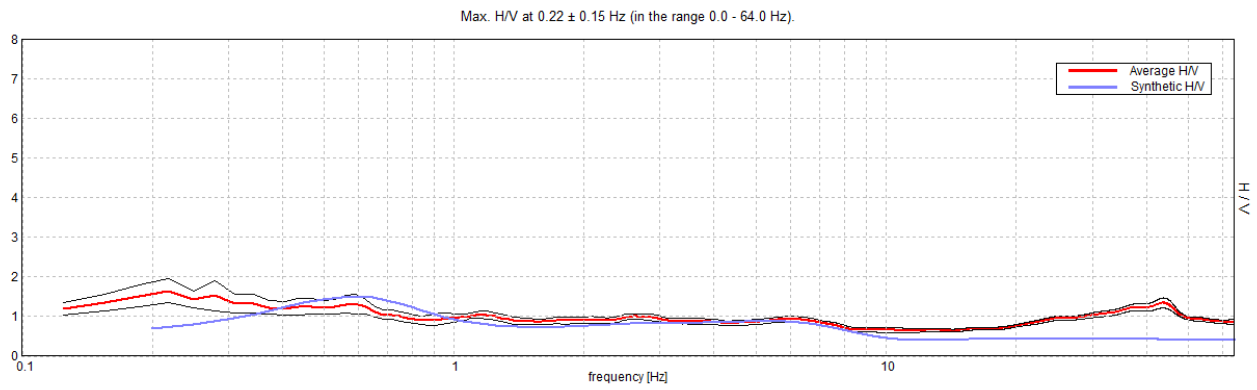
**DIRECTIONAL H/V**



**SINGLE COMPONENT SPECTRA**

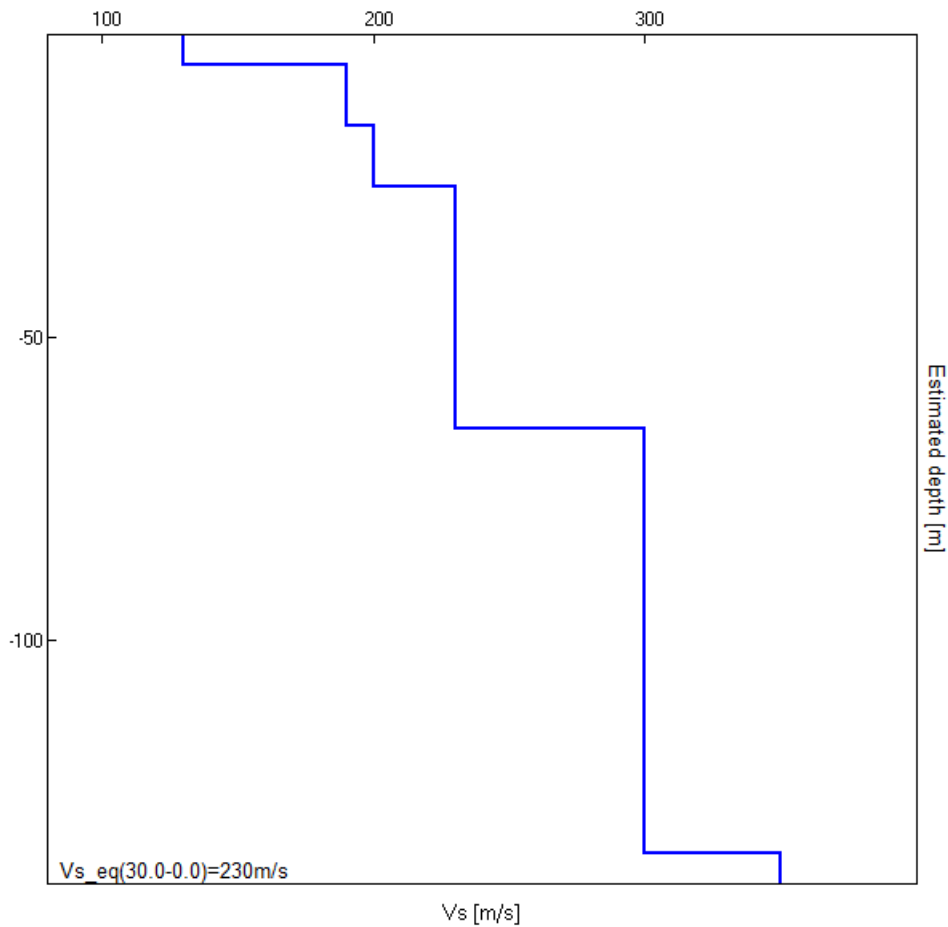


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
5.00	5.00	130	0.49
15.00	10.00	190	0.49
25.00	10.00	200	0.49
65.00	40.00	230	0.49
135.00	70.00	300	0.49
inf.	inf.	350	0.42

