

AUTOSTRADA (A14) : BOLOGNA-BARI-TARANTO

TRATTO: BOLOGNA BORGO PANIGALE - BOLOGNA SAN LAZZARO

POTENZIAMENTO IN SEDE DEL SISTEMA
AUTOSTRADALE E TANGENZIALE DI BOLOGNA

"PASSANTE DI BOLOGNA"

PROGETTO DEFINITIVO

VIABILITA' INTERFERITA



LINEA FERROVIARIA FS Bologna-Padova pk12+467

Cavalcaferrovia ex79T - F.S. - 12+467

Relazione di calcolo fondazioni

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CODICE IDENTIFICATIVO										ORDINATORE		
RIFERIMENTO PROGETTO			RIFERIMENTO DIRETTORIO				RIFERIMENTO ELABORATO					
Codice Commessa	Lotto, Sub-Prog, Cod. Appalto	Fase	Capitolo	Paragrafo	W B S	Parte d'opera	Tip.	Disciplina	Progressivo	Rev.	--	
111465	0000	PD	IN	T03	CV79F	FND00	R	A	P	E	2530 - 2	SCALA VARIE

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PONTE AD ARCO-TRAVE

PROGETTO DEFINITIVO

Relazione di calcolo fondazioni

Cavalcavia CV03 (ex CV79T) km 12+466

PROGETTAZIONE



REV.	DATA	DESCRIZIONE	REDATTO	CONTROLLATO	APPROVATO
2	15/10/2020	REVISIONE	DeBenedetti	Vaccarezza	Maestrelli
1	02/10/2020	REVISIONE	DeBenedetti	Vaccarezza	Maestrelli
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1 GENERALITA'

1.1 Descrizione dell'opera

Nel presente documento si riporta il dimensionamento delle fondazioni del cavalcavia ferroviario sulla linea BO-PD con progr. Km 12+466 (ex CV79T), la cui realizzazione è prevista nell'ambito dei lavori di potenziamento del sistema tangenziale di Bologna tra Borgo Panigale e San Lazzaro.

Le spalle del cavalcavia sono costituite da scatolari in c.a. (dimensioni in pianta 13.0 m x 15.4 m circa) che verranno realizzati mantenendo in esercizio la linea ferroviaria esistente con montaggio provvisorio di un ponte "Bologna 25" e scavo sotto di esso, previa realizzazione di paratie di micropali, opportunamente puntonate. La quota di imposta della fondazione degli scatolari delle spalle è a +26.8 m s.l.m..

In relazione ai carichi agenti ed ai terreni in sito, le fondazioni delle spalle saranno costituite da pali trivellati di grande diametro ($D=1500$ mm) disposti su due ali laterali dello scatolare.

Nella fase di varo impalcato, alcuni pali definitivi della spalla saranno utilizzati per la fase di varo impalcato con altri pali di fondazione appositamente eseguiti per la spalla provvisoria. Nella seguente Figura 3 è mostrata la configurazione dei pali di fondazione per la spalla di varo provvisoria. I dimensionamenti di questa fondazione provvisoria sono riportati in apposita relazione di calcolo a cui si rimanda [DC5].

La disposizione in pianta dei pali è mostrata nella seguente figura.

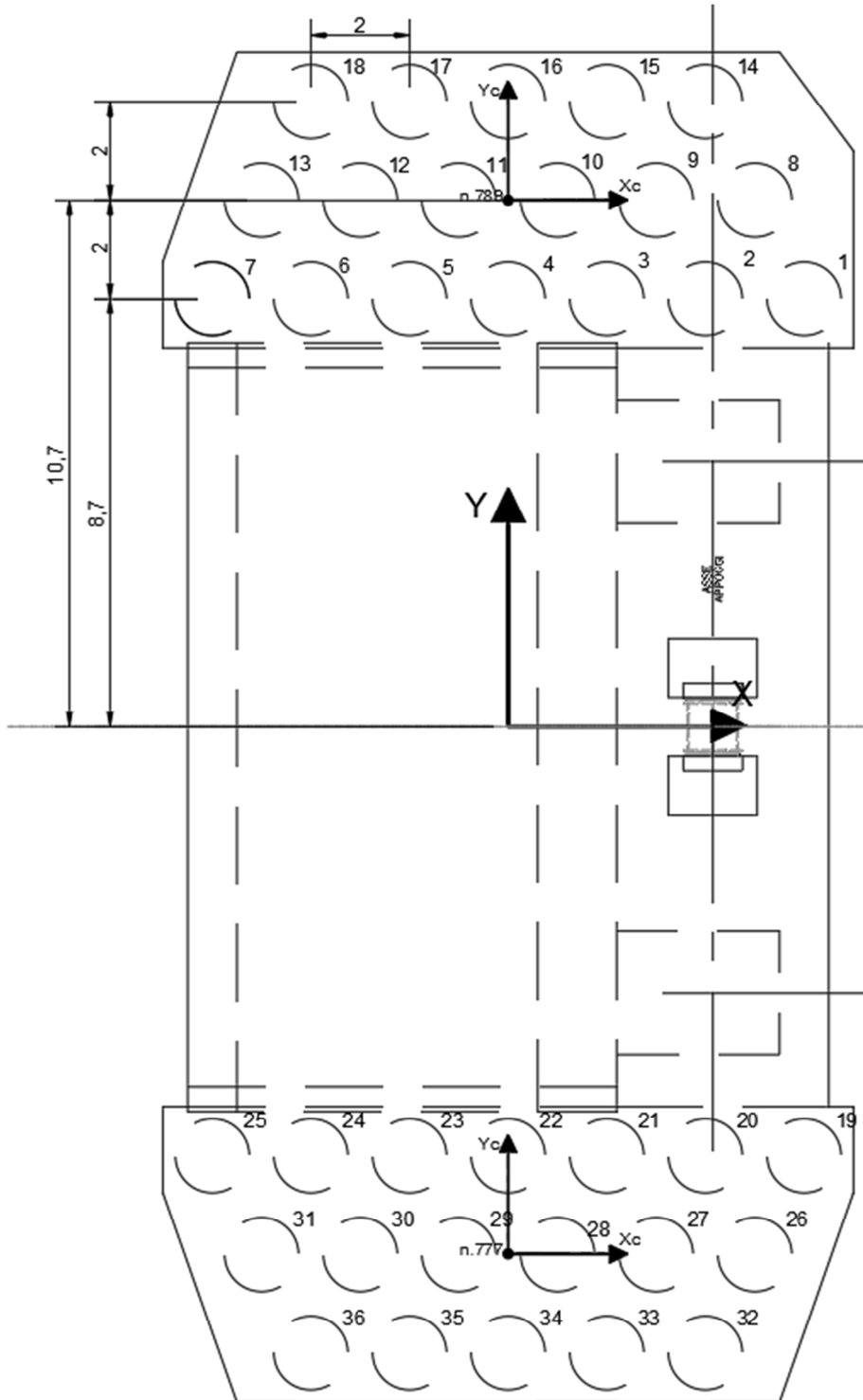


Figura 1 – Pianta pali della fondazione spalla definitiva

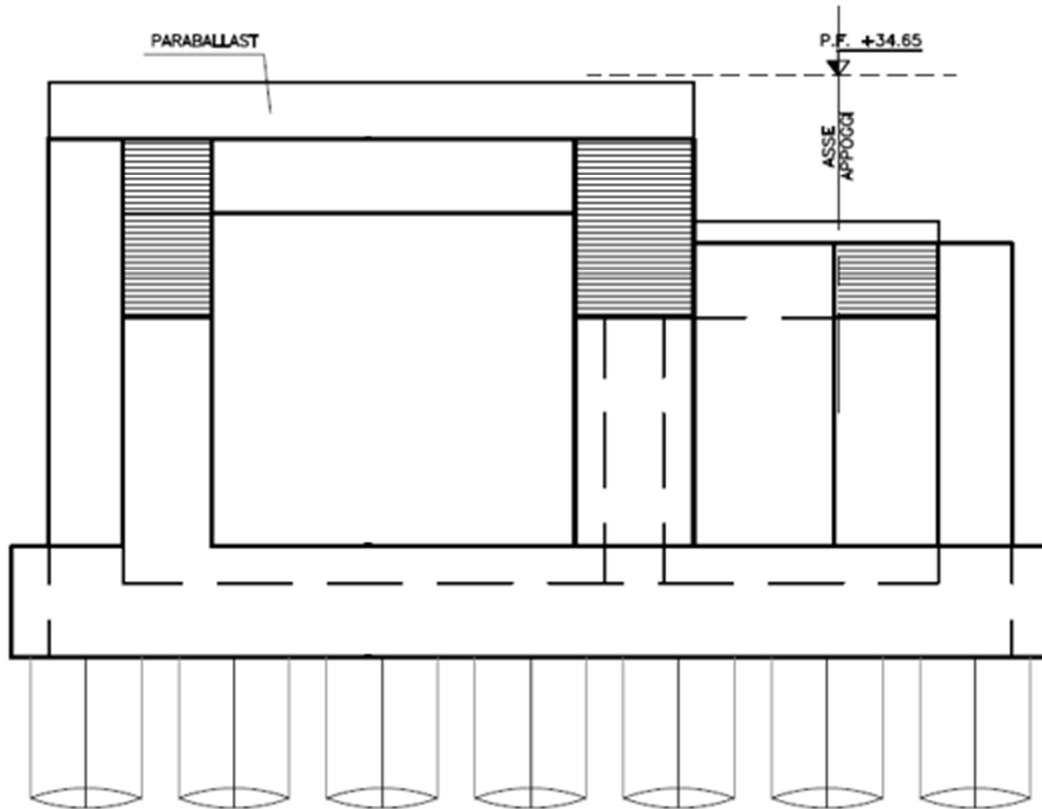


Figura 2 – Sezione trasversale spalla

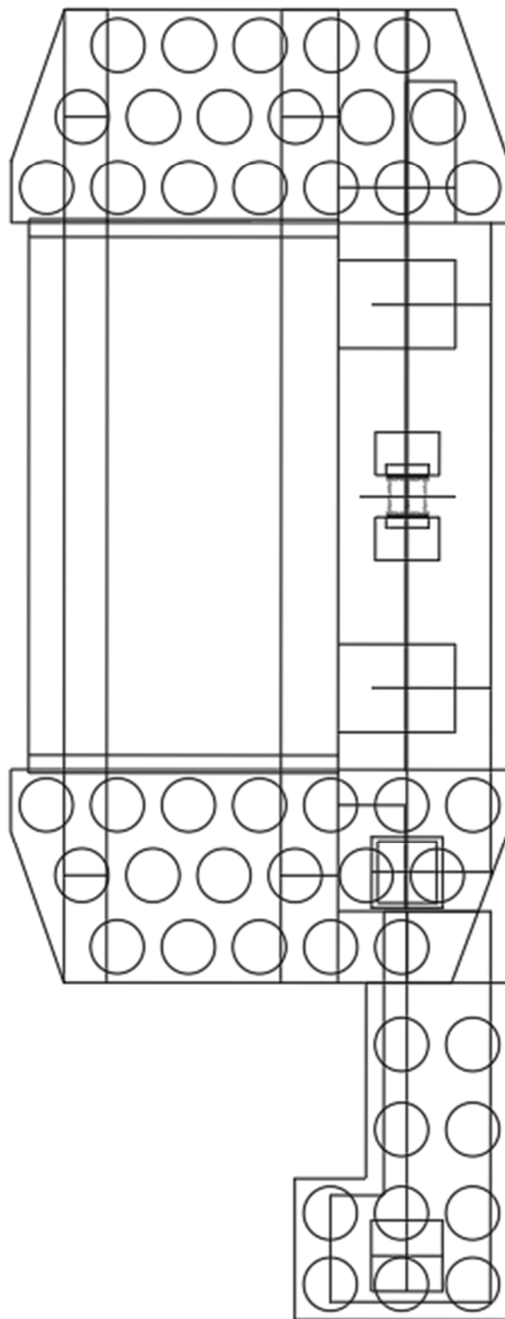


Figura 3 – Pianta pali fase provvisoria di varo

2 **NORMATIVA E DOCUMENTI DI RIFERIMENTO**

2.1 **Normativa di riferimento**

La redazione del presente documento è stata svolta secondo le prescrizioni della normativa vigente ed in particolare:

- NT1. Norme Tecniche per le Costruzioni D.M del 17.01.2018.
- NT2. Istruzioni per l'applicazione delle "Norme Tecniche per le Costruzioni approvate con D.M del 17.1.2018" - Circolare n.7 C.S.LL.PP. 21.01.2019.
- NT3. RFI DTC SI PS MA IFS 001 D manuale di progettazione delle opere civili – parte II – sezione 2 – Ponti e Strutture.
- NT4. RFI DTC SI CS MA IFS 001 D manuale di progettazione delle opere civili – parte II – sezione 3 – Corpo stradale.
- NT5. EUROCODICI.

2.2 **Documenti di riferimento**

La redazione del presente elaborato è stata svolta con riferimento ai seguenti documenti di riferimento.

- [DC1]. APE0001_ Relazione geotecnica generale potenziamento del sistema tangenziale di Bologna tra Borgo Panigale e San Lazzaro. Progetto Definitivo. Novembre 2016.
- [DC2]. Autostrada A14. Potenziamento del sistema tangenziale di Bologna tra Borgo Panigale e San Lazzaro. Planimetria e profilo geotecnico dal km 11+700 al km 13+200 (tavola 4 di 10). Progetto Definitivo. Novembre, 2016.
- [DC3]. Relazione di calcolo delle opere provvisorie dei CV1, CV2, CV3 nell'ambito sistema tangenziale di Bologna tra Borgo Panigale e San Lazzaro. Progetto Definitivo. Ottobre 2020.
- [DC4]. Elaborati grafici del cavalcaferrovia CV3 nell'ambito sistema tangenziale di Bologna tra Borgo Panigale e San Lazzaro. Progetto Definitivo. Ottobre 2020.
- [DC5]. Relazione di calcolo delle fondazioni delle pile e spalle provvisorie per il varo impalcato nell'ambito sistema tangenziale di Bologna tra Borgo Panigale e San Lazzaro. Progetto Definitivo. Ottobre 2020.

2.3 **Software**

- MAP Matrix Analysis of Piles (G. Guiducci, 1999). Rimini (RN), Italia. Programma di calcolo per analisi delle sollecitazioni e deformazioni di tipo lineare e non lineare di palificate di fondazione collegate da plinto rigido.

I risultati delle analisi ottenuti con la metodologia sopra descritta sono in linea con quelli ottenuti con il programma GROUP (Ensoft INC. engineering software Ausin Texas USA) utilizzato in vari ambiti progettuali ad esempio nella progettazione della linea ferroviaria Alta Velocità MI-NA (Roma-Napoli e Milano-Bologna) e quindi validato da Italferr. Ciò è stato possibile attraverso un procedimento di taratura e l'utilizzo dei medesimi criteri di valutazione delle rigidità e degli effetti gruppo utilizzati nel programma GROUP.

- PAL (G. Guiducci, 1999-2006). Rimini (RN), Italia.
Programma di valutazione capacità portante per pali singoli di fondazione soggetti a carichi assiali. Sono implementati diverse metodologie di calcolo di portata laterale e di base pubblicati in letteratura tecnica. L'elaborazione opera secondo somma di contributi unitari.
- APAL (G. Guiducci, 2006). Rimini (RN), Italia.
Programma per l'analisi di pali caricati assialmente: curve carico-cedimento; trasferimento sforzo assiale.

Per il programma citato, con riferimento al paragrafo 10.2 del D.M. 17.01.2018 e relativa Circolare esplicativa n° 7/19 C.S.LL.PP., si dichiara che:

- i risultati dei calcoli eseguiti con l'utilizzo del calcolatore sono stati verificati dal progettista;
- i risultati presentati nelle forme allegate al progetto ne garantiscano la leggibilità, la corretta interpretazione e la riproducibilità;
- l'affidabilità dei codici utilizzati è stata verificata attraverso esame preliminare, di valutazione dell'affidabilità e soprattutto dell'idoneità del programma nel caso specifico di applicazione;
- la validazione dei codici di calcolo è stata verificata sia per confronto con soluzioni semplificate con metodi tradizionali, sia dall'esame della documentazione fornita dal produttore/distributore sulle modalità e procedure seguite per la validazione generale del codice.

3 MATERIALI

Calcestruzzo per pali di fondazione: Classe C 28/35

Resistenza caratteristica a compressione: $R_{ck} \geq 35 \text{ N/mm}^2$

Resistenza cilindrica a compressione: $f_{ck} = 0,83 R_{ck} = 29.05 \text{ N/mm}^2$
 $f_d = 16.46 \text{ N/mm}^2$

Acciaio in barre: B450C avente caratteristiche:

tensione caratteristica di snervamento $f_{yk} \geq 450 \text{ N/mm}^2$

tensione caratteristica di rottura $f_{tk} \geq 540 \text{ N/mm}^2$

4 CARATTERIZZAZIONE GEOTECNICA

Nel presente capitolo si riporta la caratterizzazione geotecnica per l'opera in esame in accordo alla relazione geotecnica generale della tratta A14 Bologna – Bari – Taranto nell'ambito del Potenziamento del Sistema Tangenziale di Bologna tra Borgo Panigale e San Lazzaro [DC1].

La stratigrafia è stata dedotta sulla base delle indagini geotecniche eseguite in corrispondenza dell'opera, elencate nella seguente tabella.

Tabella 1 - Indagini geognostiche di riferimento

Sigla sond./pozz./prova	Campagna di indagine	Progressiva (km)	Quota p.c. (m s.l.m.)	Lunghezza (m)	Strumentazione installata
S65	1984	12+375	34.30	15.0	-
SI04	1986	12+480	34.00	30.0	C (16m)
S102	2000	12+400	34.00	10.0	-
PB12-DH	2016	12+500	33.60	35.0	DH
PZ-PB5	2016	12+500	33.70	5.0	-

C (...) = cella piezometrica Casagrande (profondità cella);
DH = tubo per misure Down-hole.

Nella seguente tabella si riassume la stratigrafia di riferimento per l'opera con riferimento ad una quota di p.c. di +34 m s.l.m..

Tabella 2 - Stratigrafia e falda

Profondità (m da p.c.)	Descrizione	Unità geotecnica
0.0 ÷ 10.0	Limo argilloso	A
10.0 ÷ 15.0	Ghiaia e sabbia	B
15.0 ÷ 20.0	Limo argilloso	A
20.0 ÷ 33.0	Ghiaia e sabbia	B
33.0 ÷ 40.0	Limo argilloso	A
FALDA: 9.0 m da p.c. (+25.4 m s.l.m.)		

Relativamente al livello di falda, è stato rilevato nel sondaggio SI-04 in data 21/03/1986: livello massimo a 9 m di profondità da p.c. (+25.4 m s.l.m.). Quindi cautelativamente per il dimensionamento delle opere si assumerà il livello massimo rilevato.

Nella seguente figura si riporta uno stralcio del profilo stratigrafico in corrispondenza dell'opera.

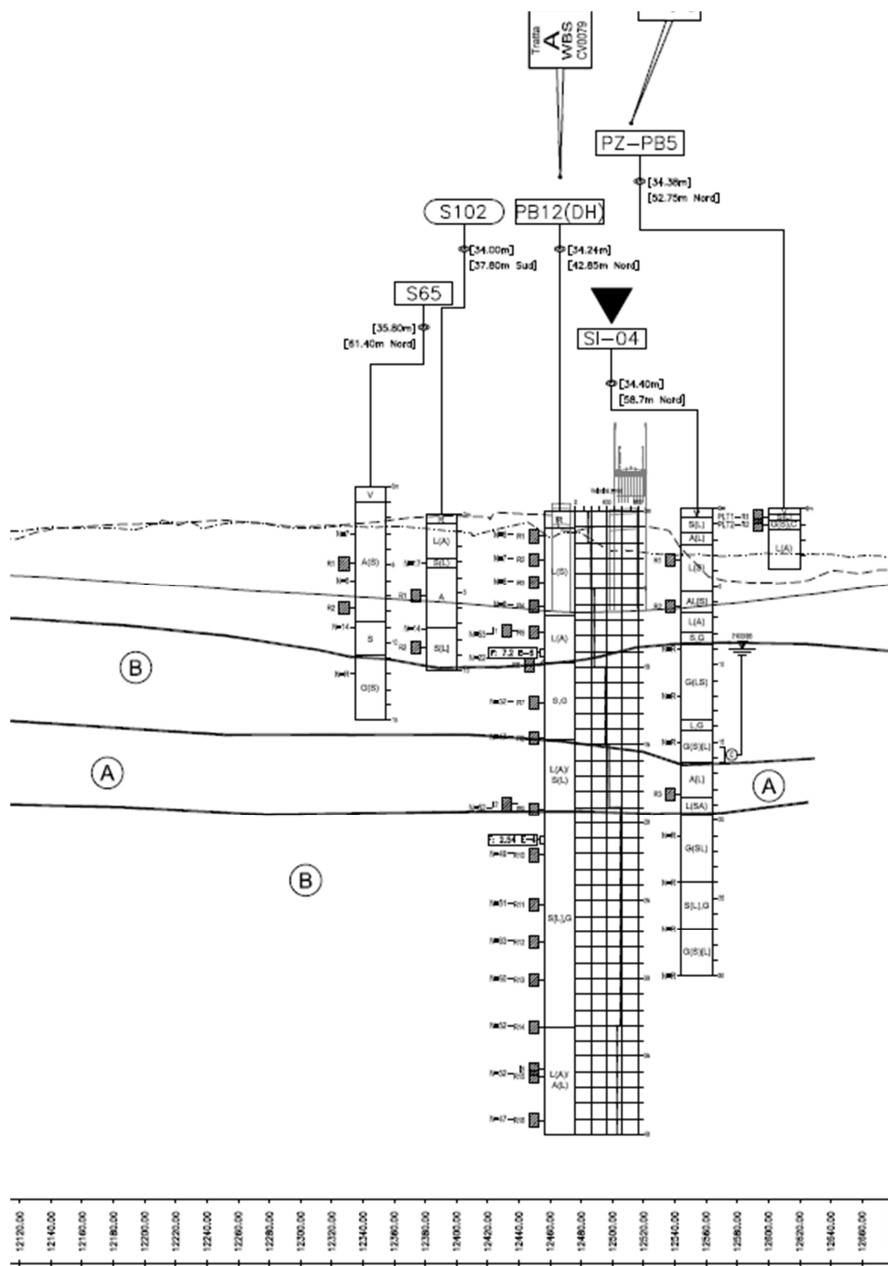


Figura 4 – stralcio profilo stratigrafico in corrispondenza dell'opera

Nelle seguenti tabelle si sintetizzano i parametri geotecnici delle unità geotecniche che interferiscono con l'opera desunti dalle tabelle riassuntive della Relazione Geotecnica generale ([DC1], a cui si rimanda per approfondimenti) e relativi grafici (vedasi Figura 5-Figura 9).

Tabella 3 - Parametri medi caratteristici dei materiali Limo argilloso (A)

Descrizione	γ	c'	ϕ'	c_u	E'
	(kN/m ³)	(kPa)	(°)	(kPa)	(kPa)
A - Limo argilloso	19÷20	0÷15	24÷28	$c_u = 30 + z$ (valori minimi) $c_u = 90 + 2 \cdot z$ (valori massimi)	$120 \cdot c_u$
Valori assunti in progetto	19	0	26	$c_u = 60 + 1.5 \cdot z$	10000

γ = peso di volume del terreno

c' = coesione efficace

ϕ' = angolo di resistenza al taglio

c_u = resistenza al taglio in condizioni non drenate

E' = modulo di deformazione elastico operativo per calcolo paratie

Tabella 4 - Parametri medi caratteristici dei materiali Ghiaia e Sabbia (B)

Descrizione	γ	Nspt	c'	ϕ'	E'
	(kN/m ³)	(colpi/30cm)	(kPa)	(°)	(MPa)
B - Ghiaia e sabbia	19	50÷65	0	35÷36	50

γ = peso di volume del terreno

c' = coesione efficace

ϕ' = angolo di resistenza al taglio

E' = modulo di deformazione elastico operativo per calcolo paratie (= $E_o / 5$)

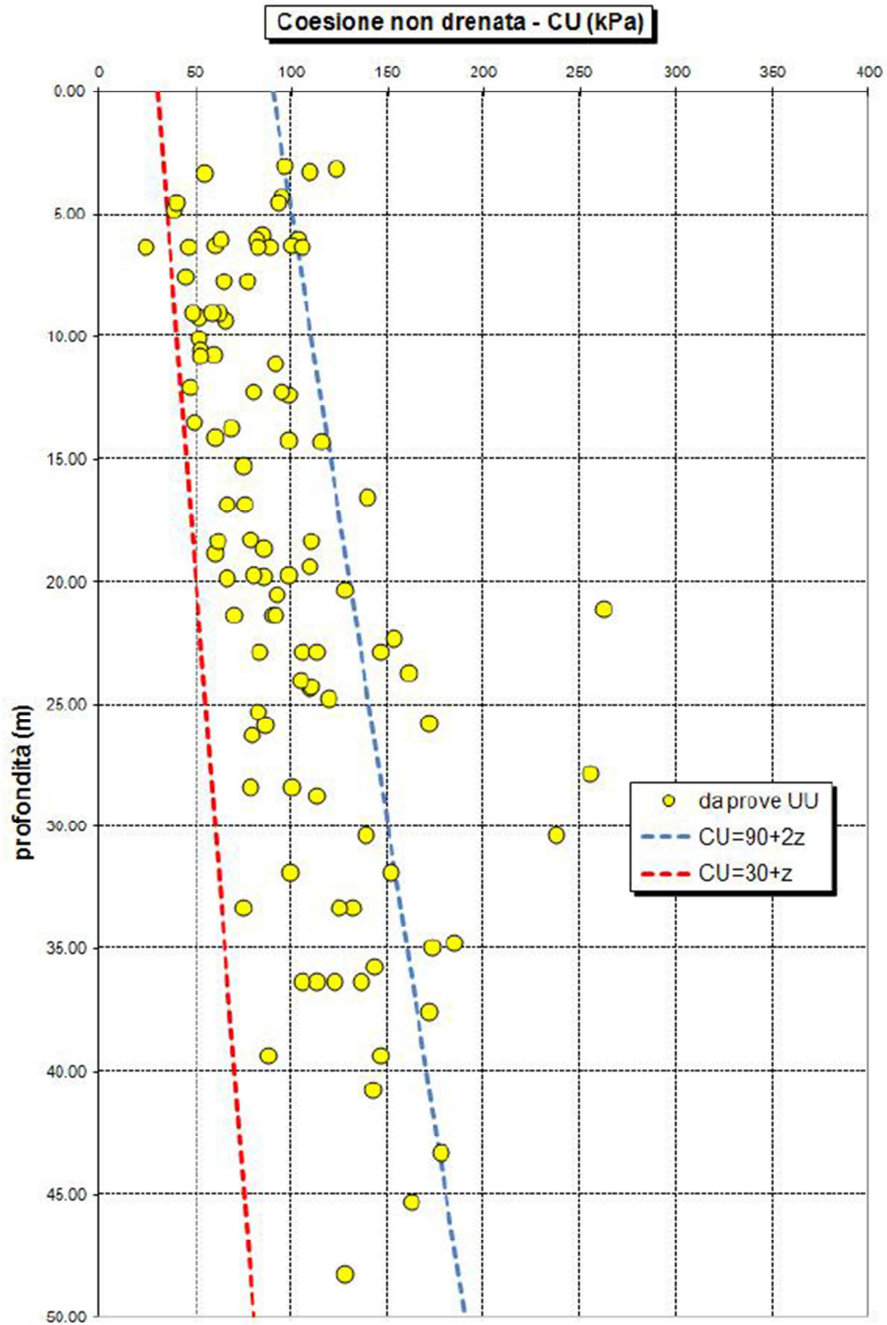


Figura 5 – Resistenza al taglio in condizione non drenate

Sondaggio PB12

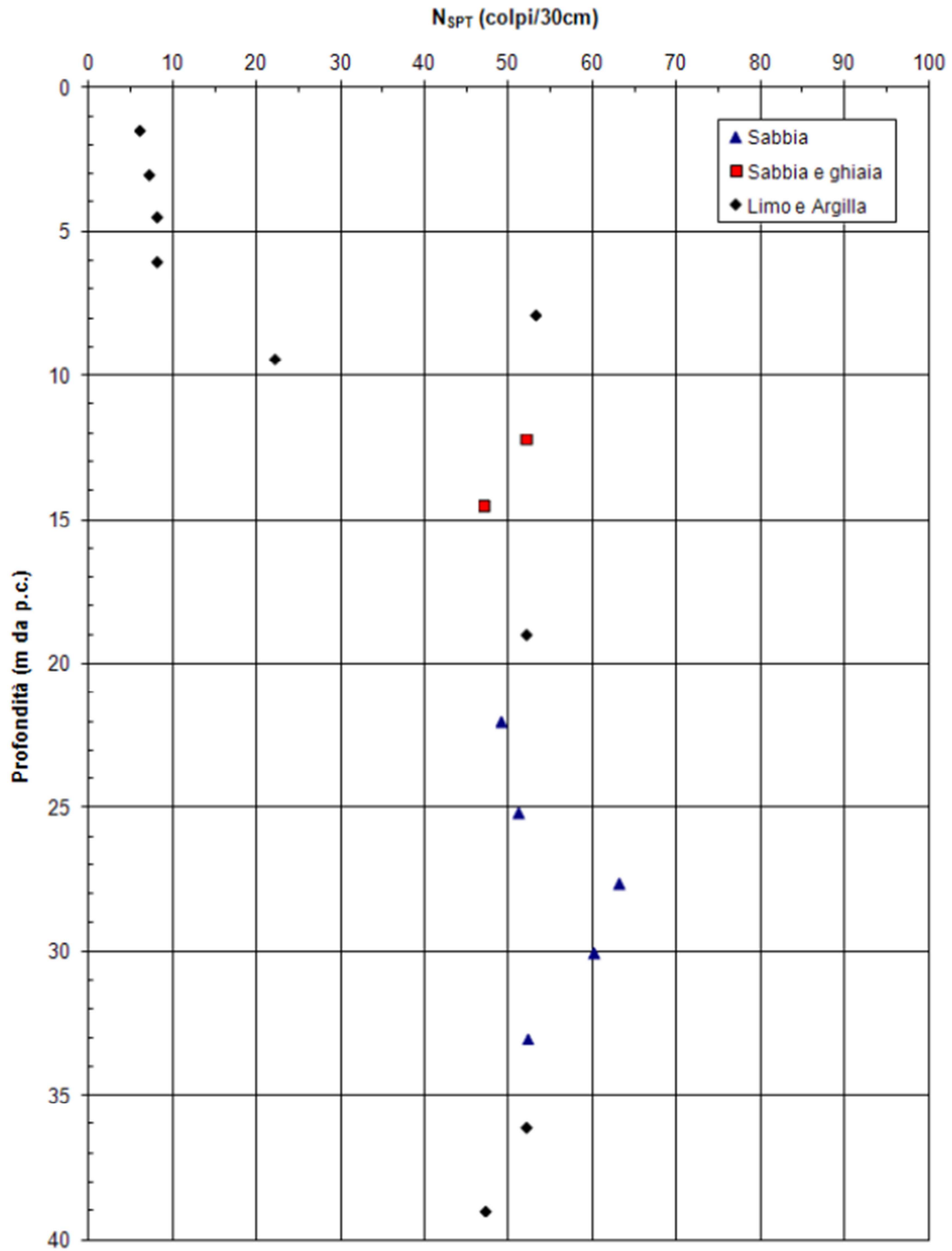


Figura 6 – Nspt (sondaggio PB12)

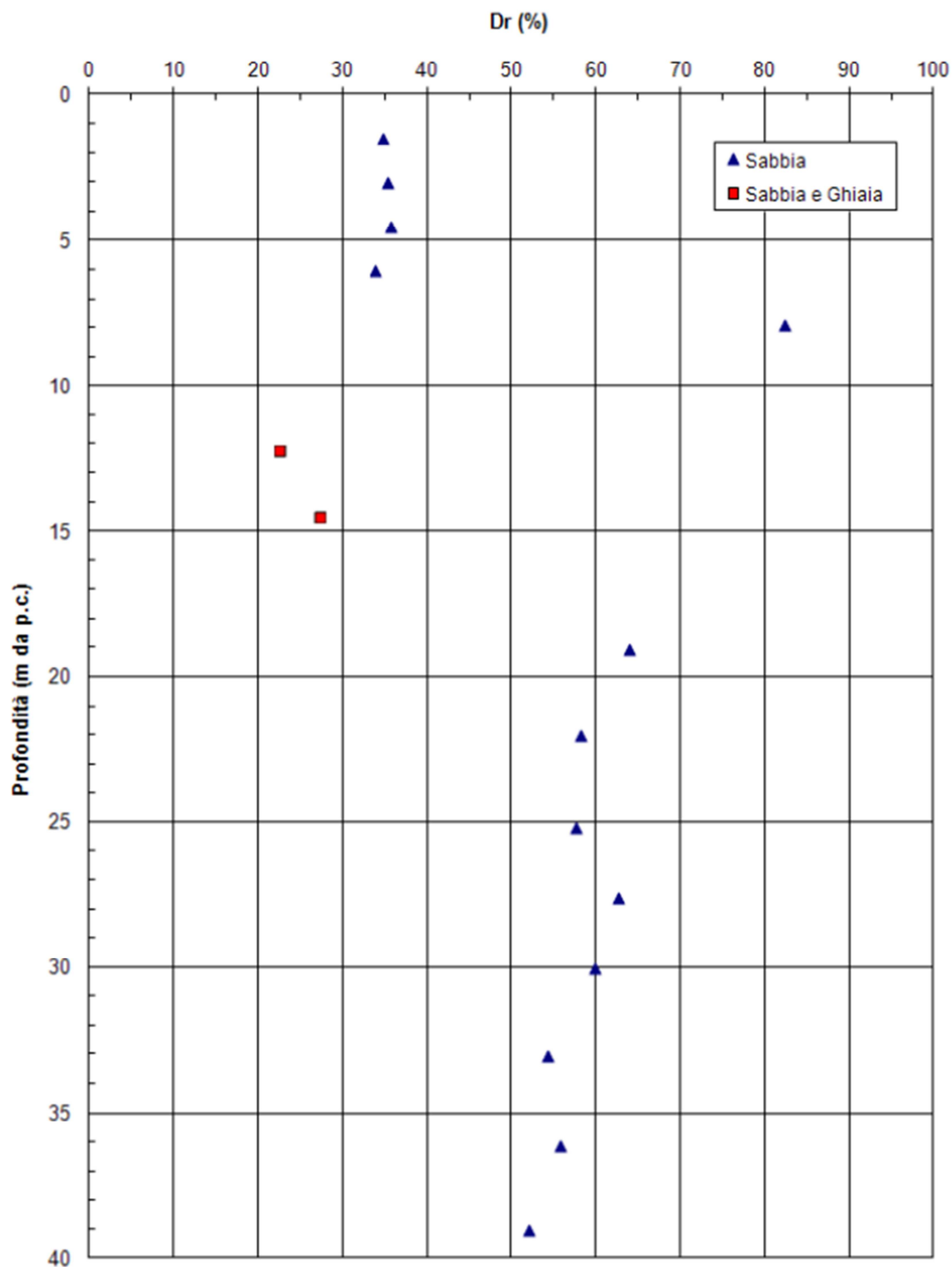


Figura 7 – Densità relativa (sondaggio PB12)

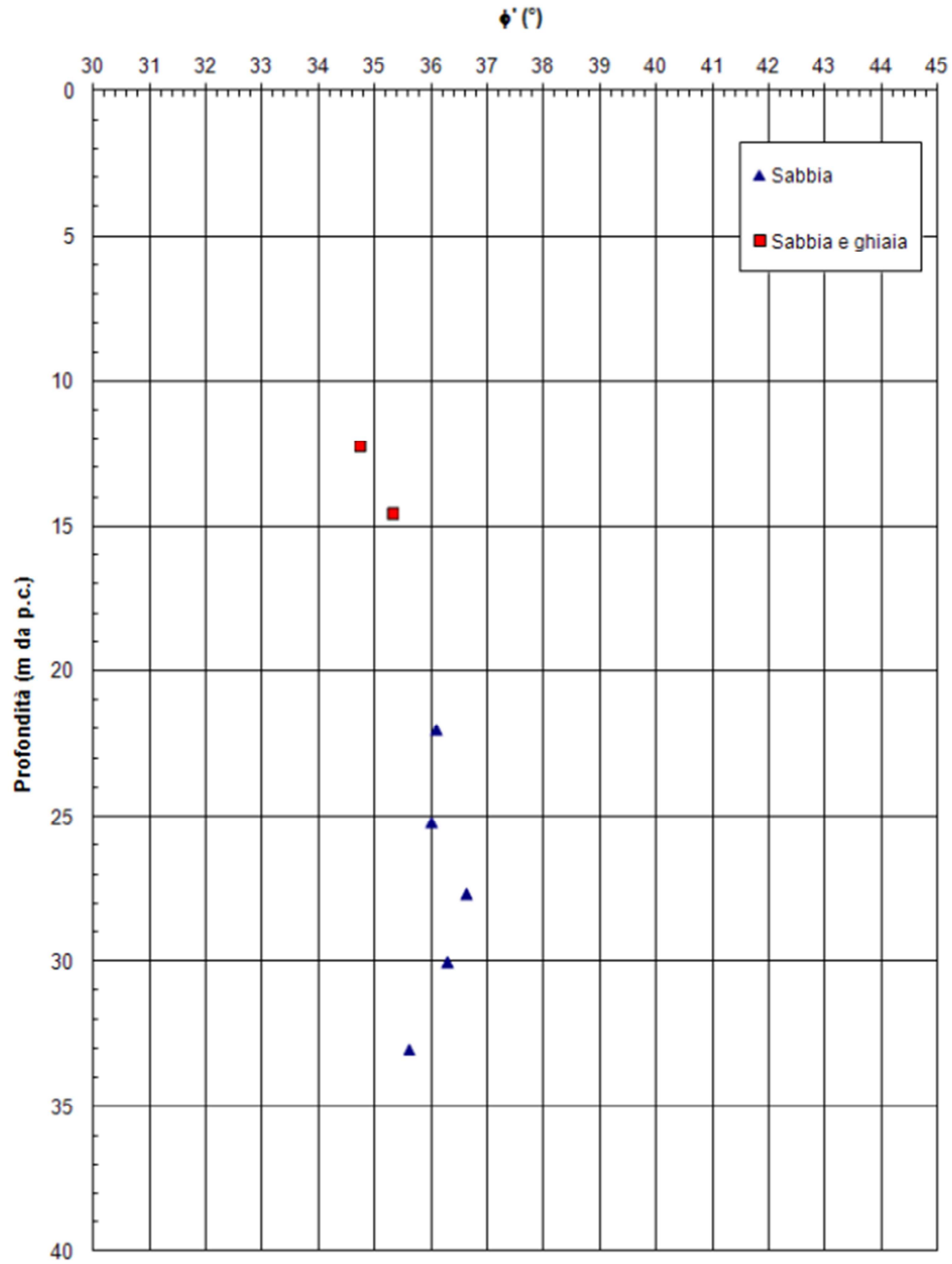


Figura 8 – Angolo di resistenza al taglio (sondaggio PB12)

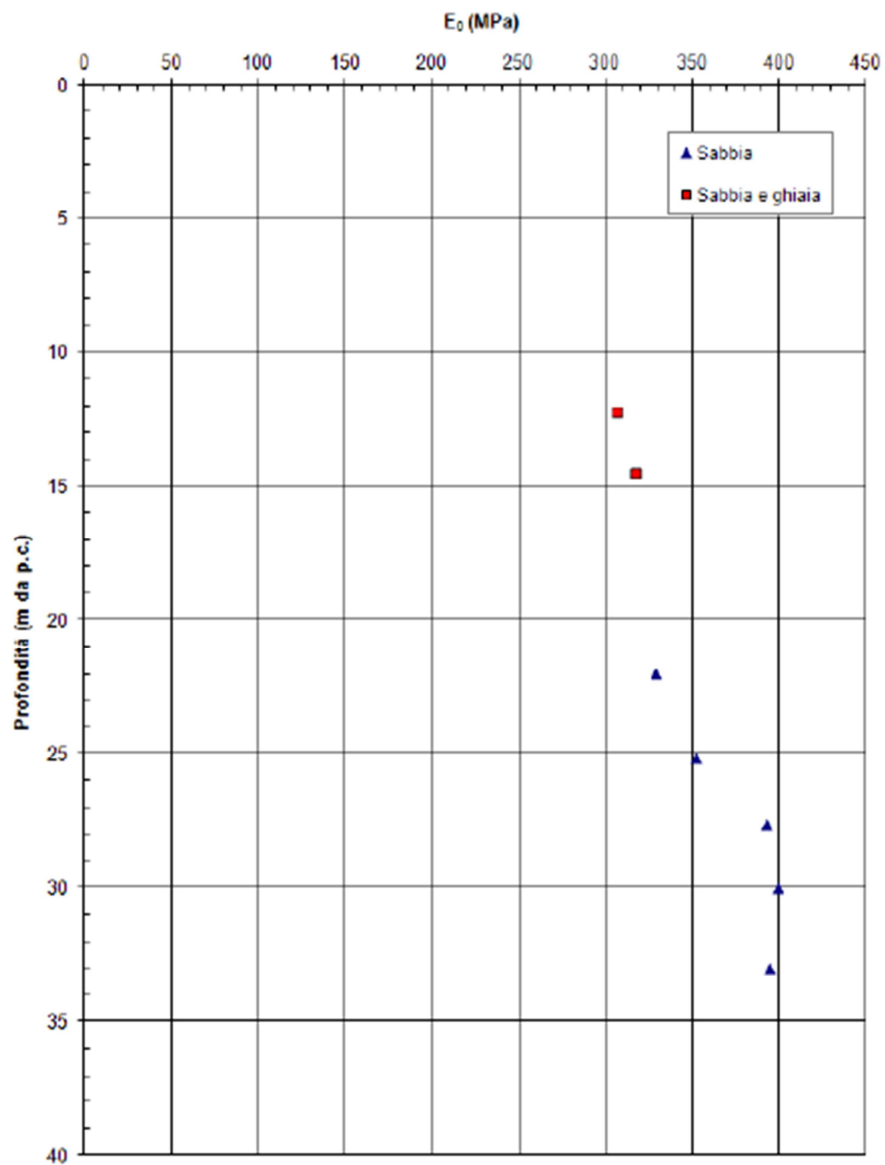


Figura 9 – Modulo di deformazione elastico iniziale (a piccole deformazioni) (sondaggio PB12)

5 CRITERI DI PROGETTAZIONE

5.1 Generale

In accordo con quanto definito nel paragrafo 6.2.4 delle NTC 2018, devono essere svolte le seguenti verifiche di sicurezza e delle prestazioni attese:

- Verifiche agli Stati Limite Ultimi (SLU);
- Verifiche agli Stati Limite d'Esercizio (SLE).

5.1.1 Stati Limite Ultimi (SLU)

Per ogni Stato Limite Ultimo (SLU) la verifica è considerata soddisfatta se vale la seguente disuguaglianza:

$$Ed \leq Rd$$

dove

Ed valore di progetto dell'azione o dell'effetto dell'azione;

Rd valore di progetto della resistenza.

L'azione e la corrispondente resistenza di progetto vanno determinate in accordo alle NTC 2018. Sono previsti coefficienti parziali da applicarsi rispettivamente alle azioni (A1 o A2), ai parametri del terreno (M1) ed alle resistenze caratteristiche di calcolo (R1 o R2 o R3). I diversi gruppi di coefficienti di sicurezza parziali sono scelti nell'ambito di due approcci progettuali distinti e alternativi.

Nel primo approccio progettuale, **Approccio 1**, sono previste due diverse combinazioni di gruppi di coefficienti:

- **Combinazione 1: A1+M1+R1;**
- **Combinazione 2: A2+M1+R2.**

Nel secondo approccio progettuale, **Approccio 2**, è prevista una sola combinazione di gruppi di coefficienti (**A1+M1+R3**) da adottarsi sia nelle verifiche strutturali, sia nelle verifiche geotecniche.

I valori assunti dai coefficienti di sicurezza parziali di ciascun gruppo, “Azioni – Parametri geotecnici del terreno – Resistenze”, sono riportati all’interno delle NTC 2018, rispettivamente alle tabelle:

- A Tabella 6.2.I (coefficienti parziali per le azioni o per l’effetto delle azioni).
- M Tabella 6.2.II (coefficienti parziali per i parametri geotecnici del terreno).
- R Tabella 6.4.II (coefficienti parziali da applicare alle resistenze caratteristiche a carico verticale dei pali) e Tabella 6.4.VI (coefficiente parziale per le verifiche dei pali soggetti a carichi trasversali).

5.1.2 Stati Limite di Esercizio (SLE)

Per ogni Stato Limite d’Esercizio (SLE) la verifica è considerata soddisfatta se vale la seguente disuguaglianza:

$$Ed \leq Cd$$

dove

Ed valore di progetto dell’effetto dell’azione;

Cd valore limite prescritto dell’effetto delle azioni.

All’interno del progetto devono essere quindi definite le prescrizioni relative agli spostamenti compatibili per l’opera e le prestazioni attese.

5.2 Verifiche statiche

Come riportato al paragrafo 6.4.3 delle NTC 2018, le verifiche delle fondazioni su pali devono essere effettuate con riferimento almeno ai seguenti stati limite, quando pertinenti:

- Stato limite ultimo di tipo Geotecnico (SLU GEO)
- Stato limite ultimo di tipo Strutturale (SLU STR)
- Stato limite di esercizio (SLE)

La verifica di stabilità globale deve essere eseguita secondo la Combinazione 2 (A2+M2+R2) dell’Approccio 1. Le rimanenti verifiche devono essere condotte con Approccio 2 combinazione

(A1+M1+R3) tenendo conto dei coefficienti parziali riportati nelle tabelle 6.2.I, 6.2.II, 6.4.II, 6.4.VI: **Combinazione A1+M1+R3** (SLU statiche e sismiche).

Nelle verifiche SLU di tipo strutturale il coefficiente γ_R non deve essere portato in conto.

5.2.1 Verifiche agli stati limite ultimi di tipo Geotecnico (GEO)

Le verifiche di sicurezza agli SLU di tipo geotecnico sono:

- collasso per carico limite della palificata nei riguardi dei carichi assiali di compressione e di trazione;
- collasso per carico limite della palificata nei riguardi dei carichi trasversali;
- stabilità globale.

5.2.2 Verifiche agli stati limite ultimi di tipo Strutturale (STR)

Le verifiche di sicurezza agli SLU di tipo strutturale sono:

- raggiungimento della resistenza strutturale dei pali;
- raggiungimento della resistenza strutturale della struttura di collegamento dei pali.

Quindi nel dettaglio le verifiche /analisi da eseguire saranno le seguenti.

Raggiungimento della resistenza strutturale dei pali

La verifica di tipo strutturale dei pali (azioni assiali, azioni di taglio e momento flettente) è condotta in accordo a quanto previsto da Normativa e verificando che le sollecitazioni calcolate sul singolo palo, a partire dai carichi forniti dal Progettista Strutturale per la combinazione di carico assunta (A1+M1+R1), siano interne al dominio di resistenza.

Di seguito si riporta nel dettaglio tale procedura di verifica:

1. Determinazione delle sollecitazioni (assiali di compressione e trazione, di taglio e momento flettente) sul singolo palo mediante l'analisi di gruppo col codice di calcolo MAP a partire dai carichi definiti dal Progettista Strutturale, come azioni agenti sull'intera palificata.

Tale calcolo viene eseguito inserendo nel codice di calcolo MAP:

- la curva carico-cedimento del palo singolo è stata abbattuta per effetto gruppo e calcolata come indicato nel paragrafo 7.1.1 e 7.1.1.1;
 - il modulo di reazione orizzontale palo-terreno con effetto gruppo orizzontale per ogni palo, come indicato nel paragrafo 7.1.2.
2. Verifica del non raggiungimento della tensione massima nella sezione in c.a. e restituzione al Progettista Strutturale degli andamenti delle azioni interne (azioni di taglio e di momento flettente) lungo il fusto del palo per le verifiche strutturali.

Raggiungimento della resistenza strutturale della struttura di collegamento dei pali

Tale verifica viene condotta dal Progettista Strutturale e sarà pertanto contemplata negli elaborati strutturali.

Collasso per carico limite della palificata nei riguardi dei carichi assiali di compressione e di trazione

Di seguito si riporta nel dettaglio la procedura di verifica nei confronti dei carichi assiali. Considerando la particolare configurazione geometrica della palificata con pali ($D=1500\text{mm}$) disposti su 3 file ad interasse 2 m (quindi molto vicini fra loro), la verifica di capacità portante a singolo palo perde di significato in quanto la fondazione lavora a “blocco”. Quindi verrà eseguita la verifica di capacità portante assiale a compressione sul blocco di fondazione. Cautelativamente si verificherà sia la portanza dell'intero blocco, sia la portanza dei 6 pali esterni maggiormente caricati, sia la portanza dei tre pali esterni maggiormente caricati. Per la verifica di capacità portante a trazione, poiché la sollecitazione di trazione si ha generalmente sul palo di spigolo, verrà cautelativamente svolta la verifica a trazione sul singolo palo di spigolo.

1. Determinazione della capacità portante di progetto del palo/ del blocco fondale, con Approccio 2 (A1+M1+R3) come previsto da Normativa, vedasi capitolo 6.
2. Determinazione dell'azione assiale massima (di compressione e di trazione) sul singolo palo/gruppo di pali, mediante l'analisi di gruppo col codice di calcolo MAP a partire dai carichi definiti dal Progettista Strutturale (secondo le metodologie già indicate).

3. Definizione della lunghezza di palo con le azioni assiali massime e le curve di capacità portante definite al punto 1.

Collasso per carico limite della palificata nei riguardi dei carichi trasversali

Considerando la particolare configurazione geometrica della palificata con pali ($D=1500\text{mm}$) disposti su 3 file ad interasse 2 m (quindi molto vicini fra loro), la verifica di capacità portante a singolo palo nei riguardi dei carichi trasversali perde di significato in quanto la fondazione lavora a “blocco”. Per quanto concerne le verifiche geotecniche nei confronti dei carichi orizzontali nel caso in esame, le problematiche progettuali della palificata sottoposta ai carichi di progetto orizzontali afferiscano piuttosto nei seguenti aspetti:

- limitazione degli spostamenti orizzontali entro i limiti accettabili, ben lontani dall'ordine di grandezza di spostamenti attesi in prossimità della rottura,
- limitazione dei carichi orizzontali e dei relativi momenti di incastro per limiti strutturali.

Stabilità globale

La stabilità globale non viene qui considerata in quanto la geometria del problema non rende possibili fenomeni di instabilità globale della fondazione.

5.2.3 Verifiche agli stati limite di esercizio (SLE)

Le verifiche agli stati limite di esercizio sono:

- eccessivi cedimenti verticali;
- eccessivi spostamenti trasversali.

Nello specifico si devono calcolare i valori degli spostamenti e delle distorsioni per verificarne la compatibilità con i requisiti prestazionali della struttura in elevazione. La geometria della fondazione deve essere stabilita nel rispetto dei requisiti di cui sopra tenendo opportunamente conto degli effetti di interazione tra i pali.

Di seguito si riporta nel dettaglio la procedura di verifica:

- Determinazione degli spostamenti (verticali, orizzontali e rotazioni) della palificata, mediante l'analisi di gruppo col codice di calcolo MAP a partire dai carichi definiti dal Progettista Strutturale a intradosso plinto, a cui si aggiungono le spinte delle terre.

Tale calcolo viene eseguito inserendo nel codice di calcolo MAP:

- la curva carico-cedimento del palo singolo abbattuta per effetto gruppo e calcolata come indicato nel paragrafo 7.1.1.1;
- il modulo di reazione orizzontale palo-terreno con effetto gruppo orizzontale per ogni palo, come indicato nel paragrafo 7.1.2.
- Determinazione degli spostamenti calcolati al punto 1 e verifica dell'ammissibilità degli stessi secondo i limiti definiti dal Progettista Strutturale.

5.3 Verifiche sismiche delle opere e sistemi geotecnici

Come definito al paragrafo 7.11.1 delle NTC 2018 le verifiche agli stati limite ultimi di opere e sistemi geotecnici si riferiscono al solo stato limite di salvaguardia della vita (SLV) di cui al paragrafo 3.2.1 delle NTC 2018 e quelle agli stati limite di esercizio si riferiscono al solo stato limite di danno (SLD) di cui allo stesso paragrafo 3.2.1 delle NTC 2018.

Le verifiche degli stati limite ultimi in presenza di azioni sismiche devono essere eseguite ponendo pari ad 1, i coefficienti parziali sulle azioni e sui parametri geotecnici e impiegando le resistenze di progetto con i coefficienti parziali γ_R delle tabelle 6.4.II e 6.4.VI rispettivamente per i carichi verticali e trasversali sui pali.

Di fatto si tratta di utilizzare, sia per le verifiche geotecniche che per quelle strutturali, la seguente combinazione di carico:

- **SISMA+M1+R3**

6 CAPACITA' PORTANTE DI PROGETTO

6.1 Analisi agli stati limite

Le verifiche di capacità portante dei pali vengono svolte secondo la metodologia degli stati limite ultimi, in accordo alla normativa vigente NTC 2018.

Le curve di resistenza di progetto a compressione (o trazione) del palo singolo $R_{c,d}$ (o $R_{t,d}$), da confrontare con la massima azione di compressione (o trazione) agente in testa al palo E_d , sono date dalle seguenti espressioni:

$$R_{c,d} = \frac{R_{c,k}}{\gamma_R} = \min \left\{ \frac{(R_{c;cal})_{media}}{\xi_3}; \frac{(R_{c;cal})_{min}}{\xi_4} \right\} / \gamma_R \quad \text{Resistenza di progetto a compressione}$$

$$R_{t,d} = \frac{R_{t,k}}{\gamma_R} = \min \left\{ \frac{(R_{t;cal})_{media}}{\xi_3}; \frac{(R_{t;cal})_{min}}{\xi_4} \right\} / \gamma_R \quad \text{Resistenza di progetto a trazione}$$

dove:

$R_{c,cal}$ e $R_{t,cal}$ resistenza di calcolo del palo singolo, rispettivamente a compressione e a trazione, determinate ad una data profondità;

ξ_3, ξ_4 fattori di correlazione per la determinazione della resistenza caratteristica del palo in funzione del numero di verticali indagate;

$R_{c,k}$ e $R_{t,k}$ resistenza caratteristica del palo singolo rispettivamente a compressione e a trazione ad una data profondità;

γ_R coefficienti parziali da applicarsi alle resistenze caratteristiche in funzione dell'approccio considerato.

Le verifiche di capacità portante dei pali agli stati limite ultimi (SLU) vengono condotte con riferimento all'Approccio 2, tenendo conto dei coefficienti parziali di riferimento normativo:

Approccio 2: Combinazione 1: A1 + M1 + R3

6.2 Metodologie di calcolo

La portata di progetto a compressione di un palo trivellato (eseguito con completa asportazione del terreno) “Qd” può essere espressa dalla seguente relazione:

$$Q_d = Q_{LL} / F_{SL} + Q_{BL} / F_{SB} - W'_P$$

dove:

Q_{LL} = portata laterale limite,

Q_{BL} = portata di base limite,

W'_P = peso efficace del palo (al netto del peso del terreno asportato),

F_{SL} = fattore di sicurezza per la portata laterale ($= \gamma_s \cdot \xi_3$).

F_{SB} = fattore di sicurezza per la portata di base ($= \gamma_b \cdot \xi_3$).

La portata a trazione di progetto di un palo trivellato (eseguito con completa asportazione del terreno) “Qd” può essere espressa dalla seguente relazione:

$$Q_d = Q_{LL} / F_{SL} + W'_P$$

dove:

Q_{LL} = portata laterale limite,

W'_P = peso efficace del palo (alleggerito se sotto falda),

F_{SL} = fattore di sicurezza per la portata laterale ($= \gamma_{st} \cdot \xi_3$).

6.2.1 Resistenza laterale di calcolo

La resistenza laterale di calcolo è stata determinata, in base al tipo di terreno attraversato, come indicato nel seguito (AGI, 1984).

Per terreni coesivi, si utilizza l'equazione:

$$\tau_{lim} = \alpha \cdot c_u \leq 100 \text{ kPa} \quad (120 \text{ kPa per terreni coesivi a profondità} > 30 \text{ m da p.c.)}$$

dove:

α = coefficiente riduttivo, valutato come segue:

$\alpha = 0.9$ per $c_U \leq 25$ kPa; 0.8 per $25 < c_U \leq 50$ kPa; 0.6 per $50 < c_U \leq 75$ kPa; 0.4 per $c_U > 75$ kPa;
(Raccomandazioni AGI [1984]);

c_U = resistenza al taglio non drenata (kPa).

I valori dell'attrito laterale limite in terreni granulari sono valutati mediante l'espressione:

$$\tau_{lim} = k \cdot \sigma'_v \cdot \tan(\phi)$$

dove:

K = rapporto tra pressione orizzontale e pressione verticale efficace in prossimità del palo.

σ'_v = pressione geostatica verticale efficace;

ϕ = angolo d'attrito;

Per pali trivellati si adotta [Reese – Wright (1977)]:

$K = 0.7$ in compressione

$K = 0.5$ in trazione

Per i pali trivellati deve essere comunque soddisfatta anche la seguente verifica:

$$\tau_{lim} \leq \tau = f(N_{SPT})$$

dove:

N_{SPT} = numero di colpi/piede in prova SPT.

Nella seguente figura è illustrata la correlazione proposta da Wright e Reese tra il valore della τ_{lim} ed il valore di N_{SPT} .

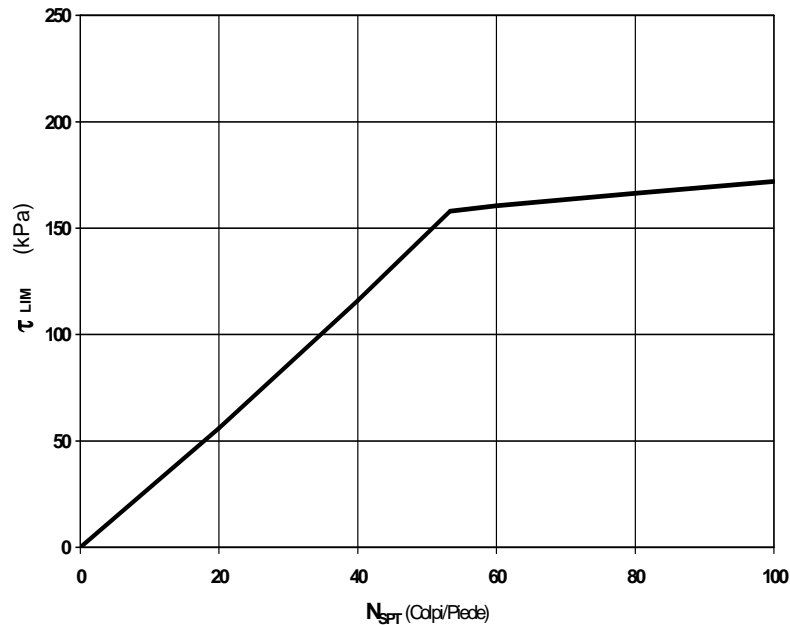


Figura 10: Terreni granulari - $\tau_{LIM} = f(N_{SPT})$ (Wright-Reese [1977])

6.2.2 Resistenza di base di calcolo

La resistenza di base di calcolo è stata determinata, in base al tipo di terreno alla base del palo, come indicato nel seguito (AGI, 1984).

Per terreni coesivi, la valutazione della capacità limite di base viene calcolata in base all'equazione:

$$q_b = 9 \cdot c_u + \sigma_v$$

dove:

c_u = resistenza al taglio non drenata (kPa).

σ_v = tensione geostatica verticale (kPa).

I valori di q_b sono interamente mobilizzati ad una profondità critica z_c (Meyerhof, Sastry [1978]), secondo l'espressione $z_c = m \cdot D$ con D pari al diametro del palo e $m = 3$.

In accordo con le più recenti metodologie di calcolo, la valutazione della capacità limite di base per terreni granulari è condotta facendo riferimento non più alle condizioni di rottura bensì riferendosi ad

una "portata critica" corrispondente ad una "condizione di servizio limite" basata su considerazioni di cedimenti ammissibili, ed in genere riferita all'insorgere di deformazioni plastiche nei terreni di fondazione. Pertanto, si porrà $q_b = q_{cr}$, dove

q_{cr} = portata critica unitaria di base;

Per pali trivellati la portata critica è valutata in accordo con le indicazioni di Reese-Wright et al. [1978]:

$$q_{cr} = 0.0667 \cdot N_{SPT} \leq 4MPa$$

I valori di q_{cr} sono interamente mobilitati ad una "profondità critica" z_c come descritto sopra, con m variabile fra 4 e 21 secondo la seguente figura.

La costruzione dell'andamento della portata di base con la profondità in condizioni stratigrafiche particolari (pali che attraversano uno strato di terreno sciolto fino a immersarsi in uno strato compatto di base di notevole spessore, piuttosto che pali immorsati in uno strato compatto di base di modesto spessore sovrastante uno strato di terreno sciolto) è condotta in accordo alle indicazioni riportate nelle figure seguenti. Nel caso in esame si assume $m=3$.

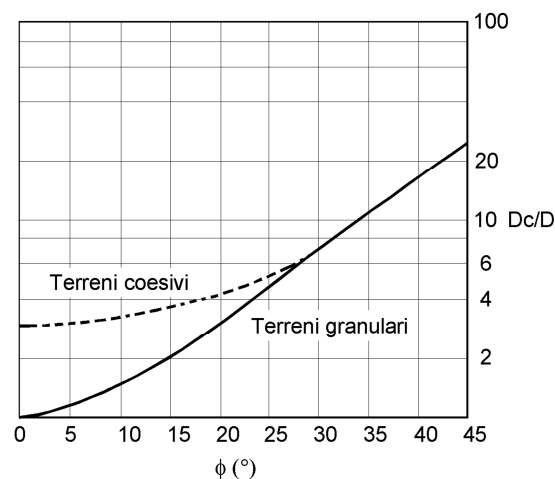


Figura 11 - $z_c/D = f(Dr)$ (Meyerhof [1976])

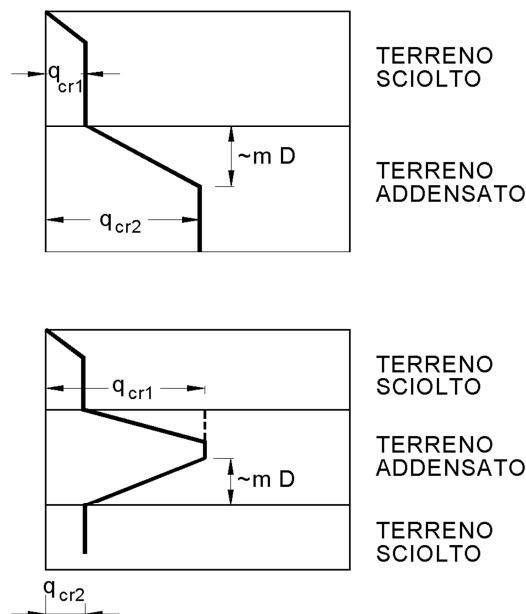


Figura 12 - Portata di base - Terreni stratificati (Meyerhof [1976])

6.2.3 Resistenza di progetto

Il valori della resistenza di progetto a compressione $R_{c,d}$ e della resistenza di progetto a trazione $R_{t,d}$ sono determinati applicando al valore caratteristico della resistenza i coefficienti parziali γ_R secondo le seguenti espressioni:

$$R_{c,d} = \frac{R_{c,k}}{\gamma_R}$$

$$R_{t,d} = \frac{R_{t,k}}{\gamma_R}$$

essendo:

$R_{c,d}$ e $R_{t,d}$ resistenza di progetto del palo singolo rispettivamente a compressione e a trazione;

$R_{c,k}$ e $R_{t,k}$ resistenza caratteristica del palo singolo rispettivamente a compressione e a trazione;

γ_R coefficienti parziali da applicarsi alle resistenze caratteristiche in funzione dell'approccio considerato e della tipologia esecutiva del palo (vedasi tabella seguente in cui sono riportati i fattori parziali relativi a pali trivellati).

Tabella 5 - Coefficienti parziali da applicare alle resistenze caratteristiche a carico verticale dei pali

Pali trivellati		
Resistenza (γ_R)	Simbolo	R3 [-]
Base	γ_b	1.35
Laterale - compressione	γ_s	1.15
Laterale - trazione	γ_{st}	1.25

La capacità portante del palo è stata valutata con Approccio 2: A1+M1+R3.

Il coefficiente $\cdot \xi_3$ è stato assunto pari a 1.65, con riferimento a 2 verticali di indagine.

Considerata la configurazione della palificata, con pali (D=1500 mm) disposti su tre file ad interasse 2 m, la verifica di capacità portante a singolo palo perde di significato in quanto la fondazione lavora a “blocco”. La capacità portante della fondazione è stata valutata considerando un meccanismo di portanza a blocco, verificando cautelativamente le seguenti situazioni:

- Portanza del blocco di fondazione (18 pali):
 - area di base = area complessiva dei 18 pali (= $18 \cdot 1.766 = 31.78 \text{ m}^2$);
 - perimetro = 33.7 m (superficie laterale esterna del perimetro del blocco di fondazione, vedasi linea rossa di Figura 13).
- Portanza del sistema di 6 pali maggiormente caricati (n. 1÷2, 8÷9, 14÷15, oppure n. 19÷20, 26÷27, 32÷33):
 - area di base = area di 6 pali (= $6 \cdot 1.766 = 10.596 \text{ m}^2$);
 - perimetro = 12.8 m (superficie laterale minima esterna relativa ai pali di spigolo maggiormente caricati, vedasi linea rossa di Figura 14).
- Portanza del sistema di 3 pali maggiormente caricati (n. 1, 8, 14, oppure n. 19, 26, 32):
 - area di base = area di 3 pali (= $3 \cdot 1.766 = 5.298 \text{ m}^2$);
 - perimetro = 9 m (superficie laterale minima esterna relativa ai pali di spigolo maggiormente caricati, vedasi linea rossa di Figura 15).

Inoltre dai calcoli eseguiti si evince che la trazione generalmente si ha sul palo di spigolo, quindi cautelativamente la verifica di capacità portante a trazione è eseguita considerando il singolo palo di spigolo con:

- area di base = area singolo palo (= 1.766 m²);
- perimetro = 3.6 m (superficie laterale minima esterna relativa al singolo palo di spigolo).

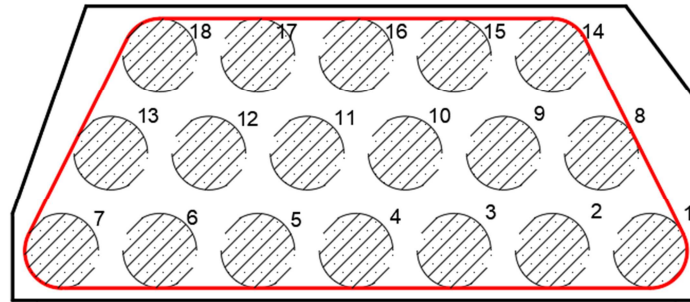


Figura 13 – Blocco di fondazione (18 pali)

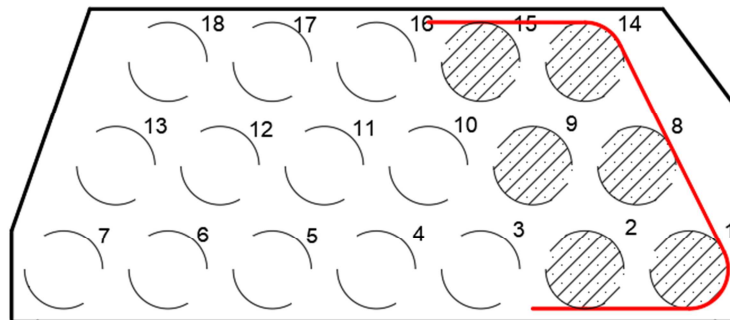


Figura 14 – Gruppo di 6 pali di fondazione maggiormente caricati

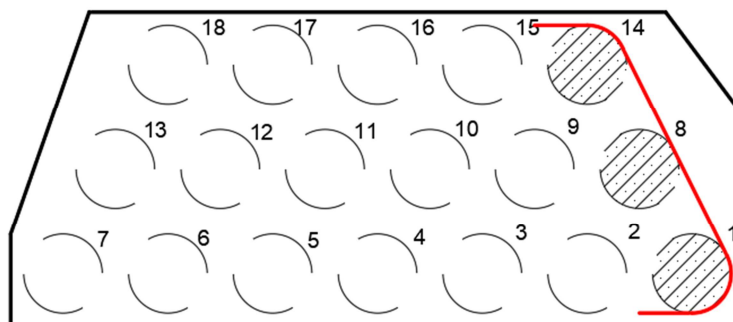


Figura 15 – Gruppo di 3 pali di fondazione maggiormente caricati

Nel seguito si riportano, i valori della portata di progetto a carico verticale (Qd).

I valori della resistenza di progetto per la lunghezza utile di palo, saranno poi confrontati con i corrispondenti valori delle sollecitazioni assiali risultanti dai calcoli.

Inoltre la portanza è stata valutata considerando:

- testa palo a 2 m p.c.; la quota testa palo è a +26.8 m s.l.m. e la stratigrafia per il calcolo della capacità portante è considerata a partire da 2 m sopra testa palo (p.c. di riferimento circa +29 m s.l.m.), quindi traslata di 5 m rispetto a quella definita al capitolo 4.
- falda a 4 m di profondità dal p.c. (di riferimento a +29 m s.l.m.).

Tabella 6 – Stratigrafia e parametri geotecnici di calcolo portanza pali

Profondità p.c. di riferimento (+29 m s.l.m.)	Unità geotecnica	cu [kPa]	ϕ' [°]	qb [kPa]
0.0÷5.0	A	67.5÷75	-	9·cu + σ_v
5.0÷10.0	B	-	35	3350
10.0÷15.0	A	82.5÷90	-	9·cu + σ_v
15.0÷28.0	B	-	36	3685
28.0÷60.0	A	109.5÷150	-	9·cu + σ_v

Nelle seguenti tabelle si riporta la capacità portante per le situazioni analizzate. In Appendice A si riportano i tabulati di calcolo completi.

Tabella 7 – Capacità portante di progetto A1+M1+R3 – Singolo blocco di fondazione (18 pali) - compressione

NODO BOLOGNA CAVALCAVIA CV03
Capacità portante blocco SLU A1+M1+R3

STAMPA capacità portante e relativi contributi

Lp m	Ql1 kN	Qb1 kN	Wp kN	Qu kN	Qd kN
.00	0.	21377.	0.	21377.	9717.
.50	396.	21894.	129.	22161.	10032.
1.00	880.	22411.	257.	23033.	10393.
1.50	1453.	22927.	386.	23994.	10800.
2.00	2113.	23444.	515.	25042.	11253.
2.50	2838.	23960.	644.	26155.	11741.
3.00	3584.	24477.	772.	27289.	12240.
3.50	4312.	26635.	901.	30046.	13475.
4.00	5070.	28793.	1030.	32833.	14726.
4.50	5865.	30951.	1159.	35658.	15997.
5.00	6697.	33110.	1287.	38519.	17287.
5.50	7566.	35268.	1416.	41418.	18597.
6.00	8473.	37426.	1545.	44354.	19926.
6.50	9416.	35480.	1674.	43223.	19410.
7.00	10397.	33534.	1802.	42129.	18912.
7.50	11415.	31588.	1931.	41072.	18435.
8.00	12405.	29642.	2060.	39988.	17943.
8.50	13028.	30159.	2189.	40999.	18377.
9.00	13592.	30675.	2317.	41950.	18780.
9.50	14161.	31192.	2446.	42907.	19185.
10.00	14734.	31709.	2575.	43868.	19593.
10.50	15317.	32225.	2704.	44839.	20006.
11.00	15917.	32742.	2832.	45827.	20428.
11.50	16534.	33258.	2961.	46832.	20859.
12.00	17169.	33775.	3090.	47854.	21299.
12.50	17821.	34291.	3219.	48894.	21748.
13.00	18593.	34808.	3347.	50054.	22260.
13.50	20009.	36974.	3476.	53508.	23862.
14.00	21567.	39141.	3605.	57103.	25538.
14.50	23163.	41308.	3734.	60737.	27234.
15.00	24798.	43474.	3862.	64410.	28950.
15.50	26471.	45641.	3991.	68121.	30687.
16.00	28183.	47807.	4120.	71870.	32444.

16.50	29933.	49974.	4248.	75659.	34221.
17.00	31722.	52141.	4377.	79485.	36019.
17.50	33549.	54307.	4506.	83351.	37837.
18.00	35415.	56474.	4635.	87255.	39675.
18.50	37320.	58640.	4763.	91197.	41533.
19.00	39263.	60807.	4892.	95178.	43412.
19.50	41245.	62974.	5021.	99198.	45311.
20.00	43265.	65140.	5150.	103256.	47231.
20.50	45324.	67307.	5278.	107352.	49170.
21.00	47421.	65573.	5407.	107588.	49358.
21.50	49557.	63840.	5536.	107861.	49565.
22.00	51732.	62106.	5665.	108174.	49793.
22.50	53945.	60373.	5793.	108524.	50041.
23.00	56197.	58639.	5922.	108914.	50309.
23.50	58487.	56906.	6051.	109342.	50598.
24.00	60816.	55172.	6180.	109808.	50907.
24.50	63183.	53439.	6308.	110313.	51236.
25.00	65589.	51705.	6437.	110857.	51586.
25.50	68033.	49972.	6566.	111439.	51956.
26.00	70345.	48238.	6695.	111889.	52256.
26.50	71657.	48721.	6823.	113555.	53037.
27.00	72815.	49204.	6952.	115067.	53737.
27.50	73990.	49687.	7081.	116596.	54446.
28.00	75182.	50170.	7210.	118143.	55165.
28.50	76393.	50653.	7338.	119708.	55893.
29.00	77620.	51136.	7467.	121290.	56630.
29.50	78865.	51619.	7596.	122889.	57376.
30.00	80128.	52103.	7724.	124506.	58131.
30.50	81407.	52586.	7853.	126140.	58895.
31.00	82705.	53069.	7982.	127791.	59669.
31.50	84020.	53552.	8111.	129460.	60452.
32.00	85352.	54035.	8239.	131147.	61244.
32.50	86701.	54518.	8368.	132851.	62045.
33.00	88069.	55001.	8497.	134572.	62855.
33.50	89453.	55484.	8626.	136311.	63675.
34.00	90855.	55967.	8754.	138067.	64503.
34.50	92274.	56450.	8883.	139841.	65341.
35.00	93711.	56933.	9012.	141632.	66188.
35.50	95166.	57416.	9141.	143441.	67045.
36.00	96637.	57899.	9269.	145267.	67910.
36.50	98126.	58382.	9398.	147110.	68785.
37.00	99633.	58865.	9527.	148971.	69668.
37.50	101157.	59348.	9656.	150849.	70561.
38.00	102699.	59831.	9784.	152745.	71463.
38.50	104257.	60314.	9913.	154658.	72375.
39.00	105834.	60797.	10042.	156589.	73295.
39.50	107428.	61280.	10171.	158537.	74225.
40.00	109039.	61763.	10299.	160503.	75164.
40.50	110668.	62246.	10428.	162486.	76112.
41.00	112314.	62729.	10557.	164486.	77069.
41.50	113977.	63212.	10686.	166504.	78035.
42.00	115658.	63695.	10814.	168539.	79011.
42.50	117357.	64178.	10943.	170592.	79996.
43.00	119073.	64661.	11072.	172662.	80989.
43.50	120806.	65144.	11201.	174750.	81993.
44.00	122557.	65627.	11329.	176855.	83005.
44.50	124325.	66110.	11458.	178977.	84026.
45.00	126110.	66593.	11587.	181117.	85057.
45.50	127913.	67076.	11715.	183274.	86097.
46.00	129734.	67559.	11844.	185449.	87146.
46.50	131572.	68042.	11973.	187641.	88204.
47.00	133427.	68525.	12102.	189851.	89271.
47.50	135300.	69009.	12230.	192078.	90348.
48.00	137190.	69492.	12359.	194323.	91433.
48.50	139098.	69975.	12488.	196585.	92528.
49.00	141023.	70458.	12617.	198864.	93632.
49.50	142966.	70941.	12745.	201161.	94746.
50.00	144926.	71424.	12874.	203475.	95868.
50.50	146903.	71907.	13003.	205807.	97000.
51.00	148898.	72390.	13132.	208156.	98140.
51.50	150911.	72873.	13260.	210523.	99290.
52.00	152932.	73356.	13389.	212899.	100445.
52.50	154954.	73839.	13518.	215275.	101600.
53.00	156976.	74322.	13647.	217652.	102755.
53.50	158998.	74805.	13775.	220028.	103910.
54.00	161020.	75288.	13904.	222404.	105065.
54.50	163042.	75771.	14033.	224781.	106220.
55.00	165064.	76254.	14162.	227157.	107375.
55.50	167086.	76737.	14290.	229533.	108530.
56.00	169108.	77220.	14419.	231909.	109685.
56.50	171130.	77703.	14548.	234286.	110840.
57.00	173152.	78186.	14677.	236662.	111995.

57.50 175174. 78669. 14805. 239038. 113151.
58.00 177196. 79152. 14934. 241415. 114306.

Lp = Lunghezza utile del palo
Q11 = Portata laterale limite
Qb1 = Portata di base limite
Wp = Peso efficace del palo
Qu = Portata totale limite
Qd = Portata di progetto = $Q11/FS,1 + Qb1/FS,b - Wp$

Tabella 8 – Capacità portante di progetto A1+M1+R3 – Gruppo 6 pali - compressione

NODO BOLOGNA CAVALCAVIA CV03
Capacità portante blocco 6pali SLU A1+M1+R3

STAMPA capacità portante e relativi contributi

Lp m	Q11 kN	Qb1 kN	Wp kN	Qu kN	Qd kN
.00	0.	7126.	0.	7126.	3239.
.50	150.	7298.	43.	7406.	3354.
1.00	334.	7470.	86.	7719.	3486.
1.50	552.	7642.	129.	8065.	3635.
2.00	803.	7815.	172.	8445.	3803.
2.50	1078.	7987.	215.	8850.	3983.
3.00	1361.	8159.	257.	9263.	4168.
3.50	1638.	9402.	300.	10739.	4835.
4.00	1926.	10644.	343.	12226.	5508.
4.50	2228.	11887.	386.	13728.	6189.
5.00	2544.	13129.	429.	15244.	6878.
5.50	2874.	14372.	472.	16774.	7573.
6.00	3218.	14425.	515.	17128.	7736.
6.50	3576.	13289.	558.	16308.	7365.
7.00	3949.	12153.	601.	15501.	7002.
7.50	4336.	11017.	644.	14709.	6646.
8.00	4712.	9881.	687.	13906.	6285.
8.50	4948.	10053.	730.	14272.	6444.
9.00	5163.	10225.	772.	14615.	6592.
9.50	5379.	10397.	815.	14961.	6742.
10.00	5596.	10570.	858.	15308.	6892.
10.50	5818.	10742.	901.	15658.	7043.
11.00	6046.	10914.	944.	16015.	7199.
11.50	6280.	11086.	987.	16379.	7357.
12.00	6521.	11258.	1030.	16749.	7520.
12.50	6769.	11430.	1073.	17126.	7685.
13.00	7062.	11603.	1116.	17549.	7875.
13.50	7600.	12850.	1159.	19291.	8682.
14.00	8192.	14097.	1202.	21088.	9518.
14.50	8798.	15345.	1245.	22898.	10361.
15.00	9419.	16592.	1287.	24724.	11212.
15.50	10054.	17613.	1330.	26337.	11967.
16.00	10704.	18634.	1373.	27965.	12730.
16.50	11369.	19654.	1416.	29607.	13501.
17.00	12049.	20675.	1459.	31265.	14280.
17.50	12743.	21696.	1502.	32936.	15066.
18.00	13452.	22716.	1545.	34623.	15860.
18.50	14175.	23737.	1588.	36324.	16662.
19.00	14913.	24757.	1631.	38040.	17472.
19.50	15666.	25778.	1674.	39770.	18289.
20.00	16433.	26799.	1717.	41515.	19114.
20.50	17215.	27819.	1759.	43275.	19946.
21.00	18012.	26752.	1802.	42961.	19837.
21.50	18823.	25685.	1845.	42662.	19736.
22.00	19649.	24618.	1888.	42378.	19643.
22.50	20489.	23550.	1931.	42109.	19557.
23.00	21345.	22483.	1974.	41854.	19480.
23.50	22215.	21416.	2017.	41613.	19409.
24.00	23099.	20348.	2060.	41388.	19347.
24.50	23998.	19281.	2103.	41177.	19292.
25.00	24912.	18214.	2146.	40980.	19245.
25.50	25841.	17147.	2189.	40799.	19206.
26.00	26719.	16079.	2232.	40567.	19140.
26.50	27217.	16240.	2274.	41183.	19432.
27.00	27657.	16401.	2317.	41741.	19694.
27.50	28103.	16562.	2360.	42305.	19959.

28.00	28556.	16723.	2403.	42876.	20228.
28.50	29016.	16884.	2446.	43454.	20500.
29.00	29482.	17045.	2489.	44038.	20776.
29.50	29955.	17206.	2532.	44629.	21055.
30.00	30434.	17368.	2575.	45227.	21338.
30.50	30920.	17529.	2618.	45831.	21624.
31.00	31413.	17690.	2661.	46442.	21913.
31.50	31912.	17851.	2704.	47059.	22206.
32.00	32418.	18012.	2746.	47684.	22503.
32.50	32931.	18173.	2789.	48314.	22803.
33.00	33450.	18334.	2832.	48952.	23107.
33.50	33976.	18495.	2875.	49596.	23414.
34.00	34509.	18656.	2918.	50246.	23724.
34.50	35048.	18817.	2961.	50903.	24038.
35.00	35594.	18978.	3004.	51567.	24356.
35.50	36146.	19139.	3047.	52238.	24677.
36.00	36705.	19300.	3090.	52915.	25001.
36.50	37271.	19461.	3133.	53598.	25329.
37.00	37843.	19622.	3176.	54289.	25661.
37.50	38422.	19783.	3219.	54986.	25996.
38.00	39007.	19944.	3261.	55689.	26334.
38.50	39599.	20105.	3304.	56400.	26676.
39.00	40198.	20266.	3347.	57116.	27021.
39.50	40803.	20427.	3390.	57840.	27370.
40.00	41415.	20588.	3433.	58570.	27722.
40.50	42034.	20749.	3476.	59307.	28078.
41.00	42659.	20910.	3519.	60050.	28438.
41.50	43291.	21071.	3562.	60800.	28801.
42.00	43930.	21232.	3605.	61557.	29167.
42.50	44575.	21393.	3648.	62320.	29537.
43.00	45226.	21554.	3691.	63090.	29910.
43.50	45885.	21715.	3734.	63866.	30287.
44.00	46550.	21876.	3776.	64649.	30667.
44.50	47221.	22037.	3819.	65439.	31051.
45.00	47900.	22198.	3862.	66235.	31438.
45.50	48584.	22359.	3905.	67038.	31829.
46.00	49276.	22520.	3948.	67848.	32223.
46.50	49974.	22681.	3991.	68664.	32621.
47.00	50679.	22842.	4034.	69487.	33022.
47.50	51390.	23003.	4077.	70316.	33426.
48.00	52108.	23164.	4120.	71152.	33835.
48.50	52833.	23325.	4163.	71995.	34246.
49.00	53564.	23486.	4206.	72844.	34661.
49.50	54302.	23647.	4248.	73700.	35080.
50.00	55046.	23808.	4291.	74563.	35502.
50.50	55797.	23969.	4334.	75432.	35928.
51.00	56555.	24130.	4377.	76308.	36357.
51.50	57319.	24291.	4420.	77190.	36789.
52.00	58087.	24452.	4463.	78076.	37224.
52.50	58855.	24613.	4506.	78962.	37658.
53.00	59623.	24774.	4549.	79848.	38093.
53.50	60391.	24935.	4592.	80734.	38527.
54.00	61159.	25096.	4635.	81620.	38962.
54.50	61927.	25257.	4678.	82506.	39396.
55.00	62695.	25418.	4721.	83393.	39831.
55.50	63463.	25579.	4763.	84279.	40265.
56.00	64231.	25740.	4806.	85165.	40700.
56.50	64999.	25901.	4849.	86051.	41134.
57.00	65767.	26062.	4892.	86937.	41568.
57.50	66535.	26223.	4935.	87823.	42003.
58.00	67303.	26384.	4978.	88709.	42437.

Lp = Lunghezza utile del palo
 Ql1 = Portata laterale limite
 Qbl = Portata di base limite
 Wp = Peso efficace del palo
 Qu = Portata totale limite
 Qd = Portata di progetto = $Ql1/FS,l + Qbl/FS,b - Wp$

Tabella 9 – Capacità portante di progetto A1+M1+R3 – Gruppo 3 pali - compressione

NODO BOLOGNA CAVALCAVIA CV03
 Capacità portante 3pali SLU A1+M1+R3

STAMPA capacità portante e relativi contributi

Lp	Ql1	Qbl	Wp	Qu	Qd
m	kN	kN	kN	kN	kN

.00	0.	3563.	0.	3563.	1620.
.50	106.	3649.	21.	3733.	1693.
1.00	235.	3735.	43.	3927.	1779.
1.50	388.	3821.	64.	4145.	1877.
2.00	564.	3907.	86.	4386.	1987.
2.50	758.	3993.	107.	4644.	2107.
3.00	957.	4079.	129.	4908.	2229.
3.50	1152.	4961.	150.	5963.	2711.
4.00	1354.	5843.	172.	7025.	3197.
4.50	1566.	6725.	193.	8098.	3688.
5.00	1788.	7607.	215.	9181.	4184.
5.50	2021.	8489.	236.	10273.	4686.
6.00	2263.	8486.	257.	10492.	4791.
6.50	2515.	7600.	279.	9836.	4499.
7.00	2777.	6713.	300.	9190.	4213.
7.50	3048.	5827.	322.	8553.	3931.
8.00	3313.	4940.	343.	7910.	3646.
8.50	3479.	5026.	365.	8141.	3751.
9.00	3630.	5113.	386.	8356.	3848.
9.50	3782.	5199.	408.	8573.	3946.
10.00	3935.	5285.	429.	8791.	4044.
10.50	4091.	5371.	451.	9011.	4144.
11.00	4251.	5457.	472.	9236.	4246.
11.50	4416.	5543.	494.	9465.	4350.
12.00	4585.	5629.	515.	9699.	4457.
12.50	4759.	5715.	536.	9938.	4566.
13.00	4966.	5801.	558.	10209.	4693.
13.50	5344.	6687.	579.	11451.	5273.
14.00	5760.	7572.	601.	12731.	5872.
14.50	6186.	8457.	622.	14021.	6478.
15.00	6623.	9342.	644.	15321.	7088.
15.50	7069.	10228.	665.	16632.	7705.
16.00	7527.	11113.	687.	17953.	8326.
16.50	7994.	11998.	708.	19284.	8953.
17.00	8472.	12884.	730.	20626.	9585.
17.50	8960.	13769.	751.	21978.	10223.
18.00	9458.	14654.	772.	23340.	10866.
18.50	9967.	15240.	794.	24412.	11379.
19.00	10486.	15525.	815.	25195.	11760.
19.50	11015.	15811.	837.	25989.	12147.
20.00	11554.	16096.	858.	26792.	12540.
20.50	12104.	16382.	880.	27606.	12937.
21.00	12664.	15623.	901.	27387.	12866.
21.50	13235.	14865.	923.	27177.	12800.
22.00	13816.	14107.	944.	26978.	12739.
22.50	14407.	13348.	966.	26789.	12684.
23.00	15008.	12590.	987.	26611.	12635.
23.50	15620.	11832.	1008.	26443.	12590.
24.00	16242.	11073.	1030.	26285.	12552.
24.50	16874.	10315.	1051.	26137.	12518.
25.00	17516.	9556.	1073.	26000.	12490.
25.50	18169.	8798.	1094.	25873.	12468.
26.00	18787.	8040.	1116.	25710.	12426.
26.50	19137.	8120.	1137.	26120.	12626.
27.00	19446.	8201.	1159.	26488.	12804.
27.50	19760.	8281.	1180.	26861.	12984.
28.00	20078.	8362.	1202.	27239.	13167.
28.50	20402.	8442.	1223.	27621.	13352.
29.00	20729.	8523.	1245.	28008.	13540.
29.50	21062.	8603.	1266.	28399.	13730.
30.00	21399.	8684.	1287.	28795.	13922.
30.50	21741.	8764.	1309.	29196.	14117.
31.00	22087.	8845.	1330.	29602.	14315.
31.50	22438.	8925.	1352.	30012.	14515.
32.00	22794.	9006.	1373.	30427.	14717.
32.50	23155.	9086.	1395.	30846.	14922.
33.00	23520.	9167.	1416.	31270.	15129.
33.50	23890.	9247.	1438.	31699.	15339.
34.00	24264.	9328.	1459.	32133.	15551.
34.50	24643.	9408.	1481.	32571.	15766.
35.00	25027.	9489.	1502.	33014.	15983.
35.50	25415.	9569.	1523.	33461.	16203.
36.00	25808.	9650.	1545.	33913.	16425.
36.50	26206.	9730.	1566.	34370.	16649.
37.00	26608.	9811.	1588.	34831.	16876.
37.50	27015.	9891.	1609.	35297.	17105.
38.00	27427.	9972.	1631.	35768.	17337.
38.50	27843.	10052.	1652.	36243.	17571.
39.00	28264.	10133.	1674.	36723.	17808.
39.50	28690.	10213.	1695.	37208.	18047.
40.00	29120.	10294.	1717.	37697.	18289.

40.50	29555.	10374.	1738.	38191.	18533.
41.00	29995.	10455.	1759.	38690.	18779.
41.50	30439.	10535.	1781.	39193.	19028.
42.00	30888.	10616.	1802.	39701.	19280.
42.50	31342.	10696.	1824.	40214.	19534.
43.00	31800.	10777.	1845.	40731.	19790.
43.50	32263.	10857.	1867.	41253.	20049.
44.00	32730.	10938.	1888.	41780.	20310.
44.50	33202.	11018.	1910.	42311.	20574.
45.00	33679.	11099.	1931.	42847.	20840.
45.50	34161.	11179.	1953.	43388.	21108.
46.00	34647.	11260.	1974.	43933.	21379.
46.50	35138.	11340.	1995.	44483.	21653.
47.00	35633.	11421.	2017.	45037.	21929.
47.50	36134.	11501.	2038.	45597.	22207.
48.00	36638.	11582.	2060.	46160.	22488.
48.50	37148.	11662.	2081.	46729.	22771.
49.00	37662.	11743.	2103.	47302.	23057.
49.50	38181.	11823.	2124.	47880.	23345.
50.00	38704.	11904.	2146.	48463.	23636.
50.50	39232.	11984.	2167.	49050.	23929.
51.00	39765.	12065.	2189.	49641.	24224.
51.50	40303.	12145.	2210.	50238.	24522.
52.00	40843.	12226.	2232.	50837.	24822.
52.50	41383.	12306.	2253.	51436.	25121.
53.00	41923.	12387.	2274.	52035.	25420.
53.50	42463.	12467.	2296.	52634.	25720.
54.00	43003.	12548.	2317.	53233.	26019.
54.50	43543.	12628.	2339.	53832.	26319.
55.00	44083.	12709.	2360.	54431.	26618.
55.50	44623.	12789.	2382.	55030.	26917.
56.00	45163.	12870.	2403.	55629.	27217.
56.50	45703.	12951.	2425.	56228.	27516.
57.00	46243.	13031.	2446.	56827.	27815.
57.50	46783.	13112.	2468.	57426.	28115.
58.00	47323.	13192.	2489.	58026.	28414.

Lp = Lunghezza utile del palo
 Qll = Portata laterale limite
 Qbl = Portata di base limite
 Wp = Peso efficace del palo
 Qu = Portata totale limite
 Qd = Portata di progetto = $Qll/FS,l + Qbl/FS,b - Wp$

Tabella 10 – Capacità portante di progetto A1+M1+R3 – Palo di spigolo - trazione

NODO BOLOGNA CAVALCAVIA CV03

Capacità portante palo spigolo SLU A1+M1+R3 trazione

STAMPA capacità portante e relativi contributi

Lp m	Q11 kN	Qb1 kN	Wp kN	Qu kN	Qd kN
.00	0.	0.	0.	0.	0.
.50	42.	0.	-13.	56.	33.
1.00	94.	0.	-26.	121.	71.
1.50	155.	0.	-40.	195.	114.
2.00	226.	0.	-53.	279.	160.
2.50	303.	0.	-66.	369.	211.
3.00	380.	0.	-79.	460.	261.
3.50	439.	0.	-93.	531.	302.
4.00	496.	0.	-106.	602.	342.
4.50	557.	0.	-119.	676.	384.
5.00	621.	0.	-132.	753.	428.
5.50	687.	0.	-146.	833.	473.
6.00	756.	0.	-159.	915.	519.
6.50	828.	0.	-172.	1000.	567.
7.00	903.	0.	-185.	1088.	615.
7.50	981.	0.	-199.	1179.	666.
8.00	1058.	0.	-212.	1270.	716.
8.50	1121.	0.	-225.	1346.	759.
9.00	1181.	0.	-238.	1419.	801.
9.50	1242.	0.	-252.	1493.	843.
10.00	1303.	0.	-265.	1568.	885.
10.50	1365.	0.	-278.	1643.	928.
11.00	1429.	0.	-291.	1721.	972.
11.50	1495.	0.	-305.	1800.	1017.
12.00	1563.	0.	-318.	1881.	1062.
12.50	1633.	0.	-331.	1964.	1109.
13.00	1710.	0.	-344.	2054.	1158.
13.50	1820.	0.	-358.	2178.	1224.
14.00	1939.	0.	-371.	2310.	1294.
14.50	2061.	0.	-384.	2445.	1365.
15.00	2186.	0.	-397.	2583.	1438.
15.50	2313.	0.	-411.	2724.	1512.
16.00	2444.	0.	-424.	2868.	1588.
16.50	2577.	0.	-437.	3014.	1664.
17.00	2714.	0.	-450.	3164.	1743.
17.50	2853.	0.	-464.	3317.	1822.
18.00	2996.	0.	-477.	3473.	1903.
18.50	3141.	0.	-490.	3631.	1986.
19.00	3289.	0.	-503.	3793.	2070.
19.50	3441.	0.	-517.	3957.	2155.
20.00	3595.	0.	-530.	4124.	2242.
20.50	3752.	0.	-543.	4295.	2330.
21.00	3912.	0.	-556.	4468.	2419.
21.50	4075.	0.	-570.	4644.	2510.
22.00	4241.	0.	-583.	4823.	2602.
22.50	4410.	0.	-596.	5006.	2696.
23.00	4581.	0.	-609.	5191.	2791.
23.50	4756.	0.	-623.	5379.	2887.
24.00	4934.	0.	-636.	5570.	2985.
24.50	5114.	0.	-649.	5763.	3084.
25.00	5298.	0.	-662.	5960.	3185.
25.50	5485.	0.	-675.	6160.	3287.
26.00	5665.	0.	-689.	6354.	3386.
26.50	5796.	0.	-702.	6498.	3462.
27.00	5920.	0.	-715.	6635.	3534.
27.50	6045.	0.	-728.	6774.	3607.
28.00	6172.	0.	-742.	6914.	3681.
28.50	6302.	0.	-755.	7057.	3756.
29.00	6433.	0.	-768.	7201.	3831.
29.50	6566.	0.	-781.	7347.	3908.
30.00	6701.	0.	-795.	7495.	3986.
30.50	6837.	0.	-808.	7645.	4064.
31.00	6976.	0.	-821.	7797.	4143.
31.50	7117.	0.	-834.	7951.	4223.
32.00	7259.	0.	-848.	8106.	4304.
32.50	7403.	0.	-861.	8264.	4386.
33.00	7549.	0.	-874.	8423.	4469.
33.50	7697.	0.	-887.	8584.	4553.
34.00	7847.	0.	-901.	8747.	4637.
34.50	7998.	0.	-914.	8912.	4723.

35.00	8152.	0.	-927.	9079.	4809.
35.50	8307.	0.	-940.	9248.	4896.
36.00	8464.	0.	-954.	9418.	4984.
36.50	8623.	0.	-967.	9590.	5073.
37.00	8784.	0.	-980.	9765.	5163.
37.50	8947.	0.	-993.	9941.	5254.
38.00	9112.	0.	-1007.	10118.	5346.
38.50	9278.	0.	-1020.	10298.	5438.
39.00	9447.	0.	-1033.	10480.	5532.
39.50	9617.	0.	-1046.	10663.	5626.
40.00	9789.	0.	-1060.	10849.	5721.
40.50	9963.	0.	-1073.	11036.	5817.
41.00	10139.	0.	-1086.	11225.	5914.
41.50	10317.	0.	-1099.	11416.	6012.
42.00	10496.	0.	-1113.	11609.	6111.
42.50	10678.	0.	-1126.	11804.	6210.
43.00	10861.	0.	-1139.	12000.	6311.
43.50	11046.	0.	-1152.	12199.	6412.
44.00	11233.	0.	-1166.	12399.	6515.
44.50	11422.	0.	-1179.	12601.	6618.
45.00	11613.	0.	-1192.	12805.	6722.
45.50	11805.	0.	-1205.	13011.	6827.
46.00	12000.	0.	-1219.	13218.	6933.
46.50	12196.	0.	-1232.	13428.	7040.
47.00	12394.	0.	-1245.	13640.	7147.
47.50	12595.	0.	-1258.	13853.	7256.
48.00	12796.	0.	-1272.	14068.	7365.
48.50	13000.	0.	-1285.	14285.	7475.
49.00	13206.	0.	-1298.	14504.	7587.
49.50	13413.	0.	-1311.	14725.	7699.
50.00	13623.	0.	-1325.	14947.	7812.
50.50	13834.	0.	-1338.	15172.	7925.
51.00	14047.	0.	-1351.	15398.	8040.
51.50	14262.	0.	-1364.	15626.	8156.
52.00	14478.	0.	-1377.	15856.	8272.
52.50	14694.	0.	-1391.	16085.	8388.
53.00	14910.	0.	-1404.	16314.	8504.
53.50	15126.	0.	-1417.	16543.	8620.
54.00	15342.	0.	-1430.	16773.	8736.
54.50	15558.	0.	-1444.	17002.	8852.
55.00	15774.	0.	-1457.	17231.	8968.
55.50	15990.	0.	-1470.	17460.	9085.
56.00	16206.	0.	-1483.	17690.	9201.
56.50	16422.	0.	-1497.	17919.	9317.
57.00	16638.	0.	-1510.	18148.	9433.
57.50	16854.	0.	-1523.	18377.	9549.
58.00	17070.	0.	-1536.	18607.	9665.

Ip = Lunghezza utile del palo

Ql1 = Portata laterale limite

Qbl = Portata di base limite

Wp = Peso efficace del palo

Qu = Portata totale limite

Qd = Portata di progetto = $Ql1/FS,l + Qbl/FS,b - Wp$

7 ANALISI PALIFICATE DI FONDAZIONE

7.1 Metodologie di calcolo

L'analisi statica nello spazio della palificata è stata condotta considerando fondazioni costituite da pali collegati (incastrati) in testa ad un plinto di fondazione assimilabile ad un corpo infinitamente rigido.

I valori massimi delle sollecitazioni agenti su ciascun palo e gli spostamenti della fondazione conseguenti ai carichi applicati sono stati determinati con l'ausilio del codice di calcolo MAP Matrix Analysis of Piles - (G. Guiducci - 1999).

Con tale metodo si tiene conto del fatto che il comportamento della palificata è influenzato sia dalla rigidità orizzontale dei singoli pali che della loro rigidità assiale, nonché dell'influenza reciproca fra i vari elementi (effetto gruppo per carichi orizzontali e verticali).

Il programma consente l'analisi di palificate del tutto generiche nella geometria, disposizione, inclinazione e lunghezza degli elementi di fondazione (pali, pali o setti comunque orientati).

Le condizioni di vincolo tra pali e plinto possono essere di incastro, cerniera e semplice appoggio anche variabili per i diversi elementi.

Il comportamento del palo isolato ai carichi assiali è definito da una caratteristica di rigidità (del sistema palo-terreno), che può essere lineare o non lineare.

Il comportamento del palo isolato soggetto a carico trasversale è definito da una caratteristica di rigidità che tiene conto di un profilo di modulo di reazione terreno-palo variabile con la profondità.

E' possibile tenere conto delle reciproche influenze fra i pali (effetto gruppo sia per carichi verticali che orizzontali) sia in ambito elastico, sulla base della teoria di Poulos e Davis (1980), che adottando curve d'interazione sperimentali quali ad esempio Prakash (1962), Cox et al. (1984), Wang (1986) e Lieng (1988).

Le azioni esterne, siano esse carichi o coazioni (effetti indotti dei cedimenti dei rilevati d'accesso in presenza di terreni compressibili) possono essere applicate al plinto in più centri di carico, per ognuno dei quali vengono definite le componenti di carico in sistemi di riferimento locali.

Le figure seguenti riportano i sistemi di riferimento globale, locale con le convenzioni sui segni delle variabili adottate, le possibili caratteristiche di rigidezza assiale ed orizzontale per i pali nonché le convenzioni adottate per la definizione dei centri di carico.

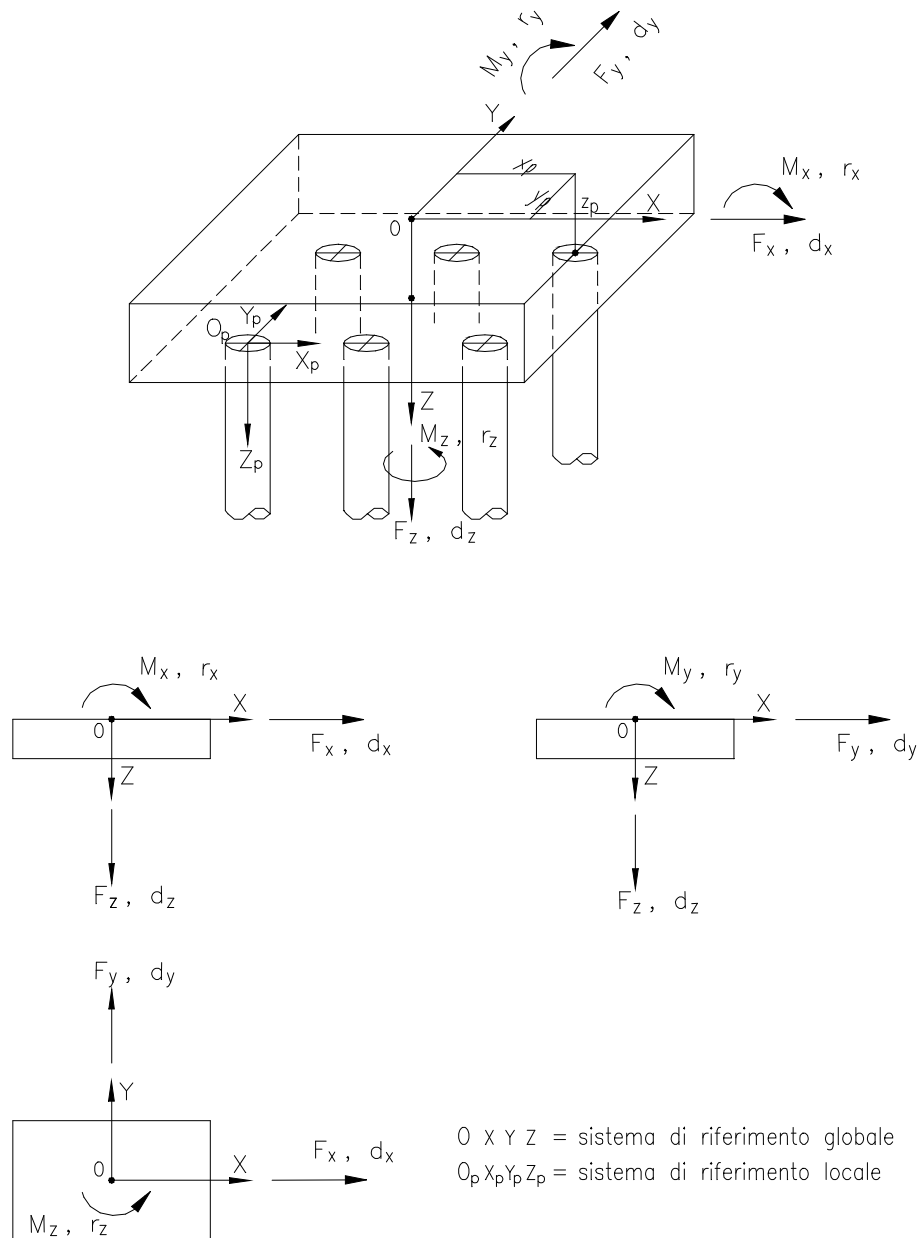
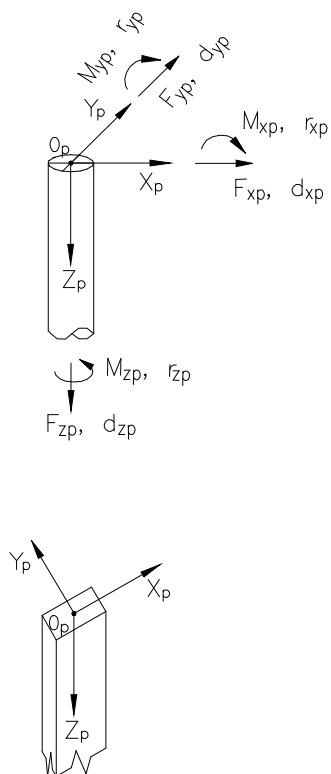


Figura 16 - Sistema di riferimento globale - convenzioni sulle variabili



$O_p X_p Y_p Z_p$ = sistema di riferimento locale

Figura 17- Sistema di riferimento locale - convenzioni sulle variabili

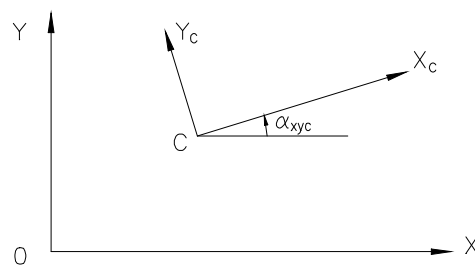
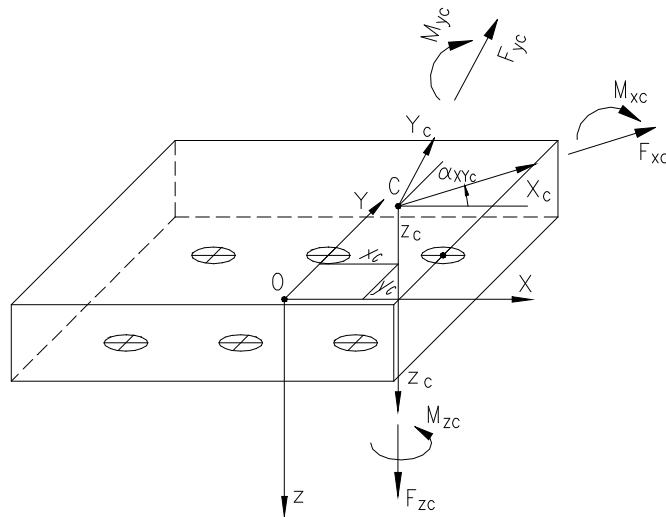


Figura 18- Carichi applicati al plinto: convenzioni relative ai centri di carico

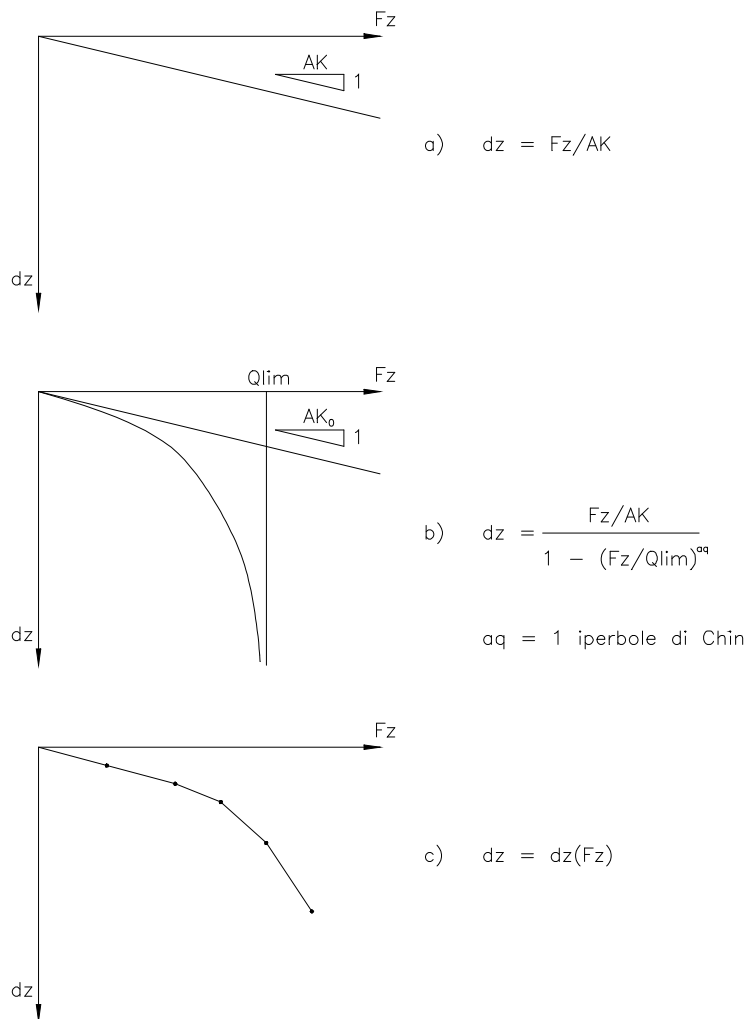


Figura 19- Pali soggetti a carichi assiali: relazioni carico-cedimento

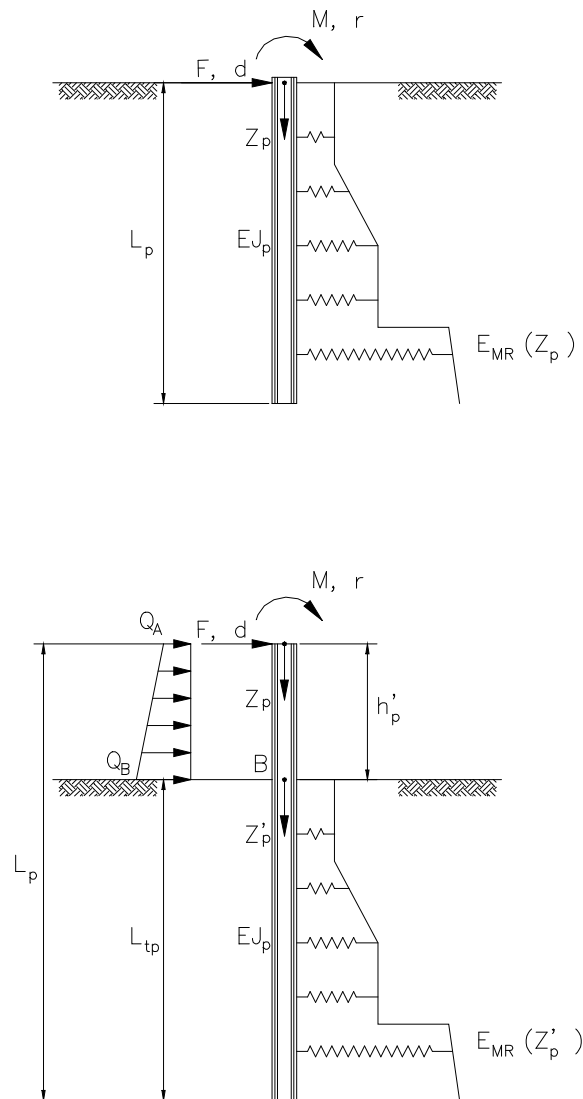


Figura 20 - Pali soggetti a carichi trasversali: moduli di reazione del terreno

Nel seguito si definiscono, per il caso in esame, gli elementi impiegati nello schema di calcolo prescelto ed i risultati delle elaborazioni.

