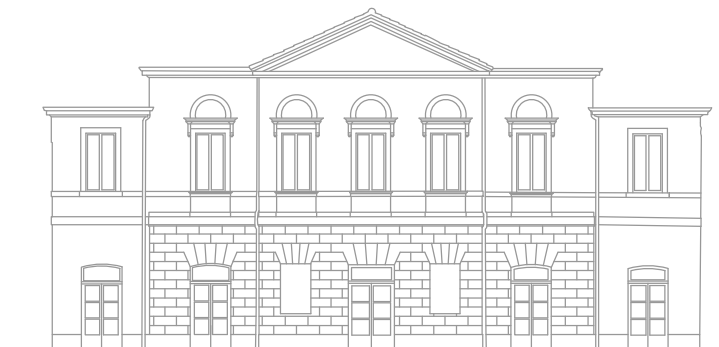


COMMITTENTE:

COMUNE DI PORTOMAGGIORE



LAVORI DI RESTAURO E RECUPERO DEL PICCOLO TEATRO DELLA CONCORDIA
Corso Vittorio Emanuele II, 52 - Portomaggiore (FE)

PROGETTO ESECUTIVO

Raggruppamento temporaneo di progettisti

Capogruppo, progetto architettonico, strutturale, impiantistico, sicurezza e prevenzione incendi:



Studio Berlucchi srl

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Tecnico acustico:

Ing. Cesare Trebeschi
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Responsabile del procedimento:

Ing. Luisa Cesari

Timbro e firma del responsabile:

E						
D						
C						
B	11-2021	Emissione a seguito di Rapporto Intermedio di Verifica Progetto - RIVP (rif. doc. J17611/21/RG/ddr) del 30/09/2021	C236_PES_r05_revB.doc	Comune	NF	NB
A	09-2021	Emissione a seguito di Rapporto Iniziale di Verifica Progetto - RIVP (rif. doc. J17596/21/RG/ddr) del 03/09/2021	C236_PES_r05_revA.doc	Comune	NF	NB
-	07-2021	prima emissione	C236_PES_r05.doc	Comune	NF	NB
	DATA	REVISIONE	NOME FILE	DIS.	CONTR.	APPR.

TITOLO:

PROGETTO STRUTTURALE
Relazione geologica

TIMBRO E FIRMA:

CODICE COMMESSA	ELABORATO				
	PRATICA	PARTE	DISC. PROG.	NUMERO	REV.
C236		P	ES	r05	B

SCALA:

-



Studio Servizi Tecnici
Settore geologia e ambiente

DOTT. GEOL. THOMAS VERONESE

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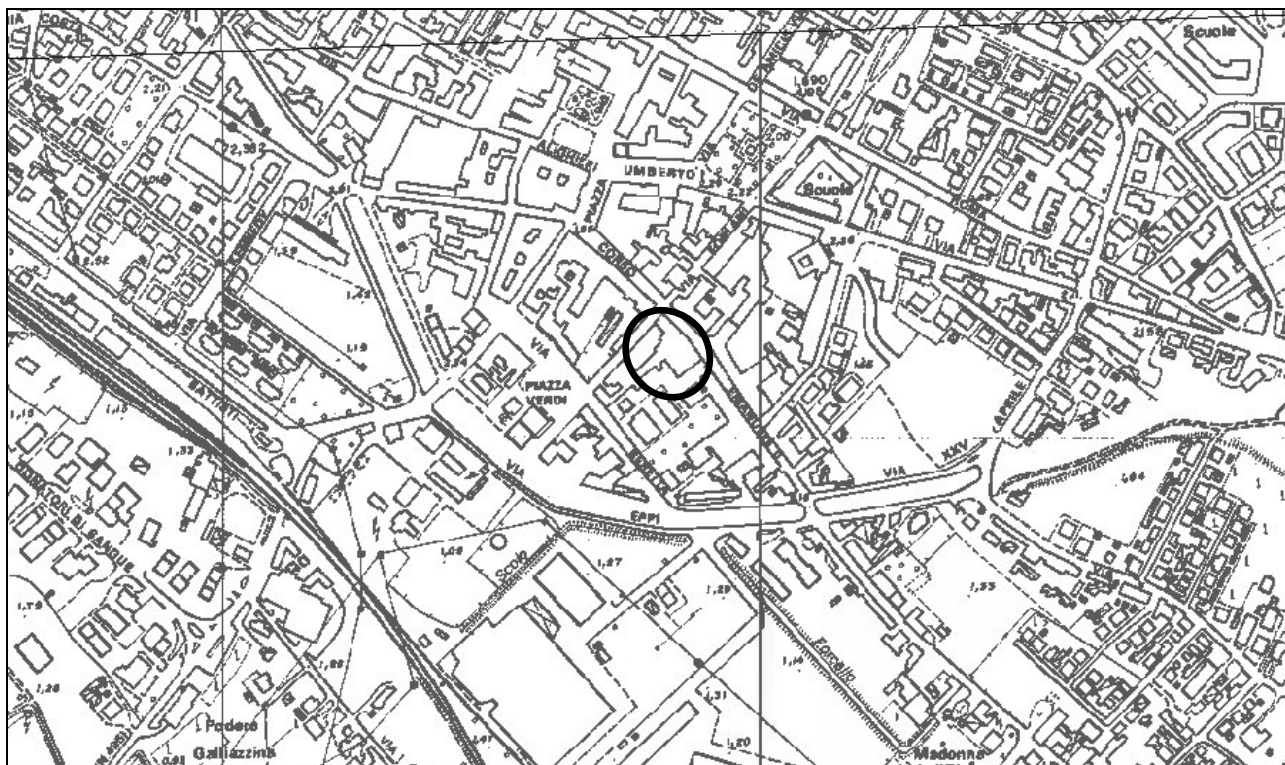
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E-mail: t.veronese@studio-sst.it

**MODELLAZIONE GEOLOGICA, SISMICA, GEOTECNICA SULLE INDAGINI
E ANALISI DI RISPOSTA SISMICA LOCALE**

Comune Portomaggiore
PROVINCIA DI FERRARA

Modellazione geologica e relazione di risposta sismica locale per lo studio della
liquefazione - Teatro Concordia di Portomaggiore FE
CIG: ZB22919198 CUP: D97D17000040002



Committente: **Comune di Portomaggiore**
Sede in: **Piazza Umberto I, 5,**
44015 Portomaggiore (FE)

30 luglio 2019

S.S.T. SETTORE GEOLOGIA E AMBIENTE

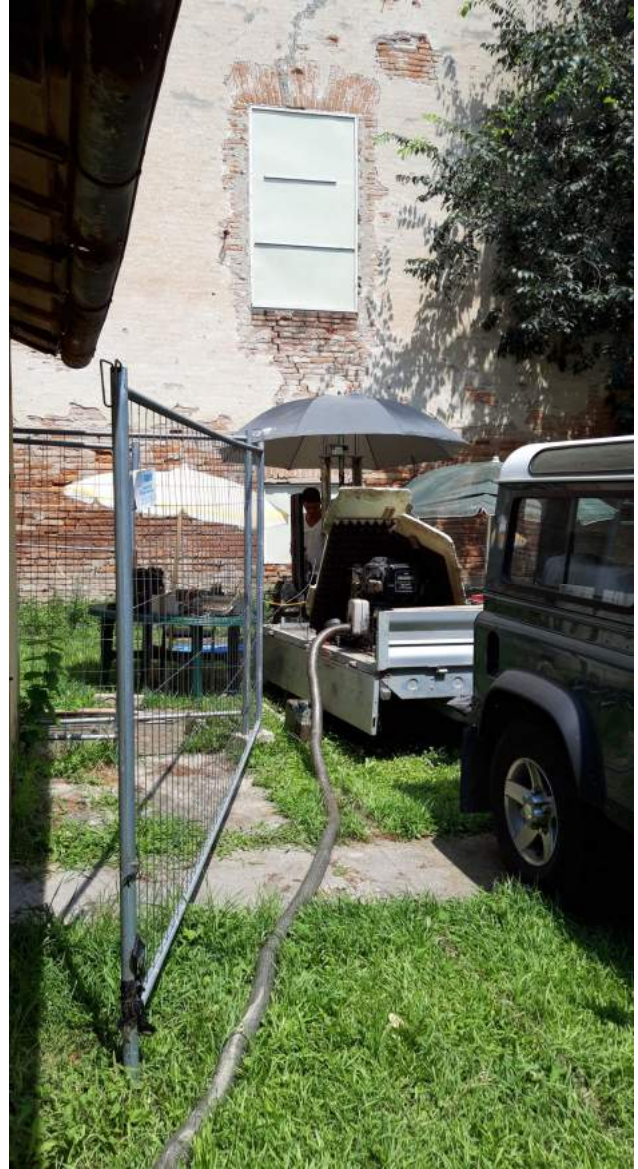
Geotecnica; Studio terreni di fondazione; Stabilità dei versanti; Rilevamento geologico; Rilievi topografici; Geofisica - Contributi allo Studio di Impatto Ambientale; Assistenza alle pubbliche amministrazioni negli studi di fattibilità e di realizzazione dei P.R.G., cimiteri, discariche, piani attività estrattive, studi di acquiferi per la tutela e per l'utilizzo di risorse idriche sotterranee; subirrigazioni.

Timbro
Thomas Veronese

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Fase di esecuzione prova penetrometrica statica SCPTU1

1. PREMESSA

Su incarico del Comune di Portomaggiore (FE), si redige lo studio di modellazione geologica, sismica e geotecnica sulle indagini, comprensiva di analisi di risposta sismica locale per lo studio della liquefazione delle sabbie dei terreni su cui sorge il Teatro Concordia a Portomaggiore FE.

In **FIGURA 1.1** si riporta l'ubicazione dell'area di intervento.



FIGURA 1.1– Planimetria dell'area allo studio a Portomaggiore FE

Normativa e Raccomandazioni di riferimento

- Decreto del Ministro delle Infrastrutture 17 gennaio 2018 Aggiornamento delle “Norme tecniche per le costruzioni”.
- Circolare n. 7/2019 del C.S.LL.PP: Istruzioni per l'applicazione dell'aggiornamento delle “Norme tecniche per le costruzioni” di cui al decreto ministeriale 17 gennaio 2018 Gazzetta Ufficiale n. 35/2019 –11 febbraio 2019.
- Delibera Assemblea Legislativa n°112/2007 della Regione Emilia Romagna “Atto di Indirizzo e coordinamento tecnico” per gli studi di microzonizzazione sismica.
- Decreto della Giunta della Regione Emilia Romagna n. 2193/2015 "Approvazione aggiornamento dell'atto di coordinamento tecnico denominato "Indirizzi per gli studi di microzonazione sismica in Emilia - Romagna per la pianificazione territoriale e urbanistica", di cui alla deliberazione dell'assemblea legislativa 2 Maggio 2007, N. 112.
- A.G.I. (Associazione Geotecnica Italiana)
“Raccomandazioni sulla programmazione ed esecuzione delle indagini geotecniche (giugno 1977).
- A.G.I. (Associazione Geotecnica Italiana)
“Raccomandazioni sui pali di fondazione (dicembre 1984)”.
- A.G.I. (Associazione Geotecnica Italiana)
“Aspetti geotecnici nella progettazione in zona sismica (Edizione Provvisoria, marzo 2005)”.
- C.N.R. UNI Ente Nazionale Italiano di Unificazione.
- Eurocode EC-7: Geotechnics, design – dicembre 1987.
- C.N.R. UNI Ente Nazionale Italiano di Unificazione.
- Eurocode EC-8: Design provisions for earthquake resistance of structures – ottobre 1994.

2. MODELLAZIONE GEOLOGICA

2.1. GEOLOGIA STRUTTURALE DELL'AREA

Nella **FIGURA 2.1** si riporta la sezione geologica passante per Medicina, Consandolo, Tresigallo, Copparo, fiume Po in cui si possono apprezzare gli spessori dei sedimenti del Quaternario sopra i pliocenici, che coincide con il passaggio dai sedimenti sciolti a quelli litificati o pseudolitificati.

Tale sezione è posta più ad ovest di Portomaggiore.

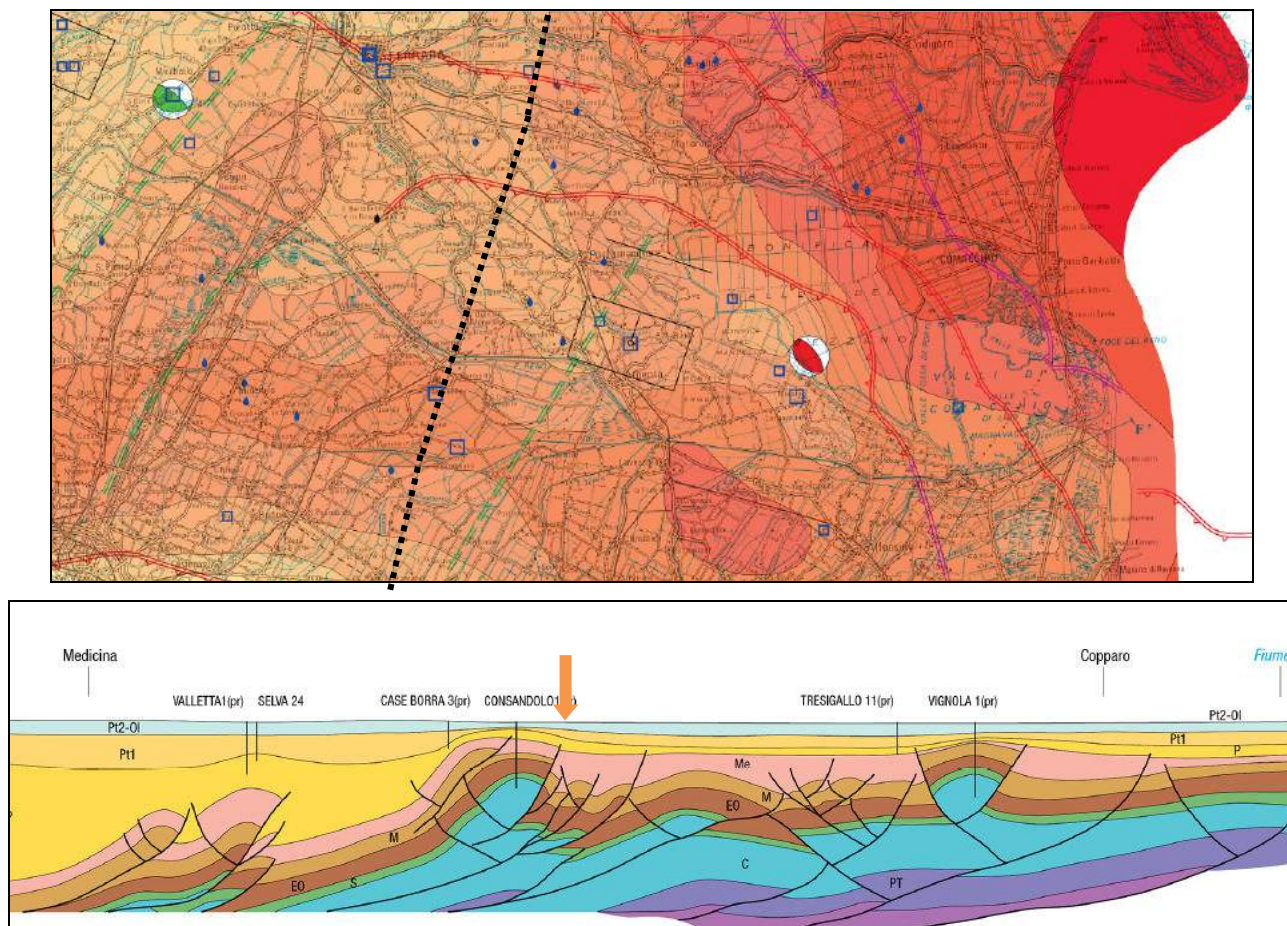


FIGURA 2.1 - Sezione geologica più vicina a Portomaggiore (FE) tratta dalla Carta Sismotettonica dell'Emilia Romagna (2016)

Nella **FIGURA 2.1 bis** (Pieri & Groppi, 1981, CNR, 1992) si riporta la sezione geologica passante poco più ad est di Portomaggiore, ovvero per Cotignola, Bagnacavallo, Ravenna, Comacchio, Codigoro, Mesola, Chioggia.

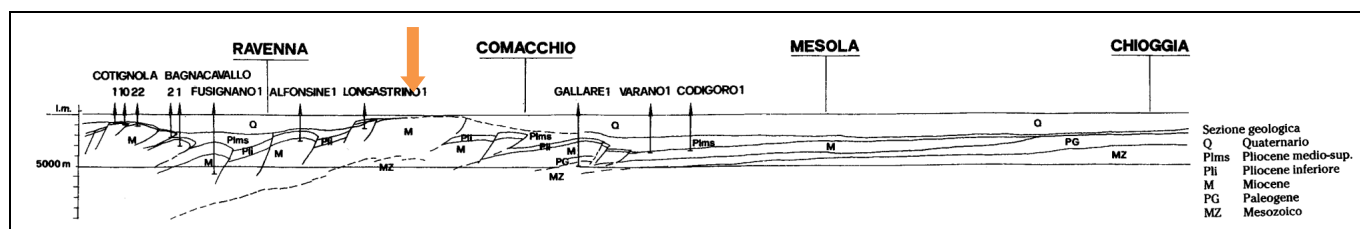
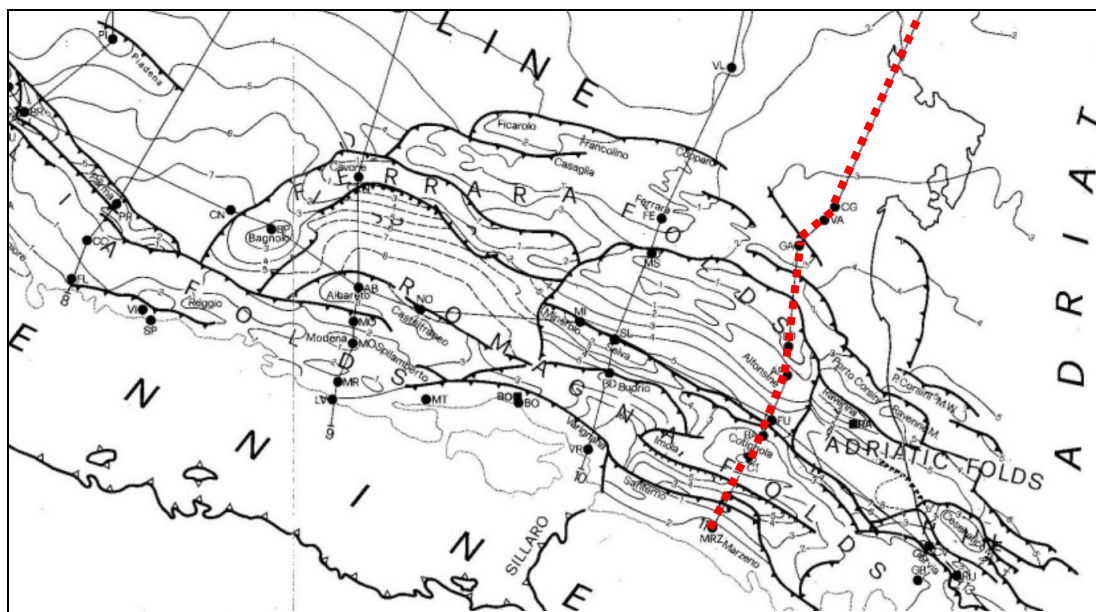


FIGURA 2.1 bis - *Pieri & Groppi, 1981, CNR, 1992*

Nella **FIGURA 2.2** viene riportata la Carta Strutturale della Pianura Padana, con le Pieghe Ferraresi dell'Appennino sepolto (Pieri & Groppi, 1981, CNR, 1992) con visibili le varie strutture sepolte e le faglie e sistemi trascorrenti attivi e non attivi, che sono all'origine della nuova attribuzione alla Zona sismica 3, in cui il comune di Portomaggiore è stato inserito nella OPCM 3274/2003.

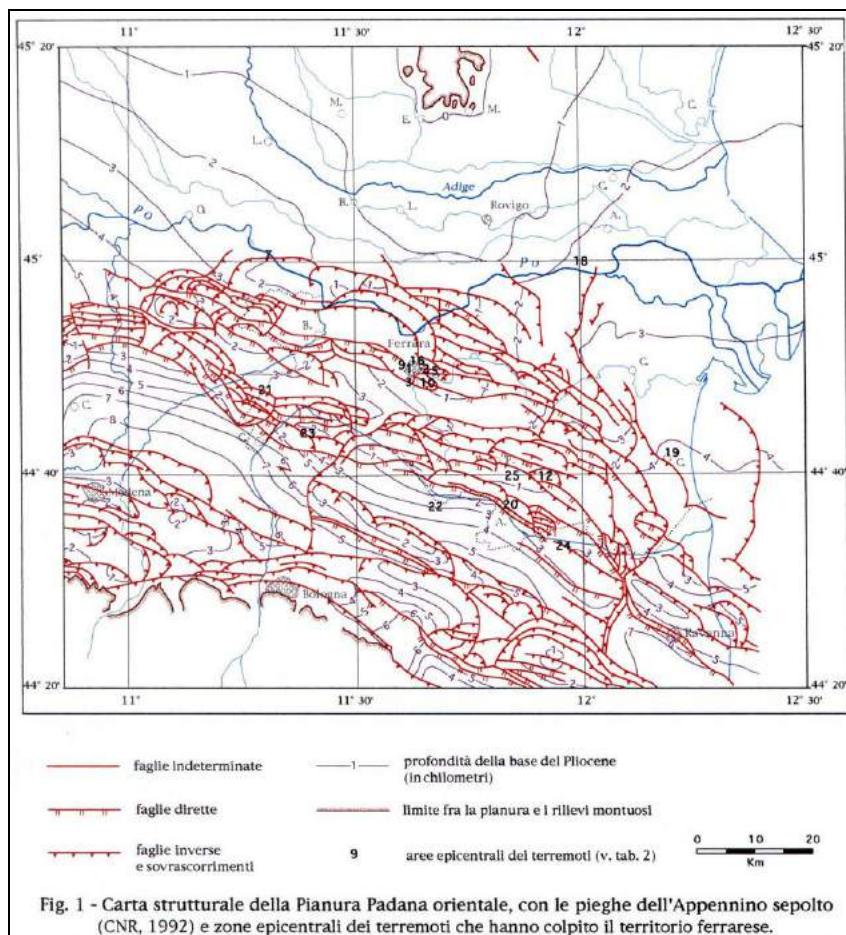


FIGURA 2.2– Carta strutturale della Pianura Padana orientale (Pieri e Groppi, 1981, CNR,1992)

Si fa inoltre presente che quasi tutto il territorio comunale di Portomaggiore ricade all'interno della zona sismogenetica 912 (**FIGURA 2.3**), dunque è potenzialmente sede epicentrale di eventi sismici.

La zonizzazione sismica ZS9 pone come magnitudo attesa massima nella zona sismogenetica 912 il valore di $M = 6,14$.

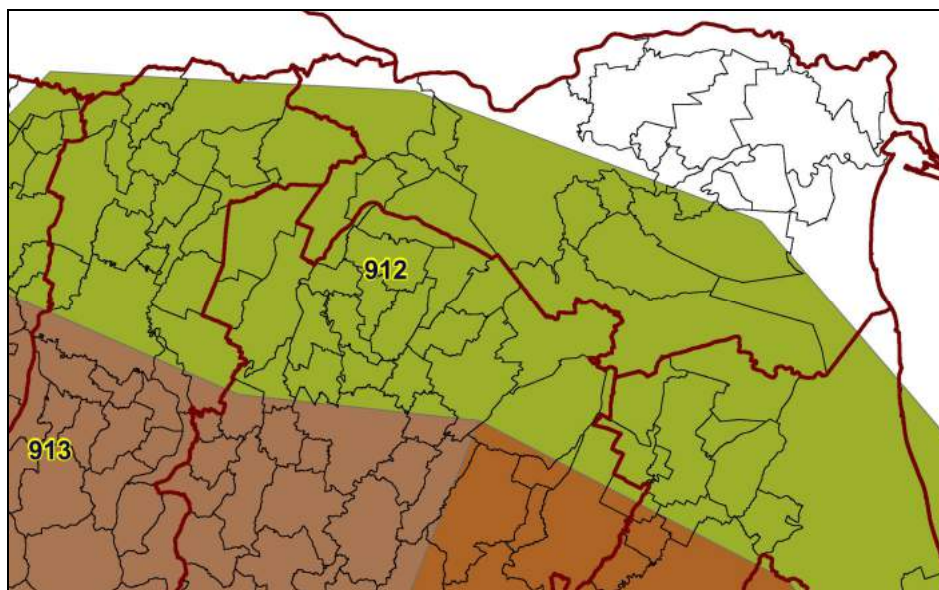


FIGURA 2.3 - Mappa delle aree sismogenetiche dell'Italia Settentrionale

2.2. CARATTERI STRATIGRAFICI E GEOMORFOLOGICI

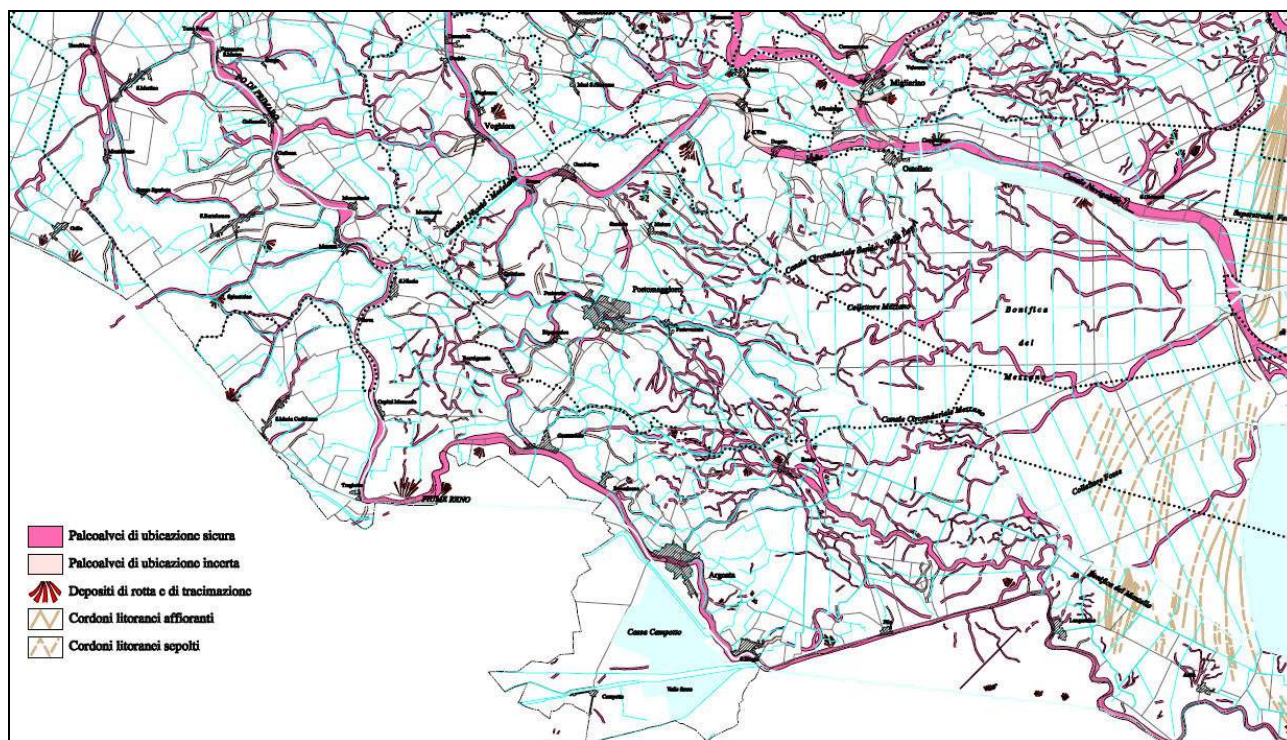
La formazione dell'ambiente, nella sua configurazione attuale, è relativamente recente e consegue a ripetute variazioni dei rapporti di equilibrio tra livello del mare, apporti solidi dei corsi d'acqua, entità di subsidenza e, non ultimo, l'intervento umano. Nell'attuale configurazione fisica del territorio sono riconoscibili le tracce sia della sua evoluzione naturale che quella operata dall'uomo.

Tra le più evidenti e più importanti nel disegnare l'assetto morfologico si possono elencare i paleoalvei, i coni di esondazione, i cordoni dunari testimoni della veloce progradazione verso est della linea di costa, ed infine si individuano quelle aree particolarmente depresse che erano sede di bacini palustri.

Per ogni struttura geomorfologica corrisponde, in linea di massima, una caratteristica classe litologica; la granulometria e la storia tensionale, strettamente legata alla storia geologica, ne condizionano le caratteristiche meccaniche ed idrauliche. L'eterogeneità degli ambienti di deposizione dei sedimenti nella porzione di Pianura Padana ferrarese che si è formata in questi ultimi millenni fa sì insomma che ai modelli geologici a grande scala vada di volta in volta affiancata una analisi puntuale locale dettagliata del suolo e sottosuolo ai fini di determinare situazioni vantaggiose che possano far risparmiare già dalla fase di progettazione sul costo della realizzazione dell'intervento, o svantaggiose che possano comunque far lavorare con preventivi realistici, che non siano vittime poi del cosiddetto "imprevisto geologico".

L'area di intervento ricade in un'area di bacino interfluviale, dove i fiumi hanno depositato nel tempo le loro alluvioni distali e risulta inoltre attraversata da una serie di paleoalvei minori, che interessano il sito di intervento.

In **FIGURA 2.4** sono riportate uno stralcio della carta geomorfologica della provincia di Ferrara ed uno stralcio della carta geomorfologica di dettaglio del comune di Portomaggiore.



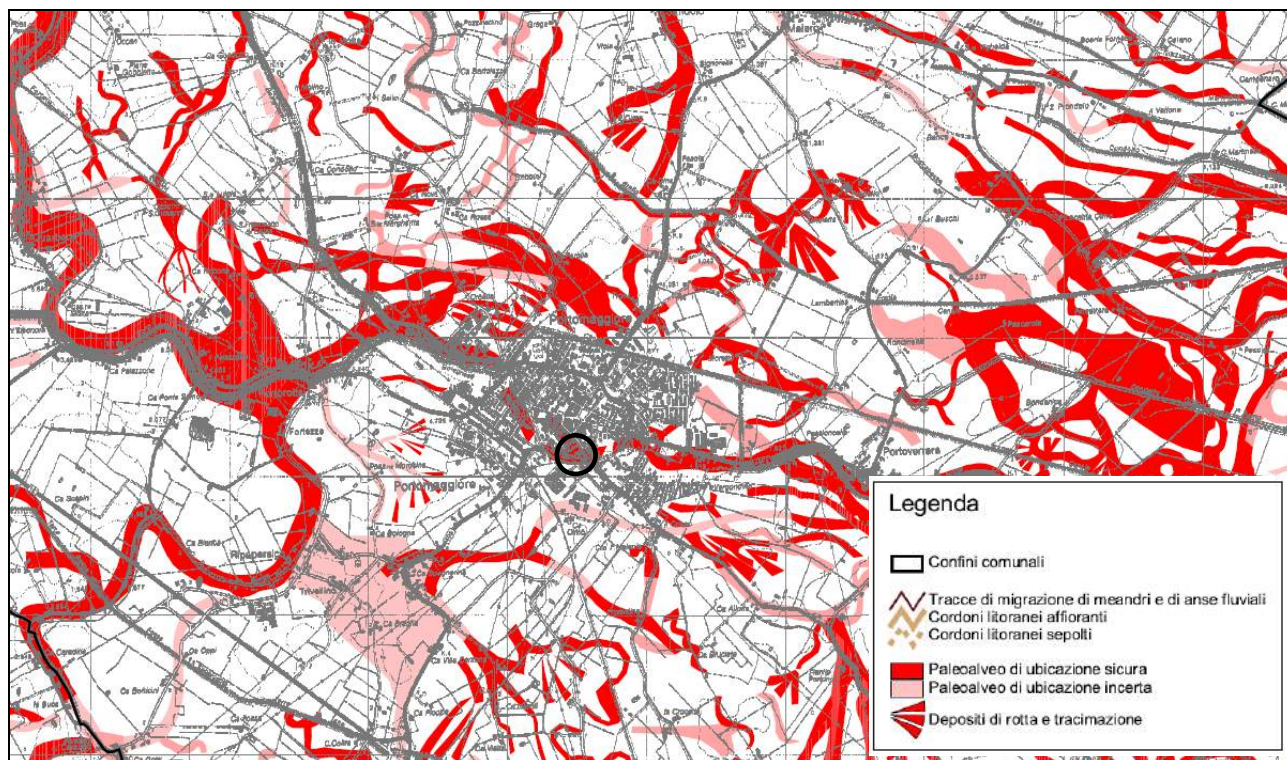


FIGURA 2.4– Carta Geomorfologica del territorio comunale di Portomaggiore

2.3. INDAGINI SITO-SPECIFICHE

Per ricostruire nel dettaglio la stratigrafia dell'area su cui sorge il Teatro di Portomaggiore si è fatto ricorso ai seguenti dati:

- una nuova penetrometria SCPTU a -31m di profondità eseguita nell'area cortiliva sul retro del Teatro.
- prova geofisica tipo ESAC eseguite per la caserma dei VVFF e per il COC, da cui si ricava il profilo delle velocità delle onde di taglio fino a circa 270metri di profondità.
- due prove geofisiche HVSr eseguite a nord e a sud nelle immediate vicinanze del Teatro Concordia.

In **FIGURA 2.5** si riporta uno stralcio catastale della provincia di Ferrara con l'ubicazione delle indagini geologiche eseguite e quelle bibliografiche.

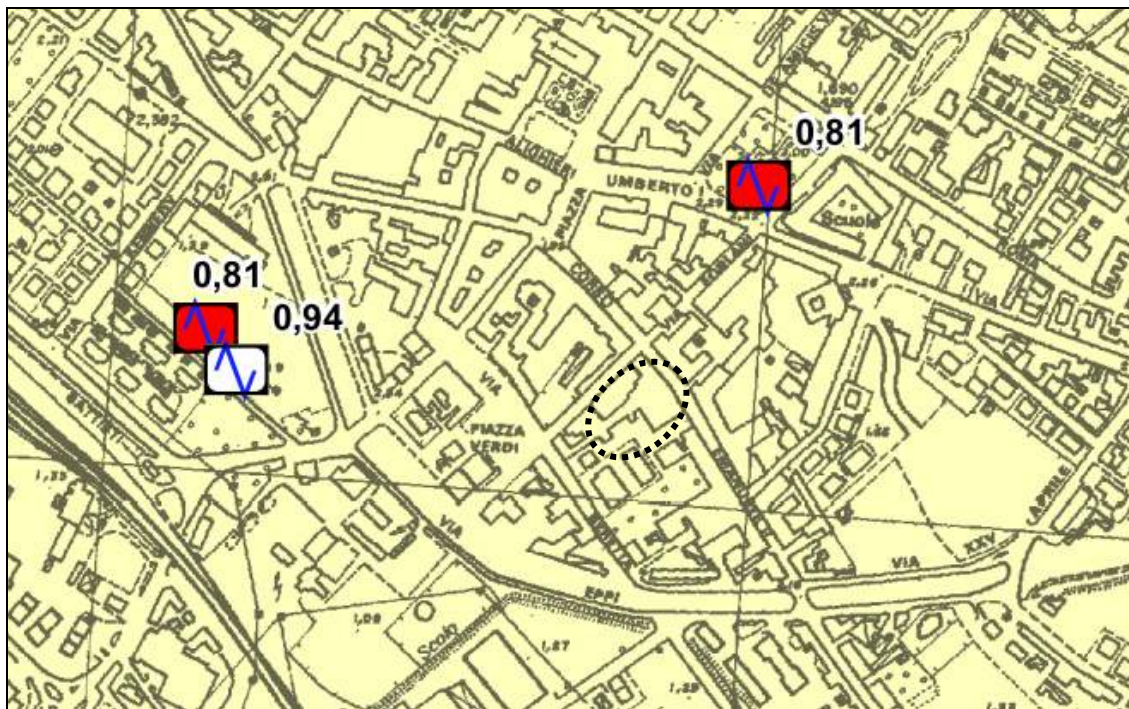
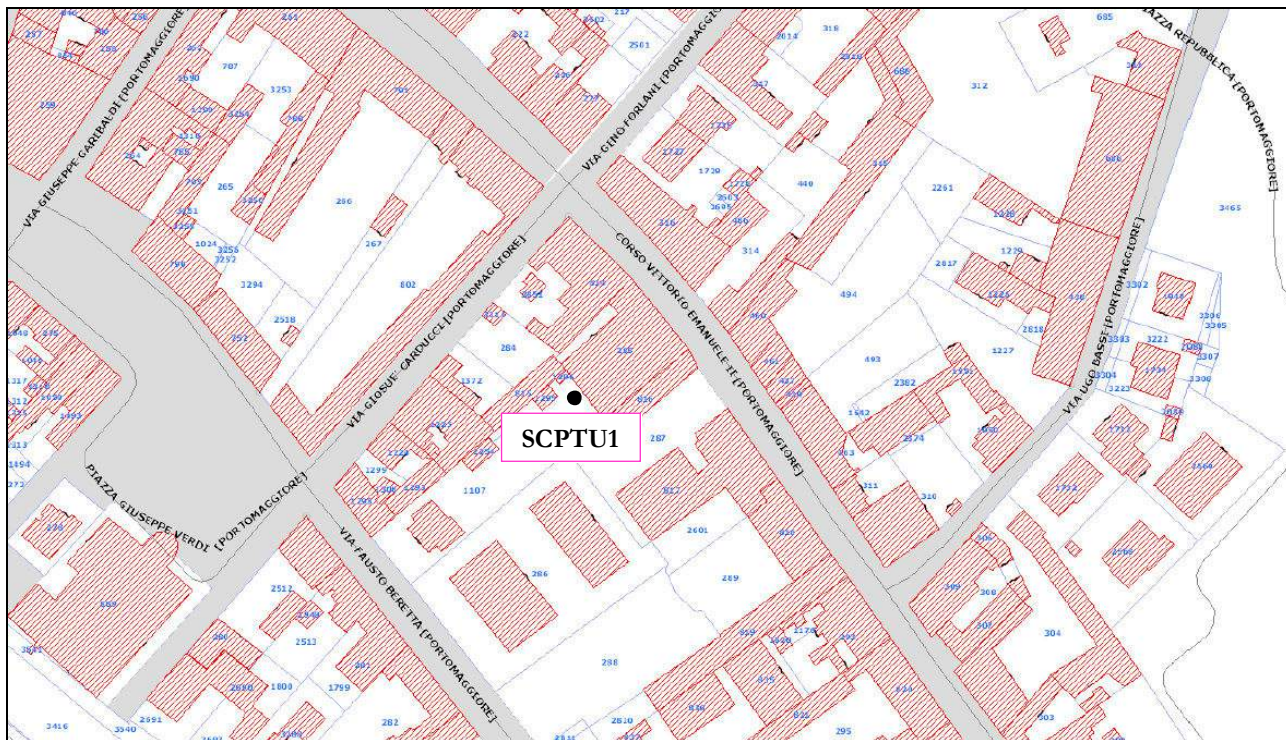


FIGURA 2.5– Stralcio catastale con ubicazione indagini eseguite e stralcio Mappa di Microzonazione Sismica con ubicazione delle due prove HVSR utilizzate

Di seguito si riportano i diagrammi delle resistenze della prova penetrometrica eseguita in sito.

**PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA
DIAGRAMMI DI RESISTENZA**

RIF. PROVA: CPTU n°:

U52-19 CPTU1

COMMITTENTE: Comune di Portomaggiore

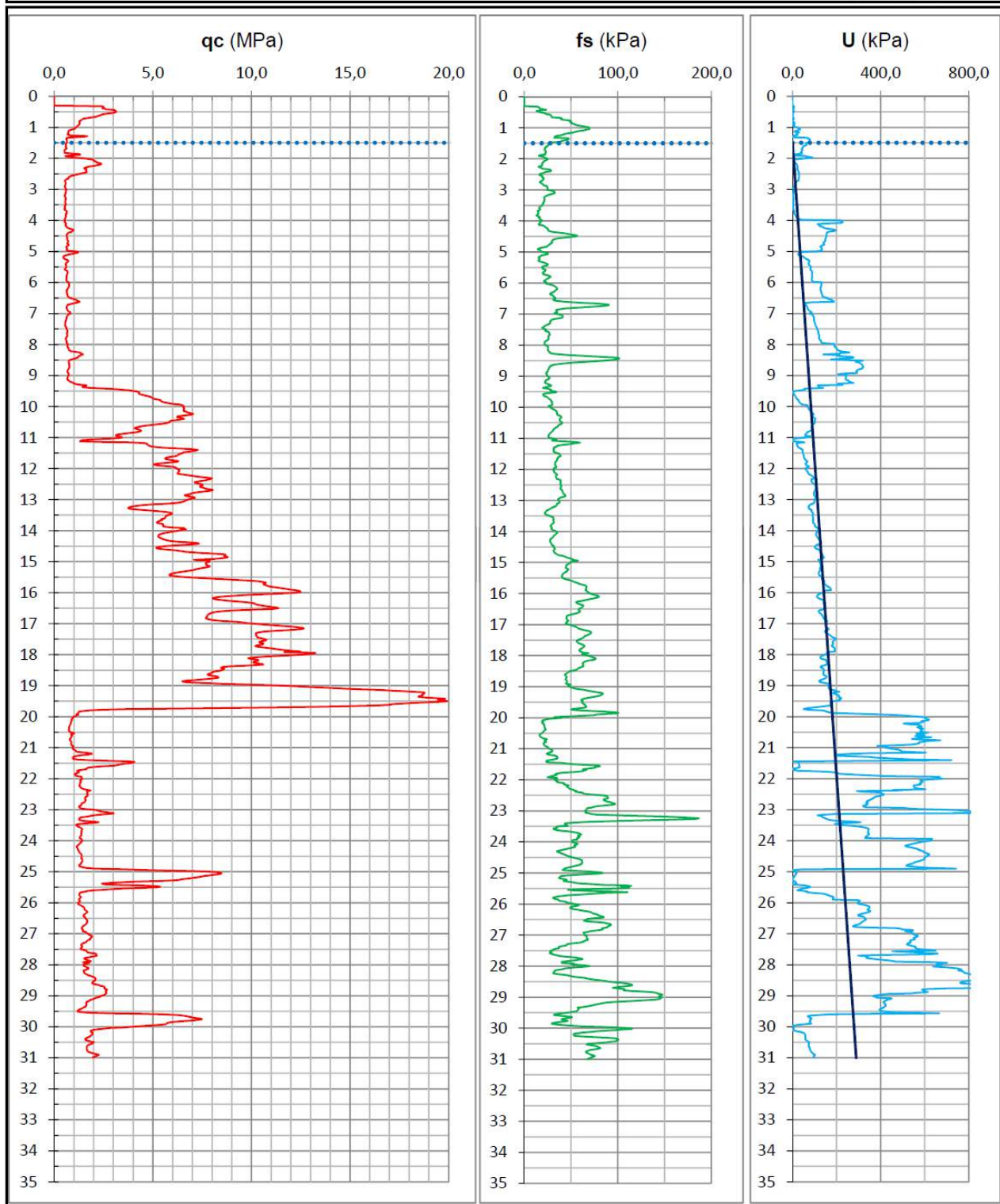
CANTIERE: Teatro Concordia, Portomaggiore (Fe)

DATA: 12/07/2019

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00

PROFONDITA' FALDA (m da p.c.): 1,50

PREFORO (m da p.c.): 0,30



Diagrammi di resistenza SCPTU1 (nuova prova in sito)

PORTOMAGGIORE, PM_27/2

Instrument: TZ3-ex04/01-13

Data format: 32 byte

Full scale [mV]: 51

Start recording: 07/10/14 13:12:52 End recording: 07/10/14 13:32:52

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h20'00". Analyzed 78% trace (manual window selection)

Sampling rate: 128 Hz

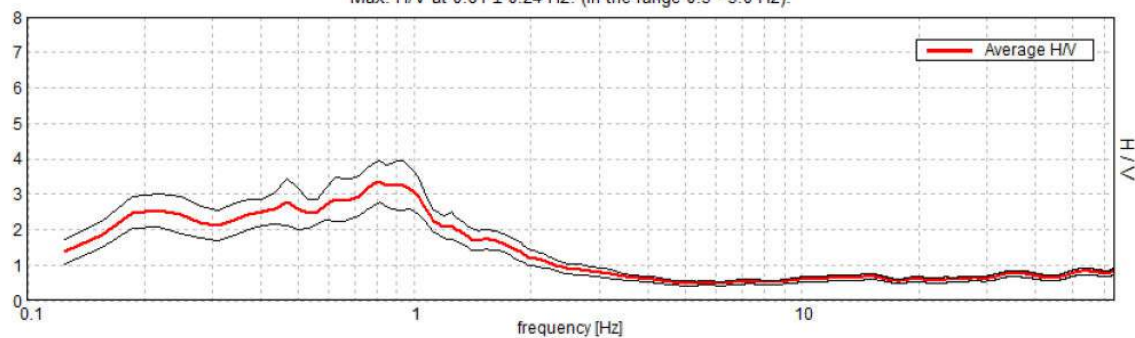
Window size: 30 s

Smoothing type: Triangular window

Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

Max. H/V at 0.81 ± 0.24 Hz. (In the range 0.5 - 5.0 Hz).



RAPPORTO SPETTRALE A STAZIONE SINGOLA (HVSr)

CLIENTE

UNIONE DEI COMUNI VALLI E DELIZIE

CODICE LAVORO

1438

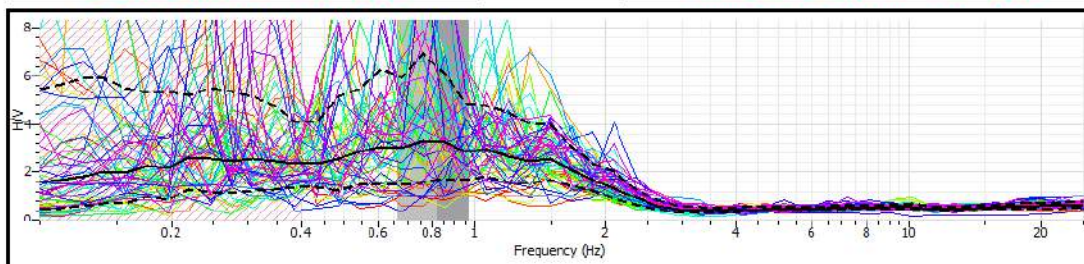
CODICE PROVA

HVSr - Masw 9

RAPPORTO SPETTRALE H/V

F0 0.81 ± 0.15 Hz. A0 = 3.31

FMax 0.81 ± 0.15 Hz. A0 = 3.31



3. DEFINIZIONE DEI PARAMETRI SISMICI

3.1. DATI DI AUSILIO PER LA PROGETTAZIONE SISMICA

“La Regione Emilia Romagna non è esente da attività sismo-tettonica. La sua sismicità può però essere definita media relativamente alla sismicità nazionale, poiché i terremoti storici hanno avuto magnitudo massima compresa tra 5,5 e 6 della scala Richter e intensità del IX-X grado della scala MCS. I maggiori terremoti (Magnitudo > 5,5) si sono verificati nel settore sud-orientale, in particolare nell’Appennino Romagnolo e lungo la costa riminese. Altri settori interessati da sismicità frequente ma **generalmente di minore energia (Magnitudo ≤ 5,5)** sono il margine appenninico-padano tra la Val d’Arda e Bologna, l’arco della dorsale ferrarese e il crinale appenninico” (Note illustrative, Carta Sismotettonica della Regione Emilia Romagna, 2004).

Gli eventi del maggio 2012 hanno avuto magnitudo M_L massima 5,90.

3.1.1. CATEGORIA DI SUOLO DI FONDAZIONE

La categoria di suolo dipende dal valore di V_{s30} . Il parametro V_{s30} rappresenta la media ponderata dei valori delle velocità dell’onda di taglio “S” nei primi 30 m di sottosuolo indagato, matematicamente espressa da (eq. 1):

$$V_{s30} = \frac{30}{\sum \frac{h_i}{v_i}}$$

dove,

V_{s30} : velocità media ponderata delle onde di taglio “S”,

h_i : spessore dello strato i -esimo,

v_i : velocità delle onde di taglio “S” nello strato i -esimo.

Il valore di V_{s30} è stato rilevato in sito attraverso misure dirette, mediante la realizzazione di una prova penetrometrica statica con punta elettrica e piezocono sismico SCPTU1 eseguita a sud nel cortile del Teatro, spinta fino alla profondità di -31,00 m da p.c..

In **FIGURA 3.1** è riportato uno stralcio di mappa catastale della provincia di Ferrara con l’ubicazione della prova SCPTU1 eseguita in sito.

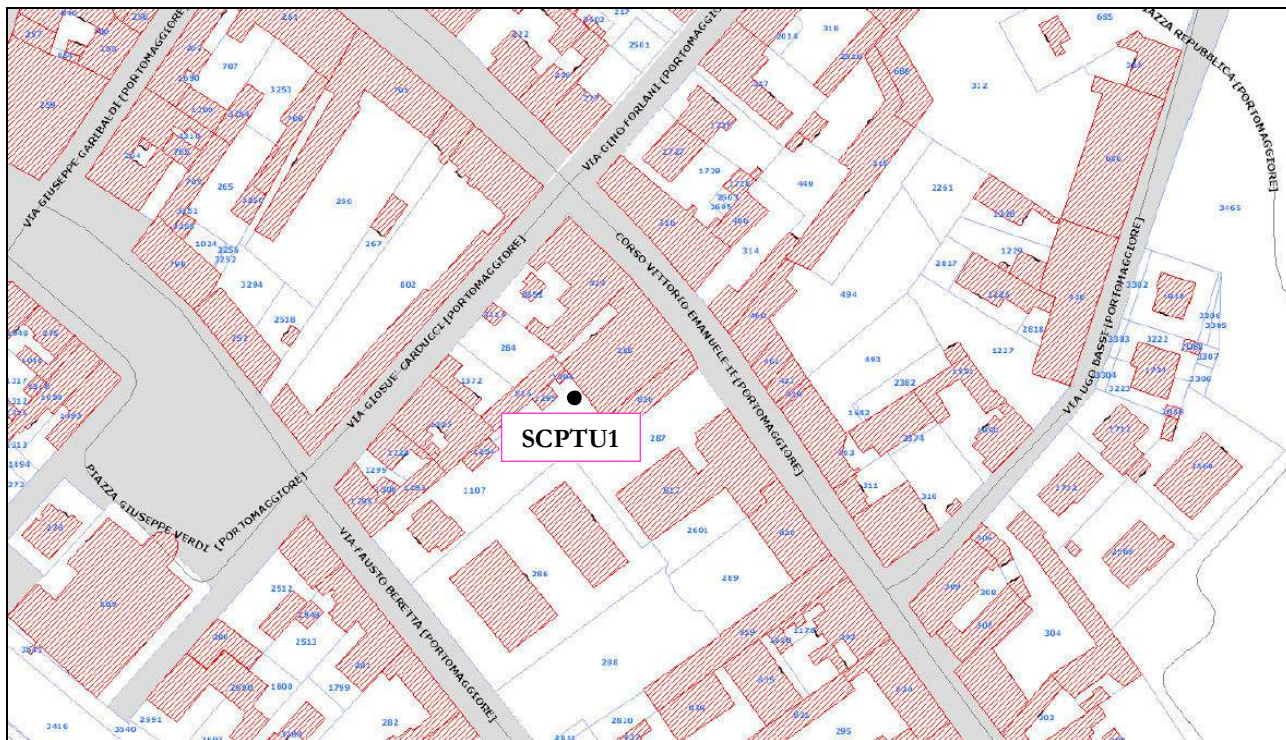


FIGURA 3.1 – Stralcio di mappa catastale con ubicazione prova SCPTU1

La prova consiste nell’inserire sulla punta elettrica della prova penetrometrica statica dei ricevitori (geofoni) che con opportuna strumentazione e una sorgente di onde in superficie possono essere misurati, a profondità diverse, in questo caso ad ogni metro di profondità (fino a -31,00 m da p.c.), i tempi di arrivo delle onde sismiche fra la superficie (sorgente) ed i ricevitori (in profondità), analogamente a quanto avviene con il metodo geofisico cosiddetto “downhole”.

La punta utilizzata prende il nome di Piezocono G1-CPL2IN (**FIGURA 3.2**).

In base ai tempi di arrivo conoscendo la distanza tra la sorgente ed il ricevitore si può calcolare la velocità delle onde sismiche ed in particolare delle onde di taglio (Vs).

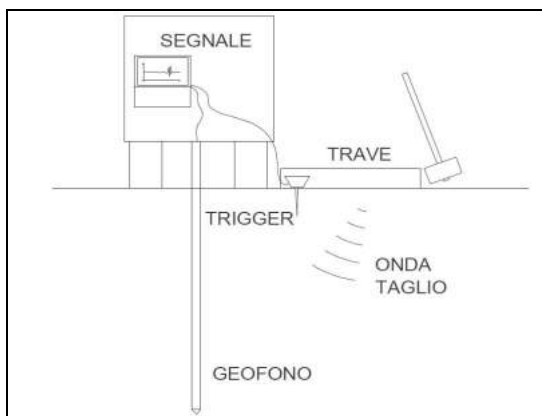
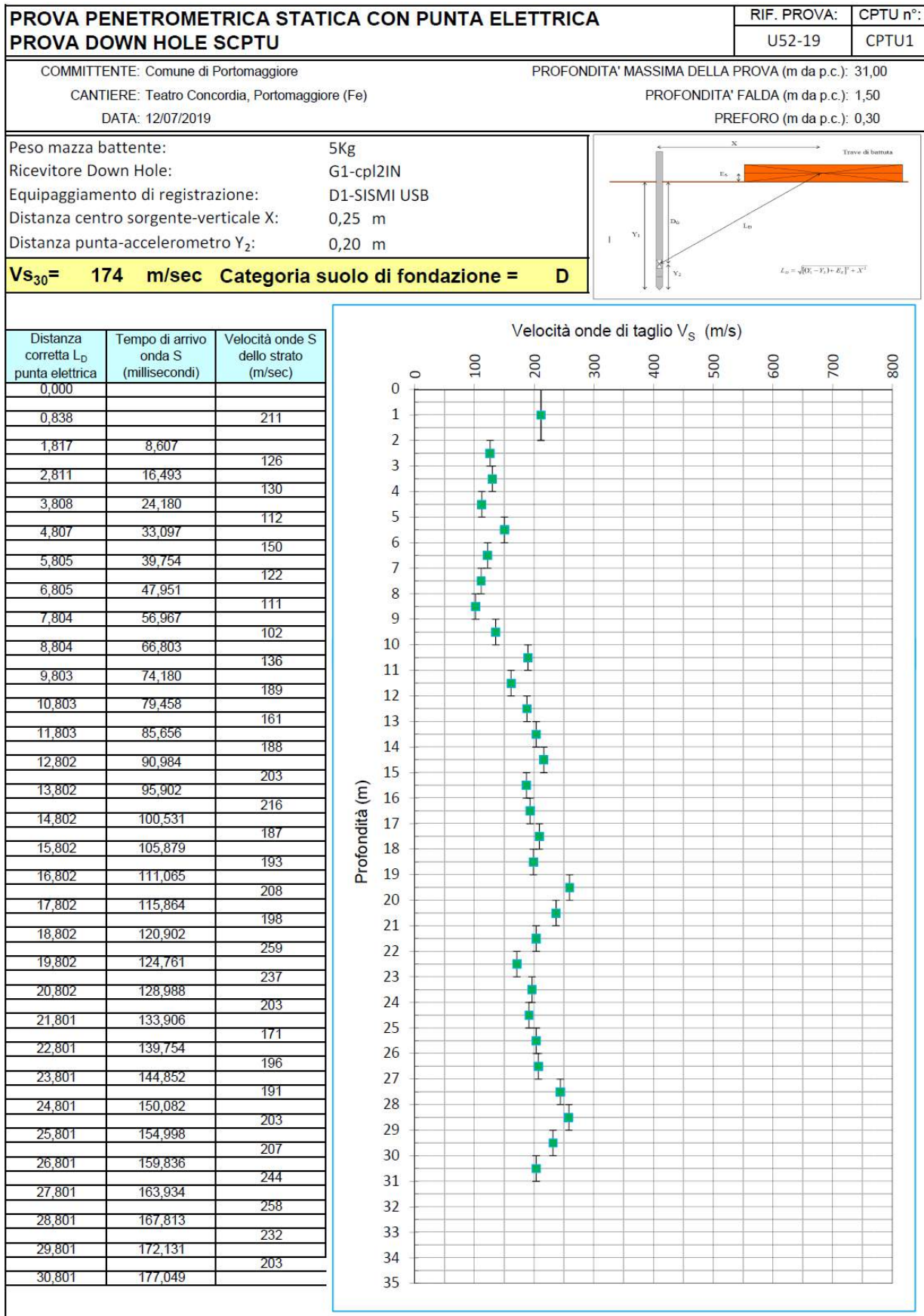
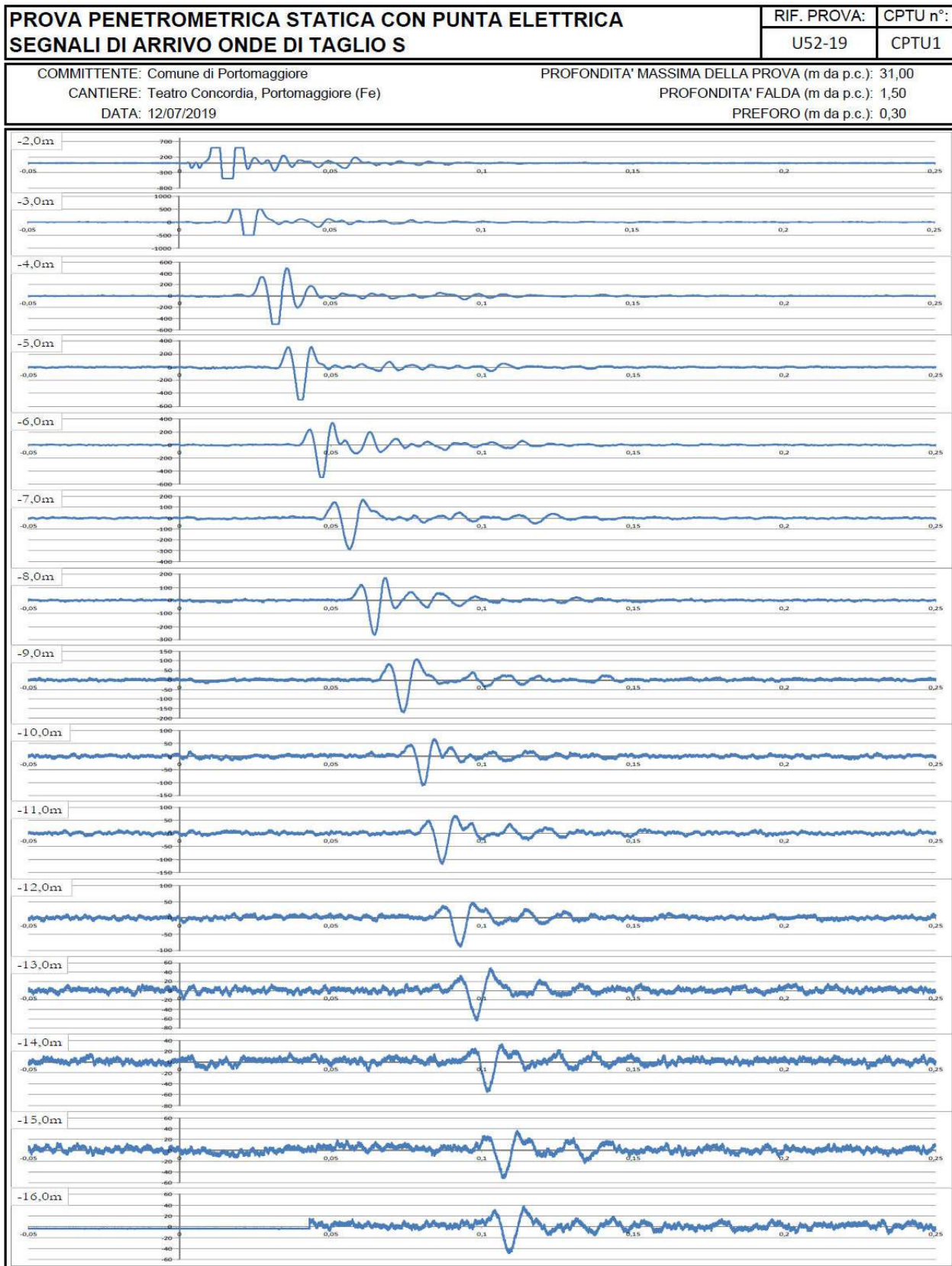


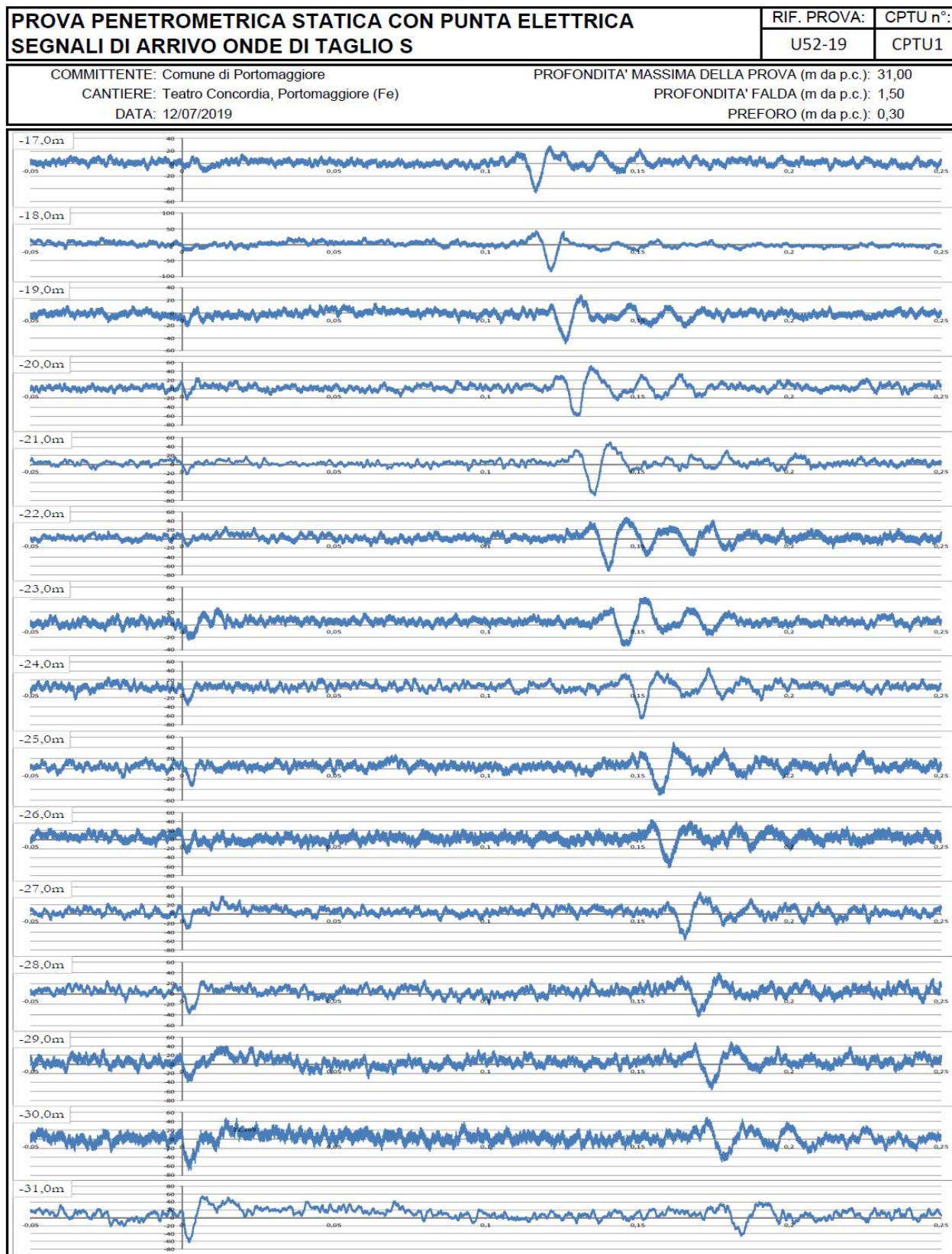
FIGURA 3.2– Rappresentazione grafica della prova penetrometrica con piezocono sismico

Durante la realizzazione della prova penetrometrica statica con punta elettrica e sismocono SCPTU1 sono state realizzate letture dirette dei tempi di arrivo delle onde di taglio S ad intervalli regolari fino alla profondità di -31,0 m da p.c.. Attraverso questo strumento è possibile determinare la velocità di propagazione delle onde S alla profondità di 31 metri (V_{S30} calcolata da -1,0m a -31,0m).

