

ITINERARIO RAGUSA-CATANIA

Collegamento viario compreso tra lo Svincolo della S.S. 514 "di Chiaramonte"
con la S.S. 115 e lo Svincolo della S.S. 194 "Ragusana"
LOTTO 1 - Dallo svincolo n. 1 sulla S.S. 115 (compreso) allo svincolo n. 3 sulla S.P. 5 (escluso)

PROGETTO ESECUTIVO

COD. **PA895**

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**CAVALCAVIA
CAVALCAVIA AL KM 3+005
Relazione di calcolo impalcato**

| CODICE PROGETTO | | NOME FILE | | REVISIONE | SCALA: |
|-----------------|---|---------------|--|------------|-----------|
| PROGETTO | LIV. PROG. | N. PROG. | T01CV03STRRE01B | | |
| L O 4 0 8 Z | E | 2 1 0 1 | CODICE ELAB. T 0 1 C V 0 3 S T R R E 0 1 | B | - |
| D | | | | | |
| C | | | | | |
| B | REVISIONE A SEGUITO DI RAPPORTO DI VERIFICA | NOVEMBRE 2021 | RAGNACCI | PELLE | GRANIERI |
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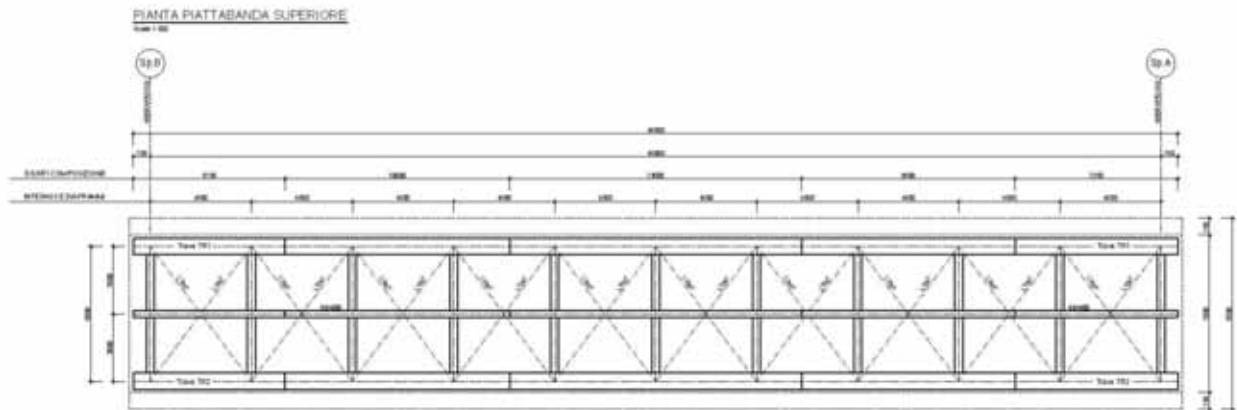


