Società Autostrada Tirrenica p.A.

GRUPPO AUTOSTRADE PER L'ITALIA S.p.A.

AUTOSTRADA (A12) : ROSIGNANO – CIVITAVECCHIA

LOTTO 2

TRATTO: SAN PIETRO IN PALAZZI – SCARLINO

PROGETTO DEFINITIVO

INFRASTRUTTURA STRATEGICA DI PREMINENTE INTERESSE NAZIONALE LE CUI PROCEDURE DI APPROVAZIONE SONO REGOLATE DALL' ART. 161 DEL D.LGS. 163/2006

AU – CORPO AUTOSTRADALE

OPERE D'ARTE MINORI

OPERE DI SOSTEGNO

TIPOLOGIE NUOVE OPERE DI SOSTEGNO

RELAZIONE DESCRITTIVA GENERALE

IL RESPONSABILE PROGETTAZIONE SPECIALISTICA	IL RESPONSABILE INTEGRAZIONE PRESTAZIONI SPECIALISTICHE	IL DIRETTORE TECNICO
Ing. Tiziano Collotta Ord. Ingg. Lecco N. 122 RESPONSABILE UFFICIO GEI–APE	Ing. Alessandro Alfì Ord. Ingg. Milano N. 20015 COORDINATORE GENERALE APS	Ing. Maurizio Torresi Ord. Ingg. Milano N. 16492 RESPONSABILE DIREZIONE SVILUPPO INFRASTRUTTURE

RIFERIMENTO ELABORATO	DIRETTORIO		FILE		DATA:	REVISIONE	
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1. GENERALITA'

1.1 Oggetto e scopo del lavoro

Oggetto della presente relazione sono le verifiche geotecniche e strutturali delle opere di sostegno tirantate provvisionali, necessarie al fine di consentire i lavori di adeguamento dell'autostrada A12 Rosignano-Civitavecchia.

1.2 Criteri di verifica

Le verifiche agli stati limite sono eseguite mediante analisi d'interazione terreno-struttura rispettando le condizioni di equilibrio e congruenza e la compatibilità con i criteri di resistenza del terreno.

Le azioni considerate sull'opera di sostegno sono quelle dovute al peso proprio del terreno, ai sovraccarichi all'acqua e ad eventuali ancoraggi presollecitati.

Gli stati limiti ultimi delle opere di sostegno si riferiscono allo sviluppo di meccanismi di collasso determinati dalla mobilitazione della resistenza del terreno interagente con le opere (GEO) e al raggiungimento della resistenza degli elementi che strutturali che compongono le opere stesse (STR).

Per ogni stato limite considerato si verifica il rispetto della condizione

$Ed \leq Rd$ [6.2.1]

In cui Ed è il valore di progetto dell'azione e dove Rd è il valore di progetto della resistenza del sistema geotecnica. Tale verifica viene condotta impiegando diverse combinazioni di gruppi di coefficienti parziali, rispettivamente definiti per le azioni (A1 e A2, per i parametri geotecnica (M1 e M2) e per le resistenze (R1, R2, R3.

Gli stati limite ultimi risultati significativi per l'opera in esame sono di seguito elencati insieme alle corrispondenti combinazioni di coefficienti utilizzati nelle verifiche:

Paratie

- SLU di tipo geotecnico GEO e strutturale STR:

combinazione 1 A1+M1+R1; combinazione 2 A2+M2+R1

- Verifica di stabilità globale terreno-opera

combinazione 2 A2+M2+R2

Tiranti ancoraggio

- SLU di tipo strutturale STR:

combinazione 1 A1+M1+R1; combinazione 2 A2+M2+R1

- SLU di tipo geotecnico GEO (sfilamento)

combinazione 1 A1+M1+R3

2. RIFERIMENTI

2.1 Normative di riferimento

[1] Legge 5/11/71 n.1086 “Norme per la disciplina delle opere in conglomerato cementizio armato, normale, precompresso e per le strutture metalliche”.

[2] Lg. 2 febbraio 1974, n.64 “Provvedimenti per le costruzioni con particolari prescrizioni per le zone sismiche”. G.U. n.76 del 21 Marzo, 1974

[3] Circ. LL.PP. del 2 febbraio 2009, n. 617 Istruzioni per l'applicazione delle “Nuove norme tecniche per le costruzioni” di cui al D.M. 14 gennaio 2008.

[4] D.M. LL.PP. 14 Gennaio 2008, Suppl.Ord. n.30 alla G.U. 4-2-2008 n. 29 “ Nuove norme tecniche per le costruzioni”

[5] prEN 1998-1:2003 “Eurocode 8: design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings”.

[6] AICAP (1991) *"Ancoraggi nei terreni e nelle rocce-Raccomandazioni"* Maggio 1993.

2.2 Software di calcolo

Le analisi sono state svolte ricorrendo ai seguenti codici di calcolo:

- *Paratie 8.1.1 (HARPACEAS)*

3. MATERIALI

- Calcestruzzo per cordolo paratie
  caratteristica di resistenza minima C25 / C30

- Acciaio per armatura ordinaria in barre nervate tipo B450C
  $f_{yk} \geq 450$ MPa, $f_{tk} \geq 540$ MPa

- Acciaio armonico per tiranti in trefoli da 0.6”
  - Tensione caratteristica di rottura: $f_{ptk} = 1860$ MPa
  - Tensione caratteristica all’1% di deformazione totale: $f_{p(1)k} = 1670$ MPa

- Acciaio in profili a sezione aperta laminati a caldo saldati
  - Tipo EN 10025-2 S355 J2+N – per spessori nominali $t \leq 40$ mm
  - Tipo EN 10025-2 S355 K2+N – per spessori nominali $t > 40$ mm

- Acciaio in profili a sezione cava
  - Tipo EN 10210-1 S355 J0H+N

- Miscela cementizia di iniezione dei tiranti
  Classe di esposizione XC2
  Eventuali additivi secondo NTA
  Caratteristica di resistenza minima C25 / C30

- Miscela cementizia per micropali
  Secondo NTA - soggetto ad approvazione della Direzione Lavori
  Caratteristica di resistenza minima C25 / C30
  Eventuali additivi secondo NTA

4. CARATTERIZZAZIONE GEOTECNICA E STRATIGRAFICA

4.1 Generalità

I dati stratigrafici e geotecnici utili per il progetto delle opere oggetto della presente relazione sono descritti nei successivi paragrafi, e si riferiscono sostanzialmente al rilevato stradale esistente da sostenere ed al terreno di fondazione.

4.2 Caratterizzazione geotecnica adottata

Ai fini delle verifiche geotecniche, i parametri riportati di seguito vengono considerati come "*parametri caratteristici*" per le verifiche agli stati limite (SLU), ai sensi delle NTC 08. .

4.2.1 Rilevato autostradale esistente

Nell'area in esame i rilevati sono costituiti da ghiaia-sabbiosa, per essi si assumono le caratteristiche meccaniche di seguito riportate:

Peso specifico γ_t = 18 kN/m^3

Angolo di attrito operativo ϕ' = 32°

Coesione efficace c' = 0 kPa

Modulo elastico operativo E'_{op}= 30 MPa

4.2.2 Terreno di fondazione

Per i terreni posti al di sotto del piano di posa dei rilevati esistenti sono state assunte, cautelativamente, le caratteristiche di resistenza meccanica e deformabilità riportate nella tabella seguente.

Tabella 4.1 – Caratteristiche geotecniche del terreno di fondazione

		Materiale in situ
Peso naturale di volume	γ (kN/m^3)	18
Angolo di attrito efficace di picco	φ' (°)	25
Coesione efficace	c' (kPa)	0
Coefficiente di Poisson	ν (-)	0.3
Modulo elastico drenato operativo di scarico-ricarico	E'_{op} (MPa)	25

4.3 Azione sismica di riferimento

Pericolosità sismica del sito

Sito: Lotto 2 parte 1 sez. 3

Latitudine: 43.312°;

Longitudine: 10.539°;

Strategia di progettazione

Classe d'uso: IV; Coefficiente d'uso: cu = 2

Vita nominale costruzione: 50 anni

Periodo di riferimento per la costruzione: V_R = 100 anni

Valori dei parametri a_g, F_0, T_C* per i periodi di ritorno T_R associati a ciascuno a stato limite

STATO LIMITE	T_R [anni]	ag [g]	F0 [-]	Tc* [sec]
SLO	60	0.049	2.520	0.237
SLD	101	0.061	2.523	0.252
SLV	949	0.143	2.516	0.277
SLC	1950	0.174	2.548	0.283

Azione sismica di progetto

Stato limite considerato: SLV

Categoria sottosuolo: D; S_S = 1.8

Categoria topografica: T1; S_T = 1.0

Acceler. orizzontale massima attesa su sito di riferimento rigido (cat. A): a_g = 0.143 g

Poiché le opere oggetto delle presenti verifiche sono di tipo provvisionale, si ritiene possibile impiegare accelerazioni sismiche di progetto opportunamente ridotte. A tale scopo, sono state seguite le considerazioni riportate nell'Appendice A dell'Eurocodice 8 Parte 2 ("Evento sismico di progetto per ponti e raccomandazioni per la scelta di un evento per la fase di costruzione").

Ipotizzando che t_c sia la durata della fase di costruzione dell'opera e p la probabilità di superamento ritenuta accettabile in questa fase, il periodo di ritorno col quale si verifica il sisma t_{rc} è individuato dalla relazione:

$$t_{rc} = 1/[1-(1-p)^{1/t_c}]$$

Per valori relativamente piccoli solitamente associati a t_c (≤ 5 anni), la formula proposta può essere approssimata con la relazione seguente:

$$t_{rc} \cong \frac{t_c}{p}$$

Il sopraccitato riferimento normativo raccomanda di assumere valori della probabilità di superamento p non superiori a 0,05.

Il valore dell'accelerazione sismica di riferimento, corrispondente ad un periodo di ritorno t_{rc}, è individuato dalla relazione:

$$a_{gc} = a_{g,475}(t_{rc} / t_{ro})^k$$

dove:

$a_{g,475}$ è l'accelerazione convenzionale massima su suolo di categoria A corrispondente ad un periodo di ritorno di riferimento t_{r0} pari a 475 anni (probabilità di superamento pari al 10% in 50anni);

k parametro che dipende dalla sismicità del luogo ($\cong$ 0,3÷0,45).

Assunto:

p = 0,05

t_c = 6 mesi = 0,5 anni

k = 0,3

ponendo cautelativamente

$a_{g,475}$ = ag (SLV) = 0.143g

risulta un'accelerazione sismica di riferimento pari a

$a_{gc} = 0.314\ a_{g,475} = 0.045$ g

L'accelerazione massima al suolo per le opere provvisionali in esame risulta dunque pari a

$a_{max} = S_S\ S_T\ a_{gc} = 0.08$g

5. ANALISI DELLA PARATIA – METODO DI CALCOLO

5.1 Codice di calcolo

Lo studio del comportamento di una paratia tirantata è condotto mediante l'ausilo di un codice di calcolo (PARATIE verisione Paratie Plus 2010) che permetta di simulare in maniera verosimile, anche se semplificata, l'interazione tra terreno e struttura di sostegno; basato sulle seguenti ipotesi di carattere generale:

1. stato piano nelle deformazioni (paratia di lunghezza infinita);
2. la paratia venga discretizzata con elementi monodimensionali a due gradi di libertà (spostamento orizzontale e rotazione);
3. gli elementi di ancoraggio siano schematizzati mediante elementi finiti (definiti da una rigidezza assiale) che divengono attivi a partire dal momento del loro inserimento;
4. il terreno venga schematizzato mediante una legge costituiva di tipo elasto-plastico, identificata da parametri di spinta/reazione e di deformabilità del terreno, che preveda cicli di scarico e ricarico;
5. i parametri di spinta/reazione del terreno siano identificabili con:
   - il coefficiente di spinta riposo K_0, (corrispondente alla condizione iniziale indeformata);
   - i coefficienti di spinta attiva (K_A) e passiva (K_P) (corrispondenti alle condizioni di equilibrio limite inferiore e superiore);
6. l'interazione terreno-struttura venga simulata, in accordo ai metodi della reazione di sottofondo, con "molle" elasto-plastiche che reagiscono elasticamente sino ad un valore limite dello spostamento, raggiunto il quale la reazione corrisponde, a seconda del segno dello spostamento, al valori limite di pressione attiva o passiva;
7. tiranti modellati per mezzo di molle di opportuna rigidezza;
8. sovraccarichi a monte ed a valle della paratia trasformati in spinte sul paramento in accordo a quanto previsto dalla teoria elastica.

Tale codice di calcolo, che permette di seguire analiticamente la successione delle fasi di costruzione, di carico e di contrasto, consente di ottenere informazioni attendibili sull'entità delle deformazioni e sugli effetti che esse inducono sul diagramma delle pressioni esercitate dal terreno sulla paratia.

5.2 Spinta della terra – Effetto dell'attrito terreno/struttura

Nella valutazione dei coefficienti di spinta (attiva e passiva) è necessario tenere in conto dell'angolo di attrito tra manufatto e terreno (δ) che risulta inferiore all'angolo di attrito interno del terreno. Nel caso in studio si assume quanto segue:

$\delta/\phi = 0.50$ Spinta attiva - Analisi statiche e sismiche

δ/ϕ = 0.50 Spinta passiva - Analisi statiche

δ/ϕ = 0 Spinta passiva - Analisi sismiche

5.3 Spinta della terra - Coefficienti di spinta in condizioni statiche

5.3.1 Spinta a riposo

Per piano campagna orizzontale si fa riferimento alla seguente correlazione (Jaky, 1944 e Schmidt, 1966):

$k_o = 1–\text{sen}(\phi') \, OCR^{\alpha}$

con :

α = 0.5

OCR = grado di sovraconsolidazione

5.3.2 Spinta attiva

Il coefficiente di spinta attiva (K_a) viene valutato ricorrendo alla correlazione generale di Muller-Breslau basata sulla teoria di Coulomb e riferita a superfici di rottura piane. In questo caso l'approssimazione (rispetto a quanto si sarebbe ottenuto considerando superfici di rottura di geometria complessa) risulta molto contenuta e a favore di sicurezza.

$$Ka = \frac{\sin^2(\alpha+\varphi)}{\sin^2\alpha \cdot \sin(\alpha-\delta)\left[1+\sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\sin(\alpha-\delta)\sin(\alpha+\beta)}}\right]^2}$$

dove:

φ = angolo d'attrito del terreno;

α = angolo che la parete forma con l'orizzontale (α = 90° per parete verticale);

δ = angolo d'attrito terreno-parete;

β = inclinazione del terreno a monte rispetto all'orizzontale.

5.3.3 Spinta passiva

Per il calcolo del coefficiente di spinta passiva si fa riferimento a superfici di rottura di tipo complesso (spirale logaritmica) come suggerito da Caquot & Kerisel (1948).

5.4 Coefficienti di spinta in condizioni sismiche

5.4.1 Coefficienti sismici

In accordo a quanto contenuto nel paragrafo 7.11.6.3 delle NTC08 l'azione sismica è definita come un'accelerazione equivalente costante avente componenti orizzontali a_h e verticali a_v legate all'accelerazione di picco a_{max} attesa nel volume di terreno significativo mediante la relazione:

$$a_h = k_h\, g = \alpha\, \beta\, a_{max} \qquad \geq 0.2\, a_{max}/g \qquad [7.11.9]$$

$$a_v = 0$$

in cui

g : accelerazione di gravità

k_h : coefficiente sismico in direzione orizzontale

$\alpha \leq 1$ coefficiente che tiene conto della deformabilità dei terreni interagenti con l'opera. Il valore viene ricavato a partire dall'altezza della paratia e dalla categoria di sottosuolo mediante il diagramma di fig. 7.11.2 (NTC08)

$\beta \leq 1$: coefficiente funzione della capacità dell'opera di subire spostamenti senza cadute di resistenza; viene ricavato dal diagramma di fig. 7.11.3 delle NTC08, in funzione del massimo spostamento u_s che può tollerare l'opera senza riduzioni di resistenza. Nelle analisi si pone us = 0.005h con h pari all'altezza di scavo della paratia.

L'accelerazione di picco a_{max} è valutata come

$a_{max} = S_S\, S_T\, a_g = 0.081$ g

Con

S_S = 1.8 effetto amplificazione stratigrafica (suolo tipo D)

S_T = 1.0 effetto amplificazione topografica

a_g = 0.045g accelerazione orizzontale massima su sito di riferimento rigido (suolo A; T_R = 10anni, opera provvisionale)

5.4.2 Spinta attiva

La spinta attiva in condizioni dinamiche in termini di tensioni totali di progetto è stata determinata, in accordo a quanto descritto nella O.P.C.M. 3274/2003 e successive modifiche e/o nell'Eurocodice 8 (2003) secondo la teoria di Mononobe-Okabe:

$$K_{as} = \frac{\sin^2(\alpha+\varphi-\vartheta)}{\cos\vartheta\cdot\sin^2\alpha\cdot\sin(\alpha-\vartheta-\delta)\left[1+\sqrt{\frac{\sin(\varphi+\delta)\cdot\sin(\varphi-\beta-\vartheta)}{\sin(\alpha-\vartheta-\delta)\cdot\sin(\alpha+\beta)}}\right]^2}$$

dove:

$$\vartheta = \arctan k_h /(1 \pm k_v) = \arctan k_h$$

Come altezza di spinta si considera l'altezza dello scavo della paratia.

5.4.3 Spinta passiva

Il coefficiente di spinta passiva in condizioni dinamiche, in termini di tensioni totali di progetto, è stato determinato, in accordo a quanto descritto nella O.P.C.M. 3274/2003 e successive modifiche e/o nell'Eurocodice 8 (2003) secondo la teoria di Mononobe-Okabe:

$$K_{ps} = \frac{\sin^2(\alpha+\varphi-\vartheta)}{\cos\vartheta\cdot\sin^2\alpha\cdot\sin(\alpha+\vartheta)\left[1-\frac{\sqrt{\sin(\varphi)\cdot\sin(\varphi+\beta-\vartheta)}}{\sqrt{\sin(\alpha+\beta)\cdot\sin(\alpha+\vartheta)}}\right]^2}$$

dove,

nel caso in esame, di terreno impermeabile in condizioni dinamiche al di sotto del livello di falda:

$$\vartheta = \arctan\left(\frac{\gamma_{sat}}{\gamma'}\cdot\frac{k_h}{1\pm k_v}\right) = \arctan\left(\frac{\gamma_{sat}}{\gamma'}\cdot k_h\right)$$

6. ANALISI DELLA PARATIA – CRITERI DI VERIFICA

Per le verifiche strutturali degli elementi in carpenteria metallica si fa riferimento a quanto prescritto in NTC08 e successiva Istruzione Tecnica (Circ. 02.02.2009 n° 617/C.S.LL:PP.).

La resistenza di calcolo della membratura si assume pari a :

$R_d = R_k / \gamma_M$

in cui

R_k : valore caratteristico della resistenza dipendente dalla resistenza f_{yk} del materiale, dalla geometria dell'elemento strutturale e dalla classe della sezione

$\gamma_M = 1.05$: coefficiente di sicurezza parziale per la resistenza delle membrature

6.1 Verifica dei micropali (paratie provvisorie)

Le tipologie di tubi commerciali impiegati per l'armatura dei micropali in esame hanno una sezione di tipo compatto (classe 1); la capacità resistente della sezione si determina pertanto con il metodo plastico assumendo una la completa plasticizzazione del materiale.

Classificazione sezione

classe 1: $D/t \leq 50 \times \varepsilon^2$

dove:

$\varepsilon = \sqrt{(235MPa/f_y)}$

f_y = tensione di snervamento (355MPa per Fe510)

D = diametro del tubo

t = spessore del tubo

6.1.1 Flessione e Taglio

Si rammenta, ai sensi del cap. 4.2.3.2 delle NTC, che "la capacità resistente delle sezioni deve essere valutata (...) determinando anche gli effetti indotti sulla resistenza dalla presenza combinata di più sollecitazioni"; tuttavia, se si verifica che il taglio di calcolo allo stato limite ultimo (V_{Ed}) è inferiore alla metà della resistenza di calcolo a taglio ($V_{c,Rd}$):

$$V_{Ed} \leq 0.5 \cdot V_{c,Rd} \qquad \text{(4.2.31 NTC)}$$

la Normativa (cap. 4.2.4.1.2) afferma che si può trascurare l'influenza del taglio sulla resistenza a flessione, pertanto le due verifiche a taglio e a flessione possono essere condotte in maniera separata.

6.1.2 Taglio

Il valore di calcolo dell'azione tagliante V_{Ed} deve rispettare la seguente condizione:

$V_{Ed} / V_{c,Rd} \leq 1$ (4.2.17 NTC)

$V_{c,Rd} = \frac{A_v \cdot f_{yk}}{\sqrt{3} \cdot \gamma_{M0}}$ in assenza di torsione (4.2.18 NTC)

dove A_v è l'area di taglio, che, nel caso specifico di sezioni tubolari vale

$A_v = 2A/\pi$ A = area lorda (4.2.24 NTC)

6.1.3 Flessione

Il momento flettente di calcolo M_{Ed} deve rispettare la seguente condizione:

$M_{Ed} / M_{c,Rd} \leq 1$ (4.2.12 NTC)

$M_{c,Rd} = M_{pl,Rd} = \frac{W_{pl} \cdot f_{yk}}{\gamma_{M0}}$ per le sezioni di classe 1 e 2 (4.2.13 NTC)

In cui

f_{yk} = 355 N/mm^2	tensione snervamento (acciaio S355 - ex Fe510)
D :	diametro esterno tubo
t :	spessore della parete
W_{pl} = 4/3 (R^3 – ^{r3}) =	modulo di resistenza plastico
R = D/2	raggio esterno
r = D/2 – t	raggio interno

6.2 Verifica delle travi di ripartizione

La verifica a flessione+taglio (essendo in questo caso l'azione assiale nulla) delle travi metalliche viene svolta in accordo a NTC08. Il profilo HEA180 ha una sezione compatta di classe 2 si assume pertanto come stato limite ultimo della sezione la completa plasticizzazione.

6.2.1 Calcolo delle sollecitazioni agenti sulla trave metallica di riscontro dei tiranti

Nel seguito si riporta il calcolo del momento e del taglio di calcolo risultanti nella trave metallica di riscontro dei tiranti posti ad interasse i, con angolo di inclinazione α.

Il comportamento globale della trave è schematizzabile come quello di una trave pluriappoggiata in corrispondenza delle teste dei tiranti (Figura 6.1). Si considera quindi un carico uniformemente distribuito sulla trave che equilibra le reazioni (tiro massimo dei tiranti). L'entità di tale carico sarà:

$p = \frac{T_{max} \cdot \cos\alpha}{i}$ [kN/m]

dove:

T_{max} = tiro massimo nei tiranti;

α = angolo d'inclinazione del tirante;

i = interasse tiranti.

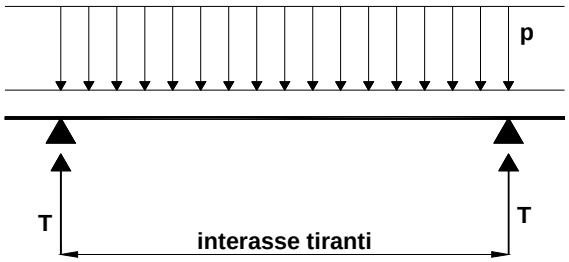


Figura 6.1 - Schema statico di calcolo travi di contrasto e cordoli

Il valore di calcolo del momento flettente sarà quindi:

$$M_{Ed} = \frac{p \cdot i^2}{10}$$ [kN·m/trave]

Il valore di calcolo del taglio sarà invece:

$$V_{Ed} = \frac{p \cdot i}{2}$$ [kN/trave]

6.2.2 Taglio

Il valore di calcolo dell'azione tagliante V_{Ed} deve rispettare la seguente condizione:

$$V_{Ed} / V_{c,Rd} \leq 1$$ (4.2.17 NTC)

$$V_{c,Rd} = \frac{A_v \cdot f_{yk}}{\sqrt{3} \cdot \gamma_{M0}}$$ in assenza di torsione (4.2.18 NTC)

dove A_v è l'area di taglio, che, nel caso specifico di profili HEA 180, può essere calcolata con la seguente espressione:

$$A_v = A - 2bt_f + (t_w + 2r)t_f$$ (4.2.19 NTC)

dove:

A è l'area lorda della sezione del profilo;

b è la larghezza delle ali;

t_f è lo spessore delle ali;

t_w è lo spessore dell'anima;

r è il raggio di raccordo tra ala e anima.

6.2.3 Flessione e taglio

Se il taglio di calcolo V_{Ed} è inferiore a metà della resistenza di calcolo a taglio $V_{c,Rd}$ si può trascurare l'influenza del taglio sulla resistenza a flessione. Nel caso contrario per le sezioni ad H di classe 1 e 2 doppiamente simmetriche soggette flessione e taglio nel piano dell'anima, la resitenza convenzionale di calcolo può essere valutata secondo la [4.2.33]

Per $V_{Ed} \leq 0.5 \times V_{pl,Rd}$ → $M_{pl,Rd} = W_{pl} \times (f_y / \gamma_{mo})$

Per $V_{Ed} > 0.5 \times V_{pl,Rd}$ →

$$M_{pl,Rd} = \frac{\left[W_{pl} - \frac{\rho A_w^{\,2}}{4t_w}\right] f_y}{\gamma_{M0}} \qquad \text{[4.2.33 NTC]}$$

dove:

V_{Ed} = taglio di progetto

$A_w = h_w \cdot t_w$

h_w = altezza anima

$\rho = [2x(V_{sd} / V_{pl,Rd}) - 1]^2$

7. TIRANTI DI ANCORAGGIO – CRITERI DI VERIFICA

7.1 Verifiche di sicurezza

L'ancoraggio delle paratie provvisionali viene realizzato a mezzo di tiranti a trefoli con bulbo iniettato a pressione valvola per valvola (iniezioni multiple e ripetute).

Gli stati limite ultimi dei tiranti di ancoraggio si riferiscono allo sviluppo di meccanismi di collasso determinati dalla mobilitazione della resistenza del terreno a al raggiungimento della resistenza degli elementi strutturali che li compongono.

7.1.1 Resistenza limite allo sfilamento del bulbo

In accordo con gli orientamenti normativi (Paragrafo 6.6.1 Criteri di Progetto delle NORME TECNICHE DELLE COSTRUZIONI) per la valutazione del carico limite della fondazione dell'ancoraggio (sfilamento bulbo-terreno) si può procedere in prima approssimazione con formule teoriche o con correlazioni empiriche. *Tuttavia, la conferma sperimentale con prove di trazione in sito nelle fasi di progetto e di collaudo risulta sempre necessaria*.

La progettazione dei tiranti di ancoraggio è avvenuta nel rispetto della condizione:

$$P_{d\,TIR} \leq R_{ad\,TIR}$$

dove:

- $P_{d\,TIR}$ è il valore della massima azione di Progetto tra tutti i possibili stati limite ultimi (SLU) e di esercizio (SLE).
- $R_{ad\,TIR}$ è la resistenza di progetto con specifico riferimento ad uno stato limite di sfilamento della fondazione dell'ancoraggio.

La verifica di tale condizione viene effettuata con riferimento alla combinazione A1+M1+R3, tenendo conto dei coefficienti parziali riportati nelle Tab. 6.2.I, 6.2.II e 6.6.I delle NTC.

La resistenza di progetto $R_{ad\,TIR}$ è determinata applicando alla resistenza caratteristica $R_{ak\,TIR\,i}$ fattori parziali riportati in Tabella 6.6.I delle NTC e di seguito riportata.

$$R_{ad\,TIR} = \frac{R_{ak\,TIR}}{\gamma_{R\,TIR}}$$

Tabella 7-1 – *Coefficienti parziali per la resistenza di ancoraggi*

	Simbolo	COEFFICIENTE PARZIALE
Temporanei	$\gamma_{R\ TIR,\ t}$	1.1
Permanenti	$\gamma_{R\ TIR,\ p}$	1.2

Il valore caratteristico della resistenza allo sfilamento dell'ancoraggio $R_{ak\ TIR}$, nel caso specifico, è stato dedotto con metodi analitici, a partire dai valori caratteristici dei parametri geotecnici (risultati di prove in sito e/o di laboratorio).

Quindi, il valore della resistenza caratteristica $R_{ak\ TIR}$ è il minore dei valori derivanti dall'applicazione dei fattori di correlazione ξ_{a3} e ξ_{a4} rispettivamente al valor medio e al valor minimo delle resistenze $R_{a,c}$ ottenute dal calcolo. Per la valutazione dei fattori ξ_{a3} e ξ_{a4} si deve tenere conto che i profili di indagine sono solo quelli che consentono la completa identificazione del modello geotecnico di sottosuolo per il terreno di fondazione dell'ancoraggio.

$$R_{ak\ TIR} = MIN\left(\frac{(R_{a,c})_{medio}}{\xi_{a3}}, \frac{(R_{a,c})_{\min}}{\xi_{a4}}\right)$$

Tabella 7-2 – Fattori di correlazione per derivare la resistenza caratteristica dalle prove geotecniche, in funzione del numero n di profili di indagine.

Numero di profili di indagine	1	2	3	4	≥ 5
ξ_{a3}	1.80	1.75	1.70	1.65	1.60
ξ_{a4}	1.80	1.70	1.65	1.60	1.55

Nel caso specifico si sono adottati i valori seguenti dei fattori di correzione:

ξ_{a3} = 1.75

ξ_{a4} = 1.70

Per ancoraggi con bulbo realizzato nel terreno naturale e/o nel rilevato dell'autostrada esistente ad iniezioni multiple e ripetute si fa riferimento a valori di resistenza allo sfilamento cautelativi come di seguito indicato:

		ordine	I	II	III	IV
Aderenza unitaria media	$\alpha\tau_{ad,kmed}$	[kN/m^2]	160	160	210	210
Aderenza unitaria min	$\alpha\tau_{ad,kmin}$	[kN/m^2]	150	150	200	200

Si precisa che nella valutazione analitica della resistenza allo sfilamento degli ancoraggi non si applicano coefficienti parziali di sicurezza sui valori caratteristici della resistenza del terreno; si fa quindi riferimento ai coefficienti parziali di sicurezza M1.

Il valore della resistenza è svolto secondo la seguente relazione:

$$\left(R_{a,c}\right)_{med} = \pi \cdot \alpha \cdot D_{perf} \cdot L_{bulbo} \cdot \tau_{ad\ k\ med}$$
$$\left(R_{a,c}\right)_{\min} = \pi \cdot \alpha \cdot D_{perf} \cdot L_{bulbo} \cdot \tau_{ad\ k\ \min}$$

in cui:

- $(R_{a,c})_{med}$ = resistenza caratteristica media
- $(R_{a,c})_{mi}$ = resistenza caratteristica minima
- $\varnothing_{perf}$ = diametro medio del bulbo per tiranti a trefoli
- L_{bulbo} = lunghezza del bulbo di ancoraggio
- α = coefficiente empirico correlato con la metodologia di esecuzione delle iniezioni del tratto di fondazione.
- $\tau_{ad\ medio}$ = aderenza media caratteristica bulbo-terreno
- $\tau_{ad\ min}$ = aderenza minima caratteristica bulbo-terreno

7.1.2 Resistenza strutturale dei tiranti

La resistenza di calcolo del tirante risulta pari a

$$R_{p(1)k} = n_{pi} \cdot A_{pi} \cdot f_{p(1)k} / \gamma s$$

dove

n_{pi} numero dei trefoli per tirante

$A_{pi} = 139\ mm^2$ area del singolo trefolo

$f_{p(1)k} \geq 1670\ N/mm^2$ tensione caratteristica all'1% di deformazione totale

γ_s: coefficiente parziale di sicurezza dell'acciaio

la resistenza dei tiranti utilizzati nelle paratie in esame risulta dunque pari a

n_{pi}	$R_{p(1)k}$
	kN
3	605.5
4	807.4
5	1009.3

Nei tiranti realizzati con trefoli in acciaio armonico per il rispetto della gerarchia delle resistenze (par. 6.6.2 NTC) si controlla che la resistenza caratteristica al limite di snervamento del tratto libero sia sempre maggiore della resistenza (caratteristica, N_{dR}) a sfilamento della fondazione dell'ancoraggio

$$R_{p(1)k} > R_{ak}$$

8. ANALISI DELLA PARATIA

8.1 Sezioni di verifica (tipo)

Sono state analizzate cinque sezioni tipo le cui caratteristiche geometriche sono riassunte in Tabella 9.1.

Tabella 9.1 - Caratteristiche di progetto dei tiranti

Sezione tipo	Altezza paratia (m)	Altezza di scavo massima (m)	Ordine tiranti	Distanza da estradosso cordolo (m)	n° trefoli (-)	Interasse orizzontale massimo i (m)	Inclinazione α (°)	Lunghezza libera L_L (m)	Lunghezza bulbo di ancoraggio L_B (m)	Pretiro T_0 (kN)
0	6	2,5	-	-	-	-	-	-	-	-
1	9	4,5	I	1,25	3	2,4	15	6	10	240
2	12	6	I	1,25	3	2,4	15	7	10	240
			II	3,75	5	2,4	20	6	13	340
3	15	7,5	I	1,25	3	2,4	15	9	10	240
			II	3,75	4	2,4	20	8	12	340
			III	6,25	4	2,4	25	6	12	340
4	18	10	I	1,5	3	2,4	15	11	10	145
			II	4	3	2,4	20	11	10	240
			III	6,5	5	2	25	12	15	570
			IV	8,5	5	2	30	12	15	510

Nelle figure 9.1, 9.2, 9.3, 9.4 e 9.5 sono illustrate le sezioni trasversali delle sezioni tipologiche analizzate.

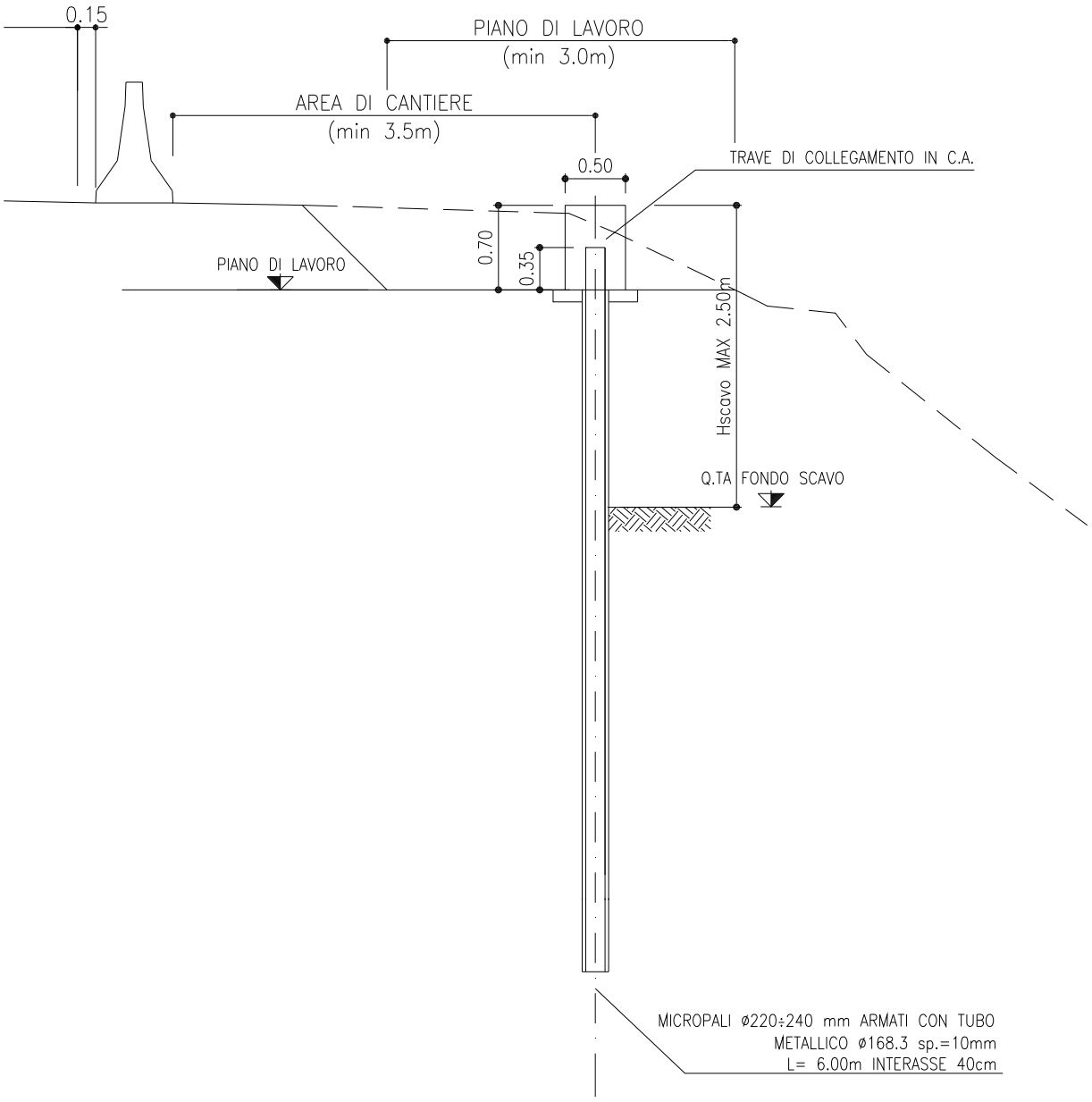


Figura 9.1 – Sezione trasversale paratia tipo 0 – H_{scavo} = 2,5m

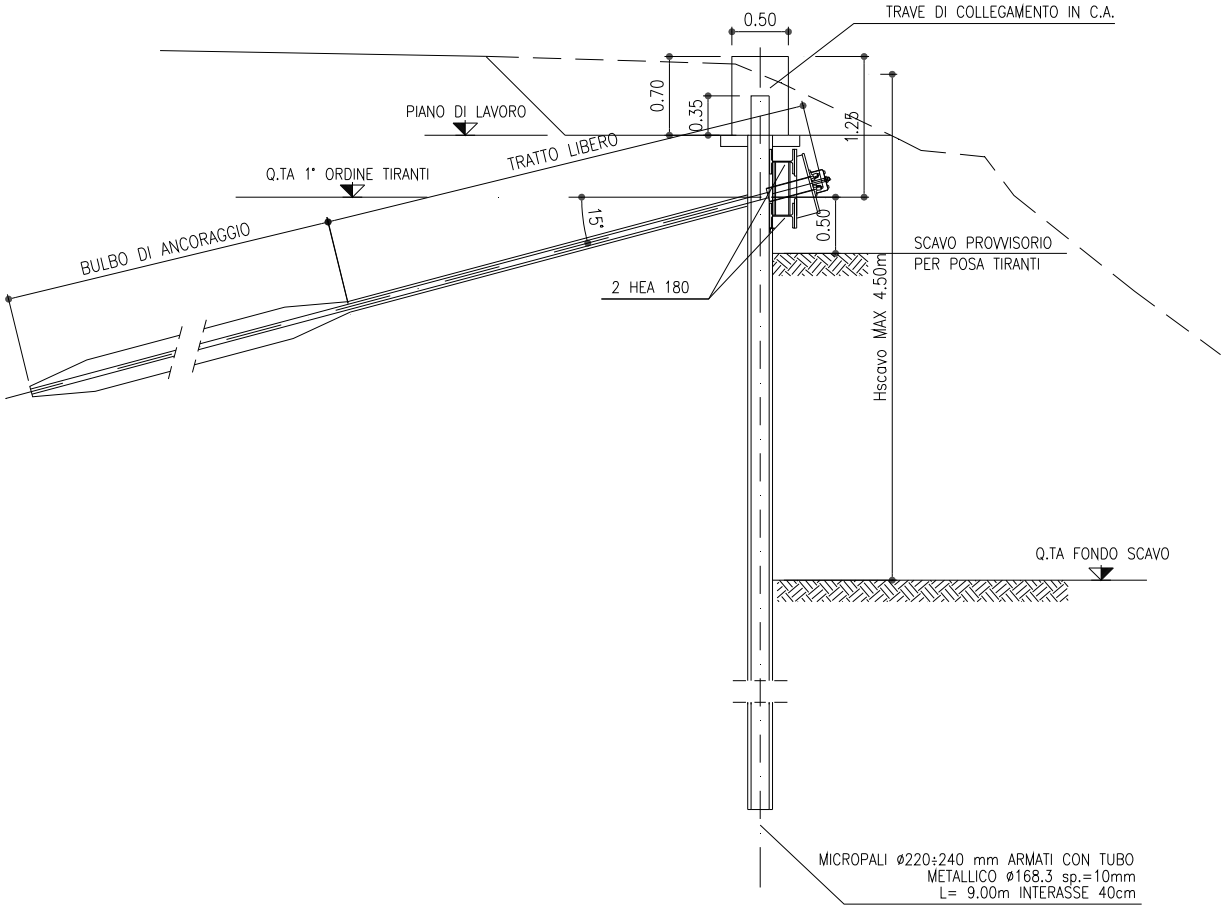


Figura 9.2 – Sezione trasversale paratia tipo 1 – H_{scavo} = 4,5m

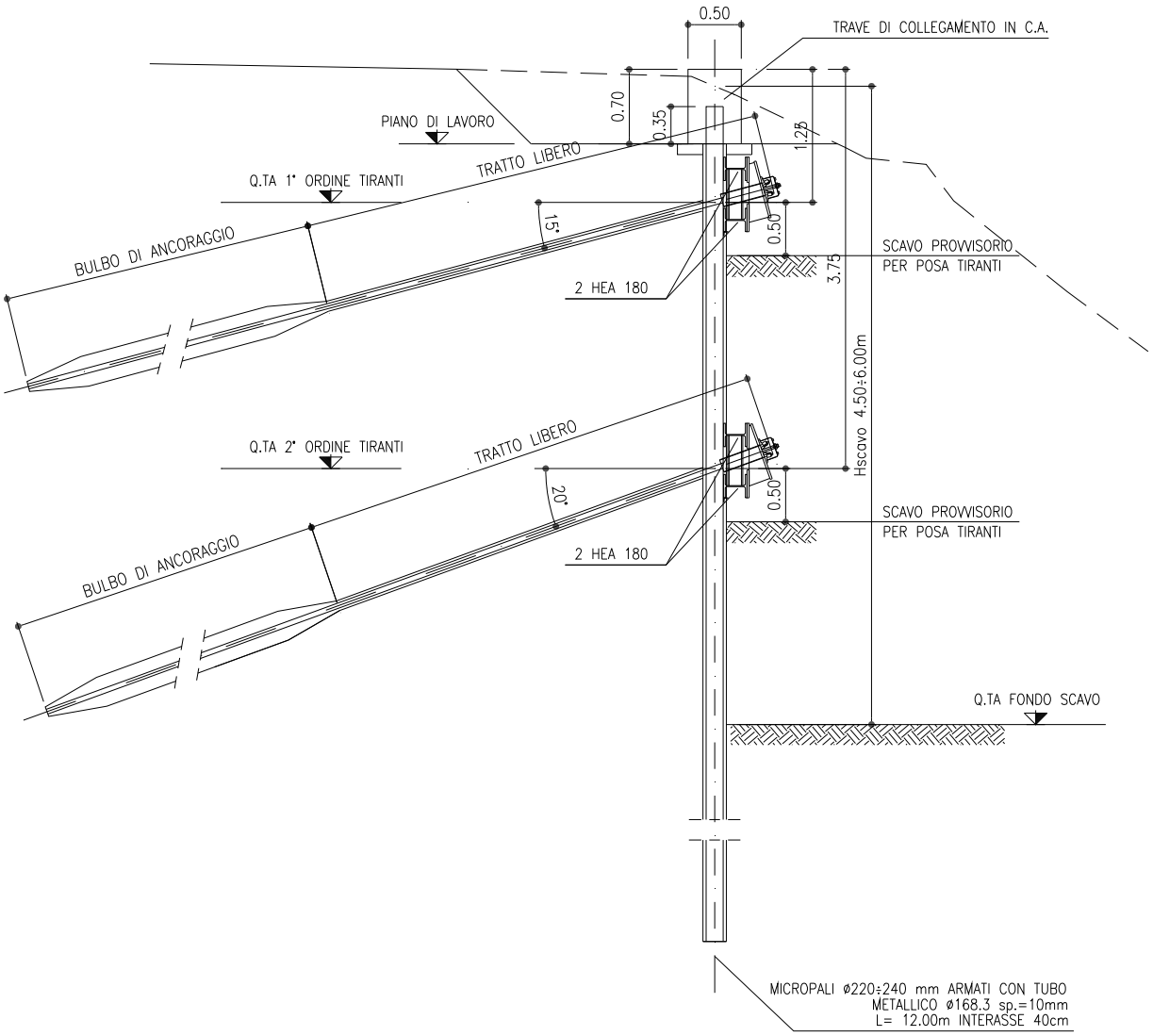


Figura 9.3 – Sezione trasversale paratia tipo 2 – H_{scavo} = 6m

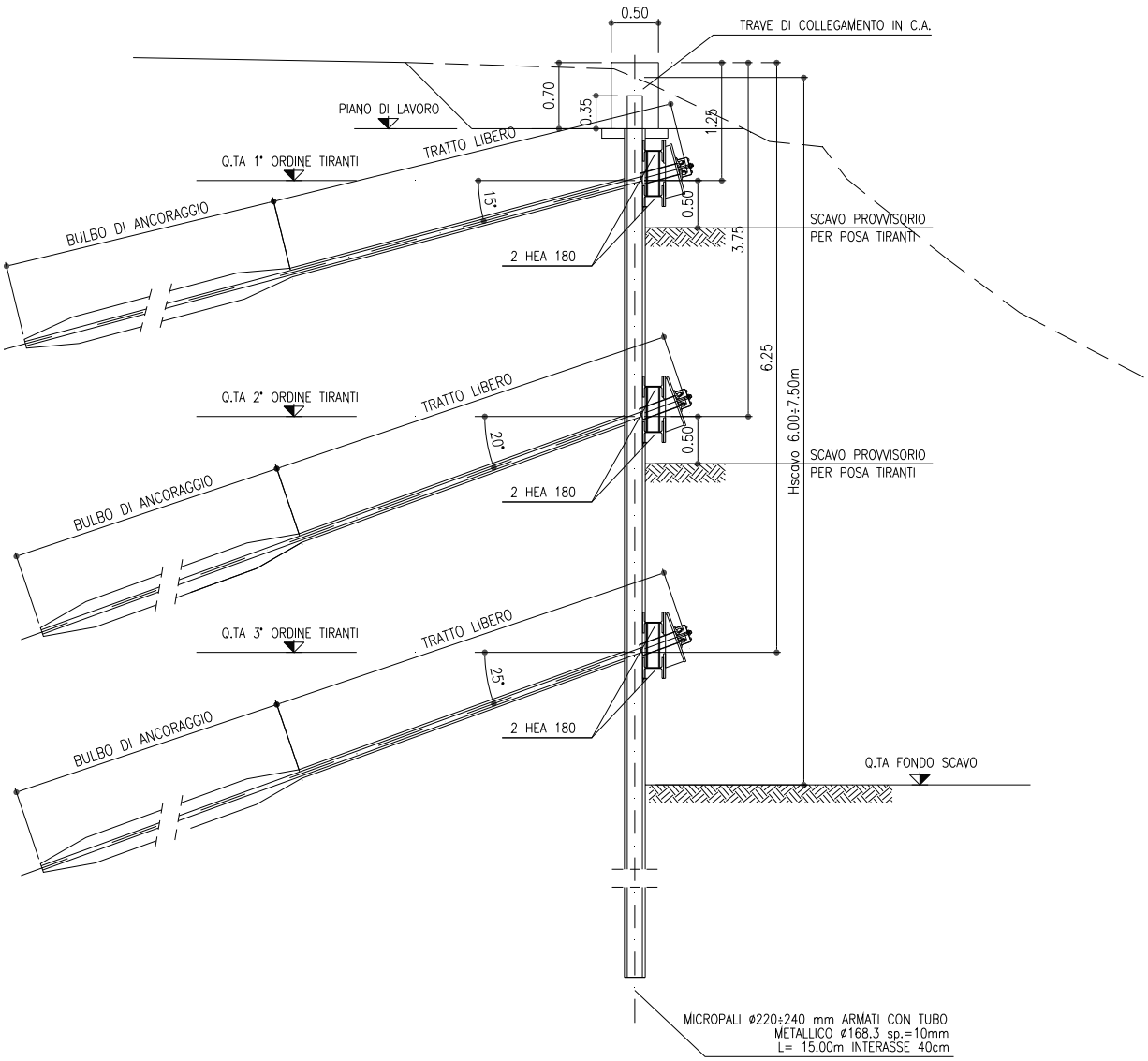


Figura 9.4 – Sezione trasversale paratia tipo 3 – H_{scavo} = 7,5m

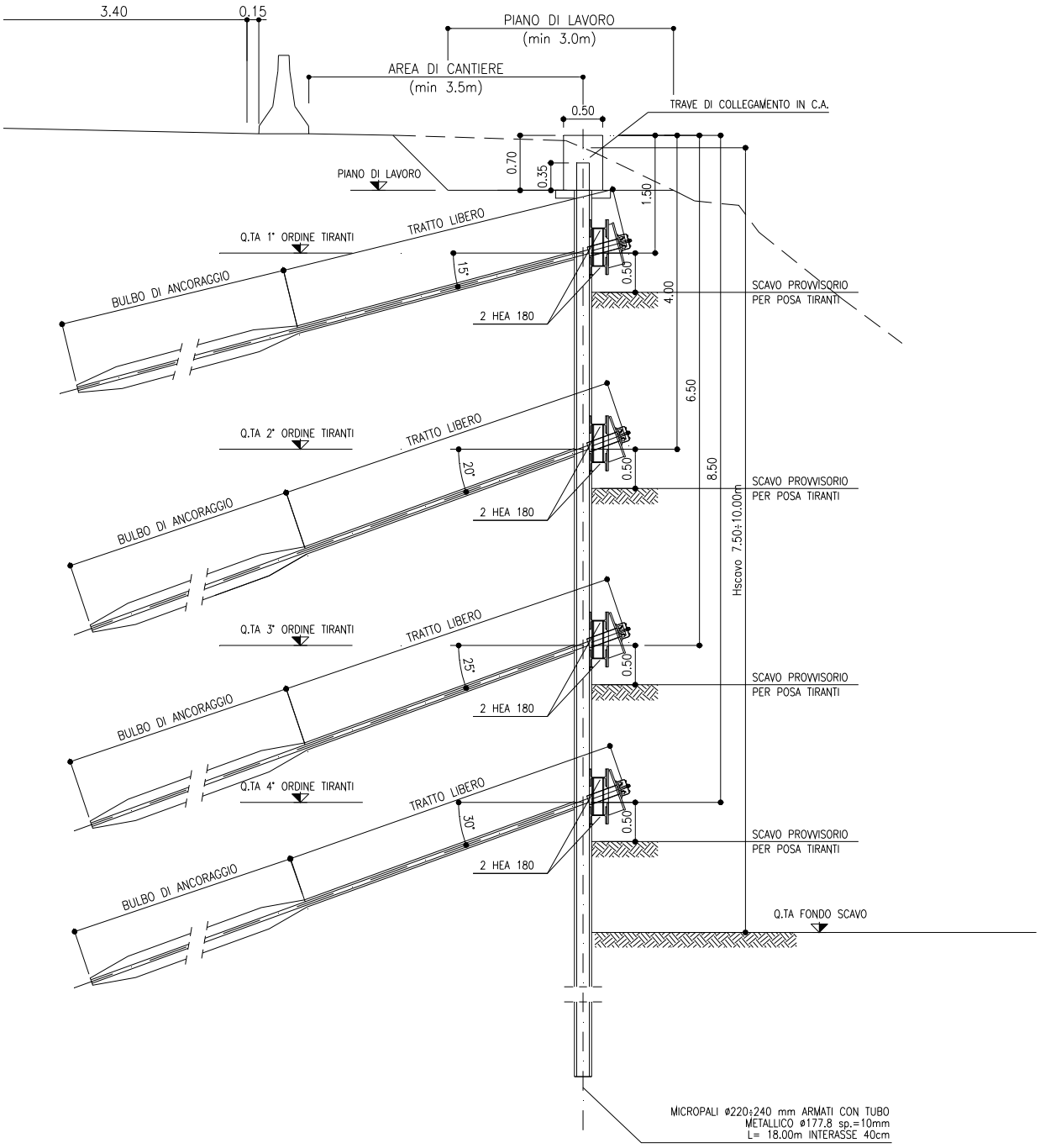


Figura 9.5 – Sezione trasversale paratia tipo 4 – H_{scavo} = 10m

8.2 Stratigrafia di calcolo

Nei calcoli si è ipotizzato (cautelativamente) che il terreno di fondazione sia presente a partire dalla quota del fondo scavo.

Per i parametri geotecnici caratteristici si rimanda al paragrafo 4.2.

8.2.1 Geometria dello scavo

Inclinazione media terreno a monte della paratia: 0°

Inclinazione terreno a valle della paratia: 0°

8.2.2 Caratteristiche geometriche della paratia

Diametro di perforazione: 220 ÷ 240mm

Sezione tipo	**Caratteristiche armatura tubolare (m)**
0	L=6m ϕ=168,3mm sp=10mm i=0,4m
1	L=9m ϕ=168,3mm sp=10mm i=0,4m
2	L=12m ϕ=168,3mm sp=10mm i=0,4m
3	L=15m ϕ=168,3mm sp=10mm i=0,4m
4	L=18m ϕ=177,8mm sp=10,0mm i=0,4m
L = lunghezza ϕ = diametro sp = spessore i = interasse	

8.2.3 Caratteristiche del sistema di ripartizione/collegamento

collegamento: cordolo in c.a.

1°,2°, 3° e 4° livello di tiranti: travi metalliche accoppiate HEA 180

8.2.4 Quota della falda

Sulla base delle informazioni riguardo all'andamento dei livelli di falda nella tratta in oggetto, il livello piezometrico è stato ipotizzato ad 1m al di sotto del fondo scavo.

8.2.5 Sovraccarichi accidentali e permanenti

Nelle verifiche statiche si considera un sovraccarico accidentale uniforme di 20kPa, dovuto al traffico stradale, posto cautelativamente in corrispondenza della testa della paratia.

Per la sezione di tipo 0 tale sovraccarico non è stato tenuto in conto, in quanto ricadente al di fuori del cuneo di spinta attiva.

8.2.6 Parametri di spinta

Nella Tabella 9.2 e Tabella 9.3 sono riportati i valori dei parametri geotecnici utilizzati nelle fasi di statiche ed in condizioni sismiche.

dell'incremento di spinta dovuto al solo sisma calcolati con il metodo di Mononobe-Okabe per i vari casi analizzati

Condizioni statiche

Tabella 9.2 – Coefficienti di spinta

TERRENO	γ	ϕ	c'	Evc	Eur	Ko	δ/ϕ	Ka	Kp
	kN/m^3	°	kPa	MPa		-	-	-	-
Rilevato	18	32	0	30	30	0.470	0.5	0.2674	5.056
Base	18	25	0	25	25	0.577	0.5	0.3587	3.324

CASO	tanϕ'	c'	cu
Caso M1	1	1	1
Caso M2	1.25	1.25	1.4

Caso M1

TERRENO	ϕ	c'	Evc	Eur	Ko	δ/ϕ	Ka	Kp
	°	kPa	MPa	0	-	-	-	-
Rilevato	32	0	30	30	0.470	0.5	0.267	5.056
Base	25	0	25	25	0.577	0.5	0.359	3.324

Caso M2

TERRENO	ϕ	c'	Evc	Eur	Ko	δ/ϕ	Ka	Kp
	°	kPa	MPa	0	-	-	-	-
Rilevato	26.56	0	30	30	0.5529	0.5	0.336	3.626
Base	20.46	0	25	25	0.6504	0.5	0.432	2.575

Condizioni sismiche

Tabella 9.3 – Coefficienti di spinta

Sez.	H	h	$u_{s,max}$	α	β	$\alpha*\beta$	a_g/g	$a_{max}/g = S\ a_g/g$	$\tan\theta = k_h$	$\tan\theta = k_h * \gamma/(\gamma-\gamma_w)$
[-]	[m]	[m]	m	[-]	[-]	[-]	[-]	[-]	[-]	
0	6	2.5	0.0125	1.000	0.661	0.661	0.045	0.081	0.053	0.120
1	9	4.5	0.0225	0.978	0.583	0.570	0.045	0.081	0.046	0.104
2	12	6	0.03	0.912	0.544	0.496	0.045	0.081	0.040	0.090
3	15	7.5	0.0375	0.847	0.515	0.436	0.045	0.081	0.035	0.079
4	18	10	0.05	0.738	0.476	0.351	0.045	0.081	0.028	0.064

			Metodo di Monobe - Okabe						
			monte				valle		
	H	h	ϕk	ϕd	δ/ϕ	kA [$\beta<\phi-\theta$]	ϕk	ϕd	kP
[-]	[m]	[m]	°	°	-	[-]	°	-	[-]
0	6	2.5	32	26.56	0.5	0.382	25	20.46	1.89
1	9	4.5	32	26.56	0.5	0.377	25	20.46	1.92
2	12	6	32	26.56	0.5	0.372	25	20.46	1.94
3	15	7.5	32	26.56	0.5	0.369	25	20.46	1.95
4	18	10	32	26.56	0.5	0.364	25	20.46	1.98

In cui

H: altezza paratia

h : altezza massima di scavo

$u_{s,max}$, α, β, a_g, a_{max} , k_h : parametri sismici definiti al punto 5.4.1

θ; angolo rispetto la verticale tra le azioni esterne orizzontali e quelle verticali agenti sul cune di spinta

ϕk: valore caratteristico angolo d'attrito

$\phi d = \arctan(\tan(\phi_k)/\gamma_{M2})$: valore di calcolo angolo d'attrito

8.3 Fasi del calcolo

Sono state modellate le seguenti fasi di calcolo:

1. Inizializzazione dello stato di sforzo geostatico.
2. Realizzazione dei micropali e della trave di testa.
3. Applicazione del sovraccarico stradale.
4. Scavo fino a 50cm sotto il primo livello di tiranti (fase non presente per la sezione di tipo 0).
5. Realizzazione del primo ordine di tiranti (fase non presente per la sezione di tipo 0).

6. Eventuale scavo sino alla quota relativa al piano di lavoro per l'esecuzione del secondo ordine di tiranti o al fondo scavo (fase non presente per la sezione di tipo 0).
7. Ripetizione delle fasi 5 e 6 sino al raggiungimento del piano relativo al fondo scavo.
8. Analisi in condizioni sismiche.

8.4 Analisi della struttura - Risultati

Nella Tabella 9.4÷Tabella 9.8 sono riassunti i principali risultati del calcolo. I valori indicati sono da intendersi come "caratteristici" per metro lineare di paratia.

Tabella 9.4 – Risultati dell'analisi tenso-deformativa (azioni "caratteristiche") – sezione tipo 0 – H_{scavo} = 2,5m

	STATICO	SISMICO
s_{max} (mm)	12	-
M_{max} (kNm/m)	32.69	38.34
V_{max} (kN/m)	21.09	24.92

Legenda

s_{max} = spostamento laterale massimo

M_{max} = momento flettente massimo

V_{max} = azione di taglio massima

M_{Vmax} = momento flettente nella sezione di taglio massimo

Tabella 9.5 – Risultati dell'analisi tenso-deformativa (azioni "caratteristiche") – sezione tipo 1 – H_{scavo} = 4,5m

	STATICO	SISMICO
s_{max} (mm)	8.9	-
M_{max} (kNm/m)	88.44	81.4
V_{max} (kN/m)	75.5	67.96

Tabella 9.6 – Risultati dell'analisi tenso-deformativa (azioni "caratteristiche") – sezione tipo 2 – H_{scavo} = 6m

	STATICO	SISMICO
s_{max} (mm)	4.5	-
M_{max} (kNm/m)	73.7	79.8
V_{max} (kN/m)	103.8	89.8

Tabella 9.7 – Risultati dell'analisi tenso-deformativa (azioni "caratteristiche") – sezione tipo 3 – H_{scavo} = 7,5m

	STATICO	SISMICO
s_{max} (mm)	9.9	-
M_{max} (kNm/m)	87.3	88.1
V_{max} (kN/m)	107.2	100.5

Tabella 9.8 – Risultati dell'analisi tenso-deformativa (azioni "caratteristiche") – sezione tipo 4 – H_{scavo} = 10m

	STATICO	SISMICO
s_{max} (mm)	12.2	-
M_{max} (kNm/m)	156.3	185.3
V_{max} (kN/m)	184.6	196.0

Nella Figura 9.6÷Figura 9.8 sono illustrati rispettivamente l'andamento degli spostamenti orizzontali, il diagramma del momento flettente, del taglio e dell'azione assiale nei tiranti (**valori "caratteristici" per metro lineare di paratia**) per le paratie non tirantate. Seguono il caso delle berlinesi con un solo ordine di tiranti (Figura 9.9÷Figura 9.12), con due ordini di tiranti (Figura 9.13÷Figura 9.17), con tre livelli di tiranti (Figura 9.18÷Figura 9.23) e con quattro livelli di tiranti (Figura 9.24÷Figura 9.30).