7.1.1 Valutazione della rigidità assiale del palo isolato

La curva carico-cedimento del palo isolato viene caratterizzata attraverso la seguente relazione lineare:

$$dz = [Fz / AK]$$

dove:

dz = spostamento verticale a testa palo;

Fz = carico assiale a testa palo.

La valutazione della curva carico-cedimento del palo isolato è stata effettuata con il programma APAL che utilizza il metodo delle curve di trasferimento riferite al fusto ed alla base dei pali sviluppate da Reese e O'Neill (curve t-s e q-s). In base a tale metodo:

- il palo è schematizzato con un elemento cilindrico, suddiviso in conci, caratterizzato da un modulo elastico E_p ;
- il legame tra palo e terreno viene schematizzato come indicato in Figura 21; le curve di trasferimento per adesione laterale sono di tipo bilaterale, definite dal valore limite della τ nel punto considerato e dallo spostamento relativo limite tra palo e terreno. Lo spostamento limite è stato assunto per i terreni in esame pari a 5 mm, in accordo con numerose risultanze sperimentali disponibili in bibliografia (vedasi Figura 22).
- La curva di trasferimento per la base è di tipo iperbolico (vedasi Figura 22). Si ipotizza che la portata di base limite venga raggiunta per una frazione k del diametro D del palo. L'interpolazione delle curve per le sabbie (Duncan e Champ) e per le argille (Burland – Whitaker) risulta soddisfacente adottando le seguenti relazioni:

$$P_b = [Q_{bl} / 0.9 \cdot E_{si} \cdot s] / [(Q_{bl} / 0.9) + (E_{si} \cdot s)]$$

Dove:

$$E_{si} = (Q_{bl} / 0.9) / C \cdot k \cdot D$$

$Q_{bl} / 0.9$ = portata limite teorica asintotica

s = spostamento generico

C = coefficiente caratteristico della curva

D = diametro del palo.

La curva di base è dunque definita dalla portata limite, dal coefficiente k che determina lo spostamento limite e da C (assunto 0.09 per le sabbie e 0.13 per le argille) che influenza la forma della curva iperbolica.

I valori di tensione laterale limite e di base, adottati per la definizione delle curve carico-cedimento dei pali, sono quelli utilizzati per la capacità portante.

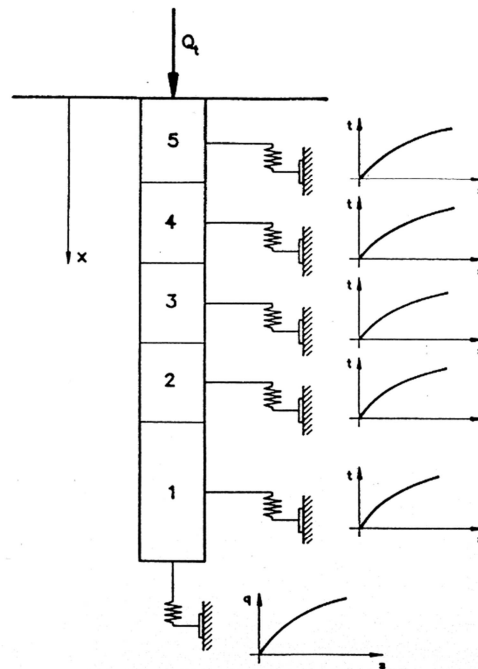


Figura 21 –Legame ideale palo-terreno

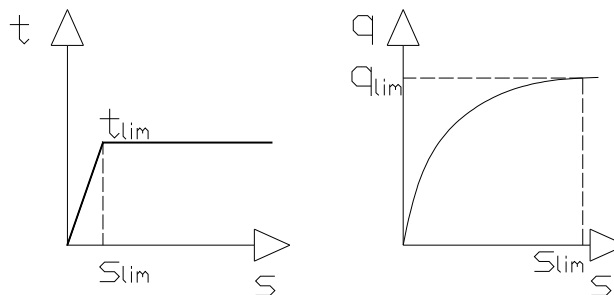


Figura 22 –curve di trasferimento (laterale e base)

La curva carico-cedimento del palo isolato è stata determinata assegnando diversi valori di carico in sommità e ottenendo i corrispondenti valori di cedimento.

Nella seguente figura è mostrata la curva carico-cedimento valutata sulla base della stratigrafia in esame e della geometria del palo (diametro e lunghezza).

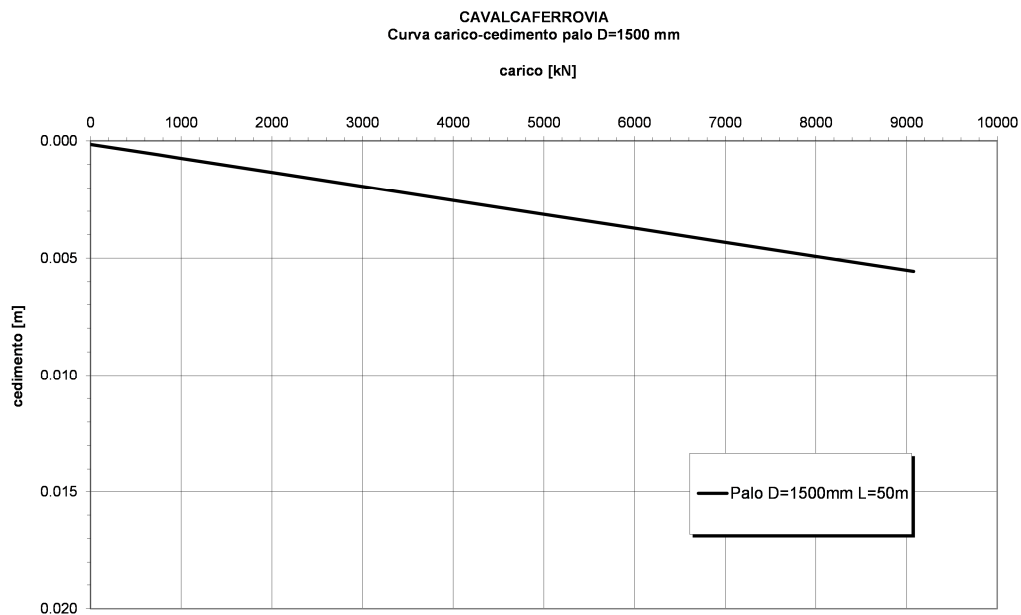


Figura 23 – curva carico – cedimento – palo isolato D=1500 mm

Nel caso in esame, si assume la seguente rigidezza assiale per palo singolo:

- $A_k = 1600000 \text{ kN/m}$ per palo diametro $D=1500 \text{ mm}$ ($L_{\text{preliminare}} = 50 \text{ m}$)

7.1.1.1 *Valutazione della rigidezza assiale del palo in gruppo*

La rigidezza assiale del palo in gruppo è stata valutata in accordo alla correlazione riportata in Mandolini, Russo, Viaggiani (vedasi figura seguente) basata sul confronto parametrico di evidenze sperimentali. Nel grafico viene rappresentato:

$$R_G = E_G / n.$$

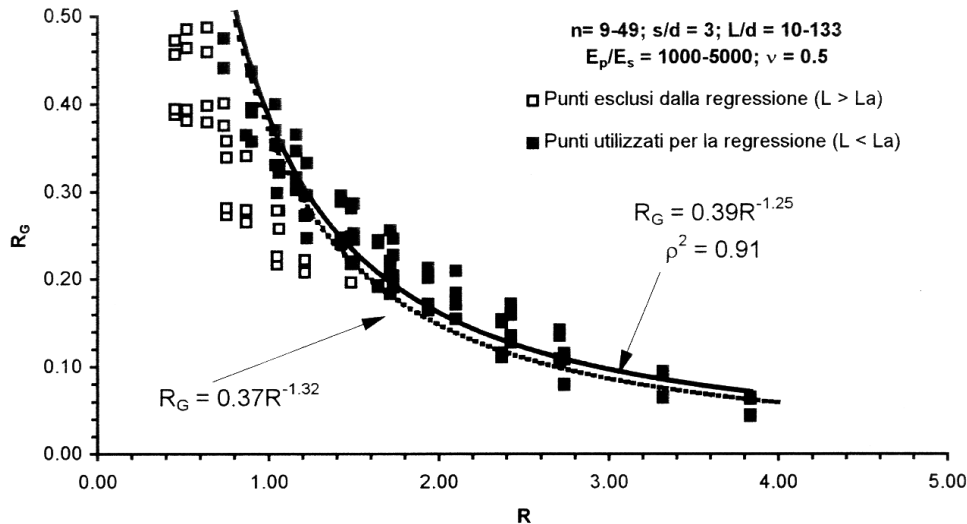


Figura 24 – valutazione E_g (effetto gruppo verticale pali)

In ascissa, il parametro geometrico R (modified aspect ratio) tiene conto della geometria della fondazione (n : numero di pali; s : interasse dei pali; L : lunghezza). Si ha:

$$R = (n \cdot s / L)^{0.5}$$

$$R_G = 0.39 \cdot R^{-1.25}$$

$$E_G = R_G \cdot n = (0.39 \cdot ((n \cdot s / L)^{0.5})^{-1.25}) \cdot n$$

Per la Spalla in esame l'effetto gruppo è stato valutato considerando una singola ala di fondazione, laterale allo scatolare, costituita da 18 pali ad interasse 2 m. Ne consegue:

$$E_G \cong 8; \quad A_{k,g} \cong 1600000 / E_G \cong 200000 \text{ kN/m.}$$

7.1.2 Comportamento del palo soggetto ai carichi orizzontali

7.1.2.1 Modulo di reazione orizzontale del terreno

Lo studio dell'interazione tra palo soggetto ai carichi orizzontali ed il terreno viene effettuato ricorrendo alla teoria di Matlock e Reese che si basa sul noto modello di suolo alla Winkler (elastico-lienare), caratterizzato da un modulo di reazione orizzontale del terreno (E_S) definito come il rapporto fra la reazione del terreno per unità di lunghezza del palo (p) ed il corrispondente spostamento orizzontale (y):

$$E_S = p / y \quad [FL^{-2}]$$

Si osservi che, definito K_w [FL^{-3}] il coefficiente di sottofondo di Winkler, per un palo di diametro D si ha:

$$E_s = K_w \cdot D \quad [FL^{-2}]$$

L'andamento del modulo di reazione orizzontale con la profondità è funzione principalmente del tipo di terreno.

Per i terreni incoerenti si assume in genere una legge di variazione lineare caratterizzata dai seguenti parametri:

$$E_s = E_{s,0} + kh \cdot z \quad [FL^{-2}]$$

dove:

$E_{s,0}$ = valore del modulo di reazione a testa palo;

kh = gradiente del modulo di reazione del terreno funzione principalmente della densità relativa (D_r);

z = profondità a partire dal p.c. locale.

Per i terreni coesivi si assume in genere una legge del tipo:

$$E_s = \xi \cdot c_u$$

dove: c_u = resistenza al taglio in condizioni non drenate.

Per le fondazioni in esame è stato considerato: $\xi = 500$, $kh = 15000 \text{ kN/m}^3$.

A tali valori corrispondono a valori secanti del modulo E_s per pali isolati con basse deformazioni ($y \leq 0.005 \cdot D$, Figura 25).

Andamento del gradiente del modulo di reazione orizzontale - Terreni incoerenti sotto falda

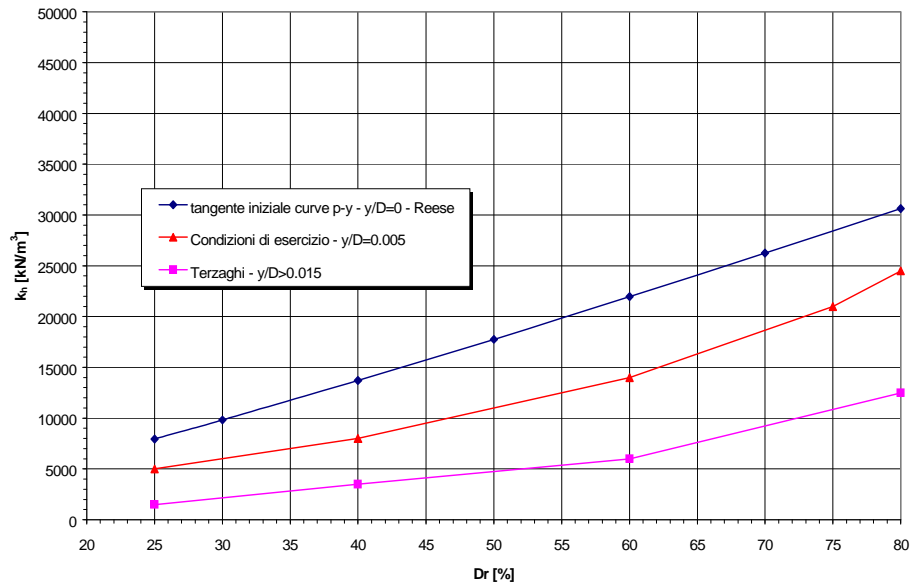


Figura 25

La quota testa palo è a +26.8 m s.l.m., quindi la stratigrafia per la definizione del modulo di reazione orizzontale palo-terreno, è traslata di 7 m rispetto a quella definita al capitolo 4. Per i pali della palificata si considera il seguente andamento del modulo di reazione orizzontale con la profondità, definito a partire da testa palo.

Prof. m	E kN/m2
.00	33750.0
3.00	35250.0
3.10	150000.0
8.00	150000.0
8.10	36750.0
13.00	44250.0
13.10	150000.0
26.00	150000.0
26.10	52500.0
60.00	75000.0

7.1.2.1 *Fattori d'interazione orizzontali per pali in gruppo*

La valutazione dell'effetto gruppo orizzontale è stata svolta in accordo alle indicazioni di Reese et al.. Tali indicazioni tengono essenzialmente conto di risultati di natura sperimentale, condotti da Prakash (1962), Cox (1984), Wang (1986), Lieng (1988).

Le interazioni orizzontali fra i pali sono essenzialmente di due tipi:

- interazione tra pali in linea, caricati in direzione parallela alla fila (figura *Figura 26*);
- interazione tra pali affiancati, caricati in direzione ortogonale alla fila (figura *Figura 27*).

L'interazione del primo tipo si esplica in una diminuzione delle caratteristiche meccaniche del terreno retrostante il palo di testa della fila, con conseguente incremento degli spostamenti dei pali retrostanti.

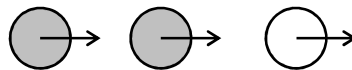


Figura 26

L'interazione del secondo tipo si esplica invece con un incremento degli spostamenti del palo centrale per effetto della presenza dei pali laterali.

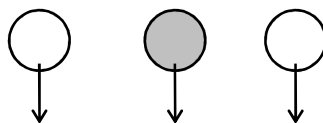


Figura 27

Si tiene inoltre in considerazione una interazione di tipo "obliquo" tra pali, combinando gli effetti precedentemente descritti tramite l'espressione matematica dell'ellisse in coordinate polari (figura *Figura 28*):

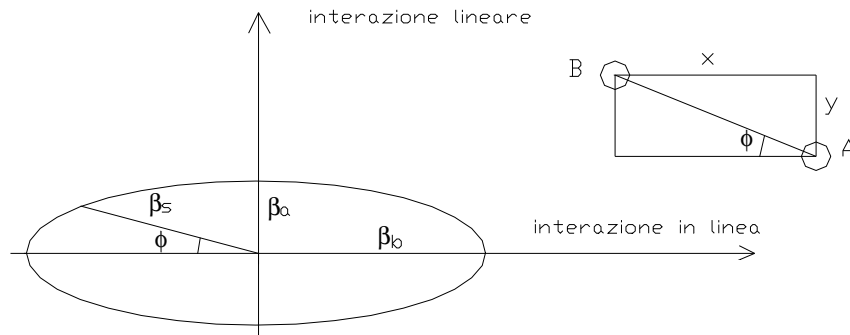


Figura 28

$$\beta_s = (\beta_b^2 \cos^2 \Phi + \beta_a^2 \sin^2 \Phi)^{1/2}$$

per n pali si ha:
$$\beta_{si} = \prod_{j=1, n}^{j \neq i} \beta_{sij}$$

- interazione tra pali affiancati, caricati in direzione perpendicolare alla fila

Il fattore di riduzione in funzione del rapporto s/D (s=interasse dei pali, D=diametro del palo) è rappresentata in figura *Figura 29*;

- interazione tra pali in linea, caricati in direzione parallela alla fila

Il fenomeno di interazione in direzione del carico è più complicato di quello nella direzione trasversale. Studi sperimentali condotti sull'argomento hanno mostrato che l'interazione dipende principalmente dalla posizione relativa dei pali. Numerosi autori indicano fattori di riduzione distinti per pali frontali e pali retrostanti. Tali fattori sono dati in funzione della spaziatura tra i pali nella direzione del carico. I fattori di riduzione per pali frontali e retrostanti sono indicati nelle figure *Figura 30÷Figura 31*.

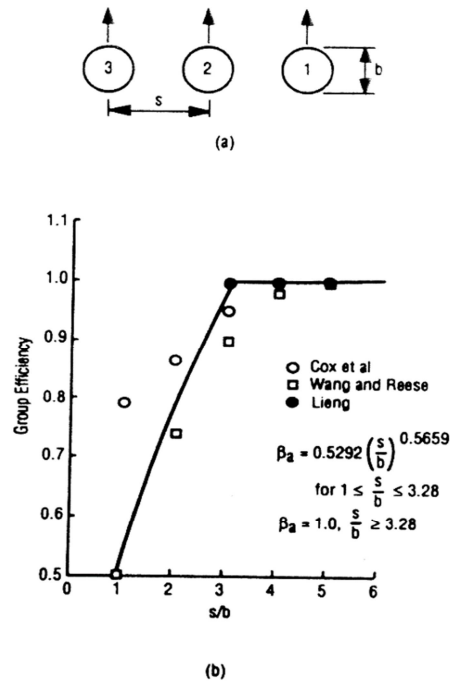


Figura 29 - Fattori di riduzione per pali disposti su file perpendicolari alla direzione di carico

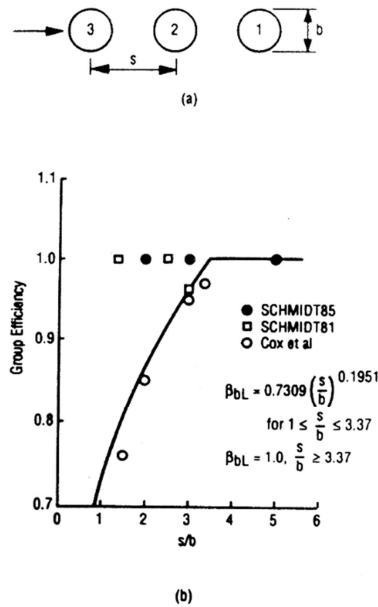


Figura 30 – Fattori di riduzione per pali disposti parallelamente alla direzione di carico- (pali frontali)

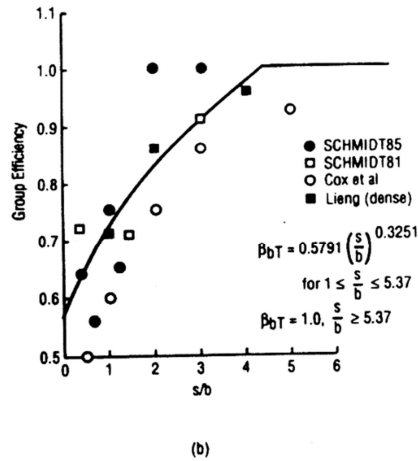
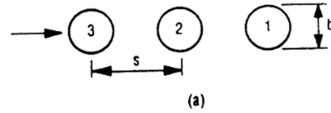


Figura 31 - Fattori di riduzione per pali disposti parallelamente alla direzione di carico- (pali retrostanti)

I fattori così determinati sono utilizzati per penalizzare i moduli di reazione orizzontali di ciascun palo della palificata.

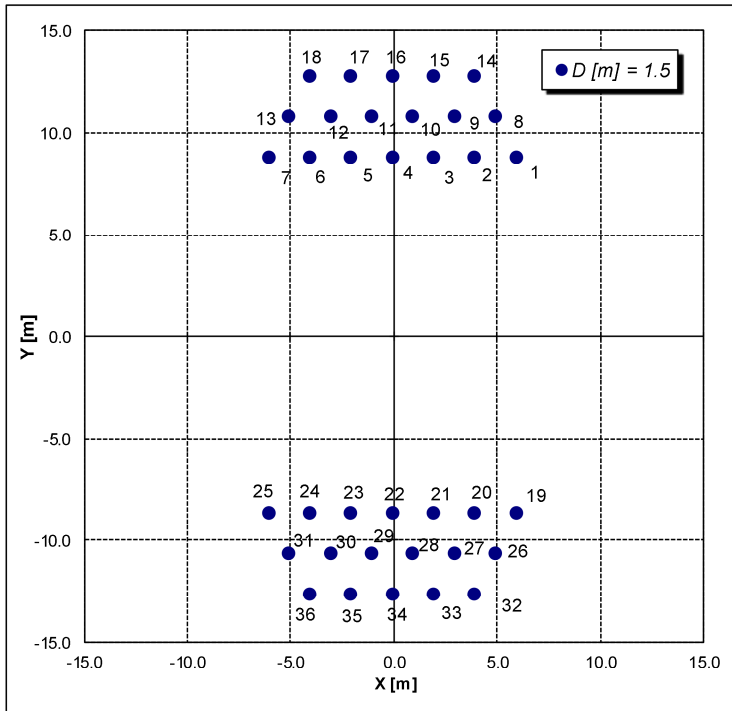
Nelle figure seguenti si riportano i fattori d'interazione ottenuti per ciascun palo delle spalle ed inseriti nel programma di calcolo MAP per l'analisi delle palificate.

E [GPa] = 30.0

J [m⁴] = 0.249

EJ [kPa] = 7455147

D [m] = 1.5



ip [--]	X [m]	Y [m]
1	6.00	8.70
2	4.00	8.70
3	2.00	8.70
4	0.00	8.70
5	-2.00	8.70
6	-4.00	8.70
7	-6.00	8.70
8	5.00	10.70
9	3.00	10.70
10	1.00	10.70
11	-1.00	10.70
12	-3.00	10.70
13	-5.00	10.70
14	4.00	12.70
15	2.00	12.70
16	0.00	12.70
17	-2.00	12.70
18	-4.00	12.70
19	6.00	-8.70
20	4.00	-8.70
21	2.00	-8.70
22	0.00	-8.70
23	-2.00	-8.70
24	-4.00	-8.70
25	-6.00	-8.70
26	5.00	-10.70
27	3.00	-10.70
28	1.00	-10.70
29	-1.00	-10.70
30	-3.00	-10.70
31	-5.00	-10.70
32	4.00	-12.70
33	2.00	-12.70
34	0.00	-12.70
35	-2.00	-12.70
36	-4.00	-12.70

fattori di riduzione

bX [--]	bY [--]
0.30	0.25
0.08	0.05
0.06	0.05
0.06	0.05
0.06	0.05
0.06	0.05
0.20	0.25
0.20	0.20
0.05	0.05
0.05	0.05
0.05	0.05
0.20	0.20
0.25	0.25
0.06	0.05
0.06	0.05
0.06	0.05
0.06	0.05
0.06	0.05
0.20	0.25
0.08	0.05
0.06	0.05
0.06	0.05
0.06	0.05
0.06	0.05
0.20	0.25
0.20	0.20
0.05	0.05
0.05	0.05
0.05	0.05
0.05	0.05
0.20	0.20
0.25	0.25
0.06	0.05
0.06	0.05
0.06	0.05
0.20	0.25

Figura 32 – Fattori di riduzione per l'analisi della palificata della Spalla

7.2 Carichi agenti in fondazione

I carichi agenti in fondazione sono stati forniti dal progettista strutturale nel baricentro palificata delle singole ali laterali allo scatolare, a quota intradosso plinto (nodo n. 777 e nodo n. 789, Figura 1). In Figura 1 è mostrato il sistema di riferimento della palificata ed i sistemi di riferimento dei due punti di applicazione del carico. Per completezza in Appendice C si riportano i carichi forniti dal progettista strutturale.

7.3 Risultati delle analisi

Le analisi sono svolte per entrambe le spalle con appoggi fissi e con appoggi mobili, anche se le geometrie sono uguali.

7.3.1 Spalla appoggi fissi

Nelle seguenti tabelle si sintetizzano le massime sollecitazioni in testa ai pali, il numero del palo e la condizione di carico per cui si ottengono, per le analisi eseguite: SLE, SLU STR, SLU SISMA. Per l'analisi SLE si riportano anche gli spostamenti massimi del plinto. Nelle figure a seguire si riportano gli andamenti del taglio e del momento lungo il fusto del palo.

Nell'Appendice B si riportano i tabulati di calcolo completi.

Tabella 11 – Spalla appoggi fissi – Analisi SLU STR

NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

36 pali L = 50.00 m D = 1500 mm

Sollecitazioni massime in sommità ai pali

	Fz kN	M kN*m	T kN	palo	c.d.c.
S.1	6111.0	1158.0	1248.0	1	7
S.2	-632.8	729.9	977.3	25	7
S.3	3855.5	1733.4	1001.3	19	1
S.4	6050.5	1643.8	1395.7	19	7
T.1	5919.9	1668.9	1364.2	1	12
T.2	1421.0	1446.5	84.6	12	2

S.1: cond. di carico con Sforzo Normale Massimo spalla fissa - n777 _STR7- n789 _STR7					
S.2: cond. di carico con Sforzo Normale Minimo spalla fissa - n777 _STR7- n789 _STR7					
S.3: cond. di carico con Momento Massimo spalla fissa - n777 _STR1 - n789 _STR1					
S.4: cond. di carico con Taglio Massimo spalla fissa - n777 _STR7- n789 _STR7					
T.1: cond. di carico con Tensione Massima (sez. interamente reagente) spalla fissa - n777 _STR12- n789 _STR12					
T.2: cond. di carico con Tensione Minima (sez. interamente reagente) spalla fissa - n777 _STR2- n789 _STR2					

Tabella 12 – Spalla appoggi fissi – Analisi SLV SISMA

NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

36 pali L = 50.00 m D = 1500 mm

Sollecitazioni massime in sommita' ai pali

	Fz kN	M kN*m	T kN	palo	c.d.c.
S.1	6294.6	5476.7	2853.1	1	19
S.2	-3254.7	4841.6	2403.8	25	19
S.3	3855.3	7301.8	2713.7	19	29
S.4	6028.5	7064.2	3337.6	19	19
T.1	6028.5	7064.2	3337.6	19	19
T.2	2792.8	7251.0	2652.9	32	29

S.1: cond. di carico con Sforzo Normale Massimo
 spalla fissa - n777 _Sis7- n789 _Sis7

S.2: cond. di carico con Sforzo Normale Minimo
 spalla fissa - n777 _Sis7- n789 _Sis7

S.3: cond. di carico con Momento Massimo
 spalla fissa - n777 _Sis17- n789 _Sis17

S.4: cond. di carico con Taglio Massimo
 spalla fissa - n777 _Sis7- n789 _Sis7

T.1: cond. di carico con Tensione Massima (sez. interamente reagente)
 spalla fissa - n777 _Sis7- n789 _Sis7

T.2: cond. di carico con Tensione Minima (sez. interamente reagente)
 spalla fissa - n777 _Sis17- n789 _Sis17

Tabella 13 – Spalla appoggi fissi – Analisi SLE FESS

NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

36 pali L = 50.00 m D = 1500 mm

Sollecitazioni massime in sommita' ai pali

	Fz kN	M kN*m	T kN	palo	c.d.c.
S.1	4006.8	702.7	775.4	1	7
S.2	-232.9	450.3	611.8	25	7
S.3	3762.4	1055.5	831.7	1	12
S.4	3966.0	1026.1	874.2	19	7
T.1	3966.0	1026.1	874.2	19	7
T.2	1045.4	888.4	55.6	12	2

S.1: cond. di carico con Sforzo Normale Massimo
spalla fissa - n777 _FESS_7 - n789 _FESS_7

S.2: cond. di carico con Sforzo Normale Minimo
spalla fissa - n777 _FESS_7 - n789 _FESS_7

S.3: cond. di carico con Momento Massimo
spalla fissa - n777 _FESS_12- n789 _FESS_12

S.4: cond. di carico con Taglio Massimo
spalla fissa - n777 _FESS_7 - n789 _FESS_7

T.1: cond. di carico con Tensione Massima (sez. interamente reagente)
spalla fissa - n777 _FESS_7 - n789 _FESS_7

T.2: cond. di carico con Tensione Minima (sez. interamente reagente)
spalla fissa - n777 _FESS_2- n789 _FESS_2

Deformazioni massime del plinto

	dz mm	dx mm	rx mRad	dy mm	ry mRad	c.d.c.
D.1	9.649	9.059	1.511	.324	.010	2
D.2	9.435	11.602	1.750	.322	.012	7
D.3	9.435	11.602	1.750	.322	.012	7
D.4	9.291	9.059	1.453	-.570	-.030	6
D.5	9.291	9.059	1.453	-.570	-.030	6

D.1: cond. di carico con dz massimo
spalla fissa - n777 _FESS_2- n789 _FESS_2

D.2: cond. di carico con dx massimo
spalla fissa - n777 _FESS_7 - n789 _FESS_7

D.3: cond. di carico con rx massimo
spalla fissa - n777 _FESS_7 - n789 _FESS_7

D.4: cond. di carico con dy massimo
spalla fissa - n777 _FESS_6- n789 _FESS_6

D.5: cond. di carico con ry massimo
spalla fissa - n777 _FESS_6- n789 _FESS_6

Tabella 14 – Spalla appoggi fissi – Analisi SLE RARA, FREQ, QP

NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

36 pali L = 50.00 m D = 1500 mm

Sollecitazioni massime in sommita' ai pali

	Fz kN	M kN*m	T kN	palo	c.d.c.
S.1	4878.3	1143.5	1003.7	19	23
S.2	-378.7	437.3	661.3	25	18
S.3	4816.3	1664.4	1161.9	1	23
S.4	4816.3	1664.4	1161.9	1	23
T.1	4816.3	1664.4	1161.9	1	23
T.2	-109.0	902.9	820.4	7	23

S.1: cond. di carico con Sforzo Normale Massimo
 spalla fissa - n777 _RARA_12- n789 _RARA_12
 S.2: cond. di carico con Sforzo Normale Minimo
 spalla fissa - n777 _RARA_7- n789 _RARA_7
 S.3: cond. di carico con Momento Massimo
 spalla fissa - n777 _RARA_12- n789 _RARA_12
 S.4: cond. di carico con Taglio Massimo
 spalla fissa - n777 _RARA_12- n789 _RARA_12
 T.1: cond. di carico con Tensione Massima (sez. interamente reagente)
 spalla fissa - n777 _RARA_12- n789 _RARA_12
 T.2: cond. di carico con Tensione Minima (sez. interamente reagente)
 spalla fissa - n777 _RARA_12- n789 _RARA_12

Deformazioni massime del plinto

	dz mm	dx mm	rx mRad	dy mm	ry mRad	c.d.c.
D.1	11.923	14.399	2.052	-.457	-.018	23
D.2	11.923	14.399	2.052	-.457	-.018	23
D.3	11.923	14.399	2.052	-.457	-.018	23
D.4	9.411	9.492	1.518	.592	.033	17
D.5	9.411	9.492	1.518	.592	.033	17

D.1: cond. di carico con dz massimo
 spalla fissa - n777 _RARA_12- n789 _RARA_12
 D.2: cond. di carico con dx massimo
 spalla fissa - n777 _RARA_12- n789 _RARA_12
 D.3: cond. di carico con rx massimo
 spalla fissa - n777 _RARA_12- n789 _RARA_12
 D.4: cond. di carico con dy massimo
 spalla fissa - n777 _RARA_5 - n789 _RARA_5
 D.5: cond. di carico con ry massimo
 spalla fissa - n777 _RARA_5 - n789 _RARA_5

Spalla appoggi fissi - Palo D=1500 mm - SLU

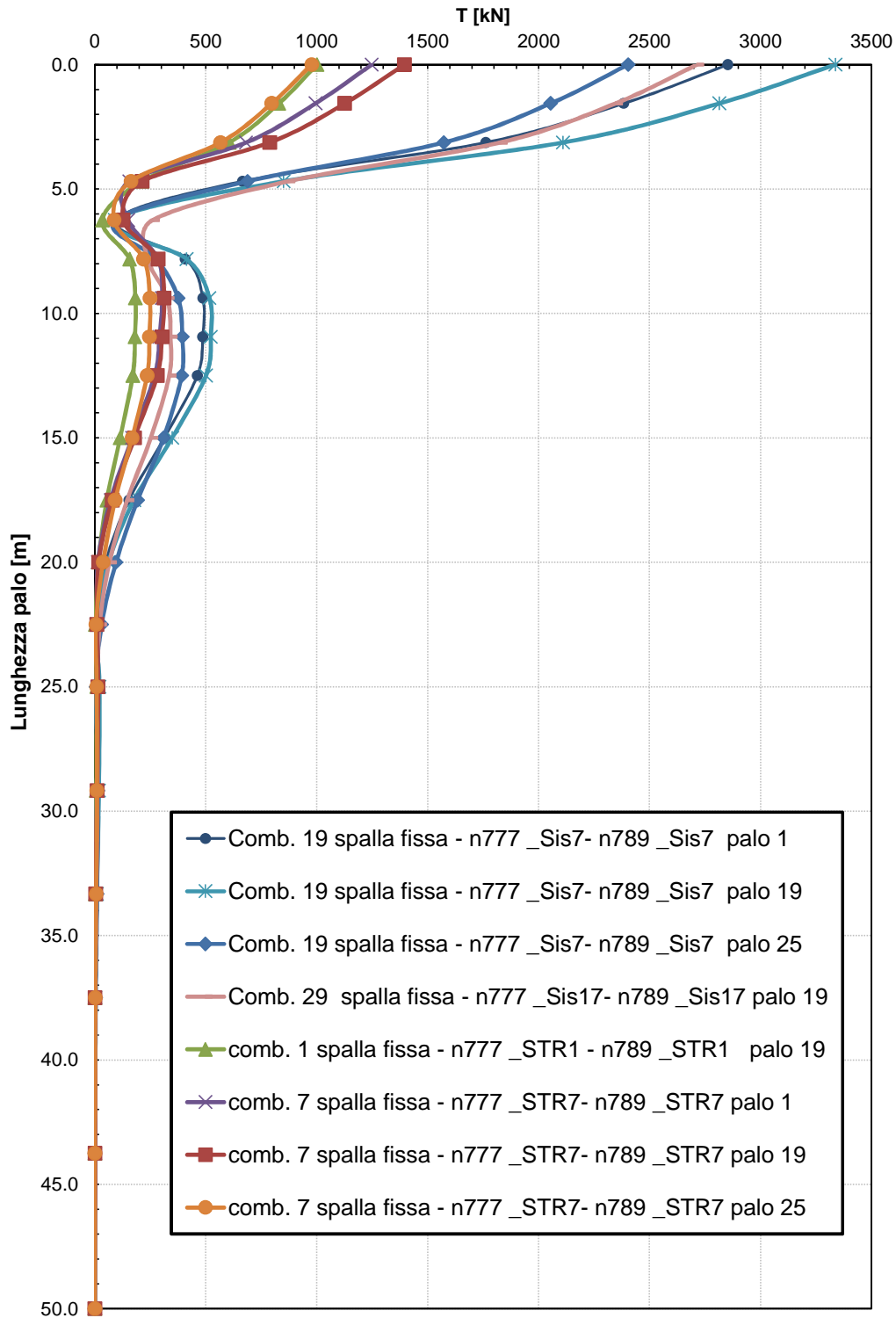


Figura 33 – Andamento del taglio lungo il fusto del palo - SLU

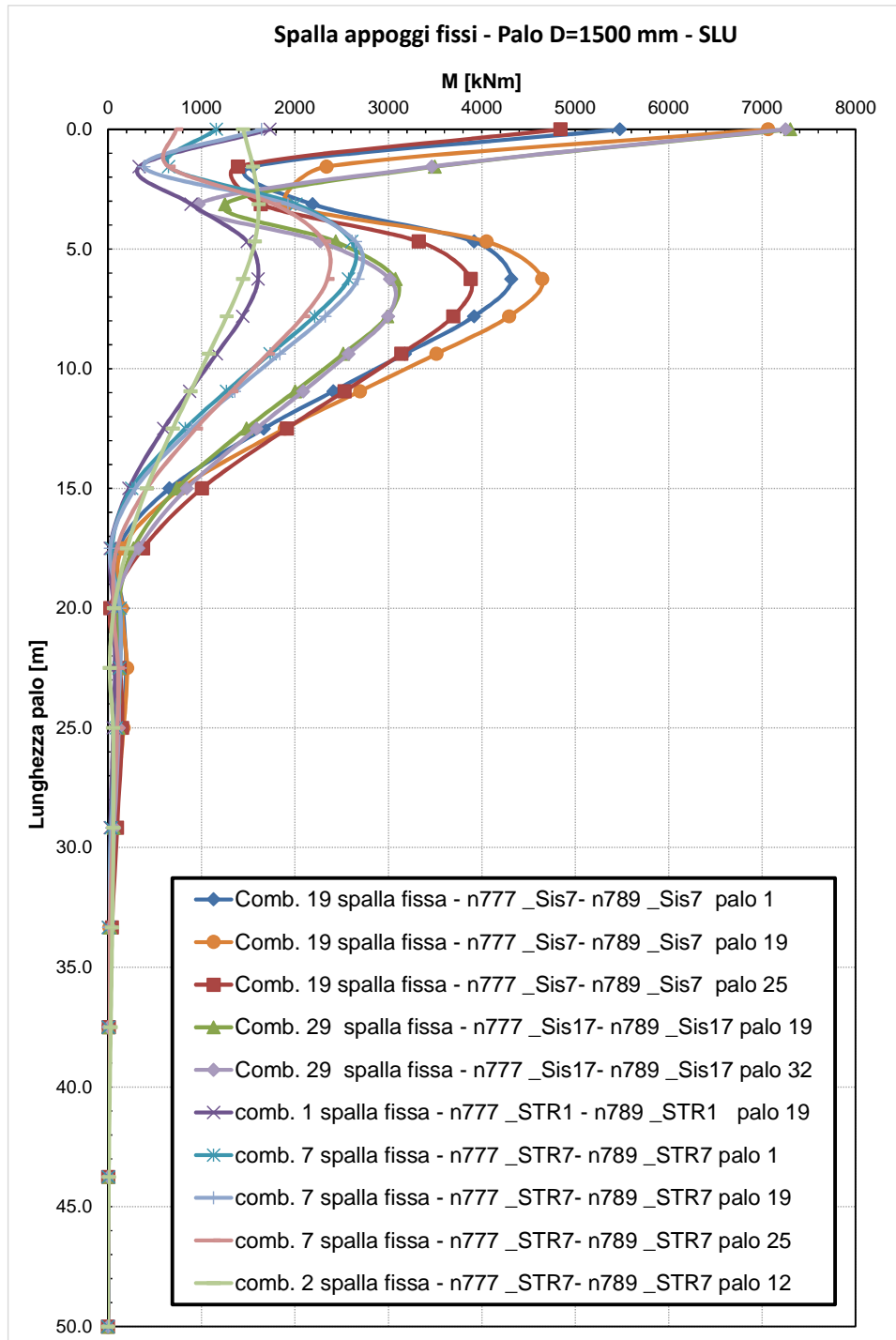


Figura 34 – Andamento del momento lungo il fusto del palo - SLU

Spalla appoggi fissi - Palo D=1500 mm - SLE

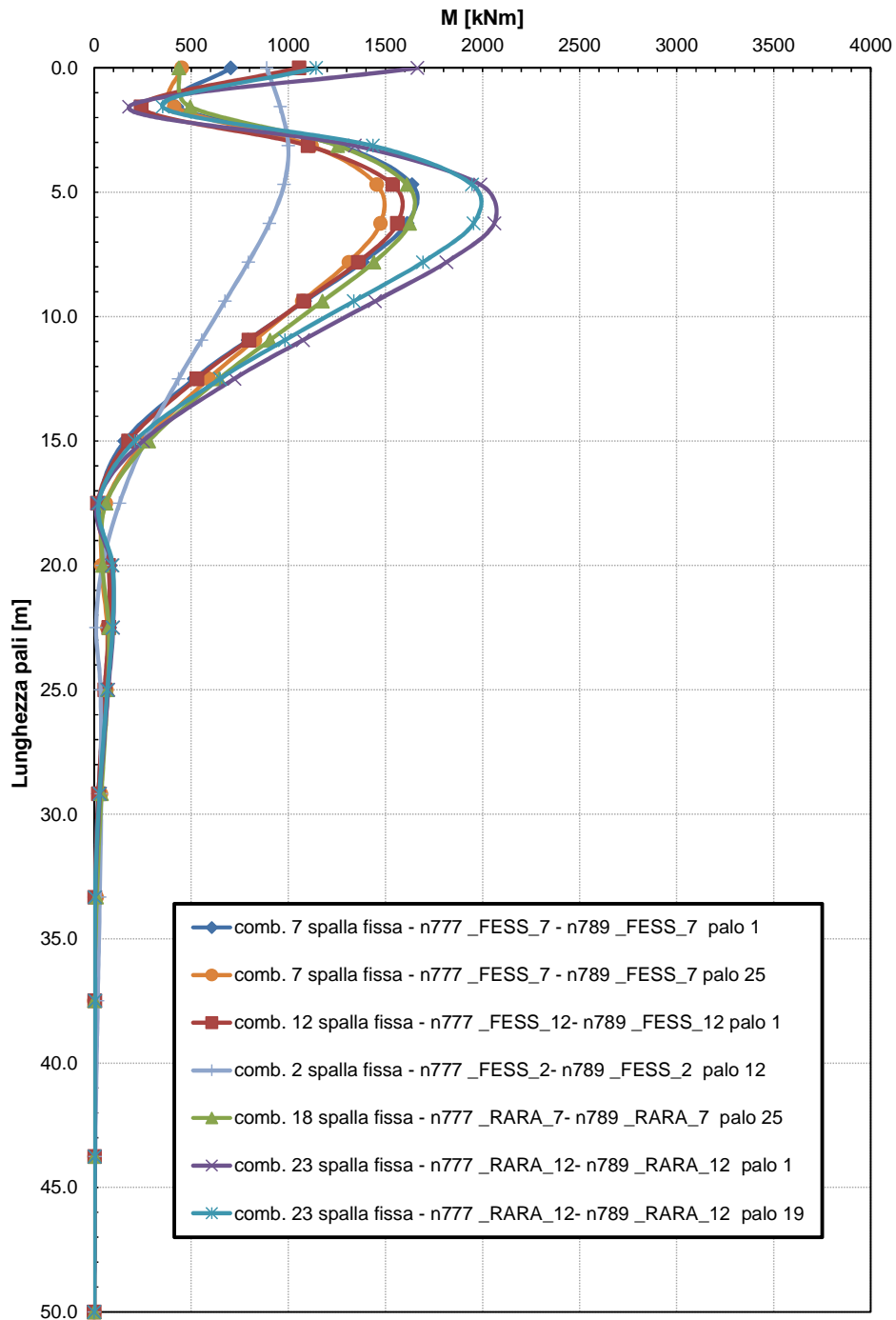


Figura 35 – Andamento del momento lungo il fusto del palo – SLE

7.3.2 Spalla appoggi mobili

Nelle seguenti tabelle si sintetizzano le massime sollecitazioni in testa ai pali, il numero del palo e la condizione di carico per cui si ottengono, per le analisi eseguite: SLE, SLU STR, SLU SISMA. Per l'analisi SLE si riportano anche gli spostamenti massimi del plinto. Nelle figure a seguire si riportano gli andamenti del taglio e del momento lungo il fusto del palo.

Nell'Appendice B si riportano i tabulati di calcolo completi.

Tabella 15 – Spalla appoggi mobili – Analisi SLU STR

NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLU statica

36 pali L = 45.00 m D = 1500 mm

Sollecitazioni massime in sommità ai pali

	Fz kN	M kN*m	T kN	palo	c.d.c.
S.1	5984.5	664.3	1006.4	1	3
S.2	-299.2	123.5	714.3	25	3
S.3	3886.2	1562.8	927.9	19	1
S.4	4959.2	1350.1	1055.8	19	13
T.1	3886.2	1562.8	927.9	19	1
T.2	1011.8	1244.4	117.6	6	4

S.1:	cond. di carico con Sforzo Normale Massimo spalla mobile - n777 _STRM3 - n789 _STRM3				
S.2:	cond. di carico con Sforzo Normale Minimo spalla mobile - n777 _STRM3 - n789 _STRM3				
S.3:	cond. di carico con Momento Massimo spalla mobile - n777 _STRM1- n789 _STRM1				
S.4:	cond. di carico con Taglio Massimo spalla mobile - n777 _STRM13- n789 _STRM13				
T.1:	cond. di carico con Tensione Massima (sez. interamente reagente) spalla mobile - n777 _STRM1- n789 _STRM1				
T.2:	cond. di carico con Tensione Minima (sez. interamente reagente) spalla mobile - n777 _STRM4- n789 _STRM4				

Tabella 16 – Spalla appoggi mobili – Analisi SLV SISMA

NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

36 pali L = 45.00 m D = 1500 mm

Sollecitazioni massime in sommita' ai pali

	Fz kN	M kN*m	T kN	palo	c.d.c.
S.1	4862.2	2210.5	1419.4	19	19
S.2	-1267.6	1928.3	1151.6	7	23
S.3	3199.9	4097.7	1511.4	19	41
S.4	3930.4	3771.8	1699.2	19	21
T.1	3265.3	4089.0	1513.3	19	37
T.2	2370.9	3955.0	1429.8	32	41

S.1: cond. di carico con Sforzo Normale Massimo
 spalla mobile - n777 _SisM3- n789 _SisM3

S.2: cond. di carico con Sforzo Normale Minimo
 spalla mobile - n777 _SisM7- n789 _SisM7

S.3: cond. di carico con Momento Massimo
 spalla mobile - n777 _SisM29 - n789 _SisM29

S.4: cond. di carico con Taglio Massimo
 spalla mobile - n777 _SisM5- n789 _SisM5

T.1: cond. di carico con Tensione Massima (sez. interamente reagente)
 spalla mobile - n777 _SisM25- n789 _SisM25

T.2: cond. di carico con Tensione Minima (sez. interamente reagente)
 spalla mobile - n777 _SisM29 - n789 _SisM29

Tabella 17 – Spalla appoggi mobili – Analisi SLE FESS

NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLE FESS

36 pali L = 45.00 m D = 1500 mm

Sollecitazioni massime in sommita' ai pali

	Fz kN	M kN*m	T kN	palo	c.d.c.
S.1	3930.4	514.2	667.8	1	3
S.2	-119.5	258.6	510.8	25	13
S.3	2823.6	799.2	60.7	9	4
S.4	3861.7	730.0	731.9	19	13
T.1	3861.7	730.0	731.9	19	13
T.2	773.3	750.7	81.9	6	4

S.1: cond. di carico con Sforzo Normale Massimo
spalla mobile - n777 _FESSM_3- n789 _FESSM_3

S.2: cond. di carico con Sforzo Normale Minimo
spalla mobile - n777 _FESSM_13- n789 _FESSM_13

S.3: cond. di carico con Momento Massimo
spalla mobile - n777 _FESSM_4- n789 _FESSM_4

S.4: cond. di carico con Taglio Massimo
spalla mobile - n777 _FESSM_13- n789 _FESSM_13

T.1: cond. di carico con Tensione Massima (sez. interamente reagente)
spalla mobile - n777 _FESSM_13- n789 _FESSM_13

T.2: cond. di carico con Tensione Minima (sez. interamente reagente)
spalla mobile - n777 _FESSM_4- n789 _FESSM_4

Deformazioni massime del plinto

	dz mm	dx mm	rx mRad	dy mm	ry mRad	c.d.c.
D.1	9.649	10.753	1.656	.228	.008	3
D.2	9.435	11.119	1.659	.226	.009	13
D.3	9.435	11.119	1.659	.226	.009	13
D.4	9.291	10.324	1.553	-.409	-.025	11
D.5	9.291	8.455	1.359	-.409	-.025	12

D.1: cond. di carico con dz massimo
spalla mobile - n777 _FESSM_3- n789 _FESSM_3

D.2: cond. di carico con dx massimo
spalla mobile - n777 _FESSM_13- n789 _FESSM_13

D.3: cond. di carico con rx massimo
spalla mobile - n777 _FESSM_13- n789 _FESSM_13

D.4: cond. di carico con dy massimo
spalla mobile - n777 _FESSM_11- n789 _FESSM_11

D.5: cond. di carico con ry massimo
spalla mobile - n777 _FESSM_12- n789 _FESSM_12

Tabella 18 – Spalla appoggi mobili – Analisi SLE RARA, FREQ, QP

NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

36 pali L = 45.00 m D = 1500 mm

Sollecitazioni massime in sommita' ai pali

	Fz kN	M kN*m	T kN	palo	c.d.c.
S.1	4351.6	805.0	876.0	1	19
S.2	-591.6	295.4	624.4	25	19
S.3	3580.1	1138.6	847.7	1	43
S.4	4327.0	872.3	895.6	19	19
T.1	3688.0	1132.9	868.2	19	17
T.2	781.7	910.1	97.5	12	20

S.1: cond. di carico con Sforzo Normale Massimo
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

S.2: cond. di carico con Sforzo Normale Minimo
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

S.3: cond. di carico con Momento Massimo
 spalla mobile - n777 _FREQM_13- n789 _FREQM_13

S.4: cond. di carico con Taglio Massimo
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

T.1: cond. di carico con Tensione Massima (sez. interamente reagente)
 spalla mobile - n777 _RARAM_1- n789 _RARAM_1

T.2: cond. di carico con Tensione Minima (sez. interamente reagente)
 spalla mobile - n777 _RARAM_4- n789 _RARAM_4

Deformazioni massime del plinto

	dz mm	dx mm	rx mRad	dy mm	ry mRad	c.d.c.
D.1	9.400	13.673	2.049	.251	.007	19
D.2	9.400	13.673	2.049	.251	.007	19
D.3	9.400	13.673	2.049	.251	.007	19
D.4	8.605	12.720	1.820	.425	.027	24
D.5	8.605	12.720	1.820	-.425	-.027	26

D.1: cond. di carico con dz massimo
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

D.2: cond. di carico con dx massimo
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

D.3: cond. di carico con rx massimo
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

D.4: cond. di carico con dy massimo
 spalla mobile - n777 _RARAM_9- n789 _RARAM_9

D.5: cond. di carico con ry massimo
 spalla mobile - n777 _RARAM_11- n789 _RARAM_11

Spalla mobile - Palo D=1500 mm - SLU

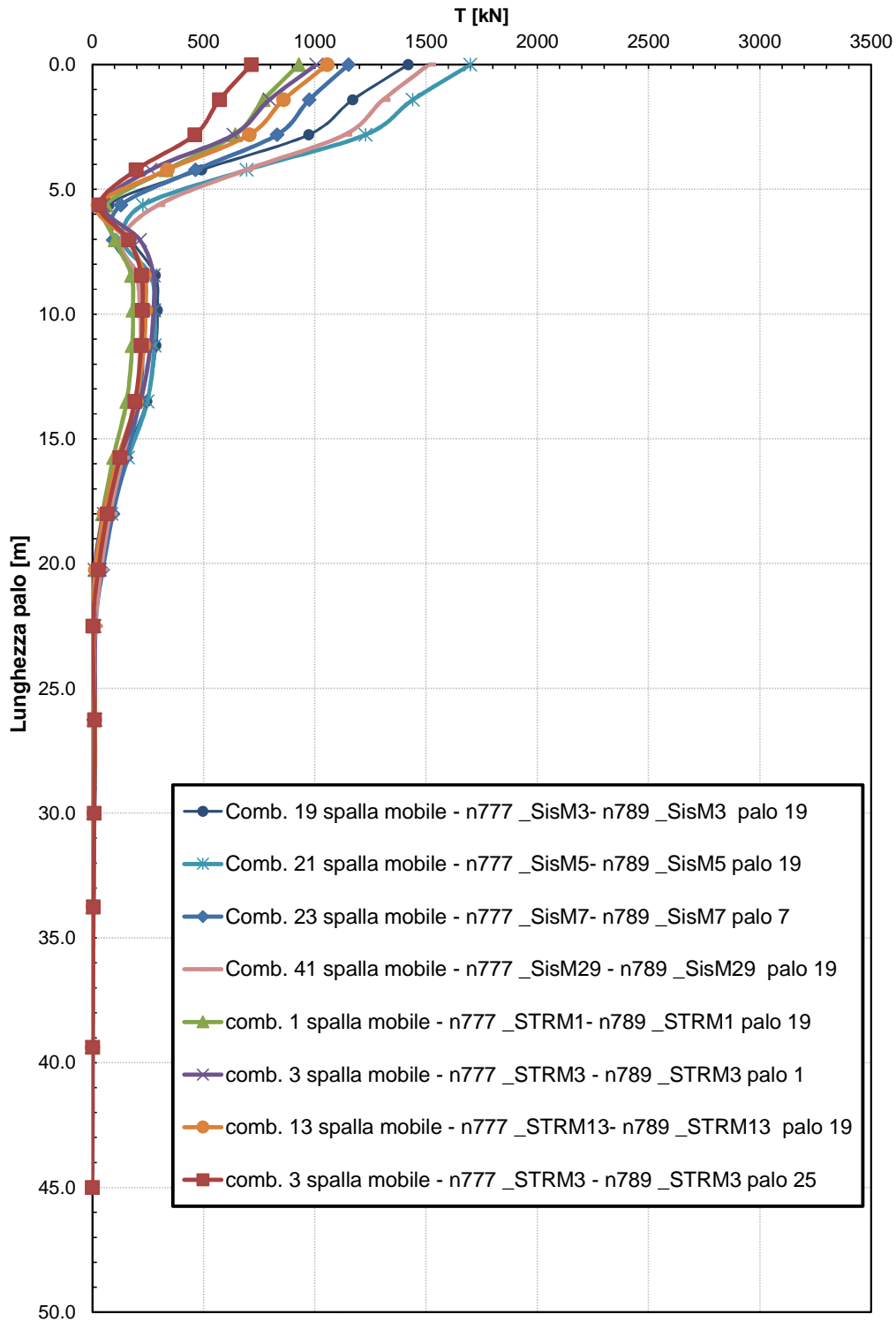


Figura 36 – Andamento del taglio lungo il fusto del palo - SLU

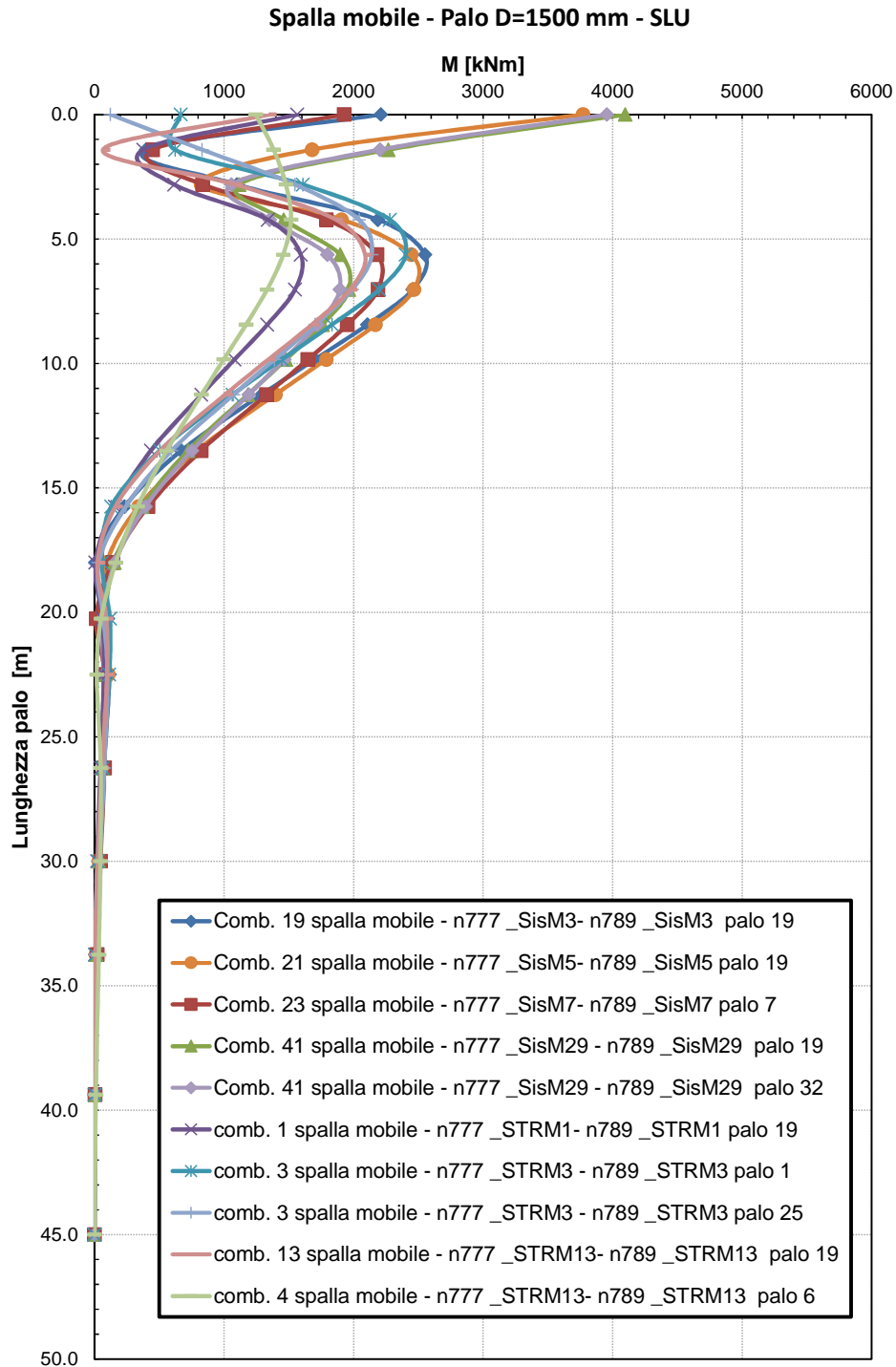


Figura 37 – Andamento del momento lungo il fusto del palo - SLU

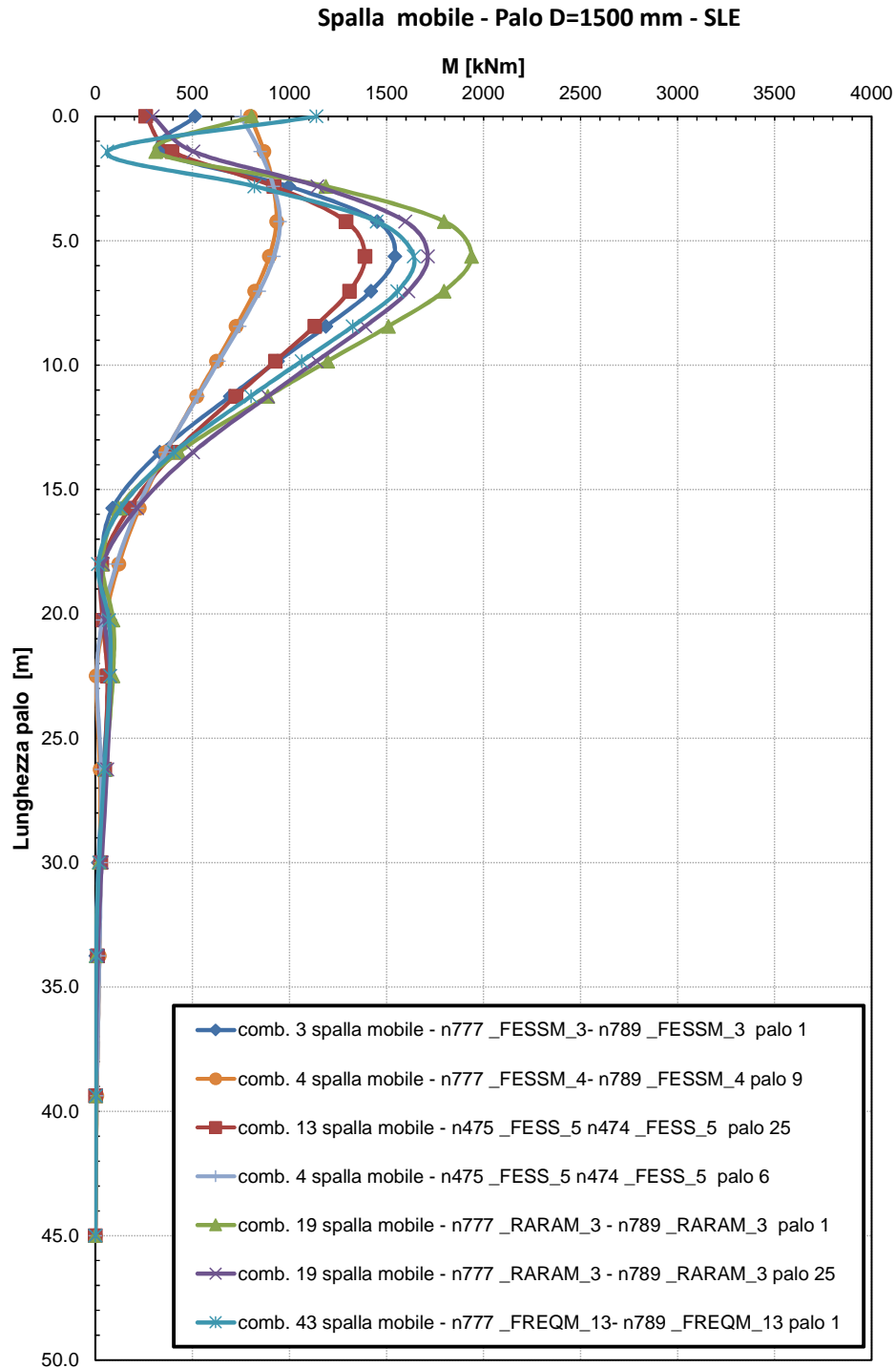


Figura 38 – Andamento del momento lungo il fusto del palo – SLE

7.4 Verifiche di capacità portante pali ai carichi verticali

Le verifiche di capacità portante dei pali sono condotte in accordo alla normativa vigente con Approccio 2 (A1+M1+R3). Nelle seguenti tabelle si sintetizzano le massime sollecitazioni derivanti dal calcolo per le analisi eseguite statiche e sismiche SLU, le lunghezze dei pali e le relative resistenze di progetto a compressione ($R_{d,c}$) ed a trazione ($R_{d,t}$) per i vari meccanismi di portanza in gruppo analizzati (come specificato al paragrafo 6.2.3). Le verifiche di portanza dei pali sono soddisfatte in quanto la resistenza di progetto (R_d) è sempre maggiore della massima sollecitazione assiale (N_{max}) sia a compressione, che a trazione.

Tabella 19 – Verifiche di capacità portante pali spalla definitiva (A1+M1+R3) – appoggi fissi

Spalla appoggi fissi	Condizione di carico	$N_{max,c}$ [kN]	$R_{d,c}$ [kN]	$N_{max,t}$ [kN]	$R_{d,t}$ [kN]	Lpalo [m]
N_{max} blocco di fondazione	Cdc2-STR2	102336	$191736 = (95868 \cdot 2)$	-	-	50.0
N_{max} gruppo di 6 pali maggiormente caricati: ($N_1+N_2+N_8+N_9+N_{14}+N_{15}$)	Cdc7-STR7	30024	35502	-	-	50.0
N_{max} gruppo di 3 pali maggiormente caricati: ($N_1+N_8+N_{14}$)	Cdc7-STR7	16683	23636	-	-	50.0
$N_{max,t}$ – singolo palo di spigolo	Cdc19-SIS7	-	-	3255	7812	50.0
Dove: $N_{max,c}$ = sollecitazione assiale massima a compressione $N_{max,t}$ = sollecitazione assiale massima a trazione $R_{d,c}$ = resistenza di progetto a compressione $R_{d,t}$ = resistenza di progetto a trazione						

Tabella 20 – Verifiche di capacità portante pali spalla definitiva (A1+M1+R3) – appoggi mobili

Spalla appoggi mobili	Condizione di carico	$N_{max,c}$ [kN]	$R_{d,c}$ [kN]	$N_{max,t}$ [kN]	$R_{d,t}$ [kN]	Lpalo [m]
N_{max} blocco di fondazione	Cdc3-STR3	102335	$170113 = (85057 \cdot 2)$	-	-	45.0
N_{max} gruppo di 6 pali maggiormente caricati: ($N_1+N_2+N_8+N_9+N_{14}+N_{15}$)	Cdc3-STR3	29687	31438	-	-	45.0
N_{max} gruppo di 3 pali maggiormente caricati: ($N_1+N_8+N_{14}$)	Cdc3-STR3	16405	20840	-	-	45.0
$N_{max,t}$ – singolo palo di spigolo	Cdc23-SIS7	-	-	1268	6722	45.0
Dove: $N_{max,c}$ = sollecitazione assiale massima a compressione $N_{max,t}$ = sollecitazione assiale massima a trazione $R_{d,c}$ = resistenza di progetto a compressione $R_{d,t}$ = resistenza di progetto a trazione						

La lunghezza palo di progetto soddisfa anche le verifiche di capacità portante relativamente alla configurazione di palificata della spalla di varo impalcato (Figura 3) in quanto la resistenza di progetto (R_d) è sempre maggiore della massima sollecitazione assiale (N_{max}) sia a compressione, che a trazione, come si evince dalla seguente tabella.

Tabella 21 – Verifiche di capacità portante pali spalla fase di varo (A1+M1+R3)

Spalla	$N_{max,c}$ (*) [kN]	$R_{d,c}$ [kN]	$N_{max,t}$ (*) [kN]	$R_{d,t}$ [kN]	L_{palo} [m]
Appoggi fissi	5788	9237	359	7812	50.0
Appoggi mobili	5788	8128	359	6722	45.0

Dove:
 $N_{max,c}$ = sollecitazione assiale massima a compressione
 $N_{max,t}$ = sollecitazione assiale massima a trazione
 $R_{d,c}$ = resistenza di progetto a compressione
 $R_{d,t}$ = resistenza di progetto a trazione
 (*) azioni derivanti dal calcolo della spalla provvisoria di varo riportate nel documento [DC5]

7.5 Verifiche strutturali dei pali

Le verifiche strutturali dei pali sono riportate nella relazione di calcolo dell'opera. Si rammenta comunque che alcuni pali definitivi della spalla saranno utilizzati anche per la fondazione della spalla provvisoria di varo impalcato e quindi le armature dovranno soddisfare le verifiche strutturali anche per le sollecitazioni relative alla fase di varo. Nella Figura 3 è mostrata la configurazione dei pali di fondazione per la spalla di varo provvisoria. I dimensionamenti della fondazione provvisoria di varo sono riportati in apposita relazione di calcolo, a cui si rimanda [DC5].

7.6 Verifica dei requisiti prestazionali della fondazione

La verifica dei requisiti prestazionali della fondazione è stata condotta analizzando le fondazioni con effetto gruppo verticale (rigidezza assiale abbattuta secondo quanto indicato al paragrafo 7.1.1.1 ed orizzontale (valutato secondo quanto indicato al paragrafo 7.1.2.1) considerando le condizioni di carico allo SLE. Nella Tabella 13, Tabella 14 sono riportati i valori di spostamento del plinto a quota testa pali per le condizioni di carico SLE, per la spalla con appoggi fissi. Nella Tabella 17, Tabella 18 sono riportati i valori di spostamento del plinto a quota testa pali per le condizioni di carico SLE, per la spalla con appoggi fissi.

Si stima uno spostamento verticale massimo allo SLE di 11.9 mm (spalla appoggi fissi). Lo spostamento orizzontale massimo agli appoggi si stima pari a: $14.4 + (2.05 \cdot 6) = 26.7$ mm (dove 6 m è la distanza da quota appoggi a intradosso plinto) per la combinazione di carico RARA.

Si tratta di spostamenti compatibili con le prestazioni della struttura.

8 APPENDICE A. VALUTAZIONE CAPACITA' PORTANTE PALI. TABULATI DI CALCOLO PAL

8.1 Portata di progetto (A1+M1+R3) - Singolo blocco di fondazione (18 pali) - compressione

*** P A L ***
Programma per l'analisi della capacita' portante
assiale di un palo di fondazione

(C) G.Guiducci - Studio SINTESI (RN - Italy)
ottobre 2006

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Capacita portante blocco SLU A1+M1+R3

Quota testa palo da p.c. = 2.00 m
Quota falda da p.c. = 4.00 m
Peso di volume del palo = 8.10 kN/m3
Fattore di sicurezza portata laterale = 1.90 (FS,l)
Fattore di sicurezza portata di base = 2.20 (FS,b)

Elemento con sezione avente:
Area =31.78800 m2 Perimetro =33.70000 m

Criterio per la determinazione della portata di base in uno strato "i"
quando la $Q_{b,i}$ ad esso attribuibile e' superiore a quella degli
strati adiacenti:

La base del palo deve essere situata almeno: $3.0 * 6.362 = 19.09$ m
entro lo strato se quello sovrastante e' piu' debole

La base del palo deve essere situata almeno: $3.0 * 6.362 = 19.09$ m
sopra lo strato sottostante se esso e' piu' debole

La variazione di Q_b viene assunta lineare dal passaggio di strato

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Capacità portante blocco SLU A1+M1+R3

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 1 "A" (Coesivo) da 0.00 a 5.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = \alpha * C_u < 100.0 \text{ kPa} \quad \text{Criterio } \alpha(C_u) \text{ nel seguito}$$

$$\tau > .23 * S'v$$
$$\tau < .55 * S'v$$

$$Q_b = 9.0 * C_u + S_v$$

Cu variabile lin. da 67.5 a 75.0 kPa

Strato 2 "GS" (Incoerente) da 5.00 a 10.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$$
$$K = .70 \quad \delta = 35.0 \text{ deg}$$

Qb variabile lin. da 3350. a 3350. kPa

Strato 3 "A1" (Coesivo) da 10.00 a 15.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = \alpha * C_u < 100.0 \text{ kPa} \quad \text{Criterio } \alpha(C_u) \text{ nel seguito}$$

$$\tau > .23 * S'v$$
$$\tau < .55 * S'v$$

$$Q_b = 9.0 * C_u + S_v$$

Cu variabile lin. da 82.5 a 90.0 kPa

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco SLU A1+M1+R3

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 4 "GS " (Incoerente) da 15.00 a 28.00 m

 $G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$
 $\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$
 $K = .70$ $\delta = 36.0 \text{ deg}$
 Q_b variabile lin. da 3685. a 3685. kPa

Strato 5 "A1 " (Coesivo) da 28.00 a 60.00 m

 $G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$
 $\tau = \alpha * C_u < 120.0 \text{ kPa}$
 Criterio $\alpha(C_u)$ nel seguito

 $\tau > .23 * S'v$
 $\tau < .55 * S'v$
 $Q_b = 9.0 * C_u + S_v$
 C_u variabile lin. da 109.5 a 150.0 kPa

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 Capacita portante blocco SLU A1+M1+R3

MOLTIPLICATORI per i parametri di calcolo

strato	Molt. Tau	Molt. Qb	Molt. Cu
1 "A "	1.00	1.00	1.00
2 "GS "	1.00	1.00	-
3 "A1 "	1.00	1.00	1.00
4 "GS "	1.00	1.00	-
5 "A1 "	1.00	1.00	1.00

NOTA: i moltiplicatori non influenzano le limitazioni superiori o inferiori dei parametri

 Per terreni coesivi: Criterio $\tau = \alpha * C_u$

Cu kPa	alfa
.0	.90
25.0	.90
25.1	.80
50.0	.80
51.0	.60
75.0	.60
75.1	.40
300.0	.40

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 Capacita portante blocco SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
2.00	38.0	38.0	70.5	.55	20.9	673.
2.50	47.5	47.5	71.3	.55	26.1	689.
3.00	57.0	57.0	72.0	.55	31.4	705.
3.50	66.5	66.5	72.8	.55	36.6	721.
4.00	76.0	76.0	73.5	.55	41.8	738.
4.50	80.5	85.5	74.3	.55	44.3	754.
5.00	85.0	95.0	75.0	.51	43.3	770.
5.50	89.5	104.5	--	.49	43.9	838.
6.00	94.0	114.0	--	.49	46.1	906.
6.50	98.5	123.5	--	.49	48.3	974.
7.00	103.0	133.0	--	.49	50.5	1042.
7.50	107.5	142.5	--	.49	52.7	1109.
8.00	112.0	152.0	--	.49	54.9	1177.
8.50	116.5	161.5	--	.49	57.1	1116.
9.00	121.0	171.0	--	.49	59.3	1055.
9.50	125.5	180.5	--	.49	61.5	994.
10.00	130.0	190.0	--	.37	48.4	933.
10.50	134.5	199.5	83.3	.25	33.3	949.
11.00	139.0	209.0	84.0	.24	33.6	965.
11.50	143.5	218.5	84.8	.24	33.9	981.
12.00	148.0	228.0	85.5	.23	34.2	998.
12.50	152.5	237.5	86.3	.23	35.1	1014.
13.00	157.0	247.0	87.0	.23	36.1	1030.
13.50	161.5	256.5	87.8	.23	37.1	1046.
14.00	166.0	266.0	88.5	.23	38.2	1063.
14.50	170.5	275.5	89.3	.23	39.2	1079.
15.00	175.0	285.0	90.0	.37	64.6	1095.
15.50	179.5	294.5	--	.51	91.3	1163.
16.00	184.0	304.0	--	.51	93.6	1231.
16.50	188.5	313.5	--	.51	95.9	1299.

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NODO BOLOGNA CAVALCAVIA CV03
Capacita portante blocco SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
17.00	193.0	323.0	--	.51	98.2	1368.
17.50	197.5	332.5	--	.51	100.4	1436.
18.00	202.0	342.0	--	.51	102.7	1504.
18.50	206.5	351.5	--	.51	105.0	1572.
19.00	211.0	361.0	--	.51	107.3	1640.
19.50	215.5	370.5	--	.51	109.6	1708.
20.00	220.0	380.0	--	.51	111.9	1777.
20.50	224.5	389.5	--	.51	114.2	1845.
21.00	229.0	399.0	--	.51	116.5	1913.
21.50	233.5	408.5	--	.51	118.8	1981.
22.00	238.0	418.0	--	.51	121.0	2049.
22.50	242.5	427.5	--	.51	123.3	2117.
23.00	247.0	437.0	--	.51	125.6	2063.
23.50	251.5	446.5	--	.51	127.9	2008.
24.00	256.0	456.0	--	.51	130.2	1954.
24.50	260.5	465.5	--	.51	132.5	1899.
25.00	265.0	475.0	--	.51	134.8	1845.
25.50	269.5	484.5	--	.51	137.1	1790.
26.00	274.0	494.0	--	.51	139.4	1736.
26.50	278.5	503.5	--	.51	141.6	1681.
27.00	283.0	513.0	--	.51	143.9	1627.
27.50	287.5	522.5	--	.51	146.2	1572.
28.00	292.0	532.0	--	.37	107.8	1518.
28.50	296.5	541.5	110.1	.23	68.2	1533.
29.00	301.0	551.0	110.8	.23	69.2	1548.
29.50	305.5	560.5	111.4	.23	70.3	1563.
30.00	310.0	570.0	112.0	.23	71.3	1578.
30.50	314.5	579.5	112.7	.23	72.3	1593.
31.00	319.0	589.0	113.3	.23	73.4	1609.
31.50	323.5	598.5	113.9	.23	74.4	1624.

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NODO BOLOGNA CAVALCAVIA CV03
Capacita portante blocco SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
32.00	328.0	608.0	114.6	.23	75.4	1639.
32.50	332.5	617.5	115.2	.23	76.5	1654.
33.00	337.0	627.0	115.8	.23	77.5	1669.
33.50	341.5	636.5	116.5	.23	78.5	1685.
34.00	346.0	646.0	117.1	.23	79.6	1700.
34.50	350.5	655.5	117.7	.23	80.6	1715.
35.00	355.0	665.0	118.4	.23	81.7	1730.
35.50	359.5	674.5	119.0	.23	82.7	1745.
36.00	364.0	684.0	119.6	.23	83.7	1761.
36.50	368.5	693.5	120.3	.23	84.8	1776.
37.00	373.0	703.0	120.9	.23	85.8	1791.
37.50	377.5	712.5	121.5	.23	86.8	1806.
38.00	382.0	722.0	122.2	.23	87.9	1821.
38.50	386.5	731.5	122.8	.23	88.9	1837.
39.00	391.0	741.0	123.4	.23	89.9	1852.
39.50	395.5	750.5	124.1	.23	91.0	1867.
40.00	400.0	760.0	124.7	.23	92.0	1882.
40.50	404.5	769.5	125.3	.23	93.0	1897.
41.00	409.0	779.0	126.0	.23	94.1	1913.
41.50	413.5	788.5	126.6	.23	95.1	1928.

42.00	418.0	798.0	127.2	.23	96.1	1943.
42.50	422.5	807.5	127.9	.23	97.2	1958.
43.00	427.0	817.0	128.5	.23	98.2	1973.
43.50	431.5	826.5	129.1	.23	99.2	1989.
44.00	436.0	836.0	129.8	.23	100.3	2004.
44.50	440.5	845.5	130.4	.23	101.3	2019.
45.00	445.0	855.0	131.0	.23	102.3	2034.
45.50	449.5	864.5	131.6	.23	103.4	2049.
46.00	454.0	874.0	132.3	.23	104.4	2065.
46.50	458.5	883.5	132.9	.23	105.5	2080.

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz	S'v	Sv	Cu	Tau/S'v	Tau	qb
m	kPa	kPa	kPa	-	kPa	kPa
47.00	463.0	893.0	133.5	.23	106.5	2095.
47.50	467.5	902.5	134.2	.23	107.5	2110.
48.00	472.0	912.0	134.8	.23	108.6	2125.
48.50	476.5	921.5	135.4	.23	109.6	2141.
49.00	481.0	931.0	136.1	.23	110.6	2156.
49.50	485.5	940.5	136.7	.23	111.7	2171.
50.00	490.0	950.0	137.3	.23	112.7	2186.
50.50	494.5	959.5	138.0	.23	113.7	2201.
51.00	499.0	969.0	138.6	.23	114.8	2216.
51.50	503.5	978.5	139.2	.23	115.8	2232.
52.00	508.0	988.0	139.9	.23	116.8	2247.
52.50	512.5	997.5	140.5	.23	117.9	2262.
53.00	517.0	1007.0	141.1	.23	118.9	2277.
53.50	521.5	1016.5	141.8	.23	119.9	2292.
54.00	526.0	1026.0	142.4	.23	120.0	2308.
54.50	530.5	1035.5	143.0	.23	120.0	2323.
55.00	535.0	1045.0	143.7	.22	120.0	2338.
55.50	539.5	1054.5	144.3	.22	120.0	2353.
56.00	544.0	1064.0	144.9	.22	120.0	2368.
56.50	548.5	1073.5	145.6	.22	120.0	2384.
57.00	553.0	1083.0	146.2	.22	120.0	2399.
57.50	557.5	1092.5	146.8	.22	120.0	2414.
58.00	562.0	1102.0	147.5	.21	120.0	2429.
58.50	566.5	1111.5	148.1	.21	120.0	2444.
59.00	571.0	1121.0	148.7	.21	120.0	2460.
59.50	575.5	1130.5	149.4	.21	120.0	2475.
60.00	580.0	1140.0	150.0	.21	120.0	2490.

 zz = Profondita' da piano campagna
 S'v = Tensione verticale efficace
 Sv = Tensione verticale totale
 Cu = Coesione non drenata
 Tau = Tensione di adesione laterale limite
 qb = Portata di base limite unitaria

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 Capacita portante blocco SLU A1+M1+R3

STAMPA capacita' portante e relativi contributi

Lp m	Ql1 kN	Qb1 kN	Wp kN	Qu kN	Qd kN
.00	0.	21377.	0.	21377.	9717.
.50	396.	21894.	129.	22161.	10032.
1.00	880.	22411.	257.	23033.	10393.
1.50	1453.	22927.	386.	23994.	10800.
2.00	2113.	23444.	515.	25042.	11253.
2.50	2838.	23960.	644.	26155.	11741.
3.00	3584.	24477.	772.	27289.	12240.
3.50	4312.	26635.	901.	30046.	13475.
4.00	5070.	28793.	1030.	32833.	14726.
4.50	5865.	30951.	1159.	35658.	15997.
5.00	6697.	33110.	1287.	38519.	17287.
5.50	7566.	35268.	1416.	41418.	18597.
6.00	8473.	37426.	1545.	44354.	19926.
6.50	9416.	35480.	1674.	43223.	19410.
7.00	10397.	33534.	1802.	42129.	18912.
7.50	11415.	31588.	1931.	41072.	18435.
8.00	12405.	29642.	2060.	39988.	17943.
8.50	13028.	30159.	2189.	40999.	18377.
9.00	13592.	30675.	2317.	41950.	18780.
9.50	14161.	31192.	2446.	42907.	19185.
10.00	14734.	31709.	2575.	43868.	19593.
10.50	15317.	32225.	2704.	44839.	20006.
11.00	15917.	32742.	2832.	45827.	20428.
11.50	16534.	33258.	2961.	46832.	20859.
12.00	17169.	33775.	3090.	47854.	21299.
12.50	17821.	34291.	3219.	48894.	21748.
13.00	18593.	34808.	3347.	50054.	22260.
13.50	20009.	36974.	3476.	53508.	23862.
14.00	21567.	39141.	3605.	57103.	25538.
14.50	23163.	41308.	3734.	60737.	27234.
15.00	24798.	43474.	3862.	64410.	28950.
15.50	26471.	45641.	3991.	68121.	30687.
16.00	28183.	47807.	4120.	71870.	32444.
16.50	29933.	49974.	4248.	75659.	34221.
17.00	31722.	52141.	4377.	79485.	36019.
17.50	33549.	54307.	4506.	83351.	37837.
18.00	35415.	56474.	4635.	87255.	39675.
18.50	37320.	58640.	4763.	91197.	41533.
19.00	39263.	60807.	4892.	95178.	43412.
19.50	41245.	62974.	5021.	99198.	45311.
20.00	43265.	65140.	5150.	103256.	47231.
20.50	45324.	67307.	5278.	107352.	49170.
21.00	47421.	65573.	5407.	107588.	49358.
21.50	49557.	63840.	5536.	107861.	49565.
22.00	51732.	62106.	5665.	108174.	49793.
22.50	53945.	60373.	5793.	108524.	50041.
23.00	56197.	58639.	5922.	108914.	50309.
23.50	58487.	56906.	6051.	109342.	50598.
24.00	60816.	55172.	6180.	109808.	50907.
24.50	63183.	53439.	6308.	110313.	51236.
25.00	65589.	51705.	6437.	110857.	51586.
25.50	68033.	49972.	6566.	111439.	51956.
26.00	70345.	48238.	6695.	111889.	52256.
26.50	71657.	48721.	6823.	113555.	53037.
27.00	72815.	49204.	6952.	115067.	53737.
27.50	73990.	49687.	7081.	116596.	54446.
28.00	75182.	50170.	7210.	118143.	55165.
28.50	76393.	50653.	7338.	119708.	55893.
29.00	77620.	51136.	7467.	121290.	56630.
29.50	78865.	51619.	7596.	122889.	57376.
30.00	80128.	52103.	7724.	124506.	58131.
30.50	81407.	52586.	7853.	126140.	58895.
31.00	82705.	53069.	7982.	127791.	59669.
31.50	84020.	53552.	8111.	129460.	60452.
32.00	85352.	54035.	8239.	131147.	61244.
32.50	86701.	54518.	8368.	132851.	62045.

33.00	88069.	55001.	8497.	134572.	62855.
33.50	89453.	55484.	8626.	136311.	63675.
34.00	90855.	55967.	8754.	138067.	64503.
34.50	92274.	56450.	8883.	139841.	65341.
35.00	93711.	56933.	9012.	141632.	66188.
35.50	95166.	57416.	9141.	143441.	67045.
36.00	96637.	57899.	9269.	145267.	67910.
36.50	98126.	58382.	9398.	147110.	68785.
37.00	99633.	58865.	9527.	148971.	69668.
37.50	101157.	59348.	9656.	150849.	70561.
38.00	102699.	59831.	9784.	152745.	71463.
38.50	104257.	60314.	9913.	154658.	72375.
39.00	105834.	60797.	10042.	156589.	73295.
39.50	107428.	61280.	10171.	158537.	74225.
40.00	109039.	61763.	10299.	160503.	75164.
40.50	110668.	62246.	10428.	162486.	76112.
41.00	112314.	62729.	10557.	164486.	77069.
41.50	113977.	63212.	10686.	166504.	78035.
42.00	115658.	63695.	10814.	168539.	79011.
42.50	117357.	64178.	10943.	170592.	79996.
43.00	119073.	64661.	11072.	172662.	80989.
43.50	120806.	65144.	11201.	174750.	81993.
44.00	122557.	65627.	11329.	176855.	83005.
44.50	124325.	66110.	11458.	178977.	84026.
45.00	126110.	66593.	11587.	181117.	85057.
45.50	127913.	67076.	11715.	183274.	86097.
46.00	129734.	67559.	11844.	185449.	87146.
46.50	131572.	68042.	11973.	187641.	88204.
47.00	133427.	68525.	12102.	189851.	89271.
47.50	135300.	69009.	12230.	192078.	90348.
48.00	137190.	69492.	12359.	194323.	91433.
48.50	139098.	69975.	12488.	196585.	92528.
49.00	141023.	70458.	12617.	198864.	93632.
49.50	142966.	70941.	12745.	201161.	94746.
50.00	144926.	71424.	12874.	203475.	95868.
50.50	146903.	71907.	13003.	205807.	97000.
51.00	148898.	72390.	13132.	208156.	98140.
51.50	150911.	72873.	13260.	210523.	99290.
52.00	152932.	73356.	13389.	212899.	100445.
52.50	154954.	73839.	13518.	215275.	101600.
53.00	156976.	74322.	13647.	217652.	102755.
53.50	158998.	74805.	13775.	220028.	103910.
54.00	161020.	75288.	13904.	222404.	105065.
54.50	163042.	75771.	14033.	224781.	106220.
55.00	165064.	76254.	14162.	227157.	107375.
55.50	167086.	76737.	14290.	229533.	108530.
56.00	169108.	77220.	14419.	231909.	109685.
56.50	171130.	77703.	14548.	234286.	110840.
57.00	173152.	78186.	14677.	236662.	111995.
57.50	175174.	78669.	14805.	239038.	113151.
58.00	177196.	79152.	14934.	241415.	114306.

Lp = Lunghezza utile del palo
 Qll = Portata laterale limite
 Qbl = Portata di base limite
 Wp = Peso efficace del palo
 Qu = Portata totale limite
 Qd = Portata di progetto = $Qll/FS,l + Qbl/FS,b - Wp$

8.2 Portata di progetto (A1+M1+R3) - Gruppo 6 pali - compressione

*** P A L ***
Programma per l'analisi della capacita' portante
assiale di un palo di fondazione

(C) G.Guiducci - Studio SINTESI (RN - Italy)
ottobre 2006

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NODO BOLOGNA CAVALCAVIA CV03
Capacita portante blocco 6pali SLU A1+M1+R3

Quota testa palo da p.c. = 2.00 m
Quota falda da p.c. = 4.00 m
Peso di volume del palo = 8.10 kN/m3
Fattore di sicurezza portata laterale = 1.90 (FS,l)
Fattore di sicurezza portata di base = 2.20 (FS,b)

Elemento con sezione avente:
Area =10.59600 m2 Perimetro =12.80000 m

Criterio per la determinazione della portata di base in uno strato "i"
quando la $Q_{b,i}$ ad esso attribuibile e' superiore a quella degli
strati adiacenti:

La base del palo deve essere situata almeno: $3.0 * 3.673 = 11.02$ m
entro lo strato se quello sovrastante e' piu' debole

La base del palo deve essere situata almeno: $3.0 * 3.673 = 11.02$ m
sopra lo strato sottostante se esso e' piu' debole

La variazione di Q_b viene assunta lineare dal passaggio di strato

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NODO BOLOGNA CAVALCAVIA CV03
Capacità portante blocco 6pali SLU A1+M1+R3

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 1 "A" (Coesivo) da 0.00 a 5.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = \alpha * C_u < 100.0 \text{ kPa} \quad \text{Criterio } \alpha(C_u) \text{ nel seguito}$$

$$\tau > .23 * S'v$$
$$\tau < .55 * S'v$$

$$Q_b = 9.0 * C_u + S_v$$

$$C_u \text{ variabile lin. da } 67.5 \text{ a } 75.0 \text{ kPa}$$

Strato 2 "GS" (Incoerente) da 5.00 a 10.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$$
$$K = .70 \quad \delta = 35.0 \text{ deg}$$

$$Q_b \text{ variabile lin. da } 3350. \text{ a } 3350. \text{ kPa}$$

Strato 3 "A1" (Coesivo) da 10.00 a 15.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = \alpha * C_u < 100.0 \text{ kPa} \quad \text{Criterio } \alpha(C_u) \text{ nel seguito}$$

$$\tau > .23 * S'v$$
$$\tau < .55 * S'v$$

$$Q_b = 9.0 * C_u + S_v$$

$$C_u \text{ variabile lin. da } 82.5 \text{ a } 90.0 \text{ kPa}$$

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco 6pali SLU A1+M1+R3

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 4 "GS " (Incoerente) da 15.00 a 28.00 m

 $G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$
 $\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$
 $K = .70$ $\delta = 36.0 \text{ deg}$
 Q_b variabile lin. da 3685. a 3685. kPa

Strato 5 "A1 " (Coesivo) da 28.00 a 60.00 m

 $G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$
 $\tau = \alpha * C_u < 120.0 \text{ kPa}$
 Criterio $\alpha(C_u)$ nel seguito
 $\tau > .23 * S'v$
 $\tau < .55 * S'v$
 $Q_b = 9.0 * C_u + S_v$
 C_u variabile lin. da 109.5 a 150.0 kPa

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco 6pali SLU A1+M1+R3

MOLTIPLICATORI per i parametri di calcolo

strato	Molt. Tau	Molt. Qb	Molt. Cu
1 "A "	1.00	1.00	1.00
2 "GS "	1.00	1.00	-
3 "A1 "	1.00	1.00	1.00
4 "GS "	1.00	1.00	-
5 "A1 "	1.00	1.00	1.00

NOTA: i moltiplicatori non influenzano le limitazioni superiori o inferiori dei parametri

 Per terreni coesivi: Criterio $\tau = \alpha * C_u$

Cu kPa	alfa
.0	.90
25.0	.90
25.1	.80
50.0	.80
51.0	.60
75.0	.60
75.1	.40
300.0	.40

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco 6pali SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
2.00	38.0	38.0	70.5	.55	20.9	673.
2.50	47.5	47.5	71.3	.55	26.1	689.
3.00	57.0	57.0	72.0	.55	31.4	705.
3.50	66.5	66.5	72.8	.55	36.6	721.
4.00	76.0	76.0	73.5	.55	41.8	738.
4.50	80.5	85.5	74.3	.55	44.3	754.
5.00	85.0	95.0	75.0	.51	43.3	770.
5.50	89.5	104.5	--	.49	43.9	887.
6.00	94.0	114.0	--	.49	46.1	1005.
6.50	98.5	123.5	--	.49	48.3	1122.
7.00	103.0	133.0	--	.49	50.5	1239.
7.50	107.5	142.5	--	.49	52.7	1356.
8.00	112.0	152.0	--	.49	54.9	1361.
8.50	116.5	161.5	--	.49	57.1	1254.
9.00	121.0	171.0	--	.49	59.3	1147.
9.50	125.5	180.5	--	.49	61.5	1040.
10.00	130.0	190.0	--	.37	48.4	933.
10.50	134.5	199.5	83.3	.25	33.3	949.
11.00	139.0	209.0	84.0	.24	33.6	965.
11.50	143.5	218.5	84.8	.24	33.9	981.
12.00	148.0	228.0	85.5	.23	34.2	998.
12.50	152.5	237.5	86.3	.23	35.1	1014.
13.00	157.0	247.0	87.0	.23	36.1	1030.
13.50	161.5	256.5	87.8	.23	37.1	1046.
14.00	166.0	266.0	88.5	.23	38.2	1063.
14.50	170.5	275.5	89.3	.23	39.2	1079.
15.00	175.0	285.0	90.0	.37	64.6	1095.
15.50	179.5	294.5	--	.51	91.3	1213.
16.00	184.0	304.0	--	.51	93.6	1330.
16.50	188.5	313.5	--	.51	95.9	1448.

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco 6pali SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
17.00	193.0	323.0	--	.51	98.2	1566.
17.50	197.5	332.5	--	.51	100.4	1662.
18.00	202.0	342.0	--	.51	102.7	1759.
18.50	206.5	351.5	--	.51	105.0	1855.
19.00	211.0	361.0	--	.51	107.3	1951.
19.50	215.5	370.5	--	.51	109.6	2048.
20.00	220.0	380.0	--	.51	111.9	2144.
20.50	224.5	389.5	--	.51	114.2	2240.
21.00	229.0	399.0	--	.51	116.5	2336.
21.50	233.5	408.5	--	.51	118.8	2433.
22.00	238.0	418.0	--	.51	121.0	2529.
22.50	242.5	427.5	--	.51	123.3	2625.
23.00	247.0	437.0	--	.51	125.6	2525.
23.50	251.5	446.5	--	.51	127.9	2424.
24.00	256.0	456.0	--	.51	130.2	2323.
24.50	260.5	465.5	--	.51	132.5	2223.
25.00	265.0	475.0	--	.51	134.8	2122.
25.50	269.5	484.5	--	.51	137.1	2021.
26.00	274.0	494.0	--	.51	139.4	1920.
26.50	278.5	503.5	--	.51	141.6	1820.
27.00	283.0	513.0	--	.51	143.9	1719.
27.50	287.5	522.5	--	.51	146.2	1618.
28.00	292.0	532.0	--	.37	107.8	1518.
28.50	296.5	541.5	110.1	.23	68.2	1533.
29.00	301.0	551.0	110.8	.23	69.2	1548.
29.50	305.5	560.5	111.4	.23	70.3	1563.
30.00	310.0	570.0	112.0	.23	71.3	1578.
30.50	314.5	579.5	112.7	.23	72.3	1593.
31.00	319.0	589.0	113.3	.23	73.4	1609.
31.50	323.5	598.5	113.9	.23	74.4	1624.

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco 6pali SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
32.00	328.0	608.0	114.6	.23	75.4	1639.
32.50	332.5	617.5	115.2	.23	76.5	1654.
33.00	337.0	627.0	115.8	.23	77.5	1669.
33.50	341.5	636.5	116.5	.23	78.5	1685.
34.00	346.0	646.0	117.1	.23	79.6	1700.
34.50	350.5	655.5	117.7	.23	80.6	1715.
35.00	355.0	665.0	118.4	.23	81.7	1730.
35.50	359.5	674.5	119.0	.23	82.7	1745.
36.00	364.0	684.0	119.6	.23	83.7	1761.
36.50	368.5	693.5	120.3	.23	84.8	1776.
37.00	373.0	703.0	120.9	.23	85.8	1791.
37.50	377.5	712.5	121.5	.23	86.8	1806.
38.00	382.0	722.0	122.2	.23	87.9	1821.
38.50	386.5	731.5	122.8	.23	88.9	1837.
39.00	391.0	741.0	123.4	.23	89.9	1852.
39.50	395.5	750.5	124.1	.23	91.0	1867.
40.00	400.0	760.0	124.7	.23	92.0	1882.
40.50	404.5	769.5	125.3	.23	93.0	1897.

41.00	409.0	779.0	126.0	.23	94.1	1913.
41.50	413.5	788.5	126.6	.23	95.1	1928.
42.00	418.0	798.0	127.2	.23	96.1	1943.
42.50	422.5	807.5	127.9	.23	97.2	1958.
43.00	427.0	817.0	128.5	.23	98.2	1973.
43.50	431.5	826.5	129.1	.23	99.2	1989.
44.00	436.0	836.0	129.8	.23	100.3	2004.
44.50	440.5	845.5	130.4	.23	101.3	2019.
45.00	445.0	855.0	131.0	.23	102.3	2034.
45.50	449.5	864.5	131.6	.23	103.4	2049.
46.00	454.0	874.0	132.3	.23	104.4	2065.
46.50	458.5	883.5	132.9	.23	105.5	2080.

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NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco 6pali SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
47.00	463.0	893.0	133.5	.23	106.5	2095.
47.50	467.5	902.5	134.2	.23	107.5	2110.
48.00	472.0	912.0	134.8	.23	108.6	2125.
48.50	476.5	921.5	135.4	.23	109.6	2141.
49.00	481.0	931.0	136.1	.23	110.6	2156.
49.50	485.5	940.5	136.7	.23	111.7	2171.
50.00	490.0	950.0	137.3	.23	112.7	2186.
50.50	494.5	959.5	138.0	.23	113.7	2201.
51.00	499.0	969.0	138.6	.23	114.8	2216.
51.50	503.5	978.5	139.2	.23	115.8	2232.
52.00	508.0	988.0	139.9	.23	116.8	2247.
52.50	512.5	997.5	140.5	.23	117.9	2262.
53.00	517.0	1007.0	141.1	.23	118.9	2277.
53.50	521.5	1016.5	141.8	.23	119.9	2292.
54.00	526.0	1026.0	142.4	.23	120.0	2308.
54.50	530.5	1035.5	143.0	.23	120.0	2323.
55.00	535.0	1045.0	143.7	.22	120.0	2338.
55.50	539.5	1054.5	144.3	.22	120.0	2353.
56.00	544.0	1064.0	144.9	.22	120.0	2368.
56.50	548.5	1073.5	145.6	.22	120.0	2384.
57.00	553.0	1083.0	146.2	.22	120.0	2399.
57.50	557.5	1092.5	146.8	.22	120.0	2414.
58.00	562.0	1102.0	147.5	.21	120.0	2429.
58.50	566.5	1111.5	148.1	.21	120.0	2444.
59.00	571.0	1121.0	148.7	.21	120.0	2460.
59.50	575.5	1130.5	149.4	.21	120.0	2475.
60.00	580.0	1140.0	150.0	.21	120.0	2490.

zz = Profondita' da piano campagna
 S'v = Tensione verticale efficace
 Sv = Tensione verticale totale
 Cu = Coesione non drenata
 Tau = Tensione di adesione laterale limite
 qb = Portata di base limite unitaria

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante blocco 6pali SLU A1+M1+R3

STAMPA capacita' portante e relativi contributi

Lp m	Ql1 kN	Qb1 kN	Wp kN	Qu kN	Qd kN
.00	0.	7126.	0.	7126.	3239.
.50	150.	7298.	43.	7406.	3354.
1.00	334.	7470.	86.	7719.	3486.
1.50	552.	7642.	129.	8065.	3635.
2.00	803.	7815.	172.	8445.	3803.
2.50	1078.	7987.	215.	8850.	3983.
3.00	1361.	8159.	257.	9263.	4168.
3.50	1638.	9402.	300.	10739.	4835.
4.00	1926.	10644.	343.	12226.	5508.
4.50	2228.	11887.	386.	13728.	6189.
5.00	2544.	13129.	429.	15244.	6878.
5.50	2874.	14372.	472.	16774.	7573.
6.00	3218.	14425.	515.	17128.	7736.
6.50	3576.	13289.	558.	16308.	7365.
7.00	3949.	12153.	601.	15501.	7002.
7.50	4336.	11017.	644.	14709.	6646.
8.00	4712.	9881.	687.	13906.	6285.
8.50	4948.	10053.	730.	14272.	6444.
9.00	5163.	10225.	772.	14615.	6592.
9.50	5379.	10397.	815.	14961.	6742.
10.00	5596.	10570.	858.	15308.	6892.
10.50	5818.	10742.	901.	15658.	7043.
11.00	6046.	10914.	944.	16015.	7199.
11.50	6280.	11086.	987.	16379.	7357.
12.00	6521.	11258.	1030.	16749.	7520.
12.50	6769.	11430.	1073.	17126.	7685.
13.00	7062.	11603.	1116.	17549.	7875.
13.50	7600.	12850.	1159.	19291.	8682.
14.00	8192.	14097.	1202.	21088.	9518.
14.50	8798.	15345.	1245.	22898.	10361.
15.00	9419.	16592.	1287.	24724.	11212.
15.50	10054.	17613.	1330.	26337.	11967.
16.00	10704.	18634.	1373.	27965.	12730.
16.50	11369.	19654.	1416.	29607.	13501.
17.00	12049.	20675.	1459.	31265.	14280.
17.50	12743.	21696.	1502.	32936.	15066.
18.00	13452.	22716.	1545.	34623.	15860.
18.50	14175.	23737.	1588.	36324.	16662.
19.00	14913.	24757.	1631.	38040.	17472.
19.50	15666.	25778.	1674.	39770.	18289.
20.00	16433.	26799.	1717.	41515.	19114.
20.50	17215.	27819.	1759.	43275.	19946.
21.00	18012.	26752.	1802.	42961.	19837.
21.50	18823.	25685.	1845.	42662.	19736.
22.00	19649.	24618.	1888.	42378.	19643.
22.50	20489.	23550.	1931.	42109.	19557.
23.00	21345.	22483.	1974.	41854.	19480.
23.50	22215.	21416.	2017.	41613.	19409.
24.00	23099.	20348.	2060.	41388.	19347.
24.50	23998.	19281.	2103.	41177.	19292.
25.00	24912.	18214.	2146.	40980.	19245.
25.50	25841.	17147.	2189.	40799.	19206.
26.00	26719.	16079.	2232.	40567.	19140.
26.50	27217.	16240.	2274.	41183.	19432.
27.00	27657.	16401.	2317.	41741.	19694.
27.50	28103.	16562.	2360.	42305.	19959.
28.00	28556.	16723.	2403.	42876.	20228.
28.50	29016.	16884.	2446.	43454.	20500.
29.00	29482.	17045.	2489.	44038.	20776.
29.50	29955.	17206.	2532.	44629.	21055.
30.00	30434.	17368.	2575.	45227.	21338.
30.50	30920.	17529.	2618.	45831.	21624.
31.00	31413.	17690.	2661.	46442.	21913.
31.50	31912.	17851.	2704.	47059.	22206.
32.00	32418.	18012.	2746.	47684.	22503.
32.50	32931.	18173.	2789.	48314.	22803.

33.00	33450.	18334.	2832.	48952.	23107.
33.50	33976.	18495.	2875.	49596.	23414.
34.00	34509.	18656.	2918.	50246.	23724.
34.50	35048.	18817.	2961.	50903.	24038.
35.00	35594.	18978.	3004.	51567.	24356.
35.50	36146.	19139.	3047.	52238.	24677.
36.00	36705.	19300.	3090.	52915.	25001.
36.50	37271.	19461.	3133.	53598.	25329.
37.00	37843.	19622.	3176.	54289.	25661.
37.50	38422.	19783.	3219.	54986.	25996.
38.00	39007.	19944.	3261.	55689.	26334.
38.50	39599.	20105.	3304.	56400.	26676.
39.00	40198.	20266.	3347.	57116.	27021.
39.50	40803.	20427.	3390.	57840.	27370.
40.00	41415.	20588.	3433.	58570.	27722.
40.50	42034.	20749.	3476.	59307.	28078.
41.00	42659.	20910.	3519.	60050.	28438.
41.50	43291.	21071.	3562.	60800.	28801.
42.00	43930.	21232.	3605.	61557.	29167.
42.50	44575.	21393.	3648.	62320.	29537.
43.00	45226.	21554.	3691.	63090.	29910.
43.50	45885.	21715.	3734.	63866.	30287.
44.00	46550.	21876.	3776.	64649.	30667.
44.50	47221.	22037.	3819.	65439.	31051.
45.00	47900.	22198.	3862.	66235.	31438.
45.50	48584.	22359.	3905.	67038.	31829.
46.00	49276.	22520.	3948.	67848.	32223.
46.50	49974.	22681.	3991.	68664.	32621.
47.00	50679.	22842.	4034.	69487.	33022.
47.50	51390.	23003.	4077.	70316.	33426.
48.00	52108.	23164.	4120.	71152.	33835.
48.50	52833.	23325.	4163.	71995.	34246.
49.00	53564.	23486.	4206.	72844.	34661.
49.50	54302.	23647.	4248.	73700.	35080.
50.00	55046.	23808.	4291.	74563.	35502.
50.50	55797.	23969.	4334.	75432.	35928.
51.00	56555.	24130.	4377.	76308.	36357.
51.50	57319.	24291.	4420.	77190.	36789.
52.00	58087.	24452.	4463.	78076.	37224.
52.50	58855.	24613.	4506.	78962.	37658.
53.00	59623.	24774.	4549.	79848.	38093.
53.50	60391.	24935.	4592.	80734.	38527.
54.00	61159.	25096.	4635.	81620.	38962.
54.50	61927.	25257.	4678.	82506.	39396.
55.00	62695.	25418.	4721.	83393.	39831.
55.50	63463.	25579.	4763.	84279.	40265.
56.00	64231.	25740.	4806.	85165.	40700.
56.50	64999.	25901.	4849.	86051.	41134.
57.00	65767.	26062.	4892.	86937.	41568.
57.50	66535.	26223.	4935.	87823.	42003.
58.00	67303.	26384.	4978.	88709.	42437.

Lp = Lunghezza utile del palo
 Q11 = Portata laterale limite
 Qbl = Portata di base limite
 Wp = Peso efficace del palo
 Qu = Portata totale limite
 Qd = Portata di progetto = $Q11/FS,1 + Qbl/FS,b - Wp$

8.3 Portata di progetto (A1+M1+R3) – Gruppo 3 pali - compressione

*** P A L ***
Programma per l'analisi della capacita' portante
assiale di un palo di fondazione

(C) G.Guiducci - Studio SINTESI (RN - Italy)
ottobre 2006

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NODO BOLOGNA CAVALCAVIA CV03
Capacita portante 3pali SLU A1+M1+R3

Quota testa palo da p.c. = 2.00 m
Quota falda da p.c. = 4.00 m
Peso di volume del palo = 8.10 kN/m³
Fattore di sicurezza portata laterale = 1.90 (FS,l)
Fattore di sicurezza portata di base = 2.20 (FS,b)

Elemento con sezione avente:
Area = 5.29800 m² Perimetro = 9.00000 m

Criterio per la determinazione della portata di base in uno strato "i"
quando la $Q_{b,i}$ ad esso attribuibile e' superiore a quella degli
strati adiacenti:

La base del palo deve essere situata almeno: $3.0 * 2.597 = 7.79$ m
entro lo strato se quello sovrastante e' piu' debole

La base del palo deve essere situata almeno: $3.0 * 2.597 = 7.79$ m
sopra lo strato sottostante se esso e' piu' debole

La variazione di Q_b viene assunta lineare dal passaggio di strato

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NODO BOLOGNA CAVALCAVIA CV03
Capacità portante 3pali SLU A1+M1+R3

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 1 "A" (Coesivo) da 0.00 a 5.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = \alpha * C_u < 100.0 \text{ kPa} \quad \text{Criterio } \alpha(C_u) \text{ nel seguito}$$

$$\tau > .23 * S'v$$
$$\tau < .55 * S'v$$

$$Q_b = 9.0 * C_u + S_v$$

Cu variabile lin. da 67.5 a 75.0 kPa

Strato 2 "GS" (Incoerente) da 5.00 a 10.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$$
$$K = .70 \quad \delta = 35.0 \text{ deg}$$

Qb variabile lin. da 3350. a 3350. kPa

Strato 3 "A1" (Coesivo) da 10.00 a 15.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = \alpha * C_u < 100.0 \text{ kPa} \quad \text{Criterio } \alpha(C_u) \text{ nel seguito}$$

$$\tau > .23 * S'v$$
$$\tau < .55 * S'v$$

$$Q_b = 9.0 * C_u + S_v$$

Cu variabile lin. da 82.5 a 90.0 kPa

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante 3pali SLU A1+M1+R3

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 4 "GS " (Incoerente) da 15.00 a 28.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$$

$$K = .70 \quad \delta = 36.0 \text{ deg}$$

$$Q_b \text{ variabile lin. da } 3685. \text{ a } 3685. \text{ kPa}$$

Strato 5 "A1 " (Coesivo) da 28.00 a 60.00 m

$$G_n = 19.0 \text{ kN/m}^3 \quad G_e = 9.0 \text{ kN/m}^3$$

$$\tau = \alpha * C_u < 120.0 \text{ kPa}$$

$$\text{Criterio } \alpha(C_u) \text{ nel seguito}$$

$$\tau > .23 * S'v$$

$$\tau < .55 * S'v$$

$$Q_b = 9.0 * C_u + S_v$$

$$C_u \text{ variabile lin. da } 109.5 \text{ a } 150.0 \text{ kPa}$$

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante 3pali SLU A1+M1+R3

MOLTIPLICATORI per i parametri di calcolo

strato	Molt. Tau	Molt. Qb	Molt. Cu
1 "A "	1.00	1.00	1.00
2 "GS "	1.00	1.00	-
3 "A1 "	1.00	1.00	1.00
4 "GS "	1.00	1.00	-
5 "A1 "	1.00	1.00	1.00

NOTA: i moltiplicatori non influenzano le limitazioni superiori o inferiori dei parametri

 Per terreni coesivi: Criterio $\tau = \alpha * C_u$

Cu kPa	alfa
.0	.90
25.0	.90
25.1	.80
50.0	.80
51.0	.60
75.0	.60
75.1	.40
300.0	.40

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante 3pali SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
2.00	38.0	38.0	70.5	.55	20.9	673.
2.50	47.5	47.5	71.3	.55	26.1	689.
3.00	57.0	57.0	72.0	.55	31.4	705.
3.50	66.5	66.5	72.8	.55	36.6	721.
4.00	76.0	76.0	73.5	.55	41.8	738.
4.50	80.5	85.5	74.3	.55	44.3	754.
5.00	85.0	95.0	75.0	.51	43.3	770.
5.50	89.5	104.5	--	.49	43.9	936.
6.00	94.0	114.0	--	.49	46.1	1103.
6.50	98.5	123.5	--	.49	48.3	1269.
7.00	103.0	133.0	--	.49	50.5	1436.
7.50	107.5	142.5	--	.49	52.7	1602.
8.00	112.0	152.0	--	.49	54.9	1602.
8.50	116.5	161.5	--	.49	57.1	1434.
9.00	121.0	171.0	--	.49	59.3	1267.
9.50	125.5	180.5	--	.49	61.5	1100.
10.00	130.0	190.0	--	.37	48.4	933.
10.50	134.5	199.5	83.3	.25	33.3	949.
11.00	139.0	209.0	84.0	.24	33.6	965.
11.50	143.5	218.5	84.8	.24	33.9	981.
12.00	148.0	228.0	85.5	.23	34.2	998.
12.50	152.5	237.5	86.3	.23	35.1	1014.
13.00	157.0	247.0	87.0	.23	36.1	1030.
13.50	161.5	256.5	87.8	.23	37.1	1046.
14.00	166.0	266.0	88.5	.23	38.2	1063.
14.50	170.5	275.5	89.3	.23	39.2	1079.
15.00	175.0	285.0	90.0	.37	64.6	1095.
15.50	179.5	294.5	--	.51	91.3	1262.
16.00	184.0	304.0	--	.51	93.6	1429.
16.50	188.5	313.5	--	.51	95.9	1596.

