



UNIVERSITÀ
DEGLI STUDI
DI PADOVA



Ordine dei Geologi
Geologenkammer
TRENTINO - ALTO ADIGE
TRENTINO - SÜDTIROL



Ordine dei Geologi
Friuli Venezia Giulia

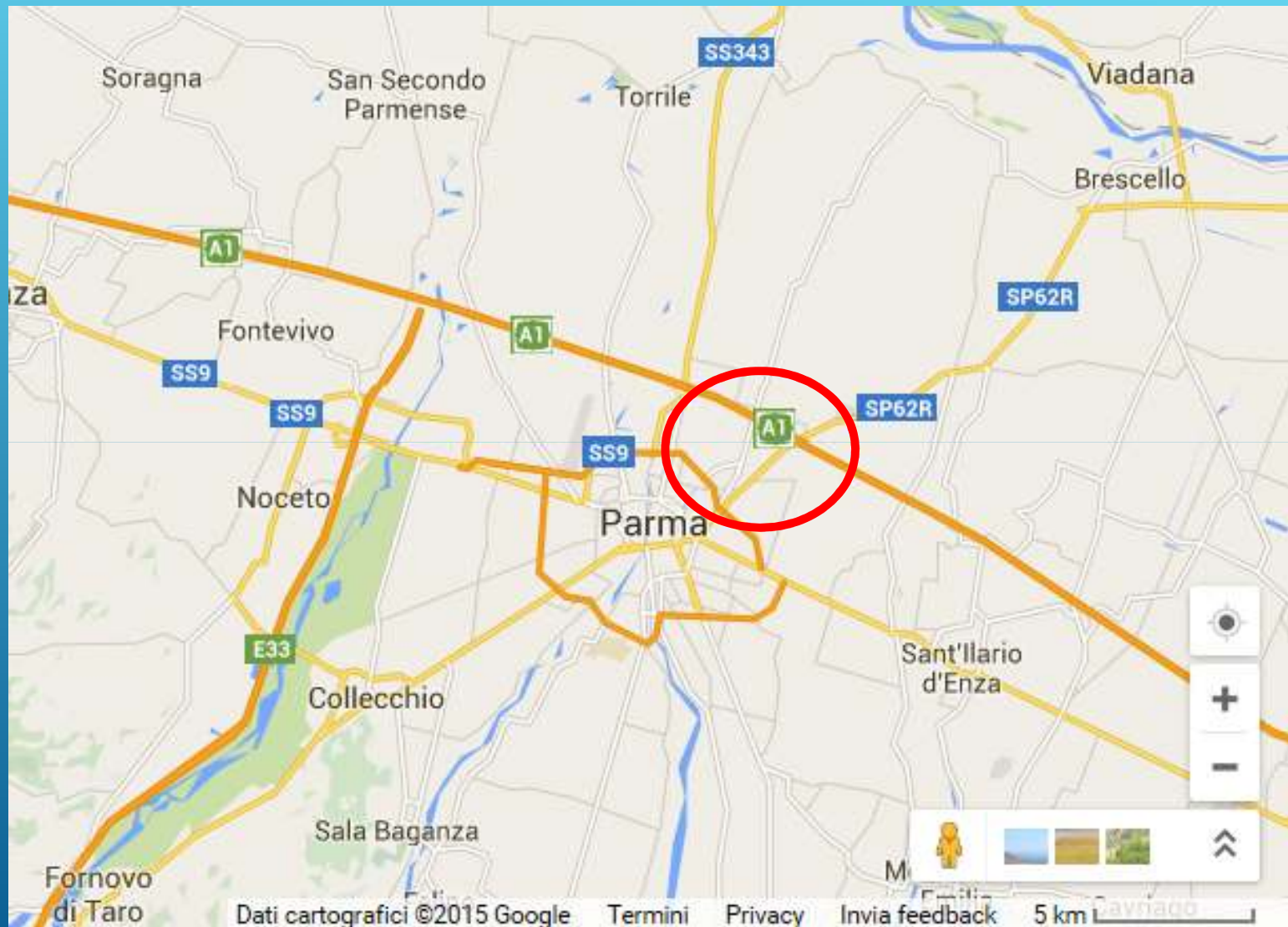


MODELLO GEOTECNICO E SISMICO DI UN SITO NEL COMUNE DI PARMA PER LA VALUTAZIONE DELLA RISPOSTA SISMICA

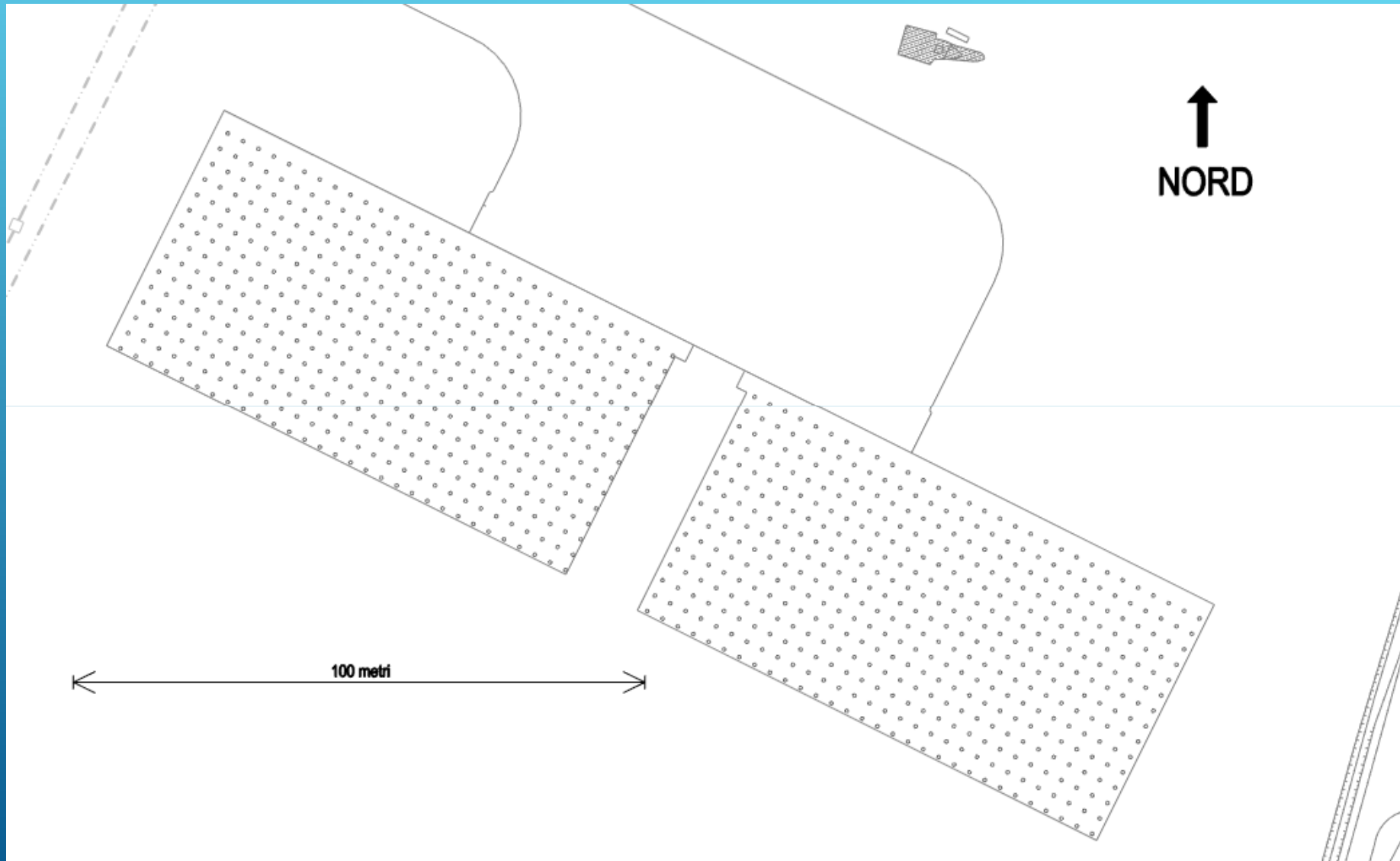
Relatore: ANDREA MASTRANGELO (Geologo, libero professionista, consulente Enser Srl – Società di Ingegneria)