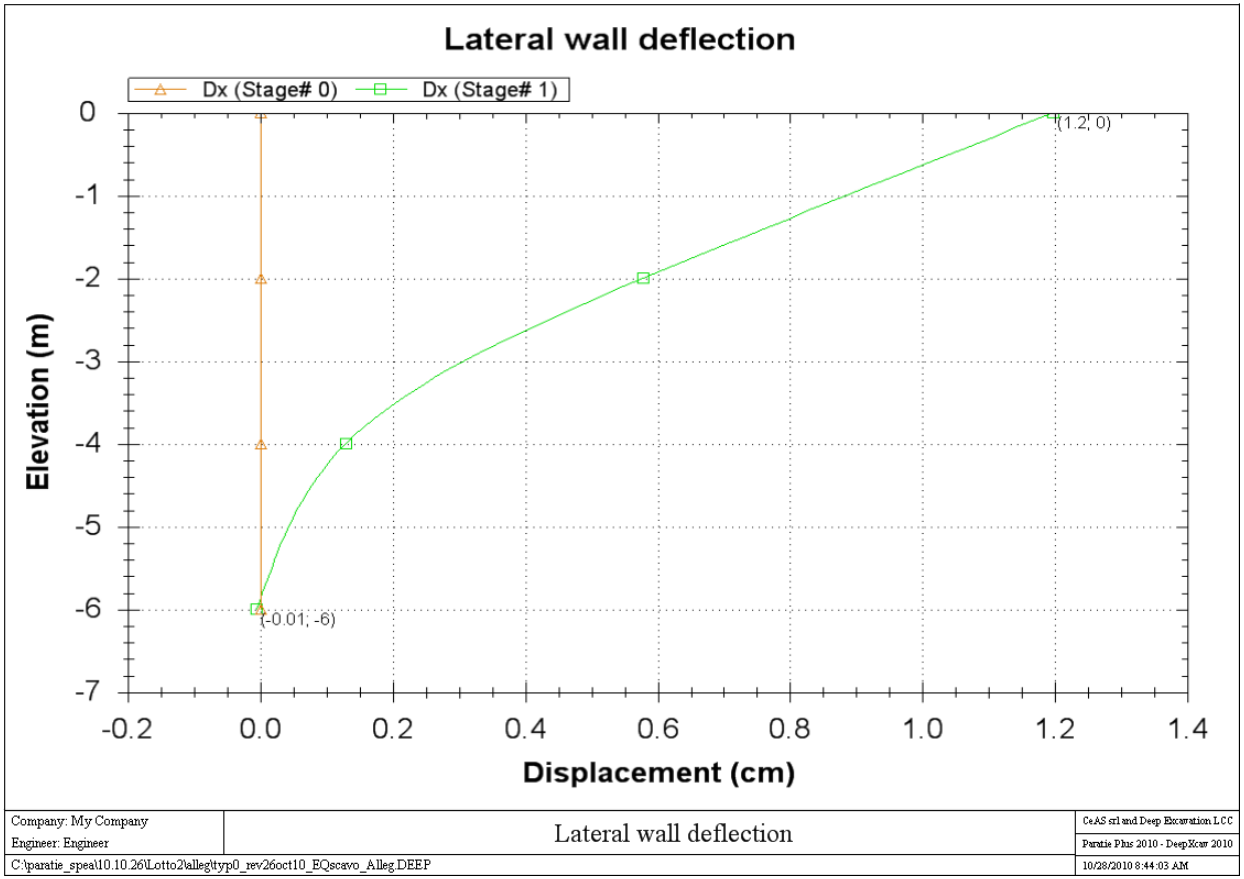


Figura 9.6 – Spostamento orizzontale - sezione tipo 0 – H_{scavo} = 2,5m

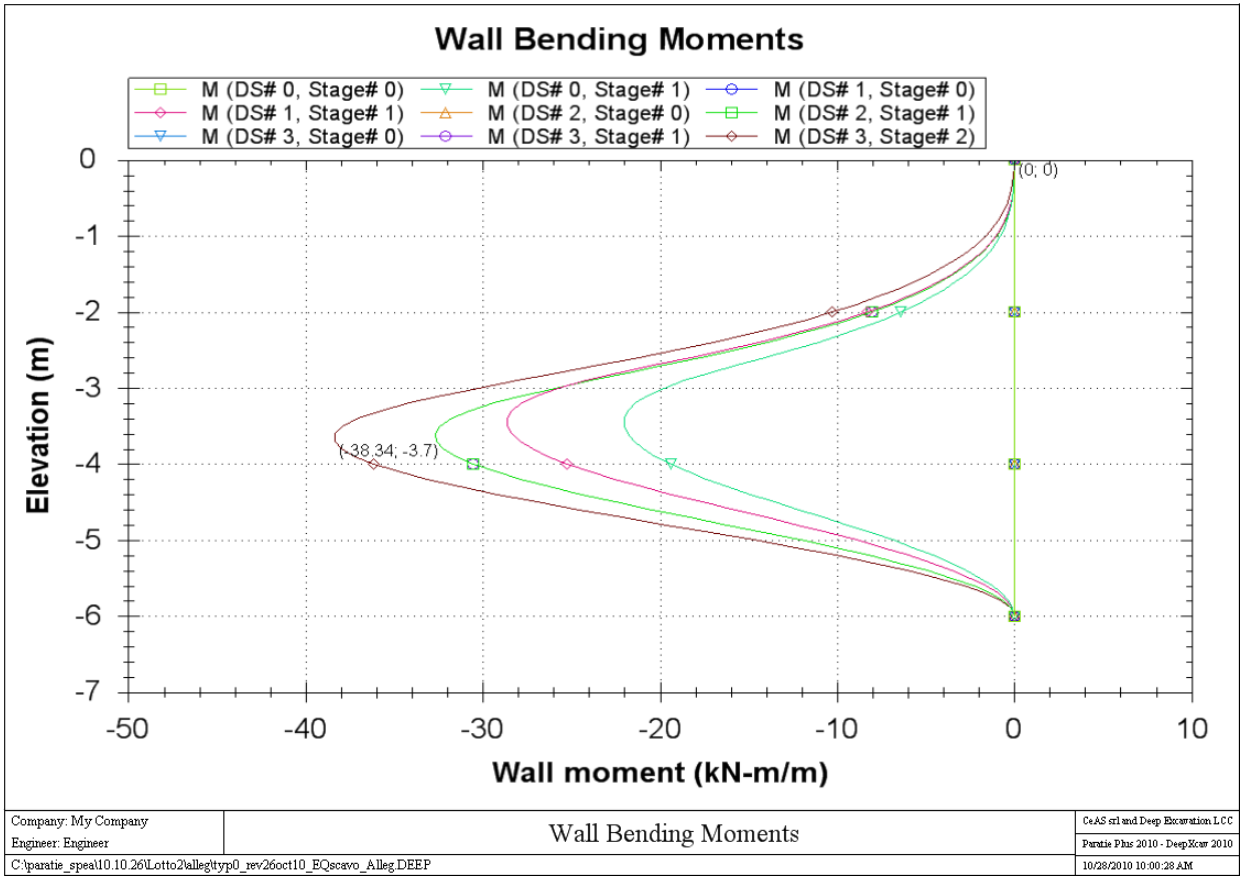


Figura 9.7 – Momento flettente - sezione tipo 0 – H_{scavo} = 2,5m

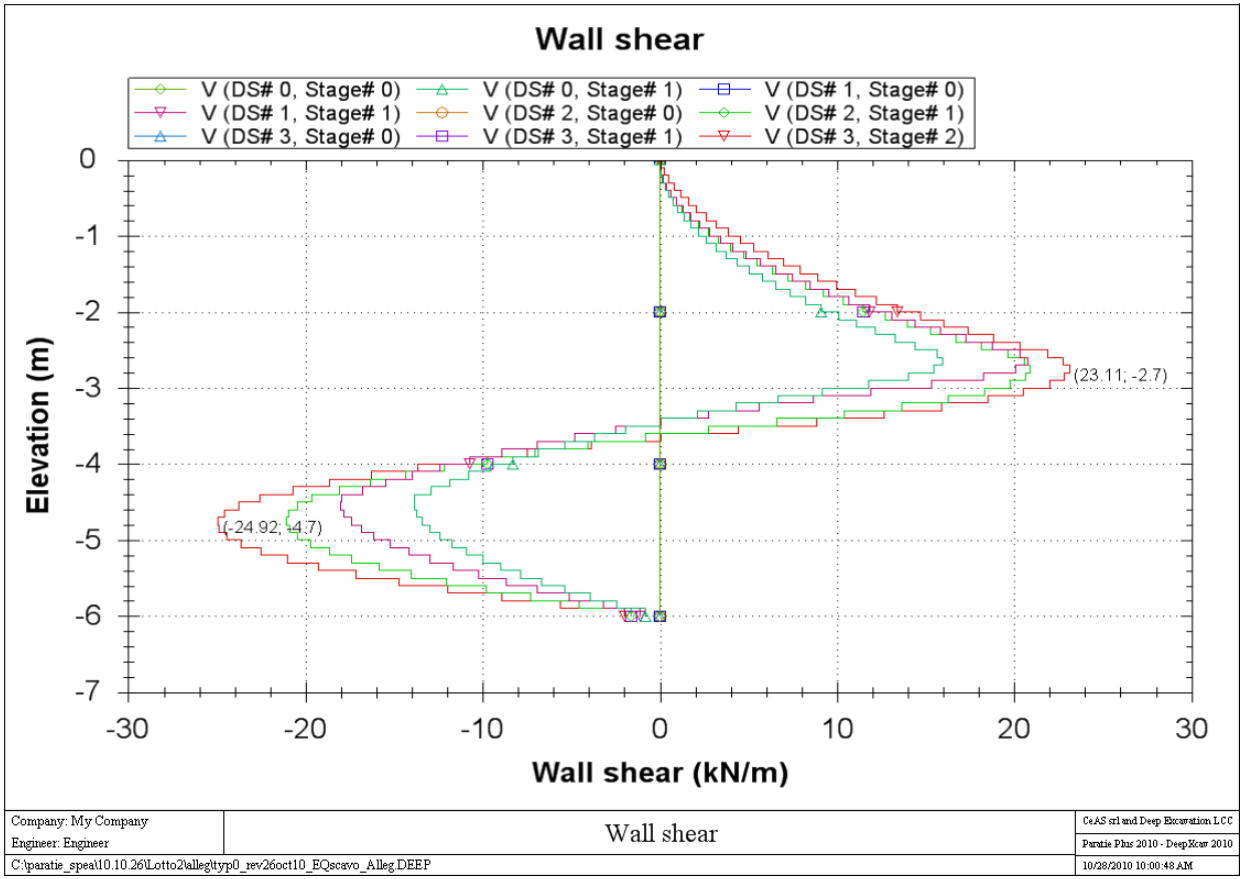


Figura 9.8 – Taglio - sezione tipo 0 – H_{scavo} = 2,5m

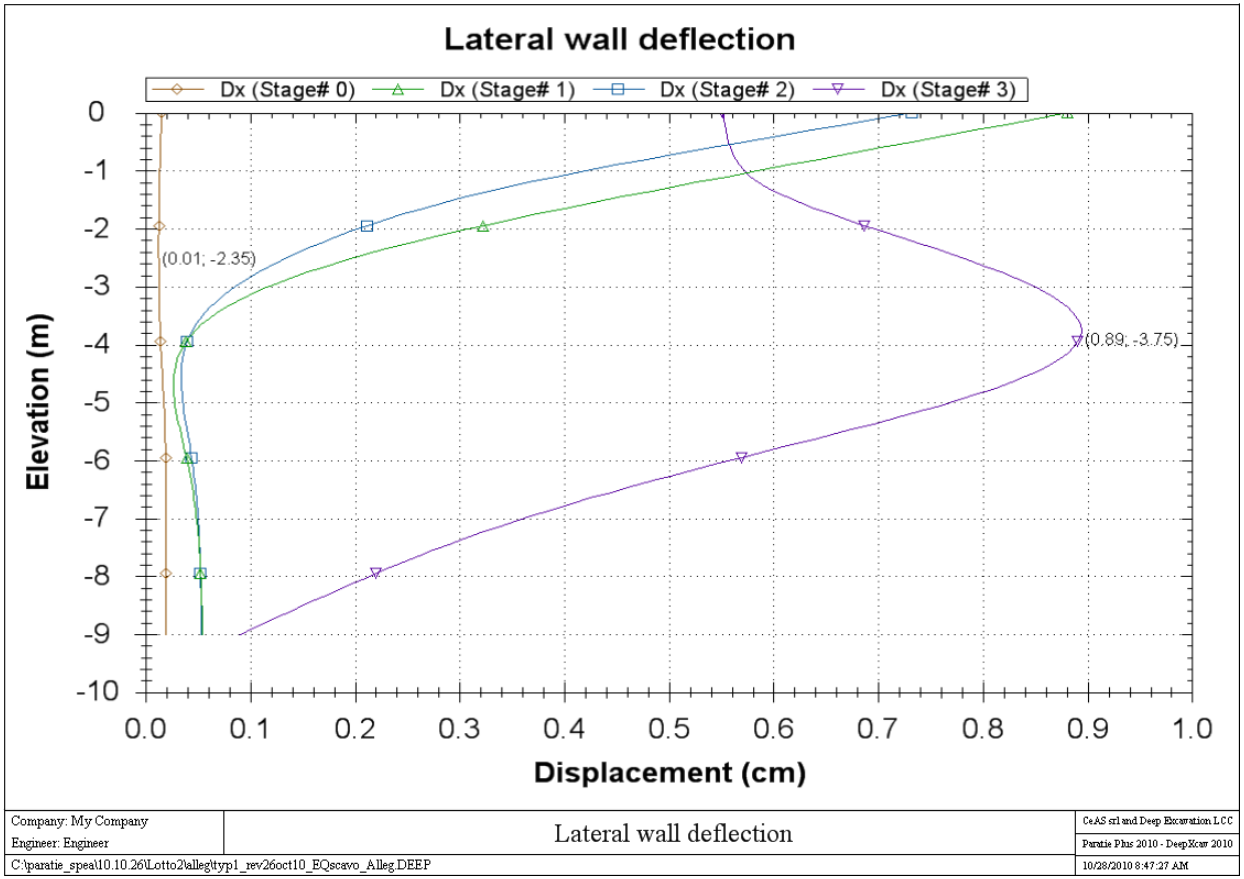


Figura 9.9 – Spostamento orizzontale - sezione tipo 1 – H_{scavo}= 4,5m

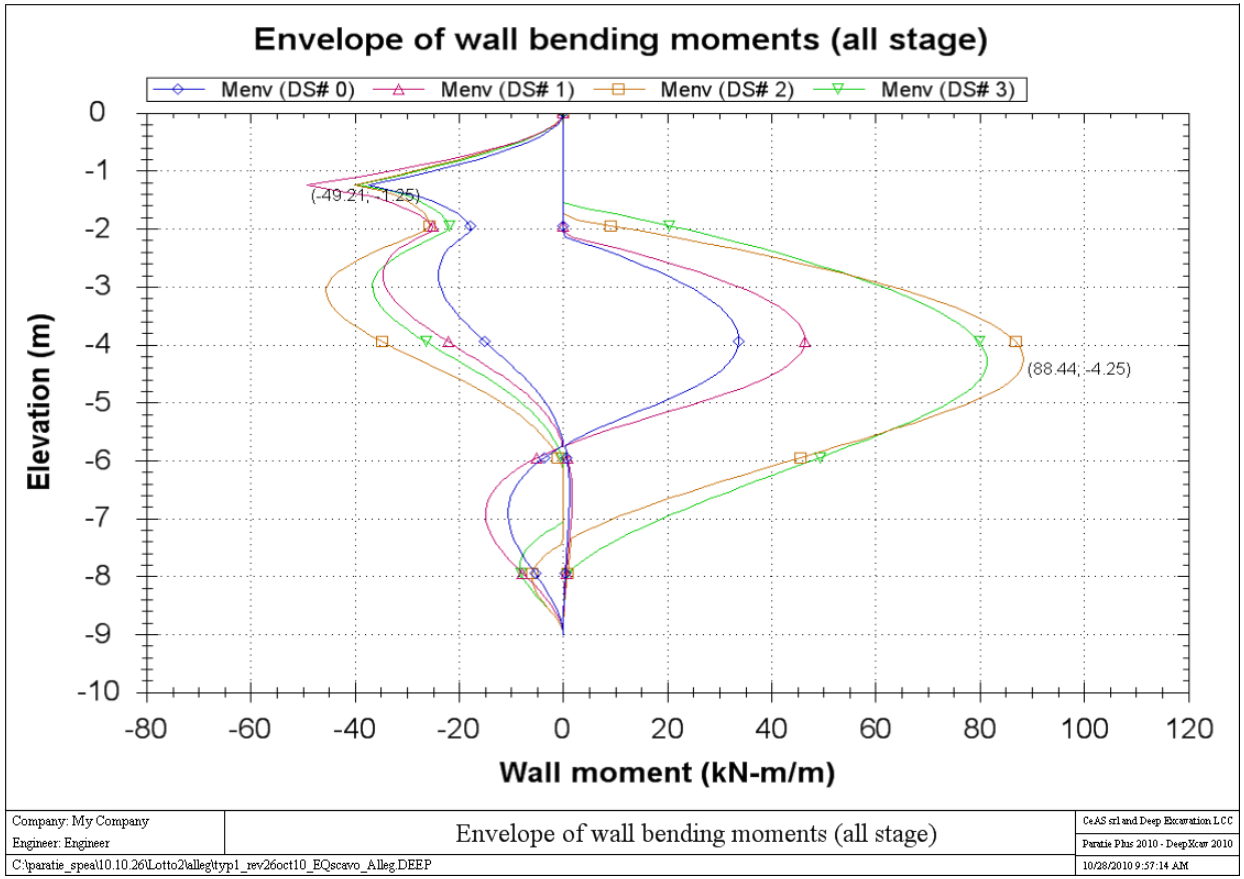


Figura 9.10 – Momento flettente - sezione tipo 1 – H_{scavo} = 4,5m

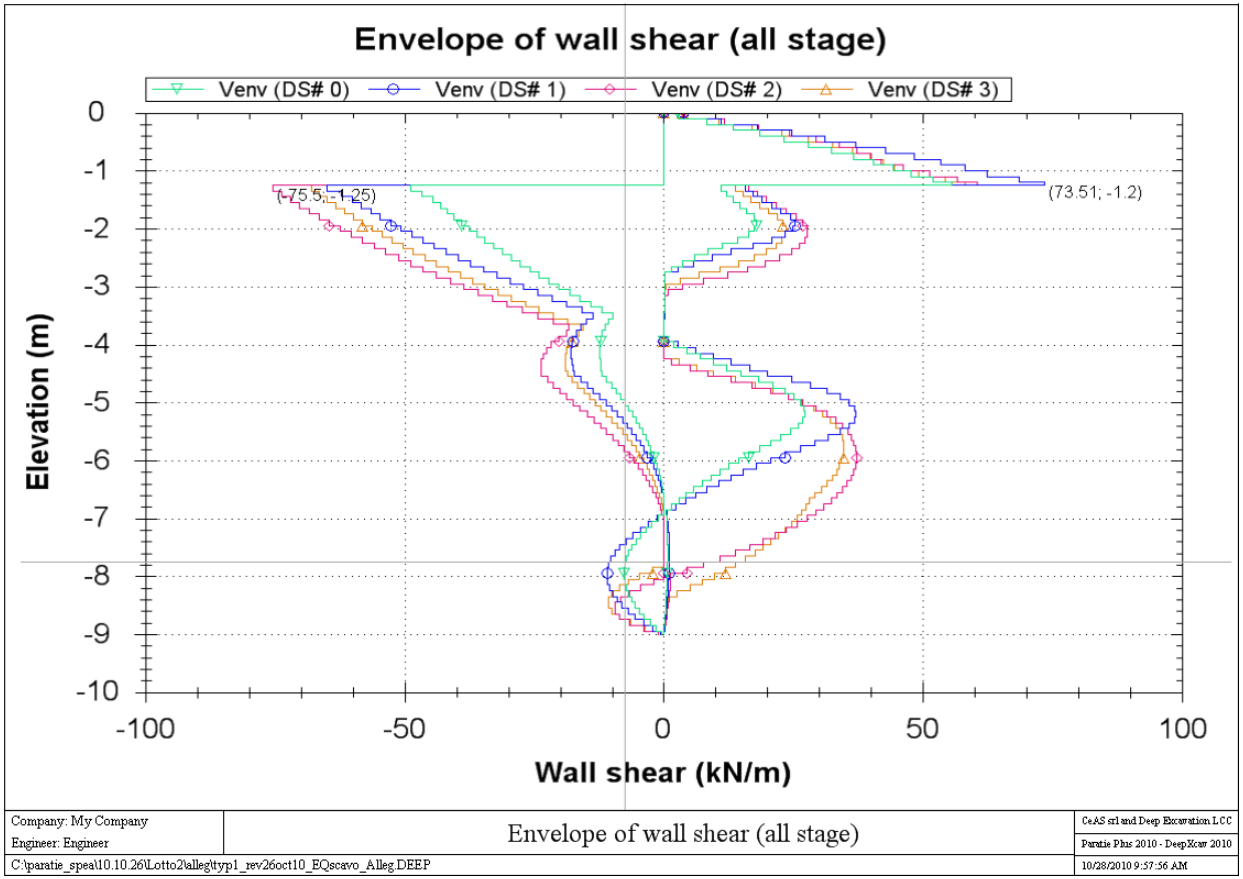


Figura 9.11 – Taglio - sezione tipo 1 – H_{scavo} = 4,5m

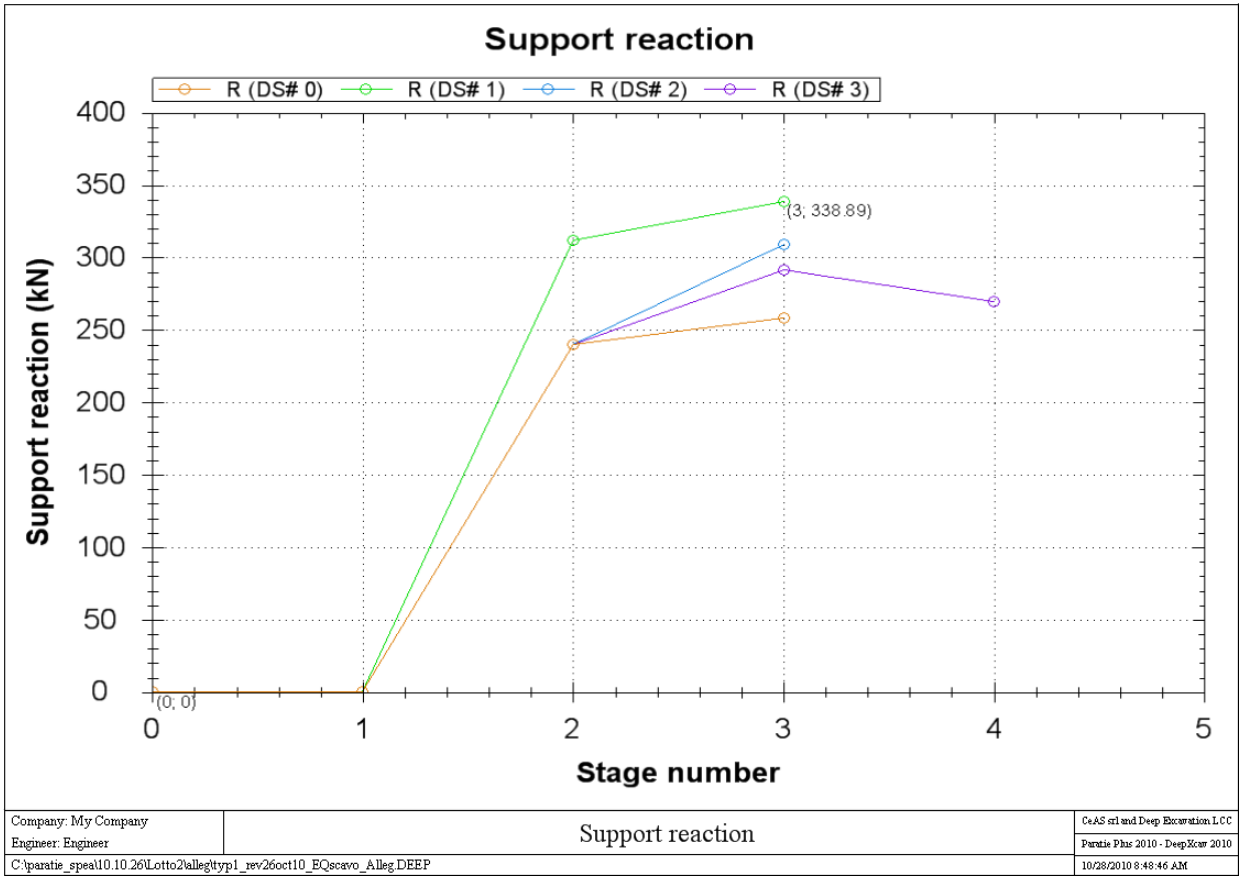


Figura 9.12 – Storia di carico nei tiranti - sezione tipo 1 – H_{scavo} = 4,5m

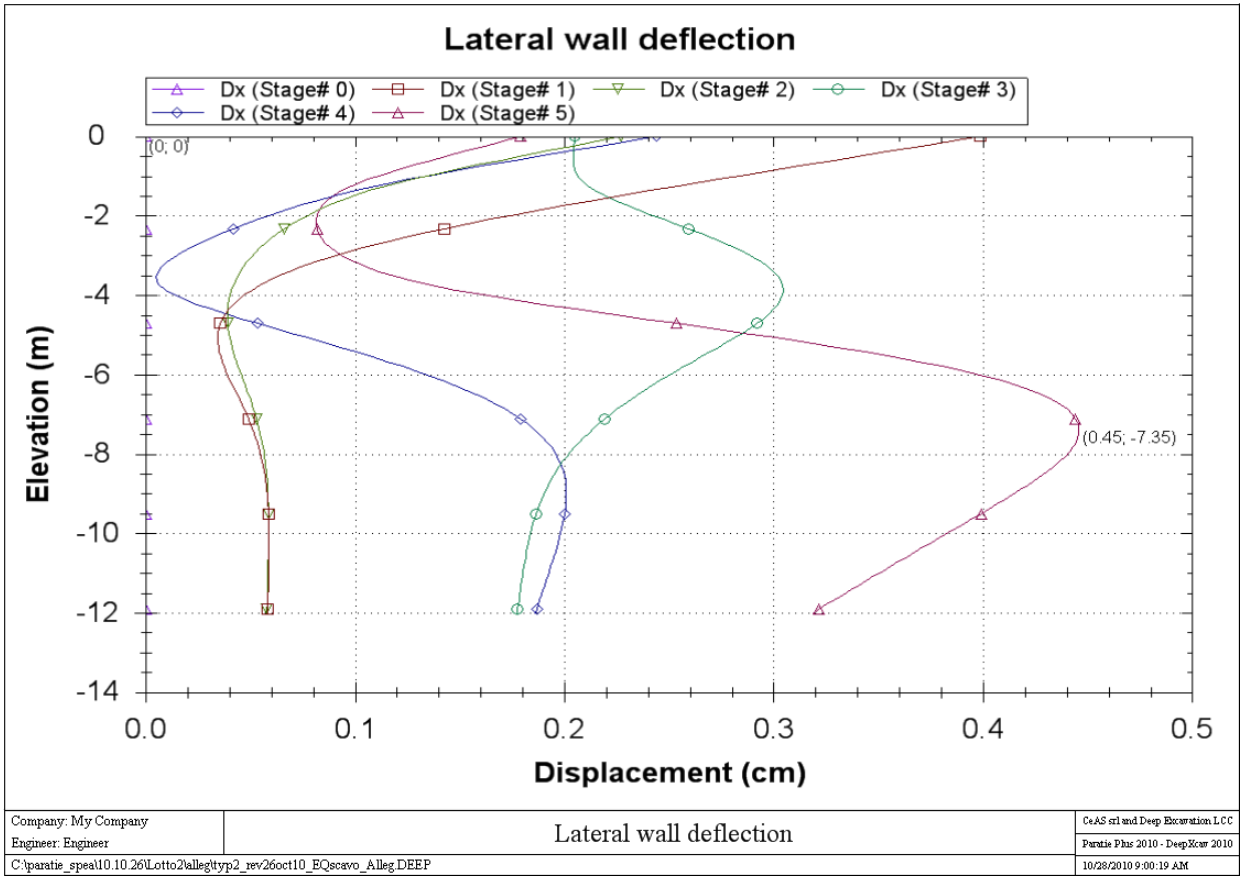


Figura 9.13 – Spostamento orizzontale - sezione tipo 2 – H_{scavo} = 6m

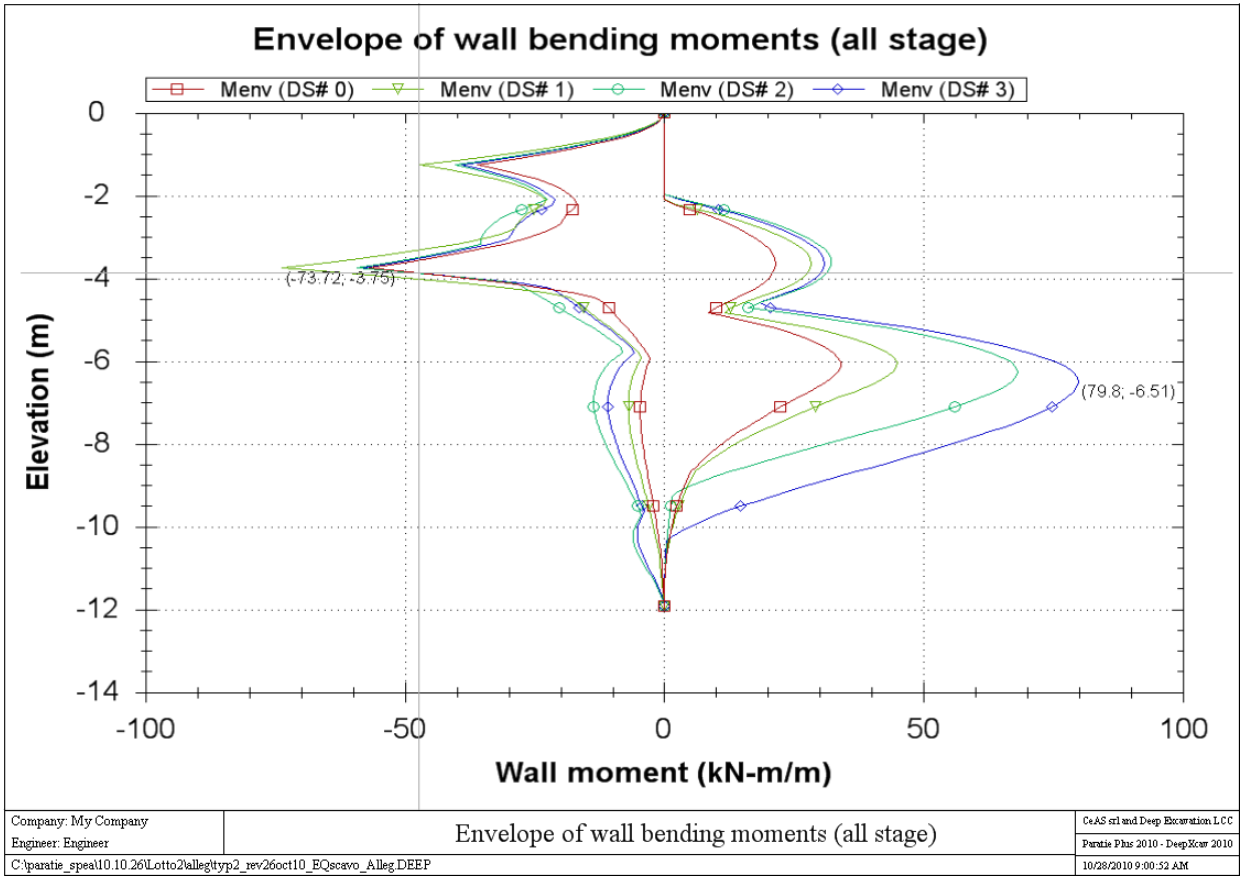


Figura 9.14 – Momento flettente - sezione tipo 2 – H_{scavo} = 6m

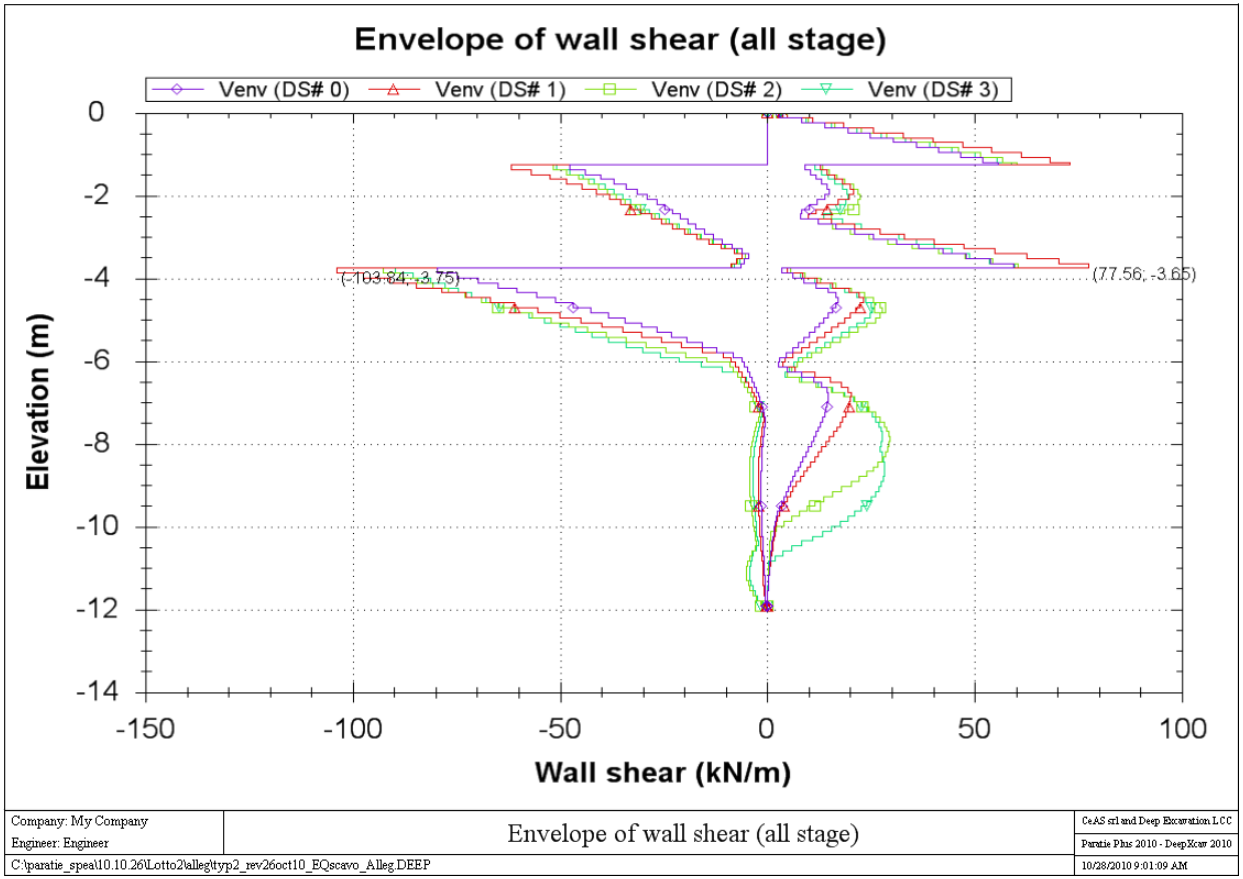


Figura 9.15 – Taglio - sezione tipo 2 – H_{scavo} = 6m

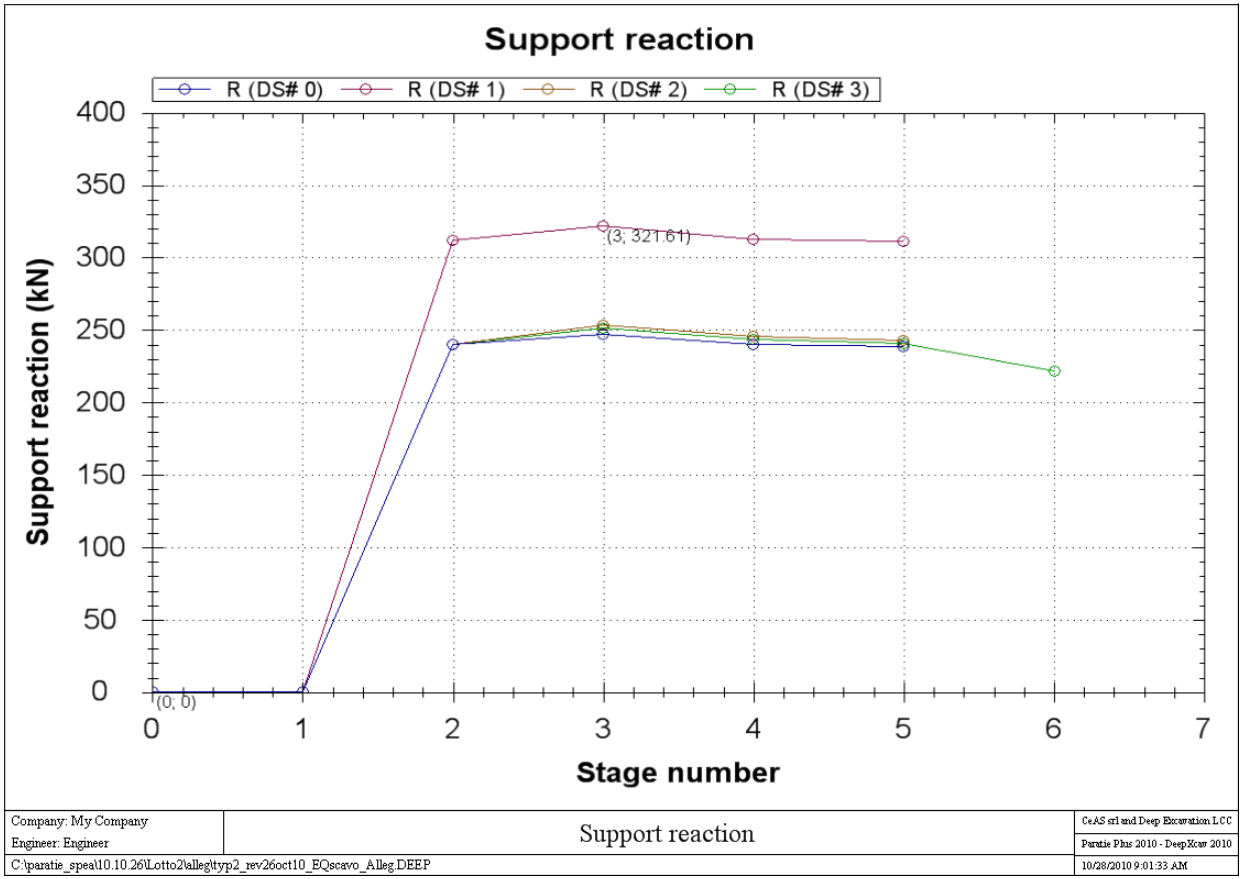


Figura 9.16 – Storia di carico nei tiranti - sezione tipo 2 – H_{scavo} = 6m - I ordine di tiranti

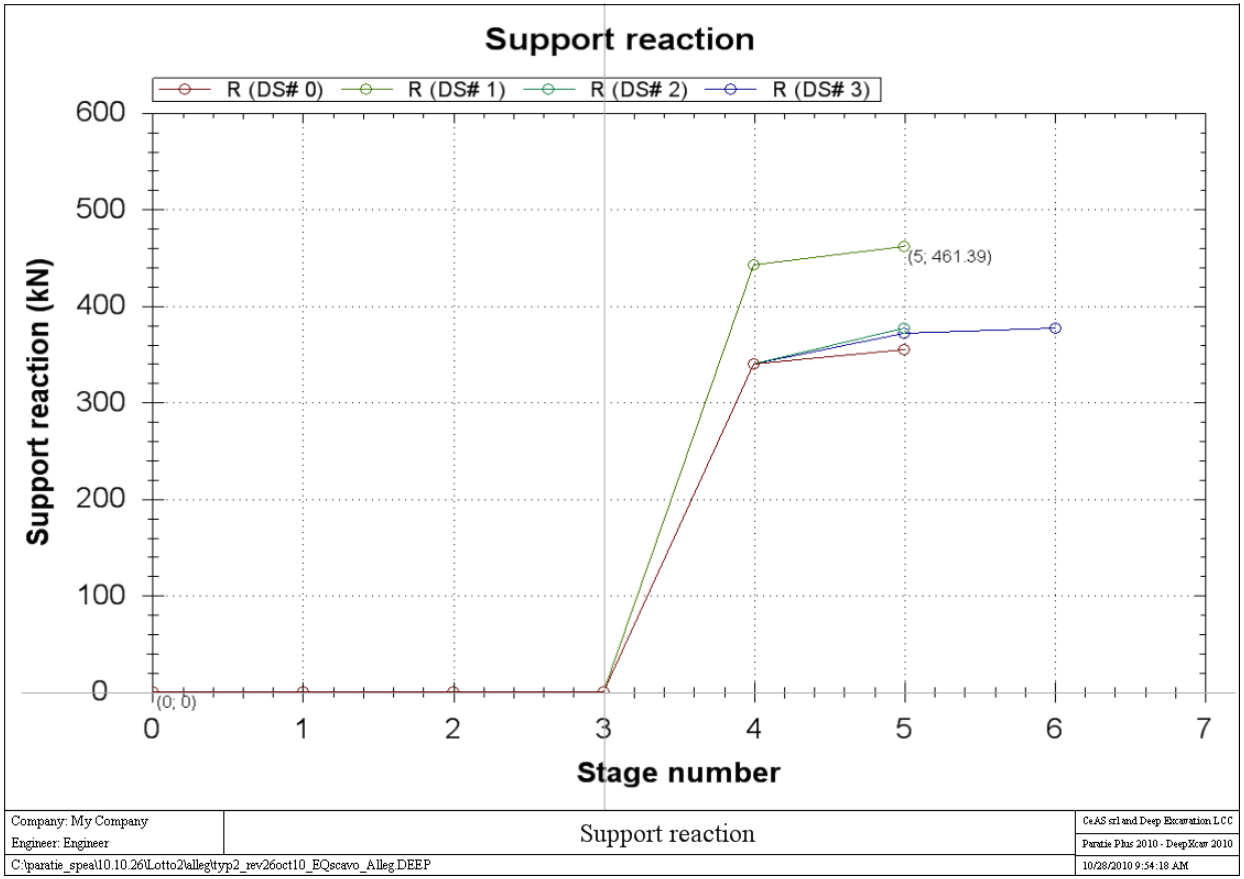


Figura 9.17 – Storia di carico nei tiranti - sezione tipo 2 – H_{scavo} = 6m - II ordine di tiranti

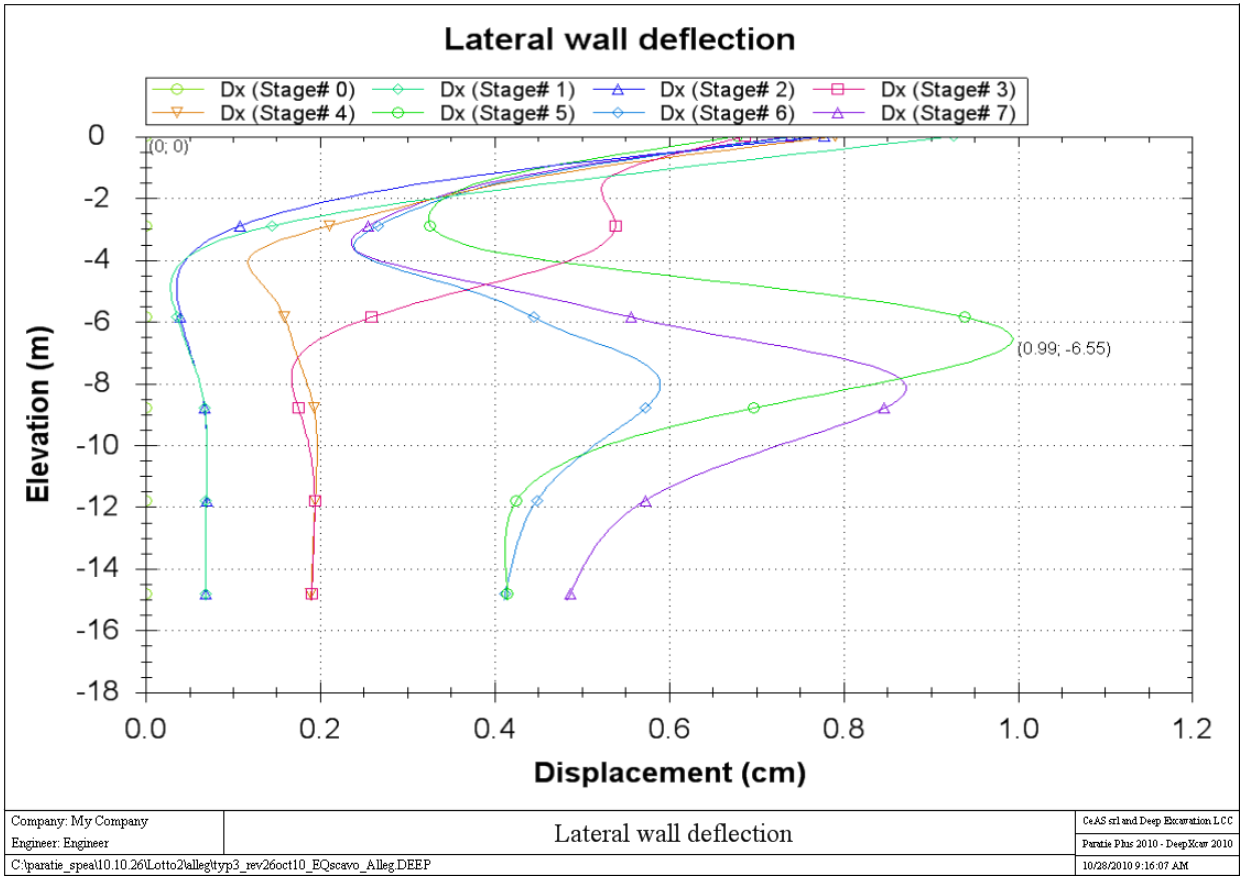


Figura 9.18 – Spostamento orizzontale - sezione tipo 3 – H_{scavo} = 7,5m

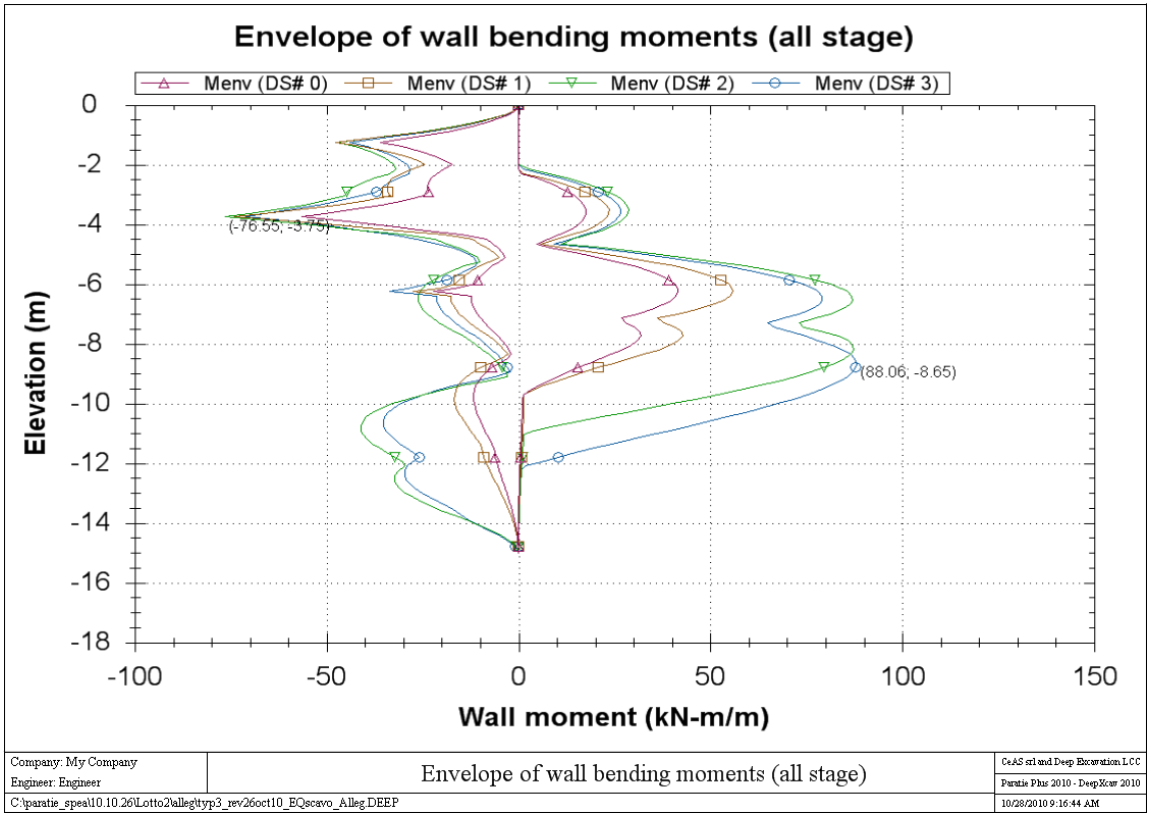


Figura 9.19 – Momento flettente - sezione tipo 3 – H_{scavo} = 7,5m

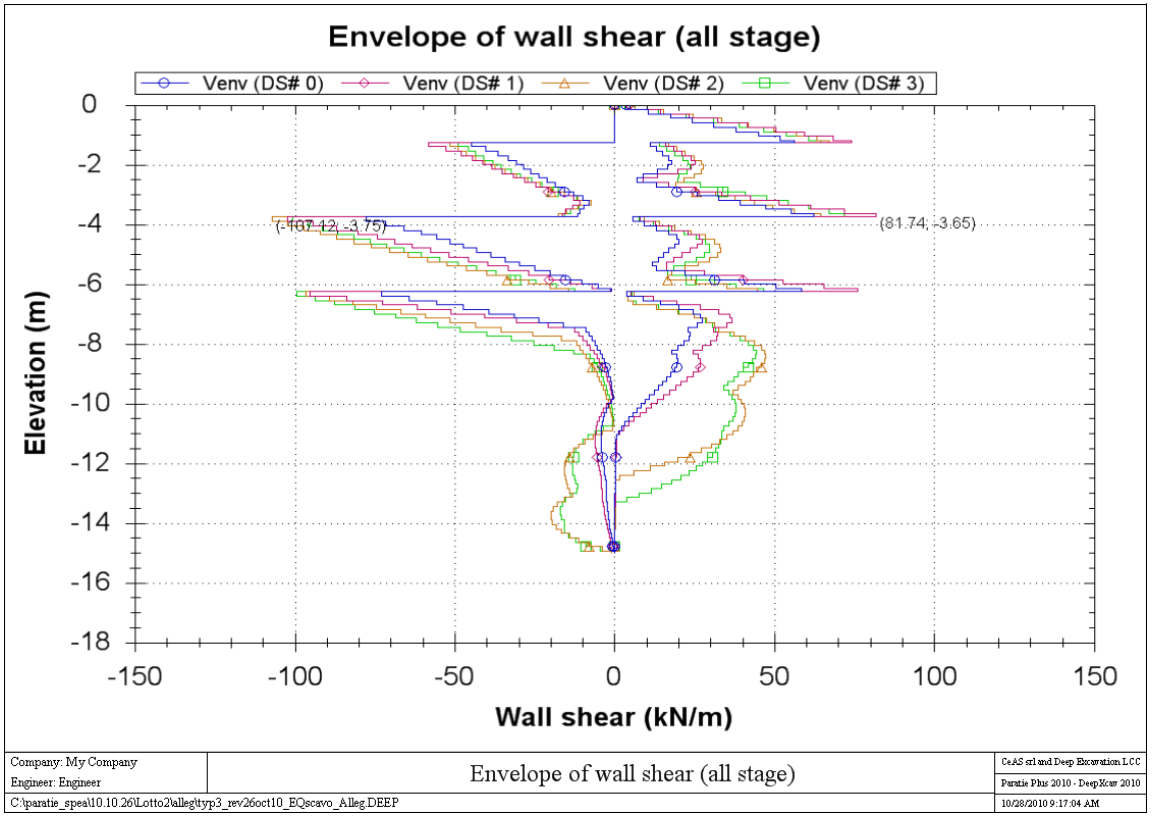


Figura 9.20 – Taglio - sezione tipo 3 – H_{scavo} = 7,5m

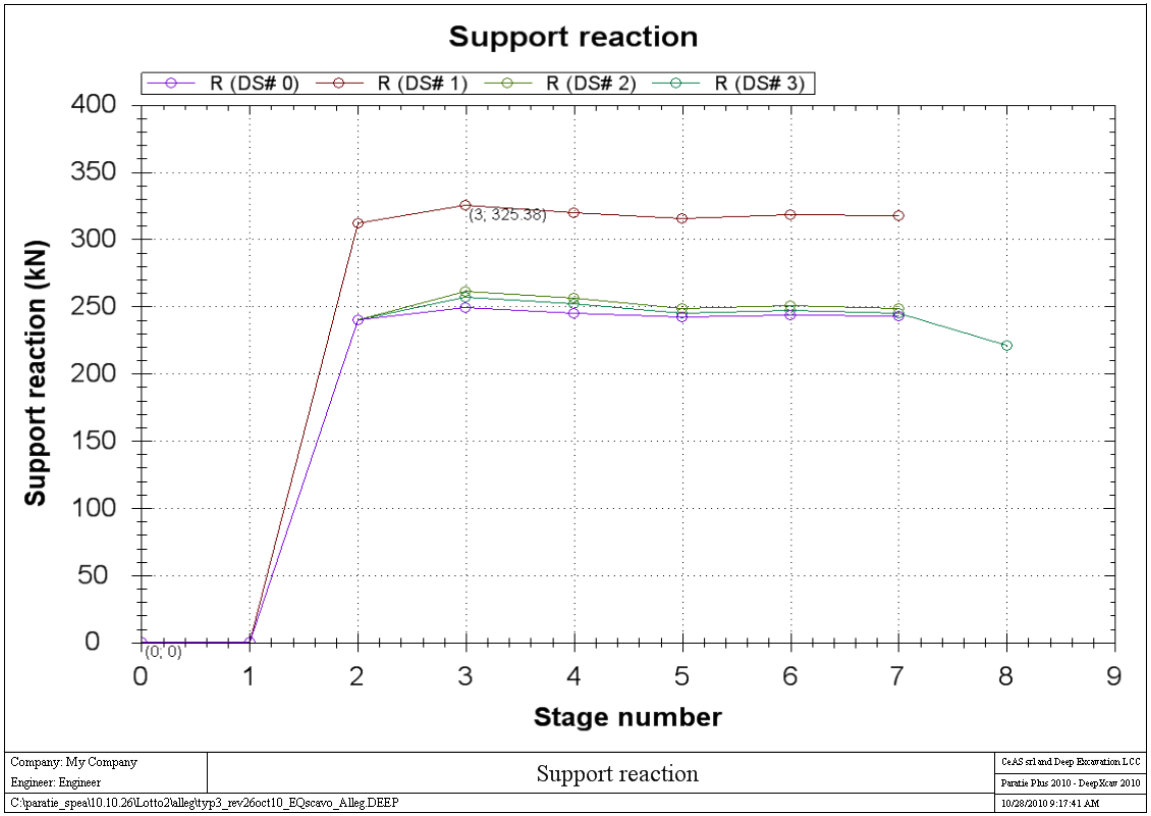


Figura 9.21 – Storia di carico nei tiranti - sezione tipo 3 – H_{scavo} = 7,5m – I ordine di tiranti

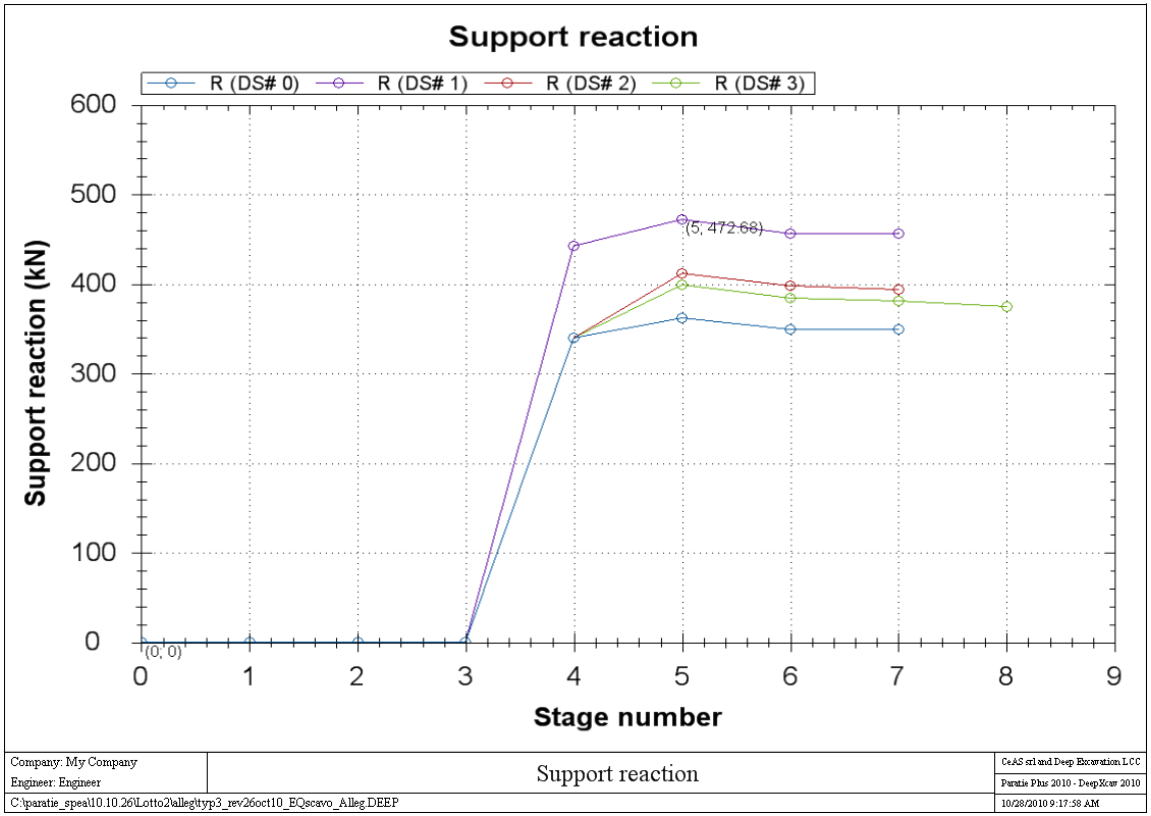


Figura 9.22 – Storia di carico nei tiranti - sezione tipo 3 – H_{scavo} = 7,5m – II ordine di tiranti

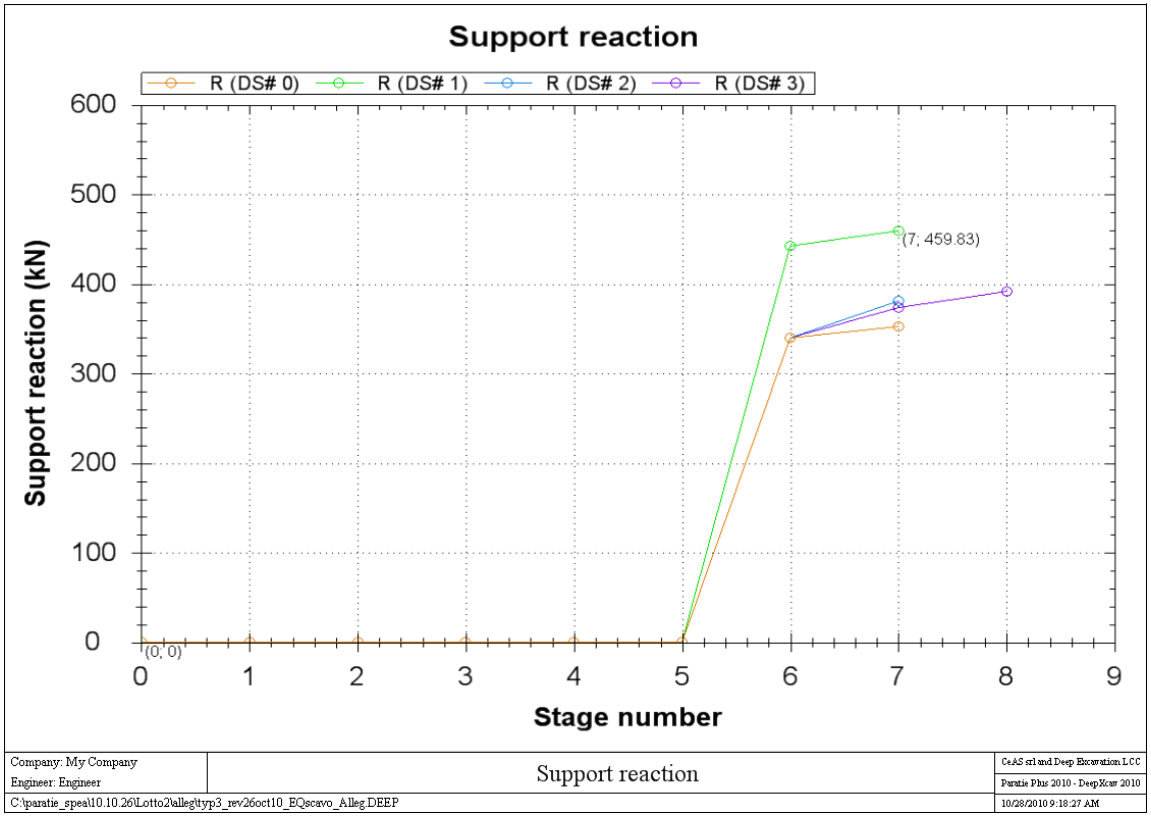


Figura 9.23 – Storia di carico nei tiranti - sezione tipo 3 – H_{scavo} = 7,5m – III ordine di tiranti

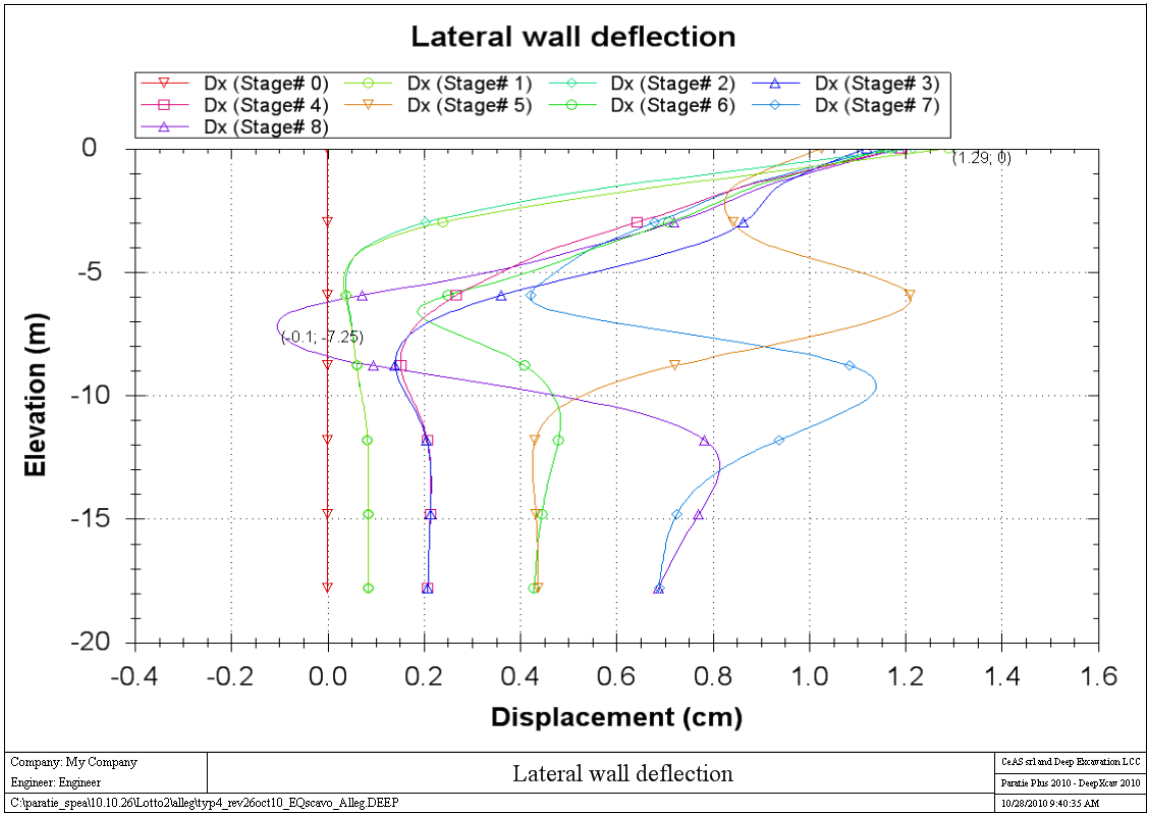


Figura 9.24 – Spostamento orizzontale - sezione tipo 4 – H_{scavo} = 10m

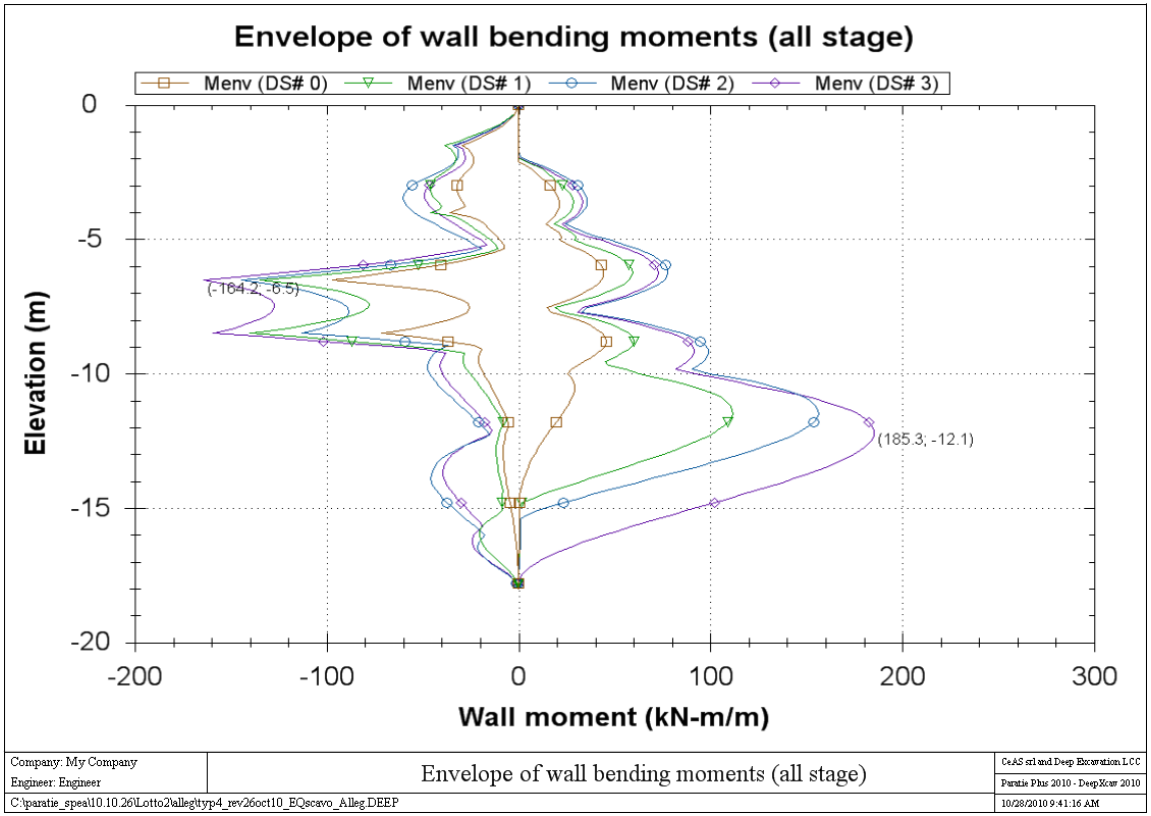


Figura 9.25 – Momento flettente - sezione tipo 4 – H_{scavo} = 10m

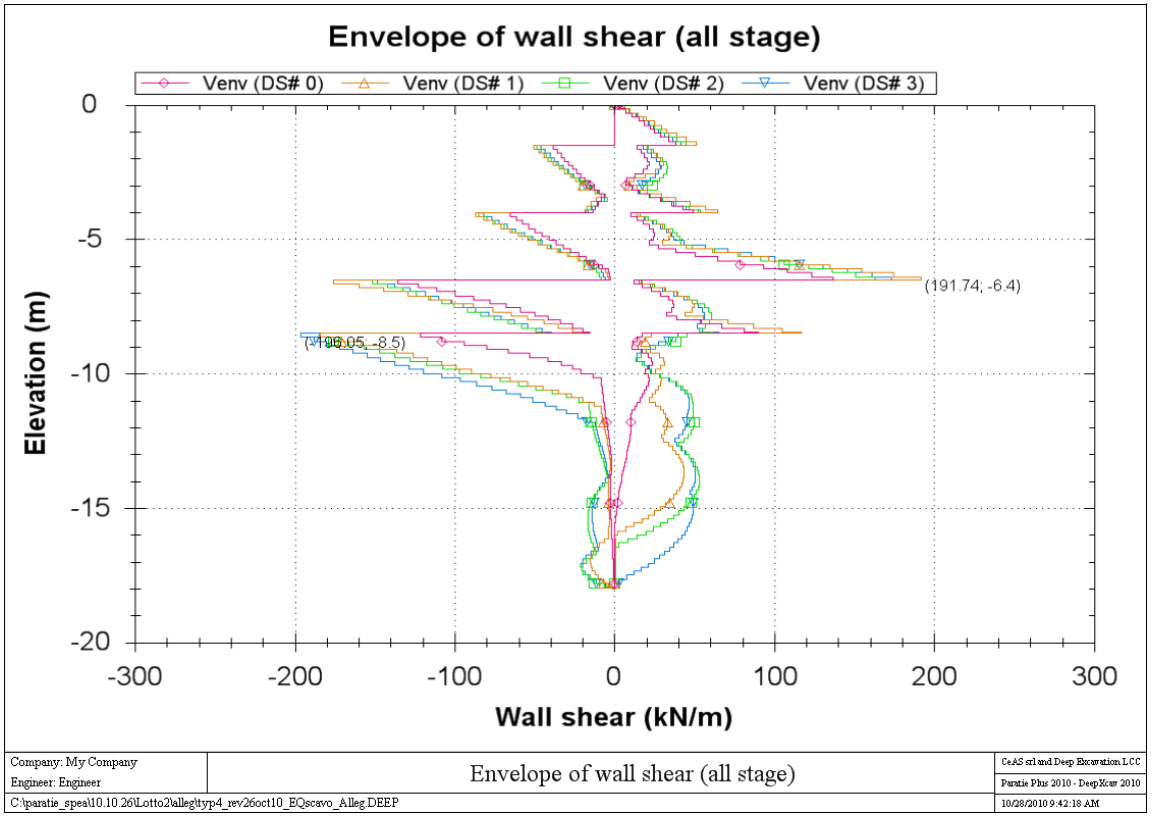


Figura 9.26 – Taglio - sezione tipo 4 – H_{scavo} = 10m

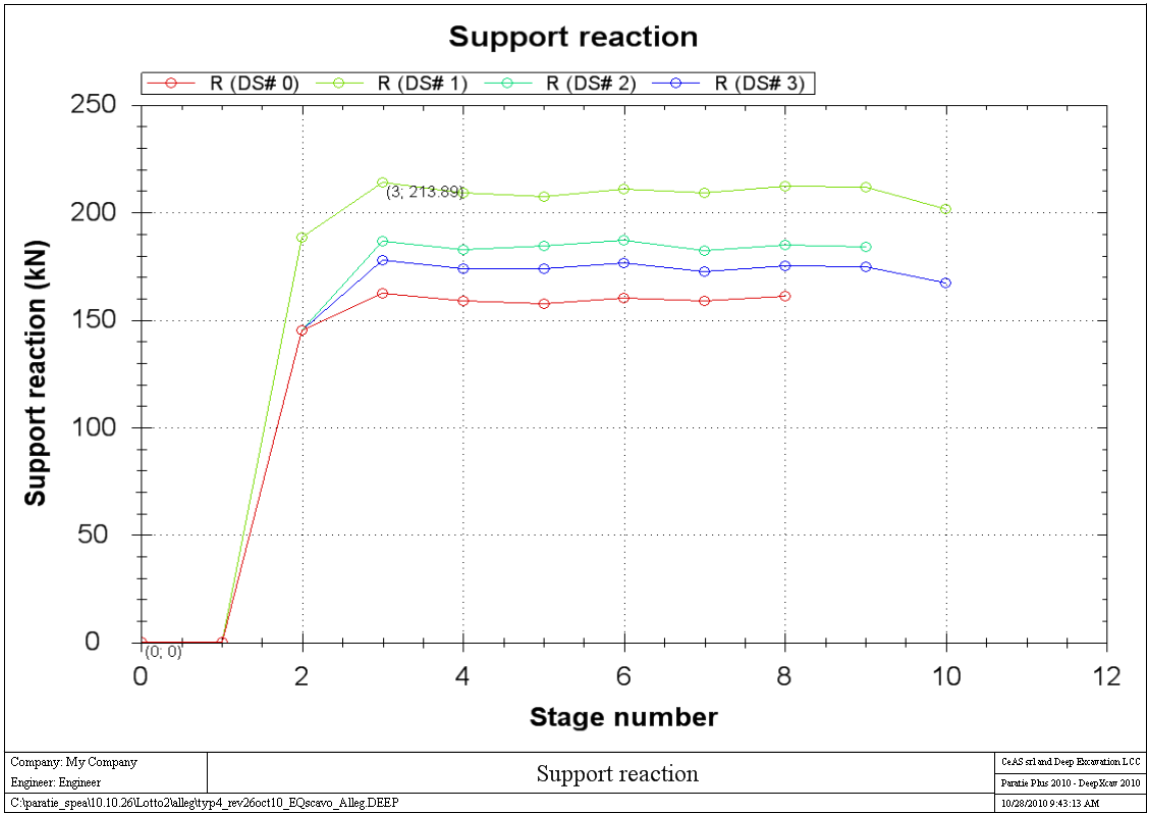


Figura 9.27 – Storia di carico nei tiranti - sezione tipo 4 – H_{scavo} = 10m – I ordine di tiranti -

