

Ordinanza Capo Dipartimento Protezione Civile n° 616/2019 - 851/2022  
Decreto del Sindaco della Città di Venezia n° 69630 del 14/02/2022

AMMINISTRAZIONE COMPETENTE

CITTA' DI  
VENEZIA



Ordinanza CDPC n° 851/2022

SOGGETTO ATTUATORE

CITTA' DI  
VENEZIA



AREA LAVORI PUBBLICI, MOBILITA' E TRASPORTI  
SETTORE VIABILITA' VENEZIA CENTRO STORICO E ISOLE ENERGIA e IMPIANTI  
SERVIZIO MANUTENZIONE VIABILITA' VENEZIA C.S.I.

**C.I. 14959-20**

**INTERVENTO DI MESSA IN SICUREZZA,  
CONSOLIDAMENTO MARGINAMENTO E  
RIPRISTINO PAVIMENTAZIONE DELLA RIVA SETTE MARTIRI**

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PROGETTO ESECUTIVO	14959-20_ <b>RG</b> T
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RESTAURO	luglio 2022

DESCRIZIONE
<b>ALLEGATO 3: RELAZIONE GEOTECNICA</b>



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REVISIONE	DATA	DESCRIZIONE	REDATTO	CONTROLLATO	APPROVATO



# **COMUNE DI VENEZIA**

## **Riva dei Sette Martiri**



<p>Data:</p> <p>Marzo 2022</p>	<p>Interventi emergenziali di riduzione del rischio residuo ai sensi dell'art. 25, co. 2, lett. d) d.lgs. 1/2018 e dell'art. 3, co. 1, dell'O.C.D.P.C. n. 616/2019 – C.I. 14959-21</p> <p>Riduzione del rischio residuo mediante messa in sicurezza di alcuni ambiti delle pavimentazioni piazza San Marco danneggiate dalle alte maree</p> <p><b>MESSA IN SICUREZZA, CONSOLIDAMENTO MARGINAMENTO E RIPRISTINO PAVIMENTAZIONE DELLA RIVA DEI SETTE MARTIRI</b></p> <p><b>RELAZIONE GEOTECNICA</b></p>	<p>Elaborato:</p> <p><b>unico</b></p> <p>Dott. Geol. <b>Matteo Vian</b> Albo dei Geologi della Regione Veneto N. 689.</p>  <p><i>Matteo Vian</i></p> <p>Dott. Geol. <b>Basilio Zanninello</b> Albo dei Geologi della Regione Veneto N. 608.</p>  <p><i>Basilio Zanninello</i></p>
<p>Revisione</p> <p>V00</p>	<p><b>COMMITTENTE</b></p> <p><b>Comune di Venezia</b></p>	

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## **1 PREMESSA**

Per incarico della committenza viene redatta la seguente relazione geotecnica relativa ai lavori di messa in sicurezza e consolidamento di Riva dei Sette Martiri nel comune di Venezia. Le opere rientrano nell'ambito degli *“Interventi emergenziali di riduzione del rischio residuo ai sensi dell'art. 25, co. 2, lett. d) d.lgs. 1/2018 e dell'art. 3, co. 1, dell'O.C.D.P.C. n. 616/2019 – C.I. 14959-21 Riduzione del rischio residuo mediante messa in sicurezza di alcuni ambiti delle pavimentazioni piazza San Marco danneggiate dalle alte maree”*.

La zona interessata dall'intervento si colloca in Riva dei Sette Martiri, tra il Ponte della Veneta Marina ad ovest e il Ponte dei Sette Martiri a est (Figura 1 e Figura 2).



**Figura 1 – Immagine satellitare dell'area; il tratteggio rosso individua la zona interessata dagli interventi**



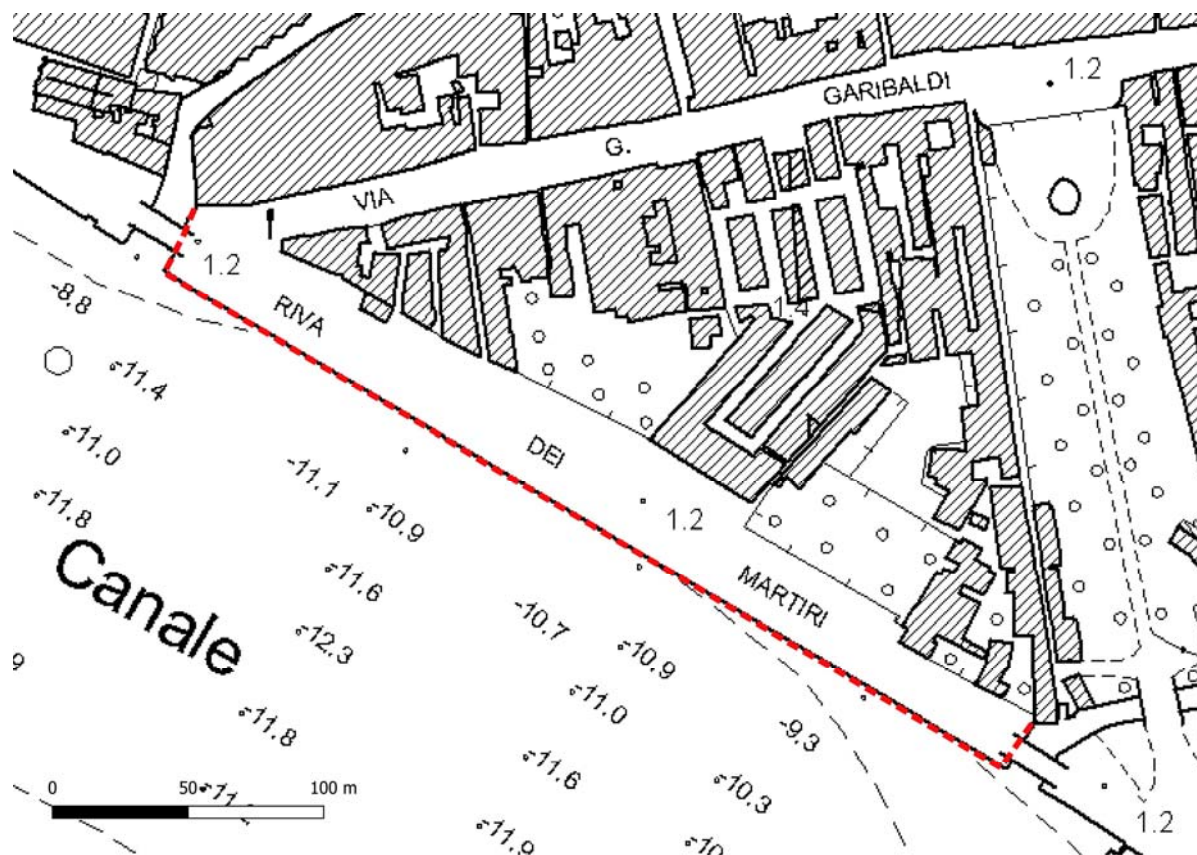
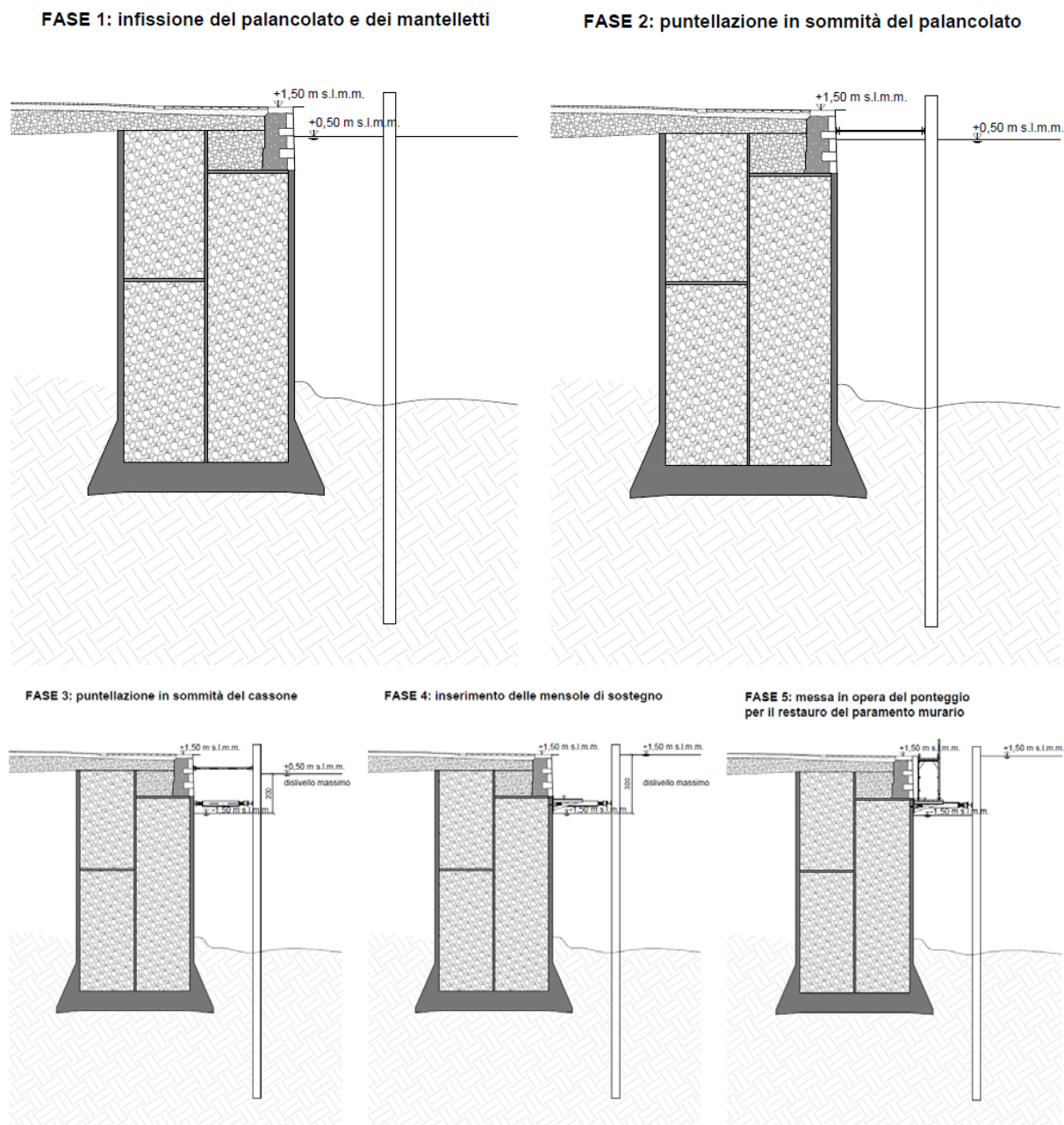


Figura 2 – Estratto di CTR in scala 1:10000 elemento 128130 "Venezia – Est"; il tratteggio rosso individua la zona interessata dagli interventi

Nello specifico si riportano le verifiche delle palancole che verranno posizionate sul canale di San Marco, a circa 3 m da Riva Sette Martiri, che permetteranno di abbassare il livello dell'acqua e eseguire i lavori di messa in sicurezza della riva. Le palancole saranno di tipo a Z e avranno lunghezza di 18 m. Di seguito si riportano le fasi principali di montaggio del ponteggio e del palancolato tratte dalla Tavola 14959-20\_PD.04 del progetto esecutivo:



**Figura 3 – Fasi di montaggio del ponteggio e del palancoleto tratte dalla Tavola 14959-20\_PD.04 del progetto esecutivo**

## **2    NORMATIVA DI RIFERIMENTO**

La normativa di interesse specifico per la presente relazione è la seguente:

- D.M. 17/01/2018 “Aggiornamento Norme Tecniche per le Costruzioni” (NTC 2018);
- Circ. Min. 21/01/2019 “Istruzioni per l’applicazione dell’Aggiornamento delle Norme tecniche per le costruzioni”;
- D.M. 14/01/2008 “Norme Tecniche per le Costruzioni” (NTC 2008);
- Circ. Min. 02/02/2009 “Istruzioni per l’applicazione delle norme tecniche”;
- O.P.C.M. 3274/2003 e succ. modd.;
- O.P.C.M. 3519/2006;
- "Norme tecniche riguardanti le indagini sui terreni e sulle rocce, la stabilità dei pendii naturali e delle scarpate, i criteri generali e le prescrizioni per la progettazione, l'esecuzione ed il collaudo delle opere di sostegno delle terre e delle opere di fondazione" – *D.M. 11/03/1988*;
- Istruzioni applicative al D.M. 11.03.88 – *Circ. Min. LL.PP. 24.09.88 n° 30483*;
- "Raccomandazioni A.G.I. riguardanti l'esecuzione e programmazione delle indagini geotecniche" – A.G.I. 1977.



### 3 RICOSTRUZIONE STRATIGRAFICA E GEOTECNICA

#### 3.1 Modello geotecnico

Le verifiche sono state eseguite sulla stratigrafia del sondaggio CV1 e sulla stratigrafia del sondaggio CV2. Di seguito i due modelli geologi-geotecnici:

Strato	Terreno	$\gamma$ dry	$\gamma$ sat	$\phi'$	$\phi_{cv}$	$\phi_p$	$c'$	Su	Modulo Elastico	Evc	Eur
		kN/m <sup>3</sup>	kN/m <sup>3</sup>	°	°	°	kPa	kPa		kPa	kPa
1	Argilla limosa con livelli organici	17.8	18.6		20	16		39	Constant	3800	6080
2	Sabbia limosa e limo sabbioso	18.6	21.6	34			0		Constant	15000	24000
3	Argilla limosa con intercalaz. di limo argilloso e livelli organici	18	18.8		22	18		60	Constant	4600	7360
4	Sabbia limosa e limo sabbioso	18.6	21.6	31			0		Constant	11400	18240
5	Argilla limosa con limo argilloso e livelli organici	17.8	18.6		22	18		55	Constant	4500	7200

**Tabella 1 – Modello geologico-geotecnico sondaggio CV1**

Strato	Terreno	$\gamma$ dry	$\gamma$ sat	$\phi'$	$\phi_{cv}$	$\phi_p$	$c'$	Su	Modulo Elastico	Evc	Eur
		kN/m <sup>3</sup>	kN/m <sup>3</sup>	°	°	°	kPa	kPa		kPa	kPa
1	Argilla limosa con livelli organici	17.8	18.6		20	16		39	Constant	3800	6080
2	Sabbia limosa e limo sabbioso	18.6	21.6	34			0		Constant	15000	24000
3	Argilla limosa con intercalaz. di limo argilloso e livelli organici	18	18.8		22	18		60	Constant	4600	7360
4	Sabbia limosa e limo sabbioso	18.6	21.6	31			0		Constant	11400	18240
5	Argilla limosa con limo argilloso e livelli organici	17.8	18.6		22	18		55	Constant	4500	7200
6	Sabbia con limo e argilla	18.6	21.6	31			0		Constant	22000	35200

**Tabella 2 – Modello geologico-geotecnico sondaggio CV2**

## **4 REPORT DI CALCOLO**

Per le analisi è stato utilizzato il software ParatiePlus, considerando palancole AZ19 di Ancelor Mittal di lunghezza 18 m; un'analisi è stata condotta assumendo la stratigrafia del sondaggio CV1 e l'altra con la stratigrafia del sondaggio CV3, verificando le seguenti fasi realizzative:

- **Stage 0** – stato attuale;
- **Stage 1** – infissione palancole;
- **Stage 2** – puntellazione in sommità del palancolato;
- **Stage 3** – abbassamento acqua fino a -1,50 m s.l.m.;
- **Stage 3 bis** – puntellazione in sommità del cassone;
- **Stage 4** – rimozione del puntello superiore;
- **Stage 4 eccezionale** – acqua alta eccezionale a quota 1,50 m fuori dal palancolato.

## 5 SEZIONE CV1

### Descrizione della Stratigrafia e degli Strati di Terreno

Tipo : HORIZONTAL

Quota : -8.6 m

OCR : 1

Tipo : HORIZONTAL

Quota : -13.5 m

OCR : 1

Tipo : HORIZONTAL

Quota : -14.3 m

OCR : 1

Tipo : HORIZONTAL

Quota : -17.9 m

OCR : 1

Tipo : HORIZONTAL

Quota : -22.8 m

OCR : 1

Strato di Terreno	Terreno	$\gamma$ dry	$\gamma$ sat	$\phi'$	$\phi$	$c'$	Su	Modulo Elastico	Eu	Evc	Eur	Ah	Av	exp	Pa	Rur/Rvc	Rvc	Ku	Kvc	Kur
		kN/m <sup>3</sup>	kN/m <sup>3</sup>	°	°	kPa	kPa			kPa	kPa				kPa		kPa	kN/m <sup>3</sup>	kN/m <sup>3</sup>	kN/m <sup>3</sup>
1	4 - Argilla limosa con livelli or- ganici	17.8	18.6	20	16		39	Constant		3800	6080									
2	5 - Sabbia limosa e limo sab- bioso	18.6	21.6	34		0		Constant		15000	24000									
3	6 - Argilla limosa con interca- laz. di limo argilloso e livelli or- ganici	18	18.8	22	18		60	Constant		4600	7360									
4	7 - Sabbia limosa e limo sab- bioso	18.6	21.6	31		0		Constant		11400	18240									
5	8 - Argilla limosa con limo ar- gilloso e livelli organici	17.8	18.6	22	18		55	Constant		4500	7200									

### Descrizione Pareti

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Muro di destra

Sezione : Palancole AZ19

Area equivalente : 0.0146 m

Inerzia equivalente : 0.0004 m<sup>4</sup>/m

Profilo palancola : AZ 19-700



## Stage 1: infissione palancole



### Scavo

#### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

Linea di scavo di sinistra (Orizzontale)

-8.6 m

Linea di scavo di destra (Orizzontale)

-8.6 m

### Falda acquifera

Falda di sinistra : 0.5 m

Falda di destra : 0.5 m

### Elementi strutturali

Paratia : Palancole

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Sezione : Palancole AZ19



## Stage 2: puntellazione in sommità del palancoato



### Scavo

#### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

#### Linea di scavo di sinistra (Orizzontale)

-8.6 m

#### Linea di scavo di destra (Orizzontale)

-8.6 m

### Falda acquifera

Falda di sinistra : 0.5 m

Falda di destra : 0.5 m

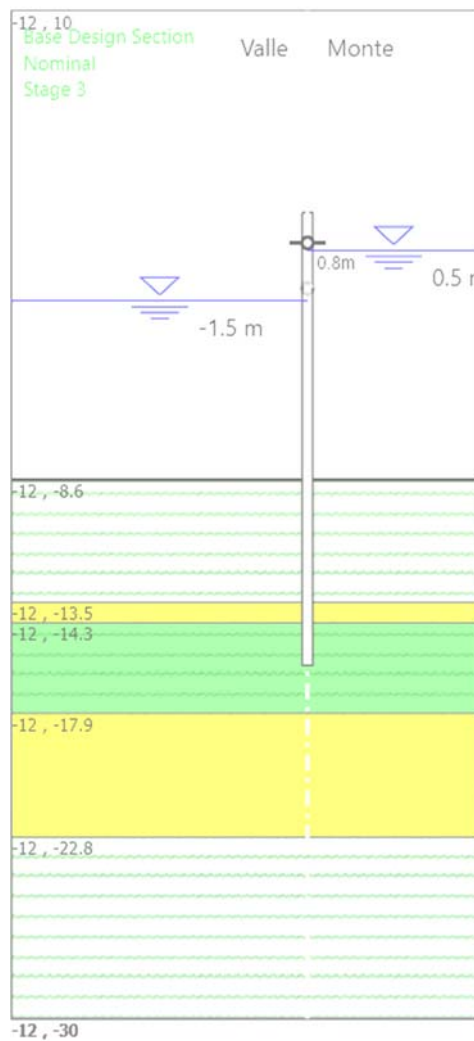
### Elementi strutturali

Paratia : Palancole

X : 0 m

Quota in alto : 2 m  
Quota di fondo : -16 m  
Sezione : Palancole AZ19  
Vincolo fisso : Puntello sup.  
X : 0 m  
Z : 0.8 m  
Angolo : 0 °

### Stage 3: abbassamento acqua fino a -1,50 m s.l.m.



Scavo

Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

Linea di scavo di sinistra (Orizzontale)

-8.6 m

Linea di scavo di destra (Orizzontale)

-8.6 m

Falda acquifera

Falda di sinistra : -1.5 m

Falda di destra : 0.5 m

Elementi strutturali

Paratia : Palancole

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Sezione : Palancole AZ19

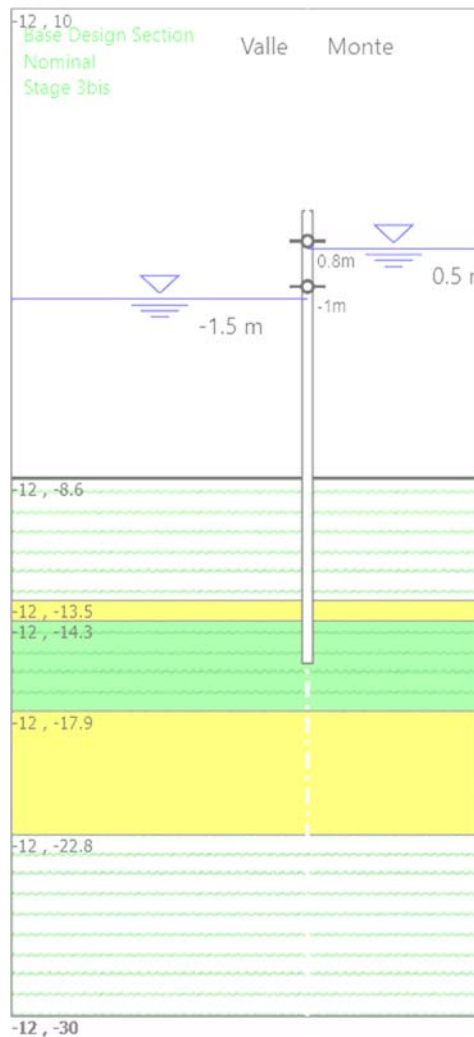
Vincolo fisso : Puntello sup.

X : 0 m

Z : 0.8 m

Angolo : 0 °

## Stage 3bis: puntellazione in sommità del cassone



### Scavo

#### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

#### Linea di scavo di sinistra (Orizzontale)

-8.6 m

#### Linea di scavo di destra (Orizzontale)

-8.6 m

### Falda acquifera

Falda di sinistra : -1.5 m

Falda di destra : 0.5 m

### Elementi strutturali

Paratia : Palancole

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Sezione : Palancole AZ19

Vincolo fisso : Puntello sup.

X : 0 m

Z : 0.8 m

Angolo : 0 °

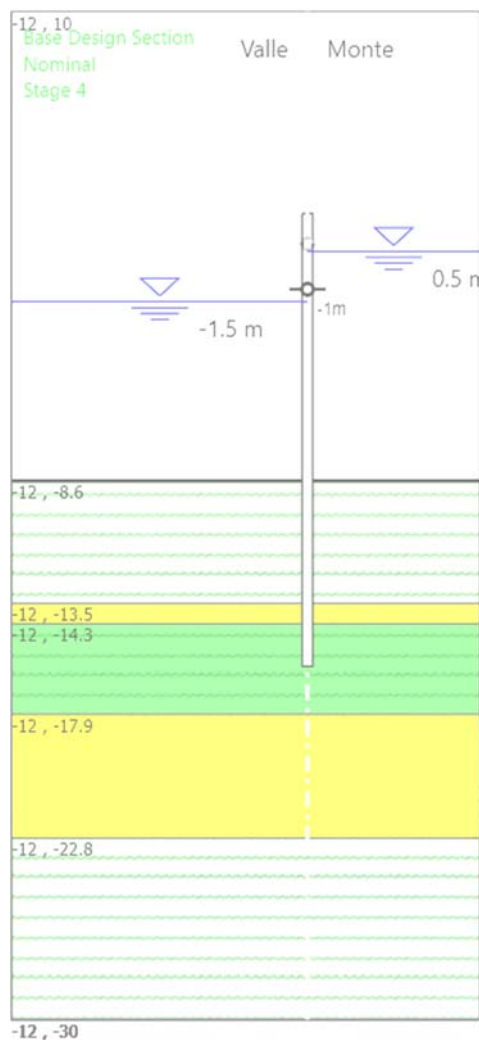
Vincolo fisso : Puntello inf.

X : 0 m

Z : -1 m

Angolo : 0 °

## Stage 4: rimozione del puntello superiore



Scavo

Muro di destra

Lato monte : -8.6 m



Lato valle : -8.6 m

Linea di scavo di sinistra (Orizzontale)

-8.6 m

Linea di scavo di destra (Orizzontale)

-8.6 m

Falda acquifera

Falda di sinistra : -1.5 m

Falda di destra : 0.5 m

Elementi strutturali

Paratia : Palancole

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Sezione : Palancole AZ19

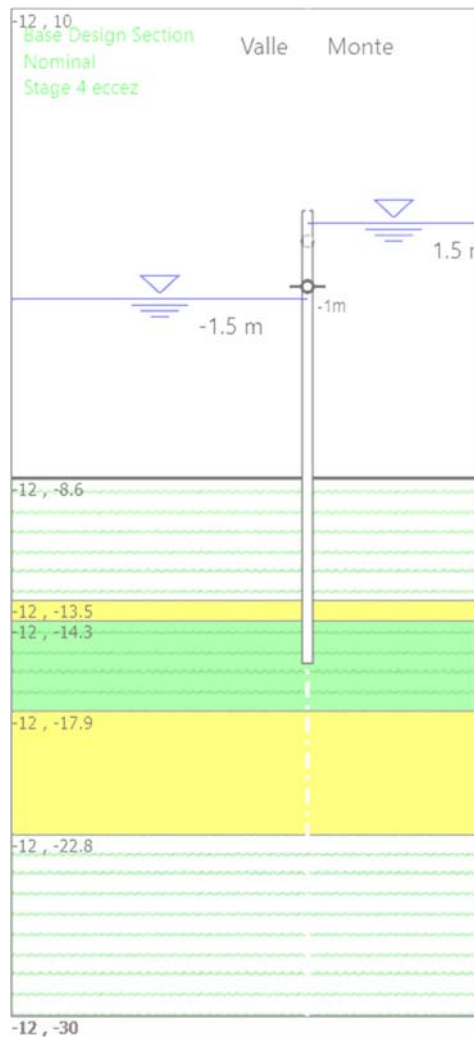
Vincolo fisso : Puntello inf.

X : 0 m

Z : -1 m

Angolo : 0 °

## Stage 4 eccez: acqua alta eccezionale a quota 1,50 m fuori dal palancoiato



### Scavo

#### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

#### Linea di scavo di sinistra (Orizzontale)

-8.6 m

#### Linea di scavo di destra (Orizzontale)

-8.6 m

### Falda acquifera

Falda di sinistra : -1.5 m

Falda di destra : 1.5 m

### Elementi strutturali

Paratia : Palancole

X : 0 m  
 Quota in alto : 2 m  
 Quota di fondo : -16 m  
 Sezione : Palancole AZ19  
 Vincolo fisso : Puntello inf.  
 X : 0 m  
 Z : -1 m  
 Angolo : 0 °

## 5.2 Descrizione Coefficienti Design Assumption

### Coefficienti A

Nome	Carichi Perma- nenti Sfavorevoli (F_dead_load_un- favour)	Carichi Perma- nenti Favorevoli (F_dead_load_fa- vour)	Carichi Variabili Sfavorevoli (F_live_load_un- favour)	Carichi Variabili Favorevoli (F_live_load_fa- vour)	Carico Sismico (F_seism_load)	Pres- sioni Acqua Lato Monte (F_Wa- terDR)	Pres- sioni Acqua Lato Valle (F_Wa- terDR)	Carichi Perma- nenti Destabiliz- zanti (F_UPL_GDStab)	Carichi Perma- nenti Stabiliz- zanti (F_UPL_GStab)	Carichi Va- riabili Destabiliz- zanti (F_UPL_QDStab)
Simbolo	$\gamma_G$	$\gamma_G$	$\gamma_Q$	$\gamma_Q$	$\gamma_{QE}$	$\gamma_G$	$\gamma_G$	$\gamma_{Gdst}$	$\gamma_{Gstb}$	$\gamma_{Qds}$
Nominal	1	1	1	1	1	1	1	1	1	1
NTC2018: SLE (Rara/Fre- quente/Quasi Permanente)	1	1	1	1	0	1	1	1	1	1
NTC2018: A1+M1+R1 (R3 per ti- ranti)	1.3	1	1.5	1	0	1.3	1	1	1	1
NTC2018: A2+M2+R1	1	1	1.3	1	0	1	1	1	1	1

### Coefficienti M

Nome	Parziale su $\tan(\phi')$ (F_Fr)	Parziale su $c'$ (F_eff_cohes)	Parziale su $S_u$ (F_Su)	Parziale su $q_u$ (F_qu)	Parziale su peso specifico (F_gamma)
Simbolo	$\gamma_\phi$	$\gamma_c$	$\gamma_{cu}$	$\gamma_{qu}$	$\gamma_\gamma$
Nominal	1	1	1	1	1
NTC2018: SLE (Rara/Frequente/Quasi Permanente)	1	1	1	1	1
NTC2018: A1+M1+R1 (R3 per tiranti)	1	1	1	1	1
NTC2018: A2+M2+R1	1.25	1.25	1.4	1	1

### Coefficienti R

Nome	Parziale resistenza terreno (es. Kp) (F_Soil_Res_walls)	Parziale resistenza Tiranti permanenti (F_Anch_P)	Parziale resistenza Tiranti temporanei (F_Anch_T)	Parziale elementi strutturali (F_wall)
Simbolo	$\gamma_{Re}$	$\gamma_P$	$\gamma_T$	
Nominal	1	1	1	1

Nome	Parziale resistenza terreno (es. Kp) (F_Soil_Res_walls)	Parziale resistenza Tiranti permanenti (F_Anch_P)	Parziale resistenza Tiranti temporanei (F_Anch_T)	Parziale elementi strutturali (F_wall)
Simbolo	$\gamma_{Re}$	$\gamma_{ap}$	$\gamma_{at}$	
NTC2018: SLE (Rara/Frequente/Quasi Permanente)	1	1	1	1
NTC2018: A1+M1+R1 (R3 per tiranti)	1	1.2	1.1	1
NTC2018: A2+M2+R1	1	1.2	1.1	1

### 5.3 Risultati NTC2018: SLE (Rara/Frequente/Quasi Permanente)

#### Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 0 geo


Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT	
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 0 geo	2	0	
Stage 0 geo	1.8	0	
Stage 0 geo	1.6	0	
Stage 0 geo	1.4	0	
Stage 0 geo	1.2	0	
Stage 0 geo	1	0	
Stage 0 geo	0.8	0	
Stage 0 geo	0.6	0	
Stage 0 geo	0.4	0	
Stage 0 geo	0.2	0	
Stage 0 geo	0	0	
Stage 0 geo	-0.2	0	
Stage 0 geo	-0.4	0	
Stage 0 geo	-0.6	0	
Stage 0 geo	-0.8	0	
Stage 0 geo	-1	0	
Stage 0 geo	-1.2	0	
Stage 0 geo	-1.4	0	
Stage 0 geo	-1.6	0	
Stage 0 geo	-1.8	0	
Stage 0 geo	-2	0	
Stage 0 geo	-2.2	0	
Stage 0 geo	-2.4	0	
Stage 0 geo	-2.6	0	
Stage 0 geo	-2.8	0	
Stage 0 geo	-3	0	
Stage 0 geo	-3.2	0	
Stage 0 geo	-3.4	0	
Stage 0 geo	-3.6	0	
Stage 0 geo	-3.8	0	
Stage 0 geo	-4	0	
Stage 0 geo	-4.2	0	
Stage 0 geo	-4.4	0	
Stage 0 geo	-4.6	0	
Stage 0 geo	-4.8	0	
Stage 0 geo	-5	0	
Stage 0 geo	-5.2	0	
Stage 0 geo	-5.4	0	
Stage 0 geo	-5.6	0	
Stage 0 geo	-5.8	0	
Stage 0 geo	-6	0	
Stage 0 geo	-6.2	0	
Stage 0 geo	-6.4	0	
Stage 0 geo	-6.6	0	
Stage 0 geo	-6.8	0	
Stage 0 geo	-7	0	
Stage 0 geo	-7.2	0	
Stage 0 geo	-7.4	0	

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 0 geo	-7.6	0	
Stage 0 geo	-7.8	0	
Stage 0 geo	-8	0	
Stage 0 geo	-8.2	0	
Stage 0 geo	-8.4	0	
Stage 0 geo	-8.6	0	
Stage 0 geo	-8.8	0	
Stage 0 geo	-9	0	
Stage 0 geo	-9.2	0	
Stage 0 geo	-9.4	0	
Stage 0 geo	-9.6	0	
Stage 0 geo	-9.8	0	
Stage 0 geo	-10	0	
Stage 0 geo	-10.2	0	
Stage 0 geo	-10.4	0	
Stage 0 geo	-10.6	0	
Stage 0 geo	-10.8	0	
Stage 0 geo	-11	0	
Stage 0 geo	-11.2	0	
Stage 0 geo	-11.4	0	
Stage 0 geo	-11.6	0	
Stage 0 geo	-11.8	0	
Stage 0 geo	-12	0	
Stage 0 geo	-12.2	0	
Stage 0 geo	-12.4	0	
Stage 0 geo	-12.6	0	
Stage 0 geo	-12.8	0	
Stage 0 geo	-13	0	
Stage 0 geo	-13.2	0	
Stage 0 geo	-13.4	0	
Stage 0 geo	-13.6	0	
Stage 0 geo	-13.8	0	
Stage 0 geo	-14	0	
Stage 0 geo	-14.2	0	
Stage 0 geo	-14.4	0	
Stage 0 geo	-14.6	0	
Stage 0 geo	-14.8	0	
Stage 0 geo	-15	0	
Stage 0 geo	-15.2	0	
Stage 0 geo	-15.4	0	
Stage 0 geo	-15.6	0	
Stage 0 geo	-15.8	0	
Stage 0 geo	-16	0	

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 1**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 1	2	0	
Stage 1	1.8	0	
Stage 1	1.6	0	
Stage 1	1.4	0	
Stage 1	1.2	0	
Stage 1	1	0	
Stage 1	0.8	0	
Stage 1	0.6	0	
Stage 1	0.4	0	
Stage 1	0.2	0	
Stage 1	0	0	
Stage 1	-0.2	0	
Stage 1	-0.4	0	
Stage 1	-0.6	0	
Stage 1	-0.8	0	



Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 1	-1	0
Stage 1	-1.2	0
Stage 1	-1.4	0
Stage 1	-1.6	0
Stage 1	-1.8	0
Stage 1	-2	0
Stage 1	-2.2	0
Stage 1	-2.4	0
Stage 1	-2.6	0
		
