

Dott. Bucci Aride Geologo, Via Montepetra Trabocchi, 83/F – 47030 Sogliano al Rubicone (FC)
tel. 349/5430080 Cod. Fisc. BCC RDA 79 I 21 C 573 O - P. IVA 03829020407



PROCEDIMENTO UNICO EX ART.53 - L.R. 24/2017 PER L'AMPLIAMENTO E LA RISTRUTTURAZIONE DELL'ATTIVITA' DI PRODUZIONE CONGLOMERATI BITUMINOSI E POTENZIAMENTO DELL'ATTIVITA' DI RECUPERO RIFIUTI NON PERICOLOSI – VIA PONARA.

LOCALITÀ:	Via Ponara
COMUNE	Bertinoro (FC) e Forlimpopoli (FC)
COMMITTENTE:	Romagnola Conglomerata SRL

RELAZIONE GEOLOGICA

Marzo 2025

IL COMMITTENTE:	IL TECNICO:
Romagnola Conglomerati SRL	Geol. Bucci Aride

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PREMESSA

La Società Romagnola Conglomerati srl mi ha incaricato di redigere il presente studio geologico relativo al PROCEDIMENTO UNICO EX ART.53 - L.R. 24/2017 PER L'AMPLIAMENTO E LA RISTRUTTURAZIONE DELL'ATTIVITA' DI PRODUZIONE CONGLOMERATI BITUMINOSI E POTENZIAMENTO DELL'ATTIVITA' DI RECUPERO RIFIUTI NON PERICOLOSI – VIA PONARA, in Località Panighina, Comune di Bertinoro e Comune di Forlimpopoli (FC).

L' intervento sarà realizzato ai sensi delle normative tecniche vigenti.

E' stato eseguito un rilevamento preliminare atto a delineare le condizioni geomorfologiche e idrogeologiche dell'area.

Le indagini geotecniche sono state programmate in funzione del tipo di intervento, hanno riguardato il volume significativo, ed hanno permesso la definizione del modello geologico di sottosuolo necessario alla progettazione.

Attraverso la modellazione geologica è stato possibile evidenziare eventuali criticità di tipo idrogeologico e geomorfologico derivante dalla realizzazione delle strutture in progetto.

NORMATIVA DI RIFERIMENTO

La stesura della seguente relazione è stata compiuta in ottemperanza alle disposizioni contenute nelle normative di riferimento di seguito elencate:

- AGI: raccomandazione sulla programmazione ed esecuzione delle indagini geotecniche, Giugno 1977;
- "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione e il collaudo delle opere di sostegno delle terre e delle opere di fondazione". D.M. 11 Marzo 1988;
- Istruzioni relative alle "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione e il collaudo delle opere di sostegno delle terre e delle opere di fondazione". Circ. Min. LL.PP. n° 30483 24 Settembre 1988;
- Eurocodice 7.1 (1997) Progettazione geotecnica – Parte I : Regole Generali . – UNI;
- Eurocodice 8 (1998) Indicazioni progettuali per la resistenza fisica delle strutture. Parte 5: Fondazioni, strutture di contenimento ed aspetti geotecnici (stesura finale 2003);
- Decreto del presidente della Repubblica 5 giugno 2001, n. 328 pubblicata nella G.U. n. 190 del 17-8-2001- Suppl. Ordinario n.212);
- Eurocodice 7.2 (2002) Progettazione geotecnica – Parte II : Progettazione assistita da prove di laboratorio (2002). UNI;
- Eurocodice 7.3 (2002).Progettazione geotecnica – Parte II : Progettazione assistita con prove in sito(2002). UNI;

- Ordinanza del Dipartimento della Protezione Civile e del Servizio Sismico Nazionale del 20 marzo 2003: “Nuove disposizioni per le costruzioni in zona sismica” pubblicata nella G.U. del 8 maggio 2003;
- Decreto del Ministero delle Infrastrutture e dei Trasporti: “Norme tecniche per le costruzioni” del 14 settembre 2005 geotecniche;
- Consiglio Superiore dei Lavori Pubblici Pericolosità sismica e Criteri generali per la classificazione sismica del territorio nazionale. Allegato al voto n. 36 del 27.07.2007;
- "Nuove Norme tecniche per le costruzioni ". D.M. 14 Gennaio 2008;
- Consiglio Superiore dei Lavori Pubblici Istruzioni per l'applicazione delle “Norme tecniche per le costruzioni” di cui al D.M. 14 gennaio 2008. Circolare 2 febbraio 2009;
- "Nuove Norme tecniche per le costruzioni ". 17/01/2018

INQUADRAMENTO GEOGRAFICO E CARTOGRAFICO

L'area in oggetto è posizionata geograficamente in Via Ponara, in Comune di Bertinoro (FC).

Nel contesto cartografico il sito di colloca nel Foglio 100 della Carta Geologica d'Italia in scala 1 : 100.000; in scala 1 : 10.000 l'area compare nella Sezione 255 030 “Cesena” mentre in scala 1 : 5.000 nell'Elemento 255 034 della Carta Tecnica Regionale dell'Emilia Romagna.

Le coordinate geografiche WGS 84 rilevate tramite strumento GPS rendono:

LATITUDINE: 44.17

LONGITUDINE: 12.15

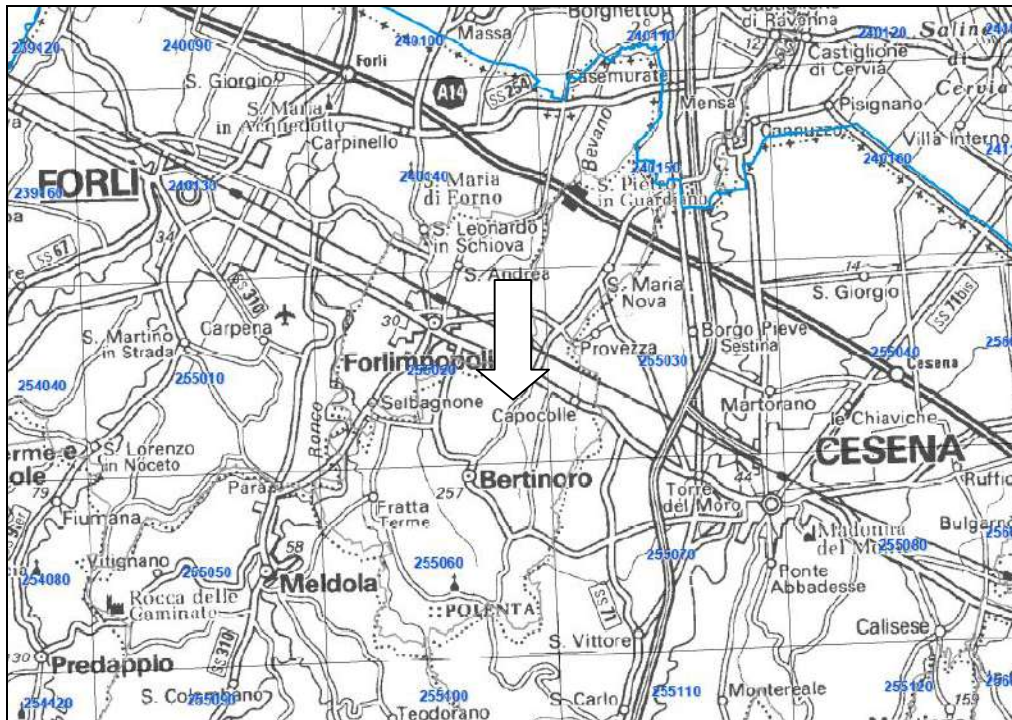


Fig. 1. Inquadramento Territoriale

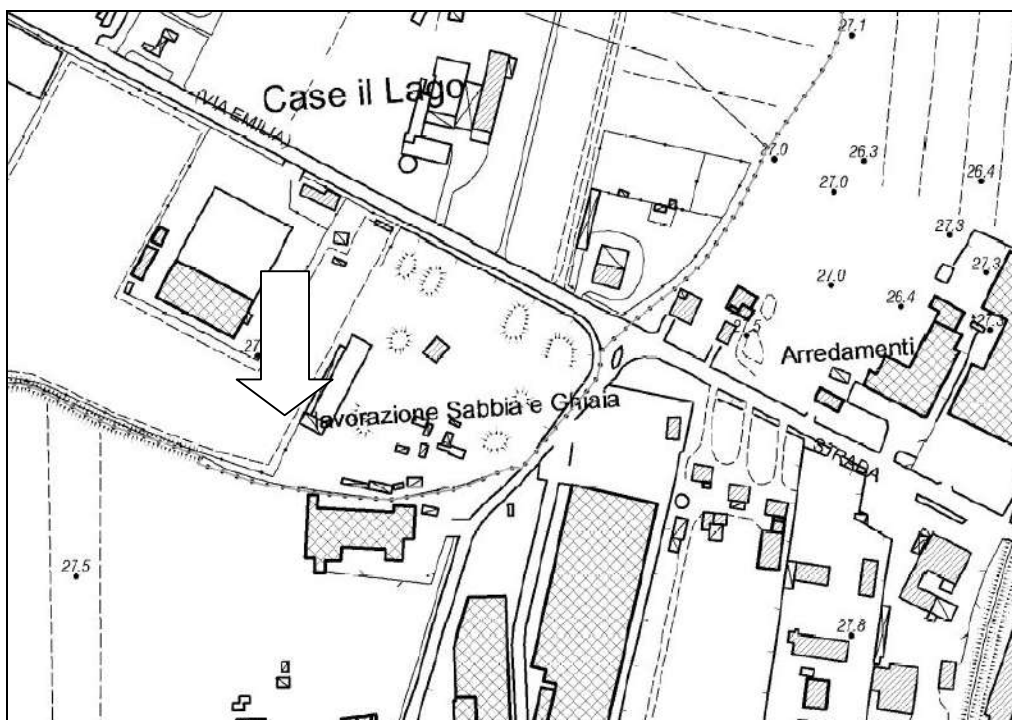


Fig. 2. Estratto Carta Tecnica Regionale dell'Emilia Romagna scala 1 : 5.000.

MODELLO GEOLOGICO

INQUADRAMENTO GEOLOGICO

Il territorio della pianura cesenate e forlivese rappresenta il comparto iniziale, il raccordo, del consistente cuneo sedimentario costituito dagli apporti detritici alluvionali dei numerosi corsi d'acqua che dal territorio alpino e da quello appenninico hanno, durante il quaternario, hanno dato origine alla Pianura Padana.

Gli apporti detritici descritti sono attribuibili in larga parte alle colmate dei collettori idrici dello spartiacque Tosco Romagnolo.

La potenza di questo consistente accumulo detritico eterogeneo è dell'ordine chilometrico nelle aree ferraresi e si riduce sensibilmente fino alla scala decametrica di queste zone. I depositi quaternari appoggiano al di sopra dei depositi di età pliocenica.

La struttura tettonica dei terreni pliocenici alla base dei sedimenti alluvionali è assimilabile alla struttura tettonica appenninica affiorante a sud e che in questi luoghi appare sepolta dal bacino sedimentologico quaternario.

In periodo pliocenico tale zona costituiva un enorme bacino sedimentario che in fasi successive è stato colmato dai detriti trasportati dalle aree montuose dai principali canali idrici verso il Mare Adriatico.

La litologia più superficiale dell'area è caratterizzata dalla presenza di sedimenti fini di tipo argilloso,finanche sabbioso fine. Presenti ad intervalli disomogenei in profondità lenti sabbiose e livelli ghiaiosi appartenenti al prisma di divagazione degli antichi alvei fluviali, che nel tempo hanno modificato percorso e tracciato, e localmente a depositi di rotta degli argini naturali durante le fasi di massimo stress idrologico dei paleoalvei.

A scala locale è interessante indicare il passaggio del Torrente Bevano e dello Scolo Ponara.

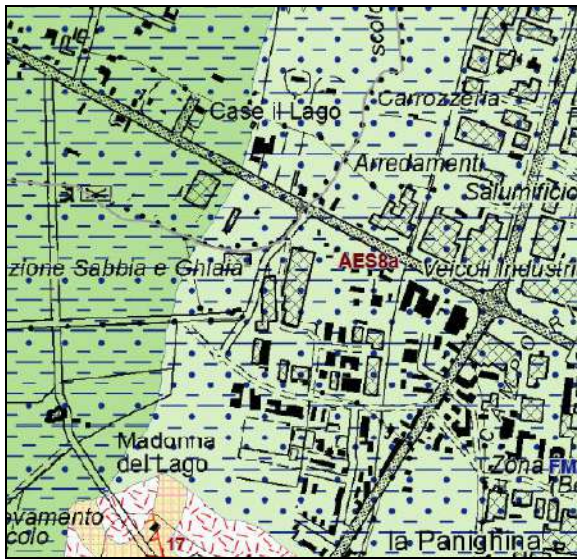
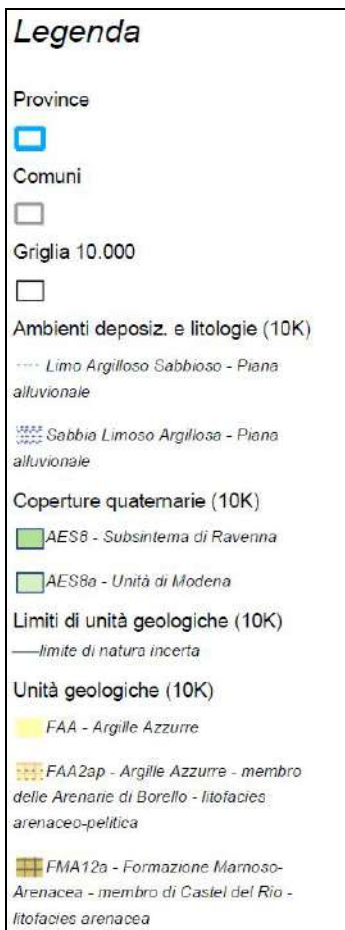


Fig. 3. Particolare Carta Geologica dell'Emilia Romagna



CONDIZIONE GEOMORFOLOGICA, IDROLOGICA E IDROGEOLOGICA

La morfologia pianeggiante costituisce il motivo principale dell'intorno analizzato.

Nel comparto e nel suo immediato intorno non sono riscontrate criticità di tipo geomorfologico.

A grande scala l'idrologia è caratterizzata dal passaggio dell'asse fluviale del Torrente Bevano il cui bacino è compreso tra quello dei Fiumi Uniti a nord e quello del Savio a sud.

Le sue sorgenti si trovano alle pendici di Monte Maggio (329 m), nei pressi di Bertinoro in provincia di Forlì-Cesena. In pianura il torrente raccoglie le acque di molti fossati, scoli agricoli e canali di bonifica.

Il Bevano prosegue il suo corso nella provincia di Ravenna in località Casemurate-San Zaccaria, in una zona dove un tempo vi era un'ampia palude, la Valle Standiana, ora bonificata.

Elemento di interesse è costituito dalla presenza della falda freatica a pari circa a – 2.00 m dal piano campagna nella stagione invernale con un abbassamento relativo durante la stagione estiva.

MODELLO GEOTECNICO

PROVA CPT / CPTe

La prova penetrometrica statica CPT (di tipo meccanico o elettrico) consiste essenzialmente nella misura della resistenza alla penetrazione di una punta meccanica di dimensioni e caratteristiche standardizzate, infissa nel terreno a velocità costante ($v = 2 \text{ cm / sec} \pm 0,5 \text{ cm / sec}$).

La penetrazione viene effettuata tramite un dispositivo di spinta (martinetto idraulico), opportunamente ancorato al suolo con coppie di coclee ad infissione, che agisce su una batteria doppia di aste (aste coassiali esterne cave e interne piene), alla cui estremità è collegata la punta.

Lo sforzo necessario per l'infissione è misurato per mezzo di manometri, collegati al martinetto mediante una testa di misura idraulica.

La punta conica (del tipo telescopico) è dotata di un manicotto sovrastante, per la misura dell'attrito laterale.

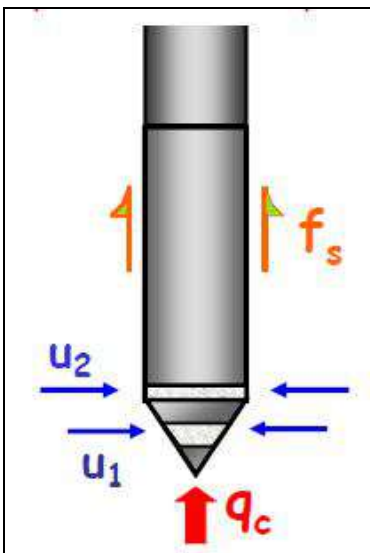


Fig. 4 - Schema Punta CPTE

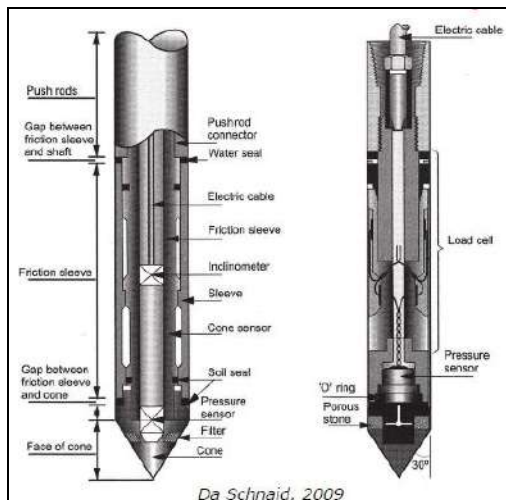


Fig. 5 - Pietra porosa collegata a trasduttore per misura elettrica

Le dimensioni della punta / manicotto sono standardizzate, e precisamente :

- diametro Punta Conica meccanica $D = 35,7 \text{ mm}$
- area di punta $A_p = 10 \text{ cm}^2$
- angolo di apertura del cono $\alpha = 60^\circ$
- superficie laterale del manicotto $A_m = 150 \text{ cm}^2$

Tramite la definizione dell'attrito laterale e dello sforzo a rottura del terreno è possibile ricostruire la litologia il primo sottosuolo.

STRATIGRAFIA DEL SOTTOSUOLO

STRATIGRAFIA CPTe1

STRATO 1	dal p.c a – 1.50 m	riporto antropico compattato
STRATO 2	da – 1.50 m a 10,30 m	Argille compatte e molto compatte
STRATO 3	da – 10,30 a - 13,50 m	Argille e limi argillosi
STRATO 4	da – 13,50 a – 15,00 m	Sabbie e limi sabbiosi

Livello falda – 2.00 m dal p.c.

STRATIGRAFIA CPTe2

STRATO 2	dal p.c a – 4,30 m	Argille compatte e molto compatte con laterizi e manufatti (canale di scolo riempito)
STRATO 3	da – 4,30 a - 11,10 m	Argille e limi argillosi
STRATO 4	da – 11,10 a – 12,00 m	Argille compatte e molto compatte

Livello falda – 2.00 m dal p.c.

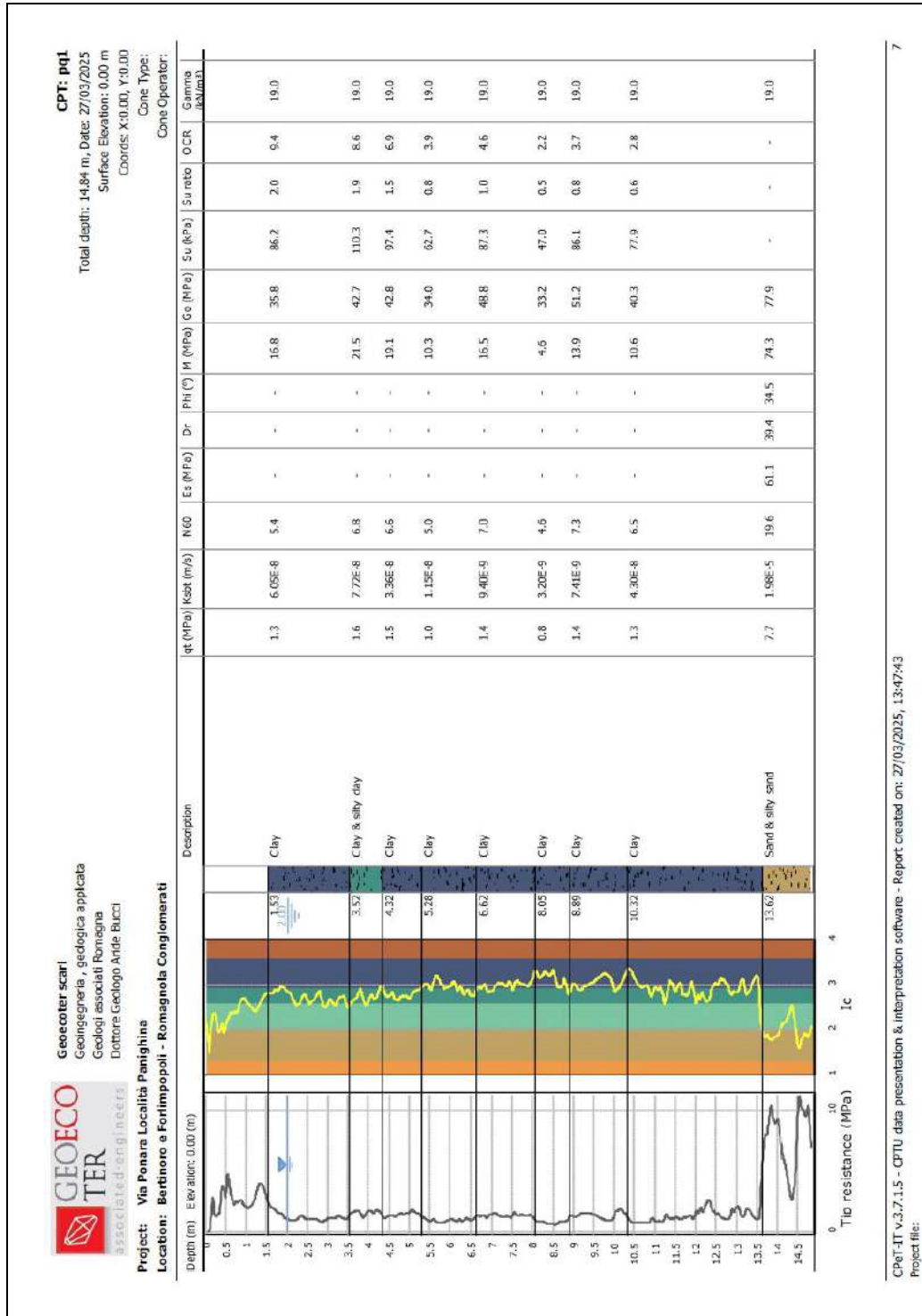


Fig. 5. Diagramma stratigrafico CPTe1

CPTe1T v.3.7.1.5 - CPTU data presentation & interpretation software - Report created on: 27/03/2025, 13:47:43
 Project file:

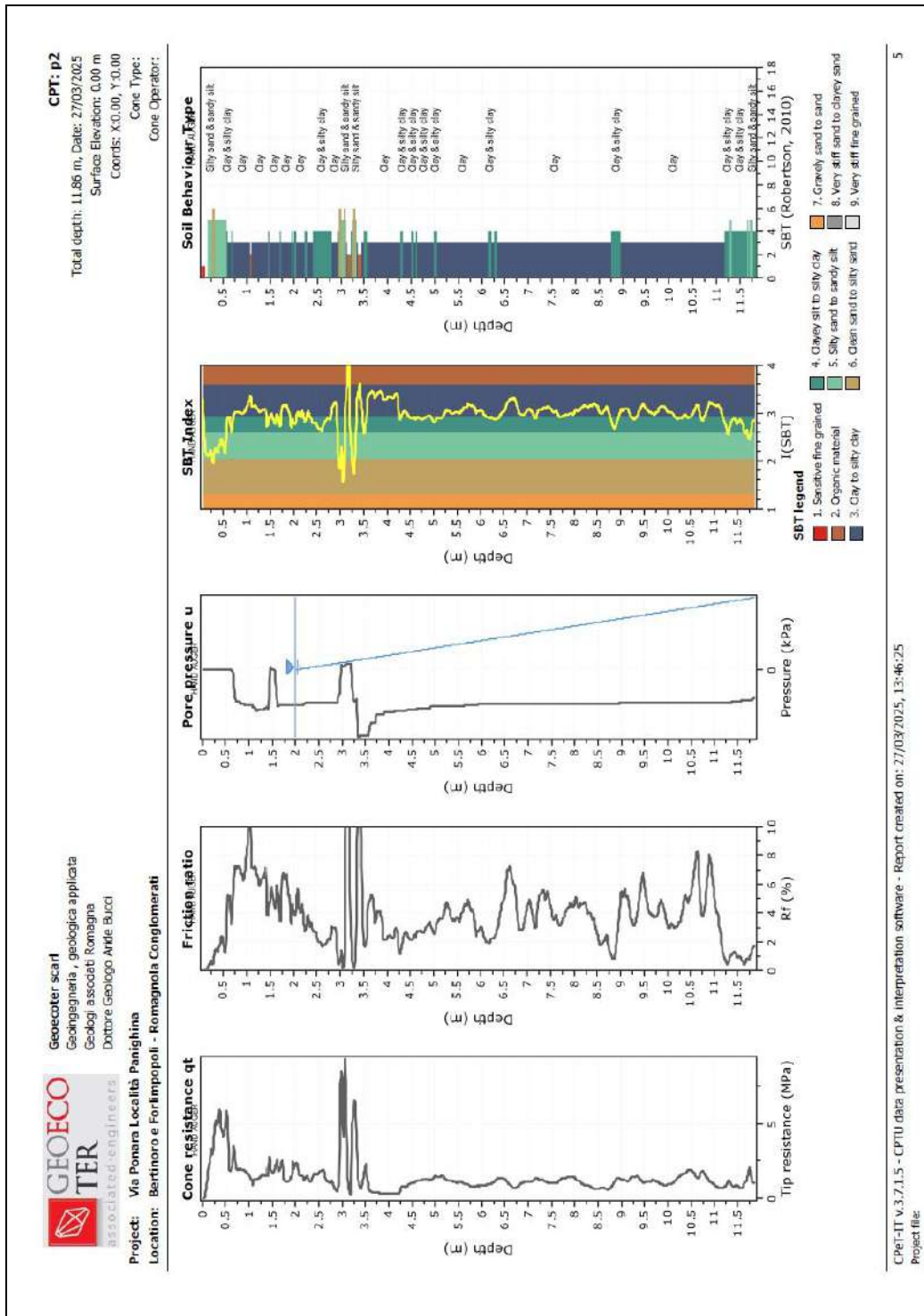


Fig. 6. Diagramma stratigrafico CPTe2

PARAMETRI GEOTECNICI CARATTERISTICI

Si indicano in seguito le stime dei valori dei parametri geotecnici caratteristici dei terreni ricavati dalle correlazioni dirette delle CPTe e grazie ai dati di letteratura presenti sui terreni contermini al presente.

Nella presente trattazione vengono indicati i parametri medi delle argille dei limi e delle sabbie.

Legenda	
Nr:	Numero progressivo strato
Prof:	Profondità strato (m)
Tipo:	C: Coesivo. I: Incoerente. CI: Coesivo-Incoerente
Cu:	Coesione non drenata (Kg/cm ²)
C':	Coesione efficace (Kg/cm ²)
Mo:	Modulo Edometrico (Kg/cm ²)
G:	Modulo di deformazione a taglio (Kg/cm ²)
OCR:	Grado di sovraconsolidazione
Puv:	Peso unità di volume (t/m ³)
PuvS:	Peso unità di volume saturo (t/m ³)
Dr:	Densità relativa (%)
Fi:	Angolo di attrito efficace (°)
Ey:	Modulo di Young (Kg/cm ²)

Nr.Prof.	Tipo	Cu	c'	Mo	G	OCR	Puv	PuvS	Dr	Fi	Vs
1	I	--	--	50		--	1.70	1.90	--	33/35°	
2	C	0.50	0.50	40		--	1.80	1.90	--	18°	
3	C	0.75	0.07	55		--	1.80	1.80	--	18/20°	
4	I	--	--	100		--	1.90	2.00	--	31/33°	

INDICAZIONI PROGETTUALI

Il progetto prevede l'ampliamento e la ristrutturazione dell'attività di produzione conglomerati bituminosi ed il potenziamento dell'attività di recupero rifiuti non pericolosi di Via Ponara.

È prevista la realizzazione di una nuova linea di nastro trasporto e di alcuni manufatti collegati quali box e silos per lo stoccaggio e la lavorazione del materiale di lavorazione.

Per le condizioni stratigrafiche e litologiche rilevate si consiglia di dotare la struttura di fondazioni superficiali tipo plinti posti – 1.50 / 2.00 m dal p.c. a contatto con lo strato 2 argille compatte molto compatte.

Presupposto che la scelta ed il dimensionamento della struttura fondale sono prerogativa del progettista si forniscono delle indicazioni sui valori di resistenza dei terreni rilevati.

Dal momento che nel capitolo 6.4.2 delle NTC si legge che *“il piano di fondazione deve essere situato sotto la coltre di terreno vegetale, nonché sotto lo strato interessato da gelo e da significative variazioni stagionali del contenuto d'acqua”*, si consiglia di impostare la struttura ad una profondità di almeno 1.50 m dal p.c. a contatto con terreni argillosi, previa preparazione del terreno tramite la posa di uno spessore di 40/50 cm di ghiaia lavata 40/70 mm, compattata alla massima densità, uno spessore di 10 cm di magrone.

Per fondazioni superficiali la capacità portante limite può essere determinata dalla relazione di Brich Hansen che in generale è espressa dalla seguente pressione di contatto limite critica P_{crit} :

$$P_{crit} = c \cdot N_c \cdot s_c \cdot d_c \cdot i_c \cdot g_c \cdot b_c + q \cdot N_q \cdot s_q \cdot d_q \cdot i_q \cdot g_q \cdot b_q + 0,5 \cdot B \cdot \gamma \cdot N_\gamma \cdot s_\gamma \cdot d_\gamma \cdot i_\gamma \cdot g_\gamma \cdot b_\gamma$$

Peso specifico del terreno sotto il piano di posa = kg/mc 1900.00

Il calcolo sarà eseguito secondo l'approccio n. 2.

Coefficiente parziale per angolo resistenza a taglio: 1

Coefficiente parziale per coesione: 1

Coefficiente parziale per resistenza non drenata: 1

Coefficiente parziale per capacità portante: 2.3

Nuovo angolo di attrito: 17

Nuova coesione: 500.00

Larghezza fondazione: 1.50

Lunghezza fondazione: 1.50

Profondità di posa: 2.00

Falda: -2.00

Fattori di capacità portante:

$$N_g = 4.07$$

$$N_c = 13.10$$

$$N_q = 5.26$$

Fattori di forma:

$$S_g = 0.60$$

$$S_c = 1.40$$

$$S_q = 1.32$$

Fattori di inclinazione carico:

$$I_g = 1.00$$

$$I_c = 1.00$$

$$I_q = 1.00$$

Fattori di inclinazione fondazione:

$$B_g = 1.00$$

$$B_c = 1.00$$

$$B_q = 1.00$$

Fattori di inclinazione piano di campagna:

$$G_g = 1.00$$

$$G_c = 1.00$$

$$G_q = 1.00$$

Fattori di profondità piano di posa:

$$D_c = 1.33$$

$$D_q = 1.31$$

Indice di rigidezza $I_r = 184.100$

Indice di rigidezza critico $I_{rc} = 25.268$

Essendo $I_r > I_{rc}$ vale l'ipotesi di terreno incompressibile

I fattori correttivi di compressibilità sono unitari.

Capacità portante limite ultima = kg/mq 26220.646

Capacità portante limite ultima = kg/cmq 2.622

Resistenza di calcolo del terreno = kg/cmq 1.14

VERIFICA SECONDO LE NTC DM 17-01-2018 – CONDIZIONI CONSOLIDATE

DRENATE CD

Le verifiche Geotecniche agli stati limite ultimi SLU devono soddisfare la relazione

$R_d > E_d$

Fondazione diretta – plinto.

APPROCCIO 1 COMBINAZIONE 1 (STR) – A1 + M1 + R1

APPROCCIO 2 COMBINAZIONE 1 (STR) – A1 + M1 + R3

$$- \mathbf{Rd1-1} = P_{crit} / \gamma r1 = 2,622 / 1 = 2,622 \text{ kg/cmq}$$

$$R3 = R1 = \gamma r = 1$$

APPROCCIO 2 COMBINAZIONE 1 (GEO) – A1 + M1 + R3

$$\mathbf{Rd2-1} = P_{crit} / \gamma r3 = 2,622 / 2,3 = 1,14 \text{ kg/cmq}$$

Per il calcolo della resistenza di progetto in condizioni non drenate di seguito è ipotizzata la capacità portante dei terreni si è utilizzata sempre attraverso la formulazione di Brinch Hansen la coesione non drenata dello strato 1 con angolo di attrito efficace pari a zero.

Peso specifico del terreno sotto il piano di posa = kg/mc 1900.00

Il calcolo sarà eseguito secondo l'approccio n. 2.

Coefficiente parziale per angolo resistenza a taglio: 1

Coefficiente parziale per coesione: 1

Coefficiente parziale per resistenza non drenata: 1

Coefficiente parziale per capacità portante: 2.3

Nuovo angolo di attrito:

Nuova coesione: 5000.00

Fattori di forma:

$$S_g = 0.60$$

$$S_c = 1.20$$

Fattore di inclinazione carico $I_c = 1.00$

Fattore di inclinazione fondazione $B_c = 1.00$

Fattore di inclinazione piano di campagna $G_c = 1.00$

Fattore di profondità piano di posa $D_c = 1.40$

Capacità portante limite ultima = kg/mq 44539.356

Capacità portante limite ultima = kg/cmq 4.454

Resistenza di calcolo del terreno = kg/cmq 1.94

VERIFICA SECONDO LE NTC DM 17-01-2018 - CONDIZIONI NON DRENATE
CU

Le verifiche Geotecniche agli stati limite ultimi SLU devono soddisfare la relazione

$$R_d > E_d$$

Fondazione diretta – platea.

APPROCCIO 1 COMBINAZIONE 1 (STR) – A1 + M1 + R1

APPROCCIO 2 COMBINAZIONE 1 (STR) – A1 + M1 + R3

- **Rd1-1** = $P_{crit} / \gamma_r1 = 4,454 / 1 = 4,454$ kg/cmq

$R3 = R1 = \gamma_r = 1$

APPROCCIO 2 COMBINAZIONE 1 (GEO) – A1 + M1 + R3

Rd2-1 = $P_{crit} / \gamma_r3 = 4,454 / 2,3 = 1,94$ kg/cmq

CONDIZIONE SISMICA LOCALE

In base alle nuove Norme Tecniche per le Costruzioni, nella fattispecie il recente D.M. del 17/01/2018, la definizione dell'azione sismica fa riferimento ad un approccio semplificato, che si basa sull'individuazione di Categorie di sottosuolo e Condizioni Topografiche.

CATEGORIE DI SOTTOSUOLO

A - *Ammassi rocciosi affioranti o terreni molto rigidi caratterizzati da valori di $V_{s,30}$ superiori a 800 m/s, eventualmente comprendenti in superficie uno strato di alterazione, con spessore massimo pari a 3 m.*

B - *Rocce tenere e depositi di terreni a grana grossa molto addensati o terreni a grana fina molto consistenti con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ compresi tra 360 m/s e 800 m/s*

C - *Depositi di terreni a grana grossa mediamente addensati o terreni a grana fina mediamente consistenti con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ compresi tra 180 m/s e 360 m/s*

D - *Depositi di terreni a grana grossa scarsamente addensati o di terreni a grana fina scarsamente consistenti, con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ tra 100 e 180 m/s*

E - *Terreni con caratteristiche e valori di velocità equivalente riconducibili a quelle definite per le categorie C o D con profondità del substrato non superiore a 30 m.*

CONDIZIONI TOPOGRAFICHE

Per condizioni topografiche complesse è necessario predisporre di specifiche analisi di risposta sismica locale. Per configurazioni superficiali semplici si può adottare invece la seguente classificazione:

T1 - Superficie pianeggiante, pendii e rilievi isolati con inclinazione media $i \leq 15^\circ$.

T2 - Pendii con inclinazione media $i > 15^\circ$.

T3 - Rilievi con larghezza in cresta molto minore che alla base e inclinazione media $15^\circ \leq i \leq 30^\circ$.

T4 - Rilievi con larghezza in cresta molto minore che alla base e inclinazione media $i > 30^\circ$.

Nel caso in oggetto ed in atteso di nuovi rilevamenti, la categoria di sottosuolo è stata rilevata utilizzando i risultati delle precedenti analisi che hanno restituito una $vs_{30} = 219$ e 210 m/s a cui viene fatta corrispondere categoria C.

Per quanto concerne la condizione topografica invece, l'area investigata si sviluppa in ambito di pianura rispecchiando il caso T1.

I coefficienti sismici necessari per le verifiche strutturali di progettazione del fabbricato artigianale sono invece ricavati dalle tabelle inserite nelle paragrafo 7.11.3.5.2 delle NTC del D.M. 14.01.2008 e confermate nelle NTC del 17/01/2018.

Innanzitutto occorre inquadrare l'area in esame sul Reticolo Geografico Nazionale in termini di Longitudine e Latitudine. Il sito oggetto del presente studio ricade nel Comune di Bertinoro, avente nel dettaglio come Coordinate Geografiche WGS84:

LATITUDINE: 44.17

LONGITUDINE: 12.15

Ipotizzando un'Opera Ordinaria con “vita nominale maggiore uguale di 50 anni”, Classe d'uso II – “Edifici Ordinari ed industrie non pericolose, ponti secondari...” e in condizioni di Stato Limite SLV “a Salvaguardia della Vita” e per un Tempo di Ritorno $T_r = 475$ anni, i parametri di Pericolosità Sismica sono secondo, il Software EDILUS MS di ACCA softwares:

Parametri di pericolosità Sismica				
Stato Limite	T_r [anni]	a_g/g [-]	F_0 [-]	T^*_c [s]
Operatività	30	0.063	2.414	0.268
Danno	50	0.081	2.404	0.270
Salvaguardia Vita	475	0.204	2.378	0.309
Prevenzione Collasso	975	0.255	2.435	0.320

dove $a_g = 2,002$ m/s (da Software: Piano Spettri S.T.A. Data)

VIA PONARA ROMAGNOLA CONGLOMERATI,

Instrument: TRZ-0194/01-12

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 26/03/25 13:42:40 End recording: 26/03/25 13:54:40

Channel labels: NORTH SOUTH; EAST WEST ; UP DOWN

GPS data not available

Trace length: 0h12'00". Analysis performed on the entire trace.

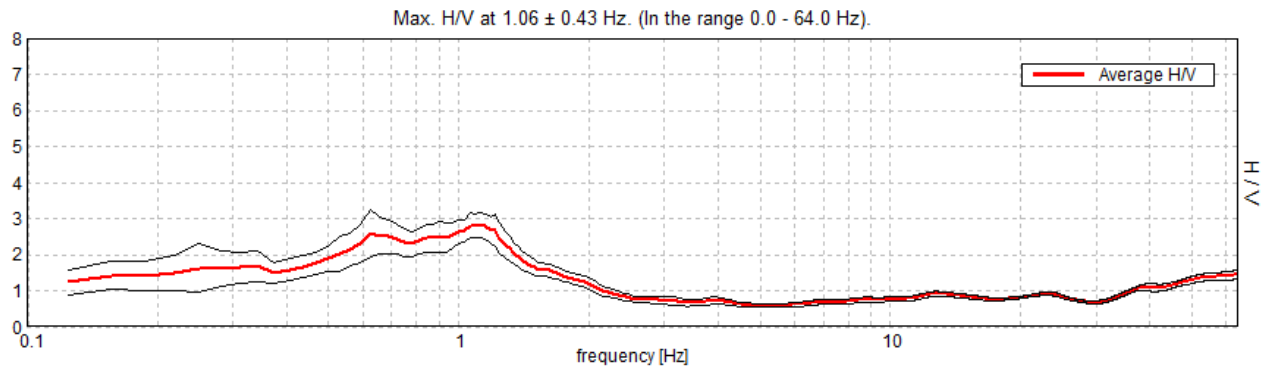
Sampling rate: 128 Hz

Window size: 20 s

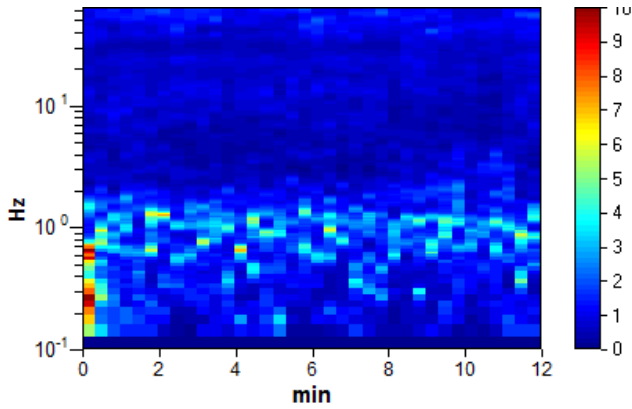
Smoothing type: Triangular window

Smoothing: 10%

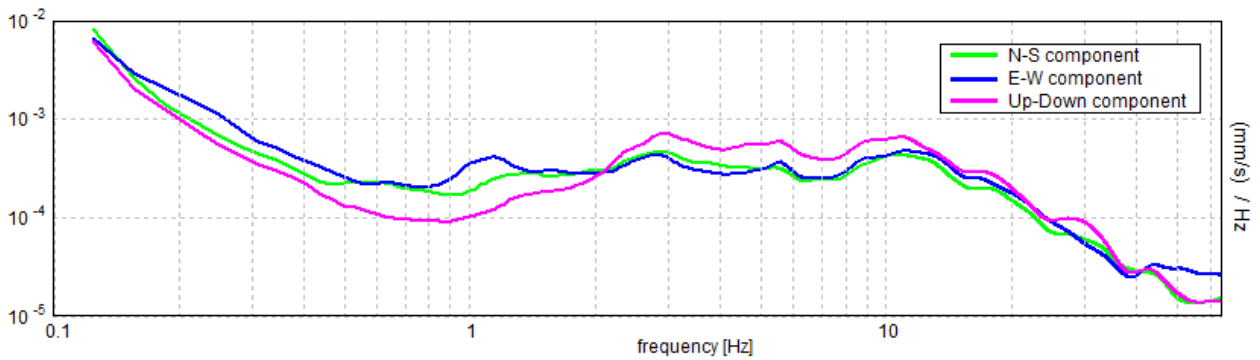
HORIZONTAL TO VERTICAL SPECTRAL RATIO



H/V TIME HISTORY

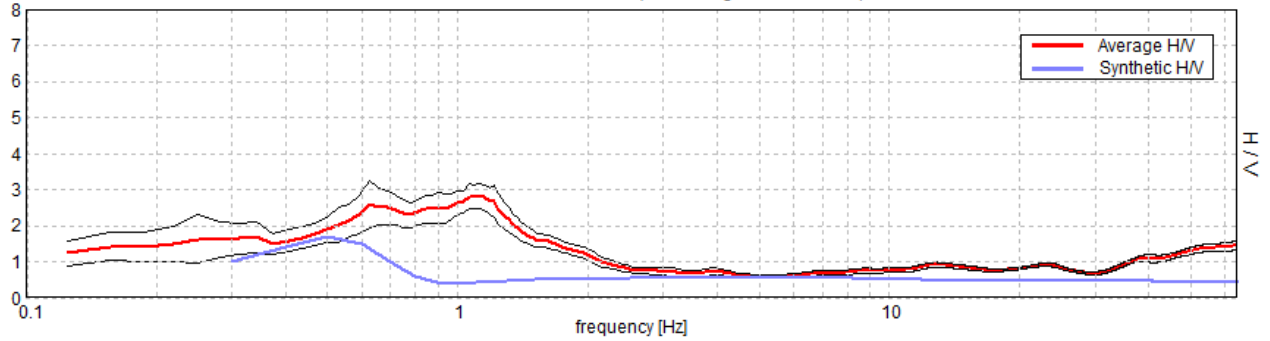


SINGLE COMPONENT SPECTRA



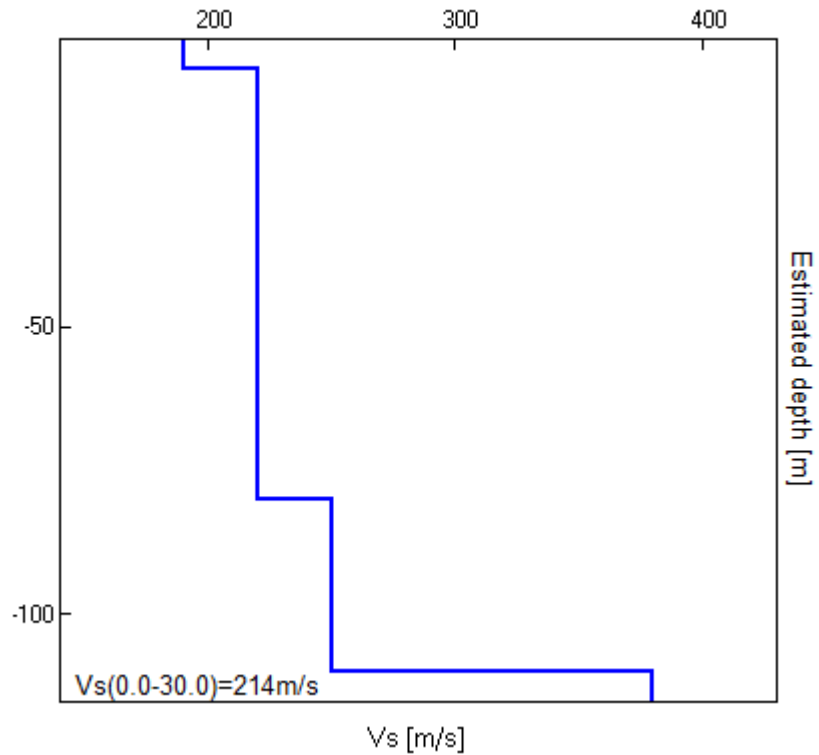
EXPERIMENTAL vs. SYNTHETIC H/V

Max. H/V at 1.06 ± 0.43 Hz. (In the range 0.0 - 64.0 Hz).



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
5.20	5.20	190	0.42
80.20	75.00	220	0.42
110.20	30.00	250	0.42
inf.	inf.	380	0.42

Vs(0.0-30.0)=214m/s



[According to the SESAME, 2005 guidelines. Please read carefully the *Grilla* manual before interpreting the following tables.]

Max. H/V at 1.06 ± 0.43 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve

[All 3 should be fulfilled]

$f_0 > 10 / L_w$	1.06 > 0.50	OK	
$n_c(f_0) > 200$	765.0 > 200	OK	
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 52 times	OK	

Criteria for a clear H/V peak

[At least 5 out of 6 should be fulfilled]

Exists f^- in $[f_0/4, f_0]$ $A_{H/V}(f^-) < A_0 / 2$			NO
Exists f^+ in $[f_0, 4f_0]$ $A_{H/V}(f^+) < A_0 / 2$	1.75 Hz	OK	
$A_0 > 2$	2.82 > 2	OK	
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.40178 < 0.05$		NO
$\sigma_f < \varepsilon(f_0)$	$0.42689 < 0.10625$		NO
$\sigma_A(f_0) < \theta(f_0)$	$0.3396 < 1.78$	OK	

L_w	window length
n_w	number of windows used in the analysis
$n_c = L_w n_w f_0$	number of significant cycles
f	current frequency
f_0	H/V peak frequency
σ_f	standard deviation of H/V peak frequency
$\varepsilon(f_0)$	threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$
A_0	H/V peak amplitude at frequency f_0
$A_{H/V}(f)$	H/V curve amplitude at frequency f
f^-	frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$
f^+	frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$
$\sigma_A(f)$	standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided
$\sigma_{\log H/V}(f)$	standard deviation of $\log A_{H/V}(f)$ curve
$\theta(f_0)$	threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$

Threshold values for σ_f and $\sigma_A(f_0)$

Freq. range [Hz]	< 0.2	0.2 – 0.5	0.5 – 1.0	1.0 – 2.0	> 2.0
$\varepsilon(f_0)$ [Hz]	$0.25 f_0$	$0.2 f_0$	$0.15 f_0$	$0.10 f_0$	$0.05 f_0$
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
$\log \theta(f_0)$ for $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

VERIFICA LIQUEFAZIONE

Con il termine liquefazione si intende la perdita di resistenza al taglio di un mezzo granulare sotto falda determinata da un aumento della pressione dell'acqua nei pori. Tale incremento può essere dovuto da varie cause, il D.M. del 4/02/2008, contiene al punto 7011.3.4.2 le linee guida per valutare la suscettibilità alla liquefazione dei terreni.

Una valutazione semplificata della suscettibilità alla liquefazione può essere ottenuta considerando le seguenti condizioni:

- Magnitudo del sisma
- Accelerazione massime attese al piano campagna
- Profondità media stagionale della falda
- Tipo di deposito

Con l'approccio semplificato la verifica a liquefazione può essere omessa quando si manifesti almeno una delle seguenti circostanze:

- 1) eventi sismici attesi di Magnitudo $M < 5$
- 2) accelerazioni massime attese al p.c. in assenza di manufatti $< 0.1 g$
- 3) profondità media stagionale della falda $> 15 m$ dal p.c.
- 4) depositi costituiti da sabbie pulite con resistenza penetrometrica normalizzata a una tensione efficace verticale di 100 kPa
- 5) distribuzione granulometrica esterna alle zone indicate nelle fasce granulometriche critiche in funzione dei coefficienti di uniformità U.

Nello studio in oggetto la procedura semplificata può essere utilizzata essendo le circostanze all'interno del perimetro dei punti sovraesposti.

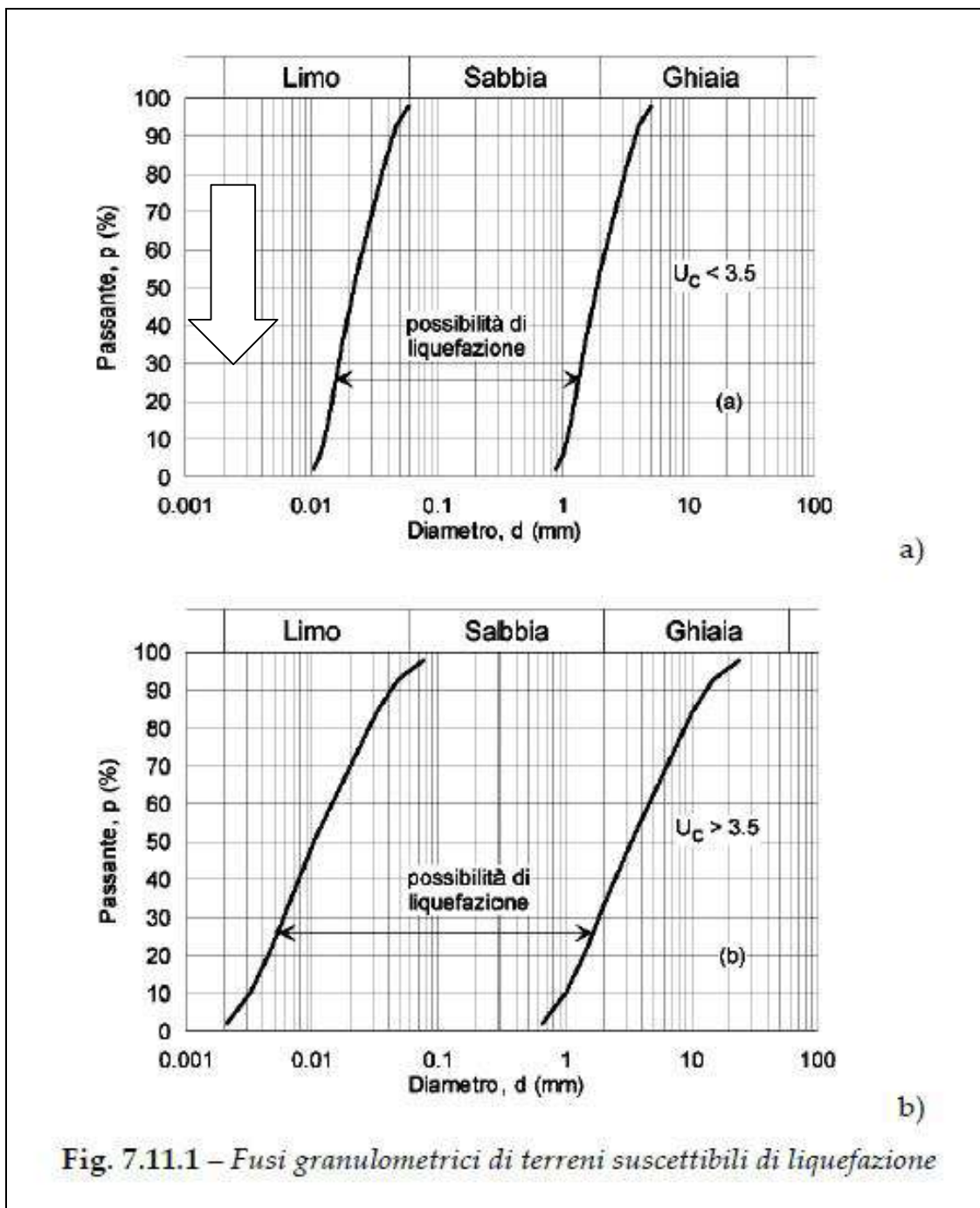


Fig. 7.11.1 – Fusi granulometrici di terreni suscettibili di liquefazione

Il volume di terreno considerato, per la presenza di terreni fini argillosi e limosi, è risultato dall'analisi, non liquefacibile.

CONCLUSIONI

Il presente studio geologico , ottenuto con il supporto di n. 2 prove penetrometriche statiche elettriche CPTe e n. 1 indagine sismica passiva a stazione singola HVSR, ha permesso la definizione del modello geologico e geofisico del comparto.

I risultati dello studio escludono problematiche di tipo idrogeologico e geomorfologico.

Secondo quanto prescritto nella normativa in materia sismica NTC18, si sono analizzate le condizioni sismiche del sito il quale è risultato appartenente alla categoria di sottosuolo C, mentre la condizione topografica rispecchia il caso T1.

Per la tipologia di intervento e le caratteristiche geotecniche dei terreni indagati si ritiene sufficiente l'utilizzo di fondazioni superficiali come indicato nel modello geotecnico.

Il volume di terreno considerato è risultato dalle analisi non liquefacibile.

Secondo quanto esposto si fornisce parere geologico favorevole sulla fattibilità degli interventi.