venerdì 4 dicembre 2015

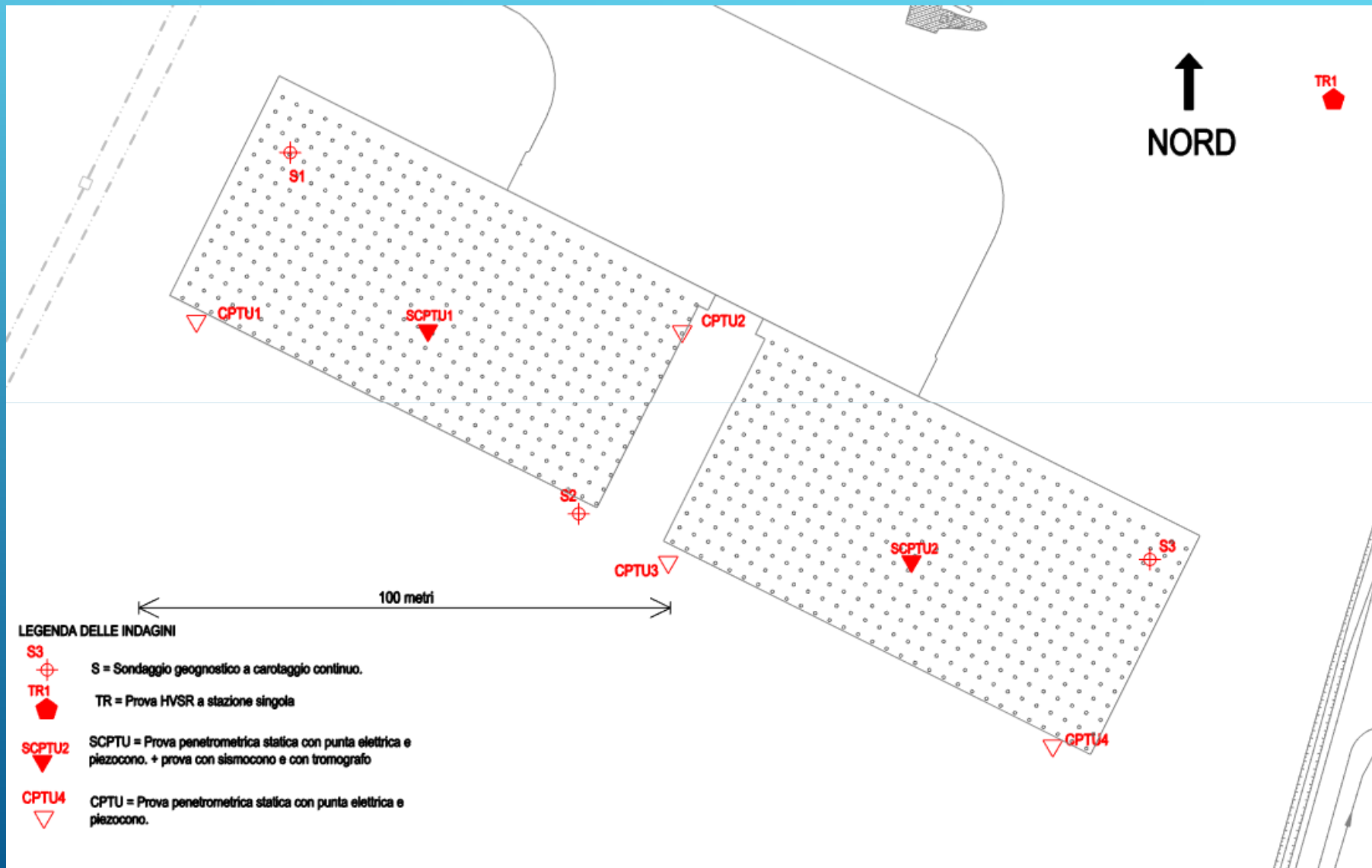
Ubicazione area di intervento



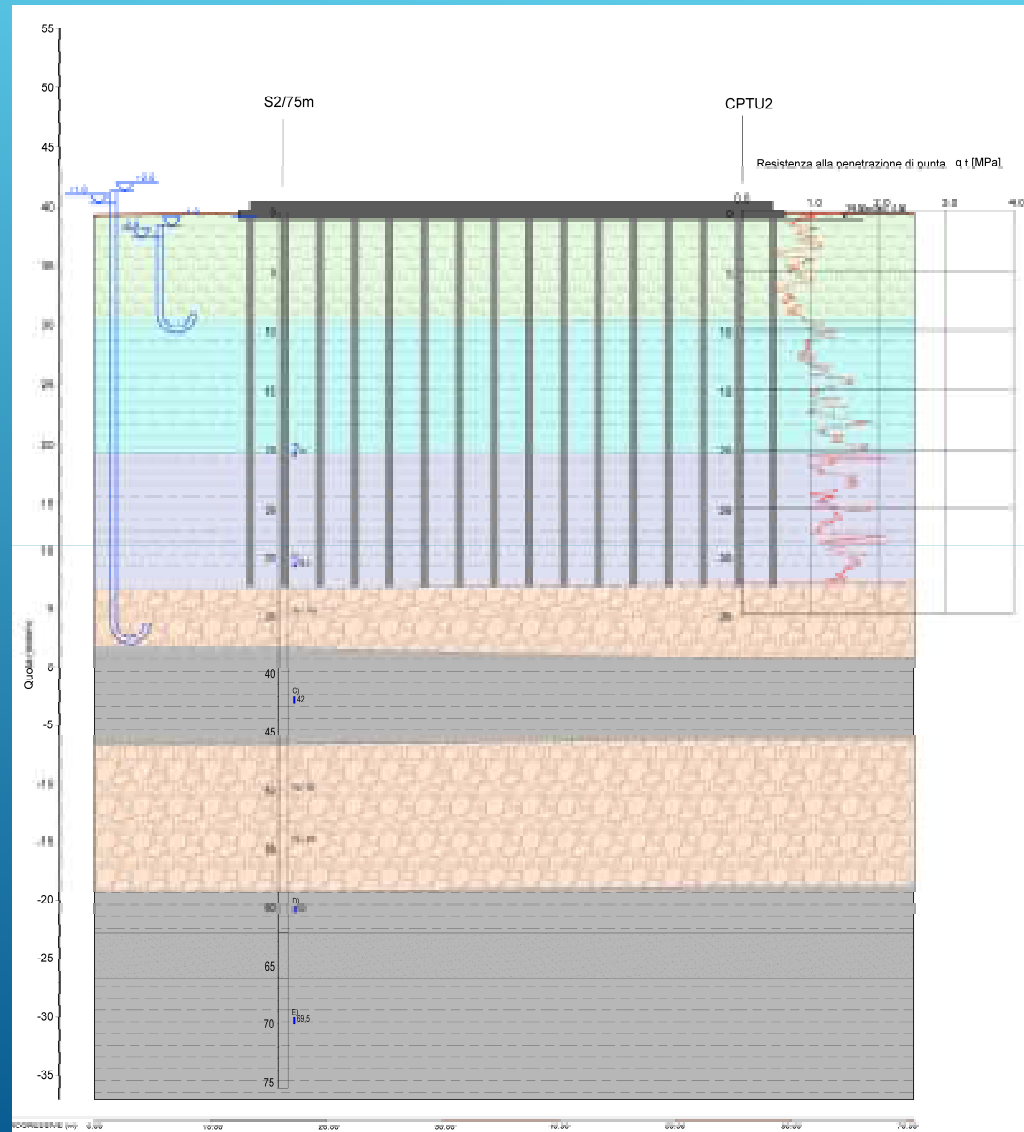
Oggetto dell'intervento



Indagini per il progetto



Stratigrafia – tipo



Terreni limo-argillosi da NC
a leggermente OC



Ghiaie e sabbie

