



ITACA (ITalian ACcelerometric Archive)

# RAN

## *Rete Accelerometric Nazionale*

*(National Accelerometric Network)*

Recording Station

**San Severo**

Station Code

**SSV**

	Day	Month	Year
<b>First compilation</b>	5	september	2006
<b>Last update</b>	28	october	2008

# General Information

Station photograph



Code

**SSV**

Owner

**DPC (Italian Civil Protection Department)**

Type of network

**Permanent**

Activation date

**29 Jan 1975**

Removal date

-

Instrument type

**Analogue**

Instrument model

**Kinematics SMA1 k0027**

Location

**ENEL cabin PG24E93**

Housing

**Free Field**

Notes

-



# Geographical Information (2)

## Coordinates

	Latitude	Longitude
Geographic (WGS84)	<b>41.680033</b>	<b>15.385832</b>
UTM (WGS84 zone 33)	<b>4614281.78m</b>	<b>532030.32m</b>
Gauss-Boaga	-	-
Elevation (m a.s.l.)	<b>79</b>	

## Cartography

	Scale	Code
Topographic map (I.G.M.I.)	<b>1:25.000</b>	<b>155 II SE</b>
	Scale	Element number
Regional technical map (C.T.R.)	-	-



I.G.M.I. map

# Geomorphology

## Site morphology

<b>Plain</b>	Valley (centre)	Valley (edge)	Alluvial fan
Saddle	Slope	Edge of scarp	Ridge

## Landslides

Not present

Present

Active or quiescent

Inactive or stabilized

Distance (m)

-

I.F.F.I. map

Notes

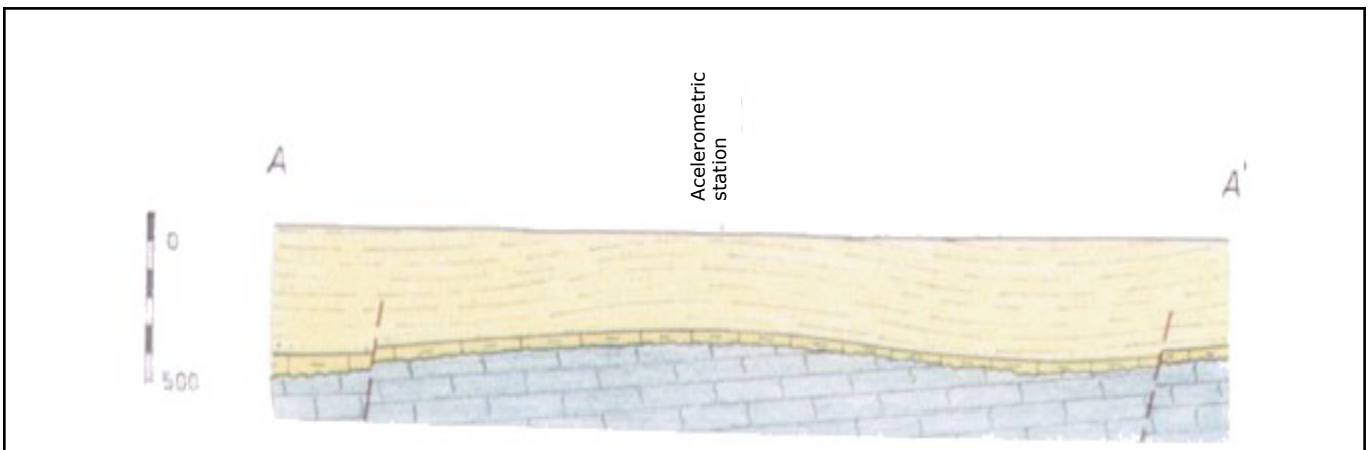
# Geology

## Cartography

Geological map	Scale	Sheet number	Sheet name
	<b>1:100.000</b>	<b>155</b>	<b>San Severo</b>



Geological cross section



Fault  present (if fault-station distance < 300 m)