Di seguito viene riportata l'elaborazione della prova SCPTU1 svolta in sito con la rappresentazione del profilo verticale della velocità delle onde di taglio S ad ogni metro di profondità e la categoria di suolo di fondazione (ricavata attraverso il profilo di Vs sito specifico fino alla profondità di -31 m da p.c.).







Il valore di V_{s30} risultante dalla lettura dei tempi di arrivo delle onde S alla profondità di -31,0 m da p.c. partendo da -1,0 m da p.c. è di 174 m/s e quindi la Categoria di suolo di fondazione, secondo gli spettri semplificati, è di tipo D.

$V_{s30} = 174 \text{ m/s}$ Categoria di suolo D
--

3.1.2. PARAMETRI SISMICI

Si valutano i parametri spettrali a_g , F_0 e T_c^* per il sito di progetto (approccio “sito-dipendente”) a titolo esemplificativo considerando l'amplificazione stratigrafica e topografica (**T1**) (Cap. 3.2.3 del D.M. 2018) la categoria del sottosuolo (**D**) e la classe d'uso della costruzione (**III**) (Cap. 2.4.2 del D.M. 2018).

Parametri sismici

Tipo di elaborazione: Stabilità dei pendii

Sito in esame.

latitudine: 44,697351

longitudine: 11,807838

Classe: 3

Vita nominale: 50

Siti di riferimento

Sito 1 ID: 16071 Lat: 44,6729 Lon: 11,8036 Distanza: 2735,793

Sito 2 ID: 16072 Lat: 44,6739 Lon: 11,8739 Distanza: 5836,749

Sito 3 ID: 15850 Lat: 44,7239 Lon: 11,8726 Distanza: 5904,800

Sito 4 ID: 15849 Lat: 44,7229 Lon: 11,8022 Distanza: 2877,352

Parametri sismici

Categoria sottosuolo: D

Categoria topografica: T1

Periodo di riferimento: 75anni

Coefficiente c_u : 1,5

Operatività (SLO):

Probabilità di superamento: 81 %

T_r : 45 [anni]

a_g : 0,050 g

F_0 : 2,485

T_c^* : 0,271 [s]

Danno (SLD):

Probabilità di superamento: 63 %

T_r : 75 [anni]

a_g : 0,064 g

F_0 : 2,496

T_c^* : 0,281 [s]

Salvaguardia della vita (SLV):

Probabilità di superamento: 10 %

T_r : 712 [anni]

a_g : 0,179 g

F_0 : 2,558

T_c^* : 0,276 [s]

Prevenzione dal collasso (SLC):

Probabilità di superamento: 5 %

Tr: 1462 [anni]
ag: 0,237 g
Fo: 2,493
Tc*: 0,285 [s]

Coefficienti Sismici Stabilità dei pendii

SLO:

Ss: 1,800
Cc: 2,400
St: 1,000
Kh: 0,018
Kv: 0,009
Amax: 0,885
Beta: 0,200

SLD:

Ss: 1,800
Cc: 2,360
St: 1,000
Kh: 0,023
Kv: 0,011
Amax: 1,125
Beta: 0,200

SLV:

Ss: 1,710
Cc: 2,380
St: 1,000
Kh: 0,073
Kv: 0,037
Amax: 2,996
Beta: 0,240

ag=0,30g

SLC:

Ss: 1,510
Cc: 2,340
St: 1,000
Kh: 0,100
Kv: 0,050
Amax: 3,514
Beta: 0,280

Le coordinate espresse in questo file sono in ED50

Geostru

Coordinate WGS84

latitudine: 44.696421
longitudine: 11.806852

3.1.3. MAGNITUDO DI PROGETTOPARAMETRI SISMICI

La zonizzazione sismica ZS9 pone come magnitudo attesa massima nella zona sismogenetica 912 il valore di $M = 6,14$. Nei tempi storici erano stati stimati eventi con magnitudo di 5,60. Durante gli eventi del maggio 2012 si sono liberate energie sismiche sulla dorsale ferrarese con magnitudo di 5,90 (che è stato stimato da Picotti, 2013, come evento con T_R di 1000 anni).

Magnitudo di progetto
 $M = 6,14 M_w$

3.2. ANALISI DELLA LIQUEFAZIONE DELLE SABBIE DA SPETTRO SEMPLIFICATO

L'obiettivo della riduzione del rischio sismico passa anche per l'analisi delle componenti territoriali che possono innescare fenomeni negativamente impattanti con le strutture antropiche e la loro sicurezza. Vale comunque la pena evidenziare che laddove sono presenti i caratteri predisponenti, non è detto che si possano realizzare le condizioni di cause scatenanti; ovvero un terreno sabbioso può avere tutti i requisiti granulometrici e di addensamento per liquefarsi, ma nell'area non si verificherà un sisma con energia sufficiente ad indurre liquefazione.

In particolare vengono ritenuti motivi di esclusione dalla verifica a liquefazione, la verifica di almeno una di queste circostanze:

1. Eventi sismici attesi di magnitudo di momento M_w inferiore a 6 e durata inferiore a 15 sec. ("La Liquefazione del terreno in condizioni sismiche" – Crespellani, Nardi, Simoncini – Zanichelli 1988).
2. Accelerazioni massime attese al piano campagna in condizioni *free-field* minori di 0,1g;
3. Accelerazioni massime al piano campagna in condizioni *free-field* minori di 0,15g e terreni con caratteristiche ricadenti in una delle tre seguenti categorie:

- -frazione di fine, FC, superiore al 20%, con indice di plasticità $PI > 10$;
- $FC \geq 35\%$ e resistenza $(N_1)_{60} > 20$;
- $FC \leq 5\%$ e resistenza $(N_1)_{60} > 25$

Dove $(N_1)_{60}$ è il valore normalizzato della resistenza penetrometrica della prova SPT.

4. Distribuzione granulometrica esterna alle zone indicate nella **FIGURA 3.3** da distinguere i materiali in funzione del coefficiente di uniformità $U_c < 3,5$ o $U_c > 3,5$.
5. Profondità media stagionale della falda superiore ai 15m dal piano campagna.
6. Copertura di strati superficiali non liquefacibili con spessore maggiore di 3m, oppure con spessore maggiore di 5m per magnitudo maggiori di $M > 7$.
7. Un ulteriore motivo di esclusione dalla verifica di liquefazione è dato dal valore della **densità relativa** D_r del deposito. Gibbs ha eseguito diversi studi su risultati di vari autori stabilendo che una densità relativa pari a 70% è valore limite tra terreni liquefacibili e non liquefacibili (*Manuale di geotecnica per l'ingegneria civile* di Nunziante Marino, Maggioli Editore, 2006), di conseguenza tutti i terreni con $D_r > 70\%$ vengono automaticamente esclusi dalla verifica alla liquefazione.

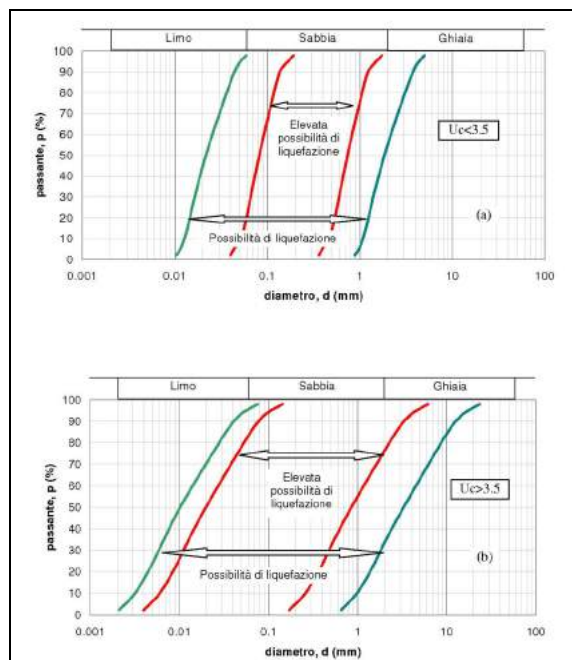


FIGURA 3.3 - Fasce granulometriche per la valutazione preliminare della suscettibilità alla liquefazione di un terreno

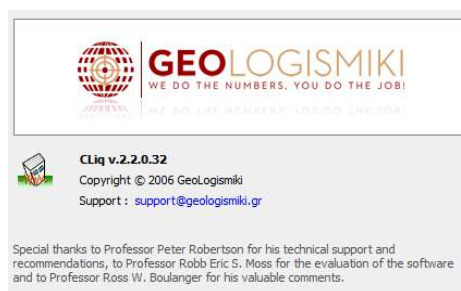
Il D.M. 17/01/2018 ha riassunto in questi 4 punti i casi in cui non è prevista liquefazione:

7.11.3.4.2 Esclusione della verifica a liquefazione

La verifica a liquefazione può essere omessa quando si manifesti almeno una delle seguenti circostanze:

1. accelerazioni massime attese al piano campagna in assenza di manufatti (condizioni di campo libero) minori di 0,1g;
2. profondità media stagionale della falda superiore a 15 m dal piano campagna, per piano campagna sub-orizzontale e strutture con fondazioni superficiali;
3. depositi costituiti da sabbie pulite con resistenza penetrometrica normalizzata $(N_1)_{60} > 30$ oppure $q_{c1N} > 180$ dove $(N_1)_{60}$ è il valore della resistenza determinata in prove penetrometriche dinamiche (Standard Penetration Test) normalizzata ad una tensione efficace verticale di 100 kPa e q_{c1N} è il valore della resistenza determinata in prove penetrometriche statiche (Cone Penetration Test) normalizzata ad una tensione efficace verticale di 100 kPa;
4. distribuzione granulometrica esterna alle zone indicate nella Fig. 7.11.1(a) nel caso di terreni con coefficiente di uniformità $U_c < 3,5$ e in Fig. 7.11.1(b) nel caso di terreni con coefficiente di uniformità $U_c > 3,5$.

Per la verifica della liquefazione delle sabbie è stato utilizzato il software di calcolo C-Liq v.2.2.0.32.



che analizzando ogni strato da 2 cm individuato dalle prove CPTU, ne verifica la potenzialità di liquefazione.

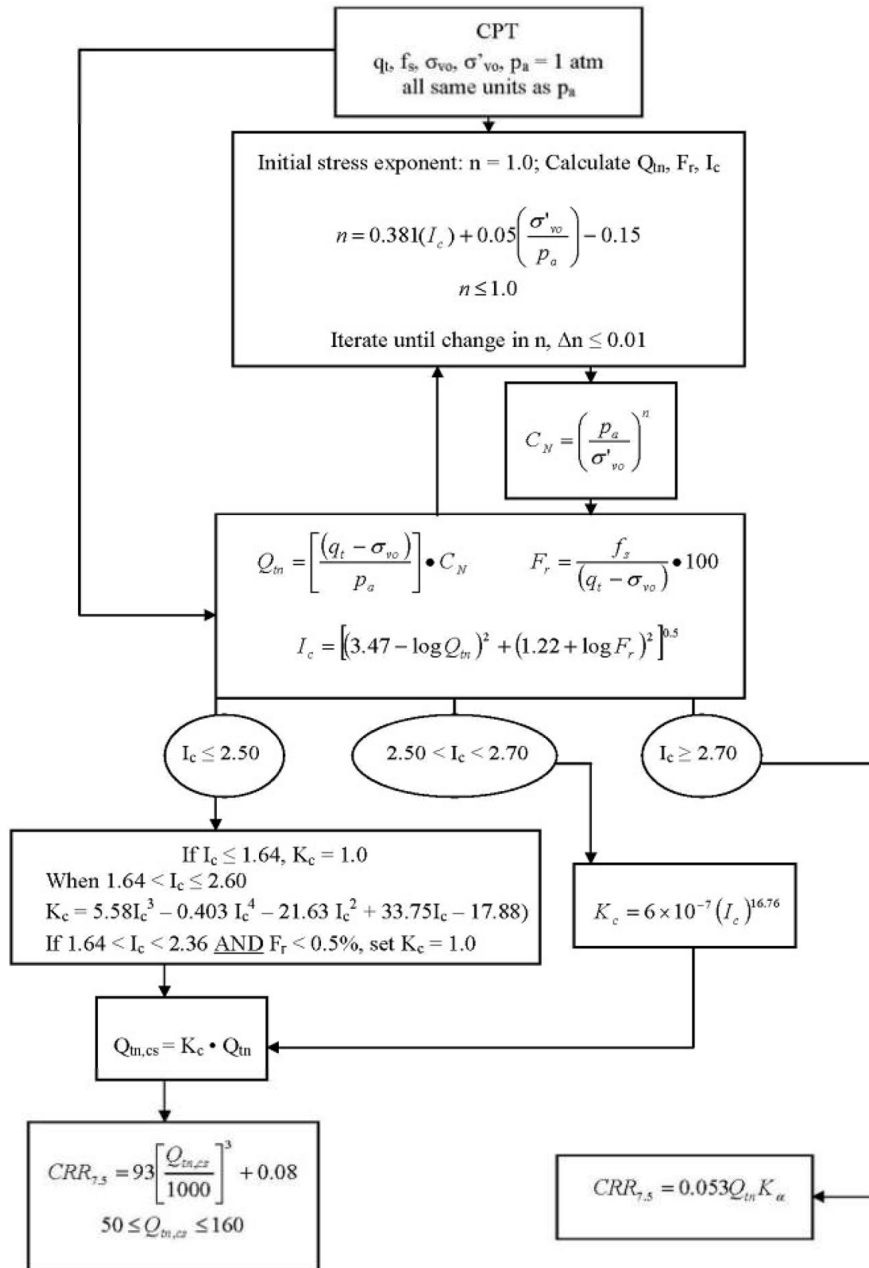
Per questo calcolo si è considerata una magnitudo di 6,14 e un'accelerazione P.G.A. di 0,30g.

L'analisi viene condotta con il metodo di Robertson (2010).

3.2.1. ANALISI CON IL METODO DI ROBERTSON (2010)

Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart¹:



¹ P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

LIQUEFACTION ANALYSIS REPORT

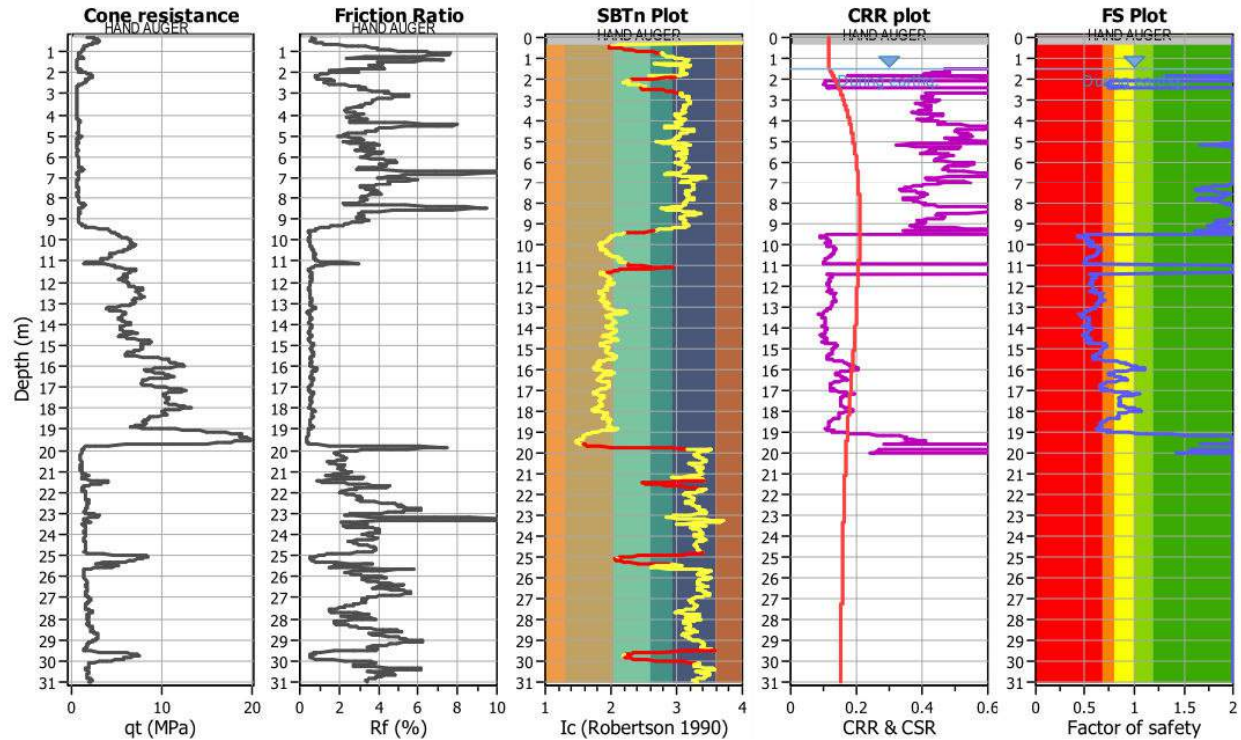
Project title :

Location :

CPT file : rif. U52-19 CPTU1 Portomaggiore

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	applied:	All soils
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.30	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based



This software is licensed to: Dott. Geol. Thomas Veronese

CPT name: rif. U52-19 CPTU1 Portomaggiore

:: Liquefaction Potential Index calculation data :: (continued)

Depth (m)	FS	F_L	w_z	d_z	LPI	Depth (m)	FS	F_L	w_z	d_z	LPI
30.74	2.00	0.00	0.00	0.00	0.00	30.76	2.00	0.00	0.00	0.00	0.00
30.78	2.00	0.00	0.00	0.00	0.00	30.80	2.00	0.00	0.00	0.00	0.00
30.82	2.00	0.00	0.00	0.00	0.00	30.84	2.00	0.00	0.00	0.00	0.00
30.86	2.00	0.00	0.00	0.00	0.00	30.88	2.00	0.00	0.00	0.00	0.00
30.90	2.00	0.00	0.00	0.00	0.00	30.92	2.00	0.00	0.00	0.00	0.00
30.94	2.00	0.00	0.00	0.00	0.00	30.96	2.00	0.00	0.00	0.00	0.00
30.98	2.00	0.00	0.00	0.00	0.00	31.00	2.00	0.00	0.00	0.00	0.00

Overall liquefaction potential: 10.40

LPI = 0.00 - Liquefaction risk very low
LPI between 0.00 and 5.00 - Liquefaction risk low
LPI between 5.00 and 15.00 - Liquefaction risk high
LPI > 15.00 - Liquefaction risk very high

Abbreviations

FS: Calculated factor of safety for test point
 F_L : 1 - FS
 w_z : Function value of the extend of soil liquefaction according to depth
 d_z : Layer thickness (m)
LPI: Liquefaction potential index value for test point

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
30.30	65.64	2.00	0.00	1.00	0.00	30.32	67.78	2.00	0.00	1.00	0.00
30.34	68.58	2.00	0.00	1.00	0.00	30.36	68.22	2.00	0.00	1.00	0.00
30.38	67.41	2.00	0.00	1.00	0.00	30.40	66.75	2.00	0.00	1.00	0.00
30.42	66.46	2.00	0.00	1.00	0.00	30.44	66.55	2.00	0.00	1.00	0.00
30.46	66.15	2.00	0.00	1.00	0.00	30.48	64.91	2.00	0.00	1.00	0.00
30.50	63.16	2.00	0.00	1.00	0.00	30.52	62.19	2.00	0.00	1.00	0.00
30.54	62.49	2.00	0.00	1.00	0.00	30.56	63.09	2.00	0.00	1.00	0.00
30.58	63.25	2.00	0.00	1.00	0.00	30.60	63.10	2.00	0.00	1.00	0.00
30.62	63.00	2.00	0.00	1.00	0.00	30.64	62.86	2.00	0.00	1.00	0.00
30.66	62.43	2.00	0.00	1.00	0.00	30.68	61.37	2.00	0.00	1.00	0.00
30.70	60.36	2.00	0.00	1.00	0.00	30.72	59.59	2.00	0.00	1.00	0.00
30.74	59.24	2.00	0.00	1.00	0.00	30.76	59.13	2.00	0.00	1.00	0.00
30.78	59.32	2.00	0.00	1.00	0.00	30.80	59.98	2.00	0.00	1.00	0.00
30.82	60.87	2.00	0.00	1.00	0.00	30.84	61.98	2.00	0.00	1.00	0.00
30.86	63.24	2.00	0.00	1.00	0.00	30.88	64.47	2.00	0.00	1.00	0.00
30.90	64.96	2.00	0.00	1.00	0.00	30.92	64.69	2.00	0.00	1.00	0.00
30.94	63.81	2.00	0.00	1.00	0.00	30.96	62.91	2.00	0.00	1.00	0.00
30.98	62.07	2.00	0.00	1.00	0.00	31.00	61.52	2.00	0.00	1.00	0.00
											Total estimated settlement: 26.13

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumetric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

Come si può vedere, applicando lo spettro semplificato di categoria D, il suolo è liquefacibile con un indice di potenziale liquefazione **elevato**.

3.2.3. SINTESI DEI RISULTATI

Si riporta in breve la teoria utilizzata per il calcolo dell'indice del potenziale di liquefazione, I_L , definito dalla seguente relazione:

$$I_L = \int_0^{20} F(z)w(z)dz ,$$

in cui z è la profondità dal piano di campagna in metri e $w(z)=10-0.5z$

Ad una quota z il fattore $F(z)=F$ vale:

$$F = 1 - F_L \text{ se } F_L \leq 1.0$$

$$F = 0 \text{ se } F_L > 1.0$$

dove F_L è il fattore di sicurezza alla liquefazione alla quota considerata.

La sintesi dei risultati ottenuti per le due verticali indagate è riportata nella seguente tabella:

Robertson 2010	Potenziale Liquefazione I_{PL}
Prova SCPTU1	10,40

Iwasaki et al. (1982) hanno introdotto la valutazione "integrale" degli effetti della liquefazione attraverso l'indice del potenziale di liquefazione I_L , e hanno proposto una classificazione in funzione del valore di I_L , spesso utilizzata nella pratica tecnica:

$I_L = 0$	Non Liquefacibile ($FL \geq 1,0$)
$0 < I_L \leq 5$	Potenziale basso
$5 < I_L \leq 15$	Potenziale elevato
$15 < I_L$	Potenziale estremamente elevato

Quindi, una volta definite le azioni sismiche attraverso gli spettri semplificati, attenendosi scrupolosamente alla NTC2018, emerge in questa prima fase un alto rischio di liquefazione delle sabbie per edifici di classe d'uso III, che devono resistere ad eventi sismici con tempo di ritorno di 712 anni.

Dal momento che emerge la possibilità della liquefazione delle sabbie, non si può più ricorrere agli spettri semplificati ma occorrerà procedere allo studio specifico del sito e definire la risposta sismica locale.

La risposta sismica locale, attraverso gli spettri semplificati, tiene esclusivamente conto delle caratteristiche dei soli primi 30m di terreno, tra l'altro solo in termini di V_s (ovvero di velocità di propagazione delle onde di taglio nei diversi strati presenti dal p.c. fino a -30m di profondità al di sotto del piano di posa della fondazione).

Si procede ora ad un approfondimento di studio sulle azioni sismiche, che verranno definite attraverso una analisi di risposta sismica locale sitospecifica; questo approccio è più rigoroso in quanto tiene conto della successione stratigrafica dal p.c. fino al bedrock sismico, poi tiene conto oltre che del profilo di V_s fino a quella profondità, anche del comportamento geotecnico in campo dinamico degli strati presenti, espressi in funzione del decadimento del modulo di taglio alle basse deformazioni G_0 con l'aumentare della deformazione di taglio indotta dal sisma ed il relativo comportamento in termini di smorzamento (D).

Per procedere con l'analisi di risposta sismica locale per la definizione delle azioni sismica, si fa riferimento al carotaggio eseguito nell'area della caserma dei Vigili del Fuoco e nell'area della Piscina, in cui sono stati prelevati dei campioni di terreni sottoposti a prove di laboratorio geotecnico; sempre per gli studi condotti presso la Caserma dei Vigili del Fuoco è stata commissionata al Dott. Nasser Abu Zeid, una prova ESAC profonda per il profilo di V_s profondo (che non ha raggiunto il bedrock sismico).

4. ANALISI DI RISPOSTA SISMICA LOCALE

La funzione di amplificazione di un sito fornisce una chiara ed efficace rappresentazione dell'effetto "filtrante" di un deposito di terreno sulle onde sismiche. Essa mette in evidenza in quale campo di frequenze la presenza del terreno può indurre effetti significativi di amplificazione del moto sismico incidente o, viceversa, se tali effetti possano addirittura tradursi in un'attenuazione delle ampiezze in superficie.

La conoscenza della sola funzione di amplificazione non è comunque sufficiente per determinare le caratteristiche del moto sismico alla superficie di un deposito. In termini applicativi, scopo finale di un'analisi di risposta sismica locale è infatti quello di disporre di uno spettro di risposta dell'accelerazione (associato ad un terremoto presunto ed ad un dato fattore di smorzamento strutturale), che includa realisticamente l'effetto di amplificazione del sottosuolo. Ciò premesso la funzione di amplificazione (o meglio la funzione di trasferimento) rappresenta comunque un indispensabile elemento per determinare il moto in superficie. Si riporta in **FIGURA 4.1** lo schema del processo che porta alla determinazione del moto sismico alla superficie di un deposito di terreno su basamento roccioso, a cui è applicata l'eccitazione sismica rappresentata, anziché da un'onda armonica stazionaria, da un moto irregolare come nel caso di un sisma reale.

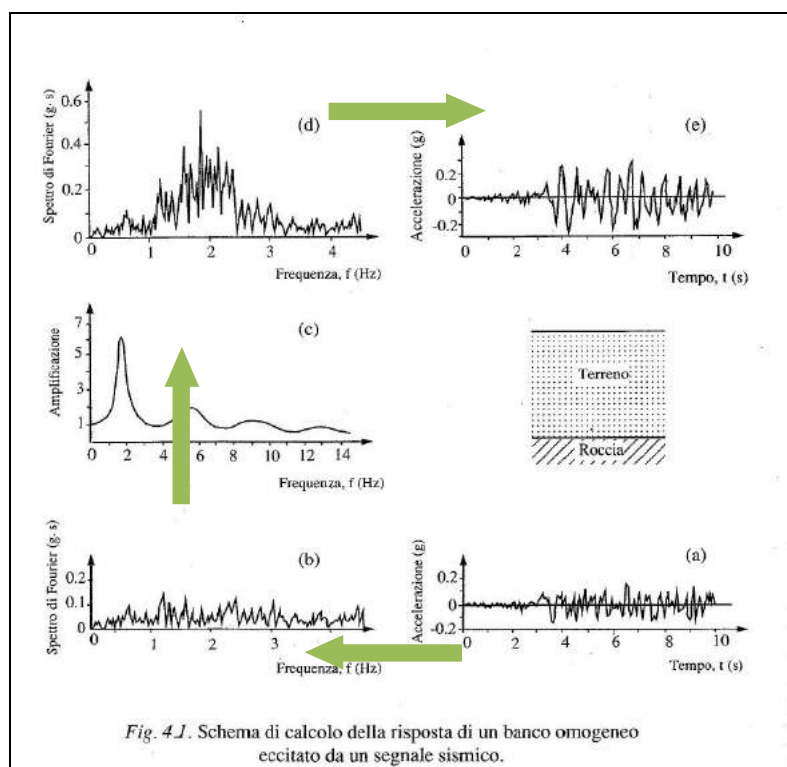


Fig. 4.1. Schema di calcolo della risposta di un banco omogeneo eccitato da un segnale sismico.

FIGURA 4.1

Per procedere a questo tipo di studio serve:

- modello geologico stratigrafico di dettaglio dei primi 30m/40m di terreno;
- profilo di Vs di dettaglio dei primi 30m/40m;
- profilo di Vs profondo fino al bedrock sismico;
- modello geologico stratigrafico di dettaglio fino al bedrock sismico;
- curve sitospecifiche di decadimento del modulo G_0 , espresse attraverso il rapporto G/G_0 , e curve di smorzamento D ricavati da prove di colonna risonante, o prove triassiali cicliche, per i terreni campionati nei primi 30m/40m;
- curve bibliografiche idonee di G_0 e D , da attribuire ai terreni profondi fino al bedrock sismico.
- gruppo di 7 accelerogrammi spettro compatibili per la definizione del moto sismico al bedrock.

I dati da ricercare sono evidenziati nei paragrafi successivi.

4.1. IL MODELLO LITOSTRATIGRAFICO DI DETTAGLIO DEI PRIMI 30m

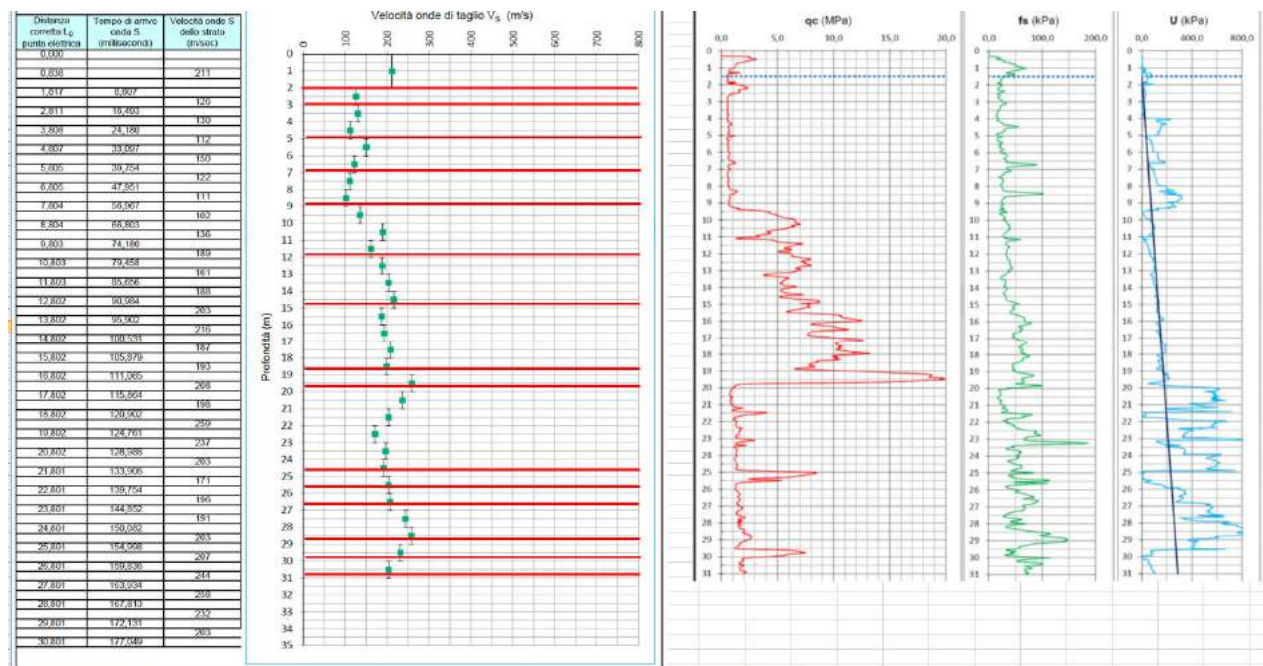
- modello geologico stratigrafico di dettaglio dei primi 30m/40m di terreno;
- profilo di Vs di dettaglio dei primi 30m/40m;
- profilo di Vs profondo fino al bedrock sismico;
- modello geologico stratigrafico di dettaglio fino al bedrock sismico;
- curve sitospecifiche di decadimento del modulo Go, espresse attraverso il rapporto G/Go, e curve di smorzamento D ricavati da prove di colonna risonante, o prove triassiali cicliche, per i terreni campionati nei primi 30m/40m;
- curve bibliografiche idonee di Go e D, da attribuire ai terreni profondi fino al bedrock sismico.
- gruppo di 7 accelerogrammi spettro compatibili per la definizione del moto sismico al bedrock.

Il dettaglio stratigrafico del sito allo studio è ricostruito dalla prova penetrometrica statica SCPTU1 spinta fino alla profondità di -31,0 m dal p.c.

4.2. PROFILO DI VS DI DETTAGLIO DEI PRIMI 30M

- modello geologico stratigrafico di dettaglio dei primi 30m/40m di terreno;
- profilo di Vs di dettaglio dei primi 30m/40m;**
- profilo di Vs profondo fino al bedrock sismico;
- modello geologico stratigrafico di dettaglio fino al bedrock sismico;
- curve sitospecifiche di decadimento del modulo Go, espresse attraverso il rapporto G/Go, e curve di smorzamento D ricavati da prove di colonna risonante, o prove triassiali cicliche, per i terreni campionati nei primi 30m/40m;
- curve bibliografiche idonee di Go e D, da attribuire ai terreni profondi fino al bedrock sismico.
- gruppo di 7 accelerogrammi spettro compatibili per la definizione del moto sismico al bedrock.

Il profilo di dettaglio delle velocità di propagazione delle onde di taglio dei primi 30,0 m è stato misurato con la prova con cono sismico SCPTU1.



4.3. PROFILO DI VS PROFONDO FINO AL BEDROCK SISMICO

- modello geologico stratigrafico di dettaglio dei primi 30m/40m di terreno;
- profilo di Vs di dettaglio dei primi 30m/40m;
- profilo di Vs profondo fino al bedrock sismico;**
- modello geologico stratigrafico di dettaglio fino al bedrock sismico;
- curve sitospecifiche di decadimento del modulo G_0 , espresse attraverso il rapporto G/G_0 , e curve di smorzamento D ricavati da prove di colonna risonante, o prove triassiali cicliche, per i terreni campionati nei primi 30m/40m;
- curve bibliografiche idonee di G_0 e D , da attribuire ai terreni profondi fino al bedrock sismico.
- gruppo di 7 accelerogrammi spettro compatibili per la definizione del moto sismico al bedrock.

Il profilo di Vs profondo adottato è quello sito-specifico, realizzato attraverso una indagine sismica con la tecnica della sismica passiva ESAC (metodo di sismica passiva che utilizza la tecnica dei microtrempi con una Autocorrelazione Spaziale Migliorato che consente misurazioni profonde).

La prova geofisica con tecnica ESAC è stata realizzata sul fianco della caserma ed è ubicata in **FIGURA 4.2.**

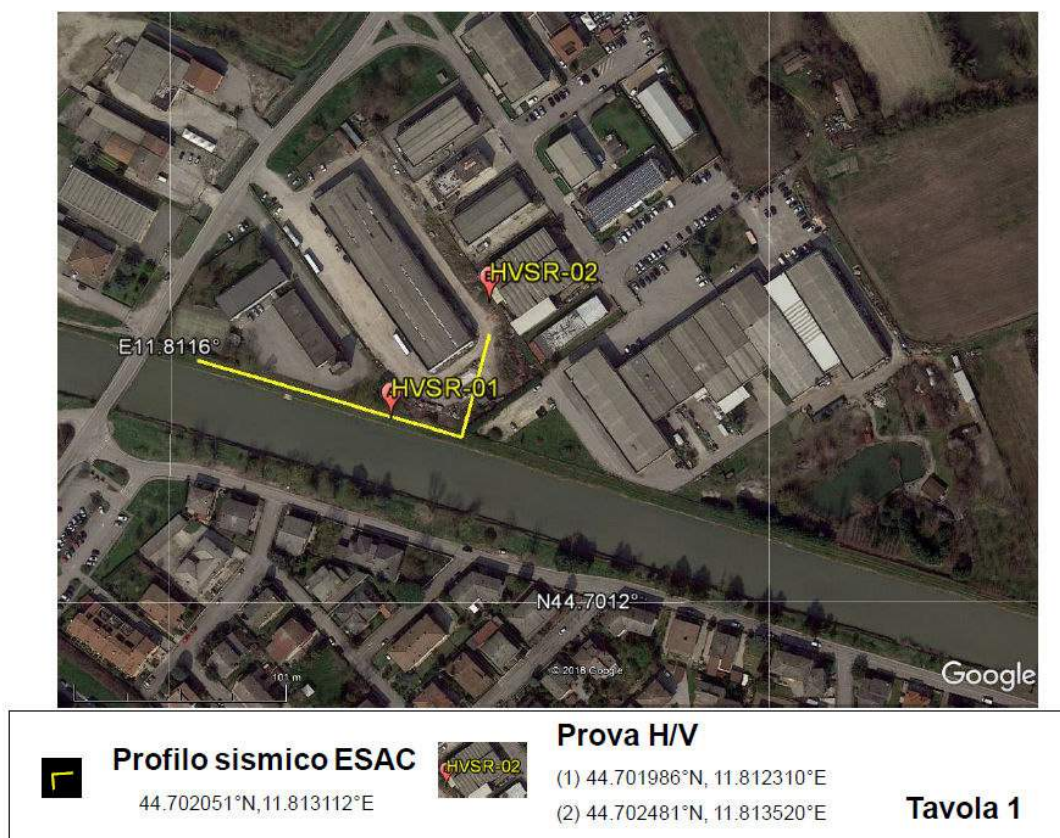


FIGURA 4.2 Ubicazione dello stendimento prova geofisica ESAC

In **FIGURA 4.3** si riportano i risultati delle indagini geofisiche, con il profilo profondo delle velocità di propagazione delle onde di taglio Vs,.

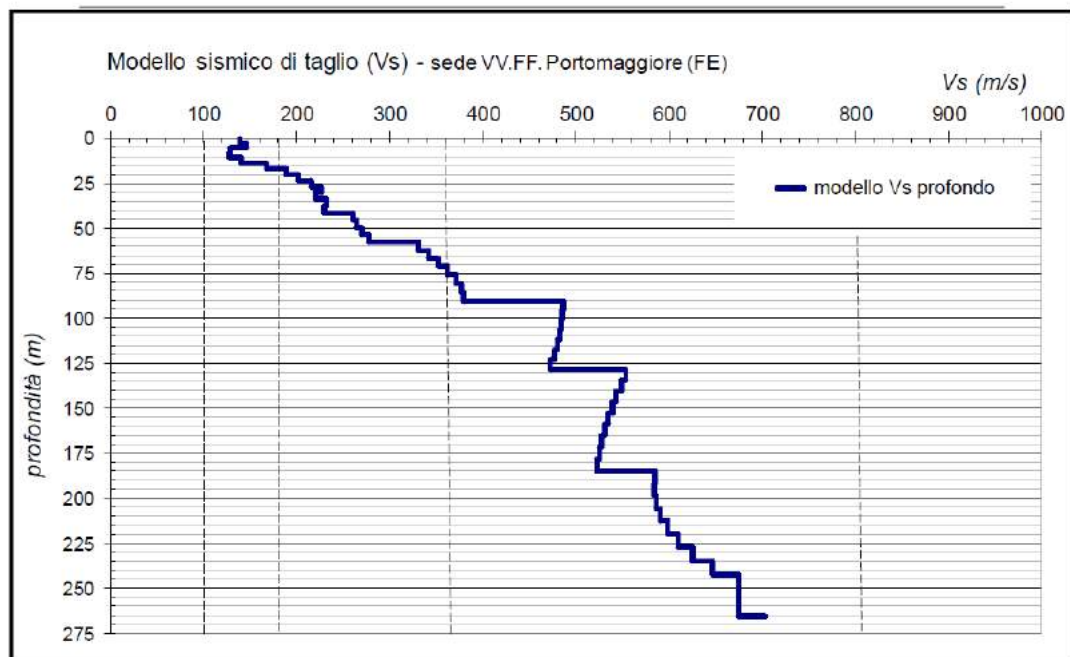


FIGURA 4.3 – Profilo di Vs profondo misurato

In **FIGURA 4.4** si riportano i risultati delle due prove a stazione singola HVSR.

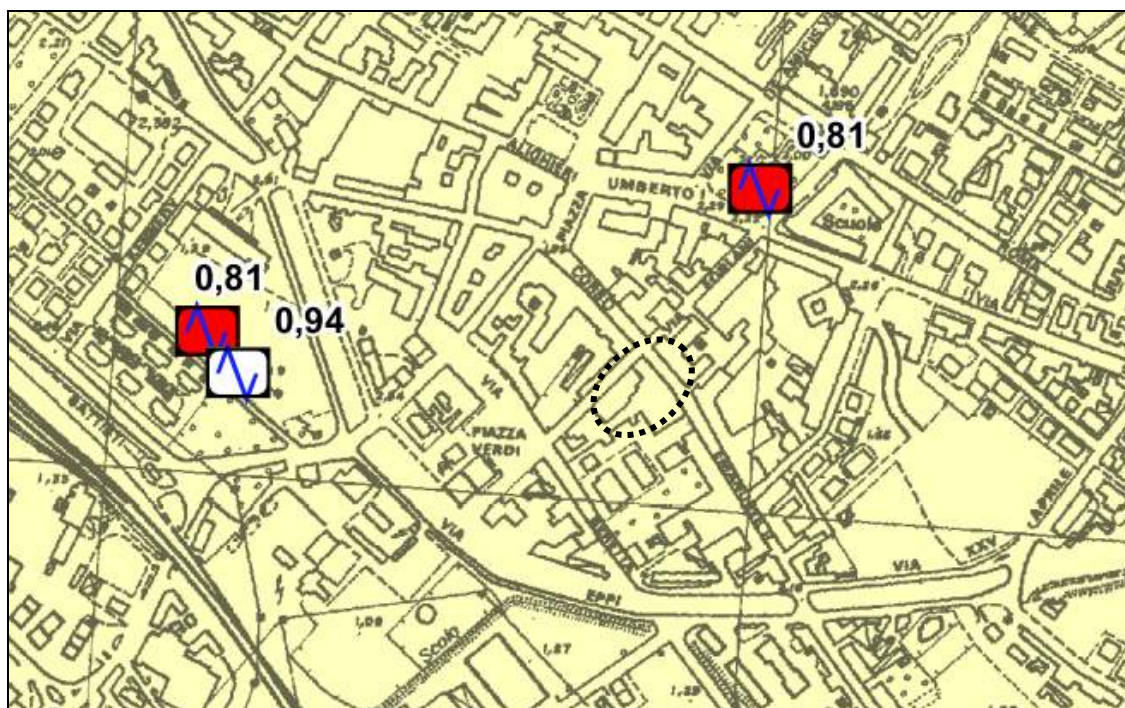


FIGURA 4.4. – Stralcio Mappa di Microzonazione Sismica con ubicazione delle due prove HVSR utilizzate

PORTOMAGGIORE, PM_27/2

Instrument: TZ3-ex04/01-13

Data format: 32 byte

Full scale [mV]: 51

Start recording: 07/10/14 13:12:52 End recording: 07/10/14 13:32:52

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h20'00". Analyzed 78% trace (manual window selection)

Sampling rate: 128 Hz

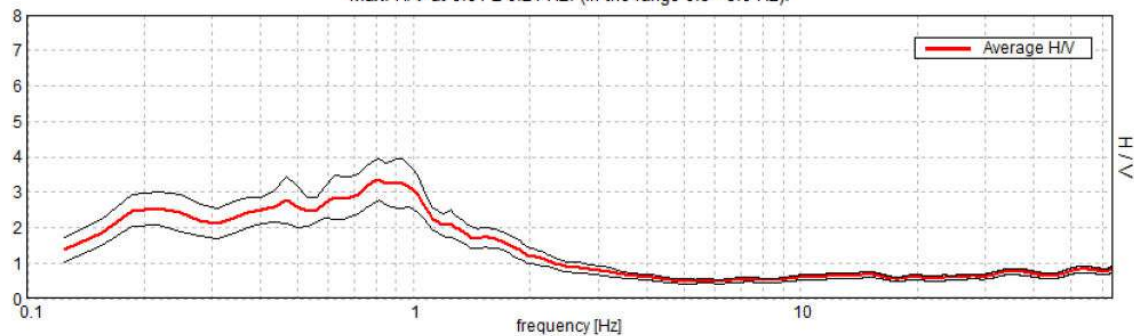
Window size: 30 s

Smoothing type: Triangular window

Smoothing: 10%

HORIZONTAL TO VERTICAL SPECTRAL RATIO

Max. H/V at 0.81 ± 0.24 Hz. (In the range 0.5 - 5.0 Hz).



RAPPORTO SPETTRALE A STAZIONE SINGOLA (HVSr)

CLIENTE

UNIONE DEI COMUNI VALLI E DELIZIE

CODICE LAVORO

1438

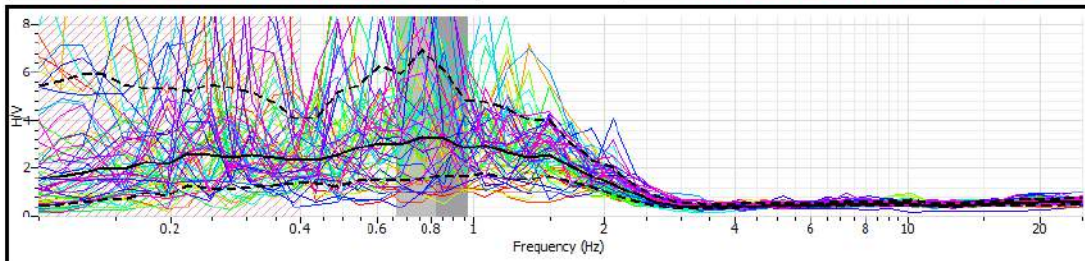
CODICE PROVA

HVSr - Masw 9

RAPPORTO SPETTRALE H/V

F0 0.81 ± 0.15 Hz. A0 = 3.31

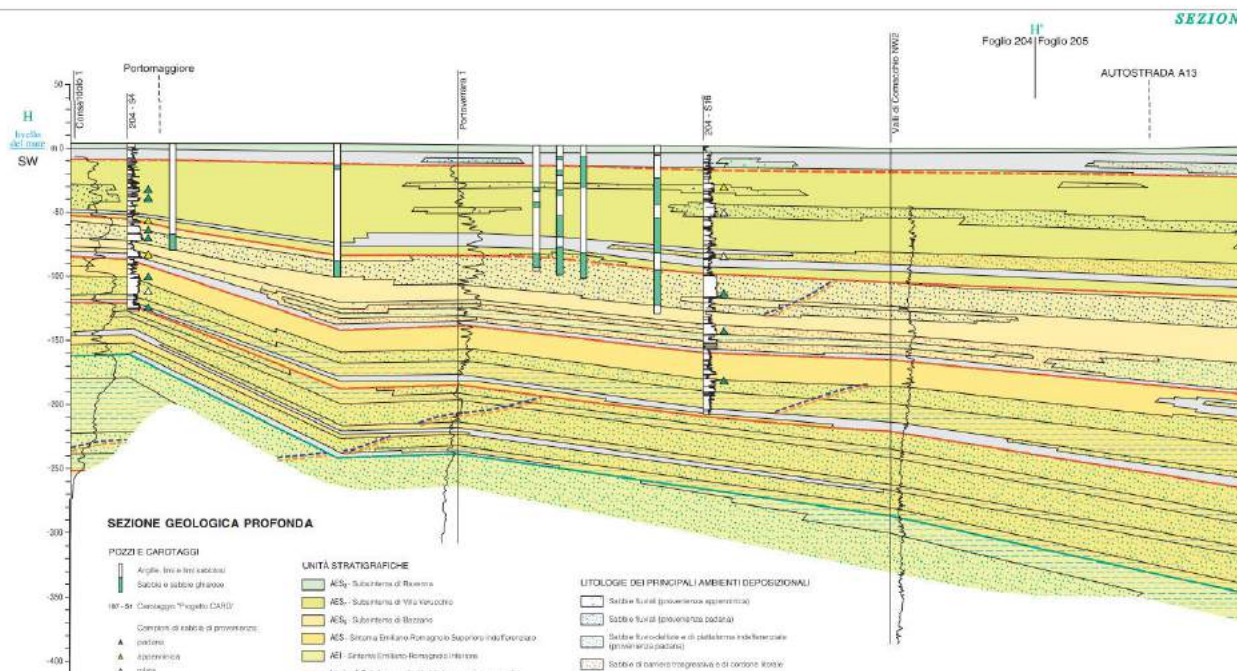
FMax 0.81 ± 0.15 Hz. A0 = 3.31



4.4. MODELLO GEOLOGICO STRATIGRAFICO FINO AL BEDROCK SISMICO

- modello geologico stratigrafico di dettaglio dei primi 30m/40m di terreno;
- profilo di Vs di dettaglio dei primi 30m/40m;
- profilo di Vs profondo fino al bedrock sismico;
- modello geologico stratigrafico di dettaglio fino al bedrock sismico;**
- curve sitospecifiche di decadimento del modulo G_0 , espresse attraverso il rapporto G/G_0 , e curve di smorzamento D ricavati da prove di colonna risonante, o prove triassiali cicliche, per i terreni campionati nei primi 30m/40m;
- curve bibliografiche idonee di G_0 e D , da attribuire ai terreni profondi fino al bedrock sismico.
- gruppo di 7 accelerogrammi spettro compatibili per la definizione del moto sismico al bedrock.

Per la ricostruzione del modello geologico profondo si è fatto ricorso alla banca dati regionale e si è reperita la sezione geologica n°69, Portomaggiore - Codigoro, riportata in **FIGURA 4.5**.



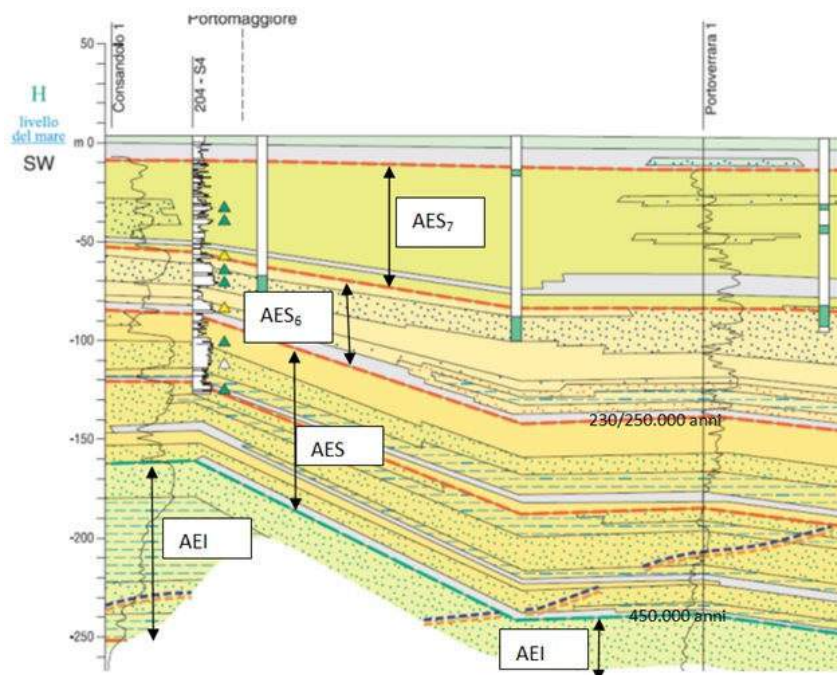


FIGURA 4.5 - sezione geologica 069 - Progetto CARG.

https://applicazioni.regione.emilia-romagna.it/cartografia_sgss/user/viewer.jsp?service=sezioni_geo

Adottato un modello stratigrafico profondo e misurato un profilo di Vs fino al bedrock sismico, si procede alla sovrapposizione dei due modelli per la suddivisione dei sismostrati pseudomogenei per Vs e per litologia (**FIGURA 4.6**).

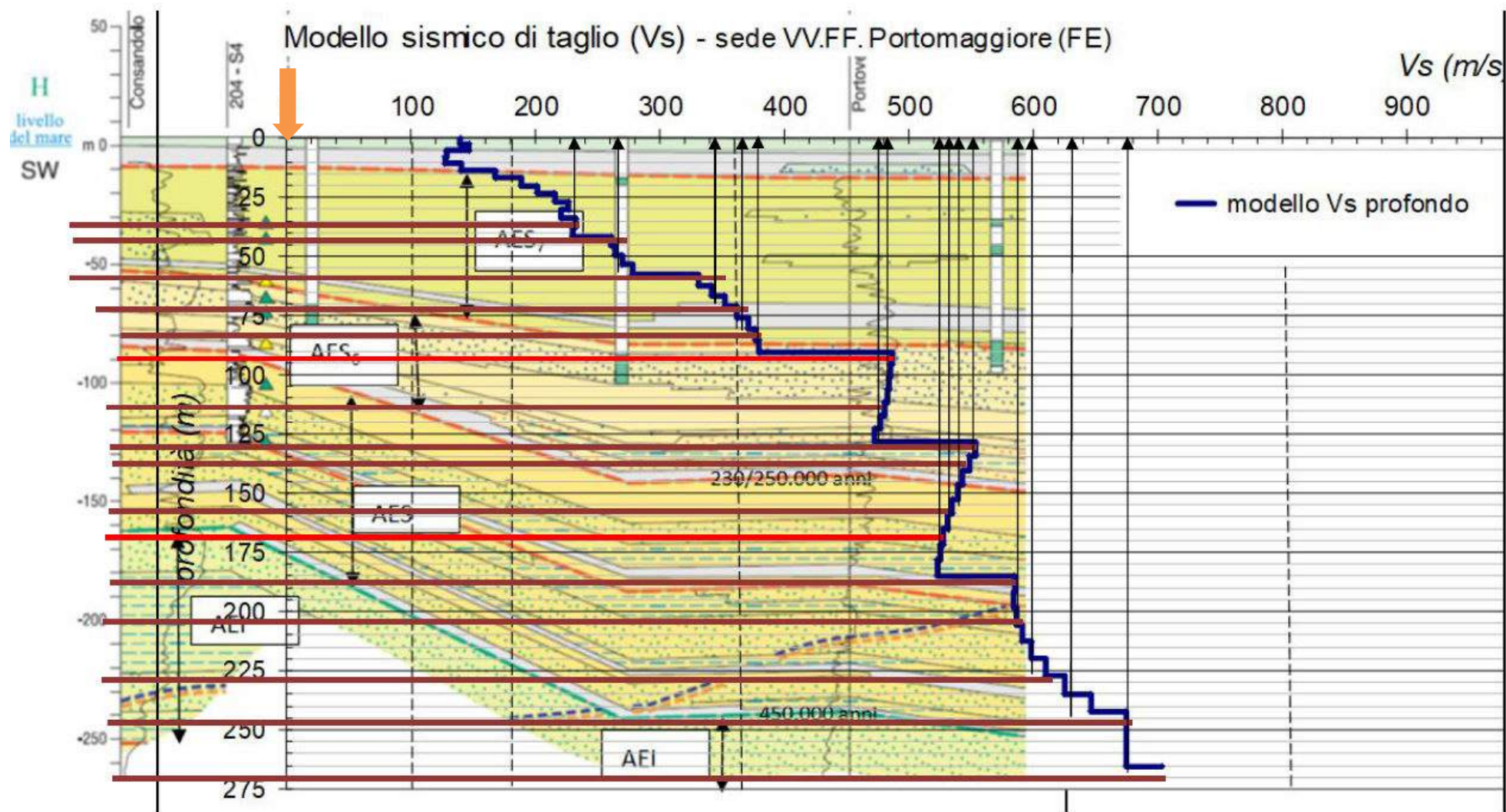


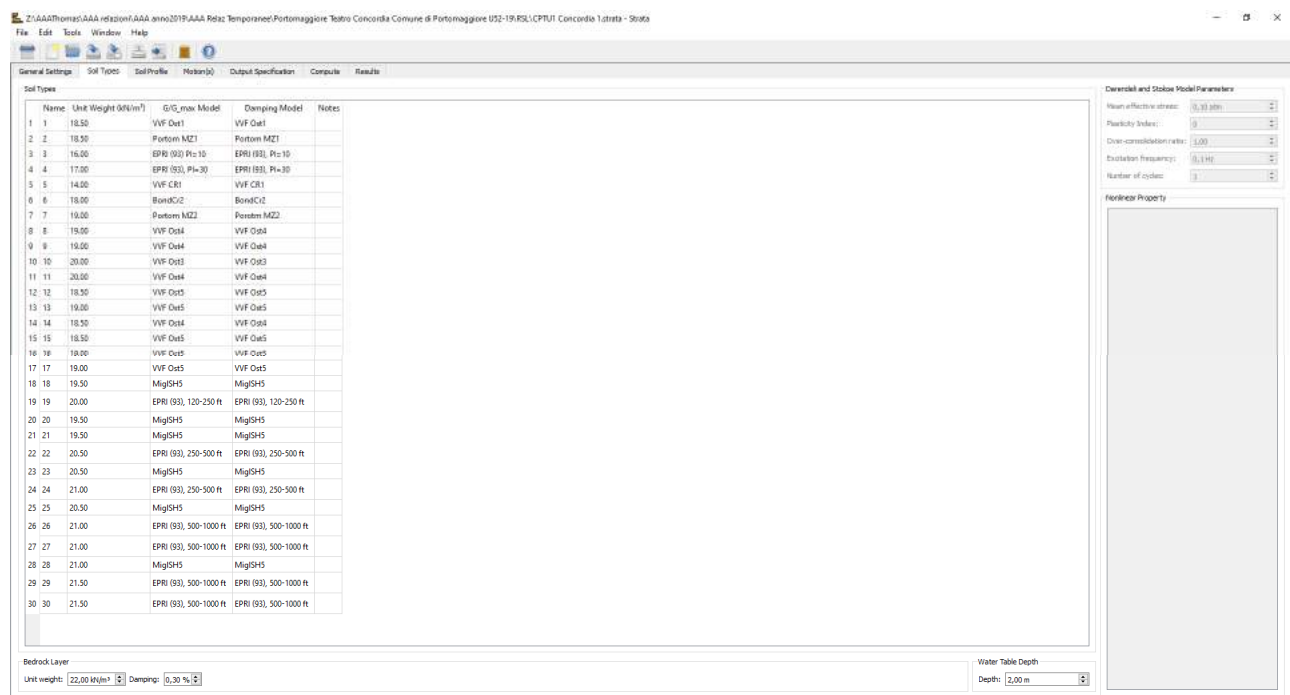
FIGURA 4.6 - modello stratigrafico profondo e modello geofisico profondo adottato per l'analisi di risposta sismica locale

4.5. CURVE SITO SPECIFICHE "Go" E "D"

- modello geologico stratigrafico di dettaglio dei primi 30m/40m di terreno;
- profilo di Vs di dettaglio dei primi 30m/40m;
- profilo di Vs profondo fino al bedrock sismico;
- modello geologico stratigrafico di dettaglio fino al bedrock sismico;
- curve sitospecifiche di decadimento del modulo Go, espresse attraverso il rapporto G/Go, e curve di smorzamento D ricavati da prove di colonna risonante, o prove triassiali cicliche, per i terreni campionati nei primi 30m/40m;**
- curve bibliografiche idonee di Go e D, da attribuire ai terreni profondi fino al bedrock sismico.
- gruppo di 7 accelerogrammi spettro compatibili per la definizione del moto sismico al bedrock.

