

AUTOSTRADA (A14): BOLOGNA - BARI -TARANTO TRATTO: BOLOGNA BORGO PANIGALE - BOLOGNA SAN LAZZARO

POTENZIAMENTO IN SEDE DEL SISTEMA AUTOSTRADALE E TANGENZIALE DI BOLOGNA INTERVENTI DI COMPLETAMENTO DELLA RETE VIARIA DI ADDUZIONE INTERMEDIA DI PIANURA

PROGETTO DEFINITIVO

DOCUMENTAZIONE GENERALE

GEOLOGIA

INDAGINI GEOGNOSTICHE IN SITO

INDAGINI IN SITO PREGRESSE (PROVE PENETROMETRICHE)

IL GEOLOGO

Dott. Massimo Roberto Campana
Ord. Geol. Toscana N. 1709

IL RESPONSABILE INTEGRAZIONE PRESTAZIONI SPECIALISTICHE


Ing. Raffaele Rinaldesi
Ord. Ingg. Macerata N. A1068

IL DIRETTORE TECNICO

Ing. Piero Bongio
Ord. Ingg. Sondrio N. A538
T.A. - Geologia e Geotecnica

CODICE IDENTIFICATIVO

RIFERIMENTO PROGETTO			RIFERIMENTO DIRETTORIO				RIFERIMENTO ELABORATO				ORDINATORE
Codice Commessa	Lotto, Sub-Prog. Cod. Appalto	Fase	Capitolo	Paragrafo	W B S	Parte d'opera	Tip.	Disciplina	Progressivo	Rev.	--
111443	0000	PD	DG	GEO	SI000	00000	R	GEO	0022	-0	SCALA -

	ENGINEER COORDINATOR:		SUPPORTO SPECIALISTICO:				REVISIONE	
	Ing. Raffaele Rinaldesi Ord. Ingg. Macerata N. A1068						n.	data
							0	DICEMBRE 2021
	REDATTO:		VERIFICATO:					

VISTO DEL COMMITTENTE



IL RESPONSABILE UNICO DEL PROCEDIMENTO
Ing. Fabio Visintin

VISTO DEL CONCEDENTE



Ministero delle Infrastrutture e della mobilità sostenibile
DIPARTIMENTO PER LA PROGRAMMAZIONE, LE INFRASTRUTTURE DI TRASPORTO A RETE
E I SISTEMI INFORMATIVI

PROVE PENETROMETRICHE
(A13)

SIGLA	IMPRESA	ANNO
CPTU-BF _x -B, CPTU _x -PE	IMPREFOND/SUBSOIL	2011/2018

**imprefond**GEOTECNICA E LAVORI SPECIALI
DEL SOTTOSUOLOTRIESTE - via dei Caraccioli, 8 - 33100 0431 827789
Sondaggio/Pit

COMMITTENTE: SPEA Ingegneria Europea S.p.A.

PROGETTO: A13 Ferrara - Bologna - Fase B

LOCALITÀ: Bologna

Sondaggio/Pit

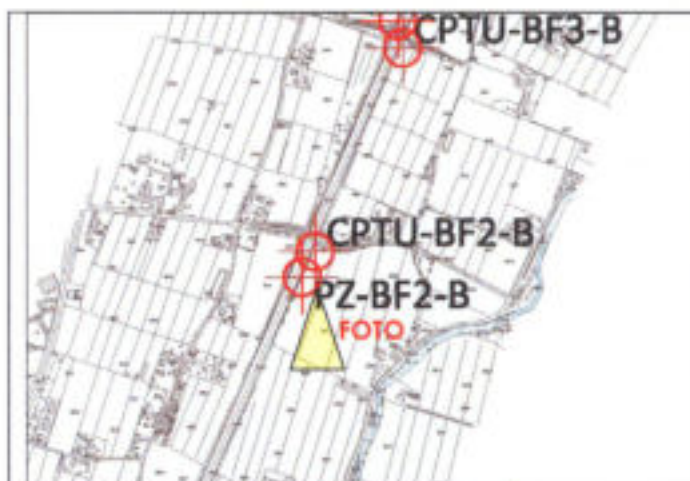
CPTU-BF2-B

SCHEDA MONOGRAFICA DEL PUNTO DI INDAGINE

DESCRIZIONE: Ubicata in un campo agricolo al quale si accede da via Vittorio Peglion (Bologna), procedendo verso via Ferrarese (SS64) e svoltando a destra prima del centro di smaltimento elettrodomestici. Seguendo lo stradello parallelo alla via Peglion sino a raggiungere l'asse autostradale.

ELEMENTI GEODETICI O TOPOGRAFICI

COORDINATE GAUSS BOAGA	COORDINATE RETTILINEE	COORDINATE WGS84
N = 4.935.372,05 m	N = 3.162.294,78 m	Lat. = 44° 32' 49,0081"N
E = 1.688.391,38 m	E = 9.895.642,39 m	Long. = 11° 22' 16,6074"E
Quota = 30,15 m		



Inquadramento generale



Schizzo planimetrico di dettaglio



CAPOSALDI DI RIFERIMENTO

I 71 I 74 I 77

NOTE

RILEVATO SUL PIANO CAMPAGNA

Con. Min. Infr. e Trasp. con Decreto n.0000151 del 19/04/2011 Settore C-Prove in situ su terreni (ai sensi dell'art. 59 del DPR n. 380/2001)

Lo sperimentatore:
dott. geol. Roberto ChiappiniIl Direttore del Laboratorio
dott. geol. Dario GubertiniAccettazione n. 110017
Certificato n. 110017-1/2011-CPTU-BF2B-M
dd. 14/09/2011
Commessa n.110017



elietipi s.r.l.

Sede operativa ed amm. via: Via Annibale Zucchini, 88 - 44100 FERRARA
tel. 0532/56771; fax 0532/56119 e-mail: info@elietipi.it sito: www.elietipi.it
P.IVA e Codice Fiscale n. 00174600387

Laboratorio Aut. del Ministero Infrastrutture e Trasporti P.C.S. 11.795 S.T.C. in base al D.P.R. n. 360/01 art. 50 lett. n. 349/98 Dec. n° 53382 del 26/05/2005

AZIENDA CON SISTEMA DI GESTIONE
INTRODOTTO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

COMMITTENTE: IMPREFOND S.r.l. - via del Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF02-B PROF. FALDA (m da p.c.): 1,70

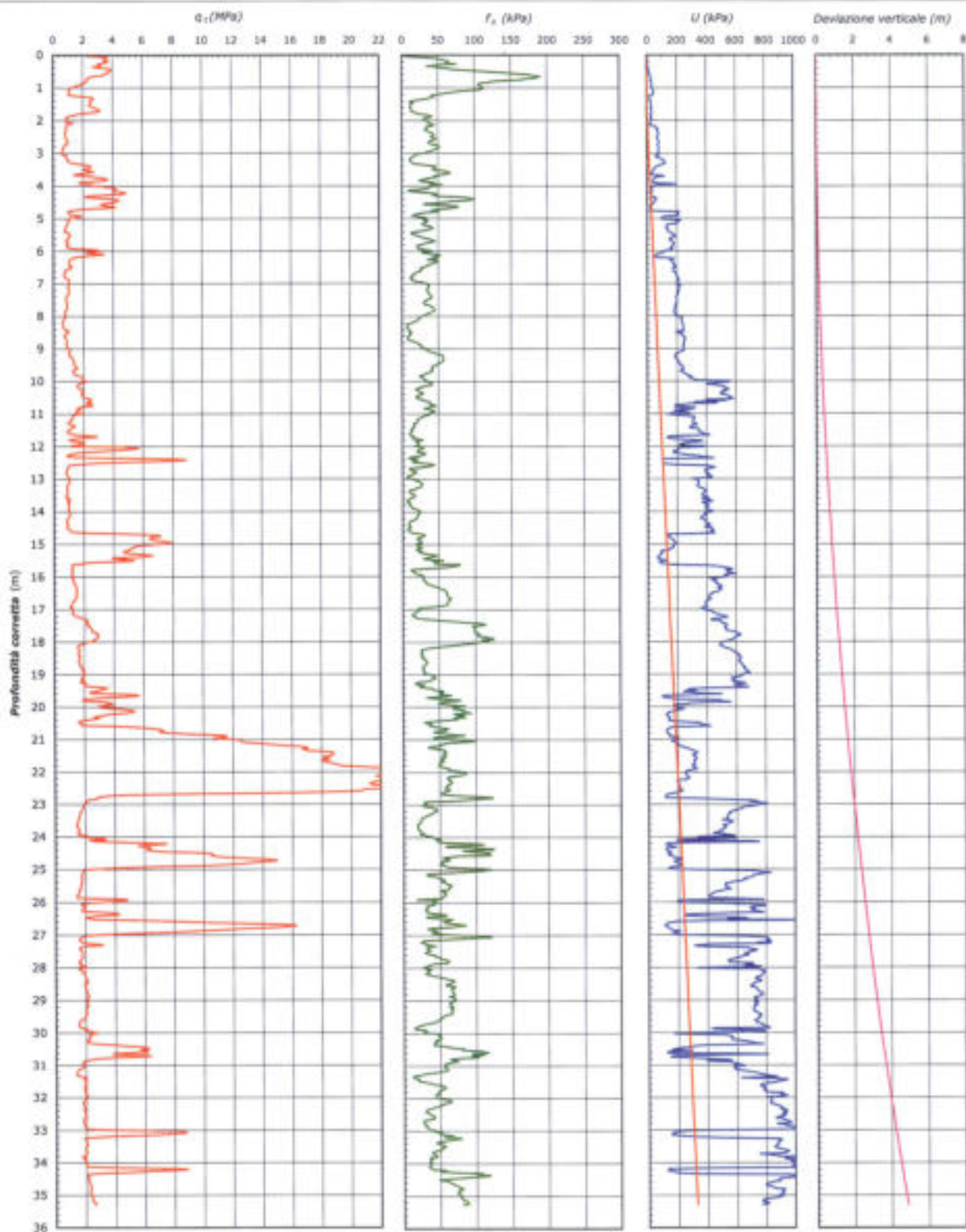
DATA: 02/05/11 PREFORO (m da p.c.):

COMMESSA: 9480/11

TIPO PUNTA: Tecnopenta G1-CPL2IN (matr. 111010) [a = 0.66]

Lat.: 44.546898 Long.: 11.371293

OPERATORE: M. Giommi





elletipi s.r.l.

Sede operativa ed amm. via: Via Annibale Zucchini, 62 - 44100 FERRARA

tel. 0532/56771; fax 0532/56119 e-mail: info@elletipi.it sito: www.elletipi.it

P.IVA e Codice Fiscale n. 00174600367

Lab. accreditato dal Ministero dell'Industria e Trasporti (D.G.S. 11.75. S.T.C. n. 30051 del 29.05.00) e 30050 del 27.05.00

AZIENDA CON SISTEMA DI GESTIONE
INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

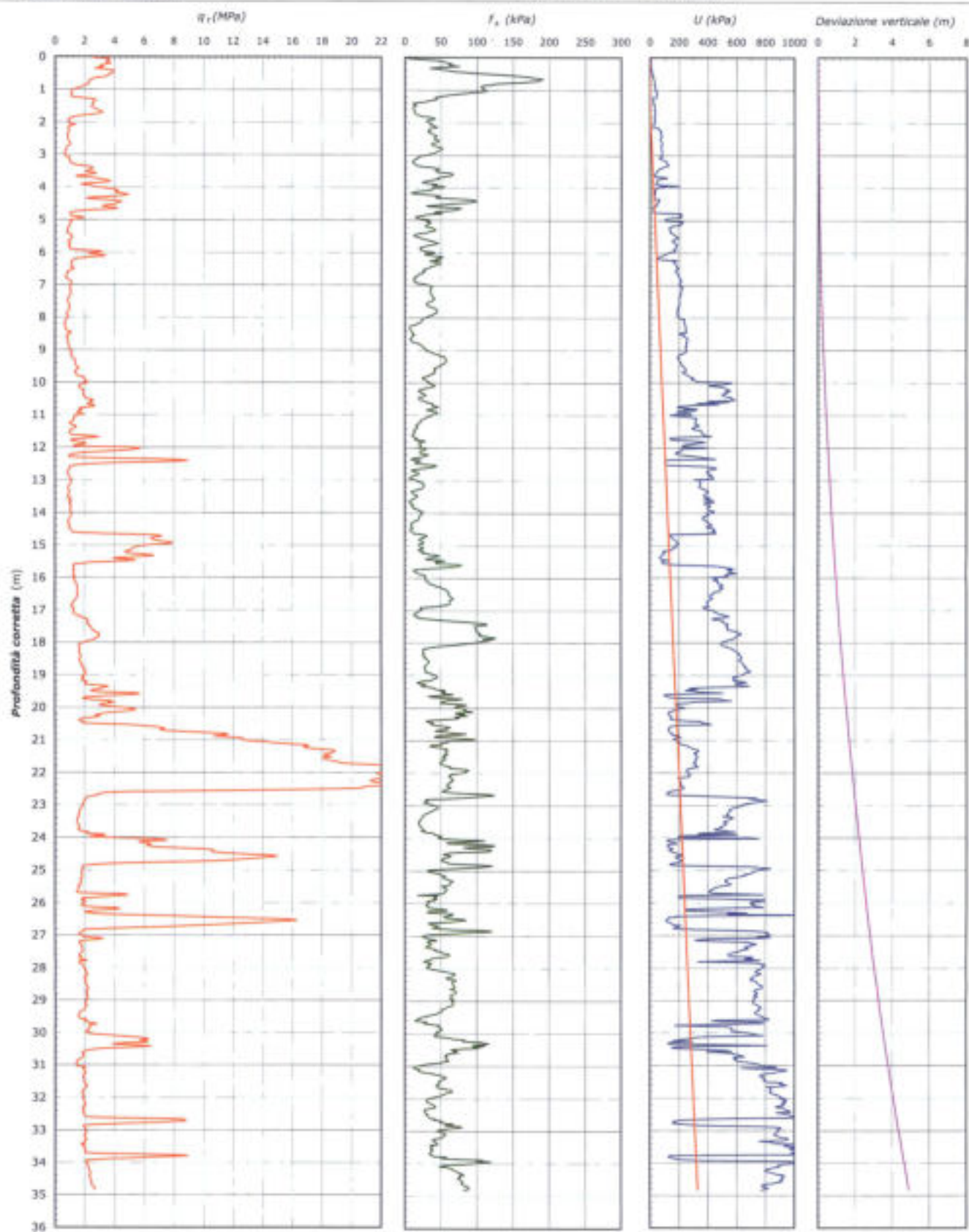
COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF02-B **PROF. FALDA (m da p.c.):** 1.70 **TIPO PUNTA:** Tecnopenta G1-CPL2IN (matr. 111010) [a = 0.66]

DATA: 02/05/11 **PREFORO (m da p.c.):** Lat.: 44.546898 Long.: 11.371293

COMMESSA: 9480/11 **OPERATORE:** M. Giommi





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tel. 0532/56771, fax 0532/56119 e-mail: info@elietipi.it sito: www.elietipi.it
P.IVA e Codice Fiscale n. 0017460387

Laboratorio aut. del Ministero Infrastrutture e Trasporti P.C.B. L. 22/99 e L. 22/01 - in linea al D.P.R. n. 280/01 art. 58 con n. 348/99 Dec. n° 52362 del 30/03/2002

ASSENDA CON SISTEMA DI GESTIONE
INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF02-B PROF. FALDA (m da p.c.): 1.70

DATA: 02/05/11 PREFORO (m da p.c.): 0.25

COMMESSA: 9480/11 C. SITO N°: S110079

TIPO PUNTA: Tecnopenta G1-CPL2IN (matr. 111010)[a = 0.66]

Lat.: 44.546898 Long.: 11.371293

OPERATORE: M. Giommi

prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.
m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi
0.02	2.46	1.95	6.23	0.57	2.02	0.91	34.42	27.59	0.70	4.02	3.18	38.42	43.47	1.61	6.02	2.74	37.75	117.34	2.44	8.02	0.79	26.60	195.78	3.48	8.04	0.75	23.93	237.61	3.48
0.04	3.07	2.50	6.23	0.77	2.04	0.92	37.08	26.37	0.71	4.04	3.56	38.42	34.92	1.62	6.04	2.41	27.42	108.79	2.44	8.04	0.75	23.93	237.61	3.48	8.06	0.72	24.04	237.00	3.49
0.08	3.40	26.06	5.01	0.66	2.06	1.02	36.42	27.59	0.71	4.06	3.86	38.31	32.48	1.65	6.06	2.23	29.53	100.85	2.47	8.06	0.69	23.71	236.39	3.51	8.08	0.69	23.71	236.39	3.51
0.10	3.72	30.83	5.01	0.38	2.08	1.37	35.56	26.37	0.72	4.08	4.08	34.75	31.87	1.65	6.08	2.86	32.53	94.14	2.50	8.08	0.69	23.71	236.39	3.51	8.10	0.66	22.82	234.55	3.51
0.12	3.52	46.28	6.84	0.71	2.10	1.17	40.22	22.71	0.71	4.10	4.23	29.87	32.48	1.64	6.10	3.23	42.97	99.11	2.51	8.10	0.66	22.82	234.55	3.51	8.12	0.62	22.93	233.94	3.52
0.14	3.48	52.39	5.62	0.59	2.12	1.08	41.11	18.44	0.77	4.12	4.18	19.87	32.48	1.67	6.12	3.38	50.31	63.61	2.53	8.12	0.62	22.93	233.94	3.52	8.14	0.61	22.04	233.16	3.52
0.16	3.55	54.73	3.17	0.61	2.14	0.95	44.90	24.54	0.72	4.14	4.04	11.98	33.09	1.66	6.14	2.90	53.08	66.56	2.52	8.14	0.61	22.04	233.16	3.52	8.16	0.61	19.04	236.39	3.52
0.18	3.56	57.95	1.34	0.40	2.16	0.90	43.23	55.07	0.76	4.16	4.04	8.64	34.31	1.68	6.16	2.37	48.86	55.68	2.53	8.16	0.61	19.04	236.39	3.52	8.18	0.58	16.93	237.61	3.55
0.18	3.46	65.18	1.10	0.59	2.18	0.89	37.79	58.12	0.75	4.18	4.35	12.31	35.53	1.68	6.18	1.94	47.97	55.67	2.56	8.18	0.58	16.93	237.61	3.55	8.20	0.57	15.16	239.44	3.58
0.20	3.75	64.96	1.71	0.21	2.20	0.85	35.23	61.78	0.79	4.20	4.60	21.87	33.09	1.68	6.20	1.55	42.08	55.67	2.57	8.20	0.57	15.16	239.44	3.58	8.22	0.56	12.82	241.27	3.59
0.22	3.68	61.41	1.71	0.23	2.22	0.90	33.12	61.78	0.76	4.22	4.90	34.64	31.26	1.70	6.22	1.33	49.53	124.66	2.58	8.22	0.56	12.82	241.27	3.59	8.24	0.57	9.82	242.49	3.58
0.24	3.37	62.41	4.16	0.27	2.24	0.90	33.12	70.94	0.77	4.24	4.84	44.98	29.43	1.70	6.24	1.23	44.94	185.71	2.59	8.24	0.57	9.82	242.49	3.58	8.26	0.58	7.80	242.71	3.59
0.26	3.25	67.53	5.38	0.41	2.26	0.90	34.45	78.88	0.79	4.26	4.53	47.87	28.82	1.70	6.26	1.15	35.08	164.96	2.59	8.26	0.58	7.80	242.71	3.59	8.28	0.61	6.71	244.32	3.61
0.28	3.03	75.54	4.16	0.30	2.28	0.91	32.45	74.60	0.82	4.28	3.97	44.53	28.21	1.68	6.28	1.09	36.64	157.02	2.61	8.28	0.61	6.71	244.32	3.61	8.30	0.61	6.49	244.32	3.62
0.30	3.24	90.44	5.99	0.31	2.30	0.91	32.12	72.16	0.78	4.30	3.37	42.64	28.21	1.72	6.30	1.06	45.86	163.74	2.61	8.30	0.61	6.49	244.32	3.62	8.32	0.63	6.93	245.54	3.63
0.32	3.26	43.78	5.38	0.32	2.32	0.89	35.57	72.16	0.83	4.32	2.61	50.64	24.54	1.71	6.32	1.05	49.08	172.28	2.61	8.32	0.63	6.93	245.54	3.63	8.34	0.63	7.38	246.76	3.66
0.34	3.13	35.46	5.99	0.38	2.34	0.86	36.90	75.21	0.85	4.34	2.15	76.42	28.82	1.74	6.34	1.05	49.75	176.56	2.64	8.34	0.63	7.38	246.76	3.66	8.36	0.65	7.38	246.76	3.66
0.36	2.70	46.91	8.43	0.35	2.36	0.80	38.88	78.27	0.83	4.36	2.20	87.87	54.46	1.73	6.36	1.03	44.53	175.95	2.63	8.36	0.65	7.38	246.76	3.66	8.38	0.66	8.00	246.15	3.68
0.38	2.98	50.25	10.26	0.41	2.38	0.80	41.46	78.88	0.84	4.38	2.87	96.09	63.61	1.74	6.38	1.01	43.41	176.56	2.64	8.38	0.66	8.00	246.15	3.68	8.40	0.72	9.30	247.99	3.69
0.40	3.44	60.70	11.48	0.35	2.40	0.83	43.02	79.49	0.83	4.40	3.62	99.09	63.61	1.76	6.40	1.03	42.19	181.44	2.66	8.42	0.74	9.68	243.10	3.71	8.44	0.81	10.40	243.10	3.71
0.42	3.75	64.38	11.48	0.36	2.42	0.85	44.13	81.93	0.83	4.42	4.15	98.53	56.90	1.74	6.42	1.08	36.83	182.68	2.66	8.44	0.74	9.68	243.10	3.71	8.46	0.98	10.82	251.65	3.72
0.44	3.97	68.06	12.09	0.39	2.44	0.83	43.57	78.88	0.86	4.44	3.43	94.98	53.85	1.75	6.44	1.05	34.97	182.68	2.66	8.46	0.98	10.82	251.65	3.72	8.48	1.01	9.93	257.08	3.73
0.46	3.94	84.62	13.31	0.25	2.46	0.82	42.13	72.77	0.89	4.46	4.40	85.64	52.01	1.74	6.46	1.06	35.08	191.21	2.69	8.46	0.98	10.82	251.65	3.72	8.48	1.01	9.93	257.08	3.73
0.48	3.92	93.52	13.92	0.29	2.48	0.84	40.46	70.33	0.87	4.48	4.23	70.64	48.96	1.75	6.48	1.17	32.98	196.70	2.68	8.48	1.01	9.93	257.08	3.73	8.50	0.92	12.04	198.76	3.75
0.50	3.61	109.63	15.15	0.35	2.50	0.86	39.91	69.11	0.88	4.50	4.16	60.97	47.13	1.77	6.50	1.23	29.74	197.92	2.72	8.50	0.92	12.04	198.76	3.75	8.52	0.81	13.71	210.74	3.75
0.52	3.77	121.87	17.59	0.33	2.52	0.85	41.91	68.50	0.90	4.52	4.03	54.19	47.13	1.78	6.52	1.21	26.07	180.22	2.71	8.52	0.81	13.71	210.74	3.75	8.54	0.83	11.04	235.78	3.77
0.54	3.64	139.32	18.81	0.26	2.54	0.85	46.58	69.72	0.90	4.54	3.72	42.08	44.69	1.78	6.54	1.06	28.29	177.17	2.71	8.54	0.83	11.04	235.78	3.77	8.56	0.81	10.38	233.94	3.79
0.56	3.66	150.44	20.64	0.39	2.56	0.85	46.36	72.77	0.91	4.56	3.41	29.97	42.24	1.78	6.56	0.97	27.18	175.95	2.72	8.56	0.81	10.38	233.94	3.79	8.58	0.72	11.16	229.67	3.79
0.58	3.59	161.23	21.86	0.28	2.58	0.86	47.02	77.05	0.91	4.58	3.23	33.55	24.54	1.83	6.58	0.91	24.96	175.34	2.74	8.58	0.72	11.16	229.67	3.79	8.60	0.66	10.16	242.49	3.82
0.60	3.42	173.68	23.08	0.32	2.60	0.91	44.13	81.32	0.92	4.60	3.21	52.99	22.71	1.81	6.60	0.80	26.52	175.34	2.75	8.60	0.66	10.16	242.49	3.82	8.62	0.70	9.27	250.43	3.83
0.62	3.35	176.82	23.08	0.30	2.62	0.95	41.80	83.15	0.93	4.62	3.52	75.55	30.04	1.83	6.62	0.75	25.74	180.22	2.75	8.62	0.70	9.27	250.43	3.83	8.64	0.73	8.16	255.31	3.82
0.64	2.91	184.92	24.91	0.37	2.64	1.05	39.47	81.32	0.93	4.64	4.05	77.99	26.37	1.83	6.64	0.78	23.29	188.16	2.74	8.64	0.73	8.16	255.31	3.82	8.66	0.74	7.49	258.97	3.84
0.66	2.71	191.26	26.13	0.43	2.66	1.03	36.80	80.10	0.96	4.66	4.20	72.21	25.15	1.85	6.66	0.78	20.85	194.87	2.77	8.66	0.74	7.49	258.97	3.84	8.68	0.75	7.49	258.97	3.84
0.68	2.54	187.27	27.36	0.36	2.68	1.02	37.03	81.32	0.95	4.68	3.75	71.88	23.93	1.85	6.68	0.75	17.96	195.48	2.79	8.68	0.75	7.49	258.97	3.84	8.70	0.79	8.38	257.75	3.88
0.70	2.42	185.83	27.97	0.32	2.70	0.98	38.03	76.43	0.97	4.70	2.87	65.99	22.71	1.86	6.70	0.76	17.29	197.92	2.81	8.70	0.79	8.38	257.75	3.88	8.72	0.79	9.16	257.75	3.88
0.72	2.33	184.51	28.58	0.39	2.72	0.96	40.58	75.82	0.99	4.72	2.14	53.21	21.49	1.86	6.72	0.73	17.29	199.15	2.81	8.72	0.79	9.16	257.75	3.88	8.74	0.81	10.16	255.31	3.88
0.74	2.33	170.18	29.80	0.35	2.74	0.88	44.91	75.82	1.00	4.74	1.65	43.66	22.71	1.87	6.74	0.70	14.07	197.92	2.82	8.74	0.81	10.16	255.31	3.88	8.76	0.81	12.38	249.82	3.89
0.76	2.32	147.20	30.41	0.38	2.76	0.80	49.25	76.43	0.96	4.76	1.30	40.88	34.31	1.86	6.76	0.66	14.84	198.53	2.82	8.76	0.81	12.38	249.82	3.89	8.78	0.81	15.71	252.26	3.89
0.78	2.32	140.23	31.02	0.43	2.78	0.78	50.92	79.49	1.00	4.78	0.99	49.10	141.15	1.86	6.78	0.66	14.95	204.03	2.85	8.78	0.81	15.71	252.26	3.89	8.80	0.80	18.71	251.65	3.92
0.80	2.31	137.43	31.63	0.39	2.80	0.74	51.47	78.88	0.99	4.80	0.97	51.32	219.29	1.89	6.80	0.70	12.29	205.86	2.85	8.80	0.80	18.71	251.65	3.92	8.82	0.80	20.27	251.65	3.92
0.82	2.23	121.77	32.24	0.44	2.82	0.71	51.81	80.10	1.00	4.82	0.97	32.21	214.41	1.89	6.82	0.76	12.07	209.52	2.87	8.82	0.80	20.27	251.65	3.92	8.84	0.81	21.16	249.82	3.93
0.84	2.11	119.56	33.46	0.42	2.84	0.69	50.92	80.71	1.01	4.84	0.97	26.99	207.69	1.92	6.84	0.82	11.73	211.36	2.89	8.84	0.8								

Lo Sperimentatore:
dott. Massimo Romagnoli

S110079-BF02-B_CPTU.ab - pag. 1 di 6

Il Direttore Settore Prove in Sito:
dott. geol. Gianluca Ferioli

COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste
CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE
PROVA N°: CPTU BF02-B PROF. FALDA (m da p.c.): 1.70
DATA: 02/05/11 PREFORO (m da p.c.):
COMMESSA: 9480/11 C. SITO N°: S110079
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Lat.: 44.546898 Long.: 11.371293
OPERATORE: M. Giommi

prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.
m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi
10.02	1.96	34.36	584.22	4.36	12.02	4.65	29.25	376.19	5.21	14.02	0.96	23.26	439.88	6.10	16.02	1.22	28.43	506.84	7.11	18.02	2.11	104.54	515.38	7.95	20.02	1.93	99.32	503.17	7.94
10.04	1.88	36.14	525.76	4.37	12.04	5.67	28.91	227.23	5.23	14.04	0.97	22.93	385.96	6.11	16.04	1.11	29.21	418.93	7.12	18.04	1.93	99.32	503.17	7.94	20.04	1.83	93.99	497.68	7.96
10.06	1.77	39.03	501.95	4.37	12.06	5.62	29.14	215.02	5.23	14.06	0.97	23.04	395.12	6.13	16.06	1.11	29.10	456.17	7.11	18.06	1.83	93.99	497.68	7.96	20.06	1.72	83.76	492.80	7.97
10.08	1.68	39.91	410.99	4.39	12.08	5.32	26.58	215.02	5.25	14.08	0.98	22.37	403.66	6.14	16.08	1.17	28.21	465.93	7.13	18.08	1.72	83.76	492.80	7.97	20.08	1.59	77.98	490.35	7.97
10.10	1.54	41.80	410.38	4.39	12.10	4.98	22.91	213.19	5.24	14.10	1.00	21.26	401.22	6.13	16.10	1.19	28.43	462.27	7.14	18.10	1.59	77.98	490.35	7.97	20.10	1.46	68.87	492.80	7.98
10.12	1.46	39.69	449.45	4.41	12.12	4.50	21.47	205.25	5.25	14.12	0.97	20.26	392.67	6.14	16.12	1.13	30.43	438.46	7.14	18.12	1.46	68.87	492.80	7.98	20.12	1.34	58.98	501.95	8.00
10.14	1.43	34.47	494.02	4.41	12.14	3.83	21.70	188.77	5.25	14.14	0.95	20.48	379.85	6.15	16.14	1.13	31.88	468.38	7.15	18.14	1.44	58.98	501.95	8.00	20.14	1.34	49.76	512.94	8.02
10.16	1.48	31.69	509.89	4.41	12.16	2.92	20.93	178.39	5.26	14.16	0.92	20.37	383.88	6.17	16.16	1.15	32.66	467.77	7.16	18.16	1.43	49.76	512.94	8.02	20.16	1.43	41.32	524.54	8.01
10.18	1.50	28.03	525.76	4.41	12.18	2.19	22.03	174.73	5.26	14.18	0.91	19.82	364.59	6.18	16.18	1.18	32.88	472.65	7.16	18.18	1.43	41.32	524.54	8.01	20.18	1.44	36.21	536.75	8.02
10.20	1.51	24.81	531.26	4.42	12.20	1.68	26.91	179.00	5.30	14.20	0.86	19.93	365.20	6.18	16.20	1.23	32.54	470.21	7.17	18.20	1.44	36.21	536.75	8.02	20.20	1.46	32.09	550.79	8.01
10.22	1.55	21.58	539.80	4.41	12.22	1.33	32.14	200.37	5.31	14.22	0.84	18.82	363.37	6.20	16.22	1.25	34.99	467.13	7.18	18.22	1.46	32.09	550.79	8.01	20.22	1.49	26.65	563.00	8.01
10.24	1.65	19.70	552.62	4.42	12.24	1.07	31.47	236.39	5.31	14.24	0.80	18.04	377.41	6.21	16.24	1.28	38.11	484.25	7.20	18.24	1.49	26.65	563.00	8.01	20.24	1.49	25.20	571.55	8.04
10.26	1.76	18.70	555.68	4.44	12.26	0.91	28.58	268.13	5.32	14.26	0.81	15.15	392.06	6.21	16.26	1.31	40.35	488.52	7.18	18.26	1.49	25.20	571.55	8.04	20.26	1.48	25.31	575.82	8.03
10.28	1.76	20.25	518.44	4.43	12.28	0.84	25.47	312.09	5.33	14.28	0.80	12.82	393.89	6.20	16.28	1.34	42.33	505.01	7.21	18.28	1.48	25.31	575.82	8.03	20.28	1.47	26.31	584.37	8.04
10.30	1.76	23.03	535.53	4.44	12.30	0.83	20.36	352.99	5.34	14.30	0.77	11.26	394.51	6.22	16.30	1.35	45.77	497.07	7.23	18.30	1.47	26.31	584.37	8.04	20.30	1.47	25.98	592.31	8.06
10.32	1.76	23.03	535.53	4.46	12.32	0.85	16.14	377.41	5.36	14.32	0.74	9.82	393.89	6.23	16.32	1.36	48.86	491.57	7.22	18.32	1.47	25.98	592.31	8.06	20.32	1.44	26.65	595.02	8.07
10.34	1.79	24.70	518.44	4.46	12.34	1.36	11.89	409.16	5.36	14.34	0.73	9.82	399.39	6.26	16.34	1.35	50.88	476.92	7.21	18.34	1.44	26.65	595.02	8.07	20.34	1.43	26.67	605.13	8.08
10.36	1.78	27.92	500.76	4.46	12.36	1.44	9.14	452.50	5.39	14.36	0.75	9.93	409.16	6.27	16.36	1.36	52.77	497.68	7.24	18.36	1.43	26.67	605.13	8.08	20.36	1.41	26.65	613.67	8.07
10.38	1.73	29.14	508.66	4.47	12.38	1.47	11.25	453.97	5.39	14.38	0.80	9.15	423.20	6.27	16.38	1.37	54.99	505.01	7.25	18.38	1.41	26.65	613.67	8.07	20.38	1.47	24.76	621.00	8.11
10.40	1.76	28.36	500.12	4.47	12.40	1.40	21.14	104.52	5.39	14.40	0.85	8.58	425.64	6.28	16.40	1.37	57.77	491.57	7.24	18.40	1.47	24.76	621.00	8.11	20.40	1.52	25.21	624.66	8.11
10.42	1.72	26.36	517.83	4.47	12.42	1.89	21.80	102.68	5.41	14.42	0.86	9.59	426.25	6.30	16.42	1.38	58.66	488.08	7.25	18.42	1.52	25.21	624.66	8.11	20.42	1.52	25.76	616.73	8.11
10.44	1.76	22.70	541.64	4.47	12.44	1.80	17.47	105.74	5.40	14.44	0.85	9.82	412.21	6.30	16.44	1.38	58.99	484.86	7.27	18.44	1.52	25.76	616.73	8.11	20.44	1.49	27.87	621.61	8.12
10.46	1.84	19.81	554.46	4.50	12.46	1.58	14.47	106.35	5.43	14.46	0.80	11.04	399.01	6.30	16.46	1.37	60.22	483.64	7.27	18.46	1.49	27.87	621.61	8.12	20.46	1.52	28.76	631.99	8.12
10.48	1.84	19.81	565.45	4.51	12.48	1.51	14.03	105.13	5.43	14.48	0.77	11.59	397.56	6.32	16.48	1.38	60.44	450.06	7.28	18.48	1.52	28.76	631.99	8.12	20.48	1.50	33.21	637.48	8.21
10.50	1.89	19.14	560.56	4.52	12.50	1.63	16.80	103.91	5.44	14.50	0.79	9.15	420.76	6.34	16.50	1.37	61.66	437.85	7.28	18.50	1.53	27.32	636.26	8.12	20.50	1.53	27.32	636.26	8.12
10.52	2.00	20.36	578.88	4.54	12.52	1.72	25.13	105.13	5.45	14.52	0.84	7.59	440.90	6.35	16.52	1.37	61.99	442.73	7.30	18.52	1.54	27.32	636.26	8.12	20.52	1.54	27.32	636.26	8.12
10.54	2.14	22.70	589.87	4.52	12.54	2.00	37.58	112.45	5.44	14.54	0.90	7.37	446.40	6.35	16.54	1.38	60.77	432.97	7.31	18.54	1.52	30.32	632.60	8.15	20.54	1.52	30.32	632.60	8.15
10.56	2.37	25.14	537.36	4.55	12.56	1.45	44.13	175.95	5.46	14.56	0.92	7.48	434.80	6.40	16.56	1.41	61.11	421.37	7.31	18.56	1.47	30.87	626.50	8.18	20.56	1.46	31.43	617.95	8.19
10.58	2.32	28.92	401.83	4.55	12.58	1.14	42.69	324.91	5.47	14.58	0.95	8.93	440.90	6.41	16.58	1.38	61.99	417.10	7.33	18.58	1.46	31.43	617.95	8.19	20.58	1.43	32.10	615.51	8.16
10.60	2.10	30.25	542.25	4.57	12.60	0.91	40.02	407.33	5.48	14.60	0.98	10.15	453.11	6.40	16.60	1.38	62.32	420.15	7.32	18.60	1.43	32.10	615.51	8.16	20.60	1.43	33.65	621.61	8.18
10.62	2.30	31.47	487.30	4.57	12.62	0.84	35.36	434.80	5.50	14.62	1.02	10.71	445.79	6.43	16.62	1.40	63.10	417.09	7.34	18.62	1.43	33.65	621.61	8.18	20.62	1.46	33.65	636.16	8.21
10.64	2.41	37.81	344.44	4.58	12.64	0.83	27.91	458.61	5.50	14.64	1.14	11.71	417.09	6.44	16.64	1.37	65.21	415.26	7.35	18.64	1.46	33.65	636.16	8.21	20.64	1.50	33.21	637.48	8.21
10.66	2.18	38.70	321.25	4.59	12.66	0.85	20.02	456.78	5.49	14.66	1.09	12.99	456.78	6.47	16.66	1.35	66.32	423.81	7.34	18.66	1.50	33.21	637.48	8.21	20.66	1.53	32.43	639.32	8.22
10.68	2.03	39.25	472.65	4.59	12.68	0.85	12.91	431.75	5.52	14.68	1.19	22.04	318.19	6.50	16.68	1.34	67.21	432.36	7.36	18.68	1.53	32.43	639.32	8.22	20.68	1.55	31.54	642.90	8.24
10.70	2.14	37.70	291.94	4.61	12.70	0.84	9.24	414.04	5.52	14.70	1.05	28.99	139.32	6.53	16.70	1.29	65.99	425.03	7.36	18.70	1.55	31.54	642.90	8.24	20.70	1.53			



elietipi s.r.l.

Sede operativa ed ammi. in: Via Annibale Zucchini, 69 - 44100 FERRARA
tel. 053256771, fax 053256119 e-mail: info@elietipi.it sito: www.elietipi.it
P.IVA e Codice Fiscale n. 00174000387

Laboratorio aut. del Ministero Infrastrutture e Trasporti P.C.S. LL.PP. S.T.C. Urbana e D.P.R. n. 30501 art. 58 ult. n. 349989 Dec. n° 53262 del 05/03/2005

AZIENDA CON SISTEMA DI GESTIONE
INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF02-B PROF. FALDA (m da p.c.): 1.70 TIPO PUNTA: Tecnopenta G1-CPL2IN (matr. 111010)[a = 0.66]

DATA: 02/05/11 PREFORO (m da p.c.): LAT.: 44.546898 Long.: 11.371293

COMMESSA: 9480/11 C. SITO N°: S110079 OPERATORE: M. Giommi

prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.	prof.	qc	fs	U	incl.
m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi
20.02	2.95	71.79	190.60	8.79	22.02	22.59	88.50	252.87	9.82	24.02	1.99	41.18	332.23	10.74	26.02	2.58	44.87	202.20	11.65	28.02	1.72	28.78	332.23	12.80	30.02	1.40	37.45	576.43	12.81	32.02	1.37	36.89	746.13	12.83
20.04	3.34	74.34	195.48	8.82	22.04	22.43	85.16	252.87	9.82	24.04	2.29	43.63	399.02	10.75	26.04	2.05	44.31	499.51	11.66	28.04	1.40	37.45	576.43	12.81	30.04	1.37	36.89	746.13	12.83	32.04	1.37	36.89	746.13	12.83
20.06	3.67	69.01	227.84	8.79	22.06	22.25	84.83	255.31	9.83	24.06	3.19	48.40	454.33	10.78	26.06	1.61	39.20	610.01	11.67	28.06	1.37	36.89	746.13	12.83	30.06	1.42	32.89	758.36	12.84	32.06	1.47	32.22	772.40	12.85
20.08	4.37	76.90	243.10	8.81	22.08	22.11	85.16	257.75	9.83	24.08	3.31	51.74	216.24	10.77	26.08	1.49	41.87	796.66	11.69	28.08	1.42	32.89	758.36	12.84	30.08	1.47	32.22	772.40	12.85	32.08	1.47	32.22	772.40	12.85
20.10	4.81	84.45	199.15	8.81	22.10	22.07	78.94	261.42	9.86	24.10	2.78	46.74	192.43	10.81	26.10	1.61	31.96	796.82	11.69	28.10	1.47	32.22	772.40	12.85	30.10	1.54	33.78	796.21	12.86	32.10	1.54	33.78	796.21	12.86
20.12	5.12	81.12	194.87	8.82	22.12	21.81	73.38	259.58	9.87	24.12	2.27	45.96	220.51	10.79	26.12	1.76	31.43	796.11	11.70	28.12	1.54	33.78	796.21	12.86	30.12	1.62	35.22	795.60	12.88	32.12	1.62	35.22	795.60	12.88
20.14	5.37	84.45	188.16	8.80	22.14	21.60	67.71	262.64	9.89	24.14	2.44	46.63	707.69	10.84	26.14	1.81	33.31	737.00	11.72	28.14	1.62	35.22	795.60	12.88	30.14	1.61	34.34	782.17	12.89	32.14	1.65	30.13	790.72	12.90
20.16	5.29	85.45	158.85	8.81	22.16	21.98	63.15	274.85	9.88	24.16	3.66	52.08	754.70	10.85	26.16	1.73	33.09	695.48	11.72	28.16	1.61	34.34	782.17	12.89	30.16	1.68	31.00	776.68	12.91	32.16	1.68	31.00	776.68	12.91
20.18	5.21	89.57	147.25	8.82	22.18	22.36	61.49	278.51	9.90	24.18	5.57	67.41	273.02	10.88	26.18	1.68	32.09	699.76	11.72	28.18	1.65	30.13	790.72	12.90	30.18	1.78	47.95	754.09	12.96	32.18	1.78	47.95	754.09	12.96
20.20	4.78	94.12	131.99	8.82	22.20	22.60	60.82	276.07	9.91	24.20	6.83	92.08	331.99	10.89	26.20	1.65	31.87	722.95	11.72	28.20	1.68	31.00	776.68	12.91	30.20	1.82	55.67	723.56	13.09	32.20	1.82	55.67	723.56	13.09
20.22	4.25	72.12	133.21	8.82	22.22	22.36	61.82	267.52	9.93	24.22	7.49	110.32	123.44	10.89	26.22	1.61	29.54	698.53	11.74	28.22	1.71	34.89	773.63	12.93	30.22	1.73	38.67	772.40	12.94	32.22	1.73	38.67	772.40	12.94
20.24	3.77	70.67	128.94	8.82	22.24	21.97	64.92	258.97	9.94	24.24	7.31	95.29	138.56	10.88	26.24	1.56	31.43	706.47	11.75	28.24	1.73	38.67	772.40	12.94	30.24	1.73	44.12	769.96	12.95	32.24	1.73	44.12	769.96	12.95
20.26	3.34	83.01	124.05	8.83	22.26	22.17	64.03	262.20	9.96	24.26	6.35	82.41	132.60	10.87	26.26	1.56	32.09	718.07	11.77	28.26	1.73	44.12	769.96	12.95	30.26	1.73	44.12	769.96	12.95	32.26	1.73	44.12	769.96	12.95
20.28	3.13	81.11	128.94	8.83	22.28	22.01	64.02	194.26	9.95	24.28	5.57	58.30	150.92	10.88	26.28	1.63	32.87	737.00	11.77	28.28	1.78	47.95	754.09	12.96	30.28	1.78	47.95	754.09	12.96	32.28	1.78	47.95	754.09	12.96
20.30	2.94	75.11	135.65	8.83	22.30	21.71	65.13	195.48	9.97	24.30	5.69	60.41	178.39	10.88	26.30	1.90	31.65	760.81	11.77	28.30	1.80	51.56	737.00	12.98	30.30	1.79	56.58	744.32	12.99	32.30	1.79	56.58	744.32	12.99
20.32	2.66	86.55	137.48	8.83	22.32	21.58	67.35	199.15	9.99	24.32	6.07	63.83	187.55	10.91	26.32	2.58	33.98	785.84	11.80	28.32	1.79	56.58	744.32	12.99	30.32	1.82	69.67	723.56	13.09	32.32	1.82	69.67	723.56	13.09
20.34	2.96	70.78	147.86	8.86	22.34	21.40	66.46	204.64	10.01	24.34	6.34	112.43	141.15	10.89	26.34	3.57	41.76	561.78	11.80	28.34	1.84	63.56	727.84	13.01	30.34	1.82	69.67	723.56	13.09	32.34	1.82	69.67	723.56	13.09
20.36	2.94	70.72	147.86	8.85	22.36	21.22	66.35	202.20	10.02	24.36	6.41	124.52	121.00	10.89	26.36	4.11	49.98	371.31	11.80	28.36	1.84	63.56	727.84	13.01	30.36	1.82	69.67	723.56	13.09	32.36	1.82	69.67	723.56	13.09
20.38	2.79	75.77	146.64	8.85	22.38	21.28	63.34	208.30	10.03	24.38	6.22	123.30	116.73	10.91	26.38	4.25	58.65	265.08	11.80	28.38	1.82	69.67	723.56	13.09	30.38	1.82	69.67	723.56	13.09	32.38	1.82	69.67	723.56	13.09
20.40	2.42	73.22	139.93	8.86	22.40	21.42	61.34	210.13	10.03	24.40	5.14	95.96	121.00	10.92	26.40	3.91	58.43	245.54	11.82	28.40	1.82	69.67	723.56	13.09	30.40	1.92	69.67	723.56	13.09	32.40	1.92	69.67	723.56	13.09
20.42	2.05	59.66	138.71	8.88	22.42	21.74	61.78	210.13	10.05	24.42	6.39	81.96	128.94	10.92	26.42	3.28	43.76	250.43	11.81	28.42	1.92	69.67	723.56	13.09	30.42	1.95	67.96	746.60	13.06	32.42	1.95	67.96	746.60	13.06
20.44	1.77	50.33	153.97	8.88	22.44	22.19	60.11	210.74	10.08	24.44	8.81	88.29	131.99	10.94	26.44	2.58	31.32	335.29	11.83	28.44	1.95	67.96	746.60	13.06	30.44	1.95	67.96	746.60	13.06	32.44	1.95	67.96	746.60	13.06
20.46	1.83	57.77	199.76	8.89	22.46	22.61	58.78	212.58	10.06	24.46	7.48	100.07	139.32	10.96	26.46	2.10	31.54	442.12	11.85	28.46	1.95	67.96	746.60	13.06	30.46	1.95	67.96	746.60	13.06	32.46	1.95	67.96	746.60	13.06
20.48	1.53	59.99	260.81	8.91	22.48	22.52	58.66	208.30	10.07	24.48	8.70	110.51	136.41	10.96	26.48	1.83	41.65	603.30	11.86	28.48	1.95	67.96	746.60	13.06	30.48	1.95	67.96	746.60	13.06	32.48	1.95	67.96	746.60	13.06
20.50	1.60	30.43	352.99	8.92	22.50	22.34	58.89	211.97	10.08	24.50	9.89	119.63	154.58	10.97	26.50	2.01	58.99	668.62	11.87	28.50	1.76	61.12	716.05	13.10	30.50	1.76	61.12	716.05	13.10	32.50	1.76	61.12	716.05	13.10
20.52	1.71	34.65	351.77	8.93	22.52	22.08	58.11	210.13	10.10	24.52	10.39	119.85	131.38	10.99	26.52	2.31	67.21	537.97	11.89	28.52	1.70	57.34	708.30	13.11	30.52	1.73	59.12	700.37	13.13	32.52	1.73	59.12	700.37	13.13
20.54	1.73	39.32	356.04	8.93	22.54	20.95	63.76	221.73	10.12	24.54	10.59	119.96	134.43	10.99	26.54	2.63	62.87	552.01	11.89	28.54	1.73	59.12	700.37	13.13	30.54	1.73	59.12	700.37	13.13	32.54	1.73	59.12	700.37	13.13
20.56	1.68	37.10	379.85	8.95	22.56	20.76	63.75	230.28	10.12	24.56	10.58	110.07	139.32	11.02	26.56	4.12	64.99	***	11.89	28.56	1.77	63.59	705.86	13.14	30.56	1.77	63.59	705.86	13.14	32.56	1.77	63.59	705.86	13.14
20.58	2.14	36.09	403.05	8.96	22.58	20.76	61.64	233.94	10.14	24.58	10.51	73.73	149.69	11.01	26.58	6.34	60.32	437.85	11.90	28.58	1.83	71.12	711.97	13.15	30.58	1.83	71							



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Sede operativa ed ammi. via Annibale Zucchini, 69 - 44100 FERRARA
tel. 053256771, fax 053256119 e-mail: info@elietipi.it sito: www.elietipi.it
P.IVA e Codice Fiscale n. 00174000387

Laboratorio aut. del Ministero dell'Università e della Ricerca P.C.B. 11, P.P. S.T.C. - idoneità al D.P.R. n. 3089/98 Dec. n° 52392 del 08/05/2009

AZIENDA CON SISTEMA DI GESTIONE
INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF02-B PROF. FALDA (m da p.c.): 1.70 TIPO PUNTA: Tecnopenta G1-CPL2IN (matr. 111010) (a = 0.66)

DATA: 02/05/11 PREFORO (m da p.c.): Lat.: 44.546898 Long.: 11.371293

COMMESSA: 9480/11 C. SITO N°: S110079 OPERATORE: M. Giommi

prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi	prof. m	qc Mpa	fs kPa	U kPa	incl. gradi
30.02	2.68	47.81	371.31	14.05	32.02	1.84	50.71	826.74	15.30	34.02	1.85	38.59	994.02	16.54										
30.04	2.21	45.48	173.50	14.06	32.04	1.77	55.82	832.23	15.31	34.04	1.88	36.48	998.90	16.56										
30.06	2.18	47.48	315.75	14.07	32.06	1.72	59.93	839.56	15.32	34.06	1.72	35.93	****	16.57										
30.08	2.19	47.48	526.98	14.09	32.08	1.67	64.49	842.00	15.33	34.08	1.73	35.71	****	16.58										
30.10	2.20	50.92	547.74	14.10	32.10	1.67	64.71	842.00	15.35	34.10	1.73	35.93	885.74	16.59										
30.12	2.16	50.03	584.22	14.11	32.12	1.62	65.49	834.07	15.36	34.12	1.69	33.82	979.36	16.61										
30.14	2.12	51.25	569.11	14.12	32.14	1.56	65.26	831.01	15.37	34.14	1.97	34.59	****	16.62										
30.16	2.03	51.59	588.72	14.14	32.16	1.57	60.38	834.88	15.38	34.16	1.47	38.26	****	16.63										
30.18	2.02	49.48	569.11	14.15	32.18	1.58	55.60	829.79	15.40	34.18	6.33	39.04	485.93	16.64										
30.20	2.04	46.37	570.33	14.16	32.20	1.55	54.15	839.56	15.41	34.20	8.56	39.48	139.93	16.66										
30.22	2.09	43.81	563.00	14.17	32.22	1.55	53.15	852.99	15.42	34.22	8.86	58.04	127.72	16.67										
30.24	2.00	45.70	605.13	14.19	32.24	1.57	50.49	865.81	15.43	34.24	7.98	54.15	129.55	16.68										
30.26	1.88	47.04	632.60	14.20	32.26	1.58	48.04	882.29	15.45	34.26	6.48	50.71	135.04	16.69										
30.28	1.86	45.04	671.67	14.21	32.28	1.61	44.82	894.50	15.46	34.28	5.79	57.37	169.84	16.71										
30.30	1.91	42.15	750.37	14.22	32.30	1.62	40.93	898.78	15.47	34.30	4.97	76.93	178.39	16.72										
30.32	1.97	41.26	715.63	14.24	32.32	1.62	38.15	907.33	15.48	34.32	3.71	108.38	182.05	16.73										
30.34	2.35	43.93	738.83	14.25	32.34	1.63	35.82	919.54	15.50	34.34	2.81	99.71	238.83	16.74										
30.36	3.01	41.48	783.39	14.26	32.36	1.61	32.04	898.78	15.51	34.36	2.24	110.04	359.10	16.76										
30.38	3.66	42.70	570.33	14.27	32.38	1.58	30.71	928.69	15.52	34.38	1.77	119.04	954.33	16.77										
30.40	4.32	53.48	411.60	14.29	32.40	1.60	30.15	943.34	15.53	34.40	1.73	108.71	****	16.78										
30.42	4.94	61.04	316.36	14.30	32.42	1.62	30.93	945.79	15.55	34.42	1.77	97.71	****	16.79										
30.44	5.42	64.26	355.37	14.31	32.44	1.63	30.37	924.42	15.56	34.44	1.78	87.93	****	16.81										
30.46	5.80	68.93	274.24	14.32	32.46	1.65	30.93	918.92	15.57	34.46	1.86	74.26	965.32	16.82										
30.48	6.16	81.70	236.39	14.34	32.48	1.65	33.93	925.03	15.58	34.48	1.89	59.71	920.76	16.83										
30.50	6.18	83.48	204.03	14.35	32.50	1.66	35.71	942.12	15.60	34.50	1.91	50.59	895.12	16.84										
30.52	5.85	80.37	174.73	14.36	32.52	1.68	35.82	927.47	15.61	34.52	1.91	48.26	884.13	16.86										
30.54	5.65	88.81	158.24	14.37	32.54	1.68	37.59	910.99	15.62	34.54	1.89	53.48	893.28	16.87										
30.56	5.96	108.83	293.16	14.39	32.56	1.67	41.37	912.82	15.63	34.56	1.89	59.59	898.78	16.88										
30.58	6.18	109.36	162.52	14.40	32.58	1.73	42.48	931.75	15.65	34.58	1.93	61.59	870.70	16.89										
30.60	5.67	116.81	130.77	14.41	32.60	1.77	40.82	904.27	15.66	34.60	1.92	64.81	846.28	16.91										
30.62	4.80	110.48	125.27	14.42	32.62	1.73	42.48	875.58	15.67	34.62	2.00	66.70	831.01	16.92										
30.64	4.04	94.25	136.26	14.44	32.64	1.62	39.37	869.47	15.68	34.64	2.03	67.92	816.97	16.93										
30.66	3.66	110.81	352.62	14.45	32.66	1.55	37.15	899.39	15.70	34.66	2.04	69.47	806.59	16.94										
30.68	4.55	107.59	812.09	14.46	32.68	1.55	32.26	921.37	15.71	34.68	2.03	71.14	796.21	16.96										
30.70	5.86	94.47	459.83	14.47	32.70	1.56	27.93	932.97	15.72	34.70	2.03	73.91	804.15	16.97										
30.72	6.36	101.36	189.38	14.49	32.72	1.56	26.48	942.73	15.73	34.72	2.07	75.13	818.19	16.98										
30.74	5.72	102.82	156.41	14.50	32.74	1.56	27.26	949.45	15.75	34.74	2.07	77.13	835.29	16.99										
30.76	4.67	82.91	149.08	14.51	32.76	1.57	28.04	985.32	15.76	34.76	2.07	79.47	848.11	17.01										
30.78	3.56	71.47	251.65	14.52	32.78	1.57	27.93	973.28	15.77	34.78	2.08	81.02	863.98	17.02										
30.80	2.88	64.03	361.54	14.54	32.80	1.57	27.93	976.31	15.78	34.80	2.07	82.34	877.41	17.03										
30.82	2.42	68.47	462.27	14.55	32.82	1.68	30.50	875.58	15.80	34.82	2.05	76.73	919.54	17.04										
30.84	2.15	72.02	532.48	14.56	32.84	1.60	31.50	906.71	15.81	34.84	2.01	75.62	932.36	17.06										
30.86	1.91	67.69	561.17	14.57	32.86	1.60	29.50	937.24	15.82	34.86	2.04	77.51	917.09	17.07										
30.88	1.91	75.22	393.28	14.59	32.88	1.60	31.05	952.50	15.83	34.88	2.01	76.18	912.82	17.08										
30.90	1.71	66.88	479.98	14.60	32.90	1.60	32.17	963.49	15.85	34.90	1.98	74.84	908.54	17.09										
30.92	1.64	63.33	562.39	14.61	32.92	1.64	33.39	989.13	15.86	34.92	2.02	73.28	911.60	17.11										
30.94	1.67	59.66	572.16	14.62	32.94	1.69	33.94	****	15.87	34.94	2.02	76.28	924.42	17.12										
30.96	1.66	55.88	583.15	14.64	32.96	1.75	34.50	****	15.88	34.96	2.03	77.39	922.59	17.13										
30.98	1.66	58.33	605.74	14.65	32.98	1.90	35.72	****	15.90	34.98	2.07	78.17	917.70	17.14										
31.00	1.70	58.66	626.50	14.66	33.00	3.46	42.61	588.64	15.91	35.00	2.09	78.17	894.50	17.16										
31.02	1.70	57.33	643.59	14.67	33.02	6.39	39.61	386.57	15.92	35.02	2.09	80.72	910.38	17.17										
31.04	1.72	56.00	652.75	14.69	33.04	8.34	44.28	248.60	15.93	35.04	2.14	80.39	909.77	17.18										
31.06	1.70	56.00	576.43	14.70	33.06	8.64	51.72	200.37	15.95	35.06	2.15	78.72	889.01	17.19										
31.08	1.65	58.33	800.85	14.71	33.08	8.74	49.17	180.83	15.96	35.08	2.17	78.94	865.20	17.21										
31.10	1.58	58.55	594.75	14.72	33.10	8.61	49.06	180.68	15.97	35.10	2.19	80.61	836.34	17.22										

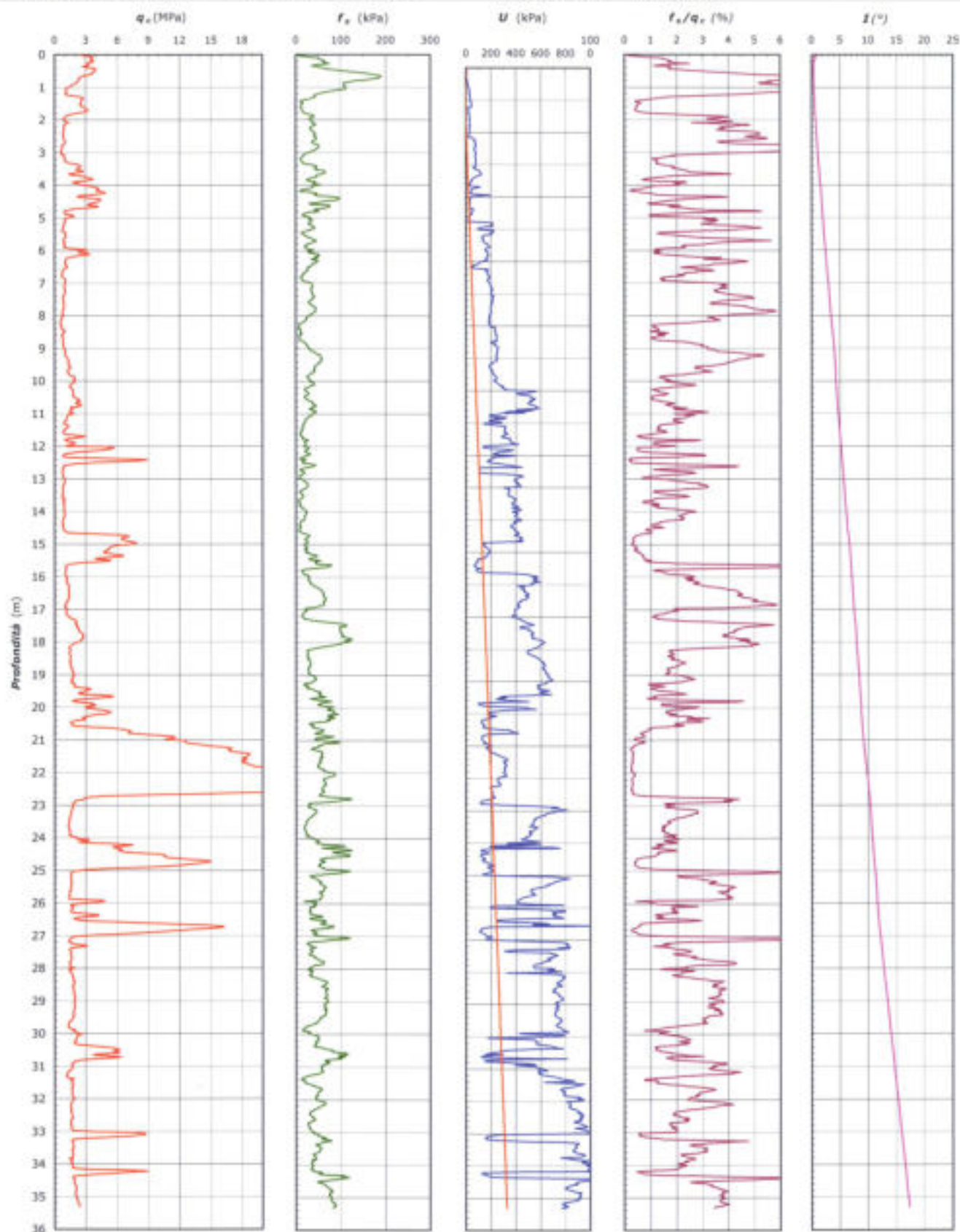
COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF02-B **PROF. FALDA (m da p.c.):** 1.70 **TIPO PUNTA:** Tecnopenta G1-CPL2IN (matr. 111010) [a = 0.66]

DATA: 02/05/11 **PREFORO (m da p.c.):** **Lat.:** 44.546898 **Long.:** 11.371293

COMMESSA: 9480/11 **C. SITO N°:** S110079 **OPERATORE:** M. Giommi



**imprefond**GEOTECNICA E LAVORI SPECIALI
DEL SOTTOSUOLOTRIESTE - via dei Colonnelli, 8 - 33100 827790
Quindici Strada 17/A - 33100 827790

COMMITTENTE: SPEA Ingegneria Europea S.p.A.

PROGETTO: A13 Ferrara - Bologna - Fase B

LOCALITÀ: Bologna

Sondaggio/Pit

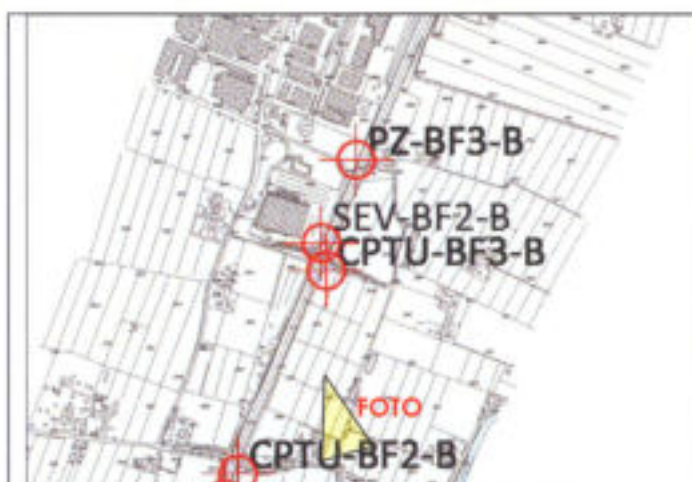
CPTU-BF3-B

SCHEDA MONOGRAFICA DEL PUNTO DI INDAGINE

DESCRIZIONE: Ubicato in area di proprietà Bayer S.p.A, si accede da via Vittorio Peglion (Bologna) dopo il ponte autostrale procedendo verso via Ferrarese e svoltando a sinistra dopo circa 170 m dall'asse autostradale. Il punto di indagine si trova ubicato al limite nord-ovest di proprietà nei pressi del ponte autostradale.

ELEMENTI GEODETICI O TOPOGRAFICI

COORDINATE GAUSS BOAGA		COORDINATE RETTILINEE		COORDINATE WGS84	
N	= 4.935.928,83 m	N	= 3.162.848,04 m	Lat.	= 44° 33' 06,8101"N
E	= 1.688.632,98 m	E	= 9.895.891,95 m	Long.	= 11° 22' 28,2809"E
Quota	= 29,10 m				



Inquadramento generale



Schizzo planimetrico di dettaglio



CAPOSALDI DI RIFERIMENTO

I 71 I 74 I 77

NOTE

RILEVATO SUL PIANO CAMPAGNA

Con. Min. Infr. e Trasp. con Decreto n.0000151 del 19/04/2011 Settore C-Prove in situ su terreni (ai sensi dell'art. 59 del DPR n. 380/2001)

Lo sperimentatore:
dott. geol. Roberto ChiappiniIl Direttore del Laboratorio
dott. geol. Dario GubertiniAccettazione n. 110017
Certificato n. 110017-1/2011-CPTU-BF3B-M
dd. 14/09/2011
Commessa n. 110017



elletipi s.r.l.