R_ Sondaggi EON		
di Torviscosa (UD).m		
Stage 1		
Stage 1	-2.8	0
Stage 1	-3	0
Stage 1	-3.2	0
Stage 1	-3.4	0
Stage 1	-3.6	0
Stage 1	-3.8	0
Stage 1	-4	0
Stage 1	-4.2	0
Stage 1	-4.4	0
Stage 1	-4.6	0
Stage 1	-4.8	0
Stage 1	-5	0
Stage 1	-5.2	0
Stage 1	-5.4	0
Stage 1	-5.6	0
Stage 1	-5.8	0
Stage 1	-6	0
Stage 1	-6.2	0
Stage 1	-6.4	0
Stage 1	-6.6	0
Stage 1	-6.8	0
Stage 1	-7	0
Stage 1	-7.2	0
Stage 1	-7.4	0
Stage 1	-7.6	0
Stage 1	-7.8	0
Stage 1	-8	0
Stage 1	-8.2	0
Stage 1	-8.4	0
Stage 1	-8.6	0
Stage 1	-8.8	0
Stage 1	-9	0
Stage 1	-9.2	0
Stage 1	-9.4	0
Stage 1	-9.6	0
Stage 1	-9.8	0
Stage 1	-10	0
Stage 1	-10.2	0
Stage 1	-10.4	0
Stage 1	-10.6	0
Stage 1	-10.8	0
Stage 1	-11	0
Stage 1	-11.2	0
Stage 1	-11.4	0
Stage 1	-11.6	0
Stage 1	-11.8	0
Stage 1	-12	0
Stage 1	-12.2	0
Stage 1	-12.4	0
Stage 1	-12.6	0
Stage 1	-12.8	0
Stage 1	-13	0
Stage 1	-13.2	0
Stage 1	-13.4	0

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 1	-13.6	0
Stage 1	-13.8	0
Stage 1	-14	0
Stage 1	-14.2	0
Stage 1	-14.4	0
Stage 1	-14.6	0
Stage 1	-14.8	0
Stage 1	-15	0
Stage 1	-15.2	0
Stage 1	-15.4	0
Stage 1	-15.6	0
Stage 1	-15.8	0
Stage 1	-16	0

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 2**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 2	2	0
Stage 2	1.8	0
Stage 2	1.6	0
Stage 2	1.4	0
Stage 2	1.2	0
Stage 2	1	0
Stage 2	0.8	0
Stage 2	0.6	0
Stage 2	0.4	0
Stage 2	0.2	0
Stage 2	0	0
Stage 2	-0.2	0
Stage 2	-0.4	0
Stage 2	-0.6	0
Stage 2	-0.8	0
Stage 2	-1	0
Stage 2	-1.2	0
Stage 2	-1.4	0
Stage 2	-1.6	0
Stage 2	-1.8	0
Stage 2	-2	0
Stage 2	-2.2	0
Stage 2	-2.4	0
Stage 2	-2.6	0
Stage 2	-2.8	0
Stage 2	-3	0
Stage 2	-3.2	0
Stage 2	-3.4	0
Stage 2	-3.6	0
Stage 2	-3.8	0
Stage 2	-4	0
Stage 2	-4.2	0
Stage 2	-4.4	0
Stage 2	-4.6	0
Stage 2	-4.8	0
Stage 2	-5	0
Stage 2	-5.2	0
Stage 2	-5.4	0
Stage 2	-5.6	0
Stage 2	-5.8	0
Stage 2	-6	0
Stage 2	-6.2	0
Stage 2	-6.4	0
Stage 2	-6.6	0
Stage 2	-6.8	0
Stage 2	-7	0

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 2	-7.2	0	
Stage 2	-7.4	0	
Stage 2	-7.6	0	
Stage 2	-7.8	0	
Stage 2	-8	0	
Stage 2	-8.2	0	
Stage 2	-8.4	0	
Stage 2	-8.6	0	
Stage 2	-8.8	0	
Stage 2	-9	0	
Stage 2	-9.2	0	
Stage 2	-9.4	0	
Stage 2	-9.6	0	
Stage 2	-9.8	0	
Stage 2	-10	0	
Stage 2	-10.2	0	
Stage 2	-10.4	0	
Stage 2	-10.6	0	
Stage 2	-10.8	0	
Stage 2	-11	0	
Stage 2	-11.2	0	
Stage 2	-11.4	0	
Stage 2	-11.6	0	
Stage 2	-11.8	0	
Stage 2	-12	0	
Stage 2	-12.2	0	
Stage 2	-12.4	0	
Stage 2	-12.6	0	
Stage 2	-12.8	0	
Stage 2	-13	0	
Stage 2	-13.2	0	
Stage 2	-13.4	0	
Stage 2	-13.6	0	
Stage 2	-13.8	0	
Stage 2	-14	0	
Stage 2	-14.2	0	
Stage 2	-14.4	0	
Stage 2	-14.6	0	
Stage 2	-14.8	0	
Stage 2	-15	0	
Stage 2	-15.2	0	
Stage 2	-15.4	0	
Stage 2	-15.6	0	
Stage 2	-15.8	0	
Stage 2	-16	0	

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 3**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 3	2	26.81	
Stage 3	1.8	22.35	
Stage 3	1.6	17.88	
Stage 3	1.4	13.41	
Stage 3	1.2	8.94	
Stage 3	1	4.47	
Stage 3	0.8	0	
Stage 3	0.6	-4.47	
Stage 3	0.4	-8.93	
Stage 3	0.2	-13.36	
Stage 3	0	-17.77	
Stage 3	-0.2	-22.14	
Stage 3	-0.4	-26.47	
Stage 3	-0.6	-30.73	

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 3	-0.8	-34.93
Stage 3	-1	-39.06
Stage 3	-1.2	-43.1
Stage 3	-1.4	-47.05
Stage 3	-1.6	-50.9
Stage 3	-1.8	-54.64
Stage 3	-2	-58.26
Stage 3	-2.2	-61.77
Stage 3	-2.4	-65.14
Stage 3	-2.6	-68.38
Stage 3	-2.8	-71.48
Stage 3	-3	-74.43
Stage 3	-3.2	-77.23
Stage 3	-3.4	-79.88
Stage 3	-3.6	-82.37
Stage 3	-3.8	-84.69
Stage 3	-4	-86.85
Stage 3	-4.2	-88.83
Stage 3	-4.4	-90.65
Stage 3	-4.6	-92.28
Stage 3	-4.8	-93.75
Stage 3	-5	-95.03
Stage 3	-5.2	-96.13
Stage 3	-5.4	-97.06
Stage 3	-5.6	-97.8
Stage 3	-5.8	-98.36
Stage 3	-6	-98.74
Stage 3	-6.2	-98.95
Stage 3	-6.4	-98.97
Stage 3	-6.6	-98.82
Stage 3	-6.8	-98.49
Stage 3	-7	-98
Stage 3	-7.2	-97.33
Stage 3	-7.4	-96.5
Stage 3	-7.6	-95.5
Stage 3	-7.8	-94.35
Stage 3	-8	-93.04
Stage 3	-8.2	-91.58
Stage 3	-8.4	-89.97
Stage 3	-8.6	-88.23
Stage 3	-8.8	-86.36
Stage 3	-9	-84.35
Stage 3	-9.2	-82.23
Stage 3	-9.4	-79.99
Stage 3	-9.6	-77.65
Stage 3	-9.8	-75.21
Stage 3	-10	-72.67
Stage 3	-10.2	-70.06
Stage 3	-10.4	-67.36
Stage 3	-10.6	-64.6
Stage 3	-10.8	-61.78
Stage 3	-11	-58.91
Stage 3	-11.2	-55.99
Stage 3	-11.4	-53.04
Stage 3	-11.6	-50.06
Stage 3	-11.8	-47.06
Stage 3	-12	-44.05
Stage 3	-12.2	-41.03
Stage 3	-12.4	-38.01
Stage 3	-12.6	-35
Stage 3	-12.8	-32.01
Stage 3	-13	-29.04
Stage 3	-13.2	-26.09
Stage 3	-13.4	-23.18
Stage 3	-13.6	-20.3
Stage 3	-13.8	-17.46
Stage 3	-14	-14.67

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 3	-14.2	-11.91
Stage 3	-14.4	-9.2
Stage 3	-14.6	-6.52
Stage 3	-14.8	-3.88
Stage 3	-15	-1.25
Stage 3	-15.2	1.35
Stage 3	-15.4	3.94
Stage 3	-15.6	6.52
Stage 3	-15.8	9.09
Stage 3	-16	11.67

### Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 3bis

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 3bis	2	26.81
Stage 3bis	1.8	22.35
Stage 3bis	1.6	17.88
Stage 3bis	1.4	13.41
Stage 3bis	1.2	8.94
Stage 3bis	1	4.47
Stage 3bis	0.8	0
Stage 3bis	0.6	-4.47
Stage 3bis	0.4	-8.93
Stage 3bis	0.2	-13.36
Stage 3bis	0	-17.77
Stage 3bis	-0.2	-22.14
Stage 3bis	-0.4	-26.47
Stage 3bis	-0.6	-30.73
Stage 3bis	-0.8	-34.93
Stage 3bis	-1	-39.06
Stage 3bis	-1.2	-43.1
Stage 3bis	-1.4	-47.05
Stage 3bis	-1.6	-50.9
Stage 3bis	-1.8	-54.64
Stage 3bis	-2	-58.26
Stage 3bis	-2.2	-61.77
Stage 3bis	-2.4	-65.14
Stage 3bis	-2.6	-68.38
Stage 3bis	-2.8	-71.48
Stage 3bis	-3	-74.43
Stage 3bis	-3.2	-77.23
Stage 3bis	-3.4	-79.88
Stage 3bis	-3.6	-82.37
Stage 3bis	-3.8	-84.69
Stage 3bis	-4	-86.85
Stage 3bis	-4.2	-88.83
Stage 3bis	-4.4	-90.65
Stage 3bis	-4.6	-92.28
Stage 3bis	-4.8	-93.75
Stage 3bis	-5	-95.03
Stage 3bis	-5.2	-96.13
Stage 3bis	-5.4	-97.06
Stage 3bis	-5.6	-97.8
Stage 3bis	-5.8	-98.36
Stage 3bis	-6	-98.74
Stage 3bis	-6.2	-98.95
Stage 3bis	-6.4	-98.97
Stage 3bis	-6.6	-98.82
Stage 3bis	-6.8	-98.49
Stage 3bis	-7	-98
Stage 3bis	-7.2	-97.33
Stage 3bis	-7.4	-96.5



Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 3bis	-7.6	-95.5	
Stage 3bis	-7.8	-94.35	
Stage 3bis	-8	-93.04	
Stage 3bis	-8.2	-91.58	
Stage 3bis	-8.4	-89.97	
Stage 3bis	-8.6	-88.23	
Stage 3bis	-8.8	-86.36	
Stage 3bis	-9	-84.35	
Stage 3bis	-9.2	-82.23	
Stage 3bis	-9.4	-79.99	
Stage 3bis	-9.6	-77.65	
Stage 3bis	-9.8	-75.21	
Stage 3bis	-10	-72.67	
Stage 3bis	-10.2	-70.06	
Stage 3bis	-10.4	-67.36	
Stage 3bis	-10.6	-64.6	
Stage 3bis	-10.8	-61.78	
Stage 3bis	-11	-58.91	
Stage 3bis	-11.2	-55.99	
Stage 3bis	-11.4	-53.04	
Stage 3bis	-11.6	-50.06	
Stage 3bis	-11.8	-47.06	
Stage 3bis	-12	-44.05	
Stage 3bis	-12.2	-41.03	
Stage 3bis	-12.4	-38.01	
Stage 3bis	-12.6	-35	
Stage 3bis	-12.8	-32.01	
Stage 3bis	-13	-29.04	
Stage 3bis	-13.2	-26.09	
Stage 3bis	-13.4	-23.18	
Stage 3bis	-13.6	-20.3	
Stage 3bis	-13.8	-17.46	
Stage 3bis	-14	-14.67	
Stage 3bis	-14.2	-11.91	
Stage 3bis	-14.4	-9.2	
Stage 3bis	-14.6	-6.52	
Stage 3bis	-14.8	-3.88	
Stage 3bis	-15	-1.25	
Stage 3bis	-15.2	1.35	
Stage 3bis	-15.4	3.94	
Stage 3bis	-15.6	6.52	
Stage 3bis	-15.8	9.09	
Stage 3bis	-16	11.67	

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 4**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 4	2	4.73	
Stage 4	1.8	1.82	
Stage 4	1.6	-1.1	
Stage 4	1.4	-4.02	
Stage 4	1.2	-6.94	
Stage 4	1	-9.86	
Stage 4	0.8	-12.78	
Stage 4	0.6	-15.7	
Stage 4	0.4	-18.62	
Stage 4	0.2	-21.54	
Stage 4	0	-24.46	
Stage 4	-0.2	-27.38	
Stage 4	-0.4	-30.3	
Stage 4	-0.6	-33.22	
Stage 4	-0.8	-36.14	
Stage 4	-1	-39.06	

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 4	-1.2	-41.98
Stage 4	-1.4	-44.9
Stage 4	-1.6	-47.8
Stage 4	-1.8	-50.66
Stage 4	-2	-53.49
Stage 4	-2.2	-56.28
Stage 4	-2.4	-59
Stage 4	-2.6	-61.66
Stage 4	-2.8	-64.25
Stage 4	-3	-66.76
Stage 4	-3.2	-69.17
Stage 4	-3.4	-71.49
Stage 4	-3.6	-73.71
Stage 4	-3.8	-75.82
Stage 4	-4	-77.82
Stage 4	-4.2	-79.69
Stage 4	-4.4	-81.44
Stage 4	-4.6	-83.06
Stage 4	-4.8	-84.55
Stage 4	-5	-85.9
Stage 4	-5.2	-87.1
Stage 4	-5.4	-88.16
Stage 4	-5.6	-89.08
Stage 4	-5.8	-89.84
Stage 4	-6	-90.45
Stage 4	-6.2	-90.91
Stage 4	-6.4	-91.22
Stage 4	-6.6	-91.36
Stage 4	-6.8	-91.36
Stage 4	-7	-91.19
Stage 4	-7.2	-90.87
Stage 4	-7.4	-90.4
Stage 4	-7.6	-89.77
Stage 4	-7.8	-88.99
Stage 4	-8	-88.05
Stage 4	-8.2	-86.97
Stage 4	-8.4	-85.74
Stage 4	-8.6	-84.37
Stage 4	-8.8	-82.87
Stage 4	-9	-81.22
Stage 4	-9.2	-79.45
Stage 4	-9.4	-77.54
Stage 4	-9.6	-75.52
Stage 4	-9.8	-73.38
Stage 4	-10	-71.13
Stage 4	-10.2	-68.78
Stage 4	-10.4	-66.33
Stage 4	-10.6	-63.8
Stage 4	-10.8	-61.18
Stage 4	-11	-58.5
Stage 4	-11.2	-55.75
Stage 4	-11.4	-52.95
Stage 4	-11.6	-50.1
Stage 4	-11.8	-47.22
Stage 4	-12	-44.3
Stage 4	-12.2	-41.37
Stage 4	-12.4	-38.42
Stage 4	-12.6	-35.47
Stage 4	-12.8	-32.52
Stage 4	-13	-29.59
Stage 4	-13.2	-26.66
Stage 4	-13.4	-23.76
Stage 4	-13.6	-20.89
Stage 4	-13.8	-18.05
Stage 4	-14	-15.25
Stage 4	-14.2	-12.48
Stage 4	-14.4	-9.75

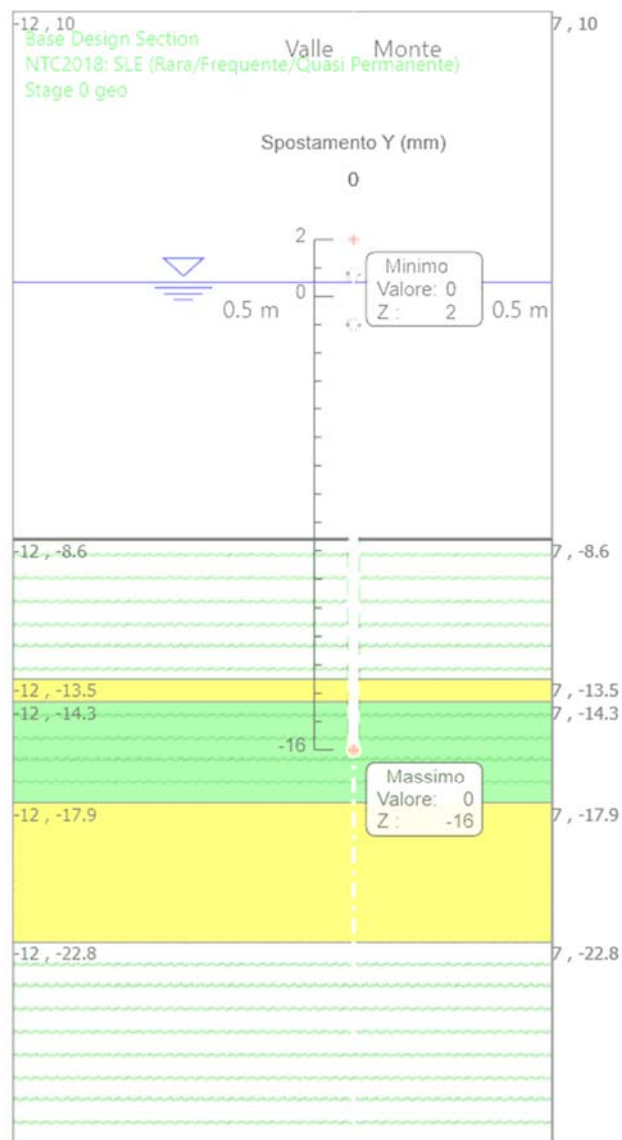
Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 4	-14.6	-7.05
Stage 4	-14.8	-4.38
Stage 4	-15	-1.73
Stage 4	-15.2	0.9
Stage 4	-15.4	3.52
Stage 4	-15.6	6.13
Stage 4	-15.8	8.74
Stage 4	-16	11.34

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 4 eccez**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 4 eccez	2	28.22
Stage 4 eccez	1.8	23.75
Stage 4 eccez	1.6	19.27
Stage 4 eccez	1.4	14.79
Stage 4 eccez	1.2	10.31
Stage 4 eccez	1	5.83
Stage 4 eccez	0.8	1.35
Stage 4 eccez	0.6	-3.13
Stage 4 eccez	0.4	-7.61
Stage 4 eccez	0.2	-12.09
Stage 4 eccez	0	-16.57
Stage 4 eccez	-0.2	-21.06
Stage 4 eccez	-0.4	-25.55
Stage 4 eccez	-0.6	-30.04
Stage 4 eccez	-0.8	-34.55
Stage 4 eccez	-1	-39.06
Stage 4 eccez	-1.2	-43.58
Stage 4 eccez	-1.4	-48.1
Stage 4 eccez	-1.6	-52.6
Stage 4 eccez	-1.8	-57.06
Stage 4 eccez	-2	-61.48
Stage 4 eccez	-2.2	-65.83
Stage 4 eccez	-2.4	-70.11
Stage 4 eccez	-2.6	-74.3
Stage 4 eccez	-2.8	-78.38
Stage 4 eccez	-3	-82.35
Stage 4 eccez	-3.2	-86.2
Stage 4 eccez	-3.4	-89.91
Stage 4 eccez	-3.6	-93.48
Stage 4 eccez	-3.8	-96.89
Stage 4 eccez	-4	-100.14
Stage 4 eccez	-4.2	-103.22
Stage 4 eccez	-4.4	-106.12
Stage 4 eccez	-4.6	-108.84
Stage 4 eccez	-4.8	-111.36
Stage 4 eccez	-5	-113.69
Stage 4 eccez	-5.2	-115.81
Stage 4 eccez	-5.4	-117.72
Stage 4 eccez	-5.6	-119.42
Stage 4 eccez	-5.8	-120.91
Stage 4 eccez	-6	-122.17
Stage 4 eccez	-6.2	-123.22
Stage 4 eccez	-6.4	-124.04
Stage 4 eccez	-6.6	-124.63
Stage 4 eccez	-6.8	-125.01
Stage 4 eccez	-7	-125.15
Stage 4 eccez	-7.2	-125.08
Stage 4 eccez	-7.4	-124.77
Stage 4 eccez	-7.6	-124.25
Stage 4 eccez	-7.8	-123.51
Stage 4 eccez	-8	-122.55

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 4 eccez	-8.2	-121.38
Stage 4 eccez	-8.4	-120
Stage 4 eccez	-8.6	-118.41
Stage 4 eccez	-8.8	-116.62
Stage 4 eccez	-9	-114.64
Stage 4 eccez	-9.2	-112.48
Stage 4 eccez	-9.4	-110.13
Stage 4 eccez	-9.6	-107.61
Stage 4 eccez	-9.8	-104.92
Stage 4 eccez	-10	-102.07
Stage 4 eccez	-10.2	-99.08
Stage 4 eccez	-10.4	-95.94
Stage 4 eccez	-10.6	-92.68
Stage 4 eccez	-10.8	-89.28
Stage 4 eccez	-11	-85.78
Stage 4 eccez	-11.2	-82.17
Stage 4 eccez	-11.4	-78.47
Stage 4 eccez	-11.6	-74.69
Stage 4 eccez	-11.8	-70.83
Stage 4 eccez	-12	-66.91
Stage 4 eccez	-12.2	-62.93
Stage 4 eccez	-12.4	-58.91
Stage 4 eccez	-12.6	-54.85
Stage 4 eccez	-12.8	-50.77
Stage 4 eccez	-13	-46.67
Stage 4 eccez	-13.2	-42.56
Stage 4 eccez	-13.4	-38.46
Stage 4 eccez	-13.6	-34.37
Stage 4 eccez	-13.8	-30.29
Stage 4 eccez	-14	-26.24
Stage 4 eccez	-14.2	-22.22
Stage 4 eccez	-14.4	-18.23
Stage 4 eccez	-14.6	-14.27
Stage 4 eccez	-14.8	-10.33
Stage 4 eccez	-15	-6.41
Stage 4 eccez	-15.2	-2.52
Stage 4 eccez	-15.4	1.37
Stage 4 eccez	-15.6	5.25
Stage 4 eccez	-15.8	9.12
Stage 4 eccez	-16	12.99

## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 0 geo



Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

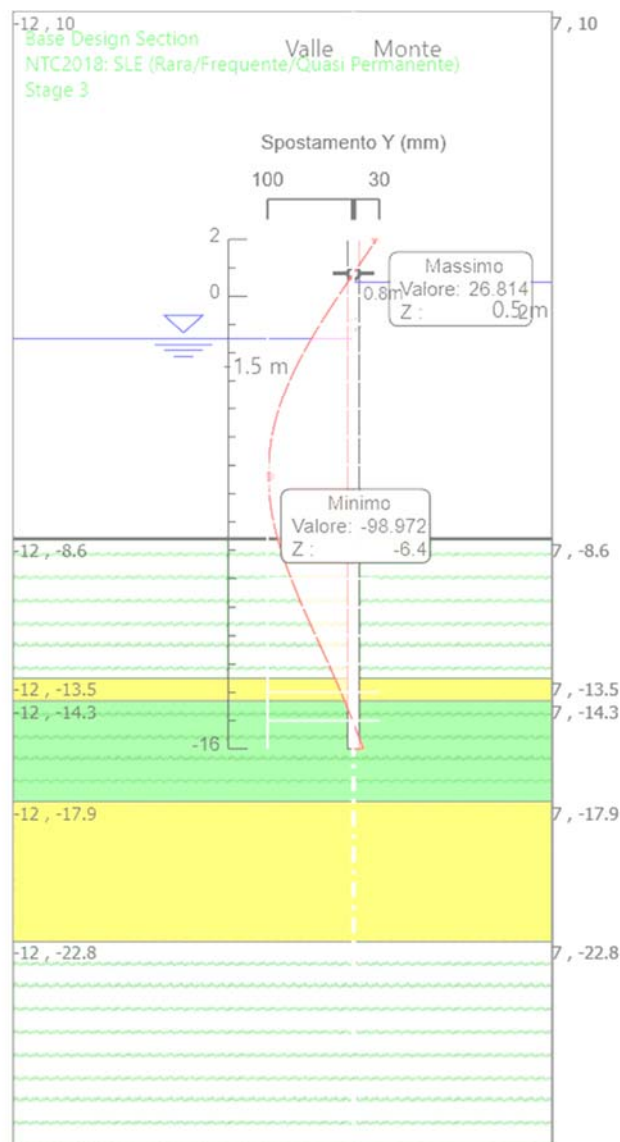
Stage: Stage 0 geo

Spostamento orizzontale

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***GE Ground Engineering S.r.l.***

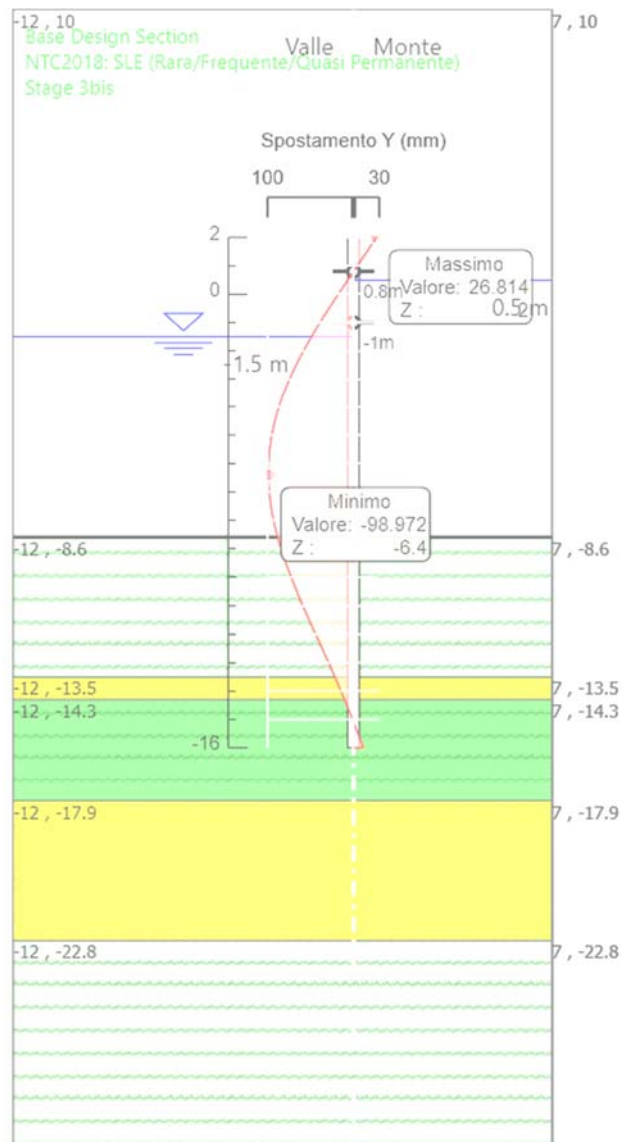
### Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 3



Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)  
 Stage: Stage 3  
 Spostamento orizzontale



### Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 3bis

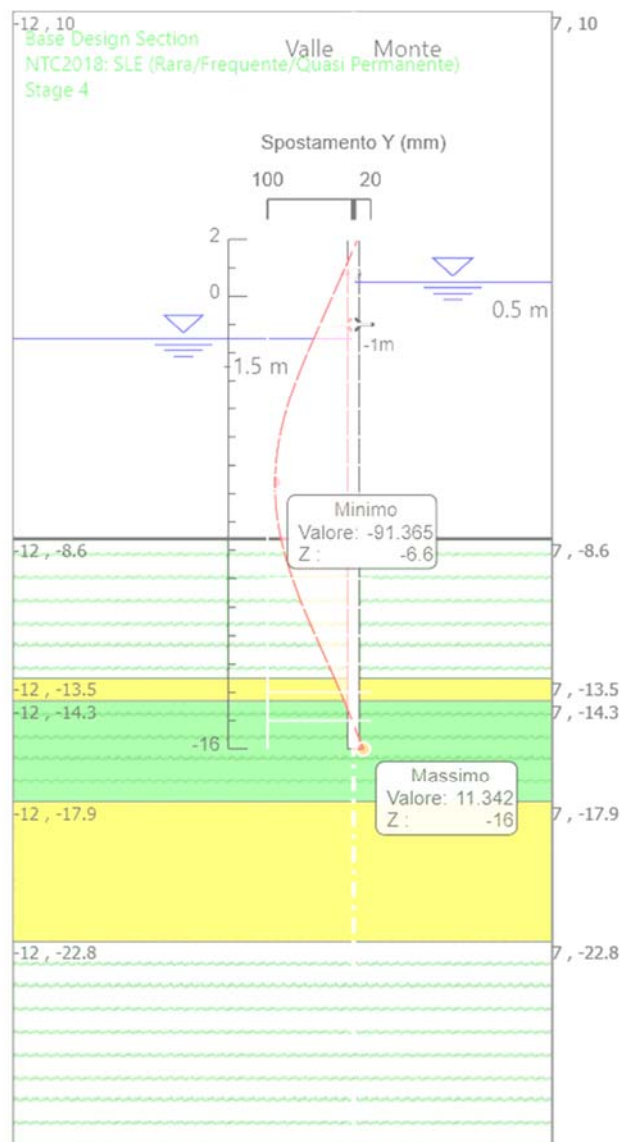


Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 3bis

Spostamento orizzontale

## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 4

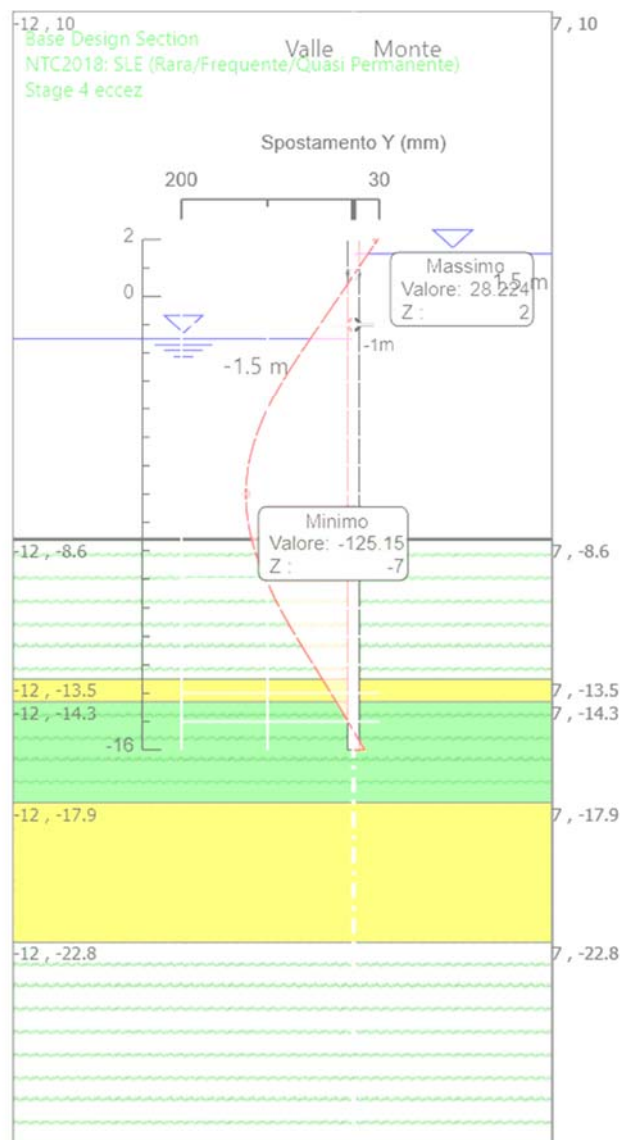


Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 4

Spostamento orizzontale

## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 4 eccez



Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 4 eccez

Spostamento orizzontale

## 5.4 Risultati NTC2018: A1+M1+R1 (R3 per tiranti)

**Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 0 geo**

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 0 geo	2	0	0
Stage 0 geo	1.8	0	0
Stage 0 geo	1.6	0	0
Stage 0 geo	1.4	0	0
Stage 0 geo	1.2	0	0
Stage 0 geo	1	0	0
Stage 0 geo	0.8	0	0
Stage 0 geo	0.6	0	0
Stage 0 geo	0.4	0	0
Stage 0 geo	0.2	0	0
Stage 0 geo	0	0	0
Stage 0 geo	-0.2	0	0
Stage 0 geo	-0.4	0	0
Stage 0 geo	-0.6	0	0
Stage 0 geo	-0.8	0	0
Stage 0 geo	-1	0	0
Stage 0 geo	-1.2	0	0
Stage 0 geo	-1.4	0	0
Stage 0 geo	-1.6	0	0
Stage 0 geo	-1.8	0	0
Stage 0 geo	-2	0	0
Stage 0 geo	-2.2	0	0
Stage 0 geo	-2.4	0	0
Stage 0 geo	-2.6	0	0
Stage 0 geo	-2.8	0	0
Stage 0 geo	-3	0	0
Stage 0 geo	-3.2	0	0
Stage 0 geo	-3.4	0	0
Stage 0 geo	-3.6	0	0
Stage 0 geo	-3.8	0	0
Stage 0 geo	-4	0	0
Stage 0 geo	-4.2	0	0
Stage 0 geo	-4.4	0	0
Stage 0 geo	-4.6	0	0
Stage 0 geo	-4.8	0	0
Stage 0 geo	-5	0	0
Stage 0 geo	-5.2	0	0
Stage 0 geo	-5.4	0	0
Stage 0 geo	-5.6	0	0
Stage 0 geo	-5.8	0	0
Stage 0 geo	-6	0	0
Stage 0 geo	-6.2	0	0
Stage 0 geo	-6.4	0	0
Stage 0 geo	-6.6	0	0
Stage 0 geo	-6.8	0	0
Stage 0 geo	-7	0	0
Stage 0 geo	-7.2	0	0
Stage 0 geo	-7.4	0	0
Stage 0 geo	-7.6	0	0
Stage 0 geo	-7.8	0	0
Stage 0 geo	-8	0	0
Stage 0 geo	-8.2	0	0
Stage 0 geo	-8.4	0	0
Stage 0 geo	-8.6	0	0
Stage 0 geo	-8.8	0	0
Stage 0 geo	-9	0	0
Stage 0 geo	-9.2	0	0
Stage 0 geo	-9.4	0	0
Stage 0 geo	-9.6	0	0
Stage 0 geo	-9.8	0	0

Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 0 geo	-10	0	0
Stage 0 geo	-10.2	0	0
Stage 0 geo	-10.4	0	0
Stage 0 geo	-10.6	0	0
Stage 0 geo	-10.8	0	0
Stage 0 geo	-11	0	0
Stage 0 geo	-11.2	0	0
Stage 0 geo	-11.4	0	0
Stage 0 geo	-11.6	0	0
Stage 0 geo	-11.8	0	0
Stage 0 geo	-12	0	0
Stage 0 geo	-12.2	0	0
Stage 0 geo	-12.4	0	0
Stage 0 geo	-12.6	0	0
Stage 0 geo	-12.8	0	0
Stage 0 geo	-13	0	0
Stage 0 geo	-13.2	0	0
Stage 0 geo	-13.4	0	0
Stage 0 geo	-13.6	0	0
Stage 0 geo	-13.8	0	0
Stage 0 geo	-14	0	0
Stage 0 geo	-14.2	0	0
Stage 0 geo	-14.4	0	0
Stage 0 geo	-14.6	0	0
Stage 0 geo	-14.8	0	0
Stage 0 geo	-15	0	0
Stage 0 geo	-15.2	0	0
Stage 0 geo	-15.4	0	0
Stage 0 geo	-15.6	0	0
Stage 0 geo	-15.8	0	0
Stage 0 geo	-16	0	0

Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 1

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 1	2	0	0
Stage 1	1.8	0	0
Stage 1	1.6	0	0
Stage 1	1.4	0	0
Stage 1	1.2	0	0
Stage 1	1	0	0
Stage 1	0.8	0	0
Stage 1	0.6	0	0
Stage 1	0.4	0	0
Stage 1	0.2	0	0
Stage 1	0	0	0
Stage 1	-0.2	0	0
Stage 1	-0.4	0	0
Stage 1	-0.6	0	0
Stage 1	-0.8	0	0
Stage 1	-1	0	0
Stage 1	-1.2	0	0
Stage 1	-1.4	0	0
Stage 1	-1.6	0	0
Stage 1	-1.8	0	0
Stage 1	-2	0	0
Stage 1	-2.2	0	0
Stage 1	-2.4	0	0
Stage 1	-2.6	0	0
Stage 1	-2.8	0	0
Stage 1	-3	0	0
Stage 1	-3.2	0	0
Stage 1	-3.4	0	0
Stage 1	-3.6	0	0