Legenda

Province



Comuni




Griglia 10.000




Ambienti deposiz. e litologie (10K)

 *Limo Argilloso Sabbioso - Piana alluvionale*


 *Sabbia Limoso Argillosa - Piana alluvionale*

Coperture quaternarie (10K)

 *AES8 - Subsintema di Ravenna*


 *AES8a - Unità di Modena*


Limiti di unità geologiche (10K)

 *limite di natura incerta*

Unità geologiche (10K)

 *FAA - Argille Azzurre*

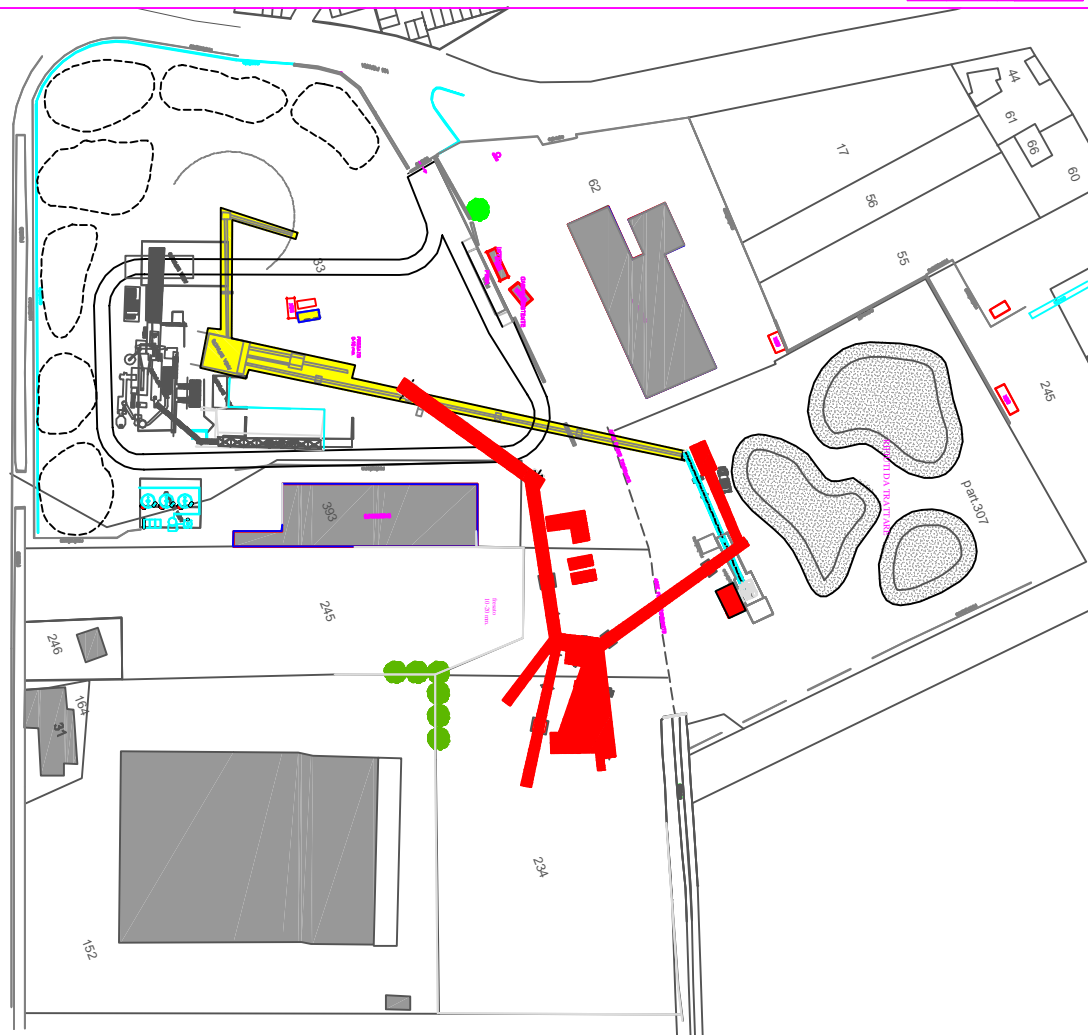
 *FAA2ap - Argille Azzurre - membro delle Arenarie di Borello - litofacies arenaceo-pelitica*

 *FMA12a - Formazione Marnoso-Arenacea - membro di Castel del Rio - litofacies arenacea*



COMUNE DI FORLÌ PROV. DI FORLÌ		REGIONE EMILIA-ROMAGNA PROV. DI FORLÌ		Foglio n. 3.3.2 scala 1:100
PROGETTO BERGAMO		PROGETTO DI INTERVENTO DI RISTRUTTURAZIONE E AMPLIAMENTO DEL IMPIANTO DI TRATTAMENTO DELLE ACQUE REFLUE URBANE DELLA ZONA S. MARCO (CANTIERE S. MARCO) (CANTIERE S. MARCO) (CANTIERE S. MARCO)		Foglio n. 3.3.2 scala 1:100
PROGETTO (CANTIERE S. MARCO)		PROGETTO (CANTIERE S. MARCO)		Foglio n. 3.3.2 scala 1:100

- parti di impianto da mantenere
- demolizione
- costruzione



PROFILO B - B
 scala 1:250

- parti di impianto da mantenere
- demolizione
- costruzione

PROFILO C - C
 scala 1:250

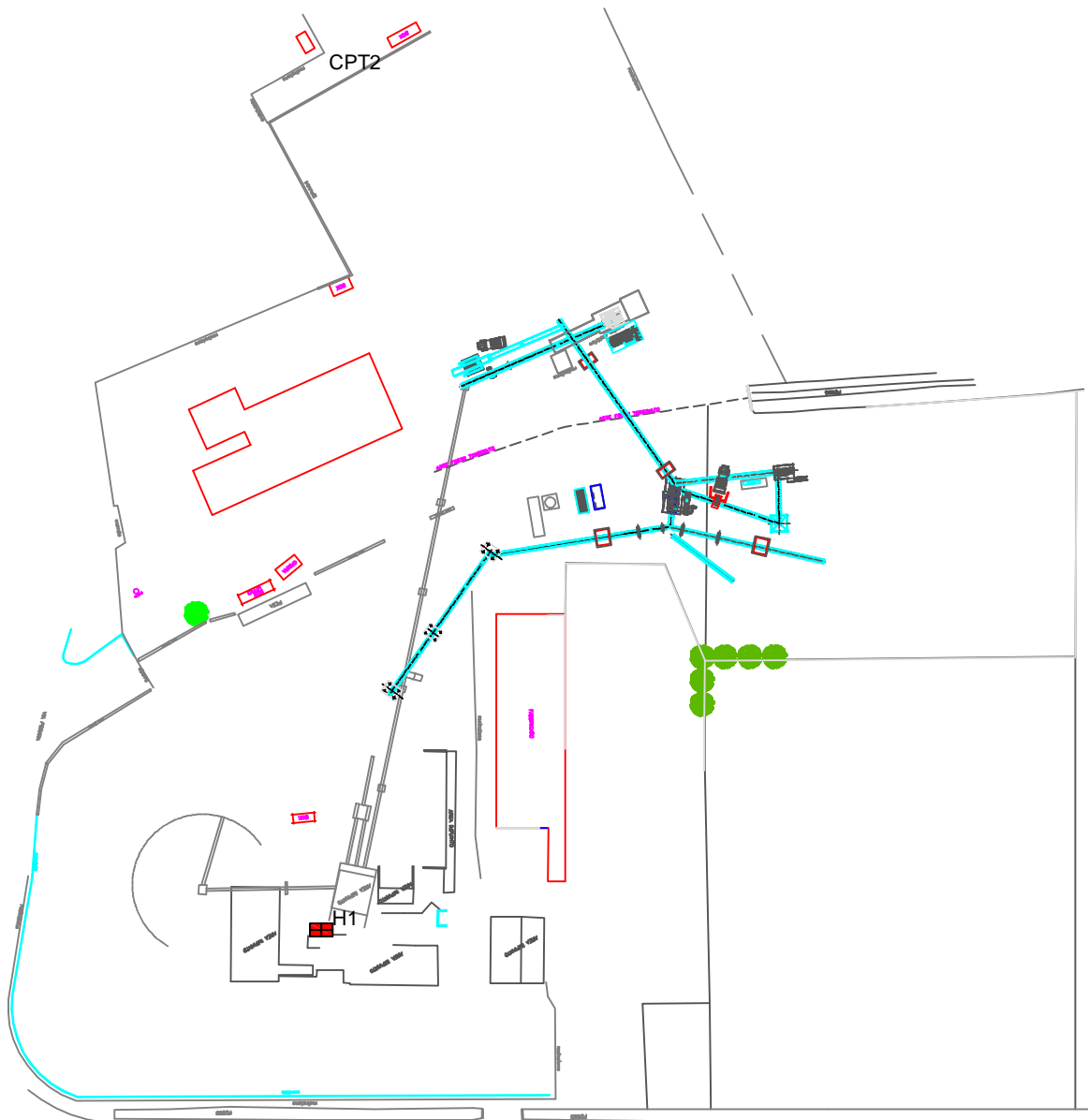
- parti di impianto da mantenere
- demolizione
- costruzione

PROFILO A - A
 scala 1:250





- parti di impianto da mantenere
- demolizione
- costruzione

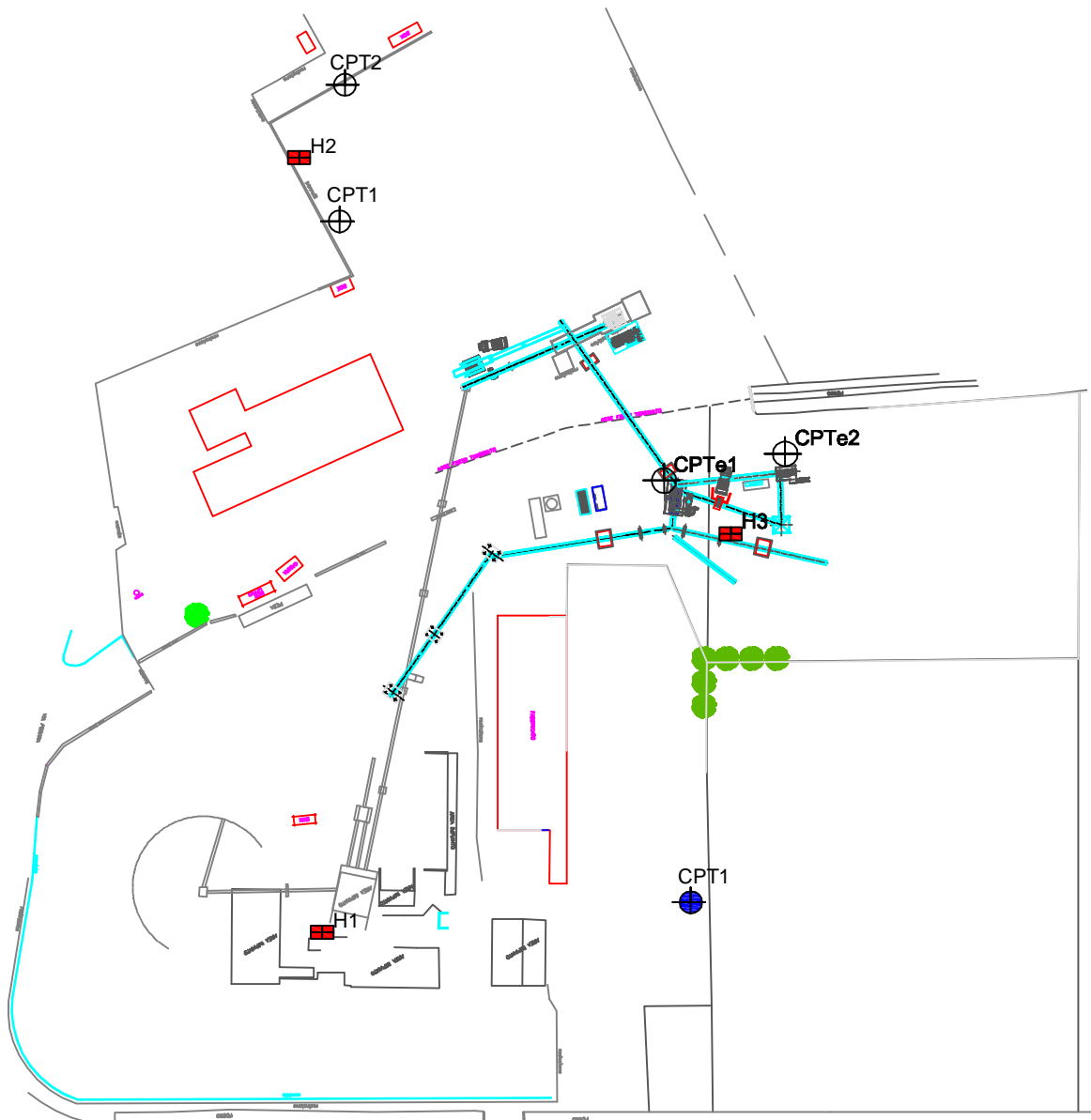


PLANIMETRIA GENERALE

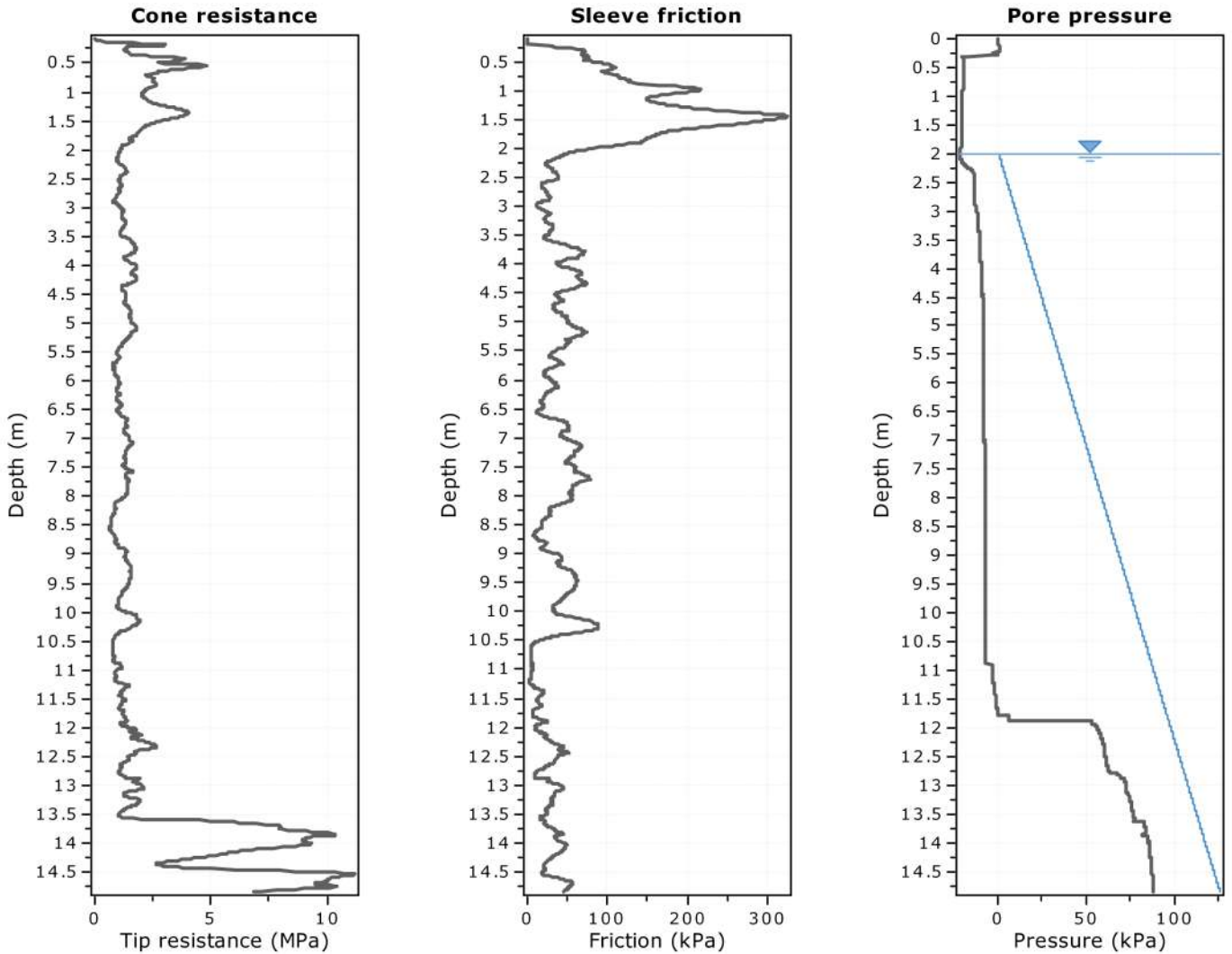


UBICAZIONE PROVE

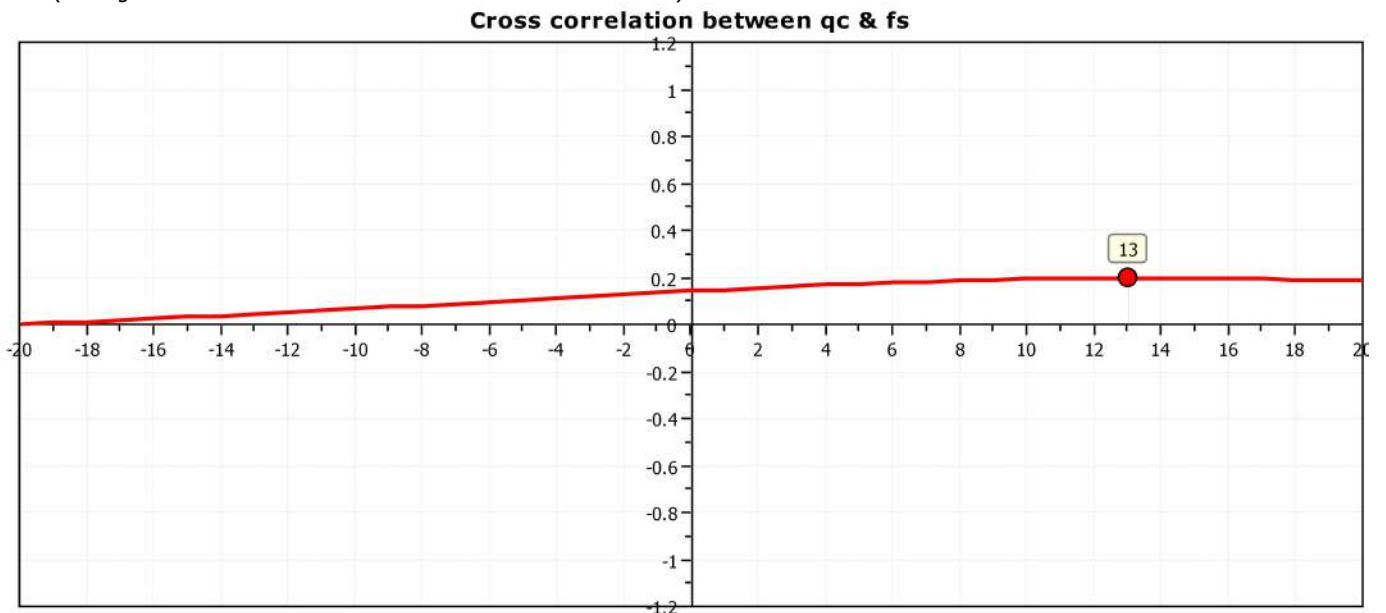
-  CPT aprile 2018
-  CPT maggio 2020
-  CPTe
-  HVSR



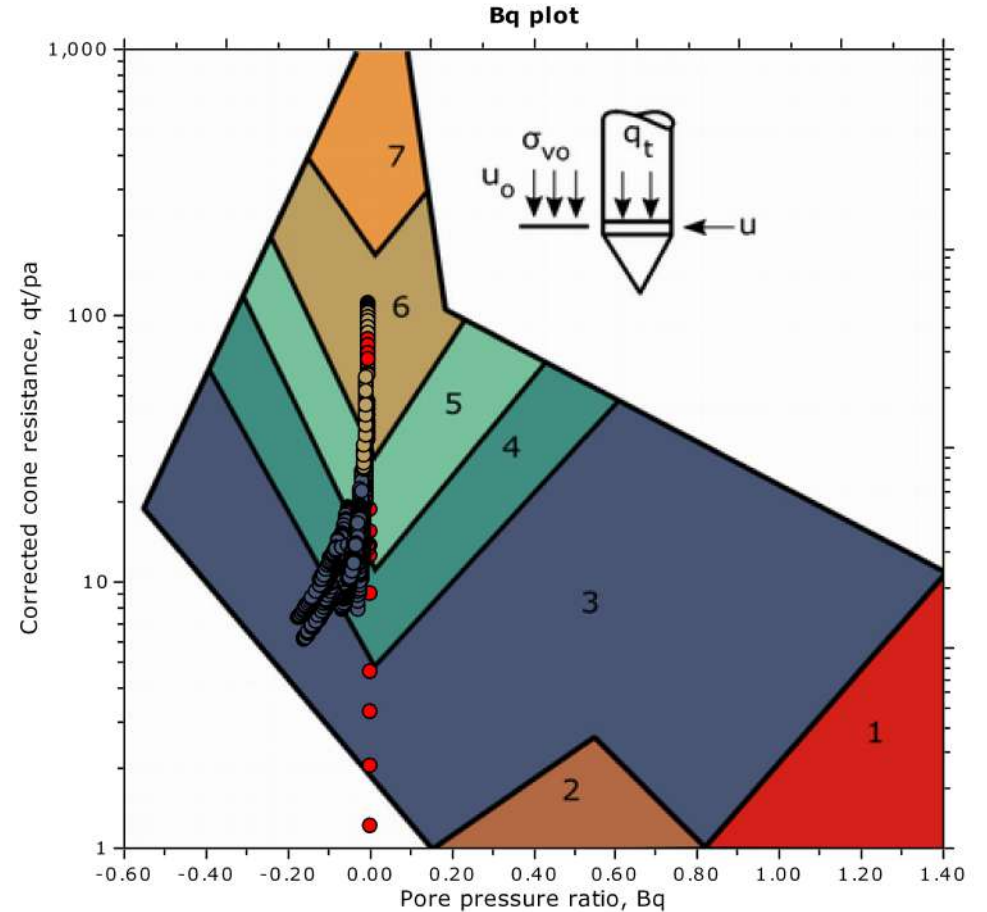
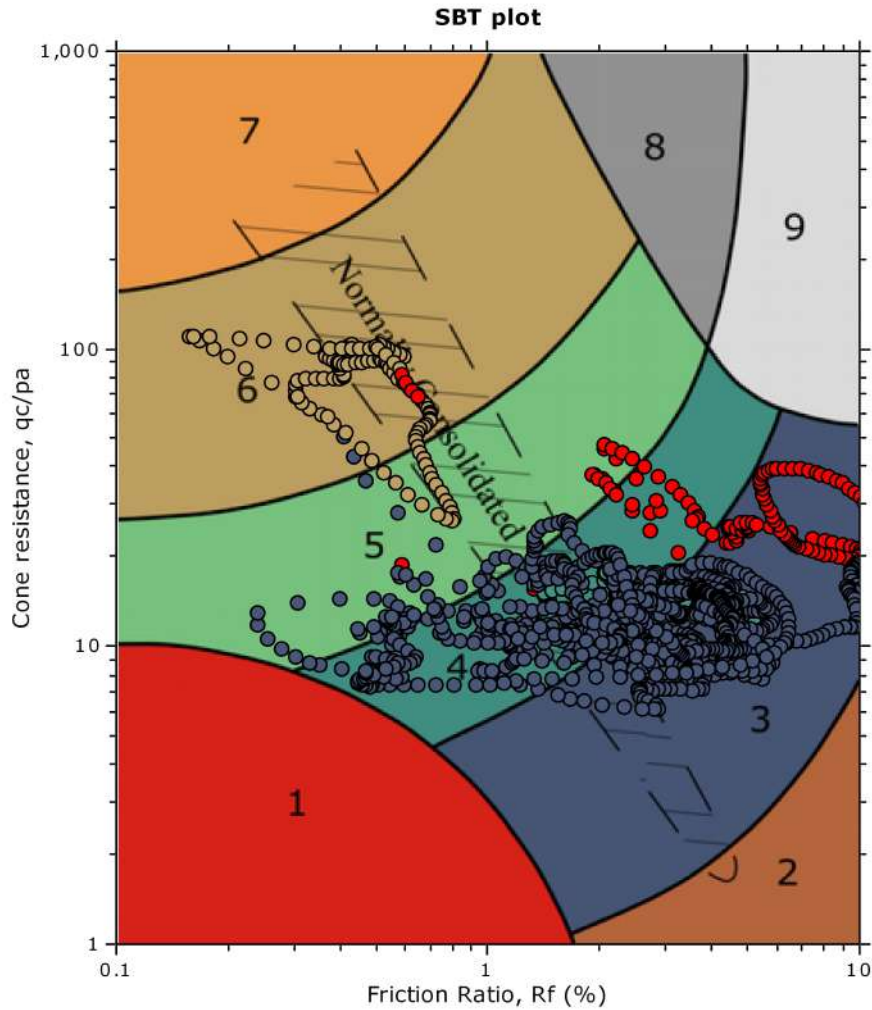
Project: Via Ponara Località Panighina
Location: Bertinoro e Forlimpopoli - Romagnola Conglomerati



The plot below presents the cross correlation coefficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two successive CPT measurements).



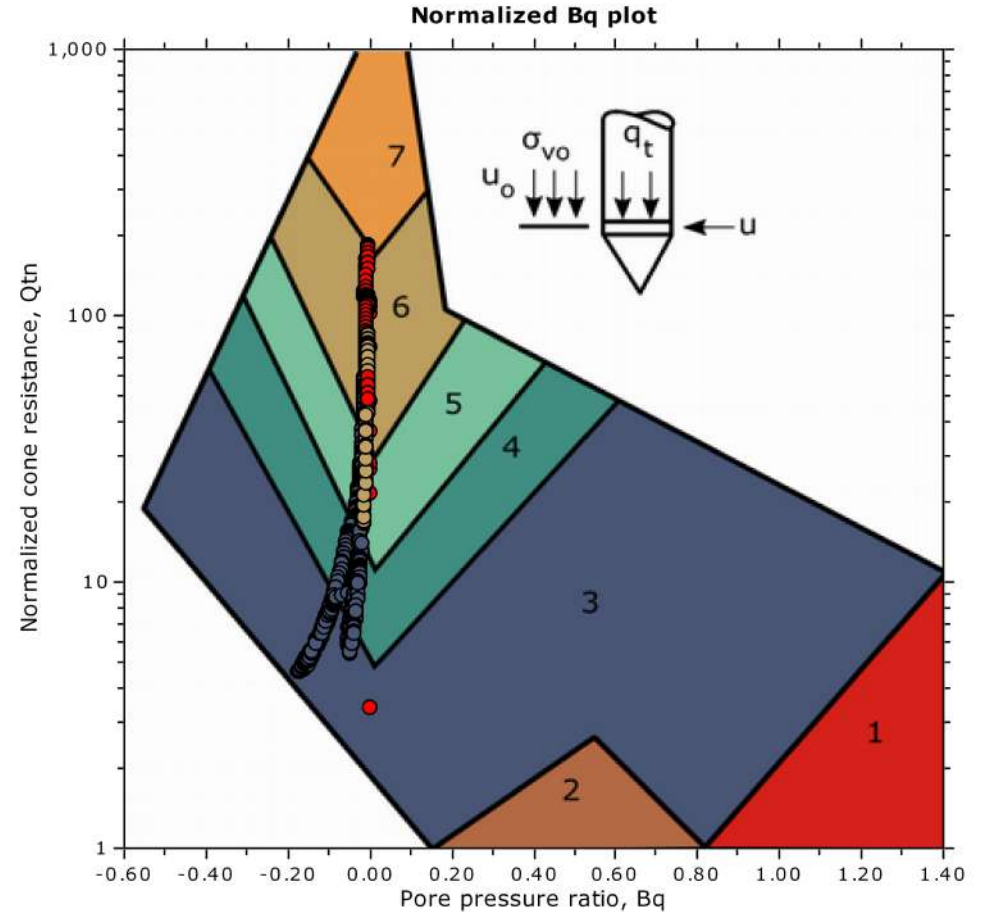
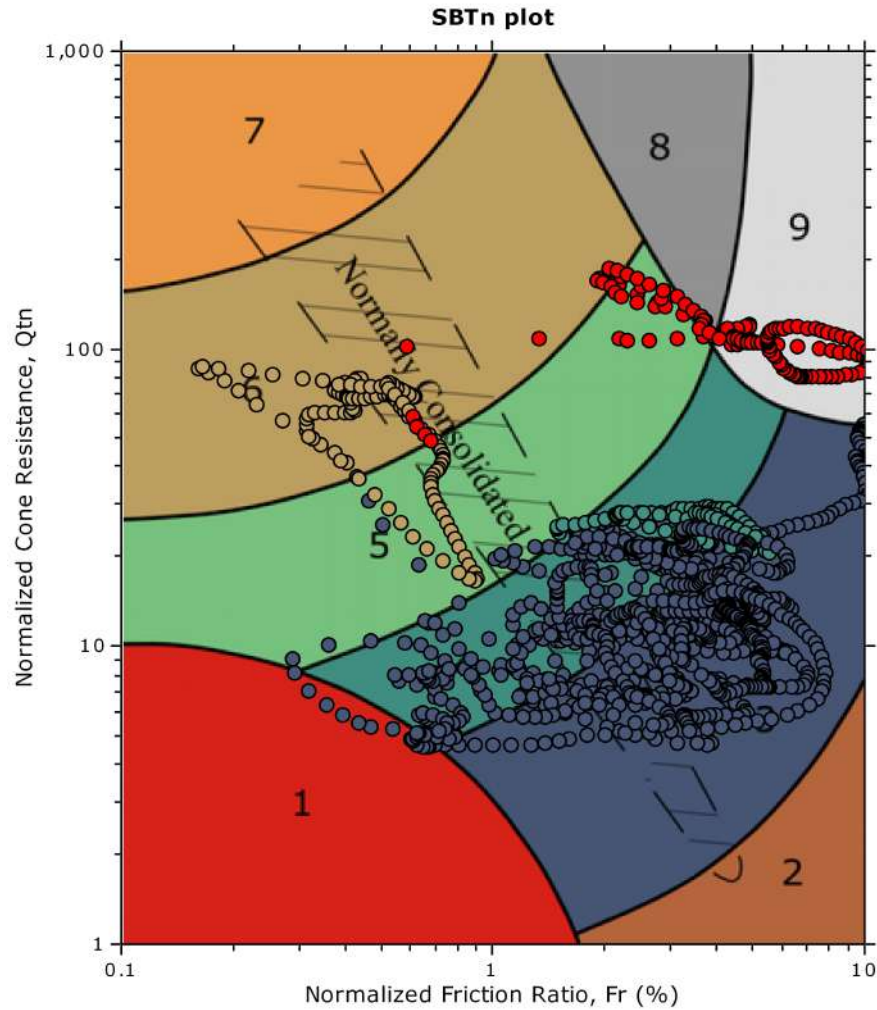
SBT - Bq plots



SBT legend

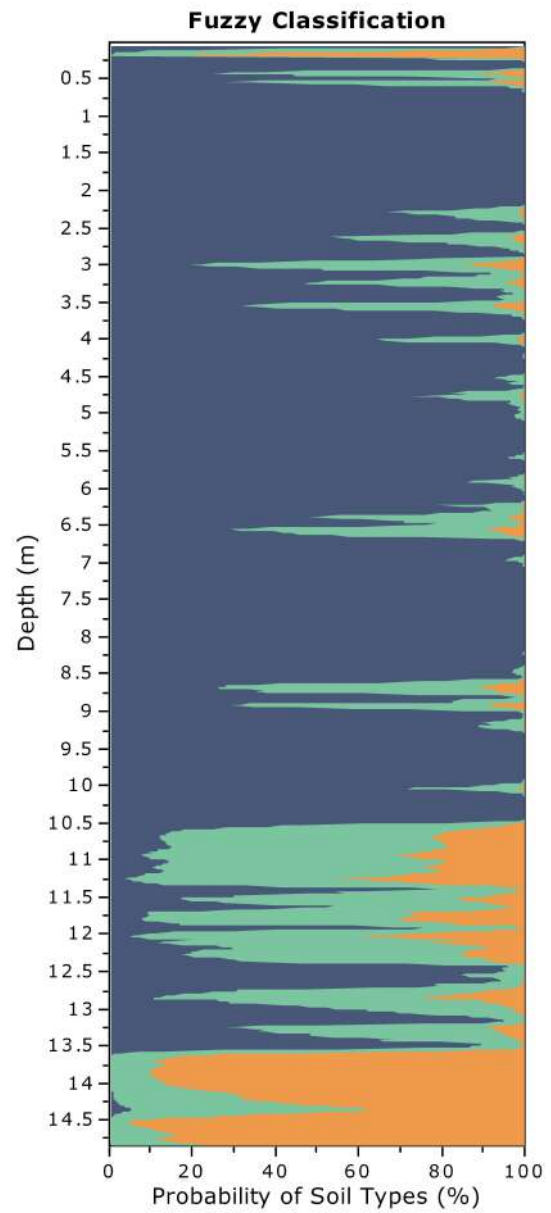
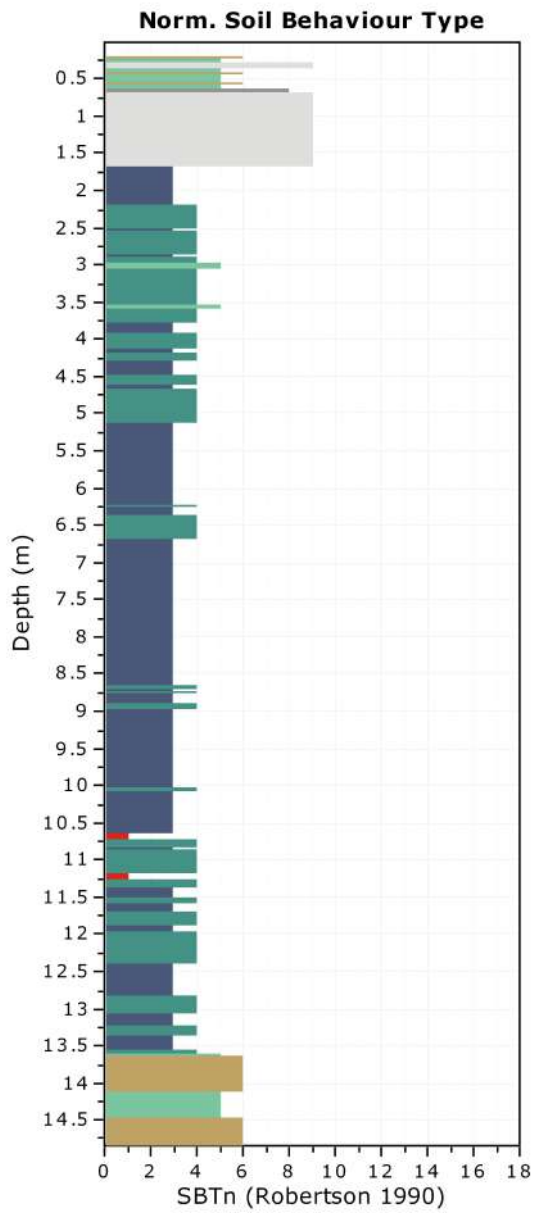
- | | | |
|--|---|---|
| ■ 1. Sensitive fine grained | ■ 4. Clayey silt to silty clay | ■ 7. Gravelly sand to sand |
| ■ 2. Organic material | ■ 5. Silty sand to sandy silt | ■ 8. Very stiff sand to clayey sand |
| ■ 3. Clay to silty clay | ■ 6. Clean sand to silty sand | ■ 9. Very stiff fine grained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

SBT - Bq plots (normalized)



SBTn legend

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

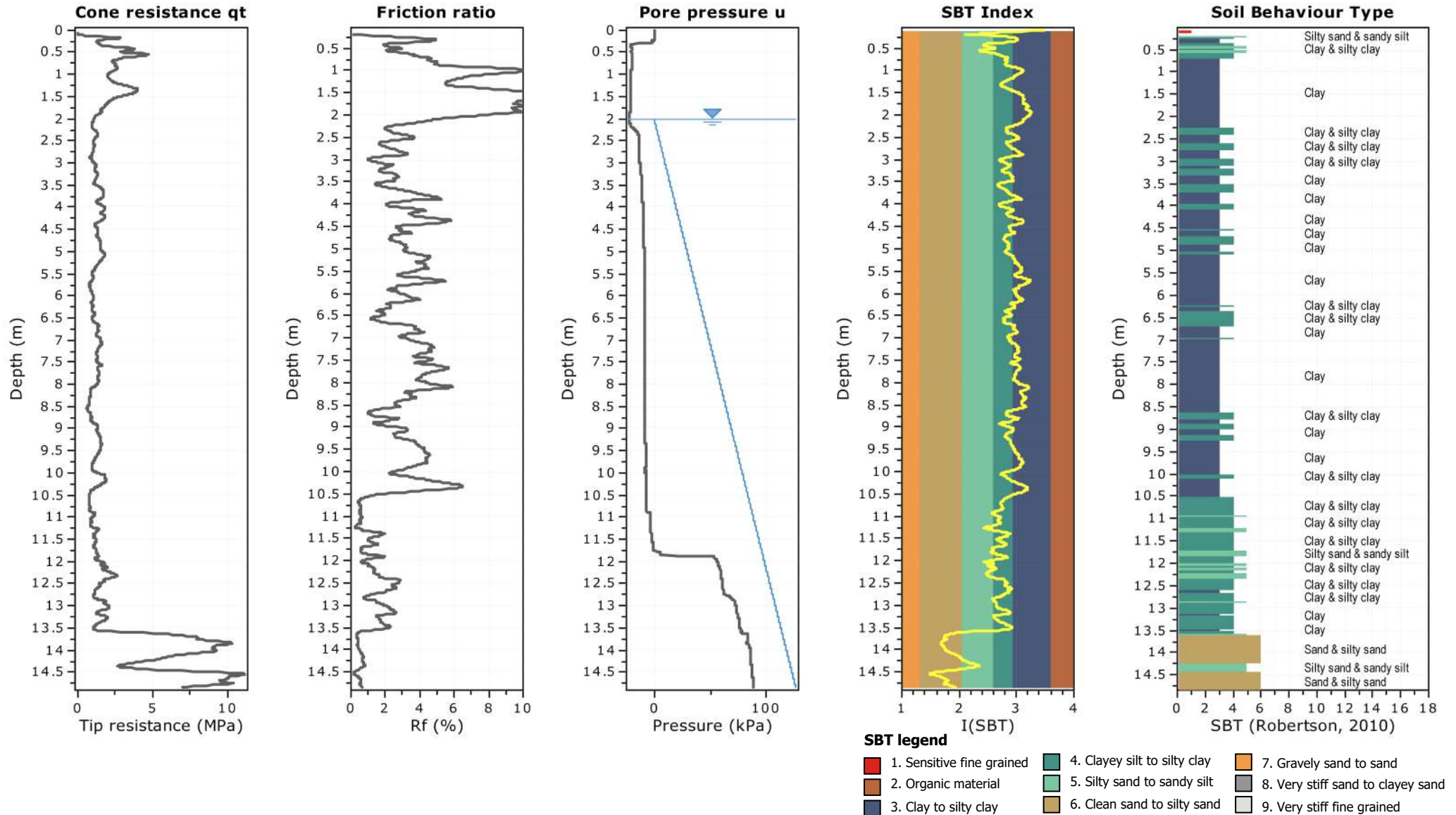


Fuzzy classification legend

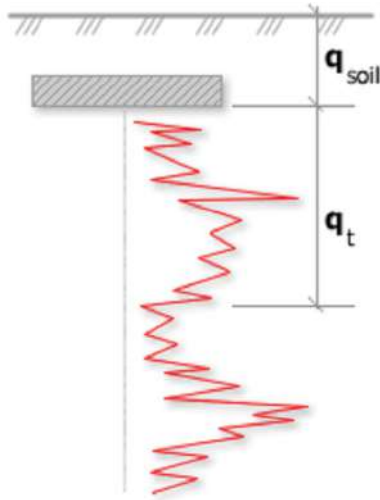
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

Project: Via Ponara Località Panighina

Location: Bertinoro e Forlimpopoli - Romagna Conglomerati



Project: Via Ponara Località Panighina
Location: Bertinoro e Forlimpopoli - Romagna Conglomerati

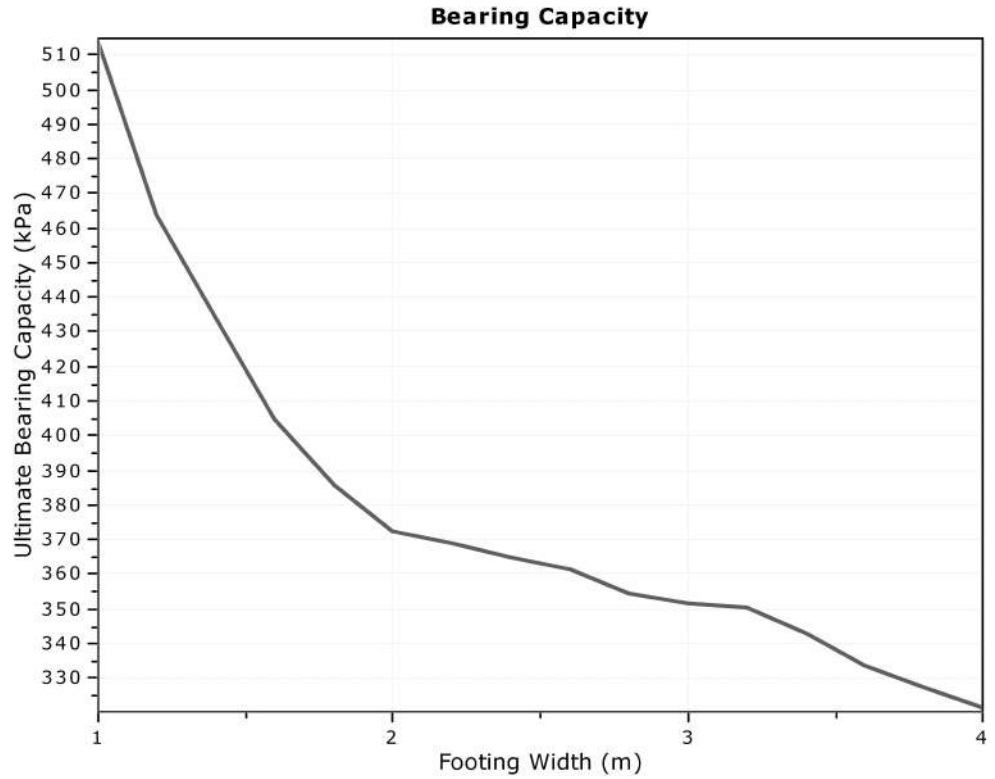


Bearing Capacity calculation is performed based on the formula:

$$Q_{ult} = R_k \times q_t + q_{soil}$$

where:

- R_k: Bearing capacity factor
- q_t: Average corrected cone resistance over calculation depth
- q_{soil}: Pressure applied by soil above footing



:: Tabular results ::

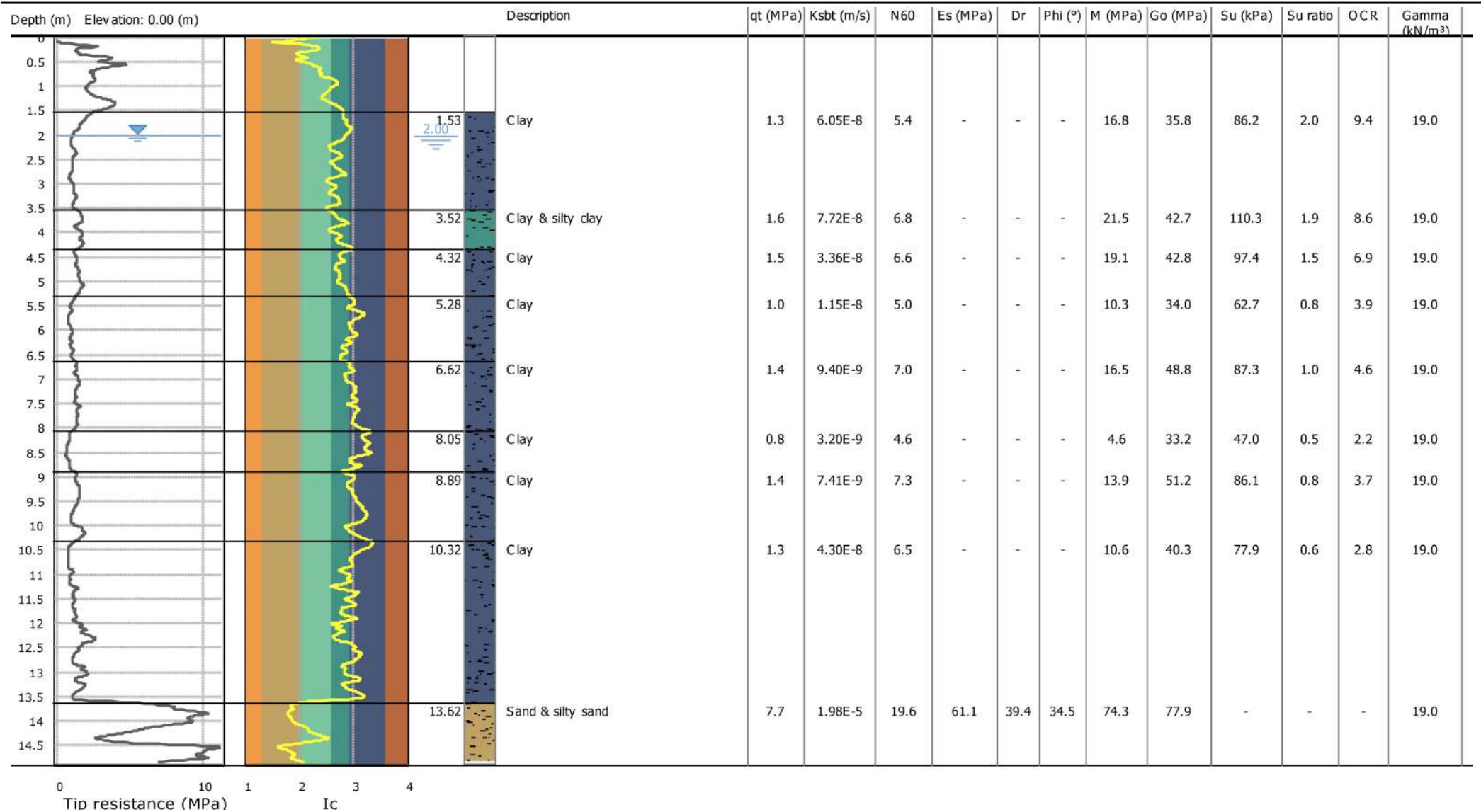
No	B (m)	Start Depth (m)	End Depth (m)	Ave. q _t (MPa)	R _k	Soil Press. (kPa)	Ult. bearing cap. (kPa)
1	1.00	0.50	2.00	2.52	0.20	9.50	513.70
2	1.20	0.50	2.30	2.27	0.20	9.50	464.15
3	1.40	0.50	2.60	2.12	0.20	9.50	433.89
4	1.60	0.50	2.90	1.98	0.20	9.50	404.63
5	1.80	0.50	3.20	1.88	0.20	9.50	385.65
6	2.00	0.50	3.50	1.81	0.20	9.50	372.16
7	2.20	0.50	3.80	1.80	0.20	9.50	368.75
8	2.40	0.50	4.10	1.78	0.20	9.50	364.58
9	2.60	0.50	4.40	1.76	0.20	9.50	361.25
10	2.80	0.50	4.70	1.73	0.20	9.50	354.59
11	3.00	0.50	5.00	1.71	0.20	9.50	351.76
12	3.20	0.50	5.30	1.70	0.20	9.50	350.43
13	3.40	0.50	5.60	1.67	0.20	9.50	342.85
14	3.60	0.50	5.90	1.62	0.20	9.50	333.80
15	3.80	0.50	6.20	1.59	0.20	9.50	327.08
16	4.00	0.50	6.50	1.56	0.20	9.50	321.39

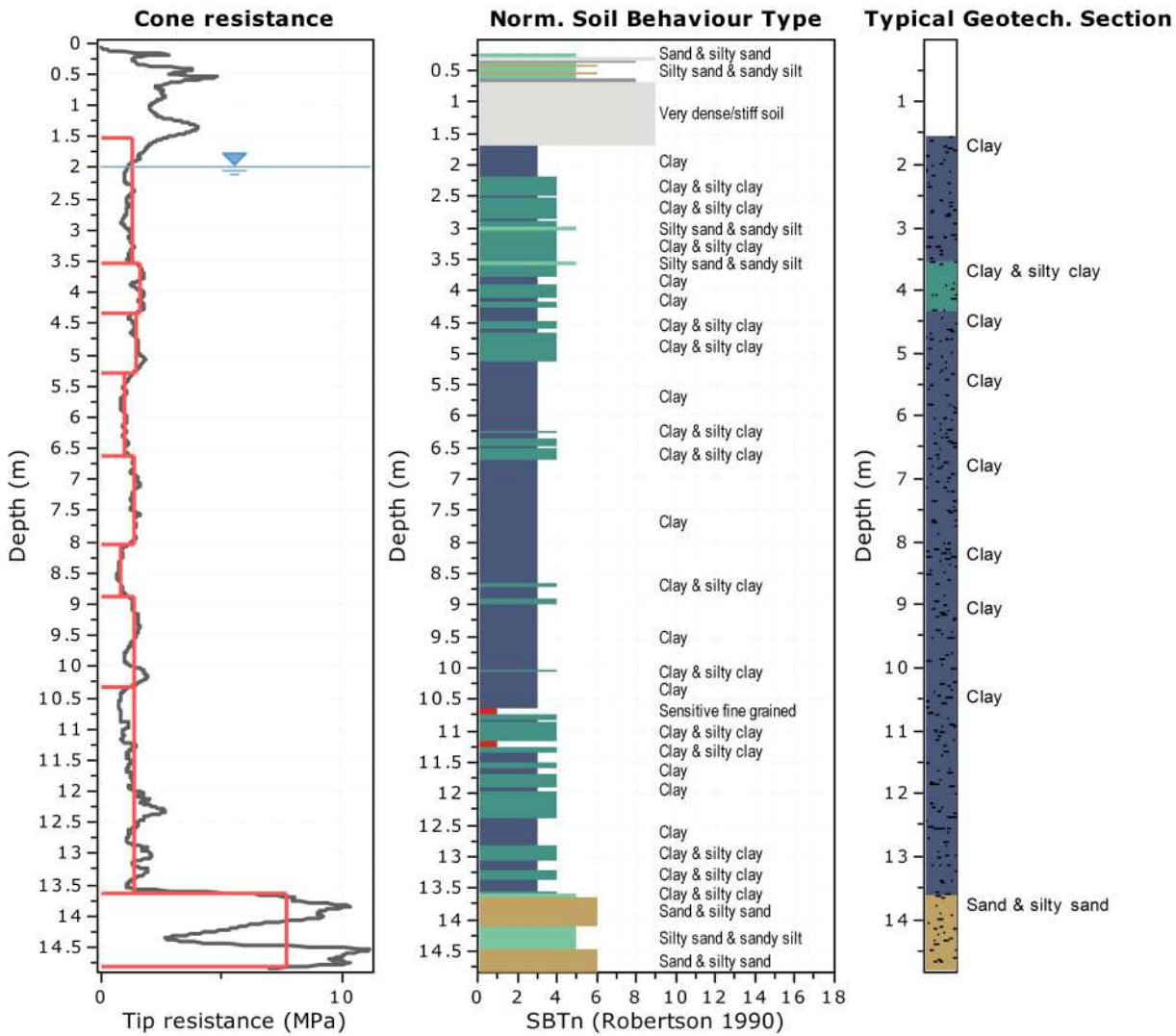
Project: Via Ponara Località Panighina

Location: Bertinoro e Forlimpopoli - Romagna Conglomerati

Cone Type:

Cone Operator:





Tabular results

::: Layer No: 1 :::		
Code: Layer_1 Start depth: 1.53 (m), End depth: 3.52 (m)		
Description: Clay		
Basic results		
Total cone resistance: 1.25 ±0.35 MPa	Estimation results	Constrained Mod.: 16.83 ±4.92 MPa
Sleeve friction: 63.84 ±69.12 kPa	Permeability: 6.05E-08 ±4.90E-08 m/s	Go: 35.84 ±13.29 MPa
Ic: 2.74 ±0.12	N ₆₀ : 5.44 ±1.71 blows	Su: 86.15 ±25.45 kPa
SBT _n : 3	Es: 0.00 ±0.00 MPa	Su ratio: 2.02 ±0.99
SBTn description: Clay	Dr (%): 0.00 ±0.00	O.C.R.: 9.35 ±4.56
	φ (degrees): 0.00 ±0.00 °	
	Unit weight: 19.00 ±0.00 kN/m ³	

::: Layer No: 2 :::**Code:** Layer_2 **Start depth:** 3.52 (m), **End depth:** 4.32 (m)**Description:** Clay & silty clay**Basic results**

Total cone resistance: 1.61 ±0.16 MPa

Sleeve friction: 52.66 ±15.42 kPa

Ic: 2.69 ±0.11

SBT_n: 4

SBTn description: Clay & silty clay

Estimation results

Permeability: 7.72E-08 ±5.74E-08 m/s

N₆₀: 6.79 ±0.67 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 21.54 ±2.18 MPa

Go: 42.65 ±5.02 MPa

Su: 110.30 ±11.34 kPa

Su ratio: 1.87 ±0.17

O.C.R.: 8.62 ±0.77

::: Layer No: 3 :::**Code:** Layer_3 **Start depth:** 4.32 (m), **End depth:** 5.28 (m)**Description:** Clay**Basic results**

Total cone resistance: 1.45 ±0.17 MPa

Sleeve friction: 50.38 ±13.27 kPa

Ic: 2.79 ±0.09

SBT_n: 3

SBTn description: Clay

Estimation results

Permeability: 3.36E-08 ±1.66E-08 m/s

N₆₀: 6.60 ±0.72 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 19.08 ±2.34 MPa

Go: 42.78 ±4.62 MPa

Su: 97.36 ±11.95 kPa

Su ratio: 1.49 ±0.13

O.C.R.: 6.86 ±0.62

::: Layer No: 4 :::**Code:** Layer_4 **Start depth:** 5.28 (m), **End depth:** 6.62 (m)**Description:** Clay**Basic results**

Total cone resistance: 0.99 ±0.12 MPa

Sleeve friction: 29.82 ±11.01 kPa

Ic: 2.96 ±0.10

SBT_n: 3

SBTn description: Clay

Estimation results

Permeability: 1.15E-08 ±8.40E-09 m/s

N₆₀: 4.99 ±0.49 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 10.33 ±2.56 MPa

Go: 34.04 ±3.89 MPa

Su: 62.70 ±8.57 kPa

Su ratio: 0.84 ±0.13

O.C.R.: 3.90 ±0.61

::: Layer No: 5 :::**Code:** Layer_5 **Start depth:** 6.62 (m), **End depth:** 8.05 (m)**Description:** Clay**Basic results**

Total cone resistance: 1.36 ±0.10 MPa

Sleeve friction: 54.99 ±10.77 kPa

Ic: 2.98 ±0.08

SBT_n: 3

SBTn description: Clay

Estimation results

Permeability: 9.40E-09 ±7.09E-09 m/s

N₆₀: 6.96 ±0.57 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 16.51 ±2.08 MPa

Go: 48.75 ±4.26 MPa

Su: 87.27 ±7.52 kPa

Su ratio: 1.00 ±0.10

O.C.R.: 4.64 ±0.47

::: Layer No: 6 :::**Code:** Layer_6 **Start depth:** 8.05 (m), **End depth:** 8.89 (m)**Description:** Clay**Basic results**

Total cone resistance: 0.82 ±0.12 MPa

Sleeve friction: 23.95 ±12.66 kPa

Ic: 3.17 ±0.12

SBT_n: 3

SBTn description: Clay

Estimation results

Permeability: 3.20E-09 ±3.23E-09 m/s

N₆₀: 4.65 ±0.61 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 4.58 ±1.61 MPa

Go: 33.24 ±5.74 MPa

Su: 47.01 ±8.22 kPa

Su ratio: 0.48 ±0.09

O.C.R.: 2.23 ±0.39

::: Layer No: 7 :::**Code:** Layer_7 **Start depth:** 8.89 (m), **End depth:** 10.32 (m)**Description:** Clay**Basic results**

Total cone resistance: 1.39 ±0.25 MPa

Sleeve friction: 50.04 ±17.55 kPa

Ic: 3.04 ±0.13

SBT_n: 3

SBTn description: Clay

Estimation results

Permeability: 7.41E-09 ±6.29E-09 m/s

N₆₀: 7.34 ±1.10 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 13.93 ±5.29 MPa

Go: 51.24 ±8.07 MPa

Su: 86.06 ±18.10 kPa

Su ratio: 0.80 ±0.16

O.C.R.: 3.69 ±0.76

::: Layer No: 8 :::**Code:** Layer_8 **Start depth:** 10.32 (m), **End depth:** 13.62 (m)**Description:** Clay**Basic results**

Total cone resistance: 1.35 ±0.53 MPa

Sleeve friction: 20.37 ±14.67 kPa

Ic: 2.93 ±0.19

SBT_n: 3

SBTn description: Clay

Estimation results

Permeability: 4.30E-08 ±2.65E-07 m/s

N₆₀: 6.50 ±1.89 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 10.59 ±8.62 MPa

Go: 40.33 ±11.73 MPa

Su: 77.87 ±30.47 kPa

Su ratio: 0.60 ±0.22

O.C.R.: 2.76 ±1.00

::: Layer No: 9 :::**Code:** Layer_9 **Start depth:** 13.62 (m), **End depth:** 14.80 (m)**Description:** Sand & silty sand**Basic results**

Total cone resistance: 7.67 ±2.47 MPa

Sleeve friction: 35.30 ±11.76 kPa

Ic: 1.98 ±0.23

SBT_n: 6

SBTn description: Sand & silty sand

Estimation results

Permeability: 1.98E-05 ±2.39E-05 m/s

N₆₀: 19.65 ±4.46 blows

Es: 61.13 ±9.32 MPa

Dr (%): 39.41 ±7.85

φ (degrees): 34.50 ±1.37 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 74.29 ±16.02 MPa