Sede operativa ed amm.va: Via Annibale Zucchini, 69 - 44100 FERRARA
tel. 0532/56771; fax 0532/56119 e-mail: info@elletipi.it sito: www.elletipi.it
P.IVA e Codice Fiscale n. 00174600367

Laboratorio sul sito: Monitoraggio e Testi di C.C. S.r.l. P.P. S.r.l. e S.p.A. e S.p.A. n. 34959 del 10/05/2009

AZIENDA CON SISTEMA DI GESTIONE
INTEGRATO CERTIFICATO DA BSI
UNI EN ISO 9001/2000
UNI EN ISO 14001

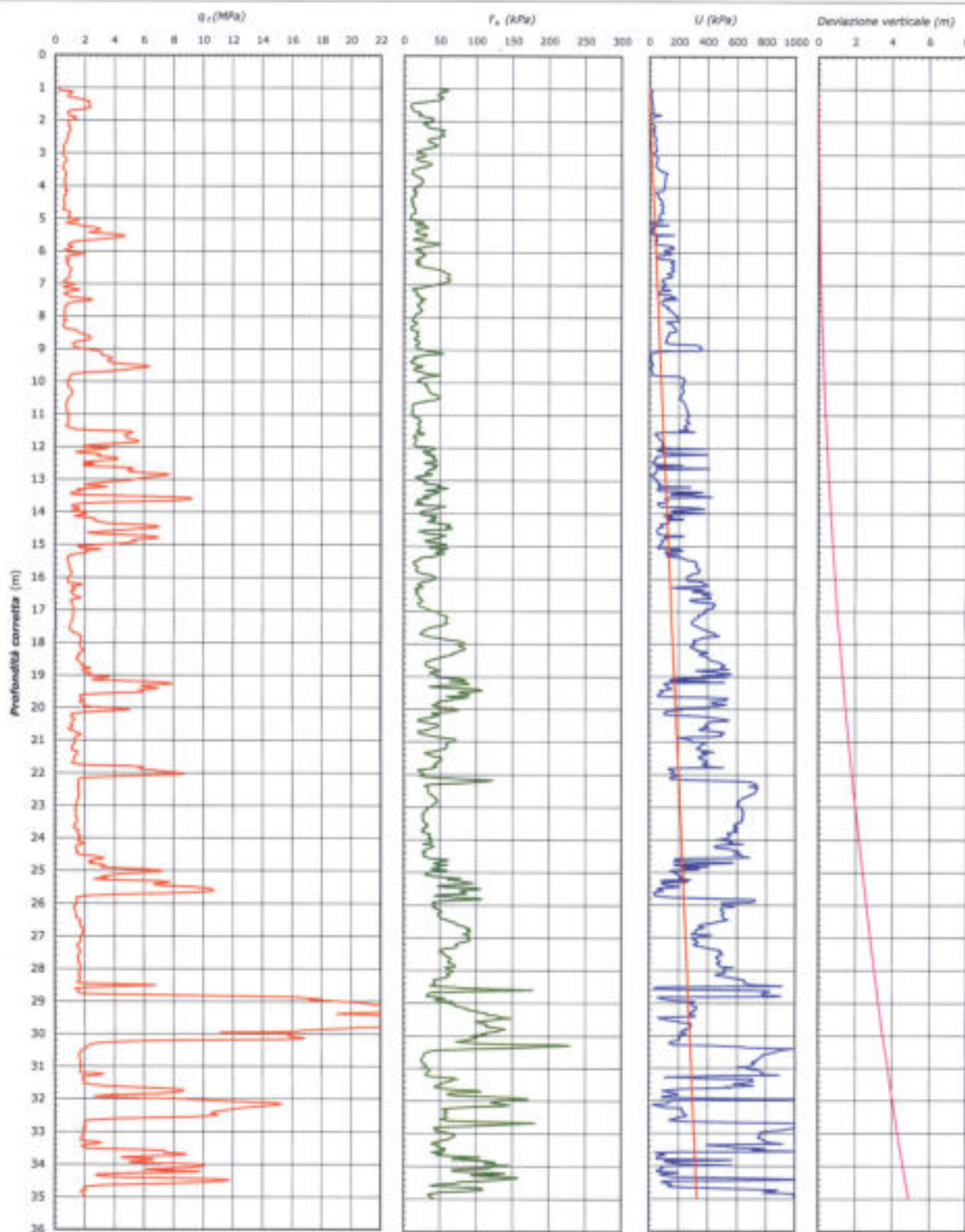
COMMITTENTE: IMPREFOND S.r.l. - via del Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3^a Corsia BO-FE

PROVA N°: CPTU BF03-B PROF. FALDA (m da p.c.): 1.35 TIPO PUNTA: Tecnopenta G1-CPL2IN (matr. 111010) [a = 0.66]

DATA: 17/05/11 PREFORO (m da p.c.): 1.00 Lat.: 44.551892° Long.: 11.374478°

COMMESSA: 9480/11 OPERATORE: M. Giommi





elietipi s.r.l.

Sede operativa ed amministrativa: Via Annibale Zucchini, 59 - 44100 FERRARA
tel. 0532/56771; fax 0532/56119 e-mail: info@elietipi.it sito: www.elietipi.it
P.IVA e Codice Fiscale n. 00174600387

Laboratorio Aut. dal Ministero Infrastrutture e Trasporti P.C.S. U.P.P. S.T.C. in base al D.P.R. n. 309/02 art. 28 par. 3, M. 08/08/08, n° 20365 del 08/05/2008

AZIENDA CON SISTEMA DI GESTIONE
INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

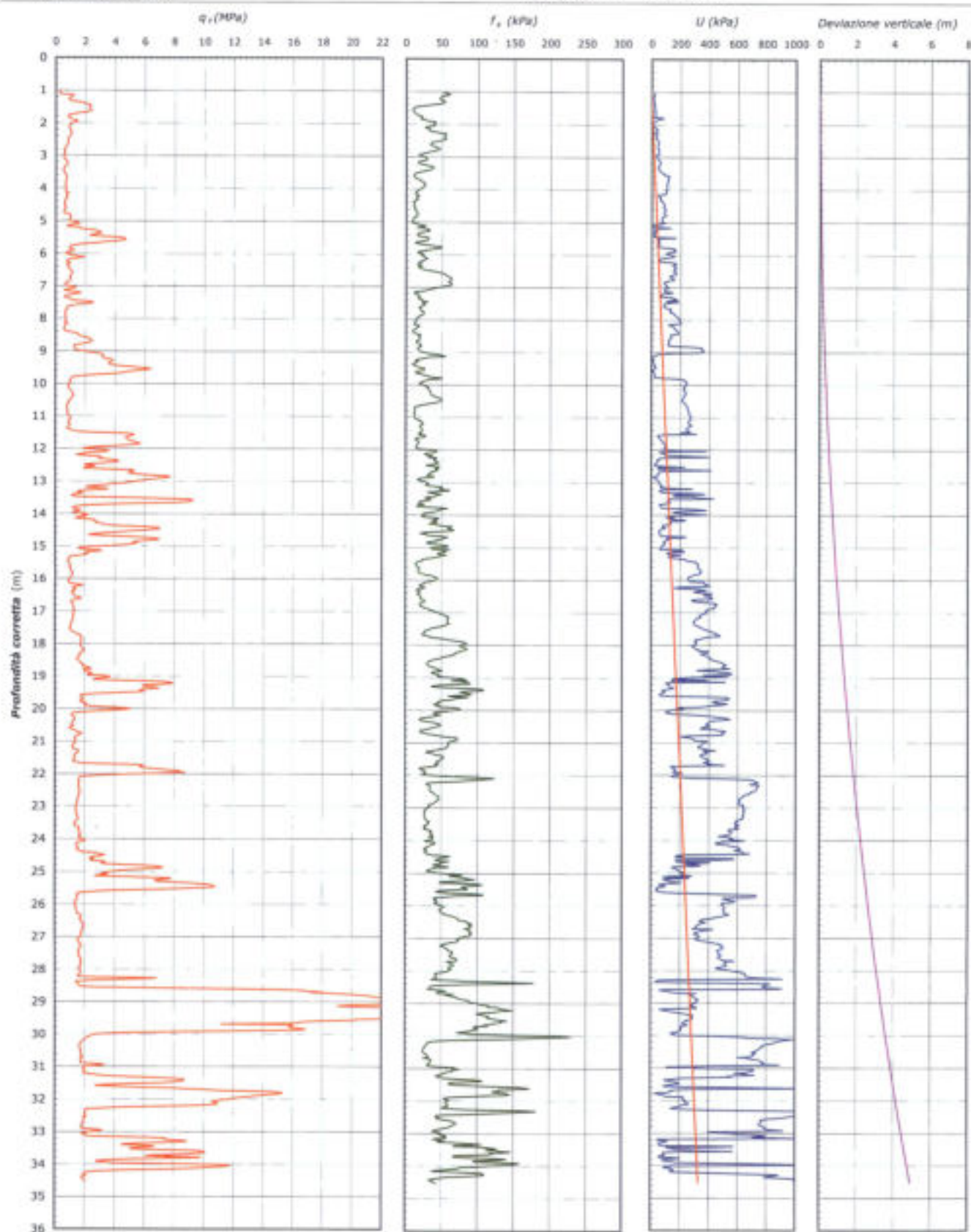
COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF03-B **PROF. FALDA (m da p.c.):** 1.35 **TIPO PUNTA:** Tecnopenta G1-CPL2IN (matr. 111010) [$\alpha = 0.66$]

DATA: 17/05/11 **PREFORO (m da p.c.):** 1.00 **Lat.:** 44.551892° **Long.:** 11.374478°

COMMESSA: 9480/11 **OPERATORE:** M. Giommi





elietipi s.r.l.

Sede operativa ed ammi. via: Via Annibale Zucchini, 69 - 44100 FERRARA
tel. 0532/56771, fax 0532/56119 e-mail: info@elietipi.it sito: www.elietipi.it
P.IVA e Codice Fiscale n. 00174900387

Laboratorio ad. dei Metodi Infrasonici e Tipologia P.C. e L.P. S.T.C. - Strada 6 D.P.R. n. 3050/01 del 28.01.02 del 08/05/2002

AZIENDA CON SISTEMA DI GESTIONE
INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF03-B PROF. FALDA (m da p.c.): 1.35

DATA: 17/05/11 PREFORO (m da p.c.): 1.00

COMMESSA: 9480/11 C. SITO N°: S110080

TIPO PUNTA: Tecnopenta G1-CPL2IN (matr. 111010)[a = 0.66]

Lat.: 44.551892° Long.: 11.374478°

OPERATORE: M. Giommi

prof.	qc	f _h	U	incl.	prof.	qc	f _h	U	incl.	prof.	qc	f _h	U	incl.	prof.	qc	f _h	U	incl.	prof.	qc	f _h	U	incl.
m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi
1.02	0.29	52.10	18.20	0.93	3.02	0.51	28.04	41.64	0.90	5.02	1.35	10.57	78.27	1.74	7.02	1.31	38.63	106.35	2.88	9.02	2.21	30.19	151.53	3.79
1.04	0.31	56.10	18.81	0.98	3.04	0.51	28.59	40.42	0.94	5.04	1.53	13.70	47.13	1.73	7.04	1.26	34.63	91.09	2.89	9.04	2.30	37.74	89.72	3.79
1.06	0.27	60.76	19.42	0.85	3.06	0.51	29.60	42.85	0.97	5.06	1.61	17.68	25.15	1.74	7.06	1.11	31.40	86.81	2.90	9.06	2.84	44.19	45.30	3.76
1.08	0.27	60.54	19.42	0.85	3.08	0.55	27.60	48.35	1.01	5.08	1.41	22.79	12.33	1.76	7.08	0.87	27.96	85.59	2.92	9.08	3.05	49.19	31.26	3.79
1.10	0.34	55.77	16.37	0.85	3.10	0.60	24.49	55.68	1.03	5.10	1.13	26.68	4.40	1.77	7.10	0.67	23.40	87.42	2.93	9.10	3.19	53.07	22.71	3.80
1.12	1.08	52.99	11.48	0.95	3.12	0.65	20.38	59.34	0.97	5.12	0.86	25.35	26.37	1.80	7.12	0.52	16.62	103.91	2.94	9.12	3.19	54.74	14.77	3.79
1.14	1.21	49.65	12.09	0.88	3.14	0.69	17.16	58.12	1.00	5.14	0.75	21.90	70.94	1.80	7.14	0.80	12.29	146.54	2.96	9.14	3.17	31.62	13.55	3.82
1.16	1.18	48.10	12.70	0.89	3.16	0.72	16.71	56.90	1.02	5.16	0.78	15.68	131.39	1.80	7.16	1.18	11.29	144.81	2.99	9.16	3.15	27.62	7.45	3.82
1.18	1.10	47.32	13.31	0.96	3.18	0.74	17.62	54.46	1.03	5.18	1.54	26.45	31.87	1.94	7.18	1.54	12.62	92.92	2.99	9.18	3.14	24.18	7.45	3.83
1.20	1.01	46.54	13.92	1.03	3.20	0.75	20.29	56.90	0.98	5.20	1.61	31.12	25.15	1.95	7.20	1.66	15.62	72.16	2.99	9.20	3.16	19.18	9.28	3.84
1.22	0.97	47.10	14.53	0.97	3.22	0.80	23.40	53.24	1.04	5.22	1.64	31.35	20.27	1.96	7.22	1.46	17.96	68.50	3.00	9.22	3.32	14.51	12.94	3.88
1.24	0.92	49.10	15.15	0.89	3.24	0.80	27.29	51.40	1.04	5.24	1.92	30.35	25.76	1.95	7.24	1.20	17.18	67.28	3.02	9.24	3.60	13.73	15.38	3.88
1.26	0.86	51.10	15.76	0.87	3.26	0.78	32.52	48.35	1.07	5.26	2.45	32.68	35.53	1.96	7.26	0.96	18.18	66.08	3.03	9.26	3.78	17.18	13.55	3.88
1.28	0.91	53.54	15.76	0.95	3.28	0.73	37.07	45.30	1.05	5.28	2.66	29.01	16.61	1.94	7.28	0.69	18.52	67.89	3.01	9.28	3.85	16.07	11.11	3.90
1.30	1.03	54.21	15.76	0.86	3.30	0.67	37.52	42.86	1.04	5.30	2.80	21.35	14.16	1.97	7.30	0.59	19.85	136.26	3.04	9.30	3.80	14.95	12.33	3.90
1.32	1.23	52.66	13.31	0.89	3.32	0.63	37.19	42.25	1.04	5.32	2.95	18.24	17.83	2.00	7.32	0.59	16.65	155.80	3.05	9.32	3.71	12.62	15.38	3.90
1.34	1.51	50.88	18.20	0.87	3.34	0.59	37.07	43.47	1.03	5.34	3.03	17.24	20.88	2.06	7.34	0.63	17.29	150.31	3.06	9.34	3.63	10.18	17.83	3.93
1.36	1.76	49.10	20.64	0.84	3.36	0.56	34.97	48.35	1.05	5.36	3.05	15.79	22.71	2.01	7.36	0.78	20.63	171.67	3.08	9.36	3.56	9.62	19.66	3.92
1.38	1.93	41.22	20.64	0.93	3.38	0.53	32.85	53.24	1.08	5.38	2.86	17.67	22.10	2.04	7.38	0.93	23.29	180.83	3.10	9.38	3.58	10.40	22.10	3.93
1.40	2.09	33.11	21.25	0.86	3.40	0.51	28.52	56.90	1.07	5.40	2.66	16.79	16.61	2.05	7.40	0.98	22.18	122.83	3.08	9.40	3.66	12.51	21.93	3.93
1.42	2.21	25.33	21.25	0.91	3.42	0.53	24.19	61.17	1.07	5.42	2.38	19.67	13.55	2.07	7.42	1.05	22.40	100.69	3.10	9.42	3.62	14.51	26.37	3.95
1.44	2.31	18.33	21.25	0.95	3.44	0.50	21.08	61.17	1.10	5.44	2.30	26.01	30.88	2.07	7.44	1.41	30.29	187.59	3.10	9.44	4.01	16.18	28.82	3.95
1.46	2.35	12.89	21.86	0.94	3.46	0.52	17.19	70.33	1.11	5.46	3.00	31.34	66.79	2.10	7.46	2.06	24.07	116.73	3.13	9.46	4.01	19.20	30.04	4.00
1.48	2.32	11.56	23.86	0.92	3.48	0.53	14.42	78.88	1.15	5.48	3.66	31.34	59.95	2.06	7.48	2.44	22.85	90.48	3.14	9.48	5.03	24.29	26.37	4.01
1.50	2.27	10.34	23.86	0.94	3.50	0.53	12.86	87.42	1.12	5.50	4.35	30.34	44.88	2.11	7.50	2.49	24.52	84.98	3.15	9.50	5.57	26.17	16.00	4.01
1.52	2.27	9.80	23.86	0.94	3.52	0.57	11.64	84.37	1.14	5.52	4.59	29.01	46.52	2.11	7.52	2.27	26.52	85.59	3.15	9.52	6.07	25.28	8.67	4.04
1.54	2.30	9.34	23.86	0.81	3.54	0.59	11.30	106.96	1.16	5.54	4.69	29.12	48.35	2.11	7.54	1.91	24.74	84.37	3.18	9.54	6.38	24.62	9.28	4.04
1.56	2.33	9.46	23.86	0.85	3.56	0.63	11.08	121.00	1.16	5.56	4.65	26.01	50.79	2.10	7.56	1.49	22.85	82.54	3.18	9.56	6.26	17.95	10.50	4.08
1.58	2.38	9.68	24.30	0.96	3.58	0.67	10.86	122.83	1.14	5.58	4.46	19.89	52.01	2.14	7.58	1.13	20.96	82.54	3.21	9.58	5.92	14.39	12.33	4.07
1.60	2.40	10.58	24.30	0.87	3.60	0.69	11.08	113.68	1.18	5.60	4.18	14.56	52.83	2.13	7.60	0.91	18.52	95.97	3.21	9.60	5.43	13.61	14.77	4.11
1.62	2.35	11.24	24.91	0.87	3.62	0.70	12.39	112.45	1.15	5.62	3.59	12.67	52.01	2.14	7.62	0.84	18.85	106.96	3.25	9.62	5.07	14.06	17.83	4.09
1.64	2.22	11.91	24.91	0.86	3.64	0.69	13.86	113.68	1.19	5.64	3.16	16.12	52.01	2.16	7.64	0.80	19.96	124.66	3.26	9.64	4.74	17.39	19.66	4.09
1.66	1.98	12.47	25.52	0.86	3.66	0.69	15.64	112.45	1.19	5.66	2.87	21.23	52.83	2.15	7.66	0.73	19.85	132.60	3.27	9.66	4.46	21.84	22.71	4.12
1.68	1.68	13.48	26.13	0.92	3.68	0.69	17.31	109.40	1.18	5.68	2.34	28.45	49.57	2.17	7.68	0.71	20.30	134.43	3.27	9.68	3.98	25.50	23.32	4.13
1.70	1.38	14.70	26.74	0.83	3.70	0.67	19.20	110.01	1.20	5.70	1.75	35.67	42.86	2.18	7.70	0.70	22.07	135.04	3.29	9.70	3.27	29.28	22.10	4.14
1.72	1.15	17.93	26.13	0.92	3.72	0.67	20.87	112.45	1.20	5.72	1.45	38.89	36.14	2.18	7.72	0.67	22.52	125.27	3.27	9.72	2.61	30.39	21.49	4.16
1.74	0.98	21.04	21.25	0.94	3.74	0.67	23.09	111.23	1.19	5.74	1.14	49.23	37.97	2.18	7.74	0.64	22.40	126.50	3.29	9.74	2.05	32.94	24.54	4.15
1.76	0.87	21.71	2.32	0.96	3.76	0.67	23.64	108.79	1.25	5.76	1.01	49.33	75.82	2.21	7.76	0.62	24.85	138.10	3.31	9.76	1.62	40.18	24.92	4.19
1.78	0.82	23.38	66.06	0.95	3.78	0.64	24.53	106.35	1.24	5.78	0.97	48.11	125.27	2.20	7.78	0.62	25.40	148.69	3.29	9.78	1.22	49.83	80.10	4.17
1.80	0.83	20.49	81.93	0.81	3.80	0.63	25.76	105.13	1.24	5.80	0.94	42.64	155.19	2.21	7.80	0.62	24.63	156.41	3.31	9.80	1.07	46.61	183.27	4.17
1.82	0.87	20.16	56.29	0.89	3.82	0.62	26.42	103.91	1.25	5.82	0.87	35.66	160.68	2.22	7.82	0.62	23.63	157.02	3.31	9.82	1.01	36.61	209.52	4.18
1.84	0.89	23.17	38.58	0.89	3.84	0.62	25.42	103.91	1.29	5.84	0.89	28.66	150.92	2.24	7.84	0.61	22.29	161.29	3.33	9.84	0.96	29.27	230.89	4.20
1.86	0.94	26.39	31.26	0.88	3.86	0.63	25.98	105.74	1.24	5.86	0.91	26.77	161.90	2.24	7.86	0.59	20.95	167.40	3.33	9.86	0.96	26.72	232.72	4.22
1.88	1.10	30.84	24.54	0.90	3.88	0.65</																		



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P.IVA e Codice Fiscale n. 00174600387

Laboratorio ad. del Ministero Infrastrutture e Trasporti P.C.S. U.P.P. S.T.C. in base al D.P.R. n. 330/01 art. 59, lett. c) 24/06/2002

AZIENDA CON SISTEMA DI GESTIONE
INTEGRATO CERTIFICATO DA DNV
UNI EN ISO 9001/2000
UNI EN ISO 14001

COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF03-B **PROF. FALDA (m da p.c.):** 1.35 **TIPO PUNTA:** Tecnopenta G1-CPL2IN (matr. 111010)[a = 0.66]

DATA: 17/05/11 **PREFORO (m da p.c.):** 1.00 **Lat.:** 44.551892° **Long.:** 11.374478°

COMMESSA: 9480/11 **C. SITO N°:** S110080 **OPERATORE:** M. Giommi

prof.	qc	fs	u	incl.	prof.	qc	fs	u	incl.	prof.	qc	fs	u	incl.	prof.	qc	fs	u	incl.	prof.	qc	fs	u	incl.	prof.	qc	fs	u	incl.
m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi	m	Mpa	kPa	kPa	gradi
21.02	1.26	62.74	379.85	9.65	23.02	1.26	32.06	639.93	10.78	25.02	7.19	36.41	180.83	11.74	27.02	1.72	90.28	316.26	12.74	29.02	19.89	64.95	204.50	13.64	31.02	19.89	64.95	204.50	13.64
21.04	1.23	61.07	369.01	9.69	23.04	1.25	33.73	632.60	10.76	25.04	7.04	33.74	180.22	11.73	27.04	1.69	91.06	299.88	12.76	29.04	20.44	68.72	292.55	13.64	31.04	20.44	68.72	292.55	13.64
21.06	1.26	59.96	376.19	9.69	23.06	1.21	33.73	639.32	10.76	25.06	6.44	31.52	185.10	11.75	27.06	1.68	89.84	298.27	12.76	29.06	21.00	71.83	292.55	13.64	31.06	21.00	71.83	292.55	13.64
21.08	1.25	58.63	361.54	9.70	23.08	1.21	31.73	636.87	10.81	25.08	5.73	29.52	197.92	11.74	27.08	1.66	92.17	317.58	12.76	29.08	21.28	71.50	298.05	13.67	31.08	21.28	71.50	298.05	13.67
21.10	1.25	59.63	356.04	9.71	23.10	1.20	31.06	632.60	10.78	25.10	4.98	28.52	204.64	11.74	27.10	1.67	91.28	328.57	12.79	29.10	21.41	75.16	303.54	13.67	31.10	21.41	75.16	303.54	13.67
21.12	1.21	60.30	354.21	9.73	23.12	1.19	31.06	639.32	10.81	25.12	4.38	38.19	210.13	11.75	27.12	1.68	86.06	329.18	12.79	29.12	22.30	77.38	326.13	13.68	31.12	22.30	77.38	326.13	13.68
21.14	1.16	59.07	349.33	9.75	23.14	1.19	30.17	641.15	10.82	25.14	3.94	45.52	221.73	11.78	27.14	1.70	82.84	336.51	12.82	29.14	23.72	81.60	327.96	13.71	31.14	23.72	81.60	327.96	13.71
21.16	1.15	59.52	345.67	9.73	23.16	1.19	28.95	648.47	10.83	25.16	3.60	55.41	219.90	11.80	27.16	1.69	78.30	335.29	12.82	29.16	25.14	88.37	327.96	13.71	31.16	25.14	88.37	327.96	13.71
21.18	1.14	57.85	331.62	9.74	23.18	1.20	26.95	645.42	10.85	25.18	3.37	66.74	211.97	11.80	27.18	1.67	74.61	317.58	12.83	29.18	26.41	87.37	323.08	13.75	31.18	26.41	87.37	323.08	13.75
21.20	1.08	58.40	324.91	9.76	23.20	1.20	26.51	638.71	10.86	25.20	3.25	78.65	218.07	11.83	27.20	1.61	73.61	304.15	12.85	29.20	27.18	88.48	323.08	13.74	31.20	27.18	88.48	323.08	13.74
21.22	1.06	56.07	329.18	9.77	23.22	1.19	27.07	639.93	10.87	25.22	3.03	76.08	238.22	11.83	27.22	1.55	72.06	305.98	12.85	29.22	27.17	91.70	312.09	13.77	31.22	27.17	91.70	312.09	13.77
21.24	1.08	54.18	348.72	9.80	23.24	1.21	26.73	646.64	10.89	25.24	3.40	81.07	282.78	11.84	27.24	1.51	74.94	318.19	12.87	29.24	26.52	97.34	305.37	13.79	31.24	26.52	97.34	305.37	13.79
21.26	1.08	50.52	370.70	9.87	23.26	1.22	25.95	642.98	10.89	25.26	2.92	79.44	106.79	11.84	27.26	1.49	73.61	336.51	12.89	29.26	26.71	101.91	310.87	13.80	31.26	26.71	101.91	310.87	13.80
21.28	1.05	45.18	374.36	9.77	23.28	1.22	26.40	644.81	10.89	25.28	2.60	77.62	87.16	11.86	27.28	1.44	72.61	336.04	12.91	29.28	24.77	103.90	292.55	13.83	31.28	24.77	103.90	292.55	13.83
21.30	1.01	41.85	403.05	9.81	23.30	1.22	26.51	641.15	10.90	25.30	3.46	83.51	263.86	11.88	27.30	1.42	70.61	378.02	12.92	29.30	23.59	108.79	279.12	13.83	31.30	23.59	108.79	279.12	13.83
21.32	1.11	35.07	443.35	9.80	23.32	1.22	26.62	633.82	10.95	25.32	5.33	88.17	246.15	11.88	27.32	1.38	65.39	396.95	12.92	29.32	22.05	116.03	288.89	13.85	31.32	22.05	116.03	288.89	13.85
21.34	1.33	30.51	558.49	9.81	23.34	1.20	27.07	635.04	10.93	25.34	6.95	95.95	106.96	11.88	27.34	1.42	59.83	417.09	12.95	29.34	20.92	116.33	290.11	13.87	31.34	20.92	116.33	290.11	13.87
21.36	1.40	28.96	373.75	9.82	23.36	1.21	26.62	639.32	10.95	25.36	7.74	85.95	87.42	11.91	27.36	1.45	54.94	438.46	12.93	29.36	18.46	114.99	277.90	13.93	31.36	18.46	114.99	277.90	13.93
21.38	1.49	31.51	389.62	9.83	23.38	1.25	26.51	640.54	10.95	25.38	7.61	79.28	101.47	11.91	27.38	1.49	52.49	468.38	12.97	29.38	18.97	127.76	300.49	13.94	31.38	18.97	127.76	300.49	13.94
21.40	1.44	35.96	390.84	9.83	23.40	1.27	26.73	641.70	10.99	25.40	7.07	62.61	120.39	11.91	27.40	1.54	50.60	486.69	12.99	29.40	20.11	129.20	315.97	13.96	31.40	20.11	129.20	315.97	13.96
21.42	1.40	38.95	378.02	9.86	23.42	1.28	26.73	636.07	10.98	25.42	6.69	46.50	140.54	11.88	27.42	1.58	48.71	492.19	12.98	29.42	21.59	134.76	318.19	13.97	31.42	21.59	134.76	318.19	13.97
21.44	1.39	40.40	352.38	9.88	23.44	1.31	27.29	627.11	11.02	25.44	6.44	47.61	169.84	11.98	27.44	1.58	49.82	480.59	12.98	29.44	22.94	138.41	326.50	14.01	31.44	22.94	138.41	326.50	14.01
21.46	1.34	44.40	360.78	9.90	23.46	1.33	28.51	630.16	11.01	25.46	7.07	57.72	209.52	11.90	27.46	1.55	55.04	492.80	13.01	29.46	23.67	148.18	326.50	14.04	31.46	23.67	148.18	326.50	14.04
21.48	1.27	50.62	340.17	9.90	23.48	1.36	28.51	619.78	11.02	25.48	8.01	90.95	183.13	11.91	27.48	1.56	54.71	498.29	13.01	29.48	24.22	137.40	347.37	14.05	31.48	24.22	137.40	347.37	14.05
21.50	1.25	51.95	350.55	9.93	23.50	1.34	29.05	598.41	11.04	25.50	8.90	101.72	77.86	11.91	27.50	1.51	55.60	503.17	13.04	29.50	24.49	128.61	310.87	14.08	31.50	24.49	128.61	310.87	14.08
21.52	1.19	52.40	352.99	9.93	23.52	1.32	32.18	593.53	11.06	25.52	9.55	106.26	58.12	11.96	27.52	1.54	57.71	501.34	13.03	29.52	23.96	124.60	312.09	14.09	31.52	23.96	124.60	312.09	14.09
21.54	1.19	52.29	359.71	9.94	23.54	1.27	32.29	587.42	11.08	25.54	10.06	98.94	67.89	11.93	27.54	1.51	59.26	494.02	13.06	29.54	23.54	114.04	314.65	14.11	31.54	23.54	114.04	314.65	14.11
21.56	1.20	52.62	382.91	9.94	23.56	1.26	33.40	598.41	11.08	25.56	10.45	85.61	95.36	11.96	27.56	1.54	59.26	472.04	13.08	29.56	23.07	106.26	309.99	14.10	31.56	23.07	106.26	309.99	14.10
21.58	1.21	51.73	391.45	9.96	23.58	1.26	30.51	581.93	11.11	25.58	10.57	78.27	100.85	11.96	27.58	1.51	60.26	461.66	13.08	29.58	22.98	99.25	316.85	14.13	31.58	22.98	99.25	316.85	14.13
21.60	1.21	46.18	388.40	9.96	23.60	1.17	32.07	578.27	11.12	25.60	10.57	80.50	68.50	11.96	27.60	1.49	62.71	458.61	13.08	29.60	22.97	104.38	341.88	14.16	31.60	22.97	104.38	341.88	14.16
21.62	1.17	47.40	400.00	9.98	23.62	1.14	32.07	583.15	11.12	25.62	10.74	85.39	42.25	11.98	27.62	1.42	66.04	462.27	13.10	29.62	23.15	108.68	268.13	14.18	31.62	23.15	108.68	268.13	14.18
21.64	1.16	46.95	402.44	10.00	23.64	1.10	30.51	595.36	11.14	25.64	10.54	83.71	36.75	12.00	27.64	1.40	65.38	466.54	13.11	29.64	23.67	111.56	290.72	14.19	31.64	23.67	111.56	290.72	14.19
21.66	1.15	43.82	385.35	10.01	23.66	1.11	27.85	608.79	11.14	25.66	9.69	86.82	42.86	11.99	27.66	1.44	64.26	467.77	13.11	29.66	23.27	116.11	271.79	14.21	31.66	23.27	116.11	271.79	14.21
21.68	1.09	43.73	367.64	10.01	23.68	1.14	26.18	597.80	11.17	25.68	8.86	82.71	46.52	12.00	27.68	1.43	65.04	475.09	13.12	29.68	24.10	113.41	284.62	14.2					

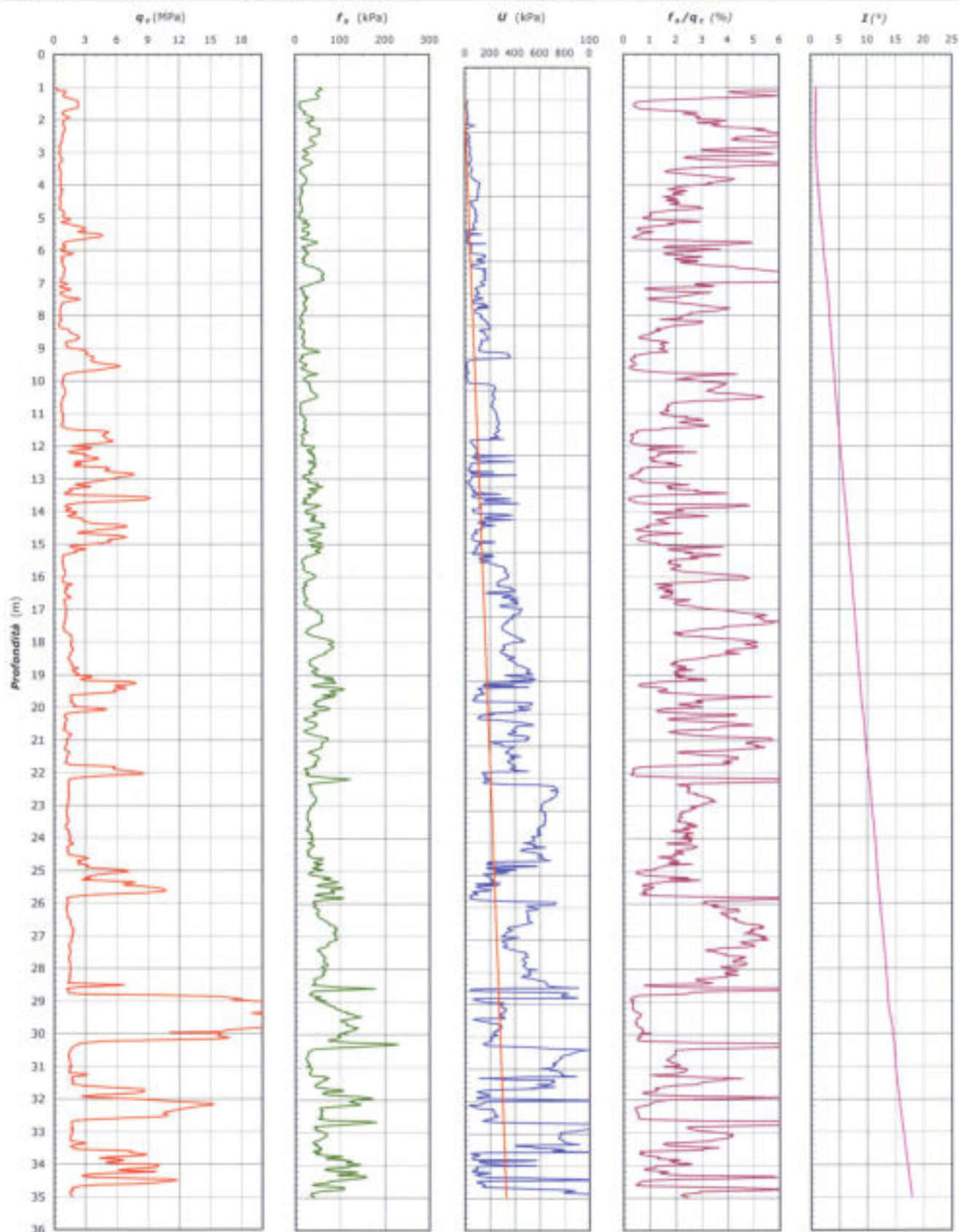
COMMITTENTE: IMPREFOND S.r.l. - via dei Cosulich, 8 - 34147 Trieste

CANTIERE: SPEA Ingegneria Europea S.p.A. - A13 3° Corsia BO-FE

PROVA N°: CPTU BF03-B **PROF. FALDA (m da p.c.):** 1.35 **TIPO PUNTA:** Tecnopenta G1-CPL21N (matr. 111010) [a = 0.66]

DATA: 17/05/11 **PREFORO (m da p.c.):** 1.00 **Lat.:** 44.551892° **Long.:** 11.374478°

COMMESSA: 9480/11 **C. SITO N°:** S110080 **OPERATORE:** M. Giommi



ESECUTORE:

SUBSOIL

CPTU

4 PE

DATA
26/07/2018

DESCRIZIONE: La prova è stata effettuata ai margini del campo coltivo presso la sovrapposizione tra Via Aposazza e il tratto autostradale A13 Bologna-Padova.

COORDINATE WGS84

44°32'09.4976"N 11°21'50.9651"E
Quota Elissoide: 72,186

COORDINATE GAUSS-BOAGA

4934123,479N 1687830,507E

COORDINATE RETTILINEE

X= 9895095,726 Y= 3161073,802
Quota s.l.m.: 33,009

PLANIMETRIA



GOOGLE EARTH



PROVA PENETROMETRICA STATICA ELETTRICA CON PIEZOCONO (CPTU)

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Commessa: 00100018_FG

Nome prova:

CPTU 4 PE

Certificato n.°

034E_2018

DOCUMENTAZIONE FOTOGRAFICA

Ubicazione / Piazzamento



CARATTERISTICHE STRUMENTAZIONE

Normativa di riferimento

A.G.I. - (1977): Raccomandazioni sulla Programmazione e d Esecuzione delle Indagini Geotecniche

ASSMFE - (1988): Dynamic Probing (DP) International Reference Test Procedure

ASTM D3441-86: Deep quasi-static cone and friction cone penetration tests of soil

DM 11.03.88: "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione ed il collaudo delle opere di sostegno delle terre e delle opere di fondazione

Caratteristiche punta elettrica

Costruttore/modello: TECNOPENTA - G1-CPLS D

Serial number: 170118

Caratteristiche penetrometro

Marca/modello: TECNOTEST

Spinta nominale: 20 ton

NOTE:

Falda: chiuso a 3,05m da p.c.

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

CERTIFICATO N. 034E_2018

PROVA PENETROMETRICA STATICA ELETTRICA CON PIEZOCONO (CPTU)

CPTU 4 PE

Committente: Spea Engineering

Data: 26/07/2018

Profondità raggiunta: 20,98m da p.c.

Lavoro: Autostrada A13 PE

Località: Bologna

Profondità Falda: F. Chiuso 3,05m da p.c.

Resistenza alla punta qt

(MPa)

Attrito laterale ft / Rap. di attrito

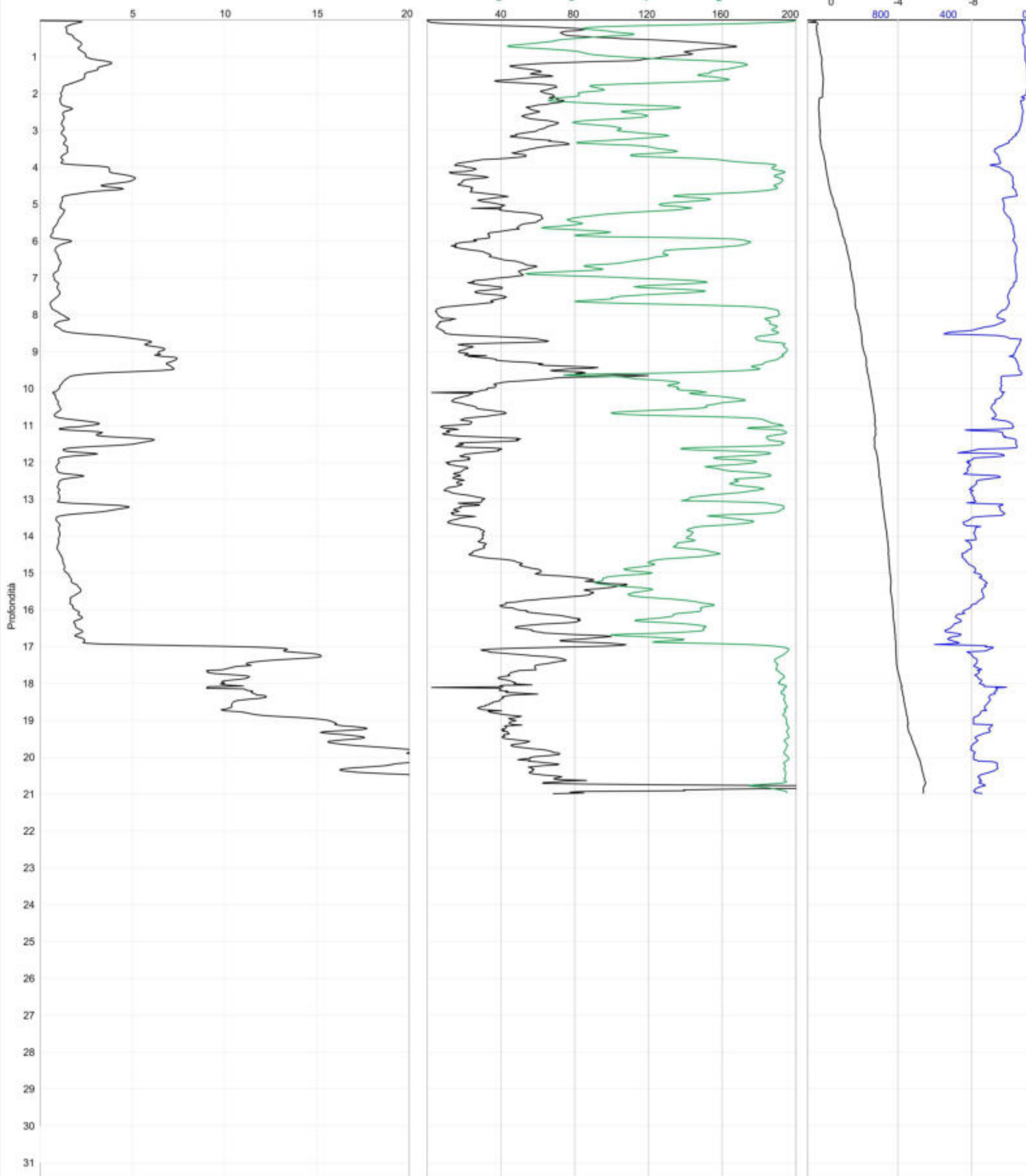
(kPa)

Rf % (ft/qt)

Inclinazione / P. neutra

(°)

U (kPa)



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n.° iscrizione alla CCIAA di Re 01999610309 - n.REA 241942 - CF e P.IVA 01999610309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
0,02	1,831	0,494	10,543	-0,002	2,001	0	19	0,380	0,000	0,380	0,006	1,343	0,000	9,864	0,000	0	7,870	9,864	0,000	0,000
0,04	2,330	0,900	12,427	0,028	2,291	0	19	0,760	0,000	0,760	0,005	1,335	0,000	11,178	0,000	0	8,919	11,178	0,000	0,000
0,06	2,201	2,258	11,184	0,406	2,165	5	19	1,140	0,000	1,140	0,005	1,432	0,000	11,932	60,000	41	9,520	11,932	0,000	0,000
0,08	1,951	6,579	9,701	-0,063	1,974	5	19	1,520	0,000	1,520	0,005	1,573	0,000	13,019	61,000	41	10,388	13,019	0,000	0,000
0,10	1,760	14,164	8,659	-0,102	1,795	5	19	1,900	0,000	1,900	0,004	1,766	0,000	15,104	63,000	41	12,051	15,104	0,000	0,000
0,12	1,666	27,362	3,969	-0,088	1,667	4	19	2,280	0,000	2,280	0,003	1,911	0,000	16,849	66,000	42	13,443	16,849	0,000	0,000
0,14	1,568	35,388	3,127	-0,076	1,570	4	19	2,660	0,000	2,660	0,002	2,051	0,000	18,948	66,000	42	15,118	18,948	0,000	0,000
0,16	1,473	50,170	2,205	-0,038	1,464	3	19	3,040	0,000	3,040	0,002	2,168	0,000	20,474	67,000	42	16,336	20,474	0,000	0,000
0,18	1,348	62,870	1,283	-0,013	1,394	3	19	3,420	0,000	3,420	0,001	2,264	0,000	19,473	0,000	0	17,559	22,008	99,352	50,969
0,20	1,361	71,813	0,401	-0,023	1,377	3	19	3,800	0,000	3,800	0,000	2,322	0,000	19,225	0,000	0	18,669	23,398	98,089	50,824
0,22	1,422	79,592	0,080	-0,055	1,413	3	19	4,180	0,000	4,180	0,000	2,352	0,000	19,722	0,000	0	19,891	24,930	100,622	50,340
0,24	1,456	85,819	0,080	-0,034	1,443	3	19	4,560	0,000	4,560	0,000	2,369	0,000	20,140	0,000	0	20,753	26,011	102,754	49,117
0,26	1,451	84,355	-0,040	-0,018	1,442	3	19	4,940	0,000	4,940	0,000	2,384	0,000	20,125	0,000	0	21,118	26,668	102,679	46,967
0,28	1,420	81,921	0,601	-0,036	1,433	3	19	5,320	0,000	5,320	0,000	2,385	0,000	19,983	0,000	0	21,015	26,339	101,956	44,180
0,30	1,427	75,130	-0,120	-0,059	1,430	3	19	5,700	0,000	5,700	0,000	2,383	0,000	19,944	0,000	0	20,908	26,204	101,755	41,739
0,32	1,444	72,978	-0,521	-0,055	1,427	3	19	6,080	0,000	6,080	0,000	2,382	0,000	19,891	0,000	0	20,823	26,098	101,487	39,600
0,34	1,410	72,202	-0,561	-0,066	1,442	3	19	6,460	0,000	6,460	0,000	2,383	0,000	20,104	0,000	0	21,080	26,421	102,571	38,281
0,36	1,473	72,890	0,641	-0,060	1,498	3	19	6,840	0,000	6,840	0,002	2,375	0,000	20,879	0,000	0	21,666	27,155	106,524	37,756
0,38	1,608	73,895	9,140	-0,057	1,598	3	19	7,220	0,000	7,220	0,004	2,355	0,000	22,271	0,000	0	22,542	28,252	113,629	37,913
0,40	1,706	74,653	9,821	-0,056	1,703	3	19	7,600	0,000	7,600	0,006	2,338	0,000	23,742	0,000	0	23,508	29,463	121,131	38,243
0,42	1,787	77,475	9,621	-0,087	1,763	3	19	7,980	0,000	7,980	0,005	2,341	0,000	24,569	0,000	0	24,416	30,602	125,350	38,276
0,44	1,787	83,896	8,819	-0,092	1,791	3	19	8,360	0,000	8,360	0,005	2,358	0,000	24,960	0,000	0	25,353	31,775	127,347	38,179
0,46	1,791	90,105	8,138	-0,111	1,805	3	19	8,740	0,000	8,740	0,005	2,386	0,000	25,145	0,000	0	26,476	33,183	128,293	38,191
0,48	1,828	100,836	7,616	-0,122	1,834	3	19	9,120	0,000	9,120	0,004	2,407	0,000	25,549	0,000	0	27,605	34,598	130,352	38,274
0,50	1,875	105,445	7,536	-0,124	1,890	3	19	9,500	0,000	9,500	0,004	2,423	0,000	26,330	0,000	0	29,029	36,382	134,337	38,778
0,52	1,960	116,249	7,536	-0,135	1,948	3	19	9,880	0,000	9,880	0,004	2,436	0,000	27,135	0,000	0	30,432	38,141	138,443	39,236
0,54	2,002	126,439	7,496	-0,126	2,008	3	19	10,260	0,000	10,260	0,004	2,450	0,000	27,962	0,000	0	31,906	39,989	142,665	39,732
0,56	2,053	133,300	7,576	-0,132	2,066	3	19	10,640	0,000	10,640	0,004	2,460	0,000	28,778	0,000	0	33,250	41,674	146,826	40,083
0,58	2,136	140,435	7,737	-0,140	2,138	3	19	11,020	0,000	11,020	0,004	2,464	0,000	29,776	0,000	0	34,578	43,338	151,919	40,266
0,60	2,217	146,238	7,737	-0,166	2,200	3	19	11,400	0,000	11,400	0,004	2,467	0,000	30,637	0,000	0	35,746	44,802	156,311	40,485
0,62	2,239	151,563	7,616	-0,156	2,235	3	19	11,780	0,000	11,780	0,003	2,476	0,000	31,131	0,000	0	36,723	46,026	158,829	40,392
0,64	2,243	157,639	6,654	-0,152	2,239	3	19	12,160	0,000	12,160	0,003	2,490	0,000	31,177	0,000	0	37,444	46,930	159,064	39,920
0,66	2,228	161,479	5,612	-0,159	2,238	3	19	12,540	0,000	12,540	0,002	2,503	0,000	31,162	0,000	0	38,023	47,655	158,989	39,338
0,68	2,238	163,151	3,648	-0,185	2,212	3	19	12,920	0,000	12,920	0,002	2,520	0,000	30,789	0,000	0	38,383	48,107	157,088	38,470
0,70	2,167	167,366	0,842	-0,189	2,182	3	19	13,300	0,000	13,300	0,000	2,535	0,000	30,357	0,000	0	38,606	48,386	154,882	37,517
0,72	2,139	167,758	-1,804	-0,191	2,120	3	19	13,680	0,000	13,680	-0,001	2,555	0,000	29,486	0,000	0	38,444	48,183	150,440	36,162
0,74	2,056	163,490	-5,933	-0,196	2,075	3	19	14,060	0,000	14,060	-0,002	2,564	0,000	28,859	0,000	0	38,065	47,708	147,240	34,852
0,76	2,036	156,968	-6,735	-0,204	2,053	3	19	14,440	0,000	14,440	-0,003	2,564	0,000	28,534	0,000	0	37,629	47,162	145,580	33,712
0,78	2,072	151,147	-6,013	-0,207	2,082	3	19	14,820	0,000	14,820	-0,003	2,551	0,000	28,936	0,000	0	37,534	47,043	147,634	33,150
0,80	2,143	147,545	-5,572	-0,210	2,134	3	19	15,200	0,000	15,200	-0,003	2,535	0,000	29,660	0,000	0	37,680	47,225	151,325	32,894
0,82	2,192	144,727	-5,372	-0,226	2,193	3	19	15,580	0,000	15,580	-0,002	2,518	0,000	30,485	0,000	0	37,915	47,520	155,536	32,749
0,84	2,250	140,971	-5,171	-0,228	2,249	3	19	15,960	0,000	15,960	-0,002	2,503	0,000	31,264	0,000	0	38,173	47,844	159,512	32,609
0,86	2,311	139,264	-5,011	-0,236	2,313	3	19	16,340	0,000	16,340	-0,002	2,490	0,000	32,159	0,000	0	38,628	48,414	164,075	32,628
0,88	2,384	141,243	-4,931	-0,234	2,381	3	19	16,720	0,000	16,720	-0,002	2,480	0,000	33,098	0,000	0	39,260	49,206	168,870	32,755
0,90	2,452	142,352	-4,770	-0,248	2,440	3	19	17,100	0,000	17,100	-0,002	2,475	0,000	33,915	0,000	0	39,950	50,070	173,035	32,854
0,92	2,487	143,887	-4,810	-0,258	2,474	3	19	17,480	0,000	17,480	-0,002	2,471	0,000	34,388	0,000	0	40,301	50,511	175,448	32,657
0,94	2,487	140,336	-5,131	-0,260	2,469	3	19	17,860	0,000	17,860	-0,002	2,471	0,000	34,321	0,000	0	40,225	50,415	175,108	32,051
0,96	2,440	135,642	-5,492	-0,287	2,453	3	19	18,240	0,000	18,240	-0,002	2,469	0,000	34,093	0,000	0	39,882	49,985	173,943	31,287
0,98	2,439	131,818	-5,291	-0,284	2,467	3	19	18,620	0,000	18,620	-0,002	2,460	0,000	34,284	0,000	0	39,632	49,673	174,919	30,773
1,00	2,529	126,612	-4,089	-0,298	2,521	3	19	19,000	0,000	19,000	-0,002	2,445	0,000	35,033	0,000	0	39,749	49,819	178,739	30,665

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

**SUBSOIL Srl - Società Unipersonale**

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n.° Iscrizione alla CCIAA di RE 01999010309 - n. REA 241942 - CF e P. IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
1,02	2,601	126,287	-3,768	-0,304	2,608	3	19	19,380	0,000	19,380	-0,002	2,423	0,000	36,244	0,000	0	39,983	50,112	184,916	30,810
1,04	2,700	121,474	-5,532	-0,323	2,713	3	19	19,760	0,000	19,760	-0,002	2,398	0,000	37,709	0,000	0	40,316	50,529	192,392	31,102
1,06	2,844	117,155	-5,291	-0,320	2,890	4	19	20,140	0,000	20,140	-0,002	2,360	0,000	40,172	0,000	0	40,911	51,275	204,960	31,900
1,08	3,130	115,568	-5,131	-0,342	3,136	4	19	20,520	0,000	20,520	-0,002	2,312	0,000	43,614	54,000	40	41,802	52,392	0,000	0,000
1,10	3,438	111,677	-4,650	-0,328	3,437	4	19	20,900	0,000	20,900	-0,002	2,244	0,000	47,831	55,000	40	42,043	52,694	0,000	0,000
1,12	3,751	90,386	-10,463	-0,303	3,682	4	19	21,280	0,000	21,280	-0,002	2,177	0,000	51,886	55,000	40	41,398	51,886	0,000	0,000
1,14	3,866	80,510	-10,583	-0,308	3,843	5	19	21,660	0,000	21,660	-0,003	2,110	0,000	49,785	55,000	40	39,722	49,785	0,000	0,000
1,16	3,924	67,160	-11,064	-0,308	3,878	5	19	22,040	0,000	22,040	-0,003	2,071	0,000	47,811	54,000	40	38,147	47,811	0,000	0,000
1,18	3,857	59,296	-11,866	-0,317	3,849	5	19	22,420	0,000	22,420	-0,003	2,043	0,000	45,756	53,000	40	36,507	45,756	0,000	0,000
1,20	3,779	54,059	-12,427	-0,302	3,732	5	19	22,800	0,000	22,800	-0,003	2,034	0,000	43,852	52,000	39	34,988	43,852	0,000	0,000
1,22	3,573	48,258	-13,309	-0,317	3,586	5	19	23,180	0,000	23,180	-0,004	2,034	0,000	42,139	51,000	39	33,621	42,139	0,000	0,000
1,24	3,420	44,750	-13,790	-0,320	3,416	5	19	23,560	0,000	23,560	-0,004	2,048	0,000	40,818	50,000	39	32,567	40,818	0,000	0,000
1,26	3,269	45,475	-14,191	-0,321	3,272	5	19	23,940	0,000	23,940	-0,004	2,073	0,000	40,339	49,000	39	32,185	40,339	0,000	0,000
1,28	3,143	48,017	-14,632	-0,318	3,160	5	19	24,320	0,000	24,320	-0,005	2,104	0,000	40,491	48,000	39	32,307	40,491	0,000	0,000
1,30	3,081	50,312	-14,792	-0,330	3,120	5	19	24,700	0,000	24,700	-0,005	2,127	0,000	41,186	48,000	38	32,861	41,186	0,000	0,000
1,32	3,149	53,877	-14,511	-0,333	3,134	5	19	25,080	0,000	25,080	-0,005	2,143	0,000	42,188	48,000	39	33,661	42,188	0,000	0,000
1,34	3,187	57,354	-14,431	-0,338	3,122	5	19	25,460	0,000	25,460	-0,005	2,161	0,000	43,029	48,000	38	34,332	43,029	0,000	0,000
1,36	3,044	58,961	-14,912	-0,337	3,023	4	19	25,840	0,000	25,840	-0,005	2,192	0,000	43,313	47,000	38	34,558	43,313	0,000	0,000
1,38	2,853	61,361	-15,353	-0,342	2,863	4	19	26,220	0,000	26,220	-0,005	2,231	0,000	39,708	46,000	38	34,331	43,028	0,000	0,000
1,40	2,707	61,856	-15,714	-0,346	2,693	4	19	26,600	0,000	26,600	-0,006	2,267	0,000	37,332	45,000	38	33,788	42,347	0,000	0,000
1,42	2,536	59,477	-15,874	-0,343	2,540	4	19	26,980	0,000	26,980	-0,006	2,294	0,000	35,184	43,000	38	32,971	41,323	0,000	0,000
1,44	2,394	56,727	-16,035	-0,354	2,447	4	19	27,360	0,000	27,360	-0,007	2,308	0,000	33,870	43,000	37	32,308	40,493	0,000	0,000
1,46	2,426	55,864	-15,874	-0,364	2,415	4	19	27,740	0,000	27,740	-0,007	2,319	0,000	33,425	42,000	37	32,332	40,523	0,000	0,000
1,48	2,442	60,329	-15,914	-0,354	2,444	4	19	28,120	0,000	28,120	-0,007	2,330	0,000	33,817	42,000	37	33,170	41,573	0,000	0,000
1,50	2,479	66,610	-15,674	-0,370	2,422	4	19	28,500	0,000	28,500	-0,007	2,355	0,000	33,512	42,000	37	33,911	42,502	0,000	0,000
1,52	2,362	68,093	-16,195	-0,382	2,401	4	19	28,880	0,000	28,880	-0,007	2,362	0,000	33,207	42,000	37	33,895	42,482	0,000	0,000
1,54	2,378	59,823	-16,235	-0,388	2,373	4	19	29,260	0,000	29,260	-0,007	2,355	0,000	32,811	41,000	37	33,221	41,637	0,000	0,000
1,56	2,395	55,573	-16,235	-0,392	2,396	4	19	29,640	0,000	29,640	-0,007	2,328	0,000	33,123	41,000	37	32,387	40,591	0,000	0,000
1,58	2,430	51,254	-16,275	-0,396	2,381	4	19	30,020	0,000	30,020	-0,007	2,314	0,000	32,909	41,000	37	31,629	39,642	0,000	0,000
1,60	2,333	47,569	-16,596	-0,405	2,318	4	19	30,400	0,000	30,400	-0,007	2,308	0,000	32,021	40,000	37	30,546	38,284	0,000	0,000
1,62	2,206	42,103	-16,876	-0,399	2,213	4	19	30,780	0,000	30,780	-0,008	2,308	0,000	30,550	39,000	37	29,149	36,533	0,000	0,000
1,64	2,116	36,513	-17,077	-0,402	2,103	4	19	31,160	0,000	31,160	-0,008	2,318	0,000	29,011	38,000	36	28,014	35,111	0,000	0,000
1,66	2,005	37,362	-17,277	-0,392	1,999	4	19	31,540	0,000	31,540	-0,009	2,349	0,000	27,541	37,000	36	27,655	34,661	0,000	0,000
1,68	1,893	42,373	-17,478	-0,381	1,878	4	19	31,920	0,000	31,920	-0,009	2,413	0,000	25,842	36,000	36	28,130	35,257	0,000	0,000
1,70	1,754	49,960	-17,718	-0,388	1,768	4	19	32,300	0,000	32,300	-0,010	2,486	0,000	24,293	0,000	0	29,019	36,370	123,943	14,346
1,72	1,674	57,988	-17,919	-0,390	1,650	3	19	32,680	0,000	32,680	-0,011	2,561	0,000	22,641	0,000	0	29,753	37,290	115,514	13,681
1,74	1,540	63,705	-18,119	-0,392	1,533	3	19	33,060	0,000	33,060	-0,012	2,630	0,000	21,001	0,000	0	0,000	37,760	107,147	12,944
1,76	1,404	67,411	-18,360	-0,380	1,406	3	19	33,440	0,000	33,440	-0,013	2,698	0,000	19,213	0,000	0	0,000	37,624	98,025	12,063
1,78	1,292	69,760	-18,520	-0,381	1,305	3	19	33,820	0,000	33,820	-0,015	2,751	0,000	17,791	0,000	0	0,000	37,260	90,768	11,306
1,80	1,237	70,009	-18,440	-0,380	1,252	3	19	34,200	0,000	34,200	-0,015	2,781	0,000	17,043	0,000	0	0,000	37,071	86,952	10,855
1,82	1,245	70,258	-18,480	-0,375	1,238	3	19	34,580	0,000	34,580	-0,015	2,788	0,000	16,842	0,000	0	0,000	36,956	85,931	10,665
1,84	1,250	68,302	-18,680	-0,370	1,239	3	19	34,960	0,000	34,960	-0,015	2,786	0,000	16,851	0,000	0	0,000	36,875	85,974	10,556
1,86	1,239	66,559	-17,558	-0,378	1,230	3	19	35,340	0,000	35,340	-0,015	2,786	0,000	16,725	0,000	0	0,000	36,609	85,332	10,375
1,88	1,218	65,379	-15,995	-0,370	1,219	3	19	35,720	0,000	35,720	-0,013	2,787	0,000	16,571	0,000	0	0,000	36,329	84,544	10,184
1,90	1,217	63,583	-12,908	-0,353	1,209	3	19	36,100	0,000	36,100	-0,012	2,788	0,000	16,415	0,000	0	0,000	36,019	83,751	9,994
1,92	1,205	61,469	-12,186	-0,358	1,190	3	19	36,480	0,000	36,480	-0,011	2,794	0,000	16,154	0,000	0	0,000	35,713	82,420	9,763
1,94	1,162	61,542	-12,667	-0,354	1,163	3	19	36,860	0,000	36,860	-0,011	2,809	0,000	15,762	0,000	0	0,000	35,533	80,416	9,490
1,96	1,134	63,061	-13,509	-0,353	1,124	3	19	37,240	0,000	37,240	-0,012	2,835	0,000	15,210	0,000	0	0,000	35,418	77,602	9,158
1,98	1,088	63,752	-12,267	-0,362	1,106	3	19	37,620	0,000	37,620	-0,011	2,853	0,000	14,959	0,000	0	0,000	35,652	76,324	8,982
2,00	1,109	66,101	-10,863	-0,351	1,112	3	19	38,000	0,000	38,000	-0,010	2,860	0,000	15,035	0,000	0	0,000	36,150	76,710	8,966

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini



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n.° Iscrizione alla CCIAA di Re 01999010309 - n.REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU4 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
2,02	1,149	68,133	-8,378	-0,352	1,139	3	19	38,380	0,000	38,380	-0,007	2,855	0,000	15,402	0,000	0	0,000	36,818	78,582	9,084
2,04	1,165	68,241	-3,688	-0,357	1,159	3	19	38,760	0,000	38,760	-0,003	2,852	0,000	15,682	0,000	0	0,000	37,331	80,012	9,153
2,06	1,166	69,126	1,163	-0,353	1,158	3	19	39,140	0,000	39,140	0,003	2,855	0,000	15,667	0,000	0	0,000	37,440	79,934	9,070
2,08	1,140	68,107	11,585	-0,363	1,144	3	19	39,520	0,000	39,520	0,009	2,862	0,000	15,469	0,000	0	0,000	37,277	78,926	8,895
2,10	1,117	66,028	16,516	-0,344	1,116	3	19	39,900	0,000	39,900	0,008	2,879	0,000	15,065	0,000	0	0,000	37,097	76,863	8,636
2,12	1,081	69,035	-1,163	-0,198	1,089	3	19	40,280	0,000	40,280	0,006	2,899	0,000	14,683	0,000	0	0,000	37,103	74,915	8,400
2,14	1,063	70,784	2,365	-0,187	1,072	3	19	40,660	0,000	40,660	0,001	2,917	0,000	14,440	0,000	0	0,000	37,331	73,672	8,237
2,16	1,071	70,717	0,441	-0,176	1,082	3	19	41,040	0,000	41,040	0,004	2,921	0,000	14,569	0,000	0	0,000	37,867	74,334	8,248
2,18	1,107	74,159	9,982	-0,175	1,090	3	19	41,420	0,000	41,420	0,010	2,922	0,000	14,676	0,000	0	0,000	38,185	74,877	8,237
2,20	1,081	72,680	20,925	-0,163	1,086	3	19	41,800	0,000	41,800	0,016	2,930	0,000	14,620	0,000	0	0,000	38,406	74,592	8,154
2,22	1,054	73,052	18,320	-0,174	1,084	3	19	42,180	0,000	42,180	0,019	2,928	0,000	14,584	0,000	0	0,000	38,213	74,409	8,057
2,24	1,097	69,562	19,081	-0,172	1,103	3	19	42,560	0,000	42,560	0,018	2,912	0,000	14,848	0,000	0	0,000	38,148	75,757	8,092
2,26	1,139	66,600	18,640	-0,165	1,128	3	19	42,940	0,000	42,940	0,016	2,891	0,000	15,191	0,000	0	0,000	37,999	77,506	8,153
2,28	1,130	65,033	15,033	-0,162	1,154	3	19	43,320	0,000	43,320	0,014	2,867	0,000	15,555	0,000	0	0,000	37,756	79,361	8,216
2,30	1,178	60,291	14,070	-0,162	1,186	3	19	43,700	0,000	43,700	0,013	2,842	0,000	15,998	0,000	0	0,000	37,590	81,623	8,314
2,32	1,237	58,087	13,790	-0,155	1,275	3	19	44,080	0,000	44,080	0,011	2,790	0,000	17,235	0,000	0	0,000	37,921	87,935	8,743
2,34	1,397	56,679	13,429	-0,149	1,401	3	19	44,460	0,000	44,460	0,010	2,728	0,000	18,987	0,000	0	0,000	38,610	96,872	9,377
2,36	1,555	53,612	12,948	-0,150	1,567	3	19	44,840	0,000	44,840	0,008	2,660	0,000	21,312	0,000	0	0,000	39,795	108,735	10,223
2,38	1,737	54,744	12,106	-0,150	1,695	3	19	45,220	0,000	45,220	0,007	2,616	0,000	23,099	0,000	0	0,000	40,774	117,852	10,853
2,40	1,782	55,699	11,345	-0,157	1,753	4	19	45,600	0,000	45,600	0,007	2,603	0,000	23,903	0,000	0	0,000	41,490	121,955	11,107
2,42	1,729	55,966	9,821	-0,137	1,701	3	19	45,980	0,000	45,980	0,006	2,627	0,000	23,175	0,000	0	0,000	41,464	118,240	10,769
2,44	1,583	57,628	8,138	-0,155	1,583	3	19	46,360	0,000	46,360	0,005	2,676	0,000	21,510	0,000	0	0,000	40,994	109,745	10,072
2,46	1,428	59,588	6,735	-0,152	1,437	3	19	46,740	0,000	46,740	0,005	2,742	0,000	19,458	0,000	0	0,000	40,304	99,278	9,226
2,48	1,292	60,949	6,735	-0,153	1,318	3	19	47,120	0,000	47,120	0,005	2,798	0,000	17,788	0,000	0	0,000	39,536	90,756	8,506
2,50	1,227	59,648	7,015	-0,172	1,245	3	19	47,500	0,000	47,500	0,006	2,830	0,000	16,763	0,000	0	0,000	38,828	85,526	8,030
2,52	1,209	57,605	8,538	-0,175	1,220	3	19	47,880	0,000	47,880	0,007	2,837	0,000	16,414	0,000	0	0,000	38,350	83,747	7,819
2,54	1,217	56,232	9,501	-0,176	1,224	3	19	48,260	0,000	48,260	0,008	2,829	0,000	16,454	0,000	0	0,000	38,025	83,947	7,762
2,56	1,235	53,643	9,941	-0,166	1,232	3	19	48,640	0,000	48,640	0,008	2,819	0,000	16,572	0,000	0	0,000	37,814	84,549	7,739
2,58	1,234	52,553	10,342	-0,176	1,252	3	19	49,020	0,000	49,020	0,009	2,804	0,000	16,837	0,000	0	0,000	37,692	85,901	7,774
2,60	1,275	51,233	10,623	-0,181	1,267	3	19	49,400	0,000	49,400	0,009	2,797	0,000	17,046	0,000	0	0,000	37,830	86,971	7,801
2,62	1,281	52,435	12,627	-0,183	1,293	3	19	49,780	0,000	49,780	0,010	2,789	0,000	17,404	0,000	0	0,000	38,237	88,794	7,892
2,64	1,311	53,532	13,309	-0,189	1,301	3	19	50,160	0,000	50,160	0,011	2,793	0,000	17,510	0,000	0	0,000	38,702	89,336	7,894
2,66	1,297	54,875	13,950	-0,187	1,309	3	19	50,540	0,000	50,540	0,011	2,800	0,000	17,614	0,000	0	0,000	39,239	89,869	7,898
2,68	1,304	57,013	14,231	-0,189	1,293	3	19	50,920	0,000	50,920	0,011	2,820	0,000	17,396	0,000	0	0,000	39,763	88,754	7,787
2,70	1,265	60,597	13,189	-0,184	1,263	3	19	51,300	0,000	51,300	0,011	2,852	0,000	16,957	0,000	0	0,000	40,388	86,518	7,600
2,72	1,205	65,362	12,066	-0,198	1,225	3	19	51,680	0,000	51,680	0,011	2,887	0,000	16,429	0,000	0	0,000	40,883	83,822	7,376
2,74	1,192	67,076	13,629	-0,212	1,199	3	19	52,060	0,000	52,060	0,012	2,914	0,000	16,054	0,000	0	0,000	41,336	81,910	7,205
2,76	1,185	69,037	15,514	-0,203	1,184	3	19	52,440	0,000	52,440	0,013	2,932	0,000	15,841	0,000	0	0,000	41,707	80,822	7,086
2,78	1,159	71,156	15,594	-0,196	1,171	3	19	52,820	0,000	52,820	0,014	2,945	0,000	15,660	0,000	0	0,000	41,926	79,897	6,981
2,80	1,153	70,612	15,914	-0,196	1,160	3	19	53,200	0,000	53,200	0,015	2,955	0,000	15,502	0,000	0	0,000	42,014	79,092	6,869
2,82	1,152	70,121	18,640	-0,210	1,162	3	19	53,580	0,000	53,580	0,016	2,953	0,000	15,517	0,000	0	0,000	41,948	79,167	6,826
2,84	1,163	68,554	19,161	-0,198	1,171	3	19	53,960	0,000	53,960	0,018	2,945	0,000	15,635	0,000	0	0,000	41,873	79,772	6,826
2,86	1,178	66,986	21,166	-0,201	1,200	3	19	54,340	0,000	54,340	0,018	2,926	0,000	16,034	0,000	0	0,000	41,909	81,805	6,918
2,88	1,238	64,978	20,284	-0,208	1,235	3	19	54,720	0,000	54,720	0,018	2,905	0,000	16,526	0,000	0	0,000	42,078	84,318	7,052
2,90	1,268	64,716	22,930	-0,204	1,275	3	19	55,100	0,000	55,100	0,019	2,884	0,000	17,077	0,000	0	0,000	42,340	87,129	7,204
2,92	1,296	63,960	24,774	-0,209	1,295	3	19	55,480	0,000	55,480	0,020	2,874	0,000	17,348	0,000	0	0,000	42,468	88,511	7,254
2,94	1,294	62,851	27,419	-0,208	1,294	3	19	55,860	0,000	55,860	0,021	2,871	0,000	17,328	0,000	0	0,000	42,268	88,406	7,194
2,96	1,263	60,931	26,698	-0,214	1,285	3	19	56,240	0,000	56,240	0,022	2,872	0,000	17,199	0,000	0	0,000	41,983	87,752	7,095
2,98	1,269	60,069	26,337	-0,228	1,256	3	19	56,620	0,000	56,620	0,023	2,883	0,000	16,787	0,000	0	0,000	41,554	85,646	6,897
3,00	1,207	59,613	29,063	-0,215	1,222	3	19	57,000	0,000	57,000	0,025	2,897	0,000	16,311	0,000	0	0,000	41,118	83,217	6,679