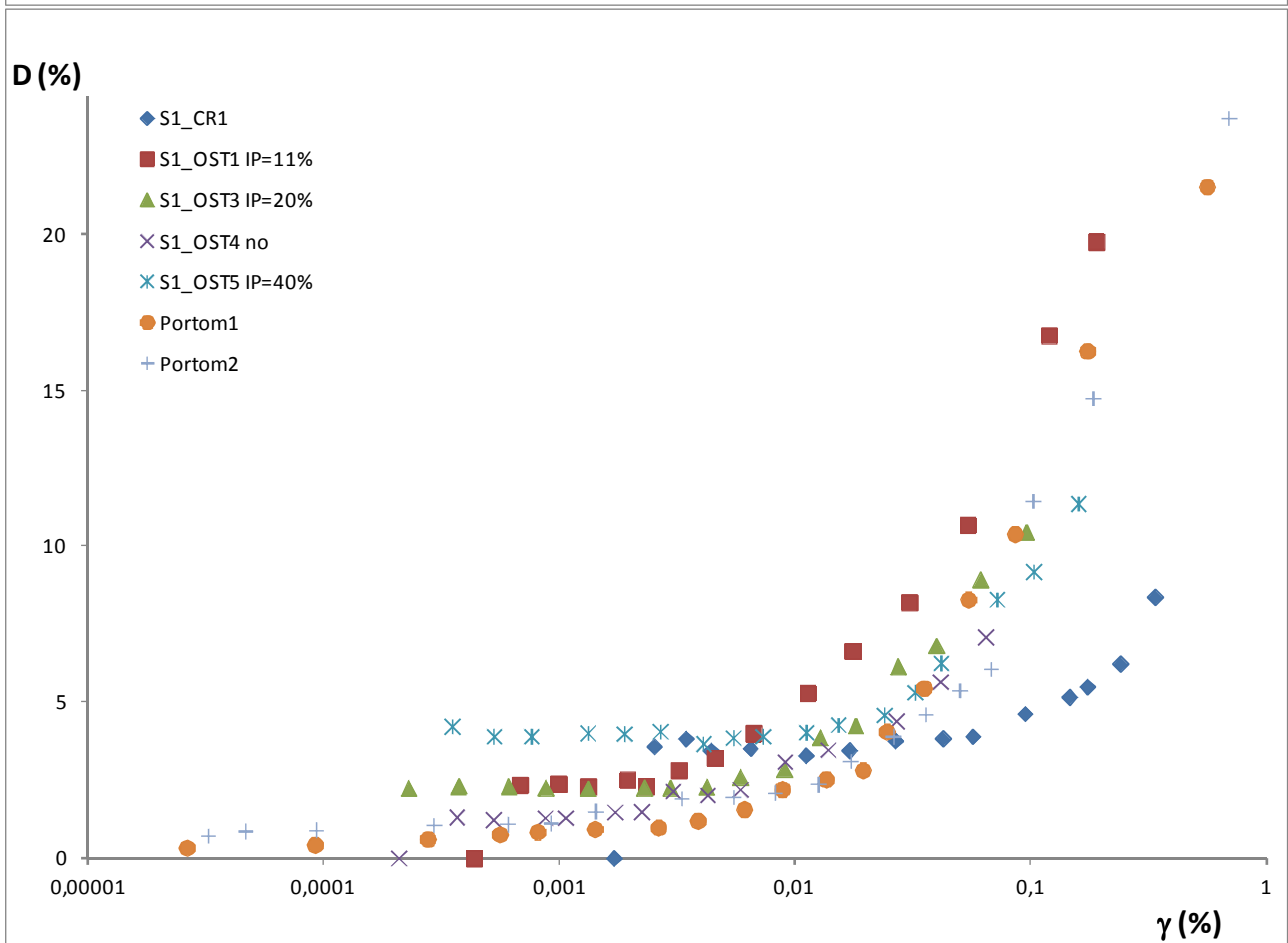
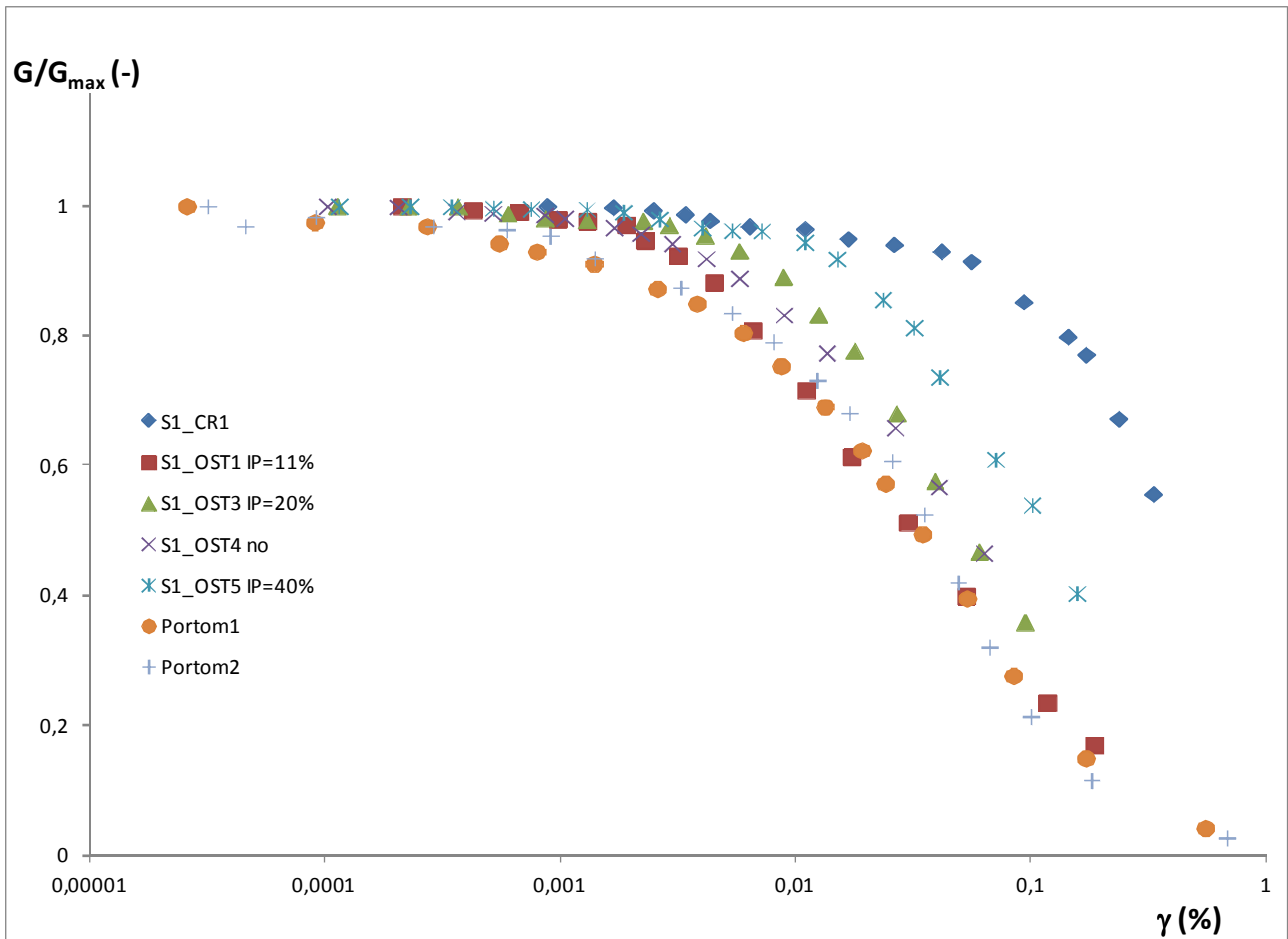
Le prove di colonna risonante consentono di determinare il modulo di taglio G e lo smorzamento dei terreni al variare delle deformazione di taglio imposta, da valori molto piccoli (intorno a 10⁻⁵%) fino a circa 10⁻²%. Vengono largamente impiegate in tutti i casi in cui i terreni sono sottoposti a sollecitazioni dinamiche, per lo studio dei problemi di deformazione dei terreni e di propagazione delle onde.

Si riporta la schermata del software Strada per le analisi 1D, in cui si vedono i nomi delle curve adottate dallo scrivente per l'analisi di risposta sismica locale condotta per ognuna delle tre verticali indagate.



SCPTU 1

Si riportano i grafici delle curve sitospecifiche utilizzate, derivate dalle indagini fatte in sito e dalle indagini condotte per la MZ 3 livello.



4.6. CURVE SITO BIBLIOGRAFICHE "Go" E "D" PER TERRENI PROFONDI

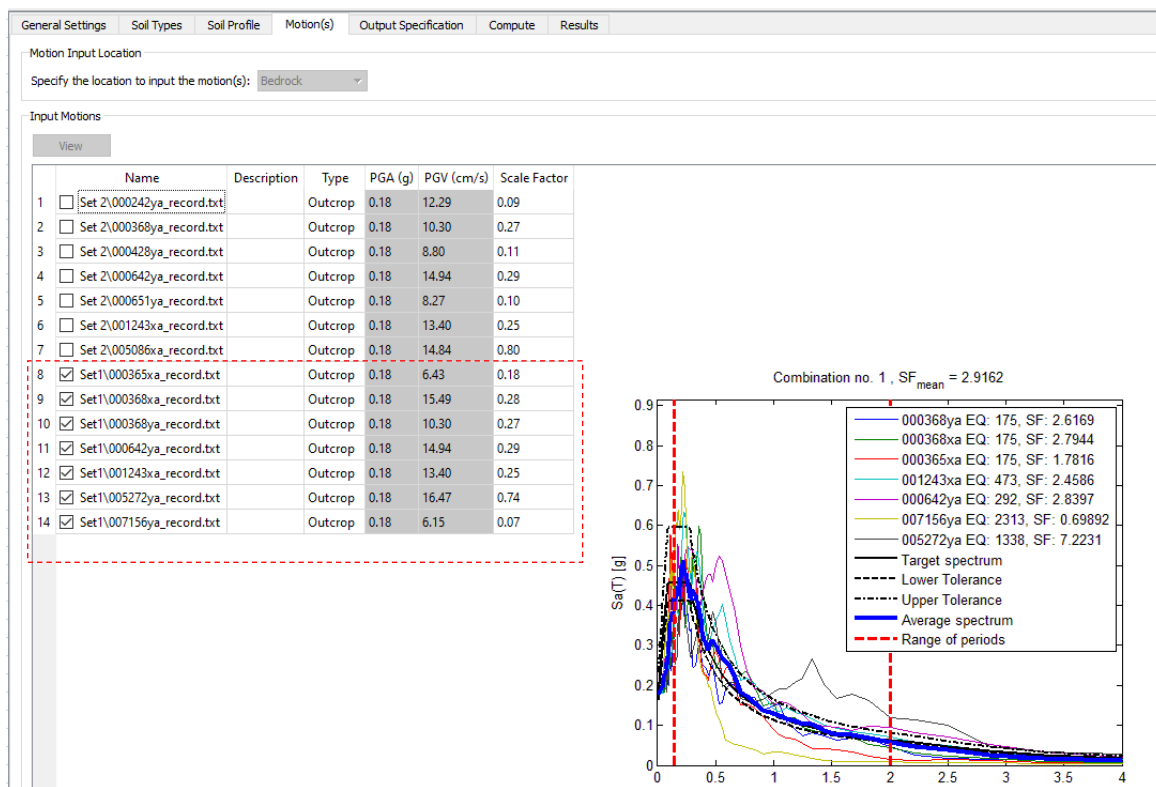
- a. modello geologico stratigrafico di dettaglio dei primi 30m/40m di terreno;
- b. profilo di Vs di dettaglio dei primi 30m/40m;
- c. profilo di Vs profondo fino al bedrock sismico;
- d. modello geologico stratigrafico di dettaglio fino al bedrock sismico;
- e. curve sitospecifiche di decadimento del modulo Go, espresse attraverso il rapporto G/G_0 , e curve di smorzamento D ricavati da prove di colonna risonante, o prove triassiali cicliche, per i terreni campionati nei primi 30m/40m;
- f. curve bibliografiche idonee di Go e D, da attribuire ai terreni profondi fino al bedrock sismico.**
- g. gruppo di 7 accelerogrammi spettro compatibili per la definizione del moto sismico al bedrock.

Nel sito codice STRATA, che verrà utilizzato per l'analisi di risposta sismica locale monodimensionale, sono contenute diverse curve bibliografiche di sedimenti di diverso tipo. In particolare si farà riferimento alle curve EPRI (93) che tengono conto dello stato tensionale (ovvero della profondità).

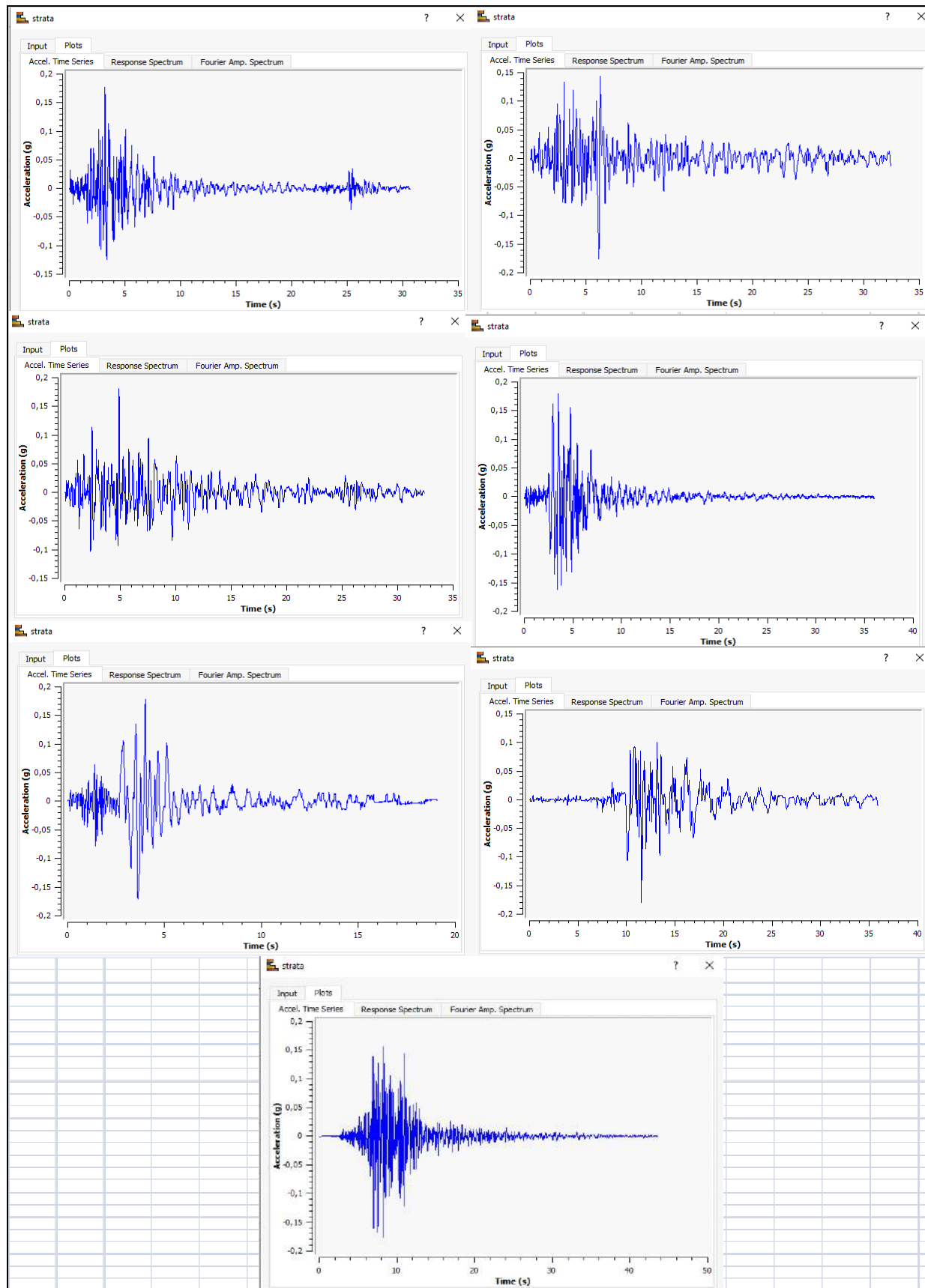
4.7. GRUPPO DI SETTE ACCELEROGRAMMI SPETTROCOMPATIBILI

- modello geologico stratigrafico di dettaglio dei primi 30m/40m di terreno;
- profilo di Vs di dettaglio dei primi 30m/40m;
- profilo di Vs profondo fino al bedrock sismico;
- modello geologico stratigrafico di dettaglio fino al bedrock sismico;
- curve sitospecifiche di decadimento del modulo G_0 , espresse attraverso il rapporto G/G_0 , e curve di smorzamento D ricavati da prove di colonna risonante, o prove triassiali cicliche, per i terreni campionati nei primi 30m/40m;
- curve bibliografiche idonee di G_0 e D , da attribuire ai terreni profondi fino al bedrock sismico.
- gruppo di minimo 7 accelerogrammi spettro compatibili per la definizione del moto sismico al bedrock.**

La procedura per l'estrazione dei 7 accelerogrammi è stata eseguita con Rexel, selezionandoli dall' European Strong-motion Database; la ricerca è iniziata attraverso l'analisi della disaggregazione per la definizione della coppia Magnitudo-distanza epicentrale.



Gli accelerogrammi sono stati tutti scalati al valore di 0,18g, che corrisponde al valore per SLV, per eventi con tempo di ritorno di 712 anni.



Con i 7 accelerogrammi adottati per caratterizzare il moto sismico, è possibile definire uno spettro di risposta medio compatibile con quello imposto dall'analisi. Ora ci sono tutti gli elementi per poter procedere ad una analisi di risposta sismica locale monodimensionale; il tipo di analisi per cui si opta è di tipo EQL, ovvero Equivalente Lineare.

5. RISULTATI DELL'ANALISI DI RISPOSTA SISMICA LOCALE

5.1. Analisi per SLV

Ora invece si riportano le schermate con evidenziati i dati di Input per l'analisi di RSL, eseguita con il software STRATA.

Strata - Z:\AAA\Thomas\AAA relazioni\AAA anno2019\AAA Relac Temporanei\Potomaggiore Teatro Concordia Comune di Potomaggiore US3-19.RSL\CPTRU Concordia Tutela - Strata

File Edit Tools Windows Help

General Settings Soil Types Soil Profile Motion(s) Output Specification Compute Results

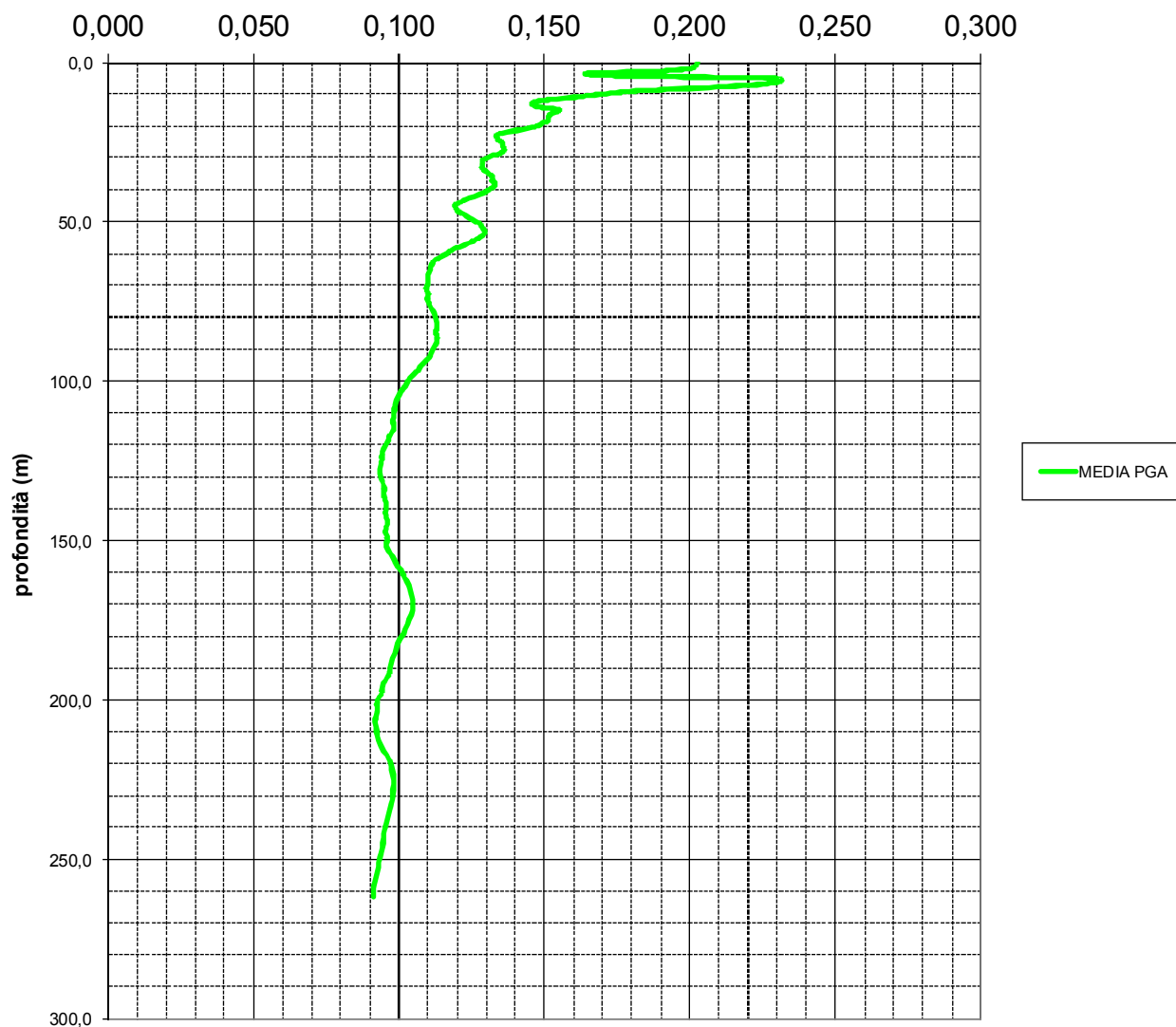
Site Profile

	Depth (m)	Thickness (m)	Soil Type	Vs (m/s)
1	0.00	2.00	1	211.00
2	2.00	1.00	2	126.00
3	3.00	2.00	3	121.00
4	5.00	2.00	4	136.00
5	7.00	2.00	5	106.00
6	9.00	3.00	6	162.00
7	12.00	3.00	7	202.00
8	15.00	4.00	8	196.00
9	19.00	1.00	9	259.00
10	20.00	5.00	10	200.00
11	25.00	1.00	11	203.00
12	26.00	1.00	12	207.00
13	27.00	2.00	13	251.00
14	29.00	1.00	14	232.00
15	30.00	1.00	15	203.00
16	31.00	7.00	16	211.00
17	38.00	15.00	17	268.00
18	53.00	13.00	18	344.00
19	66.00	11.00	19	366.00
20	77.00	9.00	20	380.00
21	86.00	21.00	21	482.00
22	107.00	16.00	22	475.00
23	123.00	8.00	23	551.00
24	131.00	19.00	24	540.00
25	150.00	11.00	25	532.00
26	161.00	19.00	26	524.00
27	180.00	16.00	27	586.00
28	196.00	24.00	28	598.00
29	220.00	18.00	29	630.00
30	238.00	23.00	30	674.00
31	261.00	Half-Space	Bedrock	703.00

La falda freatica viene assunta a -1,5m dal p.c. .

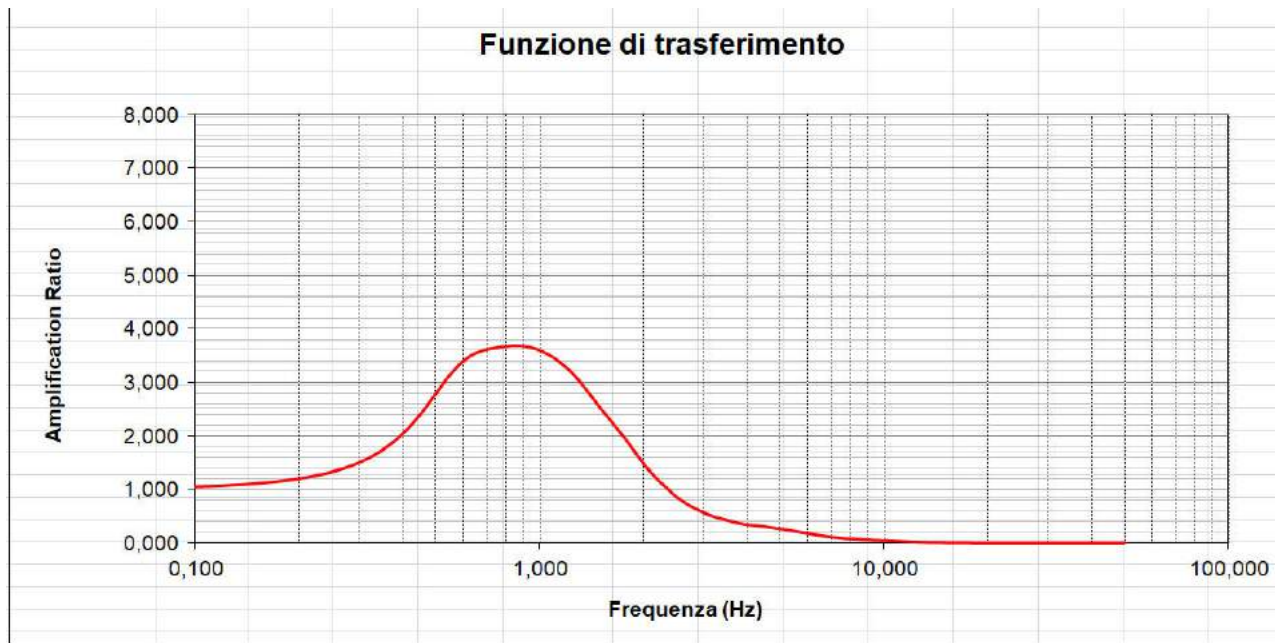
Nel grafico che segue è riportato profilo di PGA medio, ricavato dall'analisi dei 7 accelerogrammi, dal bedrock fino al piano campagna.

Profilo PGA



			F.A.
P.G.A. bedrock		0,179	
P.G.A. superficie	accelerg 1	0,163	0,91
P.G.A. superficie	accelerg 2	0,230	1,28
P.G.A. superficie	accelerg 3	0,182	1,02
P.G.A. superficie	accelerg 4	0,223	1,25
P.G.A. superficie	accelerg 5	0,232	1,30
P.G.A. superficie	accelerg 6	0,215	1,20
P.G.A. superficie	accelerg 7	0,185	1,04
P.G.A. superficie	Strata Media	0,203	1,13

La funzione di trasferimento che regola queste amplificazioni è la seguente:

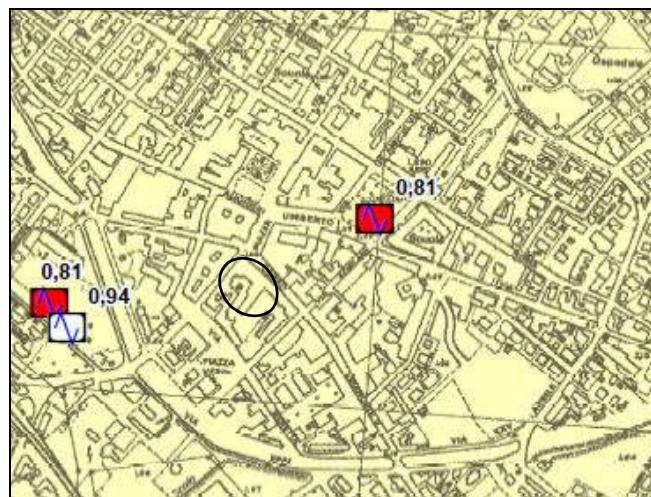


Media Strata	massima amplificazione	3,675	per Frequenza (Hz)	0,855
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SCPTU1

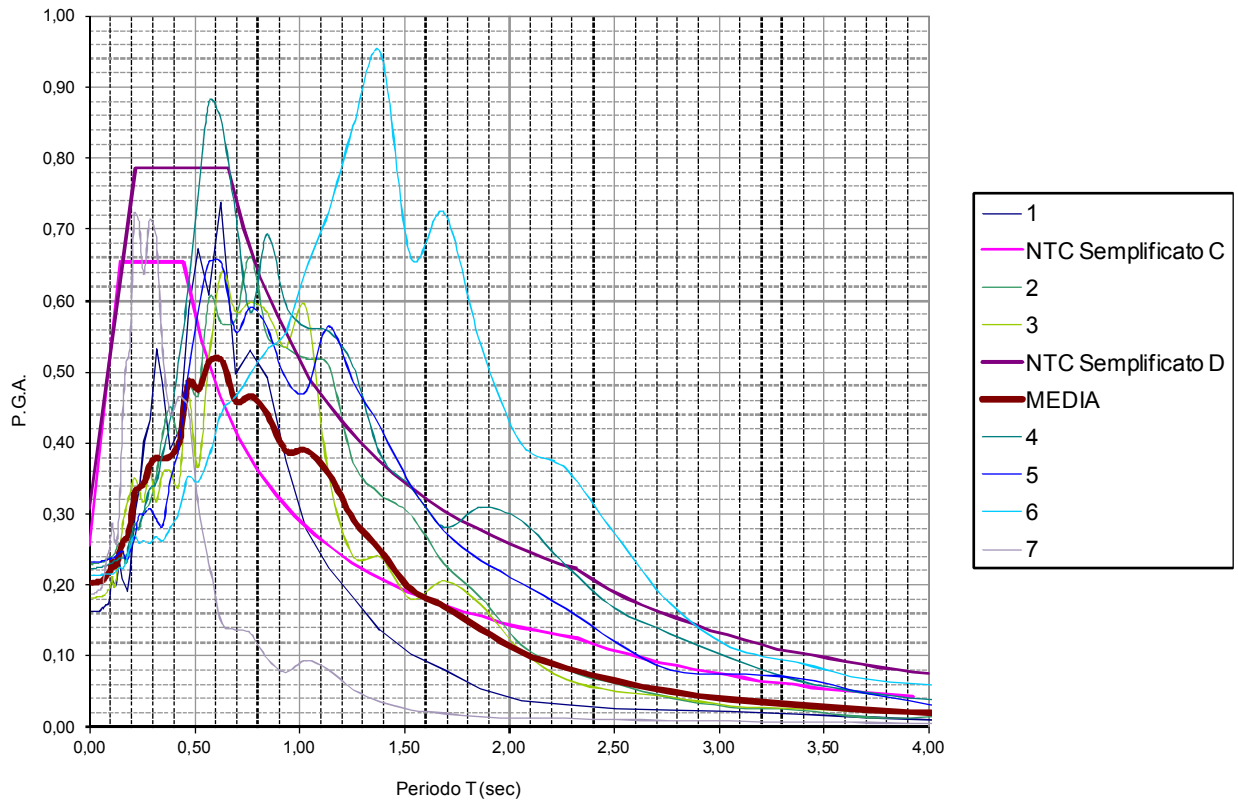
La frequenza di risonanza del terreno risulta da modello 0,85 Hz. Il rapporto di amplificazione è 3,6.

Le misure dei modi di vibrare in sito con il tromografo danno valori di frequenze molto vicine a quelle calcolate con il modello della SCPTU1 (questa coincidenza di risultato induce a ritenere validato il processo di calcolo effettuato con STRATA). Le misure effettuate confermano quanto misurato con le stesse strumentazioni anche in occasione degli studi di microzonazione sismica di II livello, ovvero un primo principale modo di vibrare a 0,81Hz, che indica una superficie con un forte contrasto di impedenza a circa 100m/120m di profondità.

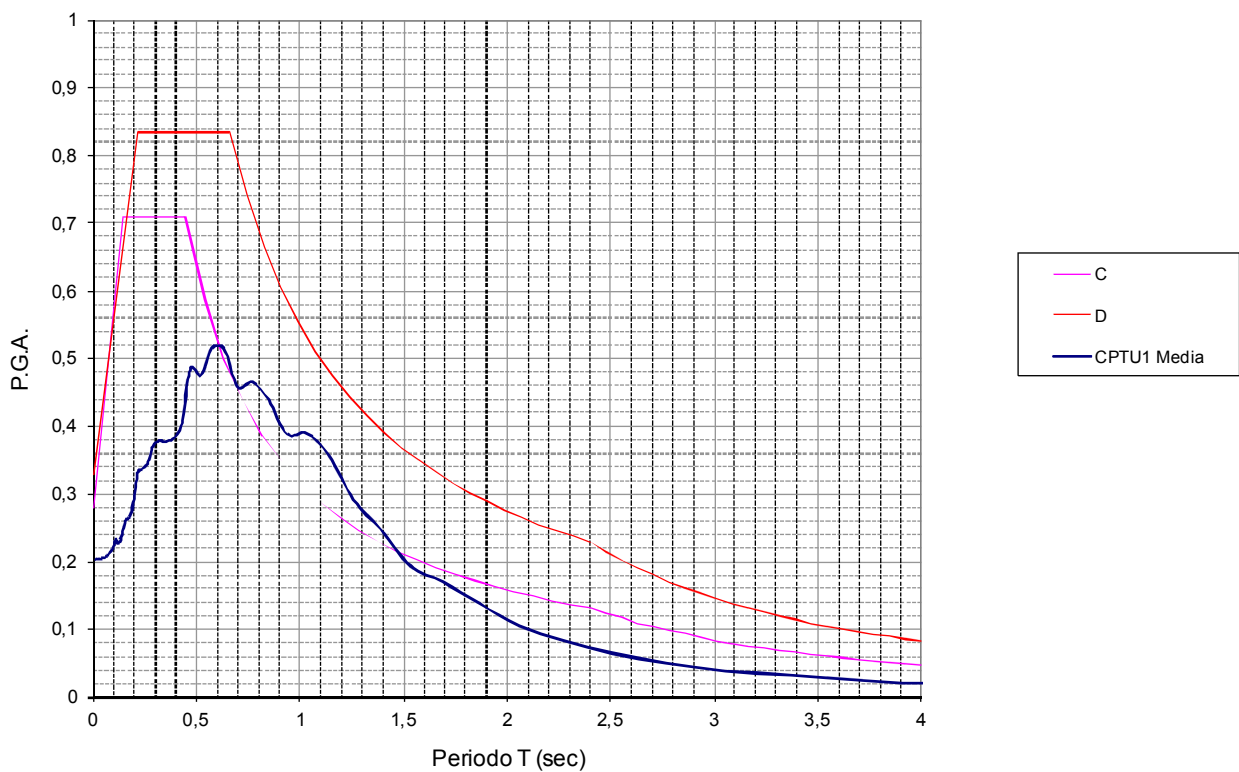


Si riporta ora un grafico in excel con lo spettro in accelerazione medio ricavato dalla analisi di RSL condotta con i 7 accelerogrammi, diagrammato con gli spettri semplificati da NTC di tipo C e tipo D.

Spettro di risposta in accelerazione



Spettro di risposta in accelerazione



SCPTU1

	accelerg 1	accelerg 2	accelerg 3	accelerg 4	accelerg 5	accelerg 6	accelerg 7	media
0,01	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,01	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,01	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,01	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,01	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,02	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,02	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,02	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,02	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,02	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,03	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,203
0,03	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,204
0,03	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,204
0,04	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,204
0,04	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,204
0,04	0,16	0,23	0,18	0,22	0,23	0,21	0,19	0,205
0,05	0,16	0,23	0,18	0,22	0,23	0,22	0,19	0,205
0,05	0,17	0,23	0,18	0,22	0,23	0,22	0,19	0,205
0,06	0,17	0,23	0,18	0,23	0,23	0,22	0,20	0,207
0,07	0,17	0,23	0,19	0,23	0,23	0,22	0,20	0,208
0,07	0,17	0,23	0,19	0,23	0,23	0,22	0,22	0,211
0,08	0,17	0,24	0,19	0,23	0,23	0,22	0,23	0,214
0,09	0,18	0,24	0,19	0,23	0,24	0,22	0,24	0,217
0,10	0,18	0,24	0,20	0,23	0,24	0,22	0,25	0,221
0,11	0,21	0,24	0,21	0,23	0,24	0,22	0,29	0,232
0,12	0,20	0,24	0,20	0,23	0,24	0,22	0,27	0,226
0,13	0,20	0,25	0,22	0,23	0,24	0,22	0,26	0,232
0,14	0,23	0,26	0,24	0,24	0,25	0,23	0,32	0,250
0,16	0,21	0,25	0,29	0,24	0,25	0,22	0,44	0,262
0,17	0,19	0,23	0,31	0,24	0,24	0,24	0,51	0,266
0,19	0,22	0,26	0,33	0,26	0,25	0,25	0,53	0,287
0,21	0,30	0,29	0,35	0,28	0,26	0,27	0,72	0,331
0,23	0,34	0,28	0,34	0,28	0,30	0,26	0,71	0,337
0,26	0,40	0,30	0,32	0,30	0,30	0,26	0,64	0,345
0,29	0,43	0,32	0,37	0,34	0,31	0,26	0,71	0,370
0,32	0,53	0,35	0,32	0,34	0,29	0,27	0,69	0,378
0,35	0,49	0,41	0,36	0,38	0,28	0,26	0,53	0,377
0,38	0,39	0,45	0,36	0,43	0,35	0,28	0,44	0,382
0,42	0,42	0,41	0,34	0,51	0,39	0,30	0,46	0,401
0,47	0,59	0,48	0,47	0,61	0,49	0,35	0,45	0,485
0,52	0,67	0,47	0,37	0,75	0,58	0,35	0,31	0,475
0,57	0,61	0,60	0,52	0,88	0,65	0,38	0,23	0,515
0,63	0,74	0,57	0,64	0,85	0,65	0,44	0,15	0,515
0,70	0,50	0,57	0,58	0,72	0,56	0,47	0,14	0,458
0,77	0,53	0,66	0,60	0,58	0,59	0,50	0,13	0,465
0,85	0,49	0,55	0,58	0,69	0,56	0,53	0,10	0,438
0,93	0,37	0,53	0,53	0,59	0,49	0,56	0,08	0,388
1,03	0,28	0,52	0,59	0,56	0,47	0,64	0,09	0,389
1,14	0,22	0,51	0,36	0,56	0,56	0,72	0,08	0,357
1,26	0,18	0,37	0,24	0,51	0,49	0,85	0,05	0,291
1,39	0,14	0,33	0,24	0,38	0,42	0,95	0,03	0,248
1,53	0,10	0,30	0,18	0,34	0,34	0,66	0,02	0,193
1,69	0,08	0,23	0,21	0,28	0,28	0,72	0,02	0,170
1,86	0,06	0,18	0,17	0,31	0,24	0,54	0,01	0,138
2,06	0,04	0,12	0,11	0,29	0,20	0,40	0,01	0,105
2,27	0,03	0,08	0,07	0,23	0,17	0,36	0,01	0,083
2,51	0,03	0,06	0,05	0,17	0,12	0,27	0,01	0,065
2,77	0,03	0,04	0,04	0,13	0,08	0,17	0,01	0,050
3,05	0,02	0,03	0,03	0,10	0,08	0,11	0,01	0,039
3,37	0,02	0,02	0,03	0,07	0,07	0,09	0,01	0,032
3,72	0,01	0,01	0,02	0,05	0,05	0,07	0,01	0,023
4,10	0,01	0,01	0,02	0,04	0,03	0,06	0,00	0,019
4,53	0,01	0,01	0,01	0,03	0,02	0,04	0,00	0,013
5,00	0,01	0,01	0,01	0,02	0,02	0,03	0,00	0,010

Si noti che fino a 0,6 sec di periodo lo spettro da RSL è inferiore a quello semplificato di tipo C, oltre 0,6 lo spettro supera quello di tipo C, e rimane comunque sempre al di sotto del D.

Si rimarca il fatto che lo spettro medio è stato derivato dalla analisi condotta con il gruppo di 7 accelerogrammi spettrocompatibili estratti con Rexel dalla banca dati "European Strong-motion Database".

Questi dati andranno valutati in sede progettuale degli edifici, anche in base allo smorzamento che può derivare dalla rigidità della struttura che si sta valutando, ovvero in base al suo fattore di struttura q . Le valutazioni a cui si è pervenuti in questo studio sono per un $q=1$ (ovvero per un coefficiente di smorzamento ξ del 5%). Lo strutturista potrà effettuare una RSL più vicina alla realtà in quanto potrà tenere conto anche del fattore di struttura.

6. ANALISI DELLA LIQUEFAZIONE DELLE SABBIE SATURE DA RSL

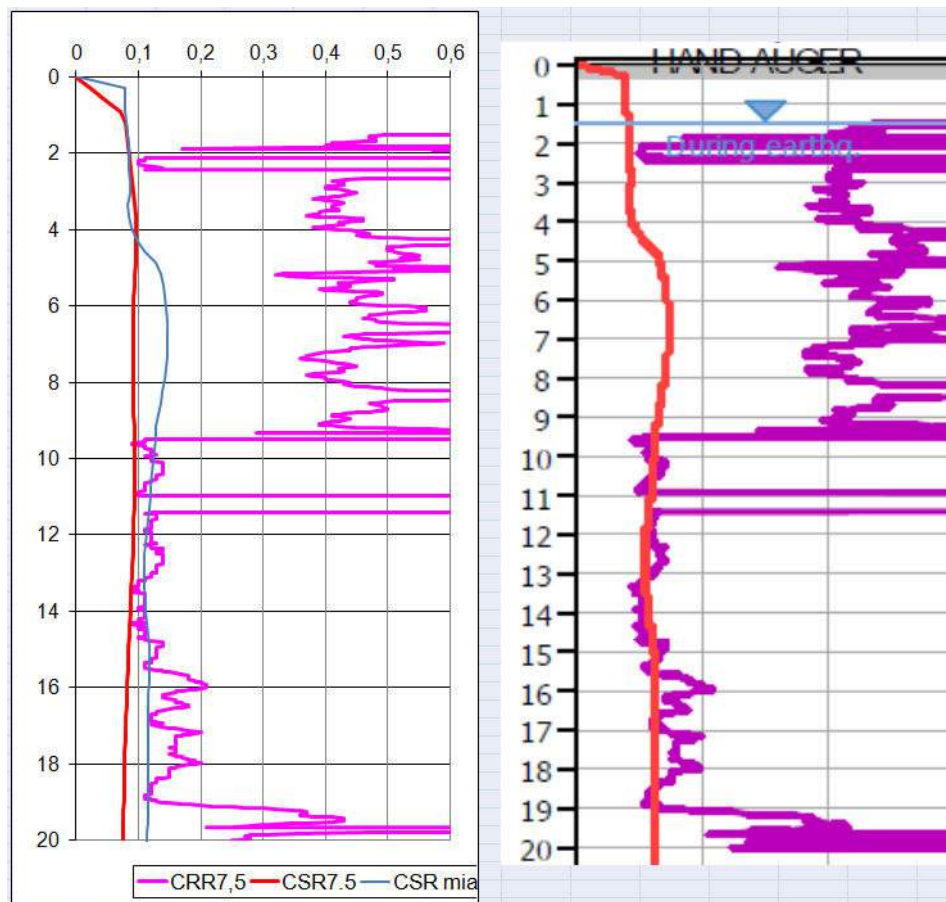
Con le indagini CPTU si è determinata la CRR del punto di indagine presso il teatro Concordia; con l'Analisi di Risposta Sismica locale si ricava invece il profilo di CSR in funzione della reale stratigrafia profonda del sito.

Con STRATA è possibile ricavare direttamente la curva della massima sollecitazione di taglio indotta dal sisma (stress ratio profile); per definizione la CSR si ottiene moltiplicando questo valore per 0,65.

Poi occorre dividere per MSF, e si ottiene il profilo della CSR_{7,5} equivalente per un sisma di Mw=6,14

Una volta ricostruito il valore della CSR ad ogni profondità, lo si può diagrammare con la CRR (ovvero la resistenza che il deposito offre allo sforzo di taglio ciclico indotto dal sisma) ricavata ad ogni profondità dalla prova penetrometrica statica. In questo caso la CRR è stimata con il metodo NCEER (Robertson).

PGA		$CSR = \frac{\tau_{media}}{\sigma'_{v0}} = 0.65 \frac{\sigma_{max}}{g} \frac{\sigma_v}{\sigma'_v} r_d$										
Prof (m)	media	prof (m)	sigma totale	sigma eff	CSR	MSF	CSR _{7,5} a mano	Prof. (m)	SRP	0.65 SRP=CSR	MSF	CSR _{7,5}
0,00	0,203	0,00	0,00	0,00		1,67	0	0	0,000	0,000	1,67	0,000
0,30	0,203	0,30	5,64	5,64	0,132	1,67	0,079	0,3048	0,061	0,040	1,67	0,024
0,61	0,203	0,61	11,28	11,28	0,132	1,67	0,079	0,6096	0,123	0,080	1,67	0,048
0,91	0,202	0,91	16,92	16,92	0,132	1,67	0,079	0,9144	0,184	0,119	1,67	0,072
1,22	0,202	1,22	22,56	21,84	0,136	1,67	0,081	1,2192	0,204	0,133	1,67	0,080
1,52	0,202	1,52	28,19	26,48	0,140	1,67	0,084	1,524	0,209	0,136	1,67	0,081
1,83	0,201	1,83	33,83	31,12	0,142	1,67	0,085	1,8288	0,214	0,139	1,67	0,083
2,13	0,199	2,13	39,47	35,77	0,143	1,67	0,086	2,1336	0,219	0,142	1,67	0,085
2,44	0,195	2,44	45,11	40,41	0,142	1,67	0,085	2,4384	0,223	0,145	1,67	0,087
2,74	0,191	2,74	50,45	43,16	0,145	1,67	0,087	2,7432	0,230	0,150	1,67	0,090
3,05	0,182	3,05	55,70	45,43	0,145	1,67	0,087	3,048	0,237	0,154	1,67	0,092
3,35	0,168	3,35	60,96	47,69	0,139	1,67	0,083	3,3528	0,244	0,159	1,67	0,095
3,66	0,164	3,66	66,02	49,77	0,141	1,67	0,085	3,6576	0,248	0,161	1,67	0,096
3,96	0,167	3,96	70,90	51,65	0,149	1,67	0,089	3,9624	0,247	0,161	1,67	0,096
4,27	0,176	4,27	75,78	53,54	0,162	1,67	0,097	4,2672	0,247	0,161	1,67	0,096
4,57	0,195	4,57	80,69	55,47	0,184	1,67	0,110	4,572	0,246	0,160	1,67	0,096
4,88	0,222	4,88	85,72	57,51	0,215	1,67	0,129	4,8768	0,244	0,159	1,67	0,095
5,18	0,231	5,18	90,75	59,55	0,229	1,67	0,137	5,1816	0,242	0,158	1,67	0,094
5,49	0,232	5,49	95,78	61,59	0,234	1,67	0,140	5,4864	0,240	0,156	1,67	0,093
5,79	0,232	5,79	100,95	63,77	0,238	1,67	0,143	5,7912	0,238	0,155	1,67	0,093
6,10	0,231	6,10	106,13	65,96	0,241	1,67	0,145	6,096	0,236	0,154	1,67	0,092
6,40	0,229	6,40	111,31	68,16	0,243	1,67	0,146	6,4008	0,235	0,152	1,67	0,091
6,71	0,227	6,71	116,19	70,04	0,244	1,67	0,146	6,7056	0,234	0,152	1,67	0,091
7,01	0,223	7,01	120,91	71,78	0,245	1,67	0,146	7,0104	0,235	0,153	1,67	0,091
7,32	0,219	7,32	125,64	73,51	0,243	1,67	0,145	7,3152	0,235	0,153	1,67	0,092
7,62	0,213	7,62	130,18	75,07	0,240	1,67	0,144	7,62	0,236	0,153	1,67	0,092
7,92	0,207	7,92	134,45	76,34	0,237	1,67	0,142	7,9248	0,237	0,154	1,67	0,092
8,23	0,200	8,23	138,71	77,62	0,232	1,67	0,139	8,2296	0,237	0,154	1,67	0,092
8,53	0,192	8,53	143,06	78,98	0,226	1,67	0,136	8,5344	0,238	0,155	1,67	0,093
8,84	0,184	8,84	148,06	80,99	0,219	1,67	0,131	8,8392	0,238	0,155	1,67	0,093
9,14	0,179	9,14	153,06	83,00	0,215	1,67	0,129	9,144	0,239	0,155	1,67	0,093
9,45	0,176	9,45	158,06	85,01	0,213	1,67	0,128	9,4488	0,240	0,156	1,67	0,093
9,75	0,173	9,75	163,06	87,03	0,211	1,67	0,126	9,7536	0,240	0,156	1,67	0,093
10,06	0,170	10,06	168,55	89,53	0,207	1,67	0,124	10,0584	0,240	0,156	1,67	0,093
10,36	0,166	10,36	174,04	92,02	0,204	1,67	0,122	10,3632	0,240	0,156	1,67	0,094
10,67	0,163	10,67	179,52	94,52	0,202	1,67	0,121	10,668	0,240	0,156	1,67	0,093
10,97	0,160	10,97	185,01	97,02	0,199	1,67	0,119	10,9728	0,240	0,156	1,67	0,093
11,28	0,157	11,28	190,51	99,53	0,196	1,67	0,117	11,2776	0,240	0,156	1,67	0,093
11,58	0,154	11,58	196,15	102,18	0,192	1,67	0,115	11,5824	0,239	0,155	1,67	0,093
11,89	0,150	11,89	201,79	104,83	0,188	1,67	0,113	11,8872	0,237	0,154	1,67	0,092
12,19	0,148	12,19	207,43	107,48	0,186	1,67	0,111	12,192	0,236	0,153	1,67	0,092
12,50	0,146	12,50	213,07	110,13	0,184	1,67	0,110	12,4968	0,234	0,152	1,67	0,091
12,80	0,146	12,80	218,73	112,80	0,184	1,67	0,110	12,8016	0,233	0,151	1,67	0,091
13,11	0,146	13,11	224,52	115,61	0,184	1,67	0,110	13,1064	0,230	0,150	1,67	0,090
13,41	0,146	13,41	230,31	118,41	0,184	1,67	0,110	13,4112	0,228	0,148	1,67	0,089
13,72	0,147	13,72	236,10	121,21	0,186	1,67	0,111	13,716	0,226	0,147	1,67	0,088
14,02	0,148	14,02	241,90	124,01	0,187	1,67	0,112	14,0208	0,223	0,145	1,67	0,087
14,33	0,151	14,33	247,69	126,81	0,191	1,67	0,114	14,3256	0,221	0,144	1,67	0,086
14,63	0,153	14,63	253,48	129,62	0,195	1,67	0,117	14,6304	0,219	0,142	1,67	0,085
14,94	0,155	14,94	259,27	132,42	0,198	1,67	0,118	14,9352	0,217	0,141	1,67	0,084
15,24	0,155	15,24	265,06	135,22	0,198	1,67	0,118	15,24	0,215	0,140	1,67	0,084
15,54	0,154	15,54	270,85	138,02	0,196	1,67	0,118	15,5448	0,213	0,138	1,67	0,083
15,85	0,153	15,85	276,64	140,82	0,195	1,67	0,117	15,8496	0,211	0,137	1,67	0,082
16,15	0,152	16,15	282,43	143,63	0,194	1,67	0,116	16,1544	0,209	0,136	1,67	0,081
16,46	0,152	16,46	288,22	146,43	0,195	1,67	0,117	16,4592	0,208	0,135	1,67	0,081
16,76	0,152	16,76	294,02	149,23	0,195	1,67	0,116	16,764	0,206	0,134	1,67	0,080
17,07	0,152	17,07	299,81	152,03	0,194	1,67	0,116	17,0688	0,204	0,133	1,67	0,080
17,37	0,151	17,37	305,60	154,83	0,194	1,67	0,116	17,3736	0,203	0,132	1,67	0,079
17,68	0,151	17,68	311,39	157,64	0,194	1,67	0,116	17,6784	0,202	0,131	1,67	0,079
17,98	0,151	17,98	317,18	160,44	0,194	1,67	0,116	17,9832	0,200	0,130	1,67	0,078
18,29	0,151	18,29	322,97	163,24	0,195	1,67	0,116	18,288	0,199	0,129	1,67	0,077
18,59	0,151	18,59	328,76	166,04	0,194	1,67	0,116	18,5928	0,198	0,129	1,67	0,077
18,90	0,150	18,90	334,55	168,85	0,193	1,67	0,116	18,8976	0,197	0,128	1,67	0,077
19,20	0,149	19,20	340,35	171,65	0,192	1,67	0,115	19,2024	0,196	0,127	1,67	0,076
19,51	0,149	19,51	346,14	174,45	0,192	1,67	0,115	19,5072	0,195	0,126	1,67	0,076
19,81	0,148	19,81	352,12	177,45	0,191	1,67	0,114	19,812	0,194	0,126	1,67	0,075
20,12	0,147	20,12	358,10	180,44	0,190	1,67	0,114	20,1168	0,193	0,125	1,67	0,075



Si procede con la curva CSR7,5 più conservativa (quella spostata più a destra con valori più alti).
Si procede al calcolo dell'IPL con il software C.Liq. utilizzando la curva CSR7,5 calcolata con la RSL.



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LIQUEFACTION ANALYSIS REPORT

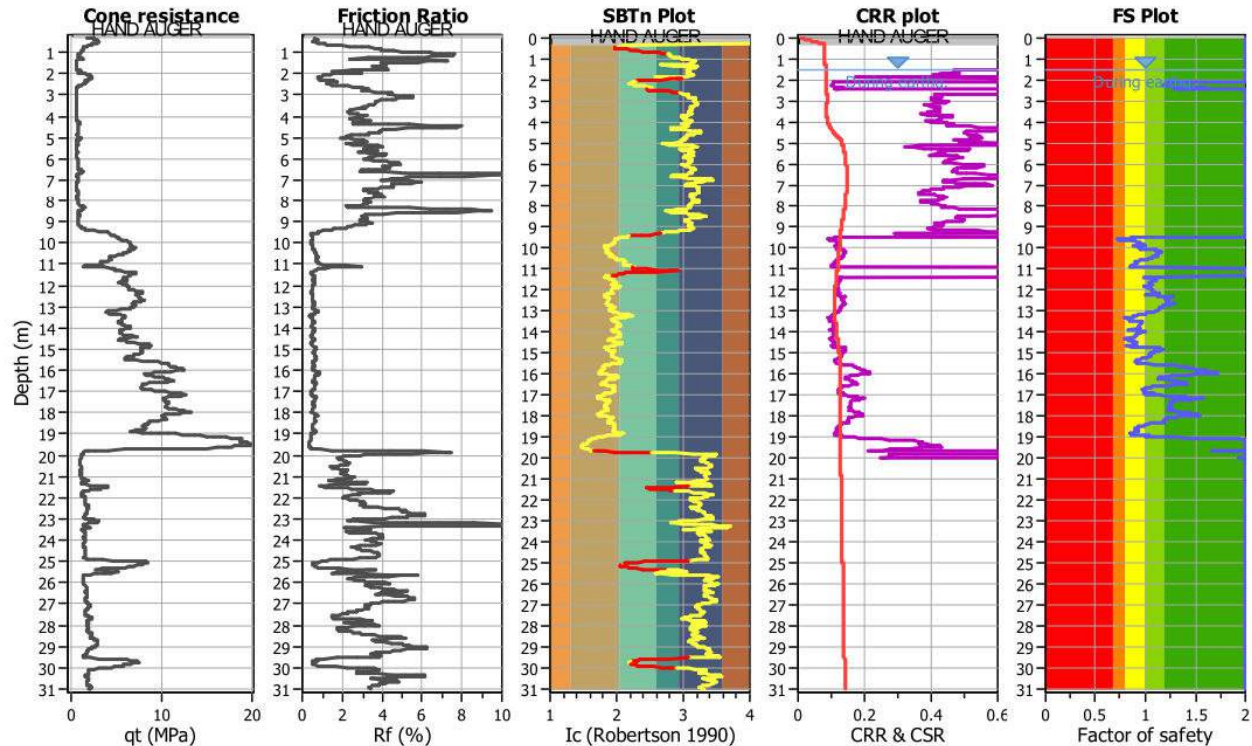
Project title :

Location :

CPT file : rif. U52-19 CPTU1 Portomaggiore

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	applied:	All soils
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.30	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based



$M = 71/2$ standard deviation

Summary of liquefaction potential

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CPT name: rif. U52-19 CPTU1 Portomaggiore

:: Liquefaction Potential Index calculation data :: (continued)

Depth (m)	FS	F_L	w_z	d_z	LPI	Depth (m)	FS	F_L	w_z	d_z	LPI
30.74	2.00	0.00	0.00	0.00	0.00	30.76	2.00	0.00	0.00	0.00	0.00
30.78	2.00	0.00	0.00	0.00	0.00	30.80	2.00	0.00	0.00	0.00	0.00
30.82	2.00	0.00	0.00	0.00	0.00	30.84	2.00	0.00	0.00	0.00	0.00
30.86	2.00	0.00	0.00	0.00	0.00	30.88	2.00	0.00	0.00	0.00	0.00
30.90	2.00	0.00	0.00	0.00	0.00	30.92	2.00	0.00	0.00	0.00	0.00
30.94	2.00	0.00	0.00	0.00	0.00	30.96	2.00	0.00	0.00	0.00	0.00
30.98	2.00	0.00	0.00	0.00	0.00	31.00	2.00	0.00	0.00	0.00	0.00

Overall liquefaction potential: 1.09

LPI = 0.00 - Liquefaction risk very low
LPI between 0.00 and 5.00 - Liquefaction risk low
LPI between 5.00 and 15.00 - Liquefaction risk high
LPI > 15.00 - Liquefaction risk very high

Abbreviations

FS: Calculated factor of safety for test point
 F_L : 1 - FS
 w_z : Function value of the extend of soil liquefaction according to depth
 d_z : Layer thickness (m)
LPI: Liquefaction potential index value for test point

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
30.30	66.32	2.00	0.00	1.00	0.00	30.32	68.51	2.00	0.00	1.00	0.00
30.34	69.33	2.00	0.00	1.00	0.00	30.36	68.98	2.00	0.00	1.00	0.00
30.38	68.17	2.00	0.00	1.00	0.00	30.40	67.51	2.00	0.00	1.00	0.00
30.42	67.21	2.00	0.00	1.00	0.00	30.44	67.28	2.00	0.00	1.00	0.00
30.46	66.86	2.00	0.00	1.00	0.00	30.48	65.56	2.00	0.00	1.00	0.00
30.50	63.78	2.00	0.00	1.00	0.00	30.52	62.79	2.00	0.00	1.00	0.00
30.54	63.11	2.00	0.00	1.00	0.00	30.56	63.73	2.00	0.00	1.00	0.00
30.58	63.91	2.00	0.00	1.00	0.00	30.60	63.77	2.00	0.00	1.00	0.00
30.62	63.68	2.00	0.00	1.00	0.00	30.64	63.53	2.00	0.00	1.00	0.00
30.66	63.10	2.00	0.00	1.00	0.00	30.68	62.02	2.00	0.00	1.00	0.00
30.70	60.99	2.00	0.00	1.00	0.00	30.72	60.21	2.00	0.00	1.00	0.00
30.74	59.85	2.00	0.00	1.00	0.00	30.76	59.74	2.00	0.00	1.00	0.00
30.78	59.92	2.00	0.00	1.00	0.00	30.80	60.59	2.00	0.00	1.00	0.00
30.82	61.47	2.00	0.00	1.00	0.00	30.84	62.59	2.00	0.00	1.00	0.00
30.86	63.85	2.00	0.00	1.00	0.00	30.88	65.07	2.00	0.00	1.00	0.00
30.90	65.56	2.00	0.00	1.00	0.00	30.92	65.29	2.00	0.00	1.00	0.00
30.94	64.41	2.00	0.00	1.00	0.00	30.96	63.51	2.00	0.00	1.00	0.00
30.98	62.66	2.00	0.00	1.00	0.00	31.00	62.11	2.00	0.00	1.00	0.00
											Total estimated settlement: 12.35

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumetric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

Al termine di questo studio che si può affermare che per le azioni sismiche di progetto attese secondo le NTC2018, per un edificio di classe d'uso III (eventi con tempo di ritorno di 712 anni), non sono attesi fenomeni di liquefazione significativi, visto che le resistenze dei depositi (esprese con la CRR) alle sollecitazioni di taglio indotte dal sisma (esprese attraverso la CSR) sono quasi sempre maggiori.

7. MODELLAZIONE GEOTECNICA SULLE INDAGINI

Con le indagini acquisite in questa fase preliminare, si forniscono delle prime indicazioni sulle caratteristiche meccaniche dei terreni di fondazione, utilizzando in via indicativa, i dati derivabili dalle indagini specifiche eseguite per la modellazione geologica.

- una penetrometria SCPTU a -31m di profondità

Negli Allegati sono inserite, per la CPTU eseguita, le seguenti schede: a) tabelle valori, b) diagrammi di resistenza, c) valutazioni litologiche, d) tabelle parametri geotecnici.

7.1. MODELLO GEOTECNICO DEL SOTTOSUOLO

L'esecuzione della prova penetrometrica è avvenuta con un Penetrometro Statico con punta elettrica con piezocono.

Si allegano i diagrammi delle resistenze dal cui confronto si possono evincere le differenze di comportamento dei terreni nei vari strati incontrati; le interpretazioni litologiche, in base alle valutazioni stratigrafiche fornite da Douglas-Olsen (1981), Robertson-Campanella (1983) e Olsen-Farr (1986).