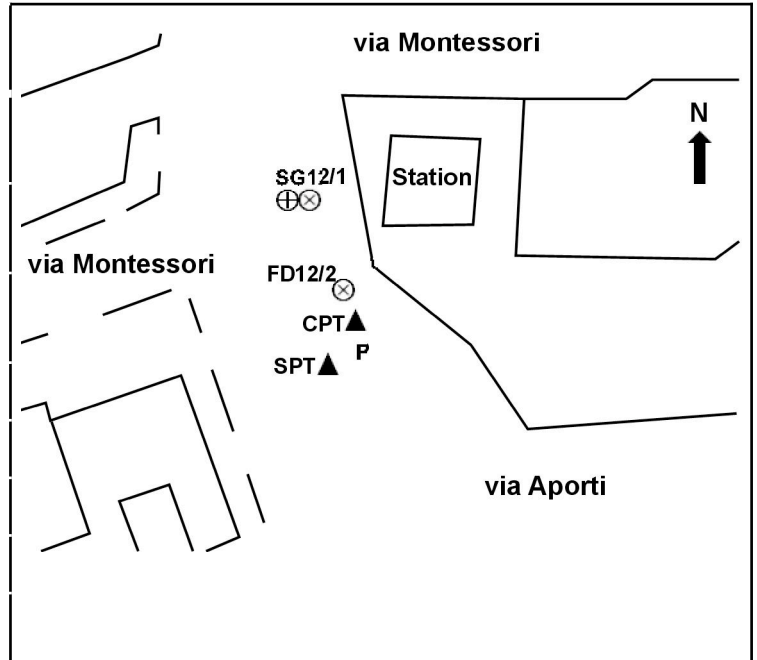
Notes

-

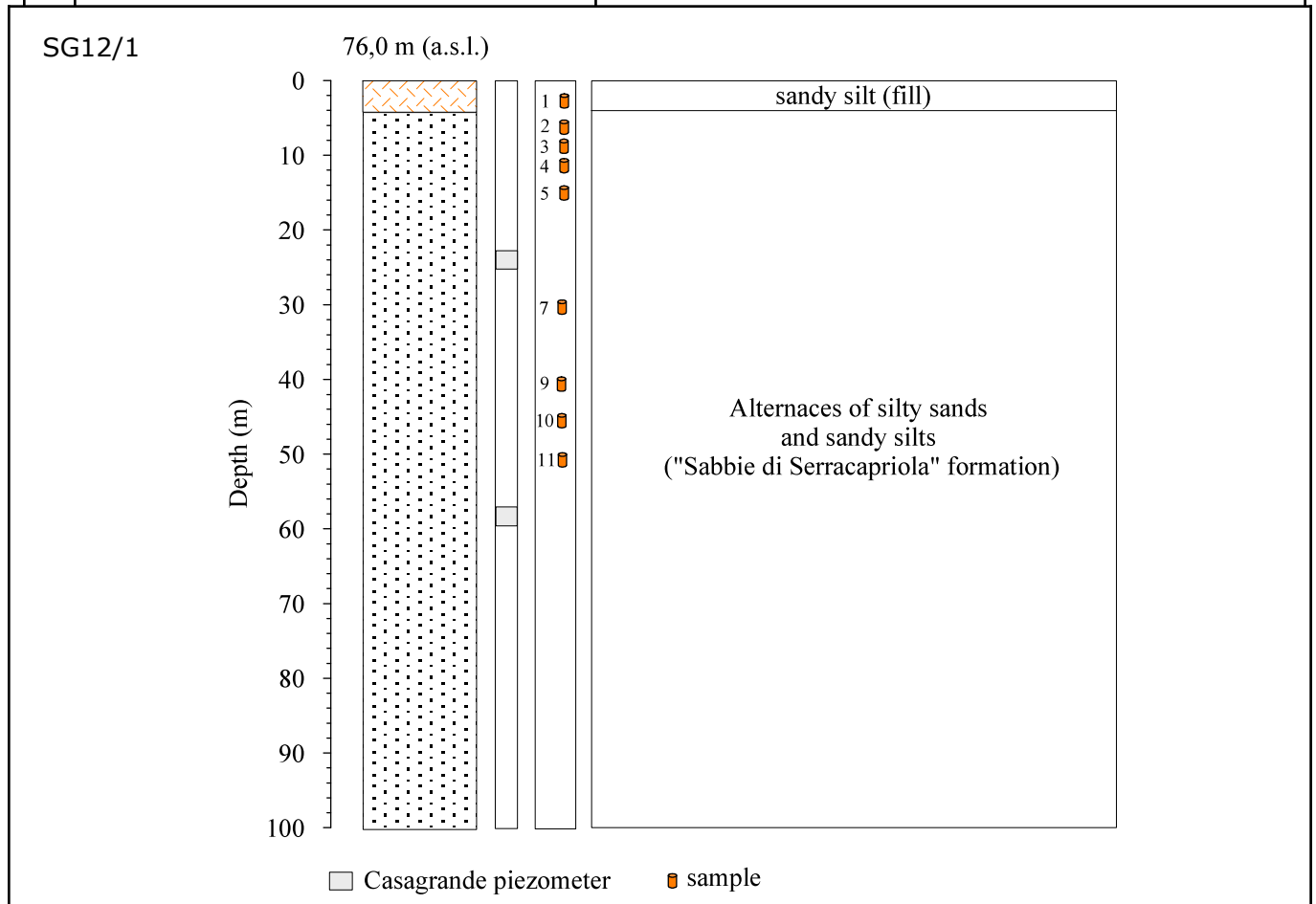
# Geotechnical & Geophysical Information (1)

## Test summary and location

X	⊗	Borehole
X	P	Piezometer
X	▲	Penetration tests (SPT, CPT)
X	⊕	Down-Hole, Cross-Hole (DH, CH)
	∇-∇	Seismic refraction/reflection
	○	SASW, MASW
	⊘	Spectral Ratio (H/V)
	◇-◇	Goelectric