Figura 3 - Pianta conci

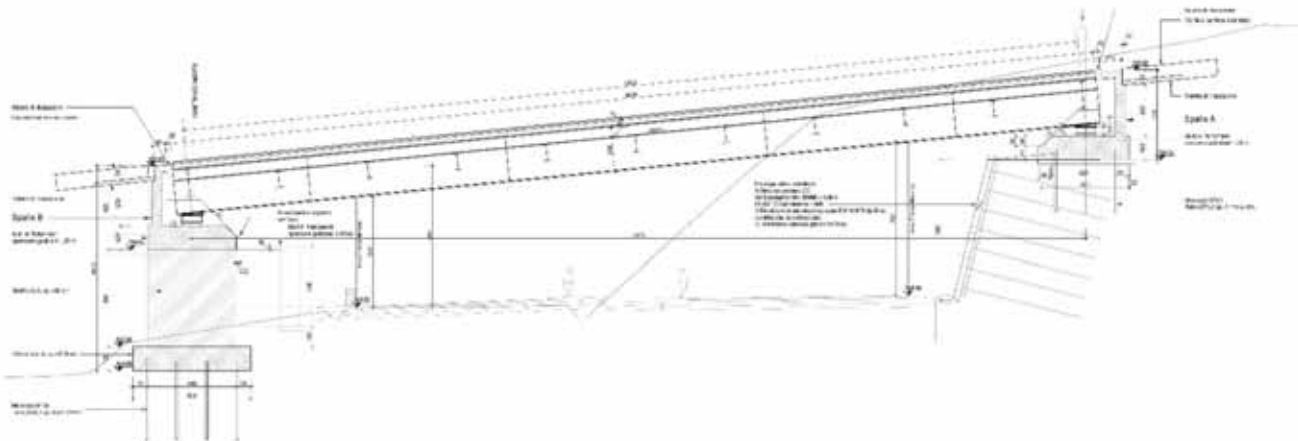


Figura 4 - Sezione prospetto

Lo schema di vincolo prevede l'utilizzo di 4 dispositivi di appoggio tipo isolatori elastomerici con nucleo di piombo che consentono uno spostamento di $\pm 200\text{mm}$ e di conseguenza un giunto di dilatazione di spalla che permetta il corrispondente spostamento. Si riporta di seguito le caratteristiche che deve avere il dispositivo di appoggio.

| V | Fzd | Ke | ξ_e | Kv | Dg | te | h | H | Z |
|-------|-------|-------|---------|-------|------|-----|-----|-----|------|
| kN | kN | kN/mm | % | kN/mm | mm | mm | mm | mm | mm |
| 20940 | 33970 | 4,42 | 19 | 4489 | 1000 | 153 | 277 | 357 | 1050 |

| | |
|---------|---|
| V | Carico verticale massimo agente in presenza del sisma allo SLC |
| Fzd | Carico verticale massimo in assenza di SISMA e spostamento 10mm |
| Ke | Rigidezza orizzontale equivalente |
| ξ_e | Coefficiente di smorzamento viscoso equivalente |
| Kv | Rigidezza verticale |
| Dg | Diametro elastomero |
| te | Spessore totale gomma |
| h | Altezza escluse piastre di ancoraggio |
| H | Altezza totale incluse piastre di ancoraggio |
| Z | Lato piastre di ancoraggio |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

SCHEMA APPOGGI



Figura 5 - Schema di vincolo

2 NORMATIVA DI RIFERIMENTO E RIFERIMENTI TECNICI

Le strutture sono state verificate con il criterio degli stati limite (SL). I calcoli sono stati eseguiti in osservanza alle seguenti disposizioni normative e regole tecniche:

2.1 NORME TECNICHE

- Ministero delle infrastrutture - D.M. 14/01/2008. Norme tecniche per le costruzioni.
- Consiglio superiore dei lavori pubblici. Istruzioni per l'applicazione delle "Norme tecniche per le costruzioni" di cui al D.M. 14/01/2008.

2.2 RIFERIMENTI TECNICI

2.2.1 CNR e UNI

- Norma UNI EN 11104:2004
- Calcestruzzo – Specificazione, prestazione, produzione e conformità – Istruzioni complementari per l'applicazione della EN 206-1.
- Norma UNI EN 13369:2013
- Regole comuni per i prodotti prefabbricati di calcestruzzo.
- Norma UNI EN 15050:2012
- Prodotti prefabbricati di calcestruzzo. Elementi da ponte.