Le caratteristiche geotecniche dei terreni ricavate dai risultati della penetrometria statica sono riportate in tabella parametri geotecnici.

Nelle tabelle viene fatta distinzione fra i terreni di natura coesiva e quelli di natura granulare.

Per i terreni di natura coesiva vengono riportati, i valori di resistenza all'infissione della punta del penetrometro q_c (MPa), la resistenza laterale F_s (MPa), il peso di volume γ' (kN/m³), la coesione non drenata C_u (kPa), il grado di sovraconsolidazione OCR, dei moduli di deformazione non drenati E_{u50} (MPa) corrispondenti rispettivamente ad un grado di mobilitazione dello sforzo deviatorico pari al 50 e 25 %, del modulo di deformazione edometrico M_o (MPa). Per i terreni di natura granulare vengono riportati, i valori di resistenza all'infissione della punta del penetrometro q_c (MPa), la resistenza laterale F_s (MPa), la densità relativa D_r (%), dell'angolo di attrito interno efficace ϕ' (°), i moduli di deformazione drenati E'_{25} (MPa) e del modulo di deformazione edometrico M_o (MPa).

Nella **Tabella 4.1** si riportano i parametri geotecnici medi per strati pseudomogenei rilevati con le prove penetrometriche statiche CPTU con *rif. U52-19*:

Identificativo	U52-19
Emissione	lug-19
Pagina	1 di 0

PROVA PENETROMETRICA STATICA

PARAMETRI GEOTECNICI

-Committente	Comune di Portomaggiore	-Prova n°	CPTU1
-Cantiere	Teatro Concordia, Portomaggiore (Fe)	-Data prova	12/07/2019
-Quota p.c.	1,70 m s.l.m.	-Prof. preforo	0,30 m
-Livello di falda	1,50 m da p.c.	-Prof. finale	31,00 m

							MATERIALI COESIVI						MATERIALI GRANULARI								
DA	A	qcm	fsm	deltaU	litol.	Peso Vol.	Cu (qc)	OCR (qc)	OCR (U)	M ₀	Eu50	CR	Dr	FI' _{DM}	FI' _{Bottom}	FI'Schm.				E'25	M ₀
m	m	MPa	MPa	MPa	(-)	kN/m3	KPa	(-)	(-)	MPa	MPa	(-)	(%)	(°)	(°)	(°)				MPa	MPa
0,0	0,5	1,06	0,01	0,00	Rip	18,15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
0,5	2,0	1,11	0,04	0,02	Al-La	18,00	52	14	8	3,63	9,963	0,09	-	-	-	-	-	-	-	-	
2,0	2,6	1,68	0,02	0,01	L-Ls	20,00	79	17	10	4,72	14,01	0,10	21	32	29	31	34	36	40	4,43	7,09
2,6	5,0	0,62	0,02	0,05	A	17,50	33	4	7	2,86	12,32	0,15	-	-	-	-	-	-	-	-	
5,0	9,4	0,75	0,03	0,09	Al-La	18,00	37	3	7	3,29	16,66	0,24	-	-	-	-	-	-	-	-	
9,4	18,9	7,35	0,04	-0,02	S	20,00	-	-	-	-	-	-	46	33	30	34	37	39	42	18,44	29,08
18,9	19,8	14,80	0,06	-0,01	S	20,00	-	-	-	-	-	-	68	35	32	37	39	41	43	37,73	49,00
19,8	24,9	1,39	0,05	0,24	Al-La	18,00	62	2	5	4,68	34,35	0,33	-	-	-	-	-	-	-	-	
24,9	25,6	5,50	0,06	-0,19	SI	19,00	-	-	-	-	-	-	26	29	26	31	34	37	40	14,39	23,02
25,6	29,5	1,71	0,07	0,23	A	17,50	80	2	6	5,46	45,09	0,32	-	-	-	-	-	-	-	-	
29,5	30,0	5,28	0,05	-0,11	SI	19,00	-	-	-	-	-	-	23	28	25	30	33	36	39	14,06	22,49
30,0	31,0	1,99	0,08	-0,22	A	17,50	96	2	#####	6,01	54,07	0,30	-	-	-	-	-	-	-	-	

Tabella 4.1 – Stratigrafia geotecnica semplificata

Nell'area è stata rilevata la quota della superficie di falda all'interno del foro di esecuzione delle prove penetrometriche statiche con punta elettrica e piezocono SCPTU, con rif. U52-19. Tale quota è stata rilevata in data 12/07/2019 a -1,50m dal p.c.

Il livello freatico potrebbe oscillare rispetto ai valori riscontrati in tal giorno, solo un monitoraggio di un anno idrogeologico permetterebbe di valutare le oscillazioni stagionali di queste quote.

In fase esecutiva si consiglia di approfondire le indagini geotecniche in quanto le penetrometrie forniscono solo parametri in condizioni non drenate (a breve termine). Lo studio di edifici molto vecchi richiede approfondimenti sui parametri in condizioni drenate a lungo termine. In diversi carotaggi a Portomaggiore si sono rilevate anche presenze di banchi di torbe, che non erano stati interpretati dalle prove penetrometriche.

Codigoro, li 30/07/2019

Dott. Geologo Thomas Veronese

Thomas Veronese

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA															RIF. PROVA:		CPTU n°:		
LETTURE DI CAMPAGNA															U52-19		CPTU1		
COMMITTENTE: Comune di Portomaggiore										PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00									
CANTIERE: Teatro Concordia, Portomaggiore (Fe)										PROFONDITA' FALDA (m da p.c.): 1,50									
DATA: 12/07/2019										PREFORO (m da p.c.): 0,30									
Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °	Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °	Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °	Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °
0,02	0,00	0,00	0,00	0,00	1,82	0,51	22,34	37,61	2,72	3,62	0,52	17,10	3,41	1,57	5,42	0,57	25,23	73,42	1,25
0,04	0,00	0,00	0,00	0,00	1,84	0,82	22,12	44,11	2,69	3,64	0,50	16,66	4,23	1,38	5,44	0,60	23,45	75,05	1,27
0,06	0,00	0,00	0,00	0,00	1,86	1,28	22,57	22,14	2,67	3,66	0,53	15,33	5,86	1,56	5,46	0,60	20,45	79,93	1,23
0,08	0,00	0,00	0,00	0,00	1,88	1,33	17,13	0,97	2,65	3,68	0,59	13,99	7,49	1,55	5,48	0,61	19,11	82,37	1,27
0,10	0,00	0,00	0,00	0,00	1,90	1,02	15,47	7,49	2,60	3,70	0,63	14,44	8,30	1,56	5,50	0,61	18,89	83,19	1,22
0,12	0,00	0,00	0,00	0,00	1,92	0,55	18,36	57,14	2,63	3,72	0,64	15,11	8,30	1,57	5,52	0,60	19,67	83,19	1,29
0,14	0,00	0,00	0,00	0,00	1,94	0,61	20,81	66,09	2,63	3,74	0,62	14,67	8,30	1,55	5,54	0,57	19,67	81,56	1,25
0,16	0,00	0,00	0,00	0,00	1,96	0,80	21,15	81,56	2,63	3,76	0,63	14,56	8,30	1,55	5,56	0,56	21,11	80,75	1,23
0,18	0,00	0,00	0,00	0,00	1,98	1,15	22,83	91,33	2,61	3,78	0,62	14,56	9,11	1,55	5,58	0,52	22,78	80,75	1,27
0,20	0,00	0,00	0,00	0,00	2,00	1,50	24,83	57,95	2,58	3,80	0,58	13,90	9,11	1,56	5,60	0,58	21,67	83,19	1,25
0,22	0,00	0,00	0,00	0,00	2,02	1,78	24,72	32,72	2,57	3,82	0,58	12,79	13,19	1,57	5,62	0,63	22,01	87,26	1,27
0,24	0,00	0,00	0,00	0,00	2,04	1,95	23,01	1,47	2,16	3,84	0,59	13,79	14,81	1,60	5,64	0,66	20,45	88,07	1,27
0,26	0,00	0,00	0,00	0,00	2,06	1,98	22,23	4,73	2,13	3,86	0,60	15,68	15,63	1,59	5,66	0,67	19,56	88,89	1,25
0,28	0,00	0,00	0,00	0,00	2,08	2,06	20,57	4,73	2,13	3,88	0,58	16,57	17,25	1,60	5,68	0,66	19,78	88,89	1,27
0,30	0,00	0,00	0,00	0,00	2,10	2,10	20,57	7,98	2,10	3,90	0,57	15,24	18,07	1,59	5,70	0,69	19,78	88,89	1,27
0,32	2,44	13,70	7,49	2,62	2,12	2,13	19,79	9,61	2,02	3,92	0,56	16,35	19,69	1,60	5,72	0,66	21,01	88,89	1,27
0,34	2,50	15,59	5,86	2,54	2,14	2,20	19,13	12,05	1,95	3,94	0,54	16,57	24,58	1,60	5,74	0,64	22,90	88,07	1,29
0,36	2,52	16,25	5,86	2,53	2,16	2,32	19,35	14,49	1,90	3,96	0,53	17,69	33,53	1,60	5,76	0,62	25,56	87,26	1,28
0,38	2,43	16,36	5,05	2,53	2,18	2,40	18,68	17,75	1,87	3,98	0,52	18,91	40,86	1,60	5,78	0,63	27,23	88,07	1,28
0,40	2,60	18,26	5,86	2,52	2,20	2,33	18,68	20,19	1,86	4,00	0,53	16,62	213,43	1,48	5,80	0,63	28,12	88,89	1,25
0,42	2,60	23,59	2,60	2,58	2,22	2,15	18,79	21,01	1,84	4,02	0,54	17,29	224,01	1,50	5,82	0,62	26,78	88,89	1,29
0,44	3,05	17,15	4,23	2,58	2,24	2,01	16,91	21,82	1,83	4,04	0,54	17,74	228,08	1,48	5,84	0,62	25,78	88,89	1,27
0,46	3,06	12,82	5,05	2,57	2,26	1,80	14,91	21,82	1,81	4,06	0,54	16,74	225,64	1,48	5,86	0,62	24,78	88,07	1,28
0,48	3,14	16,15	5,86	2,55	2,28	1,67	17,13	22,63	1,79	4,08	0,58	16,18	219,13	1,46	5,88	0,62	23,56	87,26	1,28
0,50	3,14	17,04	5,86	2,52	2,30	1,58	18,24	22,63	1,80	4,10	0,60	15,18	156,45	1,44	5,90	0,61	22,67	86,45	1,28
0,52	3,09	19,93	5,05	2,50	2,32	1,52	19,58	22,63	1,77	4,12	0,59	15,18	113,31	1,44	5,92	0,61	21,56	88,07	1,28
0,54	2,85	22,38	2,60	2,50	2,34	1,63	26,59	20,19	1,88	4,14	0,59	17,85	120,63	1,42	5,94	0,61	20,78	88,07	1,28
0,56	2,66	23,49	1,79	2,52	2,36	1,62	27,82	21,82	1,94	4,16	0,56	20,85	119,82	1,42	5,96	0,63	22,23	90,51	1,29
0,58	2,47	27,39	0,65	2,49	2,38	1,59	28,60	24,26	1,94	4,18	0,59	21,63	125,51	1,39	5,98	0,66	23,45	92,95	1,29
0,60	2,38	28,06	0,65	2,48	2,40	1,62	28,15	25,07	1,95	4,20	0,63	22,29	133,65	1,39	6,00	0,73	22,68	131,21	1,24
0,62	2,29	28,72	1,47	2,48	2,42	1,65	23,60	26,70	1,97	4,22	0,66	23,18	139,35	1,39	6,02	0,74	23,57	132,03	1,25
0,64	2,19	29,17	2,28	2,47	2,44	1,64	21,71	28,33	1,95	4,24	0,68	24,74	143,43	1,38	6,04	0,75	25,68	130,40	1,24
0,66	2,09	29,06	0,65	2,45	2,46	1,57	20,38	28,33	1,89	4,26	0,74	25,29	151,57	1,37	6,06	0,75	28,79	130,40	1,24
0,68	1,85	37,62	3,09	2,47	2,48	1,41	16,94	29,15	1,86	4,28	0,86	25,07	172,73	1,36	6,08	0,74	31,13	130,40	1,24
0,70	1,66	39,84	5,54	2,47	2,50	1,28	15,83	29,96	1,84	4,30	0,97	25,30	189,01	1,36	6,10	0,75	32,13	130,40	1,24
0,72	1,48	39,07	6,35	2,48	2,52	1,12	16,17	29,15	1,85	4,32	0,98	25,74	196,33	1,36	6,12	0,75	33,24	129,59	1,25
0,74	1,43	40,74	5,54	2,47	2,54	1,00	18,83	29,96	1,84	4,34	0,94	28,07	192,27	1,34	6,14	0,73	34,35	127,96	1,23
0,76	1,38	47,30	3,09	2,47	2,56	0,89	19,39	29,96	1,86	4,36	0,88	30,85	166,21	1,33	6,16	0,74	34,79	127,15	1,22
0,78	1,34	49,96	2,28	2,45	2,58	0,82	18,84	29,15	1,85	4,38	0,82	37,52	158,07	1,34	6,18	0,70	34,90	127,15	1,23
0,80	1,27	48,52	0,16	2,44	2,60	0,74	19,17	29,15	1,84	4,40	0,72	43,63	157,26	1,37	6,20	0,68	34,90	127,15	1,20
0,82	1,27	50,64	0,65	2,43	2,62	0,73	20,51	29,15	1,85	4,42	0,68	46,74	154,82	1,27	6,22	0,66	34,23	127,15	1,23
0,84	1,30	49,75	8,79	2,44	2,64	0,73	20,73	27,51	1,82	4,44	0,67	50,52	154,01	1,36	6,24	0,62	33,34	127,15	1,22
0,86	1,27	50,53	3,91	2,44	2,66	0,66	19,96	28,33	1,86	4,46	0,63	54,19	153,19	1,29	6,26	0,63	32,56	127,96	1,23
0,88	1,27	52,87	7,98	2,40	2,68	0,60	19,85	28,33	1,85	4,48	0,63	56,63	153,19	1,39	6,28	0,66	31,56	129,59	1,19
0,90	1,27	54,65	10,42	2,45	2,70	0,54	19,30	28,33	1,82	4,50	0,65	54,52	154,01	1,40	6,30	0,63	30,12	129,59	1,22
0,92	1,26	56,43	1,47	2,40	2,72	0,55	18,19	23,45	1,82	4,52	0,65	49,08	153,19	1,38	6,32	0,62	28,34	129,59	1,23
0,94	1,20	60,44	6,35	2,40	2,74	0,55	16,74	21,01	1,84	4,54	0,63	42,30	151,57	1,38	6,34	0,64	27,90	130,40	1,23
0,96	1,16	64,55	5,54	2,43	2,76	0,57	16,52	18,56	1,83	4,56	0,66	36,19	151,57	1,38	6,36	0,66	27,45	132,84	1,19
0,98	1,14	68,66	12,87	2,43	2,78	0,57	17,64	15,31	1,81	4,58	0,67	32,74	149,12	1,36	6,38	0,66	28,78	134,47	1

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA															RIF. PROVA:		CPTU n°:		
LETTURE DI CAMPAGNA															U52-19		CPTU1		
COMMITTENTE: Comune di Portomaggiore										PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00									
CANTIERE: Teatro Concordia, Portomaggiore (Fe)										PROFONDITA' FALDA (m da p.c.): 1,50									
DATA: 12/07/2019										PREFORO (m da p.c.): 0,30									
Prof.	qc	fs	U	Inc.	Prof.	qc	fs	U	Inc.	Prof.	qc	fs	U	Inc.	Prof.	qc	fs	U	Inc.
(m)	MPa	kPa	kPa	°	(m)	MPa	kPa	kPa	°	(m)	MPa	kPa	kPa	°	(m)	MPa	kPa	kPa	°
9,02	0,71	25,55	241,11	1,42	10,82	4,21	28,35	68,53	1,86	12,62	7,58	38,67	110,87	2,12	14,42	7,33	29,01	127,15	2,49
9,04	0,69	26,21	242,73	1,42	10,84	4,00	27,46	66,09	1,86	12,64	7,63	39,11	104,35	2,11	14,44	7,15	29,57	119,01	2,53
9,06	0,68	27,10	243,55	1,43	10,86	3,78	26,91	64,47	1,85	12,66	7,79	39,78	103,54	2,13	14,46	6,62	31,01	112,49	2,49
9,08	0,67	26,21	241,92	1,42	10,88	3,51	26,46	62,03	1,85	12,68	8,00	40,33	104,35	2,13	14,48	6,04	31,68	105,98	2,44
9,10	0,66	25,55	240,29	1,42	10,90	3,27	25,79	58,77	1,85	12,70	8,05	40,67	103,54	2,13	14,50	5,64	31,34	102,73	2,52
9,12	0,67	23,99	241,11	1,42	10,92	3,13	25,57	57,95	1,86	12,72	7,91	40,89	101,09	2,12	14,52	5,38	31,68	101,09	2,53
9,14	0,68	22,66	245,17	1,43	10,94	3,13	25,79	58,77	1,86	12,74	7,64	41,00	99,47	2,12	14,54	5,23	32,23	101,09	2,55
9,16	0,73	22,55	252,50	1,43	10,96	3,26	25,73	83,19	1,79	12,76	7,34	41,44	97,84	2,13	14,56	5,17	32,45	102,73	2,53
9,18	0,75	21,88	254,13	1,43	10,98	3,38	25,95	74,23	1,79	12,78	7,10	41,88	96,21	2,12	14,58	5,24	32,23	106,79	2,50
9,20	0,81	22,10	259,01	1,44	11,00	3,44	28,84	58,77	1,82	12,80	6,97	42,32	97,03	2,13	14,60	5,51	31,45	114,12	2,44
9,22	0,89	22,22	265,53	1,44	11,02	3,25	32,95	31,91	1,83	12,82	6,88	43,43	97,84	2,13	14,62	5,88	31,34	120,63	2,50
9,24	0,98	24,33	276,92	1,44	11,04	2,65	34,28	8,30	1,82	12,84	6,77	43,99	97,84	2,15	14,64	6,22	31,34	123,07	2,56
9,26	0,99	25,33	206,10	1,43	11,06	1,94	32,51	3,41	1,82	12,86	6,62	43,88	97,03	2,15	14,66	6,44	31,78	125,51	2,57
9,28	1,14	27,77	210,17	1,46	11,08	1,44	29,62	0,16	1,82	12,88	6,65	42,32	99,47	2,13	14,68	6,63	32,00	127,15	2,56
9,30	1,39	28,88	228,08	1,44	11,10	1,37	41,28	1,79	1,82	12,90	6,86	39,76	103,54	2,15	14,70	6,92	33,00	124,70	2,57
9,32	1,64	27,44	114,12	1,46	11,12	1,30	53,39	2,60	1,81	12,92	7,09	37,54	107,61	2,13	14,72	7,33	33,89	127,96	2,56
9,34	1,56	24,66	119,82	1,47	11,14	2,46	59,73	40,86	1,81	12,94	7,14	37,54	106,79	2,13	14,74	7,98	34,78	130,40	2,56
9,36	1,44	22,55	117,37	1,48	11,16	3,86	53,95	53,89	1,83	12,96	7,04	36,12	104,35	2,13	14,76	8,57	36,11	135,29	2,56
9,38	1,44	19,88	119,01	1,48	11,18	4,56	50,28	18,88	1,83	12,98	6,89	36,01	101,09	2,13	14,78	8,70	39,89	136,10	2,57
9,40	1,86	24,66	140,17	1,52	11,20	4,72	44,95	18,88	1,84	13,00	6,80	36,24	100,28	2,16	14,80	8,65	43,00	136,10	2,57
9,42	2,57	26,99	62,84	1,52	11,22	4,70	40,06	19,69	1,84	13,02	6,70	37,12	99,47	2,16	14,82	8,62	44,22	136,91	2,56
9,44	3,15	28,66	52,25	1,51	11,24	4,75	35,50	20,51	1,84	13,04	6,63	37,35	99,47	2,16	14,84	8,70	44,89	140,17	2,57
9,46	3,53	27,77	53,89	1,48	11,26	4,79	34,84	22,14	1,83	13,06	6,56	37,90	99,47	2,18	14,86	8,80	47,55	143,43	2,58
9,48	3,81	30,22	38,42	1,48	11,28	4,91	33,50	22,95	1,86	13,08	6,48	36,90	99,47	2,16	14,88	8,68	50,00	141,79	2,60
9,50	3,99	33,55	13,19	1,52	11,30	5,08	31,72	25,39	1,87	13,10	6,31	35,57	97,84	2,18	14,90	8,38	51,66	136,10	2,59
9,52	4,20	34,22	5,05	1,55	11,32	5,32	31,17	27,83	1,87	13,12	5,98	34,68	94,59	2,18	14,92	8,04	52,33	132,03	2,61
9,54	4,31	27,10	1,79	1,69	11,34	5,79	31,83	31,91	1,88	13,14	5,47	34,68	88,07	2,18	14,94	7,08	57,66	115,75	2,59
9,56	4,30	21,88	3,41	1,75	11,36	6,48	31,17	37,61	1,88	13,16	4,92	34,68	81,56	2,19	14,96	7,85	50,45	126,33	2,58
9,58	4,28	20,33	5,05	1,75	11,38	7,06	31,39	43,30	1,87	13,18	4,52	33,79	77,49	2,19	14,98	7,88	49,67	125,51	2,58
9,60	4,33	19,77	6,67	1,77	11,40	7,28	31,72	45,75	1,89	13,20	4,21	32,34	75,05	2,19	15,00	7,88	49,45	124,70	2,58
9,62	4,44	20,44	8,30	1,77	11,42	7,18	31,28	46,56	1,92	13,22	3,99	30,67	73,42	2,19	15,02	7,81	48,78	124,70	2,58
9,64	4,55	21,44	9,93	1,78	11,44	6,96	31,39	45,75	1,92	13,24	3,84	29,23	72,61	2,20	15,04	7,71	47,67	124,70	2,60
9,66	4,71	23,21	12,37	1,78	11,46	6,70	33,05	44,93	1,90	13,26	3,75	28,12	72,61	2,20	15,06	7,67	46,78	125,51	2,58
9,68	4,84	24,55	14,00	1,79	11,48	6,54	35,39	45,75	1,92	13,28	3,75	27,12	73,42	2,22	15,08	7,70	44,89	127,96	2,59
9,70	4,91	25,32	15,63	1,78	11,50	6,52	37,49	47,37	1,90	13,30	3,87	26,23	76,67	2,23	15,10	7,70	44,89	128,77	2,58
9,72	4,96	25,88	17,25	1,79	11,52	6,43	37,83	48,19	1,89	13,32	4,14	24,23	81,56	2,24	15,12	7,76	44,78	128,77	2,58
9,74	5,01	26,99	18,88	1,80	11,54	6,31	38,38	48,19	1,92	13,34	4,53	23,45	87,26	2,21	15,14	7,85	44,56	129,59	2,60
9,76	5,13	28,10	22,14	1,78	11,56	6,28	38,71	49,81	1,89	13,36	4,95	23,11	84,81	2,20	15,16	7,89	44,34	127,96	2,59
9,78	5,30	28,10	23,77	1,79	11,58	6,23	38,49	51,44	1,93	13,38	5,35	22,56	85,63	2,20	15,18	7,77	44,33	127,15	2,59
9,80	5,39	28,77	26,21	1,80	11,60	6,14	36,82	52,25	1,93	13,40	5,68	22,00	88,07	2,28	15,20	7,88	45,56	125,51	2,59
9,82	5,41	29,43	27,83	1,81	11,62	5,94	35,93	51,44	1,94	13,42	5,91	21,78	91,33	2,24	15,22	7,39	47,11	124,70	2,57
9,84	5,44	29,65	29,47	1,80	11,64	5,75	35,71	51,44	1,93	13,44	5,96	22,00	92,14	2,28	15,24	7,23	46,78	124,70	2,58
9,86	5,54	29,10	31,09	1,83	11,66	5,66	35,15	53,07	1,93	13,46	5,97	23,11	92,14	2,29	15,26	7,11	46,00	124,70	2,60
9,88	5,72	29,54	34,35	1,83	11,68	5,62	34,82	53,89	1,93	13,48	5,91	24,44	92,95	2,23	15,28	6,99	45,44	124,70	2,58
9,90	5,89	29,98	36,79	1,84	11,70	5,70	34,93	56,33	1,92	13,50	5,77	27,11	91,33	2,29	15,30	6,82	44,77	123,89	2,60
9,92	6,10	29,87	40,86	1,83	11,72	5,88	34,82	59,58	1,95	13,52	5,70	28,89	90,51	2,31	15,32	6,61	43,55	122,26	2,56
9,94	6,39	28,98	44,11	1,84	11,74	6,10	33,93	62,84	1,97	13,54	5,64	30,56	91,33	2,32	15,34	6,38	42,77	1	

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA																									RIF. PROVA:			CPTU n°:		
LETTURE DI CAMPAGNA																									U52-19			CPTU1		
COMMITTENTE: Comune di Portomaggiore										PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00																				
CANTIERE: Teatro Concordia, Portomaggiore (Fe)										PROFONDITA' FALDA (m da p.c.): 1,50																				
DATA: 12/07/2019										PREFORO (m da p.c.): 0,30																				
Prof.	qc	fs	U	Inc.	Prof.	qc	fs	U	Inc.	Prof.	qc	fs	U	Inc.	Prof.	qc	fs	U	Inc.	Prof.	qc	fs	U	Inc.						
(m)	MPa	kPa	kPa	°	(m)	MPa	kPa	kPa	°	(m)	MPa	kPa	kPa	°	(m)	MPa	kPa	kPa	°	(m)	MPa	kPa	kPa	°						
18,02	11,96	69,94	140,17	3,27	19,82	1,44	95,50	149,93	4,06	21,62	2,08	73,52	32,40	4,56	23,42	2,01	43,05	263,08	4,85	25,22	6,78	45,55	2,28	5,33						
18,04	11,25	72,17	132,03	3,28	19,84	1,26	100,38	155,63	4,06	21,64	1,77	69,19	29,96	4,51	23,44	1,66	43,38	218,31	4,78	25,24	6,48	42,77	1,47	5,33						
18,06	10,69	73,50	127,15	3,28	19,86	1,21	99,04	167,03	4,06	21,66	1,66	62,41	16,93	4,57	23,46	1,31	45,38	192,27	4,86	25,26	6,32	41,99	0,16	5,32						
18,08	10,39	75,94	127,15	3,28	19,88	1,21	88,04	189,01	4,07	21,68	1,66	66,30	3,09	4,49	23,48	1,12	46,60	202,85	4,99	25,28	6,14	45,99	1,79	5,35						
18,10	9,98	76,05	124,70	3,28	19,90	1,20	77,04	284,25	4,07	21,70	1,54	63,63	2,60	4,57	23,50	1,10	35,71	232,15	4,78	25,30	5,38	52,21	3,09	5,33						
18,12	9,83	75,27	127,15	3,31	19,92	1,12	74,70	355,07	4,07	21,72	1,30	62,19	7,49	4,54	23,52	1,16	34,71	275,29	4,96	25,32	4,13	54,42	12,05	5,35						
18,14	9,98	72,38	136,10	3,32	19,94	1,23	61,36	439,72	4,06	21,74	1,15	56,07	26,21	4,57	23,54	1,20	35,04	301,34	4,96	25,34	3,44	61,20	14,49	5,35						
18,16	10,27	68,71	146,68	3,33	19,96	1,13	47,59	496,70	4,07	21,76	1,23	45,52	90,51	4,54	23,56	1,28	31,82	320,87	4,81	25,36	2,84	74,42	16,93	5,37						
18,18	10,36	66,04	153,19	3,33	19,98	1,08	31,92	531,70	4,10	21,78	1,26	39,07	162,15	4,56	23,58	1,34	31,15	332,27	4,99	25,38	2,42	82,09	17,75	5,38						
18,20	10,30	64,26	154,01	3,33	20,00	0,98	39,93	574,03	4,11	21,80	1,23	35,40	193,08	4,54	23,60	1,37	32,71	342,04	5,02	25,40	2,52	107,86	0,65	5,40						
18,22	10,19	63,26	154,82	3,33	20,02	0,94	32,37	599,27	4,11	21,82	1,15	32,96	206,10	4,56	23,62	1,41	34,93	346,11	4,96	25,42	3,24	114,64	28,65	5,39						
18,24	10,09	62,37	155,63	3,33	20,04	0,92	26,59	604,96	4,12	21,84	1,06	34,73	210,99	4,54	23,64	1,41	40,04	346,11	4,96	25,44	4,29	103,19	52,25	5,27						
18,26	10,11	62,26	159,71	3,36	20,06	0,92	23,15	606,59	4,12	21,86	1,03	31,96	263,08	4,56	23,66	1,40	45,93	343,67	5,00	25,46	5,01	112,19	68,53	5,31						
18,28	10,28	62,92	156,45	3,37	20,08	0,88	20,04	613,10	4,14	21,88	1,07	29,28	318,43	4,58	23,68	1,38	50,93	345,29	5,01	25,48	5,38	112,07	78,31	5,43						
18,30	10,55	62,81	154,82	3,38	20,10	0,88	18,82	619,61	4,15	21,90	1,08	27,06	385,18	4,58	23,70	1,37	55,15	341,23	4,99	25,50	5,25	95,74	79,12	5,44						
18,32	10,60	62,36	155,63	3,41	20,12	0,88	20,15	613,10	4,16	21,92	1,16	24,73	417,74	4,60	23,72	1,40	57,82	342,85	5,02	25,52	4,49	61,96	63,65	5,43						
18,34	10,11	63,02	145,87	3,28	20,14	0,86	18,82	585,43	4,16	21,94	1,39	34,30	668,45	4,56	23,74	1,38	59,71	341,23	5,02	25,54	3,46	46,40	44,93	5,36						
18,36	9,44	61,80	135,29	3,40	20,16	0,85	18,83	596,01	4,15	21,96	1,36	35,08	659,50	4,54	23,76	1,37	60,82	345,29	5,00	25,56	2,88	50,95	34,35	5,43						
18,38	8,90	59,58	128,77	3,41	20,18	0,84	19,27	584,61	4,07	21,98	1,39	32,08	657,87	4,54	23,78	1,37	58,05	348,55	5,01	25,58	2,44	67,50	28,65	5,31						
18,40	8,55	58,24	127,15	3,41	20,20	0,85	20,27	576,47	4,17	22,00	1,43	32,97	682,29	4,54	23,80	1,37	57,05	346,11	5,01	25,60	2,06	92,17	22,14	5,46						
18,42	8,46	57,12	129,59	3,42	20,22	0,83	20,94	504,84	4,20	22,02	1,40	33,19	633,45	4,54	23,82	1,36	58,05	341,23	5,02	25,62	1,69	110,39	49,00	5,22						
18,44	8,58	56,23	136,91	3,44	20,24	0,83	21,72	520,31	4,21	22,04	1,32	35,53	578,91	4,56	23,84	1,36	59,27	341,23	5,00	25,64	1,59	87,05	66,91	5,33						
18,46	8,62	55,57	140,98	3,45	20,26	0,81	21,27	567,52	4,20	22,06	1,32	34,53	583,80	4,57	23,86	1,32	58,27	335,53	5,01	25,66	1,38	76,49	65,28	5,32						
18,48	8,55	53,01	142,61	3,37	20,28	0,79	21,27	577,29	4,10	22,08	1,33	36,75	589,49	4,57	23,88	1,30	56,60	332,27	5,01	25,68	1,29	66,71	92,95	5,49						
18,50	8,48	49,12	142,61	3,48	20,30	0,78	21,72	584,61	4,25	22,10	1,35	40,53	591,13	4,58	23,90	1,29	55,94	330,65	5,00	25,70	1,29	56,27	132,03	5,49						
18,52	8,37	47,45	143,43	3,43	20,32	0,77	21,94	586,24	4,19	22,12	1,32	42,97	584,61	4,57	23,92	1,28	56,61	329,83	5,01	25,72	1,27	47,15	149,12	5,49						
18,54	8,20	46,90	140,98	3,48	20,34	0,75	21,94	566,71	4,23	22,14	1,31	41,97	577,29	4,58	23,94	1,37	51,65	633,45	5,02	25,74	1,25	41,49	154,82	5,49						
18,56	8,06	45,67	140,17	3,43	20,36	0,75	22,51	589,49	4,27	22,16	1,29	43,97	583,80	4,60	23,96	1,39	51,65	631,83	5,04	25,76	1,27	35,04	162,15	5,49						
18,58	7,99	44,67	140,17	3,54	20,38	0,75	22,73	574,85	4,25	22,18	1,30	47,31	582,17	4,58	23,98	1,40	51,65	631,83	5,04	25,78	1,29	32,26	169,47	5,49						
18,60	7,93	43,45	140,98	3,43	20,40	0,75	22,06	594,38	4,28	22,20	1,29	45,31	566,71	4,60	24,00	1,43	50,42	624,50	5,04	25,80	1,34	30,70	180,05	5,49						
18,62	7,84	43,45	140,17	3,52	20,42	0,73	21,40	589,49	4,30	22,22	1,27	45,53	550,43	4,60	24,02	1,39	52,87	600,89	5,06	25,82	1,36	31,37	185,75	5,50						
18,64	7,77	43,56	140,17	3,52	20,44	0,73	20,51	587,05	4,35	22,24	1,27	45,97	548,79	4,53	24,04	1,37	54,87	582,99	5,07	25,84	1,34	33,93	186,57	5,49						
18,66	7,83	44,56	143,43	3,54	20,46	0,74	19,96	579,73	4,29	22,26	1,32	47,08	552,87	4,61	24,06	1,32	56,98	571,59	5,06	25,86	1,29	36,04	184,94	5,49						
18,68	8,01	45,12	149,12	3,54	20,48	0,79	19,29	580,54	4,31	22,28	1,33	48,08	552,87	4,61	24,08	1,32	55,65	561,01	5,07	25,88	1,25	36,82	182,49	5,49						
18,70	8,19	45,45	153,19	3,55	20,50	0,82	18,41	592,75	4,31	22,30	1,37	49,08	554,49	4,61	24,10	1,27	54,09	545,54	5,08	25,90	1,25	37,48	182,49	5,51						
18,72	8,31	44,56	154,82	3,57	20,52	0,96	17,74	616,36	4,31	22,32	1,43	52,64	574,85	4,62	24,12	1,25	53,42	534,96	5,08	25,92	1,27	43,08	298,90	5,46						
18,74	8,34	44,45	154,82	3,57	20,54	1,01	16,30	561,82	4,33	22,34	1,54	52,97	604,96	4,71	24,14	1,22	54,87	523,56	5,09	25,94	1,31	44,63	306,23	5,49						
18,76	8,16	61,80	135,29	3,59	20,56	0,91	15,86	565,89	4,33	22,36	1,68	55,86	4																	

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA															RIF. PROVA:		CPTU n°:							
LETTURE DI CAMPAGNA															U52-19		CPTU1							
COMMITTENTE: Comune di Portomaggiore										PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00														
CANTIERE: Teatro Concordia, Portomaggiore (Fe)										PROFONDITA' FALDA (m da p.c.): 1,50														
DATA: 12/07/2019										PREFORO (m da p.c.): 0,30														
Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °	Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °	Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °	Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °	Prof. (m)	qc MPa	fs kPa	U kPa	Inc. °
27,02	1,73	67,09	548,79	5,66	28,02	1,49	63,90	660,31	6,20	29,02	2,32	146,20	367,27	6,21	30,02	3,50	115,20	4,73	6,43					
27,04	1,80	66,20	558,57	5,68	28,04	1,50	54,23	677,41	6,19	29,04	2,26	144,86	385,18	6,21	30,04	2,87	104,87	7,17	6,43					
27,06	1,89	66,86	569,15	5,69	28,06	1,58	46,90	637,52	6,22	29,06	2,14	144,75	380,30	6,24	30,06	2,57	98,31	5,54	6,43					
27,08	1,92	66,31	568,33	5,70	28,08	1,63	43,01	693,69	6,22	29,08	2,06	139,75	450,30	6,24	30,08	2,22	84,09	4,73	6,44					
27,10	1,91	66,75	561,01	5,70	28,10	1,73	41,01	722,99	6,23	29,10	2,01	128,41	446,23	6,26	30,10	1,98	75,53	0,65	6,43					
27,12	1,86	67,31	553,68	5,73	28,12	1,75	36,78	752,29	6,23	29,12	1,90	116,74	434,83	6,26	30,12	1,86	71,97	9,11	6,43					
27,14	1,84	67,97	549,61	5,72	28,14	1,66	32,78	760,43	6,22	29,14	1,80	103,07	426,69	6,26	30,14	1,83	62,42	18,07	6,42					
27,16	1,80	67,64	551,24	5,68	28,16	1,62	31,89	766,95	6,24	29,16	1,79	91,52	422,63	6,25	30,16	1,85	58,08	35,97	6,42					
27,18	1,83	64,64	555,31	5,74	28,18	1,50	31,89	752,29	6,23	29,18	1,71	86,74	416,93	6,26	30,18	1,94	52,86	42,49	6,39					
27,20	1,75	63,75	543,10	5,74	28,20	1,48	32,00	767,76	6,23	29,20	1,65	83,07	412,05	6,27	30,20	1,92	52,41	49,81	6,38					
27,22	1,68	62,20	533,33	5,75	28,22	1,50	30,67	773,46	6,25	29,22	1,60	80,29	414,49	6,26	30,22	1,92	52,86	54,70	6,39					
27,24	1,63	59,64	532,51	5,79	28,24	1,51	31,23	777,53	6,26	29,24	1,62	75,96	417,74	6,26	30,24	1,94	53,41	56,33	6,40					
27,26	1,62	53,42	535,77	5,78	28,26	1,52	35,56	780,79	6,24	29,26	1,62	73,06	419,37	6,25	30,26	1,90	60,19	57,95	6,39					
27,28	1,59	48,53	536,59	5,78	28,28	1,56	42,56	793,81	6,25	29,28	1,64	70,06	422,63	6,27	30,28	1,86	69,52	57,95	6,38					
27,30	1,50	45,42	527,63	5,75	28,30	1,61	47,23	803,58	6,23	29,30	1,62	66,17	422,63	6,24	30,30	1,83	82,63	57,95	6,40					
27,32	1,43	45,42	521,12	5,75	28,32	1,68	49,22	818,23	6,25	29,32	1,62	61,17	422,63	6,30	30,32	1,76	94,96	57,95	6,39					
27,34	1,38	43,75	519,49	5,81	28,34	1,75	53,00	827,19	6,24	29,34	1,60	56,61	420,19	6,30	30,34	1,71	99,52	58,77	6,39					
27,36	1,36	39,20	526,01	5,77	28,36	1,83	59,11	841,02	6,22	29,36	1,53	57,50	415,30	6,30	30,36	1,66	100,63	58,77	6,39					
27,38	1,39	36,64	537,40	5,80	28,38	1,92	63,78	858,93	6,24	29,38	1,48	58,39	412,05	6,30	30,38	1,59	100,07	58,77	6,39					
27,40	1,42	36,75	549,61	5,87	28,40	2,01	66,56	869,51	6,22	29,40	1,43	57,61	406,35	6,33	30,40	1,56	98,62	58,77	6,40					
27,42	1,43	37,20	559,38	5,89	28,42	2,07	70,00	872,77	6,22	29,42	1,36	57,16	401,46	6,31	30,42	1,58	97,51	59,58	6,42					
27,44	1,39	34,31	558,57	5,88	28,44	2,10	74,89	869,51	6,15	29,44	1,29	56,50	396,58	6,34	30,44	1,65	92,62	62,84	6,42					
27,46	1,35	32,09	557,75	5,88	28,46	2,10	81,89	860,56	6,21	29,46	1,23	54,61	394,95	6,33	30,46	1,78	87,51	67,72	6,43					
27,48	1,32	30,64	561,82	5,78	28,48	2,09	87,22	853,23	5,96	29,48	1,18	50,94	398,21	6,35	30,48	1,90	78,95	71,79	6,43					
27,50	1,35	29,31	574,85	5,91	28,50	2,09	90,11	819,86	6,21	29,50	1,17	46,72	410,41	6,34	30,50	2,01	68,28	75,86	6,40					
27,52	1,51	27,53	615,55	5,89	28,52	2,02	97,22	798,69	6,23	29,52	1,28	40,72	434,83	6,37	30,52	1,97	66,39	75,05	6,42					
27,54	1,63	28,75	651,36	5,92	28,54	1,98	103,77	779,16	6,21	29,54	1,67	35,61	505,65	6,24	30,54	1,93	69,50	74,23	6,42					
27,56	1,63	27,53	453,56	5,80	28,56	1,95	108,77	765,32	6,20	29,56	2,73	31,50	666,01	6,30	30,56	1,82	74,95	73,42	6,40					
27,58	1,67	26,98	518,68	5,91	28,58	1,91	112,88	759,62	6,21	29,58	4,23	32,39	389,25	6,38	30,58	1,76	77,39	73,42	6,39					
27,60	1,67	29,98	556,93	5,91	28,60	1,92	114,88	771,02	6,23	29,60	5,49	39,84	164,59	6,37	30,60	1,69	78,50	74,23	6,39					
27,62	1,83	29,31	600,08	5,91	28,62	2,03	115,21	822,30	6,23	29,62	6,24	46,39	120,63	6,34	30,62	1,65	79,61	74,23	6,39					
27,64	2,10	32,54	659,50	5,92	28,64	2,19	110,99	871,95	6,20	29,64	6,55	50,84	72,61	6,37	30,64	1,64	81,39	75,05	6,39					
27,66	2,13	35,76	626,13	5,93	28,66	2,30	103,21	889,86	6,21	29,66	6,72	50,17	68,53	6,38	30,66	1,64	79,28	75,86	6,38					
27,68	2,12	38,76	429,14	5,93	28,68	2,34	98,65	890,67	6,21	29,68	6,88	45,39	75,05	6,40	30,68	1,65	75,05	77,49	6,38					
27,70	2,16	46,43	297,27	5,94	28,70	2,50	94,65	895,56	6,23	29,70	7,02	40,62	79,93	6,38	30,70	1,64	69,83	78,31	6,38					
27,72	2,06	54,76	343,67	5,94	28,72	2,56	99,98	921,61	6,26	29,72	7,23	39,74	85,63	6,40	30,72	1,64	68,61	79,12	6,38					
27,74	1,91	57,76	341,23	5,96	28,74	2,54	107,20	948,47	6,27	29,74	7,47	41,85	85,63	6,11	30,74	1,65	67,28	79,93	6,38					
27,76	1,75	61,43	339,60	5,96	28,76	2,55	106,31	695,31	6,06	29,76	7,49	46,40	79,12	6,33	30,76	1,66	65,72	80,75	6,38					
27,78	1,56	62,21	333,90	5,97	28,78	2,62	106,09	614,73	6,20	29,78	7,26	43,07	80,75	6,37	30,78	1,69	66,05	82,37	6,38					
27,80	1,52	57,21	352,62	5,96	28,80	2,67	114,09	587,05	6,26	29,80	6,95	38,85	81,56	6,35	30,80	1,73	66,83	84,00	6,38					
27,82	1,57	52,99	379,49	5,97	28,82	2,65	128,42	592,75	6,28	29,82	6,45	33,52	79,12	6,33	30,82	1,78	68,94	86,45	6,38					
27,84	1,66	46,10	408,79	6,00	28,84	2,63	137,86	598,45	6,29	29,84	6,06	29,30	78,31	6,35	30,84	1,87	70,05	89,70	6,38					
27,86	1,74	39,77	436,47	6,01	28,86	2,60	140,42	602,52	6,29	29,86	5,82	29,63	79,93	6,35	30,86	1,99	71,61	92,95	6,38					
27,88	1,85	4																						

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA
DIAGRAMMI DI RESISTENZA

RIF. PROVA: CPTU n°:

U52-19

CPTU1

COMMITTENTE: Comune di Portomaggiore

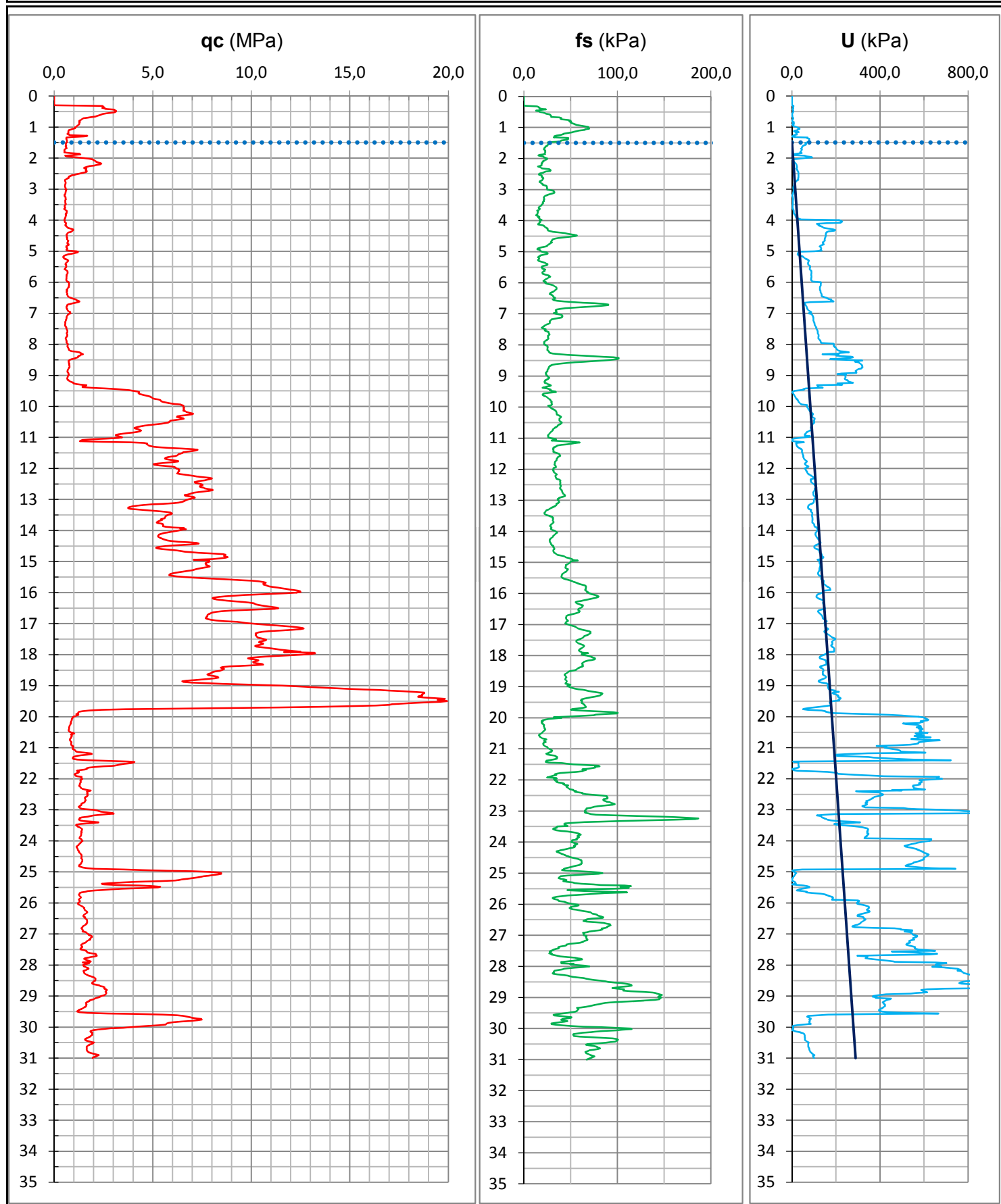
CANTIERE: Teatro Concordia, Portomaggiore (Fe)

DATA: 12/07/2019

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00

PROFONDITA' FALDA (m da p.c.): 1,50

PREFORO (m da p.c.): 0,30

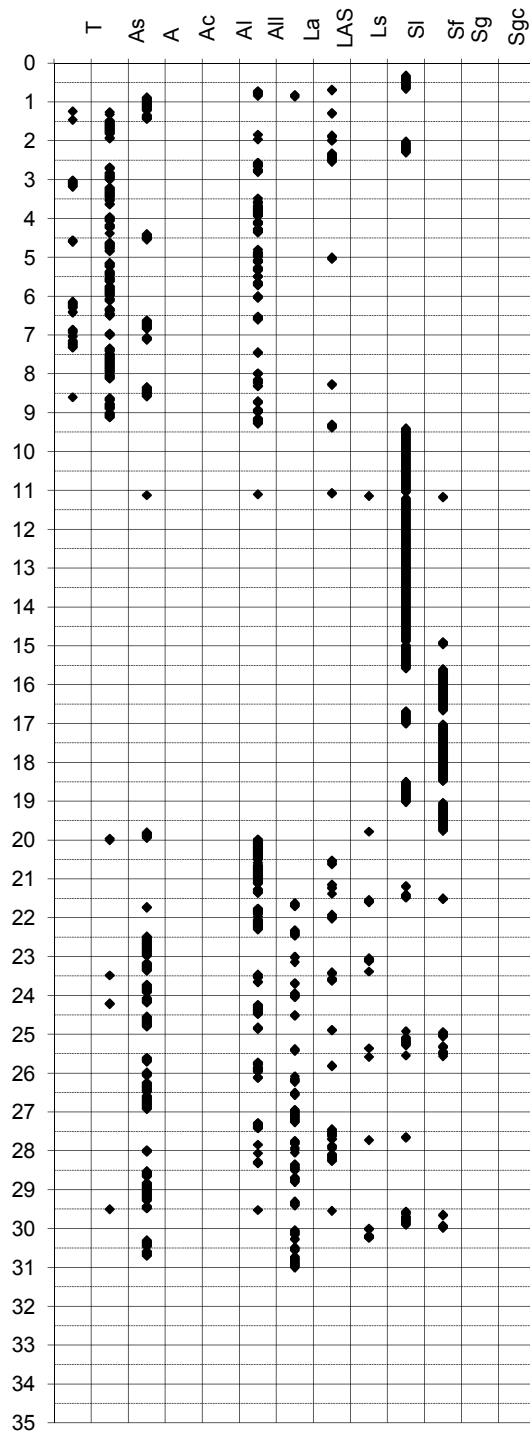
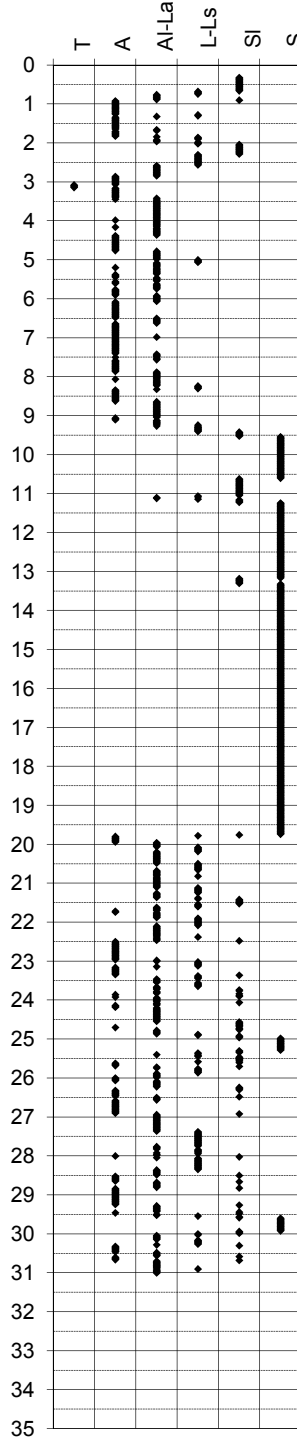
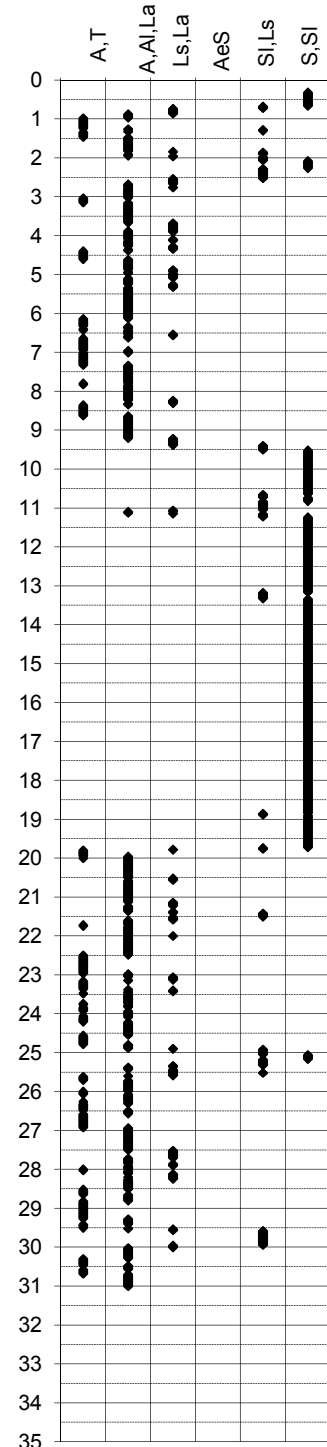


PROVA PENETROMETRICA STATICA

Identificativo	U52-19
Emissione	lug-19
Pagina	1 di

INTERPRETAZIONI LITOLOGICHE

-Committente	Comune di Portomaggiore	-Prova n°	CPTU1
-Cantiere	Teatro Concordia, Portomaggiore (Fe)	-Data prova	12/07/2019
-Quota p.c.	1,70 m s.l.m.	-Prof. preforo	0,30 m
-Livello di falda	1,50 m da p.c.	-Prof. finale	31,00 m
-Attrezzatura	Punta elettrica con piezocono		

Douglas-Olsen (1981)**Robertson-Campanella(1983)****Olsen-Farr (1986)**

PROVA PENETROMETRICA STATICA

Identificativo	U52-19
Emissione	lug-19
Pagina	1 di 0

PARAMETRI GEOTECNICI

-Committente	Comune di Portomaggiore	-Prova n°	CPTU1
-Cantiere	Teatro Concordia, Portomaggiore (Fe)	-Data prova	12/07/2019
-Quota p.c.	1,70 m s.l.m.	-Prof. preforo	0,30 m
-Livello di falda	1,50 m da p.c.	-Prof. finale	31,00 m

							MATERIALI COESIVI						MATERIALI GRANULARI									
DA	A	qcm	fsm	deltaU	litol.	Peso Vol.	Cu (qc)	OCR (qc)	OCR (U)	M ₀	Eu50	CR	Dr	FI' _{DM}	FI' _{Bottom}	FI'Schm.				E'25	M ₀	
m	m	MPa	MPa	MPa	(-)	kN/m3	KPa	(-)	(-)	MPa	MPa	(-)	(%)	(°)	(°)	(°)				MPa	MPa	
0,0	0,5	1,06	0,01	0,00	Rip	18,15	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
0,5	2,0	1,11	0,04	0,02	Al-La	18,00	52	14	8	3,63	9,963	0,09	-	-	-	-	-	-	-	-		
2,0	2,6	1,68	0,02	0,01	L-Ls	20,00	79	17	10	4,72	14,01	0,10	21	32	29	31	34	36	40	4,43	7,09	
2,6	5,0	0,62	0,02	0,05	A	17,50	33	4	7	2,86	12,32	0,15	-	-	-	-	-	-	-	-		
5,0	9,4	0,75	0,03	0,09	Al-La	18,00	37	3	7	3,29	16,66	0,24	-	-	-	-	-	-	-	-		
9,4	18,9	7,35	0,04	-0,02	S	20,00	-	-	-	-	-	-	46	33	30	34	37	39	42	18,44	29,08	
18,9	19,8	14,80	0,06	-0,01	S	20,00	-	-	-	-	-	-	68	35	32	37	39	41	43	37,73	49,00	
19,8	24,9	1,39	0,05	0,24	Al-La	18,00	62	2	5	4,68	34,35	0,33	-	-	-	-	-	-	-	-		
24,9	25,6	5,50	0,06	-0,19	SI	19,00	-	-	-	-	-	-	26	29	26	31	34	37	40	14,39	23,02	
25,6	29,5	1,71	0,07	0,23	A	17,50	80	2	6	5,46	45,09	0,32	-	-	-	-	-	-	-	-		
29,5	30,0	5,28	0,05	-0,11	SI	19,00	-	-	-	-	-	-	23	28	25	30	33	36	39	14,06	22,49	
30,0	31,0	1,99	0,08	-0,22	A	17,50	96	2	#####	6,01	54,07	0,30	-	-	-	-	-	-	-	-		

PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA PROVA DOWN HOLE SCPTU	RIF. PROVA:	CPTU n°:
	U52-19	CPTU1

COMMITTENTE: Comune di Portomaggiore

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00

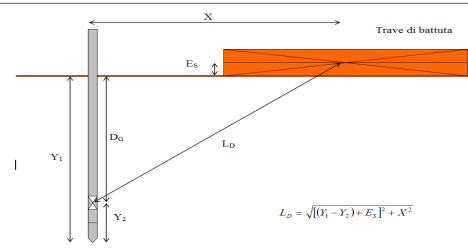
CANTIERE: Teatro Concordia, Portomaggiore (Fe)

PROFONDITA' FALDA (m da p.c.): 1,50

DATA: 12/07/2019

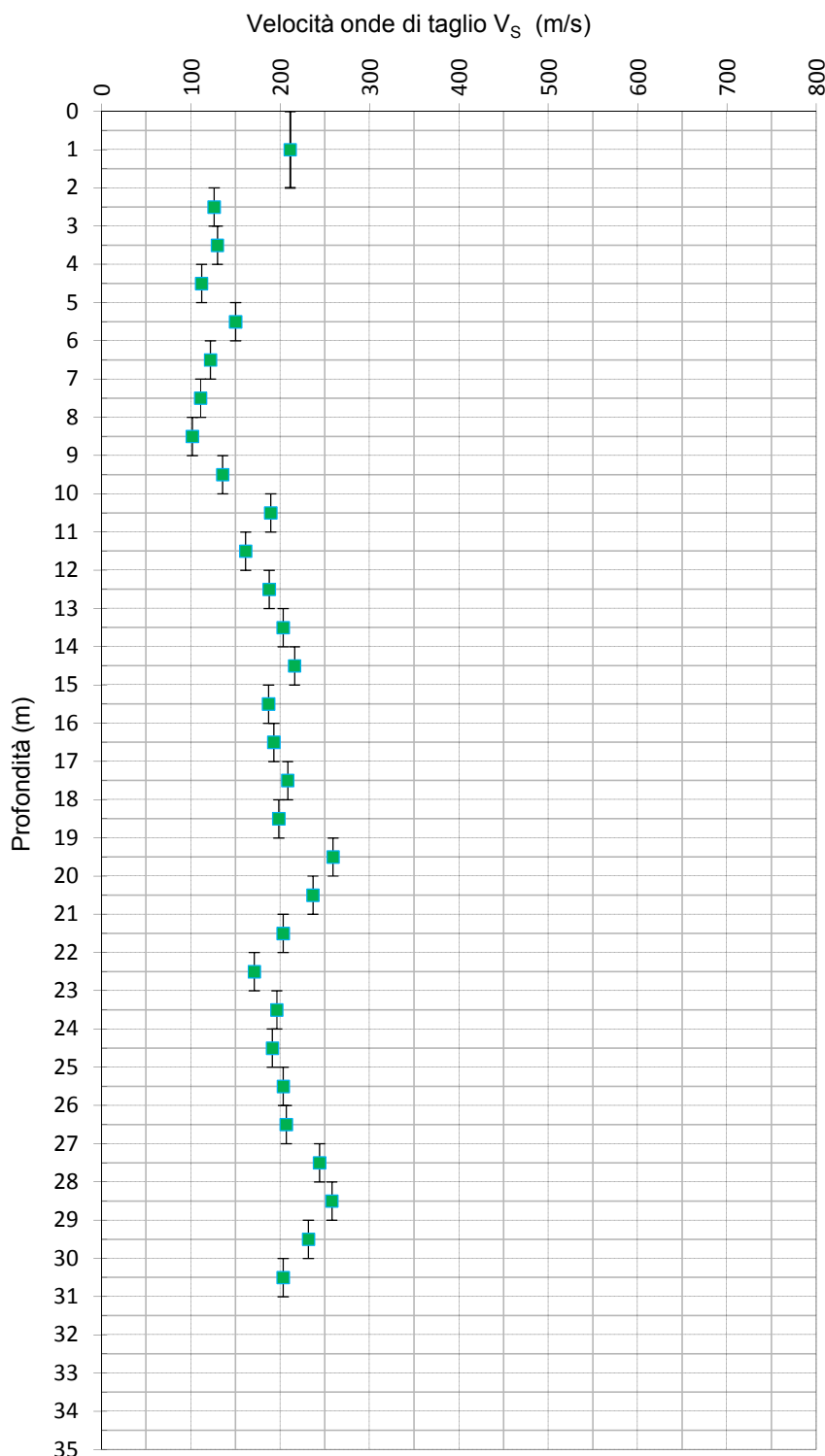
PREFORO (m da p.c.): 0,30

Peso mazza battente: 5Kg
Ricevitore Down Hole: G1-cpl2IN
Equipaggiamento di registrazione: D1-SISMI USB
Distanza centro sorgente-verticale X: 0,25 m
Distanza punta-accelerometro Y₂: 0,20 m



Vs₃₀ = 174 m/sec Categoria suolo di fondazione = D

Distanza corretta L _D punta elettrica	Tempo di arrivo onda S (millisecondi)	Velocità onde S dello strato (m/sec)
0,000		
0,838		211
1,817	8,607	
2,811	16,493	126
3,808	24,180	130
4,807	33,097	112
5,805	39,754	150
6,805	47,951	122
7,804	56,967	111
8,804	66,803	102
9,803	74,180	136
10,803	79,458	189
11,803	85,656	161
12,802	90,984	188
13,802	95,902	203
14,802	100,531	216
15,802	105,879	187
16,802	111,065	193
17,802	115,864	208
18,802	120,902	198
19,802	124,761	259
20,802	128,988	237
21,801	133,906	203
22,801	139,754	171
23,801	144,852	196
24,801	150,082	191
25,801	154,998	207
26,801	159,836	244
27,801	163,934	258
28,801	167,813	232
29,801	172,131	203
30,801	177,049	



PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA

PROVA DOWN HOLE SCPTU

RIF. PROVA: CPTU n°:
U52-19 CPTU1

COMMITTENTE: Comune di Portomaggiore

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00

CANTIERE: Teatro Concordia, Portomaggiore (Fe)

PROFONDITA' FALDA (m da p.c.): 1,50

DATA: 12/07/2019

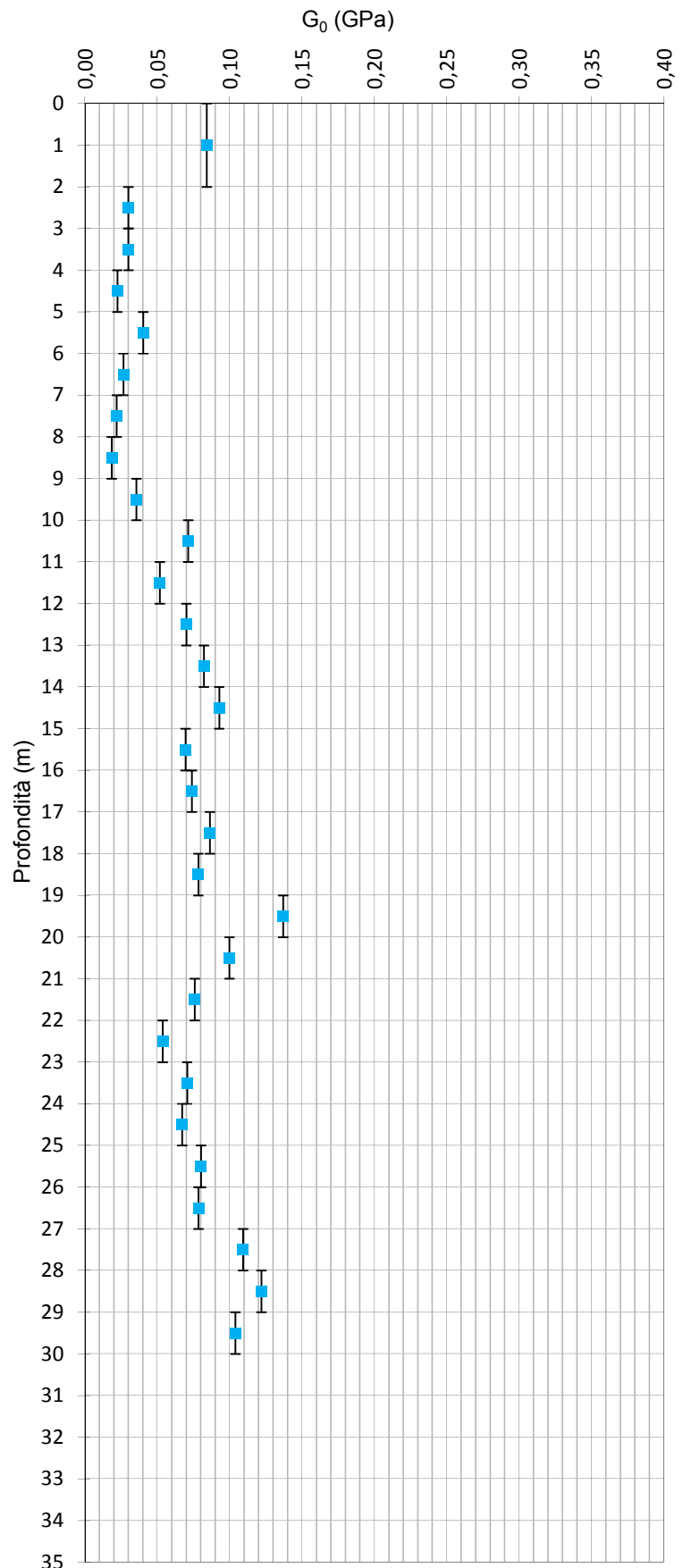
PREFORO (m da p.c.): 0,30

$$G_0 = V_s^2 \rho \longrightarrow \rho = \gamma / g$$

dove:

ρ : massa volumica data dal rapporto tra il peso di volume γ e l'accelerazione di gravita g

Profondità punta elettrica (m)	Velocità onde S dello strato (m/sec)	Peso di volume (tonn/m ³)	G ₀ (GPa)
0,0			
1,0	211	1,85	0,0841
2,0			
3,0	126	1,85	0,0300
4,0			
5,0	130	1,75	0,0300
6,0			
7,0	112	1,75	0,0224
8,0			
9,0	150	1,75	0,0402
10,0			
11,0	122	1,75	0,0265
12,0			
13,0	111	1,75	0,0219
14,0			
15,0	102	1,75	0,0184
16,0			
17,0	136	1,90	0,0356
18,0			
19,0	189	1,95	0,0713
20,0			
21,0	161	1,95	0,0517
22,0			
23,0	188	1,95	0,0700
24,0			
25,0	203	1,95	0,0822
26,0			
27,0	216	1,95	0,0927
28,0			
29,0	187	1,95	0,0695
30,0			
31,0	193	1,95	0,0739
32,0			
33,0	208	1,95	0,0863
34,0			
35,0	198	1,95	0,0783
36,0			
37,0	259	2,00	0,1369
38,0			
39,0	237	1,75	0,0998
40,0			
41,0	203	1,80	0,0759
42,0			
43,0	171	1,80	0,0536
44,0			
45,0	196	1,80	0,0706
46,0			
47,0	191	1,80	0,0671
48,0			
49,0	203	1,90	0,0801
50,0			
51,0	207	1,80	0,0784
52,0			
53,0	244	1,80	0,1093
54,0			
55,0	258	1,80	0,1219
56,0			
57,0	232	1,90	0,1039
58,0			
59,0	203	1,80	0,0759
60,0			



PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA **SEGNALI DI ARRIVO ONDE DI TAGLIO S**

RIF. PROVA:	CPTU n°:
U52-19	CPTU1

COMMITTENTE: Comune di Portomaggiore

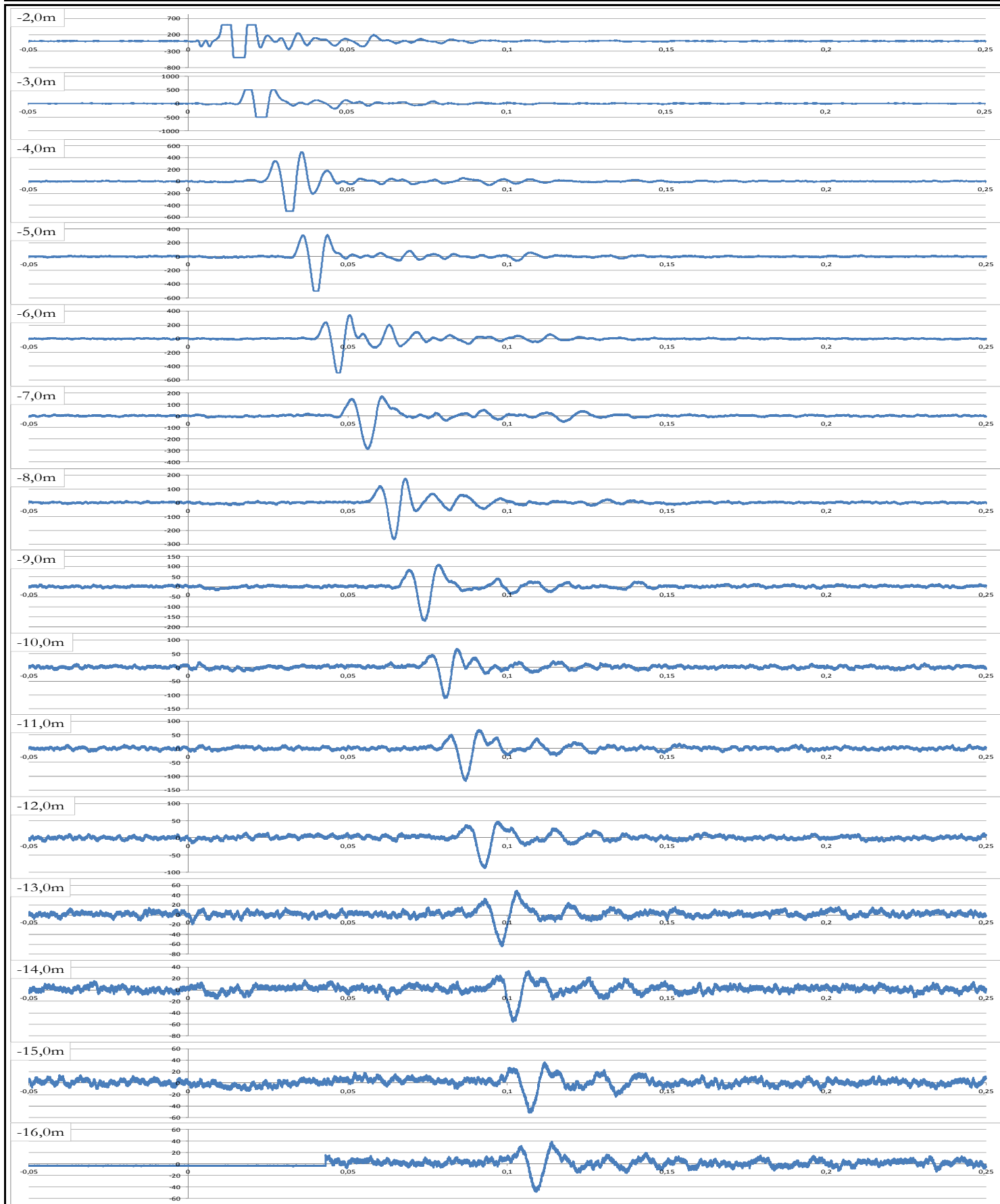
CANTIERE: Teatro Concordia, Portomaggiore (Fe)

DATA: 12/07/2019

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00

PROFONDITA' FALDA (m da p.c.): 1,50

PREFORO (m da p.c.): 0,30



PROVA PENETROMETRICA STATICA CON PUNTA ELETTRICA

SEGNALI DI ARRIVO ONDE DI TAGLIO S

RIF. PROVA:

CPTU n°:

U52-19

CPTU1

COMMITTENTE: Comune di Portomaggiore

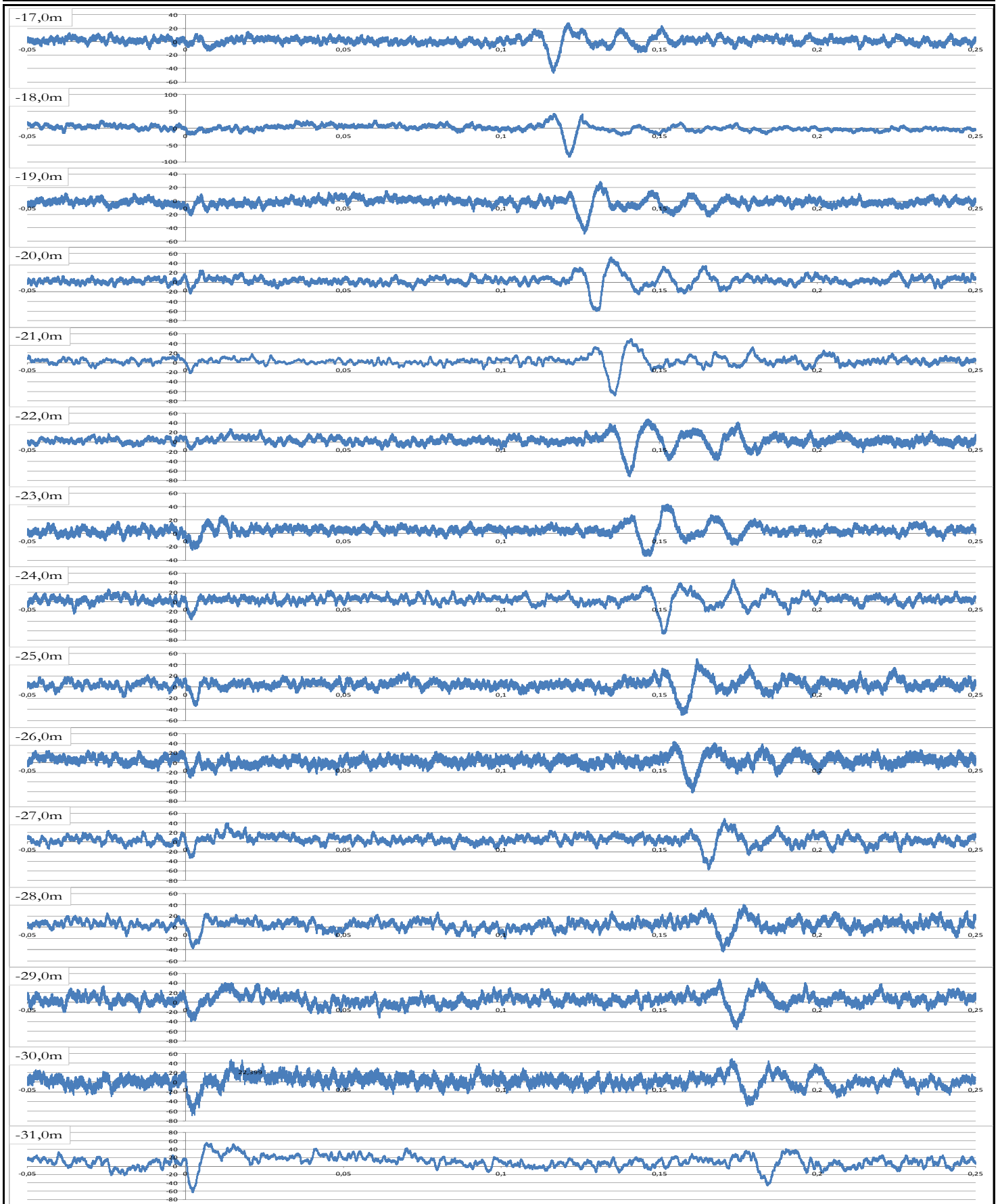
CANTIERE: Teatro Concordia, Portomaggiore (Fe)

DATA: 12/07/2019

PROFONDITA' MASSIMA DELLA PROVA (m da p.c.): 31,00

PROFONDITA' FALDA (m da p.c.): 1,50

PREFORO (m da p.c.): 0,30



LIQUEFACTION ANALYSIS REPORT

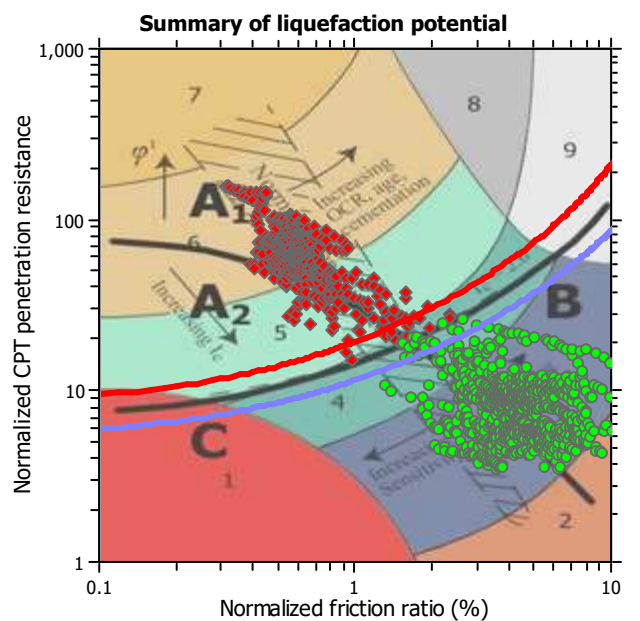
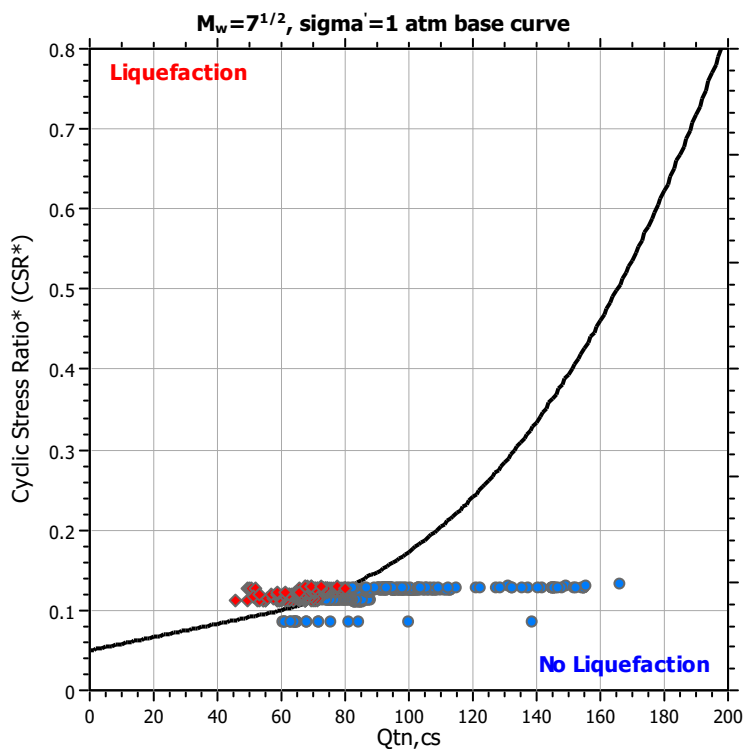
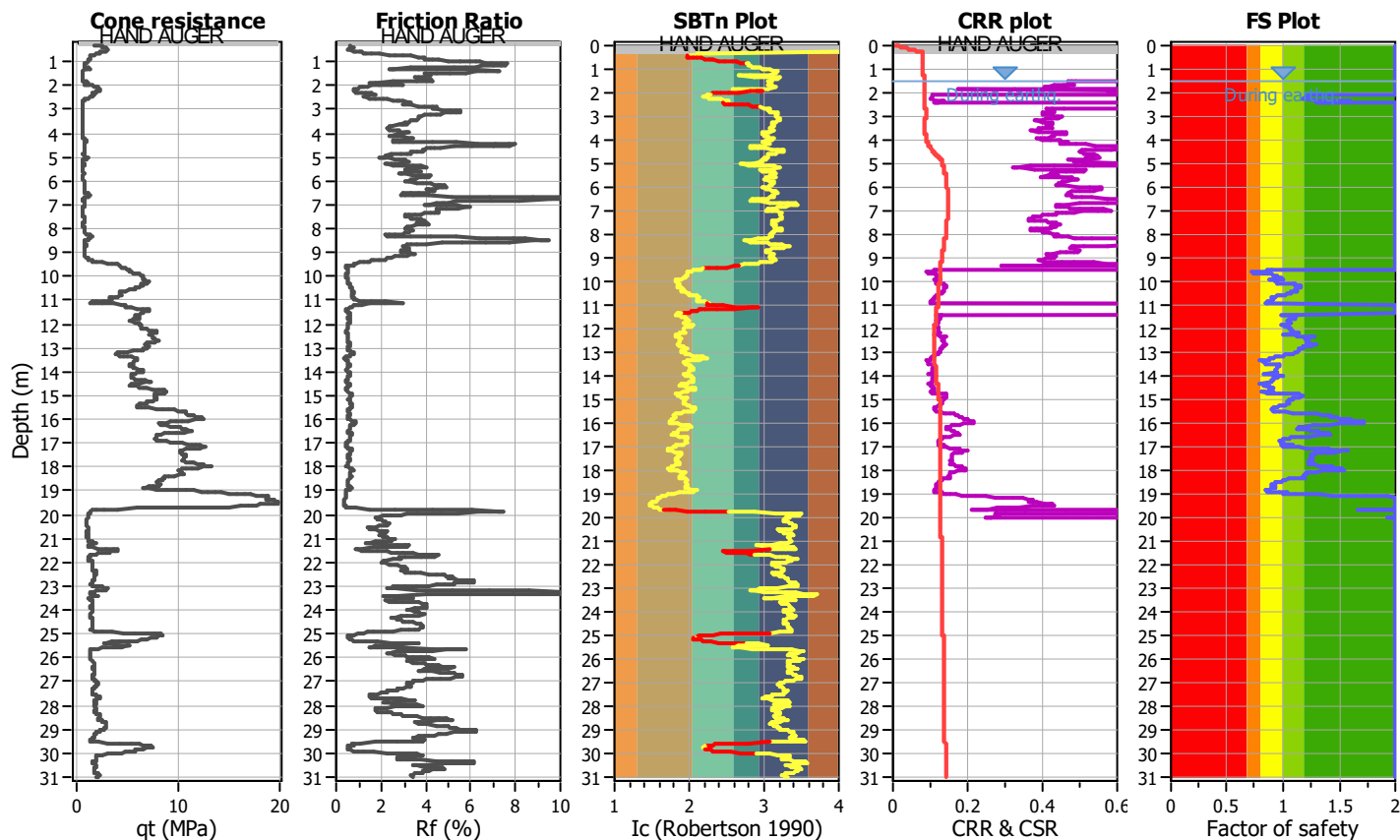
Project title :

Location :

CPT file : rif. U52-19 CPTU1 Portomaggiore

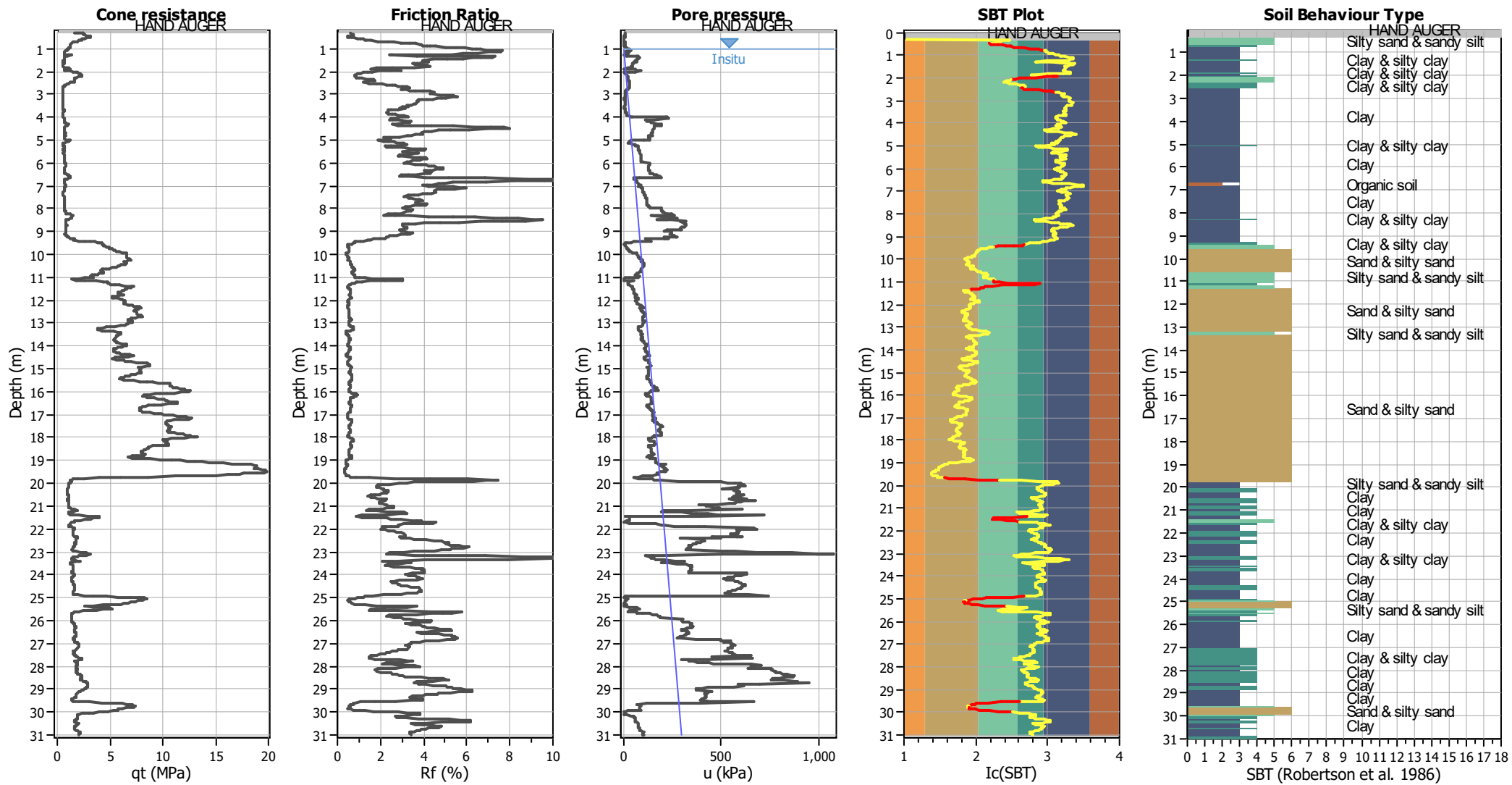
Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	applied:	All soils
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.30	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based



Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading
 Zone A₂: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
 Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
 Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



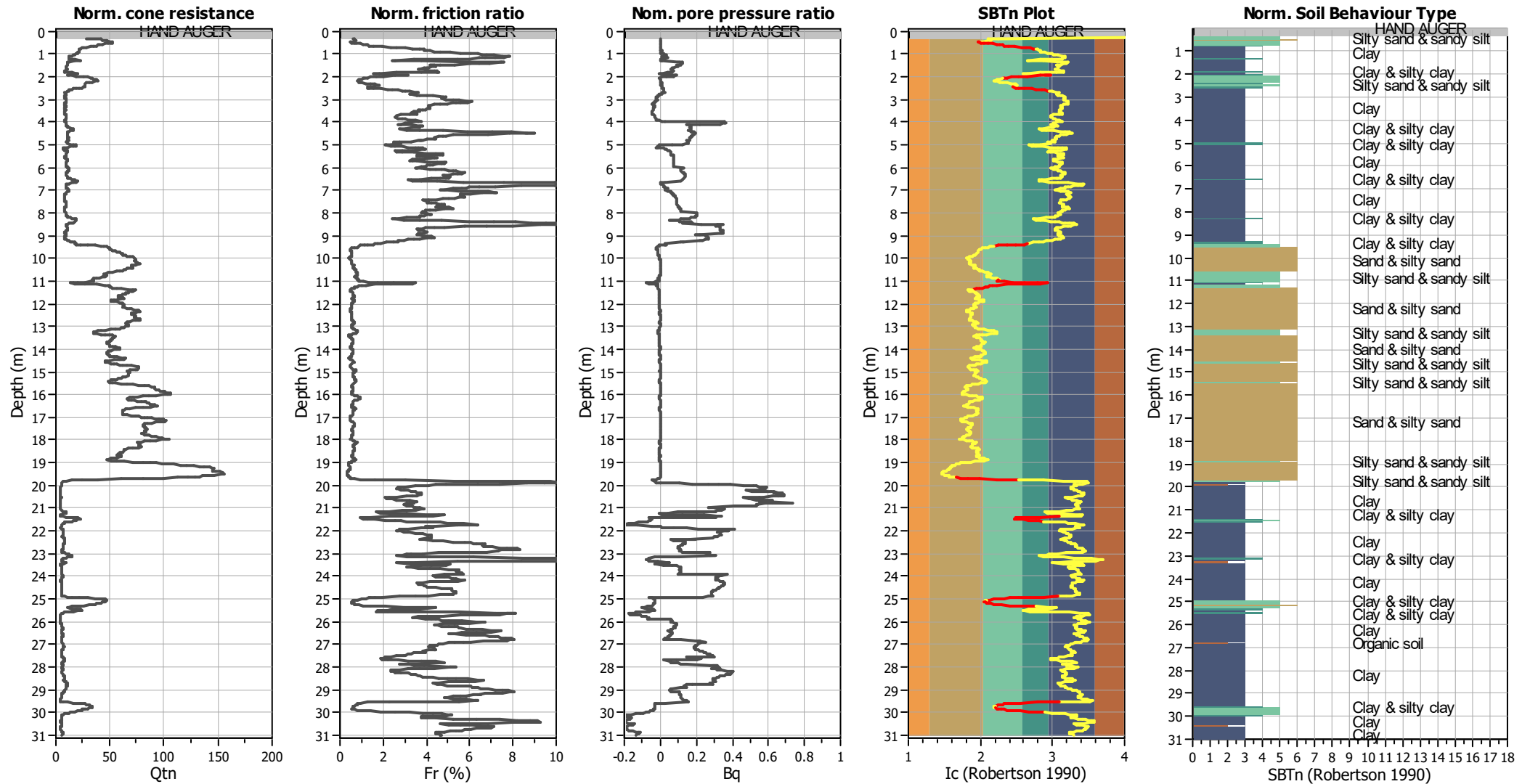
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.14	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.30	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

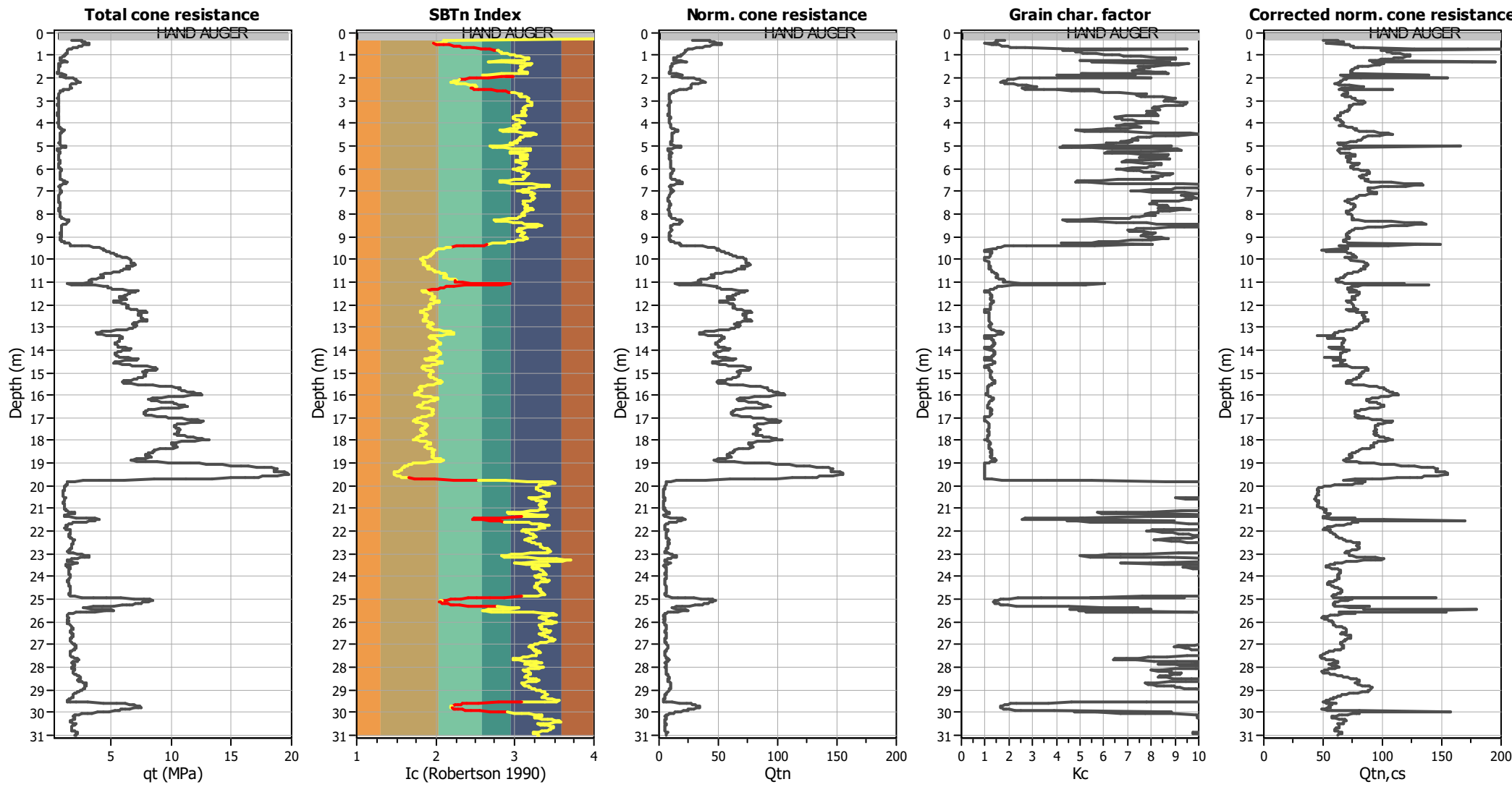
CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	6.14	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.30	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	20.00 m

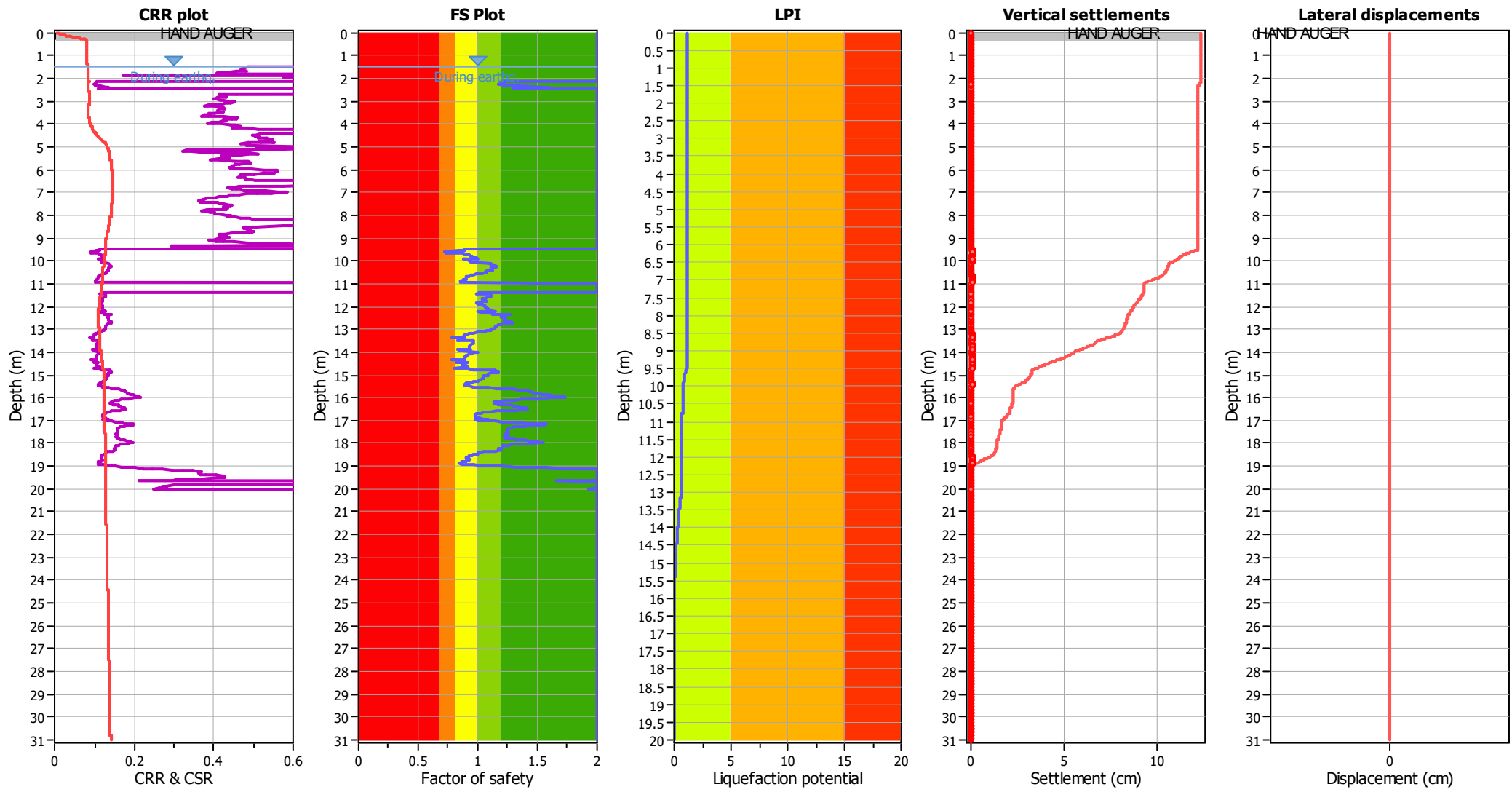
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _{cs} applied:	Yes
Earthquake magnitude M _w :	6.14	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.30	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (earthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.14	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.30	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	20.00 m

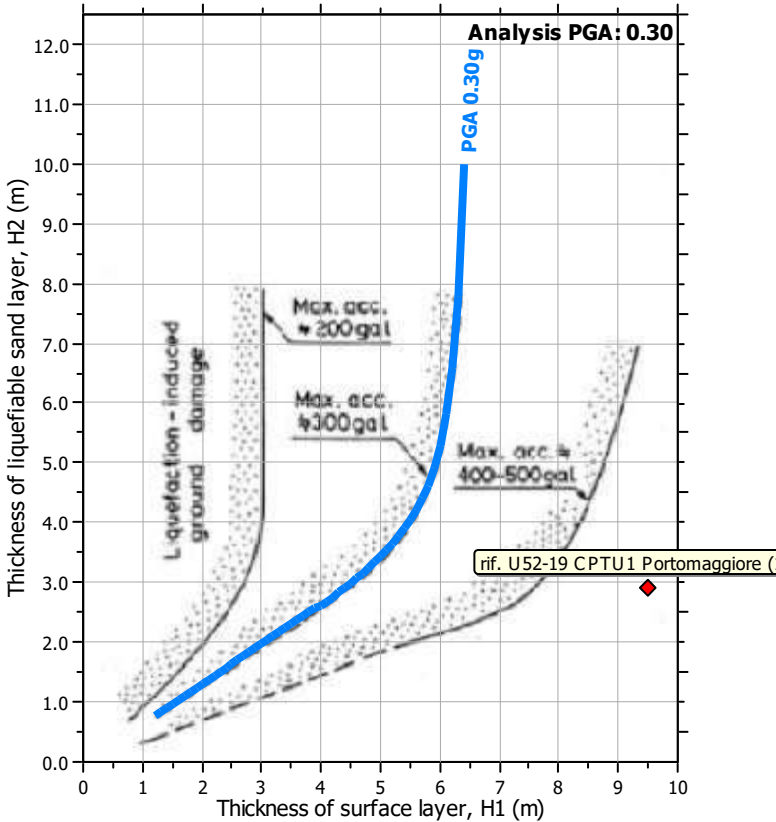
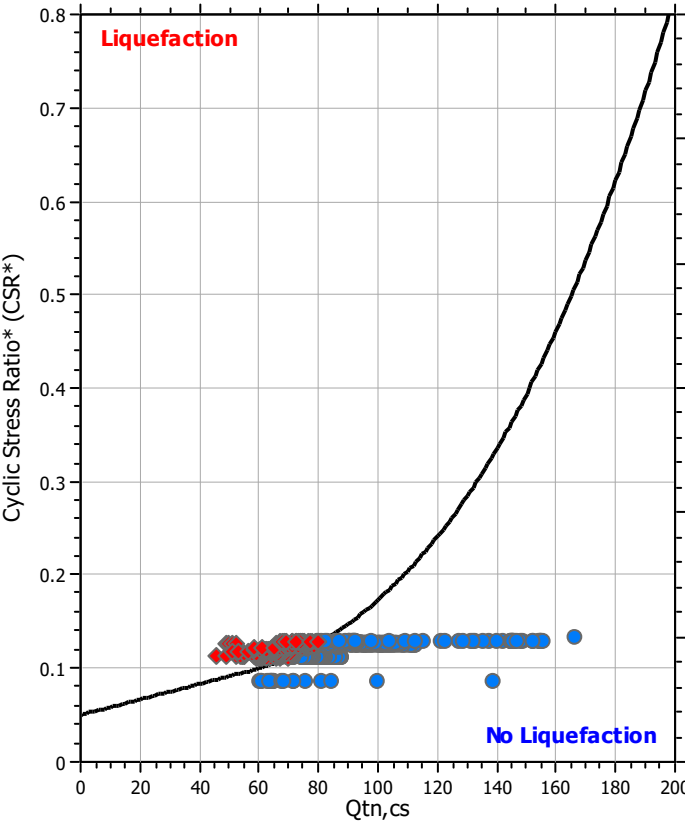
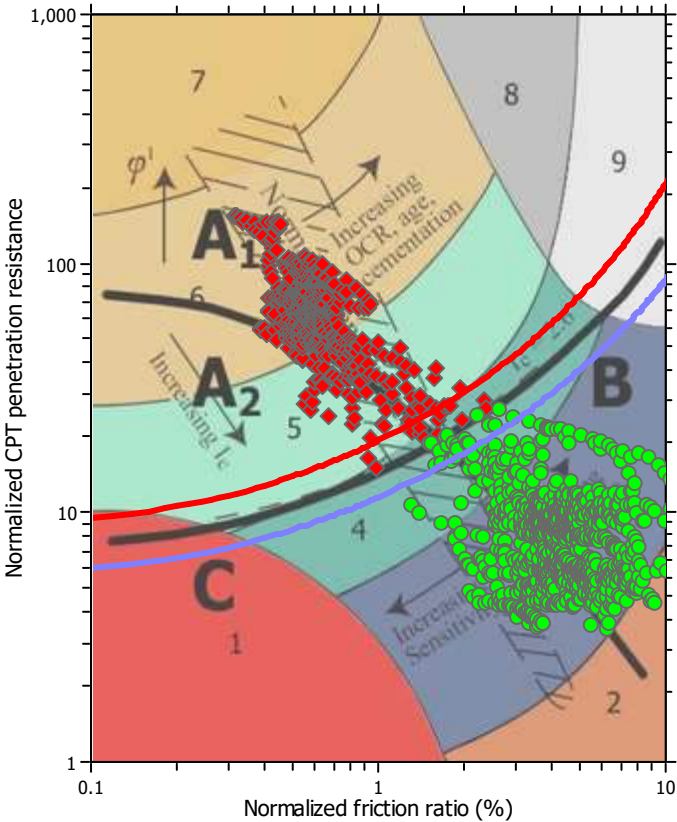
F.S. color scheme

Red	Almost certain it will liquefy
Orange	Very likely to liquefy
Yellow	Liquefaction and no liq. are equally likely
Light green	Unlike to liquefy
Dark green	Almost certain it will not liquefy

LPI color scheme

Red	Very high risk
Orange	High risk
Yellow	Low risk

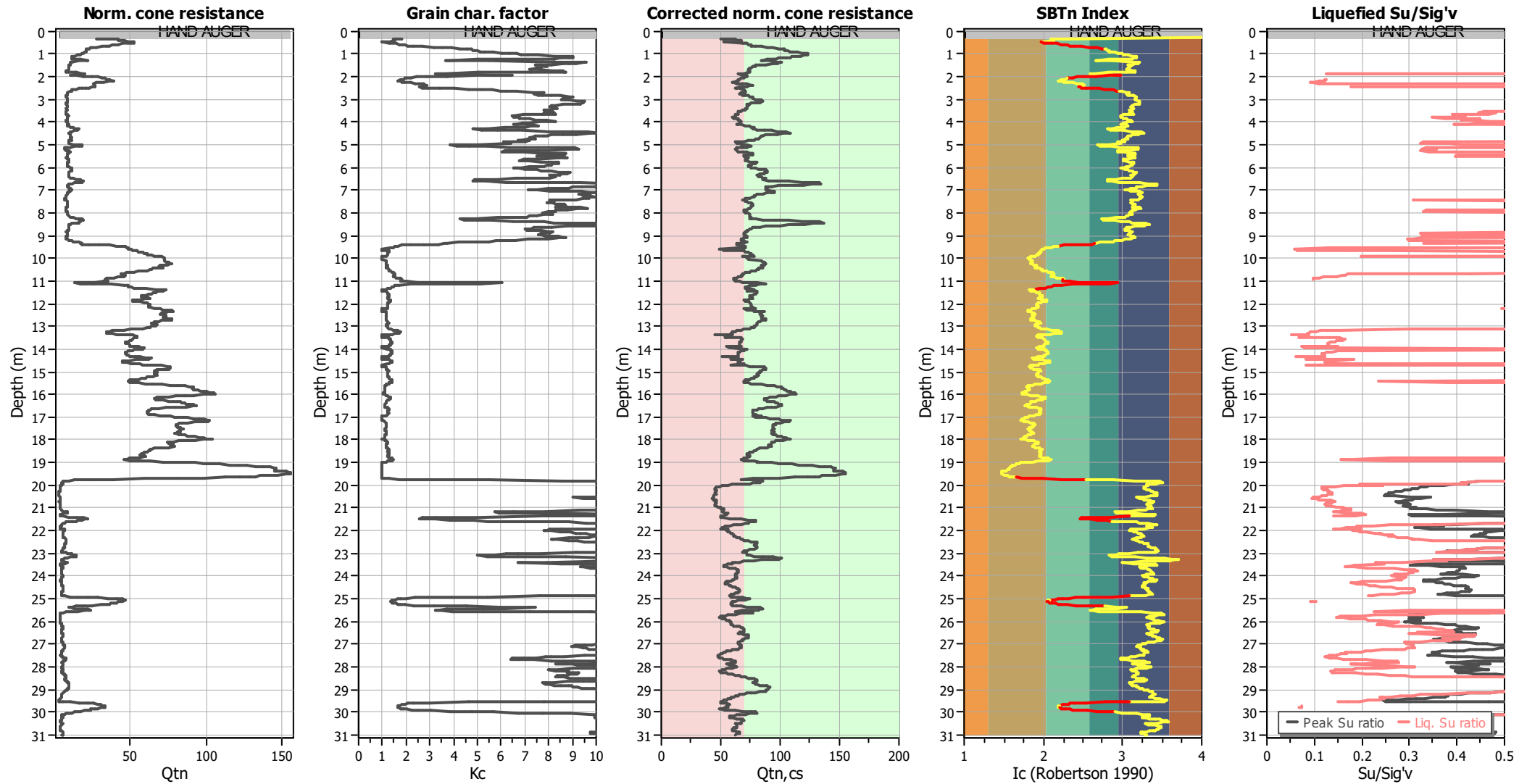
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on I_c value	I_c cut-off value:	2.60	K_v applied:	Yes
Earthquake magnitude M_w :	6.14	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.30	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	20.00 m

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	1.50 m	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _{cs} applied:	Yes
Earthquake magnitude M _w :	6.14	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.30	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	20.00 m

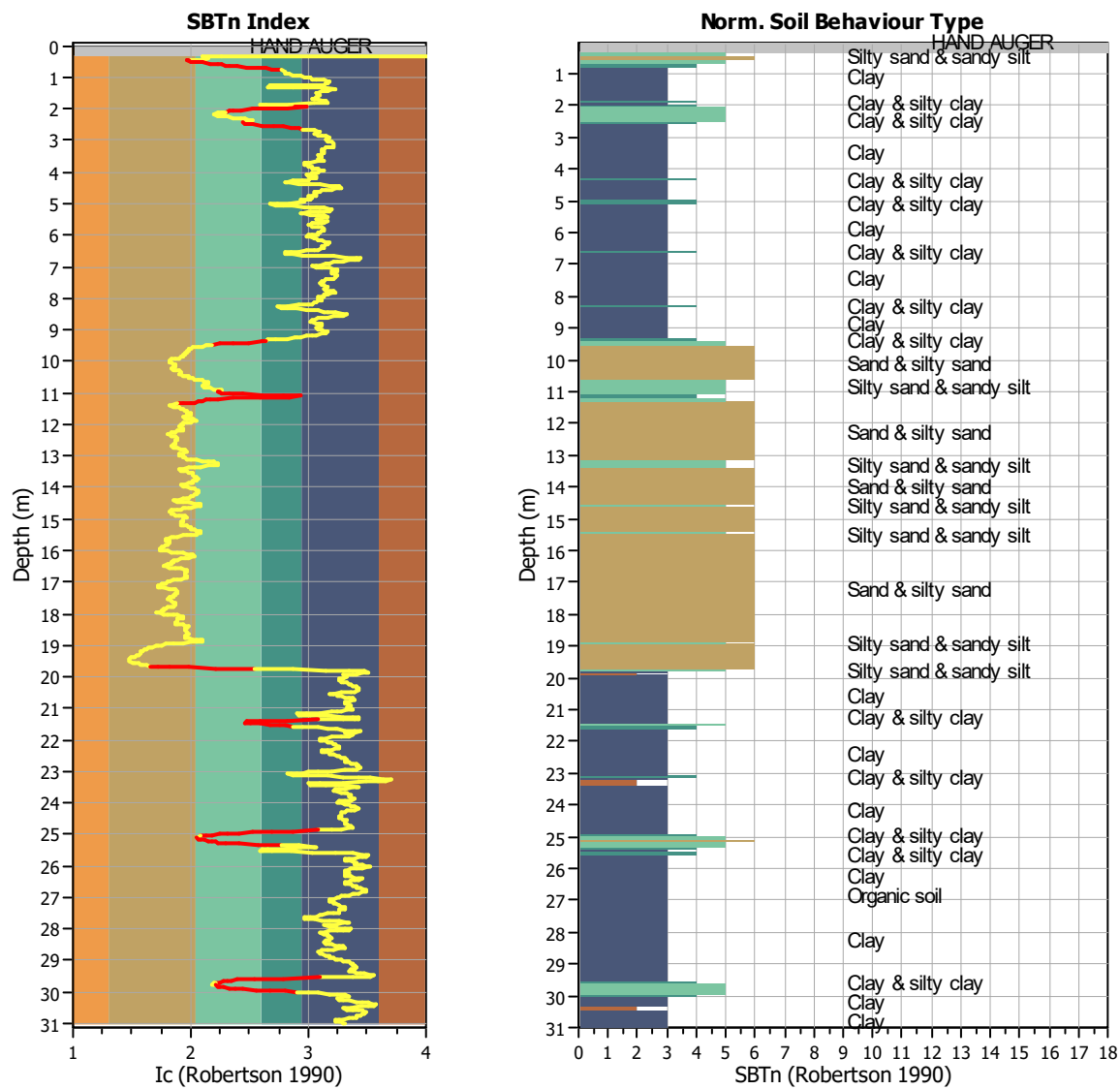
TRANSITION LAYER DETECTION ALGORITHM REPORT

Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between $1.80 < I_c < 3.0$) and a rate of change of I_c . Transitions typically occur when the rate of change of I_c is fast (i.e. ΔI_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties

I_c minimum check value: 1.70
 I_c maximum check value: 3.00
 I_c change ratio value: 0.0100
Minimum number of points in layer: 4

General statistics

Total points in CPT file: 1550
Total points excluded: 126
Exclusion percentage: 8.13%
Number of layers detected: 13