**Vs\_eq(30.0-30.0)=230m/s**



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

**Max. H/V at  $0.22 \pm 0.15$  Hz (in the range 0.0 - 64.0 Hz).**

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

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	$0.22 > 0.50$		<b>NO</b>
$n_c(f_0) > 200$	$262.5 > 200$	<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 12 times	<b>OK</b>	

**Criteria for a clear H/V peak**

[At least 5 out of 6 should be fulfilled]

Exists $f^-$ in $[f_0/4, f_0]$   $A_{H/V}(f^-) < A_0 / 2$	0.094 Hz	<b>OK</b>	
Exists $f^+$ in $[f_0, 4f_0]$   $A_{H/V}(f^+) < A_0 / 2$			<b>NO</b>
$A_0 > 2$	$1.64 > 2$		<b>NO</b>
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.66599  < 0.05$		<b>NO</b>
$\sigma_f < \varepsilon(f_0)$	$0.14568 < 0.04375$		<b>NO</b>
$\sigma_A(f_0) < \theta(f_0)$	$0.3056 < 2.5$	<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  $\sigma_A(f_0)$**

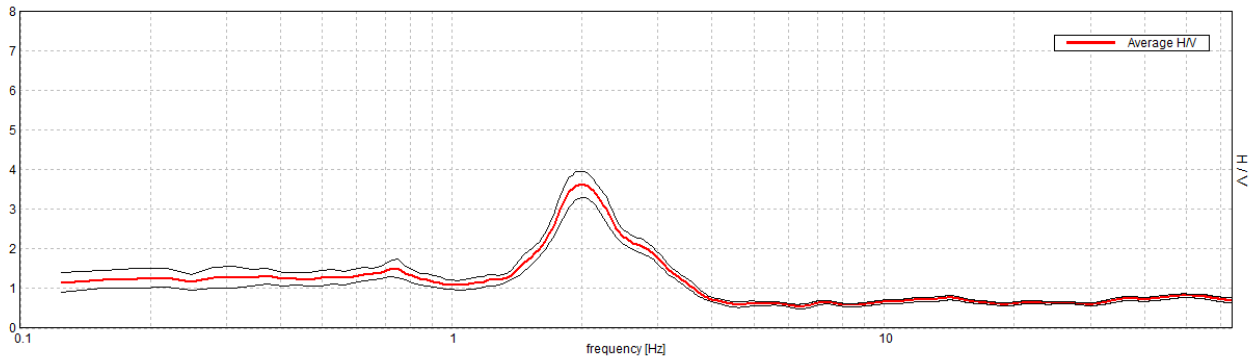
Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	$0.25 f_0$	$0.2 f_0$	$0.15 f_0$	$0.10 f_0$	$0.05 f_0$
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
$\log \theta(f_0)$ for $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

**MS3\_RIMINI, HV 0002**

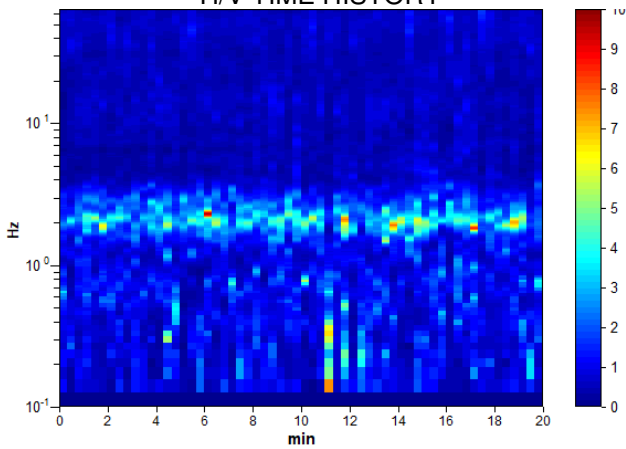
Instrument: TRZ-0144/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 23/11/20 13:13:45      End recording: 23/11/20 13:33:44  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h20'00".      Analysis performed on the entire trace.  
 Sampling rate: 128 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

**HORIZONTAL TO VERTICAL SPECTRAL RATIO**

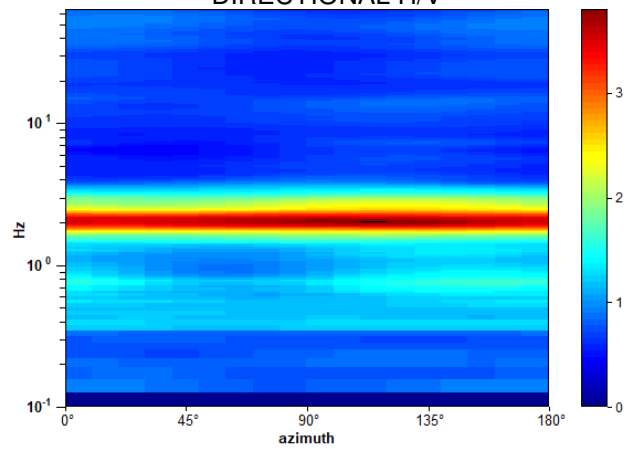
Max. H/V at 2.0 ± 0.19 Hz (in the range 0.0 - 64.0 Hz).



