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PROGETTO CIARLE

PROGETTO ESECUTIVO

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LAVORI DI IMPLEMENTAZIONE PRIMARIA DEL SISTEMA IRRIGUO CIARLE
NEI COMUNI DI POGGIO RENATICO E TERRE DEL RENO (FE)–
CONDOTTO DISTRIBUTORE SUD E IMPIANTO DI SOLLEVAMENTO

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CALCOLI ESECUTIVI

RELAZIONE DI CALCOLO STRUTTURE IN C.A.

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Comuni di Poggio Renatico e Terre del Reno

Provincia di Ferrara

Lavori di implementazione primaria del sistema irriguo Ciarle nei comuni di Poggio Renatico e Terre del Reno (FE) – Condotto distributore Sud e impianto di sollevamento

PROGETTO ESECUTIVO

RELAZIONE DI CALCOLO SPINGITUBO

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ALLEGATI

ALLEGATO A: Report calcolo diaframmi

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4 PREMESSA

La presente relazione si inserisce nel Progetto Esecutivo dei “Lavori di implementazione primaria del sistema irriguo Ciarle nei comuni di Poggio Renatico e Terre del Reno (FE) – Condotto distributore Sud e impianto di sollevamento”.

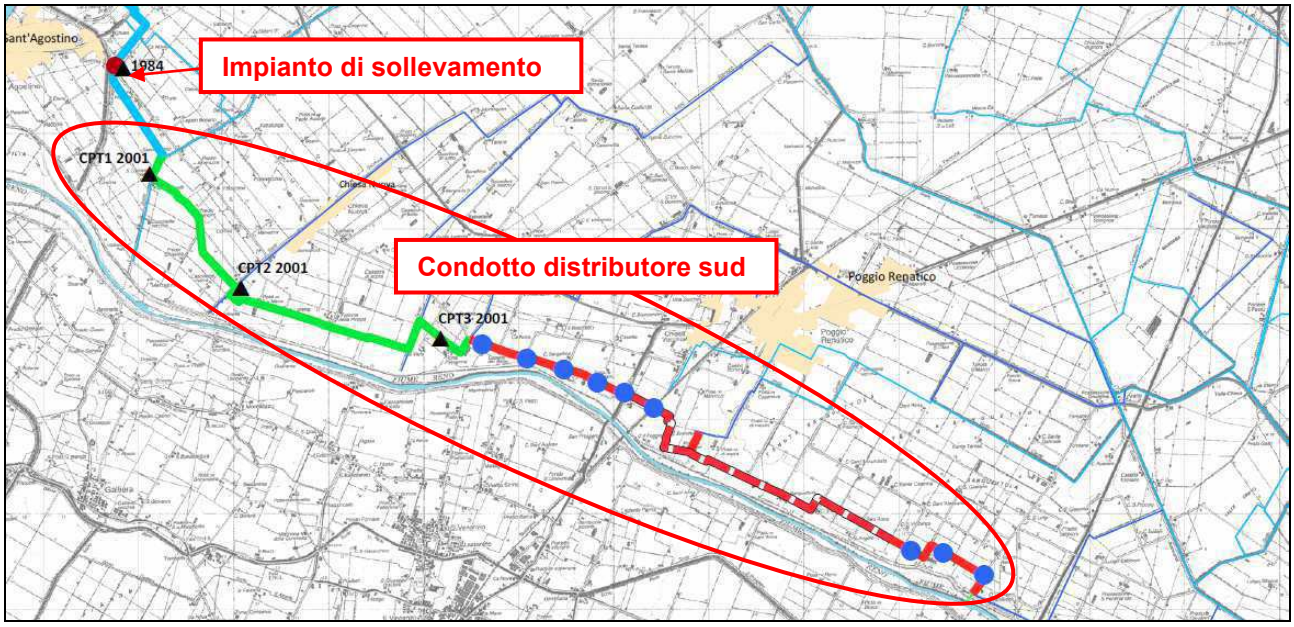


Figura 1: Quadro di unione.

In particolare il presente documento contiene i calcoli relativi allo spingitubo posizionato a cavallo della S.P.4 ved. Figura 2).

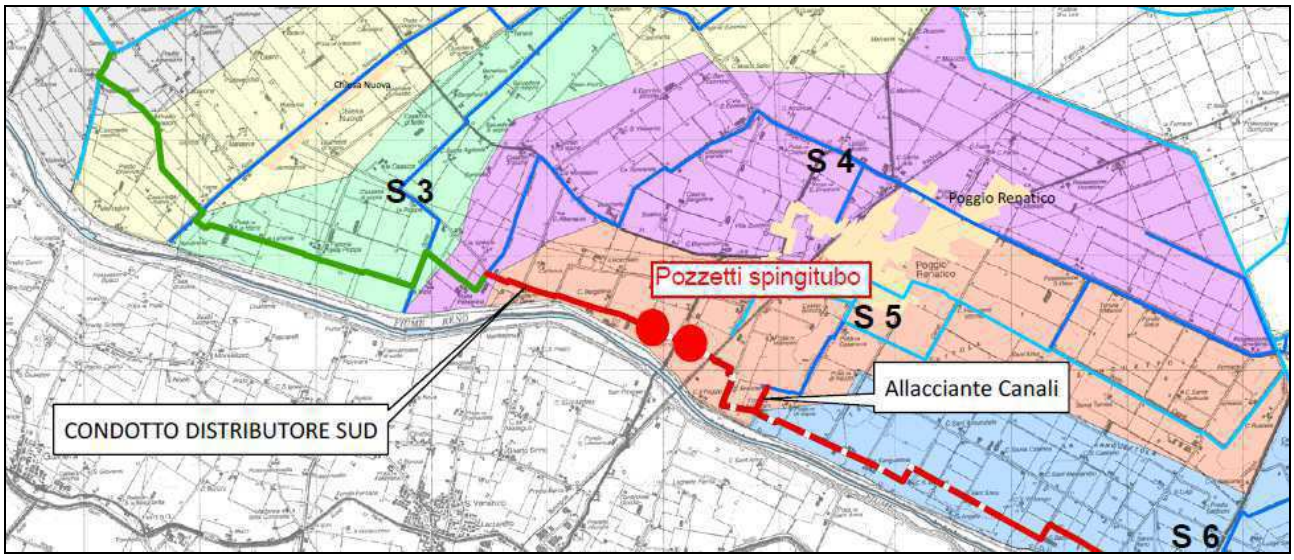


Figura 2: Ubicazione spingitubo

5 CARATTERISTICHE DEI MATERIALI

5.1 Conglomerato cementizio

Classe	C28/35
Resistenza caratteristica cubica	$f_{ck,cube}$ = 35 N/mm^2
Resistenza caratteristica cilindrica	$f_{ck,cyl}$ = 28 N/mm^2
Resistenza di calcolo a compressione	$f_{cd} = \alpha_{cc} * f_{ck}/\gamma_c = 0,85 * f_{ck}/1,5$ = 15,87 N/mm^2
Resistenza a trazione media	$f_{ctm} = 0,30 * f_{ck}^{2/3}$ = 2,766 N/mm^2
Resistenza a trazione (frattile 5%)	$f_{ctk\ 0,05} = 0,7 * f_{ctm}$= 1,936 N/mm^2
Resistenza a trazione di calcolo	$f_{ctd} = f_{ctk0,05} / \gamma_c$ = 1,290 N/mm^2
Classe di esposizione	XC2
Classe di consistenza	S4

5.2 Acciaio per cemento armato

Per le armature metalliche si adottano tondini in acciaio del tipo B450C controllato in stabilimento che presentano le seguenti caratteristiche:

Tensione di snervamento caratteristica	$f_{yk} \geq$ 450 N/mm^2
Tensione caratteristica a rottura	$f_{tk} \geq$ 540 N/mm^2
Resistenza di calcolo	$f_{yd} = f_{yk} / \gamma_s$= 450/1,15 = 391,30 N/mm^2
Deformazione caratteristica al carico massimo	ε_{uk} = 7,5 %
Deformazione di progetto	ε_{ud} = 6,75 %

6 DURABILITÀ DELLE OPERE

Per garantire la durabilità delle strutture in calcestruzzo armato ordinario, esposte all'azione dell'ambiente, si devono adottare i provvedimenti atti a limitare gli effetti di degrado indotti dall'attacco chimico, fisico e derivante dalla corrosione delle armature e dai cicli di gelo e disgelo.

Al fine di ottenere la prestazione richiesta in funzione delle condizioni ambientali, nonché per la definizione della relativa classe, si fa riferimento alle indicazioni contenute nelle Linee Guida sul calcestruzzo strutturale edite dal Servizio Tecnico Centrale del Consiglio Superiore dei Lavori Pubblici ovvero alle norme UNI EN 206-1:2006 ed UNI 11104:2004.

1 Nessun rischio di corrosione o di attacco		
X0	Calcestruzzo privo di armatura o inserti metallici: tutte le esposizioni eccetto dove c'è gelo/disgelo, abrasione o attacco chimico. Calcestruzzo con armatura o inserti metallici molto asciutto.	Calcestruzzo all'interno di edifici con umidità dell'aria molto bassa.
2 Corrosione indotta da carbonatazione		
XC1	Asciutto o permanentemente bagnato	Calcestruzzo all'interno di edifici con bassa umidità relativa. Calcestruzzo costantemente immerso in acqua
XC2	Bagnato, raramente asciutto	Superfici di calcestruzzo a contatto con acqua per lungo tempo. Molte fondazioni
XC3	Umidità moderata	Calcestruzzo all'interno di edifici con umidità dell'aria moderata oppure elevata. Calcestruzzo esposto all'esterno protetto dalla pioggia
XC4	Ciclicamente bagnato e asciutto	Superfici di calcestruzzo soggette al contatto con acqua, non nella classe di esposizione XC2
3 Corrosione indotta da cloruri		
XD1	Umidità moderata	Superfici di calcestruzzo esposte a nebbia salina
XD2	Bagnato, raramente asciutto	Piscine. Calcestruzzo esposto ad acque industriali contenenti cloruri
XD3	Ciclicamente bagnato ed asciutto	Parti di ponti esposte a spruzzi contenenti cloruri Pavimentazioni stradali e di parcheggi
4 Corrosione indotta da cloruri presenti nell'acqua di mare		
XS1	Esposto a nebbia salina ma non in contatto diretto con acqua di mare	Strutture prossime oppure sulla costa
XS2	Permanentemente sommerso	Parti di strutture marine
XS3	Zone esposte alle onde, agli spruzzi oppure alle maree	Parti di strutture marine
5 Attacco di cicli gelo/disgelo		
XF1	Moderata saturazione d'acqua, senza impiego di agente antigelo	Superfici verticali di calcestruzzo esposte alla pioggia e al gelo
XF2	Moderata saturazione d'acqua, con uso di agente antigelo	Superfici verticali di calcestruzzo di strutture stradali esposte al gelo e nebbia di agenti antigelo
XF3	Elevata saturazione d'acqua, senza antigelo	Superfici orizzontali di calcestruzzo esposte alla pioggia e al gelo
XF4	Elevata saturazione d'acqua, con antigelo oppure acqua di mare	Strade e impalcati da ponte esposti agli agenti antigelo Superfici di calcestruzzo esposte direttamente a nebbia contenente agenti antigelo e al gelo

6. Attacco chimico		
XA1	Ambiente chimico debolmente aggressivo	Suoli naturali ed acqua del terreno
XA2	Ambiente chimico moderatamente aggressivo	Suoli naturali ed acqua del terreno
XA3	Ambiente chimico fortemente aggressivo	Suoli naturali ed acqua del terreno

Per le opere della presente relazione si adottano le classi di esposizione indicate al capitolo 5.1 ricordando che per ciascuna classe di esposizione le condizioni ambientali da considerare sono le seguenti.

Condizioni ambientali	**Classe di esposizione**
Ordinarie	X0, XC1, XC2, XC3, XF1
Aggressive	XC4, XD1, XS1, XA1, XA2, XF2, XF3
Molto aggressive	XD2, XD3, XS2, XS3, XA3, XF4

Nella tabella seguente si riportano per completezza anche i limiti di apertura delle fessure in funzione delle condizioni ambientali e della sensibilità delle armature:

Gruppi di esigenze	**Condizioni ambientali**	**Combinazione di azioni**	**Armatura**			
			Sensibile		**Poco sensibile**	
			Stato limite	**w_d**	**Stato limite**	**w_d**
a	*Ordinarie*	frequente	ap. fessure	$\leq w_2$	ap. fessure	$\leq w_3$
		quasi permanente	ap. fessure	$\leq w_1$	ap. fessure	$\leq w_2$
b	*Aggressive*	frequente	ap. fessure	$\leq w_1$	ap. fessure	$\leq w_2$
		quasi permanente	decompressione	-	ap. fessure	$\leq w_1$
c	*Molto aggressive*	frequente	formazione fessure	-	ap. fessure	$\leq w_1$
		quasi permanente	decompressione	-	ap. fessure	$\leq w_1$

Per tutte le parti strutturali componenti l'opera in progetto si utilizzano armature **poco sensibili**.

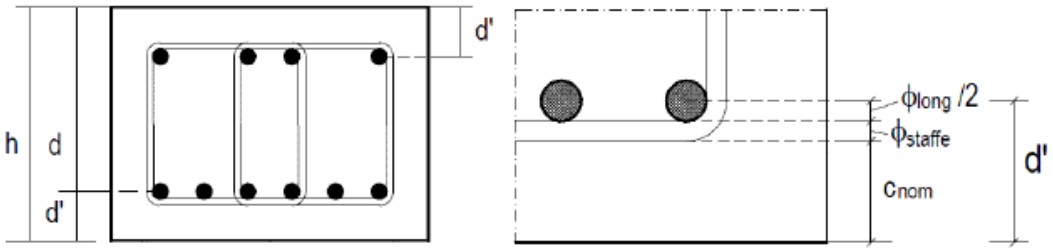
6.1 Calcolo del copriferro

Ai fini della protezione delle armature dala corrosione, lo strato di ricoprimento del calcestruzzo (copriferro) deve essere dimensionato in funzione dell'aggressività dell'ambiente e della sensibilità delle armature alla corrosione, tenendo anche conto delle tolleranze di posa delle armature; a tale scopo si può fare utile riferimento alla UNI EN 1992 1-1.

Dunque, il calcolo del copriferro di progetto è stato condotto in ottemperanza a quanto prescritto dall'EC2.

$$c_{nom} = c_{min} + \Delta c_{dev}$$

$$c_{min} = \max (c_{min,b} ; c_{min,dur} + \Delta c_{dur,\gamma} - \Delta c_{dur,st} - \Delta c_{dur,add} ; 10mm)$$



Specificatamente:

- c_{nom}= copriferro minimo di progetto (ved. formula soprastante);
- $c_{min,b}$= copriferro minimo per garantire l'aderenza – tale valore è stabilito dalla tabella seguente.

prospetto 4.2 **Copriferro minimo, $c_{min,b}$, richiesto con riferimento all'aderenza**

Requisito relativo all'aderenza	
Disposizione delle armature	Copriferro minimo $c_{min,b}$ *)
Isolate	Diametro della barra
Raggruppate	Diametro equivalente (ϕ_n) (vedere punto 8.9.1)
*) Se la dimensione nominale massima dell'aggregato è maggiore di 32 mm, si raccomanda di maggiorare $c_{min,b}$ di 5 mm.	

Nel caso in oggetto le armature possono essere di tipo raggruppato essendoci sovrapposizione tra i ferri principali.