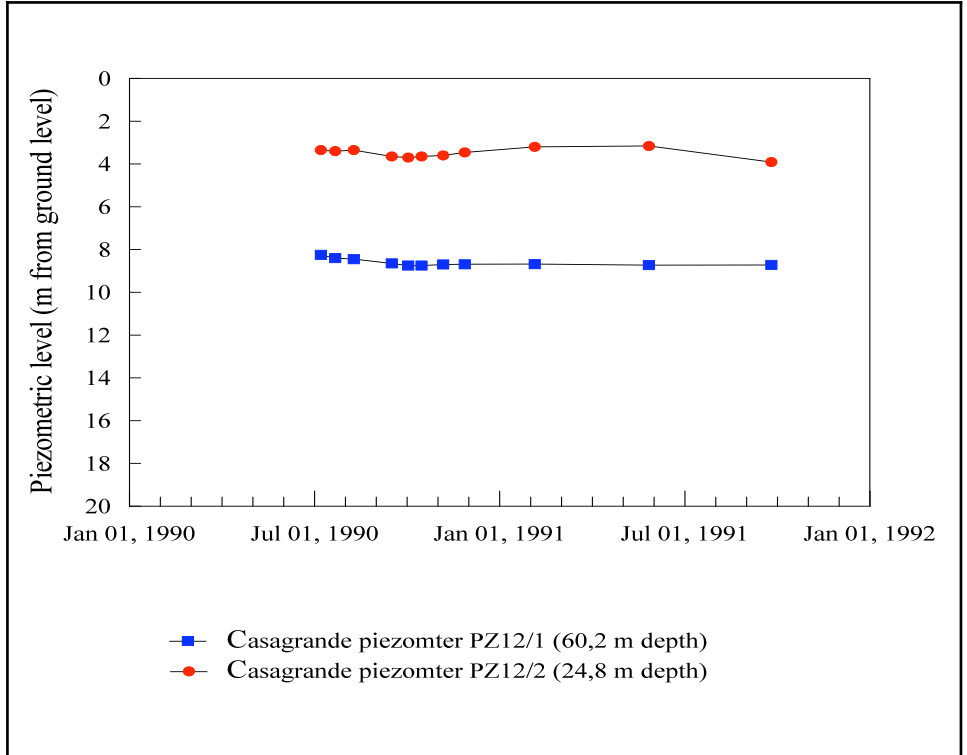
## Stratigraphic profile



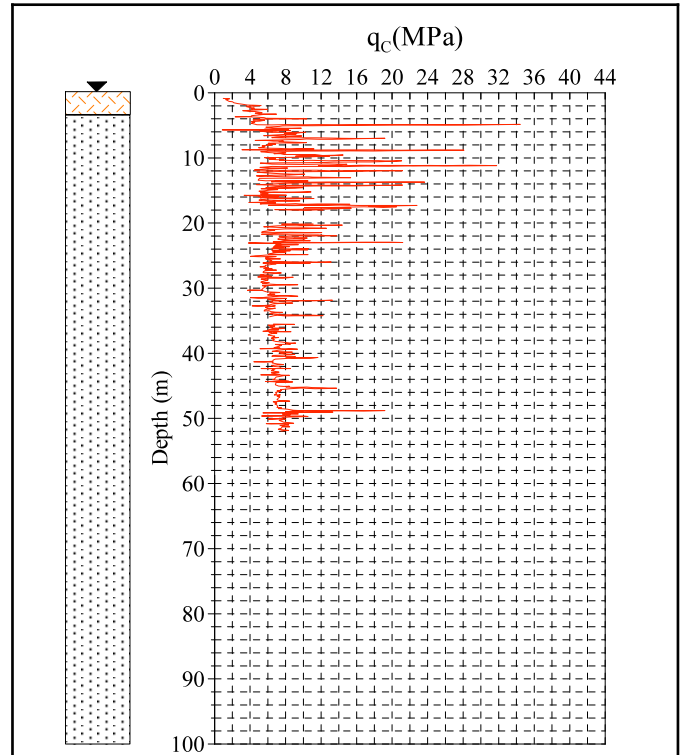
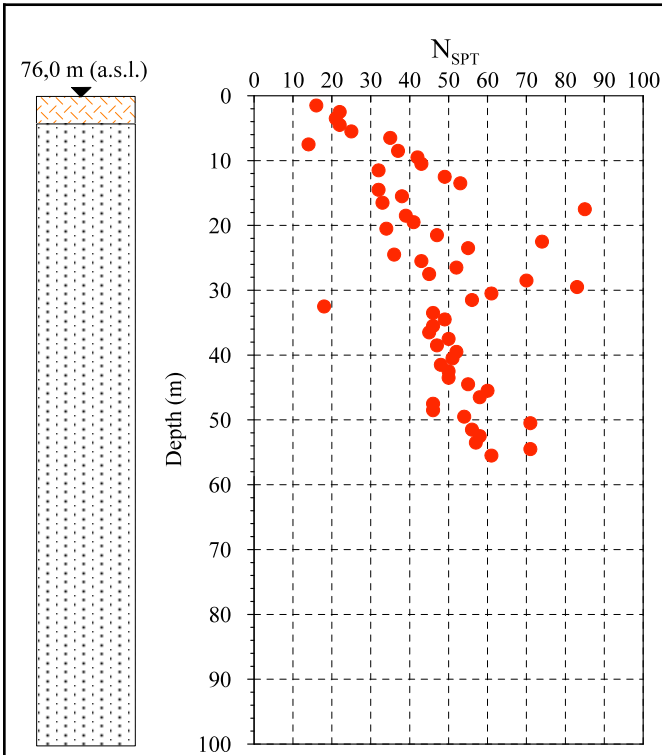
# Geotechnical & Geophysical Information (2)

## In situ Tests: Piezometric measurements

Date	Depth (m)	
	P1	P2
6 Jul 1990	8.25	3.35
20 Jul 1990	8.40	3.40
7 Aug 1990	8.45	3.35
13 Sep 1990	8.65	3.65
29 Sep 1990	8.75	3.70
12 Oct 1990	8.75	3.65
2 Nov 1990	8.70	3.60
23 Nov 1990	8.69	3.46
30 Jan 1991	8.68	3.20
21 May 1991	8.73	3.16
17 Sep 1991	8.72	3.91