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 1	-3.8	0	0
Stage 1	-4	0	0
Stage 1	-4.2	0	0
Stage 1	-4.4	0	0
Stage 1	-4.6	0	0
Stage 1	-4.8	0	0
Stage 1	-5	0	0
Stage 1	-5.2	0	0
Stage 1	-5.4	0	0
Stage 1	-5.6	0	0
Stage 1	-5.8	0	0
Stage 1	-6	0	0
Stage 1	-6.2	0	0
Stage 1	-6.4	0	0
Stage 1	-6.6	0	0
Stage 1	-6.8	0	0
Stage 1	-7	0	0
Stage 1	-7.2	0	0
Stage 1	-7.4	0	0
Stage 1	-7.6	0	0
Stage 1	-7.8	0	0
Stage 1	-8	0	0
Stage 1	-8.2	0	0
Stage 1	-8.4	0	0
Stage 1	-8.6	0	0
Stage 1	-8.8	0	0
Stage 1	-9	0	0
Stage 1	-9.2	0	0
Stage 1	-9.4	0	0
Stage 1	-9.6	0	0
Stage 1	-9.8	0	0
Stage 1	-10	0	0
Stage 1	-10.2	0	0
Stage 1	-10.4	0	0
Stage 1	-10.6	0	0
Stage 1	-10.8	0	0
Stage 1	-11	0	0
Stage 1	-11.2	0	0
Stage 1	-11.4	0	0
Stage 1	-11.6	0	0
Stage 1	-11.8	0	0
Stage 1	-12	0	0
Stage 1	-12.2	0	0
Stage 1	-12.4	0	0
Stage 1	-12.6	0	0
Stage 1	-12.8	0	0
Stage 1	-13	0	0
Stage 1	-13.2	0	0
Stage 1	-13.4	0	0
Stage 1	-13.6	0	0
Stage 1	-13.8	0	0
Stage 1	-14	0	0
Stage 1	-14.2	0	0
Stage 1	-14.4	0	0
Stage 1	-14.6	0	0
Stage 1	-14.8	0	0
Stage 1	-15	0	0
Stage 1	-15.2	0	0
Stage 1	-15.4	0	0
Stage 1	-15.6	0	0
Stage 1	-15.8	0	0
Stage 1	-16	0	0

Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 2

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 2	2	0	0
Stage 2	1.8	0	0
Stage 2	1.6	0	0
Stage 2	1.4	0	0
Stage 2	1.2	0	0
Stage 2	1	0	0
Stage 2	0.8	0	0
Stage 2	0.6	0	0
Stage 2	0.4	0	0
Stage 2	0.2	0	0
Stage 2	0	0	0
Stage 2	-0.2	0	0
Stage 2	-0.4	0	0
Stage 2	-0.6	0	0
Stage 2	-0.8	0	0
Stage 2	-1	0	0
Stage 2	-1.2	0	0
Stage 2	-1.4	0	0
Stage 2	-1.6	0	0
Stage 2	-1.8	0	0
Stage 2	-2	0	0
Stage 2	-2.2	0	0
Stage 2	-2.4	0	0
Stage 2	-2.6	0	0
Stage 2	-2.8	0	0
Stage 2	-3	0	0
Stage 2	-3.2	0	0
Stage 2	-3.4	0	0
Stage 2	-3.6	0	0
Stage 2	-3.8	0	0
Stage 2	-4	0	0
Stage 2	-4.2	0	0
Stage 2	-4.4	0	0
Stage 2	-4.6	0	0
Stage 2	-4.8	0	0
Stage 2	-5	0	0
Stage 2	-5.2	0	0
Stage 2	-5.4	0	0
Stage 2	-5.6	0	0
Stage 2	-5.8	0	0
Stage 2	-6	0	0
Stage 2	-6.2	0	0
Stage 2	-6.4	0	0
Stage 2	-6.6	0	0
Stage 2	-6.8	0	0
Stage 2	-7	0	0
Stage 2	-7.2	0	0
Stage 2	-7.4	0	0
Stage 2	-7.6	0	0
Stage 2	-7.8	0	0
Stage 2	-8	0	0
Stage 2	-8.2	0	0
Stage 2	-8.4	0	0
Stage 2	-8.6	0	0
Stage 2	-8.8	0	0
Stage 2	-9	0	0
Stage 2	-9.2	0	0
Stage 2	-9.4	0	0
Stage 2	-9.6	0	0
Stage 2	-9.8	0	0
Stage 2	-10	0	0
Stage 2	-10.2	0	0
Stage 2	-10.4	0	0
Stage 2	-10.6	0	0
Stage 2	-10.8	0	0
Stage 2	-11	0	0
Stage 2	-11.2	0	0

Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 2	-11.4	0	0
Stage 2	-11.6	0	0
Stage 2	-11.8	0	0
Stage 2	-12	0	0
Stage 2	-12.2	0	0
Stage 2	-12.4	0	0
Stage 2	-12.6	0	0
Stage 2	-12.8	0	0
Stage 2	-13	0	0
Stage 2	-13.2	0	0
Stage 2	-13.4	0	0
Stage 2	-13.6	0	0
Stage 2	-13.8	0	0
Stage 2	-14	0	0
Stage 2	-14.2	0	0
Stage 2	-14.4	0	0
Stage 2	-14.6	0	0
Stage 2	-14.8	0	0
Stage 2	-15	0	0
Stage 2	-15.2	0	0
Stage 2	-15.4	0	0
Stage 2	-15.6	0	0
Stage 2	-15.8	0	0
Stage 2	-16	0	0

Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 3

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 3	2	0	0
Stage 3	1.8	0	0
Stage 3	1.8	0	0
Stage 3	1.6	0	0
Stage 3	1.6	0	0
Stage 3	1.4	0	0
Stage 3	1.4	0	0
Stage 3	1.2	0	0
Stage 3	1.2	0	0
Stage 3	1	0	0
Stage 3	1	0	0
Stage 3	0.8	0	0
Stage 3	0.8	0	0
Stage 3	0.6	-25.87	-129.33
Stage 3	0.4	-51.73	-129.33
Stage 3	0.2	-77.54	-129.07
Stage 3	0	-103.2	-128.29
Stage 3	-0.2	-128.6	-126.99
Stage 3	-0.4	-153.63	-125.17
Stage 3	-0.6	-178.2	-122.83
Stage 3	-0.8	-202.19	-119.97
Stage 3	-1	-225.51	-116.59
Stage 3	-1.2	-248.04	-112.69
Stage 3	-1.4	-269.7	-108.27
Stage 3	-1.6	-290.36	-103.33
Stage 3	-1.8	-309.99	-98.13
Stage 3	-2	-328.57	-92.93
Stage 3	-2.2	-346.12	-87.73
Stage 3	-2.4	-362.62	-82.53
Stage 3	-2.6	-378.09	-77.33
Stage 3	-2.8	-392.51	-72.13
Stage 3	-3	-405.9	-66.93
Stage 3	-3.2	-418.24	-61.73
Stage 3	-3.4	-429.55	-56.53
Stage 3	-3.6	-439.82	-51.33
Stage 3	-3.8	-449.04	-46.13



Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 3	-4	-457.23	-40.93
Stage 3	-4.2	-464.37	-35.73
Stage 3	-4.4	-470.48	-30.53
Stage 3	-4.6	-475.54	-25.33
Stage 3	-4.8	-479.57	-20.13
Stage 3	-5	-482.55	-14.93
Stage 3	-5.2	-484.5	-9.73
Stage 3	-5.4	-485.4	-4.53
Stage 3	-5.6	-485.27	0.67
Stage 3	-5.8	-484.09	5.87
Stage 3	-6	-481.88	11.07
Stage 3	-6.2	-478.62	16.27
Stage 3	-6.4	-474.33	21.47
Stage 3	-6.6	-468.99	26.67
Stage 3	-6.8	-462.62	31.87
Stage 3	-7	-455.2	37.07
Stage 3	-7.2	-446.75	42.27
Stage 3	-7.4	-437.25	47.47
Stage 3	-7.6	-426.72	52.67
Stage 3	-7.8	-415.15	57.87
Stage 3	-8	-402.53	63.07
Stage 3	-8.2	-388.88	68.27
Stage 3	-8.4	-374.18	73.47
Stage 3	-8.6	-358.45	78.67
Stage 3	-8.8	-341.67	83.87
Stage 3	-9	-323.96	88.57
Stage 3	-9.2	-305.41	92.75
Stage 3	-9.4	-286.12	96.44
Stage 3	-9.6	-266.2	99.61
Stage 3	-9.8	-245.74	102.28
Stage 3	-10	-224.85	104.44
Stage 3	-10.2	-203.64	106.09
Stage 3	-10.4	-182.19	107.24
Stage 3	-10.6	-160.61	107.89
Stage 3	-10.8	-139.01	108.02
Stage 3	-11	-117.48	107.65
Stage 3	-11.2	-96.12	106.77
Stage 3	-11.4	-75.04	105.39
Stage 3	-11.6	-54.34	103.5
Stage 3	-11.8	-34.12	101.1
Stage 3	-12	-14.48	98.2
Stage 3	-12.2	4.48	94.79
Stage 3	-12.4	22.65	90.88
Stage 3	-12.6	39.94	86.46
Stage 3	-12.8	56.25	81.53
Stage 3	-13	71.47	76.09
Stage 3	-13.2	85.5	70.15
Stage 3	-13.4	98.24	63.71
Stage 3	-13.6	109.59	56.75
Stage 3	-13.8	114.82	26.17
Stage 3	-14	113.72	-5.52
Stage 3	-14.2	107.22	-32.49
Stage 3	-14.4	96.26	-54.83
Stage 3	-14.6	82.99	-66.31
Stage 3	-14.8	68.04	-74.78
Stage 3	-15	52.27	-78.83
Stage 3	-15.2	36.56	-78.56
Stage 3	-15.4	22.12	-72.22
Stage 3	-15.6	10.34	-58.89
Stage 3	-15.8	2.62	-38.6
Stage 3	-16	0	-13.1

Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 3bis

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 3bis	2	0	0
Stage 3bis	1.8	0	0
Stage 3bis	1.8	0	0
Stage 3bis	1.6	0	0
Stage 3bis	1.6	0	0
Stage 3bis	1.4	0	0
Stage 3bis	1.4	0	0
Stage 3bis	1.2	0	0
Stage 3bis	1.2	0	0
Stage 3bis	1	0	0
Stage 3bis	1	0	0
Stage 3bis	0.8	0	0
Stage 3bis	0.8	0	0
Stage 3bis	0.6	-25.87	-129.33
Stage 3bis	0.4	-51.73	-129.33
Stage 3bis	0.2	-77.54	-129.07
Stage 3bis	0	-103.2	-128.29
Stage 3bis	-0.2	-128.6	-126.99
Stage 3bis	-0.4	-153.63	-125.17
Stage 3bis	-0.6	-178.2	-122.83
Stage 3bis	-0.8	-202.19	-119.97
Stage 3bis	-1	-225.51	-116.59
Stage 3bis	-1.2	-248.04	-112.69
Stage 3bis	-1.4	-269.7	-108.27
Stage 3bis	-1.6	-290.36	-103.33
Stage 3bis	-1.8	-309.99	-98.13
Stage 3bis	-2	-328.57	-92.93
Stage 3bis	-2.2	-346.12	-87.73
Stage 3bis	-2.4	-362.62	-82.53
Stage 3bis	-2.6	-378.09	-77.33
Stage 3bis	-2.8	-392.51	-72.13
Stage 3bis	-3	-405.9	-66.93
Stage 3bis	-3.2	-418.24	-61.73
Stage 3bis	-3.4	-429.55	-56.53
Stage 3bis	-3.6	-439.82	-51.33
Stage 3bis	-3.8	-449.04	-46.13
Stage 3bis	-4	-457.23	-40.93
Stage 3bis	-4.2	-464.37	-35.73
Stage 3bis	-4.4	-470.48	-30.53
Stage 3bis	-4.6	-475.54	-25.33
Stage 3bis	-4.8	-479.57	-20.13
Stage 3bis	-5	-482.55	-14.93
Stage 3bis	-5.2	-484.5	-9.73
Stage 3bis	-5.4	-485.4	-4.53
Stage 3bis	-5.6	-485.27	0.67
Stage 3bis	-5.8	-484.09	5.87
Stage 3bis	-6	-481.88	11.07
Stage 3bis	-6.2	-478.62	16.27
Stage 3bis	-6.4	-474.33	21.47
Stage 3bis	-6.6	-468.99	26.67
Stage 3bis	-6.8	-462.62	31.87
Stage 3bis	-7	-455.2	37.07
Stage 3bis	-7.2	-446.75	42.27
Stage 3bis	-7.4	-437.25	47.47
Stage 3bis	-7.6	-426.72	52.67
Stage 3bis	-7.8	-415.15	57.87
Stage 3bis	-8	-402.53	63.07
Stage 3bis	-8.2	-388.88	68.27
Stage 3bis	-8.4	-374.18	73.47
Stage 3bis	-8.6	-358.45	78.67
Stage 3bis	-8.8	-341.67	83.87
Stage 3bis	-9	-323.96	88.57
Stage 3bis	-9.2	-305.41	92.75
Stage 3bis	-9.4	-286.12	96.44
Stage 3bis	-9.6	-266.2	99.61
Stage 3bis	-9.8	-245.74	102.28
Stage 3bis	-10	-224.85	104.44

Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 3bis	-10.2	-203.64	106.09
Stage 3bis	-10.4	-182.19	107.24
Stage 3bis	-10.6	-160.61	107.89
Stage 3bis	-10.8	-139.01	108.02
Stage 3bis	-11	-117.48	107.65
Stage 3bis	-11.2	-96.12	106.77
Stage 3bis	-11.4	-75.04	105.39
Stage 3bis	-11.6	-54.34	103.5
Stage 3bis	-11.8	-34.12	101.1
Stage 3bis	-12	-14.48	98.2
Stage 3bis	-12.2	4.48	94.79
Stage 3bis	-12.4	22.65	90.88
Stage 3bis	-12.6	39.94	86.46
Stage 3bis	-12.8	56.25	81.53
Stage 3bis	-13	71.47	76.09
Stage 3bis	-13.2	85.5	70.15
Stage 3bis	-13.4	98.24	63.71
Stage 3bis	-13.6	109.59	56.75
Stage 3bis	-13.8	114.82	26.17
Stage 3bis	-14	113.72	-5.52
Stage 3bis	-14.2	107.22	-32.49
Stage 3bis	-14.4	96.26	-54.83
Stage 3bis	-14.6	82.99	-66.31
Stage 3bis	-14.8	68.04	-74.78
Stage 3bis	-15	52.27	-78.83
Stage 3bis	-15.2	36.56	-78.56
Stage 3bis	-15.4	22.12	-72.22
Stage 3bis	-15.6	10.34	-58.89
Stage 3bis	-15.8	2.62	-38.6
Stage 3bis	-16	0	-13.1

Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 4

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4	2	0	0
Stage 4	1.8	0	0
Stage 4	1.8	0	0
Stage 4	1.6	0	0
Stage 4	1.6	0	0
Stage 4	1.4	0	0
Stage 4	1.4	0	0
Stage 4	1.2	0	0
Stage 4	1.2	0	0
Stage 4	1	0	0
Stage 4	1	0	0
Stage 4	0.8	0	0
Stage 4	0.8	0	0
Stage 4	0.6	0	0
Stage 4	0.6	0	0
Stage 4	0.4	0	0
Stage 4	0.4	0	0
Stage 4	0.2	0.05	0.26
Stage 4	0	0.26	1.04
Stage 4	-0.2	0.73	2.34
Stage 4	-0.4	1.56	4.16
Stage 4	-0.6	2.86	6.5
Stage 4	-0.8	4.73	9.36
Stage 4	-1	7.28	12.74
Stage 4	-1.2	-21.81	-145.46
Stage 4	-1.4	-50.02	-141.04
Stage 4	-1.6	-77.24	-136.1
Stage 4	-1.8	-103.42	-130.9
Stage 4	-2	-128.56	-125.7

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4	-2.2	-152.66	-120.5
Stage 4	-2.4	-175.73	-115.3
Stage 4	-2.6	-197.75	-110.1
Stage 4	-2.8	-218.73	-104.9
Stage 4	-3	-238.67	-99.7
Stage 4	-3.2	-257.57	-94.5
Stage 4	-3.4	-275.43	-89.3
Stage 4	-3.6	-292.25	-84.1
Stage 4	-3.8	-308.03	-78.9
Stage 4	-4	-322.77	-73.7
Stage 4	-4.2	-336.47	-68.5
Stage 4	-4.4	-349.13	-63.3
Stage 4	-4.6	-360.75	-58.1
Stage 4	-4.8	-371.34	-52.9
Stage 4	-5	-380.88	-47.7
Stage 4	-5.2	-389.38	-42.5
Stage 4	-5.4	-396.84	-37.3
Stage 4	-5.6	-403.26	-32.1
Stage 4	-5.8	-408.64	-26.9
Stage 4	-6	-412.98	-21.7
Stage 4	-6.2	-416.28	-16.5
Stage 4	-6.4	-418.54	-11.3
Stage 4	-6.6	-419.76	-6.1
Stage 4	-6.8	-419.94	-0.9
Stage 4	-7	-419.08	4.3
Stage 4	-7.2	-417.19	9.5
Stage 4	-7.4	-414.25	14.7
Stage 4	-7.6	-410.27	19.9
Stage 4	-7.8	-405.25	25.1
Stage 4	-8	-399.19	30.3
Stage 4	-8.2	-392.09	35.5
Stage 4	-8.4	-383.95	40.7
Stage 4	-8.6	-374.77	45.9
Stage 4	-8.8	-364.55	51.1
Stage 4	-9	-353.19	56.79
Stage 4	-9.2	-340.6	62.97
Stage 4	-9.4	-326.67	69.65
Stage 4	-9.6	-311.31	76.82
Stage 4	-9.8	-294.41	84.48
Stage 4	-10	-275.93	92.38
Stage 4	-10.2	-256.07	99.32
Stage 4	-10.4	-235.1	104.86
Stage 4	-10.6	-213.28	109.08
Stage 4	-10.8	-190.88	112.03
Stage 4	-11	-168.12	113.78
Stage 4	-11.2	-145.24	114.4
Stage 4	-11.4	-122.38	114.31
Stage 4	-11.6	-99.68	113.52
Stage 4	-11.8	-77.26	112.05
Stage 4	-12	-55.28	109.91
Stage 4	-12.2	-33.86	107.11
Stage 4	-12.4	-13.13	103.67
Stage 4	-12.6	6.79	99.6
Stage 4	-12.8	25.77	94.91
Stage 4	-13	43.7	89.61
Stage 4	-13.2	60.44	83.72
Stage 4	-13.4	75.89	77.25
Stage 4	-13.6	89.95	70.3
Stage 4	-13.8	97.89	39.71
Stage 4	-14	99.3	7.02
Stage 4	-14.2	95.1	-20.96
Stage 4	-14.4	86.25	-44.29
Stage 4	-14.6	75.09	-55.76
Stage 4	-14.8	62.06	-65.15
Stage 4	-15	48.05	-70.08
Stage 4	-15.2	33.92	-70.64
Stage 4	-15.4	20.68	-66.22

Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4	-15.6	9.72	-54.78
Stage 4	-15.8	2.47	-36.25
Stage 4	-16	0	-12.36

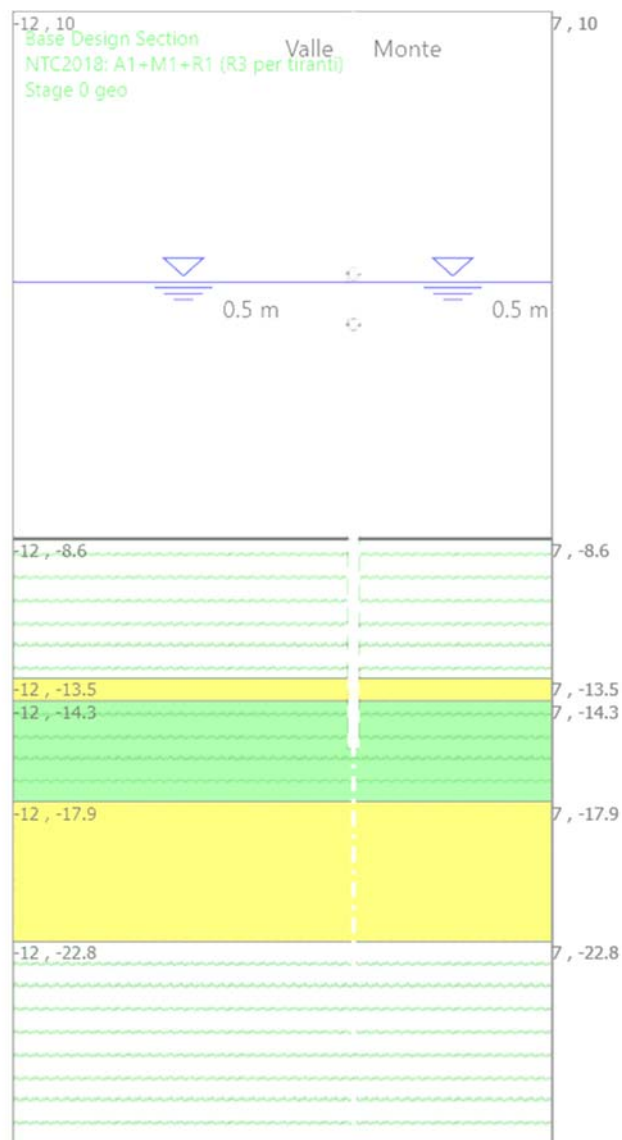
**Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 4 eccez**

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4 eccez	2	0	0
Stage 4 eccez	1.8	0	0
Stage 4 eccez	1.8	0	0
Stage 4 eccez	1.6	0	0
Stage 4 eccez	1.6	0	0
Stage 4 eccez	1.4	0	0
Stage 4 eccez	1.4	0	0
Stage 4 eccez	1.2	0.05	0.26
Stage 4 eccez	1	0.26	1.04
Stage 4 eccez	0.8	0.73	2.34
Stage 4 eccez	0.6	1.56	4.16
Stage 4 eccez	0.4	2.86	6.5
Stage 4 eccez	0.2	4.73	9.36
Stage 4 eccez	0	7.28	12.74
Stage 4 eccez	-0.2	10.61	16.64
Stage 4 eccez	-0.4	14.82	21.06
Stage 4 eccez	-0.6	20.02	26
Stage 4 eccez	-0.8	26.31	31.46
Stage 4 eccez	-1	33.8	37.44
Stage 4 eccez	-1.2	-9.87	-218.36
Stage 4 eccez	-1.4	-52.14	-211.34
Stage 4 eccez	-1.6	-92.9	-203.8
Stage 4 eccez	-1.8	-132.1	-196
Stage 4 eccez	-2	-169.74	-188.2
Stage 4 eccez	-2.2	-205.82	-180.4
Stage 4 eccez	-2.4	-240.34	-172.6
Stage 4 eccez	-2.6	-273.29	-164.8
Stage 4 eccez	-2.8	-304.69	-157
Stage 4 eccez	-3	-334.53	-149.2
Stage 4 eccez	-3.2	-362.81	-141.4
Stage 4 eccez	-3.4	-389.53	-133.6
Stage 4 eccez	-3.6	-414.69	-125.8
Stage 4 eccez	-3.8	-438.29	-118
Stage 4 eccez	-4	-460.33	-110.2
Stage 4 eccez	-4.2	-480.81	-102.4
Stage 4 eccez	-4.4	-499.73	-94.6
Stage 4 eccez	-4.6	-517.09	-86.8
Stage 4 eccez	-4.8	-532.89	-79
Stage 4 eccez	-5	-547.13	-71.2
Stage 4 eccez	-5.2	-559.8	-63.4
Stage 4 eccez	-5.4	-570.92	-55.6
Stage 4 eccez	-5.6	-580.48	-47.8
Stage 4 eccez	-5.8	-588.48	-40
Stage 4 eccez	-6	-594.92	-32.2
Stage 4 eccez	-6.2	-599.8	-24.4
Stage 4 eccez	-6.4	-603.12	-16.6
Stage 4 eccez	-6.6	-604.88	-8.8
Stage 4 eccez	-6.8	-605.08	-1
Stage 4 eccez	-7	-603.72	6.8
Stage 4 eccez	-7.2	-600.8	14.6
Stage 4 eccez	-7.4	-596.32	22.4
Stage 4 eccez	-7.6	-590.28	30.2
Stage 4 eccez	-7.8	-582.68	38
Stage 4 eccez	-8	-573.51	45.8
Stage 4 eccez	-8.2	-562.79	53.6
Stage 4 eccez	-8.4	-550.51	61.4

Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4 eccetz	-8.6	-536.67	69.2
Stage 4 eccetz	-8.8	-521.27	77
Stage 4 eccetz	-9	-504.42	84.28
Stage 4 eccetz	-9.2	-486.21	91.02
Stage 4 eccetz	-9.4	-466.76	97.25
Stage 4 eccetz	-9.6	-446.17	102.94
Stage 4 eccetz	-9.8	-424.55	108.11
Stage 4 eccetz	-10	-401.99	112.82
Stage 4 eccetz	-10.2	-378.57	117.08
Stage 4 eccetz	-10.4	-354.41	120.83
Stage 4 eccetz	-10.6	-329.59	124.07
Stage 4 eccetz	-10.8	-304.23	126.81
Stage 4 eccetz	-11	-278.42	129.04
Stage 4 eccetz	-11.2	-252.27	130.76
Stage 4 eccetz	-11.4	-225.88	131.98
Stage 4 eccetz	-11.6	-199.34	132.69
Stage 4 eccetz	-11.8	-172.76	132.89
Stage 4 eccetz	-12	-146.24	132.59
Stage 4 eccetz	-12.2	-119.89	131.78
Stage 4 eccetz	-12.4	-93.79	130.46
Stage 4 eccetz	-12.6	-68.07	128.64
Stage 4 eccetz	-12.8	-42.8	126.31
Stage 4 eccetz	-13	-18.11	123.48
Stage 4 eccetz	-13.2	5.92	120.14
Stage 4 eccetz	-13.4	29.18	116.29
Stage 4 eccetz	-13.6	51.57	111.94
Stage 4 eccetz	-13.8	67.96	81.99
Stage 4 eccetz	-14	77.74	48.87
Stage 4 eccetz	-14.2	80.25	12.58
Stage 4 eccetz	-14.4	74.87	-26.94
Stage 4 eccetz	-14.6	67.7	-35.82
Stage 4 eccetz	-14.8	58.66	-45.2
Stage 4 eccetz	-15	47.66	-55
Stage 4 eccetz	-15.2	35.43	-61.15
Stage 4 eccetz	-15.4	22.78	-63.28
Stage 4 eccetz	-15.6	11.11	-58.32
Stage 4 eccetz	-15.8	2.88	-41.16
Stage 4 eccetz	-16	0	-14.4

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 0 geo

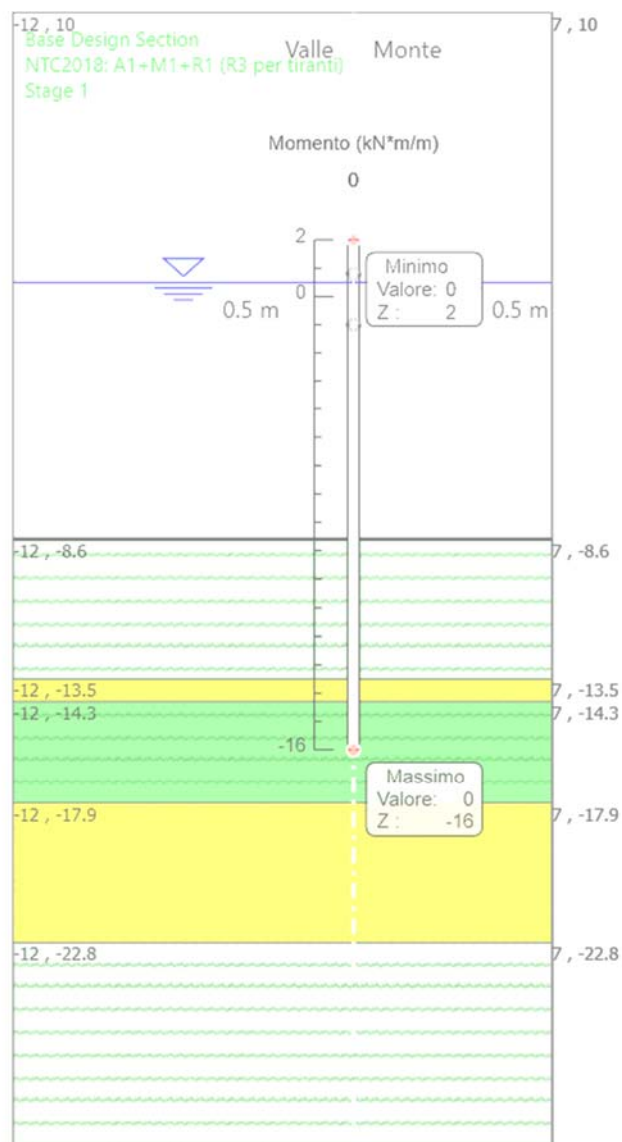


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 0 geo

Momento

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 1



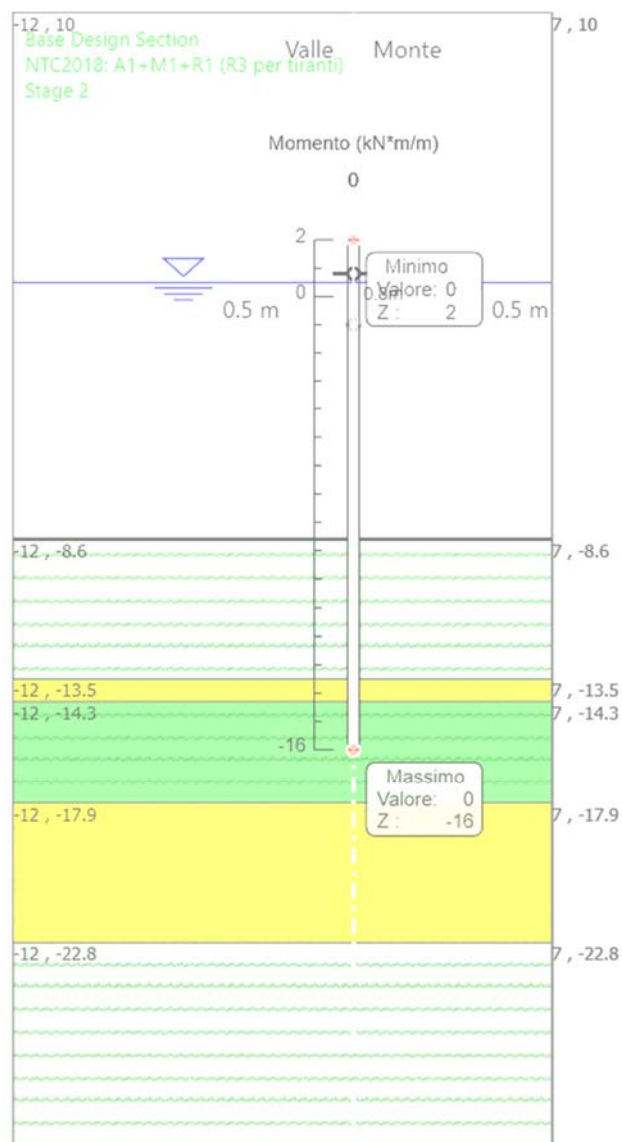
Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 1