$c_{min,\ dur}$= copriferro minimo per garantire la durabilità – tale valore è stabilito dalla tabella seguente sulla base della classe di esposizione e della classe strutturale.

prospetto 4.4N **Valori del copriferro minimo, $c_{min,dur}$, requisiti con riferimento alla durabilità per acciai da armatura ordinaria, in accordo alla EN 10080**

Requisito ambientale per $c_{min,dur}$ (mm)							
Classe strutturale	Classe di esposizione secondo il prospetto 4.1						
	X0	XC1	XC2 / XC3	XC4	XD1 / XS1	XD2 / XS2	XD3 / XS3
S1	10	10	10	15	20	25	30
S2	10	10	15	20	25	30	35
S3	10	10	20	25	30	35	40
S4	10	15	25	30	35	40	45
S5	15	20	30	35	40	45	50
S6	20	25	35	40	45	50	55

Nel caso di specie la struttura rientra nella classe di esposizione

XC2 con classe strutturale **S4**

Δc_{dev}= tolleranza di esecuzione varia da 0 a 10 mm.

Per il caso in oggetto è stata posta pari a 5mm.

Pertanto, nel caso in oggetto ed in riferimento alle armature principali si ha:

MANIFATTI IN C.A.

VERIFICA DI DURABILITA' EC 2	
Classe di esposizione	XC2
Classe strutturale	S4
Misura aggregato MAX	32
Armature isolate	si
Numero Barre	/
$c_{min,dur}$	25
Φ	26
$c_{min,b}$	26
c_{min}	26
Δc_{dev}	5
c_{nom}	31
c_{prog}	50
VERIFICA	OK

7 SPINGITUBO

Lo spingitubo, permette di posizionare una tubazione senza eseguire lo scavo a cielo aperto, che nel caso in oggetto non si potrebbe fare a causa della presenza di una condotta SNAM.

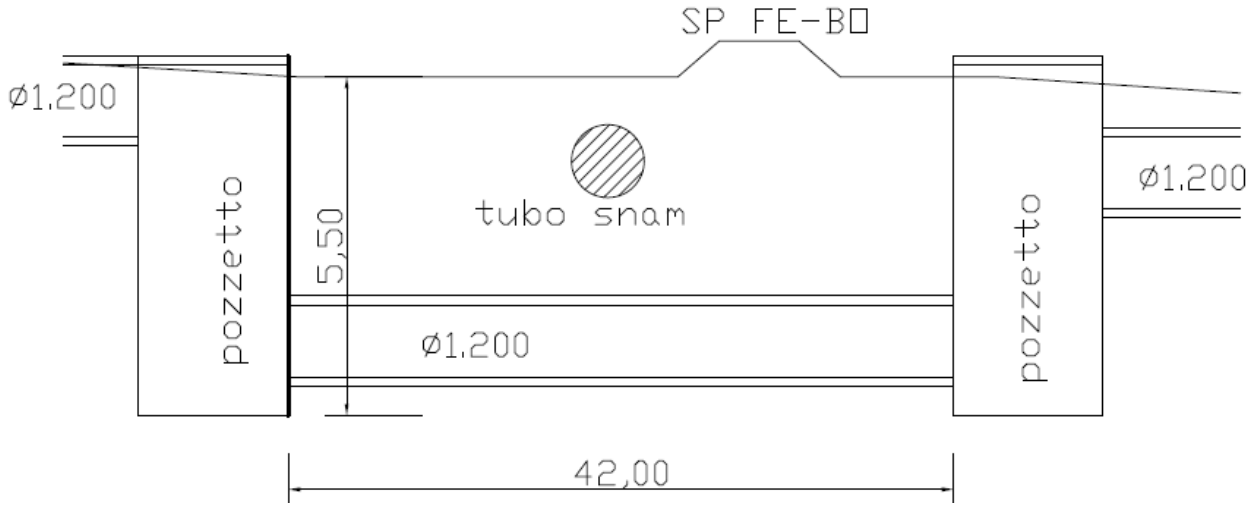


Figura 3: Schema dello spingitubo e indicazione sulla posizione del tubo SNAM.

Esso consiste in una camera di spinta, dalla quale viene spinto nel terreno il tubo DN 1200, fino alla camera di arrivo, distante circa 42 m

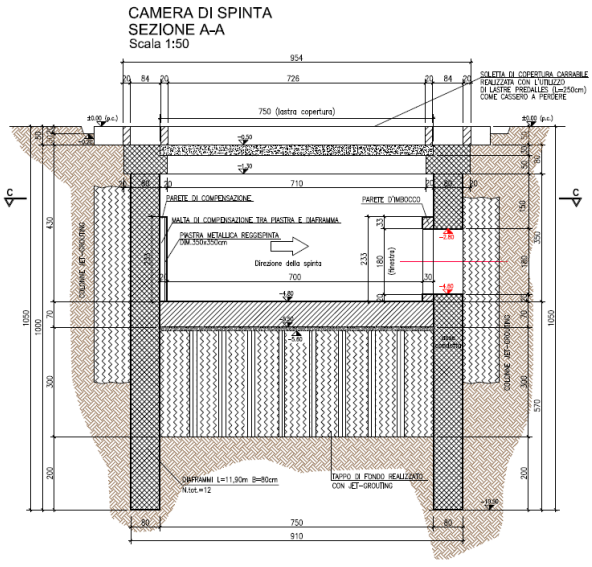


Figura 4: Camera di spinta.

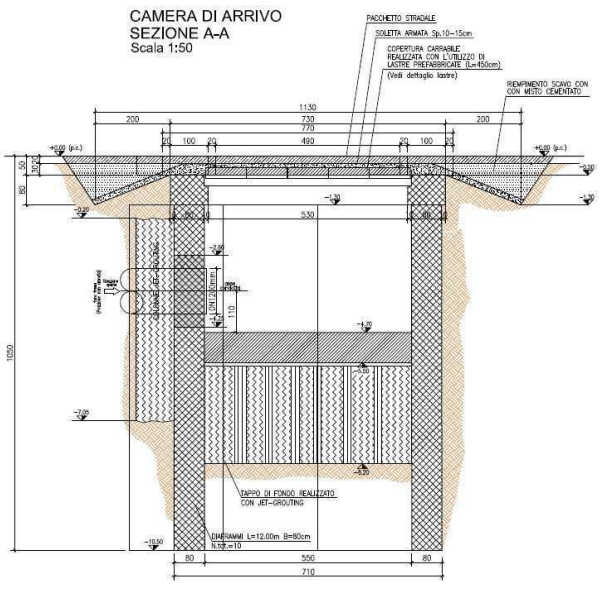


Figura 5: Camera di arrivo.

Di seguito si riportano le caratteristiche geometriche dell'opera da progettare.

Caratteristiche dell'opera:

Lunghezza diaframma	10.50m
Altezza trave di correa	0.8m
Spessore diaframma	0.8m
Profondità piano di scavo	5.5m

I parametri del terreno e della falda sono riportati nell'output di calcolo di Paratie allegato alla presente relazione.

Le lastre di copertura saranno del tipo "Predalles" e dovranno avere una portanza compatibile con i carichi da ponte di I Categoria NTC2008.

7.1 Modello

Il problema è ridotto al caso piano in un cui viene analizzata una porzione di parete di larghezza unitaria (vedi Figura 6).

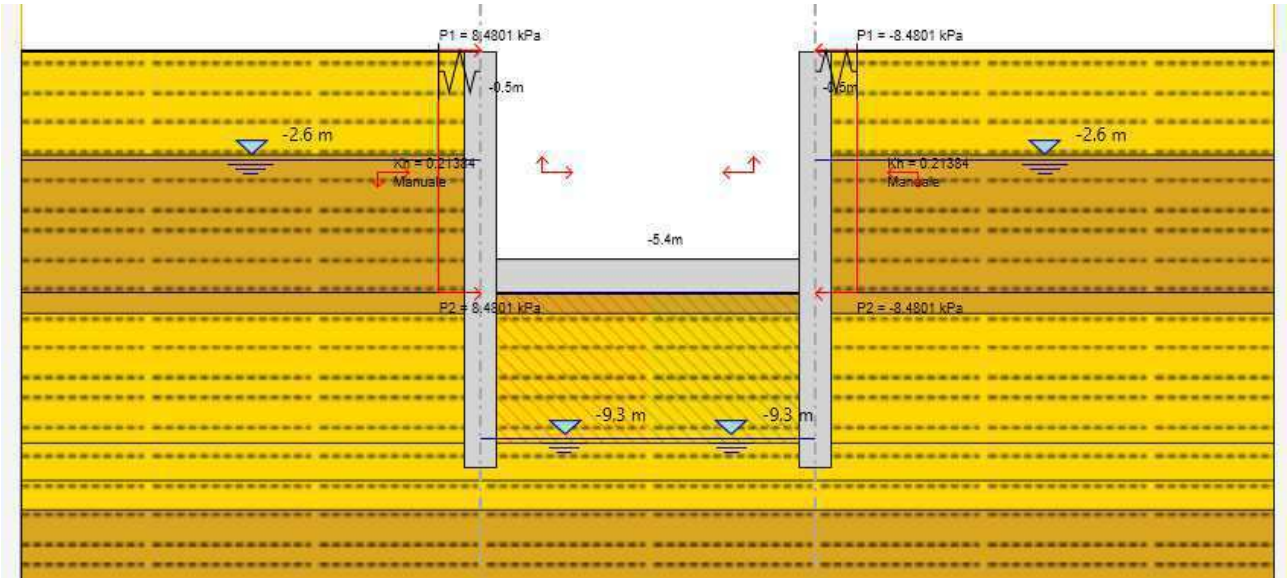


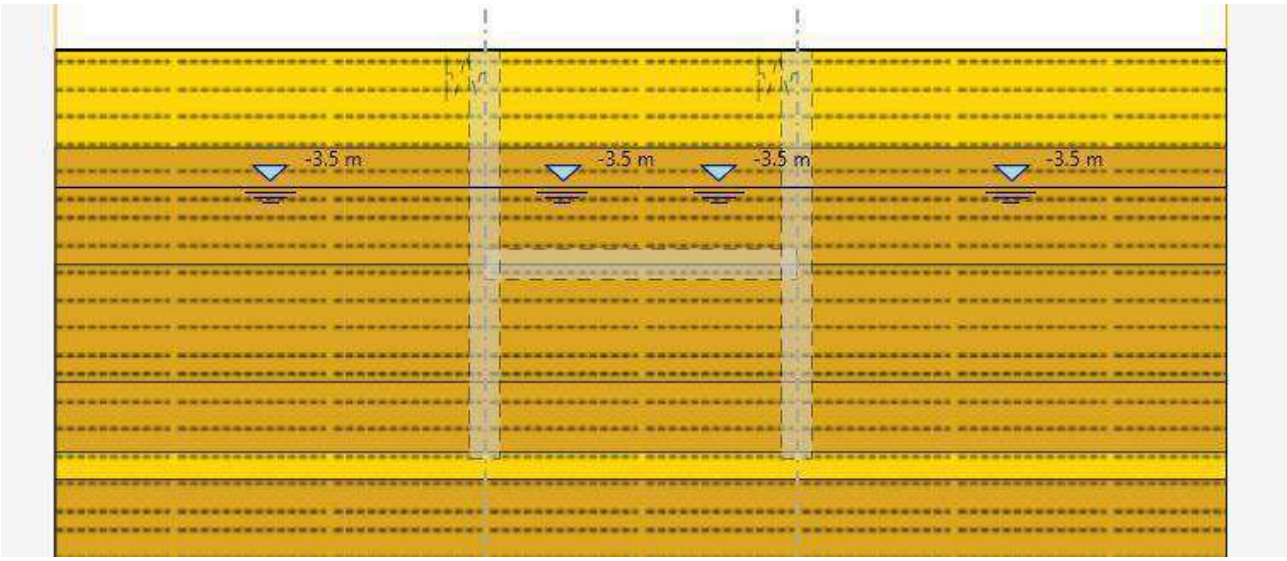
Figura 6: Modello piano dell'opera.

La modellazione numerica dell'interazione terreno-struttura è del tipo "trave su suolo elastico": le pareti di sostegno vengono rappresentate con elementi finiti trave il cui comportamento è definito dalla rigidezza

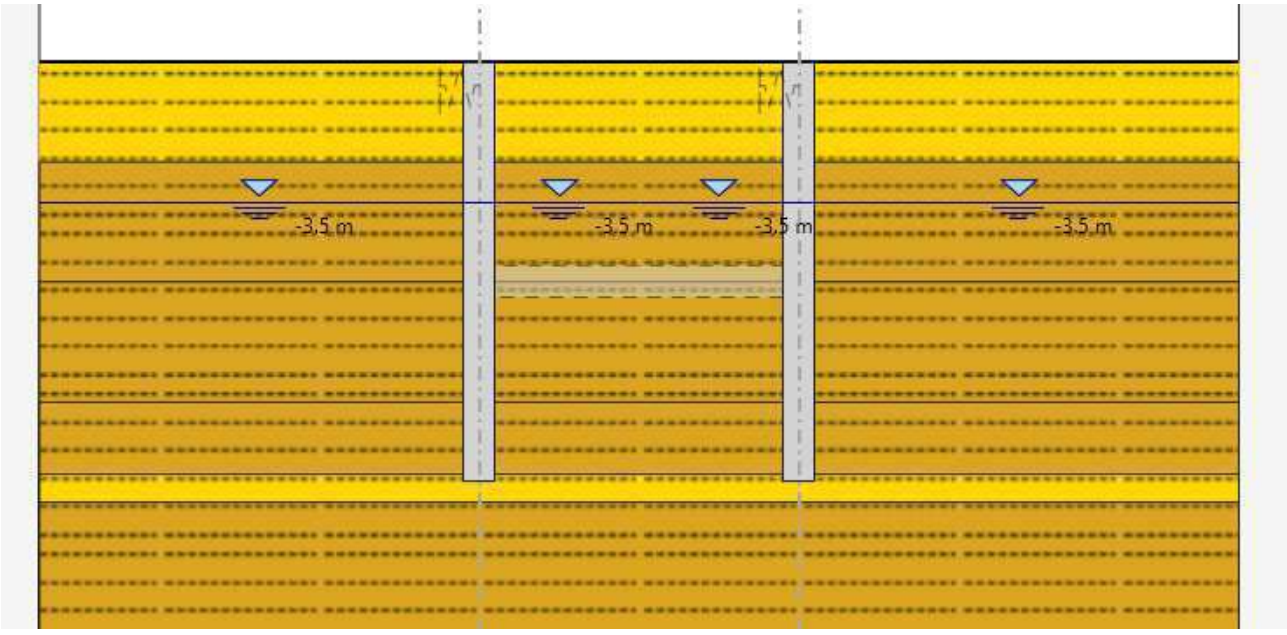
flessionale EJ, mentre il terreno viene simulato attraverso elementi elastoplastici monodimensionali (molle) connessi ai nodi delle paratie.

Si riportano di seguito le fasi di costruzione dei diaframmi e dello scavo che caratterizzano la realizzazione delle camerette.