2.2.2 EUROCODICI

- UNI EN 1993-1-1: Eurocodice 3 – Progettazione delle strutture in acciaio. Parte 1-1: Regole generali e regole per gli edifici.
- UNI EN 1993-1-5: Eurocodice 3 – Progettazione delle strutture in acciaio. Parte 1-5: Regole generali – Regole supplementari per lastre ortotrope in assenza di carichi trasversali.
- UNI EN 1993-1-9: Eurocodice 3 - Progettazione delle strutture in acciaio. Parte 1-9: Fatica.
- UNI EN 1993-1-10: Eurocodice 3 - Progettazione delle strutture in acciaio. Parte 1-10: Resilienza del materiale e proprietà attraverso lo spessore.
- UNI EN 1993-2: Eurocodice 3 – Progettazione delle strutture in acciaio. Parte 2: Ponti in acciaio.
- UNI EN 1998-2: Eurocodice 8 - Indicazioni progettuali per la resistenza sismica delle strutture. Parte 2: Ponti.

3 METODO DI CALCOLO

Lo studio delle strutture è stato condotto secondo i metodi della scienza delle costruzioni supponendo i materiali elastici, omogenei ed isotropi.

La ricerca dei parametri di sollecitazione è stata fatta secondo le disposizioni di carico più gravose avvalendosi di codici di calcolo automatico per l'analisi strutturale.

Le verifiche di resistenza delle sezioni sono state eseguite secondo il metodo degli stati limite.

3.1 CODICI DI CALCOLO

Tutti i codici di calcolo automatico utilizzati per il calcolo e la verifica delle strutture e la redazione della presente relazione di calcolo sono di sicura ed accertata validità e sono stati impiegati conformemente alle loro caratteristiche. Tale affermazione è suffragata dai seguenti elementi:

- grande diffusione del codice di calcolo sul mercato;
- storia consolidata del codice di calcolo (svariati anni di utilizzo);
- utilizzo delle versioni più aggiornate (dopo test);
- pratica d'uso frequente in studio.

In considerazione dei casi-studio, caratterizzati da piccoli spostamenti e tensioni inferiori ai limiti elastici dei materiali, si è ritenuto sufficiente adottare una schematizzazione della geometria e dei materiali di tipo lineare con leggi elastiche e isotrope ed omogenee.

3.1.1 Programmi di Verifica

Per la verifica delle sezioni in acciaio e composte è stato utilizzato un foglio di excel opportunamente testato.

4 MATERIALI

4.1 CONGLOMERATO CEMENTIZIO

4.1.1 Calcestruzzo - solette

| | | |
|---------------------------------|--|-----------------------------|
| Classe di resistenza | C32/40 | $f_{ck}/R_{ck} = 32/40$ MPa |
| Resistenza di calcolo (SLU) | $f_{cd} = \frac{\alpha_{cc} \cdot f_{ck}}{\gamma_c} = 18.81$ MPa | |
| Resistenza a compressione media | $f_{cm} = f_{ck} + 8 = 41.20$ MPa | |
| Resistenza a trazione semplice | $f_{ctm} = 0,3 \cdot f_{ck}^{2/3} = 3.10$ MPa | |
| Modulo elastico | $E_{cm} = 22000 \cdot [f_{cm} / 10]^{0.3} = 33642.78$ MPa | |

4.1.2 Calcestruzzo – pile e spalle

| | | |
|---------------------------------|--|-----------------------------|
| Classe di resistenza | C32/40 | $f_{ck}/R_{ck} = 32/40$ MPa |
| Resistenza di calcolo (SLU) | $f_{cd} = \frac{\alpha_{cc} \cdot f_{ck}}{\gamma_c} = 18.81$ MPa | |
| Resistenza a compressione media | $f_{cm} = f_{ck} + 8 = 41.20$ MPa | |
| Resistenza a trazione semplice | $f_{ctm} = 0,3 \cdot f_{ck}^{2/3} = 3.10$ MPa | |
| Modulo elastico | $E_{cm} = 22000 \cdot [f_{cm} / 10]^{0.3} = 33642.78$ MPa | |

4.2 ACCIAIO

4.2.1 Acciaio per cemento armato tipo B450C

| | |
|--|--|
| Tensione caratteristica di snervamento | $f_{yk} \geq 450$ MPa |
| Tensione caratteristica di rottura | $f_{tk} \geq 540$ MPa |
| Resistenza di calcolo | $f_{yd} = \frac{f_{yk}}{1,15} = 391$ MPa |