Momento



## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 2

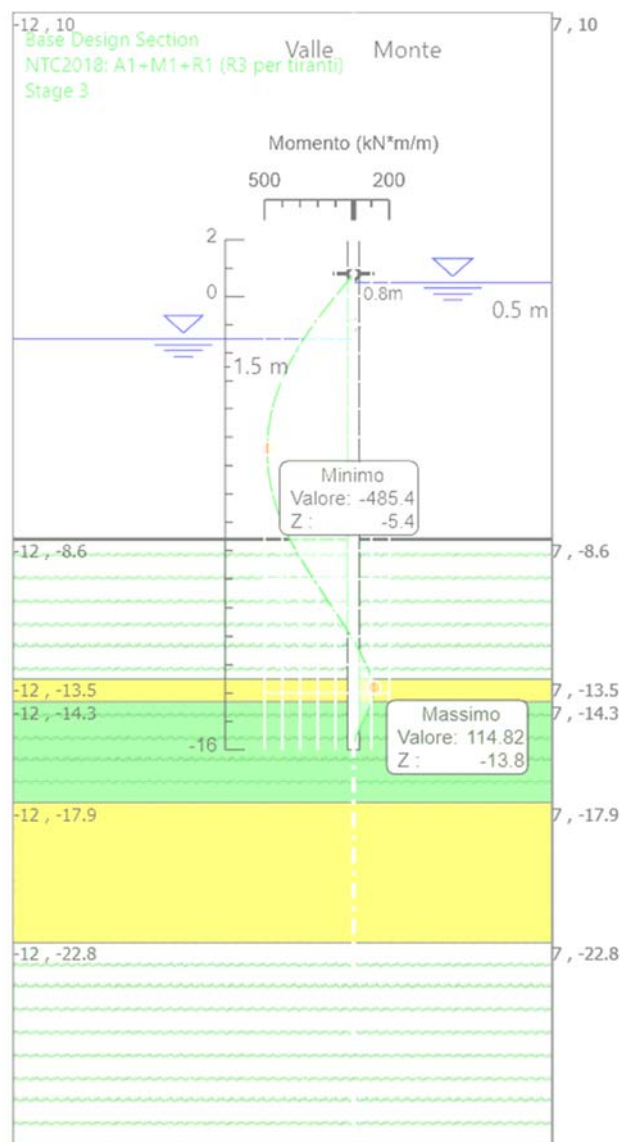


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 2

Momento

### Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 3

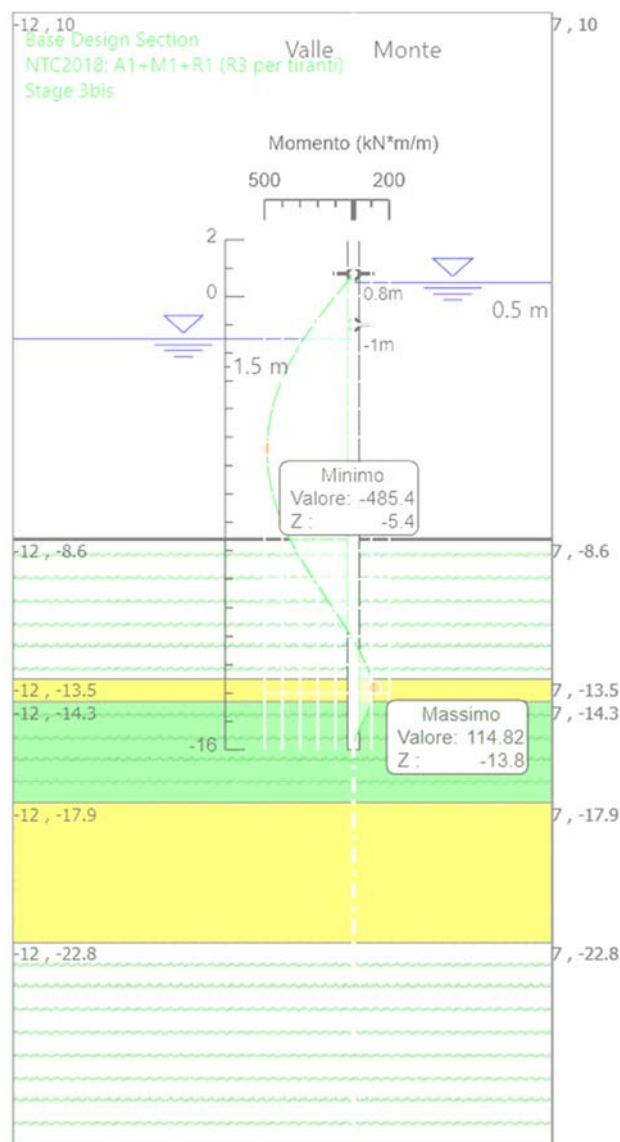


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 3

Momento

### Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 3bis

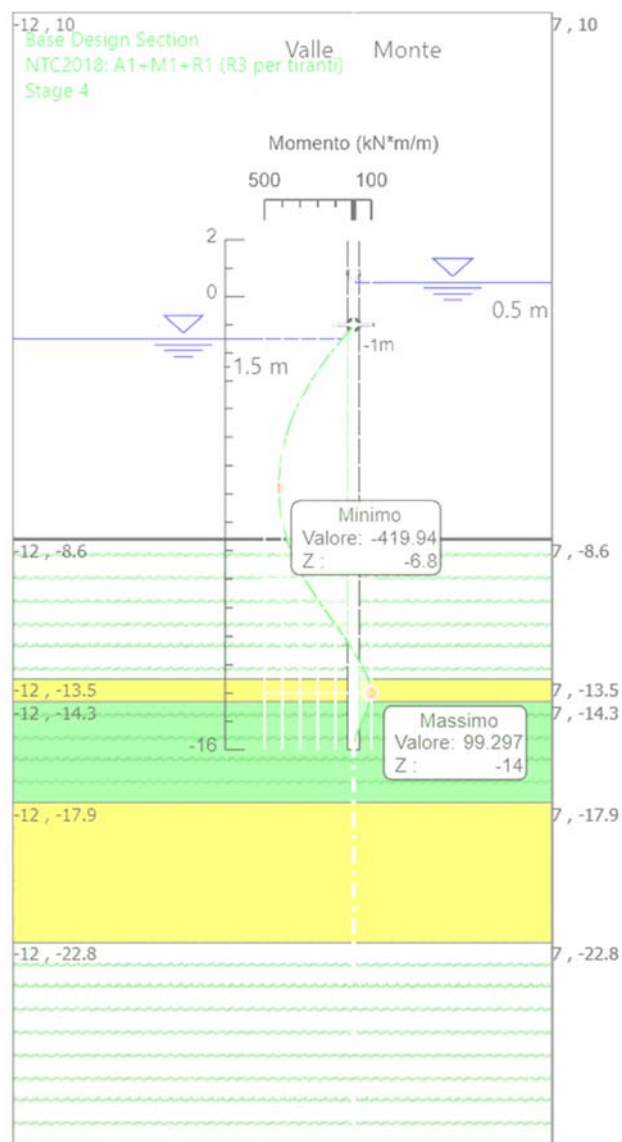


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 3bis

Momento

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 4

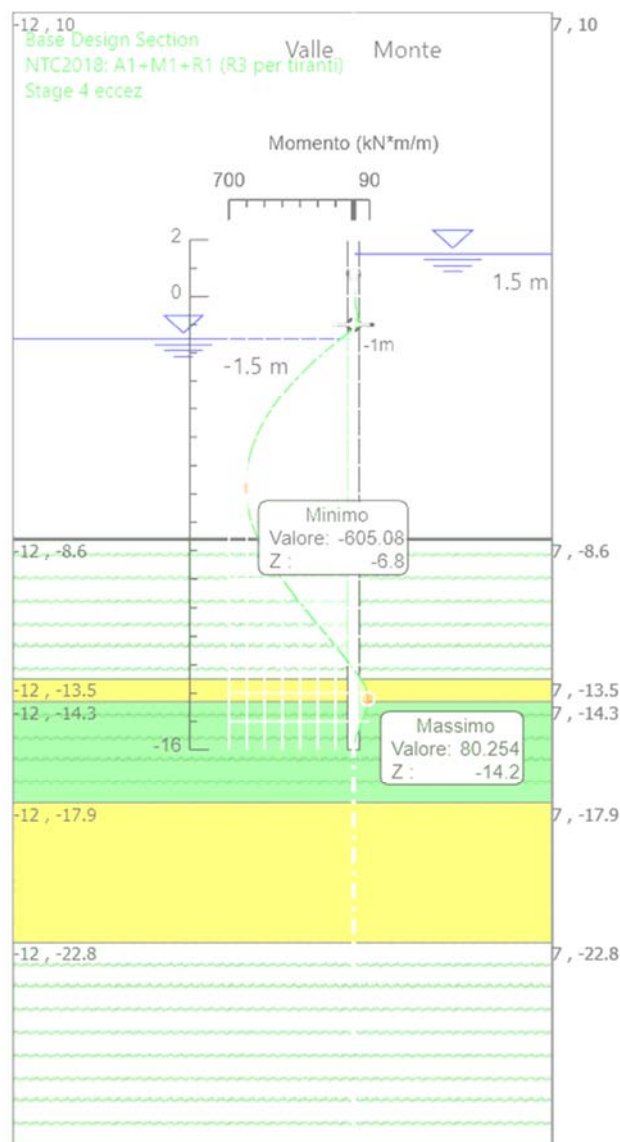


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 4

Momento

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 4 eccez

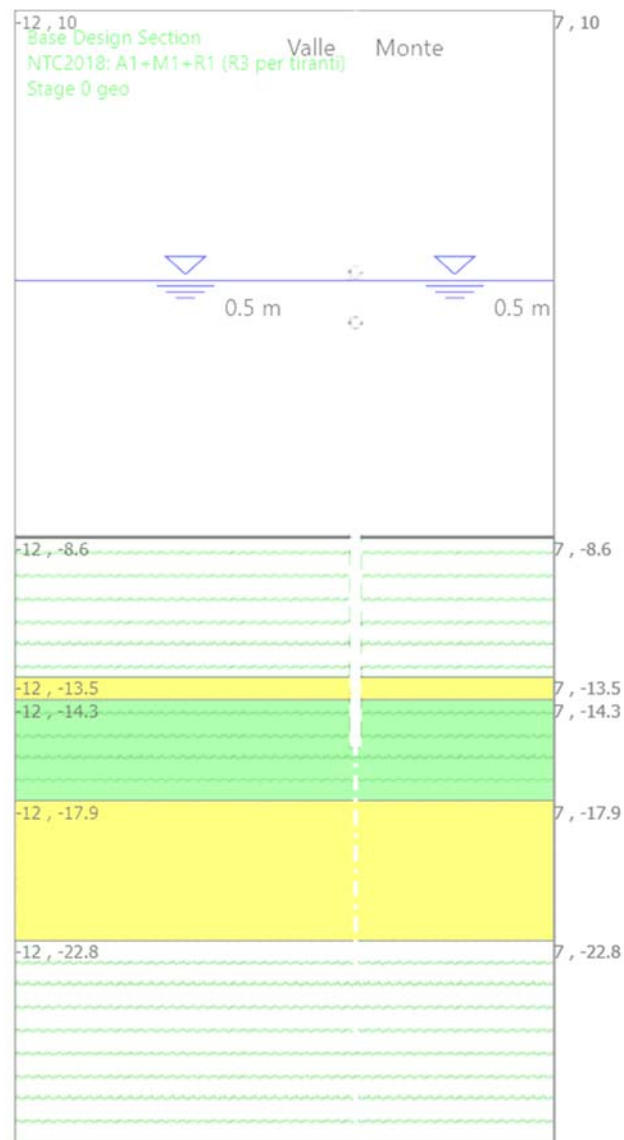


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 4 eccez

Momento

## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 0 geo

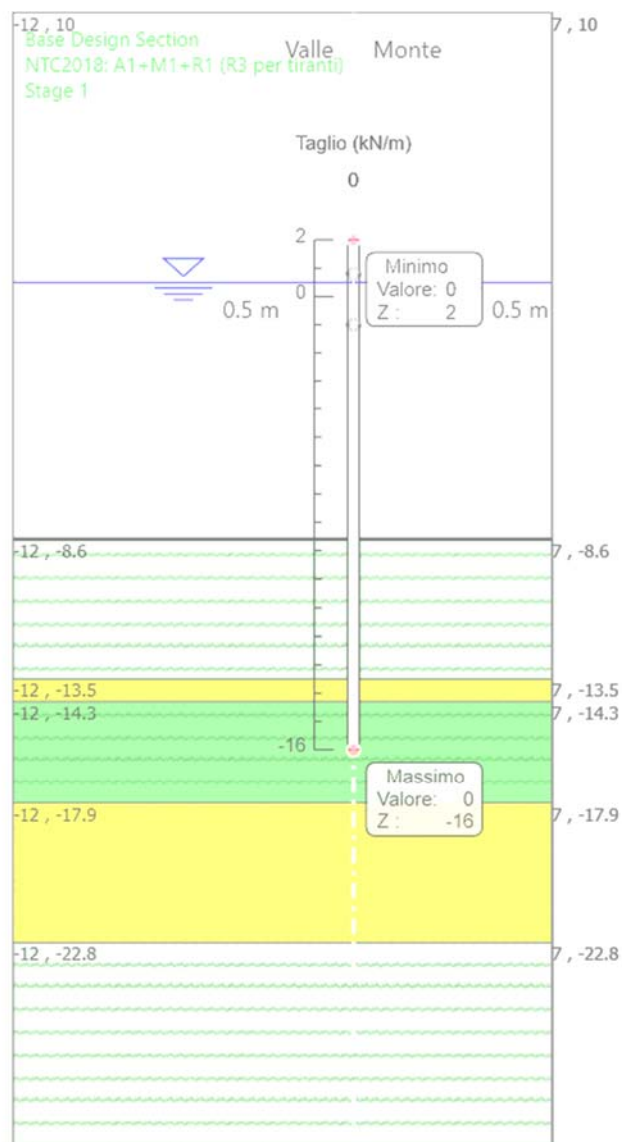


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 0 geo

Taglio

## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 1

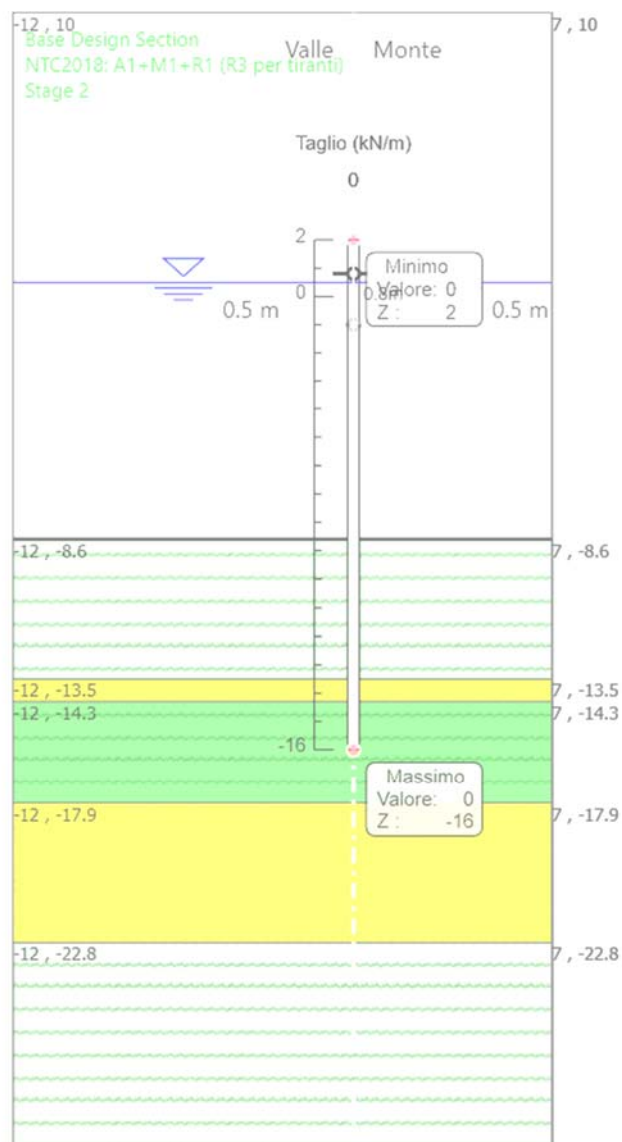


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 1

Taglio

## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 2



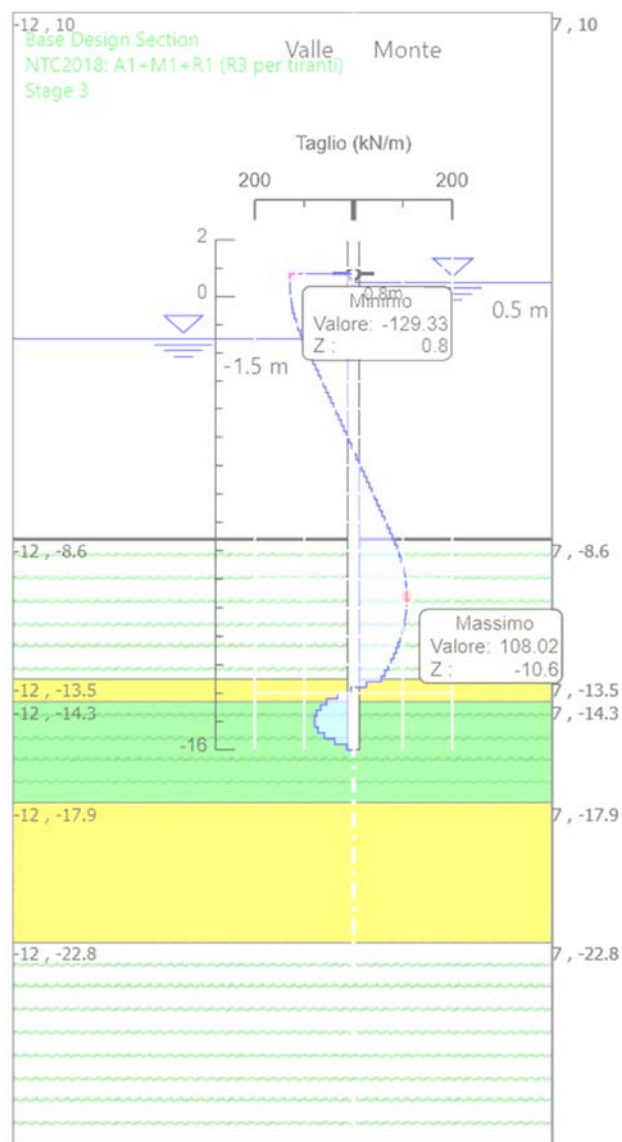
Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 2

Taglio



### Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 3

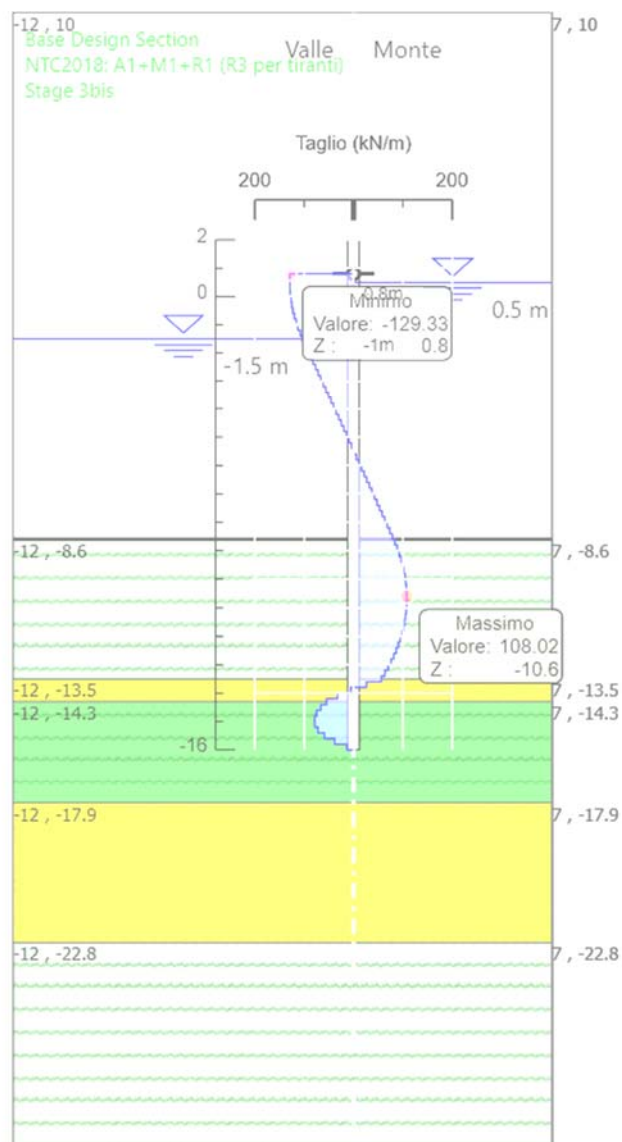


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 3

Taglio

## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 3bis

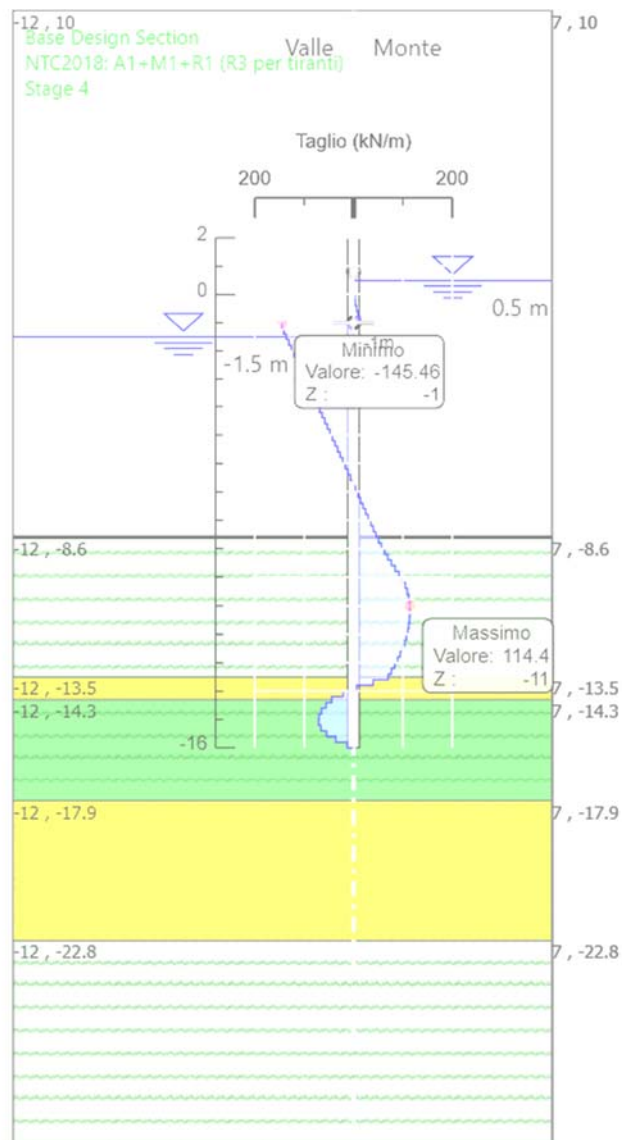


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 3bis

Taglio

## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 4

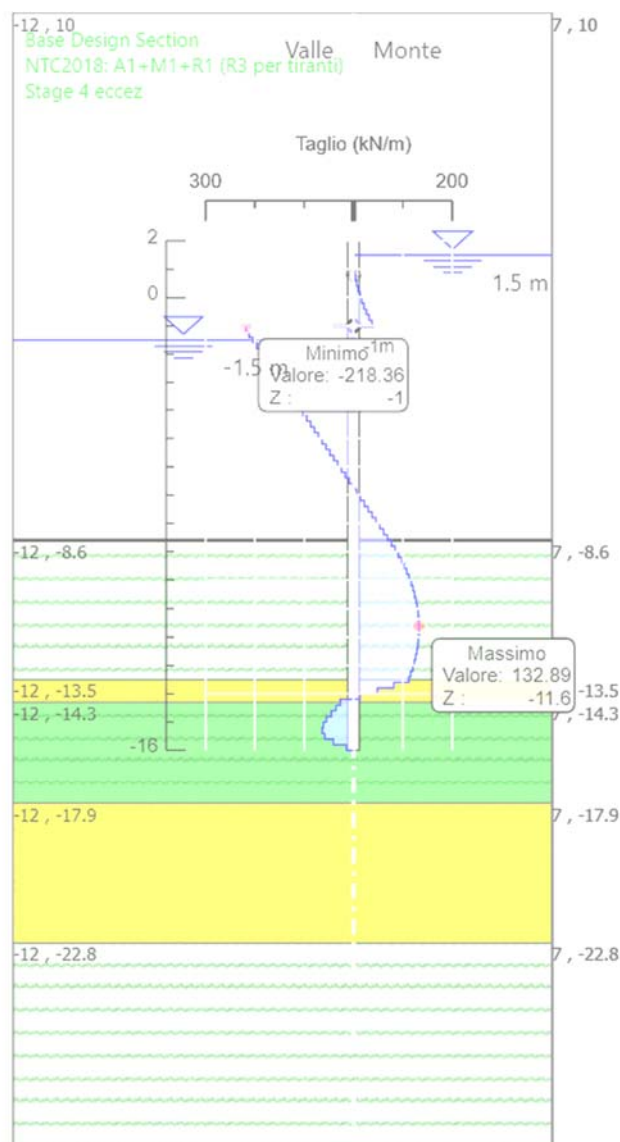


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 4

Taglio

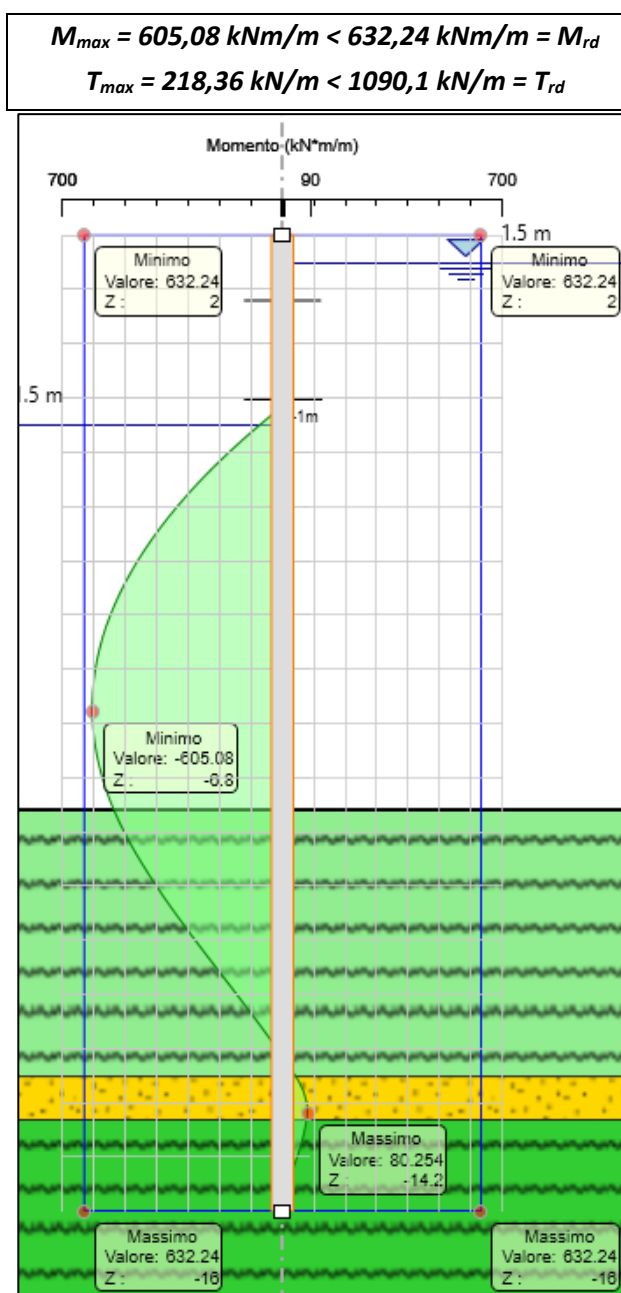
### Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 4 eccez



Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)  
Stage: Stage 4 eccez  
Taglio

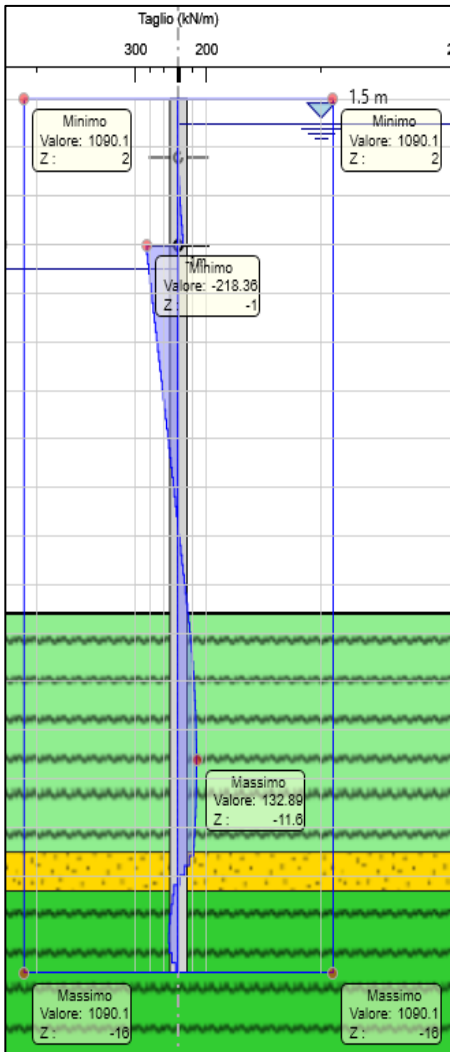
## 5.5 VERIFICHE DI RESISTENZA STRUTTURALE DELLE PALANCOLE

Le verifiche strutturali delle palancole sono effettuate nella combinazione A1+M1 delle NTC2018: nel presente paragrafo si riportano i diagrammi con l'andamento del momento di progetto agente sulle palancole e del momento resistente delle opere, e del taglio agente e del loro taglio resistente, nella fase in cui tali sollecitazioni risultano massime, ossia la 'fase 4 eccez': acqua alta eccezionale fino alla quota 1,50 m s.l.m. al di fuori del palancolato'. Dai grafici seguenti si può verificare come **il massimo momento agente sulle palancole sia inferiore al loro momento resistente, e come altrettanto valga per il massimo taglio agente rispetto al taglio resistente delle opere.**



**Confronto massimo momento agente sulle palancole e loro momento resistente**

**(comb. STR, A1+M1)**



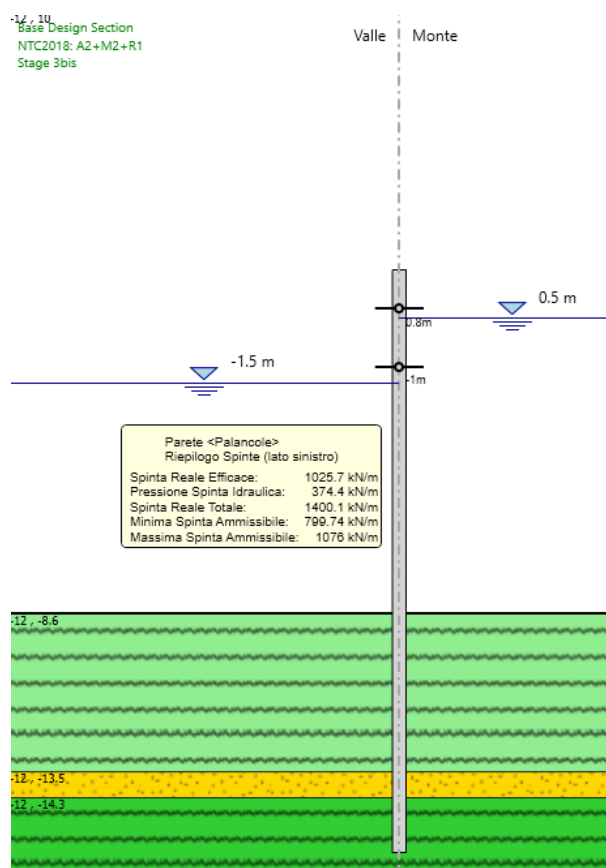
**Confronto massimo taglio agente sulle palancole e loro taglio resistente  
(comb. STR, A1+M1)**

**Risultati Elementi strutturali - NTC2018: A1+M1+R1 (R3 per tiranti)**

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Sollecitazione Puntello sup.	
Stage	Forza (kN/m)
Stage 2	0
Stage 3	-129.326184
Stage 3bis	-129.326184
Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Sollecitazione Puntello inf.	
Stage	Forza (kN/m)
Stage 3bis	0
Stage 4	-162.09947
Stage 4 eccez	-262.3179

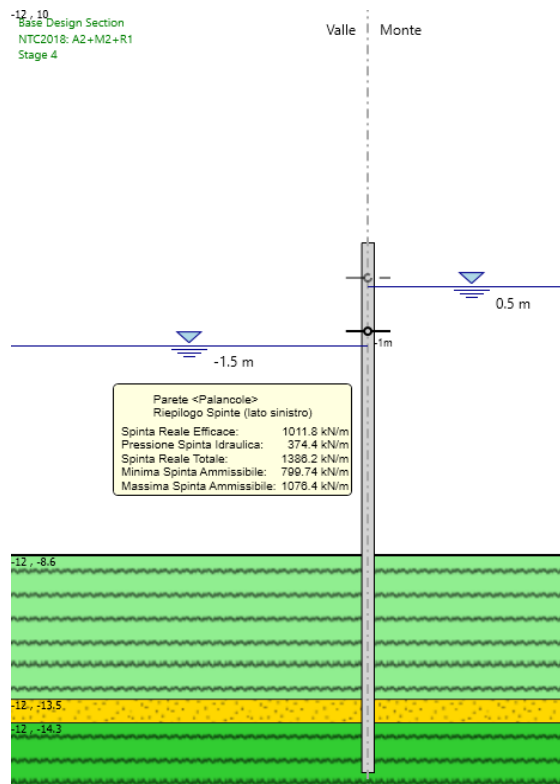
## 5.6 VERIFICHE DI RESISTENZA DEL TERRENO A VALLE DELLE PALANCOLE (GEO)

La verifica agli stati limite per il dimensionamento geotecnico delle palancole (GEO) è stata condotta considerando lo sviluppo di meccanismi di collasso determinati dalla mobilitazione della resistenza del terreno e dal raggiungimento delle condizioni di equilibrio limite nel terreno interagente con le palancole nella combinazione A2+M2+R1, secondo quanto indicato al par. C.6.5.3.1.2 della Circolare n° 7 del 21 gennaio 2019. A valle delle palancole la risultante efficace delle spinte va confrontata con la resistenza passiva offerta dalla parte infissa: il loro rapporto  $E_d / R_d$  è comunque inferiore all'unità in tutte le fasi, tale verifica risulta soddisfatta. Si riporta di seguito, in corrispondenza delle tre fasi più gravose, la *fase 3bis*, la *fase 4* e la *fase 4 eccez.*, il riepilogo delle spinte risultante nelle tre fasi:



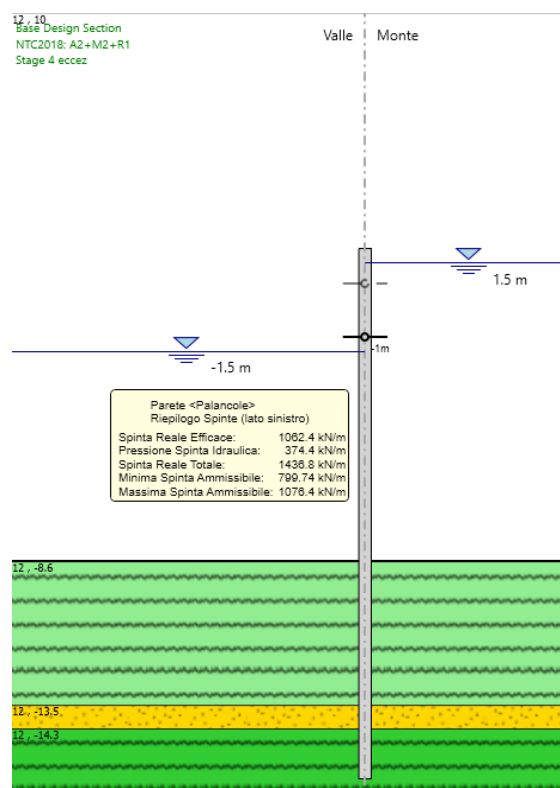
**Riepilogo delle spinte nella 'fase 3 bis' (A2+M2+R1)**

$$E_d / R_d = 1025.7 \text{ kN/m} / 1076 \text{ kN/m} \approx \mathbf{0.95}$$



**Riepilogo delle spinte nella 'fase 4' (A2+M2+R1)**

$$E_d / R_d = 1011.8 \text{ kN/m} / 1076.4 \text{ kN/m} \approx 0.94$$



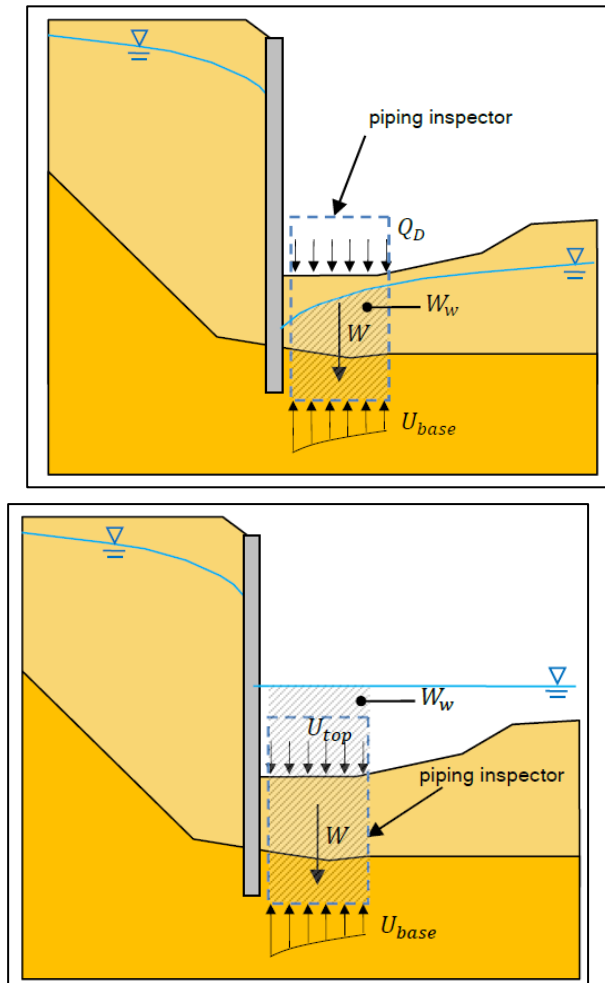
**Riepilogo delle spinte nella 'fase 4 eccez.' (A2+M2+R1)**

$$E_d / R_d = 1062.4 \text{ kN/m} / 1076.4 \text{ kN/m} \approx 0.99$$



## 5.7 VERIFICHE IDRAULICHE

### Procedura di calcolo del software Paratie Plus 22



**Schematizzazione del calcolo di filtrazione del software Paratie Plus 22**

#### 5.7.1 Verifica a sollevamento

Il software Paratie Plus calcola il rapporto tra i carichi verticali e le sottospinte idrauliche al fine di valutare la **sicurezza a sollevamento** nel seguente modo:

$$F_{S\ UPLIFT} = \frac{W + Q_d}{U_{base} - U_{top}}$$

Per la normativa italiana, assumendo un coefficiente parziale  $\gamma_{G1}$  pari a 1,10 per le azioni destabilizzanti e pari a 0,90 per quelle stabilizzanti, la verifica idraulica a sollevamento condotta con il software Paratie Plus risulta pertanto soddisfatta se

$$F_{S\ UPLIFT} > \frac{1,10}{0,90} = 1,22$$

### 5.7.2 Verifica a sifonamento

Il software determina un coefficiente di sicurezza nei confronti del sifonamento in termini efficaci, dato da

$$F_{S\text{Terzaghi}} = \frac{i_c}{i_e}$$

in cui  $i_e$ , gradiente medio di efflusso, vale  $\delta h / H$ , e  $i_c$ , gradiente critico, è pari a  $\gamma' / \gamma_w$

Secondo quanto prescritto dalle NTC 2018, la verifica a sifonamento risulta soddisfatta se  $i \leq i_c / 3$ , nei casi in cui il gradiente idraulico risulti quello medio.