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante 3pali SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
17.00	193.0	323.0	--	.51	98.2	1763.
17.50	197.5	332.5	--	.51	100.4	1930.
18.00	202.0	342.0	--	.51	102.7	2098.
18.50	206.5	351.5	--	.51	105.0	2265.
19.00	211.0	361.0	--	.51	107.3	2432.
19.50	215.5	370.5	--	.51	109.6	2599.
20.00	220.0	380.0	--	.51	111.9	2766.
20.50	224.5	389.5	--	.51	114.2	2876.
21.00	229.0	399.0	--	.51	116.5	2930.
21.50	233.5	408.5	--	.51	118.8	2984.
22.00	238.0	418.0	--	.51	121.0	3038.
22.50	242.5	427.5	--	.51	123.3	3092.
23.00	247.0	437.0	--	.51	125.6	2949.
23.50	251.5	446.5	--	.51	127.9	2806.
24.00	256.0	456.0	--	.51	130.2	2663.
24.50	260.5	465.5	--	.51	132.5	2520.
25.00	265.0	475.0	--	.51	134.8	2376.
25.50	269.5	484.5	--	.51	137.1	2233.
26.00	274.0	494.0	--	.51	139.4	2090.
26.50	278.5	503.5	--	.51	141.6	1947.
27.00	283.0	513.0	--	.51	143.9	1804.
27.50	287.5	522.5	--	.51	146.2	1661.
28.00	292.0	532.0	--	.37	107.8	1518.
28.50	296.5	541.5	110.1	.23	68.2	1533.
29.00	301.0	551.0	110.8	.23	69.2	1548.
29.50	305.5	560.5	111.4	.23	70.3	1563.
30.00	310.0	570.0	112.0	.23	71.3	1578.
30.50	314.5	579.5	112.7	.23	72.3	1593.
31.00	319.0	589.0	113.3	.23	73.4	1609.
31.50	323.5	598.5	113.9	.23	74.4	1624.

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante 3pali SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
32.00	328.0	608.0	114.6	.23	75.4	1639.
32.50	332.5	617.5	115.2	.23	76.5	1654.
33.00	337.0	627.0	115.8	.23	77.5	1669.
33.50	341.5	636.5	116.5	.23	78.5	1685.
34.00	346.0	646.0	117.1	.23	79.6	1700.
34.50	350.5	655.5	117.7	.23	80.6	1715.
35.00	355.0	665.0	118.4	.23	81.7	1730.
35.50	359.5	674.5	119.0	.23	82.7	1745.
36.00	364.0	684.0	119.6	.23	83.7	1761.
36.50	368.5	693.5	120.3	.23	84.8	1776.
37.00	373.0	703.0	120.9	.23	85.8	1791.
37.50	377.5	712.5	121.5	.23	86.8	1806.
38.00	382.0	722.0	122.2	.23	87.9	1821.
38.50	386.5	731.5	122.8	.23	88.9	1837.
39.00	391.0	741.0	123.4	.23	89.9	1852.
39.50	395.5	750.5	124.1	.23	91.0	1867.
40.00	400.0	760.0	124.7	.23	92.0	1882.
40.50	404.5	769.5	125.3	.23	93.0	1897.

41.00	409.0	779.0	126.0	.23	94.1	1913.
41.50	413.5	788.5	126.6	.23	95.1	1928.
42.00	418.0	798.0	127.2	.23	96.1	1943.
42.50	422.5	807.5	127.9	.23	97.2	1958.
43.00	427.0	817.0	128.5	.23	98.2	1973.
43.50	431.5	826.5	129.1	.23	99.2	1989.
44.00	436.0	836.0	129.8	.23	100.3	2004.
44.50	440.5	845.5	130.4	.23	101.3	2019.
45.00	445.0	855.0	131.0	.23	102.3	2034.
45.50	449.5	864.5	131.6	.23	103.4	2049.
46.00	454.0	874.0	132.3	.23	104.4	2065.
46.50	458.5	883.5	132.9	.23	105.5	2080.

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante 3pali SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
47.00	463.0	893.0	133.5	.23	106.5	2095.
47.50	467.5	902.5	134.2	.23	107.5	2110.
48.00	472.0	912.0	134.8	.23	108.6	2125.
48.50	476.5	921.5	135.4	.23	109.6	2141.
49.00	481.0	931.0	136.1	.23	110.6	2156.
49.50	485.5	940.5	136.7	.23	111.7	2171.
50.00	490.0	950.0	137.3	.23	112.7	2186.
50.50	494.5	959.5	138.0	.23	113.7	2201.
51.00	499.0	969.0	138.6	.23	114.8	2216.
51.50	503.5	978.5	139.2	.23	115.8	2232.
52.00	508.0	988.0	139.9	.23	116.8	2247.
52.50	512.5	997.5	140.5	.23	117.9	2262.
53.00	517.0	1007.0	141.1	.23	118.9	2277.
53.50	521.5	1016.5	141.8	.23	119.9	2292.
54.00	526.0	1026.0	142.4	.23	120.0	2308.
54.50	530.5	1035.5	143.0	.23	120.0	2323.
55.00	535.0	1045.0	143.7	.22	120.0	2338.
55.50	539.5	1054.5	144.3	.22	120.0	2353.
56.00	544.0	1064.0	144.9	.22	120.0	2368.
56.50	548.5	1073.5	145.6	.22	120.0	2384.
57.00	553.0	1083.0	146.2	.22	120.0	2399.
57.50	557.5	1092.5	146.8	.22	120.0	2414.
58.00	562.0	1102.0	147.5	.21	120.0	2429.
58.50	566.5	1111.5	148.1	.21	120.0	2444.
59.00	571.0	1121.0	148.7	.21	120.0	2460.
59.50	575.5	1130.5	149.4	.21	120.0	2475.
60.00	580.0	1140.0	150.0	.21	120.0	2490.

 zz = Profondita' da piano campagna
 S'v = Tensione verticale efficace
 Sv = Tensione verticale totale
 Cu = Coesione non drenata
 Tau = Tensione di adesione laterale limite
 qb = Portata di base limite unitaria

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante 3pali SLU A1+M1+R3

STAMPA capacita' portante e relativi contributi

Lp m	Ql1 kN	Qb1 kN	Wp kN	Qu kN	Qd kN
.00	0.	3563.	0.	3563.	1620.
.50	106.	3649.	21.	3733.	1693.
1.00	235.	3735.	43.	3927.	1779.
1.50	388.	3821.	64.	4145.	1877.
2.00	564.	3907.	86.	4386.	1987.
2.50	758.	3993.	107.	4644.	2107.
3.00	957.	4079.	129.	4908.	2229.
3.50	1152.	4961.	150.	5963.	2711.
4.00	1354.	5843.	172.	7025.	3197.
4.50	1566.	6725.	193.	8098.	3688.
5.00	1788.	7607.	215.	9181.	4184.
5.50	2021.	8489.	236.	10273.	4686.
6.00	2263.	8486.	257.	10492.	4791.
6.50	2515.	7600.	279.	9836.	4499.
7.00	2777.	6713.	300.	9190.	4213.
7.50	3048.	5827.	322.	8553.	3931.
8.00	3313.	4940.	343.	7910.	3646.
8.50	3479.	5026.	365.	8141.	3751.
9.00	3630.	5113.	386.	8356.	3848.
9.50	3782.	5199.	408.	8573.	3946.
10.00	3935.	5285.	429.	8791.	4044.
10.50	4091.	5371.	451.	9011.	4144.
11.00	4251.	5457.	472.	9236.	4246.
11.50	4416.	5543.	494.	9465.	4350.
12.00	4585.	5629.	515.	9699.	4457.
12.50	4759.	5715.	536.	9938.	4566.
13.00	4966.	5801.	558.	10209.	4693.
13.50	5344.	6687.	579.	11451.	5273.
14.00	5760.	7572.	601.	12731.	5872.
14.50	6186.	8457.	622.	14021.	6478.
15.00	6623.	9342.	644.	15321.	7088.
15.50	7069.	10228.	665.	16632.	7705.
16.00	7527.	11113.	687.	17953.	8326.
16.50	7994.	11998.	708.	19284.	8953.
17.00	8472.	12884.	730.	20626.	9585.
17.50	8960.	13769.	751.	21978.	10223.
18.00	9458.	14654.	772.	23340.	10866.
18.50	9967.	15240.	794.	24412.	11379.
19.00	10486.	15525.	815.	25195.	11760.
19.50	11015.	15811.	837.	25989.	12147.
20.00	11554.	16096.	858.	26792.	12540.
20.50	12104.	16382.	880.	27606.	12937.
21.00	12664.	15623.	901.	27387.	12866.
21.50	13235.	14865.	923.	27177.	12800.
22.00	13816.	14107.	944.	26978.	12739.
22.50	14407.	13348.	966.	26789.	12684.
23.00	15008.	12590.	987.	26611.	12635.
23.50	15620.	11832.	1008.	26443.	12590.
24.00	16242.	11073.	1030.	26285.	12552.
24.50	16874.	10315.	1051.	26137.	12518.
25.00	17516.	9556.	1073.	26000.	12490.
25.50	18169.	8798.	1094.	25873.	12468.
26.00	18787.	8040.	1116.	25710.	12426.
26.50	19137.	8120.	1137.	26120.	12626.
27.00	19446.	8201.	1159.	26488.	12804.
27.50	19760.	8281.	1180.	26861.	12984.
28.00	20078.	8362.	1202.	27239.	13167.
28.50	20402.	8442.	1223.	27621.	13352.
29.00	20729.	8523.	1245.	28008.	13540.
29.50	21062.	8603.	1266.	28399.	13730.
30.00	21399.	8684.	1287.	28795.	13922.
30.50	21741.	8764.	1309.	29196.	14117.
31.00	22087.	8845.	1330.	29602.	14315.
31.50	22438.	8925.	1352.	30012.	14515.
32.00	22794.	9006.	1373.	30427.	14717.
32.50	23155.	9086.	1395.	30846.	14922.

33.00	23520.	9167.	1416.	31270.	15129.
33.50	23890.	9247.	1438.	31699.	15339.
34.00	24264.	9328.	1459.	32133.	15551.
34.50	24643.	9408.	1481.	32571.	15766.
35.00	25027.	9489.	1502.	33014.	15983.
35.50	25415.	9569.	1523.	33461.	16203.
36.00	25808.	9650.	1545.	33913.	16425.
36.50	26206.	9730.	1566.	34370.	16649.
37.00	26608.	9811.	1588.	34831.	16876.
37.50	27015.	9891.	1609.	35297.	17105.
38.00	27427.	9972.	1631.	35768.	17337.
38.50	27843.	10052.	1652.	36243.	17571.
39.00	28264.	10133.	1674.	36723.	17808.
39.50	28690.	10213.	1695.	37208.	18047.
40.00	29120.	10294.	1717.	37697.	18289.
40.50	29555.	10374.	1738.	38191.	18533.
41.00	29995.	10455.	1759.	38690.	18779.
41.50	30439.	10535.	1781.	39193.	19028.
42.00	30888.	10616.	1802.	39701.	19280.
42.50	31342.	10696.	1824.	40214.	19534.
43.00	31800.	10777.	1845.	40731.	19790.
43.50	32263.	10857.	1867.	41253.	20049.
44.00	32730.	10938.	1888.	41780.	20310.
44.50	33202.	11018.	1910.	42311.	20574.
45.00	33679.	11099.	1931.	42847.	20840.
45.50	34161.	11179.	1953.	43388.	21108.
46.00	34647.	11260.	1974.	43933.	21379.
46.50	35138.	11340.	1995.	44483.	21653.
47.00	35633.	11421.	2017.	45037.	21929.
47.50	36134.	11501.	2038.	45597.	22207.
48.00	36638.	11582.	2060.	46160.	22488.
48.50	37148.	11662.	2081.	46729.	22771.
49.00	37662.	11743.	2103.	47302.	23057.
49.50	38181.	11823.	2124.	47880.	23345.
50.00	38704.	11904.	2146.	48463.	23636.
50.50	39232.	11984.	2167.	49050.	23929.
51.00	39765.	12065.	2189.	49641.	24224.
51.50	40303.	12145.	2210.	50238.	24522.
52.00	40843.	12226.	2232.	50837.	24822.
52.50	41383.	12306.	2253.	51436.	25121.
53.00	41923.	12387.	2274.	52035.	25420.
53.50	42463.	12467.	2296.	52634.	25720.
54.00	43003.	12548.	2317.	53233.	26019.
54.50	43543.	12628.	2339.	53832.	26319.
55.00	44083.	12709.	2360.	54431.	26618.
55.50	44623.	12789.	2382.	55030.	26917.
56.00	45163.	12870.	2403.	55629.	27217.
56.50	45703.	12951.	2425.	56228.	27516.
57.00	46243.	13031.	2446.	56827.	27815.
57.50	46783.	13112.	2468.	57426.	28115.
58.00	47323.	13192.	2489.	58026.	28414.

Lp = Lunghezza utile del palo
 Qll = Portata laterale limite
 Qbl = Portata di base limite
 Wp = Peso efficace del palo
 Qu = Portata totale limite
 Qd = Portata di progetto = $Qll/FS,l + Qbl/FS,b - Wp$

8.4 Portata di progetto (A1+M1+R3) - palo di spigolo - trazione

*** P A L ***
Programma per l'analisi della capacita' portante
assiale di un palo di fondazione

(C) G.Guiducci - Studio SINTESI (RN - Italy)
ottobre 2006

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NODO BOLOGNA CAVALCAVIA CV03
Capacita portante palo spigolo SLU A1+M1+R3 traz

Quota testa palo da p.c. = 2.00 m
Quota falda da p.c. = 4.00 m
Peso di volume del palo = -15.00 kN/m3
Fattore di sicurezza portata laterale = 2.10 (FS,l)
Fattore di sicurezza portata di base = 1.00 (FS,b)

Elemento con sezione avente:
Area = 1.76600 m2 Perimetro = 3.60000 m

Criterio per la determinazione della portata di base in uno strato "i"
quando la $Q_{b,i}$ ad esso attribuibile e' superiore a quella degli
strati adiacenti:

La base del palo deve essere situata almeno: $3.0 * 1.500 = 4.50$ m
entro lo strato se quello sovrastante e' piu' debole

La base del palo deve essere situata almeno: $3.0 * 1.500 = 4.50$ m
sopra lo strato sottostante se esso e' piu' debole

La variazione di Q_b viene assunta lineare dal passaggio di strato

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3 traz

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 4 "GS " (Incoerente) da 15.00 a 28.00 m

 $G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$
 $\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$
 $K = .50$ $\delta = 36.0 \text{ deg}$
 Q_b variabile lin. da 0. a 0. kPa

Strato 5 "A1 " (Coesivo) da 28.00 a 60.00 m

 $G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$
 $\tau = \alpha * C_u < 120.0 \text{ kPa}$
 Criterio $\alpha(C_u)$ nel seguito
 $\tau > .23 * S'v$
 $\tau < .55 * S'v$
 Q_b variabile lin. da 0. a 0. kPa

 C_u variabile lin. da 109.5 a 150.0 kPa

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3 traz

MOLTIPLICATORI per i parametri di calcolo

strato	Molt. Tau	Molt. Qb	Molt. Cu
1 "A "	1.00	1.00	1.00
2 "GS "	1.00	1.00	-
3 "A1 "	1.00	1.00	1.00
4 "GS "	1.00	1.00	-
5 "A1 "	1.00	1.00	1.00

NOTA: i moltiplicatori non influenzano le limitazioni superiori o inferiori dei parametri

 Per terreni coesivi: Criterio $\tau = \alpha * C_u$

Cu kPa	alfa
.0	.90
25.0	.90
25.1	.80
50.0	.80
51.0	.60
75.0	.60
75.1	.40
300.0	.40

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU Al+Ml+R3 traz

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
2.00	38.0	38.0	70.5	.55	20.9	0.
2.50	47.5	47.5	71.3	.55	26.1	0.
3.00	57.0	57.0	72.0	.55	31.4	0.
3.50	66.5	66.5	72.8	.55	36.6	0.
4.00	76.0	76.0	73.5	.55	41.8	0.
4.50	80.5	85.5	74.3	.55	44.3	0.
5.00	85.0	95.0	75.0	.44	37.4	0.
5.50	89.5	104.5	--	.35	31.3	0.
6.00	94.0	114.0	--	.35	32.9	0.
6.50	98.5	123.5	--	.35	34.5	0.
7.00	103.0	133.0	--	.35	36.1	0.
7.50	107.5	142.5	--	.35	37.6	0.
8.00	112.0	152.0	--	.35	39.2	0.
8.50	116.5	161.5	--	.35	40.8	0.
9.00	121.0	171.0	--	.35	42.4	0.
9.50	125.5	180.5	--	.35	43.9	0.
10.00	130.0	190.0	--	.30	39.3	0.
10.50	134.5	199.5	83.3	.25	33.3	0.
11.00	139.0	209.0	84.0	.24	33.6	0.
11.50	143.5	218.5	84.8	.24	33.9	0.
12.00	148.0	228.0	85.5	.23	34.2	0.
12.50	152.5	237.5	86.3	.23	35.1	0.
13.00	157.0	247.0	87.0	.23	36.1	0.
13.50	161.5	256.5	87.8	.23	37.1	0.
14.00	166.0	266.0	88.5	.23	38.2	0.
14.50	170.5	275.5	89.3	.23	39.2	0.
15.00	175.0	285.0	90.0	.30	51.9	0.
15.50	179.5	294.5	--	.36	65.2	0.
16.00	184.0	304.0	--	.36	66.8	0.
16.50	188.5	313.5	--	.36	68.5	0.

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU Al+Ml+R3 traz

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
17.00	193.0	323.0	--	.36	70.1	0.
17.50	197.5	332.5	--	.36	71.7	0.
18.00	202.0	342.0	--	.36	73.4	0.
18.50	206.5	351.5	--	.36	75.0	0.
19.00	211.0	361.0	--	.36	76.7	0.
19.50	215.5	370.5	--	.36	78.3	0.
20.00	220.0	380.0	--	.36	79.9	0.
20.50	224.5	389.5	--	.36	81.6	0.
21.00	229.0	399.0	--	.36	83.2	0.
21.50	233.5	408.5	--	.36	84.8	0.
22.00	238.0	418.0	--	.36	86.5	0.
22.50	242.5	427.5	--	.36	88.1	0.
23.00	247.0	437.0	--	.36	89.7	0.
23.50	251.5	446.5	--	.36	91.4	0.
24.00	256.0	456.0	--	.36	93.0	0.
24.50	260.5	465.5	--	.36	94.6	0.
25.00	265.0	475.0	--	.36	96.3	0.
25.50	269.5	484.5	--	.36	97.9	0.
26.00	274.0	494.0	--	.36	99.5	0.
26.50	278.5	503.5	--	.36	101.2	0.
27.00	283.0	513.0	--	.36	102.8	0.
27.50	287.5	522.5	--	.36	104.4	0.
28.00	292.0	532.0	--	.30	86.6	0.
28.50	296.5	541.5	110.1	.23	68.2	0.
29.00	301.0	551.0	110.8	.23	69.2	0.
29.50	305.5	560.5	111.4	.23	70.3	0.
30.00	310.0	570.0	112.0	.23	71.3	0.
30.50	314.5	579.5	112.7	.23	72.3	0.
31.00	319.0	589.0	113.3	.23	73.4	0.
31.50	323.5	598.5	113.9	.23	74.4	0.

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU Al+Ml+R3 traz

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
32.00	328.0	608.0	114.6	.23	75.4	0.
32.50	332.5	617.5	115.2	.23	76.5	0.
33.00	337.0	627.0	115.8	.23	77.5	0.
33.50	341.5	636.5	116.5	.23	78.5	0.
34.00	346.0	646.0	117.1	.23	79.6	0.
34.50	350.5	655.5	117.7	.23	80.6	0.
35.00	355.0	665.0	118.4	.23	81.7	0.
35.50	359.5	674.5	119.0	.23	82.7	0.
36.00	364.0	684.0	119.6	.23	83.7	0.
36.50	368.5	693.5	120.3	.23	84.8	0.
37.00	373.0	703.0	120.9	.23	85.8	0.
37.50	377.5	712.5	121.5	.23	86.8	0.
38.00	382.0	722.0	122.2	.23	87.9	0.
38.50	386.5	731.5	122.8	.23	88.9	0.
39.00	391.0	741.0	123.4	.23	89.9	0.
39.50	395.5	750.5	124.1	.23	91.0	0.
40.00	400.0	760.0	124.7	.23	92.0	0.
40.50	404.5	769.5	125.3	.23	93.0	0.
41.00	409.0	779.0	126.0	.23	94.1	0.

41.50	413.5	788.5	126.6	.23	95.1	0.
42.00	418.0	798.0	127.2	.23	96.1	0.
42.50	422.5	807.5	127.9	.23	97.2	0.
43.00	427.0	817.0	128.5	.23	98.2	0.
43.50	431.5	826.5	129.1	.23	99.2	0.
44.00	436.0	836.0	129.8	.23	100.3	0.
44.50	440.5	845.5	130.4	.23	101.3	0.
45.00	445.0	855.0	131.0	.23	102.3	0.
45.50	449.5	864.5	131.6	.23	103.4	0.
46.00	454.0	874.0	132.3	.23	104.4	0.
46.50	458.5	883.5	132.9	.23	105.5	0.

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NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3 traz

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
47.00	463.0	893.0	133.5	.23	106.5	0.
47.50	467.5	902.5	134.2	.23	107.5	0.
48.00	472.0	912.0	134.8	.23	108.6	0.
48.50	476.5	921.5	135.4	.23	109.6	0.
49.00	481.0	931.0	136.1	.23	110.6	0.
49.50	485.5	940.5	136.7	.23	111.7	0.
50.00	490.0	950.0	137.3	.23	112.7	0.
50.50	494.5	959.5	138.0	.23	113.7	0.
51.00	499.0	969.0	138.6	.23	114.8	0.
51.50	503.5	978.5	139.2	.23	115.8	0.
52.00	508.0	988.0	139.9	.23	116.8	0.
52.50	512.5	997.5	140.5	.23	117.9	0.
53.00	517.0	1007.0	141.1	.23	118.9	0.
53.50	521.5	1016.5	141.8	.23	119.9	0.
54.00	526.0	1026.0	142.4	.23	120.0	0.
54.50	530.5	1035.5	143.0	.23	120.0	0.
55.00	535.0	1045.0	143.7	.22	120.0	0.
55.50	539.5	1054.5	144.3	.22	120.0	0.
56.00	544.0	1064.0	144.9	.22	120.0	0.
56.50	548.5	1073.5	145.6	.22	120.0	0.
57.00	553.0	1083.0	146.2	.22	120.0	0.
57.50	557.5	1092.5	146.8	.22	120.0	0.
58.00	562.0	1102.0	147.5	.21	120.0	0.
58.50	566.5	1111.5	148.1	.21	120.0	0.
59.00	571.0	1121.0	148.7	.21	120.0	0.
59.50	575.5	1130.5	149.4	.21	120.0	0.
60.00	580.0	1140.0	150.0	.21	120.0	0.

zz = Profondita' da piano campagna
 S'v = Tensione verticale efficace
 Sv = Tensione verticale totale
 Cu = Coesione non drenata
 Tau = Tensione di adesione laterale limite
 qb = Portata di base limite unitaria

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3 traz

STAMPA capacita' portante e relativi contributi

Lp m	Ql1 kN	Qb1 kN	Wp kN	Qu kN	Qd kN
.00	0.	0.	0.	0.	0.
.50	42.	0.	-13.	56.	33.
1.00	94.	0.	-26.	121.	71.
1.50	155.	0.	-40.	195.	114.
2.00	226.	0.	-53.	279.	160.
2.50	303.	0.	-66.	369.	211.
3.00	380.	0.	-79.	460.	261.
3.50	439.	0.	-93.	531.	302.
4.00	496.	0.	-106.	602.	342.
4.50	557.	0.	-119.	676.	384.
5.00	621.	0.	-132.	753.	428.
5.50	687.	0.	-146.	833.	473.
6.00	756.	0.	-159.	915.	519.
6.50	828.	0.	-172.	1000.	567.
7.00	903.	0.	-185.	1088.	615.
7.50	981.	0.	-199.	1179.	666.
8.00	1058.	0.	-212.	1270.	716.
8.50	1121.	0.	-225.	1346.	759.
9.00	1181.	0.	-238.	1419.	801.
9.50	1242.	0.	-252.	1493.	843.
10.00	1303.	0.	-265.	1568.	885.
10.50	1365.	0.	-278.	1643.	928.
11.00	1429.	0.	-291.	1721.	972.
11.50	1495.	0.	-305.	1800.	1017.
12.00	1563.	0.	-318.	1881.	1062.
12.50	1633.	0.	-331.	1964.	1109.
13.00	1710.	0.	-344.	2054.	1158.
13.50	1820.	0.	-358.	2178.	1224.
14.00	1939.	0.	-371.	2310.	1294.
14.50	2061.	0.	-384.	2445.	1365.
15.00	2186.	0.	-397.	2583.	1438.
15.50	2313.	0.	-411.	2724.	1512.
16.00	2444.	0.	-424.	2868.	1588.
16.50	2577.	0.	-437.	3014.	1664.
17.00	2714.	0.	-450.	3164.	1743.
17.50	2853.	0.	-464.	3317.	1822.
18.00	2996.	0.	-477.	3473.	1903.
18.50	3141.	0.	-490.	3631.	1986.
19.00	3289.	0.	-503.	3793.	2070.
19.50	3441.	0.	-517.	3957.	2155.
20.00	3595.	0.	-530.	4124.	2242.
20.50	3752.	0.	-543.	4295.	2330.
21.00	3912.	0.	-556.	4468.	2419.
21.50	4075.	0.	-570.	4644.	2510.
22.00	4241.	0.	-583.	4823.	2602.
22.50	4410.	0.	-596.	5006.	2696.
23.00	4581.	0.	-609.	5191.	2791.
23.50	4756.	0.	-623.	5379.	2887.
24.00	4934.	0.	-636.	5570.	2985.
24.50	5114.	0.	-649.	5763.	3084.
25.00	5298.	0.	-662.	5960.	3185.
25.50	5485.	0.	-675.	6160.	3287.
26.00	5665.	0.	-689.	6354.	3386.
26.50	5796.	0.	-702.	6498.	3462.
27.00	5920.	0.	-715.	6635.	3534.
27.50	6045.	0.	-728.	6774.	3607.
28.00	6172.	0.	-742.	6914.	3681.
28.50	6302.	0.	-755.	7057.	3756.
29.00	6433.	0.	-768.	7201.	3831.
29.50	6566.	0.	-781.	7347.	3908.
30.00	6701.	0.	-795.	7495.	3986.
30.50	6837.	0.	-808.	7645.	4064.
31.00	6976.	0.	-821.	7797.	4143.
31.50	7117.	0.	-834.	7951.	4223.
32.00	7259.	0.	-848.	8106.	4304.
32.50	7403.	0.	-861.	8264.	4386.

33.00	7549.	0.	-874.	8423.	4469.
33.50	7697.	0.	-887.	8584.	4553.
34.00	7847.	0.	-901.	8747.	4637.
34.50	7998.	0.	-914.	8912.	4723.
35.00	8152.	0.	-927.	9079.	4809.
35.50	8307.	0.	-940.	9248.	4896.
36.00	8464.	0.	-954.	9418.	4984.
36.50	8623.	0.	-967.	9590.	5073.
37.00	8784.	0.	-980.	9765.	5163.
37.50	8947.	0.	-993.	9941.	5254.
38.00	9112.	0.	-1007.	10118.	5346.
38.50	9278.	0.	-1020.	10298.	5438.
39.00	9447.	0.	-1033.	10480.	5532.
39.50	9617.	0.	-1046.	10663.	5626.
40.00	9789.	0.	-1060.	10849.	5721.
40.50	9963.	0.	-1073.	11036.	5817.
41.00	10139.	0.	-1086.	11225.	5914.
41.50	10317.	0.	-1099.	11416.	6012.
42.00	10496.	0.	-1113.	11609.	6111.
42.50	10678.	0.	-1126.	11804.	6210.
43.00	10861.	0.	-1139.	12000.	6311.
43.50	11046.	0.	-1152.	12199.	6412.
44.00	11233.	0.	-1166.	12399.	6515.
44.50	11422.	0.	-1179.	12601.	6618.
45.00	11613.	0.	-1192.	12805.	6722.
45.50	11805.	0.	-1205.	13011.	6827.
46.00	12000.	0.	-1219.	13218.	6933.
46.50	12196.	0.	-1232.	13428.	7040.
47.00	12394.	0.	-1245.	13640.	7147.
47.50	12595.	0.	-1258.	13853.	7256.
48.00	12796.	0.	-1272.	14068.	7365.
48.50	13000.	0.	-1285.	14285.	7475.
49.00	13206.	0.	-1298.	14504.	7587.
49.50	13413.	0.	-1311.	14725.	7699.
50.00	13623.	0.	-1325.	14947.	7812.
50.50	13834.	0.	-1338.	15172.	7925.
51.00	14047.	0.	-1351.	15398.	8040.
51.50	14262.	0.	-1364.	15626.	8156.
52.00	14478.	0.	-1377.	15856.	8272.
52.50	14694.	0.	-1391.	16085.	8388.
53.00	14910.	0.	-1404.	16314.	8504.
53.50	15126.	0.	-1417.	16543.	8620.
54.00	15342.	0.	-1430.	16773.	8736.
54.50	15558.	0.	-1444.	17002.	8852.
55.00	15774.	0.	-1457.	17231.	8968.
55.50	15990.	0.	-1470.	17460.	9085.
56.00	16206.	0.	-1483.	17690.	9201.
56.50	16422.	0.	-1497.	17919.	9317.
57.00	16638.	0.	-1510.	18148.	9433.
57.50	16854.	0.	-1523.	18377.	9549.
58.00	17070.	0.	-1536.	18607.	9665.

Lp = Lunghezza utile del palo
 Qll = Portata laterale limite
 Qbl = Portata di base limite
 Wp = Peso efficace del palo
 Qu = Portata totale limite
 Qd = Portata di progetto = $Qll/FS,l + Qbl/FS,b - Wp$

8.5 Portata di progetto (A1+M1+R3) - palo di spigolo - compressione

*** P A L ***
Programma per l'analisi della capacita' portante
assiale di un palo di fondazione

(C) G.Guiducci - Studio SINTESI (RN - Italy)
ottobre 2006

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NODO BOLOGNA CAVALCAVIA CV03
Capacita portante palo spigolo SLU A1+M1+R3

Quota testa palo da p.c. = 2.00 m
Quota falda da p.c. = 4.00 m
Peso di volume del palo = 8.10 kN/m3
Fattore di sicurezza portata laterale = 1.90 (FS,l)
Fattore di sicurezza portata di base = 2.20 (FS,b)

Elemento con sezione avente:
Area = 1.76600 m2 Perimetro = 3.60000 m

Criterio per la determinazione della portata di base in uno strato "i"
quando la $Q_{b,i}$ ad esso attribuibile e' superiore a quella degli
strati adiacenti:

La base del palo deve essere situata almeno: $3.0 * 1.500 = 4.50$ m
entro lo strato se quello sovrastante e' piu' debole

La base del palo deve essere situata almeno: $3.0 * 1.500 = 4.50$ m
sopra lo strato sottostante se esso e' piu' debole

La variazione di Q_b viene assunta lineare dal passaggio di strato

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NODO BOLOGNA CAVALCAVIA CV03
Capacità portante palo spigolo SLU A1+M1+R3

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 1 "A" (Coesivo) da 0.00 a 5.00 m

$G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$

$\tau = \alpha * C_u < 100.0 \text{ kPa}$ Criterio $\alpha(C_u)$ nel seguito

$\tau > .23 * S'v$
 $\tau < .55 * S'v$

$Q_b = 9.0 * C_u + S_v$

C_u variabile lin. da 67.5 a 75.0 kPa

Strato 2 "GS" (Incoerente) da 5.00 a 10.00 m

$G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$

$\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$
 $K = .70$ $\delta = 35.0 \text{ deg}$

Q_b variabile lin. da 3350. a 3350. kPa

Strato 3 "A1" (Coesivo) da 10.00 a 15.00 m

$G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$

$\tau = \alpha * C_u < 100.0 \text{ kPa}$ Criterio $\alpha(C_u)$ nel seguito

$\tau > .23 * S'v$
 $\tau < .55 * S'v$

$Q_b = 9.0 * C_u + S_v$

C_u variabile lin. da 82.5 a 90.0 kPa

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3

DEFINIZIONE PARAMETRI E CRITERI DI CALCOLO PER GLI STRATI DI TERRENO

Strato 4 "GS " (Incoerente) da 15.00 a 28.00 m

 $G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$
 $\tau = K * \tan(\delta) * S'v < 150.0 \text{ kPa}$
 $K = .70$ $\delta = 36.0 \text{ deg}$
 Q_b variabile lin. da 3685. a 3685. kPa

Strato 5 "A1 " (Coesivo) da 28.00 a 60.00 m

 $G_n = 19.0 \text{ kN/m}^3$ $G_e = 9.0 \text{ kN/m}^3$
 $\tau = \alpha * C_u < 120.0 \text{ kPa}$
 Criterio $\alpha(C_u)$ nel seguito
 $\tau > .23 * S'v$
 $\tau < .55 * S'v$
 $Q_b = 9.0 * C_u + S_v$
 C_u variabile lin. da 109.5 a 150.0 kPa

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3

MOLTIPLICATORI per i parametri di calcolo

strato	Molt. Tau	Molt. Qb	Molt. Cu
1 "A "	1.00	1.00	1.00
2 "GS "	1.00	1.00	-
3 "A1 "	1.00	1.00	1.00
4 "GS "	1.00	1.00	-
5 "A1 "	1.00	1.00	1.00

NOTA: i moltiplicatori non influenzano le limitazioni superiori o inferiori dei parametri

 Per terreni coesivi: Criterio $\tau = \alpha * C_u$

Cu kPa	alfa
.0	.90
25.0	.90
25.1	.80
50.0	.80
51.0	.60
75.0	.60
75.1	.40
300.0	.40

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
2.00	38.0	38.0	70.5	.55	20.9	673.
2.50	47.5	47.5	71.3	.55	26.1	689.
3.00	57.0	57.0	72.0	.55	31.4	705.
3.50	66.5	66.5	72.8	.55	36.6	721.
4.00	76.0	76.0	73.5	.55	41.8	738.
4.50	80.5	85.5	74.3	.55	44.3	754.
5.00	85.0	95.0	75.0	.51	43.3	770.
5.50	89.5	104.5	--	.49	43.9	1057.
6.00	94.0	114.0	--	.49	46.1	1311.
6.50	98.5	123.5	--	.49	48.3	1566.
7.00	103.0	133.0	--	.49	50.5	1821.
7.50	107.5	142.5	--	.49	52.7	2076.
8.00	112.0	152.0	--	.49	54.9	2062.
8.50	116.5	161.5	--	.49	57.1	1780.
9.00	121.0	171.0	--	.49	59.3	1497.
9.50	125.5	180.5	--	.49	61.5	1215.
10.00	130.0	190.0	--	.37	48.4	933.
10.50	134.5	199.5	83.3	.25	33.3	949.
11.00	139.0	209.0	84.0	.24	33.6	965.
11.50	143.5	218.5	84.8	.24	33.9	981.
12.00	148.0	228.0	85.5	.23	34.2	998.
12.50	152.5	237.5	86.3	.23	35.1	1014.
13.00	157.0	247.0	87.0	.23	36.1	1030.
13.50	161.5	256.5	87.8	.23	37.1	1046.
14.00	166.0	266.0	88.5	.23	38.2	1063.
14.50	170.5	275.5	89.3	.23	39.2	1079.
15.00	175.0	285.0	90.0	.37	64.6	1095.
15.50	179.5	294.5	--	.51	91.3	1383.
16.00	184.0	304.0	--	.51	93.6	1671.
16.50	188.5	313.5	--	.51	95.9	1958.

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NODO BOLOGNA CAVALCAVIA CV03
Capacita portante palo spigolo SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
17.00	193.0	323.0	--	.51	98.2	2246.
17.50	197.5	332.5	--	.51	100.4	2534.
18.00	202.0	342.0	--	.51	102.7	2822.
18.50	206.5	351.5	--	.51	105.0	3109.
19.00	211.0	361.0	--	.51	107.3	3397.
19.50	215.5	370.5	--	.51	109.6	3685.
20.00	220.0	380.0	--	.51	111.9	3685.
20.50	224.5	389.5	--	.51	114.2	3685.
21.00	229.0	399.0	--	.51	116.5	3685.
21.50	233.5	408.5	--	.51	118.8	3685.
22.00	238.0	418.0	--	.51	121.0	3685.
22.50	242.5	427.5	--	.51	123.3	3685.
23.00	247.0	437.0	--	.51	125.6	3685.
23.50	251.5	446.5	--	.51	127.9	3685.
24.00	256.0	456.0	--	.51	130.2	3444.
24.50	260.5	465.5	--	.51	132.5	3203.
25.00	265.0	475.0	--	.51	134.8	2963.
25.50	269.5	484.5	--	.51	137.1	2722.
26.00	274.0	494.0	--	.51	139.4	2481.
26.50	278.5	503.5	--	.51	141.6	2240.
27.00	283.0	513.0	--	.51	143.9	1999.
27.50	287.5	522.5	--	.51	146.2	1758.
28.00	292.0	532.0	--	.37	107.8	1518.
28.50	296.5	541.5	110.1	.23	68.2	1533.
29.00	301.0	551.0	110.8	.23	69.2	1548.
29.50	305.5	560.5	111.4	.23	70.3	1563.
30.00	310.0	570.0	112.0	.23	71.3	1578.
30.50	314.5	579.5	112.7	.23	72.3	1593.
31.00	319.0	589.0	113.3	.23	73.4	1609.
31.50	323.5	598.5	113.9	.23	74.4	1624.

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NODO BOLOGNA CAVALCAVIA CV03
Capacita portante palo spigolo SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
32.00	328.0	608.0	114.6	.23	75.4	1639.
32.50	332.5	617.5	115.2	.23	76.5	1654.
33.00	337.0	627.0	115.8	.23	77.5	1669.
33.50	341.5	636.5	116.5	.23	78.5	1685.
34.00	346.0	646.0	117.1	.23	79.6	1700.
34.50	350.5	655.5	117.7	.23	80.6	1715.
35.00	355.0	665.0	118.4	.23	81.7	1730.
35.50	359.5	674.5	119.0	.23	82.7	1745.
36.00	364.0	684.0	119.6	.23	83.7	1761.
36.50	368.5	693.5	120.3	.23	84.8	1776.
37.00	373.0	703.0	120.9	.23	85.8	1791.
37.50	377.5	712.5	121.5	.23	86.8	1806.
38.00	382.0	722.0	122.2	.23	87.9	1821.
38.50	386.5	731.5	122.8	.23	88.9	1837.
39.00	391.0	741.0	123.4	.23	89.9	1852.
39.50	395.5	750.5	124.1	.23	91.0	1867.
40.00	400.0	760.0	124.7	.23	92.0	1882.
40.50	404.5	769.5	125.3	.23	93.0	1897.

41.00	409.0	779.0	126.0	.23	94.1	1913.
41.50	413.5	788.5	126.6	.23	95.1	1928.
42.00	418.0	798.0	127.2	.23	96.1	1943.
42.50	422.5	807.5	127.9	.23	97.2	1958.
43.00	427.0	817.0	128.5	.23	98.2	1973.
43.50	431.5	826.5	129.1	.23	99.2	1989.
44.00	436.0	836.0	129.8	.23	100.3	2004.
44.50	440.5	845.5	130.4	.23	101.3	2019.
45.00	445.0	855.0	131.0	.23	102.3	2034.
45.50	449.5	864.5	131.6	.23	103.4	2049.
46.00	454.0	874.0	132.3	.23	104.4	2065.
46.50	458.5	883.5	132.9	.23	105.5	2080.

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NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3

STAMPA parametri per valutazione capacita' portante

zz m	S'v kPa	Sv kPa	Cu kPa	Tau/S'v -	Tau kPa	qb kPa
47.00	463.0	893.0	133.5	.23	106.5	2095.
47.50	467.5	902.5	134.2	.23	107.5	2110.
48.00	472.0	912.0	134.8	.23	108.6	2125.
48.50	476.5	921.5	135.4	.23	109.6	2141.
49.00	481.0	931.0	136.1	.23	110.6	2156.
49.50	485.5	940.5	136.7	.23	111.7	2171.
50.00	490.0	950.0	137.3	.23	112.7	2186.
50.50	494.5	959.5	138.0	.23	113.7	2201.
51.00	499.0	969.0	138.6	.23	114.8	2216.
51.50	503.5	978.5	139.2	.23	115.8	2232.
52.00	508.0	988.0	139.9	.23	116.8	2247.
52.50	512.5	997.5	140.5	.23	117.9	2262.
53.00	517.0	1007.0	141.1	.23	118.9	2277.
53.50	521.5	1016.5	141.8	.23	119.9	2292.
54.00	526.0	1026.0	142.4	.23	120.0	2308.
54.50	530.5	1035.5	143.0	.23	120.0	2323.
55.00	535.0	1045.0	143.7	.22	120.0	2338.
55.50	539.5	1054.5	144.3	.22	120.0	2353.
56.00	544.0	1064.0	144.9	.22	120.0	2368.
56.50	548.5	1073.5	145.6	.22	120.0	2384.
57.00	553.0	1083.0	146.2	.22	120.0	2399.
57.50	557.5	1092.5	146.8	.22	120.0	2414.
58.00	562.0	1102.0	147.5	.21	120.0	2429.
58.50	566.5	1111.5	148.1	.21	120.0	2444.
59.00	571.0	1121.0	148.7	.21	120.0	2460.
59.50	575.5	1130.5	149.4	.21	120.0	2475.
60.00	580.0	1140.0	150.0	.21	120.0	2490.

zz = Profondita' da piano campagna
 S'v = Tensione verticale efficace
 Sv = Tensione verticale totale
 Cu = Coesione non drenata
 Tau = Tensione di adesione laterale limite
 qb = Portata di base limite unitaria

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 NODO BOLOGNA CAVALCAVIA CV03
 Capacita portante palo spigolo SLU A1+M1+R3

STAMPA capacita' portante e relativi contributi

Lp m	Ql1 kN	Qb1 kN	Wp kN	Qu kN	Qd kN
.00	0.	1188.	0.	1188.	540.
.50	42.	1216.	7.	1252.	568.
1.00	94.	1245.	14.	1325.	601.
1.50	155.	1274.	21.	1407.	639.
2.00	226.	1302.	29.	1500.	682.
2.50	303.	1331.	36.	1599.	729.
3.00	383.	1360.	43.	1700.	777.
3.50	461.	1866.	50.	2277.	1041.
4.00	542.	2316.	57.	2800.	1281.
4.50	627.	2766.	64.	3328.	1523.
5.00	715.	3216.	72.	3860.	1767.
5.50	808.	3666.	79.	4396.	2013.
6.00	905.	3642.	86.	4461.	2046.
6.50	1006.	3143.	93.	4056.	1865.
7.00	1111.	2644.	100.	3655.	1686.
7.50	1219.	2146.	107.	3258.	1510.
8.00	1325.	1647.	114.	2858.	1332.
8.50	1392.	1675.	122.	2946.	1373.
9.00	1452.	1704.	129.	3027.	1410.
9.50	1513.	1733.	136.	3110.	1448.
10.00	1574.	1762.	143.	3193.	1486.
10.50	1636.	1790.	150.	3276.	1525.
11.00	1700.	1819.	157.	3362.	1564.
11.50	1766.	1848.	165.	3449.	1605.
12.00	1834.	1876.	172.	3539.	1647.
12.50	1904.	1905.	179.	3630.	1689.
13.00	1986.	1934.	186.	3734.	1738.
13.50	2138.	2442.	193.	4386.	2042.
14.00	2304.	2950.	200.	5054.	2353.
14.50	2474.	3458.	207.	5725.	2667.
15.00	2649.	3967.	215.	6401.	2983.
15.50	2828.	4475.	222.	7081.	3301.
16.00	3011.	4983.	229.	7765.	3621.
16.50	3198.	5491.	236.	8453.	3943.
17.00	3389.	5999.	243.	9145.	4267.
17.50	3584.	6508.	250.	9841.	4594.
18.00	3783.	6508.	257.	10033.	4692.
18.50	3987.	6508.	265.	10230.	4792.
19.00	4194.	6508.	272.	10430.	4894.
19.50	4406.	6508.	279.	10635.	4998.
20.00	4622.	6508.	286.	10843.	5104.
20.50	4842.	6508.	293.	11056.	5213.
21.00	5066.	6508.	300.	11273.	5324.
21.50	5294.	6508.	308.	11494.	5437.
22.00	5526.	6082.	315.	11294.	5359.
22.50	5763.	5657.	322.	11098.	5283.
23.00	6003.	5232.	329.	10906.	5209.
23.50	6248.	4806.	336.	10718.	5137.
24.00	6497.	4381.	343.	10534.	5067.
24.50	6750.	3956.	350.	10355.	5000.
25.00	7007.	3531.	358.	10179.	4935.
25.50	7268.	3105.	365.	10008.	4872.
26.00	7515.	2680.	372.	9823.	4801.
26.50	7655.	2707.	379.	9982.	4880.
27.00	7778.	2734.	386.	10126.	4950.
27.50	7904.	2760.	393.	10271.	5021.
28.00	8031.	2787.	401.	10418.	5093.
28.50	8161.	2814.	408.	10567.	5167.
29.00	8292.	2841.	415.	10718.	5241.
29.50	8425.	2868.	422.	10871.	5316.
30.00	8560.	2895.	429.	11025.	5392.
30.50	8696.	2921.	436.	11181.	5469.
31.00	8835.	2948.	443.	11340.	5547.
31.50	8975.	2975.	451.	11500.	5626.
32.00	9118.	3002.	458.	11662.	5706.
32.50	9262.	3029.	465.	11826.	5786.

33.00	9408.	3056.	472.	11991.	5868.
33.50	9556.	3082.	479.	12159.	5951.
34.00	9706.	3109.	486.	12328.	6035.
34.50	9857.	3136.	494.	12500.	6120.
35.00	10011.	3163.	501.	12673.	6206.
35.50	10166.	3190.	508.	12848.	6293.
36.00	10323.	3217.	515.	13025.	6380.
36.50	10482.	3243.	522.	13204.	6469.
37.00	10643.	3270.	529.	13384.	6559.
37.50	10806.	3297.	536.	13567.	6650.
38.00	10971.	3324.	544.	13751.	6741.
38.50	11137.	3351.	551.	13937.	6834.
39.00	11306.	3378.	558.	14125.	6928.
39.50	11476.	3404.	565.	14315.	7022.
40.00	11648.	3431.	572.	14507.	7118.
40.50	11822.	3458.	579.	14701.	7215.
41.00	11998.	3485.	586.	14896.	7312.
41.50	12176.	3512.	594.	15094.	7411.
42.00	12355.	3539.	601.	15293.	7510.
42.50	12537.	3565.	608.	15494.	7611.
43.00	12720.	3592.	615.	15697.	7712.
43.50	12905.	3619.	622.	15902.	7815.
44.00	13092.	3646.	629.	16109.	7918.
44.50	13281.	3673.	637.	16317.	8023.
45.00	13472.	3700.	644.	16528.	8128.
45.50	13664.	3726.	651.	16740.	8235.
46.00	13859.	3753.	658.	16954.	8342.
46.50	14055.	3780.	665.	17170.	8451.
47.00	14253.	3807.	672.	17388.	8560.
47.50	14453.	3834.	679.	17608.	8670.
48.00	14655.	3861.	687.	17829.	8782.
48.50	14859.	3887.	694.	18053.	8894.
49.00	15065.	3914.	701.	18278.	9007.
49.50	15272.	3941.	708.	18505.	9121.
50.00	15482.	3968.	715.	18734.	9237.
50.50	15693.	3995.	722.	18965.	9353.
51.00	15906.	4022.	730.	19198.	9470.
51.50	16121.	4048.	737.	19433.	9588.
52.00	16337.	4075.	744.	19668.	9707.
52.50	16553.	4102.	751.	19904.	9826.
53.00	16769.	4129.	758.	20140.	9944.
53.50	16985.	4156.	765.	20376.	10063.
54.00	17201.	4183.	772.	20611.	10182.
54.50	17417.	4209.	780.	20847.	10301.
55.00	17633.	4236.	787.	21083.	10419.
55.50	17849.	4263.	794.	21318.	10538.
56.00	18065.	4290.	801.	21554.	10657.
56.50	18281.	4317.	808.	21790.	10776.
57.00	18497.	4344.	815.	22025.	10894.
57.50	18713.	4371.	823.	22261.	11013.
58.00	18929.	4397.	830.	22497.	11132.

Lp = Lunghezza utile del palo
 Qll = Portata laterale limite
 Qbl = Portata di base limite
 Wp = Peso efficace del palo
 Qu = Portata totale limite
 Qd = Portata di progetto = $Qll/FS,l + Qbl/FS,b - Wp$

9 APPENDICE B. ANALISI PALIFICATE DI FONDAZIONE. TABULATI DI CALCOLO MAP

9.1 Spalla appoggi fissi – Analisi SLU statica e sismica

M A P - Matrix Analysis of Piles
Programma per l'analisi di palificate collegate da un plinto rigido

(C) G.Guiducci, S.G.I. - luglio 1994

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

Geometria Palificata

palo	vin	X m	Y m	Z m	axz deg	ayz deg	axy deg	Box m	Boy m
1	0	6.000	8.700	.000	.00	.00	.00	1.50	.00
2	0	4.000	8.700	.000	.00	.00	.00	1.50	.00
3	0	2.000	8.700	.000	.00	.00	.00	1.50	.00
4	0	.000	8.700	.000	.00	.00	.00	1.50	.00
5	0	-2.000	8.700	.000	.00	.00	.00	1.50	.00
6	0	-4.000	8.700	.000	.00	.00	.00	1.50	.00
7	0	-6.000	8.700	.000	.00	.00	.00	1.50	.00
8	0	5.000	10.700	.000	.00	.00	.00	1.50	.00
9	0	3.000	10.700	.000	.00	.00	.00	1.50	.00
10	0	1.000	10.700	.000	.00	.00	.00	1.50	.00
11	0	-1.000	10.700	.000	.00	.00	.00	1.50	.00
12	0	-3.000	10.700	.000	.00	.00	.00	1.50	.00
13	0	-5.000	10.700	.000	.00	.00	.00	1.50	.00
14	0	4.000	12.700	.000	.00	.00	.00	1.50	.00
15	0	2.000	12.700	.000	.00	.00	.00	1.50	.00
16	0	.000	12.700	.000	.00	.00	.00	1.50	.00
17	0	-2.000	12.700	.000	.00	.00	.00	1.50	.00
18	0	-4.000	12.700	.000	.00	.00	.00	1.50	.00
19	0	6.000	-8.700	.000	.00	.00	.00	1.50	.00
20	0	4.000	-8.700	.000	.00	.00	.00	1.50	.00
21	0	2.000	-8.700	.000	.00	.00	.00	1.50	.00
22	0	.000	-8.700	.000	.00	.00	.00	1.50	.00
23	0	-2.000	-8.700	.000	.00	.00	.00	1.50	.00
24	0	-4.000	-8.700	.000	.00	.00	.00	1.50	.00
25	0	-6.000	-8.700	.000	.00	.00	.00	1.50	.00
26	0	5.000	-10.700	.000	.00	.00	.00	1.50	.00
27	0	3.000	-10.700	.000	.00	.00	.00	1.50	.00
28	0	1.000	-10.700	.000	.00	.00	.00	1.50	.00
29	0	-1.000	-10.700	.000	.00	.00	.00	1.50	.00
30	0	-3.000	-10.700	.000	.00	.00	.00	1.50	.00
31	0	-5.000	-10.700	.000	.00	.00	.00	1.50	.00
32	0	4.000	-12.700	.000	.00	.00	.00	1.50	.00
33	0	2.000	-12.700	.000	.00	.00	.00	1.50	.00
34	0	.000	-12.700	.000	.00	.00	.00	1.50	.00
35	0	-2.000	-12.700	.000	.00	.00	.00	1.50	.00
36	0	-4.000	-12.700	.000	.00	.00	.00	1.50	.00

vin = 0 - incastro; 1 - cerniera; 2 - appoggio

X, Y, Z = Coordinate testa pali

axz = Inclinazione palo nel piano Xp Z rispetto alla verticale
(positiva se verso Xp positivo)

ayz = Inclinazione palo nel piano Yp Z rispetto alla verticale
(positiva se verso Yp positivo)

axy = Rotazione assi Xp Yp (positiva se antioraria)

Box = Lato dell'elemento parallelo all'asse Xp

Boy = Lato dell'elemento parallelo all'asse Yp

se Boy = 0 D = Box: diametro

altrimenti D = $\sqrt{\text{Box} * \text{Boy} * 1.273}$: diametro equivalente

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 Caratterizzazione dei pali soggetti a carichi assiali e torsionali
 (uguali per tutti i pali)

palo	AK kN/m	TK kN*m/rad
1	200000.	.0

 AK = Rigidezza assiale palo-terreno
 TK = Rigidezza torsionale palo-terreno

 Baricentro palificata: Xg = .000 m Yg = .000 m
 Rotazione direzioni princip. di inerzia: .00 deg

Caratterizzazione del terreno per pali soggetti a carichi trasversali

Terreno tipo 1

Prof. m	E kN/m2
.00	33750.0
3.00	35250.0
3.10	150000.0
8.00	150000.0
8.10	36750.0
13.00	44250.0
13.10	150000.0
26.00	150000.0
26.10	52500.0
60.00	75000.0

Caratterizzazione dei pali soggetti a carichi trasversali

palo	Lp m	EJx kN*m2	Itx	Ridx	EJy kN*m2	Ity	Ridy
1	50.00	7455147.	1	.300	7455147.	1	.250
2	50.00	7455147.	1	.080	7455147.	1	.050
3	50.00	7455147.	1	.060	7455147.	1	.050
4	50.00	7455147.	1	.060	7455147.	1	.050
5	50.00	7455147.	1	.060	7455147.	1	.050
6	50.00	7455147.	1	.060	7455147.	1	.050
7	50.00	7455147.	1	.200	7455147.	1	.250
8	50.00	7455147.	1	.200	7455147.	1	.200
9	50.00	7455147.	1	.050	7455147.	1	.050
10	50.00	7455147.	1	.050	7455147.	1	.050
11	50.00	7455147.	1	.050	7455147.	1	.050
12	50.00	7455147.	1	.050	7455147.	1	.050
13	50.00	7455147.	1	.200	7455147.	1	.200
14	50.00	7455147.	1	.250	7455147.	1	.250
15	50.00	7455147.	1	.060	7455147.	1	.050
16	50.00	7455147.	1	.060	7455147.	1	.050
17	50.00	7455147.	1	.060	7455147.	1	.050
18	50.00	7455147.	1	.200	7455147.	1	.250
19	50.00	7455147.	1	.300	7455147.	1	.250
20	50.00	7455147.	1	.080	7455147.	1	.050
21	50.00	7455147.	1	.060	7455147.	1	.050
22	50.00	7455147.	1	.060	7455147.	1	.050
23	50.00	7455147.	1	.060	7455147.	1	.050
24	50.00	7455147.	1	.060	7455147.	1	.050
25	50.00	7455147.	1	.200	7455147.	1	.250
26	50.00	7455147.	1	.200	7455147.	1	.200
27	50.00	7455147.	1	.050	7455147.	1	.050
28	50.00	7455147.	1	.050	7455147.	1	.050
29	50.00	7455147.	1	.050	7455147.	1	.050
30	50.00	7455147.	1	.050	7455147.	1	.050
31	50.00	7455147.	1	.200	7455147.	1	.200

32	50.00	7455147.	1	.250	7455147.	1	.250
33	50.00	7455147.	1	.060	7455147.	1	.050
34	50.00	7455147.	1	.060	7455147.	1	.050
35	50.00	7455147.	1	.060	7455147.	1	.050
36	50.00	7455147.	1	.200	7455147.	1	.250

 Lp = Lunghezza palo (compreso eventuale tratto fuori terra)
 EJ = Rigidezza flessionale del palo
 It = Tipo di terreno
 Rid = Moltiplicatore del modulo di reazione orizzontale

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 1
spalla fissa - n777_STR1 - n789_STR1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	37143.9	7603.2	62305.4	-15916.7	-59479.7	-40366.0
2	38065.6	6043.7	63501.5	16816.7	59892.0	42601.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
75209.5	13646.9	125806.9	900.0	10274.5	18922.5

Punto di applic. carico verticale: Xv = 1.673 m Yv = .137 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
10.446	11.458	1.496	.435	.017	.058

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3913.1	852.5	-1218.6	92.3	-304.7	.0	1256.1
2	3314.7	255.0	144.7	24.0	-103.4	.0	177.8
3	2716.3	188.5	312.9	19.3	-80.6	.0	323.2
4	2118.0	188.5	312.9	14.6	-57.7	.0	318.2
5	1519.6	188.5	312.9	9.9	-34.9	.0	314.9
6	921.2	188.5	312.9	5.1	-12.1	.0	313.2
7	322.8	604.6	-681.8	4.1	3.5	.0	681.8
8	3620.5	591.9	-635.8	72.7	-248.1	.0	682.5
9	3022.2	148.7	425.6	21.7	-92.0	.0	435.5
10	2423.8	148.7	425.6	16.9	-69.2	.0	431.2
11	1825.4	148.7	425.6	12.2	-46.3	.0	428.2
12	1227.0	148.7	425.6	7.5	-23.5	.0	426.3
13	628.6	591.9	-635.8	9.5	-17.9	.0	636.0
14	3328.0	702.8	-860.4	77.6	-253.3	.0	897.0
15	2729.6	177.7	363.1	19.3	-80.6	.0	371.9
16	2131.2	177.7	363.1	14.6	-57.7	.0	367.6
17	1532.8	177.7	363.1	9.9	-34.9	.0	364.7
18	934.4	579.3	-589.7	18.8	-47.9	.0	591.7
19	3855.5	997.0	-1706.4	92.3	-304.7	.0	1733.4
20	3257.1	312.8	-107.7	24.0	-103.4	.0	149.3
21	2658.7	235.6	94.9	19.3	-80.6	.0	124.5

22	2060.3	235.6	94.9	14.6	-57.7	.0	111.1
23	1462.0	235.6	94.9	9.9	-34.9	.0	101.1
24	863.6	235.6	94.9	5.1	-12.1	.0	95.7
25	265.2	714.5	-1082.3	4.1	3.5	.0	1082.3
26	3549.7	727.2	-1128.4	72.7	-248.1	.0	1155.3
27	2951.3	199.3	181.4	21.7	-92.0	.0	203.4
28	2352.9	199.3	181.4	16.9	-69.2	.0	194.1
29	1754.5	199.3	181.4	12.2	-46.3	.0	187.2
30	1156.1	199.3	181.4	7.5	-23.5	.0	182.9
31	557.8	727.2	-1128.4	9.5	-17.9	.0	1128.5
32	3243.9	889.6	-1512.8	77.6	-253.3	.0	1533.8
33	2645.5	246.4	44.8	19.3	-80.6	.0	92.2
34	2047.1	246.4	44.8	14.6	-57.7	.0	73.1
35	1448.7	246.4	44.8	9.9	-34.9	.0	56.8
36	850.3	739.8	-1174.4	18.8	-47.9	.0	1175.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa SLU statica

 CONDIZIONE DI CARICO 1
 spalla fissa - n777_STR1 - n789_STR1

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	997.0	-1706.4	92.3	-304.7	1001.3	1733.4
1.56	825.6	-289.7	82.3	-168.4	829.7	335.1
3.13	601.9	888.9	66.8	-47.1	605.6	890.2
4.69	210.0	1490.7	36.4	31.9	213.1	1491.0
6.25	-31.1	1604.4	14.1	69.9	34.1	1605.9
7.81	-156.7	1438.7	-1.1	78.8	156.7	1440.9
9.38	-182.9	1158.7	-5.7	71.4	183.0	1160.9
10.94	-181.3	872.3	-7.1	61.2	181.4	874.4
12.50	-171.0	595.3	-7.8	49.5	171.2	597.3
15.00	-114.1	222.2	-7.3	30.1	114.3	224.2
17.50	-54.2	17.8	-5.2	14.2	54.5	22.7
20.00	-15.8	-62.9	-3.0	4.0	16.1	63.0
22.50	2.9	-73.8	-1.2	-1.0	3.1	73.8
25.00	8.2	-56.8	-.1	-2.6	8.2	56.9
29.17	6.4	-24.3	.2	-1.9	6.4	24.4
33.33	3.1	-4.6	.2	-.9	3.1	4.7
37.50	.7	2.9	.1	-.3	.7	2.9
43.75	-.4	2.2	.0	.0	.4	2.2
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 2
spalla fissa - n777_STR2- n789_STR2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	50794.0	6605.2	122920.5	-22759.2	-85136.4	-59790.7
2	51541.5	4974.6	123227.5	23877.2	84927.2	62280.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
102335.5	11579.8	246148.0	1118.0	7789.1	19936.9

Punto di applic. carico verticale: Xv = 2.405 m Yv = .076 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
14.213	14.381	2.422	.516	.015	.061

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5774.1	819.7	-82.2	105.9	-354.3	.0	363.7
2	4805.4	188.9	1212.3	28.3	-125.3	.0	1218.8
3	3836.8	123.0	1351.6	23.3	-101.2	.0	1355.4
4	2868.1	123.0	1351.6	18.3	-77.2	.0	1353.8
5	1899.5	123.0	1351.6	13.3	-53.1	.0	1352.7
6	930.9	123.0	1351.6	8.3	-29.0	.0	1352.0
7	-37.8	552.4	448.7	12.9	-29.5	.0	449.7
8	5295.6	539.1	497.2	84.1	-291.5	.0	576.4
9	4327.0	83.9	1445.9	25.8	-113.2	.0	1450.3
10	3358.3	83.9	1445.9	20.8	-89.2	.0	1448.7
11	2389.7	83.9	1445.9	15.8	-65.1	.0	1447.4
12	1421.0	83.9	1445.9	10.8	-41.1	.0	1446.5
13	452.4	539.1	497.2	17.5	-49.0	.0	499.6
14	4817.1	658.3	281.1	90.4	-300.1	.0	411.2
15	3848.5	111.6	1404.5	23.3	-101.2	.0	1408.1
16	2879.9	111.6	1404.5	18.3	-77.2	.0	1406.6
17	1911.2	111.6	1404.5	13.3	-53.1	.0	1405.5
18	942.6	525.8	545.7	28.4	-83.7	.0	552.1
19	5723.1	972.0	-596.1	105.9	-354.3	.0	693.4
20	4754.4	249.8	946.4	28.3	-125.3	.0	954.7
21	3785.8	172.5	1121.9	23.3	-101.2	.0	1126.5

22	2817.2	172.5	1121.9	18.3	-77.2	.0	1124.6
23	1848.5	172.5	1121.9	13.3	-53.1	.0	1123.2
24	879.9	172.5	1121.9	8.3	-29.0	.0	1122.3
25	-88.8	668.3	26.7	12.9	-29.5	.0	39.8
26	5232.9	681.6	-21.8	84.1	-291.5	.0	292.3
27	4264.3	137.2	1188.5	25.8	-113.2	.0	1193.9
28	3295.6	137.2	1188.5	20.8	-89.2	.0	1191.9
29	2327.0	137.2	1188.5	15.8	-65.1	.0	1190.3
30	1358.3	137.2	1188.5	10.8	-41.1	.0	1189.3
31	389.7	681.6	-21.8	17.5	-49.0	.0	53.6
32	4742.7	855.2	-406.2	90.4	-300.1	.0	505.0
33	3774.1	183.9	1069.1	23.3	-101.2	.0	1073.9
34	2805.4	183.9	1069.1	18.3	-77.2	.0	1071.9
35	1836.8	183.9	1069.1	13.3	-53.1	.0	1070.4
36	868.2	694.9	-70.3	28.4	-83.7	.0	109.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 3
spalla fissa - n777_STR3- n789_STR3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48498.8	7285.7	113881.0	-21532.8	-81112.8	-56695.0
2	50108.7	4638.1	116033.9	23206.8	81700.8	60715.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.5	11923.8	229914.9	1674.0	17813.9	32349.4

Punto di applic. carico verticale: Xv = 2.332 m Yv = .181 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	14.021	2.299	.803	.029	.098

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5548.7	780.1	-84.6	164.9	-544.8	.0	551.3
2	4629.1	180.1	1147.5	43.3	-186.9	.0	1162.6
3	3709.6	117.4	1280.2	35.3	-147.8	.0	1288.7
4	2790.0	117.4	1280.2	27.2	-108.8	.0	1284.8
5	1870.4	117.4	1280.2	19.1	-69.8	.0	1282.1
6	950.9	117.4	1280.2	11.0	-30.8	.0	1280.6
7	31.3	525.9	420.6	14.1	-18.0	.0	420.9
8	5100.6	504.3	499.3	130.5	-445.4	.0	669.1
9	4181.0	76.8	1386.2	39.3	-167.4	.0	1396.2
10	3261.5	76.8	1386.2	31.2	-128.3	.0	1392.1
11	2341.9	76.8	1386.2	23.1	-89.3	.0	1389.0
12	1422.3	76.8	1386.2	15.0	-50.3	.0	1387.1
13	502.8	504.3	499.3	22.4	-51.9	.0	502.0
14	4652.5	605.8	333.7	139.8	-457.0	.0	565.9
15	3733.0	98.9	1365.9	35.3	-147.8	.0	1373.9
16	2813.4	98.9	1365.9	27.2	-108.8	.0	1370.2
17	1893.8	98.9	1365.9	19.1	-69.8	.0	1367.7
18	974.3	482.7	578.0	39.2	-105.8	.0	587.6
19	5446.9	1027.2	-918.5	164.9	-544.8	.0	1067.9
20	4527.3	278.9	716.1	43.3	-186.9	.0	740.0
21	3607.8	197.8	907.5	35.3	-147.8	.0	919.4

22	2688.2	197.8	907.5	27.2	-108.8	.0	914.0
23	1768.6	197.8	907.5	19.1	-69.8	.0	910.2
24	849.1	197.8	907.5	11.0	-30.8	.0	908.0
25	-70.5	713.9	-264.2	14.1	-18.0	.0	264.8
26	4975.4	735.5	-342.9	130.5	-445.4	.0	562.1
27	4055.9	163.4	968.6	39.3	-167.4	.0	982.9
28	3136.3	163.4	968.6	31.2	-128.3	.0	977.0
29	2216.7	163.4	968.6	23.1	-89.3	.0	972.7
30	1297.2	163.4	968.6	15.0	-50.3	.0	969.9
31	377.6	735.5	-342.9	22.4	-51.9	.0	346.8
32	4503.9	925.2	-781.5	139.8	-457.0	.0	905.3
33	3584.4	216.2	821.8	35.3	-147.8	.0	835.0
34	2664.8	216.2	821.8	27.2	-108.8	.0	829.0
35	1745.2	216.2	821.8	19.1	-69.8	.0	824.8
36	825.7	757.1	-421.6	39.2	-105.8	.0	434.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 4
spalla fissa - n777_STR4- n789_STR4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	50108.7	4633.7	116022.3	-23161.0	-82537.7	-59426.7
2	48498.8	7290.2	113892.6	21487.0	81948.8	55447.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.5	11923.9	229914.9	-1674.0	-17814.8	-32404.3

Punto di applic. carico verticale: Xv = 2.332 m Yv = -.181 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	14.021	2.299	-.803	-.029	-.099

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5446.9	1027.5	-919.2	-165.1	545.3	.0	1068.7
2	4527.3	279.0	715.7	-43.4	187.0	.0	739.7
3	3607.8	197.8	907.2	-35.3	147.9	.0	919.1
4	2688.2	197.8	907.2	-27.2	108.8	.0	913.7
5	1768.6	197.8	907.2	-19.1	69.7	.0	909.8
6	849.1	197.8	907.2	-11.0	30.6	.0	907.7
7	-70.5	714.1	-264.8	-13.9	17.5	.0	265.3
8	4975.4	735.7	-343.6	-130.5	445.8	.0	562.8
9	4055.9	163.4	968.2	-39.3	167.5	.0	982.6
10	3136.3	163.4	968.2	-31.2	128.4	.0	976.7
11	2216.7	163.4	968.2	-23.1	89.3	.0	972.3
12	1297.1	163.4	968.2	-15.0	50.2	.0	969.5
13	377.6	735.7	-343.6	-22.3	51.6	.0	347.5
14	4503.9	925.5	-782.5	-139.9	457.3	.0	906.3
15	3584.4	216.3	821.3	-35.3	147.9	.0	834.5
16	2664.8	216.3	821.3	-27.2	108.8	.0	828.5
17	1745.2	216.3	821.3	-19.1	69.7	.0	824.3
18	825.7	757.4	-422.4	-39.1	105.5	.0	435.4
19	5548.7	779.9	-83.9	-165.1	545.3	.0	551.7
20	4629.1	180.0	1147.8	-43.4	187.0	.0	1163.0
21	3709.6	117.3	1280.5	-35.3	147.9	.0	1289.0

22	2790.0	117.3	1280.5	-27.2	108.8	.0	1285.2
23	1870.4	117.3	1280.5	-19.1	69.7	.0	1282.4
24	950.9	117.3	1280.5	-11.0	30.6	.0	1280.9
25	31.3	525.8	421.1	-13.9	17.5	.0	421.5
26	5100.6	504.1	500.0	-130.5	445.8	.0	669.8
27	4181.0	76.8	1386.5	-39.3	167.5	.0	1396.6
28	3261.5	76.8	1386.5	-31.2	128.4	.0	1392.4
29	2341.9	76.8	1386.5	-23.1	89.3	.0	1389.4
30	1422.3	76.8	1386.5	-15.0	50.2	.0	1387.4
31	502.8	504.1	500.0	-22.3	51.6	.0	502.6
32	4652.5	605.6	334.6	-139.9	457.3	.0	566.7
33	3733.0	98.8	1366.4	-35.3	147.9	.0	1374.4
34	2813.4	98.8	1366.4	-27.2	108.8	.0	1370.7
35	1893.8	98.8	1366.4	-19.1	69.7	.0	1368.1
36	974.3	482.5	578.8	-39.1	105.5	.0	588.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa SLU statica

 CONDIZIONE DI CARICO 5
 spalla fissa - n777_STR5 - n789_STR5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	37143.9	7603.2	62305.4	-15916.7	-59479.7	-40366.0
2	38065.6	6043.7	63501.5	16816.7	59892.0	42601.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
75209.5	13646.9	125806.9	900.0	10274.5	18922.5

Punto di applic. carico verticale: Xv = 1.673 m Yv = .137 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
10.446	11.458	1.496	.435	.017	.058

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3913.1	852.5	-1218.6	92.3	-304.7	.0	1256.1
2	3314.7	255.0	144.7	24.0	-103.4	.0	177.8
3	2716.3	188.5	312.9	19.3	-80.6	.0	323.2
4	2118.0	188.5	312.9	14.6	-57.7	.0	318.2
5	1519.6	188.5	312.9	9.9	-34.9	.0	314.9
6	921.2	188.5	312.9	5.1	-12.1	.0	313.2
7	322.8	604.6	-681.8	4.1	3.5	.0	681.8
8	3620.5	591.9	-635.8	72.7	-248.1	.0	682.5
9	3022.2	148.7	425.6	21.7	-92.0	.0	435.5
10	2423.8	148.7	425.6	16.9	-69.2	.0	431.2
11	1825.4	148.7	425.6	12.2	-46.3	.0	428.2
12	1227.0	148.7	425.6	7.5	-23.5	.0	426.3
13	628.6	591.9	-635.8	9.5	-17.9	.0	636.0
14	3328.0	702.8	-860.4	77.6	-253.3	.0	897.0
15	2729.6	177.7	363.1	19.3	-80.6	.0	371.9
16	2131.2	177.7	363.1	14.6	-57.7	.0	367.6
17	1532.8	177.7	363.1	9.9	-34.9	.0	364.7
18	934.4	579.3	-589.7	18.8	-47.9	.0	591.7
19	3855.5	997.0	-1706.4	92.3	-304.7	.0	1733.4
20	3257.1	312.8	-107.7	24.0	-103.4	.0	149.3
21	2658.7	235.6	94.9	19.3	-80.6	.0	124.5

22	2060.3	235.6	94.9	14.6	-57.7	.0	111.1
23	1462.0	235.6	94.9	9.9	-34.9	.0	101.1
24	863.6	235.6	94.9	5.1	-12.1	.0	95.7
25	265.2	714.5	-1082.3	4.1	3.5	.0	1082.3
26	3549.7	727.2	-1128.4	72.7	-248.1	.0	1155.3
27	2951.3	199.3	181.4	21.7	-92.0	.0	203.4
28	2352.9	199.3	181.4	16.9	-69.2	.0	194.1
29	1754.5	199.3	181.4	12.2	-46.3	.0	187.2
30	1156.1	199.3	181.4	7.5	-23.5	.0	182.9
31	557.8	727.2	-1128.4	9.5	-17.9	.0	1128.5
32	3243.9	889.6	-1512.8	77.6	-253.3	.0	1533.8
33	2645.5	246.4	44.8	19.3	-80.6	.0	92.2
34	2047.1	246.4	44.8	14.6	-57.7	.0	73.1
35	1448.7	246.4	44.8	9.9	-34.9	.0	56.8
36	850.3	739.8	-1174.4	18.8	-47.9	.0	1175.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 6
spalla fissa - n777_STR6- n789_STR6

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48484.5	5020.1	109526.1	-21985.0	-79520.2	-57304.0
2	45556.0	7611.7	101963.8	20311.0	76470.1	52629.7

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
94040.5	12631.8	211489.9	-1674.0	-34385.1	-32404.4

Punto di applic. carico verticale: Xv = 2.249 m Yv = -.366 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.061	13.782	2.170	-.883	-.049	-.099

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5131.4	1055.5	-1156.5	-166.5	529.2	.0	1271.8
2	4263.3	297.6	526.3	-42.8	168.9	.0	552.7
3	3395.2	214.6	727.3	-34.7	129.9	.0	738.8
4	2527.1	214.6	727.3	-26.6	90.8	.0	733.0
5	1659.0	214.6	727.3	-18.5	51.7	.0	729.2
6	790.8	214.6	727.3	-10.4	12.6	.0	727.4
7	-77.3	739.2	-487.0	-15.4	1.5	.0	487.0
8	4677.8	760.9	-565.9	-131.4	429.0	.0	710.1
9	3809.7	179.1	794.3	-38.7	149.4	.0	808.2
10	2941.5	179.1	794.3	-30.6	110.3	.0	801.9
11	2073.4	179.1	794.3	-22.5	71.2	.0	797.5
12	1205.3	179.1	794.3	-14.4	32.1	.0	794.9
13	337.2	760.9	-565.9	-23.2	34.8	.0	567.0
14	4224.1	952.3	-1013.0	-141.3	441.3	.0	1105.0
15	3356.0	233.1	641.5	-34.7	129.9	.0	654.5
16	2487.9	233.1	641.5	-26.6	90.8	.0	647.9
17	1619.8	233.1	641.5	-18.5	51.7	.0	643.6
18	751.7	782.5	-644.7	-40.5	89.4	.0	650.9
19	5301.7	808.0	-321.2	-166.5	529.2	.0	619.1
20	4433.6	198.6	958.4	-42.8	168.9	.0	973.2
21	3565.5	134.1	1100.7	-34.7	129.9	.0	1108.3

22	2697.4	134.1	1100.7	-26.6	90.8	.0	1104.4
23	1829.3	134.1	1100.7	-18.5	51.7	.0	1101.9
24	961.2	134.1	1100.7	-10.4	12.6	.0	1100.8
25	93.1	550.9	198.9	-15.4	1.5	.0	198.9
26	4887.3	529.3	277.7	-131.4	429.0	.0	511.0
27	4019.2	92.4	1212.6	-38.7	149.4	.0	1221.8
28	3151.0	92.4	1212.6	-30.6	110.3	.0	1217.6
29	2282.9	92.4	1212.6	-22.5	71.2	.0	1214.7
30	1414.8	92.4	1212.6	-14.4	32.1	.0	1213.0
31	546.7	529.3	277.7	-23.2	34.8	.0	279.9
32	4472.8	632.4	104.0	-141.3	441.3	.0	453.4
33	3604.7	115.6	1186.5	-34.7	129.9	.0	1193.6
34	2736.6	115.6	1186.5	-26.6	90.8	.0	1190.0
35	1868.5	115.6	1186.5	-18.5	51.7	.0	1187.7
36	1000.3	507.6	356.5	-40.5	89.4	.0	367.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 7
spalla fissa - n777_STR7- n789_STR7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48824.5	9969.3	130711.0	-21756.3	-81903.8	-71663.9
2	49783.1	8382.6	131986.7	22743.3	82266.8	74077.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.6	18351.9	262697.7	987.0	10620.0	19390.9

Punto di applic. carico verticale: Xv = 2.664 m Yv = .108 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	18.533	2.785	.474	.017	.059

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	6111.0	1244.1	-1111.8	98.0	-323.7	.0	1158.0
2	4997.1	337.8	867.8	25.7	-110.8	.0	874.8
3	3883.2	239.5	1099.6	20.9	-87.4	.0	1103.1
4	2769.3	239.5	1099.6	16.0	-64.0	.0	1101.4
5	1655.5	239.5	1099.6	11.2	-40.6	.0	1100.3
6	541.6	239.5	1099.6	6.3	-17.2	.0	1099.7
7	-572.3	864.6	-319.4	7.6	-7.9	.0	319.5
8	5561.0	851.7	-272.2	77.5	-264.4	.0	379.5
9	4447.1	183.2	1244.2	23.3	-99.1	.0	1248.2
10	3333.2	183.2	1244.2	18.4	-75.7	.0	1246.5
11	2219.4	183.2	1244.2	13.6	-52.3	.0	1245.3
12	1105.5	183.2	1244.2	8.7	-28.9	.0	1244.5
13	-8.4	851.7	-272.2	12.7	-28.5	.0	273.7
14	5011.0	1029.5	-627.9	82.9	-271.1	.0	684.0
15	3897.1	228.4	1150.9	20.9	-87.4	.0	1154.3
16	2783.3	228.4	1150.9	16.0	-64.0	.0	1152.7
17	1669.4	228.4	1150.9	11.2	-40.6	.0	1151.7
18	555.5	838.7	-225.0	22.6	-60.5	.0	233.0
19	6050.5	1392.2	-1611.6	98.0	-323.7	.0	1643.8
20	4936.6	397.0	609.2	25.7	-110.8	.0	619.2
21	3822.7	287.7	876.2	20.9	-87.4	.0	880.5

22	2708.9	287.7	876.2	16.0	-64.0	.0	878.5
23	1595.0	287.7	876.2	11.2	-40.6	.0	877.1
24	481.1	287.7	876.2	6.3	-17.2	.0	876.3
25	-632.8	977.3	-729.8	7.6	-7.9	.0	729.9
26	5486.6	990.3	-777.0	77.5	-264.4	.0	820.8
27	4372.7	235.0	993.9	23.3	-99.1	.0	998.8
28	3258.8	235.0	993.9	18.4	-75.7	.0	996.8
29	2145.0	235.0	993.9	13.6	-52.3	.0	995.3
30	1031.1	235.0	993.9	8.7	-28.9	.0	994.3
31	-82.8	990.3	-777.0	12.7	-28.5	.0	777.5
32	4922.7	1220.9	-1296.4	82.9	-271.1	.0	1324.4
33	3808.8	298.7	824.8	20.9	-87.4	.0	829.4
34	2694.9	298.7	824.8	16.0	-64.0	.0	827.3
35	1581.1	298.7	824.8	11.2	-40.6	.0	825.8
36	467.2	1003.2	-824.2	22.6	-60.5	.0	826.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa SLU statica

 CONDIZIONE DI CARICO 7
 spalla fissa - n777 _STR7- n789 _STR7

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1244.1	-1111.8	98.0	-323.7	1248.0	1158.0
1.56	991.1	621.7	87.4	-179.0	995.0	646.9
3.13	678.4	2011.2	70.9	-50.2	682.1	2011.9
4.69	151.7	2610.1	38.7	33.7	156.5	2610.3
6.25	-149.4	2573.7	15.0	74.0	150.1	2574.8
7.81	-284.4	2208.0	-1.1	83.5	284.4	2209.6
9.38	-303.4	1734.3	-6.1	75.8	303.5	1736.0
10.94	-292.1	1266.6	-7.5	65.0	292.2	1268.2
12.50	-269.5	825.2	-8.2	52.5	269.7	826.9
15.00	-168.4	250.9	-7.7	31.9	168.6	253.0
17.50	-71.3	-36.4	-5.5	15.0	71.5	39.4
20.00	-14.0	-131.2	-3.1	4.3	14.3	131.3
22.50	10.9	-126.8	-1.3	-1.1	11.0	126.8
25.00	15.1	-89.4	-.1	-2.8	15.1	89.4
29.17	10.3	-35.0	.2	-2.0	10.3	35.1
33.33	4.6	-4.4	.2	-1.0	4.7	4.6
37.50	.8	6.0	.1	-.3	.8	6.0
43.75	-.8	3.7	.0	.0	.8	3.7
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa SLU statica

 CONDIZIONE DI CARICO 7
 spalla fissa - n777 _STR7- n789 _STR7

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1392.2	-1611.6	98.0	-323.7	1395.7	1643.8
1.56	1123.2	340.6	87.4	-179.0	1126.6	384.8
3.13	785.4	1924.9	70.9	-50.2	788.6	1925.6
4.69	209.6	2650.0	38.7	33.7	213.1	2650.2
6.25	-127.2	2673.7	15.0	74.0	128.1	2674.7
7.81	-286.2	2321.9	-1.1	83.5	286.2	2323.4
9.38	-312.4	1836.6	-6.1	75.8	312.4	1838.2
10.94	-303.1	1353.0	-7.5	65.0	303.2	1354.6
12.50	-281.4	893.7	-8.2	52.5	281.5	895.3
15.00	-179.1	290.3	-7.7	31.9	179.2	292.1
17.50	-78.5	-19.6	-5.5	15.0	78.7	24.7
20.00	-17.7	-127.8	-3.1	4.3	18.0	127.8
22.50	9.6	-129.3	-1.3	-1.1	9.7	129.3
25.00	15.1	-93.3	-.1	-2.8	15.1	93.4
29.17	10.7	-37.5	.2	-2.0	10.7	37.6
33.33	4.9	-5.4	.2	-1.0	4.9	5.5
37.50	.9	5.8	.1	-.3	.9	5.8
43.75	-.8	3.8	.0	.0	.8	3.8
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 7
spalla fissa - n777 _STR7- n789 _STR7

Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 25
(riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	977.3	-729.8	7.6	-7.9	977.3	729.9
1.56	797.3	648.3	6.1	2.8	797.4	648.3
3.13	566.5	1778.9	4.4	11.5	566.5	1778.9
4.69	163.3	2315.8	1.2	15.6	163.3	2315.8
6.25	-87.0	2348.9	-6	15.8	87.0	2349.0
7.81	-219.9	2089.7	-1.6	13.9	219.9	2089.8
9.38	-248.2	1708.3	-1.8	11.2	248.2	1708.3
10.94	-246.8	1319.4	-1.7	8.5	246.8	1319.4
12.50	-235.6	940.5	-1.6	5.8	235.6	940.5
15.00	-168.4	414.8	-1.1	2.2	168.4	414.8
17.50	-92.1	94.5	-5	.2	92.1	94.5
20.00	-37.4	-60.0	-.2	-.6	37.4	60.0
22.50	-5.7	-107.3	.0	-.8	5.7	107.3
25.00	8.7	-99.8	.1	-.6	8.7	99.8
29.17	10.1	-54.5	.1	-.3	10.1	54.5
33.33	6.3	-19.7	.0	-.1	6.3	19.7
37.50	2.4	-1.6	.0	.0	2.4	1.6
43.75	-.3	3.1	.0	.0	.3	3.1
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa SLU statica

 CONDIZIONE DI CARICO 8
 spalla fissa - n777_STR8 - n789_STR8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48824.5	3372.1	97076.1	-21983.3	-80864.4	-42088.8
2	49783.0	1789.7	98352.6	22970.3	81225.9	44450.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.5	5161.8	195428.7	987.0	10617.4	19293.3

Punto di applic. carico verticale: Xv = 1.982 m Yv = .108 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	9.275	1.788	.474	.017	.059

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4914.8	394.0	651.9	97.8	-322.9	.0	727.5
2	4199.6	55.1	1263.8	25.7	-110.6	.0	1268.6
3	3484.5	22.1	1316.5	20.8	-87.3	.0	1319.4
4	2769.3	22.1	1316.5	16.0	-64.0	.0	1318.0
5	2054.2	22.1	1316.5	11.2	-40.8	.0	1317.1
6	1339.0	22.1	1316.5	6.4	-17.5	.0	1316.6
7	623.9	247.2	916.5	7.8	-8.7	.0	916.5
8	4564.2	234.3	963.4	77.3	-263.8	.0	998.9
9	3849.0	.7	1363.2	23.3	-99.0	.0	1366.8
10	3133.9	.7	1363.2	18.4	-75.7	.0	1365.3
11	2418.7	.7	1363.2	13.6	-52.4	.0	1364.2
12	1703.6	.7	1363.2	8.8	-29.1	.0	1363.5
13	988.4	234.3	963.4	12.9	-29.1	.0	963.9
14	4213.6	292.0	885.3	82.8	-270.5	.0	925.7
15	3498.4	11.1	1367.6	20.8	-87.3	.0	1370.4
16	2783.2	11.1	1367.6	16.0	-64.0	.0	1369.1
17	2068.1	11.1	1367.6	11.2	-40.8	.0	1368.2
18	1352.9	221.4	1010.4	22.8	-61.1	.0	1012.2
19	4854.3	541.4	154.6	97.8	-322.9	.0	358.0
20	4139.2	114.0	1006.5	25.7	-110.6	.0	1012.5
21	3424.0	70.1	1094.2	20.8	-87.3	.0	1097.7

22	2708.9	70.1	1094.2	16.0	-64.0	.0	1096.1
23	1993.7	70.1	1094.2	11.2	-40.8	.0	1094.9
24	1278.5	70.1	1094.2	6.4	-17.5	.0	1094.3
25	563.4	359.3	508.1	7.8	-8.7	.0	508.2
26	4489.8	372.2	461.2	77.3	-263.8	.0	531.3
27	3774.6	52.3	1114.2	23.3	-99.0	.0	1118.6
28	3059.5	52.3	1114.2	18.4	-75.7	.0	1116.7
29	2344.3	52.3	1114.2	13.6	-52.4	.0	1115.4
30	1629.2	52.3	1114.2	8.8	-29.1	.0	1114.6
31	914.0	372.2	461.2	12.9	-29.1	.0	462.1
32	4125.3	482.4	220.2	82.8	-270.5	.0	348.8
33	3410.1	81.1	1043.1	20.8	-87.3	.0	1046.7
34	2694.9	81.1	1043.1	16.0	-64.0	.0	1045.0
35	1979.8	81.1	1043.1	11.2	-40.8	.0	1043.9
36	1264.6	385.1	414.2	22.8	-61.1	.0	418.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa SLU statica

 CONDIZIONE DI CARICO 9
 spalla fissa - n777_STR9- n789_STR9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48824.5	9969.3	130711.0	-21756.3	-81903.8	-71663.9
2	49783.1	8382.6	131986.7	22743.3	82266.8	74077.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.6	18351.9	262697.7	987.0	10620.0	19390.9

Punto di applic. carico verticale: Xv = 2.664 m Yv = .108 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	18.533	2.785	.474	.017	.059

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	6111.0	1244.1	-1111.8	98.0	-323.7	.0	1158.0
2	4997.1	337.8	867.8	25.7	-110.8	.0	874.8
3	3883.2	239.5	1099.6	20.9	-87.4	.0	1103.1
4	2769.3	239.5	1099.6	16.0	-64.0	.0	1101.4
5	1655.5	239.5	1099.6	11.2	-40.6	.0	1100.3
6	541.6	239.5	1099.6	6.3	-17.2	.0	1099.7
7	-572.3	864.6	-319.4	7.6	-7.9	.0	319.5
8	5561.0	851.7	-272.2	77.5	-264.4	.0	379.5
9	4447.1	183.2	1244.2	23.3	-99.1	.0	1248.2
10	3333.2	183.2	1244.2	18.4	-75.7	.0	1246.5
11	2219.4	183.2	1244.2	13.6	-52.3	.0	1245.3
12	1105.5	183.2	1244.2	8.7	-28.9	.0	1244.5
13	-8.4	851.7	-272.2	12.7	-28.5	.0	273.7
14	5011.0	1029.5	-627.9	82.9	-271.1	.0	684.0
15	3897.1	228.4	1150.9	20.9	-87.4	.0	1154.3
16	2783.3	228.4	1150.9	16.0	-64.0	.0	1152.7
17	1669.4	228.4	1150.9	11.2	-40.6	.0	1151.7
18	555.5	838.7	-225.0	22.6	-60.5	.0	233.0
19	6050.5	1392.2	-1611.6	98.0	-323.7	.0	1643.8
20	4936.6	397.0	609.2	25.7	-110.8	.0	619.2
21	3822.7	287.7	876.2	20.9	-87.4	.0	880.5

22	2708.9	287.7	876.2	16.0	-64.0	.0	878.5
23	1595.0	287.7	876.2	11.2	-40.6	.0	877.1
24	481.1	287.7	876.2	6.3	-17.2	.0	876.3
25	-632.8	977.3	-729.8	7.6	-7.9	.0	729.9
26	5486.6	990.3	-777.0	77.5	-264.4	.0	820.8
27	4372.7	235.0	993.9	23.3	-99.1	.0	998.8
28	3258.8	235.0	993.9	18.4	-75.7	.0	996.8
29	2145.0	235.0	993.9	13.6	-52.3	.0	995.3
30	1031.1	235.0	993.9	8.7	-28.9	.0	994.3
31	-82.8	990.3	-777.0	12.7	-28.5	.0	777.5
32	4922.7	1220.9	-1296.4	82.9	-271.1	.0	1324.4
33	3808.8	298.7	824.8	20.9	-87.4	.0	829.4
34	2694.9	298.7	824.8	16.0	-64.0	.0	827.3
35	1581.1	298.7	824.8	11.2	-40.6	.0	825.8
36	467.2	1003.2	-824.2	22.6	-60.5	.0	826.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 10
spalla fissa - n777_STR10- n789_STR10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48824.5	3372.1	97076.1	-21983.3	-80864.4	-42088.8
2	49783.0	1789.7	98352.6	22970.3	81225.9	44450.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.5	5161.8	195428.7	987.0	10617.4	19293.3

Punto di applic. carico verticale: Xv = 1.982 m Yv = .108 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	9.275	1.788	.474	.017	.059

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4914.8	394.0	651.9	97.8	-322.9	.0	727.5
2	4199.6	55.1	1263.8	25.7	-110.6	.0	1268.6
3	3484.5	22.1	1316.5	20.8	-87.3	.0	1319.4
4	2769.3	22.1	1316.5	16.0	-64.0	.0	1318.0
5	2054.2	22.1	1316.5	11.2	-40.8	.0	1317.1
6	1339.0	22.1	1316.5	6.4	-17.5	.0	1316.6
7	623.9	247.2	916.5	7.8	-8.7	.0	916.5
8	4564.2	234.3	963.4	77.3	-263.8	.0	998.9
9	3849.0	.7	1363.2	23.3	-99.0	.0	1366.8
10	3133.9	.7	1363.2	18.4	-75.7	.0	1365.3
11	2418.7	.7	1363.2	13.6	-52.4	.0	1364.2
12	1703.6	.7	1363.2	8.8	-29.1	.0	1363.5
13	988.4	234.3	963.4	12.9	-29.1	.0	963.9
14	4213.6	292.0	885.3	82.8	-270.5	.0	925.7
15	3498.4	11.1	1367.6	20.8	-87.3	.0	1370.4
16	2783.2	11.1	1367.6	16.0	-64.0	.0	1369.1
17	2068.1	11.1	1367.6	11.2	-40.8	.0	1368.2
18	1352.9	221.4	1010.4	22.8	-61.1	.0	1012.2
19	4854.3	541.4	154.6	97.8	-322.9	.0	358.0
20	4139.2	114.0	1006.5	25.7	-110.6	.0	1012.5
21	3424.0	70.1	1094.2	20.8	-87.3	.0	1097.7

22	2708.9	70.1	1094.2	16.0	-64.0	.0	1096.1
23	1993.7	70.1	1094.2	11.2	-40.8	.0	1094.9
24	1278.5	70.1	1094.2	6.4	-17.5	.0	1094.3
25	563.4	359.3	508.1	7.8	-8.7	.0	508.2
26	4489.8	372.2	461.2	77.3	-263.8	.0	531.3
27	3774.6	52.3	1114.2	23.3	-99.0	.0	1118.6
28	3059.5	52.3	1114.2	18.4	-75.7	.0	1116.7
29	2344.3	52.3	1114.2	13.6	-52.4	.0	1115.4
30	1629.2	52.3	1114.2	8.8	-29.1	.0	1114.6
31	914.0	372.2	461.2	12.9	-29.1	.0	462.1
32	4125.3	482.4	220.2	82.8	-270.5	.0	348.8
33	3410.1	81.1	1043.1	20.8	-87.3	.0	1046.7
34	2694.9	81.1	1043.1	16.0	-64.0	.0	1045.0
35	1979.8	81.1	1043.1	11.2	-40.8	.0	1043.9
36	1264.6	385.1	414.2	22.8	-61.1	.0	418.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa SLU statica

 CONDIZIONE DI CARICO 11
 spalla fissa - n777_STR11- n789_STR11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48517.3	6418.5	109539.9	-21604.7	-80974.6	-52881.4
2	50090.2	3783.3	111592.8	23191.7	81610.8	56734.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.5	10201.8	221132.7	1587.0	17466.2	32049.3

Punto di applic. carico verticale: Xv = 2.243 m Yv = .177 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	12.812	2.169	.764	.028	.098

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5391.1	670.2	141.9	159.6	-527.2	.0	546.0
2	4523.6	143.7	1197.3	41.8	-179.9	.0	1210.7
3	3656.1	89.4	1306.9	33.8	-141.2	.0	1314.5
4	2788.5	89.4	1306.9	25.7	-102.5	.0	1310.9
5	1921.0	89.4	1306.9	17.7	-63.9	.0	1308.4
6	1053.5	89.4	1306.9	9.7	-25.2	.0	1307.1
7	186.0	446.1	578.9	10.2	-5.2	.0	578.9
8	4968.7	424.7	656.8	126.0	-430.1	.0	785.1
9	4101.2	53.4	1399.9	37.8	-160.5	.0	1409.0
10	3233.7	53.4	1399.9	29.7	-121.9	.0	1405.1
11	2366.2	53.4	1399.9	21.7	-83.2	.0	1402.3
12	1498.6	53.4	1399.9	13.7	-44.5	.0	1400.6
13	631.1	424.7	656.8	19.0	-40.2	.0	658.1
14	4546.3	511.0	526.3	134.7	-440.2	.0	686.1
15	3678.8	71.1	1391.8	33.8	-141.2	.0	1398.9
16	2811.3	71.1	1391.8	25.7	-102.5	.0	1395.6
17	1943.8	71.1	1391.8	17.7	-63.9	.0	1393.2
18	1076.3	403.3	734.8	35.1	-92.2	.0	740.6
19	5292.2	915.1	-684.2	159.6	-527.2	.0	863.7
20	4424.7	241.5	769.8	41.8	-179.9	.0	790.6
21	3557.2	169.0	937.6	33.8	-141.2	.0	948.2

22	2689.7	169.0	937.6	25.7	-102.5	.0	943.2
23	1822.1	169.0	937.6	17.7	-63.9	.0	939.8
24	954.6	169.0	937.6	9.7	-25.2	.0	937.9
25	87.1	632.4	-99.5	10.2	-5.2	.0	99.7
26	4847.1	653.8	-177.5	126.0	-430.1	.0	465.3
27	3979.6	139.1	986.1	37.8	-160.5	.0	999.1
28	3112.0	139.1	986.1	29.7	-121.9	.0	993.6
29	2244.5	139.1	986.1	21.7	-83.2	.0	989.6
30	1377.0	139.1	986.1	13.7	-44.5	.0	987.1
31	509.5	653.8	-177.5	19.0	-40.2	.0	182.0
32	4401.9	827.4	-578.6	134.7	-440.2	.0	727.0
33	3534.4	187.3	852.7	33.8	-141.2	.0	864.3
34	2666.9	187.3	852.7	25.7	-102.5	.0	858.8
35	1799.4	187.3	852.7	17.7	-63.9	.0	855.1
36	931.9	675.2	-255.5	35.1	-92.2	.0	271.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa SLU statica

CONDIZIONE DI CARICO 12
spalla fissa - n777_STR12- n789_STR12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	50053.4	7249.8	129070.1	-22945.2	-82953.3	-70869.7
2	48554.2	9842.0	127201.6	21532.2	82217.9	67396.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.6	17091.8	256271.7	-1413.0	-16776.9	-31209.4

Punto di applic. carico verticale: Xv = 2.599 m Yv = -.170 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	17.649	2.689	-.686	-.027	-.095

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5919.9	1356.1	-1595.3	-148.5	490.0	.0	1668.9
2	4844.1	388.0	568.3	-38.5	165.3	.0	591.8
3	3768.3	281.6	828.8	-30.7	127.6	.0	838.6
4	2692.5	281.6	828.8	-22.9	90.0	.0	833.7
5	1616.7	281.6	828.8	-15.1	52.3	.0	830.5
6	541.0	281.6	828.8	-7.3	14.6	.0	829.0
7	-534.8	952.6	-736.7	-2.9	-18.3	.0	737.0
8	5371.3	973.5	-812.7	-116.7	398.0	.0	904.9
9	4295.5	233.4	929.0	-34.6	146.4	.0	940.5
10	3219.7	233.4	929.0	-26.8	108.8	.0	935.4
11	2143.9	233.4	929.0	-19.0	71.1	.0	931.8
12	1068.1	233.4	929.0	-11.2	33.5	.0	929.6
13	-7.7	973.5	-812.7	-12.5	18.3	.0	812.9
14	4822.7	1208.7	-1355.4	-124.2	405.3	.0	1414.7
15	3746.9	299.4	746.2	-30.7	127.6	.0	757.0
16	2671.1	299.4	746.2	-22.9	90.0	.0	751.6
17	1595.3	299.4	746.2	-15.1	52.3	.0	748.0
18	519.5	994.3	-888.6	-27.2	66.4	.0	891.1
19	6013.0	1117.7	-790.9	-148.5	490.0	.0	930.3
20	4937.2	292.7	984.5	-38.5	165.3	.0	998.3
21	3861.5	204.0	1188.5	-30.7	127.6	.0	1195.3

22	2785.7	204.0	1188.5	-22.9	90.0	.0	1191.9
23	1709.9	204.0	1188.5	-15.1	52.3	.0	1189.6
24	634.1	204.0	1188.5	-7.3	14.6	.0	1188.5
25	-441.7	771.3	-76.1	-2.9	-18.3	.0	78.3
26	5485.8	750.4	-.2	-116.7	398.0	.0	398.0
27	4410.1	149.9	1331.9	-34.6	146.4	.0	1340.0
28	3334.3	149.9	1331.9	-26.8	108.8	.0	1336.4
29	2258.5	149.9	1331.9	-19.0	71.1	.0	1333.8
30	1182.7	149.9	1331.9	-11.2	33.5	.0	1332.4
31	106.9	750.4	-.2	-12.5	18.3	.0	18.3
32	4958.7	900.6	-279.5	-124.2	405.3	.0	492.3
33	3882.9	186.2	1271.1	-30.7	127.6	.0	1277.5
34	2807.1	186.2	1271.1	-22.9	90.0	.0	1274.3
35	1731.3	186.2	1271.1	-15.1	52.3	.0	1272.2
36	655.5	729.6	75.7	-27.2	66.4	.0	100.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 13
spalla fissa - n777 _Sis1- n789 _Sis1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24906.7	25526.2	132712.0	-7203.7	-44541.3	-102732.3
2	28416.6	20401.6	135382.2	14711.6	42045.3	112339.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
53323.3	45927.8	268094.2	7507.9	35059.9	64440.5

Punto di applic. carico verticale: Xv = 5.028 m Yv = .657 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.406	33.370	3.751	3.385	.078	.196

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	6117.8	2742.2	-5096.1	547.9	-1830.1	.0	5414.8
2	4617.4	881.2	-693.0	155.8	-692.4	.0	979.7
3	3117.1	669.4	-127.5	139.7	-614.7	.0	627.8
4	1616.7	669.4	-127.5	123.6	-536.9	.0	551.9
5	116.4	669.4	-127.5	107.5	-459.2	.0	476.6
6	-1384.0	669.4	-127.5	91.4	-381.4	.0	402.2
7	-2884.3	1975.9	-3385.3	247.3	-780.6	.0	3474.1
8	5398.8	1932.9	-3228.5	448.0	-1552.5	.0	3582.4
9	3898.4	540.7	256.8	147.7	-653.6	.0	702.2
10	2398.1	540.7	256.8	131.6	-575.8	.0	630.5
11	897.7	540.7	256.8	115.5	-498.1	.0	560.3
12	-602.7	540.7	256.8	99.4	-420.3	.0	492.5
13	-2103.0	1932.9	-3228.5	232.8	-768.6	.0	3318.7
14	4679.7	2271.2	-3934.7	497.8	-1655.2	.0	4268.7
15	3179.4	632.6	43.1	139.7	-614.7	.0	616.2
16	1679.0	632.6	43.1	123.6	-536.9	.0	538.7
17	178.7	632.6	43.1	107.5	-459.2	.0	461.2
18	-1321.7	1889.9	-3071.7	297.4	-955.5	.0	3216.9
19	5846.7	3234.5	-6757.2	547.9	-1830.1	.0	7000.6
20	4346.4	1078.0	-1552.4	155.8	-692.4	.0	1699.9
21	2846.0	829.5	-870.1	139.7	-614.7	.0	1065.3

22	1345.7	829.5	-870.1	123.6	-536.9	.0	1022.4
23	-154.7	829.5	-870.1	107.5	-459.2	.0	983.8
24	-1655.0	829.5	-870.1	91.4	-381.4	.0	950.0
25	-3155.4	2350.5	-4749.3	247.3	-780.6	.0	4813.0
26	5065.4	2393.5	-4906.0	448.0	-1552.5	.0	5145.8
27	3565.1	713.1	-575.1	147.7	-653.6	.0	870.6
28	2064.7	713.1	-575.1	131.6	-575.8	.0	813.8
29	564.4	713.1	-575.1	115.5	-498.1	.0	760.8
30	-936.0	713.1	-575.1	99.4	-420.3	.0	712.3
31	-2436.4	2393.5	-4906.0	232.8	-768.6	.0	4965.9
32	4284.1	2907.4	-6156.2	497.8	-1655.2	.0	6374.8
33	2783.7	866.3	-1040.7	139.7	-614.7	.0	1208.7
34	1283.4	866.3	-1040.7	123.6	-536.9	.0	1171.1
35	-217.0	866.3	-1040.7	107.5	-459.2	.0	1137.5
36	-1717.3	2436.5	-5062.8	297.4	-955.5	.0	5152.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 14
spalla fissa - n777 _Sis2- n789 _Sis2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34764.6	-3991.8	45142.3	-15487.6	-55587.6	-11799.9
2	32744.7	1204.5	42952.9	15118.5	53989.0	3875.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67509.3	-2787.3	88095.2	-369.1	-23211.5	-63525.3

Punto di applic. carico verticale: Xv = 1.305 m Yv = -.344 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.376	1.463	.635	-.270	-.029	-.193

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	2586.2	144.5	216.1	-169.5	560.7	.0	600.9
2	2332.2	21.4	440.9	-37.0	156.3	.0	467.8
3	2078.2	9.3	460.7	-21.1	79.6	.0	467.5
4	1824.1	9.3	460.7	-5.3	3.0	.0	460.7
5	1570.1	9.3	460.7	10.6	-73.7	.0	466.6
6	1316.1	9.3	460.7	26.5	-150.3	.0	484.6
7	1062.1	91.3	312.9	126.8	-473.9	.0	567.9
8	2447.4	133.7	158.3	-124.0	421.7	.0	450.5
9	2193.4	19.1	393.0	-29.1	117.9	.0	410.3
10	1939.4	19.1	393.0	-13.2	41.3	.0	395.2
11	1685.4	19.1	393.0	2.7	-35.3	.0	394.6
12	1431.4	19.1	393.0	18.5	-112.0	.0	408.7
13	1177.4	133.7	158.3	88.2	-351.1	.0	385.1
14	2308.7	217.2	-81.8	-120.2	388.3	.0	396.8
15	2054.7	45.6	292.4	-21.1	79.6	.0	303.1
16	1800.7	45.6	292.4	-5.3	3.0	.0	292.5
17	1546.6	45.6	292.4	10.6	-73.7	.0	301.6
18	1292.6	176.1	3.8	77.4	-301.5	.0	301.5
19	2688.4	-340.8	1853.6	-169.5	560.7	.0	1936.5
20	2434.4	-172.6	1288.1	-37.0	156.3	.0	1297.5
21	2180.4	-148.5	1192.7	-21.1	79.6	.0	1195.3

22	1926.4	-148.5	1192.7	-5.3	3.0	.0	1192.7
23	1672.4	-148.5	1192.7	10.6	-73.7	.0	1194.9
24	1418.3	-148.5	1192.7	26.5	-150.3	.0	1202.1
25	1164.3	-277.9	1657.5	126.8	-473.9	.0	1723.9
26	2573.1	-320.4	1812.0	-124.0	421.7	.0	1860.5
27	2319.1	-150.8	1213.1	-29.1	117.9	.0	1218.8
28	2065.1	-150.8	1213.1	-13.2	41.3	.0	1213.8
29	1811.1	-150.8	1213.1	2.7	-35.3	.0	1213.6
30	1557.1	-150.8	1213.1	18.5	-112.0	.0	1218.2
31	1303.1	-320.4	1812.0	88.2	-351.1	.0	1845.7
32	2457.9	-410.0	2108.2	-120.2	388.3	.0	2143.6
33	2203.9	-184.8	1360.9	-21.1	79.6	.0	1363.3
34	1949.9	-184.8	1360.9	-5.3	3.0	.0	1360.9
35	1695.9	-184.8	1360.9	10.6	-73.7	.0	1362.9
36	1441.8	-362.8	1966.6	77.4	-301.5	.0	1989.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 15
spalla fissa - n777 _Sis3- n789 _Sis3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25195.3	22931.0	101920.3	-6223.9	-46513.6	-64654.4
2	33768.0	5890.8	106146.4	19306.8	45219.4	87895.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58963.3	28821.8	208066.7	13082.9	90433.7	205571.6

Punto di applic. carico verticale: Xv = 3.529 m Yv = 1.534 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.189	22.272	2.683	6.040	.171	.626

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5154.4	1121.9	-812.2	1174.8	-3920.3	.0	4003.6
2	4081.1	294.7	970.1	317.0	-1399.7	.0	1703.0
3	3007.9	205.8	1175.2	265.6	-1151.7	.0	1645.4
4	1934.7	205.8	1175.2	214.2	-903.7	.0	1482.5
5	861.5	205.8	1175.2	162.8	-655.6	.0	1345.7
6	-211.7	205.8	1175.2	111.5	-407.6	.0	1243.9
7	-1284.9	774.6	-95.0	215.9	-572.3	.0	580.1
8	4686.0	637.3	405.1	938.0	-3243.1	.0	3268.3
9	3612.8	107.9	1529.7	291.3	-1275.7	.0	1991.8
10	2539.6	107.9	1529.7	239.9	-1027.7	.0	1842.9
11	1466.3	107.9	1529.7	188.5	-779.6	.0	1717.0
12	393.1	107.9	1529.7	137.1	-531.6	.0	1619.5
13	-680.1	637.3	405.1	251.4	-742.3	.0	845.7
14	4217.6	633.3	646.9	1014.9	-3362.3	.0	3424.0
15	3144.4	88.4	1719.8	265.6	-1151.7	.0	2069.8
16	2071.2	88.4	1719.8	214.2	-903.7	.0	1942.7
17	998.0	88.4	1719.8	162.8	-655.6	.0	1840.5
18	-75.2	500.0	905.3	375.7	-1130.3	.0	1448.1
19	4560.7	2692.3	-6111.0	1174.8	-3920.3	.0	7260.4
20	3487.5	922.4	-1771.5	317.0	-1399.7	.0	2257.7
21	2414.2	716.5	-1193.5	265.6	-1151.7	.0	1658.5

22	1341.0	716.5	-1193.5	214.2	-903.7	.0	1497.0
23	267.8	716.5	-1193.5	162.8	-655.6	.0	1361.7
24	-805.4	716.5	-1193.5	111.5	-407.6	.0	1261.1
25	-1878.6	1969.3	-4446.3	215.9	-572.3	.0	4483.0
26	3955.8	2106.7	-4946.4	938.0	-3243.1	.0	5914.8
27	2882.6	657.7	-1124.0	291.3	-1275.7	.0	1700.2
28	1809.4	657.7	-1124.0	239.9	-1027.7	.0	1523.0
29	736.2	657.7	-1124.0	188.5	-779.6	.0	1368.0
30	-337.0	657.7	-1124.0	137.1	-531.6	.0	1243.4
31	-1410.2	2106.7	-4946.4	251.4	-742.3	.0	5001.8
32	3351.0	2662.8	-6439.8	1014.9	-3362.3	.0	7264.8
33	2277.8	833.9	-1738.0	265.6	-1151.7	.0	2084.9
34	1204.6	833.9	-1738.0	214.2	-903.7	.0	1958.9
35	131.3	833.9	-1738.0	162.8	-655.6	.0	1857.5
36	-941.9	2244.0	-5446.6	375.7	-1130.3	.0	5562.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 16
spalla fissa - n777 _Sis4- n789 _Sis4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35140.9	-1446.0	78869.5	-16809.8	-54841.4	-50831.8
2	27980.5	15675.8	74840.3	10820.7	51957.0	29156.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63121.4	14229.8	153709.8	-5989.1	-79500.7	-204878.2