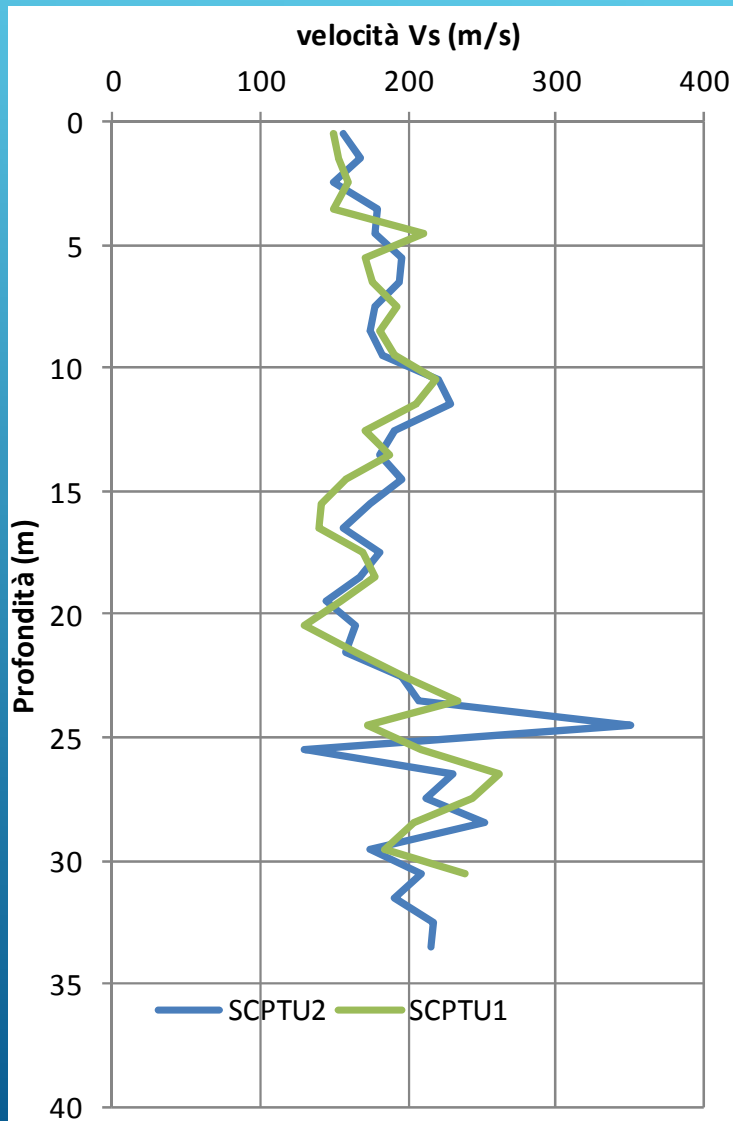


Argille e limi OC



Sabbie e limi

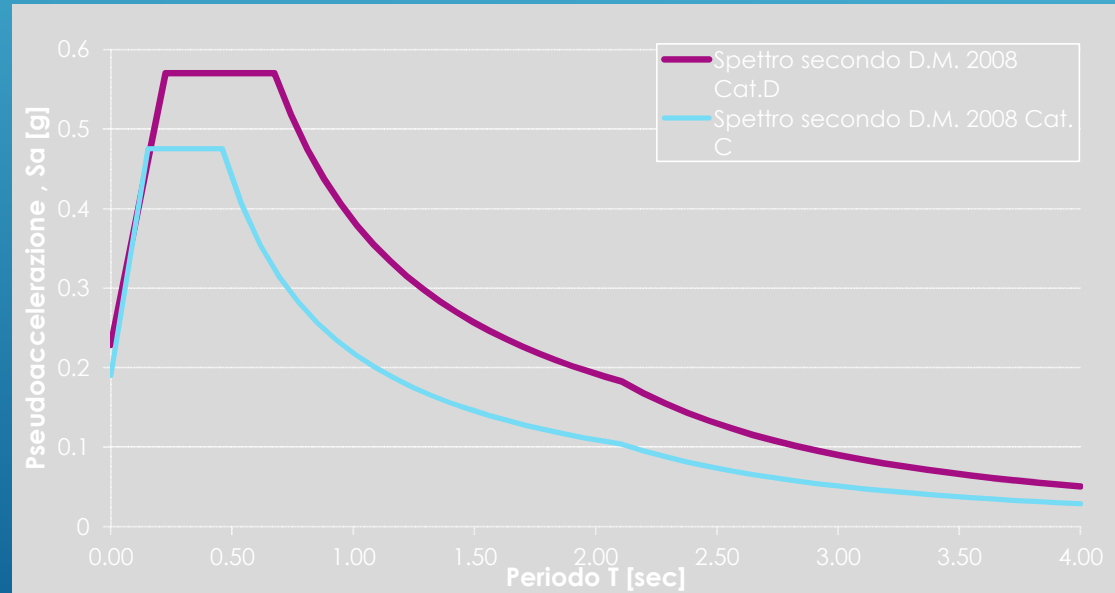
Caratterizzazione sismica



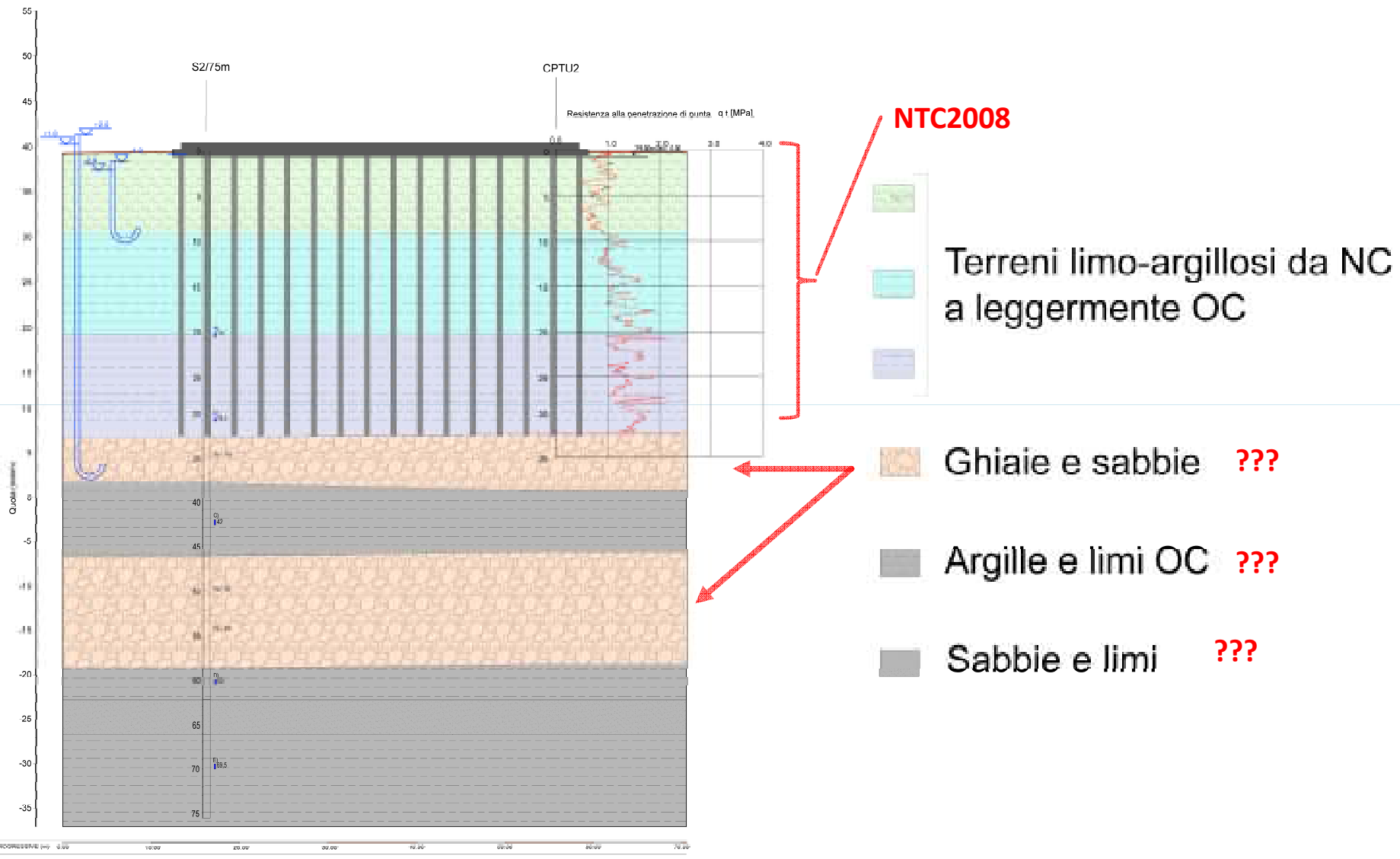
Approccio
semplificato NTC2008

| SCPTU | V_{s30} - m/s |
|-------|-----------------|
| 1 | 172 |
| 2 | 180 |

Categoria C o D!?