Affinché tale verifica sia soddisfatta secondo le NTC 2018, il coefficiente  $F_{S\text{Terzaghi}}$  risultante dall'analisi con il software Paratie Plus deve pertanto risultare

$$F_{S\text{Terzaghi}} = \frac{i_c}{i_e} \geq 3$$

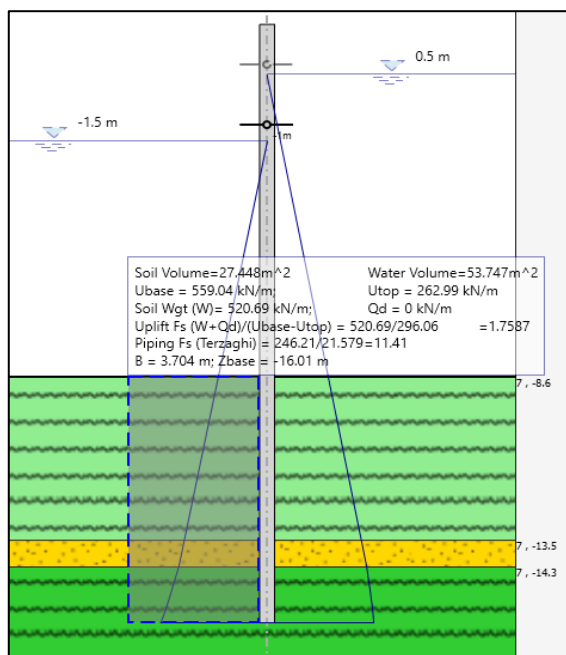
### 5.7.3 Risultati dell'analisi di filtrazione

Si riportano di seguito i risultati dell'analisi di filtrazione, condotta nei due casi seguenti:

CASO 1) acqua a monte delle palancole a quota +0,50 m s.l.m. ed acqua a valle delle palancole a quota -1,50 m s.l.m;

CASO 2) acqua a monte delle palancole a quota +1,50 m s.l.m. ed acqua a valle delle palancole a quota -1,50 m s.l.m.

#### **CASO 1**



Come si evince dalla figura sovrastante, le verifiche idrauliche risultano soddisfatte, infatti:

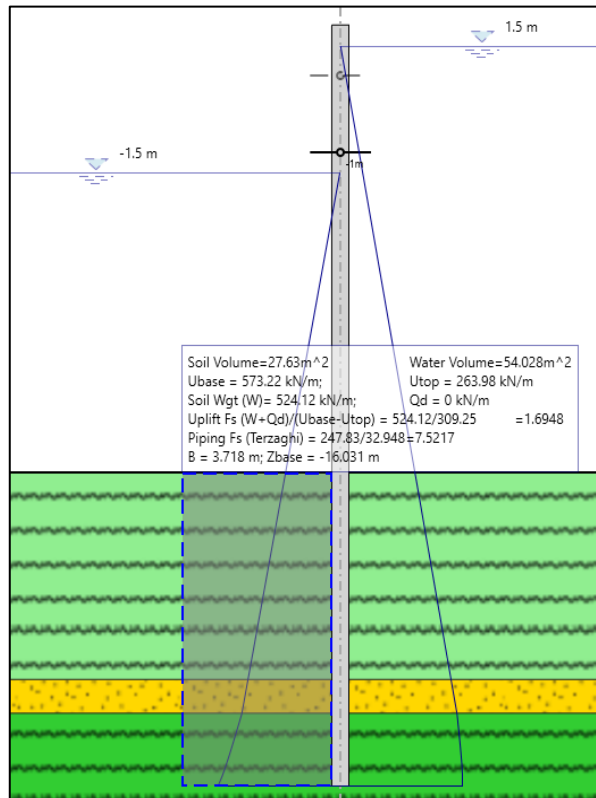
**Verifica a sollevamento**

$$F_{S\ UPLIFT} = 1,7587 > 1,22$$

**Verifica a sifonamento**

$$F_{S\ Terzaghi} = \frac{i_c}{i_e} = 11,41 \geq 3$$

## CASO 2



Come si evince dalla figura sovrastante, le verifiche idrauliche risultano soddisfatte, infatti:

**Verifica a sollevamento**

$$F_{S\ UPLIFT} = 1,6948 > 1,22$$

**Verifica a sifonamento**

$$F_{S\ Terzaghi} = \frac{i_c}{i_e} = 7,5217 \geq 3$$

-

## 6 SEZIONE CV3

### **Descrizione della Stratigrafia e degli Strati di Terreno**

Tipo : HORIZONTAL

Quota : -8.6 m

OCR : 1

Tipo : HORIZONTAL

Quota : -9.4 m

OCR : 1

Tipo : HORIZONTAL

Quota : -13 m

OCR : 1

Tipo : HORIZONTAL

Quota : -16.5 m

OCR : 1

Tipo : HORIZONTAL

Quota : -22.7 m

OCR : 1

Tipo : HORIZONTAL

Quota : -26.5 m

OCR : 1

Strato di Terreno	Terreno	$\gamma$ dry	$\gamma$ sat	$\phi'$	$\phi_{cv}$	$\phi_p$	$c'$	Su	Modulo Elastico	Eu	Evc	Eur
		kN/m <sup>3</sup>	kN/m <sup>3</sup>	°	°	°	kPa	kPa			kPa	kPa
1	4 - Argilla limosa con livelli organici	17.8	18.6	20	16		39		Constant		3800	6080
2	5 - Sabbia limosa e limo sabbioso	18.6	21.6	34			0		Constant		15000	24000
3	6 - Argilla limosa con intercalaz. di limo argilloso e livelli organici	18	18.8	22	18		60		Constant		4600	7360
4	7 - Sabbia limosa e limo sabbioso	18.6	21.6	31			0		Constant		11400	18240
5	8 - Argilla limosa con limo argilloso e livelli organici	17.8	18.6	22	18		55		Constant		4500	7200
6	9 - Sabbia con limo e argilla	18.6	21.6	31			0		Constant		22000	35200

### **Descrizione Pareti**

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Muro di destra

Sezione : Palancole AZ19

Area equivalente : 0.0146 m

Inerzia equivalente : 0.0004 m<sup>4</sup>/m

Profilo palancole : AZ 19-700

## 6.1 Fasi di Calcolo

### Stage 0 geo: stato attuale



#### Scavo

##### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

##### Linea di scavo di sinistra (Orizzontale)

-8.6 m

##### Linea di scavo di destra (Orizzontale)

-8.6 m

#### Falda acquifera

Falda di sinistra : 0.5 m

Falda di destra : 0.5 m

## Stage 1: infissione palancole



### Scavo

#### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

#### Linea di scavo di sinistra (Orizzontale)

-8.6 m

#### Linea di scavo di destra (Orizzontale)

-8.6 m

### Falda acquifera

Falda di sinistra : 0.5 m

Falda di destra : 0.5 m

### Elementi strutturali

#### Paratia : Palancole

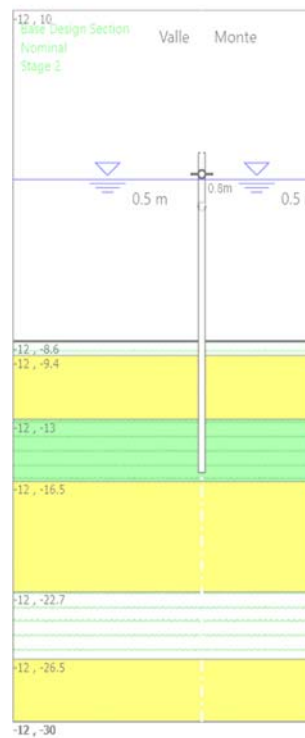
X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Sezione : Palancole AZ19

## Stage 2: puntellazione in sommità del palancoato



### Scavo

#### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

#### Linea di scavo di sinistra (Orizzontale)

-8.6 m

#### Linea di scavo di destra (Orizzontale)

-8.6 m

### Falda acquifera

Falda di sinistra : 0.5 m

Falda di destra : 0.5 m

### Elementi strutturali

#### Paratia : Palancole

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Sezione : Palancole AZ19

#### Vincolo fisso : Puntello sup.

X : 0 m

Z : 0.8 m

Angolo : 0 °

### Stage 3: abbassamento acqua fino a -1,50 m s.l.m.



#### Scavo

##### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

Linea di scavo di sinistra (Orizzontale)

-8.6 m

Linea di scavo di destra (Orizzontale)

-8.6 m

#### Falda acquifera

Falda di sinistra : -1.5 m

Falda di destra : 0.5 m

#### Elementi strutturali

Paratia : Palancole

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Sezione : Palancole AZ19

Vincolo fisso : Puntello sup.

X : 0 m

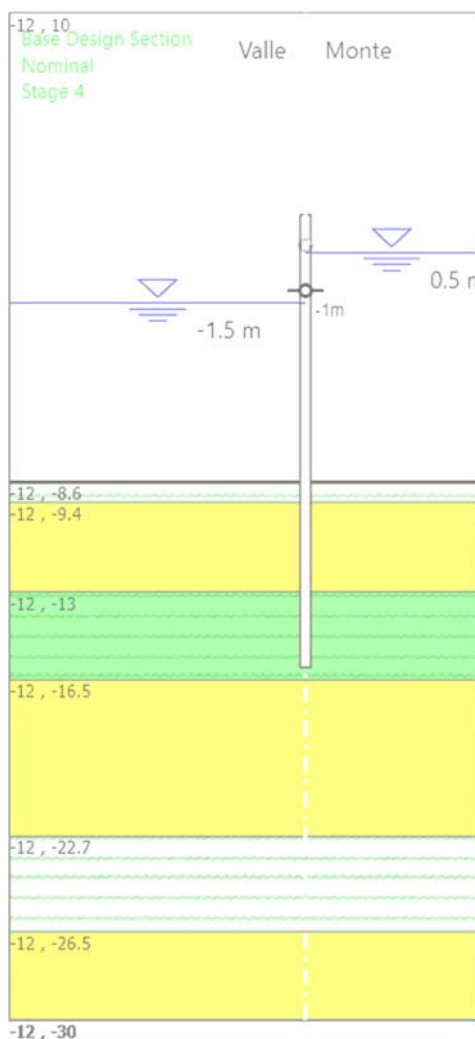
Z : 0.8 m

Angolo : 0 °





## Stage 4: rimozione del puntello superiore



### Scavo

#### Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

#### Linea di scavo di sinistra (Orizzontale)

-8.6 m

#### Linea di scavo di destra (Orizzontale)

-8.6 m

### Falda acquifera

Falda di sinistra : -1.5 m

Falda di destra : 0.5 m

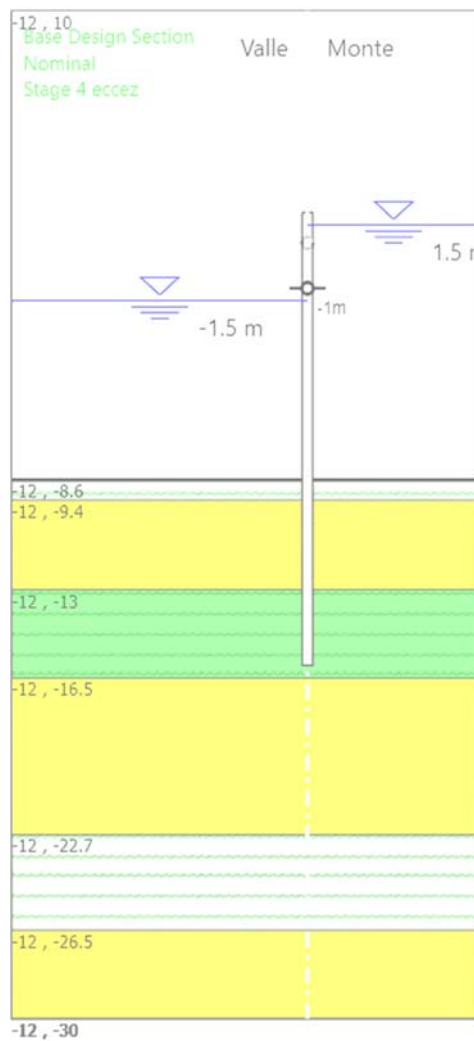
### Elementi strutturali

Paratia : Palancole

X : 0 m

Quota in alto : 2 m  
Quota di fondo : -16 m  
Sezione : Palancole AZ19  
Vincolo fisso : Puntello inf.  
X : 0 m  
Z : -1 m  
Angolo : 0 °

### Stage 4 eccez: acqua alta a quota -1,50 m fuori dal palancoleato



Scavo

Muro di destra

Lato monte : -8.6 m

Lato valle : -8.6 m

Linea di scavo di sinistra (Orizzontale)

-8.6 m

Linea di scavo di destra (Orizzontale)

-8.6 m

Falda acquifera

Falda di sinistra : -1.5 m

Falda di destra : 1.5 m

Elementi strutturali

Paratia : Palancole

X : 0 m

Quota in alto : 2 m

Quota di fondo : -16 m

Sezione : Palancole AZ19

Vincolo fisso : Puntello inf.

X : 0 m

Z : -1 m

Angolo : 0 °

## 6.2 Descrizione Coefficienti Design Assumption

Coefficienti A

Nome	Carichi Perma- nenti Sfavorevoli (F_dead_load_un- favour)	Carichi Perma- nenti Favorevoli (F_dead_load_fa- vour)	Carichi Variabili Sfavorevoli (F_live_load_un- favour)	Carichi Variabili Favorevoli (F_live_load_fa- vour)	Carico Sismico (F_seism_load)	Pres- sioni Acqua Lato Monte (F_Wa- terDR)	Pres- sioni Acqua Lato Valle (F_Wa- terRes)	Carichi Perma- nenti Destabiliz- zanti (F_UPL_GDStab)	Carichi Perma- nenti Stabiliz- zanti (F_UPL_GStab)	Carichi Va- riabili Destabiliz- zanti (F_UPL_QDStab)
Simbolo	$\gamma_G$	$\gamma_G$	$\gamma_Q$	$\gamma_Q$	$\gamma_{QE}$	$\gamma_G$	$\gamma_G$	$\gamma_{Gdst}$	$\gamma_{Gstb}$	$\gamma_{Qdst}$
Nominal	1	1	1	1	1	1	1	1	1	1
NTC2018: SLE (Rara/Frequente/Quasi Permanente)	1	1	1	1	0	1	1	1	1	1
NTC2018: A1+M1+R1 (R3 per tiranti)	1.3	1	1.5	1	0	1.3	1	1	1	1
NTC2018: A2+M2+R1	1	1	1.3	1	0	1	1	1	1	1

Coefficienti M

Nome	Parziale su tan( $\phi'$ ) (F_Fr)	Parziale su c' (F_eff_cohe)	Parziale su Su (F_Su)	Parziale su qu (F_qu)	Parziale su peso specifico (F_gamma)
Simbolo	$\gamma_\phi$	$\gamma_c$	$\gamma_{cu}$	$\gamma_{qu}$	$\gamma_\gamma$
Nominal	1	1	1	1	1
NTC2018: SLE (Rara/Frequente/Quasi Permanente)	1	1	1	1	1
NTC2018: A1+M1+R1 (R3 per tiranti)	1	1	1	1	1
NTC2018: A2+M2+R1	1.25	1.25	1.4	1	1

## Coefficienti R

Nome	Parziale resistenza terreno (es. Kp) (F_Soil_Res_walls)	Parziale resistenza Tiranti permanenti (F_Anch_P)	Parziale resistenza Tiranti temporanei (F_Anch_T)	Parziale elementi strutturali (F_wall)
Simbolo	$\gamma_{Re}$	$\gamma_{Ap}$	$\gamma_{At}$	
Nominal	1	1	1	1
NTC2018: SLE (Rara/Frequente/Quasi Permanente)	1	1	1	1
NTC2018: A1+M1+R1 (R3 per tiranti)	1	1.2	1.1	1
NTC2018: A2+M2+R1	1	1.2	1.1	1

## 6.3 Risultati NTC2018: SLE (Rara/Frequente/Quasi Permanente)

### Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 0 geo

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 0 geo	2	0	
Stage 0 geo	1.8	0	
Stage 0 geo	1.6	0	
Stage 0 geo	1.4	0	
Stage 0 geo	1.2	0	
Stage 0 geo	1	0	
Stage 0 geo	0.8	0	
Stage 0 geo	0.6	0	
Stage 0 geo	0.4	0	
Stage 0 geo	0.2	0	
Stage 0 geo	0	0	
Stage 0 geo	-0.2	0	
Stage 0 geo	-0.4	0	
Stage 0 geo	-0.6	0	
Stage 0 geo	-0.8	0	
Stage 0 geo	-1	0	
Stage 0 geo	-1.2	0	
Stage 0 geo	-1.4	0	
Stage 0 geo	-1.6	0	
Stage 0 geo	-1.8	0	
Stage 0 geo	-2	0	
Stage 0 geo	-2.2	0	
Stage 0 geo	-2.4	0	
Stage 0 geo	-2.6	0	
Stage 0 geo	-2.8	0	
Stage 0 geo	-3	0	
Stage 0 geo	-3.2	0	
Stage 0 geo	-3.4	0	
Stage 0 geo	-3.6	0	
Stage 0 geo	-3.8	0	
Stage 0 geo	-4	0	
Stage 0 geo	-4.2	0	
Stage 0 geo	-4.4	0	
Stage 0 geo	-4.6	0	
Stage 0 geo	-4.8	0	
Stage 0 geo	-5	0	
Stage 0 geo	-5.2	0	
Stage 0 geo	-5.4	0	
Stage 0 geo	-5.6	0	
Stage 0 geo	-5.8	0	
Stage 0 geo	-6	0	
Stage 0 geo	-6.2	0	
Stage 0 geo	-6.4	0	
Stage 0 geo	-6.6	0	
Stage 0 geo	-6.8	0	
Stage 0 geo	-7	0	

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 0 geo	-7.2	0	
Stage 0 geo	-7.4	0	
Stage 0 geo	-7.6	0	
Stage 0 geo	-7.8	0	
Stage 0 geo	-8	0	
Stage 0 geo	-8.2	0	
Stage 0 geo	-8.4	0	
Stage 0 geo	-8.6	0	
Stage 0 geo	-8.8	0	
Stage 0 geo	-9	0	
Stage 0 geo	-9.2	0	
Stage 0 geo	-9.4	0	
Stage 0 geo	-9.6	0	
Stage 0 geo	-9.8	0	
Stage 0 geo	-10	0	
Stage 0 geo	-10.2	0	
Stage 0 geo	-10.4	0	
Stage 0 geo	-10.6	0	
Stage 0 geo	-10.8	0	
Stage 0 geo	-11	0	
Stage 0 geo	-11.2	0	
Stage 0 geo	-11.4	0	
Stage 0 geo	-11.6	0	
Stage 0 geo	-11.8	0	
Stage 0 geo	-12	0	
Stage 0 geo	-12.2	0	
Stage 0 geo	-12.4	0	
Stage 0 geo	-12.6	0	
Stage 0 geo	-12.8	0	
Stage 0 geo	-13	0	
Stage 0 geo	-13.2	0	
Stage 0 geo	-13.4	0	
Stage 0 geo	-13.6	0	
Stage 0 geo	-13.8	0	
Stage 0 geo	-14	0	
Stage 0 geo	-14.2	0	
Stage 0 geo	-14.4	0	
Stage 0 geo	-14.6	0	
Stage 0 geo	-14.8	0	
Stage 0 geo	-15	0	
Stage 0 geo	-15.2	0	
Stage 0 geo	-15.4	0	
Stage 0 geo	-15.6	0	
Stage 0 geo	-15.8	0	
Stage 0 geo	-16	0	

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 1**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 1	2	0	
Stage 1	1.8	0	
Stage 1	1.6	0	
Stage 1	1.4	0	
Stage 1	1.2	0	
Stage 1	1	0	
Stage 1	0.8	0	
Stage 1	0.6	0	
Stage 1	0.4	0	
Stage 1	0.2	0	
Stage 1	0	0	
Stage 1	-0.2	0	
Stage 1	-0.4	0	
Stage 1	-0.6	0	

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 1	-0.8	0
Stage 1	-1	0
Stage 1	-1.2	0
Stage 1	-1.4	0
Stage 1	-1.6	0
Stage 1	-1.8	0
Stage 1	-2	0
Stage 1	-2.2	0
Stage 1	-2.4	0
Stage 1	-2.6	0
Stage 1	-2.8	0
Stage 1	-3	0
Stage 1	-3.2	0
Stage 1	-3.4	0
Stage 1	-3.6	0
Stage 1	-3.8	0
Stage 1	-4	0
Stage 1	-4.2	0
Stage 1	-4.4	0
Stage 1	-4.6	0
Stage 1	-4.8	0
Stage 1	-5	0
Stage 1	-5.2	0
Stage 1	-5.4	0
Stage 1	-5.6	0
Stage 1	-5.8	0
Stage 1	-6	0
Stage 1	-6.2	0
Stage 1	-6.4	0
Stage 1	-6.6	0
Stage 1	-6.8	0
Stage 1	-7	0
Stage 1	-7.2	0
Stage 1	-7.4	0
Stage 1	-7.6	0
Stage 1	-7.8	0
Stage 1	-8	0
Stage 1	-8.2	0
Stage 1	-8.4	0
Stage 1	-8.6	0
Stage 1	-8.8	0
Stage 1	-9	0
Stage 1	-9.2	0
Stage 1	-9.4	0
Stage 1	-9.6	0
Stage 1	-9.8	0
Stage 1	-10	0
Stage 1	-10.2	0
Stage 1	-10.4	0
Stage 1	-10.6	0
Stage 1	-10.8	0
Stage 1	-11	0
Stage 1	-11.2	0
Stage 1	-11.4	0
Stage 1	-11.6	0
Stage 1	-11.8	0
Stage 1	-12	0
Stage 1	-12.2	0
Stage 1	-12.4	0
Stage 1	-12.6	0
Stage 1	-12.8	0
Stage 1	-13	0
Stage 1	-13.2	0
Stage 1	-13.4	0
Stage 1	-13.6	0
Stage 1	-13.8	0
Stage 1	-14	0

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 1	-14.2	0
Stage 1	-14.4	0
Stage 1	-14.6	0
Stage 1	-14.8	0
Stage 1	-15	0
Stage 1	-15.2	0
Stage 1	-15.4	0
Stage 1	-15.6	0
Stage 1	-15.8	0
Stage 1	-16	0

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 2**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 2	2	0
Stage 2	1.8	0
Stage 2	1.6	0
Stage 2	1.4	0
Stage 2	1.2	0
Stage 2	1	0
Stage 2	0.8	0
Stage 2	0.6	0
Stage 2	0.4	0
Stage 2	0.2	0
Stage 2	0	0
Stage 2	-0.2	0
Stage 2	-0.4	0
Stage 2	-0.6	0
Stage 2	-0.8	0
Stage 2	-1	0
Stage 2	-1.2	0
Stage 2	-1.4	0
Stage 2	-1.6	0
Stage 2	-1.8	0
Stage 2	-2	0
Stage 2	-2.2	0
Stage 2	-2.4	0
Stage 2	-2.6	0
Stage 2	-2.8	0
Stage 2	-3	0
Stage 2	-3.2	0
Stage 2	-3.4	0
Stage 2	-3.6	0
Stage 2	-3.8	0
Stage 2	-4	0
Stage 2	-4.2	0
Stage 2	-4.4	0
Stage 2	-4.6	0
Stage 2	-4.8	0
Stage 2	-5	0
Stage 2	-5.2	0
Stage 2	-5.4	0
Stage 2	-5.6	0
Stage 2	-5.8	0
Stage 2	-6	0
Stage 2	-6.2	0
Stage 2	-6.4	0
Stage 2	-6.6	0
Stage 2	-6.8	0



Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 2	-7	0	
Stage 2	-7.2	0	
Stage 2	-7.4	0	
Stage 2	-7.6	0	
Stage 2	-7.8	0	
Stage 2	-8	0	
Stage 2	-8.2	0	
Stage 2	-8.4	0	
Stage 2	-8.6	0	
Stage 2	-8.8	0	
Stage 2	-9	0	
Stage 2	-9.2	0	
Stage 2	-9.4	0	
Stage 2	-9.6	0	
Stage 2	-9.8	0	
Stage 2	-10	0	
Stage 2	-10.2	0	
Stage 2	-10.4	0	
Stage 2	-10.6	0	
Stage 2	-10.8	0	
Stage 2	-11	0	
Stage 2	-11.2	0	
Stage 2	-11.4	0	
Stage 2	-11.6	0	
Stage 2	-11.8	0	
Stage 2	-12	0	
Stage 2	-12.2	0	
Stage 2	-12.4	0	
Stage 2	-12.6	0	
Stage 2	-12.8	0	
Stage 2	-13	0	
Stage 2	-13.2	0	
Stage 2	-13.4	0	
Stage 2	-13.6	0	
Stage 2	-13.8	0	
Stage 2	-14	0	
Stage 2	-14.2	0	
Stage 2	-14.4	0	
Stage 2	-14.6	0	
Stage 2	-14.8	0	
Stage 2	-15	0	
Stage 2	-15.2	0	
Stage 2	-15.4	0	
Stage 2	-15.6	0	
Stage 2	-15.8	0	
Stage 2	-16	0	

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 3**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 3	2	18.06	
Stage 3	1.8	15.05	
Stage 3	1.6	12.04	
Stage 3	1.4	9.03	
Stage 3	1.2	6.02	
Stage 3	1	3.01	
Stage 3	0.8	0	
Stage 3	0.6	-3.01	
Stage 3	0.4	-6.01	
Stage 3	0.2	-8.99	
Stage 3	0	-11.95	
Stage 3	-0.2	-14.88	
Stage 3	-0.4	-17.77	

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 3	-0.6	-20.61
Stage 3	-0.8	-23.39
Stage 3	-1	-26.11
Stage 3	-1.2	-28.76
Stage 3	-1.4	-31.33
Stage 3	-1.6	-33.81
Stage 3	-1.8	-36.21
Stage 3	-2	-38.51
Stage 3	-2.2	-40.7
Stage 3	-2.4	-42.8
Stage 3	-2.6	-44.78
Stage 3	-2.8	-46.64
Stage 3	-3	-48.38
Stage 3	-3.2	-50
Stage 3	-3.4	-51.5
Stage 3	-3.6	-52.86
Stage 3	-3.8	-54.1
Stage 3	-4	-55.2
Stage 3	-4.2	-56.16
Stage 3	-4.4	-56.99
Stage 3	-4.6	-57.68
Stage 3	-4.8	-58.24
Stage 3	-5	-58.66
Stage 3	-5.2	-58.94
Stage 3	-5.4	-59.08
Stage 3	-5.6	-59.09
Stage 3	-5.8	-58.96
Stage 3	-6	-58.7
Stage 3	-6.2	-58.32
Stage 3	-6.4	-57.8
Stage 3	-6.6	-57.17
Stage 3	-6.8	-56.41
Stage 3	-7	-55.53
Stage 3	-7.2	-54.55
Stage 3	-7.4	-53.45
Stage 3	-7.6	-52.25
Stage 3	-7.8	-50.96
Stage 3	-8	-49.57
Stage 3	-8.2	-48.1
Stage 3	-8.4	-46.55
Stage 3	-8.6	-44.93
Stage 3	-8.8	-43.24
Stage 3	-9	-41.49
Stage 3	-9.2	-39.7
Stage 3	-9.4	-37.87
Stage 3	-9.6	-36
Stage 3	-9.8	-34.11
Stage 3	-10	-32.21
Stage 3	-10.2	-30.3
Stage 3	-10.4	-28.39
Stage 3	-10.6	-26.5
Stage 3	-10.8	-24.63
Stage 3	-11	-22.79
Stage 3	-11.2	-20.99
Stage 3	-11.4	-19.24
Stage 3	-11.6	-17.55
Stage 3	-11.8	-15.92
Stage 3	-12	-14.36
Stage 3	-12.2	-12.87
Stage 3	-12.4	-11.46
Stage 3	-12.6	-10.13
Stage 3	-12.8	-8.87
Stage 3	-13	-7.69
Stage 3	-13.2	-6.57
Stage 3	-13.4	-5.53
Stage 3	-13.6	-4.55
Stage 3	-13.8	-3.62

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 3	-14	-2.74	
Stage 3	-14.2	-1.91	
Stage 3	-14.4	-1.12	
Stage 3	-14.6	-0.36	
Stage 3	-14.8	0.38	
Stage 3	-15	1.1	
Stage 3	-15.2	1.8	
Stage 3	-15.4	2.49	
Stage 3	-15.6	3.18	
Stage 3	-15.8	3.86	
Stage 3	-16	4.55	

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 3bis**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 3bis	2	18.06	
Stage 3bis	1.8	15.05	
Stage 3bis	1.6	12.04	
Stage 3bis	1.4	9.03	
Stage 3bis	1.2	6.02	
Stage 3bis	1	3.01	
Stage 3bis	0.8	0	
Stage 3bis	0.6	-3.01	
Stage 3bis	0.4	-6.01	
Stage 3bis	0.2	-8.99	
Stage 3bis	0	-11.95	
Stage 3bis	-0.2	-14.88	
Stage 3bis	-0.4	-17.77	
Stage 3bis	-0.6	-20.61	
Stage 3bis	-0.8	-23.39	
Stage 3bis	-1	-26.11	
Stage 3bis	-1.2	-28.76	
Stage 3bis	-1.4	-31.33	
Stage 3bis	-1.6	-33.81	
Stage 3bis	-1.8	-36.21	
Stage 3bis	-2	-38.51	
Stage 3bis	-2.2	-40.7	
Stage 3bis	-2.4	-42.8	
Stage 3bis	-2.6	-44.78	
Stage 3bis	-2.8	-46.64	
Stage 3bis	-3	-48.38	
Stage 3bis	-3.2	-50	
Stage 3bis	-3.4	-51.5	
Stage 3bis	-3.6	-52.86	
Stage 3bis	-3.8	-54.1	
Stage 3bis	-4	-55.2	
Stage 3bis	-4.2	-56.16	
Stage 3bis	-4.4	-56.99	
Stage 3bis	-4.6	-57.68	
Stage 3bis	-4.8	-58.24	
Stage 3bis	-5	-58.66	
Stage 3bis	-5.2	-58.94	
Stage 3bis	-5.4	-59.08	
Stage 3bis	-5.6	-59.09	
Stage 3bis	-5.8	-58.96	
Stage 3bis	-6	-58.7	
Stage 3bis	-6.2	-58.32	
Stage 3bis	-6.4	-57.8	
Stage 3bis	-6.6	-57.17	
Stage 3bis	-6.8	-56.41	
Stage 3bis	-7	-55.53	
Stage 3bis	-7.2	-54.55	

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 3bis	-7.4	-53.45	
Stage 3bis	-7.6	-52.25	
Stage 3bis	-7.8	-50.96	
Stage 3bis	-8	-49.57	
Stage 3bis	-8.2	-48.1	
Stage 3bis	-8.4	-46.55	
Stage 3bis	-8.6	-44.93	
Stage 3bis	-8.8	-43.24	
Stage 3bis	-9	-41.49	
Stage 3bis	-9.2	-39.7	
Stage 3bis	-9.4	-37.87	
Stage 3bis	-9.6	-36	
Stage 3bis	-9.8	-34.11	
Stage 3bis	-10	-32.21	
Stage 3bis	-10.2	-30.3	
Stage 3bis	-10.4	-28.39	
Stage 3bis	-10.6	-26.5	
Stage 3bis	-10.8	-24.63	
Stage 3bis	-11	-22.79	
Stage 3bis	-11.2	-20.99	
Stage 3bis	-11.4	-19.24	
Stage 3bis	-11.6	-17.55	
Stage 3bis	-11.8	-15.92	
Stage 3bis	-12	-14.36	
Stage 3bis	-12.2	-12.87	
Stage 3bis	-12.4	-11.46	
Stage 3bis	-12.6	-10.13	
Stage 3bis	-12.8	-8.87	
Stage 3bis	-13	-7.69	
Stage 3bis	-13.2	-6.57	
Stage 3bis	-13.4	-5.53	
Stage 3bis	-13.6	-4.55	
Stage 3bis	-13.8	-3.62	
Stage 3bis	-14	-2.74	
Stage 3bis	-14.2	-1.91	
Stage 3bis	-14.4	-1.12	
Stage 3bis	-14.6	-0.36	
Stage 3bis	-14.8	0.38	
Stage 3bis	-15	1.1	
Stage 3bis	-15.2	1.8	
Stage 3bis	-15.4	2.49	
Stage 3bis	-15.6	3.18	
Stage 3bis	-15.8	3.86	
Stage 3bis	-16	4.55	

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 4**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento			Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)	
Stage 4	2	-0.47	
Stage 4	1.8	-2.18	
Stage 4	1.6	-3.89	
Stage 4	1.4	-5.6	
Stage 4	1.2	-7.31	
Stage 4	1	-9.01	
Stage 4	0.8	-10.72	
Stage 4	0.6	-12.43	
Stage 4	0.4	-14.14	
Stage 4	0.2	-15.85	
Stage 4	0	-17.56	
Stage 4	-0.2	-19.27	
Stage 4	-0.4	-20.97	
Stage 4	-0.6	-22.68	
Stage 4	-0.8	-24.39	