## In situ Tests: Penetration Test (SPT, CPT)



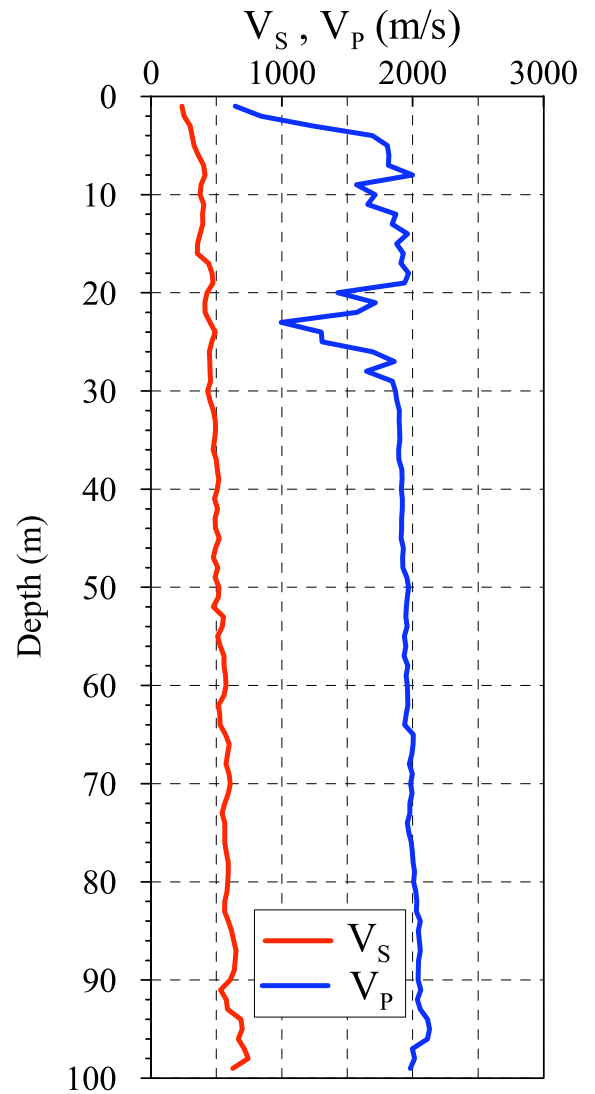
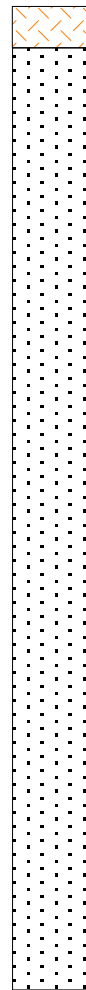


# Geotechnical & Geophysical Information (3)

*In situ Tests: Down-Hole (DH), Cross-Hole (CH), SASW, MASW*

Depth (m)	Vs (m/s)	Vp (m/s)
1	237	645
2	253	840
3	300	1234
4	314	1692
5	330	1806
6	363	1819
7	402	1815
8	414	2000
9	384	1571
10	375	1714
11	404	1657
12	394	1872
13	397	1844
14	376	1961
15	357	1878
16	354	1929
17	441	1909
18	468	1969
19	474	1938
20	429	1428
21	411	1715
22	414	1572
23	452	995
24	492	1301
25	466	1307
26	447	1695
27	450	1860
28	452	1646
29	456	1845
30	432	1868
31	451	1879
32	477	1899
33	492	1897
34	493	1901
35	486	1903
36	475	1892
37	499	1894
38	508	1918
39	518	1920
40	507	1913
41	486	1921
42	510	1921
43	490	1915
44	493	1916
45	522	1911
46	493	1928
47	477	1923
48	511	1925
49	491	1955
50	521	1968

Depth (m)	Vs (m/s)	Vp (m/s)
51	515	1959
52	476	1952
53	554	1947
54	546	1957
55	509	1936
56	530	1947
57	559	1935
58	558	1963
59	571	1950
60	574	1960
61	559	1962
62	516	1963
63	526	1949
64	528	1938
65	571	2005
66	599	2004
67	585	1993
68	573	1974
69	596	1997
70	606	1984
71	592	1996
72	564	1979
73	544	1978
74	565	1960
75	565	1970
76	565	1989
77	576	1997
78	592	2004
79	592	2014
80	588	2007
81	581	2025
82	565	2031
83	562	2028
84	592	2058
85	616	2044
86	633	2050
87	651	2058
88	644	2046
89	636	2044
90	607	2041
91	532	2063
92	576	2035
93	585	2059
94	689	2114
95	697	2129
96	668	2113
97	713	1998
98	743	2014
99	626	1983