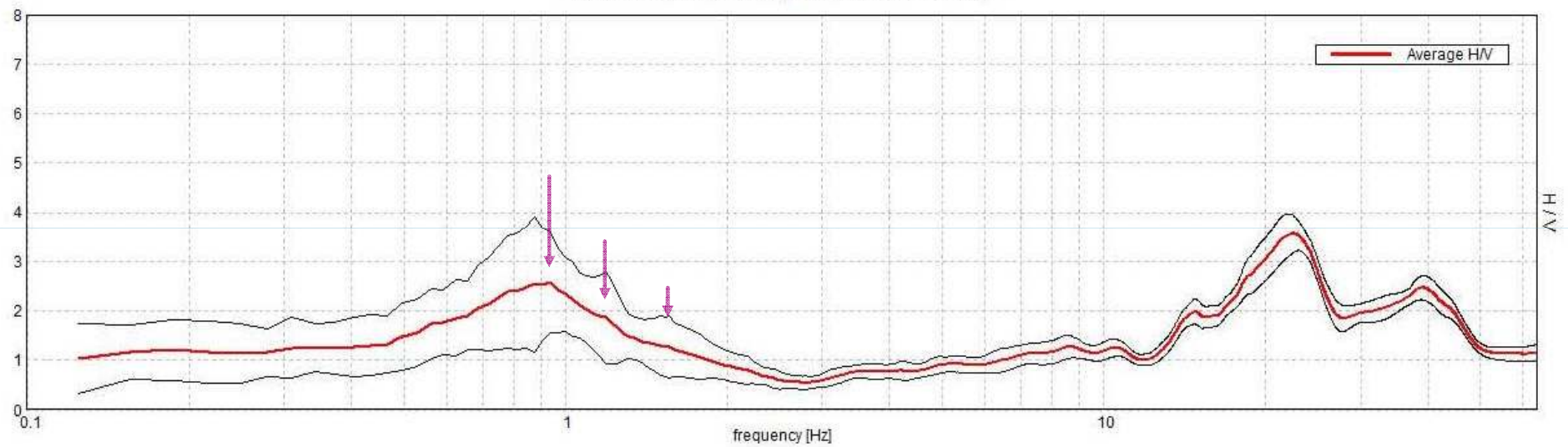
Effetto del sisma sotto i 30m



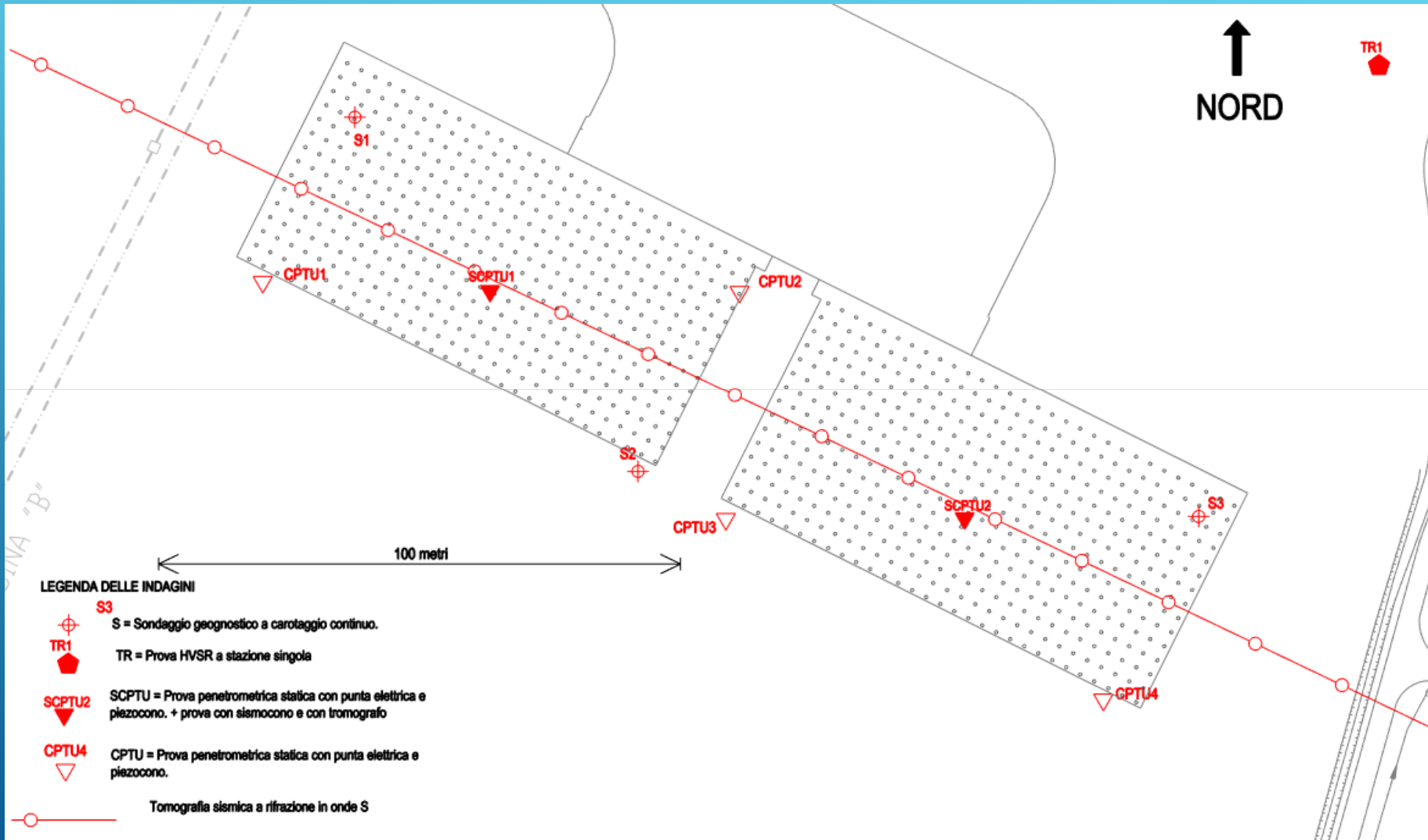
Risultati dello spettro H/V

RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

Picco H/V a 0.94 ± 0.03 Hz (nell'intervallo 0.0 - 15.0 Hz).



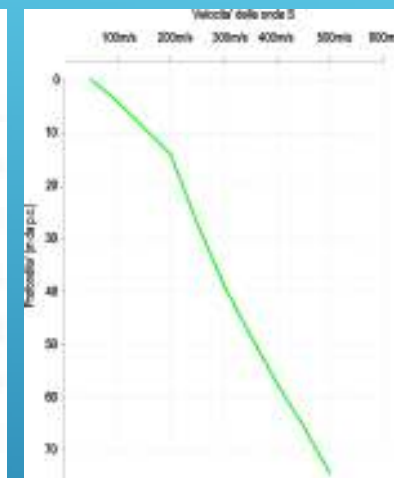
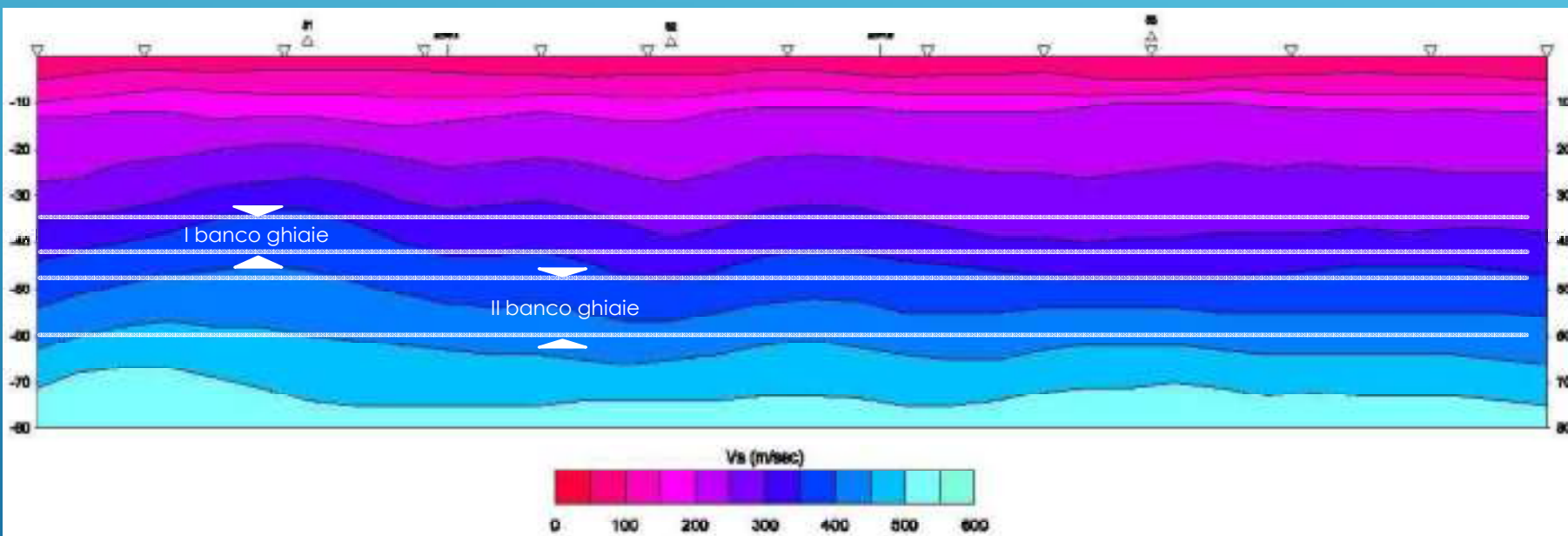
Indagini aggiuntive: tomografia sismica a rifrazione