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

**SUBSOIL Srl - Società Unipersonale**

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Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
3,02	1,161	58,240	31,829	-0,228	1,178	3	19	57,380	0,000	57,380	0,028	2,913	0,000	15,691	0,000	0	0,000	40,365	80,059	6,406
3,04	1,135	54,750	34,434	-0,241	1,156	3	19	57,760	0,000	57,760	0,032	2,916	0,000	15,369	0,000	0	0,000	39,659	78,411	6,237
3,06	1,135	52,441	37,762	-0,236	1,149	3	19	58,140	0,000	58,140	0,036	2,907	0,000	15,270	0,000	0	0,000	38,967	77,910	6,146
3,08	1,137	49,498	44,897	-0,234	1,156	3	19	58,520	0,000	58,520	0,039	2,893	0,000	15,366	0,000	0	0,000	38,547	78,398	6,129
3,10	1,152	47,895	47,182	-0,236	1,187	3	19	58,900	0,000	58,900	0,040	2,872	0,000	15,800	0,000	0	0,000	38,592	80,612	6,237
3,12	1,228	48,510	41,810	-0,205	1,237	3	19	59,280	0,000	59,280	0,039	2,842	0,000	16,484	0,000	0	0,000	38,760	84,100	6,428
3,14	1,283	45,318	49,267	-0,204	1,297	3	19	59,660	0,000	59,660	0,039	2,811	0,000	17,321	0,000	0	0,000	39,120	88,371	6,672
3,16	1,330	45,056	55,360	-0,220	1,339	3	19	60,040	0,000	60,040	0,043	2,795	0,000	17,905	0,000	0	0,000	39,636	91,351	6,835
3,18	1,348	49,220	61,894	-0,217	1,366	3	19	60,420	0,000	60,420	0,047	2,800	0,000	18,277	0,000	0	0,000	40,747	93,251	6,944
3,20	1,358	53,896	65,622	-0,218	1,379	3	19	60,800	0,000	60,800	0,049	2,816	0,000	18,457	0,000	0	0,000	41,951	94,167	6,991
3,22	1,366	56,173	65,742	-0,223	1,393	3	19	61,180	0,196	60,984	0,050	2,830	0,000	18,643	0,000	0	0,000	43,171	95,116	7,061
3,24	1,386	61,396	69,310	-0,232	1,406	3	19	61,560	0,392	61,168	0,052	2,845	0,000	18,825	0,000	0	0,000	44,423	96,047	7,130
3,26	1,394	66,866	77,608	-0,242	1,394	3	19	61,940	0,589	61,351	0,057	2,865	0,000	18,653	0,000	0	0,000	45,157	95,168	7,071
3,28	1,324	65,933	83,581	-0,247	1,366	3	19	62,320	0,785	61,535	0,062	2,893	0,000	18,249	0,000	0	0,000	45,734	93,105	6,933
3,30	1,296	71,422	83,300	-0,256	1,320	3	19	62,700	0,981	61,719	0,065	2,924	0,000	17,603	0,000	0	0,000	45,913	89,811	6,706
3,32	1,255	74,212	82,659	-0,258	1,289	3	19	63,080	1,177	61,903	0,068	2,953	0,000	17,163	0,000	0	0,000	46,451	87,567	6,535
3,34	1,229	75,926	88,111	-0,262	1,269	3	19	63,460	1,373	62,087	0,073	2,972	0,000	16,877	0,000	0	0,000	46,769	86,105	6,407
3,36	1,230	77,057	99,134	-0,269	1,273	3	19	63,840	1,570	62,270	0,080	2,972	0,000	16,924	0,000	0	0,000	46,915	86,346	6,406
3,38	1,258	75,012	108,835	-0,267	1,325	3	19	64,220	1,766	62,454	0,084	2,938	0,000	17,645	0,000	0	0,000	46,842	90,026	6,660
3,40	1,376	68,664	115,369	-0,283	1,388	3	19	64,600	1,962	62,638	0,087	2,895	0,000	18,526	0,000	0	0,000	46,558	94,519	6,921
3,42	1,411	64,821	126,433	-0,285	1,458	3	19	64,980	2,158	62,822	0,089	2,848	0,000	19,502	0,000	0	0,000	46,191	99,502	7,205
3,44	1,458	61,842	138,459	-0,298	1,486	3	19	65,360	2,354	63,006	0,094	2,824	0,000	19,883	0,000	0	0,000	45,687	101,444	7,294
3,46	1,449	59,127	144,112	-0,299	1,486	3	19	65,740	2,551	63,189	0,100	2,815	0,000	19,879	0,000	0	0,000	45,139	101,422	7,261
3,48	1,403	57,842	149,443	-0,317	1,469	3	19	66,120	2,747	63,373	0,106	2,812	0,000	19,643	0,000	0	0,000	44,471	100,219	7,152
3,50	1,401	55,233	159,866	-0,320	1,448	3	19	66,500	2,943	63,557	0,111	2,814	0,000	19,340	0,000	0	0,000	43,867	98,675	7,025
3,52	1,380	53,806	159,425	-0,328	1,458	3	19	66,880	3,139	63,741	0,113	2,801	0,000	19,477	0,000	0	0,000	43,467	99,373	7,040
3,54	1,430	51,938	161,429	-0,356	1,476	3	19	67,260	3,335	63,925	0,112	2,785	0,000	19,727	0,000	0	0,000	43,114	100,646	7,091
3,56	1,455	49,276	163,594	-0,364	1,492	3	19	67,640	3,532	64,108	0,111	2,771	0,000	19,939	0,000	0	0,000	42,827	101,728	7,132
3,58	1,426	48,943	160,908	-0,372	1,479	3	19	68,020	3,728	64,292	0,111	2,767	0,000	19,753	0,000	0	0,000	42,193	100,781	7,041
3,60	1,392	45,946	157,060	-0,377	1,435	3	19	68,400	3,924	64,476	0,112	2,783	0,000	19,134	0,000	0	0,000	41,726	97,620	6,821
3,62	1,327	47,676	152,289	-0,394	1,366	3	19	68,780	4,120	64,660	0,114	2,819	0,000	18,168	0,000	0	0,000	41,461	92,693	6,498
3,64	1,225	51,718	147,479	-0,409	1,296	3	19	69,160	4,316	64,844	0,117	2,865	0,000	17,182	0,000	0	0,000	41,592	87,662	6,176
3,66	1,186	53,518	145,114	-0,405	1,230	3	19	69,540	4,513	65,027	0,121	2,908	0,000	16,245	0,000	0	0,000	41,509	82,884	5,865
3,68	1,131	53,132	142,749	-0,425	1,185	3	19	69,920	4,709	65,211	0,124	2,935	0,000	15,610	0,000	0	0,000	41,270	79,643	5,642
3,70	1,092	53,381	140,544	-0,435	1,144	3	19	70,300	4,905	65,395	0,126	2,950	0,000	15,032	0,000	0	0,000	40,508	76,694	5,418
3,72	1,066	48,497	138,620	-0,444	1,128	3	19	70,680	5,101	65,579	0,127	2,945	0,000	14,799	0,000	0	0,000	39,633	75,505	5,319
3,74	1,084	44,812	137,778	-0,442	1,139	3	19	71,060	5,297	65,763	0,124	2,911	0,000	14,956	0,000	0	0,000	38,363	76,305	5,342
3,76	1,128	38,393	136,736	-0,461	1,186	3	19	71,440	5,494	65,946	0,118	2,849	0,000	15,608	0,000	0	0,000	36,990	79,631	5,506
3,78	1,207	30,105	136,575	-0,457	1,228	3	19	71,820	5,690	66,130	0,113	2,787	0,000	16,190	0,000	0	0,000	35,481	82,605	5,641
3,80	1,210	27,425	135,453	-0,475	1,245	4	19	72,200	5,886	66,314	0,110	2,743	0,000	16,418	0,000	0	0,000	34,058	83,763	5,667
3,82	1,179	25,081	133,489	-0,486	1,220	4	19	72,580	6,082	66,498	0,111	2,734	0,000	16,070	0,000	0	0,000	32,936	81,988	5,525
3,84	1,136	22,560	131,003	-0,490	1,169	4	19	72,960	6,278	66,682	0,114	2,735	0,000	15,343	0,000	0	0,000	31,492	78,281	5,263
3,86	1,058	19,423	128,558	-0,497	1,131	4	19	73,340	6,475	66,865	0,116	2,726	0,000	14,802	0,000	0	0,000	30,023	75,521	5,057
3,88	1,066	16,602	128,197	-0,505	1,151	4	19	73,720	6,671	67,049	0,115	2,689	0,000	15,087	0,000	0	0,000	29,211	76,972	5,113
3,90	1,197	15,899	134,892	-0,516	1,374	4	19	74,100	6,867	67,233	0,107	2,566	0,000	18,200	0,000	0	24,051	30,143	92,858	6,040
3,92	1,711	15,195	173,535	-0,524	1,882	5	19	74,480	7,063	67,417	0,087	2,374	0,000	25,310	27,000	33	26,240	32,887	0,000	0,000
3,94	2,571	14,879	185,842	-0,516	2,612	5	19	74,860	7,259	67,601	0,065	2,203	0,000	35,526	31,000	34	29,654	37,166	0,000	0,000
3,96	3,378	20,067	159,946	-0,519	3,242	5	19	75,240	7,456	67,784	0,049	2,100	0,000	40,693	34,000	35	32,468	40,693	0,000	0,000
3,98	3,610	20,404	144,192	-0,527	3,608	5	19	75,620	7,652	67,968	0,039	2,068	0,000	43,625	36,000	36	34,807	43,625	0,000	0,000
4,00	3,686	23,687	133,088	-0,537	3,716	5	19	76,000	7,848	68,152	0,035	2,069	0,000	45,031	37,000	36	35,929	45,031	0,000	0,000

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

**SUBSOIL Srl - Società Unipersonale**

Strada per Barco 1/c, 42027 Montecchio E, Reggio Emilia

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n.° iscrizione alla CCIAA di Re 01999610309 - n. REA 241942 - CF e P.IVA 01999610309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
4,02	3,716	25,876	126,193	-0,540	3,749	5	19	76,380	8,044	68,336	0,032	2,083	0,000	46,195	37,000	36	36,858	46,195	0,000	0,000
4,04	3,717	26,583	120,861	-0,553	3,762	5	19	76,760	8,240	68,520	0,031	2,086	0,000	46,536	37,000	36	37,130	46,536	0,000	0,000
4,06	3,730	25,298	116,131	-0,554	3,762	5	19	77,140	8,437	68,703	0,029	2,081	0,000	46,277	37,000	36	36,923	46,277	0,000	0,000
4,08	3,721	24,048	109,316	-0,557	3,760	5	19	77,520	8,633	68,887	0,027	2,066	0,000	45,334	37,000	36	36,171	45,334	0,000	0,000
4,10	3,717	20,681	102,181	-0,561	3,743	5	19	77,900	8,829	69,071	0,025	2,028	0,000	43,001	37,000	36	34,309	43,001	0,000	0,000
4,12	3,689	12,055	86,547	-0,581	3,785	6	19	78,280	9,025	69,255	0,022	1,980	0,000	40,952	37,000	36	32,675	40,952	0,000	0,000
4,14	3,858	12,303	81,095	-0,585	3,898	6	19	78,660	9,221	69,439	0,019	1,937	0,000	39,969	37,000	36	31,890	39,969	0,000	0,000
4,16	4,065	13,821	78,891	-0,591	4,141	6	19	79,040	9,418	69,622	0,017	1,927	0,000	41,972	38,000	36	33,488	41,972	0,000	0,000
4,18	4,421	17,791	76,325	-0,583	4,413	6	19	79,420	9,614	69,806	0,015	1,930	0,000	44,917	39,000	37	35,838	44,917	0,000	0,000
4,20	4,677	22,855	72,677	-0,603	4,665	6	19	79,800	9,810	69,990	0,014	1,941	0,000	48,226	40,000	37	38,479	48,226	0,000	0,000
4,22	4,824	27,619	67,666	-0,604	4,842	6	19	80,180	10,006	70,174	0,012	1,956	0,000	51,003	41,000	37	40,694	51,003	0,000	0,000
4,24	4,954	30,830	64,259	-0,621	4,982	6	19	80,560	10,202	70,358	0,011	1,965	0,000	53,113	42,000	37	42,377	53,113	0,000	0,000
4,26	5,101	33,124	62,896	-0,621	5,100	6	19	80,940	10,399	70,541	0,011	1,958	0,000	53,909	42,000	37	43,012	53,909	0,000	0,000
4,28	5,181	30,180	63,016	-0,640	5,161	6	19	81,320	10,595	70,725	0,010	1,939	0,000	53,274	42,000	37	42,506	53,274	0,000	0,000
4,30	5,137	25,418	63,096	-0,642	5,150	6	19	81,700	10,791	70,909	0,010	1,912	0,000	51,350	42,000	37	40,971	51,350	0,000	0,000
4,32	5,067	21,397	63,297	-0,656	5,080	6	19	82,080	10,987	71,093	0,010	1,892	0,000	49,368	42,000	37	39,389	49,368	0,000	0,000
4,34	4,971	19,723	63,497	-0,650	5,016	6	19	82,460	11,183	71,277	0,011	1,881	0,000	48,067	42,000	37	38,351	48,067	0,000	0,000
4,36	4,946	19,071	63,618	-0,655	4,925	6	19	82,840	11,380	71,460	0,011	1,885	0,000	47,440	41,000	37	37,851	47,440	0,000	0,000
4,38	4,793	19,284	63,257	-0,669	4,762	6	19	83,220	11,576	71,644	0,011	1,903	0,000	46,851	40,000	37	37,381	46,851	0,000	0,000
4,40	4,482	18,985	62,255	-0,682	4,493	6	19	83,600	11,772	71,828	0,011	1,933	0,000	45,910	39,000	37	36,630	45,910	0,000	0,000
4,42	4,140	18,263	60,932	-0,672	4,178	6	19	83,980	11,968	72,012	0,012	1,969	0,000	44,564	38,000	36	35,557	44,564	0,000	0,000
4,44	3,849	17,276	59,729	-0,687	3,828	5	19	84,360	12,164	72,196	0,013	2,010	0,000	42,967	36,000	36	34,282	42,967	0,000	0,000
4,46	3,434	16,536	58,326	-0,696	3,509	5	19	84,740	12,361	72,379	0,014	2,059	0,000	41,784	35,000	36	33,339	41,784	0,000	0,000
4,48	3,184	17,771	58,005	-0,698	3,302	5	19	85,120	12,557	72,563	0,014	2,108	0,000	41,804	34,000	35	33,355	41,804	0,000	0,000
4,50	3,228	21,300	59,449	-0,714	3,355	5	19	85,500	12,753	72,747	0,014	2,122	0,000	43,198	34,000	35	34,467	43,198	0,000	0,000
4,52	3,592	22,994	62,014	-0,721	3,663	5	19	85,880	12,949	72,931	0,014	2,092	0,000	45,549	36,000	36	36,342	45,549	0,000	0,000
4,54	4,104	24,582	65,061	-0,741	4,111	5	19	86,260	13,145	73,115	0,012	2,034	0,000	47,620	38,000	36	37,995	47,620	0,000	0,000
4,56	4,574	24,089	60,491	-0,746	4,454	6	19	86,640	13,342	73,298	0,011	1,991	0,000	48,917	39,000	37	39,030	48,917	0,000	0,000
4,58	4,624	23,807	56,041	-0,757	4,508	6	19	87,020	13,538	73,482	0,010	1,984	0,000	49,094	39,000	37	39,171	49,094	0,000	0,000
4,60	4,269	24,425	51,191	-0,762	4,163	5	19	87,400	13,734	73,666	0,009	2,030	0,000	47,978	38,000	36	38,280	47,978	0,000	0,000
4,62	3,545	23,896	47,823	-0,758	3,581	5	19	87,780	13,930	73,850	0,010	2,118	0,000	45,946	35,000	36	36,659	45,946	0,000	0,000
4,64	2,880	23,650	45,418	-0,778	3,001	5	19	88,160	14,126	74,034	0,011	2,219	0,000	40,784	32,000	35	34,723	40,784	0,000	0,000
4,66	2,532	23,245	44,817	-0,796	2,607	5	19	88,540	14,323	74,217	0,012	2,316	0,000	35,256	30,000	34	33,979	42,586	0,000	0,000
4,68	2,363	28,608	44,576	-0,804	2,354	5	19	88,920	14,519	74,401	0,013	2,400	0,000	31,706	29,000	34	33,955	42,557	0,000	0,000
4,70	2,121	31,289	43,374	-0,804	2,110	4	19	89,300	14,715	74,585	0,014	2,499	0,000	28,284	27,000	33	34,339	43,039	0,000	0,000
4,72	1,800	35,628	42,372	-0,819	1,824	4	19	89,680	14,911	74,769	0,016	2,613	0,000	24,287	0,000	0	0,000	42,719	123,914	7,401
4,74	1,509	39,051	40,528	-0,834	1,569	4	19	90,060	15,107	74,953	0,017	2,729	0,000	20,702	0,000	0	0,000	42,145	105,623	6,375
4,76	1,355	40,815	39,125	-0,844	1,375	3	19	90,440	15,304	75,136	0,021	2,829	0,000	17,989	0,000	0	0,000	41,595	91,782	5,588
4,78	1,218	43,850	48,024	-0,869	1,261	3	19	90,820	15,500	75,320	0,032	2,888	0,000	16,382	0,000	0	0,000	40,807	83,580	5,109
4,80	1,155	40,534	72,918	-0,882	1,192	3	19	91,200	15,696	75,504	0,053	2,914	0,000	15,415	0,000	0	0,000	39,696	78,647	4,810
4,82	1,128	35,878	101,419	-0,909	1,180	3	19	91,580	15,892	75,688	0,074	2,900	0,000	15,234	0,000	0	0,000	38,534	77,723	4,734
4,84	1,158	33,938	115,730	-0,909	1,197	3	19	91,960	16,088	75,872	0,087	2,866	0,000	15,464	0,000	0	0,000	37,458	78,896	4,777
4,86	1,190	29,582	118,977	-0,904	1,210	3	19	92,340	16,285	76,055	0,090	2,838	0,000	15,646	0,000	0	0,000	36,572	79,824	4,808
4,88	1,163	27,342	117,294	-0,936	1,211	4	19	92,720	16,481	76,239	0,090	2,823	0,000	15,650	0,000	0	0,000	35,897	79,849	4,791
4,90	1,160	28,294	114,047	-0,937	1,194	3	19	93,100	16,677	76,423	0,090	2,835	0,000	15,411	0,000	0	0,000	35,884	78,630	4,713
4,92	1,141	30,324	114,367	-0,943	1,184	3	19	93,480	16,873	76,607	0,089	2,856	0,000	15,266	0,000	0	0,000	36,530	77,887	4,668
4,94	1,134	32,899	113,726	-0,962	1,156	3	19	93,860	17,069	76,791	0,091	2,892	0,000	14,655	0,000	0	0,000	37,257	75,872	4,553
4,96	1,078	36,057	111,601	-0,972	1,131	3	19	94,240	17,266	76,974	0,091	2,926	0,000	13,975	0,000	0	0,000	37,948	74,083	4,446
4,98	1,068	37,857	111,120	-0,975	1,103	3	19	94,620	17,462	77,158	0,093	2,960	0,000	13,190	0,000	0	0,000	38,541	72,057	4,315
5,00	1,051	39,815	110,118	-0,993	1,095	3	19	95,000	17,658	77,342	0,093	2,980	0,000	12,937	0,000	0	0,000	39,177	71,449	4,268

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

**SUBSOIL Srl - Società Unipersonale**

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n.° Iscrizione alla CCIAA di Re 01999010309 - n. REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
5,02	1,054	42,074	109,958	-1,007	1,093	3	19	95,380	17,854	77,526	0,092	2,988	0,000	12,834	0,000	0	0,000	39,512	71,249	4,246
5,04	1,062	40,787	109,156	-1,018	1,102	3	19	95,760	18,050	77,710	0,091	2,984	0,000	13,026	0,000	0	0,000	39,646	71,864	4,272
5,06	1,079	39,958	108,394	-1,024	1,113	3	19	96,140	18,247	77,893	0,089	2,974	0,000	13,283	0,000	0	0,000	39,584	72,655	4,309
5,08	1,089	40,224	108,114	-1,037	1,075	3	19	96,520	18,443	78,077	0,092	2,959	0,000	12,272	0,000	0	0,000	37,375	69,918	4,137
5,10	0,947	24,017	110,038	-1,096	1,139	3	19	96,900	18,639	78,261	0,088	2,922	0,000	13,880	0,000	0	0,000	37,953	74,447	4,395
5,12	1,268	39,911	113,485	-1,107	1,205	3	19	97,280	18,835	78,445	0,084	2,884	0,000	15,502	0,000	0	0,000	38,443	79,090	4,645
5,14	1,283	39,135	113,044	-1,109	1,317	3	19	97,660	19,031	78,629	0,077	2,866	0,000	17,069	0,000	0	0,000	41,352	87,086	5,094
5,16	1,284	40,547	112,363	-1,114	1,317	3	19	98,040	19,228	78,812	0,076	2,877	0,000	17,063	0,000	0	0,000	41,902	87,056	5,086
5,18	1,269	44,552	110,519	-1,127	1,310	3	19	98,420	19,424	78,996	0,075	2,898	0,000	16,963	0,000	0	0,000	42,800	86,546	5,054
5,20	1,265	47,675	108,515	-1,136	1,292	3	19	98,800	19,620	79,180	0,075	2,932	0,000	16,701	0,000	0	0,000	44,006	85,210	4,972
5,22	1,231	53,197	106,470	-1,154	1,276	3	19	99,180	19,816	79,364	0,073	2,963	0,000	16,472	0,000	0	0,000	45,124	84,039	4,892
5,24	1,224	56,496	103,744	-1,159	1,250	3	19	99,560	20,012	79,548	0,073	2,995	0,000	16,104	0,000	0	0,000	45,969	82,166	4,772
5,26	1,190	58,243	101,099	-1,173	1,221	3	19	99,940	20,209	79,731	0,072	3,024	0,000	15,698	0,000	0	0,000	46,469	80,094	4,641
5,28	1,148	60,819	96,609	-1,170	1,190	3	19	100,320	20,405	79,915	0,071	3,051	0,000	14,863	0,000	0	0,000	46,712	77,847	4,500
5,30	1,134	61,877	94,043	-1,187	1,162	3	19	100,700	20,601	80,099	0,069	3,074	0,000	14,068	0,000	0	0,000	46,830	75,823	4,373
5,32	1,109	62,107	90,436	-1,189	1,138	3	19	101,080	20,797	80,283	0,067	3,091	0,000	13,385	0,000	0	0,000	46,741	74,043	4,261
5,34	1,078	62,108	87,589	-1,192	1,102	3	19	101,460	20,993	80,467	0,066	3,114	0,000	12,445	0,000	0	0,000	46,443	71,478	4,104
5,36	1,031	62,178	81,616	-1,213	1,068	3	19	101,840	21,190	80,650	0,063	3,137	0,000	11,577	0,000	0	0,000	46,175	69,021	3,954
5,38	1,012	62,690	77,287	-1,219	1,040	3	19	102,220	21,386	80,834	0,061	3,155	0,000	10,879	0,000	0	0,000	45,879	66,984	3,828
5,40	0,997	61,773	75,884	-1,240	1,013	3	19	102,600	21,582	81,018	0,059	3,172	0,000	10,232	0,000	0	0,000	45,525	65,033	3,708
5,42	0,953	61,103	73,639	-1,232	0,988	3	19	102,980	21,778	81,202	0,059	3,186	0,000	9,650	0,000	0	0,000	45,051	63,230	3,597
5,44	0,939	60,045	72,717	-1,250	0,967	3	19	103,360	21,974	81,386	0,059	3,199	0,000	9,158	0,000	0	0,000	44,675	61,667	3,501
5,46	0,934	59,869	72,276	-1,261	0,962	3	19	103,740	22,171	81,569	0,058	3,200	0,000	9,024	0,000	0	0,000	44,448	61,282	3,471
5,48	0,939	58,758	71,314	-1,273	0,953	3	19	104,120	22,367	81,753	0,057	3,202	0,000	8,820	0,000	0	0,000	44,064	60,655	3,428
5,50	0,915	56,395	69,671	-1,282	0,937	3	19	104,500	22,563	81,937	0,056	3,204	0,000	8,449	0,000	0	0,000	43,280	59,430	3,351
5,52	0,885	52,903	67,506	-1,301	0,911	3	19	104,880	22,759	82,121	0,056	3,211	0,000	7,906	0,000	0	0,000	42,322	57,552	3,238
5,54	0,863	51,227	65,341	-1,299	0,886	3	19	105,260	22,955	82,305	0,055	3,221	0,000	7,413	0,000	0	0,000	41,524	55,792	3,132
5,56	0,844	50,539	63,978	-1,322	0,859	3	19	105,640	23,152	82,488	0,053	3,238	0,000	6,875	0,000	0	0,000	40,929	53,791	3,013
5,58	0,805	49,763	60,932	-1,328	0,825	3	19	106,020	23,348	82,672	0,053	3,265	0,000	6,247	0,000	0	0,000	40,383	51,334	2,869
5,60	0,763	49,587	60,090	-1,336	0,788	3	19	106,400	23,544	82,856	0,054	3,295	0,000	5,600	0,000	0	0,000	39,772	48,653	2,713
5,62	0,734	48,793	59,809	-1,352	0,755	3	19	106,780	23,740	83,040	0,055	3,324	0,000	5,056	0,000	0	0,000	39,265	46,285	2,575
5,64	0,707	48,706	59,168	-1,369	0,720	3	19	107,160	23,936	83,224	0,058	3,360	0,000	4,506	0,000	0	0,000	38,836	43,743	2,428
5,66	0,658	49,940	58,527	-1,381	0,696	3	19	107,540	24,133	83,407	0,059	3,380	0,000	4,149	0,000	0	0,000	38,272	42,021	2,328
5,68	0,663	46,078	58,246	-1,387	0,688	3	19	107,920	24,329	83,591	0,058	3,380	0,000	4,020	0,000	0	0,000	37,678	41,406	2,288
5,70	0,683	43,273	57,765	-1,407	0,692	3	19	108,300	24,525	83,775	0,057	3,357	0,000	4,074	0,000	0	0,000	36,905	41,728	2,301
5,72	0,673	40,769	57,444	-1,411	0,696	3	19	108,680	24,721	83,959	0,056	3,339	0,000	4,105	0,000	0	0,000	36,229	41,932	2,307
5,74	0,673	38,476	57,083	-1,407	0,690	3	19	109,060	24,917	84,143	0,055	3,326	0,000	4,011	0,000	0	0,000	35,273	41,495	2,278
5,76	0,666	34,437	56,562	-1,419	0,681	3	19	109,440	25,114	84,326	0,055	3,318	0,000	3,874	0,000	0	0,000	34,371	40,824	2,237
5,78	0,646	33,186	55,841	-1,424	0,661	3	19	109,820	25,310	84,510	0,055	3,326	0,000	3,599	0,000	0	0,000	33,505	39,392	2,154
5,80	0,615	32,798	55,199	-1,440	0,632	3	19	110,200	25,506	84,694	0,057	3,358	0,000	3,213	0,000	0	0,000	32,985	37,259	2,032
5,82	0,578	33,292	54,277	-1,455	0,598	3	19	110,580	25,702	84,878	0,059	3,401	0,000	2,802	0,000	0	0,000	32,574	34,834	1,896
5,84	0,547	33,769	53,476	-1,454	0,574	3	19	110,960	25,898	85,062	0,060	3,435	0,000	2,517	0,000	0	0,000	32,269	33,052	1,795
5,86	0,542	33,311	53,075	-1,462	0,557	3	19	111,340	26,095	85,245	0,061	3,460	0,000	2,326	0,000	0	0,000	32,061	31,803	1,724
5,88	0,527	33,717	52,794	-1,477	0,565	3	19	111,720	26,291	85,429	0,059	3,450	0,000	2,405	0,000	0	0,000	32,228	32,375	1,751
5,90	0,572	33,824	53,355	-1,504	0,628	3	19	112,100	26,487	85,613	0,053	3,368	0,000	3,113	0,000	0	0,000	33,066	36,872	1,990
5,92	0,731	31,761	55,119	-1,522	0,836	3	19	112,480	26,683	85,797	0,040	3,146	0,000	6,097	0,000	0	0,000	34,981	51,661	2,782
5,94	1,147	27,140	59,128	-1,546	1,145	3	19	112,860	26,879	85,981	0,031	2,907	0,000	12,396	0,000	0	0,000	36,862	73,742	3,962
5,96	1,498	25,076	61,172	-1,547	1,487	4	19	113,240	27,076	86,164	0,024	2,723	0,000	19,236	0,000	0	0,000	38,904	98,141	5,208
5,98	1,755	26,664	61,373	-1,556	1,682	4	19	113,620	27,272	86,348	0,021	2,642	0,000	21,951	0,000	0	0,000	40,036	111,993	5,905
6,00	1,731	25,624	58,527	-1,565	1,688	4	19	114,000	27,468	86,532	0,019	2,625	0,000	22,029	0,000	0	0,000	39,320	112,393	5,909

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini



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Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU4 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

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Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
6,02	1,518	19,981	54,237	-1,575	1,555	4	19	114,380	27,664	86,716	0,019	2,647	0,000	20,162	0,000	0	0,000	37,019	102,869	5,405
6,04	1,359	17,565	52,273	-1,572	1,401	4	19	114,760	27,860	86,900	0,019	2,675	0,000	18,013	0,000	0	0,000	34,251	91,903	4,826
6,06	1,274	15,361	50,990	-1,580	1,256	4	19	115,140	28,057	87,083	0,020	2,726	0,000	14,805	0,000	0	0,000	32,399	81,487	4,283
6,08	1,083	15,345	49,226	-1,605	1,144	4	19	115,520	28,253	87,267	0,020	2,778	0,000	12,053	0,000	0	0,000	31,219	73,495	3,866
6,10	1,027	15,660	45,779	-1,646	1,050	4	19	115,900	28,449	87,451	0,019	2,823	0,000	9,937	0,000	0	0,000	30,023	66,722	3,511
6,12	0,993	12,926	44,536	-1,650	0,985	4	19	116,280	28,645	87,635	0,018	2,868	0,000	8,593	0,000	0	0,000	29,545	62,038	3,265
6,14	0,890	15,678	42,332	-1,651	0,925	4	19	116,660	28,841	87,819	0,017	2,908	0,000	7,440	0,000	0	0,000	28,906	57,738	3,038
6,16	0,849	14,991	42,051	-1,656	0,869	3	19	117,040	29,038	88,002	0,017	2,971	0,000	6,432	0,000	0	0,000	29,163	53,741	2,821
6,18	0,827	17,038	41,730	-1,668	0,843	3	19	117,420	29,234	88,186	0,017	3,012	0,000	5,964	0,000	0	0,000	29,592	51,800	2,714
6,20	0,810	19,561	41,610	-1,666	0,825	3	19	117,800	29,430	88,370	0,017	3,057	0,000	5,657	0,000	0	0,000	30,559	50,502	2,640
6,22	0,795	21,943	41,209	-1,675	0,810	3	19	118,180	29,626	88,554	0,017	3,102	0,000	5,410	0,000	0	0,000	31,640	49,438	2,579
6,24	0,783	25,065	41,169	-1,677	0,801	3	19	118,560	29,822	88,738	0,017	3,142	0,000	5,244	0,000	0	0,000	32,812	48,726	2,537
6,26	0,781	28,470	41,410	-1,690	0,810	3	19	118,940	30,019	88,921	0,017	3,162	0,000	5,371	0,000	0	0,000	34,085	49,365	2,565
6,28	0,823	30,552	42,532	-1,704	0,834	3	19	119,320	30,215	89,105	0,017	3,159	0,000	5,736	0,000	0	0,000	35,163	51,065	2,648
6,30	0,855	31,152	44,095	-1,701	0,867	3	19	119,700	30,411	89,289	0,018	3,144	0,000	6,249	0,000	0	0,000	36,010	53,354	2,761
6,32	0,877	32,105	44,937	-1,723	0,892	3	19	120,080	30,607	89,473	0,019	3,132	0,000	6,668	0,000	0	0,000	36,699	55,170	2,849
6,34	0,899	33,587	45,699	-1,730	0,916	3	19	120,460	30,803	89,657	0,019	3,123	0,000	7,054	0,000	0	0,000	37,371	56,806	2,927
6,36	0,924	34,328	46,781	-1,738	0,940	3	19	120,840	31,000	89,840	0,020	3,112	0,000	7,472	0,000	0	0,000	37,946	58,524	3,010
6,38	0,949	34,435	50,549	-1,747	0,961	3	19	121,220	31,196	90,024	0,022	3,098	0,000	7,839	0,000	0	0,000	38,209	60,005	3,079
6,40	0,961	33,659	50,910	-1,766	0,973	3	19	121,600	31,392	90,208	0,023	3,090	0,000	8,026	0,000	0	0,000	38,336	60,779	3,113
6,42	0,956	34,153	50,790	-1,769	0,978	3	19	121,980	31,588	90,392	0,022	3,093	0,000	8,113	0,000	0	0,000	38,714	61,169	3,126
6,44	0,966	36,799	50,469	-1,781	0,978	3	19	122,360	31,784	90,576	0,022	3,105	0,000	8,091	0,000	0	0,000	39,278	61,148	3,119
6,46	0,961	38,123	50,349	-1,782	0,990	3	19	122,740	31,981	90,759	0,021	3,112	0,000	8,285	0,000	0	0,000	40,158	61,941	3,153
6,48	0,991	40,398	50,309	-1,800	1,012	3	19	123,120	32,177	90,943	0,021	3,107	0,000	8,690	0,000	0	0,000	40,929	63,498	3,226
6,50	1,033	41,210	50,870	-1,805	1,046	3	19	123,500	32,373	91,127	0,020	3,100	0,000	9,333	0,000	0	0,000	42,061	65,874	3,340
6,52	1,062	44,773	51,191	-1,820	1,075	3	19	123,880	32,569	91,311	0,020	3,098	0,000	9,914	0,000	0	0,000	43,294	67,961	3,439
6,54	1,079	48,531	51,351	-1,833	1,095	3	19	124,260	32,765	91,495	0,019	3,102	0,000	10,301	0,000	0	0,000	44,391	69,343	3,501
6,56	1,092	49,236	51,191	-1,835	1,111	3	19	124,640	32,962	91,678	0,019	3,105	0,000	10,622	0,000	0	0,000	45,293	70,487	3,552
6,58	1,111	51,441	51,111	-1,845	1,111	3	19	125,020	33,158	91,862	0,018	3,113	0,000	10,590	0,000	0	0,000	45,729	70,451	3,543
6,60	1,079	52,447	49,828	-1,854	1,108	3	19	125,400	33,354	92,046	0,017	3,122	0,000	10,487	0,000	0	0,000	46,099	70,177	3,522
6,62	1,082	52,888	49,387	-1,850	1,096	3	19	125,780	33,550	92,230	0,016	3,135	0,000	10,210	0,000	0	0,000	46,260	69,314	3,472
6,64	1,077	53,946	48,425	-1,859	1,080	3	19	126,160	33,746	92,414	0,015	3,156	0,000	9,854	0,000	0	0,000	46,706	68,162	3,408
6,66	1,033	58,356	47,503	-1,850	1,051	3	19	126,540	33,943	92,597	0,015	3,186	0,000	9,226	0,000	0	0,000	47,046	66,019	3,294
6,68	0,994	59,520	47,142	-1,859	1,021	3	19	126,920	34,139	92,781	0,015	3,214	0,000	8,620	0,000	0	0,000	47,114	63,879	3,181
6,70	0,989	57,968	47,062	-1,858	1,004	3	19	127,300	34,335	92,965	0,014	3,224	0,000	8,266	0,000	0	0,000	46,768	62,617	3,112
6,72	0,981	56,503	46,661	-1,860	0,996	3	19	127,680	34,531	93,149	0,014	3,222	0,000	8,103	0,000	0	0,000	46,272	62,055	3,078
6,74	0,972	54,845	46,300	-1,874	0,994	3	19	128,060	34,727	93,333	0,013	3,218	0,000	8,032	0,000	0	0,000	45,837	61,843	3,061
6,76	0,981	53,381	46,180	-1,864	0,991	3	19	128,440	34,924	93,516	0,013	3,211	0,000	7,961	0,000	0	0,000	45,313	61,632	3,045
6,78	0,974	51,070	46,100	-1,871	0,976	3	19	128,820	35,120	93,700	0,013	3,214	0,000	7,667	0,000	0	0,000	44,663	60,540	2,985
6,80	0,927	49,711	45,619	-1,885	0,939	3	19	129,200	35,316	93,884	0,013	3,236	0,000	6,977	0,000	0	0,000	43,852	57,812	2,845
6,82	0,868	49,517	44,817	-1,914	0,875	3	19	129,580	35,512	94,068	0,012	3,285	0,000	5,900	0,000	0	0,000	42,952	53,213	2,613
6,84	0,783	49,870	43,895	-1,905	0,813	3	19	129,960	35,708	94,252	0,012	3,340	0,000	4,951	0,000	0	0,000	42,255	48,792	2,392
6,86	0,743	50,804	43,454	-1,915	0,761	3	19	130,340	35,905	94,435	0,012	3,393	0,000	4,205	0,000	0	0,000	41,653	45,014	2,202
6,88	0,711	50,875	42,813	-1,923	0,724	3	19	130,720	36,101	94,619	0,011	3,434	0,000	3,724	0,000	0	0,000	41,318	42,402	2,070
6,90	0,675	51,933	42,372	-1,928	0,701	3	19	131,100	36,297	94,803	0,011	3,461	0,000	3,429	0,000	0	0,000	41,080	40,725	1,985
6,92	0,674	51,932	42,372	-1,941	0,697	3	19	131,480	36,493	94,987	0,011	3,463	0,000	3,367	0,000	0	0,000	40,833	40,394	1,965
6,94	0,699	48,651	42,612	-1,941	0,717	3	19	131,860	36,689	95,171	0,010	3,431	0,000	3,592	0,000	0	0,000	40,583	41,760	2,027
6,96	0,733	45,634	42,893	-1,945	0,738	3	19	132,240	36,886	95,354	0,010	3,390	0,000	3,854	0,000	0	0,000	39,936	43,303	2,098
6,98	0,740	41,542	43,093	-1,965	0,756	3	19	132,620	37,082	95,538	0,010	3,350	0,000	4,062	0,000	0	0,000	39,013	44,496	2,152
7,00	0,750	36,938	43,093	-1,961	0,761	3	19	133,000	37,278	95,722	0,009	3,322	0,000	4,123	0,000	0	0,000	37,978	44,872	2,166

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015



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n.° iscrizione alla CCIAA di Re 01999010309 - n.REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0526b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU4 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
7,02	0,750	35,068	42,973	-1,976	0,764	3	19	133,380	37,474	95,906	0,009	3,295	0,000	4,151	0,000	0	0,000	36,865	45,071	2,171
7,04	0,750	31,134	43,013	-1,984	0,774	3	19	133,760	37,670	96,090	0,009	3,259	0,000	4,268	0,000	0	0,000	35,745	45,740	2,199
7,06	0,779	26,336	43,494	-1,992	0,806	3	19	134,140	37,867	96,273	0,008	3,201	0,000	4,688	0,000	0	0,000	34,832	47,988	2,303
7,08	0,845	24,660	43,935	-2,006	0,852	3	19	134,520	38,063	96,457	0,008	3,144	0,000	5,334	0,000	0	0,000	34,612	51,234	2,454
7,10	0,887	25,401	44,737	-2,000	0,910	3	19	134,900	38,259	96,641	0,013	3,084	0,000	6,213	0,000	0	0,000	34,649	55,349	2,646
7,12	0,949	21,970	56,402	-2,030	0,965	3	19	135,280	38,455	96,825	0,017	3,044	0,000	7,104	0,000	0	0,000	35,257	59,241	2,827
7,14	1,005	24,758	57,444	-2,039	0,998	3	19	135,660	38,651	97,009	0,022	3,024	0,000	7,658	0,000	0	0,000	35,727	61,564	2,932
7,16	0,981	26,169	58,326	-2,035	0,998	3	19	136,040	38,848	97,192	0,022	3,047	0,000	7,641	0,000	0	0,000	36,773	61,554	2,926
7,18	0,949	28,957	57,204	-2,043	0,971	3	19	136,420	39,044	97,376	0,022	3,093	0,000	7,154	0,000	0	0,000	37,717	59,617	2,829
7,20	0,925	33,402	57,605	-2,051	0,953	3	19	136,800	39,240	97,560	0,023	3,136	0,000	6,820	0,000	0	0,000	38,949	58,265	2,759
7,22	0,925	37,001	58,647	-2,046	0,934	3	19	137,180	39,436	97,744	0,025	3,179	0,000	6,489	0,000	0	0,000	40,133	56,886	2,689
7,24	0,891	40,194	61,854	-2,053	0,922	3	19	137,560	39,632	97,928	0,029	3,205	0,000	6,291	0,000	0	0,000	40,884	56,064	2,645
7,26	0,888	40,741	66,744	-2,060	0,914	3	19	137,940	39,829	98,111	0,035	3,219	0,000	6,143	0,000	0	0,000	41,201	55,454	2,611
7,28	0,896	40,406	72,236	-2,059	0,932	3	19	138,320	40,025	98,295	0,040	3,198	0,000	6,401	0,000	0	0,000	40,991	56,657	2,663
7,30	0,938	36,261	75,844	-2,072	0,956	3	19	138,700	40,221	98,479	0,043	3,163	0,000	6,778	0,000	0	0,000	40,377	58,358	2,738
7,32	0,957	32,857	77,287	-2,074	0,990	3	19	139,080	40,417	98,663	0,043	3,109	0,000	7,340	0,000	0	0,000	39,254	60,783	2,846
7,34	0,997	28,060	78,450	-2,078	1,017	3	19	139,460	40,613	98,847	0,043	3,063	0,000	7,799	0,000	0	0,000	38,209	62,714	2,931
7,36	1,019	26,014	79,011	-2,082	1,049	3	19	139,840	40,810	99,030	0,043	3,022	0,000	8,349	0,000	0	0,000	37,574	64,950	3,030
7,38	1,051	25,891	82,098	-2,095	1,062	3	19	140,220	41,006	99,214	0,043	3,013	0,000	8,562	0,000	0	0,000	37,641	65,833	3,066
7,40	1,034	27,479	82,098	-2,087	1,067	3	19	140,600	41,202	99,398	0,045	3,023	0,000	8,629	0,000	0	0,000	38,337	66,151	3,075
7,42	1,031	30,337	84,663	-2,091	1,054	3	19	140,980	41,398	99,582	0,048	3,059	0,000	8,379	0,000	0	0,000	39,546	65,247	3,027
7,44	1,012	35,364	87,990	-2,092	1,040	3	19	141,360	41,594	99,766	0,051	3,099	0,000	8,094	0,000	0	0,000	40,961	64,187	2,972
7,46	0,987	39,351	90,355	-2,101	1,016	3	19	141,740	41,791	99,949	0,055	3,141	0,000	7,651	0,000	0	0,000	42,015	62,464	2,887
7,48	0,958	40,850	90,436	-2,101	0,974	3	19	142,120	41,987	100,133	0,058	3,188	0,000	6,915	0,000	0	0,000	42,443	59,436	2,742
7,50	0,885	42,914	90,876	-2,108	0,932	3	19	142,500	42,183	100,317	0,061	3,226	0,000	6,211	0,000	0	0,000	42,246	56,381	2,597
7,52	0,861	41,856	89,554	-2,105	0,875	3	19	142,880	42,379	100,501	0,065	3,275	0,000	5,339	0,000	0	0,000	41,685	52,324	2,405
7,54	0,789	41,980	88,752	-2,111	0,834	3	19	143,260	42,575	100,685	0,067	3,301	0,000	4,743	0,000	0	0,000	40,676	49,363	2,265
7,56	0,763	38,435	87,469	-2,121	0,779	3	19	143,640	42,772	100,868	0,070	3,343	0,000	4,006	0,000	0	0,000	39,428	45,404	2,080
7,58	0,697	37,235	85,906	-2,118	0,737	3	19	144,020	42,968	101,052	0,073	3,369	0,000	3,483	0,000	0	0,000	38,046	42,378	1,937
7,60	0,665	34,854	84,703	-2,133	0,683	3	19	144,400	43,164	101,236	0,077	3,419	0,000	2,866	0,000	0	0,000	36,792	38,477	1,756
7,62	0,601	34,449	83,701	-2,128	0,635	3	19	144,780	43,360	101,420	0,082	3,473	0,000	2,374	0,000	0	0,000	35,885	35,051	1,597
7,64	0,555	35,860	83,100	-2,124	0,588	3	19	145,160	43,556	101,604	0,090	3,535	0,000	1,930	0,000	0	0,000	35,056	31,632	1,438
7,66	0,523	34,678	82,859	-2,125	0,559	3	19	145,540	43,753	101,787	0,095	3,567	0,000	1,683	0,000	0	0,000	34,120	29,562	1,342
7,68	0,516	30,604	83,260	-2,123	0,543	3	19	145,920	43,949	101,971	0,099	3,571	0,000	1,548	0,000	0	0,000	32,892	28,378	1,286
7,70	0,506	27,552	83,982	-2,132	0,541	3	19	146,300	44,145	102,155	0,101	3,539	0,000	1,526	0,000	0	0,000	31,387	28,199	1,275
7,72	0,516	22,279	85,304	-2,129	0,546	3	19	146,680	44,341	102,339	0,103	3,490	0,000	1,556	0,000	0	0,000	29,810	28,500	1,287
7,74	0,528	17,745	87,349	-2,135	0,567	3	19	147,060	44,537	102,523	0,102	3,406	0,000	1,718	0,000	0	0,000	28,216	29,977	1,351
7,76	0,567	14,094	89,473	-2,137	0,587	3	19	147,440	44,734	102,706	0,102	3,317	0,000	1,883	0,000	0	0,000	26,389	31,408	1,413
7,78	0,575	9,438	92,280	-2,137	0,607	3	19	147,820	44,930	102,890	0,102	3,229	0,000	2,047	0,000	0	0,000	24,650	32,779	1,472
7,80	0,585	7,409	93,883	-2,136	0,620	3	19	148,200	45,126	103,074	0,104	3,150	0,000	2,158	0,000	0	0,000	22,922	33,688	1,510
7,82	0,604	5,805	96,529	-2,158	0,638	4	19	148,580	45,322	103,258	0,105	3,088	0,000	2,318	0,000	0	0,000	21,986	34,948	1,564
7,84	0,626	5,028	99,615	-2,164	0,679	4	19	148,960	45,518	103,442	0,105	3,017	0,000	2,720	0,000	0	0,000	21,777	37,890	1,692
7,86	0,705	4,994	107,392	-2,188	0,740	4	19	149,340	45,715	103,625	0,108	2,947	0,000	3,369	0,000	0	0,000	22,201	42,203	1,882
7,88	0,778	4,994	120,701	-2,202	0,827	4	19	149,720	45,911	103,809	0,107	2,863	0,000	4,415	0,000	0	0,000	22,877	48,348	2,152
7,90	0,876	4,394	126,433	-2,220	0,905	4	19	150,100	46,107	103,993	0,105	2,802	0,000	5,487	0,000	0	0,000	23,630	53,926	2,399
7,92	0,933	5,047	129,280	-2,230	0,975	4	19	150,480	46,303	104,177	0,101	2,755	0,000	6,542	0,000	0	0,000	24,292	58,908	2,618
7,94	0,984	5,118	133,729	-2,233	1,028	4	19	150,860	46,499	104,361	0,099	2,731	0,000	7,392	0,000	0	0,000	25,070	62,659	2,781
7,96	1,031	5,384	138,139	-2,248	1,079	4	19	151,240	46,696	104,544	0,099	2,707	0,000	8,256	0,000	0	0,000	25,744	66,264	2,937
7,98	1,080	5,825	144,633	-2,256	1,145	5	19	151,620	46,892	104,728	0,097	2,678	0,000	9,458	0,000	0	0,000	26,555	70,963	3,142
8,00	1,178	6,019	147,038	-2,280	1,227	5	19	152,000	47,088	104,912	0,093	2,639	0,000	11,068	0,000	0	0,000	27,371	76,800	3,397

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

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Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
8,02	1,274	6,002	148,200	-2,281	1,314	5	19	152,380	47,284	105,096	0,086	2,606	0,000	12,912	0,000	0	0,000	28,349	82,992	3,667
8,04	1,340	6,955	148,000	-2,279	1,376	5	19	152,760	47,480	105,280	0,082	2,593	0,000	14,282	18,000	29	23,419	29,352	0,000	0,000
8,06	1,362	7,926	146,196	-2,303	1,393	5	19	153,140	47,677	105,463	0,079	2,599	0,000	14,665	18,000	29	23,921	29,980	0,000	0,000
8,08	1,328	7,697	144,192	-2,318	1,499	5	19	153,520	47,873	105,647	0,069	2,608	0,000	17,239	0,000	0	0,000	32,926	96,122	4,227
8,10	1,664	15,350	129,961	-2,313	1,576	5	19	153,900	48,069	105,831	0,057	2,605	0,000	19,213	0,000	0	0,000	34,639	101,552	4,460
8,12	1,603	12,898	112,002	-2,326	1,563	5	19	154,280	48,265	106,015	0,048	2,637	0,000	18,829	0,000	0	0,000	35,748	100,647	4,410
8,14	1,305	12,793	105,468	-2,319	1,356	4	19	154,660	48,461	106,199	0,049	2,696	0,000	13,644	0,000	0	0,000	32,849	85,800	3,748
8,16	1,050	8,630	105,107	-2,327	1,129	4	19	155,040	48,658	106,382	0,060	2,781	0,000	8,937	0,000	0	0,000	29,664	69,566	3,028
8,18	0,923	6,673	110,439	-2,335	0,988	4	19	155,420	48,854	106,566	0,076	2,831	0,000	6,513	0,000	0	0,000	27,002	59,472	2,581
8,20	0,877	7,044	120,581	-2,347	0,909	4	19	155,800	49,050	106,750	0,095	2,869	0,000	5,309	0,000	0	0,000	25,624	53,766	2,327
8,22	0,803	6,180	129,600	-2,357	0,858	4	19	156,180	49,246	106,934	0,114	2,902	0,000	4,606	0,000	0	0,000	24,919	50,129	2,166
8,24	0,762	5,827	138,339	-2,360	0,806	4	19	156,560	49,442	107,118	0,137	2,936	0,000	3,942	0,000	0	0,000	24,074	46,413	2,002
8,26	0,713	5,863	146,597	-2,371	0,777	4	19	156,940	49,639	107,301	0,158	2,959	0,000	3,584	0,000	0	0,000	23,667	44,297	1,907
8,28	0,706	5,775	158,623	-2,391	0,777	4	19	157,320	49,835	107,485	0,177	2,952	0,000	3,573	0,000	0	0,000	23,630	44,263	1,903
8,30	0,750	4,999	172,653	-2,396	0,824	4	19	157,700	50,031	107,669	0,190	2,901	0,000	4,120	0,000	0	0,000	23,615	47,576	2,041
8,32	0,836	4,876	198,269	-2,406	0,905	4	19	158,080	50,227	107,853	0,197	2,830	0,000	5,184	0,000	0	0,000	24,211	53,375	2,289
8,34	0,929	5,194	222,200	-2,403	0,988	4	19	158,460	50,423	108,037	0,203	2,781	0,000	6,393	0,000	0	0,000	25,292	59,281	2,542
8,36	0,978	6,040	235,189	-2,406	1,064	4	19	158,840	50,620	108,220	0,207	2,751	0,000	7,607	0,000	0	0,000	26,552	64,688	2,772
8,38	1,044	6,817	256,394	-2,408	1,109	4	19	159,220	50,816	108,404	0,213	2,746	0,000	8,351	0,000	0	0,000	27,680	67,828	2,902
8,40	1,047	7,699	267,098	-2,414	1,148	4	19	159,600	51,012	108,588	0,221	2,742	0,000	9,032	0,000	0	0,000	28,650	70,591	3,016
8,42	1,079	8,282	283,533	-2,433	1,211	4	19	159,980	51,208	108,772	0,230	2,725	0,000	10,198	0,000	0	0,000	29,821	75,048	3,203
8,44	1,208	9,252	327,107	-2,451	1,328	5	19	160,360	51,404	108,956	0,243	2,676	0,000	12,593	0,000	0	0,000	31,117	83,397	3,559
8,46	1,355	9,287	393,811	-2,448	1,518	5	19	160,740	51,601	109,139	0,241	2,596	0,000	17,041	0,000	0	26,082	32,689	96,959	4,143
8,48	1,605	9,341	413,494	-2,453	1,792	5	19	161,120	51,797	109,323	0,220	2,497	0,000	22,835	21,000	31	27,647	34,650	0,000	0,000
8,50	1,997	10,364	425,480	-2,456	2,132	5	19	161,500	51,993	109,507	0,190	2,408	0,000	27,584	23,000	31	29,865	37,431	0,000	0,000
8,52	2,359	12,904	437,386	-2,473	2,654	5	19	161,880	52,189	109,691	0,129	2,316	0,000	34,890	26,000	33	33,595	42,106	0,000	0,000
8,54	3,224	18,285	261,085	-2,476	3,245	5	19	162,260	52,385	109,875	0,074	2,256	0,000	43,159	29,000	34	38,556	48,324	0,000	0,000
8,56	3,865	27,281	146,717	-2,464	3,795	5	19	162,640	52,582	110,058	0,034	2,229	0,000	50,852	31,000	34	43,893	55,013	0,000	0,000
8,58	4,119	36,365	115,209	-2,468	4,176	5	19	163,020	52,778	110,242	0,016	2,234	0,000	56,176	33,000	35	48,775	61,132	0,000	0,000
8,60	4,422	45,449	94,645	-2,485	4,482	5	19	163,400	52,974	110,426	0,011	2,242	0,000	60,461	34,000	35	53,009	66,438	0,000	0,000
8,62	4,805	53,899	86,427	-2,486	4,811	5	19	163,780	53,170	110,610	0,007	2,236	0,000	65,061	35,000	36	56,604	70,943	0,000	0,000
8,64	5,118	59,085	78,810	-2,492	5,121	5	19	164,160	53,366	110,794	0,002	2,220	0,000	69,401	36,000	36	59,213	74,213	0,000	0,000
8,66	5,379	61,025	17,879	-2,495	5,439	5	19	164,540	53,563	110,977	-0,003	2,196	0,000	76,562	37,000	36	61,086	76,562	0,000	0,000
8,68	5,779	63,160	19,322	-2,479	5,704	5	19	164,920	53,759	111,161	-0,006	2,175	0,000	78,342	38,000	36	62,507	78,342	0,000	0,000
8,70	5,934	65,700	20,885	-2,490	5,942	5	19	165,300	53,955	111,345	-0,006	2,155	0,000	79,631	39,000	37	63,535	79,631	0,000	0,000
8,72	6,093	64,817	22,809	-2,494	6,033	5	19	165,680	54,151	111,529	-0,005	2,131	0,000	78,489	39,000	37	62,624	78,489	0,000	0,000
8,74	6,051	52,523	23,892	-2,503	6,006	6	19	166,060	54,347	111,713	-0,005	2,092	0,000	74,285	39,000	37	59,270	74,285	0,000	0,000
8,76	5,849	36,824	25,014	-2,484	5,864	6	19	166,440	54,544	111,896	-0,005	2,027	0,000	66,799	39,000	37	53,297	66,799	0,000	0,000
8,78	5,667	20,384	26,016	-2,488	5,717	6	19	166,820	54,740	112,080	-0,005	1,960	0,000	59,792	38,000	36	47,706	59,792	0,000	0,000
8,80	5,610	16,697	27,700	-2,507	5,666	6	19	167,200	54,936	112,264	-0,005	1,917	0,000	56,077	38,000	36	44,743	56,077	0,000	0,000
8,82	5,694	19,572	30,225	-2,513	5,790	6	19	167,580	55,132	112,448	-0,004	1,915	0,000	57,175	39,000	36	45,619	57,175	0,000	0,000
8,84	6,035	23,787	34,274	-2,528	6,021	6	19	167,960	55,328	112,632	-0,004	1,915	0,000	59,561	39,000	37	47,522	59,561	0,000	0,000
8,86	6,298	25,003	37,040	-2,537	6,320	6	19	168,340	55,525	112,815	-0,003	1,897	0,000	61,158	40,000	37	48,796	61,158	0,000	0,000
8,88	6,590	23,468	40,007	-2,535	6,546	6	19	168,720	55,721	112,999	-0,003	1,871	0,000	61,321	41,000	37	48,926	61,321	0,000	0,000
8,90	6,711	21,668	41,249	-2,548	6,710	6	19	169,100	55,917	113,183	-0,002	1,845	0,000	60,903	42,000	37	48,593	60,903	0,000	0,000
8,92	6,788	20,908	42,291	-2,549	6,769	6	19	169,480	56,113	113,367	-0,002	1,830	0,000	60,301	42,000	37	48,112	60,301	0,000	0,000
8,94	6,765	19,796	43,935	-2,569	6,731	6	19	169,860	56,309	113,551	-0,002	1,823	0,000	59,401	42,000	37	47,394	59,401	0,000	0,000
8,96	6,595	17,766	45,218	-2,580	6,630	6	19	170,240	56,506	113,734	-0,002	1,821	0,000	58,330	41,000	37	46,540	58,330	0,000	0,000
8,98	6,483	17,007	46,741	-2,586	6,484	6	19	170,620	56,702	113,918	-0,002	1,826	0,000	57,386	41,000	37	45,787	57,386	0,000	0,000
9,00	6,326	17,041	47,944	-2,600	6,399	6	19	171,000	56,898	114,102	-0,001	1,836	0,000	57,305	41,000	37	45,722	57,305	0,000	0,000

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

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n.° iscrizione alla CCIAA di Re 01999010309 - n.REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
9,02	6,340	18,221	50,429	-2,615	6,383	6	19	171,380	57,094	114,286	-0,001	1,853	0,000	58,450	40,000	37	46,636	58,450	0,000	0,000
9,04	6,432	22,242	53,836	-2,641	6,443	6	19	171,760	57,290	114,470	-0,001	1,862	0,000	59,618	41,000	37	47,568	59,618	0,000	0,000
9,06	6,501	21,623	56,602	-2,642	6,522	6	19	172,140	57,487	114,653	0,000	1,860	0,000	60,235	41,000	37	48,060	60,235	0,000	0,000
9,08	6,575	20,051	59,248	-2,646	6,201	6	19	172,520	57,683	114,837	0,000	1,918	0,000	61,523	40,000	37	49,088	61,523	0,000	0,000
9,10	5,469	32,184	56,121	-2,664	6,366	6	19	172,900	57,879	115,021	0,001	1,903	0,000	62,061	40,000	37	49,517	62,061	0,000	0,000
9,12	6,987	22,062	81,576	-2,691	6,613	6	19	173,280	58,075	115,205	0,001	1,899	0,000	64,166	41,000	37	51,196	64,166	0,000	0,000
9,14	7,316	27,354	64,459	-2,708	7,257	6	19	173,660	58,271	115,389	0,001	1,842	0,000	65,684	43,000	38	52,407	65,684	0,000	0,000
9,16	7,400	31,940	54,518	-2,718	7,402	6	19	174,040	58,468	115,572	0,000	1,860	0,000	68,589	43,000	38	54,726	68,589	0,000	0,000
9,18	7,433	35,221	48,946	-2,723	7,426	6	19	174,420	58,664	115,756	-0,001	1,880	0,000	70,543	43,000	38	56,285	70,543	0,000	0,000
9,20	7,395	37,426	45,899	-2,723	7,395	6	19	174,800	58,860	115,940	-0,002	1,893	0,000	71,458	43,000	38	57,014	71,458	0,000	0,000
9,22	7,308	37,232	45,458	-2,733	7,321	6	19	175,180	59,056	116,124	-0,002	1,910	0,000	72,257	43,000	38	57,652	72,257	0,000	0,000
9,24	7,214	40,513	44,416	-2,728	7,232	6	19	175,560	59,252	116,308	-0,002	1,935	0,000	73,659	43,000	37	58,770	73,659	0,000	0,000
9,26	7,129	46,563	41,530	-2,729	7,101	6	19	175,940	59,449	116,491	-0,003	1,978	0,000	76,258	42,000	37	60,844	76,258	0,000	0,000
9,28	6,917	54,641	38,363	-2,742	6,990	6	19	176,320	59,645	116,675	-0,003	2,017	0,000	78,891	42,000	37	62,945	78,891	0,000	0,000
9,30	6,885	58,821	36,960	-2,750	6,857	6	19	176,700	59,841	116,859	-0,003	2,054	0,000	80,990	41,000	37	64,619	80,990	0,000	0,000
9,32	6,733	62,630	36,238	-2,732	6,842	6	19	177,080	60,037	117,043	-0,004	2,063	0,000	81,805	41,000	37	65,270	81,805	0,000	0,000
9,34	6,872	60,249	35,276	-2,725	6,896	6	19	177,460	60,233	117,227	-0,004	2,065	0,000	82,630	41,000	37	65,928	82,630	0,000	0,000
9,36	7,049	63,265	33,312	-2,719	7,001	6	19	177,840	60,430	117,410	-0,004	2,070	0,000	84,505	42,000	37	67,424	84,505	0,000	0,000
9,38	7,048	73,601	30,947	-2,739	7,081	6	19	178,220	60,626	117,594	-0,004	2,094	0,000	88,108	42,000	37	70,299	88,108	0,000	0,000
9,40	7,113	84,730	30,225	-2,746	7,115	5	19	178,600	60,822	117,778	-0,004	2,125	0,000	92,045	42,000	37	73,440	92,045	0,000	0,000
9,42	7,152	92,543	30,787	-2,744	7,178	5	19	178,980	61,018	117,962	-0,004	2,136	0,000	94,227	42,000	37	75,181	94,227	0,000	0,000
9,44	7,237	89,314	31,428	-2,758	7,239	5	19	179,360	61,214	118,146	-0,004	2,123	0,000	93,405	42,000	37	74,525	93,405	0,000	0,000
9,46	7,296	76,349	31,308	-2,765	7,258	6	19	179,740	61,411	118,329	-0,004	2,099	0,000	90,933	42,000	37	72,553	90,933	0,000	0,000
9,48	7,211	72,379	29,905	-2,763	7,100	6	19	180,120	61,607	118,513	-0,005	2,087	0,000	87,561	42,000	37	69,863	87,561	0,000	0,000
9,50	6,762	66,804	27,139	-2,789	6,610	5	19	180,500	61,803	118,697	-0,005	2,124	0,000	85,225	40,000	37	67,998	85,225	0,000	0,000
9,52	5,831	68,778	23,491	-2,772	5,729	5	19	180,880	61,999	118,881	-0,007	2,229	0,000	77,670	37,000	36	67,048	84,034	0,000	0,000
9,54	4,570	83,064	19,001	-2,789	4,657	5	19	181,260	62,195	119,065	-0,010	2,386	0,000	62,666	33,000	35	65,945	82,652	0,000	0,000
9,56	3,552	85,549	15,834	-2,790	3,667	5	19	181,640	62,392	119,248	-0,013	2,556	0,000	48,799	0,000	0	63,683	79,816	248,973	9,846
9,58	2,863	80,555	14,672	-2,798	2,940	4	19	182,020	62,588	119,432	-0,017	2,704	0,000	38,617	0,000	0	0,000	76,211	197,023	7,703
9,60	2,390	84,469	14,511	-2,811	2,443	4	19	182,400	62,784	119,616	-0,021	2,851	0,000	31,642	0,000	0	0,000	75,232	161,440	6,240
9,62	2,059	105,868	15,273	-2,831	2,082	3	19	182,780	62,980	119,800	-0,020	2,996	0,000	26,591	0,000	0	0,000	75,979	135,667	5,232
9,64	1,772	119,794	42,933	-2,838	1,813	3	19	183,160	63,176	119,984	-0,002	3,113	0,000	22,130	0,000	0	0,000	75,991	116,393	4,482
9,66	1,546	109,995	119,699	-2,852	1,639	3	19	183,540	63,373	120,167	0,022	3,161	0,000	17,634	0,000	0	0,000	71,750	103,978	3,998
9,68	1,502	81,287	125,191	-2,853	1,553	3	19	183,920	63,569	120,351	0,044	3,150	0,000	15,583	0,000	0	0,000	66,600	97,819	3,755
9,70	1,486	70,649	126,353	-2,854	1,515	3	19	184,300	63,765	120,535	0,047	3,119	0,000	14,693	0,000	0	0,000	62,185	95,057	3,643
9,72	1,429	66,925	126,073	-2,855	1,457	3	19	184,680	63,961	120,719	0,049	3,124	0,000	13,400	0,000	0	0,000	59,812	90,847	3,477
9,74	1,326	63,413	125,752	-2,877	1,394	3	19	185,060	64,157	120,903	0,051	3,138	0,000	12,083	0,000	0	0,000	57,866	86,332	3,299
9,76	1,298	57,996	125,311	-2,873	1,336	3	19	185,440	64,354	121,086	0,053	3,148	0,000	10,926	0,000	0	0,000	55,747	82,159	3,135
9,78	1,256	52,631	124,790	-2,891	1,305	3	19	185,820	64,550	121,270	0,054	3,136	0,000	10,337	0,000	0	0,000	53,429	79,975	3,047
9,80	1,235	45,150	125,271	-2,912	1,262	3	19	186,200	64,746	121,454	0,056	3,131	0,000	9,533	0,000	0	0,000	51,057	76,857	2,924
9,82	1,169	41,427	124,429	-2,902	1,226	3	19	186,580	64,942	121,638	0,059	3,127	0,000	8,883	0,000	0	0,000	49,068	74,247	2,820
9,84	1,146	39,362	128,037	-2,908	1,194	3	19	186,960	65,138	121,822	0,061	3,130	0,000	8,323	0,000	0	0,000	47,693	71,924	2,728
9,86	1,138	36,891	127,917	-2,913	1,174	3	19	187,340	65,335	122,005	0,063	3,131	0,000	7,978	0,000	0	0,000	46,810	70,470	2,669
9,88	1,108	36,131	126,273	-2,925	1,139	3	19	187,720	65,531	122,189	0,064	3,149	0,000	7,413	0,000	0	0,000	46,180	67,981	2,570
9,90	1,044	37,311	123,788	-2,916	1,096	3	19	188,100	65,727	122,373	0,064	3,179	0,000	6,734	0,000	0	0,000	45,756	64,843	2,448
9,92	1,009	37,292	122,064	-2,929	1,067	3	19	188,480	65,923	122,557	0,065	3,201	0,000	6,293	0,000	0	0,000	45,534	62,728	2,365
9,94	1,021	36,904	123,547	-2,935	1,055	3	19	188,860	66,119	122,741	0,067	3,209	0,000	6,115	0,000	0	0,000	45,349	61,881	2,329
9,96	1,009	36,762	126,634	-2,948	1,062	3	19	189,240	66,316	122,924	0,069	3,194	0,000	6,201	0,000	0	0,000	44,869	62,364	2,344
9,98	1,028	32,774	130,362	-2,950	1,040	3	19	189,620	66,512	123,108	0,072	3,200	0,000	5,868	0,000	0	0,000	44,001	60,709	2,278
10,00	0,952	32,297	126,874	-2,960	1,013	3	19	190,000	66,708	123,292	0,077	3,210	0,000	5,493	0,000	0	0,000	43,132	58,783	2,203