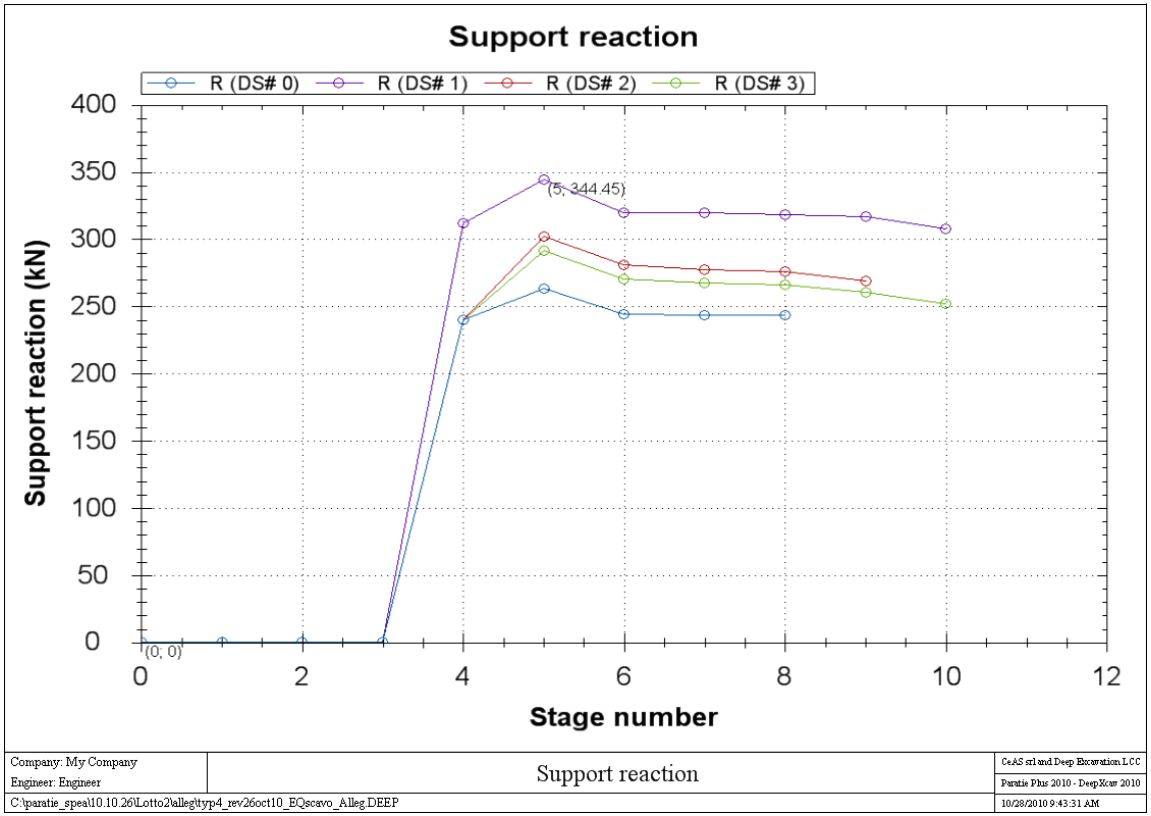


Figura 9.28 – Storia di carico nei tiranti - sezione tipo 4 – H_{scavo} = 10m – II ordine di tiranti

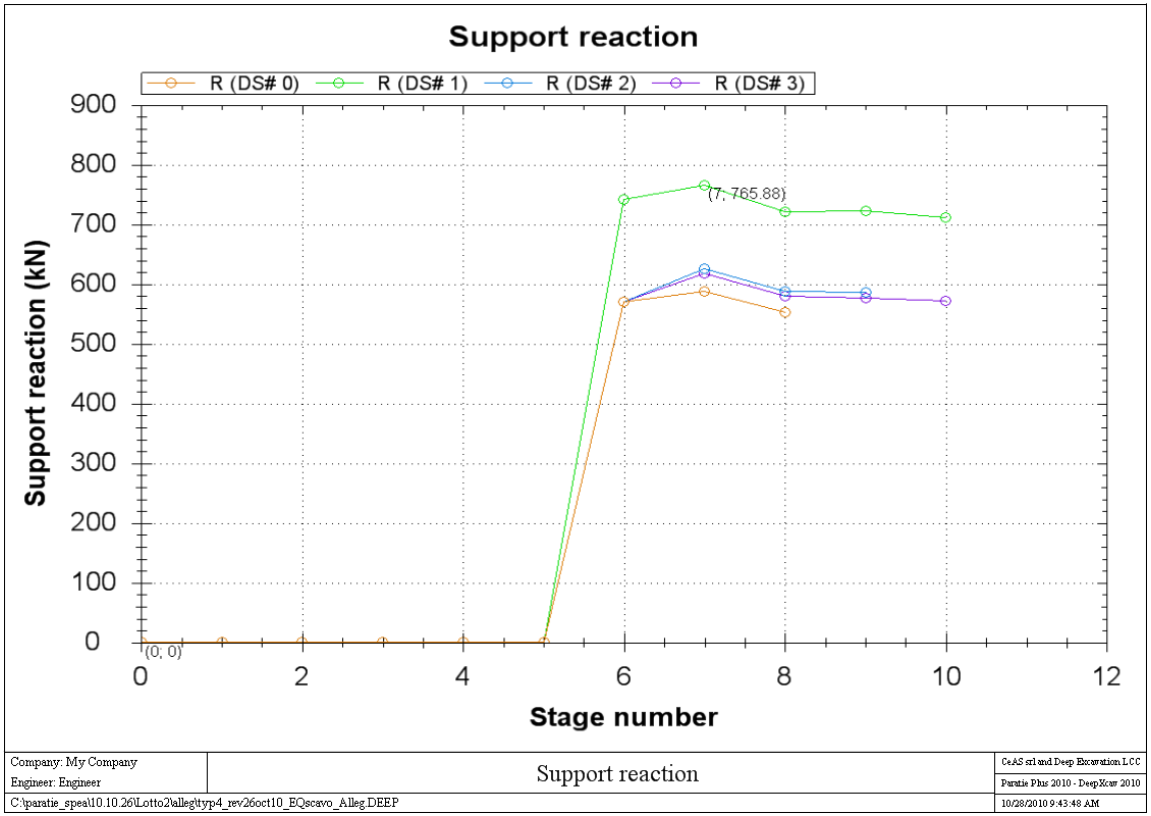


Figura 9.29 – Storia di carico nei tiranti - sezione tipo 4 – H_{scavo} = 10m – III ordine di tiranti -

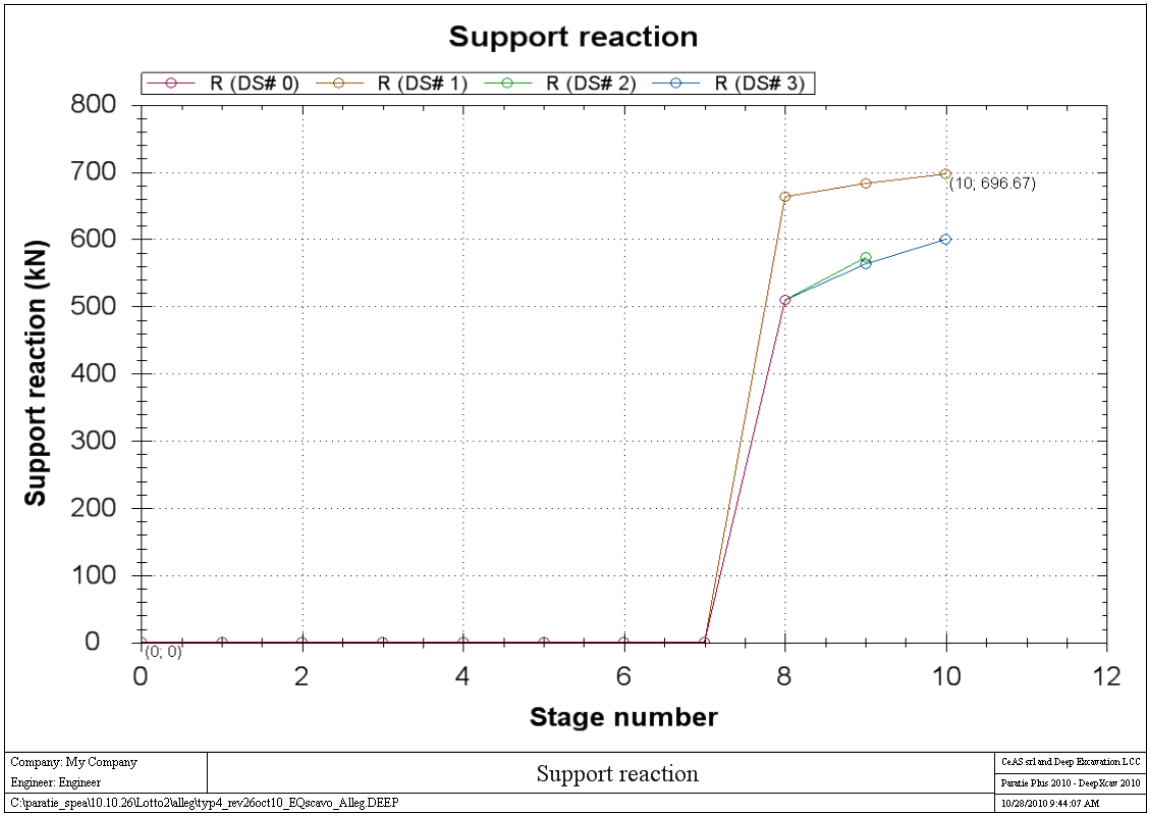


Figura 9.30 – Storia di carico nei tiranti - sezione tipo 4 – H_{scavo} = 10m – IV ordine di tiranti

In Tabella 9.9 sono riassunti i valori della forza "**caratteristica**" calcolata in corrispondenza dei tiranti, i valori riportati tengono conto dell'interasse tra i tiranti.

Tabella 9.9 – Azioni nei tiranti – Valori caratteristici

Sezione tipo	Altezza scavo (m)	Ordine di tiranti	n° trefoli	Tensione pretiro (kN)	TENSIONE IN ESERCIZIO (kN)	
					Statico	Sismico
1	4,5	1°	3	240	338.9	291.5
2	6	1°	3	240	321.6	251.5
		2°	5	340	461.4	377.2
3	7,5	1°	3	240	325.4	256.8
		2°	4	340	472.7	398.7
		3°	4	340	459.8	390.5
4	10	1°	3	145	213.9	177.8
		2°	3	240	344.4	291.6
		3°	5	570	765.9	617.4
		4°	5	510	696.7	599.7

9. VERIFICHE STRUTTURALI E GEOTECNICHE

9.1 Verifica dei micropali

Nel seguito sono riportate le verifiche delle armature dei micropali per le quattro sezioni tipologiche analizzate in accordo a quanto prescritto in NTC08 e successive Istruzioni Tecniche

		sezione tipo				
		0	1	2	3	4
Materiale						
	Acciaio	S355	S355	S355	S355	S355
Tensione di snervamento	f_{yk} [N/mm^2]	355	355	355	355	355
Coefficiente sicurezza resisten	$\gamma_{M,0}$ [-]	1.05	1.05	1.05	1.05	1.05
Caratteristiche geometriche sezione						
Diametro esterno	d [mm]	168.3	168.3	168.3	168.3	177.8
Spessore	t [mm]	10	10	10	10	10
Diametro interno	di [mm]	148.3	148.3	148.3	148.3	157.8
Area lorda	A [cm^2]	49.7	49.7	49.7	49.7	52.7
Momento d'inerzia	J [cm^4]	1564.0	1564.0	1564.0	1564.0	1862.0
Modulo di resistenza elastico	Wel [cm^3]	185.9	185.9	185.9	185.9	209.4
Modulo di resistenza plastico	Wpl [cm^3]	250.9	250.9	250.9	250.9	281.9
Raggio d'inerzia	i [cm]	5.6	5.6	5.6	5.6	5.9
Area di taglio	Av [cm^2]	31.7	31.7	31.7	31.7	33.6
Peso	p [daN/m]	39.0	39.0	39.0	39.0	41.4
Interasse pali	i [m]	0.4	0.4	0.4	0.4	0.4
	ε	0.8	0.8	0.8	0.8	0.8
	d/t	16.8	16.8	16.8	16.8	17.8
	d/t / ε^2	25.4	25.4	25.4	25.4	26.9
Classificazione della sezione	Classe	1	1	1	1	1
Sollecitazioni						
Esercizio	V_{Ed} [kN/m]	21.09	75.5	103.84	107.12	184.59
	M_{Ed} [kNm/m]	32.69	88.44	80.15	87.35	156.31
Sismica	V_{Ed} [kN/m]	24.92	67.96	89.8	100.5	196.05
	M_{Ed} [kNm/m]	38.34	81.38	79.8	88.06	185.3
Verifica di resistenza condizioni statiche						
Taglio di calcolo	V_{Ed} [kN]	8.436	30.2	41.536	42.848	73.836
Taglio resistente in assenza di	$V_{c,Rd}$ [kN]	618.00	618.00	618.00	618.00	655.09
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.01	0.05	0.07	0.07	0.11
stato verifica		ok	ok	ok	ok	ok
	ρ	0.0	0.0	0.0	0.0	0.0
Momento di calcolo	M_{Ed} [kNm]	13.076	35.376	32.06	34.94	62.524
	fy,red=(1-ρ)fyk	355	355	355	355	355
Resistenza a flessione	$M_{c,Rd}$ [kNm]	84.84	84.84	84.84	84.84	95.31
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.15	0.42	0.38	0.41	0.66
stato verifica		ok	ok	ok	ok	ok
Verifica di resistenza condizioni sismiche						
Taglio di calcolo	V_{Ed} [kN]	9.968	27.184	35.92	40.2	78.42
Taglio resistente in assenza di	$V_{c,Rd}$ [kN]	618.00	618.00	618.00	618.00	655.09
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.02	0.04	0.06	0.07	0.12
stato verifica		ok	ok	ok	ok	ok
	ρ	0.0	0.0	0.0	0.0	0.0
Momento di calcolo	M_{Ed} [kNm]	15.336	32.552	31.92	35.224	74.12
	fy,red=(1-ρ)fyk	355	355	355	355	355
Resistenza a flessione	$M_{c,Rd}$ [kNm]	84.84	84.84	84.84	84.84	95.31
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.18	0.38	0.38	0.42	0.78
stato verifica		ok	ok	ok	ok	ok

Tutte le verifiche risultano soddisfatte.

9.2 Verifica dei tiranti

Si fa riferimento a quanto esposto nei paragrafi 7.1 nonché alle azioni caratteristiche di cui alla Tabella 9.9.

9.2.1 Verifica strutturale

Vale quanto segue:

Verifica strutturale

Sezione tipo	Altezza paratia	Altezza di scavo massima	Ordine tiranti	Distanza da estradosso cordolo	n° trefoli	Area acciaio	Interasse orizzontale max	Inclinazione	Resistenza strutturale tirante	c.s. Esercizio	c.s. Sisma	c.s. Tot STR	stato verifica
	H	h		d	n	Aa	i	α	$R_{d,s}$	$R_{d,s}$ / N_{Ed}	$R_{d,s}$ / N_{Ed}	$R_{d,s}$ / N_{Ed}	STR
[-]	[m]	[m]	[-]	[m]	[-]	[mm2]	[m]	[°]	[kN]	[-]	[-]	[-]	
0	6	2.5	-	-	-		-	-	-	-	-	-	-
1	9	4.5	I	1.25	3	417	2.4	15	**605.6**	1.79	2.08	1.79	ok
2	12	6	I	1.25	3	417	2.4	15	**605.6**	1.88	2.41	1.88	ok
			II	3.75	5	695	2.4	20	**1009.3**	2.19	2.68	2.19	ok
3	15	7.5	I	1.25	3	417	2.4	15	**605.6**	1.86	2.36	1.86	ok
			II	3.75	4	556	2.4	20	**807.4**	1.71	2.02	1.71	ok
			III	6.25	4	556	2.4	25	**807.4**	1.76	2.07	1.76	ok
4	18	10	I	1.5	3	417	2.4	15	**605.6**	2.83	3.41	2.83	ok
			II	4	3	417	2.4	20	**605.6**	1.76	2.08	1.76	ok
			III	6.5	5	695	2.0	25	**1009.3**	1.32	1.63	1.32	ok
			IV	8.5	5	695	2.0	30	**1009.3**	1.48	1.68	1.48	ok

9.2.2 Verifica allo sfilamento

Vale quanto segue:

Verifica geotecnica

Sezione tipo	Ordine tiranti	Interasse orizzontale max	Inclinazione	Lungh. Libera	Lungh. Bulbo ancoraggio	Diametro perforazione	Aderenza unitaria media	Aderenza unitaria min				Ressitenza geotecnica allo sfilamento	c.s Esercizio	c.s. Sisma	c.s. Tot GEO	stato verifica
		i	α	L_L	L_B	D_{perf}	$\alpha\tau_{ad,kmed}$	$\alpha\tau_{ad,kmin}$	$R_{ac,medio}/\xi_3$	$R_{ac,min}/\xi_4$	R_{ak}	$R_{ad}=R_{ak}/\gamma_R$			R_{ad} / N_{Ed}	GEO
[-]	[-]	[m]	[°]	[m]	[m]	[mm]	[kN/m^2]	[kN/m^2]	[kN]	[kN]	[kN]	[kN]	[-]	[-]	[-]	
0	-	-	-	-	-											
1	I	2.4	15	6.0	10.0	160	160	150	459.6	443.5	443.5	**403.2**	1.2	1.4	1.19	ok
2	I	2.4	15	7.0	10.0	160	160	150	459.6	443.5	443.5	**403.2**	1.3	1.6	1.25	ok
	II	2.4	20	6.0	13.0	160	160	150	597.4	576.6	576.6	**524.2**	1.1	1.4	1.14	ok
3	I	2.4	15	9.0	10.0	160	160	150	459.6	443.5	443.5	**403.2**	1.2	1.6	1.24	ok
	II	2.4	20	8.0	12.0	160	160	150	551.5	532.2	532.2	**483.8**	1.0	1.2	1.02	ok
	III	2.4	25	6.0	12.0	160	210	200	723.8	709.6	709.6	**645.1**	1.4	1.7	1.40	ok
4	I	2.4	15	11.0	10.0	160	160	150	459.6	443.5	443.5	**403.2**	1.9	2.3	1.88	ok
	II	2.4	20	11.0	10.0	160	160	150	459.6	443.5	443.5	**403.2**	1.2	1.4	1.17	ok
	III	2.0	25	12.0	15.0	160	210	200	904.8	887.0	887.0	**806.4**	1.1	1.3	1.05	ok
	IV	2.0	30	12.0	15.0	160	210	200	904.8	887.0	887.0	**806.4**	1.2	1.3	1.18	ok

9.2.3 Gerarchia resistenze

Sezione tipo	Ordine tiranti	$R_{p(1)k}$	R_{ak}	$R_{p(1)k}/R_{ak}$	
[-]	[-]	[kN]	[kN]	[-]	
0	-				
1	I	696.39	443.52	1.57	ok
2	I	696.39	443.52	1.57	ok
	II	1160.65	576.57	2.01	ok
3	I	696.39	443.52	1.57	ok
	II	928.52	532.22	1.74	ok
	III	928.52	709.63	1.31	ok
4	I	696.39	443.52	1.57	ok
	II	696.39	443.52	1.57	ok
	III	1160.65	887.04	1.31	ok
	IV	1160.65	887.04	1.31	ok

9.3 Verifica delle travi di ripartizione

Nel seguito sono riportate le verifiche delle travi di ripartizione per le quattro sezioni tipologiche analizzate in accordo a quanto prescritto nelle norme NTC08. Per maggiori dettagli si rimanda al §6.2.

Sezione tipo 1 – altezza di scavo = 4,5m

Ordine tiranti		***I***

Configurazione Tiranti		
Interasse	i [m]	2.4
Inclinazione tirante	α [°]	15

Materiale		
	Acciaio	S 355
Tensione di snervamento	f_{yk} [N/mm^2]	355
Coefficiente sicurezza resistenza	$\gamma_{M,0}$ [-]	1.05

Caratteristiche geometriche profilo		
Profilo		HE180
Larghezza	b [mm]	180
Altezza	h [mm]	171
Spessore anima	t_w [mm]	6
Spessore flangia	t_f [mm]	9.5
Raggio di raccordo	r [mm]	15
Altezza utile	d [mm]	122
Area lorda	A [mm^2]	45.3
Asse forte y-y		
Momento d'inerzia asse y	I_y [cm^4]	2510
Modulo di resistenza elastico	$W_{el,y}$ [cm^3]	293.6
Modulo di resistenza plastico	$W_{pl,y}$ [cm^3]	324.9
Raggio d'inerzia	i_y [cm]	7.44
Area di taglio in direzione z	$A_{v,zz}$ [cm^2]	14.52
Classificazione della sezione a flessione	Classe [-]	**2**

Forza di trazione nel tirante		
Esercizio	p [kN/m]	141.2
Sismica	p[kN/m]	121.46
Sollecitazioni trave di ripartizione		
Numero travi	n	2
Esercizio	V_E [kN]	81.83
	M_E [kNm]	39.28
Sisma	V_E [kN]	70.39
	M_{Ed} [kNm]	33.79

Verifica di resitenza trave di ripartizione condizioni statiche		
Coefficiente amplificazione carichi	γ_E	1.0
	V_{Ed} [kN]	81.83
Taglio resistente in assenza di torsione	$V_{c,Rd}$ [kN]	283.43
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.29
[4.2.17] stato verifica		ok
	ρ	0.0
Momento di calcolo	M_{Ed} [kNm]	39.28
Resistenza a flessione	$M_{c,Rd}$ =$M_{y,V,Rd}$	109.85
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.36
stato verifica		ok

Verifica di resitenza trave di ripartizione condizioni sismiche		
Coefficiente amplificazione carichi	γ_E	1.0
	V_{Ed} [kN]	70.39
Taglio resistente in assenza di torsione	$V_{c,Rd}$ [kN]	283.43
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.25
[4.2.17] stato verifica		ok
	ρ	0.0
Momento di calcolo	M_{Ed} [kNm]	33.79
Resistenza a flessione	$M_{c,Rd}$ =$M_{y,V,Rd}$	109.85
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.31
stato verifica		ok

Sezione tipo 2 – altezza di scavo = 6m

Ordine tiranti		***I***	***II***
Configurazione Tiranti			
Interasse	i [m]	2.4	2.4
Inclinazione tirante	α [°]	15	20
Materiale			
	Acciaio	S 355	S 355
Tensione di snervamento	f_{yk} [N/mm^2]	355	355
Coefficiente sicurezza resistenza	$\gamma_{M,0}$ [-]	1.05	1.05
Caratteristiche geometriche profilo			
Profilo		HE180	HE180A
Larghezza	b [mm]	180	180
Altezza	h [mm]	171	171
Spessore anima	t_w [mm]	6	6
Spessore flangia	t_f [mm]	9.5	9.5
Raggio di raccordo	r [mm]	15	15
Altezza utile	d [mm]	122	122
Area lorda	A [mm^2]	45.3	45.3
Asse forte y-y			
Momento d'inerzia asse y	I_y [cm^4]	2510	2510
Modulo di resistenza elastico	$W_{el,y}$ [cm^3]	293.6	293.6
Modulo di resistenza plastico	$W_{pl,y}$ [cm^3]	324.9	324.9
Raggio d'inerzia	i_y [cm]	7.44	7.44
Area di taglio in direzione z	$A_{v,zz}$ [cm^2]	14.52	14.52
Classificazione della sezione a flessione	Classe [-]	**2**	**2**
Forza di trazione nel tirante			
Esercizio	p [kN/m]	134.0	104.8
Sismica	p[kN/m]	192.3	157.2
Sollecitazioni trave di ripartizione			
Numero travi	n	2	2
Esercizio	V_E [kN]	77.66	59.08
	M_E [kNm]	37.28	28.36
Sisma	V_E [kN]	111.42	88.61
	M_{Ed} [kNm]	53.48	42.53
Verifica di resitenza trave di ripartizione condizioni statiche			
Coefficiente amplificazione carichi	γ_E	1.0	1.0
	V_{Ed} [kN]	77.66	59.08
Taglio resistente in assenza di torsione	$V_{c,Rd}$ [kN]	283.43	283.43
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.27	0.21
[4.2.17] stato verifica		ok	ok
	ρ	0.0	0.0
Momento di calcolo	M_{Ed} [kNm]	37.28	28.36
Resistenza a flessione	$M_{c,Rd}$ =$M_{y,V,Rd}$	109.85	109.85
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.34	0.26
stato verifica		ok	ok
Verifica di resitenza trave di ripartizione condizioni sismiche			
Coefficiente amplificazione carichi	γ_E	1.0	1.0
	V_{Ed} [kN]	111.42	88.61
Taglio resistente in assenza di torsione	$V_{c,Rd}$ [kN]	283.43	283.43
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.39	0.31
[4.2.17] stato verifica		ok	ok
	ρ	0.0	0.0
Momento di calcolo	M_{Ed} [kNm]	53.48	42.53
Resistenza a flessione	$M_{c,Rd}$ =$M_{y,V,Rd}$	109.85	109.85
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.49	0.39
stato verifica		ok	ok

Sezione tipo 3 – altezza di scavo = 7,5m

Ordine tiranti		***I***	***II***	***III***
Configurazione Tiranti				
Interasse	i [m]	2.4	2.4	2.4
Inclinazione tirante	α [°]	15	20	25
Materiale				
	Acciaio	S 355	S 355	S 355
Tensione di snervamento	f_{yk} [N/mm^2]	355	355	355
Coefficiente sicurezza resistenza	$\gamma_{M,0}$ [-]	1.05	1.05	1.05
Caratteristiche geometriche profilo				
Profilo		HE180	HE180A	HE180A
Larghezza	b [mm]	180	180	180
Altezza	h [mm]	171	171	171
Spessore anima	t_w [mm]	6	6	6
Spessore flangia	t_f [mm]	9.5	9.5	9.5
Raggio di raccordo	r [mm]	15	15	15
Altezza utile	d [mm]	122	122	122
Area lorda	A [mm^2]	45.3	45.3	45.3
Asse forte y-y				
Momento d'inerzia asse y	I_y [cm^4]	2510	2510	2510
Modulo di resistenza elastico	$W_{el,y}$ [cm^3]	293.6	293.6	293.6
Modulo di resistenza plastico	$W_{pl,y}$ [cm^3]	324.9	324.9	324.9
Raggio d'inerzia	i_y [cm]	7.44	7.44	7.44
Area di taglio in direzione z	$A_{v,zz}$ [cm^2]	14.52	14.52	14.52
Classificazione della sezione a flessione	Classe [-]	**2**	**2**	**2**
Forza di trazione nel tirante				
Esercizio	p [kN/m]	135.6	197.0	191.6
Sismica	p[kN/m]	107	166.14	162.7
Sollecitazioni trave di ripartizione				
Numero travi	n	2	2	2
Esercizio	V_E [kN]	78.59	111.04	104.18
	M_E [kNm]	37.72	53.30	50.01
Sisma	V_E [kN]	62.01	93.67	88.47
	M_{Ed} [kNm]	29.77	44.96	42.47
Verifica di resitenza trave di ripartizione condizioni statiche				
Coefficiente amplificazione carichi	γ_E	1.0	1.0	1.0
	V_{Ed} [kN]	78.59	111.04	104.18
Taglio resistente in assenza di torsione	$V_{c,Rd}$ [kN]	283.43	283.43	283.43
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.28	0.39	0.37
[4.2.17] stato verifica		ok	ok	ok
	ρ	0.0	0.0	0.0
Momento di calcolo	M_{Ed} [kNm]	37.72	53.30	50.01
Resistenza a flessione	$M_{c,Rd}$ =$M_{y,V,Rd}$	109.85	109.85	109.85
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.34	0.49	0.46
stato verifica		ok	ok	ok
Verifica di resitenza trave di ripartizione condizioni sismiche				
Coefficiente amplificazione carichi	γ_E	1.0	1.0	1.0
	V_{Ed} [kN]	62.01	93.67	88.47
Taglio resistente in assenza di torsione	$V_{c,Rd}$ [kN]	283.43	283.43	283.43
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.22	0.33	0.31
[4.2.17] stato verifica		ok	ok	ok
	ρ	0.0	0.0	0.0
Momento di calcolo	M_{Ed} [kNm]	29.77	44.96	42.47
Resistenza a flessione	$M_{c,Rd}$ =$M_{y,V,Rd}$	109.85	109.85	109.85
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.27	0.41	0.39
stato verifica		ok	ok	ok

Sezione tipo 4 – altezza di scavo = 10m

Ordine tiranti		*I*	*II*	*III*	*IV*
Configurazione Tiranti					
Interasse	i [m]	2.4	2.4	2.0	2.0
Inclinazione tirante	α [°]	15	20	25	30
Materiale					
	Acciaio	S 355	S 355	S 355	S 355
Tensione di snervamento	f_{yk} [N/mm^2]	355	355	355	355
Coefficiente sicurezza resistenza	$\gamma_{M,0}$ [-]	1.05	1.05	1.05	1.05
Caratteristiche geometriche profilo					
Profilo		HE180	HE180A	HE180A	HE180A
Larghezza	b [mm]	180	180	180	180
Altezza	h [mm]	171	171	171	171
Spessore anima	t_w [mm]	6	6	6	6
Spessore flangia	t_f [mm]	9.5	9.5	9.5	9.5
Raggio di raccordo	r [mm]	15	15	15	15
Altezza utile	d [mm]	122	122	122	122
Area lorda	A [mm^2]	45.3	45.3	45.3	45.3
Asse forte y-y					
Momento d'inerzia asse y	I_y [cm^4]	2510	2510	2510	2510
Modulo di resistenza elastico	$W_{el,y}$ [cm^3]	293.6	293.6	293.6	293.6
Modulo di resistenza plastico	$W_{pl,y}$ [cm^3]	324.9	324.9	324.9	324.9
Raggio d'inerzia	i_y [cm]	7.44	7.44	7.44	7.44
Area di taglio in direzione z	$A_{v,zz}$ [cm^2]	14.52	14.52	14.52	14.52
Classificazione della sezione a flessione	Classe [-]	**2**	**2**	**2**	**2**
Forza di trazione nel tirante					
Esercizio	p [kN/m]	89.1	143.5	382.9	341.4
Sismica	p[kN/m]	74.1	121.5	308.7	299.9
Sollecitazioni trave di ripartizione					
Numero travi	n	2	2	2	2
Esercizio	V_E [kN]	51.65	80.91	173.53	147.81
	M_E [kNm]	24.79	38.84	69.41	59.12
Sisma	V_E [kN]	42.95	68.50	139.89	129.84
	M_{Ed} [kNm]	20.61	32.88	55.96	51.94
Verifica di resitenza trave di ripartizione condizioni statiche					
Coefficiente amplificazione carichi	γ_E	1.0	1.0	1.0	1.0
	V_{Ed} [kN]	51.65	80.91	173.53	147.81
Taglio resistente in assenza di torsione	$V_{c,Rd}$ [kN]	283.43	283.43	283.43	283.43
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.18	0.29	0.61	0.52
[4.2.17] stato verifica		ok	ok	ok	ok
	ρ	0.0	0.0	0.1	0.0
Momento di calcolo	M_{Ed} [kNm]	24.79	38.84	69.41	59.12
Resistenza a flessione	$M_{c,Rd}$ =$M_{y,V,Rd}$	109.85	109.85	108.35	109.79
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.23	0.35	0.64	0.54
stato verifica		ok	ok	ok	ok
Verifica di resitenza trave di ripartizione condizioni sismiche					
Coefficiente amplificazione carichi	γ_E	1.0	1.0	1.0	1.0
	V_{Ed} [kN]	42.95	68.50	139.89	129.84
Taglio resistente in assenza di torsione	$V_{c,Rd}$ [kN]	283.43	283.43	283.43	283.43
tasso lavoro	V_{Ed} / $V_{c,Rd}$	0.15	0.24	0.49	0.46
[4.2.17] stato verifica		ok	ok	ok	ok
	ρ	0.0	0.0	0.0	0.0
Momento di calcolo	M_{Ed} [kNm]	20.61	32.88	55.96	51.94
Resistenza a flessione	$M_{c,Rd}$ =$M_{y,V,Rd}$	109.85	109.85	109.85	109.85
tasso lavoro	M_{Ed} / $M_{c,Rd}$	0.19	0.30	0.51	0.47
stato verifica		ok	ok	ok	ok

10. APPENDICE 1 – ANALISI DELLA PARATIA – TABULATI DI CALCOLO

Sezione tipo 0 – H_{scavo} = 2,5m

Sezione tipo 3 – H_{scavo} = 7,5m

Sezione tipo 1 – H_{scavo} = 4,5m

Sezione tipo 2 – H_{scavo} = 6,0m

Sezione tipo 3 – H_{scavo} = 7,5m

Sezione tipo 4 – H_{scavo} = 10,0m

DeepXcav 2010: Report Output

A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:21:29 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ0_rev26oct10_EQscavo_Alleg.DEEP

DeepXcav 2010: Report Output

Copyright@2009 - 2010 Deep Excavation LLC: www.deepexcavation.com
A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:21:29 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ0_rev26oct10_EQscavo_Alleg.DEEP

OBJECTIVES

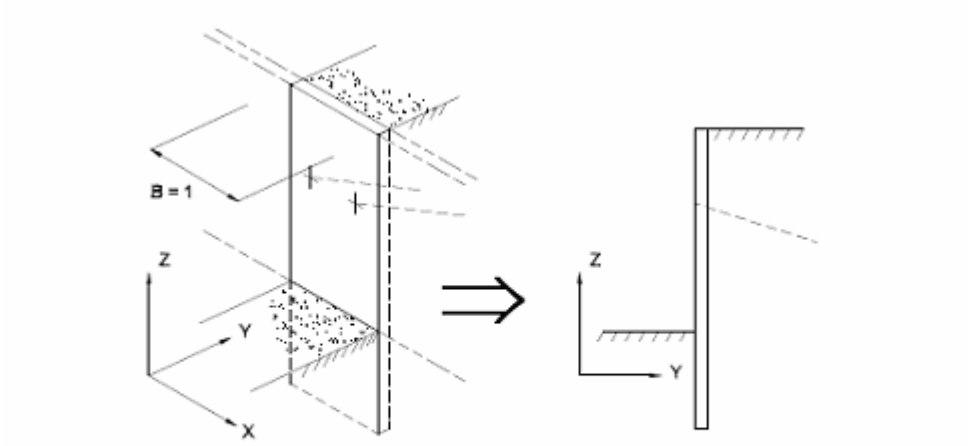
The objective of this document is to report the most imprortant results of the calculations

BIBLIOGRAPHIC REFERENCES

BECCI,B.,NOVA,R. (1987) “Un metodo di calcolo automatico per il progetto di paratie”, Rivista Italiana di

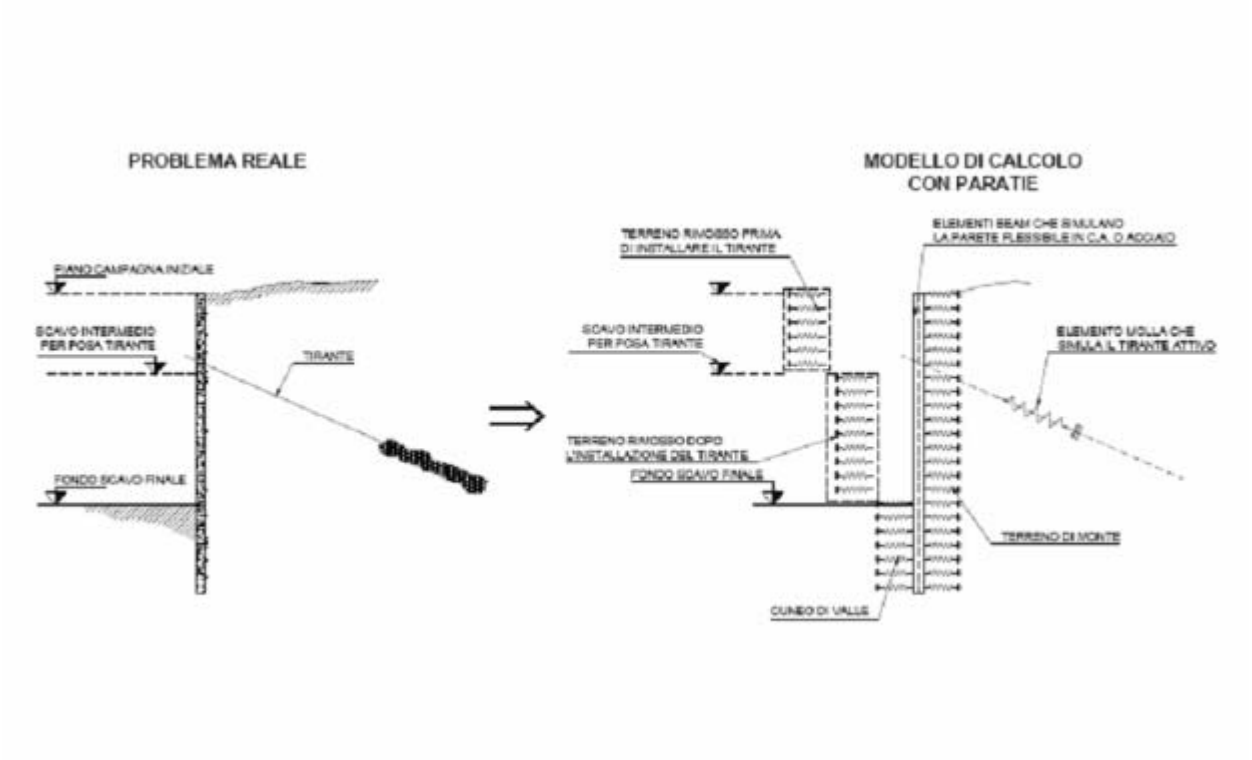
GENERAL CALCULATION ASSUMPTIONS

DEEP EXC is a program to simulate a the behaviuor of flexible diaphrams. It is possible to simulate all the different stages of excavation.
the program is able to perform both classic and non linear analysis.
For the non linear analysis a FEM model is used. The FEM model follow the well known beam on elasto plastic foundation approach. The wall is modeled using BEAM elements , the soil is simulate using a double system (for each part of the wall) of elasto plastic spring ,
An elasto plastic spring is connected on each node of the beam elements.
THe excavation procedure is performed through 2 types of analysis:
1) Classic analysis
2) Non linear analysis : every step represents an excavation phase with a defined configurations of excavations, loads, etc.
The non linear analysis has been performed using a full Newthon Raphson approach.



CONVENTIONS AND REFERENCE COORDINATE SYSTEMS

Loads, anelastic displacements, support reactions and displacements, are all referred to a rigthward coordinate system



ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
(tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

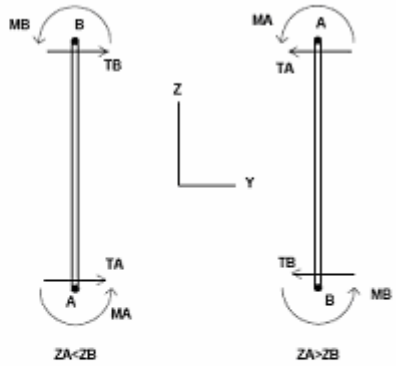


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
(tutti per unità di profondità)

Checking of cross sections is performed according to the coordinate systems showed in the next figure

- X axis follow the 2 nodes direction of the beam elements , positive going from the first to the secondo node

ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
(tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

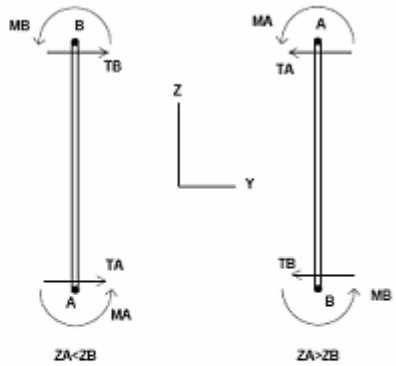


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
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3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
(tutti per unità di profondità)

DESIGN CODES

Reference codes are:
- DM 2008 - "Norme tecniche per le costruzioni"
- CSLP, "Istruzioni per l'applicazione delle Notme tecniche per le costruzioni di cui al DM 14/1/2008"
- EC2 1-1 :2004, Eurocode 2 - Design of concrete structures
- Ec3 1-1:2005, Eurocodice 3 - Design of steel structures
- Ec3 5:2002, Eurocodice 3 - Design of steel sheet piles walls
- Ec8:2004 - Seismic design of structures
- AISC ASD 9th Edition, 1989
- AISC LRFD 2nd Edition, 2003
- ACI 318-2002
- AASHTO 2000 ADS / LRFD

DESIGN PARAMETERS

Project: My Project
Results for Design Section 0: Base Section - Service

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-4.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

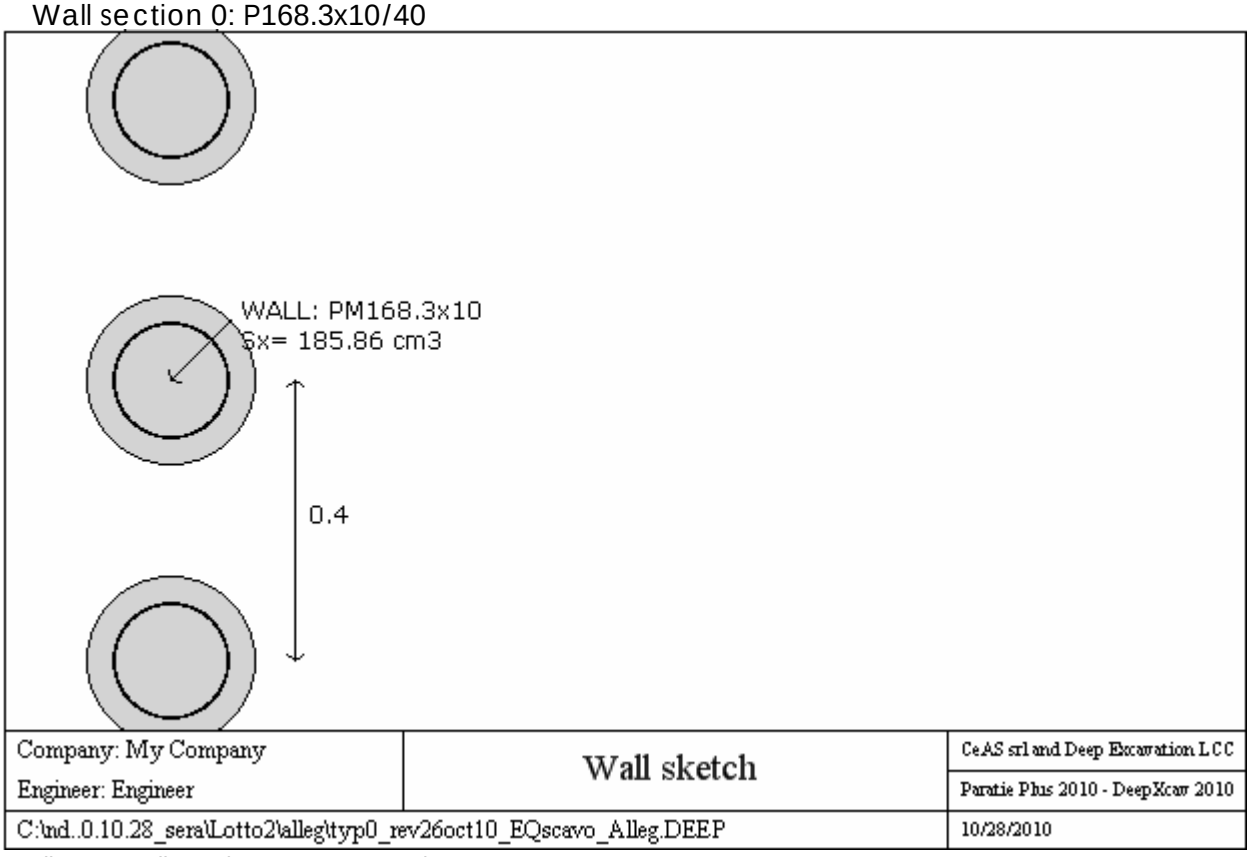
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -6 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

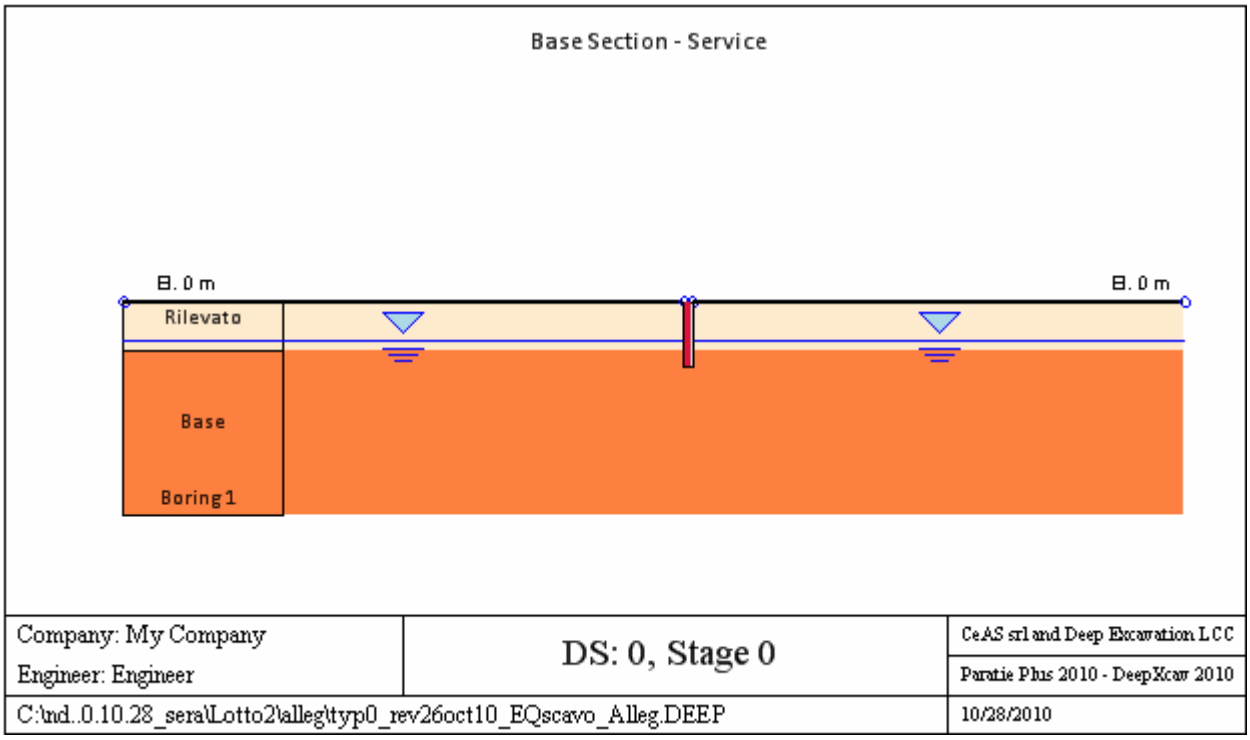
TIEBACK DATA

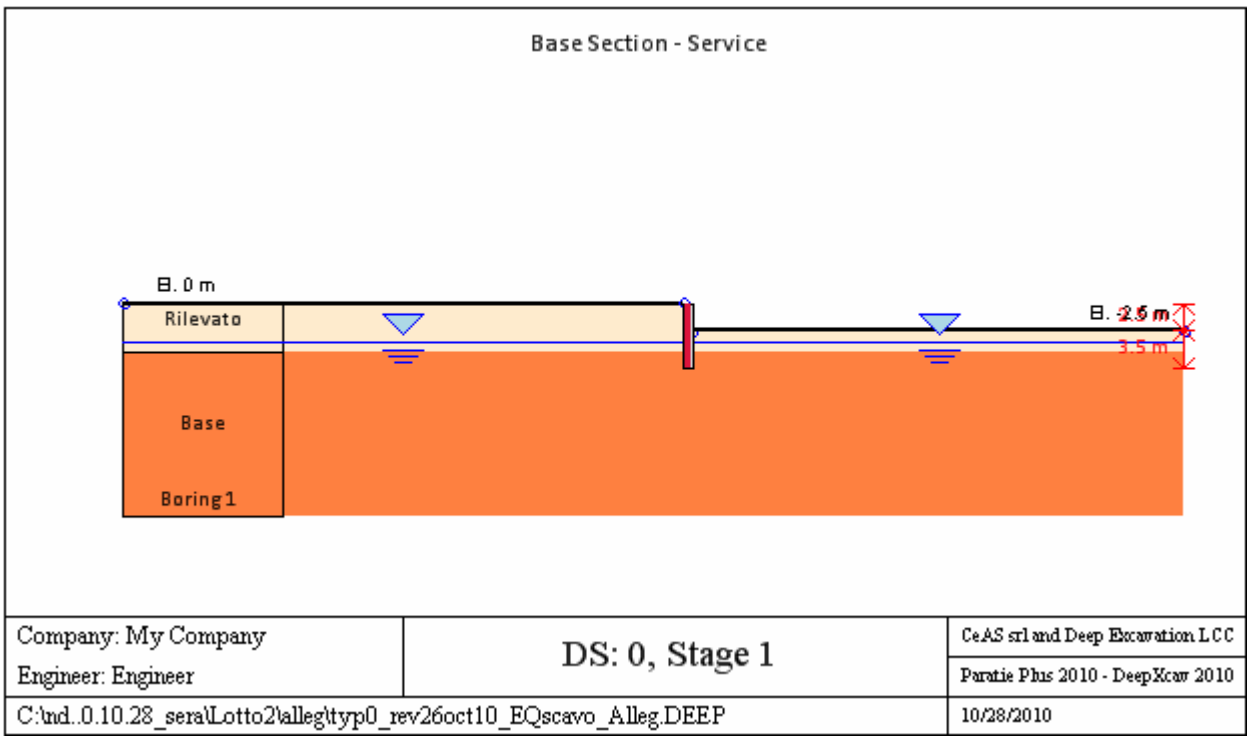
Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported





GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis Method	Drive Press	ka-Mult	Htr (%)	Resist Press	Res Mult	Contl Meth	Supp Mode	Axial Incl	Used FSwall	Min FDtoe	Toe FSrot	Toe FSpas

Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	14.51	17.25	14.51
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	2.188	2.648	3.551

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.054	0	1	N/A
1	No		0.054	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

WALL RESULTS TABLE

P168.3x10/40 Stage: 0

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	0	0	0	0	0	0	0	0	0	0
2	-0.2	1.692	1.692	1.692	1.692	0	0	0	0	0	0
4	-0.4	3.384	3.384	3.384	3.384	0	0	0	0	0	0
6	-0.6	5.076	5.076	5.076	5.076	0	0	0	0	0	0
8	-0.8	6.768	6.768	6.768	6.768	0	0	0	0	0	0
10	-1	8.46	8.46	8.46	8.46	0	0	0	0	0	0
12	-1.2	10.152	10.152	10.152	10.152	0	0	0	0	0	0
14	-1.4	11.844	11.844	11.844	11.844	0	0	0	0	0	0
16	-1.6	13.536	13.536	13.536	13.536	0	0	0	0	0	0
18	-1.8	15.228	15.228	15.228	15.228	0	0	0	0	0	0
20	-2	16.92	16.92	16.92	16.92	0	0	0	0	0	0
22	-2.2	18.612	18.612	18.612	18.612	0	0	0	0	0	0
24	-2.4	20.304	20.304	20.304	20.304	0	0	0	0	0	0
26	-2.6	21.996	21.996	21.996	21.996	0	0	0	0	0	0

28	-2.8	23.688	23.688	23.688	23.688	0	0	0	0	0	0
30	-3	25.38	25.38	25.38	25.38	0	0	0	0	0	0
32	-3.2	27.072	27.072	27.072	27.072	0	0	0	0	0	0
34	-3.4	28.764	28.764	28.764	28.764	0	0	0	0	0	0
36	-3.6	30.986	30.986	29.986	29.986	0	1	1	0	0	0
38	-3.8	33.738	33.738	30.738	30.738	0	3	3	0	0	0
40	-4	36.49	36.49	31.49	31.49	0	5	5	0	0	0
42	-4.2	39.242	39.242	32.242	32.242	0	7	7	0	0	0
44	-4.4	41.994	41.994	32.994	32.994	0	9	9	0	0	0
46	-4.6	52.429	52.429	41.429	41.429	0	11	11	0	0	0
48	-4.8	55.352	55.352	42.352	42.352	0	13	13	0	0	0
50	-5	58.275	58.275	43.275	43.275	0	15	15	0	0	0
52	-5.2	61.198	61.198	44.198	44.198	0	17	17	0	0	0
54	-5.4	64.121	64.121	45.121	45.121	0	19	19	0	0	0
56	-5.6	67.045	67.045	46.045	46.045	0	21	21	0	0	0
58	-5.8	69.968	69.968	46.968	46.968	0	23	23	0	0	0
60	-6	72.891	72.891	47.891	47.891	0	25	25	0	0	0

P168.3x10/40 Stage: 1

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	0	0	0	0	0	0	0	0	0	1.2
2	-0.2	0.961	0	0.961	0	0	0	0	0	0.05	1.13
4	-0.4	1.922	0	1.922	0	0	0	0	0.05	0.29	1.07
6	-0.6	2.884	0	2.884	0	0	0	0	0.17	0.72	1.01
8	-0.8	3.845	0	3.845	0	0	0	0	0.4	1.35	0.95
10	-1	4.806	0	4.806	0	0	0	0	0.79	2.16	0.88
12	-1.2	5.767	0	5.767	0	0	0	0	1.37	3.17	0.82
14	-1.4	6.728	0	6.728	0	0	0	0	2.19	4.37	0.76
16	-1.6	7.69	0	7.69	0	0	0	0	3.27	5.77	0.7
18	-1.8	8.651	0	8.651	0	0	0	0	4.66	7.35	0.64
20	-2	9.612	0	9.612	0	0	0	0	6.39	9.13	0.58
22	-2.2	10.573	0	10.573	0	0	0	0	8.51	11.1	0.52
24	-2.4	11.534	0	11.534	0	0	0	0	11.05	13.27	0.46
26	-2.6	12.496	9.101	12.496	9.101	0	0	0	14.06	15.62	0.41
28	-2.8	13.457	27.302	13.457	27.302	0	0	0	17.2	15.44	0.36
30	-3	14.418	40.999	14.418	40.999	0	0	0	19.78	11.8	0.31
32	-3.2	15.379	38.867	15.379	38.867	0	0	0	21.36	6.65	0.26
34	-3.4	16.34	37	16.34	37	0	0	0	22	2.09	0.22
36	-3.6	18.035	35.916	17.035	34.916	0	1	1	21.81	-1.91	0.19
38	-3.8	20.462	35.682	17.462	32.682	0	3	3	20.91	-5.35	0.16
40	-4	22.889	35.856	17.889	30.856	0	5	5	19.4	-8.27	0.13
42	-4.2	25.316	36.409	18.316	29.409	0	7	7	17.36	-10.77	0.11
44	-4.4	28.108	37.301	19.108	28.301	0	9	9	14.88	-12.91	0.09
46	-4.6	44.325	42.889	33.325	31.889	0	11	11	12.12	-13.85	0.07
48	-4.8	48.924	44.561	35.924	31.561	0	13	13	9.4	-13.41	0.05
50	-5	53.299	46.408	38.299	31.408	0	15	15	6.87	-12.4	0.04
52	-5.2	57.511	48.381	40.511	31.381	0	17	17	4.6	-10.91	0.03
54	-5.4	61.611	50.437	42.611	31.437	0	19	19	2.71	-8.98	0.02
56	-5.6	65.647	52.541	44.647	31.541	0	21	21	1.25	-6.65	0.01
58	-5.8	69.651	54.665	46.651	31.665	0	23	23	0.33	-3.93	0
60	-6	73.646	56.792	48.646	31.792	0	25	25	0	-0.84	-0.01

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

Project: My Project
Results for Design Section 1: DM08_ITA: Comb. 1: A1+M1+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
1	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-4.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

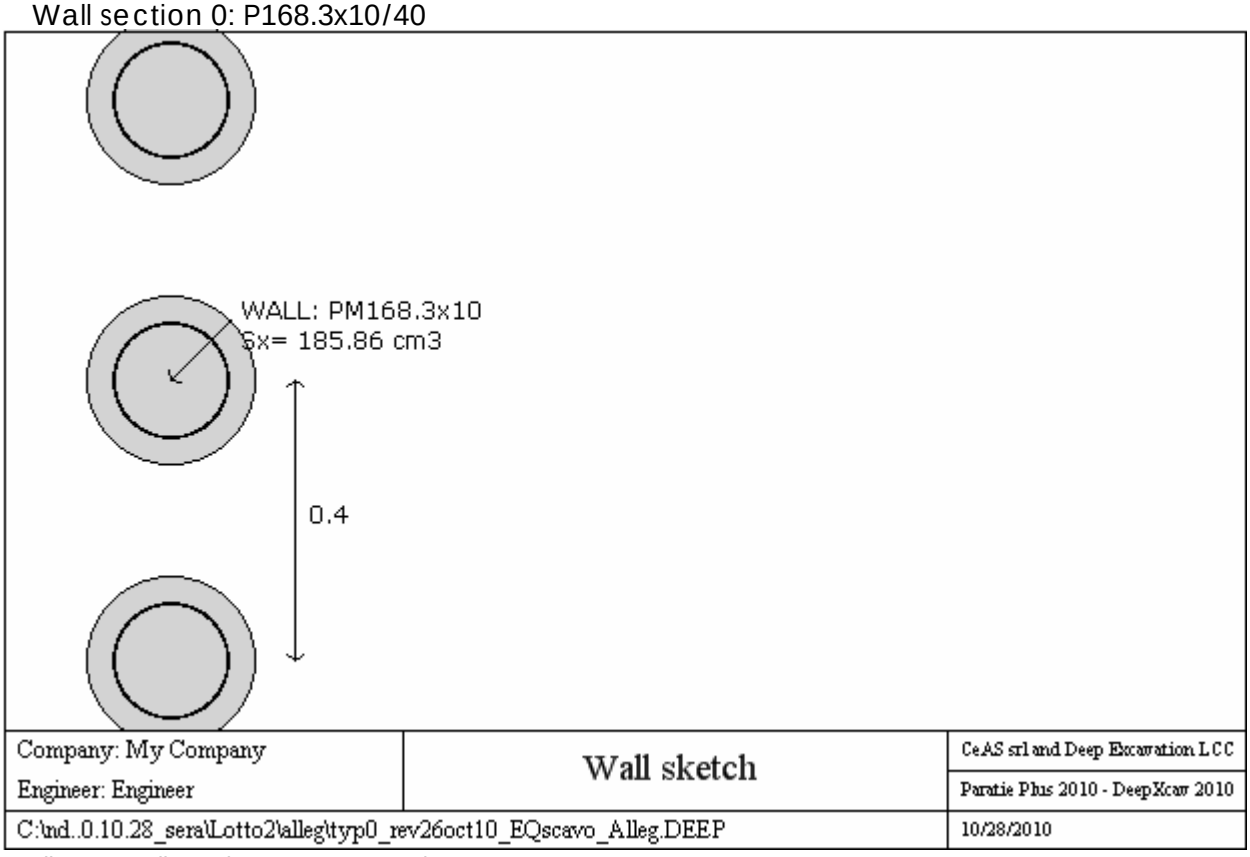
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -6 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	11.16	13.27	11.16
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	1.944	2.037	2.732

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.054	0	1	N/A
1	No		0.054	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

Project: My Project
Results for Design Section 2: DM08_ITA: Comb. 2: A2+M2+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-4.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

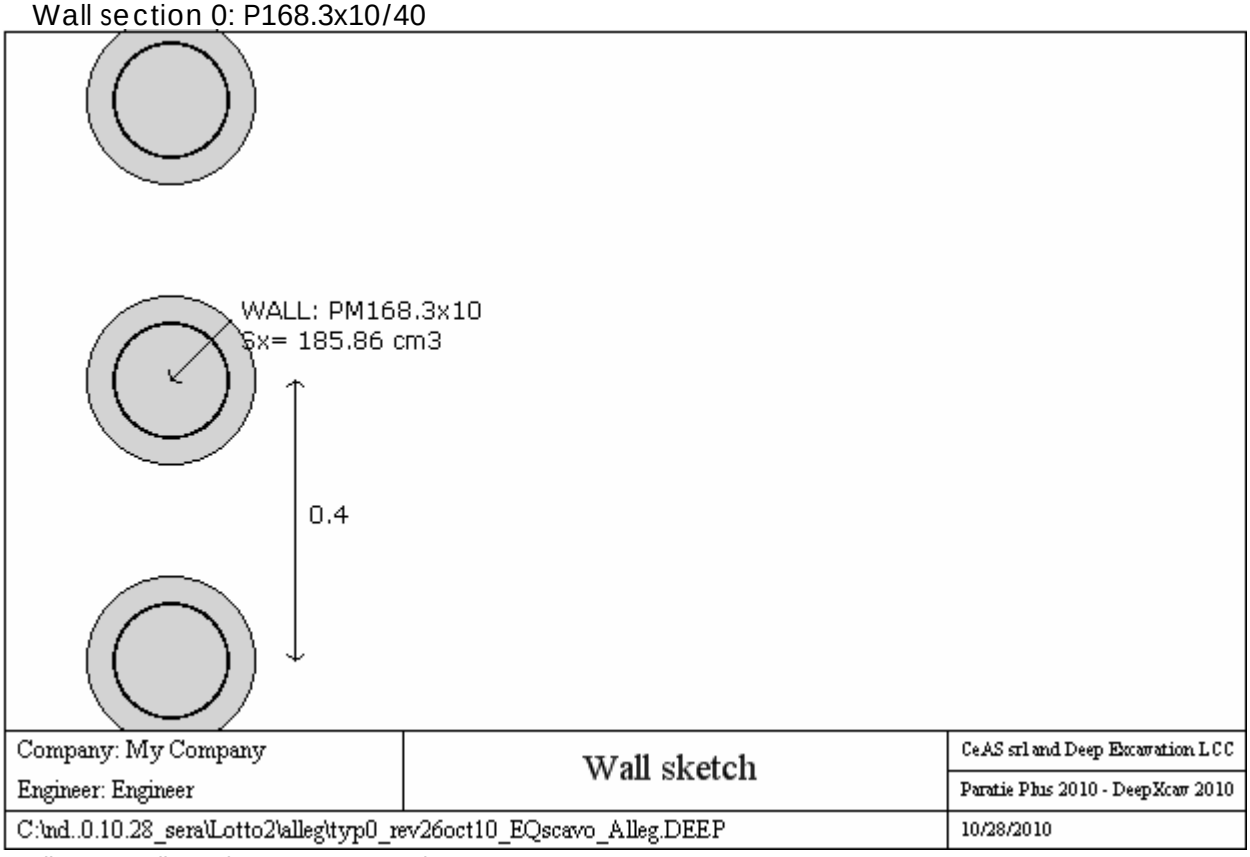
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -6 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	8.626	9.97	8.626
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	1.548	1.548	2.145

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.054	0	1	N/A
1	No		0.054	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

Project: My Project
Results for Design Section 3: DM08_ITA: EQK - Seismic

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-4.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

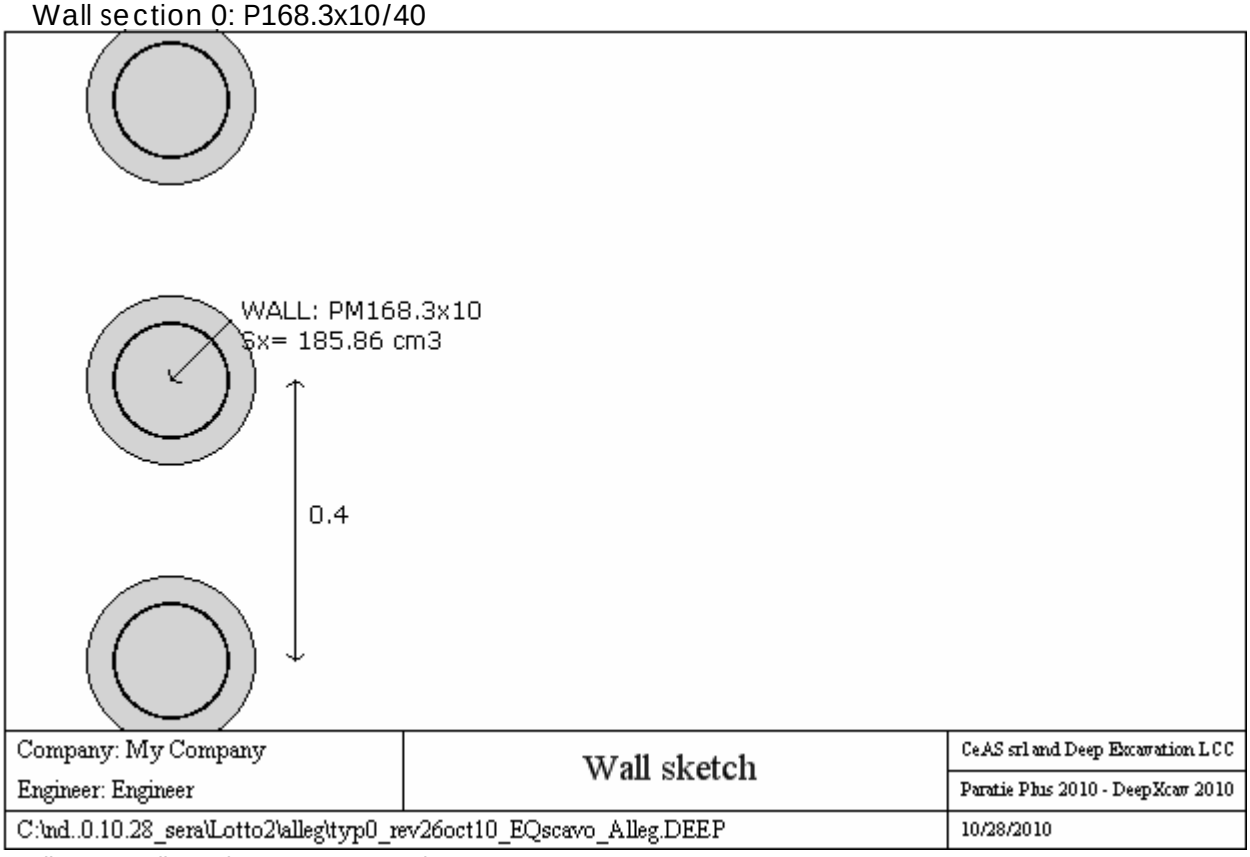
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -6 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	8.626	9.97	8.626
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	1.548	1.548	2.145
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.458	1.475	N/A

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.054	0	1	N/A
1	No		0.054	0	1	N/A
2	Yes		0.054	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

DeepXcav 2010: Report Output

A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:22:34 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ1_rev26oct10_EQscavo_Alleg.DEEP

DeepXcav 2010: Report Output

Copyright@2009 - 2010 Deep Excavation LLC: www.deepexcavation.com
A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:22:34 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ1_rev26oct10_EQscavo_Alleg.DEEP

OBJECTIVES

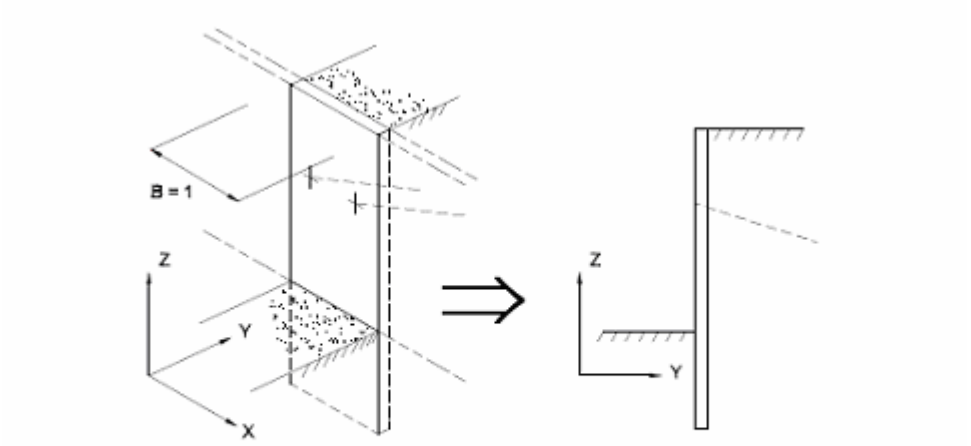
The objective of this document is to report the most imprortant results of the calculations

BIBLIOGRAPHIC REFERENCES

BECCI,B.,NOVA,R. (1987) “Un metodo di calcolo automatico per il progetto di paratie”, Rivista Italiana di

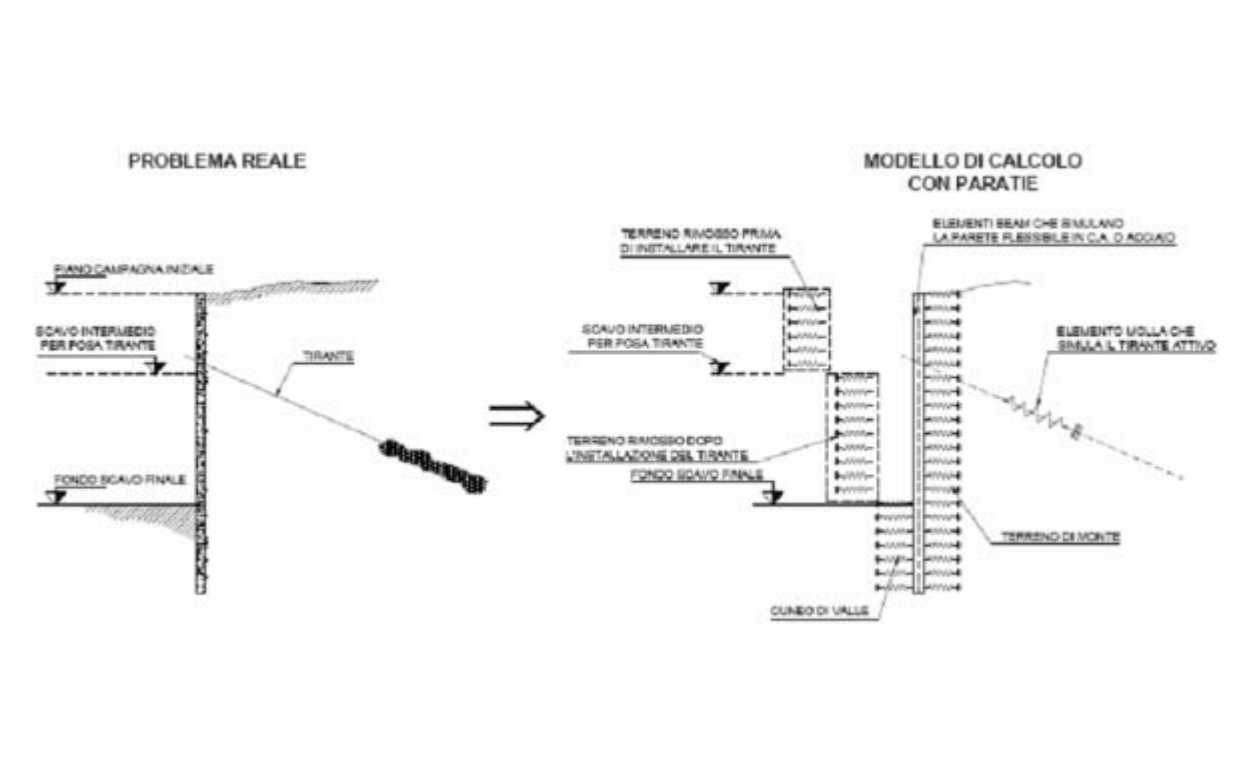
GENERAL CALCULATION ASSUMPTIONS

DEEP EXC is a program to simulate a the behaviuor of flexible diaphrams. It is possible to simulate all the different stages of excavation.
the program is able to perform both classic and non linear analysis.
For the non linear analysis a FEM model is used. The FEM model follow the well known beam on elasto plastic foundation approach. The wall is modeled using BEAM elements , the soil is simulate using a double system (for each part of the wall) of elasto plastic spring ,
An elasto plastic spring is connected on each node of the beam elements.
THe excavation procedure is performed through 2 types of analysis:
1) Classic analysis
2) Non linear analysis : every step represents an excavation phase with a defined configurations of excavations, loads, etc.
The non linear analysis has been performed using a full Newthon Raphson approach.