Indagini aggiuntive: tomografia sismica a rifrazione

Sezione tomografica

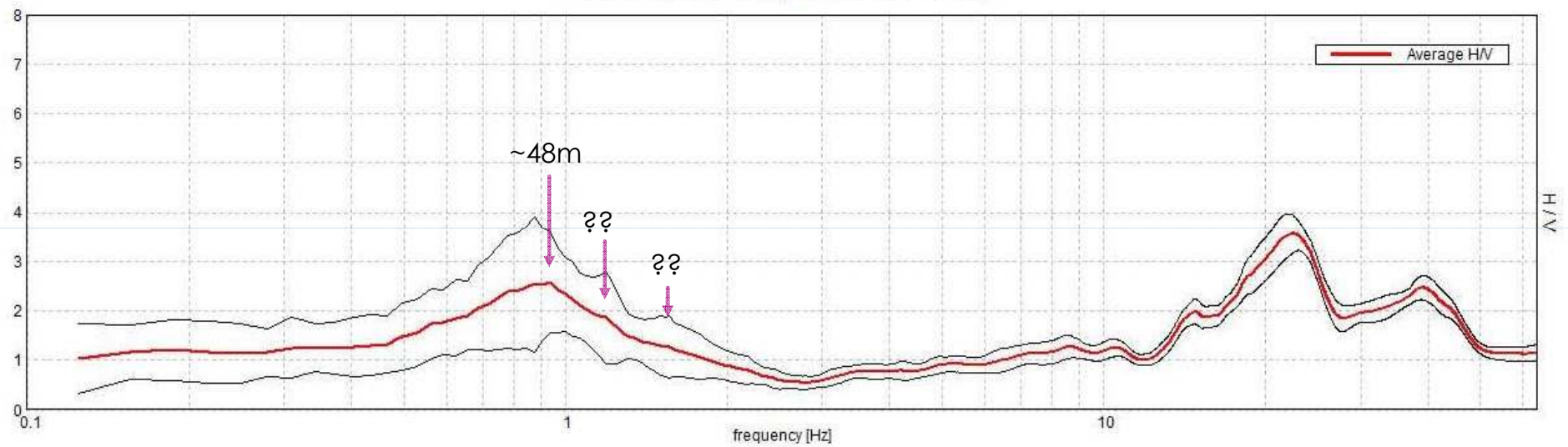
Profilo Vs – tipo



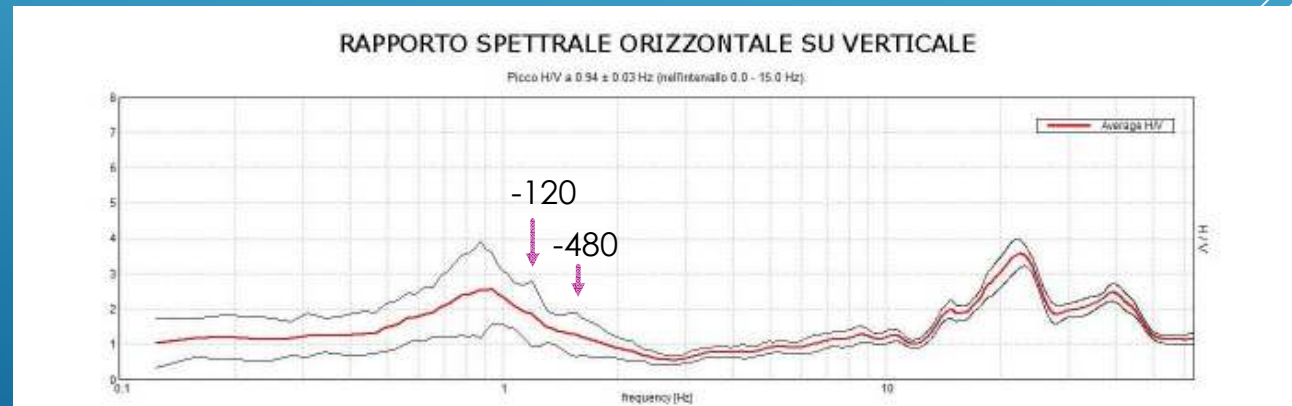
Risultati dello spettro H/V

RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

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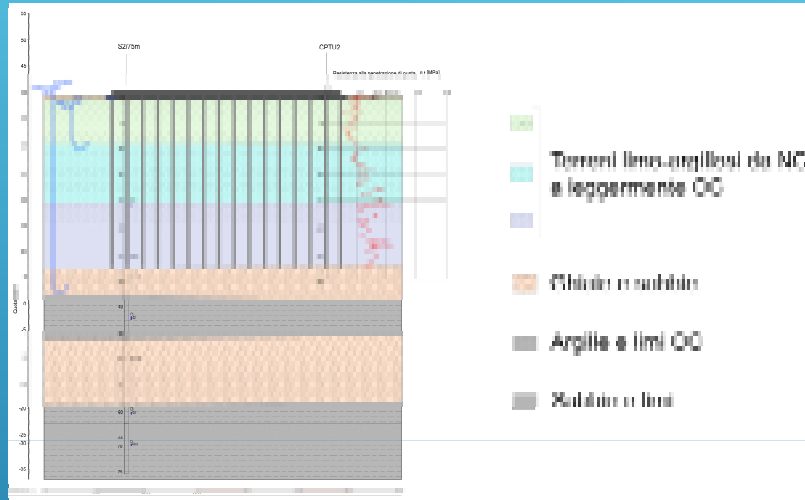


Stratigrafia profonda e bedrock sismico



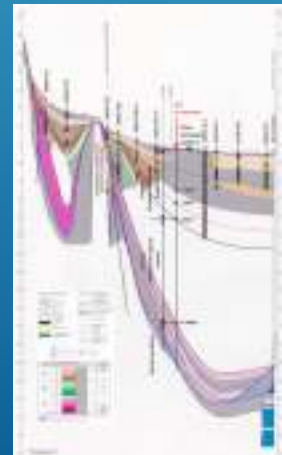
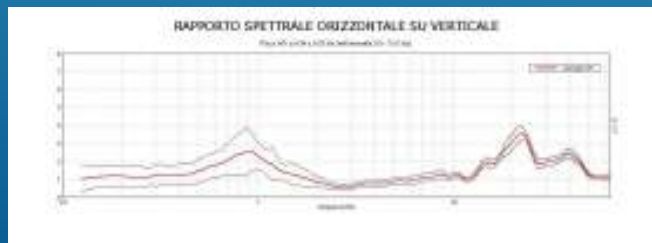
Modello Vs del sito

