GRUPPO NAZIONALE
DI GEOFISICA DELLA TERRA SOLIDA

Evidences of effects induced by pile driving in alluvial soils inferred by seismic measurements

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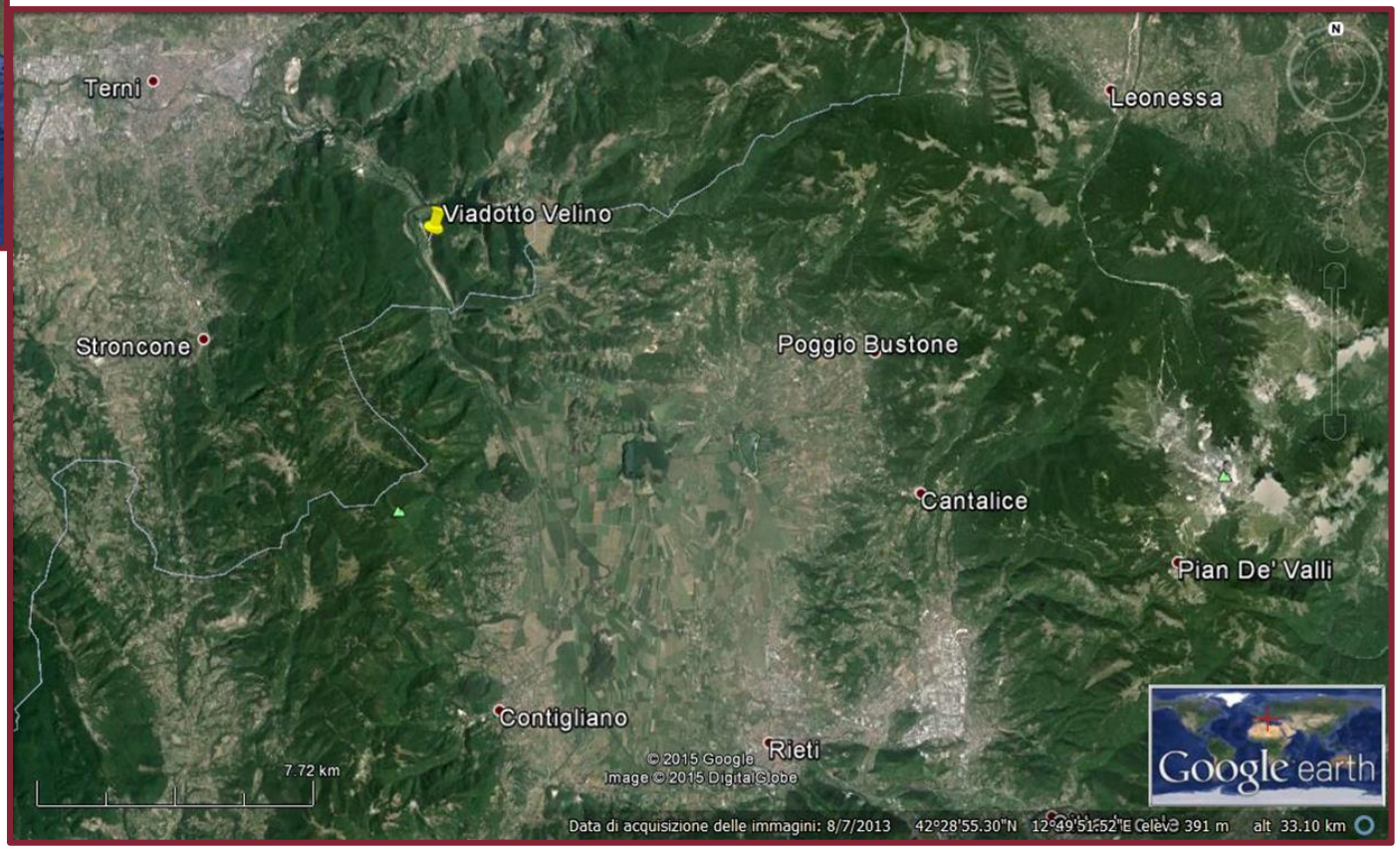
AIM OF THE WORK:

Experiment for evaluating the effects induced by pile driving in alluvial soil (change in physical properties, seismic waves velocity and densification of soil).

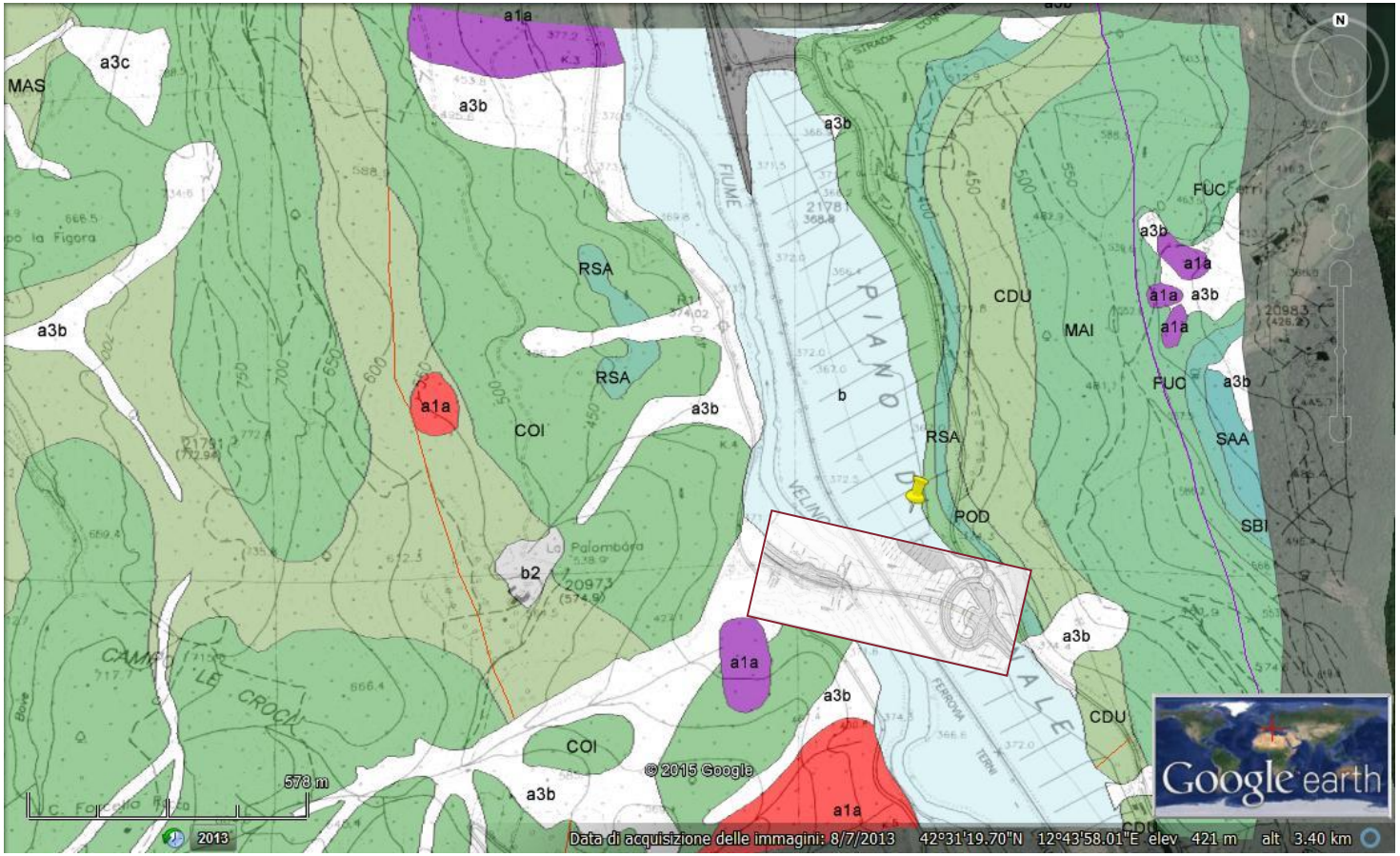
- **Availability of a test site for field measurement**
- **Use of conventional seismic techniques**