CONVENTIONS AND REFERENCE COORDINATE SYSTEMS

Loads, anelastic displacements, support reactions and displacements, are all referred to a rigthward coordinate system



ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
(tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

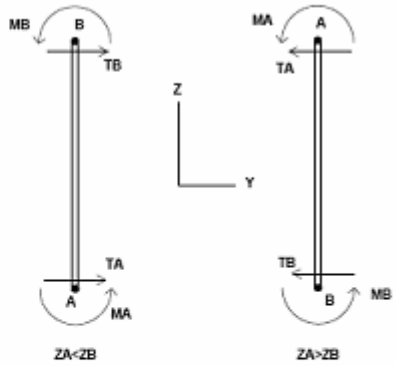


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
(tutti per unità di profondità)

Checking of cross sections is performed according to the coordinate systems showed in the next figure

- X axis follow the 2 nodes direction of the beam elements , positive going from the first to the secondo node

ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
(tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

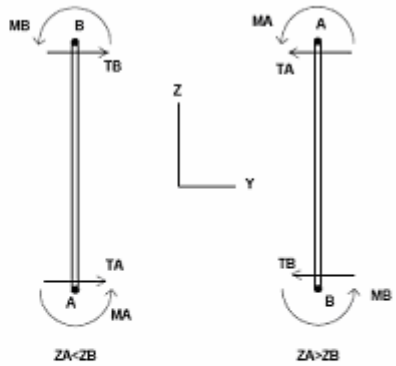


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
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3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
(tutti per unità di profondità)

DESIGN CODES

Reference codes are:
- DM 2008 - "Norme tecniche per le costruzioni"
- CSLP, "Istruzioni per l'applicazione delle Notme tecniche per le costruzioni di cui al DM 14/1/2008"
- EC2 1-1 :2004, Eurocode 2 - Design of concrete structures
- Ec3 1-1:2005, Eurocodice 3 - Design of steel structures
- Ec3 5:2002, Eurocodice 3 - Design of steel sheet piles walls
- Ec8:2004 - Seismic design of structures
- AISC ASD 9th Edition, 1989
- AISC LRFD 2nd Edition, 2003
- ACI 318-2002
- AASHTO 2000 ADS / LRFD

DESIGN PARAMETERS

Project: My Project
Results for Design Section 0: Base Section - Service

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-4.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

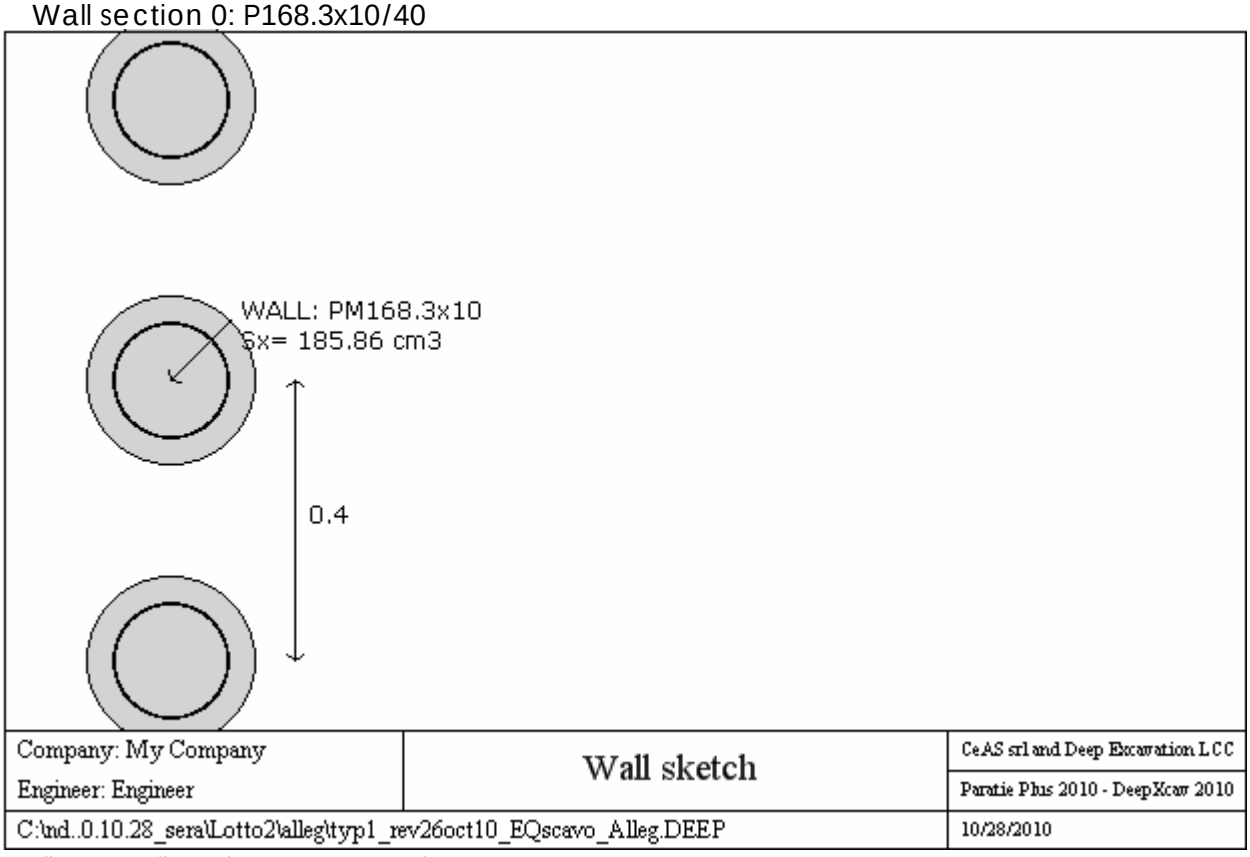
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -9 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

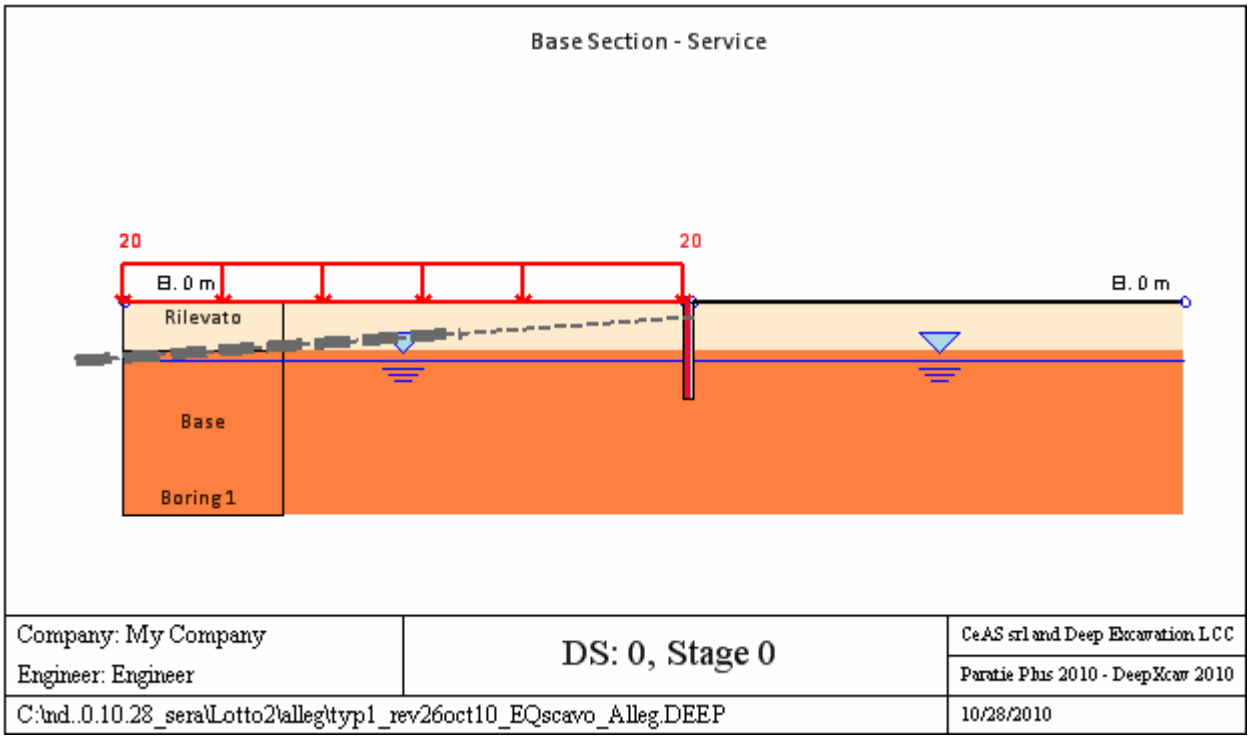
TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported



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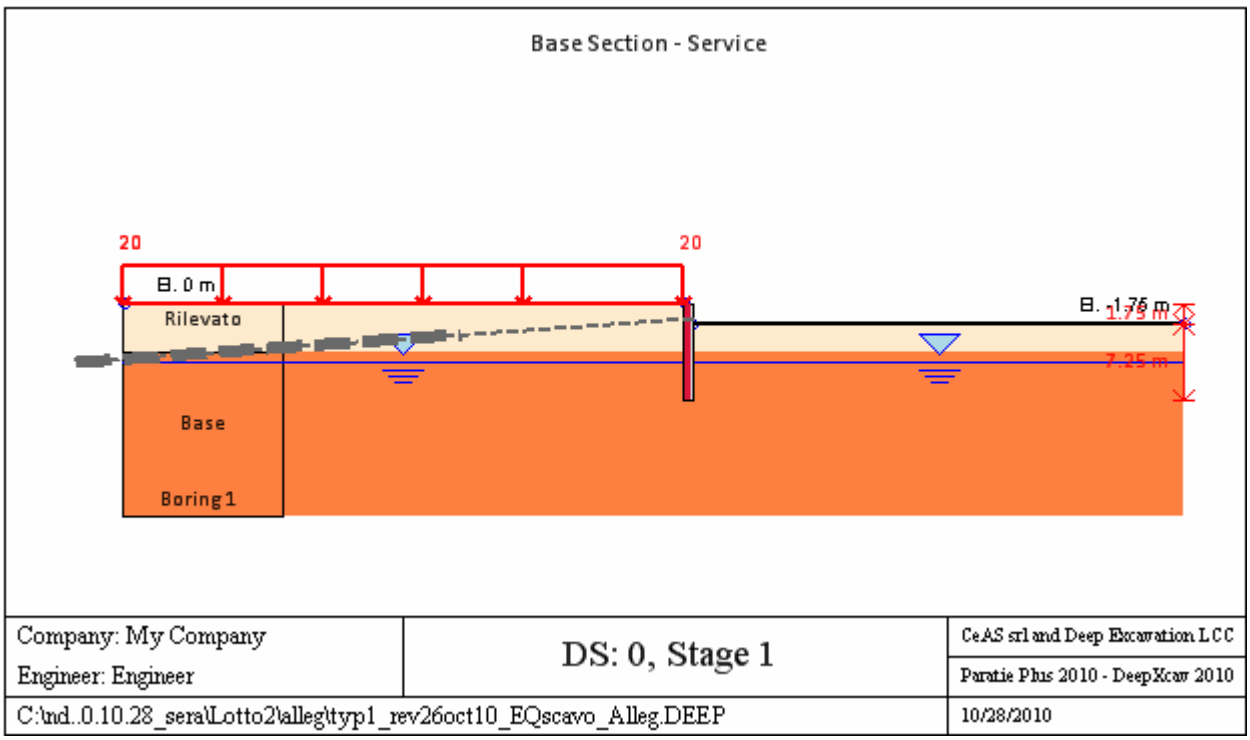

Company: My Company Engineer: Engineer	DS: 0, Stage 1	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
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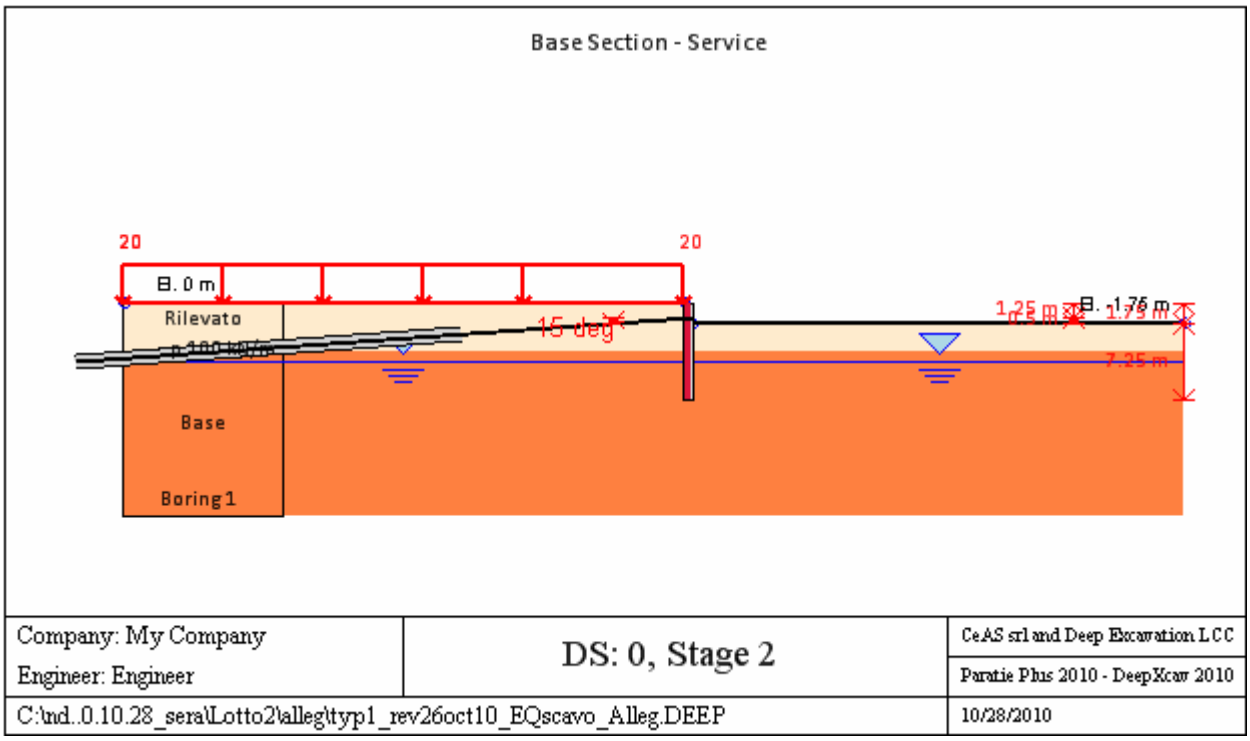
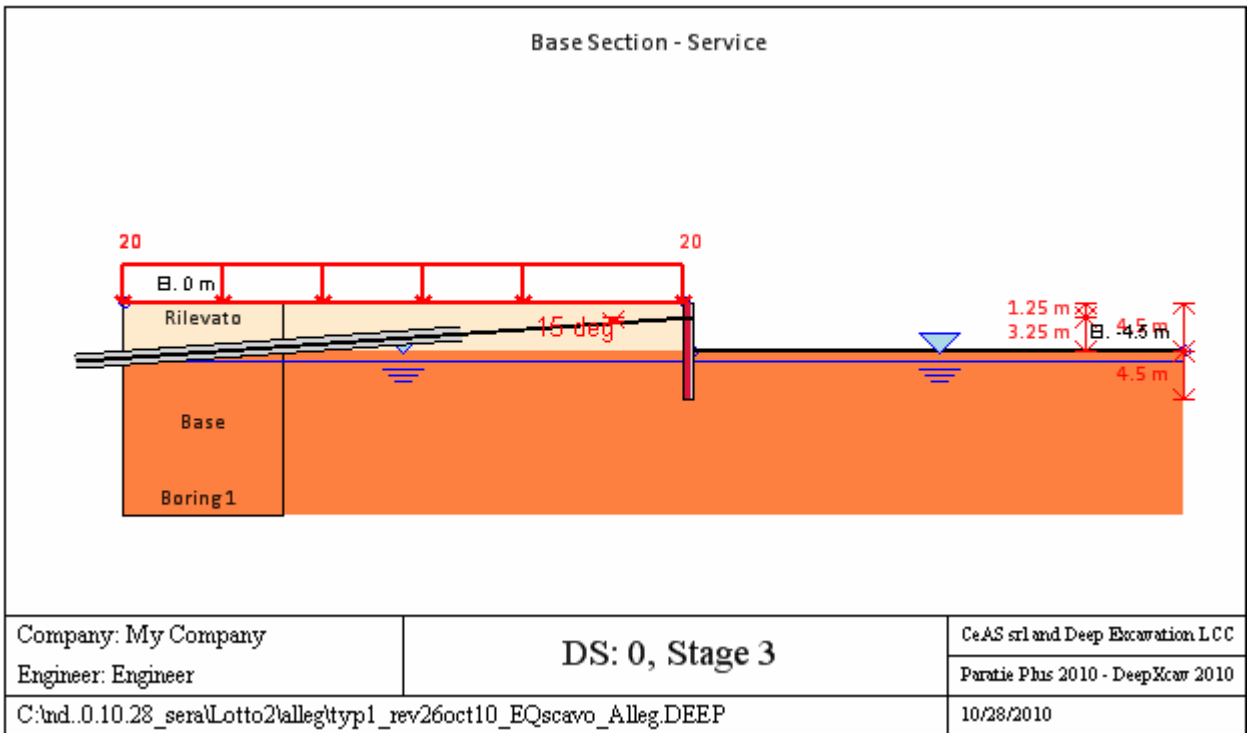




GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.046	0	1	N/A
1	No		0.046	0	1	N/A
2	No		0.046	0	1	N/A
3	No		0.046	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 6 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -14, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	Yes	-14	0	0	20	0	0	0	20
1	Yes	-14	0	0	20	0	0	0	20
2	Yes	-14	0	0	20	0	0	0	20
3	Yes	-14	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

P168.3x10/40 Stage: 0

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	5.34	0	5.34	0	0	0	0	0	0.27	0.02
2	-0.2	6.301	5.878	6.301	5.878	0	0	0	0.06	0.34	0.02
4	-0.4	7.262	7.445	7.262	7.445	0	0	0	0.14	0.39	0.01
6	-0.6	8.224	9.02	8.224	9.02	0	0	0	0.21	0.33	0.01
8	-0.8	9.922	10.607	9.922	10.607	0	0	0	0.25	0.17	0.01
10	-1	11.763	12.207	11.763	12.207	0	0	0	0.26	0.04	0.01
12	-1.2	13.58	13.822	13.58	13.822	0	0	0	0.26	-0.04	0.01
14	-1.35	14.928	15.042	14.928	15.042	0	0	0	0.25	-0.07	0.01
16	-1.55	16.705	16.682	16.705	16.682	0	0	0	0.23	-0.09	0.01
18	-1.75	18.461	18.335	18.461	18.335	0	0	0	0.22	-0.08	0.01
20	-1.95	20.197	20	20.197	20	0	0	0	0.21	-0.05	0.01
22	-2.15	21.915	21.676	21.915	21.676	0	0	0	0.2	0	0.01
24	-2.35	23.613	23.364	23.613	23.364	0	0	0	0.21	0.04	0.01
26	-2.55	25.293	25.063	25.293	25.063	0	0	0	0.23	0.09	0.01
28	-2.75	26.952	26.776	26.952	26.776	0	0	0	0.25	0.14	0.01
30	-2.95	28.588	28.502	28.588	28.502	0	0	0	0.28	0.17	0.01
32	-3.15	30.198	30.244	30.198	30.244	0	0	0	0.32	0.18	0.01

34	-3.35	31.78	32.004	31.78	32.004	0	0	0	0.35	0.16	0.01
36	-3.55	33.329	33.784	33.329	33.784	0	0	0	0.38	0.11	0.01
38	-3.75	34.844	35.585	34.844	35.585	0	0	0	0.38	0	0.01
40	-3.95	36.324	37.407	36.324	37.407	0	0	0	0.36	-0.16	0.01
42	-4.15	37.772	39.249	37.772	39.249	0	0	0	0.29	-0.4	0.01
44	-4.35	39.194	41.107	39.194	41.107	0	0	0	0.17	-0.72	0.02
46	-4.55	53.509	51.548	53.509	51.548	0	0	0	-0.04	-1.12	0.02
48	-4.75	55.382	53.791	55.382	53.791	0	0	0	-0.2	-0.75	0.02
50	-4.95	57.268	56.024	57.268	56.024	0	0	0	-0.31	-0.45	0.02
52	-5.15	59.173	58.24	59.173	58.24	0	0	0	-0.36	-0.21	0.02
54	-5.35	61.103	60.437	61.103	60.437	0	0	0	-0.38	-0.04	0.02
56	-5.55	63.268	62.826	62.768	62.326	0	0.5	0.5	-0.37	0.08	0.02
58	-5.75	66.092	65.83	63.592	63.33	0	2.5	2.5	-0.34	0.16	0.02
60	-5.95	68.939	68.815	64.439	64.315	0	4.5	4.5	-0.3	0.2	0.02
62	-6.15	71.805	71.785	65.305	65.285	0	6.5	6.5	-0.26	0.22	0.02
64	-6.35	74.688	74.741	66.188	66.241	0	8.5	8.5	-0.21	0.22	0.02
66	-6.55	77.585	77.685	67.085	67.185	0	10.5	10.5	-0.17	0.21	0.02
68	-6.75	80.493	80.621	67.993	68.121	0	12.5	12.5	-0.13	0.19	0.02
70	-6.95	83.409	83.549	68.909	69.049	0	14.5	14.5	-0.1	0.16	0.02
72	-7.15	86.332	86.473	69.832	69.973	0	16.5	16.5	-0.07	0.13	0.02
74	-7.35	89.26	89.392	70.76	70.892	0	18.5	18.5	-0.05	0.11	0.02
76	-7.55	92.19	92.309	71.69	71.809	0	20.5	20.5	-0.03	0.08	0.02
78	-7.75	95.123	95.225	72.623	72.725	0	22.5	22.5	-0.02	0.06	0.02
80	-7.95	98.056	98.14	73.556	73.64	0	24.5	24.5	-0.01	0.04	0.02
82	-8.15	100.99	101.05	74.491	74.554	0	26.5	26.5	0	0.02	0.02
84	-8.35	103.92	103.96	75.425	75.469	0	28.5	28.5	0	0.01	0.02
86	-8.55	106.85	106.88	76.359	76.383	0	30.5	30.5	0	0	0.02
88	-8.75	109.79	109.79	77.293	77.297	0	32.5	32.5	0	0	0.02
90	-8.95	112.72	112.71	78.227	78.211	0	34.5	34.5	0	0	0.02

P168.3x10/40 Stage: 1

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	5.34	0	5.34	0	0	0	0	0	0.27	0.88
2	-0.2	6.301	0	6.301	0	0	0	0	0.11	0.85	0.82
4	-0.4	7.262	0	7.262	0	0	0	0	0.48	2.16	0.76
6	-0.6	8.224	0	8.224	0	0	0	0	1.13	3.66	0.7
8	-0.8	9.185	0	9.185	0	0	0	0	2.11	5.35	0.64
10	-1	10.146	0	10.146	0	0	0	0	3.46	7.24	0.58
12	-1.2	11.107	0	11.107	0	0	0	0	5.22	9.31	0.53
14	-1.35	11.828	0	11.828	0	0	0	0	6.83	11	0.48
16	-1.55	12.789	0	12.789	0	0	0	0	9.39	13.41	0.43
18	-1.75	13.75	0	13.75	0	0	0	0	12.46	16.02	0.37
20	-1.95	14.712	18.202	14.712	18.202	0	0	0	15.99	17.9	0.32
22	-2.15	15.673	36.403	15.673	36.403	0	0	0	19.38	16.34	0.27
24	-2.35	16.634	44.469	16.634	44.469	0	0	0	21.94	11.34	0.23
26	-2.55	17.595	40.817	17.595	40.817	0	0	0	23.39	6.01	0.19
28	-2.75	18.556	37.751	18.556	37.751	0	0	0	23.92	1.57	0.15
30	-2.95	19.518	35.32	19.518	35.32	0	0	0	23.68	-2.09	0.12
32	-3.15	20.479	33.538	20.479	33.538	0	0	0	22.8	-5.1	0.1
34	-3.35	21.44	32.391	21.44	32.391	0	0	0	21.4	-7.6	0.08
36	-3.55	22.408	31.848	22.408	31.848	0	0	0	19.56	-9.71	0.06
38	-3.75	26.981	31.861	26.981	31.861	0	0	0	17.35	-11.35	0.05
40	-3.95	30.724	32.37	30.724	32.37	0	0	0	14.96	-12.15	0.04
42	-4.15	33.751	33.31	33.751	33.31	0	0	0	12.49	-12.36	0.03
44	-4.35	36.18	34.61	36.18	34.61	0	0	0	10.03	-12.21	0.03
46	-4.55	51.718	42.817	51.718	42.817	0	0	0	7.64	-11.87	0.03

48	-4.75	53.723	45.011	53.723	45.011	0	0	0	5.54	-10.09	0.03
50	-4.95	55.545	47.347	55.545	47.347	0	0	0	3.78	-8.37	0.03
52	-5.15	57.247	49.776	57.247	49.776	0	0	0	2.34	-6.77	0.03
54	-5.35	58.88	52.257	58.88	52.257	0	0	0	1.21	-5.31	0.03
56	-5.55	60.694	54.964	60.194	54.464	0	0.5	0.5	0.34	-4.03	0.03
58	-5.75	63.142	58.29	60.642	55.79	0	2.5	2.5	-0.3	-2.93	0.04
60	-5.95	65.611	61.598	61.111	57.098	0	4.5	4.5	-0.74	-2	0.04
62	-6.15	68.113	64.878	61.613	58.378	0	6.5	6.5	-1.03	-1.24	0.04
64	-6.35	70.658	68.123	62.158	59.623	0	8.5	8.5	-1.18	-0.63	0.04
66	-6.55	73.25	71.329	62.75	60.829	0	10.5	10.5	-1.23	-0.15	0.05
68	-6.75	75.889	74.497	63.389	61.997	0	12.5	12.5	-1.21	0.2	0.05
70	-6.95	78.573	77.628	64.073	63.128	0	14.5	14.5	-1.13	0.46	0.05
72	-7.15	81.298	80.724	64.798	64.224	0	16.5	16.5	-1.01	0.63	0.05
74	-7.35	84.06	83.791	65.56	65.291	0	18.5	18.5	-0.87	0.73	0.05
76	-7.55	86.853	86.832	66.353	66.332	0	20.5	20.5	-0.72	0.77	0.05
78	-7.75	89.671	89.852	67.171	67.352	0	22.5	22.5	-0.57	0.76	0.05
80	-7.95	92.509	92.855	68.009	68.355	0	24.5	24.5	-0.42	0.72	0.05
82	-8.15	95.362	95.847	68.862	69.347	0	26.5	26.5	-0.29	0.64	0.05
84	-8.35	98.224	98.829	69.724	70.329	0	28.5	28.5	-0.18	0.54	0.05
86	-8.55	101.09	101.80	70.593	71.307	0	30.5	30.5	-0.09	0.41	0.05
88	-8.75	103.96	104.78	71.465	72.282	0	32.5	32.5	-0.03	0.26	0.05
90	-8.95	106.83	107.75	72.338	73.256	0	34.5	34.5	0	0.09	0.05

P168.3x10/40 Stage: 2

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	40.011	0	40.011	0	0	0	0	0	2	0.73
2	-0.2	42.009	0	42.009	0	0	0	0	0.81	6.1	0.67
4	-0.4	43.966	0	43.966	0	0	0	0	3.3	14.6	0.6
6	-0.6	45.785	0	45.785	0	0	0	0	7.55	23.49	0.54
8	-0.8	47.295	0	47.295	0	0	0	0	13.63	32.73	0.48
10	-1	48.257	0	48.257	0	0	0	0	21.6	42.24	0.42
12	-1.2	48.363	0	48.363	0	0	0	0	31.5	51.91	0.37
14	-1.35	47.671	0	47.671	0	0	0	0	30.53	-37.44	0.33
16	-1.55	45.806	0	45.806	0	0	0	0	24.46	-27.98	0.29
18	-1.75	43.228	0	43.228	0	0	0	0	20.23	-18.95	0.25
20	-1.95	40.28	2.489	40.28	2.489	0	0	0	17.72	-10.49	0.21
22	-2.15	37.243	23.148	37.243	23.148	0	0	0	16.63	-4.12	0.18
24	-2.35	34.328	33.596	34.328	33.596	0	0	0	16.11	-2.48	0.15
26	-2.55	31.679	32.162	31.679	32.162	0	0	0	15.63	-2.39	0.13
28	-2.75	29.39	31.093	29.39	31.093	0	0	0	15.14	-2.55	0.11
30	-2.95	27.509	30.409	27.509	30.409	0	0	0	14.57	-2.95	0.09
32	-3.15	26.053	30.112	26.053	30.112	0	0	0	13.88	-3.59	0.07
34	-3.35	25.013	30.196	25.013	30.196	0	0	0	13.04	-4.46	0.06
36	-3.55	24.37	30.642	24.37	30.642	0	0	0	11.99	-5.55	0.05
38	-3.75	27.685	31.428	27.685	31.428	0	0	0	10.7	-6.67	0.04
40	-3.95	30.483	32.518	30.483	32.518	0	0	0	9.26	-7.32	0.04
42	-4.15	32.832	33.875	32.832	33.875	0	0	0	7.74	-7.67	0.04
44	-4.35	34.805	35.454	34.805	35.454	0	0	0	6.18	-7.85	0.03
46	-4.55	50.522	43.787	50.522	43.787	0	0	0	4.59	-7.98	0.03
48	-4.75	52.432	46.059	52.432	46.059	0	0	0	3.2	-6.65	0.03
50	-4.95	54.238	48.408	54.238	48.408	0	0	0	2.05	-5.4	0.04
52	-5.15	55.984	50.801	55.984	50.801	0	0	0	1.15	-4.27	0.04
54	-5.35	57.701	53.213	57.701	53.213	0	0	0	0.44	-3.26	0.04
56	-5.55	59.627	55.831	59.127	55.331	0	0.5	0.5	-0.08	-2.4	0.04
58	-5.75	62.2	59.054	59.7	56.554	0	2.5	2.5	-0.45	-1.68	0.04
60	-5.95	64.799	62.257	60.299	57.757	0	4.5	4.5	-0.69	-1.08	0.04

62	-6.15	67.431	65.432	60.931	58.932	0	6.5	6.5	-0.83	-0.6	0.05
64	-6.35	70.099	68.577	61.599	60.077	0	8.5	8.5	-0.9	-0.22	0.05
66	-6.55	72.804	71.691	62.304	61.191	0	10.5	10.5	-0.9	0.06	0.05
68	-6.75	75.545	74.776	63.045	62.276	0	12.5	12.5	-0.85	0.27	0.05
70	-6.95	78.319	77.834	63.819	63.334	0	14.5	14.5	-0.78	0.4	0.05
72	-7.15	81.122	80.867	64.622	64.367	0	16.5	16.5	-0.68	0.49	0.05
74	-7.35	83.951	83.879	65.451	65.379	0	18.5	18.5	-0.58	0.53	0.05
76	-7.55	86.801	86.874	66.301	66.374	0	20.5	20.5	-0.47	0.54	0.05
78	-7.75	89.667	89.855	67.167	67.355	0	22.5	22.5	-0.37	0.52	0.05
80	-7.95	92.547	92.824	68.047	68.324	0	24.5	24.5	-0.27	0.47	0.05
82	-8.15	95.436	95.786	68.936	69.286	0	26.5	26.5	-0.18	0.42	0.05
84	-8.35	98.331	98.742	69.831	70.242	0	28.5	28.5	-0.11	0.34	0.05
86	-8.55	101.23	101.69	70.731	71.195	0	30.5	30.5	-0.05	0.26	0.05
88	-8.75	104.13	104.64	71.632	72.146	0	32.5	32.5	-0.02	0.16	0.05
90	-8.95	107.03	107.59	72.534	73.096	0	34.5	34.5	0	0.06	0.05

P168.3x10/40 Stage: 3

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	56.253	0	56.253	0	0	0	0	0	2.81	0.55
2	-0.2	52.303	0	52.303	0	0	0	0	1.11	8.24	0.55
4	-0.4	48.306	0	48.306	0	0	0	0	4.3	18.5	0.56
6	-0.6	44.151	0	44.151	0	0	0	0	9.43	27.96	0.56
8	-0.8	39.654	0	39.654	0	0	0	0	16.33	36.57	0.56
10	-1	34.561	0	34.561	0	0	0	0	24.8	44.26	0.57
12	-1.2	28.552	0	28.552	0	0	0	0	34.66	50.88	0.59
14	-1.35	23.239	0	23.239	0	0	0	0	32.43	-48.88	0.6
16	-1.55	15.186	0	15.186	0	0	0	0	23.31	-44.62	0.62
18	-1.75	13.75	0	13.75	0	0	0	0	14.82	-41.77	0.65
20	-1.95	14.712	0	14.712	0	0	0	0	6.89	-38.98	0.69
22	-2.15	15.673	0	15.673	0	0	0	0	-0.46	-35.98	0.72
24	-2.35	16.634	0	16.634	0	0	0	0	-7.19	-32.8	0.75
26	-2.55	17.595	0	17.595	0	0	0	0	-13.24	-29.43	0.79
28	-2.75	18.556	0	18.556	0	0	0	0	-18.6	-25.86	0.82
30	-2.95	19.518	0	19.518	0	0	0	0	-23.21	-22.1	0.84
32	-3.15	20.479	0	20.479	0	0	0	0	-27.04	-18.15	0.86
34	-3.35	21.44	0	21.44	0	0	0	0	-30.05	-14.01	0.88
36	-3.55	22.401	0	22.401	0	0	0	0	-32.2	-9.67	0.89
38	-3.75	23.362	0	23.362	0	0	0	0	-33.46	-5.14	0.89
40	-3.95	24.324	0	24.324	0	0	0	0	-33.78	-0.42	0.89
42	-4.15	25.285	0	25.285	0	0	0	0	-33.13	4.49	0.88
44	-4.35	26.246	0	26.246	0	0	0	0	-31.47	9.6	0.86
46	-4.55	36.582	2.992	36.582	2.992	0	0	0	-28.76	14.89	0.84
48	-4.75	37.875	14.958	37.875	14.958	0	0	0	-24.82	21.08	0.81
50	-4.95	39.167	26.924	39.167	26.924	0	0	0	-19.97	25.13	0.78
52	-5.15	40.459	38.891	40.459	38.891	0	0	0	-14.63	27.04	0.74
54	-5.35	41.752	50.857	41.752	50.857	0	0	0	-9.23	26.82	0.7
56	-5.55	43.365	61.662	42.865	61.162	0	0.5	0.5	-4.19	24.47	0.66
58	-5.75	45.939	66.929	43.439	64.429	0	2.5	2.5	0.13	20.57	0.61
60	-5.95	48.513	68.016	44.013	63.516	0	4.5	4.5	3.62	16.45	0.57
62	-6.15	51.088	69.098	44.588	62.598	0	6.5	6.5	6.33	12.62	0.53
64	-6.35	53.662	70.206	45.162	61.706	0	8.5	8.5	8.32	9.09	0.48
66	-6.55	56.237	71.364	45.737	60.864	0	10.5	10.5	9.65	5.86	0.44
68	-6.75	58.811	72.589	46.311	60.089	0	12.5	12.5	10.38	2.9	0.41
70	-6.95	61.385	73.893	46.885	59.393	0	14.5	14.5	10.55	0.21	0.37
72	-7.15	63.96	75.281	47.46	58.781	0	16.5	16.5	10.22	-2.23	0.34
74	-7.35	67.365	76.754	48.865	58.254	0	18.5	18.5	9.44	-4.44	0.3

76	-7.55	72.199	78.306	51.699	57.806	0	20.5	20.5	8.29	-6.15	0.27
78	-7.75	76.934	79.928	54.434	57.428	0	22.5	22.5	6.89	-7.22	0.25
80	-7.95	81.587	81.608	57.087	57.108	0	24.5	24.5	5.37	-7.66	0.22
82	-8.15	86.174	83.333	59.674	56.833	0	26.5	26.5	3.85	-7.52	0.19
84	-8.35	90.714	85.089	62.214	56.589	0	28.5	28.5	2.45	-6.82	0.17
86	-8.55	95.224	86.862	64.724	56.362	0	30.5	30.5	1.27	-5.55	0.14
88	-8.75	99.717	88.642	67.217	56.142	0	32.5	32.5	0.42	-3.75	0.12
90	-8.95	104.20	90.421	69.705	55.921	0	34.5	34.5	0.02	-1.4	0.1

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	240
3	258.192

Project: My Project
Results for Design Section 1: DM08_ITA: Comb. 1: A1+M1+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
1	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
2	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
3	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color

	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-4.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)

S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

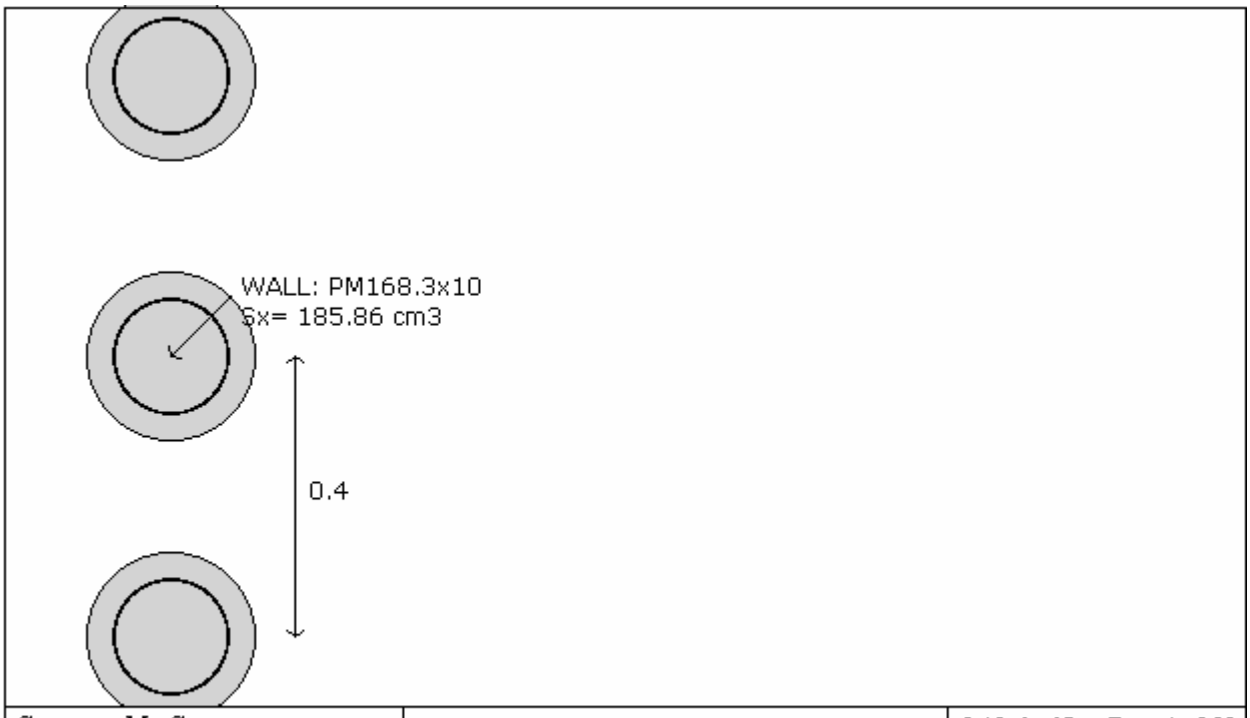
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Company: My Company Engineer: Engineer	Wall sketch	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ1_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010

Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -9 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'
Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe

	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage Number	Seismic g Used	Method Used	aX (g)	aY (g)	Beta	Building Code (Name)
0	No		0.046	0	1	N/A
1	No		0.046	0	1	N/A
2	No		0.046	0	1	N/A
3	No		0.046	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 6 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -14, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	Yes	-14	0	0	20	0	0	0	20
1	Yes	-14	0	0	20	0	0	0	20
2	Yes	-14	0	0	20	0	0	0	20
3	Yes	-14	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	312
3	338.894

Project: My Project
Results for Design Section 2: DM08_ITA: Comb. 2: A2+M2+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
3	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-4.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

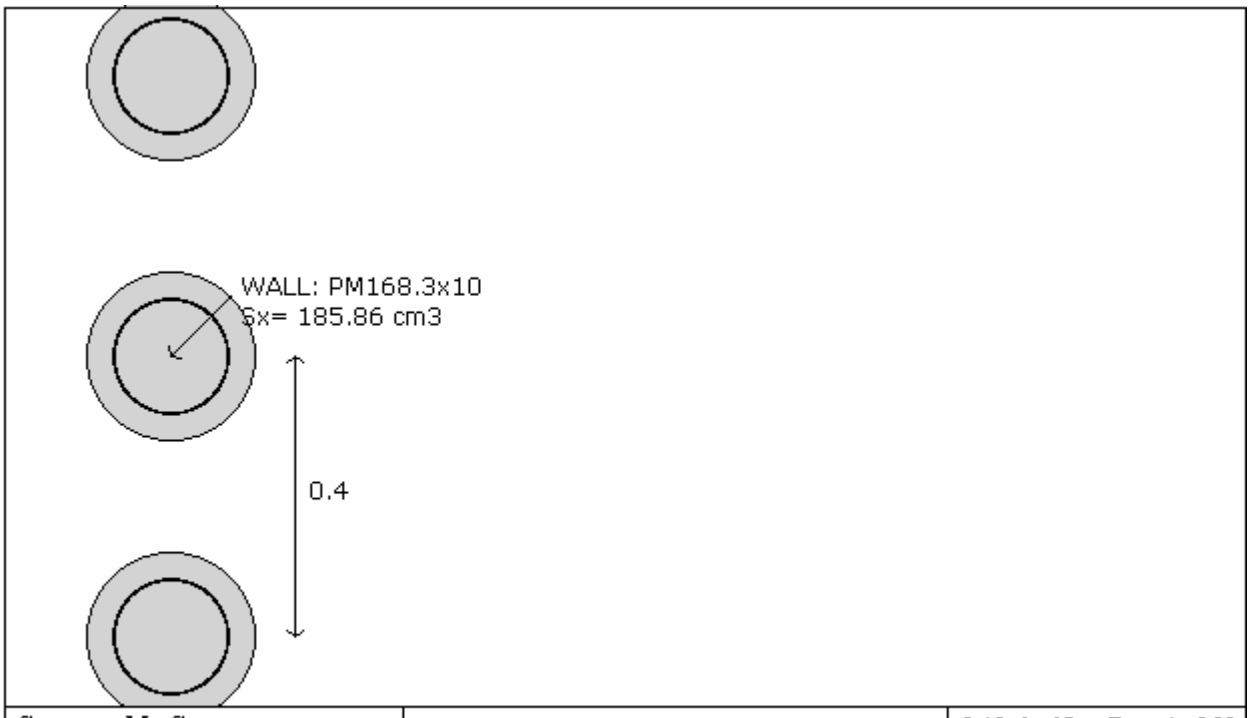
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Company: My Company Engineer: Engineer	Wall sketch	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ1_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010

Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -9 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'
Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe

	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage Number	Seismic g Used	Method Used	aX (g)	aY (g)	Beta	Building Code (Name)
0	No		0.046	0	1	N/A
1	No		0.046	0	1	N/A
2	No		0.046	0	1	N/A
3	No		0.046	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 6 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -14, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	Yes	-14	0	0	20	0	0	0	20
1	Yes	-14	0	0	20	0	0	0	20
2	Yes	-14	0	0	20	0	0	0	20
3	Yes	-14	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	240
3	308.952

Project: My Project
Results for Design Section 3: DM08_ITA: EQK - Seismic

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)

0	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
3	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
4	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
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SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-4.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength

	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

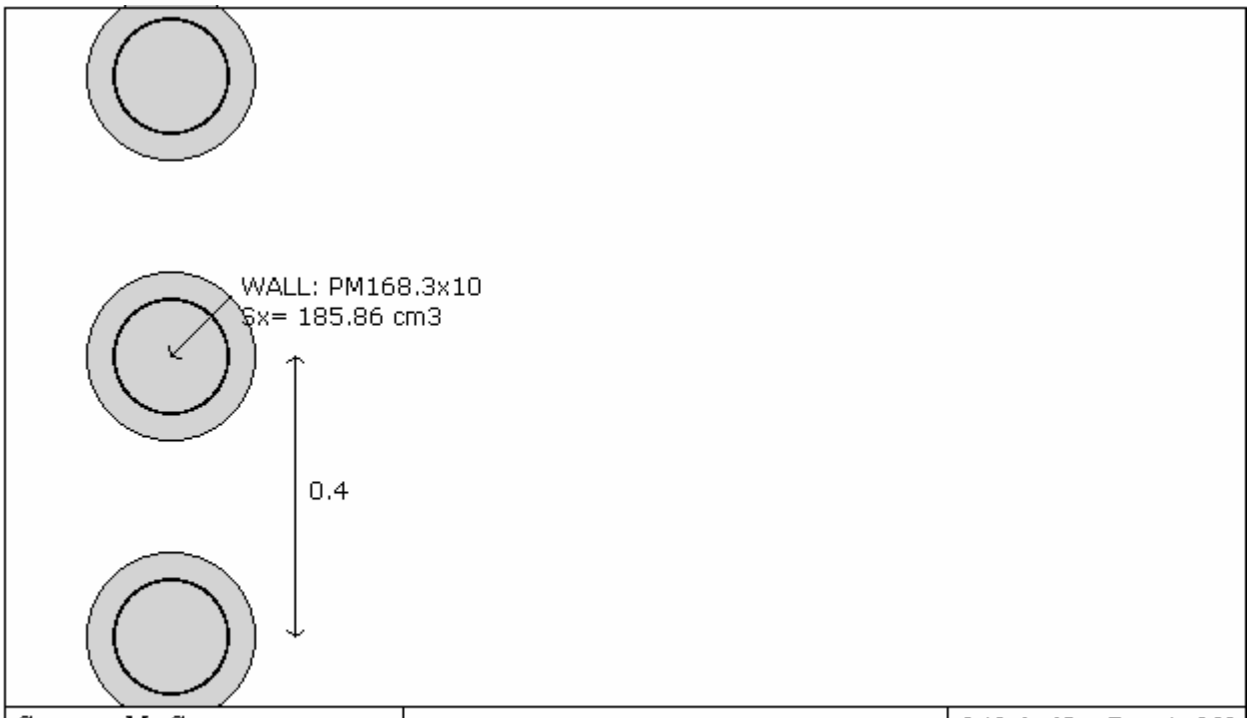
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Company: My Company Engineer: Engineer	Wall sketch	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ1_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010

Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -9 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'
Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
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Econc=Concrete Elastic modulus
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N/A= data not available
Fy=fyk
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D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
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t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
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tw=web thickness
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tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe

	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.046	0	1	N/A
1	No		0.046	0	1	N/A
2	No		0.046	0	1	N/A
3	No		0.046	0	1	N/A
4	Yes		0.046	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 6 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-

3	Yes	-	-	-
4	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -14, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	Yes	-14	0	0	20	0	0	0	20
1	Yes	-14	0	0	20	0	0	0	20
2	Yes	-14	0	0	20	0	0	0	20
3	Yes	-14	0	0	20	0	0	0	20
4	No	-14	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	240
3	291.528
4	269.904

DeepXcav 2010: Report Output

A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:24:10 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ2_rev26oct10_EQscavo_Alleg.DEEP

DeepXcav 2010: Report Output

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A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:24:10 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ2_rev26oct10_EQscavo_Alleg.DEEP

OBJECTIVES

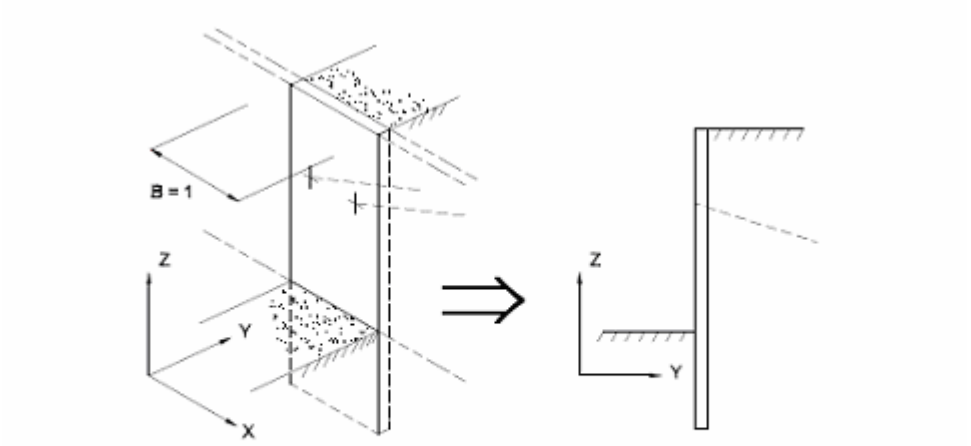
The objective of this document is to report the most imprortant results of the calculations

BIBLIOGRAPHIC REFERENCES

BECCI,B.,NOVA,R. (1987) “Un metodo di calcolo automatico per il progetto di paratie”, Rivista Italiana di

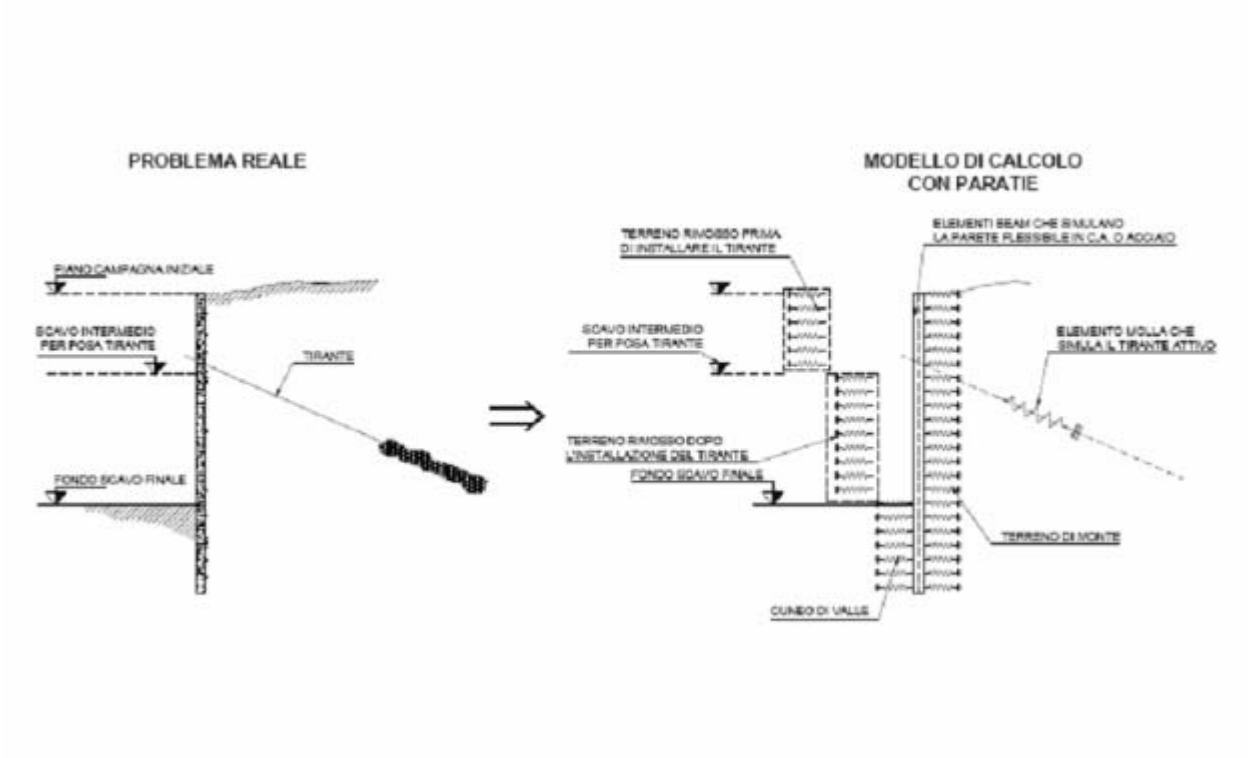
GENERAL CALCULATION ASSUMPTIONS

DEEP EXC is a program to simulate a the behaviuor of flexible diaphrams. It is possible to simulate all the different stages of excavation.
the program is able to perform both classic and non linear analysis.
For the non linear analysis a FEM model is used. The FEM model follow the well known beam on elasto plastic foundation approach. The wall is modeled using BEAM elements , the soil is simulate using a double system (for each part of the wall) of elasto plastic spring ,
An elasto plastic spring is connected on each node of the beam elements.
THe excavation procedure is performed through 2 types of analysis:
1) Classic analysis
2) Non linear analysis : every step represents an excavation phase with a defined configurations of excavations, loads, etc.
The non linear analysis has been performed using a full Newthon Raphson approach.