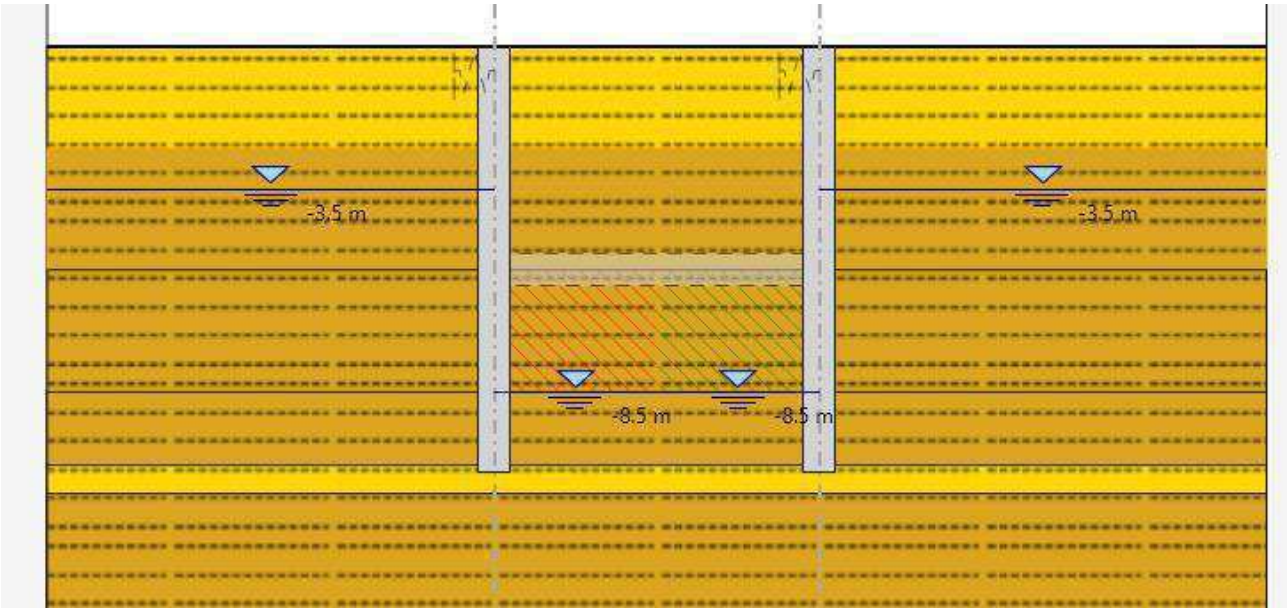
Fase 0: Condizioni allo stato di fatto: terreno indisturbato e presenza della falda.



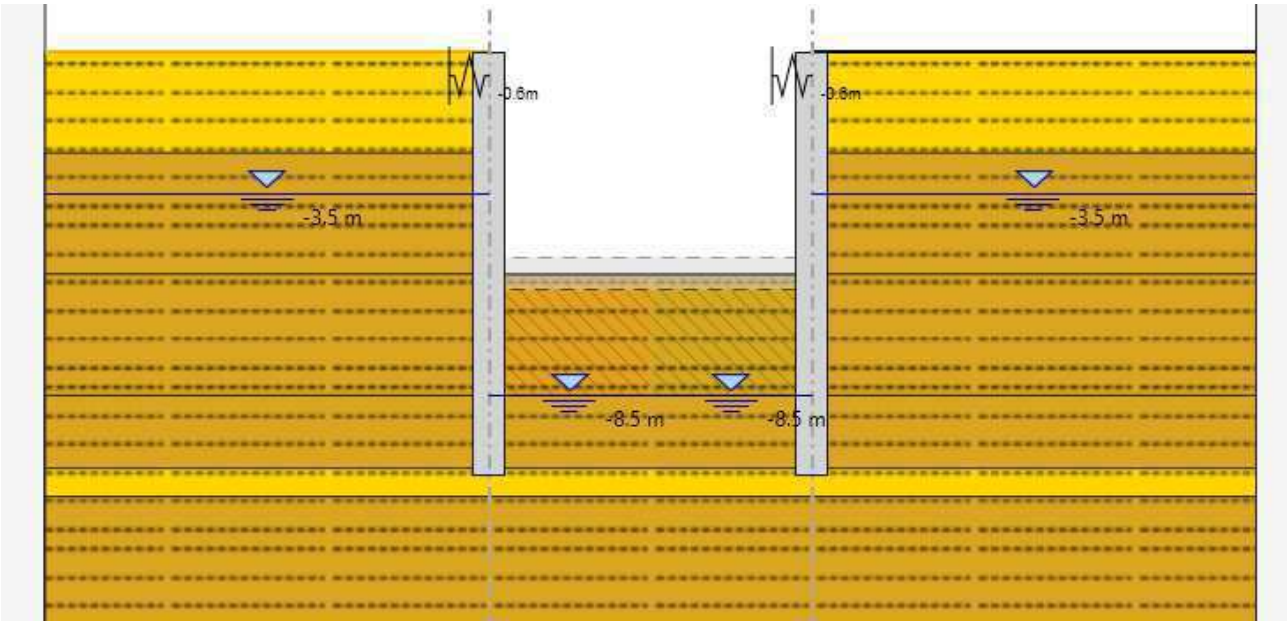
Fase 1: Realizzazione dei diaframmi di lunghezza 10.50 m, spessore 80cm



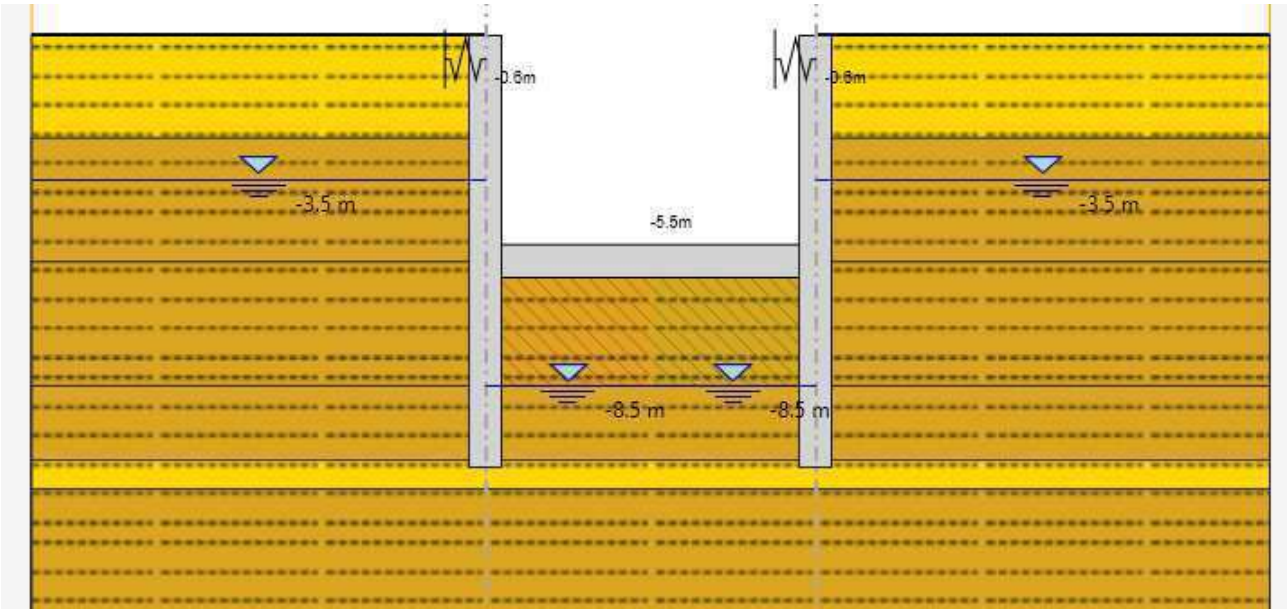
Fase 2: Realizzazione tappo di fondo Sp=3m con la tecnica del jet-grouting.



Fase 3: Si procede con lo scavo, fino alla quota di -5.00m dalla testa dei diaframmi realizzazione trave di correa



Fase 4: Si realizza la soletta di fondazione



7.2 Azioni

7.2.1 Azioni statiche

Nel caso statico per la valutazione dei coefficienti di spinta attiva e dei coefficienti di spinta passiva si è fatto ricorso rispttivamente alla teoria di Coulomb Rankine e di Caquot e Kerisel, assumendo i parametri di resistenza al taglio descritti nella sezione realtiva la stratigrafia del terreno ed angoli di attrito muro-terreno pari a $\delta = 0.5\phi'$.

Strato di Terreno	Terreno	γ dry	γ sat	ø'	øcv	øp	c'	Su	Modulo Elastico Eu	Evc	Eur	Ah	Av	exp	Pa	Rur/Rvc	Rvc	Ku	Kvc	Kur
		kN/m³	kN/m³	°	°	°	kPa	kPa		kPa	kPa				kPa		kPa	kN/m³	kN/m³	kN/m³
1	S-SL	17	20	30			0		Constant	6000	9600									
2	CL-ML	16	19	31			0		Constant	16000	25600									
3	CL-ML	16	19	31			0		Constant	16000	25600									
4	CL-ML	16	19	31			0		Constant	16000	25600									
5	S-SL	17	20	30			0		Constant	6000	9600									
6	CL-ML	16	19	31			0		Constant	16000	25600									
7	S-SL	17	20	30			0		Constant	6000	9600									

7.2.2 Azioni dinamiche

La condizione di carico SLV è stata condotta in condizioni sismiche applicando un sisma statico equivalente. La sovraspinta sismica è stata applicata come carico uniformemente distribuito sull'altezza di paratia del tratto a mensola, con direzione da monte verso valle.

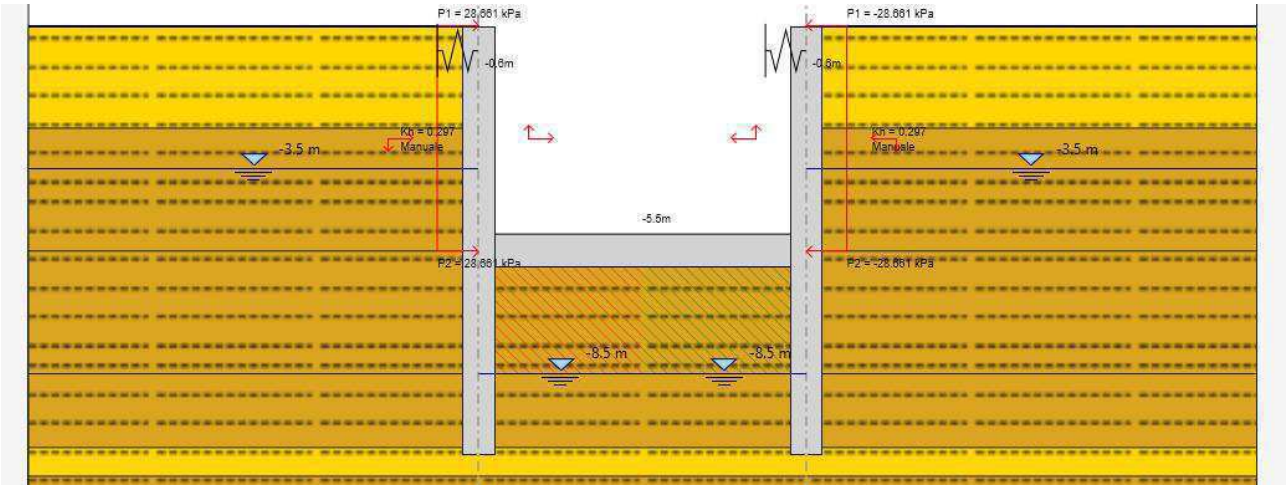


Figura 7: Applicazione carichi sismici sul diaframma.

7.3 Combinazioni di carico

Come prescritto nelle NTC 2018, per le paratie si devono considerare almeno i seguenti stati limite ultimi:

SLU di tipo strutturale

Raggiugimento della resistenza strutturale della paratia

Approccio 1 – Combinazione 1 (A1+M1+R1)

SLU di tipo geotecnico

Collasso per rotazione attorno a un punto dell'opera

Approccio 1 – Combinazione 2 (A2+M2+R1)

	Effetto	Coefficiente Parziale γ_F (o γ_E)	EQU	(A1)	(A2)
Carichi permanenti G_1	Favorevole	γ_{G1}	0,9	1,0	1,0
	Sfavorevole		1,1	1,3	1,0
Carichi permanenti G_2 [1]	Favorevole	γ_{G2}	0,8	0,8	0,8
	Sfavorevole		1,5	1,5	1,3
Azioni variabili Q	Favorevole	γ_{Qi}	0,0	0,0	0,0
	Sfavorevole		1,5	1,5	1,3

Parametro	Grandezza alla quale applicare il coefficiente parziale	Coefficiente parziale γ_M	(M1)	(M2)
Tangente dell'angolo di resistenza al taglio	$\tan \varphi'_k$	$\gamma_{\varphi'}$	1,0	1,25
Coesione efficace	c'_k	$\gamma_{c'}$	1,0	1,25
Resistenza non drenata	c_{uk}	γ_{cu}	1,0	1,4
Peso dell'unità di volume	γ_γ	γ_γ	1,0	1,0

Per quanto riguarda le resistenze si pone R1= 1

Verifiche agli SLE

In questo caso tutti i coefficienti moltiplicativi sono posti pari a 1.

Verifiche allo SLV

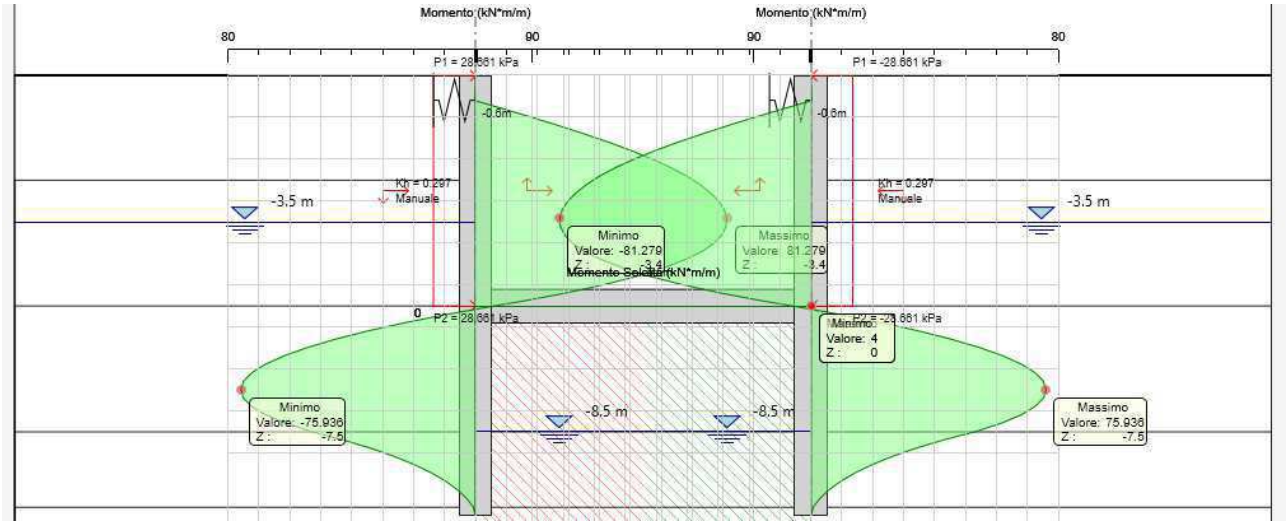
L'analisi sismica delle paratie si esegue con coefficienti parziali unitari sulle azioni e sui parametri geotecnici e considerando che la variazione delle spinte a monte e a valle della paratia per effetto delle azioni sismiche.