VELINO VIADUCT TEST SITE:

Velino Viaduct is located in Velino Valley at the border between Umbria and Lazio region

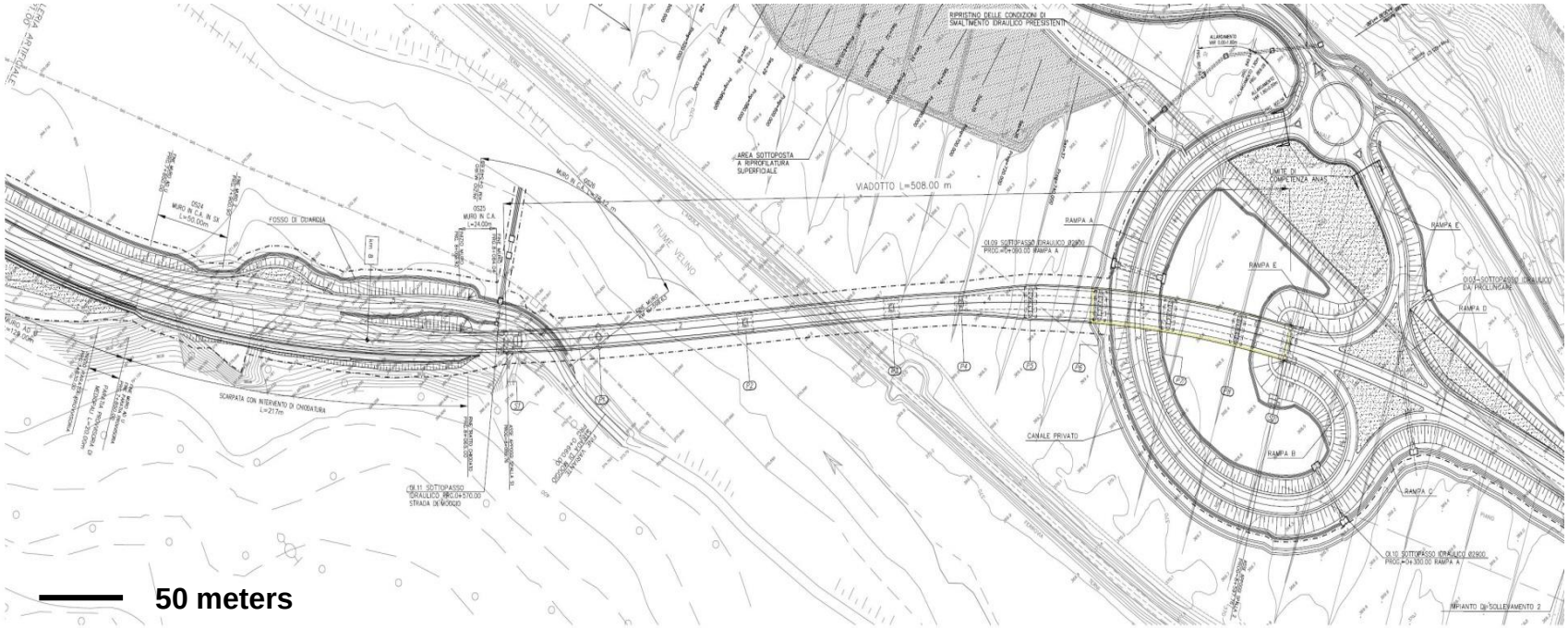


GEOLOGICAL SETTING OF TEST SITE:



a3b	Slope debris (Holocene)	b	Alluvial deposit (Holocene)	COI	Corniola (Toarcian *p.p.* – Sinemurian *sup*.)
RSA	Rosso Ammonitico (Aalenian – Toarcian *p.p.)*	CDU	Calcari Diasprigni (Kimmeridgian – Bajocian)		

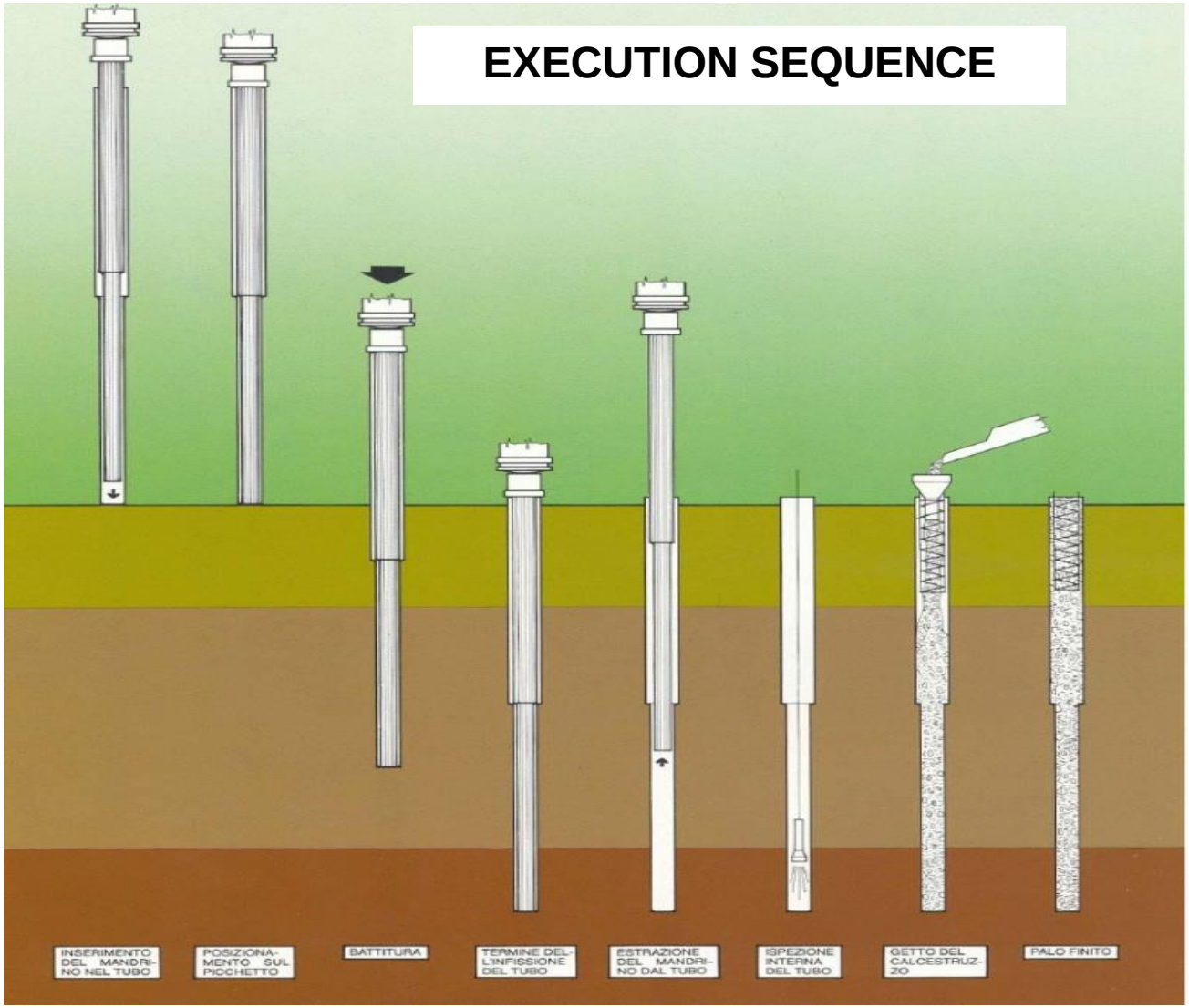
VELINO VIADUCT – SS 79 bis:



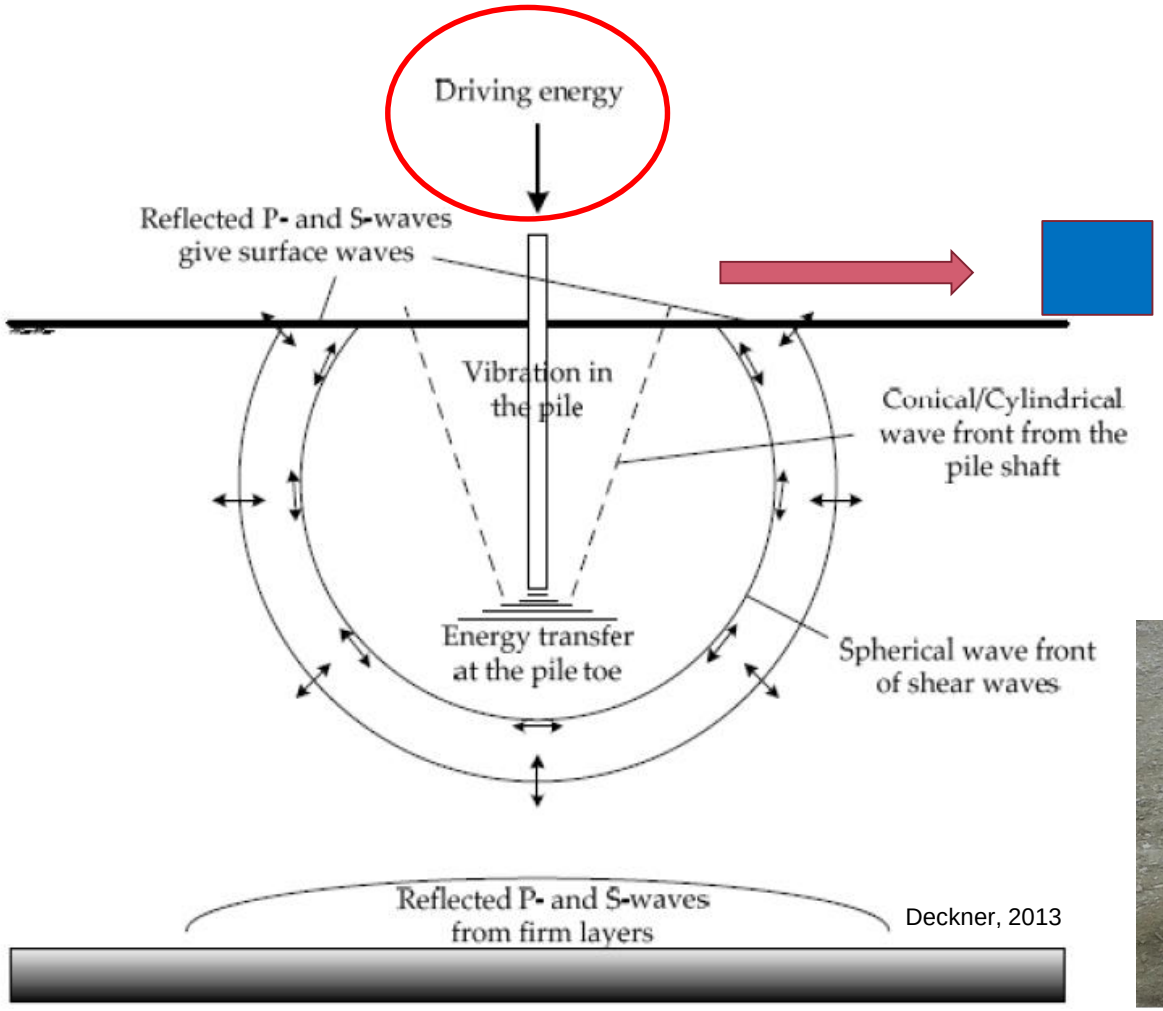
Total length 508,00 m

8 piles and 2 abutment

MULTITON PILES:



GEOPHYSICAL EXPERIMENT:



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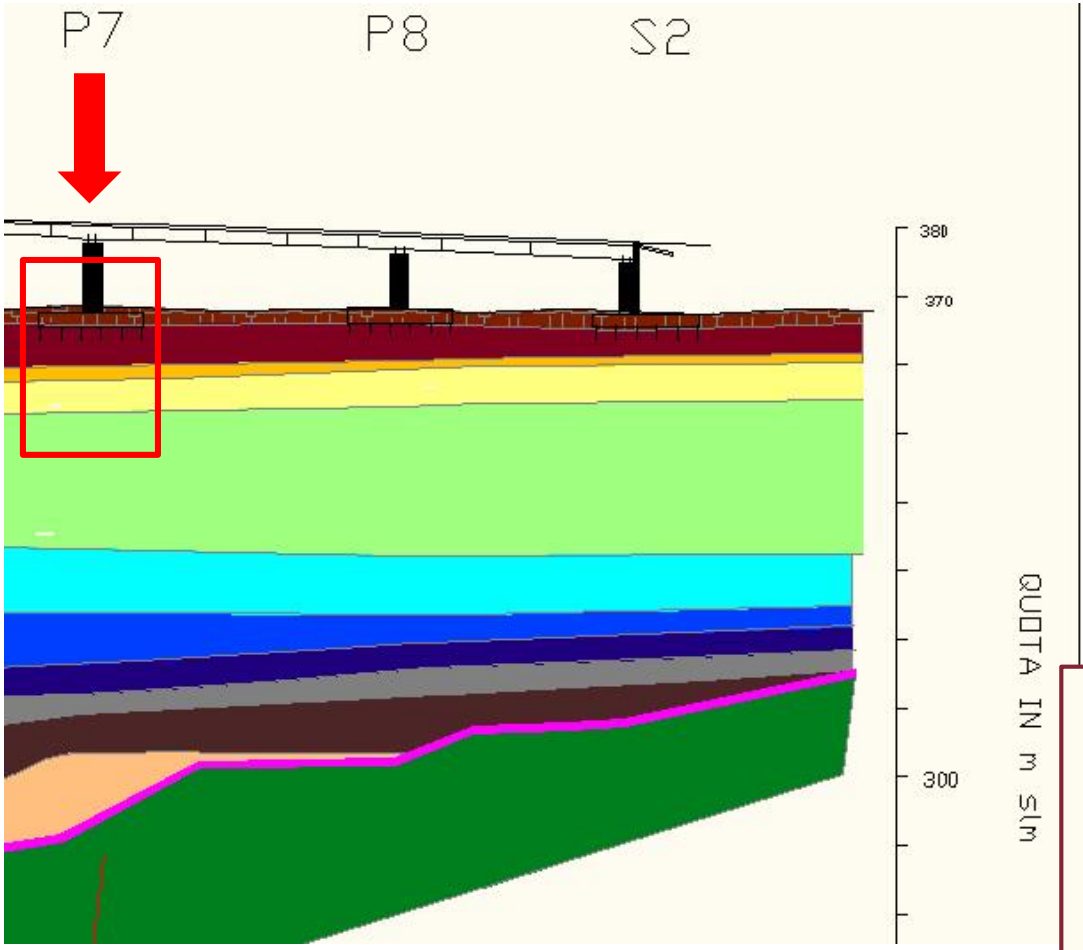
SEISMIC VELOCIMETER SENSOR LENNARTZ 5s

at 2 – 4 – 12 – 24 m from driven pile

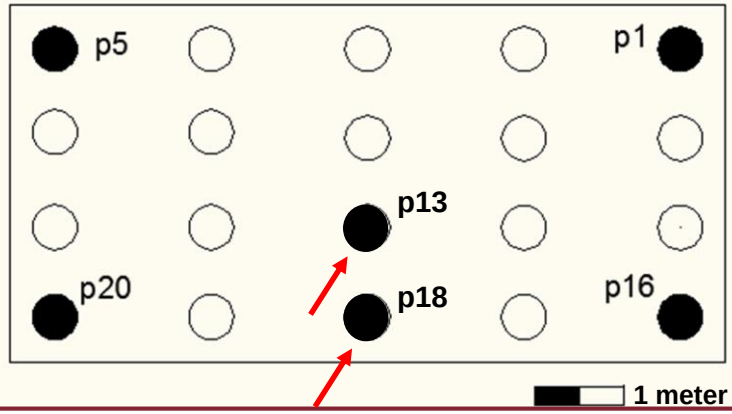
PRE- SIN- POST- driving measurements

GEOPHYSICAL EXPERIMENT :

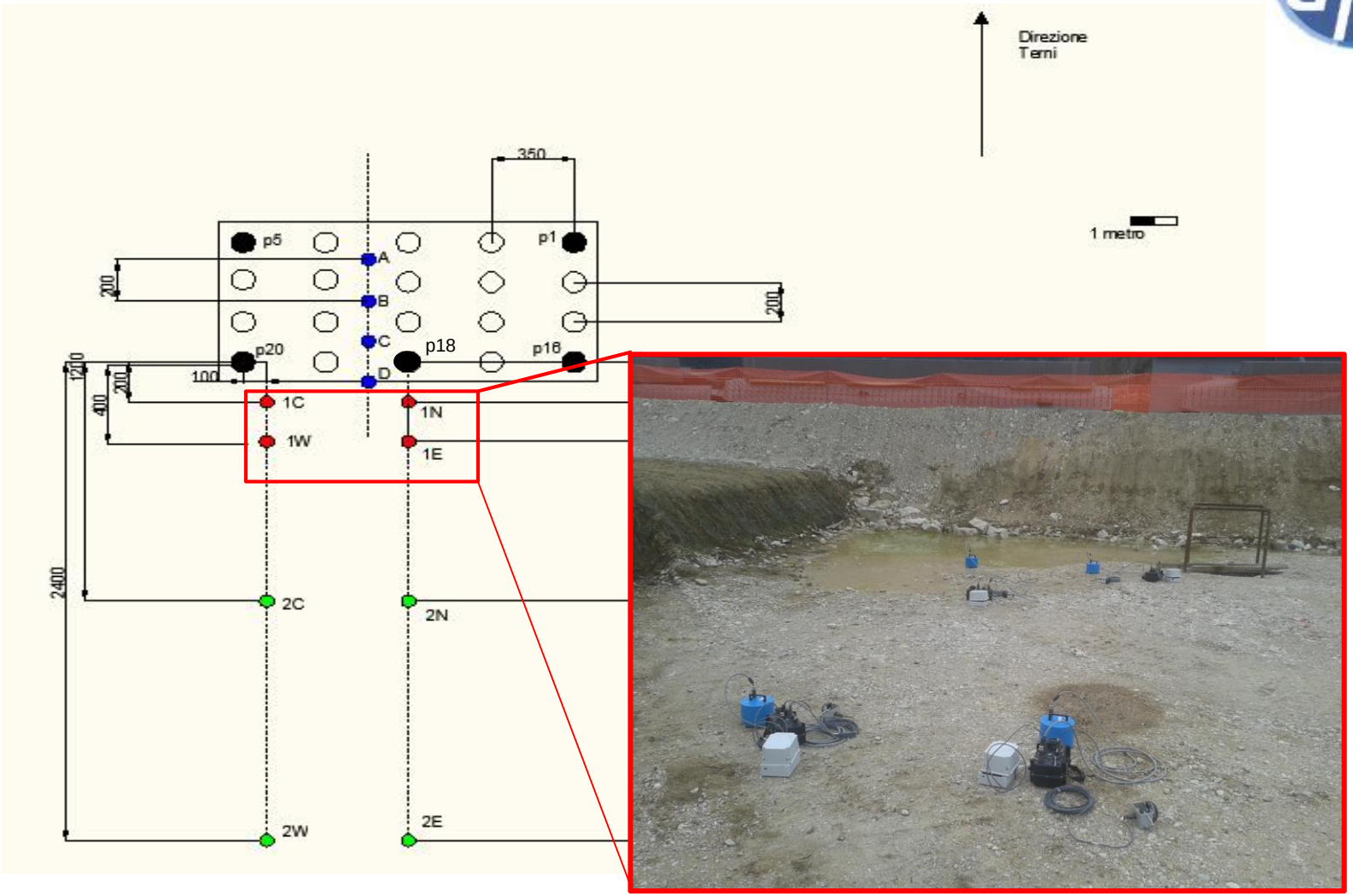


- Silty clay
- Silty sands
- Sandy silt
- Silts and clayey silts
- Silts and sandy silts
- Sandy silts
- Bedrock (Corniola)