Go: 77.90 ±11.88 MPa

Su: 0.00 ±0.00 kPa

Su ratio: 0.00 ±0.00

O.C.R.: 0.00 ±0.00

Project: Via Ponara Località Panighina

Location: Bertinoro e Forlimpopoli - Romagna Conglomerati

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT _{N60} (blows/30cm)	E _s (MPa)	D _r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G ₀ (MPa)	Undrained strength, S _u (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m ³)
1.53	1.99	6.05E-08	5.4	0.0	0.0	0.0	16.8	35.8	86.2	2.0	9.4	19.0
3.52		(±4.90E-08)	(±1.7)	(±0.0)	(±0.0)	(±0.0)	(±4.9)	(±13.3)	(±25.4)	(±1.0)	(±4.6)	(±0.0)
3.52	0.80	7.72E-08	6.8	0.0	0.0	0.0	21.5	42.7	110.3	1.9	8.6	19.0
4.32		(±5.74E-08)	(±0.7)	(±0.0)	(±0.0)	(±0.0)	(±2.2)	(±5.0)	(±11.3)	(±0.2)	(±0.8)	(±0.0)
4.32	0.96	3.36E-08	6.6	0.0	0.0	0.0	19.1	42.8	97.4	1.5	6.9	19.0
5.28		(±1.66E-08)	(±0.7)	(±0.0)	(±0.0)	(±0.0)	(±2.3)	(±4.6)	(±12.0)	(±0.1)	(±0.6)	(±0.0)
5.28	1.34	1.15E-08	5.0	0.0	0.0	0.0	10.3	34.0	62.7	0.8	3.9	19.0
6.62		(±8.40E-09)	(±0.5)	(±0.0)	(±0.0)	(±0.0)	(±2.6)	(±3.9)	(±8.6)	(±0.1)	(±0.6)	(±0.0)
6.62	1.43	9.40E-09	7.0	0.0	0.0	0.0	16.5	48.8	87.3	1.0	4.6	19.0
8.05		(±7.09E-09)	(±0.6)	(±0.0)	(±0.0)	(±0.0)	(±2.1)	(±4.3)	(±7.5)	(±0.1)	(±0.5)	(±0.0)
8.05	0.84	3.20E-09	4.6	0.0	0.0	0.0	4.6	33.2	47.0	0.5	2.2	19.0
8.89		(±3.23E-09)	(±0.6)	(±0.0)	(±0.0)	(±0.0)	(±1.6)	(±5.7)	(±8.2)	(±0.1)	(±0.4)	(±0.0)
8.89	1.43	7.41E-09	7.3	0.0	0.0	0.0	13.9	51.2	86.1	0.8	3.7	19.0
10.32		(±6.29E-09)	(±1.1)	(±0.0)	(±0.0)	(±0.0)	(±5.3)	(±8.1)	(±18.1)	(±0.2)	(±0.8)	(±0.0)
10.32	3.30	4.30E-08	6.5	0.0	0.0	0.0	10.6	40.3	77.9	0.6	2.8	19.0
13.62		(±2.65E-07)	(±1.9)	(±0.0)	(±0.0)	(±0.0)	(±8.6)	(±11.7)	(±30.5)	(±0.2)	(±1.0)	(±0.0)
13.62	1.18	1.98E-05	19.6	61.1	39.4	34.5	74.3	77.9	0.0	0.0	0.0	19.0
14.80		(±2.39E-05)	(±4.5)	(±9.3)	(±7.9)	(±1.4)	(±16.0)	(±11.9)	(±0.0)	(±0.0)	(±0.0)	(±0.0)

Depth values presented in this table are measured from free ground surface

Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log\left(\frac{q_t}{p_a}\right) + 1.236 \right)$$

where g_w = water unit weight

:: Permeability, k (m/s) ::

$$I_c < 3.27 \text{ and } I_c > 1.00 \text{ then } k = 10^{0.952 - 3.04 \cdot I_c}$$

$$I_c \leq 4.00 \text{ and } I_c > 3.27 \text{ then } k = 10^{-4.52 - 1.37 \cdot I_c}$$

:: N_{sPT} (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{p_a} \right) \cdot \frac{1}{10^{1.1268 - 0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268 - 0.2817 \cdot I_c}}$$

:: Young's Modulus, E_s (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}} \quad \text{(applicable only to SBT}_n: 5, 6, 7 \text{ and } 8 \text{ or } I_c < I_{c_cutoff})$$

:: State Parameter, ψ ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Drained Friction Angle, ϕ (°) ::

(applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c_cutoff}$)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$
 $\alpha = 14$ for $Q_{tn} > 14$
 $\alpha = Q_{tn}$ for $Q_{tn} \leq 14$
 $M_{CPT} = \alpha \cdot (q_t - \sigma_v)$

If $I_c \geq 2.20$

:: Small strain shear Modulus, G_0 (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, V_s (m/s) ::

$$V_s = \left(\frac{G_0}{\rho} \right)^{0.50}$$

:: Undrained peak shear strength, S_u (kPa) ::

$$N_{kt} = 10.50 + 7 \cdot \log(F_r) \text{ or user defined}$$

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Remolded undrained shear strength, $S_{u(rem)}$ (kPa) ::

$$S_{u(rem)} = f_s \quad \text{(applicable only to SBT}_n: 1, 2, 3, 4 \text{ and } 9 \text{ or } I_c > I_{c_cutoff})$$

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 + 7 \cdot \log(F_r))} \right]^{1.25} \text{ or user defined}$$

$$OCR = k_{OCR} \cdot Q_{tn}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: In situ Stress Ratio, K_0 ::

$$K_0 = (1 - \sin \phi') \cdot OCR^{\sin \phi'}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Soil Sensitivity, S_t ::

$$S_t = \frac{N_s}{F_r}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Peak Friction Angle, ϕ' (°) ::

$$\phi' = 29.5^\circ \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

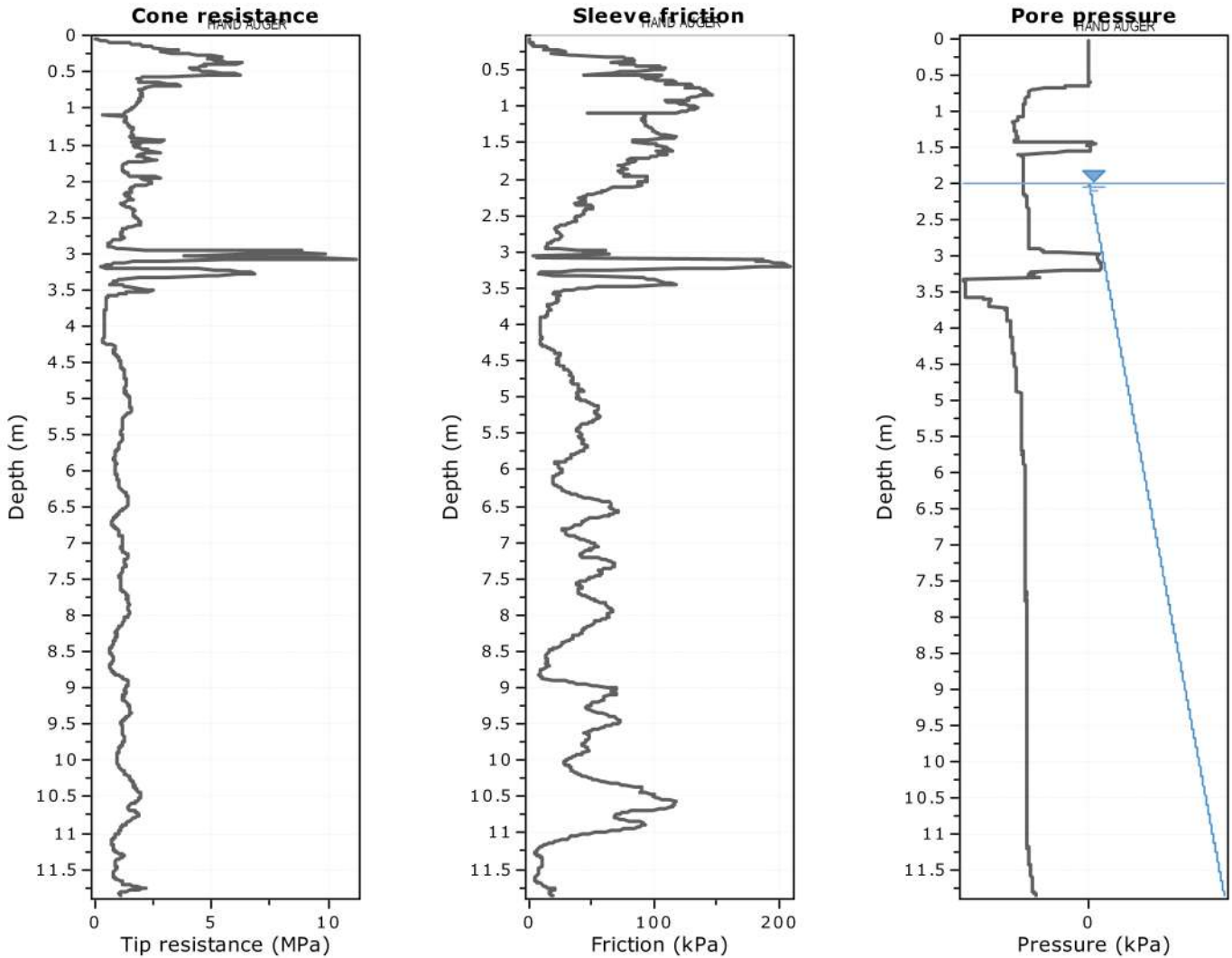
(applicable for $0.10 < B_q < 1.00$)

References

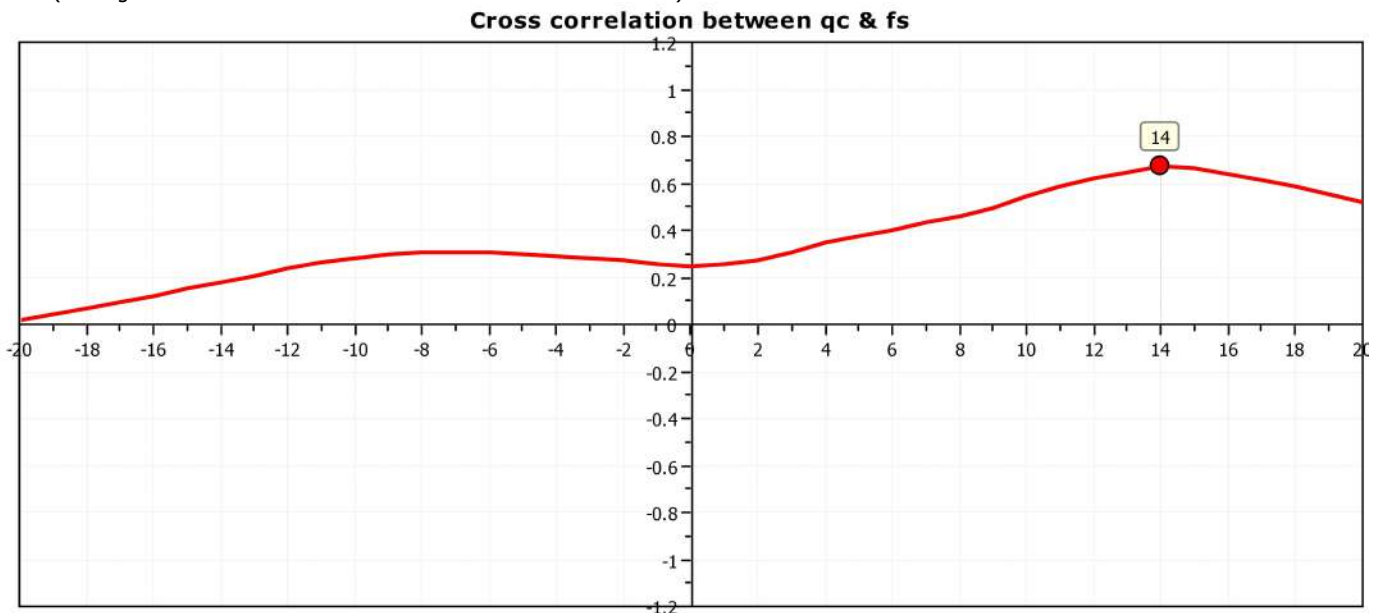
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- Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)
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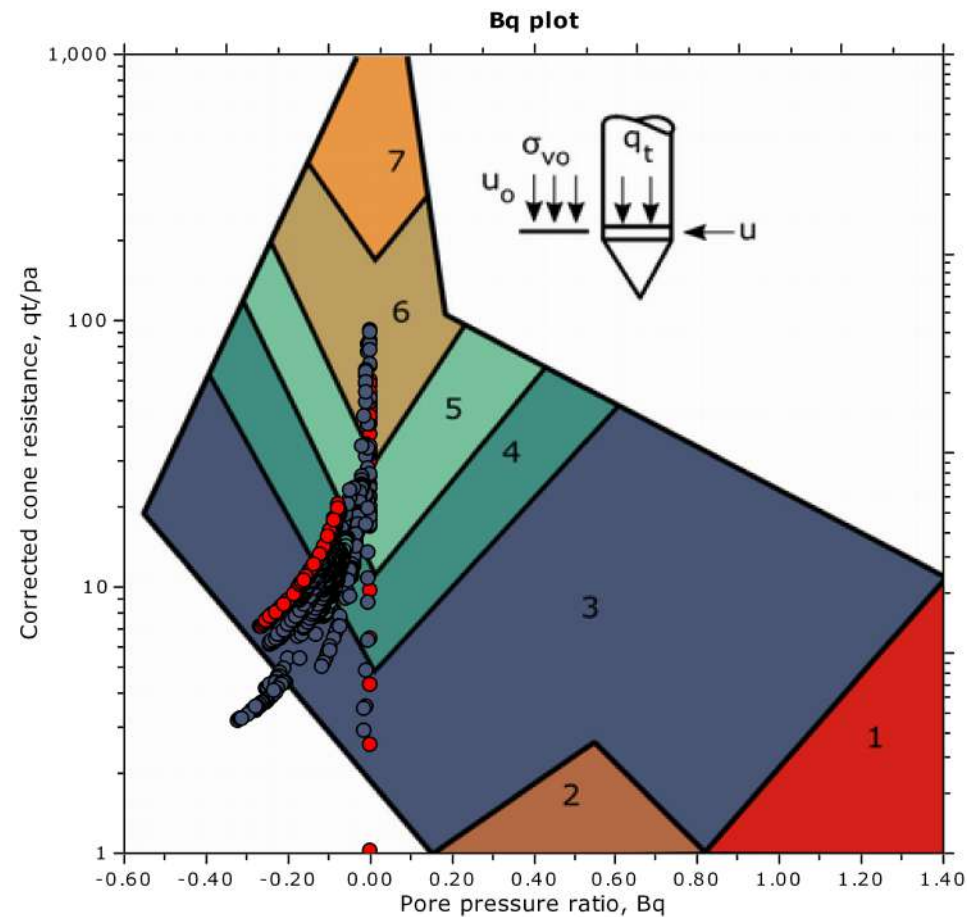
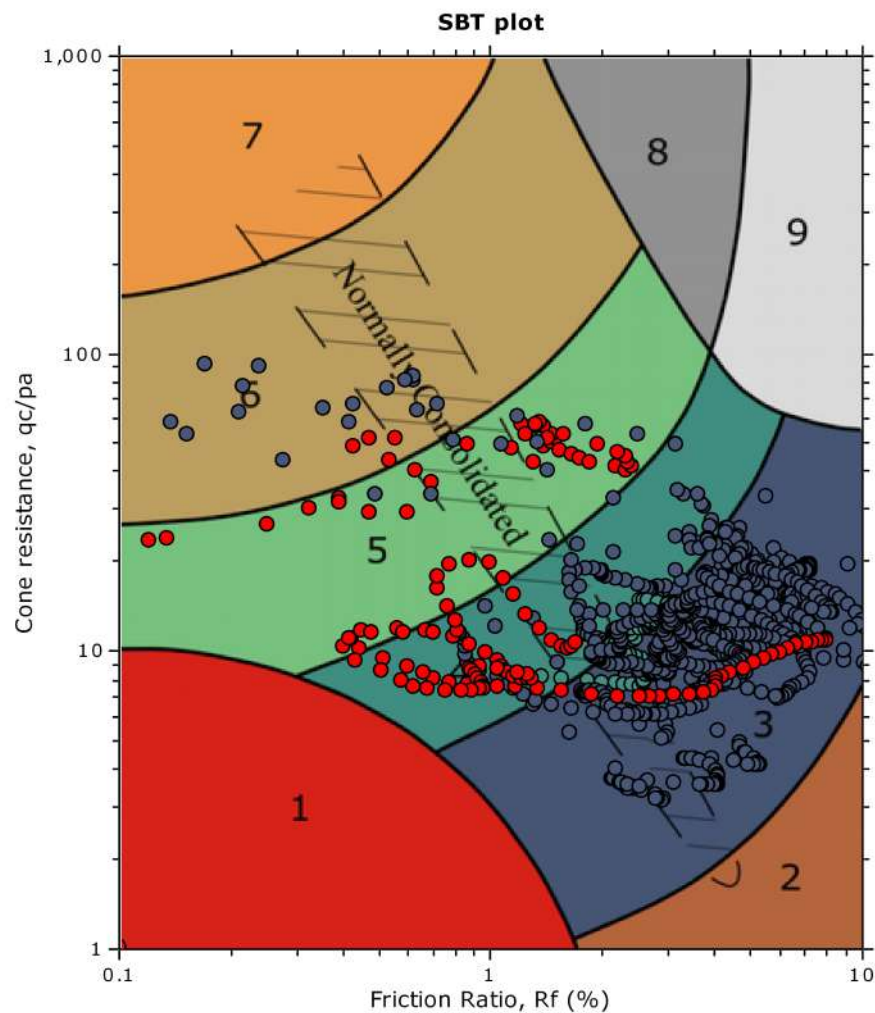
Location: Bertinoro e Forlimpopoli - Romagnola Conglomerati



The plot below presents the cross correlation coefficient between the raw q_c and f_s values (as measured on the field). X axes presents the lag distance (one lag is the distance between two successive CPT measurements).



SBT - Bq plots



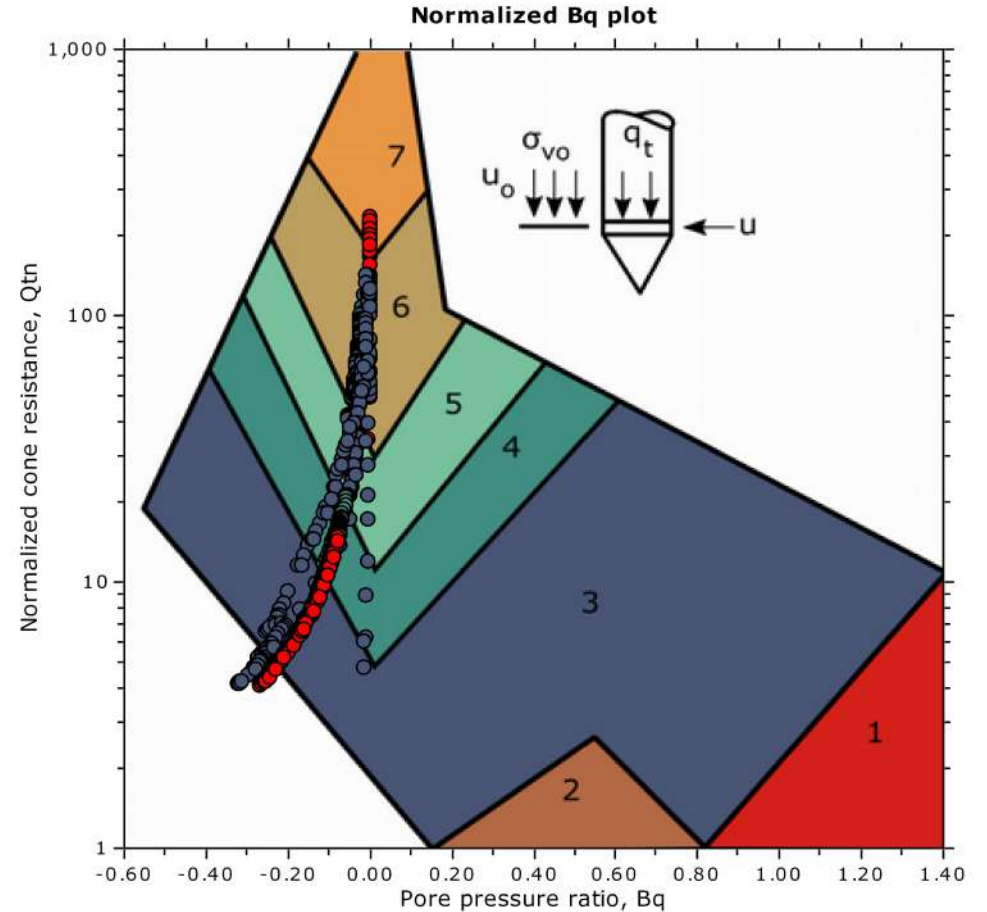
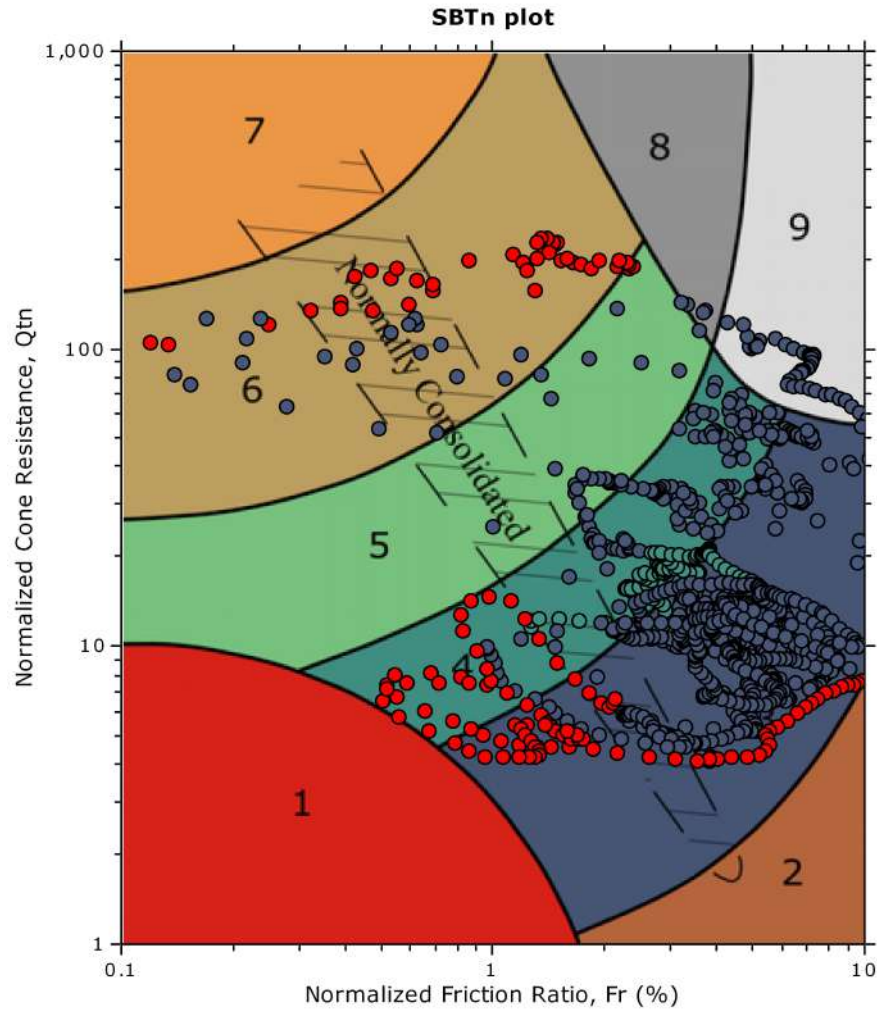
SBT legend

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

Project: Via Ponara Località Panighina

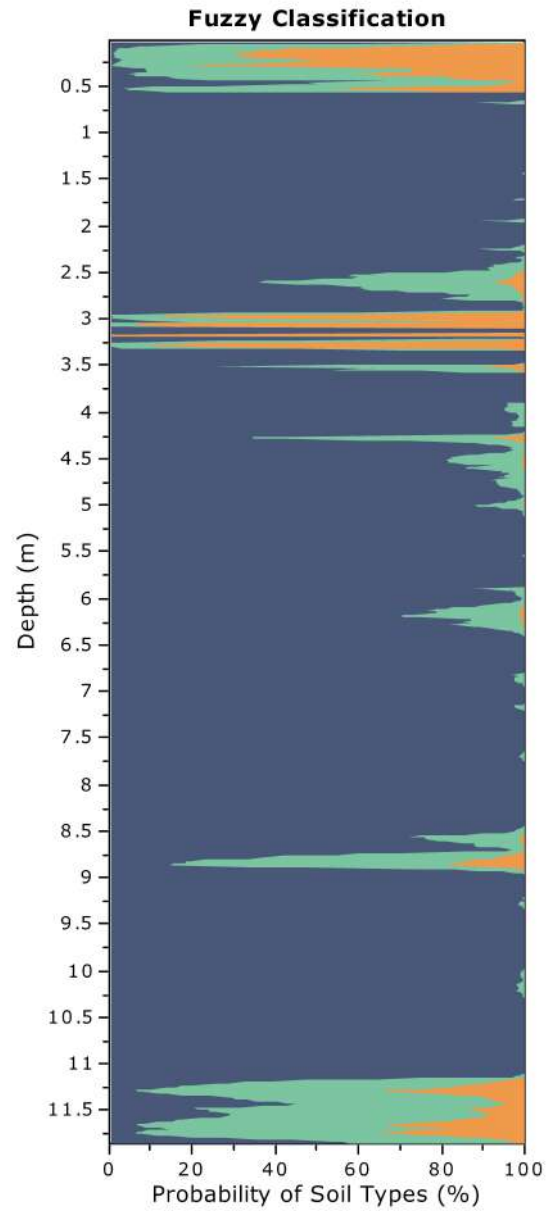
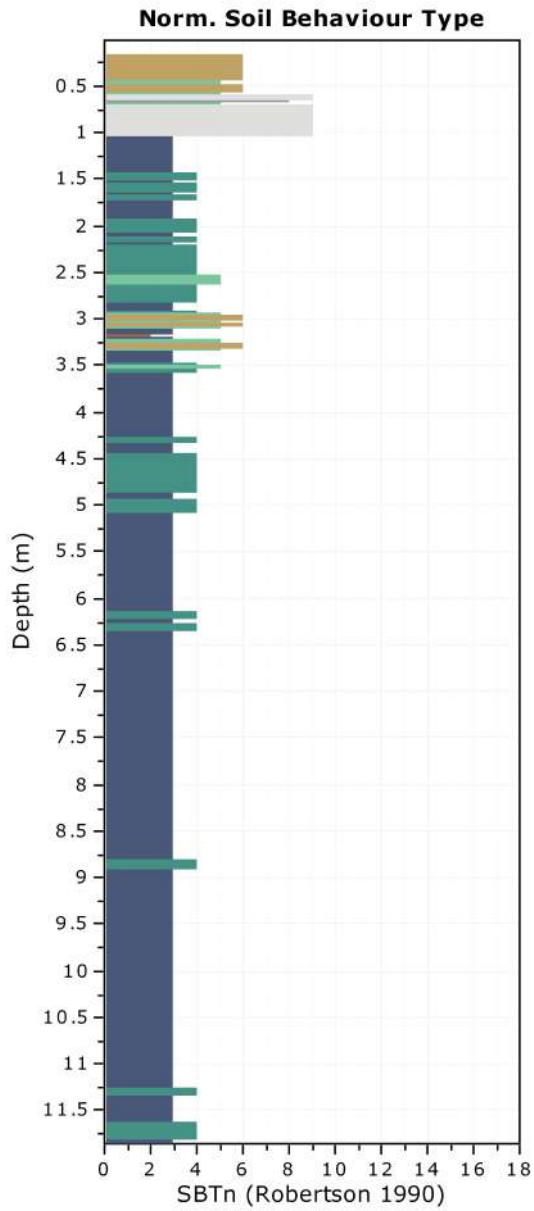
Location: Bertinoro e Forlimpopoli - Romagnola Conglomerati

SBT - Bq plots (normalized)



SBTn legend

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

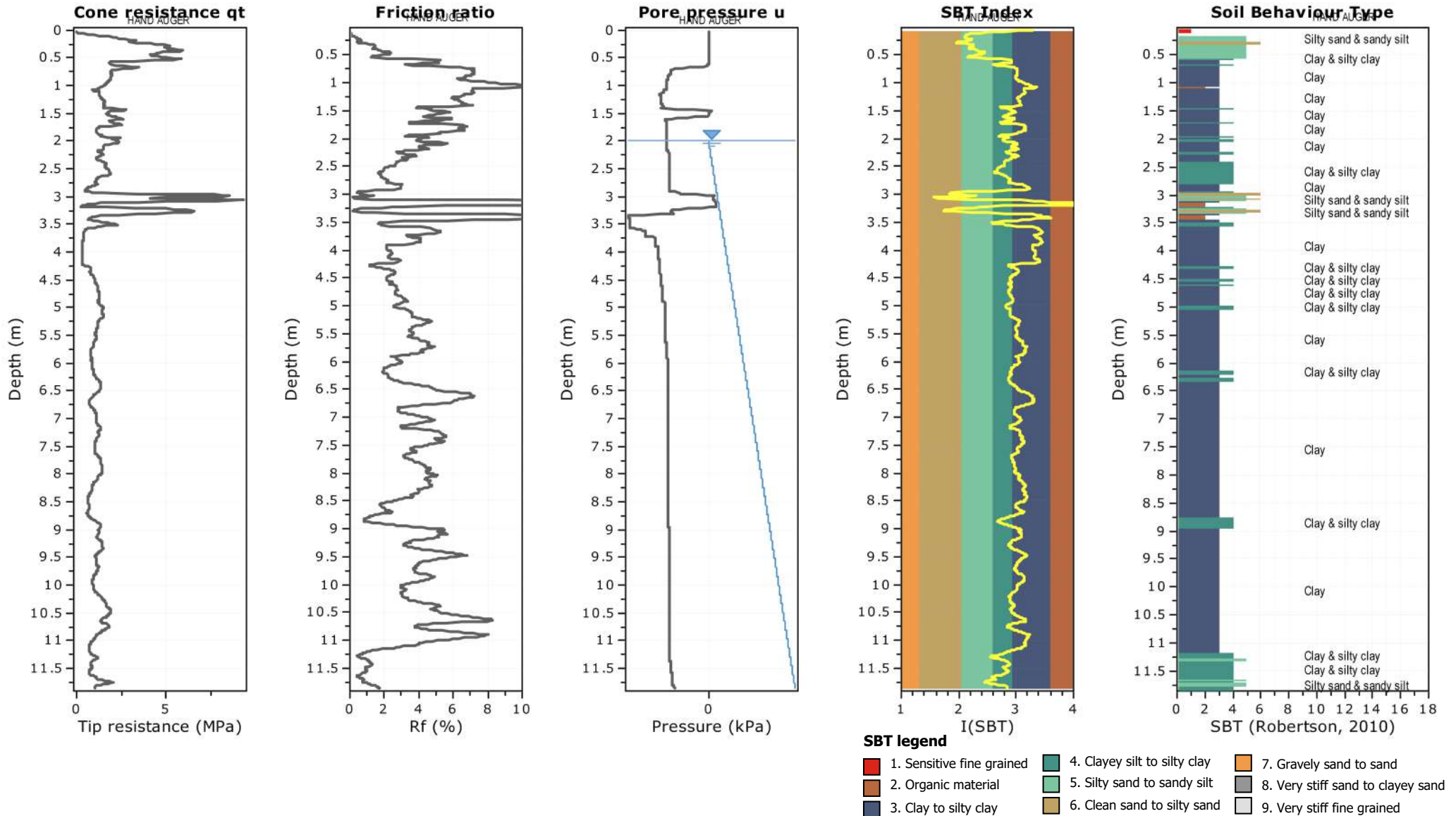


Fuzzy classification legend

- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

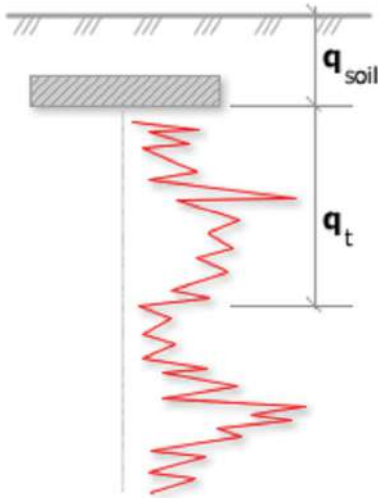
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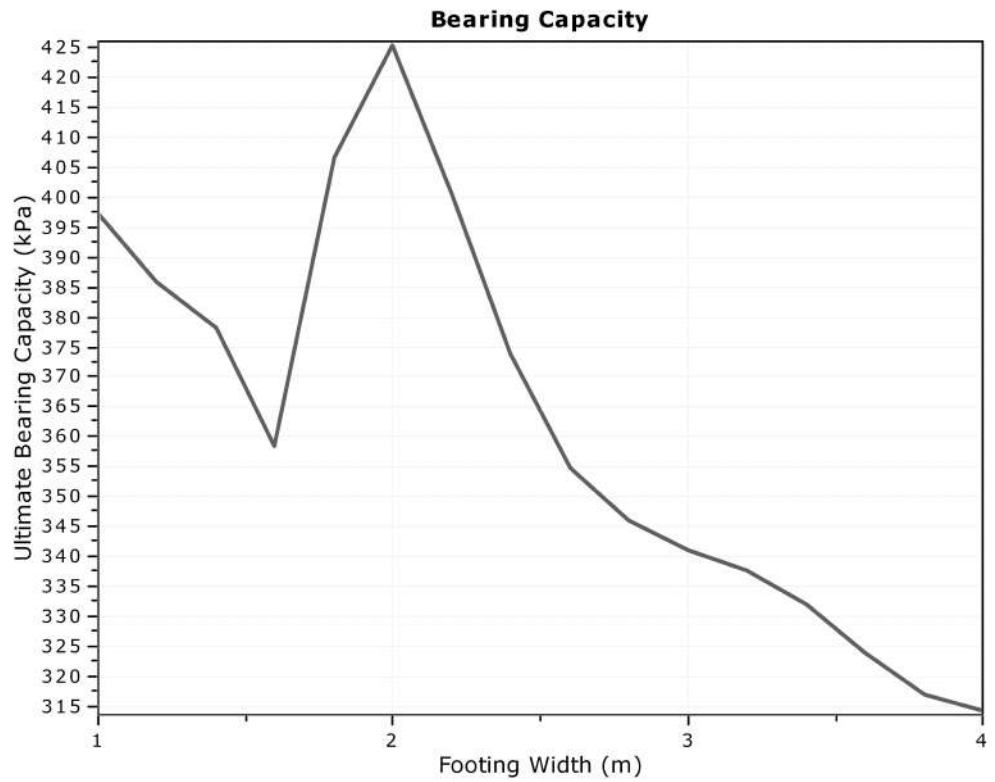


Bearing Capacity calculation is performed based on the formula:

$$Q_{ult} = R_k \times q_t + q_{soil}$$

where:

- R_k: Bearing capacity factor
- q_t: Average corrected cone resistance over calculation depth
- q_{soil}: Pressure applied by soil above footing



:: Tabular results ::

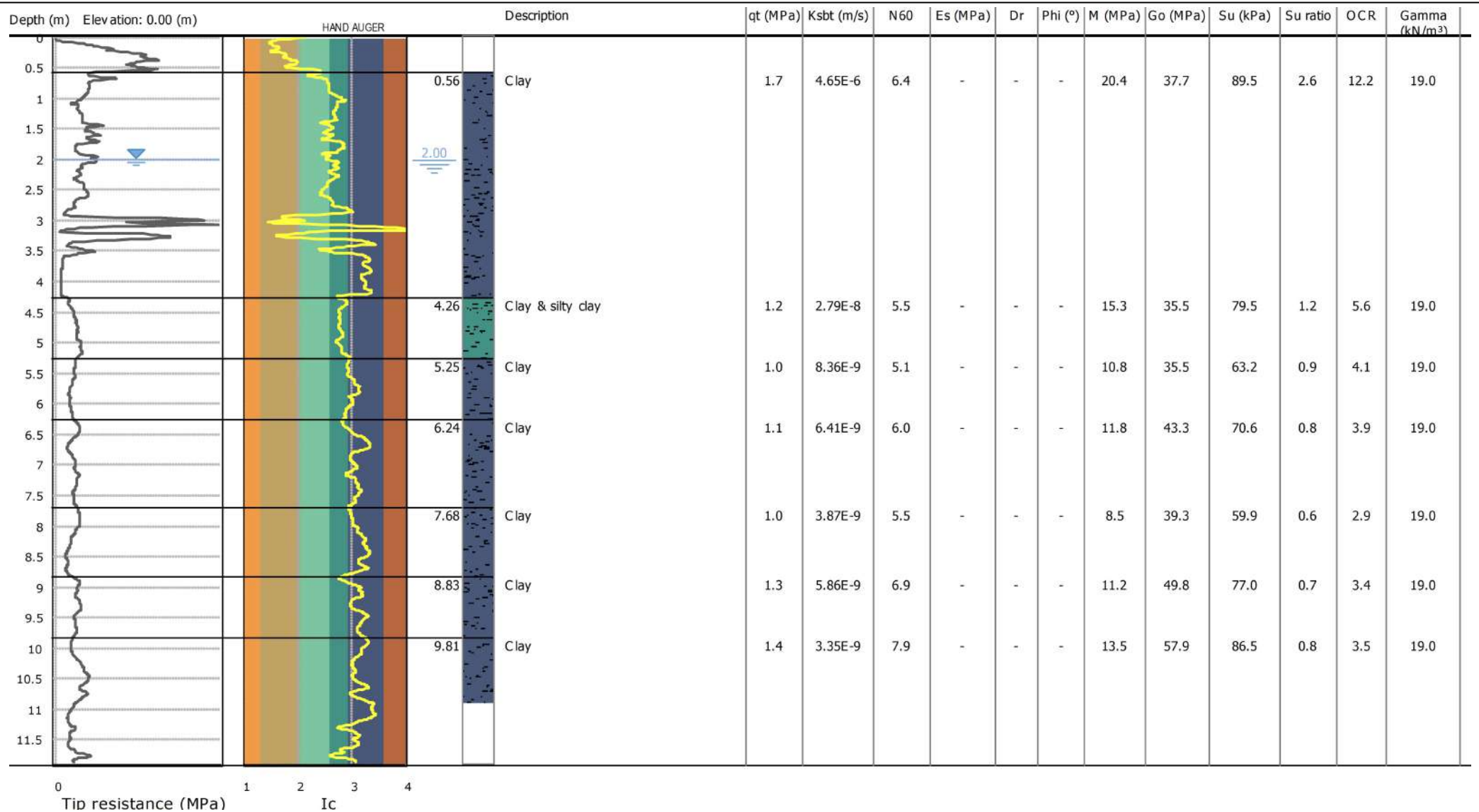
No	B (m)	Start Depth (m)	End Depth (m)	Ave. q _t (MPa)	R _k	Soil Press. (kPa)	Ult. bearing cap. (kPa)
1	1.00	0.50	2.00	1.94	0.20	9.50	397.16
2	1.20	0.50	2.30	1.88	0.20	9.50	385.77
3	1.40	0.50	2.60	1.84	0.20	9.50	378.35
4	1.60	0.50	2.90	1.75	0.20	9.50	358.57
5	1.80	0.50	3.20	1.99	0.20	9.50	406.77
6	2.00	0.50	3.50	2.08	0.20	9.50	425.41
7	2.20	0.50	3.80	1.95	0.20	9.50	400.37
8	2.40	0.50	4.10	1.82	0.20	9.50	373.96
9	2.60	0.50	4.40	1.73	0.20	9.50	354.89
10	2.80	0.50	4.70	1.68	0.20	9.50	345.95
11	3.00	0.50	5.00	1.66	0.20	9.50	340.91
12	3.20	0.50	5.30	1.64	0.20	9.50	337.80
13	3.40	0.50	5.60	1.61	0.20	9.50	331.84
14	3.60	0.50	5.90	1.57	0.20	9.50	323.86
15	3.80	0.50	6.20	1.54	0.20	9.50	316.89
16	4.00	0.50	6.50	1.52	0.20	9.50	314.24

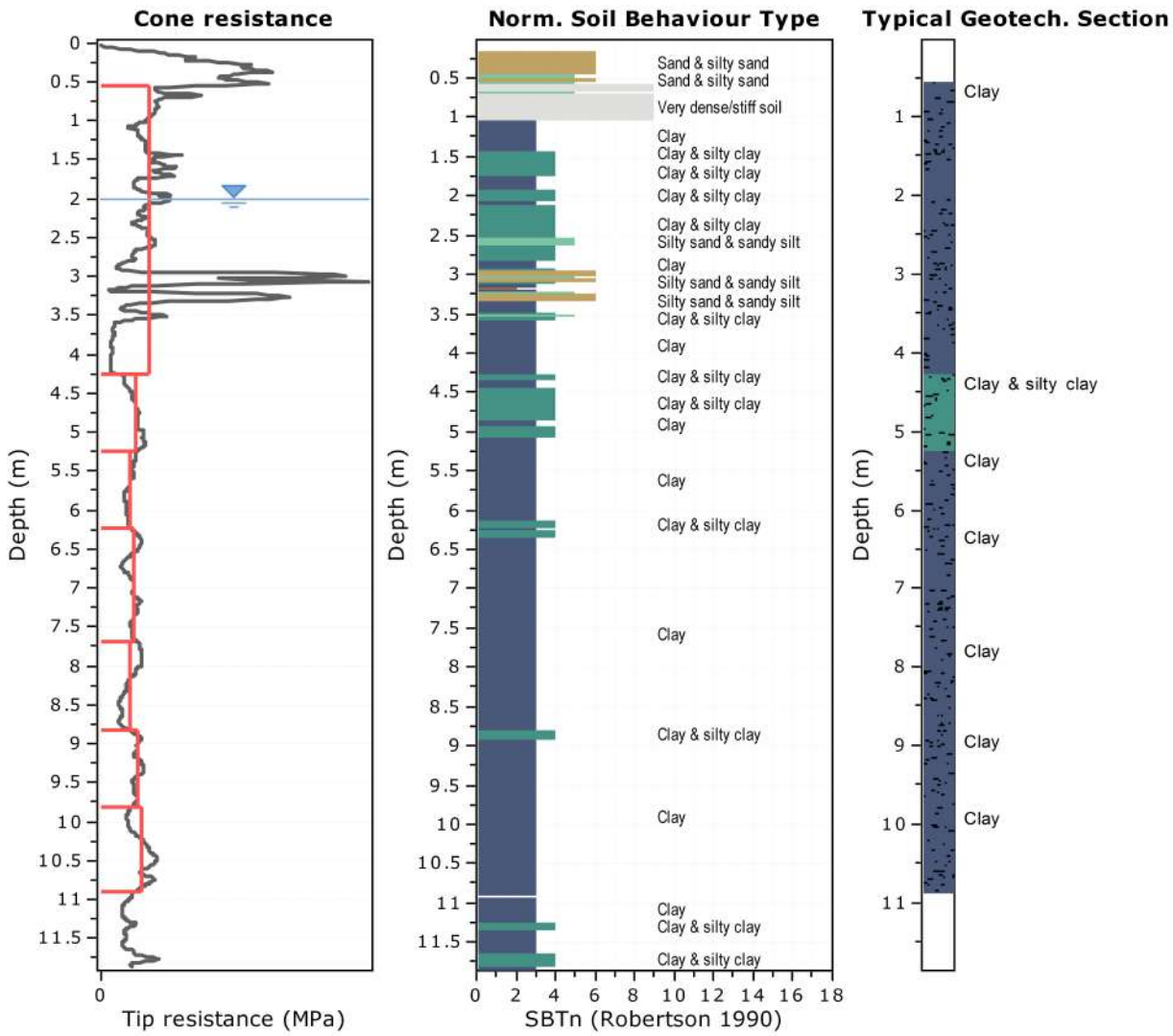
Project: Via Ponara Località Panighina

Location: Bertinoro e Forlimpopoli - Romagna Conglomerati

Cone Type:

Cone Operator:





Tabular results

::: Layer No: 1 :::		
Code: Layer_1 Start depth: 0.56 (m), End depth: 4.26 (m)		
Description: Clay		
Basic results		
Total cone resistance: 1.70 ±1.48 MPa	Estimation results	Constrained Mod.: 20.44 ±14.35 MPa
Sleeve friction: 67.26 ±47.54 kPa	Permeability: 4.65E-06 ±2.79E-05 m/s	Go: 37.66 ±13.12 MPa
Ic: 2.73 ±0.41	N ₆₀ : 6.36 ±3.27 blows	Su: 89.51 ±47.97 kPa
SBT _n : 3	Es: 0.00 ±0.00 MPa	Su ratio: 2.64 ±1.95
SBTn description: Clay	Dr (%): 0.00 ±0.00	O.C.R.: 12.20 ±9.02
	φ (degrees): 0.00 ±0.00 °	
	Unit weight: 19.00 ±0.00 kN/m ³	

::: Layer No: 2 :::**Code:** Layer_2 **Start depth:** 4.26 (m), **End depth:** 5.25 (m)**Description:** Clay & silty clay**Basic results**

Total cone resistance: 1.20 ±0.23 MPa

Sleeve friction: 33.99 ±12.49 kPa

Ic: 2.81 ±0.05

SBT_n: 4SBT_n description: Clay & silty clay**Estimation results**

Permeability: 2.79E-08 ±8.99E-09 m/s

N₆₀: 5.52 ±1.00 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 15.34 ±3.61 MPa

Go: 35.47 ±6.73 MPa

Su: 79.48 ±16.10 kPa

Su ratio: 1.22 ±0.20

O.C.R.: 5.63 ±0.95

::: Layer No: 3 :::**Code:** Layer_3 **Start depth:** 5.25 (m), **End depth:** 6.24 (m)**Description:** Clay**Basic results**

Total cone resistance: 0.99 ±0.13 MPa

Sleeve friction: 34.77 ±11.15 kPa

Ic: 2.99 ±0.08

SBT_n: 3SBT_n description: Clay**Estimation results**

Permeability: 8.36E-09 ±4.05E-09 m/s

N₆₀: 5.12 ±0.66 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 10.76 ±3.16 MPa

Go: 35.55 ±4.25 MPa

Su: 63.18 ±9.65 kPa

Su ratio: 0.88 ±0.16

O.C.R.: 4.05 ±0.75

::: Layer No: 4 :::**Code:** Layer_4 **Start depth:** 6.24 (m), **End depth:** 7.68 (m)**Description:** Clay**Basic results**

Total cone resistance: 1.12 ±0.18 MPa

Sleeve friction: 47.76 ±12.93 kPa

Ic: 3.06 ±0.13

SBT_n: 3SBT_n description: Clay**Estimation results**

Permeability: 6.41E-09 ±5.67E-09 m/s

N₆₀: 6.03 ±0.70 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 11.79 ±3.79 MPa

Go: 43.27 ±4.92 MPa

Su: 70.56 ±12.80 kPa

Su ratio: 0.85 ±0.16

O.C.R.: 3.91 ±0.76

::: Layer No: 5 :::**Code:** Layer_5 **Start depth:** 7.68 (m), **End depth:** 8.83 (m)**Description:** Clay**Basic results**

Total cone resistance: 1.00 ±0.30 MPa

Sleeve friction: 36.26 ±19.49 kPa

Ic: 3.14 ±0.13

SBT_n: 3SBT_n description: Clay**Estimation results**

Permeability: 3.87E-09 ±3.49E-09 m/s

N₆₀: 5.47 ±1.34 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 8.51 ±5.98 MPa

Go: 39.35 ±10.20 MPa

Su: 59.87 ±21.90 kPa

Su ratio: 0.63 ±0.25

O.C.R.: 2.93 ±1.15

::: Layer No: 6 :::**Code:** Layer_6 **Start depth:** 8.83 (m), **End depth:** 9.81 (m)**Description:** Clay**Basic results**

Total cone resistance: 1.26 ±0.13 MPa

Sleeve friction: 51.30 ±15.50 kPa

Ic: 3.09 ±0.13

SBT_n: 3

SBTn description: Clay

Estimation results

Permeability: 5.86E-09 ±7.90E-09 m/s

N₆₀: 6.89 ±0.65 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 11.22 ±2.78 MPa

Go: 49.81 ±6.34 MPa

Su: 77.00 ±9.15 kPa

Su ratio: 0.73 ±0.09

O.C.R.: 3.38 ±0.44

::: Layer No: 7 :::**Code:** Layer_7 **Start depth:** 9.81 (m), **End depth:** 10.89 (m)**Description:** Clay**Basic results**

Total cone resistance: 1.41 ±0.35 MPa

Sleeve friction: 67.16 ±28.98 kPa

Ic: 3.14 ±0.11

SBT_n: 3

SBTn description: Clay

Estimation results

Permeability: 3.35E-09 ±2.17E-09 m/s

N₆₀: 7.94 ±1.53 blows

Es: 0.00 ±0.00 MPa

Dr (%): 0.00 ±0.00

φ (degrees): 0.00 ±0.00 °

Unit weight: 19.00 ±0.00 kN/m³

Constrained Mod.: 13.55 ±6.77 MPa

Go: 57.92 ±12.51 MPa

Su: 86.48 ±24.50 kPa

Su ratio: 0.75 ±0.20

O.C.R.: 3.47 ±0.93

Project: Via Ponara Località Panighina

Location: Bertinoro e Forlimpopoli - Romagna Conglomerati

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT _{N60} (blows/30cm)	E _s (MPa)	D _r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G _o (MPa)	Undrained strength, S _u (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m ³)
0.56	3.70	4.65E-06	6.4	0.0	0.0	0.0	20.4	37.7	89.5	2.6	12.2	19.0
4.26		(±2.79E-05)	(±3.3)	(±0.0)	(±0.0)	(±0.0)	(±14.3)	(±13.1)	(±48.0)	(±2.0)	(±9.0)	(±0.0)
4.26	0.99	2.79E-08	5.5	0.0	0.0	0.0	15.3	35.5	79.5	1.2	5.6	19.0
5.25		(±8.99E-09)	(±1.0)	(±0.0)	(±0.0)	(±0.0)	(±3.6)	(±6.7)	(±16.1)	(±0.2)	(±0.9)	(±0.0)
5.25	0.99	8.36E-09	5.1	0.0	0.0	0.0	10.8	35.5	63.2	0.9	4.1	19.0
6.24		(±4.05E-09)	(±0.7)	(±0.0)	(±0.0)	(±0.0)	(±3.2)	(±4.3)	(±9.6)	(±0.2)	(±0.7)	(±0.0)
6.24	1.44	6.41E-09	6.0	0.0	0.0	0.0	11.8	43.3	70.6	0.8	3.9	19.0
7.68		(±5.67E-09)	(±0.7)	(±0.0)	(±0.0)	(±0.0)	(±3.8)	(±4.9)	(±12.8)	(±0.2)	(±0.8)	(±0.0)
7.68	1.15	3.87E-09	5.5	0.0	0.0	0.0	8.5	39.3	59.9	0.6	2.9	19.0
8.83		(±3.49E-09)	(±1.3)	(±0.0)	(±0.0)	(±0.0)	(±6.0)	(±10.2)	(±21.9)	(±0.2)	(±1.2)	(±0.0)
8.83	0.98	5.86E-09	6.9	0.0	0.0	0.0	11.2	49.8	77.0	0.7	3.4	19.0
9.81		(±7.90E-09)	(±0.7)	(±0.0)	(±0.0)	(±0.0)	(±2.8)	(±6.3)	(±9.1)	(±0.1)	(±0.4)	(±0.0)
9.81	1.08	3.35E-09	7.9	0.0	0.0	0.0	13.5	57.9	86.5	0.8	3.5	19.0
10.89		(±2.17E-09)	(±1.5)	(±0.0)	(±0.0)	(±0.0)	(±6.8)	(±12.5)	(±24.5)	(±0.2)	(±0.9)	(±0.0)

Depth values presented in this table are measured from free ground surface

Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log\left(\frac{q_t}{p_a}\right) + 1.236 \right)$$

where g_w = water unit weight

:: Permeability, k (m/s) ::

$$I_c < 3.27 \text{ and } I_c > 1.00 \text{ then } k = 10^{0.952 - 3.04 \cdot I_c}$$

$$I_c \leq 4.00 \text{ and } I_c > 3.27 \text{ then } k = 10^{-4.52 - 1.37 \cdot I_c}$$

:: N_{sPT} (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{p_a} \right) \cdot \frac{1}{10^{1.1268 - 0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268 - 0.2817 \cdot I_c}}$$

:: Young's Modulus, E_s (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}} \quad \text{(applicable only to SBT}_n\text{: 5, 6, 7 and 8 or } I_c < I_{c_cutoff}\text{)}$$

:: State Parameter, ψ ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Drained Friction Angle, ϕ (°) ::

(applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c_cutoff}$)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$
 $\alpha = 14$ for $Q_{tn} > 14$
 $\alpha = Q_{tn}$ for $Q_{tn} \leq 14$
 $M_{CPT} = \alpha \cdot (q_t - \sigma_v)$

If $I_c \geq 2.20$

:: Small strain shear Modulus, G_0 (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, V_s (m/s) ::

$$V_s = \left(\frac{G_0}{\rho} \right)^{0.50}$$

:: Undrained peak shear strength, S_u (kPa) ::

$$N_{kt} = 10.50 + 7 \cdot \log(F_r) \text{ or user defined}$$

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Remolded undrained shear strength, $S_u(rem)$ (kPa) ::

$$S_{u(rem)} = f_s \quad \text{(applicable only to SBT}_n\text{: 1, 2, 3, 4 and 9 or } I_c > I_{c_cutoff}\text{)}$$

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 + 7 \cdot \log(F_r))} \right]^{1.25} \text{ or user defined}$$

$$OCR = k_{OCR} \cdot Q_{tn}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: In situ Stress Ratio, K_0 ::

$$K_0 = (1 - \sin \phi') \cdot OCR^{\sin \phi'}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Soil Sensitivity, S_t ::

$$S_t = \frac{N_s}{F_r}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Peak Friction Angle, ϕ' (°) ::

$$\phi' = 29.5^\circ \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

(applicable for $0.10 < B_q < 1.00$)

References

- Robertson, P.K., Cabal K.L., Guide to Cone Penetration Testing for Geotechnical Engineering, Gregg Drilling & Testing, Inc., 5th Edition, November 2012
- Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)
- N Barounis, J Philpot, Estimation of in-situ water content, void ratio, dry unit weight and porosity using CPT for saturated sands, Proc. 20th NZGS Geotechnical Symposium

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Via Ponara – Romagnola Conglomerati

Comune:

Bertinoro e Forlimpopoli (FC)

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OGGETTO:

INDAGINE SISMICA PASSIVA MEDIANTE TROMOGRAFO
DIGITALE “TROMINO”® (METODO NAKAMURA)

STIMA DELLA VS CON MISURA DIRETTA DELLE FREQUENZE DI
RISONANZA DA STAZIONE SINGOLA - METODO H/V

Data:

Marzo 2025

Impresa esecutrice

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PREMESSA E GENERALITA'

MISURA DIRETTA DELLE FREQUENZE DI RISONANZA

In linea di principio, visto che il suolo è assimilabile ad un corpo viscoelastico, é possibile misurarne le frequenze proprie di oscillazione in ogni punto. Queste frequenze dipendono dalle proprietà meccaniche e dalla morfologia attorno al punto di misura. Per la misura delle frequenze di risonanza solitamente viene applicato al corpo una sollecitazione nota (un impulso), misurando poi la risposta del corpo in termini di spostamenti o accelerazioni. La risposta del suolo può essere studiata in questa maniera utilizzando come funzione di eccitazione le onde di un terremoto o di una sorgente artificiale (sismica attiva). In alternativa si può utilizzare come funzione di eccitazione il rumore sismico di fondo. (sismica passiva).

Il rumore sismico ambientale viene generato da fenomeni atmosferici (onde oceaniche o vento) e dall'attività antropica. Viene detto anche “microtremore” perché riguarda oscillazioni molto più piccole di quelle indotte dai terremoti. Al rumore di fondo, sempre presente, si sovrappongono le sorgenti locali antropiche e naturali. I microtremori sono in parte costituiti da onde di volume P ed S, in parte da onde di superficiali che hanno velocità prossime a quelle delle onde S.

Il rumore sismico può essere misurato con il tromografo digitale Tromino ed analizzato con il software Grilla.

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METODO H/V

Dopo i primi studi di Kanai (1957), diversi metodi sono stati proposti per estrarre l'informazione relativa al sottosuolo dal rumore sismico registrato in un sito. La tecnica maggiormente consolidata, proposta da Nogoshi & Igarashi (1970), prende in esame i rapporti spettrali tra le componenti del moto orizzontale e quella verticale (Horizontal to Vertical Spectra Ratio HVSR o H/V). La tecnica è universalmente riconosciuta come efficace nel fornire la frequenza di risonanza fondamentale del sottosuolo.

L'ampiezza del picco del rapporto H/V, pur essendo legata all'entità del contrasto di impedenza tra gli strati, non è correlabile all'amplificazione sismica in modo semplice.