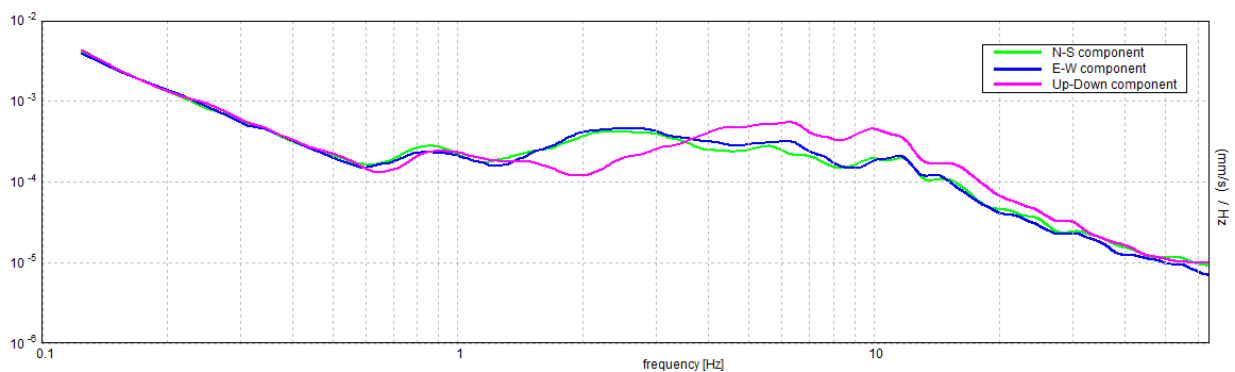
**H/V TIME HISTORY**



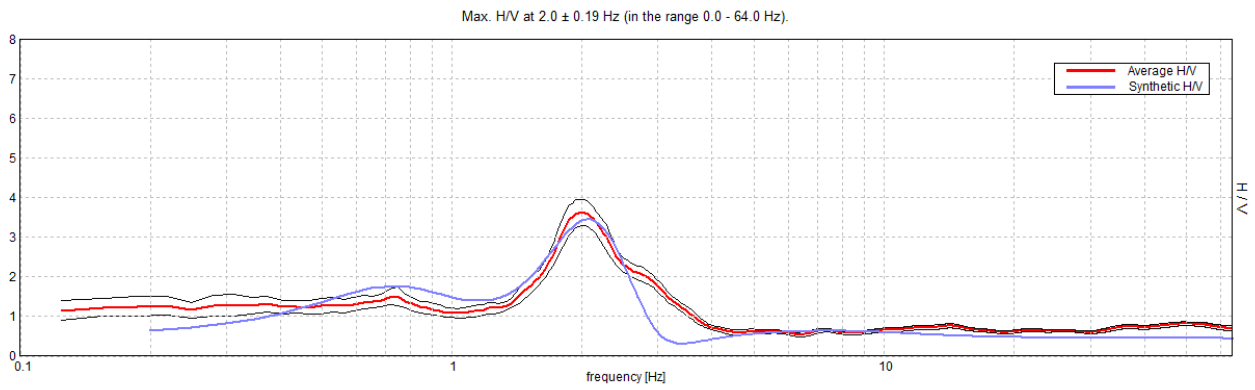
**DIRECTIONAL H/V**



**SINGLE COMPONENT SPECTRA**

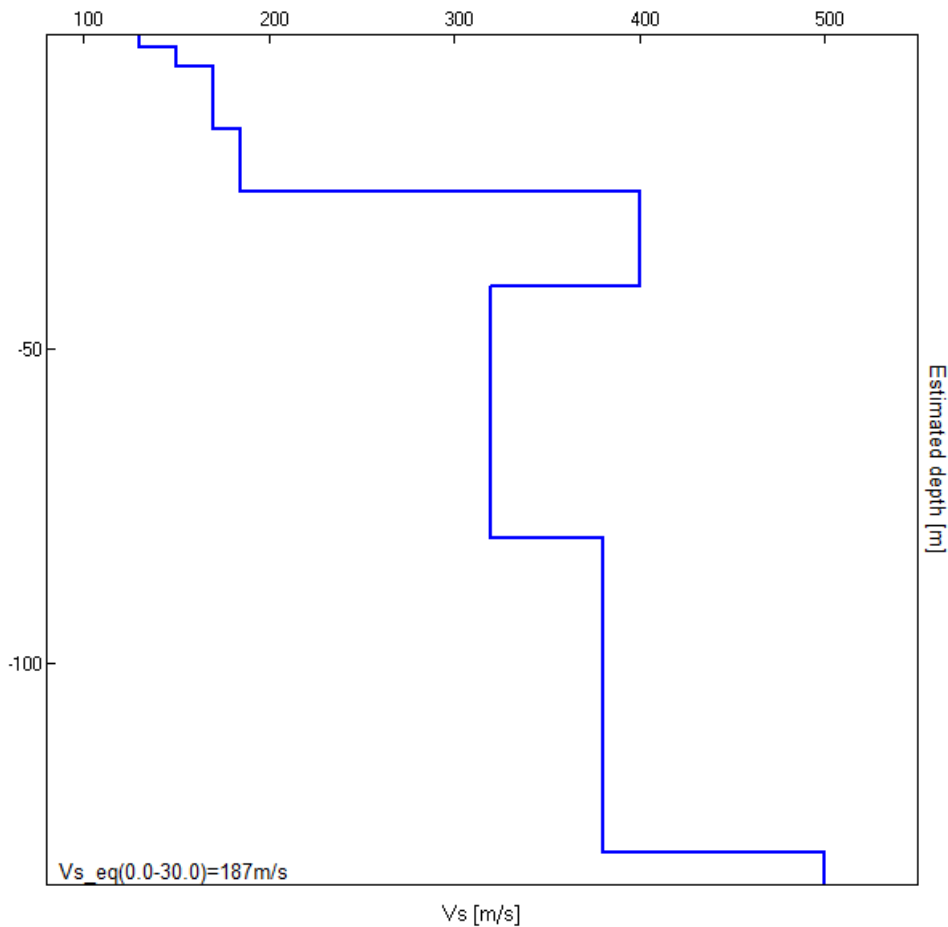


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
2.00	2.00	130	0.45
5.00	3.00	150	0.49
15.00	10.00	170	0.49
25.00	10.00	185	0.49
40.00	15.00	400	0.49
80.00	40.00	320	0.45
130.00	50.00	380	0.42
inf.	inf.	500	0.42

**Vs\_eq(0.0-30.0)=187m/s**





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

**Max. H/V at 2.0 ± 0.19 Hz (in the range 0.0 - 64.0 Hz).**

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

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	2.00 > 0.50	OK	
$n_c(f_0) > 200$	2400.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 97 times	OK	

**Criteria for a clear H/V peak**

[At least 5 out of 6 should be fulfilled]

Exists $f^-$ in $[f_0/4, f_0]$   $A_{H/V}(f^-) < A_0 / 2$	1.531 Hz	OK	
Exists $f^+$ in $[f_0, 4f_0]$   $A_{H/V}(f^+) < A_0 / 2$	2.969 Hz	OK	