Anche in questo caso si pone R1= 1

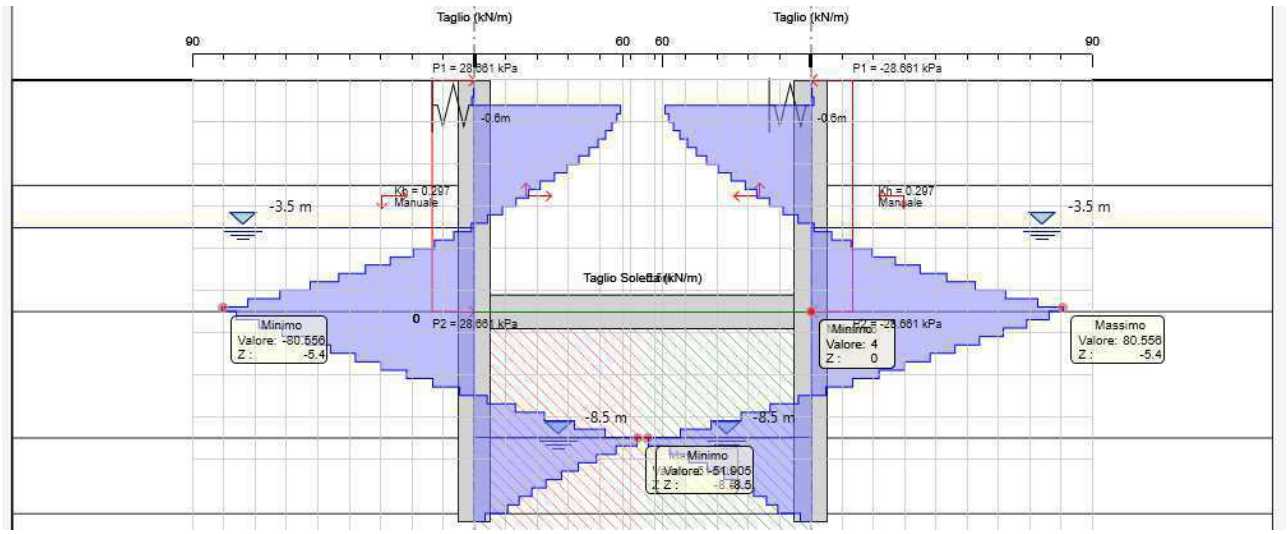
7.4 Sollecitazioni sui diaframmi

7.4.1 Combinazione SLU - Approccio 1 Combinazione 1 (STR)

Momento flettente

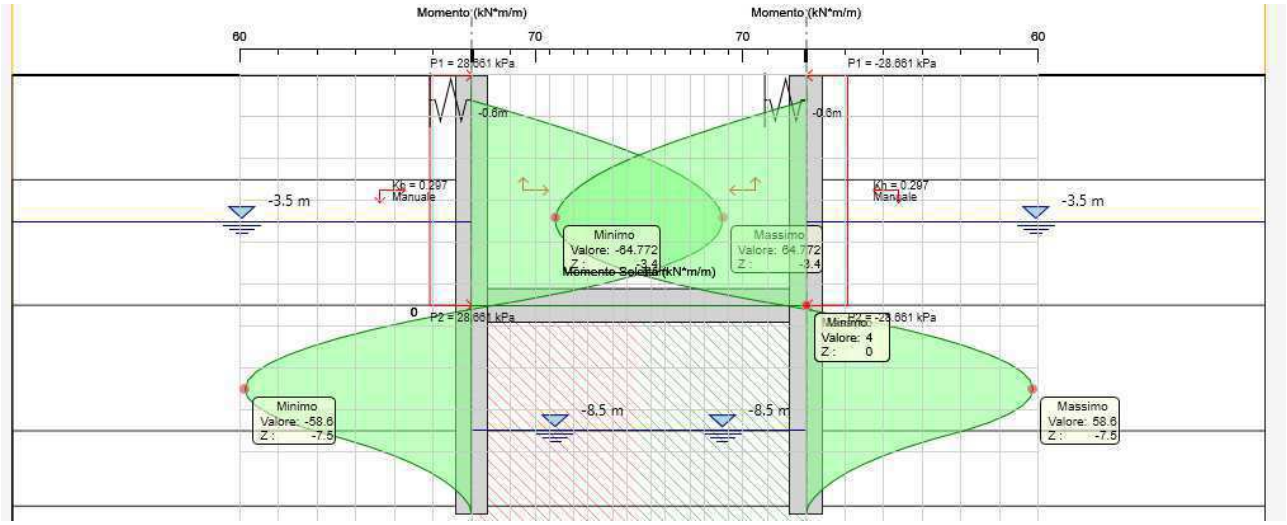


Taglio

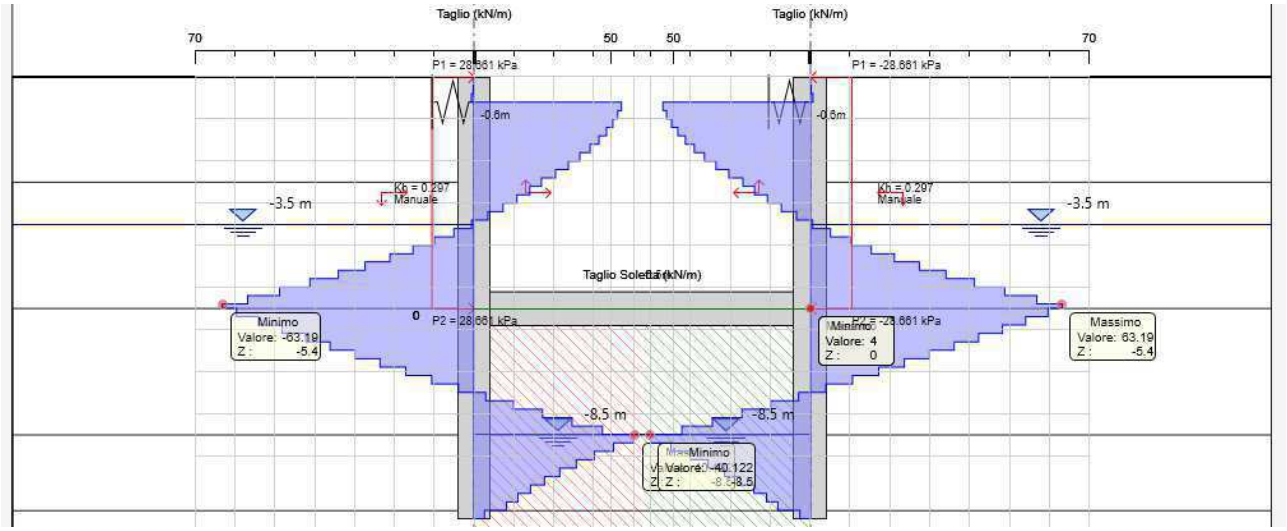


7.4.2 Combinazione SLU - Approccio 1 Combinazione 2 (GEO)

Massimo Momento Flettente

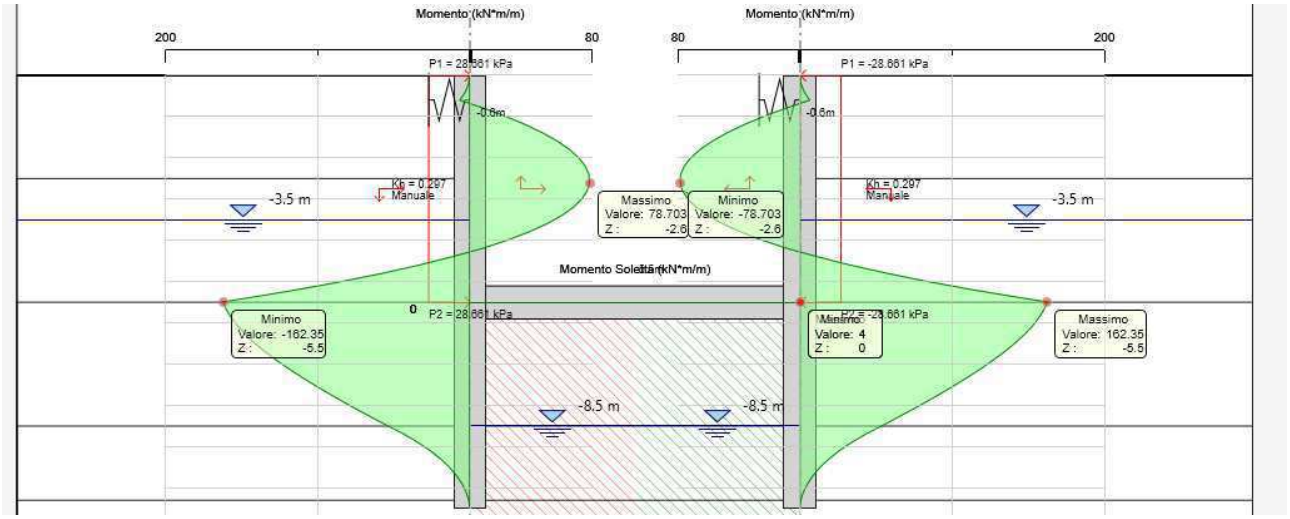


Taglio

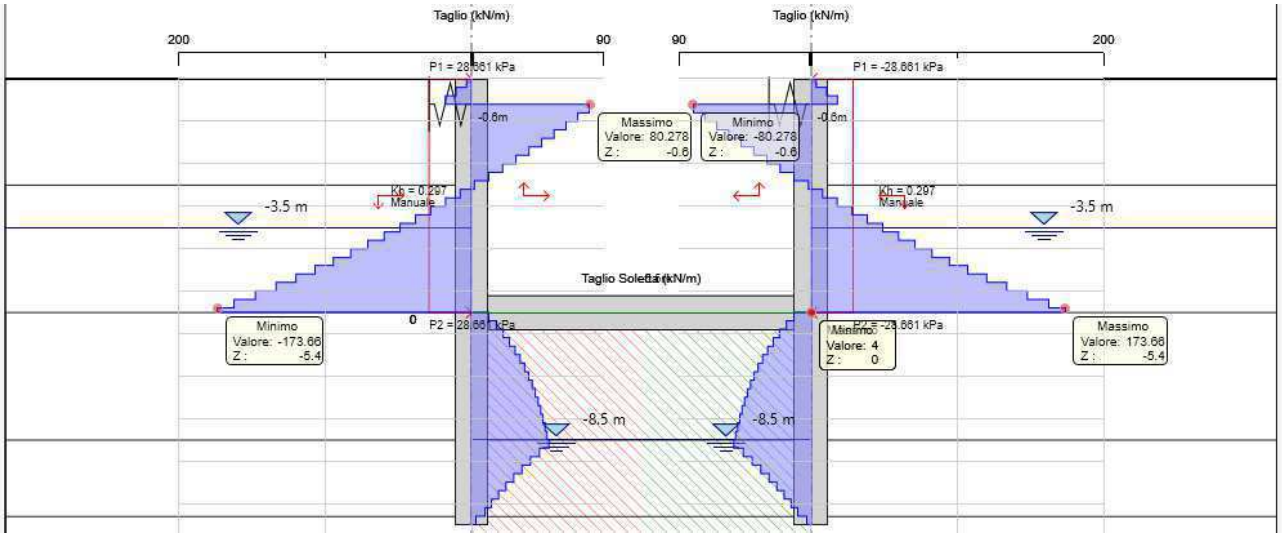


7.4.3 Verifiche agli SLV (condizioni sismiche)

Massimo Momento Flettente

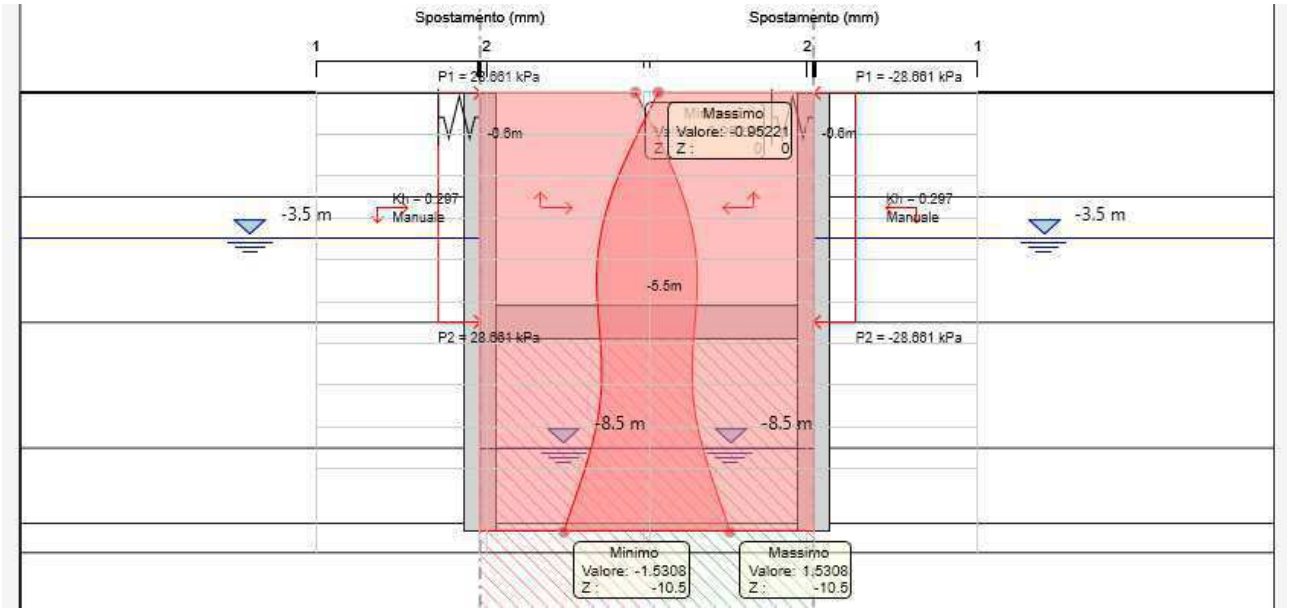


Taglio



7.4.4 Combinazione SLE

Per tale combinazione di carico si riportano di seguito i valori di spostamento ottenuti dal programma.



Tali spostamenti sono accettabili in relazione al tipo di opera prevista.