In un mezzo "semplice", per es. coltre alterazione + bedrock (o strato assimilabile al bedrock; ad es. argille su ghiaie), dove i parametri sono costanti in ciascuno strato (1-D), i due strati hanno rispettivamente diverse densità ρ_1 e ρ_2 e diverse velocità delle onde sismiche V_1 e V_2 . Un'onda che viaggia nel mezzo 1 viene parzialmente riflessa dall'interfaccia che separa i due strati. L'onda così riflessa interferisce con quelle incidenti, sommandosi e

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raggiungendo le ampiezze massime (condizione di risonanza) quando la lunghezza dell'onda incidenti (λ) è 4 volte (o i suoi multipli dispari) lo spessore H del primo strato. Quindi la frequenza fondamentale di risonanza (f_r) dello strato 1 relativa alle onde S è pari a:

$$f_r = V_s/4H \quad (1)$$

Questo effetto è sommabile, anche se non in modo lineare e senza una corrispondenza 1:1. Ciò significa che la curva H/V relativa ad un sistema a più strati contiene l'informazione relativa alle frequenze di risonanza (e quindi allo spessore) di ciascuno di essi, ma non risulta interpretabile applicando semplicemente l'equazione (1). E' necessario applicare il processo di inversione che richiede l'analisi delle singole componenti e del rapporto H/V, che fornisce un'importante normalizzazione del segnale per:

- a) contenuto in frequenza
- b) risposta strumentale
- c) ampiezza del segnale quando le registrazioni vengono effettuate in momenti con rumore di fondo più o meno alto.

I valori assoluti degli spettri orizzontali (H) e verticali (V) variano con il livello assoluto del rumore ambientale (alte frequenze, disturbi "antropici" tipo mezzi in movimento, lavorazioni, calpestio ecc.). Nella pratica si usa H/V perché è un buon normalizzatore e, come ampiamente riconosciuto nella letteratura scientifica internazionale, H/V misura direttamente le frequenze di risonanza dei terreni.

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STIMA DI VS A PARTIRE DA MISURE A STAZIONE SINGOLA

L'analisi H/V permette di identificare i contrasti di impedenza tra gli strati. Una coltre di sedimenti sovrastanti un substrato roccioso (bedrock) darà un picco nella funzione H/V. Però anche una coltre di sedimenti fini sopra uno strato di ghiaia può generare un massimo nella funzione H/V. In questo caso lo strato di ghiaia viene in genere indicato come bedrock-like (strato assimilabile al bedrock) anche se la sua velocità è inferiore agli 800 m/s previsti dalla normativa. Anche questi strati bedrock-like sono in grado di creare fenomeni di intrappolamento d'onde e quindi fenomeni di risonanza, se la discontinuità nelle Vs è netta.

In base alla precedente equazione, il segnale, una volta pulito dagli effetti antropici ad alta frequenza ($>30\text{Hz}$), si può risolvere o conoscendo la Vs del materiale per determinare gli spessori oppure, conoscendo gli spessori, per determinare la Vs.

Quindi risulta indispensabile avere a disposizione dei vincoli da prove dirette del sottosuolo (penetrometrie, carotaggi) per poter associare ai picchi rilevati dalle misure di microtremore dei contrasti di impedenza adeguati, cioè modellare il mezzo geologico affinché rappresenti in maniera attendibile il sottosuolo, cioè strati con spessori e velocità associabili alla curva misurata delle frequenze di risonanza con il rapporto spettrale H/V.

Nel caso semplice di strato omogeneo sopra un bedrock, se da misure dirette è nota la profondità H del bedrock (o bedrock-like) si può calcolare il Vs30 attraverso le misure di fr. Se $H > 30$ m, il valore di Vs30 viene calcolato direttamente dalla [1].

Se $H \leq 30$ m, allora:


$$V_{s30} = \frac{30}{t_h + t_{30-H}} = \frac{30}{(1/v_r) + (30-H)/V_B} \quad [2]$$

dove VB è la velocità delle onde S nel bedrock o bedrock-like.

Valori orientativi di velocità delle onde S sono riportati nella Tabella 1.

Tabella 1. Valori caratteristici delle onde S nei vari tipi di suolo (Borcherdt,1994).

Tipi di suolo	Vs min. (m/s)	Vs med. (m/s)	Vs max. (m/s)
Rocce molto dure (rocce metamorfiche poco fratturate)	1400	1620	-
Rocce dure (graniti, rocce ignee, conglomerati, arenarie ed argilliti da poco a mediamente fratturati)	700	1050	1400
Suoli ghiaiosi e rocce da tenere a dure (rocce sedimentarie tenere, arenarie, argilliti, ghiaie e suoli con più del 20% di ghiaia)	375	540	700
argille compatte e suoli sabbiosi (sabbie da sciolte a molto compatte, limi e argille sabbiose o limose, argille da medie a compatte)	200	290	375
Terreni teneri (terreno di riporto sotto falda, argille da tenere a molto tenere)	100	150	200

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MODI DI VIBRARE

Come il sottosuolo, eccitato dalle onde che lo attraversano, presenta più modi di vibrare anche le strutture e gli edifici in c.a. presenta a loro volta delle frequenze di risonanza proprie dell'edificio.

E' indispensabile evitare i fenomeni di doppia risonanza cioè quei casi in cui la frequenza propria del terreno ha picchi con frequenze di risonanza simili o leggermente inferiori a quelle dell'edificio.

Condizione ideale sarebbe data da una risonanza dell'edificio a frequenze minori di quelle del sottosuolo. Se le risonanze suolo-struttura coincidono la situazione è problematica dal punto di vista della vulnerabilità sismica, così come se la risonanza della struttura è a frequenze di poco superiore a quelle del sottosuolo la situazione è ugualmente problematica perché :

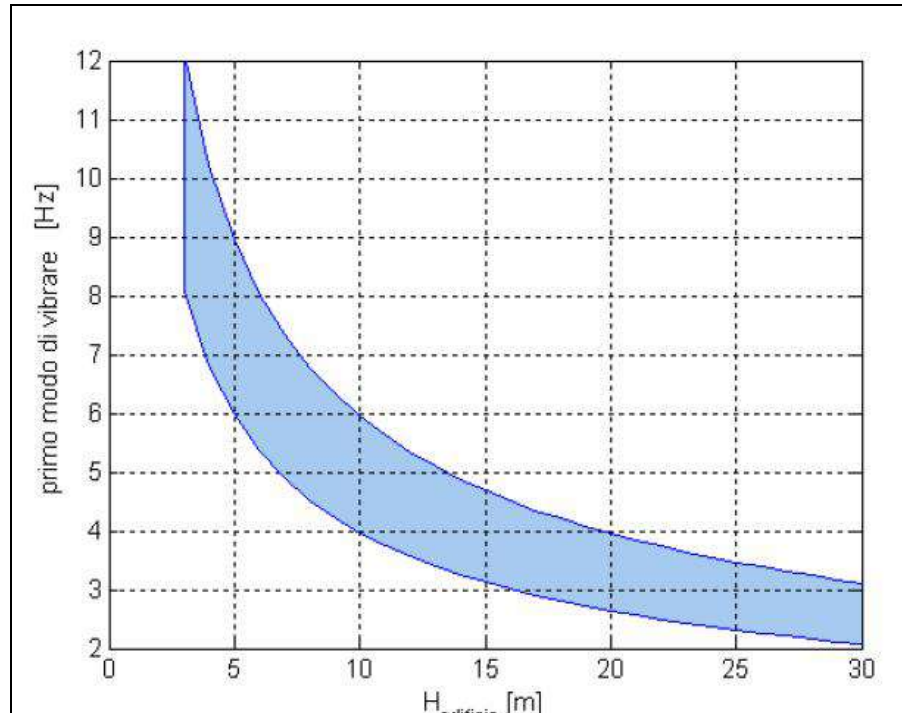
gli edifici con il proprio danneggiamento diminuiscono la loro frequenza di risonanza propria,

il sottosuolo può manifestare modi di vibrare di ampiezza maggiore e a frequenza maggiore rispetto a quella visibile con i microtremori.

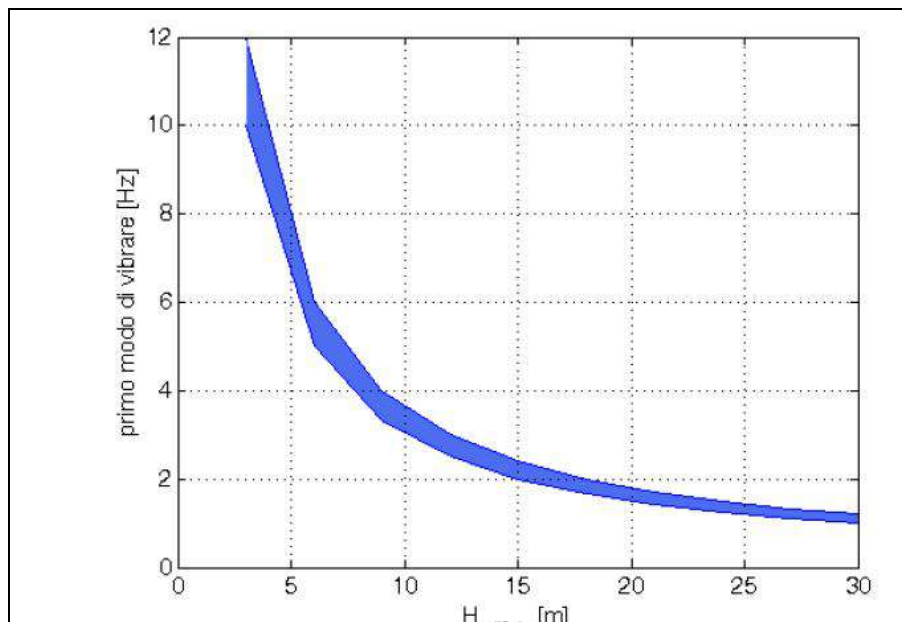
Quindi è opportuno che la frequenza di risonanza della struttura risulti sempre inferiore al picco di risonanza del terreno od almeno al di fuori del 40% dell'ampiezza del picco di risonanza del terreno.

Si allega di seguito il grafico semplificato che mette in relazione la frequenza di risonanza teorica per edifici in relazione alla loro altezza in metri, in modo da poter confrontare in maniera speditiva se sono possibili fenomeni di doppia risonanza (da "Tecniche di sismica passiva e attiva", Silvia Castellaro, 2010).

RELAZIONE TIPICA ALTEZZA EDIFICIO - I MODO FLESSIONALE



I modo vibrare edifici c.a. in funzione h



I modo vibrare edifici muratura in funzione h

VIA PONARA ROMAGNOLA CONGLOMERATI,

Instrument: TRZ-0194/01-12

Data format: 16 byte

Full scale [mV]: n.a.

Start recording: 26/03/25 13:42:40 End recording: 26/03/25 13:54:40

Channel labels: NORTH SOUTH; EAST WEST; UP DOWN

GPS data not available

Trace length: 0h12'00". Analysis performed on the entire trace.

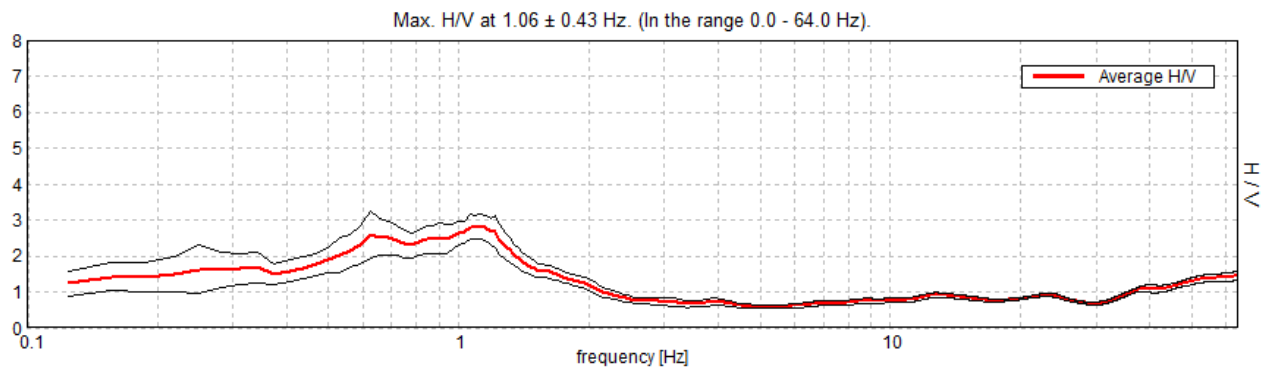
Sampling rate: 128 Hz

Window size: 20 s

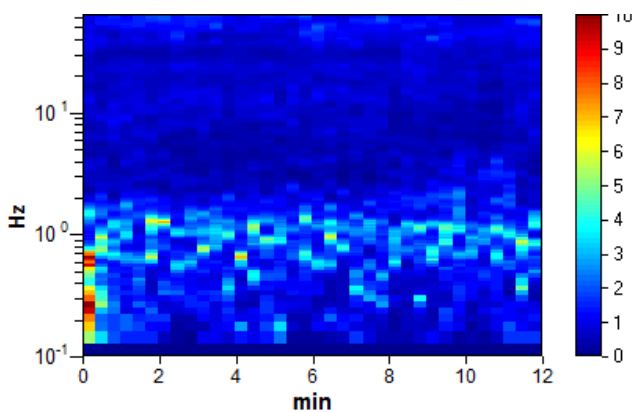
Smoothing type: Triangular window

Smoothing: 10%

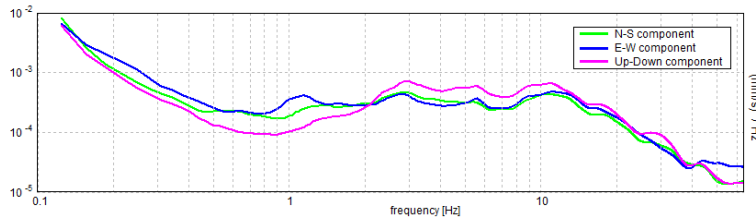
HORIZONTAL TO VERTICAL SPECTRAL RATIO



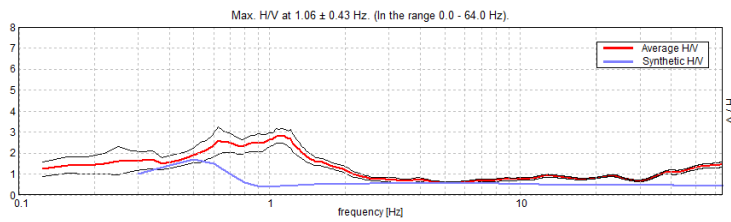
H/V TIME HISTORY



SINGLE COMPONENT SPECTRA

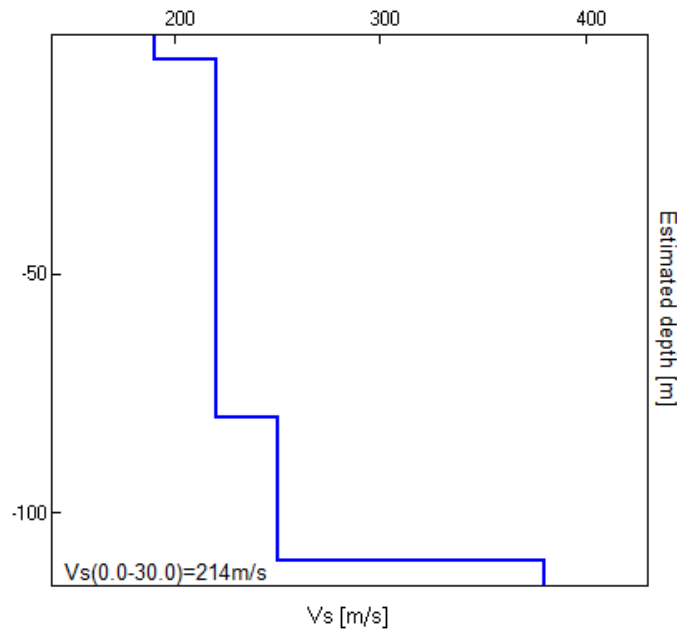


EXPERIMENTAL vs. SYNTHETIC H/V



Depth at the bottom of the layer [m]	Thickness [m]	Vs [m/s]	Poisson ratio
5.20	5.20	190	0.42
80.20	75.00	220	0.42
110.20	30.00	250	0.42
inf.	inf.	380	0.42

Vs(0.0-30.0)=214m/s



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[According to the SESAME, 2005 guidelines. **Please read carefully the *Grilla* manual before interpreting the following tables.**]

Max. H/V at 1.06 ± 0.43 Hz (in the range 0.0 - 64.0 Hz).

Criteria for a reliable H/V curve [All 3 should be fulfilled]					
$f_0 > 10 / L_w$	$1.06 > 0.50$	OK			
$n_c(f_0) > 200$	$765.0 > 200$	OK			
$\sigma_A(f) < 2$ for $0.5f_0 < f < 2f_0$ if $f_0 > 0.5\text{Hz}$ $\sigma_A(f) < 3$ for $0.5f_0 < f < 2f_0$ if $f_0 < 0.5\text{Hz}$	Exceeded 0 out of 52 times	OK			
Criteria for a clear H/V peak [At least 5 out of 6 should be fulfilled]					
Exists f^- in $[f_0/4, f_0]$ $A_{H/V}(f^-) < A_0 / 2$					NO
Exists f^+ in $[f_0, 4f_0]$ $A_{H/V}(f^+) < A_0 / 2$	1.75 Hz	OK			
$A_0 > 2$	$2.82 > 2$	OK			
$f_{\text{peak}}[A_{H/V}(f) \pm \sigma_A(f)] = f_0 \pm 5\%$	$ 0.40178 < 0.05$				NO
$\sigma_f < \varepsilon(f_0)$	$0.42689 < 0.10625$				NO
$\sigma_A(f_0) < \theta(f_0)$	$0.3396 < 1.78$	OK			
L_w n_w $n_c = L_w n_w f_0$ f f_0 σ_f $\varepsilon(f_0)$ A_0 $A_{H/V}(f)$ f^- f^+ $\sigma_A(f)$ $\sigma_{\log H/V}(f)$ $\theta(f_0)$	window length number of windows used in the analysis number of significant cycles current frequency H/V peak frequency standard deviation of H/V peak frequency threshold value for the stability condition $\sigma_f < \varepsilon(f_0)$ H/V peak amplitude at frequency f_0 H/V curve amplitude at frequency f frequency between $f_0/4$ and f_0 for which $A_{H/V}(f^-) < A_0/2$ frequency between f_0 and $4f_0$ for which $A_{H/V}(f^+) < A_0/2$ standard deviation of $A_{H/V}(f)$, $\sigma_A(f)$ is the factor by which the mean $A_{H/V}(f)$ curve should be multiplied or divided standard deviation of $\log A_{H/V}(f)$ curve threshold value for the stability condition $\sigma_A(f) < \theta(f_0)$				
Threshold values for σ_f and $\sigma_A(f_0)$					
Freq. range [Hz]	< 0.2	$0.2 - 0.5$	$0.5 - 1.0$	$1.0 - 2.0$	> 2.0
$\varepsilon(f_0)$ [Hz]	$0.25 f_0$	$0.2 f_0$	$0.15 f_0$	$0.10 f_0$	$0.05 f_0$
$\theta(f_0)$ for $\sigma_A(f_0)$	3.0	2.5	2.0	1.78	1.58
$\log \theta(f_0)$ for $\sigma_{\log H/V}(f_0)$	0.48	0.40	0.30	0.25	0.20

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Con la determinazione delle onde di taglio vs i terreni indagati vengono inseriti in una delle seguenti categorie di sottosuolo (N.T.C. 2018 _ Tabella 3.2.II e Tabella 3.2.III):

CATEGORIE DI SOTTOSUOLO

A - Ammassi rocciosi affioranti o terreni molto rigidi caratterizzati da valori di $V_{s,30}$ superiori a 800 m/s, eventualmente comprendenti in superficie uno strato di alterazione, con spessore massimo pari a 3 m.
B - Rocce tenere e depositi di terreni a grana grossa molto addensati o terreni a grana fina molto consistenti con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ compresi tra 360 m/s e 800 m/s
C - Depositati di terreni a grana grossa mediamente addensati o terreni a grana fina mediamente consistenti con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ compresi tra 180 m/s e 360 m/s
D - Depositati di terreni a grana grossa scarsamente addensati o di terreni a grana fina scarsamente consistenti, con spessori superiori a 30 m, caratterizzati da un graduale miglioramento delle proprietà meccaniche con la profondità e da valori di $V_{s,30}$ tra 100 e 180 m/s
E - Terreni con caratteristiche e valori di velocità equivalente riconducibili a quelle definite per le categorie C o D con profondità del substrato non superiore a 30 m.

CONFIZIONI TOPOGRAFICHE

T1 - Superficie pianeggiante, pendii e rilievi isolati con inclinazione media $i \leq 15^\circ$.
T2 - Pendii con inclinazione media $i > 15^\circ$.
T3 - Rilievi con larghezza in cresta molto minore che alla base e inclinazione media $15^\circ \leq i \leq 30^\circ$.
T4 - Rilievi con larghezza in cresta molto minore che alla base e inclinazione media $i > 30^\circ$.

RISULTATI INDAGINE

Dall'analisi dell'indagine si può affermare che il sito è caratterizzato da una velocità equivalente delle onde di $V_{seq} = 214$ m/sec, calcolata dalla profondità di 0,00mt. ÷ 30,00 mt., corrispondente ad un terreno di tipo C ed il picco di risonanza principale posizionato a circa 1 Hz.

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LIQUEFACTION ANALYSIS REPORT

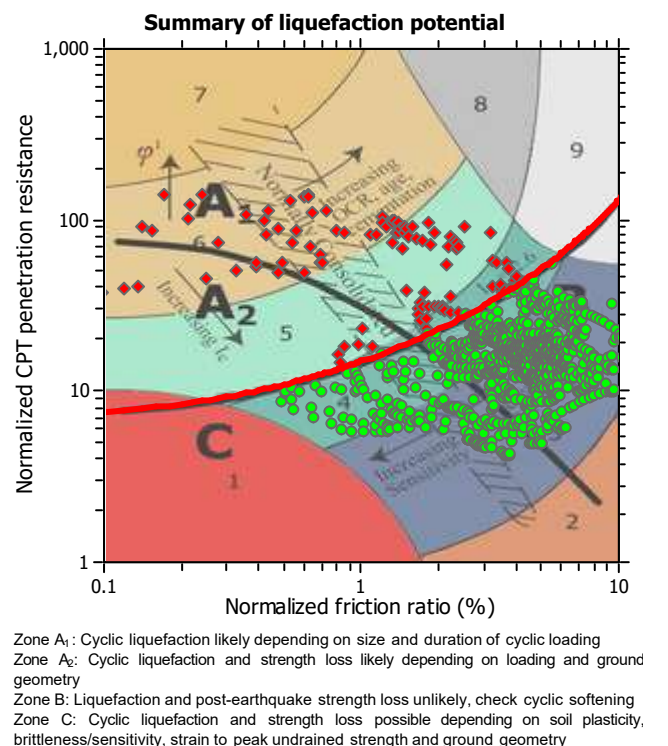
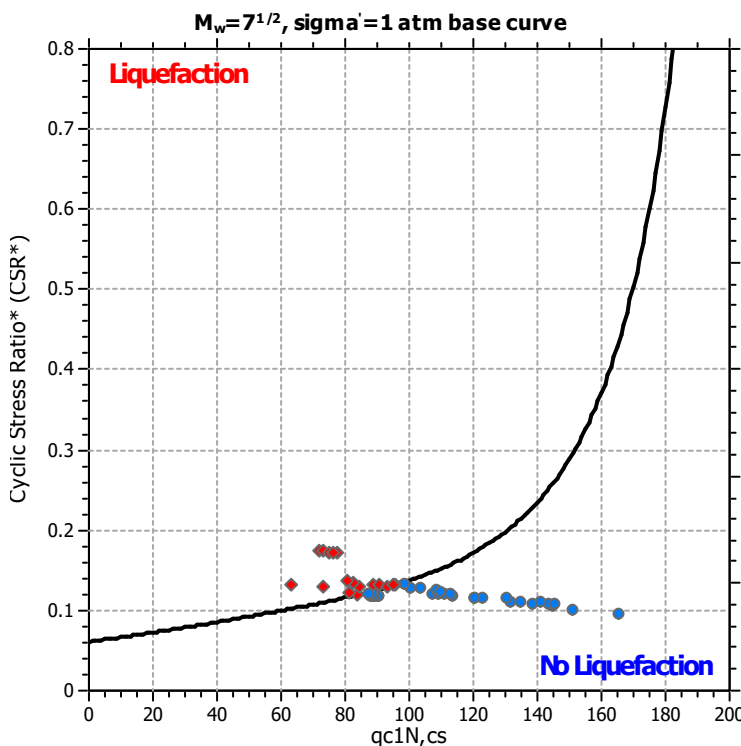
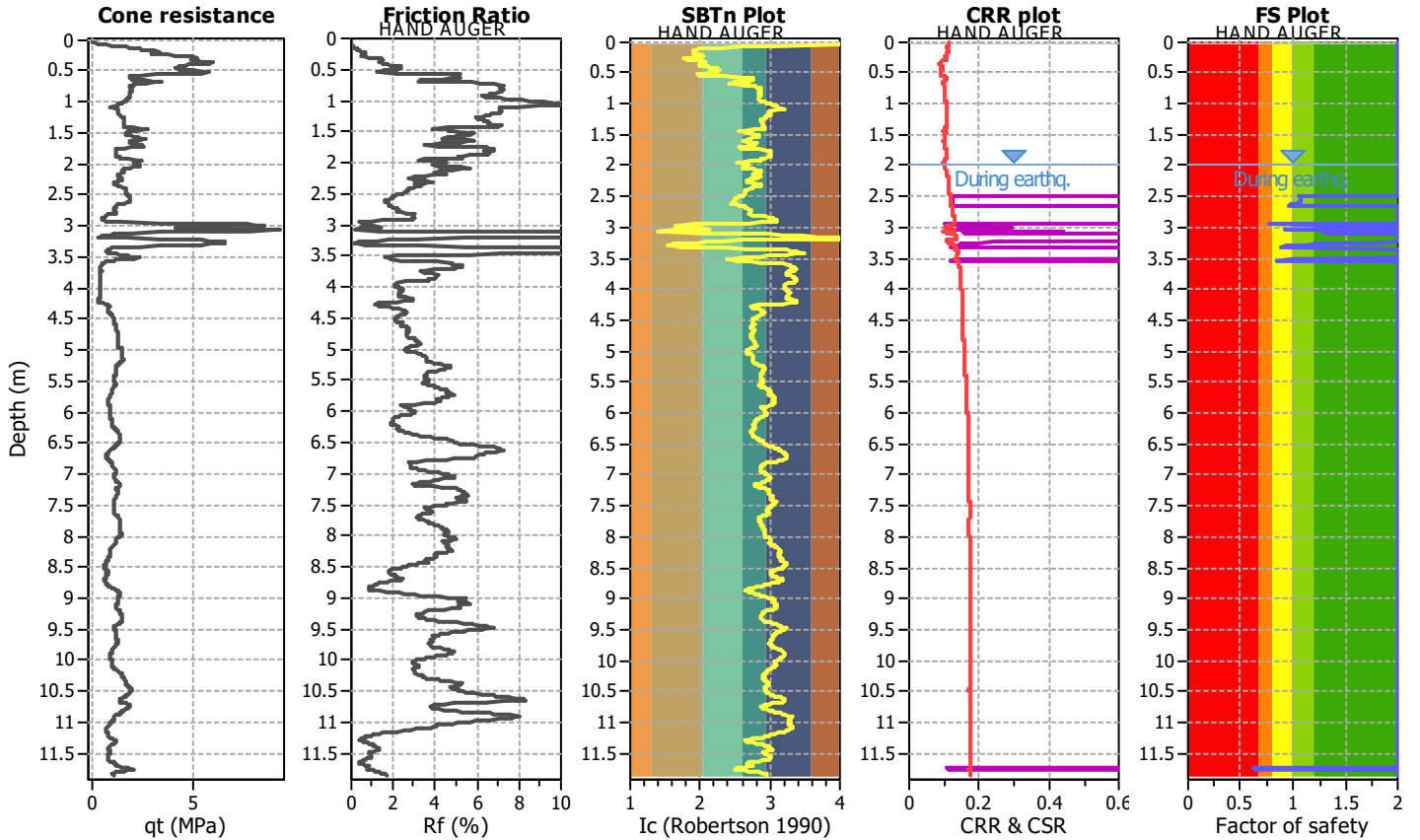
Project title : via ponara

Location : bertinoro

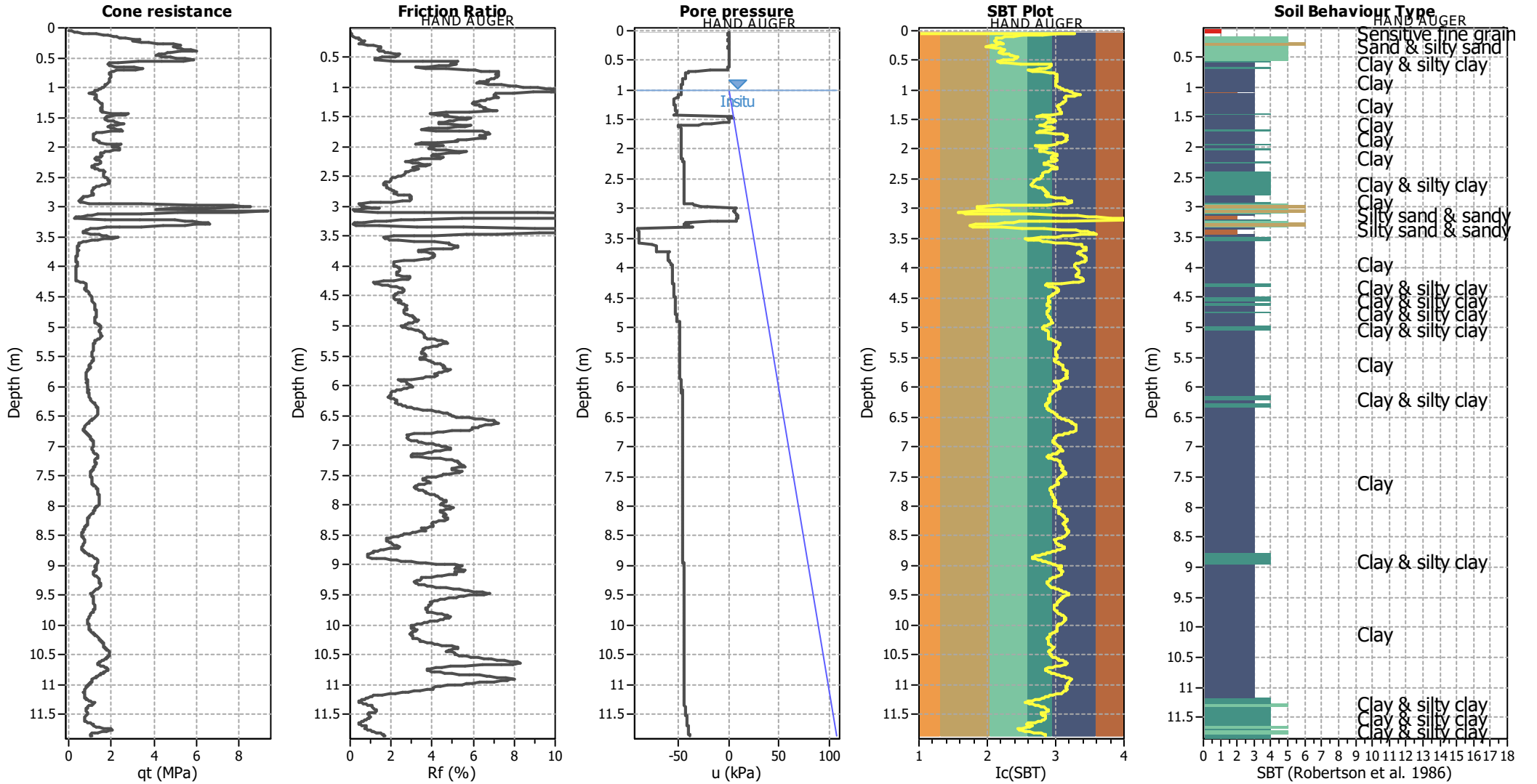
CPT file : p2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.20	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



CPT basic interpretation plots



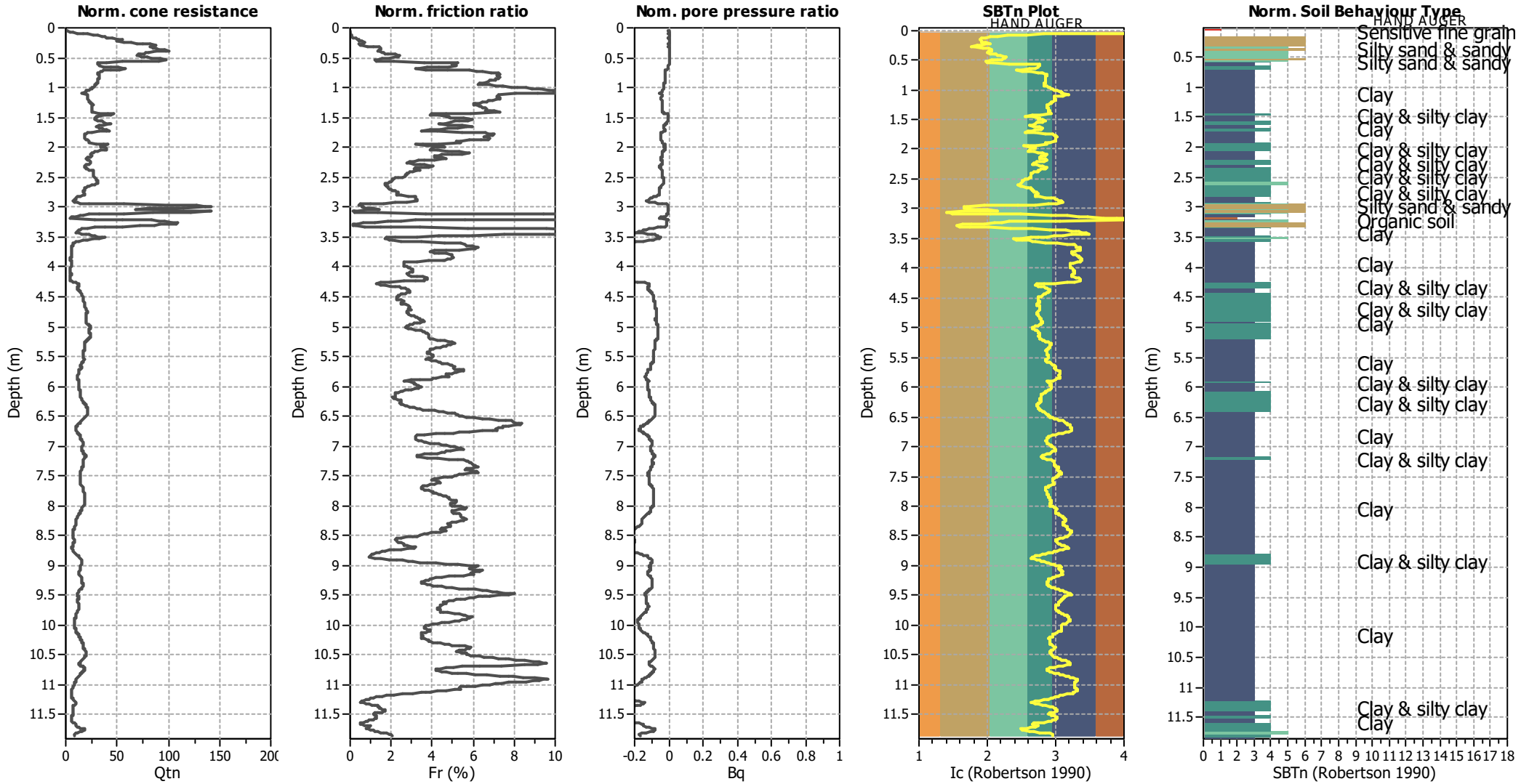
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

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)



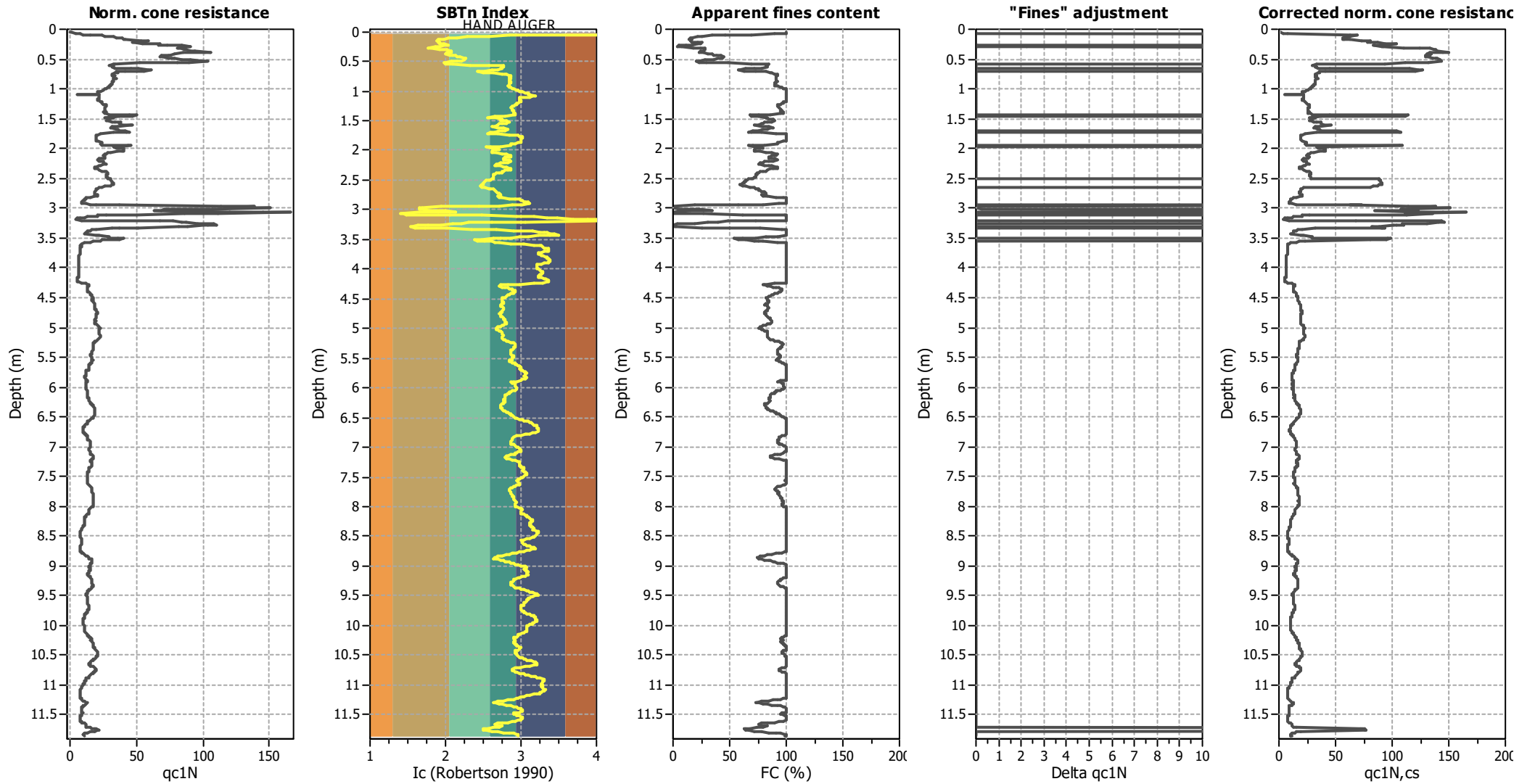
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_v applied:	Yes
Earthquake magnitude M_w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

SBTn 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

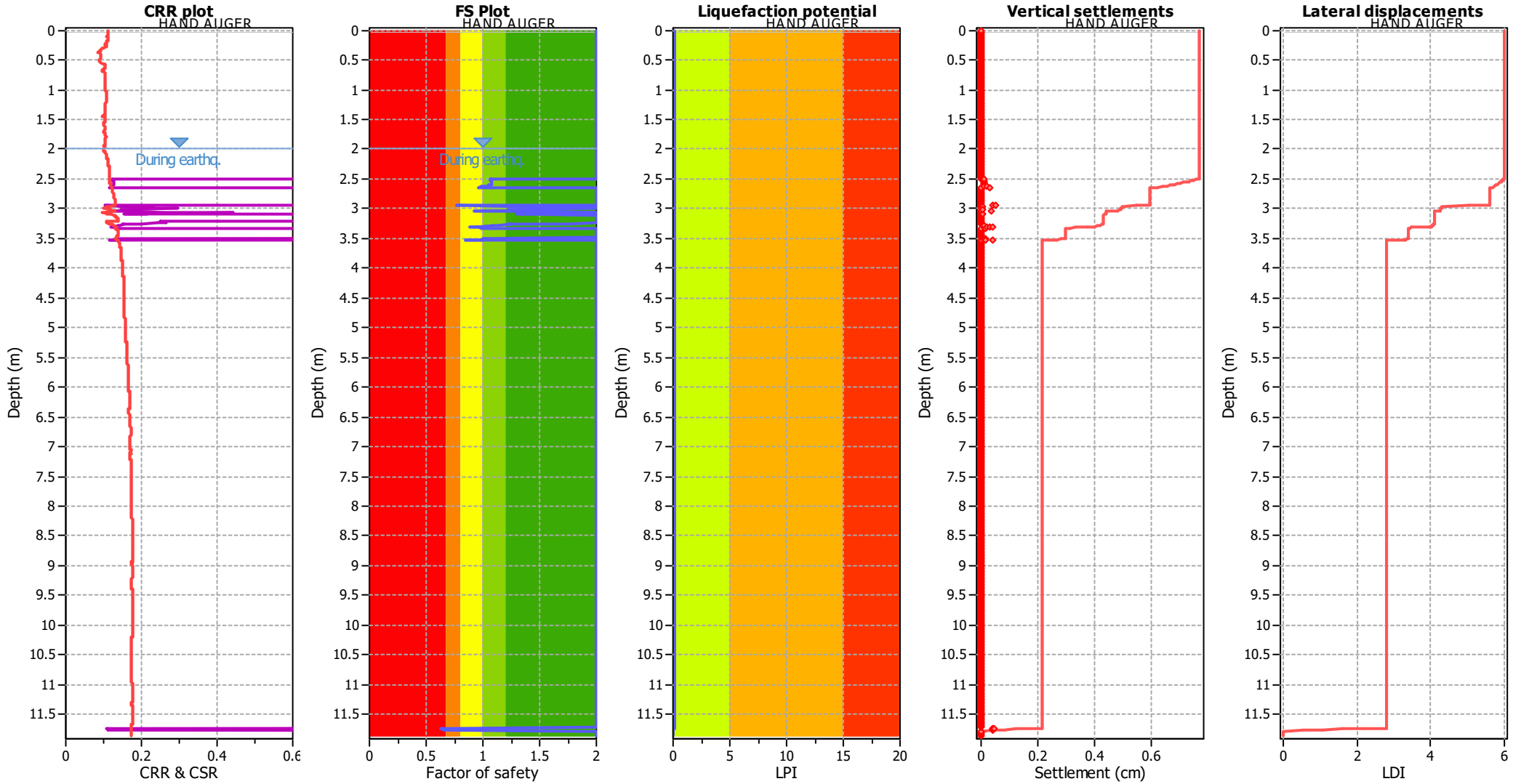
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_0 applied:	Yes
Earthquake magnitude M_w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

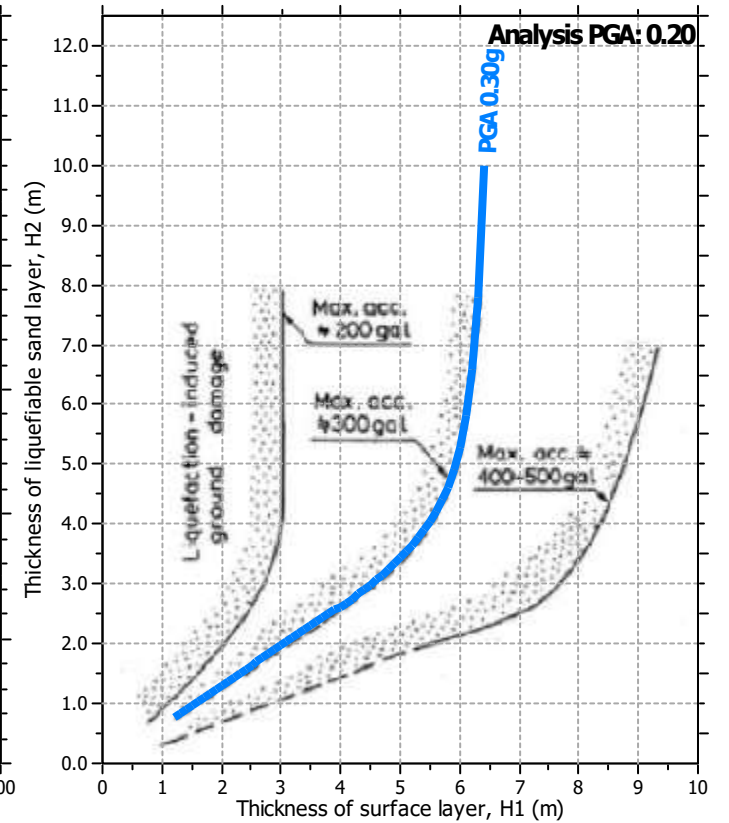
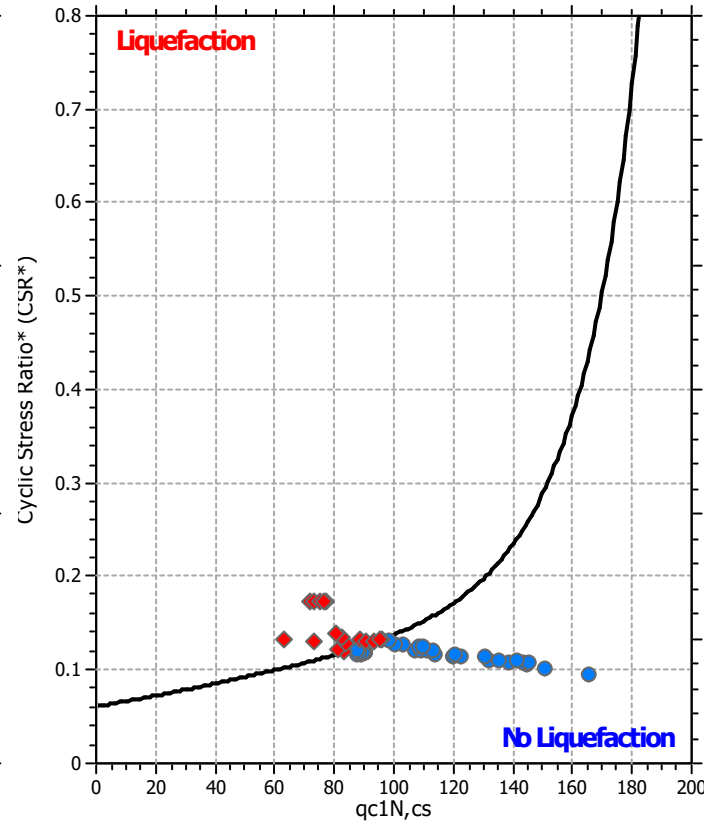
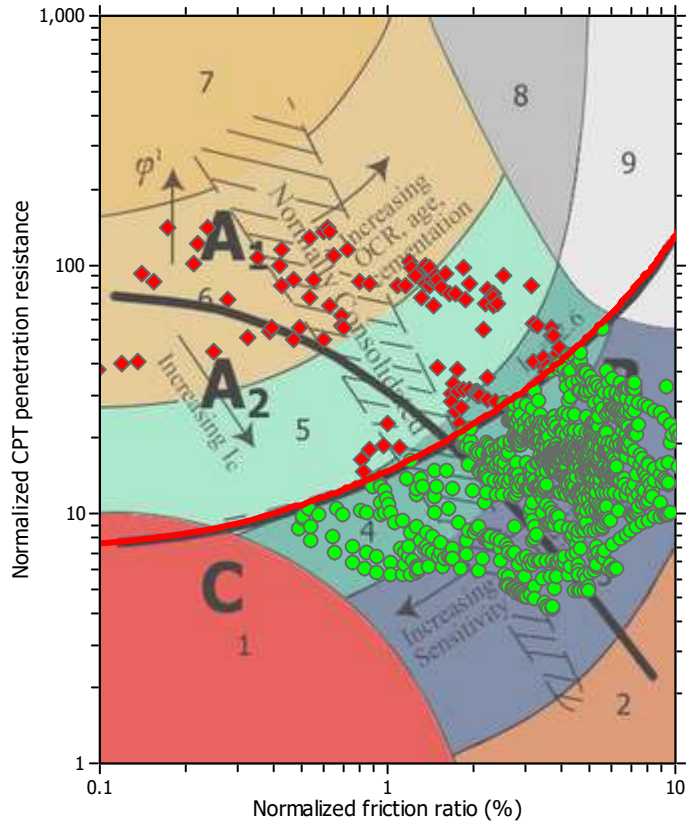
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