CONVENTIONS AND REFERENCE COORDINATE SYSTEMS

Loads, anelastic displacements, support reactions and displacements, are all referred to a rigthward coordinate system



ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
(tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

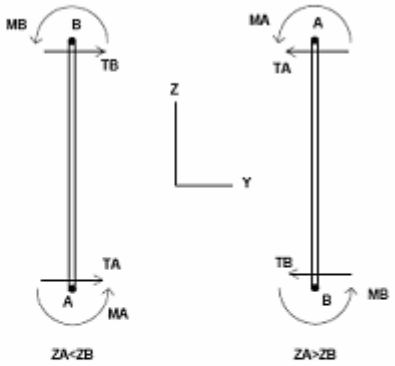


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
(tutti per unità di profondità)

Checking of cross sections is performed according to the coordinate systems showed in the next figure

- X axis follow the 2 nodes direction of the beam elements , positive going from the first to the secondo node

ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
(tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

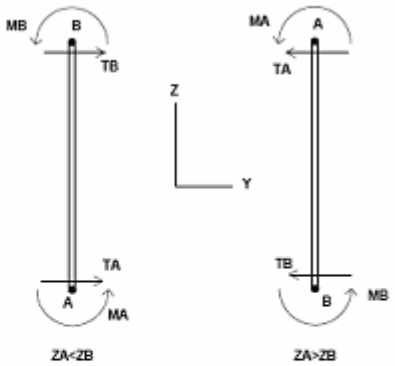


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
(tutti per unità di profondità)

DESIGN CODES

Reference codes are:
- DM 2008 - "Norme tecniche per le costruzioni"
- CSLP, "Istruzioni per l'applicazione delle Notme tecniche per le costruzioni di cui al DM 14/1/2008"
- EC2 1-1 :2004, Eurocode 2 - Design of concrete structures
- Ec3 1-1:2005, Eurocodice 3 - Design of steel structures
- Ec3 5:2002, Eurocodice 3 - Design of steel sheet piles walls
- Ec8:2004 - Seismic design of structures
- AISC ASD 9th Edition, 1989
- AISC LRFD 2nd Edition, 2003
- ACI 318-2002
- AASHTO 2000 ADS / LRFD

DESIGN PARAMETERS

Project: My Project
Results for Design Section 0: Base Section - Service

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-6	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	210000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

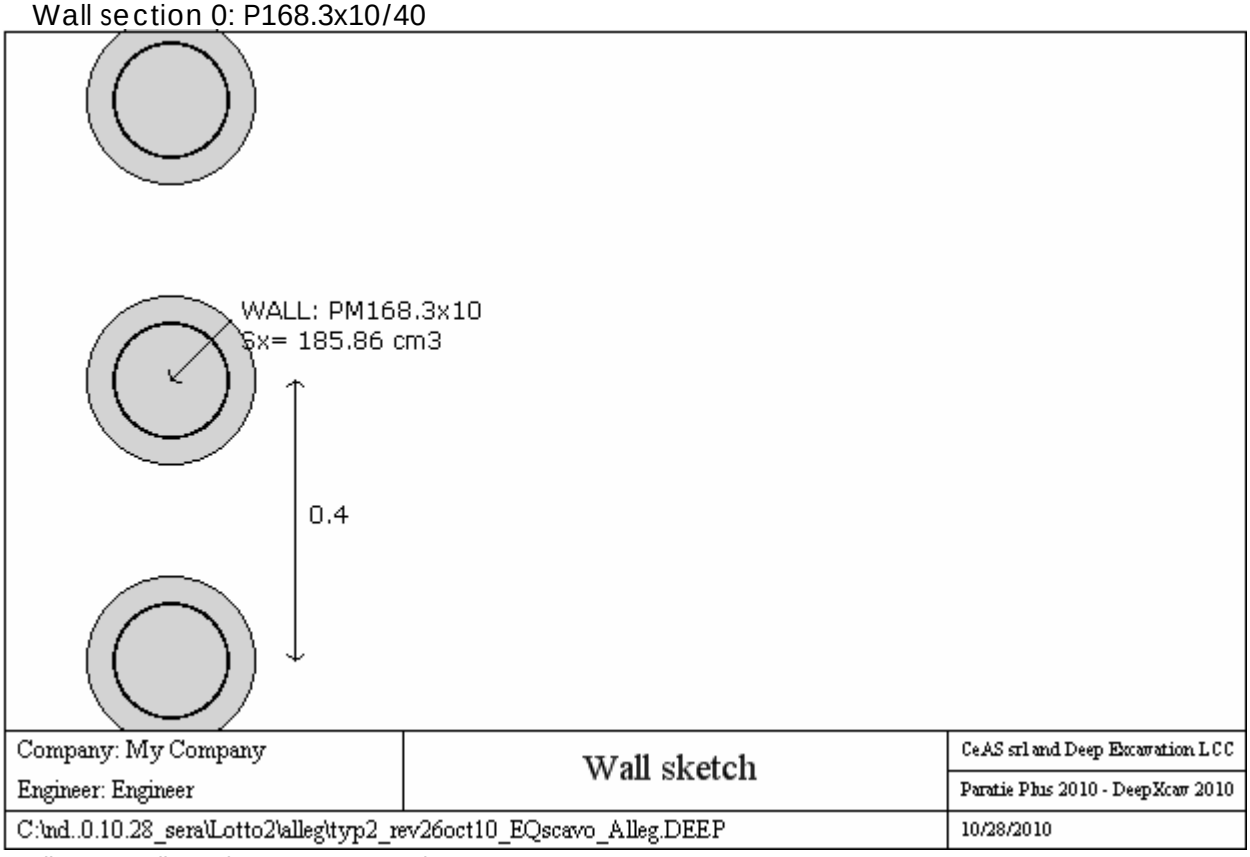
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -12 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

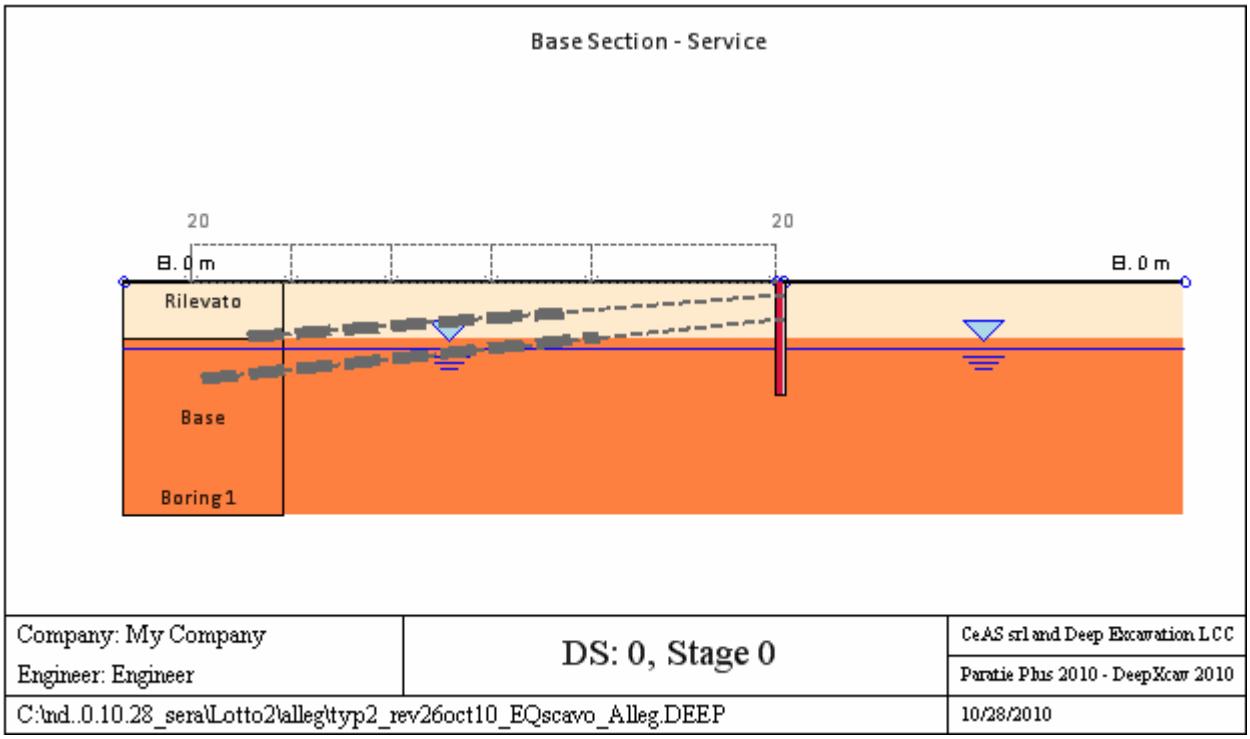
TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported



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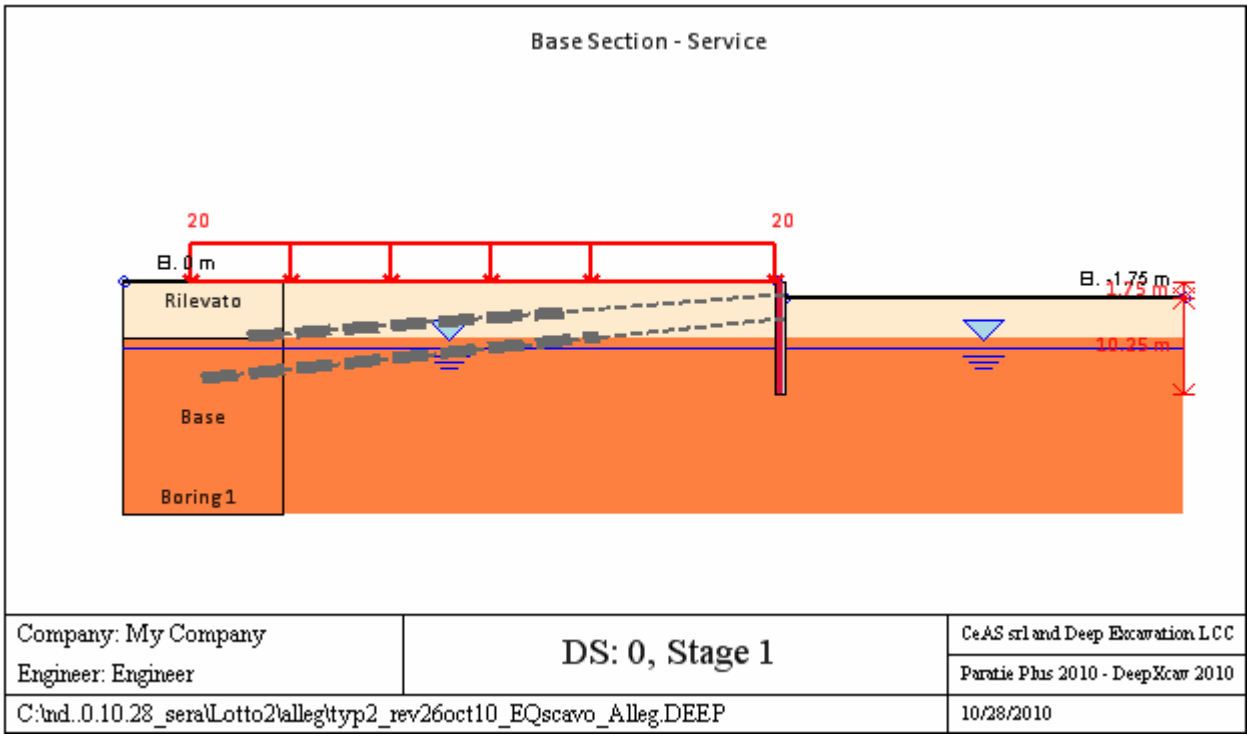

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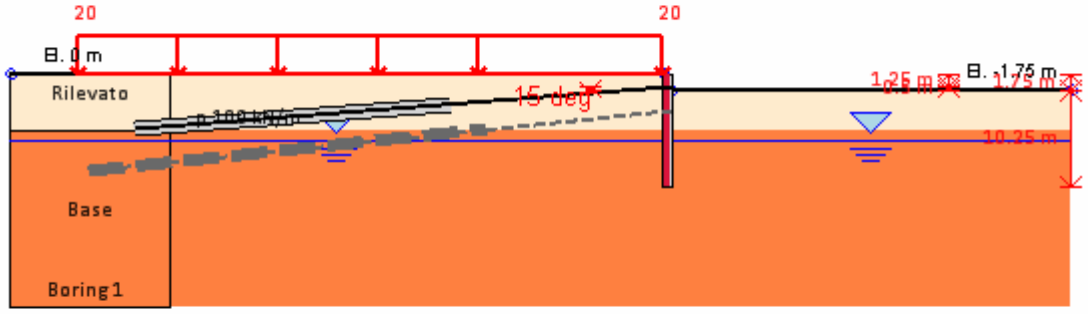
Base Section - Service



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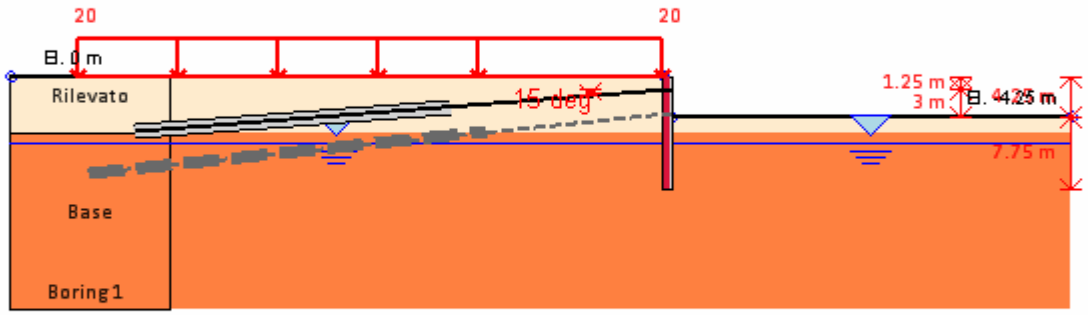
Base Section - Service



Company: My Company Engineer: Engineer	DS: 0, Stage 3	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
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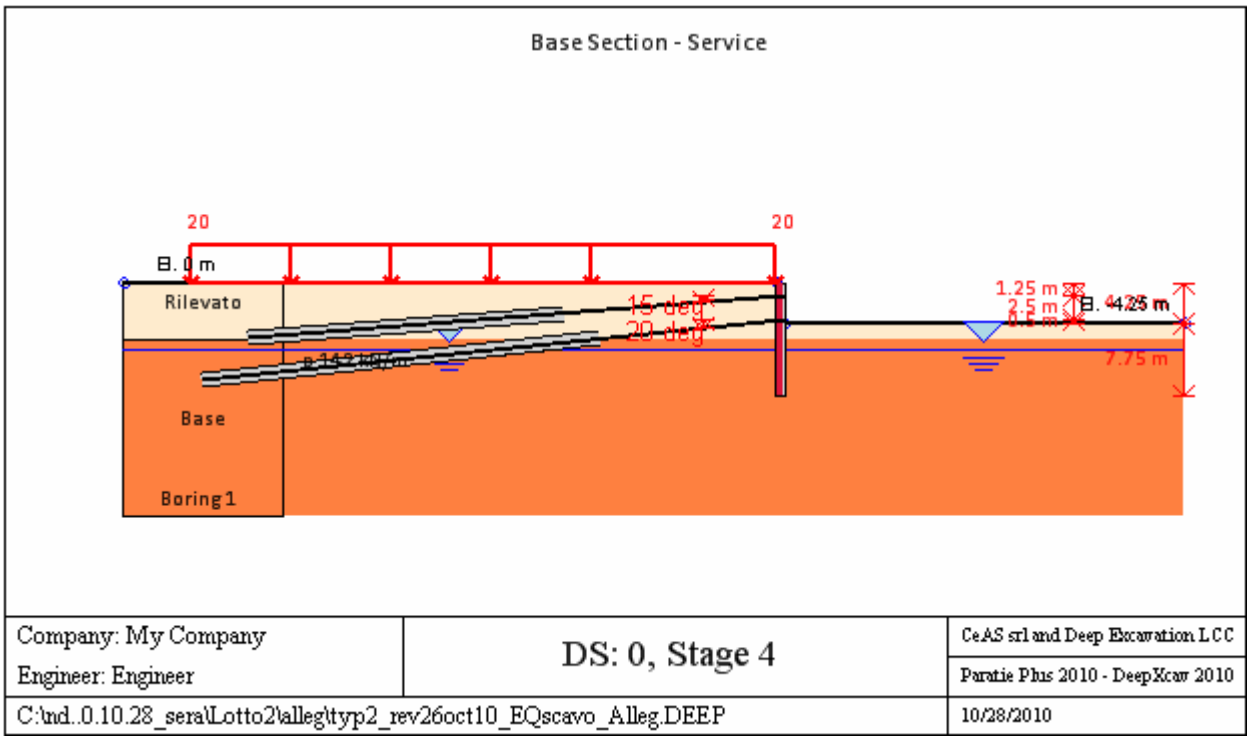
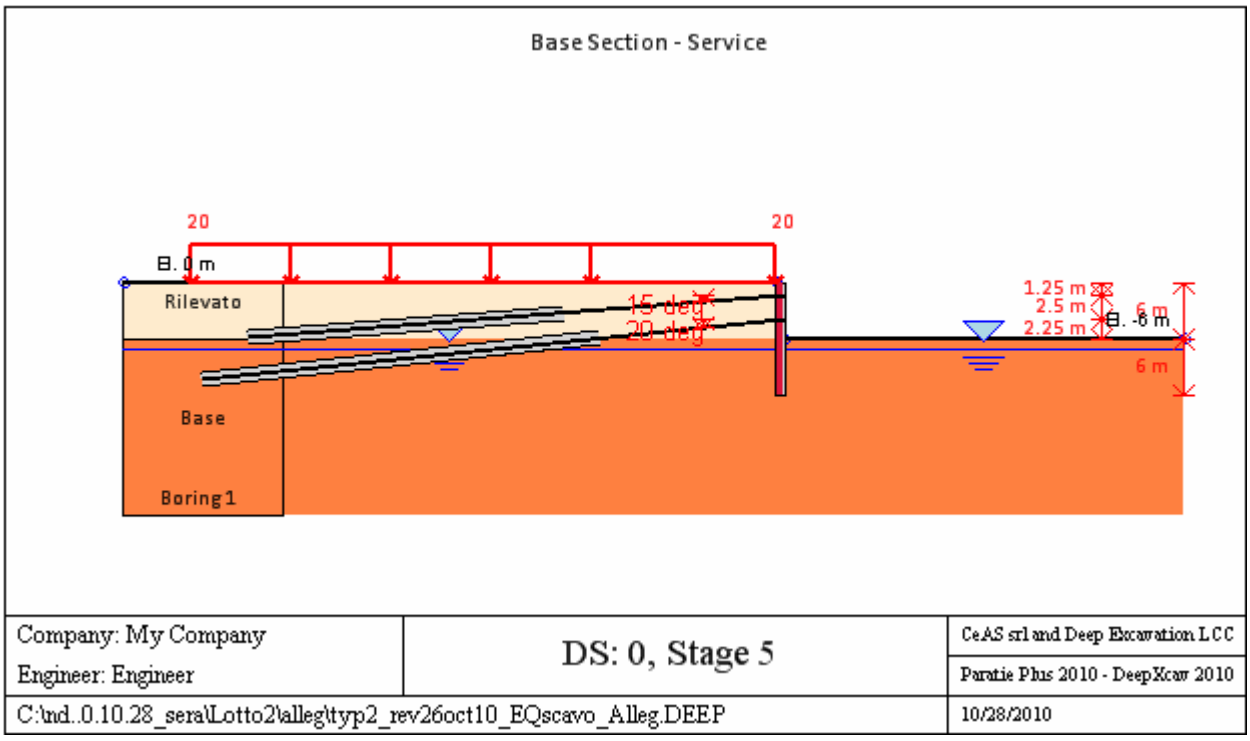




GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0

Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage Number	Seismic g Used	Method Used	aX (g)	aY (g)	Beta	Building Code (Name)
0	No		0.04	0	1	N/A
1	No		0.04	0	1	N/A
2	No		0.04	0	1	N/A
3	No		0.04	0	1	N/A
4	No		0.04	0	1	N/A
5	No		0.04	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 7 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active Yes/No	Prestress (kN)	Slab live load (kPa)	User add. strain +expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-

Support 1: type = tieback

X = 0.24 m, Z = -3.75 m, S = 2.4 m
Lfree = 6 m, Lfix = 13 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	340	-	-
5	Yes	-	-	-
6	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -17.9427272727273, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-	0	0	20	0	0	0	20
1	Yes	-	0	0	20	0	0	0	20
2	Yes	-	0	0	20	0	0	0	20
3	Yes	-	0	0	20	0	0	0	20
4	Yes	-	0	0	20	0	0	0	20
5	Yes	-	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

P168.3x10/40 Stage: 0

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	0	0	0	0	0	0	0	0	0	0

2	-0.24	2.03	2.03	2.03	2.03	0	0	0	0	0	0
4	-0.48	4.061	4.061	4.061	4.061	0	0	0	0	0	0
6	-0.72	6.091	6.091	6.091	6.091	0	0	0	0	0	0
8	-0.96	8.122	8.122	8.122	8.122	0	0	0	0	0	0
10	-1.2	10.152	10.152	10.152	10.152	0	0	0	0	0	0
12	-1.37	11.59	11.59	11.59	11.59	0	0	0	0	0	0
14	-1.61	13.621	13.621	13.621	13.621	0	0	0	0	0	0
16	-1.85	15.651	15.651	15.651	15.651	0	0	0	0	0	0
18	-2.09	17.681	17.681	17.681	17.681	0	0	0	0	0	0
20	-2.33	19.712	19.712	19.712	19.712	0	0	0	0	0	0
22	-2.57	21.742	21.742	21.742	21.742	0	0	0	0	0	0
24	-2.81	23.773	23.773	23.773	23.773	0	0	0	0	0	0
26	-3.05	25.803	25.803	25.803	25.803	0	0	0	0	0	0
28	-3.29	27.833	27.833	27.833	27.833	0	0	0	0	0	0
30	-3.53	29.864	29.864	29.864	29.864	0	0	0	0	0	0
32	-3.75	31.725	31.725	31.725	31.725	0	0	0	0	0	0
34	-3.99	33.755	33.755	33.755	33.755	0	0	0	0	0	0
36	-4.23	35.786	35.786	35.786	35.786	0	0	0	0	0	0
38	-4.47	37.816	37.816	37.816	37.816	0	0	0	0	0	0
40	-4.71	39.847	39.847	39.847	39.847	0	0	0	0	0	0
42	-4.95	41.877	41.877	41.877	41.877	0	0	0	0	0	0
44	-5.19	43.907	43.907	43.907	43.907	0	0	0	0	0	0
46	-5.43	45.938	45.938	45.938	45.938	0	0	0	0	0	0
48	-5.67	47.968	47.968	47.968	47.968	0	0	0	0	0	0
50	-5.91	49.999	49.999	49.999	49.999	0	0	0	0	0	0
52	-6.15	63.916	63.916	63.916	63.916	0	0	0	0	0	0
54	-6.39	66.41	66.41	66.41	66.41	0	0	0	0	0	0
56	-6.63	68.905	68.905	68.905	68.905	0	0	0	0	0	0
58	-6.87	71.399	71.399	71.399	71.399	0	0	0	0	0	0
60	-7.11	74.358	74.358	73.258	73.258	0	1.1	1.1	0	0	0
62	-7.35	77.867	77.867	74.367	74.367	0	3.5	3.5	0	0	0
64	-7.59	81.375	81.375	75.475	75.475	0	5.9	5.9	0	0	0
66	-7.83	84.884	84.884	76.584	76.584	0	8.3	8.3	0	0	0
68	-8.07	88.392	88.392	77.692	77.692	0	10.7	10.7	0	0	0
70	-8.31	91.901	91.901	78.801	78.801	0	13.1	13.1	0	0	0
72	-8.55	95.409	95.409	79.909	79.909	0	15.5	15.5	0	0	0
74	-8.79	98.918	98.918	81.018	81.018	0	17.9	17.9	0	0	0
76	-9.03	102.42	102.42	82.127	82.127	0	20.3	20.3	0	0	0
78	-9.27	105.93	105.93	83.235	83.235	0	22.7	22.7	0	0	0
80	-9.51	109.44	109.44	84.344	84.344	0	25.1	25.1	0	0	0
82	-9.75	112.95	112.95	85.452	85.452	0	27.5	27.5	0	0	0
84	-9.99	116.46	116.46	86.561	86.561	0	29.9	29.9	0	0	0
86	-10.23	119.96	119.96	87.669	87.669	0	32.3	32.3	0	0	0
88	-10.47	123.47	123.47	88.778	88.778	0	34.7	34.7	0	0	0
90	-10.71	126.98	126.98	89.887	89.887	0	37.1	37.1	0	0	0
92	-10.95	130.49	130.49	90.995	90.995	0	39.5	39.5	0	0	0
94	-11.19	134.00	134.00	92.104	92.104	0	41.9	41.9	0	0	0
96	-11.43	137.51	137.51	93.212	93.212	0	44.3	44.3	0	0	0
98	-11.67	141.02	141.02	94.321	94.321	0	46.7	46.7	0	0	0
100	-11.91	144.52	144.52	95.429	95.429	0	49.1	49.1	0	0	0

P168.3x10/40 Stage: 1

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	5.34	0	5.34	0	0	0	0	0	0.32	0.4
2	-0.24	5.038	0	5.038	0	0	0	0	0.13	0.77	0.37
4	-0.48	5.843	0	5.843	0	0	0	0	0.55	2.09	0.34
6	-0.72	7.434	0	7.434	0	0	0	0	1.31	3.59	0.32

8	-0.96	8.378	0	8.378	0	0	0	0	2.5	5.4	0.29
10	-1.2	9.395	0	9.395	0	0	0	0	4.17	7.49	0.26
12	-1.37	10.238	0	10.238	0	0	0	0	5.67	9.1	0.24
14	-1.61	11.302	0	11.302	0	0	0	0	8.31	11.64	0.21
16	-1.85	12.637	9.101	12.637	9.101	0	0	0	11.6	14.43	0.19
18	-2.09	13.712	30.659	13.712	30.659	0	0	0	15.07	14.02	0.17
20	-2.33	14.801	30.164	14.801	30.164	0	0	0	17.71	10.06	0.14
22	-2.57	16.083	29.696	16.083	29.696	0	0	0	19.48	6.48	0.12
24	-2.81	17.179	29.414	17.179	29.414	0	0	0	20.45	3.29	0.1
26	-3.05	18.435	29.385	18.435	29.385	0	0	0	20.72	0.43	0.09
28	-3.29	19.535	29.642	19.535	29.642	0	0	0	20.36	-2.15	0.07
30	-3.53	21.715	30.192	21.715	30.192	0	0	0	19.41	-4.53	0.06
32	-3.75	25.489	30.95	25.489	30.95	0	0	0	18.12	-6.28	0.05
34	-3.99	29.347	32.037	29.347	32.037	0	0	0	16.41	-7.35	0.05
36	-4.23	32.563	33.376	32.563	33.376	0	0	0	14.55	-7.89	0.04
38	-4.47	35.405	34.937	35.405	34.937	0	0	0	12.63	-7.99	0.04
40	-4.71	38.098	36.693	38.098	36.693	0	0	0	10.74	-7.81	0.04
42	-4.95	40.331	38.615	40.331	38.615	0	0	0	8.93	-7.46	0.03
44	-5.19	42.334	40.675	42.334	40.675	0	0	0	7.21	-7.04	0.03
46	-5.43	44.305	42.846	44.305	42.846	0	0	0	5.59	-6.65	0.04
48	-5.67	45.975	45.104	45.975	45.104	0	0	0	4.06	-6.34	0.04
50	-5.91	47.542	47.423	47.542	47.423	0	0	0	2.57	-6.16	0.04
52	-6.15	65.145	59.592	65.145	59.592	0	0	0	1.18	-5.45	0.04
54	-6.39	67.21	62.423	67.21	62.423	0	0	0	0.1	-4.17	0.04
56	-6.63	69.276	65.254	69.276	65.254	0	0	0	-0.69	-3.06	0.04
58	-6.87	71.507	68.071	71.507	68.071	0	0	0	-1.26	-2.13	0.05
60	-7.11	74.077	71.326	72.977	70.226	0	1.1	1.1	-1.63	-1.36	0.05
62	-7.35	77.229	75.097	73.729	71.597	0	3.5	3.5	-1.84	-0.72	0.05
64	-7.59	80.554	78.84	74.654	72.94	0	5.9	5.9	-1.92	-0.24	0.05
66	-7.83	83.779	82.552	75.479	74.252	0	8.3	8.3	-1.91	0.13	0.05
68	-8.07	87.043	86.235	76.343	75.535	0	10.7	10.7	-1.83	0.41	0.06
70	-8.31	90.467	89.89	77.367	76.79	0	13.1	13.1	-1.7	0.59	0.06
72	-8.55	93.799	93.518	78.299	78.018	0	15.5	15.5	-1.53	0.7	0.06
74	-8.79	97.163	97.122	79.263	79.222	0	17.9	17.9	-1.35	0.76	0.06
76	-9.03	100.66	100.70	80.367	80.405	0	20.3	20.3	-1.17	0.77	0.06
78	-9.27	104.08	104.26	81.38	81.569	0	22.7	22.7	-0.99	0.75	0.06
80	-9.51	107.62	107.81	82.52	82.718	0	25.1	25.1	-0.82	0.71	0.06
82	-9.75	111.06	111.35	83.568	83.854	0	27.5	27.5	-0.66	0.65	0.06
84	-9.99	114.53	114.88	84.63	84.98	0	29.9	29.9	-0.51	0.58	0.06
86	-10.23	118.10	118.39	85.804	86.098	0	32.3	32.3	-0.39	0.5	0.06
88	-10.47	121.58	121.90	86.884	87.209	0	34.7	34.7	-0.28	0.42	0.06
90	-10.71	125.07	125.41	87.971	88.316	0	37.1	37.1	-0.19	0.35	0.06
92	-10.95	128.65	128.92	89.156	89.42	0	39.5	39.5	-0.12	0.27	0.06
94	-11.19	132.15	132.42	90.25	90.521	0	41.9	41.9	-0.07	0.2	0.06
96	-11.43	135.64	135.92	91.347	91.621	0	44.3	44.3	-0.03	0.14	0.06
98	-11.67	139.23	139.42	92.533	92.721	0	46.7	46.7	-0.01	0.08	0.06
100	-11.91	142.73	142.92	93.631	93.82	0	49.1	49.1	0	0.03	0.06

P168.3x10/40 Stage: 2

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	45.122	0	45.122	0	0	0	0	0	2.71	0.23
2	-0.24	43.752	0	43.752	0	0	0	0	1.27	7.87	0.2
4	-0.48	43.454	0	43.454	0	0	0	0	5.05	18.41	0.18
6	-0.72	43.817	0	43.817	0	0	0	0	11.35	28.87	0.16
8	-0.96	43.265	0	43.265	0	0	0	0	20.17	39.32	0.14
10	-1.2	42.317	0	42.317	0	0	0	0	31.47	49.68	0.12
12	-1.37	41.361	0	41.361	0	0	0	0	29.36	-39.74	0.11

14	-1.61	39.377	0	39.377	0	0	0	0	21.6	-29.91	0.09
16	-1.85	37.312	0.481	37.312	0.481	0	0	0	16.11	-20.58	0.08
18	-2.09	34.862	17.662	34.862	17.662	0	0	0	12.66	-12.56	0.07
20	-2.33	32.485	19.297	32.485	19.297	0	0	0	10.36	-8.66	0.07
22	-2.57	30.489	20.844	30.489	20.844	0	0	0	8.83	-5.71	0.06
24	-2.81	28.582	22.407	28.582	22.407	0	0	0	7.85	-3.62	0.05
26	-3.05	27.163	24.022	27.163	24.022	0	0	0	7.22	-2.33	0.05
28	-3.29	25.94	25.706	25.94	25.706	0	0	0	6.78	-1.76	0.05
30	-3.53	26.151	27.466	26.151	27.466	0	0	0	6.35	-1.86	0.04
32	-3.75	28.421	29.148	28.421	29.148	0	0	0	5.89	-2.11	0.04
34	-3.99	30.943	31.057	30.943	31.057	0	0	0	5.36	-2.24	0.04
36	-4.23	33.114	33.037	33.114	33.037	0	0	0	4.82	-2.26	0.04
38	-4.47	35.165	35.085	35.165	35.085	0	0	0	4.28	-2.23	0.04
40	-4.71	37.286	37.192	37.286	37.192	0	0	0	3.75	-2.21	0.04
42	-4.95	39.129	39.353	39.129	39.353	0	0	0	3.22	-2.21	0.04
44	-5.19	40.894	41.56	40.894	41.56	0	0	0	2.68	-2.28	0.04
46	-5.43	42.745	43.805	42.745	43.805	0	0	0	2.1	-2.46	0.04
48	-5.67	44.387	46.08	44.387	46.08	0	0	0	1.46	-2.76	0.04
50	-5.91	45.994	48.374	45.994	48.374	0	0	0	0.72	-3.2	0.05
52	-6.15	64.088	60.45	64.088	60.45	0	0	0	-0.06	-3.02	0.05
54	-6.39	66.241	63.209	66.241	63.209	0	0	0	-0.63	-2.2	0.05
56	-6.63	68.41	65.956	68.41	65.956	0	0	0	-1.03	-1.49	0.05
58	-6.87	70.751	68.685	70.751	68.685	0	0	0	-1.29	-0.93	0.05
60	-7.11	73.431	71.851	72.331	70.751	0	1.1	1.1	-1.43	-0.47	0.05
62	-7.35	76.689	75.536	73.189	72.036	0	3.5	3.5	-1.47	-0.11	0.05
64	-7.59	80.114	79.197	74.214	73.297	0	5.9	5.9	-1.45	0.15	0.06
66	-7.83	83.43	82.836	75.13	74.536	0	8.3	8.3	-1.38	0.34	0.06
68	-8.07	86.774	86.454	76.074	75.754	0	10.7	10.7	-1.27	0.48	0.06
70	-8.31	90.269	90.051	77.169	76.951	0	13.1	13.1	-1.15	0.55	0.06
72	-8.55	93.66	93.631	78.16	78.131	0	15.5	15.5	-1.01	0.58	0.06
74	-8.79	97.073	97.194	79.173	79.294	0	17.9	17.9	-0.87	0.58	0.06
76	-9.03	100.61	100.74	80.319	80.444	0	20.3	20.3	-0.73	0.55	0.06
78	-9.27	104.06	104.28	81.363	81.583	0	22.7	22.7	-0.6	0.52	0.06
80	-9.51	107.62	107.81	82.529	82.712	0	25.1	25.1	-0.49	0.47	0.06
82	-9.75	111.09	111.33	83.595	83.833	0	27.5	27.5	-0.38	0.42	0.06
84	-9.99	114.57	114.84	84.67	84.947	0	29.9	29.9	-0.29	0.37	0.06
86	-10.23	118.15	118.35	85.853	86.058	0	32.3	32.3	-0.22	0.3	0.06
88	-10.47	121.63	121.86	86.939	87.164	0	34.7	34.7	-0.15	0.25	0.06
90	-10.71	125.13	125.36	88.03	88.268	0	37.1	37.1	-0.1	0.2	0.06
92	-10.95	128.71	128.87	89.217	89.37	0	39.5	39.5	-0.06	0.15	0.06
94	-11.19	132.21	132.37	90.312	90.471	0	41.9	41.9	-0.04	0.1	0.06
96	-11.43	135.70	135.87	91.408	91.572	0	44.3	44.3	-0.02	0.07	0.06
98	-11.67	139.29	139.37	92.594	92.672	0	46.7	46.7	-0.01	0.04	0.06
100	-11.91	142.79	142.87	93.691	93.771	0	49.1	49.1	0	0.01	0.06

P168.3x10/40 Stage: 3

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	47.22	0	47.22	0	0	0	0	0	2.83	0.21
2	-0.24	43.675	0	43.675	0	0	0	0	1.31	8.12	0.2
4	-0.48	41.202	0	41.202	0	0	0	0	5.14	18.51	0.2
6	-0.72	39.39	0	39.39	0	0	0	0	11.35	28.3	0.2
8	-0.96	36.662	0	36.662	0	0	0	0	19.82	37.56	0.21
10	-1.2	33.542	0	33.542	0	0	0	0	30.4	46.2	0.21
12	-1.37	31.056	0	31.056	0	0	0	0	27.15	-47.5	0.21
14	-1.61	26.933	0	26.933	0	0	0	0	17.07	-40.26	0.22
16	-1.85	22.779	0	22.779	0	0	0	0	8.54	-34.05	0.23
18	-2.09	18.323	0	18.323	0	0	0	0	1.32	-28.86	0.25

20	-2.33	14.801	0	14.801	0	0	0	0	-4.85	-24.71	0.26
22	-2.57	16.083	0	16.083	0	0	0	0	-10.13	-21.08	0.27
24	-2.81	17.179	0	17.179	0	0	0	0	-14.49	-17.17	0.28
26	-3.05	18.435	0	18.435	0	0	0	0	-17.86	-12.97	0.29
28	-3.29	19.535	0	19.535	0	0	0	0	-20.17	-8.49	0.3
30	-3.53	20.643	0	20.643	0	0	0	0	-21.35	-3.72	0.3
32	-3.75	21.673	0	21.673	0	0	0	0	-21.39	1.09	0.3
34	-3.99	22.907	0	22.907	0	0	0	0	-20.24	6.15	0.3
36	-4.23	24.022	0	24.022	0	0	0	0	-17.76	11.71	0.3
38	-4.47	25.14	20.022	25.14	20.022	0	0	0	-14.04	16.45	0.3
40	-4.71	26.362	32.891	26.362	32.891	0	0	0	-10.02	16.45	0.29
42	-4.95	27.482	35.826	27.482	35.826	0	0	0	-6.37	14.76	0.29
44	-5.19	28.605	38.392	28.605	38.392	0	0	0	-3.2	12.67	0.28
46	-5.43	29.818	40.752	29.818	40.752	0	0	0	-0.59	10.25	0.27
48	-5.67	30.942	42.99	30.942	42.99	0	0	0	1.39	7.55	0.26
50	-5.91	32.069	45.153	32.069	45.153	0	0	0	2.68	4.6	0.25
52	-6.15	50.307	53.099	50.307	53.099	0	0	0	3.36	2.68	0.25
54	-6.39	53.082	55.732	53.082	55.732	0	0	0	3.89	2.01	0.24
56	-6.63	55.837	58.331	55.837	58.331	0	0	0	4.25	1.39	0.23
58	-6.87	58.723	60.903	58.723	60.903	0	0	0	4.48	0.81	0.23
60	-7.11	61.902	63.854	60.802	62.754	0	1.1	1.1	4.58	0.29	0.22
62	-7.35	65.614	67.278	62.114	63.778	0	3.5	3.5	4.57	-0.15	0.21
64	-7.59	69.444	70.711	63.544	64.811	0	5.9	5.9	4.47	-0.53	0.21
66	-7.83	73.12	74.154	64.82	65.854	0	8.3	8.3	4.29	-0.83	0.2
68	-8.07	76.78	77.607	66.08	66.907	0	10.7	10.7	4.04	-1.05	0.2
70	-8.31	80.548	81.07	67.448	67.97	0	13.1	13.1	3.76	-1.23	0.2
72	-8.55	84.175	84.542	68.675	69.042	0	15.5	15.5	3.44	-1.36	0.19
74	-8.79	87.788	88.023	69.888	70.123	0	17.9	17.9	3.1	-1.43	0.19
76	-9.03	91.503	91.511	71.203	71.211	0	20.3	20.3	2.75	-1.47	0.19
78	-9.27	95.09	95.008	72.39	72.308	0	22.7	22.7	2.4	-1.46	0.19
80	-9.51	98.775	98.51	73.675	73.41	0	25.1	25.1	2.05	-1.43	0.19
82	-9.75	102.34	102.01	74.84	74.519	0	27.5	27.5	1.72	-1.37	0.19
84	-9.99	105.89	105.53	75.998	75.632	0	29.9	29.9	1.41	-1.28	0.18
86	-10.23	109.55	109.04	77.25	76.748	0	32.3	32.3	1.11	-1.19	0.18
88	-10.47	113.09	112.56	78.394	77.867	0	34.7	34.7	0.85	-1.07	0.18
90	-10.71	116.63	116.08	79.536	78.988	0	37.1	37.1	0.62	-0.94	0.18
92	-10.95	120.26	119.60	80.768	80.109	0	39.5	39.5	0.42	-0.8	0.18
94	-11.19	123.80	123.13	81.904	81.23	0	41.9	41.9	0.25	-0.65	0.18
96	-11.43	127.33	126.65	83.039	82.351	0	44.3	44.3	0.13	-0.48	0.18
98	-11.67	130.96	130.17	84.263	83.47	0	46.7	46.7	0.04	-0.31	0.18
100	-11.91	134.49	133.68	85.398	84.588	0	49.1	49.1	0	-0.12	0.18

P168.3x10/40 Stage: 4

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	43.484	0	43.484	0	0	0	0	0	2.61	0.24
2	-0.24	42.505	0	42.505	0	0	0	0	1.22	7.6	0.22
4	-0.48	42.599	0	42.599	0	0	0	0	4.89	17.86	0.19
6	-0.72	43.357	0	43.357	0	0	0	0	11.03	28.14	0.16
8	-0.96	43.202	0	43.202	0	0	0	0	19.65	38.51	0.14
10	-1.2	42.657	0	42.657	0	0	0	0	30.76	48.88	0.11
12	-1.37	41.991	0	41.991	0	0	0	0	28.54	-40.36	0.1
14	-1.61	40.425	0	40.425	0	0	0	0	20.66	-30.35	0.08
16	-1.85	38.787	0	38.787	0	0	0	0	15.11	-20.74	0.07
18	-2.09	36.775	0	36.775	0	0	0	0	11.79	-11.57	0.05
20	-2.33	35.584	0	35.584	0	0	0	0	10.59	-2.85	0.04
22	-2.57	39.028	0	39.028	0	0	0	0	11.47	5.9	0.03
24	-2.81	42.051	0	42.051	0	0	0	0	14.59	15.44	0.02

26	-3.05	44.919	0	44.919	0	0	0	0	20.14	25.71	0.01
28	-3.29	47.22	0	47.22	0	0	0	0	28.26	36.63	0.01
30	-3.53	49.002	0	49.002	0	0	0	0	39.11	48.09	0.01
32	-3.75	50.08	0	50.08	0	0	0	0	51.53	59.44	0.01
34	-3.99	50.663	0	50.663	0	0	0	0	35.88	-62.15	0.01
36	-4.23	50.519	0	50.519	0	0	0	0	23.16	-50	0.02
38	-4.47	49.935	4.785	49.935	4.785	0	0	0	13.33	-37.96	0.04
40	-4.71	49.156	18.883	49.156	18.883	0	0	0	6	-28.55	0.05
42	-4.95	48.101	23.155	48.101	23.155	0	0	0	0.41	-21.61	0.07
44	-5.19	46.973	27.105	46.973	27.105	0	0	0	-3.73	-15.93	0.09
46	-5.43	45.939	30.846	45.939	30.846	0	0	0	-6.73	-11.45	0.1
48	-5.67	44.881	34.425	44.881	34.425	0	0	0	-8.86	-8.11	0.12
50	-5.91	43.934	37.861	43.934	37.861	0	0	0	-10.39	-5.87	0.13
52	-6.15	57.508	47.254	57.508	47.254	0	0	0	-11.46	-3.78	0.14
54	-6.39	58.997	50.931	58.997	50.931	0	0	0	-11.94	-1.46	0.15
56	-6.63	60.589	54.474	60.589	54.474	0	0	0	-11.95	0.37	0.16
58	-6.87	62.438	57.888	62.438	57.888	0	0	0	-11.61	1.74	0.17
60	-7.11	64.706	61.578	63.606	60.478	0	1.1	1.1	-11.01	2.73	0.18
62	-7.35	67.629	65.642	64.129	62.142	0	3.5	3.5	-10.23	3.41	0.19
64	-7.59	70.786	69.622	64.886	63.722	0	5.9	5.9	-9.33	3.84	0.19
66	-7.83	73.896	73.524	65.596	65.224	0	8.3	8.3	-8.37	4.06	0.19
68	-8.07	77.09	77.355	66.39	66.655	0	10.7	10.7	-7.38	4.12	0.2
70	-8.31	80.481	81.124	67.381	68.024	0	13.1	13.1	-6.41	4.03	0.2
72	-8.55	83.811	84.837	68.311	69.337	0	15.5	15.5	-5.47	3.84	0.2
74	-8.79	87.197	88.503	69.297	70.603	0	17.9	17.9	-4.6	3.59	0.2
76	-9.03	90.744	92.127	70.444	71.827	0	20.3	20.3	-3.79	3.27	0.2
78	-9.27	94.215	95.718	71.515	73.018	0	22.7	22.7	-3.07	2.93	0.2
80	-9.51	97.826	99.28	72.726	74.18	0	25.1	25.1	-2.43	2.57	0.2
82	-9.75	101.35	102.81	73.854	75.319	0	27.5	27.5	-1.87	2.22	0.2
84	-9.99	104.90	106.34	75.002	76.44	0	29.9	29.9	-1.4	1.87	0.2
86	-10.23	108.56	109.84	76.266	77.546	0	32.3	32.3	-1.02	1.54	0.2
88	-10.47	112.14	113.34	77.44	78.642	0	34.7	34.7	-0.7	1.23	0.2
90	-10.71	115.72	116.82	78.622	79.729	0	37.1	37.1	-0.46	0.95	0.19
92	-10.95	119.40	120.31	79.905	80.81	0	39.5	39.5	-0.28	0.7	0.19
94	-11.19	122.99	123.78	81.096	81.887	0	41.9	41.9	-0.15	0.48	0.19
96	-11.43	126.58	127.26	82.289	82.96	0	44.3	44.3	-0.06	0.3	0.19
98	-11.67	130.27	130.73	83.573	84.03	0	46.7	46.7	-0.02	0.16	0.19
100	-11.91	133.86	134.19	84.769	85.099	0	49.1	49.1	0	0.05	0.19

P168.3x10/40 Stage: 5

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	47.874	0	47.874	0	0	0	0	0	2.87	0.18
2	-0.24	46.217	0	46.217	0	0	0	0	1.35	8.35	0.16
4	-0.48	45.63	0	45.63	0	0	0	0	5.35	19.46	0.14
6	-0.72	45.703	0	45.703	0	0	0	0	11.99	30.43	0.13
8	-0.96	44.857	0	44.857	0	0	0	0	21.26	41.32	0.11
10	-1.2	43.608	0	43.608	0	0	0	0	33.11	52.04	0.1
12	-1.37	42.433	0	42.433	0	0	0	0	31.49	-36.71	0.09
14	-1.61	40.128	0	40.128	0	0	0	0	24.5	-26.64	0.09
16	-1.85	37.722	0	37.722	0	0	0	0	19.82	-17.15	0.08
18	-2.09	34.906	0	34.906	0	0	0	0	17.31	-8.28	0.08
20	-2.33	32.868	0	32.868	0	0	0	0	16.82	-0.06	0.08
22	-2.57	35.419	0	35.419	0	0	0	0	18.24	7.99	0.08
24	-2.81	37.496	0	37.496	0	0	0	0	21.7	16.61	0.09
26	-3.05	39.365	0	39.365	0	0	0	0	27.32	25.72	0.1
28	-3.29	40.611	0	40.611	0	0	0	0	35.21	35.25	0.11
30	-3.53	41.286	0	41.286	0	0	0	0	45.43	45.05	0.12

32	-3.75	41.307	0	41.307	0	0	0	0	56.88	54.56	0.14
34	-3.99	40.7	0	40.7	0	0	0	0	38.37	-74.68	0.16
36	-4.23	39.347	0	39.347	0	0	0	0	22.19	-65	0.19
38	-4.47	37.562	0	37.562	0	0	0	0	8.28	-55.65	0.22
40	-4.71	35.622	0	35.622	0	0	0	0	-3.46	-46.75	0.25
42	-4.95	33.476	0	33.476	0	0	0	0	-13.16	-38.33	0.29
44	-5.19	31.362	0	31.362	0	0	0	0	-20.93	-30.42	0.32
46	-5.43	29.818	0	29.818	0	0	0	0	-26.89	-23.01	0.34
48	-5.67	30.942	0	30.942	0	0	0	0	-31.12	-15.79	0.37
50	-5.91	32.069	0	32.069	0	0	0	0	-33.56	-8.29	0.39
52	-6.15	44.74	8.975	44.74	8.975	0	0	0	-34.02	0.61	0.41
54	-6.39	46.257	23.334	46.257	23.334	0	0	0	-32.42	8.42	0.42
56	-6.63	47.776	37.694	47.776	37.694	0	0	0	-29.5	13.16	0.43
58	-6.87	49.39	49.897	49.39	49.897	0	0	0	-26	14.81	0.44
60	-7.11	51.689	54.242	50.589	53.142	0	1.1	1.1	-22.49	14.52	0.44
62	-7.35	54.831	58.527	51.331	55.027	0	3.5	3.5	-19.12	13.85	0.45
64	-7.59	58.258	62.649	52.358	56.749	0	5.9	5.9	-15.96	12.91	0.45
66	-7.83	61.674	66.63	53.374	58.33	0	8.3	8.3	-13.06	11.81	0.44
68	-8.07	65.199	70.49	54.499	59.79	0	10.7	10.7	-10.44	10.61	0.44
70	-8.31	68.94	74.25	55.84	61.15	0	13.1	13.1	-8.12	9.33	0.43
72	-8.55	72.628	77.925	57.128	62.425	0	15.5	15.5	-6.11	8.05	0.43
74	-8.79	76.377	81.53	58.477	63.63	0	17.9	17.9	-4.41	6.79	0.42
76	-9.03	80.286	85.078	59.986	64.778	0	20.3	20.3	-2.99	5.58	0.41
78	-9.27	84.114	88.581	61.414	65.881	0	22.7	22.7	-1.86	4.45	0.41
80	-9.51	88.076	92.047	62.976	66.947	0	25.1	25.1	-0.98	3.41	0.4
82	-9.75	91.946	95.485	64.446	67.985	0	27.5	27.5	-0.33	2.48	0.39
84	-9.99	95.829	98.901	65.929	69.001	0	29.9	29.9	0.11	1.66	0.38
86	-10.23	99.819	102.3	67.519	70	0	32.3	32.3	0.38	0.96	0.38
88	-10.47	103.71	105.68	69.011	70.985	0	34.7	34.7	0.51	0.39	0.37
90	-10.71	107.60	109.05	70.505	71.959	0	37.1	37.1	0.52	-0.05	0.36
92	-10.95	111.59	112.42	72.094	72.923	0	39.5	39.5	0.45	-0.36	0.35
94	-11.19	115.48	115.78	73.587	73.88	0	41.9	41.9	0.33	-0.53	0.34
96	-11.43	119.38	119.12	75.08	74.829	0	44.3	44.3	0.2	-0.57	0.34
98	-11.67	123.36	122.47	76.662	75.771	0	46.7	46.7	0.08	-0.47	0.33
100	-11.91	127.25	125.80	78.154	76.706	0	49.1	49.1	0.01	-0.23	0.32

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)

0	0
1	0
2	240
3	246.816
4	239.686
5	238.85

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	340.08
5	354.288
6	0

Project: My Project
Results for Design Section 1: DM08_ITA: Comb. 1: A1+M1+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
1	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
2	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
3	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
4	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
5	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-6	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	210000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

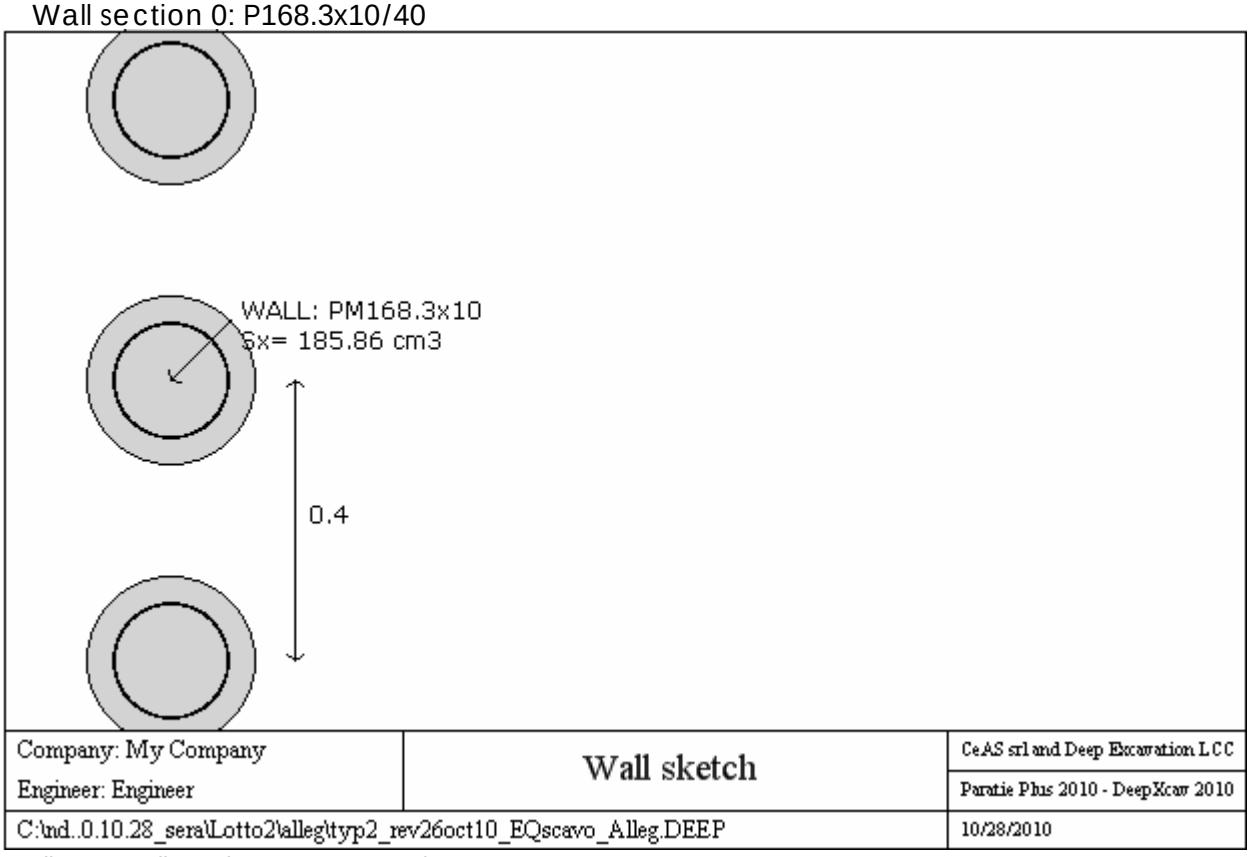
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -12 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.04	0	1	N/A
1	No		0.04	0	1	N/A
2	No		0.04	0	1	N/A
3	No		0.04	0	1	N/A
4	No		0.04	0	1	N/A
5	No		0.04	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 7 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -3.75 m, S = 2.4 m
Lfree = 6 m, Lfix = 13 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	340	-	-
5	Yes	-	-	-
6	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -17.9427272727273, X2 = 0
Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-	0	0	20	0	0	0	20

1	Yes	-	0	0	20	0	0	0	20
2	Yes	-	0	0	20	0	0	0	20
3	Yes	-	0	0	20	0	0	0	20
4	Yes	-	0	0	20	0	0	0	20
5	Yes	-	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	312
3	321.61
4	312.374
5	311.257

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0

4	442.104
5	461.386
6	0

Project: My Project
Results for Design Section 2: DM08_ITA: Comb. 2: A2+M2+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design Name	Design Case	F(tan fr)	F (c')	F (Su)	F (EQ)	F(perm load)	F(temp load)	F(perm sup)	F(temp sup)	F Earth (Dstab)	F Earth (stab)	F GWT (Dstab)	F GWT (stab)	F HYD (Dstab)	F HYD (stab)	F UPL (Dstab)	F UPL (stab)
0	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
3	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1

4	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
5	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-6	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	210000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10

C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

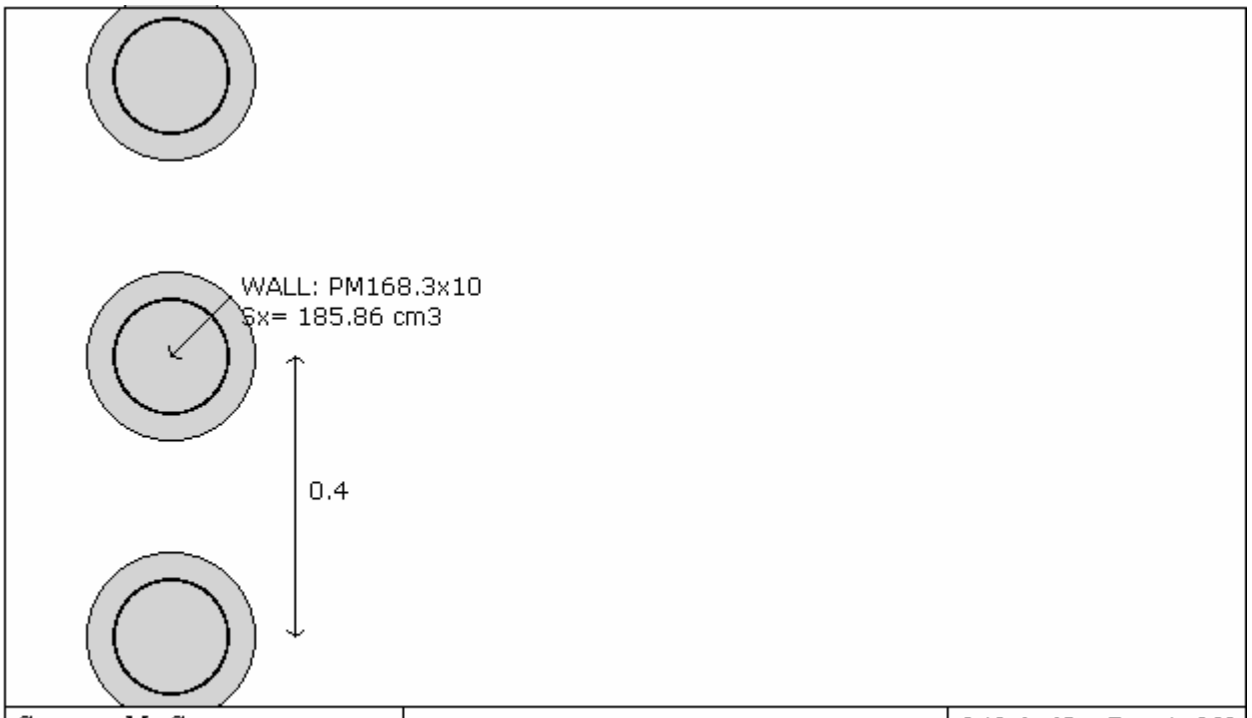
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Company: My Company Engineer: Engineer	Wall sketch	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ2_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010

Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -12 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'
Steel members fy = 355 Esteel = 210000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	257.3	75.62	16.8	1	16.83	1	1	3771	185.9	7.06	3771	185.9	7.06	7.06	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.04	0	1	N/A
1	No		0.04	0	1	N/A
2	No		0.04	0	1	N/A
3	No		0.04	0	1	N/A
4	No		0.04	0	1	N/A
5	No		0.04	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 7 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion

0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -3.75 m, S = 2.4 m
Lfree = 6 m, Lfix = 13 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	340	-	-
5	Yes	-	-	-
6	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -17.9427272727273, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-	0	0	20	0	0	0	20
1	Yes	-	0	0	20	0	0	0	20
2	Yes	-	0	0	20	0	0	0	20
3	Yes	-	0	0	20	0	0	0	20
4	Yes	-	0	0	20	0	0	0	20
5	Yes	-	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	240
3	253.512
4	245.448
5	242.76

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	340.08
5	376.56
6	0

Project: My Project
Results for Design Section 3: DM08_ITA: EQK - Seismic

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
3	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
4	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
5	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
6	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color

	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-6	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	210000	77
Fe510	355	510	210000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)

S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

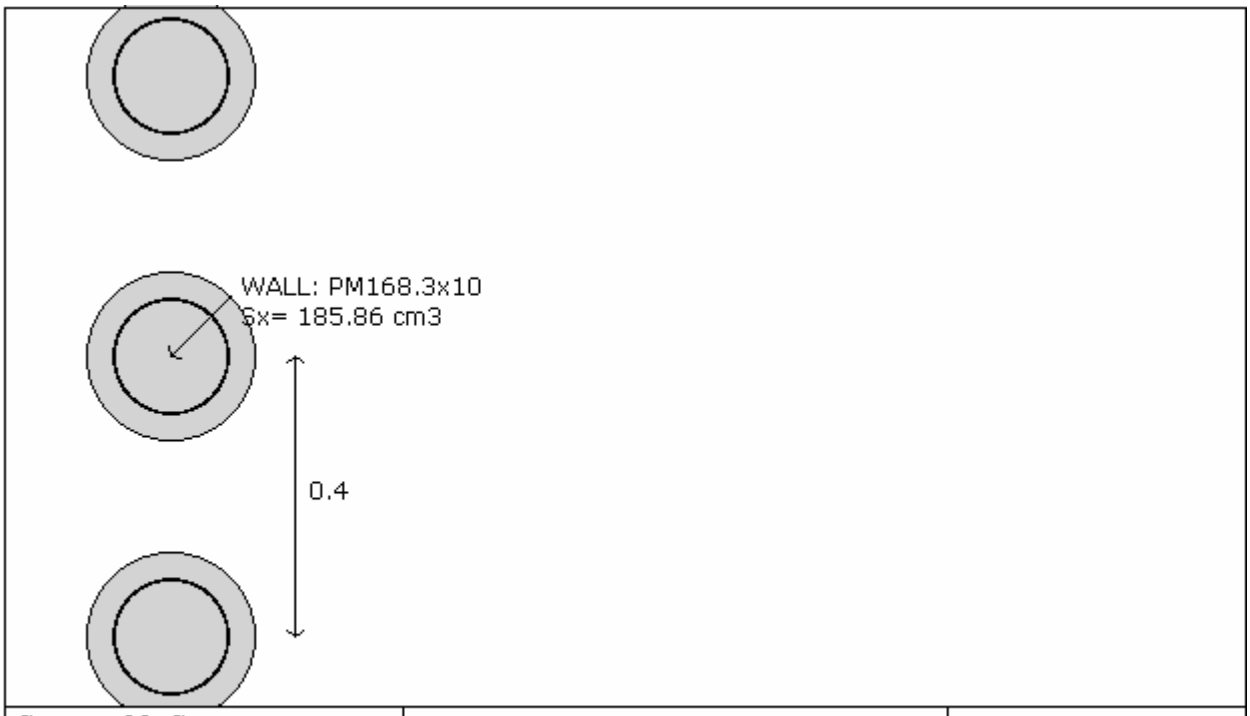
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



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C:\nd..0.10.28_sera\Lotto2\alleg\typ2_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010

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4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	0	200100	0	0	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	8.39	200100	1357.9	1357.9	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	N/A	1	False	N/A	N/A	Yes

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Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	0	0	0

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
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Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.04	0	1	N/A
1	No		0.04	0	1	N/A
2	No		0.04	0	1	N/A
3	No		0.04	0	1	N/A
4	No		0.04	0	1	N/A
5	No		0.04	0	1	N/A
6	Yes		0.04	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 7 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -3.75 m, S = 2.4 m
Lfree = 6 m, Lfix = 13 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	340	-	-
5	Yes	-	-	-
6	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -17.9427272727273, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-	0	0	20	0	0	0	20
1	Yes	-	0	0	20	0	0	0	20
2	Yes	-	0	0	20	0	0	0	20
3	Yes	-	0	0	20	0	0	0	20
4	Yes	-	0	0	20	0	0	0	20
5	Yes	-	0	0	20	0	0	0	20
6	No	-	0	0	20	0	0	0	20
7	Yes	-	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	240
3	251.472
4	243.384
5	241.08
6	222.422

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	340.08
5	371.304
6	377.208

DeepXcav 2010: Report Output

A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:29:54 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ3_rev26oct10_EQscavo_Alleg.DEEP

DeepXcav 2010: Report Output

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A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:29:54 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ3_rev26oct10_EQscavo_Alleg.DEEP

OBJECTIVES

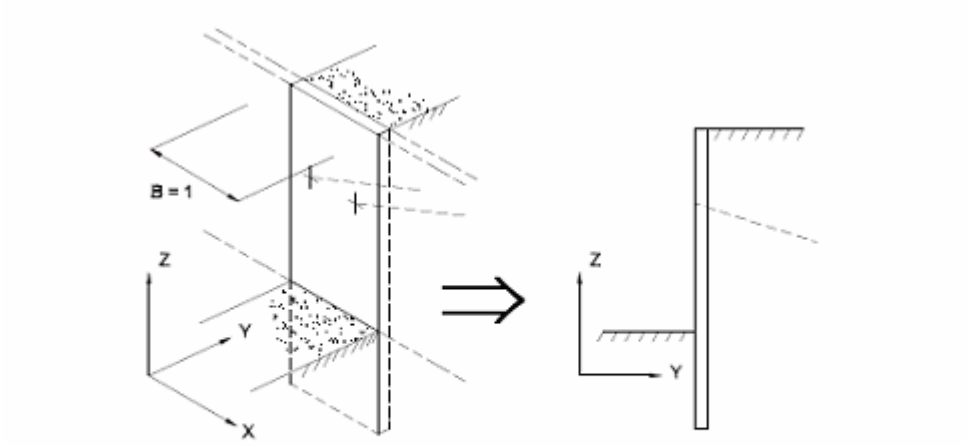
The objective of this document is to report the most imprortant results of the calculations

BIBLIOGRAPHIC REFERENCES

BECCI,B.,NOVA,R. (1987) “Un metodo di calcolo automatico per il progetto di paratie”, Rivista Italiana di

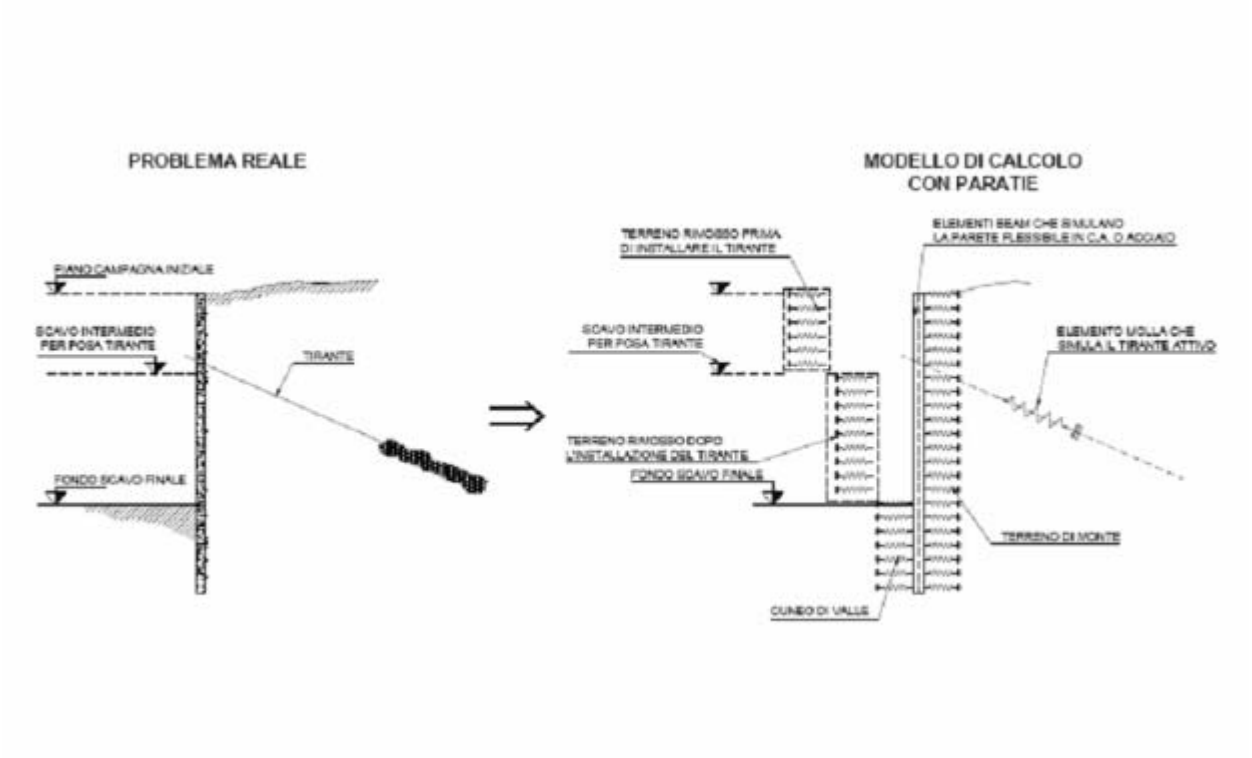
GENERAL CALCULATION ASSUMPTIONS

DEEP EXC is a program to simulate a the behaviuor of flexible diaphrams. It is possible to simulate all the different stages of excavation.
the program is able to perform both classic and non linear analysis.
For the non linear analysis a FEM model is used. The FEM model follow the well known beam on elasto plastic foundation approach. The wall is modeled using BEAM elements , the soil is simulate using a double system (for each part of the wall) of elasto plastic spring ,
An elasto plastic spring is connected on each node of the beam elements.
THe excavation procedure is performed through 2 types of analysis:
1) Classic analysis
2) Non linear analysis : every step represents an excavation phase with a defined configurations of excavations, loads, etc.
The non linear analysis has been performed using a full Newthon Raphson approach.