$A_0 > 2$	3.62 > 2	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.09392  < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	0.18785 < 0.1		NO
$\sigma_A(f_0) < \theta(f_0)$	0.3355 < 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
$\sigma_f$	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  $\sigma_A(f_0)$

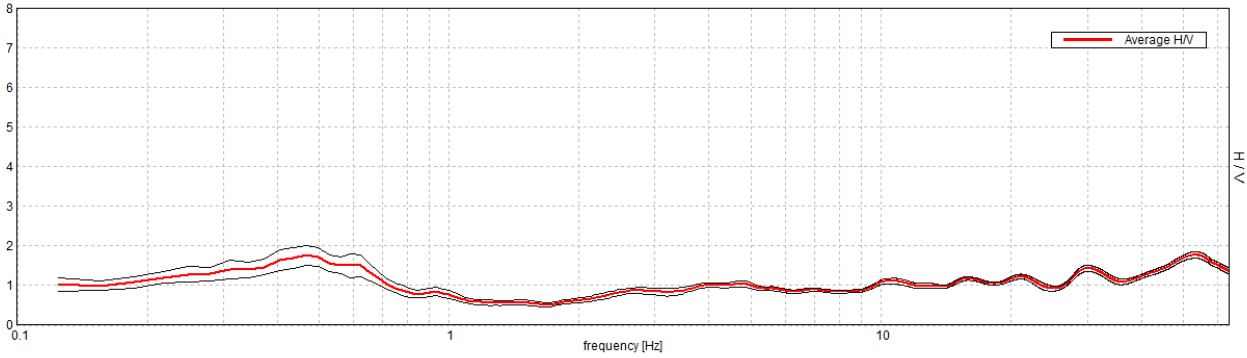
Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	0.25 $f_0$	0.2 $f_0$	0.15 $f_0$	0.10 $f_0$	0.05 $f_0$
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
$\log \theta(f_0)$ for $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

**MS3\_RIMINI, HV 0003**

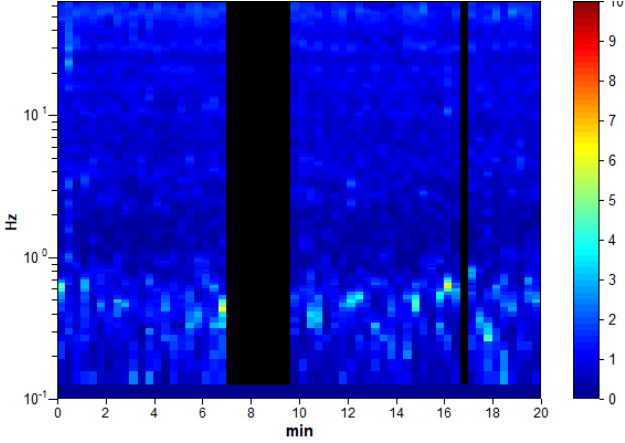
Instrument: TRZ-0144/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 23/11/20 13:49:52      End recording: 23/11/20 14:09:51  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h20'00".      Analyzed 85% trace (manual window selection)  
 Sampling rate: 128 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