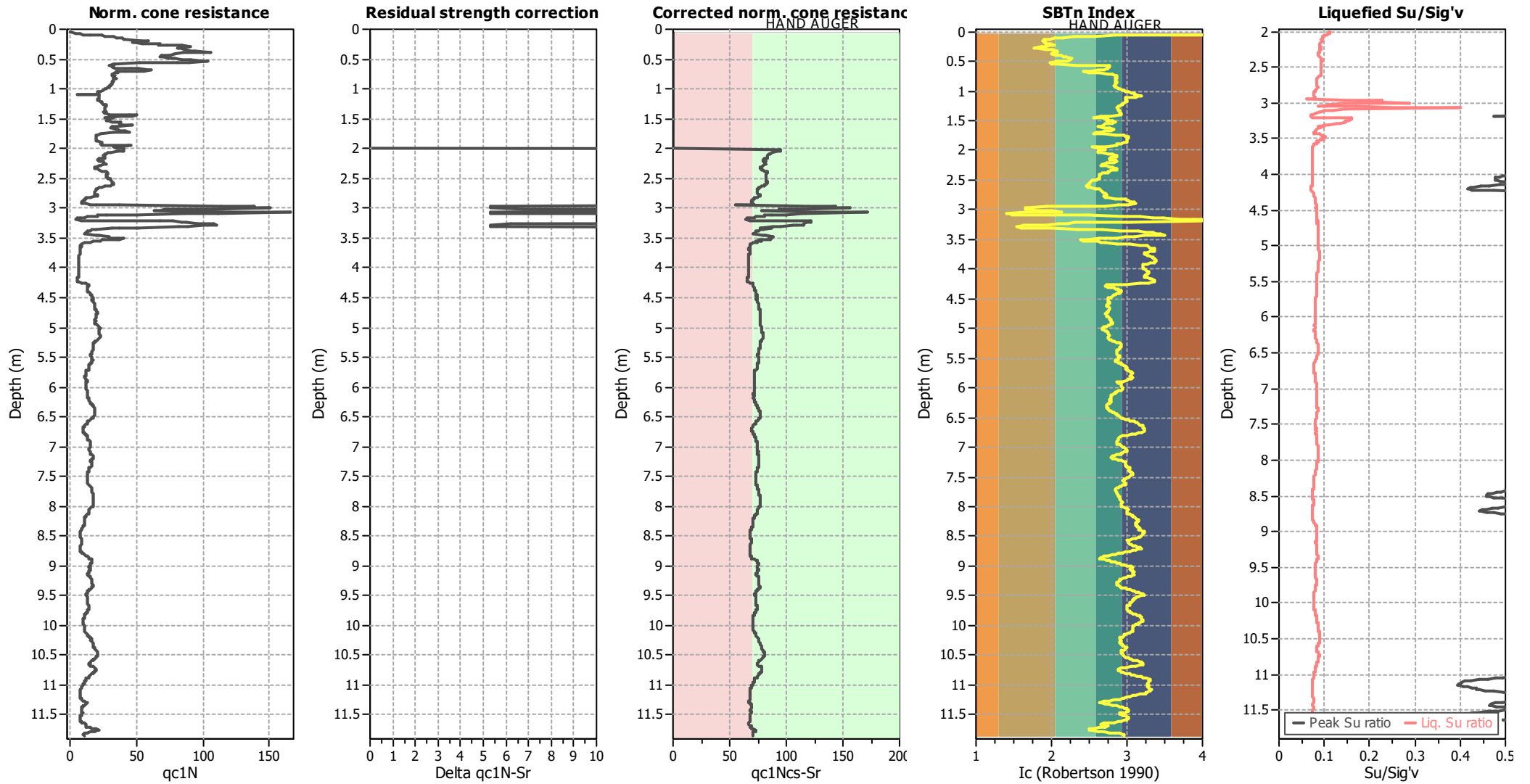
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _o applied:	Yes
Earthquake magnitude M _w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
0.01	2.00	0.00	0.00	0.01	0.00	0.02	2.00	0.00	0.00	0.01	0.00
0.03	2.00	0.00	0.00	0.00	0.00	0.04	2.00	0.00	0.00	0.01	0.00
0.05	2.00	0.00	0.00	0.01	0.00	0.06	2.00	0.00	0.00	0.01	0.00
0.07	2.00	0.00	0.00	0.01	0.00	0.08	2.00	0.00	0.00	0.01	0.00
0.09	2.00	0.00	0.00	0.01	0.00	0.10	2.00	0.00	0.00	0.01	0.00
0.11	2.00	0.00	0.00	0.01	0.00	0.12	2.00	0.00	0.00	0.01	0.00
0.13	2.00	0.00	0.00	0.01	0.00	0.14	2.00	0.00	0.00	0.01	0.00
0.15	2.00	0.00	0.00	0.01	0.00	0.16	2.00	0.00	0.00	0.01	0.00
0.17	2.00	0.00	0.00	0.01	0.00	0.18	2.00	0.00	0.00	0.01	0.00
0.19	2.00	0.00	0.00	0.01	0.00	0.20	2.00	0.00	0.00	0.01	0.00
0.21	2.00	0.00	0.00	0.01	0.00	0.22	2.00	0.00	0.00	0.01	0.00
0.23	2.00	0.00	0.00	0.01	0.00	0.24	2.00	0.00	0.00	0.01	0.00
0.25	2.00	0.00	0.00	0.01	0.00	0.26	2.00	0.00	0.00	0.01	0.00
0.27	2.00	0.00	0.00	0.01	0.00	0.28	2.00	0.00	0.00	0.01	0.00
0.29	2.00	0.00	0.00	0.01	0.00	0.30	2.00	0.00	0.00	0.01	0.00
0.31	2.00	0.00	0.00	0.01	0.00	0.32	2.00	0.00	0.00	0.01	0.00
0.33	2.00	0.00	0.00	0.01	0.00	0.34	2.00	0.00	0.00	0.01	0.00
0.35	2.00	0.00	0.00	0.01	0.00	0.36	2.00	0.00	0.00	0.01	0.00
0.37	2.00	0.00	0.00	0.01	0.00	0.38	2.00	0.00	0.00	0.01	0.00
0.39	2.00	0.00	0.00	0.01	0.00	0.40	2.00	0.00	0.00	0.01	0.00
0.41	2.00	0.00	0.00	0.01	0.00	0.42	2.00	0.00	0.00	0.01	0.00
0.43	2.00	0.00	0.00	0.01	0.00	0.44	2.00	0.00	0.00	0.01	0.00
0.45	2.00	0.00	0.00	0.01	0.00	0.46	2.00	0.00	0.00	0.01	0.00
0.47	2.00	0.00	0.00	0.01	0.00	0.48	2.00	0.00	0.00	0.01	0.00
0.49	2.00	0.00	0.00	0.01	0.00	0.50	2.00	0.00	0.00	0.01	0.00
0.51	2.00	0.00	0.00	0.01	0.00	0.52	2.00	0.00	0.00	0.01	0.00
0.53	2.00	0.00	0.00	0.01	0.00	0.54	2.00	0.00	0.00	0.01	0.00
0.55	2.00	0.00	0.00	0.01	0.00	0.56	2.00	0.00	0.00	0.01	0.00
0.57	2.00	0.00	0.00	0.01	0.00	0.58	2.00	0.00	0.00	0.01	0.00
0.59	2.00	0.00	0.00	0.01	0.00	0.60	2.00	0.00	0.00	0.01	0.00
0.61	2.00	0.00	0.00	0.01	0.00	0.62	2.00	0.00	0.00	0.01	0.00
0.63	2.00	0.00	0.00	0.01	0.00	0.64	2.00	0.00	0.00	0.01	0.00
0.65	2.00	0.00	0.00	0.01	0.00	0.66	2.00	0.00	0.00	0.01	0.00
0.67	2.00	0.00	0.00	0.01	0.00	0.68	2.00	0.00	0.00	0.01	0.00
0.69	2.00	0.00	0.00	0.01	0.00	0.70	2.00	0.00	0.00	0.01	0.00
0.71	2.00	0.00	0.00	0.01	0.00	0.72	2.00	0.00	0.00	0.01	0.00
0.73	2.00	0.00	0.00	0.01	0.00	0.74	2.00	0.00	0.00	0.01	0.00
0.75	2.00	0.00	0.00	0.01	0.00	0.76	2.00	0.00	0.00	0.01	0.00
0.77	2.00	0.00	0.00	0.01	0.00	0.78	2.00	0.00	0.00	0.01	0.00
0.79	2.00	0.00	0.00	0.01	0.00	0.80	2.00	0.00	0.00	0.01	0.00
0.81	2.00	0.00	0.00	0.01	0.00	0.82	2.00	0.00	0.00	0.01	0.00
0.83	2.00	0.00	0.00	0.01	0.00	0.84	2.00	0.00	0.00	0.01	0.00
0.85	2.00	0.00	0.00	0.01	0.00	0.86	2.00	0.00	0.00	0.01	0.00
0.87	2.00	0.00	0.00	0.01	0.00	0.88	2.00	0.00	0.00	0.01	0.00
0.89	2.00	0.00	0.00	0.01	0.00	0.90	2.00	0.00	0.00	0.01	0.00
0.91	2.00	0.00	0.00	0.01	0.00	0.92	2.00	0.00	0.00	0.01	0.00
0.93	2.00	0.00	0.00	0.01	0.00	0.94	2.00	0.00	0.00	0.01	0.00
0.95	2.00	0.00	0.00	0.01	0.00	0.96	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
0.97	2.00	0.00	0.00	0.01	0.00	0.98	2.00	0.00	0.00	0.01	0.00
0.99	2.00	0.00	0.00	0.01	0.00	1.00	2.00	0.00	0.00	0.01	0.00
1.01	2.00	0.00	0.00	0.01	0.00	1.02	2.00	0.00	0.00	0.01	0.00
1.03	2.00	0.00	0.00	0.01	0.00	1.04	2.00	0.00	0.00	0.01	0.00
1.05	2.00	0.00	0.00	0.01	0.00	1.06	2.00	0.00	0.00	0.01	0.00
1.07	2.00	0.00	0.00	0.01	0.00	1.08	2.00	0.00	0.00	0.01	0.00
1.09	2.00	0.00	0.00	0.01	0.00	1.10	2.00	0.00	0.00	0.01	0.00
1.11	2.00	0.00	0.00	0.01	0.00	1.12	2.00	0.00	0.00	0.01	0.00
1.13	2.00	0.00	0.00	0.01	0.00	1.14	2.00	0.00	0.00	0.01	0.00
1.15	2.00	0.00	0.00	0.01	0.00	1.16	2.00	0.00	0.00	0.01	0.00
1.17	2.00	0.00	0.00	0.01	0.00	1.18	2.00	0.00	0.00	0.01	0.00
1.19	2.00	0.00	0.00	0.01	0.00	1.20	2.00	0.00	0.00	0.01	0.00
1.21	2.00	0.00	0.00	0.01	0.00	1.22	2.00	0.00	0.00	0.01	0.00
1.23	2.00	0.00	0.00	0.01	0.00	1.24	2.00	0.00	0.00	0.01	0.00
1.25	2.00	0.00	0.00	0.01	0.00	1.26	2.00	0.00	0.00	0.01	0.00
1.27	2.00	0.00	0.00	0.01	0.00	1.28	2.00	0.00	0.00	0.01	0.00
1.29	2.00	0.00	0.00	0.01	0.00	1.30	2.00	0.00	0.00	0.01	0.00
1.31	2.00	0.00	0.00	0.01	0.00	1.32	2.00	0.00	0.00	0.01	0.00
1.33	2.00	0.00	0.00	0.01	0.00	1.34	2.00	0.00	0.00	0.01	0.00
1.35	2.00	0.00	0.00	0.01	0.00	1.36	2.00	0.00	0.00	0.01	0.00
1.37	2.00	0.00	0.00	0.01	0.00	1.38	2.00	0.00	0.00	0.01	0.00
1.39	2.00	0.00	0.00	0.01	0.00	1.40	2.00	0.00	0.00	0.01	0.00
1.41	2.00	0.00	0.00	0.01	0.00	1.42	2.00	0.00	0.00	0.01	0.00
1.43	2.00	0.00	0.00	0.01	0.00	1.44	2.00	0.00	0.00	0.01	0.00
1.45	2.00	0.00	0.00	0.01	0.00	1.46	2.00	0.00	0.00	0.01	0.00
1.47	2.00	0.00	0.00	0.01	0.00	1.48	2.00	0.00	0.00	0.01	0.00
1.49	2.00	0.00	0.00	0.01	0.00	1.50	2.00	0.00	0.00	0.01	0.00
1.51	2.00	0.00	0.00	0.01	0.00	1.52	2.00	0.00	0.00	0.01	0.00
1.53	2.00	0.00	0.00	0.01	0.00	1.54	2.00	0.00	0.00	0.01	0.00
1.55	2.00	0.00	0.00	0.01	0.00	1.56	2.00	0.00	0.00	0.01	0.00
1.57	2.00	0.00	0.00	0.01	0.00	1.58	2.00	0.00	0.00	0.01	0.00
1.59	2.00	0.00	0.00	0.01	0.00	1.60	2.00	0.00	0.00	0.01	0.00
1.61	2.00	0.00	0.00	0.01	0.00	1.62	2.00	0.00	0.00	0.01	0.00
1.63	2.00	0.00	0.00	0.01	0.00	1.64	2.00	0.00	0.00	0.01	0.00
1.65	2.00	0.00	0.00	0.01	0.00	1.66	2.00	0.00	0.00	0.01	0.00
1.67	2.00	0.00	0.00	0.01	0.00	1.68	2.00	0.00	0.00	0.01	0.00
1.69	2.00	0.00	0.00	0.01	0.00	1.70	2.00	0.00	0.00	0.01	0.00
1.71	2.00	0.00	0.00	0.01	0.00	1.72	2.00	0.00	0.00	0.01	0.00
1.73	2.00	0.00	0.00	0.01	0.00	1.74	2.00	0.00	0.00	0.01	0.00
1.75	2.00	0.00	0.00	0.01	0.00	1.76	2.00	0.00	0.00	0.01	0.00
1.77	2.00	0.00	0.00	0.01	0.00	1.78	2.00	0.00	0.00	0.01	0.00
1.79	2.00	0.00	0.00	0.01	0.00	1.80	2.00	0.00	0.00	0.01	0.00
1.81	2.00	0.00	0.00	0.01	0.00	1.82	2.00	0.00	0.00	0.01	0.00
1.83	2.00	0.00	0.00	0.01	0.00	1.84	2.00	0.00	0.00	0.01	0.00
1.85	2.00	0.00	0.00	0.01	0.00	1.86	2.00	0.00	0.00	0.01	0.00
1.87	2.00	0.00	0.00	0.01	0.00	1.88	2.00	0.00	0.00	0.01	0.00
1.89	2.00	0.00	0.00	0.01	0.00	1.90	2.00	0.00	0.00	0.01	0.00
1.91	2.00	0.00	0.00	0.01	0.00	1.92	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
1.93	2.00	0.00	0.00	0.01	0.00	1.94	2.00	0.00	0.00	0.01	0.00
1.95	2.00	0.00	0.00	0.01	0.00	1.96	2.00	0.00	0.00	0.01	0.00
1.97	2.00	0.00	0.00	0.01	0.00	1.98	2.00	0.00	0.00	0.01	0.00
1.99	2.00	0.00	0.00	0.01	0.00	2.00	2.00	0.00	0.00	0.01	0.00
2.01	2.00	0.00	0.00	0.01	0.00	2.02	2.00	0.00	0.00	0.01	0.00
2.03	2.00	0.00	0.00	0.01	0.00	2.04	2.00	0.00	0.00	0.01	0.00
2.05	2.00	0.00	0.00	0.01	0.00	2.06	2.00	0.00	0.00	0.01	0.00
2.07	2.00	0.00	0.00	0.01	0.00	2.08	2.00	0.00	0.00	0.01	0.00
2.09	2.00	0.00	0.00	0.01	0.00	2.10	2.00	0.00	0.00	0.01	0.00
2.11	2.00	0.00	0.00	0.01	0.00	2.12	2.00	0.00	0.00	0.01	0.00
2.13	2.00	0.00	0.00	0.01	0.00	2.14	2.00	0.00	0.00	0.01	0.00
2.15	2.00	0.00	0.00	0.01	0.00	2.16	2.00	0.00	0.00	0.01	0.00
2.17	2.00	0.00	0.00	0.01	0.00	2.18	2.00	0.00	0.00	0.01	0.00
2.19	2.00	0.00	0.00	0.01	0.00	2.20	2.00	0.00	0.00	0.01	0.00
2.21	2.00	0.00	0.00	0.01	0.00	2.22	2.00	0.00	0.00	0.01	0.00
2.23	2.00	0.00	0.00	0.01	0.00	2.24	2.00	0.00	0.00	0.01	0.00
2.25	2.00	0.00	0.00	0.01	0.00	2.26	2.00	0.00	0.00	0.01	0.00
2.27	2.00	0.00	0.00	0.01	0.00	2.28	2.00	0.00	0.00	0.01	0.00
2.29	2.00	0.00	0.00	0.01	0.00	2.30	2.00	0.00	0.00	0.01	0.00
2.31	2.00	0.00	0.00	0.01	0.00	2.32	2.00	0.00	0.00	0.01	0.00
2.33	2.00	0.00	0.00	0.01	0.00	2.34	2.00	0.00	0.00	0.01	0.00
2.35	2.00	0.00	0.00	0.01	0.00	2.36	2.00	0.00	0.00	0.01	0.00
2.37	2.00	0.00	0.00	0.01	0.00	2.38	2.00	0.00	0.00	0.01	0.00
2.39	2.00	0.00	0.00	0.01	0.00	2.40	2.00	0.00	0.00	0.01	0.00
2.41	2.00	0.00	0.00	0.01	0.00	2.42	2.00	0.00	0.00	0.01	0.00
2.43	2.00	0.00	0.00	0.01	0.00	2.44	2.00	0.00	0.00	0.01	0.00
2.45	2.00	0.00	0.00	0.01	0.00	2.46	2.00	0.00	0.00	0.01	0.00
2.47	2.00	0.00	0.00	0.01	0.00	2.48	2.00	0.00	0.00	0.01	0.00
2.49	2.00	0.00	0.00	0.01	0.00	2.50	1.06	0.00	0.00	0.01	0.00
2.51	1.07	0.00	0.00	0.01	0.00	2.52	1.07	0.00	0.00	0.01	0.00
2.53	1.07	0.00	0.00	0.01	0.00	2.54	1.07	0.00	0.00	0.01	0.00
2.55	1.07	0.00	0.00	0.01	0.00	2.56	1.08	0.00	0.00	0.01	0.00
2.57	1.08	0.00	0.00	0.01	0.00	2.58	1.08	0.00	0.00	0.01	0.00
2.59	1.07	0.00	0.00	0.01	0.00	2.60	1.06	0.00	0.00	0.01	0.00
2.61	1.05	0.00	0.00	0.01	0.00	2.62	1.03	0.00	0.00	0.01	0.00
2.63	0.99	0.01	4656611.4 1	0.01	0.00	2.64	0.96	0.04	211.34	0.01	0.00
2.65	2.00	0.00	0.00	0.01	0.00	2.66	2.00	0.00	0.00	0.01	0.00
2.67	2.00	0.00	0.00	0.01	0.00	2.68	2.00	0.00	0.00	0.01	0.00
2.69	2.00	0.00	0.00	0.01	0.00	2.70	2.00	0.00	0.00	0.01	0.00
2.71	2.00	0.00	0.00	0.01	0.00	2.72	2.00	0.00	0.00	0.01	0.00
2.73	2.00	0.00	0.00	0.01	0.00	2.74	2.00	0.00	0.00	0.01	0.00
2.75	2.00	0.00	0.00	0.01	0.00	2.76	2.00	0.00	0.00	0.01	0.00
2.77	2.00	0.00	0.00	0.01	0.00	2.78	2.00	0.00	0.00	0.01	0.00
2.79	2.00	0.00	0.00	0.01	0.00	2.80	2.00	0.00	0.00	0.01	0.00
2.81	2.00	0.00	0.00	0.01	0.00	2.82	2.00	0.00	0.00	0.01	0.00
2.83	2.00	0.00	0.00	0.01	0.00	2.84	2.00	0.00	0.00	0.01	0.00
2.85	2.00	0.00	0.00	0.01	0.00	2.86	2.00	0.00	0.00	0.01	0.00
2.87	2.00	0.00	0.00	0.01	0.00	2.88	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
2.89	2.00	0.00	0.00	0.01	0.00	2.90	2.00	0.00	0.00	0.01	0.00
2.91	2.00	0.00	0.00	0.01	0.00	2.92	2.00	0.00	0.00	0.01	0.00
2.93	2.00	0.00	0.00	0.01	0.00	2.94	0.85	0.15	2.59	0.01	0.01
2.95	0.77	0.23	1.35	0.01	0.02	2.96	1.37	0.00	0.00	0.01	0.00
2.97	2.00	0.00	0.00	0.01	0.00	2.98	1.51	0.00	0.00	0.01	0.00
2.99	1.87	0.00	0.00	0.01	0.00	3.00	2.00	0.00	0.00	0.01	0.00
3.01	1.24	0.00	0.00	0.01	0.00	3.02	1.27	0.00	0.00	0.01	0.00
3.03	1.57	0.00	0.00	0.01	0.00	3.04	0.93	0.07	14.91	0.01	0.01
3.05	1.50	0.00	0.00	0.01	0.00	3.06	2.00	0.00	0.00	0.01	0.00
3.07	2.00	0.00	0.00	0.01	0.00	3.08	1.29	0.00	0.00	0.01	0.00
3.09	1.97	0.00	0.00	0.01	0.00	3.10	1.33	0.00	0.00	0.01	0.00
3.11	2.00	0.00	0.00	0.01	0.00	3.12	2.00	0.00	0.00	0.01	0.00
3.13	2.00	0.00	0.00	0.01	0.00	3.14	2.00	0.00	0.00	0.01	0.00
3.15	2.00	0.00	0.00	0.01	0.00	3.16	2.00	0.00	0.00	0.01	0.00
3.17	2.00	0.00	0.00	0.01	0.00	3.18	2.00	0.00	0.00	0.01	0.00
3.19	2.00	0.00	0.00	0.01	0.00	3.20	2.00	0.00	0.00	0.01	0.00
3.21	2.00	0.00	0.00	0.01	0.00	3.22	2.00	0.00	0.00	0.01	0.00
3.23	2.00	0.00	0.00	0.01	0.00	3.24	2.00	0.00	0.00	0.01	0.00
3.25	1.76	0.00	0.00	0.01	0.00	3.26	1.21	0.00	0.00	0.01	0.00
3.27	1.24	0.00	0.00	0.01	0.00	3.28	1.13	0.00	0.00	0.01	0.00
3.29	1.09	0.00	0.00	0.01	0.00	3.30	0.95	0.05	34.92	0.01	0.00
3.31	0.88	0.12	4.18	0.01	0.01	3.32	0.96	0.04	138.43	0.01	0.00
3.33	0.99	0.01	8423006.74	0.01	0.00	3.34	2.00	0.00	0.00	0.01	0.00
3.35	2.00	0.00	0.00	0.01	0.00	3.36	2.00	0.00	0.00	0.01	0.00
3.37	2.00	0.00	0.00	0.01	0.00	3.38	2.00	0.00	0.00	0.01	0.00
3.39	2.00	0.00	0.00	0.01	0.00	3.40	2.00	0.00	0.00	0.01	0.00
3.41	2.00	0.00	0.00	0.01	0.00	3.42	2.00	0.00	0.00	0.01	0.00
3.43	2.00	0.00	0.00	0.01	0.00	3.44	2.00	0.00	0.00	0.01	0.00
3.45	2.00	0.00	0.00	0.01	0.00	3.46	2.00	0.00	0.00	0.01	0.00
3.47	2.00	0.00	0.00	0.01	0.00	3.48	2.00	0.00	0.00	0.01	0.00
3.49	2.00	0.00	0.00	0.01	0.00	3.50	1.00	0.00	14665796	0.01	0.00
3.51	1.03	0.00	0.00	0.01	0.00	3.52	0.99	0.01	6222813.25	0.01	0.00
3.53	0.84	0.16	2.46	0.01	0.01	3.54	2.00	0.00	0.00	0.01	0.00
3.55	2.00	0.00	0.00	0.01	0.00	3.56	2.00	0.00	0.00	0.01	0.00
3.57	2.00	0.00	0.00	0.01	0.00	3.58	2.00	0.00	0.00	0.01	0.00
3.59	2.00	0.00	0.00	0.01	0.00	3.60	2.00	0.00	0.00	0.01	0.00
3.61	2.00	0.00	0.00	0.01	0.00	3.62	2.00	0.00	0.00	0.01	0.00
3.63	2.00	0.00	0.00	0.01	0.00	3.64	2.00	0.00	0.00	0.01	0.00
3.65	2.00	0.00	0.00	0.01	0.00	3.66	2.00	0.00	0.00	0.01	0.00
3.67	2.00	0.00	0.00	0.01	0.00	3.68	2.00	0.00	0.00	0.01	0.00
3.69	2.00	0.00	0.00	0.01	0.00	3.70	2.00	0.00	0.00	0.01	0.00
3.71	2.00	0.00	0.00	0.01	0.00	3.72	2.00	0.00	0.00	0.01	0.00
3.73	2.00	0.00	0.00	0.01	0.00	3.74	2.00	0.00	0.00	0.01	0.00
3.75	2.00	0.00	0.00	0.01	0.00	3.76	2.00	0.00	0.00	0.01	0.00
3.77	2.00	0.00	0.00	0.01	0.00	3.78	2.00	0.00	0.00	0.01	0.00
3.79	2.00	0.00	0.00	0.01	0.00	3.80	2.00	0.00	0.00	0.01	0.00
3.81	2.00	0.00	0.00	0.01	0.00	3.82	2.00	0.00	0.00	0.01	0.00
3.83	2.00	0.00	0.00	0.01	0.00	3.84	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
3.85	2.00	0.00	0.00	0.01	0.00	3.86	2.00	0.00	0.00	0.01	0.00
3.87	2.00	0.00	0.00	0.01	0.00	3.88	2.00	0.00	0.00	0.01	0.00
3.89	2.00	0.00	0.00	0.01	0.00	3.90	2.00	0.00	0.00	0.01	0.00
3.91	2.00	0.00	0.00	0.01	0.00	3.92	2.00	0.00	0.00	0.01	0.00
3.93	2.00	0.00	0.00	0.01	0.00	3.94	2.00	0.00	0.00	0.01	0.00
3.95	2.00	0.00	0.00	0.01	0.00	3.96	2.00	0.00	0.00	0.01	0.00
3.97	2.00	0.00	0.00	0.01	0.00	3.98	2.00	0.00	0.00	0.01	0.00
3.99	2.00	0.00	0.00	0.01	0.00	4.00	2.00	0.00	0.00	0.01	0.00
4.01	2.00	0.00	0.00	0.01	0.00	4.02	2.00	0.00	0.00	0.01	0.00
4.03	2.00	0.00	0.00	0.01	0.00	4.04	2.00	0.00	0.00	0.01	0.00
4.05	2.00	0.00	0.00	0.01	0.00	4.06	2.00	0.00	0.00	0.01	0.00
4.07	2.00	0.00	0.00	0.01	0.00	4.08	2.00	0.00	0.00	0.01	0.00
4.09	2.00	0.00	0.00	0.01	0.00	4.10	2.00	0.00	0.00	0.01	0.00
4.11	2.00	0.00	0.00	0.01	0.00	4.12	2.00	0.00	0.00	0.01	0.00
4.13	2.00	0.00	0.00	0.01	0.00	4.14	2.00	0.00	0.00	0.01	0.00
4.15	2.00	0.00	0.00	0.01	0.00	4.16	2.00	0.00	0.00	0.01	0.00
4.17	2.00	0.00	0.00	0.01	0.00	4.18	2.00	0.00	0.00	0.01	0.00
4.19	2.00	0.00	0.00	0.01	0.00	4.20	2.00	0.00	0.00	0.01	0.00
4.21	2.00	0.00	0.00	0.01	0.00	4.22	2.00	0.00	0.00	0.01	0.00
4.23	2.00	0.00	0.00	0.01	0.00	4.24	2.00	0.00	0.00	0.01	0.00
4.25	2.00	0.00	0.00	0.01	0.00	4.26	2.00	0.00	0.00	0.01	0.00
4.27	2.00	0.00	0.00	0.01	0.00	4.28	2.00	0.00	0.00	0.01	0.00
4.29	2.00	0.00	0.00	0.01	0.00	4.30	2.00	0.00	0.00	0.01	0.00
4.31	2.00	0.00	0.00	0.01	0.00	4.32	2.00	0.00	0.00	0.01	0.00
4.33	2.00	0.00	0.00	0.01	0.00	4.34	2.00	0.00	0.00	0.01	0.00
4.35	2.00	0.00	0.00	0.01	0.00	4.36	2.00	0.00	0.00	0.01	0.00
4.37	2.00	0.00	0.00	0.01	0.00	4.38	2.00	0.00	0.00	0.01	0.00
4.39	2.00	0.00	0.00	0.01	0.00	4.40	2.00	0.00	0.00	0.01	0.00
4.41	2.00	0.00	0.00	0.01	0.00	4.42	2.00	0.00	0.00	0.01	0.00
4.43	2.00	0.00	0.00	0.01	0.00	4.44	2.00	0.00	0.00	0.01	0.00
4.45	2.00	0.00	0.00	0.01	0.00	4.46	2.00	0.00	0.00	0.01	0.00
4.47	2.00	0.00	0.00	0.01	0.00	4.48	2.00	0.00	0.00	0.01	0.00
4.49	2.00	0.00	0.00	0.01	0.00	4.50	2.00	0.00	0.00	0.01	0.00
4.51	2.00	0.00	0.00	0.01	0.00	4.52	2.00	0.00	0.00	0.01	0.00
4.53	2.00	0.00	0.00	0.01	0.00	4.54	2.00	0.00	0.00	0.01	0.00
4.55	2.00	0.00	0.00	0.01	0.00	4.56	2.00	0.00	0.00	0.01	0.00
4.57	2.00	0.00	0.00	0.01	0.00	4.58	2.00	0.00	0.00	0.01	0.00
4.59	2.00	0.00	0.00	0.01	0.00	4.60	2.00	0.00	0.00	0.01	0.00
4.61	2.00	0.00	0.00	0.01	0.00	4.62	2.00	0.00	0.00	0.01	0.00
4.63	2.00	0.00	0.00	0.01	0.00	4.64	2.00	0.00	0.00	0.01	0.00
4.65	2.00	0.00	0.00	0.01	0.00	4.66	2.00	0.00	0.00	0.01	0.00
4.67	2.00	0.00	0.00	0.01	0.00	4.68	2.00	0.00	0.00	0.01	0.00
4.69	2.00	0.00	0.00	0.01	0.00	4.70	2.00	0.00	0.00	0.01	0.00
4.71	2.00	0.00	0.00	0.01	0.00	4.72	2.00	0.00	0.00	0.01	0.00
4.73	2.00	0.00	0.00	0.01	0.00	4.74	2.00	0.00	0.00	0.01	0.00
4.75	2.00	0.00	0.00	0.01	0.00	4.76	2.00	0.00	0.00	0.01	0.00
4.77	2.00	0.00	0.00	0.01	0.00	4.78	2.00	0.00	0.00	0.01	0.00
4.79	2.00	0.00	0.00	0.01	0.00	4.80	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
4.81	2.00	0.00	0.00	0.01	0.00	4.82	2.00	0.00	0.00	0.01	0.00
4.83	2.00	0.00	0.00	0.01	0.00	4.84	2.00	0.00	0.00	0.01	0.00
4.85	2.00	0.00	0.00	0.01	0.00	4.86	2.00	0.00	0.00	0.01	0.00
4.87	2.00	0.00	0.00	0.01	0.00	4.88	2.00	0.00	0.00	0.01	0.00
4.89	2.00	0.00	0.00	0.01	0.00	4.90	2.00	0.00	0.00	0.01	0.00
4.91	2.00	0.00	0.00	0.01	0.00	4.92	2.00	0.00	0.00	0.01	0.00
4.93	2.00	0.00	0.00	0.01	0.00	4.94	2.00	0.00	0.00	0.01	0.00
4.95	2.00	0.00	0.00	0.01	0.00	4.96	2.00	0.00	0.00	0.01	0.00
4.97	2.00	0.00	0.00	0.01	0.00	4.98	2.00	0.00	0.00	0.01	0.00
4.99	2.00	0.00	0.00	0.01	0.00	5.00	2.00	0.00	0.00	0.01	0.00
5.01	2.00	0.00	0.00	0.01	0.00	5.02	2.00	0.00	0.00	0.01	0.00
5.03	2.00	0.00	0.00	0.01	0.00	5.04	2.00	0.00	0.00	0.01	0.00
5.05	2.00	0.00	0.00	0.01	0.00	5.06	2.00	0.00	0.00	0.01	0.00
5.07	2.00	0.00	0.00	0.01	0.00	5.08	2.00	0.00	0.00	0.01	0.00
5.09	2.00	0.00	0.00	0.01	0.00	5.10	2.00	0.00	0.00	0.01	0.00
5.11	2.00	0.00	0.00	0.01	0.00	5.12	2.00	0.00	0.00	0.01	0.00
5.13	2.00	0.00	0.00	0.01	0.00	5.14	2.00	0.00	0.00	0.01	0.00
5.15	2.00	0.00	0.00	0.01	0.00	5.16	2.00	0.00	0.00	0.01	0.00
5.17	2.00	0.00	0.00	0.01	0.00	5.18	2.00	0.00	0.00	0.01	0.00
5.19	2.00	0.00	0.00	0.01	0.00	5.20	2.00	0.00	0.00	0.01	0.00
5.21	2.00	0.00	0.00	0.01	0.00	5.22	2.00	0.00	0.00	0.01	0.00
5.23	2.00	0.00	0.00	0.01	0.00	5.24	2.00	0.00	0.00	0.01	0.00
5.25	2.00	0.00	0.00	0.01	0.00	5.26	2.00	0.00	0.00	0.01	0.00
5.27	2.00	0.00	0.00	0.01	0.00	5.28	2.00	0.00	0.00	0.01	0.00
5.29	2.00	0.00	0.00	0.01	0.00	5.30	2.00	0.00	0.00	0.01	0.00
5.31	2.00	0.00	0.00	0.01	0.00	5.32	2.00	0.00	0.00	0.01	0.00
5.33	2.00	0.00	0.00	0.01	0.00	5.34	2.00	0.00	0.00	0.01	0.00
5.35	2.00	0.00	0.00	0.01	0.00	5.36	2.00	0.00	0.00	0.01	0.00
5.37	2.00	0.00	0.00	0.01	0.00	5.38	2.00	0.00	0.00	0.01	0.00
5.39	2.00	0.00	0.00	0.01	0.00	5.40	2.00	0.00	0.00	0.01	0.00
5.41	2.00	0.00	0.00	0.01	0.00	5.42	2.00	0.00	0.00	0.01	0.00
5.43	2.00	0.00	0.00	0.01	0.00	5.44	2.00	0.00	0.00	0.01	0.00
5.45	2.00	0.00	0.00	0.01	0.00	5.46	2.00	0.00	0.00	0.01	0.00
5.47	2.00	0.00	0.00	0.01	0.00	5.48	2.00	0.00	0.00	0.01	0.00
5.49	2.00	0.00	0.00	0.01	0.00	5.50	2.00	0.00	0.00	0.01	0.00
5.51	2.00	0.00	0.00	0.01	0.00	5.52	2.00	0.00	0.00	0.01	0.00
5.53	2.00	0.00	0.00	0.01	0.00	5.54	2.00	0.00	0.00	0.01	0.00
5.55	2.00	0.00	0.00	0.01	0.00	5.56	2.00	0.00	0.00	0.01	0.00
5.57	2.00	0.00	0.00	0.01	0.00	5.58	2.00	0.00	0.00	0.01	0.00
5.59	2.00	0.00	0.00	0.01	0.00	5.60	2.00	0.00	0.00	0.01	0.00
5.61	2.00	0.00	0.00	0.01	0.00	5.62	2.00	0.00	0.00	0.01	0.00
5.63	2.00	0.00	0.00	0.01	0.00	5.64	2.00	0.00	0.00	0.01	0.00
5.65	2.00	0.00	0.00	0.01	0.00	5.66	2.00	0.00	0.00	0.01	0.00
5.67	2.00	0.00	0.00	0.01	0.00	5.68	2.00	0.00	0.00	0.01	0.00
5.69	2.00	0.00	0.00	0.01	0.00	5.70	2.00	0.00	0.00	0.01	0.00
5.71	2.00	0.00	0.00	0.01	0.00	5.72	2.00	0.00	0.00	0.01	0.00
5.73	2.00	0.00	0.00	0.01	0.00	5.74	2.00	0.00	0.00	0.01	0.00
5.75	2.00	0.00	0.00	0.01	0.00	5.76	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
5.77	2.00	0.00	0.00	0.01	0.00	5.78	2.00	0.00	0.00	0.01	0.00
5.79	2.00	0.00	0.00	0.01	0.00	5.80	2.00	0.00	0.00	0.01	0.00
5.81	2.00	0.00	0.00	0.01	0.00	5.82	2.00	0.00	0.00	0.01	0.00
5.83	2.00	0.00	0.00	0.01	0.00	5.84	2.00	0.00	0.00	0.01	0.00
5.85	2.00	0.00	0.00	0.01	0.00	5.86	2.00	0.00	0.00	0.01	0.00
5.87	2.00	0.00	0.00	0.01	0.00	5.88	2.00	0.00	0.00	0.01	0.00
5.89	2.00	0.00	0.00	0.01	0.00	5.90	2.00	0.00	0.00	0.01	0.00
5.91	2.00	0.00	0.00	0.01	0.00	5.92	2.00	0.00	0.00	0.01	0.00
5.93	2.00	0.00	0.00	0.01	0.00	5.94	2.00	0.00	0.00	0.01	0.00
5.95	2.00	0.00	0.00	0.01	0.00	5.96	2.00	0.00	0.00	0.01	0.00
5.97	2.00	0.00	0.00	0.01	0.00	5.98	2.00	0.00	0.00	0.01	0.00
5.99	2.00	0.00	0.00	0.01	0.00	6.00	2.00	0.00	0.00	0.01	0.00
6.01	2.00	0.00	0.00	0.01	0.00	6.02	2.00	0.00	0.00	0.01	0.00
6.03	2.00	0.00	0.00	0.01	0.00	6.04	2.00	0.00	0.00	0.01	0.00
6.05	2.00	0.00	0.00	0.01	0.00	6.06	2.00	0.00	0.00	0.01	0.00
6.07	2.00	0.00	0.00	0.01	0.00	6.08	2.00	0.00	0.00	0.01	0.00
6.09	2.00	0.00	0.00	0.01	0.00	6.10	2.00	0.00	0.00	0.01	0.00
6.11	2.00	0.00	0.00	0.01	0.00	6.12	2.00	0.00	0.00	0.01	0.00
6.13	2.00	0.00	0.00	0.01	0.00	6.14	2.00	0.00	0.00	0.01	0.00
6.15	2.00	0.00	0.00	0.01	0.00	6.16	2.00	0.00	0.00	0.01	0.00
6.17	2.00	0.00	0.00	0.01	0.00	6.18	2.00	0.00	0.00	0.01	0.00
6.19	2.00	0.00	0.00	0.01	0.00	6.20	2.00	0.00	0.00	0.01	0.00
6.21	2.00	0.00	0.00	0.01	0.00	6.22	2.00	0.00	0.00	0.01	0.00
6.23	2.00	0.00	0.00	0.01	0.00	6.24	2.00	0.00	0.00	0.01	0.00
6.25	2.00	0.00	0.00	0.01	0.00	6.26	2.00	0.00	0.00	0.01	0.00
6.27	2.00	0.00	0.00	0.01	0.00	6.28	2.00	0.00	0.00	0.01	0.00
6.29	2.00	0.00	0.00	0.01	0.00	6.30	2.00	0.00	0.00	0.01	0.00
6.31	2.00	0.00	0.00	0.01	0.00	6.32	2.00	0.00	0.00	0.01	0.00
6.33	2.00	0.00	0.00	0.01	0.00	6.34	2.00	0.00	0.00	0.01	0.00
6.35	2.00	0.00	0.00	0.01	0.00	6.36	2.00	0.00	0.00	0.01	0.00
6.37	2.00	0.00	0.00	0.01	0.00	6.38	2.00	0.00	0.00	0.01	0.00
6.39	2.00	0.00	0.00	0.01	0.00	6.40	2.00	0.00	0.00	0.01	0.00
6.41	2.00	0.00	0.00	0.01	0.00	6.42	2.00	0.00	0.00	0.01	0.00
6.43	2.00	0.00	0.00	0.01	0.00	6.44	2.00	0.00	0.00	0.01	0.00
6.45	2.00	0.00	0.00	0.01	0.00	6.46	2.00	0.00	0.00	0.01	0.00
6.47	2.00	0.00	0.00	0.01	0.00	6.48	2.00	0.00	0.00	0.01	0.00
6.49	2.00	0.00	0.00	0.01	0.00	6.50	2.00	0.00	0.00	0.01	0.00
6.51	2.00	0.00	0.00	0.01	0.00	6.52	2.00	0.00	0.00	0.01	0.00
6.53	2.00	0.00	0.00	0.01	0.00	6.54	2.00	0.00	0.00	0.01	0.00
6.55	2.00	0.00	0.00	0.01	0.00	6.56	2.00	0.00	0.00	0.01	0.00
6.57	2.00	0.00	0.00	0.01	0.00	6.58	2.00	0.00	0.00	0.01	0.00
6.59	2.00	0.00	0.00	0.01	0.00	6.60	2.00	0.00	0.00	0.01	0.00
6.61	2.00	0.00	0.00	0.01	0.00	6.62	2.00	0.00	0.00	0.01	0.00
6.63	2.00	0.00	0.00	0.01	0.00	6.64	2.00	0.00	0.00	0.01	0.00
6.65	2.00	0.00	0.00	0.01	0.00	6.66	2.00	0.00	0.00	0.01	0.00
6.67	2.00	0.00	0.00	0.01	0.00	6.68	2.00	0.00	0.00	0.01	0.00
6.69	2.00	0.00	0.00	0.01	0.00	6.70	2.00	0.00	0.00	0.01	0.00
6.71	2.00	0.00	0.00	0.01	0.00	6.72	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
6.73	2.00	0.00	0.00	0.01	0.00	6.74	2.00	0.00	0.00	0.01	0.00
6.75	2.00	0.00	0.00	0.01	0.00	6.76	2.00	0.00	0.00	0.01	0.00
6.77	2.00	0.00	0.00	0.01	0.00	6.78	2.00	0.00	0.00	0.01	0.00
6.79	2.00	0.00	0.00	0.01	0.00	6.80	2.00	0.00	0.00	0.01	0.00
6.81	2.00	0.00	0.00	0.01	0.00	6.82	2.00	0.00	0.00	0.01	0.00
6.83	2.00	0.00	0.00	0.01	0.00	6.84	2.00	0.00	0.00	0.01	0.00
6.85	2.00	0.00	0.00	0.01	0.00	6.86	2.00	0.00	0.00	0.01	0.00
6.87	2.00	0.00	0.00	0.01	0.00	6.88	2.00	0.00	0.00	0.01	0.00
6.89	2.00	0.00	0.00	0.01	0.00	6.90	2.00	0.00	0.00	0.01	0.00
6.91	2.00	0.00	0.00	0.01	0.00	6.92	2.00	0.00	0.00	0.01	0.00
6.93	2.00	0.00	0.00	0.01	0.00	6.94	2.00	0.00	0.00	0.01	0.00
6.95	2.00	0.00	0.00	0.01	0.00	6.96	2.00	0.00	0.00	0.01	0.00
6.97	2.00	0.00	0.00	0.01	0.00	6.98	2.00	0.00	0.00	0.01	0.00
6.99	2.00	0.00	0.00	0.01	0.00	7.00	2.00	0.00	0.00	0.01	0.00
7.01	2.00	0.00	0.00	0.01	0.00	7.02	2.00	0.00	0.00	0.01	0.00
7.03	2.00	0.00	0.00	0.01	0.00	7.04	2.00	0.00	0.00	0.01	0.00
7.05	2.00	0.00	0.00	0.01	0.00	7.06	2.00	0.00	0.00	0.01	0.00
7.07	2.00	0.00	0.00	0.01	0.00	7.08	2.00	0.00	0.00	0.01	0.00
7.09	2.00	0.00	0.00	0.01	0.00	7.10	2.00	0.00	0.00	0.01	0.00
7.11	2.00	0.00	0.00	0.01	0.00	7.12	2.00	0.00	0.00	0.01	0.00
7.13	2.00	0.00	0.00	0.01	0.00	7.14	2.00	0.00	0.00	0.01	0.00
7.15	2.00	0.00	0.00	0.01	0.00	7.16	2.00	0.00	0.00	0.01	0.00
7.17	2.00	0.00	0.00	0.01	0.00	7.18	2.00	0.00	0.00	0.01	0.00
7.19	2.00	0.00	0.00	0.01	0.00	7.20	2.00	0.00	0.00	0.01	0.00
7.21	2.00	0.00	0.00	0.01	0.00	7.22	2.00	0.00	0.00	0.01	0.00
7.23	2.00	0.00	0.00	0.01	0.00	7.24	2.00	0.00	0.00	0.01	0.00
7.25	2.00	0.00	0.00	0.01	0.00	7.26	2.00	0.00	0.00	0.01	0.00
7.27	2.00	0.00	0.00	0.01	0.00	7.28	2.00	0.00	0.00	0.01	0.00
7.29	2.00	0.00	0.00	0.01	0.00	7.30	2.00	0.00	0.00	0.01	0.00
7.31	2.00	0.00	0.00	0.01	0.00	7.32	2.00	0.00	0.00	0.01	0.00
7.33	2.00	0.00	0.00	0.01	0.00	7.34	2.00	0.00	0.00	0.01	0.00
7.35	2.00	0.00	0.00	0.01	0.00	7.36	2.00	0.00	0.00	0.01	0.00
7.37	2.00	0.00	0.00	0.01	0.00	7.38	2.00	0.00	0.00	0.01	0.00
7.39	2.00	0.00	0.00	0.01	0.00	7.40	2.00	0.00	0.00	0.01	0.00
7.41	2.00	0.00	0.00	0.01	0.00	7.42	2.00	0.00	0.00	0.01	0.00
7.43	2.00	0.00	0.00	0.01	0.00	7.44	2.00	0.00	0.00	0.01	0.00
7.45	2.00	0.00	0.00	0.01	0.00	7.46	2.00	0.00	0.00	0.01	0.00
7.47	2.00	0.00	0.00	0.01	0.00	7.48	2.00	0.00	0.00	0.01	0.00
7.49	2.00	0.00	0.00	0.01	0.00	7.50	2.00	0.00	0.00	0.01	0.00
7.51	2.00	0.00	0.00	0.01	0.00	7.52	2.00	0.00	0.00	0.01	0.00
7.53	2.00	0.00	0.00	0.01	0.00	7.54	2.00	0.00	0.00	0.01	0.00
7.55	2.00	0.00	0.00	0.01	0.00	7.56	2.00	0.00	0.00	0.01	0.00
7.57	2.00	0.00	0.00	0.01	0.00	7.58	2.00	0.00	0.00	0.01	0.00
7.59	2.00	0.00	0.00	0.01	0.00	7.60	2.00	0.00	0.00	0.01	0.00
7.61	2.00	0.00	0.00	0.01	0.00	7.62	2.00	0.00	0.00	0.01	0.00
7.63	2.00	0.00	0.00	0.01	0.00	7.64	2.00	0.00	0.00	0.01	0.00
7.65	2.00	0.00	0.00	0.01	0.00	7.66	2.00	0.00	0.00	0.01	0.00
7.67	2.00	0.00	0.00	0.01	0.00	7.68	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
7.69	2.00	0.00	0.00	0.01	0.00	7.70	2.00	0.00	0.00	0.01	0.00
7.71	2.00	0.00	0.00	0.01	0.00	7.72	2.00	0.00	0.00	0.01	0.00
7.73	2.00	0.00	0.00	0.01	0.00	7.74	2.00	0.00	0.00	0.01	0.00
7.75	2.00	0.00	0.00	0.01	0.00	7.76	2.00	0.00	0.00	0.01	0.00
7.77	2.00	0.00	0.00	0.01	0.00	7.78	2.00	0.00	0.00	0.01	0.00
7.79	2.00	0.00	0.00	0.01	0.00	7.80	2.00	0.00	0.00	0.01	0.00
7.81	2.00	0.00	0.00	0.01	0.00	7.82	2.00	0.00	0.00	0.01	0.00
7.83	2.00	0.00	0.00	0.01	0.00	7.84	2.00	0.00	0.00	0.01	0.00
7.85	2.00	0.00	0.00	0.01	0.00	7.86	2.00	0.00	0.00	0.01	0.00
7.87	2.00	0.00	0.00	0.01	0.00	7.88	2.00	0.00	0.00	0.01	0.00
7.89	2.00	0.00	0.00	0.01	0.00	7.90	2.00	0.00	0.00	0.01	0.00
7.91	2.00	0.00	0.00	0.01	0.00	7.92	2.00	0.00	0.00	0.01	0.00
7.93	2.00	0.00	0.00	0.01	0.00	7.94	2.00	0.00	0.00	0.01	0.00
7.95	2.00	0.00	0.00	0.01	0.00	7.96	2.00	0.00	0.00	0.01	0.00
7.97	2.00	0.00	0.00	0.01	0.00	7.98	2.00	0.00	0.00	0.01	0.00
7.99	2.00	0.00	0.00	0.01	0.00	8.00	2.00	0.00	0.00	0.01	0.00
8.01	2.00	0.00	0.00	0.01	0.00	8.02	2.00	0.00	0.00	0.01	0.00
8.03	2.00	0.00	0.00	0.01	0.00	8.04	2.00	0.00	0.00	0.01	0.00
8.05	2.00	0.00	0.00	0.01	0.00	8.06	2.00	0.00	0.00	0.01	0.00
8.07	2.00	0.00	0.00	0.01	0.00	8.08	2.00	0.00	0.00	0.01	0.00
8.09	2.00	0.00	0.00	0.01	0.00	8.10	2.00	0.00	0.00	0.01	0.00
8.11	2.00	0.00	0.00	0.01	0.00	8.12	2.00	0.00	0.00	0.01	0.00
8.13	2.00	0.00	0.00	0.01	0.00	8.14	2.00	0.00	0.00	0.01	0.00
8.15	2.00	0.00	0.00	0.01	0.00	8.16	2.00	0.00	0.00	0.01	0.00
8.17	2.00	0.00	0.00	0.01	0.00	8.18	2.00	0.00	0.00	0.01	0.00
8.19	2.00	0.00	0.00	0.01	0.00	8.20	2.00	0.00	0.00	0.01	0.00
8.21	2.00	0.00	0.00	0.01	0.00	8.22	2.00	0.00	0.00	0.01	0.00
8.23	2.00	0.00	0.00	0.01	0.00	8.24	2.00	0.00	0.00	0.01	0.00
8.25	2.00	0.00	0.00	0.01	0.00	8.26	2.00	0.00	0.00	0.01	0.00
8.27	2.00	0.00	0.00	0.01	0.00	8.28	2.00	0.00	0.00	0.01	0.00
8.29	2.00	0.00	0.00	0.01	0.00	8.30	2.00	0.00	0.00	0.01	0.00
8.31	2.00	0.00	0.00	0.01	0.00	8.32	2.00	0.00	0.00	0.01	0.00
8.33	2.00	0.00	0.00	0.01	0.00	8.34	2.00	0.00	0.00	0.01	0.00
8.35	2.00	0.00	0.00	0.01	0.00	8.36	2.00	0.00	0.00	0.01	0.00
8.37	2.00	0.00	0.00	0.01	0.00	8.38	2.00	0.00	0.00	0.01	0.00
8.39	2.00	0.00	0.00	0.01	0.00	8.40	2.00	0.00	0.00	0.01	0.00
8.41	2.00	0.00	0.00	0.01	0.00	8.42	2.00	0.00	0.00	0.01	0.00
8.43	2.00	0.00	0.00	0.01	0.00	8.44	2.00	0.00	0.00	0.01	0.00
8.45	2.00	0.00	0.00	0.01	0.00	8.46	2.00	0.00	0.00	0.01	0.00
8.47	2.00	0.00	0.00	0.01	0.00	8.48	2.00	0.00	0.00	0.01	0.00
8.49	2.00	0.00	0.00	0.01	0.00	8.50	2.00	0.00	0.00	0.01	0.00
8.51	2.00	0.00	0.00	0.01	0.00	8.52	2.00	0.00	0.00	0.01	0.00
8.53	2.00	0.00	0.00	0.01	0.00	8.54	2.00	0.00	0.00	0.01	0.00
8.55	2.00	0.00	0.00	0.01	0.00	8.56	2.00	0.00	0.00	0.01	0.00
8.57	2.00	0.00	0.00	0.01	0.00	8.58	2.00	0.00	0.00	0.01	0.00
8.59	2.00	0.00	0.00	0.01	0.00	8.60	2.00	0.00	0.00	0.01	0.00
8.61	2.00	0.00	0.00	0.01	0.00	8.62	2.00	0.00	0.00	0.01	0.00
8.63	2.00	0.00	0.00	0.01	0.00	8.64	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
8.65	2.00	0.00	0.00	0.01	0.00	8.66	2.00	0.00	0.00	0.01	0.00
8.67	2.00	0.00	0.00	0.01	0.00	8.68	2.00	0.00	0.00	0.01	0.00
8.69	2.00	0.00	0.00	0.01	0.00	8.70	2.00	0.00	0.00	0.01	0.00
8.71	2.00	0.00	0.00	0.01	0.00	8.72	2.00	0.00	0.00	0.01	0.00
8.73	2.00	0.00	0.00	0.01	0.00	8.74	2.00	0.00	0.00	0.01	0.00
8.75	2.00	0.00	0.00	0.01	0.00	8.76	2.00	0.00	0.00	0.01	0.00
8.77	2.00	0.00	0.00	0.01	0.00	8.78	2.00	0.00	0.00	0.01	0.00
8.79	2.00	0.00	0.00	0.01	0.00	8.80	2.00	0.00	0.00	0.01	0.00
8.81	2.00	0.00	0.00	0.01	0.00	8.82	2.00	0.00	0.00	0.01	0.00
8.83	2.00	0.00	0.00	0.01	0.00	8.84	2.00	0.00	0.00	0.01	0.00
8.85	2.00	0.00	0.00	0.01	0.00	8.86	2.00	0.00	0.00	0.01	0.00
8.87	2.00	0.00	0.00	0.01	0.00	8.88	2.00	0.00	0.00	0.01	0.00
8.89	2.00	0.00	0.00	0.01	0.00	8.90	2.00	0.00	0.00	0.01	0.00
8.91	2.00	0.00	0.00	0.01	0.00	8.92	2.00	0.00	0.00	0.01	0.00
8.93	2.00	0.00	0.00	0.01	0.00	8.94	2.00	0.00	0.00	0.01	0.00
8.95	2.00	0.00	0.00	0.01	0.00	8.96	2.00	0.00	0.00	0.01	0.00
8.97	2.00	0.00	0.00	0.01	0.00	8.98	2.00	0.00	0.00	0.01	0.00
8.99	2.00	0.00	0.00	0.01	0.00	9.00	2.00	0.00	0.00	0.01	0.00
9.01	2.00	0.00	0.00	0.01	0.00	9.02	2.00	0.00	0.00	0.01	0.00
9.03	2.00	0.00	0.00	0.01	0.00	9.04	2.00	0.00	0.00	0.01	0.00
9.05	2.00	0.00	0.00	0.01	0.00	9.06	2.00	0.00	0.00	0.01	0.00
9.07	2.00	0.00	0.00	0.01	0.00	9.08	2.00	0.00	0.00	0.01	0.00
9.09	2.00	0.00	0.00	0.01	0.00	9.10	2.00	0.00	0.00	0.01	0.00
9.11	2.00	0.00	0.00	0.01	0.00	9.12	2.00	0.00	0.00	0.01	0.00
9.13	2.00	0.00	0.00	0.01	0.00	9.14	2.00	0.00	0.00	0.01	0.00
9.15	2.00	0.00	0.00	0.01	0.00	9.16	2.00	0.00	0.00	0.01	0.00
9.17	2.00	0.00	0.00	0.01	0.00	9.18	2.00	0.00	0.00	0.01	0.00
9.19	2.00	0.00	0.00	0.01	0.00	9.20	2.00	0.00	0.00	0.01	0.00
9.21	2.00	0.00	0.00	0.01	0.00	9.22	2.00	0.00	0.00	0.01	0.00
9.23	2.00	0.00	0.00	0.01	0.00	9.24	2.00	0.00	0.00	0.01	0.00
9.25	2.00	0.00	0.00	0.01	0.00	9.26	2.00	0.00	0.00	0.01	0.00
9.27	2.00	0.00	0.00	0.01	0.00	9.28	2.00	0.00	0.00	0.01	0.00
9.29	2.00	0.00	0.00	0.01	0.00	9.30	2.00	0.00	0.00	0.01	0.00
9.31	2.00	0.00	0.00	0.01	0.00	9.32	2.00	0.00	0.00	0.01	0.00
9.33	2.00	0.00	0.00	0.01	0.00	9.34	2.00	0.00	0.00	0.01	0.00
9.35	2.00	0.00	0.00	0.01	0.00	9.36	2.00	0.00	0.00	0.01	0.00
9.37	2.00	0.00	0.00	0.01	0.00	9.38	2.00	0.00	0.00	0.01	0.00
9.39	2.00	0.00	0.00	0.01	0.00	9.40	2.00	0.00	0.00	0.01	0.00
9.41	2.00	0.00	0.00	0.01	0.00	9.42	2.00	0.00	0.00	0.01	0.00
9.43	2.00	0.00	0.00	0.01	0.00	9.44	2.00	0.00	0.00	0.01	0.00
9.45	2.00	0.00	0.00	0.01	0.00	9.46	2.00	0.00	0.00	0.01	0.00
9.47	2.00	0.00	0.00	0.01	0.00	9.48	2.00	0.00	0.00	0.01	0.00
9.49	2.00	0.00	0.00	0.01	0.00	9.50	2.00	0.00	0.00	0.01	0.00
9.51	2.00	0.00	0.00	0.01	0.00	9.52	2.00	0.00	0.00	0.01	0.00
9.53	2.00	0.00	0.00	0.01	0.00	9.54	2.00	0.00	0.00	0.01	0.00
9.55	2.00	0.00	0.00	0.01	0.00	9.56	2.00	0.00	0.00	0.01	0.00
9.57	2.00	0.00	0.00	0.01	0.00	9.58	2.00	0.00	0.00	0.01	0.00
9.59	2.00	0.00	0.00	0.01	0.00	9.60	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
9.61	2.00	0.00	0.00	0.01	0.00	9.62	2.00	0.00	0.00	0.01	0.00
9.63	2.00	0.00	0.00	0.01	0.00	9.64	2.00	0.00	0.00	0.01	0.00
9.65	2.00	0.00	0.00	0.01	0.00	9.66	2.00	0.00	0.00	0.01	0.00
9.67	2.00	0.00	0.00	0.01	0.00	9.68	2.00	0.00	0.00	0.01	0.00
9.69	2.00	0.00	0.00	0.01	0.00	9.70	2.00	0.00	0.00	0.01	0.00
9.71	2.00	0.00	0.00	0.01	0.00	9.72	2.00	0.00	0.00	0.01	0.00
9.73	2.00	0.00	0.00	0.01	0.00	9.74	2.00	0.00	0.00	0.01	0.00
9.75	2.00	0.00	0.00	0.01	0.00	9.76	2.00	0.00	0.00	0.01	0.00
9.77	2.00	0.00	0.00	0.01	0.00	9.78	2.00	0.00	0.00	0.01	0.00
9.79	2.00	0.00	0.00	0.01	0.00	9.80	2.00	0.00	0.00	0.01	0.00
9.81	2.00	0.00	0.00	0.01	0.00	9.82	2.00	0.00	0.00	0.01	0.00
9.83	2.00	0.00	0.00	0.01	0.00	9.84	2.00	0.00	0.00	0.01	0.00
9.85	2.00	0.00	0.00	0.01	0.00	9.86	2.00	0.00	0.00	0.01	0.00
9.87	2.00	0.00	0.00	0.01	0.00	9.88	2.00	0.00	0.00	0.01	0.00
9.89	2.00	0.00	0.00	0.01	0.00	9.90	2.00	0.00	0.00	0.01	0.00
9.91	2.00	0.00	0.00	0.01	0.00	9.92	2.00	0.00	0.00	0.01	0.00
9.93	2.00	0.00	0.00	0.01	0.00	9.94	2.00	0.00	0.00	0.01	0.00
9.95	2.00	0.00	0.00	0.01	0.00	9.96	2.00	0.00	0.00	0.01	0.00
9.97	2.00	0.00	0.00	0.01	0.00	9.98	2.00	0.00	0.00	0.01	0.00
9.99	2.00	0.00	0.00	0.01	0.00	10.00	2.00	0.00	0.00	0.01	0.00
10.01	2.00	0.00	0.00	0.01	0.00	10.02	2.00	0.00	0.00	0.01	0.00
10.03	2.00	0.00	0.00	0.01	0.00	10.04	2.00	0.00	0.00	0.01	0.00
10.05	2.00	0.00	0.00	0.01	0.00	10.06	2.00	0.00	0.00	0.01	0.00
10.07	2.00	0.00	0.00	0.01	0.00	10.08	2.00	0.00	0.00	0.01	0.00
10.09	2.00	0.00	0.00	0.01	0.00	10.10	2.00	0.00	0.00	0.01	0.00
10.11	2.00	0.00	0.00	0.01	0.00	10.12	2.00	0.00	0.00	0.01	0.00
10.13	2.00	0.00	0.00	0.01	0.00	10.14	2.00	0.00	0.00	0.01	0.00
10.15	2.00	0.00	0.00	0.01	0.00	10.16	2.00	0.00	0.00	0.01	0.00
10.17	2.00	0.00	0.00	0.01	0.00	10.18	2.00	0.00	0.00	0.01	0.00
10.19	2.00	0.00	0.00	0.01	0.00	10.20	2.00	0.00	0.00	0.01	0.00
10.21	2.00	0.00	0.00	0.01	0.00	10.22	2.00	0.00	0.00	0.01	0.00
10.23	2.00	0.00	0.00	0.01	0.00	10.24	2.00	0.00	0.00	0.01	0.00
10.25	2.00	0.00	0.00	0.01	0.00	10.26	2.00	0.00	0.00	0.01	0.00
10.27	2.00	0.00	0.00	0.01	0.00	10.28	2.00	0.00	0.00	0.01	0.00
10.29	2.00	0.00	0.00	0.01	0.00	10.30	2.00	0.00	0.00	0.01	0.00
10.31	2.00	0.00	0.00	0.01	0.00	10.32	2.00	0.00	0.00	0.01	0.00
10.33	2.00	0.00	0.00	0.01	0.00	10.34	2.00	0.00	0.00	0.01	0.00
10.35	2.00	0.00	0.00	0.01	0.00	10.36	2.00	0.00	0.00	0.01	0.00
10.37	2.00	0.00	0.00	0.01	0.00	10.38	2.00	0.00	0.00	0.01	0.00
10.39	2.00	0.00	0.00	0.01	0.00	10.40	2.00	0.00	0.00	0.01	0.00
10.41	2.00	0.00	0.00	0.01	0.00	10.42	2.00	0.00	0.00	0.01	0.00
10.43	2.00	0.00	0.00	0.01	0.00	10.44	2.00	0.00	0.00	0.01	0.00
10.45	2.00	0.00	0.00	0.01	0.00	10.46	2.00	0.00	0.00	0.01	0.00
10.47	2.00	0.00	0.00	0.01	0.00	10.48	2.00	0.00	0.00	0.01	0.00
10.49	2.00	0.00	0.00	0.01	0.00	10.50	2.00	0.00	0.00	0.01	0.00
10.51	2.00	0.00	0.00	0.01	0.00	10.52	2.00	0.00	0.00	0.01	0.00
10.53	2.00	0.00	0.00	0.01	0.00	10.54	2.00	0.00	0.00	0.01	0.00
10.55	2.00	0.00	0.00	0.01	0.00	10.56	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
10.57	2.00	0.00	0.00	0.01	0.00	10.58	2.00	0.00	0.00	0.01	0.00
10.59	2.00	0.00	0.00	0.01	0.00	10.60	2.00	0.00	0.00	0.01	0.00
10.61	2.00	0.00	0.00	0.01	0.00	10.62	2.00	0.00	0.00	0.01	0.00
10.63	2.00	0.00	0.00	0.01	0.00	10.64	2.00	0.00	0.00	0.01	0.00
10.65	2.00	0.00	0.00	0.01	0.00	10.66	2.00	0.00	0.00	0.01	0.00
10.67	2.00	0.00	0.00	0.01	0.00	10.68	2.00	0.00	0.00	0.01	0.00
10.69	2.00	0.00	0.00	0.01	0.00	10.70	2.00	0.00	0.00	0.01	0.00
10.71	2.00	0.00	0.00	0.01	0.00	10.72	2.00	0.00	0.00	0.01	0.00
10.73	2.00	0.00	0.00	0.01	0.00	10.74	2.00	0.00	0.00	0.01	0.00
10.75	2.00	0.00	0.00	0.01	0.00	10.76	2.00	0.00	0.00	0.01	0.00
10.77	2.00	0.00	0.00	0.01	0.00	10.78	2.00	0.00	0.00	0.01	0.00
10.79	2.00	0.00	0.00	0.01	0.00	10.80	2.00	0.00	0.00	0.01	0.00
10.81	2.00	0.00	0.00	0.01	0.00	10.82	2.00	0.00	0.00	0.01	0.00
10.83	2.00	0.00	0.00	0.01	0.00	10.84	2.00	0.00	0.00	0.01	0.00
10.85	2.00	0.00	0.00	0.01	0.00	10.86	2.00	0.00	0.00	0.01	0.00
10.87	2.00	0.00	0.00	0.01	0.00	10.88	2.00	0.00	0.00	0.01	0.00
10.89	2.00	0.00	0.00	0.01	0.00	10.90	2.00	0.00	0.00	0.01	0.00
10.91	2.00	0.00	0.00	0.01	0.00	10.92	2.00	0.00	0.00	0.01	0.00
10.93	2.00	0.00	0.00	0.01	0.00	10.94	2.00	0.00	0.00	0.01	0.00
10.95	2.00	0.00	0.00	0.01	0.00	10.96	2.00	0.00	0.00	0.01	0.00
10.97	2.00	0.00	0.00	0.01	0.00	10.98	2.00	0.00	0.00	0.01	0.00
10.99	2.00	0.00	0.00	0.01	0.00	11.00	2.00	0.00	0.00	0.01	0.00
11.01	2.00	0.00	0.00	0.01	0.00	11.02	2.00	0.00	0.00	0.01	0.00
11.03	2.00	0.00	0.00	0.01	0.00	11.04	2.00	0.00	0.00	0.01	0.00
11.05	2.00	0.00	0.00	0.01	0.00	11.06	2.00	0.00	0.00	0.01	0.00
11.07	2.00	0.00	0.00	0.01	0.00	11.08	2.00	0.00	0.00	0.01	0.00
11.09	2.00	0.00	0.00	0.01	0.00	11.10	2.00	0.00	0.00	0.01	0.00
11.11	2.00	0.00	0.00	0.01	0.00	11.12	2.00	0.00	0.00	0.01	0.00
11.13	2.00	0.00	0.00	0.01	0.00	11.14	2.00	0.00	0.00	0.01	0.00
11.15	2.00	0.00	0.00	0.01	0.00	11.16	2.00	0.00	0.00	0.01	0.00
11.17	2.00	0.00	0.00	0.01	0.00	11.18	2.00	0.00	0.00	0.01	0.00
11.19	2.00	0.00	0.00	0.01	0.00	11.20	2.00	0.00	0.00	0.01	0.00
11.21	2.00	0.00	0.00	0.01	0.00	11.22	2.00	0.00	0.00	0.01	0.00
11.23	2.00	0.00	0.00	0.01	0.00	11.24	2.00	0.00	0.00	0.01	0.00
11.25	2.00	0.00	0.00	0.01	0.00	11.26	2.00	0.00	0.00	0.01	0.00
11.27	2.00	0.00	0.00	0.01	0.00	11.28	2.00	0.00	0.00	0.01	0.00
11.29	2.00	0.00	0.00	0.01	0.00	11.30	2.00	0.00	0.00	0.01	0.00
11.31	2.00	0.00	0.00	0.01	0.00	11.32	2.00	0.00	0.00	0.01	0.00
11.33	2.00	0.00	0.00	0.01	0.00	11.34	2.00	0.00	0.00	0.01	0.00
11.35	2.00	0.00	0.00	0.01	0.00	11.36	2.00	0.00	0.00	0.01	0.00
11.37	2.00	0.00	0.00	0.01	0.00	11.38	2.00	0.00	0.00	0.01	0.00
11.39	2.00	0.00	0.00	0.01	0.00	11.40	2.00	0.00	0.00	0.01	0.00
11.41	2.00	0.00	0.00	0.01	0.00	11.42	2.00	0.00	0.00	0.01	0.00
11.43	2.00	0.00	0.00	0.01	0.00	11.44	2.00	0.00	0.00	0.01	0.00
11.45	2.00	0.00	0.00	0.01	0.00	11.46	2.00	0.00	0.00	0.01	0.00
11.47	2.00	0.00	0.00	0.01	0.00	11.48	2.00	0.00	0.00	0.01	0.00
11.49	2.00	0.00	0.00	0.01	0.00	11.50	2.00	0.00	0.00	0.01	0.00
11.51	2.00	0.00	0.00	0.01	0.00	11.52	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
11.53	2.00	0.00	0.00	0.01	0.00	11.54	2.00	0.00	0.00	0.01	0.00
11.55	2.00	0.00	0.00	0.01	0.00	11.56	2.00	0.00	0.00	0.01	0.00
11.57	2.00	0.00	0.00	0.01	0.00	11.58	2.00	0.00	0.00	0.01	0.00
11.59	2.00	0.00	0.00	0.01	0.00	11.60	2.00	0.00	0.00	0.01	0.00
11.61	2.00	0.00	0.00	0.01	0.00	11.62	2.00	0.00	0.00	0.01	0.00
11.63	2.00	0.00	0.00	0.01	0.00	11.64	2.00	0.00	0.00	0.01	0.00
11.65	2.00	0.00	0.00	0.01	0.00	11.66	2.00	0.00	0.00	0.01	0.00
11.67	2.00	0.00	0.00	0.01	0.00	11.68	2.00	0.00	0.00	0.01	0.00
11.69	2.00	0.00	0.00	0.01	0.00	11.70	2.00	0.00	0.00	0.01	0.00
11.71	2.00	0.00	0.00	0.01	0.00	11.72	2.00	0.00	0.00	0.01	0.00
11.73	0.63	0.37	0.69	0.01	0.02	11.74	0.63	0.37	0.71	0.01	0.02
11.75	0.65	0.35	0.74	0.01	0.01	11.76	0.66	0.34	0.77	0.01	0.01
11.77	0.65	0.35	0.75	0.01	0.01	11.78	2.00	0.00	0.00	0.01	0.00
11.79	2.00	0.00	0.00	0.01	0.00	11.80	2.00	0.00	0.00	0.01	0.00
11.81	2.00	0.00	0.00	0.01	0.00	11.82	2.00	0.00	0.00	0.01	0.00
11.83	2.00	0.00	0.00	0.01	0.00	11.84	2.00	0.00	0.00	0.01	0.00
11.85	2.00	0.00	0.00	0.01	0.00	11.86	2.00	0.00	0.00	0.01	0.00