4.2.2 Acciaio per carpenteria tipo S355

| | |
|--|--------------------------------------|
| Tensione caratteristica di rottura | $f_{tk} = 470$ MPa (per $s > 40$ mm) |
| | $f_{tk} = 510$ MPa (per $s < 40$ mm) |
| Resistenza caratteristica di snervamento | $f_{yk} = 335$ MPa (per $s > 40$ mm) |

$$f_{yk} = 355 \text{ MPa (per } s < 40 \text{ mm)}$$

Coefficiente di sicurezza

$$\gamma_{M0} = 1,05$$

Coefficiente di sicurezza per verifiche a fatica

$$\gamma_{M,F} = 1,35$$

4.2.3 Acciaio in reti e tralicci elettrosaldati ad aderenza migliorata per c.a.

Tipo di acciaio: B450C ad aderenza migliorata, controllato in stabilimento

Tensione caratteristica di snervamento: $f_{yk} \geq 450 \text{ MPa}$

Tensione caratteristica di rottura: $f_{tk} \geq 540 \text{ MPa}$

Allungamento percentuale: $A_{gtk} \geq 7.5\%$

4.3 BULLONI AD ALTA RESISTENZA – CLASSE 10.9

Vite: classe 10.9 (UNI EN 14399:2005)

Tensione di rottura a trazione $f_{tk} \geq 1000 \text{ MPa}$

Tensione di snervamento $f_{yk} \geq 900 \text{ MPa}$

4.4 PIOLI CON TESTA

Acciaio: S235J2G3+C450

Tensione di rottura a trazione $f_{tk} \geq 450 \text{ MPa}$

Tensione di snervamento $f_{yk} \geq 370 \text{ MPa}$

Allungamento $A_5 \geq 15\%$

4.5 SALDATURE DI TESTA O A T A COMPLETA PENETRAZIONE

Giunto di prima classe: $f_{d,S355} = 338 \text{ MPa}$

Giunto di seconda classe: $0.85 f_{d,S355} = 287.38 \text{ MPa}$

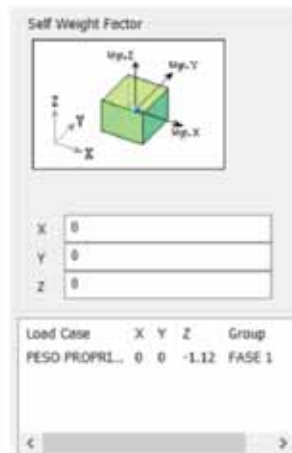
4.6 SALDATURE A CORDONE D'ANGOLO

Per S355: $|\sigma_{\perp}|, |\tau_{\perp}|, |\tau_{//}| \leq 0.70 f_{d,S355} = 236.6 \text{ MPa}$

5 ANALISI GENERALE DEI CARICHI

5.1 PESI PROPRI STRUTTURALI

I pesi strutturali delle opere in acciaio comprensive di travi principali, trave di spina, traversi e controventi, vengono considerati in automatico nel programma di calcolo. Per considerare l'effetto del "piastrame", è stato scelto di aumentare il peso proprio del 12%, come riportato nell'immagine che segue.



5.2 PESI PROPRI PORTATI

I pesi proprio portati sono stati presi in conto nel modello di calcolo utilizzato, come carichi lineari direttamente applicati alle singole travi portanti. Si riporta di seguito la definizione dei carichi applicati.