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

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n.° iscrizione alla CCIAA di Re 01999010309 - n.REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
10,02	0,927	32,597	132,005	-2,972	0,967	3	19	190,380	66,904	123,476	0,081	3,237	0,000	4,886	0,000	0	0,000	42,135	55,480	2,076
10,04	0,890	29,545	130,442	-2,982	0,933	3	19	190,760	67,100	123,660	0,085	3,253	0,000	4,453	0,000	0	0,000	41,094	53,005	1,980
10,06	0,848	27,851	127,997	-2,973	0,888	3	19	191,140	67,297	123,843	0,087	3,277	0,000	3,920	0,000	0	0,000	39,793	49,770	1,857
10,08	0,795	27,498	125,311	-2,986	0,719	3	19	191,520	67,493	124,027	0,100	3,354	0,000	2,240	0,000	0	0,000	33,174	37,646	1,402
10,10	0,390	2,318	107,112	-3,002	0,698	3	19	191,900	67,689	124,211	0,097	3,367	0,000	2,061	0,000	0	0,000	32,355	36,138	1,344
10,12	0,790	24,809	117,454	-3,013	0,691	3	19	192,280	67,885	124,395	0,092	3,361	0,000	1,995	0,000	0	0,000	31,628	35,587	1,322
10,14	0,775	23,893	116,933	-3,016	0,816	3	19	192,660	68,081	124,579	0,079	3,305	0,000	3,121	0,000	0	0,000	36,892	44,539	1,652
10,16	0,763	22,817	118,456	-3,007	0,806	3	19	193,040	68,278	124,762	0,082	3,308	0,000	3,013	0,000	0	0,000	36,386	43,791	1,622
10,18	0,759	22,359	119,739	-3,019	0,809	3	19	193,420	68,474	124,946	0,084	3,293	0,000	3,036	0,000	0	0,000	35,877	43,995	1,627
10,20	0,783	20,296	121,663	-3,031	0,820	3	19	193,800	68,670	125,130	0,087	3,269	0,000	3,138	0,000	0	0,000	35,389	44,758	1,653
10,22	0,793	18,815	127,596	-3,028	0,839	3	19	194,180	68,866	125,314	0,088	3,231	0,000	3,323	0,000	0	0,000	34,761	46,093	1,699
10,24	0,813	17,122	127,957	-3,051	0,846	3	19	194,560	69,062	125,498	0,094	3,206	0,000	3,383	0,000	0	0,000	34,006	46,542	1,713
10,26	0,799	15,553	135,293	-3,047	0,854	3	19	194,940	69,259	125,681	0,102	3,181	0,000	3,457	0,000	0	0,000	33,313	47,082	1,731
10,28	0,811	14,548	145,394	-3,062	0,874	4	19	195,320	69,455	125,865	0,112	3,150	0,000	3,658	0,000	0	0,000	32,969	48,465	1,779
10,30	0,863	14,073	156,218	-3,068	0,911	4	19	195,700	69,651	126,049	0,116	3,108	0,000	4,055	0,000	0	0,000	32,966	51,068	1,872
10,32	0,902	13,332	156,507	-3,074	0,953	4	19	196,080	69,847	126,233	0,116	3,070	0,000	4,543	0,000	0	0,000	33,246	54,090	1,980
10,34	0,934	13,491	160,507	-3,075	0,983	4	19	196,460	70,043	126,417	0,112	3,051	0,000	4,894	0,000	0	0,000	33,709	56,182	2,053
10,36	0,952	14,621	157,100	-3,079	0,981	4	19	196,840	70,240	126,600	0,112	3,072	0,000	4,855	0,000	0	0,000	34,534	55,997	2,043
10,38	0,895	17,285	156,418	-3,078	0,963	4	19	197,220	70,436	126,784	0,113	3,113	0,000	4,629	0,000	0	0,000	35,518	54,720	1,994
10,40	0,881	19,350	162,231	-3,094	0,949	3	19	197,600	70,632	126,968	0,123	3,149	0,000	4,442	0,000	0	0,000	36,456	53,644	1,952
10,42	0,903	20,461	169,366	-3,113	0,972	3	19	197,980	70,828	127,152	0,126	3,150	0,000	4,711	0,000	0	0,000	37,594	55,285	2,009
10,44	0,960	22,014	172,774	-3,115	1,006	3	19	198,360	71,024	127,336	0,126	3,143	0,000	5,127	0,000	0	0,000	38,929	57,713	2,094
10,46	0,980	24,643	175,299	-3,113	1,030	3	19	198,740	71,221	127,519	0,125	3,144	0,000	5,412	0,000	0	0,000	40,087	59,340	2,150
10,48	0,970	25,685	176,782	-3,115	1,044	3	19	199,120	71,417	127,703	0,125	3,149	0,000	5,595	0,000	0	0,000	41,023	60,376	2,184
10,50	1,002	26,620	179,428	-3,127	1,062	3	19	199,500	71,613	127,887	0,124	3,143	0,000	5,821	0,000	0	0,000	41,569	61,629	2,226
10,52	1,032	26,639	179,949	-3,121	1,099	3	19	199,880	71,809	128,071	0,120	3,124	0,000	6,309	0,000	0	0,000	42,282	64,207	2,316
10,54	1,079	27,433	179,428	-3,124	1,118	3	19	200,260	72,005	128,255	0,116	3,124	0,000	6,571	0,000	0	0,000	43,159	65,572	2,362
10,56	1,062	30,715	176,462	-3,132	1,118	3	19	200,640	72,202	128,438	0,113	3,146	0,000	6,548	0,000	0	0,000	44,344	65,503	2,356
10,58	1,033	34,437	172,733	-3,141	1,082	3	19	201,020	72,398	128,622	0,114	3,195	0,000	6,039	0,000	0	0,000	45,331	62,955	2,261
10,60	0,977	37,136	168,645	-3,142	1,029	3	19	201,400	72,594	128,806	0,116	3,256	0,000	5,317	0,000	0	0,000	46,029	59,113	2,120
10,62	0,906	40,753	164,155	-3,153	0,971	3	19	201,780	72,790	128,990	0,121	3,318	0,000	4,588	0,000	0	0,000	46,275	54,947	1,968
10,64	0,862	42,358	163,914	-3,154	0,916	3	19	202,160	72,986	129,174	0,126	3,376	0,000	3,941	0,000	0	0,000	46,180	50,966	1,823
10,66	0,813	42,765	160,627	-3,156	0,861	3	19	202,540	73,183	129,357	0,133	3,426	0,000	3,355	0,000	0	0,000	45,435	47,053	1,680
10,68	0,745	41,372	157,420	-3,180	0,810	3	19	202,920	73,379	129,541	0,139	3,468	0,000	2,844	0,000	0	0,000	44,139	43,356	1,546
10,70	0,711	38,285	155,256	-3,177	0,769	3	19	203,300	73,575	129,725	0,145	3,496	0,000	2,462	0,000	0	0,000	42,577	40,371	1,438
10,72	0,691	35,375	153,772	-3,186	0,757	3	19	203,680	73,771	129,909	0,146	3,490	0,000	2,356	0,000	0	0,000	41,340	39,515	1,405
10,74	0,711	32,712	154,614	-3,192	0,777	3	19	204,060	73,967	130,093	0,142	3,445	0,000	2,522	0,000	0	0,000	40,441	40,918	1,453
10,76	0,770	28,444	157,781	-3,190	0,859	3	19	204,440	74,164	130,276	0,129	3,333	0,000	3,289	0,000	0	0,000	40,113	46,754	1,658
10,78	0,934	23,647	164,155	-3,184	0,999	3	19	204,820	74,360	130,460	0,114	3,180	0,000	4,834	0,000	0	0,000	40,097	56,724	2,009
10,80	1,125	20,384	171,811	-3,179	1,230	4	19	205,200	74,556	130,644	0,094	2,998	0,000	8,034	0,000	0	0,000	41,071	73,180	2,588
10,82	1,456	19,344	176,782	-3,196	1,536	4	19	205,580	74,752	130,828	0,070	2,822	0,000	13,554	0,000	0	0,000	42,696	95,002	3,363
10,84	1,855	18,021	155,176	-3,206	1,884	5	19	205,960	74,948	131,012	0,047	2,680	0,000	21,866	0,000	0	0,000	44,964	119,864	4,300
10,86	2,185	20,261	127,917	-3,201	2,236	5	19	206,340	75,145	131,195	0,026	2,579	0,000	28,415	0,000	0	0,000	38,171	144,973	5,248
10,88	2,538	23,454	98,613	-3,210	2,564	5	19	206,720	75,341	131,379	0,012	2,508	0,000	33,003	23,000	32	40,532	50,800	0,000	0,000
10,90	2,863	24,160	84,583	-3,197	2,866	5	19	207,100	75,537	131,563	0,005	2,446	0,000	37,222	25,000	32	42,279	52,990	0,000	0,000
10,92	3,107	24,019	79,492	-3,193	3,108	5	19	207,480	75,733	131,747	0,001	2,393	0,000	40,606	26,000	33	43,135	54,062	0,000	0,000
10,94	3,274	23,455	71,595	-3,194	3,210	5	19	207,860	75,929	131,931	-0,001	2,370	0,000	42,035	26,000	33	43,333	54,311	0,000	0,000
10,96	3,177	23,173	65,462	-3,196	3,157	5	19	208,240	76,126	132,114	-0,003	2,358	0,000	41,278	26,000	33	41,948	52,575	0,000	0,000
10,98	2,951	16,718	64,580	-3,187	2,933	5	19	208,620	76,322	132,298	-0,004	2,354	0,000	38,139	25,000	32	38,564	48,333	0,000	0,000
11,00	2,605	8,799	63,137	-3,202	2,540	5	19	209,000	76,518	132,482	-0,006	2,376	0,000	32,635	23,000	32	33,920	42,513	0,000	0,000

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

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n.° iscrizione alla CCIAA di Re 01999010309 - n.REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
11,02	2,001	7,229	59,849	-3,212	2,059	5	19	209,570	76,812	132,758	-0,009	2,460	0,000	25,886	20,000	30	29,912	37,490	0,000	0,000
11,04	1,509	7,635	58,126	-3,223	1,594	5	19	209,760	76,910	132,850	-0,012	2,632	0,000	14,749	0,000	0	0,000	34,918	98,847	3,517
11,06	1,210	9,135	62,856	-3,226	1,256	4	19	210,140	77,107	133,033	-0,011	2,846	0,000	8,224	0,000	0	0,000	34,602	74,711	2,595
11,08	0,983	14,163	75,563	-3,250	1,024	4	19	210,520	77,303	133,217	0,025	3,045	0,000	4,967	0,000	0	0,000	34,593	58,103	2,015
11,10	0,780	16,897	154,213	-3,251	1,061	4	19	210,900	77,499	133,401	0,125	3,033	0,000	5,420	0,000	0	0,000	35,637	60,736	2,103
11,12	1,234	11,969	320,934	-3,222	1,560	5	19	211,280	77,695	133,585	0,131	2,741	0,000	13,771	0,000	0	0,000	39,046	96,336	3,369
11,14	2,407	10,382	287,983	-3,225	2,368	5	19	211,660	77,891	133,769	0,081	2,435	0,000	30,182	22,000	31	33,786	42,345	0,000	0,000
11,16	3,205	12,093	147,078	-3,229	3,086	5	19	212,040	78,088	133,952	0,037	2,263	0,000	40,239	26,000	33	36,262	45,448	0,000	0,000
11,18	3,458	11,670	121,342	-3,226	3,375	6	19	212,420	78,284	134,136	0,016	2,205	0,000	44,280	27,000	33	37,061	46,450	0,000	0,000
11,20	3,332	9,836	118,015	-3,233	3,328	6	19	212,800	78,480	134,320	0,013	2,195	0,000	45,180	27,000	33	36,048	45,180	0,000	0,000
11,22	3,073	8,161	117,454	-3,230	3,167	5	19	213,180	78,676	134,504	0,013	2,216	0,000	41,353	26,000	33	35,078	43,964	0,000	0,000
11,24	2,976	9,590	116,933	-3,241	3,039	5	19	213,560	78,872	134,688	0,014	2,260	0,000	39,550	25,000	32	35,506	44,501	0,000	0,000
11,26	2,947	13,365	116,893	-3,235	3,080	5	19	213,940	79,069	134,871	0,013	2,297	0,000	40,131	25,000	32	37,758	47,323	0,000	0,000
11,28	3,200	17,775	113,686	-3,214	3,303	5	19	214,320	79,265	135,055	0,010	2,321	0,000	43,236	26,000	33	41,929	52,552	0,000	0,000
11,30	3,648	27,370	102,502	-3,194	3,827	5	19	214,700	79,461	135,239	0,008	2,300	0,000	50,575	28,000	34	47,713	59,800	0,000	0,000
11,32	4,523	38,130	109,797	-3,175	4,631	5	19	215,080	79,657	135,423	0,004	2,247	0,000	61,826	32,000	35	54,590	68,420	0,000	0,000
11,34	5,624	48,908	79,933	-3,178	5,472	5	19	215,460	79,853	135,607	0,000	2,183	0,000	75,059	35,000	35	59,887	75,059	0,000	0,000
11,36	6,187	50,620	55,921	-3,167	6,030	6	19	215,840	80,050	135,790	-0,003	2,137	0,000	78,366	36,000	36	62,526	78,366	0,000	0,000
11,38	6,217	48,221	48,465	-3,160	6,193	6	19	216,220	80,246	135,974	-0,005	2,121	0,000	78,922	37,000	36	62,970	78,922	0,000	0,000
11,40	6,125	49,333	44,536	-3,180	6,101	6	19	216,600	80,442	136,158	-0,006	2,122	0,000	77,840	37,000	36	62,106	77,840	0,000	0,000
11,42	5,915	45,364	42,933	-3,178	5,911	6	19	216,980	80,638	136,342	-0,006	2,119	0,000	74,976	36,000	36	59,821	74,976	0,000	0,000
11,44	5,649	34,216	44,216	-3,180	5,669	6	19	217,360	80,834	136,526	-0,007	2,087	0,000	68,966	35,000	36	55,026	68,966	0,000	0,000
11,46	5,396	19,840	45,418	-3,187	5,452	6	19	217,740	81,031	136,709	-0,007	2,043	0,000	62,591	35,000	35	49,940	62,591	0,000	0,000
11,48	5,264	16,930	46,781	-3,183	5,250	6	19	218,120	81,227	136,893	-0,007	2,024	0,000	58,744	34,000	35	46,870	58,744	0,000	0,000
11,50	5,043	19,593	44,977	-3,187	5,027	6	19	218,500	81,423	137,077	-0,008	2,048	0,000	57,888	33,000	35	46,188	57,888	0,000	0,000
11,52	4,730	18,800	43,534	-3,177	4,555	6	19	218,880	81,619	137,261	-0,009	2,109	0,000	56,413	31,000	35	45,010	56,413	0,000	0,000
11,54	3,849	16,576	41,450	-3,172	3,844	6	19	219,260	81,815	137,445	-0,011	2,202	0,000	50,741	29,000	34	42,327	53,050	0,000	0,000
11,56	2,910	15,235	39,285	-3,167	2,979	5	19	219,640	82,012	137,628	-0,015	2,371	0,000	38,637	25,000	32	39,894	50,001	0,000	0,000
11,58	2,138	19,662	39,445	-3,183	2,232	5	19	220,020	82,208	137,812	-0,021	2,628	0,000	28,170	0,000	0	0,000	50,466	143,723	4,943
11,60	1,607	34,478	43,093	-3,178	1,697	4	19	220,400	82,404	137,996	-0,019	2,890	0,000	15,807	0,000	0	0,000	51,670	105,494	3,532
11,62	1,291	40,299	81,135	-3,194	1,390	3	19	220,780	82,600	138,180	0,034	3,078	0,000	9,900	0,000	0	0,000	51,919	83,542	2,793
11,64	1,149	40,280	241,803	-3,206	1,262	3	19	221,160	82,796	138,364	0,108	3,157	0,000	7,836	0,000	0	0,000	51,074	74,378	2,484
11,66	1,148	38,339	262,888	-3,215	1,244	3	19	221,540	82,993	138,547	0,174	3,166	0,000	7,539	0,000	0	0,000	50,676	73,001	2,434
11,68	1,168	38,780	276,758	-3,244	1,305	3	19	221,920	83,189	138,731	0,182	3,121	0,000	8,451	0,000	0	0,000	50,755	77,342	2,576
11,70	1,312	35,621	301,492	-3,259	1,546	4	19	222,300	83,385	138,915	0,165	2,984	0,000	12,610	0,000	0	0,000	52,131	94,539	3,144
11,72	1,850	30,735	326,827	-3,284	2,097	4	19	222,680	83,581	139,099	0,131	2,743	0,000	25,556	0,000	0	0,000	54,425	133,893	4,499
11,74	2,793	26,783	361,261	-3,285	2,764	5	19	223,060	83,777	139,283	0,078	2,519	0,000	35,571	23,000	32	44,327	55,556	0,000	0,000
11,76	3,362	22,742	154,213	-3,277	3,116	5	19	223,440	83,974	139,466	0,044	2,408	0,000	40,501	25,000	32	43,845	54,952	0,000	0,000
11,78	2,979	20,078	118,296	-3,282	2,923	5	19	223,820	84,170	139,650	0,016	2,429	0,000	37,783	24,000	32	42,020	52,666	0,000	0,000
11,80	2,297	19,900	111,601	-3,310	2,373	5	19	224,200	84,366	139,834	0,013	2,552	0,000	30,082	21,000	31	39,093	48,996	0,000	0,000
11,82	1,728	17,642	108,595	-3,311	1,838	5	19	224,580	84,562	140,018	0,021	2,724	0,000	18,858	0,000	0	0,000	45,713	115,248	3,857
11,84	1,368	18,541	135,333	-3,324	1,448	4	19	224,960	84,758	140,202	0,049	2,903	0,000	10,661	0,000	0	0,000	43,458	87,328	2,878
11,86	1,099	22,544	189,129	-3,331	1,199	4	19	225,340	84,955	140,385	0,118	3,057	0,000	6,757	0,000	0	0,000	42,100	69,568	2,289
11,88	0,927	23,020	274,754	-3,331	1,063	4	19	225,720	85,151	140,569	0,194	3,160	0,000	4,984	0,000	0	0,000	41,217	59,788	1,965
11,90	0,910	22,084	279,043	-3,354	1,000	3	19	226,100	85,347	140,753	0,248	3,209	0,000	4,255	0,000	0	0,000	40,548	55,281	1,815
11,92	0,880	23,036	278,442	-3,344	0,982	3	19	226,480	85,543	140,937	0,259	3,211	0,000	4,054	0,000	0	0,000	39,696	53,994	1,770
11,94	0,870	19,314	286,459	-3,362	0,982	4	19	226,860	85,739	141,121	0,269	3,183	0,000	4,037	0,000	0	0,000	38,262	53,911	1,765
11,96	0,899	14,180	302,454	-3,355	1,016	4	19	227,240	85,936	141,304	0,272	3,111	0,000	4,398	0,000	0	0,000	36,464	56,307	1,841
11,98	0,970	11,940	312,997	-3,351	1,032	4	19	227,620	86,132	141,488	0,271	3,053	0,000	4,574	0,000	0	0,000	34,573	57,463	1,876
12,00	0,916	10,034	297,363	-3,366	1,023	4	19	228,000	86,328	141,672	0,276	3,047	0,000	4,466	0,000	0	0,000	33,916	56,819	1,853

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

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n.° iscrizione alla CCIAA di Re 01999010309 - n.REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
12,02	0,872	11,815	307,144	-3,374	0,988	4	19	228,380	86,524	141,856	0,283	3,070	0,000	4,073	0,000	0	0,000	33,366	54,292	1,768
12,04	0,869	11,251	300,650	-3,378	0,957	4	19	228,760	86,720	142,040	0,293	3,110	0,000	3,731	0,000	0	0,000	33,653	52,000	1,691
12,06	0,823	12,662	292,232	-3,375	0,928	4	19	229,140	86,917	142,223	0,298	3,154	0,000	3,437	0,000	0	0,000	34,138	49,937	1,622
12,08	0,791	15,325	293,635	-3,391	0,901	4	19	229,520	87,113	142,407	0,307	3,206	0,000	3,162	0,000	0	0,000	35,016	47,932	1,555
12,10	0,789	16,824	294,076	-3,393	0,876	3	19	229,900	87,309	142,591	0,325	3,269	0,000	2,926	0,000	0	0,000	36,496	46,139	1,495
12,12	0,745	21,672	303,536	-3,385	0,867	3	19	230,280	87,505	142,775	0,334	3,303	0,000	2,842	0,000	0	0,000	37,573	45,501	1,472
12,14	0,762	21,743	303,256	-3,385	0,873	3	19	230,660	87,701	142,959	0,338	3,317	0,000	2,887	0,000	0	0,000	38,584	45,891	1,483
12,16	0,801	22,025	307,986	-3,407	0,898	3	19	231,040	87,898	143,142	0,328	3,289	0,000	3,112	0,000	0	0,000	38,682	47,675	1,539
12,18	0,819	20,033	309,710	-3,405	0,920	3	19	231,420	88,094	143,326	0,320	3,262	0,000	3,312	0,000	0	0,000	38,585	49,210	1,586
12,20	0,826	19,380	307,906	-3,410	0,927	3	19	231,800	88,290	143,510	0,315	3,247	0,000	3,364	0,000	0	0,000	38,166	49,628	1,598
12,22	0,821	19,151	304,138	-3,412	0,925	3	19	232,180	88,486	143,694	0,314	3,242	0,000	3,344	0,000	0	0,000	37,876	49,516	1,592
12,24	0,817	18,463	305,821	-3,415	0,944	3	19	232,560	88,682	143,878	0,306	3,220	0,000	3,522	0,000	0	0,000	37,793	50,846	1,633
12,26	0,883	17,511	309,028	-3,431	0,982	4	19	232,940	88,879	144,061	0,296	3,176	0,000	3,892	0,000	0	0,000	37,597	53,483	1,715
12,28	0,929	15,606	315,683	-3,421	1,085	4	19	233,320	89,075	144,245	0,265	3,082	0,000	5,032	0,000	0	0,000	37,972	60,857	1,949
12,30	1,123	14,231	319,371	-3,428	1,321	4	19	233,700	89,271	144,429	0,214	2,928	0,000	8,187	0,000	0	0,000	39,919	77,670	2,485
12,32	1,583	15,236	329,472	-3,428	1,733	5	19	234,080	89,467	144,613	0,139	2,746	0,000	15,726	0,000	0	0,000	43,706	107,097	3,461
12,34	2,190	17,882	245,571	-3,428	2,161	5	19	234,460	89,663	144,797	0,079	2,608	0,000	26,436	0,000	0	0,000	47,145	137,603	4,529
12,36	2,462	18,041	152,249	-3,426	2,372	5	19	234,840	89,860	144,980	0,041	2,547	0,000	29,921	21,000	31	38,601	48,380	0,000	0,000
12,38	2,283	15,713	132,326	-3,431	2,251	5	19	235,220	90,056	145,164	0,024	2,569	0,000	28,226	20,000	30	37,446	46,933	0,000	0,000
12,40	1,867	14,355	130,362	-3,425	1,940	5	19	235,600	90,252	145,348	0,027	2,654	0,000	20,486	0,000	0	0,000	44,193	121,744	3,966
12,42	1,530	13,791	147,278	-3,440	1,620	5	19	235,980	90,448	145,532	0,045	2,783	0,000	13,246	0,000	0	0,000	42,249	98,859	3,158
12,44	1,307	15,767	180,510	-3,455	1,365	4	19	236,360	90,644	145,716	0,079	2,923	0,000	8,743	0,000	0	0,000	41,131	80,621	2,556
12,46	1,075	18,413	212,820	-3,478	1,192	4	19	236,740	90,841	145,899	0,127	3,048	0,000	6,249	0,000	0	0,000	40,762	68,205	2,160
12,48	0,977	20,124	243,246	-3,472	1,084	4	19	237,120	91,037	146,083	0,173	3,123	0,000	4,915	0,000	0	0,000	39,786	60,523	1,914
12,50	0,960	16,773	256,434	-3,471	1,051	4	19	237,500	91,233	146,267	0,199	3,140	0,000	4,522	0,000	0	0,000	39,029	58,092	1,835
12,52	0,957	16,509	260,684	-3,482	1,031	4	19	237,880	91,429	146,451	0,211	3,139	0,000	4,291	0,000	0	0,000	37,981	56,627	1,786
12,54	0,911	16,068	259,000	-3,486	1,012	4	19	238,260	91,625	146,635	0,216	3,151	0,000	4,084	0,000	0	0,000	37,634	55,272	1,741
12,56	0,904	16,104	257,517	-3,494	0,996	4	19	238,640	91,822	146,818	0,220	3,173	0,000	3,911	0,000	0	0,000	37,923	54,129	1,703
12,58	0,911	18,767	258,599	-3,495	1,002	4	19	239,020	92,018	147,002	0,221	3,181	0,000	3,963	0,000	0	0,000	38,557	54,517	1,713
12,60	0,926	18,785	266,336	-3,487	0,997	4	19	239,400	92,214	147,186	0,227	3,190	0,000	3,900	0,000	0	0,000	38,718	54,116	1,699
12,62	0,884	17,163	268,180	-3,505	0,979	4	19	239,780	92,410	147,370	0,239	3,194	0,000	3,709	0,000	0	0,000	37,995	52,808	1,656
12,64	0,853	16,175	272,549	-3,511	0,944	4	19	240,160	92,606	147,554	0,256	3,203	0,000	3,355	0,000	0	0,000	36,563	50,258	1,574
12,66	0,816	13,917	278,202	-3,527	0,927	4	19	240,540	92,803	147,737	0,272	3,190	0,000	3,186	0,000	0	0,000	35,082	49,002	1,532
12,68	0,826	11,254	288,384	-3,528	0,947	4	19	240,920	92,999	147,921	0,272	3,144	0,000	3,371	0,000	0	0,000	34,064	50,442	1,575
12,70	0,909	10,584	287,662	-3,545	0,993	4	19	241,300	93,195	148,105	0,263	3,085	0,000	3,818	0,000	0	0,000	33,653	53,709	1,675
12,72	0,948	9,967	295,880	-3,543	1,040	4	19	241,680	93,391	148,289	0,251	3,039	0,000	4,298	0,000	0	0,000	33,711	57,027	1,777
12,74	0,963	9,367	298,205	-3,536	1,059	4	19	242,060	93,587	148,473	0,241	3,017	0,000	4,498	0,000	0	0,000	33,572	58,373	1,816
12,76	0,970	9,226	276,758	-3,542	1,038	4	19	242,440	93,784	148,656	0,242	3,046	0,000	4,252	0,000	0	0,000	33,857	56,791	1,765
12,78	0,887	11,855	282,892	-3,557	1,004	4	19	242,820	93,980	148,840	0,249	3,089	0,000	3,894	0,000	0	0,000	34,262	54,378	1,688
12,80	0,865	12,349	290,228	-3,549	0,981	4	19	243,200	94,176	149,024	0,263	3,132	0,000	3,649	0,000	0	0,000	35,019	52,673	1,633
12,82	0,895	13,408	291,911	-3,557	0,987	4	19	243,580	94,372	149,208	0,263	3,146	0,000	3,703	0,000	0	0,000	35,932	53,095	1,644
12,84	0,905	15,383	287,502	-3,560	1,004	4	19	243,960	94,568	149,392	0,254	3,159	0,000	3,869	0,000	0	0,000	37,374	54,303	1,679
12,86	0,920	17,853	283,814	-3,567	1,018	4	19	244,340	94,765	149,575	0,245	3,183	0,000	4,000	0,000	0	0,000	39,212	55,252	1,707
12,88	0,939	21,452	281,930	-3,568	1,031	4	19	244,720	94,961	149,759	0,239	3,205	0,000	4,131	0,000	0	0,000	40,982	56,181	1,733
12,90	0,947	23,692	282,210	-3,579	1,037	3	19	245,100	95,157	149,943	0,235	3,227	0,000	4,187	0,000	0	0,000	42,468	56,595	1,744
12,92	0,939	25,633	279,965	-3,578	1,046	3	19	245,480	95,353	150,127	0,229	3,240	0,000	4,272	0,000	0	0,000	43,648	57,202	1,760
12,94	0,969	27,609	272,950	-3,588	1,051	3	19	245,860	95,549	150,311	0,223	3,256	0,000	4,312	0,000	0	0,000	44,732	57,503	1,767
12,96	0,964	29,849	271,467	-3,592	1,054	3	19	246,240	95,746	150,494	0,218	3,269	0,000	4,337	0,000	0	0,000	45,670	57,710	1,772
12,98	0,952	31,190	271,788	-3,586	1,046	3	19	246,620	95,942	150,678	0,221	3,284	0,000	4,236	0,000	0	0,000	46,034	57,063	1,750
13,00	0,942	30,625	275,075	-3,587	1,039	3	19	247,000	96,138	150,862	0,223	3,289	0,000	4,159	0,000	0	0,000	45,932	56,582	1,733

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

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n.° Iscrizione alla CCIAA di Re 01999610309 - n.REA 241942 - CF e P.IVA 01999610309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
13,02	0,945	29,620	272,148	-3,589	1,021	3	19	247,380	96,334	151,046	0,226	3,300	0,000	3,959	0,000	0	0,000	45,444	55,236	1,690
13,04	0,898	29,532	266,576	-3,588	0,982	3	19	247,760	96,530	151,230	0,233	3,329	0,000	3,564	0,000	0	0,000	44,770	52,440	1,602
13,06	0,830	29,709	263,450	-3,600	0,929	3	19	248,140	96,727	151,413	0,249	3,371	0,000	3,066	0,000	0	0,000	43,798	48,664	1,485
13,08	0,788	28,245	269,302	-3,607	1,166	4	19	248,520	96,923	151,597	0,201	3,156	0,000	5,547	0,000	0	0,000	44,920	65,498	1,996
13,10	1,591	16,716	311,754	-3,608	1,637	4	19	248,900	97,119	151,781	0,124	2,880	0,000	12,692	0,000	0				

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Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
14,02	0,936	29,888	266,536	-3,849	1,029	3	19	266,380	106,144	160,236	0,210	3,330	0,000	3,628	0,000	0	0,000	46,571	54,462	1,570
14,04	0,926	29,975	263,850	-3,868	1,010	3	19	266,760	106,340	160,420	0,212	3,347	0,000	3,444	0,000	0	0,000	46,344	53,096	1,529
14,06	0,899	30,311	261,125	-3,867	0,996	3	19	267,140	106,537	160,603	0,214	3,357	0,000	3,305	0,000	0	0,000	46,042	52,036	1,497
14,08	0,894	29,217	261,806	-3,872	0,982	3	19	267,520	106,733	160,787	0,217	3,367	0,000	3,171	0,000	0	0,000	45,661	51,004	1,466
14,10	0,884	28,776	262,287	-3,876	0,991	3	19	267,900	106,929	160,971	0,242	3,355	0,000	3,2						

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Concessione Mineraria n.° 3655 Circ 7619/STC

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PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

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Data: 16/07/2018

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Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
15,02	1,444	58,535	251,143	-4,022	1,519	3	19	285,380	115,954	169,426	0,110	3,230	0,000	8,976	0,000	0	0,000	66,311	88,085	2,402
15,04	1,475	61,163	236,912	-4,032	1,551	3	19	285,760	116,150	169,610	0,099	3,225	0,000	9,432	0,000	0	0,000	67,606	90,343	2,461
15,06	1,487	66,878	234,387	-4,028	1,571	3	19	286,140	116,347	169,793	0,092	3,237	0,000	9,725	0,000	0	0,000	69,700	91,785	2,497
15,08	1,512	74,162	232,302	-4,033	1,584	3	19	286,520	116,543	169,977	0,089	3,252	0,000	9,906	0,000	0	0,000	71,789	92,686	2,519
15,10	1,516	78,201	230,538	-4,037	1,603	3	19	286,900	116,739	170,161	0,090	3,263	0,000	10,184	0,000	0	0,000	73,820	94,029	2,553
15,12	1,541	83,265	244,529	-4,050	1,630	3	19	287,280	116,935	170,345	0,090	3,265	0,000	10,588	0,000	0	0,000	75,476	95,927	2,602
15,14	1,591	86,458	238,115	-4,053	1,669	3	19	287,660	117,131	170,529	0,087	3,259	0,000	11,185	0,000	0	0,000	77,099	98,647	2,673
15,16	1,632	88,980	229,376	-4,055	1,686	3	19	288,040	117,328	170,712	0,081	3,260	0,000	11,453	0,000	0	0,000	78,074	99,875	2,703
15,18	1,600	90,409	226,089	-4,060	1,694	3	19	288,420	117,524	170,896	0,077	3,259	0,000	11,563	0,000	0	0,000	78,424	100,407	2,714
15,20	1,620	88,645	220,597	-4,072	1,678	3	19	288,800	117,720	171,080	0,074									

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n.° iscrizione alla CCIAA di Re 01999010309 - n.REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Miniateriale n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
16,02	1,897	54,172	327,588	-4,189	2,020	4	19	304,380	125,764	178,616	0,117	3,016	0,000	16,486	0,000	0	0,000	70,409	122,572	3,170
16,04	1,995	53,696	333,401	-4,179	2,082	4	19	304,760	125,960	178,800	0,116	3,004	0,000	17,663	0,000	0	0,000	71,764	126,938	3,280
16,06	2,015	55,125	333,561	-4,189	2,119	4	19	305,140	126,157	178,983	0,114	2,998	0,000	18,387	0,000	0	0,000	72,712	129,579	3,345
16,08	2,008	58,300	332,078	-4,191	2,113	4	19	305,520	126,353	179,167	0,112	3,013	0,000	18,239	0,000	0	0,000	73,887	129,123	3,330
16,10	1,981	62,640	322,658	-4,216	2,067	4	19	305,900	126,549	179,351	0,120	3,044	0,000	17,294	0,000	0	0,000	74,850	125,797	3,240
16,12	1,867	65,725	361,181	-4,184	2,063	4	19	306,280	126,745	179,535	0,127	3,063	0,000	17,188	0,000	0	0,000	76,445	125,475	3,229
16,14	1,985	71,053	363,626	-4,177	2,095	4	19	306,660	126,941	179,719	0,133	3,066	0,000	17,792	0,000	0	0,000	78,155	127,727	3,283
16,1																				

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17,02	12,708	59,783	167,683	-4,333	12,562	6	19	323,380	135,574	187,806	0,004	1,804	0,000	108,195	48,000	39	86,326	108,195	0,000	0,000
17,04	13,312	45,106	174,978	-4,331	13,203	6	19	323,760	135,770	187,990	0,003	1,709	0,000	100,922	50,000	39	80,523	100,922	0,000	0,000
17,06	13,410	33,676	185,321	-4,335	13,409	6	19	324,140	135,967	188,173	0,004	1,648	0,000	94,908	51,000	39	75,725	94,908	0,000	0,000
17,08	13,317	29,142	193,178	-4,334	13,309	6	19	324,520	136,163	188,357	0,004	1,626	0,000	91,551	51,000	39	73,046	91,551	0,000	0,000
17,10	13,004	30,182	201,796	-4,343	13,199	6	19	324,900	136,359	188,541	0,005	1,631	0,000	91,376	51,000	39	72,907	91,376	0,000	0,000
17,12	13,070	33,480	214,824	-4,340	13,246	6	19	325,280	136,555	188,725	0,008	1,637	0,000	92,441	51,000	39	73,756	92,441	0,000	0,000
17,14	13,415	33,529	311,674	-4,329	13,676	6	19	325,660	136,751	188,909	0,010	1,633	0,000	94,975	52,000	39	75,778	94,975	0,000	0,000
17,16	14,260	38,839	303,737	-4,335	14,233	6	19	326,040	136,948	189,092	0,012	1,625	0,000	97,979	53,000	39	78,175	97,979	0,000	0,000
17,18	14,714	43,795	296,040	-4,340	14,771	6	19	326,420	137,144	189,276	0,011	1,626	0,000	101,838	54,000	40	81,254	101,838	0,000	0,000
17,20	15,038	48,505	290,308	-4,340	15,035	6	19	326,800	137,340	189,460	0,010	1,636	0,000	105,089	54,000	40	83,847	105,089	0,000	0,000
17,22	15,058	53,126	283,293	-4,349	15,176	6	19	327,180	137,536	189,644	0,010	1,650	0,000	107,999	54,000	40	86,170	107,999	0,000	0,000
17,24	15,141	57,571	283,092	-4,347	15,234	6	19	327,560	137,732	189,828	0,010	1,669	0,000	111,012	54,000	40	88,573	111,012	0,000	0,000
17,26	15,216	63,762	281,168	-4,351	15,235	6	19	327,940	137,929	190,011	0,010	1,689	0,000	113,834	54,000	40	90,825	113,834	0,000	0,000
17,28	15,060	68,189	278,522	-4,355	15,062	6	19	328,320	138,125	190,195	0,009	1,714	0,000	116,150	54,000	40	92,673	116,150	0,000	0,000
17,30	14,625	71,487	271,547	-4,363	14,604	6	19	328,700	138,321	190,379	0,009	1,746	0,000	117,199	52,000	39	93,510	117,199	0,000	0,000
17,32	13,851	73,004	262,888	-4,359	13,926	6	19	329,080	138,517	190,563	0,009	1,785	0,000	117,354	51,000	39	93,634	117,354	0,000	0,000
17,34	13,031	74,361	266,795	-4,362	13,185	6	19	329,460	138,713	190,747	0,009	1,827	0,000	116,966	49,000	39	93,324	116,966	0,000	0,000
17,36	12,408	75,348	255,793	-4,363	12,554	6	19	329,840	138,910	190,930	0,010	1,861	0,000	116,184	48,000	39	92,700	116,184	0,000	0,000
17,38	11,961	73,865	255,673	-4,363	12,060	6	19	330,220	139,106	191,114	0,010	1,885	0,000	114,799	47,000	38	91,595	114,799	0,000	0,000
17,40	11,548	70,600	256,875	-4,374	11,681	6	19	330,600	139,302	191,298	0,010	1,898	0,000	113,066	46,000	38	90,212	113,066	0,000	0,000
17,42	11,272	68,588	256,314	-4,371	11,399	6	19	330,980	139,498	191,482	0,011	1,906	0,000	111,347	45,000	38	88,841	111,347	0,000	0,000
17,44	11,115	66,399	257,276	-4,362	11,219	6	19	331,360	139,694	191,666	0,011	1,909	0,000	109,933	45,000	38	87,713	109,933	0,000	0,000
17,46	11,007	64,016	260,363	-4,367	11,170	6	19	331,740	139,891	191,849	0,011	1,902	0,000	108,493	45,000	38	86,564	108,493	0,000	0,000
17,48	11,121	60,716	265,735	-4,375	11,253	6	19	332,120	140,087	192,033	0,012	1,887	0,000	107,283	45,000	38	85,598	107,283	0,000	0,000
17,50	11,360	58,703	271,026	-4,383	11,443	6	19	332,500	140,283	192,217	0,012	1,869	0,000	106,573	45,000	38	85,031	106,573	0,000	0,000
17,52	11,571	58,225	274,113	-4,390	10,610	6	19	333,070	140,577	192,493	0,011	1,979	0,000	104,148	43,000	38	83,709	104,915	0,000	0,000
17,54	11,512	58,251	269,127	-4,390	12,695	6	19	333,130	140,777	192,571	0,015	1,980	0,000	104,478	43,000	38	83,700	104,948	0,000	0,000
17,56	11,712	58,307	273,168	-4,390	11,095	6	19	333,330	140,873	192,893	0,049	1,979	0,000	104,561	43,000	38	83,871	104,918	0,000	0,000
17,58	11,571	59,251	271,138	-4,390	10,953	6	19	333,560	140,935	192,927	0,049	1,788	0,000	104,918	43,000	38	83,786	104,978	0,000	0,000
17,60	11,371	58,555	271,113	-4,500	13,603	6	19	334,070	141,773	193,493	0,015	1,188	0,000	104,458	43,000	38	83,860	104,918	0,000	0,000
17,62	8,634	58,991	230,899	-4,417	9,878	6	19	334,780	141,460	193,320	0,012	1,955	0,000	102,143	42,000	37	81,497	102,143	0,000	0,000
17,64	9,172	49,823	255,112	-4,439	9,016	6	19	335,160	141,656	193,504	0,012	2,003	0,000	98,701	39,000	37	78,751	98,701	0,000	0,000
17,66	8,994	48,356	247,335	-4,441	9,112	6	19	335,540	141,853	193,687	0,012	1,977	0,000	96,564	40,000	37	77,046	96,564	0,000	0,000
17,68	8,916	46,818	244,368	-4,447	9,050	6	19	335,920	142,049	193,871	0,012	1,974	0,000	95,542	40,000	37	76,230	95,542	0,000	0,000
17,70	8,992	45,069	244,489	-4,455	9,130	6	19	336,300	142,245	194,055	0,012	1,963	0,000	95,024	40,000	37	75,817	95,024	0,000	0,000
17,72	9,232	44,837	247,535	-4,458	9,442	6	19	336,680	142,441	194,239	0,012	1,936	0,000	95,159	41,000	37	75,925	95,159	0,000	0,000
17,74	9,849	44,429	256,475	-4,483	9,965	6	19	337,060	142,637	194,423	0,012	1,898	0,000	95,883	42,000	37	76,502	95,883	0,000	0,000
17,76	10,553	43,827	265,093	-4,493	10,654	6	19	337,440	142,834	194,606	0,012	1,854	0,000	97,091	44,000	38	77,467	97,091	0,000	0,000
17,78	11,292	44,778	269,222	-4,503	11,135	6	19	337,820	143,030	194,790	0,011	1,820	0,000	97,334	45,000	38	77,660	97,334	0,000	0,000
17,80	11,289	41,584	258,158	-4,511	11,353	6	19	338,200	143,226	194,974	0,011	1,800	0,000	96,811	45,000	38	77,243	96,811	0,000	0,000
17,82	11,213	39,448	253,869	-4,519	11,310	6	19	338,580	143,422	195,158	0,010	1,791	0,000	95,422	45,000	38	76,135	95,422	0,000	0,000
17,84	11,168	38,352	251,424	-4,535	11,250	6	19	338,960	143,618	195,342	0,010	1,790	0,000	94,783	45,000	38	75,625	94,783	0,000	0,000
17,86	11,112	38,880	249,981	-4,546	11,095	6	19	339,340	143,815	195,525	0,010	1,802	0,000	94,806	45,000	38	75,643	94,806	0,000	0,000
17,88	10,752	40,572	243,005	-4,546	10,762	6	19	339,720	144,011	195,709	0,009	1,832	0,000	95,381	44,000	38	76,102	95,381	0,000	0,000
17,90	10,175	43,481	234,026	-4,557	10,335	6	19	340,100	144,207	195,893	0,009	1,870	0,000	96,021	43,000	37	76,613	96,021	0,000	0,000
17,92	9,836	45,226	231,260	-4,572	9,987	6	19	340,480	144,403	196,077	0,009	1,902	0,000	96,574	42,000	37	77,053	96,574	0,000	0,000
17,94	9,713	46,018	232,423	-4,576	9,850	6	19	340,860	144,599	196,261	0,009	1,919	0,000	97,160	41,000	37	77,522	97,160	0,000	0,000
17,96	9,763	47,392	235,429	-4,583	9,868	6	19	341,240	144,796	196,444	0,010	1,922	0,000	97,778	41,000	37	78,014	97,778	0,000	0,000
17,98	9,887	47,956	239,438	-4,608	10,005	6	19	341,620	144,992	196,628	0,010	1,915	0,000	98,254	42,000	37	78,394	98,254	0,000	0,000
18,00	10,120	47,002	244,368	-4,613	9,766	6	19	342,000	145,188	196,812	0,009	1,946	0,000	99,733	41,000	37	79,574	99,733	0,000	0,000

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

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18,02	9,051	56,840	219,475	-4,638	10,029	6	19	342,570	145,482	197,088	0,008	1,918	0,000	98,891	42,000	37	78,902	98,891	0,000	0,000
18,04	10,683	41,034	219,314	-4,635	10,316	6	19	342,760	145,580	197,180	0,007	1,887	0,000	97,877	43,000	37	78,093	97,877	0,000	0,000
18,06	10,991	39,394	220,036	-4,642	11,011	6	19	343,140	145,777	197,363	0,007	1,817	0,000	95,792	44,000	38	76,430	95,792	0,000	0,000
18,08	11,136	41,052	218,994	-4,673	9,057	6	19	343,520	145,973	197,547	0,004	1,870	0,000	83,707	40,000	37	66,787	83,707	0,000	0,000
18,10	4,862	2,334	96,288	-4,626	9,077	6	19	343,900	146,169	197,731	0,001	1,869	0,000	83,827	40,000	37	66,883	83,827	0,000	0,000
18,12	11,074	39,606	155,176	-4,641	9,011	6	19	344,280	146,365	197,915	-0,001	1,872	0,000	83,451	40,000	37	66,583	83,451	0,000	0,000
18,14	10,962	39,871	150,004	-4,639	11,095	6	19	344,660	146,561	198,099	0,001	1,809	0,000	95,595	45,000	38	76,272	95,595	0,000	0,000
18,16	11,094	39,801	151,367	-4,646	11,120	6	19	345,040	146,758	198,282	0,000	1,806	0,000	95,523	45,000	38	76,215	95,523	0,000	0,000
18,18	11,152	38,920	146,998	-4,669	11,254	6	19	345,420	146,954	198,466	0,000	1,806	0,000	96,596	45,000	38	77,071	96,596	0,000	0,000
18,20	11,362	43,735	152,690	-4,671	11,523	6	19	345,800	147,150	198,650	0,001	1,795	0,000	97,632	45,000	38	77,898	97,632	0,000	0,000
18,22	11,897	42,518	163,353	-4,698	11,438	6	19	346,370	147,444	198,926	0,001	1,834	0,000	101,874	45,000	38	81,282	101,874	0,000	0,000
18,24	11,584	41,873	152,307	-4,873	11,568	6	19	346,560	147,528	199,132	0,001	1,354	0,000	101,974	45,000	38	82,3823	102,874	0,000	0,000
18,26	11,965	42,262	154,404	-4,893	11,588	6	19	346,960	147,625	199,215	0,001	1,344	0,000	102,548	45,000	38	0,000	102,562	0,000	0,000
18,28	10,894	59,963	158,262	-4,712	11,670	6	19	347,320	147,935	199,385	0,002	1,827	0,000	103,041	46,000	38	82,213	103,041	0,000	0,000
18,30	12,048	47,298	182,956	-4,706	11,738	6	19	347,700	148,131	199,569	0,002	1,826	0,000	103,450	46,000	38	82,540	103,450	0,000	0,000
18,32	12,094	43,858	185,000	-4,716	12,182	6	19	348,080	148,327	199,753	0,003	1,771	0,000	100,367	47,000	38	80,080	100,367	0,000	0,000
18,34	12,214	41,248	189,089	-4,728	12,250	6	19	348,460	148,523	199,937	0,003	1,757	0,000	99,110	47,000	38	79,077	99,110	0,000	0,000
18,36	12,251	40,630	191,454	-4,748	12,259	6	19	348,840	148,720	200,120	0,004	1,753	0,000	98,656	47,000	38	78,715	98,656	0,000	0,000
18,38	12,116	41,494	193,178	-4,760	12,103	6	19	349,220	148,916	200,304	0,004	1,760	0,000	98,244	47,000	38	78,386	98,244	0,000	0,000
18,40	11,745	40,259	190,532	-4,763	11,754	6	19	349,600	149,112	200,488	0,004	1,778	0,000	97,579	46,000	38	77,855	97,579	0,000	0,000
18,42	11,208	39,854	186,082	-4,765	11,299	6	19	349,980	149,308	200,672	0,003	1,801	0,000	96,448	45,000	38	76,953	96,448	0,000	0,000
18,44	10,754	39,394	184,118	-4,761	10,896	6	19	350,360	149,504	200,856	0,003	1,824	0,000	95,645	44,000	38	76,313	95,645	0,000	0,000
18,46	10,538	39,394	185,281	-4,770	10,640	6	19	350,740	149,701	201,039	0,004	1,836	0,000	94,688	43,000	38	75,549	94,688	0,000	0,000
18,48	10,438	37,224	189,369	-4,775	10,517	6	19	351,120	149,897	201,223	0,004	1,837	0,000	93,657	43,000	38	74,726	93,657	0,000	0,000
18,50	10,381	35,459	193,298	-4,778	10,459	6	19	351,500	150,093	201,407	0,004	1,833	0,000	92,725	43,000	37	73,982	92,725	0,000	0,000
18,52	10,361	35,458	196,345	-4,795	10,422	6	19	351,880	150,289	201,591	0,005	1,829	0,000	91,913	43,000	37	73,335	91,913	0,000	0,000
18,54	10,325	33,711	200,153	-4,801	10,400	6	19	352,260	150,485	201,775	0,005	1,828	0,000	91,515	43,000	37	73,017	91,515	0,000	0,000
18,56	10,310	33,710	204,442	-4,816	10,379	6	19	352,640	150,682	201,958	0,005	1,822	0,000	90,632	43,000	37	72,313	90,632	0,000	0,000
18,58	10,295	31,575	206,607	-4,802	10,368	6	19	353,020	150,878	202,142	0,006	1,819	0,000	90,166	43,000	37	71,941	90,166	0,000	0,000
18,60	10,289	31,609	209,854	-4,822	10,383	6	19	353,400	151,074	202,326	0,006	1,809	0,000	89,237	43,000	37	71,200	89,237	0,000	0,000
18,62	10,351	29,439	214,103	-4,838	10,396	6	19	353,780	151,270	202,510	0,006	1,802	0,000	88,503	43,000	37	70,614	88,503	0,000	0,000
18,64	10,329	28,203	215,426	-4,839	10,359	6	19	354,160	151,466	202,694	0,006	1,795	0,000	87,451	43,000	37	69,775	87,451	0,000	0,000
18,66	10,179	27,285	214,063	-4,856	10,238	6	19	354,540	151,663	202,877	0,006	1,802	0,000	87,116	42,000	37	69,508	87,116	0,000	0,000
18,68	9,987	28,783	212,700	-4,853	10,117	6	19	354,920	151,859	203,061	0,006	1,813	0,000	87,273	42,000	37	69,632	87,273	0,000	0,000
18,70	9,967	29,612	214,343	-4,862	9,811	6	19	355,300	152,055	203,245	0,006	1,861	0,000	89,816	41,000	37	71,661	89,816	0,000	0,000
18,72	9,266	40,334	204,202	-4,875	9,979	6	19	355,680	152,249	203,429	0,007	1,858	0,000	91,098	41,000	37	72,685	91,098	0,000	0,000
18,74	10,483	32,906	229,897	-4,871	10,258	6	19	356,060	152,447	203,613	0,007	1,848	0,000	92,497	42,000	37	73,801	92,497	0,000	0,000
18,76	10,799	33,610	234,066	-4,885	10,866	6	19	356,440	152,644	203,796	0,008	1,799	0,000	92,343	44,000	38	73,678	92,343	0,000	0,000
18,78	11,077	34,985	237,634	-4,885	11,120	6	19	356,820	152,840	203,980	0,008	1,793	0,000	93,819	44,000	38	74,855	93,819	0,000	0,000
18,80	11,243	37,472	238,596	-4,909	11,307	6	19	357,200	153,036	204,164	0,008	1,794	0,000	95,533	45,000	38	76,223	95,533	0,000	0,000
18,82	11,358	39,835	239,398	-4,914	11,485	6	19	357,580	153,232	204,348	0,008	1,797	0,000	97,528	45,000	38	77,815	97,528	0,000	0,000
18,84	11,609	42,692	242,605	-4,917	11,744	6	19	357,960	153,428	204,532	0,008	1,798	0,000	99,859	45,000	38	79,675	99,859	0,000	0,000
18,86	12,016	46,343	249,059	-4,918	12,100	6	19	358,340	153,625	204,715	0,008	1,796	0,000	102,783	46,000	38	82,008	102,783	0,000	0,000
18,88	12,424	51,087	251,664	-4,931	12,721	6	19	358,720	153,821	204,899	0,008	1,773	0,000	105,092	47,000	38	83,850	105,092	0,000	0,000
18,90	13,463	49,321	266,256	-4,946	13,428	6	19	359,100	154,017	205,083	0,008	1,739	0,000	106,336	49,000	39	84,843	106,336	0,000	0,000
18,92	14,129	47,327	273,712	-4,956	14,203	6	19	359,480	154,213	205,267	0,009	1,691	0,000	105,998	51,000	39	84,573	105,998	0,000	0,000
18,94	14,739	44,064	275,917	-4,960	14,745	6	19	359,860	154,409	205,451	0,008	1,660	0,000	105,913	52,000	39	84,505	105,913	0,000	0,000
18,96	15,088	45,263	274,754	-4,962	15,175	6	19	360,240	154,606	205,634	0,008	1,639	0,000	106,280	53,000	39	84,798	106,280	0,000	0,000
18,98	15,417	46,250	276,839	-4,967	15,473	6	19	360,620	154,802	205,818	0,008	1,633	0,000	107,546	53,000	40	85,808	107,546	0,000	0,000
19,00	15,631	48,189	276,839	-4,962	15,677	6	19	361,000	154,998	206,002	0,008	1,625	0,000	107,963	54,000	40	86,141	107,963	0,000	0,000

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

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n.° Iscrizione alla CCIAA di Re 01999010309 - n.REA 241942 - CF e P.IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
19,02	15,702	45,877	274,554	-4,984	15,811	6	19	361,380	155,194	206,186	0,008	1,618	0,000	107,924	54,000	40	86,110	107,924	0,000	0,000
19,04	15,819	45,083	274,353	-4,979	15,914	6	19	361,760	155,390	206,370	0,008	1,608	0,000	107,268	54,000	40	85,586	107,268	0,000	0,000
19,06	15,940	44,235	275,917	-4,989	16,006	6	19	362,140	155,587	206,553	0,008	1,603	0,000	107,222	54,000	40	85,549	107,222	0,000	0,000
19,08	15,979	44,940	276,879	-5,001	16,066	6	19	362,520	155,783	206,737	0,008	1,601	0,000	107,391	55,000	40	85,685	107,391	0,000	0,000
19,10	15,998	45,380	275,355	-5,008	15,961	6	19	362,900	155,979	206,921	0,005	1,617	0,000	108,766	54,000	40	86,781	108,766	0,000	0,000
19,12	15,659	51,354	172,693	-4,965	16,116	6	19	363,280	156,175	207,105	0,003	1,606	0,000	108,357	55,000	40	86,455	108,357	0,000	0,000
19,14	16,479	41,865	175,059	-4,967	16,417	6	19	363,660	156,371	207,289	0,001	1,590	0,000	108,210	55,000	40	86,337	108,210	0,000	0,000
19,16	16,933	42,730	177,744	-4,970	16,995	6	19	364,040	156,568	207,472	0,001	1,555	0,000	107,195	56,000	40	85,528	107,195	0,000	0,000
19,18	17,390	42,996	183,196	-4,984	17,382	6	19	364,420	156,764	207,656	0,002	1,541	0,000	107,845	57,000	40	86,046	107,845	0,000	0,000
19,20	17,637	42,626	187,125	-4,984	17,689	6	19	364,800	156,960	207,840	0,002	1,528	0,000	107,960	58,000	40	86,138	107,960	0,000	0,000
19,22	17,849	41,409	193,498	-5,002	17,716	6	19	365,180	157,156	208,024	0,002	1,523	0,000	107,455	58,000	40	85,735	107,455	0,000	0,000
19,24	17,466	40,281	193,057	-4,995	17,450	6	19	365,560	157,352	208,208	0,002	1,532	0,000	107,018	57,000	40	85,386	107,018	0,000	0,000
19,26	16,839	41,868	190,612	-5,008	16,783	6	19	365,940	157,549	208,391	0,002	1,557	0,000	106,122	56,000	40	84,672	106,122	0,000	0,000
19,28	15,850	40,774	185,561	-5,010	15,996	6	19	366,320	157,745	208,575	0,002	1,594	0,000	105,903	54,000	40	84,497	105,903	0,000	0,000
19,30	15,108	43,632	184,519	-5,019	15,372	6	19	366,700	157,941	208,759	0,002	1,623	0,000	105,508	53,000	40	84,182	105,508	0,000	0,000
19,32	14,967	43,543	189,490	-5,030	15,192	6	19	367,080	158,137	208,943	0,002	1,637	0,000	106,027	53,000	39	84,596	106,027	0,000	0,000
19,34	15,303	44,160	205,083	-5,062	15,499	6	19	367,460	158,333	209,127	0,003	1,625	0,000	106,628	53,000	40	85,075	106,628	0,000	0,000
19,36	16,016	44,477	223,924	-5,086	15,965	6	19	367,840	158,530	209,310	0,004	1,603	0,000	106,812	54,000	40	85,222	106,812	0,000	0,000
19,38	16,350	41,495	231,701	-5,090	16,460	6	19	368,220	158,726	209,494	0,005	1,578	0,000	106,868	55,000	40	85,267	106,868	0,000	0,000
19,40	16,777	41,388	241,683	-5,115	16,865	6	19	368,600	158,922	209,678	0,005	1,559	0,000	106,881	56,000	40	85,278	106,881	0,000	0,000
19,42	17,220	42,075	253,428	-5,137	17,237	6	19	368,980	159,118	209,862	0,005	1,543	0,000	107,140	57,000	40	85,484	107,140	0,000	0,000
19,44	17,457	40,468	260,203	-5,153	17,525	6	19	369,360	159,314	210,046	0,006	1,532	0,000	107,394	57,000	40	85,687	107,394	0,000	0,000
19,46	17,632	40,837	267,298	-5,178	17,590	6	19	369,740	159,511	210,229	0,006	1,529	0,000	107,394	57,000	40	85,687	107,394	0,000	0,000
19,48	17,411	41,558	266,977	-5,186	17,410	6	19	370,120	159,707	210,413	0,006	1,542	0,000	108,105	57,000	40	86,254	108,105	0,000	0,000
19,50	16,917	44,678	260,563	-5,193	16,999	6	19	370,500	159,903	210,597	0,006	1,570	0,000	109,228	56,000	40	87,150	109,228	0,000	0,000
19,52	16,402	48,345	258,399	-5,187	16,443	6	19	370,880	160,099	210,781	0,006	1,607	0,000	110,694	55,000	40	88,320	110,694	0,000	0,000
19,54	15,747	51,677	251,464	-5,210	15,965	6	19	371,260	160,295	210,965	0,006	1,643	0,000	112,382	54,000	40	89,666	112,382	0,000	0,000
19,56	15,488	55,644	255,392	-5,245	15,647	6	19	371,640	160,492	211,148	0,006	1,665	0,000	113,230	53,000	40	90,343	113,230	0,000	0,000
19,58	15,445	54,355	259,040	-5,251	15,597	6	19	372,020	160,688	211,332	0,007	1,669	0,000	113,459	53,000	39	90,526	113,459	0,000	0,000
19,60	15,591	52,959	267,218	-5,272	15,756	6	19	372,400	160,884	211,516	0,007	1,656	0,000	112,746	53,000	40	89,957	112,746	0,000	0,000
19,62	15,959	50,911	273,592	-5,268	16,031	6	19	372,780	161,080	211,700	0,007	1,634	0,000	111,626	54,000	40	89,063	111,626	0,000	0,000
19,64	16,263	46,976	276,558	-5,292	16,370	6	19	373,160	161,276	211,884	0,007	1,610	0,000	110,548	55,000	40	88,204	110,548	0,000	0,000
19,66	16,604	45,528	280,406	-5,310	16,770	6	19	373,540	161,473	212,067	0,007	1,586	0,000	109,937	55,000	40	87,716	109,937	0,000	0,000
19,68	17,155	45,490	284,134	-5,330	17,233	6	19	373,920	161,669	212,251	0,007	1,568	0,000	110,499	56,000	40	88,164	110,499	0,000	0,000
19,70	17,650	46,899	286,700	-5,339	17,848	6	19	374,300	161,865	212,435	0,007	1,551	0,000	112,128	57,000	40	89,464	112,128	0,000	0,000
19,72	18,447	49,825	289,346	-5,361	18,449	6	19	374,680	162,061	212,619	0,007	1,541	0,000	114,437	59,000	40	91,306	114,437	0,000	0,000
19,74	18,956	53,332	286,099	-5,374	19,013	6	19	375,060	162,257	212,803	0,007	1,534	0,000	117,073	59,000	41	93,409	117,073	0,000	0,000
19,76	19,342	56,770	287,662	-5,385	19,539	6	19	375,440	162,454	212,986	0,007	1,532	0,000	119,967	60,000	41	95,718	119,967	0,000	0,000
19,78	20,024	61,442	291,791	-5,410	20,051	6	19	375,820	162,650	213,170	0,006	1,528	0,000	122,648	61,000	41	97,858	122,648	0,000	0,000
19,80	20,492	64,191	289,787	-5,429	20,440	6	19	376,200	162,846	213,354	0,006	1,527	0,000	124,877	62,000	41	99,636	124,877	0,000	0,000
19,82	20,513	66,129	280,607	-5,433	20,486	6	19	376,580	163,042	213,538	0,006	1,533	0,000	126,146	62,000	41	100,648	126,146	0,000	0,000
19,84	20,165	67,696	275,035	-5,448	20,254	6	19	376,960	163,238	213,722	0,006	1,546	0,000	126,703	61,000	41	101,093	126,703	0,000	0,000
19,86	19,803	68,205	267,057	-5,464	19,973	6	19	377,340	163,435	213,905	0,005	1,562	0,000	127,481	61,000	41	101,714	127,481	0,000	0,000
19,88	19,676	71,625	267,378	-5,462	19,874	6	19	377,720	163,631	214,089	0,005	1,570	0,000	128,152	60,000	41	102,249	128,152	0,000	0,000
19,90	19,867	71,658	272,950	-5,494	20,041	6	19	378,100	163,827	214,273	0,005	1,569	0,000	128,978	61,000	41	102,908	128,978	0,000	0,000
19,92	20,303	71,532	275,155	-5,502	20,282	6	19	378,480	164,023	214,457	0,005	1,556	0,000	128,470	61,000	41	102,502	128,470	0,000	0,000
19,94	20,395	67,350	271,868	-5,512	20,543	6	19	378,860	164,219	214,641	0,005	1,537	0,000	127,114	62,000	41	101,420	127,114	0,000	0,000
19,96	20,651	62,796	273,712	-5,536	20,830	6	19	379,240	164,416	214,824	0,005	1,512	0,000	124,833	62,000	41	99,601	124,833	0,000	0,000
19,98	21,166	57,837	275,035	-5,545	21,238	6	19	379,620	164,612	215,008	0,005	1,485	0,000	123,017	63,000	41	98,152	123,017	0,000	0,000
20,00	21,616	55,700	276,879	-5,552	21,670	7	19	380,000	164,808	215,192	0,005	1,463	0,000	122,129	64,000	41	97,443	122,129	0,000	0,000

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

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n.° Iscrizione alla CCIAA di Re 01999010309 - n. REA 241942 - CF e P. IVA 01999010309

Certificazione Qualità 9001:2008 SOA 0520b 1ª categoria

Concessione Miniateriale n.° 3655 Circ 7619/STC

Certificato n.° 034E 2018

Del 03/09/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU4 PE**

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 16/07/2018

Profondità raggiunta: 20,98 m da p.c.