Punto di applic. carico verticale: Xv = 2.435 m Yv = -1.259 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.767	12.700	1.746	-2.949	-.123	-.623

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3634.0	1764.8	-4019.7	-799.4	2659.9	.0	4820.0
2	2935.5	605.4	-1175.0	-199.0	866.5	.0	1459.9
3	2237.1	470.4	-795.8	-147.8	619.3	.0	1008.4
4	1538.7	470.4	-795.8	-96.6	372.1	.0	878.5
5	840.2	470.4	-795.8	-45.4	125.0	.0	805.5
6	141.8	470.4	-795.8	5.8	-122.2	.0	805.1
7	-556.6	1291.3	-2928.7	156.2	-676.9	.0	3005.9
8	3235.4	1428.1	-3427.1	-616.5	2119.8	.0	4029.8
9	2537.0	449.4	-834.7	-173.4	742.9	.0	1117.4
10	1838.5	449.4	-834.7	-122.2	495.7	.0	970.8
11	1140.1	449.4	-834.7	-71.0	248.5	.0	870.9
12	441.7	449.4	-834.7	-19.8	1.4	.0	834.7
13	-256.8	1428.1	-3427.1	67.8	-372.5	.0	3447.3
14	2836.8	1854.7	-4616.1	-640.1	2103.7	.0	5072.8
15	2138.4	587.4	-1338.5	-147.8	619.3	.0	1474.8
16	1440.0	587.4	-1338.5	-96.6	372.1	.0	1389.2
17	741.5	587.4	-1338.5	-45.4	125.0	.0	1344.3
18	43.1	1565.0	-3925.6	-3.1	-120.8	.0	3927.5
19	4063.4	199.7	1261.3	-799.4	2659.9	.0	2943.7
20	3364.9	-20.2	1557.4	-199.0	866.5	.0	1782.2
21	2666.5	-38.6	1564.9	-147.8	619.3	.0	1683.0

22	1968.1	-38.6	1564.9	-96.6	372.1	.0	1608.5
23	1269.6	-38.6	1564.9	-45.4	125.0	.0	1569.9
24	571.2	-38.6	1564.9	5.8	-122.2	.0	1569.7
25	-127.2	100.6	1407.9	156.2	-676.9	.0	1562.2
26	3763.5	-36.3	1906.4	-616.5	2119.8	.0	2851.0
27	3065.1	-98.5	1810.1	-173.4	742.9	.0	1956.7
28	2366.6	-98.5	1810.1	-122.2	495.7	.0	1876.8
29	1668.2	-98.5	1810.1	-71.0	248.5	.0	1827.1
30	969.8	-98.5	1810.1	-19.8	1.4	.0	1810.1
31	271.3	-36.3	1906.4	67.8	-372.5	.0	1942.4
32	3463.7	-168.0	2446.8	-640.1	2103.7	.0	3226.8
33	2765.2	-155.6	2107.6	-147.8	619.3	.0	2196.7
34	2066.8	-155.6	2107.6	-96.6	372.1	.0	2140.2
35	1368.4	-155.6	2107.6	-45.4	125.0	.0	2111.3
36	669.9	-173.1	2404.9	-3.1	-120.8	.0	2407.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 17
spalla fissa - n777 _Sis5- n789 _Sis5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24687.6	22986.8	99862.4	-6020.9	-45568.4	-64167.3
2	33487.7	5957.0	105024.3	19103.9	44698.6	87529.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58175.3	28943.8	204886.7	13083.0	93291.3	205581.4

Punto di applic. carico verticale: Xv = 3.522 m Yv = 1.604 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.080	22.231	2.661	6.054	.174	.626

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5111.7	1126.7	-853.0	1175.0	-3917.7	.0	4009.4
2	4047.4	297.9	937.5	316.9	-1396.6	.0	1682.1
3	2983.1	208.7	1144.3	265.5	-1148.6	.0	1621.3
4	1918.7	208.7	1144.3	214.1	-900.5	.0	1456.1
5	854.4	208.7	1144.3	162.7	-652.5	.0	1317.2
6	-209.9	208.7	1144.3	111.3	-404.5	.0	1213.6
7	-1274.3	778.9	-133.2	216.2	-569.4	.0	584.8
8	4649.2	641.6	366.9	938.2	-3240.2	.0	3261.0
9	3584.8	110.6	1499.8	291.2	-1272.6	.0	1966.9
10	2520.5	110.6	1499.8	239.8	-1024.6	.0	1816.3
11	1456.2	110.6	1499.8	188.4	-776.5	.0	1688.9
12	391.8	110.6	1499.8	137.0	-528.5	.0	1590.2
13	-672.5	641.6	366.9	251.6	-739.4	.0	825.4
14	4186.6	637.9	607.3	1015.2	-3359.6	.0	3414.1
15	3122.3	91.2	1688.8	265.5	-1148.6	.0	2042.4
16	2057.9	91.2	1688.8	214.1	-900.5	.0	1913.9
17	993.6	91.2	1688.8	162.7	-652.5	.0	1810.5
18	-70.7	504.3	867.1	376.0	-1127.5	.0	1422.4
19	4506.2	2697.1	-6152.1	1175.0	-3917.7	.0	7293.6
20	3441.9	925.7	-1804.2	316.9	-1396.6	.0	2281.6
21	2377.6	719.4	-1224.5	265.5	-1148.6	.0	1678.9

22	1313.2	719.4	-1224.5	214.1	-900.5	.0	1520.0
23	248.9	719.4	-1224.5	162.7	-652.5	.0	1387.5
24	-815.4	719.4	-1224.5	111.3	-404.5	.0	1289.6
25	-1879.8	1973.7	-4484.7	216.2	-569.4	.0	4520.7
26	3904.5	2111.0	-4984.9	938.2	-3240.2	.0	5945.5
27	2840.1	660.4	-1154.1	291.2	-1272.6	.0	1718.0
28	1775.8	660.4	-1154.1	239.8	-1024.6	.0	1543.3
29	711.5	660.4	-1154.1	188.4	-776.5	.0	1391.0
30	-352.9	660.4	-1154.1	137.0	-528.5	.0	1269.4
31	-1417.2	2111.0	-4984.9	251.6	-739.4	.0	5039.4
32	3302.7	2667.5	-6479.8	1015.2	-3359.6	.0	7298.9
33	2238.4	836.8	-1769.1	265.5	-1148.6	.0	2109.2
34	1174.0	836.8	-1769.1	214.1	-900.5	.0	1985.1
35	109.7	836.8	-1769.1	162.7	-652.5	.0	1885.6
36	-954.6	2248.4	-5485.1	376.0	-1127.5	.0	5599.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 18
spalla fissa - n777 _Sis6- n789 _Sis6

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34861.6	-1379.4	77752.9	-16607.4	-54322.5	-50466.9
2	27473.8	15731.2	72786.7	10618.3	51013.7	28672.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
62335.4	14351.8	150539.6	-5989.1	-82358.3	-204878.1

Punto di applic. carico verticale: Xv = 2.415 m Yv = -1.321 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.658	12.659	1.724	-2.962	-.127	-.623

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3579.7	1769.6	-4060.6	-799.6	2657.1	.0	4852.6
2	2890.1	608.6	-1207.6	-198.9	863.4	.0	1484.5
3	2200.5	473.3	-826.7	-147.7	616.2	.0	1031.1
4	1510.9	473.3	-826.7	-96.5	369.0	.0	905.4
5	821.3	473.3	-826.7	-45.3	121.8	.0	835.7
6	131.8	473.3	-826.7	5.9	-125.3	.0	836.2
7	-557.8	1295.6	-2966.9	156.0	-679.7	.0	3043.8
8	3184.2	1432.4	-3465.4	-616.6	2117.0	.0	4060.9
9	2494.6	452.1	-864.6	-173.3	739.8	.0	1137.9
10	1805.0	452.1	-864.6	-122.1	492.6	.0	995.1
11	1115.4	452.1	-864.6	-70.9	245.4	.0	898.8
12	425.8	452.1	-864.6	-19.7	-1.7	.0	864.6
13	-263.7	1432.4	-3465.4	67.7	-375.3	.0	3485.7
14	2788.7	1859.3	-4655.8	-640.4	2101.0	.0	5107.9
15	2099.1	590.3	-1369.4	-147.7	616.2	.0	1501.7
16	1409.5	590.3	-1369.4	-96.5	369.0	.0	1418.3
17	719.9	590.3	-1369.4	-45.3	121.8	.0	1374.8
18	30.3	1569.3	-3963.9	-3.3	-123.5	.0	3965.8
19	4020.9	204.5	1220.4	-799.6	2657.1	.0	2924.0
20	3331.3	-17.0	1524.8	-198.9	863.4	.0	1752.2
21	2641.7	-35.7	1534.0	-147.7	616.2	.0	1653.1

22	1952.1	-35.7	1534.0	-96.5	369.0	.0	1577.7
23	1262.6	-35.7	1534.0	-45.3	121.8	.0	1538.8
24	573.0	-35.7	1534.0	5.9	-125.3	.0	1539.1
25	-116.6	104.9	1369.7	156.0	-679.7	.0	1529.0
26	3726.8	-31.9	1868.1	-616.6	2117.0	.0	2823.4
27	3037.2	-95.8	1780.2	-173.3	739.8	.0	1927.8
28	2347.7	-95.8	1780.2	-122.1	492.6	.0	1847.1
29	1658.1	-95.8	1780.2	-70.9	245.4	.0	1797.0
30	968.5	-95.8	1780.2	-19.7	-1.7	.0	1780.2
31	278.9	-31.9	1868.1	67.7	-375.3	.0	1905.5
32	3432.7	-163.3	2407.1	-640.4	2101.0	.0	3195.0
33	2743.2	-152.7	2076.6	-147.7	616.2	.0	2166.1
34	2053.6	-152.7	2076.6	-96.5	369.0	.0	2109.2
35	1364.0	-152.7	2076.6	-45.3	121.8	.0	2080.2
36	674.4	-168.8	2366.6	-3.3	-123.5	.0	2369.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 19
spalla fissa - n777 _Sis7- n789 _Sis7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25651.4	25935.9	138347.6	-7544.9	-46008.2	-105821.8
2	29066.0	20805.9	140624.1	15052.8	43334.2	115381.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
54717.4	46741.8	278971.7	7507.9	33862.2	64450.8

Punto di applic. carico verticale: Xv = 5.098 m Yv = .619 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.600	34.166	3.868	3.379	.076	.196

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	6294.6	2800.0	-5161.4	547.8	-1831.4	.0	5476.7
2	4747.4	897.6	-666.1	155.8	-693.8	.0	961.8
3	3200.2	681.3	-89.6	139.7	-616.0	.0	622.5
4	1653.0	681.3	-89.6	123.6	-538.2	.0	545.6
5	105.8	681.3	-89.6	107.5	-460.5	.0	469.1
6	-1441.4	681.3	-89.6	91.4	-382.7	.0	393.1
7	-2988.6	2016.5	-3413.9	247.2	-781.7	.0	3502.3
8	5551.6	1973.4	-3257.1	447.9	-1553.8	.0	3608.7
9	4004.4	550.2	300.6	147.8	-654.9	.0	720.6
10	2457.2	550.2	300.6	131.7	-577.1	.0	650.7
11	910.0	550.2	300.6	115.6	-499.4	.0	582.8
12	-637.2	550.2	300.6	99.4	-421.6	.0	517.8
13	-2184.4	1973.4	-3257.1	232.7	-769.8	.0	3346.8
14	4808.5	2320.2	-3982.5	497.7	-1656.4	.0	4313.2
15	3261.3	644.5	81.1	139.7	-616.0	.0	621.3
16	1714.1	644.5	81.1	123.6	-538.2	.0	544.3
17	166.9	644.5	81.1	107.5	-460.5	.0	467.6
18	-1380.3	1930.4	-3100.3	297.3	-956.6	.0	3244.5
19	6028.5	3292.4	-6822.7	547.8	-1831.4	.0	7064.2
20	4481.3	1094.4	-1525.7	155.8	-693.8	.0	1676.0
21	2934.1	841.4	-832.2	139.7	-616.0	.0	1035.4

22	1386.9	841.4	-832.2	123.6	-538.2	.0	991.1
23	-160.3	841.4	-832.2	107.5	-460.5	.0	951.1
24	-1707.5	841.4	-832.2	91.4	-382.7	.0	916.0
25	-3254.7	2391.1	-4778.1	247.2	-781.7	.0	4841.6
26	5224.3	2434.1	-4934.9	447.9	-1553.8	.0	5173.8
27	3677.1	722.6	-531.4	147.8	-654.9	.0	843.4
28	2129.9	722.6	-531.4	131.7	-577.1	.0	784.5
29	582.7	722.6	-531.4	115.6	-499.4	.0	729.2
30	-964.5	722.6	-531.4	99.4	-421.6	.0	678.4
31	-2511.7	2434.1	-4934.9	232.7	-769.8	.0	4994.6
32	4420.1	2956.9	-6204.3	497.7	-1656.4	.0	6421.6
33	2872.9	878.2	-1002.9	139.7	-616.0	.0	1177.0
34	1325.7	878.2	-1002.9	123.6	-538.2	.0	1138.2
35	-221.5	878.2	-1002.9	107.5	-460.5	.0	1103.6
36	-1768.7	2477.2	-5091.7	297.3	-956.6	.0	5180.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 19
 spalla fissa - n777 _Sis7- n789 _Sis7

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	2800.0	-5161.4	547.8	-1831.4	2853.1	5476.7
1.56	2332.8	-1170.3	489.0	-1022.1	2383.5	1553.8
3.13	1716.9	2169.0	397.8	-300.4	1762.4	2189.7
4.69	629.8	3914.1	218.4	171.7	666.6	3917.9
6.25	-47.0	4298.3	86.1	400.8	98.1	4316.9
7.81	-407.9	3890.6	-4.5	457.2	407.9	3917.4
9.38	-486.2	3149.4	-32.3	416.6	487.3	3176.8
10.94	-485.2	2385.0	-40.7	358.6	486.9	2411.8
12.50	-459.9	1641.8	-44.7	291.3	462.1	1667.5
15.00	-310.9	633.5	-42.6	178.7	313.8	658.3
17.50	-151.0	71.3	-30.8	85.3	154.1	111.1
20.00	-46.5	-157.4	-17.7	25.1	49.7	159.4
22.50	5.4	-194.5	-7.5	-5.1	9.3	194.6
25.00	21.2	-152.9	-.9	-15.0	21.2	153.6
29.17	17.2	-66.6	1.3	-11.3	17.2	67.5
33.33	8.5	-13.3	1.2	-5.6	8.6	14.4
37.50	2.0	7.2	.6	-1.7	2.1	7.4
43.75	-1.1	6.0	.1	.2	1.1	6.0
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 19
 spalla fissa - n777 _Sis7- n789 _Sis7

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	3292.4	-6822.7	547.8	-1831.4	3337.6	7064.2
1.56	2771.9	-2104.4	489.0	-1022.1	2814.7	2339.5
3.13	2072.7	1882.1	397.8	-300.4	2110.5	1905.9
4.69	822.2	4046.7	218.4	171.7	850.8	4050.4
6.25	26.7	4630.5	86.1	400.8	90.1	4647.8
7.81	-413.8	4268.9	-4.5	457.2	413.8	4293.4
9.38	-516.0	3489.4	-32.3	416.6	517.0	3514.2
10.94	-521.6	2672.4	-40.7	358.6	523.2	2696.3
12.50	-499.2	1869.4	-44.7	291.3	501.2	1892.0
15.00	-346.3	764.4	-42.6	178.7	348.9	785.1
17.50	-174.8	127.2	-30.8	85.3	177.5	153.1
20.00	-58.9	-145.9	-17.7	25.1	61.5	148.1
22.50	1.0	-203.0	-7.5	-5.1	7.6	203.1
25.00	21.3	-166.0	-.9	-15.0	21.3	166.7
29.17	18.5	-74.8	1.3	-11.3	18.6	75.7
33.33	9.5	-16.6	1.2	-5.6	9.5	17.5
37.50	2.4	6.8	.6	-1.7	2.4	7.0
43.75	-1.1	6.4	.1	.2	1.1	6.4
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 19
spalla fissa - n777 _Sis7- n789 _Sis7

Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 25
(riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	2391.1	-4778.1	247.2	-781.7	2403.8	4841.6
1.56	2042.5	-1326.5	219.1	-417.9	2054.2	1390.8
3.13	1563.1	1631.9	176.6	-95.4	1573.0	1634.7
4.69	682.1	3325.5	94.0	111.4	688.6	3327.4
6.25	87.0	3875.5	34.2	207.3	93.5	3881.1
7.81	-277.5	3687.4	-5.9	225.9	277.6	3694.3
9.38	-375.6	3131.2	-18.0	202.0	376.0	3137.7
10.94	-394.0	2525.1	-21.4	170.8	394.6	2530.9
12.50	-390.9	1908.1	-22.8	136.0	391.5	1912.9
15.00	-309.4	1000.5	-20.6	80.1	310.1	1003.7
17.50	-192.8	374.2	-14.2	36.0	193.3	375.9
20.00	-95.7	23.0	-7.8	8.9	96.1	24.7
22.50	-31.4	-125.5	-3.1	-4.1	31.5	125.6
25.00	5.0	-152.7	-.2	-7.8	5.0	152.9
29.17	14.2	-96.8	.7	-5.4	14.3	97.0
33.33	10.6	-42.8	.6	-2.5	10.6	42.9
37.50	4.9	-10.1	.3	-.6	4.9	10.1
43.75	.2	3.2	.0	.2	.2	3.2
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 20
 spalla fissa - n777 _Sis8- n789 _Sis8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34678.5	-5199.1	38589.1	-15500.1	-55229.3	-6270.7
2	32688.9	2.8	36535.0	15116.0	53707.2	-1672.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67367.4	-5196.3	75124.1	-384.1	-22810.8	-63603.0

Punto di applic. carico verticale: Xv = 1.115 m Yv = -.339 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.357	-.251	.447	-.275	-.029	-.194

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	2357.7	-11.1	533.1	-170.5	564.4	.0	776.3
2	2178.8	-30.0	507.6	-37.3	158.0	.0	531.6
3	1999.8	-30.1	494.7	-21.4	81.3	.0	501.4
4	1820.9	-30.1	494.7	-5.5	4.6	.0	494.8
5	1642.0	-30.1	494.7	10.4	-72.2	.0	500.0
6	1463.1	-30.1	494.7	26.3	-148.9	.0	516.7
7	1284.1	-21.6	533.1	126.2	-471.5	.0	711.7
8	2256.6	20.9	378.3	-124.8	425.0	.0	569.0
9	2077.7	-13.9	409.2	-29.4	119.7	.0	426.3
10	1898.8	-13.9	409.2	-13.5	42.9	.0	411.4
11	1719.9	-13.9	409.2	2.4	-33.8	.0	410.6
12	1540.9	-13.9	409.2	18.3	-110.5	.0	423.8
13	1362.0	20.9	378.3	87.7	-348.7	.0	514.6
14	2155.6	82.4	188.9	-121.0	391.8	.0	434.9
15	1976.7	6.2	326.3	-21.4	81.3	.0	336.2
16	1797.7	6.2	326.3	-5.5	4.6	.0	326.3
17	1618.8	6.2	326.3	10.4	-72.2	.0	334.2
18	1439.9	63.4	223.6	76.7	-298.8	.0	373.2
19	2458.5	-496.9	2172.5	-170.5	564.4	.0	2244.6
20	2279.6	-224.3	1355.8	-37.3	158.0	.0	1365.0
21	2100.6	-188.1	1227.6	-21.4	81.3	.0	1230.3

22	1921.7	-188.1	1227.6	-5.5	4.6	.0	1227.6
23	1742.8	-188.1	1227.6	10.4	-72.2	.0	1229.7
24	1563.9	-188.1	1227.6	26.3	-148.9	.0	1236.6
25	1385.0	-391.2	1879.4	126.2	-471.5	.0	1937.6
26	2380.6	-433.7	2034.1	-124.8	425.0	.0	2078.0
27	2201.7	-184.0	1230.2	-29.4	119.7	.0	1236.0
28	2022.8	-184.0	1230.2	-13.5	42.9	.0	1231.0
29	1843.8	-184.0	1230.2	2.4	-33.8	.0	1230.7
30	1664.9	-184.0	1230.2	18.3	-110.5	.0	1235.2
31	1486.0	-433.7	2034.1	87.7	-348.7	.0	2063.8
32	2302.7	-545.5	2381.5	-121.0	391.8	.0	2413.5
33	2123.8	-224.5	1396.1	-21.4	81.3	.0	1398.4
34	1944.9	-224.5	1396.1	-5.5	4.6	.0	1396.1
35	1766.0	-224.5	1396.1	10.4	-72.2	.0	1397.9
36	1587.1	-476.2	2188.9	76.7	-298.8	.0	2209.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 21
spalla fissa - n777 _Sis9- n789 _Sis9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25651.4	25935.9	138347.6	-7544.9	-46008.2	-105821.8
2	29066.0	20805.9	140624.1	15052.8	43334.2	115381.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
54717.4	46741.8	278971.7	7507.9	33862.2	64450.8

Punto di applic. carico verticale: Xv = 5.098 m Yv = .619 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.600	34.166	3.868	3.379	.076	.196

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	6294.6	2800.0	-5161.4	547.8	-1831.4	.0	5476.7
2	4747.4	897.6	-666.1	155.8	-693.8	.0	961.8
3	3200.2	681.3	-89.6	139.7	-616.0	.0	622.5
4	1653.0	681.3	-89.6	123.6	-538.2	.0	545.6
5	105.8	681.3	-89.6	107.5	-460.5	.0	469.1
6	-1441.4	681.3	-89.6	91.4	-382.7	.0	393.1
7	-2988.6	2016.5	-3413.9	247.2	-781.7	.0	3502.3
8	5551.6	1973.4	-3257.1	447.9	-1553.8	.0	3608.7
9	4004.4	550.2	300.6	147.8	-654.9	.0	720.6
10	2457.2	550.2	300.6	131.7	-577.1	.0	650.7
11	910.0	550.2	300.6	115.6	-499.4	.0	582.8
12	-637.2	550.2	300.6	99.4	-421.6	.0	517.8
13	-2184.4	1973.4	-3257.1	232.7	-769.8	.0	3346.8
14	4808.5	2320.2	-3982.5	497.7	-1656.4	.0	4313.2
15	3261.3	644.5	81.1	139.7	-616.0	.0	621.3
16	1714.1	644.5	81.1	123.6	-538.2	.0	544.3
17	166.9	644.5	81.1	107.5	-460.5	.0	467.6
18	-1380.3	1930.4	-3100.3	297.3	-956.6	.0	3244.5
19	6028.5	3292.4	-6822.7	547.8	-1831.4	.0	7064.2
20	4481.3	1094.4	-1525.7	155.8	-693.8	.0	1676.0
21	2934.1	841.4	-832.2	139.7	-616.0	.0	1035.4

22	1386.9	841.4	-832.2	123.6	-538.2	.0	991.1
23	-160.3	841.4	-832.2	107.5	-460.5	.0	951.1
24	-1707.5	841.4	-832.2	91.4	-382.7	.0	916.0
25	-3254.7	2391.1	-4778.1	247.2	-781.7	.0	4841.6
26	5224.3	2434.1	-4934.9	447.9	-1553.8	.0	5173.8
27	3677.1	722.6	-531.4	147.8	-654.9	.0	843.4
28	2129.9	722.6	-531.4	131.7	-577.1	.0	784.5
29	582.7	722.6	-531.4	115.6	-499.4	.0	729.2
30	-964.5	722.6	-531.4	99.4	-421.6	.0	678.4
31	-2511.7	2434.1	-4934.9	232.7	-769.8	.0	4994.6
32	4420.1	2956.9	-6204.3	497.7	-1656.4	.0	6421.6
33	2872.9	878.2	-1002.9	139.7	-616.0	.0	1177.0
34	1325.7	878.2	-1002.9	123.6	-538.2	.0	1138.2
35	-221.5	878.2	-1002.9	107.5	-460.5	.0	1103.6
36	-1768.7	2477.2	-5091.7	297.3	-956.6	.0	5180.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 22
 spalla fissa - n777 _Sis10- n789 _Sis10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34678.5	-5199.1	38589.1	-15500.1	-55229.3	-6270.7
2	32688.9	2.8	36535.0	15116.0	53707.2	-1672.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67367.4	-5196.3	75124.1	-384.1	-22810.8	-63603.0

Punto di applic. carico verticale: Xv = 1.115 m Yv = -.339 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.357	-.251	.447	-.275	-.029	-.194

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	2357.7	-11.1	533.1	-170.5	564.4	.0	776.3
2	2178.8	-30.0	507.6	-37.3	158.0	.0	531.6
3	1999.8	-30.1	494.7	-21.4	81.3	.0	501.4
4	1820.9	-30.1	494.7	-5.5	4.6	.0	494.8
5	1642.0	-30.1	494.7	10.4	-72.2	.0	500.0
6	1463.1	-30.1	494.7	26.3	-148.9	.0	516.7
7	1284.1	-21.6	533.1	126.2	-471.5	.0	711.7
8	2256.6	20.9	378.3	-124.8	425.0	.0	569.0
9	2077.7	-13.9	409.2	-29.4	119.7	.0	426.3
10	1898.8	-13.9	409.2	-13.5	42.9	.0	411.4
11	1719.9	-13.9	409.2	2.4	-33.8	.0	410.6
12	1540.9	-13.9	409.2	18.3	-110.5	.0	423.8
13	1362.0	20.9	378.3	87.7	-348.7	.0	514.6
14	2155.6	82.4	188.9	-121.0	391.8	.0	434.9
15	1976.7	6.2	326.3	-21.4	81.3	.0	336.2
16	1797.7	6.2	326.3	-5.5	4.6	.0	326.3
17	1618.8	6.2	326.3	10.4	-72.2	.0	334.2
18	1439.9	63.4	223.6	76.7	-298.8	.0	373.2
19	2458.5	-496.9	2172.5	-170.5	564.4	.0	2244.6
20	2279.6	-224.3	1355.8	-37.3	158.0	.0	1365.0
21	2100.6	-188.1	1227.6	-21.4	81.3	.0	1230.3

22	1921.7	-188.1	1227.6	-5.5	4.6	.0	1227.6
23	1742.8	-188.1	1227.6	10.4	-72.2	.0	1229.7
24	1563.9	-188.1	1227.6	26.3	-148.9	.0	1236.6
25	1385.0	-391.2	1879.4	126.2	-471.5	.0	1937.6
26	2380.6	-433.7	2034.1	-124.8	425.0	.0	2078.0
27	2201.7	-184.0	1230.2	-29.4	119.7	.0	1236.0
28	2022.8	-184.0	1230.2	-13.5	42.9	.0	1231.0
29	1843.8	-184.0	1230.2	2.4	-33.8	.0	1230.7
30	1664.9	-184.0	1230.2	18.3	-110.5	.0	1235.2
31	1486.0	-433.7	2034.1	87.7	-348.7	.0	2063.8
32	2302.7	-545.5	2381.5	-121.0	391.8	.0	2413.5
33	2123.8	-224.5	1396.1	-21.4	81.3	.0	1398.4
34	1944.9	-224.5	1396.1	-5.5	4.6	.0	1396.1
35	1766.0	-224.5	1396.1	10.4	-72.2	.0	1397.9
36	1587.1	-476.2	2188.9	76.7	-298.8	.0	2209.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 23
spalla fissa - n777 _Sis11- n789 _Sis11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25198.5	22781.7	101172.0	-6236.3	-46489.8	-63996.6
2	33764.9	5743.1	105380.0	19304.2	45203.8	87209.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58963.4	28524.8	206552.0	13067.9	90374.5	205525.6

Punto di applic. carico verticale: Xv = 3.503 m Yv = 1.533 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.189	22.064	2.661	6.033	.170	.625

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5127.2	1102.9	-773.0	1173.9	-3917.3	.0	3992.9
2	4062.9	288.4	978.7	316.7	-1398.5	.0	1707.0
3	2998.7	200.9	1179.9	265.3	-1150.5	.0	1648.0
4	1934.5	200.9	1179.9	214.0	-902.6	.0	1485.5
5	870.2	200.9	1179.9	162.6	-654.6	.0	1349.3
6	-194.0	200.9	1179.9	111.2	-406.6	.0	1248.0
7	-1258.3	760.9	-67.6	215.3	-570.0	.0	574.0
8	4663.2	623.6	432.4	937.3	-3240.4	.0	3269.2
9	3599.0	103.9	1532.1	291.0	-1274.5	.0	1992.9
10	2534.8	103.9	1532.1	239.7	-1026.5	.0	1844.2
11	1470.5	103.9	1532.1	188.3	-778.6	.0	1718.6
12	406.3	103.9	1532.1	136.9	-530.6	.0	1621.4
13	-658.0	623.6	432.4	250.8	-740.3	.0	857.3
14	4199.3	617.0	680.2	1014.1	-3359.5	.0	3427.6
15	3135.1	83.6	1724.3	265.3	-1150.5	.0	2072.9
16	2070.8	83.6	1724.3	214.0	-902.6	.0	1946.2
17	1006.6	83.6	1724.3	162.6	-654.6	.0	1844.3
18	-57.6	486.3	932.4	375.0	-1127.9	.0	1463.4
19	4534.0	2672.9	-6070.7	1173.9	-3917.3	.0	7224.9
20	3469.8	916.0	-1762.2	316.7	-1398.5	.0	2249.7
21	2405.5	711.5	-1188.3	265.3	-1150.5	.0	1654.0

22	1341.3	711.5	-1188.3	214.0	-902.6	.0	1492.2
23	277.0	711.5	-1188.3	162.6	-654.6	.0	1356.7
24	-787.2	711.5	-1188.3	111.2	-406.6	.0	1255.9
25	-1851.4	1955.3	-4418.0	215.3	-570.0	.0	4454.6
26	3933.7	2092.6	-4918.0	937.3	-3240.4	.0	5889.6
27	2869.5	653.5	-1121.0	291.0	-1274.5	.0	1697.4
28	1805.2	653.5	-1121.0	239.7	-1026.5	.0	1520.0
29	741.0	653.5	-1121.0	188.3	-778.6	.0	1364.9
30	-323.3	653.5	-1121.0	136.9	-530.6	.0	1240.3
31	-1387.5	2092.6	-4918.0	250.8	-740.3	.0	4973.4
32	3333.4	2646.0	-6404.9	1014.1	-3359.5	.0	7232.5
33	2269.2	828.9	-1732.7	265.3	-1150.5	.0	2079.9
34	1204.9	828.9	-1732.7	214.0	-902.6	.0	1953.7
35	140.7	828.9	-1732.7	162.6	-654.6	.0	1852.2
36	-923.6	2229.9	-5418.0	375.0	-1127.9	.0	5534.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 24
spalla fissa - n777_Sis12 - n789_Sis12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35131.3	-995.2	81118.7	-16772.6	-54913.1	-52804.6
2	27990.0	16116.0	77135.2	10828.5	52003.4	31217.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63121.3	15120.8	158253.9	-5944.1	-79321.6	-204677.3

Punto di applic. carico verticale: Xv = 2.507 m Yv = -1.257 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.767	13.325	1.813	-2.929	-.123	-.623

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3715.5	1821.4	-4136.3	-796.5	2650.4	.0	4912.6
2	2990.2	624.2	-1200.4	-198.2	862.8	.0	1478.3
3	2264.8	484.8	-809.3	-147.0	615.8	.0	1017.0
4	1539.4	484.8	-809.3	-95.9	368.9	.0	889.4
5	814.0	484.8	-809.3	-44.7	121.9	.0	818.5
6	88.7	484.8	-809.3	6.4	-125.0	.0	818.9
7	-636.7	1332.4	-3010.1	158.1	-683.1	.0	3086.6
8	3303.7	1469.1	-3508.1	-614.1	2111.6	.0	4094.6
9	2578.3	461.5	-841.5	-172.6	739.3	.0	1120.1
10	1852.9	461.5	-841.5	-121.5	492.4	.0	974.9
11	1127.5	461.5	-841.5	-70.3	245.4	.0	876.5
12	402.2	461.5	-841.5	-19.2	-1.5	.0	841.5
13	-323.2	1469.1	-3508.1	69.5	-378.2	.0	3528.4
14	2891.8	1903.5	-4714.9	-637.4	2094.8	.0	5159.3
15	2166.4	601.7	-1351.5	-147.0	615.8	.0	1485.2
16	1441.0	601.7	-1351.5	-95.9	368.9	.0	1400.9
17	715.7	601.7	-1351.5	-44.7	121.9	.0	1357.0
18	-9.7	1605.9	-4006.1	-1.0	-127.6	.0	4008.1
19	4143.4	257.9	1139.5	-796.5	2650.4	.0	2884.9
20	3418.1	-.8	1529.2	-198.2	862.8	.0	1755.8
21	2692.7	-23.6	1549.1	-147.0	615.8	.0	1667.0

22	1967.3	-23.6	1549.1	-95.9	368.9	.0	1592.4
23	1242.0	-23.6	1549.1	-44.7	121.9	.0	1553.9
24	516.6	-23.6	1549.1	6.4	-125.0	.0	1554.1
25	-208.8	142.9	1322.3	158.1	-683.1	.0	1488.3
26	3829.9	6.2	1820.2	-614.1	2111.6	.0	2787.9
27	3104.6	-85.9	1800.8	-172.6	739.3	.0	1946.6
28	2379.2	-85.9	1800.8	-121.5	492.4	.0	1866.9
29	1653.8	-85.9	1800.8	-70.3	245.4	.0	1817.4
30	928.5	-85.9	1800.8	-19.2	-1.5	.0	1800.8
31	203.1	6.2	1820.2	69.5	-378.2	.0	1859.1
32	3516.4	-117.1	2341.0	-637.4	2094.8	.0	3141.4
33	2791.1	-140.5	2091.2	-147.0	615.8	.0	2180.0
34	2065.7	-140.5	2091.2	-95.9	368.9	.0	2123.5
35	1340.3	-140.5	2091.2	-44.7	121.9	.0	2094.8
36	615.0	-130.6	2318.2	-1.0	-127.6	.0	2321.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 25
 spalla fissa - n777 _Sis13- n789 _Sis13

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24083.2	21349.8	121370.9	-3126.2	-46856.2	-88191.2
2	29240.2	16301.9	124218.0	18910.2	39478.8	99438.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
53323.4	37651.7	245588.9	15784.0	47802.5	65260.2

Punto di applic. carico verticale: Xv = 4.606 m Yv = .896 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.406	28.219	3.288	6.991	.133	.199

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5658.5	2221.2	-3850.7	985.8	-3300.8	.0	5071.8
2	4343.2	699.5	-288.3	293.4	-1314.5	.0	1345.8
3	3027.8	527.4	164.0	277.1	-1235.8	.0	1246.6
4	1712.5	527.4	164.0	260.8	-1157.0	.0	1168.6
5	397.2	527.4	164.0	244.4	-1078.3	.0	1090.7
6	-918.1	527.4	164.0	228.1	-999.6	.0	1012.9
7	-2233.4	1593.1	-2461.1	681.5	-2237.9	.0	3326.5
8	5054.0	1549.6	-2302.3	823.2	-2863.0	.0	3673.9
9	3738.7	419.8	486.9	285.2	-1275.1	.0	1364.9
10	2423.4	419.8	486.9	268.9	-1196.4	.0	1291.7
11	1108.1	419.8	486.9	252.6	-1117.7	.0	1219.1
12	-207.3	419.8	486.9	236.3	-1038.9	.0	1147.4
13	-1522.6	1549.6	-2302.3	605.2	-2069.1	.0	3095.5
14	4449.5	1815.6	-2836.6	935.1	-3123.6	.0	4219.4
15	3134.2	490.1	336.8	277.1	-1235.8	.0	1280.9
16	1818.9	490.1	336.8	260.8	-1157.0	.0	1205.1
17	503.6	490.1	336.8	244.4	-1078.3	.0	1129.7
18	-811.7	1506.0	-2143.6	732.2	-2415.1	.0	3229.2
19	5195.8	2719.7	-5532.8	985.8	-3300.8	.0	6442.6
20	3880.5	898.7	-1158.7	293.4	-1314.5	.0	1752.3
21	2565.2	689.5	-588.0	277.1	-1235.8	.0	1368.5

22	1249.9	689.5	-588.0	260.8	-1157.0	.0	1297.9
23	-65.4	689.5	-588.0	244.4	-1078.3	.0	1228.2
24	-1380.7	689.5	-588.0	228.1	-999.6	.0	1159.7
25	-2696.1	1972.4	-3842.5	681.5	-2237.9	.0	4446.7
26	4485.0	2016.0	-4001.2	823.2	-2863.0	.0	4920.0
27	3169.7	594.3	-355.6	285.2	-1275.1	.0	1323.8
28	1854.4	594.3	-355.6	268.9	-1196.4	.0	1248.1
29	539.0	594.3	-355.6	252.6	-1117.7	.0	1172.9
30	-776.3	594.3	-355.6	236.3	-1038.9	.0	1098.1
31	-2091.6	2016.0	-4001.2	605.2	-2069.1	.0	4504.6
32	3774.2	2459.9	-5086.3	935.1	-3123.6	.0	5968.9
33	2458.8	726.8	-760.8	277.1	-1235.8	.0	1451.2
34	1143.5	726.8	-760.8	260.8	-1157.0	.0	1384.8
35	-171.8	726.8	-760.8	244.4	-1078.3	.0	1319.7
36	-1487.1	2059.6	-4160.0	732.2	-2415.1	.0	4810.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 26
 spalla fissa - n777 _Sis14- n789 _Sis14

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33941.1	-8168.1	33801.3	-11410.1	-57902.5	2741.3
2	33568.3	-2895.2	31788.6	19317.1	51422.5	-9025.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67509.4	-11063.3	65589.9	7907.0	-10469.0	-62704.5

Punto di applic. carico verticale: Xv = .972 m Yv = -.155 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.376	-3.688	.172	3.336	.026	-.191

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	2126.9	-376.5	1461.6	268.4	-910.0	.0	1721.7
2	2057.9	-160.4	845.6	100.6	-465.8	.0	965.4
3	1988.9	-132.7	752.2	116.2	-541.5	.0	926.9
4	1920.0	-132.7	752.2	131.9	-617.1	.0	973.0
5	1851.0	-132.7	752.2	147.6	-692.8	.0	1022.6
6	1782.0	-132.7	752.2	163.3	-768.4	.0	1075.3
7	1713.0	-291.5	1237.0	560.9	-1931.2	.0	2293.4
8	2102.7	-249.6	1084.4	251.2	-888.8	.0	1402.1
9	2033.7	-101.8	623.2	108.4	-503.7	.0	801.3
10	1964.7	-101.8	623.2	124.1	-579.3	.0	850.8
11	1895.7	-101.8	623.2	139.8	-655.0	.0	904.0
12	1826.8	-101.8	623.2	155.4	-730.6	.0	960.3
13	1757.8	-249.6	1084.4	460.6	-1651.6	.0	1975.8
14	2078.4	-238.5	1016.4	317.2	-1080.2	.0	1483.2
15	2009.5	-96.9	586.1	116.2	-541.5	.0	798.0
16	1940.5	-96.9	586.1	131.9	-617.1	.0	851.1
17	1871.5	-96.9	586.1	147.6	-692.8	.0	907.5
18	1802.6	-207.8	931.9	512.2	-1761.0	.0	1992.4
19	2037.5	-855.5	3077.9	268.4	-910.0	.0	3209.6
20	1968.5	-351.8	1681.8	100.6	-465.8	.0	1745.2
21	1899.5	-288.5	1474.7	116.2	-541.5	.0	1571.0

22	1830.6	-288.5	1474.7	131.9	-617.1	.0	1598.7
23	1761.6	-288.5	1474.7	147.6	-692.8	.0	1629.4
24	1692.6	-288.5	1474.7	163.3	-768.4	.0	1662.9
25	1623.7	-655.9	2564.3	560.9	-1931.2	.0	3210.1
26	1992.7	-697.8	2716.8	251.2	-888.8	.0	2858.5
27	1923.7	-269.5	1432.6	108.4	-503.7	.0	1518.6
28	1854.8	-269.5	1432.6	124.1	-579.3	.0	1545.3
29	1785.8	-269.5	1432.6	139.8	-655.0	.0	1575.2
30	1716.8	-269.5	1432.6	155.4	-730.6	.0	1608.2
31	1647.9	-697.8	2716.8	460.6	-1651.6	.0	3179.4
32	1948.0	-857.5	3178.0	317.2	-1080.2	.0	3356.6
33	1879.0	-324.3	1640.8	116.2	-541.5	.0	1727.9
34	1810.0	-324.3	1640.8	131.9	-617.1	.0	1753.1
35	1741.0	-324.3	1640.8	147.6	-692.8	.0	1781.1
36	1672.1	-739.7	2869.4	512.2	-1761.0	.0	3366.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 27
spalla fissa - n777_Sis15- n789_Sis15

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24371.8	18754.6	90579.2	-2146.4	-48828.5	-50113.3
2	34591.6	1791.1	94982.1	23505.4	42652.9	74995.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58963.4	20545.7	185561.3	21359.0	103176.3	206391.2

Punto di applic. carico verticale: Xv = 3.147 m Yv = 1.750 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.189	17.121	2.220	9.646	.226	.628

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4695.0	600.9	433.3	1612.7	-5391.0	.0	5408.4
2	3806.9	113.0	1374.8	454.6	-2021.8	.0	2444.9
3	2918.7	63.8	1466.8	403.0	-1772.8	.0	2300.9
4	2030.5	63.8	1466.8	351.4	-1523.8	.0	2115.0
5	1142.3	63.8	1466.8	299.8	-1274.8	.0	1943.3
6	254.2	63.8	1466.8	248.2	-1025.7	.0	1789.8
7	-634.0	391.8	829.1	650.1	-2029.6	.0	2192.4
8	4341.2	254.0	1331.3	1313.2	-4553.5	.0	4744.2
9	3453.0	-13.0	1759.9	428.8	-1897.3	.0	2587.8
10	2564.9	-13.0	1759.9	377.2	-1648.3	.0	2411.2
11	1676.7	-13.0	1759.9	325.6	-1399.3	.0	2248.4
12	788.5	-13.0	1759.9	274.0	-1150.3	.0	2102.4
13	-99.7	254.0	1331.3	623.8	-2042.8	.0	2438.3
14	3987.4	177.7	1745.0	1452.3	-4830.8	.0	5136.3
15	3099.2	-54.1	2013.4	403.0	-1772.8	.0	2682.7
16	2211.0	-54.1	2013.4	351.4	-1523.8	.0	2525.0
17	1322.9	-54.1	2013.4	299.8	-1274.8	.0	2383.1
18	434.7	116.1	1833.4	810.5	-2589.8	.0	3173.1
19	3909.8	2177.5	-4886.7	1612.7	-5391.0	.0	7276.1
20	3021.6	743.2	-1377.7	454.6	-2021.8	.0	2446.6
21	2133.4	576.5	-911.4	403.0	-1772.8	.0	1993.3

22	1245.2	576.5	-911.4	351.4	-1523.8	.0	1775.5
23	357.1	576.5	-911.4	299.8	-1274.8	.0	1567.0
24	-531.1	576.5	-911.4	248.2	-1025.7	.0	1372.1
25	-1419.3	1591.3	-3539.5	650.1	-2029.6	.0	4080.1
26	3375.4	1729.2	-4041.6	1313.2	-4553.5	.0	6088.5
27	2487.2	539.0	-904.5	428.8	-1897.3	.0	2101.8
28	1599.1	539.0	-904.5	377.2	-1648.3	.0	1880.1
29	710.9	539.0	-904.5	325.6	-1399.3	.0	1666.1
30	-177.3	539.0	-904.5	274.0	-1150.3	.0	1463.3
31	-1065.5	1729.2	-4041.6	623.8	-2042.8	.0	4528.6
32	2841.1	2215.3	-5370.0	1452.3	-4830.8	.0	7223.1
33	1952.9	694.4	-1458.1	403.0	-1772.8	.0	2295.4
34	1064.7	694.4	-1458.1	351.4	-1523.8	.0	2109.0
35	176.5	694.4	-1458.1	299.8	-1274.8	.0	1936.7
36	-711.6	1867.0	-4543.8	810.5	-2589.8	.0	5230.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 28
 spalla fissa - n777 _Sis16- n789 _Sis16

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34317.3	-5622.4	67528.5	-12732.4	-57156.3	-36290.6
2	28804.0	11576.1	63676.0	15019.4	49390.5	16256.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63121.3	5953.7	131204.5	2287.0	-66758.1	-204058.5

Punto di applic. carico verticale: Xv = 2.079 m Yv = -1.058 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.767	7.549	1.283	.658	-.068	-.621

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3174.6	1243.7	-2774.2	-361.4	1189.2	.0	3018.4
2	2661.3	423.6	-770.3	-61.5	244.4	.0	808.1
3	2147.9	328.4	-504.3	-10.5	-1.8	.0	504.3
4	1634.5	328.4	-504.3	40.6	-248.0	.0	561.9
5	1121.1	328.4	-504.3	91.6	-494.2	.0	706.0
6	607.7	328.4	-504.3	142.6	-740.4	.0	895.8
7	94.3	908.5	-2004.5	590.3	-2134.2	.0	2928.0
8	2890.6	1044.8	-2501.0	-241.3	809.4	.0	2628.7
9	2377.2	328.5	-604.5	-36.0	121.3	.0	616.6
10	1863.8	328.5	-604.5	15.1	-124.9	.0	617.3
11	1350.4	328.5	-604.5	66.1	-371.1	.0	709.3
12	837.1	328.5	-604.5	117.1	-617.3	.0	864.0
13	323.7	1044.8	-2501.0	440.3	-1673.0	.0	3009.0
14	2606.6	1399.1	-3517.9	-202.8	635.3	.0	3574.9
15	2093.2	444.9	-1044.8	-10.5	-1.8	.0	1044.8
16	1579.8	444.9	-1044.8	40.6	-248.0	.0	1073.8
17	1066.4	444.9	-1044.8	91.6	-494.2	.0	1155.7
18	553.0	1181.1	-2997.5	431.7	-1580.3	.0	3388.5
19	3412.4	-315.1	2485.6	-361.4	1189.2	.0	2755.5
20	2899.0	-199.5	1951.1	-61.5	244.4	.0	1966.4
21	2385.7	-178.6	1847.0	-10.5	-1.8	.0	1847.0

22	1872.3	-178.6	1847.0	40.6	-248.0	.0	1863.6
23	1358.9	-178.6	1847.0	91.6	-494.2	.0	1912.0
24	845.5	-178.6	1847.0	142.6	-740.4	.0	1989.8
25	332.1	-277.5	2314.7	590.3	-2134.2	.0	3148.5
26	3183.1	-413.8	2811.2	-241.3	809.4	.0	2925.4
27	2669.7	-217.3	2029.7	-36.0	121.3	.0	2033.3
28	2156.3	-217.3	2029.7	15.1	-124.9	.0	2033.5
29	1642.9	-217.3	2029.7	66.1	-371.1	.0	2063.3
30	1129.5	-217.3	2029.7	117.1	-617.3	.0	2121.5
31	616.1	-413.8	2811.2	440.3	-1673.0	.0	3271.3
32	2953.7	-615.5	3516.6	-202.8	635.3	.0	3573.5
33	2440.3	-295.1	2387.5	-10.5	-1.8	.0	2387.5
34	1926.9	-295.1	2387.5	40.6	-248.0	.0	2400.3
35	1413.5	-295.1	2387.5	91.6	-494.2	.0	2438.1
36	900.1	-550.1	3307.7	431.7	-1580.3	.0	3665.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 29
spalla fissa - n777_Sis17- n789_Sis17

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	23864.1	18810.4	88521.4	-1943.5	-47883.3	-49626.1
2	34311.3	1857.2	93860.0	23302.5	42132.1	74629.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58175.4	20667.6	182381.4	21359.0	106033.9	206402.3

Punto di applic. carico verticale: Xv = 3.135 m Yv = 1.823 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.080	17.080	2.198	9.660	.229	.628

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4652.4	605.6	392.5	1613.0	-5388.3	.0	5402.6
2	3773.1	116.2	1342.2	454.5	-2018.7	.0	2424.2
3	2893.8	66.6	1435.8	402.9	-1769.7	.0	2278.9
4	2014.5	66.6	1435.8	351.3	-1520.6	.0	2091.4
5	1135.2	66.6	1435.8	299.7	-1271.6	.0	1918.0
6	256.0	66.6	1435.8	248.1	-1022.6	.0	1762.7
7	-623.3	396.1	790.9	650.3	-2026.7	.0	2175.6
8	4304.4	258.3	1293.1	1313.4	-4550.7	.0	4730.9
9	3425.1	-10.3	1730.0	428.7	-1894.2	.0	2565.3
10	2545.8	-10.3	1730.0	377.1	-1645.2	.0	2387.3
11	1666.5	-10.3	1730.0	325.5	-1396.1	.0	2223.0
12	787.2	-10.3	1730.0	273.9	-1147.1	.0	2075.7
13	-92.1	258.3	1293.1	624.0	-2039.9	.0	2415.2
14	3956.4	182.3	1705.5	1452.5	-4828.1	.0	5120.4
15	3077.1	-51.3	1982.5	402.9	-1769.7	.0	2657.5
16	2197.8	-51.3	1982.5	351.3	-1520.6	.0	2498.6
17	1318.5	-51.3	1982.5	299.7	-1271.6	.0	2355.3
18	439.2	120.4	1795.3	810.7	-2587.0	.0	3148.9
19	3855.3	2182.4	-4927.7	1613.0	-5388.3	.0	7301.8
20	2976.0	746.4	-1410.5	454.5	-2018.7	.0	2462.6
21	2096.7	579.4	-942.5	402.9	-1769.7	.0	2005.0

22	1217.4	579.4	-942.5	351.3	-1520.6	.0	1789.0
23	338.1	579.4	-942.5	299.7	-1271.6	.0	1582.8
24	-541.2	579.4	-942.5	248.1	-1022.6	.0	1390.7
25	-1420.4	1595.7	-3577.9	650.3	-2026.7	.0	4112.1
26	3324.0	1733.5	-4080.1	1313.4	-4550.7	.0	6112.0
27	2444.7	541.7	-934.5	428.7	-1894.2	.0	2112.2
28	1565.5	541.7	-934.5	377.1	-1645.2	.0	1892.1
29	686.2	541.7	-934.5	325.5	-1396.1	.0	1680.1
30	-193.1	541.7	-934.5	273.9	-1147.1	.0	1479.6
31	-1072.4	1733.5	-4080.1	624.0	-2039.9	.0	4561.6
32	2792.8	2220.0	-5409.9	1452.5	-4828.1	.0	7251.0
33	1913.5	697.3	-1489.2	402.9	-1769.7	.0	2312.9
34	1034.2	697.3	-1489.2	351.3	-1520.6	.0	2128.4
35	154.9	697.3	-1489.2	299.7	-1271.6	.0	1958.2
36	-724.4	1871.4	-4582.3	810.7	-2587.0	.0	5262.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 29
 spalla fissa - n777 _Sis17- n789 _Sis17

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	2182.4	-4927.7	1613.0	-5388.3	2713.7	7301.8
1.56	1852.9	-1786.5	1439.8	-3005.4	2346.5	3496.3
3.13	1402.8	888.2	1171.2	-880.7	1827.5	1250.8
4.69	589.0	2383.6	642.8	508.9	871.8	2437.3
6.25	61.7	2841.6	253.1	1182.8	260.6	3077.9
7.81	-238.9	2665.2	-13.5	1348.1	239.2	2986.8
9.38	-312.1	2198.0	-95.4	1228.0	326.3	2517.8
10.94	-319.5	1700.4	-120.0	1056.8	341.3	2002.0
12.50	-308.6	1206.3	-131.7	858.2	335.5	1480.4
15.00	-219.2	517.2	-125.7	526.3	252.6	737.9
17.50	-114.4	107.7	-90.9	250.8	146.1	272.9
20.00	-41.4	-75.7	-52.0	73.8	66.4	105.7
22.50	-2.3	-120.7	-22.1	-15.2	22.2	121.7
25.00	12.2	-102.7	-2.7	-44.2	12.5	111.8
29.17	11.3	-47.7	3.9	-33.3	12.0	58.2
33.33	6.0	-11.5	3.5	-16.5	6.9	20.2
37.50	1.6	3.5	1.9	-4.9	2.4	6.1
43.75	-.7	3.9	.2	.7	.7	3.9
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLV

 CONDIZIONE DI CARICO 30
 spalla fissa - n777 _Sis18 - n789 _Sis18

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34038.0	-5555.8	66411.8	-12530.0	-56637.5	-35925.7
2	28297.3	11631.5	61622.4	14817.0	48447.2	15771.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
62335.3	6075.7	128034.2	2287.0	-69615.8	-204058.3

Punto di applic. carico verticale: Xv = 2.054 m Yv = -1.117 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.658	7.508	1.261	.644	-.072	-.621

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3120.4	1248.6	-2815.1	-361.7	1186.4	.0	3054.9
2	2615.8	426.8	-802.9	-61.3	241.3	.0	838.4
3	2111.3	331.3	-535.2	-10.3	-4.9	.0	535.2
4	1606.7	331.3	-535.2	40.7	-251.1	.0	591.2
5	1102.2	331.3	-535.2	91.7	-497.3	.0	730.6
6	597.6	331.3	-535.2	142.7	-743.5	.0	916.1
7	93.1	912.8	-2042.8	590.1	-2137.0	.0	2956.3
8	2839.4	1049.1	-2539.3	-241.4	806.5	.0	2664.3
9	2334.8	331.2	-634.5	-35.8	118.2	.0	645.4
10	1830.3	331.2	-634.5	15.2	-128.0	.0	647.3
11	1325.8	331.2	-634.5	66.2	-374.2	.0	736.6
12	821.2	331.2	-634.5	117.2	-620.4	.0	887.4
13	316.7	1049.1	-2539.3	440.1	-1675.9	.0	3042.4
14	2558.4	1403.7	-3557.6	-203.0	632.5	.0	3613.4
15	2053.9	447.8	-1075.7	-10.3	-4.9	.0	1075.7
16	1549.3	447.8	-1075.7	40.7	-251.1	.0	1104.6
17	1044.8	447.8	-1075.7	91.7	-497.3	.0	1185.1
18	540.3	1185.4	-3035.7	431.5	-1583.1	.0	3423.7
19	3370.0	-310.3	2444.8	-361.7	1186.4	.0	2717.4
20	2865.4	-196.3	1918.5	-61.3	241.3	.0	1933.6
21	2360.9	-175.7	1816.0	-10.3	-4.9	.0	1816.0

22	1856.3	-175.7	1816.0	40.7	-251.1	.0	1833.3
23	1351.8	-175.7	1816.0	91.7	-497.3	.0	1882.9
24	847.3	-175.7	1816.0	142.7	-743.5	.0	1962.3
25	342.7	-273.1	2276.5	590.1	-2137.0	.0	3122.3
26	3146.4	-409.4	2772.9	-241.4	806.5	.0	2887.8
27	2641.8	-214.6	1999.8	-35.8	118.2	.0	2003.3
28	2137.3	-214.6	1999.8	15.2	-128.0	.0	2003.9
29	1632.8	-214.6	1999.8	66.2	-374.2	.0	2034.5
30	1128.2	-214.6	1999.8	117.2	-620.4	.0	2093.8
31	623.7	-409.4	2772.9	440.1	-1675.9	.0	3240.0
32	2922.8	-610.9	3476.9	-203.0	632.5	.0	3534.0
33	2418.3	-292.2	2356.6	-10.3	-4.9	.0	2356.6
34	1913.7	-292.2	2356.6	40.7	-251.1	.0	2369.9
35	1409.2	-292.2	2356.6	91.7	-497.3	.0	2408.4
36	904.6	-545.7	3269.4	431.5	-1583.1	.0	3632.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 31
spalla fissa - n777 _Sis19 - n789 _Sis19

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24827.8	21759.5	127006.5	-3467.4	-48323.1	-91280.6
2	29889.5	16706.2	129459.8	19251.5	40767.7	102480.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
54717.3	38465.7	256466.3	15784.1	46604.8	65270.5

Punto di applic. carico verticale: Xv = 4.687 m Yv = .852 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.600	29.016	3.405	6.985	.132	.199

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5835.2	2279.0	-3915.9	985.8	-3302.0	.0	5122.3
2	4473.1	715.9	-261.4	293.4	-1315.8	.0	1341.6
3	3110.9	539.3	201.9	277.1	-1237.1	.0	1253.5
4	1748.8	539.3	201.9	260.8	-1158.4	.0	1175.8
5	386.6	539.3	201.9	244.5	-1079.6	.0	1098.3
6	-975.5	539.3	201.9	228.2	-1000.9	.0	1021.0
7	-2337.7	1633.7	-2489.8	681.3	-2239.0	.0	3348.4
8	5206.8	1590.1	-2331.0	823.1	-2864.3	.0	3692.9
9	3844.6	429.3	530.7	285.3	-1276.5	.0	1382.4
10	2482.5	429.3	530.7	269.0	-1197.7	.0	1310.0
11	1120.3	429.3	530.7	252.6	-1119.0	.0	1238.5
12	-241.9	429.3	530.7	236.3	-1040.2	.0	1167.8
13	-1604.0	1590.1	-2331.0	605.1	-2070.3	.0	3117.6
14	4578.3	1865.0	-2884.3	935.0	-3124.9	.0	4252.6
15	3216.1	502.0	374.8	277.1	-1237.1	.0	1292.6
16	1854.0	502.0	374.8	260.8	-1158.4	.0	1217.5
17	491.8	502.0	374.8	244.5	-1079.6	.0	1142.8
18	-870.3	1546.5	-2172.2	732.1	-2416.2	.0	3249.0
19	5377.6	2777.6	-5598.3	985.8	-3302.0	.0	6499.6
20	4015.4	915.2	-1131.9	293.4	-1315.8	.0	1735.7
21	2653.2	701.4	-550.1	277.1	-1237.1	.0	1353.9

22	1291.1	701.4	-550.1	260.8	-1158.4	.0	1282.4
23	-71.1	701.4	-550.1	244.5	-1079.6	.0	1211.7
24	-1433.2	701.4	-550.1	228.2	-1000.9	.0	1142.1
25	-2795.4	2013.0	-3871.3	681.3	-2239.0	.0	4472.2
26	4643.9	2056.6	-4030.1	823.1	-2864.3	.0	4944.3
27	3281.7	603.8	-311.9	285.3	-1276.5	.0	1314.0
28	1919.5	603.8	-311.9	269.0	-1197.7	.0	1237.7
29	557.4	603.8	-311.9	252.6	-1119.0	.0	1161.6
30	-804.8	603.8	-311.9	236.3	-1040.2	.0	1086.0
31	-2166.9	2056.6	-4030.1	605.1	-2070.3	.0	4530.8
32	3910.2	2509.4	-5134.4	935.0	-3124.9	.0	6010.6
33	2548.0	738.7	-723.0	277.1	-1237.1	.0	1432.9
34	1185.9	738.7	-723.0	260.8	-1158.4	.0	1365.5
35	-176.3	738.7	-723.0	244.5	-1079.6	.0	1299.4
36	-1538.5	2100.2	-4188.9	732.1	-2416.2	.0	4835.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 32
spalla fissa - n777 _Sis20- n789 _Sis20

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33854.9	-9375.4	27248.1	-11422.6	-57544.2	8270.5
2	33512.4	-4096.9	25370.8	19314.7	51140.7	-14572.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67367.3	-13472.3	52618.9	7892.1	-10068.2	-62782.3

Punto di applic. carico verticale: Xv = .781 m Yv = -.149 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.357	-5.402	-.015	3.332	.026	-.191

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	1898.4	-532.1	1778.5	267.5	-906.3	.0	1996.1
2	1904.5	-211.8	912.3	100.3	-464.1	.0	1023.5
3	1910.6	-172.1	786.3	116.0	-539.8	.0	953.7
4	1916.7	-172.1	786.3	131.7	-615.6	.0	998.6
5	1922.8	-172.1	786.3	147.3	-691.3	.0	1047.0
6	1928.9	-172.1	786.3	163.0	-767.0	.0	1098.4
7	1935.1	-404.4	1457.2	560.3	-1928.8	.0	2417.4
8	1911.9	-362.4	1304.5	250.4	-885.5	.0	1576.7
9	1918.0	-134.9	639.3	108.1	-501.9	.0	812.8
10	1924.1	-134.9	639.3	123.8	-577.7	.0	861.6
11	1930.2	-134.9	639.3	139.5	-653.4	.0	914.2
12	1936.3	-134.9	639.3	155.2	-729.2	.0	969.7
13	1942.4	-362.4	1304.5	460.1	-1649.3	.0	2102.8
14	1925.3	-373.3	1287.1	316.3	-1076.7	.0	1678.0
15	1931.5	-136.3	620.0	116.0	-539.8	.0	822.0
16	1937.6	-136.3	620.0	131.7	-615.6	.0	873.7
17	1943.7	-136.3	620.0	147.3	-691.3	.0	928.6
18	1949.8	-320.5	1151.7	511.5	-1758.4	.0	2102.0
19	1807.6	-1011.7	3396.8	267.5	-906.3	.0	3515.6
20	1813.7	-403.5	1749.6	100.3	-464.1	.0	1810.1
21	1819.8	-328.1	1509.7	116.0	-539.8	.0	1603.3

22	1825.9	-328.1	1509.7	131.7	-615.6	.0	1630.3
23	1832.0	-328.1	1509.7	147.3	-691.3	.0	1660.4
24	1838.2	-328.1	1509.7	163.0	-767.0	.0	1693.4
25	1844.3	-769.2	2786.1	560.3	-1928.8	.0	3388.6
26	1800.2	-811.2	2938.9	250.4	-885.5	.0	3069.4
27	1806.3	-302.8	1449.8	108.1	-501.9	.0	1534.2
28	1812.4	-302.8	1449.8	123.8	-577.7	.0	1560.6
29	1818.5	-302.8	1449.8	139.5	-653.4	.0	1590.2
30	1824.7	-302.8	1449.8	155.2	-729.2	.0	1622.8
31	1830.8	-811.2	2938.9	460.1	-1649.3	.0	3370.0
32	1792.8	-993.1	3451.4	316.3	-1076.7	.0	3615.4
33	1798.9	-364.0	1676.0	116.0	-539.8	.0	1760.8
34	1805.0	-364.0	1676.0	131.7	-615.6	.0	1785.4
35	1811.2	-364.0	1676.0	147.3	-691.3	.0	1813.0
36	1817.3	-853.1	3091.6	511.5	-1758.4	.0	3556.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 33
spalla fissa - n777 _Sis21- n789 _Sis21

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24827.8	21759.5	127006.5	-3467.4	-48323.1	-91280.6
2	29889.5	16706.2	129459.8	19251.5	40767.7	102480.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
54717.3	38465.7	256466.3	15784.1	46604.8	65270.5

Punto di applic. carico verticale: Xv = 4.687 m Yv = .852 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.600	29.016	3.405	6.985	.132	.199

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5835.2	2279.0	-3915.9	985.8	-3302.0	.0	5122.3
2	4473.1	715.9	-261.4	293.4	-1315.8	.0	1341.6
3	3110.9	539.3	201.9	277.1	-1237.1	.0	1253.5
4	1748.8	539.3	201.9	260.8	-1158.4	.0	1175.8
5	386.6	539.3	201.9	244.5	-1079.6	.0	1098.3
6	-975.5	539.3	201.9	228.2	-1000.9	.0	1021.0
7	-2337.7	1633.7	-2489.8	681.3	-2239.0	.0	3348.4
8	5206.8	1590.1	-2331.0	823.1	-2864.3	.0	3692.9
9	3844.6	429.3	530.7	285.3	-1276.5	.0	1382.4
10	2482.5	429.3	530.7	269.0	-1197.7	.0	1310.0
11	1120.3	429.3	530.7	252.6	-1119.0	.0	1238.5
12	-241.9	429.3	530.7	236.3	-1040.2	.0	1167.8
13	-1604.0	1590.1	-2331.0	605.1	-2070.3	.0	3117.6
14	4578.3	1865.0	-2884.3	935.0	-3124.9	.0	4252.6
15	3216.1	502.0	374.8	277.1	-1237.1	.0	1292.6
16	1854.0	502.0	374.8	260.8	-1158.4	.0	1217.5
17	491.8	502.0	374.8	244.5	-1079.6	.0	1142.8
18	-870.3	1546.5	-2172.2	732.1	-2416.2	.0	3249.0
19	5377.6	2777.6	-5598.3	985.8	-3302.0	.0	6499.6
20	4015.4	915.2	-1131.9	293.4	-1315.8	.0	1735.7
21	2653.2	701.4	-550.1	277.1	-1237.1	.0	1353.9

22	1291.1	701.4	-550.1	260.8	-1158.4	.0	1282.4
23	-71.1	701.4	-550.1	244.5	-1079.6	.0	1211.7
24	-1433.2	701.4	-550.1	228.2	-1000.9	.0	1142.1
25	-2795.4	2013.0	-3871.3	681.3	-2239.0	.0	4472.2
26	4643.9	2056.6	-4030.1	823.1	-2864.3	.0	4944.3
27	3281.7	603.8	-311.9	285.3	-1276.5	.0	1314.0
28	1919.5	603.8	-311.9	269.0	-1197.7	.0	1237.7
29	557.4	603.8	-311.9	252.6	-1119.0	.0	1161.6
30	-804.8	603.8	-311.9	236.3	-1040.2	.0	1086.0
31	-2166.9	2056.6	-4030.1	605.1	-2070.3	.0	4530.8
32	3910.2	2509.4	-5134.4	935.0	-3124.9	.0	6010.6
33	2548.0	738.7	-723.0	277.1	-1237.1	.0	1432.9
34	1185.9	738.7	-723.0	260.8	-1158.4	.0	1365.5
35	-176.3	738.7	-723.0	244.5	-1079.6	.0	1299.4
36	-1538.5	2100.2	-4188.9	732.1	-2416.2	.0	4835.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 34
spalla fissa - n777 _Sis22- n789 _Sis22

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33854.9	-9375.4	27248.1	-11422.6	-57544.2	8270.5
2	33512.4	-4096.9	25370.8	19314.7	51140.7	-14572.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67367.3	-13472.3	52618.9	7892.1	-10068.2	-62782.3

Punto di applic. carico verticale: Xv = .781 m Yv = -.149 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.357	-5.402	-.015	3.332	.026	-.191

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	1898.4	-532.1	1778.5	267.5	-906.3	.0	1996.1
2	1904.5	-211.8	912.3	100.3	-464.1	.0	1023.5
3	1910.6	-172.1	786.3	116.0	-539.8	.0	953.7
4	1916.7	-172.1	786.3	131.7	-615.6	.0	998.6
5	1922.8	-172.1	786.3	147.3	-691.3	.0	1047.0
6	1928.9	-172.1	786.3	163.0	-767.0	.0	1098.4
7	1935.1	-404.4	1457.2	560.3	-1928.8	.0	2417.4
8	1911.9	-362.4	1304.5	250.4	-885.5	.0	1576.7
9	1918.0	-134.9	639.3	108.1	-501.9	.0	812.8
10	1924.1	-134.9	639.3	123.8	-577.7	.0	861.6
11	1930.2	-134.9	639.3	139.5	-653.4	.0	914.2
12	1936.3	-134.9	639.3	155.2	-729.2	.0	969.7
13	1942.4	-362.4	1304.5	460.1	-1649.3	.0	2102.8
14	1925.3	-373.3	1287.1	316.3	-1076.7	.0	1678.0
15	1931.5	-136.3	620.0	116.0	-539.8	.0	822.0
16	1937.6	-136.3	620.0	131.7	-615.6	.0	873.7
17	1943.7	-136.3	620.0	147.3	-691.3	.0	928.6
18	1949.8	-320.5	1151.7	511.5	-1758.4	.0	2102.0
19	1807.6	-1011.7	3396.8	267.5	-906.3	.0	3515.6
20	1813.7	-403.5	1749.6	100.3	-464.1	.0	1810.1
21	1819.8	-328.1	1509.7	116.0	-539.8	.0	1603.3

22	1825.9	-328.1	1509.7	131.7	-615.6	.0	1630.3
23	1832.0	-328.1	1509.7	147.3	-691.3	.0	1660.4
24	1838.2	-328.1	1509.7	163.0	-767.0	.0	1693.4
25	1844.3	-769.2	2786.1	560.3	-1928.8	.0	3388.6
26	1800.2	-811.2	2938.9	250.4	-885.5	.0	3069.4
27	1806.3	-302.8	1449.8	108.1	-501.9	.0	1534.2
28	1812.4	-302.8	1449.8	123.8	-577.7	.0	1560.6
29	1818.5	-302.8	1449.8	139.5	-653.4	.0	1590.2
30	1824.7	-302.8	1449.8	155.2	-729.2	.0	1622.8
31	1830.8	-811.2	2938.9	460.1	-1649.3	.0	3370.0
32	1792.8	-993.1	3451.4	316.3	-1076.7	.0	3615.4
33	1798.9	-364.0	1676.0	116.0	-539.8	.0	1760.8
34	1805.0	-364.0	1676.0	131.7	-615.6	.0	1785.4
35	1811.2	-364.0	1676.0	147.3	-691.3	.0	1813.0
36	1817.3	-853.1	3091.6	511.5	-1758.4	.0	3556.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 35
spalla fissa - n777 _Sis23- n789 _Sis23

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24375.0	18605.3	89830.9	-2158.8	-48804.7	-49455.5
2	34588.4	1643.4	94215.7	23502.8	42637.3	74308.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58963.4	20248.7	184046.6	21344.0	103116.0	206345.3

Punto di applic. carico verticale: Xv = 3.121 m Yv = 1.749 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.189	16.913	2.198	9.639	.226	.628

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4667.9	581.9	472.5	1611.8	-5388.0	.0	5408.7
2	3788.7	106.7	1383.4	454.3	-2020.6	.0	2448.8
3	2909.5	58.9	1471.4	402.7	-1771.6	.0	2303.0
4	2030.3	58.9	1471.4	351.2	-1522.7	.0	2117.4
5	1151.1	58.9	1471.4	299.6	-1273.7	.0	1946.1
6	271.9	58.9	1471.4	248.0	-1024.8	.0	1793.1
7	-607.3	378.1	856.5	649.4	-2027.3	.0	2200.8
8	4318.5	240.2	1358.5	1312.4	-4550.9	.0	4749.4
9	3439.3	-17.1	1762.3	428.5	-1896.1	.0	2588.6
10	2560.1	-17.1	1762.3	376.9	-1647.2	.0	2412.2
11	1680.9	-17.1	1762.3	325.4	-1398.2	.0	2249.6
12	801.7	-17.1	1762.3	273.8	-1149.3	.0	2103.9
13	-77.5	240.2	1358.5	623.2	-2040.8	.0	2451.6
14	3969.1	161.3	1778.3	1451.4	-4827.9	.0	5145.0
15	3089.9	-58.9	2018.0	402.7	-1771.6	.0	2685.3
16	2210.7	-58.9	2018.0	351.2	-1522.7	.0	2528.0
17	1331.5	-58.9	2018.0	299.6	-1273.7	.0	2386.3
18	452.3	102.4	1860.6	809.8	-2587.5	.0	3186.9
19	3883.1	2158.2	-4846.3	1611.8	-5388.0	.0	7246.9
20	3003.9	736.7	-1368.5	454.3	-2020.6	.0	2440.4
21	2124.7	571.5	-906.2	402.7	-1771.6	.0	1989.9

22	1245.5	571.5	-906.2	351.2	-1522.7	.0	1771.9
23	366.3	571.5	-906.2	299.6	-1273.7	.0	1563.2
24	-512.9	571.5	-906.2	248.0	-1024.8	.0	1368.0
25	-1392.1	1577.3	-3511.2	649.4	-2027.3	.0	4054.4
26	3353.3	1715.1	-4013.2	1312.4	-4550.9	.0	6067.7
27	2474.1	534.8	-901.5	428.5	-1896.1	.0	2099.5
28	1594.9	534.8	-901.5	376.9	-1647.2	.0	1877.7
29	715.7	534.8	-901.5	325.4	-1398.2	.0	1663.6
30	-163.5	534.8	-901.5	273.8	-1149.3	.0	1460.6
31	-1042.7	1715.1	-4013.2	623.2	-2040.8	.0	4502.3
32	2823.5	2198.5	-5335.1	1451.4	-4827.9	.0	7195.2
33	1944.3	689.4	-1452.8	402.7	-1771.6	.0	2291.1
34	1065.1	689.4	-1452.8	351.2	-1522.7	.0	2104.6
35	185.9	689.4	-1452.8	299.6	-1273.7	.0	1932.1
36	-693.3	1852.9	-4515.2	809.8	-2587.5	.0	5204.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLV

CONDIZIONE DI CARICO 36
spalla fissa - n777 _Sis24- n789 _Sis24

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34307.8	-5171.6	69777.7	-12695.2	-57228.0	-38263.5
2	28813.6	12016.3	65970.9	15027.2	49436.9	18316.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63121.4	6844.7	135748.6	2332.0	-66579.1	-203857.7

Punto di applic. carico verticale: Xv = 2.151 m Yv = -1.055 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.767	8.175	1.351	.678	-.068	-.620

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3256.2	1300.4	-2890.9	-358.6	1179.7	.0	3122.3
2	2715.9	442.4	-795.7	-60.6	240.7	.0	831.3
3	2175.6	342.8	-517.8	-9.7	-5.3	.0	517.8
4	1635.2	342.8	-517.8	41.3	-251.2	.0	575.5
5	1094.9	342.8	-517.8	92.2	-497.2	.0	717.8
6	554.6	342.8	-517.8	143.2	-743.1	.0	905.7
7	14.2	949.6	-2086.0	592.3	-2140.4	.0	2988.8
8	2958.9	1085.8	-2581.9	-238.9	801.2	.0	2703.4
9	2418.6	340.5	-611.3	-35.1	117.7	.0	622.6
10	1878.2	340.5	-611.3	15.8	-128.2	.0	624.6
11	1337.9	340.5	-611.3	66.8	-374.2	.0	716.8
12	797.6	340.5	-611.3	117.7	-620.1	.0	870.8
13	257.2	1085.8	-2581.9	442.0	-1678.7	.0	3079.7
14	2661.6	1447.9	-3616.8	-200.1	626.3	.0	3670.7
15	2121.2	459.2	-1057.8	-9.7	-5.3	.0	1057.8
16	1580.9	459.2	-1057.8	41.3	-251.2	.0	1087.2
17	1040.6	459.2	-1057.8	92.2	-497.2	.0	1168.8
18	500.2	1222.0	-3077.9	433.8	-1587.1	.0	3463.0
19	3492.5	-256.9	2363.8	-358.6	1179.7	.0	2641.8
20	2952.2	-180.1	1923.0	-60.6	240.7	.0	1938.0
21	2411.8	-163.6	1831.1	-9.7	-5.3	.0	1831.1

22	1871.5	-163.6	1831.1	41.3	-251.2	.0	1848.3
23	1331.2	-163.6	1831.1	92.2	-497.2	.0	1897.4
24	790.9	-163.6	1831.1	143.2	-743.1	.0	1976.2
25	250.5	-235.1	2229.1	592.3	-2140.4	.0	3090.3
26	3249.5	-371.3	2725.0	-238.9	801.2	.0	2840.4
27	2709.2	-204.7	2020.3	-35.1	117.7	.0	2023.8
28	2168.8	-204.7	2020.3	15.8	-128.2	.0	2024.4
29	1628.5	-204.7	2020.3	66.8	-374.2	.0	2054.7
30	1088.2	-204.7	2020.3	117.7	-620.1	.0	2113.4
31	547.9	-371.3	2725.0	442.0	-1678.7	.0	3200.6
32	3006.5	-564.7	3410.8	-200.1	626.3	.0	3467.9
33	2466.2	-280.1	2371.1	-9.7	-5.3	.0	2371.1
34	1925.8	-280.1	2371.1	41.3	-251.2	.0	2384.4
35	1385.5	-280.1	2371.1	92.2	-497.2	.0	2422.7
36	845.2	-507.5	3221.0	433.8	-1587.1	.0	3590.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

9.2 Spalla appoggi fissi – Analisi SLE

M A P - Matrix Analysis of Piles
Programma per l'analisi di palificate collegate da un plinto rigido
(C) G.Guiducci, S.G.I. - luglio 1994

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

Geometria Palificata

palo	vin	X m	Y m	Z m	axz deg	ayz deg	axy deg	Box m	Boy m
1	0	6.000	8.700	.000	.00	.00	.00	1.50	.00
2	0	4.000	8.700	.000	.00	.00	.00	1.50	.00
3	0	2.000	8.700	.000	.00	.00	.00	1.50	.00
4	0	.000	8.700	.000	.00	.00	.00	1.50	.00
5	0	-2.000	8.700	.000	.00	.00	.00	1.50	.00
6	0	-4.000	8.700	.000	.00	.00	.00	1.50	.00
7	0	-6.000	8.700	.000	.00	.00	.00	1.50	.00
8	0	5.000	10.700	.000	.00	.00	.00	1.50	.00
9	0	3.000	10.700	.000	.00	.00	.00	1.50	.00
10	0	1.000	10.700	.000	.00	.00	.00	1.50	.00
11	0	-1.000	10.700	.000	.00	.00	.00	1.50	.00
12	0	-3.000	10.700	.000	.00	.00	.00	1.50	.00
13	0	-5.000	10.700	.000	.00	.00	.00	1.50	.00
14	0	4.000	12.700	.000	.00	.00	.00	1.50	.00
15	0	2.000	12.700	.000	.00	.00	.00	1.50	.00
16	0	.000	12.700	.000	.00	.00	.00	1.50	.00
17	0	-2.000	12.700	.000	.00	.00	.00	1.50	.00
18	0	-4.000	12.700	.000	.00	.00	.00	1.50	.00
19	0	6.000	-8.700	.000	.00	.00	.00	1.50	.00
20	0	4.000	-8.700	.000	.00	.00	.00	1.50	.00
21	0	2.000	-8.700	.000	.00	.00	.00	1.50	.00
22	0	.000	-8.700	.000	.00	.00	.00	1.50	.00
23	0	-2.000	-8.700	.000	.00	.00	.00	1.50	.00
24	0	-4.000	-8.700	.000	.00	.00	.00	1.50	.00
25	0	-6.000	-8.700	.000	.00	.00	.00	1.50	.00
26	0	5.000	-10.700	.000	.00	.00	.00	1.50	.00
27	0	3.000	-10.700	.000	.00	.00	.00	1.50	.00
28	0	1.000	-10.700	.000	.00	.00	.00	1.50	.00
29	0	-1.000	-10.700	.000	.00	.00	.00	1.50	.00
30	0	-3.000	-10.700	.000	.00	.00	.00	1.50	.00
31	0	-5.000	-10.700	.000	.00	.00	.00	1.50	.00
32	0	4.000	-12.700	.000	.00	.00	.00	1.50	.00
33	0	2.000	-12.700	.000	.00	.00	.00	1.50	.00
34	0	.000	-12.700	.000	.00	.00	.00	1.50	.00
35	0	-2.000	-12.700	.000	.00	.00	.00	1.50	.00
36	0	-4.000	-12.700	.000	.00	.00	.00	1.50	.00

vin = 0 - incastro; 1 - cerniera; 2 - appoggio
X, Y, Z = Coordinate testa pali
axz = Inclinazione palo nel piano Xp Z rispetto alla verticale
(positiva se verso Xp positivo)
ayz = Inclinazione palo nel piano Yp Z rispetto alla verticale
(positiva se verso Yp positivo)
axy = Rotazione assi Xp Yp (positiva se antioraria)
Box = Lato dell'elemento parallelo all'asse Xp
Boy = Lato dell'elemento parallelo all'asse Yp
se Boy = 0 D = Box: diametro
altrimenti D = $\sqrt{\text{Box} * \text{Boy} * 1.273}$: diametro equivalente

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 Caratterizzazione dei pali soggetti a carichi assiali e torsionali
 (uguali per tutti i pali)

palo	AK kN/m	TK kN*m/rad
1	200000.	.0

 AK = Rigidezza assiale palo-terreno
 TK = Rigidezza torsionale palo-terreno

 Baricentro palificata: Xg = .000 m Yg = .000 m
 Rotazione direzioni princip. di inerzia: .00 deg

Caratterizzazione del terreno per pali soggetti a carichi trasversali

Terreno tipo 1

Prof. m	E kN/m2
.00	33750.0
3.00	35250.0
3.10	150000.0
8.00	150000.0
8.10	36750.0
13.00	44250.0
13.10	150000.0
26.00	150000.0
26.10	52500.0
60.00	75000.0

Caratterizzazione dei pali soggetti a carichi trasversali

palo	Lp m	EJx kN*m2	Itx	Ridx	EJy kN*m2	Ity	Ridy
1	50.00	7455147.	1	.300	7455147.	1	.250
2	50.00	7455147.	1	.080	7455147.	1	.050
3	50.00	7455147.	1	.060	7455147.	1	.050
4	50.00	7455147.	1	.060	7455147.	1	.050
5	50.00	7455147.	1	.060	7455147.	1	.050
6	50.00	7455147.	1	.060	7455147.	1	.050
7	50.00	7455147.	1	.200	7455147.	1	.250
8	50.00	7455147.	1	.200	7455147.	1	.200
9	50.00	7455147.	1	.050	7455147.	1	.050
10	50.00	7455147.	1	.050	7455147.	1	.050
11	50.00	7455147.	1	.050	7455147.	1	.050
12	50.00	7455147.	1	.050	7455147.	1	.050
13	50.00	7455147.	1	.200	7455147.	1	.200
14	50.00	7455147.	1	.250	7455147.	1	.250
15	50.00	7455147.	1	.060	7455147.	1	.050
16	50.00	7455147.	1	.060	7455147.	1	.050
17	50.00	7455147.	1	.060	7455147.	1	.050
18	50.00	7455147.	1	.200	7455147.	1	.250
19	50.00	7455147.	1	.300	7455147.	1	.250
20	50.00	7455147.	1	.080	7455147.	1	.050
21	50.00	7455147.	1	.060	7455147.	1	.050
22	50.00	7455147.	1	.060	7455147.	1	.050
23	50.00	7455147.	1	.060	7455147.	1	.050
24	50.00	7455147.	1	.060	7455147.	1	.050
25	50.00	7455147.	1	.200	7455147.	1	.250
26	50.00	7455147.	1	.200	7455147.	1	.200
27	50.00	7455147.	1	.050	7455147.	1	.050
28	50.00	7455147.	1	.050	7455147.	1	.050
29	50.00	7455147.	1	.050	7455147.	1	.050
30	50.00	7455147.	1	.050	7455147.	1	.050
31	50.00	7455147.	1	.200	7455147.	1	.200

32	50.00	7455147.	1	.250	7455147.	1	.250
33	50.00	7455147.	1	.060	7455147.	1	.050
34	50.00	7455147.	1	.060	7455147.	1	.050
35	50.00	7455147.	1	.060	7455147.	1	.050
36	50.00	7455147.	1	.200	7455147.	1	.250

 Lp = Lunghezza palo (compreso eventuale tratto fuori terra)
 EJ = Rigidezza flessionale del palo
 It = Tipo di terreno
 Rid = Moltiplicatore del modulo di reazione orizzontale

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 1
 spalla fissa - n777 _FESS_1- n789 _FESS_1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32384.3	5092.6	69612.9	-14298.7	-53438.2	-36567.4
2	34058.5	3361.7	73538.7	15394.7	54979.1	39534.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.8	8454.3	143151.6	1096.0	19454.9	21488.1

Punto di applic. carico verticale: Xv = 2.155 m Yv = .293 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	9.277	1.466	.563	.028	.065

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3654.0	542.8	-207.2	109.4	-351.7	.0	408.2
2	3067.7	133.0	652.4	28.2	-114.6	.0	662.4
3	2481.4	89.6	747.8	22.9	-88.7	.0	753.0
4	1895.1	89.6	747.8	17.5	-62.8	.0	750.4
5	1308.8	89.6	747.8	12.1	-36.8	.0	748.7
6	722.4	89.6	747.8	6.8	-10.9	.0	747.9
7	136.1	369.9	142.3	9.2	-1.7	.0	142.3
8	3372.2	355.5	194.6	86.3	-285.6	.0	345.6
9	2785.9	61.7	822.5	25.6	-101.6	.0	828.7
10	2199.6	61.7	822.5	20.2	-75.7	.0	826.0
11	1613.3	61.7	822.5	14.8	-49.8	.0	824.0
12	1027.0	61.7	822.5	9.4	-23.9	.0	822.8
13	440.6	355.5	194.6	14.6	-24.2	.0	196.1
14	3090.4	425.2	77.1	92.7	-293.3	.0	303.3
15	2504.1	77.4	804.7	22.9	-88.7	.0	809.6
16	1917.8	77.4	804.7	17.5	-62.8	.0	807.1
17	1331.5	77.4	804.7	12.1	-36.8	.0	805.5
18	745.2	341.2	246.9	25.9	-60.0	.0	254.1
19	3555.2	707.0	-761.1	109.4	-351.7	.0	838.4
20	2968.8	198.6	365.8	28.2	-114.6	.0	383.3
21	2382.5	143.0	500.2	22.9	-88.7	.0	508.0

22	1796.2	143.0	500.2	17.5	-62.8	.0	504.1
23	1209.9	143.0	500.2	12.1	-36.8	.0	501.5
24	623.6	143.0	500.2	6.8	-10.9	.0	500.3
25	37.2	494.8	-312.5	9.2	-1.7	.0	312.5
26	3250.6	509.1	-364.8	86.3	-285.6	.0	463.3
27	2664.3	119.2	545.1	25.6	-101.6	.0	554.5
28	2078.0	119.2	545.1	20.2	-75.7	.0	550.3
29	1491.7	119.2	545.1	14.8	-49.8	.0	547.3
30	905.3	119.2	545.1	9.4	-23.9	.0	545.6
31	319.0	509.1	-364.8	14.6	-24.2	.0	365.6
32	2946.1	637.3	-663.7	92.7	-293.3	.0	725.6
33	2359.8	155.3	443.3	22.9	-88.7	.0	452.1
34	1773.5	155.3	443.3	17.5	-62.8	.0	447.7
35	1187.1	155.3	443.3	12.1	-36.8	.0	444.8
36	600.8	523.5	-417.1	25.9	-60.0	.0	421.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 2
 spalla fissa - n777 _FESS_2- n789 _FESS_2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34465.4	4257.9	76103.6	-15285.6	-57077.7	-37535.1
2	35007.3	3189.5	76532.0	15975.6	57094.6	39125.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
69472.7	7447.4	152635.6	690.0	5815.3	13022.3

Punto di applic. carico verticale: Xv = 2.197 m Yv = .084 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.649	9.059	1.511	.324	.010	.040

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3760.3	521.9	-87.0	67.1	-223.5	.0	239.8
2	3156.1	122.1	737.7	17.8	-77.9	.0	741.9
3	2551.8	80.2	827.2	14.5	-62.2	.0	829.5
4	1947.6	80.2	827.2	11.3	-46.5	.0	828.5
5	1343.4	80.2	827.2	8.0	-30.8	.0	827.7
6	739.2	80.2	827.2	4.7	-15.1	.0	827.3
7	135.0	352.6	250.6	6.4	-11.4	.0	250.8
8	3462.3	343.9	282.3	53.2	-183.2	.0	336.5
9	2858.0	55.2	888.1	16.1	-70.1	.0	890.9
10	2253.8	55.2	888.1	12.9	-54.4	.0	889.8
11	1649.6	55.2	888.1	9.6	-38.7	.0	888.9
12	1045.4	55.2	888.1	6.4	-23.0	.0	888.4
13	441.2	343.9	282.3	9.7	-24.8	.0	283.3
14	3164.2	419.1	145.8	57.0	-188.2	.0	238.0
15	2560.0	72.7	861.7	14.5	-62.2	.0	863.9
16	1955.8	72.7	861.7	11.3	-46.5	.0	862.9
17	1351.6	72.7	861.7	8.0	-30.8	.0	862.2
18	747.4	335.2	313.9	16.5	-46.8	.0	317.4
19	3724.6	621.4	-422.6	67.1	-223.5	.0	478.1
20	3120.4	161.8	564.1	17.8	-77.9	.0	569.4
21	2516.2	112.5	677.1	14.5	-62.2	.0	680.0

22	1912.0	112.5	677.1	11.3	-46.5	.0	678.7
23	1307.8	112.5	677.1	8.0	-30.8	.0	677.8
24	703.5	112.5	677.1	4.7	-15.1	.0	677.3
25	99.3	428.3	-25.1	6.4	-11.4	.0	27.5
26	3418.4	437.0	-56.7	53.2	-183.2	.0	191.8
27	2814.2	90.0	720.0	16.1	-70.1	.0	723.4
28	2210.0	90.0	720.0	12.9	-54.4	.0	722.0
29	1605.8	90.0	720.0	9.6	-38.7	.0	721.0
30	1001.6	90.0	720.0	6.4	-23.0	.0	720.4
31	397.3	437.0	-56.7	9.7	-24.8	.0	61.9
32	3112.2	547.7	-303.1	57.0	-188.2	.0	356.8
33	2508.0	120.0	642.6	14.5	-62.2	.0	645.6
34	1903.8	120.0	642.6	11.3	-46.5	.0	644.3
35	1299.6	120.0	642.6	8.0	-30.8	.0	643.4
36	695.4	445.7	-88.4	16.5	-46.8	.0	100.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

CONDIZIONE DI CARICO 3
spalla fissa - n777 _FESS_3- n789 _FESS_3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32384.3	5092.6	69612.9	-14298.7	-53438.2	-36567.4
2	34058.5	3361.7	73538.7	15394.7	54979.1	39534.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.8	8454.3	143151.6	1096.0	19454.9	21488.1

Punto di applic. carico verticale: Xv = 2.155 m Yv = .293 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	9.277	1.466	.563	.028	.065

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3654.0	542.8	-207.2	109.4	-351.7	.0	408.2
2	3067.7	133.0	652.4	28.2	-114.6	.0	662.4
3	2481.4	89.6	747.8	22.9	-88.7	.0	753.0
4	1895.1	89.6	747.8	17.5	-62.8	.0	750.4
5	1308.8	89.6	747.8	12.1	-36.8	.0	748.7
6	722.4	89.6	747.8	6.8	-10.9	.0	747.9
7	136.1	369.9	142.3	9.2	-1.7	.0	142.3
8	3372.2	355.5	194.6	86.3	-285.6	.0	345.6
9	2785.9	61.7	822.5	25.6	-101.6	.0	828.7
10	2199.6	61.7	822.5	20.2	-75.7	.0	826.0
11	1613.3	61.7	822.5	14.8	-49.8	.0	824.0
12	1027.0	61.7	822.5	9.4	-23.9	.0	822.8
13	440.6	355.5	194.6	14.6	-24.2	.0	196.1
14	3090.4	425.2	77.1	92.7	-293.3	.0	303.3
15	2504.1	77.4	804.7	22.9	-88.7	.0	809.6
16	1917.8	77.4	804.7	17.5	-62.8	.0	807.1
17	1331.5	77.4	804.7	12.1	-36.8	.0	805.5
18	745.2	341.2	246.9	25.9	-60.0	.0	254.1
19	3555.2	707.0	-761.1	109.4	-351.7	.0	838.4
20	2968.8	198.6	365.8	28.2	-114.6	.0	383.3
21	2382.5	143.0	500.2	22.9	-88.7	.0	508.0

22	1796.2	143.0	500.2	17.5	-62.8	.0	504.1
23	1209.9	143.0	500.2	12.1	-36.8	.0	501.5
24	623.6	143.0	500.2	6.8	-10.9	.0	500.3
25	37.2	494.8	-312.5	9.2	-1.7	.0	312.5
26	3250.6	509.1	-364.8	86.3	-285.6	.0	463.3
27	2664.3	119.2	545.1	25.6	-101.6	.0	554.5
28	2078.0	119.2	545.1	20.2	-75.7	.0	550.3
29	1491.7	119.2	545.1	14.8	-49.8	.0	547.3
30	905.3	119.2	545.1	9.4	-23.9	.0	545.6
31	319.0	509.1	-364.8	14.6	-24.2	.0	365.6
32	2946.1	637.3	-663.7	92.7	-293.3	.0	725.6
33	2359.8	155.3	443.3	22.9	-88.7	.0	452.1
34	1773.5	155.3	443.3	17.5	-62.8	.0	447.7
35	1187.1	155.3	443.3	12.1	-36.8	.0	444.8
36	600.8	523.5	-417.1	25.9	-60.0	.0	421.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

CONDIZIONE DI CARICO 4
spalla fissa - n777 _FESS_4- n789 _FESS_4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33449.1	3330.1	71021.4	-15364.7	-54389.4	-38366.3
2	32993.7	5124.2	72130.2	14268.7	55123.1	36075.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.8	8454.3	143151.6	-1096.0	-4139.1	-21487.8

Punto di applic. carico verticale: Xv = 2.155 m Yv = -.062 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	9.277	1.466	-.489	-.010	-.065

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3586.8	707.0	-761.1	-108.1	366.5	.0	844.7
2	3000.5	198.6	365.8	-28.8	131.3	.0	388.6
3	2414.2	143.0	500.2	-23.4	105.4	.0	511.2
4	1827.9	143.0	500.2	-18.1	79.4	.0	506.5
5	1241.6	143.0	500.2	-12.7	53.5	.0	503.0
6	655.2	143.0	500.2	-7.3	27.6	.0	501.0
7	68.9	494.8	-312.5	-7.8	16.5	.0	312.9
8	3289.6	509.1	-364.8	-85.5	301.1	.0	473.0
9	2703.3	119.2	545.1	-26.1	118.3	.0	557.8
10	2117.0	119.2	545.1	-20.8	92.4	.0	552.9
11	1530.6	119.2	545.1	-15.4	66.5	.0	549.1
12	944.3	119.2	545.1	-10.0	40.6	.0	546.6
13	358.0	509.1	-364.8	-13.8	39.7	.0	366.9
14	2992.4	637.3	-663.7	-91.4	308.2	.0	731.7
15	2406.0	155.3	443.3	-23.4	105.4	.0	455.6
16	1819.7	155.3	443.3	-18.1	79.4	.0	450.3
17	1233.4	155.3	443.3	-12.7	53.5	.0	446.5
18	647.1	523.5	-417.1	-24.5	74.8	.0	423.7
19	3622.4	542.8	-207.2	-108.1	366.5	.0	421.0
20	3036.0	133.0	652.4	-28.8	131.3	.0	665.4
21	2449.7	89.6	747.8	-23.4	105.4	.0	755.2

22	1863.4	89.6	747.8	-18.1	79.4	.0	752.0
23	1277.1	89.6	747.8	-12.7	53.5	.0	749.7
24	690.8	89.6	747.8	-7.3	27.6	.0	748.3
25	104.4	369.9	142.3	-7.8	16.5	.0	143.3
26	3333.3	355.5	194.6	-85.5	301.1	.0	358.5
27	2747.0	61.7	822.5	-26.1	118.3	.0	830.9
28	2160.6	61.7	822.5	-20.8	92.4	.0	827.6
29	1574.3	61.7	822.5	-15.4	66.5	.0	825.2
30	988.0	61.7	822.5	-10.0	40.6	.0	823.5
31	401.7	355.5	194.6	-13.8	39.7	.0	198.6
32	3044.2	425.2	77.1	-91.4	308.2	.0	317.6
33	2457.9	77.4	804.7	-23.4	105.4	.0	811.6
34	1871.6	77.4	804.7	-18.1	79.4	.0	808.6
35	1285.2	77.4	804.7	-12.7	53.5	.0	806.5
36	698.9	341.2	246.9	-24.5	74.8	.0	258.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 5
 spalla fissa - n777 _FESS_5- n789 _FESS_5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32552.8	4883.0	69406.8	-14421.8	-53724.1	-36005.3
2	34345.0	3154.3	73813.4	15517.8	55484.9	39034.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66897.8	8037.3	143220.2	1096.0	20937.3	21526.0

Punto di applic. carico verticale: Xv = 2.141 m Yv = .313 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.291	9.058	1.452	.570	.030	.066

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3653.7	517.5	-136.7	109.6	-350.6	.0	376.3
2	3072.7	123.7	681.9	28.2	-113.1	.0	691.2
3	2491.7	82.2	771.6	22.8	-87.1	.0	776.5
4	1910.8	82.2	771.6	17.4	-61.1	.0	774.0
5	1329.8	82.2	771.6	12.1	-35.2	.0	772.4
6	748.8	82.2	771.6	6.7	-9.2	.0	771.7
7	167.9	351.0	197.4	9.2	.0	.0	197.4
8	3375.3	336.7	249.7	86.5	-284.4	.0	378.5
9	2794.3	55.3	843.2	25.5	-100.1	.0	849.1
10	2213.3	55.3	843.2	20.1	-74.1	.0	846.4
11	1632.4	55.3	843.2	14.8	-48.2	.0	844.6
12	1051.4	55.3	843.2	9.4	-22.2	.0	843.5
13	470.4	336.7	249.7	14.6	-22.5	.0	250.7
14	3096.9	402.9	140.5	92.9	-292.1	.0	324.1
15	2515.9	69.9	828.6	22.8	-87.1	.0	833.2
16	1934.9	69.9	828.6	17.4	-61.1	.0	830.9
17	1353.9	69.9	828.6	12.1	-35.2	.0	829.4
18	773.0	322.3	302.1	25.9	-58.4	.0	307.7
19	3548.7	682.0	-691.5	109.6	-350.6	.0	775.3
20	2967.7	189.4	394.8	28.2	-113.1	.0	410.7
21	2386.7	135.7	523.6	22.8	-87.1	.0	530.8

22	1805.8	135.7	523.6	17.4	-61.1	.0	527.2
23	1224.8	135.7	523.6	12.1	-35.2	.0	524.8
24	643.8	135.7	523.6	6.7	-9.2	.0	523.7
25	62.9	476.1	-258.3	9.2	.0	.0	258.3
26	3246.1	490.5	-310.6	86.5	-284.4	.0	421.1
27	2665.2	112.9	565.3	25.5	-100.1	.0	574.1
28	2084.2	112.9	565.3	20.1	-74.1	.0	570.1
29	1503.2	112.9	565.3	14.8	-48.2	.0	567.4
30	922.2	112.9	565.3	9.4	-22.2	.0	565.7
31	341.3	490.5	-310.6	14.6	-22.5	.0	311.5
32	2943.6	615.4	-601.6	92.9	-292.1	.0	668.8
33	2362.6	148.0	466.6	22.8	-87.1	.0	474.6
34	1781.6	148.0	466.6	17.4	-61.1	.0	470.6
35	1200.7	148.0	466.6	12.1	-35.2	.0	467.9
36	619.7	504.9	-363.0	25.9	-58.4	.0	367.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 6
 spalla fissa - n777 _FESS_6- n789 _FESS_6

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34345.0	3153.8	73810.8	-15487.8	-56033.1	-38192.1
2	32552.7	4884.6	69414.5	14391.8	54271.4	35191.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66897.7	8038.4	143225.3	-1096.0	-20939.3	-21520.6

Punto di applic. carico verticale: Xv = 2.141 m Yv = -.313 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.291	9.059	1.453	-.570	-.030	-.065

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3548.8	682.0	-691.6	-109.6	350.5	.0	775.4
2	2967.8	189.4	394.8	-28.2	113.1	.0	410.7
3	2386.8	135.7	523.6	-22.8	87.1	.0	530.8
4	1805.8	135.7	523.6	-17.4	61.1	.0	527.2
5	1224.8	135.7	523.6	-12.1	35.2	.0	524.8
6	643.8	135.7	523.6	-6.7	9.2	.0	523.7
7	62.7	476.2	-258.3	-9.2	.0	.0	258.3
8	3246.2	490.5	-310.7	-86.5	284.3	.0	421.1
9	2665.2	112.9	565.3	-25.5	100.1	.0	574.1
10	2084.2	112.9	565.3	-20.1	74.1	.0	570.2
11	1503.2	112.9	565.3	-14.8	48.2	.0	567.4
12	922.2	112.9	565.3	-9.4	22.2	.0	565.8
13	341.2	490.5	-310.7	-14.6	22.5	.0	311.5
14	2943.6	615.5	-601.6	-92.9	292.1	.0	668.8
15	2362.6	148.0	466.6	-22.8	87.1	.0	474.7
16	1781.6	148.0	466.6	-17.4	61.1	.0	470.6
17	1200.6	148.0	466.6	-12.1	35.2	.0	467.9
18	619.6	504.9	-363.0	-25.9	58.4	.0	367.7
19	3653.8	517.6	-136.9	-109.6	350.5	.0	376.3
20	3072.8	123.7	681.8	-28.2	113.1	.0	691.1
21	2491.8	82.2	771.6	-22.8	87.1	.0	776.5

22	1910.8	82.2	771.6	-17.4	61.1	.0	774.0
23	1329.8	82.2	771.6	-12.1	35.2	.0	772.4
24	748.8	82.2	771.6	-6.7	9.2	.0	771.6
25	167.8	351.1	197.2	-9.2	.0	.0	197.2
26	3375.4	336.7	249.6	-86.5	284.3	.0	378.3
27	2794.4	55.3	843.1	-25.5	100.1	.0	849.1
28	2213.4	55.3	843.1	-20.1	74.1	.0	846.4
29	1632.3	55.3	843.1	-14.8	48.2	.0	844.5
30	1051.3	55.3	843.1	-9.4	22.2	.0	843.4
31	470.3	336.7	249.6	-14.6	22.5	.0	250.6
32	3096.9	403.0	140.3	-92.9	292.1	.0	324.0
33	2515.9	69.9	828.6	-22.8	87.1	.0	833.1
34	1934.9	69.9	828.6	-17.4	61.1	.0	830.8
35	1353.9	69.9	828.6	-12.1	35.2	.0	829.3
36	772.9	322.3	301.9	-25.9	58.4	.0	307.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

CONDIZIONE DI CARICO 7
spalla fissa - n777 _FESS_7 - n789 _FESS_7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33642.4	6242.7	82304.4	-14832.7	-55833.1	-45061.6
2	34287.4	5181.7	83168.9	15504.7	56067.1	46693.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67929.8	11424.4	165473.3	672.0	7135.5	12984.1

Punto di applic. carico verticale: Xv = 2.436 m Yv = .105 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.435	11.602	1.750	.322	.012	.040

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4006.8	772.5	-667.8	66.2	-218.7	.0	702.7
2	3307.0	208.6	561.1	17.4	-75.0	.0	566.1
3	2607.2	147.5	704.6	14.2	-59.4	.0	707.1
4	1907.3	147.5	704.6	10.9	-43.7	.0	705.9
5	1207.5	147.5	704.6	7.7	-28.0	.0	705.1
6	507.7	147.5	704.6	4.4	-12.4	.0	704.7
7	-192.1	536.3	-175.4	5.6	-7.2	.0	175.6
8	3661.6	527.6	-143.8	52.4	-178.8	.0	229.5
9	2961.8	112.3	795.2	15.8	-67.2	.0	798.0
10	2261.9	112.3	795.2	12.5	-51.5	.0	796.8
11	1562.1	112.3	795.2	9.3	-35.9	.0	796.0
12	862.3	112.3	795.2	6.0	-20.2	.0	795.4
13	162.5	527.6	-143.8	9.0	-20.9	.0	145.4
14	3316.4	637.5	-362.0	56.1	-183.5	.0	405.9
15	2616.5	140.1	739.0	14.2	-59.4	.0	741.3
16	1916.7	140.1	739.0	10.9	-43.7	.0	740.3
17	1216.9	140.1	739.0	7.7	-28.0	.0	739.5
18	517.1	518.9	-112.3	15.7	-42.5	.0	120.0
19	3966.0	871.7	-1002.5	66.2	-218.7	.0	1026.1
20	3266.2	248.2	387.9	17.4	-75.0	.0	395.1
21	2566.4	179.8	555.0	14.2	-59.4	.0	558.1

22	1866.5	179.8	555.0	10.9	-43.7	.0	556.7
23	1166.7	179.8	555.0	7.7	-28.0	.0	555.7
24	466.9	179.8	555.0	4.4	-12.4	.0	555.1
25	-232.9	611.7	-450.3	5.6	-7.2	.0	450.3
26	3611.4	620.4	-481.9	52.4	-178.8	.0	514.0
27	2911.6	147.0	627.6	15.8	-67.2	.0	631.2
28	2211.8	147.0	627.6	12.5	-51.5	.0	629.7
29	1511.9	147.0	627.6	9.3	-35.9	.0	628.6
30	812.1	147.0	627.6	6.0	-20.2	.0	627.9
31	112.3	620.4	-481.9	9.0	-20.9	.0	482.3
32	3256.8	765.7	-809.6	56.1	-183.5	.0	830.2
33	2557.0	187.2	520.6	14.2	-59.4	.0	523.9
34	1857.2	187.2	520.6	10.9	-43.7	.0	522.4
35	1157.3	187.2	520.6	7.7	-28.0	.0	521.3
36	457.5	629.1	-513.4	15.7	-42.5	.0	515.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 7
 spalla fissa - n777 _FESS_7 - n789 _FESS_7

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	772.5	-667.8	66.2	-218.7	775.4	702.7
1.56	614.6	407.8	59.0	-121.0	617.4	425.4
3.13	419.6	1268.9	47.9	-33.9	422.3	1269.4
4.69	91.7	1637.4	26.1	22.8	95.4	1637.6
6.25	-95.2	1610.9	10.1	50.0	95.8	1611.6
7.81	-178.6	1380.3	-.8	56.4	178.6	1381.4
9.38	-190.1	1083.4	-4.1	51.2	190.1	1084.6
10.94	-182.8	790.4	-5.1	43.9	182.9	791.7
12.50	-168.6	514.3	-5.6	35.5	168.7	515.5
15.00	-105.2	155.2	-5.2	21.6	105.3	156.7
17.50	-44.4	-23.9	-3.7	10.2	44.5	26.0
20.00	-8.6	-82.6	-2.1	2.9	8.8	82.7
22.50	6.9	-79.5	-.9	-.7	7.0	79.5
25.00	9.5	-55.9	-.1	-1.9	9.5	55.9
29.17	6.5	-21.9	.2	-1.4	6.5	21.9
33.33	2.9	-2.7	.1	-.7	2.9	2.8
37.50	.5	3.8	.1	-.2	.5	3.8
43.75	-.5	2.3	.0	.0	.5	2.3
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

CONDIZIONE DI CARICO 7
spalla fissa - n777 _FESS_7 - n789 _FESS_7

Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 25
(riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	611.7	-450.3	5.6	-7.2	611.8	450.3
1.56	498.9	412.2	4.6	.8	498.9	412.2
3.13	354.2	1119.5	3.3	7.4	354.2	1119.5
4.69	101.6	1454.7	1.1	10.6	101.6	1454.7
6.25	-55.1	1474.4	-.3	11.0	55.1	1474.5
7.81	-138.2	1311.2	-1.1	9.8	138.2	1311.3
9.38	-155.9	1071.6	-1.2	8.0	155.9	1071.6
10.94	-155.0	827.4	-1.2	6.0	155.0	827.4
12.50	-147.9	589.5	-1.1	4.2	147.9	589.6
15.00	-105.6	259.6	-.8	1.7	105.6	259.7
17.50	-57.7	58.8	-.4	.2	57.7	58.8
20.00	-23.4	-37.9	-.1	-.4	23.4	37.9
22.50	-3.5	-67.5	.0	-.5	3.5	67.5
25.00	5.5	-62.7	.1	-.4	5.5	62.7
29.17	6.3	-34.2	.0	-.2	6.3	34.2
33.33	4.0	-12.3	.0	-.1	4.0	12.3
37.50	1.5	-1.0	.0	.0	1.5	1.0
43.75	-.2	1.9	.0	.0	.2	1.9
50.00	.0	.0	.0	.0	.0	.0

Tris = (Txp² + Typ²)^{0.5}
Mris = (Mxp² + Myp²)^{0.5}

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 7
 spalla fissa - n777 _FESS_7 - n789 _FESS_7

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	871.7	-1002.5	66.2	-218.7	874.2	1026.1
1.56	703.0	219.7	59.0	-121.0	705.5	250.8
3.13	491.3	1211.1	47.9	-33.9	493.6	1211.6
4.69	130.5	1664.1	26.1	22.8	133.1	1664.3
6.25	-80.4	1677.8	10.1	50.0	81.0	1678.5
7.81	-179.8	1456.5	-.8	56.4	179.8	1457.6
9.38	-196.1	1151.9	-4.1	51.2	196.1	1153.0
10.94	-190.2	848.3	-5.1	43.9	190.3	849.5
12.50	-176.5	560.1	-5.6	35.5	176.6	561.2
15.00	-112.3	181.6	-5.2	21.6	112.4	182.9
17.50	-49.2	-12.6	-3.7	10.2	49.3	16.2
20.00	-11.1	-80.3	-2.1	2.9	11.3	80.4
22.50	6.0	-81.2	-.9	-.7	6.1	81.2
25.00	9.5	-58.6	-.1	-1.9	9.5	58.6
29.17	6.7	-23.5	.2	-1.4	6.7	23.6
33.33	3.1	-3.4	.1	-.7	3.1	3.5
37.50	.6	3.7	.1	-.2	.6	3.7
43.75	-.5	2.4	.0	.0	.5	2.4
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

CONDIZIONE DI CARICO 8
spalla fissa - n777 _FESS_8- n789 _FESS_8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33642.4	2715.9	64322.2	-14954.1	-55277.4	-29249.3
2	34287.3	1656.4	65186.0	15626.1	55510.6	30853.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67929.7	4372.3	129508.2	672.0	7133.7	12940.6

Punto di applic. carico verticale: Xv = 1.907 m Yv = .105 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.435	6.652	1.217	.322	.012	.039

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3367.3	318.0	275.3	66.1	-218.4	.0	351.4
2	2880.6	57.4	772.9	17.4	-74.9	.0	776.5
3	2394.0	31.3	820.6	14.1	-59.3	.0	822.7
4	1907.3	31.3	820.6	10.9	-43.7	.0	821.8
5	1420.7	31.3	820.6	7.7	-28.1	.0	821.1
6	934.0	31.3	820.6	4.4	-12.5	.0	820.7
7	447.4	206.2	485.4	5.8	-7.6	.0	485.5
8	3128.6	197.5	516.9	52.3	-178.5	.0	546.9
9	2642.0	14.7	858.9	15.8	-67.1	.0	861.5
10	2155.3	14.7	858.9	12.5	-51.5	.0	860.4
11	1668.7	14.7	858.9	9.3	-35.9	.0	859.6
12	1182.1	14.7	858.9	6.1	-20.3	.0	859.1
13	695.4	197.5	516.9	9.1	-21.1	.0	517.3
14	2890.0	243.1	447.2	56.0	-183.2	.0	483.2
15	2403.4	23.9	854.9	14.1	-59.3	.0	856.9
16	1916.7	23.9	854.9	10.9	-43.7	.0	856.0
17	1430.1	23.9	854.9	7.7	-28.1	.0	855.3
18	943.4	188.9	548.4	15.8	-42.7	.0	550.0
19	3326.5	416.8	-58.3	66.1	-218.4	.0	226.0
20	2839.8	96.9	600.3	17.4	-74.9	.0	604.9
21	2353.2	63.4	671.5	14.1	-59.3	.0	674.1