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
0.02	2.00	0.00	0.00	0.00	0.00	0.04	2.00	0.00	0.00	0.00	0.00
0.06	2.00	0.00	0.00	0.00	0.00	0.08	2.00	0.00	0.00	0.00	0.00
0.10	2.00	0.00	0.00	0.00	0.00	0.12	2.00	0.00	0.00	0.00	0.00
0.14	2.00	0.00	0.00	0.00	0.00	0.16	2.00	0.00	0.00	0.00	0.00
0.18	2.00	0.00	0.00	0.00	0.00	0.20	2.00	0.00	0.00	0.00	0.00
0.22	2.00	0.00	0.00	0.00	0.00	0.24	2.00	0.00	0.00	0.00	0.00
0.26	2.00	0.00	0.00	0.00	0.00	0.28	2.00	0.00	0.00	0.00	0.00
0.30	2.00	0.00	0.00	0.00	0.00	0.32	2.00	0.00	9.84	0.02	0.00
0.34	2.00	0.00	9.83	0.02	0.00	0.36	2.00	0.00	9.82	0.02	0.00
0.38	2.00	0.00	9.81	0.02	0.00	0.40	2.00	0.00	9.80	0.02	0.00
0.42	2.00	0.00	9.79	0.02	0.00	0.44	2.00	0.00	9.78	0.02	0.00
0.46	2.00	0.00	9.77	0.02	0.00	0.48	2.00	0.00	9.76	0.02	0.00
0.50	2.00	0.00	9.75	0.02	0.00	0.52	2.00	0.00	9.74	0.02	0.00
0.54	2.00	0.00	9.73	0.02	0.00	0.56	2.00	0.00	9.72	0.02	0.00
0.58	2.00	0.00	9.71	0.02	0.00	0.60	2.00	0.00	9.70	0.02	0.00
0.62	2.00	0.00	9.69	0.02	0.00	0.64	2.00	0.00	9.68	0.02	0.00
0.66	2.00	0.00	9.67	0.02	0.00	0.68	2.00	0.00	9.66	0.02	0.00
0.70	2.00	0.00	9.65	0.02	0.00	0.72	2.00	0.00	9.64	0.02	0.00
0.74	2.00	0.00	9.63	0.02	0.00	0.76	2.00	0.00	9.62	0.02	0.00
0.78	2.00	0.00	9.61	0.02	0.00	0.80	2.00	0.00	9.60	0.02	0.00
0.82	2.00	0.00	9.59	0.02	0.00	0.84	2.00	0.00	9.58	0.02	0.00
0.86	2.00	0.00	9.57	0.02	0.00	0.88	2.00	0.00	9.56	0.02	0.00
0.90	2.00	0.00	9.55	0.02	0.00	0.92	2.00	0.00	9.54	0.02	0.00
0.94	2.00	0.00	9.53	0.02	0.00	0.96	2.00	0.00	9.52	0.02	0.00
0.98	2.00	0.00	9.51	0.02	0.00	1.00	2.00	0.00	9.50	0.02	0.00
1.02	2.00	0.00	9.49	0.02	0.00	1.04	2.00	0.00	9.48	0.02	0.00
1.06	2.00	0.00	9.47	0.02	0.00	1.08	2.00	0.00	9.46	0.02	0.00
1.10	2.00	0.00	9.45	0.02	0.00	1.12	2.00	0.00	9.44	0.02	0.00
1.14	2.00	0.00	9.43	0.02	0.00	1.16	2.00	0.00	9.42	0.02	0.00
1.18	2.00	0.00	9.41	0.02	0.00	1.20	2.00	0.00	9.40	0.02	0.00
1.22	2.00	0.00	9.39	0.02	0.00	1.24	2.00	0.00	9.38	0.02	0.00
1.26	2.00	0.00	9.37	0.02	0.00	1.28	2.00	0.00	9.36	0.02	0.00
1.30	2.00	0.00	9.35	0.02	0.00	1.32	2.00	0.00	9.34	0.02	0.00
1.34	2.00	0.00	9.33	0.02	0.00	1.36	2.00	0.00	9.32	0.02	0.00
1.38	2.00	0.00	9.31	0.02	0.00	1.40	2.00	0.00	9.30	0.02	0.00
1.42	2.00	0.00	9.29	0.02	0.00	1.44	2.00	0.00	9.28	0.02	0.00
1.46	2.00	0.00	9.27	0.02	0.00	1.48	2.00	0.00	9.26	0.02	0.00
1.50	2.00	0.00	9.25	0.02	0.00	1.52	2.00	0.00	9.24	0.02	0.00
1.54	2.00	0.00	9.23	0.02	0.00	1.56	2.00	0.00	9.22	0.02	0.00
1.58	2.00	0.00	9.21	0.02	0.00	1.60	2.00	0.00	9.20	0.02	0.00
1.62	2.00	0.00	9.19	0.02	0.00	1.64	2.00	0.00	9.18	0.02	0.00
1.66	2.00	0.00	9.17	0.02	0.00	1.68	2.00	0.00	9.16	0.02	0.00
1.70	2.00	0.00	9.15	0.02	0.00	1.72	2.00	0.00	9.14	0.02	0.00
1.74	2.00	0.00	9.13	0.02	0.00	1.76	2.00	0.00	9.12	0.02	0.00
1.78	2.00	0.00	9.11	0.02	0.00	1.80	2.00	0.00	9.10	0.02	0.00
1.82	2.00	0.00	9.09	0.02	0.00	1.84	2.00	0.00	9.08	0.02	0.00
1.86	2.00	0.00	9.07	0.02	0.00	1.88	2.00	0.00	9.06	0.02	0.00
1.90	2.00	0.00	9.05	0.02	0.00	1.92	2.00	0.00	9.04	0.02	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
1.94	2.00	0.00	9.03	0.02	0.00	1.96	2.00	0.00	9.02	0.02	0.00
1.98	2.00	0.00	9.01	0.02	0.00	2.00	2.00	0.00	9.00	0.02	0.00
2.02	2.00	0.00	8.99	0.02	0.00	2.04	2.00	0.00	8.98	0.02	0.00
2.06	2.00	0.00	8.97	0.02	0.00	2.08	2.00	0.00	8.96	0.02	0.00
2.10	2.00	0.00	8.95	0.02	0.00	2.12	1.23	0.00	8.94	0.02	0.00
2.14	1.23	0.00	8.93	0.02	0.00	2.16	1.22	0.00	8.92	0.02	0.00
2.18	1.22	0.00	8.91	0.02	0.00	2.20	1.22	0.00	8.90	0.02	0.00
2.22	1.21	0.00	8.89	0.02	0.00	2.24	1.18	0.00	8.88	0.02	0.00
2.26	1.17	0.00	8.87	0.02	0.00	2.28	1.18	0.00	8.86	0.02	0.00
2.30	1.21	0.00	8.85	0.02	0.00	2.32	1.28	0.00	8.84	0.02	0.00
2.34	1.35	0.00	8.83	0.02	0.00	2.36	1.52	0.00	8.82	0.02	0.00
2.38	1.59	0.00	8.81	0.02	0.00	2.40	1.42	0.00	8.80	0.02	0.00
2.42	1.34	0.00	8.79	0.02	0.00	2.44	1.29	0.00	8.78	0.02	0.00
2.46	2.00	0.00	8.77	0.02	0.00	2.48	2.00	0.00	8.76	0.02	0.00
2.50	2.00	0.00	8.75	0.02	0.00	2.52	2.00	0.00	8.74	0.02	0.00
2.54	2.00	0.00	8.73	0.02	0.00	2.56	2.00	0.00	8.72	0.02	0.00
2.58	2.00	0.00	8.71	0.02	0.00	2.60	2.00	0.00	8.70	0.02	0.00
2.62	2.00	0.00	8.69	0.02	0.00	2.64	2.00	0.00	8.68	0.02	0.00
2.66	2.00	0.00	8.67	0.02	0.00	2.68	2.00	0.00	8.66	0.02	0.00
2.70	2.00	0.00	8.65	0.02	0.00	2.72	2.00	0.00	8.64	0.02	0.00
2.74	2.00	0.00	8.63	0.02	0.00	2.76	2.00	0.00	8.62	0.02	0.00
2.78	2.00	0.00	8.61	0.02	0.00	2.80	2.00	0.00	8.60	0.02	0.00
2.82	2.00	0.00	8.59	0.02	0.00	2.84	2.00	0.00	8.58	0.02	0.00
2.86	2.00	0.00	8.57	0.02	0.00	2.88	2.00	0.00	8.56	0.02	0.00
2.90	2.00	0.00	8.55	0.02	0.00	2.92	2.00	0.00	8.54	0.02	0.00
2.94	2.00	0.00	8.53	0.02	0.00	2.96	2.00	0.00	8.52	0.02	0.00
2.98	2.00	0.00	8.51	0.02	0.00	3.00	2.00	0.00	8.50	0.02	0.00
3.02	2.00	0.00	8.49	0.02	0.00	3.04	2.00	0.00	8.48	0.02	0.00
3.06	2.00	0.00	8.47	0.02	0.00	3.08	2.00	0.00	8.46	0.02	0.00
3.10	2.00	0.00	8.45	0.02	0.00	3.12	2.00	0.00	8.44	0.02	0.00
3.14	2.00	0.00	8.43	0.02	0.00	3.16	2.00	0.00	8.42	0.02	0.00
3.18	2.00	0.00	8.41	0.02	0.00	3.20	2.00	0.00	8.40	0.02	0.00
3.22	2.00	0.00	8.39	0.02	0.00	3.24	2.00	0.00	8.38	0.02	0.00
3.26	2.00	0.00	8.37	0.02	0.00	3.28	2.00	0.00	8.36	0.02	0.00
3.30	2.00	0.00	8.35	0.02	0.00	3.32	2.00	0.00	8.34	0.02	0.00
3.34	2.00	0.00	8.33	0.02	0.00	3.36	2.00	0.00	8.32	0.02	0.00
3.38	2.00	0.00	8.31	0.02	0.00	3.40	2.00	0.00	8.30	0.02	0.00
3.42	2.00	0.00	8.29	0.02	0.00	3.44	2.00	0.00	8.28	0.02	0.00
3.46	2.00	0.00	8.27	0.02	0.00	3.48	2.00	0.00	8.26	0.02	0.00
3.50	2.00	0.00	8.25	0.02	0.00	3.52	2.00	0.00	8.24	0.02	0.00
3.54	2.00	0.00	8.23	0.02	0.00	3.56	2.00	0.00	8.22	0.02	0.00
3.58	2.00	0.00	8.21	0.02	0.00	3.60	2.00	0.00	8.20	0.02	0.00
3.62	2.00	0.00	8.19	0.02	0.00	3.64	2.00	0.00	8.18	0.02	0.00
3.66	2.00	0.00	8.17	0.02	0.00	3.68	2.00	0.00	8.16	0.02	0.00
3.70	2.00	0.00	8.15	0.02	0.00	3.72	2.00	0.00	8.14	0.02	0.00
3.74	2.00	0.00	8.13	0.02	0.00	3.76	2.00	0.00	8.12	0.02	0.00
3.78	2.00	0.00	8.11	0.02	0.00	3.80	2.00	0.00	8.10	0.02	0.00
3.82	2.00	0.00	8.09	0.02	0.00	3.84	2.00	0.00	8.08	0.02	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
3.86	2.00	0.00	8.07	0.02	0.00	3.88	2.00	0.00	8.06	0.02	0.00
3.90	2.00	0.00	8.05	0.02	0.00	3.92	2.00	0.00	8.04	0.02	0.00
3.94	2.00	0.00	8.03	0.02	0.00	3.96	2.00	0.00	8.02	0.02	0.00
3.98	2.00	0.00	8.01	0.02	0.00	4.00	2.00	0.00	8.00	0.02	0.00
4.02	2.00	0.00	7.99	0.02	0.00	4.04	2.00	0.00	7.98	0.02	0.00
4.06	2.00	0.00	7.97	0.02	0.00	4.08	2.00	0.00	7.96	0.02	0.00
4.10	2.00	0.00	7.95	0.02	0.00	4.12	2.00	0.00	7.94	0.02	0.00
4.14	2.00	0.00	7.93	0.02	0.00	4.16	2.00	0.00	7.92	0.02	0.00
4.18	2.00	0.00	7.91	0.02	0.00	4.20	2.00	0.00	7.90	0.02	0.00
4.22	2.00	0.00	7.89	0.02	0.00	4.24	2.00	0.00	7.88	0.02	0.00
4.26	2.00	0.00	7.87	0.02	0.00	4.28	2.00	0.00	7.86	0.02	0.00
4.30	2.00	0.00	7.85	0.02	0.00	4.32	2.00	0.00	7.84	0.02	0.00
4.34	2.00	0.00	7.83	0.02	0.00	4.36	2.00	0.00	7.82	0.02	0.00
4.38	2.00	0.00	7.81	0.02	0.00	4.40	2.00	0.00	7.80	0.02	0.00
4.42	2.00	0.00	7.79	0.02	0.00	4.44	2.00	0.00	7.78	0.02	0.00
4.46	2.00	0.00	7.77	0.02	0.00	4.48	2.00	0.00	7.76	0.02	0.00
4.50	2.00	0.00	7.75	0.02	0.00	4.52	2.00	0.00	7.74	0.02	0.00
4.54	2.00	0.00	7.73	0.02	0.00	4.56	2.00	0.00	7.72	0.02	0.00
4.58	2.00	0.00	7.71	0.02	0.00	4.60	2.00	0.00	7.70	0.02	0.00
4.62	2.00	0.00	7.69	0.02	0.00	4.64	2.00	0.00	7.68	0.02	0.00
4.66	2.00	0.00	7.67	0.02	0.00	4.68	2.00	0.00	7.66	0.02	0.00
4.70	2.00	0.00	7.65	0.02	0.00	4.72	2.00	0.00	7.64	0.02	0.00
4.74	2.00	0.00	7.63	0.02	0.00	4.76	2.00	0.00	7.62	0.02	0.00
4.78	2.00	0.00	7.61	0.02	0.00	4.80	2.00	0.00	7.60	0.02	0.00
4.82	2.00	0.00	7.59	0.02	0.00	4.84	2.00	0.00	7.58	0.02	0.00
4.86	2.00	0.00	7.57	0.02	0.00	4.88	2.00	0.00	7.56	0.02	0.00
4.90	2.00	0.00	7.55	0.02	0.00	4.92	2.00	0.00	7.54	0.02	0.00
4.94	2.00	0.00	7.53	0.02	0.00	4.96	2.00	0.00	7.52	0.02	0.00
4.98	2.00	0.00	7.51	0.02	0.00	5.00	2.00	0.00	7.50	0.02	0.00
5.02	2.00	0.00	7.49	0.02	0.00	5.04	2.00	0.00	7.48	0.02	0.00
5.06	2.00	0.00	7.47	0.02	0.00	5.08	2.00	0.00	7.46	0.02	0.00
5.10	2.00	0.00	7.45	0.02	0.00	5.12	2.00	0.00	7.44	0.02	0.00
5.14	2.00	0.00	7.43	0.02	0.00	5.16	2.00	0.00	7.42	0.02	0.00
5.18	2.00	0.00	7.41	0.02	0.00	5.20	2.00	0.00	7.40	0.02	0.00
5.22	2.00	0.00	7.39	0.02	0.00	5.24	2.00	0.00	7.38	0.02	0.00
5.26	2.00	0.00	7.37	0.02	0.00	5.28	2.00	0.00	7.36	0.02	0.00
5.30	2.00	0.00	7.35	0.02	0.00	5.32	2.00	0.00	7.34	0.02	0.00
5.34	2.00	0.00	7.33	0.02	0.00	5.36	2.00	0.00	7.32	0.02	0.00
5.38	2.00	0.00	7.31	0.02	0.00	5.40	2.00	0.00	7.30	0.02	0.00
5.42	2.00	0.00	7.29	0.02	0.00	5.44	2.00	0.00	7.28	0.02	0.00
5.46	2.00	0.00	7.27	0.02	0.00	5.48	2.00	0.00	7.26	0.02	0.00
5.50	2.00	0.00	7.25	0.02	0.00	5.52	2.00	0.00	7.24	0.02	0.00
5.54	2.00	0.00	7.23	0.02	0.00	5.56	2.00	0.00	7.22	0.02	0.00
5.58	2.00	0.00	7.21	0.02	0.00	5.60	2.00	0.00	7.20	0.02	0.00
5.62	2.00	0.00	7.19	0.02	0.00	5.64	2.00	0.00	7.18	0.02	0.00
5.66	2.00	0.00	7.17	0.02	0.00	5.68	2.00	0.00	7.16	0.02	0.00
5.70	2.00	0.00	7.15	0.02	0.00	5.72	2.00	0.00	7.14	0.02	0.00
5.74	2.00	0.00	7.13	0.02	0.00	5.76	2.00	0.00	7.12	0.02	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
5.78	2.00	0.00	7.11	0.02	0.00	5.80	2.00	0.00	7.10	0.02	0.00
5.82	2.00	0.00	7.09	0.02	0.00	5.84	2.00	0.00	7.08	0.02	0.00
5.86	2.00	0.00	7.07	0.02	0.00	5.88	2.00	0.00	7.06	0.02	0.00
5.90	2.00	0.00	7.05	0.02	0.00	5.92	2.00	0.00	7.04	0.02	0.00
5.94	2.00	0.00	7.03	0.02	0.00	5.96	2.00	0.00	7.02	0.02	0.00
5.98	2.00	0.00	7.01	0.02	0.00	6.00	2.00	0.00	7.00	0.02	0.00
6.02	2.00	0.00	6.99	0.02	0.00	6.04	2.00	0.00	6.98	0.02	0.00
6.06	2.00	0.00	6.97	0.02	0.00	6.08	2.00	0.00	6.96	0.02	0.00
6.10	2.00	0.00	6.95	0.02	0.00	6.12	2.00	0.00	6.94	0.02	0.00
6.14	2.00	0.00	6.93	0.02	0.00	6.16	2.00	0.00	6.92	0.02	0.00
6.18	2.00	0.00	6.91	0.02	0.00	6.20	2.00	0.00	6.90	0.02	0.00
6.22	2.00	0.00	6.89	0.02	0.00	6.24	2.00	0.00	6.88	0.02	0.00
6.26	2.00	0.00	6.87	0.02	0.00	6.28	2.00	0.00	6.86	0.02	0.00
6.30	2.00	0.00	6.85	0.02	0.00	6.32	2.00	0.00	6.84	0.02	0.00
6.34	2.00	0.00	6.83	0.02	0.00	6.36	2.00	0.00	6.82	0.02	0.00
6.38	2.00	0.00	6.81	0.02	0.00	6.40	2.00	0.00	6.80	0.02	0.00
6.42	2.00	0.00	6.79	0.02	0.00	6.44	2.00	0.00	6.78	0.02	0.00
6.46	2.00	0.00	6.77	0.02	0.00	6.48	2.00	0.00	6.76	0.02	0.00
6.50	2.00	0.00	6.75	0.02	0.00	6.52	2.00	0.00	6.74	0.02	0.00
6.54	2.00	0.00	6.73	0.02	0.00	6.56	2.00	0.00	6.72	0.02	0.00
6.58	2.00	0.00	6.71	0.02	0.00	6.60	2.00	0.00	6.70	0.02	0.00
6.62	2.00	0.00	6.69	0.02	0.00	6.64	2.00	0.00	6.68	0.02	0.00
6.66	2.00	0.00	6.67	0.02	0.00	6.68	2.00	0.00	6.66	0.02	0.00
6.70	2.00	0.00	6.65	0.02	0.00	6.72	2.00	0.00	6.64	0.02	0.00
6.74	2.00	0.00	6.63	0.02	0.00	6.76	2.00	0.00	6.62	0.02	0.00
6.78	2.00	0.00	6.61	0.02	0.00	6.80	2.00	0.00	6.60	0.02	0.00
6.82	2.00	0.00	6.59	0.02	0.00	6.84	2.00	0.00	6.58	0.02	0.00
6.86	2.00	0.00	6.57	0.02	0.00	6.88	2.00	0.00	6.56	0.02	0.00
6.90	2.00	0.00	6.55	0.02	0.00	6.92	2.00	0.00	6.54	0.02	0.00
6.94	2.00	0.00	6.53	0.02	0.00	6.96	2.00	0.00	6.52	0.02	0.00
6.98	2.00	0.00	6.51	0.02	0.00	7.00	2.00	0.00	6.50	0.02	0.00
7.02	2.00	0.00	6.49	0.02	0.00	7.04	2.00	0.00	6.48	0.02	0.00
7.06	2.00	0.00	6.47	0.02	0.00	7.08	2.00	0.00	6.46	0.02	0.00
7.10	2.00	0.00	6.45	0.02	0.00	7.12	2.00	0.00	6.44	0.02	0.00
7.14	2.00	0.00	6.43	0.02	0.00	7.16	2.00	0.00	6.42	0.02	0.00
7.18	2.00	0.00	6.41	0.02	0.00	7.20	2.00	0.00	6.40	0.02	0.00
7.22	2.00	0.00	6.39	0.02	0.00	7.24	2.00	0.00	6.38	0.02	0.00
7.26	2.00	0.00	6.37	0.02	0.00	7.28	2.00	0.00	6.36	0.02	0.00
7.30	2.00	0.00	6.35	0.02	0.00	7.32	2.00	0.00	6.34	0.02	0.00
7.34	2.00	0.00	6.33	0.02	0.00	7.36	2.00	0.00	6.32	0.02	0.00
7.38	2.00	0.00	6.31	0.02	0.00	7.40	2.00	0.00	6.30	0.02	0.00
7.42	2.00	0.00	6.29	0.02	0.00	7.44	2.00	0.00	6.28	0.02	0.00
7.46	2.00	0.00	6.27	0.02	0.00	7.48	2.00	0.00	6.26	0.02	0.00
7.50	2.00	0.00	6.25	0.02	0.00	7.52	2.00	0.00	6.24	0.02	0.00
7.54	2.00	0.00	6.23	0.02	0.00	7.56	2.00	0.00	6.22	0.02	0.00
7.58	2.00	0.00	6.21	0.02	0.00	7.60	2.00	0.00	6.20	0.02	0.00
7.62	2.00	0.00	6.19	0.02	0.00	7.64	2.00	0.00	6.18	0.02	0.00
7.66	2.00	0.00	6.17	0.02	0.00	7.68	2.00	0.00	6.16	0.02	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
7.70	2.00	0.00	6.15	0.02	0.00	7.72	2.00	0.00	6.14	0.02	0.00
7.74	2.00	0.00	6.13	0.02	0.00	7.76	2.00	0.00	6.12	0.02	0.00
7.78	2.00	0.00	6.11	0.02	0.00	7.80	2.00	0.00	6.10	0.02	0.00
7.82	2.00	0.00	6.09	0.02	0.00	7.84	2.00	0.00	6.08	0.02	0.00
7.86	2.00	0.00	6.07	0.02	0.00	7.88	2.00	0.00	6.06	0.02	0.00
7.90	2.00	0.00	6.05	0.02	0.00	7.92	2.00	0.00	6.04	0.02	0.00
7.94	2.00	0.00	6.03	0.02	0.00	7.96	2.00	0.00	6.02	0.02	0.00
7.98	2.00	0.00	6.01	0.02	0.00	8.00	2.00	0.00	6.00	0.02	0.00
8.02	2.00	0.00	5.99	0.02	0.00	8.04	2.00	0.00	5.98	0.02	0.00
8.06	2.00	0.00	5.97	0.02	0.00	8.08	2.00	0.00	5.96	0.02	0.00
8.10	2.00	0.00	5.95	0.02	0.00	8.12	2.00	0.00	5.94	0.02	0.00
8.14	2.00	0.00	5.93	0.02	0.00	8.16	2.00	0.00	5.92	0.02	0.00
8.18	2.00	0.00	5.91	0.02	0.00	8.20	2.00	0.00	5.90	0.02	0.00
8.22	2.00	0.00	5.89	0.02	0.00	8.24	2.00	0.00	5.88	0.02	0.00
8.26	2.00	0.00	5.87	0.02	0.00	8.28	2.00	0.00	5.86	0.02	0.00
8.30	2.00	0.00	5.85	0.02	0.00	8.32	2.00	0.00	5.84	0.02	0.00
8.34	2.00	0.00	5.83	0.02	0.00	8.36	2.00	0.00	5.82	0.02	0.00
8.38	2.00	0.00	5.81	0.02	0.00	8.40	2.00	0.00	5.80	0.02	0.00
8.42	2.00	0.00	5.79	0.02	0.00	8.44	2.00	0.00	5.78	0.02	0.00
8.46	2.00	0.00	5.77	0.02	0.00	8.48	2.00	0.00	5.76	0.02	0.00
8.50	2.00	0.00	5.75	0.02	0.00	8.52	2.00	0.00	5.74	0.02	0.00
8.54	2.00	0.00	5.73	0.02	0.00	8.56	2.00	0.00	5.72	0.02	0.00
8.58	2.00	0.00	5.71	0.02	0.00	8.60	2.00	0.00	5.70	0.02	0.00
8.62	2.00	0.00	5.69	0.02	0.00	8.64	2.00	0.00	5.68	0.02	0.00
8.66	2.00	0.00	5.67	0.02	0.00	8.68	2.00	0.00	5.66	0.02	0.00
8.70	2.00	0.00	5.65	0.02	0.00	8.72	2.00	0.00	5.64	0.02	0.00
8.74	2.00	0.00	5.63	0.02	0.00	8.76	2.00	0.00	5.62	0.02	0.00
8.78	2.00	0.00	5.61	0.02	0.00	8.80	2.00	0.00	5.60	0.02	0.00
8.82	2.00	0.00	5.59	0.02	0.00	8.84	2.00	0.00	5.58	0.02	0.00
8.86	2.00	0.00	5.57	0.02	0.00	8.88	2.00	0.00	5.56	0.02	0.00
8.90	2.00	0.00	5.55	0.02	0.00	8.92	2.00	0.00	5.54	0.02	0.00
8.94	2.00	0.00	5.53	0.02	0.00	8.96	2.00	0.00	5.52	0.02	0.00
8.98	2.00	0.00	5.51	0.02	0.00	9.00	2.00	0.00	5.50	0.02	0.00
9.02	2.00	0.00	5.49	0.02	0.00	9.04	2.00	0.00	5.48	0.02	0.00
9.06	2.00	0.00	5.47	0.02	0.00	9.08	2.00	0.00	5.46	0.02	0.00
9.10	2.00	0.00	5.45	0.02	0.00	9.12	2.00	0.00	5.44	0.02	0.00
9.14	2.00	0.00	5.43	0.02	0.00	9.16	2.00	0.00	5.42	0.02	0.00
9.18	2.00	0.00	5.41	0.02	0.00	9.20	2.00	0.00	5.40	0.02	0.00
9.22	2.00	0.00	5.39	0.02	0.00	9.24	2.00	0.00	5.38	0.02	0.00
9.26	2.00	0.00	5.37	0.02	0.00	9.28	2.00	0.00	5.36	0.02	0.00
9.30	2.00	0.00	5.35	0.02	0.00	9.32	2.00	0.00	5.34	0.02	0.00
9.34	2.00	0.00	5.33	0.02	0.00	9.36	2.00	0.00	5.32	0.02	0.00
9.38	2.00	0.00	5.31	0.02	0.00	9.40	2.00	0.00	5.30	0.02	0.00
9.42	2.00	0.00	5.29	0.02	0.00	9.44	2.00	0.00	5.28	0.02	0.00
9.46	2.00	0.00	5.27	0.02	0.00	9.48	2.00	0.00	5.26	0.02	0.00
9.50	0.89	0.11	5.25	0.02	0.01	9.52	0.89	0.11	5.24	0.02	0.01
9.54	0.86	0.14	5.23	0.02	0.01	9.56	0.84	0.16	5.22	0.02	0.02
9.58	0.72	0.28	5.21	0.02	0.03	9.60	0.72	0.28	5.20	0.02	0.03

:: Liquefaction Potential Index calculation data :: (continued)

Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
9.62	0.73	0.27	5.19	0.02	0.03	9.64	0.74	0.26	5.18	0.02	0.03
9.66	0.86	0.14	5.17	0.02	0.01	9.68	0.88	0.12	5.16	0.02	0.01
9.70	0.89	0.11	5.15	0.02	0.01	9.72	0.90	0.10	5.14	0.02	0.01
9.74	0.91	0.09	5.13	0.02	0.01	9.76	0.92	0.08	5.12	0.02	0.01
9.78	0.94	0.06	5.11	0.02	0.01	9.80	0.95	0.05	5.10	0.02	0.01
9.82	0.95	0.05	5.09	0.02	0.00	9.84	0.96	0.04	5.08	0.02	0.00
9.86	0.97	0.03	5.07	0.02	0.00	9.88	0.98	0.02	5.06	0.02	0.00
9.90	1.00	0.00	5.05	0.02	0.00	9.92	0.88	0.12	5.04	0.02	0.01
9.94	0.91	0.09	5.03	0.02	0.01	9.96	0.92	0.08	5.02	0.02	0.01
9.98	0.93	0.07	5.01	0.02	0.01	10.00	0.94	0.06	5.00	0.02	0.01
10.02	0.94	0.06	4.99	0.02	0.01	10.04	0.94	0.06	4.98	0.02	0.01
10.06	0.94	0.06	4.97	0.02	0.01	10.08	0.94	0.06	4.96	0.02	0.01
10.10	1.09	0.00	4.95	0.02	0.00	10.12	1.10	0.00	4.94	0.02	0.00
10.14	1.11	0.00	4.93	0.02	0.00	10.16	1.11	0.00	4.92	0.02	0.00
10.18	1.13	0.00	4.91	0.02	0.00	10.20	1.14	0.00	4.90	0.02	0.00
10.22	1.15	0.00	4.89	0.02	0.00	10.24	1.16	0.00	4.88	0.02	0.00
10.26	1.16	0.00	4.87	0.02	0.00	10.28	1.15	0.00	4.86	0.02	0.00
10.30	1.13	0.00	4.85	0.02	0.00	10.32	1.11	0.00	4.84	0.02	0.00
10.34	1.11	0.00	4.83	0.02	0.00	10.36	1.11	0.00	4.82	0.02	0.00
10.38	1.12	0.00	4.81	0.02	0.00	10.40	1.12	0.00	4.80	0.02	0.00
10.42	1.11	0.00	4.79	0.02	0.00	10.44	1.09	0.00	4.78	0.02	0.00
10.46	1.07	0.00	4.77	0.02	0.00	10.48	1.07	0.00	4.76	0.02	0.00
10.50	1.07	0.00	4.75	0.02	0.00	10.52	1.06	0.00	4.74	0.02	0.00
10.54	1.04	0.00	4.73	0.02	0.00	10.56	1.02	0.00	4.72	0.02	0.00
10.58	0.99	0.01	4.71	0.02	0.00	10.60	0.97	0.03	4.70	0.02	0.00
10.62	0.95	0.05	4.69	0.02	0.00	10.64	0.94	0.06	4.68	0.02	0.01
10.66	0.92	0.08	4.67	0.02	0.01	10.68	0.91	0.09	4.66	0.02	0.01
10.70	0.91	0.09	4.65	0.02	0.01	10.72	0.90	0.10	4.64	0.02	0.01
10.74	0.90	0.10	4.63	0.02	0.01	10.76	0.91	0.09	4.62	0.02	0.01
10.78	0.90	0.10	4.61	0.02	0.01	10.80	0.90	0.10	4.60	0.02	0.01
10.82	0.89	0.11	4.59	0.02	0.01	10.84	0.88	0.12	4.58	0.02	0.01
10.86	0.87	0.13	4.57	0.02	0.01	10.88	0.86	0.14	4.56	0.02	0.01
10.90	0.85	0.15	4.55	0.02	0.01	10.92	0.85	0.15	4.54	0.02	0.01
10.94	0.85	0.15	4.53	0.02	0.01	10.96	0.85	0.15	4.52	0.02	0.01
10.98	2.00	0.00	4.51	0.02	0.00	11.00	2.00	0.00	4.50	0.02	0.00
11.02	2.00	0.00	4.49	0.02	0.00	11.04	2.00	0.00	4.48	0.02	0.00
11.06	2.00	0.00	4.47	0.02	0.00	11.08	2.00	0.00	4.46	0.02	0.00
11.10	2.00	0.00	4.45	0.02	0.00	11.12	2.00	0.00	4.44	0.02	0.00
11.14	2.00	0.00	4.43	0.02	0.00	11.16	2.00	0.00	4.42	0.02	0.00
11.18	2.00	0.00	4.41	0.02	0.00	11.20	2.00	0.00	4.40	0.02	0.00
11.22	2.00	0.00	4.39	0.02	0.00	11.24	2.00	0.00	4.38	0.02	0.00
11.26	2.00	0.00	4.37	0.02	0.00	11.28	2.00	0.00	4.36	0.02	0.00
11.30	2.00	0.00	4.35	0.02	0.00	11.32	2.00	0.00	4.34	0.02	0.00
11.34	2.00	0.00	4.33	0.02	0.00	11.36	2.00	0.00	4.32	0.02	0.00
11.38	2.00	0.00	4.31	0.02	0.00	11.40	1.01	0.00	4.30	0.02	0.00
11.42	1.01	0.00	4.29	0.02	0.00	11.44	0.98	0.02	4.28	0.02	0.00
11.46	1.11	0.00	4.27	0.02	0.00	11.48	1.11	0.00	4.26	0.02	0.00
11.50	1.11	0.00	4.25	0.02	0.00	11.52	1.11	0.00	4.24	0.02	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
11.54	1.11	0.00	4.23	0.02	0.00	11.56	1.10	0.00	4.22	0.02	0.00
11.58	1.10	0.00	4.21	0.02	0.00	11.60	1.08	0.00	4.20	0.02	0.00
11.62	1.06	0.00	4.19	0.02	0.00	11.64	1.05	0.00	4.18	0.02	0.00
11.66	1.04	0.00	4.17	0.02	0.00	11.68	1.03	0.00	4.16	0.02	0.00
11.70	1.04	0.00	4.15	0.02	0.00	11.72	1.05	0.00	4.14	0.02	0.00
11.74	1.06	0.00	4.13	0.02	0.00	11.76	1.07	0.00	4.12	0.02	0.00
11.78	1.07	0.00	4.11	0.02	0.00	11.80	1.05	0.00	4.10	0.02	0.00
11.82	1.02	0.00	4.09	0.02	0.00	11.84	1.00	0.00	4.08	0.02	0.00
11.86	0.99	0.01	4.07	0.02	0.00	11.88	0.99	0.01	4.06	0.02	0.00
11.90	1.01	0.00	4.05	0.02	0.00	11.92	1.03	0.00	4.04	0.02	0.00
11.94	1.05	0.00	4.03	0.02	0.00	11.96	1.06	0.00	4.02	0.02	0.00
11.98	1.06	0.00	4.01	0.02	0.00	12.00	1.06	0.00	4.00	0.02	0.00
12.02	1.07	0.00	3.99	0.02	0.00	12.04	1.07	0.00	3.98	0.02	0.00
12.06	1.08	0.00	3.97	0.02	0.00	12.08	1.08	0.00	3.96	0.02	0.00
12.10	1.08	0.00	3.95	0.02	0.00	12.12	1.08	0.00	3.94	0.02	0.00
12.14	1.09	0.00	3.93	0.02	0.00	12.16	1.09	0.00	3.92	0.02	0.00
12.18	1.11	0.00	3.91	0.02	0.00	12.20	1.12	0.00	3.90	0.02	0.00
12.22	1.14	0.00	3.89	0.02	0.00	12.24	1.01	0.00	3.88	0.02	0.00
12.26	1.03	0.00	3.87	0.02	0.00	12.28	1.07	0.00	3.86	0.02	0.00
12.30	1.11	0.00	3.85	0.02	0.00	12.32	1.13	0.00	3.84	0.02	0.00
12.34	1.12	0.00	3.83	0.02	0.00	12.36	1.27	0.00	3.82	0.02	0.00
12.38	1.25	0.00	3.81	0.02	0.00	12.40	1.23	0.00	3.80	0.02	0.00
12.42	1.21	0.00	3.79	0.02	0.00	12.44	1.20	0.00	3.78	0.02	0.00
12.46	1.20	0.00	3.77	0.02	0.00	12.48	1.21	0.00	3.76	0.02	0.00
12.50	1.22	0.00	3.75	0.02	0.00	12.52	1.24	0.00	3.74	0.02	0.00
12.54	1.23	0.00	3.73	0.02	0.00	12.56	1.23	0.00	3.72	0.02	0.00
12.58	1.22	0.00	3.71	0.02	0.00	12.60	1.22	0.00	3.70	0.02	0.00
12.62	1.23	0.00	3.69	0.02	0.00	12.64	1.25	0.00	3.68	0.02	0.00
12.66	1.26	0.00	3.67	0.02	0.00	12.68	1.28	0.00	3.66	0.02	0.00
12.70	1.29	0.00	3.65	0.02	0.00	12.72	1.27	0.00	3.64	0.02	0.00
12.74	1.24	0.00	3.63	0.02	0.00	12.76	1.21	0.00	3.62	0.02	0.00
12.78	1.19	0.00	3.61	0.02	0.00	12.80	1.18	0.00	3.60	0.02	0.00
12.82	1.17	0.00	3.59	0.02	0.00	12.84	1.16	0.00	3.58	0.02	0.00
12.86	1.15	0.00	3.57	0.02	0.00	12.88	1.14	0.00	3.56	0.02	0.00
12.90	1.14	0.00	3.55	0.02	0.00	12.92	1.15	0.00	3.54	0.02	0.00
12.94	1.15	0.00	3.53	0.02	0.00	12.96	1.14	0.00	3.52	0.02	0.00
12.98	1.12	0.00	3.51	0.02	0.00	13.00	1.11	0.00	3.50	0.02	0.00
13.02	1.10	0.00	3.49	0.02	0.00	13.04	1.10	0.00	3.48	0.02	0.00
13.06	1.09	0.00	3.47	0.02	0.00	13.08	1.08	0.00	3.46	0.02	0.00
13.10	1.05	0.00	3.45	0.02	0.00	13.12	1.03	0.00	3.44	0.02	0.00
13.14	0.99	0.01	3.43	0.02	0.00	13.16	0.97	0.03	3.42	0.02	0.00
13.18	0.95	0.05	3.41	0.02	0.00	13.20	0.93	0.07	3.40	0.02	0.00
13.22	0.91	0.09	3.39	0.02	0.01	13.24	0.90	0.10	3.38	0.02	0.01
13.26	0.89	0.11	3.37	0.02	0.01	13.28	0.89	0.11	3.36	0.02	0.01
13.30	0.88	0.12	3.35	0.02	0.01	13.32	0.88	0.12	3.34	0.02	0.01
13.34	0.88	0.12	3.33	0.02	0.01	13.36	0.78	0.22	3.32	0.02	0.01
13.38	0.81	0.19	3.31	0.02	0.01	13.40	0.83	0.17	3.30	0.02	0.01
13.42	0.84	0.16	3.29	0.02	0.01	13.44	0.85	0.15	3.28	0.02	0.01

:: Liquefaction Potential Index calculation data :: (continued)

Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
13.46	0.85	0.15	3.27	0.02	0.01	13.48	0.84	0.16	3.26	0.02	0.01
13.50	0.83	0.17	3.25	0.02	0.01	13.52	0.96	0.04	3.24	0.02	0.00
13.54	0.96	0.04	3.23	0.02	0.00	13.56	0.96	0.04	3.22	0.02	0.00
13.58	0.96	0.04	3.21	0.02	0.00	13.60	0.96	0.04	3.20	0.02	0.00
13.62	0.95	0.05	3.19	0.02	0.00	13.64	0.95	0.05	3.18	0.02	0.00
13.66	0.94	0.06	3.17	0.02	0.00	13.68	0.94	0.06	3.16	0.02	0.00
13.70	0.94	0.06	3.15	0.02	0.00	13.72	0.93	0.07	3.14	0.02	0.00
13.74	0.93	0.07	3.13	0.02	0.00	13.76	0.93	0.07	3.12	0.02	0.00
13.78	0.93	0.07	3.11	0.02	0.00	13.80	0.93	0.07	3.10	0.02	0.00
13.82	0.93	0.07	3.09	0.02	0.00	13.84	0.93	0.07	3.08	0.02	0.00
13.86	0.93	0.07	3.07	0.02	0.00	13.88	0.94	0.06	3.06	0.02	0.00
13.90	0.83	0.17	3.05	0.02	0.01	13.92	0.85	0.15	3.04	0.02	0.01
13.94	0.87	0.13	3.03	0.02	0.01	13.96	0.86	0.14	3.02	0.02	0.01
13.98	1.00	0.00	3.01	0.02	0.00	14.00	0.99	0.01	3.00	0.02	0.00
14.02	0.98	0.02	2.99	0.02	0.00	14.04	0.97	0.03	2.98	0.02	0.00
14.06	0.95	0.05	2.97	0.02	0.00	14.08	0.94	0.06	2.96	0.02	0.00
14.10	0.93	0.07	2.95	0.02	0.00	14.12	0.92	0.08	2.94	0.02	0.00
14.14	0.91	0.09	2.93	0.02	0.01	14.16	0.90	0.10	2.92	0.02	0.01
14.18	0.90	0.10	2.91	0.02	0.01	14.20	0.89	0.11	2.90	0.02	0.01
14.22	0.89	0.11	2.89	0.02	0.01	14.24	0.89	0.11	2.88	0.02	0.01
14.26	0.89	0.11	2.87	0.02	0.01	14.28	0.89	0.11	2.86	0.02	0.01
14.30	0.89	0.11	2.85	0.02	0.01	14.32	0.78	0.22	2.84	0.02	0.01
14.34	0.79	0.21	2.83	0.02	0.01	14.36	0.82	0.18	2.82	0.02	0.01
14.38	0.85	0.15	2.81	0.02	0.01	14.40	0.87	0.13	2.80	0.02	0.01
14.42	0.88	0.12	2.79	0.02	0.01	14.44	0.86	0.14	2.78	0.02	0.01
14.46	0.82	0.18	2.77	0.02	0.01	14.48	0.91	0.09	2.76	0.02	0.00
14.50	0.89	0.11	2.75	0.02	0.01	14.52	0.88	0.12	2.74	0.02	0.01
14.54	0.87	0.13	2.73	0.02	0.01	14.56	0.87	0.13	2.72	0.02	0.01
14.58	0.87	0.13	2.71	0.02	0.01	14.60	0.87	0.13	2.70	0.02	0.01
14.62	0.89	0.11	2.69	0.02	0.01	14.64	0.90	0.10	2.68	0.02	0.01
14.66	0.92	0.08	2.67	0.02	0.00	14.68	0.81	0.19	2.66	0.02	0.01
14.70	0.83	0.17	2.65	0.02	0.01	14.72	0.87	0.13	2.64	0.02	0.01
14.74	0.92	0.08	2.63	0.02	0.00	14.76	0.97	0.03	2.62	0.02	0.00
14.78	0.99	0.01	2.61	0.02	0.00	14.80	1.14	0.00	2.60	0.02	0.00
14.82	1.15	0.00	2.59	0.02	0.00	14.84	1.16	0.00	2.58	0.02	0.00
14.86	1.17	0.00	2.57	0.02	0.00	14.88	1.17	0.00	2.56	0.02	0.00
14.90	1.15	0.00	2.55	0.02	0.00	14.92	1.11	0.00	2.54	0.02	0.00
14.94	1.09	0.00	2.53	0.02	0.00	14.96	1.08	0.00	2.52	0.02	0.00
14.98	1.09	0.00	2.51	0.02	0.00	15.00	1.08	0.00	2.50	0.02	0.00
15.02	1.07	0.00	2.49	0.02	0.00	15.04	1.06	0.00	2.48	0.02	0.00
15.06	1.05	0.00	2.47	0.02	0.00	15.08	1.04	0.00	2.46	0.02	0.00
15.10	1.04	0.00	2.45	0.02	0.00	15.12	1.05	0.00	2.44	0.02	0.00
15.14	1.05	0.00	2.43	0.02	0.00	15.16	1.05	0.00	2.42	0.02	0.00
15.18	1.04	0.00	2.41	0.02	0.00	15.20	1.03	0.00	2.40	0.02	0.00
15.22	1.02	0.00	2.39	0.02	0.00	15.24	1.01	0.00	2.38	0.02	0.00
15.26	0.99	0.01	2.37	0.02	0.00	15.28	0.98	0.02	2.36	0.02	0.00
15.30	0.97	0.03	2.35	0.02	0.00	15.32	0.95	0.05	2.34	0.02	0.00
15.34	0.93	0.07	2.33	0.02	0.00	15.36	0.92	0.08	2.32	0.02	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
15.38	0.90	0.10	2.31	0.02	0.00	15.40	0.90	0.10	2.30	0.02	0.00
15.42	0.89	0.11	2.29	0.02	0.00	15.44	0.89	0.11	2.28	0.02	0.00
15.46	0.90	0.10	2.27	0.02	0.00	15.48	0.91	0.09	2.26	0.02	0.00
15.50	0.93	0.07	2.25	0.02	0.00	15.52	0.97	0.03	2.24	0.02	0.00
15.54	1.02	0.00	2.23	0.02	0.00	15.56	1.09	0.00	2.22	0.02	0.00
15.58	1.16	0.00	2.21	0.02	0.00	15.60	1.23	0.00	2.20	0.02	0.00
15.62	1.29	0.00	2.19	0.02	0.00	15.64	1.35	0.00	2.18	0.02	0.00
15.66	1.38	0.00	2.17	0.02	0.00	15.68	1.41	0.00	2.16	0.02	0.00
15.70	1.42	0.00	2.15	0.02	0.00	15.72	1.42	0.00	2.14	0.02	0.00
15.74	1.44	0.00	2.13	0.02	0.00	15.76	1.45	0.00	2.12	0.02	0.00
15.78	1.46	0.00	2.11	0.02	0.00	15.80	1.48	0.00	2.10	0.02	0.00
15.82	1.51	0.00	2.09	0.02	0.00	15.84	1.54	0.00	2.08	0.02	0.00
15.86	1.57	0.00	2.07	0.02	0.00	15.88	1.60	0.00	2.06	0.02	0.00
15.90	1.64	0.00	2.05	0.02	0.00	15.92	1.67	0.00	2.04	0.02	0.00
15.94	1.70	0.00	2.03	0.02	0.00	15.96	1.73	0.00	2.02	0.02	0.00
15.98	1.73	0.00	2.01	0.02	0.00	16.00	1.69	0.00	2.00	0.02	0.00
16.02	1.62	0.00	1.99	0.02	0.00	16.04	1.52	0.00	1.98	0.02	0.00
16.06	1.43	0.00	1.97	0.02	0.00	16.08	1.36	0.00	1.96	0.02	0.00
16.10	1.31	0.00	1.95	0.02	0.00	16.12	1.26	0.00	1.94	0.02	0.00
16.14	1.21	0.00	1.93	0.02	0.00	16.16	1.18	0.00	1.92	0.02	0.00
16.18	1.15	0.00	1.91	0.02	0.00	16.20	1.14	0.00	1.90	0.02	0.00
16.22	1.13	0.00	1.89	0.02	0.00	16.24	1.13	0.00	1.88	0.02	0.00
16.26	1.14	0.00	1.87	0.02	0.00	16.28	1.17	0.00	1.86	0.02	0.00
16.30	1.21	0.00	1.85	0.02	0.00	16.32	1.25	0.00	1.84	0.02	0.00
16.34	1.28	0.00	1.83	0.02	0.00	16.36	1.30	0.00	1.82	0.02	0.00
16.38	1.31	0.00	1.81	0.02	0.00	16.40	1.33	0.00	1.80	0.02	0.00
16.42	1.35	0.00	1.79	0.02	0.00	16.44	1.37	0.00	1.78	0.02	0.00
16.46	1.40	0.00	1.77	0.02	0.00	16.48	1.42	0.00	1.76	0.02	0.00
16.50	1.42	0.00	1.75	0.02	0.00	16.52	1.39	0.00	1.74	0.02	0.00
16.54	1.32	0.00	1.73	0.02	0.00	16.56	1.23	0.00	1.72	0.02	0.00
16.58	1.15	0.00	1.71	0.02	0.00	16.60	1.10	0.00	1.70	0.02	0.00
16.62	1.07	0.00	1.69	0.02	0.00	16.64	1.05	0.00	1.68	0.02	0.00
16.66	1.03	0.00	1.67	0.02	0.00	16.68	1.01	0.00	1.66	0.02	0.00
16.70	0.99	0.01	1.65	0.02	0.00	16.72	0.98	0.02	1.64	0.02	0.00
16.74	0.98	0.02	1.63	0.02	0.00	16.76	0.98	0.02	1.62	0.02	0.00
16.78	0.98	0.02	1.61	0.02	0.00	16.80	0.97	0.03	1.60	0.02	0.00
16.82	0.97	0.03	1.59	0.02	0.00	16.84	0.98	0.02	1.58	0.02	0.00
16.86	0.99	0.01	1.57	0.02	0.00	16.88	1.00	0.00	1.56	0.02	0.00
16.90	1.01	0.00	1.55	0.02	0.00	16.92	1.05	0.00	1.54	0.02	0.00
16.94	1.08	0.00	1.53	0.02	0.00	16.96	0.98	0.02	1.52	0.02	0.00
16.98	1.00	0.00	1.51	0.02	0.00	17.00	1.04	0.00	1.50	0.02	0.00
17.02	1.09	0.00	1.49	0.02	0.00	17.04	1.14	0.00	1.48	0.02	0.00
17.06	1.21	0.00	1.47	0.02	0.00	17.08	1.28	0.00	1.46	0.02	0.00
17.10	1.35	0.00	1.45	0.02	0.00	17.12	1.41	0.00	1.44	0.02	0.00
17.14	1.44	0.00	1.43	0.02	0.00	17.16	1.58	0.00	1.42	0.02	0.00
17.18	1.56	0.00	1.41	0.02	0.00	17.20	1.52	0.00	1.40	0.02	0.00
17.22	1.45	0.00	1.39	0.02	0.00	17.24	1.38	0.00	1.38	0.02	0.00
17.26	1.34	0.00	1.37	0.02	0.00	17.28	1.31	0.00	1.36	0.02	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
17.30	1.29	0.00	1.35	0.02	0.00	17.32	1.27	0.00	1.34	0.02	0.00
17.34	1.26	0.00	1.33	0.02	0.00	17.36	1.26	0.00	1.32	0.02	0.00
17.38	1.25	0.00	1.31	0.02	0.00	17.40	1.25	0.00	1.30	0.02	0.00
17.42	1.25	0.00	1.29	0.02	0.00	17.44	1.24	0.00	1.28	0.02	0.00
17.46	1.24	0.00	1.27	0.02	0.00	17.48	1.25	0.00	1.26	0.02	0.00
17.50	1.26	0.00	1.25	0.02	0.00	17.52	1.26	0.00	1.24	0.02	0.00
17.54	1.25	0.00	1.23	0.02	0.00	17.56	1.24	0.00	1.22	0.02	0.00
17.58	1.23	0.00	1.21	0.02	0.00	17.60	1.23	0.00	1.20	0.02	0.00
17.62	1.24	0.00	1.19	0.02	0.00	17.64	1.25	0.00	1.18	0.02	0.00
17.66	1.26	0.00	1.17	0.02	0.00	17.68	1.25	0.00	1.16	0.02	0.00
17.70	1.23	0.00	1.15	0.02	0.00	17.72	1.22	0.00	1.14	0.02	0.00
17.74	1.22	0.00	1.13	0.02	0.00	17.76	1.24	0.00	1.12	0.02	0.00
17.78	1.26	0.00	1.11	0.02	0.00	17.80	1.28	0.00	1.10	0.02	0.00
17.82	1.31	0.00	1.09	0.02	0.00	17.84	1.34	0.00	1.08	0.02	0.00
17.86	1.38	0.00	1.07	0.02	0.00	17.88	1.43	0.00	1.06	0.02	0.00
17.90	1.44	0.00	1.05	0.02	0.00	17.92	1.49	0.00	1.04	0.02	0.00
17.94	1.52	0.00	1.03	0.02	0.00	17.96	1.46	0.00	1.02	0.02	0.00
17.98	1.55	0.00	1.01	0.02	0.00	18.00	1.50	0.00	1.00	0.02	0.00
18.02	1.43	0.00	0.99	0.02	0.00	18.04	1.35	0.00	0.98	0.02	0.00
18.06	1.30	0.00	0.97	0.02	0.00	18.08	1.25	0.00	0.96	0.02	0.00
18.10	1.22	0.00	0.95	0.02	0.00	18.12	1.20	0.00	0.94	0.02	0.00
18.14	1.20	0.00	0.93	0.02	0.00	18.16	1.21	0.00	0.92	0.02	0.00
18.18	1.20	0.00	0.91	0.02	0.00	18.20	1.19	0.00	0.90	0.02	0.00
18.22	1.18	0.00	0.89	0.02	0.00	18.24	1.17	0.00	0.88	0.02	0.00
18.26	1.17	0.00	0.87	0.02	0.00	18.28	1.18	0.00	0.86	0.02	0.00
18.30	1.20	0.00	0.85	0.02	0.00	18.32	1.19	0.00	0.84	0.02	0.00
18.34	1.15	0.00	0.83	0.02	0.00	18.36	1.09	0.00	0.82	0.02	0.00
18.38	1.05	0.00	0.81	0.02	0.00	18.40	1.01	0.00	0.80	0.02	0.00
18.42	1.00	0.00	0.79	0.02	0.00	18.44	1.00	0.00	0.78	0.02	0.00
18.46	1.00	0.00	0.77	0.02	0.00	18.48	0.98	0.02	0.76	0.02	0.00
18.50	0.97	0.03	0.75	0.02	0.00	18.52	0.95	0.05	0.74	0.02	0.00
18.54	0.94	0.06	0.73	0.02	0.00	18.56	0.93	0.07	0.72	0.02	0.00
18.58	0.92	0.08	0.71	0.02	0.00	18.60	0.91	0.09	0.70	0.02	0.00
18.62	0.90	0.10	0.69	0.02	0.00	18.64	0.90	0.10	0.68	0.02	0.00
18.66	0.91	0.09	0.67	0.02	0.00	18.68	0.91	0.09	0.66	0.02	0.00
18.70	0.92	0.08	0.65	0.02	0.00	18.72	0.93	0.07	0.64	0.02	0.00
18.74	0.93	0.07	0.63	0.02	0.00	18.76	0.92	0.08	0.62	0.02	0.00
18.78	0.90	0.10	0.61	0.02	0.00	18.80	0.88	0.12	0.60	0.02	0.00
18.82	0.87	0.13	0.59	0.02	0.00	18.84	0.85	0.15	0.58	0.02	0.00
18.86	0.85	0.15	0.57	0.02	0.00	18.88	0.85	0.15	0.56	0.02	0.00
18.90	0.86	0.14	0.55	0.02	0.00	18.92	0.90	0.10	0.54	0.02	0.00
18.94	0.96	0.04	0.53	0.02	0.00	18.96	1.03	0.00	0.52	0.02	0.00
18.98	1.00	0.00	0.51	0.02	0.00	19.00	1.10	0.00	0.50	0.02	0.00
19.02	1.20	0.00	0.49	0.02	0.00	19.04	1.31	0.00	0.48	0.02	0.00
19.06	1.43	0.00	0.47	0.02	0.00	19.08	1.57	0.00	0.46	0.02	0.00
19.10	1.74	0.00	0.45	0.02	0.00	19.12	1.93	0.00	0.44	0.02	0.00
19.14	2.00	0.00	0.43	0.02	0.00	19.16	2.00	0.00	0.42	0.02	0.00
19.18	2.00	0.00	0.41	0.02	0.00	19.20	2.00	0.00	0.40	0.02	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
19.22	2.00	0.00	0.39	0.02	0.00	19.24	2.00	0.00	0.38	0.02	0.00
19.26	2.00	0.00	0.37	0.02	0.00	19.28	2.00	0.00	0.36	0.02	0.00
19.30	2.00	0.00	0.35	0.02	0.00	19.32	2.00	0.00	0.34	0.02	0.00
19.34	2.00	0.00	0.33	0.02	0.00	19.36	2.00	0.00	0.32	0.02	0.00
19.38	2.00	0.00	0.31	0.02	0.00	19.40	2.00	0.00	0.30	0.02	0.00
19.42	2.00	0.00	0.29	0.02	0.00	19.44	2.00	0.00	0.28	0.02	0.00
19.46	2.00	0.00	0.27	0.02	0.00	19.48	2.00	0.00	0.26	0.02	0.00
19.50	2.00	0.00	0.25	0.02	0.00	19.52	2.00	0.00	0.24	0.02	0.00
19.54	2.00	0.00	0.23	0.02	0.00	19.56	2.00	0.00	0.22	0.02	0.00
19.58	2.00	0.00	0.21	0.02	0.00	19.60	2.00	0.00	0.20	0.02	0.00
19.62	2.00	0.00	0.19	0.02	0.00	19.64	1.96	0.00	0.18	0.02	0.00
19.66	1.66	0.00	0.17	0.02	0.00	19.68	2.00	0.00	0.16	0.02	0.00
19.70	2.00	0.00	0.15	0.02	0.00	19.72	2.00	0.00	0.14	0.02	0.00
19.74	2.00	0.00	0.13	0.02	0.00	19.76	2.00	0.00	0.12	0.02	0.00
19.78	2.00	0.00	0.11	0.02	0.00	19.80	2.00	0.00	0.10	0.02	0.00
19.82	2.00	0.00	0.09	0.02	0.00	19.84	2.00	0.00	0.08	0.02	0.00
19.86	2.00	0.00	0.07	0.02	0.00	19.88	2.00	0.00	0.06	0.02	0.00
19.90	2.00	0.00	0.05	0.02	0.00	19.92	2.00	0.00	0.04	0.02	0.00
19.94	2.00	0.00	0.03	0.02	0.00	19.96	2.00	0.00	0.02	0.02	0.00
19.98	2.00	0.00	0.01	0.02	0.00	20.00	1.93	0.00	0.00	0.02	0.00
20.02	2.00	0.00	0.00	0.00	0.00	20.04	2.00	0.00	0.00	0.00	0.00
20.06	2.00	0.00	0.00	0.00	0.00	20.08	2.00	0.00	0.00	0.00	0.00
20.10	2.00	0.00	0.00	0.00	0.00	20.12	2.00	0.00	0.00	0.00	0.00
20.14	2.00	0.00	0.00	0.00	0.00	20.16	2.00	0.00	0.00	0.00	0.00
20.18	2.00	0.00	0.00	0.00	0.00	20.20	2.00	0.00	0.00	0.00	0.00
20.22	2.00	0.00	0.00	0.00	0.00	20.24	2.00	0.00	0.00	0.00	0.00
20.26	2.00	0.00	0.00	0.00	0.00	20.28	2.00	0.00	0.00	0.00	0.00
20.30	2.00	0.00	0.00	0.00	0.00	20.32	2.00	0.00	0.00	0.00	0.00
20.34	2.00	0.00	0.00	0.00	0.00	20.36	2.00	0.00	0.00	0.00	0.00
20.38	2.00	0.00	0.00	0.00	0.00	20.40	2.00	0.00	0.00	0.00	0.00
20.42	2.00	0.00	0.00	0.00	0.00	20.44	2.00	0.00	0.00	0.00	0.00
20.46	2.00	0.00	0.00	0.00	0.00	20.48	2.00	0.00	0.00	0.00	0.00
20.50	2.00	0.00	0.00	0.00	0.00	20.52	2.00	0.00	0.00	0.00	0.00
20.54	2.00	0.00	0.00	0.00	0.00	20.56	2.00	0.00	0.00	0.00	0.00
20.58	2.00	0.00	0.00	0.00	0.00	20.60	2.00	0.00	0.00	0.00	0.00
20.62	2.00	0.00	0.00	0.00	0.00	20.64	2.00	0.00	0.00	0.00	0.00
20.66	2.00	0.00	0.00	0.00	0.00	20.68	2.00	0.00	0.00	0.00	0.00
20.70	2.00	0.00	0.00	0.00	0.00	20.72	2.00	0.00	0.00	0.00	0.00
20.74	2.00	0.00	0.00	0.00	0.00	20.76	2.00	0.00	0.00	0.00	0.00
20.78	2.00	0.00	0.00	0.00	0.00	20.80	2.00	0.00	0.00	0.00	0.00
20.82	2.00	0.00	0.00	0.00	0.00	20.84	2.00	0.00	0.00	0.00	0.00
20.86	2.00	0.00	0.00	0.00	0.00	20.88	2.00	0.00	0.00	0.00	0.00
20.90	2.00	0.00	0.00	0.00	0.00	20.92	2.00	0.00	0.00	0.00	0.00
20.94	2.00	0.00	0.00	0.00	0.00	20.96	2.00	0.00	0.00	0.00	0.00
20.98	2.00	0.00	0.00	0.00	0.00	21.00	2.00	0.00	0.00	0.00	0.00
21.02	2.00	0.00	0.00	0.00	0.00	21.04	2.00	0.00	0.00	0.00	0.00
21.06	2.00	0.00	0.00	0.00	0.00	21.08	2.00	0.00	0.00	0.00	0.00
21.10	2.00	0.00	0.00	0.00	0.00	21.12	2.00	0.00	0.00	0.00	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
21.14	2.00	0.00	0.00	0.00	0.00	21.16	2.00	0.00	0.00	0.00	0.00
21.18	2.00	0.00	0.00	0.00	0.00	21.20	2.00	0.00	0.00	0.00	0.00
21.22	2.00	0.00	0.00	0.00	0.00	21.24	2.00	0.00	0.00	0.00	0.00
21.26	2.00	0.00	0.00	0.00	0.00	21.28	2.00	0.00	0.00	0.00	0.00
21.30	2.00	0.00	0.00	0.00	0.00	21.32	2.00	0.00	0.00	0.00	0.00
21.34	2.00	0.00	0.00	0.00	0.00	21.36	2.00	0.00	0.00	0.00	0.00
21.38	2.00	0.00	0.00	0.00	0.00	21.40	2.00	0.00	0.00	0.00	0.00
21.42	2.00	0.00	0.00	0.00	0.00	21.44	2.00	0.00	0.00	0.00	0.00
21.46	2.00	0.00	0.00	0.00	0.00	21.48	2.00	0.00	0.00	0.00	0.00
21.50	2.00	0.00	0.00	0.00	0.00	21.52	2.00	0.00	0.00	0.00	0.00
21.54	2.00	0.00	0.00	0.00	0.00	21.56	2.00	0.00	0.00	0.00	0.00
21.58	2.00	0.00	0.00	0.00	0.00	21.60	2.00	0.00	0.00	0.00	0.00
21.62	2.00	0.00	0.00	0.00	0.00	21.64	2.00	0.00	0.00	0.00	0.00
21.66	2.00	0.00	0.00	0.00	0.00	21.68	2.00	0.00	0.00	0.00	0.00
21.70	2.00	0.00	0.00	0.00	0.00	21.72	2.00	0.00	0.00	0.00	0.00
21.74	2.00	0.00	0.00	0.00	0.00	21.76	2.00	0.00	0.00	0.00	0.00
21.78	2.00	0.00	0.00	0.00	0.00	21.80	2.00	0.00	0.00	0.00	0.00
21.82	2.00	0.00	0.00	0.00	0.00	21.84	2.00	0.00	0.00	0.00	0.00
21.86	2.00	0.00	0.00	0.00	0.00	21.88	2.00	0.00	0.00	0.00	0.00
21.90	2.00	0.00	0.00	0.00	0.00	21.92	2.00	0.00	0.00	0.00	0.00
21.94	2.00	0.00	0.00	0.00	0.00	21.96	2.00	0.00	0.00	0.00	0.00
21.98	2.00	0.00	0.00	0.00	0.00	22.00	2.00	0.00	0.00	0.00	0.00
22.02	2.00	0.00	0.00	0.00	0.00	22.04	2.00	0.00	0.00	0.00	0.00
22.06	2.00	0.00	0.00	0.00	0.00	22.08	2.00	0.00	0.00	0.00	0.00
22.10	2.00	0.00	0.00	0.00	0.00	22.12	2.00	0.00	0.00	0.00	0.00
22.14	2.00	0.00	0.00	0.00	0.00	22.16	2.00	0.00	0.00	0.00	0.00
22.18	2.00	0.00	0.00	0.00	0.00	22.20	2.00	0.00	0.00	0.00	0.00
22.22	2.00	0.00	0.00	0.00	0.00	22.24	2.00	0.00	0.00	0.00	0.00
22.26	2.00	0.00	0.00	0.00	0.00	22.28	2.00	0.00	0.00	0.00	0.00
22.30	2.00	0.00	0.00	0.00	0.00	22.32	2.00	0.00	0.00	0.00	0.00
22.34	2.00	0.00	0.00	0.00	0.00	22.36	2.00	0.00	0.00	0.00	0.00
22.38	2.00	0.00	0.00	0.00	0.00	22.40	2.00	0.00	0.00	0.00	0.00
22.42	2.00	0.00	0.00	0.00	0.00	22.44	2.00	0.00	0.00	0.00	0.00
22.46	2.00	0.00	0.00	0.00	0.00	22.48	2.00	0.00	0.00	0.00	0.00
22.50	2.00	0.00	0.00	0.00	0.00	22.52	2.00	0.00	0.00	0.00	0.00
22.54	2.00	0.00	0.00	0.00	0.00	22.56	2.00	0.00	0.00	0.00	0.00
22.58	2.00	0.00	0.00	0.00	0.00	22.60	2.00	0.00	0.00	0.00	0.00
22.62	2.00	0.00	0.00	0.00	0.00	22.64	2.00	0.00	0.00	0.00	0.00
22.66	2.00	0.00	0.00	0.00	0.00	22.68	2.00	0.00	0.00	0.00	0.00
22.70	2.00	0.00	0.00	0.00	0.00	22.72	2.00	0.00	0.00	0.00	0.00
22.74	2.00	0.00	0.00	0.00	0.00	22.76	2.00	0.00	0.00	0.00	0.00
22.78	2.00	0.00	0.00	0.00	0.00	22.80	2.00	0.00	0.00	0.00	0.00
22.82	2.00	0.00	0.00	0.00	0.00	22.84	2.00	0.00	0.00	0.00	0.00
22.86	2.00	0.00	0.00	0.00	0.00	22.88	2.00	0.00	0.00	0.00	0.00
22.90	2.00	0.00	0.00	0.00	0.00	22.92	2.00	0.00	0.00	0.00	0.00
22.94	2.00	0.00	0.00	0.00	0.00	22.96	2.00	0.00	0.00	0.00	0.00
22.98	2.00	0.00	0.00	0.00	0.00	23.00	2.00	0.00	0.00	0.00	0.00
23.02	2.00	0.00	0.00	0.00	0.00	23.04	2.00	0.00	0.00	0.00	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
23.06	2.00	0.00	0.00	0.00	0.00	23.08	2.00	0.00	0.00	0.00	0.00
23.10	2.00	0.00	0.00	0.00	0.00	23.12	2.00	0.00	0.00	0.00	0.00
23.14	2.00	0.00	0.00	0.00	0.00	23.16	2.00	0.00	0.00	0.00	0.00
23.18	2.00	0.00	0.00	0.00	0.00	23.20	2.00	0.00	0.00	0.00	0.00
23.22	2.00	0.00	0.00	0.00	0.00	23.24	2.00	0.00	0.00	0.00	0.00
23.26	2.00	0.00	0.00	0.00	0.00	23.28	2.00	0.00	0.00	0.00	0.00
23.30	2.00	0.00	0.00	0.00	0.00	23.32	2.00	0.00	0.00	0.00	0.00
23.34	2.00	0.00	0.00	0.00	0.00	23.36	2.00	0.00	0.00	0.00	0.00
23.38	2.00	0.00	0.00	0.00	0.00	23.40	2.00	0.00	0.00	0.00	0.00
23.42	2.00	0.00	0.00	0.00	0.00	23.44	2.00	0.00	0.00	0.00	0.00
23.46	2.00	0.00	0.00	0.00	0.00	23.48	2.00	0.00	0.00	0.00	0.00
23.50	2.00	0.00	0.00	0.00	0.00	23.52	2.00	0.00	0.00	0.00	0.00
23.54	2.00	0.00	0.00	0.00	0.00	23.56	2.00	0.00	0.00	0.00	0.00
23.58	2.00	0.00	0.00	0.00	0.00	23.60	2.00	0.00	0.00	0.00	0.00
23.62	2.00	0.00	0.00	0.00	0.00	23.64	2.00	0.00	0.00	0.00	0.00
23.66	2.00	0.00	0.00	0.00	0.00	23.68	2.00	0.00	0.00	0.00	0.00
23.70	2.00	0.00	0.00	0.00	0.00	23.72	2.00	0.00	0.00	0.00	0.00
23.74	2.00	0.00	0.00	0.00	0.00	23.76	2.00	0.00	0.00	0.00	0.00
23.78	2.00	0.00	0.00	0.00	0.00	23.80	2.00	0.00	0.00	0.00	0.00
23.82	2.00	0.00	0.00	0.00	0.00	23.84	2.00	0.00	0.00	0.00	0.00
23.86	2.00	0.00	0.00	0.00	0.00	23.88	2.00	0.00	0.00	0.00	0.00
23.90	2.00	0.00	0.00	0.00	0.00	23.92	2.00	0.00	0.00	0.00	0.00
23.94	2.00	0.00	0.00	0.00	0.00	23.96	2.00	0.00	0.00	0.00	0.00
23.98	2.00	0.00	0.00	0.00	0.00	24.00	2.00	0.00	0.00	0.00	0.00
24.02	2.00	0.00	0.00	0.00	0.00	24.04	2.00	0.00	0.00	0.00	0.00
24.06	2.00	0.00	0.00	0.00	0.00	24.08	2.00	0.00	0.00	0.00	0.00
24.10	2.00	0.00	0.00	0.00	0.00	24.12	2.00	0.00	0.00	0.00	0.00
24.14	2.00	0.00	0.00	0.00	0.00	24.16	2.00	0.00	0.00	0.00	0.00
24.18	2.00	0.00	0.00	0.00	0.00	24.20	2.00	0.00	0.00	0.00	0.00
24.22	2.00	0.00	0.00	0.00	0.00	24.24	2.00	0.00	0.00	0.00	0.00
24.26	2.00	0.00	0.00	0.00	0.00	24.28	2.00	0.00	0.00	0.00	0.00
24.30	2.00	0.00	0.00	0.00	0.00	24.32	2.00	0.00	0.00	0.00	0.00
24.34	2.00	0.00	0.00	0.00	0.00	24.36	2.00	0.00	0.00	0.00	0.00
24.38	2.00	0.00	0.00	0.00	0.00	24.40	2.00	0.00	0.00	0.00	0.00
24.42	2.00	0.00	0.00	0.00	0.00	24.44	2.00	0.00	0.00	0.00	0.00
24.46	2.00	0.00	0.00	0.00	0.00	24.48	2.00	0.00	0.00	0.00	0.00
24.50	2.00	0.00	0.00	0.00	0.00	24.52	2.00	0.00	0.00	0.00	0.00
24.54	2.00	0.00	0.00	0.00	0.00	24.56	2.00	0.00	0.00	0.00	0.00
24.58	2.00	0.00	0.00	0.00	0.00	24.60	2.00	0.00	0.00	0.00	0.00
24.62	2.00	0.00	0.00	0.00	0.00	24.64	2.00	0.00	0.00	0.00	0.00
24.66	2.00	0.00	0.00	0.00	0.00	24.68	2.00	0.00	0.00	0.00	0.00
24.70	2.00	0.00	0.00	0.00	0.00	24.72	2.00	0.00	0.00	0.00	0.00
24.74	2.00	0.00	0.00	0.00	0.00	24.76	2.00	0.00	0.00	0.00	0.00
24.78	2.00	0.00	0.00	0.00	0.00	24.80	2.00	0.00	0.00	0.00	0.00
24.82	2.00	0.00	0.00	0.00	0.00	24.84	2.00	0.00	0.00	0.00	0.00
24.86	2.00	0.00	0.00	0.00	0.00	24.88	2.00	0.00	0.00	0.00	0.00
24.90	2.00	0.00	0.00	0.00	0.00	24.92	2.00	0.00	0.00	0.00	0.00
24.94	2.00	0.00	0.00	0.00	0.00	24.96	2.00	0.00	0.00	0.00	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
24.98	2.00	0.00	0.00	0.00	0.00	25.00	2.00	0.00	0.00	0.00	0.00
25.02	2.00	0.00	0.00	0.00	0.00	25.04	2.00	0.00	0.00	0.00	0.00
25.06	2.00	0.00	0.00	0.00	0.00	25.08	2.00	0.00	0.00	0.00	0.00
25.10	2.00	0.00	0.00	0.00	0.00	25.12	2.00	0.00	0.00	0.00	0.00
25.14	2.00	0.00	0.00	0.00	0.00	25.16	2.00	0.00	0.00	0.00	0.00
25.18	2.00	0.00	0.00	0.00	0.00	25.20	2.00	0.00	0.00	0.00	0.00
25.22	2.00	0.00	0.00	0.00	0.00	25.24	2.00	0.00	0.00	0.00	0.00
25.26	2.00	0.00	0.00	0.00	0.00	25.28	2.00	0.00	0.00	0.00	0.00
25.30	2.00	0.00	0.00	0.00	0.00	25.32	2.00	0.00	0.00	0.00	0.00
25.34	2.00	0.00	0.00	0.00	0.00	25.36	2.00	0.00	0.00	0.00	0.00
25.38	2.00	0.00	0.00	0.00	0.00	25.40	2.00	0.00	0.00	0.00	0.00
25.42	2.00	0.00	0.00	0.00	0.00	25.44	2.00	0.00	0.00	0.00	0.00
25.46	2.00	0.00	0.00	0.00	0.00	25.48	2.00	0.00	0.00	0.00	0.00
25.50	2.00	0.00	0.00	0.00	0.00	25.52	2.00	0.00	0.00	0.00	0.00
25.54	2.00	0.00	0.00	0.00	0.00	25.56	2.00	0.00	0.00	0.00	0.00
25.58	2.00	0.00	0.00	0.00	0.00	25.60	2.00	0.00	0.00	0.00	0.00
25.62	2.00	0.00	0.00	0.00	0.00	25.64	2.00	0.00	0.00	0.00	0.00
25.66	2.00	0.00	0.00	0.00	0.00	25.68	2.00	0.00	0.00	0.00	0.00
25.70	2.00	0.00	0.00	0.00	0.00	25.72	2.00	0.00	0.00	0.00	0.00
25.74	2.00	0.00	0.00	0.00	0.00	25.76	2.00	0.00	0.00	0.00	0.00
25.78	2.00	0.00	0.00	0.00	0.00	25.80	2.00	0.00	0.00	0.00	0.00
25.82	2.00	0.00	0.00	0.00	0.00	25.84	2.00	0.00	0.00	0.00	0.00
25.86	2.00	0.00	0.00	0.00	0.00	25.88	2.00	0.00	0.00	0.00	0.00
25.90	2.00	0.00	0.00	0.00	0.00	25.92	2.00	0.00	0.00	0.00	0.00
25.94	2.00	0.00	0.00	0.00	0.00	25.96	2.00	0.00	0.00	0.00	0.00
25.98	2.00	0.00	0.00	0.00	0.00	26.00	2.00	0.00	0.00	0.00	0.00
26.02	2.00	0.00	0.00	0.00	0.00	26.04	2.00	0.00	0.00	0.00	0.00
26.06	2.00	0.00	0.00	0.00	0.00	26.08	2.00	0.00	0.00	0.00	0.00
26.10	2.00	0.00	0.00	0.00	0.00	26.12	2.00	0.00	0.00	0.00	0.00
26.14	2.00	0.00	0.00	0.00	0.00	26.16	2.00	0.00	0.00	0.00	0.00
26.18	2.00	0.00	0.00	0.00	0.00	26.20	2.00	0.00	0.00	0.00	0.00
26.22	2.00	0.00	0.00	0.00	0.00	26.24	2.00	0.00	0.00	0.00	0.00
26.26	2.00	0.00	0.00	0.00	0.00	26.28	2.00	0.00	0.00	0.00	0.00
26.30	2.00	0.00	0.00	0.00	0.00	26.32	2.00	0.00	0.00	0.00	0.00
26.34	2.00	0.00	0.00	0.00	0.00	26.36	2.00	0.00	0.00	0.00	0.00
26.38	2.00	0.00	0.00	0.00	0.00	26.40	2.00	0.00	0.00	0.00	0.00
26.42	2.00	0.00	0.00	0.00	0.00	26.44	2.00	0.00	0.00	0.00	0.00
26.46	2.00	0.00	0.00	0.00	0.00	26.48	2.00	0.00	0.00	0.00	0.00
26.50	2.00	0.00	0.00	0.00	0.00	26.52	2.00	0.00	0.00	0.00	0.00
26.54	2.00	0.00	0.00	0.00	0.00	26.56	2.00	0.00	0.00	0.00	0.00
26.58	2.00	0.00	0.00	0.00	0.00	26.60	2.00	0.00	0.00	0.00	0.00
26.62	2.00	0.00	0.00	0.00	0.00	26.64	2.00	0.00	0.00	0.00	0.00
26.66	2.00	0.00	0.00	0.00	0.00	26.68	2.00	0.00	0.00	0.00	0.00
26.70	2.00	0.00	0.00	0.00	0.00	26.72	2.00	0.00	0.00	0.00	0.00
26.74	2.00	0.00	0.00	0.00	0.00	26.76	2.00	0.00	0.00	0.00	0.00
26.78	2.00	0.00	0.00	0.00	0.00	26.80	2.00	0.00	0.00	0.00	0.00
26.82	2.00	0.00	0.00	0.00	0.00	26.84	2.00	0.00	0.00	0.00	0.00
26.86	2.00	0.00	0.00	0.00	0.00	26.88	2.00	0.00	0.00	0.00	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
26.90	2.00	0.00	0.00	0.00	0.00	26.92	2.00	0.00	0.00	0.00	0.00
26.94	2.00	0.00	0.00	0.00	0.00	26.96	2.00	0.00	0.00	0.00	0.00
26.98	2.00	0.00	0.00	0.00	0.00	27.00	2.00	0.00	0.00	0.00	0.00
27.02	2.00	0.00	0.00	0.00	0.00	27.04	2.00	0.00	0.00	0.00	0.00
27.06	2.00	0.00	0.00	0.00	0.00	27.08	2.00	0.00	0.00	0.00	0.00
27.10	2.00	0.00	0.00	0.00	0.00	27.12	2.00	0.00	0.00	0.00	0.00
27.14	2.00	0.00	0.00	0.00	0.00	27.16	2.00	0.00	0.00	0.00	0.00
27.18	2.00	0.00	0.00	0.00	0.00	27.20	2.00	0.00	0.00	0.00	0.00
27.22	2.00	0.00	0.00	0.00	0.00	27.24	2.00	0.00	0.00	0.00	0.00
27.26	2.00	0.00	0.00	0.00	0.00	27.28	2.00	0.00	0.00	0.00	0.00
27.30	2.00	0.00	0.00	0.00	0.00	27.32	2.00	0.00	0.00	0.00	0.00
27.34	2.00	0.00	0.00	0.00	0.00	27.36	2.00	0.00	0.00	0.00	0.00
27.38	2.00	0.00	0.00	0.00	0.00	27.40	2.00	0.00	0.00	0.00	0.00
27.42	2.00	0.00	0.00	0.00	0.00	27.44	2.00	0.00	0.00	0.00	0.00
27.46	2.00	0.00	0.00	0.00	0.00	27.48	2.00	0.00	0.00	0.00	0.00
27.50	2.00	0.00	0.00	0.00	0.00	27.52	2.00	0.00	0.00	0.00	0.00
27.54	2.00	0.00	0.00	0.00	0.00	27.56	2.00	0.00	0.00	0.00	0.00
27.58	2.00	0.00	0.00	0.00	0.00	27.60	2.00	0.00	0.00	0.00	0.00
27.62	2.00	0.00	0.00	0.00	0.00	27.64	2.00	0.00	0.00	0.00	0.00
27.66	2.00	0.00	0.00	0.00	0.00	27.68	2.00	0.00	0.00	0.00	0.00
27.70	2.00	0.00	0.00	0.00	0.00	27.72	2.00	0.00	0.00	0.00	0.00
27.74	2.00	0.00	0.00	0.00	0.00	27.76	2.00	0.00	0.00	0.00	0.00
27.78	2.00	0.00	0.00	0.00	0.00	27.80	2.00	0.00	0.00	0.00	0.00
27.82	2.00	0.00	0.00	0.00	0.00	27.84	2.00	0.00	0.00	0.00	0.00
27.86	2.00	0.00	0.00	0.00	0.00	27.88	2.00	0.00	0.00	0.00	0.00
27.90	2.00	0.00	0.00	0.00	0.00	27.92	2.00	0.00	0.00	0.00	0.00
27.94	2.00	0.00	0.00	0.00	0.00	27.96	2.00	0.00	0.00	0.00	0.00
27.98	2.00	0.00	0.00	0.00	0.00	28.00	2.00	0.00	0.00	0.00	0.00
28.02	2.00	0.00	0.00	0.00	0.00	28.04	2.00	0.00	0.00	0.00	0.00
28.06	2.00	0.00	0.00	0.00	0.00	28.08	2.00	0.00	0.00	0.00	0.00
28.10	2.00	0.00	0.00	0.00	0.00	28.12	2.00	0.00	0.00	0.00	0.00
28.14	2.00	0.00	0.00	0.00	0.00	28.16	2.00	0.00	0.00	0.00	0.00
28.18	2.00	0.00	0.00	0.00	0.00	28.20	2.00	0.00	0.00	0.00	0.00
28.22	2.00	0.00	0.00	0.00	0.00	28.24	2.00	0.00	0.00	0.00	0.00
28.26	2.00	0.00	0.00	0.00	0.00	28.28	2.00	0.00	0.00	0.00	0.00
28.30	2.00	0.00	0.00	0.00	0.00	28.32	2.00	0.00	0.00	0.00	0.00
28.34	2.00	0.00	0.00	0.00	0.00	28.36	2.00	0.00	0.00	0.00	0.00
28.38	2.00	0.00	0.00	0.00	0.00	28.40	2.00	0.00	0.00	0.00	0.00
28.42	2.00	0.00	0.00	0.00	0.00	28.44	2.00	0.00	0.00	0.00	0.00
28.46	2.00	0.00	0.00	0.00	0.00	28.48	2.00	0.00	0.00	0.00	0.00
28.50	2.00	0.00	0.00	0.00	0.00	28.52	2.00	0.00	0.00	0.00	0.00
28.54	2.00	0.00	0.00	0.00	0.00	28.56	2.00	0.00	0.00	0.00	0.00
28.58	2.00	0.00	0.00	0.00	0.00	28.60	2.00	0.00	0.00	0.00	0.00
28.62	2.00	0.00	0.00	0.00	0.00	28.64	2.00	0.00	0.00	0.00	0.00
28.66	2.00	0.00	0.00	0.00	0.00	28.68	2.00	0.00	0.00	0.00	0.00
28.70	2.00	0.00	0.00	0.00	0.00	28.72	2.00	0.00	0.00	0.00	0.00
28.74	2.00	0.00	0.00	0.00	0.00	28.76	2.00	0.00	0.00	0.00	0.00
28.78	2.00	0.00	0.00	0.00	0.00	28.80	2.00	0.00	0.00	0.00	0.00