Prof. Falda: Chiuso a 3,05 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
20,02	21,948	55,926	275,476	-5,579	22,035	7	19	380,380	165,004	215,376	0,005	1,444	0,000	121,317	65,000	41	96,795	121,317	0,000	0,000
20,04	22,260	51,761	275,155	-5,609	22,292	7	19	380,760	165,200	215,560	0,005	1,428	0,000	120,278	65,000	42	95,966	120,278	0,000	0,000
20,06	22,387	49,059	273,471	-5,619	22,366	7	19	381,140	165,397	215,743	0,005	1,426	0,000	120,363	65,000	42	96,034	120,363	0,000	0,000
20,08	22,175	55,829	260,684	-5,630	22,166	7	19	381,520	165,593	215,927	0,004	1,436	0,000	120,850	65,000	41	96,423	120,850	0,000	0,000
20,10	21,669	54,997	249,459	-5,640	21,559	7	19	381,900	165,789	216,111	0,003	1,470	0,000	122,556	64,000	41	97,784	122,556	0,000	0,000
20,12	20,600	60,479	174,297	-5,654	20,746	6	19	382,280	165,985	216,295	0,001	1,506	0,000	123,321	62,000	41	98,394	123,321	0,000	0,000
20,14	19,771	63,656	153,211	-5,662	19,954	6	19	382,660	166,181	216,479	0,000	1,548	0,000	125,087	61,000	41	99,804	125,087	0,000	0,000
20,16	19,330	68,102	148,241	-5,675	19,407	6	19	383,040	166,378	216,662	-0,001	1,580	0,000	126,640	59,000	41	101,042	126,640	0,000	0,000
20,18	18,967	71,455	145,996	-5,687	19,150	6	19	383,420	166,574	216,846	-0,001	1,597	0,000	127,650	59,000	41	101,848	127,650	0,000	0,000
20,20	19,004	70,291	148,481	-5,686	18,967	6	19	383,800	166,770	217,030	-0,001	1,598	0,000	126,466	58,000	40	100,903	126,466	0,000	0,000
20,22	18,779	62,619	149,603	-5,706	18,720	6	19	384,180	166,966	217,214	-0,001	1,592	0,000	123,878	58,000	40	98,839	123,878	0,000	0,000
20,24	18,225	59,021	147,038	-5,706	18,224	6	19	384,560	167,162	217,398	-0,001	1,591	0,000	120,356	57,000	40	96,029	120,356	0,000	0,000
20,26	17,517	54,717	146,517	-5,725	17,613	6	19	384,940	167,359	217,581	-0,001	1,606	0,000	118,547	56,000	40	94,586	118,547	0,000	0,000
20,28	16,946	56,710	145,234	-5,724	17,010	6	19	385,320	167,555	217,765	-0,001	1,627	0,000	117,423	55,000	40	93,689	117,423	0,000	0,000
20,30	16,417	56,640	144,953	-5,728	16,555	6	19	385,700	167,751	217,949	-0,001	1,650	0,000	117,558	54,000	40	93,796	117,558	0,000	0,000
20,32	16,153	57,874	149,764	-5,751	16,292	6	19	386,080	167,947	218,133	-0,001	1,661	0,000	117,364	54,000	40	93,641	117,364	0,000	0,000
20,34	16,155	57,115	155,376	-5,750	16,248	6	19	386,460	168,143	218,317	-0,001	1,665	0,000	117,504	53,000	40	93,753	117,504	0,000	0,000
20,36	16,277	57,432	161,269	-5,760	16,408	6	19	386,840	168,340	218,500	0,000	1,656	0,000	117,464	54,000	40	93,721	117,464	0,000	0,000
20,38	16,626	56,532	172,012	-5,764	16,723	6	19	387,220	168,536	218,684	0,000	1,641	0,000	117,499	54,000	40	93,749	117,499	0,000	0,000
20,40	17,091	55,243	183,958	-5,782	17,206	6	19	387,600	168,732	218,868	0,001	1,620	0,000	117,753	55,000	40	93,952	117,753	0,000	0,000
20,42	17,714	55,736	195,823	-5,785	17,912	6	19	387,980	168,928	219,052	0,002	1,594	0,000	118,702	57,000	40	94,709	118,702	0,000	0,000
20,44	18,731	57,128	210,816	-5,806	18,842	6	19	388,360	169,124	219,236	0,002	1,567	0,000	120,764	58,000	40	96,354	120,764	0,000	0,000
20,46	19,866	60,355	226,690	-5,825	19,869	6	19	388,740	169,321	219,419	0,003	1,542	0,000	123,561	60,000	41	98,586	123,561	0,000	0,000
20,48	20,780	64,322	239,317	-5,825	20,759	6	19	389,120	169,517	219,603	0,003	1,528	0,000	126,882	62,000	41	101,236	126,882	0,000	0,000
20,50	21,390	69,471	244,729	-5,825	21,470	6	19	389,500	169,713	219,787	0,004	1,520	0,000	130,015	63,000	41	103,735	130,015	0,000	0,000
20,52	21,992	72,979	250,061	-5,840	21,965	6	19	389,880	169,909	219,971	0,004	1,513	0,000	131,862	64,000	41	105,209	131,862	0,000	0,000
20,54	22,260	71,443	251,384	-5,857	22,058	6	19	390,260	170,105	220,155	0,004	1,510	0,000	131,956	64,000	41	105,284	131,956	0,000	0,000
20,56	21,670	69,307	241,683	-5,868	21,856	6	19	390,640	170,302	220,338	0,003	1,511	0,000	130,980	63,000	41	104,506	130,980	0,000	0,000
20,58	21,390	68,600	239,798	-5,888	21,689	6	19	391,020	170,498	220,522	0,003	1,517	0,000	130,804	63,000	41	104,365	130,804	0,000	0,000
20,60	21,763	71,155	239,518	-5,880	21,791	6	19	391,400	170,694	220,706	0,003	1,533	0,000	134,121	63,000	41	107,012	134,121	0,000	0,000
20,62	21,975	86,411	243,807	-5,891	22,068	6	19	391,780	170,890	220,890	0,003	1,530	0,000	135,428	63,000	41	108,054	135,428	0,000	0,000
20,64	22,223	74,080	230,899	-5,909	22,301	6	19	392,160	171,086	221,074	0,003	1,522	0,000	135,523	64,000	41	108,130	135,523	0,000	0,000
20,66	22,463	70,267	236,912	-5,927	22,478	6	19	392,540	171,283	221,257	0,003	1,491	0,000	131,362	64,000	41	104,810	131,362	0,000	0,000
20,68	22,506	62,945	244,048	-5,947	22,459	7	19	392,920	171,479	221,441	0,003	1,479	0,000	129,196	64,000	41	103,082	129,196	0,000	0,000
20,70	22,160	62,609	243,727	-5,950	22,184	6	19	393,300	171,675	221,625	0,003	1,507	0,000	132,230	64,000	41	105,503	132,230	0,000	0,000
20,72	21,644	87,424	228,294	-5,936	22,358	6	19	393,680	171,871	221,809	0,003	1,573	0,000	144,826	63,000	41	115,553	144,826	0,000	0,000
20,74	23,035	131,988	224,004	-5,922	22,061	6	19	394,060	172,067	221,993	0,002	1,686	0,000	164,881	62,000	41	131,554	164,881	0,000	0,000
20,76	21,278	189,439	211,096	-5,889	21,345	6	19	394,440	172,264	222,176	0,002	1,843	0,000	194,575	59,000	41	155,246	194,575	0,000	0,000
20,78	19,499	311,546	218,753	-5,878	20,576	6	19	394,820	172,460	222,360	0,003	1,933	0,000	210,115	57,000	40	167,645	210,115	0,000	0,000
20,80	20,722	271,226	238,836	-5,858	20,744	6	19	395,200	172,656	222,544	0,003	1,943	0,000	214,545	58,000	40	171,180	214,545	0,000	0,000
20,82	21,722	226,092	248,978	-5,839	21,718	6	19	395,580	172,852	222,728	0,004	1,860	0,000	202,178	60,000	41	161,312	202,178	0,000	0,000
20,84	22,406	192,445	260,924	-5,835	22,517	6	19	395,960	173,048	222,912	0,004	1,778	0,000	189,170	62,000	41	150,933	189,170	0,000	0,000
20,86	23,109	159,037	265,574	-5,812	23,129	6	19	396,340	173,245	223,095	0,004	1,709	0,000	178,108	63,000	41	142,107	178,108	0,000	0,000
20,88	23,603	138,859	266,456	-5,822	23,801	6	19	396,720	173,441	223,279	0,004	1,655	0,000	171,255	64,000	41	136,640	171,255	0,000	0,000
20,90	24,417	139,590	272,790	-5,835	24,526	6	19	397,100	173,637	223,463	0,004	1,579	0,000	160,437	66,000	42	128,008	160,437	0,000	0,000
20,92	25,281	83,474	274,634	-5,834	25,308	6	19	397,480	173,833	223,647	0,004	1,507	0,000	151,090	68,000	42	120,550	151,090	0,000	0,000
20,94	25,950	77,505	265,935	-5,841	26,323	7	19	397,860	174,029	223,831	0,004	1,428	0,000	142,378	70,000	42	113,599	142,378	0,000	0,000
20,96	27,464	84,903	267,939	-5,814	27,050	7	19	398,240	174,226	224,014	0,003	1,411	0,000	143,267	71,000	42	114,308	143,267	0,000	0,000
20,98	27,236	68,371	229,576	-5,804	27,395	7	19	398,620	174,422	224,198	0,003	1,377	0,001	138,863	72,000	42	110,795	138,863	0,000	0,000
21,00																				

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

DESCRIZIONE: La prova è stata effettuata nel campo agricolo del Sig. Coltelli al limite con l'area di rispetto autostradale.

COORDINATE WGS84

44°32'23.6713"N 11°22'00.1294"E
Quota Elissoide: 71,681

COORDINATE GAUSS-BOAGA

4934566,676N 1688020,079E

COORDINATE RETTILINEE

X= 9895291,603 Y= 3161514,235
Quota s.l.m.: 32,501

PLANIMETRIA



GOOGLE EARTH



PROVA PENETROMETRICA STATICA ELETTRICA CON PIEZOCONO (CPTU)

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Commessa: 00100018_FG

Nome prova:

CPTU 5 PE

Certificato n.°

032E_2018

DOCUMENTAZIONE FOTOGRAFICA

Ubicazione / Piazzamento



CARATTERISTICHE STRUMENTAZIONE

Normativa di riferimento

A.G.I. - (1977): Raccomandazioni sulla Programmazione e d Esecuzione delle Indagini Geotecniche

ASSMFE - (1988): Dynamic Probing (DP) International Reference Test Procedure

ASTM D3441-86: Deep quasi-static cone and friction cone penetration tests of soil

DM 11.03.88: "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione ed il collaudo delle opere di sostegno delle terre e delle opere di fondazione

Caratteristiche punta elettrica

Costruttore/modello: TECNOPENTA - G1-CPLS D

Serial number: 170118

Caratteristiche penetrometro

Marca/modello: TECNOTEST

Spinta nominale: 20 ton

NOTE:

Falda: 2,50m da p.c.

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

CERTIFICATO N. 032E_2018

PROVA PENETROMETRICA STATICA ELETTRICA CON PIEZOCONO (CPTU)

CPTU 5 PE

Committente: Spea Engineering

Data: 13/07/2018

Profondità raggiunta: 23,78m da p.c.

Lavoro: Autostrada A13 PE

Località: Bologna

Profondità Falda: F. Chiuso 2,50m da p.c.

Resistenza alla punta qt

(MPa)

Attrito laterale ft / Rap. di attrito

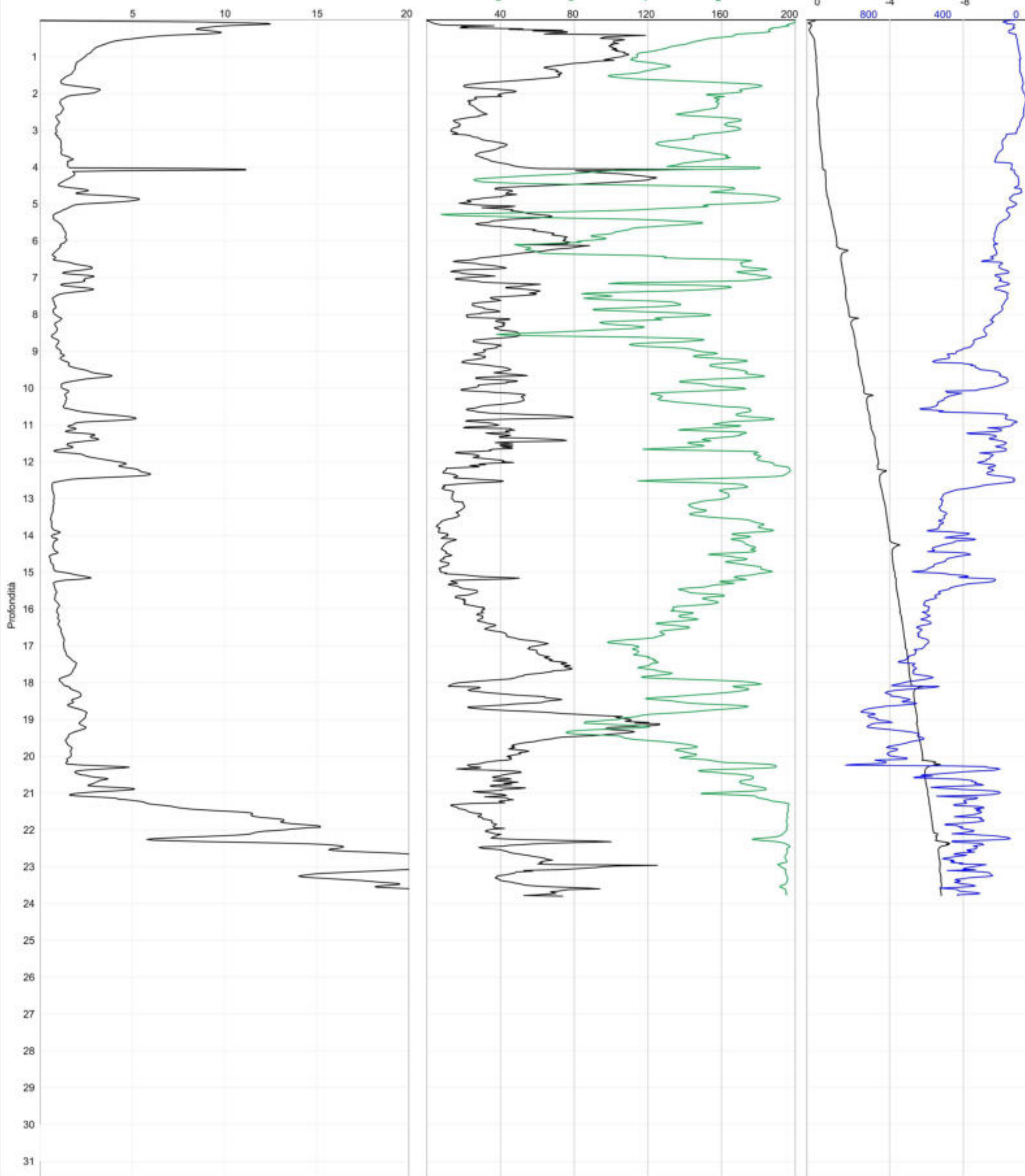
(kPa)

Rf % (ft/qt)

Inclinazione / P. neutra

(°)

U (kPa)





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I.T. ISOLAZIONE S.p.A. CODA S.R.L. 01999510358 - AREA 241942 CP e P.IVA 01999510358

Certificazione Qualità 9001:2008 SOA 05290 1° categoria

Concessione Ministeriale n.° 3655 Circ. 7619/STC

Certificato n.° 032E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU5 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 13/07/2018

Profondità raggiunta: 23,78 m da p.c.

Prof. Falda: 2,50 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
0,02	2,670	1,300	51,784	-0,062	4,361	0	19	0,380	0,000	0,380	0,013	1,162	0,000	17,100	0,000	0	13,643	17,100	0,000	0,000
0,04	7,683	2,251	70,656	-0,186	8,753	0	19	0,760	0,000	0,760	0,008	1,056	0,000	30,011	0,000	0	23,945	30,011	0,000	0,000
0,06	10,821	2,994	72,305	-0,336	10,683	0	19	1,140	0,000	1,140	0,006	1,017	0,000	34,856	0,000	0	27,811	34,856	0,000	0,000
0,08	13,479	4,100	54,354	-0,429	12,399	0	19	1,520	0,000	1,520	0,005	0,996	0,000	39,369	0,000	0	31,412	39,369	0,000	0,000
0,10	12,834	6,155	54,277	-0,389	12,483	0	19	1,900	0,000	1,900	0,003	0,993	0,000	39,483	0,000	0	31,502	39,483	0,000	0,000
0,12	11,095	8,228	13,042	-0,247	11,276	6	19	2,280	0,000	2,280	0,002	1,074	0,005	39,548	92,000	45	31,554	39,548	0,000	0,000
0,14	9,873	36,506	12,198	-0,268	10,113	6	19	2,660	0,000	2,660	0,001	1,143	0,003	38,679	91,000	45	30,861	38,679	0,000	0,000
0,16	9,359	18,646	13,847	-0,246	9,514	6	19	3,040	0,000	3,040	0,002	1,212	0,002	39,713	89,000	45	31,686	39,713	0,000	0,000
0,18	9,296	21,583	17,453	-0,270	9,201	6	19	3,420	0,000	3,420	0,002	1,188	0,002	37,256	86,000	44	29,726	37,256	0,000	0,000
0,20	8,931	17,938	18,489	-0,286	8,786	6	19	3,800	0,000	3,800	0,002	1,290	0,001	40,489	88,000	44	32,305	40,489	0,000	0,000
0,22	8,117	52,124	10,242	-0,316	8,520	6	19	4,180	0,000	4,180	0,002	1,350	0,001	42,374	89,000	44	33,809	42,374	0,000	0,000
0,24	8,494	44,730	21,941	-0,345	8,455	6	19	4,560	0,000	4,560	0,002	1,451	0,000	47,787	91,000	45	38,128	47,787	0,000	0,000
0,26	8,733	73,871	25,662	-0,368	8,878	6	19	4,940	0,000	4,940	0,003	1,443	0,000	49,664	92,000	45	39,625	49,664	0,000	0,000
0,28	9,379	57,547	39,662	-0,355	9,253	6	19	5,320	0,000	5,320	0,004	1,469	0,000	53,502	94,000	45	42,688	53,502	0,000	0,000
0,30	9,611	76,166	42,117	-0,340	9,615	6	19	5,700	0,000	5,700	0,004	1,460	0,000	54,945	94,000	45	43,839	54,945	0,000	0,000
0,32	9,811	76,063	42,616	-0,316	9,833	6	19	6,080	0,000	6,080	0,004	1,467	0,000	56,676	94,000	45	45,221	56,676	0,000	0,000
0,34	10,033	67,772	41,580	-0,315	9,739	6	19	6,460	0,000	6,460	0,004	1,463	0,000	55,836	92,000	45	44,504	55,836	0,000	0,000
0,36	9,333	63,819	34,139	-0,286	9,116	6	19	6,840	0,000	6,840	0,003	1,524	0,000	56,503	91,000	45	45,082	56,503	0,000	0,000
0,38	7,953	98,486	9,283	-0,248	8,066	6	19	7,220	0,000	7,220	0,002	1,640	0,000	57,860	90,000	45	46,165	57,860	0,000	0,000
0,40	6,896	118,679	3,414	-0,222	7,093	5	19	7,600	0,000	7,600	0,001	1,745	0,000	58,129	88,000	44	46,380	58,129	0,000	0,000
0,42	6,425	107,433	1,764	-0,211	6,427	5	19	7,980	0,000	7,980	0,000	1,798	0,000	56,277	85,000	44	44,902	56,277	0,000	0,000
0,44	5,958	97,483	1,764	-0,181	5,961	5	19	8,360	0,000	8,360	0,000	1,819	0,000	53,609	82,000	44	42,773	53,609	0,000	0,000
0,46	5,499	95,443	1,189	-0,160	5,601	5	19	8,740	0,000	8,740	0,000	1,842	0,000	51,867	79,000	43	41,383	51,867	0,000	0,000
0,48	5,343	94,251	2,110	-0,143	5,244	5	19	9,120	0,000	9,120	0,000	1,887	0,000	51,377	77,000	43	40,992	51,377	0,000	0,000
0,50	4,890	104,995	-0,422	-0,116	4,935	5	19	9,500	0,000	9,500	0,000	1,933	0,000	51,240	75,000	43	40,883	51,240	0,000	0,000
0,52	4,573	107,308	-1,074	-0,108	4,559	5	19	9,880	0,000	9,880	0,000	1,986	0,000	50,625	73,000	43	40,393	50,625	0,000	0,000
0,54	4,217	104,249	-2,915	-0,086	4,273	5	19	10,260	0,000	10,260	-0,001	2,020	0,000	49,501	71,000	42	39,495	49,501	0,000	0,000
0,56	4,031	101,121	-3,337	-0,076	4,042	4	19	10,640	0,000	10,640	-0,001	2,047	0,000	48,451	69,000	42	38,658	48,451	0,000	0,000
0,58	3,882	101,327	-3,989	-0,073	3,878	4	19	11,020	0,000	11,020	-0,001	2,070	0,000	47,838	68,000	42	38,169	47,838	0,000	0,000
0,60	3,725	101,325	-4,795	-0,072	3,746	4	19	11,400	0,000	11,400	-0,001	2,094	0,000	47,681	66,000	42	38,044	47,681	0,000	0,000
0,62	3,637	104,121	-4,795	-0,065	3,632	4	19	11,780	0,000	11,780	-0,001	2,113	0,000	47,342	65,000	42	37,773	47,342	0,000	0,000
0,64	3,539	99,974	-5,447	-0,057	3,532	4	19	12,160	0,000	12,160	-0,002	2,132	0,000	47,101	64,000	41	37,581	47,101	0,000	0,000
0,66	3,426	100,784	-6,176	-0,058	3,413	4	19	12,540	0,000	12,540	-0,002	2,148	0,000	46,494	63,000	41	37,096	46,494	0,000	0,000
0,68	3,282	98,899	-6,904	-0,064	3,306	4	19	12,920	0,000	12,920	-0,002	2,168	0,000	46,166	62,000	41	36,835	46,166	0,000	0,000
0,70	3,217	99,105	-7,787	-0,060	3,180	4	19	13,300	0,000	13,300	-0,002	2,192	0,000	45,762	60,000	41	36,512	45,762	0,000	0,000
0,72	3,049	100,588	-8,899	-0,055	3,082	4	19	13,680	0,000	13,680	-0,003	2,215	0,000	42,950	59,000	41	36,399	45,620	0,000	0,000
0,74	2,987	101,243	-9,014	-0,052	2,993	4	19	14,060	0,000	14,060	-0,003	2,238	0,000	41,705	59,000	40	36,375	45,590	0,000	0,000
0,76	2,952	102,865	-9,513	-0,052	2,953	4	19	14,440	0,000	14,440	-0,003	2,248	0,000	41,143	58,000	40	36,383	45,600	0,000	0,000
0,78	2,930	100,359	-10,472	-0,042	2,917	4	19	14,820	0,000	14,820	-0,004	2,261	0,000	40,628	57,000	40	36,508	45,756	0,000	0,000
0,80	2,879	103,502	-11,201	-0,035	2,858	4	19	15,200	0,000	15,200	-0,004	2,275	0,000	39,797	56,000	40	36,402	45,623	0,000	0,000
0,82	2,776	102,207	-11,738	-0,033	2,816	4	19	15,580	0,000	15,580	-0,004	2,291	0,000	39,207	56,000	40	36,590	45,859	0,000	0,000
0,84	2,805	104,918	-12,466	-0,019	2,783	4	19	15,960	0,000	15,960	-0,005	2,305	0,000	38,743	55,000	40	36,786	46,105	0,000	0,000
0,86	2,781	107,406	-13,310	-0,014	2,772	4	19	16,340	0,000	16,340	-0,005	2,315	0,000	38,586	55,000	40	37,118	46,522	0,000	0,000
0,88	2,745	107,026	-14,423	-0,007	2,709	4	19	16,720	0,000	16,720	-0,005	2,335	0,000	37,689	0,000	0	37,191	192,290	33,745	
0,90	2,616	108,598	-16,072	-0,008	2,634	4	19	17,100	0,000	17,100	-0,006	2,355	0,000	36,634	0,000	0	37,096	46,494	186,907	32,719
0,92	2,557	109,704	-16,839	-0,009	2,552	3	19	17,480	0,000	17,480	-0,007	2,377	0,000	35,478	0,000	0	36,917	46,269	181,011	31,630
0,94	2,499	108,392	-17,530	-0,004	2,506	3	19	17,860	0,000	17,860	-0,007	2,388	0,000	34,837	0,000	0	36,759	46,071	177,740	30,789
0,96	2,480	106,199	-17,952	0,009	2,464	3	19	18,240	0,000	18,240	-0,007	2,397	0,000	34,242	0,000	0	36,554	45,815	174,704	29,969
0,98	2,432	105,889	-18,680	0,009	2,429	3	19	18,620	0,000	18,620	-0,008	2,403	0,000	33,750	0,000	0	36,307	45,505	172,192	29,197
1,00	2,395	102,764	-19,486	0,013	2,386	3	19	19,000	0,000	19,000	-0,008	2,411	0,000	33,132	0,000	0	36,002	45,123	169,042	28,372

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015



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I.T. ISOLAZIONE SPA CODA S.R.L. 01999510355 - AREA 241942 CP 4 P.IVA 01999510355

Certificazione Qualità 9001:2008 SOA 05290 1° categoria

Concessione Mineraria n.° 3655 Circ. 7619/STC

Certificato n.° 032E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU5 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 13/07/2018

Profondità raggiunta: 23,78 m da p.c.

Prof. Falda: 2,50 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
1,02	2,3496	100,4501	-20,0230	0,0160	2,3290	3	19	19,3800	0,0000	19,3800	-0,0088	2,4207	0,0000	32,3345	0,0000	0	35,5631	44,5724	164,9719	27,4400
1,04	2,2626	98,7075	-21,2505	0,0197	2,2724	3	19	19,7600	0,0000	19,7600	-0,0094	2,4310	0,0000	31,5365	0,0000	0	35,1429	44,0458	160,9006	26,5396
1,06	2,2265	96,2385	-22,3629	0,0197	2,2140	3	19	20,1400	0,0000	20,1400	-0,0087	2,4494	0,0000	30,7144	0,0000	0	35,0321	43,9069	156,7061	25,7625
1,08	2,1724	101,5867	-13,7706	-0,0117	2,1726	3	19	20,5200	0,0000	20,5200	-0,0082	2,4568	0,0000	30,1296	0,0000	0	34,6899	43,4780	153,7225	25,0216
1,10	2,1369	92,3995	-16,5324	0,0019	2,1013	3	19	20,9000	0,0000	20,9000	-0,0078	2,4714	0,0000	29,1256	0,0000	0	34,1573	42,8105	148,5997	24,0543
1,12	2,0112	89,5001	-18,3353	0,0086	2,0229	3	19	21,2800	0,0000	21,2800	-0,0089	2,4791	0,0000	28,0231	0,0000	0	33,1885	41,5963	142,9750	22,9242
1,14	1,9390	85,9961	-18,8339	0,0123	1,9637	3	19	21,6600	0,0000	21,6600	-0,0095	2,4853	0,0000	27,1879	0,0000	0	32,4510	40,6719	138,7138	22,0125
1,16	1,9595	80,0910	-17,9517	0,0154	1,9410	3	19	22,0400	0,0000	22,0400	-0,0095	2,4806	0,0000	26,8659	0,0000	0	31,8779	39,9536	137,0711	21,3973
1,18	1,9432	76,6555	-18,0284	0,0222	1,9418	3	19	22,4200	0,0000	22,4200	-0,0095	2,4701	0,0000	26,8712	0,0000	0	31,4626	39,4331	137,0979	20,9885
1,20	1,9413	74,1694	-18,7572	0,0228	1,9354	3	19	22,8000	0,0000	22,8000	-0,0092	2,4639	0,0000	26,7758	0,0000	0	31,1056	38,9856	136,6112	20,5680
1,22	1,9394	70,6817	-15,7269	0,0283	1,9174	3	19	23,1800	0,0000	23,1800	-0,0091	2,4611	0,0000	26,5189	0,0000	0	30,6982	38,4751	135,3005	20,0779
1,24	1,8890	67,7642	-17,0694	0,0296	1,8985	3	19	23,5600	0,0000	23,5600	-0,0092	2,4568	0,0000	26,2487	0,0000	0	30,2192	37,8747	133,9221	19,5757
1,26	1,8846	64,2071	-18,9873	0,0271	1,8783	3	19	23,9400	0,0000	23,9400	-0,0099	2,4562	0,0000	25,9617	0,0000	0	29,8681	37,4347	132,4574	19,1163
1,28	1,8802	63,6038	-19,0257	0,0302	1,8836	4	19	24,3200	0,0000	24,3200	-0,0102	2,4550	0,0000	26,0295	0,0000	0	29,9002	37,4749	132,8034	18,9206
1,30	1,9052	65,5748	-18,7956	0,0351	1,8884	3	19	24,7000	0,0000	24,7000	-0,0100	2,4617	0,0000	26,0912	0,0000	0	30,2258	37,8829	133,1182	18,8058
1,32	1,8986	67,7014	-17,8366	0,0388	1,8801	3	19	25,0800	0,0000	25,0800	-0,0099	2,4761	0,0000	25,9707	0,0000	0	30,6400	38,4021	132,5036	18,6395
1,34	1,8553	70,1905	-18,4887	0,0462	1,8572	3	19	25,4600	0,0000	25,4600	-0,0101	2,4930	0,0000	25,6449	0,0000	0	30,9114	38,7423	130,8415	18,3518
1,36	1,8366	71,0390	-18,9106	0,0542	1,8248	3	19	25,8400	0,0000	25,8400	-0,0100	2,5087	0,0000	25,1850	0,0000	0	30,9652	38,8097	128,4946	17,9576
1,38	1,8007	70,0216	-16,5708	0,0603	1,7932	3	19	26,2200	0,0000	26,2200	-0,0099	2,5227	0,0000	24,7370	0,0000	0	30,9598	38,8029	126,2091	17,5596
1,40	1,7600	71,3190	-17,0311	0,0536	1,7622	3	19	26,6000	0,0000	26,6000	-0,0100	2,5379	0,0000	24,2987	0,0000	0	31,0030	38,8571	123,9732	17,1821
1,42	1,7437	73,1348	-18,4887	0,0603	1,7462	3	19	26,9800	0,0000	26,9800	-0,0110	2,5499	0,0000	24,0690	0,0000	0	31,1794	39,0782	122,8012	16,9266
1,44	1,7542	73,1196	-21,0587	0,0665	1,7184	3	19	27,3600	0,0000	27,3600	-0,0128	2,5614	0,0000	23,6742	0,0000	0	31,1170	39,0000	120,7869	16,5541
1,46	1,6793	71,0485	-25,2781	0,0653	1,6714	3	19	27,7400	0,0000	27,7400	-0,0142	2,5783	0,0000	23,0119	0,0000	0	30,9004	38,7285	117,4074	16,0424
1,48	1,6047	72,1392	-23,8588	0,0690	1,5856	3	19	28,1200	0,0000	28,1200	-0,0160	2,6085	0,0000	21,8042	0,0000	0	0,0000	38,1278	111,2461	15,2525
1,50	1,4981	71,8472	-25,7384	0,0684	1,5025	3	19	28,5000	0,0000	28,5000	-0,0174	2,6422	0,0000	20,6357	0,0000	0	0,0000	37,6562	105,2843	14,5061
1,52	1,4307	71,9531	-27,23																	



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Certificazione Qualità 9001:2008 SOA 05290 1° categoria

Concessione Mineraria n.° 3655 Circ. 7619/STC

Certificato n.° 032E 2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU5 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 13/07/2018

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Prof. Falda: 2,50 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m ³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
2,02	1,934	38,636	-45,033	0,140	1,943	4	19	38,380	0,000	38,380	-0,024	2,414	0,000	26,659	34,000	35	29,057	36,418	0,000	0,000
2,04	1,622	40,247	-46,797	0,129	1,635	4	19	38,760	0,000	38,760	-0,029	2,515	0,000	22,347	0,000	0	27,704	34,722	114,016	11,539
2,06	1,397	40,631	-48,178	0,121	1,467	4	19	39,140	0,000	39,140	-0,033	2,551	0,000	19,991	0,000	0	25,921	32,488	101,996	10,372
2,08	1,432	25,962	-48,408	0,087	1,400	4	19	39,520	0,000	39,520	-0,036	2,545	0,000	19,041	0,000	0	24,524	30,737	97,150	9,782
2,10	1,420	26,206	-49,252	0,078	1,349	4	19	39,900	0,000	39,900	-0,038	2,531	0,000	18,325	0,000	0	23,175	29,046	93,496	9,294
2,12	1,246	26,986	-51,554	0,079	1,257	4	19	40,280	0,000	40,280	-0,042	2,574	0,000	17,027	0,000	0	22,751	28,515	86,873	8,699
2,14	1,156	26,348	-52,589	0,076	1,162	4	19	40,660	0,000	40,660	-0,047	2,616	0,000	15,697	0,000	0	0,000	27,708	80,087	8,072
2,16	1,137	24,502	-52,781	0,071	1,119	4	19	41,040	0,000	41,040	-0,049	2,625	0,000	15,088	0,000	0	0,000	26,949	76,978	7,722
2,18	1,116	22,259	-51,937	0,068	1,099	4	19	41,420	0,000	41,420	-0,049	2,626	0,000	14,811	0,000	0	0,000	26,464	75,568	7,522
2,20	1,097	22,589	-51,093	0,068	1,085	4	19	41,800	0,000	41,800	-0,049	2,633	0,000	14,603	0,000	0	0,000	26,345	74,508	7,377
2,22	1,093	23,748	-50,863	0,063	1,070	4	19	42,180	0,000	42,180	-0,049	2,647	0,000	14,396	0,000	0	0,000	26,441	73,449	7,250
2,24	1,072	23,439	-48,984	0,064	1,067	3	19	42,560	0,000	42,560	-0,048	2,653	0,000	14,336	0,000	0	0,000	26,513	73,143	7,177
2,26	1,085	22,819	-48,408	0,062	1,081	4	19	42,940	0,000	42,940	-0,047	2,646	0,000	14,539	0,000	0	0,000	26,664	74,177	7,208
2,28	1,137	23,339	-47,794	0,068	1,114	4	19	43,320	0,000	43,320	-0,045	2,635	0,000	14,990	0,000	0	0,000	27,092	76,480	7,348
2,30	1,169	24,274	-47,066	0,060	1,151	4	19	43,700	0,000	43,700	-0,042	2,627	0,000	15,500	0,000	0	0,000	27,733	79,083	7,523
2,32	1,194	25,278	-45,992	0,068	1,176	4	19	44,080	0,000	44,080	-0,041	2,625	0,000	15,841	0,000	0	0,000	28,286	80,821	7,628
2,34	1,210	25,885	-44,534	0,065	1,202	4	19	44,460	0,000	44,460	-0,039	2,621	0,000	16,207	0,000	0	0,000	28,785	82,689	7,737
2,36	1,248	26,234	-43,460	0,082	1,227	4	19	44,840	0,000	44,840	-0,037	2,616	0,000	16,551	0,000	0	0,000	29,208	84,446	7,832
2,38	1,268	26,668	-41,695	0,087	1,247	4	19	45,220	0,000	45,220	-0,035	2,613	0,000	16,830	0,000	0	0,000	29,604	85,869	7,901
2,40	1,269	27,363	-40,008	0,083	1,253	4	19	45,600	0,000	45,600	-0,034	2,617	0,000	16,902	0,000	0	0,000	29,873	86,233	7,887
2,42	1,263	27,572	-40,008	0,093	1,240	4	19	45,980	0,000	45,980	-0,033	2,631	0,000	16,713	0,000	0	0,000	30,059	85,268	7,776
2,44	1,228	28,526	-39,049	0,097	1,212	4	19	46,360	0,000	46,360	-0,034	2,652	0,000	16,317	0,000	0	0,000	30,139	83,250	7,585
2,46	1,185	29,341	-38,205	0,110	1,177	3	19	46,740	0,000	46,740	-0,034	2,677	0,000	15,822	0,000	0	0,000	30,182	80,723	7,357
2,48	1,157	29,794	-37,936	0,122	1,152	3	19	47,120	0,000	47,120	-0,034	2,698	0,000	15,462	0,000	0	0,000	30,269	78,887	7,181
2,50	1,151	30,541	-37,975	0,126	1,138	3	19	47,500	0,000	47,500	-0,035	2,714	0,000	15,263	0,000	0	0,000	30,491	77,875	7,076
2,52	1,143	31,893	-37,361	0,129	1,118	3	19	47,880	0,196	47,684	-0,035	2,733	0,000	14,975	0,000	0	0,000	30,649	76,401	6,955
2,54	1,096	32,640	-36,747	0,138	1,062	3	19	48,260	0,392	47,868	-0,037	2,765	0,000	14,193	0,000	0	0,000	30,254	72,412	6,628
2,56	0,985	30,984	-37,821	0,137	0,979	3	19	48,640	0,589	48,051	-0,041	2,804	0,000	13,031	0,000	0	0,000	29,201	66,483	6,131
2,58	0,896	28,378	-38,013	0,133	0,899	3	19	49,020	0,785	48,235	-0,046	2,845	0,000	11,899	0,000	0	0,000	28,065	60,710	5,641
2,60	0,855	28,484	-38,473	0,133	0,859	3	19	49,400	0,981	48,419	-0,048	2,856	0,000	11,328	0,000	0	0,000	27,092	57,794	5,367
2,62	0,864	24,894	-38,128	0,140	0,854	3	19	49,780	1,177	48,603	-0,047	2,841	0,000	11,254	0,000	0	0,000	26,409	57,417	5,291
2,64	0,880	21,944	-33,563	0,149	0,873	3	19	50,160	1,373	48,787	-0,043	2,799	0,000	11,515	0,000	0	0,000	25,639	58,749	5,335
2,66	0,910	19,563	-30,878	0,155	0,894	3	19	50,540	1,570	48,970	-0,039	2,759	0,000	11,813	0,000	0	0,000	25,007	60,272	5,396
2,68	0,926	17,597	-28,692	0,142	0,915	3	19	50,920	1,766	49,154	-0,036	2,720	0,000	12,095	0,000	0	0,000	24,368	61,710	5,449
2,70	0,939	15,234	-27,426	0,151	0,939	4	19	51,300	1,962	49,338	-0,033	2,684	0,000	12,421	0,000	0	0,000	23,896	63,373	5,518
2,72	0,979	14,304	-26,084	0,154	0,972	4	19	51,680	2,158	49,522	-0,030	2,653	0,000	12,883	0,000	0	0,000	23,849	65,731	5,659
2,74	1,024	15,136	-23,744	0,148	1,015	4	19	52,060	2,354	49,706	-0,027	2,633	0,000	13,487	0,000	0	0,000	24,325	68,809	5,872
2,76	1,067	15,952	-19,755	0,147	1,040	4	19	52,630	2,649	49,981	-0,024	2,634	0,000	13,825	0,000	0	0,000	24,953	70,536	5,992
2,78	1,051	17,042	-18,259	0,140	1,033	4	19	52,820	2,747	50,073	-0,022	2,649	0,000	13,723	0,000	0	0,000	25,275	70,016	5,963
2,80	1,001	17,737	-18,028	0,145	0,994	4	19	53,200	2,943	50,257	-0,023	2,683	0,000	13,168	0,000	0	0,000	25,293	67,184	5,754
2,82	0,949	18,172	-18,565	0,155	0,948	4	19	53,580	3,139	50,441	-0,024	2,714	0,000	12,522	0,000	0	0,000	25,039	63,886	5,503
2,84	0,913	17,813	-18,527	0,161	0,918	3	19	54,150	3,434	50,717	-0,025	2,733	0,000	12,088	0,000	0	0,000	24,748	61,676	5,312
2,86	0,910	17,143	-18,067	0,156	0,897	3	19	54,340	3,532	50,808	-0,025	2,745	0,000	11,800	0,000	0	0,000	24,515	60,204	5,192
2,88	0,887	17,630	-16,686	0,167	0,874	3	19	54,720	3,728	50,992	-0,024	2,753	0,000	11,470	0,000	0	0,000	24,098	58,521	5,042
2,90	0,842	15,976	-12,850	0,167	0,860	3	19	55,100	3,924	51,176	-0,021	2,751	0,000	11,272	0,000	0	0,000	23,621	57,508	4,936
2,92	0,865	14,304	-8,324	0,171	0,856	4	19	55,480	4,120	51,360	-0,016	2,737	0,000	11,211	0,000	0	0,000	23,065	57,201	4,876
2,94	0,871	13,703	-5,754	0,171	0,864	4	19	55,860	4,316	51,544	-0,013	2,720	0,000	11,307	0,000	0	0,000	22,768	57,689	4,881
2,96	0,861	13,310	-4,565	0,172	0,868	4	19	56,240	4,513	51,727	-0,011	2,713	0,000	11,366	0,000	0	0,000	22,682	57,990	4,882
2,98	0,877	13,280	-3,107	0,170	0,870	4	19	56,620	4,709	51,911	-0,010	2,709	0,000	11,391	0,000	0	0,000	22,610	58,119	4,872
3,00	0,876	12,922	-1,841	0,173	0,879	4	19	57,000	4,905	52,095	-0,008	2,709	0,000	11,510	0,000	0	0,000	22,869	58,725	4,908

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015



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1° ISO 9001:2008 CONFORME - N° 01999510358 - N° REA 241942 - CP e P.IVA 01999510358

Certificazione Qualità 9001:2008 SOA 05290 1° categoria

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Del 29/08/2018

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Committente: SPEA Engineering SpA

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Località: Bologna

Data: 13/07/2018

Profondità raggiunta: 23,78 m da p.c.

Prof. Falda: 2,50 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
3,02	0,886	14,345	-0,537	0,178	0,881	4	19	57,380	5,101	52,279	-0,007	2,722	0,000	11,524	0,000	0	0,000	23,281	58,796	4,915
3,04	0,880	15,782	0,115	0,183	0,889	4	19	57,760	5,297	52,463	-0,006	2,736	0,000	11,641	0,000	0	0,000	23,925	59,393	4,965
3,06	0,901	16,685	2,455	0,186	0,805	3	19	58,140	5,494	52,646	-0,006	2,793	0,000	10,215	0,000	0	0,000	23,116	53,381	4,511
3,08	0,634	13,723	0,729	0,196	0,833	3	19	58,520	5,690	52,830	0,017	2,798	0,000	10,846	0,000	0	0,000	24,101	55,337	4,666
3,10	0,945	20,930	54,392	0,191	0,838	3	19	58,900	5,886	53,014	0,040	2,823	0,000	10,905	0,000	0	0,000	25,032	55,637	4,705
3,12	0,897	23,350	56,041	0,188	0,934	3	19	59,280	6,082	53,198	0,057	2,799	0,000	12,250	0,000	0	0,000	27,249	62,499	5,237
3,14	0,904	24,370	56,732	0,196	0,922	3	19	59,660	6,278	53,382	0,059	2,822	0,000	12,075	0,000	0	0,000	27,667	61,605	5,174
3,16	0,907	25,218	57,768	0,212	0,941	3	19	60,040	6,475	53,565	0,058	2,826	0,000	12,329	0,000	0	0,000	28,402	62,902	5,271
3,18	0,952	28,052	58,266	0,203	0,972	3	19	60,420	6,671	53,749	0,058	2,821	0,000	12,759	0,000	0	0,000	29,189	65,099	5,431
3,20	0,996	28,589	62,140	0,210	1,023	3	19	60,800	6,867	53,933	0,057	2,803	0,000	13,466	0,000	0	0,000	30,137	68,706	5,690
3,22	1,057	29,367	65,708	0,213	1,067	3	19	61,180	7,063	54,117	0,058	2,786	0,000	14,075	0,000	0	0,000	30,831	71,812	5,906
3,24	1,080	30,543	69,122	0,207	1,096	3	19	61,560	7,259	54,301	0,061	2,782	0,000	14,483	0,000	0	0,000	31,560	73,894	6,052
3,26	1,080	32,669	75,911	0,214	1,103	3	19	61,940	7,456	54,484	0,064	2,797	0,000	14,579	0,000	0	0,000	32,358	74,384	6,094
3,28	1,075	36,073	76,410	0,222	1,115	3	19	62,320	7,652	54,668	0,065	2,808	0,000	14,739	0,000	0	0,000	33,192	75,200	6,157
3,30	1,112	37,404	77,330	0,214	1,117	3	19	62,700	7,848	54,852	0,066	2,827	0,000	14,755	0,000	0	0,000	34,014	75,280	6,170
3,32	1,083	40,566	78,673	0,223	1,124	3	19	63,080	8,044	55,036	0,066	2,836	0,000	14,850	0,000	0	0,000	34,656	75,765	6,204
3,34	1,096	41,742	79,095	0,223	1,128	3	19	63,460	8,240	55,220	0,066	2,848	0,000	14,898	0,000	0	0,000	35,294	76,010	6,221
3,36	1,123	43,487	78,750	0,228	1,134	3	19	63,840	8,437	55,403	0,065	2,852	0,000	14,989	0,000	0	0,000	35,655	76,474	6,244
3,38	1,104	43,385	77,829	0,227	1,135	3	19	64,220	8,633	55,587	0,064	2,854	0,000	14,997	0,000	0	0,000	35,804	76,518	6,232
3,40	1,100	42,834	76,295	0,232	1,127	3	19	64,600	8,829	55,771	0,064	2,857	0,000	14,880	0,000	0	0,000	35,640	75,920	6,168
3,42	1,100	42,058	75,527	0,239	1,113	3	19	64,980	9,025	55,955	0,064	2,858	0,000	14,672	0,000	0	0,000	35,196	74,855	6,064
3,44	1,062	39,571	74,914	0,240	1,113	3	19	65,360	9,221	56,139	0,063	2,852	0,000	14,669	0,000	0	0,000	34,900	74,841	6,035
3,46	1,101	39,209	74,607	0,248	1,120	3	19	65,740	9,418	56,322	0,062	2,841	0,000	14,759	0,000	0	0,000	34,645	75,302	6,039
3,48	1,121	38,278	74,952	0,248	1,136	3	19	66,120	9,614	56,506	0,061	2,829	0,000	14,978	0,000	0	0,000	34,614	76,416	6,094
3,50	1,109	37,329	75,873	0,257	1,168	3	19	66,500	9,810	56,690	0,061	2,805	0,000	15,417	0,000	0	0,000	34,598	78,659	6,222
3,52	1,195	35,758	78,519	0,275	1,166	3	19	66,880	10,006	56,874	0,062	2,797	0,000	15,382	0,000	0	0,000	34,146	78,479	6,178
3,54	1,112	33,583	81,051	0,276	1,154	3	19	67,260	10,202	57,058	0,067	2,790	0,000	15,211	0,000	0	0,000	33,492	77,607	6,083
3,56	1,069	31,598	89,758	0,284	1,117	3	19	67,640	10,399	57,241	0,074	2,795	0,000	14,690	0,000	0	0,000	32,522	74,949	5,862
3,58	1,079	29,267	93,709	0,296	1,116	3	19	68,020	10,595	57,425	0,079	2,782	0,000	14,670	0,000	0	0,000	31,947	74,847	5,821
3,60	1,104	28,059	96,509	0,299	1,127	3	19	68,400	10,791	57,609	0,081	2,764	0,000	14,822	0,000	0	0,000	31,556	75,625	5,842
3,62	1,100	26,955	99,041	0,307	1,146	3	19	68,780	10,987	57,793	0,082	2,747	0,000	15,075	0,000	0	0,000	31,424	76,912	5,904
3,64	1,132	26,490	101,419	0,313	1,169	4	19	69,160	11,183	57,977	0,082	2,731	0,000	15,394	0,000	0	0,000	31,432	78,541	5,991
3,66	1,171	26,214	103,529	0,315	1,250	4	19	69,540	11,380	58,160	0,078	2,695	0,000	16,520	0,000	0	0,000	32,215	84,285	6,364
3,68	1,340	27,857	105,639	0,317	1,407	4	19	69,920	11,576	58,344	0,070	2,631	0,000	18,716	0,000	0	0,000	33,688	95,487	7,097
3,70	1,601	28,705	107,979	0,322	1,541	4	19	70,300	11,772	58,528	0,066	2,590	0,000	20,584	0,000	0	28,055	35,163	105,019	7,716
3,72	1,570	30,331	110,855	0,324	1,605	4	19	70,680	11,968	58,712	0,064	2,575	0,000	21,484	0,000	0	28,724	36,000	109,612	8,007
3,74	1,532	30,885	111,738	0,323	1,630	4	19	71,060	12,164	58,896	0,064	2,577	0,000	21,825	0,000	0	29,252	36,663	111,351	8,116
3,76	1,674	32,565	112,927	0,330	1,797	4	19	71,440	12,361	59,079	0,058	2,528	0,000	24,152	0,000	0	30,449	38,163	123,225	8,871
3,78	2,069	33,618	113,579	0,324	1,760	4	19	71,820	12,557	59,263	0,060	2,550	0,000	23,640	0,000	0	30,615	38,370	120,615	8,698
3,80	1,422	34,243	115,343	0,332	1,680	4	19	72,200	12,753	59,447	0,064	2,585	0,000	22,504	0,000	0	30,480	38,201	114,819	8,320
3,82	1,430	35,367	116,878	0,334	1,480	4	19	72,580	12,949	59,631	0,074	2,671	0,000	19,701	0,000	0	0,000	37,273	100,513	7,387
3,84	1,468	37,460	119,102	0,344	1,500	4	19	72,960	13,145	59,815	0,073	2,675	0,000	19,984	0,000	0	0,000	37,998	101,957	7,478
3,86	1,483	39,190	118,143	0,348	1,508	4	19	73,340	13,342	59,998	0,056	2,687	0,000	20,091	0,000	0	0,000	38,795	102,505	7,516
3,88	1,479	41,973	44,342	0,350	1,487	4	19	73,720	13,538	60,182	0,035	2,710	0,000	19,788	0,000	0	0,000	39,354	100,961	7,416
3,90	1,436	44,065	25,201	0,356	1,466	3	19	74,100	13,734	60,366	0,013	2,732	0,000	19,489	0,000	0	0,000	39,872	99,432	7,315
3,92	1,451	45,605	26,160	0,352	1,462	3	19	74,480	13,930	60,550	0,009	2,745	0,000	19,430	0,000	0	0,000	40,376	99,133	7,290
3,94	1,474	47,023	25,853	0,356	1,481	3	19	74,860	14,126	60,734	0,008	2,747	0,000	19,685	0,000	0	0,000	41,006	100,435	7,368
3,96	1,491	48,648	25,585	0,362	1,502	3	19	75,240	14,323	60,917	0,008	2,750	0,000	19,974	0,000	0	0,000	41,760	101,908	7,459
3,98	1,514	51,363	26,007	0,355	1,528	3	19	75,620	14,519	61,101	0,008	2,755	0,000	20,331	0,000	0	0,000	42,803	103,731	7,579
4,00	1,551	55,579	26,621	0,357	1,588	3	19	76,000	14,715	61,285	0,008	2,752	0,000	21,173	0,000	0	0,000	44,401	108,023	7,867

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015





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I.T. GORIZIONE 010 CODA 01/RB 019995010355 - AREA 241942 CP 019995010355

Certificazione Qualità 9001:2008 SOA 05290 1° categoria

Concessione Ministeriale n.° 3655 Circ 7619/STC

Certificato n.° 032E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU5 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 13/07/2018

Profondità raggiunta: 23,78 m da p.c.

Prof. Falda: 2,50 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
5,02	1,775	34,200	4,450	0,712	1,795	4	19	95,380	24,721	70,659	-0,012	2,613	0,000	23,793	0,000	0	0,000	41,825	121,392	7,616
5,04	1,752	47,797	10,012	0,719	1,728	4	19	95,760	24,917	70,843	-0,009	2,676	0,000	22,848	0,000	0	0,000	43,525	116,571	7,358
5,06	1,645	44,102	18,412	0,739	1,606	4	19	96,140	25,114	71,026	-0,006	2,714	0,000	21,134	0,000	0	0,000	42,211	107,825	6,823
5,08	1,405	29,870	18,067	0,756	1,552	4	19	96,520	25,310	71,210	0,002	2,713	0,000	20,377	0,000	0	0,000	40,686	103,963	6,563
5,10	1,577	37,457	50,134	0,772	1,461	4	19	96,900	25,506	71,394	0,009	2,750	0,000	19,099	0,000	0	0,000	39,934	97,445	6,166
5,12	1,363	43,175	47,066	0,781	1,393	3	19	97,280	25,702	71,578	0,018	2,816	0,000	18,134	0,000	0	0,000	41,266	92,523	5,890
5,14	1,188	46,665	51,170	0,788	1,259	3	19	97,660	25,898	71,762	0,022	2,897	0,000	16,265	0,000	0	0,000	40,988	82,985	5,324
5,16	1,176	45,664	55,313	0,799	1,179	3	19	98,040	26,095	71,945	0,026	2,952	0,000	15,140	0,000	0	0,000	40,993	77,244	4,960
5,18	1,120	48,912	55,274	0,809	1,130	3	19	98,420	26,291	72,129	0,027	2,992	0,000	14,446	0,000	0	0,000	41,073	73,702	4,721
5,20	1,040	52,437	51,937	0,819	1,034	3	19	98,800	26,487	72,313	0,027	3,067	0,000	12,091	0,000	0	0,000	40,930	66,791	4,267
5,22	0,889	53,267	47,526	0,819	0,936	3	19	99,180	26,683	72,497	0,025	3,147	0,000	9,664	0,000	0	0,000	40,520	59,788	3,810
5,24	0,831	55,081	43,959	0,831	0,838	3	19	99,560	26,879	72,681	0,023	3,236	0,000	7,497	0,000	0	0,000	39,986	52,728	3,352
5,26	0,748	58,865	40,468	0,836	0,769	3	19	99,940	27,076	72,864	0,021	3,313	0,000	6,134	0,000	0	0,000	39,968	47,755	3,028
5,28	0,685	63,235	37,936	0,845	0,716	3	19	100,320	27,272	73,048	0,018	3,384	0,000	5,186	0,000	0	0,000	40,228	43,962	2,780
5,30	0,675	67,242	37,131	0,855	0,686	2	19	100,700	27,468	73,232	0,018	3,429	0,000	4,682	0,000	0	0,000	40,506	41,823	2,639
5,32	0,660	67,933	38,166	0,862	0,701	2	19	101,080	27,664	73,416	0,020	3,416	0,000	4,909	0,000	0	0,000	40,879	42,880	2,698
5,34	0,729	64,634	43,076	0,867	0,713	3	19	101,460	27,860	73,600	0,024	3,396	0,000	5,079	0,000	0	0,000	40,557	43,670	2,741
5,36	0,706	60,211	45,876	0,869	0,724	3	19	101,840	28,057	73,783	0,029	3,360	0,000	5,254	0,000	0	0,000	39,477	44,473	2,785
5,38	0,692	51,539	48,677	0,869	0,713	3	19	102,220	28,253	73,967	0,034	3,339	0,000	5,047	0,000	0	0,000	37,713	43,644	2,726
5,40	0,692	44,819	52,512	0,869	0,728	3	19	102,600	28,449	74,151	0,041	3,288	0,000	5,271	0,000	0	0,000	36,200	44,655	2,782
5,42	0,745	40,552	60,222	0,884	0,790	3	19	102,980	28,645	74,335	0,048	3,197	0,000	6,358	0,000	0	0,000	35,459	49,107	3,052
5,44	0,872	35,405	71,768	0,890	0,868	3	19	103,360	28,841	74,519	0,053	3,110	0,000	7,845	0,000	0	0,000	35,328	54,615	3,386
5,46	0,916	34,939	76,717	0,906	0,931	3	19	103,740	29,038	74,702	0,058	3,045	0,000	9,172	0,000	0	0,000	35,208	59,125	3,657
5,48	0,928	33,298	82,240	0,916	0,973	3	19	104,120	29,234	74,886	0,061	2,999	0,000	10,070	0,000	0	0,000	34,863	62,029	3,827
5,50	0,989	28,738	88,416	0,928	1,020	3	19	104,500	29,430	75,070	0,064	2,944	0,000	11,165	0,000	0	0,000	34,299	65,394	4,025
5,52	1,053	26,510	93,249	0,930	1,078	3	19	104,880	29,626	75,254	0,065	2,893	0,000	12,542	0,000	0	0,000	34,141	69,494	4,254
5,54	1,097	27,650	96,816	0,937	1,123	3	19	105,260	29,822	75,438	0,066	2,876	0,000	13,669	0,000	0	0,000	34,951	72,702	4,432
5,56	1,121	31,658	101,189	0,949	1,166	3	19	105,640	30,019	75,621	0,066	2,877	0,000	14,814	0,000	0	0,000	36,469	75,772	4,608
5,58	1,179	35,458	103,414	0,957	1,180	3	19	106,020	30,215	75,805	0,068	2,903	0,000	15,040	0,000	0	0,000	38,196	76,736	4,669
5,60	1,136	41,124	104,872	0,975	1,204	3	19	106,400	30,411	75,989	0,068	2,920	0,000	15,365	0,000	0	0,000	39,874	78,392	4,766
5,62	1,189	44,648	108,324	0,984	1,217	3	19	106,780	30,607	76,173	0,069	2,942	0,000	15,539	0,000	0	0,000	41,460	79,282	4,809
5,64	1,216	48,794	108,784	0,983	1,250	3	19	107,160	30,803	76,357	0,068	2,952	0,000	15,997	0,000	0	0,000	43,192	81,618	4,938
5,66	1,233	54,823	109,551	1,001	1,267	3	19	107,540	31,000	76,540	0,068	2,969	0,000	16,226	0,000	0	0,000	44,785	82,786	4,997
5,68	1,238	58,917	111,738	1,012	1,284	3	19	107,920	31,196	76,724	0,068	2,975	0,000	16,466	0,000	0	0,000	45,801	84,010	5,059
5,70	1,267	57,397	112,045	1,015	1,306	3	19	108,300	31,392	76,908	0,067	2,974	0,000	16,763	0,000	0	0,000	46,573	85,526	5,138
5,72	1,297	60,577	112,620	1,025	1,328	3	19	108,680	31,588	77,092	0,067	2,971	0,000	17,071	0,000	0	0,000	47,227	87,097	5,220
5,74	1,304	63,393	114,193	1,031	1,361	3	19	109,060	31,784	77,276	0,066	2,969	0,000	17,529	0,000	0	0,000	48,397	89,434	5,347
5,76	1,365	66,554	115,995	1,047	1,381	3	19	109,440	31,981	77,459	0,066	2,973	0,000	17,796	0,000	0	0,000	49,371	90,796	5,415
5,78	1,353	69,042	118,028	1,049	1,385	3	19	109,820	32,177	77,643	0,067	2,979	0,000	17,847	0,000	0	0,000	49,911	91,059	5,418
5,80	1,315	68,576	120,483	1,056	1,387	3	19	110,200	32,373	77,827	0,068	2,981	0,000	17,873	0,000	0	0,000	50,091	91,190	5,413
5,82	1,371	67,868	120,100	1,066	1,385	3	19	110,580	32,569	78,011	0,068	2,986	0,000	17,835	0,000	0	0,000	50,304	90,996	5,389
5,84	1,346	71,185	118,067	1,071	1,388	3	19	110,960	32,765	78,195	0,067	2,994	0,000	17,872	0,000	0	0,000	50,898	91,185	5,388
5,86	1,324	74,588	117,913	1,079	1,366	3	19	111,340	32,962	78,378	0,068	3,016	0,000	17,571	0,000	0	0,000	51,462	89,650	5,284
5,88	1,308	76,195	119,601	1,090	1,351	3	19	111,720	33,158	78,562	0,070	3,029	0,000	17,343	0,000	0	0,000	51,679	88,485	5,204
5,90	1,298	74,985	120,637	1,092	1,354	3	19	112,100	33,354	78,746	0,070	3,029	0,000	17,391	0,000	0	0,000	51,771	88,729	5,206
5,92	1,334	74,709	122,248	1,105	1,390	3	19	112,480	33,550	78,930	0,070	3,011	0,000	17,884	0,000	0	0,000	52,074	91,246	5,341
5,94	1,412	75,331	125,662	1,112	1,429	3	19	112,860	33,746	79,114	0,069	2,993	0,000	18,422	0,000	0	0,000	52,398	93,992	5,489
5,96	1,412	74,122	126,429	1,115	1,444	3	19	113,240	33,943	79,297	0,069	2,986	0,000	18,624	0,000	0	0,000	52,514	95,023	5,536
5,98	1,378	73,983	124,396	1,118	1,415	3	19	113,620	34,139	79,481	0,069	3,000	0,000	18,215	0,000	0	0,000	52,324	92,935	5,402
6,00	1,327	75,572	122,785	1,116	1,371	3	19	114,000	34,335	79,665	0,070	3,027	0,000	17,598	0,000	0	0,000	52,264	89,784	5,207

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015



Del 29/08/2018

CPTU5 PE

Data: 13/07/2018

Profondità raggiunta: 23,78 m da p.c.

Prof. Falda: 2.50 m. da p.c.

Tecnico del laboratorio
Dott. Federico Baldi Cantù

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All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

26 **SUBSOIL Srl Strada per Barco 1/c 42027 Montecchio E (RE)**



SUBSOIL Srl - Società Unipersonale

Strada per Barco 1/C, 42027 Montecchio E, Reggio Emilia
Tel.: 0522/617260 - Fax: 0522/243540

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1° ISOLAZIONE alla CCIAA di RE 01999510355 - N. REA 241942 - CP e P.IVA 01999510355

Certificazione Qualità 9001:2008 SOA 05290 1° categoria

Concessione Mineraria n.° 3655 Circ. 7619/STC

Certificato n.° 032E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU5 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 13/07/2018

Profondità raggiunta: 23,78 m da p.c.

Prof. Falda: 2,50 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
8,02	0,886	21,642	118,489	1,798	0,906	3	19	152,380	54,151	98,229	0,084	3,083	0,000	5,782	0,000	0	0,000	33,633	53,831	2,532
8,04	0,906	22,161	124,971	1,810	0,945	3	19	152,760	54,347	98,413	0,085	3,056	0,000	6,378	0,000	0	0,000	34,162	56,589	2,657
8,06	0,918	21,902	122,746	1,827	1,057	3	19	153,140	54,544	98,596	0,079	3,024	0,000	8,291	0,000	0	0,000	37,485	64,581	3,026
8,08	1,219	36,159	130,303	1,979	1,126	3	19	153,520	54,740	98,780	0,074	3,043	0,000	9,579	0,000	0	0,000	41,276	69,480	3,250
8,10	1,112	44,934	128,232	2,315	1,164	3	19	153,900	54,936	98,964	0,075	3,072	0,000	10,320	0,000	0	0,000	44,502	72,185	3,370
8,12	1,029	44,986	134,714	2,111	1,112	3	19	154,280	55,132	99,148	0,083	3,110	0,000	9,251	0,000	0	0,000	44,239	68,408	3,188
8,14	1,058	38,318	140,008	2,026	1,079	3	19	154,660	55,328	99,332	0,091	3,116	0,000	8,598	0,000	0	0,000	43,030	66,011	3,070
8,16	1,007	37,265	142,463	1,966	1,043	3	19	155,040	55,525	99,515	0,092	3,127	0,000	7,916	0,000	0	0,000	41,896	63,395	2,943
8,18	0,922	38,458	128,615	1,933	0,959	3	19	155,420	55,721	99,699	0,096	3,196	0,000	6,482	0,000	0	0,000	41,406	57,421	2,661
8,20	0,813	41,948	127,004	1,920	0,867	3	19	155,800	55,917	99,883	0,102	3,282	0,000	5,065	0,000	0	0,000	40,865	50,807	2,350
8,22	0,735	42,432	129,843	1,904	0,806	3	19	156,180	56,113	100,067	0,115	3,343	0,000	4,223	0,000	0	0,000	40,345	46,434	2,144
8,24	0,738	41,084	135,251	1,900	0,779	3	19	156,560	56,309	100,251	0,126	3,369	0,000	3,868	0,000	0	0,000	39,931	44,480	2,050
8,26	0,728	41,464	139,087	1,901	0,791	3	19	156,940	56,506	100,434	0,132	3,358	0,000	4,002	0,000	0	0,000	40,095	45,282	2,083
8,28	0,765	42,139	145,646	1,908	0,808	3	19	157,320	56,702	100,618	0,137	3,343	0,000	4,202	0,000	0	0,000	40,378	46,445	2,133
8,30	0,782	41,241	151,899	1,919	0,837	3	19	157,700	56,898	100,802	0,141	3,312	0,000	4,578	0,000	0	0,000	40,547	48,522	2,224
8,32	0,809	38,996	161,028	1,935	0,865	3	19	158,080	57,094	100,986	0,146	3,277	0,000	4,947	0,000	0	0,000	40,337	50,485	2,310
8,34	0,840	36,664	168,163	1,947	0,888	3	19	158,460	57,290	101,170	0,150	3,249	0,000	5,266	0,000	0	0,000	40,209	52,134	2,381
8,36	0,845	37,251	171,807	1,968	0,909	3	19	158,840	57,487	101,353	0,152	3,232	0,000	5,558	0,000	0	0,000	40,473	53,611	2,444
8,38	0,867	38,754	174,645	1,980	0,919	3	19	159,220	57,683	101,537	0,154	3,233	0,000	5,678	0,000	0	0,000	40,971	54,235	2,468
8,40	0,865	39,721	176,985	1,994	0,918	3	19	159,600	57,879	101,721	0,156	3,246	0,000	5,659	0,000	0	0,000	41,649	54,192	2,461
8,42	0,843	42,951	177,445	2,001	0,902	3	19	159,980	58,075	101,905	0,160	3,278	0,000	5,406	0,000	0	0,000	42,443	53,015	2,404
8,44	0,818	47,529	176,295	2,018	0,875	3	19	160,360	58,271	102,089	0,164	3,321	0,000	5,002	0,000	0	0,000	43,114	51,042	2,310
8,46	0,784	49,204	173,686	2,029	0,849	3	19	160,740	58,468	102,272	0,168	3,356	0,000	4,633	0,000	0	0,000	43,421	49,169	2,221
8,48	0,767	49,221	172,190	2,034	0,807	3	19	161,120	58,664	102,456	0,174	3,400	0,000	4,067	0,000	0	0,000	43,081	46,108	2,079
8,50	0,694	50,137	167,741	2,053	0,763	3	19	161,500	58,860	102,640	0,181	3,446	0,000	3,527	0,000	0	0,000	42,531	42,975	1,934
8,52	0,657	50,240	163,905	2,061	0,703	3	19	161,880	59,056	102,824	0,195	3,513	0,000	2,852	0,000	0	0,000	41,676	38,684	1,738
8,54	0,591	50,464	162,869	2,055	0,652	3	19	162,260	59,252	103,008	0,213	3,575	0,000	2,325	0,000	0	0,000	40,753	34,953	1,568
8,56	0,540	50,083	163,406	2,059	0,611	3	19	162,640	59,449	103,191	0,233	3,626	0,000	1,949	0,000	0	0,000	39,825	32,034	1,434
8,58	0,535	48,494	166,130	2,071	0,605	3	19	163,020	59,645	103,375	0,245	3,625	0,000	1,889	0,000	0	0,000	39,215	31,568	1,411
8,60	0,569	44,969	174,722	2,074	0,641	3	19	163,400	59,841	103,559	0,244	3,558	0,000	2,202	0,000	0	0,000	38,922	34,108	1,522
8,62	0,639	39,562	187,917	2,091	0,711	3	19	163,780	60,037	103,743	0,234	3,445	0,000	2,891	0,000	0	0,000	38,656	39,117	1,742
8,64	0,734	33,878	202,033	2,104	0,801	3	19	164,160	60,233	103,927	0,222	3,317	0,000	3,904	0,000	0	0,000	38,244	45,497	2,023
8,66	0,824	29,352	214,998	2,108	0,															





Del 29/08/2018

CPTU5 PE

Prof. Falda: 2.50 m. da p.c.