22	1866.5	63.4	671.5	10.9	-43.7	.0	672.9
23	1379.9	63.4	671.5	7.7	-28.1	.0	672.1
24	893.3	63.4	671.5	4.4	-12.5	.0	671.6
25	406.6	281.4	211.5	5.8	-7.6	.0	211.6
26	3078.5	290.0	180.0	52.3	-178.5	.0	253.5
27	2591.8	49.3	691.8	15.8	-67.1	.0	695.1
28	2105.2	49.3	691.8	12.5	-51.5	.0	693.7
29	1618.5	49.3	691.8	9.3	-35.9	.0	692.7
30	1131.9	49.3	691.8	6.1	-20.3	.0	692.1
31	645.2	290.0	180.0	9.1	-21.1	.0	181.2
32	2830.5	370.9	1.1	56.0	-183.2	.0	183.2
33	2343.8	70.8	637.2	14.1	-59.3	.0	640.0
34	1857.2	70.8	637.2	10.9	-43.7	.0	638.7
35	1370.5	70.8	637.2	7.7	-28.1	.0	637.8
36	883.9	298.6	148.5	15.8	-42.7	.0	154.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

CONDIZIONE DI CARICO 9
spalla fissa - n777 _FESS_9- n789 _FESS_9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33642.4	6242.7	82304.4	-14832.7	-55833.1	-45061.6
2	34287.4	5181.7	83168.9	15504.7	56067.1	46693.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67929.8	11424.4	165473.3	672.0	7135.5	12984.1

Punto di applic. carico verticale: Xv = 2.436 m Yv = .105 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.435	11.602	1.750	.322	.012	.040

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4006.8	772.5	-667.8	66.2	-218.7	.0	702.7
2	3307.0	208.6	561.1	17.4	-75.0	.0	566.1
3	2607.2	147.5	704.6	14.2	-59.4	.0	707.1
4	1907.3	147.5	704.6	10.9	-43.7	.0	705.9
5	1207.5	147.5	704.6	7.7	-28.0	.0	705.1
6	507.7	147.5	704.6	4.4	-12.4	.0	704.7
7	-192.1	536.3	-175.4	5.6	-7.2	.0	175.6
8	3661.6	527.6	-143.8	52.4	-178.8	.0	229.5
9	2961.8	112.3	795.2	15.8	-67.2	.0	798.0
10	2261.9	112.3	795.2	12.5	-51.5	.0	796.8
11	1562.1	112.3	795.2	9.3	-35.9	.0	796.0
12	862.3	112.3	795.2	6.0	-20.2	.0	795.4
13	162.5	527.6	-143.8	9.0	-20.9	.0	145.4
14	3316.4	637.5	-362.0	56.1	-183.5	.0	405.9
15	2616.5	140.1	739.0	14.2	-59.4	.0	741.3
16	1916.7	140.1	739.0	10.9	-43.7	.0	740.3
17	1216.9	140.1	739.0	7.7	-28.0	.0	739.5
18	517.1	518.9	-112.3	15.7	-42.5	.0	120.0
19	3966.0	871.7	-1002.5	66.2	-218.7	.0	1026.1
20	3266.2	248.2	387.9	17.4	-75.0	.0	395.1
21	2566.4	179.8	555.0	14.2	-59.4	.0	558.1

22	1866.5	179.8	555.0	10.9	-43.7	.0	556.7
23	1166.7	179.8	555.0	7.7	-28.0	.0	555.7
24	466.9	179.8	555.0	4.4	-12.4	.0	555.1
25	-232.9	611.7	-450.3	5.6	-7.2	.0	450.3
26	3611.4	620.4	-481.9	52.4	-178.8	.0	514.0
27	2911.6	147.0	627.6	15.8	-67.2	.0	631.2
28	2211.8	147.0	627.6	12.5	-51.5	.0	629.7
29	1511.9	147.0	627.6	9.3	-35.9	.0	628.6
30	812.1	147.0	627.6	6.0	-20.2	.0	627.9
31	112.3	620.4	-481.9	9.0	-20.9	.0	482.3
32	3256.8	765.7	-809.6	56.1	-183.5	.0	830.2
33	2557.0	187.2	520.6	14.2	-59.4	.0	523.9
34	1857.2	187.2	520.6	10.9	-43.7	.0	522.4
35	1157.3	187.2	520.6	7.7	-28.0	.0	521.3
36	457.5	629.1	-513.4	15.7	-42.5	.0	515.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 9
 spalla fissa - n777 _FESS_9- n789 _FESS_9

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	871.7	-1002.5	66.2	-218.7	874.2	1026.1
1.56	703.0	219.7	59.0	-121.0	705.5	250.8
3.13	491.3	1211.1	47.9	-33.9	493.6	1211.6
4.69	130.5	1664.1	26.1	22.8	133.1	1664.3
6.25	-80.4	1677.8	10.1	50.0	81.0	1678.5
7.81	-179.8	1456.5	-.8	56.4	179.8	1457.6
9.38	-196.1	1151.9	-4.1	51.2	196.1	1153.0
10.94	-190.2	848.3	-5.1	43.9	190.3	849.5
12.50	-176.5	560.1	-5.6	35.5	176.6	561.2
15.00	-112.3	181.6	-5.2	21.6	112.4	182.9
17.50	-49.2	-12.6	-3.7	10.2	49.3	16.2
20.00	-11.1	-80.3	-2.1	2.9	11.3	80.4
22.50	6.0	-81.2	-.9	-.7	6.1	81.2
25.00	9.5	-58.6	-.1	-1.9	9.5	58.6
29.17	6.7	-23.5	.2	-1.4	6.7	23.6
33.33	3.1	-3.4	.1	-.7	3.1	3.5
37.50	.6	3.7	.1	-.2	.6	3.7
43.75	-.5	2.4	.0	.0	.5	2.4
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 9
 spalla fissa - n777 _FESS_9- n789 _FESS_9

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 25
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	611.7	-450.3	5.6	-7.2	611.8	450.3
1.56	498.9	412.2	4.6	.8	498.9	412.2
3.13	354.2	1119.5	3.3	7.4	354.2	1119.5
4.69	101.6	1454.7	1.1	10.6	101.6	1454.7
6.25	-55.1	1474.4	-.3	11.0	55.1	1474.5
7.81	-138.2	1311.2	-1.1	9.8	138.2	1311.3
9.38	-155.9	1071.6	-1.2	8.0	155.9	1071.6
10.94	-155.0	827.4	-1.2	6.0	155.0	827.4
12.50	-147.9	589.5	-1.1	4.2	147.9	589.6
15.00	-105.6	259.6	-.8	1.7	105.6	259.7
17.50	-57.7	58.8	-.4	.2	57.7	58.8
20.00	-23.4	-37.9	-.1	-.4	23.4	37.9
22.50	-3.5	-67.5	.0	-.5	3.5	67.5
25.00	5.5	-62.7	.1	-.4	5.5	62.7
29.17	6.3	-34.2	.0	-.2	6.3	34.2
33.33	4.0	-12.3	.0	-.1	4.0	12.3
37.50	1.5	-1.0	.0	.0	1.5	1.0
43.75	-.2	1.9	.0	.0	.2	1.9
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

CONDIZIONE DI CARICO 10
spalla fissa - n777 _FESS_10- n789 _FESS_10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33642.4	2715.9	64322.2	-14954.1	-55277.4	-29249.3
2	34287.3	1656.4	65186.0	15626.1	55510.6	30853.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67929.7	4372.3	129508.2	672.0	7133.7	12940.6

Punto di applic. carico verticale: Xv = 1.907 m Yv = .105 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.435	6.652	1.217	.322	.012	.039

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3367.3	318.0	275.3	66.1	-218.4	.0	351.4
2	2880.6	57.4	772.9	17.4	-74.9	.0	776.5
3	2394.0	31.3	820.6	14.1	-59.3	.0	822.7
4	1907.3	31.3	820.6	10.9	-43.7	.0	821.8
5	1420.7	31.3	820.6	7.7	-28.1	.0	821.1
6	934.0	31.3	820.6	4.4	-12.5	.0	820.7
7	447.4	206.2	485.4	5.8	-7.6	.0	485.5
8	3128.6	197.5	516.9	52.3	-178.5	.0	546.9
9	2642.0	14.7	858.9	15.8	-67.1	.0	861.5
10	2155.3	14.7	858.9	12.5	-51.5	.0	860.4
11	1668.7	14.7	858.9	9.3	-35.9	.0	859.6
12	1182.1	14.7	858.9	6.1	-20.3	.0	859.1
13	695.4	197.5	516.9	9.1	-21.1	.0	517.3
14	2890.0	243.1	447.2	56.0	-183.2	.0	483.2
15	2403.4	23.9	854.9	14.1	-59.3	.0	856.9
16	1916.7	23.9	854.9	10.9	-43.7	.0	856.0
17	1430.1	23.9	854.9	7.7	-28.1	.0	855.3
18	943.4	188.9	548.4	15.8	-42.7	.0	550.0
19	3326.5	416.8	-58.3	66.1	-218.4	.0	226.0
20	2839.8	96.9	600.3	17.4	-74.9	.0	604.9
21	2353.2	63.4	671.5	14.1	-59.3	.0	674.1

22	1866.5	63.4	671.5	10.9	-43.7	.0	672.9
23	1379.9	63.4	671.5	7.7	-28.1	.0	672.1
24	893.3	63.4	671.5	4.4	-12.5	.0	671.6
25	406.6	281.4	211.5	5.8	-7.6	.0	211.6
26	3078.5	290.0	180.0	52.3	-178.5	.0	253.5
27	2591.8	49.3	691.8	15.8	-67.1	.0	695.1
28	2105.2	49.3	691.8	12.5	-51.5	.0	693.7
29	1618.5	49.3	691.8	9.3	-35.9	.0	692.7
30	1131.9	49.3	691.8	6.1	-20.3	.0	692.1
31	645.2	290.0	180.0	9.1	-21.1	.0	181.2
32	2830.5	370.9	1.1	56.0	-183.2	.0	183.2
33	2343.8	70.8	637.2	14.1	-59.3	.0	640.0
34	1857.2	70.8	637.2	10.9	-43.7	.0	638.7
35	1370.5	70.8	637.2	7.7	-28.1	.0	637.8
36	883.9	298.6	148.5	15.8	-42.7	.0	154.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA fissa - SLE FESS

CONDIZIONE DI CARICO 11
spalla fissa - n777 _FESS_11- n789 _FESS_11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32384.3	4847.9	68358.5	-14307.2	-53399.4	-35461.7
2	34058.5	3113.4	72278.8	15403.2	54940.0	38427.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.8	7961.3	140637.3	1096.0	19454.5	21525.3

Punto di applic. carico verticale: Xv = 2.117 m Yv = .293 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	8.931	1.429	.563	.028	.066

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3609.3	510.9	-140.7	109.5	-352.0	.0	379.1
2	3037.9	122.4	667.4	28.3	-114.7	.0	677.2
3	2466.5	81.5	756.1	22.9	-88.7	.0	761.3
4	1895.1	81.5	756.1	17.5	-62.8	.0	758.7
5	1323.7	81.5	756.1	12.1	-36.8	.0	757.0
6	752.2	81.5	756.1	6.7	-10.8	.0	756.2
7	180.8	346.7	189.0	9.1	-1.4	.0	189.0
8	3335.0	332.3	241.3	86.4	-285.9	.0	374.1
9	2763.6	54.8	827.2	25.6	-101.7	.0	833.4
10	2192.1	54.8	827.2	20.2	-75.7	.0	830.6
11	1620.7	54.8	827.2	14.8	-49.8	.0	828.7
12	1049.3	54.8	827.2	9.4	-23.8	.0	827.5
13	477.9	332.3	241.3	14.5	-24.0	.0	242.5
14	3060.6	397.4	134.3	92.7	-293.6	.0	322.8
15	2489.2	69.2	813.1	22.9	-88.7	.0	818.0
16	1917.8	69.2	813.1	17.5	-62.8	.0	815.6
17	1346.4	69.2	813.1	12.1	-36.8	.0	814.0
18	775.0	317.9	293.7	25.8	-59.8	.0	299.7
19	3510.4	675.3	-695.6	109.5	-352.0	.0	779.6
20	2939.0	188.1	380.4	28.3	-114.7	.0	397.3
21	2367.6	134.9	508.1	22.9	-88.7	.0	515.8

22	1796.2	134.9	508.1	17.5	-62.8	.0	512.0
23	1224.8	134.9	508.1	12.1	-36.8	.0	509.4
24	653.4	134.9	508.1	6.7	-10.8	.0	508.2
25	81.9	471.8	-266.7	9.1	-1.4	.0	266.7
26	3213.4	486.2	-319.0	86.4	-285.9	.0	428.4
27	2642.0	112.4	549.3	25.6	-101.7	.0	558.6
28	2070.5	112.4	549.3	20.2	-75.7	.0	554.5
29	1499.1	112.4	549.3	14.8	-49.8	.0	551.6
30	927.7	112.4	549.3	9.4	-23.8	.0	549.8
31	356.3	486.2	-319.0	14.5	-24.0	.0	319.9
32	2916.3	609.9	-607.7	92.7	-293.6	.0	674.9
33	2344.9	147.2	451.1	22.9	-88.7	.0	459.7
34	1773.5	147.2	451.1	17.5	-62.8	.0	455.4
35	1202.0	147.2	451.1	12.1	-36.8	.0	452.6
36	630.6	500.5	-371.4	25.8	-59.8	.0	376.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 12
 spalla fissa - n777 _FESS_12- n789 _FESS_12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33408.4	4305.0	75774.4	-15238.6	-54545.5	-42522.0
2	33034.4	6050.3	77072.3	14334.6	55171.0	40596.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.8	10355.3	152846.7	-904.0	-3376.3	-20599.9

Punto di applic. carico verticale: Xv = 2.300 m Yv = -.051 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	10.612	1.609	-.403	-.008	-.063

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3762.4	826.2	-1004.0	-95.8	325.7	.0	1055.5
2	3118.6	238.0	314.6	-25.2	115.3	.0	335.0
3	2474.9	173.3	474.0	-20.1	90.4	.0	482.5
4	1831.1	173.3	474.0	-14.9	65.6	.0	478.5
5	1187.3	173.3	474.0	-9.8	40.7	.0	475.7
6	543.5	173.3	474.0	-4.6	15.9	.0	474.2
7	-100.3	581.2	-481.4	.2	-9.8	.0	481.5
8	3437.2	595.0	-531.5	-75.3	265.9	.0	594.3
9	2793.4	144.3	533.6	-22.6	102.9	.0	543.4
10	2149.6	144.3	533.6	-17.5	78.0	.0	539.2
11	1505.8	144.3	533.6	-12.3	53.1	.0	536.2
12	862.0	144.3	533.6	-7.2	28.3	.0	534.3
13	218.2	595.0	-531.5	-6.5	15.3	.0	531.7
14	3111.9	739.3	-866.7	-79.8	269.8	.0	907.8
15	2468.2	185.0	419.4	-20.1	90.4	.0	429.0
16	1824.4	185.0	419.4	-14.9	65.6	.0	424.5
17	1180.6	185.0	419.4	-9.8	40.7	.0	421.4
18	536.8	608.7	-581.6	-15.8	46.2	.0	583.4
19	3791.6	668.8	-473.0	-95.8	325.7	.0	574.3
20	3147.8	175.1	589.3	-25.2	115.3	.0	600.4
21	2504.0	122.1	711.3	-20.1	90.4	.0	717.0

22	1860.2	122.1	711.3	-14.9	65.6	.0	714.3
23	1216.4	122.1	711.3	-9.8	40.7	.0	712.5
24	572.6	122.1	711.3	-4.6	15.9	.0	711.5
25	-71.2	461.5	-45.3	.2	-9.8	.0	46.4
26	3473.0	447.7	4.8	-75.3	265.9	.0	265.9
27	2829.2	89.2	799.5	-22.6	102.9	.0	806.1
28	2185.4	89.2	799.5	-17.5	78.0	.0	803.3
29	1541.7	89.2	799.5	-12.3	53.1	.0	801.3
30	897.9	89.2	799.5	-7.2	28.3	.0	800.0
31	254.1	447.7	4.8	-6.5	15.3	.0	16.0
32	3154.5	535.9	-156.6	-79.8	269.8	.0	312.0
33	2510.7	110.3	765.9	-20.1	90.4	.0	771.2
34	1866.9	110.3	765.9	-14.9	65.6	.0	768.7
35	1223.1	110.3	765.9	-9.8	40.7	.0	767.0
36	579.3	434.0	54.9	-15.8	46.2	.0	71.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA fissa - SLE FESS

 CONDIZIONE DI CARICO 12
 spalla fissa - n777 _FESS_12- n789 _FESS_12

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	826.2	-1004.0	-95.8	325.7	831.7	1055.5
1.56	668.4	156.1	-85.7	184.0	673.8	241.3
3.13	469.5	1100.0	-70.0	57.3	474.7	1101.5
4.69	129.5	1537.4	-38.8	-26.0	135.2	1537.6
6.25	-70.3	1559.8	-15.6	-67.0	72.0	1561.2
7.81	-165.7	1358.5	.3	-77.7	165.7	1360.7
9.38	-181.8	1076.4	5.2	-71.2	181.9	1078.7
10.94	-176.8	794.5	6.8	-61.7	176.9	796.9
12.50	-164.3	526.5	7.5	-50.4	164.5	528.9
15.00	-105.0	173.5	7.3	-31.3	105.3	176.3
17.50	-46.4	-8.9	5.4	-15.2	46.7	17.6
20.00	-10.8	-73.3	3.1	-4.7	11.2	73.5
22.50	5.3	-75.1	1.4	.7	5.5	75.1
25.00	8.7	-54.5	.2	2.5	8.7	54.6
29.17	6.3	-22.0	-.2	1.9	6.3	22.1
33.33	2.9	-3.3	-.2	1.0	2.9	3.4
37.50	.5	3.3	-.1	.3	.6	3.4
43.75	-.5	2.2	.0	.0	.5	2.2
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 13
 spalla fissa - n777 _RARA_1- n789 _RARA_1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31948.2	5005.3	66959.9	-14034.8	-52584.7	-35261.5
2	33378.6	3273.0	69909.4	15094.8	53719.3	38040.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
65326.8	8278.3	136869.3	1060.0	16439.9	21314.2

Punto di applic. carico verticale: Xv = 2.095 m Yv = .252 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.073	8.974	1.408	.533	.025	.065

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3547.1	527.8	-220.7	106.8	-346.8	.0	411.0
2	2983.9	130.3	615.4	27.7	-114.7	.0	626.0
3	2420.7	88.2	708.6	22.3	-89.0	.0	714.2
4	1857.5	88.2	708.6	17.0	-63.3	.0	711.4
5	1294.3	88.2	708.6	11.7	-37.6	.0	709.6
6	731.1	88.2	708.6	6.4	-11.9	.0	708.7
7	167.9	360.2	118.9	7.4	.4	.0	118.9
8	3275.4	345.9	170.8	84.3	-281.9	.0	329.6
9	2712.2	60.9	782.0	25.0	-101.9	.0	788.6
10	2149.0	60.9	782.0	19.7	-76.1	.0	785.7
11	1585.8	60.9	782.0	14.4	-50.4	.0	783.6
12	1022.6	60.9	782.0	9.0	-24.7	.0	782.4
13	459.4	345.9	170.8	13.1	-22.6	.0	172.2
14	3003.6	413.0	57.8	90.3	-288.9	.0	294.6
15	2440.5	76.0	765.0	22.3	-89.0	.0	770.2
16	1877.3	76.0	765.0	17.0	-63.3	.0	767.7
17	1314.1	76.0	765.0	11.7	-37.6	.0	766.0
18	750.9	331.7	222.6	24.0	-57.5	.0	229.9
19	3461.3	690.7	-770.1	106.8	-346.8	.0	844.6
20	2898.1	195.4	331.2	27.7	-114.7	.0	350.5
21	2334.9	141.1	463.0	22.3	-89.0	.0	471.5

22	1771.7	141.1	463.0	17.0	-63.3	.0	467.3
23	1208.5	141.1	463.0	11.7	-37.6	.0	464.5
24	645.3	141.1	463.0	6.4	-11.9	.0	463.2
25	82.1	484.0	-332.3	7.4	.4	.0	332.3
26	3169.9	498.3	-384.1	84.3	-281.9	.0	476.4
27	2606.7	117.9	506.9	25.0	-101.9	.0	517.0
28	2043.5	117.9	506.9	19.7	-76.1	.0	512.5
29	1480.3	117.9	506.9	14.4	-50.4	.0	509.4
30	917.1	117.9	506.9	9.0	-24.7	.0	507.5
31	353.9	498.3	-384.1	13.1	-22.6	.0	384.8
32	2878.4	623.5	-677.0	90.3	-288.9	.0	736.0
33	2315.2	153.3	406.5	22.3	-89.0	.0	416.2
34	1752.0	153.3	406.5	17.0	-63.3	.0	411.4
35	1188.8	153.3	406.5	11.7	-37.6	.0	408.3
36	625.6	512.5	-436.0	24.0	-57.5	.0	439.7

 $M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 14
 spalla fissa - n777 _RARA_2- n789 _RARA_2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	36491.4	4410.7	86613.0	-16272.0	-60944.0	-41718.9
2	36985.4	3321.6	86795.5	17022.0	60789.9	43383.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
73476.8	7732.3	173408.5	750.0	5131.7	13317.7

Punto di applic. carico verticale: Xv = 2.360 m Yv = .070 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
10.205	9.905	1.692	.346	.010	.041

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4088.1	554.5	3.7	70.9	-237.3	.0	237.3
2	3411.3	124.7	878.6	18.9	-84.0	.0	882.6
3	2734.6	80.0	971.6	15.6	-67.9	.0	974.0
4	2057.9	80.0	971.6	12.3	-51.9	.0	973.0
5	1381.2	80.0	971.6	9.0	-35.8	.0	972.3
6	704.5	80.0	971.6	5.6	-19.7	.0	971.8
7	27.8	372.1	363.7	8.8	-20.4	.0	364.2
8	3753.6	363.3	396.1	56.3	-195.3	.0	441.6
9	3076.9	53.6	1034.3	17.3	-76.0	.0	1037.1
10	2400.2	53.6	1034.3	13.9	-59.9	.0	1036.0
11	1723.5	53.6	1034.3	10.6	-43.8	.0	1035.2
12	1046.8	53.6	1034.3	7.3	-27.8	.0	1034.7
13	370.0	363.3	396.1	11.8	-33.3	.0	397.5
14	3419.1	444.8	249.1	60.6	-201.1	.0	320.1
15	2742.4	72.4	1006.9	15.6	-67.9	.0	1009.2
16	2065.7	72.4	1006.9	12.3	-51.9	.0	1008.2
17	1389.0	72.4	1006.9	9.0	-35.8	.0	1007.5
18	712.3	354.4	428.5	19.2	-56.5	.0	432.2
19	4054.2	656.3	-339.6	70.9	-237.3	.0	414.3
20	3377.5	165.4	701.0	18.9	-84.0	.0	706.0
21	2700.8	113.1	818.2	15.6	-67.9	.0	821.0

22	2024.1	113.1	818.2	12.3	-51.9	.0	819.8
23	1347.4	113.1	818.2	9.0	-35.8	.0	818.9
24	670.7	113.1	818.2	5.6	-19.7	.0	818.4
25	-6.0	449.5	81.8	8.8	-20.4	.0	84.3
26	3712.0	458.4	49.4	56.3	-195.3	.0	201.4
27	3035.3	89.2	862.4	17.3	-76.0	.0	865.7
28	2358.6	89.2	862.4	13.9	-59.9	.0	864.4
29	1681.9	89.2	862.4	10.6	-43.8	.0	863.5
30	1005.2	89.2	862.4	7.3	-27.8	.0	862.8
31	328.5	458.4	49.4	11.8	-33.3	.0	59.5
32	3369.8	576.3	-210.0	60.6	-201.1	.0	290.8
33	2693.0	120.7	782.9	15.6	-67.9	.0	785.8
34	2016.3	120.7	782.9	12.3	-51.9	.0	784.6
35	1339.6	120.7	782.9	9.0	-35.8	.0	783.7
36	662.9	467.3	17.0	19.2	-56.5	.0	59.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 15
 spalla fissa - n777 _RARA_3- n789 _RARA_3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34915.4	4868.1	80388.8	-15432.7	-58175.5	-39597.1
2	35990.3	3102.2	81828.3	16552.7	58565.2	42283.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
70905.7	7970.3	162217.1	1120.0	11891.2	21581.8

Punto di applic. carico verticale: Xv = 2.288 m Yv = .168 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.848	9.657	1.607	.537	.020	.066

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3932.3	528.4	-1.9	110.2	-364.0	.0	364.0
2	3289.4	119.1	831.9	29.0	-124.9	.0	841.2
3	2646.5	76.6	920.6	23.6	-98.9	.0	925.9
4	2003.6	76.6	920.6	18.2	-72.8	.0	923.5
5	1360.7	76.6	920.6	12.8	-46.8	.0	921.8
6	717.8	76.6	920.6	7.4	-20.8	.0	920.9
7	74.9	354.8	341.0	9.6	-12.5	.0	341.3
8	3618.6	340.4	393.6	87.2	-297.7	.0	493.4
9	2975.7	49.1	991.2	26.3	-111.9	.0	997.5
10	2332.9	49.1	991.2	20.9	-85.9	.0	994.9
11	1690.0	49.1	991.2	15.5	-59.8	.0	993.0
12	1047.1	49.1	991.2	10.1	-33.8	.0	991.7
13	404.2	340.4	393.6	15.1	-35.1	.0	395.1
14	3305.0	410.1	280.1	93.4	-305.5	.0	414.5
15	2662.1	64.2	977.8	23.6	-98.9	.0	982.8
16	2019.2	64.2	977.8	18.2	-72.8	.0	980.5
17	1376.3	64.2	977.8	12.8	-46.8	.0	978.9
18	733.5	325.9	446.1	26.3	-71.1	.0	451.7
19	3864.3	693.3	-558.2	110.2	-364.0	.0	666.4
20	3221.4	185.0	544.0	29.0	-124.9	.0	558.2
21	2578.5	130.2	672.0	23.6	-98.9	.0	679.2

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

REV. 2

22	1935.6	130.2	672.0	18.2	-72.8	.0	675.9
23	1292.7	130.2	672.0	12.8	-46.8	.0	673.6
24	649.8	130.2	672.0	7.4	-20.8	.0	672.3
25	6.9	480.2	-115.8	9.6	-12.5	.0	116.4
26	3535.0	494.6	-168.3	87.2	-297.7	.0	341.9
27	2892.1	106.9	712.6	26.3	-111.9	.0	721.3
28	2249.2	106.9	712.6	20.9	-85.9	.0	717.7
29	1606.4	106.9	712.6	15.5	-59.8	.0	715.1
30	963.5	106.9	712.6	10.1	-33.8	.0	713.4
31	320.6	494.6	-168.3	15.1	-35.1	.0	171.9
32	3205.8	623.2	-463.9	93.4	-305.5	.0	555.4
33	2562.9	142.5	614.8	23.6	-98.9	.0	622.7
34	1920.0	142.5	614.8	18.2	-72.8	.0	619.1
35	1277.1	142.5	614.8	12.8	-46.8	.0	616.6
36	634.2	509.0	-220.8	26.3	-71.1	.0	232.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 16
 spalla fissa - n777 _RARA_4- n789 _RARA_4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35990.4	3099.0	81820.2	-16522.1	-59125.2	-41422.7
2	34915.4	4871.3	80397.0	15402.1	58734.8	38761.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
70905.8	7970.3	162217.2	-1120.0	-11892.9	-21625.0

Punto di applic. carico verticale: Xv = 2.288 m Yv = -.168 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.848	9.657	1.607	-.537	-.020	-.066

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3864.3	693.5	-558.7	-110.3	364.4	.0	667.1
2	3221.4	185.1	543.8	-29.0	125.0	.0	557.9
3	2578.5	130.2	671.7	-23.6	98.9	.0	679.0
4	1935.6	130.2	671.7	-18.2	72.8	.0	675.6
5	1292.7	130.2	671.7	-12.8	46.7	.0	673.3
6	649.8	130.2	671.7	-7.4	20.7	.0	672.0
7	6.9	480.3	-116.2	-9.5	12.2	.0	116.9
8	3535.0	494.8	-168.8	-87.3	297.9	.0	342.4
9	2892.1	106.9	712.3	-26.3	112.0	.0	721.0
10	2249.2	106.9	712.3	-20.9	85.9	.0	717.4
11	1606.3	106.9	712.3	-15.5	59.8	.0	714.8
12	963.5	106.9	712.3	-10.1	33.7	.0	713.1
13	320.6	494.8	-168.8	-15.0	34.9	.0	172.4
14	3205.8	623.4	-464.6	-93.5	305.7	.0	556.1
15	2562.9	142.6	614.4	-23.6	98.9	.0	622.3
16	1920.0	142.6	614.4	-18.2	72.8	.0	618.7
17	1277.1	142.6	614.4	-12.8	46.7	.0	616.2
18	634.2	509.2	-221.5	-26.3	70.9	.0	232.5
19	3932.3	528.3	-1.3	-110.3	364.4	.0	364.4
20	3289.4	119.1	832.1	-29.0	125.0	.0	841.5
21	2646.5	76.5	920.9	-23.6	98.9	.0	926.2

22	2003.6	76.5	920.9	-18.2	72.8	.0	923.8
23	1360.7	76.5	920.9	-12.8	46.7	.0	922.1
24	717.8	76.5	920.9	-7.4	20.7	.0	921.1
25	74.9	354.6	341.5	-9.5	12.2	.0	341.7
26	3618.6	340.2	394.1	-87.3	297.9	.0	494.1
27	2975.8	49.1	991.4	-26.3	112.0	.0	997.8
28	2332.9	49.1	991.4	-20.9	85.9	.0	995.2
29	1690.0	49.1	991.4	-15.5	59.8	.0	993.2
30	1047.1	49.1	991.4	-10.1	33.7	.0	992.0
31	404.2	340.2	394.1	-15.0	34.9	.0	395.7
32	3305.0	409.9	280.9	-93.5	305.7	.0	415.1
33	2662.1	64.2	978.2	-23.6	98.9	.0	983.1
34	2019.2	64.2	978.2	-18.2	72.8	.0	980.9
35	1376.3	64.2	978.2	-12.8	46.7	.0	979.3
36	733.5	325.8	446.7	-26.3	70.9	.0	452.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 17
 spalla fissa - n777 _RARA_5 - n789 _RARA_5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32885.6	5091.5	72162.3	-14621.6	-54396.6	-37650.4
2	34870.2	3366.8	77344.9	15741.6	56484.0	40821.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67755.8	8458.3	149507.2	1120.0	23322.6	21625.7

Punto di applic. carico verticale: Xv = 2.207 m Yv = .344 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.411	9.492	1.518	.592	.033	.066

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3761.9	547.6	-165.0	111.3	-353.3	.0	389.9
2	3154.5	131.9	701.5	28.6	-112.6	.0	710.5
3	2547.1	88.1	796.9	23.2	-86.5	.0	801.5
4	1939.7	88.1	796.9	17.8	-60.4	.0	799.1
5	1332.4	88.1	796.9	12.3	-34.3	.0	797.6
6	725.0	88.1	796.9	6.9	-8.2	.0	796.9
7	117.6	372.0	188.2	10.4	-1.1	.0	188.2
8	3471.5	357.5	240.8	87.9	-286.4	.0	374.2
9	2864.1	59.9	871.5	25.9	-99.5	.0	877.1
10	2256.7	59.9	871.5	20.5	-73.4	.0	874.6
11	1649.3	59.9	871.5	15.1	-47.3	.0	872.8
12	1041.9	59.9	871.5	9.6	-21.2	.0	871.7
13	434.5	357.5	240.8	15.6	-23.3	.0	242.0
14	3181.0	428.4	121.9	94.5	-294.6	.0	318.9
15	2573.6	75.7	854.1	23.2	-86.5	.0	858.5
16	1966.2	75.7	854.1	17.8	-60.4	.0	856.3
17	1358.9	75.7	854.1	12.3	-34.3	.0	854.8
18	751.5	343.1	293.5	27.2	-59.8	.0	299.5
19	3646.6	712.8	-722.4	111.3	-353.3	.0	804.2
20	3039.2	197.9	413.1	28.6	-112.6	.0	428.2
21	2431.9	141.8	547.7	23.2	-86.5	.0	554.5

22	1824.5	141.8	547.7	17.8	-60.4	.0	551.0
23	1217.1	141.8	547.7	12.3	-34.3	.0	548.7
24	609.7	141.8	547.7	6.9	-8.2	.0	547.7
25	2.3	497.6	-269.5	10.4	-1.1	.0	269.5
26	3329.7	512.1	-322.1	87.9	-286.4	.0	431.0
27	2722.3	117.7	592.3	25.9	-99.5	.0	600.6
28	2114.9	117.7	592.3	20.5	-73.4	.0	596.8
29	1507.5	117.7	592.3	15.1	-47.3	.0	594.2
30	900.1	117.7	592.3	9.6	-21.2	.0	592.7
31	292.7	512.1	-322.1	15.6	-23.3	.0	323.0
32	3012.7	641.9	-623.6	94.5	-294.6	.0	689.7
33	2405.4	154.1	490.4	23.2	-86.5	.0	498.0
34	1798.0	154.1	490.4	17.8	-60.4	.0	494.1
35	1190.6	154.1	490.4	12.3	-34.3	.0	491.6
36	583.2	526.5	-374.7	27.2	-59.8	.0	379.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 18
 spalla fissa - n777 _RARA_7- n789 _RARA_7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35132.9	6716.4	91912.5	-15580.7	-58712.2	-49843.6
2	35772.8	5658.0	92765.0	16240.7	58953.0	51455.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
70905.7	12374.4	184677.5	660.0	7087.8	12937.1

Punto di applic. carico verticale: Xv = 2.605 m Yv = .100 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.848	12.749	1.940	.317	.012	.039

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4317.9	845.4	-702.6	65.5	-216.2	.0	735.2
2	3541.8	226.8	641.8	17.2	-74.1	.0	646.0
3	2765.8	159.9	798.2	13.9	-58.4	.0	800.3
4	1989.8	159.9	798.2	10.7	-42.8	.0	799.4
5	1213.8	159.9	798.2	7.5	-27.2	.0	798.7
6	437.8	159.9	798.2	4.2	-11.6	.0	798.3
7	-338.3	586.1	-163.4	5.1	-5.5	.0	163.5
8	3934.5	577.5	-132.0	51.7	-176.7	.0	220.5
9	3158.5	121.7	895.4	15.6	-66.2	.0	897.9
10	2382.5	121.7	895.4	12.3	-50.6	.0	896.8
11	1606.4	121.7	895.4	9.1	-35.0	.0	896.1
12	830.4	121.7	895.4	5.9	-19.4	.0	895.6
13	54.4	577.5	-132.0	8.5	-19.3	.0	133.4
14	3551.1	699.2	-374.7	55.4	-181.1	.0	416.2
15	2775.1	152.5	832.5	13.9	-58.4	.0	834.5
16	1999.1	152.5	832.5	10.7	-42.8	.0	833.6
17	1223.1	152.5	832.5	7.5	-27.2	.0	832.9
18	447.0	568.9	-100.5	15.2	-40.6	.0	108.4
19	4277.5	944.2	-1036.1	65.5	-216.2	.0	1058.4
20	3501.4	266.3	469.2	17.2	-74.1	.0	475.0
21	2725.4	192.1	649.1	13.9	-58.4	.0	651.8

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

REV. 2

22	1949.4	192.1	649.1	10.7	-42.8	.0	650.6
23	1173.4	192.1	649.1	7.5	-27.2	.0	649.7
24	397.4	192.1	649.1	4.2	-11.6	.0	649.2
25	-378.7	661.3	-437.3	5.1	-5.5	.0	437.3
26	3884.8	670.0	-468.7	51.7	-176.7	.0	500.9
27	3108.8	156.3	728.4	15.6	-66.2	.0	731.4
28	2332.8	156.3	728.4	12.3	-50.6	.0	730.2
29	1556.8	156.3	728.4	9.1	-35.0	.0	729.3
30	780.7	156.3	728.4	5.9	-19.4	.0	728.7
31	4.7	670.0	-468.7	8.5	-19.3	.0	469.1
32	3492.2	826.9	-820.7	55.4	-181.1	.0	840.4
33	2716.1	199.4	614.9	13.9	-58.4	.0	617.6
34	1940.1	199.4	614.9	10.7	-42.8	.0	616.4
35	1164.1	199.4	614.9	7.5	-27.2	.0	615.5
36	388.1	678.6	-500.2	15.2	-40.6	.0	501.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 18
 spalla fissa - n777 _RARA_7- n789 _RARA_7

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 25
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	661.3	-437.3	5.1	-5.5	661.3	437.3
1.56	537.8	493.8	4.2	1.7	537.8	493.8
3.13	380.0	1255.2	3.0	7.6	380.0	1255.2
4.69	105.1	1611.3	.9	10.4	105.1	1611.3
6.25	-64.5	1624.9	-.4	10.6	64.5	1624.9
7.81	-153.7	1441.0	-1.1	9.4	153.7	1441.1
9.38	-172.4	1175.8	-1.2	7.5	172.4	1175.8
10.94	-171.0	906.1	-1.2	5.7	171.0	906.1
12.50	-162.9	643.8	-1.1	3.9	162.9	643.8
15.00	-115.9	280.9	-.7	1.5	115.9	280.9
17.50	-63.0	61.2	-.4	.2	63.0	61.2
20.00	-25.3	-43.8	-.1	-.4	25.3	43.8
22.50	-3.5	-75.2	.0	-.5	3.5	75.2
25.00	6.2	-69.3	.1	-.4	6.2	69.3
29.17	7.0	-37.6	.0	-.2	7.0	37.6
33.33	4.4	-13.4	.0	.0	4.4	13.4
37.50	1.7	-1.0	.0	.0	1.7	1.0
43.75	-.2	2.2	.0	.0	.2	2.2
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 19
spalla fissa - n777 _RARA_8- n789 _RARA_8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35133.0	2239.0	69084.8	-15734.7	-58006.8	-29771.1
2	35772.8	1183.4	69937.6	16394.7	58246.5	31348.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
70905.8	3422.4	139022.4	660.0	7085.6	12872.1

Punto di applic. carico verticale: Xv = 1.961 m Yv = .100 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.848	6.465	1.264	.317	.012	.039

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3506.0	268.5	494.4	65.3	-215.7	.0	539.4
2	3000.6	34.9	910.5	17.1	-73.9	.0	913.5
3	2495.2	12.4	945.4	13.9	-58.4	.0	947.2
4	1989.8	12.4	945.4	10.7	-42.8	.0	946.4
5	1484.4	12.4	945.4	7.5	-27.3	.0	945.8
6	979.0	12.4	945.4	4.3	-11.8	.0	945.5
7	473.6	167.1	675.3	5.3	-6.1	.0	675.4
8	3257.9	158.5	706.7	51.6	-176.3	.0	728.3
9	2752.5	-2.2	976.2	15.5	-66.1	.0	978.4
10	2247.1	-2.2	976.2	12.3	-50.6	.0	977.5
11	1741.7	-2.2	976.2	9.1	-35.1	.0	976.8
12	1236.3	-2.2	976.2	5.9	-19.5	.0	976.4
13	730.9	158.5	706.7	8.6	-19.7	.0	706.9
14	3009.9	198.7	652.3	55.3	-180.8	.0	676.9
15	2504.5	5.0	979.5	13.9	-58.4	.0	981.3
16	1999.1	5.0	979.5	10.7	-42.8	.0	980.5
17	1493.7	5.0	979.5	7.5	-27.3	.0	979.9
18	988.3	149.9	738.0	15.3	-41.0	.0	739.1
19	3465.6	366.8	162.6	65.3	-215.7	.0	270.1
20	2960.2	74.2	738.9	17.1	-73.9	.0	742.6
21	2454.8	44.4	797.1	13.9	-58.4	.0	799.2

22	1949.4	44.4	797.1	10.7	-42.8	.0	798.3
23	1444.0	44.4	797.1	7.5	-27.3	.0	797.6
24	938.6	44.4	797.1	4.3	-11.8	.0	797.2
25	433.2	241.9	402.9	5.3	-6.1	.0	402.9
26	3208.3	250.5	371.6	51.6	-176.3	.0	411.3
27	2702.9	32.2	810.0	15.5	-66.1	.0	812.7
28	2197.5	32.2	810.0	12.3	-50.6	.0	811.6
29	1692.1	32.2	810.0	9.1	-35.1	.0	810.8
30	1186.7	32.2	810.0	5.9	-19.5	.0	810.3
31	681.3	250.5	371.6	8.6	-19.7	.0	372.1
32	2950.9	325.8	208.6	55.3	-180.8	.0	276.0
33	2445.5	51.7	763.0	13.9	-58.4	.0	765.2
34	1940.1	51.7	763.0	10.7	-42.8	.0	764.2
35	1434.7	51.7	763.0	7.5	-27.3	.0	763.5
36	929.3	259.1	340.2	15.3	-41.0	.0	342.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 20
 spalla fissa - n777 _RARA_9 - n789 _RARA_9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35132.9	6716.4	91912.5	-15580.7	-58712.2	-49843.6
2	35772.8	5658.0	92765.0	16240.7	58953.0	51455.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
70905.7	12374.4	184677.5	660.0	7087.8	12937.1

Punto di applic. carico verticale: Xv = 2.605 m Yv = .100 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.848	12.749	1.940	.317	.012	.039

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4317.9	845.4	-702.6	65.5	-216.2	.0	735.2
2	3541.8	226.8	641.8	17.2	-74.1	.0	646.0
3	2765.8	159.9	798.2	13.9	-58.4	.0	800.3
4	1989.8	159.9	798.2	10.7	-42.8	.0	799.4
5	1213.8	159.9	798.2	7.5	-27.2	.0	798.7
6	437.8	159.9	798.2	4.2	-11.6	.0	798.3
7	-338.3	586.1	-163.4	5.1	-5.5	.0	163.5
8	3934.5	577.5	-132.0	51.7	-176.7	.0	220.5
9	3158.5	121.7	895.4	15.6	-66.2	.0	897.9
10	2382.5	121.7	895.4	12.3	-50.6	.0	896.8
11	1606.4	121.7	895.4	9.1	-35.0	.0	896.1
12	830.4	121.7	895.4	5.9	-19.4	.0	895.6
13	54.4	577.5	-132.0	8.5	-19.3	.0	133.4
14	3551.1	699.2	-374.7	55.4	-181.1	.0	416.2
15	2775.1	152.5	832.5	13.9	-58.4	.0	834.5
16	1999.1	152.5	832.5	10.7	-42.8	.0	833.6
17	1223.1	152.5	832.5	7.5	-27.2	.0	832.9
18	447.0	568.9	-100.5	15.2	-40.6	.0	108.4
19	4277.5	944.2	-1036.1	65.5	-216.2	.0	1058.4
20	3501.4	266.3	469.2	17.2	-74.1	.0	475.0
21	2725.4	192.1	649.1	13.9	-58.4	.0	651.8

22	1949.4	192.1	649.1	10.7	-42.8	.0	650.6
23	1173.4	192.1	649.1	7.5	-27.2	.0	649.7
24	397.4	192.1	649.1	4.2	-11.6	.0	649.2
25	-378.7	661.3	-437.3	5.1	-5.5	.0	437.3
26	3884.8	670.0	-468.7	51.7	-176.7	.0	500.9
27	3108.8	156.3	728.4	15.6	-66.2	.0	731.4
28	2332.8	156.3	728.4	12.3	-50.6	.0	730.2
29	1556.8	156.3	728.4	9.1	-35.0	.0	729.3
30	780.7	156.3	728.4	5.9	-19.4	.0	728.7
31	4.7	670.0	-468.7	8.5	-19.3	.0	469.1
32	3492.2	826.9	-820.7	55.4	-181.1	.0	840.4
33	2716.1	199.4	614.9	13.9	-58.4	.0	617.6
34	1940.1	199.4	614.9	10.7	-42.8	.0	616.4
35	1164.1	199.4	614.9	7.5	-27.2	.0	615.5
36	388.1	678.6	-500.2	15.2	-40.6	.0	501.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 21
spalla fissa - n777 _RARA_10- n789 _RARA_10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35133.0	2239.0	69084.8	-15734.7	-58006.8	-29771.1
2	35772.8	1183.4	69937.6	16394.7	58246.5	31348.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
70905.8	3422.4	139022.4	660.0	7085.6	12872.1

Punto di applic. carico verticale: Xv = 1.961 m Yv = .100 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.848	6.465	1.264	.317	.012	.039

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3506.0	268.5	494.4	65.3	-215.7	.0	539.4
2	3000.6	34.9	910.5	17.1	-73.9	.0	913.5
3	2495.2	12.4	945.4	13.9	-58.4	.0	947.2
4	1989.8	12.4	945.4	10.7	-42.8	.0	946.4
5	1484.4	12.4	945.4	7.5	-27.3	.0	945.8
6	979.0	12.4	945.4	4.3	-11.8	.0	945.5
7	473.6	167.1	675.3	5.3	-6.1	.0	675.4
8	3257.9	158.5	706.7	51.6	-176.3	.0	728.3
9	2752.5	-2.2	976.2	15.5	-66.1	.0	978.4
10	2247.1	-2.2	976.2	12.3	-50.6	.0	977.5
11	1741.7	-2.2	976.2	9.1	-35.1	.0	976.8
12	1236.3	-2.2	976.2	5.9	-19.5	.0	976.4
13	730.9	158.5	706.7	8.6	-19.7	.0	706.9
14	3009.9	198.7	652.3	55.3	-180.8	.0	676.9
15	2504.5	5.0	979.5	13.9	-58.4	.0	981.3
16	1999.1	5.0	979.5	10.7	-42.8	.0	980.5
17	1493.7	5.0	979.5	7.5	-27.3	.0	979.9
18	988.3	149.9	738.0	15.3	-41.0	.0	739.1
19	3465.6	366.8	162.6	65.3	-215.7	.0	270.1
20	2960.2	74.2	738.9	17.1	-73.9	.0	742.6
21	2454.8	44.4	797.1	13.9	-58.4	.0	799.2

22	1949.4	44.4	797.1	10.7	-42.8	.0	798.3
23	1444.0	44.4	797.1	7.5	-27.3	.0	797.6
24	938.6	44.4	797.1	4.3	-11.8	.0	797.2
25	433.2	241.9	402.9	5.3	-6.1	.0	402.9
26	3208.3	250.5	371.6	51.6	-176.3	.0	411.3
27	2702.9	32.2	810.0	15.5	-66.1	.0	812.7
28	2197.5	32.2	810.0	12.3	-50.6	.0	811.6
29	1692.1	32.2	810.0	9.1	-35.1	.0	810.8
30	1186.7	32.2	810.0	5.9	-19.5	.0	810.3
31	681.3	250.5	371.6	8.6	-19.7	.0	372.1
32	2950.9	325.8	208.6	55.3	-180.8	.0	276.0
33	2445.5	51.7	763.0	13.9	-58.4	.0	765.2
34	1940.1	51.7	763.0	10.7	-42.8	.0	764.2
35	1434.7	51.7	763.0	7.5	-27.3	.0	763.5
36	929.3	259.1	340.2	15.3	-41.0	.0	342.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 22
spalla fissa - n777 _RARA_11- n789 _RARA_11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34928.2	4270.0	77394.2	-15482.3	-58080.3	-36966.1
2	35977.6	2512.3	78764.2	16542.3	58503.1	39537.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
70905.8	6782.3	156158.4	1060.0	11651.4	21378.7

Punto di applic. carico verticale: Xv = 2.202 m Yv = .164 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.848	8.823	1.517	.510	.019	.065

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3823.5	452.6	154.5	106.6	-351.9	.0	384.3
2	3216.5	94.0	866.2	27.9	-120.1	.0	874.5
3	2609.6	57.2	939.0	22.5	-94.3	.0	943.8
4	2002.6	57.2	939.0	17.2	-68.5	.0	941.5
5	1395.6	57.2	939.0	11.9	-42.7	.0	940.0
6	788.7	57.2	939.0	6.5	-16.9	.0	939.2
7	181.7	299.7	450.3	6.9	-3.7	.0	450.3
8	3527.6	285.4	502.3	84.1	-287.1	.0	578.6
9	2920.6	33.0	1000.6	25.2	-107.2	.0	1006.4
10	2313.7	33.0	1000.6	19.9	-81.4	.0	1003.9
11	1706.7	33.0	1000.6	14.5	-55.6	.0	1002.2
12	1099.7	33.0	1000.6	9.2	-29.8	.0	1001.1
13	492.8	285.4	502.3	12.7	-27.0	.0	503.0
14	3231.7	344.7	413.1	89.9	-293.9	.0	507.0
15	2624.7	45.0	995.7	22.5	-94.3	.0	1000.1
16	2017.8	45.0	995.7	17.2	-68.5	.0	998.0
17	1410.8	45.0	995.7	11.9	-42.7	.0	996.6
18	803.8	271.2	554.3	23.5	-61.8	.0	557.8
19	3757.5	615.9	-396.6	106.6	-351.9	.0	530.2
20	3150.6	159.3	581.1	27.9	-120.1	.0	593.4
21	2543.6	110.3	692.7	22.5	-94.3	.0	699.1

22	1936.6	110.3	692.7	17.2	-68.5	.0	696.1
23	1329.6	110.3	692.7	11.9	-42.7	.0	694.0
24	722.7	110.3	692.7	6.5	-16.9	.0	692.9
25	115.7	424.0	-2.2	6.9	-3.7	.0	4.3
26	3446.5	438.2	-54.2	84.1	-287.1	.0	292.2
27	2839.5	90.1	724.7	25.2	-107.2	.0	732.5
28	2232.5	90.1	724.7	19.9	-81.4	.0	729.2
29	1625.5	90.1	724.7	14.5	-55.6	.0	726.8
30	1018.6	90.1	724.7	9.2	-29.8	.0	725.3
31	411.6	438.2	-54.2	12.7	-27.0	.0	60.6
32	3135.4	555.7	-323.9	89.9	-293.9	.0	437.4
33	2528.4	122.5	636.1	22.5	-94.3	.0	643.0
34	1921.4	122.5	636.1	17.2	-68.5	.0	639.8
35	1314.5	122.5	636.1	11.9	-42.7	.0	637.5
36	707.5	452.5	-106.2	23.5	-61.8	.0	122.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 23
spalla fissa - n777 _RARA_12- n789 _RARA_12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	43423.1	6832.0	93640.0	-19492.6	-70554.1	-55310.5
2	42424.4	8560.8	92399.8	18552.6	70062.7	53008.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
85847.5	15392.8	186039.8	-940.0	-11177.6	-20800.6

Punto di applic. carico verticale: Xv = 2.167 m Yv = -.130 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
11.923	14.399	2.052	-.457	-.018	-.063

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4816.3	1157.7	-1632.1	-98.9	326.3	.0	1664.4
2	3995.4	345.2	219.0	-25.6	110.0	.0	245.1
3	3174.5	254.8	447.0	-20.4	84.9	.0	455.0
4	2353.6	254.8	447.0	-15.2	59.8	.0	451.0
5	1532.8	254.8	447.0	-10.0	34.7	.0	448.3
6	711.9	254.8	447.0	-4.8	9.6	.0	447.1
7	-109.0	820.4	-902.8	-1.9	-12.5	.0	902.9
8	4398.7	834.3	-953.4	-77.7	265.0	.0	989.5
9	3577.8	212.3	543.6	-23.0	97.5	.0	552.3
10	2757.0	212.3	543.6	-17.8	72.4	.0	548.4
11	1936.1	212.3	543.6	-12.6	47.3	.0	545.7
12	1115.2	212.3	543.6	-7.4	22.2	.0	544.1
13	294.3	834.3	-953.4	-8.2	11.9	.0	953.5
14	3981.1	1026.5	-1397.9	-82.7	269.8	.0	1423.7
15	3160.3	266.7	391.9	-20.4	84.9	.0	401.0
16	2339.4	266.7	391.9	-15.2	59.8	.0	396.4
17	1518.5	266.7	391.9	-10.0	34.7	.0	393.4
18	697.6	848.2	-1004.0	-18.0	43.9	.0	1005.0
19	4878.3	998.8	-1096.0	-98.9	326.3	.0	1143.5
20	4057.4	281.7	496.4	-25.6	110.0	.0	508.4
21	3236.5	203.2	686.7	-20.4	84.9	.0	691.9

22	2415.7	203.2	686.7	-15.2	59.8	.0	689.3
23	1594.8	203.2	686.7	-10.0	34.7	.0	687.6
24	773.9	203.2	686.7	-4.8	9.6	.0	686.7
25	-47.0	699.5	-462.5	-1.9	-12.5	.0	462.7
26	4475.0	685.6	-411.9	-77.7	265.0	.0	489.8
27	3654.1	156.7	812.1	-23.0	97.5	.0	818.0
28	2833.2	156.7	812.1	-17.8	72.4	.0	815.3
29	2012.4	156.7	812.1	-12.6	47.3	.0	813.5
30	1191.5	156.7	812.1	-7.4	22.2	.0	812.4
31	370.6	685.6	-411.9	-8.2	11.9	.0	412.1
32	4071.7	821.1	-680.9	-82.7	269.8	.0	732.4
33	3250.8	191.3	741.8	-20.4	84.9	.0	746.6
34	2429.9	191.3	741.8	-15.2	59.8	.0	744.2
35	1609.0	191.3	741.8	-10.0	34.7	.0	742.6
36	788.2	671.8	-361.3	-18.0	43.9	.0	364.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 23
 spalla fissa - n777 _RARA_12- n789 _RARA_12

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1157.7	-1632.1	-98.9	326.3	1161.9	1664.4
1.56	945.2	1.1	-88.1	180.3	949.3	180.3
3.13	674.0	1341.8	-71.5	50.4	677.8	1342.7
4.69	205.9	1988.4	-39.0	-34.2	209.6	1988.7
6.25	-74.0	2059.2	-15.1	-74.9	75.6	2060.6
7.81	-212.5	1812.3	1.2	-84.4	212.5	1814.3
9.38	-238.2	1444.5	6.2	-76.5	238.2	1446.5
10.94	-233.1	1074.0	7.6	-65.6	233.2	1076.0
12.50	-217.9	719.5	8.3	-53.0	218.0	721.5
15.00	-141.4	249.0	7.8	-32.2	141.6	251.0
17.50	-64.2	.5	5.6	-15.2	64.5	15.2
20.00	-16.4	-91.1	3.2	-4.3	16.7	91.2
22.50	5.9	-97.6	1.3	1.1	6.0	97.6
25.00	11.2	-72.3	.1	2.8	11.2	72.4
29.17	8.2	-29.8	-.2	2.1	8.3	29.9
33.33	3.9	-4.9	-.2	1.0	3.9	5.0
37.50	.8	4.2	-.1	.3	.8	4.2
43.75	-.6	2.9	.0	.0	.6	2.9
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 23
spalla fissa - n777 _RARA_12- n789 _RARA_12

Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
(riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	998.8	-1096.0	-98.9	326.3	1003.7	1143.5
1.56	803.5	302.6	-88.1	180.3	808.3	352.2
3.13	559.2	1434.4	-71.5	50.4	563.7	1435.3
4.69	143.8	1945.6	-39.0	-34.2	149.0	1945.9
6.25	-97.8	1952.0	-15.1	-74.9	99.0	1953.5
7.81	-210.6	1690.2	1.2	-84.4	210.6	1692.3
9.38	-228.6	1334.7	6.2	-76.5	228.6	1336.9
10.94	-221.3	981.2	7.6	-65.6	221.5	983.4
12.50	-205.2	646.1	8.3	-53.0	205.4	648.2
15.00	-130.0	206.7	7.8	-32.2	130.2	209.2
17.50	-56.5	-17.5	5.6	-15.2	56.8	23.2
20.00	-12.4	-94.8	3.2	-4.3	12.8	94.9
22.50	7.3	-94.8	1.3	1.1	7.4	94.8
25.00	11.1	-68.1	.1	2.8	11.1	68.1
29.17	7.8	-27.2	-.2	2.1	7.8	27.3
33.33	3.6	-3.8	-.2	1.0	3.6	4.0
37.50	.7	4.3	-.1	.3	.7	4.3
43.75	-.6	2.8	.0	.0	.6	2.8
50.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 24
spalla fissa - n777 _FREQ_1 - n789 _FREQ_1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31477.9	4907.3	65325.7	-13821.9	-51478.5	-35668.7
2	31989.9	4041.0	65990.9	14321.9	51707.2	36911.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63467.8	8948.3	131316.6	500.0	5707.1	10512.2

Punto di applic. carico verticale: Xv = 2.069 m Yv = .090 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.815	9.145	1.384	.242	.009	.032

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3440.4	605.2	-507.6	51.3	-169.3	.0	535.1
2	2886.6	162.6	454.8	13.4	-57.4	.0	458.4
3	2332.8	114.7	566.9	10.7	-44.8	.0	568.6
4	1779.0	114.7	566.9	8.1	-32.1	.0	567.8
5	1225.2	114.7	566.9	5.5	-19.4	.0	567.2
6	671.4	114.7	566.9	2.8	-6.7	.0	566.9
7	117.6	419.7	-121.7	2.3	1.9	.0	121.7
8	3167.2	412.7	-96.1	40.4	-137.8	.0	168.0
9	2613.4	87.0	638.0	12.0	-51.1	.0	640.1
10	2059.6	87.0	638.0	9.4	-38.4	.0	639.2
11	1505.8	87.0	638.0	6.8	-25.7	.0	638.5
12	952.0	87.0	638.0	4.2	-13.1	.0	638.2
13	398.2	412.7	-96.1	5.3	-9.9	.0	96.6
14	2893.9	498.6	-266.1	43.1	-140.7	.0	301.0
15	2340.1	108.7	594.7	10.7	-44.8	.0	596.4
16	1786.4	108.7	594.7	8.1	-32.1	.0	595.6
17	1232.6	108.7	594.7	5.5	-19.4	.0	595.0
18	678.8	405.6	-70.6	10.4	-26.6	.0	75.4
19	3408.4	685.5	-778.6	51.3	-169.3	.0	796.8
20	2854.6	194.7	314.6	13.4	-57.4	.0	319.8
21	2300.8	140.8	445.7	10.7	-44.8	.0	448.0

22	1747.0	140.8	445.7	8.1	-32.1	.0	446.9
23	1193.2	140.8	445.7	5.5	-19.4	.0	446.2
24	639.4	140.8	445.7	2.8	-6.7	.0	445.8
25	85.6	480.8	-344.2	2.3	1.9	.0	344.2
26	3127.8	487.8	-369.8	40.4	-137.8	.0	394.6
27	2574.0	115.2	502.3	12.0	-51.1	.0	504.9
28	2020.2	115.2	502.3	9.4	-38.4	.0	503.8
29	1466.4	115.2	502.3	6.8	-25.7	.0	503.0
30	912.6	115.2	502.3	4.2	-13.1	.0	502.5
31	358.8	487.8	-369.8	5.3	-9.9	.0	369.9
32	2847.2	602.4	-628.5	43.1	-140.7	.0	644.1
33	2293.4	146.8	417.9	10.7	-44.8	.0	420.3
34	1739.6	146.8	417.9	8.1	-32.1	.0	419.1
35	1185.8	146.8	417.9	5.5	-19.4	.0	418.3
36	632.1	494.8	-395.4	10.4	-26.6	.0	396.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 25
spalla fissa - n777 _FREQ_2- n789 _FREQ_2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34772.7	4060.4	78146.6	-15566.3	-57415.9	-39491.1
2	34700.1	4032.9	77783.7	15656.3	57158.0	39614.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
69472.8	8093.3	155930.3	90.0	-1034.7	417.4

Punto di applic. carico verticale: Xv = 2.244 m Yv = -.015 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.649	9.513	1.559	.034	-.001	.001

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3799.6	611.7	-335.9	5.6	-20.5	.0	336.5
2	3175.9	155.2	634.3	1.7	-9.0	.0	634.3
3	2552.2	106.5	743.9	1.6	-8.5	.0	744.0
4	1928.4	106.5	743.9	1.5	-8.0	.0	744.0
5	1304.7	106.5	743.9	1.4	-7.5	.0	743.9
6	680.9	106.5	743.9	1.3	-7.0	.0	743.9
7	57.2	419.5	56.6	3.7	-13.7	.0	58.2
8	3487.5	419.2	57.6	4.7	-17.9	.0	60.3
9	2863.7	81.0	800.9	1.7	-8.8	.0	800.9
10	2240.0	81.0	800.9	1.6	-8.3	.0	800.9
11	1616.2	81.0	800.9	1.5	-7.8	.0	800.9
12	992.5	81.0	800.9	1.4	-7.3	.0	800.9
13	368.7	419.2	57.6	3.3	-12.8	.0	59.0
14	3175.3	517.5	-145.6	5.3	-19.3	.0	146.9
15	2551.5	106.2	745.0	1.6	-8.5	.0	745.1
16	1927.8	106.2	745.0	1.5	-8.0	.0	745.1
17	1304.0	106.2	745.0	1.4	-7.5	.0	745.1
18	680.3	419.0	58.6	4.0	-14.8	.0	60.5
19	3802.4	614.9	-346.6	5.6	-20.5	.0	347.2
20	3178.7	156.4	628.7	1.7	-9.0	.0	628.8
21	2554.9	107.5	739.1	1.6	-8.5	.0	739.1

22	1931.2	107.5	739.1	1.5	-8.0	.0	739.1
23	1307.4	107.5	739.1	1.4	-7.5	.0	739.1
24	683.7	107.5	739.1	1.3	-7.0	.0	739.1
25	60.0	421.9	47.8	3.7	-13.7	.0	49.7
26	3490.9	422.2	46.8	4.7	-17.9	.0	50.1
27	2867.1	82.1	795.5	1.7	-8.8	.0	795.5
28	2243.4	82.1	795.5	1.6	-8.3	.0	795.5
29	1619.6	82.1	795.5	1.5	-7.8	.0	795.5
30	995.9	82.1	795.5	1.4	-7.3	.0	795.5
31	372.1	422.2	46.8	3.3	-12.8	.0	48.5
32	3179.3	521.6	-160.0	5.3	-19.3	.0	161.2
33	2555.6	107.7	738.0	1.6	-8.5	.0	738.0
34	1931.8	107.7	738.0	1.5	-8.0	.0	738.0
35	1308.1	107.7	738.0	1.4	-7.5	.0	738.0
36	684.3	422.5	45.7	4.0	-14.8	.0	48.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 26
 spalla fissa - n777_FREQ_3- n789_FREQ_3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31989.9	4039.3	65984.4	-14308.2	-51957.3	-36514.5
2	31477.8	4909.0	65332.2	13808.2	51728.1	35307.7

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63467.7	8948.3	131316.6	-500.0	-5708.7	-10512.6

Punto di applic. carico verticale: Xv = 2.069 m Yv = -.090 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.815	9.145	1.384	-.242	-.009	-.032

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3408.4	685.5	-778.6	-51.3	169.3	.0	796.8
2	2854.6	194.7	314.6	-13.4	57.4	.0	319.8
3	2300.8	140.8	445.7	-10.7	44.8	.0	448.0
4	1747.0	140.8	445.7	-8.1	32.1	.0	446.9
5	1193.2	140.8	445.7	-5.5	19.4	.0	446.2
6	639.4	140.8	445.7	-2.8	6.7	.0	445.8
7	85.6	480.8	-344.2	-2.3	-1.9	.0	344.2
8	3127.8	487.8	-369.8	-40.4	137.8	.0	394.6
9	2574.0	115.2	502.3	-12.0	51.1	.0	504.9
10	2020.2	115.2	502.3	-9.4	38.4	.0	503.8
11	1466.4	115.2	502.3	-6.8	25.7	.0	503.0
12	912.6	115.2	502.3	-4.2	13.1	.0	502.5
13	358.8	487.8	-369.8	-5.3	9.9	.0	369.9
14	2847.2	602.4	-628.5	-43.1	140.7	.0	644.1
15	2293.4	146.8	417.9	-10.7	44.8	.0	420.3
16	1739.6	146.8	417.9	-8.1	32.1	.0	419.1
17	1185.8	146.8	417.9	-5.5	19.4	.0	418.3
18	632.0	494.8	-395.4	-10.4	26.6	.0	396.3
19	3440.4	605.1	-507.6	-51.3	169.3	.0	535.1
20	2886.6	162.6	454.8	-13.4	57.4	.0	458.4
21	2332.8	114.7	566.9	-10.7	44.8	.0	568.6

22	1779.0	114.7	566.9	-8.1	32.1	.0	567.8
23	1225.2	114.7	566.9	-5.5	19.4	.0	567.2
24	671.4	114.7	566.9	-2.8	6.7	.0	566.9
25	117.6	419.7	-121.7	-2.3	-1.9	.0	121.7
26	3167.2	412.7	-96.1	-40.4	137.8	.0	168.0
27	2613.4	87.0	638.0	-12.0	51.1	.0	640.1
28	2059.6	87.0	638.0	-9.4	38.4	.0	639.2
29	1505.8	87.0	638.0	-6.8	25.7	.0	638.5
30	952.0	87.0	638.0	-4.2	13.1	.0	638.2
31	398.2	412.7	-96.1	-5.3	9.9	.0	96.6
32	2893.9	498.6	-266.1	-43.1	140.7	.0	301.0
33	2340.1	108.7	594.7	-10.7	44.8	.0	596.4
34	1786.4	108.7	594.7	-8.1	32.1	.0	595.6
35	1232.6	108.7	594.7	-5.5	19.4	.0	595.0
36	678.8	405.6	-70.6	-10.4	26.6	.0	75.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 27
 spalla fissa - n777_FREQ_4- n789_FREQ_4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33397.7	4118.5	72285.6	-15111.5	-54858.9	-38025.3
2	34358.1	4129.8	76150.6	15231.5	56488.3	38746.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67755.8	8248.3	148436.2	120.0	11905.7	600.2

Punto di applic. carico verticale: Xv = 2.191 m Yv = .176 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.411	9.345	1.503	.109	.015	.002

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3710.9	614.4	-407.8	8.7	-14.8	.0	408.1
2	3109.8	159.5	567.6	1.8	2.3	.0	567.6
3	2508.8	110.7	679.2	1.7	3.1	.0	679.2
4	1907.7	110.7	679.2	1.5	3.8	.0	679.2
5	1306.7	110.7	679.2	1.4	4.5	.0	679.2
6	705.7	110.7	679.2	1.2	5.2	.0	679.2
7	104.6	423.2	-14.6	5.9	-5.0	.0	15.4
8	3416.2	422.8	-13.1	7.1	-10.7	.0	17.0
9	2815.2	85.1	737.7	1.8	2.7	.0	737.7
10	2214.2	85.1	737.7	1.6	3.4	.0	737.7
11	1613.1	85.1	737.7	1.5	4.1	.0	737.7
12	1012.1	85.1	737.7	1.3	4.9	.0	737.7
13	411.0	422.8	-13.1	5.1	-3.4	.0	13.6
14	3121.6	520.4	-216.4	8.3	-13.2	.0	216.8
15	2520.6	110.4	680.8	1.7	3.1	.0	680.8
16	1919.5	110.4	680.8	1.5	3.8	.0	680.8
17	1318.5	110.4	680.8	1.4	4.5	.0	680.8
18	717.4	422.4	-11.7	6.4	-6.6	.0	13.4
19	3659.6	619.0	-423.3	8.7	-14.8	.0	423.6
20	3058.6	161.3	559.6	1.8	2.3	.0	559.6
21	2457.5	112.2	672.3	1.7	3.1	.0	672.3

22	1856.5	112.2	672.3	1.5	3.8	.0	672.3
23	1255.4	112.2	672.3	1.4	4.5	.0	672.3
24	654.4	112.2	672.3	1.2	5.2	.0	672.3
25	53.4	426.7	-27.3	5.9	-5.0	.0	27.8
26	3353.2	427.1	-28.8	7.1	-10.7	.0	30.7
27	2752.1	86.7	729.9	1.8	2.7	.0	729.9
28	2151.1	86.7	729.9	1.6	3.4	.0	729.9
29	1550.1	86.7	729.9	1.5	4.1	.0	729.9
30	949.0	86.7	729.9	1.3	4.9	.0	729.9
31	348.0	427.1	-28.8	5.1	-3.4	.0	29.0
32	3046.8	526.3	-237.1	8.3	-13.2	.0	237.5
33	2445.7	112.5	670.7	1.7	3.1	.0	670.7
34	1844.7	112.5	670.7	1.5	3.8	.0	670.7
35	1243.6	112.5	670.7	1.4	4.5	.0	670.7
36	642.6	427.5	-30.2	6.4	-6.6	.0	30.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 28
 spalla fissa - n777_FREQ_5- n789_FREQ_5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34358.1	4128.4	76144.9	-15228.2	-56548.7	-38641.3
2	33397.6	4119.9	72291.3	15108.2	54918.4	37949.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67755.7	8248.3	148436.2	-120.0	-11907.6	-601.0

Punto di applic. carico verticale: Xv = 2.191 m Yv = -.176 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.411	9.345	1.503	-.109	-.015	-.002

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3659.6	619.0	-423.3	-8.7	14.8	.0	423.6
2	3058.5	161.3	559.6	-1.8	-2.3	.0	559.6
3	2457.5	112.2	672.3	-1.7	-3.1	.0	672.3
4	1856.5	112.2	672.3	-1.5	-3.8	.0	672.3
5	1255.4	112.2	672.3	-1.4	-4.5	.0	672.3
6	654.4	112.2	672.3	-1.2	-5.2	.0	672.3
7	53.3	426.7	-27.3	-5.9	5.0	.0	27.8
8	3353.2	427.1	-28.8	-7.1	10.7	.0	30.7
9	2752.1	86.7	729.9	-1.8	-2.7	.0	729.9
10	2151.1	86.7	729.9	-1.6	-3.4	.0	729.9
11	1550.1	86.7	729.9	-1.5	-4.2	.0	729.9
12	949.0	86.7	729.9	-1.3	-4.9	.0	729.9
13	348.0	427.1	-28.8	-5.1	3.4	.0	29.0
14	3046.8	526.3	-237.1	-8.3	13.2	.0	237.5
15	2445.7	112.5	670.7	-1.7	-3.1	.0	670.7
16	1844.7	112.5	670.7	-1.5	-3.8	.0	670.7
17	1243.6	112.5	670.7	-1.4	-4.5	.0	670.7
18	642.6	427.5	-30.2	-6.4	6.6	.0	31.0
19	3710.9	614.4	-407.8	-8.7	14.8	.0	408.1
20	3109.8	159.5	567.6	-1.8	-2.3	.0	567.6
21	2508.8	110.7	679.2	-1.7	-3.1	.0	679.2

22	1907.7	110.7	679.2	-1.5	-3.8	.0	679.2
23	1306.7	110.7	679.2	-1.4	-4.5	.0	679.2
24	705.7	110.7	679.2	-1.2	-5.2	.0	679.2
25	104.6	423.2	-14.6	-5.9	5.0	.0	15.4
26	3416.2	422.8	-13.1	-7.1	10.7	.0	17.0
27	2815.2	85.1	737.7	-1.8	-2.7	.0	737.7
28	2214.2	85.1	737.7	-1.6	-3.4	.0	737.7
29	1613.1	85.1	737.7	-1.5	-4.2	.0	737.7
30	1012.1	85.1	737.7	-1.3	-4.9	.0	737.7
31	411.0	422.8	-13.1	-5.1	3.4	.0	13.6
32	3121.6	520.4	-216.4	-8.3	13.2	.0	216.8
33	2520.6	110.4	680.8	-1.7	-3.1	.0	680.8
34	1919.5	110.4	680.8	-1.5	-3.8	.0	680.8
35	1318.5	110.4	680.8	-1.4	-4.5	.0	680.8
36	717.4	422.4	-11.7	-6.4	6.6	.0	13.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 29
 spalla fissa - n777_FREQ_6-n789_FREQ_6

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34513.4	5371.3	83635.5	-15434.0	-57116.6	-45020.0
2	34532.4	5359.1	83683.2	15479.0	57090.9	45128.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
69045.8	10730.4	167318.7	45.0	177.6	238.8

Punto di applic. carico verticale: Xv = 2.423 m Yv = .003 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.590	11.295	1.742	.020	.000	.001

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4008.6	780.8	-704.4	2.9	-9.8	.0	704.4
2	3312.0	212.3	538.1	.9	-3.8	.0	538.1
3	2615.3	150.7	683.7	.8	-3.5	.0	683.7
4	1918.7	150.7	683.7	.7	-3.3	.0	683.7
5	1222.0	150.7	683.7	.7	-3.0	.0	683.7
6	525.4	150.7	683.7	.6	-2.7	.0	683.7
7	-171.3	542.8	-207.2	1.8	-5.9	.0	207.2
8	3660.5	542.6	-206.6	2.4	-8.4	.0	206.7
9	2963.8	118.3	760.1	.8	-3.7	.0	760.2
10	2267.2	118.3	760.1	.8	-3.4	.0	760.2
11	1570.5	118.3	760.1	.7	-3.1	.0	760.2
12	873.9	118.3	760.1	.7	-2.8	.0	760.1
13	177.2	542.6	-206.6	1.6	-5.5	.0	206.6
14	3312.3	664.7	-465.5	2.8	-9.2	.0	465.6
15	2615.7	150.5	684.3	.8	-3.5	.0	684.3
16	1919.0	150.5	684.3	.7	-3.3	.0	684.3
17	1222.4	150.5	684.3	.7	-3.0	.0	684.3
18	525.7	542.5	-206.0	2.0	-6.6	.0	206.1
19	4007.1	782.6	-710.5	2.9	-9.8	.0	710.6
20	3310.5	213.0	534.9	.9	-3.8	.0	534.9
21	2613.8	151.2	680.9	.8	-3.5	.0	680.9

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

REV. 2

22	1917.2	151.2	680.9	.7	-3.3	.0	680.9
23	1220.5	151.2	680.9	.7	-3.0	.0	680.9
24	523.9	151.2	680.9	.6	-2.7	.0	680.9
25	-172.8	544.2	-212.2	1.8	-5.9	.0	212.3
26	3658.6	544.3	-212.8	2.4	-8.4	.0	213.0
27	2962.0	118.9	757.1	.8	-3.7	.0	757.1
28	2265.3	118.9	757.1	.8	-3.4	.0	757.1
29	1568.7	118.9	757.1	.7	-3.1	.0	757.1
30	872.0	118.9	757.1	.7	-2.8	.0	757.1
31	175.4	544.3	-212.8	1.6	-5.5	.0	212.9
32	3310.2	667.1	-473.8	2.8	-9.2	.0	473.9
33	2613.5	151.4	680.3	.8	-3.5	.0	680.3
34	1916.9	151.4	680.3	.7	-3.3	.0	680.3
35	1220.2	151.4	680.3	.7	-3.0	.0	680.3
36	523.6	544.5	-213.4	2.0	-6.6	.0	213.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 30
spalla fissa - n777 _FREQ_7 - n789 _FREQ_7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34513.4	2538.3	69192.0	-15531.5	-56670.2	-32320.0
2	34532.4	2528.1	69240.3	15576.5	56643.9	32406.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
69045.8	5066.4	138432.3	45.0	177.0	195.2

Punto di applic. carico verticale: Xv = 2.005 m Yv = .003 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.590	7.319	1.314	.020	.000	.001

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3495.0	415.7	53.0	2.8	-9.4	.0	53.8
2	2969.5	90.9	708.1	.8	-3.7	.0	708.1
3	2444.1	57.3	776.8	.8	-3.5	.0	776.8
4	1918.7	57.3	776.8	.7	-3.3	.0	776.8
5	1393.3	57.3	776.8	.7	-3.0	.0	776.8
6	867.8	57.3	776.8	.6	-2.8	.0	776.8
7	342.4	277.7	323.5	1.9	-6.3	.0	323.6
8	3232.4	277.5	324.0	2.4	-8.2	.0	324.1
9	2707.0	39.9	811.2	.8	-3.6	.0	811.2
10	2181.6	39.9	811.2	.8	-3.4	.0	811.2
11	1656.1	39.9	811.2	.7	-3.1	.0	811.2
12	1130.7	39.9	811.2	.7	-2.9	.0	811.2
13	605.3	277.5	324.0	1.7	-5.8	.0	324.0
14	2969.9	348.0	184.2	2.7	-8.9	.0	184.4
15	2444.5	57.2	777.3	.8	-3.5	.0	777.3
16	1919.0	57.2	777.3	.7	-3.3	.0	777.3
17	1393.6	57.2	777.3	.7	-3.0	.0	777.3
18	868.2	277.4	324.5	2.1	-6.8	.0	324.5
19	3493.5	417.2	48.0	2.8	-9.4	.0	48.9
20	2968.1	91.5	705.5	.8	-3.7	.0	705.5
21	2442.6	57.8	774.6	.8	-3.5	.0	774.6

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

REV. 2

22	1917.2	57.8	774.6	.7	-3.3	.0	774.6
23	1391.8	57.8	774.6	.7	-3.0	.0	774.6
24	866.3	57.8	774.6	.6	-2.8	.0	774.6
25	340.9	278.8	319.4	1.9	-6.3	.0	319.4
26	3230.6	278.9	318.9	2.4	-8.2	.0	319.0
27	2705.2	40.4	808.7	.8	-3.6	.0	808.7
28	2179.7	40.4	808.7	.8	-3.4	.0	808.7
29	1654.3	40.4	808.7	.7	-3.1	.0	808.7
30	1128.9	40.4	808.7	.7	-2.9	.0	808.7
31	603.5	278.9	318.9	1.7	-5.8	.0	319.0
32	2967.7	349.9	177.5	2.7	-8.9	.0	177.7
33	2442.3	57.9	774.0	.8	-3.5	.0	774.0
34	1916.9	57.9	774.0	.7	-3.3	.0	774.0
35	1391.4	57.9	774.0	.7	-3.0	.0	774.0
36	866.0	279.0	318.4	2.1	-6.8	.0	318.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla fissa - SLE RARA QP FREQ

CONDIZIONE DI CARICO 31
spalla fissa - n777 _PERM_1- n789 _PERM_1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31733.9	4473.3	65655.1	-14065.0	-51717.9	-36091.6
2	31733.9	4475.0	65661.5	14065.0	51717.6	36109.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63467.8	8948.3	131316.6	.0	-.3	-.2

Punto di applic. carico verticale: Xv = 2.069 m Yv = .000 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.815	9.145	1.384	.000	.000	.000

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3424.4	645.3	-643.1	.0	.0	.0	643.1
2	2870.6	178.6	384.7	.0	.0	.0	384.7
3	2316.8	127.8	506.3	.0	.0	.0	506.3
4	1763.0	127.8	506.3	.0	.0	.0	506.3
5	1209.2	127.8	506.3	.0	.0	.0	506.3
6	655.4	127.8	506.3	.0	.0	.0	506.3
7	101.6	450.2	-233.0	.0	.0	.0	233.0
8	3147.5	450.2	-233.0	.0	.0	.0	233.0
9	2593.7	101.1	570.2	.0	.0	.0	570.2
10	2039.9	101.1	570.2	.0	.0	.0	570.2
11	1486.1	101.1	570.2	.0	.0	.0	570.2
12	932.3	101.1	570.2	.0	.0	.0	570.2
13	378.5	450.2	-233.0	.0	.0	.0	233.0
14	2870.6	550.5	-447.3	.0	.0	.0	447.3
15	2316.8	127.8	506.3	.0	.0	.0	506.3
16	1763.0	127.8	506.3	.0	.0	.0	506.3
17	1209.2	127.8	506.3	.0	.0	.0	506.3
18	655.4	450.2	-233.0	.0	.0	.0	233.0
19	3424.4	645.3	-643.1	.0	.0	.0	643.1
20	2870.6	178.6	384.7	.0	.0	.0	384.7
21	2316.8	127.8	506.3	.0	.0	.0	506.3

22	1763.0	127.8	506.3	.0	.0	.0	506.3
23	1209.2	127.8	506.3	.0	.0	.0	506.3
24	655.4	127.8	506.3	.0	.0	.0	506.3
25	101.6	450.2	-233.0	.0	.0	.0	233.0
26	3147.5	450.2	-233.0	.0	.0	.0	233.0
27	2593.7	101.1	570.2	.0	.0	.0	570.2
28	2039.9	101.1	570.2	.0	.0	.0	570.2
29	1486.1	101.1	570.2	.0	.0	.0	570.2
30	932.3	101.1	570.2	.0	.0	.0	570.2
31	378.5	450.2	-233.0	.0	.0	.0	233.0
32	2870.6	550.5	-447.3	.0	.0	.0	447.3
33	2316.8	127.8	506.3	.0	.0	.0	506.3
34	1763.0	127.8	506.3	.0	.0	.0	506.3
35	1209.2	127.8	506.3	.0	.0	.0	506.3
36	655.4	450.2	-233.0	.0	.0	.0	233.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla fissa - SLE RARA QP FREQ

 CONDIZIONE DI CARICO 32
 spalla fissa - n777 _PERM_2 - n789 _PERM_2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31733.9	3423.7	60301.0	-14101.2	-51552.5	-31382.8
2	31733.9	3424.6	60305.6	14101.2	51551.9	31392.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63467.8	6848.3	120606.6	.0	-.6	.4

Punto di applic. carico verticale: Xv = 1.900 m Yv = .000 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.815	7.670	1.226	.000	.000	.000

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3233.9	509.9	-362.1	.0	.0	.0	362.1
2	2743.6	133.6	447.8	.0	.0	.0	447.8
3	2253.3	93.1	540.9	.0	.0	.0	540.9
4	1763.0	93.1	540.9	.0	.0	.0	540.9
5	1272.7	93.1	540.9	.0	.0	.0	540.9
6	782.4	93.1	540.9	.0	.0	.0	540.9
7	292.1	351.9	-36.0	.0	.0	.0	36.0
8	2988.8	351.9	-36.0	.0	.0	.0	36.0
9	2498.5	72.0	589.2	.0	.0	.0	589.2
10	2008.1	72.0	589.2	.0	.0	.0	589.2
11	1517.8	72.0	589.2	.0	.0	.0	589.2
12	1027.5	72.0	589.2	.0	.0	.0	589.2
13	537.2	351.9	-36.0	.0	.0	.0	36.0
14	2743.6	433.0	-206.1	.0	.0	.0	206.1
15	2253.3	93.1	540.9	.0	.0	.0	540.9
16	1763.0	93.1	540.9	.0	.0	.0	540.9
17	1272.7	93.1	540.9	.0	.0	.0	540.9
18	782.4	351.9	-36.0	.0	.0	.0	36.0
19	3233.9	509.9	-362.1	.0	.0	.0	362.1
20	2743.6	133.6	447.8	.0	.0	.0	447.8
21	2253.3	93.1	540.9	.0	.0	.0	540.9

22	1763.0	93.1	540.9	.0	.0	.0	540.9
23	1272.7	93.1	540.9	.0	.0	.0	540.9
24	782.4	93.1	540.9	.0	.0	.0	540.9
25	292.1	351.9	-36.0	.0	.0	.0	36.0
26	2988.8	351.9	-36.0	.0	.0	.0	36.0
27	2498.5	72.0	589.2	.0	.0	.0	589.2
28	2008.2	72.0	589.2	.0	.0	.0	589.2
29	1517.8	72.0	589.2	.0	.0	.0	589.2
30	1027.5	72.0	589.2	.0	.0	.0	589.2
31	537.2	351.9	-36.0	.0	.0	.0	36.0
32	2743.6	433.0	-206.1	.0	.0	.0	206.1
33	2253.3	93.1	540.9	.0	.0	.0	540.9
34	1763.0	93.1	540.9	.0	.0	.0	540.9
35	1272.7	93.1	540.9	.0	.0	.0	540.9
36	782.4	351.9	-36.0	.0	.0	.0	36.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

9.3 Spalla appoggi mobili – Analisi SLU statica e sismica

M A P - Matrix Analysis of Piles
 Programma per l'analisi di palificate collegate da un plinto rigido

(C) G.Guiducci, S.G.I. - luglio 1994

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NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

Geometria Palificata

palo	vin	X m	Y m	Z m	axz deg	ayz deg	axy deg	Box m	Boy m
1	0	6.000	8.700	.000	.00	.00	.00	1.50	.00
2	0	4.000	8.700	.000	.00	.00	.00	1.50	.00
3	0	2.000	8.700	.000	.00	.00	.00	1.50	.00
4	0	.000	8.700	.000	.00	.00	.00	1.50	.00
5	0	-2.000	8.700	.000	.00	.00	.00	1.50	.00
6	0	-4.000	8.700	.000	.00	.00	.00	1.50	.00
7	0	-6.000	8.700	.000	.00	.00	.00	1.50	.00
8	0	5.000	10.700	.000	.00	.00	.00	1.50	.00
9	0	3.000	10.700	.000	.00	.00	.00	1.50	.00
10	0	1.000	10.700	.000	.00	.00	.00	1.50	.00
11	0	-1.000	10.700	.000	.00	.00	.00	1.50	.00
12	0	-3.000	10.700	.000	.00	.00	.00	1.50	.00
13	0	-5.000	10.700	.000	.00	.00	.00	1.50	.00
14	0	4.000	12.700	.000	.00	.00	.00	1.50	.00
15	0	2.000	12.700	.000	.00	.00	.00	1.50	.00
16	0	.000	12.700	.000	.00	.00	.00	1.50	.00
17	0	-2.000	12.700	.000	.00	.00	.00	1.50	.00
18	0	-4.000	12.700	.000	.00	.00	.00	1.50	.00
19	0	6.000	-8.700	.000	.00	.00	.00	1.50	.00
20	0	4.000	-8.700	.000	.00	.00	.00	1.50	.00
21	0	2.000	-8.700	.000	.00	.00	.00	1.50	.00
22	0	.000	-8.700	.000	.00	.00	.00	1.50	.00
23	0	-2.000	-8.700	.000	.00	.00	.00	1.50	.00
24	0	-4.000	-8.700	.000	.00	.00	.00	1.50	.00
25	0	-6.000	-8.700	.000	.00	.00	.00	1.50	.00
26	0	5.000	-10.700	.000	.00	.00	.00	1.50	.00
27	0	3.000	-10.700	.000	.00	.00	.00	1.50	.00
28	0	1.000	-10.700	.000	.00	.00	.00	1.50	.00
29	0	-1.000	-10.700	.000	.00	.00	.00	1.50	.00
30	0	-3.000	-10.700	.000	.00	.00	.00	1.50	.00
31	0	-5.000	-10.700	.000	.00	.00	.00	1.50	.00
32	0	4.000	-12.700	.000	.00	.00	.00	1.50	.00
33	0	2.000	-12.700	.000	.00	.00	.00	1.50	.00
34	0	.000	-12.700	.000	.00	.00	.00	1.50	.00
35	0	-2.000	-12.700	.000	.00	.00	.00	1.50	.00
36	0	-4.000	-12.700	.000	.00	.00	.00	1.50	.00

vin = 0 - incastro; 1 - cerniera; 2 - appoggio

X, Y, Z = Coordinate testa pali

axz = Inclinazione palo nel piano Xp Z rispetto alla verticale
 (positiva se verso Xp positivo)

ayz = Inclinazione palo nel piano Yp Z rispetto alla verticale
 (positiva se verso Yp positivo)

axy = Rotazione assi Xp Yp (positiva se antioraria)

Box = Lato dell'elemento parallelo all'asse Xp

Boy = Lato dell'elemento parallelo all'asse Yp

se Boy = 0 D = Box: diametro

altrimenti D = $\sqrt{\text{Box} * \text{Boy} * 1.273}$: diametro equivalente

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 Caratterizzazione dei pali soggetti a carichi assiali e torsionali
 (uguali per tutti i pali)

palo	AK kN/m	TK kN*m/rad
1	200000.	.0

 AK = Rigidezza assiale palo-terreno
 TK = Rigidezza torsionale palo-terreno

 Baricentro palificata: Xg = .000 m Yg = .000 m
 Rotazione direzioni princip. di inerzia: .00 deg

Caratterizzazione del terreno per pali soggetti a carichi trasversali

Terreno tipo 1

Prof. m	E kN/m2
.00	33750.0
3.00	35250.0
3.10	150000.0
8.00	150000.0
8.10	36750.0
13.00	44250.0
13.10	150000.0
26.00	150000.0
26.10	52500.0
60.00	75000.0

Caratterizzazione dei pali soggetti a carichi trasversali

palo	Lp m	EJx kN*m2	Itx	Ridx	EJy kN*m2	Ity	Ridy
1	45.00	7455147.	1	.300	7455147.	1	.250
2	45.00	7455147.	1	.080	7455147.	1	.050
3	45.00	7455147.	1	.060	7455147.	1	.050
4	45.00	7455147.	1	.060	7455147.	1	.050
5	45.00	7455147.	1	.060	7455147.	1	.050
6	45.00	7455147.	1	.060	7455147.	1	.050
7	45.00	7455147.	1	.200	7455147.	1	.250
8	45.00	7455147.	1	.200	7455147.	1	.200
9	45.00	7455147.	1	.050	7455147.	1	.050
10	45.00	7455147.	1	.050	7455147.	1	.050
11	45.00	7455147.	1	.050	7455147.	1	.050
12	45.00	7455147.	1	.050	7455147.	1	.050
13	45.00	7455147.	1	.200	7455147.	1	.200
14	45.00	7455147.	1	.250	7455147.	1	.250
15	45.00	7455147.	1	.060	7455147.	1	.050
16	45.00	7455147.	1	.060	7455147.	1	.050
17	45.00	7455147.	1	.060	7455147.	1	.050
18	45.00	7455147.	1	.200	7455147.	1	.250
19	45.00	7455147.	1	.300	7455147.	1	.250
20	45.00	7455147.	1	.080	7455147.	1	.050
21	45.00	7455147.	1	.060	7455147.	1	.050
22	45.00	7455147.	1	.060	7455147.	1	.050
23	45.00	7455147.	1	.060	7455147.	1	.050
24	45.00	7455147.	1	.060	7455147.	1	.050
25	45.00	7455147.	1	.200	7455147.	1	.250
26	45.00	7455147.	1	.200	7455147.	1	.200
27	45.00	7455147.	1	.050	7455147.	1	.050
28	45.00	7455147.	1	.050	7455147.	1	.050
29	45.00	7455147.	1	.050	7455147.	1	.050
30	45.00	7455147.	1	.050	7455147.	1	.050
31	45.00	7455147.	1	.200	7455147.	1	.200

32	45.00	7455147.	1	.250	7455147.	1	.250
33	45.00	7455147.	1	.060	7455147.	1	.050
34	45.00	7455147.	1	.060	7455147.	1	.050
35	45.00	7455147.	1	.060	7455147.	1	.050
36	45.00	7455147.	1	.200	7455147.	1	.250

Lp = Lunghezza palo (compreso eventuale tratto fuori terra)
 EJ = Rigidezza flessionale del palo
 It = Tipo di terreno
 Rid = Moltiplicatore del modulo di reazione orizzontale

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 1
 spalla mobile - n777 _STRM1- n789 _STRM1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	37242.8	6884.3	61621.6	-16091.9	-59466.5	-40694.8
2	37966.8	6762.6	64185.2	16631.9	60085.1	41998.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
75209.6	13646.9	125806.8	540.0	8365.4	2605.6

Punto di applic. carico verticale: Xv = 1.673 m Yv = .111 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
10.446	12.064	1.516	.288	.013	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3930.2	907.4	-1490.3	35.0	-112.1	.0	1494.5
2	3323.8	282.2	-13.0	10.1	-40.5	.0	42.5
3	2717.5	210.7	176.2	9.4	-37.2	.0	180.0
4	2111.1	210.7	176.2	8.7	-34.0	.0	179.4
5	1504.8	210.7	176.2	8.1	-30.7	.0	178.8
6	898.5	210.7	176.2	7.4	-27.4	.0	178.3
7	292.1	648.8	-913.2	22.9	-68.8	.0	915.8
8	3632.0	647.1	-906.7	29.0	-96.0	.0	911.8
9	3025.7	173.0	278.5	9.7	-38.9	.0	281.2
10	2419.4	173.0	278.5	9.1	-35.6	.0	280.8
11	1813.0	173.0	278.5	8.4	-32.3	.0	280.4
12	1206.7	173.0	278.5	7.8	-29.1	.0	280.0
13	600.3	647.1	-906.7	20.3	-63.5	.0	909.0
14	3333.9	778.1	-1201.7	32.9	-104.9	.0	1206.3
15	2727.6	209.2	183.3	9.4	-37.2	.0	187.0
16	2121.2	209.2	183.3	8.7	-34.0	.0	186.4
17	1514.9	209.2	183.3	8.1	-30.7	.0	185.8
18	908.6	645.4	-900.2	24.9	-76.0	.0	903.4
19	3886.2	927.2	-1558.8	35.0	-112.1	.0	1562.8
20	3279.9	290.2	-48.9	10.1	-40.5	.0	63.5
21	2673.5	217.2	145.1	9.4	-37.2	.0	149.8

22	2067.2	217.2	145.1	8.7	-34.0	.0	149.0
23	1460.8	217.2	145.1	8.1	-30.7	.0	148.3
24	854.5	217.2	145.1	7.4	-27.4	.0	147.7
25	248.2	663.9	-969.7	22.9	-68.8	.0	972.1
26	3578.0	665.7	-976.2	29.0	-96.0	.0	980.9
27	2971.6	180.0	243.6	9.7	-38.9	.0	246.7
28	2365.3	180.0	243.6	9.1	-35.6	.0	246.2
29	1759.0	180.0	243.6	8.4	-32.3	.0	245.7
30	1152.6	180.0	243.6	7.8	-29.1	.0	245.3
31	546.3	665.7	-976.2	20.3	-63.5	.0	978.2
32	3269.8	803.7	-1293.5	32.9	-104.9	.0	1297.7
33	2663.4	218.7	137.9	9.4	-37.2	.0	142.9
34	2057.1	218.7	137.9	8.7	-34.0	.0	142.1
35	1450.7	218.7	137.9	8.1	-30.7	.0	141.3
36	844.4	667.4	-982.7	24.9	-76.0	.0	985.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 1
 spalla mobile - n777 _STRM1- n789 _STRM1

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	927.2	-1558.8	35.0	-112.1	927.9	1562.8
1.41	768.6	-371.6	31.1	-65.7	769.3	377.4
2.81	641.9	614.3	27.6	-24.6	642.5	614.7
4.22	331.3	1337.3	18.0	8.8	331.8	1337.3
5.63	61.4	1592.5	8.6	26.9	62.0	1592.7
7.03	-101.9	1547.6	1.8	33.8	101.9	1548.0
8.44	-175.5	1334.0	-2.1	32.8	175.5	1334.4
9.84	-182.2	1080.5	-2.8	29.3	182.3	1080.9
11.25	-179.3	824.7	-3.2	25.0	179.3	825.1
13.50	-154.4	434.4	-3.4	17.4	154.4	434.8
15.75	-94.5	155.7	-2.9	10.2	94.6	156.0
18.00	-46.0	2.2	-2.0	4.6	46.0	5.1
20.25	-14.5	-61.1	-1.1	1.2	14.5	61.1
22.50	2.6	-71.7	-.4	-.6	2.6	71.7
26.25	7.8	-45.5	.0	-1.0	7.8	45.5
30.00	5.6	-19.4	.1	-.7	5.6	19.4
33.75	2.5	-4.2	.1	-.4	2.5	4.2
39.38	.0	1.7	.0	-.1	.1	1.7
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 2
 spalla mobile - n777 _STRM2- n789 _STRM2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	37242.8	4994.9	51984.4	-16156.9	-59168.8	-32218.9
2	37966.7	4871.9	54544.4	16696.9	59786.7	33508.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
75209.5	9866.8	106528.8	540.0	8363.6	2605.2

Punto di applic. carico verticale: Xv = 1.416 m Yv = .111 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
10.446	9.260	1.225	.288	.013	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3581.4	665.5	-969.0	35.0	-112.1	.0	975.4
2	3091.3	200.6	112.9	10.1	-40.5	.0	119.9
3	2601.2	147.9	249.2	9.4	-37.2	.0	252.0
4	2111.1	147.9	249.2	8.7	-34.0	.0	251.5
5	1621.0	147.9	249.2	8.1	-30.7	.0	251.1
6	1130.9	147.9	249.2	7.4	-27.4	.0	250.7
7	640.8	472.6	-544.0	22.9	-68.8	.0	548.4
8	3341.4	470.8	-537.5	29.0	-96.0	.0	546.0
9	2851.3	120.0	323.3	9.7	-38.9	.0	325.6
10	2361.2	120.0	323.3	9.1	-35.6	.0	325.3
11	1871.1	120.0	323.3	8.4	-32.3	.0	324.9
12	1381.0	120.0	323.3	7.8	-29.1	.0	324.6
13	890.9	470.8	-537.5	20.3	-63.5	.0	541.3
14	3101.4	567.9	-752.4	32.9	-104.9	.0	759.7
15	2611.3	146.4	256.3	9.4	-37.2	.0	259.0
16	2121.2	146.4	256.3	8.7	-34.0	.0	258.6
17	1631.1	146.4	256.3	8.1	-30.7	.0	258.2
18	1141.0	469.1	-531.1	24.9	-76.0	.0	536.5
19	3537.5	685.2	-1037.5	35.0	-112.1	.0	1043.5
20	3047.4	208.6	77.0	10.1	-40.5	.0	87.0
21	2557.3	154.4	218.1	9.4	-37.2	.0	221.3

22	2067.2	154.4	218.1	8.7	-34.0	.0	220.8
23	1577.1	154.4	218.1	8.1	-30.7	.0	220.3
24	1087.0	154.4	218.1	7.4	-27.4	.0	219.9
25	596.9	487.6	-600.5	22.9	-68.8	.0	604.4
26	3287.4	489.4	-607.0	29.0	-96.0	.0	614.5
27	2797.3	127.0	288.4	9.7	-38.9	.0	291.0
28	2307.2	127.0	288.4	9.1	-35.6	.0	290.6
29	1817.1	127.0	288.4	8.4	-32.3	.0	290.2
30	1327.0	127.0	288.4	7.8	-29.1	.0	289.9
31	836.9	489.4	-607.0	20.3	-63.5	.0	610.3
32	3037.3	593.5	-844.2	32.9	-104.9	.0	850.7
33	2547.2	155.9	211.0	9.4	-37.2	.0	214.3
34	2057.1	155.9	211.0	8.7	-34.0	.0	213.7
35	1567.0	155.9	211.0	8.1	-30.7	.0	213.2
36	1076.9	491.1	-613.5	24.9	-76.0	.0	618.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 3
 spalla mobile - n777 _STRM3 - n789 _STRM3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	50892.2	6921.1	127506.0	-22899.0	-85284.7	-64753.8
2	51443.3	6725.8	129183.6	23656.5	85285.1	66319.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
102335.5	13646.9	256689.6	757.5	5897.2	3655.1

Punto di applic. carico verticale: Xv = 2.508 m Yv = .058 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
14.213	16.584	2.603	.374	.011	.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5984.5	1005.2	-644.1	48.6	-162.8	.0	664.3
2	4943.4	261.1	980.6	14.3	-63.1	.0	982.6
3	3902.4	179.9	1170.5	13.4	-58.5	.0	1172.0
4	2861.4	179.9	1170.5	12.5	-53.9	.0	1171.8
5	1820.4	179.9	1170.5	11.6	-49.3	.0	1171.6
6	779.4	179.9	1170.5	10.6	-44.8	.0	1171.4
7	-261.7	692.4	9.6	31.6	-102.0	.0	102.4
8	5468.3	690.0	18.7	40.4	-140.4	.0	141.6
9	4427.2	137.4	1270.2	13.9	-60.8	.0	1271.7
10	3386.2	137.4	1270.2	12.9	-56.2	.0	1271.5
11	2345.2	137.4	1270.2	12.0	-51.6	.0	1271.3
12	1304.2	137.4	1270.2	11.1	-47.1	.0	1271.1
13	263.2	690.0	18.7	28.2	-94.9	.0	96.7
14	4952.1	847.4	-311.2	45.7	-152.7	.0	346.6
15	3911.0	177.8	1180.6	13.4	-58.5	.0	1182.0
16	2870.0	177.8	1180.6	12.5	-53.9	.0	1181.8
17	1829.0	177.8	1180.6	11.6	-49.3	.0	1181.6
18	788.0	687.5	27.8	34.4	-112.1	.0	115.5
19	5947.0	1033.0	-740.2	48.6	-162.8	.0	757.9
20	4905.9	272.3	930.2	14.3	-63.1	.0	932.3
21	3864.9	189.0	1127.0	13.4	-58.5	.0	1128.5

22	2823.9	189.0	1127.0	12.5	-53.9	.0	1128.2
23	1782.9	189.0	1127.0	11.6	-49.3	.0	1128.0
24	741.9	189.0	1127.0	10.6	-44.8	.0	1127.8
25	-299.2	713.6	-69.7	31.6	-102.0	.0	123.5
26	5422.1	716.0	-78.8	40.4	-140.4	.0	161.0
27	4381.1	147.3	1221.2	13.9	-60.8	.0	1222.7
28	3340.1	147.3	1221.2	12.9	-56.2	.0	1222.5
29	2299.1	147.3	1221.2	12.0	-51.6	.0	1222.3
30	1258.1	147.3	1221.2	11.1	-47.1	.0	1222.1
31	217.0	716.0	-78.8	28.2	-94.9	.0	123.3
32	4897.3	883.3	-440.0	45.7	-152.7	.0	465.7
33	3856.3	191.1	1116.9	13.4	-58.5	.0	1118.5
34	2815.3	191.1	1116.9	12.5	-53.9	.0	1118.2
35	1774.3	191.1	1116.9	11.6	-49.3	.0	1118.0
36	733.2	718.4	-87.9	34.4	-112.1	.0	142.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 3
 spalla mobile - n777 _STRM3 - n789 _STRM3

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1005.2	-644.1	48.6	-162.8	1006.4	664.3
1.41	794.5	612.7	43.4	-98.2	795.6	620.5
2.81	633.3	1607.9	38.7	-40.6	634.5	1608.4
4.22	259.6	2279.9	25.6	6.4	260.9	2279.9
5.63	-47.2	2401.3	12.6	32.7	48.9	2401.5
7.03	-214.3	2196.3	3.2	43.2	214.3	2196.7
8.44	-275.2	1834.0	-2.3	42.7	275.3	1834.5
9.84	-274.7	1444.9	-3.4	38.6	274.7	1445.4
11.25	-262.3	1065.1	-4.0	33.4	262.3	1065.6
13.50	-216.6	502.6	-4.3	23.8	216.7	503.2
15.75	-121.1	128.1	-3.8	14.3	121.1	128.9
18.00	-51.1	-57.3	-2.7	6.8	51.2	57.7
20.25	-9.7	-118.3	-1.6	2.0	9.8	118.3
22.50	9.9	-113.6	-.7	-.5	9.9	113.6
26.25	12.5	-63.9	.0	-1.3	12.5	63.9
30.00	8.1	-24.4	.1	-1.0	8.1	24.4
33.75	3.3	-3.1	.1	-.5	3.3	3.2
39.38	-.2	3.2	.0	-.1	.2	3.2
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 3
 spalla mobile - n777 _STRM3 - n789 _STRM3

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 25
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	713.6	-69.7	31.6	-102.0	714.3	123.5
1.41	570.9	827.8	28.1	-60.1	571.6	830.0
2.81	460.1	1547.3	25.0	-22.8	460.8	1547.5
4.22	196.3	2041.6	16.3	7.4	197.0	2041.6
5.63	-30.1	2140.0	7.8	23.9	31.1	2140.1
7.03	-163.7	1989.5	1.7	30.2	163.8	1989.7
8.44	-221.1	1703.8	-1.8	29.4	221.1	1704.0
9.84	-224.9	1388.4	-2.5	26.3	224.9	1388.6
11.25	-219.8	1074.0	-2.9	22.5	219.9	1074.3
13.50	-191.4	594.9	-3.0	15.7	191.4	595.1
15.75	-123.8	241.4	-2.6	9.2	123.8	241.6
18.00	-66.8	31.5	-1.8	4.2	66.8	31.7
20.25	-26.9	-69.0	-1.0	1.1	26.9	69.0
22.50	-2.1	-98.9	-.4	-.5	2.1	98.9
26.25	9.6	-75.0	.0	-.9	9.6	75.0
30.00	8.2	-40.1	.1	-.6	8.2	40.1
33.75	4.7	-15.3	.1	-.3	4.7	15.3
39.38	1.0	-.4	.0	-.1	1.0	.4
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 4
 spalla mobile - n777 _STRM4- n789 _STRM4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	50892.2	5031.7	117868.8	-22964.0	-84986.9	-56277.9
2	51443.3	4835.1	119542.8	23721.5	84986.7	57829.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
102335.5	9866.8	237411.6	757.5	5896.6	3654.7

Punto di applic. carico verticale: Xv = 2.320 m Yv = .058 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
14.213	13.780	2.312	.374	.011	.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5635.7	763.2	-122.7	48.6	-162.8	.0	203.9
2	4711.0	179.5	1106.5	14.3	-63.1	.0	1108.3
3	3786.2	117.1	1243.6	13.4	-58.5	.0	1245.0
4	2861.4	117.1	1243.6	12.5	-53.9	.0	1244.8
5	1936.6	117.1	1243.6	11.6	-49.3	.0	1244.6
6	1011.8	117.1	1243.6	10.6	-44.8	.0	1244.4
7	87.1	516.1	378.8	31.6	-102.0	.0	392.2
8	5177.7	513.7	387.9	40.4	-140.4	.0	412.5
9	4252.9	84.5	1315.0	13.9	-60.8	.0	1316.4
10	3328.1	84.5	1315.0	12.9	-56.2	.0	1316.2
11	2403.3	84.5	1315.0	12.0	-51.6	.0	1316.1
12	1478.5	84.5	1315.0	11.1	-47.1	.0	1315.9
13	553.8	513.7	387.9	28.2	-94.9	.0	399.3
14	4719.6	637.1	138.1	45.7	-152.7	.0	205.9
15	3794.8	115.0	1253.6	13.4	-58.5	.0	1255.0
16	2870.0	115.0	1253.6	12.5	-53.9	.0	1254.8
17	1945.2	115.0	1253.6	11.6	-49.3	.0	1254.6
18	1020.5	511.3	397.0	34.4	-112.1	.0	412.5
19	5598.2	791.0	-218.9	48.6	-162.8	.0	272.8
20	4673.5	190.7	1056.1	14.3	-63.1	.0	1058.0
21	3748.7	126.2	1200.0	13.4	-58.5	.0	1201.4

22	2823.9	126.2	1200.0	12.5	-53.9	.0	1201.2
23	1899.1	126.2	1200.0	11.6	-49.3	.0	1201.0
24	974.4	126.2	1200.0	10.6	-44.8	.0	1200.8
25	49.6	537.3	299.5	31.6	-102.0	.0	316.4
26	5131.5	539.7	290.4	40.4	-140.4	.0	322.6
27	4206.8	94.4	1266.1	13.9	-60.8	.0	1267.5
28	3282.0	94.4	1266.1	12.9	-56.2	.0	1267.3
29	2357.2	94.4	1266.1	12.0	-51.6	.0	1267.1
30	1432.4	94.4	1266.1	11.1	-47.1	.0	1266.9
31	507.7	539.7	290.4	28.2	-94.9	.0	305.5
32	4664.8	673.0	9.3	45.7	-152.7	.0	153.0
33	3740.1	128.3	1190.0	13.4	-58.5	.0	1191.4
34	2815.3	128.3	1190.0	12.5	-53.9	.0	1191.2
35	1890.5	128.3	1190.0	11.6	-49.3	.0	1191.0
36	965.7	542.2	281.3	34.4	-112.1	.0	302.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 5
 spalla mobile - n777 _STRM5- n789 _STRM5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	37242.8	6884.3	61621.6	-16091.9	-59466.5	-40694.8
2	37966.8	6762.6	64185.2	16631.9	60085.1	41998.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
75209.6	13646.9	125806.8	540.0	8365.4	2605.6

Punto di applic. carico verticale: Xv = 1.673 m Yv = .111 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
10.446	12.064	1.516	.288	.013	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3930.2	907.4	-1490.3	35.0	-112.1	.0	1494.5
2	3323.8	282.2	-13.0	10.1	-40.5	.0	42.5
3	2717.5	210.7	176.2	9.4	-37.2	.0	180.0
4	2111.1	210.7	176.2	8.7	-34.0	.0	179.4
5	1504.8	210.7	176.2	8.1	-30.7	.0	178.8
6	898.5	210.7	176.2	7.4	-27.4	.0	178.3
7	292.1	648.8	-913.2	22.9	-68.8	.0	915.8
8	3632.0	647.1	-906.7	29.0	-96.0	.0	911.8
9	3025.7	173.0	278.5	9.7	-38.9	.0	281.2
10	2419.4	173.0	278.5	9.1	-35.6	.0	280.8
11	1813.0	173.0	278.5	8.4	-32.3	.0	280.4
12	1206.7	173.0	278.5	7.8	-29.1	.0	280.0
13	600.3	647.1	-906.7	20.3	-63.5	.0	909.0
14	3333.9	778.1	-1201.7	32.9	-104.9	.0	1206.3
15	2727.6	209.2	183.3	9.4	-37.2	.0	187.0
16	2121.2	209.2	183.3	8.7	-34.0	.0	186.4
17	1514.9	209.2	183.3	8.1	-30.7	.0	185.8
18	908.6	645.4	-900.2	24.9	-76.0	.0	903.4
19	3886.2	927.2	-1558.8	35.0	-112.1	.0	1562.8
20	3279.9	290.2	-48.9	10.1	-40.5	.0	63.5
21	2673.5	217.2	145.1	9.4	-37.2	.0	149.8

22	2067.2	217.2	145.1	8.7	-34.0	.0	149.0
23	1460.8	217.2	145.1	8.1	-30.7	.0	148.3
24	854.5	217.2	145.1	7.4	-27.4	.0	147.7
25	248.2	663.9	-969.7	22.9	-68.8	.0	972.1
26	3578.0	665.7	-976.2	29.0	-96.0	.0	980.9
27	2971.6	180.0	243.6	9.7	-38.9	.0	246.7
28	2365.3	180.0	243.6	9.1	-35.6	.0	246.2
29	1759.0	180.0	243.6	8.4	-32.3	.0	245.7
30	1152.6	180.0	243.6	7.8	-29.1	.0	245.3
31	546.3	665.7	-976.2	20.3	-63.5	.0	978.2
32	3269.8	803.7	-1293.5	32.9	-104.9	.0	1297.7
33	2663.4	218.7	137.9	9.4	-37.2	.0	142.9
34	2057.1	218.7	137.9	8.7	-34.0	.0	142.1
35	1450.7	218.7	137.9	8.1	-30.7	.0	141.3
36	844.4	667.4	-982.7	24.9	-76.0	.0	985.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobileSLU statica