# Geotechnical & Geophysical Information (4)

***In situ Tests:*** Refraction/Reflection section – Geoelectric section

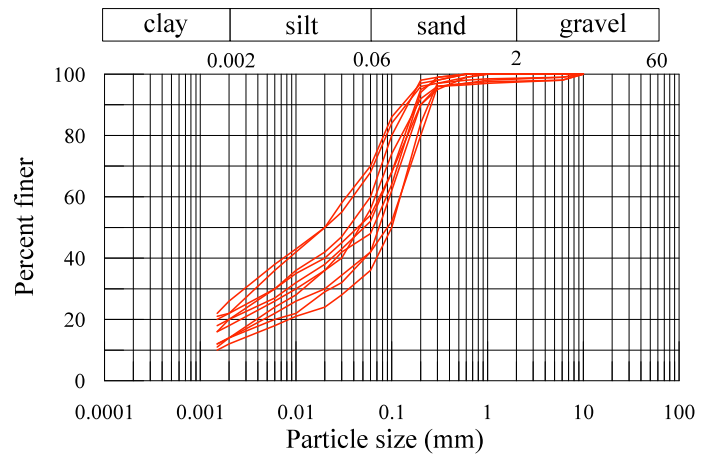
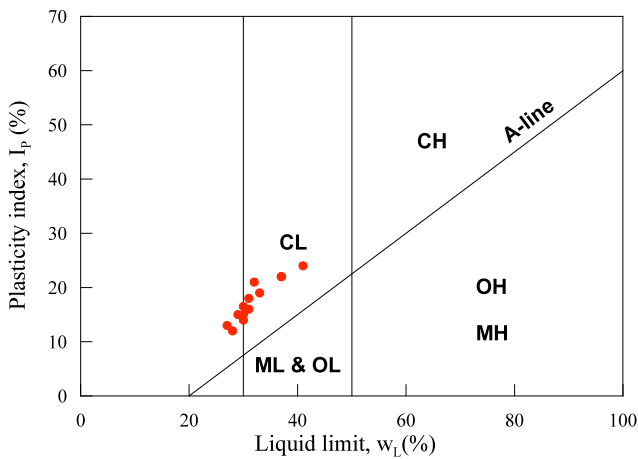
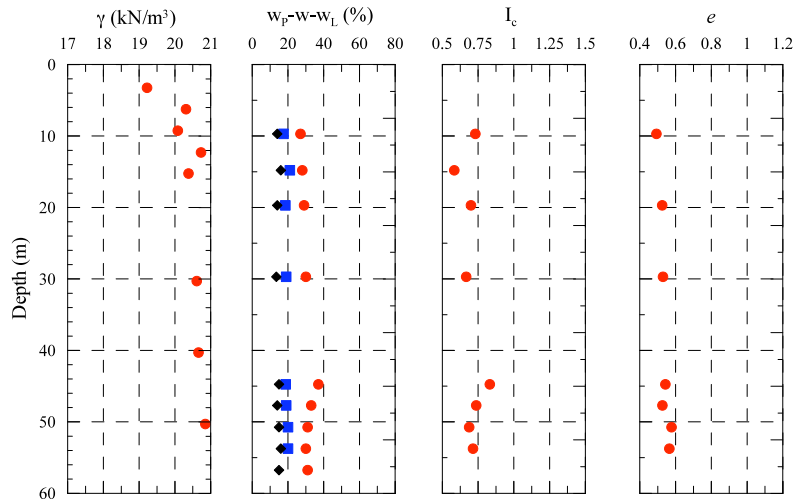
*Refraction/Reflection section*

*Geoelectric section*

# Geotechnical & Geophysical Information (5)

## Laboratory Tests: physical properties

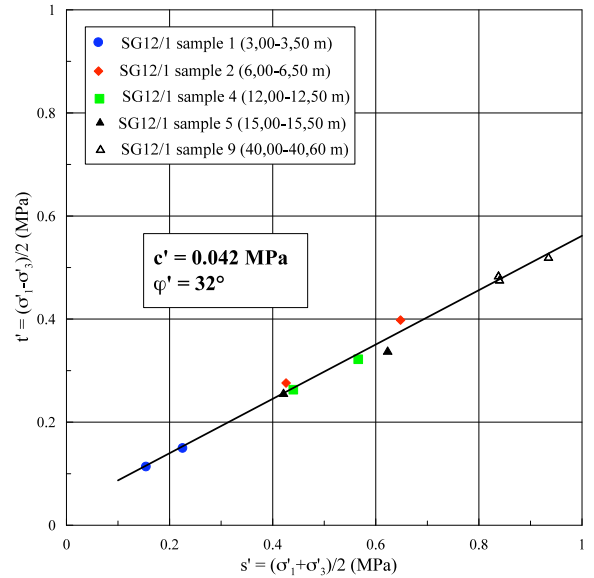
Borehole	Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	w (%)	$\gamma_s$ (kN/m <sup>3</sup> )	$\gamma$ (kN/m <sup>3</sup> )	$w_L$ (%)	$I_p$ (%)	$I_c$	A	e
SG12/1	1	3.0-3.5	1	41	43	15	22	26.4	19.22	31	16	0.56	0.54	0.675
SG12/1	2	6.0-6.5	2	56	27	15	19	26.5	20.31	30	14	0.71	1.07	0.565
SG12/1	3	9.0-9.5	2	56	28	14	20	26.4	20.08	31	16	0.69	0.88	0.577
SG12/1	4	12.0-12.5	0	46	31	23	19	26.6	20.73	33	19	0.74	1.21	0.526
SG12/1	5	15.0-15.5	1	30	46	23	18.7	26.5	20.38	37	22	0.83	1.05	0.543
SG12/1	7	30.0-30.6	0	30	44	26	19	26.5	20.43	33	19	0.74	1.37	0.542
SG12/1	7	30.0-30.6	0	48	32	20	18	26.5	20.71	27	14	0.64	1.43	0.509
SG12/1	9	40.0-40.6	0	38	41	22	18.5	26.6	20.66	29	15	0.70	1.47	0.525
SG12/1	10	44.8-45.4	0	51	31	18	21	26.5	-	28	12	0.58	1.50	-
SG12/1	11	50.0-50.6	0	48	33	19	17.5	26.5	20.85	27	13	0.73	1.46	0.493
SPT12/1	6	6.5-6.95	4	55	25	16	-	-	-	30	15	-	1.07	-
SPT12/1	14	14.5-14.9	1	28	38	33	-	-	-	41	14	-	1.38	-
SPT12/1	20	20.5-20.9	12	30	32	26	-	-	-	37	22	-	1.18	-
SPT12/1	34	34.5-34.9	0	39	37	23	-	-	-	31	18	-	1.28	-
SPT12/1	44	44.5-44.9	0	39	37	24	-	-	-	32	21	-	1.14	-