DISTRIBUTION OF PILES IN 7th PILE-FOOTING

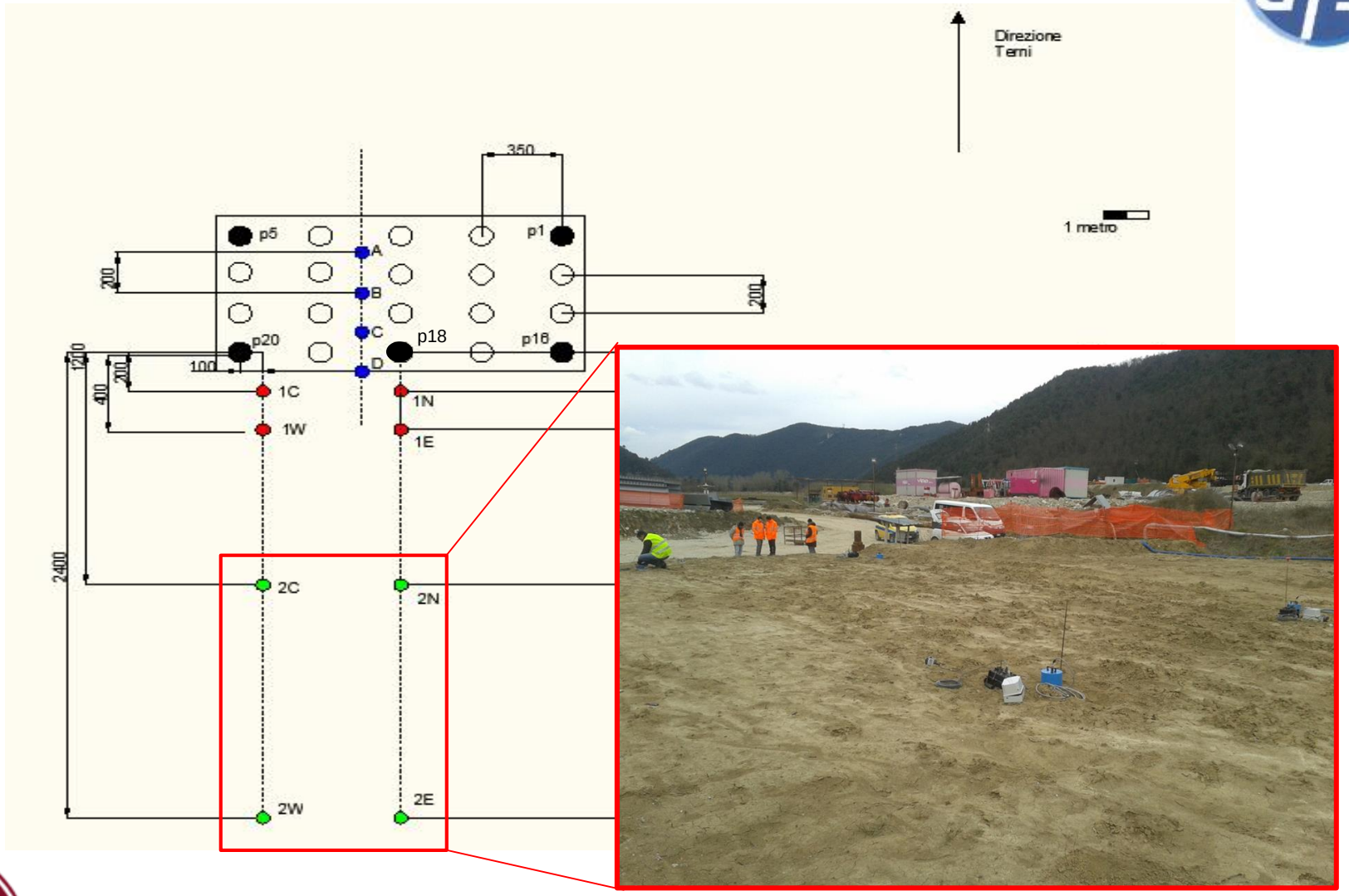


NOISE MEASUREMENTS (PRE- and POST- DRIVING):



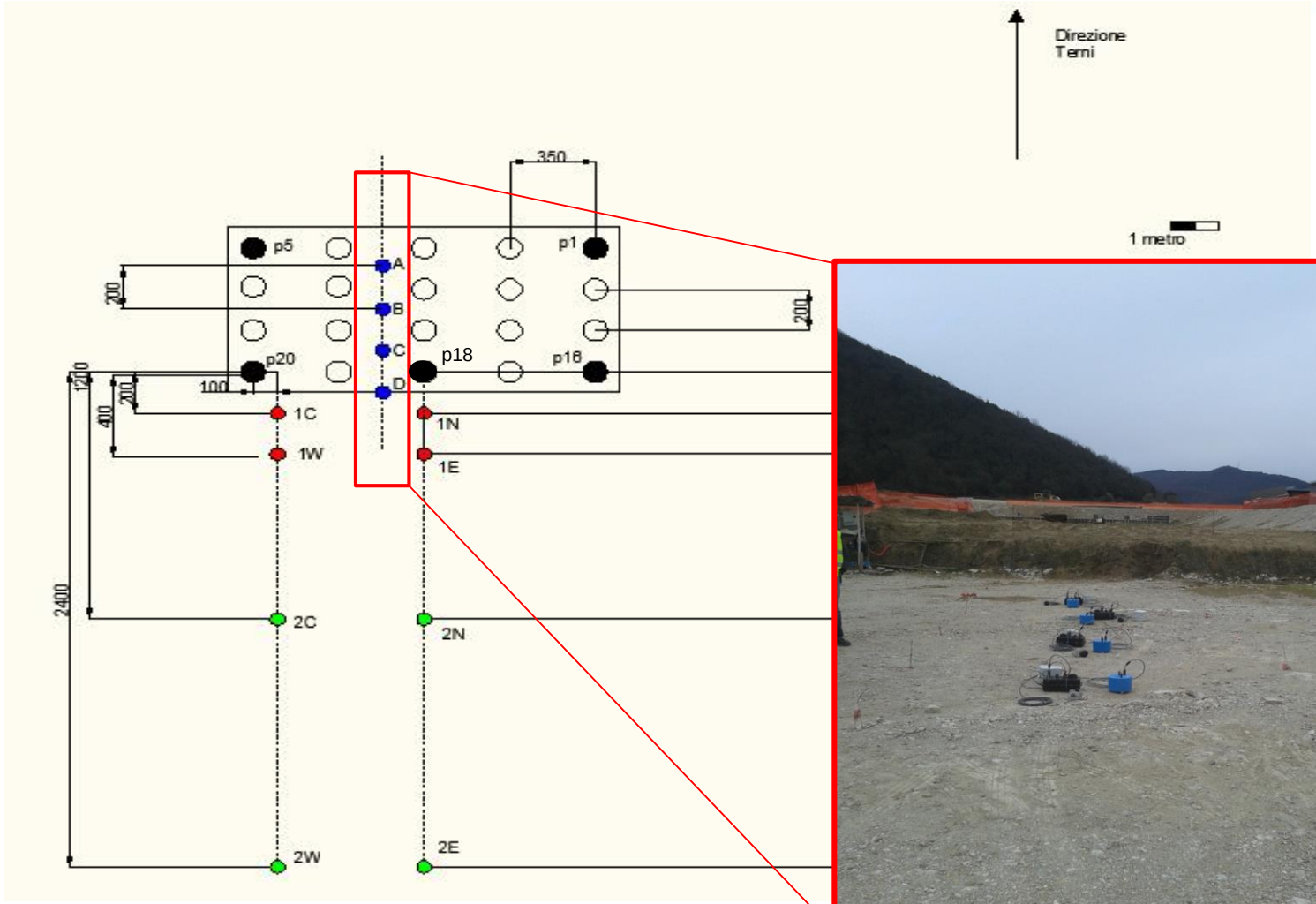
● **Sensor at 2 and 4 meters from piles 20 and 18**