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 4	-1	-26.11
Stage 4	-1.2	-27.82
Stage 4	-1.4	-29.53
Stage 4	-1.6	-31.22
Stage 4	-1.8	-32.89
Stage 4	-2	-34.53
Stage 4	-2.2	-36.13
Stage 4	-2.4	-37.68
Stage 4	-2.6	-39.18
Stage 4	-2.8	-40.62
Stage 4	-3	-42
Stage 4	-3.2	-43.3
Stage 4	-3.4	-44.53
Stage 4	-3.6	-45.68
Stage 4	-3.8	-46.75
Stage 4	-4	-47.72
Stage 4	-4.2	-48.6
Stage 4	-4.4	-49.39
Stage 4	-4.6	-50.07
Stage 4	-4.8	-50.65
Stage 4	-5	-51.13
Stage 4	-5.2	-51.51
Stage 4	-5.4	-51.78
Stage 4	-5.6	-51.94
Stage 4	-5.8	-51.99
Stage 4	-6	-51.93
Stage 4	-6.2	-51.76
Stage 4	-6.4	-51.49
Stage 4	-6.6	-51.11
Stage 4	-6.8	-50.62
Stage 4	-7	-50.03
Stage 4	-7.2	-49.34
Stage 4	-7.4	-48.54
Stage 4	-7.6	-47.66
Stage 4	-7.8	-46.67
Stage 4	-8	-45.6
Stage 4	-8.2	-44.45
Stage 4	-8.4	-43.21
Stage 4	-8.6	-41.9
Stage 4	-8.8	-40.51
Stage 4	-9	-39.06
Stage 4	-9.2	-37.55
Stage 4	-9.4	-35.99
Stage 4	-9.6	-34.38
Stage 4	-9.8	-32.74
Stage 4	-10	-31.06
Stage 4	-10.2	-29.36
Stage 4	-10.4	-27.65
Stage 4	-10.6	-25.93
Stage 4	-10.8	-24.22
Stage 4	-11	-22.52
Stage 4	-11.2	-20.85
Stage 4	-11.4	-19.21
Stage 4	-11.6	-17.61
Stage 4	-11.8	-16.06
Stage 4	-12	-14.57
Stage 4	-12.2	-13.13
Stage 4	-12.4	-11.77
Stage 4	-12.6	-10.46
Stage 4	-12.8	-9.23
Stage 4	-13	-8.06
Stage 4	-13.2	-6.96
Stage 4	-13.4	-5.91
Stage 4	-13.6	-4.93
Stage 4	-13.8	-3.99
Stage 4	-14	-3.1
Stage 4	-14.2	-2.25

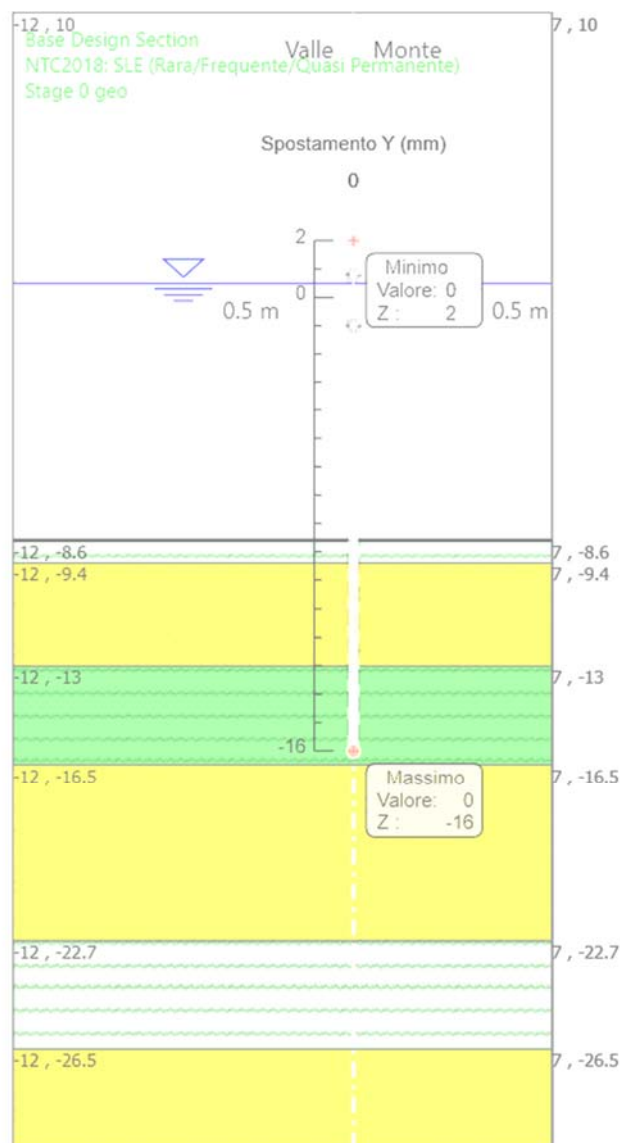
Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 4	-14.4	-1.44
Stage 4	-14.6	-0.66
Stage 4	-14.8	0.1
Stage 4	-15	0.84
Stage 4	-15.2	1.57
Stage 4	-15.4	2.29
Stage 4	-15.6	3
Stage 4	-15.8	3.71
Stage 4	-16	4.42

**Tabella Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - RIGHT Stage: Stage 4 eccez**

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 4 eccez	2	11.07
Stage 4 eccez	1.8	8.59
Stage 4 eccez	1.6	6.12
Stage 4 eccez	1.4	3.65
Stage 4 eccez	1.2	1.18
Stage 4 eccez	1	-1.29
Stage 4 eccez	0.8	-3.76
Stage 4 eccez	0.6	-6.24
Stage 4 eccez	0.4	-8.71
Stage 4 eccez	0.2	-11.18
Stage 4 eccez	0	-13.66
Stage 4 eccez	-0.2	-16.14
Stage 4 eccez	-0.4	-18.62
Stage 4 eccez	-0.6	-21.11
Stage 4 eccez	-0.8	-23.6
Stage 4 eccez	-1	-26.11
Stage 4 eccez	-1.2	-28.62
Stage 4 eccez	-1.4	-31.14
Stage 4 eccez	-1.6	-33.64
Stage 4 eccez	-1.8	-36.11
Stage 4 eccez	-2	-38.55
Stage 4 eccez	-2.2	-40.94
Stage 4 eccez	-2.4	-43.26
Stage 4 eccez	-2.6	-45.52
Stage 4 eccez	-2.8	-47.7
Stage 4 eccez	-3	-49.79
Stage 4 eccez	-3.2	-51.78
Stage 4 eccez	-3.4	-53.67
Stage 4 eccez	-3.6	-55.44
Stage 4 eccez	-3.8	-57.1
Stage 4 eccez	-4	-58.63
Stage 4 eccez	-4.2	-60.04
Stage 4 eccez	-4.4	-61.31
Stage 4 eccez	-4.6	-62.44
Stage 4 eccez	-4.8	-63.43
Stage 4 eccez	-5	-64.27
Stage 4 eccez	-5.2	-64.96
Stage 4 eccez	-5.4	-65.5
Stage 4 eccez	-5.6	-65.9
Stage 4 eccez	-5.8	-66.14
Stage 4 eccez	-6	-66.22
Stage 4 eccez	-6.2	-66.16
Stage 4 eccez	-6.4	-65.94
Stage 4 eccez	-6.6	-65.57
Stage 4 eccez	-6.8	-65.06
Stage 4 eccez	-7	-64.4
Stage 4 eccez	-7.2	-63.6
Stage 4 eccez	-7.4	-62.66
Stage 4 eccez	-7.6	-61.59
Stage 4 eccez	-7.8	-60.39

Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente) Tipo Risultato: Spostamento		Muro: RIGHT
Stage	Z (m)	Spostamento orizzontale (mm)
Stage 4 eccez	-8	-59.07
Stage 4 eccez	-8.2	-57.63
Stage 4 eccez	-8.4	-56.08
Stage 4 eccez	-8.6	-54.42
Stage 4 eccez	-8.8	-52.68
Stage 4 eccez	-9	-50.84
Stage 4 eccez	-9.2	-48.93
Stage 4 eccez	-9.4	-46.95
Stage 4 eccez	-9.6	-44.92
Stage 4 eccez	-9.8	-42.83
Stage 4 eccez	-10	-40.71
Stage 4 eccez	-10.2	-38.57
Stage 4 eccez	-10.4	-36.41
Stage 4 eccez	-10.6	-34.24
Stage 4 eccez	-10.8	-32.08
Stage 4 eccez	-11	-29.94
Stage 4 eccez	-11.2	-27.82
Stage 4 eccez	-11.4	-25.75
Stage 4 eccez	-11.6	-23.72
Stage 4 eccez	-11.8	-21.75
Stage 4 eccez	-12	-19.85
Stage 4 eccez	-12.2	-18.01
Stage 4 eccez	-12.4	-16.26
Stage 4 eccez	-12.6	-14.58
Stage 4 eccez	-12.8	-12.98
Stage 4 eccez	-13	-11.46
Stage 4 eccez	-13.2	-10.02
Stage 4 eccez	-13.4	-8.65
Stage 4 eccez	-13.6	-7.35
Stage 4 eccez	-13.8	-6.12
Stage 4 eccez	-14	-4.93
Stage 4 eccez	-14.2	-3.8
Stage 4 eccez	-14.4	-2.71
Stage 4 eccez	-14.6	-1.66
Stage 4 eccez	-14.8	-0.63
Stage 4 eccez	-15	0.37
Stage 4 eccez	-15.2	1.35
Stage 4 eccez	-15.4	2.32
Stage 4 eccez	-15.6	3.29
Stage 4 eccez	-15.8	4.25
Stage 4 eccez	-16	5.21

## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 0 geo



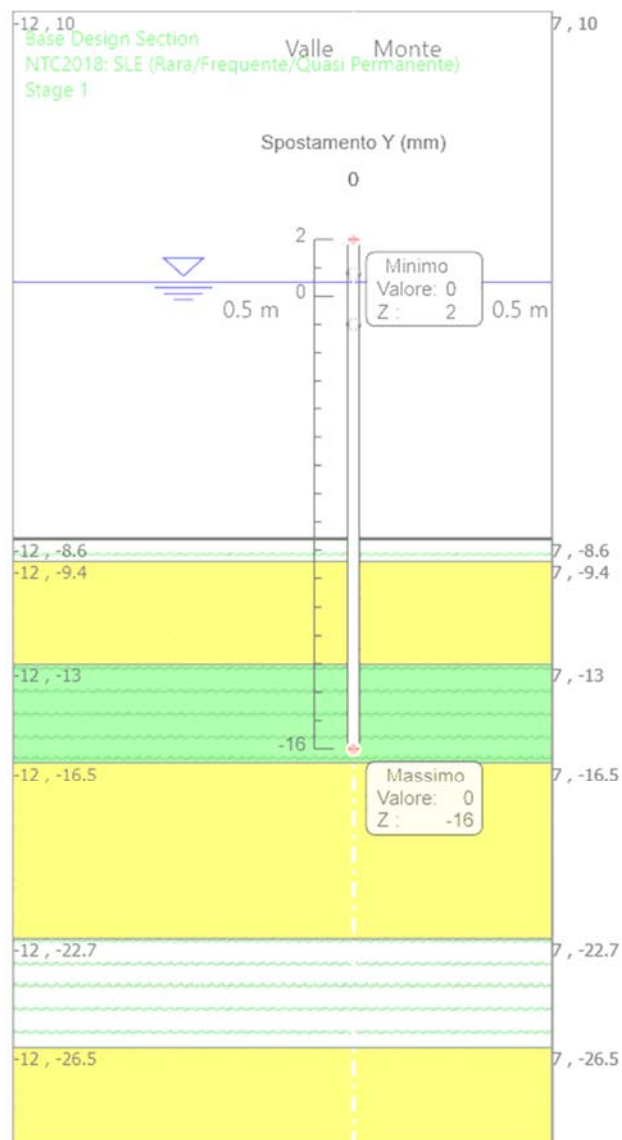
Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 0 geo

Spostamento orizzontale



## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 1

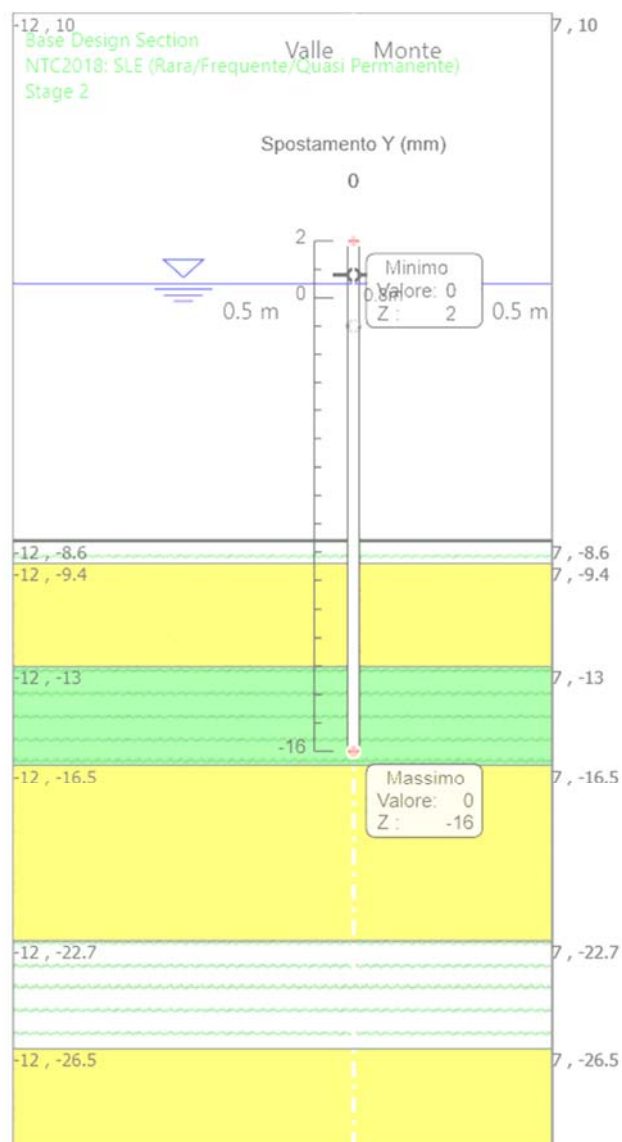


Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 1

Spostamento orizzontale

## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 2

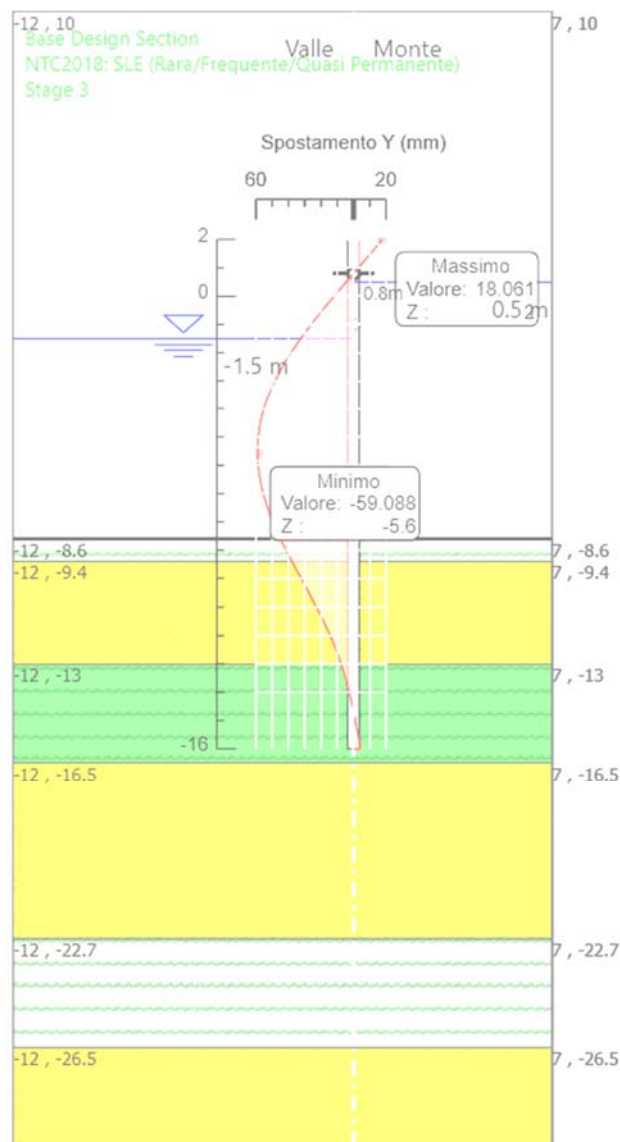


Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 2

Spostamento orizzontale

### Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 3

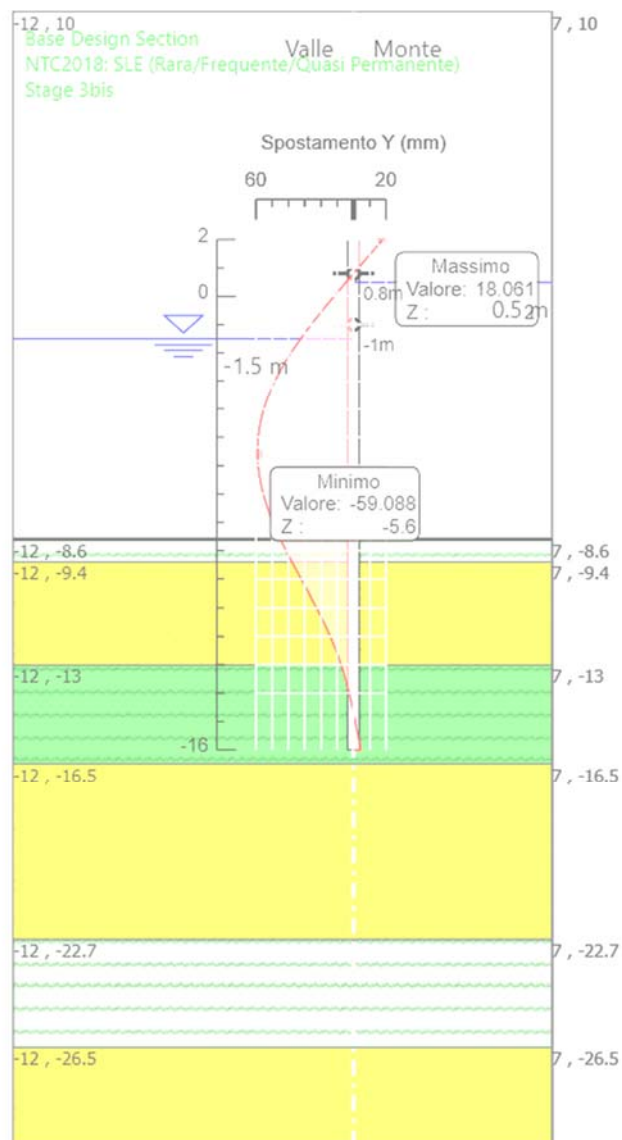


Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 3

Spostamento orizzontale

## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 3bis

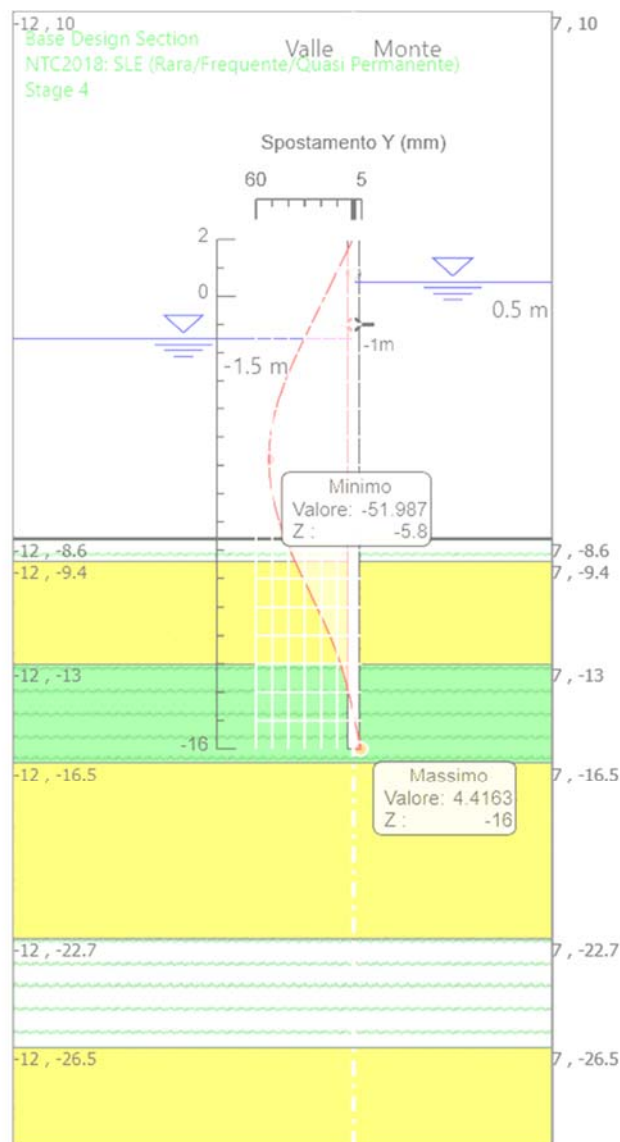


Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 3bis

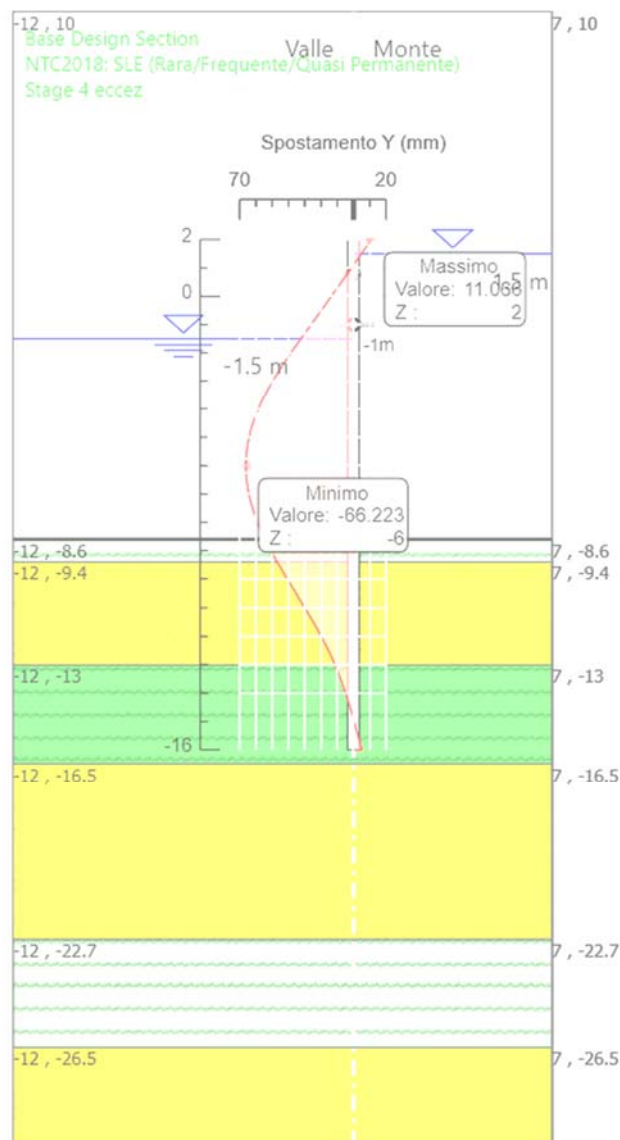
Spostamento orizzontale

## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 4



Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)  
 Stage: Stage 4  
 Spostamento orizzontale

## Grafico Spostamento NTC2018: SLE (Rara/Frequente/Quasi Permanente) - Stage: Stage 4 eccez



Design Assumption: NTC2018: SLE (Rara/Frequente/Quasi Permanente)

Stage: Stage 4 eccez

Spostamento orizzontale

## 6.4 Risultati NTC2018: A1+M1+R1 (R3 per tiranti)

**Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 0 geo**

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 0 geo	2	0	0
Stage 0 geo	1.8	0	0
Stage 0 geo	1.6	0	0
Stage 0 geo	1.4	0	0
Stage 0 geo	1.2	0	0
Stage 0 geo	1	0	0
Stage 0 geo	0.8	0	0
Stage 0 geo	0.6	0	0
Stage 0 geo	0.4	0	0
Stage 0 geo	0.2	0	0
Stage 0 geo	0	0	0
Stage 0 geo	-0.2	0	0
Stage 0 geo	-0.4	0	0
Stage 0 geo	-0.6	0	0
Stage 0 geo	-0.8	0	0
Stage 0 geo	-1	0	0
Stage 0 geo	-1.2	0	0
Stage 0 geo	-1.4	0	0
Stage 0 geo	-1.6	0	0
Stage 0 geo	-1.8	0	0
Stage 0 geo	-2	0	0
Stage 0 geo	-2.2	0	0
Stage 0 geo	-2.4	0	0
Stage 0 geo	-2.6	0	0
Stage 0 geo	-2.8	0	0
Stage 0 geo	-3	0	0
Stage 0 geo	-3.2	0	0
Stage 0 geo	-3.4	0	0
Stage 0 geo	-3.6	0	0
Stage 0 geo	-3.8	0	0
Stage 0 geo	-4	0	0
Stage 0 geo	-4.2	0	0
Stage 0 geo	-4.4	0	0
Stage 0 geo	-4.6	0	0
Stage 0 geo	-4.8	0	0
Stage 0 geo	-5	0	0
Stage 0 geo	-5.2	0	0
Stage 0 geo	-5.4	0	0
Stage 0 geo	-5.6	0	0
Stage 0 geo	-5.8	0	0
Stage 0 geo	-6	0	0
Stage 0 geo	-6.2	0	0
Stage 0 geo	-6.4	0	0
Stage 0 geo	-6.6	0	0
Stage 0 geo	-6.8	0	0
Stage 0 geo	-7	0	0
Stage 0 geo	-7.2	0	0
Stage 0 geo	-7.4	0	0
Stage 0 geo	-7.6	0	0
Stage 0 geo	-7.8	0	0
Stage 0 geo	-8	0	0
Stage 0 geo	-8.2	0	0
Stage 0 geo	-8.4	0	0
Stage 0 geo	-8.6	0	0
Stage 0 geo	-8.8	0	0
Stage 0 geo	-9	0	0
Stage 0 geo	-9.2	0	0
Stage 0 geo	-9.4	0	0

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 0 geo	-9.6	0	0
Stage 0 geo	-9.8	0	0
Stage 0 geo	-10	0	0
Stage 0 geo	-10.2	0	0
Stage 0 geo	-10.4	0	0
Stage 0 geo	-10.6	0	0
Stage 0 geo	-10.8	0	0
Stage 0 geo	-11	0	0
Stage 0 geo	-11.2	0	0
Stage 0 geo	-11.4	0	0
Stage 0 geo	-11.6	0	0
Stage 0 geo	-11.8	0	0
Stage 0 geo	-12	0	0
Stage 0 geo	-12.2	0	0
Stage 0 geo	-12.4	0	0
Stage 0 geo	-12.6	0	0
Stage 0 geo	-12.8	0	0
Stage 0 geo	-13	0	0
Stage 0 geo	-13.2	0	0
Stage 0 geo	-13.4	0	0
Stage 0 geo	-13.6	0	0
Stage 0 geo	-13.8	0	0
Stage 0 geo	-14	0	0
Stage 0 geo	-14.2	0	0
Stage 0 geo	-14.4	0	0
Stage 0 geo	-14.6	0	0
Stage 0 geo	-14.8	0	0
Stage 0 geo	-15	0	0
Stage 0 geo	-15.2	0	0
Stage 0 geo	-15.4	0	0
Stage 0 geo	-15.6	0	0
Stage 0 geo	-15.8	0	0
Stage 0 geo	-16	0	0

**Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 1**

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 1	2	0	0
Stage 1	1.8	0	0
Stage 1	1.6	0	0
Stage 1	1.4	0	0
Stage 1	1.2	0	0
Stage 1	1	0	0
Stage 1	0.8	0	0
Stage 1	0.6	0	0
Stage 1	0.4	0	0
Stage 1	0.2	0	0
Stage 1	0	0	0
Stage 1	-0.2	0	0
Stage 1	-0.4	0	0
Stage 1	-0.6	0	0
Stage 1	-0.8	0	0
Stage 1	-1	0	0
Stage 1	-1.2	0	0
Stage 1	-1.4	0	0
Stage 1	-1.6	0	0
Stage 1	-1.8	0	0
Stage 1	-2	0	0
Stage 1	-2.2	0	0
Stage 1	-2.4	0	0
Stage 1	-2.6	0	0
Stage 1	-2.8	0	0
Stage 1	-3	0	0
Stage 1	-3.2	0	0



Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 1	-3.4	0	0
Stage 1	-3.6	0	0
Stage 1	-3.8	0	0
Stage 1	-4	0	0
Stage 1	-4.2	0	0
Stage 1	-4.4	0	0
Stage 1	-4.6	0	0
Stage 1	-4.8	0	0
Stage 1	-5	0	0
Stage 1	-5.2	0	0
Stage 1	-5.4	0	0
Stage 1	-5.6	0	0
Stage 1	-5.8	0	0
Stage 1	-6	0	0
Stage 1	-6.2	0	0
Stage 1	-6.4	0	0
Stage 1	-6.6	0	0
Stage 1	-6.8	0	0
Stage 1	-7	0	0
Stage 1	-7.2	0	0
Stage 1	-7.4	0	0
Stage 1	-7.6	0	0
Stage 1	-7.8	0	0
Stage 1	-8	0	0
Stage 1	-8.2	0	0
Stage 1	-8.4	0	0
Stage 1	-8.6	0	0
Stage 1	-8.8	0	0
Stage 1	-9	0	0
Stage 1	-9.2	0	0
Stage 1	-9.4	0	0
Stage 1	-9.6	0	0
Stage 1	-9.8	0	0
Stage 1	-10	0	0
Stage 1	-10.2	0	0
Stage 1	-10.4	0	0
Stage 1	-10.6	0	0
Stage 1	-10.8	0	0
Stage 1	-11	0	0
Stage 1	-11.2	0	0
Stage 1	-11.4	0	0
Stage 1	-11.6	0	0
Stage 1	-11.8	0	0
Stage 1	-12	0	0
Stage 1	-12.2	0	0
Stage 1	-12.4	0	0
Stage 1	-12.6	0	0
Stage 1	-12.8	0	0
Stage 1	-13	0	0
Stage 1	-13.2	0	0
Stage 1	-13.4	0	0
Stage 1	-13.6	0	0
Stage 1	-13.8	0	0
Stage 1	-14	0	0
Stage 1	-14.2	0	0
Stage 1	-14.4	0	0
Stage 1	-14.6	0	0
Stage 1	-14.8	0	0
Stage 1	-15	0	0
Stage 1	-15.2	0	0
Stage 1	-15.4	0	0
Stage 1	-15.6	0	0
Stage 1	-15.8	0	0
Stage 1	-16	0	0

## Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 2

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 2	2	0	0
Stage 2	1.8	0	0
Stage 2	1.6	0	0
Stage 2	1.4	0	0
Stage 2	1.2	0	0
Stage 2	1	0	0
Stage 2	0.8	0	0
Stage 2	0.6	0	0
Stage 2	0.4	0	0
Stage 2	0.2	0	0
Stage 2	0	0	0
Stage 2	-0.2	0	0
Stage 2	-0.4	0	0
Stage 2	-0.6	0	0
Stage 2	-0.8	0	0
Stage 2	-1	0	0
Stage 2	-1.2	0	0
Stage 2	-1.4	0	0
Stage 2	-1.6	0	0
Stage 2	-1.8	0	0
Stage 2	-2	0	0
Stage 2	-2.2	0	0
Stage 2	-2.4	0	0
Stage 2	-2.6	0	0
Stage 2	-2.8	0	0
Stage 2	-3	0	0
Stage 2	-3.2	0	0
Stage 2	-3.4	0	0
Stage 2	-3.6	0	0
Stage 2	-3.8	0	0
Stage 2	-4	0	0
Stage 2	-4.2	0	0
Stage 2	-4.4	0	0
Stage 2	-4.6	0	0
Stage 2	-4.8	0	0
Stage 2	-5	0	0
Stage 2	-5.2	0	0
Stage 2	-5.4	0	0
Stage 2	-5.6	0	0
Stage 2	-5.8	0	0
Stage 2	-6	0	0
Stage 2	-6.2	0	0
Stage 2	-6.4	0	0
Stage 2	-6.6	0	0
Stage 2	-6.8	0	0
Stage 2	-7	0	0
Stage 2	-7.2	0	0
Stage 2	-7.4	0	0
Stage 2	-7.6	0	0
Stage 2	-7.8	0	0
Stage 2	-8	0	0
Stage 2	-8.2	0	0
Stage 2	-8.4	0	0
Stage 2	-8.6	0	0
Stage 2	-8.8	0	0
Stage 2	-9	0	0
Stage 2	-9.2	0	0
Stage 2	-9.4	0	0
Stage 2	-9.6	0	0
Stage 2	-9.8	0	0
Stage 2	-10	0	0
Stage 2	-10.2	0	0
Stage 2	-10.4	0	0

Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 2	-10.6	0	0
Stage 2	-10.8	0	0
Stage 2	-11	0	0
Stage 2	-11.2	0	0
Stage 2	-11.4	0	0
Stage 2	-11.6	0	0
Stage 2	-11.8	0	0
Stage 2	-12	0	0
Stage 2	-12.2	0	0
Stage 2	-12.4	0	0
Stage 2	-12.6	0	0
Stage 2	-12.8	0	0
Stage 2	-13	0	0
Stage 2	-13.2	0	0
Stage 2	-13.4	0	0
Stage 2	-13.6	0	0
Stage 2	-13.8	0	0
Stage 2	-14	0	0
Stage 2	-14.2	0	0
Stage 2	-14.4	0	0
Stage 2	-14.6	0	0
Stage 2	-14.8	0	0
Stage 2	-15	0	0
Stage 2	-15.2	0	0
Stage 2	-15.4	0	0
Stage 2	-15.6	0	0
Stage 2	-15.8	0	0
Stage 2	-16	0	0

**Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 3**

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 3	2	0	0
Stage 3	1.8	0	0
Stage 3	1.8	0	0
Stage 3	1.6	0	0
Stage 3	1.6	0	0
Stage 3	1.4	0	0
Stage 3	1.4	0	0
Stage 3	1.2	0	0
Stage 3	1.2	0	0
Stage 3	1	0	0
Stage 3	1	0	0
Stage 3	0.8	0	0
Stage 3	0.8	0	0
Stage 3	0.6	-21.94	-109.71
Stage 3	0.4	-43.88	-109.71
Stage 3	0.2	-65.77	-109.45
Stage 3	0	-87.51	-108.67
Stage 3	-0.2	-108.98	-107.37
Stage 3	-0.4	-130.09	-105.55
Stage 3	-0.6	-150.73	-103.21
Stage 3	-0.8	-170.8	-100.35
Stage 3	-1	-190.2	-96.97
Stage 3	-1.2	-208.81	-93.07
Stage 3	-1.4	-226.54	-88.65
Stage 3	-1.6	-243.28	-83.71
Stage 3	-1.8	-258.98	-78.51
Stage 3	-2	-273.64	-73.31
Stage 3	-2.2	-287.27	-68.11
Stage 3	-2.4	-299.85	-62.91
Stage 3	-2.6	-311.39	-57.71
Stage 3	-2.8	-321.89	-52.51
Stage 3	-3	-331.35	-47.31

Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 3	-3.2	-339.77	-42.11
Stage 3	-3.4	-347.16	-36.91
Stage 3	-3.6	-353.5	-31.71
Stage 3	-3.8	-358.8	-26.51
Stage 3	-4	-363.06	-21.31
Stage 3	-4.2	-366.28	-16.11
Stage 3	-4.4	-368.46	-10.91
Stage 3	-4.6	-369.61	-5.71
Stage 3	-4.8	-369.71	-0.51
Stage 3	-5	-368.77	4.69
Stage 3	-5.2	-366.79	9.89
Stage 3	-5.4	-363.77	15.09
Stage 3	-5.6	-359.71	20.29
Stage 3	-5.8	-354.62	25.49
Stage 3	-6	-348.48	30.69
Stage 3	-6.2	-341.3	35.89
Stage 3	-6.4	-333.08	41.09
Stage 3	-6.6	-323.82	46.29
Stage 3	-6.8	-313.52	51.49
Stage 3	-7	-302.19	56.69
Stage 3	-7.2	-289.81	61.89
Stage 3	-7.4	-276.39	67.09
Stage 3	-7.6	-261.93	72.29
Stage 3	-7.8	-246.43	77.49
Stage 3	-8	-229.89	82.69
Stage 3	-8.2	-212.32	87.89
Stage 3	-8.4	-193.7	93.09
Stage 3	-8.6	-174.04	98.29
Stage 3	-8.8	-153.34	103.49
Stage 3	-9	-131.7	108.19
Stage 3	-9.2	-109.23	112.37
Stage 3	-9.4	-86.02	116.05
Stage 3	-9.6	-62.17	119.23
Stage 3	-9.8	-38.21	119.81
Stage 3	-10	-14.1	120.55
Stage 3	-10.2	10.19	121.43
Stage 3	-10.4	34.68	122.46
Stage 3	-10.6	59.4	123.64
Stage 3	-10.8	84.17	123.82
Stage 3	-11	108.33	120.82
Stage 3	-11.2	131.26	114.66
Stage 3	-11.4	152.33	105.32
Stage 3	-11.6	170.89	92.81
Stage 3	-11.8	186.32	77.13
Stage 3	-12	197.97	58.28
Stage 3	-12.2	205.23	36.26
Stage 3	-12.4	207.79	12.85
Stage 3	-12.6	206.14	-8.25
Stage 3	-12.8	200.71	-27.17
Stage 3	-13	191.9	-44.04
Stage 3	-13.2	180.11	-58.98
Stage 3	-13.4	166.64	-67.34
Stage 3	-13.6	151.85	-73.93
Stage 3	-13.8	136.08	-78.87
Stage 3	-14	119.62	-82.3
Stage 3	-14.2	102.76	-84.32
Stage 3	-14.4	85.76	-84.99
Stage 3	-14.6	68.88	-84.39
Stage 3	-14.8	52.7	-80.91
Stage 3	-15	37.88	-74.08
Stage 3	-15.2	25.04	-64.19
Stage 3	-15.4	14.55	-52.47
Stage 3	-15.6	6.69	-39.31
Stage 3	-15.8	1.74	-24.72
Stage 3	-16	0	-8.71

## Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 3bis

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 3bis	2	0	0
Stage 3bis	1.8	0	0
Stage 3bis	1.8	0	0
Stage 3bis	1.6	0	0
Stage 3bis	1.6	0	0
Stage 3bis	1.4	0	0
Stage 3bis	1.4	0	0
Stage 3bis	1.2	0	0
Stage 3bis	1.2	0	0
Stage 3bis	1	0	0
Stage 3bis	1	0	0
Stage 3bis	0.8	0	0
Stage 3bis	0.8	0	0
Stage 3bis	0.6	-21.94	-109.71
Stage 3bis	0.4	-43.88	-109.71
Stage 3bis	0.2	-65.77	-109.45
Stage 3bis	0	-87.51	-108.67
Stage 3bis	-0.2	-108.98	-107.37
Stage 3bis	-0.4	-130.09	-105.55
Stage 3bis	-0.6	-150.73	-103.21
Stage 3bis	-0.8	-170.8	-100.35
Stage 3bis	-1	-190.2	-96.97
Stage 3bis	-1.2	-208.81	-93.07
Stage 3bis	-1.4	-226.54	-88.65
Stage 3bis	-1.6	-243.28	-83.71
Stage 3bis	-1.8	-258.98	-78.51
Stage 3bis	-2	-273.64	-73.31
Stage 3bis	-2.2	-287.27	-68.11
Stage 3bis	-2.4	-299.85	-62.91
Stage 3bis	-2.6	-311.39	-57.71
Stage 3bis	-2.8	-321.89	-52.51
Stage 3bis	-3	-331.35	-47.31
Stage 3bis	-3.2	-339.77	-42.11
Stage 3bis	-3.4	-347.16	-36.91
Stage 3bis	-3.6	-353.5	-31.71
Stage 3bis	-3.8	-358.8	-26.51
Stage 3bis	-4	-363.06	-21.31
Stage 3bis	-4.2	-366.28	-16.11
Stage 3bis	-4.4	-368.46	-10.91
Stage 3bis	-4.6	-369.61	-5.71
Stage 3bis	-4.8	-369.71	-0.51
Stage 3bis	-5	-368.77	4.69
Stage 3bis	-5.2	-366.79	9.89
Stage 3bis	-5.4	-363.77	15.09
Stage 3bis	-5.6	-359.71	20.29
Stage 3bis	-5.8	-354.62	25.49
Stage 3bis	-6	-348.48	30.69
Stage 3bis	-6.2	-341.3	35.89
Stage 3bis	-6.4	-333.08	41.09
Stage 3bis	-6.6	-323.82	46.29
Stage 3bis	-6.8	-313.52	51.49
Stage 3bis	-7	-302.19	56.69
Stage 3bis	-7.2	-289.81	61.89
Stage 3bis	-7.4	-276.39	67.09
Stage 3bis	-7.6	-261.93	72.29
Stage 3bis	-7.8	-246.43	77.49
Stage 3bis	-8	-229.89	82.69
Stage 3bis	-8.2	-212.32	87.89
Stage 3bis	-8.4	-193.7	93.09
Stage 3bis	-8.6	-174.04	98.29
Stage 3bis	-8.8	-153.34	103.49
Stage 3bis	-9	-131.7	108.19
Stage 3bis	-9.2	-109.23	112.37
Stage 3bis	-9.4	-86.02	116.05

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 3bis	-9.6	-62.17	119.23
Stage 3bis	-9.8	-38.21	119.81
Stage 3bis	-10	-14.1	120.55
Stage 3bis	-10.2	10.19	121.43
Stage 3bis	-10.4	34.68	122.46
Stage 3bis	-10.6	59.4	123.64
Stage 3bis	-10.8	84.17	123.82
Stage 3bis	-11	108.33	120.82
Stage 3bis	-11.2	131.26	114.66
Stage 3bis	-11.4	152.33	105.32
Stage 3bis	-11.6	170.89	92.81
Stage 3bis	-11.8	186.32	77.13
Stage 3bis	-12	197.97	58.28
Stage 3bis	-12.2	205.23	36.26
Stage 3bis	-12.4	207.79	12.85
Stage 3bis	-12.6	206.14	-8.25
Stage 3bis	-12.8	200.71	-27.17
Stage 3bis	-13	191.9	-44.04
Stage 3bis	-13.2	180.11	-58.98
Stage 3bis	-13.4	166.64	-67.34
Stage 3bis	-13.6	151.85	-73.93
Stage 3bis	-13.8	136.08	-78.87
Stage 3bis	-14	119.62	-82.3
Stage 3bis	-14.2	102.76	-84.32
Stage 3bis	-14.4	85.76	-84.99
Stage 3bis	-14.6	68.88	-84.39
Stage 3bis	-14.8	52.7	-80.91
Stage 3bis	-15	37.88	-74.08
Stage 3bis	-15.2	25.04	-64.19
Stage 3bis	-15.4	14.55	-52.47
Stage 3bis	-15.6	6.69	-39.31
Stage 3bis	-15.8	1.74	-24.72
Stage 3bis	-16	0	-8.71

**Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 4**

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4	2	0	0
Stage 4	1.8	0	0
Stage 4	1.8	0	0
Stage 4	1.6	0	0
Stage 4	1.6	0	0
Stage 4	1.4	0	0
Stage 4	1.4	0	0
Stage 4	1.2	0	0
Stage 4	1.2	0	0
Stage 4	1	0	0
Stage 4	1	0	0
Stage 4	0.8	0	0
Stage 4	0.8	0	0
Stage 4	0.6	0	0
Stage 4	0.6	0	0
Stage 4	0.4	0	0
Stage 4	0.4	0	0
Stage 4	0.2	0.05	0.26
Stage 4	0	0.26	1.04
Stage 4	-0.2	0.73	2.34
Stage 4	-0.4	1.56	4.16
Stage 4	-0.6	2.86	6.5
Stage 4	-0.8	4.73	9.36
Stage 4	-1	7.28	12.74
Stage 4	-1.2	-16.97	-121.26
Stage 4	-1.4	-40.34	-116.84
Stage 4	-1.6	-62.72	-111.9

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4	-1.8	-84.06	-106.7
Stage 4	-2	-104.36	-101.5
Stage 4	-2.2	-123.62	-96.3
Stage 4	-2.4	-141.84	-91.1
Stage 4	-2.6	-159.02	-85.9
Stage 4	-2.8	-175.16	-80.7
Stage 4	-3	-190.25	-75.5
Stage 4	-3.2	-204.31	-70.3
Stage 4	-3.4	-217.33	-65.1
Stage 4	-3.6	-229.31	-59.9
Stage 4	-3.8	-240.25	-54.7
Stage 4	-4	-250.15	-49.5
Stage 4	-4.2	-259.01	-44.3
Stage 4	-4.4	-266.83	-39.1
Stage 4	-4.6	-273.61	-33.9
Stage 4	-4.8	-279.35	-28.7
Stage 4	-5	-284.05	-23.5
Stage 4	-5.2	-287.71	-18.3
Stage 4	-5.4	-290.33	-13.1
Stage 4	-5.6	-291.91	-7.9
Stage 4	-5.8	-292.45	-2.7
Stage 4	-6	-291.95	2.5
Stage 4	-6.2	-290.41	7.7
Stage 4	-6.4	-287.83	12.9
Stage 4	-6.6	-284.21	18.1
Stage 4	-6.8	-279.54	23.3
Stage 4	-7	-273.84	28.5
Stage 4	-7.2	-267.1	33.7
Stage 4	-7.4	-259.32	38.9
Stage 4	-7.6	-250.5	44.1
Stage 4	-7.8	-240.64	49.3
Stage 4	-8	-229.74	54.5
Stage 4	-8.2	-217.8	59.7
Stage 4	-8.4	-204.82	64.9
Stage 4	-8.6	-190.8	70.1
Stage 4	-8.8	-175.74	75.3
Stage 4	-9	-159.53	81.04
Stage 4	-9.2	-142.08	87.24
Stage 4	-9.4	-123.3	93.92
Stage 4	-9.6	-103.09	101.07
Stage 4	-9.8	-81.73	106.76
Stage 4	-10	-59.36	111.88
Stage 4	-10.2	-36.06	116.49
Stage 4	-10.4	-11.93	120.64
Stage 4	-10.6	12.94	124.37
Stage 4	-10.8	38.46	127.57
Stage 4	-11	63.92	127.31
Stage 4	-11.2	88.54	123.08
Stage 4	-11.4	111.63	115.44
Stage 4	-11.6	132.49	104.33
Stage 4	-11.8	150.44	89.76
Stage 4	-12	164.8	71.78
Stage 4	-12.2	174.88	50.4
Stage 4	-12.4	180.25	26.88
Stage 4	-12.6	181.35	5.47
Stage 4	-12.8	178.56	-13.93
Stage 4	-13	172.28	-31.43
Stage 4	-13.2	162.87	-47.03
Stage 4	-13.4	151.66	-56.06
Stage 4	-13.6	139	-63.32
Stage 4	-13.8	125.21	-68.93
Stage 4	-14	110.61	-73
Stage 4	-14.2	95.48	-75.65
Stage 4	-14.4	80.1	-76.92
Stage 4	-14.6	64.72	-76.89
Stage 4	-14.8	49.78	-74.7
Stage 4	-15	35.95	-69.14

Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4	-15.2	23.87	-60.4
Stage 4	-15.4	13.93	-49.72
Stage 4	-15.6	6.43	-37.49
Stage 4	-15.8	1.68	-23.73
Stage 4	-16	0	-8.42

**Tabella Risultati Paratia NTC2018: A1+M1+R1 (R3 per tiranti) - Palancole - Stage: Stage 4  
eccez**

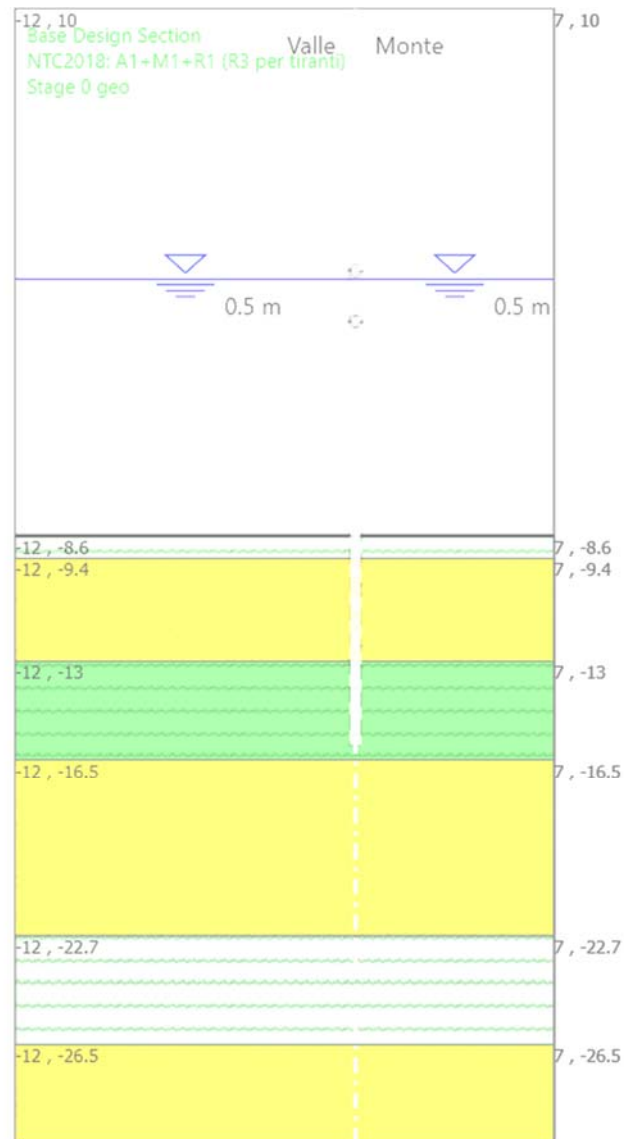
Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4 eccez	2	0	0
Stage 4 eccez	1.8	0	0
Stage 4 eccez	1.8	0	0
Stage 4 eccez	1.6	0	0
Stage 4 eccez	1.6	0	0
Stage 4 eccez	1.4	0	0
Stage 4 eccez	1.4	0	0
Stage 4 eccez	1.2	0.05	0.26
Stage 4 eccez	1	0.26	1.04
Stage 4 eccez	0.8	0.73	2.34
Stage 4 eccez	0.6	1.56	4.16
Stage 4 eccez	0.4	2.86	6.5
Stage 4 eccez	0.2	4.73	9.36
Stage 4 eccez	0	7.28	12.74
Stage 4 eccez	-0.2	10.61	16.64
Stage 4 eccez	-0.4	14.82	21.06
Stage 4 eccez	-0.6	20.02	26
Stage 4 eccez	-0.8	26.31	31.46
Stage 4 eccez	-1	33.8	37.44
Stage 4 eccez	-1.2	-2.45	-181.26
Stage 4 eccez	-1.4	-37.3	-174.24
Stage 4 eccez	-1.6	-70.64	-166.7
Stage 4 eccez	-1.8	-102.42	-158.9
Stage 4 eccez	-2	-132.64	-151.1
Stage 4 eccez	-2.2	-161.3	-143.3
Stage 4 eccez	-2.4	-188.4	-135.5
Stage 4 eccez	-2.6	-213.94	-127.7
Stage 4 eccez	-2.8	-237.92	-119.9
Stage 4 eccez	-3	-260.34	-112.1
Stage 4 eccez	-3.2	-281.2	-104.3
Stage 4 eccez	-3.4	-300.5	-96.5
Stage 4 eccez	-3.6	-318.24	-88.7
Stage 4 eccez	-3.8	-334.42	-80.9
Stage 4 eccez	-4	-349.04	-73.1
Stage 4 eccez	-4.2	-362.1	-65.3
Stage 4 eccez	-4.4	-373.6	-57.5
Stage 4 eccez	-4.6	-383.54	-49.7
Stage 4 eccez	-4.8	-391.92	-41.9
Stage 4 eccez	-5	-398.74	-34.1
Stage 4 eccez	-5.2	-404	-26.3
Stage 4 eccez	-5.4	-407.7	-18.5
Stage 4 eccez	-5.6	-409.84	-10.7
Stage 4 eccez	-5.8	-410.42	-2.9
Stage 4 eccez	-6	-409.44	4.9
Stage 4 eccez	-6.2	-406.9	12.7
Stage 4 eccez	-6.4	-402.8	20.5
Stage 4 eccez	-6.6	-397.14	28.3
Stage 4 eccez	-6.8	-389.92	36.1
Stage 4 eccez	-7	-381.14	43.9
Stage 4 eccez	-7.2	-370.8	51.7
Stage 4 eccez	-7.4	-358.9	59.5
Stage 4 eccez	-7.6	-345.44	67.3
Stage 4 eccez	-7.8	-330.42	75.1
Stage 4 eccez	-8	-313.84	82.9



Riva dei Sette Martiri – Venezia

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Risultati Paratia		Muro: RIGHT	
Stage	Z (m)	Momento (kN*m/m)	Taglio (kN/m)
Stage 4 eccetz	-8.2	-295.7	90.7
Stage 4 eccetz	-8.4	-276	98.5
Stage 4 eccetz	-8.6	-254.74	106.3
Stage 4 eccetz	-8.8	-231.92	114.1
Stage 4 eccetz	-9	-207.65	121.37
Stage 4 eccetz	-9.2	-182.02	128.12
Stage 4 eccetz	-9.4	-155.15	134.34
Stage 4 eccetz	-9.6	-127.15	140.04
Stage 4 eccetz	-9.8	-98.9	141.26
Stage 4 eccetz	-10	-70.37	142.63
Stage 4 eccetz	-10.2	-41.54	144.15
Stage 4 eccetz	-10.4	-12.38	145.82
Stage 4 eccetz	-10.6	17.15	147.63
Stage 4 eccetz	-10.8	46.84	148.45
Stage 4 eccetz	-11	76.06	146.09
Stage 4 eccetz	-11.2	104.17	140.57
Stage 4 eccetz	-11.4	130.54	131.87
Stage 4 eccetz	-11.6	154.54	119.99
Stage 4 eccetz	-11.8	175.53	104.95
Stage 4 eccetz	-12	192.88	86.73
Stage 4 eccetz	-12.2	205.95	65.35
Stage 4 eccetz	-12.4	214.11	40.79
Stage 4 eccetz	-12.6	216.72	13.05
Stage 4 eccetz	-12.8	214.13	-12.92
Stage 4 eccetz	-13	206.88	-36.26
Stage 4 eccetz	-13.2	195.46	-57.1
Stage 4 eccetz	-13.4	182.39	-65.36
Stage 4 eccetz	-13.6	167.55	-74.19
Stage 4 eccetz	-13.8	151.26	-81.45
Stage 4 eccetz	-14	133.93	-86.64
Stage 4 eccetz	-14.2	115.96	-89.88
Stage 4 eccetz	-14.4	97.7	-91.27
Stage 4 eccetz	-14.6	79.53	-90.85
Stage 4 eccetz	-14.8	61.79	-88.7
Stage 4 eccetz	-15	45.02	-83.86
Stage 4 eccetz	-15.2	30.09	-74.67
Stage 4 eccetz	-15.4	17.61	-62.38
Stage 4 eccetz	-15.6	8.13	-47.39
Stage 4 eccetz	-15.8	2.13	-30
Stage 4 eccetz	-16	0	-10.65

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 0 geo

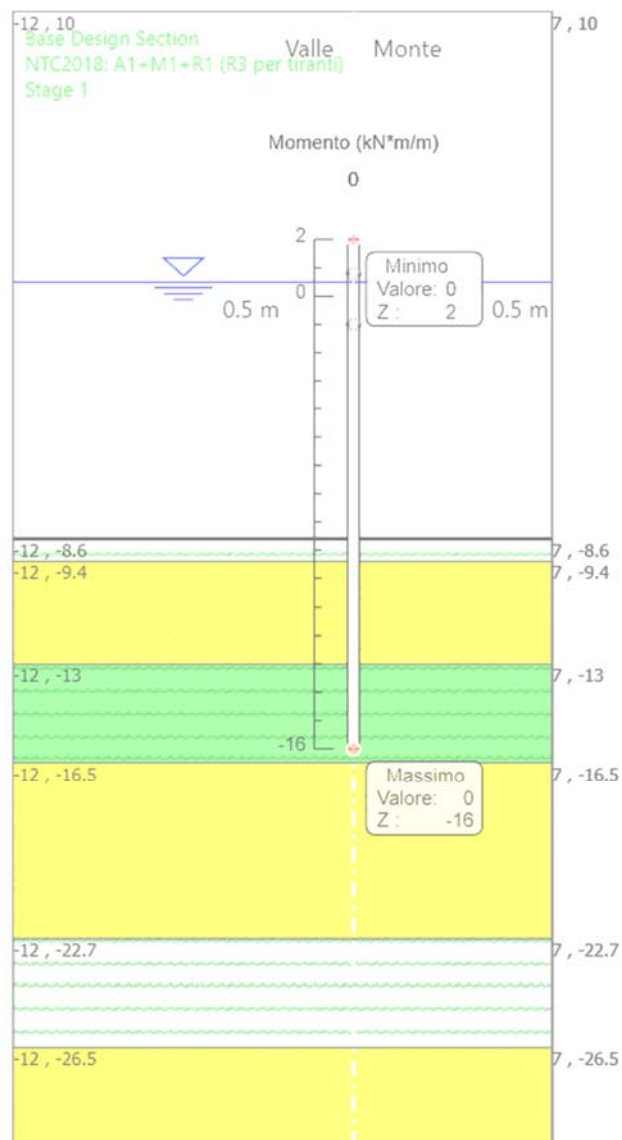


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 0 geo

Momento

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 1

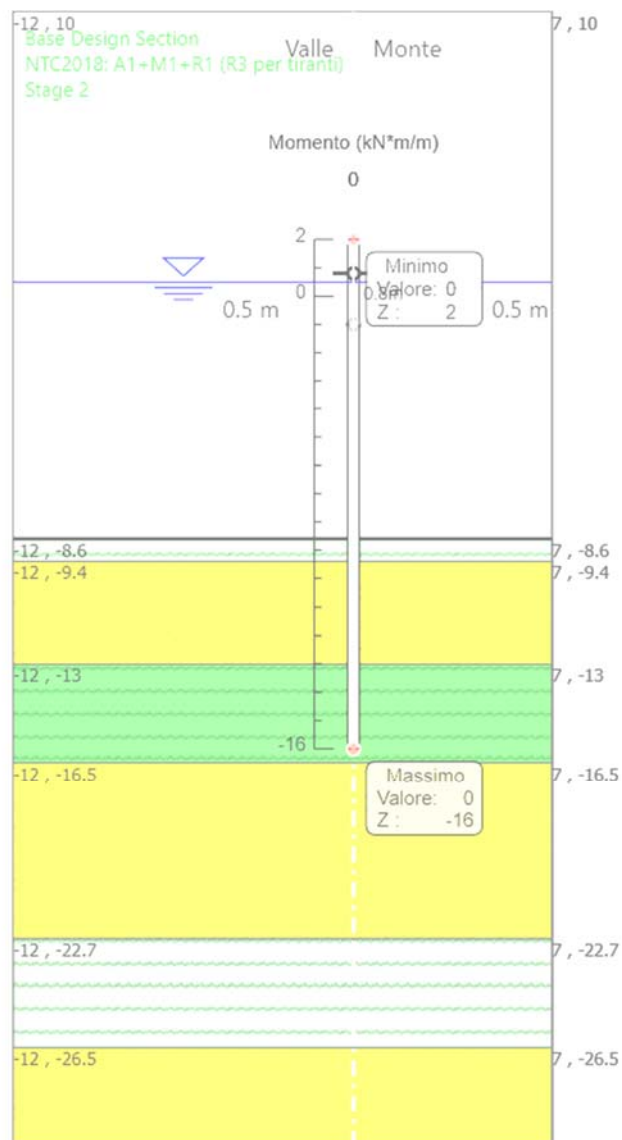


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 1

Momento

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 2

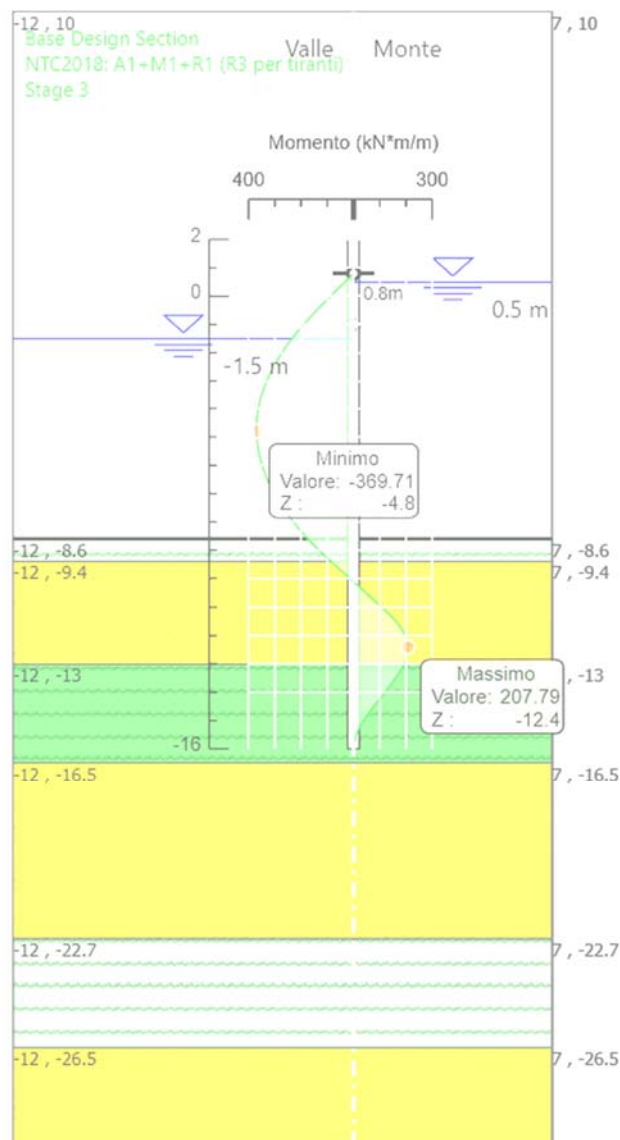


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 2

Momento

### Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 3

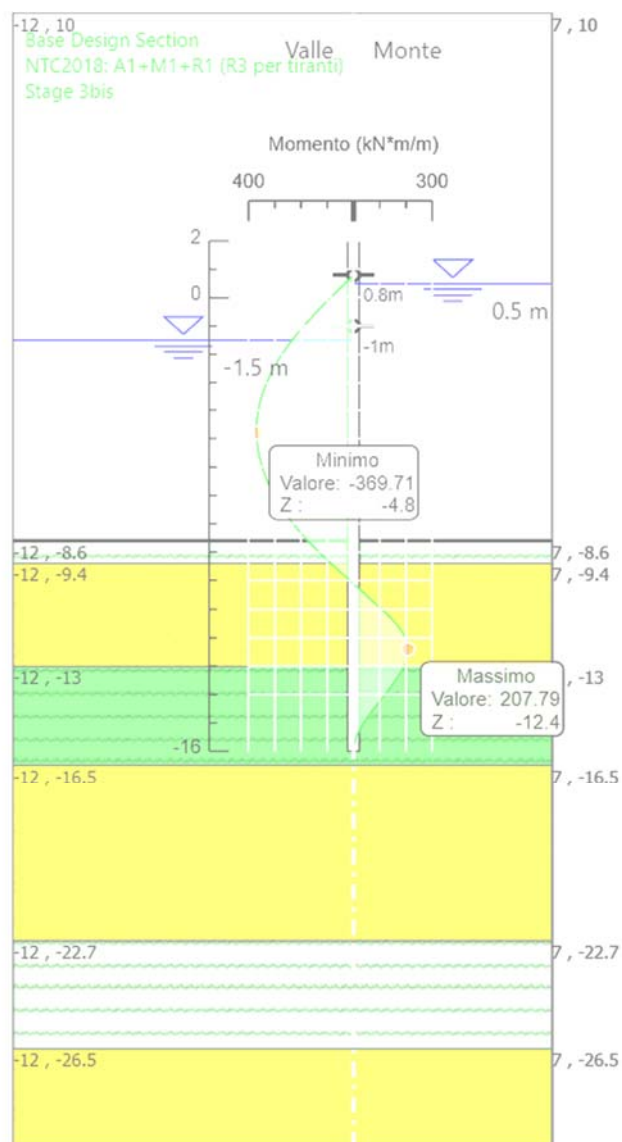


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 3

Momento

### Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 3bis

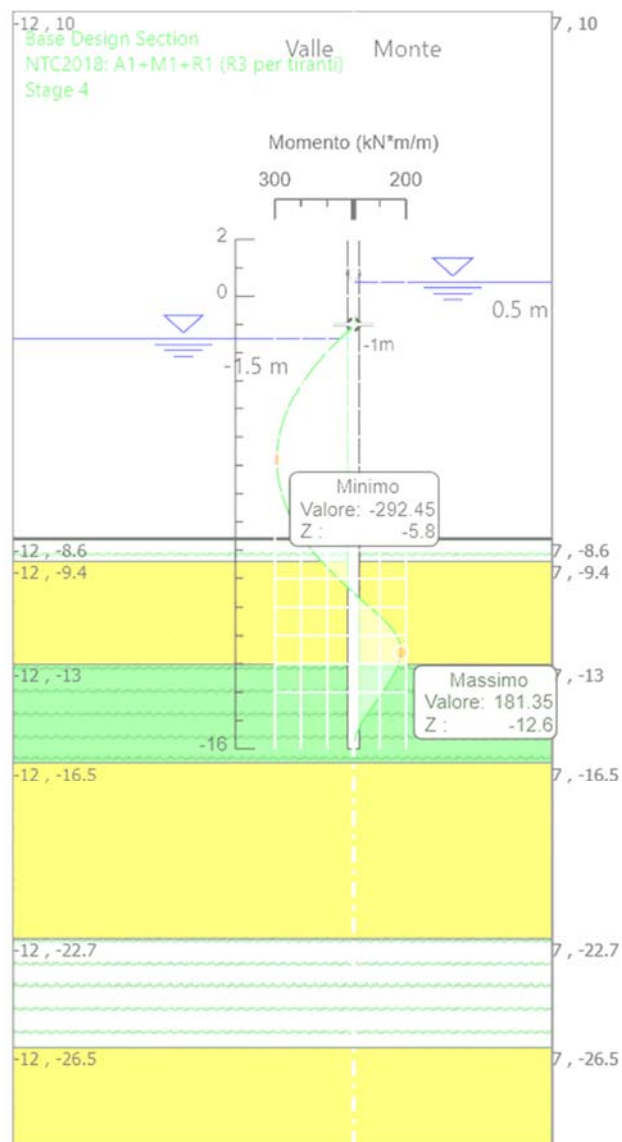


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 3bis

Momento

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 4

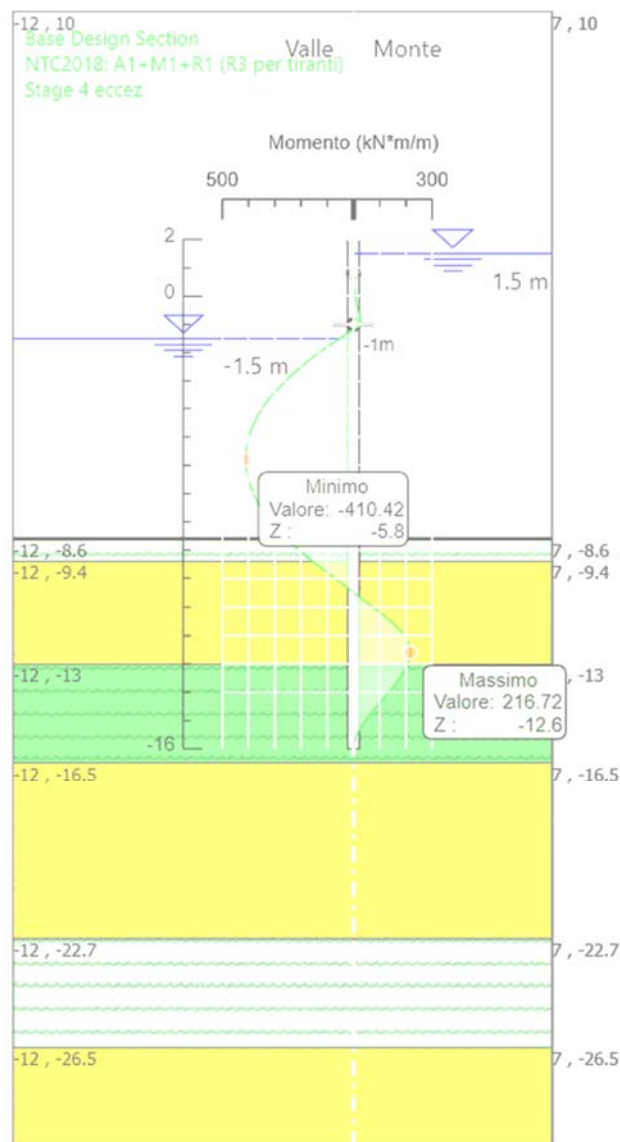


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 4

Momento

## Grafico Risultati Momento NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 4 eccez



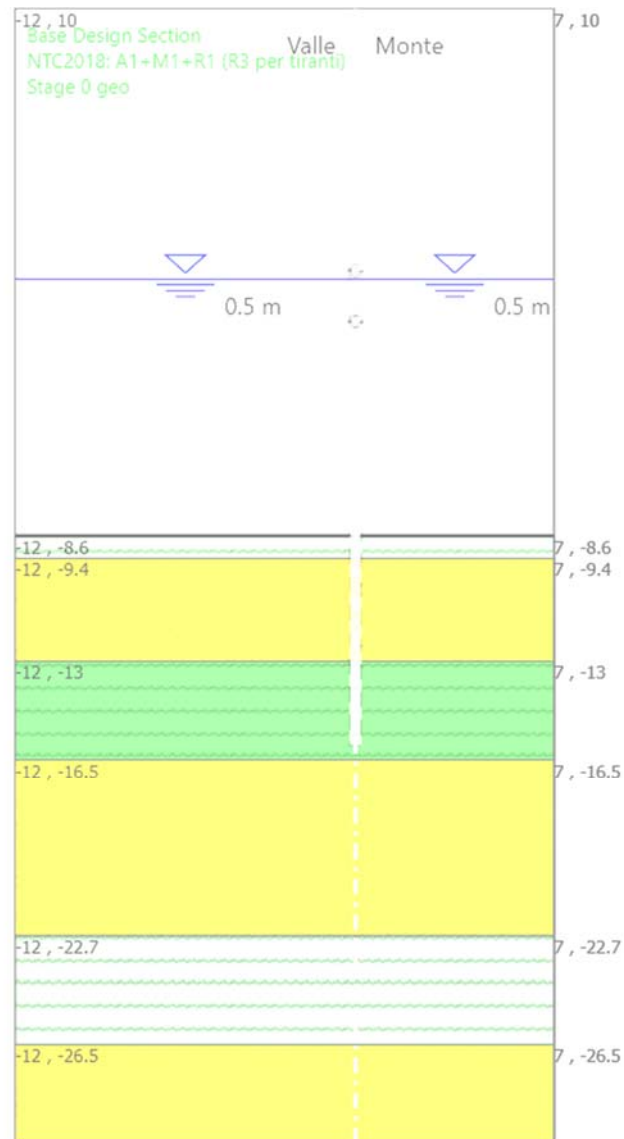
Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 4 eccez