7.5 Verifiche agli SLU e agli SLE

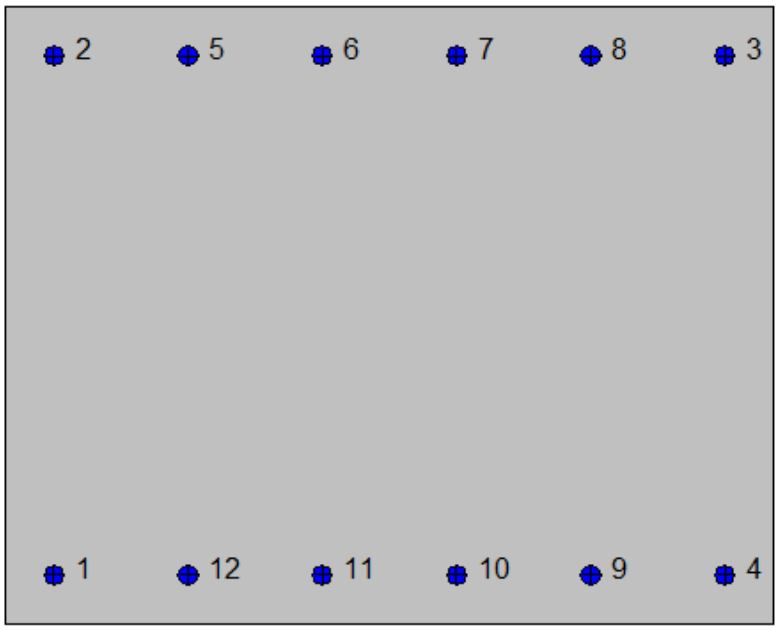
7.5.1 Verifiche a pressoflessione

2SI s.r.l - ProVLIM - Verifica sezioni



Geometria della sezione:

Vert.	X	Y
n.	cm	cm
1	0,0	0,0
2	0,0	80,0
3	100,0	80,0
4	100,0	0,0



Armature:

Pos.	X	Y	Area	Pretens.
n.	cm	cm	cmq	(s/n)
1	6,3	6,3	5,31	no
2	6,3	73,7	5,31	no
3	93,7	73,7	5,31	no
4	93,7	6,3	5,31	no
5	23,8	73,7	5,31	no
6	41,3	73,7	5,31	no
7	58,7	73,7	5,31	no
8	76,2	73,7	5,31	no
9	76,2	6,3	5,31	no
10	58,7	6,3	5,31	no
11	41,3	6,3	5,31	no
12	23,8	6,3	5,31	no

Normativa di riferimento:

D.M. 17/01/2018 - 'Norme tecniche per le costruzioni'

Note:

Verifiche SLE per ambiente ordinario

Materiali:
Calcestruzzo classe: C25/30
Rck (resistenza caratteristica cubica a compressione) = 300 daN/cmq
fck (resistenza caratteristica cilindrica a compressione) = 249 daN/cmq
fctm (resistenza a trazione media) = 26 daN/cmq
G (modulo di elasticità tangenziale) = 140388 daN/cmq
E (modulo elastico istantaneo iniziale) = 314470 daN/cmq
C. Poisson (coefficiente di contrazione trasversale) = 0.12
Coefficiente di dilatazione termica = 0.000050
Peso specifico del calcestruzzo armato = 2500 daN/mc

Barre d'acciaio ad aderenza migliorata tipo: B450C
fyk (tensione caratteristica di snervamento) = 4500 daN/cmq
fkt (tensione caratteristica di rottura) = 5400 daN/cmq
εuk (deformazione di rottura) = 0.075
G (modulo di elasticità tangenziale) = 770000 daN/cmq
E (modulo elastico) = 2000000 daN/cmq
C. Poisson (coefficiente di contrazione trasversale) = 0.30
Coefficiente di dilatazione termica = 0.000012
Peso specifico = 7850 daN/mc

Verifiche stato limite ultimo:
Per ogni combinazione di carico saranno svolte le verifiche:
Verifica per Mxu, Myu e Nu proporzionali (sigla verifica: P)
Verifica con rapporto Mxu, Myu assegnato (sigla verifica: M)
Verifica con Nu costante (sigla verifica: N)

Cmb.	N	Mx	My	Tipo	Nu	Mxu	Myu	Sd/Su	Verif.
	kN	kN m	kN m		kN	kN m	kN m		
1	0,0	-81,0	0,0	P	0,0	-865,7	0,0	0,090	OK
				M	n.d.	n.d.	n.d.	n.d.	
				N	0,0	-865,7	0,0	0,090	
2	0,0	-65,0	0,0	P	0,0	-865,7	0,0	0,070	OK
				M	n.d.	n.d.	n.d.	n.d.	
				N	0,0	-865,7	0,0	0,070	
3	0,0	163,0	0,0	P	0,0	865,7	0,0	0,190	OK

M	n.d.	n.d.	n.d.	n.d.
N	0,0	865,7	0,0	0,190

Riepilogo combinazioni maggiormente gravose:

Cmb.	N	Mx	My	Tipo	Nu	Mxu	Myu	Sd/Su	Verif.
	kN	kN m	kN m		kN	kN m	kN m		
3	0,0	163,0	0,0	P	0,0	865,7	0,0	0,190	OK
1	0,0	-81,0	0,0	M	n.d.	n.d.	n.d.	n.d.	OK
3	0,0	163,0	0,0	N	0,0	865,7	0,0	0,190	OK

Verifiche stato limite di esercizio per c. c. frequenti:

Valori limite:

Fessure: WkL = 0,40 mm (verifica Ok per Wk/WkL < 1)

Cmb		Mx	My	N	Wk	Wk/WkL
n.	e stato		kN m	kN m	kN	mm
4	OK	-63,0	0,0	0,0	0.00	0,00

7.5.2 Verifica al taglio

Come prescritto dalle NTC 2018 è stata eseguita la verifica a taglio per sezioni prive di armatura resistente a taglio.

ELEMENTI CHE NON RICHIEDONO ARMATURA AL TAGLIO

b	**1000**	**mm**
h	**800**	**mm**
d	**730**	**mm**
Rck	**35**	**MPa**
k	1,523	
ro1	0,026183	
fck	29,05	MPa
gammac	1,5	
sigmacp	0	MPa
bw	1000	mm
d	730	mm
n.ferri Long	36	
ϕ long	26	mm
Asl	530,93	mm^2
vmin	0,3547	
V_{Ed}	173,66	kN

VERIFICHE DI SICUREZZA			
	VRd (kN)	Vmin (kN)	V_{Rd} (kN)
	565,430	258,9376	565,4302
VERIFICA SODDISFATTA			

Come è possibile notare dai risultati della verifica, la sezione non necessiterebbe di armatura aggiuntiva resistente a taglio. Tuttavia, si prescrive un minimo quantitativo di armatura, costituita da staffe ϕ16/25.

7.5.3 Verifica a galleggiamento

Per la stabilità al sollevamento deve risultare che il valore di progetto dell'azione instabilizzante $V_{inst,d}$, combinazione di azioni permanenti ($G_{inst,d}$), sia non maggiore della combinazione dei valori di progetto delle azioni stabilizzanti ($G_{stb,d}$) e delle resistenze (R_d):

$$V_{inst,d} \leq G_{stb,d} + R_d \qquad \text{dove} \quad V_{inst,d} = G_{inst,d}$$

I coefficienti parziali sulle azioni sono i seguenti:

	Effetto	Coefficiente Parziale γ_F (o γ_E)	Sollevamento (UPL)
Carichi permanenti G_1	Favorevole	γ_{G1}	0,9
	Sfavorevole		1,1
Carichi permanenti G_2[1]	Favorevole	γ_{G2}	0,8
	Sfavorevole		1,5
Azioni variabili Q	Favorevole	γ_{Qi}	0,0
	Sfavorevole		1,5

[1] Per i carichi permanenti G2 si applica quanto indicato alla Tabella 2.6.I. Per la spinta delle terre si fa riferimento ai coefficienti γ_{G1}

Nel calcolo si assume anche il contributo stabilizzante dell'aderenza muro/terreno, assunta pari a 35 kPa.

VERIFICA A GALLEGGIAMENTO

γ_W =	10	kN/m^3	peso specifico volume d'acqua
γ_{CLS} =	25	kN/m^3	peso specifico struttura in c.a.
c_a =	35	kPa	aderenza muro in c.a./terreno
h_W =	2,9	m	altezza del battente idraulico in fase di esercizio
s_s =	0,8	m	spessore soletta inferiore
$h_{diaf.}$ =	5	m	altezza muro verticale
$s_{diaf.}$ =	0,8	m	spessore parete
L =	38,16	m	perimetro vasca
A=	73,4976	m	superfice vasca
P_s=	1469,95	kN	peso soletta
$P_{diaf.}$=	3816,00	kN	peso pareti
C_a =	6678	kN	Risultante aderenza muro/terreno
Fw=	2131,43	kN	Sottospinta con battente in fase di esercizio

$1,1 \cdot F_W$	≤	$0,9 \cdot P_{scat}$	+	$0,9 \cdot Pdiaf.$	+	$0,9 \cdot Ca$		
2344,6	≤	1322,957	+	3434,4	+	6010,2	=	10767,6
[kN]		[kN]		[kN]		[kN]		[kN]

La verifica a galleggiamento risulta soddisfatta.

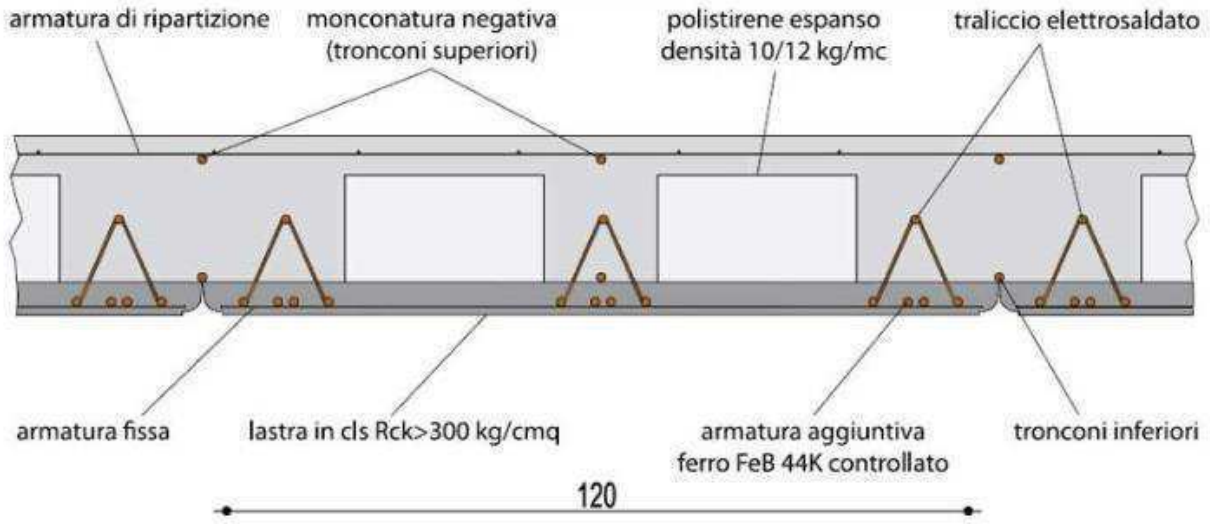
7.5.4 Verifiche a compressione

Si esegue la verifica a compressione di due elementi compressi:

1. della lastra predalles posta in copertura;
2. della soletta di completamento;

VERIFICA LASTRA PREDALLES

La lastra da progetto è la seguente:



Spessore Solaio	Spessore Lastra (a)	Altezza polistirolo (b)	Spessore cappa (c)	CLS da gettare sulle lastre modulo 120	CLS da gettare sulle lastre modulo 250	Peso solaio modulo 120	Peso solaio modulo 250
cm	cm	cm	cm	m³/m²	m³/m²	daN/m²	daN/m²
20	5	10	5	0,087	0,089	342	348
22	5	12	5	0,094	0,097	360	368
24	5	14	5	0,101	0,104	378	387
26	5	16	5	0,109	0,112	397	407
28	5	18	5	0,116	0,119	415	425
30	5	20	5	0,123	0,126	433	446
36	5	26	5	0,145	0,149	488	504
40	5	30	5	0,160	0,164	525	544

Resistenza a compressione della sezione in c.a. è data dalla seguente relazione:

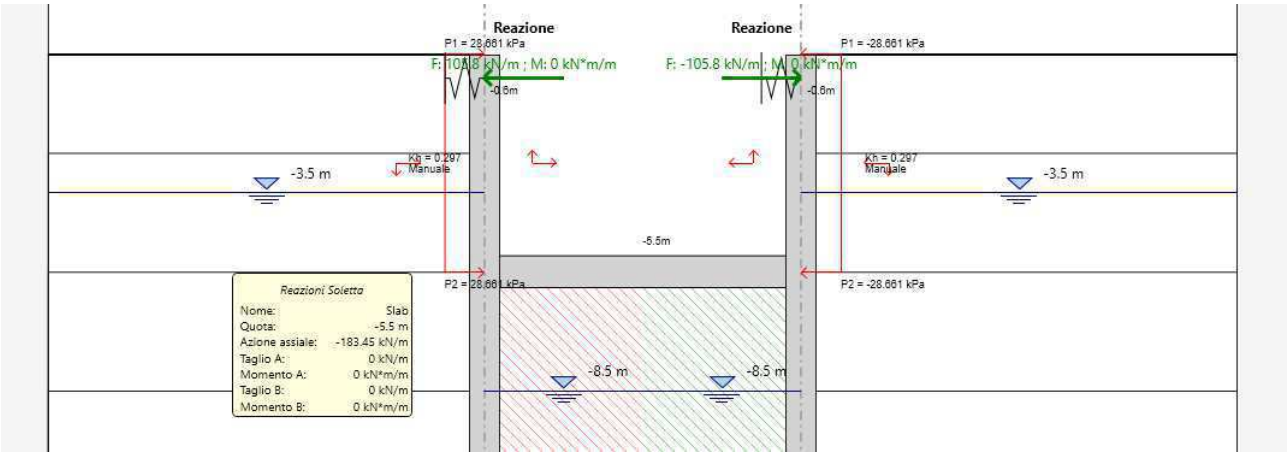
σ_{cp}=Ned/A≤0.2 f_{cd}

Dove:

A= 0.14 mq - Area della sezione in calcestruzzo

fcd=15.87 MPa (rif. Capitolo 5)

Lo sforzo normale agente sulla sezione è dato dal calcolo della paratia (in condizioni sismiche):



Ned= 183.45 kN/m

Dunque si ha:

σ_{cp}=(183.45/1.2)/0.14 =1092 kPa << 3174 kPa

LA VERIFICA A COMPRESSIONE RISULTA SODDISFATTA

VERIFICA SOLETTA

La soletta da progetto ha spessore pari a 80 cm (per maggiori dettagli si vedano i disegni di progetto).

Resistenza a compressione della sezione in c.a. è data dalla seguente relazione:

σ_{cp}=Ned/A≤0.2 f_{cd}

Dove:

A= 0.8 mq - Area della sezione in calcestruzzo

fcd=15.87 MPa (rif. Capitolo 5)

Ned= 105.8 kN/m

Dunque si ha:

σ_{cp}=105.8/0.8 =132 kPa << 3174 kPa

LA VERIFICA A COMPRESSIONE RISULTA SODDISFATTA

ALLEGATO A:
OUTPUT DI CALCOLO SPINGITUBO

Report di Calcolo

Nome Progetto: Spingitubo_REV2020

Autore: Ingegnere

Jobname: C:\Users\Bianca Maria\Desktop\StudioITA\2020-04_ConsorzioBonificaFE_CIARLE_NTC2018\Lavoro\Paratie\Spingitubo_TARATO_REV2020-A.pplus

Data: 30/03/2020 17:53:00

Design Section: Base Design Section

Sommario
Contenuto Sommario

Descrizione del Software

ParatiePlus è un codice agli elementi finiti che simula il problema di uno scavo sostenuto da diaframmi flessibili e permette di valutare il comportamento della parete di sostegno durante tutte le fasi intermedie e nella configurazione finale.