CONDIZIONE DI CARICO 6
spalla mobile - n777 _STRM6- n789 _STRM6

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48663.7	5060.7	107499.0	-21860.1	-80928.9	-52630.3
2	49943.9	4806.2	111925.5	22934.1	81860.2	55089.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.6	9866.9	219424.5	1074.0	14629.5	5181.9

Punto di applic. carico verticale: Xv = 2.225 m Yv = .148 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	13.159	2.163	.562	.023	.017

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5373.8	743.5	-217.1	69.4	-224.9	.0	312.6
2	4508.7	179.8	981.4	20.1	-82.7	.0	984.9
3	3643.7	119.2	1116.9	18.8	-76.2	.0	1119.5
4	2778.7	119.2	1116.9	17.5	-69.7	.0	1119.1
5	1913.6	119.2	1116.9	16.2	-63.2	.0	1118.7
6	1048.6	119.2	1116.9	14.9	-56.7	.0	1118.3
7	183.5	505.3	270.0	45.3	-138.7	.0	303.6
8	4950.4	501.9	282.9	57.6	-192.8	.0	342.4
9	4085.3	87.1	1189.9	19.4	-79.4	.0	1192.6
10	3220.3	87.1	1189.9	18.1	-73.0	.0	1192.2
11	2355.2	87.1	1189.9	16.8	-66.5	.0	1191.8
12	1490.2	87.1	1189.9	15.5	-60.0	.0	1191.5
13	625.2	501.9	282.9	40.4	-128.3	.0	310.7
14	4526.9	619.4	45.1	65.4	-210.5	.0	215.3
15	3661.9	116.3	1131.1	18.8	-76.2	.0	1133.7
16	2796.8	116.3	1131.1	17.5	-69.7	.0	1133.3
17	1931.8	116.3	1131.1	16.2	-63.2	.0	1132.9
18	1066.8	498.4	295.8	49.3	-153.0	.0	333.1
19	5294.7	782.8	-353.4	69.4	-224.9	.0	418.9
20	4429.6	195.7	910.0	20.1	-82.7	.0	913.8
21	3564.6	132.2	1055.1	18.8	-76.2	.0	1057.8

22	2699.5	132.2	1055.1	17.5	-69.7	.0	1057.4
23	1834.5	132.2	1055.1	16.2	-63.2	.0	1057.0
24	969.5	132.2	1055.1	14.9	-56.7	.0	1056.6
25	104.4	535.3	157.7	45.3	-138.7	.0	210.0
26	4853.0	538.8	144.8	57.6	-192.8	.0	241.2
27	3988.0	101.1	1120.5	19.4	-79.4	.0	1123.3
28	3123.0	101.1	1120.5	18.1	-73.0	.0	1122.9
29	2257.9	101.1	1120.5	16.8	-66.5	.0	1122.5
30	1392.9	101.1	1120.5	15.5	-60.0	.0	1122.1
31	527.8	538.8	144.8	40.4	-128.3	.0	193.5
32	4411.4	670.3	-137.4	65.4	-210.5	.0	251.4
33	3546.4	135.2	1040.9	18.8	-76.2	.0	1043.7
34	2681.4	135.2	1040.9	17.5	-69.7	.0	1043.2
35	1816.3	135.2	1040.9	16.2	-63.2	.0	1042.8
36	951.3	542.2	131.9	49.3	-153.0	.0	202.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 7
 spalla mobile - n777 _STRM7- n789 _STRM7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	49944.0	6694.3	121556.6	-22839.5	-82695.5	-62742.1
2	48663.6	6952.5	117145.9	21765.5	81762.9	60323.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.6	13646.8	238702.5	-1074.0	-14632.9	-5181.4

Punto di applic. carico verticale: Xv = 2.421 m Yv = -.148 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	15.963	2.453	-.562	-.023	-.017

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5643.4	1024.8	-874.6	-69.4	224.9	.0	903.1
2	4662.1	277.3	784.1	-20.1	82.7	.0	788.5
3	3680.8	195.0	982.1	-18.8	76.2	.0	985.0
4	2699.5	195.0	982.1	-17.5	69.7	.0	984.5
5	1718.3	195.0	982.1	-16.2	63.2	.0	984.1
6	737.0	195.0	982.1	-14.9	56.7	.0	983.7
7	-244.3	711.6	-211.4	-45.3	138.7	.0	252.8
8	5143.6	715.0	-224.3	-57.6	192.8	.0	295.8
9	4162.4	154.0	1075.7	-19.4	79.4	.0	1078.6
10	3181.1	154.0	1075.7	-18.1	73.0	.0	1078.2
11	2199.8	154.0	1075.7	-16.8	66.5	.0	1077.7
12	1218.5	154.0	1075.7	-15.5	60.0	.0	1077.4
13	237.2	715.0	-224.3	-40.4	128.3	.0	258.4
14	4643.9	880.5	-586.7	-65.4	210.5	.0	623.3
15	3662.6	197.9	967.9	-18.8	76.2	.0	970.8
16	2681.3	197.9	967.9	-17.5	69.7	.0	970.4
17	1700.1	197.9	967.9	-16.2	63.2	.0	969.9
18	718.8	718.5	-237.2	-49.3	153.0	.0	282.3
19	5722.5	985.4	-738.4	-69.4	224.9	.0	771.9
20	4741.2	261.4	855.5	-20.1	82.7	.0	859.5
21	3759.9	182.0	1043.9	-18.8	76.2	.0	1046.6

22	2778.7	182.0	1043.9	-17.5	69.7	.0	1046.2
23	1797.4	182.0	1043.9	-16.2	63.2	.0	1045.8
24	816.1	182.0	1043.9	-14.9	56.7	.0	1045.4
25	-165.2	681.6	-99.1	-45.3	138.7	.0	170.5
26	5241.0	678.1	-86.2	-57.6	192.8	.0	211.2
27	4259.7	140.1	1145.1	-19.4	79.4	.0	1147.9
28	3278.4	140.1	1145.1	-18.1	73.0	.0	1147.4
29	2297.1	140.1	1145.1	-16.8	66.5	.0	1147.0
30	1315.8	140.1	1145.1	-15.5	60.0	.0	1146.7
31	334.6	678.1	-86.2	-40.4	128.3	.0	154.6
32	4759.4	829.6	-404.2	-65.4	210.5	.0	455.7
33	3778.1	179.0	1058.1	-18.8	76.2	.0	1060.8
34	2796.9	179.0	1058.1	-17.5	69.7	.0	1060.4
35	1815.6	179.0	1058.1	-16.2	63.2	.0	1059.9
36	834.3	674.7	-73.3	-49.3	153.0	.0	169.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 8
 spalla mobile - n777 _STRM8 - n789 _STRM8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	49944.0	4805.0	111919.3	-22904.5	-82397.7	-54266.3
2	48663.6	5061.9	107505.1	21830.5	81464.5	51833.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
98607.6	9866.9	219424.4	-1074.0	-14633.5	-5181.9

Punto di applic. carico verticale: Xv = 2.225 m Yv = -.148 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.695	13.159	2.163	-.562	-.023	-.017

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5294.7	782.8	-353.4	-69.4	224.9	.0	418.9
2	4429.6	195.7	910.0	-20.1	82.7	.0	913.8
3	3564.6	132.2	1055.1	-18.8	76.2	.0	1057.8
4	2699.5	132.2	1055.1	-17.5	69.7	.0	1057.4
5	1834.5	132.2	1055.1	-16.2	63.2	.0	1057.0
6	969.5	132.2	1055.1	-14.9	56.7	.0	1056.6
7	104.4	535.3	157.7	-45.3	138.7	.0	210.0
8	4853.0	538.8	144.8	-57.6	192.8	.0	241.2
9	3988.0	101.1	1120.5	-19.4	79.4	.0	1123.3
10	3123.0	101.1	1120.5	-18.1	73.0	.0	1122.9
11	2257.9	101.1	1120.5	-16.8	66.5	.0	1122.5
12	1392.9	101.1	1120.5	-15.5	60.0	.0	1122.1
13	527.8	538.8	144.8	-40.4	128.3	.0	193.5
14	4411.4	670.3	-137.4	-65.4	210.5	.0	251.4
15	3546.4	135.2	1040.9	-18.8	76.2	.0	1043.7
16	2681.3	135.2	1040.9	-17.5	69.7	.0	1043.2
17	1816.3	135.2	1040.9	-16.2	63.2	.0	1042.8
18	951.3	542.2	131.9	-49.3	153.0	.0	202.0
19	5373.8	743.5	-217.1	-69.4	224.9	.0	312.6
20	4508.7	179.8	981.4	-20.1	82.7	.0	984.9
21	3643.7	119.2	1116.9	-18.8	76.2	.0	1119.5

22	2778.7	119.2	1116.9	-17.5	69.7	.0	1119.1
23	1913.6	119.2	1116.9	-16.2	63.2	.0	1118.7
24	1048.6	119.2	1116.9	-14.9	56.7	.0	1118.3
25	183.5	505.3	270.0	-45.3	138.7	.0	303.6
26	4950.4	501.9	282.9	-57.6	192.8	.0	342.4
27	4085.3	87.1	1189.9	-19.4	79.4	.0	1192.6
28	3220.3	87.1	1189.9	-18.1	73.0	.0	1192.2
29	2355.2	87.1	1189.9	-16.8	66.5	.0	1191.8
30	1490.2	87.1	1189.9	-15.5	60.0	.0	1191.5
31	625.2	501.9	282.9	-40.4	128.3	.0	310.7
32	4526.9	619.4	45.1	-65.4	210.5	.0	215.3
33	3661.9	116.3	1131.1	-18.8	76.2	.0	1133.7
34	2796.9	116.3	1131.1	-17.5	69.7	.0	1133.3
35	1931.8	116.3	1131.1	-16.2	63.2	.0	1132.9
36	1066.8	498.4	295.8	-49.3	153.0	.0	333.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobileSLU statica

CONDIZIONE DI CARICO 9
spalla mobile - n777 _STRM9- n789 _STRM9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	45742.3	6918.4	103490.3	-20631.3	-75732.2	-56709.4
2	48298.8	6728.4	113178.7	21705.3	79046.2	59859.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
94041.1	13646.8	216669.0	1074.0	30668.6	5182.6

Punto di applic. carico verticale: Xv = 2.304 m Yv = .326 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.061	15.202	2.270	.642	.042	.017

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5409.3	968.3	-878.5	70.7	-209.7	.0	903.2
2	4501.2	264.7	689.5	19.5	-65.5	.0	692.6
3	3593.1	187.0	877.5	18.2	-59.0	.0	879.5
4	2685.0	187.0	877.5	16.9	-52.5	.0	879.1
5	1776.9	187.0	877.5	15.6	-46.0	.0	878.7
6	868.8	187.0	877.5	14.3	-39.5	.0	878.4
7	-39.3	673.7	-252.6	46.7	-123.5	.0	281.1
8	4972.0	670.3	-239.7	58.5	-176.9	.0	297.9
9	4063.9	145.8	979.4	18.8	-62.2	.0	981.3
10	3155.8	145.8	979.4	17.5	-55.7	.0	980.9
11	2247.7	145.8	979.4	16.2	-49.2	.0	980.6
12	1339.6	145.8	979.4	14.9	-42.7	.0	980.3
13	431.5	670.3	-239.7	41.2	-112.4	.0	264.7
14	4534.7	817.1	-550.9	66.7	-195.3	.0	584.5
15	3626.6	184.0	891.7	18.2	-59.0	.0	893.7
16	2718.5	184.0	891.7	16.9	-52.5	.0	893.3
17	1810.4	184.0	891.7	15.6	-46.0	.0	892.9
18	902.2	666.8	-226.7	50.7	-137.8	.0	265.4
19	5263.8	1007.7	-1014.8	70.7	-209.7	.0	1036.2
20	4355.7	280.6	618.1	19.5	-65.5	.0	621.5
21	3447.6	199.9	815.7	18.2	-59.0	.0	817.8

22	2539.5	199.9	815.7	16.9	-52.5	.0	817.4
23	1631.4	199.9	815.7	15.6	-46.0	.0	817.0
24	723.3	199.9	815.7	14.3	-39.5	.0	816.7
25	-184.8	703.7	-364.9	46.7	-123.5	.0	385.2
26	4793.0	707.2	-377.8	58.5	-176.9	.0	417.2
27	3884.9	159.8	909.9	18.8	-62.2	.0	912.0
28	2976.8	159.8	909.9	17.5	-55.7	.0	911.6
29	2068.7	159.8	909.9	16.2	-49.2	.0	911.2
30	1160.6	159.8	909.9	14.9	-42.7	.0	910.9
31	252.5	707.2	-377.8	41.2	-112.4	.0	394.2
32	4322.3	868.0	-733.5	66.7	-195.3	.0	759.1
33	3414.2	202.9	801.5	18.2	-59.0	.0	803.7
34	2506.0	202.9	801.5	16.9	-52.5	.0	803.2
35	1597.9	202.9	801.5	15.6	-46.0	.0	802.8
36	689.8	710.6	-390.7	50.7	-137.8	.0	414.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 10
 spalla mobile - n777 _STRM10- n789 _STRM10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	45742.4	5029.1	93853.0	-20696.4	-75434.4	-48233.6
2	48298.7	4837.8	103538.0	21770.4	78747.8	51368.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
94041.1	9866.9	197391.0	1074.0	30665.8	5182.1

Punto di applic. carico verticale: Xv = 2.099 m Yv = .326 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.061	12.398	1.980	.642	.042	.017

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5060.6	726.3	-357.2	70.7	-209.7	.0	414.2
2	4268.7	183.1	815.4	19.5	-65.5	.0	818.0
3	3476.9	124.2	950.6	18.2	-59.0	.0	952.4
4	2685.0	124.2	950.6	16.9	-52.5	.0	952.0
5	1893.1	124.2	950.6	15.6	-46.0	.0	951.7
6	1101.3	124.2	950.6	14.3	-39.5	.0	951.4
7	309.4	497.5	116.6	46.7	-123.5	.0	169.8
8	4681.4	494.0	129.5	58.5	-176.9	.0	219.3
9	3889.5	92.9	1024.2	18.8	-62.2	.0	1026.1
10	3097.7	92.9	1024.2	17.5	-55.7	.0	1025.7
11	2305.8	92.9	1024.2	16.2	-49.2	.0	1025.4
12	1513.9	92.9	1024.2	14.9	-42.7	.0	1025.1
13	722.1	494.0	129.5	41.2	-112.4	.0	171.5
14	4302.2	606.9	-101.7	66.7	-195.3	.0	220.2
15	3510.3	121.2	964.8	18.2	-59.0	.0	966.6
16	2718.5	121.2	964.8	16.9	-52.5	.0	966.2
17	1926.6	121.2	964.8	15.6	-46.0	.0	965.9
18	1134.7	490.6	142.4	50.7	-137.8	.0	198.2
19	4915.1	765.7	-493.5	70.7	-209.7	.0	536.2
20	4123.2	199.0	744.0	19.5	-65.5	.0	746.9
21	3331.4	137.2	888.8	18.2	-59.0	.0	890.7

22	2539.5	137.2	888.8	16.9	-52.5	.0	890.3
23	1747.6	137.2	888.8	15.6	-46.0	.0	889.9
24	955.8	137.2	888.8	14.3	-39.5	.0	889.6
25	163.9	527.5	4.3	46.7	-123.5	.0	123.6
26	4502.4	530.9	-8.6	58.5	-176.9	.0	177.2
27	3710.6	106.9	954.7	18.8	-62.2	.0	956.8
28	2918.7	106.9	954.7	17.5	-55.7	.0	956.4
29	2126.8	106.9	954.7	16.2	-49.2	.0	956.0
30	1335.0	106.9	954.7	14.9	-42.7	.0	955.7
31	543.1	530.9	-8.6	41.2	-112.4	.0	112.7
32	4089.8	657.8	-284.2	66.7	-195.3	.0	344.9
33	3297.9	140.1	874.5	18.2	-59.0	.0	876.5
34	2506.1	140.1	874.5	16.9	-52.5	.0	876.1
35	1714.2	140.1	874.5	15.6	-46.0	.0	875.8
36	922.3	534.4	-21.5	50.7	-137.8	.0	139.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobileSLU statica

CONDIZIONE DI CARICO 11
spalla mobile - n777 _STRM11- n789 _STRM11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48298.8	6725.8	113168.9	-21675.7	-79583.0	-59021.1
2	45742.3	6921.0	103500.1	20601.7	76268.4	55927.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
94041.1	13646.8	216669.0	-1074.0	-30669.1	-5182.2

Punto di applic. carico verticale: Xv = 2.304 m Yv = -.326 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.061	15.202	2.270	-.642	-.042	-.017

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5263.8	1007.7	-1014.8	-70.7	209.7	.0	1036.2
2	4355.7	280.6	618.1	-19.5	65.5	.0	621.5
3	3447.6	199.9	815.7	-18.2	59.0	.0	817.8
4	2539.5	199.9	815.7	-16.9	52.5	.0	817.4
5	1631.4	199.9	815.7	-15.6	46.0	.0	817.0
6	723.3	199.9	815.7	-14.3	39.5	.0	816.7
7	-184.8	703.7	-364.9	-46.7	123.5	.0	385.2
8	4793.0	707.2	-377.8	-58.5	176.9	.0	417.2
9	3884.9	159.8	909.9	-18.8	62.2	.0	912.0
10	2976.8	159.8	909.9	-17.5	55.7	.0	911.6
11	2068.7	159.8	909.9	-16.2	49.2	.0	911.2
12	1160.6	159.8	909.9	-14.9	42.7	.0	910.9
13	252.5	707.2	-377.8	-41.2	112.4	.0	394.2
14	4322.3	868.0	-733.5	-66.7	195.3	.0	759.1
15	3414.1	202.9	801.5	-18.2	59.0	.0	803.7
16	2506.0	202.9	801.5	-16.9	52.5	.0	803.2
17	1597.9	202.9	801.5	-15.6	46.0	.0	802.8
18	689.8	710.6	-390.7	-50.7	137.8	.0	414.3
19	5409.3	968.3	-878.5	-70.7	209.7	.0	903.2
20	4501.2	264.7	689.5	-19.5	65.5	.0	692.6
21	3593.1	187.0	877.5	-18.2	59.0	.0	879.5

22	2685.0	187.0	877.5	-16.9	52.5	.0	879.1
23	1776.9	187.0	877.5	-15.6	46.0	.0	878.7
24	868.8	187.0	877.5	-14.3	39.5	.0	878.4
25	-39.3	673.7	-252.6	-46.7	123.5	.0	281.1
26	4972.0	670.3	-239.7	-58.5	176.9	.0	297.9
27	4063.9	145.8	979.4	-18.8	62.2	.0	981.3
28	3155.8	145.8	979.4	-17.5	55.7	.0	980.9
29	2247.7	145.8	979.4	-16.2	49.2	.0	980.6
30	1339.6	145.8	979.4	-14.9	42.7	.0	980.3
31	431.5	670.3	-239.7	-41.2	112.4	.0	264.7
32	4534.7	817.1	-550.9	-66.7	195.3	.0	584.5
33	3626.6	184.0	891.7	-18.2	59.0	.0	893.7
34	2718.5	184.0	891.7	-16.9	52.5	.0	893.3
35	1810.4	184.0	891.7	-15.6	46.0	.0	892.9
36	902.3	666.8	-226.8	-50.7	137.8	.0	265.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLU statica

CONDIZIONE DI CARICO 12
spalla mobile - n777 _STRM12- n789 _STRM12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	48298.8	4836.5	103531.7	-21740.8	-79285.2	-50545.3
2	45742.3	5030.3	93859.3	20666.8	75970.0	47437.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
94041.1	9866.8	197391.0	-1074.0	-30669.8	-5181.7

Punto di applic. carico verticale: Xv = 2.099 m Yv = -.326 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
13.061	12.398	1.980	-.642	-.042	-.017

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4915.1	765.7	-493.5	-70.7	209.7	.0	536.2
2	4123.2	199.0	744.0	-19.5	65.5	.0	746.9
3	3331.4	137.1	888.8	-18.2	59.0	.0	890.7
4	2539.5	137.1	888.8	-16.9	52.5	.0	890.3
5	1747.6	137.1	888.8	-15.6	46.0	.0	890.0
6	955.8	137.1	888.8	-14.3	39.5	.0	889.6
7	163.9	527.5	4.3	-46.7	123.5	.0	123.6
8	4502.4	530.9	-8.6	-58.5	176.9	.0	177.1
9	3710.6	106.9	954.7	-18.8	62.2	.0	956.8
10	2918.7	106.9	954.7	-17.5	55.7	.0	956.4
11	2126.8	106.9	954.7	-16.2	49.2	.0	956.0
12	1335.0	106.9	954.7	-14.9	42.7	.0	955.7
13	543.1	530.9	-8.6	-41.2	112.4	.0	112.7
14	4089.8	657.8	-284.2	-66.7	195.3	.0	344.8
15	3297.9	140.1	874.6	-18.2	59.0	.0	876.5
16	2506.0	140.1	874.6	-16.9	52.5	.0	876.1
17	1714.2	140.1	874.6	-15.6	46.0	.0	875.8
18	922.3	534.4	-21.5	-50.7	137.8	.0	139.5
19	5060.6	726.3	-357.2	-70.7	209.7	.0	414.2
20	4268.7	183.1	815.4	-19.5	65.5	.0	818.0
21	3476.9	124.2	950.6	-18.2	59.0	.0	952.4

22	2685.0	124.2	950.6	-16.9	52.5	.0	952.0
23	1893.1	124.2	950.6	-15.6	46.0	.0	951.7
24	1101.3	124.2	950.6	-14.3	39.5	.0	951.4
25	309.4	497.5	116.6	-46.7	123.5	.0	169.8
26	4681.4	494.0	129.5	-58.5	176.9	.0	219.3
27	3889.5	92.9	1024.2	-18.8	62.2	.0	1026.1
28	3097.7	92.9	1024.2	-17.5	55.7	.0	1025.7
29	2305.8	92.9	1024.2	-16.2	49.2	.0	1025.4
30	1513.9	92.9	1024.2	-14.9	42.7	.0	1025.1
31	722.1	494.0	129.5	-41.2	112.4	.0	171.5
32	4302.2	606.9	-101.7	-66.7	195.3	.0	220.2
33	3510.3	121.2	964.8	-18.2	59.0	.0	966.6
34	2718.5	121.2	964.8	-16.9	52.5	.0	966.2
35	1926.6	121.2	964.8	-15.6	46.0	.0	965.9
36	1134.7	490.6	142.4	-50.7	137.8	.0	198.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 13
 spalla mobile - n777 _STRM13- n789 _STRM13

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	43549.8	7514.1	95265.6	-19284.8	-71453.3	-54731.7
2	44273.8	7392.7	97829.8	19824.8	72071.8	56037.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
87823.6	14906.8	193095.4	540.0	8365.3	2605.1

Punto di applic. carico verticale: Xv = 2.199 m Yv = .095 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
12.198	15.101	2.118	.288	.013	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	5003.2	1035.4	-1276.9	35.0	-112.1	.0	1281.9
2	4156.0	300.3	403.7	10.1	-40.5	.0	405.7
3	3308.7	217.9	611.3	9.4	-37.2	.0	612.4
4	2461.5	217.9	611.3	8.7	-34.0	.0	612.2
5	1614.3	217.9	611.3	8.1	-30.7	.0	612.1
6	767.1	217.9	611.3	7.4	-27.4	.0	611.9
7	-80.1	729.3	-612.5	22.9	-68.8	.0	616.3
8	4584.6	727.5	-606.0	29.0	-96.0	.0	613.5
9	3737.4	174.7	721.4	9.7	-38.9	.0	722.5
10	2890.2	174.7	721.4	9.1	-35.6	.0	722.3
11	2043.0	174.7	721.4	8.4	-32.3	.0	722.2
12	1195.7	174.7	721.4	7.8	-29.1	.0	722.0
13	348.5	727.5	-606.0	20.3	-63.5	.0	609.3
14	4166.1	882.8	-946.0	32.9	-104.9	.0	951.8
15	3318.9	216.4	618.4	9.4	-37.2	.0	619.6
16	2471.6	216.4	618.4	8.7	-34.0	.0	619.4
17	1624.4	216.4	618.4	8.1	-30.7	.0	619.2
18	777.2	725.8	-599.5	24.9	-76.0	.0	604.3
19	4959.2	1055.2	-1345.5	35.0	-112.1	.0	1350.1
20	4112.0	308.3	367.8	10.1	-40.5	.0	370.0
21	3264.8	224.4	580.2	9.4	-37.2	.0	581.4

22	2417.6	224.4	580.2	8.7	-34.0	.0	581.2
23	1570.3	224.4	580.2	8.1	-30.7	.0	581.0
24	723.1	224.4	580.2	7.4	-27.4	.0	580.9
25	-124.1	744.3	-668.9	22.9	-68.8	.0	672.4
26	4530.6	746.1	-675.4	29.0	-96.0	.0	682.2
27	3683.3	181.8	686.5	9.7	-38.9	.0	687.6
28	2836.1	181.8	686.5	9.1	-35.6	.0	687.5
29	1988.9	181.8	686.5	8.4	-32.3	.0	687.3
30	1141.7	181.8	686.5	7.8	-29.1	.0	687.1
31	294.5	746.1	-675.4	20.3	-63.5	.0	678.4
32	4101.9	908.4	-1037.7	32.9	-104.9	.0	1043.0
33	3254.7	225.9	573.1	9.4	-37.2	.0	574.3
34	2407.5	225.9	573.1	8.7	-34.0	.0	574.1
35	1560.2	225.9	573.1	8.1	-30.7	.0	573.9
36	713.0	747.8	-681.9	24.9	-76.0	.0	686.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 13
 spalla mobile - n777 _STRM13- n789 _STRM13

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1055.2	-1345.5	35.0	-112.1	1055.8	1350.1
1.41	858.8	-6.8	31.1	-65.7	859.4	66.1
2.81	704.9	1084.9	27.6	-24.6	705.4	1085.2
4.22	336.3	1861.9	18.0	8.8	336.7	1861.9
5.63	23.3	2088.8	8.6	26.9	24.8	2088.9
7.03	-158.5	1973.7	1.8	33.8	158.5	1973.9
8.44	-234.5	1677.0	-2.1	32.8	234.5	1677.3
9.84	-239.0	1341.7	-2.8	29.3	239.0	1342.0
11.25	-231.8	1008.6	-3.2	25.0	231.9	1008.9
13.50	-195.9	507.3	-3.4	17.4	195.9	507.6
15.75	-115.2	160.5	-2.9	10.2	115.2	160.8
18.00	-52.9	-22.0	-2.0	4.6	52.9	22.5
20.25	-14.0	-90.8	-1.1	1.2	14.1	90.9
22.50	5.9	-96.3	-.4	-.6	5.9	96.3
26.25	10.6	-57.7	.0	-1.0	10.6	57.7
30.00	7.2	-23.5	.1	-.7	7.2	23.5
33.75	3.1	-4.2	.1	-.4	3.1	4.2
39.38	-.1	2.5	.0	-.1	.1	2.5
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 14
 spalla mobile - n777 _STRM14- n789 _STRM14

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	43549.8	4365.3	79203.5	-19393.2	-70957.0	-40605.3
2	44273.7	4241.6	81761.9	19933.2	71574.5	41887.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
87823.5	8606.9	160965.4	540.0	8363.2	2605.7

Punto di applic. carico verticale: Xv = 1.833 m Yv = .095 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
12.198	10.427	1.634	.288	.013	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4422.0	632.1	-408.1	35.0	-112.1	.0	423.3
2	3768.5	164.3	613.5	10.1	-40.5	.0	614.9
3	3115.0	113.3	733.1	9.4	-37.2	.0	734.0
4	2461.5	113.3	733.1	8.7	-34.0	.0	733.8
5	1808.0	113.3	733.1	8.1	-30.7	.0	733.7
6	1154.5	113.3	733.1	7.4	-27.4	.0	733.6
7	501.1	435.5	2.8	22.9	-68.8	.0	68.8
8	4100.3	433.7	9.3	29.0	-96.0	.0	96.4
9	3446.8	86.5	796.2	9.7	-38.9	.0	797.1
10	2793.3	86.5	796.2	9.1	-35.6	.0	797.0
11	2139.8	86.5	796.2	8.4	-32.3	.0	796.8
12	1486.3	86.5	796.2	7.8	-29.1	.0	796.7
13	832.9	433.7	9.3	20.3	-63.5	.0	64.2
14	3778.6	532.4	-197.2	32.9	-104.9	.0	223.3
15	3125.1	111.8	740.2	9.4	-37.2	.0	741.1
16	2471.6	111.8	740.2	8.7	-34.0	.0	741.0
17	1818.1	111.8	740.2	8.1	-30.7	.0	740.8
18	1164.7	432.0	15.8	24.9	-76.0	.0	77.6
19	4378.0	651.9	-476.7	35.0	-112.1	.0	489.7
20	3724.5	172.3	577.6	10.1	-40.5	.0	579.0
21	3071.1	119.8	702.0	9.4	-37.2	.0	703.0

22	2417.6	119.8	702.0	8.7	-34.0	.0	702.8
23	1764.1	119.8	702.0	8.1	-30.7	.0	702.6
24	1110.6	119.8	702.0	7.4	-27.4	.0	702.5
25	457.1	450.6	-53.6	22.9	-68.8	.0	87.2
26	4046.2	452.3	-60.1	29.0	-96.0	.0	113.2
27	3392.7	93.5	761.2	9.7	-38.9	.0	762.2
28	2739.3	93.5	761.2	9.1	-35.6	.0	762.1
29	2085.8	93.5	761.2	8.4	-32.3	.0	761.9
30	1432.3	93.5	761.2	7.8	-29.1	.0	761.8
31	778.8	452.3	-60.1	20.3	-63.5	.0	87.4
32	3714.4	558.0	-288.9	32.9	-104.9	.0	307.4
33	3060.9	121.3	694.8	9.4	-37.2	.0	695.8
34	2407.5	121.3	694.8	8.7	-34.0	.0	695.7
35	1754.0	121.3	694.8	8.1	-30.7	.0	695.5
36	1100.5	454.0	-66.6	24.9	-76.0	.0	101.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 15
 spalla mobile - n777 _STRM17- n789 _STRM17

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	43549.8	6884.4	92053.1	-19306.5	-71354.0	-51906.4
2	44273.7	6762.5	94616.2	19846.5	71972.4	53207.7

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
87823.5	13646.9	186669.3	540.0	8364.1	2605.6

Punto di applic. carico verticale: Xv = 2.126 m Yv = .095 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
12.198	14.166	2.021	.288	.013	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4886.9	954.8	-1103.2	35.0	-112.1	.0	1108.9
2	4078.5	273.1	445.6	10.1	-40.5	.0	447.5
3	3270.0	197.0	635.6	9.4	-37.2	.0	636.7
4	2461.5	197.0	635.6	8.7	-34.0	.0	636.6
5	1653.0	197.0	635.6	8.1	-30.7	.0	636.4
6	844.6	197.0	635.6	7.4	-27.4	.0	636.2
7	36.1	670.5	-489.4	22.9	-68.8	.0	494.2
8	4487.8	668.8	-482.9	29.0	-96.0	.0	492.4
9	3679.3	157.1	736.4	9.7	-38.9	.0	737.4
10	2870.8	157.1	736.4	9.1	-35.6	.0	737.2
11	2062.3	157.1	736.4	8.4	-32.3	.0	737.1
12	1253.9	157.1	736.4	7.8	-29.1	.0	737.0
13	445.4	668.8	-482.9	20.3	-63.5	.0	487.1
14	4088.6	812.7	-796.2	32.9	-104.9	.0	803.1
15	3280.1	195.5	642.8	9.4	-37.2	.0	643.9
16	2471.6	195.5	642.8	8.7	-34.0	.0	643.7
17	1663.1	195.5	642.8	8.1	-30.7	.0	643.5
18	854.7	667.0	-476.4	24.9	-76.0	.0	482.4
19	4843.0	974.5	-1171.7	35.0	-112.1	.0	1177.1
20	4034.5	281.1	409.7	10.1	-40.5	.0	411.7
21	3226.0	203.5	604.6	9.4	-37.2	.0	605.7

22	2417.6	203.5	604.6	8.7	-34.0	.0	605.5
23	1609.1	203.5	604.6	8.1	-30.7	.0	605.4
24	800.6	203.5	604.6	7.4	-27.4	.0	605.2
25	-7.9	685.6	-545.9	22.9	-68.8	.0	550.2
26	4433.7	687.3	-552.4	29.0	-96.0	.0	560.6
27	3625.2	164.1	701.5	9.7	-38.9	.0	702.5
28	2816.7	164.1	701.5	9.1	-35.6	.0	702.4
29	2008.3	164.1	701.5	8.4	-32.3	.0	702.2
30	1199.8	164.1	701.5	7.8	-29.1	.0	702.1
31	391.3	687.3	-552.4	20.3	-63.5	.0	556.0
32	4024.4	838.3	-888.0	32.9	-104.9	.0	894.2
33	3215.9	205.0	597.4	9.4	-37.2	.0	598.6
34	2407.5	205.0	597.4	8.7	-34.0	.0	598.4
35	1599.0	205.0	597.4	8.1	-30.7	.0	598.2
36	790.5	689.1	-558.9	24.9	-76.0	.0	564.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobileSLU statica

 CONDIZIONE DI CARICO 16
 spalla mobile - n777 _STRM18- n789 _STRM18

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	43549.8	4995.0	82415.9	-19371.5	-71056.3	-43430.6
2	44273.7	4871.8	84975.5	19911.5	71674.0	44717.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
87823.5	9866.8	167391.4	540.0	8363.4	2605.1

Punto di applic. carico verticale: Xv = 1.906 m Yv = .095 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
12.198	11.362	1.731	.288	.013	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4538.2	712.8	-581.9	35.0	-112.1	.0	592.6
2	3846.0	191.5	571.6	10.1	-40.5	.0	573.0
3	3153.7	134.2	708.7	9.4	-37.2	.0	709.7
4	2461.5	134.2	708.7	8.7	-34.0	.0	709.5
5	1769.3	134.2	708.7	8.1	-30.7	.0	709.4
6	1077.1	134.2	708.7	7.4	-27.4	.0	709.2
7	384.8	494.2	-120.2	22.9	-68.8	.0	138.5
8	4197.1	492.5	-113.7	29.0	-96.0	.0	148.8
9	3504.9	104.2	781.2	9.7	-38.9	.0	782.2
10	2812.7	104.2	781.2	9.1	-35.6	.0	782.0
11	2120.5	104.2	781.2	8.4	-32.3	.0	781.9
12	1428.2	104.2	781.2	7.8	-29.1	.0	781.8
13	736.0	492.5	-113.7	20.3	-63.5	.0	130.3
14	3856.1	602.5	-346.9	32.9	-104.9	.0	362.4
15	3163.9	132.7	715.8	9.4	-37.2	.0	716.8
16	2471.6	132.7	715.8	8.7	-34.0	.0	716.7
17	1779.4	132.7	715.8	8.1	-30.7	.0	716.5
18	1087.2	490.8	-107.2	24.9	-76.0	.0	131.4
19	4494.3	732.6	-650.4	35.0	-112.1	.0	660.0
20	3802.0	199.5	535.7	10.1	-40.5	.0	537.2
21	3109.8	140.7	677.6	9.4	-37.2	.0	678.7

22	2417.6	140.7	677.6	8.7	-34.0	.0	678.5
23	1725.3	140.7	677.6	8.1	-30.7	.0	678.3
24	1033.1	140.7	677.6	7.4	-27.4	.0	678.2
25	340.9	509.3	-176.7	22.9	-68.8	.0	189.6
26	4143.1	511.1	-183.2	29.0	-96.0	.0	206.8
27	3450.9	111.2	746.3	9.7	-38.9	.0	747.3
28	2758.6	111.2	746.3	9.1	-35.6	.0	747.2
29	2066.4	111.2	746.3	8.4	-32.3	.0	747.0
30	1374.2	111.2	746.3	7.8	-29.1	.0	746.9
31	681.9	511.1	-183.2	20.3	-63.5	.0	193.9
32	3791.9	628.1	-438.7	32.9	-104.9	.0	451.0
33	3099.7	142.2	670.5	9.4	-37.2	.0	671.5
34	2407.5	142.2	670.5	8.7	-34.0	.0	671.4
35	1715.2	142.2	670.5	8.1	-30.7	.0	671.2
36	1023.0	512.8	-189.6	24.9	-76.0	.0	204.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 17
spalla mobile - n777 _SisM1- n789 _SisM1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25586.6	11273.7	71152.5	-8372.9	-43378.1	-50534.7
2	28873.5	10549.1	79490.9	14925.3	42026.9	57634.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
54460.1	21822.8	150643.4	6552.4	33818.6	14852.8

Punto di applic. carico verticale: Xv = 2.766 m Yv = .621 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.564	17.546	2.004	3.154	.073	.048

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4044.7	1371.2	-2564.0	379.7	-1285.1	.0	2868.0
2	3242.9	442.4	-328.1	116.1	-522.1	.0	616.6
3	2441.2	335.0	-36.1	112.4	-503.5	.0	504.8
4	1639.4	335.0	-36.1	108.6	-484.9	.0	486.2
5	837.6	335.0	-36.1	104.9	-466.3	.0	467.7
6	35.8	335.0	-36.1	101.1	-447.7	.0	449.1
7	-765.9	988.6	-1696.5	310.7	-1037.9	.0	1988.8
8	3672.9	978.7	-1659.5	320.6	-1127.0	.0	2006.0
9	2871.2	275.3	136.7	114.3	-512.8	.0	530.7
10	2069.4	275.3	136.7	110.5	-494.2	.0	512.8
11	1267.6	275.3	136.7	106.8	-475.6	.0	494.9
12	465.8	275.3	136.7	103.0	-457.0	.0	477.0
13	-335.9	978.7	-1659.5	271.2	-942.1	.0	1908.2
14	3301.1	1163.1	-2070.1	368.2	-1243.9	.0	2415.1
15	2499.4	326.4	4.6	112.4	-503.5	.0	503.5
16	1697.6	326.4	4.6	108.6	-484.9	.0	484.9
17	895.8	326.4	4.6	104.9	-466.3	.0	466.3
18	94.1	968.8	-1622.5	322.2	-1079.1	.0	1948.6
19	3791.5	1484.0	-2954.6	379.7	-1285.1	.0	3222.0
20	2989.7	488.0	-532.7	116.1	-522.1	.0	745.9
21	2187.9	372.1	-213.3	112.4	-503.5	.0	546.8

22	1386.2	372.1	-213.3	108.6	-484.9	.0	529.7
23	584.4	372.1	-213.3	104.9	-466.3	.0	512.7
24	-217.4	372.1	-213.3	101.1	-447.7	.0	495.9
25	-1019.1	1074.6	-2018.3	310.7	-1037.9	.0	2269.6
26	3361.5	1084.5	-2055.3	320.6	-1127.0	.0	2344.1
27	2559.7	315.4	-62.3	114.3	-512.8	.0	516.6
28	1758.0	315.4	-62.3	110.5	-494.2	.0	498.1
29	956.2	315.4	-62.3	106.8	-475.6	.0	479.7
30	154.4	315.4	-62.3	103.0	-457.0	.0	461.2
31	-647.4	1084.5	-2055.3	271.2	-942.1	.0	2260.9
32	2931.5	1309.0	-2593.3	368.2	-1243.9	.0	2876.2
33	2129.7	380.6	-254.0	112.4	-503.5	.0	563.9
34	1328.0	380.6	-254.0	108.6	-484.9	.0	547.4
35	526.2	380.6	-254.0	104.9	-466.3	.0	531.0
36	-275.6	1094.4	-2092.3	322.2	-1079.1	.0	2354.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 18
 spalla mobile - n777 _SisM2- n789 _SisM2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25586.6	10224.1	65798.5	-8409.1	-43212.7	-45825.9
2	28873.5	9498.7	74135.0	14961.5	41861.1	52917.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
54460.1	19722.8	139933.5	6552.4	33818.2	14853.4

Punto di applic. carico verticale: Xv = 2.569 m Yv = .621 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.564	15.989	1.843	3.154	.073	.048

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3851.0	1236.8	-2274.4	379.7	-1285.1	.0	2612.3
2	3113.8	397.1	-258.1	116.1	-522.1	.0	582.4
3	2376.6	300.1	4.5	112.4	-503.5	.0	503.5
4	1639.4	300.1	4.5	108.6	-484.9	.0	484.9
5	902.2	300.1	4.5	104.9	-466.3	.0	466.3
6	165.0	300.1	4.5	101.1	-447.7	.0	447.7
7	-572.2	890.7	-1491.3	310.7	-1037.9	.0	1817.0
8	3511.5	880.8	-1454.3	320.6	-1127.0	.0	1839.9
9	2774.3	245.9	161.6	114.3	-512.8	.0	537.7
10	2037.1	245.9	161.6	110.5	-494.2	.0	520.0
11	1299.9	245.9	161.6	106.8	-475.6	.0	502.3
12	562.7	245.9	161.6	103.0	-457.0	.0	484.7
13	-174.5	880.8	-1454.3	271.2	-942.1	.0	1732.8
14	3172.0	1046.3	-1820.5	368.2	-1243.9	.0	2204.9
15	2434.8	291.6	45.2	112.4	-503.5	.0	505.5
16	1697.6	291.6	45.2	108.6	-484.9	.0	487.0
17	960.4	291.6	45.2	104.9	-466.3	.0	468.5
18	223.2	870.9	-1417.4	322.2	-1079.1	.0	1781.4
19	3597.8	1349.6	-2665.0	379.7	-1285.1	.0	2958.7
20	2860.6	442.7	-462.7	116.1	-522.1	.0	697.7
21	2123.4	337.2	-172.7	112.4	-503.5	.0	532.3

22	1386.2	337.2	-172.7	108.6	-484.9	.0	514.7
23	649.0	337.2	-172.7	104.9	-466.3	.0	497.2
24	-88.2	337.2	-172.7	101.1	-447.7	.0	479.8
25	-825.4	976.7	-1813.2	310.7	-1037.9	.0	2089.3
26	3200.0	986.6	-1850.2	320.6	-1127.0	.0	2166.5
27	2462.9	286.0	-37.4	114.3	-512.8	.0	514.2
28	1725.7	286.0	-37.4	110.5	-494.2	.0	495.6
29	988.5	286.0	-37.4	106.8	-475.6	.0	477.1
30	251.3	286.0	-37.4	103.0	-457.0	.0	458.5
31	-485.9	986.6	-1850.2	271.2	-942.1	.0	2076.3
32	2802.3	1192.2	-2343.7	368.2	-1243.9	.0	2653.4
33	2065.2	345.7	-213.4	112.4	-503.5	.0	546.8
34	1328.0	345.7	-213.4	108.6	-484.9	.0	529.8
35	590.8	345.7	-213.4	104.9	-466.3	.0	512.8
36	-146.4	996.5	-1887.2	322.2	-1079.1	.0	2174.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 19
 spalla mobile - n777 _SisM3- n789 _SisM3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34086.7	10513.4	107998.0	-14309.7	-56794.3	-65131.2
2	32286.4	11309.3	100125.8	14896.1	54044.4	59714.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66373.1	21822.7	208123.8	586.4	-22013.1	-13933.1

Punto di applic. carico verticale: Xv = 3.136 m Yv = -.332 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.218	19.531	2.482	.158	-.023	-.045

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4781.2	1525.2	-2577.0	-3.5	-11.7	.0	2577.0
2	3788.5	478.0	-93.2	3.6	-35.4	.0	99.7
3	2795.9	358.0	226.2	7.1	-52.9	.0	232.3
4	1803.2	358.0	226.2	10.6	-70.3	.0	236.9
5	810.5	358.0	226.2	14.2	-87.7	.0	242.6
6	-182.1	358.0	226.2	17.7	-105.2	.0	249.5
7	-1174.8	1092.4	-1608.1	61.1	-243.6	.0	1626.4
8	4275.6	1101.7	-1642.8	2.0	-30.6	.0	1643.1
9	3282.9	299.2	376.3	5.4	-44.1	.0	378.9
10	2290.2	299.2	376.3	8.9	-61.6	.0	381.3
11	1297.6	299.2	376.3	12.4	-79.0	.0	384.5
12	304.9	299.2	376.3	15.9	-96.5	.0	388.5
13	-687.8	1101.7	-1642.8	48.3	-204.2	.0	1655.4
14	3769.9	1337.1	-2194.1	7.2	-50.4	.0	2194.7
15	2777.3	366.0	188.0	7.1	-52.9	.0	195.3
16	1784.6	366.0	188.0	10.6	-70.3	.0	200.7
17	791.9	366.0	188.0	14.2	-87.7	.0	207.5
18	-200.8	1111.0	-1677.5	50.4	-205.0	.0	1690.0
19	4862.2	1419.4	-2210.5	-3.5	-11.7	.0	2210.5
20	3869.5	435.2	98.8	3.6	-35.4	.0	105.0
21	2876.9	323.2	392.4	7.1	-52.9	.0	395.9

22	1884.2	323.2	392.4	10.6	-70.3	.0	398.6
23	891.5	323.2	392.4	14.2	-87.7	.0	402.1
24	-101.1	323.2	392.4	17.7	-105.2	.0	406.2
25	-1093.8	1011.7	-1306.1	61.1	-243.6	.0	1328.7
26	4375.2	1002.5	-1271.4	2.0	-30.6	.0	1271.8
27	3382.5	261.6	563.0	5.4	-44.1	.0	564.8
28	2389.8	261.6	563.0	8.9	-61.6	.0	566.4
29	1397.2	261.6	563.0	12.4	-79.0	.0	568.5
30	404.5	261.6	563.0	15.9	-96.5	.0	571.2
31	-588.2	1002.5	-1271.4	48.3	-204.2	.0	1287.7
32	3888.2	1200.3	-1703.3	7.2	-50.4	.0	1704.1
33	2895.5	315.1	430.6	7.1	-52.9	.0	433.8
34	1902.8	315.1	430.6	10.6	-70.3	.0	436.3
35	910.1	315.1	430.6	14.2	-87.7	.0	439.4
36	-82.5	993.2	-1236.7	50.4	-205.0	.0	1253.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 19
 spalla mobile - n777 _SisM3- n789 _SisM3

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1419.4	-2210.5	-3.5	-11.7	1419.4	2210.5
1.41	1170.1	-398.2	-2.4	-15.8	1170.1	398.5
2.81	972.2	1098.6	-1.5	-18.5	972.2	1098.8
4.22	490.5	2186.6	.2	-19.6	490.5	2186.7
5.63	74.9	2551.2	1.5	-18.2	74.9	2551.3
7.03	-173.5	2456.2	2.1	-15.6	173.5	2456.3
8.44	-282.9	2107.3	2.1	-12.6	282.9	2107.3
9.84	-291.9	1700.1	2.0	-9.7	291.9	1700.1
11.25	-285.8	1291.2	1.9	-6.9	285.8	1291.3
13.50	-244.6	670.3	1.5	-2.9	244.6	670.3
15.75	-147.8	231.5	.8	-.4	147.8	231.5
18.00	-70.6	-6.7	.3	.8	70.6	6.8
20.25	-21.2	-102.3	.0	1.1	21.2	102.3
22.50	5.2	-115.8	-.1	1.0	5.2	115.8
26.25	12.7	-72.1	-.1	.5	12.7	72.1
30.00	8.9	-30.3	-.1	.2	8.9	30.3
33.75	3.9	-6.1	.0	.0	3.9	6.1
39.38	.0	2.8	.0	.0	.0	2.8
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 20
 spalla mobile - n777 _SisM4- n789 _SisM4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34086.7	9463.8	102644.0	-14345.9	-56628.9	-60422.4
2	32286.4	10258.9	94769.8	14932.3	53878.6	54997.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66373.1	19722.7	197413.8	586.4	-22013.5	-13932.6

Punto di applic. carico verticale: Xv = 2.974 m Yv = -.332 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.218	17.974	2.320	.158	-.023	-.045

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4587.5	1390.8	-2287.3	-3.5	-11.7	.0	2287.4
2	3659.4	432.7	-23.2	3.6	-35.4	.0	42.3
3	2731.3	323.1	266.8	7.1	-52.9	.0	272.0
4	1803.2	323.1	266.8	10.6	-70.3	.0	275.9
5	875.1	323.1	266.8	14.2	-87.7	.0	280.8
6	-53.0	323.1	266.8	17.7	-105.2	.0	286.8
7	-981.1	994.5	-1403.0	61.1	-243.6	.0	1424.0
8	4114.1	1003.8	-1437.7	2.0	-30.6	.0	1438.0
9	3186.0	269.8	401.2	5.4	-44.1	.0	403.6
10	2257.9	269.8	401.2	8.9	-61.6	.0	405.9
11	1329.8	269.8	401.2	12.4	-79.0	.0	408.9
12	401.8	269.8	401.2	15.9	-96.5	.0	412.7
13	-526.3	1003.8	-1437.7	48.3	-204.2	.0	1452.1
14	3640.8	1220.3	-1944.5	7.2	-50.4	.0	1945.2
15	2712.7	331.1	228.6	7.1	-52.9	.0	234.6
16	1784.6	331.1	228.6	10.6	-70.3	.0	239.2
17	856.5	331.1	228.6	14.2	-87.7	.0	244.9
18	-71.6	1013.0	-1472.4	50.4	-205.0	.0	1486.6
19	4668.5	1285.0	-1920.9	-3.5	-11.7	.0	1920.9
20	3740.4	389.9	168.7	3.6	-35.4	.0	172.4
21	2812.3	288.3	432.9	7.1	-52.9	.0	436.2

22	1884.2	288.3	432.9	10.6	-70.3	.0	438.6
23	956.1	288.3	432.9	14.2	-87.7	.0	441.8
24	28.0	288.3	432.9	17.7	-105.2	.0	445.5
25	-900.1	913.8	-1101.0	61.1	-243.6	.0	1127.7
26	4213.7	904.5	-1066.3	2.0	-30.6	.0	1066.8
27	3285.6	232.2	587.9	5.4	-44.1	.0	589.6
28	2357.5	232.2	587.9	8.9	-61.6	.0	591.1
29	1429.5	232.2	587.9	12.4	-79.0	.0	593.2
30	501.4	232.2	587.9	15.9	-96.5	.0	595.8
31	-426.7	904.5	-1066.3	48.3	-204.2	.0	1085.7
32	3759.0	1083.5	-1453.7	7.2	-50.4	.0	1454.6
33	2830.9	280.3	471.1	7.1	-52.9	.0	474.1
34	1902.8	280.3	471.1	10.6	-70.3	.0	476.4
35	974.7	280.3	471.1	14.2	-87.7	.0	479.2
36	46.6	895.3	-1031.6	50.4	-205.0	.0	1051.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 21
 spalla mobile - n777 _SisM5- n789 _SisM5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25196.3	11771.0	72466.9	-7320.6	-44436.9	-50796.6
2	32937.4	10051.8	95902.1	17962.7	45849.4	66986.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58133.7	21822.8	168369.0	10642.1	84242.2	34585.1

Punto di applic. carico verticale: Xv = 2.896 m Yv = 1.449 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.074	18.159	2.152	5.268	.153	.112

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4463.1	1310.1	-2191.7	643.3	-2146.5	.0	3067.8
2	3602.4	409.5	-58.5	192.8	-842.7	.0	844.7
3	2741.8	306.3	215.4	184.1	-799.4	.0	827.9
4	1881.1	306.3	215.4	175.4	-756.0	.0	786.1
5	1020.5	306.3	215.4	166.6	-712.7	.0	744.6
6	159.9	306.3	215.4	157.9	-669.4	.0	703.2
7	-700.8	937.8	-1359.2	482.8	-1571.0	.0	2077.4
8	4094.0	914.8	-1273.1	539.7	-1866.6	.0	2259.4
9	3233.3	244.1	402.3	188.4	-821.0	.0	914.3
10	2372.7	244.1	402.3	179.7	-777.7	.0	875.6
11	1512.0	244.1	402.3	171.0	-734.4	.0	837.4
12	651.4	244.1	402.3	162.3	-691.1	.0	799.6
13	-209.2	914.8	-1273.1	424.6	-1435.8	.0	1918.9
14	3724.9	1076.2	-1604.5	616.6	-2050.6	.0	2603.7
15	2864.2	286.5	310.2	184.1	-799.4	.0	857.4
16	2003.6	286.5	310.2	175.4	-756.0	.0	817.2
17	1142.9	286.5	310.2	166.6	-712.7	.0	777.3
18	282.3	891.7	-1186.9	509.6	-1666.9	.0	2046.3
19	3930.4	1572.7	-3101.4	643.3	-2146.5	.0	3771.8
20	3069.8	515.6	-535.0	192.8	-842.7	.0	998.2
21	2209.2	392.7	-197.1	184.1	-799.4	.0	823.3

22	1348.5	392.7	-197.1	175.4	-756.0	.0	781.3
23	487.9	392.7	-197.1	166.6	-712.7	.0	739.5
24	-372.8	392.7	-197.1	157.9	-669.4	.0	697.8
25	-1233.4	1138.1	-2108.7	482.8	-1571.0	.0	2629.6
26	3438.9	1161.1	-2194.9	539.7	-1866.6	.0	2881.2
27	2578.3	337.4	-61.1	188.4	-821.0	.0	823.3
28	1717.6	337.4	-61.1	179.7	-777.7	.0	780.1
29	857.0	337.4	-61.1	171.0	-734.4	.0	736.9
30	-3.7	337.4	-61.1	162.3	-691.1	.0	693.8
31	-864.3	1161.1	-2194.9	424.6	-1435.8	.0	2622.8
32	2947.4	1416.0	-2822.8	616.6	-2050.6	.0	3489.0
33	2086.7	412.6	-291.9	184.1	-799.4	.0	851.0
34	1226.1	412.6	-291.9	175.4	-756.0	.0	810.4
35	365.4	412.6	-291.9	166.6	-712.7	.0	770.2
36	-495.2	1184.1	-2281.0	509.6	-1666.9	.0	2825.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 21
 spalla mobile - n777 _SisM5- n789 _SisM5

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1572.7	-3101.4	643.3	-2146.5	1699.2	3771.8
1.41	1320.7	-1074.6	574.7	-1290.9	1440.4	1679.6
2.81	1116.2	629.9	512.3	-528.2	1228.2	822.1
4.22	605.5	1905.1	337.9	94.0	693.4	1907.4
5.63	154.0	2405.9	166.4	439.9	226.7	2445.8
7.03	-127.5	2398.2	41.3	578.2	134.0	2466.9
8.44	-260.4	2093.1	-31.5	569.8	262.3	2169.2
9.84	-275.3	1713.1	-45.4	514.6	279.1	1788.8
11.25	-274.3	1324.1	-54.0	444.2	279.6	1396.6
13.50	-240.3	723.0	-58.2	316.2	247.2	789.1
15.75	-152.2	281.9	-51.2	189.2	160.6	339.5
18.00	-77.4	29.8	-36.2	90.1	85.5	94.9
20.25	-27.2	-80.9	-21.1	26.3	34.5	85.0
22.50	1.3	-106.0	-8.6	-7.0	8.7	106.2
26.25	11.5	-70.7	.4	-17.4	11.5	72.8
30.00	8.5	-31.5	1.6	-12.8	8.7	34.0
33.75	4.0	-7.7	1.4	-6.8	4.3	10.3
39.38	.2	2.2	.6	-1.2	.6	2.5
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 22
spalla mobile - n777 _SisM6- n789 _SisM6

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25196.4	10721.4	67112.9	-7356.7	-44271.4	-46087.8
2	32937.4	9001.4	90546.2	17998.9	45683.6	62269.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58133.8	19722.8	157659.1	10642.2	84240.9	34585.8

Punto di applic. carico verticale: Xv = 2.712 m Yv = 1.449 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.074	16.601	1.990	5.268	.153	.112

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4269.3	1175.6	-1902.1	643.4	-2146.6	.0	2868.1
2	3473.3	364.1	11.4	192.8	-842.7	.0	842.8
3	2677.2	271.4	256.0	184.1	-799.4	.0	839.3
4	1881.1	271.4	256.0	175.4	-756.0	.0	798.2
5	1085.1	271.4	256.0	166.6	-712.7	.0	757.3
6	289.0	271.4	256.0	157.9	-669.4	.0	716.7
7	-507.1	839.9	-1154.1	482.8	-1571.0	.0	1949.3
8	3932.5	816.8	-1068.0	539.7	-1866.6	.0	2150.5
9	3136.4	214.7	427.2	188.4	-821.0	.0	925.5
10	2340.4	214.7	427.2	179.7	-777.7	.0	887.3
11	1544.3	214.7	427.2	171.0	-734.4	.0	849.6
12	748.3	214.7	427.2	162.3	-691.1	.0	812.5
13	-47.8	816.8	-1068.0	424.6	-1435.9	.0	1789.5
14	3595.7	959.4	-1354.9	616.6	-2050.6	.0	2457.8
15	2799.6	251.6	350.8	184.1	-799.4	.0	872.9
16	2003.6	251.6	350.8	175.4	-756.0	.0	833.5
17	1207.5	251.6	350.8	166.6	-712.7	.0	794.4
18	411.5	793.8	-981.8	509.6	-1666.9	.0	1934.6
19	3736.7	1438.3	-2811.8	643.4	-2146.6	.0	3537.5
20	2940.6	470.3	-465.1	192.8	-842.7	.0	962.5
21	2144.6	357.9	-156.5	184.1	-799.4	.0	814.5

22	1348.5	357.9	-156.5	175.4	-756.0	.0	772.1
23	552.5	357.9	-156.5	166.6	-712.7	.0	729.7
24	-243.6	357.9	-156.5	157.9	-669.4	.0	687.5
25	-1039.7	1040.2	-1903.6	482.8	-1571.0	.0	2468.1
26	3277.5	1063.2	-1989.8	539.7	-1866.6	.0	2728.3
27	2481.4	308.0	-36.2	188.4	-821.0	.0	821.8
28	1685.3	308.0	-36.2	179.7	-777.7	.0	778.5
29	889.3	308.0	-36.2	171.0	-734.4	.0	735.3
30	93.2	308.0	-36.2	162.3	-691.1	.0	692.0
31	-702.9	1063.2	-1989.8	424.6	-1435.9	.0	2453.7
32	2818.2	1299.2	-2573.2	616.6	-2050.6	.0	3290.3
33	2022.1	377.7	-251.3	184.1	-799.4	.0	837.9
34	1226.1	377.7	-251.3	175.4	-756.0	.0	796.7
35	430.0	377.7	-251.3	166.6	-712.7	.0	755.7
36	-366.0	1086.2	-2075.9	509.6	-1666.9	.0	2662.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 23
spalla mobile - n777 _SisM7- n789 _SisM7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35140.2	10011.3	109839.6	-15703.0	-56965.6	-66022.0
2	28811.4	11811.5	86600.3	12154.7	51374.4	51401.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63951.6	21822.8	196439.9	-3548.3	-73309.3	-33882.9

Punto di applic. carico verticale: Xv = 3.072 m Yv = -1.146 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.882	19.128	2.385	-1.981	-.105	-.110

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4455.6	1591.9	-2913.6	-270.1	858.9	.0	3037.6
2	3501.8	510.4	-318.7	-73.9	288.4	.0	429.8
3	2547.9	385.5	19.0	-65.4	245.9	.0	246.7
4	1594.0	385.5	19.0	-56.8	203.5	.0	204.4
5	640.2	385.5	19.0	-48.3	161.1	.0	162.2
6	-313.7	385.5	19.0	-39.7	118.6	.0	120.1
7	-1267.6	1146.0	-1905.6	-112.9	295.0	.0	1928.3
8	3936.8	1168.6	-1990.0	-219.5	716.7	.0	2115.2
9	2982.9	329.1	154.7	-69.6	267.1	.0	308.7
10	2029.0	329.1	154.7	-61.1	224.7	.0	272.8
11	1075.2	329.1	154.7	-52.5	182.3	.0	239.1
12	121.3	329.1	154.7	-44.0	139.8	.0	208.6
13	-832.6	1168.6	-1990.0	-106.8	294.7	.0	2011.7
14	3417.9	1428.5	-2623.4	-243.9	764.9	.0	2732.6
15	2464.1	405.0	-73.9	-65.4	245.9	.0	256.8
16	1510.2	405.0	-73.9	-56.8	203.5	.0	216.5
17	556.3	405.0	-73.9	-48.3	161.1	.0	177.2
18	-397.5	1191.1	-2074.4	-139.1	389.0	.0	2110.6
19	4820.4	1334.6	-2022.4	-270.1	858.9	.0	2197.3
20	3866.6	406.4	148.2	-73.9	288.4	.0	324.2
21	2912.7	300.9	423.1	-65.4	245.9	.0	489.4

22	1958.8	300.9	423.1	-56.8	203.5	.0	469.5
23	1005.0	300.9	423.1	-48.3	161.1	.0	452.7
24	51.1	300.9	423.1	-39.7	118.6	.0	439.4
25	-902.8	949.8	-1171.4	-112.9	295.0	.0	1207.9
26	4385.4	927.2	-1087.0	-219.5	716.7	.0	1302.0
27	3431.6	237.7	608.8	-69.6	267.1	.0	664.8
28	2477.7	237.7	608.8	-61.1	224.7	.0	648.9
29	1523.8	237.7	608.8	-52.5	182.3	.0	635.5
30	570.0	237.7	608.8	-44.0	139.8	.0	624.6
31	-383.9	927.2	-1087.0	-106.8	294.7	.0	1126.2
32	3950.4	1095.6	-1429.8	-243.9	764.9	.0	1621.6
33	2996.5	281.4	516.0	-65.4	245.9	.0	571.6
34	2042.7	281.4	516.0	-56.8	203.5	.0	554.7
35	1088.8	281.4	516.0	-48.3	161.1	.0	540.6
36	134.9	904.7	-1002.6	-139.1	389.0	.0	1075.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 23
 spalla mobile - n777 _SisM7- n789 _SisM7

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 7
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1146.0	-1905.6	-112.9	295.0	1151.6	1928.3
1.41	970.0	-423.1	-98.1	147.0	975.0	447.9
2.81	826.2	834.2	-85.4	18.3	830.6	834.4
4.22	460.9	1787.2	-52.1	-82.8	463.9	1789.1
5.63	126.7	2178.1	-20.7	-132.1	128.4	2182.1
7.03	-93.3	2183.7	.7	-144.6	93.3	2188.4
8.44	-206.2	1947.1	12.3	-132.9	206.6	1951.6
9.84	-222.4	1643.4	14.2	-114.1	222.8	1647.3
11.25	-226.9	1325.7	15.0	-93.4	227.4	1329.0
13.50	-209.5	820.7	14.4	-59.5	210.0	822.8
15.75	-151.3	411.7	10.8	-30.8	151.7	412.8
18.00	-92.6	139.6	6.7	-11.3	92.8	140.1
20.25	-46.2	-12.2	3.4	-.3	46.3	12.2
22.50	-13.2	-76.9	1.0	4.5	13.2	77.1
26.25	6.8	-75.8	-.4	4.6	6.8	76.0
30.00	7.6	-46.6	-.5	2.7	7.6	46.6
33.75	5.2	-21.5	-.3	1.2	5.2	21.5
39.38	1.6	-2.6	-.1	.1	1.6	2.6
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 24
 spalla mobile - n777 _SisM8- n789 _SisM8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	35140.2	8961.7	104485.6	-15739.2	-56800.2	-61313.2
2	28811.4	10761.1	81244.3	12190.9	51208.7	46684.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63951.6	19722.8	185729.9	-3548.3	-73309.6	-33882.4

Punto di applic. carico verticale: Xv = 2.904 m Yv = -1.146 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.882	17.570	2.223	-1.981	-.105	-.110

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4261.9	1457.4	-2624.0	-270.1	858.9	.0	2761.0
2	3372.6	465.0	-248.7	-73.9	288.4	.0	380.8
3	2483.3	350.7	59.6	-65.4	245.9	.0	253.0
4	1594.0	350.7	59.6	-56.8	203.5	.0	212.0
5	704.8	350.7	59.6	-48.3	161.1	.0	171.7
6	-184.5	350.7	59.6	-39.7	118.6	.0	132.8
7	-1073.8	1048.1	-1700.5	-112.9	295.0	.0	1725.9
8	3775.3	1070.7	-1784.9	-219.5	716.7	.0	1923.4
9	2886.0	299.7	179.7	-69.6	267.1	.0	321.9
10	1996.8	299.7	179.7	-61.1	224.7	.0	287.7
11	1107.5	299.7	179.7	-52.5	182.3	.0	255.9
12	218.2	299.7	179.7	-44.0	139.8	.0	227.7
13	-671.1	1070.7	-1784.9	-106.8	294.7	.0	1809.1
14	3288.8	1311.7	-2373.7	-243.9	764.9	.0	2493.9
15	2399.5	370.1	-33.3	-65.4	245.9	.0	248.2
16	1510.2	370.1	-33.3	-56.8	203.5	.0	206.2
17	620.9	370.1	-33.3	-48.3	161.1	.0	164.5
18	-268.4	1093.2	-1869.3	-139.1	389.0	.0	1909.4
19	4626.7	1200.1	-1732.8	-270.1	858.9	.0	1934.0
20	3737.4	361.0	218.1	-73.9	288.4	.0	361.6
21	2848.1	266.0	463.7	-65.4	245.9	.0	524.9

22	1958.8	266.0	463.7	-56.8	203.5	.0	506.4
23	1069.5	266.0	463.7	-48.3	161.1	.0	490.9
24	180.2	266.0	463.7	-39.7	118.6	.0	478.6
25	-709.0	851.9	-966.3	-112.9	295.0	.0	1010.3
26	4224.0	829.3	-881.9	-219.5	716.7	.0	1136.4
27	3334.7	208.3	633.7	-69.6	267.1	.0	687.7
28	2445.4	208.3	633.7	-61.1	224.7	.0	672.3
29	1556.1	208.3	633.7	-52.5	182.3	.0	659.4
30	666.8	208.3	633.7	-44.0	139.8	.0	648.9
31	-222.5	829.3	-881.9	-106.8	294.7	.0	929.8
32	3821.3	978.8	-1180.2	-243.9	764.9	.0	1406.4
33	2932.0	246.5	556.6	-65.4	245.9	.0	608.5
34	2042.7	246.5	556.6	-56.8	203.5	.0	592.6
35	1153.4	246.5	556.6	-48.3	161.1	.0	579.4
36	264.1	806.8	-797.5	-139.1	389.0	.0	887.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 25
spalla mobile - n777 _SisM9- n789 _SisM9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24692.7	11765.6	70114.2	-7120.0	-43489.5	-50038.5
2	32653.8	10057.2	94456.0	17762.1	45312.7	66344.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57346.5	21822.8	164570.2	10642.1	87007.0	34586.3

Punto di applic. carico verticale: Xv = 2.870 m Yv = 1.517 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.965	18.027	2.120	5.282	.156	.112

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4409.1	1307.1	-2215.9	643.6	-2143.9	.0	3083.3
2	3561.0	410.0	-87.2	192.7	-839.7	.0	844.2
3	2713.0	307.2	186.7	184.0	-796.4	.0	818.0
4	1865.0	307.2	186.7	175.3	-753.1	.0	775.9
5	1017.0	307.2	186.7	166.5	-709.8	.0	733.9
6	168.9	307.2	186.7	157.8	-666.4	.0	692.1
7	-679.1	936.4	-1385.7	483.1	-1568.3	.0	2092.8
8	4047.6	913.4	-1299.5	539.9	-1863.9	.0	2272.2
9	3199.6	245.1	373.7	188.3	-818.0	.0	899.4
10	2351.5	245.1	373.7	179.6	-774.7	.0	860.2
11	1503.5	245.1	373.7	170.9	-731.4	.0	821.4
12	655.5	245.1	373.7	162.2	-688.1	.0	783.0
13	-192.5	913.4	-1299.5	424.7	-1433.1	.0	1934.6
14	3686.1	1074.1	-1629.8	616.8	-2048.0	.0	2617.3
15	2838.1	287.3	281.5	184.0	-796.4	.0	844.7
16	1990.1	287.3	281.5	175.3	-753.1	.0	804.0
17	1142.0	287.3	281.5	166.5	-709.8	.0	763.5
18	294.0	890.4	-1213.4	509.8	-1664.3	.0	2059.6
19	3865.0	1569.7	-3125.6	643.6	-2143.9	.0	3790.2
20	3017.0	516.2	-563.7	192.7	-839.7	.0	1011.3
21	2169.0	393.6	-225.8	184.0	-796.4	.0	827.8

22	1320.9	393.6	-225.8	175.3	-753.1	.0	786.2
23	472.9	393.6	-225.8	166.5	-709.8	.0	744.8
24	-375.1	393.6	-225.8	157.8	-666.4	.0	703.6
25	-1223.1	1136.7	-2135.2	483.1	-1568.3	.0	2649.3
26	3378.5	1159.7	-2221.3	539.9	-1863.9	.0	2899.7
27	2530.4	338.4	-89.7	188.3	-818.0	.0	822.9
28	1682.4	338.4	-89.7	179.6	-774.7	.0	779.9
29	834.4	338.4	-89.7	170.9	-731.4	.0	736.9
30	-13.6	338.4	-89.7	162.2	-688.1	.0	693.9
31	-861.7	1159.7	-2221.3	424.7	-1433.1	.0	2643.5
32	2891.9	1413.8	-2848.1	616.8	-2048.0	.0	3508.0
33	2043.9	413.5	-320.6	184.0	-796.4	.0	858.5
34	1195.9	413.5	-320.6	175.3	-753.1	.0	818.5
35	347.8	413.5	-320.6	166.5	-709.8	.0	778.8
36	-500.2	1182.8	-2307.5	509.8	-1664.3	.0	2845.0

 $M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 26
spalla mobile - n777 _SisM10- n789 _SisM10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24692.7	10715.9	64760.1	-7156.1	-43324.1	-45329.7
2	32653.8	9006.8	89100.0	17798.2	45147.0	61628.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57346.5	19722.7	153860.1	10642.1	87006.7	34585.8

Punto di applic. carico verticale: Xv = 2.683 m Yv = 1.517 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.965	16.470	1.959	5.282	.156	.112

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4215.3	1172.7	-1926.3	643.6	-2143.9	.0	2882.2
2	3431.9	364.7	-17.2	192.7	-839.7	.0	839.9
3	2648.4	272.3	227.3	184.0	-796.4	.0	828.2
4	1865.0	272.3	227.3	175.3	-753.1	.0	786.6
5	1081.5	272.3	227.3	166.5	-709.8	.0	745.3
6	298.1	272.3	227.3	157.8	-666.4	.0	704.1
7	-485.3	838.5	-1180.5	483.1	-1568.3	.0	1963.0
8	3886.1	815.5	-1094.4	539.9	-1863.9	.0	2161.4
9	3102.7	215.7	398.6	188.3	-818.0	.0	910.0
10	2319.2	215.7	398.6	179.6	-774.7	.0	871.3
11	1535.8	215.7	398.6	170.9	-731.4	.0	833.0
12	752.4	215.7	398.6	162.2	-688.1	.0	795.2
13	-31.1	815.5	-1094.4	424.7	-1433.1	.0	1803.2
14	3556.9	957.3	-1380.2	616.8	-2048.0	.0	2469.6
15	2773.5	252.4	322.1	184.0	-796.4	.0	859.1
16	1990.1	252.4	322.1	175.3	-753.1	.0	819.1
17	1206.6	252.4	322.1	166.5	-709.8	.0	779.4
18	423.2	792.4	-1008.2	509.8	-1664.3	.0	1945.9
19	3671.3	1435.3	-2836.0	643.6	-2143.9	.0	3555.1
20	2887.8	470.9	-493.7	192.7	-839.7	.0	974.1
21	2104.4	358.7	-185.2	184.0	-796.4	.0	817.6

22	1320.9	358.7	-185.2	175.3	-753.1	.0	775.5
23	537.5	358.7	-185.2	166.5	-709.8	.0	733.5
24	-246.0	358.7	-185.2	157.8	-666.4	.0	691.7
25	-1029.4	1038.8	-1930.1	483.1	-1568.3	.0	2486.9
26	3217.0	1061.8	-2016.2	539.9	-1863.9	.0	2745.7
27	2433.6	309.0	-64.8	188.3	-818.0	.0	820.6
28	1650.1	309.0	-64.8	179.6	-774.7	.0	777.4
29	866.7	309.0	-64.8	170.9	-731.4	.0	734.3
30	83.2	309.0	-64.8	162.2	-688.1	.0	691.1
31	-700.2	1061.8	-2016.2	424.7	-1433.1	.0	2473.6
32	2762.7	1297.0	-2598.5	616.8	-2048.0	.0	3308.5
33	1979.3	378.6	-280.0	184.0	-796.4	.0	844.2
34	1195.9	378.6	-280.0	175.3	-753.1	.0	803.4
35	412.4	378.6	-280.0	166.5	-709.8	.0	763.0
36	-371.0	1084.8	-2102.4	509.8	-1664.3	.0	2681.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 27
spalla mobile - n777 _SisM11- n789 _SisM11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34856.5	10016.7	108393.4	-15502.4	-56429.0	-65380.5
2	28307.7	11806.0	84247.6	11954.1	50427.1	50643.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63164.2	21822.7	192641.0	-3548.3	-76074.1	-33882.7

Punto di applic. carico verticale: Xv = 3.050 m Yv = -1.204 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.773	18.997	2.353	-1.995	-.108	-.110

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4390.2	1588.9	-2937.8	-270.4	856.2	.0	3060.0
2	3448.9	510.9	-347.3	-73.8	285.4	.0	449.5
3	2507.7	386.4	-9.6	-65.3	243.0	.0	243.1
4	1566.4	386.4	-9.6	-56.7	200.5	.0	200.8
5	625.2	386.4	-9.6	-48.2	158.1	.0	158.4
6	-316.1	386.4	-9.6	-39.6	115.7	.0	116.1
7	-1257.3	1144.7	-1932.1	-113.1	292.4	.0	1954.1
8	3876.3	1167.2	-2016.5	-219.7	714.0	.0	2139.1
9	2935.1	330.1	126.2	-69.5	264.2	.0	292.8
10	1993.8	330.1	126.2	-61.0	221.7	.0	255.1
11	1052.6	330.1	126.2	-52.4	179.3	.0	219.2
12	111.3	330.1	126.2	-43.9	136.9	.0	186.2
13	-829.9	1167.2	-2016.5	-106.9	292.0	.0	2037.5
14	3362.5	1426.3	-2648.7	-244.2	762.3	.0	2756.2
15	2421.2	405.8	-102.5	-65.3	243.0	.0	263.7
16	1480.0	405.8	-102.5	-56.7	200.5	.0	225.2
17	538.7	405.8	-102.5	-48.2	158.1	.0	188.4
18	-402.5	1189.8	-2100.9	-139.3	386.3	.0	2136.1
19	4766.4	1331.6	-2046.6	-270.4	856.2	.0	2218.5
20	3825.2	406.9	119.6	-73.8	285.4	.0	309.4
21	2883.9	301.7	394.4	-65.3	243.0	.0	463.3

22	1942.7	301.7	394.4	-56.7	200.5	.0	442.5
23	1001.4	301.7	394.4	-48.2	158.1	.0	424.9
24	60.2	301.7	394.4	-39.6	115.7	.0	411.0
25	-881.1	948.4	-1197.8	-113.1	292.4	.0	1233.0
26	4339.0	925.9	-1113.4	-219.7	714.0	.0	1322.7
27	3397.8	238.7	580.2	-69.5	264.2	.0	637.5
28	2456.5	238.7	580.2	-61.0	221.7	.0	621.1
29	1515.3	238.7	580.2	-52.4	179.3	.0	607.3
30	574.0	238.7	580.2	-43.9	136.9	.0	596.1
31	-367.2	925.9	-1113.4	-106.9	292.0	.0	1151.0
32	3911.7	1093.5	-1455.1	-244.2	762.3	.0	1642.7
33	2970.4	282.3	487.3	-65.3	243.0	.0	544.5
34	2029.2	282.3	487.3	-56.7	200.5	.0	527.0
35	1087.9	282.3	487.3	-48.2	158.1	.0	512.3
36	146.7	903.3	-1029.0	-139.3	386.3	.0	1099.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 28
spalla mobile - n777 _SisM12- n789 _SisM12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34856.5	8967.1	103039.4	-15538.5	-56263.5	-60671.6
2	28307.7	10755.7	78891.6	11990.2	50261.3	45926.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63164.2	19722.8	181931.0	-3548.3	-76074.4	-33883.1

Punto di applic. carico verticale: Xv = 2.880 m Yv = -1.204 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.773	17.439	2.192	-1.995	-.108	-.110

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4196.5	1454.5	-2648.2	-270.4	856.2	.0	2783.2
2	3319.8	465.6	-277.3	-73.8	285.4	.0	398.0
3	2443.1	351.5	30.9	-65.3	243.0	.0	244.9
4	1566.4	351.5	30.9	-56.7	200.5	.0	202.9
5	689.8	351.5	30.9	-48.2	158.1	.0	161.1
6	-186.9	351.5	30.9	-39.6	115.7	.0	119.7
7	-1063.6	1046.8	-1727.0	-113.1	292.4	.0	1751.6
8	3714.9	1069.3	-1811.4	-219.7	714.0	.0	1947.0
9	2838.2	300.7	151.1	-69.5	264.2	.0	304.3
10	1961.5	300.7	151.1	-61.0	221.7	.0	268.3
11	1084.9	300.7	151.1	-52.4	179.3	.0	234.5
12	208.2	300.7	151.1	-43.9	136.9	.0	203.8
13	-668.5	1069.3	-1811.4	-106.9	292.0	.0	1834.8
14	3233.3	1309.5	-2399.1	-244.2	762.3	.0	2517.3
15	2356.6	371.0	-62.0	-65.3	243.0	.0	250.7
16	1480.0	371.0	-62.0	-56.7	200.5	.0	209.9
17	603.3	371.0	-62.0	-48.2	158.1	.0	169.8
18	-273.4	1091.9	-1895.8	-139.3	386.3	.0	1934.7
19	4572.7	1197.2	-1757.0	-270.4	856.2	.0	1954.5
20	3696.0	361.6	189.5	-73.8	285.4	.0	342.6
21	2819.3	266.8	435.0	-65.3	243.0	.0	498.3

22	1942.7	266.8	435.0	-56.7	200.5	.0	479.0
23	1066.0	266.8	435.0	-48.2	158.1	.0	462.8
24	189.3	266.8	435.0	-39.6	115.7	.0	450.1
25	-687.3	850.5	-992.7	-113.1	292.4	.0	1034.9
26	4177.6	828.0	-908.3	-219.7	714.0	.0	1155.3
27	3300.9	209.3	605.1	-69.5	264.2	.0	660.3
28	2424.3	209.3	605.1	-61.0	221.7	.0	644.5
29	1547.6	209.3	605.1	-52.4	179.3	.0	631.1
30	670.9	209.3	605.1	-43.9	136.9	.0	620.4
31	-205.8	828.0	-908.3	-106.9	292.0	.0	954.1
32	3782.5	976.7	-1205.5	-244.2	762.3	.0	1426.3
33	2905.8	247.4	527.9	-65.3	243.0	.0	581.1
34	2029.2	247.4	527.9	-56.7	200.5	.0	564.7
35	1152.5	247.4	527.9	-48.2	158.1	.0	551.1
36	275.8	805.4	-823.9	-139.3	386.3	.0	910.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 29
 spalla mobile - n777 _SisM13- n789 _SisM13

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	26326.6	11278.1	74698.6	-8721.0	-44778.4	-51790.1
2	29528.0	10544.7	82673.2	15288.4	43247.4	58868.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
55854.6	21822.8	157371.8	6567.4	32724.0	14926.2

Punto di applic. carico verticale: Xv = 2.818 m Yv = .586 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.758	17.779	2.060	3.155	.072	.048

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4148.3	1376.2	-2520.2	380.5	-1289.5	.0	2831.0
2	3324.2	441.3	-276.8	116.5	-524.6	.0	593.2
3	2500.1	333.4	15.1	112.7	-506.0	.0	506.2
4	1676.0	333.4	15.1	108.9	-487.3	.0	487.5
5	851.9	333.4	15.1	105.2	-468.6	.0	468.8
6	27.8	333.4	15.1	101.4	-449.9	.0	450.1
7	-796.4	990.8	-1648.8	311.2	-1041.1	.0	1950.0
8	3764.9	980.9	-1611.6	321.4	-1131.0	.0	1968.9
9	2940.8	273.5	187.8	114.6	-515.3	.0	548.5
10	2116.7	273.5	187.8	110.8	-496.6	.0	530.9
11	1292.5	273.5	187.8	107.0	-477.9	.0	513.5
12	468.4	273.5	187.8	103.3	-459.2	.0	496.2
13	-355.7	980.9	-1611.6	271.7	-945.1	.0	1868.3
14	3381.5	1166.5	-2024.0	369.0	-1248.1	.0	2377.9
15	2557.3	324.8	56.0	112.7	-506.0	.0	509.0
16	1733.2	324.8	56.0	108.9	-487.3	.0	490.5
17	909.1	324.8	56.0	105.2	-468.6	.0	471.9
18	85.0	970.9	-1574.5	322.8	-1082.5	.0	1910.7
19	3899.4	1489.5	-2912.8	380.5	-1289.5	.0	3185.5
20	3075.3	487.1	-482.5	116.5	-524.6	.0	712.8
21	2251.2	370.7	-162.9	112.7	-506.0	.0	531.5

22	1427.0	370.7	-162.9	108.9	-487.3	.0	513.8
23	602.9	370.7	-162.9	105.2	-468.6	.0	496.1
24	-221.2	370.7	-162.9	101.4	-449.9	.0	478.5
25	-1045.3	1077.2	-1972.3	311.2	-1041.1	.0	2230.2
26	3458.7	1087.2	-2009.5	321.4	-1131.0	.0	2305.9
27	2634.6	313.7	-12.2	114.6	-515.3	.0	515.4
28	1810.5	313.7	-12.2	110.8	-496.6	.0	496.8
29	986.4	313.7	-12.2	107.0	-477.9	.0	478.1
30	162.3	313.7	-12.2	103.3	-459.2	.0	459.4
31	-661.9	1087.2	-2009.5	271.7	-945.1	.0	2220.6
32	3018.1	1313.2	-2549.8	369.0	-1248.1	.0	2838.9
33	2193.9	379.2	-203.8	112.7	-506.0	.0	545.5
34	1369.8	379.2	-203.8	108.9	-487.3	.0	528.2
35	545.7	379.2	-203.8	105.2	-468.6	.0	511.0
36	-278.4	1097.1	-2046.6	322.8	-1082.5	.0	2315.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 30
spalla mobile - n777 _SisM14- n789 _SisM14

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	26326.6	10228.4	69344.6	-8757.1	-44613.0	-47081.3
2	29528.0	9494.3	77317.3	15324.5	43081.7	54152.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
55854.6	19722.7	146661.9	6567.4	32723.7	14925.7

Punto di applic. carico verticale: Xv = 2.626 m Yv = .586 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.758	16.221	1.899	3.155	.072	.048

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3954.6	1241.7	-2230.6	380.5	-1289.5	.0	2576.5
2	3195.1	395.9	-206.9	116.5	-524.6	.0	564.0
3	2435.5	298.5	55.7	112.7	-506.0	.0	509.0
4	1676.0	298.5	55.7	108.9	-487.3	.0	490.4
5	916.5	298.5	55.7	105.2	-468.6	.0	471.9
6	156.9	298.5	55.7	101.4	-449.9	.0	453.3
7	-602.6	892.9	-1443.7	311.2	-1041.1	.0	1779.9
8	3603.4	882.9	-1406.5	321.4	-1131.0	.0	1804.9
9	2843.9	244.1	212.8	114.6	-515.3	.0	557.5
10	2084.4	244.1	212.8	110.8	-496.6	.0	540.3
11	1324.8	244.1	212.8	107.0	-477.9	.0	523.1
12	565.3	244.1	212.8	103.3	-459.2	.0	506.1
13	-194.2	882.9	-1406.5	271.7	-945.1	.0	1694.6
14	3252.3	1049.7	-1774.4	369.0	-1248.1	.0	2169.4
15	2492.8	289.9	96.6	112.7	-506.0	.0	515.1
16	1733.2	289.9	96.6	108.9	-487.3	.0	496.7
17	973.7	289.9	96.6	105.2	-468.6	.0	478.4
18	214.1	873.0	-1369.3	322.8	-1082.5	.0	1745.5
19	3705.7	1355.1	-2623.2	380.5	-1289.5	.0	2923.0
20	2946.1	441.8	-412.5	116.5	-524.6	.0	667.4
21	2186.6	335.8	-122.3	112.7	-506.0	.0	520.5

22	1427.0	335.8	-122.3	108.9	-487.3	.0	502.4
23	667.5	335.8	-122.3	105.2	-468.6	.0	484.3
24	-92.0	335.8	-122.3	101.4	-449.9	.0	466.2
25	-851.6	979.3	-1767.2	311.2	-1041.1	.0	2051.0
26	3297.3	989.2	-1804.3	321.4	-1131.0	.0	2129.5
27	2537.7	284.3	12.7	114.6	-515.3	.0	515.5
28	1778.2	284.3	12.7	110.8	-496.6	.0	496.8
29	1018.7	284.3	12.7	107.0	-477.9	.0	478.1
30	259.1	284.3	12.7	103.3	-459.2	.0	459.4
31	-500.4	989.2	-1804.3	271.7	-945.1	.0	2036.9
32	2888.9	1196.4	-2300.1	369.0	-1248.1	.0	2616.9
33	2129.4	344.4	-163.2	112.7	-506.0	.0	531.6
34	1369.8	344.4	-163.2	108.9	-487.3	.0	513.9
35	610.3	344.4	-163.2	105.2	-468.6	.0	496.2
36	-149.3	999.2	-1841.5	322.8	-1082.5	.0	2136.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 31
spalla mobile - n777 _SisM17- n789 _SisM17

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	26326.6	11278.1	74698.6	-8721.0	-44778.4	-51790.1
2	29528.0	10544.7	82673.2	15288.4	43247.4	58868.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
55854.6	21822.8	157371.8	6567.4	32724.0	14926.2

Punto di applic. carico verticale: Xv = 2.818 m Yv = .586 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.758	17.779	2.060	3.155	.072	.048

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4148.3	1376.2	-2520.2	380.5	-1289.5	.0	2831.0
2	3324.2	441.3	-276.8	116.5	-524.6	.0	593.2
3	2500.1	333.4	15.1	112.7	-506.0	.0	506.2
4	1676.0	333.4	15.1	108.9	-487.3	.0	487.5
5	851.9	333.4	15.1	105.2	-468.6	.0	468.8
6	27.8	333.4	15.1	101.4	-449.9	.0	450.1
7	-796.4	990.8	-1648.8	311.2	-1041.1	.0	1950.0
8	3764.9	980.9	-1611.6	321.4	-1131.0	.0	1968.9
9	2940.8	273.5	187.8	114.6	-515.3	.0	548.5
10	2116.7	273.5	187.8	110.8	-496.6	.0	530.9
11	1292.5	273.5	187.8	107.0	-477.9	.0	513.5
12	468.4	273.5	187.8	103.3	-459.2	.0	496.2
13	-355.7	980.9	-1611.6	271.7	-945.1	.0	1868.3
14	3381.5	1166.5	-2024.0	369.0	-1248.1	.0	2377.9
15	2557.3	324.8	56.0	112.7	-506.0	.0	509.0
16	1733.2	324.8	56.0	108.9	-487.3	.0	490.5
17	909.1	324.8	56.0	105.2	-468.6	.0	471.9
18	85.0	970.9	-1574.5	322.8	-1082.5	.0	1910.7
19	3899.4	1489.5	-2912.8	380.5	-1289.5	.0	3185.5
20	3075.3	487.1	-482.5	116.5	-524.6	.0	712.8
21	2251.2	370.7	-162.9	112.7	-506.0	.0	531.5

22	1427.0	370.7	-162.9	108.9	-487.3	.0	513.8
23	602.9	370.7	-162.9	105.2	-468.6	.0	496.1
24	-221.2	370.7	-162.9	101.4	-449.9	.0	478.5
25	-1045.3	1077.2	-1972.3	311.2	-1041.1	.0	2230.2
26	3458.7	1087.2	-2009.5	321.4	-1131.0	.0	2305.9
27	2634.6	313.7	-12.2	114.6	-515.3	.0	515.4
28	1810.5	313.7	-12.2	110.8	-496.6	.0	496.8
29	986.4	313.7	-12.2	107.0	-477.9	.0	478.1
30	162.3	313.7	-12.2	103.3	-459.2	.0	459.4
31	-661.9	1087.2	-2009.5	271.7	-945.1	.0	2220.6
32	3018.1	1313.2	-2549.8	369.0	-1248.1	.0	2838.9
33	2193.9	379.2	-203.8	112.7	-506.0	.0	545.5
34	1369.8	379.2	-203.8	108.9	-487.3	.0	528.2
35	545.7	379.2	-203.8	105.2	-468.6	.0	511.0
36	-278.4	1097.1	-2046.6	322.8	-1082.5	.0	2315.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 32
spalla mobile - n777 _SisM18- n789 _SisM18

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	26326.6	10228.4	69344.6	-8757.1	-44613.0	-47081.3
2	29528.0	9494.3	77317.3	15324.5	43081.7	54152.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
55854.6	19722.7	146661.9	6567.4	32723.7	14925.7

Punto di applic. carico verticale: Xv = 2.626 m Yv = .586 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.758	16.221	1.899	3.155	.072	.048

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3954.6	1241.7	-2230.6	380.5	-1289.5	.0	2576.5
2	3195.1	395.9	-206.9	116.5	-524.6	.0	564.0
3	2435.5	298.5	55.7	112.7	-506.0	.0	509.0
4	1676.0	298.5	55.7	108.9	-487.3	.0	490.4
5	916.5	298.5	55.7	105.2	-468.6	.0	471.9
6	156.9	298.5	55.7	101.4	-449.9	.0	453.3
7	-602.6	892.9	-1443.7	311.2	-1041.1	.0	1779.9
8	3603.4	882.9	-1406.5	321.4	-1131.0	.0	1804.9
9	2843.9	244.1	212.8	114.6	-515.3	.0	557.5
10	2084.4	244.1	212.8	110.8	-496.6	.0	540.3
11	1324.8	244.1	212.8	107.0	-477.9	.0	523.1
12	565.3	244.1	212.8	103.3	-459.2	.0	506.1
13	-194.2	882.9	-1406.5	271.7	-945.1	.0	1694.6
14	3252.3	1049.7	-1774.4	369.0	-1248.1	.0	2169.4
15	2492.8	289.9	96.6	112.7	-506.0	.0	515.1
16	1733.2	289.9	96.6	108.9	-487.3	.0	496.7
17	973.7	289.9	96.6	105.2	-468.6	.0	478.4
18	214.1	873.0	-1369.3	322.8	-1082.5	.0	1745.5
19	3705.7	1355.1	-2623.2	380.5	-1289.5	.0	2923.0
20	2946.1	441.8	-412.5	116.5	-524.6	.0	667.4
21	2186.6	335.8	-122.3	112.7	-506.0	.0	520.5

22	1427.0	335.8	-122.3	108.9	-487.3	.0	502.4
23	667.5	335.8	-122.3	105.2	-468.6	.0	484.3
24	-92.0	335.8	-122.3	101.4	-449.9	.0	466.2
25	-851.6	979.3	-1767.2	311.2	-1041.1	.0	2051.0
26	3297.3	989.2	-1804.3	321.4	-1131.0	.0	2129.5
27	2537.7	284.3	12.7	114.6	-515.3	.0	515.5
28	1778.2	284.3	12.7	110.8	-496.6	.0	496.8
29	1018.7	284.3	12.7	107.0	-477.9	.0	478.1
30	259.1	284.3	12.7	103.3	-459.2	.0	459.4
31	-500.4	989.2	-1804.3	271.7	-945.1	.0	2036.9
32	2888.9	1196.4	-2300.1	369.0	-1248.1	.0	2616.9
33	2129.4	344.4	-163.2	112.7	-506.0	.0	531.6
34	1369.8	344.4	-163.2	108.9	-487.3	.0	513.9
35	610.3	344.4	-163.2	105.2	-468.6	.0	496.2
36	-149.3	999.2	-1841.5	322.8	-1082.5	.0	2136.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 33
spalla mobile - n777 _SisM21- n789 _SisM21

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24763.1	7097.3	59811.5	-4295.5	-45693.0	-35993.5
2	29697.0	6449.3	68326.7	19124.0	39460.4	44733.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
54460.1	13546.6	128138.2	14828.5	46560.1	15673.6

Punto di applic. carico verticale: Xv = 2.353 m Yv = .855 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.564	12.088	1.532	6.989	.129	.051

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3575.4	853.6	-1286.5	815.1	-2787.4	.0	3070.0
2	2962.7	259.6	101.8	254.9	-1168.8	.0	1173.2
3	2350.0	192.1	277.5	250.9	-1149.2	.0	1182.2
4	1737.3	192.1	277.5	246.9	-1129.5	.0	1163.1
5	1124.6	192.1	277.5	243.0	-1109.9	.0	1144.1
6	511.9	192.1	277.5	239.0	-1090.3	.0	1125.0
7	-100.8	607.3	-742.0	742.3	-2526.6	.0	2633.3
8	3320.6	596.9	-703.0	694.2	-2468.6	.0	2566.7
9	2707.9	153.2	388.6	252.9	-1159.0	.0	1222.4
10	2095.2	153.2	388.6	248.9	-1139.4	.0	1203.8
11	1482.5	153.2	388.6	245.0	-1119.7	.0	1185.3
12	869.8	153.2	388.6	241.0	-1100.1	.0	1166.7
13	257.1	596.9	-703.0	642.0	-2273.4	.0	2379.6
14	3065.9	710.0	-940.7	802.9	-2744.0	.0	2900.7
15	2453.2	183.1	320.4	250.9	-1149.2	.0	1193.0
16	1840.5	183.1	320.4	246.9	-1129.5	.0	1174.1
17	1227.8	183.1	320.4	243.0	-1109.9	.0	1155.2
18	615.1	586.5	-664.0	754.4	-2570.1	.0	2654.5
19	3126.4	972.6	-1698.8	815.1	-2787.4	.0	3264.3
20	2513.7	307.7	-114.2	254.9	-1168.8	.0	1174.4
21	1901.0	231.2	90.6	250.9	-1149.2	.0	1152.7

22	1288.3	231.2	90.6	246.9	-1129.5	.0	1133.2
23	675.6	231.2	90.6	243.0	-1109.9	.0	1113.6
24	62.9	231.2	90.6	239.0	-1090.3	.0	1094.0
25	-549.8	698.1	-1081.7	742.3	-2526.6	.0	2748.4
26	2768.4	708.5	-1120.7	694.2	-2468.6	.0	2711.1
27	2155.7	195.5	178.6	252.9	-1159.0	.0	1172.7
28	1543.0	195.5	178.6	248.9	-1139.4	.0	1153.3
29	930.3	195.5	178.6	245.0	-1119.7	.0	1133.9
30	317.6	195.5	178.6	241.0	-1100.1	.0	1114.5
31	-295.1	708.5	-1120.7	642.0	-2273.4	.0	2534.6
32	2410.5	863.9	-1492.8	802.9	-2744.0	.0	3123.7
33	1797.8	240.2	47.6	250.9	-1149.2	.0	1150.2
34	1185.1	240.2	47.6	246.9	-1129.5	.0	1130.5
35	572.4	240.2	47.6	243.0	-1109.9	.0	1110.9
36	-40.3	719.0	-1159.8	754.4	-2570.1	.0	2819.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 34
spalla mobile - n777 _SisM22 - n789 _SisM22

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24763.1	6047.7	54457.4	-4331.6	-45527.6	-31284.7
2	29697.0	5399.0	62970.7	19160.1	39294.6	40016.7

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
54460.1	11446.7	117428.1	14828.5	46559.7	15673.1

Punto di applic. carico verticale: Xv = 2.156 m Yv = .855 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.564	10.530	1.370	6.989	.129	.051

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3381.6	719.2	-996.9	815.1	-2787.4	.0	2960.3
2	2833.5	214.2	171.7	254.9	-1168.8	.0	1181.3
3	2285.4	157.2	318.1	250.9	-1149.2	.0	1192.4
4	1737.3	157.2	318.1	246.9	-1129.5	.0	1173.5
5	1189.1	157.2	318.1	243.0	-1109.9	.0	1154.6
6	641.0	157.2	318.1	239.0	-1090.3	.0	1135.7
7	92.9	509.4	-537.0	742.3	-2526.6	.0	2583.0
8	3159.2	499.0	-497.9	694.2	-2468.6	.0	2518.3
9	2611.1	123.8	413.5	252.9	-1159.0	.0	1230.5
10	2062.9	123.8	413.5	248.9	-1139.4	.0	1212.1
11	1514.8	123.8	413.5	245.0	-1119.7	.0	1193.6
12	966.7	123.8	413.5	241.0	-1100.1	.0	1175.3
13	418.6	499.0	-497.9	642.0	-2273.4	.0	2327.2
14	2936.7	593.2	-691.1	802.9	-2744.0	.0	2829.7
15	2388.6	148.2	361.0	250.9	-1149.2	.0	1204.5
16	1840.5	148.2	361.0	246.9	-1129.5	.0	1185.8
17	1292.4	148.2	361.0	243.0	-1109.9	.0	1167.2
18	744.2	488.5	-458.9	754.4	-2570.1	.0	2610.7
19	2932.7	838.2	-1409.2	815.1	-2787.4	.0	3123.4
20	2384.5	262.3	-44.2	254.9	-1168.8	.0	1169.6
21	1836.4	196.4	131.1	250.9	-1149.2	.0	1156.6

22	1288.3	196.4	131.1	246.9	-1129.5	.0	1137.1
23	740.2	196.4	131.1	243.0	-1109.9	.0	1117.6
24	192.1	196.4	131.1	239.0	-1090.3	.0	1098.1
25	-356.1	600.2	-876.6	742.3	-2526.6	.0	2674.4
26	2607.0	610.6	-915.6	694.2	-2468.6	.0	2632.9
27	2058.9	166.1	203.5	252.9	-1159.0	.0	1176.7
28	1510.8	166.1	203.5	248.9	-1139.4	.0	1157.4
29	962.6	166.1	203.5	245.0	-1119.7	.0	1138.1
30	414.5	166.1	203.5	241.0	-1100.1	.0	1118.8
31	-133.6	610.6	-915.6	642.0	-2273.4	.0	2450.8
32	2281.3	747.1	-1243.2	802.9	-2744.0	.0	3012.4
33	1733.2	205.4	88.2	250.9	-1149.2	.0	1152.6
34	1185.1	205.4	88.2	246.9	-1129.5	.0	1133.0
35	637.0	205.4	88.2	243.0	-1109.9	.0	1113.4
36	88.8	621.0	-954.7	754.4	-2570.1	.0	2741.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 35
spalla mobile - n777 _SisM23- n789 _SisM23

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33263.1	6337.1	96657.0	-10232.3	-59109.2	-50590.0
2	33110.0	7209.6	88961.5	19094.8	51477.9	46813.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66373.1	13546.7	185618.5	8862.5	-9269.5	-13112.4

Punto di applic. carico verticale: Xv = 2.797 m Yv = -.140 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.218	14.073	2.009	3.993	.033	-.043

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4311.9	1007.6	-1299.5	431.9	-1514.0	.0	1995.3
2	3508.3	295.2	336.6	142.3	-682.1	.0	760.7
3	2704.7	215.1	539.8	145.6	-698.5	.0	882.8
4	1901.1	215.1	539.8	149.0	-715.0	.0	895.8
5	1097.5	215.1	539.8	152.3	-731.4	.0	909.0
6	293.9	215.1	539.8	155.6	-747.8	.0	922.3
7	-509.7	711.1	-653.7	492.7	-1732.2	.0	1851.5
8	3923.3	719.9	-686.4	375.5	-1372.1	.0	1534.2
9	3119.7	177.0	628.2	144.0	-690.3	.0	933.4
10	2316.1	177.0	628.2	147.3	-706.7	.0	945.6
11	1512.5	177.0	628.2	150.6	-723.2	.0	957.9
12	708.9	177.0	628.2	153.9	-739.6	.0	970.4
13	-94.7	719.9	-686.4	419.2	-1535.5	.0	1681.9
14	3534.7	884.0	-1064.7	442.0	-1550.4	.0	1880.8
15	2731.1	222.6	503.8	145.6	-698.5	.0	861.3
16	1927.5	222.6	503.8	149.0	-715.0	.0	874.6
17	1123.9	222.6	503.8	152.3	-731.4	.0	888.1
18	320.3	728.6	-719.0	482.6	-1695.9	.0	1842.0
19	4197.1	908.0	-954.6	431.9	-1514.0	.0	1789.9
20	3393.5	254.9	517.3	142.3	-682.1	.0	856.1
21	2589.9	182.3	696.2	145.6	-698.5	.0	986.2

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

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22	1786.3	182.3	696.2	149.0	-715.0	.0	997.9
23	982.7	182.3	696.2	152.3	-731.4	.0	1009.7
24	179.1	182.3	696.2	155.6	-747.8	.0	1021.7
25	-624.5	635.2	-369.5	492.7	-1732.2	.0	1771.2
26	3782.1	626.5	-336.9	375.5	-1372.1	.0	1412.9
27	2978.5	141.7	803.9	144.0	-690.3	.0	1059.6
28	2174.9	141.7	803.9	147.3	-706.7	.0	1070.4
29	1371.3	141.7	803.9	150.6	-723.2	.0	1081.3
30	567.7	141.7	803.9	153.9	-739.6	.0	1092.4
31	-235.9	626.5	-336.9	419.2	-1535.5	.0	1572.0
32	3367.1	755.2	-602.8	442.0	-1550.4	.0	1663.5
33	2563.5	174.8	732.1	145.6	-698.5	.0	1011.9
34	1759.9	174.8	732.1	149.0	-715.0	.0	1023.3
35	956.3	174.8	732.1	152.3	-731.4	.0	1034.8
36	152.7	617.8	-304.2	482.6	-1695.9	.0	1722.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 36
spalla mobile - n777 _SisM24- n789 _SisM24

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33263.2	5287.4	91302.9	-10268.4	-58943.8	-45881.2
2	33110.0	6159.2	83605.5	19130.9	51312.2	42096.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66373.2	11446.6	174908.4	8862.5	-9270.8	-13112.9

Punto di applic. carico verticale: Xv = 2.635 m Yv = -.140 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.219	12.515	1.848	3.993	.033	-.043

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4118.1	873.2	-1009.9	431.9	-1514.0	.0	1819.9
2	3379.1	249.8	406.6	142.3	-682.1	.0	794.1
3	2640.1	180.2	580.4	145.6	-698.5	.0	908.2
4	1901.1	180.2	580.4	149.0	-715.0	.0	920.9
5	1162.1	180.2	580.4	152.3	-731.4	.0	933.7
6	423.0	180.2	580.4	155.6	-747.8	.0	946.6
7	-316.0	613.2	-448.6	492.7	-1732.3	.0	1789.4
8	3761.8	622.0	-481.2	375.5	-1372.1	.0	1454.1
9	3022.8	147.6	653.1	144.0	-690.3	.0	950.3
10	2283.8	147.6	653.1	147.3	-706.7	.0	962.3
11	1544.8	147.6	653.1	150.6	-723.2	.0	974.4
12	805.7	147.6	653.1	153.9	-739.6	.0	986.7
13	66.7	622.0	-481.2	419.2	-1535.5	.0	1609.1
14	3405.5	767.2	-815.1	442.0	-1550.4	.0	1751.6
15	2666.5	187.7	544.4	145.6	-698.5	.0	885.6
16	1927.5	187.7	544.4	149.0	-715.0	.0	898.6
17	1188.4	187.7	544.4	152.3	-731.4	.0	911.8
18	449.4	630.7	-513.9	482.6	-1695.9	.0	1772.0
19	4003.4	773.6	-665.0	431.9	-1514.0	.0	1653.6
20	3264.4	209.6	587.2	142.3	-682.1	.0	900.1
21	2525.3	147.4	736.8	145.6	-698.5	.0	1015.3

22	1786.3	147.4	736.8	149.0	-715.0	.0	1026.6
23	1047.3	147.4	736.8	152.3	-731.4	.0	1038.1
24	308.3	147.4	736.8	155.6	-747.8	.0	1049.8
25	-430.7	537.3	-164.4	492.7	-1732.3	.0	1740.0
26	3620.7	528.6	-131.7	375.5	-1372.1	.0	1378.5
27	2881.7	112.2	828.8	144.0	-690.3	.0	1078.6
28	2142.6	112.2	828.8	147.3	-706.7	.0	1089.2
29	1403.6	112.2	828.8	150.6	-723.2	.0	1100.0
30	664.6	112.2	828.8	153.9	-739.6	.0	1110.8
31	-74.4	528.6	-131.7	419.2	-1535.5	.0	1541.1
32	3238.0	638.4	-353.2	442.0	-1550.4	.0	1590.1
33	2499.0	139.9	772.7	145.6	-698.5	.0	1041.6
34	1759.9	139.9	772.7	149.0	-715.0	.0	1052.7
35	1020.9	139.9	772.7	152.3	-731.4	.0	1063.9
36	281.9	519.8	-99.1	482.6	-1695.9	.0	1698.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 37
 spalla mobile - n777 _SisM25- n789 _SisM25

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24372.8	7594.6	61125.8	-3243.1	-46751.8	-36255.4
2	33761.0	5952.0	84737.8	22161.4	43282.9	54085.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58133.8	13546.6	145863.6	18918.3	96984.8	35406.0

Punto di applic. carico verticale: Xv = 2.509 m Yv = 1.668 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.074	12.700	1.679	9.103	.209	.115

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3993.7	792.5	-914.3	1078.8	-3648.9	.0	3761.7
2	3322.1	226.6	371.3	331.5	-1489.4	.0	1535.0
3	2650.6	163.4	529.0	322.6	-1445.0	.0	1538.8
4	1979.0	163.4	529.0	313.7	-1400.7	.0	1497.3
5	1307.4	163.4	529.0	304.7	-1356.4	.0	1455.9
6	635.9	163.4	529.0	295.8	-1312.0	.0	1414.6
7	-35.7	556.5	-404.8	914.4	-3059.6	.0	3086.3
8	3741.7	532.9	-316.6	913.2	-3208.1	.0	3223.7
9	3070.1	121.9	654.2	327.1	-1467.2	.0	1606.4
10	2398.5	121.9	654.2	318.1	-1422.9	.0	1566.1
11	1727.0	121.9	654.2	309.2	-1378.5	.0	1525.9
12	1055.4	121.9	654.2	300.3	-1334.2	.0	1485.9
13	383.8	532.9	-316.6	795.4	-2767.2	.0	2785.2
14	3489.6	623.1	-475.0	1051.4	-3550.7	.0	3582.3
15	2818.0	143.1	626.0	322.6	-1445.0	.0	1574.8
16	2146.5	143.1	626.0	313.7	-1400.7	.0	1534.2
17	1474.9	143.1	626.0	304.7	-1356.4	.0	1493.9
18	803.3	509.4	-228.4	941.8	-3157.8	.0	3166.1
19	3265.3	1061.3	-1845.5	1078.8	-3648.9	.0	4089.0
20	2593.8	335.3	-116.5	331.5	-1489.4	.0	1493.9
21	1922.2	251.9	106.7	322.6	-1445.0	.0	1449.0

22	1250.6	251.9	106.7	313.7	-1400.7	.0	1404.8
23	579.1	251.9	106.7	304.7	-1356.4	.0	1360.5
24	-92.5	251.9	106.7	295.8	-1312.0	.0	1316.3
25	-764.1	761.5	-1172.1	914.4	-3059.6	.0	3276.5
26	2845.8	785.1	-1260.3	913.2	-3208.1	.0	3446.8
27	2174.3	217.5	179.7	327.1	-1467.2	.0	1478.2
28	1502.7	217.5	179.7	318.1	-1422.9	.0	1434.2
29	831.1	217.5	179.7	309.2	-1378.5	.0	1390.2
30	159.6	217.5	179.7	300.3	-1334.2	.0	1346.2
31	-512.0	785.1	-1260.3	795.4	-2767.2	.0	3040.6
32	2426.3	970.9	-1722.2	1051.4	-3550.7	.0	3946.3
33	1754.8	272.2	9.6	322.6	-1445.0	.0	1445.1
34	1083.2	272.2	9.6	313.7	-1400.7	.0	1400.7
35	411.6	272.2	9.6	304.7	-1356.4	.0	1356.4
36	-259.9	808.7	-1348.5	941.8	-3157.8	.0	3433.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 38
spalla mobile - n777 _SisM26- n789 _SisM26

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	24372.8	6545.0	55771.8	-3279.3	-46586.4	-31546.6
2	33761.0	4901.6	79381.9	22197.5	43117.1	49368.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
58133.8	11446.6	135153.7	18918.2	96984.4	35406.6

Punto di applic. carico verticale: Xv = 2.325 m Yv = 1.668 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.074	11.142	1.517	9.103	.209	.115

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3800.0	658.0	-624.7	1078.7	-3648.8	.0	3701.9
2	3193.0	181.3	441.2	331.5	-1489.4	.0	1553.4
3	2586.0	128.5	569.6	322.6	-1445.0	.0	1553.2
4	1979.0	128.5	569.6	313.7	-1400.7	.0	1512.1
5	1372.0	128.5	569.6	304.7	-1356.3	.0	1471.1
6	765.0	128.5	569.6	295.8	-1312.0	.0	1430.3
7	158.0	458.6	-199.7	914.4	-3059.6	.0	3066.1
8	3580.2	435.0	-111.5	913.2	-3208.1	.0	3210.0
9	2973.2	92.5	679.1	327.1	-1467.2	.0	1616.7
10	2366.2	92.5	679.1	318.1	-1422.9	.0	1576.6
11	1759.2	92.5	679.1	309.2	-1378.5	.0	1536.7
12	1152.3	92.5	679.1	300.3	-1334.2	.0	1497.1
13	545.3	435.0	-111.5	795.4	-2767.1	.0	2769.4
14	3360.4	506.3	-225.4	1051.4	-3550.6	.0	3557.8
15	2753.4	108.2	666.6	322.6	-1445.0	.0	1591.4
16	2146.5	108.2	666.6	313.7	-1400.7	.0	1551.2
17	1539.5	108.2	666.6	304.7	-1356.3	.0	1511.3
18	932.5	411.4	-23.3	941.8	-3157.8	.0	3157.9
19	3071.6	926.9	-1555.9	1078.7	-3648.8	.0	3966.7
20	2464.6	290.0	-46.6	331.5	-1489.4	.0	1490.1
21	1857.6	217.0	147.3	322.6	-1445.0	.0	1452.5