Momento



## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 0 geo

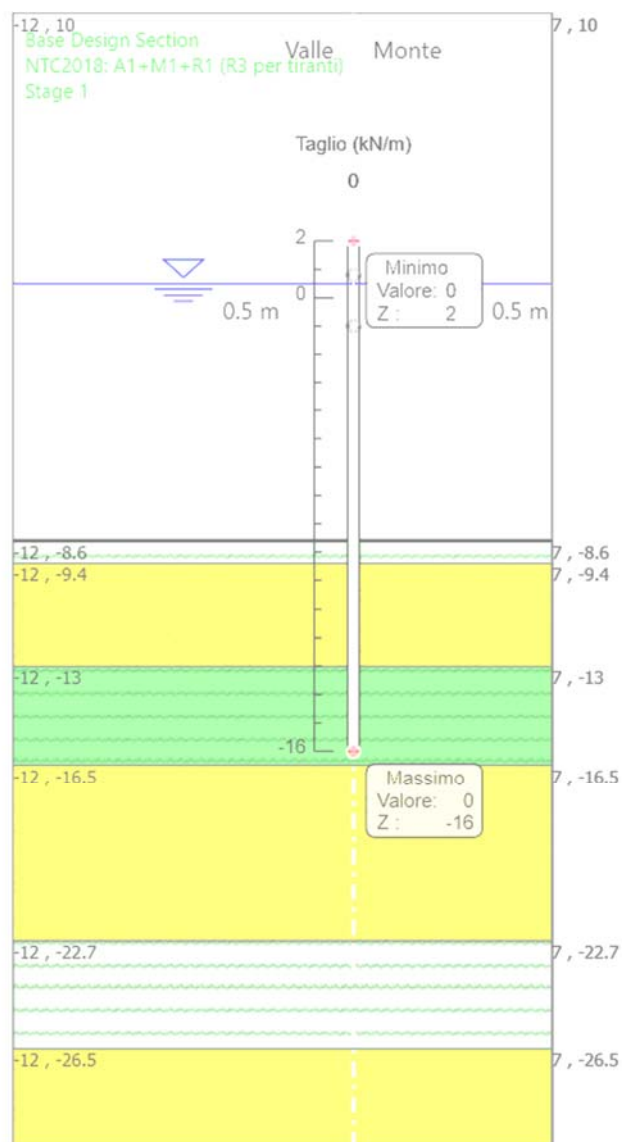


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 0 geo

Taglio

## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 1

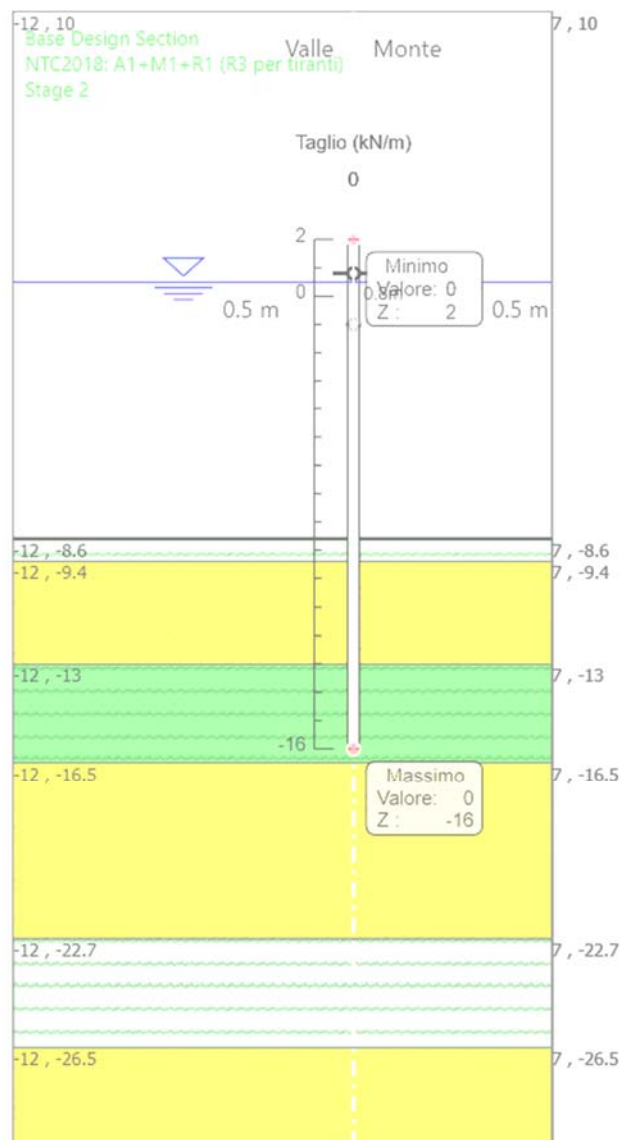


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 1

Taglio

## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 2

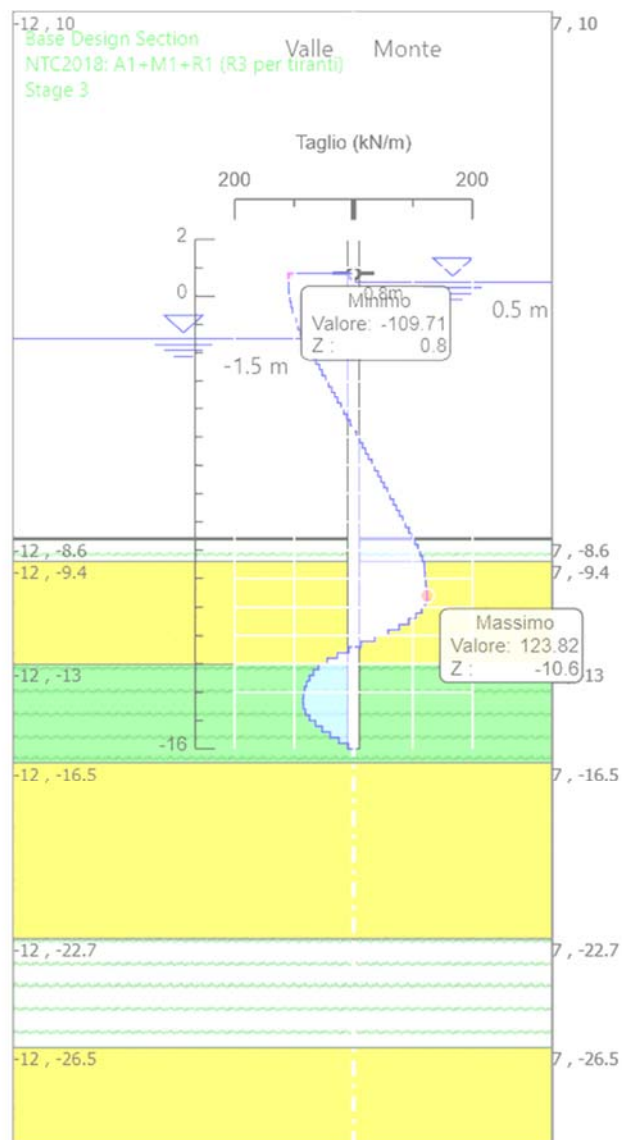


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 2

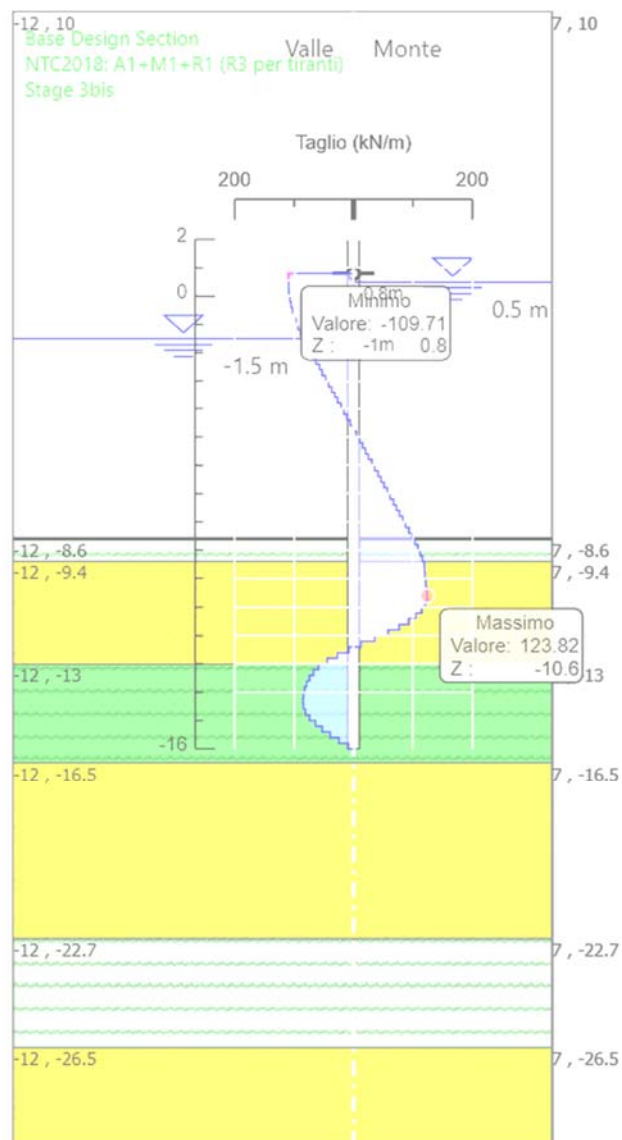
Taglio

### Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 3



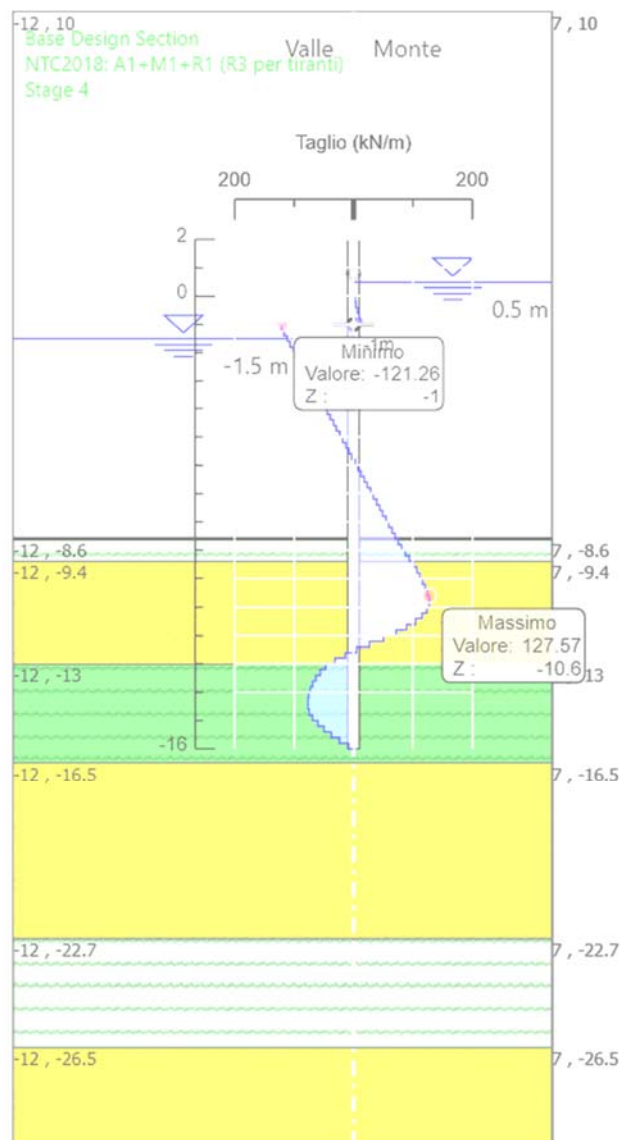
Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)  
 Stage: Stage 3  
 Taglio

### Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 3bis



Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)  
 Stage: Stage 3bis  
 Taglio

## Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 4

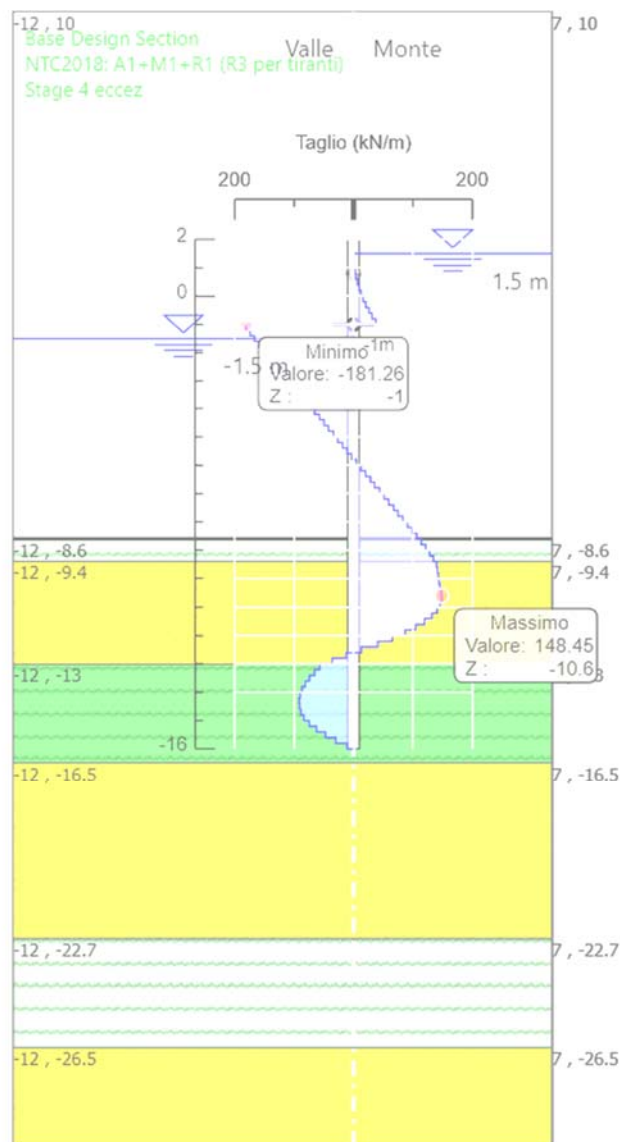


Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)

Stage: Stage 4

Taglio

### Grafico Risultati Taglio NTC2018: A1+M1+R1 (R3 per tiranti) - Stage: Stage 4 eccez



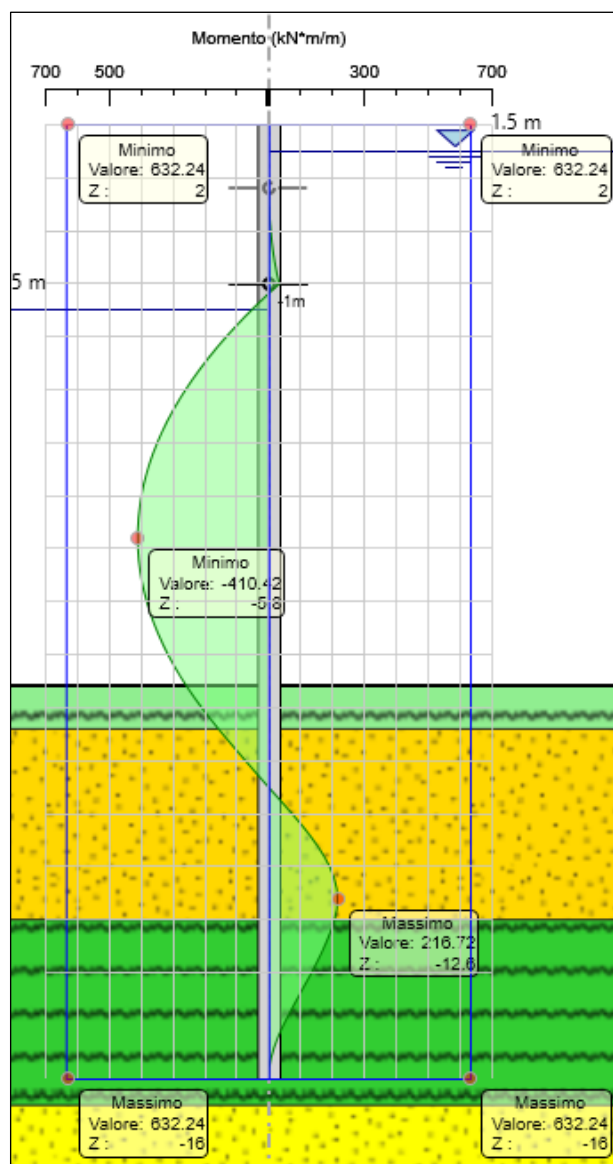
Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti)  
 Stage: Stage 4 eccez  
 Taglio

## 6.5 VERIFICHE DI RESISTENZA STRUTTURALE DELLE PALANCOLE

Le verifiche strutturali delle palancole sono effettuate nella combinazione A1+M1 delle NTC2018: nel presente paragrafo si riportano i diagrammi con l'andamento del momento di progetto agente sulle palancole e del momento resistente delle opere, e del taglio agente e del loro taglio resistente, nella fase in cui tali sollecitazioni risultano massime, ossia la 'fase 4 eccez': acqua alta eccezionale fino alla quota 1,50 m s.l.m. al di fuori del palancolato'. Dai grafici seguenti si può verificare come ***il massimo momento agente sulle palancole sia inferiore al loro momento resistente, e come altrettanto valga per il massimo taglio agente rispetto al taglio resistente delle opere.***

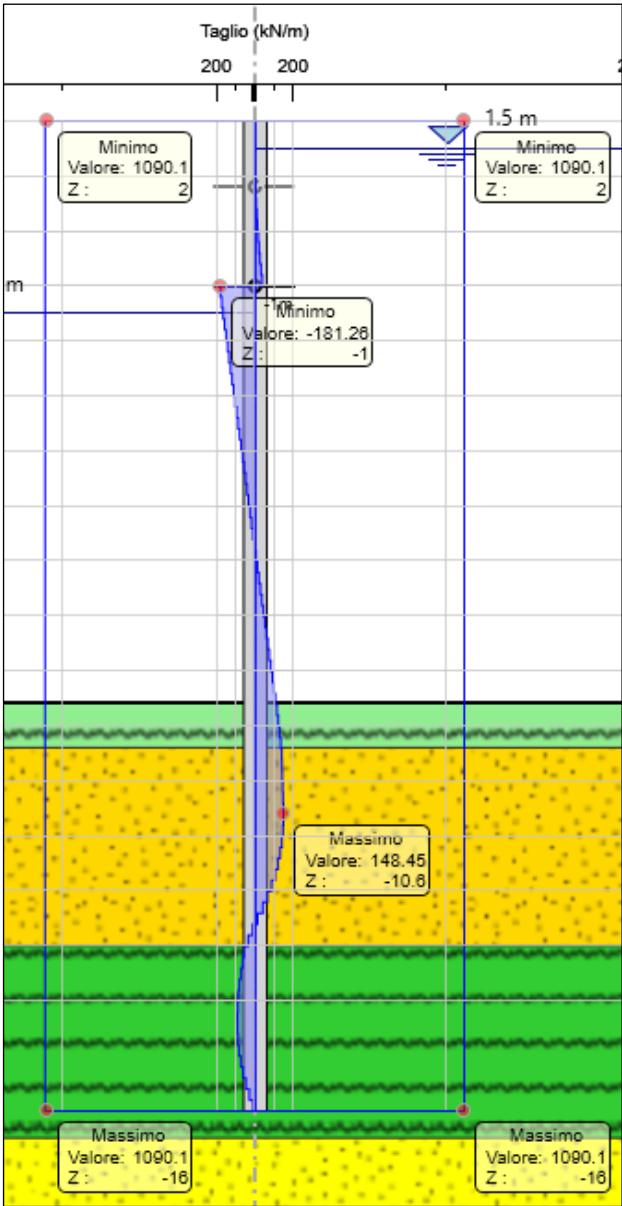
$$M_{max} = 410,42 \text{ kNm/m} < 632,24 \text{ kNm/m} = M_{rd}$$

$$T_{max} = 181,26 \text{ kN/m} < 1090,1 \text{ kN/m} = T_{rd}$$





**Confronto massimo momento agente sulle palancole e loro momento resistente  
(comb. STR, A1+M1)**



**Confronto massimo taglio agente sulle palancole e loro taglio resistente  
(comb. STR, A1+M1)**

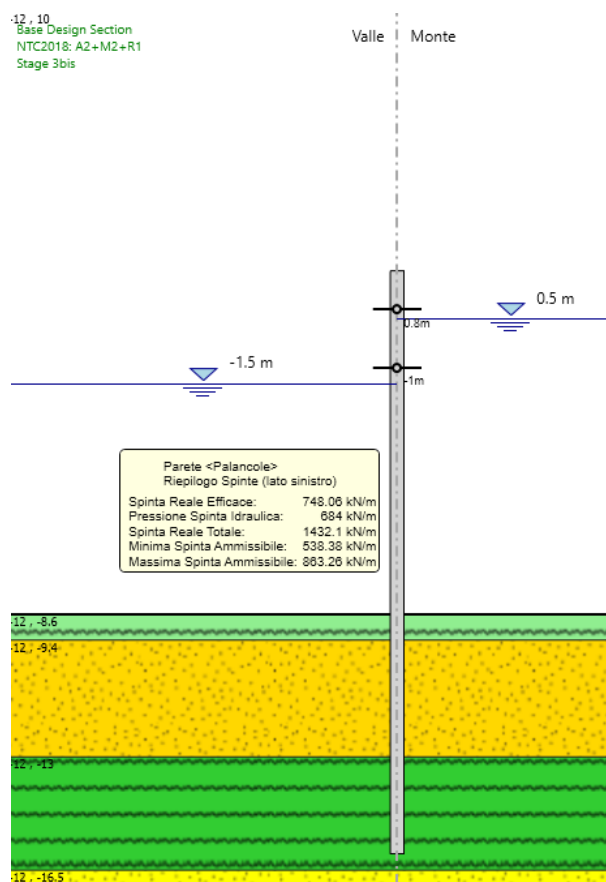
**Risultati Elementi strutturali - NTC2018: A1+M1+R1 (R3 per tiranti)**

Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Sollecitazione Puntello sup.	
Stage	Forza (kN/m)
Stage 2	0
Stage 3	-109.708352
Stage 3bis	-109.708352
Design Assumption: NTC2018: A1+M1+R1 (R3 per tiranti) Sollecitazione Puntello inf.	
Stage	Forza (kN/m)
Stage 3bis	0
Stage 4	-137.8793

Stage	Forza (kN/m)
Stage 4 eccz	-225.19835

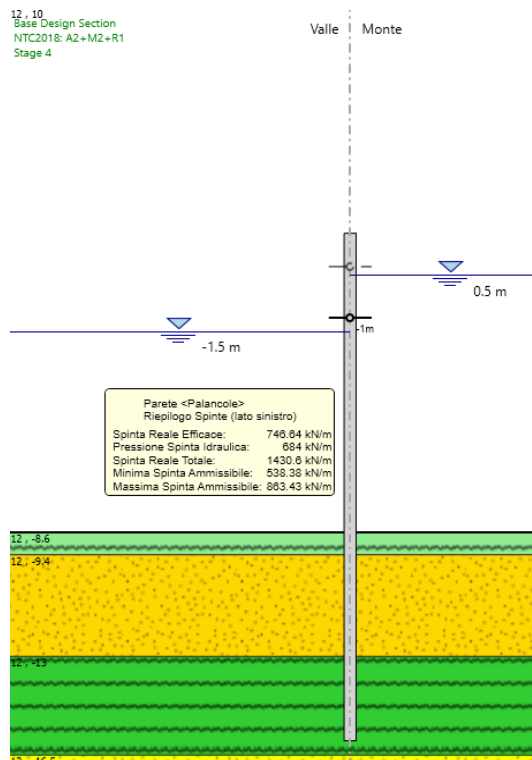
## 6.6 VERIFICHE DI RESISTENZA DEL TERRENO A VALLE DELLE PALANCOLE (GEO)

La verifica agli stati limite per il dimensionamento geotecnico delle palancole (GEO) è stata condotta considerando lo sviluppo di meccanismi di collasso determinati dalla mobilitazione della resistenza del terreno e dal raggiungimento delle condizioni di equilibrio limite nel terreno interagente con le palancole nella combinazione A2+M2+R1, secondo quanto indicato al par. C.6.5.3.1.2 della Circolare n° 7 del 21 gennaio 2019. A valle delle palancole la risultante efficace delle spinte va confrontata con la resistenza passiva offerta dalla parte infissa: il loro rapporto  $E_d / R_d$  è comunque inferiore all'unità in tutte le fasi, tale verifica risulta soddisfatta. Si riporta di seguito, in corrispondenza delle tre fasi più gravose, la *fase 3bis*, la *fase 4* e la *fase 4 eccez.*, il riepilogo delle spinte risultante nelle tre fasi:



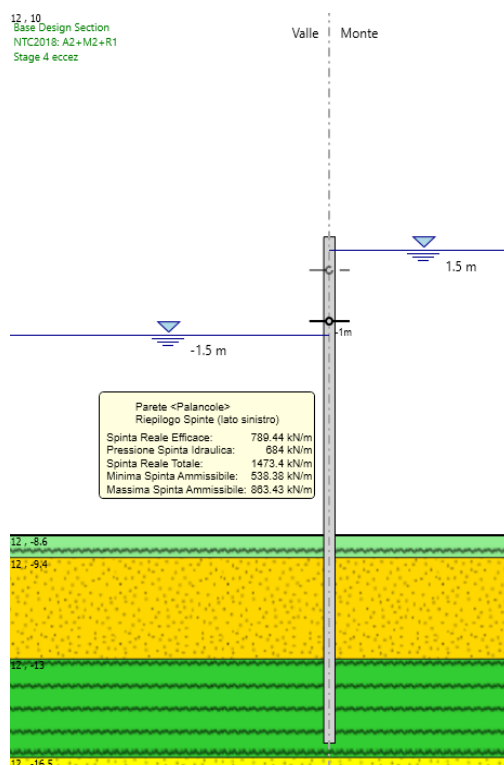
### **Riepilogo delle spinte nella 'fase 3 bis' (A2+M2+R1)**

$$E_d / R_d = 748.06 \text{ kN/m} / 863.26 \text{ kN/m} \approx \mathbf{0.87}$$



**Riepilogo delle spinte nella 'fase 4' (A2+M2+R1)**

$$E_d / R_d = 746.64 \text{ kN/m} / 863.43 \text{ kN/m} \approx 0.86$$

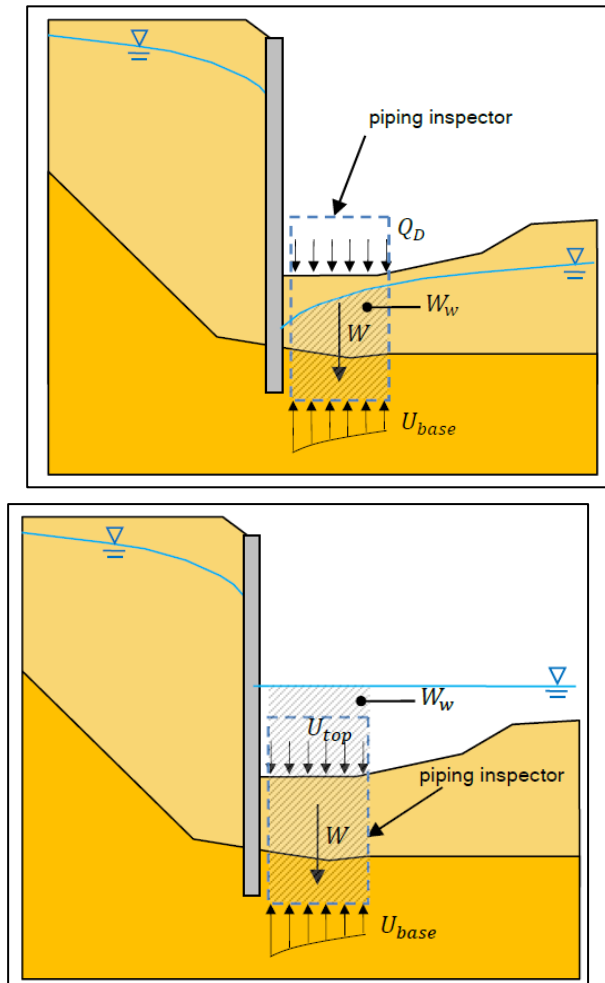


**Riepilogo delle spinte nella 'fase 4 eccez.' (A2+M2+R1)**

$$E_d / R_d = 789.44 \text{ kN/m} / 863.43 \text{ kN/m} \approx 0.91$$

## 6.7 VERIFICHE IDRAULICHE

### Procedura di calcolo del software Paratie Plus 22



**Schematizzazione del calcolo di filtrazione del software Paratie Plus 22**

#### 6.7.1 Verifica a sollevamento

Il software Paratie Plus calcola il rapporto tra i carichi verticali e le sottospinte idrauliche al fine di valutare la **sicurezza a sollevamento** nel seguente modo:

$$F_{S\ UPLIFT} = \frac{W + Q_d}{U_{base} - U_{top}}$$

Per la normativa italiana, assumendo un coefficiente parziale  $\gamma_{G1}$  pari a 1,10 per le azioni destabilizzanti e pari a 0,90 per quelle stabilizzanti, la verifica idraulica a sollevamento condotta con il software Paratie Plus risulta pertanto soddisfatta se

$$F_{S\ UPLIFT} > \frac{1,10}{0,90} = 1,22$$

### 6.7.2 Verifica a sifonamento

Il software determina un coefficiente di sicurezza nei confronti del sifonamento in termini efficaci, dato da

$$F_{S\text{Terzaghi}} = \frac{i_c}{i_e}$$

in cui  $i_e$ , gradiente medio di efflusso, vale  $\delta h / H$ , e  $i_c$ , gradiente critico, è pari a  $\gamma' / \gamma_w$

Secondo quanto prescritto dalle NTC 2018, la verifica a sifonamento risulta soddisfatta se  $i \leq i_c / 3$ , nei casi in cui il gradiente idraulico risulti quello medio.

Affinché tale verifica sia soddisfatta secondo le NTC 2018, il coefficiente  $F_{S\text{Terzaghi}}$  risultante dall'analisi con il software Paratie Plus deve pertanto risultare

$$F_{S\text{Terzaghi}} = \frac{i_c}{i_e} \geq 3$$

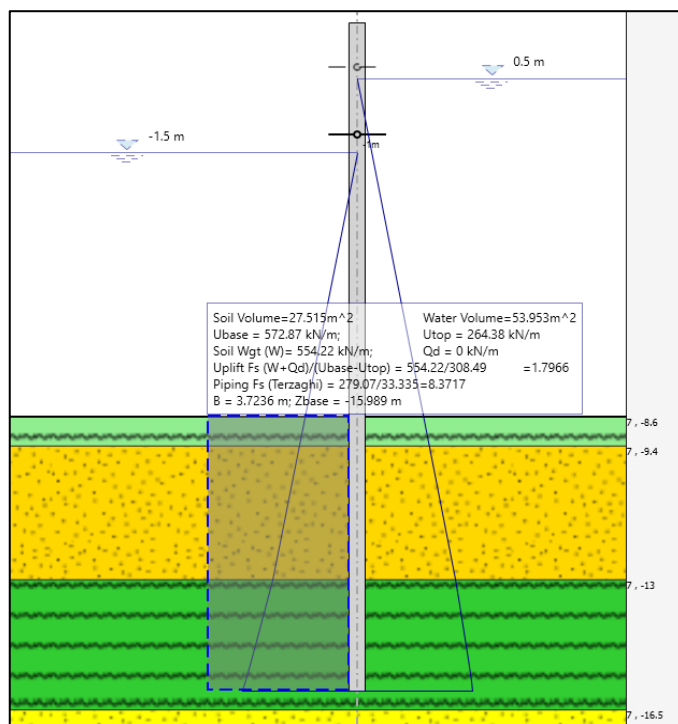
### 6.7.3 Risultati dell'analisi di filtrazione

Si riportano di seguito i risultati dell'analisi di filtrazione, condotta nei due casi seguenti:

CASO 1) acqua a monte delle palancole a quota +0,50 m s.l.m. ed acqua a valle delle palancole a quota -1,50 m s.l.m;

CASO 2) acqua a monte delle palancole a quota +1,50 m s.l.m. ed acqua a valle delle palancole a quota -1,50 m s.l.m.

#### **CASO 1**



Come si evince dalla figura sovrastante, le verifiche idrauliche risultano soddisfatte, infatti:

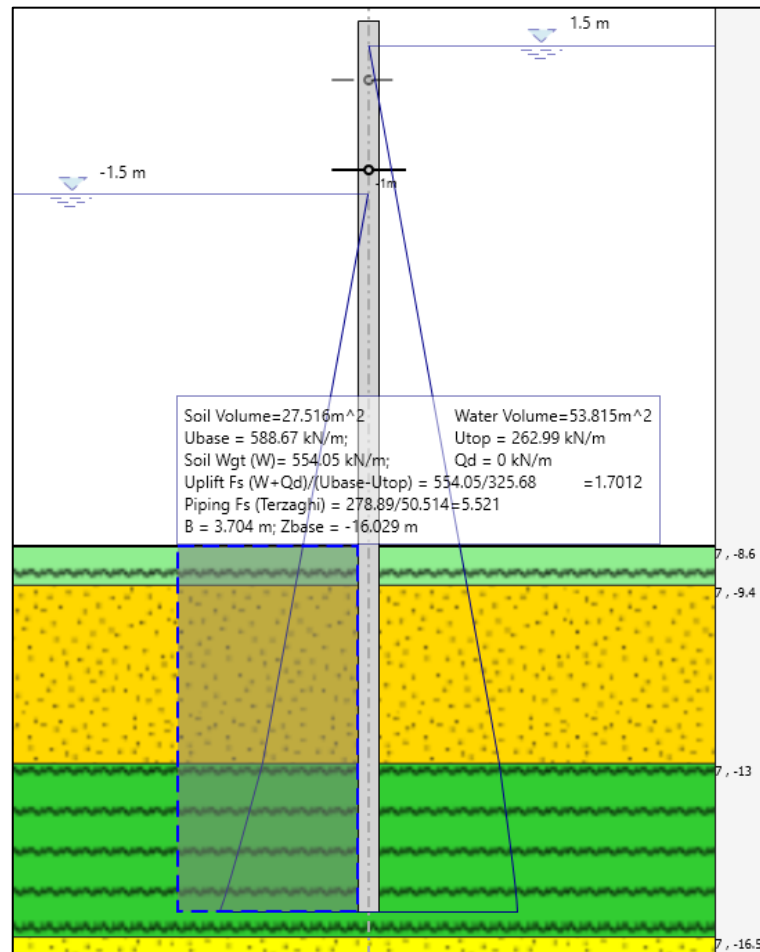
**Verifica a sollevamento**

$$F_{S\ UPLIFT} = 1,7966 > 1,22$$

**Verifica a sifonamento**

$$F_{S\ Terzaghi} = \frac{i_c}{i_e} = 8,3717 \geq 3$$

**CASO 2**



Come si evince dalla figura sovrastante, le verifiche idrauliche risultano soddisfatte, infatti:

**Verifica a sollevamento**

$$F_{S\ UPLIFT} = 1,7012 > 1,22$$

**Verifica a sifonamento**

$$F_{S\ Terzaghi} = \frac{i_c}{i_e} = 5,521 \geq 3$$

## **7 CONSIDERAZIONI CONCLUSIVE**

Nell'analisi con la stratigrafia CV1 la verifica geotecnica dell'infissione delle palancole è soddisfatta al limite (è richiesto un rapporto spinta/resistenza passiva inferiore all'unità e nell'analisi nella fase di marea eccezionale a 1,50 m a monte delle palancole tale rapporto risulta 0,99). Sempre con la stratigrafia CV1 si ha uno spostamento delle palancole di 12,5 cm nella fase eccezionale di marea a 1,50 m a monte.