Descrizione della Stratigrafia e degli Strati di Terreno

Tipo : HORIZONTAL
Quota : 0 m
OCR : 1

Tipo : HORIZONTAL
Quota : -2.5 m
OCR : 1

Tipo : HORIZONTAL
Quota : -5.5 m
OCR : 1

Tipo : HORIZONTAL
Quota : -8.5 m
OCR : 1

Tipo : HORIZONTAL
Quota : -10.3 m
OCR : 1

Tipo : HORIZONTAL
Quota : -11 m
OCR : 1

Tipo : HORIZONTAL
Quota : -27.5 m
OCR : 1

Strato di Terreno	Terreno	γ dry	γ sat	ø'	øcv	øp	c'	Su	Modulo Elastico Eu	Evc	Eur	Ah	Av	exp	Pa	Rur/Rvc	Rvc	Ku	Kvc	Kur
		kN/m³	kN/m³	°	°	°	kPa	kPa		kPa	kPa				kPa		kPa	kN/m³	kN/m³	kN/m³
1	S-SL	17	20	30			0		Constant	6000	9600									
2	CL-ML	16	19	31			0		Constant	16000	25600									
3	CL-ML	16	19	31			0		Constant	16000	25600									
4	CL-ML	16	19	31			0		Constant	16000	25600									
5	S-SL	17	20	30			0		Constant	6000	9600									
6	CL-ML	16	19	31			0		Constant	16000	25600									
7	S-SL	17	20	30			0		Constant	6000	9600									

Descrizione Pareti

X : -4 m
Quota in alto : 0 m
Quota di fondo : -10.5 m
Muro di sinistra

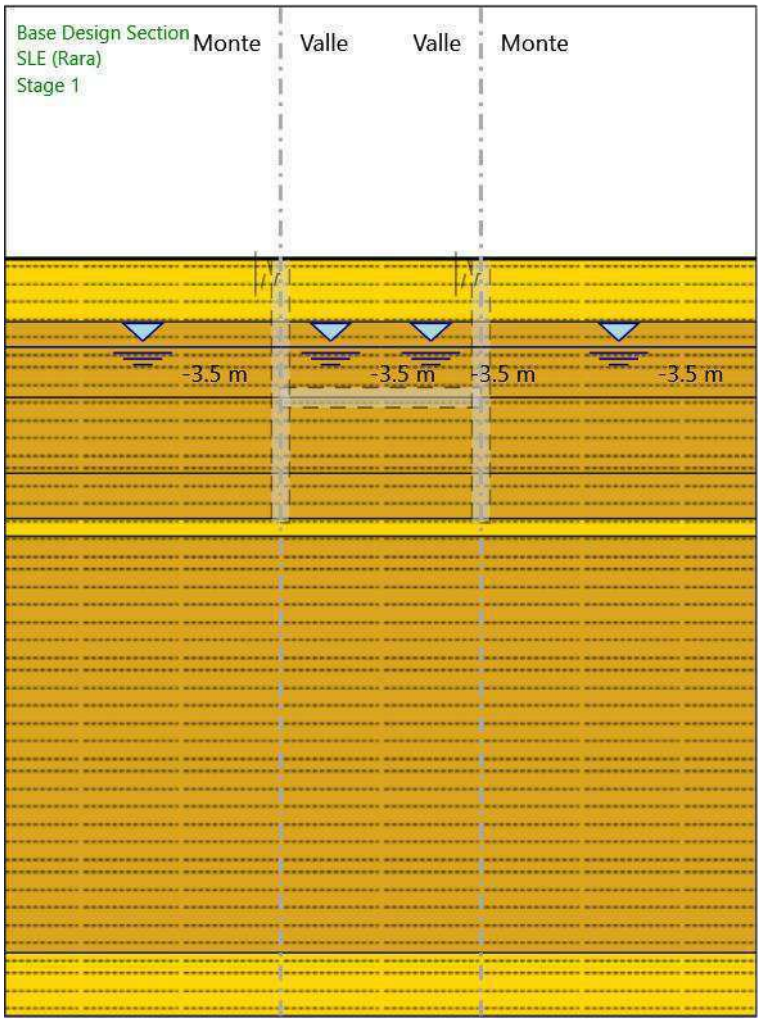
Sezione : Diaframma
Area equivalente : 0.8 m
Inerzia equivalente : 0.0427 m^4/m
Materiale calcestruzzo : C28/35
Tipo sezione : Solid
Spessore : 0.8 m
Efficacia : 1

X : 4 m
Quota in alto : 0 m
Quota di fondo : -10.5 m
Muro di destra

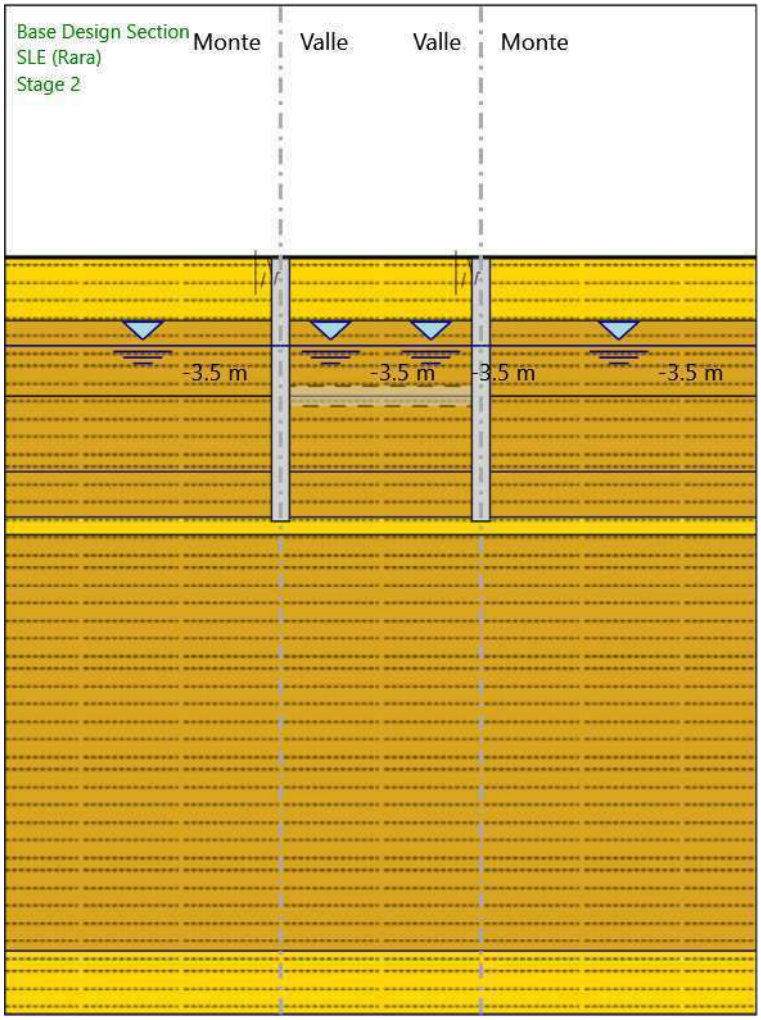
Sezione : Diaframma
Area equivalente : 0.8 m
Inerzia equivalente : 0.0427 m^4/m
Materiale calcestruzzo : C28/35
Tipo sezione : Solid
Spessore : 0.8 m
Efficacia : 1
Sezione : Diaframma
Area equivalente : 0.8 m
Inerzia equivalente : 0.0427 m^4/m
Materiale calcestruzzo : C28/35
Tipo sezione : Solid
Spessore : 0.8 m
Efficacia : 1

Fasi di Calcolo

Stage 1



Stage 2



Stage 2

Elementi strutturali

Paratia : WallElement

X : -4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Paratia : WallElement_New

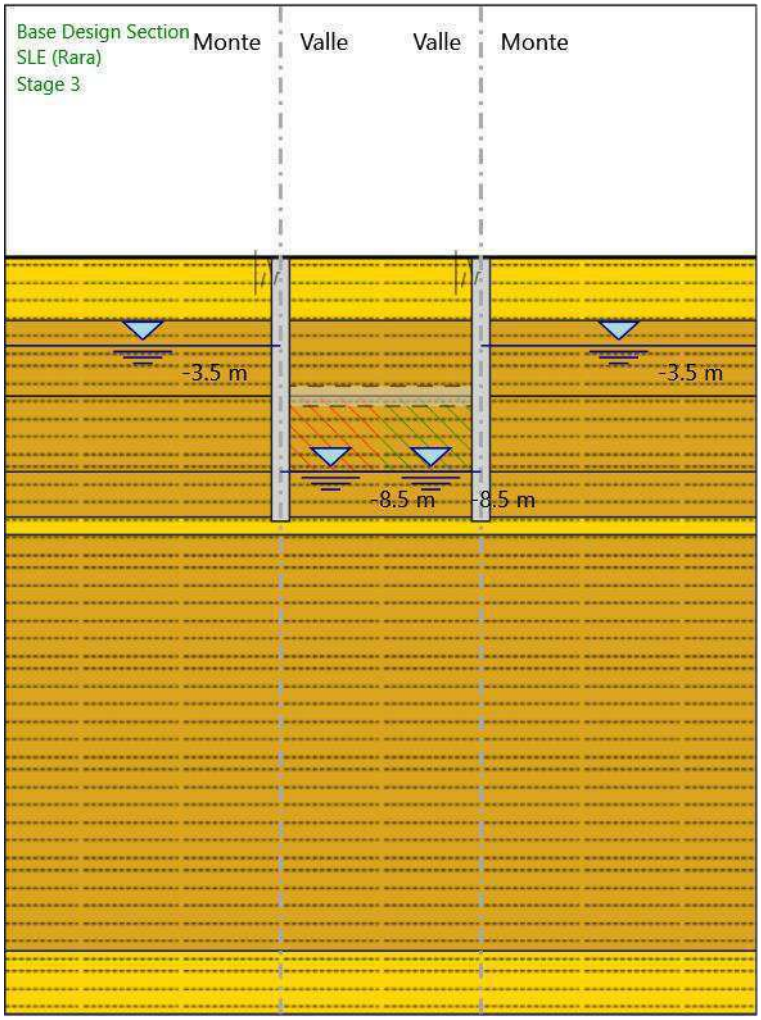
X : 4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Stage 3



Stage 3

Elementi strutturali

Paratia : WallElement

X : -4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Paratia : WallElement_New

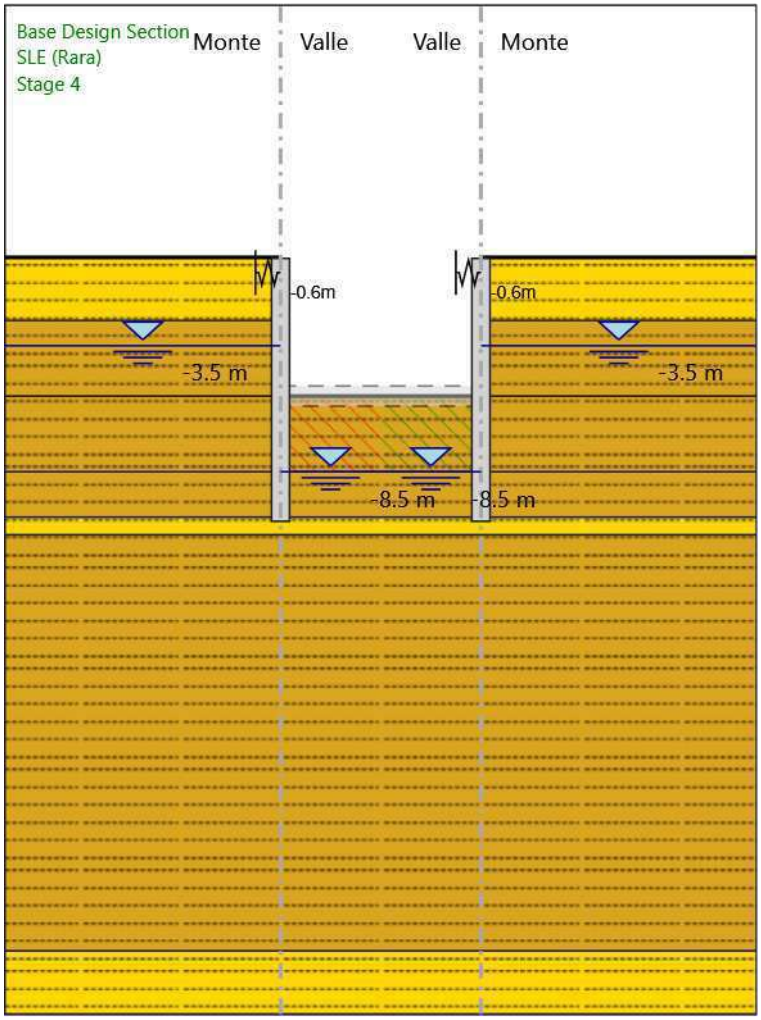
X : 4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Stage 4



Stage 4

Elementi strutturali

Paratia : WallElement

X : -4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Paratia : WallElement_New

X : 4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Vincolo elastico : Spring

X : -4 m

Z : -0.6 m

Angolo : 0 °

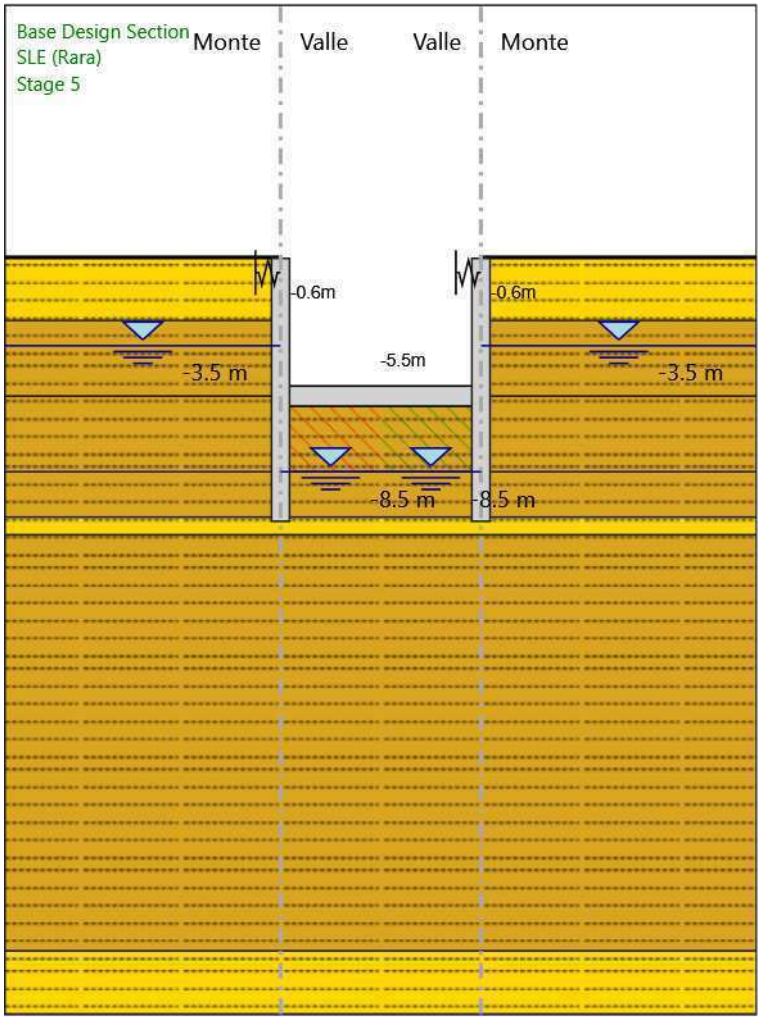
Vincolo elastico : Spring_New

X : 4 m

Z : -0.6 m

Angolo : 0 °

Stage 5



Stage 5

Elementi strutturali

Paratia : WallElement

X : -4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Paratia : WallElement_New