Dati superficiali

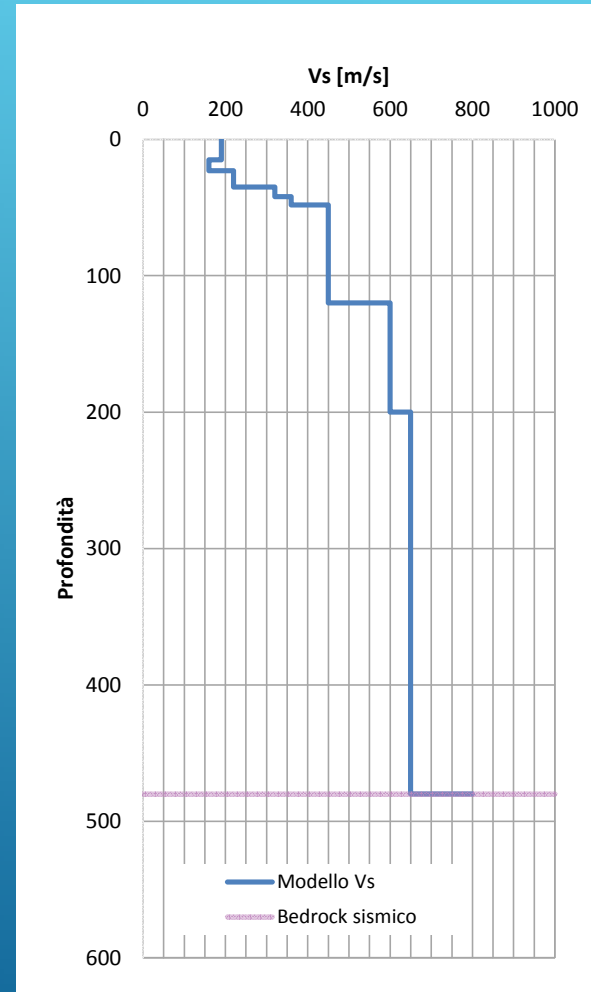


+

Dati profondi



=



Pesi di volume, Ridigezza e viscosità degli strati

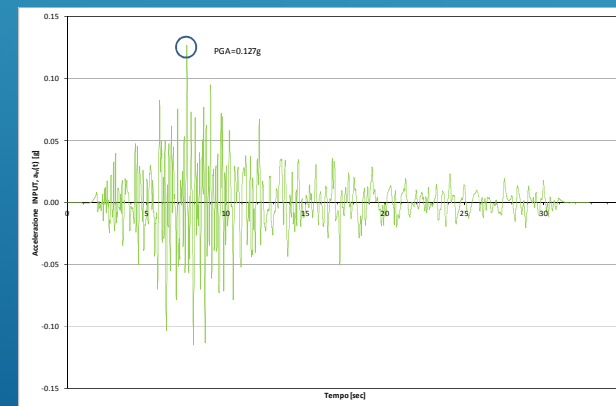
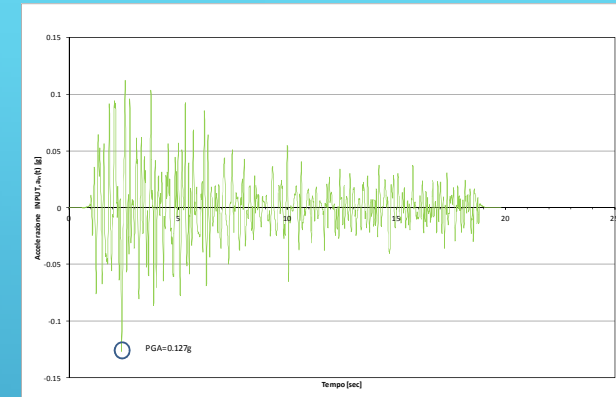
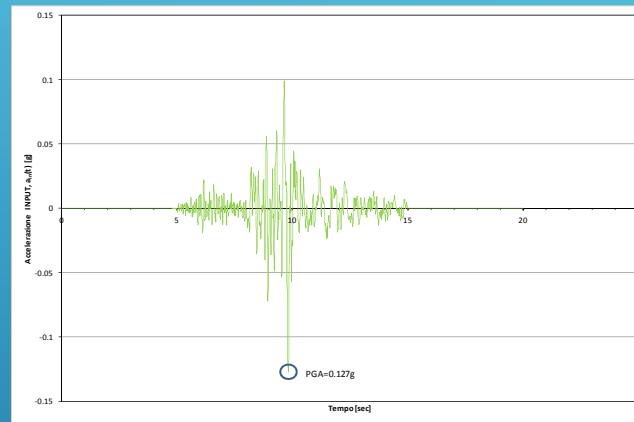
| Profondità base dello strato [m da p.c.] | Spessore strato [m] | Litologia | Peso in volume del terreno [kN/m ³] |
|--|---------------------|----------------------|---|
| 4.0 | 4.0 | Argille superficiali | 18.0 |
| 10.0 | 6.0 | Argille superficiali | 18.0 |
| 12.0 | 2.0 | Argille superficiali | 18.0 |
| 19.0 | 7.0 | Argille superficiali | 18.0 |
| 22.0 | 3 | Argille superficiali | 18.0 |
| 34.0 | 12.0 | Argille superficiali | 18.0 |
| 38.0 | 4.0 | Ghiaie e sabbie | 20.0 |
| 45.0 | 7.0 | Argille profonde | 19.0 |
| 58.0 | 13.0 | Ghiaie e sabbie | 20.0 |
| 120.0 | 62.0 | Argille profonde | 19.5 |
| 200.0 | 80.0 | Argille profonde | 19.5 |
| 480.0 | 280.0 | Argille profonde | 20.0 |
| Bedrock sismico | | | 21.0 |

| Profondità base dello strato [m da p.c.] | Spessore strato [m] | Litologia | $\gamma - G/G_0$ | $\gamma - D/D_0$ |
|--|---------------------|----------------------|------------------------|----------------------|
| 4.0 | 4.0 | Argille superficiali | Vucetic & Dobry (1991) | |
| 10.0 | 6.0 | Argille superficiali | | |
| 12.0 | 2.0 | Argille superficiali | | |
| 19.0 | 7.0 | Argille superficiali | | |
| 22.0 | 3 | Argille superficiali | | |
| 34.0 | 12.0 | Argille superficiali | | |
| 38.0 | 4.0 | Ghiaie e sabbie | Rollins (1986) | Rollins et al (1998) |
| 45.0 | 7.0 | Argille profonde | Vucetic & Dobry (1991) | |
| 58.0 | 13.0 | Ghiaie e sabbie | Rollins (1986) | Rollins et al (1998) |
| 120.0 | 62.0 | Argille profonde | Vucetic & Dobry (1991) | |
| 200.0 | 80.0 | Argille profonde | | |
| 480.0 | 280.0 | Argille profonde | | |
| Bedrock smorzamento pari al 2% | | | | |

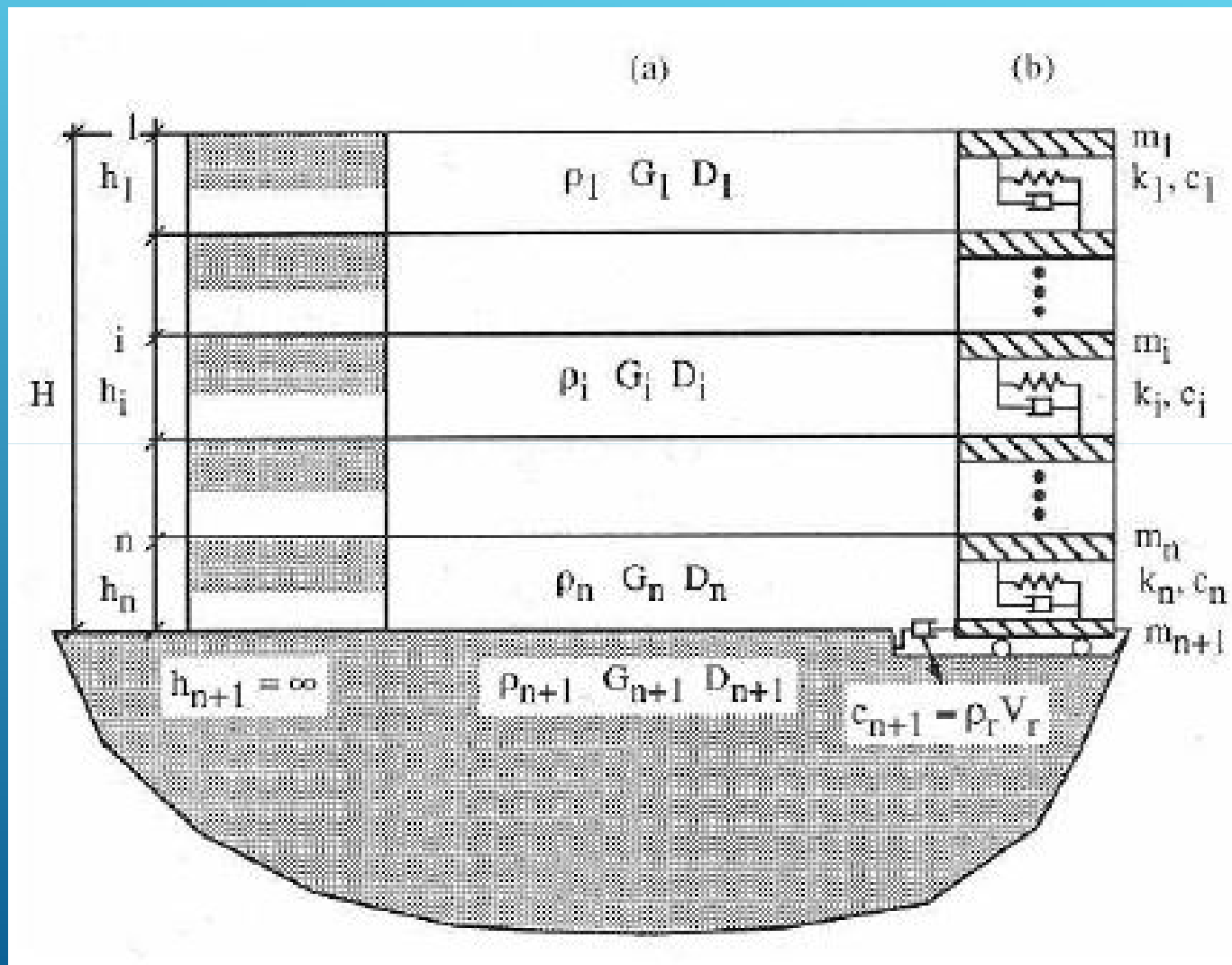
Azione sismica di base (NTC 2008)

- $V_N = 50$ anni
- Classe II $\rightarrow C_u = 1.0$.