CONVENTIONS AND REFERENCE COORDINATE SYSTEMS

Loads, anelastic displacements, support reactions and displacements, are all referred to a rigthward coordinate system



ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
(tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

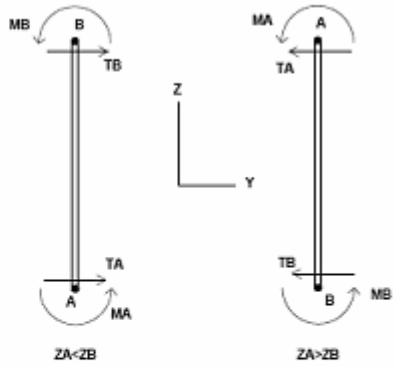


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
(tutti per unità di profondità)

Checking of cross sections is performed according to the coordinate systems showed in the next figure

- X axis follow the 2 nodes direction of the beam elements , positive going from the first to the secondo node

ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
(tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

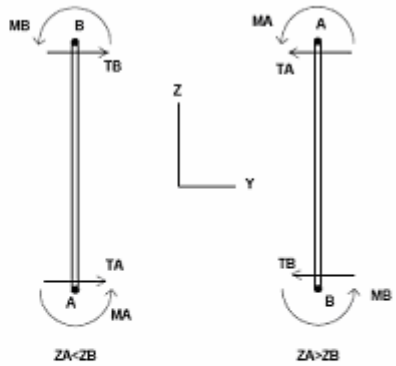


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
(tutti per unità di profondità)

DESIGN CODES

Reference codes are:
- DM 2008 - "Norme tecniche per le costruzioni"
- CSLP, "Istruzioni per l'applicazione delle Notme tecniche per le costruzioni di cui al DM 14/1/2008"
- EC2 1-1 :2004, Eurocode 2 - Design of concrete structures
- Ec3 1-1:2005, Eurocodice 3 - Design of steel structures
- Ec3 5:2002, Eurocodice 3 - Design of steel sheet piles walls
- Ec8:2004 - Seismic design of structures
- AISC ASD 9th Edition, 1989
- AISC LRFD 2nd Edition, 2003
- ACI 318-2002
- AASHTO 2000 ADS / LRFD

DESIGN PARAMETERS

Project: My Project
Results for Design Section 0: Base Section - Service

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-7.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	206000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

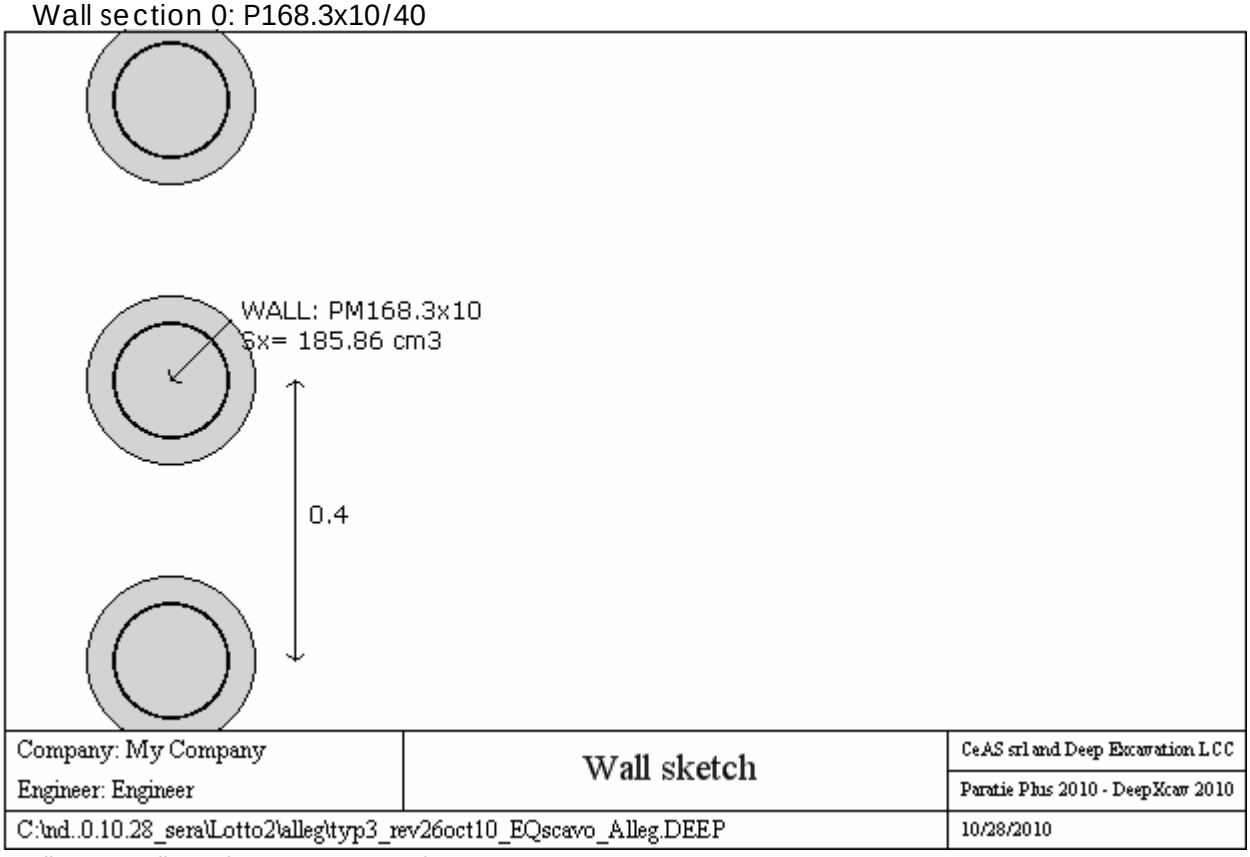
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -15 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 206000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	254.7	74.85	16.8	1	16.83	1	1	3705	185.9	7.04	3705	185.9	7.04	7.04	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

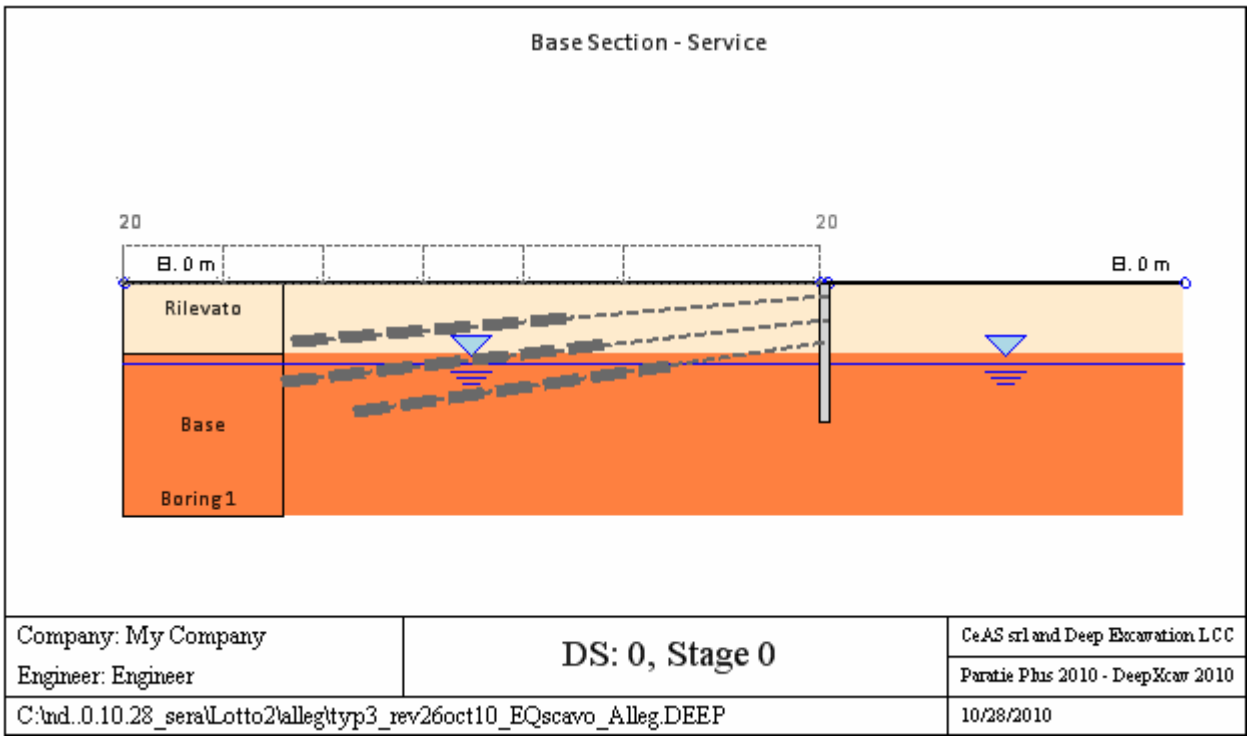
TIEBACK DATA

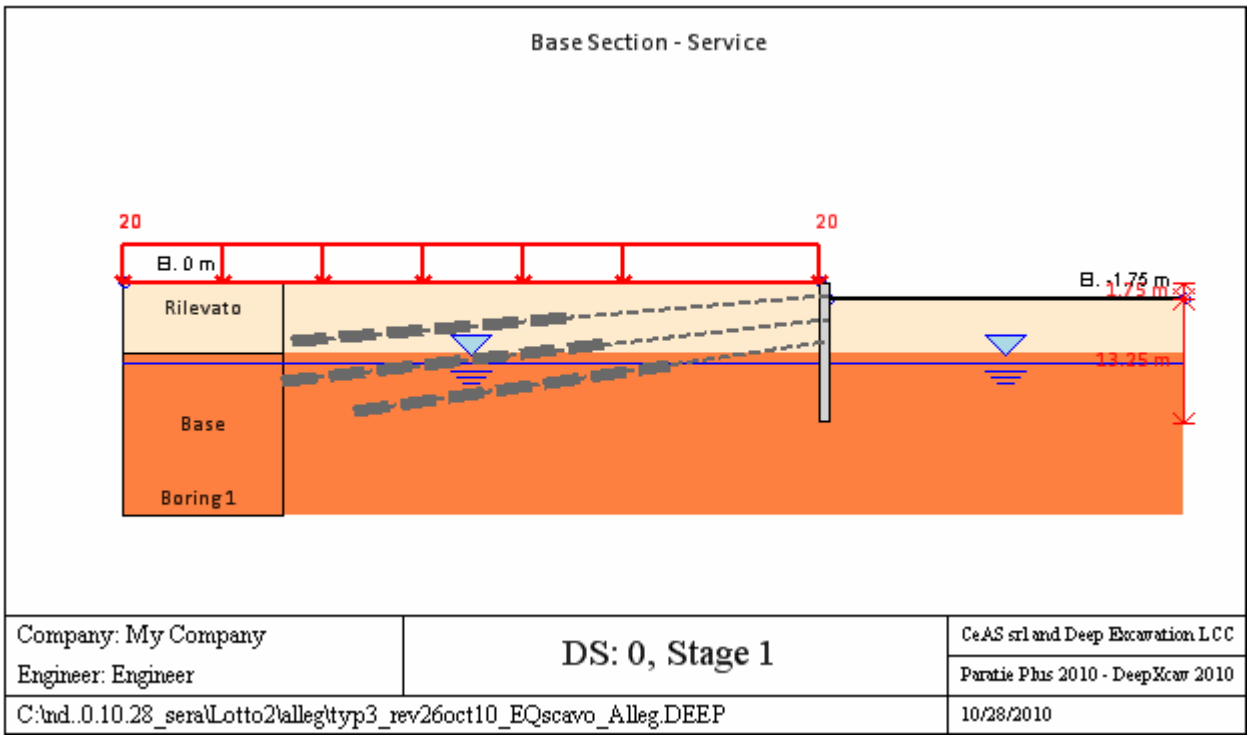
Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	1.4	200100	226.7	226.7	N/A	1.4	False	N/A	N/A	Yes

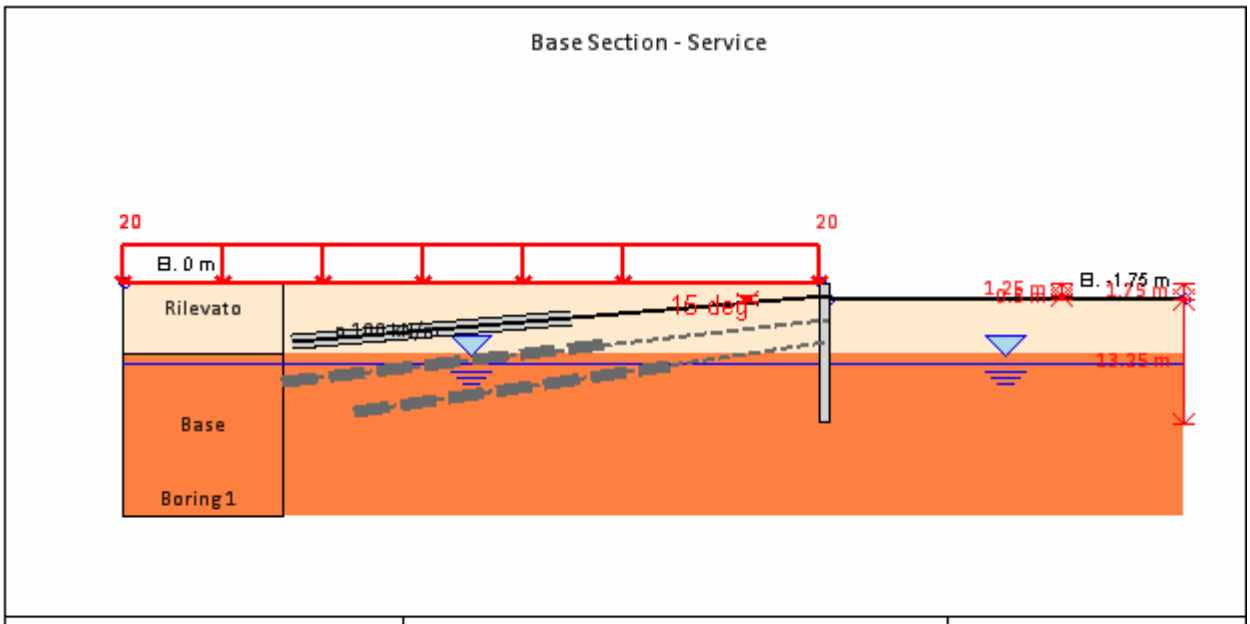
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	5.56	210000	807	807	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported







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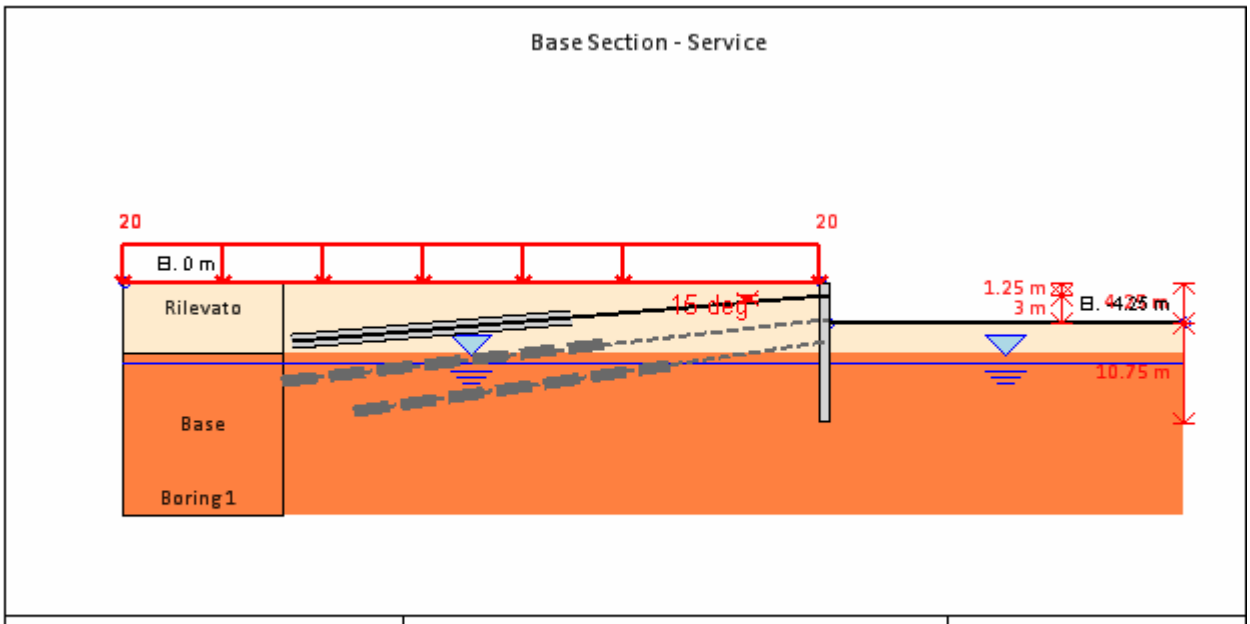

Company: My Company Engineer: Engineer	DS: 0, Stage 3	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
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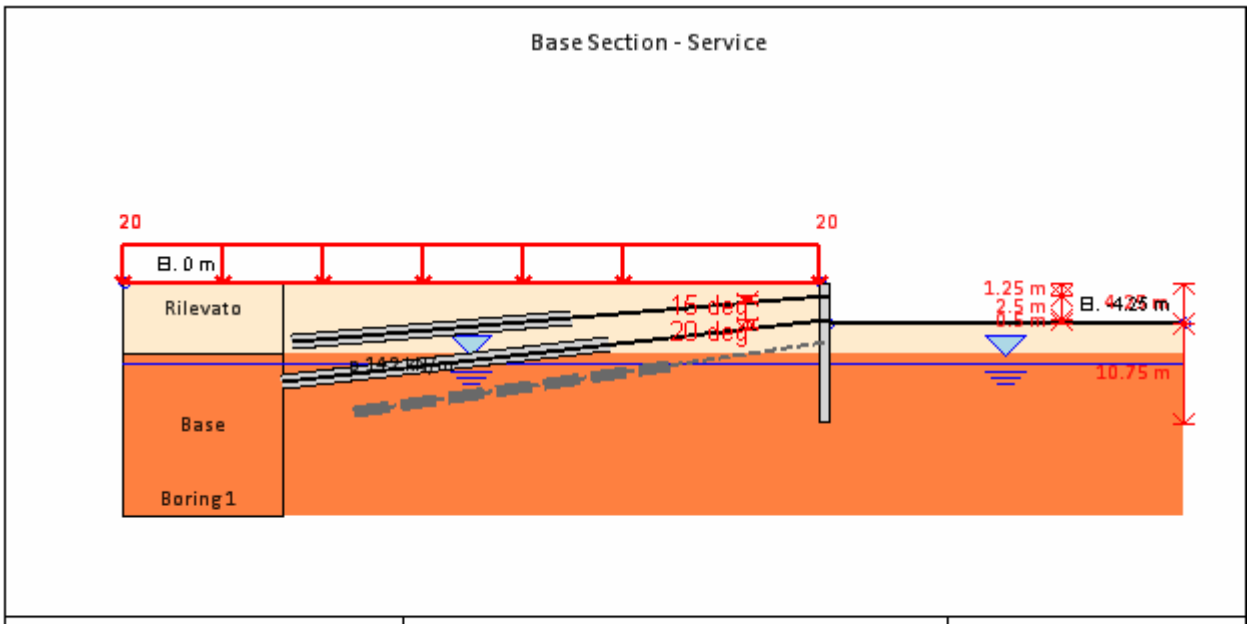
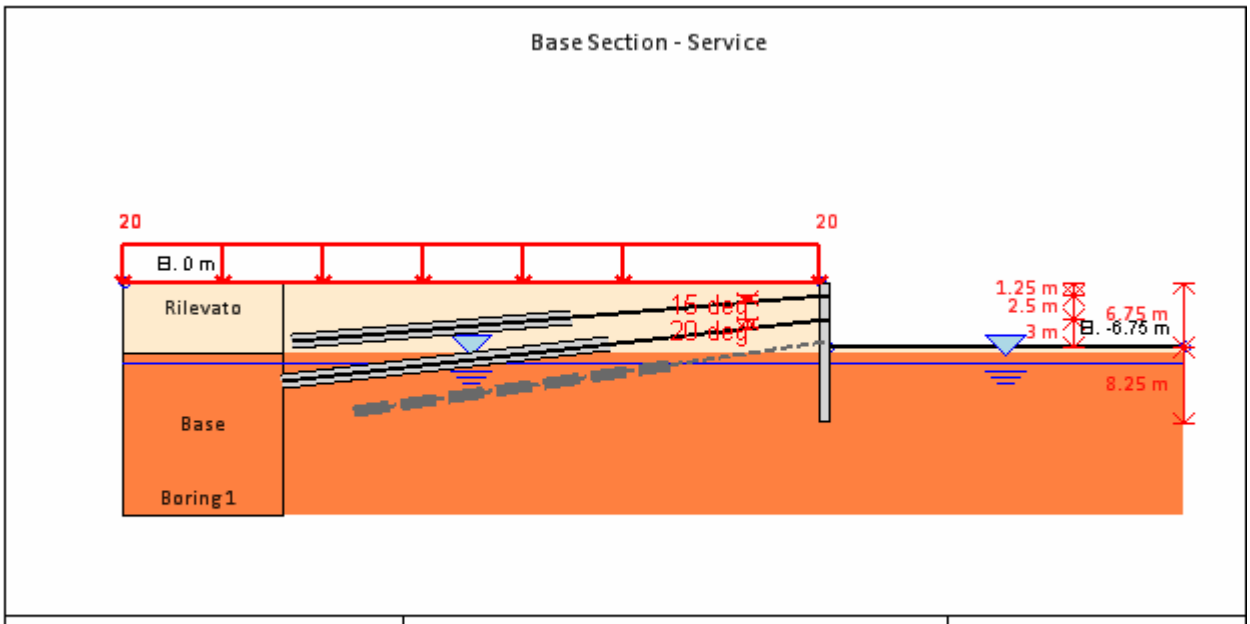
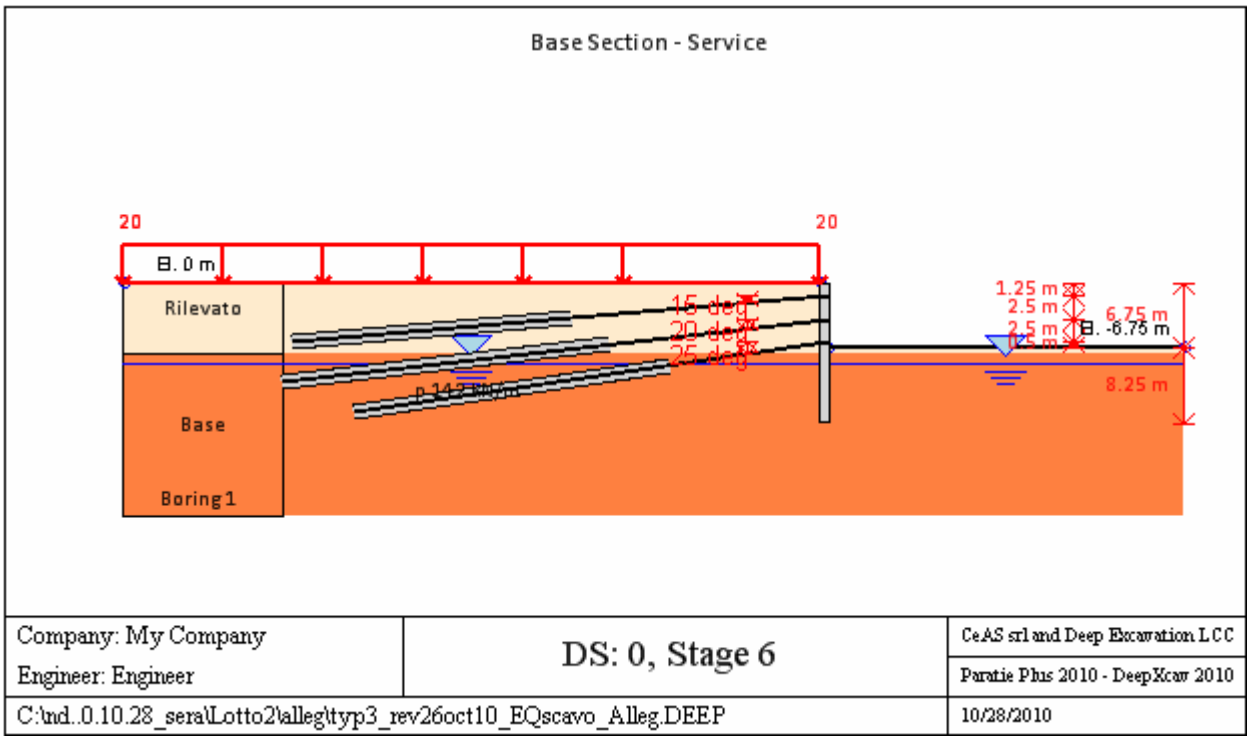
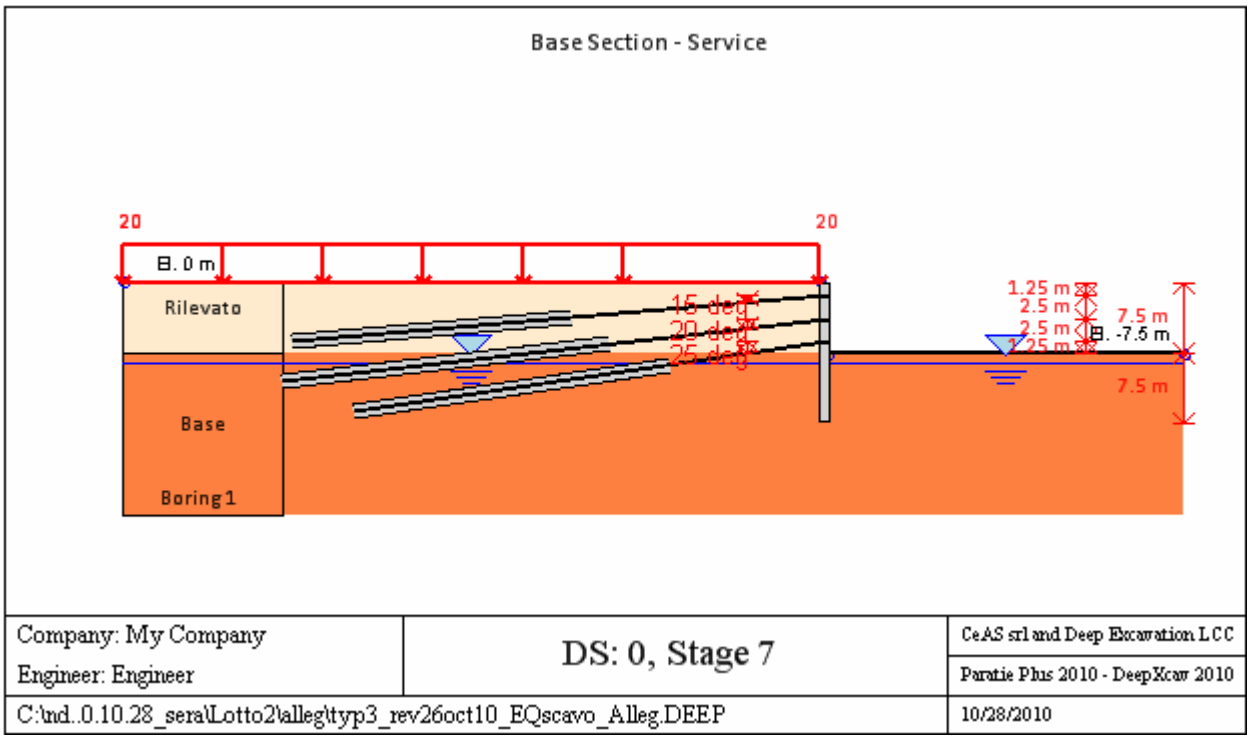


Company: My Company Engineer: Engineer	DS: 0, Stage 4	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ3_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010



Company: My Company Engineer: Engineer	DS: 0, Stage 5	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ3_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010





GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	11.45	13.62	11.45
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	6.974	6.974	7.255
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	7.44	7.44	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	4.83	4.83	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	4.764	4.966	4.764

Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.688	2.688	31.72
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.549	2.869	2.549
Stage 7	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.236	2.236	26.85

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage Number	Seismic g Used	Method Used	aX (g)	aY (g)	Beta	Building Code (Name)
0	No		0.035	0	1	N/A
1	No		0.035	0	1	N/A
2	No		0.035	0	1	N/A
3	No		0.035	0	1	N/A
4	No		0.035	0	1	N/A
5	No		0.035	0	1	N/A
6	No		0.035	0	1	N/A
7	No		0.035	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 9.1 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-

3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -3.75 m, S = 2.4 m
Lfree = 8 m, Lfix = 12 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	340	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support 2: type = tieback
X = 0.24 m, Z = -6.25 m, S = 2.4 m
Lfree = 6 m, Lfix = 12 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	340	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -24, X2 = 0
Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)

0	No	-24	0	0	20	0	0	0	20
1	Yes	-24	0	0	20	0	0	0	20
2	Yes	-24	0	0	20	0	0	0	20
3	Yes	-24	0	0	20	0	0	0	20
4	Yes	-24	0	0	20	0	0	0	20
5	Yes	-24	0	0	20	0	0	0	20
6	Yes	-24	0	0	20	0	0	0	20
7	Yes	-24	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

P168.3x10/40 Stage: 0

Wall Nod	EL (m)	Sht L (kPa)	Sht R (kPa)	Shs L (kPa)	Shs R (kPa)	q (kPa)	U L (kPa)	U R (kPa)	M (kN-	V (kN/m)	dx (cm)
0	0	0	0	0	0	0	0	0	0	0	0
2	-0.3	2.538	2.538	2.538	2.538	0	0	0	0	0	0
4	-0.6	5.076	5.076	5.076	5.076	0	0	0	0	0	0
6	-0.9	7.614	7.614	7.614	7.614	0	0	0	0	0	0
8	-1.2	10.152	10.152	10.152	10.152	0	0	0	0	0	0
10	-1.4	11.844	11.844	11.844	11.844	0	0	0	0	0	0
12	-1.7	14.382	14.382	14.382	14.382	0	0	0	0	0	0
14	-2	16.92	16.92	16.92	16.92	0	0	0	0	0	0
16	-2.3	19.458	19.458	19.458	19.458	0	0	0	0	0	0
18	-2.6	21.996	21.996	21.996	21.996	0	0	0	0	0	0
20	-2.9	24.534	24.534	24.534	24.534	0	0	0	0	0	0
22	-3.2	27.072	27.072	27.072	27.072	0	0	0	0	0	0
24	-3.5	29.61	29.61	29.61	29.61	0	0	0	0	0	0
26	-3.75	31.725	31.725	31.725	31.725	0	0	0	0	0	0
28	-4.05	34.263	34.263	34.263	34.263	0	0	0	0	0	0
30	-4.35	36.801	36.801	36.801	36.801	0	0	0	0	0	0
32	-4.65	39.339	39.339	39.339	39.339	0	0	0	0	0	0
34	-4.95	41.877	41.877	41.877	41.877	0	0	0	0	0	0
36	-5.25	44.415	44.415	44.415	44.415	0	0	0	0	0	0
38	-5.55	46.953	46.953	46.953	46.953	0	0	0	0	0	0
40	-5.85	49.491	49.491	49.491	49.491	0	0	0	0	0	0
42	-6.15	52.029	52.029	52.029	52.029	0	0	0	0	0	0
44	-6.4	54.144	54.144	54.144	54.144	0	0	0	0	0	0
46	-6.7	56.682	56.682	56.682	56.682	0	0	0	0	0	0
48	-7	59.22	59.22	59.22	59.22	0	0	0	0	0	0
50	-7.3	61.758	61.758	61.758	61.758	0	0	0	0	0	0
52	-7.6	78.986	78.986	78.986	78.986	0	0	0	0	0	0
54	-7.9	82.103	82.103	82.103	82.103	0	0	0	0	0	0
56	-8.2	85.221	85.221	85.221	85.221	0	0	0	0	0	0
58	-8.5	88.339	88.339	88.339	88.339	0	0	0	0	0	0
60	-8.8	92.725	92.725	89.725	89.725	0	3	3	0	0	0

62	-9.1	97.111	97.111	91.111	91.111	0	6	6	0	0	0
64	-9.4	101.49	101.49	92.496	92.496	0	9	9	0	0	0
66	-9.7	105.88	105.88	93.882	93.882	0	12	12	0	0	0
68	-10	110.26	110.26	95.268	95.268	0	15	15	0	0	0
70	-10.3	114.65	114.65	96.653	96.653	0	18	18	0	0	0
72	-10.6	119.03	119.03	98.039	98.039	0	21	21	0	0	0
74	-10.9	123.42	123.42	99.425	99.425	0	24	24	0	0	0
76	-11.2	127.81	127.81	100.81	100.81	0	27	27	0	0	0
78	-11.5	132.2	132.2	102.2	102.2	0	30	30	0	0	0
80	-11.8	136.58	136.58	103.58	103.58	0	33	33	0	0	0
82	-12.1	140.97	140.97	104.97	104.97	0	36	36	0	0	0
84	-12.4	145.35	145.35	106.35	106.35	0	39	39	0	0	0
86	-12.7	149.74	149.74	107.74	107.74	0	42	42	0	0	0
88	-13	154.12	154.12	109.12	109.12	0	45	45	0	0	0
90	-13.3	158.51	158.51	110.51	110.51	0	48	48	0	0	0
92	-13.6	162.9	162.9	111.9	111.9	0	51	51	0	0	0
94	-13.9	167.28	167.28	113.28	113.28	0	54	54	0	0	0
96	-14.2	171.67	171.67	114.67	114.67	0	57	57	0	0	0
98	-14.5	176.05	176.05	116.05	116.05	0	60	60	0	0	0
100	-14.8	180.44	180.44	117.44	117.44	0	63	63	0	0	0
102	-15	183.36	183.36	118.36	118.36	0	65	65	0	0	0

P168.3x10/40 Stage: 1

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	5.34	0	5.34	0	0	0	0	0	0.4	0.93
2	-0.3	6.782	0	6.782	0	0	0	0	0.26	1.31	0.83
4	-0.6	8.224	0	8.224	0	0	0	0	1.12	3.45	0.74
6	-0.9	9.665	0	9.665	0	0	0	0	2.73	6.03	0.65
8	-1.2	11.107	0	11.107	0	0	0	0	5.21	9.04	0.56
10	-1.4	12.068	0	12.068	0	0	0	0	7.41	11.28	0.5
12	-1.7	13.51	0	13.51	0	0	0	0	11.62	15.01	0.41
14	-2	14.952	22.752	14.952	22.752	0	0	0	16.85	17.8	0.33
16	-2.3	16.394	46.483	16.394	46.483	0	0	0	21.37	13.53	0.26
18	-2.6	17.836	40.632	17.836	40.632	0	0	0	23.48	5.07	0.2
20	-2.9	19.277	36.156	19.277	36.156	0	0	0	23.54	-1.3	0.15
22	-3.2	20.719	33.153	20.719	33.153	0	0	0	22.06	-6	0.1
24	-3.5	22.161	31.566	22.161	31.566	0	0	0	19.46	-9.48	0.07
26	-3.75	28.029	31.216	28.029	31.216	0	0	0	16.67	-11.59	0.06
28	-4.05	33.957	31.785	33.957	31.785	0	0	0	13.07	-12.01	0.04
30	-4.35	38.453	33.213	38.453	33.213	0	0	0	9.65	-11.1	0.03
32	-4.65	41.888	35.277	41.888	35.277	0	0	0	6.7	-9.39	0.03
34	-4.95	44.583	37.784	44.583	37.784	0	0	0	4.33	-7.38	0.03
36	-5.25	46.798	40.577	46.798	40.577	0	0	0	2.57	-5.37	0.03
38	-5.55	48.726	43.539	48.726	43.539	0	0	0	1.37	-3.57	0.03
40	-5.85	50.498	46.59	50.498	46.59	0	0	0	0.63	-2.11	0.04
42	-6.15	52.198	49.681	52.198	49.681	0	0	0	0.25	-1.04	0.04
44	-6.4	53.59	52.268	53.59	52.268	0	0	0	0.1	-0.47	0.04
46	-6.7	55.25	55.377	55.25	55.377	0	0	0	0.03	-0.18	0.05
48	-7	56.907	58.484	56.907	58.484	0	0	0	-0.05	-0.33	0.05
50	-7.3	58.57	61.585	58.57	61.585	0	0	0	-0.27	-0.91	0.05
52	-7.6	80.795	77.202	80.795	77.202	0	0	0	-0.76	-1.92	0.06
54	-7.9	83.36	80.795	83.36	80.795	0	0	0	-1.11	-0.92	0.06
56	-8.2	86.011	84.315	86.011	84.315	0	0	0	-1.22	-0.22	0.06
58	-8.5	88.758	87.755	88.758	87.755	0	0	0	-1.18	0.23	0.07
60	-8.8	92.865	92.376	89.865	89.376	0	3	3	-1.05	0.49	0.07
62	-9.1	97.056	96.929	91.056	90.929	0	6	6	-0.88	0.61	0.07
64	-9.4	101.31	101.42	92.316	92.425	0	9	9	-0.69	0.62	0.07

66	-9.7	105.63	105.87	93.631	93.877	0	12	12	-0.51	0.58	0.07
68	-10	109.98	110.29	94.986	95.295	0	15	15	-0.35	0.5	0.07
70	-10.3	114.36	114.69	96.369	96.69	0	18	18	-0.22	0.41	0.07
72	-10.6	118.77	119.07	97.771	98.07	0	21	21	-0.12	0.31	0.07
74	-10.9	123.18	123.44	99.183	99.442	0	24	24	-0.05	0.22	0.07
76	-11.2	127.6	127.81	100.6	100.81	0	27	27	0	0.15	0.07
78	-11.5	132.02	132.18	102.02	102.18	0	30	30	0.03	0.09	0.07
80	-11.8	136.43	136.55	103.43	103.55	0	33	33	0.05	0.04	0.07
82	-12.1	140.84	140.92	104.84	104.92	0	36	36	0.05	0.01	0.07
84	-12.4	145.25	145.29	106.25	106.29	0	39	39	0.05	-0.01	0.07
86	-12.7	149.65	149.67	107.65	107.67	0	42	42	0.05	-0.02	0.07
88	-13	154.05	154.05	109.05	109.05	0	45	45	0.04	-0.03	0.07
90	-13.3	158.44	158.44	110.44	110.44	0	48	48	0.03	-0.03	0.07
92	-13.6	162.83	162.82	111.83	111.82	0	51	51	0.02	-0.03	0.07
94	-13.9	167.23	167.21	113.23	113.21	0	54	54	0.01	-0.02	0.07
96	-14.2	171.62	171.6	114.62	114.6	0	57	57	0.01	-0.02	0.07
98	-14.5	176.01	175.98	116.01	115.98	0	60	60	0	-0.01	0.07
100	-14.8	180.4	180.37	117.4	117.37	0	63	63	0	-0.01	0.07
102	-15	183.32	183.3	118.32	118.3	0	65	65	0	0	0.07

P168.3x10/40 Stage: 2

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	39.648	0	39.648	0	0	0	0	0	2.97	0.78
2	-0.3	42.808	0	42.808	0	0	0	0	1.82	9.16	0.68
4	-0.6	45.76	0	45.76	0	0	0	0	7.49	22.23	0.58
6	-0.9	47.977	0	47.977	0	0	0	0	17.28	36.15	0.48
8	-1.2	48.563	0	48.563	0	0	0	0	31.37	50.62	0.4
10	-1.4	47.503	0	47.503	0	0	0	0	28.7	-36.27	0.35
12	-1.7	44.086	0	44.086	0	0	0	0	21	-22.24	0.28
14	-2	39.612	7.598	39.612	7.598	0	0	0	17.24	-9.42	0.23
16	-2.3	35.055	35.015	35.055	35.015	0	0	0	16.17	-2.49	0.18
18	-2.6	31.036	32.52	31.036	32.52	0	0	0	15.41	-2.59	0.14
20	-2.9	27.878	30.871	27.878	30.871	0	0	0	14.52	-3.15	0.11
22	-3.2	25.692	30.097	25.692	30.097	0	0	0	13.36	-4.16	0.08
24	-3.5	24.451	30.159	24.451	30.159	0	0	0	11.8	-5.58	0.06
26	-3.75	28.726	30.788	28.726	30.788	0	0	0	10.14	-6.87	0.05
28	-4.05	33.388	32.134	33.388	32.134	0	0	0	8	-7.16	0.04
30	-4.35	37.174	33.998	37.174	33.998	0	0	0	5.96	-6.62	0.04
32	-4.65	40.304	36.25	40.304	36.25	0	0	0	4.2	-5.59	0.04
34	-4.95	42.971	38.775	42.971	38.775	0	0	0	2.8	-4.35	0.04
36	-5.25	45.327	41.481	45.327	41.481	0	0	0	1.78	-3.11	0.04
38	-5.55	47.484	44.302	47.484	44.302	0	0	0	1.1	-2	0.04
40	-5.85	49.517	47.193	49.517	47.193	0	0	0	0.71	-1.11	0.04
42	-6.15	51.471	50.128	51.471	50.128	0	0	0	0.52	-0.48	0.04
44	-6.4	53.054	52.598	53.054	52.598	0	0	0	0.46	-0.19	0.05
46	-6.7	54.907	55.587	54.907	55.587	0	0	0	0.42	-0.13	0.05
48	-7	56.715	58.602	56.715	58.602	0	0	0	0.32	-0.43	0.05
50	-7.3	58.49	61.634	58.49	61.634	0	0	0	0.05	-1.09	0.05
52	-7.6	80.792	77.205	80.792	77.205	0	0	0	-0.5	-2.13	0.06
54	-7.9	83.392	80.769	83.392	80.769	0	0	0	-0.91	-1.12	0.06
56	-8.2	86.061	84.274	86.061	84.274	0	0	0	-1.08	-0.4	0.06
58	-8.5	88.815	87.709	88.815	87.709	0	0	0	-1.08	0.08	0.07
60	-8.8	92.922	92.33	89.922	89.33	0	3	3	-0.99	0.37	0.07
62	-9.1	97.107	96.887	91.107	90.887	0	6	6	-0.85	0.52	0.07
64	-9.4	101.35	101.39	92.359	92.39	0	9	9	-0.68	0.56	0.07
66	-9.7	105.66	105.84	93.665	93.849	0	12	12	-0.51	0.54	0.07
68	-10	110.01	110.27	95.012	95.274	0	15	15	-0.37	0.48	0.07

70	-10.3	114.38	114.67	96.388	96.675	0	18	18	-0.24	0.4	0.07
72	-10.6	118.78	119.06	97.783	98.061	0	21	21	-0.14	0.31	0.07
74	-10.9	123.19	123.43	99.19	99.436	0	24	24	-0.07	0.23	0.07
76	-11.2	127.6	127.81	100.6	100.81	0	27	27	-0.01	0.16	0.07
78	-11.5	132.02	132.18	102.02	102.18	0	30	30	0.02	0.1	0.07
80	-11.8	136.43	136.55	103.43	103.55	0	33	33	0.04	0.05	0.07
82	-12.1	140.84	140.92	104.84	104.92	0	36	36	0.05	0.02	0.07
84	-12.4	145.24	145.3	106.24	106.3	0	39	39	0.05	0	0.07
86	-12.7	149.64	149.68	107.64	107.68	0	42	42	0.04	-0.02	0.07
88	-13	154.04	154.06	109.04	109.06	0	45	45	0.04	-0.02	0.07
90	-13.3	158.44	158.44	110.44	110.44	0	48	48	0.03	-0.03	0.07
92	-13.6	162.83	162.82	111.83	111.82	0	51	51	0.02	-0.03	0.07
94	-13.9	167.22	167.21	113.22	113.21	0	54	54	0.01	-0.02	0.07
96	-14.2	171.62	171.6	114.62	114.6	0	57	57	0.01	-0.02	0.07
98	-14.5	176.01	175.98	116.01	115.98	0	60	60	0	-0.01	0.07
100	-14.8	180.4	180.37	117.4	117.37	0	63	63	0	-0.01	0.07
102	-15	183.32	183.3	118.32	118.3	0	65	65	0	0	0.07

P168.3x10/40 Stage: 3

Wall Nod	EL (m)	Sht L (kPa)	Sht R (kPa)	Shs L (kPa)	Shs R (kPa)	q (kPa)	U L (kPa)	U R (kPa)	M (kN-	V (kN/m)	dx (cm)
0	0	48.408	0	48.408	0	0	0	0	0	3.63	0.69
2	-0.3	46.015	0	46.015	0	0	0	0	2.15	10.71	0.64
4	-0.6	43.397	0	43.397	0	0	0	0	8.44	24.33	0.6
6	-0.9	40.003	0	40.003	0	0	0	0	18.64	37.12	0.57
8	-1.2	34.92	0	34.92	0	0	0	0	32.42	48.78	0.54
10	-1.4	30.055	0	30.055	0	0	0	0	28.34	-44.63	0.53
12	-1.7	20.963	0	20.963	0	0	0	0	16.88	-36.26	0.52
14	-2	14.952	0	14.952	0	0	0	0	7.31	-30.72	0.53
16	-2.3	16.394	0	16.394	0	0	0	0	-0.88	-26.12	0.53
18	-2.6	17.836	0	17.836	0	0	0	0	-7.6	-21.1	0.54
20	-2.9	19.277	0	19.277	0	0	0	0	-12.71	-15.64	0.54
22	-3.2	20.719	0	20.719	0	0	0	0	-16.08	-9.75	0.54
24	-3.5	22.161	0	22.161	0	0	0	0	-17.59	-3.42	0.52
26	-3.75	23.362	0	23.362	0	0	0	0	-17.33	2.76	0.51
28	-4.05	24.804	0	24.804	0	0	0	0	-15.08	9.29	0.48
30	-4.35	26.246	9.101	26.246	9.101	0	0	0	-10.6	16.84	0.45
32	-4.65	27.688	36.403	27.688	36.403	0	0	0	-4.68	20.05	0.41
34	-4.95	29.13	40.502	29.13	40.502	0	0	0	0.68	17.05	0.37
36	-5.25	30.572	41.855	30.572	41.855	0	0	0	5.03	13.64	0.33
38	-5.55	32.013	43.119	32.013	43.119	0	0	0	8.36	10.27	0.29
40	-5.85	33.455	44.475	33.455	44.475	0	0	0	10.69	6.94	0.26
42	-6.15	34.897	46.031	34.897	46.031	0	0	0	12.03	3.63	0.23
44	-6.4	37.27	47.528	37.27	47.528	0	0	0	12.38	0.84	0.21
46	-6.7	41.159	49.592	41.159	49.592	0	0	0	11.96	-2.09	0.19
48	-7	44.485	51.949	44.485	51.949	0	0	0	10.78	-4.53	0.18
50	-7.3	47.31	54.574	47.31	54.574	0	0	0	8.93	-6.74	0.17
52	-7.6	73.159	66.543	73.159	66.543	0	0	0	6.41	-8.94	0.17
54	-7.9	76.005	70.131	76.005	70.131	0	0	0	4.17	-7.01	0.17
56	-8.2	78.754	73.771	78.754	73.771	0	0	0	2.45	-5.31	0.17
58	-8.5	81.472	77.413	81.472	77.413	0	0	0	1.19	-3.88	0.17
60	-8.8	85.467	82.198	82.467	79.198	0	3	3	0.29	-2.73	0.18
62	-9.1	89.498	86.95	83.498	80.95	0	6	6	-0.32	-1.8	0.18
64	-9.4	93.577	91.66	84.577	82.66	0	9	9	-0.69	-1.09	0.18
66	-9.7	97.711	96.322	85.711	84.322	0	12	12	-0.9	-0.55	0.18
68	-10	101.89	100.93	86.898	85.939	0	15	15	-0.97	-0.17	0.19
70	-10.3	106.13	105.51	88.133	87.513	0	18	18	-0.96	0.09	0.19
72	-10.6	110.41	110.05	89.411	89.05	0	21	21	-0.9	0.26	0.19

74	-10.9	114.72	114.55	90.725	90.555	0	24	24	-0.8	0.35	0.19
76	-11.2	119.06	119.03	92.068	92.035	0	27	27	-0.68	0.39	0.19
78	-11.5	123.43	123.49	93.434	93.493	0	30	30	-0.57	0.39	0.19
80	-11.8	127.81	127.93	94.818	94.935	0	33	33	-0.45	0.37	0.19
82	-12.1	132.21	132.36	96.215	96.364	0	36	36	-0.35	0.33	0.19
84	-12.4	136.62	136.78	97.622	97.784	0	39	39	-0.26	0.29	0.19
86	-12.7	141.03	141.19	99.034	99.197	0	42	42	-0.19	0.24	0.19
88	-13	145.45	145.61	100.45	100.61	0	45	45	-0.13	0.19	0.19
90	-13.3	149.87	150.01	101.87	102.01	0	48	48	-0.08	0.14	0.19
92	-13.6	154.29	154.41	103.29	103.41	0	51	51	-0.05	0.1	0.19
94	-13.9	158.71	158.81	104.71	104.81	0	54	54	-0.02	0.07	0.19
96	-14.2	163.13	163.21	106.13	106.21	0	57	57	-0.01	0.04	0.19
98	-14.5	167.56	167.61	107.56	107.61	0	60	60	0	0.02	0.19
100	-14.8	171.98	172	108.98	109	0	63	63	0	0.01	0.19
102	-15	174.93	174.93	109.93	109.93	0	65	65	0	0	0.19

P168.3x10/40 Stage: 4

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	38.459	0	38.459	0	0	0	0	0	2.88	0.79
2	-0.3	40.076	0	40.076	0	0	0	0	1.75	8.78	0.71
4	-0.6	41.489	0	41.489	0	0	0	0	7.1	20.91	0.62
6	-0.9	42.186	0	42.186	0	0	0	0	16.19	33.43	0.54
8	-1.2	41.304	0	41.304	0	0	0	0	29.06	46.06	0.47
10	-1.4	39.32	0	39.32	0	0	0	0	24.94	-44.2	0.43
12	-1.7	34.673	0	34.673	0	0	0	0	14.28	-32.73	0.38
14	-2	33.218	0	33.218	0	0	0	0	6.75	-22.73	0.33
16	-2.3	39.233	0	39.233	0	0	0	0	2.24	-12.31	0.29
18	-2.6	45.099	0	45.099	0	0	0	0	1.26	-0.1	0.25
20	-2.9	50.554	0	50.554	0	0	0	0	4.34	13.85	0.21
22	-3.2	55.228	0	55.228	0	0	0	0	11.96	29.39	0.17
24	-3.5	58.625	0	58.625	0	0	0	0	24.55	46.24	0.14
26	-3.75	60.025	0	60.025	0	0	0	0	39.05	62.49	0.12
28	-4.05	59.623	0	59.623	0	0	0	0	21.45	-54.15	0.12
30	-4.35	57.56	0.481	57.56	0.481	0	0	0	9.21	-36.39	0.12
32	-4.65	54.588	19.872	54.588	19.872	0	0	0	2.02	-20.13	0.13
34	-4.95	51.296	26.88	51.296	26.88	0	0	0	-1.82	-10.67	0.14
36	-5.25	48.102	31.082	48.102	31.082	0	0	0	-3.46	-3.92	0.15
38	-5.55	45.277	34.968	45.277	34.968	0	0	0	-3.56	0.67	0.15
40	-5.85	42.982	38.621	42.982	38.621	0	0	0	-2.74	3.3	0.16
42	-6.15	41.284	42.106	41.284	42.106	0	0	0	-1.51	4.21	0.16
44	-6.4	41.505	44.925	41.505	44.925	0	0	0	-0.53	3.81	0.17
46	-6.7	43.34	48.252	43.34	48.252	0	0	0	0.37	2.67	0.17
48	-7	45.133	51.551	45.133	51.551	0	0	0	0.82	1.09	0.17
50	-7.3	46.873	54.843	46.873	54.843	0	0	0	0.7	-0.96	0.18
52	-7.6	72.324	67.221	72.324	67.221	0	0	0	-0.15	-3.46	0.18
54	-7.9	74.867	71.055	74.867	71.055	0	0	0	-0.86	-2.03	0.18
56	-8.2	77.479	74.806	77.479	74.806	0	0	0	-1.22	-0.98	0.19
58	-8.5	80.178	78.463	80.178	78.463	0	0	0	-1.35	-0.25	0.19
60	-8.8	84.24	83.194	81.24	80.194	0	3	3	-1.31	0.21	0.19
62	-9.1	88.389	87.85	82.389	81.85	0	6	6	-1.19	0.48	0.19
64	-9.4	92.617	92.439	83.617	83.439	0	9	9	-1.01	0.61	0.2
66	-9.7	96.91	96.972	84.91	84.972	0	12	12	-0.82	0.65	0.2
68	-10	101.25	101.46	86.253	86.462	0	15	15	-0.63	0.62	0.2
70	-10.3	105.63	105.91	87.634	87.918	0	18	18	-0.46	0.55	0.2
72	-10.6	110.04	110.35	89.042	89.35	0	21	21	-0.31	0.46	0.2
74	-10.9	114.46	114.76	90.466	90.765	0	24	24	-0.2	0.37	0.2
76	-11.2	118.90	119.17	91.901	92.17	0	27	27	-0.11	0.28	0.2

78	-11.5	123.33	123.57	93.339	93.57	0	30	30	-0.04	0.2	0.2
80	-11.8	127.77	127.96	94.779	94.967	0	33	33	0.01	0.14	0.19
82	-12.1	132.21	132.36	96.216	96.364	0	36	36	0.03	0.08	0.19
84	-12.4	136.65	136.76	97.65	97.761	0	39	39	0.05	0.04	0.19
86	-12.7	141.08	141.16	99.081	99.16	0	42	42	0.05	0.01	0.19
88	-13	145.51	145.56	100.51	100.56	0	45	45	0.05	-0.01	0.19
90	-13.3	149.93	149.96	101.93	101.96	0	48	48	0.05	-0.03	0.19
92	-13.6	154.35	154.36	103.35	103.36	0	51	51	0.04	-0.03	0.19
94	-13.9	158.77	158.77	104.77	104.77	0	54	54	0.03	-0.04	0.19
96	-14.2	163.19	163.17	106.19	106.17	0	57	57	0.01	-0.03	0.19
98	-14.5	167.6	167.57	107.6	107.57	0	60	60	0.01	-0.03	0.19
100	-14.8	172.02	171.97	109.02	108.97	0	63	63	0	-0.01	0.19
102	-15	174.96	174.9	109.96	109.9	0	65	65	0	0	0.19

P168.3x10/40 Stage: 5

Wall Nod	EL (m)	Sht L (kPa)	Sht R (kPa)	Shs L (kPa)	Shs R (kPa)	q (kPa)	U L (kPa)	U R (kPa)	M (kN-	V (kN/m)	dx (cm)
0	0	45.251	0	45.251	0	0	0	0	0	3.39	0.68
2	-0.3	45.952	0	45.952	0	0	0	0	2.04	10.24	0.61
4	-0.6	46.44	0	46.44	0	0	0	0	8.22	24.06	0.54
6	-0.9	46.179	0	46.179	0	0	0	0	18.58	38	0.48
8	-1.2	44.27	0	44.27	0	0	0	0	33.08	51.75	0.42
10	-1.4	41.541	0	41.541	0	0	0	0	30.36	-36.82	0.39
12	-1.7	35.641	0	35.641	0	0	0	0	22.06	-24.77	0.36
14	-2	32.712	0	32.712	0	0	0	0	16.96	-14.59	0.34
16	-2.3	36.965	0	36.965	0	0	0	0	14.84	-4.45	0.33
18	-2.6	40.711	0	40.711	0	0	0	0	16.05	6.94	0.32
20	-2.9	43.628	0	43.628	0	0	0	0	20.91	19.39	0.33
22	-3.2	45.296	0	45.296	0	0	0	0	29.69	32.63	0.34
24	-3.5	45.186	0	45.186	0	0	0	0	42.54	46.25	0.37
26	-3.75	43.276	0	43.276	0	0	0	0	56.35	58.56	0.4
28	-4.05	38.47	0	38.47	0	0	0	0	33.96	-71.55	0.47
30	-4.35	31.654	0	31.654	0	0	0	0	15.02	-60.49	0.55
32	-4.65	27.688	0	27.688	0	0	0	0	-1.08	-51.58	0.64
34	-4.95	29.13	0	29.13	0	0	0	0	-14.66	-43.16	0.73
36	-5.25	30.572	0	30.572	0	0	0	0	-25.63	-34.31	0.81
38	-5.55	32.013	0	32.013	0	0	0	0	-33.84	-25.04	0.88
40	-5.85	33.455	0	33.455	0	0	0	0	-39.18	-15.32	0.94
42	-6.15	34.897	0	34.897	0	0	0	0	-41.5	-5.18	0.98
44	-6.4	36.098	0	36.098	0	0	0	0	-41.04	3.61	0.99
46	-6.7	37.54	0	37.54	0	0	0	0	-37.51	14.54	0.99
48	-7	38.982	22.752	38.982	22.752	0	0	0	-30.8	24.55	0.98
50	-7.3	40.424	50.054	40.424	50.054	0	0	0	-22.63	27.48	0.95
52	-7.6	56.291	50.857	56.291	50.857	0	0	0	-15.29	22.89	0.9
54	-7.9	58.23	68.807	58.23	68.807	0	0	0	-8.24	23.32	0.86
56	-8.2	60.168	73.264	60.168	73.264	0	0	0	-2	19.83	0.8
58	-8.5	62.107	75.847	62.107	75.847	0	0	0	3.05	15.85	0.75
60	-8.8	65.969	79.002	62.969	76.002	0	3	3	6.89	11.78	0.7
62	-9.1	69.83	82.188	63.83	76.188	0	6	6	9.55	7.92	0.65
64	-9.4	74.857	85.459	65.857	76.459	0	9	9	11.1	4.26	0.6
66	-9.7	80.898	88.853	68.898	76.853	0	12	12	11.69	1.29	0.56
68	-10	86.735	92.391	71.735	77.391	0	15	15	11.57	-0.92	0.53
70	-10.3	92.359	96.081	74.359	78.081	0	18	18	10.94	-2.47	0.5
72	-10.6	97.777	99.921	76.777	78.921	0	21	21	9.96	-3.46	0.48
74	-10.9	103	103.90	79	79.901	0	24	24	8.79	-4	0.46
76	-11.2	108.04	108.00	81.049	81.009	0	27	27	7.54	-4.2	0.44
78	-11.5	112.94	112.22	82.944	82.227	0	30	30	6.3	-4.13	0.43
80	-11.8	117.70	116.53	84.709	83.538	0	33	33	5.11	-3.88	0.43

82	-12.1	122.36	120.92	86.368	84.924	0	36	36	4.03	-3.5	0.42
84	-12.4	126.94	125.36	87.94	86.369	0	39	39	3.08	-3.06	0.42
86	-12.7	131.44	129.85	89.446	87.859	0	42	42	2.27	-2.58	0.41
88	-13	135.90	134.37	90.903	89.379	0	45	45	1.6	-2.11	0.41
90	-13.3	140.32	138.91	92.324	90.919	0	48	48	1.07	-1.66	0.41
92	-13.6	144.72	143.47	93.721	92.472	0	51	51	0.67	-1.25	0.41
94	-13.9	149.10	148.02	95.102	94.029	0	54	54	0.37	-0.89	0.41
96	-14.2	153.47	152.58	96.475	95.587	0	57	57	0.18	-0.58	0.41
98	-14.5	157.84	157.14	97.843	97.141	0	60	60	0.06	-0.33	0.41
100	-14.8	162.21	161.69	99.21	98.691	0	63	63	0.01	-0.13	0.41
102	-15	165.12	164.72	100.12	99.722	0	65	65	0	-0.01	0.42

P168.3x10/40 Stage: 6

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	41.213	0	41.213	0	0	0	0	0	3.09	0.75
2	-0.3	42.395	0	42.395	0	0	0	0	1.87	9.36	0.67
4	-0.6	43.37	0	43.37	0	0	0	0	7.55	22.16	0.59
6	-0.9	43.616	0	43.616	0	0	0	0	17.13	35.21	0.52
8	-1.2	42.256	0	42.256	0	0	0	0	30.63	48.24	0.46
10	-1.4	39.929	0	39.929	0	0	0	0	27.03	-41.5	0.42
12	-1.7	34.716	0	34.716	0	0	0	0	17.22	-29.88	0.38
14	-2	32.613	0	32.613	0	0	0	0	10.53	-19.92	0.34
16	-2.3	37.872	0	37.872	0	0	0	0	6.82	-9.74	0.31
18	-2.6	42.852	0	42.852	0	0	0	0	6.51	2.01	0.29
20	-2.9	47.273	0	47.273	0	0	0	0	10.06	15.21	0.27
22	-3.2	50.752	0	50.752	0	0	0	0	17.85	29.67	0.25
24	-3.5	52.787	0	52.787	0	0	0	0	30.21	45.08	0.24
26	-3.75	52.931	0	52.931	0	0	0	0	44.12	59.64	0.24
28	-4.05	50.897	0	50.897	0	0	0	0	24.14	-62.69	0.26
30	-4.35	47.129	0	47.129	0	0	0	0	8.73	-47.68	0.29
32	-4.65	46.385	0	46.385	0	0	0	0	-2.44	-33.88	0.33
34	-4.95	51.082	0	51.082	0	0	0	0	-9.43	-19.61	0.37
36	-5.25	55.625	0	55.625	0	0	0	0	-11.81	-3.94	0.4
38	-5.55	59.769	0	59.769	0	0	0	0	-9.19	13.06	0.42
40	-5.85	63.207	0	63.207	0	0	0	0	-1.19	31.27	0.44
42	-6.15	65.56	0	65.56	0	0	0	0	12.48	50.43	0.47
44	-6.4	66.389	0	66.389	0	0	0	0	9.11	-61.54	0.49
46	-6.7	66.109	0	66.109	0	0	0	0	-4.87	-41.62	0.52
48	-7	64.895	6.828	64.895	6.828	0	0	0	-12.92	-21.94	0.55
50	-7.3	63.163	36.081	63.163	36.081	0	0	0	-15.93	-6.84	0.57
52	-7.6	70.333	39.459	70.333	39.459	0	0	0	-16.46	-0.82	0.58
54	-7.9	69.845	59.379	69.845	59.379	0	0	0	-14.86	6.91	0.59
56	-8.2	69.489	65.699	69.489	65.699	0	0	0	-12.17	9.42	0.59
58	-8.5	69.338	69.977	69.338	69.977	0	0	0	-9.14	10.21	0.58
60	-8.8	71.359	74.626	68.359	71.626	0	3	3	-6.15	9.81	0.57
62	-9.1	73.646	79.09	67.646	73.09	0	6	6	-3.45	8.66	0.56
64	-9.4	77.365	83.423	68.365	74.423	0	9	9	-1.24	6.89	0.55
66	-9.7	82.351	87.674	70.351	75.674	0	12	12	0.42	5.13	0.53
68	-10	87.364	91.881	72.364	76.881	0	15	15	1.61	3.59	0.52
70	-10.3	92.369	96.073	74.369	78.073	0	18	18	2.39	2.29	0.5
72	-10.6	97.342	100.27	76.342	79.273	0	21	21	2.84	1.24	0.49
74	-10.9	102.26	104.49	78.269	80.495	0	24	24	3.02	0.42	0.48
76	-11.2	107.13	108.74	80.139	81.747	0	27	27	3	-0.2	0.47
78	-11.5	111.95	113.03	81.95	83.034	0	30	30	2.84	-0.64	0.46
80	-11.8	116.70	117.35	83.703	84.355	0	33	33	2.58	-0.94	0.45
82	-12.1	121.40	121.70	85.401	85.709	0	36	36	2.26	-1.1	0.44
84	-12.4	126.05	126.09	87.05	87.092	0	39	39	1.91	-1.17	0.44

86	-12.7	130.65	130.49	88.657	88.499	0	42	42	1.55	-1.17	0.43
88	-13	135.23	134.92	90.23	89.925	0	45	45	1.22	-1.11	0.43
90	-13.3	139.77	139.36	91.775	91.365	0	48	48	0.9	-1.01	0.42
92	-13.6	144.3	143.81	93.3	92.814	0	51	51	0.63	-0.88	0.42
94	-13.9	148.81	148.26	94.81	94.267	0	54	54	0.4	-0.73	0.42
96	-14.2	153.31	152.72	96.311	95.72	0	57	57	0.22	-0.57	0.42
98	-14.5	157.80	157.17	97.807	97.171	0	60	60	0.09	-0.39	0.41
100	-14.8	162.3	161.61	99.3	98.618	0	63	63	0.01	-0.19	0.41
102	-15	165.3	164.58	100.3	99.58	0	65	65	0	-0.02	0.41

P168.3x10/40 Stage: 7

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	41.507	0	41.507	0	0	0	0	0	3.11	0.74
2	-0.3	42.761	0	42.761	0	0	0	0	1.88	9.43	0.66
4	-0.6	43.806	0	43.806	0	0	0	0	7.61	22.35	0.58
6	-0.9	44.121	0	44.121	0	0	0	0	17.28	35.53	0.51
8	-1.2	42.826	0	42.826	0	0	0	0	30.91	48.71	0.45
10	-1.4	40.54	0	40.54	0	0	0	0	27.46	-40.65	0.41
12	-1.7	35.377	0	35.377	0	0	0	0	17.95	-28.84	0.37
14	-2	33.304	0	33.304	0	0	0	0	11.62	-18.68	0.33
16	-2.3	38.566	0	38.566	0	0	0	0	8.33	-8.29	0.3
18	-2.6	43.511	0	43.511	0	0	0	0	8.5	3.66	0.28
20	-2.9	47.845	0	47.845	0	0	0	0	12.59	17.06	0.26
22	-3.2	51.172	0	51.172	0	0	0	0	20.97	31.68	0.24
24	-3.5	52.977	0	52.977	0	0	0	0	33.96	47.2	0.24
26	-3.75	52.855	0	52.855	0	0	0	0	48.41	61.79	0.24
28	-4.05	50.402	0	50.402	0	0	0	0	29.05	-60.63	0.27
30	-4.35	46.09	0	46.09	0	0	0	0	14.22	-45.81	0.31
32	-4.65	44.661	0	44.661	0	0	0	0	3.53	-32.37	0.36
34	-4.95	48.522	0	48.522	0	0	0	0	-3.12	-18.68	0.41
36	-5.25	52.069	0	52.069	0	0	0	0	-5.41	-3.85	0.46
38	-5.55	55.054	0	55.054	0	0	0	0	-3.01	12.01	0.51
40	-5.85	57.176	0	57.176	0	0	0	0	4.33	28.71	0.56
42	-6.15	58.073	0	58.073	0	0	0	0	16.82	45.95	0.6
44	-6.4	57.605	0	57.605	0	0	0	0	11.21	-72.88	0.65
46	-6.7	55.727	0	55.727	0	0	0	0	-6.78	-55.71	0.71
48	-7	52.966	0	52.966	0	0	0	0	-19.77	-39.19	0.77
50	-7.3	49.863	0	49.863	0	0	0	0	-27.98	-23.53	0.81
52	-7.6	59.914	5.983	59.914	5.983	0	0	0	-31.71	-8.8	0.85
54	-7.9	58.929	23.933	58.929	23.933	0	0	0	-30.93	5.95	0.87
56	-8.2	60.168	41.882	60.168	41.882	0	0	0	-26.98	15.14	0.87
58	-8.5	62.107	59.832	62.107	59.832	0	0	0	-21.38	19.42	0.86
60	-8.8	65.969	70.81	62.969	67.81	0	3	3	-15.48	19.57	0.85
62	-9.1	69.83	78.378	63.83	72.378	0	6	6	-10.01	17.6	0.82
64	-9.4	73.692	82.523	64.692	73.523	0	9	9	-5.31	15.01	0.79
66	-9.7	77.553	86.491	65.553	74.491	0	12	12	-1.41	12.35	0.76
68	-10	81.415	90.358	66.415	75.358	0	15	15	1.69	9.67	0.73
70	-10.3	85.277	94.188	67.277	76.188	0	18	18	3.99	6.99	0.7
72	-10.6	90.369	98.029	69.369	77.029	0	21	21	5.49	4.37	0.67
74	-10.9	95.916	101.91	71.916	77.914	0	24	24	6.31	2.2	0.64
76	-11.2	101.34	105.86	74.347	78.864	0	27	27	6.58	0.51	0.61
78	-11.5	106.65	109.89	76.653	79.89	0	30	30	6.44	-0.74	0.59
80	-11.8	111.83	113.99	78.834	80.992	0	33	33	6.02	-1.63	0.57
82	-12.1	116.89	118.16	80.897	82.169	0	36	36	5.39	-2.21	0.56
84	-12.4	121.85	122.41	82.854	83.414	0	39	39	4.65	-2.53	0.54
86	-12.7	126.71	126.71	84.717	84.716	0	42	42	3.86	-2.65	0.53
88	-13	131.50	131.06	86.504	86.065	0	45	45	3.07	-2.62	0.52

90	-13.3	136.22	135.44	88.228	87.449	0	48	48	2.32	-2.46	0.52
92	-13.6	140.90	139.85	89.906	88.858	0	51	51	1.64	-2.21	0.51
94	-13.9	145.55	144.28	91.551	90.281	0	54	54	1.05	-1.87	0.5
96	-14.2	150.17	148.71	93.174	91.71	0	57	57	0.58	-1.48	0.5
98	-14.5	154.78	153.13	94.786	93.138	0	60	60	0.23	-1.02	0.49
100	-14.8	159.39	157.56	96.392	94.56	0	63	63	0.04	-0.52	0.49
102	-15	162.46	160.50	97.462	95.504	0	65	65	0	-0.05	0.48