Overall liquefaction potential: 0.15

LPI_{ISH} > 5.0 - Liquefaction manifestation is expected

Abbreviations

FS: Calculated factor of safety for test point
d_z: Layer thickness (m)
LPI: Liquefaction potential index value for test point

LIQUEFACTION ANALYSIS REPORT

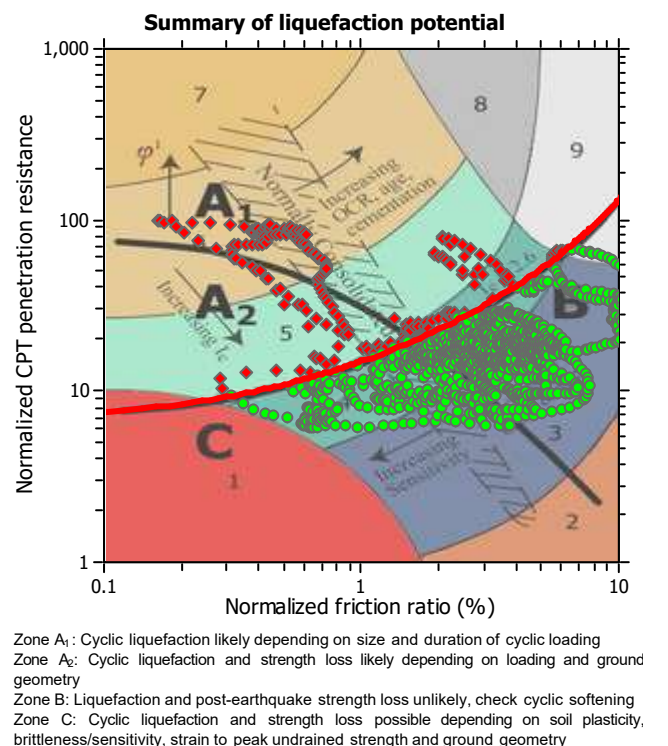
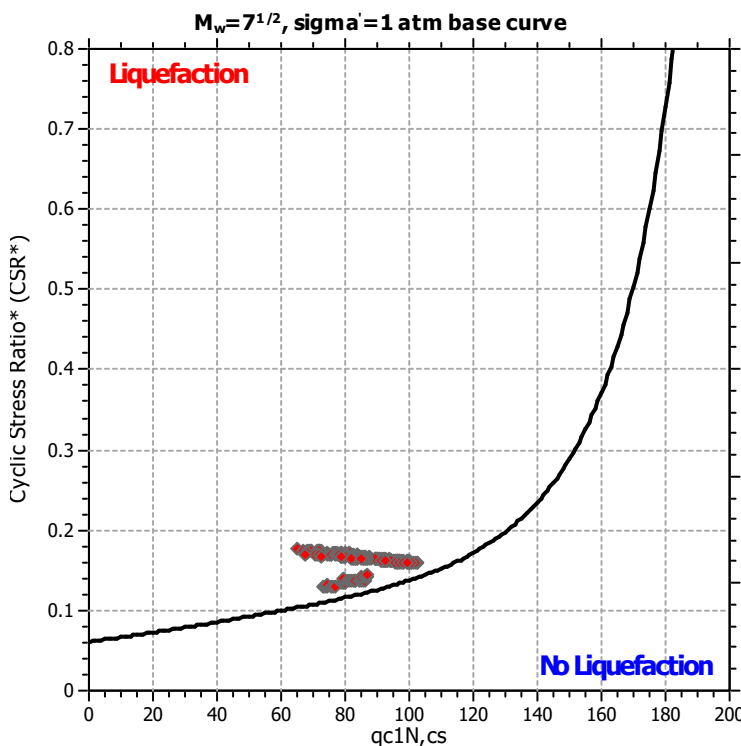
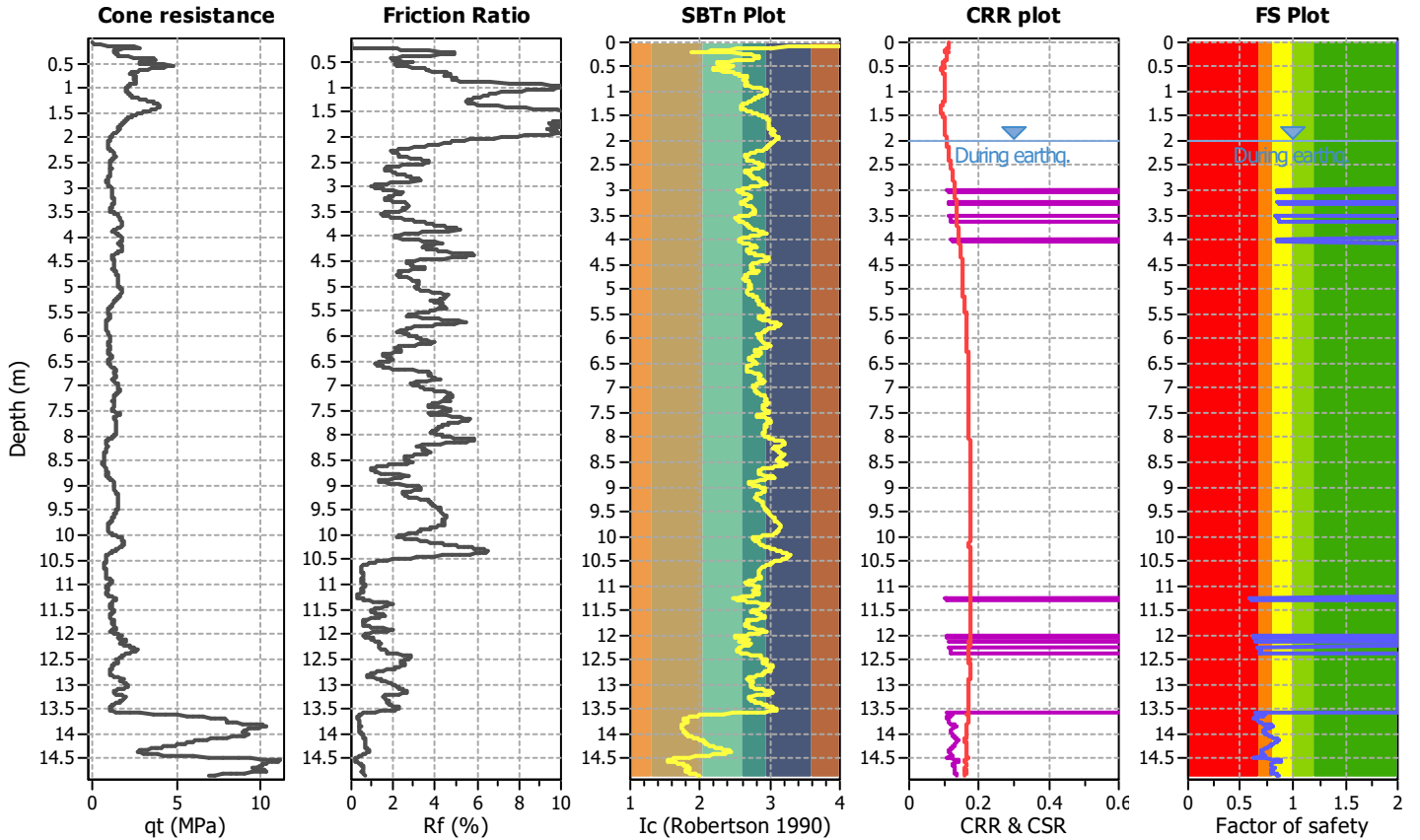
Project title : via ponara

Location : bertinoro

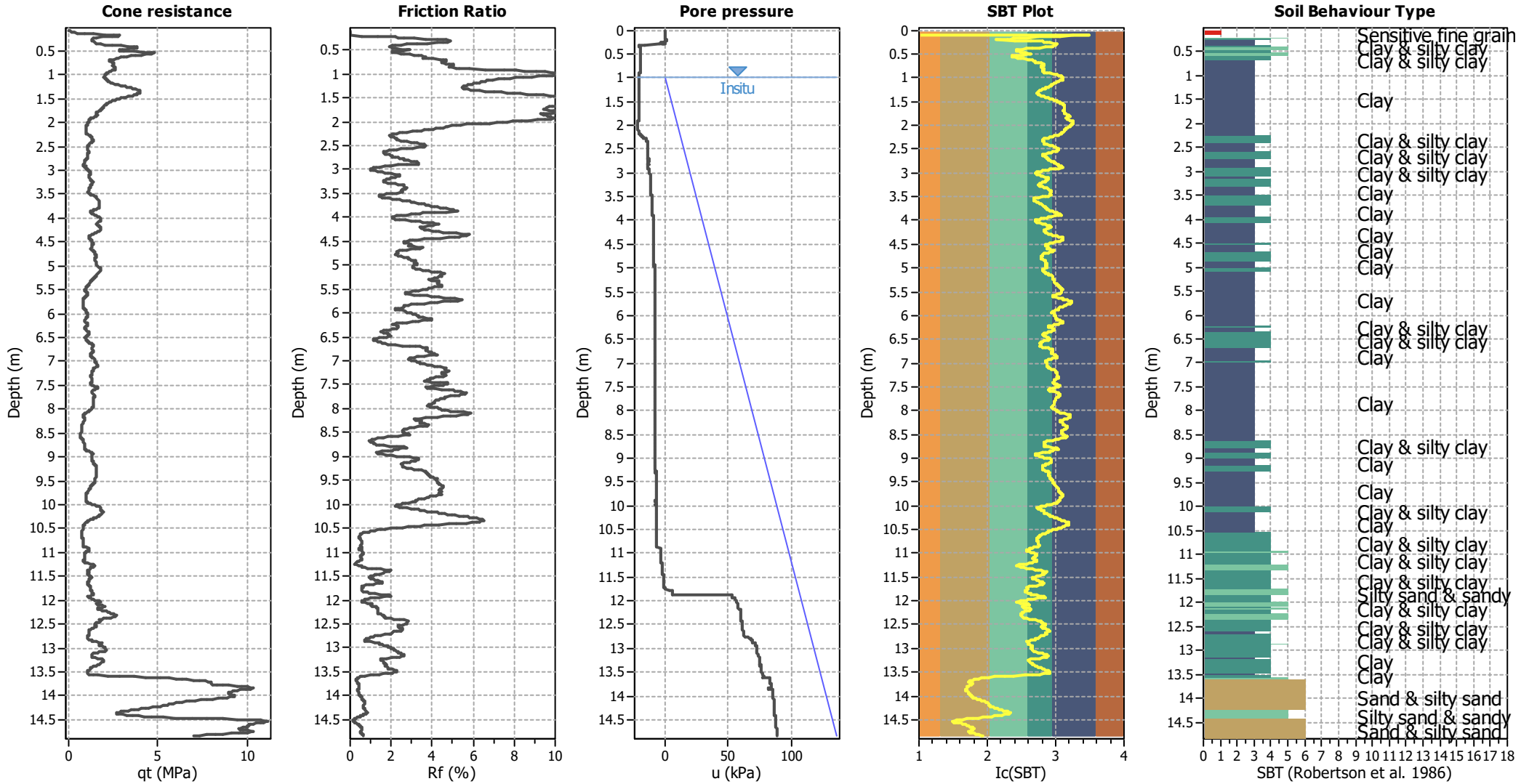
CPT file : pq1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	6.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.20	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based



CPT basic interpretation plots



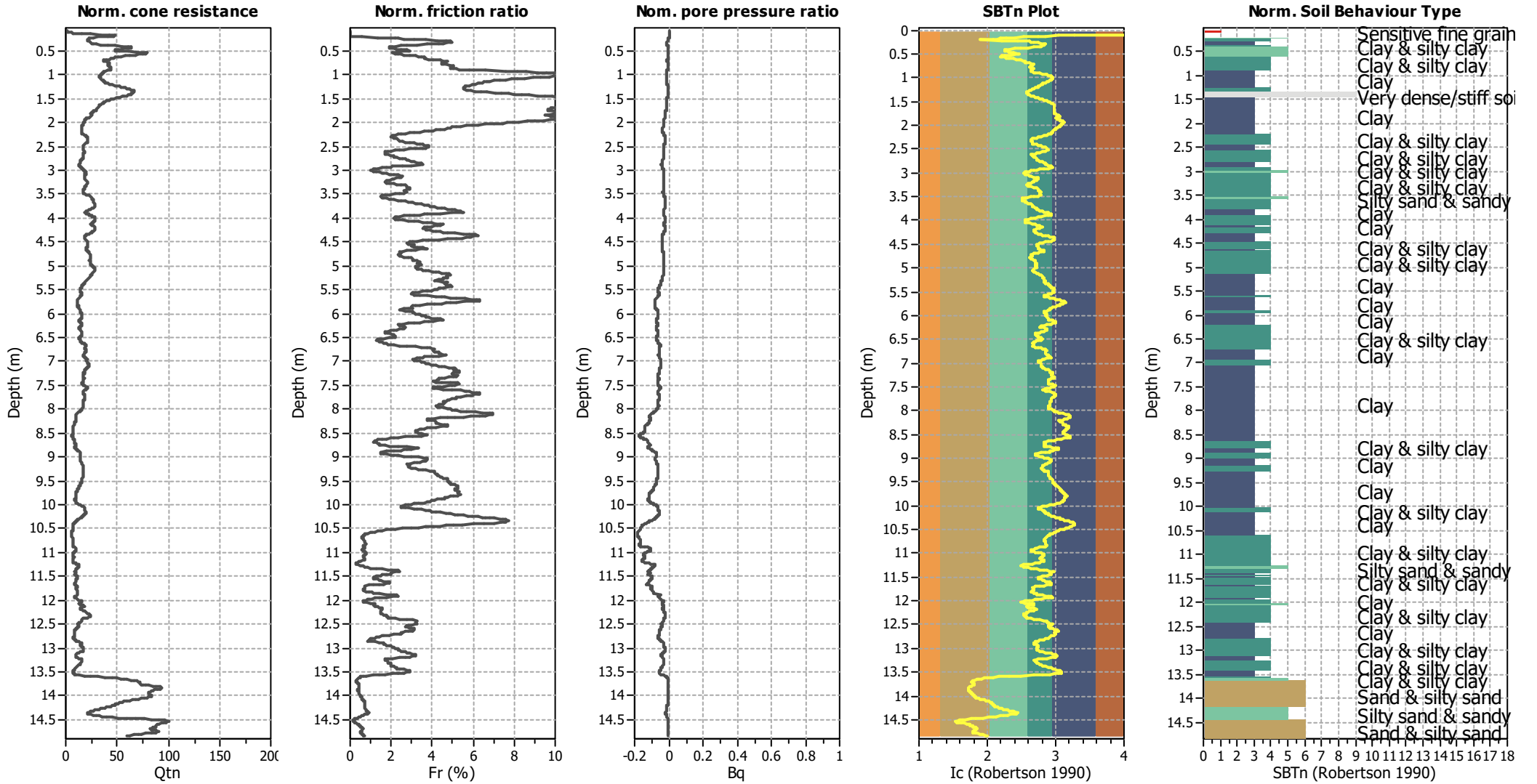
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_v applied:	Yes
Earthquake magnitude M_w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

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)



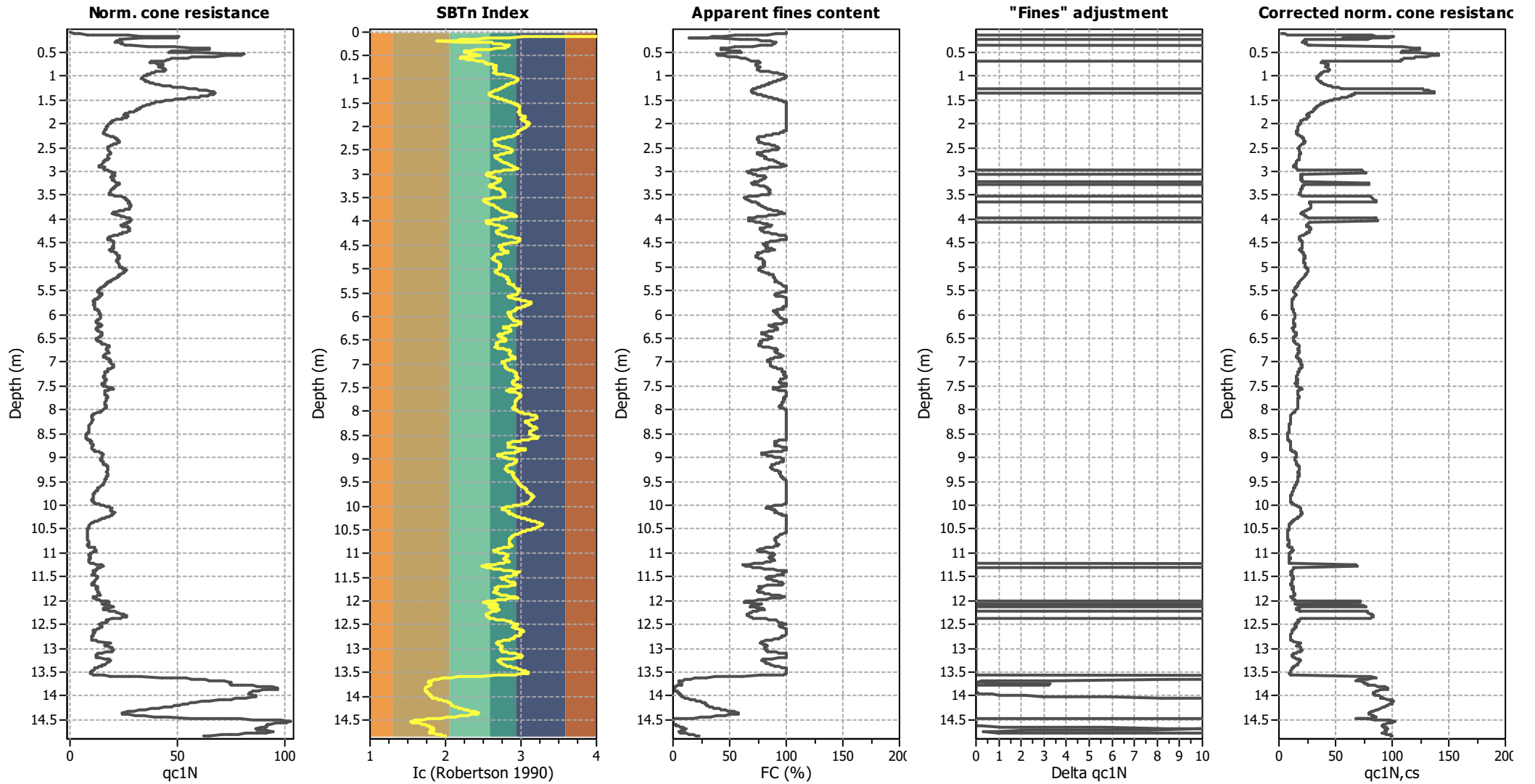
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K ₀ applied:	Yes
Earthquake magnitude M _w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

SBTn 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

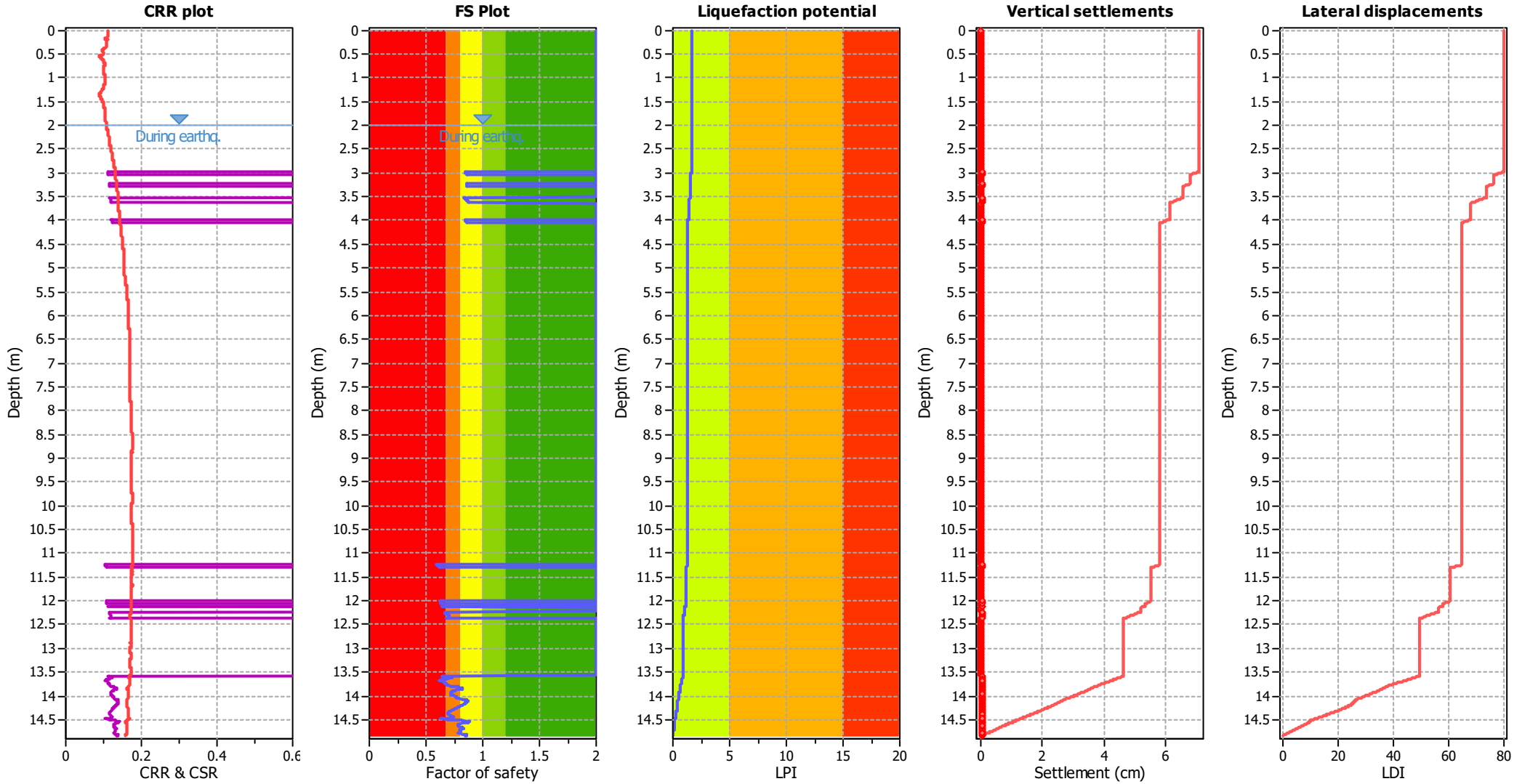
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

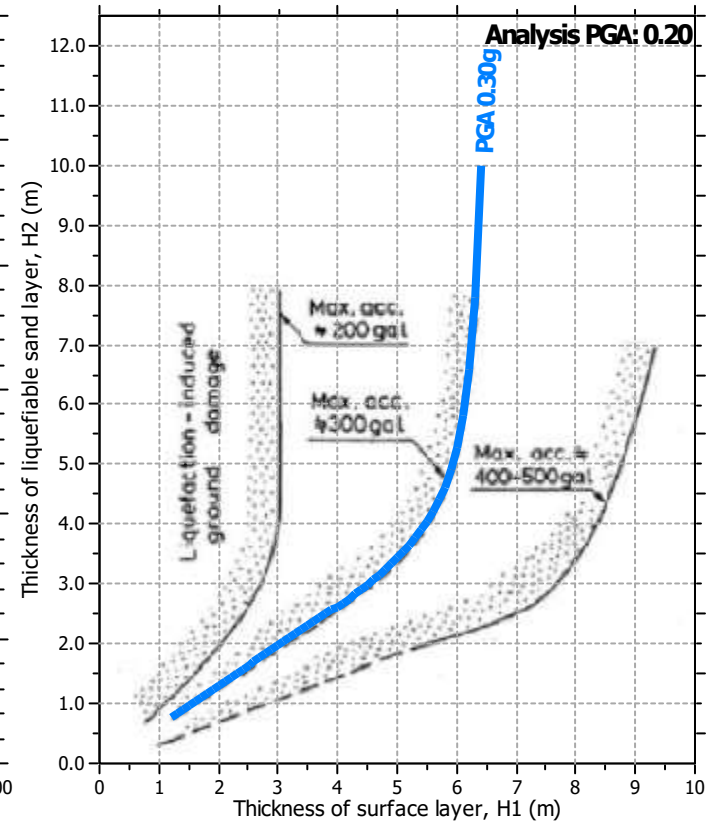
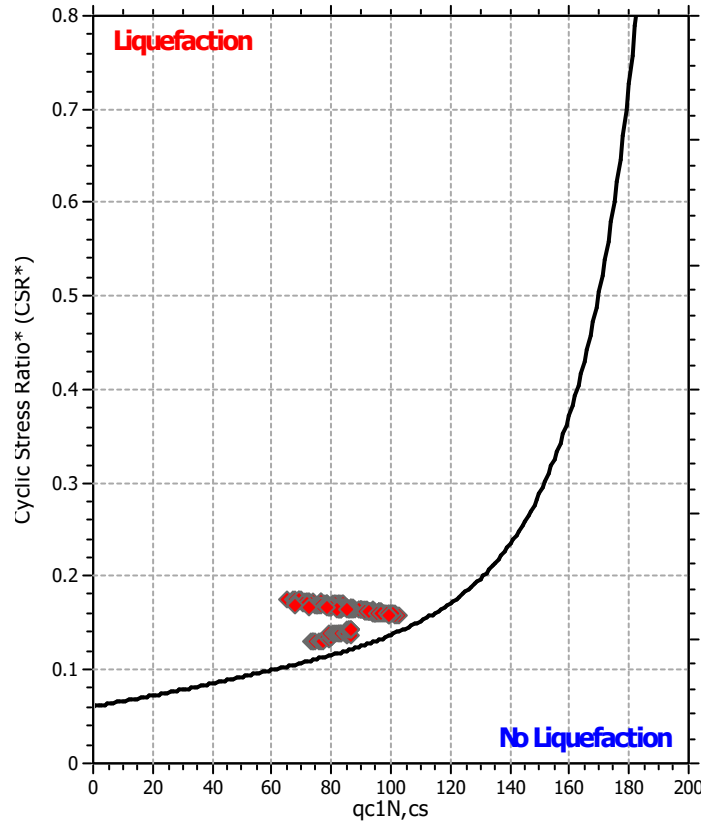
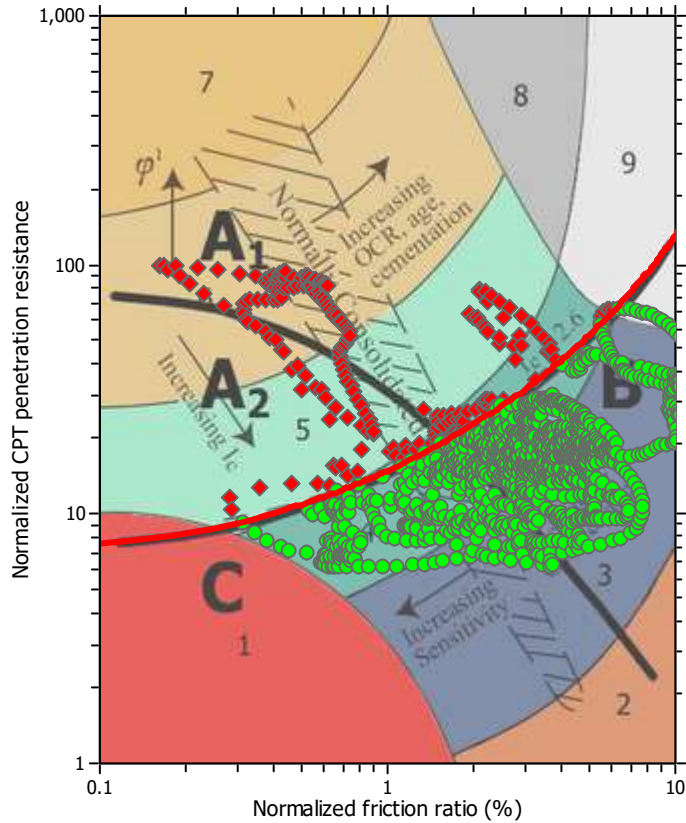
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

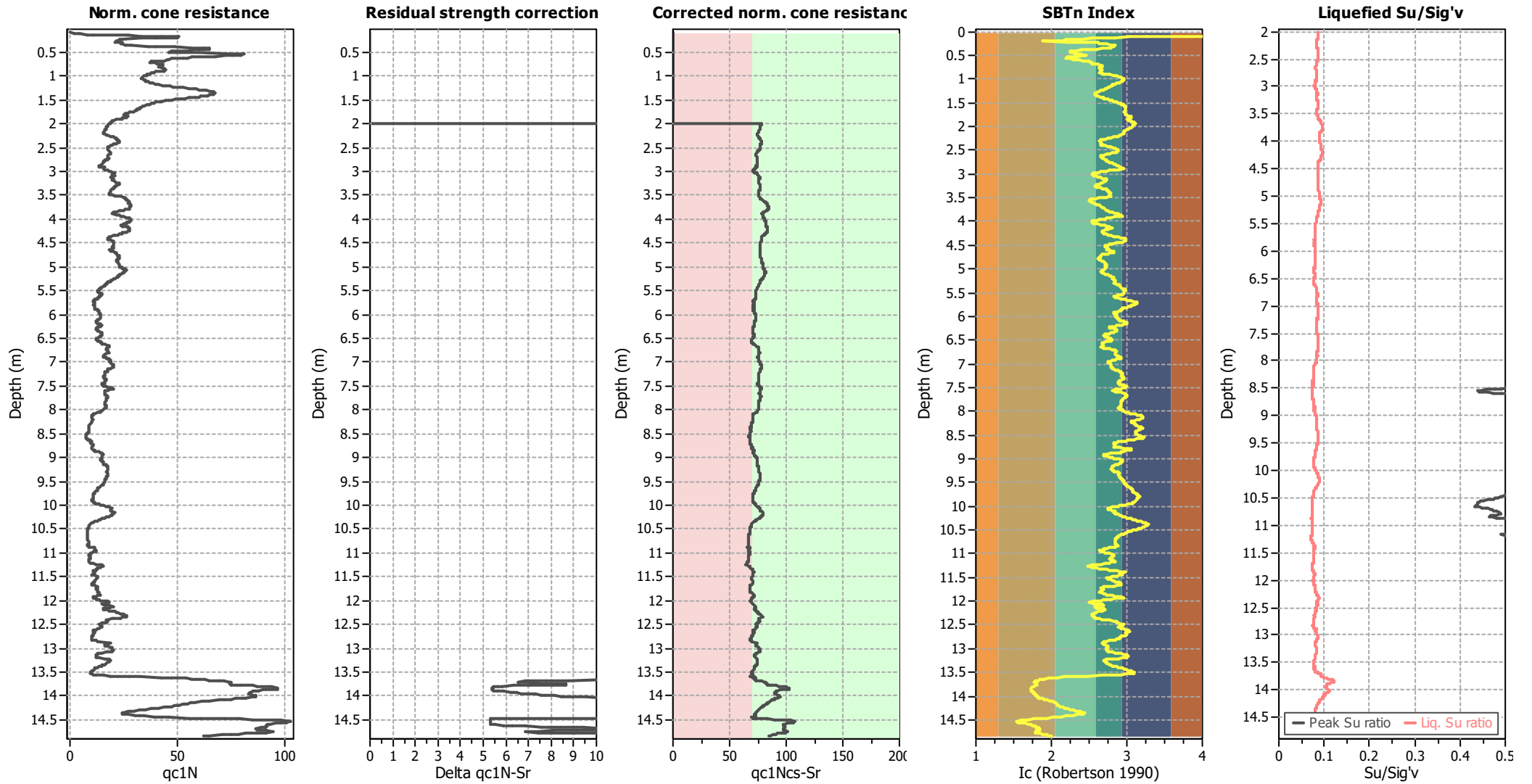
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{ϕ} applied:	Yes
Earthquake magnitude M_w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K _σ applied:	Yes
Earthquake magnitude M _w :	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.20	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.00 m	Fill height:	N/A	Limit depth:	N/A