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

26 **SUBSOIL Srl Strada per Barco 1/c 42027 Montecchio E (RE)**





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I.T. ISOLAZIONE S.R.L. CODA S.R.L. 01999510359 - AREA 241942 CP e P.IVA 01999510359

Certificazione Qualità 9001:2008 SOA 05290 1° categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 032E 2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU5 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 13/07/2018

Profondità raggiunta: 23,78 m da p.c.

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13,02	0,597	14,466	412,773	3,671	0,731	3	19	247,380	103,201	144,179	0,629	3,397	0,000	1,624	0,000	0	0,000	32,133	34,562	1,107
13,04	0,581	14,673	400,575	3,682	0,722	3	19	247,760	103,397	144,363	0,635	3,413	0,000	1,560	0,000	0	0,000	32,169	33,894	1,085
13,06	0,576	14,898	401,266	3,689	0,721	3	19	248,140	103,594	144,546	0,631	3,440	0,000	1,548	0,000	0	0,000	33,190	33,788	1,080
13,08	0,597	19,725	403,951	3,704	0,734	3	19	248,520	103,790	144,730	0,617	3,446	0,000	1,626	0,000	0	0,000	34,286	34,652	1,106
13,10	0,617	19,346	403,606	3,713	0,745	3	19	248,900	103,986	144,914	0,607	3,452	0,000	1,697	0,000	0	0,000	35,318	35,422	1,129
13,12	0,607	19,537	406,904	3,729	0,744	3	19	249,280	104,182	145,098	0,610	3,455	0,000	1,685	0,000	0	0,000	35,362	35,320	1,125
13,14	0,593	20,003	407,288	3,739	0,721	3	19	249,660	104,378	145,282	0,640	3,486	0,000	1,531	0,000	0	0,000	35,105	33,693	1,071
13,16	0,549	20,073	405,217	3,744	0,710	3	19	250,040	104,575	145,465	0,657	3,505	0,000	1,456	0,000	0	0,000	35,065	32,867	1,044
13,18	0,574	20,419	407,710	3,750	0,698	3	19	250,420	104,771	145,649	0,678	3,524	0,000	1,375	0,000	0	0,000	34,940	31,960	1,014
13,20	0,554	20,540	412,121	3,762	0,701	3	19	250,800	104,967	145,833	0,684	3,522	0,000	1,391	0,000	0	0,000	35,061	32,166	1,019
13,22	0,554	20,350	418,796	3,767	0,696	3	19	251,180	105,163	146,017	0,701	3,527	0,000	1,356	0,000	0	0,000	34,880	31,789	1,006
13,24	0,554	19,815	420,905	3,774	0,693	3	19	251,560	105,359	146,201	0,711	3,528	0,000	1,332	0,000	0	0,000	34,617	31,523	0,996
13,26	0,542	19,280	417,568	3,782	0,689	3	19	251,940	105,556	146,384	0,717	3,529	0,000	1,304	0,000	0	0,000	34,325	31,203	0,985
13,28	0,542	19,021	417,798	3,787	0,682	3	19	252,320	105,752	146,568	0,724	3,534	0,000	1,257	0,000	0	0,000	33,934	30,659	0,966
13,30	0,535	18,278	413,732	3,793	0,685	3	19	252,700	105,948	146,752	0,714	3,522	0,000	1,274	0,000	0	0,000	33,680	30,883	0,972
13,32	0,555	17,380	412,351	3,797	0,682	3	19	253,080	106,144	146,936	0,709	3,518	0,000	1,252	0,000	0	0,000	33,241	30,635	0,963
13,34	0,538	16,827	404,219	3,803	0,683	3	19	253,460	106,340	147,120	0,692	3,507	0,000	1,254	0,000	0	0,000	32,813	30,685	0,964
13,36	0,545	15,774	393,863	3,799	0,667	3	19	253,840	106,537	147,303	0,696	3,528	0,000	1,159	0,000	0	0,000	32,407	29,507	0,925
13,38	0,516	16,776	384,427	3,808	0,649	3	19	254,220	106,733	147,487	0,708	3,557	0,000	1,056	0,000	0	0,000	32,116	28,187	0,883
13,40	0,492	17,104	379,977	3,813	0,624	3	19	254,600	106,929	147,671	0,744	3,604	0,000	0,923	0,000	0	0,000	31,876	26,376	0,825
13,42	0,475	17,208	380,591	3,822	0,606	3	19	254,980	107,125	147,855	0,783	3,638	0,000	0,835	0,000	0	0,000	31,682	25,094	0,784
13,44	0,463	17,744	386,229	3,829	0,596	3	19	255,360	107,321	148,039	0,818	3,656	0,000	0,785	0,000	0	0,000	31,450	24,356	0,760
13,46	0,458	16,984	391,983	3,821	0,594	3	19	255,740	107,518	148,222	0,839	3,657	0,000	0,772	0,000	0	0,000	31,249	24,162	0,753
13,48	0,463	16,310	395,320	3,839	0,592	3	19	256,120	107,714	148,406	0,850	3,650	0,000	0,762	0,000	0	0,000	30,771	24,022	0,748
13,50	0,455	15,222	393,402	3,846	0,583	3	19	256,500	107,910	148,590	0,875	3,652	0,000	0,716	0,000	0	0,000	29,938	23,295	0,724
13,52	0,429	13,616	390,832	3,849	0,565	3	19	256,880	108,106	148,774	0,922	3,660	0,000	0,640	0,000	0	0,000	28,601	22,037	0,684
13,54	0,412	11,371	393,057	3,846	0,550	3	19	257,260	108,302	148,958	0,978	3,662	0,000	0,596	0,000	0	0,000	27,218	20,904	0,648
13,56	0,407	10,179	399,386	3,865	0,560	3	19	257,640	108,499	149,141	0,972	3,611	0,000	0,613	0,000	0	0,000	26,337	21,601	0,669
13,58	0,451	8,573	414,998	3,861	0,591	3	19	258,020	108,695	149,325	0,912	3,528	0,000	0,744	0,000	0	0,000	26,152	23,806	0,737
13,60	0,495	7,848	424,051	3,869	0,619	3	19	258,400	108,891	149,509	0,855	3,465	0,000	0,870	0,000	0	0,000	26,130	25,755	0,796
13,62	0,485	7,986	412,927	3,875	0,624	3	19	258,780	109,087	149,693	0,830	3,448	0,000	0,890	0,000	0	0,000	25,888	26,076	0,805
13,64	0,471	7,313	399,578	3,875	0,610	3	19	259,160	109,283	149,877	0,839	3,463	0,000	0,819	0,000	0	0,000	25,296	25,026	0,771
13,66	0,461	6,657	396,893	3,891	0,605	3	19	259,540	109,480	150,060	0,846	3,456	0,000	0,796	0,000	0	0,000	24,734	24,684	0,760
13,68	0,474	6,294	408,822	3,901	0,614	4	19	260,110	109,774	150,336	0,843	3,426	0,000	0,832	0,000	0	0,000	24,389	25,267	0,776
13,70	0,491	5,587	417,913	3,909	0,617	4	19	260,300	109,872	150,428	0,854	3,408	0,000	0,846	0,000	0	0,000	24,045	25,484	0,783
13,72	0,464	5,363	416,763	3,906	0,614	4	19	260,680	110,068	150,612	0,870	3,402	0,000	0,830	0,000	0	0,000	23,641	25,256	0,775
13,74	0,462	5,190	418,067	3,912	0,610	4	19	261,060	110,264	150,796	0,882	3,416	0,000	0,806	0,000	0	0,000	23,731	24,905	0,763
13,76	0,477	6,089	418,949	3,909	0,622	4	19	261,440	110,461	150,979	0,859	3,416	0,000	0,862	0,000	0	0,000	24,549	25,761	0,788
13,78	0,499	7,195	423,782	3,909	0,644	4	19	261,820	110,657	151,163	0,814	3,396	0,000	0,966	0,000	0	0,000	25,380	27,299	0,834
13,80	0,526	6,591	423,092	3,926	0,666	4	19	262,200	110,853	151,347	0,779	3,373	0,000	1,075	0,000	0	0,000	26,004	28,813	0,880
13,82	0,538	6,886	428,232	3,946	0,697	4	19	262,580	111,049	151,531	0,739	3,325	0,000	1,243	0,000	0	0,000	26,341	31,002	0,945
13,84	0,585	6,558	444,381	3,959	0,763	4	19	262,960	111,245	151,715	0,674	3,243	0,000	1,651	0,000	0	0,000	27,375	35,744	1,088
13,86	0,709	6,541	472,881	3,963	0,885	4	19	263,340	111,442	151,898	0,573	3,114	0,000	2,548	0,000	0	0,000	28,906	44,437	1,352
13,88	0,885	6,369	466,114	3,959	1,026	4	19	263,720	111,638	152,082	0,430	2,997	0,000	3,825	0,000	0	0,000	30,534	54,477	1,655
13,90	1,036	6,318	360,836	3,971	1,084	4	19	264,100	111,834	152,266	0,339	2,980	0,000	4,410	0,000	0	0,000	32,111	58,530	1,776
13,92	0,932	9,411	322,938	3,971	1,022	4	19	264,480	112,030	152,450	0,266	3,061	0,000	3,766	0,000	0	0,000	32,905	54,121	1,640
13,94	0,779	11,295	257,844	3,969	0,869	4	19	264,860	112,226	152,634	0,278	3,227	0,000	2,389	0,000	0	0,000	32,366	43,135	1,306
13,96	0,611	11,554	258,650	3,973	0,726	3	19	265,240	112,423	152,817	0,324	3,393	0,000	1,392	0,000	0	0,000	30,503	32,942	0,996
13,98	0,523	10,639	268,661	3,978	0,636	3	19	265,620	112,619	153,001	0,440	3,522	0,000	0,894	0,000	0	0,000	28,815	26,424	0,798
14,00	0,492	11,107	299,271	3,994	0,609	3	19	266,000	112,815	153,185	0,548	3,554	0,000	0,766	0,000	0	0,000	27,772	24,473	0,738

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015



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I.T. GORIZIONE 810 CCIAA di RA 01999510355 - N.REA 241942 CP e P.IVA 01999510355

Certificazione Qualità 9001:2000 SOA 05290 1° categoria

Concessione Mineraria n.° 3655 Circ 7619/STC

Certificato n.° 032E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU5 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 13/07/2018

Profondità raggiunta: 23,78 m da p.c.

Prof. Falda: 2,50 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
14,02	0,504	9,363	333,832	3,995	0,623	3	19	266,380	113,011	153,369	0,615	3,518	0,000	0,829	0,000	0	0,000	27,614	25,468	0,767
14,04	0,534	8,741	363,982	4,003	0,665	3	19	266,760	113,207	153,553	0,626	3,429	0,000	1,034	0,000	0	0,000	27,580	28,455	0,856
14,06	0,588	7,809	390,065	4,003	0,831	4	19	267,140	113,404	153,736	0,404	3,263	0,000	2,068	0,000	0	0,000	31,636	40,279	1,210
14,08	1,024	14,629	269,582	3,982	0,922	4	19	267,520	113,600	153,920	0,276	3,218	0,000	2,787	0,000	0	0,000	34,714	46,781	1,404
14,10	0,856	16,063	223,207	4,017	0,939	4	19	267,900	113,796	154,104	0,189	3,239	0,000	2,918	0,000	0	0,000	36,481	47,902	1,436
14,12	0,690	14,665	229,229	4,004	0,826	3	19	268,280	113,992	154,288	0,243	3,342	0,000	2,013	0,000	0	0,000	34,524	39,807	1,192
14,14	0,676	13,110	296,164	4,010	0,766	3	19	268,660	114,188	154,472	0,347	3,387	0,000	1,602	0,000	0	0,000	32,655	35,537	1,063
14,16	0,640	11,763	334,983	4,040	0,751	3	19	269,040	114,385	154,655	0,435	3,384	0,000	1,499	0,000	0	0,000	31,485	34,391	1,027
14,18	0,606	10,589	340,430	4,121	0,726	3	19	269,610	114,679	154,931	0,537	3,392	0,000	1,347	0,000	0	0,000	30,145	32,629	0,973
14,20	0,690	13,104	232,164	4,020	0,762	3	19	268,600	114,198	154,472	0,393	3,373	0,000	1,602	0,000	0	0,000	32,605	35,588	1,063
14,22	0,658	11,789	334,983	4,037	0,741	3	19	269,140	115,315	154,675	0,431	3,383	0,000	1,499	0,000	0	0,000	31,483	34,391	1,027
14,24	0,699	10,587	363,430	4,121	0,764	3	19	269,100	115,279	155,110	0,537	3,392	0,000	1,347	0,000	0	0,000	30,145	32,629	0,973
14,26	0,567	9,121	404,641	4,548	0,693	3	19	270,940	115,366	155,574	0,643	3,420	0,000	1,142	0,000	0	0,000	28,846	30,113	0,894
14,28	0,511	8,776	414,615	4,423	0,674	3	19	271,320	115,562	155,758	0,746	3,432	0,000	1,043	0,000	0	0,000	28,004	28,787	0,854
14,30	0,521	8,569	429,843	4,338	0,678	4	19	271,700	115,758	155,942	0,774	3,423	0,000	1,061	0,000	0	0,000	27,930	29,049	0,861
14,32	0,565	8,535	446,835	4,258	0,704	4	19	272,080	115,954	156,126	0,760	3,382	0,000	1,197	0,000	0	0,000	28,168	30,873	0,914
14,34	0,574	7,947	456,540	4,214	0,730	4	19	272,460	116,150	156,310	0,737	3,344	0,000	1,341	0,000	0	0,000	28,449	32,697	0,966
14,36	0,589	7,982	457,537	4,184	0,747	4	19	272,840	116,347	156,493	0,718	3,328	0,000	1,434	0,000	0	0,000	28,838	33,843	0,999
14,38	0,611	8,932	455,351	4,152	0,760	4	19	273,220	116,543	156,677	0,691	3,325	0,000	1,512	0,000	0	0,000	29,540	34,770	1,025
14,40	0,618	9,675	445,224	4,140	0,784	4	19	273,600	116,739	156,861	0,653	3,316	0,000	1,663	0,000	0	0,000	30,625	36,478	1,074
14,42	0,665	10,573	449,559	4,132	0,869	4	19	273,980	116,935	157,045	0,575	3,238	0,000	2,258	0,000	0	0,000	32,359	42,533	1,251
14,44	0,857	10,677	482,854	4,133	0,944	4	19	274,360	117,131	157,229	0,456	3,173	0,000	2,850	0,000	0	0,000	33,503	47,811	1,405
14,46	0,879	10,124	333,909	4,133	0,953	4	19	274,740	117,328	157,412	0,365	3,171	0,000	2,926	0,000	0	0,000	33,892	48,476	1,423
14,48	0,752	11,523	277,637	4,122	0,829	4	19	275,120	117,524	157,596	0,312	3,299	0,000	1,946	0,000	0	0,000	32,514	39,559	1,160
14,50	0,560	12,093	259,148	4,127	0,675	3	19	275,500	117,720	157,780	0,362	3,512	0,000	1,011	0,000	0	0,000	30,709	28,523	0,835
14,52	0,445	13,596	249,751	4,132	0,555	3	19	275,880	117,916	157,964	0,516	3,729	0,000	0,632	0,000	0	0,000	28,292	19,968	0,584
14,54	0,394	12,421	277,330	4,136	0,500	3	19	276,260	118,112	158,148	0,721	3,850	0,000	0,633	0,000	0	0,000	26,323	15,946	0,466
14,56	0,375	9,830	310,012	4,143	0,493	3	19	276,640	118,309	158,331	0,864	3,838	0,000	0,633	0,000	0	0,000	25,149	15,463	0,451
14,58	0,399	8,915	328,960	4,144	0,505	3	19	277,020	118,505	158,515	0,924	3,786	0,000	0,634	0,000	0	0,000	24,855	16,320	0,476
14,60	0,406	9,571	350,173	4,152	0,527	3	19	277,400	118,701	158,699	0,924	3,728	0,000	0,635	0,000	0	0,000	25,206	17,813	0,519
14,62	0,419	8,915	368,470	4,144	0,542	3	19	277,780	118,897	158,883	0,933	3,686	0,000	0,636	0,000	0	0,000	25,314	18,880	0,549
14,64	0,428	7,775	377,944	4,153	0,554	3	19	278,160	119,093	159,067	0,932	3,643	0,000	0,636	0,000	0	0,000	25,004	19,693	0,572
14,66	0,431	7,257	381,780	4,155	0,557	3	19	278,540	119,290	159,250	0,941	3,623	0,000	0,637	0,000	0	0,000	24,657	19,919	0,578
14,68	0,424	7,309	385,194	4,167	0,558	3	19	278,920	119,486	159,434	0,949	3,628	0,000	0,638	0,000	0	0,000	24,880	19,966	0,579
14,70	0,428	8,484	386,881	4,165	0,558	3	19	279,300	119,682	159,618	0,969	3,662	0,000	0,638	0,000	0	0,000	25,882	19,881	0,575
14,72	0,424	11,161	396,126	4,163	0,576	3	19	279,680	119,878	159,802	0,944	3,661	0,000	0,639	0,000	0	0,000	27,461	21,137	0,611
14,74	0,467	12,111	414,768	4,178	0,606	3	19	280,060	120,074	159,986	0,901	3,626	0,000	0,662	0,000	0	0,000	28,905	23,246	0,671
14,76	0,504	11,817	428,654	4,178	0,657	3	19	280,440	120,271	160,169	0,822	3,544	0,000	0,883	0,000	0	0,000	30,112	26,866	0,775
14,78	0,560	11,679	445,263	4,185	0,692	3	19	280,820	120,467	160,353	0,779	3,485	0,000	1,055	0,000	0	0,000	30,570	29,378	0,846
14,80	0,563	11,041	448,562	4,197	0,712	3	19	281,200	120,663	160,537	0,759	3,445	0,000	1,158	0,000	0	0,000	30,438	30,802	0,886
14,82	0,558	9,641	449,904	4,196	0,709	3	19	281,580	120,859	160,721	0,769	3,429	0,000	1,136	0,000	0	0,000	29,582	30,523	0,877
14,84	0,548	8,466	449,942	4,196	0,708	4	19	281,960	121,055	160,905	0,781	3,406	0,000	1,128	0,000	0	0,000	28,634	30,428	0,874
14,86	0,555	7,499	461,603	4,205	0,713	4	19	282,340	121,252	161,088	0,790	3,376	0,000	1,151	0,000	0	0,000	27,876	30,753	0,882
14,88	0,565	6,636	471,998	4,205	0,729	4	19	282,720	121,448	161,272	0,784	3,342	0,000	1,238	0,000	0	0,000	27,689	31,912	0,914
14,90	0,587	6,878	481,396	4,218	0,737	4	19	283,100	121,644	161,456	0,788	3,334	0,000	1,276	0,000	0	0,000	27,827	32,416	0,928
14,92	0,570	7,517	484,005	4,229	0,745	4	19	283,480	121,840	161,640	0,789	3,329	0,000	1,317	0,000	0	0,000	28,127	32,961	0,942
14,94	0,582	7,154	492,328	4,239	0,767	4	19	283,860	122,036	161,824	0,774	3,308	0,000	1,443	0,000	0	0,000	28,673	34,513	0,985
14,96	0,643	7,465	511,469	4,250	0,893	4	19	284,240	122,233	162,007	0,660	3,176	0,000	2,284	0,000	0	0,000	30,539	43,453	1,239
14,98	0,918	7,534	566,935	4,266	1,138	4	19	284,620	122,429	162,191	0,487	3,008	0,000	4,490	0,000	0	0,000	34,633	60,954	1,736
15,00	1,303	10,627	536,402	4,272	1,438	5	19	285,000	122,625	162,375	0,334	2,852	0,000	8,186	0,000	0	0,000	38,410	82,350	2,343

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015



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Certificazione Qualità 9001:2008 SOA 05290 1° categoria

Concessione Mineraria n.° 3655 Circ. 7619/STC

Certificato n.° 032E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)

CPTU5 PE

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Data: 13/07/2018

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Prof. Falda: 2,50 m. da p.c.

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15,02	1,574	9,901	420,790	4,273	1,666	5	19	285,380	122,821	162,559	0,234	2,795	0,000	11,751	0,000	0	0,000	42,807	98,634	2,808
15,04	1,666	16,051	381,933	4,282	1,769	5	19	285,760	123,017	162,743	0,180	2,802	0,000	13,523	0,000	0	0,000	46,364	105,934	3,009
15,06	1,669	21,095	366,590	4,281	1,991	5	19	286,140	123,214	162,926	0,133	2,774	0,000	17,945	0,000	0	0,000	51,454	121,786	3,473
15,08	2,281	24,991	300,997	4,284	2,200	5	19	286,520	123,410	163,110	0,098	2,743	0,000	22,703	0,000	0	0,000	55,544	136,674	3,915
15,10	2,333	28,878	265,209	4,289	2,466	5	19	286,900	123,606	163,294	0,070	2,713	0,000	29,585	0,000	0	0,000	60,930	155,678	4,480
15,12	2,503	40,227	263,828	4,289	2,648	5	19	287,280	123,802	163,478	0,066	2,720	0,000	33,050	0,000	0	0,000	66,571	168,622	4,840
15,14	2,822	50,211	132,965	4,297	2,761	5	19	287,660	123,998	163,662	0,058	2,724	0,000	34,626	0,000	0	0,000	70,117	176,663	5,061
15,16	2,686	46,049	222,900	4,336	2,501	4	19	288,040	124,195	163,845	0,043	2,778	0,000	30,013	0,000	0	0,000	67,180	158,049	4,476
15,18	1,770	30,761	123,667	4,351	1,956	4	19	288,420	124,391	164,029	0,018	2,878	0,000	16,958	0,000	0	0,000	57,436	119,129	3,355
15,20	1,256	16,165	114,193	4,345	1,369	4	19	288,800	124,587	164,213	-0,005	3,040	0,000	7,112	0,000	0	0,000	45,696	77,191	2,172
15,22	0,961	12,986	118,105	4,348	1,048	4	19	289,180	124,783	164,397	-0,009	3,179	0,000	3,507	0,000	0	0,000	38,275	54,233	1,524
15,24	0,808	13,728	121,941	4,343	0,866	4	19	289,560	124,979	164,581	0,001	3,340	0,000	2,017	0,000	0	0,000	35,627	41,152	1,155
15,26	0,700	15,836	136,057	4,343	0,758	3	19	289,940	125,176	164,764	0,039	3,481	0,000	1,330	0,000	0	0,000	34,589	33,437	0,938
15,28	0,620	16,595	172,305	4,338	0,713	3	19	290,320	125,372	164,948	0,130	3,534	0,000	1,083	0,000	0	0,000	33,408	30,188	0,846
15,30	0,634	12,104	232,988	4,353	0,720	3	19	290,700	125,568	165,132	0,232	3,504	0,000	1,115	0,000	0	0,000	32,650	30,652	0,858
15,32	0,676	11,586	269,467	4,345	0,747	3	19	291,080	125,764	165,316	0,301	3,456	0,000	1,255	0,000	0	0,000	32,610	32,531	0,909
15,34	0,661	14,142	266,651	4,344	0,758	3	19	291,460	125,960	165,500	0,345	3,468	0,000	1,314	0,000	0	0,000	33,906	33,307	0,930
15,36	0,644	16,992	304,948	4,361	0,755	3	19	291,840	126,157	165,683	0,389	3,500	0,000	1,296	0,000	0	0,000	35,085	33,095	0,923
15,38	0,648	17,457	326,928	4,356	0,761	3	19	292,220	126,353	165,867	0,425	3,512	0,000	1,323	0,000	0	0,000	36,022	33,459	0,932
15,40	0,658	18,338	344,150	4,361	0,783	3	19	292,600	126,549	166,051	0,442	3,496	0,000	1,447	0,000	0	0,000	36,907	35,012	0,974
15,42	0,692	19,408	358,765	4,370	0,799	3	19	292,980	126,745	166,235	0,451	3,495	0,000	1,538	0,000	0	0,000	38,051	36,121	1,004
15,44	0,684	21,981	361,757	4,374	0,812	3	19	293,360	126,941	166,419	0,453	3,506	0,000	1,617	0,000	0	0,000	39,554	37,057	1,029
15,46	0,691	25,349	364,595	4,362	0,812	3	19	293,740	127,138	166,602	0,469	3,533	0,000	1,610	0,000	0	0,000	40,878	36,990	1,026
15,48	0,681	27,318	384,273	4,393	0,835	3	19	294,120	127,334	166,786	0,475	3,524	0,000	1,753	0,000	0	0,000	42,216	38,627	1,070
15,50	0,740	27,525	404,143	4,385	0,867	3	19	294,500	127,530	166,970	0,480	3,497	0,000	1,962	0,000	0	0,000	43,161	40,879	1,131
15,52	0,769	27,542	418,335	4,391	0,895	3	19	294,880	127,726	167,154	0,480	3,468	0,000	2,153	0,000	0	0,000	43,604	42,849	1,184
15,54	0,752	26,885	424,511	4,406	0,891	3	19	295,260	127,922	167,338	0,492	3,465	0,000	2,119	0,000	0	0,000	43,118	42,532	1,174
15,56	0,722	24,829	419,831	4,412	0,861	3	19	295,640	128,119	167,521	0,515	3,486	0,000	1,907	0,000	0	0,000	42,050	40,373	1,113
15,58	0,681	24,120	413,962	4,420	0,828	3	19	296,020	128,315	167,705	0,547	3,506	0,000	1,689	0,000	0	0,000	40,625	38,021	1,047
15,60	0,654	21,771	425,010	4,425	0,809	3	19	296,400	128,511	167,889	0,581	3,501	0,000	1,568	0,000	0	0,000	38,915	36,648	1,009
15,62	0,659	16,882	441,043	4,439	0,814	3	19	296,780	128,707	168,073	0,595	3,464	0,000	1,594	0,000	0	0,000	37,440	36,968	1,016
15,64	0,685	15,620	443,805	4,446	0,815	3	19	297,160	128,903	168,257	0,603	3,437	0,000	1,592	0,000	0	0,000	36,205	36,974	1,015
15,66	0,651	15,482	437,553	4,454	0,809	3	19	297,540	129,198	168,532	0,606	3,445	0,000	1,552	0,000	0	0,000	36,103	36,529	1,001
15,68	0,643	16,777	435,673	4,458	0,787	3	19	297,920	129,296	168,624	0,628	3,484	0,000	1,418	0,000	0	0,000	36,297	34,933	0,957
15,70	0,621	18,521	435,903	4,459	0,775	3	19	298,300	129,492	168,808	0,652	3,521	0,000	1,348	0,000	0	0,000	37,092	34,069	0,932
15,72	0,611	20,680	450,288	4,474	0,781	3	19	298,680	129,688	168,992	0,666	3,526	0,000	1,378	0,000	0	0,000	37,768	34,464	0,942
15,74	0,650	19,747	467,511	4,480	0,801	3	19	299,060	129,884	169,176	0,670	3,512	0,000	1,487	0,000	0	0,000	38,567	35,820	0,978
15,76	0,665	20,835	479,325	4,485	0,836	3	19	299,440	130,081	169,359	0,652	3,473	0,000	1,701	0,000	0	0,000	39,279	38,338	1,046
15,78	0,704	20,938	493,479	4,489	0,875	3	19	299,820	130,277	169,543	0,626	3,433	0,000	1,953	0,000	0	0,000	40,048	41,104	1,120
15,80	0,757	20,143	498,197	4,500	0,914	3	19	300,200	130,473	169,727	0,598	3,395	0,000	2,221	0,000	0	0,000	40,681	43,857	1,194
15,82	0,774	20,678	501,074	4,510	0,947	3	19	300,580	130,669	169,911	0,573	3,361	0,000	2,459	0,000	0	0,000	41,046	46,168	1,255
15,84	0,798	20,022	503,529	4,513	0,972	3	19	300,960	130,865	170,095	0,552	3,343	0,000	2,649	0,000	0	0,000	41,657	47,944	1,302
15,86	0,832	21,231	499,847	4,513	0,999	3	19	301,340	131,062	170,278	0,532	3,331	0,000	2,860	0,000	0	0,000	42,650	49,843	1,352
15,88	0,854	23,718	503,529	4,518	1,027	3	19	301,720	131,258	170,462	0,511	3,327	0,000	3,089	0,000	0	0,000	44,138	51,831	1,405
15,90	0,883	25,790	502,723	4,521	1,039	3	19	302,100	131,454	170,646	0,497	3,338	0,000	3,180	0,000	0	0,000	45,439	52,620	1,425
15,92	0,871	27,604	486,728	4,532	1,013	3	19	302,480	131,650	170,830	0,501	3,381	0,000	2,959	0,000	0	0,000	46,282	50,781	1,373
15,94	0,788	31,007	473,993	4,539	0,973	3	19	302,860	131,846	171,014	0,517	3,430	0,000	2,624	0,000	0	0,000	46,389	47,852	1,293
15,96	0,771	30,471	474,568	4,547	0,933	3	19	303,240	132,043	171,197	0,544	3,477	0,000	2,319	0,000	0	0,000	46,325	45,002	1,214
15,98	0,756	31,473	475,374	4,556	0,921	3	19	303,620	132,239	171,381	0,556	3,488	0,000	2,227	0,000	0	0,000	46,081	44,132	1,190
16,00	0,751	30,661	477,829	4,559	0,915	3	19	304,000	132,435	171,565	0,566	3,493	0,000	2,176	0,000	0	0,000	45,862	43,642	1,175

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015











06 SUBSOIL S.r.l Strada per Barco 1/c 42027 Montecchio E (RE)







Del 29/08/2018

CPTU5 PE

Prof. Falda: 2.50 m. da p.c.

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

26 **SUBSOIL Srl Strada per Barco 1/c 42027 Montecchio E (RE)**

DESCRIZIONE: La prova è stata effettuata tra due campi coltivati, al limite con l'area di rispetto autostradale.

COORDINATE WGS84

44°32'41.5331"N 11°22'08.5780"E
Quota Elissoide: 70,06

COORDINATE GAUSS-BOAGA

4935123,22N 1688190,53E

COORDINATE RETTILINEE

X= 9895469,98 Y= 3162068,273
Quota s.l.m.: 30,876

PLANIMETRIA



GOOGLE EARTH



PROVA PENETROMETRICA STATICA ELETTRICA CON PIEZOCONO (CPTU)

Committente: SPEA Engineering SpA

Lavoro: Autostrada A13 PE

Località: Bologna

Commessa: 00100018_FG

Nome prova: CPTU 6 PE

Certificato n.° 031E_2018

DOCUMENTAZIONE FOTOGRAFICA

Ubicazione / Piazzamento



CARATTERISTICHE STRUMENTAZIONE

Normativa di riferimento

A.G.I. - (1977): Raccomandazioni sulla Programmazione e d Esecuzione delle Indagini Geotecniche

ASSMFE - (1988): Dynamic Probing (DP) International Reference Test Procedure

ASTM D3441-86: Deep quasi-static cone and friction cone penetration tests of soil

DM 11.03.88: "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione ed il collaudo delle opere di sostegno delle terre e delle opere di fondazione

Caratteristiche punta elettrica

Costruttore/modello: TECNOPENTA - G1-CPLS D

Serial number: 170118

Caratteristiche penetrometro

Marca/modello: TECNOTEST

Spinta nominale: 20 ton

NOTE:

Falda: 2,40m

Tecnico del laboratorio
Dott. Marco Cocchi

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

CERTIFICATO N. 031E_2018

PROVA PENETROMETRICA STATICA ELETTRICA CON PIEZOCONO (CPTU)

CPTU 6 PE

Committente: Spea Engineering

Data: 13/07/2018

Profondità raggiunta: 36,48m da p.c.

Lavoro: Autostrada A13 PE

Località: Bologna

Profondità Falda: 2,40m da p.c.

Resistenza alla punta qt

(MPa)

Attrito laterale ft / Rap. di attrito

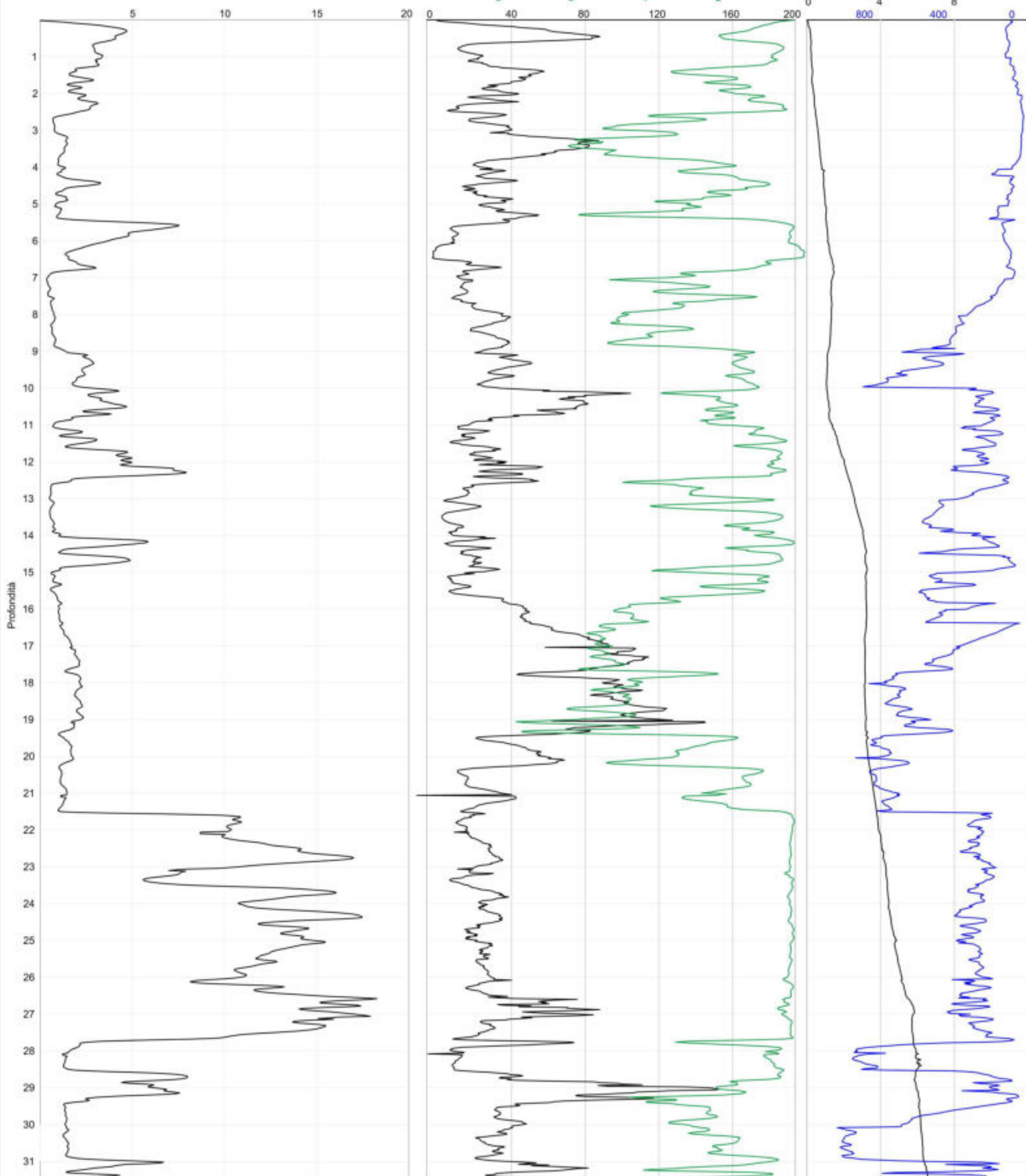
(kPa)

Rf % (ft/qt)

Inclinazione / P. neutra

(°)

U (kPa)



CERTIFICATO N. 031E_2018

PROVA PENETROMETRICA STATICA ELETTRICA CON PIEZOCONO (CPTU)

CPTU 6 PE

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Profondità Falda: 2,40m da p.c.

Resistenza alla punta qt

(MPa)

Attrito laterale ft / Rap. di attrito

(kPa)

Rf % (ft/qt)

Inclinazione / P. neutra

(°)

U (kPa)

5 10 15 20 0

8 6 4 2 0

800 400 0



**SUBSOIL Srl - Società Unipersonale**

Strada per Barco 1/c, 42027 Montecchio E, Reggio Emilia
Tel.: 0522/667268 - Fax: 0522/349840
www.subsoil.it e-mail: subsoil@gmail.com

1.^a Iscrizione alla CCIAA di Re 01999610309 - N. REA 241542 - CF e P.IVA 01999610309
Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria
Concessione Miniateriale n.° 3653 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
0,02	0,540	-0,426	-0,422	0,014	0,753	1	19	0,380	0,000	0,380	0,003	1,559	0,000	4,882	0,000	0	3,895	4,882	0,000	0,000
0,04	1,178	2,338	6,521	0,024	1,346	5	19	0,760	0,000	0,760	0,006	1,566	0,000	8,793	57,000	40	7,016	8,793	0,000	0,000
0,06	1,673	7,175	11,124	0,087	1,699	5	19	1,140	0,000	1,140	0,004	1,600	0,000	11,585	62,000	41	9,243	11,585	0,000	0,000
0,08	2,240	13,804	2,493	0,044	2,208	5	19	1,520	0,000	1,520	0,003	1,612	0,000	15,300	67,000	42	12,208	15,300	0,000	0,000
0,10	2,703	18,157	8,400	0,070	2,699	5	19	1,900	0,000	1,900	0,003	1,621	0,000	18,900	70,000	42	15,080	18,900	0,000	0,000
0,12	3,146	21,750	14,154	0,081	3,104	5	19	2,280	0,000	2,280	0,005	1,622	0,000	21,762	72,000	42	17,363	21,762	0,000	0,000
0,14	3,449	26,915	19,870	0,084	3,422	5	19	2,660	0,000	2,660	0,006	1,633	0,000	24,347	74,000	43	19,426	24,347	0,000	0,000
0,16	3,651	33,860	23,437	0,079	3,713	5	19	3,040	0,000	3,040	0,006	1,658	0,000	27,243	76,000	43	21,737	27,243	0,000	0,000
0,18	4,014	40,856	28,347	0,103	3,995	5	19	3,420	0,000	3,420	0,007	1,673	0,000	29,872	77,000	43	23,834	29,872	0,000	0,000
0,20	4,292	43,707	33,180	0,123	4,250	5	19	3,800	0,000	3,800	0,008	1,687	0,000	32,341	78,000	43	25,804	32,341	0,000	0,000
0,22	4,411	48,336	35,712	0,147	4,445	5	19	4,180	0,000	4,180	0,008	1,700	0,000	34,402	78,000	43	27,448	34,402	0,000	0,000
0,24	4,597	55,144	37,092	0,164	4,582	5	19	4,560	0,000	4,560	0,008	1,719	0,000	36,308	79,000	43	28,969	36,308	0,000	0,000
0,26	4,700	58,876	38,435	0,179	4,671	5	19	4,940	0,000	4,940	0,008	1,734	0,000	37,758	79,000	43	30,126	37,758	0,000	0,000
0,28	4,678	59,413	37,629	0,174	4,692	5	19	5,320	0,000	5,320	0,008	1,749	0,000	38,623	78,000	43	30,816	38,623	0,000	0,000
0,30	4,659	61,211	37,323	0,180	4,658	5	19	5,700	0,000	5,700	0,008	1,765	0,000	39,144	77,000	43	31,232	39,144	0,000	0,000
0,32	4,599	62,801	37,783	0,175	4,583	5	19	6,080	0,000	6,080	0,008	1,791	0,000	39,807	76,000	43	31,761	39,807	0,000	0,000
0,34	4,453	67,847	36,824	0,187	4,482	5	19	6,460	0,000	6,460	0,008	1,823	0,000	40,525	76,000	43	32,334	40,525	0,000	0,000
0,36	4,358	72,253	35,213	0,193	4,366	5	19	6,840	0,000	6,840	0,008	1,858	0,000	41,273	75,000	43	32,931	41,273	0,000	0,000
0,38	4,252	75,778	33,142	0,199	4,246	5	19	7,220	0,000	7,220	0,008	1,890	0,000	41,788	74,000	43	33,341	41,788	0,000	0,000
0,40	4,094	79,613	32,259	0,206	4,133	5	19	7,600	0,000	7,600	0,008	1,923	0,000	42,371	73,000	43	33,807	42,371	0,000	0,000
0,42	4,021	83,449	31,914	0,212	4,051	5	19	7,980	0,000	7,980	0,008	1,951	0,000	43,069	73,000	43	34,364	43,069	0,000	0,000
0,44	4,007	87,406	31,339	0,214	4,035	5	19	8,360	0,000	8,360	0,008	1,968	0,000	43,818	72,000	42	34,961	43,818	0,000	0,000
0,46	4,046	87,890	31,185	0,206	4,076	5	19	8,740	0,000	8,740	0,008	1,969	0,000	44,305	71,000	42	35,349	44,305	0,000	0,000
0,48	4,144	83,418	32,605	0,217	4,082	5	19	9,120	0,000	9,120	0,008	1,970	0,000	44,423	71,000	42	35,444	44,423	0,000	0,000
0,50	4,025	83,798	31,722	0,219	4,040	5	19	9,500	0,000	9,500	0,008	1,975	0,000	44,259	69,000	42	35,313	44,259	0,000	0,000
0,52	3,920	83,108	30,917	0,218	3,911	5	19	9,880	0,000	9,880	0,008	1,986	0,000	43,416	68,000	42	34,640	43,416	0,000	0,000
0,54	3,757	73,763	29,421	0,221	3,758	5	19	10,260	0,000	10,260	0,008	1,987	0,000	41,771	66,000	42	33,328	41,771	0,000	0,000
0,56	3,567	63,468	26,621	0,235	3,562	5	19	10,640	0,000	10,640	0,007	1,979	0,000	39,186	63,000	41	31,266	39,186	0,000	0,000
0,58	3,336	52,361	22,823	0,234	3,350	5	19	11,020	0,000	11,020	0,007	1,971	0,000	36,449	60,000	41	29,082	36,449	0,000	0,000
0,60	3,124	43,880	20,368	0,235	3,151	5	19	11,400	0,000	11,400	0,006	1,951	0,000	33,408	58,000	40	26,655	33,408	0,000	0,000
0,62	2,973	31,287	17,952	0,235	2,998	5	19	11,780	0,000	11,780	0,006	1,919	0,000	30,525	55,000	40	24,355	30,525	0,000	0,000
0,64	2,878	23,030	16,916	0,229	2,898	5	19	12,160	0,000	12,160	0,006	1,875	0,000	27,901	52,000	39	22,261	27,901	0,000	0,000
0,66	2,824	17,692	17,415	0,226	2,847	5	19	12,540	0,000	12,540	0,006	1,840	0,000	26,199	51,000	39	20,904	26,199	0,000	0,000
0,68	2,819	15,670	17,913	0,221	2,837	5	19	12,920	0,000	12,920	0,006	1,813	0,000	25,253	50,000	39	20,149	25,253	0,000	0,000
0,70	2,848	13,994	19,064	0,225	2,855	5	19	13,300	0,000	13,300	0,007	1,796	0,000	24,864	49,000	39	19,838	24,864	0,000	0,000
0,72	2,877	12,922	20,445	0,223	2,881	5	19	13,680	0,000	13,680	0,007	1,783	0,000	24,670	49,000	39	19,684	24,670	0,000	0,000
0,74	2,897	12,421	21,596	0,222	2,906	5	19	14,060	0,000	14,060	0,007	1,771	0,000	24,506	48,000	39	19,553	24,506	0,000	0,000
0,76	2,923	11,142	22,823	0,222	2,925	5	19	14,440	0,000	14,440	0,008	1,762	0,000	24,409	48,000	39	19,475	24,409	0,000	0,000
0,78	2,933	10,831	23,974	0,220	2,939	5	19	14,820	0,000	14,820	0,008	1,759	0,000	24,408	48,000	39	19,475	24,408	0,000	0,000
0,80	2,938	11,211	24,434	0,222	2,935	5	19	15,200	0,000	15,200	0,008	1,768	0,000	24,656	48,000	38	19,673	24,656	0,000	0,000
0,82	2,908	12,161	25,010	0,228	2,936	5	19	15,580	0,000	15,580	0,009	1,779	0,000	25,004	47,000	38	19,950	25,004	0,000	0,000
0,84	2,935	12,420	25,969	0,227	2,949	5	19	15,960	0,000	15,960	0,009	1,794	0,000	25,582	48,000	38	20,411	25,582	0,000	0,000
0,86	2,977	14,165	27,349	0,224	2,988	5	19	16,340	0,000	16,340	0,009	1,804	0,000	26,253	48,000	39	20,947	26,253	0,000	0,000
0,88	3,023	15,615	29,459	0,232	3,053	5	19	16,720	0,000	16,720	0,010	1,816	0,000	27,257	48,000	39	21,748	27,257	0,000	0,000
0,90	3,128	17,274	33,180	0,239	3,157	5	19	17,100	0,000	17,100	0,011	1,824	0,000	28,470	49,000	39	22,715	28,470	0,000	0,000
0,92	3,286	19,693	38,282	0,240	3,283	5	19	17,480	0,000	17,480	0,012	1,828	0,000	29,730	50,000	39	23,721	29,730	0,000	0,000
0,94	3,396	21,092	41,427	0,241	3,372	5	19	17,860	0,000	17,860	0,012	1,840	0,000	31,004	50,000	39	24,737	31,004	0,000	0,000
0,96	3,391	24,098	41,964	0,240	3,379	5	19	18,240	0,000	18,240	0,012	1,856	0,000	31,735	50,000	39	25,320	31,735	0,000	0,000
0,98	3,309	24,531	39,586	0,240	3,347	5	19	18,620	0,000	18,620	0,012	1,870	0,000	31,990	50,000	39	25,524	31,990	0,000	0,000
1,00	3,299	23,150	38,780	0,235	3,312	5	19	19,000	0,000	19,000	0,012	1,875	0,000	31,843	49,000	39	25,407	31,843	0,000	0,000

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

**SUBSOIL Srl - Società Unipersonale**

Strada per Barco 1/c, 42027 Montecchio E, Reggio Emilia
Tel.: 0522/667358 - Fax: 0522/349540
www.subsoil.it e-mail: subsoil@gmail.com

1.^a Iscrizione alla CCIAA di RE 01999610309 - N. REA 241542 - CF e P.IVA 01999610309
Certificazione Qualità 9001:2008 SOA OS20b 1.^a categoria
Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
1,02	3,290	22,754	38,742	0,246	3,292	5	19	19,380	0,000	19,380	0,012	1,873	0,000	31,549	49,000	39	25,172	31,549	0,000	0,000
1,04	3,249	21,546	38,588	0,238	3,083	5	19	19,760	0,000	19,760	0,009	1,905	0,000	30,772	48,000	38	24,552	30,772	0,000	0,000
1,06	2,681	22,040	6,981	0,229	3,037	5	19	20,140	0,000	20,140	0,007	1,903	0,000	30,222	47,000	38	24,113	30,222	0,000	0,000
1,08	3,162	18,569	13,617	0,248	2,973	5	19	20,520	0,000	20,520	0,004	1,901	0,000	29,502	46,000	38	23,539	29,502	0,000	0,000
1,10	3,065	16,723	12,582	0,247	3,092	5	19	20,900	0,000	20,900	0,004	1,866	0,000	29,345	46,000	38	23,413	29,345	0,000	0,000
1,12	3,036	16,535	12,160	0,248	3,031	5	19	21,280	0,000	21,280	0,004	1,883	0,000	29,408	46,000	38	23,464	29,408	0,000	0,000
1,14	2,978	19,887	12,351	0,251	3,032	5	19	21,660	0,000	21,660	0,004	1,912	0,000	30,506	46,000	38	24,340	30,506	0,000	0,000
1,16	3,069	24,345	14,384	0,265	3,073	5	19	22,040	0,000	22,040	0,005	1,931	0,000	31,687	46,000	38	25,282	31,687	0,000	0,000
1,18	3,157	23,967	14,806	0,264	3,147	5	19	22,420	0,000	22,420	0,005	1,940	0,000	32,803	47,000	38	26,173	32,803	0,000	0,000
1,20	3,199	25,937	14,499	0,260	3,179	5	19	22,800	0,000	22,800	0,005	1,945	0,000	33,341	47,000	38	26,602	33,341	0,000	0,000
1,22	3,165	26,888	13,694	0,262	3,130	5	19	23,180	0,000	23,180	0,004	1,964	0,000	33,626	47,000	38	26,830	33,626	0,000	0,000
1,24	3,012	27,027	11,009	0,270	2,936	5	19	23,560	0,000	23,560	0,003	2,006	0,000	33,262	45,000	38	26,539	33,262	0,000	0,000
1,26	2,621	28,445	4,565	0,271	2,600	5	19	23,940	0,000	23,940	0,002	2,089	0,000	32,651	43,000	38	26,051	32,651	0,000	0,000
1,28	2,163	33,300	-2,417	0,280	2,230	5	19	24,320	0,000	24,320	-0,001	2,191	0,000	31,814	41,000	37	25,383	31,814	0,000	0,000
1,30	1,908	34,753	-6,214	0,278	1,956	4	19	24,700	0,000	24,700	-0,003	2,295	0,000	27,032	39,000	37	25,355	31,778	0,000	0,000
1,32	1,801	42,044	-6,137	0,292	1,893	4	19	25,080	0,000	25,080	-0,003	2,345	0,000	26,157	39,000	37	26,136	32,757	0,000	0,000
1,34	1,977	47,538	-3,759	0,300	1,917	4	19	25,460	0,000	25,460	-0,002	2,377	0,000	26,482	39,000	37	27,563	34,545	0,000	0,000
1,36	1,978	53,759	-3,299	0,312	1,963	4	19	25,840	0,000	25,840	-0,002	2,392	0,000	27,124	40,000	37	28,759	36,044	0,000	0,000
1,38	1,939	56,282	-4,488	0,315	1,861	4	19	26,220	0,000	26,220	-0,003	2,440	0,000	25,686	0,000	0	28,944	36,277	131,050	17,473
1,40	1,672	57,735	-9,321	0,310	1,739	3	19	26,600	0,000	26,600	-0,005	2,481	0,000	23,972	0,000	0	28,474	35,687	122,306	16,471
1,42	1,614	55,025	-11,431	0,311	1,621	3	19	26,980	0,000	26,980	-0,007	2,520	0,000	22,316	0,000	0	27,831	34,882	113,856	15,458
1,44	1,588	54,647	-12,275	0,312	1,573	3	19	27,360	0,000	27,360	-0,008	2,530	0,000	21,644	0,000	0	27,337	34,263	110,428	14,899
1,46	1,531	51,920	-13,694	0,303	1,549	3	19	27,740	0,000	27,740	-0,009	2,532	0,000	21,293	0,000	0	26,976	33,810	108,637	14,512
1,48	1,541	49,365	-13,809	0,302	1,588	3	19	28,120	0,000	28,120	-0,008	2,514	0,000	21,845	0,000	0	27,027	33,874	111,452	14,592
1,50	1,707	49,886	-12,083	0,294	1,720	4	19	28,500	0,000	28,500	-0,007	2,471	0,000	23,688	0,000	0	27,776	34,813	120,857	15,338
1,52	1,925	50,666	-9,551	0,293	1,925	4	19	28,880	0,000	28,880	-0,005	2,412	0,000	26,549	38,000	36	28,880	36,197	0,000	0,000
1,54	2,153	48,595	-6,329	0,287	2,181	4	19	29,260	0,000	29,260	-0,003	2,337	0,000	30,129	39,000	37	29,804	37,354	0,000	0,000
1,56	2,473	43,934	-3,107	0,272	2,441	4	19	29,640	0,000	29,640	-0,001	2,270	0,000	33,755	41,000	37	30,657	38,424	0,000	0,000
1,58	2,700	45,319	-1,074	0,271	2,664	5	19	30,020	0,000	30,020	0,000	2,224	0,000	36,869	42,000	37	31,601	39,606	0,000	0,000
1,60	2,818	47,879	1,074	0,271	2,857	5	19	30,400	0,000	30,400	0,000	2,194	0,000	40,954	43,000	38	32,676	40,954	0,000	0,000
1,62	3,051	47,191	1,304	0,268	2,872	5	19	30,780	0,000	30,780	0,000	2,195	0,000	41,212	43,000	38	32,882	41,212	0,000	0,000
1,64	2,748	46,002	-4,526	0,274	2,700	5	19	31,160	0,000	31,160	-0,002	2,224	0,000	37,370	42,000	37	32,028	40,142	0,000	0,000
1,66	2,308	43,829	-12,006	0,277	2,327	4	19	31,540	0,000	31,540	-0,005	2,293	0,000	32,133	39,000	37	30,069	37,687	0,000	0,000
1,68	1,936	39,772	-17,683	0,279	1,943	4	19	31,920	0,000	31,920	-0,009	2,382	0,000	26,762	36,000	36	28,020	35,118	0,000	0,000
1,70	1,604	40,000	-22,286	0,277	1,679	4	19	32,300	0,000	32,300	-0,013	2,455	0,000	23,059	34,000	35	26,478	33,186	0,000	0,000
1,72	1,520	39,175	-24,396	0,283	1,495	4	19	32,680	0,000	32,680	-0,017	2,511	0,000	20,466	0,000	0	25,242	31,636	104,420	12,104
1,74	1,385	34,963	-26,160	0,294	1,447	4	19	33,060	0,000	33,060	-0,018	2,510	0,000	19,800	0,000	0	24,397	30,577	101,022	11,598
1,76	1,464	30,579	-27,196	0,307	1,590	4	19	33,440	0,000	33,440	-0,016	2,433	0,000	21,788	33,000	35	24,326	30,489	0,000	0,000
1,78	1,945	27,197	-19,294	0,320	1,891	4	19	33,820	0,000	33,820	-0,011	2,334	0,000	26,001	35,000	35	25,614	32,103	0,000	0,000
1,80	2,285	32,227	-15,458	0,318	2,214	5	19	34,200	0,000	34,200	-0,008	2,249	0,000	30,513	37,000	36	27,001	33,841	0,000	0,000
1,82	2,428	29,865	-15,458	0,314	2,251	5	19	34,580	0,000	34,580	-0,008	2,240	0,000	31,034	37,000	36	27,137	34,012	0,000	0,000
1,84	2,059	26,137	-20,982	0,322	2,094	5	19	34,960	0,000	34,960	-0,010	2,259	0,000	28,827	36,000	36	25,832	32,376	0,000	0,000
1,86	1,816	23,947	-24,779	0,327	1,841	4	19	35,340	0,000	35,340	-0,014	2,316	0,000	25,286	34,000	35	24,345	30,512	0,000	0,000
1,88	1,674	24,538	-27,388	0,342	1,679	4	19	35,720	0,000	35,720	-0,017	2,373	0,000	23,001	32,000	35	23,817	29,851	0,000	0,000
1,90	1,573	27,668	-30,150	0,360	1,557	4	19	36,100	0,000	36,100	-0,019	2,443	0,000	21,292	31,000	34	24,088	30,191	0,000	0,000
1,92	1,453	33,080	-29,996	0,353	1,507	4	19	36,480	0,000	36,480	-0,020	2,487	0,000	20,588	31,000	34	24,642	30,885	0,000	0,000
1,94	1,526	33,602	-30,111	0,366	1,587	4	19	36,860	0,000	36,860	-0,019	2,480	0,000	21,701	32,000	35	25,745	32,267	0,000	0,000
1,96	1,812	35,420	-27,810	0,366	1,805	4	19	37,240	0,000	37,240	-0,016	2,425	0,000	24,747	33,000	35	27,383	34,320	0,000	0,000
1,98	2,106	39,017	-25,585	0,361	2,090	4	19	37,620	0,000	37,620	-0,013	2,369	0,000	28,740	35,000	36	29,607	37,108	0,000	0,000
2,00	2,380	43,997	-24,204	0,366	2,336	4	19	38,000	0,000	38,000	-0,011	2,325	0,000	32,173	37,000	36	31,357	39,301	0,000	0,000

Tecnico del laboratorio
Dott. Federico Baldi Cantù

Direttore del Laboratorio
Dott. Geol. Fabrizio Giorgini

All. 09/09 Certificato di prova Rev. 1 del 27/10/2015

**SUBSOIL Srl - Società Unipersonale**Strada per Barco 1/c, 42027 Montecchio E, Reggio Emilia
Tel.: 0522/667268 - Fax: 0522/349840

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1.^a Iscrizione alla CCIAA di Re 01999610309 - N. REA 241542 - CF e P.IVA 01999610309Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
2,02	2,547	43,068	-23,514	0,377	2,471	4	19	38,380	0,000	38,380	-0,010	2,295	0,000	34,055	38,000	36	31,936	40,027	0,000	0,000
2,04	2,510	38,167	-25,163	0,387	2,421	5	19	38,760	0,000	38,760	-0,013	2,267	0,000	33,358	37,000	36	30,198	37,848	0,000	0,000
2,06	2,240	24,295	-47,372	0,401	2,289	5	19	39,140	0,000	39,140	-0,018	2,240	0,000	31,499	36,000	36	27,561	34,543	0,000	0,000
2,08	2,158	18,874	-47,909	0,400	2,152	5	19	39,520	0,000	39,520	-0,023	2,208	0,000	29,568	34,000	35	24,857	31,154	0,000	0,000
2,10	2,105	16,302	-48,562	0,399	2,055	5	19	39,900	0,000	39,900	-0,024	2,222	0,000	28,209	33,000	35	24,136	30,251	0,000	0,000
2,12	1,951	20,606	-50,019	0,396	2,029	5	19	40,280	0,000	40,280	-0,025	2,259	0,000	27,838	33,000	35	24,936	31,254	0,000	0,000
2,14	2,080	26,568	-49,060	0,399	2,099	5	19	40,660	0,000	40,660	-0,024	2,283	0,000	28,812	34,000	35	26,622	33,366	0,000	0,000
2,16	2,315	29,386	-47,411	0,412	2,267	5	19	41,040	0,000	41,040	-0,021	2,275	0,000	31,164	35,000	36	28,490	35,708	0,000	0,000
2,18	2,454	32,237	-45,838	0,412	2,514	5	19	41,420	0,000	41,420	-0,018	2,245	0,000	34,622	37,000	36	30,475	38,195	0,000	0,000
2,20	2,820	36,748	-43,383	0,408	2,779	5	19	41,800	0,000	41,800	-0,016	2,224	0,000	38,317	38,000	36	32,843	41,163	0,000	0,000
2,22	3,106	43,883	-41,580	0,408	3,042	5	19	42,180	0,000	42,180	-0,014	2,186	0,000	43,005	40,000	37	34,313	43,005	0,000	0,000
2,24	3,243	37,252	-40,698	0,408	3,130	5	19	42,560	0,000	42,560	-0,013	2,151	0,000	42,338	40,000	37	33,780	42,338	0,000	0,000
2,26	3,083	26,613	-42,194	0,411	3,060	5	19	42,940	0,000	42,940	-0,014	2,107	0,000	39,129	39,000	37	31,220	39,129	0,000	0,000
2,28	2,898	19,308	-43,652	0,409	2,917	5	19	43,320	0,000	43,320	-0,015	2,068	0,000	35,477	38,000	36	28,306	35,477	0,000	0,000
2,30	2,814	14,508	-44,687	0,413	2,807	5	19	43,700	0,000	43,700	-0,016	2,039	0,000	32,879	37,000	36	26,233	32,879	0,000	0,000
2,32	2,754	12,333	-45,493	0,416	2,740	5	19	44,080	0,000	44,080	-0,017	2,017	0,000	31,197	36,000	36	24,892	31,197	0,000	0,000
2,34	2,698	10,659	-46,107	0,416	2,702	5	19	44,460	0,000	44,460	-0,017	2,005	0,000	30,282	36,000	36	24,161	30,282	0,000	0,000
2,36	2,702	9,953	-46,490	0,423	2,690	5	19	44,840	0,000	44,840	-0,018	2,003	0,000	30,074	35,000	36	23,995	30,074	0,000	0,000
2,38	2,717	11,129	-46,414	0,432	2,702	5	19	45,220	0,000	45,220	-0,018	2,007	0,000	30,362	35,000	36	24,225	30,362	0,000	0,000
2,40	2,735	11,563	-46,567	0,445	2,676	5	19	45,600	0,000	45,600	-0,018	2,017	0,000	30,458	35,000	36	24,301	30,458	0,000	0,000
2,42	2,626	10,632	-47,296	0,452	2,579	5	19	45,980	0,196	45,784	-0,019	2,020	0,000	29,435	35,000	35	23,486	29,435	0,000	0,000
2,44	2,424	7,697	-48,523	0,466	2,391	5	19	46,360	0,392	45,968	-0,021	2,024	0,000	27,387	33,000	35	21,852	27,387	0,000	0,000
2,46	2,172	5,160	-49,904	0,477	2,182	5	19	46,740	0,589	46,151	-0,024	2,048	0,000	25,720	32,000	35	20,522	25,720	0,000	0,000
2,48	2,002	6,959	-50,863	0,478	1,996	5	19	47,120	0,785	46,335	-0,026	2,136	0,000	26,213	31,000	34	20,915	26,213	0,000	0,000
2,50	1,866	13,922	-51,477	0,462	1,877	5	19	47,500	0,981	46,519	-0,029	2,264	0,000	25,614	30,000	34	23,091	28,941	0,000	0,000
2,52	1,816	23,408	-52,052	0,462	1,734	4	19	47,880	1,177	46,703	-0,032	2,397	0,000	23,603	30,000	34	25,206	31,592	0,000	0,000
2,54	1,573	30,458	-53,548	0,474	1,543	4	19	48,260	1,373	46,887	-0,037	2,527	0,000	20,932	0,000	0	26,352	33,027	106,797	9,295
2,56	1,296	35,331	-54,891	0,480	1,302	3	19	48,640	1,570	47,070	-0,045	2,661	0,000	17,544	0,000	0	0,000	32,799	89,511	8,071
2,58	1,092	37,303	-55,850	0,492	1,088	3	19	49,020	1,766	47,254	-0,055	2,776	0,000	14,543	0,000	0	0,000	31,451	74,200	6,894
2,60	0,932	34,541	-56,694	0,495	0,910	3	19	49,400	1,962	47,438	-0,068	2,876	0,000	12,055	0,000	0	0,000	29,598	61,506	5,857
2,62	0,765	32,937	-57,537	0,495	0,781	3	19	49,780	2,158	47,622	-0,081	2,944	0,000	10,240	0,000	0	0,000	27,395	52,243	5,050
2,64	0,705	27,532	-57,998	0,507	0,702	3	19	50,160	2,354	47,806	-0,092	2,982	0,000	8,896	0,000	0	0,000	25,630	46,580	4,502
2,66	0,696	23,958	-57,691	0,513	0,680	3	19	50,540	2,551	47,989	-0,096	2,957	0,000	8,245	0,000	0	0,000	23,952	44,931	4,326
2,68	0,697	18,951	-57,231	0,512	0,681	3	19	50,920	2,747	48,173	-0,095	2,919	0,000	8,148	0,000	0	0,000	22,838	44,974	4,270
2,70	0,707	16,881	-56,578	0,523	0,683	3	19	51,300	2,943	48,357	-0,094	2,890	0,000	8,113	0,000	0	0,000	22,104	45,138	4,237
2,72	0,703	17,159	-56,080	0,528	0,684	3	19	51,680	3,139	48,541	-0,094	2,882	0,000	8,084	0,000	0	0,000	21,899	45,190	4,217
2,74	0,699	16,937	-55,581	0,536	0,689	3	19	52,060	3,335	48,725	-0,092	2,887	0,000	8,188	0,000	0	0,000	22,210	45,530	4,239
2,76	0,722	18,754	-55,121	0,544	0,701	3	19	52,440	3,532	48,908	-0,091	2,897	0,000	8,470	0,000	0	0,000	22,893	46,327	4,310
2,78	0,738	21,623	-54,929	0,543	0,717	3	19	52,820	3,728	49,092	-0,088	2,919	0,000	8,911	0,000	0	0,000	24,095	47,469	4,425
2,80	0,748	25,771	-54,507	0,548	0,732	3	19	53,200	3,924	49,276	-0,086	2,941	0,000	9,318	0,000	0	0,000	25,333	48,490	4,530
2,82	0,766	28,624	-54,200	0,555	0,752	3	19	53,580	4,120	49,460	-0,084	2,957	0,000	9,773	0,000	0	0,000	26,581	49,863	4,658
2,84	0,796	31,597	-54,162	0,553	0,767	3	19	53,960	4,316	49,644	-0,082	2,974	0,000	9,985	0,000	0	0,000	27,739	50,943	4,741
2,86	0,795	35,331	-54,200	0,557	0,772	3	19	54,340	4,513	49,827	-0,082	2,999	0,000	10,049	0,000	0	0,000	28,814	51,269	4,754
2,88	0,781	38,736	-54,085	0,566	0,774	3	19	54,720	4,709	50,011	-0,082	3,014	0,000	10,067	0,000	0	0,000	29,426	51,364	4,745
2,90	0,801	37,477	-53,970	0,571	0,774	3	19	55,100	4,905	50,195	-0,082	3,023	0,000	10,063	0,000	0	0,000	29,759	51,343	4,726
2,92	0,795	38,465	-53,970	0,578	0,772	3	19	55,480	5,101	50,379	-0,082	3,027	0,000	10,035	0,000	0	0,000	29,817	51,199	4,695
2,94	0,776	39,071	-54,047	0,587	0,764	3	19	55,860	5,297	50,563	-0,084	3,041	0,000	9,916	0,000	0	0,000	29,972	50,593	4,623
2,96	0,777	39,557	-54,124	0,593	0,750	3	19	56,240	5,494	50,746	-0,086	3,059	0,000	9,472	0,000	0	0,000	30,038	49,522	4,509
2,98	0,751	40,285	-54,008	0,592	0,750	3	19	56,620	5,690	50,930	-0,086	3,060	0,000	9,428	0,000	0	0,000	30,064	49,495	4,490
3,00	0,776	38,887	-53,587	0,591	0,768	3	19	57,000	5,886	51,114	-0,084	3,038	0,000	9,877	0,000	0	0,000	29,984	50,751	4,587

Tecnico del laboratorio
Dott. Federico Baldi CantùDirettore del Laboratorio
Dott. Geol. Fabrizio Giorgini