:: Liquefaction Potential Index calculation data :: (continued)											
Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
28.82	2.00	0.00	0.00	0.00	0.00	28.84	2.00	0.00	0.00	0.00	0.00
28.86	2.00	0.00	0.00	0.00	0.00	28.88	2.00	0.00	0.00	0.00	0.00
28.90	2.00	0.00	0.00	0.00	0.00	28.92	2.00	0.00	0.00	0.00	0.00
28.94	2.00	0.00	0.00	0.00	0.00	28.96	2.00	0.00	0.00	0.00	0.00
28.98	2.00	0.00	0.00	0.00	0.00	29.00	2.00	0.00	0.00	0.00	0.00
29.02	2.00	0.00	0.00	0.00	0.00	29.04	2.00	0.00	0.00	0.00	0.00
29.06	2.00	0.00	0.00	0.00	0.00	29.08	2.00	0.00	0.00	0.00	0.00
29.10	2.00	0.00	0.00	0.00	0.00	29.12	2.00	0.00	0.00	0.00	0.00
29.14	2.00	0.00	0.00	0.00	0.00	29.16	2.00	0.00	0.00	0.00	0.00
29.18	2.00	0.00	0.00	0.00	0.00	29.20	2.00	0.00	0.00	0.00	0.00
29.22	2.00	0.00	0.00	0.00	0.00	29.24	2.00	0.00	0.00	0.00	0.00
29.26	2.00	0.00	0.00	0.00	0.00	29.28	2.00	0.00	0.00	0.00	0.00
29.30	2.00	0.00	0.00	0.00	0.00	29.32	2.00	0.00	0.00	0.00	0.00
29.34	2.00	0.00	0.00	0.00	0.00	29.36	2.00	0.00	0.00	0.00	0.00
29.38	2.00	0.00	0.00	0.00	0.00	29.40	2.00	0.00	0.00	0.00	0.00
29.42	2.00	0.00	0.00	0.00	0.00	29.44	2.00	0.00	0.00	0.00	0.00
29.46	2.00	0.00	0.00	0.00	0.00	29.48	2.00	0.00	0.00	0.00	0.00
29.50	2.00	0.00	0.00	0.00	0.00	29.52	2.00	0.00	0.00	0.00	0.00
29.54	2.00	0.00	0.00	0.00	0.00	29.56	2.00	0.00	0.00	0.00	0.00
29.58	2.00	0.00	0.00	0.00	0.00	29.60	2.00	0.00	0.00	0.00	0.00
29.62	2.00	0.00	0.00	0.00	0.00	29.64	2.00	0.00	0.00	0.00	0.00
29.66	2.00	0.00	0.00	0.00	0.00	29.68	2.00	0.00	0.00	0.00	0.00
29.70	2.00	0.00	0.00	0.00	0.00	29.72	2.00	0.00	0.00	0.00	0.00
29.74	2.00	0.00	0.00	0.00	0.00	29.76	2.00	0.00	0.00	0.00	0.00
29.78	2.00	0.00	0.00	0.00	0.00	29.80	2.00	0.00	0.00	0.00	0.00
29.82	2.00	0.00	0.00	0.00	0.00	29.84	2.00	0.00	0.00	0.00	0.00
29.86	2.00	0.00	0.00	0.00	0.00	29.88	2.00	0.00	0.00	0.00	0.00
29.90	2.00	0.00	0.00	0.00	0.00	29.92	2.00	0.00	0.00	0.00	0.00
29.94	2.00	0.00	0.00	0.00	0.00	29.96	2.00	0.00	0.00	0.00	0.00
29.98	2.00	0.00	0.00	0.00	0.00	30.00	2.00	0.00	0.00	0.00	0.00
30.02	2.00	0.00	0.00	0.00	0.00	30.04	2.00	0.00	0.00	0.00	0.00
30.06	2.00	0.00	0.00	0.00	0.00	30.08	2.00	0.00	0.00	0.00	0.00
30.10	2.00	0.00	0.00	0.00	0.00	30.12	2.00	0.00	0.00	0.00	0.00
30.14	2.00	0.00	0.00	0.00	0.00	30.16	2.00	0.00	0.00	0.00	0.00
30.18	2.00	0.00	0.00	0.00	0.00	30.20	2.00	0.00	0.00	0.00	0.00
30.22	2.00	0.00	0.00	0.00	0.00	30.24	2.00	0.00	0.00	0.00	0.00
30.26	2.00	0.00	0.00	0.00	0.00	30.28	2.00	0.00	0.00	0.00	0.00
30.30	2.00	0.00	0.00	0.00	0.00	30.32	2.00	0.00	0.00	0.00	0.00
30.34	2.00	0.00	0.00	0.00	0.00	30.36	2.00	0.00	0.00	0.00	0.00
30.38	2.00	0.00	0.00	0.00	0.00	30.40	2.00	0.00	0.00	0.00	0.00
30.42	2.00	0.00	0.00	0.00	0.00	30.44	2.00	0.00	0.00	0.00	0.00
30.46	2.00	0.00	0.00	0.00	0.00	30.48	2.00	0.00	0.00	0.00	0.00
30.50	2.00	0.00	0.00	0.00	0.00	30.52	2.00	0.00	0.00	0.00	0.00
30.54	2.00	0.00	0.00	0.00	0.00	30.56	2.00	0.00	0.00	0.00	0.00
30.58	2.00	0.00	0.00	0.00	0.00	30.60	2.00	0.00	0.00	0.00	0.00
30.62	2.00	0.00	0.00	0.00	0.00	30.64	2.00	0.00	0.00	0.00	0.00
30.66	2.00	0.00	0.00	0.00	0.00	30.68	2.00	0.00	0.00	0.00	0.00
30.70	2.00	0.00	0.00	0.00	0.00	30.72	2.00	0.00	0.00	0.00	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (m)	FS	F _L	w _z	d _z	LPI	Depth (m)	FS	F _L	w _z	d _z	LPI
30.74	2.00	0.00	0.00	0.00	0.00	30.76	2.00	0.00	0.00	0.00	0.00
30.78	2.00	0.00	0.00	0.00	0.00	30.80	2.00	0.00	0.00	0.00	0.00
30.82	2.00	0.00	0.00	0.00	0.00	30.84	2.00	0.00	0.00	0.00	0.00
30.86	2.00	0.00	0.00	0.00	0.00	30.88	2.00	0.00	0.00	0.00	0.00
30.90	2.00	0.00	0.00	0.00	0.00	30.92	2.00	0.00	0.00	0.00	0.00
30.94	2.00	0.00	0.00	0.00	0.00	30.96	2.00	0.00	0.00	0.00	0.00
30.98	2.00	0.00	0.00	0.00	0.00	31.00	2.00	0.00	0.00	0.00	0.00

Overall liquefaction potential: 1.09

LPI = 0.00 - Liquefaction risk very low

LPI between 0.00 and 5.00 - Liquefaction risk low

LPI between 5.00 and 15.00 - Liquefaction risk high

LPI > 15.00 - Liquefaction risk very high

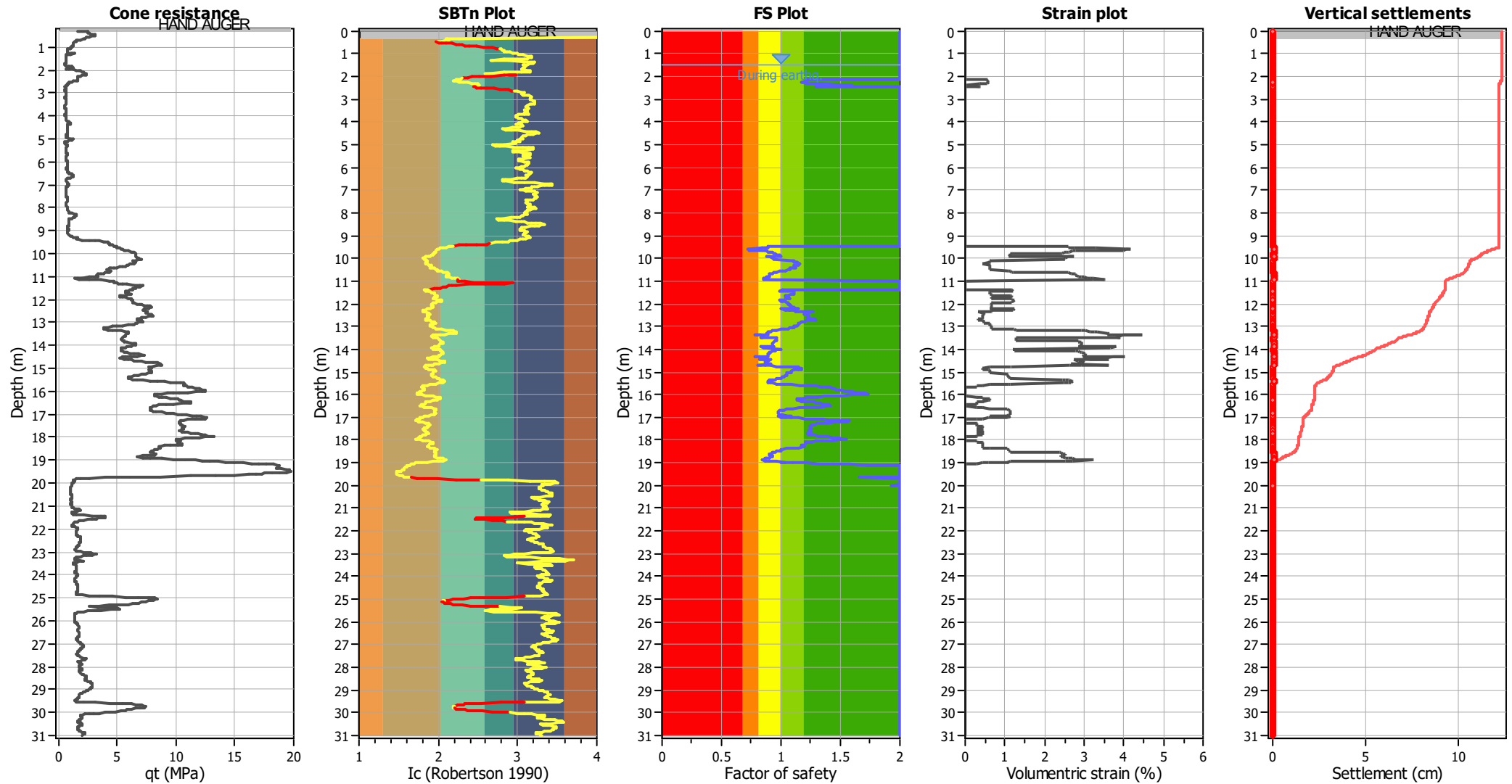
Abbreviations

FS: Calculated factor of safety for test point

F_L: 1 - FSw_z: Function value of the extend of soil liquefaction according to depthd_z: Layer thickness (m)

LPI: Liquefaction potential index value for test point

Estimation of post-earthquake settlements



Abbreviations

q_t : Total cone resistance (cone resistance q_c corrected for pore water effects)
 I_c : Soil Behaviour Type Index
 FS: Calculated Factor of Safety against liquefaction
 Volumetric strain: Post-liquefaction volumetric strain

:: Post-earthquake settlement due to soil liquefaction ::											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
1.50	78.67	2.00	0.00	1.00	0.00	1.52	78.88	2.00	0.00	1.00	0.00
1.54	78.69	2.00	0.00	1.00	0.00	1.56	78.05	2.00	0.00	1.00	0.00
1.58	77.01	2.00	0.00	1.00	0.00	1.60	76.12	2.00	0.00	1.00	0.00
1.62	75.04	2.00	0.00	1.00	0.00	1.64	74.26	2.00	0.00	1.00	0.00
1.66	73.71	2.00	0.00	1.00	0.00	1.68	73.00	2.00	0.00	1.00	0.00
1.70	72.91	2.00	0.00	1.00	0.00	1.72	73.10	2.00	0.00	1.00	0.00
1.74	73.59	2.00	0.00	1.00	0.00	1.76	73.90	2.00	0.00	1.00	0.00
1.78	73.91	2.00	0.00	1.00	0.00	1.80	73.78	2.00	0.00	1.00	0.00
1.82	74.07	2.00	0.00	1.00	0.00	1.84	73.28	2.00	0.00	1.00	0.00
1.86	138.77	2.00	0.00	1.00	0.00	1.88	99.79	2.00	0.00	1.00	0.00
1.90	64.46	2.00	0.00	1.00	0.00	1.92	67.73	2.00	0.00	1.00	0.00
1.94	70.77	2.00	0.00	1.00	0.00	1.96	72.20	2.00	0.00	1.00	0.00
1.98	154.70	2.00	0.00	1.00	0.00	2.00	81.64	2.00	0.00	1.00	0.00
2.02	70.87	2.00	0.00	1.00	0.00	2.04	69.40	2.00	0.00	1.00	0.00
2.06	67.60	2.00	0.00	1.00	0.00	2.08	66.61	2.00	0.00	1.00	0.00
2.10	65.67	2.00	0.00	1.00	0.00	2.12	65.16	1.23	0.54	1.00	0.01
2.14	64.84	1.23	0.55	1.00	0.01	2.16	64.69	1.22	0.55	1.00	0.01
2.18	64.68	1.22	0.55	1.00	0.01	2.20	64.26	1.22	0.55	1.00	0.01
2.22	63.18	1.21	0.56	1.00	0.01	2.24	61.25	1.18	0.57	1.00	0.01
2.26	60.35	1.17	0.57	1.00	0.01	2.28	61.02	1.18	0.57	1.00	0.01
2.30	63.42	1.21	0.55	1.00	0.01	2.32	67.89	1.28	0.38	1.00	0.01
2.34	72.13	1.35	0.36	1.00	0.01	2.36	81.16	1.52	0.00	1.00	0.00
2.38	84.26	1.59	0.00	1.00	0.00	2.40	75.78	1.42	0.00	1.00	0.00
2.42	71.69	1.34	0.37	1.00	0.01	2.44	68.31	1.29	0.38	1.00	0.01
2.46	65.52	2.00	0.00	1.00	0.00	2.48	63.13	2.00	0.00	1.00	0.00
2.50	72.50	2.00	0.00	1.00	0.00	2.52	107.97	2.00	0.00	1.00	0.00
2.54	66.12	2.00	0.00	1.00	0.00	2.56	68.16	2.00	0.00	1.00	0.00
2.58	68.83	2.00	0.00	1.00	0.00	2.60	69.65	2.00	0.00	1.00	0.00
2.62	70.70	2.00	0.00	1.00	0.00	2.64	71.16	2.00	0.00	1.00	0.00
2.66	70.89	2.00	0.00	1.00	0.00	2.68	70.13	2.00	0.00	1.00	0.00
2.70	69.13	2.00	0.00	1.00	0.00	2.72	67.53	2.00	0.00	1.00	0.00
2.74	66.18	2.00	0.00	1.00	0.00	2.76	65.92	2.00	0.00	1.00	0.00
2.78	67.04	2.00	0.00	1.00	0.00	2.80	68.75	2.00	0.00	1.00	0.00
2.82	69.82	2.00	0.00	1.00	0.00	2.84	71.13	2.00	0.00	1.00	0.00
2.86	72.75	2.00	0.00	1.00	0.00	2.88	74.66	2.00	0.00	1.00	0.00
2.90	75.76	2.00	0.00	1.00	0.00	2.92	76.25	2.00	0.00	1.00	0.00
2.94	76.39	2.00	0.00	1.00	0.00	2.96	76.66	2.00	0.00	1.00	0.00
2.98	76.70	2.00	0.00	1.00	0.00	3.00	78.84	2.00	0.00	1.00	0.00
3.02	81.44	2.00	0.00	1.00	0.00	3.04	84.34	2.00	0.00	1.00	0.00
3.06	85.33	2.00	0.00	1.00	0.00	3.08	85.71	2.00	0.00	1.00	0.00
3.10	85.13	2.00	0.00	1.00	0.00	3.12	83.46	2.00	0.00	1.00	0.00
3.14	80.88	2.00	0.00	1.00	0.00	3.16	78.16	2.00	0.00	1.00	0.00
3.18	75.89	2.00	0.00	1.00	0.00	3.20	74.01	2.00	0.00	1.00	0.00
3.22	72.87	2.00	0.00	1.00	0.00	3.24	72.30	2.00	0.00	1.00	0.00
3.26	72.30	2.00	0.00	1.00	0.00	3.28	72.47	2.00	0.00	1.00	0.00
3.30	72.69	2.00	0.00	1.00	0.00	3.32	72.46	2.00	0.00	1.00	0.00
3.34	72.07	2.00	0.00	1.00	0.00	3.36	71.90	2.00	0.00	1.00	0.00
3.38	71.49	2.00	0.00	1.00	0.00	3.40	71.11	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
3.42	70.65	2.00	0.00	1.00	0.00	3.44	70.46	2.00	0.00	1.00	0.00
3.46	69.94	2.00	0.00	1.00	0.00	3.48	69.14	2.00	0.00	1.00	0.00
3.50	68.46	2.00	0.00	1.00	0.00	3.52	67.58	2.00	0.00	1.00	0.00
3.54	66.16	2.00	0.00	1.00	0.00	3.56	64.76	2.00	0.00	1.00	0.00
3.58	64.06	2.00	0.00	1.00	0.00	3.60	64.55	2.00	0.00	1.00	0.00
3.62	64.95	2.00	0.00	1.00	0.00	3.64	64.62	2.00	0.00	1.00	0.00
3.66	63.17	2.00	0.00	1.00	0.00	3.68	62.12	2.00	0.00	1.00	0.00
3.70	62.02	2.00	0.00	1.00	0.00	3.72	62.40	2.00	0.00	1.00	0.00
3.74	62.47	2.00	0.00	1.00	0.00	3.76	62.16	2.00	0.00	1.00	0.00
3.78	61.73	2.00	0.00	1.00	0.00	3.80	60.71	2.00	0.00	1.00	0.00
3.82	60.26	2.00	0.00	1.00	0.00	3.84	61.28	2.00	0.00	1.00	0.00
3.86	63.38	2.00	0.00	1.00	0.00	3.88	64.15	2.00	0.00	1.00	0.00
3.90	64.46	2.00	0.00	1.00	0.00	3.92	64.41	2.00	0.00	1.00	0.00
3.94	65.60	2.00	0.00	1.00	0.00	3.96	66.79	2.00	0.00	1.00	0.00
3.98	66.94	2.00	0.00	1.00	0.00	4.00	66.87	2.00	0.00	1.00	0.00
4.02	66.37	2.00	0.00	1.00	0.00	4.04	66.44	2.00	0.00	1.00	0.00
4.06	65.89	2.00	0.00	1.00	0.00	4.08	64.54	2.00	0.00	1.00	0.00
4.10	63.69	2.00	0.00	1.00	0.00	4.12	64.60	2.00	0.00	1.00	0.00
4.14	67.52	2.00	0.00	1.00	0.00	4.16	70.67	2.00	0.00	1.00	0.00
4.18	72.79	2.00	0.00	1.00	0.00	4.20	73.96	2.00	0.00	1.00	0.00
4.22	75.42	2.00	0.00	1.00	0.00	4.24	76.77	2.00	0.00	1.00	0.00
4.26	77.51	2.00	0.00	1.00	0.00	4.28	77.36	2.00	0.00	1.00	0.00
4.30	77.09	2.00	0.00	1.00	0.00	4.32	78.28	2.00	0.00	1.00	0.00
4.34	80.94	2.00	0.00	1.00	0.00	4.36	86.20	2.00	0.00	1.00	0.00
4.38	92.42	2.00	0.00	1.00	0.00	4.40	97.87	2.00	0.00	1.00	0.00
4.42	101.69	2.00	0.00	1.00	0.00	4.44	104.50	2.00	0.00	1.00	0.00
4.46	107.05	2.00	0.00	1.00	0.00	4.48	108.02	2.00	0.00	1.00	0.00
4.50	106.72	2.00	0.00	1.00	0.00	4.52	102.59	2.00	0.00	1.00	0.00
4.54	96.98	2.00	0.00	1.00	0.00	4.56	91.57	2.00	0.00	1.00	0.00
4.58	87.41	2.00	0.00	1.00	0.00	4.60	85.13	2.00	0.00	1.00	0.00
4.62	84.11	2.00	0.00	1.00	0.00	4.64	83.71	2.00	0.00	1.00	0.00
4.66	83.20	2.00	0.00	1.00	0.00	4.68	83.21	2.00	0.00	1.00	0.00
4.70	82.91	2.00	0.00	1.00	0.00	4.72	82.29	2.00	0.00	1.00	0.00
4.74	80.90	2.00	0.00	1.00	0.00	4.76	79.68	2.00	0.00	1.00	0.00
4.78	78.64	2.00	0.00	1.00	0.00	4.80	77.77	2.00	0.00	1.00	0.00
4.82	76.13	2.00	0.00	1.00	0.00	4.84	73.15	2.00	0.00	1.00	0.00
4.86	68.97	2.00	0.00	1.00	0.00	4.88	65.09	2.00	0.00	1.00	0.00
4.90	62.75	2.00	0.00	1.00	0.00	4.92	63.13	2.00	0.00	1.00	0.00
4.94	64.55	2.00	0.00	1.00	0.00	4.96	66.60	2.00	0.00	1.00	0.00
4.98	67.22	2.00	0.00	1.00	0.00	5.00	69.75	2.00	0.00	1.00	0.00
5.02	166.44	2.00	0.00	1.00	0.00	5.04	75.48	2.00	0.00	1.00	0.00
5.06	76.09	2.00	0.00	1.00	0.00	5.08	74.95	2.00	0.00	1.00	0.00
5.10	71.68	2.00	0.00	1.00	0.00	5.12	68.24	2.00	0.00	1.00	0.00
5.14	65.07	2.00	0.00	1.00	0.00	5.16	63.37	2.00	0.00	1.00	0.00
5.18	62.56	2.00	0.00	1.00	0.00	5.20	63.18	2.00	0.00	1.00	0.00
5.22	63.95	2.00	0.00	1.00	0.00	5.24	63.88	2.00	0.00	1.00	0.00
5.26	63.37	2.00	0.00	1.00	0.00	5.28	63.30	2.00	0.00	1.00	0.00
5.30	65.14	2.00	0.00	1.00	0.00	5.32	68.13	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
5.34	71.53	2.00	0.00	1.00	0.00	5.36	74.02	2.00	0.00	1.00	0.00
5.38	75.79	2.00	0.00	1.00	0.00	5.40	76.64	2.00	0.00	1.00	0.00
5.42	76.41	2.00	0.00	1.00	0.00	5.44	74.50	2.00	0.00	1.00	0.00
5.46	71.86	2.00	0.00	1.00	0.00	5.48	69.74	2.00	0.00	1.00	0.00
5.50	69.37	2.00	0.00	1.00	0.00	5.52	69.58	2.00	0.00	1.00	0.00
5.54	70.52	2.00	0.00	1.00	0.00	5.56	71.70	2.00	0.00	1.00	0.00
5.58	72.61	2.00	0.00	1.00	0.00	5.60	73.23	2.00	0.00	1.00	0.00
5.62	72.47	2.00	0.00	1.00	0.00	5.64	71.57	2.00	0.00	1.00	0.00
5.66	70.52	2.00	0.00	1.00	0.00	5.68	70.20	2.00	0.00	1.00	0.00
5.70	70.90	2.00	0.00	1.00	0.00	5.72	72.38	2.00	0.00	1.00	0.00
5.74	74.94	2.00	0.00	1.00	0.00	5.76	77.57	2.00	0.00	1.00	0.00
5.78	79.69	2.00	0.00	1.00	0.00	5.80	80.18	2.00	0.00	1.00	0.00
5.82	79.57	2.00	0.00	1.00	0.00	5.84	78.18	2.00	0.00	1.00	0.00
5.86	76.83	2.00	0.00	1.00	0.00	5.88	75.48	2.00	0.00	1.00	0.00
5.90	74.05	2.00	0.00	1.00	0.00	5.92	72.79	2.00	0.00	1.00	0.00
5.94	72.62	2.00	0.00	1.00	0.00	5.96	73.56	2.00	0.00	1.00	0.00
5.98	74.55	2.00	0.00	1.00	0.00	6.00	75.20	2.00	0.00	1.00	0.00
6.02	76.19	2.00	0.00	1.00	0.00	6.04	78.89	2.00	0.00	1.00	0.00
6.06	82.10	2.00	0.00	1.00	0.00	6.08	84.72	2.00	0.00	1.00	0.00
6.10	86.46	2.00	0.00	1.00	0.00	6.12	87.69	2.00	0.00	1.00	0.00
6.14	88.68	2.00	0.00	1.00	0.00	6.16	89.23	2.00	0.00	1.00	0.00
6.18	89.34	2.00	0.00	1.00	0.00	6.20	88.95	2.00	0.00	1.00	0.00
6.22	88.16	2.00	0.00	1.00	0.00	6.24	87.15	2.00	0.00	1.00	0.00
6.26	86.18	2.00	0.00	1.00	0.00	6.28	85.02	2.00	0.00	1.00	0.00
6.30	83.40	2.00	0.00	1.00	0.00	6.32	81.92	2.00	0.00	1.00	0.00
6.34	80.94	2.00	0.00	1.00	0.00	6.36	81.20	2.00	0.00	1.00	0.00
6.38	82.09	2.00	0.00	1.00	0.00	6.40	83.57	2.00	0.00	1.00	0.00
6.42	84.58	2.00	0.00	1.00	0.00	6.44	85.25	2.00	0.00	1.00	0.00
6.46	86.18	2.00	0.00	1.00	0.00	6.48	87.08	2.00	0.00	1.00	0.00
6.50	87.47	2.00	0.00	1.00	0.00	6.52	86.23	2.00	0.00	1.00	0.00
6.54	85.20	2.00	0.00	1.00	0.00	6.56	85.95	2.00	0.00	1.00	0.00
6.58	90.35	2.00	0.00	1.00	0.00	6.60	97.82	2.00	0.00	1.00	0.00
6.62	107.44	2.00	0.00	1.00	0.00	6.64	118.06	2.00	0.00	1.00	0.00
6.66	127.31	2.00	0.00	1.00	0.00	6.68	133.12	2.00	0.00	1.00	0.00
6.70	134.18	2.00	0.00	1.00	0.00	6.72	131.19	2.00	0.00	1.00	0.00
6.74	126.33	2.00	0.00	1.00	0.00	6.76	119.78	2.00	0.00	1.00	0.00
6.78	112.40	2.00	0.00	1.00	0.00	6.80	104.62	2.00	0.00	1.00	0.00
6.82	98.19	2.00	0.00	1.00	0.00	6.84	93.24	2.00	0.00	1.00	0.00
6.86	89.94	2.00	0.00	1.00	0.00	6.88	88.25	2.00	0.00	1.00	0.00
6.90	88.12	2.00	0.00	1.00	0.00	6.92	88.73	2.00	0.00	1.00	0.00
6.94	88.87	2.00	0.00	1.00	0.00	6.96	87.97	2.00	0.00	1.00	0.00
6.98	87.72	2.00	0.00	1.00	0.00	7.00	89.43	2.00	0.00	1.00	0.00
7.02	92.50	2.00	0.00	1.00	0.00	7.04	94.53	2.00	0.00	1.00	0.00
7.06	95.16	2.00	0.00	1.00	0.00	7.08	94.85	2.00	0.00	1.00	0.00
7.10	93.96	2.00	0.00	1.00	0.00	7.12	92.16	2.00	0.00	1.00	0.00
7.14	89.18	2.00	0.00	1.00	0.00	7.16	85.55	2.00	0.00	1.00	0.00
7.18	82.59	2.00	0.00	1.00	0.00	7.20	80.76	2.00	0.00	1.00	0.00
7.22	79.82	2.00	0.00	1.00	0.00	7.24	79.05	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
7.26	78.60	2.00	0.00	1.00	0.00	7.28	78.45	2.00	0.00	1.00	0.00
7.30	77.93	2.00	0.00	1.00	0.00	7.32	76.63	2.00	0.00	1.00	0.00
7.34	74.73	2.00	0.00	1.00	0.00	7.36	72.75	2.00	0.00	1.00	0.00
7.38	71.31	2.00	0.00	1.00	0.00	7.40	70.02	2.00	0.00	1.00	0.00
7.42	68.91	2.00	0.00	1.00	0.00	7.44	68.42	2.00	0.00	1.00	0.00
7.46	69.15	2.00	0.00	1.00	0.00	7.48	71.00	2.00	0.00	1.00	0.00
7.50	71.99	2.00	0.00	1.00	0.00	7.52	72.32	2.00	0.00	1.00	0.00
7.54	72.87	2.00	0.00	1.00	0.00	7.56	74.63	2.00	0.00	1.00	0.00
7.58	76.21	2.00	0.00	1.00	0.00	7.60	76.95	2.00	0.00	1.00	0.00
7.62	77.06	2.00	0.00	1.00	0.00	7.64	77.33	2.00	0.00	1.00	0.00
7.66	77.33	2.00	0.00	1.00	0.00	7.68	76.79	2.00	0.00	1.00	0.00
7.70	76.11	2.00	0.00	1.00	0.00	7.72	75.55	2.00	0.00	1.00	0.00
7.74	75.50	2.00	0.00	1.00	0.00	7.76	75.32	2.00	0.00	1.00	0.00
7.78	75.21	2.00	0.00	1.00	0.00	7.80	74.65	2.00	0.00	1.00	0.00
7.82	74.12	2.00	0.00	1.00	0.00	7.84	73.08	2.00	0.00	1.00	0.00
7.86	72.05	2.00	0.00	1.00	0.00	7.88	70.80	2.00	0.00	1.00	0.00
7.90	69.95	2.00	0.00	1.00	0.00	7.92	69.69	2.00	0.00	1.00	0.00
7.94	69.54	2.00	0.00	1.00	0.00	7.96	69.74	2.00	0.00	1.00	0.00
7.98	70.23	2.00	0.00	1.00	0.00	8.00	71.51	2.00	0.00	1.00	0.00
8.02	72.86	2.00	0.00	1.00	0.00	8.04	73.83	2.00	0.00	1.00	0.00
8.06	74.11	2.00	0.00	1.00	0.00	8.08	74.13	2.00	0.00	1.00	0.00
8.10	73.99	2.00	0.00	1.00	0.00	8.12	73.96	2.00	0.00	1.00	0.00
8.14	73.86	2.00	0.00	1.00	0.00	8.16	74.04	2.00	0.00	1.00	0.00
8.18	74.54	2.00	0.00	1.00	0.00	8.20	75.21	2.00	0.00	1.00	0.00
8.22	75.42	2.00	0.00	1.00	0.00	8.24	74.84	2.00	0.00	1.00	0.00
8.26	75.34	2.00	0.00	1.00	0.00	8.28	79.15	2.00	0.00	1.00	0.00
8.30	85.89	2.00	0.00	1.00	0.00	8.32	96.05	2.00	0.00	1.00	0.00
8.34	107.04	2.00	0.00	1.00	0.00	8.36	117.90	2.00	0.00	1.00	0.00
8.38	126.58	2.00	0.00	1.00	0.00	8.40	132.83	2.00	0.00	1.00	0.00
8.42	135.99	2.00	0.00	1.00	0.00	8.44	136.11	2.00	0.00	1.00	0.00
8.46	132.93	2.00	0.00	1.00	0.00	8.48	127.79	2.00	0.00	1.00	0.00
8.50	120.68	2.00	0.00	1.00	0.00	8.52	113.86	2.00	0.00	1.00	0.00
8.54	106.98	2.00	0.00	1.00	0.00	8.56	100.41	2.00	0.00	1.00	0.00
8.58	94.09	2.00	0.00	1.00	0.00	8.60	87.87	2.00	0.00	1.00	0.00
8.62	82.66	2.00	0.00	1.00	0.00	8.64	78.78	2.00	0.00	1.00	0.00
8.66	76.42	2.00	0.00	1.00	0.00	8.68	75.08	2.00	0.00	1.00	0.00
8.70	74.18	2.00	0.00	1.00	0.00	8.72	73.78	2.00	0.00	1.00	0.00
8.74	73.45	2.00	0.00	1.00	0.00	8.76	73.03	2.00	0.00	1.00	0.00
8.78	72.40	2.00	0.00	1.00	0.00	8.80	71.84	2.00	0.00	1.00	0.00
8.82	71.46	2.00	0.00	1.00	0.00	8.84	71.15	2.00	0.00	1.00	0.00
8.86	70.66	2.00	0.00	1.00	0.00	8.88	69.90	2.00	0.00	1.00	0.00
8.90	69.30	2.00	0.00	1.00	0.00	8.92	69.22	2.00	0.00	1.00	0.00
8.94	69.33	2.00	0.00	1.00	0.00	8.96	69.73	2.00	0.00	1.00	0.00
8.98	70.18	2.00	0.00	1.00	0.00	9.00	70.87	2.00	0.00	1.00	0.00
9.02	71.42	2.00	0.00	1.00	0.00	9.04	71.99	2.00	0.00	1.00	0.00
9.06	72.07	2.00	0.00	1.00	0.00	9.08	71.69	2.00	0.00	1.00	0.00
9.10	70.48	2.00	0.00	1.00	0.00	9.12	69.13	2.00	0.00	1.00	0.00
9.14	68.08	2.00	0.00	1.00	0.00	9.16	67.32	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
9.18	67.15	2.00	0.00	1.00	0.00	9.20	67.00	2.00	0.00	1.00	0.00
9.22	67.87	2.00	0.00	1.00	0.00	9.24	68.98	2.00	0.00	1.00	0.00
9.26	70.82	2.00	0.00	1.00	0.00	9.28	71.84	2.00	0.00	1.00	0.00
9.30	71.31	2.00	0.00	1.00	0.00	9.32	149.18	2.00	0.00	1.00	0.00
9.34	131.38	2.00	0.00	1.00	0.00	9.36	128.06	2.00	0.00	1.00	0.00
9.38	105.26	2.00	0.00	1.00	0.00	9.40	63.33	2.00	0.00	1.00	0.00
9.42	64.89	2.00	0.00	1.00	0.00	9.44	65.62	2.00	0.00	1.00	0.00
9.46	67.08	2.00	0.00	1.00	0.00	9.48	68.98	2.00	0.00	1.00	0.00
9.50	71.14	0.89	2.60	1.00	0.05	9.52	70.93	0.89	2.61	1.00	0.05
9.54	68.70	0.86	2.73	1.00	0.05	9.56	65.72	0.84	3.30	1.00	0.07
9.58	49.31	0.72	4.17	1.00	0.08	9.60	49.76	0.72	4.14	1.00	0.08
9.62	50.73	0.73	4.08	1.00	0.08	9.64	52.14	0.74	3.99	1.00	0.08
9.66	67.81	0.86	2.79	1.00	0.06	9.68	69.27	0.88	2.70	1.00	0.05
9.70	70.25	0.89	2.64	1.00	0.05	9.72	71.01	0.90	2.60	1.00	0.05
9.74	71.93	0.91	2.55	1.00	0.05	9.76	72.99	0.92	2.50	1.00	0.05
9.78	74.05	0.94	2.45	1.00	0.05	9.80	74.82	0.95	2.41	1.00	0.05
9.82	75.33	0.95	1.15	1.00	0.02	9.84	75.66	0.96	1.15	1.00	0.02
9.86	76.29	0.97	1.14	1.00	0.02	9.88	77.28	0.98	1.12	1.00	0.02
9.90	78.61	1.00	1.11	1.00	0.02	9.92	68.80	0.88	2.73	1.00	0.05
9.94	70.80	0.91	2.61	1.00	0.05	9.96	72.37	0.92	2.53	1.00	0.05
9.98	72.88	0.93	2.50	1.00	0.05	10.00	73.12	0.94	2.49	1.00	0.05
10.02	73.24	0.94	2.49	1.00	0.05	10.04	73.24	0.94	2.49	1.00	0.05
10.06	73.25	0.94	2.49	1.00	0.05	10.08	73.22	0.94	2.49	1.00	0.05
10.10	84.14	1.09	0.62	1.00	0.01	10.12	84.38	1.10	0.62	1.00	0.01
10.14	84.66	1.11	0.61	1.00	0.01	10.16	85.12	1.11	0.61	1.00	0.01
10.18	85.79	1.13	0.61	1.00	0.01	10.20	86.49	1.14	0.61	1.00	0.01
10.22	87.27	1.15	0.44	1.00	0.01	10.24	87.79	1.16	0.44	1.00	0.01
10.26	87.59	1.16	0.44	1.00	0.01	10.28	86.64	1.15	0.61	1.00	0.01
10.30	85.34	1.13	0.61	1.00	0.01	10.32	84.31	1.11	0.62	1.00	0.01
10.34	84.03	1.11	0.62	1.00	0.01	10.36	84.37	1.11	0.62	1.00	0.01
10.38	84.89	1.12	0.61	1.00	0.01	10.40	84.77	1.12	0.61	1.00	0.01
10.42	83.87	1.11	0.62	1.00	0.01	10.44	82.46	1.09	0.62	1.00	0.01
10.46	81.60	1.07	0.63	1.00	0.01	10.48	81.25	1.07	0.63	1.00	0.01
10.50	81.21	1.07	0.63	1.00	0.01	10.52	80.62	1.06	0.63	1.00	0.01
10.54	79.38	1.04	1.10	1.00	0.02	10.56	77.55	1.02	1.12	1.00	0.02
10.58	75.60	0.99	1.15	1.00	0.02	10.60	73.85	0.97	1.17	1.00	0.02
10.62	72.43	0.95	1.19	1.00	0.02	10.64	71.04	0.94	2.60	1.00	0.05
10.66	69.81	0.92	2.67	1.00	0.05	10.68	68.73	0.91	2.73	1.00	0.05
10.70	68.10	0.91	2.77	1.00	0.06	10.72	67.80	0.90	2.79	1.00	0.06
10.74	67.86	0.90	2.78	1.00	0.06	10.76	67.87	0.91	2.78	1.00	0.06
10.78	67.54	0.90	2.80	1.00	0.06	10.80	66.80	0.90	2.85	1.00	0.06
10.82	65.71	0.89	2.92	1.00	0.06	10.84	64.55	0.88	3.00	1.00	0.06
10.86	63.35	0.87	3.08	1.00	0.06	10.88	62.31	0.86	3.16	1.00	0.06
10.90	61.55	0.85	3.22	1.00	0.06	10.92	61.19	0.85	3.50	1.00	0.07
10.94	61.14	0.85	3.50	1.00	0.07	10.96	61.31	0.85	3.23	1.00	0.06
10.98	62.24	2.00	0.00	1.00	0.00	11.00	64.12	2.00	0.00	1.00	0.00
11.02	66.29	2.00	0.00	1.00	0.00	11.04	68.11	2.00	0.00	1.00	0.00
11.06	117.94	2.00	0.00	1.00	0.00	11.08	73.57	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
11.10	80.76	2.00	0.00	1.00	0.00	11.12	87.82	2.00	0.00	1.00	0.00
11.14	138.55	2.00	0.00	1.00	0.00	11.16	82.44	2.00	0.00	1.00	0.00
11.18	79.12	2.00	0.00	1.00	0.00	11.20	76.80	2.00	0.00	1.00	0.00
11.22	74.04	2.00	0.00	1.00	0.00	11.24	72.11	2.00	0.00	1.00	0.00
11.26	71.07	2.00	0.00	1.00	0.00	11.28	70.78	2.00	0.00	1.00	0.00
11.30	70.90	2.00	0.00	1.00	0.00	11.32	72.11	2.00	0.00	1.00	0.00
11.34	74.69	2.00	0.00	1.00	0.00	11.36	78.39	2.00	0.00	1.00	0.00
11.38	71.75	2.00	0.00	1.00	0.00	11.40	74.10	1.01	1.17	1.00	0.02
11.42	73.68	1.01	1.17	1.00	0.02	11.44	71.61	0.98	1.21	1.00	0.02
11.46	80.78	1.11	0.63	1.00	0.01	11.48	80.58	1.11	0.63	1.00	0.01
11.50	80.60	1.11	0.63	1.00	0.01	11.52	80.47	1.11	0.63	1.00	0.01
11.54	80.10	1.11	0.64	1.00	0.01	11.56	79.73	1.10	0.64	1.00	0.01
11.58	79.11	1.10	0.64	1.00	0.01	11.60	77.98	1.08	0.65	1.00	0.01
11.62	76.59	1.06	0.66	1.00	0.01	11.64	75.37	1.05	1.15	1.00	0.02
11.66	74.56	1.04	1.16	1.00	0.02	11.68	74.29	1.03	1.16	1.00	0.02
11.70	74.59	1.04	1.16	1.00	0.02	11.72	75.31	1.05	1.15	1.00	0.02
11.74	76.15	1.06	0.66	1.00	0.01	11.76	76.66	1.07	0.66	1.00	0.01
11.78	76.27	1.07	0.66	1.00	0.01	11.80	74.82	1.05	1.16	1.00	0.02
11.82	72.73	1.02	1.19	1.00	0.02	11.84	70.94	1.00	1.22	1.00	0.02
11.86	70.06	0.99	1.23	1.00	0.02	11.88	70.37	0.99	1.22	1.00	0.02
11.90	71.60	1.01	1.21	1.00	0.02	11.92	73.28	1.03	1.18	1.00	0.02
11.94	74.37	1.05	1.16	1.00	0.02	11.96	74.87	1.06	0.67	1.00	0.01
11.98	74.90	1.06	0.67	1.00	0.01	12.00	75.13	1.06	0.66	1.00	0.01
12.02	75.43	1.07	0.66	1.00	0.01	12.04	75.66	1.07	0.66	1.00	0.01
12.06	75.80	1.08	0.66	1.00	0.01	12.08	75.84	1.08	0.66	1.00	0.01
12.10	75.85	1.08	0.66	1.00	0.01	12.12	75.99	1.08	0.66	1.00	0.01
12.14	76.15	1.09	0.66	1.00	0.01	12.16	76.60	1.09	0.66	1.00	0.01
12.18	77.26	1.11	0.65	1.00	0.01	12.20	78.33	1.12	0.65	1.00	0.01
12.22	79.54	1.14	0.64	1.00	0.01	12.24	69.85	1.01	1.23	1.00	0.02
12.26	71.95	1.03	1.20	1.00	0.02	12.28	74.64	1.07	0.67	1.00	0.01
12.30	77.16	1.11	0.65	1.00	0.01	12.32	78.46	1.13	0.65	1.00	0.01
12.34	77.99	1.12	0.65	1.00	0.01	12.36	86.96	1.27	0.32	1.00	0.01
12.38	85.92	1.25	0.32	1.00	0.01	12.40	84.74	1.23	0.45	1.00	0.01
12.42	83.60	1.21	0.46	1.00	0.01	12.44	82.91	1.20	0.46	1.00	0.01
12.46	82.82	1.20	0.46	1.00	0.01	12.48	83.39	1.21	0.46	1.00	0.01
12.50	84.23	1.22	0.46	1.00	0.01	12.52	84.91	1.24	0.45	1.00	0.01
12.54	84.87	1.23	0.45	1.00	0.01	12.56	84.44	1.23	0.45	1.00	0.01
12.58	84.00	1.22	0.46	1.00	0.01	12.60	84.21	1.22	0.46	1.00	0.01
12.62	84.70	1.23	0.45	1.00	0.01	12.64	85.59	1.25	0.45	1.00	0.01
12.66	86.63	1.26	0.32	1.00	0.01	12.68	87.66	1.28	0.32	1.00	0.01
12.70	87.98	1.29	0.32	1.00	0.01	12.72	87.20	1.27	0.32	1.00	0.01
12.74	85.67	1.24	0.45	1.00	0.01	12.76	83.99	1.21	0.46	1.00	0.01
12.78	82.70	1.19	0.46	1.00	0.01	12.80	81.96	1.18	0.46	1.00	0.01
12.82	81.52	1.17	0.47	1.00	0.01	12.84	81.00	1.16	0.47	1.00	0.01
12.86	80.37	1.15	0.47	1.00	0.01	12.88	79.93	1.14	0.64	1.00	0.01
12.90	79.98	1.14	0.64	1.00	0.01	12.92	80.33	1.15	0.64	1.00	0.01
12.94	80.20	1.15	0.64	1.00	0.01	12.96	79.53	1.14	0.64	1.00	0.01
12.98	78.60	1.12	0.64	1.00	0.01	13.00	77.97	1.11	0.65	1.00	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
13.02	77.57	1.10	0.65	1.00	0.01	13.04	77.25	1.10	0.65	1.00	0.01
13.06	76.74	1.09	0.65	1.00	0.01	13.08	75.84	1.08	0.66	1.00	0.01
13.10	74.25	1.05	0.67	1.00	0.01	13.12	72.06	1.03	1.20	1.00	0.02
13.14	69.60	0.99	1.24	1.00	0.02	13.16	67.39	0.97	1.28	1.00	0.03
13.18	65.54	0.95	2.93	1.00	0.06	13.20	63.88	0.93	3.04	1.00	0.06
13.22	62.39	0.91	3.15	1.00	0.06	13.24	61.13	0.90	3.25	1.00	0.06
13.26	60.15	0.89	3.33	1.00	0.07	13.28	59.43	0.89	3.58	1.00	0.07
13.30	58.76	0.88	3.61	1.00	0.07	13.32	58.64	0.88	3.62	1.00	0.07
13.34	59.28	0.88	3.59	1.00	0.07	13.36	45.51	0.78	4.46	1.00	0.09
13.38	49.20	0.81	4.18	1.00	0.08	13.40	52.28	0.83	3.98	1.00	0.08
13.42	54.21	0.84	3.86	1.00	0.08	13.44	55.10	0.85	3.81	1.00	0.08
13.46	55.04	0.85	3.81	1.00	0.08	13.48	54.35	0.84	3.85	1.00	0.08
13.50	53.40	0.83	3.91	1.00	0.08	13.52	67.28	0.96	1.28	1.00	0.03
13.54	67.64	0.96	1.27	1.00	0.03	13.56	67.76	0.96	1.27	1.00	0.03
13.58	67.75	0.96	1.27	1.00	0.03	13.60	67.54	0.96	1.27	1.00	0.03
13.62	67.14	0.95	1.28	1.00	0.03	13.64	66.86	0.95	2.85	1.00	0.06
13.66	66.60	0.94	2.86	1.00	0.06	13.68	66.57	0.94	2.86	1.00	0.06
13.70	66.26	0.94	2.88	1.00	0.06	13.72	65.84	0.93	2.91	1.00	0.06
13.74	65.46	0.93	2.94	1.00	0.06	13.76	65.28	0.93	2.95	1.00	0.06
13.78	65.38	0.93	2.94	1.00	0.06	13.80	65.45	0.93	2.94	1.00	0.06
13.82	65.44	0.93	2.94	1.00	0.06	13.84	65.47	0.93	2.93	1.00	0.06
13.86	65.90	0.93	2.91	1.00	0.06	13.88	66.95	0.94	2.84	1.00	0.06
13.90	55.34	0.83	3.80	1.00	0.08	13.92	57.62	0.85	3.67	1.00	0.07
13.94	59.58	0.87	3.57	1.00	0.07	13.96	59.08	0.86	3.60	1.00	0.07
13.98	72.15	1.00	1.20	1.00	0.02	14.00	71.64	0.99	1.20	1.00	0.02
14.02	71.00	0.98	1.21	1.00	0.02	14.04	70.16	0.97	1.23	1.00	0.02
14.06	69.12	0.95	1.25	1.00	0.02	14.08	68.03	0.94	2.77	1.00	0.06
14.10	67.00	0.93	2.84	1.00	0.06	14.12	66.13	0.92	2.89	1.00	0.06
14.14	65.47	0.91	2.93	1.00	0.06	14.16	65.05	0.90	2.96	1.00	0.06
14.18	64.73	0.90	2.98	1.00	0.06	14.20	64.41	0.89	3.01	1.00	0.06
14.22	64.15	0.89	3.02	1.00	0.06	14.24	64.05	0.89	3.03	1.00	0.06
14.26	64.08	0.89	3.03	1.00	0.06	14.28	64.34	0.89	3.01	1.00	0.06
14.30	64.78	0.89	2.98	1.00	0.06	14.32	51.26	0.78	4.04	1.00	0.08
14.34	53.33	0.79	3.91	1.00	0.08	14.36	56.58	0.82	3.73	1.00	0.07
14.38	60.47	0.85	3.53	1.00	0.07	14.40	63.62	0.87	3.06	1.00	0.06
14.42	64.66	0.88	2.99	1.00	0.06	14.44	62.67	0.86	3.13	1.00	0.06
14.46	58.50	0.82	3.63	1.00	0.07	14.48	68.47	0.91	2.75	1.00	0.05
14.50	66.45	0.89	2.87	1.00	0.06	14.52	65.28	0.88	2.95	1.00	0.06
14.54	64.78	0.87	2.98	1.00	0.06	14.56	64.66	0.87	2.99	1.00	0.06
14.58	64.87	0.87	2.98	1.00	0.06	14.60	65.67	0.87	2.92	1.00	0.06
14.62	67.04	0.89	2.83	1.00	0.06	14.64	68.65	0.90	2.74	1.00	0.05
14.66	70.06	0.92	2.65	1.00	0.05	14.68	58.46	0.81	3.63	1.00	0.07
14.70	61.17	0.83	3.50	1.00	0.07	14.72	65.32	0.87	2.95	1.00	0.06
14.74	70.41	0.92	2.64	1.00	0.05	14.76	74.60	0.97	1.16	1.00	0.02
14.78	76.57	0.99	1.13	1.00	0.02	14.80	86.69	1.14	0.60	1.00	0.01
14.82	87.11	1.15	0.44	1.00	0.01	14.84	87.80	1.16	0.44	1.00	0.01
14.86	88.41	1.17	0.44	1.00	0.01	14.88	88.33	1.17	0.44	1.00	0.01
14.90	87.21	1.15	0.60	1.00	0.01	14.92	84.89	1.11	0.61	1.00	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
14.94	83.76	1.09	0.62	1.00	0.01	14.96	83.12	1.08	0.62	1.00	0.01
14.98	83.64	1.09	0.62	1.00	0.01	15.00	83.33	1.08	0.62	1.00	0.01
15.02	82.74	1.07	0.62	1.00	0.01	15.04	82.01	1.06	0.63	1.00	0.01
15.06	81.33	1.05	0.63	1.00	0.01	15.08	80.96	1.04	1.08	1.00	0.02
15.10	80.87	1.04	1.08	1.00	0.02	15.12	81.07	1.05	1.07	1.00	0.02
15.14	81.32	1.05	1.07	1.00	0.02	15.16	81.24	1.05	1.07	1.00	0.02
15.18	80.77	1.04	1.08	1.00	0.02	15.20	80.07	1.03	1.09	1.00	0.02
15.22	79.31	1.02	1.10	1.00	0.02	15.24	78.49	1.01	1.11	1.00	0.02
15.26	77.56	0.99	1.12	1.00	0.02	15.28	76.59	0.98	1.13	1.00	0.02
15.30	75.43	0.97	1.15	1.00	0.02	15.32	74.08	0.95	2.44	1.00	0.05
15.34	72.65	0.93	2.52	1.00	0.05	15.36	71.40	0.92	2.58	1.00	0.05
15.38	70.36	0.90	2.64	1.00	0.05	15.40	69.69	0.90	2.68	1.00	0.05
15.42	69.27	0.89	2.70	1.00	0.05	15.44	69.29	0.89	2.70	1.00	0.05
15.46	69.76	0.90	2.67	1.00	0.05	15.48	70.95	0.91	2.61	1.00	0.05
15.50	72.96	0.93	2.50	1.00	0.05	15.52	75.94	0.97	1.14	1.00	0.02
15.54	79.84	1.02	1.09	1.00	0.02	15.56	84.17	1.09	0.62	1.00	0.01
15.58	88.48	1.16	0.44	1.00	0.01	15.60	92.30	1.23	0.43	1.00	0.01
15.62	95.53	1.29	0.30	1.00	0.01	15.64	98.00	1.35	0.29	1.00	0.01
15.66	99.78	1.38	0.00	1.00	0.00	15.68	100.72	1.41	0.00	1.00	0.00
15.70	101.15	1.42	0.00	1.00	0.00	15.72	101.43	1.42	0.00	1.00	0.00
15.74	101.95	1.44	0.00	1.00	0.00	15.76	102.55	1.45	0.00	1.00	0.00
15.78	103.12	1.46	0.00	1.00	0.00	15.80	103.79	1.48	0.00	1.00	0.00
15.82	104.86	1.51	0.00	1.00	0.00	15.84	106.13	1.54	0.00	1.00	0.00
15.86	107.45	1.57	0.00	1.00	0.00	15.88	108.56	1.60	0.00	1.00	0.00
15.90	109.79	1.64	0.00	1.00	0.00	15.92	111.10	1.67	0.00	1.00	0.00
15.94	112.24	1.70	0.00	1.00	0.00	15.96	113.00	1.73	0.00	1.00	0.00
15.98	112.96	1.73	0.00	1.00	0.00	16.00	111.74	1.69	0.00	1.00	0.00
16.02	108.94	1.62	0.00	1.00	0.00	16.04	105.11	1.52	0.00	1.00	0.00
16.06	101.39	1.43	0.00	1.00	0.00	16.08	98.39	1.36	0.00	1.00	0.00
16.10	95.81	1.31	0.30	1.00	0.01	16.12	93.42	1.26	0.30	1.00	0.01
16.14	91.08	1.21	0.43	1.00	0.01	16.16	89.18	1.18	0.44	1.00	0.01
16.18	87.75	1.15	0.44	1.00	0.01	16.20	86.91	1.14	0.60	1.00	0.01
16.22	86.57	1.13	0.61	1.00	0.01	16.24	86.60	1.13	0.61	1.00	0.01
16.26	87.29	1.14	0.60	1.00	0.01	16.28	88.84	1.17	0.44	1.00	0.01
16.30	90.99	1.21	0.43	1.00	0.01	16.32	93.20	1.25	0.42	1.00	0.01
16.34	94.79	1.28	0.30	1.00	0.01	16.36	95.94	1.30	0.30	1.00	0.01
16.38	96.69	1.31	0.30	1.00	0.01	16.40	97.50	1.33	0.29	1.00	0.01
16.42	98.46	1.35	0.29	1.00	0.01	16.44	99.59	1.37	0.00	1.00	0.00
16.46	100.80	1.40	0.00	1.00	0.00	16.48	101.68	1.42	0.00	1.00	0.00
16.50	101.71	1.42	0.00	1.00	0.00	16.52	100.19	1.39	0.00	1.00	0.00
16.54	96.93	1.32	0.30	1.00	0.01	16.56	92.53	1.23	0.43	1.00	0.01
16.58	88.49	1.15	0.44	1.00	0.01	16.60	85.46	1.10	0.61	1.00	0.01
16.62	83.40	1.07	0.62	1.00	0.01	16.64	81.75	1.05	1.07	1.00	0.02
16.66	80.34	1.03	1.08	1.00	0.02	16.68	79.04	1.01	1.10	1.00	0.02
16.70	77.99	0.99	1.11	1.00	0.02	16.72	77.31	0.98	1.12	1.00	0.02
16.74	77.05	0.98	1.13	1.00	0.02	16.76	76.86	0.98	1.13	1.00	0.02
16.78	76.68	0.98	1.13	1.00	0.02	16.80	76.48	0.97	1.13	1.00	0.02
16.82	76.53	0.97	1.13	1.00	0.02	16.84	76.83	0.98	1.13	1.00	0.02