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
0.01	2.00	0.00	0.00	0.01	0.00	0.02	2.00	0.00	0.00	0.01	0.00
0.03	2.00	0.00	0.00	0.01	0.00	0.04	2.00	0.00	0.00	0.01	0.00
0.05	2.00	0.00	0.00	0.01	0.00	0.06	2.00	0.00	0.00	0.01	0.00
0.07	2.00	0.00	0.00	0.01	0.00	0.08	2.00	0.00	0.00	0.01	0.00
0.09	2.00	0.00	0.00	0.01	0.00	0.10	2.00	0.00	0.00	0.01	0.00
0.11	2.00	0.00	0.00	0.01	0.00	0.12	2.00	0.00	0.00	0.01	0.00
0.13	2.00	0.00	0.00	0.01	0.00	0.14	2.00	0.00	0.00	0.01	0.00
0.15	2.00	0.00	0.00	0.01	0.00	0.16	2.00	0.00	0.00	0.01	0.00
0.17	2.00	0.00	0.00	0.01	0.00	0.18	2.00	0.00	0.00	0.01	0.00
0.19	2.00	0.00	0.00	0.01	0.00	0.20	2.00	0.00	0.00	0.01	0.00
0.21	2.00	0.00	0.00	0.01	0.00	0.22	2.00	0.00	0.00	0.01	0.00
0.23	2.00	0.00	0.00	0.01	0.00	0.24	2.00	0.00	0.00	0.01	0.00
0.25	2.00	0.00	0.00	0.01	0.00	0.26	2.00	0.00	0.00	0.01	0.00
0.27	2.00	0.00	0.00	0.01	0.00	0.28	2.00	0.00	0.00	0.01	0.00
0.29	2.00	0.00	0.00	0.01	0.00	0.30	2.00	0.00	0.00	0.01	0.00
0.31	2.00	0.00	0.00	0.01	0.00	0.32	2.00	0.00	0.00	0.01	0.00
0.33	2.00	0.00	0.00	0.01	0.00	0.34	2.00	0.00	0.00	0.01	0.00
0.35	2.00	0.00	0.00	0.01	0.00	0.36	2.00	0.00	0.00	0.01	0.00
0.37	2.00	0.00	0.00	0.01	0.00	0.38	2.00	0.00	0.00	0.01	0.00
0.39	2.00	0.00	0.00	0.01	0.00	0.40	2.00	0.00	0.00	0.01	0.00
0.41	2.00	0.00	0.00	0.01	0.00	0.42	2.00	0.00	0.00	0.01	0.00
0.43	2.00	0.00	0.00	0.01	0.00	0.44	2.00	0.00	0.00	0.01	0.00
0.45	2.00	0.00	0.00	0.01	0.00	0.46	2.00	0.00	0.00	0.01	0.00
0.47	2.00	0.00	0.00	0.01	0.00	0.48	2.00	0.00	0.00	0.01	0.00
0.49	2.00	0.00	0.00	0.01	0.00	0.50	2.00	0.00	0.00	0.01	0.00
0.51	2.00	0.00	0.00	0.01	0.00	0.52	2.00	0.00	0.00	0.01	0.00
0.53	2.00	0.00	0.00	0.01	0.00	0.54	2.00	0.00	0.00	0.01	0.00
0.55	2.00	0.00	0.00	0.01	0.00	0.56	2.00	0.00	0.00	0.01	0.00
0.57	2.00	0.00	0.00	0.01	0.00	0.58	2.00	0.00	0.00	0.01	0.00
0.59	2.00	0.00	0.00	0.01	0.00	0.60	2.00	0.00	0.00	0.01	0.00
0.61	2.00	0.00	0.00	0.01	0.00	0.62	2.00	0.00	0.00	0.01	0.00
0.63	2.00	0.00	0.00	0.01	0.00	0.64	2.00	0.00	0.00	0.01	0.00
0.65	2.00	0.00	0.00	0.01	0.00	0.66	2.00	0.00	0.00	0.01	0.00
0.67	2.00	0.00	0.00	0.01	0.00	0.68	2.00	0.00	0.00	0.01	0.00
0.69	2.00	0.00	0.00	0.01	0.00	0.70	2.00	0.00	0.00	0.01	0.00
0.71	2.00	0.00	0.00	0.01	0.00	0.72	2.00	0.00	0.00	0.01	0.00
0.73	2.00	0.00	0.00	0.01	0.00	0.74	2.00	0.00	0.00	0.01	0.00
0.75	2.00	0.00	0.00	0.01	0.00	0.76	2.00	0.00	0.00	0.01	0.00
0.77	2.00	0.00	0.00	0.01	0.00	0.78	2.00	0.00	0.00	0.01	0.00
0.79	2.00	0.00	0.00	0.01	0.00	0.80	2.00	0.00	0.00	0.01	0.00
0.81	2.00	0.00	0.00	0.01	0.00	0.82	2.00	0.00	0.00	0.01	0.00
0.83	2.00	0.00	0.00	0.01	0.00	0.84	2.00	0.00	0.00	0.01	0.00
0.85	2.00	0.00	0.00	0.01	0.00	0.86	2.00	0.00	0.00	0.01	0.00
0.87	2.00	0.00	0.00	0.01	0.00	0.88	2.00	0.00	0.00	0.01	0.00
0.89	2.00	0.00	0.00	0.01	0.00	0.90	2.00	0.00	0.00	0.01	0.00
0.91	2.00	0.00	0.00	0.01	0.00	0.92	2.00	0.00	0.00	0.01	0.00
0.93	2.00	0.00	0.00	0.01	0.00	0.94	2.00	0.00	0.00	0.01	0.00
0.95	2.00	0.00	0.00	0.01	0.00	0.96	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
0.97	2.00	0.00	0.00	0.01	0.00	0.98	2.00	0.00	0.00	0.01	0.00
0.99	2.00	0.00	0.00	0.01	0.00	1.00	2.00	0.00	0.00	0.01	0.00
1.01	2.00	0.00	0.00	0.01	0.00	1.02	2.00	0.00	0.00	0.01	0.00
1.03	2.00	0.00	0.00	0.01	0.00	1.04	2.00	0.00	0.00	0.01	0.00
1.05	2.00	0.00	0.00	0.01	0.00	1.06	2.00	0.00	0.00	0.01	0.00
1.07	2.00	0.00	0.00	0.01	0.00	1.08	2.00	0.00	0.00	0.01	0.00
1.09	2.00	0.00	0.00	0.01	0.00	1.10	2.00	0.00	0.00	0.01	0.00
1.11	2.00	0.00	0.00	0.01	0.00	1.12	2.00	0.00	0.00	0.01	0.00
1.13	2.00	0.00	0.00	0.01	0.00	1.14	2.00	0.00	0.00	0.01	0.00
1.15	2.00	0.00	0.00	0.01	0.00	1.16	2.00	0.00	0.00	0.01	0.00
1.17	2.00	0.00	0.00	0.01	0.00	1.18	2.00	0.00	0.00	0.01	0.00
1.19	2.00	0.00	0.00	0.01	0.00	1.20	2.00	0.00	0.00	0.01	0.00
1.21	2.00	0.00	0.00	0.01	0.00	1.22	2.00	0.00	0.00	0.01	0.00
1.23	2.00	0.00	0.00	0.01	0.00	1.24	2.00	0.00	0.00	0.01	0.00
1.25	2.00	0.00	0.00	0.01	0.00	1.26	2.00	0.00	0.00	0.01	0.00
1.27	2.00	0.00	0.00	0.01	0.00	1.28	2.00	0.00	0.00	0.01	0.00
1.29	2.00	0.00	0.00	0.01	0.00	1.30	2.00	0.00	0.00	0.01	0.00
1.31	2.00	0.00	0.00	0.01	0.00	1.32	2.00	0.00	0.00	0.01	0.00
1.33	2.00	0.00	0.00	0.01	0.00	1.34	2.00	0.00	0.00	0.01	0.00
1.35	2.00	0.00	0.00	0.01	0.00	1.36	2.00	0.00	0.00	0.01	0.00
1.37	2.00	0.00	0.00	0.01	0.00	1.38	2.00	0.00	0.00	0.01	0.00
1.39	2.00	0.00	0.00	0.01	0.00	1.40	2.00	0.00	0.00	0.01	0.00
1.41	2.00	0.00	0.00	0.01	0.00	1.42	2.00	0.00	0.00	0.01	0.00
1.43	2.00	0.00	0.00	0.01	0.00	1.44	2.00	0.00	0.00	0.01	0.00
1.45	2.00	0.00	0.00	0.01	0.00	1.46	2.00	0.00	0.00	0.01	0.00
1.47	2.00	0.00	0.00	0.01	0.00	1.48	2.00	0.00	0.00	0.01	0.00
1.49	2.00	0.00	0.00	0.01	0.00	1.50	2.00	0.00	0.00	0.01	0.00
1.51	2.00	0.00	0.00	0.01	0.00	1.52	2.00	0.00	0.00	0.01	0.00
1.53	2.00	0.00	0.00	0.01	0.00	1.54	2.00	0.00	0.00	0.01	0.00
1.55	2.00	0.00	0.00	0.01	0.00	1.56	2.00	0.00	0.00	0.01	0.00
1.57	2.00	0.00	0.00	0.01	0.00	1.58	2.00	0.00	0.00	0.01	0.00
1.59	2.00	0.00	0.00	0.01	0.00	1.60	2.00	0.00	0.00	0.01	0.00
1.61	2.00	0.00	0.00	0.01	0.00	1.62	2.00	0.00	0.00	0.01	0.00
1.63	2.00	0.00	0.00	0.01	0.00	1.64	2.00	0.00	0.00	0.01	0.00
1.65	2.00	0.00	0.00	0.01	0.00	1.66	2.00	0.00	0.00	0.01	0.00
1.67	2.00	0.00	0.00	0.01	0.00	1.68	2.00	0.00	0.00	0.01	0.00
1.69	2.00	0.00	0.00	0.01	0.00	1.70	2.00	0.00	0.00	0.01	0.00
1.71	2.00	0.00	0.00	0.01	0.00	1.72	2.00	0.00	0.00	0.01	0.00
1.73	2.00	0.00	0.00	0.01	0.00	1.74	2.00	0.00	0.00	0.01	0.00
1.75	2.00	0.00	0.00	0.01	0.00	1.76	2.00	0.00	0.00	0.01	0.00
1.77	2.00	0.00	0.00	0.01	0.00	1.78	2.00	0.00	0.00	0.01	0.00
1.79	2.00	0.00	0.00	0.01	0.00	1.80	2.00	0.00	0.00	0.01	0.00
1.81	2.00	0.00	0.00	0.01	0.00	1.82	2.00	0.00	0.00	0.01	0.00
1.83	2.00	0.00	0.00	0.01	0.00	1.84	2.00	0.00	0.00	0.01	0.00
1.85	2.00	0.00	0.00	0.01	0.00	1.86	2.00	0.00	0.00	0.01	0.00
1.87	2.00	0.00	0.00	0.01	0.00	1.88	2.00	0.00	0.00	0.01	0.00
1.89	2.00	0.00	0.00	0.01	0.00	1.90	2.00	0.00	0.00	0.01	0.00
1.91	2.00	0.00	0.00	0.01	0.00	1.92	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
1.93	2.00	0.00	0.00	0.01	0.00	1.94	2.00	0.00	0.00	0.01	0.00
1.95	2.00	0.00	0.00	0.01	0.00	1.96	2.00	0.00	0.00	0.01	0.00
1.97	2.00	0.00	0.00	0.01	0.00	1.98	2.00	0.00	0.00	0.01	0.00
1.99	2.00	0.00	0.00	0.01	0.00	2.00	2.00	0.00	0.00	0.01	0.00
2.01	2.00	0.00	0.00	0.01	0.00	2.02	2.00	0.00	0.00	0.01	0.00
2.03	2.00	0.00	0.00	0.01	0.00	2.04	2.00	0.00	0.00	0.01	0.00
2.05	2.00	0.00	0.00	0.01	0.00	2.06	2.00	0.00	0.00	0.01	0.00
2.07	2.00	0.00	0.00	0.01	0.00	2.08	2.00	0.00	0.00	0.01	0.00
2.09	2.00	0.00	0.00	0.01	0.00	2.10	2.00	0.00	0.00	0.01	0.00
2.11	2.00	0.00	0.00	0.01	0.00	2.12	2.00	0.00	0.00	0.01	0.00
2.13	2.00	0.00	0.00	0.01	0.00	2.14	2.00	0.00	0.00	0.01	0.00
2.15	2.00	0.00	0.00	0.01	0.00	2.16	2.00	0.00	0.00	0.01	0.00
2.17	2.00	0.00	0.00	0.01	0.00	2.18	2.00	0.00	0.00	0.01	0.00
2.19	2.00	0.00	0.00	0.01	0.00	2.20	2.00	0.00	0.00	0.01	0.00
2.21	2.00	0.00	0.00	0.01	0.00	2.22	2.00	0.00	0.00	0.01	0.00
2.23	2.00	0.00	0.00	0.01	0.00	2.24	2.00	0.00	0.00	0.01	0.00
2.25	2.00	0.00	0.00	0.01	0.00	2.26	2.00	0.00	0.00	0.01	0.00
2.27	2.00	0.00	0.00	0.01	0.00	2.28	2.00	0.00	0.00	0.01	0.00
2.29	2.00	0.00	0.00	0.01	0.00	2.30	2.00	0.00	0.00	0.01	0.00
2.31	2.00	0.00	0.00	0.01	0.00	2.32	2.00	0.00	0.00	0.01	0.00
2.33	2.00	0.00	0.00	0.01	0.00	2.34	2.00	0.00	0.00	0.01	0.00
2.35	2.00	0.00	0.00	0.01	0.00	2.36	2.00	0.00	0.00	0.01	0.00
2.37	2.00	0.00	0.00	0.01	0.00	2.38	2.00	0.00	0.00	0.01	0.00
2.39	2.00	0.00	0.00	0.01	0.00	2.40	2.00	0.00	0.00	0.01	0.00
2.41	2.00	0.00	0.00	0.01	0.00	2.42	2.00	0.00	0.00	0.01	0.00
2.43	2.00	0.00	0.00	0.01	0.00	2.44	2.00	0.00	0.00	0.01	0.00
2.45	2.00	0.00	0.00	0.01	0.00	2.46	2.00	0.00	0.00	0.01	0.00
2.47	2.00	0.00	0.00	0.01	0.00	2.48	2.00	0.00	0.00	0.01	0.00
2.49	2.00	0.00	0.00	0.01	0.00	2.50	2.00	0.00	0.00	0.01	0.00
2.51	2.00	0.00	0.00	0.01	0.00	2.52	2.00	0.00	0.00	0.01	0.00
2.53	2.00	0.00	0.00	0.01	0.00	2.54	2.00	0.00	0.00	0.01	0.00
2.55	2.00	0.00	0.00	0.01	0.00	2.56	2.00	0.00	0.00	0.01	0.00
2.57	2.00	0.00	0.00	0.01	0.00	2.58	2.00	0.00	0.00	0.01	0.00
2.59	2.00	0.00	0.00	0.01	0.00	2.60	2.00	0.00	0.00	0.01	0.00
2.61	2.00	0.00	0.00	0.01	0.00	2.62	2.00	0.00	0.00	0.01	0.00
2.63	2.00	0.00	0.00	0.01	0.00	2.64	2.00	0.00	0.00	0.01	0.00
2.65	2.00	0.00	0.00	0.01	0.00	2.66	2.00	0.00	0.00	0.01	0.00
2.67	2.00	0.00	0.00	0.01	0.00	2.68	2.00	0.00	0.00	0.01	0.00
2.69	2.00	0.00	0.00	0.01	0.00	2.70	2.00	0.00	0.00	0.01	0.00
2.71	2.00	0.00	0.00	0.01	0.00	2.72	2.00	0.00	0.00	0.01	0.00
2.73	2.00	0.00	0.00	0.01	0.00	2.74	2.00	0.00	0.00	0.01	0.00
2.75	2.00	0.00	0.00	0.01	0.00	2.76	2.00	0.00	0.00	0.01	0.00
2.77	2.00	0.00	0.00	0.01	0.00	2.78	2.00	0.00	0.00	0.01	0.00
2.79	2.00	0.00	0.00	0.01	0.00	2.80	2.00	0.00	0.00	0.01	0.00
2.81	2.00	0.00	0.00	0.01	0.00	2.82	2.00	0.00	0.00	0.01	0.00
2.83	2.00	0.00	0.00	0.01	0.00	2.84	2.00	0.00	0.00	0.01	0.00
2.85	2.00	0.00	0.00	0.01	0.00	2.86	2.00	0.00	0.00	0.01	0.00
2.87	2.00	0.00	0.00	0.01	0.00	2.88	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
2.89	2.00	0.00	0.00	0.01	0.00	2.90	2.00	0.00	0.00	0.01	0.00
2.91	2.00	0.00	0.00	0.01	0.00	2.92	2.00	0.00	0.00	0.01	0.00
2.93	2.00	0.00	0.00	0.01	0.00	2.94	2.00	0.00	0.00	0.01	0.00
2.95	2.00	0.00	0.00	0.01	0.00	2.96	2.00	0.00	0.00	0.01	0.00
2.97	2.00	0.00	0.00	0.01	0.00	2.98	0.84	0.00	0.00	0.01	0.01
2.99	0.85	0.00	0.00	0.01	0.01	3.00	0.85	0.00	0.00	0.01	0.01
3.01	0.85	0.00	0.00	0.01	0.01	3.02	0.86	0.00	0.00	0.01	0.01
3.03	0.86	0.00	0.00	0.01	0.01	3.04	0.87	0.00	0.00	0.01	0.01
3.05	2.00	0.00	0.00	0.01	0.00	3.06	2.00	0.00	0.00	0.01	0.00
3.07	2.00	0.00	0.00	0.01	0.00	3.08	2.00	0.00	0.00	0.01	0.00
3.09	2.00	0.00	0.00	0.01	0.00	3.10	2.00	0.00	0.00	0.01	0.00
3.11	2.00	0.00	0.00	0.01	0.00	3.12	2.00	0.00	0.00	0.01	0.00
3.13	2.00	0.00	0.00	0.01	0.00	3.14	2.00	0.00	0.00	0.01	0.00
3.15	2.00	0.00	0.00	0.01	0.00	3.16	2.00	0.00	0.00	0.01	0.00
3.17	2.00	0.00	0.00	0.01	0.00	3.18	2.00	0.00	0.00	0.01	0.00
3.19	2.00	0.00	0.00	0.01	0.00	3.20	2.00	0.00	0.00	0.01	0.00
3.21	2.00	0.00	0.00	0.01	0.00	3.22	2.00	0.00	0.00	0.01	0.00
3.23	0.86	0.00	0.00	0.01	0.01	3.24	0.86	0.00	0.00	0.01	0.01
3.25	0.86	0.00	0.00	0.01	0.01	3.26	0.86	0.00	0.00	0.01	0.01
3.27	0.86	0.00	0.00	0.01	0.01	3.28	2.00	0.00	0.00	0.01	0.00
3.29	2.00	0.00	0.00	0.01	0.00	3.30	2.00	0.00	0.00	0.01	0.00
3.31	2.00	0.00	0.00	0.01	0.00	3.32	2.00	0.00	0.00	0.01	0.00
3.33	2.00	0.00	0.00	0.01	0.00	3.34	2.00	0.00	0.00	0.01	0.00
3.35	2.00	0.00	0.00	0.01	0.00	3.36	2.00	0.00	0.00	0.01	0.00
3.37	2.00	0.00	0.00	0.01	0.00	3.38	2.00	0.00	0.00	0.01	0.00
3.39	2.00	0.00	0.00	0.01	0.00	3.40	2.00	0.00	0.00	0.01	0.00
3.41	2.00	0.00	0.00	0.01	0.00	3.42	2.00	0.00	0.00	0.01	0.00
3.43	2.00	0.00	0.00	0.01	0.00	3.44	2.00	0.00	0.00	0.01	0.00
3.45	2.00	0.00	0.00	0.01	0.00	3.46	2.00	0.00	0.00	0.01	0.00
3.47	2.00	0.00	0.00	0.01	0.00	3.48	2.00	0.00	0.00	0.01	0.00
3.49	2.00	0.00	0.00	0.01	0.00	3.50	2.00	0.00	0.00	0.01	0.00
3.51	2.00	0.00	0.00	0.01	0.00	3.52	0.83	0.00	0.00	0.01	0.01
3.53	0.84	0.00	0.00	0.01	0.01	3.54	0.85	0.00	0.00	0.01	0.01
3.55	0.85	0.00	0.00	0.01	0.01	3.56	0.86	0.00	0.00	0.01	0.01
3.57	0.86	0.00	0.00	0.01	0.01	3.58	0.86	0.00	0.00	0.01	0.01
3.59	0.86	0.00	0.00	0.01	0.01	3.60	0.87	0.00	0.00	0.01	0.01
3.61	0.88	0.00	0.00	0.01	0.01	3.62	0.88	0.00	0.00	0.01	0.01
3.63	0.88	0.00	0.00	0.01	0.01	3.64	2.00	0.00	0.00	0.01	0.00
3.65	2.00	0.00	0.00	0.01	0.00	3.66	2.00	0.00	0.00	0.01	0.00
3.67	2.00	0.00	0.00	0.01	0.00	3.68	2.00	0.00	0.00	0.01	0.00
3.69	2.00	0.00	0.00	0.01	0.00	3.70	2.00	0.00	0.00	0.01	0.00
3.71	2.00	0.00	0.00	0.01	0.00	3.72	2.00	0.00	0.00	0.01	0.00
3.73	2.00	0.00	0.00	0.01	0.00	3.74	2.00	0.00	0.00	0.01	0.00
3.75	2.00	0.00	0.00	0.01	0.00	3.76	2.00	0.00	0.00	0.01	0.00
3.77	2.00	0.00	0.00	0.01	0.00	3.78	2.00	0.00	0.00	0.01	0.00
3.79	2.00	0.00	0.00	0.01	0.00	3.80	2.00	0.00	0.00	0.01	0.00
3.81	2.00	0.00	0.00	0.01	0.00	3.82	2.00	0.00	0.00	0.01	0.00
3.83	2.00	0.00	0.00	0.01	0.00	3.84	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
3.85	2.00	0.00	0.00	0.01	0.00	3.86	2.00	0.00	0.00	0.01	0.00
3.87	2.00	0.00	0.00	0.01	0.00	3.88	2.00	0.00	0.00	0.01	0.00
3.89	2.00	0.00	0.00	0.01	0.00	3.90	2.00	0.00	0.00	0.01	0.00
3.91	2.00	0.00	0.00	0.01	0.00	3.92	2.00	0.00	0.00	0.01	0.00
3.93	2.00	0.00	0.00	0.01	0.00	3.94	2.00	0.00	0.00	0.01	0.00
3.95	2.00	0.00	0.00	0.01	0.00	3.96	2.00	0.00	0.00	0.01	0.00
3.97	2.00	0.00	0.00	0.01	0.00	3.98	0.84	0.00	0.00	0.01	0.01
3.99	0.85	0.00	0.00	0.01	0.01	4.00	0.85	0.00	0.00	0.01	0.01
4.01	0.85	0.00	0.00	0.01	0.01	4.02	0.85	0.00	0.00	0.01	0.01
4.03	0.85	0.00	0.00	0.01	0.01	4.04	0.85	0.00	0.00	0.01	0.01
4.05	0.85	0.00	0.00	0.01	0.01	4.06	2.00	0.00	0.00	0.01	0.00
4.07	2.00	0.00	0.00	0.01	0.00	4.08	2.00	0.00	0.00	0.01	0.00
4.09	2.00	0.00	0.00	0.01	0.00	4.10	2.00	0.00	0.00	0.01	0.00
4.11	2.00	0.00	0.00	0.01	0.00	4.12	2.00	0.00	0.00	0.01	0.00
4.13	2.00	0.00	0.00	0.01	0.00	4.14	2.00	0.00	0.00	0.01	0.00
4.15	2.00	0.00	0.00	0.01	0.00	4.16	2.00	0.00	0.00	0.01	0.00
4.17	2.00	0.00	0.00	0.01	0.00	4.18	2.00	0.00	0.00	0.01	0.00
4.19	2.00	0.00	0.00	0.01	0.00	4.20	2.00	0.00	0.00	0.01	0.00
4.21	2.00	0.00	0.00	0.01	0.00	4.22	2.00	0.00	0.00	0.01	0.00
4.23	2.00	0.00	0.00	0.01	0.00	4.24	2.00	0.00	0.00	0.01	0.00
4.25	2.00	0.00	0.00	0.01	0.00	4.26	2.00	0.00	0.00	0.01	0.00
4.27	2.00	0.00	0.00	0.01	0.00	4.28	2.00	0.00	0.00	0.01	0.00
4.29	2.00	0.00	0.00	0.01	0.00	4.30	2.00	0.00	0.00	0.01	0.00
4.31	2.00	0.00	0.00	0.01	0.00	4.32	2.00	0.00	0.00	0.01	0.00
4.33	2.00	0.00	0.00	0.01	0.00	4.34	2.00	0.00	0.00	0.01	0.00
4.35	2.00	0.00	0.00	0.01	0.00	4.36	2.00	0.00	0.00	0.01	0.00
4.37	2.00	0.00	0.00	0.01	0.00	4.38	2.00	0.00	0.00	0.01	0.00
4.39	2.00	0.00	0.00	0.01	0.00	4.40	2.00	0.00	0.00	0.01	0.00
4.41	2.00	0.00	0.00	0.01	0.00	4.42	2.00	0.00	0.00	0.01	0.00
4.43	2.00	0.00	0.00	0.01	0.00	4.44	2.00	0.00	0.00	0.01	0.00
4.45	2.00	0.00	0.00	0.01	0.00	4.46	2.00	0.00	0.00	0.01	0.00
4.47	2.00	0.00	0.00	0.01	0.00	4.48	2.00	0.00	0.00	0.01	0.00
4.49	2.00	0.00	0.00	0.01	0.00	4.50	2.00	0.00	0.00	0.01	0.00
4.51	2.00	0.00	0.00	0.01	0.00	4.52	2.00	0.00	0.00	0.01	0.00
4.53	2.00	0.00	0.00	0.01	0.00	4.54	2.00	0.00	0.00	0.01	0.00
4.55	2.00	0.00	0.00	0.01	0.00	4.56	2.00	0.00	0.00	0.01	0.00
4.57	2.00	0.00	0.00	0.01	0.00	4.58	2.00	0.00	0.00	0.01	0.00
4.59	2.00	0.00	0.00	0.01	0.00	4.60	2.00	0.00	0.00	0.01	0.00
4.61	2.00	0.00	0.00	0.01	0.00	4.62	2.00	0.00	0.00	0.01	0.00
4.63	2.00	0.00	0.00	0.01	0.00	4.64	2.00	0.00	0.00	0.01	0.00
4.65	2.00	0.00	0.00	0.01	0.00	4.66	2.00	0.00	0.00	0.01	0.00
4.67	2.00	0.00	0.00	0.01	0.00	4.68	2.00	0.00	0.00	0.01	0.00
4.69	2.00	0.00	0.00	0.01	0.00	4.70	2.00	0.00	0.00	0.01	0.00
4.71	2.00	0.00	0.00	0.01	0.00	4.72	2.00	0.00	0.00	0.01	0.00
4.73	2.00	0.00	0.00	0.01	0.00	4.74	2.00	0.00	0.00	0.01	0.00
4.75	2.00	0.00	0.00	0.01	0.00	4.76	2.00	0.00	0.00	0.01	0.00
4.77	2.00	0.00	0.00	0.01	0.00	4.78	2.00	0.00	0.00	0.01	0.00
4.79	2.00	0.00	0.00	0.01	0.00	4.80	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
4.81	2.00	0.00	0.00	0.01	0.00	4.82	2.00	0.00	0.00	0.01	0.00
4.83	2.00	0.00	0.00	0.01	0.00	4.84	2.00	0.00	0.00	0.01	0.00
4.85	2.00	0.00	0.00	0.01	0.00	4.86	2.00	0.00	0.00	0.01	0.00
4.87	2.00	0.00	0.00	0.01	0.00	4.88	2.00	0.00	0.00	0.01	0.00
4.89	2.00	0.00	0.00	0.01	0.00	4.90	2.00	0.00	0.00	0.01	0.00
4.91	2.00	0.00	0.00	0.01	0.00	4.92	2.00	0.00	0.00	0.01	0.00
4.93	2.00	0.00	0.00	0.01	0.00	4.94	2.00	0.00	0.00	0.01	0.00
4.95	2.00	0.00	0.00	0.01	0.00	4.96	2.00	0.00	0.00	0.01	0.00
4.97	2.00	0.00	0.00	0.01	0.00	4.98	2.00	0.00	0.00	0.01	0.00
4.99	2.00	0.00	0.00	0.01	0.00	5.00	2.00	0.00	0.00	0.01	0.00
5.01	2.00	0.00	0.00	0.01	0.00	5.02	2.00	0.00	0.00	0.01	0.00
5.03	2.00	0.00	0.00	0.01	0.00	5.04	2.00	0.00	0.00	0.01	0.00
5.05	2.00	0.00	0.00	0.01	0.00	5.06	2.00	0.00	0.00	0.01	0.00
5.07	2.00	0.00	0.00	0.01	0.00	5.08	2.00	0.00	0.00	0.01	0.00
5.09	2.00	0.00	0.00	0.01	0.00	5.10	2.00	0.00	0.00	0.01	0.00
5.11	2.00	0.00	0.00	0.01	0.00	5.12	2.00	0.00	0.00	0.01	0.00
5.13	2.00	0.00	0.00	0.01	0.00	5.14	2.00	0.00	0.00	0.01	0.00
5.15	2.00	0.00	0.00	0.01	0.00	5.16	2.00	0.00	0.00	0.01	0.00
5.17	2.00	0.00	0.00	0.01	0.00	5.18	2.00	0.00	0.00	0.01	0.00
5.19	2.00	0.00	0.00	0.01	0.00	5.20	2.00	0.00	0.00	0.01	0.00
5.21	2.00	0.00	0.00	0.01	0.00	5.22	2.00	0.00	0.00	0.01	0.00
5.23	2.00	0.00	0.00	0.01	0.00	5.24	2.00	0.00	0.00	0.01	0.00
5.25	2.00	0.00	0.00	0.01	0.00	5.26	2.00	0.00	0.00	0.01	0.00
5.27	2.00	0.00	0.00	0.01	0.00	5.28	2.00	0.00	0.00	0.01	0.00
5.29	2.00	0.00	0.00	0.01	0.00	5.30	2.00	0.00	0.00	0.01	0.00
5.31	2.00	0.00	0.00	0.01	0.00	5.32	2.00	0.00	0.00	0.01	0.00
5.33	2.00	0.00	0.00	0.01	0.00	5.34	2.00	0.00	0.00	0.01	0.00
5.35	2.00	0.00	0.00	0.01	0.00	5.36	2.00	0.00	0.00	0.01	0.00
5.37	2.00	0.00	0.00	0.01	0.00	5.38	2.00	0.00	0.00	0.01	0.00
5.39	2.00	0.00	0.00	0.01	0.00	5.40	2.00	0.00	0.00	0.01	0.00
5.41	2.00	0.00	0.00	0.01	0.00	5.42	2.00	0.00	0.00	0.01	0.00
5.43	2.00	0.00	0.00	0.01	0.00	5.44	2.00	0.00	0.00	0.01	0.00
5.45	2.00	0.00	0.00	0.01	0.00	5.46	2.00	0.00	0.00	0.01	0.00
5.47	2.00	0.00	0.00	0.01	0.00	5.48	2.00	0.00	0.00	0.01	0.00
5.49	2.00	0.00	0.00	0.01	0.00	5.50	2.00	0.00	0.00	0.01	0.00
5.51	2.00	0.00	0.00	0.01	0.00	5.52	2.00	0.00	0.00	0.01	0.00
5.53	2.00	0.00	0.00	0.01	0.00	5.54	2.00	0.00	0.00	0.01	0.00
5.55	2.00	0.00	0.00	0.01	0.00	5.56	2.00	0.00	0.00	0.01	0.00
5.57	2.00	0.00	0.00	0.01	0.00	5.58	2.00	0.00	0.00	0.01	0.00
5.59	2.00	0.00	0.00	0.01	0.00	5.60	2.00	0.00	0.00	0.01	0.00
5.61	2.00	0.00	0.00	0.01	0.00	5.62	2.00	0.00	0.00	0.01	0.00
5.63	2.00	0.00	0.00	0.01	0.00	5.64	2.00	0.00	0.00	0.01	0.00
5.65	2.00	0.00	0.00	0.01	0.00	5.66	2.00	0.00	0.00	0.01	0.00
5.67	2.00	0.00	0.00	0.01	0.00	5.68	2.00	0.00	0.00	0.01	0.00
5.69	2.00	0.00	0.00	0.01	0.00	5.70	2.00	0.00	0.00	0.01	0.00
5.71	2.00	0.00	0.00	0.01	0.00	5.72	2.00	0.00	0.00	0.01	0.00
5.73	2.00	0.00	0.00	0.01	0.00	5.74	2.00	0.00	0.00	0.01	0.00
5.75	2.00	0.00	0.00	0.01	0.00	5.76	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
5.77	2.00	0.00	0.00	0.01	0.00	5.78	2.00	0.00	0.00	0.01	0.00
5.79	2.00	0.00	0.00	0.01	0.00	5.80	2.00	0.00	0.00	0.01	0.00
5.81	2.00	0.00	0.00	0.01	0.00	5.82	2.00	0.00	0.00	0.01	0.00
5.83	2.00	0.00	0.00	0.01	0.00	5.84	2.00	0.00	0.00	0.01	0.00
5.85	2.00	0.00	0.00	0.01	0.00	5.86	2.00	0.00	0.00	0.01	0.00
5.87	2.00	0.00	0.00	0.01	0.00	5.88	2.00	0.00	0.00	0.01	0.00
5.89	2.00	0.00	0.00	0.01	0.00	5.90	2.00	0.00	0.00	0.01	0.00
5.91	2.00	0.00	0.00	0.01	0.00	5.92	2.00	0.00	0.00	0.01	0.00
5.93	2.00	0.00	0.00	0.01	0.00	5.94	2.00	0.00	0.00	0.01	0.00
5.95	2.00	0.00	0.00	0.01	0.00	5.96	2.00	0.00	0.00	0.01	0.00
5.97	2.00	0.00	0.00	0.01	0.00	5.98	2.00	0.00	0.00	0.01	0.00
5.99	2.00	0.00	0.00	0.01	0.00	6.00	2.00	0.00	0.00	0.01	0.00
6.01	2.00	0.00	0.00	0.01	0.00	6.02	2.00	0.00	0.00	0.01	0.00
6.03	2.00	0.00	0.00	0.01	0.00	6.04	2.00	0.00	0.00	0.01	0.00
6.05	2.00	0.00	0.00	0.01	0.00	6.06	2.00	0.00	0.00	0.01	0.00
6.07	2.00	0.00	0.00	0.01	0.00	6.08	2.00	0.00	0.00	0.01	0.00
6.09	2.00	0.00	0.00	0.01	0.00	6.10	2.00	0.00	0.00	0.01	0.00
6.11	2.00	0.00	0.00	0.01	0.00	6.12	2.00	0.00	0.00	0.01	0.00
6.13	2.00	0.00	0.00	0.01	0.00	6.14	2.00	0.00	0.00	0.01	0.00
6.15	2.00	0.00	0.00	0.01	0.00	6.16	2.00	0.00	0.00	0.01	0.00
6.17	2.00	0.00	0.00	0.01	0.00	6.18	2.00	0.00	0.00	0.01	0.00
6.19	2.00	0.00	0.00	0.01	0.00	6.20	2.00	0.00	0.00	0.01	0.00
6.21	2.00	0.00	0.00	0.01	0.00	6.22	2.00	0.00	0.00	0.01	0.00
6.23	2.00	0.00	0.00	0.01	0.00	6.24	2.00	0.00	0.00	0.01	0.00
6.25	2.00	0.00	0.00	0.01	0.00	6.26	2.00	0.00	0.00	0.01	0.00
6.27	2.00	0.00	0.00	0.01	0.00	6.28	2.00	0.00	0.00	0.01	0.00
6.29	2.00	0.00	0.00	0.01	0.00	6.30	2.00	0.00	0.00	0.01	0.00
6.31	2.00	0.00	0.00	0.01	0.00	6.32	2.00	0.00	0.00	0.01	0.00
6.33	2.00	0.00	0.00	0.01	0.00	6.34	2.00	0.00	0.00	0.01	0.00
6.35	2.00	0.00	0.00	0.01	0.00	6.36	2.00	0.00	0.00	0.01	0.00
6.37	2.00	0.00	0.00	0.01	0.00	6.38	2.00	0.00	0.00	0.01	0.00
6.39	2.00	0.00	0.00	0.01	0.00	6.40	2.00	0.00	0.00	0.01	0.00
6.41	2.00	0.00	0.00	0.01	0.00	6.42	2.00	0.00	0.00	0.01	0.00
6.43	2.00	0.00	0.00	0.01	0.00	6.44	2.00	0.00	0.00	0.01	0.00
6.45	2.00	0.00	0.00	0.01	0.00	6.46	2.00	0.00	0.00	0.01	0.00
6.47	2.00	0.00	0.00	0.01	0.00	6.48	2.00	0.00	0.00	0.01	0.00
6.49	2.00	0.00	0.00	0.01	0.00	6.50	2.00	0.00	0.00	0.01	0.00
6.51	2.00	0.00	0.00	0.01	0.00	6.52	2.00	0.00	0.00	0.01	0.00
6.53	2.00	0.00	0.00	0.01	0.00	6.54	2.00	0.00	0.00	0.01	0.00
6.55	2.00	0.00	0.00	0.01	0.00	6.56	2.00	0.00	0.00	0.01	0.00
6.57	2.00	0.00	0.00	0.01	0.00	6.58	2.00	0.00	0.00	0.01	0.00
6.59	2.00	0.00	0.00	0.01	0.00	6.60	2.00	0.00	0.00	0.01	0.00
6.61	2.00	0.00	0.00	0.01	0.00	6.62	2.00	0.00	0.00	0.01	0.00
6.63	2.00	0.00	0.00	0.01	0.00	6.64	2.00	0.00	0.00	0.01	0.00
6.65	2.00	0.00	0.00	0.01	0.00	6.66	2.00	0.00	0.00	0.01	0.00
6.67	2.00	0.00	0.00	0.01	0.00	6.68	2.00	0.00	0.00	0.01	0.00
6.69	2.00	0.00	0.00	0.01	0.00	6.70	2.00	0.00	0.00	0.01	0.00
6.71	2.00	0.00	0.00	0.01	0.00	6.72	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
6.73	2.00	0.00	0.00	0.01	0.00	6.74	2.00	0.00	0.00	0.01	0.00
6.75	2.00	0.00	0.00	0.01	0.00	6.76	2.00	0.00	0.00	0.01	0.00
6.77	2.00	0.00	0.00	0.01	0.00	6.78	2.00	0.00	0.00	0.01	0.00
6.79	2.00	0.00	0.00	0.01	0.00	6.80	2.00	0.00	0.00	0.01	0.00
6.81	2.00	0.00	0.00	0.01	0.00	6.82	2.00	0.00	0.00	0.01	0.00
6.83	2.00	0.00	0.00	0.01	0.00	6.84	2.00	0.00	0.00	0.01	0.00
6.85	2.00	0.00	0.00	0.01	0.00	6.86	2.00	0.00	0.00	0.01	0.00
6.87	2.00	0.00	0.00	0.01	0.00	6.88	2.00	0.00	0.00	0.01	0.00
6.89	2.00	0.00	0.00	0.01	0.00	6.90	2.00	0.00	0.00	0.01	0.00
6.91	2.00	0.00	0.00	0.01	0.00	6.92	2.00	0.00	0.00	0.01	0.00
6.93	2.00	0.00	0.00	0.01	0.00	6.94	2.00	0.00	0.00	0.01	0.00
6.95	2.00	0.00	0.00	0.01	0.00	6.96	2.00	0.00	0.00	0.01	0.00
6.97	2.00	0.00	0.00	0.01	0.00	6.98	2.00	0.00	0.00	0.01	0.00
6.99	2.00	0.00	0.00	0.01	0.00	7.00	2.00	0.00	0.00	0.01	0.00
7.01	2.00	0.00	0.00	0.01	0.00	7.02	2.00	0.00	0.00	0.01	0.00
7.03	2.00	0.00	0.00	0.01	0.00	7.04	2.00	0.00	0.00	0.01	0.00
7.05	2.00	0.00	0.00	0.01	0.00	7.06	2.00	0.00	0.00	0.01	0.00
7.07	2.00	0.00	0.00	0.01	0.00	7.08	2.00	0.00	0.00	0.01	0.00
7.09	2.00	0.00	0.00	0.01	0.00	7.10	2.00	0.00	0.00	0.01	0.00
7.11	2.00	0.00	0.00	0.01	0.00	7.12	2.00	0.00	0.00	0.01	0.00
7.13	2.00	0.00	0.00	0.01	0.00	7.14	2.00	0.00	0.00	0.01	0.00
7.15	2.00	0.00	0.00	0.01	0.00	7.16	2.00	0.00	0.00	0.01	0.00
7.17	2.00	0.00	0.00	0.01	0.00	7.18	2.00	0.00	0.00	0.01	0.00
7.19	2.00	0.00	0.00	0.01	0.00	7.20	2.00	0.00	0.00	0.01	0.00
7.21	2.00	0.00	0.00	0.01	0.00	7.22	2.00	0.00	0.00	0.01	0.00
7.23	2.00	0.00	0.00	0.01	0.00	7.24	2.00	0.00	0.00	0.01	0.00
7.25	2.00	0.00	0.00	0.01	0.00	7.26	2.00	0.00	0.00	0.01	0.00
7.27	2.00	0.00	0.00	0.01	0.00	7.28	2.00	0.00	0.00	0.01	0.00
7.29	2.00	0.00	0.00	0.01	0.00	7.30	2.00	0.00	0.00	0.01	0.00
7.31	2.00	0.00	0.00	0.01	0.00	7.32	2.00	0.00	0.00	0.01	0.00
7.33	2.00	0.00	0.00	0.01	0.00	7.34	2.00	0.00	0.00	0.01	0.00
7.35	2.00	0.00	0.00	0.01	0.00	7.36	2.00	0.00	0.00	0.01	0.00
7.37	2.00	0.00	0.00	0.01	0.00	7.38	2.00	0.00	0.00	0.01	0.00
7.39	2.00	0.00	0.00	0.01	0.00	7.40	2.00	0.00	0.00	0.01	0.00
7.41	2.00	0.00	0.00	0.01	0.00	7.42	2.00	0.00	0.00	0.01	0.00
7.43	2.00	0.00	0.00	0.01	0.00	7.44	2.00	0.00	0.00	0.01	0.00
7.45	2.00	0.00	0.00	0.01	0.00	7.46	2.00	0.00	0.00	0.01	0.00
7.47	2.00	0.00	0.00	0.01	0.00	7.48	2.00	0.00	0.00	0.01	0.00
7.49	2.00	0.00	0.00	0.01	0.00	7.50	2.00	0.00	0.00	0.01	0.00
7.51	2.00	0.00	0.00	0.01	0.00	7.52	2.00	0.00	0.00	0.01	0.00
7.53	2.00	0.00	0.00	0.01	0.00	7.54	2.00	0.00	0.00	0.01	0.00
7.55	2.00	0.00	0.00	0.01	0.00	7.56	2.00	0.00	0.00	0.01	0.00
7.57	2.00	0.00	0.00	0.01	0.00	7.58	2.00	0.00	0.00	0.01	0.00
7.59	2.00	0.00	0.00	0.01	0.00	7.60	2.00	0.00	0.00	0.01	0.00
7.61	2.00	0.00	0.00	0.01	0.00	7.62	2.00	0.00	0.00	0.01	0.00
7.63	2.00	0.00	0.00	0.01	0.00	7.64	2.00	0.00	0.00	0.01	0.00
7.65	2.00	0.00	0.00	0.01	0.00	7.66	2.00	0.00	0.00	0.01	0.00
7.67	2.00	0.00	0.00	0.01	0.00	7.68	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
7.69	2.00	0.00	0.00	0.01	0.00	7.70	2.00	0.00	0.00	0.01	0.00
7.71	2.00	0.00	0.00	0.01	0.00	7.72	2.00	0.00	0.00	0.01	0.00
7.73	2.00	0.00	0.00	0.01	0.00	7.74	2.00	0.00	0.00	0.01	0.00
7.75	2.00	0.00	0.00	0.01	0.00	7.76	2.00	0.00	0.00	0.01	0.00
7.77	2.00	0.00	0.00	0.01	0.00	7.78	2.00	0.00	0.00	0.01	0.00
7.79	2.00	0.00	0.00	0.01	0.00	7.80	2.00	0.00	0.00	0.01	0.00
7.81	2.00	0.00	0.00	0.01	0.00	7.82	2.00	0.00	0.00	0.01	0.00
7.83	2.00	0.00	0.00	0.01	0.00	7.84	2.00	0.00	0.00	0.01	0.00
7.85	2.00	0.00	0.00	0.01	0.00	7.86	2.00	0.00	0.00	0.01	0.00
7.87	2.00	0.00	0.00	0.01	0.00	7.88	2.00	0.00	0.00	0.01	0.00
7.89	2.00	0.00	0.00	0.01	0.00	7.90	2.00	0.00	0.00	0.01	0.00
7.91	2.00	0.00	0.00	0.01	0.00	7.92	2.00	0.00	0.00	0.01	0.00
7.93	2.00	0.00	0.00	0.01	0.00	7.94	2.00	0.00	0.00	0.01	0.00
7.95	2.00	0.00	0.00	0.01	0.00	7.96	2.00	0.00	0.00	0.01	0.00
7.97	2.00	0.00	0.00	0.01	0.00	7.98	2.00	0.00	0.00	0.01	0.00
7.99	2.00	0.00	0.00	0.01	0.00	8.00	2.00	0.00	0.00	0.01	0.00
8.01	2.00	0.00	0.00	0.01	0.00	8.02	2.00	0.00	0.00	0.01	0.00
8.03	2.00	0.00	0.00	0.01	0.00	8.04	2.00	0.00	0.00	0.01	0.00
8.05	2.00	0.00	0.00	0.01	0.00	8.06	2.00	0.00	0.00	0.01	0.00
8.07	2.00	0.00	0.00	0.01	0.00	8.08	2.00	0.00	0.00	0.01	0.00
8.09	2.00	0.00	0.00	0.01	0.00	8.10	2.00	0.00	0.00	0.01	0.00
8.11	2.00	0.00	0.00	0.01	0.00	8.12	2.00	0.00	0.00	0.01	0.00
8.13	2.00	0.00	0.00	0.01	0.00	8.14	2.00	0.00	0.00	0.01	0.00
8.15	2.00	0.00	0.00	0.01	0.00	8.16	2.00	0.00	0.00	0.01	0.00
8.17	2.00	0.00	0.00	0.01	0.00	8.18	2.00	0.00	0.00	0.01	0.00
8.19	2.00	0.00	0.00	0.01	0.00	8.20	2.00	0.00	0.00	0.01	0.00
8.21	2.00	0.00	0.00	0.01	0.00	8.22	2.00	0.00	0.00	0.01	0.00
8.23	2.00	0.00	0.00	0.01	0.00	8.24	2.00	0.00	0.00	0.01	0.00
8.25	2.00	0.00	0.00	0.01	0.00	8.26	2.00	0.00	0.00	0.01	0.00
8.27	2.00	0.00	0.00	0.01	0.00	8.28	2.00	0.00	0.00	0.01	0.00
8.29	2.00	0.00	0.00	0.01	0.00	8.30	2.00	0.00	0.00	0.01	0.00
8.31	2.00	0.00	0.00	0.01	0.00	8.32	2.00	0.00	0.00	0.01	0.00
8.33	2.00	0.00	0.00	0.01	0.00	8.34	2.00	0.00	0.00	0.01	0.00
8.35	2.00	0.00	0.00	0.01	0.00	8.36	2.00	0.00	0.00	0.01	0.00
8.37	2.00	0.00	0.00	0.01	0.00	8.38	2.00	0.00	0.00	0.01	0.00
8.39	2.00	0.00	0.00	0.01	0.00	8.40	2.00	0.00	0.00	0.01	0.00
8.41	2.00	0.00	0.00	0.01	0.00	8.42	2.00	0.00	0.00	0.01	0.00
8.43	2.00	0.00	0.00	0.01	0.00	8.44	2.00	0.00	0.00	0.01	0.00
8.45	2.00	0.00	0.00	0.01	0.00	8.46	2.00	0.00	0.00	0.01	0.00
8.47	2.00	0.00	0.00	0.01	0.00	8.48	2.00	0.00	0.00	0.01	0.00
8.49	2.00	0.00	0.00	0.01	0.00	8.50	2.00	0.00	0.00	0.01	0.00
8.51	2.00	0.00	0.00	0.01	0.00	8.52	2.00	0.00	0.00	0.01	0.00
8.53	2.00	0.00	0.00	0.01	0.00	8.54	2.00	0.00	0.00	0.01	0.00
8.55	2.00	0.00	0.00	0.01	0.00	8.56	2.00	0.00	0.00	0.01	0.00
8.57	2.00	0.00	0.00	0.01	0.00	8.58	2.00	0.00	0.00	0.01	0.00
8.59	2.00	0.00	0.00	0.01	0.00	8.60	2.00	0.00	0.00	0.01	0.00
8.61	2.00	0.00	0.00	0.01	0.00	8.62	2.00	0.00	0.00	0.01	0.00
8.63	2.00	0.00	0.00	0.01	0.00	8.64	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
8.65	2.00	0.00	0.00	0.01	0.00	8.66	2.00	0.00	0.00	0.01	0.00
8.67	2.00	0.00	0.00	0.01	0.00	8.68	2.00	0.00	0.00	0.01	0.00
8.69	2.00	0.00	0.00	0.01	0.00	8.70	2.00	0.00	0.00	0.01	0.00
8.71	2.00	0.00	0.00	0.01	0.00	8.72	2.00	0.00	0.00	0.01	0.00
8.73	2.00	0.00	0.00	0.01	0.00	8.74	2.00	0.00	0.00	0.01	0.00
8.75	2.00	0.00	0.00	0.01	0.00	8.76	2.00	0.00	0.00	0.01	0.00
8.77	2.00	0.00	0.00	0.01	0.00	8.78	2.00	0.00	0.00	0.01	0.00
8.79	2.00	0.00	0.00	0.01	0.00	8.80	2.00	0.00	0.00	0.01	0.00
8.81	2.00	0.00	0.00	0.01	0.00	8.82	2.00	0.00	0.00	0.01	0.00
8.83	2.00	0.00	0.00	0.01	0.00	8.84	2.00	0.00	0.00	0.01	0.00
8.85	2.00	0.00	0.00	0.01	0.00	8.86	2.00	0.00	0.00	0.01	0.00
8.87	2.00	0.00	0.00	0.01	0.00	8.88	2.00	0.00	0.00	0.01	0.00
8.89	2.00	0.00	0.00	0.01	0.00	8.90	2.00	0.00	0.00	0.01	0.00
8.91	2.00	0.00	0.00	0.01	0.00	8.92	2.00	0.00	0.00	0.01	0.00
8.93	2.00	0.00	0.00	0.01	0.00	8.94	2.00	0.00	0.00	0.01	0.00
8.95	2.00	0.00	0.00	0.01	0.00	8.96	2.00	0.00	0.00	0.01	0.00
8.97	2.00	0.00	0.00	0.01	0.00	8.98	2.00	0.00	0.00	0.01	0.00
8.99	2.00	0.00	0.00	0.01	0.00	9.00	2.00	0.00	0.00	0.01	0.00
9.01	2.00	0.00	0.00	0.01	0.00	9.02	2.00	0.00	0.00	0.01	0.00
9.03	2.00	0.00	0.00	0.01	0.00	9.04	2.00	0.00	0.00	0.01	0.00
9.05	2.00	0.00	0.00	0.01	0.00	9.06	2.00	0.00	0.00	0.01	0.00
9.07	2.00	0.00	0.00	0.01	0.00	9.08	2.00	0.00	0.00	0.01	0.00
9.09	2.00	0.00	0.00	0.01	0.00	9.10	2.00	0.00	0.00	0.01	0.00
9.11	2.00	0.00	0.00	0.01	0.00	9.12	2.00	0.00	0.00	0.01	0.00
9.13	2.00	0.00	0.00	0.01	0.00	9.14	2.00	0.00	0.00	0.01	0.00
9.15	2.00	0.00	0.00	0.01	0.00	9.16	2.00	0.00	0.00	0.01	0.00
9.17	2.00	0.00	0.00	0.01	0.00	9.18	2.00	0.00	0.00	0.01	0.00
9.19	2.00	0.00	0.00	0.01	0.00	9.20	2.00	0.00	0.00	0.01	0.00
9.21	2.00	0.00	0.00	0.01	0.00	9.22	2.00	0.00	0.00	0.01	0.00
9.23	2.00	0.00	0.00	0.01	0.00	9.24	2.00	0.00	0.00	0.01	0.00
9.25	2.00	0.00	0.00	0.01	0.00	9.26	2.00	0.00	0.00	0.01	0.00
9.27	2.00	0.00	0.00	0.01	0.00	9.28	2.00	0.00	0.00	0.01	0.00
9.29	2.00	0.00	0.00	0.01	0.00	9.30	2.00	0.00	0.00	0.01	0.00
9.31	2.00	0.00	0.00	0.01	0.00	9.32	2.00	0.00	0.00	0.01	0.00
9.33	2.00	0.00	0.00	0.01	0.00	9.34	2.00	0.00	0.00	0.01	0.00
9.35	2.00	0.00	0.00	0.01	0.00	9.36	2.00	0.00	0.00	0.01	0.00
9.37	2.00	0.00	0.00	0.01	0.00	9.38	2.00	0.00	0.00	0.01	0.00
9.39	2.00	0.00	0.00	0.01	0.00	9.40	2.00	0.00	0.00	0.01	0.00
9.41	2.00	0.00	0.00	0.01	0.00	9.42	2.00	0.00	0.00	0.01	0.00
9.43	2.00	0.00	0.00	0.01	0.00	9.44	2.00	0.00	0.00	0.01	0.00
9.45	2.00	0.00	0.00	0.01	0.00	9.46	2.00	0.00	0.00	0.01	0.00
9.47	2.00	0.00	0.00	0.01	0.00	9.48	2.00	0.00	0.00	0.01	0.00
9.49	2.00	0.00	0.00	0.01	0.00	9.50	2.00	0.00	0.00	0.01	0.00
9.51	2.00	0.00	0.00	0.01	0.00	9.52	2.00	0.00	0.00	0.01	0.00
9.53	2.00	0.00	0.00	0.01	0.00	9.54	2.00	0.00	0.00	0.01	0.00
9.55	2.00	0.00	0.00	0.01	0.00	9.56	2.00	0.00	0.00	0.01	0.00
9.57	2.00	0.00	0.00	0.01	0.00	9.58	2.00	0.00	0.00	0.01	0.00
9.59	2.00	0.00	0.00	0.01	0.00	9.60	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
9.61	2.00	0.00	0.00	0.01	0.00	9.62	2.00	0.00	0.00	0.01	0.00
9.63	2.00	0.00	0.00	0.01	0.00	9.64	2.00	0.00	0.00	0.01	0.00
9.65	2.00	0.00	0.00	0.01	0.00	9.66	2.00	0.00	0.00	0.01	0.00
9.67	2.00	0.00	0.00	0.01	0.00	9.68	2.00	0.00	0.00	0.01	0.00
9.69	2.00	0.00	0.00	0.01	0.00	9.70	2.00	0.00	0.00	0.01	0.00
9.71	2.00	0.00	0.00	0.01	0.00	9.72	2.00	0.00	0.00	0.01	0.00
9.73	2.00	0.00	0.00	0.01	0.00	9.74	2.00	0.00	0.00	0.01	0.00
9.75	2.00	0.00	0.00	0.01	0.00	9.76	2.00	0.00	0.00	0.01	0.00
9.77	2.00	0.00	0.00	0.01	0.00	9.78	2.00	0.00	0.00	0.01	0.00
9.79	2.00	0.00	0.00	0.01	0.00	9.80	2.00	0.00	0.00	0.01	0.00
9.81	2.00	0.00	0.00	0.01	0.00	9.82	2.00	0.00	0.00	0.01	0.00
9.83	2.00	0.00	0.00	0.01	0.00	9.84	2.00	0.00	0.00	0.01	0.00
9.85	2.00	0.00	0.00	0.01	0.00	9.86	2.00	0.00	0.00	0.01	0.00
9.87	2.00	0.00	0.00	0.01	0.00	9.88	2.00	0.00	0.00	0.01	0.00
9.89	2.00	0.00	0.00	0.01	0.00	9.90	2.00	0.00	0.00	0.01	0.00
9.91	2.00	0.00	0.00	0.01	0.00	9.92	2.00	0.00	0.00	0.01	0.00
9.93	2.00	0.00	0.00	0.01	0.00	9.94	2.00	0.00	0.00	0.01	0.00
9.95	2.00	0.00	0.00	0.01	0.00	9.96	2.00	0.00	0.00	0.01	0.00
9.97	2.00	0.00	0.00	0.01	0.00	9.98	2.00	0.00	0.00	0.01	0.00
9.99	2.00	0.00	0.00	0.01	0.00	10.00	2.00	0.00	0.00	0.01	0.00
10.01	2.00	0.00	0.00	0.01	0.00	10.02	2.00	0.00	0.00	0.01	0.00
10.03	2.00	0.00	0.00	0.01	0.00	10.04	2.00	0.00	0.00	0.01	0.00
10.05	2.00	0.00	0.00	0.01	0.00	10.06	2.00	0.00	0.00	0.01	0.00
10.07	2.00	0.00	0.00	0.01	0.00	10.08	2.00	0.00	0.00	0.01	0.00
10.09	2.00	0.00	0.00	0.01	0.00	10.10	2.00	0.00	0.00	0.01	0.00
10.11	2.00	0.00	0.00	0.01	0.00	10.12	2.00	0.00	0.00	0.01	0.00
10.13	2.00	0.00	0.00	0.01	0.00	10.14	2.00	0.00	0.00	0.01	0.00
10.15	2.00	0.00	0.00	0.01	0.00	10.16	2.00	0.00	0.00	0.01	0.00
10.17	2.00	0.00	0.00	0.01	0.00	10.18	2.00	0.00	0.00	0.01	0.00
10.19	2.00	0.00	0.00	0.01	0.00	10.20	2.00	0.00	0.00	0.01	0.00
10.21	2.00	0.00	0.00	0.01	0.00	10.22	2.00	0.00	0.00	0.01	0.00
10.23	2.00	0.00	0.00	0.01	0.00	10.24	2.00	0.00	0.00	0.01	0.00
10.25	2.00	0.00	0.00	0.01	0.00	10.26	2.00	0.00	0.00	0.01	0.00
10.27	2.00	0.00	0.00	0.01	0.00	10.28	2.00	0.00	0.00	0.01	0.00
10.29	2.00	0.00	0.00	0.01	0.00	10.30	2.00	0.00	0.00	0.01	0.00
10.31	2.00	0.00	0.00	0.01	0.00	10.32	2.00	0.00	0.00	0.01	0.00
10.33	2.00	0.00	0.00	0.01	0.00	10.34	2.00	0.00	0.00	0.01	0.00
10.35	2.00	0.00	0.00	0.01	0.00	10.36	2.00	0.00	0.00	0.01	0.00
10.37	2.00	0.00	0.00	0.01	0.00	10.38	2.00	0.00	0.00	0.01	0.00
10.39	2.00	0.00	0.00	0.01	0.00	10.40	2.00	0.00	0.00	0.01	0.00
10.41	2.00	0.00	0.00	0.01	0.00	10.42	2.00	0.00	0.00	0.01	0.00
10.43	2.00	0.00	0.00	0.01	0.00	10.44	2.00	0.00	0.00	0.01	0.00
10.45	2.00	0.00	0.00	0.01	0.00	10.46	2.00	0.00	0.00	0.01	0.00
10.47	2.00	0.00	0.00	0.01	0.00	10.48	2.00	0.00	0.00	0.01	0.00
10.49	2.00	0.00	0.00	0.01	0.00	10.50	2.00	0.00	0.00	0.01	0.00
10.51	2.00	0.00	0.00	0.01	0.00	10.52	2.00	0.00	0.00	0.01	0.00
10.53	2.00	0.00	0.00	0.01	0.00	10.54	2.00	0.00	0.00	0.01	0.00
10.55	2.00	0.00	0.00	0.01	0.00	10.56	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
10.57	2.00	0.00	0.00	0.01	0.00	10.58	2.00	0.00	0.00	0.01	0.00
10.59	2.00	0.00	0.00	0.01	0.00	10.60	2.00	0.00	0.00	0.01	0.00
10.61	2.00	0.00	0.00	0.01	0.00	10.62	2.00	0.00	0.00	0.01	0.00
10.63	2.00	0.00	0.00	0.01	0.00	10.64	2.00	0.00	0.00	0.01	0.00
10.65	2.00	0.00	0.00	0.01	0.00	10.66	2.00	0.00	0.00	0.01	0.00
10.67	2.00	0.00	0.00	0.01	0.00	10.68	2.00	0.00	0.00	0.01	0.00
10.69	2.00	0.00	0.00	0.01	0.00	10.70	2.00	0.00	0.00	0.01	0.00
10.71	2.00	0.00	0.00	0.01	0.00	10.72	2.00	0.00	0.00	0.01	0.00
10.73	2.00	0.00	0.00	0.01	0.00	10.74	2.00	0.00	0.00	0.01	0.00
10.75	2.00	0.00	0.00	0.01	0.00	10.76	2.00	0.00	0.00	0.01	0.00
10.77	2.00	0.00	0.00	0.01	0.00	10.78	2.00	0.00	0.00	0.01	0.00
10.79	2.00	0.00	0.00	0.01	0.00	10.80	2.00	0.00	0.00	0.01	0.00
10.81	2.00	0.00	0.00	0.01	0.00	10.82	2.00	0.00	0.00	0.01	0.00
10.83	2.00	0.00	0.00	0.01	0.00	10.84	2.00	0.00	0.00	0.01	0.00
10.85	2.00	0.00	0.00	0.01	0.00	10.86	2.00	0.00	0.00	0.01	0.00
10.87	2.00	0.00	0.00	0.01	0.00	10.88	2.00	0.00	0.00	0.01	0.00
10.89	2.00	0.00	0.00	0.01	0.00	10.90	2.00	0.00	0.00	0.01	0.00
10.91	2.00	0.00	0.00	0.01	0.00	10.92	2.00	0.00	0.00	0.01	0.00
10.93	2.00	0.00	0.00	0.01	0.00	10.94	2.00	0.00	0.00	0.01	0.00
10.95	2.00	0.00	0.00	0.01	0.00	10.96	2.00	0.00	0.00	0.01	0.00
10.97	2.00	0.00	0.00	0.01	0.00	10.98	2.00	0.00	0.00	0.01	0.00
10.99	2.00	0.00	0.00	0.01	0.00	11.00	2.00	0.00	0.00	0.01	0.00
11.01	2.00	0.00	0.00	0.01	0.00	11.02	2.00	0.00	0.00	0.01	0.00
11.03	2.00	0.00	0.00	0.01	0.00	11.04	2.00	0.00	0.00	0.01	0.00
11.05	2.00	0.00	0.00	0.01	0.00	11.06	2.00	0.00	0.00	0.01	0.00
11.07	2.00	0.00	0.00	0.01	0.00	11.08	2.00	0.00	0.00	0.01	0.00
11.09	2.00	0.00	0.00	0.01	0.00	11.10	2.00	0.00	0.00	0.01	0.00
11.11	2.00	0.00	0.00	0.01	0.00	11.12	2.00	0.00	0.00	0.01	0.00
11.13	2.00	0.00	0.00	0.01	0.00	11.14	2.00	0.00	0.00	0.01	0.00
11.15	2.00	0.00	0.00	0.01	0.00	11.16	2.00	0.00	0.00	0.01	0.00
11.17	2.00	0.00	0.00	0.01	0.00	11.18	2.00	0.00	0.00	0.01	0.00
11.19	2.00	0.00	0.00	0.01	0.00	11.20	2.00	0.00	0.00	0.01	0.00
11.21	2.00	0.00	0.00	0.01	0.00	11.22	2.00	0.00	0.00	0.01	0.00
11.23	2.00	0.00	0.00	0.01	0.00	11.24	0.59	0.00	0.00	0.01	0.02
11.25	0.60	0.00	0.00	0.01	0.02	11.26	0.60	0.00	0.00	0.01	0.02
11.27	0.61	0.00	0.00	0.01	0.02	11.28	0.61	0.00	0.00	0.01	0.02
11.29	0.61	0.00	0.00	0.01	0.02	11.30	2.00	0.00	0.00	0.01	0.00
11.31	2.00	0.00	0.00	0.01	0.00	11.32	2.00	0.00	0.00	0.01	0.00
11.33	2.00	0.00	0.00	0.01	0.00	11.34	2.00	0.00	0.00	0.01	0.00
11.35	2.00	0.00	0.00	0.01	0.00	11.36	2.00	0.00	0.00	0.01	0.00
11.37	2.00	0.00	0.00	0.01	0.00	11.38	2.00	0.00	0.00	0.01	0.00
11.39	2.00	0.00	0.00	0.01	0.00	11.40	2.00	0.00	0.00	0.01	0.00
11.41	2.00	0.00	0.00	0.01	0.00	11.42	2.00	0.00	0.00	0.01	0.00
11.43	2.00	0.00	0.00	0.01	0.00	11.44	2.00	0.00	0.00	0.01	0.00
11.45	2.00	0.00	0.00	0.01	0.00	11.46	2.00	0.00	0.00	0.01	0.00
11.47	2.00	0.00	0.00	0.01	0.00	11.48	2.00	0.00	0.00	0.01	0.00
11.49	2.00	0.00	0.00	0.01	0.00	11.50	2.00	0.00	0.00	0.01	0.00
11.51	2.00	0.00	0.00	0.01	0.00	11.52	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
11.53	2.00	0.00	0.00	0.01	0.00	11.54	2.00	0.00	0.00	0.01	0.00
11.55	2.00	0.00	0.00	0.01	0.00	11.56	2.00	0.00	0.00	0.01	0.00
11.57	2.00	0.00	0.00	0.01	0.00	11.58	2.00	0.00	0.00	0.01	0.00
11.59	2.00	0.00	0.00	0.01	0.00	11.60	2.00	0.00	0.00	0.01	0.00
11.61	2.00	0.00	0.00	0.01	0.00	11.62	2.00	0.00	0.00	0.01	0.00
11.63	2.00	0.00	0.00	0.01	0.00	11.64	2.00	0.00	0.00	0.01	0.00
11.65	2.00	0.00	0.00	0.01	0.00	11.66	2.00	0.00	0.00	0.01	0.00
11.67	2.00	0.00	0.00	0.01	0.00	11.68	2.00	0.00	0.00	0.01	0.00
11.69	2.00	0.00	0.00	0.01	0.00	11.70	2.00	0.00	0.00	0.01	0.00
11.71	2.00	0.00	0.00	0.01	0.00	11.72	2.00	0.00	0.00	0.01	0.00
11.73	2.00	0.00	0.00	0.01	0.00	11.74	2.00	0.00	0.00	0.01	0.00
11.75	2.00	0.00	0.00	0.01	0.00	11.76	2.00	0.00	0.00	0.01	0.00
11.77	2.00	0.00	0.00	0.01	0.00	11.78	2.00	0.00	0.00	0.01	0.00
11.79	2.00	0.00	0.00	0.01	0.00	11.80	2.00	0.00	0.00	0.01	0.00
11.81	2.00	0.00	0.00	0.01	0.00	11.82	2.00	0.00	0.00	0.01	0.00
11.83	2.00	0.00	0.00	0.01	0.00	11.84	2.00	0.00	0.00	0.01	0.00
11.85	2.00	0.00	0.00	0.01	0.00	11.86	2.00	0.00	0.00	0.01	0.00
11.87	2.00	0.00	0.00	0.01	0.00	11.88	2.00	0.00	0.00	0.01	0.00
11.89	2.00	0.00	0.00	0.01	0.00	11.90	2.00	0.00	0.00	0.01	0.00
11.91	2.00	0.00	0.00	0.01	0.00	11.92	2.00	0.00	0.00	0.01	0.00
11.93	2.00	0.00	0.00	0.01	0.00	11.94	2.00	0.00	0.00	0.01	0.00
11.95	2.00	0.00	0.00	0.01	0.00	11.96	2.00	0.00	0.00	0.01	0.00
11.97	2.00	0.00	0.00	0.01	0.00	11.98	2.00	0.00	0.00	0.01	0.00
11.99	2.00	0.00	0.00	0.01	0.00	12.00	2.00	0.00	0.00	0.01	0.00
12.01	0.62	0.00	0.00	0.01	0.02	12.02	0.63	0.00	0.00	0.01	0.01
12.03	0.63	0.00	0.00	0.01	0.01	12.04	0.63	0.00	0.00	0.01	0.01
12.05	0.63	0.00	0.00	0.01	0.01	12.06	2.00	0.00	0.00	0.01	0.00
12.07	2.00	0.00	0.00	0.01	0.00	12.08	2.00	0.00	0.00	0.01	0.00
12.09	2.00	0.00	0.00	0.01	0.00	12.10	2.00	0.00	0.00	0.01	0.00
12.11	0.64	0.00	0.00	0.01	0.01	12.12	0.65	0.00	0.00	0.01	0.01
12.13	0.66	0.00	0.00	0.01	0.01	12.14	2.00	0.00	0.00	0.01	0.00
12.15	2.00	0.00	0.00	0.01	0.00	12.16	2.00	0.00	0.00	0.01	0.00
12.17	2.00	0.00	0.00	0.01	0.00	12.18	2.00	0.00	0.00	0.01	0.00
12.19	2.00	0.00	0.00	0.01	0.00	12.20	2.00	0.00	0.00	0.01	0.00
12.21	2.00	0.00	0.00	0.01	0.00	12.22	2.00	0.00	0.00	0.01	0.00
12.23	0.66	0.00	0.00	0.01	0.01	12.24	0.67	0.00	0.00	0.01	0.01
12.25	0.67	0.00	0.00	0.01	0.01	12.26	0.67	0.00	0.00	0.01	0.01
12.27	0.68	0.00	0.00	0.01	0.01	12.28	0.68	0.00	0.00	0.01	0.01
12.29	0.69	0.00	0.00	0.01	0.01	12.30	0.70	0.00	0.00	0.01	0.01
12.31	0.70	0.00	0.00	0.01	0.01	12.32	0.70	0.00	0.00	0.01	0.01
12.33	0.70	0.00	0.00	0.01	0.01	12.34	0.70	0.00	0.00	0.01	0.01
12.35	0.69	0.00	0.00	0.01	0.01	12.36	0.69	0.00	0.00	0.01	0.01
12.37	2.00	0.00	0.00	0.01	0.00	12.38	2.00	0.00	0.00	0.01	0.00
12.39	2.00	0.00	0.00	0.01	0.00	12.40	2.00	0.00	0.00	0.01	0.00
12.41	2.00	0.00	0.00	0.01	0.00	12.42	2.00	0.00	0.00	0.01	0.00
12.43	2.00	0.00	0.00	0.01	0.00	12.44	2.00	0.00	0.00	0.01	0.00
12.45	2.00	0.00	0.00	0.01	0.00	12.46	2.00	0.00	0.00	0.01	0.00
12.47	2.00	0.00	0.00	0.01	0.00	12.48	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
12.49	2.00	0.00	0.00	0.01	0.00	12.50	2.00	0.00	0.00	0.01	0.00
12.51	2.00	0.00	0.00	0.01	0.00	12.52	2.00	0.00	0.00	0.01	0.00
12.53	2.00	0.00	0.00	0.01	0.00	12.54	2.00	0.00	0.00	0.01	0.00
12.55	2.00	0.00	0.00	0.01	0.00	12.56	2.00	0.00	0.00	0.01	0.00
12.57	2.00	0.00	0.00	0.01	0.00	12.58	2.00	0.00	0.00	0.01	0.00
12.59	2.00	0.00	0.00	0.01	0.00	12.60	2.00	0.00	0.00	0.01	0.00
12.61	2.00	0.00	0.00	0.01	0.00	12.62	2.00	0.00	0.00	0.01	0.00
12.63	2.00	0.00	0.00	0.01	0.00	12.64	2.00	0.00	0.00	0.01	0.00
12.65	2.00	0.00	0.00	0.01	0.00	12.66	2.00	0.00	0.00	0.01	0.00
12.67	2.00	0.00	0.00	0.01	0.00	12.68	2.00	0.00	0.00	0.01	0.00
12.69	2.00	0.00	0.00	0.01	0.00	12.70	2.00	0.00	0.00	0.01	0.00
12.71	2.00	0.00	0.00	0.01	0.00	12.72	2.00	0.00	0.00	0.01	0.00
12.73	2.00	0.00	0.00	0.01	0.00	12.74	2.00	0.00	0.00	0.01	0.00
12.75	2.00	0.00	0.00	0.01	0.00	12.76	2.00	0.00	0.00	0.01	0.00
12.77	2.00	0.00	0.00	0.01	0.00	12.78	2.00	0.00	0.00	0.01	0.00
12.79	2.00	0.00	0.00	0.01	0.00	12.80	2.00	0.00	0.00	0.01	0.00
12.81	2.00	0.00	0.00	0.01	0.00	12.82	2.00	0.00	0.00	0.01	0.00
12.83	2.00	0.00	0.00	0.01	0.00	12.84	2.00	0.00	0.00	0.01	0.00
12.85	2.00	0.00	0.00	0.01	0.00	12.86	2.00	0.00	0.00	0.01	0.00
12.87	2.00	0.00	0.00	0.01	0.00	12.88	2.00	0.00	0.00	0.01	0.00
12.89	2.00	0.00	0.00	0.01	0.00	12.90	2.00	0.00	0.00	0.01	0.00
12.91	2.00	0.00	0.00	0.01	0.00	12.92	2.00	0.00	0.00	0.01	0.00
12.93	2.00	0.00	0.00	0.01	0.00	12.94	2.00	0.00	0.00	0.01	0.00
12.95	2.00	0.00	0.00	0.01	0.00	12.96	2.00	0.00	0.00	0.01	0.00
12.97	2.00	0.00	0.00	0.01	0.00	12.98	2.00	0.00	0.00	0.01	0.00
12.99	2.00	0.00	0.00	0.01	0.00	13.00	2.00	0.00	0.00	0.01	0.00
13.01	2.00	0.00	0.00	0.01	0.00	13.02	2.00	0.00	0.00	0.01	0.00
13.03	2.00	0.00	0.00	0.01	0.00	13.04	2.00	0.00	0.00	0.01	0.00
13.05	2.00	0.00	0.00	0.01	0.00	13.06	2.00	0.00	0.00	0.01	0.00
13.07	2.00	0.00	0.00	0.01	0.00	13.08	2.00	0.00	0.00	0.01	0.00
13.09	2.00	0.00	0.00	0.01	0.00	13.10	2.00	0.00	0.00	0.01	0.00
13.11	2.00	0.00	0.00	0.01	0.00	13.12	2.00	0.00	0.00	0.01	0.00
13.13	2.00	0.00	0.00	0.01	0.00	13.14	2.00	0.00	0.00	0.01	0.00
13.15	2.00	0.00	0.00	0.01	0.00	13.16	2.00	0.00	0.00	0.01	0.00
13.17	2.00	0.00	0.00	0.01	0.00	13.18	2.00	0.00	0.00	0.01	0.00
13.19	2.00	0.00	0.00	0.01	0.00	13.20	2.00	0.00	0.00	0.01	0.00
13.21	2.00	0.00	0.00	0.01	0.00	13.22	2.00	0.00	0.00	0.01	0.00
13.23	2.00	0.00	0.00	0.01	0.00	13.24	2.00	0.00	0.00	0.01	0.00
13.25	2.00	0.00	0.00	0.01	0.00	13.26	2.00	0.00	0.00	0.01	0.00
13.27	2.00	0.00	0.00	0.01	0.00	13.28	2.00	0.00	0.00	0.01	0.00
13.29	2.00	0.00	0.00	0.01	0.00	13.30	2.00	0.00	0.00	0.01	0.00
13.31	2.00	0.00	0.00	0.01	0.00	13.32	2.00	0.00	0.00	0.01	0.00
13.33	2.00	0.00	0.00	0.01	0.00	13.34	2.00	0.00	0.00	0.01	0.00
13.35	2.00	0.00	0.00	0.01	0.00	13.36	2.00	0.00	0.00	0.01	0.00
13.37	2.00	0.00	0.00	0.01	0.00	13.38	2.00	0.00	0.00	0.01	0.00
13.39	2.00	0.00	0.00	0.01	0.00	13.40	2.00	0.00	0.00	0.01	0.00
13.41	2.00	0.00	0.00	0.01	0.00	13.42	2.00	0.00	0.00	0.01	0.00
13.43	2.00	0.00	0.00	0.01	0.00	13.44	2.00	0.00	0.00	0.01	0.00