**SUBSOIL Srl - Società Unipersonale**Brada per Barco 1/C, 42027 Montecchio E, Reggio Emilia
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1.^a Iscrizione alla CCIAA di Re 01999610309 - N. REA 241542 - CF e P.IVA 01999610309Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
3,02	0,830	36,316	-52,934	0,597	0,826	3	19	57,380	6,082	51,298	-0,077	2,980	0,000	10,762	0,000	0	0,000	30,120	54,909	4,945
3,04	0,926	35,558	-52,052	0,600	0,859	3	19	57,760	6,278	51,482	-0,073	2,930	0,000	11,220	0,000	0	0,000	29,490	57,245	5,108
3,06	0,874	28,444	-51,515	0,611	0,951	3	19	58,140	6,475	51,665	-0,064	2,876	0,000	12,496	0,000	0	0,000	30,677	63,757	5,597
3,08	1,104	38,671	-49,521	0,622	1,044	3	19	58,520	6,671	51,849	-0,057	2,828	0,000	13,795	0,000	0	0,000	31,860	70,381	6,084
3,10	1,204	38,223	-48,408	0,618	1,184	3	19	58,900	6,867	52,033	-0,049	2,783	0,000	15,758	0,000	0	0,000	34,382	80,396	6,850
3,12	1,295	41,299	-47,564	0,625	1,293	3	19	59,280	7,063	52,217	-0,044	2,749	0,000	17,276	0,000	0	0,000	36,114	88,145	7,424
3,14	1,429	46,880	-45,992	0,630	1,393	3	19	59,660	7,259	52,401	-0,040	2,728	0,000	18,669	0,000	0	0,000	37,981	95,250	7,955
3,16	1,503	49,213	-45,531	0,640	1,467	3	19	60,040	7,456	52,584	-0,038	2,728	0,000	19,696	0,000	0	0,000	40,070	100,490	8,366
3,18	1,515	57,679	-45,455	0,639	1,475	3	19	60,420	7,652	52,768	-0,038	2,752	0,000	19,799	0,000	0	0,000	41,520	101,013	8,432
3,20	1,452	62,741	-46,068	0,644	1,454	3	19	60,800	7,848	52,952	-0,039	2,792	0,000	19,501	0,000	0	0,000	43,041	99,495	8,360
3,22	1,440	69,790	-46,452	0,645	1,410	3	19	61,180	8,044	53,136	-0,040	2,837	0,000	18,884	0,000	0	0,000	44,097	96,347	8,156
3,24	1,385	76,113	-46,989	0,647	1,388	3	19	61,560	8,240	53,320	-0,042	2,870	0,000	18,574	0,000	0	0,000	45,211	94,766	8,059
3,26	1,387	80,311	-47,142	0,651	1,367	3	19	61,940	8,437	53,503	-0,042	2,901	0,000	18,267	0,000	0	0,000	46,260	93,199	7,958
3,28	1,376	87,257	-46,529	0,655	1,380	3	19	62,320	8,633	53,687	-0,042	2,904	0,000	18,452	0,000	0	0,000	46,912	94,140	8,018
3,30	1,425	83,060	-45,531	0,656	1,411	3	19	62,700	8,829	53,871	-0,040	2,890	0,000	18,876	0,000	0	0,000	47,137	96,305	8,148
3,32	1,479	78,432	-45,224	0,666	1,449	3	19	63,080	9,025	54,055	-0,039	2,862	0,000	19,401	0,000	0	0,000	46,775	98,987	8,294
3,34	1,489	75,980	-44,994	0,663	1,458	3	19	63,460	9,221	54,239	-0,039	2,852	0,000	19,526	0,000	0	0,000	46,496	99,620	8,301
3,36	1,453	77,121	-45,570	0,665	1,442	3	19	63,840	9,418	54,422	-0,040	2,860	0,000	19,296	0,000	0	0,000	46,397	98,447	8,192
3,38	1,431	78,400	-45,953	0,672	1,398	3	19	64,220	9,614	54,606	-0,042	2,887	0,000	18,676	0,000	0	0,000	46,464	95,288	7,952
3,40	1,358	82,079	-46,068	0,677	1,367	3	19	64,600	9,810	54,790	-0,043	2,908	0,000	18,230	0,000	0	0,000	46,564	93,008	7,774
3,42	1,358	82,269	-45,531	0,684	1,335	3	19	64,980	10,006	54,974	-0,044	2,927	0,000	17,783	0,000	0	0,000	46,549	90,730	7,589
3,44	1,336	81,924	-45,493	0,683	1,309	3	19	65,360	10,202	55,158	-0,045	2,938	0,000	17,405	0,000	0	0,000	46,223	88,800	7,424
3,46	1,278	80,508	-45,953	0,680	1,297	3	19	65,740	10,399	55,341	-0,046	2,941	0,000	17,232	0,000	0	0,000	45,910	87,917	7,331
3,48	1,322	78,678	-45,531	0,690	1,285	3	19	66,120	10,595	55,525	-0,046	2,941	0,000	17,071	0,000	0	0,000	45,456	87,095	7,238
3,50	1,303	76,174	-45,148	0,703	1,298	3	19	66,500	10,791	55,709	-0,045	2,927	0,000	17,241	0,000	0	0,000	45,129	87,966	7,263
3,52	1,315	73,151	-44,304	0,704	1,301	3	19	66,880	10,987	55,893	-0,045	2,911	0,000	17,276	0,000	0	0,000	44,288	88,141	7,230
3,54	1,330	65,810	-43,345	0,701	1,313	3	19	67,260	11,183	56,077	-0,044	2,890	0,000	17,435	0,000	0	0,000	43,520	88,953	7,240
3,56	1,337	63,495	-42,846	0,707	1,307	3	19	67,640	11,380	56,260	-0,044	2,881	0,000	17,354	0,000	0	0,000	42,838	88,540	7,170
3,58	1,298	64,169	-42,731	0,714	1,267	3	19	68,020	11,576	56,444	-0,045	2,897	0,000	16,782	0,000	0	0,000	42,296	85,623	6,937
3,60	1,208	63,168	-42,961	0,716	1,224	3	19	68,400	11,772	56,628	-0,047	2,915	0,000	16,177	0,000	0	0,000	41,690	82,535	6,691
3,62	1,209	60,439	-42,271	0,720	1,169	3	19	68,780	11,968	56,812	-0,049	2,932	0,000	15,401	0,000	0	0,000	40,579	78,578	6,373
3,64	1,133	56,224	-42,117	0,722	1,128	3	19	69,160	12,164	56,996	-0,051	2,948	0,000	14,820	0,000	0	0,000	39,857	75,611	6,129
3,66	1,085	58,540	-42,041	0,719	1,083	3	19	69,540	12,361	57,179	-0,054	2,968	0,000	14,183	0,000	0	0,000	39,099	72,360	5,847
3,68	1,073	55,379	-41,350	0,719	1,050	3	19	69,920	12,557	57,363	-0,055	2,981	0,000	13,717	0,000	0	0,000	38,466	69,986	5,637
3,70	1,034	51,528	-40,890	0,722	1,026	3	19	70,300	12,753	57,547	-0,056	2,977	0,000	13,379	0,000	0	0,000	37,301	68,259	5,480
3,72	1,013	46,865	-40,161	0,725	1,000	3	19	70,680	12,949	57,731	-0,057	2,971	0,000	13,007	0,000	0	0,000	35,986	66,360	5,311
3,74	0,993	42,668	-38,972	0,743	0,983	3	19	71,060	13,145	57,915	-0,057	2,960	0,000	12,772	0,000	0	0,000	34,879	65,166	5,198
3,76	0,984	40,631	-37,476	0,747	0,971	3	19	71,440	13,342	58,098	-0,056	2,944	0,000	12,587	0,000	0	0,000	33,672	64,222	5,107
3,78	0,972	35,070	-34,714	0,749	0,963	3	19	71,820	13,538	58,282	-0,054	2,924	0,000	12,483	0,000	0	0,000	32,544	63,690	5,029
3,80	0,970	31,184	-32,758	0,751	0,973	3	19	72,200	13,734	58,466	-0,051	2,884	0,000	12,610	0,000	0	0,000	31,256	64,336	5,025
3,82	1,009	26,677	-29,382	0,767	0,984	3	19	72,580	13,930	58,650	-0,047	2,853	0,000	12,761	0,000	0	0,000	30,396	65,108	5,037
3,84	1,003	25,832	-25,738	0,769	0,989	3	19	72,960	14,126	58,834	-0,044	2,829	0,000	12,821	0,000	0	0,000	29,641	65,415	5,022
3,86	0,981	23,915	-23,859	0,768	0,971	3	19	73,340	14,323	59,017	-0,042	2,824	0,000	12,564	0,000	0	0,000	28,871	64,101	4,902
3,88	0,952	21,326	-20,790	0,774	0,951	3	19	73,720	14,519	59,201	-0,040	2,819	0,000	12,282	0,000	0	0,000	28,025	62,662	4,773
3,90	0,941	20,187	-18,297	0,786	0,933	3	19	74,100	14,715	59,385	-0,038	2,816	0,000	12,025	0,000	0	0,000	27,348	61,353	4,657
3,92	0,924	19,671																		

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
4,02	1,323	27,057	1,918	0,808	1,296	4	19	76,380	15,892	60,488	-0,011	2,686	0,000	17,078	0,000	0	0,000	32,925	87,132	6,341
4,04	1,146	29,547	2,225	0,819	1,156	4	19	76,760	16,088	60,672	-0,012	2,755	0,000	15,110	0,000	0	0,000	31,798	77,093	5,669
4,06	0,996	22,951	4,756	0,811	1,147	3	19	77,140	16,285	60,855	0,013	2,784	0,000	14,971	0,000	0	0,000	32,693	76,384	5,633
4,08	1,267	35,060	82,355	0,913	1,139	3	19	77,520	16,481	61,039	0,038	2,809	0,000	14,855	0,000	0	0,000	33,476	75,790	5,599
4,10	1,094	36,822	83,698	0,961	1,147	3	19	77,900	16,677	61,223	0,063	2,830	0,000	14,964	0,000	0	0,000	34,643	76,345	5,647
4,12	0,993	32,817	86,536	0,911	1,027	3	19	78,280	16,873	61,407	0,073	2,888	0,000	13,281	0,000	0	0,000	33,098	67,762	5,052
4,14	0,905	30,520	88,991	0,895	0,941	3	19	78,660	17,069	61,591	0,084	2,921	0,000	12,030	0,000	0	0,000	31,347	61,587	4,604
4,16	0,833	27,896	93,633	0,893	0,893	3	19	79,040	17,266	61,774	0,095	2,936	0,000	10,713	0,000	0	0,000	30,172	58,111	4,345
4,18	0,843	26,239	100,806	0,898	0,914	3	19	79,420	17,462	61,958	0,102	2,904	0,000	11,166	0,000	0	0,000	29,704	59,588	4,417
4,20	0,960	24,219	113,003	0,896	0,998	3	19	79,800	17,658	62,142	0,099	2,836	0,000	12,858	0,000	0	0,000	29,974	65,604	4,789
4,22	1,080	23,166	112,773	0,897	1,116	4	19	80,180	17,854	62,326	0,079	2,749	0,000	14,498	0,000	0	0,000	30,309	73,972	5,302
4,24	1,205	20,594	73,763	0,903	1,189	4	19	80,560	18,050	62,510	0,040	2,708	0,000	15,513	0,000	0	0,000	30,761	79,145	5,616
4,26	1,217	22,978	0,115	0,906	1,288	4	19	80,940	18,247	62,693	0,003	2,664	0,000	16,903	0,000	0	0,000	31,726	86,240	6,057
4,28	1,420	24,465	-6,828	0,909	1,422	4	19	81,320	18,443	62,877	-0,016	2,622	0,000	18,774	0,000	0	0,000	33,390	95,788	6,660
4,30	1,632	25,554	-0,767	0,917	1,670	4	19	81,700	18,639	63,061	-0,012	2,555	0,000	22,239	0,000	0	29,011	36,360	113,464	7,778
4,32	1,959	32,690	5,025	0,925	1,994	4	19	82,080	18,835	63,245	-0,007	2,489	0,000	26,760	28,000	34	32,080	40,207	0,000	0,000
4,34	2,383	38,858	12,620	0,918	2,384	4	19	82,460	19,031	63,429	-0,005	2,424	0,000	32,225	31,000	34	35,570	44,581	0,000	0,000
4,36	2,803	43,247	3,529	0,921	2,792	5	19	82,840	19,228	63,612	-0,003	2,349	0,000	37,923	33,000	35	38,103	47,755	0,000	0,000
4,38	3,178	41,624	13,962	0,916	3,087	5	19	83,220	19,424	63,796	-0,003	2,286	0,000	42,056	35,000	35	39,017	48,901	0,000	0,000
4,40	3,269	36,633	15,689	0,911	3,252	5	19	83,600	19,620	63,980	-0,001	2,233	0,000	44,361	35,000	36	38,470	48,216	0,000	0,000
4,42	3,294	31,867	15,727	0,914	3,250	5	19	83,980	19,816	64,164	-0,001	2,201	0,000	44,318	35,000	36	36,888	46,233	0,000	0,000
4,44	3,170	26,720	14,998	0,910	3,140	5	19	84,360	20,012	64,348	-0,002	2,184	0,000	43,685	35,000	35	34,855	43,685	0,000	0,000
4,46	2,941	21,850	12,083	0,912	2,901	5	19	84,740	20,209	64,531	-0,003	2,196	0,000	40,917	33,000	35	32,646	40,917	0,000	0,000
4,48	2,581	20,088	7,633	0,910	2,532	5	19	85,120	20,405	64,715	-0,006	2,241	0,000	34,250	31,000	34	30,016	37,620	0,000	0,000
4,50	2,065	16,151	0,921	0,911	2,096	5	19	85,500	20,601	64,899	-0,010	2,320	0,000	28,142	28,000	34	27,234	34,133	0,000	0,000
4,52	1,639	13,354	-4,373	0,913	1,714	5	19	85,880	20,797	65,083	-0,015	2,418	0,000	22,791	26,000	33	24,988	31,318	0,000	0,000
4,54	1,440	15,463	-5,715	0,926	1,477	4	19	86,260	20,993	65,267	-0,019	2,513	0,000	19,464	24,000	32	24,059	30,154	0,000	0,000
4,56	1,355	17,450	-4,526	0,929	1,343	4	19	86,640	21,190	65,450	-0,019	2,600	0,000	17,585	0,000	0	0,000	30,430	89,718	6,003
4,58	1,236	20,301	0,806	0,941	1,280	4	19	87,020	21,386	65,634	-0,017	2,636	0,000	16,707	0,000	0	0,000	30,261	85,238	5,723
4,60	1,249	17,020	7,211	0,929	1,257	4	19	87,400	21,582	65,818	-0,014	2,636	0,000	16,376	0,000	0	0,000	29,658	83,549	5,596
4,62	1,281	14,447	9,129	0,940	1,191	4	19	87,780	21,778	66,002	-0,013	2,666	0,000	15,439	0,000	0	0,000	29,025	78,772	5,287
4,64	1,035	19,199	5,485	0,949	1,068	4	19	88,160	21,974	66,186	-0,016	2,751	0,000	13,719	0,000	0	0,000	28,751	69,994	4,750
4,66	0,882	21,342	4,565	0,949	0,925	3	19	88,540	22,171	66,369	-0,020	2,868	0,000	10,446	0,000	0	0,000	28,458	59,766	4,120
4,68	0,853	21,066	6,674	0,957	0,852	3	19	88,920	22,367	66,553	-0,021	2,921	0,000	8,736	0,000	0	0,000	27,763	54,507	3,778
4,70	0,814	19,098	8,017	0,957	0,829	3	19	89,300	22,563	66,737	-0,019	2,939	0,000	8,209	0,000	0	0,000	27,551	52,869	3,660
4,72	0,812	21,137	10,510	0,951	0,862	3	19	89,680	22,759	66,921	-0,015	2,915	0,000	8,883	0,000	0	0,000	27,870	55,140	3,797
4,74	0,947	20,914	15,497	0,954	0,994	3	19	90,060	22,955	67,105	-0,007	2,837	0,000	12,017	0,000	0	0,000	29,584	64,594	4,385
4,76	1,208	22,314	22,670	0,955	1,196	4	19	90,440	23,152	67,288	0,000	2,742	0,000	15,478	0,000	0	0,000	32,072	78,972	5,271
4,78	1,410	26,703	30,878	0,970	1,364	4	19	90,820	23,348	67,472	0,003	2,676	0,000	17,819	0,000	0	0,000	33,931	90,914	5,993
4,80	1,445	24,976	29,267	0,980	1,408	4	19	91,200	23,544	67,656	0,004	2,681	0,000	18,438	0,000	0	0,000	35,351	94,072	6,191
4,82	1,340	30,349	25,853	0,983	1,384	4	19	91,580	23,740	67,840	0,003	2,718	0,000	18,098	0,000	0	0,000	36,346	92,339	6,095
4,84	1,341	35,774	25,815	0,992	1,405	4	19	91,960	23,936	68,024	0,003	2,749	0,000	18,384	0,000	0	0,000	38,394	93,798	6,205
4,86	1,506	40,749	31,569	0,985	1,479	4	19	92,340	24,133	68,207	0,005	2,737	0,000	19,407	0,000	0	0,000	39,918	99,018	6,522
4,88	1,558	38,574	34,101	0,989	1,470	4	19	92,720	24,329	68,391	0,005	2,738	0,000	19,282	0,000	0	0,000	39,742	98,378	6,466
4,90	1,314	34,429	26,774	0,991	1,330	3	19	93,100	24,525	68,575	0,002	2,792	0,000	17,310	0,000	0	0,000	38,198	88,316	5,835
4,92	1,088	36,537																		

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1.^a Iscrizione alla CCIAA di RE 01999610309 - N. REA 241542 - CF e P.IVA 01999610309
Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria
Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
5,02	0,795	22,358	26,160	1,005	0,803	3	19	95,380	25,702	69,678	0,000	3,014	0,000	7,180	0,000	0	0,000	28,945	50,521	3,350
5,04	0,749	22,860	25,662	1,010	0,775	3	19	95,760	25,898	69,862	0,001	3,041	0,000	6,612	0,000	0	0,000	28,767	48,547	3,210
5,06	0,756	24,968	27,081	1,017	0,879	3	19	96,140	26,095	70,045	0,022	2,977	0,000	8,747	0,000	0	0,000	30,567	55,911	3,688
5,08	1,088	28,467	77,177	1,060	1,012	3	19	96,520	26,291	70,229	0,038	2,906	0,000	11,898	0,000	0	0,000	32,660	65,386	4,289
5,10	1,129	29,660	79,248	1,058	1,140	3	19	96,900	26,487	70,413	0,050	2,850	0,000	14,600	0,000	0	0,000	34,662	74,491	4,838
5,12	1,122	31,612	78,289	1,055	1,143	3	19	97,280	26,683	70,597	0,050	2,867	0,000	14,633	0,000	0	0,000	35,487	74,660	4,848
5,14	1,096	34,999	77,906	1,057	1,111	3	19	97,660	26,879	70,781	0,051	2,902	0,000	14,190	0,000	0	0,000	35,982	72,398	4,710
5,16	1,035	36,243	80,859	1,061	1,090	3	19	98,040	27,076	70,964	0,054	2,915	0,000	13,852	0,000	0	0,000	35,823	70,867	4,607
5,18	1,057	31,666	84,158	1,055	1,076	3	19	98,420	27,272	71,148	0,057	2,918	0,000	13,431	0,000	0	0,000	35,437	69,858	4,532
5,20	1,052	32,392	83,890	1,052	1,080	3	19	98,800	27,468	71,332	0,057	2,917	0,000	13,487	0,000	0	0,000	35,522	70,096	4,535
5,22	1,045	36,383	83,122	1,060	1,059	3	19	99,180	27,664	71,516	0,057	2,959	0,000	12,872	0,000	0	0,000	36,621	68,532	4,427
5,24	0,994	42,775	79,095	1,050	1,020	3	19	99,560	27,860	71,700	0,057	3,020	0,000	11,814	0,000	0	0,000	37,949	65,740	4,236
5,26	0,938	47,819	77,752	1,042	0,972	3	19	99,940	28,057	71,883	0,057	3,085	0,000	10,583	0,000	0	0,000	39,022	62,302	4,004
5,28	0,904	51,533	76,870	1,044	0,930	3	19	100,320	28,253	72,067	0,060	3,138	0,000	9,549	0,000	0	0,000	39,734	59,255	3,799
5,30	0,868	54,729	78,251	1,036	0,899	3	19	100,700	28,449	72,251	0,062	3,173	0,000	8,828	0,000	0	0,000	39,955	57,045	3,648
5,32	0,846	53,606	79,900	1,039	0,873	3	19	101,080	28,645	72,435	0,066	3,187	0,000	8,227	0,000	0	0,000	39,302	55,141	3,517
5,34	0,824	47,112	80,054	1,028	0,872	3	19	101,460	28,841	72,619	0,067	3,170	0,000	8,173	0,000	0	0,000	38,391	55,030	3,501
5,36	0,863	44,452	80,936	1,033	0,958	3	19	101,840	29,038	72,802	0,066	3,086	0,000	10,071	0,000	0	0,000	38,362	61,161	3,881
5,38	1,100	43,260	94,400	1,036	1,228	3	19	102,220	29,234	72,986	0,062	2,909	0,000	15,754	0,000	0	0,000	40,328	80,378	5,080
5,40	1,618	41,791	121,864	1,029	1,678	4	19	102,600	29,430	73,170	0,054	2,695	0,000	22,052	0,000	0	0,000	43,006	112,512	6,914
5,42	2,198	35,297	127,465	1,034	2,358	4	19	102,980	29,626	73,354	0,022	2,472	0,000	31,576	29,000	34	37,040	46,423	0,000	0,000
5,44	3,178	36,454	-11,047	1,036	3,188	5	19	103,360	29,822	73,538	0,003	2,284	0,000	43,192	33,000	35	39,969	50,094	0,000	0,000
5,46	4,150	39,011	1,227	1,058	4,222	5	19	103,740	30,019	73,721	-0,006	2,125	0,000	54,620	38,000	36	43,579	54,620	0,000	0,000
5,48	5,333	38,613	22,977	1,066	5,239	6	19	104,120	30,215	73,905	-0,002	2,000	0,000	58,155	42,000	37	46,401	58,155	0,000	0,000
5,50	6,213	37,542	40,008	1,075	6,203	6	19	104,500	30,411	74,089	0,001	1,887	0,000	59,880	46,000	38	47,777	59,880	0,000	0,000
5,52	7,024	31,860	53,241	1,068	6,918	6	19	104,880	30,607	74,273	0,003	1,797	0,000	59,652	48,000	39	47,595	59,652	0,000	0,000
5,54	7,465	25,365	58,765	1,066	7,374	6	19	105,260	30,803	74,457	0,004	1,720	0,000	57,787	49,000	39	46,107	57,787	0,000	0,000
5,56	7,575	19,941	58,995	1,074	7,518	6	19	105,640	31,000	74,640	0,004	1,667	0,000	55,099	50,000	39	43,962	55,099	0,000	0,000
5,58	7,456	15,105	56,885	1,076	7,439	6	19	106,020	31,196	74,824	0,004	1,630	0,000	52,002	49,000	39	41,491	52,002	0,000	0,000
5,60	7,227	10,147	55,006	1,087	7,240	6	19	106,400	31,392	75,008	0,003	1,608	0,000	49,210	49,000	39	39,263	49,210	0,000	0,000
5,62	6,981	8,178	53,702	1,091	6,958	6	19	106,780	31,588	75,192	0,003	1,605	0,000	47,054	48,000	38	37,543	47,054	0,000	0,000
5,64	6,611	7,609	52,014	1,098	6,666	6	19	107,160	31,784	75,376	0,003	1,616	0,000	45,671	46,000	38	36,440	45,671	0,000	0,000
5,66	6,353	6,780	50,288	1,099	6,356	6	19	107,540	31,981	75,559	0,003	1,635	0,000	44,603	45,000	38	35,587	44,603	0,000	0,000
5,68	6,053	6,884	48,984	1,100	6,035	6	19	107,920	32,177	75,743	0,003	1,661	0,000	43,709	44,000	38	34,874	43,709	0,000	0,000
5,70	5,649	7,558	46,030	1,114	5,677	6	19	108,300	32,373	75,927	0,002	1,697	0,000	42,960	43,000	38	34,277	42,960	0,000	0,000
5,72	5,284	8,042	43,191	1,120	5,288	6	19	108,680	32,569	76,111	0,002	1,742	0,000	42,330	41,000	37	33,774	42,330	0,000	0,000
5,74	4,887	9,147	40,775	1,116	4,992	6	19	109,060	32,765	76,295	0,002	1,781	0,000	41,904	40,000	37	33,434	41,904	0,000	0,000
5,76	4,762	9,493	41,389	1,119	4,795	6	19	109,440	32,962	76,478	0,002	1,813	0,000	41,893	40,000	37	33,426	41,893	0,000	0,000
5,78	4,692	10,529	44,419	1,123	4,753	6	19	109,820	33,158	76,662	0,002	1,827	0,000	42,263	39,000	37	33,721	42,263	0,000	0,000
5,80	4,760	11,237	48,025	1,118	4,782	6	19	110,200	33,354	76,846	0,003	1,831	0,000	42,728	39,000	37	34,091	42,728	0,000	0,000
5,82	4,845	11,065	52,436	1,128	4,821	6	19	110,580	33,550	77,030	0,004	1,827	0,000	42,870	40,000	37	34,205	42,870	0,000	0,000
5,84	4,806	10,511	54,699	1,129	4,789	6	19	110,960	33,746	77,214	0,004	1,826	0,000	42,538	39,000	37	33,940	42,538	0,000	0,000
5,86	4,662	10,045	54,584	1,133	4,676	6	19	111,340	33,943	77,397	0,004	1,831	0,000	41,722	39,000	37	33,289	41,722	0,000	0,000
5,88	4,504	8,853	53,510	1,134	4,494	6	19	111,720	34,139	77,581	0,004	1,842	0,000	40,627	38,000	36	32,415	40,627	0,000	0,000
5,90	4,262	8,075	51,400	1,146	4,297	6	19	112,100	34,335	77,765	0,004	1,856	0,000	39,500	37,000	36	31,516	39,500	0,000	0,000
5,92	4,072	7,798																		

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
6,02	3,362	8,157	45,339	1,129	3,371	6	19	114,380	35,512	78,868	0,003	1,990	0,000	36,415	33,000	35	29,054	36,415	0,000	0,000
6,04	3,194	7,431	43,153	1,132	3,159	6	19	114,760	35,708	79,052	0,002	2,027	0,000	35,680	32,000	35	28,468	35,680	0,000	0,000
6,06	2,876	9,146	39,125	1,191	2,990	5	19	115,140	35,905	79,235	0,001	2,048	0,000	34,621	31,000	34	27,623	34,621	0,000	0,000
6,08	2,860	6,435	37,553	1,190	2,807	5	19	115,520	36,101	79,419	0,000	2,063	0,000	33,032	30,000	34	26,355	33,032	0,000	0,000
6,10	2,648	4,034	33,794	1,188	2,690	5	19	115,900	36,297	79,603	-0,001	2,036	0,000	30,534	29,000	34	24,362	30,534	0,000	0,000
6,12	2,529	1,651	30,840	1,201	2,533	0	19	116,280	36,493	79,787	-0,002	2,028	0,000	28,347	0,000	0	22,617	28,347	0,000	0,000
6,14	2,390	0,511	28,730	1,209	2,413	0	19	116,660	36,689	79,971	-0,003	2,058	0,000	27,999	0,000	0	22,340	27,999	0,000	0,000
6,16	2,290	0,201	26,621	1,219	2,290	0	19	117,040	36,886	80,154	-0,005	0,000	0,000	1,956	0,000	0	1,560	1,956	0,000	0,000
6,18	2,164	-0,783	24,012	1,213	2,167	0	19	117,420	37,082	80,338	-0,006	0,000	0,000	1,844	0,000	0	1,472	1,844	0,000	0,000
6,20	2,023	-1,181	21,672	1,217	2,030	0	19	117,800	37,278	80,522	-0,008	0,000	0,000	1,721	0,000	0	1,373	1,721	0,000	0,000
6,22	1,881	-0,835	18,987	1,227	1,892	0	19	118,180	37,474	80,706	-0,010	0,000	0,000	1,596	0,000	0	1,274	1,596	0,000	0,000
6,24	1,753	-0,972	16,379	1,228	1,757	0	19	118,560	37,670	80,890	-0,013	0,000	0,000	1,475	0,000	0	1,177	1,475	0,000	0,000
6,26	1,621	-1,369	14,154	1,230	1,633	0	19	118,940	37,867	81,073	-0,016	0,000	0,000	1,363	0,000	0	1,087	1,363	0,000	0,000
6,28	1,512	-2,233	11,738	1,230	1,518	0	19	119,320	38,063	81,257	-0,019	0,000	0,000	1,259	0,000	0	1,004	1,259	0,000	0,000
6,30	1,410	-2,509	10,395	1,233	1,424	0	19	119,700	38,259	81,441	-0,021	0,000	0,000	1,174	0,000	0	0,937	1,174	0,000	0,000
6,32	1,341	-2,353	8,899	1,251	1,358	0	19	120,080	38,455	81,625	-0,024	0,000	0,000	1,114	0,000	0	0,888	1,114	0,000	0,000
6,34	1,312	-2,370	8,400	1,253	1,339	0	19	120,460	38,651	81,809	-0,025	0,000	0,000	1,096	0,000	0	0,875	1,096	0,000	0,000
6,36	1,354	-2,283	8,746	1,273	1,372	0	19	120,840	38,848	81,992	-0,024	0,000	0,000	1,125	0,000	0	0,898	1,125	0,000	0,000
6,38	1,439	-2,472	9,743	1,288	1,439	0	19	121,220	39,044	82,176	-0,022	0,000	0,000	1,186	0,000	0	0,946	1,186	0,000	0,000
6,40	1,515	-2,316	10,970	1,297	1,509	0	19	121,600	39,240	82,360	-0,021	0,000	0,000	1,248	0,000	0	0,996	1,248	0,000	0,000
6,42	1,562	-2,350	11,277	1,306	1,534	0	19	121,980	39,436	82,544	-0,020	0,000	0,000	1,270	0,000	0	1,013	1,270	0,000	0,000
6,44	1,513	-2,419	10,203	1,307	1,521	0	19	122,360	39,632	82,728	-0,021	0,000	0,000	1,258	0,000	0	1,004	1,258	0,000	0,000
6,46	1,477	-2,954	9,398	1,331	1,503	0	19	122,740	39,829	82,911	-0,022	0,000	0,000	1,242	0,000	0	0,991	1,242	0,000	0,000
6,48	1,511	-1,710	9,590	1,353	1,530	0	19	123,120	40,025	83,095	-0,021	0,000	0,000	1,266	0,000	0	1,010	1,266	0,000	0,000
6,50	1,592	0,882	11,277	1,364	1,633	0	19	123,500	40,221	83,279	-0,019	2,243	0,000	21,133	22,000	31	18,560	23,262	0,000	0,000
6,52	1,784	5,391	15,228	1,378	1,769	5	19	123,880	40,417	83,463	-0,016	2,332	0,000	23,030	23,000	32	22,629	28,361	0,000	0,000
6,54	1,916	12,198	16,878	1,379	1,879	5	19	124,260	40,613	83,647	-0,014	2,391	0,000	24,560	24,000	32	26,005	32,593	0,000	0,000
6,56	1,918	15,376	17,606	1,376	1,955	5	19	124,640	40,810	83,830	-0,013	2,430	0,000	25,619	25,000	32	28,495	35,714	0,000	0,000
6,58	2,011	18,193	18,374	1,380	1,982	5	19	125,020	41,006	84,014	-0,013	2,447	0,000	25,992	25,000	32	29,541	37,025	0,000	0,000
6,60	1,997	18,142	16,571	1,395	2,025	5	19	125,400	41,202	84,198	-0,013	2,438	0,000	26,592	25,000	32	29,880	37,450	0,000	0,000
6,62	2,048	16,259	17,069	1,411	2,101	5	19	125,780	41,398	84,382	-0,012	2,404	0,000	27,650	25,000	33	29,789	37,336	0,000	0,000
6,64	2,239	15,327	20,483	1,428	2,277	5	19	126,160	41,594	84,566	-0,010	2,357	0,000	30,106	26,000	33	30,561	38,303	0,000	0,000
6,66	2,522	18,438	25,278	1,436	2,505	5	19	126,540	41,791	84,749	-0,007	2,330	0,000	33,304	28,000	33	32,663	40,937	0,000	0,000
6,68	2,731	24,311	27,733	1,456	2,773	5	19	126,920	41,987	84,933	-0,005	2,319	0,000	37,040	29,000	34	35,833	44,911	0,000	0,000
6,70	3,036	30,876	34,024	1,459	2,977	5	19	127,300	42,183	85,117	-0,004									

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
7,02	0,341	12,259	-0,729	1,383	0,348	3	19	133,380	45,322	88,058	-0,214	3,662	0,000	0,524	0,000	0	0,000	19,963	15,342	0,805
7,04	0,346	13,002	1,036	1,378	0,342	3	19	133,760	45,518	88,242	-0,149	3,724	0,000	0,492	0,000	0	0,000	20,965	14,887	0,779
7,06	0,325	18,908	43,345	1,345	0,355	3	19	134,140	45,715	88,425	-0,071	3,724	0,000	0,552	0,000	0	0,000	22,210	15,779	0,824
7,08	0,364	18,874	45,800	1,342	0,368	3	19	134,520	45,911	88,609	-0,002	3,718	0,000	0,615	0,000	0	0,000	23,275	16,671	0,869
7,10	0,369	18,649	47,296	1,337	0,383	3	19	134,900	46,107	88,793	0,005	3,661	0,000	0,695	0,000	0	0,000	23,056	17,746	0,923
7,12	0,369	14,556	49,252	1,339	0,386	3	19	135,280	46,303	88,977	0,013	3,633	0,000	0,706	0,000	0	0,000	22,455	17,896	0,929
7,14	0,369	14,142	52,244	1,336	0,392	3	19	135,660	46,499	89,161	0,023	3,596	0,000	0,736	0,000	0	0,000	21,903	18,295	0,948
7,16	0,384	14,038	55,773	1,329	0,410	3	19	136,040	46,696	89,344	0,034	3,551	0,000	0,841	0,000	0	0,000	22,129	19,581	1,013
7,18	0,420	13,572	59,954	1,335	0,433	3	19	136,420	46,892	89,528	0,043	3,499	0,000	0,986	0,000	0	0,000	22,453	21,219	1,095
7,20	0,435	13,348	63,675	1,344	0,455	3	19	136,800	47,088	89,712	0,051	3,453	0,000	1,129	0,000	0	0,000	22,696	22,735	1,171
7,22	0,445	13,106	66,398	1,331	0,480	3	19	137,180	47,284	89,896	0,058	3,403	0,000	1,308	0,000	0	0,000	22,966	24,492	1,259
7,24	0,491	12,606	71,883	1,329	0,511	3	19	137,560	47,480	90,080	0,063	3,345	0,000	1,552	0,000	0	0,000	23,265	26,709	1,370
7,26	0,526	12,139	75,105	1,332	0,537	3	19	137,940	47,677	90,263	0,068	3,309	0,000	1,766	0,000	0	0,000	23,739	28,514	1,459
7,28	0,518	13,539	77,445	1,329	0,541	3	19	138,320	47,873	90,447	0,074	3,313	0,000	1,789	0,000	0	0,000	24,031	28,732	1,468
7,30	0,499	13,884	80,437	1,316	0,528	3	19	138,700	48,069	90,631	0,082	3,349	0,000	1,668	0,000	0	0,000	24,306	27,774	1,416
7,32	0,484	14,765	81,473	1,316	0,503	3	19	139,080	48,265	90,815	0,091	3,401	0,000	1,458	0,000	0	0,000	24,303	25,994	1,322
7,34	0,443	15,733	82,317	1,313	0,473	3	19	139,460	48,461	90,999	0,102	3,466	0,000	1,219	0,000	0	0,000	24,170	23,791	1,208
7,36	0,406	16,148	83,276	1,315	0,440	3	19	139,840	48,658	91,182	0,115	3,538	0,000	0,985	0,000	0	0,000	23,807	21,409	1,085
7,38	0,384	16,199	84,043	1,307	0,417	3	19	140,220	48,854	91,366	0,128	3,589	0,000	0,840	0,000	0	0,000	23,464	19,789	1,001
7,40	0,375	16,252	85,807	1,300	0,406	3	19	140,600	49,050	91,550	0,138	3,611	0,000	0,772	0,000	0	0,000	23,162	18,988	0,958
7,42	0,373	15,509	87,227	1,308	0,407	3	19	140,980	49,246	91,734	0,144	3,603	0,000	0,772	0,000	0	0,000	22,957	19,012	0,957
7,44	0,385	14,628	89,490	1,297	0,407	3	19	141,360	49,442	91,918	0,151	3,587	0,000	0,768	0,000	0	0,000	22,449	18,982	0,954
7,46	0,373	12,849	91,983	1,306	0,416	3	19	141,740	49,639	92,101	0,156	3,544	0,000	0,818	0,000	0	0,000	21,964	19,609	0,984
7,48	0,397	11,295	95,550	1,314	0,447	3	19	142,120	49,835	92,285	0,154	3,449	0,000	1,008	0,000	0	0,000	21,637	21,787	1,091
7,50	0,473	9,447	102,685	1,323	0,556	3	19	142,500	50,031	92,469	0,135	3,241	0,000	1,848	0,000	0	0,000	22,562	29,531	1,475
7,52	0,690	8,946	119,409	1,334	0,679	3	19	142,880	50,227	92,653	0,120	3,067	0,000	3,104	0,000	0	0,000	23,455	38,303	1,910
7,54	0,758	8,324	121,557	1,343	0,747	4	19	143,260	50,423	92,837	0,110	2,983	0,000	3,931	0,000	0	0,000	23,778	43,149	2,147
7,56	0,675	7,616	109,781	1,336	0,715	4	19	143,640	50,620	93,020	0,113	3,028	0,000	3,512	0,000	0	0,000	23,813	40,828	2,028
7,58	0,595	10,449	114,921	1,333	0,646	3	19	144,020	50,816	93,204	0,125	3,134	0,000	2,700	0,000	0	0,000	23,890	35,835	1,776
7,60	0,551	12,160	116,456	1,340	0,601	3	19	144,400	51,012	93,388	0,147	3,227	0,000	2,232	0,000	0	0,000	24,470	32,613	1,613
7,62	0,537	13,231	122,862	1,336	0,573	3	19	144,780	51,208	93,572	0,167	3,279	0,000	1,963	0,000	0	0,000	24,515	30,614	1,512
7,64	0,507	12,610	128,385	1,339	0,558	3	19	145,160	51,404	93,756	0,187	3,310	0,000	1,816	0,000	0	0,000	24,557	29,473	1,452
7,66	0,498	13,526	134,944	1,351	0,554	3	19	145,540	51,601	93,939	0,206	3,335	0,000	1,775	0,000	0	0,000	25,081	29,166	1,434
7,68	0,518	16,464	143,268	1,349	0,564	3	19	145,920	51,797	94,123	0,218	3,362	0,000	1,857	0,000	0	0,000	26,584	29,859	1,466

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Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
8,02	0,665	34,605	244,572	1,323	0,754	3	19	152,380	55,132	97,248	0,315	3,331	0,000	3,726	0,000	0	0,000	36,786	42,999	2,043
8,04	0,690	34,692	247,986	1,321	0,778	3	19	152,760	55,328	97,432	0,332	3,320	0,000	4,012	0,000	0	0,000	37,676	44,656	2,118
8,06	0,711	39,308	295,282	1,337	0,804	3	19	153,140	55,525	97,615	0,343	3,306	0,000	4,343	0,000	0	0,000	38,583	46,510	2,201
8,08	0,728	39,187	293,633	1,333	0,802	3	19	153,520	55,721	97,799	0,366	3,317	0,000	4,305	0,000	0	0,000	38,954	46,346	2,189
8,10	0,669	38,013	290,947	1,335	0,785	3	19	153,900	55,917	97,983	0,371	3,330	0,000	4,065	0,000	0	0,000	38,509	45,080	2,126
8,12	0,662	37,235	284,848	1,331	0,765	3	19	154,280	56,113	98,167	0,377	3,346	0,000	3,802	0,000	0	0,000	38,036	43,640	2,054
8,14	0,672	37,218	282,969	1,321	0,755	3	19	154,660	56,309	98,351	0,378	3,354	0,000	3,668	0,000	0	0,000	37,790	42,900	2,015
8,16	0,643	36,873	281,320	1,325	0,737	3	19	155,040	56,506	98,534	0,388	3,367	0,000	3,440	0,000	0	0,000	37,260	41,588	1,950
8,18	0,609	34,627	283,506	1,320	0,711	3	19	155,420	56,702	98,718	0,406	3,386	0,000	3,128	0,000	0	0,000	36,408	39,692	1,858
8,20	0,594	32,934	281,435	1,315	0,677	3	19	155,800	56,898	98,902	0,428	3,410	0,000	2,747	0,000	0	0,000	35,191	37,231	1,739
8,22	0,543	30,654	274,645	1,312	0,642	3	19	156,180	57,094	99,086	0,448	3,439	0,000	2,381	0,000	0	0,000	34,060	34,697	1,618
8,24	0,509	29,565	268,201	1,308	0,592	3	19	156,560	57,290	99,270	0,487	3,497	0,000	1,910	0,000	0	0,000	32,846	31,104	1,448
8,26	0,450	29,599	264,710	1,306	0,566	3	19	156,940	57,487	99,453	0,516	3,525	0,000	1,680	0,000	0	0,000	31,944	29,193	1,356
8,28	0,465	26,853	272,382	1,301	0,559	3	19	157,320	57,683	99,637	0,539	3,524	0,000	1,623	0,000	0	0,000	31,395	28,723	1,332
8,30	0,484	25,798	286,229	1,305	0,586	3	19	157,700	57,879	99,821	0,533	3,470	0,000	1,837	0,000	0	0,000	31,216	30,591	1,416
8,32	0,518	24,295	299,233	1,297	0,613	3	19	158,080	58,075	100,005	0,526	3,416	0,000	2,073	0,000	0	0,000	30,989	32,523	1,502
8,34	0,535	21,549	307,480	1,291	0,634	3	19	158,460	58,271	100,189	0,519	3,370	0,000	2,254	0,000	0	0,000	30,502	33,943	1,565
8,36	0,537	19,873	308,055	1,300	0,635	3	19	158,840	58,468	100,372	0,525	3,346	0,000	2,256	0,000	0	0,000	29,639	33,992	1,565
8,38	0,518	18,162	309,321	1,299	0,634	3	19	159,220	58,664	100,556	0,527	3,333	0,000	2,243	0,000	0	0,000	29,091	33,921	1,558
8,40	0,532	17,903	310,127	1,289	0,629	3	19	159,600	58,860	100,740	0,534	3,332	0,000	2,190	0,000	0	0,000	28,766	33,552	1,539
8,42	0,522	18,127	309,666	1,294	0,633	3	19	159,980	59,056	100,924	0,531	3,327	0,000	2,213	0,000	0	0,000	28,746	33,753	1,545
8,44	0,527	17,626	309,551	1,285	0,629	3	19	160,360	59,252	101,108	0,532	3,346	0,000	2,170	0,000	0	0,000	29,164	33,455	1,529
8,46	0,522	20,804	305,907	1,293	0,632	3	19	160,740	59,449	101,291	0,526	3,365	0,000	2,188	0,000	0	0,000	30,031	33,626	1,534
8,48	0,532	23,464	306,176	1,299	0,631	3	19	161,120	59,645	101,475	0,525	3,392	0,000	2,177	0,000	0	0,000	31,041	33,572	1,529
8,50	0,527	24,570	306,713	1,294	0,645	3	19	161,500	59,841	101,659	0,513	3,396	0,000	2,295	0,000	0	0,000	32,043	34,500	1,568
8,52	0,561	26,452	309,858	1,284	0,660	3	19	161,880	60,037	101,843	0,502	3,391	0,000	2,436	0,000	0	0,000	32,862	35,577	1,614
8,54	0,575	27,661	314,308	1,282	0,691	3	19	162,260	60,233	102,027	0,482	3,371	0,000	2,736	0,000	0	0,000	33,964	37,740	1,709
8,56	0,614	29,285	320,176	1,276	0,716	3	19	162,640	60,430	102,210	0,468	3,357	0,000	2,993	0,000	0	0,000	34,952	39,508	1,786
8,58	0,632	31,082	324,051	1,279	0,753	3	19	163,020	60,626	102,394	0,448	3,329	0,000	3,394	0,000	0	0,000	35,952	42,105	1,900
8,60	0,680	31,202	330,687	1,278	0,781	3	19	163,400	60,822	102,578	0,434	3,308	0,000	3,724	0,000	0	0,000	36,673	44,146	1,988
8,62	0,697	31,617	332,029	1,272	0,807	3	19	163,780	61,018	102,762	0,420	3,288	0,000	4,032	0,000	0	0,000	37,251	45,977	2,067
8,64	0,707	32,671	331,684	1,278	0,821	3	19	164,160	61,214	102,946	0,414	3,286	0,000	4,191	0,000	0	0,000	37,909	46,918	2,106
8,66	0,719	34,847	335,903	1,269	0,825	3	19	164,540	61,411	103,129	0,415	3,294	0,000	4,229	0,000	0	0,000	38,521	47,172	2,113
8,68	0,707	36,004	338,665	1,266	0,820	3	19	164,920	61,607	103,313	0,422	3,310	0,000	4,155	0,000	0				

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9,02	1,309	21,887	571,423	1,147	1,514	4	19	171,380	64,942	106,438	0,377	2,768	0,000	16,982	0,000	0	0,000	40,240	95,905	4,174
9,04	1,402	20,056	601,496	1,138	1,957	5	19	171,760	65,138	106,622	0,259	2,608	0,000	24,992	0,000	0	0,000	43,665	127,512	5,562
9,06	2,622	27,012	409,244	1,132	2,327	5	19	172,140	65,335	106,805	0,167	2,539	0,000	30,172	24,000	32	38,541	48,304	0,000	0,000
9,08	2,524	36,582	264,979	1,129	2,565	5	19	172,520	65,531	106,989	0,107	2,534	0,000	33,493	0,000	0	42,531	53,305	170,880	7,445
9,10	2,220	43,406	290,832	1,119	2,395	4	19	172,900	65,727	107,173	0,105	2,610	0,000	31,103	0,000	0	0,000	54,467	158,691	6,889
9,12	2,135	40,902	338,895	1,114	2,304	4	19	173,280	65,923	107,357	0,132	2,636	0,000	29,831	0,000	0	0,000	54,002	152,199	6,593
9,14	2,203	36,670	410,510	1,108	2,363	4	19	173,660	66,119	107,541	0,153	2,599	0,000	30,655	0,000	0	42,232	52,931	156,403	6,771
9,16	2,342	33,405	453,702	1,112	2,477	5	19	174,040	66,316	107,724	0,166	2,557	0,000	32,236	0,000	0	42,121	52,791	164,471	7,118
9,18	2,428	35,651	478,097	1,105	2,591	5	19	174,420	66,512	107,908	0,169	2,532	0,000	33,836	25,000	32	42,834	53,686	0,000	0,000
9,20	2,520	38,398	490,142	1,108	2,672	5	19	174,800	66,708	108,092	0,167	2,526	0,000	34,959	26,000	33	43,930	55,059	0,000	0,000
9,22	2,574	39,556	483,276	1,111	2,725	5	19	175,180	66,904	108,276	0,163	2,527	0,000	35,693	0,000	0	44,895	56,268	182,108	7,853
9,24	2,589	41,784	471,001	1,111	2,768	5	19	175,560	67,100	108,460	0,154	2,530	0,000	36,291	0,000	0	45,871	57,491	185,160	7,972
9,26	2,664	45,100	448,063	1,107	2,816	5	19	175,940	67,297	108,643	0,145	2,536	0,000	36,960	0,000	0	47,041	58,957	188,570	8,105
9,28	2,737	47,967	428,692	1,110	2,872	5	19	176,320	67,493	108,827	0,133	2,540	0,000	37,733	0,000	0	48,258	60,483	192,518	8,262
9,30	2,778	50,575	404,488	1,119	2,892	5	19	176,700	67,689	109,011	0,125	2,546	0,000	38,009	0,000	0	49,003	61,417	193,922	8,308
9,32	2,744	51,007	389,605	1,118	2,856	5	19	177,080	67,885	109,195	0,121	2,559	0,000	37,501	0,000	0	49,148	61,599	191,333	8,181
9,34	2,646	50,419	378,328	1,123	2,785	5	19	177,460	68,081	109,379	0,120	2,571	0,000	36,503	0,000	0	48,597	60,908	186,240	7,948
9,36	2,576	47,828	374,760	1,121	2,693	4	19	177,840	68,278	109,562	0,123	2,584	0,000	35,215	0,000	0	47,633	59,700	179,670	7,653
9,38	2,473	45,270	378,558	1,113	2,604	4	19	178,220	68,474	109,746	0,129	2,593	0,000	33,966	0,000	0	46,474	58,248	173,298	7,368
9,40	2,375	42,937	391,983	1,116	2,496	4	19	178,600	68,670	109,930	0,140	2,607	0,000	32,441	0,000	0	0,000	56,598	165,516	7,024
9,42	2,239	39,914	407,748	1,112	2,395	4	19	178,980	68,866	110,114	0,155	2,618	0,000	31,024	0,000	0	0,000	54,905	158,284	6,704
9,44	2,151	37,029	436,210	1,104	2,310	4	19	179,360	69,062	110,298	0,172	2,628	0,000	29,835	0,000	0	0,000	53,464	152,219	6,435
9,46	2,097	36,060	465,056	1,098	2,269	4	19	179,740	69,259	110,481	0,190	2,628	0,000	29,251	0,000	0	0,000	52,402	149,241	6,299
9,48	2,084	34,125	497,085	1,095	2,250	4	19	180,120	69,455	110,665	0,206	2,622	0,000	28,972	0,000	0	0,000	51,551	147,816	6,231
9,50	2,062	31,948	523,859	1,099	2,256	5	19	180,500	69,651	110,849	0,220	2,608	0,000	29,052	0,000	0	0,000	50,773	148,223	6,242
9,52	2,084	30,652	556,655	1,103	2,272	5	19	180,880	69,847	111,033	0,231	2,591	0,000	29,279	0,000	0	39,935	50,051	149,384	6,286
9,54	2,106	28,854	581,396	1,105	2,310	5	19	181,260	70,043	111,217	0,240	2,571	0,000	29,799	0,000	0	39,637	49,678	152,035	6,393
9,56	2,147	28,249	606,483	1,100	2,35															

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1.^a Iscrizione alla CCIAA di RE 01999610309 - N. REA 241542 - CF e P.IVA 01999610309Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
10,02	3,815	41,190	198,312	1,078	3,775	5	19	190,380	74,752	115,628	0,071	2,348	0,000	50,178	30,000	34	50,314	63,060	0,000	0,000
10,04	4,007	49,446	206,252	1,090	4,181	5	19	190,760	74,948	115,812	0,035	2,331	0,000	55,860	32,000	35	54,827	68,716	0,000	0,000
10,06	4,502	60,665	237,860	1,095	4,258	5	19	191,140	75,145	115,995	0,033	2,345	0,000	56,932	32,000	35	56,879	71,288	0,000	0,000
10,08	4,051	57,021	181,550	1,092	3,997	5	19	191,520	75,341	116,179	0,028	2,432	0,000	53,277	31,000	34	59,422	74,475	0,000	0,000
10,10	3,253	81,135	124,933	1,113	3,451	4	19	191,900	75,537	116,363	0,019	2,567	0,000	45,631	0,000	0	60,433	75,743	232,814	9,404
10,12	2,909	91,430	108,132	1,115	2,950	4	19	192,280	75,733	116,547	0,013	2,725	0,000	38,615	0,000	0	0,000	78,209	197,013	7,874
10,14	2,575	104,627	105,025	1,108	2,693	4	19	192,660	75,929	116,731	0,013	2,802	0,000	35,009	0,000	0	0,000	78,224	178,620	7,096
10,16	2,485	96,992	114,116	1,123	2,579	4	19	193,040	76,126	116,914	0,018	2,826	0,000	33,410	0,000	0	0,000	76,997	170,461	6,751
10,18	2,558	86,075	135,750	1,131	2,600	4	19	193,420	76,322	117,098	0,024	2,796	0,000	33,693	0,000	0	0,000	74,675	171,902	6,810
10,20	2,621	79,373	150,058	1,142	2,709	4	19	193,800	76,518	117,282	0,031	2,750	0,000	35,207	0,000	0	0,000	73,687	179,630	7,125
10,22	2,789	80,408	177,407	1,143	2,931	4	19	194,180	76,714	117,466	0,036	2,680	0,000	38,315	0,000	0	0,000	73,376	195,486	7,776
10,24	3,203	70,716	201,611	1,141	3,160	4	19	194,560	76,910	117,650	0,038	2,625	0,000	41,521	0,000	0	0,000	74,097	211,841	8,443
10,26	3,295	74,273	193,134	1,134	3,322	5	19	194,940	77,107	117,833	0,036	2,576	0,000	43,782	0,000	0	58,636	73,491	223,379	8,917
10,28	3,277	67,707	171,270	1,139	3,292	5	19	195,320	77,303	118,017	0,031	2,577	0,000	43,358	0,000	0	58,103	72,822	221,217	8,818
10,30	3,128	65,996	157,346	1,145	3,232	4	19	195,700	77,499	118,201	0,028	2,586	0,000	42,509	0,000	0	57,618	72,215	216,883	8,628
10,32	3,125	71,367	159,954	1,158	3,274	4	19	196,080	77,695	118,385	0,028	2,592	0,000	43,087	0,000	0	58,866	73,778	219,830	8,730
10,34	3,400	78,707	176,985	1,170	3,455	4	19	196,460	77,891	118,569	0,030	2,573	0,000	45,620	0,000	0	60,870	76,290	232,753	9,241
10,36	3,662	79,396	185,846	1,171	3,644	5	19	196,840	78,088	118,752	0,030	2,548	0,000	48,253	0,000	0	62,341	78,134	246,191	9,777
10,38	3,684	79,050	180,361	1,183	3,781	5	19	197,220	78,284	118,936	0,029	2,526	0,000	50,169	0,000	0	63,015	78,979	255,963	10,166
10,40	3,810	80,067	181,243	1,195	3,916	5	19	197,600	78,480	119,120	0,028	2,505	0,000	52,052	0,000	0	63,735	79,882	265,573	10,548
10,42	4,065	81,482	191,369	1,200	4,156	5	19	197,980	78,676	119,304	0,029	2,469	0,000	55,410	31,000	34	64,812	81,231	0,000	0,000
10,44	4,396	81,170	205,830	1,212	4,403	5	19	198,360	78,872	119,488	0,029	2,429	0,000	58,864	32,000	35	65,391	81,957	0,000	0,000
10,46	4,544	77,057	202,532	1,207	4,583	5	19	198,740	79,069	119,671	0,028	2,397	0,000	61,377	33,000	35	65,521	82,119	0,000	0,000
10,48	4,601	76,449	202,148	1,196	4,679	5	19	199,120	79,265	119,855	0,028	2,377	0,000	62,723	33,000	35	65,290	81,830	0,000	0,000
10,50	4,686	75,359	204,833	1,198	4,600	5	19	199,500	79,461	120,039	0,026	2,387	0,000	61,608	33,000	35	64,923	81,371	0,000	0,000
10,52	4,318	75,444	168,278	1,206	4,276	5	19	199,880	79,657	120,223	0,021	2,432	0,000	57,072	32,000	35	63,689	79,823	0,000	0,000
10,54	3,657	73,991	124,588	1,223	3,718	5	19	200,260	79,853	120,407	0,014	2,524	0,000	49,249	0,000	0	61,773	77,422	251,271	9,873
10,56	3,047																			

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1^a Iscrizione alla CCIAA di RE 01999610309 - N. REA 241542 - CF e P.IVA 01999610309Certificazione Qualità 9001:2008 SOA 05208 1^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
11,02	0,607	13,500	163,713	1,388	0,663	3	19	209,380	84,562	124,818	0,174	3,370	0,000	1,648	0,000	0	0,000	29,134	32,394	1,199
11,04	0,571	10,839	171,155	1,390	0,723	3	19	209,760	84,758	125,002	0,224	3,267	0,000	2,111	0,000	0	0,000	28,940	36,694	1,356
11,06	0,789	11,387	264,787	1,380	0,816	4	19	210,140	84,955	125,185	0,244	3,157	0,000	2,928	0,000	0	0,000	29,698	43,243	1,596
11,08	0,850	11,319	262,524	1,410	1,047	4	19	210,520	85,151	125,369	0,220	2,969	0,000	5,579	0,000	0	0,000	32,311	59,739	2,201
11,10	1,228	10,871	279,440	1,436	1,349	4	19	210,900	85,347	125,553	0,143	2,808	0,000	10,365	0,000	0	0,000	35,893	81,325	3,004
11,12	1,718	15,069	202,071	1,462	1,745	5	19	211,280	85,543	125,737	0,096	2,687	0,000	18,978	0,000	0	0,000	41,455	109,541	4,084
11,14	2,052	23,535	216,417	1,478	2,098	5	19	211,660	85,739	125,921	0,059	2,626	0,000	26,402	0,000	0	0,000	47,188	134,704	5,042
11,16	2,322	28,164	172,075	1,501	2,273	5	19	212,040	85,936	126,104	0,036	2,605	0,000	28,857	0,000	0	0,000	50,256	147,230	5,513
11,18	2,283	25,850	88,838	1,512	2,255	5	19	212,420	86,132	126,288	0,012	2,614	0,000	28,597	0,000	0	0,000	50,388	145,906	5,452
11,20	2,047	24,607	69,007	1,530	2,046	5	19	212,800	86,328	126,472	-0,007	2,659	0,000	25,661	0,000	0	0,000	47,853	130,922	4,866
11,22	1,731	20,790	63,560	1,534	1,710	4	19	213,180	86,524	126,656	-0,016	2,748	0,000	17,855	0,000	0	0,000	43,721	106,914	3,937
11,24	1,288	15,194	54,507	1,534	1,366	4	19	213,560	86,720	126,840	-0,025	2,862	0,000	10,470	0,000	0	0,000	38,871	82,315	2,998
11,26	1,020	12,983	55,121	1,557	1,076	4	19	213,940	86,917	127,023	-0,034	3,005	0,000	5,853	0,000	0	0,000	34,898	61,591	2,240
11,28	0,862	14,712	62,677	1,586	1,036	4	19	214,320	87,113	127,207	-0,014	3,023	0,000	5,312	0,000	0	0,000	34,009	58,715	2,132
11,30	1,150	12,916	108,477	1,609	1,345	4	19	214,700	87,309	127,391	0,024	2,842	0,000	10,034	0,000	0	0,000	37,195	80,726	2,930
11,32	1,905	14,195	173,725	1,626	1,999	5	19	215,080	87,505	127,575	0,041	2,586	0,000	24,976	0,000	0	33,872	42,453	127,431	4,729
11,34	2,778	18,998	201,764	1,632	2,620	5	19	215,460	87,701	127,759	0,041	2,436	0,000	33,670	24,000	32	37,762	47,328	0,000	0,000
11,36	2,989	20,328	180,130	1,635	3,003	5	19	215,840	87,898	127,942	0,033	2,359	0,000	39,016	26,000	33	39,699	49,757	0,000	0,000
11,38	3,058	17,409	157,384	1,640	3,070	5	19	216,220	88,094	128,126	0,026	2,335	0,000	39,953	26,000	33	39,413	49,397	0,000	0,000
11,40	2,997	16,044	150,786	1,646	3,028	5	19	216,600	88,290	128,310	0,022	2,308	0,000	39,355	26,000	33	37,543	47,054	0,000	0,000
11,42	2,875	11,070	142,424	1,656	2,897	5	19	216,980	88,486	128,494	0,020	2,298	0,000	37,517	25,000	32	35,304	44,247	0,000	0,000
11,44	2,673	8,496	132,873	1,664	2,712	5	19	217,360	88,682	128,678	0,018	2,291	0,000	34,922	24,000	32	32,603	40,862	0,000	0,000
11,46	2,452	6,769	122,555	1,677	2,486	5	19	217,740	88,879	128,861	0,015	2,321	0,000	31,758	23,000	32	30,793	38,594	0,000	0,000
11,48	2,208	6,925	114,039	1,682	2,201	5	19	218,120	89,075	129,045	0,012	2,415	0,000	27,758	21,000	31	30,307	37,985	0,000	0,000
11,50	1,828	10,933	100,269	1,686	1,897	5	19	218,500	89,271	129,229	0,008	2,548	0,000	22,455	20,000	30	30,386	38,083	0,000	0,000
11,52	1,551	12,539	93,402	1,702	1,624	5	19	218,880	89,467	129,413	0,004	2,691	0,000	15,503	0,000	0	0,000	38,187	100,395	3,640
11,54	1,397	13,335	91,676	1,715	1,450	4	19	219,260	89,663	129,597	0,002	2,809	0,000	11,730	0,000	0	0,000	38,857	87,900	3,146
11,56	1,307	18,465	91,983	1,727	1,354	4	19	219,640	89,860	129,780	0,003	2,9								

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1.^a Iscrizione alla CCIAA di RE 01999610309 - N. REA 241942 - CF e P.IVA 01999610309Certificazione Qualità 9001:2008 SOA OS20b 1.^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
12,02	4,825	32,416	156,118	2,026	4,757	5	19	228,380	94,372	134,008	0,013	2,211	0,000	63,404	32,000	35	53,485	67,035	0,000	0,000
12,04	4,320	36,475	128,577	2,027	4,539	5	19	228,760	94,568	134,192	0,011	2,221	0,000	60,339	31,000	35	51,519	64,570	0,000	0,000
12,06	4,325	27,653	145,838	2,037	4,326	5	19	229,140	94,765	134,375	0,011	2,228	0,000	57,352	31,000	34	49,449	61,976	0,000	0,000
12,08	4,191	22,437	141,312	2,047	4,494	5	19	229,520	94,961	134,559	0,014	2,208	0,000	59,708	31,000	34	50,181	62,894	0,000	0,000
12,10	4,810	38,156	177,062	2,064	4,961	5	19	229,900	95,157	134,743	0,018	2,200	0,000	66,231	33,000	35	55,109	69,070	0,000	0,000
12,12	5,697	52,581	225,470	2,084	5,920	6	19	230,280	95,353	134,927	0,026	2,149	0,000	77,800	36,000	36	62,074	77,800	0,000	0,000
12,14	7,010	56,796	318,911	2,099	6,739	6	19	230,660	95,549	135,111	0,030	2,091	0,000	82,698	39,000	37	65,982	82,698	0,000	0,000
12,16	7,217	54,550	322,708	2,106	7,221	6	19	231,040	95,746	135,294	0,032	2,049	0,000	84,215	40,000	37	67,193	84,215	0,000	0,000
12,18	7,114	54,170	309,359	2,117	7,222	6	19	231,420	95,942	135,478	0,031	2,022	0,000	81,481	40,000	37	65,011	81,481	0,000	0,000
12,20	7,019	39,764	299,808	2,128	7,195	6	19	231,800	96,138	135,662	0,030	1,982	0,000	77,106	40,000	37	61,520	77,106	0,000	0,000
12,22	7,141	29,434	307,288	2,130	7,346	6	19	232,180	96,334	135,846	0,031	1,913	0,000	72,179	41,000	37	57,590	72,179	0,000	0,000
12,24	7,558	26,031	335,481	2,148	7,627	6	19	232,560	96,530	136,030	0,030	1,850	0,000	69,285	42,000	37	55,281	69,285	0,000	0,000
12,26	7,860	22,437	304,411	2,152	7,900	6	19	232,940	96,727	136,213	0,026	1,824	0,000	69,460	43,000	37	55,420	69,460	0,000	0,000
12,28	7,979	27,307	253,970	2,159	7,888	6	19	233,320	96,923	136,397	0,020	1,855	0,000	72,124	42,000	37	57,545	72,124	0,000	0,000
12,30	7,574	38,742	184,887	2,175	7,551	6	19	233,700	97,119	136,581	0,014	1,931	0,000	75,948	41,000	37	60,597	75,948	0,000	0,000
12,32	6,899	45,599	153,663	2,194	6,874	6	19	234,080	97,315	136,765	0,008	2,027	0,000	77,793	39,000	37	62,069	77,793	0,000	0,000
12,34	5,994	46,081	116,034	2,207	6,047	6	19	234,460	97,511	136,949	0,004	2,116	0,000	76,244	36,000	36	60,833	76,244	0,000	0,000
12,36	5,127	41,986	88,761	2,212	5,058	5	19	234,840	97,708	137,132	-0,002	2,193	0,000	69,769	33,000	35	55,666	69,769	0,000	0,000
12,38	3,964	24,814	58,305	2,219	4,026	5	19	235,220	97,904	137,316	-0,010	2,282	0,000	53,068	29,000	34	48,959	61,362	0,000	0,000
12,40	2,924	19,233	36,594	2,236	3,047	5	19	235,600	98,100	137,500	-0,021	2,414	0,000	39,358	25,000	32	42,947	53,827	0,000	0,000
12,42	2,212	23,481	25,086	2,252	2,324	5	19	235,980	98,296	137,684	-0,034	2,620	0,000	29,226	0,000	0	0,000	51,846	149,114	5,138
12,44	1,807	31,616	21,097	2,262	1,872	4	19	236,360	98,492	137,868	-0,046	2,845	0,000	19,403	0,000	0	0,000	53,990	116,826	3,915
12,46	1,572	45,882	25,547	2,271	1,684	4	19	236,740	98,689	138,051	-0,048	2,977	0,000	15,170	0,000	0	0,000	56,531	103,368	3,459
12,48	1,643	51,426	40,583	2,282	1,658	4	19	237,120	98,885	138,235	-0,042	3,023	0,000	14,613	0,000	0	0,000	58,827	101,520	3,393
12,50	1,720	50,578	52,244	2,305	1,654	3	19	237,500	99,081	138,419	-0,036	3,040	0,000	14,504	0,000	0	0,000	59,914	101,207	3,378
12,52	1,551	54,601	52,781	2,322	1,517	3	19	237,880	99,277	138,603	-0,040	3,103	0,000	11,809	0,000	0	0,000	58,571	91,385	3,046
12,54																				