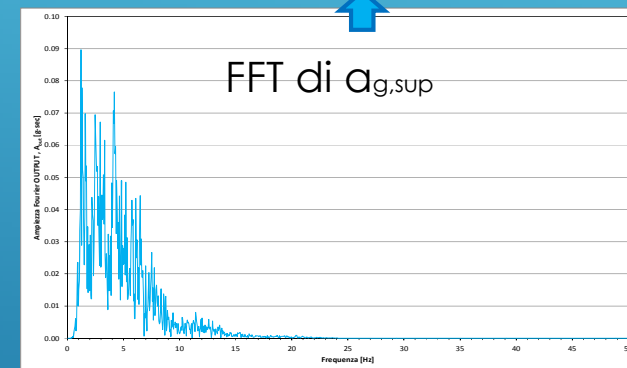
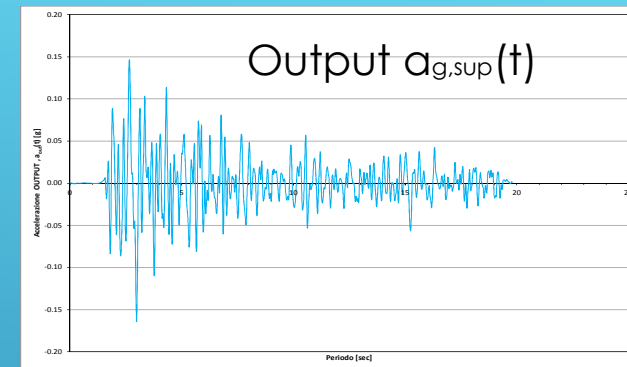
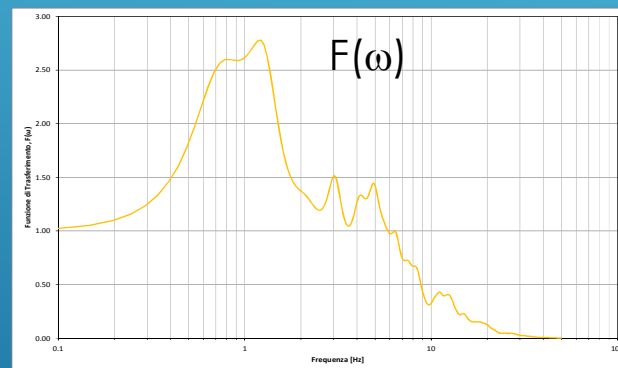
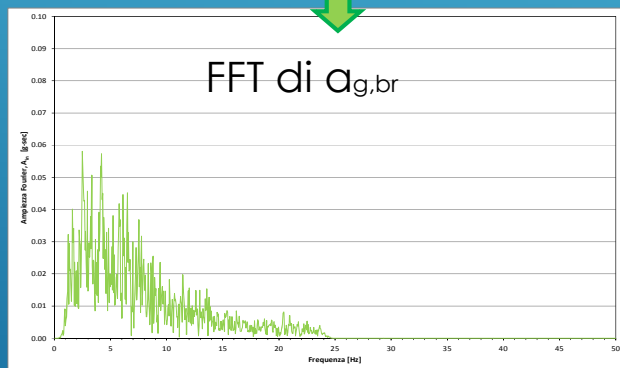
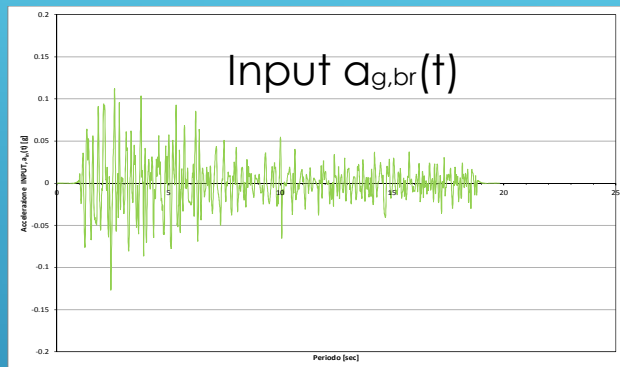
| Stato Limite | T_R [anni] | a_g [g] |
|--------------|--------------|--------------|
| SLO | 30 | 0.043 |
| SLD | 50 | 0.053 |
| SLV | 475 | 0.127 |
| SLC | 975 | 0.164 |



Analisi RSL monodimensionale di tipo lineare equivalente



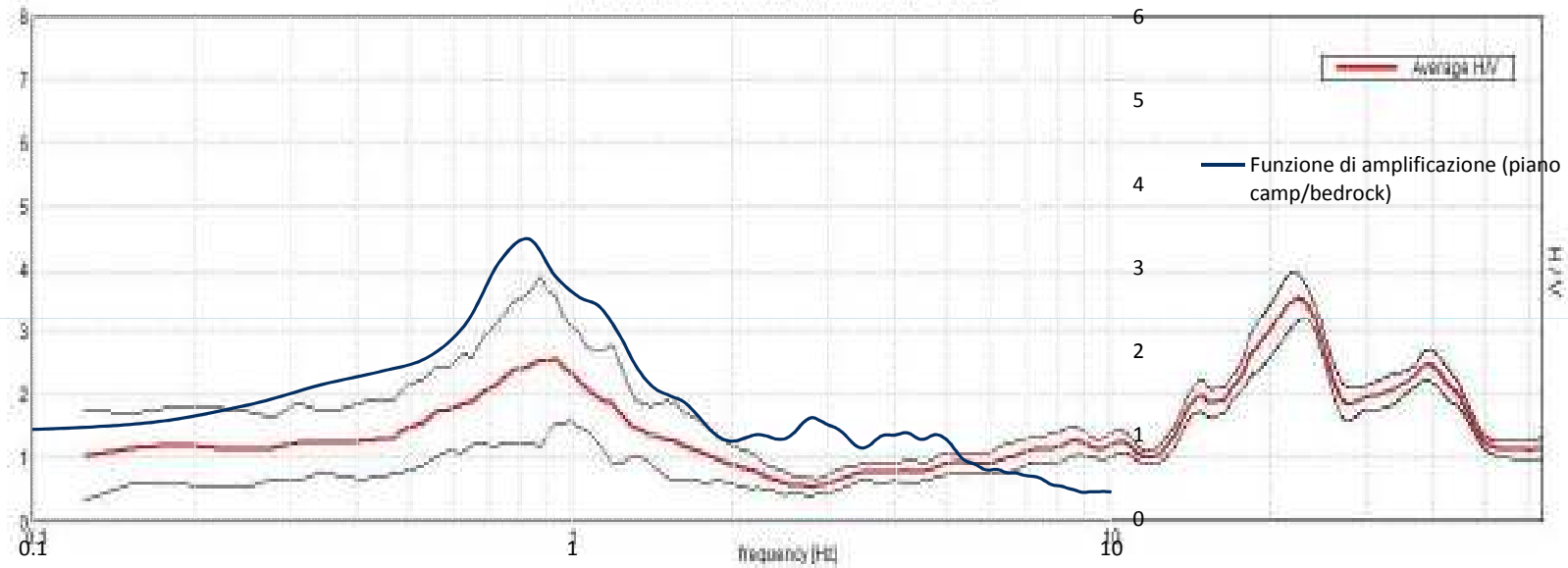
Iterazione tipica in un'analisi di RSL lineare - equivalente