X : 4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Soletta : Slab

X del primo muro : -4 m

X del secondo muro : 4 m

Z : -5.5 m

Lunghezza : 8 m

Angolo : 0 °

Sezione : Soletta

Vincolo elastico : Spring

X : -4 m

Z : -0.6 m

Angolo : 0 °

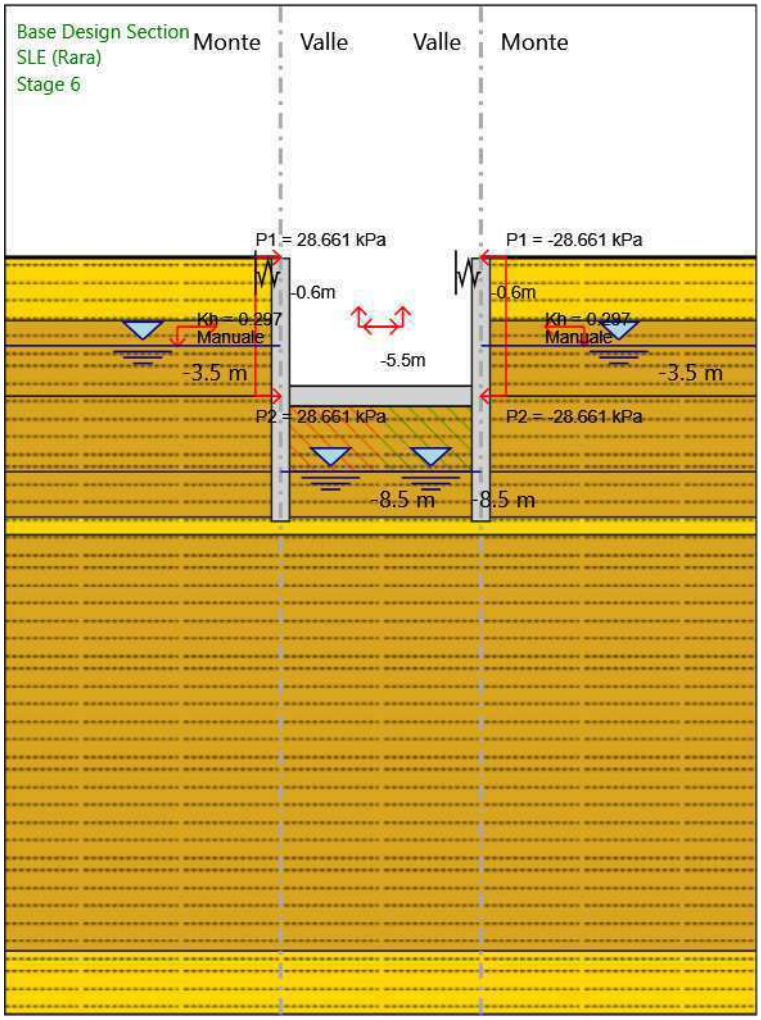
Vincolo elastico : Spring_New

X : 4 m

Z : -0.6 m

Angolo : 0 °

Stage 6



Stage 6

Elementi strutturali

Paratia : WallElement

X : -4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Paratia : WallElement_New

X : 4 m

Quota in alto : 0 m

Quota di fondo : -10.5 m

Sezione : Diaframma

Soletta : Slab

X del primo muro : -4 m

X del secondo muro : 4 m

Z : -5.5 m

Lunghezza : 8 m

Angolo : 0 °

Sezione : Soletta

Vincolo elastico : Spring

X : -4 m

Z : -0.6 m

Angolo : 0 °

Vincolo elastico : Spring_New

X : 4 m

Z : -0.6 m

Angolo : 0 °

Allegati

Design Assumption : Nominal - File di Paratie - File di input (.d)

```
* PARATIE ANALYSIS FOR DESIGN SECTION:Base Design Section USING ASSUMPTION: Nominal
 * Time:lunedi 30 marzo 2020 17:45:24
 * 1: Defining general settings
 UNIT  m kN
 TITLE Spingitubo_REV2020
 DELTA 0.2
 option param itemax 40
 option control hinges 0 0.0001 0.001

 * 2: Defining wall(s)
 WALL LeftWall_32 -4 -10.5 0 1
 WALL Rightwall_158 4 -10.5 0 -1

 * 3: Defining surfaces for wall(s)
 SOIL 0_L LeftWall_32 -10.5 0 1 0
 SOIL 0_R LeftWall_32 -10.5 0 2 180
 SOIL 1_L Rightwall_158 -10.5 0 2 0
 SOIL 1_R Rightwall_158 -10.5 0 1 180

 * 4: Defining soil layers
 *
 * Soil Profile (S-SL_164_170_0)
 *
 LDATA S-SL_164_170_0 0
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL
 *
 * Soil Profile (CL-ML_165_171_0)
 *
 LDATA CL-ML_165_171_0 -2.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_125890_0)
 *
 LDATA CL-ML_165_125890_0 -5.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_166_0)
 *
 LDATA CL-ML_165_166_0 -8.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (S-SL_164_142853_0)
 *
 LDATA S-SL_164_142853_0 -10.3
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL

 * 5: Defining structural materials
 * Steel material: 108 Name=Fe360 E=206000200 kPa
 MATERIAL Fe360_108 2.06E+08
 * Concrete material: 105 Name=C28/35 E=32308200 kPa
 MATERIAL C2835_105 3.231E+07

 * 6: Defining structural elements
 * 6.1: Beams and combined Wall Elements
 BEAM WallElement_893 LeftWall_32 -10.5 0 C2835_105 0.8 00 00 0
 BEAM WallElement_New_894 Rightwall_158 -10.5 0 C2835_105 0.8 00 00 0
```

```
* 6.2: Supports

SLAB Slab_96350 -5.5 C2835_105 0.8 0 0



CELA Spring_139030 LeftWall_32 -0.6 3.5E+04 0 1 1
CELA Spring_New_139031 Rightwall_158 -0.6 3.5E+04 0 1 1


* 6.3: Strips

* 7: Defining Steps
STEP Stage1_31
CHANGE S-SL_164_170_0 U-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 U-FRICT=30 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 U-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 U-FRICT=30 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ENDSTEP

STEP Stage2_789
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ADD WallElement_893 WallElement_New_894
ENDSTEP
```

```
STEP Stage3_895
CHANGE CL-ML_165_125890_0 D-COHE=200 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=50 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KA=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KP=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-PERM=0.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=200 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=50 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KA=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KP=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-PERM=0.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 5 -10.5 0 0
ENDSTEP

STEP Stage4_1103
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Spring_139030 Spring_New_139031
ENDSTEP

STEP Stage5_89160
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Slab_96350
ENDSTEP

STEP Stage6_95633
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
```

```
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
CHANGE S-SL_164_170_0 U-KAED=0.32 LeftWall_32
CHANGE S-SL_164_170_0 U-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_170_0 U-KPED=3.1 LeftWall_32
CHANGE S-SL_164_170_0 U-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_170_0 D-KAED=0.32 LeftWall_32
CHANGE S-SL_164_170_0 D-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_170_0 D-KPED=3.1 LeftWall_32
CHANGE S-SL_164_170_0 D-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 D-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 D-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 D-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 D-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KAED=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KAEW=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KPED=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KPEW=20.57 LeftWall_32
CHANGE CL-ML_165_166_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 D-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 D-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 D-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 D-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 U-KAED=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 U-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 U-KPED=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 U-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 D-KAED=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 D-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 D-KPED=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 D-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_170_0 U-KAED=0.32 Rightwall_158
CHANGE S-SL_164_170_0 U-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_170_0 U-KPED=3.1 Rightwall_158
CHANGE S-SL_164_170_0 U-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_170_0 D-KAED=0.32 Rightwall_158
CHANGE S-SL_164_170_0 D-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_170_0 D-KPED=3.1 Rightwall_158
CHANGE S-SL_164_170_0 D-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 D-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 D-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 D-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 D-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KAED=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KAEW=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KPED=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KPEW=20.57 Rightwall_158
CHANGE CL-ML_165_166_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 D-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 D-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 D-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 D-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 U-KAED=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 U-KAEW=0.32 Rightwall_158
```

```
CHANGE S-SL_164_142853_0 U-KPED=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 U-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 D-KAED=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 D-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 D-KPED=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 D-KPEW=3.1 Rightwall_158
EQK USER 0.297 0.1485 -0.1485 0 0.5 0 0.5 0 0
* Defining seismic surcharge pressures on wall LeftWall_32
*          min elevation = -5,5
*          max elevation = 0
*          average gamma = 17,5454545454545
*                 amax/g = 0,297
*                 deltaQ = 157,63275
DLOAD step LeftWall_32 -5.5 28.66 0 28.66
* Include pressure contribution from wall: LeftWall_32
* Include wall contribution
DLOAD step LeftWall_32 -5.5 5.94 0 5.94
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
CHANGE S-SL_164_170_0 U-KAED=0.32 LeftWall_32
CHANGE S-SL_164_170_0 U-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_170_0 U-KPED=3.1 LeftWall_32
CHANGE S-SL_164_170_0 U-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_170_0 D-KAED=0.32 LeftWall_32
CHANGE S-SL_164_170_0 D-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_170_0 D-KPED=3.1 LeftWall_32
CHANGE S-SL_164_170_0 D-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 D-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 D-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 D-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 D-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KAED=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KAEW=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KPED=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KPEW=20.57 LeftWall_32
CHANGE CL-ML_165_166_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 D-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 D-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 D-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 D-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 U-KAED=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 U-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 U-KPED=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 U-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 D-KAED=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 D-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 D-KPED=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 D-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_170_0 U-KAED=0.32 Rightwall_158
CHANGE S-SL_164_170_0 U-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_170_0 U-KPED=3.1 Rightwall_158
CHANGE S-SL_164_170_0 U-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_170_0 D-KAED=0.32 Rightwall_158
CHANGE S-SL_164_170_0 D-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_170_0 D-KPED=3.1 Rightwall_158
CHANGE S-SL_164_170_0 D-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 D-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 D-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 D-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 D-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KAED=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KAEW=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KPED=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KPEW=20.57 Rightwall_158
CHANGE CL-ML_165_166_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 D-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 D-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 D-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 D-KPEW=3.1 Rightwall_158
```

```
CHANGE S-SL_164_142853_0 U-KAED=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 U-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 U-KPED=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 U-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 D-KAED=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 D-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 D-KPED=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 D-KPEW=3.1 Rightwall_158
EQK USER 0.297 0.1485 -0.1485 0 0.5 0 0.5 0 0
* Defining seismic surcharge pressures on wall Rightwall_158
*          min elevation = -5,5
*          max elevation = 0
*          average gamma = 17,5454545454545
*                 amax/g = 0,297
*                 deltaQ = 157,63275
DLOAD step Rightwall_158 -5.5 -28.66 0 -28.66
* Include pressure contribution from wall: Rightwall_158
* Include wall contribution
DLOAD step Rightwall_158 -5.5 -5.94 0 -5.94
ENDSTEP
```

Design Assumption : SLE (Rara) - File di Paratie - File di input (.d)

```
* PARATIE ANALYSIS FOR DESIGN SECTION:Base Design Section USING ASSUMPTION: SLE (Rara)
 * Time:lunedì 30 marzo 2020 17:45:26
 * 1: Defining general settings
 UNIT  m kN
 TITLE Spingitubo_REV2020
 DELTA 0.2
 option param itemax 40
 option control hinges 0 0.0001 0.001

 * 2: Defining wall(s)
 WALL LeftWall_32 -4 -10.5 0 1
 WALL Rightwall_158 4 -10.5 0 -1

 * 3: Defining surfaces for wall(s)
 SOIL 0_L LeftWall_32 -10.5 0 1 0
 SOIL 0_R LeftWall_32 -10.5 0 2 180
 SOIL 1_L Rightwall_158 -10.5 0 2 0
 SOIL 1_R Rightwall_158 -10.5 0 1 180

 * 4: Defining soil layers
 *
 * Soil Profile (S-SL_164_170_0)
 *
 LDATA S-SL_164_170_0 0
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL
 *
 * Soil Profile (CL-ML_165_171_0)
 *
 LDATA CL-ML_165_171_0 -2.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_125890_0)
 *
 LDATA CL-ML_165_125890_0 -5.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_166_0)
 *
 LDATA CL-ML_165_166_0 -8.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (S-SL_164_142853_0)
 *
 LDATA S-SL_164_142853_0 -10.3
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL

 * 5: Defining structural materials
 * Steel material: 108 Name=Fe360 E=206000200 kPa
 MATERIAL Fe360_108 2.06E+08
 * Concrete material: 105 Name=C28/35 E=32308200 kPa
 MATERIAL C2835_105 3.231E+07

 * 6: Defining structural elements
 * 6.1: Beams and combined Wall Elements
 BEAM WallElement_893 LeftWall_32 -10.5 0 C2835_105 0.8 00 00 0
 BEAM WallElement_New_894 Rightwall_158 -10.5 0 C2835_105 0.8 00 00 0


 * 6.2: Supports

 SLAB Slab_96350 -5.5 C2835_105 0.8 0 0
```

```
CELA Spring_139030 LeftWall_32 -0.6 3.5E+04 0 1 1
CELA Spring_New_139031 Rightwall_158 -0.6 3.5E+04 0 1 1


* 6.3: Strips

* 7: Defining Steps
STEP Stage1_31
CHANGE S-SL_164_170_0 U-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 U-FRICT=30 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 U-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 U-FRICT=30 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ENDSTEP

STEP Stage2_789
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ADD WallElement_893 WallElement_New_894
ENDSTEP

STEP Stage3_895
CHANGE CL-ML_165_125890_0 D-COHE=200 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=50 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KA=0.108 LeftWall_32
```

```
CHANGE CL-ML_165_125890_0 D-KP=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-PERM=0.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=200 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=50 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KA=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KP=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-PERM=0.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 5 -10.5 0 0
ENDSTEP

STEP Stage4_1103
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Spring_139030 Spring_New_139031
ENDSTEP

STEP Stage5_89160
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Slab_96350
ENDSTEP

STEP Stage6_95633
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
```

```
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ENDSTEP
```

Design Assumption : A1+M1+R1 - File di Paratie - File di input (.d)

```
* PARATIE ANALYSIS FOR DESIGN SECTION:Base Design Section USING ASSUMPTION: A1+M1+R1
 * Time:lunedì 30 marzo 2020 17:45:29
 * 1: Defining general settings
 UNIT  m kN
 TITLE Spingitubo_REV2020
 DELTA 0.2
 option param itemax 40
 option control hinges 0 0.0001 0.001

 * 2: Defining wall(s)
 WALL LeftWall_32 -4 -10.5 0 1
 WALL Rightwall_158 4 -10.5 0 -1

 * 3: Defining surfaces for wall(s)
 SOIL 0_L LeftWall_32 -10.5 0 1 0
 SOIL 0_R LeftWall_32 -10.5 0 2 180
 SOIL 1_L Rightwall_158 -10.5 0 2 0
 SOIL 1_R Rightwall_158 -10.5 0 1 180

 * 4: Defining soil layers
 *
 * Soil Profile (S-SL_164_170_0)
 *
 LDATA S-SL_164_170_0 0
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL
 *
 * Soil Profile (CL-ML_165_171_0)
 *
 LDATA CL-ML_165_171_0 -2.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_125890_0)
 *
 LDATA CL-ML_165_125890_0 -5.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_166_0)
 *
 LDATA CL-ML_165_166_0 -8.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (S-SL_164_142853_0)
 *
 LDATA S-SL_164_142853_0 -10.3
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL

 * 5: Defining structural materials
 * Steel material: 108 Name=Fe360 E=206000200 kPa
 MATERIAL Fe360_108 2.06E+08
 * Concrete material: 105 Name=C28/35 E=32308200 kPa
 MATERIAL C2835_105 3.231E+07

 * 6: Defining structural elements
 * 6.1: Beams and combined Wall Elements
 BEAM WallElement_893 LeftWall_32 -10.5 0 C2835_105 0.8 00 00 0
 BEAM WallElement_New_894 Rightwall_158 -10.5 0 C2835_105 0.8 00 00 0


 * 6.2: Supports

 SLAB Slab_96350 -5.5 C2835_105 0.8 0 0
```

```
CELA Spring_139030 LeftWall_32 -0.6 3.5E+04 0 1 1
CELA Spring_New_139031 Rightwall_158 -0.6 3.5E+04 0 1 1


* 6.3: Strips

* 7: Defining Steps
STEP Stage1_31
CHANGE S-SL_164_170_0 U-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 U-FRICT=30 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 U-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 U-FRICT=30 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ENDSTEP

STEP Stage2_789
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ADD WallElement_893 WallElement_New_894
ENDSTEP

STEP Stage3_895
CHANGE CL-ML_165_125890_0 D-COHE=200 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=50 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KA=0.108 LeftWall_32
```

```
CHANGE CL-ML_165_125890_0 D-KP=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-PERM=0.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=200 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=50 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KA=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KP=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-PERM=0.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 5 -10.5 0 0
ENDSTEP

STEP Stage4_1103
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Spring_139030 Spring_New_139031
ENDSTEP

STEP Stage5_89160
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Slab_96350
ENDSTEP

STEP Stage6_95633
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
```

```
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ENDSTEP
```