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	240
3	249.168
4	244.704
5	241.92
6	243.84
7	243.192

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	340.08
5	361.896
6	349.32
7	349.44
8	0

Support 2

Stage No	R
	(kN)
0	0

1	0
2	0
3	0
4	0
5	0
6	340.08
7	353.112
8	0

Project: My Project
Results for Design Section 1: DM08_ITA: Comb. 1: A1+M1+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
1	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
2	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
3	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
4	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
5	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
6	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
7	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-7.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	206000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

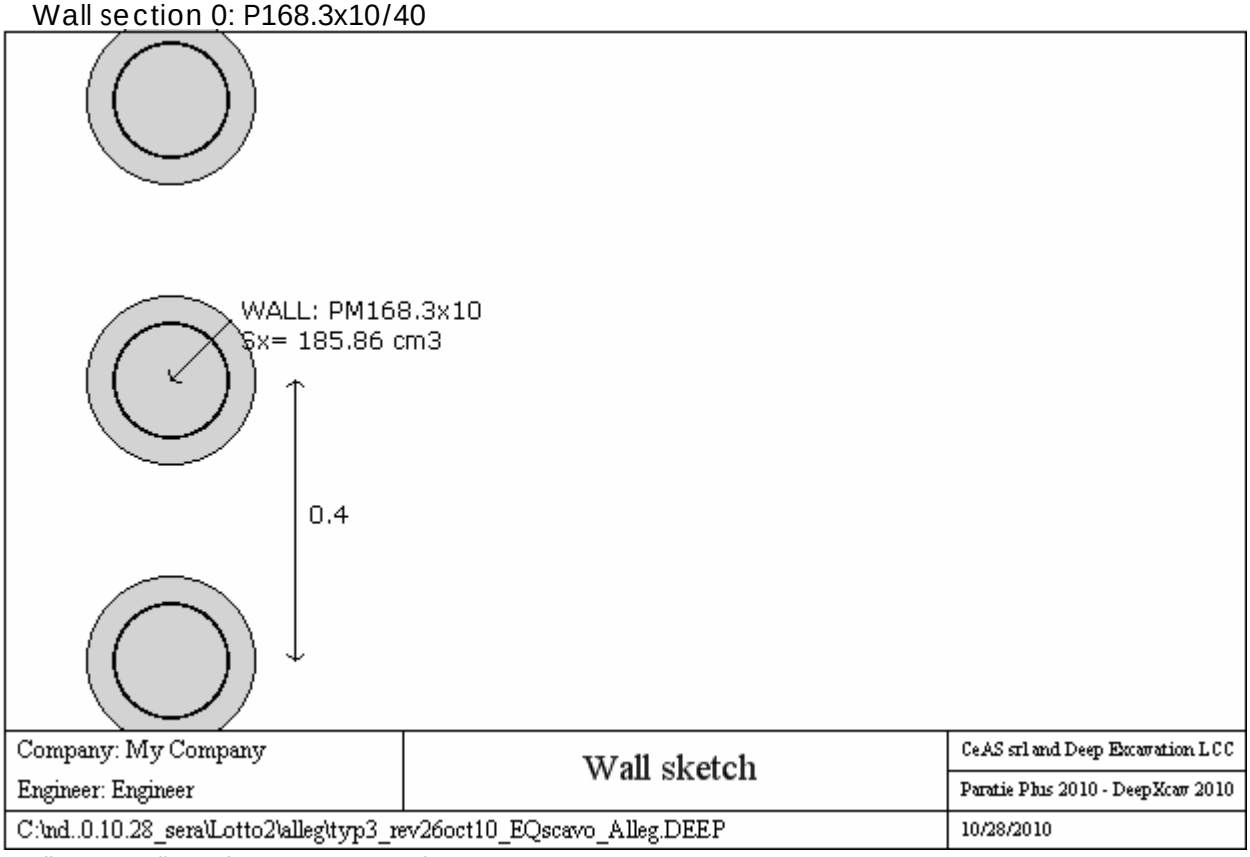
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -15 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 206000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	254.7	74.85	16.8	1	16.83	1	1	3705	185.9	7.04	3705	185.9	7.04	7.04	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	1.4	200100	226.7	226.7	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	5.56	210000	807	807	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	8.809	10.47	8.809
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	5.196	5.196	5.467
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	5.65	5.65	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.667	3.667	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.613	3.777	3.613
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.044	2.044	19.63
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.185	2.185	149.2
Stage 7	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.703	1.703	12.80

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.035	0	1	N/A
1	No		0.035	0	1	N/A
2	No		0.035	0	1	N/A
3	No		0.035	0	1	N/A
4	No		0.035	0	1	N/A
5	No		0.035	0	1	N/A
6	No		0.035	0	1	N/A
7	No		0.035	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 9.1 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -3.75 m, S = 2.4 m
Lfree = 8 m, Lfix = 12 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	340	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support 2: type = tieback
X = 0.24 m, Z = -6.25 m, S = 2.4 m
Lfree = 6 m, Lfix = 12 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	340	-	-
7	Yes	-	-	-

8	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -24, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-24	0	0	20	0	0	0	20
1	Yes	-24	0	0	20	0	0	0	20
2	Yes	-24	0	0	20	0	0	0	20
3	Yes	-24	0	0	20	0	0	0	20
4	Yes	-24	0	0	20	0	0	0	20
5	Yes	-24	0	0	20	0	0	0	20
6	Yes	-24	0	0	20	0	0	0	20
7	Yes	-24	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	312
3	325.385
4	319.613
5	315.775
6	318.24
7	317.366

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	442.104
5	472.68
6	456.331
7	456.425
8	0

Support 2

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	442.104
7	459.826

8	0

Project: My Project
Results for Design Section 2: DM08_ITA: Comb. 2: A2+M2+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
3	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
4	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
5	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
6	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1

7	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-7.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	206000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10

C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

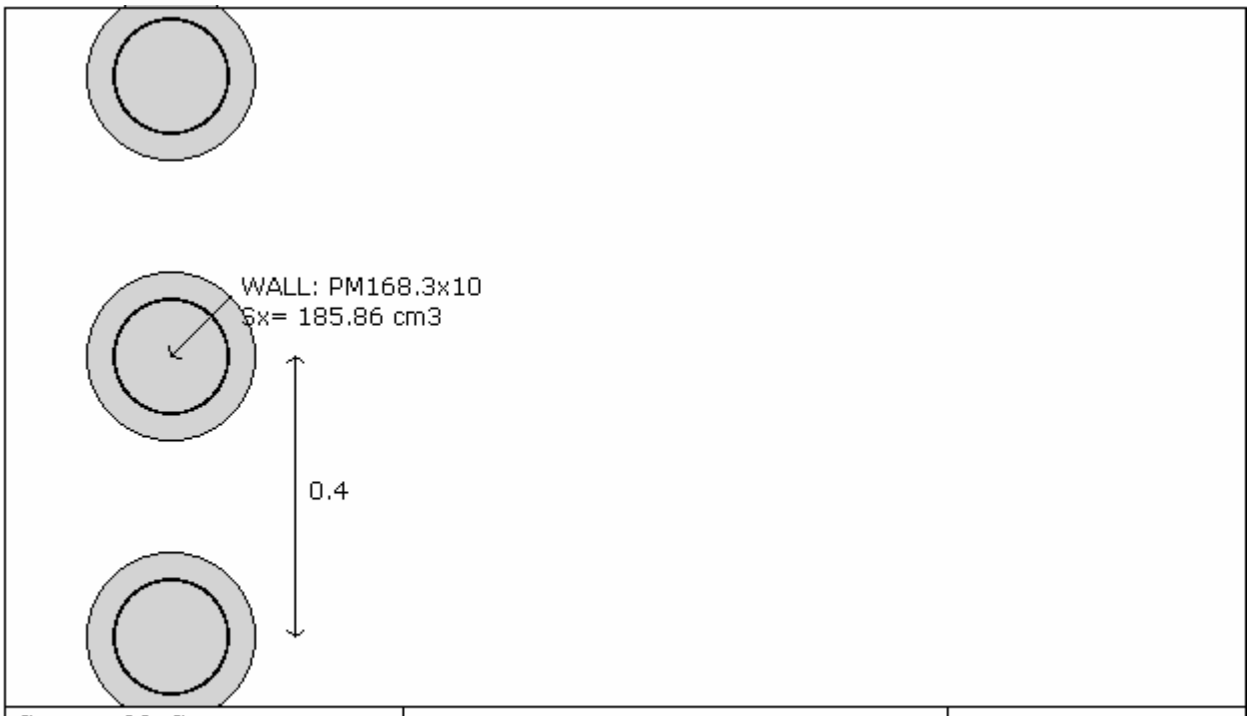
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Company: My Company Engineer: Engineer	Wall sketch	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ3_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010

Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -15 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'
Steel members fy = 355 Esteel = 206000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	254.7	74.85	16.8	1	16.83	1	1	3705	185.9	7.04	3705	185.9	7.04	7.04	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	1.4	200100	226.7	226.7	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	5.56	210000	807	807	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	7.084	8.181	7.084
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	4.168	4.168	4.472
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	4.679	4.679	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.052	3.052	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.001	3.152	3.001
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.714	1.714	10.55
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.834	1.834	37.72
Stage 7	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.43	1.43	7.055

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.035	0	1	N/A
1	No		0.035	0	1	N/A
2	No		0.035	0	1	N/A
3	No		0.035	0	1	N/A
4	No		0.035	0	1	N/A
5	No		0.035	0	1	N/A
6	No		0.035	0	1	N/A
7	No		0.035	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback

X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 9.1 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -3.75 m, S = 2.4 m
Lfree = 8 m, Lfix = 12 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	340	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support 2: type = tieback
X = 0.24 m, Z = -6.25 m, S = 2.4 m
Lfree = 6 m, Lfix = 12 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	340	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -24, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-24	0	0	20	0	0	0	20
1	Yes	-24	0	0	20	0	0	0	20
2	Yes	-24	0	0	20	0	0	0	20
3	Yes	-24	0	0	20	0	0	0	20
4	Yes	-24	0	0	20	0	0	0	20
5	Yes	-24	0	0	20	0	0	0	20
6	Yes	-24	0	0	20	0	0	0	20
7	Yes	-24	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	240
3	261.528
4	256.368
5	248.64
6	250.704
7	248.376

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	340.08
5	412.104
6	397.848
7	394.08
8	0

Support 2

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	340.08
7	381
8	0

Project: My Project
Results for Design Section 3: DM08_ITA: EQK - Seismic

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
3	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
4	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
5	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
6	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
7	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
8	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-7.5	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	206000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E

	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

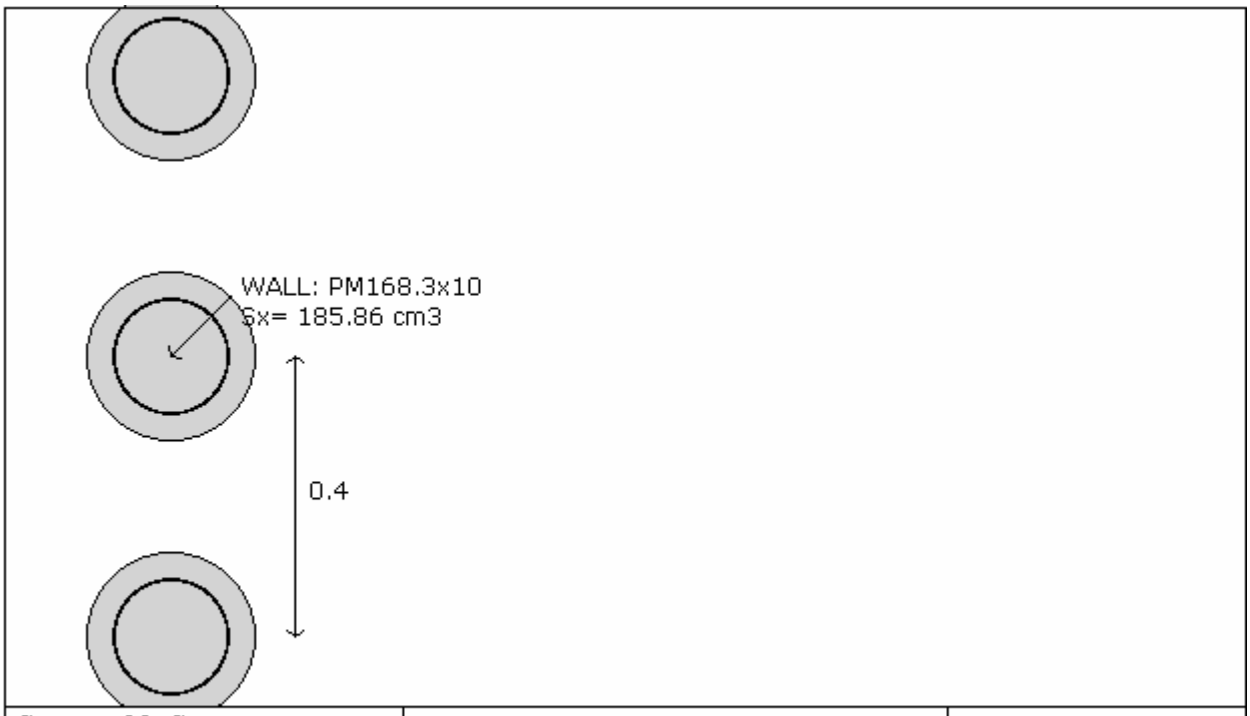
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P168.3x10/40



Company: My Company Engineer: Engineer	Wall sketch	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ3_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010

Wall uses wall section 0: P168.3x10/40
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -15 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'
Steel members fy = 355 Esteel = 206000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM16	254.7	74.85	16.8	1	16.83	1	1	3705	185.9	7.04	3705	185.9	7.04	7.04	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	1.4	200100	226.7	226.7	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	N/A	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	5.56	210000	807	807	N/A	1	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	7.084	8.181	7.084
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	4.391	4.391	4.625
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	4.779	4.779	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.118	3.118	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.07	3.211	3.07
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.747	1.747	11.89
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.864	1.864	44.06
Stage 7	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.454	1.454	7.504
Stage 8	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.54	1.54	10.15

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.035	0	1	N/A
1	No		0.035	0	1	N/A
2	No		0.035	0	1	N/A
3	No		0.035	0	1	N/A
4	No		0.035	0	1	N/A
5	No		0.035	0	1	N/A
6	No		0.035	0	1	N/A
7	No		0.035	0	1	N/A
8	Yes		0.035	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.25 m, S = 2.4 m
Lfree = 9.1 m, Lfix = 10 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	240	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -3.75 m, S = 2.4 m
Lfree = 8 m, Lfix = 12 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	340	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support 2: type = tieback
X = 0.24 m, Z = -6.25 m, S = 2.4 m
Lfree = 6 m, Lfix = 12 m, Rfix = 50 %
Walls: P168.3x10/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	340	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -24, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-24	0	0	20	0	0	0	20
1	Yes	-24	0	0	20	0	0	0	20
2	Yes	-24	0	0	20	0	0	0	20
3	Yes	-24	0	0	20	0	0	0	20
4	Yes	-24	0	0	20	0	0	0	20
5	Yes	-24	0	0	20	0	0	0	20
6	Yes	-24	0	0	20	0	0	0	20
7	Yes	-24	0	0	20	0	0	0	20
8	No	-24	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	240
3	256.848
4	251.688
5	244.824
6	246.888
7	244.968
8	220.644

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	340.08
5	398.736
6	384.48
7	381.456
8	374.616

Support 2

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	340.08

7	374.064
8	391.632

DeepXcav 2010: Report Output

A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:33:00 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ4_rev26oct10_EQscavo_Alleg.DEEP

DeepXcav 2010: Report Output

Copyright@2009 - 2010 Deep Excavation LLC: www.deepexcavation.com
A program for the evaluation of deep excavations

Project: My Project

Company: My Company
Prepared by engineer: Engineer
File number: 1
Time: 10/28/2010 9:33:00 PM

File: C:\nda\paratie\10.10.28_sera\Lotto2\alleg\typ4_rev26oct10_EQscavo_Alleg.DEEP

OBJECTIVES

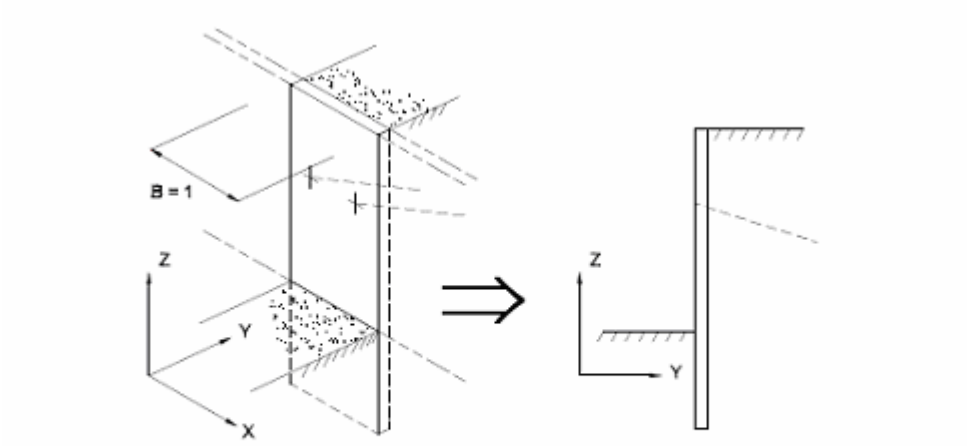
The objective of this document is to report the most imprortant results of the calculations

BIBLIOGRAPHIC REFERENCES

BECCI,B.,NOVA,R. (1987) “Un metodo di calcolo automatico per il progetto di paratie”, Rivista Italiana di

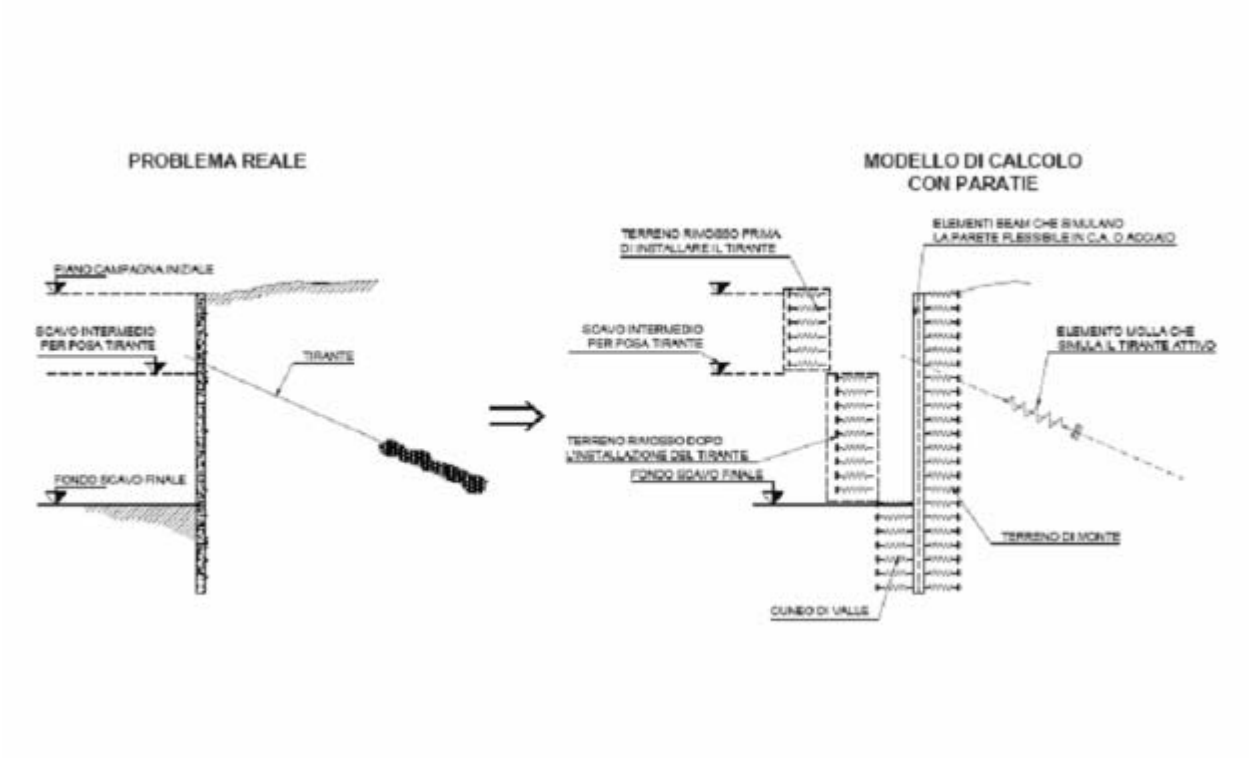
GENERAL CALCULATION ASSUMPTIONS

DEEP EXC is a program to simulate a the behaviuor of flexible diaphrams. It is possible to simulate all the different stages of excavation.
the program is able to perform both classic and non linear analysis.
For the non linear analysis a FEM model is used. The FEM model follow the well known beam on elasto plastic foundation approach. The wall is modeled using BEAM elements , the soil is simulate using a double system (for each part of the wall) of elasto plastic spring ,
An elasto plastic spring is connected on each node of the beam elements.
THe excavation procedure is performed through 2 types of analysis:
1) Classic analysis
2) Non linear analysis : every step represents an excavation phase with a defined configurations of excavations, loads, etc.
The non linear analysis has been performed using a full Newthon Raphson approach.



CONVENTIONS AND REFERENCE COORDINATE SYSTEMS

Loads, anelastic displacements, support reactions and displacements, are all referred to a rigthward coordinate system



ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
   (tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

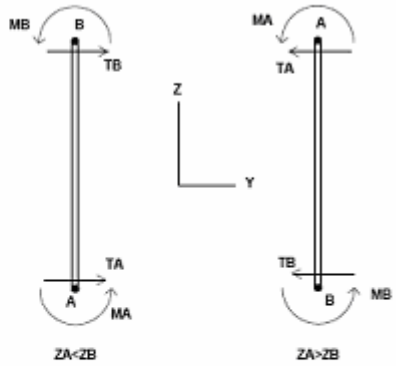


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
   (tutti per unità di profondità)

Checking of cross sections is performed according to the coordinate systems showed in the next figure

- X axis follow the 2 nodes direction of the beam elements , positive going from the first to the secondo node

ELEMENTO TRUSS

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. STRESS : SFORZO

ELEMENTO BEAM (vedi figura 11-1)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
   (tutti per unità di profondità)

ELEMENTO ELPL (MOLLA ELASTOPLASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. PLASTIC: DEFORMAZIONE PLASTICA

ELEMENTO WIRE (TIRANTE)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

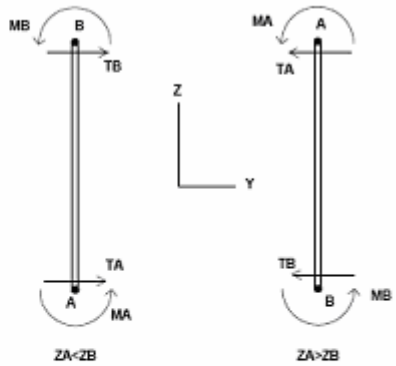


Figura 11-1: convenzioni di segno per l'elemento BEAM

ELEMENTO CELAS (MOLLA ELASTICA)

1. FORCE : FORZA NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ
2. MOMENT : MOMENTO NELL'ELEMENTO PER UNITÀ DI PROFONDITÀ

ELEMENTO SLAB (SOLETTA FRA DUE PARETI)

1. VA : TAGLIO AL PRIMO ESTREMO
2. VB : TAGLIO AL SECONDO ESTREMO
3. MA : MOMENTO AL PRIMO ESTREMO
4. MB : MOMENTO AL SECONDO ESTREMO
5. AXIAL : AZIONE ASSIALE
   (tutti per unità di profondità)

DESIGN CODES

Reference codes are:
- DM 2008 - "Norme tecniche per le costruzioni"
- CSLP, "Istruzioni per l'applicazione delle Notme tecniche per le costruzioni di cui al DM 14/1/2008"
- EC2 1-1 :2004, Eurocode 2 - Design of concrete structures
- Ec3 1-1:2005, Eurocodice 3 - Design of steel structures
- Ec3 5:2002, Eurocodice 3 - Design of steel sheet piles walls
- Ec8:2004 - Seismic design of structures
- AISC ASD 9th Edition, 1989
- AISC LRFD 2nd Edition, 2003
- ACI 318-2002
- AASHTO 2000 ADS / LRFD

DESIGN PARAMETERS

Project: My Project
Results for Design Section 0: Base Section - Service

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	Default	Service	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-10	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	206000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

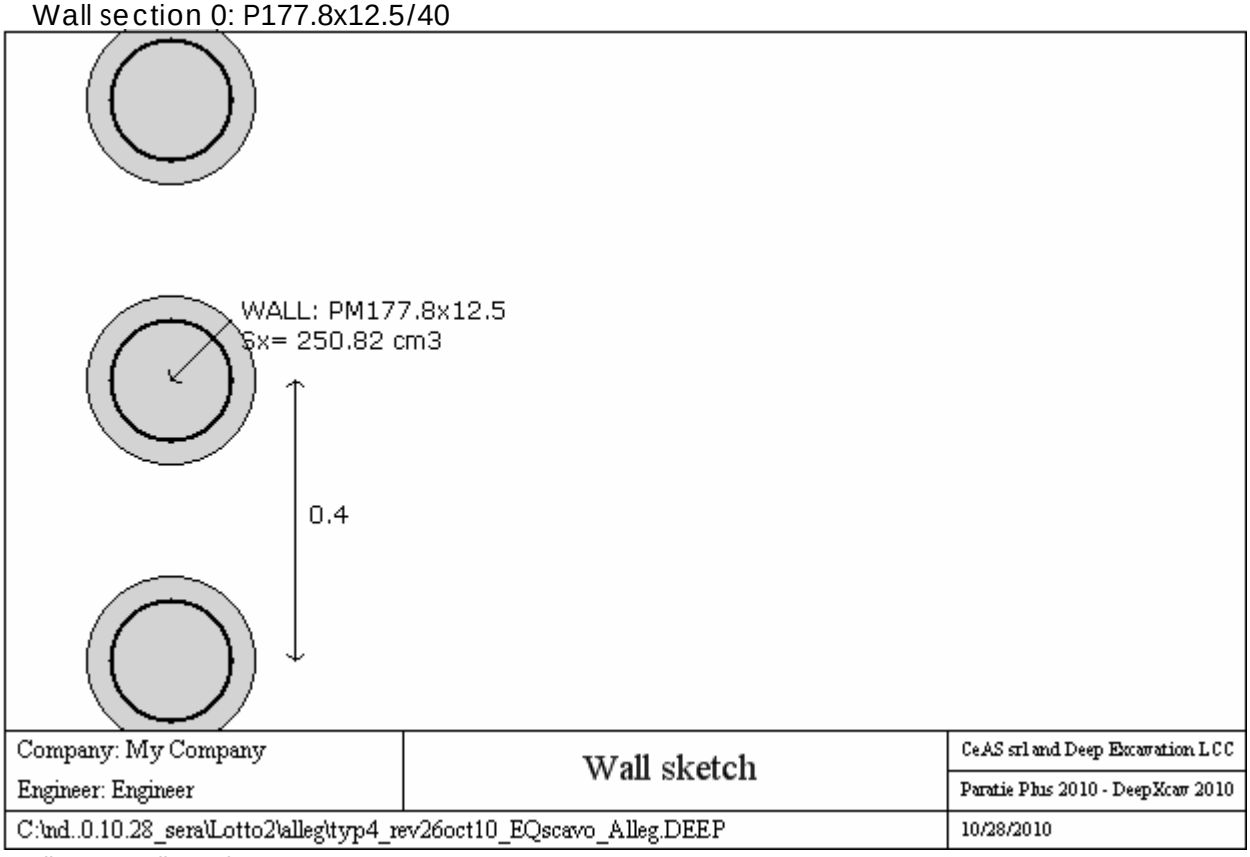
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P177.8x12.5/40



Wall uses wall section 2: P177.8x12.5
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -18 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 206000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM17	311.6	91.58	17.8	1.25	17.78	1.25	1.25	4274	250.8	6.83	4274	250.8	6.83	6.83	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

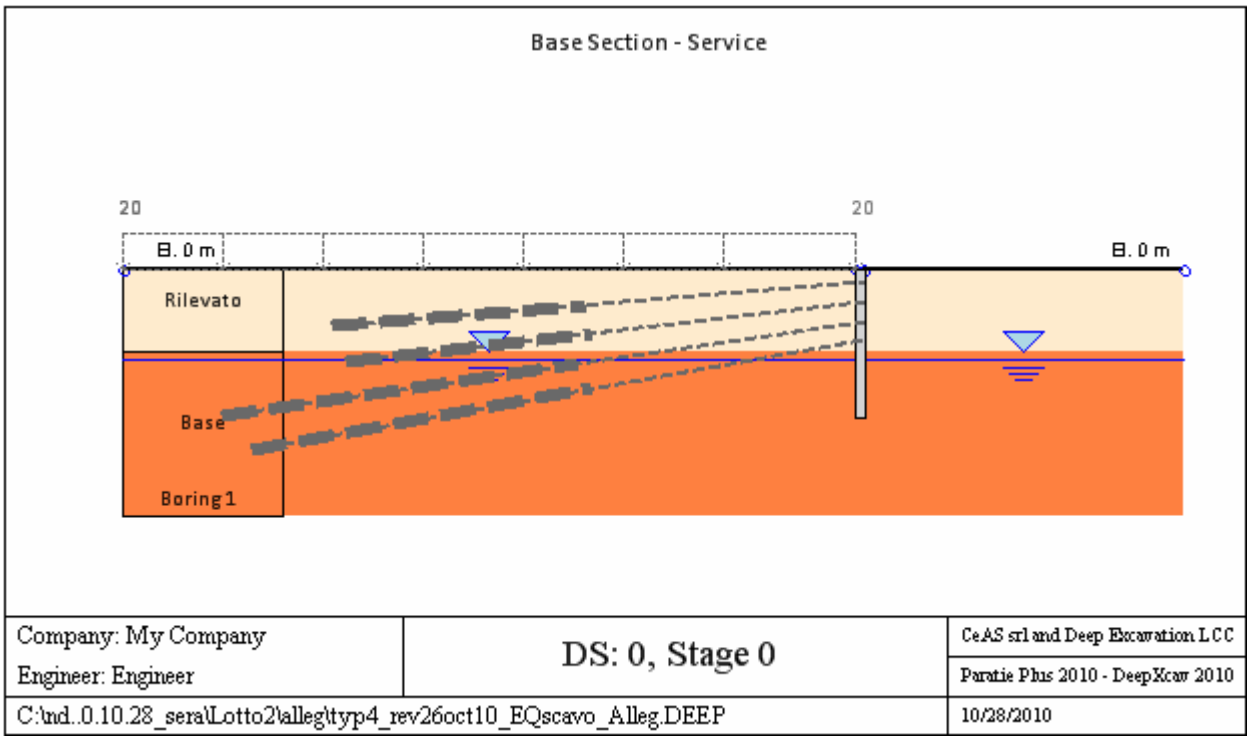
TIEBACK DATA

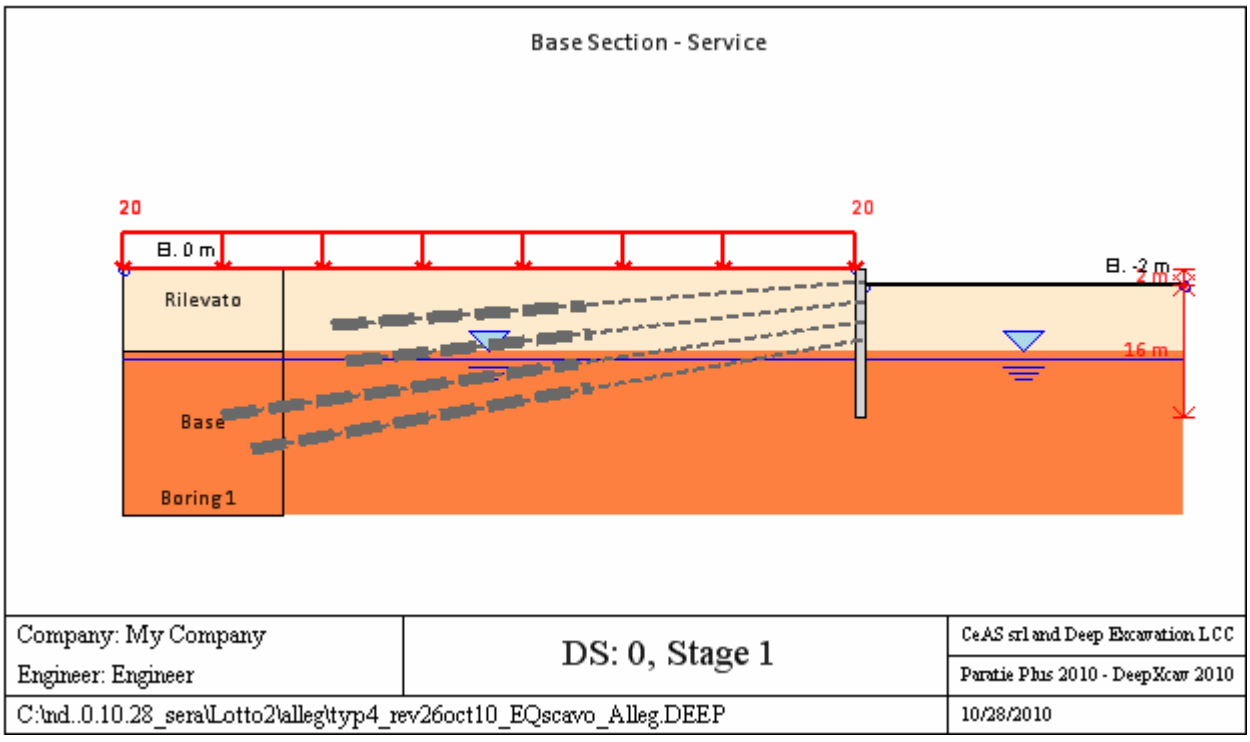
Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	1.4	200100	226.7	226.7	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	150	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	180	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	5.56	210000	807	807	N/A	1.4	False	N/A	N/A	Yes

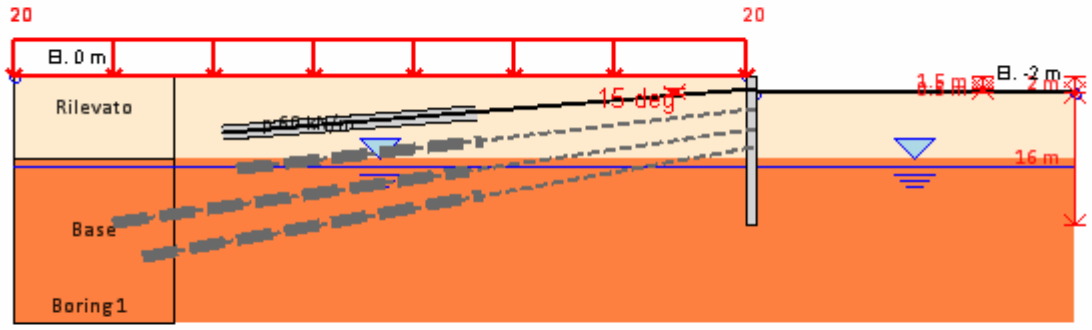
EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported





Base Section - Service



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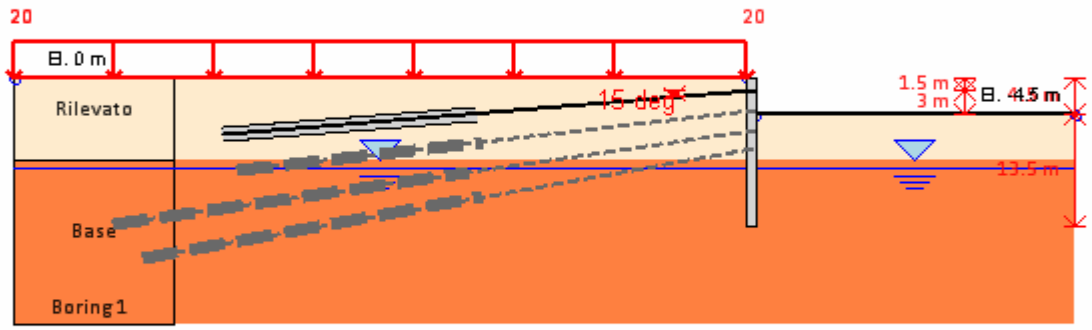
Base Section - Service



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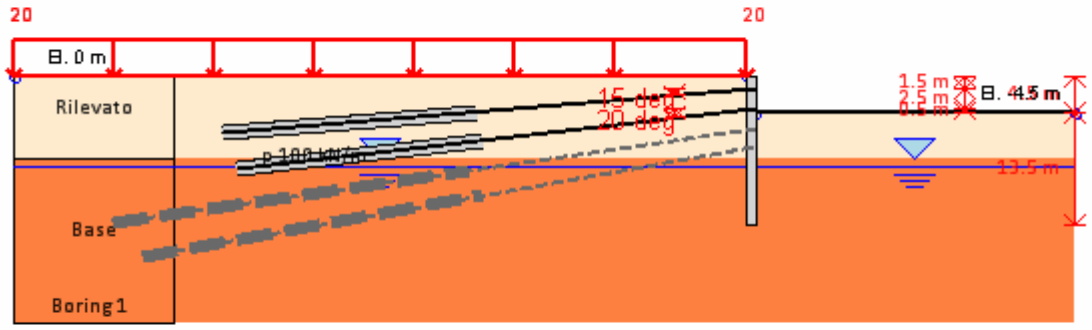
Base Section - Service



Company: My Company Engineer: Engineer	DS: 0, Stage 4	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
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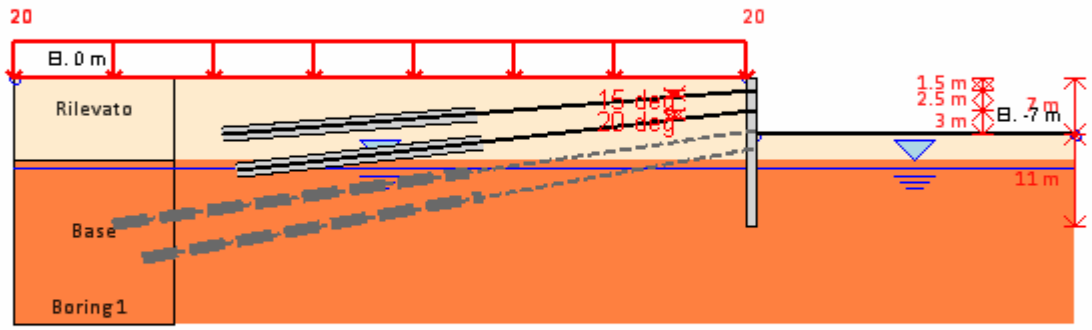
Base Section - Service



Company: My Company Engineer: Engineer	DS: 0, Stage 5	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
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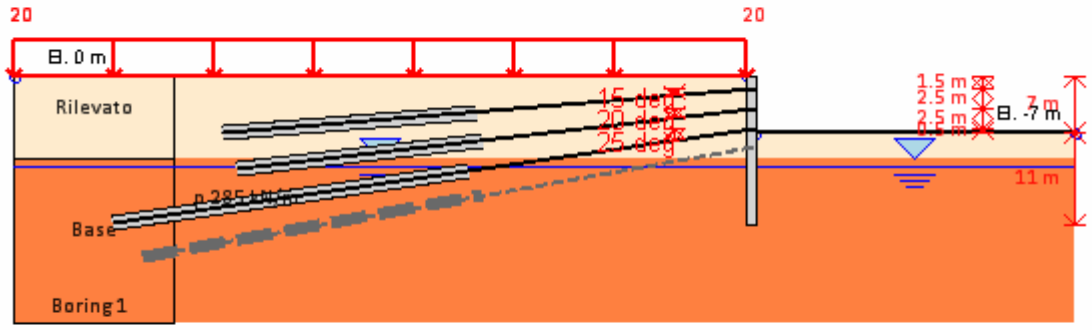
Base Section - Service



Company: My Company Engineer: Engineer	DS: 0, Stage 6	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
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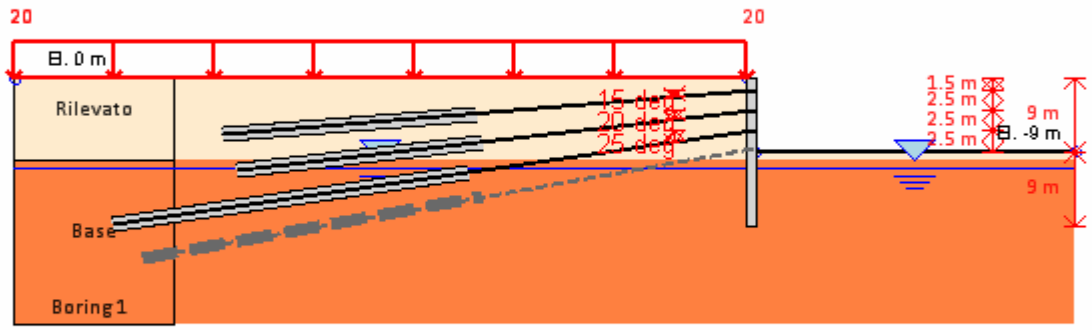
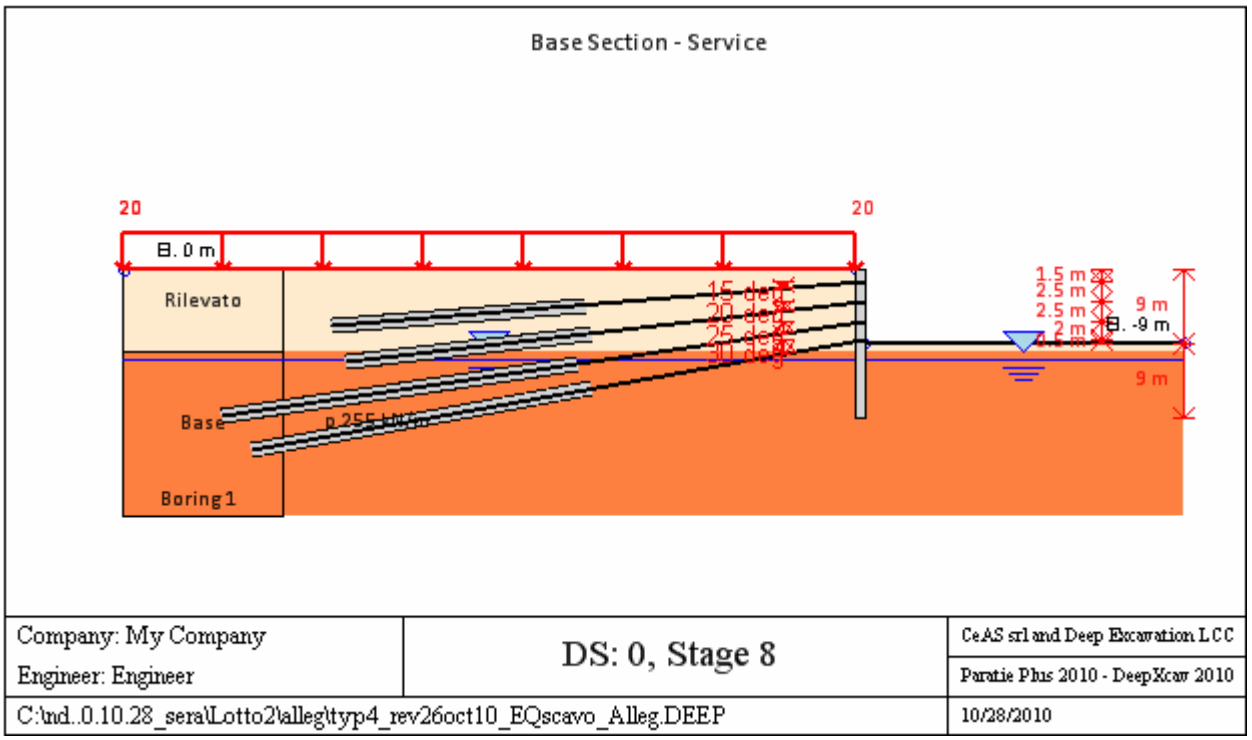
Base Section - Service



Company: My Company Engineer: Engineer	DS: 0, Stage 7	CeAS srl and Deep Excavation LCC Paratie Plus 2010 - DeepXcav 2010
C:\nd..0.10.28_sera\Lotto2\alleg\typ4_rev26oct10_EQscavo_Alleg.DEEP		10/28/2010



GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis Method	Drive Press	ka-Mult	Htr (%)	Resist Press	Res Mult	Contl Meth	Supp Mode	Axial Incl	Used FSwall	Min FDtoe	Toe FSrot	Toe FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	11.97	14.39	11.97
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	7.273	7.822	7.942
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	7.976	7.976	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	5.717	5.717	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	5.718	5.791	5.718
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.776	3.776	79.55
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.688	3.897	3.688
Stage 7	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.45	2.45	35.45
Stage 8	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.569	2.569	215.1

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage Number	Seismic g Used	Method Used	aX (g)	aY (g)	Beta	Building Code (Name)
0	No		0.028	0	1	N/A
1	No		0.028	0	1	N/A
2	No		0.028	0	1	N/A
3	No		0.028	0	1	N/A
4	No		0.028	0	1	N/A
5	No		0.028	0	1	N/A
6	No		0.028	0	1	N/A
7	No		0.028	0	1	N/A
8	No		0.028	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.5 m, S = 2.4 m
Lfree = 11 m, Lfix = 10 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active Yes/No	Prestress (kN)	Slab live load (kPa)	User add. strain +expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	145	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -4 m, S = 2.4 m
Lfree = 11 m, Lfix = 10 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active Yes/No	Prestress (kN)	Slab live load (kPa)	User add. strain +expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	240	-	-
5	Yes	-	-	-
6	Yes	-	-	-

7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support 2: type = tieback
X = 0.24 m, Z = -6.5 m, S = 2 m
Lfree = 12 m, Lfix = 15 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	570	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support 3: type = tieback
X = 0.24 m, Z = -8.5 m, S = 2 m
Lfree = 12 m, Lfix = 15 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	No	-	-	-
7	No	-	-	-
8	Yes	510	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -28, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-28	0	0	20	0	0	0	20
1	Yes	-28	0	0	20	0	0	0	20
2	Yes	-28	0	0	20	0	0	0	20
3	Yes	-28	0	0	20	0	0	0	20
4	Yes	-28	0	0	20	0	0	0	20
5	Yes	-28	0	0	20	0	0	0	20
6	Yes	-28	0	0	20	0	0	0	20
7	Yes	-28	0	0	20	0	0	0	20
8	Yes	-28	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

P177.8x12.5/40 Stage: 0

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	0	0	0	0	0	0	0	0	0	0
2	-0.3	2.538	2.538	2.538	2.538	0	0	0	0	0	0
4	-0.6	5.076	5.076	5.076	5.076	0	0	0	0	0	0
6	-0.9	7.614	7.614	7.614	7.614	0	0	0	0	0	0
8	-1.2	10.152	10.152	10.152	10.152	0	0	0	0	0	0
10	-1.5	12.69	12.69	12.69	12.69	0	0	0	0	0	0
12	-1.8	15.228	15.228	15.228	15.228	0	0	0	0	0	0
14	-2.1	17.766	17.766	17.766	17.766	0	0	0	0	0	0
16	-2.4	20.304	20.304	20.304	20.304	0	0	0	0	0	0
18	-2.7	22.842	22.842	22.842	22.842	0	0	0	0	0	0
20	-3	25.38	25.38	25.38	25.38	0	0	0	0	0	0
22	-3.3	27.918	27.918	27.918	27.918	0	0	0	0	0	0
24	-3.6	30.456	30.456	30.456	30.456	0	0	0	0	0	0
26	-3.9	32.994	32.994	32.994	32.994	0	0	0	0	0	0
28	-4.15	35.109	35.109	35.109	35.109	0	0	0	0	0	0
30	-4.45	37.647	37.647	37.647	37.647	0	0	0	0	0	0
32	-4.75	40.185	40.185	40.185	40.185	0	0	0	0	0	0
34	-5.05	42.723	42.723	42.723	42.723	0	0	0	0	0	0
36	-5.35	45.261	45.261	45.261	45.261	0	0	0	0	0	0
38	-5.65	47.799	47.799	47.799	47.799	0	0	0	0	0	0
40	-5.95	50.337	50.337	50.337	50.337	0	0	0	0	0	0
42	-6.25	52.875	52.875	52.875	52.875	0	0	0	0	0	0
44	-6.5	54.99	54.99	54.99	54.99	0	0	0	0	0	0

46	-6.8	57.528	57.528	57.528	57.528	0	0	0	0	0	0
48	-7.1	60.066	60.066	60.066	60.066	0	0	0	0	0	0
50	-7.4	62.604	62.604	62.604	62.604	0	0	0	0	0	0
52	-7.7	65.142	65.142	65.142	65.142	0	0	0	0	0	0
54	-8	67.68	67.68	67.68	67.68	0	0	0	0	0	0
56	-8.3	70.218	70.218	70.218	70.218	0	0	0	0	0	0
58	-8.5	71.91	71.91	71.91	71.91	0	0	0	0	0	0
60	-8.8	74.448	74.448	74.448	74.448	0	0	0	0	0	0
62	-9.1	76.986	76.986	76.986	76.986	0	0	0	0	0	0
64	-9.4	79.524	79.524	79.524	79.524	0	0	0	0	0	0
66	-9.7	82.062	82.062	82.062	82.062	0	0	0	0	0	0
68	-10	103.93	103.93	103.93	103.93	0	0	0	0	0	0
70	-10.3	107.05	107.05	107.05	107.05	0	0	0	0	0	0
72	-10.6	110.16	110.16	110.16	110.16	0	0	0	0	0	0
74	-10.9	113.28	113.28	113.28	113.28	0	0	0	0	0	0
76	-11.2	117.25	117.25	115.25	115.25	0	2	2	0	0	0
78	-11.5	121.63	121.63	116.63	116.63	0	5	5	0	0	0
80	-11.8	126.02	126.02	118.02	118.02	0	8	8	0	0	0
82	-12.1	130.4	130.4	119.4	119.4	0	11	11	0	0	0
84	-12.4	134.79	134.79	120.79	120.79	0	14	14	0	0	0
86	-12.7	139.17	139.17	122.17	122.17	0	17	17	0	0	0
88	-13	143.56	143.56	123.56	123.56	0	20	20	0	0	0
90	-13.3	147.95	147.95	124.95	124.95	0	23	23	0	0	0
92	-13.6	152.33	152.33	126.33	126.33	0	26	26	0	0	0
94	-13.9	156.72	156.72	127.72	127.72	0	29	29	0	0	0
96	-14.2	161.1	161.1	129.1	129.1	0	32	32	0	0	0
98	-14.5	165.49	165.49	130.49	130.49	0	35	35	0	0	0
100	-14.8	169.87	169.87	131.87	131.87	0	38	38	0	0	0
102	-15.1	174.26	174.26	133.26	133.26	0	41	41	0	0	0
104	-15.4	178.65	178.65	134.65	134.65	0	44	44	0	0	0
106	-15.7	183.03	183.03	136.03	136.03	0	47	47	0	0	0
108	-16	187.42	187.42	137.42	137.42	0	50	50	0	0	0
110	-16.3	191.8	191.8	138.8	138.8	0	53	53	0	0	0
112	-16.6	196.19	196.19	140.19	140.19	0	56	56	0	0	0
114	-16.9	200.57	200.57	141.57	141.57	0	59	59	0	0	0
116	-17.2	204.96	204.96	142.96	142.96	0	62	62	0	0	0
118	-17.5	209.35	209.35	144.35	144.35	0	65	65	0	0	0
120	-17.8	213.73	213.73	145.73	145.73	0	68	68	0	0	0
122	-18	216.65	216.65	146.65	146.65	0	70	70	0	0	0

P177.8x12.5/40 Stage: 1

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	5.34	0	5.34	0	0	0	0	0	0.4	1.29
2	-0.3	6.782	0	6.782	0	0	0	0	0.26	1.31	1.17
4	-0.6	8.224	0	8.224	0	0	0	0	1.12	3.45	1.05
6	-0.9	9.665	0	9.665	0	0	0	0	2.73	6.03	0.94
8	-1.2	11.107	0	11.107	0	0	0	0	5.21	9.04	0.82
10	-1.5	12.549	0	12.549	0	0	0	0	8.68	12.48	0.71
12	-1.8	13.991	0	13.991	0	0	0	0	13.29	16.35	0.6
14	-2.1	15.433	9.101	15.433	9.101	0	0	0	19.16	20.65	0.49
16	-2.4	16.874	36.403	16.874	36.403	0	0	0	25.49	20.61	0.4
18	-2.7	18.316	50.599	18.316	50.599	0	0	0	30.06	12.82	0.31
20	-3	19.758	44.405	19.758	44.405	0	0	0	31.82	3.73	0.24
22	-3.3	21.2	39.668	21.2	39.668	0	0	0	31.35	-3.17	0.18
24	-3.6	22.642	36.432	22.642	36.432	0	0	0	29.2	-8.34	0.13
26	-3.9	24.083	34.624	24.083	34.624	0	0	0	25.81	-12.2	0.09
28	-4.15	30.145	34.097	30.145	34.097	0	0	0	22.28	-14.52	0.07

30	-4.45	36.414	34.468	36.414	34.468	0	0	0	17.74	-15.21	0.05
32	-4.75	41.209	35.723	41.209	35.723	0	0	0	13.35	-14.32	0.04
34	-5.05	44.893	37.645	44.893	37.645	0	0	0	9.45	-12.52	0.04
36	-5.35	47.786	40.04	47.786	40.04	0	0	0	6.19	-10.28	0.03
38	-5.65	50.16	42.744	50.16	42.744	0	0	0	3.63	-7.97	0.03
40	-5.95	52.227	45.629	52.227	45.629	0	0	0	1.73	-5.8	0.04
42	-6.25	54.146	48.597	54.146	48.597	0	0	0	0.42	-3.9	0.04
44	-6.5	55.712	51.087	55.712	51.087	0	0	0	-0.29	-2.44	0.04
46	-6.8	57.612	54.058	57.612	54.058	0	0	0	-0.75	-1.25	0.05
48	-7.1	59.573	56.987	59.573	56.987	0	0	0	-0.9	-0.26	0.05
50	-7.4	61.606	59.869	61.606	59.869	0	0	0	-0.82	0.45	0.05
52	-7.7	63.705	62.706	63.705	62.706	0	0	0	-0.57	0.91	0.05
54	-8	65.852	65.512	65.852	65.512	0	0	0	-0.24	1.16	0.06
56	-8.3	68.018	68.304	68.018	68.304	0	0	0	0.12	1.21	0.06
58	-8.5	69.458	70.167	69.458	70.167	0	0	0	0.35	1.11	0.06
60	-8.8	71.592	72.975	71.592	72.975	0	0	0	0.64	0.88	0.06
62	-9.1	73.673	75.814	73.673	75.814	0	0	0	0.81	0.41	0.06
64	-9.4	75.689	78.691	75.689	78.691	0	0	0	0.78	-0.29	0.07
66	-9.7	77.643	81.606	77.643	81.606	0	0	0	0.48	-1.26	0.07
68	-10	105.01	101.45	105.01	101.45	0	0	0	-0.18	-2.53	0.07
70	-10.3	107.68	104.95	107.68	104.95	0	0	0	-0.71	-1.52	0.07
72	-10.6	110.4	108.41	110.4	108.41	0	0	0	-0.99	-0.76	0.08
74	-10.9	113.18	111.82	113.18	111.82	0	0	0	-1.09	-0.21	0.08
76	-11.2	116.86	116.02	114.86	114.02	0	2	2	-1.07	0.15	0.08
78	-11.5	121.04	120.58	116.04	115.58	0	5	5	-0.97	0.38	0.08
80	-11.8	125.27	125.1	117.27	117.1	0	8	8	-0.83	0.49	0.08
82	-12.1	129.55	129.58	118.55	118.58	0	11	11	-0.67	0.52	0.08
84	-12.4	133.87	134.02	119.87	120.02	0	14	14	-0.52	0.5	0.08
86	-12.7	138.22	138.44	121.22	121.44	0	17	17	-0.38	0.45	0.08
88	-13	142.6	142.84	122.6	122.84	0	20	20	-0.26	0.38	0.09
90	-13.3	146.99	147.23	123.99	124.23	0	23	23	-0.16	0.31	0.08
92	-13.6	151.39	151.61	125.39	125.61	0	26	26	-0.09	0.23	0.08
94	-13.9	155.79	155.99	126.79	126.99	0	29	29	-0.03	0.17	0.08
96	-14.2	160.2	160.36	128.2	128.36	0	32	32	0.01	0.11	0.08
98	-14.5	164.61	164.73	129.61	129.73	0	35	35	0.03	0.07	0.08
100	-14.8	169.02	169.11	131.02	131.11	0	38	38	0.04	0.03	0.08
102	-15.1	173.42	173.48	132.42	132.48	0	41	41	0.05	0.01	0.08
104	-15.4	177.82	177.86	133.82	133.86	0	44	44	0.05	-0.01	0.08
106	-15.7	182.22	182.24	135.22	135.24	0	47	47	0.04	-0.02	0.08
108	-16	186.61	186.62	136.61	136.62	0	50	50	0.03	-0.02	0.08
110	-16.3	191.01	191.01	138.01	138.01	0	53	53	0.03	-0.03	0.08
112	-16.6	195.4	195.39	139.4	139.39	0	56	56	0.02	-0.02	0.08
114	-16.9	199.79	199.78	140.79	140.78	0	59	59	0.01	-0.02	0.08
116	-17.2	204.18	204.16	142.18	142.16	0	62	62	0.01	-0.02	0.08
118	-17.5	208.57	208.55	143.57	143.55	0	65	65	0	-0.01	0.08
120	-17.8	212.96	212.94	144.96	144.94	0	68	68	0	-0.01	0.08
122	-18	215.89	215.86	145.89	145.86	0	70	70	0	0	0.08

P177.8x12.5/40 Stage: 2

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	20.171	0	20.171	0	0	0	0	0	1.51	1.22
2	-0.3	23.252	0	23.252	0	0	0	0	0.94	4.77	1.09
4	-0.6	26.263	0	26.263	0	0	0	0	3.98	11.97	0.97
6	-0.9	29.023	0	29.023	0	0	0	0	9.37	20.07	0.84
8	-1.2	31.217	0	31.217	0	0	0	0	17.38	28.95	0.72
10	-1.5	32.385	0	32.385	0	0	0	0	28.19	38.43	0.61
12	-1.8	32.161	0	32.161	0	0	0	0	24.4	-10.21	0.51

14	-2.1	31.002	0.481	31.002	0.481	0	0	0	23.5	-0.64	0.42
16	-2.4	29.464	28.667	29.464	28.667	0	0	0	25.04	6.37	0.34
18	-2.7	27.947	44.681	27.947	44.681	0	0	0	26.66	4.3	0.26
20	-3	26.7	40.139	26.7	40.139	0	0	0	26.86	-0.46	0.2
22	-3.3	25.857	36.806	25.857	36.806	0	0	0	25.85	-4.28	0.15
24	-3.6	25.464	34.698	25.464	34.698	0	0	0	23.84	-7.43	0.12
26	-3.9	25.512	33.746	25.512	33.746	0	0	0	21	-10.11	0.09
28	-4.15	30.718	33.745	30.718	33.745	0	0	0	18.1	-11.92	0.07
30	-4.45	36.275	34.554	36.275	34.554	0	0	0	14.38	-12.43	0.05
32	-4.75	40.636	36.075	40.636	36.075	0	0	0	10.8	-11.67	0.04
34	-5.05	44.098	38.134	44.098	38.134	0	0	0	7.63	-10.18	0.04
36	-5.35	46.922	40.571	46.922	40.571	0	0	0	4.99	-8.34	0.04
38	-5.65	49.327	43.256	49.327	43.256	0	0	0	2.91	-6.45	0.04
40	-5.95	51.486	46.084	51.486	46.084	0	0	0	1.38	-4.67	0.04
42	-6.25	53.527	48.978	53.527	48.978	0	0	0	0.33	-3.11	0.04
44	-6.5	55.201	51.401	55.201	51.401	0	0	0	-0.23	-1.92	0.05
46	-6.8	57.227	54.294	57.227	54.294	0	0	0	-0.58	-0.94	0.05
48	-7.1	59.3	57.155	59.3	57.155	0	0	0	-0.68	-0.12	0.05
50	-7.4	61.427	59.979	61.427	59.979	0	0	0	-0.58	0.47	0.05
52	-7.7	63.601	62.771	63.601	62.771	0	0	0	-0.35	0.85	0.05
54	-8	65.803	65.542	65.803	65.542	0	0	0	-0.04	1.06	0.06
56	-8.3	68.008	68.31	68.008	68.31	0	0	0	0.29	1.1	0.06
58	-8.5	69.467	70.161	69.467	70.161	0	0	0	0.5	0.99	0.06
60	-8.8	71.619	72.959	71.619	72.959	0	0	0	0.75	0.77	0.06
62	-9.1	73.709	75.792	73.709	75.792	0	0	0	0.88	0.32	0.06
64	-9.4	75.728	78.668	75.728	78.668	0	0	0	0.83	-0.37	0.07
66	-9.7	77.681	81.583	77.681	81.583	0	0	0	0.51	-1.32	0.07
68	-10	105.03	101.43	105.03	101.43	0	0	0	-0.16	-2.57	0.07
70	-10.3	107.7	104.93	107.7	104.93	0	0	0	-0.7	-1.55	0.07
72	-10.6	110.42	108.4	110.42	108.4	0	0	0	-0.99	-0.78	0.08
74	-10.9	113.19	111.81	113.19	111.81	0	0	0	-1.1	-0.22	0.08
76	-11.2	116.87	116.01	114.87	114.01	0	2	2	-1.08	0.15	0.08
78	-11.5	121.04	120.58	116.04	115.58	0	5	5	-0.98	0.38	0.08
80	-11.8	125.27	125.1	117.27	117.1	0	8	8	-0.84	0.49	0.08
82	-12.1	129.55	129.58	118.55	118.58	0	11	11	-0.68	0.53	0.08
84	-12.4	133.87	134.02	119.87	120.02	0	14	14	-0.53	0.51	0.08
86	-12.7	138.22	138.44	121.22	121.44	0	17	17	-0.39	0.45	0.08
88	-13	142.59	142.84	122.59	122.84	0	20	20	-0.26	0.38	0.09
90	-13.3	146.99	147.23	123.99	124.23	0	23	23	-0.17	0.31	0.08
92	-13.6	151.39	151.61	125.39	125.61	0	26	26	-0.09	0.24	0.08
94	-13.9	155.79	155.99	126.79	126.99	0	29	29	-0.03	0.17	0.08
96	-14.2	160.2	160.36	128.2	128.36	0	32	32	0	0.12	0.08
98	-14.5	164.61	164.73	129.61	129.73	0	35	35	0.03	0.07	0.08
100	-14.8	169.01	169.11	131.01	131.11	0	38	38	0.04	0.04	0.08
102	-15.1	173.42	173.48	132.42	132.48	0	41	41	0.05	0.01	0.08
104	-15.4	177.82	177.86	133.82	133.86	0	44	44	0.05	-0.01	0.08
106	-15.7	182.22	182.24	135.22	135.24	0	47	47	0.04	-0.02	0.08
108	-16	186.61	186.62	136.61	136.62	0	50	50	0.03	-0.02	0.08
110	-16.3	191.01	191.01	138.01	138.01	0	53	53	0.03	-0.03	0.08
112	-16.6	195.4	195.39	139.4	139.39	0	56	56	0.02	-0.02	0.08
114	-16.9	199.79	199.78	140.79	140.78	0	59	59	0.01	-0.02	0.08
116	-17.2	204.18	204.16	142.18	142.16	0	62	62	0.01	-0.02	0.08
118	-17.5	208.57	208.55	143.57	143.55	0	65	65	0	-0.01	0.08
120	-17.8	212.96	212.94	144.96	144.94	0	68	68	0	-0.01	0.08
122	-18	215.89	215.86	145.89	145.86	0	70	70	0	0	0.08