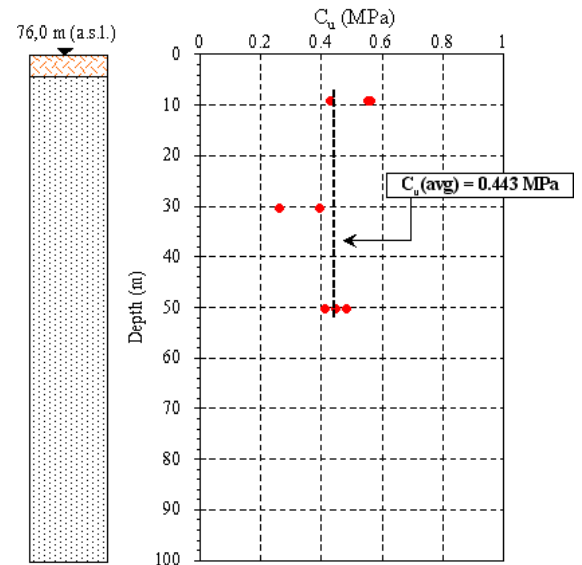
# Geotechnical & Geophysical Information (6)

## Laboratory Tests: Direct shear/Triaxial tests

Borehole/ Sample	Litotype	Depth (m)	$\sigma'_1$ (MPa)	$\sigma'_3$ (MPa)	Test type*
SG12/1/1	Clayey silty sands	3.0-3.5	0.375	0.075	CIU
SG12/1/1	Clayey silty sands	3.0-3.5	0.268	0.040	CIU
SG12/1/2	Clayey silty sands	6.0-6.5	0.702	0.150	CID
SG12/1/2	Clayey silty sands	6.0-6.5	1.046	0.250	CID
SG12/1/4	Clayey silty sands	12.0-12.5	0.703	0.177	CIU
SG12/1/4	Clayey silty sands	12.0-12.5	0.888	0.244	CIU
SG12/1/5	Clayey silty sands	15.0-15.5	0.962	0.284	CIU
SG12/1/5	Clayey silty sands	15.0-15.5	0.678	0.164	CIU
SG12/1/9	Clayey silty sands	40.0-40.6	1.323	0.353	CIU
SG12/1/9	Clayey silty sands	40.0-40.6	1.317	0.363	CIU
SG12/1/9	Clayey silty sands	40.0-40.6	1.456	0.414	CIU



Borehole	Litotype	Depth (m)	$C_u$ (MPa)	Test type*
SG12/1/3	Clayey silty sands	9.25	0.431	UU
SG12/1/3	Clayey silty sands	9.25	0.551	UU
SG12/1/3	Clayey silty sands	9.25	0.562	UU
SG12/1/7	Clayey silty sands	30.3	0.261	UU
SG12/1/7	Clayey silty sands	30.3	0.393	UU
SG12/1/11	Clayey silty sands	50.3	0.413	UU
SG12/1/11	Clayey silty sands	50.3	0.448	UU
SG12/1/11	Clayey silty sands	50.3	0.483	UU