Design Assumption : A2+M2+R1 - File di Paratie - File di input (.d)

```
* PARATIE ANALYSIS FOR DESIGN SECTION:Base Design Section USING ASSUMPTION: A2+M2+R1
 * Time:lunedì 30 marzo 2020 17:45:31
 * 1: Defining general settings
 UNIT  m kN
 TITLE Spingitubo_REV2020
 DELTA 0.2
 option param itemax 40
 option control hinges 0 0.0001 0.001

 * 2: Defining wall(s)
 WALL LeftWall_32 -4 -10.5 0 1
 WALL Rightwall_158 4 -10.5 0 -1

 * 3: Defining surfaces for wall(s)
 SOIL 0_L LeftWall_32 -10.5 0 1 0
 SOIL 0_R LeftWall_32 -10.5 0 2 180
 SOIL 1_L Rightwall_158 -10.5 0 2 0
 SOIL 1_R Rightwall_158 -10.5 0 1 180

 * 4: Defining soil layers
 *
 * Soil Profile (S-SL_164_170_0)
 *
 LDATA S-SL_164_170_0 0
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL
 *
 * Soil Profile (CL-ML_165_171_0)
 *
 LDATA CL-ML_165_171_0 -2.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_125890_0)
 *
 LDATA CL-ML_165_125890_0 -5.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_166_0)
 *
 LDATA CL-ML_165_166_0 -8.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (S-SL_164_142853_0)
 *
 LDATA S-SL_164_142853_0 -10.3
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL

 * 5: Defining structural materials
 * Steel material: 108 Name=Fe360 E=206000200 kPa
 MATERIAL Fe360_108 2.06E+08
 * Concrete material: 105 Name=C28/35 E=32308200 kPa
 MATERIAL C2835_105 3.231E+07

 * 6: Defining structural elements
 * 6.1: Beams and combined Wall Elements
 BEAM WallElement_893 LeftWall_32 -10.5 0 C2835_105 0.8 00 00 0
 BEAM WallElement_New_894 Rightwall_158 -10.5 0 C2835_105 0.8 00 00 0


 * 6.2: Supports

 SLAB Slab_96350 -5.5 C2835_105 0.8 0 0
```

```
CELA Spring_139030 LeftWall_32 -0.6 3.5E+04 0 1 1
CELA Spring_New_139031 Rightwall_158 -0.6 3.5E+04 0 1 1


* 6.3: Strips

* 7: Defining Steps
STEP Stage1_31
CHANGE S-SL_164_170_0 U-FRICT=24.79 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=24.79 LeftWall_32
CHANGE CL-ML_165_171_0 U-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_125890_0 U-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_166_0 U-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=25.67 LeftWall_32
CHANGE S-SL_164_142853_0 U-FRICT=24.79 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=24.79 LeftWall_32
CHANGE S-SL_164_170_0 U-FRICT=24.79 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=24.79 Rightwall_158
CHANGE CL-ML_165_171_0 U-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_125890_0 U-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_166_0 U-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=25.67 Rightwall_158
CHANGE S-SL_164_142853_0 U-FRICT=24.79 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=24.79 Rightwall_158
CHANGE S-SL_164_170_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ENDSTEP

STEP Stage2_789
CHANGE S-SL_164_170_0 D-FRICT=24.79 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=25.67 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=24.79 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=24.79 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=25.67 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=24.79 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ADD WallElement_893 WallElement_New_894
ENDSTEP

STEP Stage3_895
CHANGE CL-ML_165_125890_0 D-COHE=200 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=50 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KA=0.108 LeftWall_32
```

```
CHANGE CL-ML_165_125890_0 D-KP=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-PERM=0.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=200 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=50 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KA=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KP=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-PERM=0.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=24.79 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=25.67 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=24.79 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=24.79 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=25.67 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=24.79 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 5 -10.5 0 0
ENDSTEP

STEP Stage4_1103
CHANGE S-SL_164_170_0 D-FRICT=24.79 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=25.67 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=24.79 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=24.79 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=25.67 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=24.79 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Spring_139030 Spring_New_139031
ENDSTEP

STEP Stage5_89160
CHANGE S-SL_164_170_0 D-FRICT=24.79 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=25.67 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=24.79 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=24.79 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=25.67 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=25.67 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=24.79 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Slab_96350
ENDSTEP

STEP Stage6_95633
CHANGE S-SL_164_170_0 D-FRICT=24.79 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=25.67 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=25.67 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=24.79 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=24.79 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=25.67 Rightwall_158
```

```
CHANGE CL-ML_165_166_0 D-FRICT=25.67 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=24.79 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ENDSTEP
```

Design Assumption : SISMICA STR+GEO - File di Paratie - File di input (.d)

```
* PARATIE ANALYSIS FOR DESIGN SECTION:Base Design Section USING ASSUMPTION: SISMICA STR+GEO
 * Time:lunedì 30 marzo 2020 17:45:34
 * 1: Defining general settings
 UNIT  m kN
 TITLE Spingitubo_REV2020
 DELTA 0.2
 option param itemax 40
 option control hinges 0 0.0001 0.001

 * 2: Defining wall(s)
 WALL LeftWall_32 -4 -10.5 0 1
 WALL Rightwall_158 4 -10.5 0 -1

 * 3: Defining surfaces for wall(s)
 SOIL 0_L LeftWall_32 -10.5 0 1 0
 SOIL 0_R LeftWall_32 -10.5 0 2 180
 SOIL 1_L Rightwall_158 -10.5 0 2 0
 SOIL 1_R Rightwall_158 -10.5 0 1 180

 * 4: Defining soil layers
 *
 * Soil Profile (S-SL_164_170_0)
 *
 LDATA S-SL_164_170_0 0
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL
 *
 * Soil Profile (CL-ML_165_171_0)
 *
 LDATA CL-ML_165_171_0 -2.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_125890_0)
 *
 LDATA CL-ML_165_125890_0 -5.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (CL-ML_165_166_0)
 *
 LDATA CL-ML_165_166_0 -8.5
 ATREST 0.5 0.5 1
 WEIGHT 16 9 10
 PERMEABILITY 1E-05
 RESISTANCE 0 31 0.32 3.1
 YOUNG 1.6E+04 2.56E+04
 ENDL
 *
 * Soil Profile (S-SL_164_142853_0)
 *
 LDATA S-SL_164_142853_0 -10.3
 ATREST 0.5 0.5 1
 WEIGHT 17 10 10
 PERMEABILITY 1E-05
 RESISTANCE 0 30 0.32 3.1
 YOUNG 6000 9600
 ENDL

 * 5: Defining structural materials
 * Steel material: 108 Name=Fe360 E=206000200 kPa
 MATERIAL Fe360_108 2.06E+08
 * Concrete material: 105 Name=C28/35 E=32308200 kPa
 MATERIAL C2835_105 3.231E+07

 * 6: Defining structural elements
 * 6.1: Beams and combined Wall Elements
 BEAM WallElement_893 LeftWall_32 -10.5 0 C2835_105 0.8 00 00 0
 BEAM WallElement_New_894 Rightwall_158 -10.5 0 C2835_105 0.8 00 00 0


 * 6.2: Supports

 SLAB Slab_96350 -5.5 C2835_105 0.8 0 0
```

```
CELA Spring_139030 LeftWall_32 -0.6 3.5E+04 0 1 1
CELA Spring_New_139031 Rightwall_158 -0.6 3.5E+04 0 1 1


* 6.3: Strips

* 7: Defining Steps
STEP Stage1_31
CHANGE S-SL_164_170_0 U-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 U-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 U-FRICT=30 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 U-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 U-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 U-FRICT=30 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 U-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 U-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 U-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 U-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ENDSTEP

STEP Stage2_789
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_125890_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 0 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 0 -10.5 0 0
ADD WallElement_893 WallElement_New_894
ENDSTEP

STEP Stage3_895
CHANGE CL-ML_165_125890_0 D-COHE=200 LeftWall_32
CHANGE CL-ML_165_125890_0 D-FRICT=50 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KA=0.108 LeftWall_32
```

```
CHANGE CL-ML_165_125890_0 D-KP=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-PERM=0.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 LeftWall_32
CHANGE CL-ML_165_125890_0 D-COHE=200 Rightwall_158
CHANGE CL-ML_165_125890_0 D-FRICT=50 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KA=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KP=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-PERM=0.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-STIFAC=18.75 Rightwall_158
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 0
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 0
WATER -3.5 5 -10.5 0 0
ENDSTEP

STEP Stage4_1103
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Spring_139030 Spring_New_139031
ENDSTEP

STEP Stage5_89160
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
ADD Slab_96350
ENDSTEP

STEP Stage6_95633
CHANGE S-SL_164_170_0 D-FRICT=30 LeftWall_32
CHANGE CL-ML_165_171_0 D-FRICT=31 LeftWall_32
CHANGE CL-ML_165_166_0 D-FRICT=31 LeftWall_32
CHANGE S-SL_164_142853_0 D-FRICT=30 LeftWall_32
CHANGE S-SL_164_170_0 D-FRICT=30 Rightwall_158
CHANGE CL-ML_165_171_0 D-FRICT=31 Rightwall_158
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CHANGE CL-ML_165_166_0 D-FRICT=31 Rightwall_158
CHANGE S-SL_164_142853_0 D-FRICT=30 Rightwall_158
CHANGE S-SL_164_170_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_170_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_171_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_171_0 D-COHE=0 Rightwall_158
CHANGE CL-ML_165_166_0 D-COHE=0 LeftWall_32
CHANGE CL-ML_165_166_0 D-COHE=0 Rightwall_158
CHANGE S-SL_164_142853_0 D-COHE=0 LeftWall_32
CHANGE S-SL_164_142853_0 D-COHE=0 Rightwall_158
SETWALL LeftWall_32
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
CHANGE S-SL_164_170_0 U-KAED=0.32 LeftWall_32
CHANGE S-SL_164_170_0 U-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_170_0 U-KPED=3.1 LeftWall_32
CHANGE S-SL_164_170_0 U-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_170_0 D-KAED=0.32 LeftWall_32
CHANGE S-SL_164_170_0 D-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_170_0 D-KPED=3.1 LeftWall_32
CHANGE S-SL_164_170_0 D-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 D-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 D-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 D-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 D-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KAED=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KAEW=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KPED=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KPEW=20.57 LeftWall_32
CHANGE CL-ML_165_166_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 D-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 D-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 D-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 D-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 U-KAED=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 U-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 U-KPED=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 U-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 D-KAED=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 D-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 D-KPED=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 D-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_170_0 U-KAED=0.32 Rightwall_158
CHANGE S-SL_164_170_0 U-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_170_0 U-KPED=3.1 Rightwall_158
CHANGE S-SL_164_170_0 U-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_170_0 D-KAED=0.32 Rightwall_158
CHANGE S-SL_164_170_0 D-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_170_0 D-KPED=3.1 Rightwall_158
CHANGE S-SL_164_170_0 D-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 D-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 D-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 D-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 D-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KAED=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KAEW=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KPED=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KPEW=20.57 Rightwall_158
CHANGE CL-ML_165_166_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 D-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 D-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 D-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 D-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 U-KAED=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 U-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 U-KPED=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 U-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 D-KAED=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 D-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 D-KPED=3.1 Rightwall_158
```

```
CHANGE S-SL_164_142853_0 D-KPEW=3.1 Rightwall_158
EQK USER 0.297 0.1485 -0.1485 0 0.5 0 0.5 0 0
* Defining seismic surcharge pressures on wall LeftWall_32
*          min elevation = -5,5
*          max elevation = 0
*          average gamma = 17,5454545454545
*                 amax/g = 0,297
*                 deltaQ = 157,63275
DLOAD step LeftWall_32 -5.5 28.66 0 28.66
* Include pressure contribution from wall: LeftWall_32
* Include wall contribution
DLOAD step LeftWall_32 -5.5 5.94 0 5.94
SETWALL Rightwall_158
GEOM 0 -5.5
WATER -3.5 5 -10.5 0 0
CHANGE S-SL_164_170_0 U-KAED=0.32 LeftWall_32
CHANGE S-SL_164_170_0 U-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_170_0 U-KPED=3.1 LeftWall_32
CHANGE S-SL_164_170_0 U-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_170_0 D-KAED=0.32 LeftWall_32
CHANGE S-SL_164_170_0 D-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_170_0 D-KPED=3.1 LeftWall_32
CHANGE S-SL_164_170_0 D-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 D-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 D-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_171_0 D-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_171_0 D-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KAED=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KAEW=0.108 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KPED=20.57 LeftWall_32
CHANGE CL-ML_165_125890_0 D-KPEW=20.57 LeftWall_32
CHANGE CL-ML_165_166_0 U-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 U-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 U-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 U-KPEW=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 D-KAED=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 D-KAEW=0.32 LeftWall_32
CHANGE CL-ML_165_166_0 D-KPED=3.1 LeftWall_32
CHANGE CL-ML_165_166_0 D-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 U-KAED=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 U-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 U-KPED=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 U-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 D-KAED=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 D-KAEW=0.32 LeftWall_32
CHANGE S-SL_164_142853_0 D-KPED=3.1 LeftWall_32
CHANGE S-SL_164_142853_0 D-KPEW=3.1 LeftWall_32
CHANGE S-SL_164_170_0 U-KAED=0.32 Rightwall_158
CHANGE S-SL_164_170_0 U-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_170_0 U-KPED=3.1 Rightwall_158
CHANGE S-SL_164_170_0 U-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_170_0 D-KAED=0.32 Rightwall_158
CHANGE S-SL_164_170_0 D-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_170_0 D-KPED=3.1 Rightwall_158
CHANGE S-SL_164_170_0 D-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 D-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 D-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_171_0 D-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_171_0 D-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KAED=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KAEW=0.108 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KPED=20.57 Rightwall_158
CHANGE CL-ML_165_125890_0 D-KPEW=20.57 Rightwall_158
CHANGE CL-ML_165_166_0 U-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 U-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 U-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 U-KPEW=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 D-KAED=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 D-KAEW=0.32 Rightwall_158
CHANGE CL-ML_165_166_0 D-KPED=3.1 Rightwall_158
CHANGE CL-ML_165_166_0 D-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 U-KAED=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 U-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 U-KPED=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 U-KPEW=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 D-KAED=0.32 Rightwall_158
```

```
CHANGE S-SL_164_142853_0 D-KAEW=0.32 Rightwall_158
CHANGE S-SL_164_142853_0 D-KPED=3.1 Rightwall_158
CHANGE S-SL_164_142853_0 D-KPEW=3.1 Rightwall_158
EQK USER 0.297 0.1485 -0.1485 0 0.5 0 0.5 0 0
* Defining seismic surcharge pressures on wall Rightwall_158
*          min elevation = -5,5
*          max elevation = 0
*          average gamma = 17,5454545454545
*                 amax/g = 0,297
*                 deltaQ = 157,63275
DLOAD step Rightwall_158 -5.5 -28.66 0 -28.66
* Include pressure contribution from wall: Rightwall_158
* Include wall contribution
DLOAD step Rightwall_158 -5.5 -5.94 0 -5.94
ENDSTEP
```