P177.8x12.5/40 Stage: 3

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx

Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	28.916	0	28.916	0	0	0	0	0	2.17	1.12
2	-0.3	24.353	0	24.353	0	0	0	0	1.25	6.16	1.08
4	-0.6	19.709	0	19.709	0	0	0	0	4.69	13.12	1.04
6	-0.9	14.789	0	14.789	0	0	0	0	9.9	18.68	1
8	-1.2	11.107	0	11.107	0	0	0	0	16.45	22.72	0.97
10	-1.5	12.549	0	12.549	0	0	0	0	24.03	26.16	0.94
12	-1.8	13.991	0	13.991	0	0	0	0	13.14	-35.31	0.92
14	-2.1	15.433	0	15.433	0	0	0	0	3.5	-31	0.91
16	-2.4	16.874	0	16.874	0	0	0	0	-4.74	-26.26	0.9
18	-2.7	18.316	0	18.316	0	0	0	0	-11.46	-21.09	0.88
20	-3	19.758	0	19.758	0	0	0	0	-16.54	-15.49	0.86
22	-3.3	21.2	0	21.2	0	0	0	0	-19.84	-9.46	0.84
24	-3.6	22.642	0	22.642	0	0	0	0	-21.22	-2.99	0.81
26	-3.9	24.083	0	24.083	0	0	0	0	-20.58	3.91	0.76
28	-4.15	25.285	0	25.285	0	0	0	0	-18.39	9.99	0.72
30	-4.45	26.727	0	26.727	0	0	0	0	-13.66	17.69	0.67
32	-4.75	28.169	22.752	28.169	22.752	0	0	0	-6.74	24.45	0.61
34	-5.05	29.61	46.885	29.61	46.885	0	0	0	0.67	24.14	0.54
36	-5.35	31.052	47.184	31.052	47.184	0	0	0	6.75	19.03	0.48
38	-5.65	32.494	47.359	32.494	47.359	0	0	0	11.39	14.29	0.42
40	-5.95	33.936	47.634	33.936	47.634	0	0	0	14.69	9.92	0.36
42	-6.25	35.377	48.123	35.377	48.123	0	0	0	16.75	5.89	0.31
44	-6.5	36.579	48.744	36.579	48.744	0	0	0	17.59	2.43	0.27
46	-6.8	40.381	49.771	40.381	49.771	0	0	0	17.6	-0.83	0.23
48	-7.1	45.434	51.117	45.434	51.117	0	0	0	16.76	-3.35	0.2
50	-7.4	49.901	52.773	49.901	52.773	0	0	0	15.4	-4.83	0.18
52	-7.7	53.828	54.724	53.828	54.724	0	0	0	13.78	-5.53	0.16
54	-8	57.262	56.945	57.262	56.945	0	0	0	12.08	-5.69	0.15
56	-8.3	60.252	59.413	60.252	59.413	0	0	0	10.4	-5.55	0.14
58	-8.5	62.022	61.183	62.022	61.183	0	0	0	9.32	-5.34	0.14
60	-8.8	64.375	64.007	64.375	64.007	0	0	0	7.76	-5.15	0.14
62	-9.1	66.408	67.012	66.408	67.012	0	0	0	6.23	-5.11	0.14
64	-9.4	68.172	70.168	68.172	70.168	0	0	0	4.64	-5.38	0.15
66	-9.7	69.729	73.439	69.729	73.439	0	0	0	2.88	-6.11	0.16
68	-10	98.914	90.519	98.914	90.519	0	0	0	0.77	-7.36	0.16
70	-10.3	101.21	94.438	101.21	94.438	0	0	0	-0.89	-4.96	0.17
72	-10.6	103.55	98.311	103.55	98.311	0	0	0	-1.94	-3.05	0.18
74	-10.9	105.98	102.11	105.98	102.11	0	0	0	-2.51	-1.58	0.19
76	-11.2	109.35	106.62	107.35	104.62	0	2	2	-2.74	-0.51	0.2
78	-11.5	113.25	111.44	108.25	106.44	0	5	5	-2.72	0.23	0.2
80	-11.8	117.26	116.18	109.26	108.18	0	8	8	-2.54	0.72	0.21
82	-12.1	121.36	120.84	110.36	109.84	0	11	11	-2.26	1	0.21
84	-12.4	125.55	125.43	111.55	111.43	0	14	14	-1.93	1.12	0.21
86	-12.7	129.8	129.96	112.8	112.96	0	17	17	-1.59	1.13	0.21
88	-13	134.11	134.45	114.11	114.45	0	20	20	-1.26	1.07	0.21
90	-13.3	138.47	138.9	115.47	115.9	0	23	23	-0.97	0.96	0.22
92	-13.6	142.85	143.32	116.85	117.32	0	26	26	-0.71	0.83	0.22
94	-13.9	147.26	147.73	118.26	118.73	0	29	29	-0.49	0.69	0.22
96	-14.2	151.68	152.12	119.68	120.12	0	32	32	-0.32	0.55	0.21
98	-14.5	156.11	156.5	121.11	121.5	0	35	35	-0.18	0.42	0.21
100	-14.8	160.55	160.88	122.55	122.88	0	38	38	-0.08	0.31	0.21
102	-15.1	164.98	165.26	123.98	124.26	0	41	41	-0.01	0.21	0.21
104	-15.4	169.42	169.64	125.42	125.64	0	44	44	0.04	0.13	0.21
106	-15.7	173.85	174.02	126.85	127.02	0	47	47	0.06	0.07	0.21
108	-16	178.28	178.4	128.28	128.4	0	50	50	0.07	0.02	0.21
110	-16.3	182.7	182.79	129.7	129.79	0	53	53	0.07	-0.02	0.21
112	-16.6	187.12	187.17	131.12	131.17	0	56	56	0.06	-0.04	0.21

114	-16.9	191.54	191.56	132.54	132.56	0	59	59	0.04	-0.05	0.21
116	-17.2	195.96	195.94	133.96	133.94	0	62	62	0.03	-0.05	0.21
118	-17.5	200.38	200.33	135.38	135.33	0	65	65	0.01	-0.04	0.21
120	-17.8	204.8	204.71	136.8	136.71	0	68	68	0	-0.03	0.21
122	-18	207.74	207.64	137.74	137.64	0	70	70	0	0	0.21

P177.8x12.5/40 Stage: 4

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	22.256	0	22.256	0	0	0	0	0	1.67	1.19
2	-0.3	20.152	0	20.152	0	0	0	0	0.98	4.85	1.12
4	-0.6	17.979	0	17.979	0	0	0	0	3.77	10.73	1.06
6	-0.9	15.565	0	15.565	0	0	0	0	8.18	15.96	0.99
8	-1.2	14.452	0	14.452	0	0	0	0	13.98	20.42	0.93
10	-1.5	18.553	0	18.553	0	0	0	0	21.13	25.06	0.87
12	-1.8	22.756	0	22.756	0	0	0	0	10.77	-32.98	0.82
14	-2.1	27.043	0	27.043	0	0	0	0	2.46	-25.83	0.78
16	-2.4	31.365	0	31.365	0	0	0	0	-3.42	-17.4	0.73
18	-2.7	35.632	0	35.632	0	0	0	0	-6.47	-7.67	0.69
20	-3	39.71	0	39.71	0	0	0	0	-6.32	3.33	0.64
22	-3.3	43.404	0	43.404	0	0	0	0	-2.59	15.53	0.59
24	-3.6	46.454	0	46.454	0	0	0	0	5.03	28.8	0.54
26	-3.9	48.527	0	48.527	0	0	0	0	16.84	42.91	0.49
28	-4.15	49.237	0	49.237	0	0	0	0	15.9	-38.87	0.46
30	-4.45	48.956	0	48.956	0	0	0	0	7.56	-24.1	0.42
32	-4.75	47.885	10.636	47.885	10.636	0	0	0	3.61	-9.56	0.39
34	-5.05	46.421	36.554	46.421	36.554	0	0	0	2.92	-0.67	0.36
36	-5.35	44.865	38.696	44.865	38.696	0	0	0	3.34	2.01	0.32
38	-5.65	43.426	40.641	43.426	40.641	0	0	0	4.32	3.6	0.3
40	-5.95	42.243	42.529	42.243	42.529	0	0	0	5.55	4.2	0.27
42	-6.25	41.392	44.428	41.392	44.428	0	0	0	6.76	3.9	0.24
44	-6.5	40.961	46.051	40.961	46.051	0	0	0	7.57	2.91	0.22
46	-6.8	43.14	48.075	43.14	48.075	0	0	0	8.11	1.38	0.2
48	-7.1	46.919	50.204	46.919	50.204	0	0	0	8.22	0.04	0.19
50	-7.4	50.427	52.451	50.427	52.451	0	0	0	8.02	-0.85	0.17
52	-7.7	53.665	54.823	53.665	54.823	0	0	0	7.64	-1.38	0.16
54	-8	56.638	57.328	56.638	57.328	0	0	0	7.15	-1.69	0.16
56	-8.3	59.349	59.967	59.349	59.967	0	0	0	6.6	-1.88	0.15
58	-8.5	61.013	61.803	61.013	61.803	0	0	0	6.2	-2.05	0.15
60	-8.8	63.301	64.667	63.301	64.667	0	0	0	5.54	-2.28	0.15
62	-9.1	65.352	67.662	65.352	67.662	0	0	0	4.76	-2.76	0.16
64	-9.4	67.188	70.773	67.188	70.773	0	0	0	3.76	-3.54	0.16
66	-9.7	68.849	73.98	68.849	73.98	0	0	0	2.44	-4.73	0.17
68	-10	98.365	90.965	98.365	90.965	0	0	0	0.66	-6.39	0.17
70	-10.3	100.75	94.81	100.75	94.81	0	0	0	-0.78	-4.28	0.18
72	-10.6	103.18	98.61	103.18	98.61	0	0	0	-1.68	-2.6	0.19
74	-10.9	105.69	102.34	105.69	102.34	0	0	0	-2.16	-1.33	0.19
76	-11.2	109.13	106.79	107.13	104.79	0	2	2	-2.35	-0.4	0.2
78	-11.5	113.1	111.57	108.1	106.57	0	5	5	-2.32	0.24	0.2
80	-11.8	117.16	116.26	109.16	108.26	0	8	8	-2.15	0.65	0.21
82	-12.1	121.3	120.89	110.3	109.89	0	11	11	-1.91	0.88	0.21
84	-12.4	125.52	125.45	111.52	111.45	0	14	14	-1.62	0.97	0.21
86	-12.7	129.8	129.96	112.8	112.96	0	17	17	-1.32	0.98	0.21
88	-13	134.13	134.44	114.13	114.44	0	20	20	-1.04	0.91	0.21
90	-13.3	138.49	138.88	115.49	115.88	0	23	23	-0.79	0.82	0.21
92	-13.6	142.89	143.3	116.89	117.3	0	26	26	-0.57	0.7	0.21
94	-13.9	147.3	147.7	118.3	118.7	0	29	29	-0.39	0.57	0.21
96	-14.2	151.72	152.09	119.72	120.09	0	32	32	-0.25	0.45	0.21

98	-14.5	156.15	156.48	121.15	121.48	0	35	35	-0.14	0.35	0.21
100	-14.8	160.58	160.86	122.58	122.86	0	38	38	-0.05	0.25	0.21
102	-15.1	165.01	165.24	124.01	124.24	0	41	41	0	0.17	0.21
104	-15.4	169.44	169.62	125.44	125.62	0	44	44	0.04	0.1	0.21
106	-15.7	173.86	174.01	126.86	127.01	0	47	47	0.06	0.05	0.21
108	-16	178.29	178.39	128.29	128.39	0	50	50	0.06	0.01	0.21
110	-16.3	182.71	182.78	129.71	129.78	0	53	53	0.06	-0.02	0.21
112	-16.6	187.13	187.17	131.13	131.17	0	56	56	0.05	-0.04	0.21
114	-16.9	191.55	191.55	132.55	132.55	0	59	59	0.04	-0.05	0.21
116	-17.2	195.96	195.94	133.96	133.94	0	62	62	0.02	-0.05	0.21
118	-17.5	200.38	200.33	135.38	135.33	0	65	65	0.01	-0.04	0.21
120	-17.8	204.79	204.72	136.79	136.72	0	68	68	0	-0.02	0.21
122	-18	207.74	207.65	137.74	137.65	0	70	70	0	0	0.21

P177.8x12.5/40 Stage: 5

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	31.875	0	31.875	0	0	0	0	0	2.39	1.03
2	-0.3	28.238	0	28.238	0	0	0	0	1.39	6.9	0.99
4	-0.6	24.52	0	24.52	0	0	0	0	5.33	15.1	0.94
6	-0.9	20.523	0	20.523	0	0	0	0	11.47	22.16	0.91
8	-1.2	17.747	0	17.747	0	0	0	0	19.45	27.99	0.87
10	-1.5	20.055	0	20.055	0	0	0	0	29.07	33.48	0.85
12	-1.8	22.275	0	22.275	0	0	0	0	21.48	-23.7	0.83
14	-2.1	24.326	0	24.326	0	0	0	0	15.9	-16.86	0.83
16	-2.4	26.094	0	26.094	0	0	0	0	12.51	-9.42	0.83
18	-2.7	27.431	0	27.431	0	0	0	0	11.46	-1.48	0.83
20	-3	28.155	0	28.155	0	0	0	0	12.88	6.81	0.84
22	-3.3	28.042	0	28.042	0	0	0	0	16.82	15.27	0.86
24	-3.6	26.829	0	26.829	0	0	0	0	23.28	23.61	0.88
26	-3.9	24.211	0	24.211	0	0	0	0	32.16	31.5	0.91
28	-4.15	25.285	0	25.285	0	0	0	0	25.8	-65.39	0.95
30	-4.45	26.727	0	26.727	0	0	0	0	7.9	-57.7	1
32	-4.75	28.169	0	28.169	0	0	0	0	-7.58	-49.57	1.06
34	-5.05	29.61	0	29.61	0	0	0	0	-20.54	-41.01	1.11
36	-5.35	31.052	0	31.052	0	0	0	0	-30.82	-32.02	1.16
38	-5.65	32.494	0	32.494	0	0	0	0	-38.32	-22.6	1.19
40	-5.95	33.936	0	33.936	0	0	0	0	-42.89	-12.74	1.21
42	-6.25	35.377	0	35.377	0	0	0	0	-44.4	-2.45	1.21
44	-6.5	36.579	0	36.579	0	0	0	0	-43.24	7.37	1.19
46	-6.8	38.021	0	38.021	0	0	0	0	-38.82	17.54	1.16
48	-7.1	39.463	9.101	39.463	9.101	0	0	0	-30.97	29.05	1.11
50	-7.4	40.904	36.403	40.904	36.403	0	0	0	-20.5	36.22	1.05
52	-7.7	42.346	61.65	42.346	61.65	0	0	0	-9.62	35.63	0.98
54	-8	43.788	63.303	43.788	63.303	0	0	0	-0.24	29.81	0.91
56	-8.3	45.23	64.579	45.23	64.579	0	0	0	7.39	23.97	0.84
58	-8.5	46.191	65.362	46.191	65.362	0	0	0	11.51	19.14	0.79
60	-8.8	47.633	66.568	47.633	66.568	0	0	0	16.25	14.37	0.72
62	-9.1	49.075	67.925	49.075	67.925	0	0	0	19.28	8.7	0.66
64	-9.4	50.516	69.51	50.516	69.51	0	0	0	20.62	3.04	0.61
66	-9.7	51.958	71.359	51.958	71.359	0	0	0	20.24	-2.69	0.56
68	-10	83.471	82.903	83.471	82.903	0	0	0	18.12	-8.55	0.53
70	-10.3	87.384	85.925	87.384	85.925	0	0	0	15.61	-8.31	0.5
72	-10.6	91.057	89.083	91.057	89.083	0	0	0	13.22	-7.82	0.48
74	-10.9	94.551	92.339	94.551	92.339	0	0	0	11.01	-7.21	0.46
76	-11.2	98.757	96.362	96.757	94.362	0	2	2	9	-6.53	0.45
78	-11.5	103.28	100.80	98.288	95.801	0	5	5	7.2	-5.81	0.44
80	-11.8	107.75	105.29	99.75	97.291	0	8	8	5.63	-5.06	0.43

82	-12.1	112.16	109.81	101.16	98.813	0	11	11	4.27	-4.33	0.43
84	-12.4	116.54	114.36	102.54	100.36	0	14	14	3.13	-3.64	0.43
86	-12.7	120.9	118.91	103.9	101.91	0	17	17	2.19	-2.99	0.43
88	-13	125.25	123.47	105.25	103.47	0	20	20	1.42	-2.41	0.43
90	-13.3	129.59	128.03	106.59	105.03	0	23	23	0.81	-1.89	0.43
92	-13.6	133.93	132.58	107.93	106.58	0	26	26	0.35	-1.44	0.43
94	-13.9	138.27	137.13	109.27	108.13	0	29	29	0.01	-1.05	0.43
96	-14.2	142.62	141.67	110.62	109.67	0	32	32	-0.23	-0.72	0.43
98	-14.5	146.97	146.2	111.97	111.2	0	35	35	-0.39	-0.45	0.43
100	-14.8	151.33	150.72	113.33	112.72	0	38	38	-0.47	-0.23	0.43
102	-15.1	155.7	155.23	114.7	114.23	0	41	41	-0.5	-0.06	0.43
104	-15.4	160.08	159.74	116.08	115.74	0	44	44	-0.49	0.07	0.43
106	-15.7	164.46	164.23	117.46	117.23	0	47	47	-0.45	0.17	0.44
108	-16	168.84	168.72	118.84	118.72	0	50	50	-0.38	0.23	0.44
110	-16.3	173.24	173.19	120.24	120.19	0	53	53	-0.31	0.26	0.44
112	-16.6	177.63	177.67	121.63	121.67	0	56	56	-0.23	0.26	0.44
114	-16.9	182.03	182.14	123.03	123.14	0	59	59	-0.15	0.25	0.44
116	-17.2	186.43	186.6	124.43	124.6	0	62	62	-0.09	0.21	0.44
118	-17.5	190.83	191.06	125.83	126.06	0	65	65	-0.04	0.15	0.44
120	-17.8	195.23	195.52	127.23	127.52	0	68	68	-0.01	0.08	0.44
122	-18	198.17	198.49	128.17	128.49	0	70	70	0	0.01	0.44

P177.8x12.5/40 Stage: 6

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	23.521	0	23.521	0	0	0	0	0	1.76	1.17
2	-0.3	20.926	0	20.926	0	0	0	0	1.03	5.1	1.11
4	-0.6	18.261	0	18.261	0	0	0	0	3.94	11.18	1.05
6	-0.9	15.35	0	15.35	0	0	0	0	8.5	16.44	1
8	-1.2	13.733	0	13.733	0	0	0	0	14.43	20.81	0.94
10	-1.5	17.319	0	17.319	0	0	0	0	21.64	25.19	0.89
12	-1.8	20.996	0	20.996	0	0	0	0	11.09	-33.71	0.85
14	-2.1	24.75	0	24.75	0	0	0	0	2.44	-27.13	0.82
16	-2.4	28.539	0	28.539	0	0	0	0	-3.99	-19.42	0.78
18	-2.7	32.289	0	32.289	0	0	0	0	-7.84	-10.58	0.75
20	-3	35.881	0	35.881	0	0	0	0	-8.8	-0.62	0.71
22	-3.3	39.15	0	39.15	0	0	0	0	-6.52	10.4	0.67
24	-3.6	41.869	0	41.869	0	0	0	0	-0.73	22.36	0.62
26	-3.9	43.749	0	43.749	0	0	0	0	8.83	35.08	0.58
28	-4.15	48.991	0	48.991	0	0	0	0	5.48	-49.37	0.54
30	-4.45	55.866	0	55.866	0	0	0	0	-5.94	-34.16	0.5
32	-4.75	63.062	0	63.062	0	0	0	0	-12.34	-16.87	0.46
34	-5.05	70.363	0	70.363	0	0	0	0	-13.06	2.6	0.41
36	-5.35	77.478	0	77.478	0	0	0	0	-7.45	24.25	0.36
38	-5.65	84.028	0	84.028	0	0	0	0	5.13	48	0.3
40	-5.95	89.537	0	89.537	0	0	0	0	25.26	73.64	0.25
42	-6.25	93.418	0	93.418	0	0	0	0	53.45	100.83	0.21
44	-6.5	94.904	0	94.904	0	0	0	0	83.34	126.66	0.19
46	-6.8	94.187	0	94.187	0	0	0	0	49.54	-105.54	0.19
48	-7.1	91.363	0.481	91.363	0.481	0	0	0	24.21	-77.47	0.22
50	-7.4	87.218	7.943	87.218	7.943	0	0	0	7.04	-50.6	0.25
52	-7.7	82.403	37.035	82.403	37.035	0	0	0	-3.19	-29.51	0.29
54	-8	77.421	42.635	77.421	42.635	0	0	0	-9.1	-16.7	0.33
56	-8.3	72.637	47.737	72.637	47.737	0	0	0	-11.88	-7.02	0.36
58	-8.5	69.685	50.924	69.685	50.924	0	0	0	-12.43	-1.26	0.38
60	-8.8	65.736	55.443	65.736	55.443	0	0	0	-11.92	2.78	0.41
62	-9.1	62.45	59.706	62.45	59.706	0	0	0	-10.48	5.28	0.43
64	-9.4	59.864	63.766	59.864	63.766	0	0	0	-8.79	5.59	0.45

66	-9.7	57.972	67.663	57.972	67.663	0	0	0	-7.44	3.97	0.46
68	-10	85.889	80.94	85.889	80.94	0	0	0	-6.97	0.67	0.47
70	-10.3	88.289	85.19	88.289	85.19	0	0	0	-6.45	2.01	0.48
72	-10.6	90.829	89.268	90.829	89.268	0	0	0	-5.66	2.82	0.48
74	-10.9	93.514	93.18	93.514	93.18	0	0	0	-4.72	3.19	0.48
76	-11.2	97.182	97.64	95.182	95.64	0	2	2	-3.75	3.22	0.48
78	-11.5	101.39	102.33	96.395	97.338	0	5	5	-2.82	3.05	0.48
80	-11.8	105.71	106.94	97.711	98.946	0	8	8	-1.97	2.74	0.48
82	-12.1	110.11	111.48	99.11	100.48	0	11	11	-1.24	2.35	0.48
84	-12.4	114.57	115.96	100.57	101.96	0	14	14	-0.62	1.94	0.47
86	-12.7	119.08	120.39	102.08	103.39	0	17	17	-0.14	1.53	0.47
88	-13	123.61	124.8	103.61	104.8	0	20	20	0.23	1.14	0.46
90	-13.3	128.16	129.19	105.16	106.19	0	23	23	0.5	0.8	0.46
92	-13.6	132.71	133.57	106.71	107.57	0	26	26	0.67	0.5	0.46
94	-13.9	137.26	137.95	108.26	108.95	0	29	29	0.76	0.25	0.45
96	-14.2	141.8	142.33	109.8	110.33	0	32	32	0.79	0.06	0.45
98	-14.5	146.33	146.72	111.33	111.72	0	35	35	0.78	-0.09	0.45
100	-14.8	150.85	151.11	112.85	113.11	0	38	38	0.73	-0.19	0.44
102	-15.1	155.36	155.51	114.36	114.51	0	41	41	0.65	-0.26	0.44
104	-15.4	159.85	159.92	115.85	115.92	0	44	44	0.56	-0.3	0.44
106	-15.7	164.33	164.33	117.33	117.33	0	47	47	0.47	-0.32	0.44
108	-16	168.8	168.75	118.8	118.75	0	50	50	0.37	-0.32	0.44
110	-16.3	173.26	173.17	120.26	120.17	0	53	53	0.28	-0.3	0.44
112	-16.6	177.72	177.6	121.72	121.6	0	56	56	0.2	-0.27	0.43
114	-16.9	182.17	182.02	123.17	123.02	0	59	59	0.13	-0.23	0.43
116	-17.2	186.62	186.44	124.62	124.44	0	62	62	0.07	-0.18	0.43
118	-17.5	191.07	190.87	126.07	125.87	0	65	65	0.03	-0.13	0.43
120	-17.8	195.51	195.29	127.51	127.29	0	68	68	0	-0.06	0.43
122	-18	198.48	198.24	128.48	128.24	0	70	70	0	-0.01	0.43

P177.8x12.5/40 Stage: 7

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	23.959	0	23.959	0	0	0	0	0	1.8	1.16
2	-0.3	21.508	0	21.508	0	0	0	0	1.05	5.21	1.1
4	-0.6	18.985	0	18.985	0	0	0	0	4.04	11.47	1.04
6	-0.9	16.216	0	16.216	0	0	0	0	8.73	16.97	0.98
8	-1.2	14.735	0	14.735	0	0	0	0	14.88	21.6	0.92
10	-1.5	18.449	0	18.449	0	0	0	0	22.4	26.3	0.87
12	-1.8	22.24	0	22.24	0	0	0	0	12.42	-31.73	0.83
14	-2.1	26.082	0	26.082	0	0	0	0	4.45	-24.77	0.79
16	-2.4	29.923	0	29.923	0	0	0	0	-1.18	-16.65	0.75
18	-2.7	33.672	0	33.672	0	0	0	0	-4.11	-7.39	0.72
20	-3	37.196	0	37.196	0	0	0	0	-4.02	2.98	0.68
22	-3.3	40.307	0	40.307	0	0	0	0	-0.58	14.38	0.64
24	-3.6	42.758	0	42.758	0	0	0	0	6.49	26.67	0.6
26	-3.9	44.237	0	44.237	0	0	0	0	17.4	39.63	0.57
28	-4.15	49.026	0	49.026	0	0	0	0	15.23	-44.58	0.54
30	-4.45	55.19	0	55.19	0	0	0	0	5.23	-29.41	0.52
32	-4.75	61.469	0	61.469	0	0	0	0	0.2	-12.38	0.49
34	-5.05	67.623	0	67.623	0	0	0	0	0.71	6.53	0.47
36	-5.35	73.337	0	73.337	0	0	0	0	7.3	27.25	0.45
38	-5.65	78.215	0	78.215	0	0	0	0	20.48	49.64	0.43
40	-5.95	81.77	0	81.77	0	0	0	0	40.7	73.4	0.42
42	-6.25	83.413	0	83.413	0	0	0	0	68.26	98.1	0.43
44	-6.5	82.825	0	82.825	0	0	0	0	96.96	121.02	0.46
46	-6.8	79.402	0	79.402	0	0	0	0	58.24	-122.93	0.52
48	-7.1	73.713	0	73.713	0	0	0	0	26.66	-99.5	0.61

50	-7.4	66.66	0	66.66	0	0	0	0	1.71	-77.9	0.71
52	-7.7	59.039	0	59.039	0	0	0	0	-17.24	-58.47	0.81
54	-8	51.507	0	51.507	0	0	0	0	-30.88	-41.33	0.9
56	-8.3	45.23	0	45.23	0	0	0	0	-39.89	-26.41	0.99
58	-8.5	46.191	0	46.191	0	0	0	0	-43.58	-15.04	1.03
60	-8.8	47.633	0	47.633	0	0	0	0	-45.65	-3.38	1.08
62	-9.1	49.075	9.101	49.075	9.101	0	0	0	-43.44	11.02	1.12
64	-9.4	50.516	36.403	50.516	36.403	0	0	0	-37.72	21.07	1.14
66	-9.7	51.958	63.706	51.958	63.706	0	0	0	-30.74	23.37	1.14
68	-10	71.8	59.832	71.8	59.832	0	0	0	-24.6	19.34	1.13
70	-10.3	73.739	77.782	73.739	77.782	0	0	0	-18.17	21.73	1.11
72	-10.6	75.677	83.754	75.677	83.754	0	0	0	-11.99	20.08	1.08
74	-10.9	77.616	87.667	77.616	87.667	0	0	0	-6.53	17.5	1.05
76	-11.2	80.836	91.675	78.836	89.675	0	2	2	-1.97	14.39	1.01
78	-11.5	85.306	95.759	80.306	90.759	0	5	5	1.61	11.1	0.97
80	-11.8	90.718	99.777	82.718	91.777	0	8	8	4.25	8.07	0.94
82	-12.1	96.13	103.76	85.13	92.767	0	11	11	6.07	5.46	0.9
84	-12.4	101.50	107.76	87.508	93.761	0	14	14	7.21	3.27	0.87
86	-12.7	106.82	111.78	89.825	94.782	0	17	17	7.78	1.49	0.84
88	-13	112.06	115.84	92.066	95.845	0	20	20	7.91	0.1	0.82
90	-13.3	117.21	119.96	94.219	96.96	0	23	23	7.7	-0.96	0.8
92	-13.6	122.28	124.13	96.281	98.132	0	26	26	7.24	-1.71	0.78
94	-13.9	127.25	128.36	98.252	99.362	0	29	29	6.61	-2.21	0.76
96	-14.2	132.14	132.65	100.14	100.65	0	32	32	5.88	-2.49	0.75
98	-14.5	136.94	136.98	101.94	101.98	0	35	35	5.1	-2.61	0.73
100	-14.8	141.68	141.36	103.68	103.36	0	38	38	4.32	-2.59	0.73
102	-15.1	146.35	145.78	105.35	104.78	0	41	41	3.57	-2.47	0.72
104	-15.4	150.98	150.23	106.98	106.23	0	44	44	2.87	-2.29	0.71
106	-15.7	155.55	154.71	108.55	107.71	0	47	47	2.23	-2.06	0.71
108	-16	160.1	159.2	110.1	109.2	0	50	50	1.68	-1.8	0.7
110	-16.3	164.62	163.7	111.62	110.7	0	53	53	1.2	-1.52	0.7
112	-16.6	169.12	168.21	113.12	112.21	0	56	56	0.8	-1.25	0.7
114	-16.9	173.61	172.73	114.61	113.73	0	59	59	0.49	-0.98	0.69
116	-17.2	178.09	177.24	116.09	115.24	0	62	62	0.26	-0.71	0.69
118	-17.5	182.57	181.75	117.57	116.75	0	65	65	0.1	-0.46	0.69
120	-17.8	187.04	186.25	119.04	118.25	0	68	68	0.02	-0.22	0.69
122	-18	190.03	189.25	120.03	119.25	0	70	70	0	-0.02	0.69

P177.8x12.5/40 Stage: 8

Wall	EL	Sht L	Sht R	Shs L	Shs R	q	U L	U R	M	V	dx
Nod	(m)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kN-	(kN/m)	(cm)
0	0	22.722	0	22.722	0	0	0	0	0	1.7	1.19
2	-0.3	20.1	0	20.1	0	0	0	0	0.99	4.92	1.13
4	-0.6	17.408	0	17.408	0	0	0	0	3.79	10.75	1.07
6	-0.9	14.475	0	14.475	0	0	0	0	8.16	15.76	1.01
8	-1.2	12.841	0	12.841	0	0	0	0	13.83	19.85	0.96
10	-1.5	16.421	0	16.421	0	0	0	0	20.69	23.97	0.91
12	-1.8	20.111	0	20.111	0	0	0	0	9.59	-35.62	0.87
14	-2.1	23.905	0	23.905	0	0	0	0	0.31	-29.31	0.84
16	-2.4	27.774	0	27.774	0	0	0	0	-6.83	-21.85	0.8
18	-2.7	31.656	0	31.656	0	0	0	0	-11.46	-13.22	0.76
20	-3	35.448	0	35.448	0	0	0	0	-13.25	-3.44	0.72
22	-3.3	38.998	0	38.998	0	0	0	0	-11.85	7.47	0.67
24	-3.6	42.096	0	42.096	0	0	0	0	-6.94	19.41	0.62
26	-3.9	44.471	0	44.471	0	0	0	0	1.75	32.23	0.56
28	-4.15	50.224	0	50.224	0	0	0	0	-2.21	-51.6	0.51
30	-4.45	57.841	0	57.841	0	0	0	0	-14.22	-35.98	0.46
32	-4.75	65.933	0	65.933	0	0	0	0	-21.01	-18.02	0.39

34	-5.05	74.289	0	74.289	0	0	0	0	-21.88	2.38	0.32
36	-5.35	82.621	0	82.621	0	0	0	0	-16.06	25.29	0.24
38	-5.65	90.546	0	90.546	0	0	0	0	-2.8	50.69	0.16
40	-5.95	97.574	0	97.574	0	0	0	0	18.6	78.4	0.07
42	-6.25	103.1	0	103.1	0	0	0	0	48.78	108.12	-0.01
44	-6.5	106.02	0	106.02	0	0	0	0	80.98	136.72	-0.06
46	-6.8	107.05	0	107.05	0	0	0	0	53.16	-84.73	-0.09
48	-7.1	105.9	0	105.9	0	0	0	0	34.96	-52.67	-0.1
50	-7.4	103.24	0	103.24	0	0	0	0	26.28	-21.07	-0.1
52	-7.7	99.544	0	99.544	0	0	0	0	26.89	9.64	-0.09
54	-8	95.118	0	95.118	0	0	0	0	36.45	39.18	-0.06
56	-8.3	90.699	0	90.699	0	0	0	0	54.57	67.35	-0.02
58	-8.5	91.96	0	91.96	0	0	0	0	71.22	90.12	0.02
60	-8.8	92.232	0	92.232	0	0	0	0	36.84	-107.67	0.1
62	-9.1	90.974	0.481	90.974	0.481	0	0	0	10.76	-80.07	0.19
64	-9.4	88.709	12.933	88.709	12.933	0	0	0	-7.2	-53.18	0.29
66	-9.7	85.87	42.866	85.87	42.866	0	0	0	-18.4	-32.9	0.39
68	-10	93.113	42.532	93.113	42.532	0	0	0	-25.53	-21.04	0.48
70	-10.3	91.783	63.134	91.783	63.134	0	0	0	-28.67	-7.52	0.56
72	-10.6	90.59	71.649	90.59	71.649	0	0	0	-29.12	0.21	0.62
74	-10.9	89.623	77.921	89.623	77.921	0	0	0	-27.87	5.34	0.68
76	-11.2	90.22	84.058	88.22	82.058	0	2	2	-25.54	8.38	0.72
78	-11.5	92.379	90.018	87.379	85.018	0	5	5	-22.66	9.89	0.76
80	-11.8	95.803	95.649	87.803	87.649	0	8	8	-19.57	10.42	0.78
82	-12.1	99.545	100.99	88.545	89.995	0	11	11	-16.45	10.34	0.8
84	-12.4	103.55	106.10	89.553	92.101	0	14	14	-13.46	9.81	0.81
86	-12.7	107.77	111.01	90.776	94.01	0	17	17	-10.7	8.99	0.81
88	-13	112.17	115.76	92.17	95.76	0	20	20	-8.22	7.98	0.81
90	-13.3	116.69	120.38	93.692	97.388	0	23	23	-6.07	6.9	0.81
92	-13.6	121.30	124.92	95.306	98.923	0	26	26	-4.25	5.79	0.81
94	-13.9	125.98	129.39	96.984	100.39	0	29	29	-2.76	4.72	0.8
96	-14.2	130.70	133.81	98.702	101.81	0	32	32	-1.57	3.72	0.79
98	-14.5	135.44	138.2	100.44	103.2	0	35	35	-0.66	2.81	0.78
100	-14.8	140.18	142.58	102.18	104.58	0	38	38	0	2.01	0.77
102	-15.1	144.93	146.94	103.93	105.94	0	41	41	0.45	1.32	0.76
104	-15.4	149.66	151.3	105.66	107.3	0	44	44	0.71	0.74	0.75
106	-15.7	154.38	155.66	107.38	108.66	0	47	47	0.83	0.28	0.74
108	-16	159.08	160.03	109.08	110.03	0	50	50	0.83	-0.08	0.73
110	-16.3	163.77	164.39	110.77	111.39	0	53	53	0.74	-0.34	0.73
112	-16.6	168.45	168.76	112.45	112.76	0	56	56	0.6	-0.51	0.72
114	-16.9	173.12	173.13	114.12	114.13	0	59	59	0.43	-0.58	0.71
116	-17.2	177.78	177.5	115.78	115.5	0	62	62	0.26	-0.56	0.7
118	-17.5	182.43	181.86	117.43	116.86	0	65	65	0.11	-0.45	0.69
120	-17.8	187.09	186.22	119.09	118.22	0	68	68	0.02	-0.26	0.69
122	-18	190.19	189.12	120.19	119.12	0	70	70	0	-0.03	0.68

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	145.008
3	162.336
4	158.82
5	157.452
6	159.943
7	158.621
8	160.994

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	240
5	263.016
6	244.248
7	243.888
8	243.216

Support 2

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	570

7	588.16
8	553.3

Support 3

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	510

Project: My Project
Results for Design Section 1: 0: DM08_ITA: Comb. 1: A1+M1+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
1	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
2	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
3	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
4	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
5	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
6	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
7	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
8	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
9	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1
10	DM08_ITA	1: A1+M1+R1	1	1	1	0	1.3	1.5	1.2	1.1	1.3	1	1.3	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-10	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	206000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10
Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

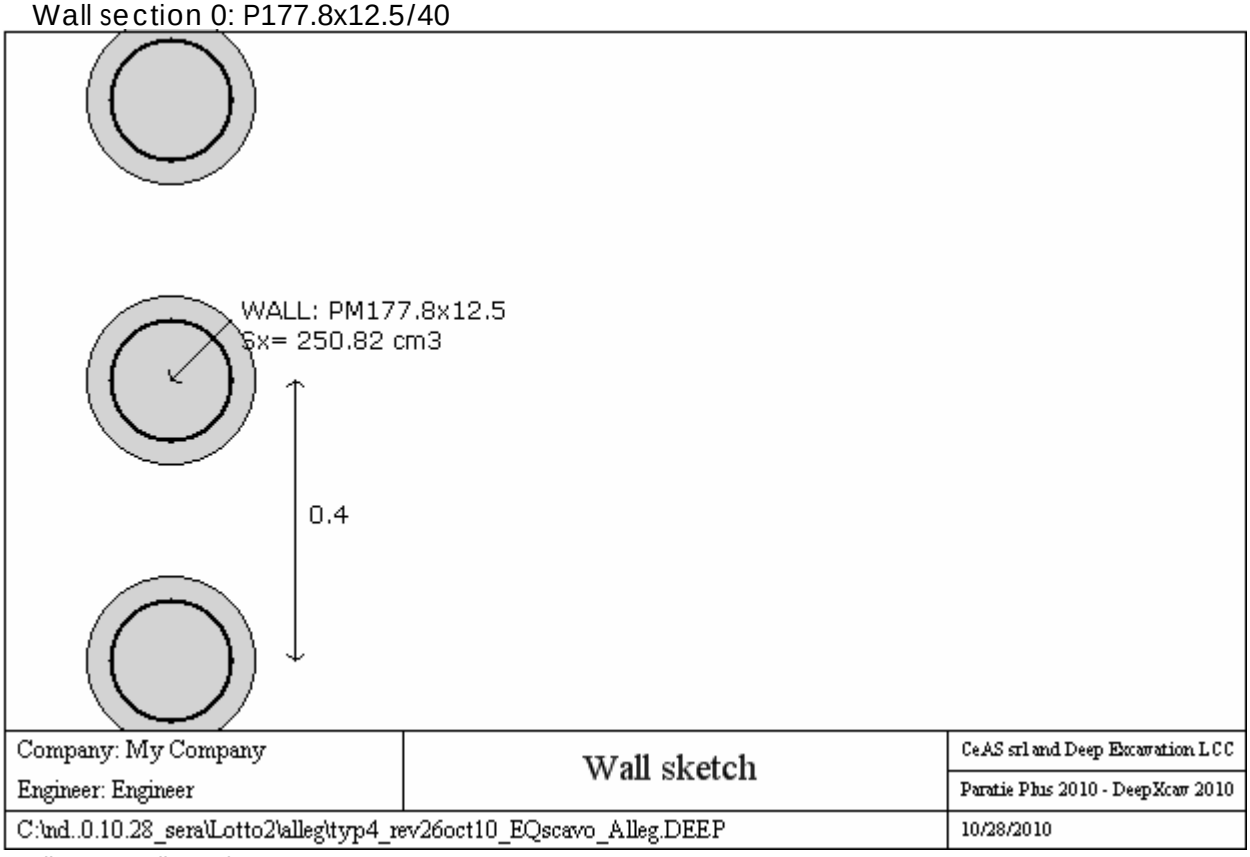
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P177.8x12.5/40



Wall uses wall section 2: P177.8x12.5
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -18 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'

Steel members fy = 355 Esteel = 206000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM17	311.6	91.58	17.8	1.25	17.78	1.25	1.25	4274	250.8	6.83	4274	250.8	6.83	6.83	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	1.4	200100	226.7	226.7	N/A	1.4	False	N/A	N/A	Yes

Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	150	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	180	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	5.56	210000	807	807	N/A	1.4	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	9.21	11.07	9.21
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	5.846	5.846	6.002
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	6.071	6.071	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	4.351	4.351	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	4.364	4.413	4.364
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.877	2.877	48.88
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.824	2.973	2.824
Stage 7	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.869	1.869	18.27
Stage 8	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.961	1.961	73.36
Stage 9	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.442	1.442	6.634
Stage	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.531	1.531	8.97

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.028	0	1	N/A
1	No		0.028	0	1	N/A
2	No		0.028	0	1	N/A
3	No		0.028	0	1	N/A
4	No		0.028	0	1	N/A
5	No		0.028	0	1	N/A
6	No		0.028	0	1	N/A

7	No		0.028	0	1	N/A
8	No		0.028	0	1	N/A
9	No		0.028	0	1	N/A
10	Yes		0.016	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.5 m, S = 2.4 m
Lfree = 11 m, Lfix = 10 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	145	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -4 m, S = 2.4 m
Lfree = 11 m, Lfix = 10 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	240	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support 2: type = tieback
X = 0.24 m, Z = -6.5 m, S = 2 m
Lfree = 12 m, Lfix = 15 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	570	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support 3: type = tieback
X = 0.24 m, Z = -8.5 m, S = 2 m
Lfree = 12 m, Lfix = 15 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	No	-	-	-
7	No	-	-	-
8	Yes	510	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -28, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-28	0	0	20	0	0	0	20
1	Yes	-28	0	0	20	0	0	0	20
2	Yes	-28	0	0	20	0	0	0	20

3	Yes	-28	0	0	20	0	0	0	20
4	Yes	-28	0	0	20	0	0	0	20
5	Yes	-28	0	0	20	0	0	0	20
6	Yes	-28	0	0	20	0	0	0	20
7	Yes	-28	0	0	20	0	0	0	20
8	Yes	-28	0	0	20	0	0	0	20
9	Yes	-28	0	0	20	0	0	0	20
10	No	-28	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	188.51
3	213.892
4	209.318
5	207.558
6	210.8
7	208.984
8	212.073
9	211.736
10	201.571

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	312
5	344.448
6	320.05
7	319.55
8	318.677
9	317.148
10	307.52

Support 2

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	741
7	765.882
8	720.564
9	722.696
10	711.698

Support 3

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	663
9	682.734
10	696.67

Project: My Project
Results for Design Section 2: 0: DM08_ITA: Comb. 2: A2+M2+R1

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design	Design Case	F(tan	F	F	F	F(perm	F(temp	F(perm	F(temp	F Earth	F Earth	F GWT	F GWT	F HYD	F HYD	F UPL	F UPL
	Name		fr)	(c')	(Su)	(EQ)	load)	load)	sup)	sup)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)	(Dstab)	(stab)
0	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
3	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
4	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
5	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
6	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
7	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
8	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1
9	DM08_ITA	2: A2+M2+R1	1.25	1.25	1.4	0	1	1.3	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-10	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	206000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10

Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

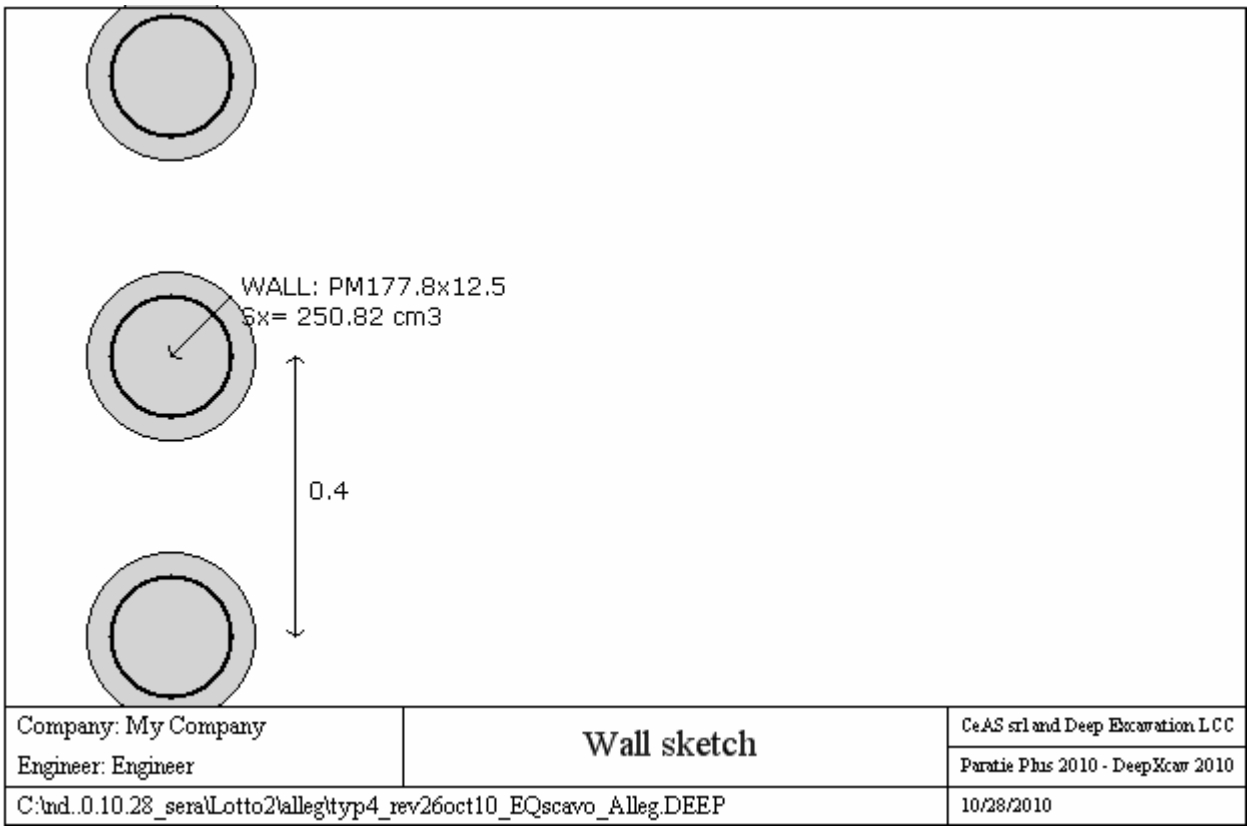
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P177.8x12.5/40



Wall uses wall section 2: P177.8x12.5
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -18 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'
Steel members fy = 355 Esteel = 206000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM17	311.6	91.58	17.8	1.25	17.78	1.25	1.25	4274	250.8	6.83	4274	250.8	6.83	6.83	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	1.4	200100	226.7	226.7	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	150	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	180	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	5.56	210000	807	807	N/A	1.4	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	7.349	8.568	7.349
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	4.633	4.633	4.862
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	4.991	4.991	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.591	3.591	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.654	3.654	2827.
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.394	2.394	32.74
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.48	2.48	415.2
Stage 7	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.564	1.564	10.16
Stage 8	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.644	1.644	23.20
Stage 9	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.209	1.209	3.129

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.028	0	1	N/A
1	No		0.028	0	1	N/A
2	No		0.028	0	1	N/A
3	No		0.028	0	1	N/A
4	No		0.028	0	1	N/A
5	No		0.028	0	1	N/A
6	No		0.028	0	1	N/A
7	No		0.028	0	1	N/A
8	No		0.028	0	1	N/A
9	No		0.028	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.5 m, S = 2.4 m
Lfree = 11 m, Lfix = 10 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	145	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -4 m, S = 2.4 m
Lfree = 11 m, Lfix = 10 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	240	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support 2: type = tieback
X = 0.24 m, Z = -6.5 m, S = 2 m
Lfree = 12 m, Lfix = 15 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-

3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	570	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support 3: type = tieback
X = 0.24 m, Z = -8.5 m, S = 2 m
Lfree = 12 m, Lfix = 15 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	No	-	-	-
7	No	-	-	-
8	Yes	510	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -28, X2 = 0

Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-28	0	0	20	0	0	0	20
1	Yes	-28	0	0	20	0	0	0	20
2	Yes	-28	0	0	20	0	0	0	20
3	Yes	-28	0	0	20	0	0	0	20
4	Yes	-28	0	0	20	0	0	0	20
5	Yes	-28	0	0	20	0	0	0	20
6	Yes	-28	0	0	20	0	0	0	20
7	Yes	-28	0	0	20	0	0	0	20
8	Yes	-28	0	0	20	0	0	0	20

9	Yes	-28	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	145.008
3	186.506
4	182.585
5	184.325
6	186.898
7	182.244
8	184.97
9	184.133

Support 1

Stage No	R
	(kN)
0	0
1	0
2	0

3	0
4	240
5	301.968
6	280.704
7	277.416
8	276.168
9	269.088

Support 2

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	570
7	625.52
8	587.22
9	585.42

Support 3

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	510
9	573.2

Project: My Project
Results for Design Section 3: 0: DM08_ITA: EQK - Seismic

DESIGN APPROACHES AND COMBINATION FACTORS

The Design Approaches (from Codes or Customized by the user) and related safety factors are the following:
Ftan fr=mult factor for friction angle
F C'=mult factor for effective cohesion
F Su'=mult factof for undrained cohesion
F EQ=mult factor for seismic action
F perm load=mult factor for perm loads
F temp load=mult factor for live loads
F perm supp=reduct factor for resistence for pull out checking
F temp supp=fattore di riduzione resistence per verifica pull out tirante
F earth Dstab=mult factor for active press coeff , unfavorable
F earth stab=mult factor for passive pressure , favorable
F GWT Dstab (ground water)=mult factor for hydrostatic pressure , unfavorable
F GWT stab (ground water)=mult factor for hydrostatic pressure, favorable
F HYD Dstab=mult factor for hydrodynamic pressure, unfavorable
F HYD stab=mult factor for hydrodynamic pressure, favorable
F UPL Dstab=mult factor for hydraulic heave, unfavorable

Stage	Design Name	Design Case	F(tan fr)	F (c')	F (Su)	F (EQ)	F(perm load)	F(temp load)	F(perm sup)	F(temp sup)	F Earth (Dstab)	F Earth (stab)	F GWT (Dstab)	F GWT (stab)	F HYD (Dstab)	F HYD (stab)	F UPL (Dstab)	F UPL (stab)
0	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
1	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
2	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
3	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
4	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
5	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
6	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
7	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
8	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
9	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1
10	DM08_ITA	EQK - Seismic	1.25	1.25	1.4	1	1	1	1.2	1.1	1	1	1	1	1.35	0.9	1	1

SOIL DATA

Name	g tot	g dry	Frict	C'	Su	FRp	FRcv	Eload	Eur	kAp	kPp	kAcv	kPcv	Vary	Spring	Color
	(kN/m3)	(kN/m3)	(deg)	(kPa)	(kPa)	(deg)	(deg)	(kPa)	(kPa)	Springs	Springs	Springs	Springs		Model	
F	20	19	30	0	N/A	N/A	N/A	15000	45000	0.33	3	N/A	N/A	True	Linear	
O1	16.5	14	22	2	20	22	22	2874	8622	0.46	2.2	0.46	2.2	True	Linear	
O2	19	16.5	28	2	N/A	N/A	N/A	7185	21555	0.36	2.77	N/A	N/A	True	Linear	
S1	21	19	34	0	N/A	N/A	N/A	25000	75000	0.28	3.54	N/A	N/A	True	Linear	
Clay	20	19	28	0	150	28	28	20000	60000	0.36	2.77	0.36	2.77	True	Linear	
GT	22	20	36	10	N/A	N/A	N/A	30000	90000	0.26	3.85	N/A	N/A	True	Linear	
Rock	27	25	30	100	N/A	N/A	N/A	479000	143700	0.33	3	N/A	N/A	True	Linear	
Rileva	18	18	32	0	N/A	N/A	N/A	30000	30000	0.31	3.26	N/A	N/A	True	Linear	
Base	18	18	25	0	N/A	N/A	N/A	25000	25000	0.41	2.46	N/A	N/A	True	Linear	

gtot=total soil specific weigth
gdry=dry weigth of the soil
Frict=friction angle
C'=effective cohesion
Su = Undrained cohesiona (only for CLAY soils in undrained conditions)
Dilat=SOil Dilatancy (only for non linear analysis)
Evc=Virgin compression elastic module
Eur=unloading/reloading elastic module
Kap= Peak active thrust coeff
Kpp= Peak passive thrust coeff
Kacv= Constant volume active thrust coeff
Kpcv= Constant volume passive thrust coeff
Spring models= spring model (LIN=constant over the soil layer heigth , EXP=exponential , SIMC=semplified winkler)
LIN= Linear-Elastic-Perfectly Plastic,
EXP: Exponential, SUB: Modulus of Subgrade Reaction

SOIL BORINGS

Top Elev= superior SOil level
Soil type=type of the soil (sand , clay , etc)
OCR=overconsolidation ratio
K0=at rest coefficient

Name: Boring 1, pos: (-20, 0)

Top elev.	Soil type	OCR	Ko
0	Rilevato	1	0.47
-10	Base	1	0.58

STRUCTURAL MATERIALS DATA

Steel

Name	Strength Fy	Fu	Elastic E	Density g
	(MPa)	(MPa)	(MPa)	(kN/m3)
Fe360	235	360	206000	77
Fe510	355	510	206000	77
A36	248.3	400	206000	77
A50	355	500	206000	77
New steel 4	241.4	413.8	206000	77

Concrete

Name	Strength Fc'	Elastic E	Density g	Tension Strength
	(MPa)	(MPa)	(kN/m3)	(MPa)
C20/25	20	29962	25	10
C25/30	25	31476	25	10

Fc 3ksi	20.7	21541.8	23.573	10

Steel rebar

Name	Strength Fy	Elastic E
	(MPa)	(MPa)
S1860 (Strands)	1670	210000
Grade 75	517.2	200100
Grade 80	551.7	200100
Grade 150	1034.5	200100
Strands 270 ksi	1862.1	200100
S410	410	210000
S500	500	210000
B450C	450	210000

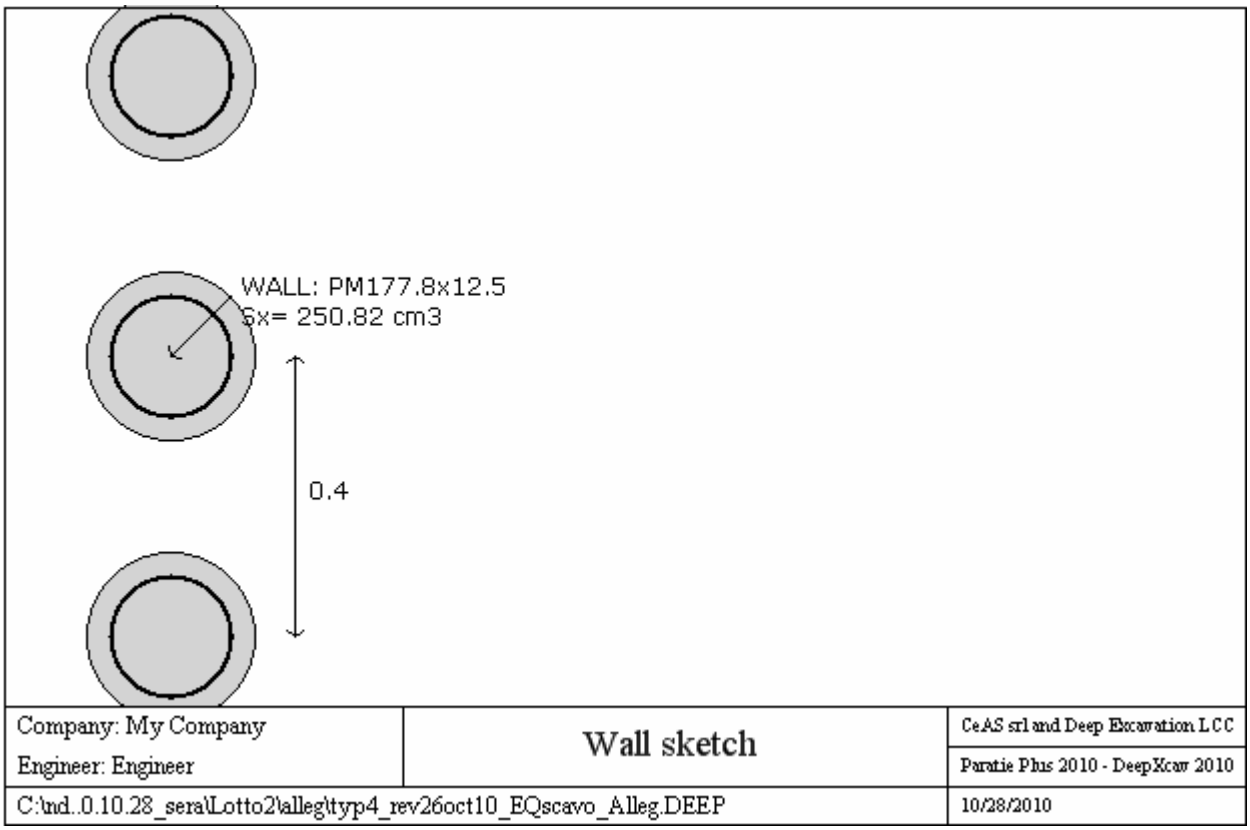
Wood

Name	Ultimate Bending	Ultimate Tensile Strength	Ultimate Shear Strength	Density g	Elastic E
	(MPa)	(MPa)	(MPa)	(kN/m3)	(MPa)
Construction	11	9.7	5.5	7.8576	6900
Regular grade	6.9	6.9	4.1	7.8576	5520

STEEL
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
CONCRETE
Name=material name
f'c=fck=cylindrical resistence for concrete (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
Tension strength=ft=fctk=characteristic tension resistence for concrete
STEEL REBARS
Name=material name
fy=fyk=characteristc resistence for steel (for all the codes)
Fu=fuk=ultimate resistence for steel (for all the codes)
Elastic E=Elastic modulus
Density g=specific weigth
WOOD
Name=material name
Fb=fbk=Ultimate bending strength
Ftu=ftuk=Ultimate tensile strength
Fvu=fvuk=Ultimate shear strength
Density g=specific weigth
Elastic E=Elastic modulus

WALL DATA

Wall section 0: P177.8x12.5/40



Wall uses wall section 2: P177.8x12.5
Wall type: Tangent pile wall
Top wall El: 0 m Bottom wall El: -18 m
Hor. wall spacing: 0.4 Wall thickness = 0.24
Passive width below exc: 0.4 Active width below exc: 0.4
Concrete fc' = 25 Rebar Fy = 410 Econc = 31476 Concrete tension FcT = 10% of Fc'
Steel members fy = 355 Esteel = 206000
Wall friction: Percentage of Soil Friction = 50%
Steel wall capacities are calculated with NTC 2008
Concrete capacities are calculated with ACI 318-2002.
Note: With ultimate capacities you may have to use a structural safety factor.
Tangent pile wall soldier pile properties

Table: Soldier Pile Properties

Name	Sectio	W	A	D	tw or	bf	tf	k	Ixx	Sxx	rX	Iyy	Syy	rY	rT	Cw	fy
		(kN/m	(cm2)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm4)	(cm3)	(cm)	(cm4)	(cm3)	(cm)	(cm)	(cm6)	(MPa
	PM17	311.6	91.58	17.8	1.25	17.78	1.25	1.25	4274	250.8	6.83	4274	250.8	6.83	6.83	1	355

GENERAL WALL DATA
Hor wall spacing=wall horizontal spacing
Passive width below exc=spacing for passive thrust pressure for classic analsyis
f'c=fck=cylindrical concrete resistence
fyk=fy=steel rebar characteristic resistence
Econc=Concrete Elastic modulus
fctk=characteristic Concrete tension
Esteel=steel elastic modulus
TABULAR DATA (principal parameters)
1) Diaphragm wall (rectangular cross section section)
N/A= data not available
Fy=fyk
F'c=fck
D=wall heigt
B=wall width
2)Steel sheet pile
DES=shape (Z or U)
W=wigth per unit of length
A=area
h=heigth
t=horiz part thickness
b=wodth of the single sheet pile part
s=inclined part thickness
Ixx=strong axis inertia (per unit of length)
Sxx=strong axis section modulus (per unit of length)
3)Secant piles wall, Tangent piles wall, soldier piles, soildier piles and timber lagging
W=weigth per unit of length
A=area
D=diameter
tw=web thickness
tp= pipe thickness
bf=flange width
tf=flange thickness
k=flange thickness+stam thickness
Ixx=strong axis inertia modulus (per unit of length)
Sxx=strong axis section modulus (per unit of length)
rx=radius of gyration about X axis
ry=radius of gyration about Y axis
Iyy=weak axis inertia modulus (per unit of length)
Syy=weak axis section modulus (per unit of length)
rT=radius of gyration for torsion
Cw=warping constant

TIEBACK DATA

Name	Fy	Fc'	Dfix	Afix	Efix	Afree	Efree	Pa STR	Pu STR	PresGr	FSgeo	UserGca	Pa	Pu	WireMod
	(MPa)	(MPa)	(cm)	(cm2)	(MPa)	(cm2)	(MPa)	(kN)	(kN)	(kPa)			(kN)	(kN)	Yes/No
4-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
5-Strands	1862.1	25	15	176.7	31476	2.8	200100	453.4	453.4	N/A	1.4	False	N/A	N/A	Yes
6-Strands	1862.1	25	15	176.7	31476	1.4	200100	226.7	226.7	N/A	1.4	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	4.17	210000	605.2	605.2	150	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	6.95	210000	1008.7	1008.7	180	1	False	N/A	N/A	Yes
Tieback_	1670	25	16	201.0	31476	5.56	210000	807	807	N/A	1.4	False	N/A	N/A	Yes

EXCAVATION STAGES SKETCHES

A sequence of figures for each excavation stage is reported

GENERAL ANALYSIS CRITERIA

Summary of stage assumptions

Name	Analysis	Drive	ka-Mult	Htr	Resist	Res	Contl	Supp	Axial	Used	Min	Toe	Toe
	Method	Press		(%)	Press	Mult	Meth	Mode	Incl	FSwall	FDtoe	FSrot	FSpas
Stage 0	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	7.349	8.568	7.349
Stage 1	Springs-Up	Ka+ d	N/A	N/A	Kp+ d	N/A		Fixed	N/A	1	4.855	4.855	5.004
Stage 2	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	5.077	5.077	N/A
Stage 3	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.654	3.654	N/A
Stage 4	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	3.711	3.711	40486
Stage 5	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.431	2.431	36.28
Stage 6	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	2.514	2.514	507.0
Stage 7	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.586	1.586	10.67
Stage 8	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.664	1.664	23.86
Stage 9	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.225	1.225	3.286
Stage	Springs-Up	FHWA	1.3	m=	Kp+ d	N/A		Fixed	N/A	1	1.28	1.28	4.363

Name=excavation phase name
Analysis method
springs=elasto plastic springs are used
DR=Drained condition for CLAY model
U=Undrained condition for CLAY model for all the soils
Up=Undrained condition just for selected soil
Drive press=Ka
ka mult=multiply factor for Ka
Htr T/B (%)=trapezioidal pressure scheme
Resit press=Kp
Res Mult=Multiply factor for Kp
COntle Method=cantilver method
Support Model=Fix support type
Axial Incl=Axial action is included for design
Used FS wall=Reduction factor for axial+bending resistence dominium
Min FD TOe=embedded minimum safety factor (for classic analsysis)
Toe FS rot=rotation safety factor (classic for classic analsysis)
Toe FSpas=driving/resistent pressure safety factor (for classic analsysis)

SEISMIC DATA

Seismic action is modeled through a pseudo static approach

Summary of stage assumptions

Stage	Seismic g	Method	aX	aY	Beta	Building Code
Number	Used	Used	(g)	(g)		(Name)
0	No		0.028	0	1	N/A
1	No		0.028	0	1	N/A
2	No		0.028	0	1	N/A
3	No		0.028	0	1	N/A
4	No		0.028	0	1	N/A
5	No		0.028	0	1	N/A
6	No		0.028	0	1	N/A
7	No		0.028	0	1	N/A
8	No		0.028	0	1	N/A
9	No		0.028	0	1	N/A
10	Yes		0.028	0	1	N/A

N/A= data non available
Stage number=number of stage input
Seismic ag =value of design acceleration according to a code or input by the user
Method=the method used to evaluated the seismic thrustover the wall
ahd or khd otr axd=design horizontal acceleration
avd or kvd or ayd=design vertical acceleration
Beta=multip coeff for the semirigd approach
Buildind code=code used for design acceleration calculation

SUPPORTS PROPERTIES

Support 0: type = tieback
X = 0.24 m, Z = -1.5 m, S = 2.4 m
Lfree = 11 m, Lfix = 10 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	Yes	145	-	-
3	Yes	-	-	-
4	Yes	-	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-

Support 1: type = tieback
X = 0.24 m, Z = -4 m, S = 2.4 m
Lfree = 11 m, Lfix = 10 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	Yes	240	-	-
5	Yes	-	-	-
6	Yes	-	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support 2: type = tieback
X = 0.24 m, Z = -6.5 m, S = 2 m
Lfree = 12 m, Lfix = 15 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-

2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	570	-	-
7	Yes	-	-	-
8	Yes	-	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support 3: type = tieback
X = 0.24 m, Z = -8.5 m, S = 2 m
Lfree = 12 m, Lfix = 15 m, Rfix = 50 %
Walls: P177.8x12.5/40

Stage No	Active	Prestress	Slab live load	User add. strain
	Yes/No	(kN)	(kPa)	+expansion
0	No	-	-	-
1	No	-	-	-
2	No	-	-	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	No	-	-	-
7	No	-	-	-
8	Yes	510	-	-
9	Yes	-	-	-
10	Yes	-	-	-
11	Yes	-	-	-

Support type
LEGENDA for TIEBACKS
General data
Z=support level
S=horizontal distance between each tieback
Lfree=free length
Lfix=rigid body length
Rfix=% effective part of the rigid body length
Stage No=excavation steps number
Active=tieback status (YES=active)
Post stress= tieback preload (Load considering the horiz distance bewteen the tiebacks)

SURFACE LOADS

Surcharge 0: X1 = -28, X2 = 0
Variable surcharge

Stage No	Active	X1	Z1	qX1	qZ1	X2	Z2	qX2	qZ2
	Yes/No	(m)	(m)	(kPa)	(kPa)	(m)	(m)	(kPa)	(kPa)
0	No	-28	0	0	20	0	0	0	20
1	Yes	-28	0	0	20	0	0	0	20
2	Yes	-28	0	0	20	0	0	0	20
3	Yes	-28	0	0	20	0	0	0	20
4	Yes	-28	0	0	20	0	0	0	20
5	Yes	-28	0	0	20	0	0	0	20
6	Yes	-28	0	0	20	0	0	0	20

7	Yes	-28	0	0	20	0	0	0	20
8	Yes	-28	0	0	20	0	0	0	20
9	Yes	-28	0	0	20	0	0	0	20
10	No	-28	0	0	20	0	0	0	20

LEGENDA
Stage No=Excavation step number
Active=load status (Yes=active)

X1=first X coordinate position of the load
Z1=first Z coordinate position of the load
qX1=first horizontal point load value
qZ1=first vertical point load value

X2=second X coordinate position of the load
Z2=second Z coordinate position of the load
qX2=second horizontal point load value
qZ2=second vertical point load value

WALL RESULTS TABLE

LEGENDA
Wall node=number of the node
EL=elevation
Sht L=Total horizontal soil pressure (on the left side of the wall)
Sht R=Total horizontal soil pressure (on the right side of the wall)
Shs L=Effective horizontal soil pressure (on the left side of the wall)
Shs R=Effective horizontal soil pressure (on the right side of the wall)
q=pressure given by the surcharge
U L=Water pressure (on the left side of the wall)
U R=pressione acqua (on the right side of the wall)
M=bending moment (per meter)
V=shear (per metro)
dx=wall deflection
McapL=Ultimate bending moment (on the left side of the wall)
McapR=Ultimate bending moment (on the right side of the wall)
VcapL=Ultimate resistance shear (on the left side of the wall)
VcapR=Ultimate resistance shear (on the right side of the wall)

SUPORTS REACTIONS (TIEBACKS, STRUTS, SLABS, RAKERS)

Support 0

Stage No	R
	(kN)
0	0
1	0
2	145.008
3	177.876
4	173.868
5	173.995
6	176.568
7	172.598
8	175.322
9	174.631
10	167.237

Support 1

Stage No	R
	(kN)

0	0
1	0
2	0
3	0
4	240
5	291.624
6	270.36
7	267.552
8	266.304
9	260.304
10	251.712

Support 2

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	570
7	617.38
8	579.08
9	577.34
10	571.06

Support 3

Stage No	R
	(kN)
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	510
9	563.1
10	599.72