22	1250.6	217.0	147.3	313.7	-1400.7	.0	1408.4
23	643.7	217.0	147.3	304.7	-1356.3	.0	1364.3
24	36.7	217.0	147.3	295.8	-1312.0	.0	1320.2
25	-570.3	663.6	-967.0	914.4	-3059.6	.0	3208.8
26	2684.4	687.2	-1055.2	913.2	-3208.1	.0	3377.2
27	2077.4	188.1	204.6	327.1	-1467.2	.0	1481.4
28	1470.4	188.1	204.6	318.1	-1422.9	.0	1437.5
29	863.4	188.1	204.6	309.2	-1378.5	.0	1393.6
30	256.4	188.1	204.6	300.3	-1334.2	.0	1349.8
31	-350.5	687.2	-1055.2	795.4	-2767.1	.0	2961.5
32	2297.2	854.1	-1472.6	1051.4	-3550.6	.0	3843.9
33	1690.2	237.3	50.2	322.6	-1445.0	.0	1445.9
34	1083.2	237.3	50.2	313.7	-1400.7	.0	1401.6
35	476.2	237.3	50.2	304.7	-1356.3	.0	1357.3
36	-130.8	710.8	-1143.4	941.8	-3157.8	.0	3358.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 39
 spalla mobile - n777 _SisM27 - n789 _SisM27

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34316.6	5834.9	98498.5	-11625.6	-59280.5	-51480.8
2	29634.9	7711.7	75436.0	16353.4	48807.9	38500.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63951.5	13546.6	173934.5	4727.8	-60566.8	-33062.2

Punto di applic. carico verticale: Xv = 2.720 m Yv = -.947 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.882	13.669	1.912	1.854	-.049	-.107

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3986.3	1074.3	-1636.2	165.3	-643.5	.0	1758.2
2	3221.5	327.5	111.2	64.8	-358.4	.0	375.2
3	2456.7	242.6	332.6	73.2	-399.8	.0	520.0
4	1691.9	242.6	332.6	81.5	-441.2	.0	552.5
5	927.1	242.6	332.6	89.8	-482.6	.0	586.1
6	162.3	242.6	332.6	98.2	-524.0	.0	620.6
7	-602.5	764.8	-951.2	318.7	-1193.7	.0	1526.3
8	3584.5	786.8	-1033.6	154.0	-624.8	.0	1207.7
9	2819.7	207.0	406.6	69.0	-379.1	.0	555.9
10	2054.9	207.0	406.6	77.3	-420.5	.0	584.9
11	1290.1	207.0	406.6	85.7	-461.9	.0	615.4
12	525.3	207.0	406.6	94.0	-503.3	.0	647.0
13	-239.5	786.8	-1033.6	264.0	-1036.6	.0	1463.8
14	3182.6	975.4	-1493.9	190.8	-735.2	.0	1665.0
15	2417.9	261.6	242.0	73.2	-399.8	.0	467.3
16	1653.1	261.6	242.0	81.5	-441.2	.0	503.2
17	888.3	261.6	242.0	89.8	-482.6	.0	539.8
18	123.5	808.8	-1115.9	293.1	-1102.0	.0	1568.3
19	4155.3	823.2	-766.6	165.3	-643.5	.0	1000.8
20	3390.5	226.1	566.7	64.8	-358.4	.0	670.5
21	2625.7	160.0	726.9	73.2	-399.8	.0	829.6

22	1860.9	160.0	726.9	81.5	-441.2	.0	850.3
23	1096.1	160.0	726.9	89.8	-482.6	.0	872.5
24	331.4	160.0	726.9	98.2	-524.0	.0	896.1
25	-433.4	573.3	-234.7	318.7	-1193.7	.0	1216.5
26	3792.4	551.3	-152.4	154.0	-624.8	.0	643.1
27	3027.6	117.8	849.7	69.0	-379.1	.0	930.4
28	2262.8	117.8	849.7	77.3	-420.5	.0	948.0
29	1498.0	117.8	849.7	85.7	-461.9	.0	967.1
30	733.2	117.8	849.7	94.0	-503.3	.0	987.5
31	-31.6	551.3	-152.4	264.0	-1036.6	.0	1047.7
32	3429.4	650.6	-329.3	190.8	-735.2	.0	805.5
33	2664.6	141.0	817.6	73.2	-399.8	.0	910.1
34	1899.8	141.0	817.6	81.5	-441.2	.0	929.0
35	1135.0	141.0	817.6	89.8	-482.6	.0	949.4
36	370.2	529.3	-70.0	293.1	-1102.0	.0	1104.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 40
 spalla mobile - n777 _SisM28- n789 _SisM28

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34316.7	4785.3	93144.5	-11661.7	-59115.1	-46772.0
2	29634.9	6661.4	70080.1	16389.5	48642.2	33783.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63951.6	11446.7	163224.6	4727.8	-60568.2	-33062.7

Punto di applic. carico verticale: Xv = 2.552 m Yv = -.947 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.882	12.112	1.751	1.854	-.049	-.107

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3792.6	939.8	-1346.6	165.2	-643.4	.0	1492.4
2	3092.4	282.2	181.1	64.8	-358.4	.0	401.5
3	2392.1	207.7	373.2	73.2	-399.8	.0	546.9
4	1691.9	207.7	373.2	81.5	-441.2	.0	577.8
5	991.7	207.7	373.2	89.8	-482.6	.0	610.0
6	291.5	207.7	373.2	98.2	-524.0	.0	643.3
7	-408.7	666.8	-746.1	318.7	-1193.7	.0	1407.7
8	3423.0	688.8	-828.5	154.0	-624.8	.0	1037.7
9	2722.8	177.6	431.5	69.0	-379.1	.0	574.4
10	2022.6	177.6	431.5	77.3	-420.5	.0	602.5
11	1322.4	177.6	431.5	85.7	-461.9	.0	632.1
12	622.2	177.6	431.5	94.0	-503.3	.0	663.0
13	-78.1	688.8	-828.5	264.0	-1036.6	.0	1327.0
14	3053.5	858.6	-1244.3	190.8	-735.2	.0	1445.3
15	2353.3	226.7	282.6	73.2	-399.8	.0	489.5
16	1653.1	226.7	282.6	81.5	-441.2	.0	523.9
17	952.8	226.7	282.6	89.8	-482.6	.0	559.2
18	252.6	710.9	-910.8	293.1	-1102.0	.0	1429.7
19	3961.6	688.8	-477.0	165.2	-643.4	.0	800.9
20	3261.4	180.7	636.6	64.8	-358.4	.0	730.6
21	2561.2	125.1	767.5	73.2	-399.8	.0	865.4

22	1860.9	125.1	767.5	81.5	-441.2	.0	885.3
23	1160.7	125.1	767.5	89.8	-482.6	.0	906.6
24	460.5	125.1	767.5	98.2	-524.0	.0	929.3
25	-239.7	475.4	-29.6	318.7	-1193.7	.0	1194.0
26	3630.9	453.3	52.7	154.0	-624.8	.0	627.0
27	2930.7	88.4	874.6	69.0	-379.1	.0	953.2
28	2230.5	88.4	874.6	77.3	-420.5	.0	970.4
29	1530.3	88.4	874.6	85.7	-461.9	.0	989.0
30	830.1	88.4	874.6	94.0	-503.3	.0	1009.0
31	129.8	453.3	52.7	264.0	-1036.6	.0	1037.9
32	3300.2	533.8	-79.7	190.8	-735.2	.0	739.5
33	2600.0	106.1	858.1	73.2	-399.8	.0	946.7
34	1899.8	106.1	858.1	81.5	-441.2	.0	964.9
35	1199.6	106.1	858.1	89.8	-482.6	.0	984.5
36	499.4	431.3	135.1	293.1	-1102.0	.0	1110.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 41
 spalla mobile - n777 _SisM29 - n789 _SisM29

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	23869.1	7589.2	58773.1	-3042.5	-45804.5	-35497.4
2	33477.3	5957.5	83291.7	21960.7	42746.3	53444.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57346.4	13546.7	142064.8	18918.2	99749.5	35405.9

Punto di applic. carico verticale: Xv = 2.477 m Yv = 1.739 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.965	12.569	1.647	9.116	.213	.115

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3939.7	789.5	-938.4	1079.0	-3646.2	.0	3765.1
2	3280.8	227.2	342.6	331.4	-1486.4	.0	1525.4
3	2621.8	164.3	500.3	322.5	-1442.1	.0	1526.4
4	1962.9	164.3	500.3	313.6	-1397.7	.0	1484.6
5	1303.9	164.3	500.3	304.6	-1353.4	.0	1442.9
6	645.0	164.3	500.3	295.7	-1309.0	.0	1401.4
7	-14.0	555.1	-431.3	914.7	-3057.0	.0	3087.3
8	3695.3	531.6	-343.1	913.4	-3205.4	.0	3223.7
9	3036.3	122.9	625.6	327.0	-1464.2	.0	1592.3
10	2377.4	122.9	625.6	318.0	-1419.9	.0	1551.6
11	1718.4	122.9	625.6	309.1	-1375.5	.0	1511.1
12	1059.5	122.9	625.6	300.2	-1331.2	.0	1470.9
13	400.5	531.6	-343.1	795.5	-2764.4	.0	2785.6
14	3450.8	621.0	-500.4	1051.6	-3548.0	.0	3583.1
15	2791.9	143.9	597.3	322.5	-1442.1	.0	1560.9
16	2132.9	143.9	597.3	313.6	-1397.7	.0	1520.0
17	1474.0	143.9	597.3	304.6	-1353.4	.0	1479.3
18	815.0	508.0	-254.9	942.0	-3155.2	.0	3165.5
19	3199.9	1058.4	-1869.7	1079.0	-3646.2	.0	4097.7
20	2541.0	335.9	-145.2	331.4	-1486.4	.0	1493.5
21	1882.0	252.7	78.0	322.5	-1442.1	.0	1444.2

22	1223.0	252.7	78.0	313.6	-1397.7	.0	1399.9
23	564.1	252.7	78.0	304.6	-1353.4	.0	1355.6
24	-94.9	252.7	78.0	295.7	-1309.0	.0	1311.4
25	-753.8	760.2	-1198.5	914.7	-3057.0	.0	3283.6
26	2785.4	783.8	-1286.7	913.4	-3205.4	.0	3454.0
27	2126.4	218.5	151.2	327.0	-1464.2	.0	1472.0
28	1467.5	218.5	151.2	318.0	-1419.9	.0	1427.9
29	808.5	218.5	151.2	309.1	-1375.5	.0	1383.8
30	149.6	218.5	151.2	300.2	-1331.2	.0	1339.8
31	-509.4	783.8	-1286.7	795.5	-2764.4	.0	3049.2
32	2370.9	968.8	-1747.5	1051.6	-3548.0	.0	3955.0
33	1711.9	273.1	-19.0	322.5	-1442.1	.0	1442.2
34	1053.0	273.1	-19.0	313.6	-1397.7	.0	1397.8
35	394.0	273.1	-19.0	304.6	-1353.4	.0	1353.5
36	-264.9	807.3	-1374.9	942.0	-3155.2	.0	3441.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 41
 spalla mobile - n777 _SisM29 - n789 _SisM29

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	1058.4	-1869.7	1079.0	-3646.2	1511.4	4097.7
1.41	880.7	-512.0	965.4	-2210.0	1306.8	2268.5
2.81	738.2	619.7	861.7	-927.9	1134.6	1115.8
4.22	386.8	1454.7	570.8	120.1	689.5	1459.6
5.63	80.0	1759.4	283.9	706.7	294.9	1896.1
7.03	-107.4	1721.7	73.7	945.4	130.2	1964.2
8.44	-192.9	1489.2	-49.1	937.1	199.1	1759.5
9.84	-201.3	1209.7	-72.6	849.7	214.0	1478.3
11.25	-198.7	926.6	-87.4	736.2	217.1	1183.5
13.50	-172.0	493.1	-95.2	528.0	196.6	722.5
15.75	-106.3	181.2	-84.9	318.7	136.0	366.6
18.00	-52.4	7.6	-60.5	153.6	80.0	153.8
20.25	-17.1	-65.2	-35.6	46.5	39.5	80.1
22.50	2.3	-78.8	-14.8	-9.8	15.0	79.4
26.25	8.6	-50.6	.5	-28.3	8.6	58.0
30.00	6.2	-21.9	2.5	-21.2	6.7	30.4
33.75	2.8	-4.9	2.3	-11.4	3.6	12.4
39.38	.1	1.8	.9	-2.0	.9	2.7
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 42
spalla mobile - n777 _SisM30 - n789 _SisM30

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	23869.1	6539.6	53419.1	-3078.6	-45639.0	-30788.6
2	33477.3	4907.1	77935.7	21996.8	42580.5	48727.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57346.4	11446.7	131354.8	18918.2	99749.2	35406.5

Punto di applic. carico verticale: Xv = 2.291 m Yv = 1.739 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.965	11.011	1.486	9.116	.213	.115

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3746.0	655.1	-648.8	1079.0	-3646.2	.0	3703.5
2	3151.6	181.9	412.6	331.4	-1486.4	.0	1542.6
3	2557.2	129.4	540.9	322.5	-1442.1	.0	1540.2
4	1962.9	129.4	540.9	313.6	-1397.7	.0	1498.7
5	1368.5	129.4	540.9	304.6	-1353.4	.0	1457.5
6	774.1	129.4	540.9	295.7	-1309.0	.0	1416.4
7	179.7	457.2	-226.2	914.7	-3057.0	.0	3065.4
8	3533.8	433.7	-138.0	913.4	-3205.4	.0	3208.3
9	2939.5	93.5	650.5	327.0	-1464.2	.0	1602.2
10	2345.1	93.5	650.5	318.0	-1419.9	.0	1561.8
11	1750.7	93.5	650.5	309.1	-1375.5	.0	1521.6
12	1156.3	93.5	650.5	300.2	-1331.2	.0	1481.6
13	562.0	433.7	-138.0	795.5	-2764.4	.0	2767.8
14	3321.7	504.2	-250.8	1051.6	-3548.0	.0	3556.9
15	2727.3	109.1	637.9	322.5	-1442.1	.0	1576.9
16	2132.9	109.1	637.9	313.6	-1397.7	.0	1536.4
17	1538.6	109.1	637.9	304.6	-1353.4	.0	1496.2
18	944.2	410.1	-49.8	942.0	-3155.2	.0	3155.6
19	3006.2	923.9	-1580.1	1079.0	-3646.2	.0	3973.9
20	2411.8	290.5	-75.2	331.4	-1486.4	.0	1488.3
21	1817.4	217.9	118.6	322.5	-1442.1	.0	1446.9

22	1223.0	217.9	118.6	313.6	-1397.7	.0	1402.7
23	628.7	217.9	118.6	304.6	-1353.4	.0	1358.6
24	34.3	217.9	118.6	295.7	-1309.0	.0	1314.4
25	-560.1	662.3	-993.4	914.7	-3057.0	.0	3214.4
26	2623.9	685.8	-1081.6	913.4	-3205.4	.0	3382.9
27	2029.6	189.1	176.1	327.0	-1464.2	.0	1474.8
28	1435.2	189.1	176.1	318.0	-1419.9	.0	1430.8
29	840.8	189.1	176.1	309.1	-1375.5	.0	1386.8
30	246.5	189.1	176.1	300.2	-1331.2	.0	1342.8
31	-347.9	685.8	-1081.6	795.5	-2764.4	.0	2968.5
32	2241.7	852.0	-1498.0	1051.6	-3548.0	.0	3851.3
33	1647.3	238.2	21.5	322.5	-1442.1	.0	1442.2
34	1053.0	238.2	21.5	313.6	-1397.7	.0	1397.9
35	458.6	238.2	21.5	304.6	-1353.4	.0	1353.5
36	-135.8	709.4	-1169.8	942.0	-3155.2	.0	3365.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 43
 spalla mobile - n777 _SisM31- n789 _SisM31

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34033.0	5840.4	97052.4	-11424.9	-58743.9	-50839.3
2	29131.3	7706.3	73083.3	16152.7	47860.6	37742.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63164.3	13546.7	170135.7	4727.8	-63331.5	-33061.9

Punto di applic. carico verticale: Xv = 2.694 m Yv = -1.003 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.773	13.538	1.880	1.840	-.052	-.107

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3920.9	1071.3	-1660.3	165.0	-646.1	.0	1781.6
2	3168.7	328.1	82.5	64.9	-361.3	.0	370.6
3	2416.5	243.5	303.9	73.3	-402.7	.0	504.5
4	1664.3	243.5	303.9	81.6	-444.1	.0	538.2
5	912.1	243.5	303.9	89.9	-485.5	.0	572.8
6	160.0	243.5	303.9	98.3	-526.9	.0	608.3
7	-592.2	763.4	-977.7	318.5	-1196.3	.0	1545.0
8	3524.0	785.4	-1060.0	153.9	-627.5	.0	1231.8
9	2771.9	208.0	378.0	69.1	-382.0	.0	537.5
10	2019.7	208.0	378.0	77.4	-423.4	.0	567.6
11	1267.5	208.0	378.0	85.8	-464.8	.0	599.2
12	515.3	208.0	378.0	94.1	-506.2	.0	631.8
13	-236.9	785.4	-1060.0	263.9	-1039.3	.0	1484.5
14	3127.2	973.2	-1519.2	190.6	-737.8	.0	1688.9
15	2375.0	262.5	213.3	73.3	-402.7	.0	455.7
16	1622.8	262.5	213.3	81.6	-444.1	.0	492.7
17	870.7	262.5	213.3	89.9	-485.5	.0	530.3
18	118.5	807.4	-1142.4	292.9	-1104.6	.0	1589.1
19	4101.3	820.3	-790.7	165.0	-646.1	.0	1021.1
20	3349.2	226.6	538.0	64.9	-361.3	.0	648.1
21	2597.0	160.9	698.2	73.3	-402.7	.0	806.0

22	1844.8	160.9	698.2	81.6	-444.1	.0	827.5
23	1092.6	160.9	698.2	89.9	-485.5	.0	850.5
24	340.4	160.9	698.2	98.3	-526.9	.0	874.8
25	-411.7	571.9	-261.2	318.5	-1196.3	.0	1224.5
26	3746.0	549.9	-178.8	153.9	-627.5	.0	652.5
27	2993.8	118.8	821.1	69.1	-382.0	.0	905.6
28	2241.6	118.8	821.1	77.4	-423.4	.0	923.8
29	1489.5	118.8	821.1	85.8	-464.8	.0	943.5
30	737.3	118.8	821.1	94.1	-506.2	.0	964.6
31	-14.9	549.9	-178.8	263.9	-1039.3	.0	1054.6
32	3390.6	648.4	-354.6	190.6	-737.8	.0	818.6
33	2638.5	141.9	788.9	73.3	-402.7	.0	885.7
34	1886.3	141.9	788.9	81.6	-444.1	.0	905.3
35	1134.1	141.9	788.9	89.9	-485.5	.0	926.3
36	381.9	527.9	-96.5	292.9	-1104.6	.0	1108.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 44
spalla mobile - n777 _SisM32- n789 _SisM32

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34033.0	4790.7	91698.4	-11461.0	-58578.5	-46130.5
2	29131.3	6655.9	67727.3	16188.9	47694.9	33025.7

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63164.3	11446.6	159425.7	4727.9	-63331.8	-33062.4

Punto di applic. carico verticale: Xv = 2.524 m Yv = -1.003 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.773	11.980	1.719	1.840	-.052	-.107

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3727.1	936.9	-1370.7	165.0	-646.1	.0	1515.4
2	3039.5	282.8	152.5	64.9	-361.3	.0	392.2
3	2351.9	208.6	344.5	73.3	-402.7	.0	530.0
4	1664.3	208.6	344.5	81.6	-444.1	.0	562.1
5	976.7	208.6	344.5	89.9	-485.5	.0	595.4
6	289.1	208.6	344.5	98.3	-527.0	.0	629.6
7	-398.5	665.5	-772.6	318.5	-1196.3	.0	1424.1
8	3362.6	687.5	-854.9	153.9	-627.5	.0	1060.5
9	2675.0	178.6	403.0	69.1	-382.0	.0	555.3
10	1987.4	178.6	403.0	77.4	-423.4	.0	584.5
11	1299.8	178.6	403.0	85.8	-464.8	.0	615.2
12	612.2	178.6	403.0	94.1	-506.3	.0	647.0
13	-75.4	687.5	-854.9	263.9	-1039.3	.0	1345.8
14	2998.0	856.4	-1269.6	190.6	-737.8	.0	1468.4
15	2310.4	227.6	253.9	73.3	-402.7	.0	476.1
16	1622.8	227.6	253.9	81.6	-444.1	.0	511.6
17	935.2	227.6	253.9	89.9	-485.5	.0	547.9
18	247.6	709.5	-937.3	292.9	-1104.6	.0	1448.7
19	3907.6	685.8	-501.1	165.0	-646.1	.0	817.6
20	3220.0	181.3	608.0	64.9	-361.3	.0	707.3
21	2532.4	126.0	738.8	73.3	-402.7	.0	841.5

22	1844.8	126.0	738.8	81.6	-444.1	.0	862.0
23	1157.2	126.0	738.8	89.9	-485.5	.0	884.1
24	469.6	126.0	738.8	98.3	-527.0	.0	907.5
25	-218.0	474.0	-56.1	318.5	-1196.3	.0	1197.6
26	3584.5	452.0	26.3	153.9	-627.5	.0	628.1
27	2896.9	89.4	846.0	69.1	-382.0	.0	928.3
28	2209.3	89.4	846.0	77.4	-423.4	.0	946.1
29	1521.7	89.4	846.0	85.8	-464.8	.0	965.3
30	834.1	89.4	846.0	94.1	-506.3	.0	985.9
31	146.5	452.0	26.3	263.9	-1039.3	.0	1039.6
32	3261.5	531.6	-105.0	190.6	-737.8	.0	745.2
33	2573.9	107.0	829.5	73.3	-402.7	.0	922.1
34	1886.3	107.0	829.5	81.6	-444.1	.0	940.9
35	1198.7	107.0	829.5	89.9	-485.5	.0	961.1
36	511.1	430.0	108.6	292.9	-1104.6	.0	1109.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLV

CONDIZIONE DI CARICO 45
spalla mobile - n777 _SisM33 - n789 _SisM33

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25503.0	7101.7	63357.6	-4643.5	-47093.3	-37248.9
2	30351.6	6445.0	71509.0	19487.1	40680.9	45968.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
55854.6	13546.7	134866.6	14843.6	45467.6	15745.9

Punto di applic. carico verticale: Xv = 2.415 m Yv = .814 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.758	12.320	1.588	6.990	.128	.051

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3679.0	858.6	-1242.8	815.9	-2791.8	.0	3055.9
2	3044.0	258.4	153.0	255.2	-1171.4	.0	1181.3
3	2408.9	190.5	328.7	251.2	-1151.6	.0	1197.6
4	1773.9	190.5	328.7	247.2	-1131.9	.0	1178.7
5	1138.8	190.5	328.7	243.3	-1112.2	.0	1159.8
6	503.8	190.5	328.7	239.3	-1092.5	.0	1140.9
7	-131.3	609.5	-694.4	742.8	-2529.8	.0	2623.4
8	3412.6	599.0	-655.2	694.9	-2472.6	.0	2557.9
9	2777.6	151.3	439.7	253.2	-1161.5	.0	1241.9
10	2142.5	151.3	439.7	249.2	-1141.8	.0	1223.5
11	1507.5	151.3	439.7	245.3	-1122.1	.0	1205.1
12	872.4	151.3	439.7	241.3	-1102.3	.0	1186.8
13	237.4	599.0	-655.2	642.5	-2276.4	.0	2368.9
14	3146.2	713.4	-894.6	803.7	-2748.2	.0	2890.1
15	2511.1	181.4	371.9	251.2	-1151.6	.0	1210.2
16	1876.1	181.4	371.9	247.2	-1131.9	.0	1191.4
17	1241.1	181.4	371.9	243.3	-1112.2	.0	1172.7
18	606.0	588.5	-616.0	755.0	-2573.5	.0	2646.1
19	3234.3	978.1	-1656.9	815.9	-2791.8	.0	3246.5
20	2599.3	306.8	-64.0	255.2	-1171.4	.0	1173.1
21	1964.2	229.8	140.9	251.2	-1151.6	.0	1160.2

22	1329.2	229.8	140.9	247.2	-1131.9	.0	1140.7
23	694.1	229.8	140.9	243.3	-1112.2	.0	1121.1
24	59.1	229.8	140.9	239.3	-1092.5	.0	1101.5
25	-576.0	700.7	-1035.6	742.8	-2529.8	.0	2733.6
26	2865.7	711.2	-1074.9	694.9	-2472.6	.0	2696.1
27	2230.6	193.8	228.7	253.2	-1161.5	.0	1183.8
28	1595.6	193.8	228.7	249.2	-1141.8	.0	1164.5
29	960.5	193.8	228.7	245.3	-1122.1	.0	1145.1
30	325.5	193.8	228.7	241.3	-1102.3	.0	1125.8
31	-309.6	711.2	-1074.9	642.5	-2276.4	.0	2517.4
32	2497.0	868.1	-1449.2	803.7	-2748.2	.0	3106.9
33	1862.0	238.8	97.7	251.2	-1151.6	.0	1155.8
34	1226.9	238.8	97.7	247.2	-1131.9	.0	1136.1
35	591.9	238.8	97.7	243.3	-1112.2	.0	1116.5
36	-43.2	721.7	-1114.1	755.0	-2573.5	.0	2804.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLV

 CONDIZIONE DI CARICO 46
 spalla mobile - n777 _SisM34 - n789 _SisM34

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	25503.0	6052.0	58003.6	-4679.7	-46927.9	-32540.1
2	30351.6	5394.6	66153.0	19523.2	40515.2	41251.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
55854.6	11446.6	124156.6	14843.5	45467.3	15745.4

Punto di applic. carico verticale: Xv = 2.223 m Yv = .814 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
7.758	10.762	1.426	6.990	.128	.051

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3485.3	724.1	-953.2	815.9	-2791.8	.0	2950.0
2	2914.8	213.1	222.9	255.2	-1171.3	.0	1192.4
3	2344.3	155.6	369.3	251.2	-1151.6	.0	1209.4
4	1773.9	155.6	369.3	247.2	-1131.9	.0	1190.6
5	1203.4	155.6	369.3	243.3	-1112.2	.0	1171.9
6	632.9	155.6	369.3	239.3	-1092.5	.0	1153.2
7	62.5	511.6	-489.3	742.8	-2529.8	.0	2576.7
8	3251.1	501.1	-450.1	694.9	-2472.5	.0	2513.2
9	2680.7	121.9	464.6	253.2	-1161.5	.0	1251.0
10	2110.2	121.9	464.6	249.2	-1141.8	.0	1232.7
11	1539.8	121.9	464.6	245.3	-1122.1	.0	1214.4
12	969.3	121.9	464.6	241.3	-1102.3	.0	1196.3
13	398.8	501.1	-450.1	642.5	-2276.4	.0	2320.5
14	3017.0	596.6	-645.0	803.7	-2748.1	.0	2822.8
15	2446.6	146.5	412.5	251.2	-1151.6	.0	1223.3
16	1876.1	146.5	412.5	247.2	-1131.9	.0	1204.7
17	1305.6	146.5	412.5	243.3	-1112.2	.0	1186.2
18	735.2	490.6	-410.9	755.0	-2573.4	.0	2606.0
19	3040.6	843.7	-1367.3	815.9	-2791.8	.0	3108.6
20	2470.1	261.4	6.0	255.2	-1171.3	.0	1171.4
21	1899.6	194.9	181.5	251.2	-1151.6	.0	1165.8

22	1329.2	194.9	181.5	247.2	-1131.9	.0	1146.4
23	758.7	194.9	181.5	243.3	-1112.2	.0	1126.9
24	188.2	194.9	181.5	239.3	-1092.5	.0	1107.5
25	-382.2	602.8	-830.5	742.8	-2529.8	.0	2662.6
26	2704.2	613.3	-869.7	694.9	-2472.5	.0	2621.0
27	2133.7	164.4	253.6	253.2	-1161.5	.0	1188.9
28	1563.3	164.4	253.6	249.2	-1141.8	.0	1169.6
29	992.8	164.4	253.6	245.3	-1122.1	.0	1150.4
30	422.4	164.4	253.6	241.3	-1102.3	.0	1131.1
31	-148.1	613.3	-869.7	642.5	-2276.4	.0	2436.9
32	2367.9	751.3	-1199.6	803.7	-2748.1	.0	2998.5
33	1797.4	204.0	138.3	251.2	-1151.6	.0	1159.9
34	1226.9	204.0	138.3	247.2	-1131.9	.0	1140.3
35	656.5	204.0	138.3	243.3	-1112.2	.0	1120.8
36	86.0	623.7	-909.0	755.0	-2573.4	.0	2729.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

9.4 Spalla appoggi mobili – Analisi SLE

M A P - Matrix Analysis of Piles
 Programma per l'analisi di palificate collegate da un plinto rigido

(C) G.Guiducci, S.G.I. - luglio 1994

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NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

Geometria Palificata

palo	vin	X m	Y m	Z m	axz deg	ayz deg	axy deg	Box m	Boy m
1	0	6.000	8.700	.000	.00	.00	.00	1.50	.00
2	0	4.000	8.700	.000	.00	.00	.00	1.50	.00
3	0	2.000	8.700	.000	.00	.00	.00	1.50	.00
4	0	.000	8.700	.000	.00	.00	.00	1.50	.00
5	0	-2.000	8.700	.000	.00	.00	.00	1.50	.00
6	0	-4.000	8.700	.000	.00	.00	.00	1.50	.00
7	0	-6.000	8.700	.000	.00	.00	.00	1.50	.00
8	0	5.000	10.700	.000	.00	.00	.00	1.50	.00
9	0	3.000	10.700	.000	.00	.00	.00	1.50	.00
10	0	1.000	10.700	.000	.00	.00	.00	1.50	.00
11	0	-1.000	10.700	.000	.00	.00	.00	1.50	.00
12	0	-3.000	10.700	.000	.00	.00	.00	1.50	.00
13	0	-5.000	10.700	.000	.00	.00	.00	1.50	.00
14	0	4.000	12.700	.000	.00	.00	.00	1.50	.00
15	0	2.000	12.700	.000	.00	.00	.00	1.50	.00
16	0	.000	12.700	.000	.00	.00	.00	1.50	.00
17	0	-2.000	12.700	.000	.00	.00	.00	1.50	.00
18	0	-4.000	12.700	.000	.00	.00	.00	1.50	.00
19	0	6.000	-8.700	.000	.00	.00	.00	1.50	.00
20	0	4.000	-8.700	.000	.00	.00	.00	1.50	.00
21	0	2.000	-8.700	.000	.00	.00	.00	1.50	.00
22	0	.000	-8.700	.000	.00	.00	.00	1.50	.00
23	0	-2.000	-8.700	.000	.00	.00	.00	1.50	.00
24	0	-4.000	-8.700	.000	.00	.00	.00	1.50	.00
25	0	-6.000	-8.700	.000	.00	.00	.00	1.50	.00
26	0	5.000	-10.700	.000	.00	.00	.00	1.50	.00
27	0	3.000	-10.700	.000	.00	.00	.00	1.50	.00
28	0	1.000	-10.700	.000	.00	.00	.00	1.50	.00
29	0	-1.000	-10.700	.000	.00	.00	.00	1.50	.00
30	0	-3.000	-10.700	.000	.00	.00	.00	1.50	.00
31	0	-5.000	-10.700	.000	.00	.00	.00	1.50	.00
32	0	4.000	-12.700	.000	.00	.00	.00	1.50	.00
33	0	2.000	-12.700	.000	.00	.00	.00	1.50	.00
34	0	.000	-12.700	.000	.00	.00	.00	1.50	.00
35	0	-2.000	-12.700	.000	.00	.00	.00	1.50	.00
36	0	-4.000	-12.700	.000	.00	.00	.00	1.50	.00

vin = 0 - incastro; 1 - cerniera; 2 - appoggio

X, Y, Z = Coordinate testa pali

axz = Inclinazione palo nel piano Xp Z rispetto alla verticale
 (positiva se verso Xp positivo)

ayz = Inclinazione palo nel piano Yp Z rispetto alla verticale
 (positiva se verso Yp positivo)

axy = Rotazione assi Xp Yp (positiva se antioraria)

Box = Lato dell'elemento parallelo all'asse Xp

Boy = Lato dell'elemento parallelo all'asse Yp

se Boy = 0 D = Box: diametro

altrimenti D = $\sqrt{\text{Box} * \text{Boy} * 1.273}$: diametro equivalente

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 Caratterizzazione dei pali soggetti a carichi assiali e torsionali
 (uguali per tutti i pali)

palo	AK kN/m	TK kN*m/rad
1	200000.	.0

 AK = Rigidezza assiale palo-terreno
 TK = Rigidezza torsionale palo-terreno

 Baricentro palificata: Xg = .000 m Yg = .000 m
 Rotazione direzioni princip. di inerzia: .00 deg

Caratterizzazione del terreno per pali soggetti a carichi trasversali

Terreno tipo 1

Prof. m	E kN/m2
.00	33750.0
3.00	35250.0
3.10	150000.0
8.00	150000.0
8.10	36750.0
13.00	44250.0
13.10	150000.0
26.00	150000.0
26.10	52500.0
60.00	75000.0

Caratterizzazione dei pali soggetti a carichi trasversali

palo	Lp m	EJx kN*m2	Itx	Ridx	EJy kN*m2	Ity	Ridy
1	45.00	7455147.	1	.300	7455147.	1	.250
2	45.00	7455147.	1	.080	7455147.	1	.050
3	45.00	7455147.	1	.060	7455147.	1	.050
4	45.00	7455147.	1	.060	7455147.	1	.050
5	45.00	7455147.	1	.060	7455147.	1	.050
6	45.00	7455147.	1	.060	7455147.	1	.050
7	45.00	7455147.	1	.200	7455147.	1	.250
8	45.00	7455147.	1	.200	7455147.	1	.200
9	45.00	7455147.	1	.050	7455147.	1	.050
10	45.00	7455147.	1	.050	7455147.	1	.050
11	45.00	7455147.	1	.050	7455147.	1	.050
12	45.00	7455147.	1	.050	7455147.	1	.050
13	45.00	7455147.	1	.200	7455147.	1	.200
14	45.00	7455147.	1	.250	7455147.	1	.250
15	45.00	7455147.	1	.060	7455147.	1	.050
16	45.00	7455147.	1	.060	7455147.	1	.050
17	45.00	7455147.	1	.060	7455147.	1	.050
18	45.00	7455147.	1	.200	7455147.	1	.250
19	45.00	7455147.	1	.300	7455147.	1	.250
20	45.00	7455147.	1	.080	7455147.	1	.050
21	45.00	7455147.	1	.060	7455147.	1	.050
22	45.00	7455147.	1	.060	7455147.	1	.050
23	45.00	7455147.	1	.060	7455147.	1	.050
24	45.00	7455147.	1	.060	7455147.	1	.050
25	45.00	7455147.	1	.200	7455147.	1	.250
26	45.00	7455147.	1	.200	7455147.	1	.200
27	45.00	7455147.	1	.050	7455147.	1	.050
28	45.00	7455147.	1	.050	7455147.	1	.050
29	45.00	7455147.	1	.050	7455147.	1	.050
30	45.00	7455147.	1	.050	7455147.	1	.050
31	45.00	7455147.	1	.200	7455147.	1	.200

32	45.00	7455147.	1	.250	7455147.	1	.250
33	45.00	7455147.	1	.060	7455147.	1	.050
34	45.00	7455147.	1	.060	7455147.	1	.050
35	45.00	7455147.	1	.060	7455147.	1	.050
36	45.00	7455147.	1	.200	7455147.	1	.250

 Lp = Lunghezza palo (compreso eventuale tratto fuori terra)
 EJ = Rigidezza flessionale del palo
 It = Tipo di terreno
 Rid = Moltiplicatore del modulo di reazione orizzontale

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 1
 spalla mobile - n777 _FESSM_1- n789 _FESSM_1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32505.2	4646.3	70693.9	-14481.1	-53499.8	-38517.1
2	33937.4	4512.1	76047.7	15177.1	55228.3	40439.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.6	9158.4	146741.6	696.0	17053.0	3358.2

Punto di applic. carico verticale: Xv = 2.209 m Yv = .257 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	10.248	1.535	.402	.024	.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3728.5	651.3	-582.6	45.6	-138.6	.0	598.9
2	3114.7	177.6	471.9	12.7	-45.5	.0	474.1
3	2500.8	125.3	598.3	11.9	-41.2	.0	599.7
4	1886.9	125.3	598.3	11.0	-37.0	.0	599.4
5	1273.1	125.3	598.3	10.2	-32.8	.0	599.2
6	659.2	125.3	598.3	9.4	-28.6	.0	598.9
7	45.3	453.0	-161.5	30.0	-82.7	.0	181.4
8	3431.1	450.7	-153.1	37.7	-117.5	.0	193.0
9	2817.2	97.7	666.5	12.3	-43.4	.0	667.9
10	2203.4	97.7	666.5	11.5	-39.1	.0	667.6
11	1589.5	97.7	666.5	10.6	-34.9	.0	667.4
12	975.6	97.7	666.5	9.8	-30.7	.0	667.2
13	361.8	450.7	-153.1	26.6	-75.6	.0	170.8
14	3133.7	549.7	-363.0	43.0	-129.3	.0	385.3
15	2519.8	123.4	607.5	11.9	-41.2	.0	608.9
16	1905.9	123.4	607.5	11.0	-37.0	.0	608.6
17	1292.1	123.4	607.5	10.2	-32.8	.0	608.4
18	678.2	448.5	-144.8	32.6	-92.0	.0	171.5
19	3645.9	676.8	-671.0	45.6	-138.6	.0	685.1
20	3032.0	187.9	425.7	12.7	-45.5	.0	428.1
21	2418.2	133.7	558.2	11.9	-41.2	.0	559.7

22	1804.3	133.7	558.2	11.0	-37.0	.0	559.4
23	1190.5	133.7	558.2	10.2	-32.8	.0	559.2
24	576.6	133.7	558.2	9.4	-28.6	.0	558.9
25	-37.3	472.4	-234.3	30.0	-82.7	.0	248.4
26	3329.5	474.6	-242.6	37.7	-117.5	.0	269.6
27	2715.6	106.7	621.5	12.3	-43.4	.0	623.0
28	2101.8	106.7	621.5	11.5	-39.1	.0	622.7
29	1487.9	106.7	621.5	10.6	-34.9	.0	622.5
30	874.0	106.7	621.5	9.8	-30.7	.0	622.2
31	260.2	474.6	-242.6	26.6	-75.6	.0	254.2
32	3013.1	582.7	-481.2	43.0	-129.3	.0	498.3
33	2399.2	135.6	549.0	11.9	-41.2	.0	550.6
34	1785.3	135.6	549.0	11.0	-37.0	.0	550.3
35	1171.5	135.6	549.0	10.2	-32.8	.0	550.0
36	557.6	476.9	-251.0	32.6	-92.0	.0	267.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 2
 spalla mobile - n777 _FESSM_2- n789 _FESSM_2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32505.3	3386.7	64269.0	-14524.5	-53301.3	-32866.5
2	33937.4	3251.6	69620.5	15220.5	55029.4	34779.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.7	6638.3	133889.5	696.0	17051.5	3358.4

Punto di applic. carico verticale: Xv = 2.015 m Yv = .257 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	8.379	1.341	.402	.024	.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3496.0	490.0	-235.1	45.6	-138.6	.0	272.9
2	2959.7	123.2	555.9	12.7	-45.5	.0	557.7
3	2423.3	83.5	647.0	11.9	-41.2	.0	648.3
4	1886.9	83.5	647.0	11.0	-37.0	.0	648.0
5	1350.6	83.5	647.0	10.2	-32.8	.0	647.8
6	814.2	83.5	647.0	9.4	-28.6	.0	647.6
7	277.8	335.4	84.6	30.0	-82.7	.0	118.3
8	3237.3	333.2	93.0	37.7	-117.5	.0	149.8
9	2701.0	62.4	696.4	12.3	-43.4	.0	697.7
10	2164.6	62.4	696.4	11.5	-39.1	.0	697.5
11	1628.2	62.4	696.4	10.6	-34.9	.0	697.3
12	1091.9	62.4	696.4	9.8	-30.7	.0	697.1
13	555.5	333.2	93.0	26.6	-75.6	.0	119.9
14	2978.7	409.5	-63.4	43.0	-129.3	.0	144.0
15	2442.3	81.5	656.2	11.9	-41.2	.0	657.5
16	1905.9	81.5	656.2	11.0	-37.0	.0	657.2
17	1369.6	81.5	656.2	10.2	-32.8	.0	657.0
18	833.2	331.0	101.4	32.6	-92.0	.0	136.9
19	3413.4	515.5	-323.4	45.6	-138.6	.0	351.9
20	2877.1	133.5	509.6	12.7	-45.5	.0	511.6
21	2340.7	91.9	606.9	11.9	-41.2	.0	608.3

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

REV. 2

22	1804.3	91.9	606.9	11.0	-37.0	.0	608.0
23	1268.0	91.9	606.9	10.2	-32.8	.0	607.8
24	731.6	91.9	606.9	9.4	-28.6	.0	607.6
25	195.2	354.9	11.9	30.0	-82.7	.0	83.5
26	3135.7	357.1	3.5	37.7	-117.5	.0	117.5
27	2599.4	71.4	651.4	12.3	-43.4	.0	652.8
28	2063.0	71.4	651.4	11.5	-39.1	.0	652.5
29	1526.6	71.4	651.4	10.6	-34.9	.0	652.3
30	990.3	71.4	651.4	9.8	-30.7	.0	652.1
31	453.9	357.1	3.5	26.6	-75.6	.0	75.7
32	2858.1	442.5	-181.7	43.0	-129.3	.0	223.0
33	2321.7	93.8	597.7	11.9	-41.2	.0	599.1
34	1785.3	93.8	597.7	11.0	-37.0	.0	598.9
35	1249.0	93.8	597.7	10.2	-32.8	.0	598.6
36	712.6	359.4	-4.9	32.6	-92.0	.0	92.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLE FESS

CONDIZIONE DI CARICO 3
spalla mobile - n777 _FESSM_3- n789 _FESSM_3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34530.8	4635.0	80009.6	-15372.9	-57202.8	-41590.3
2	34941.9	4523.3	81351.9	15822.9	57359.2	42566.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
69472.7	9158.3	161361.5	450.0	4555.1	2171.4

Punto di applic. carico verticale: Xv = 2.323 m Yv = .066 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.649	10.753	1.656	.228	.008	.007

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3930.4	667.2	-505.2	28.9	-95.7	.0	514.2
2	3267.9	177.3	574.0	8.5	-36.3	.0	575.1
3	2605.5	123.5	701.6	7.9	-33.6	.0	702.4
4	1943.1	123.5	701.6	7.4	-30.9	.0	702.2
5	1280.7	123.5	701.6	6.8	-28.2	.0	702.1
6	618.3	123.5	701.6	6.3	-25.5	.0	702.0
7	-44.1	461.6	-72.5	18.9	-59.6	.0	93.9
8	3602.2	460.1	-67.1	24.1	-82.4	.0	106.3
9	2939.8	95.5	768.5	8.2	-35.0	.0	769.3
10	2277.4	95.5	768.5	7.7	-32.3	.0	769.2
11	1615.0	95.5	768.5	7.1	-29.5	.0	769.1
12	952.5	95.5	768.5	6.6	-26.8	.0	769.0
13	290.1	460.1	-67.1	16.8	-55.3	.0	87.0
14	3274.1	563.8	-286.4	27.3	-89.7	.0	300.2
15	2611.7	122.3	707.5	7.9	-33.6	.0	708.3
16	1949.2	122.3	707.5	7.4	-30.9	.0	708.2
17	1286.8	122.3	707.5	6.8	-28.2	.0	708.1
18	624.4	458.7	-61.7	20.5	-65.6	.0	90.1
19	3903.7	683.7	-562.4	28.9	-95.7	.0	570.5
20	3241.3	183.9	544.0	8.5	-36.3	.0	545.2
21	2578.9	128.9	675.7	7.9	-33.6	.0	676.5

22	1916.5	128.9	675.7	7.4	-30.9	.0	676.4
23	1254.1	128.9	675.7	6.8	-28.2	.0	676.3
24	591.6	128.9	675.7	6.3	-25.5	.0	676.1
25	-70.8	474.2	-119.6	18.9	-59.6	.0	133.6
26	3569.5	475.6	-125.0	24.1	-82.4	.0	149.7
27	2907.0	101.3	739.4	8.2	-35.0	.0	740.3
28	2244.6	101.3	739.4	7.7	-32.3	.0	740.1
29	1582.2	101.3	739.4	7.1	-29.5	.0	740.0
30	919.8	101.3	739.4	6.6	-26.8	.0	739.9
31	257.4	475.6	-125.0	16.8	-55.3	.0	136.7
32	3235.2	585.2	-362.9	27.3	-89.7	.0	373.8
33	2572.8	130.2	669.7	7.9	-33.6	.0	670.6
34	1910.4	130.2	669.7	7.4	-30.9	.0	670.4
35	1247.9	130.2	669.7	6.8	-28.2	.0	670.3
36	585.5	477.1	-130.4	20.5	-65.6	.0	146.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 3
 spalla mobile - n777 _FESSM_3- n789 _FESSM_3

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	667.2	-505.2	28.9	-95.7	667.8	514.2
1.41	530.2	331.2	25.8	-57.3	530.8	336.1
2.81	425.0	997.1	23.0	-23.0	425.6	997.4
4.22	179.7	1451.5	15.1	4.9	180.4	1451.5
5.63	-22.9	1543.6	7.4	20.3	24.0	1543.7
7.03	-134.5	1419.2	1.8	26.4	134.5	1419.4
8.44	-176.4	1188.4	-1.5	25.9	176.4	1188.7
9.84	-176.6	938.7	-2.1	23.4	176.6	939.0
11.25	-169.0	694.2	-2.5	20.1	169.0	694.5
13.50	-140.1	331.2	-2.7	14.3	140.1	331.5
15.75	-79.0	88.1	-2.3	8.5	79.0	88.5
18.00	-33.8	-33.6	-1.6	4.0	33.9	33.9
20.25	-6.9	-74.6	-.9	1.1	6.9	74.6
22.50	6.1	-72.7	-.4	-.3	6.1	72.8
26.25	8.0	-41.3	.0	-.8	8.0	41.3
30.00	5.2	-15.9	.1	-.6	5.2	15.9
33.75	2.1	-2.2	.1	-.3	2.1	2.2
39.38	-.1	2.0	.0	-.1	.1	2.0
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 4
 spalla mobile - n777 _FESSM_4- n789 _FESSM_4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34530.8	3375.5	73584.8	-15416.3	-57004.2	-35939.7
2	34941.9	3262.9	74924.7	15866.3	57160.3	36906.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
69472.7	6638.4	148509.5	450.0	4554.9	2171.5

Punto di applic. carico verticale: Xv = 2.138 m Yv = .066 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.649	8.884	1.462	.228	.008	.007

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3697.9	505.9	-157.7	28.9	-95.7	.0	184.5
2	3113.0	122.9	657.9	8.5	-36.3	.0	658.9
3	2528.0	81.7	750.3	7.9	-33.6	.0	751.0
4	1943.1	81.7	750.3	7.4	-30.9	.0	750.9
5	1358.2	81.7	750.3	6.8	-28.2	.0	750.8
6	773.3	81.7	750.3	6.3	-25.5	.0	750.7
7	188.3	344.1	173.6	18.9	-59.6	.0	183.5
8	3408.5	342.6	179.0	24.1	-82.4	.0	197.0
9	2823.6	60.2	798.4	8.2	-35.0	.0	799.2
10	2238.6	60.2	798.4	7.7	-32.3	.0	799.1
11	1653.7	60.2	798.4	7.1	-29.5	.0	799.0
12	1068.8	60.2	798.4	6.6	-26.8	.0	798.9
13	483.9	342.6	179.0	16.8	-55.3	.0	187.3
14	3119.1	423.7	13.1	27.3	-89.7	.0	90.7
15	2534.2	80.4	756.2	7.9	-33.6	.0	757.0
16	1949.2	80.4	756.2	7.4	-30.9	.0	756.8
17	1364.3	80.4	756.2	6.8	-28.2	.0	756.7
18	779.4	341.2	184.4	20.5	-65.6	.0	195.7
19	3671.3	522.4	-214.8	28.9	-95.7	.0	235.2
20	3086.3	129.5	628.0	8.5	-36.3	.0	629.0
21	2501.4	87.1	724.4	7.9	-33.6	.0	725.1

22	1916.5	87.1	724.4	7.4	-30.9	.0	725.0
23	1331.6	87.1	724.4	6.8	-28.2	.0	724.9
24	746.6	87.1	724.4	6.3	-25.5	.0	724.8
25	161.7	356.7	126.5	18.9	-59.6	.0	139.8
26	3375.7	358.1	121.1	24.1	-82.4	.0	146.5
27	2790.8	66.0	769.3	8.2	-35.0	.0	770.1
28	2205.9	66.0	769.3	7.7	-32.3	.0	770.0
29	1621.0	66.0	769.3	7.1	-29.5	.0	769.9
30	1036.0	66.0	769.3	6.6	-26.8	.0	769.8
31	451.1	358.1	121.1	16.8	-55.3	.0	133.1
32	3080.2	445.0	-63.4	27.3	-89.7	.0	109.9
33	2495.3	88.3	718.4	7.9	-33.6	.0	719.2
34	1910.4	88.3	718.4	7.4	-30.9	.0	719.1
35	1325.4	88.3	718.4	6.8	-28.2	.0	719.0
36	740.5	359.6	115.7	20.5	-65.6	.0	133.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 4
 spalla mobile - n777 _FESSM_4- n789 _FESSM_4

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 9
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	60.2	798.4	8.2	-35.0	60.7	799.2
1.41	41.5	869.2	7.6	-23.9	42.2	869.5
2.81	26.8	916.6	7.1	-13.5	27.8	916.7
4.22	-9.1	933.6	5.4	-4.5	10.6	933.7
5.63	-41.3	895.9	3.5	1.7	41.4	895.9
7.03	-61.7	821.7	2.0	5.5	61.7	821.7
8.44	-71.4	725.7	.9	7.4	71.4	725.7
9.84	-72.4	624.2	.6	8.4	72.4	624.3
11.25	-72.0	522.4	.4	9.1	72.0	522.5
13.50	-67.3	362.6	.0	9.7	67.3	362.8
15.75	-53.9	225.6	-.5	9.0	53.9	225.8
18.00	-39.4	120.7	-.7	7.5	39.5	120.9
20.25	-26.0	47.5	-.8	5.8	26.0	47.8
22.50	-13.7	2.4	-.6	4.1	13.8	4.8
26.25	-2.4	-23.2	-.4	2.3	2.4	23.3
30.00	.6	-25.7	-.3	1.1	.6	25.8
33.75	2.1	-20.2	-.1	.4	2.1	20.2
39.38	2.0	-7.1	.0	.0	2.0	7.1
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 5
 spalla mobile - n777 _FESSM_5 - n789 _FESSM_5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32505.2	4646.3	70693.9	-14481.1	-53499.8	-38517.1
2	33937.4	4512.1	76047.7	15177.1	55228.3	40439.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.6	9158.4	146741.6	696.0	17053.0	3358.2

Punto di applic. carico verticale: Xv = 2.209 m Yv = .257 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	10.248	1.535	.402	.024	.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3728.5	651.3	-582.6	45.6	-138.6	.0	598.9
2	3114.7	177.6	471.9	12.7	-45.5	.0	474.1
3	2500.8	125.3	598.3	11.9	-41.2	.0	599.7
4	1886.9	125.3	598.3	11.0	-37.0	.0	599.4
5	1273.1	125.3	598.3	10.2	-32.8	.0	599.2
6	659.2	125.3	598.3	9.4	-28.6	.0	598.9
7	45.3	453.0	-161.5	30.0	-82.7	.0	181.4
8	3431.1	450.7	-153.1	37.7	-117.5	.0	193.0
9	2817.2	97.7	666.5	12.3	-43.4	.0	667.9
10	2203.4	97.7	666.5	11.5	-39.1	.0	667.6
11	1589.5	97.7	666.5	10.6	-34.9	.0	667.4
12	975.6	97.7	666.5	9.8	-30.7	.0	667.2
13	361.8	450.7	-153.1	26.6	-75.6	.0	170.8
14	3133.7	549.7	-363.0	43.0	-129.3	.0	385.3
15	2519.8	123.4	607.5	11.9	-41.2	.0	608.9
16	1905.9	123.4	607.5	11.0	-37.0	.0	608.6
17	1292.1	123.4	607.5	10.2	-32.8	.0	608.4
18	678.2	448.5	-144.8	32.6	-92.0	.0	171.5
19	3645.9	676.8	-671.0	45.6	-138.6	.0	685.1
20	3032.0	187.9	425.7	12.7	-45.5	.0	428.1
21	2418.2	133.7	558.2	11.9	-41.2	.0	559.7

22	1804.3	133.7	558.2	11.0	-37.0	.0	559.4
23	1190.5	133.7	558.2	10.2	-32.8	.0	559.2
24	576.6	133.7	558.2	9.4	-28.6	.0	558.9
25	-37.3	472.4	-234.3	30.0	-82.7	.0	248.4
26	3329.5	474.6	-242.6	37.7	-117.5	.0	269.6
27	2715.6	106.7	621.5	12.3	-43.4	.0	623.0
28	2101.8	106.7	621.5	11.5	-39.1	.0	622.7
29	1487.9	106.7	621.5	10.6	-34.9	.0	622.5
30	874.0	106.7	621.5	9.8	-30.7	.0	622.2
31	260.2	474.6	-242.6	26.6	-75.6	.0	254.2
32	3013.1	582.7	-481.2	43.0	-129.3	.0	498.3
33	2399.2	135.6	549.0	11.9	-41.2	.0	550.6
34	1785.3	135.6	549.0	11.0	-37.0	.0	550.3
35	1171.5	135.6	549.0	10.2	-32.8	.0	550.0
36	557.6	476.9	-251.0	32.6	-92.0	.0	267.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 6
 spalla mobile - n777 _FESSM_6- n789 _FESSM_6

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32505.3	3386.7	64269.0	-14524.5	-53301.3	-32866.5
2	33937.4	3251.6	69620.5	15220.5	55029.4	34779.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.7	6638.3	133889.5	696.0	17051.5	3358.4

Punto di applic. carico verticale: Xv = 2.015 m Yv = .257 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	8.379	1.341	.402	.024	.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3496.0	490.0	-235.1	45.6	-138.6	.0	272.9
2	2959.7	123.2	555.9	12.7	-45.5	.0	557.7
3	2423.3	83.5	647.0	11.9	-41.2	.0	648.3
4	1886.9	83.5	647.0	11.0	-37.0	.0	648.0
5	1350.6	83.5	647.0	10.2	-32.8	.0	647.8
6	814.2	83.5	647.0	9.4	-28.6	.0	647.6
7	277.8	335.4	84.6	30.0	-82.7	.0	118.3
8	3237.3	333.2	93.0	37.7	-117.5	.0	149.8
9	2701.0	62.4	696.4	12.3	-43.4	.0	697.7
10	2164.6	62.4	696.4	11.5	-39.1	.0	697.5
11	1628.2	62.4	696.4	10.6	-34.9	.0	697.3
12	1091.9	62.4	696.4	9.8	-30.7	.0	697.1
13	555.5	333.2	93.0	26.6	-75.6	.0	119.9
14	2978.7	409.5	-63.4	43.0	-129.3	.0	144.0
15	2442.3	81.5	656.2	11.9	-41.2	.0	657.5
16	1905.9	81.5	656.2	11.0	-37.0	.0	657.2
17	1369.6	81.5	656.2	10.2	-32.8	.0	657.0
18	833.2	331.0	101.4	32.6	-92.0	.0	136.9
19	3413.4	515.5	-323.4	45.6	-138.6	.0	351.9
20	2877.1	133.5	509.6	12.7	-45.5	.0	511.6
21	2340.7	91.9	606.9	11.9	-41.2	.0	608.3

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

REV. 2

22	1804.3	91.9	606.9	11.0	-37.0	.0	608.0
23	1268.0	91.9	606.9	10.2	-32.8	.0	607.8
24	731.6	91.9	606.9	9.4	-28.6	.0	607.6
25	195.2	354.9	11.9	30.0	-82.7	.0	83.5
26	3135.7	357.1	3.5	37.7	-117.5	.0	117.5
27	2599.4	71.4	651.4	12.3	-43.4	.0	652.8
28	2063.0	71.4	651.4	11.5	-39.1	.0	652.5
29	1526.6	71.4	651.4	10.6	-34.9	.0	652.3
30	990.3	71.4	651.4	9.8	-30.7	.0	652.1
31	453.9	357.1	3.5	26.6	-75.6	.0	75.7
32	2858.1	442.5	-181.7	43.0	-129.3	.0	223.0
33	2321.7	93.8	597.7	11.9	-41.2	.0	599.1
34	1785.3	93.8	597.7	11.0	-37.0	.0	598.9
35	1249.0	93.8	597.7	10.2	-32.8	.0	598.6
36	712.6	359.4	-4.9	32.6	-92.0	.0	92.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLE FESS

CONDIZIONE DI CARICO 7
spalla mobile - n777 _FESSM_7- n789 _FESSM_7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33350.3	4481.3	73621.8	-15158.0	-54480.3	-39585.4
2	33092.4	4677.0	73119.8	14462.0	54943.1	38321.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.7	9158.3	146741.6	-696.0	-2296.8	-3358.0

Punto di applic. carico verticale: Xv = 2.209 m Yv = -.035 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	10.248	1.535	-.329	-.006	-.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3676.5	676.8	-671.0	-44.4	152.5	.0	688.1
2	3062.6	187.9	425.7	-13.3	61.3	.0	430.1
3	2448.7	133.7	558.2	-12.4	57.1	.0	561.1
4	1834.9	133.7	558.2	-11.6	52.9	.0	560.7
5	1221.0	133.7	558.2	-10.7	48.7	.0	560.3
6	607.1	133.7	558.2	-9.9	44.5	.0	560.0
7	-6.7	472.4	-234.3	-28.8	96.7	.0	253.4
8	3367.0	474.6	-242.6	-37.0	132.1	.0	276.3
9	2753.2	106.7	621.5	-12.9	59.2	.0	624.3
10	2139.3	106.7	621.5	-12.0	55.0	.0	623.9
11	1525.5	106.7	621.5	-11.2	50.8	.0	623.6
12	911.6	106.7	621.5	-10.3	46.6	.0	623.2
13	297.7	474.6	-242.6	-25.8	90.3	.0	258.9
14	3057.6	582.7	-481.2	-41.8	143.2	.0	502.1
15	2443.8	135.6	549.0	-12.4	57.1	.0	552.0
16	1829.9	135.6	549.0	-11.6	52.9	.0	551.6
17	1216.1	135.6	549.0	-10.7	48.7	.0	551.2
18	602.2	476.9	-251.0	-31.4	106.0	.0	272.4
19	3698.0	651.3	-582.6	-44.4	152.5	.0	602.3
20	3084.1	177.6	472.0	-13.3	61.3	.0	475.9
21	2470.3	125.3	598.3	-12.4	57.1	.0	601.0

22	1856.4	125.3	598.3	-11.6	52.9	.0	600.6
23	1242.5	125.3	598.3	-10.7	48.7	.0	600.2
24	628.7	125.3	598.3	-9.9	44.5	.0	599.9
25	14.8	452.9	-161.5	-28.8	96.7	.0	188.2
26	3393.5	450.7	-153.1	-37.0	132.1	.0	202.2
27	2779.7	97.7	666.5	-12.9	59.2	.0	669.1
28	2165.8	97.7	666.5	-12.0	55.0	.0	668.8
29	1551.9	97.7	666.5	-11.2	50.8	.0	668.4
30	938.1	97.7	666.5	-10.3	46.6	.0	668.1
31	324.2	450.7	-153.1	-25.8	90.3	.0	177.8
32	3089.1	549.7	-362.9	-41.8	143.2	.0	390.2
33	2475.2	123.4	607.5	-12.4	57.1	.0	610.1
34	1861.3	123.4	607.5	-11.6	52.9	.0	609.8
35	1247.5	123.4	607.5	-10.7	48.7	.0	609.4
36	633.6	448.5	-144.8	-31.4	106.0	.0	179.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLE FESS

CONDIZIONE DI CARICO 8
spalla mobile - n777 _FESSM_8- n789 _FESSM_8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33350.3	3221.8	67197.0	-15201.3	-54281.8	-33934.9
2	33092.3	3416.6	66692.6	14505.3	54744.2	32661.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66442.6	6638.4	133889.6	-696.0	-2298.2	-3358.1

Punto di applic. carico verticale: Xv = 2.015 m Yv = -.035 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.228	8.379	1.341	-.329	-.006	-.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3444.0	515.5	-323.4	-44.4	152.5	.0	357.6
2	2907.6	133.5	509.6	-13.3	61.3	.0	513.3
3	2371.2	91.9	606.9	-12.4	57.1	.0	609.6
4	1834.9	91.9	606.9	-11.6	52.9	.0	609.2
5	1298.5	91.9	606.9	-10.7	48.7	.0	608.9
6	762.1	91.9	606.9	-9.9	44.5	.0	608.5
7	225.8	354.9	11.8	-28.8	96.7	.0	97.4
8	3173.3	357.1	3.5	-37.0	132.1	.0	132.1
9	2636.9	71.4	651.4	-12.9	59.2	.0	654.1
10	2100.6	71.4	651.4	-12.0	55.0	.0	653.7
11	1564.2	71.4	651.4	-11.2	50.8	.0	653.3
12	1027.8	71.4	651.4	-10.3	46.6	.0	653.0
13	491.5	357.1	3.5	-25.8	90.3	.0	90.3
14	2902.6	442.5	-181.7	-41.8	143.2	.0	231.4
15	2366.3	93.8	597.7	-12.4	57.1	.0	600.4
16	1829.9	93.8	597.7	-11.6	52.9	.0	600.0
17	1293.5	93.8	597.7	-10.7	48.7	.0	599.7
18	757.2	359.4	-4.9	-31.4	106.0	.0	106.1
19	3465.5	490.0	-235.1	-44.4	152.5	.0	280.3
20	2929.1	123.2	555.9	-13.3	61.3	.0	559.3
21	2392.8	83.5	647.0	-12.4	57.1	.0	649.5

22	1856.4	83.5	647.0	-11.6	52.9	.0	649.1
23	1320.0	83.5	647.0	-10.7	48.7	.0	648.8
24	783.7	83.5	647.0	-9.9	44.5	.0	648.5
25	247.3	335.4	84.6	-28.8	96.7	.0	128.5
26	3199.8	333.2	93.0	-37.0	132.1	.0	161.5
27	2663.4	62.4	696.4	-12.9	59.2	.0	698.9
28	2127.1	62.4	696.4	-12.0	55.0	.0	698.5
29	1590.7	62.4	696.4	-11.2	50.8	.0	698.2
30	1054.3	62.4	696.4	-10.3	46.6	.0	697.9
31	518.0	333.2	93.0	-25.8	90.3	.0	129.6
32	2934.1	409.6	-63.4	-41.8	143.2	.0	156.6
33	2397.7	81.5	656.2	-12.4	57.1	.0	658.6
34	1861.3	81.5	656.2	-11.6	52.9	.0	658.3
35	1325.0	81.5	656.2	-10.7	48.7	.0	658.0
36	788.6	331.0	101.3	-31.4	106.0	.0	146.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 9
 spalla mobile - n777 _FESSM_9- n789 _FESSM_9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32674.5	4643.4	71551.8	-14597.2	-53819.9	-38890.9
2	34223.6	4515.0	77387.3	15293.2	55766.6	40875.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66898.1	9158.4	148939.1	696.0	18522.1	3358.1

Punto di applic. carico verticale: Xv = 2.226 m Yv = .277 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.291	10.324	1.553	.409	.025	.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3766.1	653.0	-568.7	45.7	-137.2	.0	585.0
2	3145.0	177.3	488.5	12.7	-43.9	.0	490.5
3	2523.8	124.8	614.8	11.8	-39.7	.0	616.1
4	1902.6	124.8	614.8	11.0	-35.5	.0	615.9
5	1281.5	124.8	614.8	10.1	-31.3	.0	615.6
6	660.3	124.8	614.8	9.3	-27.1	.0	615.4
7	39.1	453.7	-146.2	30.1	-81.3	.0	167.3
8	3465.7	451.5	-137.8	37.8	-116.0	.0	180.2
9	2844.6	97.1	683.0	12.3	-41.8	.0	684.3
10	2223.4	97.1	683.0	11.4	-37.6	.0	684.0
11	1602.2	97.1	683.0	10.6	-33.4	.0	683.8
12	981.1	97.1	683.0	9.7	-29.2	.0	683.6
13	359.9	451.5	-137.8	26.6	-74.2	.0	156.5
14	3165.3	551.0	-348.3	43.1	-127.9	.0	371.0
15	2544.2	122.9	624.1	11.8	-39.7	.0	625.3
16	1923.0	122.9	624.1	11.0	-35.5	.0	625.1
17	1301.9	122.9	624.1	10.1	-31.3	.0	624.8
18	680.7	449.3	-129.5	32.7	-90.6	.0	158.0
19	3677.4	678.5	-657.0	45.7	-137.2	.0	671.2
20	3056.3	187.6	442.2	12.7	-43.9	.0	444.4
21	2435.1	133.2	574.8	11.8	-39.7	.0	576.2

22	1813.9	133.2	574.8	11.0	-35.5	.0	575.9
23	1192.8	133.2	574.8	10.1	-31.3	.0	575.7
24	571.6	133.2	574.8	9.3	-27.1	.0	575.4
25	-49.6	473.2	-219.0	30.1	-81.3	.0	233.6
26	3356.6	475.4	-227.3	37.8	-116.0	.0	255.2
27	2735.5	106.2	638.0	12.3	-41.8	.0	639.4
28	2114.3	106.2	638.0	11.4	-37.6	.0	639.1
29	1493.2	106.2	638.0	10.6	-33.4	.0	638.9
30	872.0	106.2	638.0	9.7	-29.2	.0	638.7
31	250.8	475.4	-227.3	26.6	-74.2	.0	239.1
32	3035.9	583.9	-466.6	43.1	-127.9	.0	483.8
33	2414.7	135.2	565.6	11.8	-39.7	.0	567.0
34	1793.5	135.2	565.6	11.0	-35.5	.0	566.7
35	1172.4	135.2	565.6	10.1	-31.3	.0	566.5
36	551.2	477.7	-235.7	32.7	-90.6	.0	252.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 10
 spalla mobile - n777 _FESSM_10- n789 _FESSM_10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32674.5	3383.8	65127.0	-14640.6	-53621.3	-33240.4
2	34223.6	3254.5	70960.2	15336.6	55567.7	35215.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66898.1	6638.3	136087.2	696.0	18521.8	3358.1

Punto di applic. carico verticale: Xv = 2.034 m Yv = .277 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.291	8.455	1.359	.409	.025	.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3533.6	491.7	-221.1	45.7	-137.2	.0	260.2
2	2990.0	122.9	572.5	12.7	-43.9	.0	574.1
3	2446.3	83.0	663.6	11.8	-39.7	.0	664.7
4	1902.6	83.0	663.6	11.0	-35.5	.0	664.5
5	1359.0	83.0	663.6	10.1	-31.3	.0	664.3
6	815.3	83.0	663.6	9.3	-27.1	.0	664.1
7	271.6	336.2	99.9	30.1	-81.3	.0	128.8
8	3272.0	334.0	108.3	37.8	-116.0	.0	158.7
9	2728.3	61.8	712.9	12.3	-41.8	.0	714.1
10	2184.7	61.8	712.9	11.4	-37.6	.0	713.9
11	1641.0	61.8	712.9	10.6	-33.4	.0	713.7
12	1097.3	61.8	712.9	9.7	-29.2	.0	713.5
13	553.7	334.0	108.3	26.6	-74.2	.0	131.3
14	3010.4	410.8	-48.8	43.1	-127.9	.0	136.9
15	2466.7	81.1	672.8	11.8	-39.7	.0	673.9
16	1923.0	81.1	672.8	11.0	-35.5	.0	673.7
17	1379.4	81.1	672.8	10.1	-31.3	.0	673.5
18	835.7	331.8	116.7	32.7	-90.6	.0	147.7
19	3444.9	517.2	-309.4	45.7	-137.2	.0	338.5
20	2901.3	133.2	526.2	12.7	-43.9	.0	528.0
21	2357.6	91.4	623.5	11.8	-39.7	.0	624.8

22	1813.9	91.4	623.5	11.0	-35.5	.0	624.5
23	1270.3	91.4	623.5	10.1	-31.3	.0	624.3
24	726.6	91.4	623.5	9.3	-27.1	.0	624.1
25	182.9	355.7	27.2	30.1	-81.3	.0	85.7
26	3162.9	357.9	18.8	37.8	-116.0	.0	117.5
27	2619.2	70.9	667.9	12.3	-41.8	.0	669.2
28	2075.6	70.9	667.9	11.4	-37.6	.0	669.0
29	1531.9	70.9	667.9	10.6	-33.4	.0	668.7
30	988.2	70.9	667.9	9.7	-29.2	.0	668.5
31	444.6	357.9	18.8	26.6	-74.2	.0	76.5
32	2880.9	443.8	-167.1	43.1	-127.9	.0	210.4
33	2337.2	93.3	614.3	11.8	-39.7	.0	615.6
34	1793.5	93.3	614.3	11.0	-35.5	.0	615.3
35	1249.9	93.3	614.3	10.1	-31.3	.0	615.1
36	706.2	360.1	10.4	32.7	-90.6	.0	91.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLE FESS

CONDIZIONE DI CARICO 11
spalla mobile - n777 _FESSM_11- n789 _FESSM_11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34223.7	4513.3	77380.8	-15274.0	-56114.6	-40332.1
2	32674.5	4645.1	71558.3	14578.0	54167.3	38384.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66898.2	9158.4	148939.1	-696.0	-18523.7	-3358.1

Punto di applic. carico verticale: Xv = 2.226 m Yv = -.277 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.291	10.324	1.553	-.409	-.025	-.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3677.4	678.5	-657.0	-45.7	137.2	.0	671.2
2	3056.3	187.6	442.2	-12.7	43.9	.0	444.4
3	2435.1	133.2	574.8	-11.8	39.7	.0	576.2
4	1813.9	133.2	574.8	-11.0	35.5	.0	575.9
5	1192.8	133.2	574.8	-10.1	31.3	.0	575.7
6	571.6	133.2	574.8	-9.3	27.1	.0	575.4
7	-49.6	473.2	-219.0	-30.1	81.3	.0	233.6
8	3356.6	475.4	-227.3	-37.8	116.0	.0	255.2
9	2735.5	106.2	638.0	-12.3	41.8	.0	639.4
10	2114.3	106.2	638.0	-11.4	37.6	.0	639.1
11	1493.2	106.2	638.0	-10.6	33.4	.0	638.9
12	872.0	106.2	638.0	-9.7	29.2	.0	638.7
13	250.8	475.4	-227.3	-26.6	74.2	.0	239.1
14	3035.9	583.9	-466.6	-43.1	127.9	.0	483.8
15	2414.7	135.2	565.6	-11.8	39.7	.0	567.0
16	1793.5	135.2	565.6	-11.0	35.5	.0	566.7
17	1172.4	135.2	565.6	-10.1	31.3	.0	566.5
18	551.2	477.7	-235.7	-32.7	90.6	.0	252.5
19	3766.1	653.0	-568.7	-45.7	137.2	.0	585.0
20	3145.0	177.3	488.5	-12.7	43.9	.0	490.5
21	2523.8	124.8	614.8	-11.8	39.7	.0	616.1

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

REV. 2

22	1902.6	124.8	614.8	-11.0	35.5	.0	615.9
23	1281.5	124.8	614.8	-10.1	31.3	.0	615.6
24	660.3	124.8	614.8	-9.3	27.1	.0	615.4
25	39.2	453.7	-146.2	-30.1	81.3	.0	167.3
26	3465.7	451.5	-137.8	-37.8	116.0	.0	180.2
27	2844.6	97.1	683.0	-12.3	41.8	.0	684.3
28	2223.4	97.1	683.0	-11.4	37.6	.0	684.0
29	1602.3	97.1	683.0	-10.6	33.4	.0	683.8
30	981.1	97.1	683.0	-9.7	29.2	.0	683.6
31	359.9	451.5	-137.8	-26.6	74.2	.0	156.5
32	3165.4	551.0	-348.3	-43.1	127.9	.0	371.0
33	2544.2	122.9	624.1	-11.8	39.7	.0	625.3
34	1923.0	122.9	624.1	-11.0	35.5	.0	625.1
35	1301.9	122.9	624.1	-10.1	31.3	.0	624.8
36	680.7	449.3	-129.5	-32.7	90.6	.0	158.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 12
 spalla mobile - n777 _FESSM_12- n789 _FESSM_12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34223.7	3253.7	70956.0	-15317.4	-55916.1	-34681.5
2	32674.5	3384.6	65131.2	14621.4	53968.3	32724.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66898.2	6638.3	136087.2	-696.0	-18524.2	-3358.0

Punto di applic. carico verticale: Xv = 2.034 m Yv = -.277 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.291	8.455	1.359	-.409	-.025	-.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3444.9	517.2	-309.4	-45.7	137.2	.0	338.5
2	2901.3	133.2	526.2	-12.7	43.9	.0	528.0
3	2357.6	91.4	623.5	-11.8	39.7	.0	624.8
4	1813.9	91.4	623.5	-11.0	35.5	.0	624.5
5	1270.3	91.4	623.5	-10.1	31.3	.0	624.3
6	726.6	91.4	623.5	-9.3	27.1	.0	624.1
7	182.9	355.7	27.2	-30.1	81.3	.0	85.7
8	3162.9	357.9	18.8	-37.8	116.0	.0	117.5
9	2619.2	70.9	667.9	-12.3	41.8	.0	669.2
10	2075.6	70.9	667.9	-11.4	37.6	.0	669.0
11	1531.9	70.9	667.9	-10.6	33.4	.0	668.7
12	988.2	70.9	667.9	-9.7	29.2	.0	668.5
13	444.6	357.9	18.8	-26.6	74.2	.0	76.5
14	2880.9	443.8	-167.1	-43.1	127.9	.0	210.4
15	2337.2	93.3	614.3	-11.8	39.7	.0	615.6
16	1793.5	93.3	614.3	-11.0	35.5	.0	615.3
17	1249.9	93.3	614.3	-10.1	31.3	.0	615.1
18	706.2	360.1	10.4	-32.7	90.6	.0	91.2
19	3533.6	491.7	-221.1	-45.7	137.2	.0	260.2
20	2990.0	122.9	572.5	-12.7	43.9	.0	574.1
21	2446.3	83.0	663.6	-11.8	39.7	.0	664.7

22	1902.6	83.0	663.6	-11.0	35.5	.0	664.5
23	1359.0	83.0	663.6	-10.1	31.3	.0	664.3
24	815.3	83.0	663.6	-9.3	27.1	.0	664.1
25	271.6	336.2	99.9	-30.1	81.3	.0	128.8
26	3272.0	334.0	108.3	-37.8	116.0	.0	158.7
27	2728.3	61.8	712.9	-12.3	41.8	.0	714.1
28	2184.7	61.8	712.9	-11.4	37.6	.0	713.9
29	1641.0	61.8	712.9	-10.6	33.4	.0	713.7
30	1097.3	61.8	712.9	-9.7	29.2	.0	713.5
31	553.7	334.0	108.3	-26.6	74.2	.0	131.3
32	3010.4	410.8	-48.8	-43.1	127.9	.0	136.9
33	2466.7	81.1	672.8	-11.8	39.7	.0	673.9
34	1923.0	81.1	672.8	-11.0	35.5	.0	673.7
35	1379.4	81.1	672.8	-10.1	31.3	.0	673.5
36	835.7	331.8	116.7	-32.7	90.6	.0	147.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLE FESS

CONDIZIONE DI CARICO 13
spalla mobile - n777 _FESSM_13- n789 _FESSM_13

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33708.5	5049.6	78212.4	-14974.1	-55712.3	-42083.8
2	34221.6	4948.7	79990.1	15406.1	56083.7	43087.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67930.1	9998.3	158202.5	432.0	5861.6	2083.6

Punto di applic. carico verticale: Xv = 2.329 m Yv = .086 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.435	11.119	1.659	.226	.009	.007

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3893.4	715.5	-669.6	27.9	-90.5	.0	675.7
2	3229.9	196.6	489.3	8.1	-33.3	.0	490.4
3	2566.3	139.2	628.6	7.6	-30.7	.0	629.4
4	1902.8	139.2	628.6	7.0	-28.1	.0	629.2
5	1239.3	139.2	628.6	6.5	-25.5	.0	629.1
6	575.8	139.2	628.6	6.0	-22.8	.0	629.0
7	-87.8	498.4	-207.4	18.2	-55.8	.0	214.7
8	3565.3	497.0	-202.2	23.2	-77.6	.0	216.6
9	2901.8	109.3	702.0	7.8	-32.0	.0	702.7
10	2238.2	109.3	702.0	7.3	-29.4	.0	702.6
11	1574.7	109.3	702.0	6.8	-26.8	.0	702.5
12	911.2	109.3	702.0	6.2	-24.2	.0	702.4
13	247.6	497.0	-202.2	16.2	-51.6	.0	208.7
14	3237.2	606.8	-437.4	26.3	-84.7	.0	445.5
15	2573.6	138.1	634.3	7.6	-30.7	.0	635.1
16	1910.1	138.1	634.3	7.0	-28.1	.0	634.9
17	1246.6	138.1	634.3	6.5	-25.5	.0	634.8
18	583.0	495.6	-197.0	19.8	-61.6	.0	206.4
19	3861.7	731.3	-724.4	27.9	-90.5	.0	730.0
20	3198.1	203.0	460.6	8.1	-33.3	.0	461.8
21	2534.6	144.5	603.8	7.6	-30.7	.0	604.5

22	1871.1	144.5	603.8	7.0	-28.1	.0	604.4
23	1207.6	144.5	603.8	6.5	-25.5	.0	604.3
24	544.0	144.5	603.8	6.0	-22.8	.0	604.2
25	-119.5	510.4	-252.5	18.2	-55.8	.0	258.6
26	3526.3	511.8	-257.7	23.2	-77.6	.0	269.1
27	2862.7	114.9	674.1	7.8	-32.0	.0	674.8
28	2199.2	114.9	674.1	7.3	-29.4	.0	674.7
29	1535.7	114.9	674.1	6.8	-26.8	.0	674.6
30	872.1	114.9	674.1	6.2	-24.2	.0	674.5
31	208.6	511.8	-257.7	16.2	-51.6	.0	262.8
32	3190.8	627.2	-510.8	26.3	-84.7	.0	517.8
33	2527.3	145.7	598.1	7.6	-30.7	.0	598.8
34	1863.8	145.7	598.1	7.0	-28.1	.0	598.7
35	1200.3	145.7	598.1	6.5	-25.5	.0	598.6
36	536.7	513.2	-262.9	19.8	-61.6	.0	270.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 13
 spalla mobile - n777 _FESSM_13- n789 _FESSM_13

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	731.3	-724.4	27.9	-90.5	731.9	730.0
1.41	587.5	197.4	24.8	-53.4	588.0	204.5
2.81	476.1	939.4	22.1	-20.5	476.6	939.6
4.22	213.2	1455.6	14.4	6.2	213.7	1455.6
5.63	-6.5	1581.9	6.9	20.8	9.5	1582.1
7.03	-130.5	1471.1	1.5	26.4	130.5	1471.3
8.44	-179.5	1239.4	-1.6	25.8	179.5	1239.7
9.84	-181.0	984.3	-2.2	23.1	181.0	984.6
11.25	-174.2	733.1	-2.5	19.8	174.2	733.3
13.50	-145.6	357.9	-2.7	13.8	145.6	358.2
15.75	-83.5	103.2	-2.3	8.1	83.6	103.5
18.00	-36.9	-27.1	-1.6	3.8	36.9	27.4
20.25	-8.5	-73.3	-.9	1.0	8.6	73.3
22.50	5.5	-73.9	-.4	-.4	5.5	73.9
26.25	8.1	-42.9	.0	-.8	8.1	42.9
30.00	5.4	-16.9	.1	-.6	5.4	16.9
33.75	2.2	-2.6	.1	-.3	2.2	2.6
39.38	-.1	2.0	.0	.0	.1	2.0
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 13
 spalla mobile - n777 _FESSM_13- n789 _FESSM_13

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 25
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	510.4	-252.5	18.2	-55.8	510.8	258.6
1.41	414.4	394.1	16.1	-31.7	414.7	395.4
2.81	339.0	920.3	14.2	-10.4	339.3	920.4
4.22	156.9	1291.8	9.1	6.7	157.2	1291.8
5.63	-1.7	1388.6	4.2	15.8	4.5	1388.6
7.03	-98.0	1308.8	.7	19.0	98.0	1309.0
8.44	-141.3	1129.6	-1.3	18.2	141.4	1129.7
9.84	-145.2	926.9	-1.7	16.0	145.2	927.0
11.25	-143.0	723.2	-1.9	13.5	143.0	723.3
13.50	-125.9	410.3	-1.9	9.2	125.9	410.4
15.75	-83.2	175.4	-1.6	5.2	83.2	175.5
18.00	-46.1	32.6	-1.0	2.3	46.1	32.7
20.25	-19.6	-38.2	-.6	.5	19.6	38.2
22.50	-2.6	-61.5	-.2	-.4	2.6	61.5
26.25	5.9	-48.6	.0	-.6	5.9	48.6
30.00	5.2	-26.7	.1	-.4	5.2	26.7
33.75	3.1	-10.6	.0	-.2	3.1	10.6
39.38	.7	-.5	.0	.0	.7	.5
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 14
 spalla mobile - n777 _FESSM_14- n789 _FESSM_14

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33708.5	2950.4	67504.4	-15046.4	-55381.4	-32666.1
2	34221.6	2847.9	69278.2	15478.4	55752.1	33654.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67930.1	5798.3	136782.6	432.0	5860.9	2084.8

Punto di applic. carico verticale: Xv = 2.014 m Yv = .086 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.435	8.004	1.336	.226	.009	.007

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3505.9	446.6	-90.4	27.9	-90.5	.0	127.9
2	2971.6	106.0	629.2	8.1	-33.3	.0	630.1
3	2437.2	69.5	709.8	7.6	-30.7	.0	710.5
4	1902.8	69.5	709.8	7.0	-28.1	.0	710.3
5	1368.4	69.5	709.8	6.5	-25.5	.0	710.2
6	834.1	69.5	709.8	6.0	-22.8	.0	710.2
7	299.7	302.5	202.9	18.2	-55.8	.0	210.4
8	3242.4	301.1	208.0	23.2	-77.6	.0	222.0
9	2708.0	50.5	751.8	7.8	-32.0	.0	752.5
10	2173.6	50.5	751.8	7.3	-29.4	.0	752.4
11	1639.3	50.5	751.8	6.8	-26.8	.0	752.3
12	1104.9	50.5	751.8	6.2	-24.2	.0	752.2
13	570.5	301.1	208.0	16.2	-51.6	.0	214.4
14	2978.8	373.2	61.8	26.3	-84.7	.0	104.9
15	2444.5	68.3	715.5	7.6	-30.7	.0	716.2
16	1910.1	68.3	715.5	7.0	-28.1	.0	716.1
17	1375.7	68.3	715.5	6.5	-25.5	.0	716.0
18	841.4	299.7	213.2	19.8	-61.6	.0	222.0
19	3474.2	462.5	-145.2	27.9	-90.5	.0	171.1
20	2939.8	112.4	600.5	8.1	-33.3	.0	601.4
21	2405.5	74.7	684.9	7.6	-30.7	.0	685.6

22	1871.1	74.7	684.9	7.0	-28.1	.0	685.5
23	1336.7	74.7	684.9	6.5	-25.5	.0	685.4
24	802.3	74.7	684.9	6.0	-22.8	.0	685.3
25	268.0	314.6	157.7	18.2	-55.8	.0	167.3
26	3203.4	316.0	152.5	23.2	-77.6	.0	171.1
27	2669.0	56.1	723.9	7.8	-32.0	.0	724.6
28	2134.6	56.1	723.9	7.3	-29.4	.0	724.5
29	1600.3	56.1	723.9	6.8	-26.8	.0	724.4
30	1065.9	56.1	723.9	6.2	-24.2	.0	724.3
31	531.5	316.0	152.5	16.2	-51.6	.0	161.0
32	2932.5	393.6	-11.6	26.3	-84.7	.0	85.5
33	2398.2	75.9	679.2	7.6	-30.7	.0	679.9
34	1863.8	75.9	679.2	7.0	-28.1	.0	679.8
35	1329.4	75.9	679.2	6.5	-25.5	.0	679.7
36	795.0	317.4	147.3	19.8	-61.6	.0	159.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
SPALLA mobile SLE FESS

CONDIZIONE DI CARICO 15
spalla mobile - n777 _FESSM_17- n789 _FESSM_17

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34262.5	4632.3	78753.7	-15264.1	-56698.1	-41181.8
2	34783.2	4526.0	80547.6	15714.1	57059.1	42216.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
69045.7	9158.3	159301.3	450.0	5932.5	2171.7

Punto di applic. carico verticale: Xv = 2.307 m Yv = .086 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.590	10.682	1.639	.235	.009	.007

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3900.8	665.6	-518.3	29.0	-94.4	.0	526.9
2	3245.3	177.6	558.4	8.4	-34.9	.0	559.5
3	2589.7	124.0	686.0	7.9	-32.1	.0	686.8
4	1934.1	124.0	686.0	7.3	-29.4	.0	686.6
5	1278.5	124.0	686.0	6.8	-26.7	.0	686.5
6	623.0	124.0	686.0	6.2	-24.0	.0	686.4
7	-32.6	460.9	-86.9	19.0	-58.3	.0	104.6
8	3576.8	459.4	-81.5	24.1	-81.0	.0	114.9
9	2921.2	96.0	753.0	8.1	-33.5	.0	753.8
10	2265.6	96.0	753.0	7.6	-30.8	.0	753.7
11	1610.0	96.0	753.0	7.1	-28.1	.0	753.6
12	954.5	96.0	753.0	6.5	-25.3	.0	753.5
13	298.9	459.4	-81.5	16.9	-53.9	.0	97.7
14	3252.7	562.7	-300.2	27.4	-88.4	.0	312.9
15	2597.1	122.7	692.0	7.9	-32.1	.0	692.7
16	1941.5	122.7	692.0	7.3	-29.4	.0	692.6
17	1286.0	122.7	692.0	6.8	-26.7	.0	692.5
18	630.4	458.0	-76.1	20.6	-64.3	.0	99.6
19	3868.5	682.1	-575.5	29.0	-94.4	.0	583.2
20	3212.9	184.2	528.5	8.4	-34.9	.0	529.7
21	2557.3	129.4	660.1	7.9	-32.1	.0	660.9

22	1901.8	129.4	660.1	7.3	-29.4	.0	660.8
23	1246.2	129.4	660.1	6.8	-26.7	.0	660.7
24	590.6	129.4	660.1	6.2	-24.0	.0	660.5
25	-65.0	473.4	-133.9	19.0	-58.3	.0	146.1
26	3537.0	474.9	-139.4	24.1	-81.0	.0	161.2
27	2881.4	101.8	723.9	8.1	-33.5	.0	724.7
28	2225.8	101.8	723.9	7.6	-30.8	.0	724.6
29	1570.3	101.8	723.9	7.1	-28.1	.0	724.5
30	914.7	101.8	723.9	6.5	-25.3	.0	724.4
31	259.1	474.9	-139.4	16.9	-53.9	.0	149.4
32	3205.5	584.0	-376.7	27.4	-88.4	.0	386.9
33	2549.9	130.6	654.2	7.9	-32.1	.0	654.9
34	1894.3	130.6	654.2	7.3	-29.4	.0	654.8
35	1238.8	130.6	654.2	6.8	-26.7	.0	654.7
36	583.2	476.3	-144.8	20.6	-64.3	.0	158.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 SPALLA mobile SLE FESS

 CONDIZIONE DI CARICO 16
 spalla mobile - n777 _FESSM_18- n789 _FESSM_18

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	34262.5	3372.7	72328.8	-15307.5	-56499.5	-35531.2
2	34783.2	3265.6	74120.5	15757.5	56860.2	36556.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
69045.7	6638.3	146449.3	450.0	5932.2	2170.8

Punto di applic. carico verticale: Xv = 2.121 m Yv = .086 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.590	8.813	1.445	.235	.009	.007

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3668.3	504.3	-170.8	29.0	-94.4	.0	195.2
2	3090.3	123.2	642.4	8.4	-34.9	.0	643.3
3	2512.2	82.1	734.7	7.9	-32.1	.0	735.4
4	1934.1	82.1	734.7	7.3	-29.4	.0	735.3
5	1356.0	82.1	734.7	6.8	-26.7	.0	735.2
6	777.9	82.1	734.7	6.2	-24.0	.0	735.1
7	199.9	343.4	159.2	19.0	-58.3	.0	169.6
8	3383.0	341.9	164.6	24.1	-81.0	.0	183.5
9	2804.9	60.7	782.9	8.1	-33.5	.0	783.6
10	2226.9	60.7	782.9	7.6	-30.8	.0	783.5
11	1648.8	60.7	782.9	7.1	-28.1	.0	783.4
12	1070.7	60.7	782.9	6.5	-25.3	.0	783.3
13	492.6	341.9	164.6	16.9	-54.0	.0	173.3
14	3097.7	422.5	-.6	27.4	-88.4	.0	88.4
15	2519.6	80.9	740.7	7.9	-32.1	.0	741.4
16	1941.5	80.9	740.7	7.3	-29.4	.0	741.2
17	1363.5	80.9	740.7	6.8	-26.7	.0	741.1
18	785.4	340.5	170.0	20.7	-64.3	.0	181.8
19	3636.0	520.8	-227.9	29.0	-94.4	.0	246.7
20	3057.9	129.8	612.5	8.4	-34.9	.0	613.4
21	2479.8	87.6	708.8	7.9	-32.1	.0	709.5

22	1901.8	87.6	708.8	7.3	-29.4	.0	709.4
23	1323.7	87.6	708.8	6.8	-26.7	.0	709.3
24	745.6	87.6	708.8	6.2	-24.0	.0	709.2
25	167.5	355.9	112.2	19.0	-58.3	.0	126.4
26	3343.3	357.4	106.8	24.1	-81.0	.0	134.0
27	2765.2	66.6	753.8	8.1	-33.5	.0	754.6
28	2187.1	66.6	753.8	7.6	-30.8	.0	754.5
29	1609.0	66.6	753.8	7.1	-28.1	.0	754.3
30	1030.9	66.6	753.8	6.5	-25.3	.0	754.3
31	452.9	357.4	106.8	16.9	-54.0	.0	119.6
32	3050.5	443.8	-77.1	27.4	-88.4	.0	117.3
33	2472.4	88.8	702.9	7.9	-32.1	.0	703.6
34	1894.3	88.8	702.9	7.3	-29.4	.0	703.5
35	1316.3	88.8	702.9	6.8	-26.7	.0	703.4
36	738.2	358.8	101.4	20.7	-64.3	.0	120.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 17
spalla mobile - n777 _RARAM_1- n789 _RARAM_1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	29158.3	6168.2	76139.2	-14058.5	-20985.5	-41629.8
2	30371.7	6032.9	80624.9	14718.5	21287.9	43488.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
59530.0	12201.1	156764.1	660.0	13285.8	3306.0

Punto di applic. carico verticale: Xv = 2.633 m Yv = .223 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.268	12.315	1.723	.367	.019	.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3754.4	842.0	-1037.9	43.3	-135.2	.0	1046.7
2	3065.2	244.2	328.8	12.2	-46.5	.0	332.1
3	2376.0	177.2	497.7	11.4	-42.4	.0	499.5
4	1686.8	177.2	497.7	10.6	-38.2	.0	499.1
5	997.6	177.2	497.7	9.7	-34.1	.0	498.8
6	308.4	177.2	497.7	8.9	-29.9	.0	498.6
7	-380.7	593.0	-497.5	27.9	-80.1	.0	503.9
8	3417.4	590.8	-489.3	35.8	-115.0	.0	502.6
9	2728.2	141.8	588.7	11.8	-44.4	.0	590.4
10	2039.0	141.8	588.7	11.0	-40.3	.0	590.1
11	1349.9	141.8	588.7	10.2	-36.2	.0	589.8
12	660.7	141.8	588.7	9.3	-32.0	.0	589.6
13	-28.5	590.8	-489.3	24.8	-73.8	.0	494.8
14	3080.4	716.1	-762.1	40.7	-126.0	.0	772.5
15	2391.3	175.3	506.7	11.4	-42.4	.0	508.5
16	1702.1	175.3	506.7	10.6	-38.2	.0	508.2
17	1012.9	175.3	506.7	9.7	-34.1	.0	507.9
18	323.7	588.6	-481.0	30.5	-89.3	.0	489.3
19	3688.0	867.1	-1124.9	43.3	-135.2	.0	1132.9
20	2998.8	254.4	283.3	12.2	-46.5	.0	287.1
21	2309.6	185.4	458.2	11.4	-42.4	.0	460.2

22	1620.4	185.4	458.2	10.6	-38.2	.0	459.8
23	931.2	185.4	458.2	9.7	-34.1	.0	459.5
24	242.0	185.4	458.2	8.9	-29.9	.0	459.2
25	-447.1	612.2	-569.2	27.9	-80.1	.0	574.8
26	3335.7	614.4	-577.4	35.8	-115.0	.0	588.7
27	2646.6	150.7	544.4	11.8	-44.4	.0	546.2
28	1957.4	150.7	544.4	11.0	-40.3	.0	545.9
29	1268.2	150.7	544.4	10.2	-36.2	.0	545.6
30	579.0	150.7	544.4	9.3	-32.0	.0	545.3
31	-110.2	614.4	-577.4	24.8	-73.8	.0	582.1
32	2983.5	748.5	-878.6	40.7	-126.0	.0	887.6
33	2294.3	187.3	449.2	11.4	-42.4	.0	451.2
34	1605.1	187.3	449.2	10.6	-38.2	.0	450.8
35	916.0	187.3	449.2	9.7	-34.1	.0	450.5
36	226.8	616.6	-585.6	30.5	-89.3	.0	592.4

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 18
 spalla mobile - n777 _RARAM_2- n789 _RARAM_2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	29158.3	4908.2	69713.2	-14053.7	-21046.6	-36988.6
2	30371.7	4772.9	74198.9	14713.7	21349.0	38846.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
59530.0	9681.1	143912.1	660.0	13285.8	3306.0

Punto di applic. carico verticale: Xv = 2.417 m Yv = .223 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.268	10.446	1.529	.367	.019	.011

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3521.9	680.7	-690.4	43.3	-135.2	.0	703.5
2	2910.2	189.8	412.8	12.2	-46.5	.0	415.4
3	2298.5	135.3	546.4	11.4	-42.4	.0	548.0
4	1686.8	135.3	546.4	10.6	-38.2	.0	547.7
5	1075.1	135.3	546.4	9.7	-34.1	.0	547.4
6	463.4	135.3	546.4	8.9	-29.9	.0	547.2
7	-148.2	475.5	-251.4	27.9	-80.1	.0	263.8
8	3223.7	473.3	-243.2	35.8	-115.0	.0	269.0
9	2612.0	106.5	618.6	11.8	-44.4	.0	620.2
10	2000.3	106.5	618.6	11.0	-40.3	.0	619.9
11	1388.6	106.5	618.6	10.2	-36.2	.0	619.6
12	776.9	106.5	618.6	9.3	-32.0	.0	619.4
13	165.2	473.3	-243.2	24.8	-73.8	.0	254.1
14	2925.5	575.9	-462.6	40.7	-126.0	.0	479.5
15	2313.8	133.4	555.4	11.4	-42.4	.0	557.0
16	1702.1	133.4	555.4	10.6	-38.2	.0	556.7
17	1090.4	133.4	555.4	9.7	-34.1	.0	556.5
18	478.7	471.1	-234.9	30.5	-89.3	.0	251.3
19	3455.5	705.8	-777.3	43.3	-135.2	.0	789.0
20	2843.8	200.0	367.2	12.2	-46.5	.0	370.1
21	2232.1	143.6	506.9	11.4	-42.4	.0	508.7

22	1620.4	143.6	506.9	10.6	-38.2	.0	508.4
23	1008.7	143.6	506.9	9.7	-34.1	.0	508.1
24	397.0	143.6	506.9	8.9	-29.9	.0	507.8
25	-214.7	494.7	-323.0	27.9	-80.1	.0	332.8
26	3142.0	496.9	-331.3	35.8	-115.0	.0	350.7
27	2530.3	115.4	574.3	11.8	-44.4	.0	576.0
28	1918.6	115.4	574.3	11.0	-40.3	.0	575.7
29	1306.9	115.4	574.3	10.2	-36.2	.0	575.4
30	695.2	115.4	574.3	9.3	-32.0	.0	575.2
31	83.6	496.9	-331.3	24.8	-73.8	.0	339.4
32	2828.5	608.4	-579.1	40.7	-126.0	.0	592.6
33	2216.8	145.5	497.9	11.4	-42.4	.0	499.7
34	1605.1	145.5	497.9	10.6	-38.2	.0	499.3
35	993.5	145.5	497.9	9.7	-34.1	.0	499.0
36	381.8	499.1	-339.5	30.5	-89.3	.0	351.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 19
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33650.3	6167.8	97464.9	-16323.4	-24435.7	-49572.6
2	34028.5	6033.3	98617.7	16833.4	24201.0	50714.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67678.8	12201.1	196082.6	510.0	3812.0	2580.7

Punto di applic. carico verticale: Xv = 2.897 m Yv = .056 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.400	13.673	2.049	.251	.007	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4351.6	875.4	-797.4	33.0	-110.8	.0	805.0
2	3531.8	239.5	620.1	9.7	-42.9	.0	621.6
3	2712.0	169.2	790.2	9.1	-39.7	.0	791.2
4	1892.3	169.2	790.2	8.4	-36.5	.0	791.0
5	1072.5	169.2	790.2	7.8	-33.2	.0	790.9
6	252.7	169.2	790.2	7.1	-30.0	.0	790.7
7	-567.0	609.1	-231.6	21.0	-67.8	.0	241.3
8	3944.5	607.4	-225.1	27.4	-95.4	.0	244.5
9	3124.7	132.5	879.7	9.4	-41.3	.0	880.6
10	2305.0	132.5	879.7	8.7	-38.1	.0	880.5
11	1485.2	132.5	879.7	8.1	-34.9	.0	880.3
12	665.4	132.5	879.7	7.4	-31.6	.0	880.2
13	-154.3	607.4	-225.1	18.8	-63.3	.0	233.9
14	3537.4	742.0	-513.0	31.0	-103.6	.0	523.3
15	2717.7	167.7	797.3	9.1	-39.7	.0	798.2
16	1897.9	167.7	797.3	8.4	-36.5	.0	798.1
17	1078.2	167.7	797.3	7.8	-33.2	.0	797.9
18	258.4	605.7	-218.7	23.0	-75.0	.0	231.2
19	4327.0	895.0	-865.2	33.0	-110.8	.0	872.3
20	3507.2	247.4	584.6	9.7	-42.9	.0	586.2
21	2687.4	175.6	759.4	9.1	-39.7	.0	760.4

22	1867.7	175.6	759.4	8.4	-36.5	.0	760.3
23	1047.9	175.6	759.4	7.8	-33.2	.0	760.1
24	228.1	175.6	759.4	7.1	-30.0	.0	760.0
25	-591.6	624.1	-287.5	21.0	-67.8	.0	295.4
26	3914.3	625.8	-293.9	27.4	-95.4	.0	309.0
27	3094.5	139.5	845.1	9.4	-41.3	.0	846.1
28	2274.7	139.5	845.1	8.7	-38.1	.0	845.9
29	1455.0	139.5	845.1	8.1	-34.9	.0	845.8
30	635.2	139.5	845.1	7.4	-31.6	.0	845.7
31	-184.6	625.8	-293.9	18.8	-63.3	.0	300.7
32	3501.5	767.3	-603.9	31.0	-103.6	.0	612.7
33	2681.8	177.1	752.3	9.1	-39.7	.0	753.4
34	1862.0	177.1	752.3	8.4	-36.5	.0	753.2
35	1042.3	177.1	752.3	7.8	-33.2	.0	753.1
36	222.5	627.5	-300.4	23.0	-75.0	.0	309.6

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 19
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	875.4	-797.4	33.0	-110.8	876.0	805.0
1.41	700.6	303.9	29.5	-66.9	701.2	311.2
2.81	565.6	1187.1	26.3	-27.8	566.3	1187.4
4.22	248.6	1797.6	17.4	4.2	249.2	1797.6
5.63	-15.4	1938.4	8.6	22.0	17.6	1938.6
7.03	-163.2	1795.3	2.2	29.2	163.2	1795.6
8.44	-220.5	1509.4	-1.5	28.9	220.5	1509.6
9.84	-221.8	1196.4	-2.3	26.1	221.8	1196.7
11.25	-213.0	888.8	-2.7	22.6	213.0	889.1
13.50	-177.5	430.5	-2.9	16.2	177.5	430.8
15.75	-101.2	120.8	-2.6	9.7	101.3	121.1
18.00	-44.2	-36.4	-1.8	4.7	44.3	36.7
20.25	-9.8	-91.2	-1.1	1.4	9.8	91.2
22.50	7.0	-90.8	-.4	-.3	7.0	90.8
26.25	10.0	-52.3	.0	-.9	10.0	52.4
30.00	6.6	-20.5	.1	-.6	6.6	20.5
33.75	2.7	-3.0	.1	-.3	2.7	3.0
39.38	-.1	2.5	.0	-.1	.1	2.5
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 19
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 25
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	624.1	-287.5	21.0	-67.8	624.4	295.4
1.41	506.0	502.6	18.7	-40.0	506.3	504.2
2.81	413.4	1144.8	16.6	-15.2	413.8	1144.9
4.22	190.1	1597.1	10.8	4.8	190.4	1597.1
5.63	-4.2	1712.6	5.2	15.8	6.7	1712.7
7.03	-121.8	1612.2	1.1	20.0	121.8	1612.3
8.44	-174.6	1390.4	-1.2	19.5	174.6	1390.5
9.84	-179.2	1140.2	-1.6	17.4	179.2	1140.3
11.25	-176.3	888.9	-1.9	14.9	176.3	889.0
13.50	-155.0	503.3	-2.0	10.4	155.0	503.4
15.75	-102.3	214.2	-1.7	6.1	102.3	214.3
18.00	-56.6	38.8	-1.2	2.8	56.6	38.9
20.25	-23.9	-47.9	-.7	.7	23.9	47.9
22.50	-3.1	-76.1	-.3	-.3	3.1	76.1
26.25	7.3	-59.9	.0	-.6	7.3	59.9
30.00	6.4	-32.8	.1	-.4	6.5	32.8
33.75	3.8	-13.0	.0	-.2	3.8	13.0
39.38	.9	-.6	.0	.0	.9	.6
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 19
 spalla mobile - n777 _RARAM_3 - n789 _RARAM_3

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 19
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	895.0	-865.2	33.0	-110.8	895.6	872.3
1.41	718.1	262.1	29.5	-66.9	718.8	270.5
2.81	581.3	1168.6	26.3	-27.8	581.9	1169.0
4.22	258.9	1798.1	17.4	4.2	259.5	1798.1
5.63	-10.3	1949.6	8.6	22.0	13.4	1949.7
7.03	-161.8	1810.7	2.2	29.2	161.9	1810.9
8.44	-221.3	1524.6	-1.5	28.9	221.3	1524.9
9.84	-223.1	1210.1	-2.3	26.1	223.1	1210.4
11.25	-214.5	900.6	-2.7	22.6	214.6	900.8
13.50	-179.1	438.6	-2.9	16.2	179.1	438.9
15.75	-102.6	125.4	-2.6	9.7	102.6	125.8
18.00	-45.2	-34.4	-1.8	4.7	45.2	34.7
20.25	-10.3	-90.8	-1.1	1.4	10.3	90.8
22.50	6.8	-91.2	-.4	-.3	6.9	91.2
26.25	10.0	-52.8	.0	-.9	10.0	52.8
30.00	6.6	-20.8	.1	-.6	6.6	20.8
33.75	2.8	-3.2	.1	-.3	2.8	3.2
39.38	-.1	2.5	.0	-.1	.1	2.5
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 20
spalla mobile - n777 _RARAM_4- n789 _RARAM_4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33650.3	4907.8	91038.9	-16318.6	-24496.8	-44931.4
2	34028.5	4773.3	92191.7	16828.6	24262.1	46073.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
67678.8	9681.1	183230.6	510.0	3812.0	2580.8

Punto di applic. carico verticale: Xv = 2.707 m Yv = .056 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.400	11.804	1.856	.251	.007	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4119.1	714.0	-449.8	33.0	-110.8	.0	463.3
2	3376.8	185.1	704.1	9.7	-42.9	.0	705.4
3	2634.5	127.3	838.9	9.1	-39.7	.0	839.8
4	1892.3	127.3	838.9	8.4	-36.5	.0	839.7
5	1150.0	127.3	838.9	7.8	-33.2	.0	839.5
6	407.7	127.3	838.9	7.1	-30.0	.0	839.4
7	-334.5	491.6	14.6	21.0	-67.8	.0	69.4
8	3750.8	489.9	21.0	27.4	-95.4	.0	97.7
9	3008.5	97.2	909.5	9.4	-41.3	.0	910.5
10	2266.2	97.2	909.5	8.7	-38.1	.0	910.3
11	1524.0	97.2	909.5	8.1	-34.9	.0	910.2
12	781.7	97.2	909.5	7.4	-31.6	.0	910.1
13	39.4	489.9	21.0	18.8	-63.3	.0	66.7
14	3382.5	601.8	-213.4	31.0	-103.6	.0	237.2
15	2640.2	125.9	846.0	9.1	-39.7	.0	846.9
16	1897.9	125.9	846.0	8.4	-36.5	.0	846.7
17	1155.6	125.9	846.0	7.8	-33.2	.0	846.6
18	413.4	488.2	27.4	23.0	-75.0	.0	79.8
19	4094.5	733.6	-517.7	33.0	-110.8	.0	529.4
20	3352.2	193.0	668.5	9.7	-42.9	.0	669.9
21	2609.9	133.8	808.1	9.1	-39.7	.0	809.1

22	1867.7	133.8	808.1	8.4	-36.5	.0	808.9
23	1125.4	133.8	808.1	7.8	-33.2	.0	808.8
24	383.1	133.8	808.1	7.1	-30.0	.0	808.7
25	-359.1	506.6	-41.4	21.0	-67.8	.0	79.4
26	3720.5	508.3	-47.8	27.4	-95.4	.0	106.7
27	2978.2	104.2	875.0	9.4	-41.3	.0	875.9
28	2236.0	104.2	875.0	8.7	-38.1	.0	875.8
29	1493.7	104.2	875.0	8.1	-34.9	.0	875.7
30	751.4	104.2	875.0	7.4	-31.6	.0	875.5
31	9.2	508.3	-47.8	18.8	-63.3	.0	79.3
32	3346.6	627.2	-304.3	31.0	-103.6	.0	321.5
33	2604.3	135.3	801.0	9.1	-39.7	.0	802.0
34	1862.0	135.3	801.0	8.4	-36.5	.0	801.9
35	1119.7	135.3	801.0	7.8	-33.2	.0	801.7
36	377.5	510.0	-54.2	23.0	-75.0	.0	92.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 21
spalla mobile - n777 _RARAM_5- n789 _RARAM_5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32116.5	6186.6	90320.7	-15527.5	-23307.5	-46910.3
2	32991.4	6014.5	93357.1	16247.5	23261.7	48701.5

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
65107.9	12201.1	183677.8	720.0	9315.6	3632.7

Punto di applic. carico verticale: Xv = 2.821 m Yv = .143 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.043	13.245	1.946	.374	.015	.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4169.8	861.7	-862.4	46.8	-152.6	.0	875.8
2	3391.2	239.7	533.9	13.6	-56.4	.0	536.9
3	2612.6	170.7	702.8	12.6	-51.8	.0	704.7
4	1834.1	170.7	702.8	11.7	-47.3	.0	704.4
5	1055.5	170.7	702.8	10.8	-42.7	.0	704.1
6	276.9	170.7	702.8	9.9	-38.2	.0	703.8
7	-501.6	601.7	-306.6	30.0	-92.1	.0	320.1
8	3786.3	599.2	-297.5	38.9	-130.8	.0	325.0
9	3007.8	134.3	793.4	13.1	-54.1	.0	795.2
10	2229.2	134.3	793.4	12.2	-49.5	.0	794.9
11	1450.6	134.3	793.4	11.3	-45.0	.0	794.7
12	672.1	134.3	793.4	10.4	-40.4	.0	794.4
13	-106.5	599.2	-297.5	26.8	-85.5	.0	309.6
14	3402.9	729.7	-577.1	44.0	-142.5	.0	594.4
15	2624.3	168.6	712.8	12.6	-51.8	.0	714.6
16	1845.8	168.6	712.8	11.7	-47.3	.0	714.3
17	1067.2	168.6	712.8	10.8	-42.7	.0	714.0
18	288.6	596.8	-288.5	32.8	-102.2	.0	306.0
19	4118.7	889.3	-958.0	46.8	-152.6	.0	970.0
20	3340.2	250.8	483.8	13.6	-56.4	.0	487.1
21	2561.6	179.8	659.5	12.6	-51.8	.0	661.5

22	1783.1	179.8	659.5	11.7	-47.3	.0	661.2
23	1004.5	179.8	659.5	10.8	-42.7	.0	660.9
24	225.9	179.8	659.5	9.9	-38.2	.0	660.6
25	-552.6	622.7	-385.3	30.0	-92.1	.0	396.1
26	3723.6	625.1	-394.3	38.9	-130.8	.0	415.4
27	2945.0	144.1	744.7	13.1	-54.1	.0	746.7
28	2166.5	144.1	744.7	12.2	-49.5	.0	746.3
29	1387.9	144.1	744.7	11.3	-45.0	.0	746.1
30	609.3	144.1	744.7	10.4	-40.4	.0	745.8
31	-169.2	625.1	-394.3	26.8	-85.5	.0	403.5
32	3328.5	765.4	-705.0	44.0	-142.5	.0	719.3
33	2549.9	181.8	649.5	12.6	-51.8	.0	651.6
34	1771.3	181.8	649.5	11.7	-47.3	.0	651.2
35	992.8	181.8	649.5	10.8	-42.7	.0	650.9
36	214.2	627.5	-403.4	32.8	-102.2	.0	416.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 22
spalla mobile - n777 _RARAM_7- n789 _RARAM_7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32991.4	6013.1	93353.3	-16247.2	-23527.2	-48212.0
2	32116.5	6188.0	90324.5	15527.2	23572.6	46419.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
65107.9	12201.1	183677.8	-720.0	-9316.0	-3663.5