**HORIZONTAL TO VERTICAL SPECTRAL RATIO**

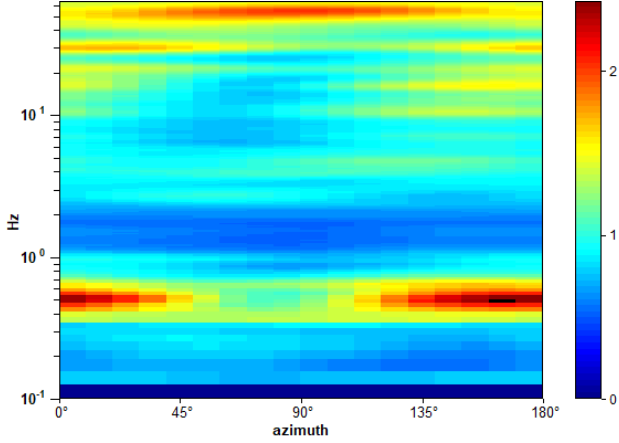
Max. H/V at 53.41 ± 29.64 Hz (in the range 0.0 - 64.0 Hz).



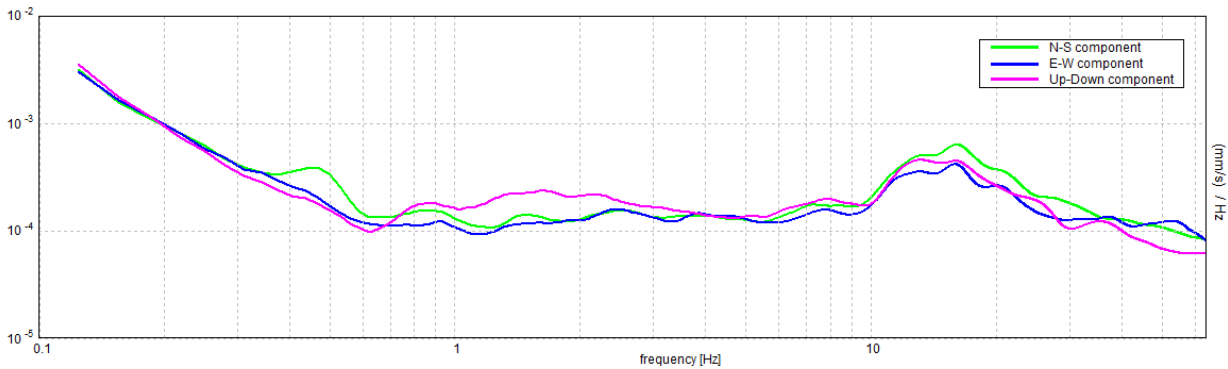
**H/V TIME HISTORY**



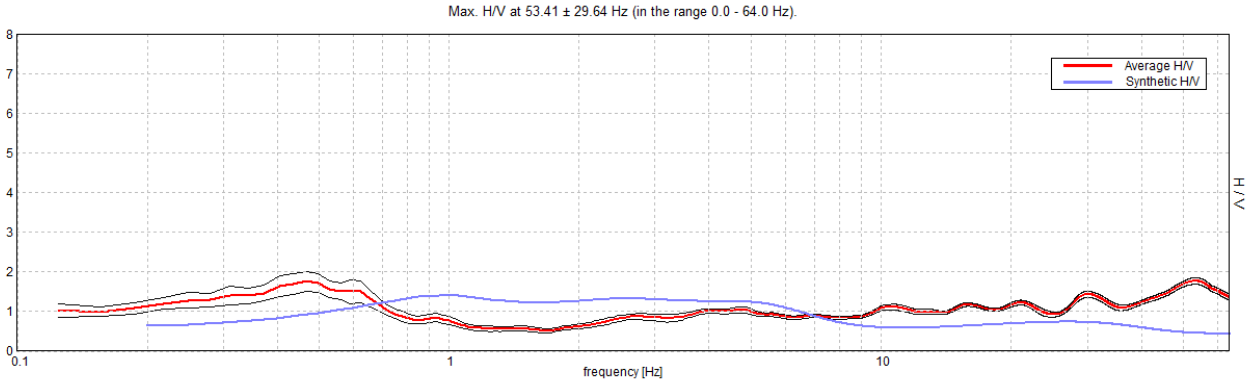
**DIRECTIONAL H/V**



**SINGLE COMPONENT SPECTRA**

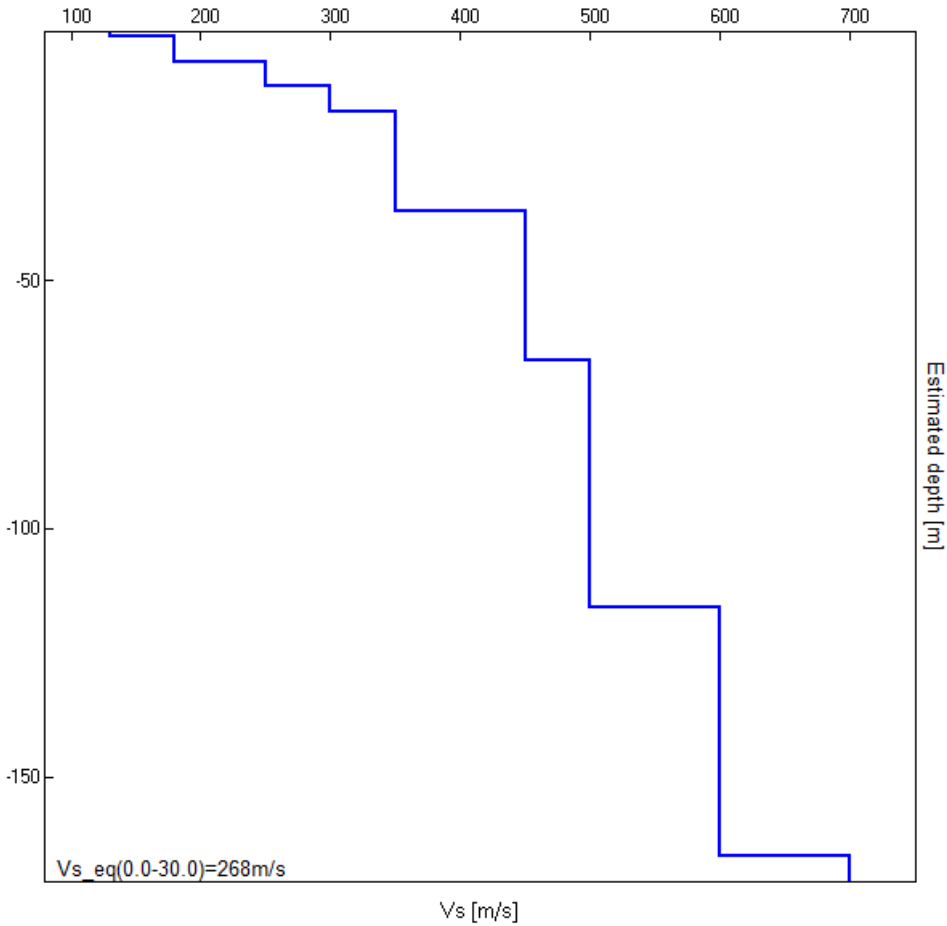


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
1.00	1.00	130	0.40
6.00	5.00	180	0.40
11.00	5.00	250	0.40
16.00	5.00	300	0.40
36.00	20.00	350	0.40
66.00	30.00	450	0.35
116.00	50.00	500	0.30
166.00	50.00	600	0.30
inf.	inf.	700	0.30

**Vs\_eq(0.0-30.0)=268m/s**



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