### \*Legend

DS = Direct shear

CIU = Triaxial-Consolidated Undrained

CID = Triaxial-Consolidated Drained

UU = Triaxial-Unconsolidated Undrained

Note

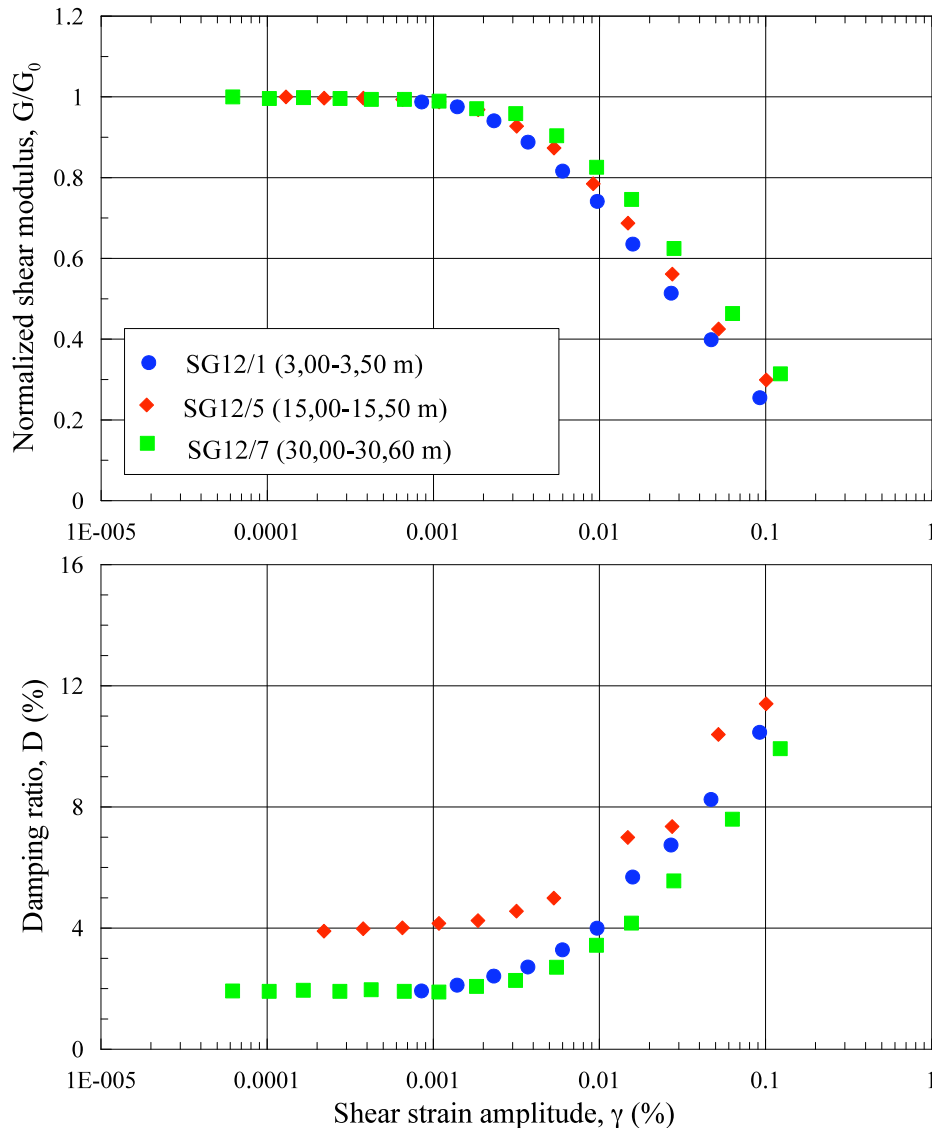
### Average values of mechanical parameters

Litotype	$c'$ (MPa)	$\phi'$ ( $^\circ$ )	$C_u$ (MPa)
Clayey silty sand	0.042	32	0.443

# Geotechnical & Geophysical Information (7)

## Laboratory Tests: Resonant Column (RC)

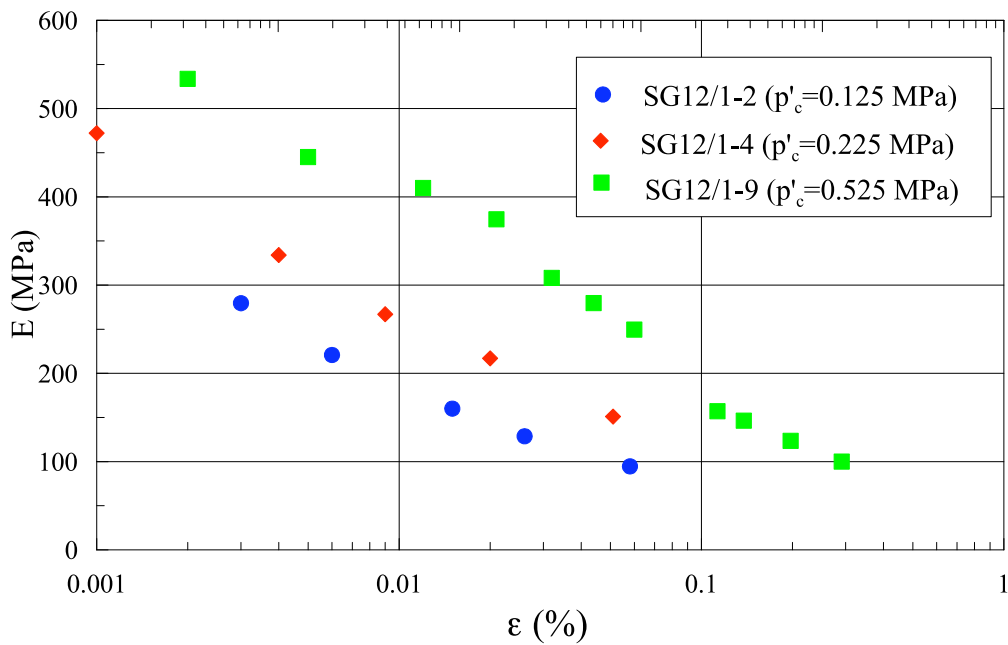
Borehole / Sample																
SG12/ 1/1	γ (%)	0.00051	0.00085	0.00139	0.00231	0.00371	0.0599	0.00968	0.01585	0.02699	0.04694	0.09216	-	-	-	-
	G/G <sub>0</sub>	1.00	0.99	0.98	0.94	0.89	0.82	0.74	0.64	0.51	0.40	0.26	-	-	-	-
	D (%)	1.89	1.93	2.12	2.42	2.72	3.28	4.00	5.69	6.74	8.25	10.47	-	-	-	-
SG12/ 1/5	γ (%)	0.00013	0.00022	0.00038	0.00065	0.00108	0.00186	0.00317	0.00532	0.00915	0.01481	0.02740	0.05197	0.10086	-	-
	G/G <sub>0</sub>	1.00	1.00	1.00	0.99	0.99	0.97	0.93	0.87	0.78	0.69	0.56	0.43	0.30	-	-
	D (%)	3.79	3.90	3.98	4.01	4.16	4.25	4.56	4.99	-	6.99	7.35	10.39	11.41	-	-
SG12/ 1/7	γ (%)	0.00006	0.00010	0.00016	0.00027	0.00042	0.00067	0.00108	0.00182	0.00313	0.00551	0.00960	0.01558	0.02810	0.06311	0.12247
	G/G <sub>0</sub>	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.97	0.96	0.90	0.83	0.75	0.62	0.46	0.31
	D (%)	1.93	1.91	1.94	1.91	1.96	1.91	1.89	2.07	2.27	2.71	3.43	4.16	5.56	7.60	9.93