Punto di applic. carico verticale: Xv = 2.821 m Yv = -.143 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.043	13.245	1.946	-.374	-.015	-.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4118.7	889.4	-958.4	-46.9	152.8	.0	970.5
2	3340.2	250.9	483.6	-13.6	56.4	.0	486.9
3	2561.6	179.8	659.3	-12.7	51.9	.0	661.3
4	1783.1	179.8	659.3	-11.7	47.3	.0	661.0
5	1004.5	179.8	659.3	-10.8	42.7	.0	660.7
6	225.9	179.8	659.3	-9.9	38.1	.0	660.4
7	-552.6	622.8	-385.6	-29.9	91.8	.0	396.4
8	3723.6	625.2	-394.7	-38.9	130.9	.0	415.9
9	2945.0	144.2	744.5	-13.1	54.1	.0	746.5
10	2166.5	144.2	744.5	-12.2	49.6	.0	746.1
11	1387.9	144.2	744.5	-11.3	45.0	.0	745.9
12	609.3	144.2	744.5	-10.3	40.4	.0	745.6
13	-169.2	625.2	-394.7	-26.7	85.3	.0	403.9
14	3328.5	765.6	-705.6	-44.1	142.7	.0	719.9
15	2549.9	181.9	649.2	-12.7	51.9	.0	651.3
16	1771.3	181.9	649.2	-11.7	47.3	.0	651.0
17	992.8	181.9	649.2	-10.8	42.7	.0	650.6
18	214.2	627.7	-403.9	-32.7	102.0	.0	416.5
19	4169.8	861.6	-862.0	-46.9	152.8	.0	875.5
20	3391.2	239.6	534.1	-13.6	56.4	.0	537.1
21	2612.6	170.6	703.0	-12.7	51.9	.0	704.9

22	1834.1	170.6	703.0	-11.7	47.3	.0	704.6
23	1055.5	170.6	703.0	-10.8	42.7	.0	704.3
24	276.9	170.6	703.0	-9.9	38.1	.0	704.0
25	-501.6	601.6	-306.2	-29.9	91.8	.0	319.7
26	3786.3	599.1	-297.1	-38.9	130.9	.0	324.7
27	3007.8	134.3	793.6	-13.1	54.1	.0	795.4
28	2229.2	134.3	793.6	-12.2	49.6	.0	795.1
29	1450.6	134.3	793.6	-11.3	45.0	.0	794.9
30	672.1	134.3	793.6	-10.3	40.4	.0	794.6
31	-106.5	599.1	-297.1	-26.7	85.3	.0	309.1
32	3402.9	729.6	-576.5	-44.1	142.7	.0	593.9
33	2624.3	168.5	713.0	-12.7	51.9	.0	714.9
34	1845.8	168.5	713.0	-11.7	47.3	.0	714.6
35	1067.2	168.5	713.0	-10.8	42.7	.0	714.3
36	288.6	596.7	-288.0	-32.7	102.0	.0	305.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 23
spalla mobile - n777 _RARAM_8- n789 _RARAM_8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32991.4	4753.1	86927.3	-16242.4	-23588.3	-43570.9
2	32116.5	4928.0	83898.5	15522.4	23633.6	41778.7

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
65107.9	9681.1	170825.8	-720.0	-9316.1	-3663.6

Punto di applic. carico verticale: Xv = 2.624 m Yv = -.143 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.043	11.376	1.753	-.374	-.015	-.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3886.3	728.1	-610.8	-46.9	152.8	.0	629.7
2	3185.2	196.5	567.6	-13.6	56.4	.0	570.4
3	2484.1	137.9	708.0	-12.7	51.9	.0	709.9
4	1783.0	137.9	708.0	-11.7	47.3	.0	709.6
5	1082.0	137.9	708.0	-10.8	42.7	.0	709.3
6	380.9	137.9	708.0	-9.9	38.1	.0	709.0
7	-320.2	505.3	-139.5	-29.9	91.8	.0	167.0
8	3529.9	507.7	-148.6	-38.9	130.9	.0	198.1
9	2828.8	108.9	774.4	-13.1	54.1	.0	776.3
10	2127.7	108.9	774.4	-12.2	49.6	.0	776.0
11	1426.7	108.9	774.4	-11.3	45.0	.0	775.7
12	725.6	108.9	774.4	-10.3	40.4	.0	775.4
13	24.5	507.7	-148.6	-26.7	85.3	.0	171.4
14	3173.5	625.4	-406.1	-44.1	142.7	.0	430.4
15	2472.4	140.1	697.9	-12.7	51.9	.0	699.9
16	1771.3	140.1	697.9	-11.7	47.3	.0	699.5
17	1070.3	140.1	697.9	-10.8	42.7	.0	699.3
18	369.2	510.2	-157.7	-32.7	102.0	.0	187.9
19	3937.3	700.3	-514.5	-46.9	152.8	.0	536.7
20	3236.2	185.3	618.0	-13.6	56.4	.0	620.6
21	2535.1	128.8	751.7	-12.7	51.9	.0	753.5

22	1834.1	128.8	751.7	-11.7	47.3	.0	753.2
23	1133.0	128.8	751.7	-10.8	42.7	.0	752.9
24	431.9	128.8	751.7	-9.9	38.1	.0	752.6
25	-269.2	484.1	-60.1	-29.9	91.8	.0	109.8
26	3592.6	481.6	-51.0	-38.9	130.9	.0	140.5
27	2891.5	99.0	823.5	-13.1	54.1	.0	825.3
28	2190.5	99.0	823.5	-12.2	49.6	.0	825.0
29	1489.4	99.0	823.5	-11.3	45.0	.0	824.7
30	788.3	99.0	823.5	-10.3	40.4	.0	824.5
31	87.2	481.6	-51.0	-26.7	85.3	.0	99.4
32	3247.9	589.4	-277.0	-44.1	142.7	.0	311.6
33	2546.9	126.7	761.7	-12.7	51.9	.0	763.5
34	1845.8	126.7	761.7	-11.7	47.3	.0	763.2
35	1144.7	126.7	761.7	-10.8	42.7	.0	762.9
36	443.6	479.2	-41.8	-32.7	102.0	.0	110.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 24
 spalla mobile - n777 _RARAM_9- n789 _RARAM_9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	30103.3	6162.8	80908.6	-14681.2	-21721.4	-43728.7
2	31855.3	6038.3	87573.7	15401.2	22409.9	45981.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
61958.6	12201.1	168482.3	720.0	19434.9	3584.7

Punto di applic. carico verticale: Xv = 2.719 m Yv = .314 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.605	12.720	1.820	.425	.027	.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3951.8	850.1	-959.7	47.6	-142.6	.0	970.2
2	3223.7	242.0	419.1	13.2	-45.4	.0	421.5
3	2495.6	174.2	587.8	12.3	-40.9	.0	589.2
4	1767.5	174.2	587.8	11.4	-36.4	.0	588.9
5	1039.4	174.2	587.8	10.5	-31.9	.0	588.7
6	311.3	174.2	587.8	9.6	-27.4	.0	588.4
7	-416.8	596.4	-412.9	30.9	-82.9	.0	421.1
8	3598.4	594.0	-404.0	39.3	-120.4	.0	421.5
9	2870.3	138.3	678.7	12.7	-43.1	.0	680.1
10	2142.2	138.3	678.7	11.8	-38.6	.0	679.8
11	1414.1	138.3	678.7	10.9	-34.1	.0	679.6
12	686.0	138.3	678.7	10.0	-29.7	.0	679.4
13	-42.1	594.0	-404.0	27.4	-75.8	.0	411.0
14	3245.1	721.3	-679.2	44.8	-132.6	.0	692.0
15	2517.0	172.1	597.6	12.3	-40.9	.0	599.0
16	1788.9	172.1	597.6	11.4	-36.4	.0	598.7
17	1060.8	172.1	597.6	10.5	-31.9	.0	598.5
18	332.7	591.6	-395.0	33.7	-92.9	.0	405.8
19	3858.9	877.3	-1054.0	47.6	-142.6	.0	1063.6
20	3130.8	253.0	369.7	13.2	-45.4	.0	372.4
21	2402.7	183.1	545.0	12.3	-40.9	.0	546.6

22	1674.6	183.1	545.0	11.4	-36.4	.0	546.3
23	946.5	183.1	545.0	10.5	-31.9	.0	546.0
24	218.4	183.1	545.0	9.6	-27.4	.0	545.7
25	-509.7	617.2	-490.6	30.9	-82.9	.0	497.5
26	3484.2	619.5	-499.5	39.3	-120.4	.0	513.8
27	2756.1	148.0	630.7	12.7	-43.1	.0	632.2
28	2028.0	148.0	630.7	11.8	-38.6	.0	631.9
29	1299.9	148.0	630.7	10.9	-34.1	.0	631.6
30	571.8	148.0	630.7	10.0	-29.7	.0	631.4
31	-156.3	619.5	-499.5	27.4	-75.8	.0	505.2
32	3109.5	756.6	-805.4	44.8	-132.6	.0	816.3
33	2381.4	185.2	535.2	12.3	-40.9	.0	536.8
34	1653.3	185.2	535.2	11.4	-36.4	.0	536.4
35	925.2	185.2	535.2	10.5	-31.9	.0	536.2
36	197.1	621.9	-508.4	33.7	-92.9	.0	516.8

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 25
spalla mobile - n777 _RARAM_10 - n789 _RARAM_10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	30103.3	4902.8	74482.6	-14676.4	-21782.5	-39087.6
2	31855.3	4778.3	81147.7	15396.4	22471.0	41340.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
61958.6	9681.1	155630.3	720.0	19434.9	3584.6

Punto di applic. carico verticale: Xv = 2.512 m Yv = .314 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.605	10.851	1.627	.425	.027	.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3719.3	688.8	-612.2	47.6	-142.6	.0	628.6
2	3068.7	187.6	503.0	13.2	-45.4	.0	505.0
3	2418.1	132.3	636.5	12.3	-40.9	.0	637.8
4	1767.5	132.3	636.5	11.4	-36.4	.0	637.5
5	1116.9	132.3	636.5	10.5	-31.9	.0	637.3
6	466.3	132.3	636.5	9.6	-27.4	.0	637.1
7	-184.3	478.9	-166.8	30.9	-82.9	.0	186.2
8	3404.7	476.5	-157.8	39.3	-120.4	.0	198.5
9	2754.1	103.1	708.6	12.7	-43.1	.0	709.9
10	2103.5	103.1	708.6	11.8	-38.6	.0	709.7
11	1452.9	103.1	708.6	10.9	-34.1	.0	709.4
12	802.3	103.1	708.6	10.0	-29.7	.0	709.2
13	151.7	476.5	-157.8	27.4	-75.8	.0	175.1
14	3090.1	581.2	-379.6	44.8	-132.6	.0	402.1
15	2439.5	130.3	646.3	12.3	-40.9	.0	647.6
16	1788.9	130.3	646.3	11.4	-36.4	.0	647.3
17	1138.3	130.3	646.3	10.5	-31.9	.0	647.1
18	487.7	474.1	-148.9	33.7	-92.9	.0	175.5
19	3626.4	716.0	-706.5	47.6	-142.6	.0	720.7
20	2975.8	198.6	453.6	13.2	-45.4	.0	455.9
21	2325.2	141.3	593.7	12.3	-40.9	.0	595.1

22	1674.6	141.3	593.7	11.4	-36.4	.0	594.9
23	1024.0	141.3	593.7	10.5	-31.9	.0	594.6
24	373.4	141.3	593.7	9.6	-27.4	.0	594.4
25	-277.2	499.6	-244.4	30.9	-82.9	.0	258.1
26	3290.5	502.0	-253.4	39.3	-120.4	.0	280.5
27	2639.9	112.7	660.6	12.7	-43.1	.0	662.0
28	1989.3	112.7	660.6	11.8	-38.6	.0	661.7
29	1338.6	112.7	660.6	10.9	-34.1	.0	661.5
30	688.0	112.7	660.6	10.0	-29.7	.0	661.3
31	37.4	502.0	-253.4	27.4	-75.8	.0	264.5
32	2954.5	616.4	-505.9	44.8	-132.6	.0	523.0
33	2303.9	143.3	583.9	12.3	-40.9	.0	585.3
34	1653.3	143.3	583.9	11.4	-36.4	.0	585.0
35	1002.7	143.3	583.9	10.5	-31.9	.0	584.8
36	352.1	504.4	-262.3	33.7	-92.9	.0	278.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 26
spalla mobile - n777 _RARAM_11- n789 _RARAM_11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31855.3	6036.9	87570.0	-15400.8	-22675.5	-45491.8
2	30103.3	6164.2	80912.3	14680.8	21986.4	43238.4

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
61958.6	12201.1	168482.3	-720.0	-19435.5	-3615.5

Punto di applic. carico verticale: Xv = 2.719 m Yv = -.314 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.605	12.720	1.820	-.425	-.027	-.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3858.9	877.4	-1054.4	-47.6	142.8	.0	1064.0
2	3130.8	253.1	369.5	-13.2	45.4	.0	372.2
3	2402.7	183.2	544.9	-12.3	40.9	.0	546.4
4	1674.6	183.2	544.9	-11.4	36.4	.0	546.1
5	946.5	183.2	544.9	-10.4	31.9	.0	545.8
6	218.4	183.2	544.9	-9.5	27.3	.0	545.5
7	-509.7	617.2	-490.9	-30.9	82.7	.0	497.8
8	3484.2	619.7	-499.9	-39.4	120.6	.0	514.3
9	2756.1	148.1	630.5	-12.7	43.2	.0	632.0
10	2028.0	148.1	630.5	-11.8	38.7	.0	631.7
11	1299.9	148.1	630.5	-10.9	34.1	.0	631.4
12	571.8	148.1	630.5	-10.0	29.6	.0	631.2
13	-156.3	619.7	-499.9	-27.3	75.6	.0	505.6
14	3109.5	756.7	-806.0	-44.8	132.8	.0	816.8
15	2381.4	185.2	534.9	-12.3	40.9	.0	536.5
16	1653.3	185.2	534.9	-11.4	36.4	.0	536.2
17	925.2	185.2	534.9	-10.4	31.9	.0	535.9
18	197.1	622.1	-508.9	-33.7	92.7	.0	517.3
19	3951.8	850.0	-959.3	-47.6	142.8	.0	969.9
20	3223.7	242.0	419.3	-13.2	45.4	.0	421.7
21	2495.6	174.1	588.0	-12.3	40.9	.0	589.4

22	1767.5	174.1	588.0	-11.4	36.4	.0	589.1
23	1039.4	174.1	588.0	-10.4	31.9	.0	588.8
24	311.3	174.1	588.0	-9.5	27.3	.0	588.6
25	-416.8	596.3	-412.6	-30.9	82.7	.0	420.8
26	3598.4	593.9	-403.6	-39.4	120.6	.0	421.2
27	2870.3	138.3	678.9	-12.7	43.2	.0	680.3
28	2142.2	138.3	678.9	-11.8	38.7	.0	680.0
29	1414.1	138.3	678.9	-10.9	34.1	.0	679.8
30	686.0	138.3	678.9	-10.0	29.6	.0	679.6
31	-42.1	593.9	-403.6	-27.3	75.6	.0	410.6
32	3245.1	721.2	-678.6	-44.8	132.8	.0	691.5
33	2517.0	172.1	597.9	-12.3	40.9	.0	599.3
34	1788.9	172.1	597.9	-11.4	36.4	.0	599.0
35	1060.8	172.1	597.9	-10.4	31.9	.0	598.7
36	332.7	591.5	-394.5	-33.7	92.7	.0	405.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 26
 spalla mobile - n777 _RARAM_11- n789 _RARAM_11

 Sollecitazioni Taglienti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	877.4	-1054.4	-47.6	142.8	878.7	1064.0
1.41	711.7	56.8	-42.0	79.9	713.0	98.1
2.81	582.3	960.1	-37.1	24.5	583.4	960.5
4.22	273.5	1599.3	-23.6	-20.0	274.5	1599.5
5.63	12.4	1778.4	-10.7	-43.4	16.3	1778.9
7.03	-138.2	1673.1	-1.5	-51.3	138.2	1673.8
8.44	-200.2	1418.3	3.7	-48.7	200.3	1419.2
9.84	-203.5	1132.5	4.6	-42.8	203.5	1133.3
11.25	-197.0	849.2	5.1	-35.9	197.0	850.0
13.50	-165.9	423.8	5.1	-24.2	166.0	424.5
15.75	-96.9	131.0	4.1	-13.5	97.0	131.7
18.00	-44.0	-22.0	2.7	-5.8	44.1	22.7
20.25	-11.3	-78.7	1.5	-1.1	11.4	78.8
22.50	5.3	-82.3	.5	1.2	5.3	82.3
26.25	9.0	-48.9	-.1	1.6	9.0	48.9
30.00	6.1	-19.7	-.2	1.0	6.1	19.7
33.75	2.6	-3.4	-.1	.5	2.6	3.4
39.38	-.1	2.1	.0	.1	.1	2.1
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 27
 spalla mobile - n777 _RARAM_12- n789 _RARAM_12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31855.3	4776.9	81144.0	-15396.0	-22736.6	-40850.6
2	30103.3	4904.2	74486.3	14676.0	22047.5	38597.2

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
61958.6	9681.1	155630.3	-720.0	-19435.5	-3615.5

Punto di applic. carico verticale: Xv = 2.512 m Yv = -.314 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.605	10.851	1.627	-.425	-.027	-.012

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3626.4	716.1	-706.9	-47.6	142.8	.0	721.1
2	2975.8	198.7	453.4	-13.2	45.4	.0	455.7
3	2325.2	141.3	593.6	-12.3	40.9	.0	595.0
4	1674.6	141.3	593.6	-11.4	36.4	.0	594.7
5	1024.0	141.3	593.6	-10.4	31.9	.0	594.4
6	373.4	141.3	593.6	-9.5	27.3	.0	594.2
7	-277.2	499.7	-244.8	-30.9	82.7	.0	258.4
8	3290.5	502.1	-253.8	-39.4	120.6	.0	281.0
9	2639.9	112.8	660.4	-12.7	43.2	.0	661.8
10	1989.2	112.8	660.4	-11.8	38.7	.0	661.5
11	1338.6	112.8	660.4	-10.9	34.1	.0	661.3
12	688.0	112.8	660.4	-10.0	29.6	.0	661.0
13	37.4	502.1	-253.8	-27.3	75.6	.0	264.8
14	2954.5	616.6	-506.4	-44.8	132.8	.0	523.6
15	2303.9	143.4	583.6	-12.3	40.9	.0	585.1
16	1653.3	143.4	583.6	-11.4	36.4	.0	584.8
17	1002.7	143.4	583.6	-10.4	31.9	.0	584.5
18	352.1	504.6	-262.8	-33.7	92.7	.0	278.7
19	3719.3	688.6	-611.8	-47.6	142.8	.0	628.2
20	3068.7	187.6	503.2	-13.2	45.4	.0	505.3
21	2418.1	132.3	636.7	-12.3	40.9	.0	638.0

22	1767.5	132.3	636.7	-11.4	36.4	.0	637.7
23	1116.9	132.3	636.7	-10.4	31.9	.0	637.5
24	466.3	132.3	636.7	-9.5	27.3	.0	637.3
25	-184.3	478.8	-166.4	-30.9	82.7	.0	185.8
26	3404.7	476.4	-157.4	-39.4	120.6	.0	198.3
27	2754.1	103.0	708.8	-12.7	43.2	.0	710.1
28	2103.5	103.0	708.8	-11.8	38.7	.0	709.9
29	1452.9	103.0	708.8	-10.9	34.1	.0	709.6
30	802.3	103.0	708.8	-10.0	29.6	.0	709.4
31	151.7	476.4	-157.4	-27.3	75.6	.0	174.6
32	3090.1	581.0	-379.1	-44.8	132.8	.0	401.7
33	2439.5	130.2	646.6	-12.3	40.9	.0	647.9
34	1788.9	130.2	646.6	-11.4	36.4	.0	647.6
35	1138.3	130.2	646.6	-10.4	31.9	.0	647.4
36	487.7	474.0	-148.4	-33.7	92.7	.0	175.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 28
spalla mobile - n777 _RARAM_14- n789 _RARAM_14

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	32280.6	4478.7	82333.7	-15641.1	-23440.9	-40948.6
2	32827.3	4362.5	84208.0	16121.1	23379.6	42123.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
65107.9	8841.2	166541.7	480.0	5788.4	2418.0

Punto di applic. carico verticale: Xv = 2.558 m Yv = .089 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.043	10.753	1.688	.247	.009	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3850.4	651.2	-415.0	31.2	-102.1	.0	427.4
2	3175.2	169.0	637.4	9.1	-38.0	.0	638.6
3	2499.9	116.4	760.5	8.4	-35.0	.0	761.3
4	1824.7	116.4	760.5	7.8	-32.0	.0	761.2
5	1149.4	116.4	760.5	7.2	-28.9	.0	761.0
6	474.2	116.4	760.5	6.6	-25.9	.0	760.9
7	-201.0	448.5	8.4	20.0	-61.8	.0	62.4
8	3516.5	446.9	14.5	25.9	-87.6	.0	88.7
9	2841.2	88.9	825.1	8.8	-36.5	.0	825.9
10	2166.0	88.9	825.1	8.1	-33.5	.0	825.8
11	1490.8	88.9	825.1	7.5	-30.4	.0	825.6
12	815.5	88.9	825.1	6.9	-27.4	.0	825.5
13	140.3	446.9	14.5	17.8	-57.4	.0	59.2
14	3182.6	548.9	-199.1	29.3	-95.4	.0	220.8
15	2507.3	115.0	767.1	8.4	-35.0	.0	767.9
16	1832.1	115.0	767.1	7.8	-32.0	.0	767.8
17	1156.9	115.0	767.1	7.2	-28.9	.0	767.7
18	481.6	445.3	20.5	21.8	-68.5	.0	71.5
19	3818.1	669.6	-478.6	31.2	-102.1	.0	489.4
20	3142.9	176.5	604.1	9.1	-38.0	.0	605.3
21	2467.7	122.4	731.6	8.4	-35.0	.0	732.5

22	1792.4	122.4	731.6	7.8	-32.0	.0	732.3
23	1117.2	122.4	731.6	7.2	-28.9	.0	732.2
24	441.9	122.4	731.6	6.6	-25.9	.0	732.1
25	-233.3	462.5	-44.0	20.0	-61.8	.0	75.9
26	3476.8	464.1	-50.0	25.9	-87.6	.0	100.8
27	2801.6	95.4	792.7	8.8	-36.5	.0	793.5
28	2126.3	95.4	792.7	8.1	-33.5	.0	793.4
29	1451.1	95.4	792.7	7.5	-30.4	.0	793.3
30	775.9	95.4	792.7	6.9	-27.4	.0	793.2
31	100.6	464.1	-50.0	17.8	-57.4	.0	76.2
32	3135.5	572.6	-284.3	29.3	-95.4	.0	299.9
33	2460.3	123.8	725.0	8.4	-35.0	.0	725.9
34	1785.0	123.8	725.0	7.8	-32.0	.0	725.7
35	1109.8	123.8	725.0	7.2	-28.9	.0	725.6
36	434.5	465.7	-56.0	21.8	-68.5	.0	88.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 29
spalla mobile - n777 _RARAM_17 - n789 _RARAM_17

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33203.5	6162.9	95371.4	-16132.2	-24084.0	-48857.9
2	33763.8	6038.2	97277.5	16642.2	24001.8	50095.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66967.3	12201.1	192648.9	510.0	5913.0	2571.7

Punto di applic. carico verticale: Xv = 2.877 m Yv = .088 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.301	13.555	2.021	.262	.010	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4301.9	872.7	-819.3	33.1	-108.7	.0	826.5
2	3493.6	240.0	594.2	9.6	-40.7	.0	595.6
3	2685.2	170.0	764.2	9.0	-37.4	.0	765.1
4	1876.8	170.0	764.2	8.3	-34.2	.0	765.0
5	1068.5	170.0	764.2	7.7	-31.0	.0	764.8
6	260.1	170.0	764.2	7.0	-27.8	.0	764.7
7	-548.2	607.9	-255.6	21.2	-65.9	.0	263.9
8	3901.6	606.2	-249.2	27.5	-93.3	.0	266.1
9	3093.2	133.4	853.8	9.3	-39.0	.0	854.7
10	2284.9	133.4	853.8	8.7	-35.8	.0	854.5
11	1476.5	133.4	853.8	8.0	-32.6	.0	854.4
12	668.1	133.4	853.8	7.4	-29.4	.0	854.3
13	-140.2	606.2	-249.2	18.9	-61.3	.0	256.6
14	3501.2	740.1	-536.0	31.1	-101.6	.0	545.5
15	2692.9	168.5	771.3	9.0	-37.4	.0	772.2
16	1884.5	168.5	771.3	8.3	-34.2	.0	772.0
17	1076.1	168.5	771.3	7.7	-31.0	.0	771.9
18	267.8	604.5	-242.8	23.2	-73.0	.0	253.5
19	4268.6	892.2	-887.0	33.1	-108.7	.0	893.6
20	3460.3	247.9	558.8	9.6	-40.7	.0	560.2
21	2651.9	176.4	733.5	9.0	-37.4	.0	734.5

22	1843.6	176.4	733.5	8.3	-34.2	.0	734.3
23	1035.2	176.4	733.5	7.7	-31.0	.0	734.2
24	226.8	176.4	733.5	7.0	-27.8	.0	734.1
25	-581.5	622.8	-311.3	21.2	-65.9	.0	318.2
26	3860.6	624.5	-317.7	27.5	-93.3	.0	331.1
27	3052.3	140.4	819.3	9.3	-39.0	.0	820.2
28	2243.9	140.4	819.3	8.7	-35.8	.0	820.1
29	1435.6	140.4	819.3	8.0	-32.6	.0	820.0
30	627.2	140.4	819.3	7.4	-29.4	.0	819.8
31	-181.2	624.5	-317.7	18.9	-61.3	.0	323.6
32	3452.6	765.3	-626.6	31.1	-101.6	.0	634.8
33	2644.3	177.9	726.5	9.0	-37.4	.0	727.4
34	1835.9	177.9	726.5	8.3	-34.2	.0	727.3
35	1027.5	177.9	726.5	7.7	-31.0	.0	727.1
36	219.2	626.3	-324.1	23.2	-73.0	.0	332.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 30
 spalla mobile - n777 _RARAM_18 - n789 _RARAM_18

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	33203.5	4902.9	88945.4	-16127.4	-24145.1	-44216.7
2	33763.8	4778.2	90851.5	16637.4	24062.9	45454.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
66967.3	9681.1	179796.9	510.0	5913.0	2571.7

Punto di applic. carico verticale: Xv = 2.685 m Yv = .088 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
9.301	11.685	1.827	.262	.010	.008

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4069.4	711.4	-471.8	33.1	-108.7	.0	484.2
2	3338.6	185.6	678.1	9.6	-40.7	.0	679.4
3	2607.7	128.1	812.9	9.0	-37.4	.0	813.8
4	1876.8	128.1	812.9	8.3	-34.2	.0	813.6
5	1146.0	128.1	812.9	7.7	-31.0	.0	813.5
6	415.1	128.1	812.9	7.0	-27.8	.0	813.4
7	-315.7	490.4	-9.5	21.2	-65.9	.0	66.6
8	3707.8	488.7	-3.1	27.5	-93.3	.0	93.3
9	2977.0	98.1	883.7	9.3	-39.0	.0	884.5
10	2246.1	98.1	883.7	8.7	-35.8	.0	884.4
11	1515.2	98.1	883.7	8.0	-32.6	.0	884.3
12	784.4	98.1	883.7	7.4	-29.4	.0	884.1
13	53.5	488.7	-3.1	18.9	-61.3	.0	61.3
14	3346.2	599.9	-236.5	31.1	-101.6	.0	257.4
15	2615.4	126.7	820.0	9.0	-37.4	.0	820.8
16	1884.5	126.7	820.0	8.3	-34.2	.0	820.7
17	1153.6	126.7	820.0	7.7	-31.0	.0	820.5
18	422.8	487.0	3.4	23.2	-73.0	.0	73.1
19	4036.2	730.9	-539.4	33.1	-108.7	.0	550.3
20	3305.3	193.5	642.7	9.6	-40.7	.0	644.0
21	2574.4	134.6	782.2	9.0	-37.4	.0	783.1

22	1843.6	134.6	782.2	8.3	-34.2	.0	783.0
23	1112.7	134.6	782.2	7.7	-31.0	.0	782.8
24	381.8	134.6	782.2	7.0	-27.8	.0	782.7
25	-349.0	505.3	-65.2	21.2	-65.9	.0	92.7
26	3666.9	507.0	-71.6	27.5	-93.3	.0	117.6
27	2936.0	105.1	849.2	9.3	-39.0	.0	850.1
28	2205.2	105.1	849.2	8.7	-35.8	.0	849.9
29	1474.3	105.1	849.2	8.0	-32.6	.0	849.8
30	743.4	105.1	849.2	7.4	-29.4	.0	849.7
31	12.6	507.0	-71.6	18.9	-61.3	.0	94.2
32	3297.6	625.2	-327.1	31.1	-101.6	.0	342.5
33	2566.8	136.0	775.2	9.0	-37.4	.0	776.1
34	1835.9	136.0	775.2	8.3	-34.2	.0	775.9
35	1105.0	136.0	775.2	7.7	-31.0	.0	775.8
36	374.2	508.7	-78.0	23.2	-73.0	.0	106.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 31
 spalla mobile - n777 _FREQM_1 - n789 _FREQM_1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	28630.2	6029.7	72632.8	-13738.3	-20479.0	-39922.5
2	29040.4	5961.4	74089.1	14038.3	20498.0	40692.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	11991.1	146721.9	300.0	4408.2	1500.9

Punto di applic. carico verticale: Xv = 2.544 m Yv = .076 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	11.850	1.632	.159	.007	.005

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3572.5	828.5	-1089.7	19.5	-63.0	.0	1091.5
2	2919.5	243.8	255.8	5.6	-22.9	.0	256.8
3	2266.6	178.0	423.2	5.2	-21.0	.0	423.7
4	1613.7	178.0	423.2	4.9	-19.1	.0	423.7
5	960.7	178.0	423.2	4.5	-17.2	.0	423.6
6	307.8	178.0	423.2	4.1	-15.4	.0	423.5
7	-345.1	585.3	-559.0	12.6	-38.0	.0	560.3
8	3248.7	584.3	-555.3	16.2	-53.9	.0	557.9
9	2595.8	143.6	511.6	5.4	-21.9	.0	512.1
10	1942.8	143.6	511.6	5.1	-20.1	.0	512.0
11	1289.9	143.6	511.6	4.7	-18.2	.0	511.9
12	637.0	143.6	511.6	4.3	-16.3	.0	511.9
13	-16.0	584.3	-555.3	11.2	-35.2	.0	556.4
14	2924.9	708.1	-828.7	18.4	-58.8	.0	830.8
15	2272.0	177.1	427.3	5.2	-21.0	.0	427.9
16	1619.1	177.1	427.3	4.9	-19.1	.0	427.8
17	966.1	177.1	427.3	4.5	-17.2	.0	427.7
18	313.2	583.3	-551.6	13.7	-42.1	.0	553.2
19	3549.0	839.9	-1129.2	19.5	-63.0	.0	1131.0
20	2896.1	248.4	235.1	5.6	-22.9	.0	236.2
21	2243.2	181.7	405.3	5.2	-21.0	.0	405.9

22	1590.2	181.7	405.3	4.9	-19.1	.0	405.8
23	937.3	181.7	405.3	4.5	-17.2	.0	405.7
24	284.4	181.7	405.3	4.1	-15.4	.0	405.6
25	-368.5	594.0	-591.6	12.6	-38.0	.0	592.8
26	3219.9	595.0	-595.3	16.2	-53.9	.0	597.7
27	2566.9	147.7	491.5	5.4	-21.9	.0	492.0
28	1914.0	147.7	491.5	5.1	-20.1	.0	491.9
29	1261.1	147.7	491.5	4.7	-18.2	.0	491.8
30	608.2	147.7	491.5	4.3	-16.3	.0	491.8
31	-44.8	595.0	-595.3	11.2	-35.2	.0	596.3
32	2890.7	722.9	-881.6	18.4	-58.8	.0	883.6
33	2237.8	182.6	401.2	5.2	-21.0	.0	401.8
34	1584.9	182.6	401.2	4.9	-19.1	.0	401.7
35	931.9	182.6	401.2	4.5	-17.2	.0	401.6
36	279.0	596.0	-599.0	13.7	-42.1	.0	600.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 32
spalla mobile - n777 _FREQM_2 - n789 _FREQM_2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	28630.2	4979.7	67277.8	-13734.3	-20529.9	-36054.9
2	29040.4	4911.4	68734.1	14034.3	20548.9	36825.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	9891.1	136011.9	300.0	4408.1	1500.9

Punto di applic. carico verticale: Xv = 2.358 m Yv = .076 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	10.292	1.471	.159	.007	.005

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3378.7	694.0	-800.1	19.5	-63.0	.0	802.6
2	2790.4	198.5	325.7	5.6	-22.9	.0	326.5
3	2202.0	143.1	463.8	5.2	-21.0	.0	464.3
4	1613.7	143.1	463.8	4.9	-19.1	.0	464.2
5	1025.3	143.1	463.8	4.5	-17.2	.0	464.1
6	437.0	143.1	463.8	4.1	-15.4	.0	464.1
7	-151.4	487.3	-353.9	12.6	-38.0	.0	356.0
8	3087.2	486.3	-350.2	16.2	-53.9	.0	354.3
9	2498.9	114.2	536.5	5.4	-21.9	.0	537.0
10	1910.5	114.2	536.5	5.1	-20.1	.0	536.9
11	1322.2	114.2	536.5	4.7	-18.2	.0	536.8
12	733.8	114.2	536.5	4.3	-16.3	.0	536.8
13	145.5	486.3	-350.2	11.2	-35.2	.0	352.0
14	2795.8	591.4	-579.1	18.4	-58.8	.0	582.1
15	2207.4	142.2	467.9	5.2	-21.0	.0	468.4
16	1619.1	142.2	467.9	4.9	-19.1	.0	468.3
17	1030.7	142.2	467.9	4.5	-17.2	.0	468.2
18	442.4	485.3	-346.5	13.7	-42.1	.0	349.0
19	3355.3	705.4	-839.6	19.5	-63.0	.0	842.0
20	2766.9	203.1	305.0	5.6	-22.9	.0	305.9
21	2178.6	146.8	445.9	5.2	-21.0	.0	446.4

22	1590.2	146.8	445.9	4.9	-19.1	.0	446.3
23	1001.9	146.8	445.9	4.5	-17.2	.0	446.2
24	413.5	146.8	445.9	4.1	-15.4	.0	446.2
25	-174.8	496.0	-386.5	12.6	-38.0	.0	388.3
26	3058.4	497.0	-390.2	16.2	-53.9	.0	393.9
27	2470.1	118.2	516.4	5.4	-21.9	.0	516.9
28	1881.7	118.2	516.4	5.1	-20.1	.0	516.8
29	1293.4	118.2	516.4	4.7	-18.2	.0	516.7
30	705.0	118.2	516.4	4.3	-16.3	.0	516.7
31	116.7	497.0	-390.2	11.2	-35.2	.0	391.8
32	2761.6	606.1	-632.0	18.4	-58.8	.0	634.7
33	2173.2	147.7	441.8	5.2	-21.0	.0	442.3
34	1584.9	147.7	441.8	4.9	-19.1	.0	442.2
35	996.5	147.7	441.8	4.5	-17.2	.0	442.1
36	408.2	498.0	-393.9	13.7	-42.1	.0	396.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 33
 spalla mobile - n777 _FREQM_3- n789 _FREQM_3

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31872.0	6010.5	88024.2	-15457.0	-22928.8	-45797.7
2	31803.6	5980.6	87671.5	15547.0	22774.0	45927.7

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63675.6	11991.1	175695.7	90.0	-886.7	449.9

Punto di applic. carico verticale: Xv = 2.759 m Yv = -.014 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.844	12.850	1.873	.037	-.001	.001

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	4015.2	855.0	-919.3	5.7	-21.0	.0	919.5
2	3266.0	241.1	466.9	1.8	-9.2	.0	467.0
3	2516.9	172.7	635.7	1.7	-8.7	.0	635.8
4	1767.7	172.7	635.7	1.5	-8.1	.0	635.8
5	1018.6	172.7	635.7	1.4	-7.5	.0	635.7
6	269.4	172.7	635.7	1.3	-7.0	.0	635.7
7	-479.8	598.6	-368.7	3.6	-13.5	.0	368.9
8	3640.4	598.3	-367.5	4.7	-18.4	.0	368.0
9	2891.2	137.5	722.6	1.7	-9.0	.0	722.6
10	2142.0	137.5	722.6	1.6	-8.4	.0	722.6
11	1392.9	137.5	722.6	1.5	-7.8	.0	722.6
12	643.7	137.5	722.6	1.4	-7.3	.0	722.6
13	-105.4	598.3	-367.5	3.2	-12.7	.0	367.8
14	3265.5	729.8	-654.2	5.3	-19.7	.0	654.5
15	2516.4	172.5	636.9	1.7	-8.7	.0	637.0
16	1767.2	172.5	636.9	1.5	-8.1	.0	637.0
17	1018.1	172.5	636.9	1.4	-7.5	.0	637.0
18	268.9	598.0	-366.4	3.9	-14.7	.0	366.7
19	4017.3	858.4	-931.1	5.7	-21.0	.0	931.3
20	3268.1	242.5	460.7	1.8	-9.2	.0	460.8
21	2519.0	173.9	630.3	1.7	-8.7	.0	630.4

22	1769.8	173.9	630.3	1.5	-8.1	.0	630.4
23	1020.7	173.9	630.3	1.4	-7.5	.0	630.4
24	271.5	173.9	630.3	1.3	-7.0	.0	630.4
25	-477.6	601.2	-378.4	3.6	-13.5	.0	378.6
26	3643.0	601.5	-379.5	4.7	-18.4	.0	380.0
27	2893.8	138.7	716.5	1.7	-9.0	.0	716.6
28	2144.6	138.7	716.5	1.6	-8.4	.0	716.6
29	1395.5	138.7	716.5	1.5	-7.8	.0	716.6
30	646.3	138.7	716.5	1.4	-7.3	.0	716.6
31	-102.8	601.5	-379.5	3.2	-12.7	.0	379.7
32	3268.6	734.2	-670.1	5.3	-19.7	.0	670.4
33	2519.5	174.1	629.1	1.7	-8.7	.0	629.2
34	1770.3	174.1	629.1	1.5	-8.1	.0	629.2
35	1021.2	174.1	629.1	1.4	-7.5	.0	629.1
36	272.0	601.8	-380.6	3.9	-14.7	.0	380.9

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 34
spalla mobile - n777 _FREQM_4 - n789 _FREQM_4

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31872.0	4960.5	82669.2	-15453.0	-22979.7	-41930.1
2	31803.6	4930.6	82316.5	15543.0	22824.9	42060.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63675.6	9891.1	164985.7	90.0	-886.7	449.8

Punto di applic. carico verticale: Xv = 2.591 m Yv = -.014 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.844	11.293	1.711	.037	-.001	.001

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3821.4	720.6	-629.7	5.7	-21.0	.0	630.0
2	3136.9	195.7	536.8	1.8	-9.2	.0	536.9
3	2452.3	137.9	676.3	1.7	-8.7	.0	676.3
4	1767.7	137.9	676.3	1.5	-8.1	.0	676.3
5	1083.1	137.9	676.3	1.4	-7.5	.0	676.3
6	398.6	137.9	676.3	1.3	-7.0	.0	676.3
7	-286.0	500.7	-163.6	3.6	-13.5	.0	164.1
8	3478.9	500.4	-162.4	4.7	-18.4	.0	163.5
9	2794.3	108.1	747.5	1.7	-9.0	.0	747.5
10	2109.8	108.1	747.5	1.6	-8.4	.0	747.5
11	1425.2	108.1	747.5	1.5	-7.8	.0	747.5
12	740.6	108.1	747.5	1.4	-7.3	.0	747.5
13	56.0	500.4	-162.4	3.2	-12.7	.0	162.9
14	3136.4	613.0	-404.6	5.3	-19.7	.0	405.1
15	2451.8	137.6	677.5	1.7	-8.7	.0	677.6
16	1767.2	137.6	677.5	1.5	-8.1	.0	677.6
17	1082.6	137.6	677.5	1.4	-7.5	.0	677.6
18	398.1	500.1	-161.3	3.9	-14.7	.0	162.0
19	3823.6	724.0	-641.5	5.7	-21.0	.0	641.8
20	3139.0	197.1	530.6	1.8	-9.2	.0	530.7
21	2454.4	139.0	670.9	1.7	-8.7	.0	671.0

22	1769.8	139.0	670.9	1.5	-8.1	.0	671.0
23	1085.2	139.0	670.9	1.4	-7.5	.0	671.0
24	400.7	139.0	670.9	1.3	-7.0	.0	671.0
25	-283.9	503.3	-173.3	3.6	-13.5	.0	173.8
26	3481.5	503.6	-174.4	4.7	-18.4	.0	175.4
27	2796.9	109.3	741.4	1.7	-9.0	.0	741.5
28	2112.4	109.3	741.4	1.6	-8.4	.0	741.5
29	1427.8	109.3	741.4	1.5	-7.8	.0	741.5
30	743.2	109.3	741.4	1.4	-7.3	.0	741.5
31	58.6	503.6	-174.4	3.2	-12.7	.0	174.9
32	3139.5	617.4	-420.5	5.3	-19.7	.0	420.9
33	2454.9	139.2	669.7	1.7	-8.7	.0	669.7
34	1770.3	139.2	669.7	1.5	-8.1	.0	669.7
35	1085.7	139.2	669.7	1.4	-7.5	.0	669.7
36	401.2	503.9	-175.5	3.9	-14.7	.0	176.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 35
spalla mobile - n777 _FREQM_5- n789 _FREQM_5

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	28630.2	6029.7	72632.8	-13738.3	-20479.0	-39922.5
2	29040.4	5961.4	74089.1	14038.3	20498.0	40692.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	11991.1	146721.9	300.0	4408.2	1500.9

Punto di applic. carico verticale: Xv = 2.544 m Yv = .076 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	11.850	1.632	.159	.007	.005

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3572.5	828.5	-1089.7	19.5	-63.0	.0	1091.5
2	2919.5	243.8	255.8	5.6	-22.9	.0	256.8
3	2266.6	178.0	423.2	5.2	-21.0	.0	423.7
4	1613.7	178.0	423.2	4.9	-19.1	.0	423.7
5	960.7	178.0	423.2	4.5	-17.2	.0	423.6
6	307.8	178.0	423.2	4.1	-15.4	.0	423.5
7	-345.1	585.3	-559.0	12.6	-38.0	.0	560.3
8	3248.7	584.3	-555.3	16.2	-53.9	.0	557.9
9	2595.8	143.6	511.6	5.4	-21.9	.0	512.1
10	1942.8	143.6	511.6	5.1	-20.1	.0	512.0
11	1289.9	143.6	511.6	4.7	-18.2	.0	511.9
12	637.0	143.6	511.6	4.3	-16.3	.0	511.9
13	-16.0	584.3	-555.3	11.2	-35.2	.0	556.4
14	2924.9	708.1	-828.7	18.4	-58.8	.0	830.8
15	2272.0	177.1	427.3	5.2	-21.0	.0	427.9
16	1619.1	177.1	427.3	4.9	-19.1	.0	427.8
17	966.1	177.1	427.3	4.5	-17.2	.0	427.7
18	313.2	583.3	-551.6	13.7	-42.1	.0	553.2
19	3549.0	839.9	-1129.2	19.5	-63.0	.0	1131.0
20	2896.1	248.4	235.1	5.6	-22.9	.0	236.2
21	2243.2	181.7	405.3	5.2	-21.0	.0	405.9

22	1590.2	181.7	405.3	4.9	-19.1	.0	405.8
23	937.3	181.7	405.3	4.5	-17.2	.0	405.7
24	284.4	181.7	405.3	4.1	-15.4	.0	405.6
25	-368.5	594.0	-591.6	12.6	-38.0	.0	592.8
26	3219.9	595.0	-595.3	16.2	-53.9	.0	597.7
27	2566.9	147.7	491.5	5.4	-21.9	.0	492.0
28	1914.0	147.7	491.5	5.1	-20.1	.0	491.9
29	1261.1	147.7	491.5	4.7	-18.2	.0	491.8
30	608.2	147.7	491.5	4.3	-16.3	.0	491.8
31	-44.8	595.0	-595.3	11.2	-35.2	.0	596.3
32	2890.7	722.9	-881.6	18.4	-58.8	.0	883.6
33	2237.8	182.6	401.2	5.2	-21.0	.0	401.8
34	1584.9	182.6	401.2	4.9	-19.1	.0	401.7
35	931.9	182.6	401.2	4.5	-17.2	.0	401.6
36	279.0	596.0	-599.0	13.7	-42.1	.0	600.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 36
spalla mobile - n777 _FREQM_6- n789 _FREQM_6

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	28630.2	4979.7	67277.8	-13734.3	-20529.9	-36054.9
2	29040.4	4911.4	68734.1	14034.3	20548.9	36825.0

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	9891.1	136011.9	300.0	4408.1	1500.9

Punto di applic. carico verticale: Xv = 2.358 m Yv = .076 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	10.292	1.471	.159	.007	.005

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3378.7	694.0	-800.1	19.5	-63.0	.0	802.6
2	2790.4	198.5	325.7	5.6	-22.9	.0	326.5
3	2202.0	143.1	463.8	5.2	-21.0	.0	464.3
4	1613.7	143.1	463.8	4.9	-19.1	.0	464.2
5	1025.3	143.1	463.8	4.5	-17.2	.0	464.1
6	437.0	143.1	463.8	4.1	-15.4	.0	464.1
7	-151.4	487.3	-353.9	12.6	-38.0	.0	356.0
8	3087.2	486.3	-350.2	16.2	-53.9	.0	354.3
9	2498.9	114.2	536.5	5.4	-21.9	.0	537.0
10	1910.5	114.2	536.5	5.1	-20.1	.0	536.9
11	1322.2	114.2	536.5	4.7	-18.2	.0	536.8
12	733.8	114.2	536.5	4.3	-16.3	.0	536.8
13	145.5	486.3	-350.2	11.2	-35.2	.0	352.0
14	2795.8	591.4	-579.1	18.4	-58.8	.0	582.1
15	2207.4	142.2	467.9	5.2	-21.0	.0	468.4
16	1619.1	142.2	467.9	4.9	-19.1	.0	468.3
17	1030.7	142.2	467.9	4.5	-17.2	.0	468.2
18	442.4	485.3	-346.5	13.7	-42.1	.0	349.0
19	3355.3	705.4	-839.6	19.5	-63.0	.0	842.0
20	2766.9	203.1	305.0	5.6	-22.9	.0	305.9
21	2178.6	146.8	445.9	5.2	-21.0	.0	446.4

22	1590.2	146.8	445.9	4.9	-19.1	.0	446.3
23	1001.9	146.8	445.9	4.5	-17.2	.0	446.2
24	413.5	146.8	445.9	4.1	-15.4	.0	446.2
25	-174.8	496.0	-386.5	12.6	-38.0	.0	388.3
26	3058.4	497.0	-390.2	16.2	-53.9	.0	393.9
27	2470.1	118.2	516.4	5.4	-21.9	.0	516.9
28	1881.7	118.2	516.4	5.1	-20.1	.0	516.8
29	1293.4	118.2	516.4	4.7	-18.2	.0	516.7
30	705.0	118.2	516.4	4.3	-16.3	.0	516.7
31	116.7	497.0	-390.2	11.2	-35.2	.0	391.8
32	2761.6	606.1	-632.0	18.4	-58.8	.0	634.7
33	2173.2	147.7	441.8	5.2	-21.0	.0	442.3
34	1584.9	147.7	441.8	4.9	-19.1	.0	442.2
35	996.5	147.7	441.8	4.5	-17.2	.0	442.1
36	408.2	498.0	-393.9	13.7	-42.1	.0	396.2

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 37
 spalla mobile - n777 _FREQM_7 - n789 _FREQM_7

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	29040.4	5960.0	74085.4	-14038.2	-20608.8	-40488.9
2	28630.2	6031.2	72636.5	13738.2	20589.3	39717.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	11991.2	146721.9	-300.0	-4408.7	-1532.8

Punto di applic. carico verticale: Xv = 2.544 m Yv = -.076 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	11.850	1.632	-.159	-.007	-.005

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3549.0	840.0	-1129.6	-19.6	63.2	.0	1131.4
2	2896.1	248.4	234.9	-5.6	23.0	.0	236.0
3	2243.2	181.7	405.1	-5.3	21.0	.0	405.7
4	1590.2	181.7	405.1	-4.9	19.1	.0	405.6
5	937.3	181.7	405.1	-4.5	17.2	.0	405.5
6	284.4	181.7	405.1	-4.1	15.3	.0	405.4
7	-368.5	594.1	-591.9	-12.5	37.7	.0	593.1
8	3219.9	595.1	-595.7	-16.3	54.1	.0	598.2
9	2566.9	147.7	491.3	-5.4	22.0	.0	491.8
10	1914.0	147.7	491.3	-5.1	20.1	.0	491.7
11	1261.1	147.7	491.3	-4.7	18.2	.0	491.6
12	608.2	147.7	491.3	-4.3	16.2	.0	491.5
13	-44.8	595.1	-595.7	-11.1	35.0	.0	596.8
14	2890.7	723.0	-882.2	-18.4	59.0	.0	884.2
15	2237.8	182.6	400.9	-5.3	21.0	.0	401.5
16	1584.9	182.6	400.9	-4.9	19.1	.0	401.4
17	931.9	182.6	400.9	-4.5	17.2	.0	401.3
18	279.0	596.1	-599.6	-13.7	42.0	.0	601.0
19	3572.5	828.3	-1089.3	-19.6	63.2	.0	1091.2
20	2919.5	243.7	256.0	-5.6	23.0	.0	257.0
21	2266.6	177.9	423.4	-5.3	21.0	.0	423.9

22	1613.7	177.9	423.4	-4.9	19.1	.0	423.8
23	960.7	177.9	423.4	-4.5	17.2	.0	423.8
24	307.8	177.9	423.4	-4.1	15.3	.0	423.7
25	-345.1	585.2	-558.7	-12.5	37.7	.0	560.0
26	3248.7	584.2	-554.9	-16.3	54.1	.0	557.5
27	2595.8	143.6	511.8	-5.4	22.0	.0	512.3
28	1942.8	143.6	511.8	-5.1	20.1	.0	512.2
29	1289.9	143.6	511.8	-4.7	18.2	.0	512.1
30	637.0	143.6	511.8	-4.3	16.2	.0	512.1
31	-16.0	584.2	-554.9	-11.1	35.0	.0	556.0
32	2924.9	708.0	-828.2	-18.4	59.0	.0	830.3
33	2272.0	177.0	427.6	-5.3	21.0	.0	428.1
34	1619.1	177.0	427.6	-4.9	19.1	.0	428.0
35	966.1	177.0	427.6	-4.5	17.2	.0	428.0
36	313.2	583.1	-551.1	-13.7	42.0	.0	552.7

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 38
 spalla mobile - n777 _FREQM_8- n789 _FREQM_8

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	29040.4	4910.0	68730.4	-14034.2	-20659.7	-36621.3
2	28630.2	4981.2	67281.5	13734.2	20640.2	35850.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	9891.2	136011.9	-300.0	-4408.6	-1532.8

Punto di applic. carico verticale: Xv = 2.358 m Yv = -.076 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	10.292	1.471	-.159	-.007	-.005

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3355.3	705.6	-840.0	-19.6	63.2	.0	842.4
2	2766.9	203.1	304.8	-5.6	23.0	.0	305.7
3	2178.6	146.9	445.7	-5.3	21.0	.0	446.2
4	1590.2	146.9	445.7	-4.9	19.1	.0	446.1
5	1001.9	146.9	445.7	-4.5	17.2	.0	446.0
6	413.5	146.9	445.7	-4.1	15.3	.0	446.0
7	-174.8	496.1	-386.8	-12.5	37.7	.0	388.6
8	3058.4	497.2	-390.6	-16.3	54.1	.0	394.4
9	2470.1	118.3	516.2	-5.4	22.0	.0	516.7
10	1881.7	118.3	516.2	-5.1	20.1	.0	516.6
11	1293.4	118.3	516.2	-4.7	18.2	.0	516.5
12	705.0	118.3	516.2	-4.3	16.2	.0	516.4
13	116.7	497.2	-390.6	-11.1	35.0	.0	392.2
14	2761.6	606.3	-632.6	-18.4	59.0	.0	635.3
15	2173.2	147.8	441.5	-5.3	21.0	.0	442.0
16	1584.9	147.8	441.5	-4.9	19.1	.0	441.9
17	996.5	147.8	441.5	-4.5	17.2	.0	441.8
18	408.2	498.2	-394.4	-13.7	42.0	.0	396.7
19	3378.7	693.9	-799.7	-19.6	63.2	.0	802.2
20	2790.4	198.4	325.9	-5.6	23.0	.0	326.7
21	2202.0	143.0	464.0	-5.3	21.0	.0	464.5

22	1613.7	143.0	464.0	-4.9	19.1	.0	464.4
23	1025.3	143.0	464.0	-4.5	17.2	.0	464.3
24	437.0	143.0	464.0	-4.1	15.3	.0	464.2
25	-151.4	487.3	-353.6	-12.5	37.7	.0	355.6
26	3087.3	486.2	-349.8	-16.3	54.1	.0	353.9
27	2498.9	114.2	536.7	-5.4	22.0	.0	537.2
28	1910.5	114.2	536.7	-5.1	20.1	.0	537.1
29	1322.2	114.2	536.7	-4.7	18.2	.0	537.0
30	733.8	114.2	536.7	-4.3	16.2	.0	537.0
31	145.5	486.2	-349.8	-11.1	35.0	.0	351.5
32	2795.8	591.2	-578.6	-18.4	59.0	.0	581.6
33	2207.4	142.2	468.2	-5.3	21.0	.0	468.7
34	1619.1	142.2	468.2	-4.9	19.1	.0	468.6
35	1030.7	142.2	468.2	-4.5	17.2	.0	468.5
36	442.4	485.2	-346.0	-13.7	42.0	.0	348.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 39
 spalla mobile - n777 _FREQM_9- n789 _FREQM_9

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	30513.5	5988.0	81825.7	-14980.6	-21856.3	-43908.4
2	31445.1	6003.1	85585.6	15100.6	22506.3	44619.8

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
61958.6	11991.1	167411.3	120.0	10618.1	549.8

Punto di applic. carico verticale: Xv = 2.702 m Yv = .171 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.605	12.564	1.804	.107	.013	.002

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3909.0	848.2	-970.7	8.4	-16.4	.0	970.8
2	3187.4	242.2	405.1	1.9	.5	.0	405.1
3	2465.7	174.5	573.8	1.8	1.2	.0	573.8
4	1744.1	174.5	573.8	1.6	1.9	.0	573.8
5	1022.4	174.5	573.8	1.5	2.6	.0	573.8
6	300.8	174.5	573.8	1.3	3.2	.0	573.8
7	-420.8	595.4	-425.3	5.9	-7.2	.0	425.3
8	3553.5	595.0	-423.9	6.9	-12.5	.0	424.1
9	2831.8	139.5	660.9	1.8	.8	.0	660.9
10	2110.2	139.5	660.9	1.7	1.5	.0	660.9
11	1388.6	139.5	660.9	1.6	2.2	.0	660.9
12	666.9	139.5	660.9	1.4	2.9	.0	660.9
13	-54.7	595.0	-423.9	5.0	-5.6	.0	423.9
14	3198.0	724.6	-707.7	8.0	-14.9	.0	707.8
15	2476.3	174.2	575.3	1.8	1.2	.0	575.3
16	1754.7	174.2	575.3	1.6	1.9	.0	575.3
17	1033.0	174.2	575.3	1.5	2.6	.0	575.3
18	311.4	594.7	-422.5	6.3	-8.8	.0	422.6
19	3863.0	852.3	-985.1	8.4	-16.4	.0	985.3
20	3141.3	243.8	397.6	1.9	.5	.0	397.6
21	2419.7	175.8	567.2	1.8	1.2	.0	567.2

22	1698.1	175.8	567.2	1.6	1.9	.0	567.2
23	976.4	175.8	567.2	1.5	2.6	.0	567.2
24	254.8	175.8	567.2	1.3	3.2	.0	567.2
25	-466.9	598.6	-437.2	5.9	-7.2	.0	437.2
26	3496.9	598.9	-438.5	6.9	-12.5	.0	438.7
27	2775.2	141.0	653.5	1.8	.8	.0	653.5
28	2053.6	141.0	653.5	1.7	1.5	.0	653.5
29	1331.9	141.0	653.5	1.6	2.2	.0	653.5
30	610.3	141.0	653.5	1.4	2.9	.0	653.5
31	-111.3	598.9	-438.5	5.0	-5.6	.0	438.6
32	3130.8	730.0	-727.0	8.0	-14.9	.0	727.2
33	2409.1	176.2	565.7	1.8	1.2	.0	565.7
34	1687.5	176.2	565.7	1.6	1.9	.0	565.7
35	965.8	176.2	565.7	1.5	2.6	.0	565.7
36	244.2	599.3	-439.9	6.3	-8.8	.0	440.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 40
spalla mobile - n777 _FREQM_10- n789 _FREQM_10

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	30513.5	4938.0	76470.7	-14976.6	-21907.2	-40040.7
2	31445.1	4953.1	80230.6	15096.6	22557.2	40752.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
61958.6	9891.1	156701.3	120.0	10618.1	549.8

Punto di applic. carico verticale: Xv = 2.529 m Yv = .171 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.605	11.007	1.643	.107	.013	.002

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3715.3	713.7	-681.0	8.4	-16.4	.0	681.2
2	3058.2	196.8	475.1	1.9	.5	.0	475.1
3	2401.1	139.6	614.3	1.8	1.2	.0	614.3
4	1744.1	139.6	614.3	1.6	1.9	.0	614.3
5	1087.0	139.6	614.3	1.5	2.6	.0	614.3
6	430.0	139.6	614.3	1.3	3.2	.0	614.3
7	-227.1	497.5	-220.2	5.9	-7.2	.0	220.3
8	3392.0	497.1	-218.8	6.9	-12.5	.0	219.1
9	2735.0	110.1	685.8	1.8	.8	.0	685.8
10	2077.9	110.1	685.8	1.7	1.5	.0	685.8
11	1420.8	110.1	685.8	1.6	2.2	.0	685.8
12	763.8	110.1	685.8	1.4	2.9	.0	685.8
13	106.7	497.1	-218.8	5.0	-5.6	.0	218.9
14	3068.8	607.8	-458.0	8.0	-14.9	.0	458.3
15	2411.7	139.3	615.8	1.8	1.2	.0	615.8
16	1754.7	139.3	615.8	1.6	1.9	.0	615.8
17	1097.6	139.3	615.8	1.5	2.6	.0	615.8
18	440.5	496.7	-217.4	6.3	-8.8	.0	217.6
19	3669.2	717.9	-695.5	8.4	-16.4	.0	695.7
20	3012.2	198.5	467.5	1.9	.5	.0	467.5
21	2355.1	141.0	607.8	1.8	1.2	.0	607.8

22	1698.1	141.0	607.8	1.6	1.9	.0	607.8
23	1041.0	141.0	607.8	1.5	2.6	.0	607.8
24	383.9	141.0	607.8	1.3	3.2	.0	607.8
25	-273.1	500.7	-232.1	5.9	-7.2	.0	232.2
26	3335.4	501.0	-233.4	6.9	-12.5	.0	233.8
27	2678.4	111.6	678.4	1.8	.8	.0	678.4
28	2021.3	111.6	678.4	1.7	1.5	.0	678.4
29	1364.2	111.6	678.4	1.6	2.2	.0	678.4
30	707.2	111.6	678.4	1.4	2.9	.0	678.4
31	50.1	501.0	-233.4	5.0	-5.6	.0	233.5
32	3001.6	613.2	-477.4	8.0	-14.9	.0	477.6
33	2344.5	141.3	606.3	1.8	1.2	.0	606.3
34	1687.5	141.3	606.3	1.6	1.9	.0	606.3
35	1030.4	141.3	606.3	1.5	2.6	.0	606.3
36	373.4	501.4	-234.8	6.3	-8.8	.0	235.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 41
spalla mobile - n777 _FREQM_11 - n789 _FREQM_11

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31445.1	6001.7	85581.8	-15100.6	-22550.8	-44538.6
2	30513.5	5989.4	81829.4	14980.6	21900.3	43826.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
61958.6	11991.1	167411.2	-120.0	-10618.6	-580.7

Punto di applic. carico verticale: Xv = 2.702 m Yv = -.171 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.605	12.564	1.804	-.107	-.013	-.002

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3863.0	852.5	-985.5	-8.5	16.6	.0	985.7
2	3141.3	243.9	397.4	-1.9	-.4	.0	397.4
3	2419.7	175.9	567.0	-1.8	-1.1	.0	567.0
4	1698.1	175.9	567.0	-1.6	-1.9	.0	567.0
5	976.4	175.9	567.0	-1.5	-2.6	.0	567.0
6	254.8	175.9	567.0	-1.3	-3.3	.0	567.0
7	-466.9	598.7	-437.5	-5.8	7.0	.0	437.6
8	3496.9	599.1	-439.0	-6.9	12.7	.0	439.1
9	2775.2	141.0	653.3	-1.8	-.8	.0	653.3
10	2053.6	141.0	653.3	-1.7	-1.5	.0	653.3
11	1331.9	141.0	653.3	-1.5	-2.2	.0	653.3
12	610.3	141.0	653.3	-1.4	-3.0	.0	653.3
13	-111.3	599.1	-439.0	-5.0	5.4	.0	439.0
14	3130.8	730.1	-727.6	-8.1	15.0	.0	727.7
15	2409.1	176.2	565.4	-1.8	-1.1	.0	565.4
16	1687.5	176.2	565.4	-1.6	-1.9	.0	565.4
17	965.8	176.2	565.4	-1.5	-2.6	.0	565.4
18	244.2	599.4	-440.4	-6.3	8.6	.0	440.5
19	3909.0	848.0	-970.2	-8.5	16.6	.0	970.4
20	3187.4	242.1	405.4	-1.9	-.4	.0	405.4
21	2465.7	174.4	573.9	-1.8	-1.1	.0	573.9

22	1744.1	174.4	573.9	-1.6	-1.9	.0	573.9
23	1022.4	174.4	573.9	-1.5	-2.6	.0	573.9
24	300.8	174.4	573.9	-1.3	-3.3	.0	573.9
25	-420.8	595.3	-424.9	-5.8	7.0	.0	425.0
26	3553.5	594.9	-423.5	-6.9	12.7	.0	423.7
27	2831.8	139.5	661.1	-1.8	-.8	.0	661.1
28	2110.2	139.5	661.1	-1.7	-1.5	.0	661.1
29	1388.6	139.5	661.1	-1.5	-2.2	.0	661.1
30	666.9	139.5	661.1	-1.4	-3.0	.0	661.1
31	-54.7	594.9	-423.5	-5.0	5.4	.0	423.5
32	3198.0	724.4	-707.1	-8.1	15.0	.0	707.3
33	2476.3	174.1	575.5	-1.8	-1.1	.0	575.5
34	1754.7	174.1	575.5	-1.6	-1.9	.0	575.5
35	1033.0	174.1	575.5	-1.5	-2.6	.0	575.5
36	311.4	594.5	-422.0	-6.3	8.6	.0	422.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 42
spalla mobile - n777 _FREQM_12 - n789 _FREQM_12

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31445.1	4951.7	80226.8	-15096.6	-22601.7	-40671.0
2	30513.5	4939.4	76474.4	14976.6	21951.2	39958.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
61958.6	9891.1	156701.2	-120.0	-10618.6	-580.8

Punto di applic. carico verticale: Xv = 2.529 m Yv = -.171 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.605	11.007	1.643	-.107	-.013	-.002

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3669.2	718.0	-695.9	-8.5	16.6	.0	696.1
2	3012.2	198.6	467.3	-1.9	-.4	.0	467.3
3	2355.1	141.0	607.6	-1.8	-1.1	.0	607.6
4	1698.1	141.0	607.6	-1.6	-1.9	.0	607.6
5	1041.0	141.0	607.6	-1.5	-2.6	.0	607.6
6	383.9	141.0	607.6	-1.3	-3.3	.0	607.6
7	-273.1	500.7	-232.4	-5.8	7.0	.0	232.5
8	3335.4	501.1	-233.9	-6.9	12.7	.0	234.2
9	2678.4	111.6	678.2	-1.8	-.8	.0	678.2
10	2021.3	111.6	678.2	-1.7	-1.5	.0	678.2
11	1364.2	111.6	678.2	-1.5	-2.2	.0	678.2
12	707.2	111.6	678.2	-1.4	-3.0	.0	678.2
13	50.1	501.1	-233.9	-5.0	5.4	.0	233.9
14	3001.6	613.3	-478.0	-8.1	15.0	.0	478.2
15	2344.5	141.3	606.0	-1.8	-1.1	.0	606.0
16	1687.5	141.3	606.0	-1.6	-1.9	.0	606.0
17	1030.4	141.3	606.0	-1.5	-2.6	.0	606.0
18	373.4	501.5	-235.3	-6.3	8.6	.0	235.5
19	3715.3	713.6	-680.6	-8.5	16.6	.0	680.8
20	3058.2	196.8	475.3	-1.9	-.4	.0	475.3
21	2401.1	139.6	614.5	-1.8	-1.1	.0	614.5

22	1744.1	139.6	614.5	-1.6	-1.9	.0	614.5
23	1087.0	139.6	614.5	-1.5	-2.6	.0	614.5
24	430.0	139.6	614.5	-1.3	-3.3	.0	614.5
25	-227.1	497.4	-219.8	-5.8	7.0	.0	219.9
26	3392.0	497.0	-218.4	-6.9	12.7	.0	218.7
27	2735.0	110.0	686.0	-1.8	-.8	.0	686.0
28	2077.9	110.0	686.0	-1.7	-1.5	.0	686.0
29	1420.8	110.0	686.0	-1.5	-2.2	.0	686.0
30	763.8	110.0	686.0	-1.4	-3.0	.0	686.0
31	106.7	497.0	-218.4	-5.0	5.4	.0	218.4
32	3068.8	607.6	-457.5	-8.1	15.0	.0	457.7
33	2411.7	139.2	616.1	-1.8	-1.1	.0	616.1
34	1754.7	139.2	616.1	-1.6	-1.9	.0	616.1
35	1097.6	139.2	616.1	-1.5	-2.6	.0	616.1
36	440.5	496.6	-216.9	-6.3	8.6	.0	217.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 43
 spalla mobile - n777 _FREQM_13- n789 _FREQM_13

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	28835.3	6099.8	73894.6	-13888.6	-20538.8	-40592.5
2	28835.3	6101.3	73898.3	13888.6	20538.6	40592.1

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	12201.1	147792.9	.0	-.2	-16.4

Punto di applic. carico verticale: Xv = 2.563 m Yv = .000 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	12.006	1.648	.000	.000	.000

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3580.1	847.7	-1138.6	.0	.1	.0	1138.6
2	2920.7	250.6	238.3	.0	.0	.0	238.3
3	2261.3	183.3	410.1	.0	.0	.0	410.1
4	1602.0	183.3	410.1	.0	.0	.0	410.1
5	942.6	183.3	410.1	.0	.0	.0	410.1
6	283.2	183.3	410.1	.0	.0	.0	410.1
7	-376.2	599.5	-596.0	.0	-.1	.0	596.0
8	3250.4	599.5	-596.0	.0	.1	.0	596.0
9	2591.0	148.6	499.0	.0	.0	.0	499.0
10	1931.7	148.6	499.0	.0	.0	.0	499.0
11	1272.3	148.6	499.0	.0	.0	.0	499.0
12	612.9	148.6	499.0	.0	.0	.0	499.0
13	-46.5	599.5	-596.0	.0	-.1	.0	596.0
14	2920.7	727.3	-880.4	.0	.1	.0	880.4
15	2261.3	183.3	410.1	.0	.0	.0	410.1
16	1602.0	183.3	410.1	.0	.0	.0	410.1
17	942.6	183.3	410.1	.0	.0	.0	410.1
18	283.2	599.5	-596.1	.0	-.1	.0	596.1
19	3580.1	847.5	-1138.2	.0	.1	.0	1138.2
20	2920.7	250.6	238.6	.0	.0	.0	238.6
21	2261.3	183.3	410.3	.0	.0	.0	410.3

22	1602.0	183.3	410.3	.0	.0	.0	410.3
23	942.6	183.3	410.3	.0	.0	.0	410.3
24	283.2	183.3	410.3	.0	.0	.0	410.3
25	-376.2	599.4	-595.6	.0	-.1	.0	595.6
26	3250.4	599.4	-595.6	.0	.1	.0	595.6
27	2591.0	148.5	499.2	.0	.0	.0	499.2
28	1931.7	148.5	499.2	.0	.0	.0	499.2
29	1272.3	148.5	499.2	.0	.0	.0	499.2
30	612.9	148.5	499.2	.0	.0	.0	499.2
31	-46.5	599.4	-595.6	.0	-.1	.0	595.6
32	2920.7	727.1	-879.8	.0	.1	.0	879.8
33	2261.3	183.3	410.4	.0	.0	.0	410.4
34	1602.0	183.3	410.4	.0	.0	.0	410.4
35	942.6	183.3	410.4	.0	.0	.0	410.4
36	283.2	599.3	-595.5	.0	-.1	.0	595.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 43
 spalla mobile - n777 _FREQM_13- n789 _FREQM_13

 Sollecitazioni Taglianti e Flettenti lungo il fusto del palo 1
 (riferimento locale)

profond. m	Txp kN	Mxp kN*m	Typ kN	Myp kN*m	Tris kN	Mris kN*m
.00	847.7	-1138.6	.0	.1	847.7	1138.6
1.41	692.1	-61.6	.0	.1	692.1	61.6
2.81	569.7	819.5	.0	.0	569.7	819.5
4.22	275.6	1449.8	.0	.0	275.6	1449.8
5.63	25.0	1640.7	.0	.0	25.0	1640.7
7.03	-121.6	1556.8	.0	.0	121.6	1556.8
8.44	-183.7	1325.7	.0	.0	183.7	1325.7
9.84	-187.7	1062.7	.0	.0	187.7	1062.7
11.25	-182.5	800.8	.0	.0	182.5	800.8
13.50	-154.6	405.8	.0	.0	154.6	405.8
15.75	-91.5	131.2	.0	.0	91.5	131.2
18.00	-42.4	-14.4	.0	.0	42.4	14.4
20.25	-11.6	-70.1	.0	.0	11.6	70.1
22.50	4.3	-75.4	.0	.0	4.3	75.4
26.25	8.3	-45.6	.0	.0	8.3	45.6
30.00	5.7	-18.7	.0	.0	5.7	18.7
33.75	2.4	-3.4	.0	.0	2.4	3.4
39.38	.0	1.9	.0	.0	.0	1.9
45.00	.0	.0	.0	.0	.0	.0

$$\text{Tris} = (\text{Txp}^2 + \text{Typ}^2)^{0.5}$$

$$\text{Mris} = (\text{Mxp}^2 + \text{Myp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 44
 spalla mobile - n777 _FREQM_14- n789 _FREQM_14

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	28835.3	4839.9	67468.6	-13883.8	-20599.9	-35951.3
2	28835.3	4841.3	67472.3	13883.8	20599.6	35950.9

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	9681.2	134940.9	.0	-.3	-15.4

Punto di applic. carico verticale: Xv = 2.340 m Yv = .000 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	10.136	1.455	.000	.000	.000

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3347.6	686.3	-791.1	.0	.1	.0	791.1
2	2765.7	196.2	322.3	.0	.0	.0	322.3
3	2183.9	141.5	458.8	.0	.0	.0	458.8
4	1602.0	141.5	458.8	.0	.0	.0	458.8
5	1020.1	141.5	458.8	.0	.0	.0	458.8
6	438.2	141.5	458.8	.0	.0	.0	458.8
7	-143.7	481.9	-349.9	.0	-.1	.0	349.9
8	3056.7	482.0	-349.9	.0	.1	.0	349.9
9	2474.8	113.3	528.8	.0	.0	.0	528.8
10	1892.9	113.3	528.8	.0	.0	.0	528.8
11	1311.0	113.3	528.8	.0	.0	.0	528.8
12	729.1	113.3	528.8	.0	.0	.0	528.8
13	147.2	482.0	-349.9	.0	-.1	.0	349.9
14	2765.7	587.1	-580.9	.0	.1	.0	580.9
15	2183.9	141.5	458.8	.0	.0	.0	458.8
16	1602.0	141.5	458.8	.0	.0	.0	458.8
17	1020.1	141.5	458.8	.0	.0	.0	458.8
18	438.2	482.0	-349.9	.0	-.1	.0	349.9
19	3347.6	686.2	-790.7	.0	.1	.0	790.7
20	2765.8	196.2	322.5	.0	.0	.0	322.5
21	2183.9	141.4	459.0	.0	.0	.0	459.0

22	1602.0	141.4	459.0	.0	.0	.0	459.0
23	1020.1	141.4	459.0	.0	.0	.0	459.0
24	438.2	141.4	459.0	.0	.0	.0	459.0
25	-143.7	481.9	-349.5	.0	-.1	.0	349.5
26	3056.7	481.9	-349.5	.0	-.1	.0	349.5
27	2474.8	113.3	529.0	.0	.0	.0	529.0
28	1892.9	113.3	529.0	.0	.0	.0	529.0
29	1311.0	113.3	529.0	.0	.0	.0	529.0
30	729.1	113.3	529.0	.0	.0	.0	529.0
31	147.2	481.9	-349.5	.0	-.1	.0	349.5
32	2765.8	587.0	-580.4	.0	-.1	.0	580.4
33	2183.9	141.4	459.0	.0	.0	.0	459.0
34	1602.0	141.4	459.0	.0	.0	.0	459.0
35	1020.1	141.4	459.0	.0	.0	.0	459.0
36	438.2	481.8	-349.5	.0	-.1	.0	349.5

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 45
 spalla mobile - n777 _FREQM_17- n789 _FREQM_17

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31603.9	6007.5	86768.1	-15342.3	-22717.8	-45368.9
2	31644.7	5983.6	86867.4	15432.3	22654.4	45556.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63248.6	11991.1	173635.5	90.0	373.1	443.1

Punto di applic. carico verticale: Xv = 2.745 m Yv = .006 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.785	12.779	1.856	.043	.001	.001

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3985.4	853.4	-932.5	5.8	-19.7	.0	932.7
2	3243.1	241.4	451.3	1.7	-7.9	.0	451.4
3	2500.8	173.2	620.1	1.6	-7.3	.0	620.1
4	1758.5	173.2	620.1	1.5	-6.8	.0	620.1
5	1016.1	173.2	620.1	1.4	-6.2	.0	620.1
6	273.8	173.2	620.1	1.3	-5.6	.0	620.1
7	-468.5	597.9	-383.1	3.7	-12.4	.0	383.3
8	3614.6	597.6	-382.0	4.8	-17.1	.0	382.4
9	2872.3	138.0	707.0	1.7	-7.6	.0	707.0
10	2130.0	138.0	707.0	1.6	-7.0	.0	707.0
11	1387.7	138.0	707.0	1.4	-6.5	.0	707.0
12	645.3	138.0	707.0	1.3	-5.9	.0	707.0
13	-97.0	597.6	-382.0	3.3	-11.5	.0	382.1
14	3243.8	728.6	-668.1	5.4	-18.5	.0	668.3
15	2501.5	172.9	621.3	1.6	-7.3	.0	621.4
16	1759.2	172.9	621.3	1.5	-6.8	.0	621.4
17	1016.9	172.9	621.3	1.4	-6.2	.0	621.4
18	274.5	597.3	-380.9	4.0	-13.6	.0	381.1
19	3982.3	856.8	-944.1	5.8	-19.7	.0	944.3
20	3240.0	242.8	445.2	1.7	-7.9	.0	445.3
21	2497.7	174.3	614.8	1.6	-7.3	.0	614.9

22	1755.4	174.3	614.8	1.5	-6.8	.0	614.9
23	1013.0	174.3	614.8	1.4	-6.2	.0	614.9
24	270.7	174.3	614.8	1.3	-5.6	.0	614.8
25	-471.6	600.5	-392.7	3.7	-12.4	.0	392.9
26	3610.8	600.8	-393.8	4.8	-17.1	.0	394.2
27	2868.5	139.2	701.1	1.7	-7.6	.0	701.1
28	2126.2	139.2	701.1	1.6	-7.0	.0	701.1
29	1383.8	139.2	701.1	1.4	-6.5	.0	701.1
30	641.5	139.2	701.1	1.3	-5.9	.0	701.1
31	-100.8	600.8	-393.8	3.3	-11.5	.0	394.0
32	3239.3	733.0	-683.7	5.4	-18.5	.0	683.9
33	2497.0	174.6	613.6	1.6	-7.3	.0	613.6
34	1754.6	174.6	613.6	1.5	-6.8	.0	613.6
35	1012.3	174.6	613.6	1.4	-6.2	.0	613.6
36	270.0	601.1	-394.9	4.0	-13.6	.0	395.1

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 46
spalla mobile - n777 _FREQM_18 - n789 _FREQM_18

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	31603.9	4957.6	81413.1	-15338.3	-22768.7	-41501.2
2	31644.7	4933.6	81512.4	15428.3	22705.3	41688.7

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
63248.6	9891.2	162925.5	90.0	373.2	444.3

Punto di applic. carico verticale: Xv = 2.576 m Yv = .006 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.785	11.222	1.694	.043	.001	.001

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3791.7	719.0	-642.9	5.8	-19.7	.0	643.2
2	3113.9	196.1	521.3	1.7	-7.9	.0	521.3
3	2436.2	138.3	660.7	1.6	-7.3	.0	660.7
4	1758.5	138.3	660.7	1.5	-6.8	.0	660.7
5	1080.7	138.3	660.7	1.4	-6.2	.0	660.7
6	403.0	138.3	660.7	1.3	-5.6	.0	660.7
7	-274.8	500.0	-178.0	3.7	-12.3	.0	178.4
8	3453.2	499.7	-176.9	4.8	-17.1	.0	177.7
9	2775.4	108.6	731.9	1.7	-7.6	.0	732.0
10	2097.7	108.6	731.9	1.6	-7.0	.0	731.9
11	1419.9	108.6	731.9	1.4	-6.5	.0	731.9
12	742.2	108.6	731.9	1.3	-5.9	.0	731.9
13	64.5	499.7	-176.9	3.3	-11.5	.0	177.2
14	3114.6	611.8	-418.4	5.4	-18.5	.0	418.9
15	2436.9	138.1	661.9	1.6	-7.3	.0	662.0
16	1759.2	138.1	661.9	1.5	-6.8	.0	661.9
17	1081.4	138.1	661.9	1.4	-6.2	.0	661.9
18	403.7	499.4	-175.8	4.0	-13.6	.0	176.3
19	3788.6	722.3	-654.5	5.8	-19.7	.0	654.8
20	3110.8	197.4	515.1	1.7	-7.9	.0	515.2
21	2433.1	139.4	655.4	1.6	-7.3	.0	655.4

RELAZIONE DI CALCOLO DELLE FONDAZIONI DEL CAVALCAVIA CV03 (ex CV79T)

PR_2020

REV. 2

22	1755.4	139.4	655.4	1.5	-6.8	.0	655.4
23	1077.6	139.4	655.4	1.4	-6.2	.0	655.4
24	399.9	139.4	655.4	1.3	-5.6	.0	655.4
25	-277.9	502.6	-187.6	3.7	-12.3	.0	188.0
26	3449.3	502.9	-188.7	4.8	-17.1	.0	189.5
27	2771.6	109.8	726.0	1.7	-7.6	.0	726.0
28	2093.9	109.8	726.0	1.6	-7.0	.0	726.0
29	1416.1	109.8	726.0	1.4	-6.5	.0	726.0
30	738.4	109.8	726.0	1.3	-5.9	.0	726.0
31	60.7	502.9	-188.7	3.3	-11.5	.0	189.1
32	3110.1	616.2	-434.1	5.4	-18.5	.0	434.5
33	2432.4	139.7	654.2	1.6	-7.3	.0	654.2
34	1754.6	139.7	654.2	1.5	-6.8	.0	654.2
35	1076.9	139.7	654.2	1.4	-6.2	.0	654.2
36	399.2	503.2	-189.8	4.0	-13.6	.0	190.3

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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NODO DI BOLOGNA CAVALCAVIA
spalla mobile- SLE RARA FREQ QP

CONDIZIONE DI CARICO 47
spalla mobile - n777 _PERMM_1- n789 _PERMM_1

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	28835.3	5994.8	73359.1	-13888.2	-20543.9	-40205.7
2	28835.3	5996.3	73362.8	13888.2	20543.6	40205.3

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	11991.1	146721.9	.0	-.3	-16.4

Punto di applic. carico verticale: Xv = 2.544 m Yv = .000 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	11.850	1.632	.000	.000	.000

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3560.8	834.2	-1109.7	.0	.1	.0	1109.7
2	2907.8	246.1	245.3	.0	.0	.0	245.3
3	2254.9	179.8	414.2	.0	.0	.0	414.2
4	1602.0	179.8	414.2	.0	.0	.0	414.2
5	949.0	179.8	414.2	.0	.0	.0	414.2
6	296.1	179.8	414.2	.0	.0	.0	414.2
7	-356.8	589.7	-575.5	.0	-.1	.0	575.5
8	3234.3	589.7	-575.5	.0	.1	.0	575.5
9	2581.4	145.7	501.4	.0	.0	.0	501.4
10	1928.4	145.7	501.4	.0	.0	.0	501.4
11	1275.5	145.7	501.4	.0	.0	.0	501.4
12	622.6	145.7	501.4	.0	.0	.0	501.4
13	-30.4	589.7	-575.5	.0	-.1	.0	575.5
14	2907.8	715.6	-855.5	.0	.1	.0	855.5
15	2254.9	179.9	414.1	.0	.0	.0	414.1
16	1602.0	179.9	414.1	.0	.0	.0	414.1
17	949.0	179.9	414.1	.0	.0	.0	414.1
18	296.1	589.7	-575.6	.0	-.1	.0	575.6
19	3560.8	834.1	-1109.3	.0	.1	.0	1109.3
20	2907.8	246.1	245.5	.0	.0	.0	245.5
21	2254.9	179.8	414.4	.0	.0	.0	414.4

22	1602.0	179.8	414.4	.0	.0	.0	414.4
23	949.0	179.8	414.4	.0	.0	.0	414.4
24	296.1	179.8	414.4	.0	.0	.0	414.4
25	-356.8	589.6	-575.1	.0	-.1	.0	575.1
26	3234.3	589.6	-575.1	.0	-.1	.0	575.1
27	2581.4	145.6	501.7	.0	.0	.0	501.7
28	1928.4	145.6	501.7	.0	.0	.0	501.7
29	1275.5	145.6	501.7	.0	.0	.0	501.7
30	622.6	145.6	501.7	.0	.0	.0	501.7
31	-30.4	589.6	-575.1	.0	-.1	.0	575.1
32	2907.8	715.4	-854.9	.0	-.1	.0	854.9
33	2254.9	179.8	414.4	.0	.0	.0	414.4
34	1602.0	179.8	414.4	.0	.0	.0	414.4
35	949.0	179.8	414.4	.0	.0	.0	414.4
36	296.1	589.5	-575.0	.0	-.1	.0	575.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

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 NODO DI BOLOGNA CAVALCAVIA
 spalla mobile- SLE RARA FREQ QP

 CONDIZIONE DI CARICO 48
 spalla mobile - n777 _PERMM_2- n789 _PERMM_2

Coordinate Centri di Carico (c.c.)

c.c.	Xc m	Yc m	Zc m	Alfc deg
1	.000	-10.700	.000	.00
2	.000	10.700	.000	.00

Componenti di Azioni Esterne riferite ai Centri di Carico

c.c.	Fzc kN	Fxc kN	Mxc kN*m	Fyc kN	Myc kN*m	Mzc kN*m
1	28835.3	4944.9	68004.1	-13884.2	-20594.8	-36338.1
2	28835.3	4946.3	68007.8	13884.2	20594.6	36337.6

Componenti di Carico Risultanti (riferimento globale)

Fz kN	Fx kN	Mx kN*m	Fy kN	My kN*m	Mz kN*m
57670.6	9891.2	136011.9	.0	-.2	-15.5

Punto di applic. carico verticale: Xv = 2.358 m Yv = .000 m

Componenti di Spostamento del Plinto (riferimento globale)

dz mm	dx mm	rx mRad	dy mm	ry mRad	rz mRad
8.010	10.292	1.471	.000	.000	.000

Sollecitazioni in Sommita' ai Singoli Pali (riferimento locale)

palo	Fzp kN	Fxp kN	Mxp kN*m	Fyp kN	Myp kN*m	Mzp kN*m	Mris kN*m
1	3367.0	699.8	-820.1	.0	.1	.0	820.1
2	2778.7	200.8	315.3	.0	.0	.0	315.3
3	2190.3	145.0	454.8	.0	.0	.0	454.8
4	1602.0	145.0	454.8	.0	.0	.0	454.8
5	1013.6	145.0	454.8	.0	.0	.0	454.8
6	425.3	145.0	454.8	.0	.0	.0	454.8
7	-163.1	491.7	-370.4	.0	-.1	.0	370.4
8	3072.8	491.8	-370.4	.0	.1	.0	370.4
9	2484.5	116.2	526.3	.0	.0	.0	526.3
10	1896.1	116.2	526.3	.0	.0	.0	526.3
11	1307.8	116.2	526.3	.0	.0	.0	526.3
12	719.4	116.2	526.3	.0	.0	.0	526.3
13	131.1	491.8	-370.4	.0	-.1	.0	370.4
14	2778.7	598.8	-605.9	.0	.1	.0	605.9
15	2190.3	145.0	454.7	.0	.0	.0	454.7
16	1602.0	145.0	454.7	.0	.0	.0	454.7
17	1013.6	145.0	454.7	.0	.0	.0	454.7
18	425.3	491.8	-370.4	.0	-.1	.0	370.4
19	3367.0	699.7	-819.7	.0	.1	.0	819.7
20	2778.7	200.7	315.5	.0	.0	.0	315.5
21	2190.3	144.9	454.9	.0	.0	.0	454.9

22	1602.0	144.9	454.9	.0	.0	.0	454.9
23	1013.6	144.9	454.9	.0	.0	.0	454.9
24	425.3	144.9	454.9	.0	.0	.0	454.9
25	-163.1	491.7	-370.0	.0	-.1	.0	370.0
26	3072.8	491.6	-370.0	.0	-.1	.0	370.0
27	2484.5	116.2	526.6	.0	.0	.0	526.6
28	1896.1	116.2	526.6	.0	.0	.0	526.6
29	1307.8	116.2	526.6	.0	.0	.0	526.6
30	719.4	116.2	526.6	.0	.0	.0	526.6
31	131.1	491.6	-370.0	.0	-.1	.0	370.0
32	2778.7	598.7	-605.3	.0	-.1	.0	605.3
33	2190.3	144.9	455.0	.0	.0	.0	455.0
34	1602.0	144.9	455.0	.0	.0	.0	455.0
35	1013.6	144.9	455.0	.0	.0	.0	455.0
36	425.3	491.6	-370.0	.0	-.1	.0	370.0

$$M_{ris} = (M_{xp}^2 + M_{yp}^2)^{0.5}$$

10 APPENDICE C. CARICHI AGENTI IN FONDAZIONE

10.1 Spalla appoggi fissi

F1 (kN) Forza direzione longitudinale

F2 (kN) Forza direzione trasversale

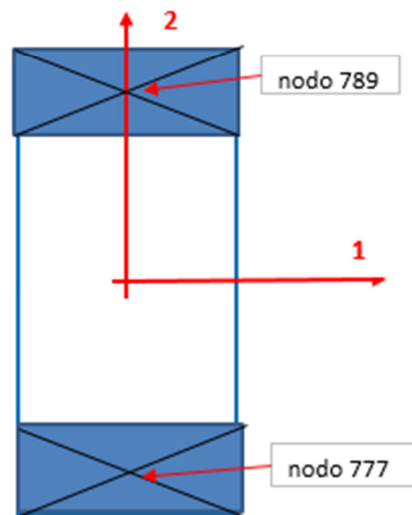
F3 (kN) Forza direzione verticale

M1 (kNm) Momento direzione trasversale (rotazione asse 1)

M2 (kNm) Momento direzione longitudinale (rotazione asse 2)

M3 (kNm) Momento direzione verticale (rotazione asse 3)

NOTA: asse 1, 2, 3 terna destrorsa, scarichi a quota testa palo



Azioni Joint 777							
OutputCase	CaseType	F1	F2	F3	M1	M2	M3
Text	Text	KN	KN	KN	KN-m	KN-m	KN-m
STR1	Combination	7603	-15917	-37144	-59480	62305	-40366
STR2	Combination	6605	-22759	-50794	-85136	122921	-59791
STR3	Combination	7286	-21533	-48499	-81113	113881	-56695
STR4	Combination	4634	-23161	-50109	-82538	116022	-59427
STR5	Combination	7603	-15917	-37144	-59480	62305	-40366
STR6	Combination	5020	-21985	-48485	-79520	109526	-57304
STR7	Combination	9969	-21756	-48824	-81904	130711	-71664
STR8	Combination	3372	-21983	-48825	-80864	97076	-42089
STR9	Combination	9969	-21756	-48824	-81904	130711	-71664
STR10	Combination	3372	-21983	-48825	-80864	97076	-42089
STR11	Combination	6419	-21605	-48517	-80975	109540	-52881
STR12	Combination	7250	-22945	-50053	-82953	129070	-70870
Sis1	Combination	25526	-7204	-24907	-44541	132712	-102732
Sis2	Combination	-3992	-15488	-34765	-55588	45142	-11800
Sis3	Combination	22931	-6224	-25195	-46514	101920	-64654
Sis4	Combination	-1446	-16810	-35141	-54841	78870	-50832
Sis5	Combination	22987	-6021	-24688	-45568	99862	-64167
Sis6	Combination	-1379	-16607	-34862	-54323	77753	-50467
Sis7	Combination	25936	-7545	-25651	-46008	138348	-105822
Sis8	Combination	-5199	-15500	-34678	-55229	38589	-6271
Sis9	Combination	25936	-7545	-25651	-46008	138348	-105822
Sis10	Combination	-5199	-15500	-34678	-55229	38589	-6271
Sis11	Combination	22782	-6236	-25199	-46490	101172	-63997
Sis12	Combination	-995	-16773	-35131	-54913	81119	-52805
Sis13	Combination	21350	-3126	-24083	-46856	121371	-88191
Sis14	Combination	-8168	-11410	-33941	-57903	33801	2741
Sis15	Combination	18755	-2146	-24372	-48829	90579	-50113
Sis16	Combination	-5622	-12732	-34317	-57156	67528	-36291
Sis17	Combination	18810	-1943	-23864	-47883	88521	-49626
Sis18	Combination	-5556	-12530	-34038	-56637	66412	-35926
Sis19	Combination	21760	-3467	-24828	-48323	127007	-91281
Sis20	Combination	-9375	-11423	-33855	-57544	27248	8270
Sis21	Combination	21760	-3467	-24828	-48323	127007	-91281
Sis22	Combination	-9375	-11423	-33855	-57544	27248	8270
Sis23	Combination	18605	-2159	-24375	-48805	89831	-49455
Sis24	Combination	-5172	-12695	-34308	-57228	69778	-38263
FESS_1	Combination	5093	-14299	-32384	-53438	69613	-36567
FESS_2	Combination	4258	-15286	-34465	-57078	76104	-37535
FESS_3	Combination	5093	-14299	-32384	-53438	69613	-36567
FESS_4	Combination	3330	-15365	-33449	-54389	71021	-38366
FESS_5	Combination	4883	-14422	-32553	-53724	69407	-36005
FESS_6	Combination	3154	-15488	-34345	-56033	73811	-38192
FESS_7	Combination	6243	-14833	-33642	-55833	82304	-45062
FESS_8	Combination	2716	-14954	-33642	-55277	64322	-29249
FESS_9	Combination	6243	-14833	-33642	-55833	82304	-45062
FESS_10	Combination	2716	-14954	-33642	-55277	64322	-29249
FESS_11	Combination	4848	-14307	-32384	-53399	68358	-35462
FESS_12	Combination	4305	-15239	-33408	-54545	75774	-42522
RARA_1	Combination	5005	-14035	-31948	-52585	66960	-35261
RARA_2	Combination	4411	-16272	-36491	-60944	86613	-41719
RARA_3	Combination	4868	-15433	-34915	-58176	80389	-39597
RARA_4	Combination	3099	-16522	-35990	-59125	81820	-41423
RARA_5	Combination	5092	-14622	-32886	-54397	72162	-37650
RARA_7	Combination	6716	-15581	-35133	-58712	91913	-49844
RARA_8	Combination	2239	-15735	-35133	-58007	69085	-29771
RARA_9	Combination	6716	-15581	-35133	-58712	91913	-49844
RARA_10	Combination	2239	-15735	-35133	-58007	69085	-29771
RARA_11	Combination	4270	-15482	-34928	-58080	77394	-36966
RARA_12	Combination	6832	-19493	-43423	-70554	93640	-55311
FREQ_1	Combination	4907	-13822	-31478	-51478	65326	-35669
FREQ_2	Combination	4060	-15566	-34773	-57416	78147	-39491
FREQ_3	Combination	4039	-14308	-31990	-51957	65984	-36515
FREQ_4	Combination	4119	-15112	-33398	-54859	72286	-38025
FREQ_5	Combination	4128	-15228	-34358	-56549	76145	-38641
FREQ_6	Combination	5371	-15434	-34513	-57117	83635	-45020
FREQ_7	Combination	2538	-15531	-34513	-56670	69192	-32320
PERM_1	Combination	4473	-14065	-31734	-51718	65655	-36092
PERM_2	Combination	3424	-14101	-31734	-51552	60301	-31383

Azioni Joint 789							
OutputCase	CaseType	F1	F2	F3	M1	M2	M3
Text	Text	KN	KN	KN	KN-m	KN-m	KN-m
STR1	Combination	6044	16817	-38066	59892	63501	42602
STR2	Combination	4975	23877	-51542	84927	123228	62280
STR3	Combination	4638	23207	-50109	81701	116034	60715
STR4	Combination	7290	21487	-48499	81949	113893	55447
STR5	Combination	6044	16817	-38066	59892	63501	42602
STR6	Combination	7612	20311	-45556	76470	101964	52630
STR7	Combination	8383	22743	-49783	82267	131987	74077
STR8	Combination	1790	22970	-49783	81226	98353	44450
STR9	Combination	8383	22743	-49783	82267	131987	74077
STR10	Combination	1790	22970	-49783	81226	98353	44450
STR11	Combination	3783	23192	-50090	81611	111593	56734
STR12	Combination	9842	21532	-48554	82218	127202	67397
Sis1	Combination	20402	14712	-28417	42045	135382	112340
Sis2	Combination	1205	15118	-32745	53989	42953	3875
Sis3	Combination	5891	19307	-33768	45219	106146	87896
Sis4	Combination	15676	10821	-27980	51957	74840	29157
Sis5	Combination	5957	19104	-33488	44699	105024	87530
Sis6	Combination	15731	10618	-27474	51014	72787	28672
Sis7	Combination	20806	15053	-29066	43334	140624	115382
Sis8	Combination	3	15116	-32689	53707	36535	-1672
Sis9	Combination	20806	15053	-29066	43334	140624	115382
Sis10	Combination	3	15116	-32689	53707	36535	-1672
Sis11	Combination	5743	19304	-33765	45204	105380	87209
Sis12	Combination	16116	10829	-27990	52003	77135	31217
Sis13	Combination	16302	18910	-29240	39479	124218	99439
Sis14	Combination	-2895	19317	-33568	51422	31789	-9026
Sis15	Combination	1791	23505	-34592	42653	94982	74995
Sis16	Combination	11576	15019	-28804	49391	63676	16256
Sis17	Combination	1857	23302	-34311	42132	93860	74629
Sis18	Combination	11631	14817	-28297	48447	61622	15771
Sis19	Combination	16706	19251	-29890	40768	129460	102481
Sis20	Combination	-4097	19315	-33512	51141	25371	-14573
Sis21	Combination	16706	19251	-29890	40768	129460	102481
Sis22	Combination	-4097	19315	-33512	51141	25371	-14573
Sis23	Combination	1643	23503	-34588	42637	94216	74308
Sis24	Combination	12016	15027	-28814	49437	65971	18316
FESS_1	Combination	3362	15395	-34059	54979	73539	39535
FESS_2	Combination	3189	15976	-35007	57095	76532	39125
FESS_3	Combination	3362	15395	-34059	54979	73539	39535
FESS_4	Combination	5124	14269	-32994	55123	72130	36075
FESS_5	Combination	3154	15518	-34345	55485	73813	39034
FESS_6	Combination	4885	14392	-32553	54271	69415	35191
FESS_7	Combination	5182	15505	-34287	56067	83169	46693
FESS_8	Combination	1656	15626	-34287	55511	65186	30853
FESS_9	Combination	5182	15505	-34287	56067	83169	46693
FESS_10	Combination	1656	15626	-34287	55511	65186	30853
FESS_11	Combination	3113	15403	-34058	54940	72279	38428
FESS_12	Combination	6050	14335	-33034	55171	77072	40597
RARA_1	Combination	3273	15095	-33379	53719	69909	38040
RARA_2	Combination	3322	17022	-36985	60790	86795	43383
RARA_3	Combination	3102	16553	-35990	58565	81828	42284
RARA_4	Combination	4871	15402	-34915	58735	80397	38761
RARA_5	Combination	3367	15742	-34870	56484	77345	40822
RARA_7	Combination	5658	16241	-35773	58953	92765	51456
RARA_8	Combination	1183	16395	-35773	58247	69938	31348
RARA_9	Combination	5658	16241	-35773	58953	92765	51456
RARA_10	Combination	1183	16395	-35773	58247	69938	31348
RARA_11	Combination	2512	16542	-35978	58503	78764	39537
RARA_12	Combination	8561	18553	-42424	70063	92400	53008
FREQ_1	Combination	4041	14322	-31990	51707	65991	36911
FREQ_2	Combination	4033	15656	-34700	57158	77784	39614
FREQ_3	Combination	4909	13808	-31478	51728	65332	35308
FREQ_4	Combination	4130	15232	-34358	56488	76151	38746
FREQ_5	Combination	4120	15108	-33398	54918	72291	37949
FREQ_6	Combination	5359	15479	-34532	57091	83683	45128
FREQ_7	Combination	2528	15576	-34532	56644	69240	32406
PERM_1	Combination	4475	14065	-31734	51718	65662	36110
PERM_2	Combination	3425	14101	-31734	51552	60306	31393

10.2 Spalla appoggi mobili

F1 (kN) Forza direzione longitudinale

F2 (kN) Forza direzione trasversale

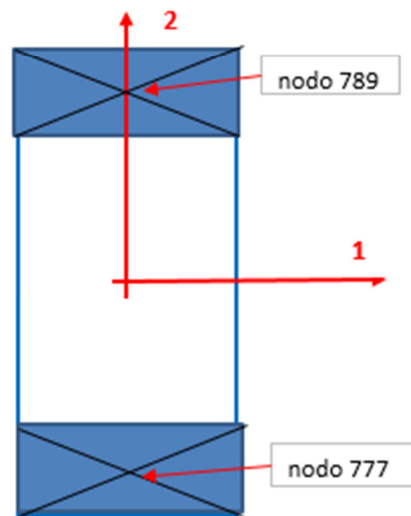
F3 (kN) Forza direzione verticale

M1 (kNm) Momento direzione trasversale (rotazione asse 1)

M2 (kNm) Momento direzione longitudinale (rotazione asse 2)

M3 (kNm) Momento direzione verticale (rotazione asse 3)

NOTA: asse 1, 2, 3 terna destrorsa, scarichi a quota testa palo



Azioni Joint 777								Azioni Joint 789							
OutputCase	CaseType	F1	F2	F3	M1	M2	M3	OutputCase	CaseType	F1	F2	F3	M1	M2	M3
Text	Text	KN	KN	KN	KN-m	KN-m	KN-m	Text	Text	KN	KN	KN	KN-m	KN-m	KN-m
STRM1	Combination	6884	-16092	-37243	-59467	61622	-40695	STRM1	Combination	6763	16632	-37967	60085	64185	41998
STRM2	Combination	4995	-16157	-37243	-59169	51984	-32219	STRM2	Combination	4872	16697	-37967	59787	54544	33508
STRM3	Combination	6921	-22899	-50892	-85285	127506	-64754	STRM3	Combination	6726	23657	-51443	85285	129184	66319
STRM4	Combination	5032	-22964	-50892	-84987	117869	-56278	STRM4	Combination	4835	23722	-51443	84987	119543	57829
STRM5	Combination	6884	-16092	-37243	-59467	61622	-40695	STRM5	Combination	6763	16632	-37967	60085	64185	41998
STRM6	Combination	5061	-21860	-48664	-80929	107499	-52630	STRM6	Combination	4806	22934	-49944	81860	111925	55089
STRM7	Combination	6694	-22839	-49944	-82695	121557	-62742	STRM7	Combination	6953	21765	-48664	81763	117146	60323
STRM8	Combination	4805	-22905	-49944	-82398	111919	-54266	STRM8	Combination	5062	21831	-48664	81464	107505	51833
STRM9	Combination	6918	-20631	-45742	-75732	103490	-56709	STRM9	Combination	6728	21705	-48299	79046	113179	59859
STRM10	Combination	5029	-20696	-45742	-75434	93853	-48234	STRM10	Combination	4838	21770	-48299	78748	103538	51369
STRM11	Combination	6726	-21676	-48299	-79583	113169	-59021	STRM11	Combination	6921	20602	-45742	76268	103500	55927
STRM12	Combination	4837	-21741	-48299	-79285	103532	-50545	STRM12	Combination	5030	20667	-45742	75970	93859	47437
STRM13	Combination	7514	-19285	-43550	-71453	95266	-54732	STRM13	Combination	7393	19825	-44274	72072	97830	56038
STRM14	Combination	4365	-19393	-43550	-70957	79203	-40605	STRM14	Combination	4242	19933	-44274	71574	81762	41887
STRM17	Combination	6884	-19306	-43550	-71354	92053	-51906	STRM17	Combination	6762	19846	-44274	71972	94616	53208
STRM18	Combination	4995	-19371	-43550	-71056	82416	-43431	STRM18	Combination	4872	19911	-44274	71674	84975	44718
SisM1	Combination	11274	-8373	-25587	-43378	71153	-50535	SisM1	Combination	10549	14925	-28873	42027	79491	57634
SisM2	Combination	10224	-8409	-25587	-43213	65798	-45826	SisM2	Combination	9499	14961	-28873	41861	74135	52918
SisM3	Combination	10513	-14310	-34087	-56794	107998	-65131	SisM3	Combination	11309	14896	-32286	54044	100126	59714
SisM4	Combination	9464	-14346	-34087	-56629	102644	-60422	SisM4	Combination	10259	14932	-32286	53879	94770	54997
SisM5	Combination	11771	-7321	-25196	-44437	72467	-50797	SisM5	Combination	10052	17963	-32937	45849	95902	66986
SisM6	Combination	10721	-7357	-25196	-44271	67113	-46088	SisM6	Combination	9001	17999	-32937	45684	90546	62270
SisM7	Combination	10011	-15703	-35140	-56966	109480	-66022	SisM7	Combination	11811	12155	-28811	51374	86600	51401
SisM8	Combination	8962	-15739	-35140	-56800	104486	-61313	SisM8	Combination	10761	12191	-28811	51209	81244	46684
SisM9	Combination	11766	-7120	-24693	-43490	70114	-50039	SisM9	Combination	10057	17762	-32654	45313	94456	66345
SisM10	Combination	10716	-7156	-24693	-43324	64760	-45330	SisM10	Combination	9007	17798	-32654	45147	89100	61628
SisM11	Combination	10017	-15502	-34857	-56429	108393	-65380	SisM11	Combination	11806	11954	-28308	50427	84248	50643
SisM12	Combination	8967	-15539	-34857	-56264	103039	-60672	SisM12	Combination	10756	11990	-28308	50261	78892	45926
SisM13	Combination	11278	-8721	-26327	-44778	74699	-51790	SisM13	Combination	10545	15288	-29528	43247	82673	58869
SisM14	Combination	10228	-8757	-26327	-44613	69345	-47081	SisM14	Combination	9494	15325	-29528	43082	77317	54152
SisM17	Combination	11278	-8721	-26327	-44778	74699	-51790	SisM17	Combination	10545	15288	-29528	43247	82673	58869
SisM18	Combination	10228	-8757	-26327	-44613	69345	-47081	SisM18	Combination	9494	15325	-29528	43082	77317	54152
SisM21	Combination	7097	-4295	-24763	-45693	58811	-35994	SisM21	Combination	6449	19124	-29697	39460	68327	44734
SisM22	Combination	6048	-4332	-24763	-45528	54457	-31285	SisM22	Combination	5399	19160	-29697	39295	62971	40017
SisM23	Combination	6337	-10232	-33263	-59109	96657	-50590	SisM23	Combination	7210	19095	-33110	51478	88961	46813
SisM24	Combination	5287	-10268	-33263	-58944	91303	-45881	SisM24	Combination	6159	19131	-33110	51312	83606	42097
SisM25	Combination	7595	-3243	-24373	-46752	61126	-36255	SisM25	Combination	5952	22161	-33761	43283	84738	54086
SisM26	Combination	6545	-3279	-24373	-46586	55772	-31547	SisM26	Combination	4902	22197	-33761	43117	79382	49369
SisM27	Combination	5835	-11626	-34317	-59281	98499	-51481	SisM27	Combination	7712	16353	-29635	48808	75436	38500
SisM28	Combination	4785	-11662	-34317	-59115	93145	-46772	SisM28	Combination	6661	16390	-29635	48642	70080	33784
SisM29	Combination	7589	-3043	-23869	-45804	58773	-35497	SisM29	Combination	5957	21961	-33477	42746	83292	53444
SisM30	Combination	6540	-3079	-23869	-45630	53419	-30789	SisM30	Combination	4907	21997	-33477	42580	77936	48727
SisM31	Combination	5840	-11425	-34033	-58744	97052	-50839	SisM31	Combination	7706	16153	-29131	47861	73083	37742
SisM32	Combination	4791	-11461	-34033	-58578	91698	-46130	SisM32	Combination	6656	16189	-29131	47695	67727	33026
SisM33	Combination	7102	-4644	-25503	-47093	63358	-37249	SisM33	Combination	6445	19487	-30352	40681	71509	45968
SisM34	Combination	6052	-4680	-25503	-46928	58004	-32540	SisM34	Combination	5395	19523	-30352	40515	66153	41251
FESSM_1	Combination	4646	-14481	-32505	-53500	70694	-38517	FESSM_1	Combination	4512	15177	-33937	55228	76048	40439
FESSM_2	Combination	3387	-14525	-32505	-53301	64269	-32867	FESSM_2	Combination	3252	15221	-33937	55029	69621	34779
FESSM_3	Combination	4635	-15373	-34531	-57203	80010	-41590	FESSM_3	Combination	4523	15823	-34942	57359	81352	42567
FESSM_4	Combination	3375	-15416	-34531	-57004	73585	-35940	FESSM_4	Combination	3263	15868	-34942	57160	74925	36906
FESSM_5	Combination	4646	-14481	-32505	-53500	70694	-38517	FESSM_5	Combination	4512	15177	-33937	55228	76048	40439
FESSM_6	Combination	3387	-14525	-32505	-53301	64269	-32867	FESSM_6	Combination	3252	15221	-33937	55029	69621	34779
FESSM_7	Combination	4481	-15158	-33350	-54480	73622	-39585	FESSM_7	Combination	4677	14462	-33092	54943	73120	38321
FESSM_8	Combination	3222	-15201	-33350	-54282	67197	-33935	FESSM_8	Combination	3417	14505	-33092	54744	66693	32661
FESSM_9	Combination	4643	-14597	-32675	-53820	71552	-38891	FESSM_9	Combination	4515	15293	-34224	55767	77387	40875
FESSM_10	Combination	3384	-14641	-32675	-53621	65127	-33240	FESSM_10	Combination	3255	15337	-34224	55568	70960	35215
FESSM_11	Combination	4513	-15274	-34224	-56115	77381	-40332	FESSM_11	Combination	4645	14578	-32674	54167	71558	38384
FESSM_12	Combination	3254	-15317	-34224	-55916	70956	-34682	FESSM_12	Combination	3385	14621	-32674	53968	65131	32724
FESSM_13	Combination	5050	-14974	-33708	-55712	78212	-42084	FESSM_13	Combination	4949	15406	-34222	56084	79990	43088
FESSM_14	Combination	2950	-15046	-33709	-55381	67504	-32666	FESSM_14	Combination	2848	15478	-34222	55752	69278	33654
FESSM_17	Combination	4632	-15264	-34262	-56698	78754	-41182	FESSM_17	Combination	4526	15714	-34783	57059	80548	42216
FESSM_18	Combination	3373	-15307	-34263	-56500	72329	-35531	FESSM_18	Combination	3266	15757	-34783	56860	74120	36556
RARAM_1	Combination	6168	-14058	-29158	-20986	76139	-41630	RARAM_1	Combination	6033	14718	-30372	21288	80625	43488
RARAM_2	Combination	4908	-14054	-29158	-21047	69713	-36989	RARAM_2	Combination	4773	14714	-30372	21349	74199	38847
RARAM_3	Combination	6168	-16323	-33650	-24436	97465	-49573	RARAM_3	Combination	6033	16833	-34029	24201	88618	50714
RARAM_4	Combination	4908	-16319	-33650	-24497	91039	-44931	RARAM_4	Combination	4773	16829	-34029	24262	92192	46073
RARAM_5	Combination	6187	-15528	-32117	-23307	90321	-46910	RARAM_5	Combination	6015	16248	-32991	23262	93357	48701
RARAM_7	Combination	6013	-16247	-32991	-23527	93353	-48212	RARAM_7	Combination	6188	15527	-32116	23573	90324	46420
RARAM_8	Combination	4753	-16242	-32991	-23588	86927	-43571	RARAM_8	Combination	4928	15522	-32116	23634	83898	41779
RARAM_9	Combination	6163	-14681	-30103	-21721	80909	-43729	RARAM_9	Combination	6038	15401	-31855	22410	87574	45981
RARAM_10	Combination	4903	-14676	-30103	-21783	74483	-39088	RARAM_10	Combination	4778	15396	-31855	22471	81148	41340
RARAM_11	Combination	6037	-15401	-31855	-22675	87570	-45492	RARAM_11	Combination	6164	14681	-30103	21986	80912	43238
RARAM_12	Combination	4777	-15396	-31855	-22737	81144	-40851	RARAM_12	Combination	4904	14676	-30103	22048	74486	38597
RARAM_14	Combination	4479	-15641	-32281	-23441	82334	-40949	RARAM_14	Combination	4362	16121	-32827	23380	84208	42123
RARAM_17	Combination	6163	-16132	-33203	-24084	95371	-48858	RARAM_17	Combination	6038	16642	-33764	24002	97278	50095
RARAM_18	Combination	4903	-16127	-33203	-24145	88945	-44217	RARAM_18	Combination	4778	16637	-33764	24063	90852	45454
FREQM_1	Combination	6030	-13738	-28630	-20										