**Max. H/V at 53.41 ± 29.64 Hz (in the range 0.0 - 64.0 Hz).**

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

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	53.41 > 0.50	OK	
$n_c(f_0) > 200$	54474.4 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 1194 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
$A_0 > 2$	1.77 > 2		NO
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.55492  < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	29.63606 < 2.67031		NO
$\sigma_A(f_0) < \theta(f_0)$	0.0827 < 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
$\sigma_f$	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 $\sigma_A(f) < \theta(f_0)$

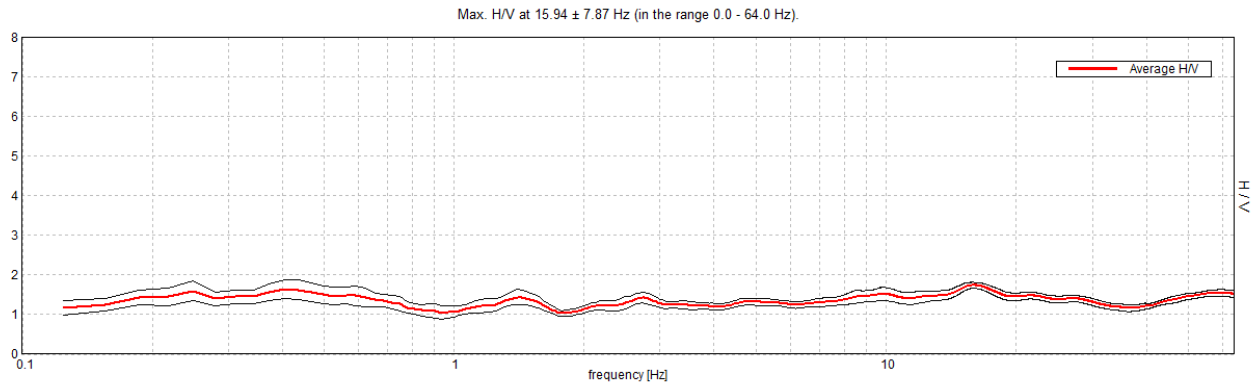
Threshold values for  $\sigma_f$  and  $\sigma_A(f_0)$