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
16.86	77.46	0.99	1.12	1.00	0.02	16.88	78.35	1.00	1.11	1.00	0.02
16.90	79.61	1.01	1.09	1.00	0.02	16.92	81.80	1.05	1.06	1.00	0.02
16.94	84.11	1.08	0.62	1.00	0.01	16.96	76.82	0.98	1.13	1.00	0.02
16.98	78.96	1.00	1.10	1.00	0.02	17.00	81.35	1.04	1.07	1.00	0.02
17.02	84.41	1.09	0.62	1.00	0.01	17.04	87.98	1.14	0.60	1.00	0.01
17.06	91.77	1.21	0.43	1.00	0.01	17.08	95.50	1.28	0.30	1.00	0.01
17.10	98.71	1.35	0.00	1.00	0.00	17.12	101.22	1.41	0.00	1.00	0.00
17.14	102.61	1.44	0.00	1.00	0.00	17.16	108.26	1.58	0.00	1.00	0.00
17.18	107.75	1.56	0.00	1.00	0.00	17.20	105.98	1.52	0.00	1.00	0.00
17.22	103.24	1.45	0.00	1.00	0.00	17.24	100.37	1.38	0.00	1.00	0.00
17.26	98.13	1.34	0.29	1.00	0.01	17.28	96.71	1.31	0.30	1.00	0.01
17.30	95.80	1.29	0.30	1.00	0.01	17.32	95.16	1.27	0.30	1.00	0.01
17.34	94.69	1.26	0.30	1.00	0.01	17.36	94.30	1.26	0.30	1.00	0.01
17.38	94.06	1.25	0.30	1.00	0.01	17.40	93.89	1.25	0.42	1.00	0.01
17.42	93.86	1.25	0.42	1.00	0.01	17.44	93.77	1.24	0.42	1.00	0.01
17.46	93.84	1.24	0.42	1.00	0.01	17.48	94.06	1.25	0.42	1.00	0.01
17.50	94.45	1.26	0.30	1.00	0.01	17.52	94.58	1.26	0.30	1.00	0.01
17.54	94.26	1.25	0.30	1.00	0.01	17.56	93.58	1.24	0.42	1.00	0.01
17.58	93.04	1.23	0.43	1.00	0.01	17.60	93.09	1.23	0.42	1.00	0.01
17.62	93.75	1.24	0.42	1.00	0.01	17.64	94.45	1.25	0.30	1.00	0.01
17.66	94.69	1.26	0.30	1.00	0.01	17.68	94.19	1.25	0.42	1.00	0.01
17.70	93.37	1.23	0.42	1.00	0.01	17.72	92.85	1.22	0.43	1.00	0.01
17.74	92.95	1.22	0.43	1.00	0.01	17.76	93.71	1.24	0.42	1.00	0.01
17.78	94.86	1.26	0.30	1.00	0.01	17.80	96.16	1.28	0.30	1.00	0.01
17.82	97.49	1.31	0.29	1.00	0.01	17.84	99.03	1.34	0.29	1.00	0.01
17.86	100.89	1.38	0.00	1.00	0.00	17.88	103.04	1.43	0.00	1.00	0.00
17.90	103.27	1.44	0.00	1.00	0.00	17.92	105.40	1.49	0.00	1.00	0.00
17.94	106.74	1.52	0.00	1.00	0.00	17.96	104.13	1.46	0.00	1.00	0.00
17.98	107.94	1.55	0.00	1.00	0.00	18.00	105.89	1.50	0.00	1.00	0.00
18.02	102.86	1.43	0.00	1.00	0.00	18.04	99.55	1.35	0.00	1.00	0.00
18.06	96.91	1.30	0.30	1.00	0.01	18.08	94.81	1.25	0.30	1.00	0.01
18.10	93.37	1.22	0.42	1.00	0.01	18.12	92.34	1.20	0.43	1.00	0.01
18.14	92.22	1.20	0.43	1.00	0.01	18.16	92.43	1.21	0.43	1.00	0.01
18.18	92.36	1.20	0.43	1.00	0.01	18.20	91.76	1.19	0.43	1.00	0.01
18.22	90.94	1.18	0.43	1.00	0.01	18.24	90.38	1.17	0.43	1.00	0.01
18.26	90.47	1.17	0.43	1.00	0.01	18.28	91.30	1.18	0.43	1.00	0.01
18.30	92.17	1.20	0.43	1.00	0.01	18.32	91.79	1.19	0.43	1.00	0.01
18.34	89.58	1.15	0.44	1.00	0.01	18.36	86.24	1.09	0.61	1.00	0.01
18.38	83.12	1.05	1.05	1.00	0.02	18.40	81.05	1.01	1.07	1.00	0.02
18.42	80.19	1.00	1.08	1.00	0.02	18.44	80.02	1.00	1.09	1.00	0.02
18.46	79.75	1.00	1.09	1.00	0.02	18.48	78.89	0.98	1.10	1.00	0.02
18.50	77.69	0.97	1.12	1.00	0.02	18.52	76.50	0.95	1.13	1.00	0.02
18.54	75.43	0.94	2.38	1.00	0.05	18.56	74.49	0.93	2.42	1.00	0.05
18.58	73.67	0.92	2.46	1.00	0.05	18.60	73.05	0.91	2.50	1.00	0.05
18.62	72.54	0.90	2.52	1.00	0.05	18.64	72.45	0.90	2.53	1.00	0.05
18.66	72.86	0.91	2.51	1.00	0.05	18.68	73.69	0.91	2.46	1.00	0.05
18.70	74.44	0.92	2.43	1.00	0.05	18.72	74.90	0.93	2.41	1.00	0.05
18.74	74.69	0.93	2.42	1.00	0.05	18.76	73.84	0.92	2.46	1.00	0.05

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
18.78	72.43	0.90	2.53	1.00	0.05	18.80	70.88	0.88	2.61	1.00	0.05
18.82	69.44	0.87	2.69	1.00	0.05	18.84	68.21	0.85	2.76	1.00	0.06
18.86	67.45	0.85	3.23	1.00	0.06	18.88	67.51	0.85	3.22	1.00	0.06
18.90	69.42	0.86	2.69	1.00	0.05	18.92	72.79	0.90	2.51	1.00	0.05
18.94	77.50	0.96	1.12	1.00	0.02	18.96	82.74	1.03	1.05	1.00	0.02
18.98	80.15	1.00	1.09	1.00	0.02	19.00	87.14	1.10	0.60	1.00	0.01
19.02	92.85	1.20	0.43	1.00	0.01	19.04	98.24	1.31	0.29	1.00	0.01
19.06	103.71	1.43	0.00	1.00	0.00	19.08	109.31	1.57	0.00	1.00	0.00
19.10	115.27	1.74	0.00	1.00	0.00	19.12	121.42	1.93	0.00	1.00	0.00
19.14	127.19	2.00	0.00	1.00	0.00	19.16	132.62	2.00	0.00	1.00	0.00
19.18	137.37	2.00	0.00	1.00	0.00	19.20	142.16	2.00	0.00	1.00	0.00
19.22	145.03	2.00	0.00	1.00	0.00	19.24	146.28	2.00	0.00	1.00	0.00
19.26	145.93	2.00	0.00	1.00	0.00	19.28	145.60	2.00	0.00	1.00	0.00
19.30	145.51	2.00	0.00	1.00	0.00	19.32	145.18	2.00	0.00	1.00	0.00
19.34	144.84	2.00	0.00	1.00	0.00	19.36	145.36	2.00	0.00	1.00	0.00
19.38	148.02	2.00	0.00	1.00	0.00	19.40	152.15	2.00	0.00	1.00	0.00
19.42	154.80	2.00	0.00	1.00	0.00	19.44	155.01	2.00	0.00	1.00	0.00
19.46	154.52	2.00	0.00	1.00	0.00	19.48	155.18	2.00	0.00	1.00	0.00
19.50	155.45	2.00	0.00	1.00	0.00	19.52	152.43	2.00	0.00	1.00	0.00
19.54	146.76	2.00	0.00	1.00	0.00	19.56	140.50	2.00	0.00	1.00	0.00
19.58	135.69	2.00	0.00	1.00	0.00	19.60	132.40	2.00	0.00	1.00	0.00
19.62	128.88	2.00	0.00	1.00	0.00	19.64	122.64	1.96	0.00	1.00	0.00
19.66	112.63	1.66	0.00	1.00	0.00	19.68	98.77	2.00	0.00	1.00	0.00
19.70	90.96	2.00	0.00	1.00	0.00	19.72	76.26	2.00	0.00	1.00	0.00
19.74	67.45	2.00	0.00	1.00	0.00	19.76	85.02	2.00	0.00	1.00	0.00
19.78	77.57	2.00	0.00	1.00	0.00	19.80	83.49	2.00	0.00	1.00	0.00
19.82	85.17	2.00	0.00	1.00	0.00	19.84	84.48	2.00	0.00	1.00	0.00
19.86	82.42	2.00	0.00	1.00	0.00	19.88	79.81	2.00	0.00	1.00	0.00
19.90	76.91	2.00	0.00	1.00	0.00	19.92	74.17	2.00	0.00	1.00	0.00
19.94	70.26	2.00	0.00	1.00	0.00	19.96	63.88	2.00	0.00	1.00	0.00
19.98	59.63	2.00	0.00	1.00	0.00	20.00	56.38	1.93	0.01	1.00	0.00
20.02	54.91	2.00	0.00	1.00	0.00	20.04	51.41	2.00	0.00	1.00	0.00
20.06	48.54	2.00	0.00	1.00	0.00	20.08	46.59	2.00	0.00	1.00	0.00
20.10	45.73	2.00	0.00	1.00	0.00	20.12	45.33	2.00	0.00	1.00	0.00
20.14	45.21	2.00	0.00	1.00	0.00	20.16	44.82	2.00	0.00	1.00	0.00
20.18	45.12	2.00	0.00	1.00	0.00	20.20	45.44	2.00	0.00	1.00	0.00
20.22	45.87	2.00	0.00	1.00	0.00	20.24	45.92	2.00	0.00	1.00	0.00
20.26	45.91	2.00	0.00	1.00	0.00	20.28	45.77	2.00	0.00	1.00	0.00
20.30	45.75	2.00	0.00	1.00	0.00	20.32	45.68	2.00	0.00	1.00	0.00
20.34	45.69	2.00	0.00	1.00	0.00	20.36	45.72	2.00	0.00	1.00	0.00
20.38	45.77	2.00	0.00	1.00	0.00	20.40	45.41	2.00	0.00	1.00	0.00
20.42	44.84	2.00	0.00	1.00	0.00	20.44	44.29	2.00	0.00	1.00	0.00
20.46	44.07	2.00	0.00	1.00	0.00	20.48	43.96	2.00	0.00	1.00	0.00
20.50	44.21	2.00	0.00	1.00	0.00	20.52	43.96	2.00	0.00	1.00	0.00
20.54	43.41	2.00	0.00	1.00	0.00	20.56	42.80	2.00	0.00	1.00	0.00
20.58	42.71	2.00	0.00	1.00	0.00	20.60	43.11	2.00	0.00	1.00	0.00
20.62	43.68	2.00	0.00	1.00	0.00	20.64	44.26	2.00	0.00	1.00	0.00
20.66	45.31	2.00	0.00	1.00	0.00	20.68	46.38	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
20.70	46.60	2.00	0.00	1.00	0.00	20.72	46.12	2.00	0.00	1.00	0.00
20.74	45.71	2.00	0.00	1.00	0.00	20.76	46.09	2.00	0.00	1.00	0.00
20.78	46.28	2.00	0.00	1.00	0.00	20.80	46.13	2.00	0.00	1.00	0.00
20.82	45.62	2.00	0.00	1.00	0.00	20.84	45.52	2.00	0.00	1.00	0.00
20.86	45.50	2.00	0.00	1.00	0.00	20.88	45.69	2.00	0.00	1.00	0.00
20.90	46.02	2.00	0.00	1.00	0.00	20.92	46.93	2.00	0.00	1.00	0.00
20.94	47.95	2.00	0.00	1.00	0.00	20.96	48.81	2.00	0.00	1.00	0.00
20.98	49.20	2.00	0.00	1.00	0.00	21.00	49.62	2.00	0.00	1.00	0.00
21.02	50.31	2.00	0.00	1.00	0.00	21.04	51.30	2.00	0.00	1.00	0.00
21.06	52.08	2.00	0.00	1.00	0.00	21.08	52.27	2.00	0.00	1.00	0.00
21.10	51.84	2.00	0.00	1.00	0.00	21.12	51.29	2.00	0.00	1.00	0.00
21.14	50.89	2.00	0.00	1.00	0.00	21.16	50.68	2.00	0.00	1.00	0.00
21.18	51.22	2.00	0.00	1.00	0.00	21.20	53.44	2.00	0.00	1.00	0.00
21.22	55.46	2.00	0.00	1.00	0.00	21.24	56.38	2.00	0.00	1.00	0.00
21.26	55.47	2.00	0.00	1.00	0.00	21.28	54.57	2.00	0.00	1.00	0.00
21.30	53.94	2.00	0.00	1.00	0.00	21.32	53.23	2.00	0.00	1.00	0.00
21.34	52.19	2.00	0.00	1.00	0.00	21.36	50.96	2.00	0.00	1.00	0.00
21.38	50.56	2.00	0.00	1.00	0.00	21.40	49.42	2.00	0.00	1.00	0.00
21.42	77.28	2.00	0.00	1.00	0.00	21.44	52.85	2.00	0.00	1.00	0.00
21.46	57.24	2.00	0.00	1.00	0.00	21.48	65.05	2.00	0.00	1.00	0.00
21.50	101.38	2.00	0.00	1.00	0.00	21.52	169.39	2.00	0.00	1.00	0.00
21.54	77.21	2.00	0.00	1.00	0.00	21.56	78.80	2.00	0.00	1.00	0.00
21.58	78.73	2.00	0.00	1.00	0.00	21.60	78.04	2.00	0.00	1.00	0.00
21.62	76.94	2.00	0.00	1.00	0.00	21.64	74.28	2.00	0.00	1.00	0.00
21.66	72.60	2.00	0.00	1.00	0.00	21.68	71.33	2.00	0.00	1.00	0.00
21.70	70.39	2.00	0.00	1.00	0.00	21.72	67.31	2.00	0.00	1.00	0.00
21.74	63.69	2.00	0.00	1.00	0.00	21.76	60.47	2.00	0.00	1.00	0.00
21.78	57.69	2.00	0.00	1.00	0.00	21.80	55.39	2.00	0.00	1.00	0.00
21.82	54.04	2.00	0.00	1.00	0.00	21.84	52.79	2.00	0.00	1.00	0.00
21.86	51.95	2.00	0.00	1.00	0.00	21.88	50.81	2.00	0.00	1.00	0.00
21.90	49.91	2.00	0.00	1.00	0.00	21.92	51.85	2.00	0.00	1.00	0.00
21.94	54.01	2.00	0.00	1.00	0.00	21.96	55.80	2.00	0.00	1.00	0.00
21.98	55.55	2.00	0.00	1.00	0.00	22.00	55.17	2.00	0.00	1.00	0.00
22.02	55.77	2.00	0.00	1.00	0.00	22.04	55.91	2.00	0.00	1.00	0.00
22.06	56.47	2.00	0.00	1.00	0.00	22.08	57.43	2.00	0.00	1.00	0.00
22.10	58.94	2.00	0.00	1.00	0.00	22.12	59.80	2.00	0.00	1.00	0.00
22.14	60.25	2.00	0.00	1.00	0.00	22.16	60.91	2.00	0.00	1.00	0.00
22.18	61.39	2.00	0.00	1.00	0.00	22.20	61.55	2.00	0.00	1.00	0.00
22.22	61.21	2.00	0.00	1.00	0.00	22.24	61.52	2.00	0.00	1.00	0.00
22.26	62.03	2.00	0.00	1.00	0.00	22.28	62.71	2.00	0.00	1.00	0.00
22.30	63.78	2.00	0.00	1.00	0.00	22.32	64.91	2.00	0.00	1.00	0.00
22.34	66.32	2.00	0.00	1.00	0.00	22.36	67.01	2.00	0.00	1.00	0.00
22.38	67.83	2.00	0.00	1.00	0.00	22.40	68.77	2.00	0.00	1.00	0.00
22.42	69.75	2.00	0.00	1.00	0.00	22.44	70.91	2.00	0.00	1.00	0.00
22.46	72.71	2.00	0.00	1.00	0.00	22.48	75.47	2.00	0.00	1.00	0.00
22.50	78.32	2.00	0.00	1.00	0.00	22.52	80.04	2.00	0.00	1.00	0.00
22.54	80.64	2.00	0.00	1.00	0.00	22.56	80.50	2.00	0.00	1.00	0.00
22.58	80.11	2.00	0.00	1.00	0.00	22.60	79.32	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
22.62	78.52	2.00	0.00	1.00	0.00	22.64	78.07	2.00	0.00	1.00	0.00
22.66	78.32	2.00	0.00	1.00	0.00	22.68	78.89	2.00	0.00	1.00	0.00
22.70	79.58	2.00	0.00	1.00	0.00	22.72	80.09	2.00	0.00	1.00	0.00
22.74	80.61	2.00	0.00	1.00	0.00	22.76	80.70	2.00	0.00	1.00	0.00
22.78	80.16	2.00	0.00	1.00	0.00	22.80	78.60	2.00	0.00	1.00	0.00
22.82	76.57	2.00	0.00	1.00	0.00	22.84	74.23	2.00	0.00	1.00	0.00
22.86	72.26	2.00	0.00	1.00	0.00	22.88	70.60	2.00	0.00	1.00	0.00
22.90	69.27	2.00	0.00	1.00	0.00	22.92	68.88	2.00	0.00	1.00	0.00
22.94	68.99	2.00	0.00	1.00	0.00	22.96	69.86	2.00	0.00	1.00	0.00
22.98	71.03	2.00	0.00	1.00	0.00	23.00	71.80	2.00	0.00	1.00	0.00
23.02	71.90	2.00	0.00	1.00	0.00	23.04	71.80	2.00	0.00	1.00	0.00
23.06	72.04	2.00	0.00	1.00	0.00	23.08	72.62	2.00	0.00	1.00	0.00
23.10	74.03	2.00	0.00	1.00	0.00	23.12	78.58	2.00	0.00	1.00	0.00
23.14	85.75	2.00	0.00	1.00	0.00	23.16	93.67	2.00	0.00	1.00	0.00
23.18	98.39	2.00	0.00	1.00	0.00	23.20	100.80	2.00	0.00	1.00	0.00
23.22	100.83	2.00	0.00	1.00	0.00	23.24	98.73	2.00	0.00	1.00	0.00
23.26	94.35	2.00	0.00	1.00	0.00	23.28	89.86	2.00	0.00	1.00	0.00
23.30	84.05	2.00	0.00	1.00	0.00	23.32	78.12	2.00	0.00	1.00	0.00
23.34	73.02	2.00	0.00	1.00	0.00	23.36	69.73	2.00	0.00	1.00	0.00
23.38	65.62	2.00	0.00	1.00	0.00	23.40	62.13	2.00	0.00	1.00	0.00
23.42	60.33	2.00	0.00	1.00	0.00	23.44	60.01	2.00	0.00	1.00	0.00
23.46	58.94	2.00	0.00	1.00	0.00	23.48	55.94	2.00	0.00	1.00	0.00
23.50	53.84	2.00	0.00	1.00	0.00	23.52	52.44	2.00	0.00	1.00	0.00
23.54	52.42	2.00	0.00	1.00	0.00	23.56	52.28	2.00	0.00	1.00	0.00
23.58	52.20	2.00	0.00	1.00	0.00	23.60	53.01	2.00	0.00	1.00	0.00
23.62	54.73	2.00	0.00	1.00	0.00	23.64	57.04	2.00	0.00	1.00	0.00
23.66	59.52	2.00	0.00	1.00	0.00	23.68	61.65	2.00	0.00	1.00	0.00
23.70	63.29	2.00	0.00	1.00	0.00	23.72	64.44	2.00	0.00	1.00	0.00
23.74	65.16	2.00	0.00	1.00	0.00	23.76	65.08	2.00	0.00	1.00	0.00
23.78	64.67	2.00	0.00	1.00	0.00	23.80	64.25	2.00	0.00	1.00	0.00
23.82	64.34	2.00	0.00	1.00	0.00	23.84	64.29	2.00	0.00	1.00	0.00
23.86	63.87	2.00	0.00	1.00	0.00	23.88	63.16	2.00	0.00	1.00	0.00
23.90	62.76	2.00	0.00	1.00	0.00	23.92	62.66	2.00	0.00	1.00	0.00
23.94	62.61	2.00	0.00	1.00	0.00	23.96	62.39	2.00	0.00	1.00	0.00
23.98	62.29	2.00	0.00	1.00	0.00	24.00	62.42	2.00	0.00	1.00	0.00
24.02	62.77	2.00	0.00	1.00	0.00	24.04	63.37	2.00	0.00	1.00	0.00
24.06	63.51	2.00	0.00	1.00	0.00	24.08	63.06	2.00	0.00	1.00	0.00
24.10	62.31	2.00	0.00	1.00	0.00	24.12	61.82	2.00	0.00	1.00	0.00
24.14	61.42	2.00	0.00	1.00	0.00	24.16	60.77	2.00	0.00	1.00	0.00
24.18	59.62	2.00	0.00	1.00	0.00	24.20	58.45	2.00	0.00	1.00	0.00
24.22	57.33	2.00	0.00	1.00	0.00	24.24	56.20	2.00	0.00	1.00	0.00
24.26	54.99	2.00	0.00	1.00	0.00	24.28	53.81	2.00	0.00	1.00	0.00
24.30	53.21	2.00	0.00	1.00	0.00	24.32	53.38	2.00	0.00	1.00	0.00
24.34	54.19	2.00	0.00	1.00	0.00	24.36	55.11	2.00	0.00	1.00	0.00
24.38	56.09	2.00	0.00	1.00	0.00	24.40	57.02	2.00	0.00	1.00	0.00
24.42	58.01	2.00	0.00	1.00	0.00	24.44	58.86	2.00	0.00	1.00	0.00
24.46	59.68	2.00	0.00	1.00	0.00	24.48	60.63	2.00	0.00	1.00	0.00
24.50	61.66	2.00	0.00	1.00	0.00	24.52	62.81	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
24.54	63.77	2.00	0.00	1.00	0.00	24.56	64.65	2.00	0.00	1.00	0.00
24.58	65.24	2.00	0.00	1.00	0.00	24.60	65.65	2.00	0.00	1.00	0.00
24.62	65.72	2.00	0.00	1.00	0.00	24.64	65.72	2.00	0.00	1.00	0.00
24.66	65.65	2.00	0.00	1.00	0.00	24.68	65.46	2.00	0.00	1.00	0.00
24.70	65.04	2.00	0.00	1.00	0.00	24.72	64.44	2.00	0.00	1.00	0.00
24.74	63.49	2.00	0.00	1.00	0.00	24.76	62.27	2.00	0.00	1.00	0.00
24.78	60.91	2.00	0.00	1.00	0.00	24.80	59.64	2.00	0.00	1.00	0.00
24.82	58.69	2.00	0.00	1.00	0.00	24.84	58.01	2.00	0.00	1.00	0.00
24.86	57.91	2.00	0.00	1.00	0.00	24.88	57.98	2.00	0.00	1.00	0.00
24.90	58.24	2.00	0.00	1.00	0.00	24.92	144.82	2.00	0.00	1.00	0.00
24.94	73.95	2.00	0.00	1.00	0.00	24.96	68.73	2.00	0.00	1.00	0.00
24.98	72.13	2.00	0.00	1.00	0.00	25.00	73.90	2.00	0.00	1.00	0.00
25.02	73.28	2.00	0.00	1.00	0.00	25.04	70.94	2.00	0.00	1.00	0.00
25.06	67.77	2.00	0.00	1.00	0.00	25.08	64.74	2.00	0.00	1.00	0.00
25.10	62.32	2.00	0.00	1.00	0.00	25.12	60.53	2.00	0.00	1.00	0.00
25.14	59.57	2.00	0.00	1.00	0.00	25.16	59.01	2.00	0.00	1.00	0.00
25.18	59.00	2.00	0.00	1.00	0.00	25.20	59.36	2.00	0.00	1.00	0.00
25.22	59.15	2.00	0.00	1.00	0.00	25.24	58.52	2.00	0.00	1.00	0.00
25.26	58.18	2.00	0.00	1.00	0.00	25.28	58.95	2.00	0.00	1.00	0.00
25.30	60.33	2.00	0.00	1.00	0.00	25.32	89.49	2.00	0.00	1.00	0.00
25.34	66.94	2.00	0.00	1.00	0.00	25.36	71.80	2.00	0.00	1.00	0.00
25.38	77.98	2.00	0.00	1.00	0.00	25.40	82.86	2.00	0.00	1.00	0.00
25.42	85.13	2.00	0.00	1.00	0.00	25.44	84.27	2.00	0.00	1.00	0.00
25.46	178.81	2.00	0.00	1.00	0.00	25.48	138.64	2.00	0.00	1.00	0.00
25.50	115.53	2.00	0.00	1.00	0.00	25.52	115.46	2.00	0.00	1.00	0.00
25.54	153.43	2.00	0.00	1.00	0.00	25.56	63.62	2.00	0.00	1.00	0.00
25.58	70.63	2.00	0.00	1.00	0.00	25.60	77.02	2.00	0.00	1.00	0.00
25.62	77.20	2.00	0.00	1.00	0.00	25.64	73.30	2.00	0.00	1.00	0.00
25.66	67.32	2.00	0.00	1.00	0.00	25.68	62.80	2.00	0.00	1.00	0.00
25.70	59.16	2.00	0.00	1.00	0.00	25.72	56.02	2.00	0.00	1.00	0.00
25.74	53.13	2.00	0.00	1.00	0.00	25.76	51.04	2.00	0.00	1.00	0.00
25.78	49.62	2.00	0.00	1.00	0.00	25.80	49.25	2.00	0.00	1.00	0.00
25.82	49.65	2.00	0.00	1.00	0.00	25.84	50.40	2.00	0.00	1.00	0.00
25.86	50.92	2.00	0.00	1.00	0.00	25.88	51.15	2.00	0.00	1.00	0.00
25.90	52.23	2.00	0.00	1.00	0.00	25.92	53.68	2.00	0.00	1.00	0.00
25.94	55.24	2.00	0.00	1.00	0.00	25.96	56.05	2.00	0.00	1.00	0.00
25.98	56.90	2.00	0.00	1.00	0.00	26.00	57.77	2.00	0.00	1.00	0.00
26.02	58.55	2.00	0.00	1.00	0.00	26.04	59.02	2.00	0.00	1.00	0.00
26.06	58.84	2.00	0.00	1.00	0.00	26.08	58.44	2.00	0.00	1.00	0.00
26.10	58.12	2.00	0.00	1.00	0.00	26.12	58.44	2.00	0.00	1.00	0.00
26.14	59.07	2.00	0.00	1.00	0.00	26.16	60.15	2.00	0.00	1.00	0.00
26.18	61.39	2.00	0.00	1.00	0.00	26.20	62.84	2.00	0.00	1.00	0.00
26.22	64.38	2.00	0.00	1.00	0.00	26.24	66.03	2.00	0.00	1.00	0.00
26.26	67.39	2.00	0.00	1.00	0.00	26.28	68.28	2.00	0.00	1.00	0.00
26.30	68.86	2.00	0.00	1.00	0.00	26.32	69.31	2.00	0.00	1.00	0.00
26.34	69.52	2.00	0.00	1.00	0.00	26.36	69.48	2.00	0.00	1.00	0.00
26.38	69.55	2.00	0.00	1.00	0.00	26.40	69.78	2.00	0.00	1.00	0.00
26.42	70.04	2.00	0.00	1.00	0.00	26.44	69.26	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
26.46	67.78	2.00	0.00	1.00	0.00	26.48	66.14	2.00	0.00	1.00	0.00
26.50	65.40	2.00	0.00	1.00	0.00	26.52	65.14	2.00	0.00	1.00	0.00
26.54	65.33	2.00	0.00	1.00	0.00	26.56	66.86	2.00	0.00	1.00	0.00
26.58	69.29	2.00	0.00	1.00	0.00	26.60	71.50	2.00	0.00	1.00	0.00
26.62	72.92	2.00	0.00	1.00	0.00	26.64	73.56	2.00	0.00	1.00	0.00
26.66	73.78	2.00	0.00	1.00	0.00	26.68	73.44	2.00	0.00	1.00	0.00
26.70	72.72	2.00	0.00	1.00	0.00	26.72	71.80	2.00	0.00	1.00	0.00
26.74	70.72	2.00	0.00	1.00	0.00	26.76	69.61	2.00	0.00	1.00	0.00
26.78	68.86	2.00	0.00	1.00	0.00	26.80	68.55	2.00	0.00	1.00	0.00
26.82	68.51	2.00	0.00	1.00	0.00	26.84	67.93	2.00	0.00	1.00	0.00
26.86	66.91	2.00	0.00	1.00	0.00	26.88	65.75	2.00	0.00	1.00	0.00
26.90	64.46	2.00	0.00	1.00	0.00	26.92	64.22	2.00	0.00	1.00	0.00
26.94	64.08	2.00	0.00	1.00	0.00	26.96	64.64	2.00	0.00	1.00	0.00
26.98	64.81	2.00	0.00	1.00	0.00	27.00	65.37	2.00	0.00	1.00	0.00
27.02	65.87	2.00	0.00	1.00	0.00	27.04	66.45	2.00	0.00	1.00	0.00
27.06	66.58	2.00	0.00	1.00	0.00	27.08	66.75	2.00	0.00	1.00	0.00
27.10	66.75	2.00	0.00	1.00	0.00	27.12	66.83	2.00	0.00	1.00	0.00
27.14	66.77	2.00	0.00	1.00	0.00	27.16	66.37	2.00	0.00	1.00	0.00
27.18	65.69	2.00	0.00	1.00	0.00	27.20	64.80	2.00	0.00	1.00	0.00
27.22	63.81	2.00	0.00	1.00	0.00	27.24	62.25	2.00	0.00	1.00	0.00
27.26	60.27	2.00	0.00	1.00	0.00	27.28	58.08	2.00	0.00	1.00	0.00
27.30	56.58	2.00	0.00	1.00	0.00	27.32	55.43	2.00	0.00	1.00	0.00
27.34	54.20	2.00	0.00	1.00	0.00	27.36	52.82	2.00	0.00	1.00	0.00
27.38	51.85	2.00	0.00	1.00	0.00	27.40	51.68	2.00	0.00	1.00	0.00
27.42	51.31	2.00	0.00	1.00	0.00	27.44	50.41	2.00	0.00	1.00	0.00
27.46	49.10	2.00	0.00	1.00	0.00	27.48	48.17	2.00	0.00	1.00	0.00
27.50	47.67	2.00	0.00	1.00	0.00	27.52	47.77	2.00	0.00	1.00	0.00
27.54	47.65	2.00	0.00	1.00	0.00	27.56	47.63	2.00	0.00	1.00	0.00
27.58	47.86	2.00	0.00	1.00	0.00	27.60	48.35	2.00	0.00	1.00	0.00
27.62	49.61	2.00	0.00	1.00	0.00	27.64	50.79	2.00	0.00	1.00	0.00
27.66	52.55	2.00	0.00	1.00	0.00	27.68	54.96	2.00	0.00	1.00	0.00
27.70	58.00	2.00	0.00	1.00	0.00	27.72	60.70	2.00	0.00	1.00	0.00
27.74	62.40	2.00	0.00	1.00	0.00	27.76	62.60	2.00	0.00	1.00	0.00
27.78	61.71	2.00	0.00	1.00	0.00	27.80	60.26	2.00	0.00	1.00	0.00
27.82	58.49	2.00	0.00	1.00	0.00	27.84	56.53	2.00	0.00	1.00	0.00
27.86	55.33	2.00	0.00	1.00	0.00	27.88	54.51	2.00	0.00	1.00	0.00
27.90	56.36	2.00	0.00	1.00	0.00	27.92	57.45	2.00	0.00	1.00	0.00
27.94	59.70	2.00	0.00	1.00	0.00	27.96	61.50	2.00	0.00	1.00	0.00
27.98	63.35	2.00	0.00	1.00	0.00	28.00	63.66	2.00	0.00	1.00	0.00
28.02	62.19	2.00	0.00	1.00	0.00	28.04	59.59	2.00	0.00	1.00	0.00
28.06	57.07	2.00	0.00	1.00	0.00	28.08	55.48	2.00	0.00	1.00	0.00
28.10	54.10	2.00	0.00	1.00	0.00	28.12	52.45	2.00	0.00	1.00	0.00
28.14	50.80	2.00	0.00	1.00	0.00	28.16	49.72	2.00	0.00	1.00	0.00
28.18	49.39	2.00	0.00	1.00	0.00	28.20	49.03	2.00	0.00	1.00	0.00
28.22	48.92	2.00	0.00	1.00	0.00	28.24	49.58	2.00	0.00	1.00	0.00
28.26	51.65	2.00	0.00	1.00	0.00	28.28	54.28	2.00	0.00	1.00	0.00
28.30	56.52	2.00	0.00	1.00	0.00	28.32	58.23	2.00	0.00	1.00	0.00
28.34	60.12	2.00	0.00	1.00	0.00	28.36	62.32	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
28.38	64.32	2.00	0.00	1.00	0.00	28.40	65.89	2.00	0.00	1.00	0.00
28.42	67.39	2.00	0.00	1.00	0.00	28.44	69.30	2.00	0.00	1.00	0.00
28.46	71.30	2.00	0.00	1.00	0.00	28.48	72.97	2.00	0.00	1.00	0.00
28.50	74.50	2.00	0.00	1.00	0.00	28.52	76.02	2.00	0.00	1.00	0.00
28.54	77.61	2.00	0.00	1.00	0.00	28.56	78.85	2.00	0.00	1.00	0.00
28.58	79.71	2.00	0.00	1.00	0.00	28.60	80.46	2.00	0.00	1.00	0.00
28.62	80.82	2.00	0.00	1.00	0.00	28.64	80.27	2.00	0.00	1.00	0.00
28.66	78.93	2.00	0.00	1.00	0.00	28.68	77.42	2.00	0.00	1.00	0.00
28.70	77.19	2.00	0.00	1.00	0.00	28.72	78.17	2.00	0.00	1.00	0.00
28.74	79.37	2.00	0.00	1.00	0.00	28.76	79.96	2.00	0.00	1.00	0.00
28.78	80.65	2.00	0.00	1.00	0.00	28.80	82.88	2.00	0.00	1.00	0.00
28.82	85.92	2.00	0.00	1.00	0.00	28.84	88.27	2.00	0.00	1.00	0.00
28.86	89.46	2.00	0.00	1.00	0.00	28.88	90.06	2.00	0.00	1.00	0.00
28.90	90.66	2.00	0.00	1.00	0.00	28.92	90.87	2.00	0.00	1.00	0.00
28.94	90.66	2.00	0.00	1.00	0.00	28.96	90.08	2.00	0.00	1.00	0.00
28.98	89.77	2.00	0.00	1.00	0.00	29.00	89.47	2.00	0.00	1.00	0.00
29.02	89.07	2.00	0.00	1.00	0.00	29.04	88.40	2.00	0.00	1.00	0.00
29.06	87.34	2.00	0.00	1.00	0.00	29.08	85.45	2.00	0.00	1.00	0.00
29.10	82.60	2.00	0.00	1.00	0.00	29.12	78.83	2.00	0.00	1.00	0.00
29.14	75.00	2.00	0.00	1.00	0.00	29.16	71.73	2.00	0.00	1.00	0.00
29.18	69.39	2.00	0.00	1.00	0.00	29.20	67.73	2.00	0.00	1.00	0.00
29.22	66.39	2.00	0.00	1.00	0.00	29.24	65.29	2.00	0.00	1.00	0.00
29.26	64.35	2.00	0.00	1.00	0.00	29.28	63.31	2.00	0.00	1.00	0.00
29.30	62.01	2.00	0.00	1.00	0.00	29.32	60.38	2.00	0.00	1.00	0.00
29.34	59.12	2.00	0.00	1.00	0.00	29.36	58.40	2.00	0.00	1.00	0.00
29.38	57.98	2.00	0.00	1.00	0.00	29.40	57.35	2.00	0.00	1.00	0.00
29.42	56.40	2.00	0.00	1.00	0.00	29.44	55.20	2.00	0.00	1.00	0.00
29.46	53.68	2.00	0.00	1.00	0.00	29.48	52.05	2.00	0.00	1.00	0.00
29.50	50.81	2.00	0.00	1.00	0.00	29.52	50.82	2.00	0.00	1.00	0.00
29.54	51.05	2.00	0.00	1.00	0.00	29.56	49.52	2.00	0.00	1.00	0.00
29.58	61.11	2.00	0.00	1.00	0.00	29.60	52.08	2.00	0.00	1.00	0.00
29.62	55.06	2.00	0.00	1.00	0.00	29.64	56.71	2.00	0.00	1.00	0.00
29.66	56.79	2.00	0.00	1.00	0.00	29.68	55.74	2.00	0.00	1.00	0.00
29.70	54.77	2.00	0.00	1.00	0.00	29.72	54.72	2.00	0.00	1.00	0.00
29.74	55.68	2.00	0.00	1.00	0.00	29.76	56.04	2.00	0.00	1.00	0.00
29.78	55.35	2.00	0.00	1.00	0.00	29.80	53.17	2.00	0.00	1.00	0.00
29.82	50.72	2.00	0.00	1.00	0.00	29.84	48.85	2.00	0.00	1.00	0.00
29.86	48.60	2.00	0.00	1.00	0.00	29.88	50.28	2.00	0.00	1.00	0.00
29.90	53.35	2.00	0.00	1.00	0.00	29.92	57.28	2.00	0.00	1.00	0.00
29.94	80.52	2.00	0.00	1.00	0.00	29.96	157.80	2.00	0.00	1.00	0.00
29.98	75.04	2.00	0.00	1.00	0.00	30.00	79.20	2.00	0.00	1.00	0.00
30.02	80.13	2.00	0.00	1.00	0.00	30.04	78.36	2.00	0.00	1.00	0.00
30.06	74.38	2.00	0.00	1.00	0.00	30.08	70.32	2.00	0.00	1.00	0.00
30.10	66.38	2.00	0.00	1.00	0.00	30.12	63.26	2.00	0.00	1.00	0.00
30.14	61.07	2.00	0.00	1.00	0.00	30.16	59.03	2.00	0.00	1.00	0.00
30.18	57.96	2.00	0.00	1.00	0.00	30.20	57.40	2.00	0.00	1.00	0.00
30.22	57.46	2.00	0.00	1.00	0.00	30.24	58.40	2.00	0.00	1.00	0.00
30.26	60.28	2.00	0.00	1.00	0.00	30.28	63.26	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)	Depth (m)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (cm)
30.30	66.32	2.00	0.00	1.00	0.00	30.32	68.51	2.00	0.00	1.00	0.00
30.34	69.33	2.00	0.00	1.00	0.00	30.36	68.98	2.00	0.00	1.00	0.00
30.38	68.17	2.00	0.00	1.00	0.00	30.40	67.51	2.00	0.00	1.00	0.00
30.42	67.21	2.00	0.00	1.00	0.00	30.44	67.28	2.00	0.00	1.00	0.00
30.46	66.86	2.00	0.00	1.00	0.00	30.48	65.56	2.00	0.00	1.00	0.00
30.50	63.78	2.00	0.00	1.00	0.00	30.52	62.79	2.00	0.00	1.00	0.00
30.54	63.11	2.00	0.00	1.00	0.00	30.56	63.73	2.00	0.00	1.00	0.00
30.58	63.91	2.00	0.00	1.00	0.00	30.60	63.77	2.00	0.00	1.00	0.00
30.62	63.68	2.00	0.00	1.00	0.00	30.64	63.53	2.00	0.00	1.00	0.00
30.66	63.10	2.00	0.00	1.00	0.00	30.68	62.02	2.00	0.00	1.00	0.00
30.70	60.99	2.00	0.00	1.00	0.00	30.72	60.21	2.00	0.00	1.00	0.00
30.74	59.85	2.00	0.00	1.00	0.00	30.76	59.74	2.00	0.00	1.00	0.00
30.78	59.92	2.00	0.00	1.00	0.00	30.80	60.59	2.00	0.00	1.00	0.00
30.82	61.47	2.00	0.00	1.00	0.00	30.84	62.59	2.00	0.00	1.00	0.00
30.86	63.85	2.00	0.00	1.00	0.00	30.88	65.07	2.00	0.00	1.00	0.00
30.90	65.56	2.00	0.00	1.00	0.00	30.92	65.29	2.00	0.00	1.00	0.00
30.94	64.41	2.00	0.00	1.00	0.00	30.96	63.51	2.00	0.00	1.00	0.00
30.98	62.66	2.00	0.00	1.00	0.00	31.00	62.11	2.00	0.00	1.00	0.00
											Total estimated settlement: 12.35

Abbreviations

$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
 FS: Factor of safety against liquefaction
 e_v (%): Post-liquefaction volumetric strain
 DF: e_v depth weighting factor
 Settlement: Calculated settlement



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Settore geologia e ambiente

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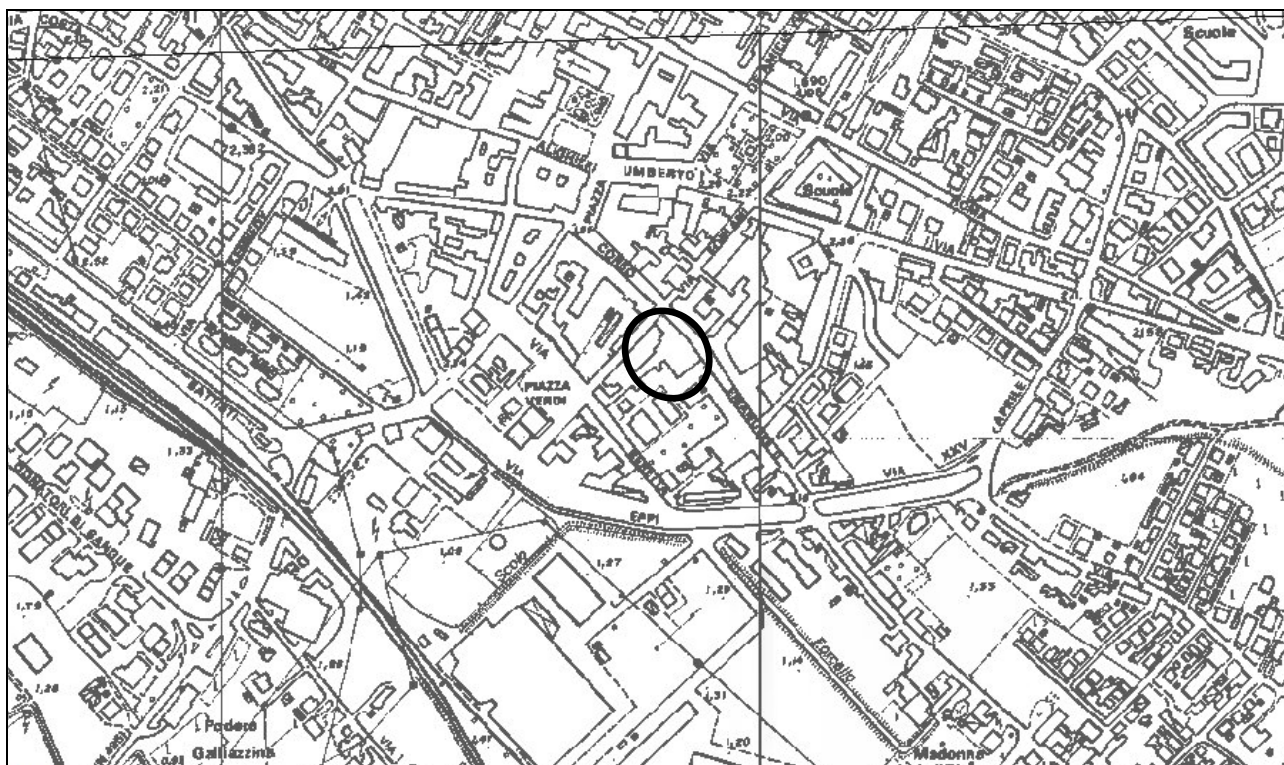
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SEZIONE GEOLOGICA E GEOTECNICA

Comune Portomaggiore
PROVINCIA DI FERRARA

Lavori di Restauro e recupero del Piccolo Teatro della Concordia di Portomaggiore (Fe)
CIG: ZB22919198 CUP: D97D17000040002



Committente: **Comune di Portomaggiore**
Sede in: **Piazza Umberto I, 5,**
44015 Portomaggiore (FE)

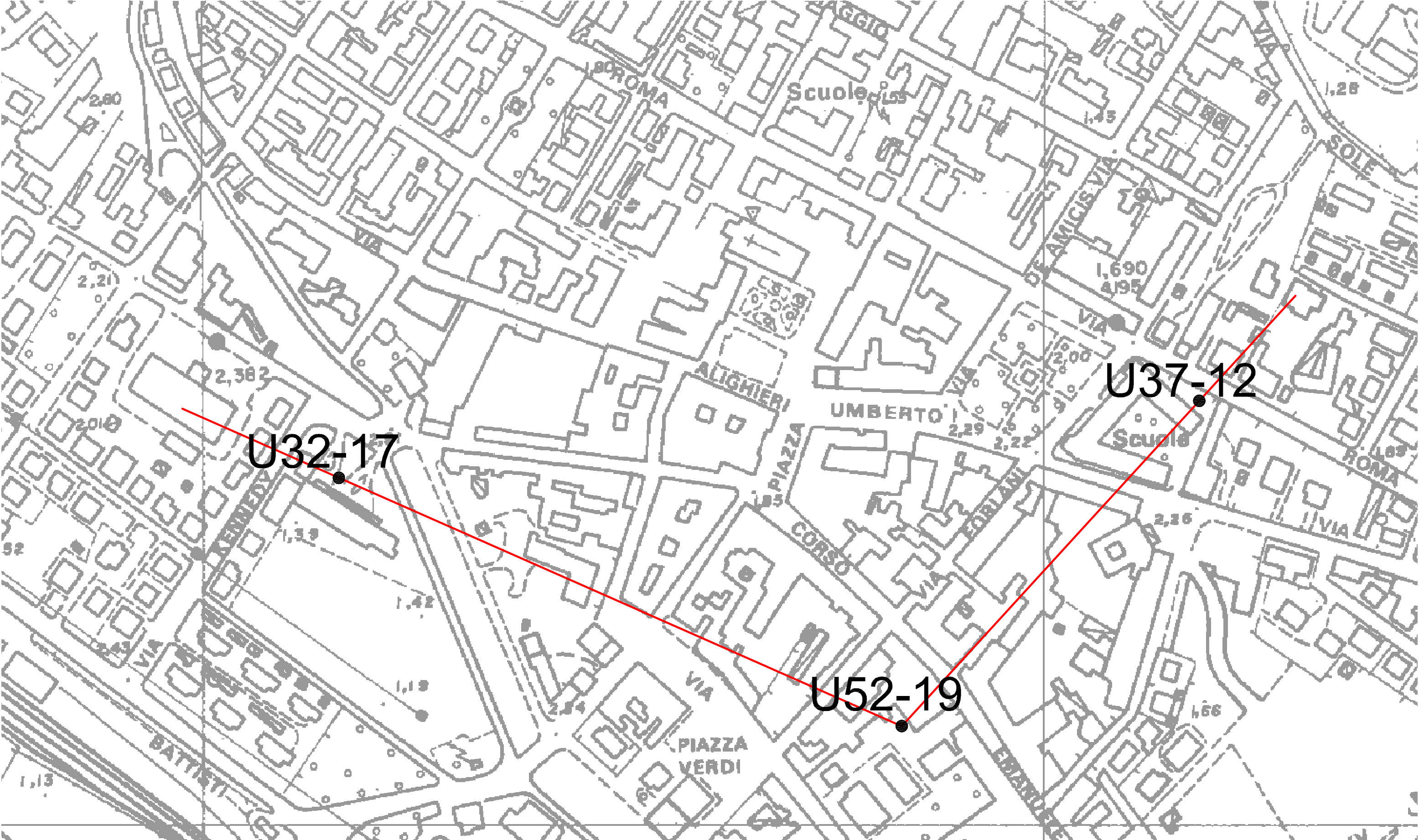
S.S.T. SETTORE GEOLOGIA E AMBIENTE

Geotecnica; Studio terreni di fondazione; Stabilità dei versanti; Rilevamento geologico; Rilievi topografici; Geofisica - Contributi allo Studio di Impatto Ambientale; Assistenza alle pubbliche amministrazioni negli studi di fattibilità e di realizzazione dei P.R.G., cimiteri, discariche, piani attività estrattive, studi di acquiferi per la tutela e per l'utilizzo di risorse idriche sotterranee; subirrigazioni.

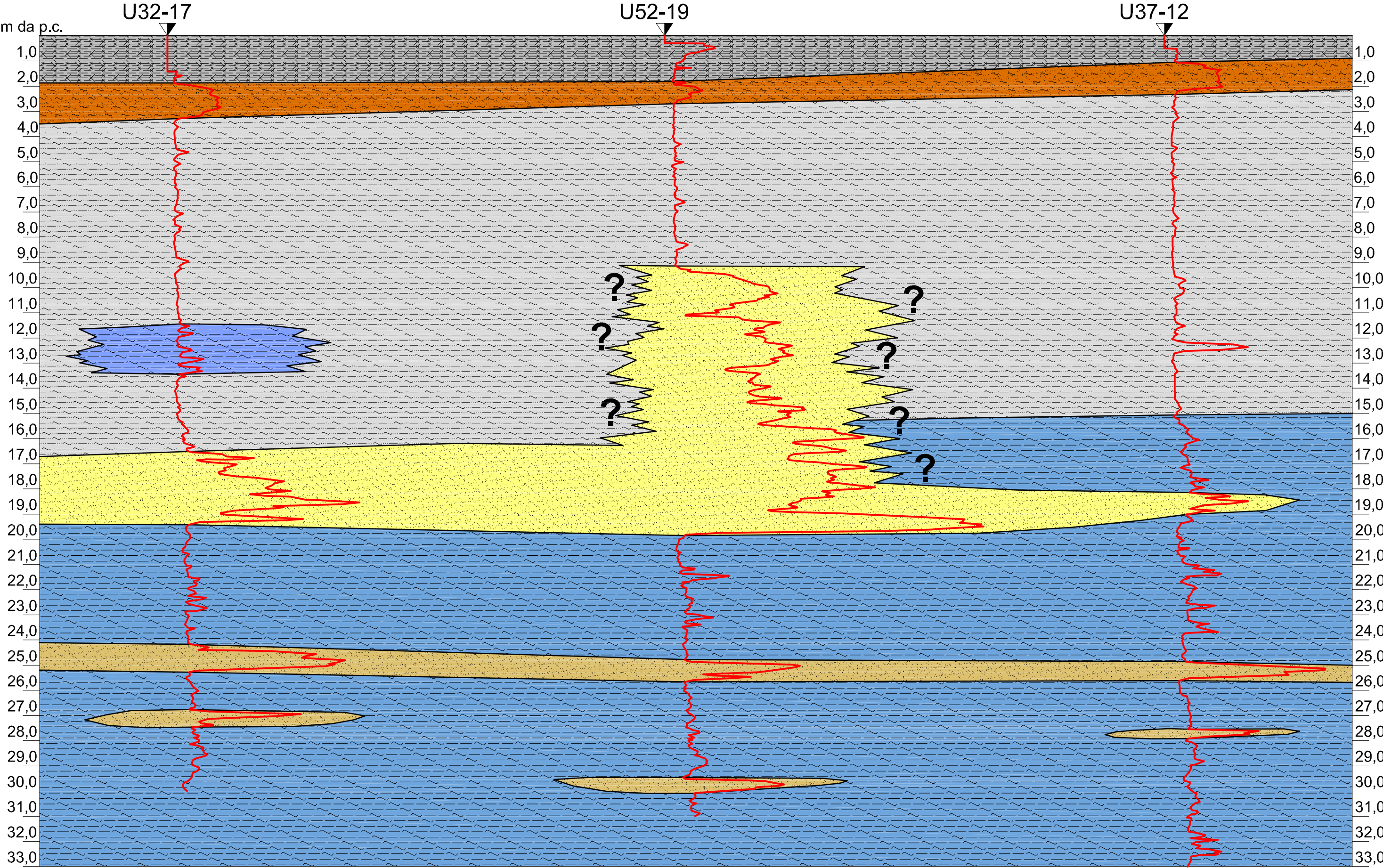
18 ottobre 2021

Timbro

Thomas Veronese



COMUNE DI PORTOMAGGIORE PROVINCIA DI FERRARA		TAVOLA: UBICAZIONE SEZIONE
OGGETTO: Lavori di restauro e recupero del Piccolo Teatro della Concordia di Portomaggiore (Fe)		
TECNICO: Geol. Thomas Veronese		



SCALA ORIZZONTALE

0,0 50,0 100,0 m

LEGENDA

Argille Sovraconsolidate

Sabbie Limose sciolte e poco addensate

Argille e Argille Limose moderatamente consistenti

Sabbie e Sabbie debolmente Limose da moderatamente addensate ad addensate

Limi e Argille Limose consistenti

Argille e Argille Limose consistenti

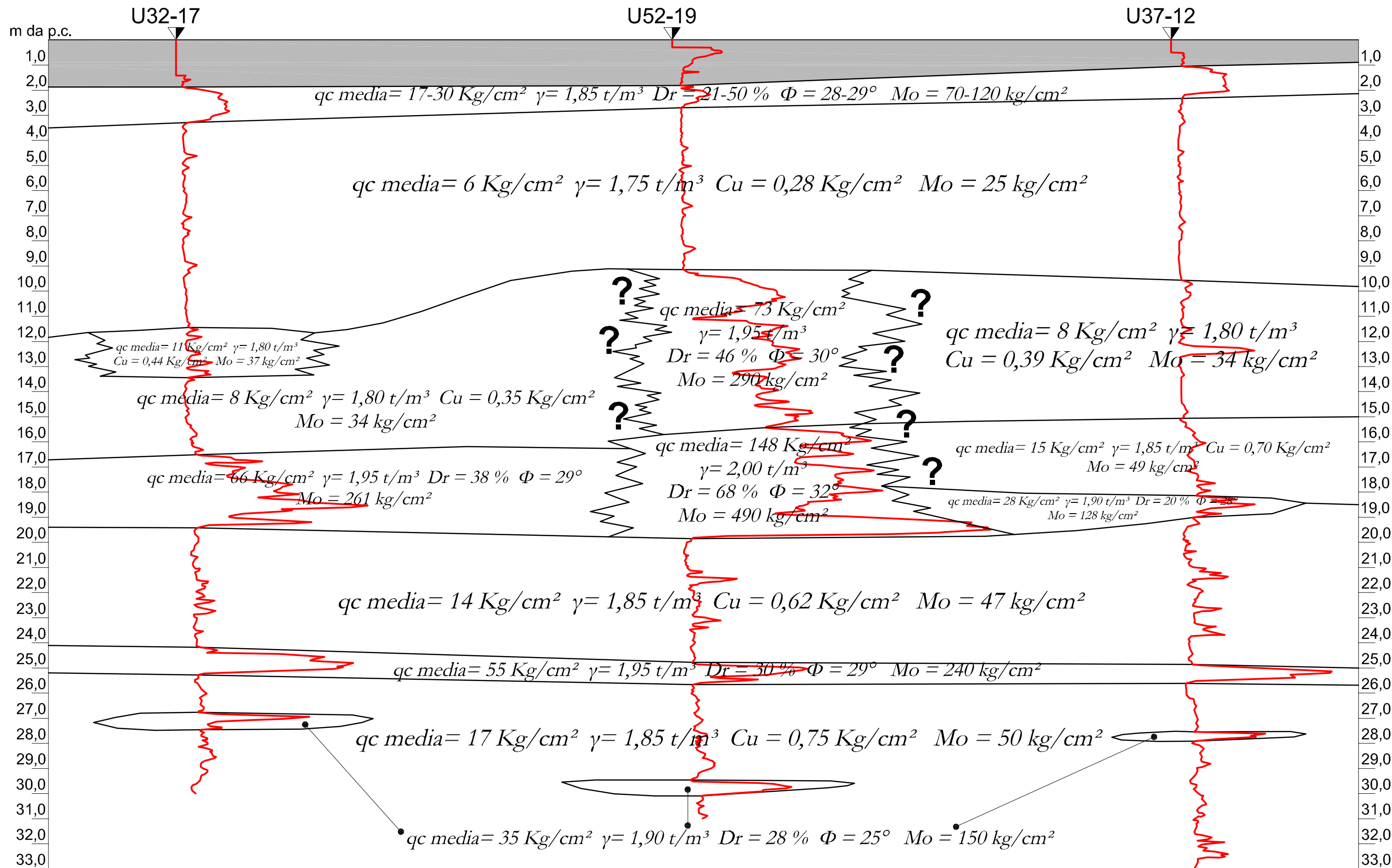
Sabbie e Sabbie Limose da poco a moderatamente addensate

COMUNE DI PORTOMAGGIORE
PROVINCIA DI FERRARA

TAVOLA:
SEZIONE GEOLOGICA

OGGETTO: Lavori di restauro e recupero del Piccolo Teatro della Concordia di Portomaggiore (Fe)

TECNICO: Geol. Thomas Veronese



SCALA ORIZZONTALE

0,0 50,0 100,0 m

COMUNE DI PORTOMAGGIORE
PROVINCIA DI FERRARA

TAVOLA:
SEZIONE GEOTECNICA

OGGETTO: Lavori di restauro e recupero del Piccolo Teatro della Concordia di Portomaggiore (Fe)

TECNICO: Geol. Thomas Veronese