# Geotechnical & Geophysical Information (8)

## Laboratory Tests: Cyclic Triaxial (CTX)

Borehole / Sample	$p'_c$ (MPa)												
S12/1/2	0.125	$\epsilon$ (%)	0.003	0.006	0.015	0.026	0.058	-	-	-	-	-	-
		E (MPa)	279.5	220.8	160.0	128.7	94.6	-	-	-	-	-	-
S12/1/4	0.225	$\epsilon$ (%)	0.001	0.004	0.009	0.020	0.051	-	-	-	-	-	-
		E (MPa)	472.2	334.0	267.0	217.0	151.0	-	-	-	-	-	-
S12/1/9	0.525	$\epsilon$ (%)	0.002	0.005	0.012	0.021	0.032	0.044	0.060	0.113	0.138	0.197	0.291
		E (MPa)	533.7	445.2	410.0	374.5	308.1	279.7	249.5	157.0	146.4	123.6	100.0



# Microtremor H/V spectral ratio

Table

Chart

**$f_0$  (mt) (Hz)**

**Date of measurements**

Day

Month

Year

# Earthquake H/V spectral ratio

Table

Chart

$f_0$  (eq) (Hz)

List of selected records from ITACA

Year-Month-Day\_Hour:Minute:Second

Year-Month-Day_Hour:Minute:Second



# Site classification (EC8 – NTC2008)

## Lithostratigraphic classification

### Estimated

Method <sup>1</sup>	Soil class <sup>2</sup>	Notes
-	-	-

Legend	1	GEO Geological data
		EC Empirical correlation
		HV H/V spectral ratio

### Based on in-situ measurements

Method <sup>3</sup>	$V_{s30}$ (m/s)	Soil class <sup>3</sup>
CH	386	B

Legend	2	A	Rock or other rock-like geological formation, including at most 5 m of weaker material at the surface ( $V_{s30} > 800$ m/s).
		B	Deposits of very dense sand, gravel, or very stiff clay, at least several tens of m in thickness, characterised by a gradual increase of mechanical properties with depth ( $V_{s30} = 360-800$ m/s).
		C	Deep deposits of dense or mediumdense sand, gravel or stiff clay with thickness from several tens to many hundreds of m ( $V_{s30} = 180-360$ m/s).
		D	Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers), or of predominantly soft-to-firm coesive soil ( $V_{s30} < 180$ m/s).
		E	A soil profile consisting of a surface alluvium layer with $V_s$ values of type C or D and thickness varying between about 5 m and 20 m, underlain by stiffer material with $V_s > 800$ m/s.

Legend	3	CH	Cross-Hole
		DH	Down-Hole
		MW	MASW
		SH	SH-Refraction
		SW	SASW

## Topographic classification

Topographic category <sup>4</sup>
T1

Legend	4	T1	Flat surface, isolated slopes and cliffs with average slope angle $i \leq 15^\circ$ .
		T2	Slopes with average slope angle $i > 15^\circ$ .
		T3	Ridges with crest width significantly less than the base width and average slope angle $15^\circ \leq i \leq 30^\circ$ .
		T4	Ridges with crest width significantly less than the base width and average slope angle $i > 30^\circ$ .

# Synthesis of information

## Information relevant to site classification

## Notes

$V_{s30}$ (m/s)	386	Cross-hole
Average $N_{SPT}$ to 30m	34	
Average $c_u$ to 30m (kPa)	440	
Site class (EC8 – NTC2008)	B	
Topographic category (EC8 – NTC2008)	T1	

## Geological and geomorphological information

Lithology	Variable grain sands, more or less cemented, with intercalations of conglomerates and clays	
Morphology	Plain	

## Other information relevant to seismic site response

Depth to bedrock (m)	> 100	
Average $V_s$ to bedrock (m/s)	-	
$f_0$ from H/V microtremors (Hz)	-	
$f_0$ from H/V earthquakes (Hz)	-	

## Observed anomalies of station response

-	
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# References

## ***Geomorphology & Geology***

Carta geologica d'Italia in scala 1:100.000 – Foglio n. 116 "San Severo". Servizio Geologico Nazionale
Sito web del Progetto IFFI: <a href="http://www.mais.sinanet.apat.it/cartanetiffi/">http://www.mais.sinanet.apat.it/cartanetiffi/</a>

## ***Geotechnical & Geophysical Information***

Palazzo S. (1991). PROGETTO IRPINIA. Elaborazione dei risultati delle indagini geotecniche in sito e in laboratorio eseguite nelle postazioni accelerometriche di: Sannicandro, Tricarico, Vieste, Arienzo, S. Severo e Garigliano. Ottobre 1991

# Enclosures

## ***List***

N.	Description
1	ISMES – Progetto Irpinia. Studi e indagini geotecniche sulle postazioni della rete accelerometrica nazionale ENEL. Prove geotecniche di Laboratorio. Prog. DTA 4929 - Doc. RTF-DTA-071 – Rev. 01 – Severo, Certificati di Prova