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

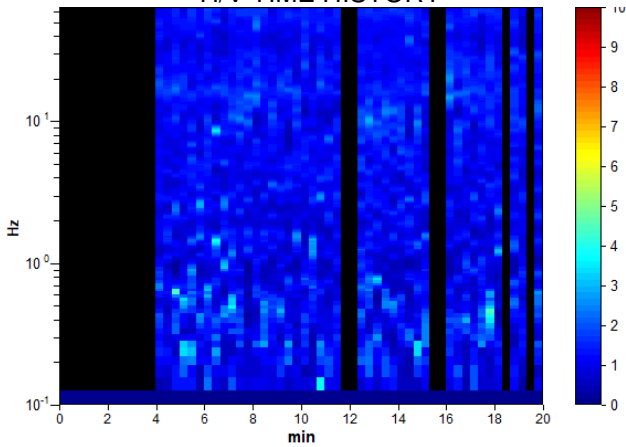
**MS3\_RIMINI, HV 0004**

Instrument: TRZ-0144/01-11  
 Data format: 16 byte  
 Full scale [mV]: n.a.  
 Start recording: 23/11/20 14:27:23      End recording: 23/11/20 14:47:22  
 Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN  
 GPS data not available  
 Trace length: 0h20'00".      Analyzed 70% trace (manual window selection)  
 Sampling rate: 128 Hz  
 Window size: 20 s  
 Smoothing type: Triangular window  
 Smoothing: 10%

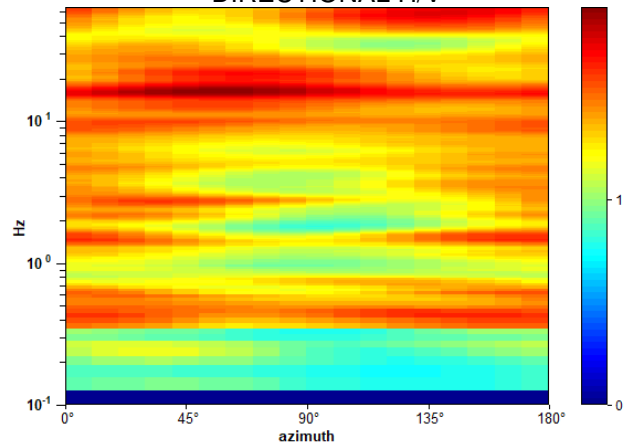
**HORIZONTAL TO VERTICAL SPECTRAL RATIO**