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1^a Iscrizione alla CCIAA di Re 01999610309 - N.REA 241542 CF e P.IVA 01999610309Certificazione Qualità 9001:2008 SOA 0520b 1^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
13,02	0,449	5,648	292,137	2,595	0,561	3	19	247,380	104,182	143,198	0,600	3,476	0,000	0,687	0,000	0	0,000	23,034	22,403	0,723
13,04	0,525	4,335	313,694	2,603	0,614	4	19	247,760	104,378	143,382	0,628	3,326	0,000	0,937	0,000	0	0,000	22,256	26,176	0,843
13,06	0,527	3,155	397,315	2,591	0,682	4	19	248,140	104,575	143,565	0,612	3,229	0,000	1,314	0,000	0	0,000	23,344	31,024	0,998
13,08	0,617	5,608	400,115	2,605	0,725	4	19	248,520	104,771	143,749	0,617	3,230	0,000	1,576	0,000	0	0,000	25,613	34,002	1,093
13,10	0,622	9,063	398,542	2,606	0,743	4	19	248,900	104,967	143,933	0,595	3,284	0,000	1,694	0,000	0	0,000	28,450	35,266	1,132
13,12	0,581	11,966	397,545	2,612	0,725	3	19	249,280	105,163	144,117	0,612	3,368	0,000	1,569	0,000	0	0,000	30,447	33,966	1,089
13,14	0,567	14,937	391,906	2,632	0,692	3	19	249,660	105,359	144,301	0,649	3,458	0,000	1,356	0,000	0	0,000	31,745	31,602	1,012
13,16	0,528	17,823	387,649	2,641	0,667	3	19	250,040	105,556	144,484	0,674	3,534	0,000	1,202	0,000	0	0,000	32,935	29,762	0,952
13,18	0,511	20,777	379,939	2,649	0,633	3	19	250,420	105,752	144,668	0,721	3,620	0,000	1,009	0,000	0	0,000	33,682	27,295	0,872
13,20	0,470	23,368	375,758	2,665	0,600	3	19	250,800	105,948	144,852	0,778	3,695	0,000	0,841	0,000	0	0,000	33,830	24,926	0,795
13,22	0,433	23,334	376,410	2,675	0,570	3	19	251,180	106,144	145,036	0,853	3,754	0,000	0,702	0,000	0	0,000	33,295	22,784	0,726
13,24	0,421	21,866	382,969	2,686	0,554	3	19	251,560	106,340	145,220	0,916	3,774	0,000	0,630	0,000	0	0,000	32,415	21,610	0,688
13,26	0,417	20,104	390,832	2,696	0,540	3	19	251,940	106,537	145,403	0,984	3,783	0,000	0,582	0,000	0	0,000	31,241	20,599	0,655
13,28	0,385	17,928	397,277	2,706	0,528	3	19	252,320	106,733	145,587	1,053	3,783	0,000	0,582	0,000	0	0,000	29,879	19,695	0,625
13,30	0,378	15,320	402,723	2,715	0,514	3	19	252,700	106,929	145,771	1,132	3,783	0,000	0,583	0,000	0	0,000	28,305	18,650	0,591
13,32	0,368	13,040	407,672	2,728	0,509	3	19	253,080	107,125	145,955	1,174	3,754	0,000	0,584	0,000	0	0,000	26,723	18,283	0,579
13,34	0,366	10,052	412,236	2,737	0,507	3	19	253,460	107,321	146,139	1,204	3,711	0,000	0,585	0,000	0	0,000	25,048	18,079	0,572
13,36	0,366	7,530	416,264	2,749	0,508	3	19	253,840	107,518	146,322	1,215	3,648	0,000	0,585	0,000	0	0,000	23,231	18,161	0,573
13,38	0,368	5,267	420,713	2,760	0,514	3	19	254,220	107,714	146,506	1,206	3,580	0,000	0,586	0,000	0	0,000	21,733	18,535	0,584
13,40	0,378	4,248	425,278	2,766	0,517	3	19	254,600	107,910	146,690	1,204	3,523	0,000	0,587	0,000	0	0,000	20,481	18,776	0,591
13,42	0,373	3,453	427,503	2,781	0,524	4	19	254,980	108,106	146,874	1,186	3,477	0,000	0,588	0,000	0	0,000	19,814	19,239	0,605
13,44	0,386	3,074	430,150	2,790	0,525	1	19	255,360	108,302	147,058	1,194	3,446	0,000	0,588	0,000	0	0,000	19,098	19,290	0,606
13,46	0,378	2,435	434,561	2,805	0,533	1	19	255,740	108,499	147,241	1,175	3,408	0,000	0,589	0,000	0	0,000	18,708	19,835	0,622
13,48	0,393	2,211	439,931	2,819	0,536	1	19	256,120	108,695	147,425	1,185	3,385	0,000	0,590	0,000	0	0,000	18,348	20,013	0,627
13,50	0,388	2,194	447,488	2,826	0,554	1	19	256,500	108,891	147,609	1,137	3,350	0,000	0,600	0,000	0	0,000	18,643	21,257	0,665
13,52	0,425	2,332	454,315	2,835	0,572	1	19	256,880	109,087	147,793	1,097	3,326	0,000	0,673	0,000	0	0,000	19,157	22,535	0,704
13,54																				

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Certificazione Qualità 9001:2008 SOA OS20b 1.^a categoria
Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
14,02	0,888	11,811	222,401	3,074	1,304	4	19	266,380	113,992	152,388	0,082	2,981	0,000	7,064	0,000	0	0,000	40,704	74,109	2,247
14,04	1,871	25,682	156,233	3,060	1,911	5	19	266,760	114,188	152,572	0,027	2,762	0,000	17,879	0,000	0	0,000	48,915	117,445	3,588
14,06	2,813	22,780	96,471	3,066	2,935	5	19	267,140	114,385	152,755	0,009	2,521	0,000	37,354	23,000	31	46,653	58,471	0,000	0,000
14,08	3,980	31,296	164,864	3,071	4,043	5	19	267,520	114,581	152,939	0,007	2,293	0,000	52,861	28,000	33	49,473	62,007	0,000	0,000
14,10	5,193	21,847	160,069	3,087	4,991	6	19	267,900	114,777	153,123	0,010	2,149	0,000	64,609	31,000	34	51,550	64,609	0,000	0,000
14,12	5,634	20,776	161,335	3,101	5,586	6	19	268,280	114,973	153,307	0,008	2,035	0,000	62,958	34,000	35	50,232	62,958	0,000	0,000
14,14	5,773	16,872	144,112	3,099	5,809	6	19	268,660	115,169	153,491	0,006	1,971	0,000	60,494	34,000	35	48,267	60,494	0,000	0,000
14,16	5,868	9,497	138,090	3,110	5,820	6	19	269,040	115,366	153,674	0,004	1,925	0,000	57,167	35,000	35	45,612	57,167	0,000	0,000
14,18	5,678	8,046	131,799	3,128	5,676	6	19	269,420	115,562	153,858	0,003	1,898	0,000	53,839	34,000	35	42,957	53,839	0,000	0,000
14,20	5,347	6,180	123,859	3,138	5,323	6	19	269,800	115,758	154,042	0,001	1,913	0,000	51,245	33,000	35	40,887	51,245	0,000	0,000
14,22	4,821	3,848	108,861	3,130	4,893	6	19	270,180	115,954	154,226	-0,001	1,949	0,000	49,093	31,000	35	39,170	49,093	0,000	0,000
14,24	4,399	5,299	99,310	3,138	4,414	6	19	270,560	116,150	154,410	-0,004	2,005	0,000	47,215	30,000	34	37,671	47,215	0,000	0,000
14,26	3,922	5,575	92,520	3,149	3,950	6	19	270,940	116,347	154,593	-0,007	2,087	0,000	46,536	28,000	33	37,130	46,536	0,000	0,000
14,28	3,437	7,285	83,544	3,155	3,397	6	19	271,320	116,543	154,777	-0,011	2,243	0,000	43,757	25,000	32	38,436	48,173	0,000	0,000
14,30	2,747	16,992	74,031	3,164	2,782	5	19	271,700	116,739	154,961	-0,016	2,456	0,000	35,149	22,000	31	40,419	50,659	0,000	0,000
14,32	2,084	23,124	74,185	3,171	2,122	5	19	272,080	116,935	155,145	-0,018	2,725	0,000	22,380	0,000	0	0,000	52,508	132,110	3,993
14,34	1,448	28,944	101,688	3,180	1,620	4	19	272,460	117,131	155,329	0,002	2,951	0,000	11,697	0,000	0	0,000	50,904	96,279	2,864
14,36	1,207	27,873	181,665	3,193	1,317	4	19	272,840	117,328	155,512	0,063	3,097	0,000	7,011	0,000	0	0,000	47,469	74,585	2,216
14,38	1,109	20,927	266,935	3,204	1,196	4	19	273,220	117,524	155,696	0,148	3,131	0,000	5,469	0,000	0	0,000	43,766	65,915	1,956
14,40	1,013	16,020	313,234	3,228	1,123	4	19	273,600	117,720	155,880	0,222	3,129	0,000	4,631	0,000	0	0,000	40,190	60,689	1,799
14,42	0,935	14,119	338,742	3,231	1,045	4	19	273,980	117,916	156,064	0,287	3,149	0,000	3,806	0,000	0	0,000	37,432	55,051	1,630
14,44	0,840	12,598	365,401	3,231	0,978	4	19	274,360	118,112	156,248	0,348	3,192	0,000	3,167	0,000	0	0,000	36,063	50,243	1,486
14,46	0,788	13,703	384,465	3,224	1,044	4	19	274,740	118,309	156,431	0,372	3,132	0,000	3,787	0,000	0	0,000	36,559	54,978	1,624
14,48	1,093	12,562	463,867	3,214	1,399	4	19	275,120	118,505	156,615	0,297	2,911	0,000	8,064	0,000	0	0,000	40,351	80,271	2,368
14,50	1,854	12,491	508,707	3,203	1,987	5	19	275,500	118,701	156,799	0,193	2,660	0,000	19,183	0,000	0	0,000	44,742	122,278	3,698
14,52	2,558	14,200	372,305	3,178	2,724	5	19	275,880	118,897	156,983	0,101	2,466	0,000	34,272	22,000	31	39,897	50,004	0,000	0,000
14,54	3,385	18,102	218,565	3,180	3,389	5	19	276,260												

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Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
15,02	0,486	14,557	265,554	3,242	0,587	3	19	285,380	123,802	161,578	0,552	3,768	0,000	0,646	0,000	0	0,000	32,004	21,517	0,615
15,04	0,474	19,916	405,485	3,199	0,668	3	19	285,760	123,998	161,762	0,627	3,603	0,000	0,902	0,000	0	0,000	32,964	27,285	0,779
15,06	0,672	13,542	419,409	3,204	0,747	3	19	286,140	124,195	161,945	0,634	3,475	0,000	1,310	0,000	0	0,000	33,771	32,902	0,939
15,08	0,669	10,778	423,897	3,201	0,802	4	19	286,520	124,391	162,129	0,594	3,341	0,000	1,639	0,000	0	0,000	31,915	36,825	1,049
15,10	0,625	7,616	449,214	3,188	0,786	4	19	286,900	124,587	162,313	0,636	3,303	0,000	1,537	0,000	0	0,000	29,480	35,678	1,016
15,12	0,613	5,440	453,471	3,191	0,760	4	19	287,280	124,783	162,497	0,684	3,289	0,000	1,375	0,000	0	0,000	27,389	33,758	0,960
15,14	0,584	5,371	440,852	3,190	0,734	4	19	287,660	124,979	162,681	0,716	3,311	0,000	1,222	0,000	0	0,000	26,585	31,849	0,904
15,16	0,550	6,459	438,895	3,194	0,704	4	19	288,040	125,176	162,864	0,745	3,371	0,000	1,060	0,000	0	0,000	26,724	29,676	0,842
15,18	0,533	7,375	424,588	3,198	0,684	4	19	288,420	125,372	163,048	0,739	3,412	0,000	0,958	0,000	0	0,000	26,754	28,234	0,800
15,20	0,542	6,562	388,723	3,204	0,670	4	19	288,800	125,568	163,232	0,718	3,441	0,000	0,891	0,000	0	0,000	26,780	27,242	0,771
15,22	0,528	7,339	384,887	3,204	0,677	4	19	289,180	125,764	163,416	0,672	3,436	0,000	0,920	0,000	0	0,000	27,069	27,700	0,783
15,24	0,567	7,892	385,079	3,212	0,702	4	19	289,560	125,960	163,600	0,634	3,413	0,000	1,037	0,000	0	0,000	27,945	29,426	0,831
15,26	0,615	7,995	391,024	3,215	0,824	4	19	289,940	126,157	163,783	0,512	3,265	0,000	1,743	0,000	0	0,000	30,052	38,165	1,077
15,28	0,883	7,615	422,401	3,221	0,987	4	19	290,320	126,353	163,967	0,380	3,119	0,000	2,961	0,000	0	0,000	32,576	49,773	1,402
15,30	1,064	8,755	361,028	3,218	1,135	4	19	290,700	126,549	164,151	0,268	3,032	0,000	4,340	0,000	0	0,000	35,319	60,289	1,697
15,32	1,098	11,209	273,725	3,212	1,131	4	19	291,080	126,745	164,335	0,185	3,071	0,000	4,297	0,000	0	0,000	36,954	60,025	1,688
15,34	0,945	13,576	212,236	3,205	1,023	4	19	291,460	126,941	164,519	0,140	3,193	0,000	3,250	0,000	0	0,000	37,531	52,227	1,467
15,36	0,791	16,410	201,764	3,205	0,863	3	19	291,840	127,138	164,702	0,148	3,371	0,000	1,983	0,000	0	0,000	36,735	40,823	1,145
15,38	0,638	17,999	221,366	3,200	0,731	3	19	292,220	127,334	164,886	0,244	3,545	0,000	1,170	0,000	0	0,000	35,217	31,375	0,879
15,40	0,526	17,637	279,939	3,203	0,635	3	19	292,600	127,530	165,070	0,439	3,687	0,000	0,711	0,000	0	0,000	32,8		

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Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

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Profondità raggiunta: 36,48 m da p.c.

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Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
16,02	0,890	47,828	250,595	3,237	0,980	3	19	304,380	133,612	170,768	0,226	3,540	0,000	2,674	0,000	0	0,000	53,837	48,269	1,306
16,04	0,844	47,288	368,124	3,230	0,975	3	19	304,760	133,808	170,952	0,289	3,547	0,000	2,630	0,000	0	0,000	53,843	47,891	1,294
16,06	0,858	48,774	363,061	3,242	0,974	3	19	305,140	134,005	171,135	0,351	3,552	0,000	2,614	0,000	0	0,000	54,069	47,772	1,290
16,08	0,844	49,758	375,949	3,241	0,983	3	19	305,520	134,201	171,319	0,358	3,546	0,000	2,681	0,000	0	0,000	54,410	48,408	1,305
16,10	0,863	48,532	392,290	3,243	0,995	3	19	305,900	134,397	171,503	0,371	3,535	0,000	2,768	0,000	0	0,000	54,510	49,218	1,326
16,12	0,880	47,634	401,534	3,249	1,018	3	19	306,280	134,593	171,687	0,369	3,509	0,000	2,948	0,000	0	0,000	54,471	50,814	1,367
16,14	0,904	45,906	397,507	3,251	1,027	3	19	306,660	134,789	171,871	0,359	3,496	0,000	3,017	0,000	0	0,000	54,278	51,436	1,383
16,16	0,895	45,508	380,322	3,243	1,025	3	19	307,040	134,986	172,054	0,353	3,496	0,000	2,996	0,000	0	0,000	54,065	51,281	1,377
16,18	0,880	46,026	386,997	3,252	1,016	3	19	307,420	135,182	172,238	0,352	3,502	0,000	2,918	0,000	0	0,000	53,806	50,639	1,358
16,20	0,882	44,902	387,802	3,244	1,013	3	19	307,800	135,378	172,422	0,362	3,504	0,000	2,886	0,000	0	0,000	53,690	50,384	1,350
16,22	0,879	44,885	397,123	3,250	1,015	3	19	308,180	135,574	172,606	0,372	3,504	0,000	2,891	0,000	0	0,000	53,732	50,459	1,351
16,24	0,877	46,007	409,244	3,244	1,022	3	19	308,560	135,770	172,790	0,382	3,500	0,000	2,944	0,000	0	0,000	54,018	50,948	1,362
16,26	0,893	46,006	417,645	3,246	1,027	3	19	308,940	135,967	172,973	0,392	3,501	0,000	2,984	0,000	0	0,000	54,468	51,318	1,371
16,28	0,886	47,543	426,966	3,238	1,036	3	19	309,320	136,163	173,157	0,402	3,497	0,000	3,052	0,000	0	0,000	54,832	51,925	1,385
16,30	0,893	47,525	439,586	3,228	1,061	3	19	309,700	136,359	173,341	0,401	3,479	0,000	3,259	0,000	0	0,000	55,410	53,685	1,431
16,32	0,958	47,006	447,526	3,234	1,095	3	19	310,080	136,555	173,525	0,396	3,455	0,000	3,550	0,000	0	0,000	56,105	56,065	1,493
16,34	0,978	48,387	454,737	3,220	1,138	3	19	310,460	136,751	173,709	0,388	3,428	0,000	3,942	0,000	0	0,000	57,195	58,109	1,572
16,36	1,011	50,441	470,733	3,223	1,225	3	19	310,840	136,948	173,892	0,360	3,373	0,000	4,804	0,000	0	0,000	58,935	65,283	1,734
16,38	1,211	49,940	471,308	3,210	1,206	3	19	311,220	137,144	174,076	0,184	3,391	0,000	4,601	0,000	0	0,000	58,998	63,921	1,696
16,40	1,089	50,975	-37,054	3,225	1,169	3	19	311,600	137,340	174,260	0,003	3,424	0,000	4,215	0,000	0	0,000	58,902		

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
17,02	1,675	93,019	290,717	3,155	1,615	3	19	323,380	143,422	179,958	0,114	3,303	0,000	9,268	0,000	0	0,000	76,191	92,245	2,368
17,04	1,232	58,308	307,403	3,157	1,657	3	19	323,760	143,618	180,142	0,114	3,298	0,000	9,874	0,000	0	0,000	78,226	95,263	2,443
17,06	1,765	106,399	287,227	3,148	1,684	3	19	324,140	143,815	180,325	0,112	3,302	0,000	10,251	0,000	0	0,000	80,069	97,116	2,488
17,08	1,753	107,418	293,863	3,162	1,865	3	19	324,520	144,011	180,509	0,099	3,270	0,000	13,141	0,000	0	0,000	87,107	110,012	2,816
17,10	1,775	106,036	306,789	3,170	1,881	3	19	324,900	144,207	180,693	0,105	3,263	0,000	13,394	0,000	0	0,000	87,289	111,120	2,841
17,12	1,801	105,829	320,176	3,165	1,904	3	19	325,280	144,403	180,877	0,109	3,252	0,000	13,786	0,000	0	0,000	87,299	112,794	2,881
17,14	1,814	104,015	324,856	3,160	1,903	3	19	325,660	144,599	181,061	0,113	3,245	0,000	13,736	0,000	0	0,000	86,467	112,645	2,874
17,16	1,765	97,277	321,289	3,167	1,883	3	19	326,040	144,796	181,244	0,115	3,246	0,000	13,368	0,000	0	0,000	85,429	111,181	2,834
17,18	1,740	97,415	323,168	3,161	1,849	3	19	326,420	144,992	181,428	0,118	3,254	0,000	12,784	0,000	0	0,000	84,434	108,782	2,770
17,20	1,713	97,811	328,423	3,175	1,844	3	19	326,800	145,188	181,612	0,119	3,250	0,000	12,672	0,000	0	0,000	83,722	108,358	2,757
17,22	1,746	90,502	326,812	3,168	1,862	3	19	327,180	145,384	181,796	0,121	3,243	0,000	12,951	0,000	0	0,000	83,910	109,602	2,785
17,24	1,789	96,752	336,287	3,160	1,907	3	19	327,560	145,580	181,980	0,121	3,232	0,000	13,701	0,000	0	0,000	85,145	112,788	2,863
17,26	1,842	104,282	345,455	3,153	1,960	3	19	327,940	145,777	182,163	0,123	3,227	0,000	14,625	0,000	0	0,000	87,457	116,588	2,957
17,28	1,897	106,957	355,466	3,159	1,974	3	19	328,320	145,973	182,347	0,129	3,237	0,000	14,857	0,000	0	0,000	89,367	117,567	2,979
17,30	1,818	114,435	373,801	3,165	1,992	3	19	328,700	146,169	182,531	0,136	3,239	0,000	15,161	0,000	0	0,000	90,449	118,824	3,008
17,32	1,881	113,034	388,646	3,169	2,002	3	19	329,080	146,365	182,715	0,145	3,239	0,000	15,316	0,000	0	0,000	90,989	119,489	3,021
17,34	1,910	111,080	404,411	3,161	2,049	3	19	329,460	146,561	182,899	0,149	3,220	0,000	16,166	0,000	0	0,000	91,376	122,823	3,102
17,36	1,946	112,098	415,152	3,159	2,085	3	19	329,840	146,758	183,082	0,154	3,207	0,000	16,825	0,000	0	0,000	91,639	125,365	3,164
17,38	1,974	110,922	432,029	3,157	2,124	3	19	330,220	146,954	183,266	0,156	3,189	0,000	17,564	0,000	0	0,000	91,649	128,152	3,231
17,40	2,017	106,014	434,714	3,155	2,133	3	19	330,600	147,150	183,450										

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
18,02	1,920	90,398	684,043	3,170	2,140	3	19	342,380	153,232	189,148	0,315	3,151	0,000	17,093	0,000	0	0,000	87,491	128,433	3,137
18,04	1,799	95,848	781,013	3,132	2,166	3	19	342,760	153,428	189,332	0,315	3,154	0,000	17,559	0,000	0	0,000	89,014	130,237	3,178
18,06	2,038	100,668	717,645	3,124	2,215	3	19	343,140	153,625	189,515	0,309	3,145	0,000	18,492	0,000	0	0,000	90,418	133,718	3,260
18,08	2,062	98,319	697,699	3,127	2,275	3	19	343,520	153,821	189,699	0,281	3,127	0,000	19,663	0,000	0	0,000	91,176	137,954	3,360
18,10	2,014	96,557	675,873	3,132	2,239	3	19	343,900	154,017	189,883	0,272	3,134	0,000	18,923	0,000	0	0,000	90,287	135,397	3,294
18,12	1,960	95,521	633,257	3,133	2,160	3	19	344,280	154,213	190,067	0,266	3,161	0,000	17,341	0,000	0	0,000	89,531	129,677	3,152
18,14	1,855	99,183	602,839	3,146	2,090	3	19	344,660	154,409	190,251	0,260	3,190	0,000	16,011	0,000	0	0,000	89,201	124,663	3,027
18,16	1,833	100,772	590,257	3,141	2,048	3	19	345,040	154,606	190,434	0,256	3,211	0,000	15,231	0,000	0	0,000	89,467	121,650	2,951
18,18	1,853	102,655	580,514	3,141	2,000	3	19	345,420	154,802	190,618	0,260	3,240	0,000	14,368	0,000	0	0,000	90,097	118,209	2,865
18,20	1,718	111,015	583,813	3,139	1,955	3	19	345,800	154,998	190,802	0,271	3,264	0,000	13,573	0,000	0	0,000	90,417	114,946	2,783
18,22	1,691	109,563	607,863	3,142	1,911	3	19	346,180	155,194	190,986	0,286	3,281	0,000	12,822	0,000	0	0,000	89,764	111,778	2,704
18,24	1,708	101,409	617,146	3,145	1,914	3	19	346,560	155,390	191,170	0,291	3,269	0,000	12,845	0,000	0	0,000	88,583	111,932	2,705
18,26	1,718	98,195	608,247	3,144	1,905	3	19	346,940	155,587	191,353	0,292	3,260	0,000	12,691	0,000	0	0,000	87,013	111,311	2,687
18,28	1,666	94,532	608,784	3,149	1,893	3	19	347,320	155,783	191,537	0,294	3,256	0,000	12,480	0,000	0	0,000	85,931	110,434	2,664
18,30	1,673	91,940	615,343	3,140	1,853	3	19	347,700	155,979	191,721	0,305	3,260	0,000	11,818	0,000	0	0,000	84,064	107,517	2,591
18,32	1,592	84,822	620,598	3,138	1,849	3	19	348,080	156,175	191,905	0,310	3,250	0,000	11,736	0,000	0	0,000	82,802	107,197	2,581
18,34	1,648	82,799	627,349	3,136	1,873	3	19	348,460	156,371	192,089	0,306	3,238	0,000	12,092	0,000	0	0,000	82,837	108,861	2,618
18,36	1,742	89,223	621,979	3,143	1,925	3	19	348,840	156,568	192,272	0,295	3,228	0,000	12,916	0,000	0	0,000	84,565	112,562	

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
19,02	1,845	127,462	444,918	3,216	1,742	3	19	361,380	163,042	198,338	0,226	3,361	0,000	9,606	0,000	0	0,000	87,622	98,595	2,297
19,04	0,969	61,990	507,787	3,194	1,704	3	19	361,760	163,238	198,522	0,252	3,398	0,000	9,077	0,000	0	0,000	89,282	95,884	2,231
19,06	1,787	144,697	552,474	3,189	1,663	3	19	362,140	163,435	198,705	0,282	3,431	0,000	8,516	0,000	0	0,000	90,296	92,917	2,160
19,08	1,692	145,232	532,374	3,188	1,876	3	19	362,520	163,631	198,889	0,248	3,395	0,000	11,512	0,000	0	0,000	100,321	108,084	2,511
19,10	1,599	140,362	530,150	3,186	1,829	3	19	362,900	163,827	199,073	0,255	3,402	0,000	10,801	0,000	0	0,000	98,005	104,740	2,431
19,12	1,648	124,954	549,444	3,193	1,798	3	19	363,280	164,023	199,257	0,267	3,395	0,000	10,337	0,000	0	0,000	95,154	102,511	2,377
19,14	1,590	117,060	559,954	3,193	1,820	3	19	363,660	164,219	199,441	0,275	3,356	0,000	10,634	0,000	0	0,000	91,864	104,023	2,410
19,16	1,646	100,027	583,698	3,191	1,826	3	19	364,040	164,416	199,624	0,282	3,326	0,000	10,706	0,000	0	0,000	88,774	104,420	2,417
19,18	1,653	91,459	588,186	3,193	1,833	3	19	364,420	164,612	199,808	0,287	3,293	0,000	10,791	0,000	0	0,000	85,568	104,883	2,425
19,20	1,602	84,221	585,501	3,192	1,811	3	19	364,800	164,808	199,992	0,282	3,276	0,000	10,460	0,000	0	0,000	82,493	103,311	2,387
19,22	1,594	73,717	544,841	3,186	1,746	3	19	365,180	165,004	200,176	0,275	3,285	0,000	9,529	0,000	0	0,000	79,637	98,652	2,277
19,24	1,487	73,284	505,946	3,197	1,690	3	19	365,560	165,200	200,360	0,247	3,294	0,000	8,750	0,000	0	0,000	77,238	94,577	2,181
19,26	1,486	69,707	426,084	3,192	1,585	3	19	365,940	165,397	200,543	0,216	3,343	0,000	7,407	0,000	0	0,000	75,606	87,056	2,006
19,28	1,344	71,968	354,354	3,196	1,454	3	19	366,320	165,593	200,727	0,190	3,423	0,000	5,898	0,000	0	0,000	74,751	77,722	1,789
19,30	1,154	82,867	335,251	3,196	1,298	3	19	366,700	165,789	200,911	0,185	3,533	0,000	4,317	0,000	0	0,000	73,479	66,523	1,530
19,32	1,051	82,278	325,853	3,206	1,154	3	19	367,080	165,985	201,095	0,211	3,644	0,000	3,079	0,000	0	0,000	71,512	56,202	1,291
19,34	0,919	79,858	334,446	3,297	1,057	3	19	367,460	166,181	201,279	0,252									

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20,02	1,545	59,379	707,940	3,329	1,776	3	19	380,380	172,852	207,528	0,382	3,225	0,000	9,383	0,000	0	0,000	74,583	99,671	2,219
20,04	1,540	61,348	726,045	3,336	1,786	3	19	380,760	173,048	207,712	0,420	3,225	0,000	9,502	0,000	0	0,000	75,067	100,347	2,232
20,06	1,493	59,997	853,778	3,332	1,776	3	19	381,140	173,245	207,895	0,425	3,239	0,000	9,359	0,000	0	0,000	75,920	99,637	2,214
20,08	1,513	66,683	718,949	3,338	1,722	3	19	381,520	173,441	208,079	0,432	3,273	0,000	8,641	0,000	0	0,000	76,191	95,780	2,127
20,10	1,394	68,773	684,887	3,345	1,635	3	19	381,900	173,637	208,263	0,403	3,322	0,000	7,535	0,000	0	0,000	75,743	89,480	1,985
20,12	1,306	65,871	630,073	3,354	1,518	3	19	382,280	173,833	208,447	0,407	3,379	0,000	6,189	0,000	0	0,000	73,805	81,128	1,798
20,14	1,206	64,455	592,904	3,360	1,415	3	19	382,660	174,029	208,631	0,412	3,433	0,000	5,106	0,000	0	0,000	71,746	73,726	1,633
20,16	1,121	64,800	576,103	3,369	1,312	3	19	383,040	174,226	208,814	0,435	3,494	0,000	4,130	0,000	0	0,000	69,785	66,330	1,468
20,18	1,019	63,695	565,017	3,370	1,227	3	19	383,420	174,422	208,998	0,466	3,548	0,000	3,404	0,000	0	0,000	67,886	60,249	1,332
20,20	0,962	61,086	561,680	3,380	1,148	3	19	383,800	174,618	209,182	0,512	3,594	0,000	2,794	0,000	0	0,000	65,169	54,607	1,206
20,22	0,887	54,297	571,001	3,390	1,092	3	19	384,180	174,814	209,366	0,564	3,619	0,000	2,391	0,000	0	0,000	62,278	50,541	1,115
20,24	0,840	48,872	589,950	3,398	1,049	3	19	384,560	175,010	209,550	0,627	3,630	0,000	2,105	0,000	0	0,000	59,281	47,443	1,046
20,26	0,816	44,001	613,387	3,398	1,021	3	19	384,940	175,207	209,733	0,690	3,618	0,000	1,932	0,000	0	0,000	55,982	45,466	1,002
20,28	0,782	33,532	639,509	3,406	1,004	3	19	385,320	175,403	209,917	0,744	3,590	0,000	1,826	0,000	0	0,000	52,545	44,225	0,973
20,30	0,767	27,331	656,041	3,420	1,009	3	19	385,700	175,599	210,101	0,779	3,527	0,000	1,847	0,000	0	0,000	48,775	44,495	0,978
20,32	0,803	20,161	687,418	3,419	1,038	4	19	386,080	175,795	210,285	0,784	3,446	0,000	2,024	0,000	0	0,000	46,139	46,597	1,024
20,34	0,844	16,395	717,722	3,438	1,086	4	19	386,460	175,991	210,469	0,771	3,354	0,000	2,324	0,000	0	0,000	43,994	49,9	

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
21,02	1,217	36,507	621,327	3,640	1,415	4	19	399,380	182,662	216,718	0,438	3,318	0,000	4,762	0,000	0	0,000	61,092	72,559	1,547
21,04	1,163	40,118	615,919	3,640	1,118	4	19	399,760	182,858	216,902	0,612	3,405	0,000	2,379	0,000	0	0,000	48,235	51,308	1,093
21,06	0,340	-11,391	629,382	3,650	1,103	4	19	400,140	183,055	217,085	0,622	3,436	0,000	2,274	0,000	0	0,000	49,044	50,183	1,068
21,08	1,173	41,830	614,615	3,660	1,112	4	19	400,520	183,251	217,269	0,621	3,435	0,000	2,327	0,000	0	0,000	49,604	50,793	1,080
21,10	1,185	42,159	630,341	3,670	1,384	3	19	400,900	183,447	217,453	0,452	3,370	0,000	4,442	0,000	0	0,000	63,116	70,202	1,492
21,12	1,153	42,642	637,898	3,675	1,367	3	19	401,280	183,643	217,637	0,471	3,382	0,000	4,286	0,000	0	0,000	62,973	68,988	1,464
21,14	1,112	42,452	647,104	3,686	1,338	3	19	401,660	183,839	217,821	0,496	3,399	0,000	4,023	0,000	0	0,000	62,381	66,867	1,418
21,16	1,087	41,156	658,535	3,687	1,305	3	19	402,040	184,036	218,004	0,527	3,414	0,000	3,743	0,000	0	0,000	61,339	64,523	1,367
21,18	1,044	39,049	674,223	3,688	1,288	3	19	402,420	184,232	218,188	0,553	3,416	0,000	3,597	0,000	0	0,000	60,315	63,277	1,340
21,20	1,046	37,442	690,257	3,699	1,272	3	19	402,800	184,428	218,372	0,580	3,415	0,000	3,461	0,000	0	0,000	59,110	62,096	1,314
21,22	1,024	35,006	702,723	3,699	1,263	3	19	403,180	184,624	218,556	0,601	3,407	0,000	3,386	0,000	0	0,000	57,883	61,447	1,299
21,24	1,005	32,191	712,428	3,710	1,247	3	19	403,560	184,820	218,740	0,620	3,399	0,000	3,249	0,000	0	0,000	56,137	60,216	1,272
21,26	0,990	28,511	706,789	3,715	1,230	4	19	403,940	185,017	218,923	0,633	3,390	0,000	3,113	0,000	0	0,000	54,347	58,970	1,244
21,28	0,973	26,248	703,030	3,720	1,206	4	19	404,320	185,213	219,107	0,646	3,386	0,000	2,935	0,000	0	0,000	52,570	57,279	1,208
21,30	0,939	24,451	700,997	3,732	1,182	4	19	404,700	185,409	219,291	0,663	3,388	0,000	2,752	0,000	0	0,000	51,032	55,489	1,169
21,32	0,919	22,464	697,699	3,729	1,154	4	19	405,080	185,605	219,475	0,682	3,395	0,000	2,556	0,000	0	0,000	49,659	53,496	1,126
21,34	0,894	21,497	690,526	3,736	1,128	4	19	405,460	185,801	219,659	0,698	3,405	0,000	2,378						

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Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
22,02	10,088	15,287	176,908	3,909	10,164	6	19	418,380	192,472	225,908	-0,002	1,757	0,000	81,165	41,000	37	64,759	81,165	0,000	0,000
22,04	10,050	16,389	168,431	3,920	8,693	6	19	418,760	192,668	226,092	-0,003	1,840	0,000	76,516	37,000	36	61,050	76,516	0,000	0,000
22,06	5,771	8,983	157,614	3,935	8,679	6	19	419,140	192,865	226,275	-0,004	1,846	0,000	76,961	37,000	36	61,405	76,961	0,000	0,000
22,08	10,049	16,877	165,056	3,964	8,671	6	19	419,520	193,061	226,459	-0,004	1,846	0,000	76,890	37,000	36	61,349	76,890	0,000	0,000
22,10	10,027	16,101	164,557	3,963	10,039	6	19	419,900	193,257	226,643	-0,003	1,774	0,000	81,837	40,000	37	65,295	81,837	0,000	0,000
22,12	9,872	16,740	164,557	3,997	9,951	6	19	420,280	193,453	226,827	-0,003	1,780	0,000	81,665	40,000	37	65,158	81,665	0,000	0,000
22,14	9,784	16,758	171,193	3,996	9,860	6	19	420,660	193,649	227,011	-0,002	1,789	0,000	81,853	40,000	37	65,308	81,853	0,000	0,000
22,16	9,750	17,345	176,870	4,020	9,851	6	19	421,040	193,846	227,194	-0,002	1,793	0,000	82,191	40,000	37	65,578	82,191	0,000	0,000
22,18	9,835	17,950	190,219	4,011	9,918	6	19	421,420	194,042	227,378	-0,001	1,791	0,000	82,586	40,000	37	65,893	82,586	0,000	0,000
22,20	9,977	17,639	194,476	4,013	10,065	6	19	421,800	194,238	227,562	-0,001	1,787	0,000	83,364	40,000	37	66,513	83,364	0,000	0,000
22,22	10,193	19,090	178,251	4,033	10,248	6	19	422,180	194,434	227,746	-0,001	1,782	0,000	84,409	41,000	37	67,348	84,409	0,000	0,000
22,24	10,381	20,489	195,627	4,013	10,468	6	19	422,560	194,630	227,930	0,000	1,777	0,000	85,766	41,000	37	68,430	85,766	0,000	0,000
22,26	10,636	21,145	197,622	4,030	10,718	6	19	422,940	194,827	228,113	0,001	1,769	0,000	87,075	42,000	37	69,475	87,075	0,000	0,000
22,28	10,931	22,285	214,308	4,031	11,066	6	19	423,320	195,023	228,297	0,002	1,754	0,000	88,308	42,000	37	70,459	88,308	0,000	0,000
22,30	11,410	22,819	234,829	4,021	11,451	6	19	423,700	195,219	228,481	0,003	1,738	0,000	89,661	43,000	38	71,538	89,661	0,000	0,000
22,32	11,776	23,786	242,386	4,023	11,817	6	19	424,080	195,415	228,665										

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Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
23,02	9,671	19,725	101,688	4,283	9,728	6	19	437,380	202,282	235,098	-0,011	1,834	0,000	85,281	39,000	37	68,044	85,281	0,000	0,000
23,04	9,154	19,412	91,254	4,281	7,907	6	19	437,760	202,478	235,282	-0,012	1,945	0,000	78,894	34,000	35	62,948	78,894	0,000	0,000
23,06	4,781	10,683	140,008	4,303	7,404	6	19	438,140	202,675	235,465	-0,010	1,986	0,000	77,543	33,000	35	61,869	77,543	0,000	0,000
23,08	8,141	18,837	169,582	4,313	6,959	6	19	438,520	202,871	235,649	-0,008	2,020	0,000	75,799	31,000	35	60,478	75,799	0,000	0,000
23,10	7,798	16,973	150,441	4,306	7,880	6	19	438,900	203,067	235,833	-0,007	1,957	0,000	79,854	34,000	35	63,713	79,854	0,000	0,000
23,12	7,547	17,181	138,128	4,307	7,657	6	19	439,280	203,263	236,017	-0,008	1,972	0,000	78,952	33,000	35	62,993	78,952	0,000	0,000
23,14	7,479	17,320	140,928	4,301	7,591	6	19	439,660	203,459	236,201	-0,008	1,980	0,000	78,985	33,000	35	63,020	78,985	0,000	0,000
23,16	7,599	17,477	155,811	4,310	7,563	6	19	440,040	203,656	236,384	-0,008	2,019	0,000	82,703	33,000	35	65,986	82,703	0,000	0,000
23,18	7,460	30,190	149,559	4,301	7,507	6	19	440,420	203,852	236,568	-0,008	2,052	0,000	85,447	33,000	35	68,176	85,447	0,000	0,000
23,20	7,311	27,599	139,701	4,298	7,327	6	19	440,800	204,048	236,752	-0,009	2,076	0,000	85,870	32,000	35	68,513	85,870	0,000	0,000
23,22	7,066	20,362	131,415	4,305	7,048	6	19	441,180	204,244	236,936	-0,011	2,069	0,000	81,625	31,000	35	65,127	81,625	0,000	0,000
23,24	6,635	16,873	118,182	4,307	6,686	6	19	441,560	204,440	237,120	-0,014	2,067	0,000	77,052	30,000	34	61,478	77,052	0,000	0,000
23,26	6,237	14,731	106,598	4,315	6,279	6	19	441,940	204,637	237,303	-0,016	2,091	0,000	74,157	29,000	34	59,168	74,157	0,000	0,000
23,28	5,855	14,126	101,534	4,321	5,952	6	19	442,320	204,833	237,487	-0,018	2,115	0,000	72,190	28,000	34	57,598	72,190	0,000	0,000
23,30	5,658	13,279	102,954	4,325	5,714	6	19	442,700	205,029	237,671	-0,019	2,119								

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Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
24,02	10,990	26,879	207,058	4,444	11,031	6	19	456,380	212,092	244,288	-0,001	1,807	0,000	93,805	41,000	37	74,844	93,805	0,000	0,000
24,04	11,038	26,427	212,006	4,438	11,135	6	19	456,760	212,288	244,472	0,000	1,800	0,000	93,932	41,000	37	74,946	93,932	0,000	0,000
24,06	11,159	23,558	223,092	4,442	11,243	6	19	457,140	212,485	244,655	0,001	1,790	0,000	93,672	41,000	37	74,738	93,672	0,000	0,000
24,08	11,305	25,083	235,443	4,416	11,453	6	19	457,520	212,681	244,839	0,001	1,769	0,000	92,926	42,000	37	74,143	92,926	0,000	0,000
24,10	11,663	22,148	220,483	4,425	11,804	6	19	457,900	212,877	245,023	0,002	1,748	0,000	93,405	43,000	37	74,525	93,405	0,000	0,000
24,12	12,209	23,099	234,292	4,444	12,313	6	19	458,280	213,073	245,207	0,002	1,715	0,000	93,576	44,000	38	74,661	93,576	0,000	0,000
24,14	12,828	22,496	244,112	4,452	13,009	6	19	458,660	213,269	245,391	0,003	1,686	0,000	95,476	45,000	38	76,178	95,476	0,000	0,000
24,16	13,737	25,243	263,943	4,464	13,804	6	19	459,040	213,466	245,574	0,004	1,652	0,000	97,349	47,000	38	77,672	97,349	0,000	0,000
24,18	14,578	25,727	279,977	4,477	14,638	6	19	459,420	213,662	245,758	0,005	1,622	0,000	99,508	49,000	39	79,395	99,508	0,000	0,000
24,20	15,316	26,315	289,988	4,488	15,352	6	19	459,800	213,858	245,942	0,005	1,595	0,000	101,003	50,000	39	80,588	101,003	0,000	0,000
24,22	15,872	27,249	284,120	4,489	15,973	6	19	460,180	214,054	246,126	0,005	1,575	0,000	102,647	51,000	39	81,899	102,647	0,000	0,000
24,24	16,439	29,028	286,114	4,502	16,473	6	19	460,560	214,250	246,310	0,005	1,563	0,000	104,238	52,000	39	83,168	104,238	0,000	0,000
24,26	16,812	30,203	294,898	4,500	16,889	6	19	460,940	214,447	246,493	0,005	1,556	0,000	106,006	53,000	40	84,580	106,006	0,000	0,000
24,28	17,117	32,448	302,186	4,513	17,135	6	19	461,320	214,643	246,677	0,005	1,554	0,000	107,356	53,000	40	85,656	107,356	0,000	0,000

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25,02	15,530	20,265	306,099	4,806	15,462	6	19	475,380	221,902	253,478	0,005	1,572	0,000	98,761	50,000	39	78,799	98,761	0,000	0,000
25,04	15,425	22,302	285,807	4,812	15,394	6	19	475,760	222,098	253,662	0,004	1,582	0,000	99,476	50,000	39	79,369	99,476	0,000	0,000
25,06	14,938	24,650	254,354	4,784	14,958	6	19	476,140	222,295	253,845	0,004	1,617	0,000	101,057	49,000	39	80,630	101,057	0,000	0,000
25,08	14,226	29,151	294,553	4,757	14,532	6	19	476,520	222,491	254,029	0,003	1,647	0,000	101,873	48,000	39	81,282	101,873	0,000	0,000
25,10	14,163	27,856	242,232	4,759	14,170	6	19	476,900	222,687	254,213	0,002	1,674	0,000	102,612	47,000	38	81,871	102,612	0,000	0,000
25,12	13,867	29,499	209,628	4,767	13,999	6	19	477,280	222,883	254,397	0,000	1,683	0,000	102,536	47,000	38	81,811	102,536	0,000	0,000
25,14	13,745	29,655	202,647	4,769	13,795	6	19	477,660	223,079	254,581	-0,002	1,693	0,000	102,284	46,000	38	81,609	102,284	0,000	0,000
25,16	13,566	27,843	195,742	4,772	13,621	6	19	478,040	223,276	254,764	-0,002	1,697	0,000	101,470	46,000	38	80,960	101,470	0,000	0,000
25,18	13,352	27,084	187,649	4,785	13,422	6	19	478,420	223,472	254,948	-0,003	1,702	0,000	100,557	45,000	38	80,231	100,557	0,000	0,000
25,20	13,155	27,016	182,394	4,798	13,228	6	19	478,800	223,668	255,132	-0,003	1,706	0,000	99,470	45,000	38	79,364	99,470	0,000	0,000
25,22	12,992	24,529	178,404	4,803	13,035	6	19	479,180	223,864	255,316	-0,004	1,708	0,000	98,323	45,000	38	78,449	98,323	0,000	0,000
25,24	12,777	23,579	175,949	4,811	12,864	6	19	479,560	224,060	255,500	-0,004	1,708	0,000	96,932	44,000	38	77,339	96,932	0,000	0,000
25,26	12,643	22,491	175,834	4,814	12,688	6	19	479,940	224,257	255,683	-0,004	1,718	0,000	96,713	44,000	38	77,165	96,713	0,000	0,000
25,28	12,465	24,598	175,067	4,833	12,572	6	19	480,320	224,453	255,867	-0,004	1,724	0,000	96,526	44,000	38	77,015	96,526	0,000	0,000
25,30	12,426	23,422	184,465	4,8																

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1^a Iscrizione alla CCIAA di Re 01999610309 - N. REA 241542 - CF e P.IVA 01999610309Certificazione Qualità 9001:2008 SOA 0520b 1^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
26,02	10,075	30,246	148,523	5,161	10,033	6	19	494,380	231,712	262,668	-0,009	1,930	0,000	98,850	37,000	36	78,870	98,850	0,000	0,000
26,04	9,312	30,867	123,590	5,166	9,376	6	19	494,760	231,908	262,852	-0,012	1,981	0,000	98,162	35,000	36	78,320	98,162	0,000	0,000
26,06	8,611	30,348	110,510	5,179	8,655	6	19	495,140	232,105	263,035	-0,005	2,058	0,000	99,476	33,000	35	79,369	99,476	0,000	0,000
26,08	7,850	40,085	329,958	5,115	8,291	6	19	495,520	232,301	263,219	-0,001	2,086	0,000	98,416	32,000	35	78,523	98,416	0,000	0,000
26,10	8,187	29,238	225,048	5,135	8,122	6	19	495,900	232,497	263,403	0,003	2,093	0,000	97,200	32,000	35	77,554	97,200	0,000	0,000
26,12	8,070	26,786	207,096	5,154	8,294	6	19	496,280	232,693	263,587	-0,002	2,046	0,000	93,621	33,000	35	74,698	93,621	0,000	0,000
26,14	8,402	25,440	220,637	5,163	8,730	6	19	496,660	232,889	263,771	0,000	1,996	0,000	92,780	34,000	35	74,027	92,780	0,000	0,000
26,16	9,484	23,126	262,217	5,189	9,654	6	19	497,040	233,086	263,954	0,000	1,915	0,000	93,194	36,000	36	74,357	93,194	0,000	0,000
26,18	10,834	22,143	228,040	5,210	10,905	6	19	497,420	233,282	264,138	0,002	1,826	0,000	94,546	39,000	37	75,436	94,546	0,000	0,000
26,20	12,143	22,438	259,187	5,233	12,099	6	19	497,800	233,478	264,322	0,000	1,751	0,000	95,818	42,000	37	76,450	95,818	0,000	0,000
26,22	13,076	20,521	227,8																	

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Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria
Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
27,02	17,311	84,453	230,456	5,743	17,675	6	19	513,380	241,522	271,858	0,003	1,757	0,000	142,887	50,000	39	114,005	142,887	0,000	0,000
27,04	17,935	76,415	292,520	5,741	17,900	6	19	513,760	241,718	272,042	0,002	1,735	0,000	140,727	51,000	39	112,282	140,727	0,000	0,000
27,06	18,178	62,247	285,539	5,735	16,125	6	19	514,140	241,915	272,225	0,003	1,763	0,000	130,903	48,000	39	104,444	130,903	0,000	0,000
27,08	11,973	45,430	271,231	5,726	15,814	6	19	514,520	242,111	272,409	0,000	1,743	0,000	125,116	48,000	39	99,826	125,116	0,000	0,000
27,10	17,040	51,098	183,698	5,720	15,065	6	19	514,900	242,307	272,593	-0,003	1,752	0,000	120,438	46,000	38	96,094	120,438	0,000	0,000
27,12	15,976	45,140	151,016	5,710	15,908	6	19	515,280	242,503	272,777	-0,006	1,704	0,000	119,872	48,000	39	95,643	119,872	0,000	0,000
27,14	14,557	38,595	112,390	5,703	14,886	6	19	515,660	242,699	272,961	-0,008	1,729	0,000	115,443	46,000	38	92,108	115,443	0,000	0,000
27,16	13,997	37,215	106,598	5,700	14,063	6	19	516,040	242,896	273,144	-0,010	1,733	0,000	109,432	45,000	38	87,313	109,432	0,000	0,000
27,18	13,521	24,659	112,965	5,710	13,726	6	19	516,420	243,092	273,328	-0,009	1,721	0,000	105,073	44,000	38	83,835	105,073	0,000	0,000
27,20	13,538	23,106	136,095	5,706	13,684	6	19	516,800	243,288	273,512	-0,008	1,696	0,000	101,452	45,000	38	80,946	101,452	0,000	0,000
27,22	13,848	23,400	173,303	5,707	13,973	6	19													

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
28,02	1,222	10,001	841,926	5,936	1,496	5	19	532,380	251,332	281,048	0,621	3,199	0,000	3,303	0,000	0	0,000	49,802	68,825	1,131
28,04	1,140	14,409	856,502	5,927	1,446	4	19	532,760	251,528	281,232	0,659	3,257	0,000	2,967	0,000	0	0,000	50,821	65,247	1,072
28,06	1,107	13,566	860,798	5,929	1,200	4	19	533,140	251,725	281,415	0,827	3,347	0,000	1,579	0,000	0	0,000	41,603	47,614	0,782
28,08	0,534	-5,322	690,871	6,048	1,218	5	19	533,520	251,921	281,599	0,770	3,310	0,000	1,662	0,000	0	0,000	40,716	48,870	0,802
28,10	1,218	11,383	784,043	5,969	1,233	5	19	533,900	252,117	281,783	0,731	3,296	0,000	1,733	0,000	0	0,000	40,874	49,910	0,818
28,12	1,168	13,319	814,499	5,917	1,449	4	19	534,280	252,313	281,967	0,611	3,256	0,000	2,968	0,000	0	0,000	50,859	65,346	1,071
28,14	1,134	13,113	834,868	5,907	1,417	4	19	534,660	252,509	282,151	0,657	3,285	0,000	2,758	0,000	0	0,000	50,893	63,010	1,032
28,16	1,100	13,080	846,068	5,905	1,390	4	19	535,040	252,706	282,334	0,694	3,299	0,000	2,586	0,000	0	0,000	50,159	61,033	0,999
28,18	1,072	12,269	856,157	5,907	1,367	4	19	535,420	252,902	282,518	0,724	3,307	0,000	2,449	0,000	0	0,000	49,309	59,418	0,972
28,20	1,057	11,458	864,480	5,913	1,360	4	19	535,800	253,098	282,702	0,740	3,303	0,000	2,402	0,000	0	0,000	48,637	58,856	0,962
28,22	1,070	11,287	869,122	6,074	1,358	4	19	536,1												

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Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
29,02	6,854	149,977	119,870	5,954	6,822	5	19	551,380	261,142	290,238	-0,023	2,668	0,000	87,787	0,000	0	0,000	165,464	447,892	7,130
29,04	6,951	153,103	111,316	5,958	6,834	5	19	551,760	261,338	290,422	-0,025	2,669	0,000	87,956	0,000	0	0,000	165,960	448,757	7,139
29,06	6,590	150,165	83,237	5,967	6,693	5	19	552,140	261,535	290,605	-0,028	2,668	0,000	85,976	0,000	0	0,000	162,139	438,652	6,974
29,08	6,447	125,393	74,262	5,975	6,908	5	19	552,520	261,731	290,789	-0,018	2,624	0,000	88,983	0,000	0	0,000	158,705	453,996	7,246
29,10	7,541	118,086	275,796	6,030	7,258	5	19	552,900	261,927	290,973	-0,014	2,553	0,000	93,868	0,000	0	122,097	153,029	478,920	7,862
29,12	7,612	107,808	161,335	6,040	7,557	5	19	553,280	262,123	291,157	-0,012	2,507	0,000	98,051	27,000	33	120,237	150,697	0,000	0,000
29,14	7,335	106,307	101,611	6,044	7,355	5	19	553,660	262,319	291,341	-0,022	2,509	0,000	95,225	26,000	33	117,056	146,710	0,000	0,000
29,16	7,004	96,703	78,174	6,054	6,709	5	19	554,040	262,516	291,524	-0,032	2,562	0,000	86,163	0,000	0	113,274	141,970	439,606	7,177
29,18	5,720	88,947	17,069	6,047	5,713	5	19	554,420	262,712	291,708	-0,046	2,652	0,000	72,219	0,000	0	0,000	133,488	368,466	5,836
29,20	4,388	75,699	-15,689	6,055	4,570	5	19	554,800	262,908	291,892	-0,067	2,782	0,000	55,240	0,000					

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
30,02	1,200	43,317	603,644	6,182	1,401	3	19	570,380	270,952	299,428	0,395	3,594	0,000	2,303	0,000	0	0,000	70,813	59,314	0,915
30,04	1,227	40,295	605,217	6,188	1,413	3	19	570,760	271,148	299,612	0,396	3,574	0,000	2,366	0,000	0	0,000	70,050	60,145	0,927
30,06	1,196	40,141	604,411	6,188	1,401	3	19	571,140	271,345	299,795	0,409	3,578	0,000	2,296	0,000	0	0,000	69,366	59,265	0,913
30,08	1,157	40,592	623,092	6,192	1,423	3	19	571,520	271,541	299,979	0,535	3,562	0,000	2,416	0,000	0	0,000	69,673	60,803	0,936
30,10	1,174	39,446	953,663	6,176	1,478	4	19	571,900	271,737	300,163	0,624	3,521	0,000	2,736	0,000	0	0,000	70,454	64,734	0,996
30,12	1,250	38,376	933,870	6,190	1,532	4	19	572,280	271,933	300,347	0,690	3,478	0,000	3,065	0,000	0	0,000	70,639	68,533	1,054
30,14	1,218	35,958	915,267	6,195	1,519	4	19	572,660	272,129	300,531	0,683	3,478	0,000	2,982	0,000	0	0,000	69,697	67,624	1,040
30,16	1,153	35,371	906,943	6,195	1,465	4	19	573,040	272,326	300,714	0,706	3,505	0,000	2,647	0,000	0	0,000	68,016	63,729	0,979
30,18	1,104	34,526	883,851	6,210	1,412	4	19	573,420	272,522	300,898	0,730	3,535	0,000	2,336	0,000	0	0,000	66,342	59,881	0,919
30,20	1,075	32,315	863,943	6,217	1,359	4	19	573,800	272,718	301,082	0,756	3,573	0,000	2,050	0,000	0	0,000	65,220	56,112	0,861
30,22	1,015	34,855	860,863	6,227	1,314	3	19	574,180	272,914	301,266	0,787	3,615	0,000	1,815	0,000	0	0,000	64,763	52,815	0,810
30,24	0,978	37,205	850,748	6,229	1,266	3	19	574,560	273,110	301,450	0,838	3,667	0,000	1,585	0,000	0	0,000	64,640	49,371	0,

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Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
31,02	7,246	46,190	460,146	6,373	6,542	6	19	589,380	280,762	308,618	0,023	2,415	0,000	83,334	24,000	32	90,993	114,044	0,000	0,000
31,04	5,349	53,499	171,040	6,392	5,868	6	19	589,760	280,958	308,802	-0,006	2,519	0,000	73,891	23,000	31	92,078	115,404	0,000	0,000
31,06	4,753	48,335	119,179	6,394	4,666	5	19	590,140	281,155	308,985	-0,039	2,683	0,000	53,776	0,000	0	0,000	109,700	291,162	4,354
31,08	3,773	43,740	74,645	6,405	4,266	5	19	590,520	281,351	309,169	-0,026	2,754	0,000	43,699	0,000	0	0,000	108,216	262,547	3,923
31,10	4,083	60,212	363,905	6,431	4,035	5	19	590,900	281,547	309,353	-0,015	2,797	0,000	38,349	0,000	0	0,000	107,006	246,023	3,674
31,12	4,015	50,970	251,400	6,445	3,874	5	19	591,280	281,743	309,537	-0,008	2,853	0,000	34,812	0,000	0	0,000	109,529	234,473	3,500
31,14	3,262	64,375	155,082	6,466	3,433	5	19	591,660	281,939	309,721	-0,038	2,952	0,000	26,073	0,000	0	0,000	107,422	202,979	3,028
31,16	2,845	69,937	116,609	6,476	2,948	4	19	592,040	282,136	309,904	-0,064	3,100	0,000	17,909	0,000	0	0,000	107,493	168,274	2,509
31,18	2,602	81,666	123,322	6,489	2,676	4	19	592,420	282,332	310,088	-0,071	3,185	0,000	13,999	0,000	0	0,000	105,914	148,818	2,217
31,20	2,443	74,601	162,754	6,479	2,406	4	19	592,800	282,528	310,272	-0,084	3,271	0,000	10,602	0,000	0	0,000	102,782	129,548	1,929
31,22	2,042	71,751	103,376	6,485	2,079	4	19	593,180	282,724	310,456	-0,113	3,376	0,000	7,113	0,000	0	0,000	96,176	106,143	1,580
31,24	1,635	67,605	80,169	6,498	1,689	3	19	593,560	282,920	310,640	-0,164	3,546	0,000	3,860	0,000	0	0,000			

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1.^a Iscrizione alla CCIAA di Re 01999610308 - N. REA 241542 CF e P.IVA 01999610308Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
32,02	1,220	54,131	345,378	6,823	1,342	3	19	608,380	290,572	317,808	0,065	3,735	0,000	1,692	0,000	0	0,000	74,805	52,383	0,762
32,04	1,225	36,390	426,390	6,823	1,366	3	19	608,760	290,768	317,992	0,185	3,648	0,000	1,801	0,000	0	0,000	69,079	54,053	0,785
32,06	1,212	26,698	520,790	6,830	1,385	4	19	609,140	290,965	318,175	0,277	3,569	0,000	1,890	0,000	0	0,000	64,086	55,394	0,804
32,08	1,202	24,986	569,160	6,828	1,523	4	19	609,520	291,161	318,359	0,268	3,494	0,000	2,623	0,000	0	0,000	68,637	65,276	0,947
32,10	1,609	45,623	518,987	6,822	1,607	4	19	609,900	291,357	318,543	0,248	3,471	0,000	3,123	0,000	0	0,000	72,762	71,241	1,033
32,12	1,461	40,217	528,845	6,809	1,654	4	19	610,280	291,553	318,727	0,239	3,467	0,000	3,417	0,000	0	0,000	75,812	74,539	1,080
32,14	1,339	37,142	574,914	6,809	1,538	4	19	610,660	291,749	318,911	0,294	3,521	0,000	2,694	0,000	0	0,000	72,071	66,209	0,959
32,16	1,237	36,555	588,876	6,816	1,467	4	19	611,040	291,946	319,094	0,370	3,561	0,000	2,299	0,000	0	0,000	70,047	61,175	0,886
32,18	1,205	36,521	661,757	6,816	1,432	4	19	611,420	292,142	319,278	0,453	3,577	0,000	2,109	0,000	0	0,000	68,508	58,610	0,848
32,20	1,176	32,599	740,928	6,826	1,443	4	19	611,800	292,338	319,462	0,537	3,547	0,000	2,163	0,000	0	0,000	66,767	59,369	0,859
32,22	1,193	26,173	814,538	6,843	1,465	4	19	612,180	292,534	319,646	0,597	3,501	0,000	2,277	0,000	0	0,000	64,694	60,933	0,881
32,24	1,208	24,170	850,671	6,844	1,496	4	19	612,560	292,730	319,830	0,630	3,452	0,000	2,440	0,000	0</				

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1.^a Iscrizione alla CCIAA di Re 01999610309 - N. REA 241542 - CF e P.IVA 01999610309
Certificazione Qualità 9001:2008 SOA 0520b 1.^a categoria
Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
33,02	1,277	28,985	500,077	7,107	1,546	4	19	627,380	300,382	326,998	0,259	3,488	0,000	2,582	0,000	0	0,000	68,484	65,630	0,927
33,04	1,246	22,197	603,951	7,115	1,465	4	19	627,760	300,578	327,182	0,345	3,489	0,000	2,144	0,000	0	0,000	62,563	59,830	0,845
33,06	1,272	20,227	663,713	7,128	1,488	4	19	628,140	300,775	327,365	0,423	3,441	0,000	2,261	0,000	0	0,000	60,454	61,449	0,867
33,08	1,270	18,448	725,585	7,137	1,578	4	19	628,520	300,971	327,549	0,456	3,425	0,000	2,752	0,000	0	0,000	65,404	67,820	0,957
33,10	1,443	36,082	813,157	7,295	1,640	4	19	628,900	301,167	327,733	0,459	3,422	0,000	3,120	0,000	0	0,000	69,328	72,234	1,018
33,12	1,427	33,009	758,381	7,426	1,669	4	19	629,280	301,363	327,917	0,467	3,446	0,000	3,296	0,000	0	0,000	73,487	74,253	1,046
33,14	1,334	36,360	788,646	7,355	1,641	4	19	629,660	301,559	328,101	0,488	3,457	0,000	3,118	0,000	0	0,000	72,471	72,240	1,017
33,16	1,351	33,320	837,706	7,423	1,668	4	19	630,040	301,756	328,284	0,518	3,435	0,000	3,285	0,000	0	0,000	72,412	74,172	1,044
33,18	1,464	30,228	891,753	7,383	1,738	4	19	630,420	301,952	328,468	0,516	3,378	0,000	3,738	0,000	0	0,000	71,891	79,147	1,113
33,20	1,510	28,069	890,257	7,337	1,825	4	19	630,800	302,148	328,652	0,497	3,326	0,000	4,339	0,000	0	0,000	72,498	85,297	1,199
33,22	1,588	29,745	905,792	7,330	1,831	4	19	631,180	302,344	328,836	0,482	3,323								

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1.^a Iscrizione alla CCIAA di Re 01999610308 - N. REA 241542 - CF e P.IVA 01999610308Certificazione Qualità 9001:2008 SOA OS20b 1.^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
34,02	1,550	50,903	1082,854	7,401	1,911	4	19	646,380	310,192	336,188	0,610	3,421	0,000	4,760	0,000	0	0,000	86,661	90,360	1,242
34,04	1,570	52,993	1088,493	7,397	1,941	4	19	646,760	310,388	336,372	0,601	3,419	0,000	4,981	0,000	0	0,000	88,471	92,455	1,270
34,06	1,594	56,344	1092,021	7,408	1,963	4	19	647,140	310,585	336,555	0,593	3,418	0,000	5,145	0,000	0	0,000	89,833	93,993	1,290
34,08	1,613	57,000	1091,216	7,415	1,942	4	19	647,520	310,781	336,739	0,596	3,430	0,000	4,975	0,000	0	0,000	89,668	92,450	1,268
34,10	1,515	54,051	1061,488	7,399	1,955	4	19	647,900	310,977	336,923	0,589	3,435	0,000	5,074	0,000	0	0,000	91,190	93,397	1,281
34,12	1,635	64,467	1092,405	7,412	1,967	4	19	648,280	311,173	337,107	0,587	3,438	0,000	5,158	0,000	0	0,000	92,329	94,185	1,291
34,14	1,644	63,034	1100,038	7,429	2,026	4	19	648,660	311,369	337,291	0,573	3,421	0,000	5,625	0,000	0	0,000	94,348	98,390	

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1.^a Iscrizione alla CCIAA di Re 01999610309 - N.REA 241942 CF e P.IVA 01999610309Certificazione Qualità 9001:2008 SOA 05206 1.^a categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ _v (kPa)	u0 (kPa)	σ' _{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	φ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
35,02	5,519	72,927	140,890	7,699	6,256	5	19	665,380	320,002	345,378	-0,014	2,613	0,000	78,270	0,000	0	0,000	137,696	399,334	5,342
35,04	7,413	68,260	473,878	7,692	7,458	6	19	665,760	320,198	345,562	0,011	2,500	0,000	95,089	24,000	32	115,583	144,864	0,000	0,000
35,06	9,040	78,158	563,406	7,697	8,881	6	19	666,140	320,395	345,745	0,021	2,389	0,000	115,004	27,000	33	121,530	152,317	0,000	0,000
35,08	9,687	95,309	436,287	7,684	9,574	6	19	666,520	320,591	345,929	0,019	2,350	0,000	124,709	29,000	34	125,345	157,099	0,000	0,000
35,10	9,497	86,397	464,020	7,617	9,343	6	19	666,900	320,787	346,113	0,008	2,363	0,000	121,467	28,000	33	124,210	155,677	0,000	0,000
35,12	8,450	72,750	259,685	7,619	8,026	6	19	667,280	320,983	346,297	-0,008	2,455	0,000	103,029	25,000	32	118,366	148,352	0,000	0,000
35,14	5,863	70,315	66,513	7,615	6,304	5	19	667,660	321,179	346,481	-0,036	2,616	0,000	78,913	0,000	0	0,000	139,2		

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1° Iscrizione alla CCIAA di Re 01999610309 - N. REA 241942 CP e P.IVA 01999610309

Certificazione Qualità 9001:2008 SOA OS20b 1° categoria

Concessione Miniateriale n.° 3655 Circ. 7619/STC

Certificato n.° 031E_2018

Del 29/08/2018

PROVA PENETROMETRICA STATICA CON PIEZOCONO (CPTU)**CPTU6 PE**

Committente: SPEA Engineering SpA

Data: 13/07/2018

Lavoro: Autostrada A13 PE

Profondità raggiunta: 36,48 m da p.c.

Località: Bologna

Prof. Falda: 2,40 m. da p.c.

Depth (m)	qc (MPa)	fs (kPa)	u (kPa)	Incli (°)	qt (MPa)	STB	γ (kN/m³)	σ_v (kPa)	u0 (kPa)	σ'_{vo} (kPa)	Bq	lc	Kstb (m/s)	M (Mpa)	Dr (%)	ϕ (°)	Es (Mpa)	G0 (Mpa)	Su (kPa)	OCR
36,02	1,778	63,001	872,229	8,083	2,076	4	19	684,380	329,812	354,568	0,391	3,428	0,000	5,461	0,000	0	0,000	96,211	99,395	1,295
36,04	1,781	60,203	873,226	8,094	2,073	4	19	684,760	330,008	354,752	0,394	3,421	0,000	5,433	0,000	0	0,000	95,142	99,164	1,291
36,06	1,767	54,832	883,890	8,107	2,071	4	19	685,140	330,205	354,935	0,400	3,404	0,000	5,413	0,000	0	0,000	92,875	99,003	1,289
36,08	1,764	49,132	895,972	8,121	2,034	4	19	685,520	330,401	355,119	0,456	3,392	0,000	5,119	0,000	0	0,000	89,082	96,303	1,253
36,10	1,607	41,463	1054,814	7,982	2,064	4	19	685,900	330,597	355,303	0,475	3,364	0,000	5,347	0,000	0	0,000	87,879	98,456	1,280
36,12	1,816	45,367	1006,636	8,013	2,091	4	19	686,280	330,793	355,487	0,483	3,344	0,000	5,552	0,000	0	0,000	87,257	100,352	1,304
36,14	1,821	43,468	965,593	8,020	2,128	4	19	686,660	330,989	355,671	0,444	3,334	0,000	5,842	0,000	0	0,000	88,437	102,966	1,337
36,16	1,756	44,677	942,4																	