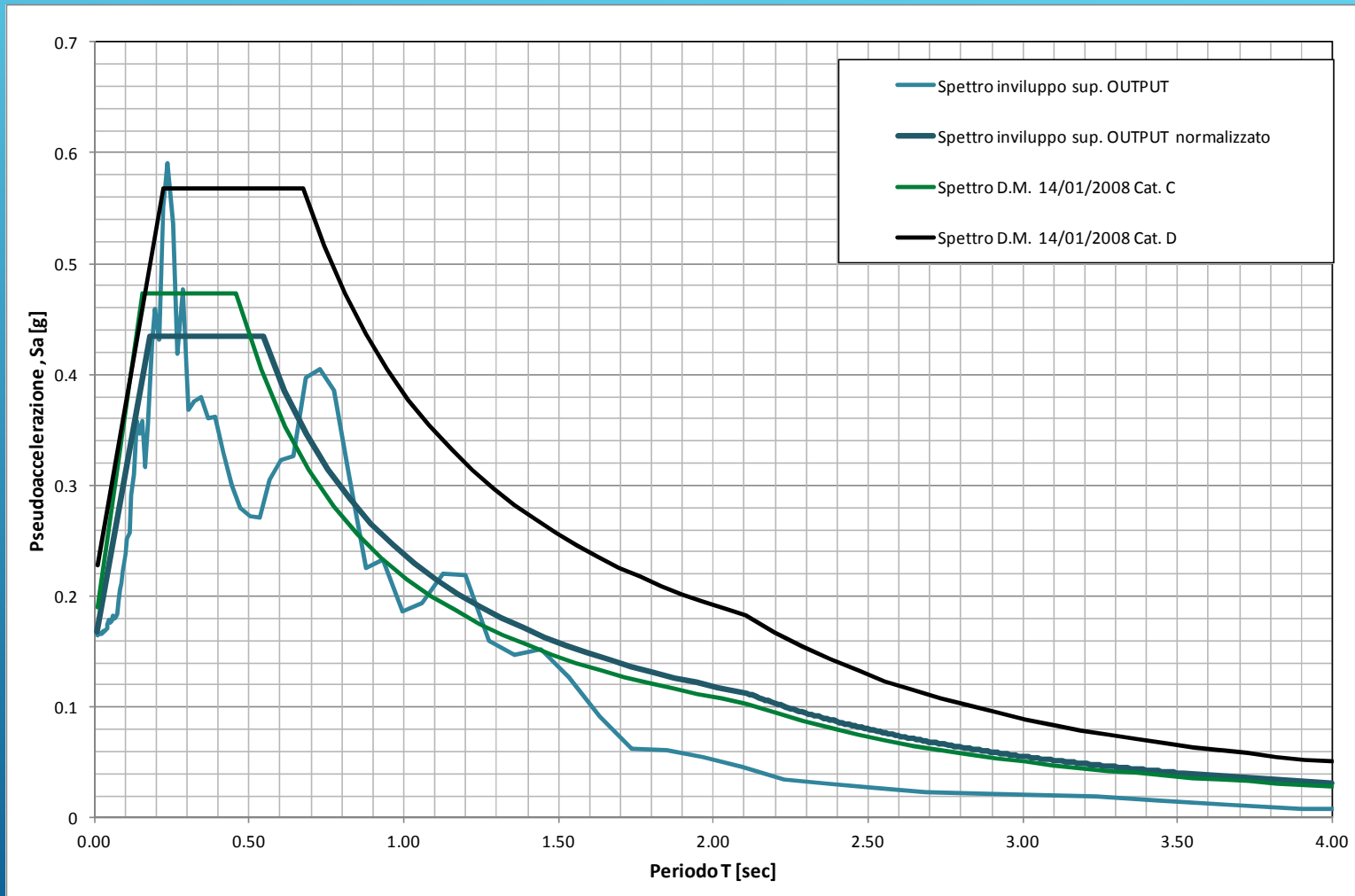
Confronto fra Funzione di Trasferimento e Spettro H/V

RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

Picco H/V a 0.94 ± 0.03 Hz (intervallo 0.0 - 15.0 Hz)



Risultato dell'analisi di RSL

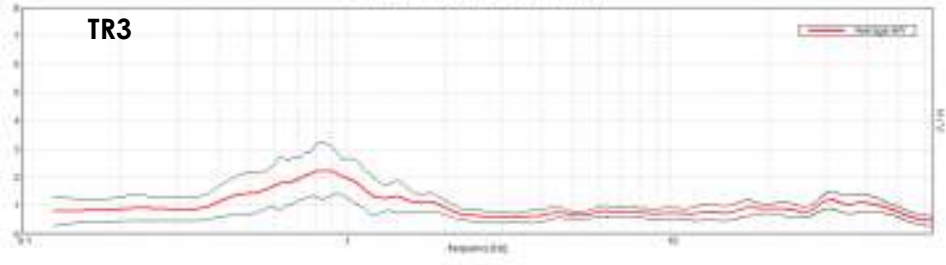


Risposta omogenea del sito

RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

Pico HV a 0.81 ± 0.04 Hz (nell'intervallo 0.3 - 64.0 Hz)

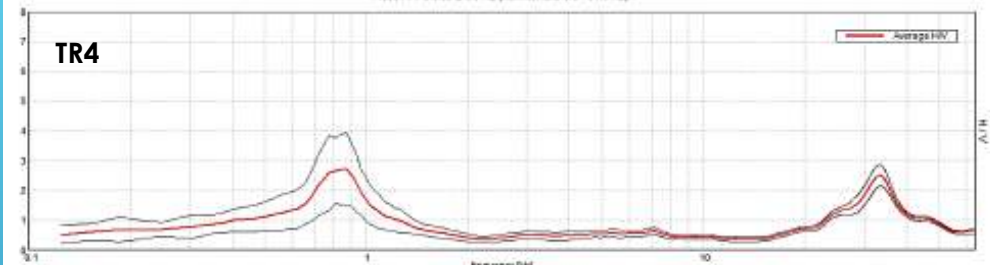
TR3



RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

Pico HV a 0.88 ± 0.0 Hz (nell'intervallo 0.3 - 64.0 Hz)

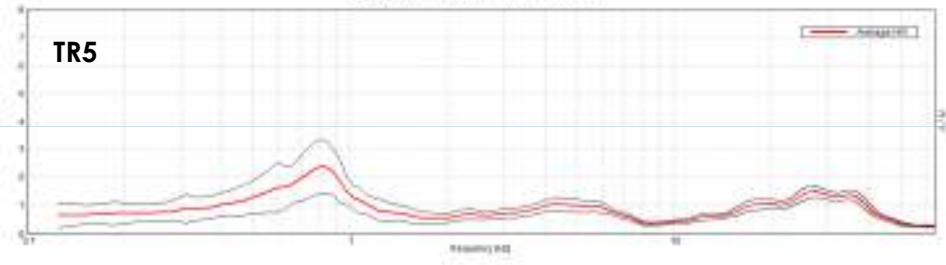
TR4



RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

Pico HV a 0.81 ± 0.01 Hz (nell'intervallo 0.3 - 64.0 Hz)

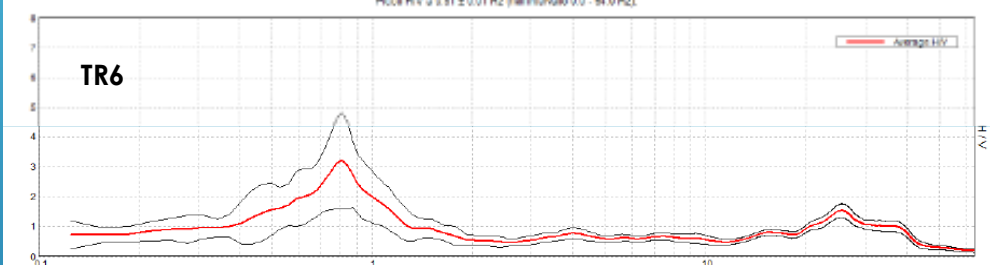
TR5



RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

Pico HV a 0.81 ± 0.01 Hz (nell'intervallo 0.3 - 64.0 Hz)

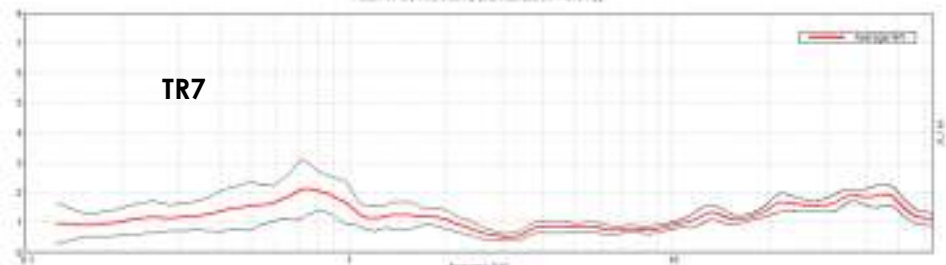
TR6



RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

Pico HV a 0.78 ± 0.03 Hz (nell'intervallo 0.3 - 64.0 Hz)

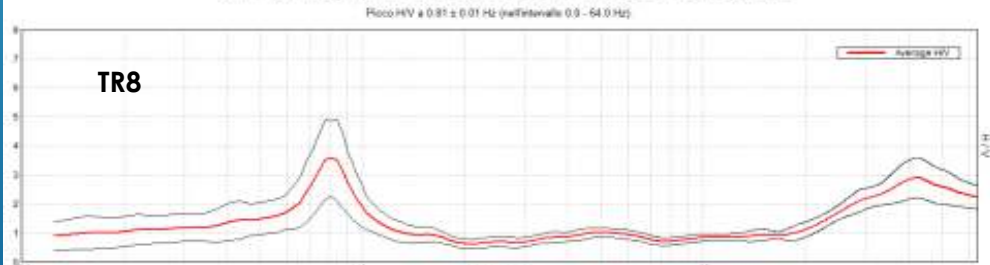
TR7



RAPPORTO SPETTRALE ORIZZONTALE SU VERTICALE

Pico HV a 0.81 ± 0.01 Hz (nell'intervallo 0.3 - 64.0 Hz)

TR8



Grazie per l'attenzione!