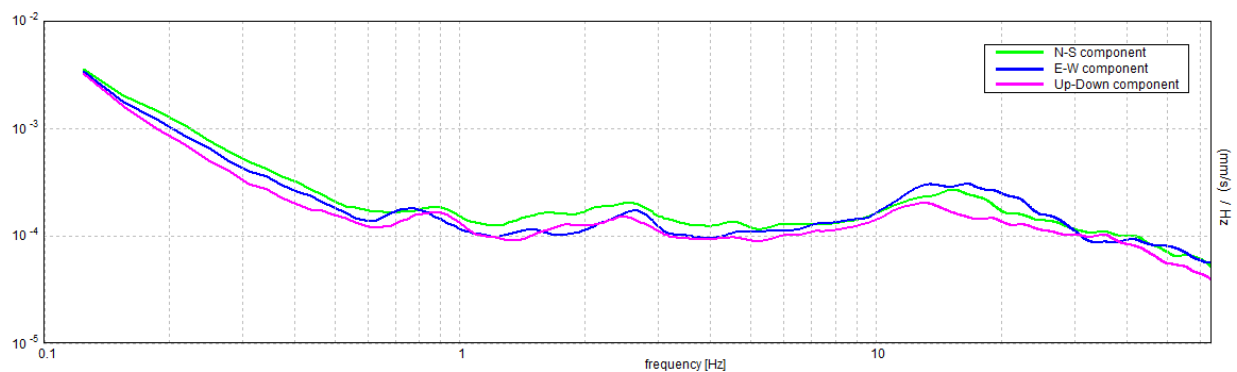
**H/V TIME HISTORY**



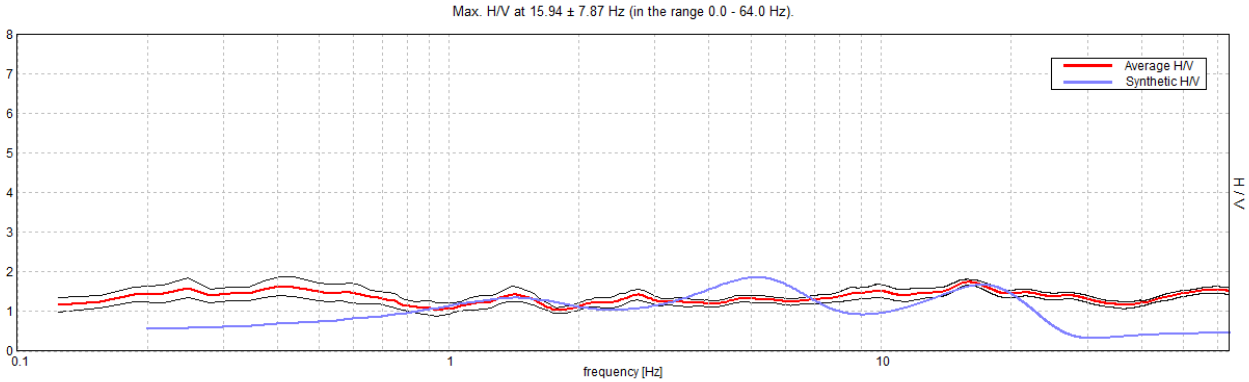
**DIRECTIONAL H/V**



**SINGLE COMPONENT SPECTRA**

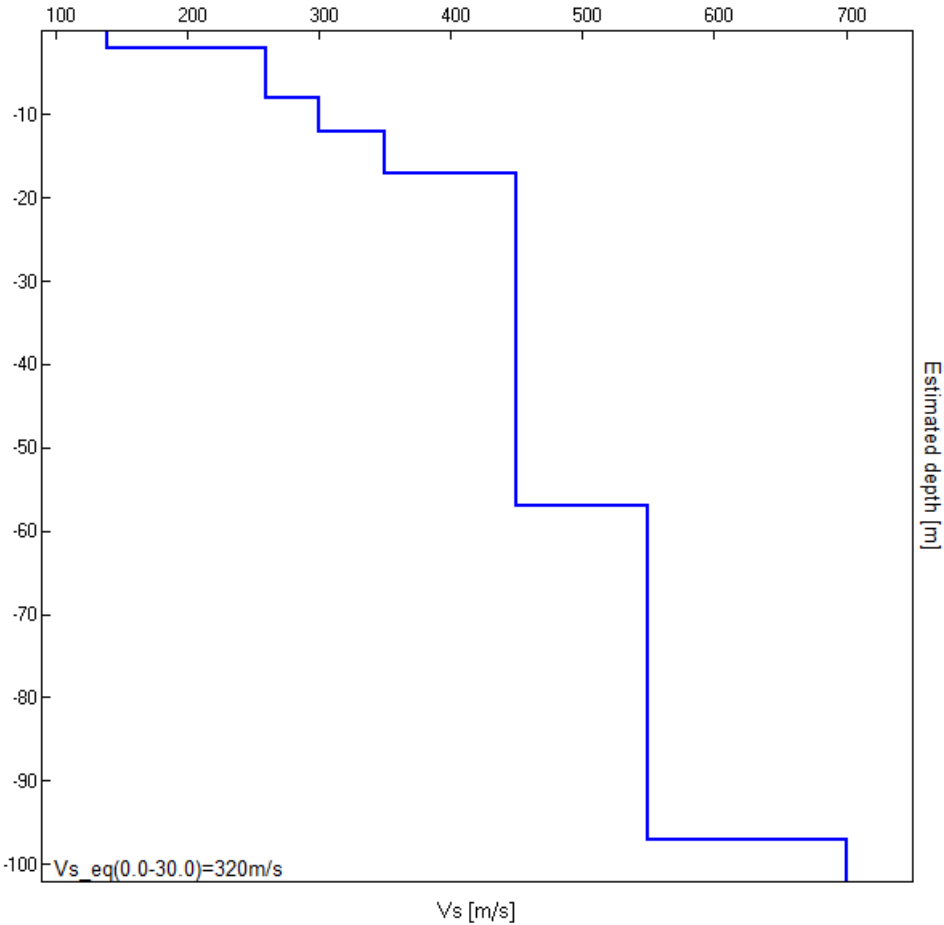


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
2.00	2.00	140	0.45
8.00	6.00	260	0.45
12.00	4.00	300	0.40
17.00	5.00	350	0.40
57.00	40.00	450	0.35
97.00	40.00	550	0.30
inf.	inf.	700	0.30

**Vs\_eq(0.0-30.0)=320m/s**



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

**Max. H/V at 15.94 ± 7.87 Hz (in the range 0.0 - 64.0 Hz).**

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

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	15.94 > 0.50	OK	
$n_c(f_0) > 200$	13387.5 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 766 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
$A_0 > 2$	1.74 > 2		NO
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.49379  < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	7.86975 < 0.79688		NO
$\sigma_A(f_0) < \theta(f_0)$	0.0758 < 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
$\sigma_f$	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