NOISE MEASUREMENTS (PRE- and POST- DRIVING):



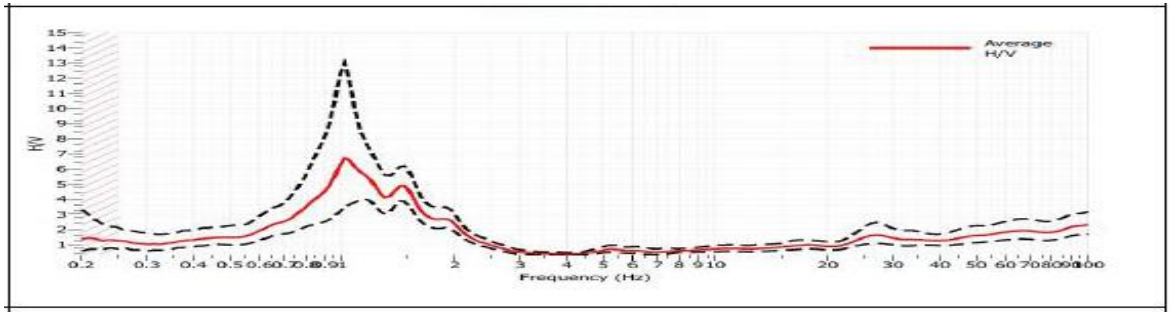
Sensor at 12 and 24 meters from piles 20 and 18

NOISE MEASUREMENTS (PRE- and POST- DRIVING):

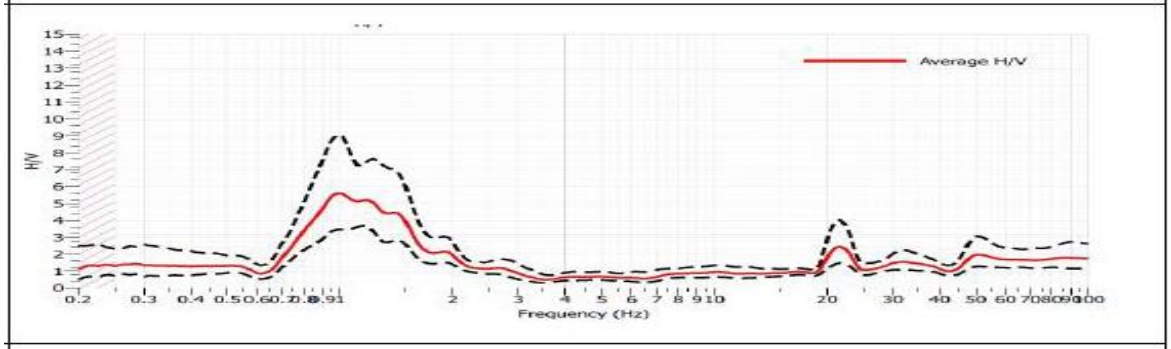


● **Inter-pile footing measurements**

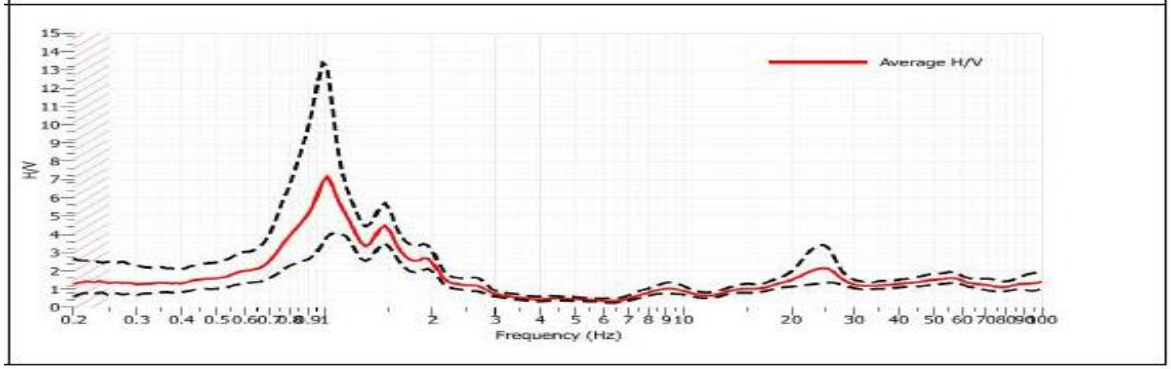
HVSR RESULTS:



PILE 18
PRE-DRIVING RESULTS

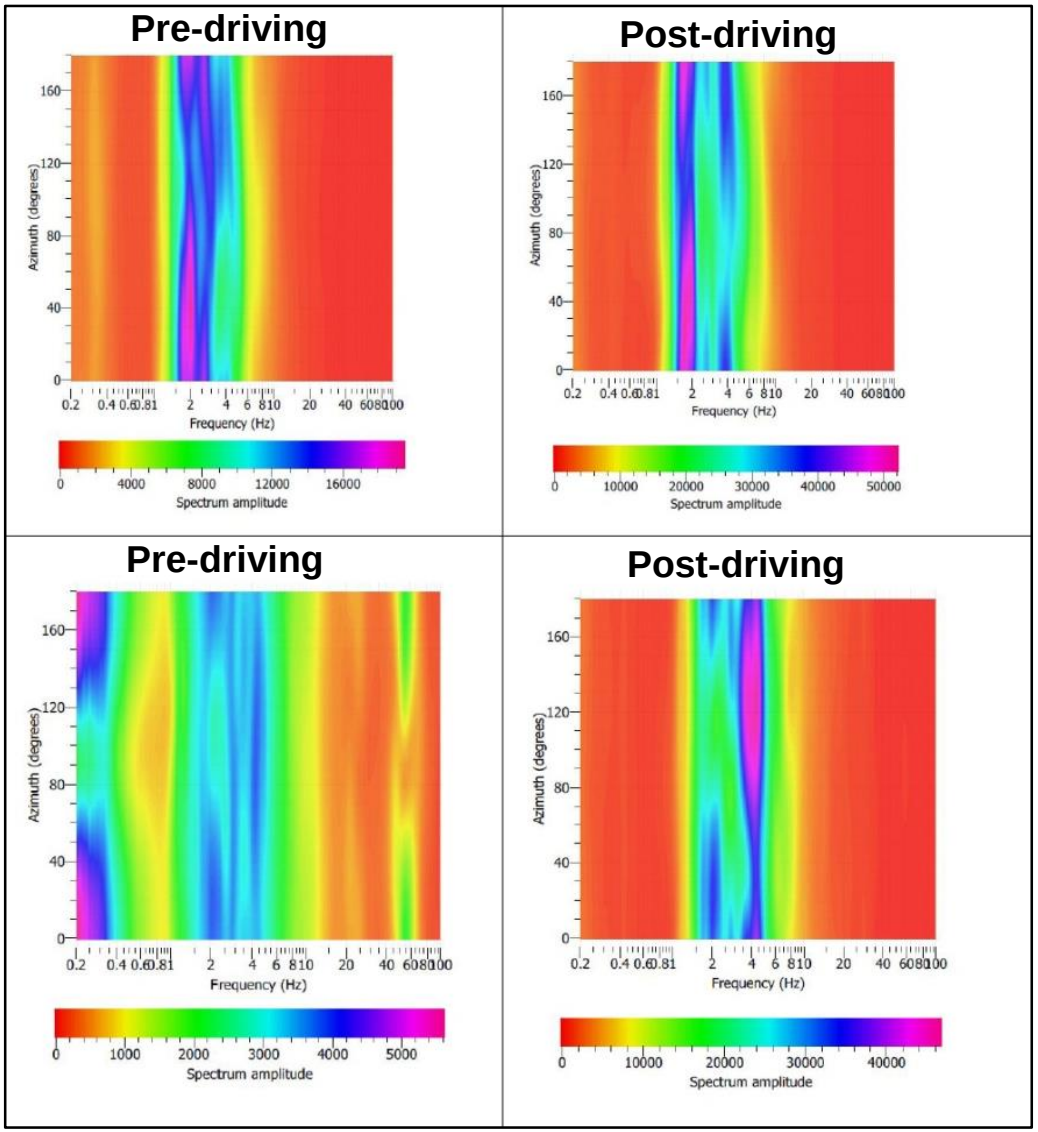


PILE 18
POST- 13 PILE DRIVING RESULTS



PILE 18
POST- 13 AND 18 PILE DRIVING RESULTS

HORIZONTAL SPECTRUM ROTATE RESULTS:



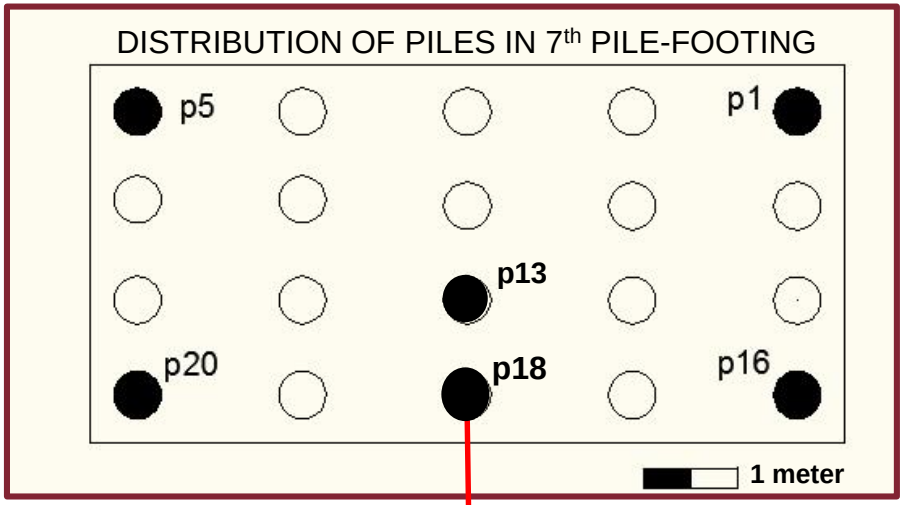
Sensor at 4 m from pile

Sensor at 24 m from pile

CO-DRIVING MEASUREMENTS:

DRIVING OF 18 PILE

SENSOR AT 3 – 6 – 12 – 24 m FROM DRIVING PILE



SENSOR DISTRIBUTION

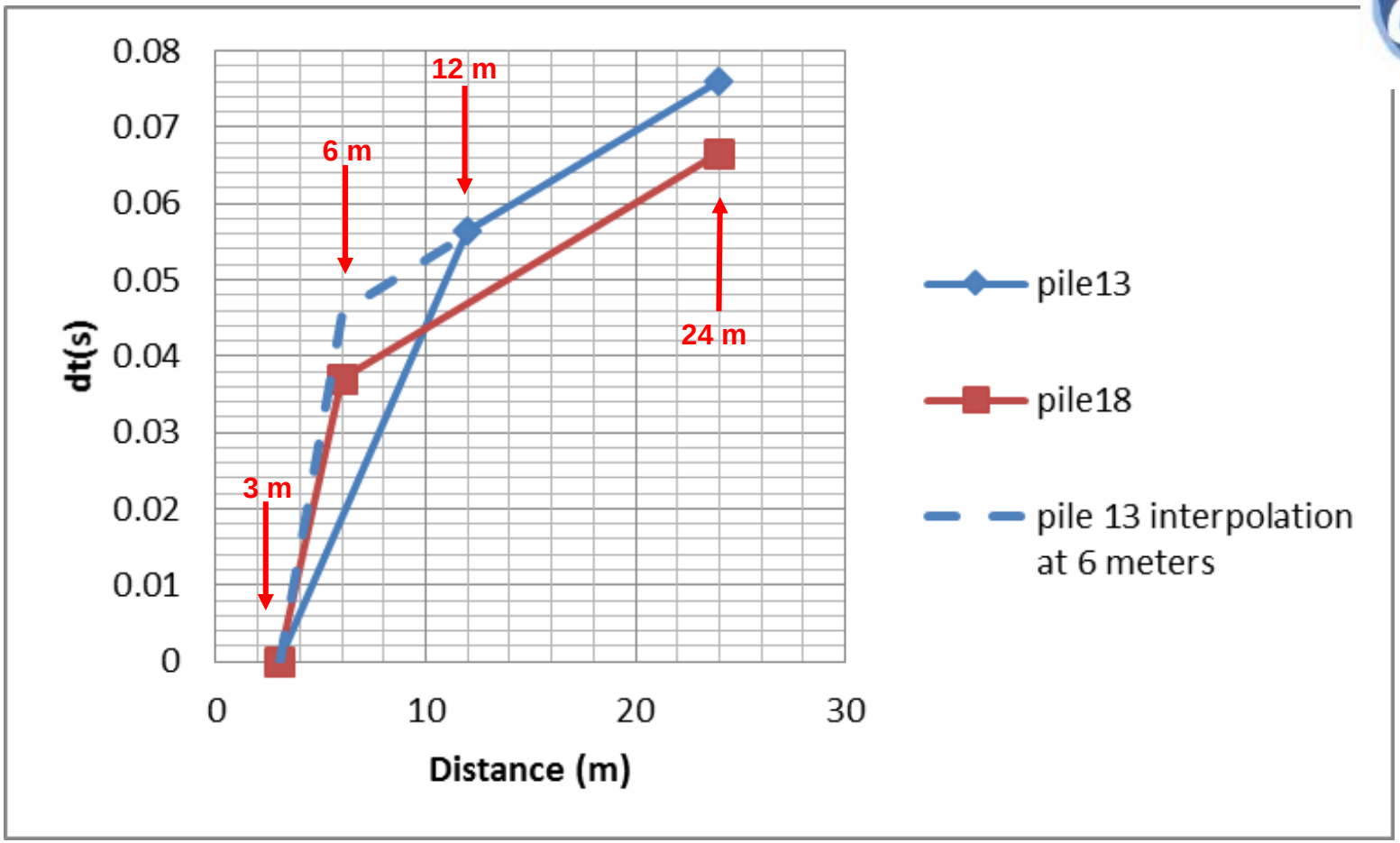
DATA PROCESSING:

MANUAL PICKING ON P-WAVES

Sensors distance from the pile (m)	Dt (s) (pile 13)	Dt (s) (pile 18)
3	0	0
6	-	0,037
12	0,056	-
24	0,076	0,066

TIME DELAY

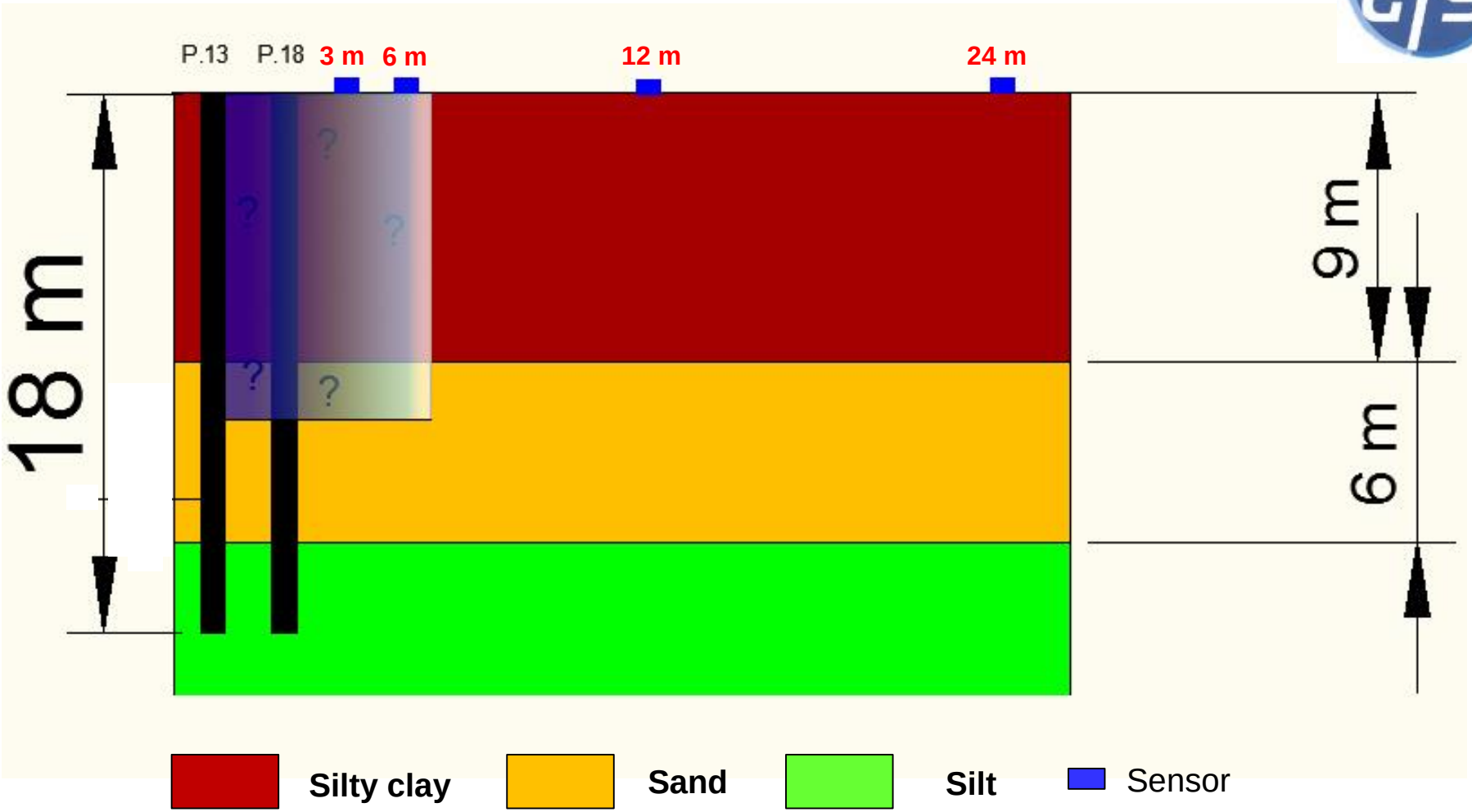
DROMOCHRONES:



Vp(13)= 316 m/s **Vp(18)=361 m/s** **[+15%]**

Vs(13)= 130 m/s **Vs(18)=162 m/s** **[+24%]**

CONCLUSION (I):



CONCLUSION (II):

CONCLUSION (III):

CONCLUSION (IV):

The conventional seismic techniques have allowed to identify the effects induced by pile driving in the proximity of the investigated zone:

- Liquefaction of 6 m in sands due to pile-driving: increase of impedance contrast within the first 10 m below ground level in the short-period;
- Increasing of the P-Waves velocity due to the soil densifications during the pile-driving, up to 12 m from the driven pile.

If more measurements within 10 m from the driven piles had been available, the volume of densified soil could be better recognized.

THANKS FOR YOUR ATTENTION