:: Liquefaction Potential Index calculation data ::											
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
13.45	2.00	0.00	0.00	0.01	0.00	13.46	2.00	0.00	0.00	0.01	0.00
13.47	2.00	0.00	0.00	0.01	0.00	13.48	2.00	0.00	0.00	0.01	0.00
13.49	2.00	0.00	0.00	0.01	0.00	13.50	2.00	0.00	0.00	0.01	0.00
13.51	2.00	0.00	0.00	0.01	0.00	13.52	2.00	0.00	0.00	0.01	0.00
13.53	2.00	0.00	0.00	0.01	0.00	13.54	2.00	0.00	0.00	0.01	0.00
13.55	2.00	0.00	0.00	0.01	0.00	13.56	2.00	0.00	0.00	0.01	0.00
13.57	2.00	0.00	0.00	0.01	0.00	13.58	0.65	0.00	0.00	0.01	0.01
13.59	0.69	0.00	0.00	0.01	0.01	13.60	0.69	0.00	0.00	0.01	0.01
13.61	0.73	0.00	0.00	0.01	0.01	13.62	0.71	0.00	0.00	0.01	0.01
13.63	0.71	0.00	0.00	0.01	0.01	13.64	0.68	0.00	0.00	0.01	0.01
13.65	0.65	0.00	0.00	0.01	0.01	13.66	0.64	0.00	0.00	0.01	0.01
13.67	0.62	0.00	0.00	0.01	0.01	13.68	0.63	0.00	0.00	0.01	0.01
13.69	0.64	0.00	0.00	0.01	0.01	13.70	0.65	0.00	0.00	0.01	0.01
13.71	0.66	0.00	0.00	0.01	0.01	13.72	0.66	0.00	0.00	0.01	0.01
13.73	0.66	0.00	0.00	0.01	0.01	13.74	0.67	0.00	0.00	0.01	0.01
13.75	0.67	0.00	0.00	0.01	0.01	13.76	0.68	0.00	0.00	0.01	0.01
13.77	0.69	0.00	0.00	0.01	0.01	13.78	0.69	0.00	0.00	0.01	0.01
13.79	0.72	0.00	0.00	0.01	0.01	13.80	0.74	0.00	0.00	0.01	0.01
13.81	0.78	0.00	0.00	0.01	0.01	13.82	0.79	0.00	0.00	0.01	0.01
13.83	0.81	0.00	0.00	0.01	0.01	13.84	0.82	0.00	0.00	0.01	0.01
13.85	0.82	0.00	0.00	0.01	0.01	13.86	0.82	0.00	0.00	0.01	0.01
13.87	0.77	0.00	0.00	0.01	0.01	13.88	0.76	0.00	0.00	0.01	0.01
13.89	0.74	0.00	0.00	0.01	0.01	13.90	0.74	0.00	0.00	0.01	0.01
13.91	0.73	0.00	0.00	0.01	0.01	13.92	0.72	0.00	0.00	0.01	0.01
13.93	0.72	0.00	0.00	0.01	0.01	13.94	0.72	0.00	0.00	0.01	0.01
13.95	0.71	0.00	0.00	0.01	0.01	13.96	0.72	0.00	0.00	0.01	0.01
13.97	0.72	0.00	0.00	0.01	0.01	13.98	0.73	0.00	0.00	0.01	0.01
13.99	0.74	0.00	0.00	0.01	0.01	14.00	0.75	0.00	0.00	0.01	0.01
14.01	0.76	0.00	0.00	0.01	0.01	14.02	0.76	0.00	0.00	0.01	0.01
14.03	0.77	0.00	0.00	0.01	0.01	14.04	0.77	0.00	0.00	0.01	0.01
14.05	0.78	0.00	0.00	0.01	0.01	14.06	0.78	0.00	0.00	0.01	0.01
14.07	0.81	0.00	0.00	0.01	0.01	14.08	0.82	0.00	0.00	0.01	0.01
14.09	0.85	0.00	0.00	0.01	0.00	14.10	0.85	0.00	0.00	0.01	0.00
14.11	0.86	0.00	0.00	0.01	0.00	14.12	0.87	0.00	0.00	0.01	0.00
14.13	0.86	0.00	0.00	0.01	0.00	14.14	0.86	0.00	0.00	0.01	0.00
14.15	0.85	0.00	0.00	0.01	0.00	14.16	0.85	0.00	0.00	0.01	0.00
14.17	0.84	0.00	0.00	0.01	0.00	14.18	0.83	0.00	0.00	0.01	0.00
14.19	0.82	0.00	0.00	0.01	0.01	14.20	0.82	0.00	0.00	0.01	0.01
14.21	0.80	0.00	0.00	0.01	0.01	14.22	0.80	0.00	0.00	0.01	0.01
14.23	0.79	0.00	0.00	0.01	0.01	14.24	0.79	0.00	0.00	0.01	0.01
14.25	0.77	0.00	0.00	0.01	0.01	14.26	0.77	0.00	0.00	0.01	0.01
14.27	0.76	0.00	0.00	0.01	0.01	14.28	0.74	0.00	0.00	0.01	0.01
14.29	0.74	0.00	0.00	0.01	0.01	14.30	0.74	0.00	0.00	0.01	0.01
14.31	0.72	0.00	0.00	0.01	0.01	14.32	0.71	0.00	0.00	0.01	0.01
14.33	0.71	0.00	0.00	0.01	0.01	14.34	0.70	0.00	0.00	0.01	0.01
14.35	0.69	0.00	0.00	0.01	0.01	14.36	0.69	0.00	0.00	0.01	0.01
14.37	0.69	0.00	0.00	0.01	0.01	14.38	0.70	0.00	0.00	0.01	0.01
14.39	0.70	0.00	0.00	0.01	0.01	14.40	0.72	0.00	0.00	0.01	0.01

:: Liquefaction Potential Index calculation data ::

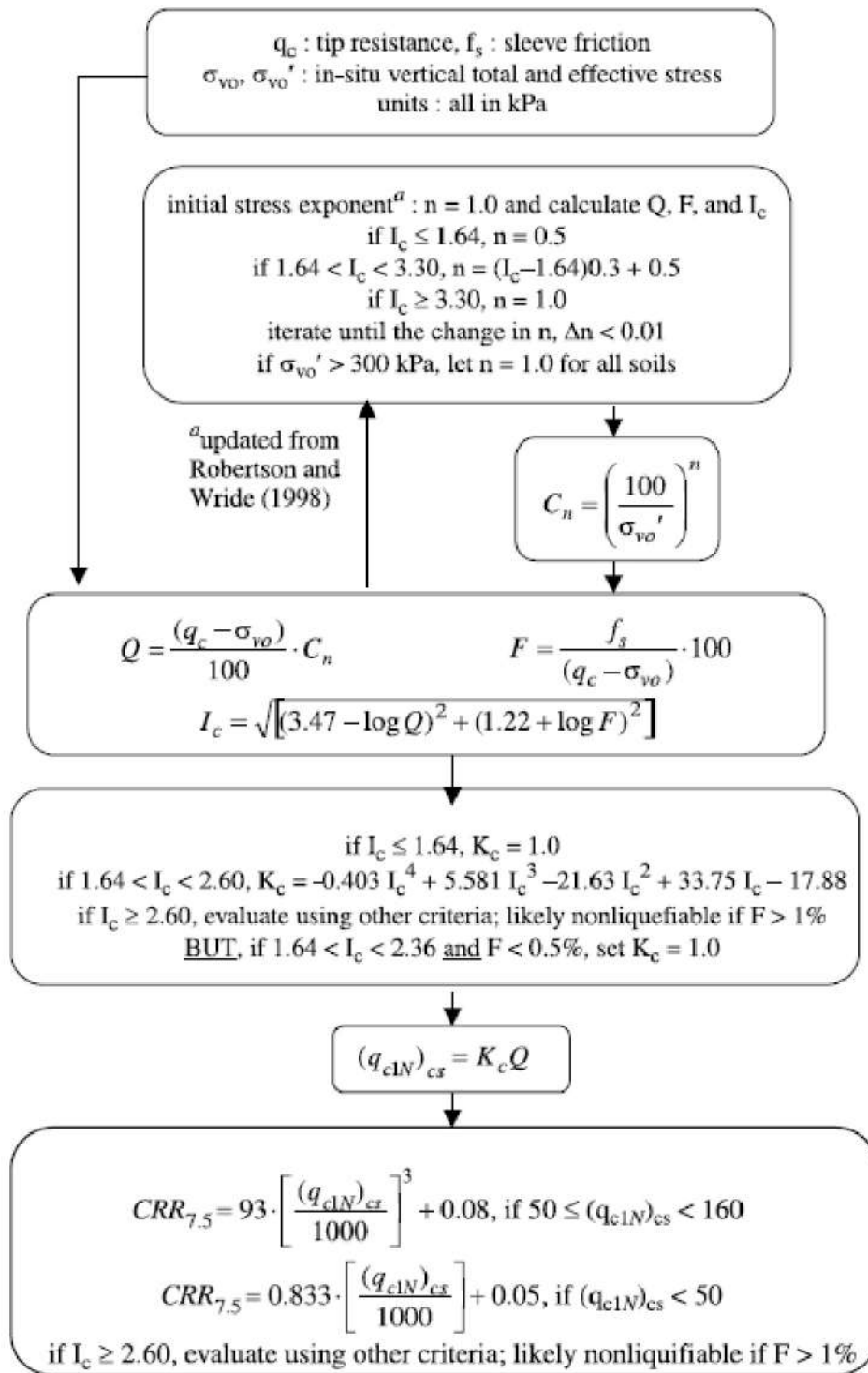
Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}	Depth (m)	FS	m(FS)	H ₁ *m(FS)	d _z	LPI _{ISH}
14.41	0.72	0.00	0.00	0.01	0.01	14.42	0.72	0.00	0.00	0.01	0.01
14.43	0.74	0.00	0.00	0.01	0.01	14.44	0.74	0.00	0.00	0.01	0.01
14.45	0.71	0.00	0.00	0.01	0.01	14.46	0.71	0.00	0.00	0.01	0.01
14.47	0.63	0.00	0.00	0.01	0.01	14.48	0.65	0.00	0.00	0.01	0.01
14.49	0.69	0.00	0.00	0.01	0.01	14.50	0.73	0.00	0.00	0.01	0.01
14.51	0.81	0.00	0.00	0.01	0.01	14.52	0.84	0.00	0.00	0.01	0.00
14.53	0.88	0.00	0.00	0.01	0.00	14.54	0.89	0.00	0.00	0.01	0.00
14.55	0.88	0.00	0.00	0.01	0.00	14.56	0.87	0.00	0.00	0.01	0.00
14.57	0.84	0.00	0.00	0.01	0.00	14.58	0.82	0.00	0.00	0.01	0.00
14.59	0.80	0.00	0.00	0.01	0.01	14.60	0.79	0.00	0.00	0.01	0.01
14.61	0.79	0.00	0.00	0.01	0.01	14.62	0.78	0.00	0.00	0.01	0.01
14.63	0.78	0.00	0.00	0.01	0.01	14.64	0.79	0.00	0.00	0.01	0.01
14.65	0.79	0.00	0.00	0.01	0.01	14.66	0.80	0.00	0.00	0.01	0.01
14.67	0.81	0.00	0.00	0.01	0.00	14.68	0.82	0.00	0.00	0.01	0.00
14.69	0.83	0.00	0.00	0.01	0.00	14.70	0.82	0.00	0.00	0.01	0.00
14.71	0.81	0.00	0.00	0.01	0.01	14.72	0.81	0.00	0.00	0.01	0.01
14.73	0.80	0.00	0.00	0.01	0.01	14.74	0.81	0.00	0.00	0.01	0.00
14.75	0.81	0.00	0.00	0.01	0.00	14.76	0.81	0.00	0.00	0.01	0.00
14.77	0.79	0.00	0.00	0.01	0.01	14.78	0.79	0.00	0.00	0.01	0.01
14.79	0.79	0.00	0.00	0.01	0.01	14.80	0.82	0.00	0.00	0.01	0.00
14.81	0.83	0.00	0.00	0.01	0.00	14.82	0.86	0.00	0.00	0.01	0.00
14.83	0.85	0.00	0.00	0.01	0.00	14.84	0.86	0.00	0.00	0.01	0.00

Overall liquefaction potential: 1.65LPI_{ISH} > 5.0 - Liquefaction manifestation is expected**Abbreviations**

FS: Calculated factor of safety for test point
d_z: Layer thickness (m)
LPI: Liquefaction potential index value for test point

Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

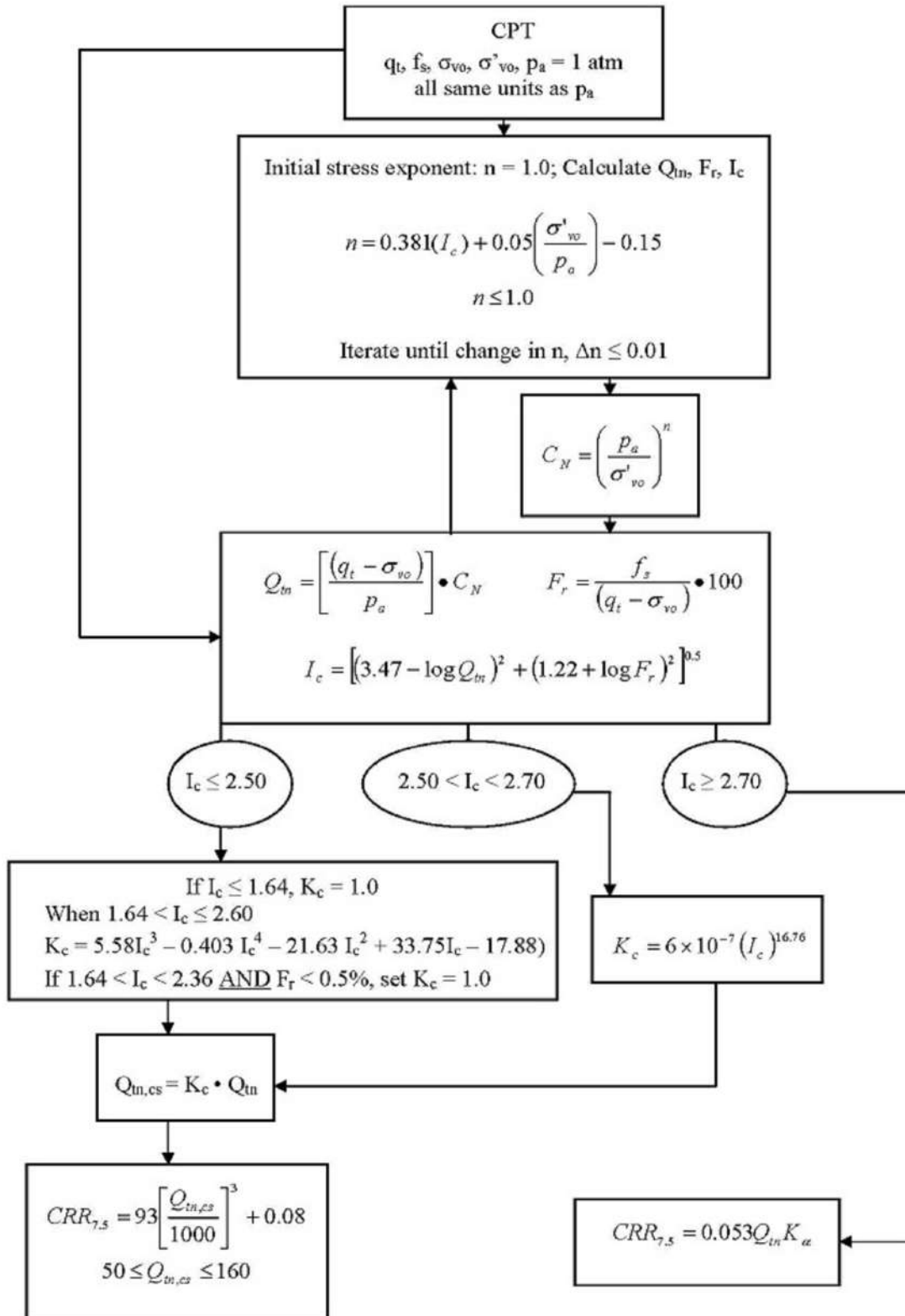
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of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



¹ "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

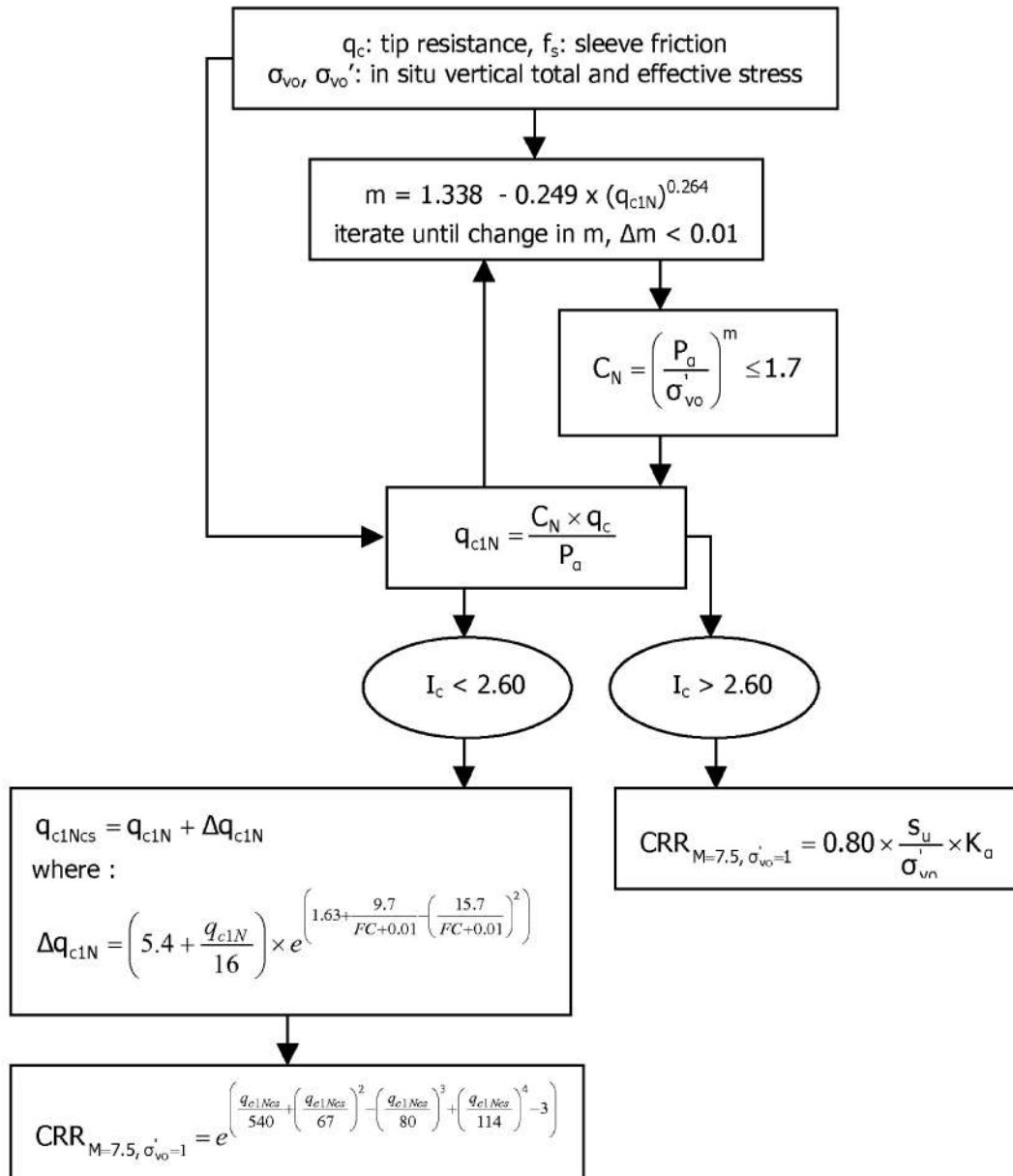
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

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:

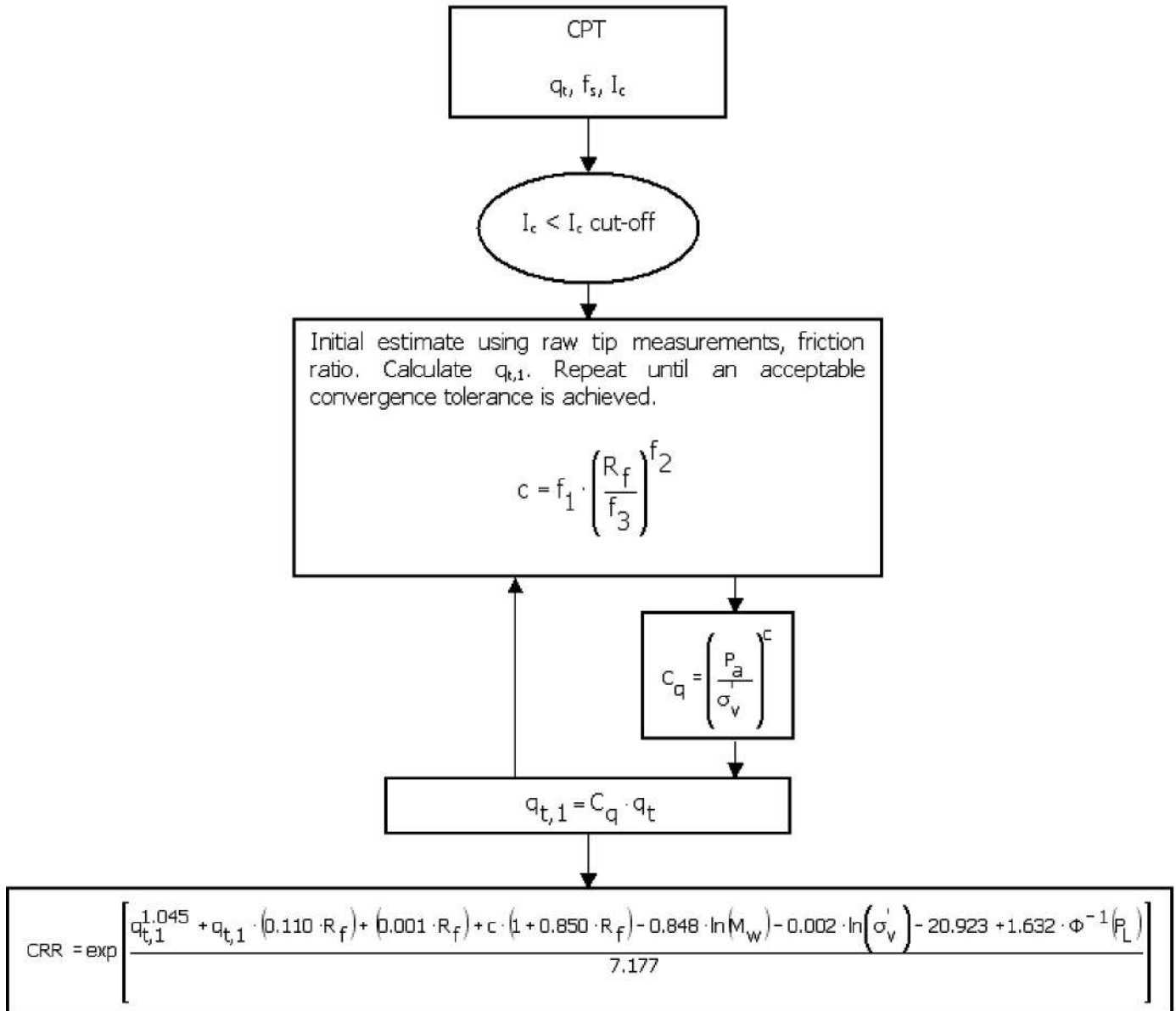


¹ P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

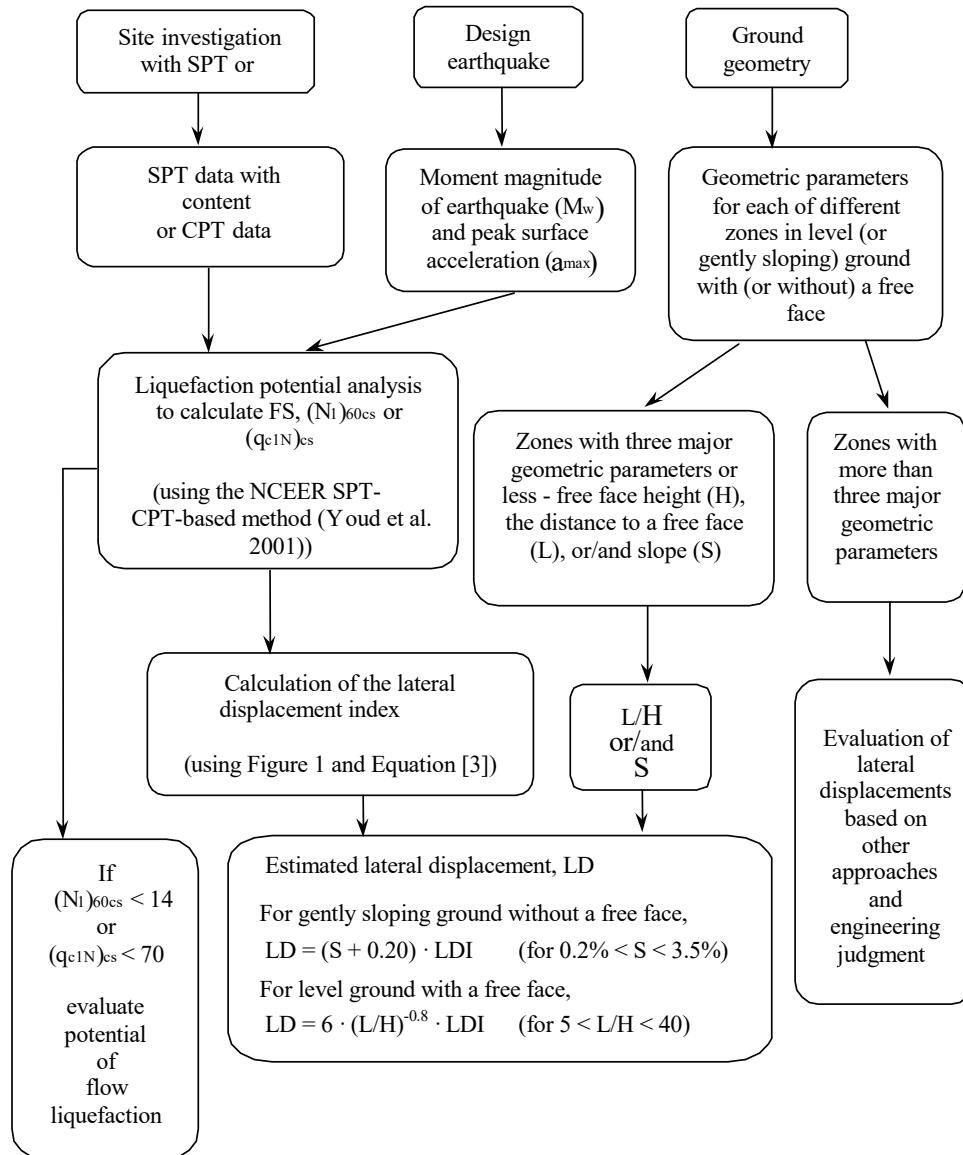
Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



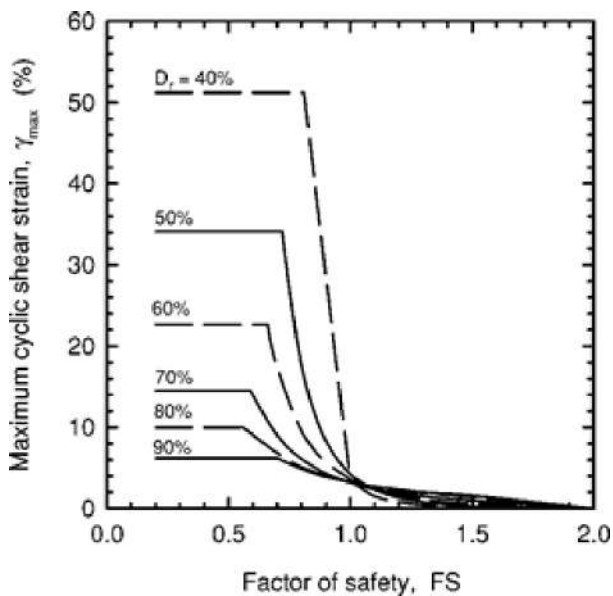
Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)



Procedure for the evaluation of liquefaction-induced lateral spreading displacements



¹ Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



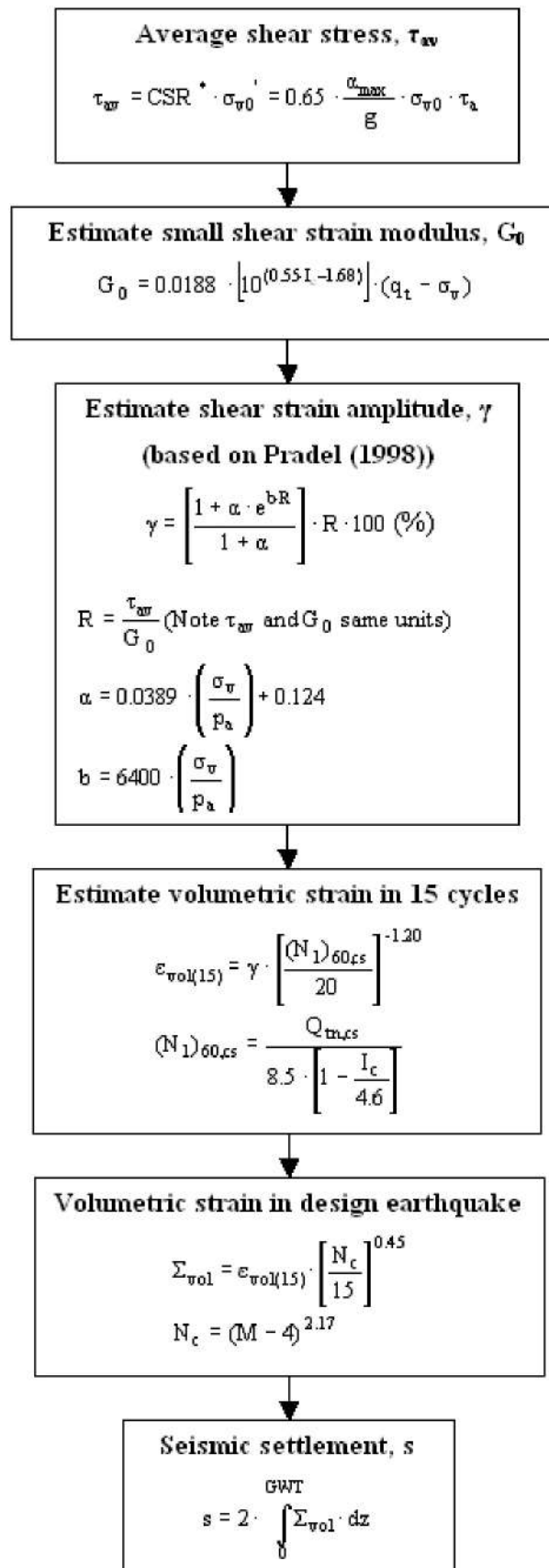
¹ Figure 1

$$LDI = \int_0^{Z_{max}} \gamma_{max} dz$$

¹ Equation [3]

¹ "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Bradman

Procedure for the estimation of seismic induced settlements in dry sands



Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methodology developed by Iwasaki (1982) and is adopted by AFPS.

To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\mathbf{LPI} = \int_0^{20} (10 - 0,5z) \times F_L \times dz$$

where:

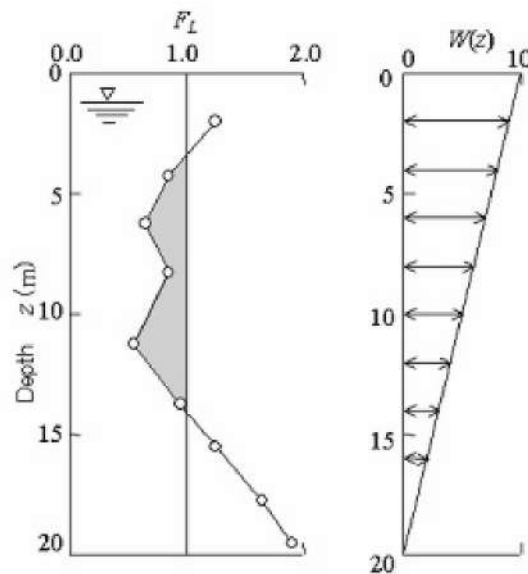
$F_L = 1 - F.S.$ when F.S. less than 1

$F_L = 0$ when F.S. greater than 1

z depth of measurement in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- $0 < \text{LPI} \leq 5$: Liquefaction risk is low
- $5 < \text{LPI} \leq 15$: Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high



Graphical presentation of the LPI calculation procedure

Shear-Induced Building Settlement (Ds) calculation procedure

The shear-induced building settlement (Ds) due to liquefaction below the building can be estimated using the relationship developed by Bray and Macedo (2017):

$$\begin{aligned} \ln(Ds) = & c1 + c2 * LBS + 0.58 * \ln\left(\tanh\left(\frac{HL}{6}\right)\right) + \\ & 4.59 * \ln(Q) - 0.42 * \ln(Q)^2 - 0.02 * B + \\ & 0.84 * \ln(CAVdp) + 0.41 * \ln(Sa1) + \varepsilon \end{aligned}$$

where Ds is in the units of mm, c1= -8.35 and c2= 0.072 for LBS ≤ 16, and c1= -7.48 and c2= 0.014 otherwise. Q is the building contact pressure in units of kPa, HL is the cumulative thickness of the liquefiable layers in the units of m, B is the building width in the units of m, CAVdp is a standardized version of the cumulative absolute velocity in the units of g-s, Sa1 is 5%-damped pseudo-acceleration response spectral value at a period of 1 s in the units of g, and ε is a normal random variable with zero mean and 0.50 standard deviation in Ln units. The liquefaction-induced building settlement index (LBS) is:

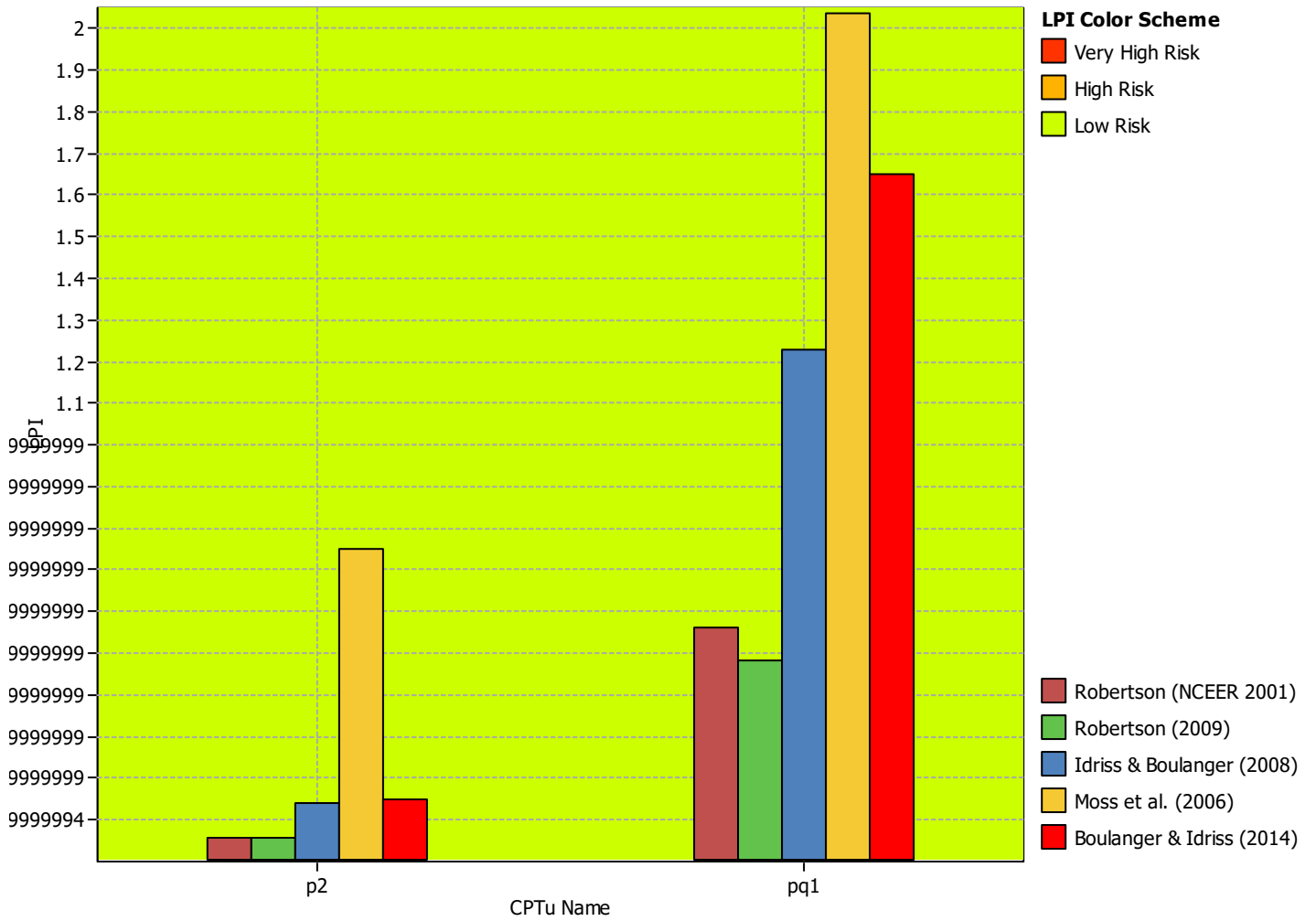
$$LBS = \sum W * \frac{\varepsilon_{shear}}{z} dz$$

where z (m) is the depth measured from the ground surface > 0, w is a foundation-weighting factor wherein W = 0.0 for z less than Df, which is the embedment depth of the foundation, and W = 1.0 otherwise. The shear strain parameter (ε_{shear}) is the liquefaction-induced free-field shear strain (in %) estimated using Zhang et al. (2004). It is calculated based on the estimated Dr of the liquefied soil layer and the calculated safety factor against liquefaction triggering (FSL).

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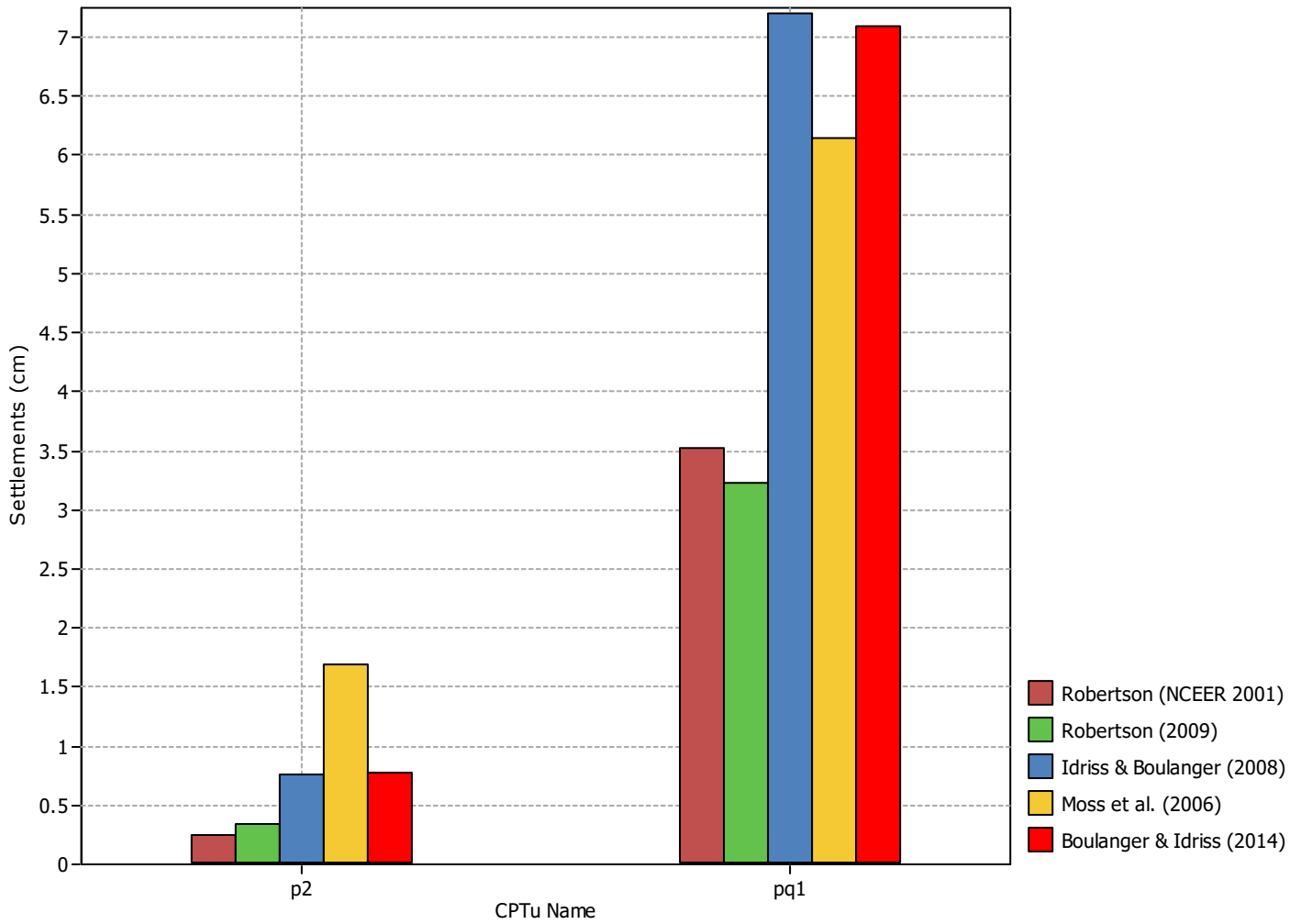
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Overall Parametric Assessment Method



:: CPT main liquefaction parameters details ::				
CPT Name	Earthquake Mag.	Earthquake Accel.	GWT in situ (m)	GWT earthq. (m)
p2	6.10	0.20	1.00	2.00
pq1	6.10	0.20	1.00	2.00

Overall Parametric Assessment Method



:: CPT main liquefaction parameters details ::

CPT Name	Earthquake Mag.	Earthquake Accel.	GWT in situ (m)	GWT earthq. (m)
p2	6.10	0.20	1.00	2.00
pq1	6.10	0.20	1.00	2.00

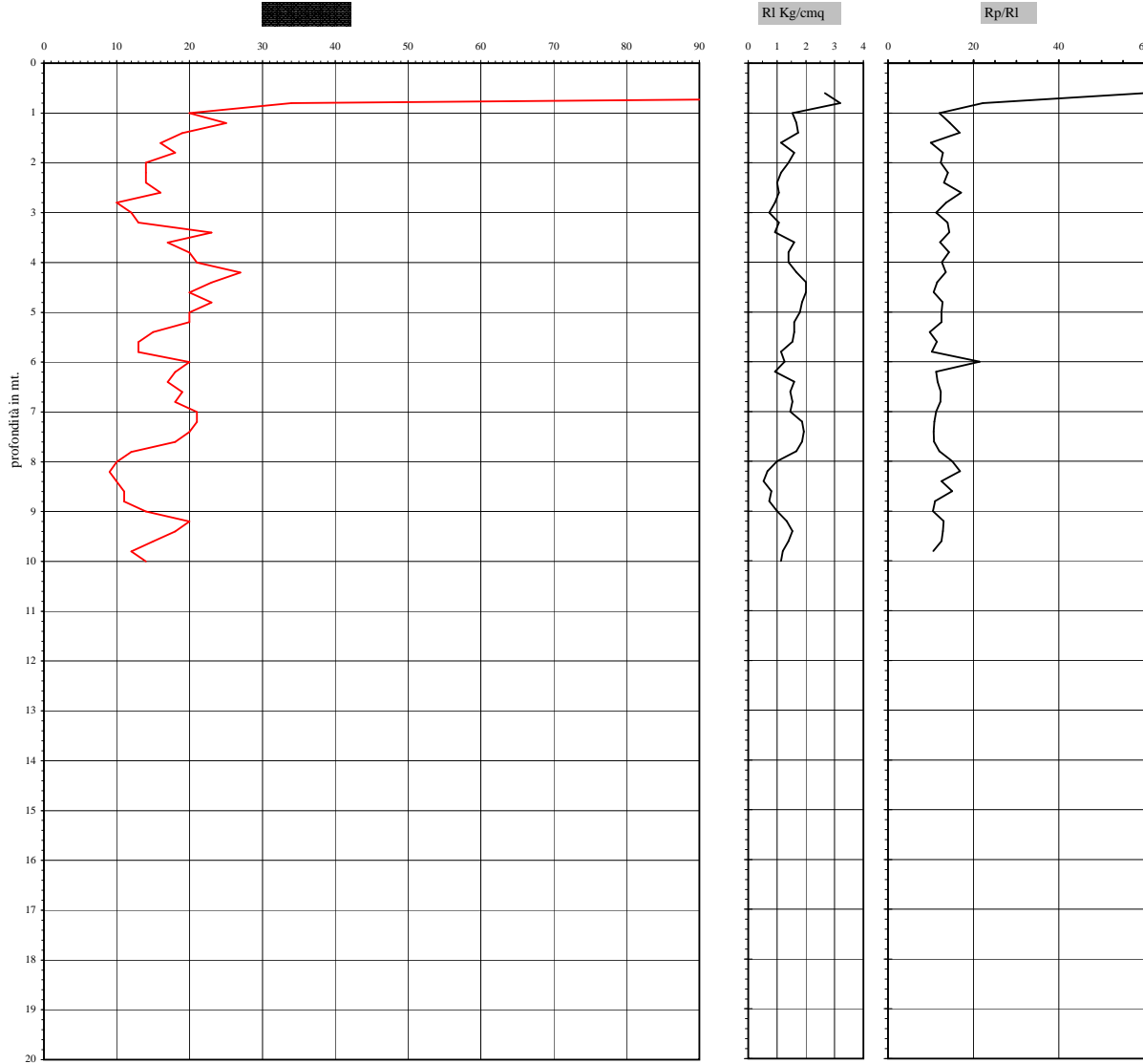
Prova Penetrometrica Statica

Prova n.: CPT1
 Cantiere: Bertinoro (FC), via Ponara
 Data: Maggio 2020

Quota inizio: piano campagna
 Liv.falda: non rilevabile
 Note:



Classificazione orientativa dei terreni (Schmertmann - 1978)



A A A A A A A A S S S S S S										Angolo d'attrito interno, densità relativa e coesione						
0	M	T	M	C	M	S	L	L	S	mt.	Rp	Rl	Rp/Rl	ϕ°	Dr	Cu Kg/cmq
										0.4	178		66.75	44	0.75	/
										0.6	192	2.67	60.00	45	0.78	/
										0.8	34	3.20	22.17	/	/	1.7
										1	20	1.53	12.00	/	/	1.25
										1.2	25	1.67	14.42	/	/	0.95
										1.4	19	1.73	16.76	/	/	0.8
										1.6	16	1.13	10.00	/	/	0.9
										1.8	18	1.60	12.86	/	/	0.7
										2	14	1.40	12.35	/	/	0.7
										2.2	14	1.13	14.00	/	/	0.7
										2.4	14	1.00	13.13	/	/	0.8
										2.6	16	1.07	17.14	/	/	0.5
										2.8	10	0.93	3.64	/	/	0.65
										3	12	0.73	11.25	/	/	1
										3.2	13	1.07	13.93	/	/	1.15
										3.4	23	0.93	14.38	/	/	0.85
										3.6	17	1.60	12.14	/	/	1
										3.8	20	1.40	14.29	/	/	1.05
										4	21	1.40	12.60	/	/	1.35
										4.2	27	1.67	13.50	/	/	1.15
										4.4	23	2.00	11.50	/	/	1
										4.6	20	2.00	10.71	/	/	1.15
										4.8	23	1.87	12.78	/	/	1
										5	20	1.80	12.50	/	/	0.75
										5.2	20	1.60	12.50	/	/	0.65
										5.4	15	1.60	9.78	/	/	1
										5.6	13	1.53	11.47	/	/	0.95
										5.8	13	1.13	10.26	/	/	0.9
										6	20	1.27	21.43	/	/	1.05
										6.2	18	0.93	11.25	/	/	1
										6.4	17	1.60	11.59	/	/	0.85
										6.6	19	1.47	12.39	/	/	0.95
										6.8	18	1.53	12.27	/	/	0.9
										7	21	1.47	11.25	/	/	1.05
										7.2	21	1.87	10.86	/	/	1
										7.4	20	1.93	10.71	/	/	0.9
										7.6	18	1.87	10.80	/	/	0.6
										7.8	12	1.67	12.00	/	/	0.5
										8	10	1.00	15.00	/	/	0.45
										8.2	9	0.67	16.88	/	/	0.55
										8.4	10	0.53	12.50	/	/	0.7
										8.6	11	0.80	15.00	/	/	0.55
										8.8	11	0.73	11.00	/	/	0.7
										9	14	1.00	10.50	/	/	0.9
										9.2	20	1.53	13.04	/	/	0.75
										9.4	18	1.53	12.86	/	/	0.6
										9.6	15	1.40	12.50	/	/	
										9.8	12	1.20	10.59	/	/	
										10	14	1.13		/	/	
										10.2				/	/	
										10.4				/	/	
										10.6				/	/	
										10.8				/	/	
										11				/	/	
										11.2				/	/	
										11.4				/	/	
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										11.8				/	/	
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										18.8				/	/	
										19				/	/	
										19.2				/	/	
										19.4				/	/	
										19.6				/	/	
										19.8				/	/	
										20				/	/	

Legenda:
 AO argilla organica e terreni misti; AMT argilla molto tenera;
 AT argilla tenera; AM argilla media; AC argilla compatta
 AMC argilla molto compatta; ASL argilla sabbiosa limosa;
 SL sabbia e limo; SLA sabbia limoso argillosa
 SS sabbia sciolta; S sabbia; SD sabbia densa



Case Foschini

Allevamento Bovino

Casa Bro

la Fossa
la Magnana

Casa di San Giuseppe
Casa Agirelli

Casa Ricci
Casa Bolserra

Case Giunchi

Arla

scolo Bagallona

la Livona

iva Ortofrutticola

a Colombani

Macchine Agricole

Case Viroli

scolo Ponara

Prati

Ferramenta

Cavallina

Case il Lago

Carrozzeria

Podere Prati

Metalmeccanica

255020

Arredamenti

Salumificio

255030

lavorazione Sabbia e Ghiaia

Veicoli Industriali

la Ponara

Casa Benelli

Aziend

Podere Carpentieri

Prati del Lago

Madonna del Lago

SS 9

SS 9

Podere Pozzo

Allevamento Avicolo

Zona Industriale (Bertinoro)

Podere Francescona

Podere Fienile

Castalunga

Poggio di Sopra

la Panighina

Capocoll

Legenda

Province



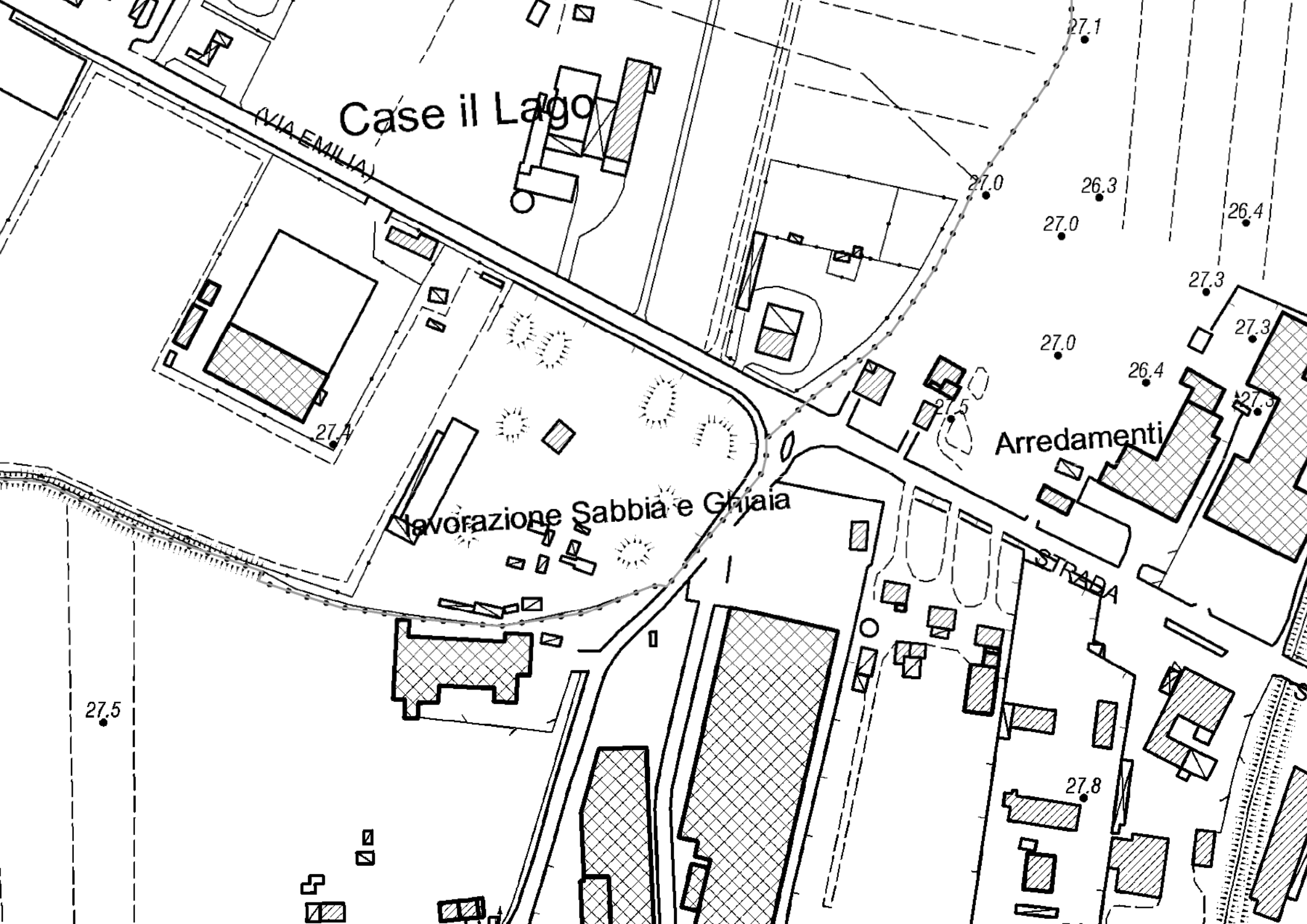
Comuni



Griglia 10.000







Case il Lago

VIA EMILIA

Arredamenti

Lavorazione Sabbia e Ghiaia

STRADA

27.1

27.0

26.3

27.0

26.4

27.3

27.0

26.4

27.3

27.3

27.4

27.5

27.8

Legenda

Province



Comuni



Griglia 10.000