5.2.1 PESO PROPRIO SOLETTA E CORDOLI

Per la determinazione delle azioni da applicare alle singole travi è stata schematizzata una trave su più appoggi a cui è stata applicato il carico distribuito della soletta e dei cordoli laterali. Le reazioni vincolari risultanti sono poi state applicate alle travi del modello.

| PESO SOLETTA | | |
|-------------------------|---------------|-------|
| Hsoletta = | 0,26 | m |
| γ = | 25 | kN/mc |
| peso = | 6,5 | kN/mq |
| Carico trave SX = | 17,976 | |
| Carico trave Centrale = | 19,299 | |
| Carico trave DX = | 17,976 | |
| CORDOLI | | |
| Hcordoli = | 0,15 | m |
| γ = | 25 | kN/mc |
| peso = | 3,75 | kN/mq |
| Carico trave SX = | 4,037 | |
| Carico trave Centrale = | -2,449 | |
| Carico trave DX = | 4,037 | |

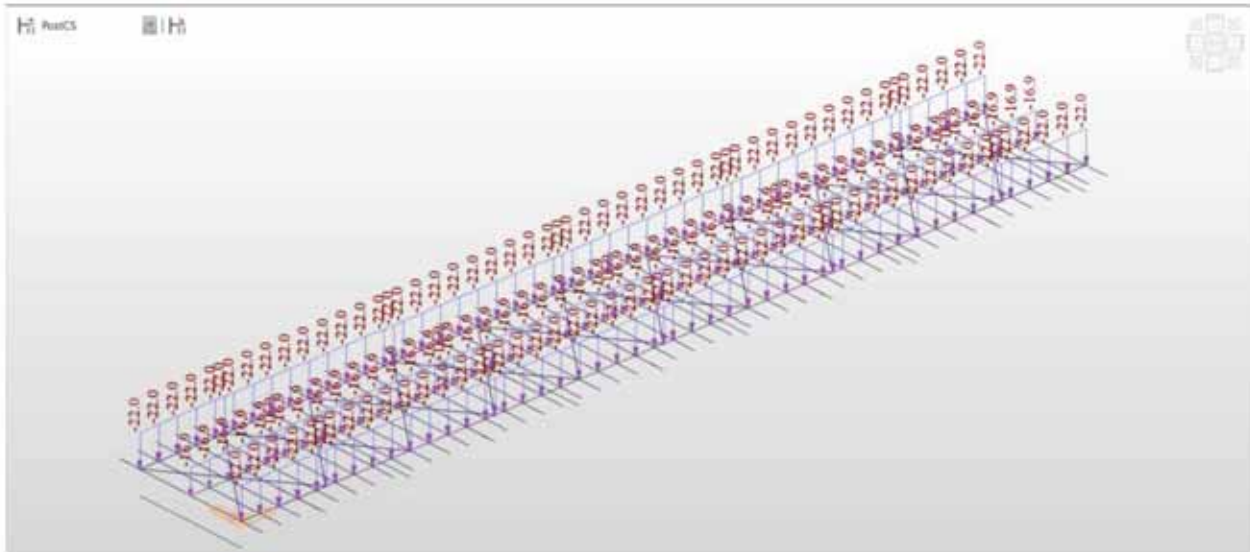


Figura 6 – Pesì propri soletta e cordoli

5.2.2 PESO PERMANENTE PORTATO

Per la determinazione delle azioni da applicare alle singole travi è stata schematizzata una trave su più appoggi a cui è stata applicato il carico del pacchetto stradale e delle barriere bordo ponte. Le reazioni vincolari risultanti sono poi state applicate alle travi del modello.

PERMANENTE PORTATO

| | | |
|-------------------------|--------------|-------|
| Hsoletta = | 0,11 | cm |
| γ = | 24 | kN/mc |
| peso = | 2,64 | kN/mq |
| Carico trave SX = | 4,459 | |
| Carico trave Centrale = | 9,562 | |
| Carico trave DX = | 4,459 | |

BARRIERE+VELETTE E TUBAZIONI

| | | |
|-------------------------|---------------|-------|
| Barriere = | 1,5 | kN/ml |
| Tubazioni = | 0,1 | kN/ml |
| Veletta = | 0,4 | kN/ml |
| Totale | 2,000 | kN/ml |
| Carico trave SX = | 2,498 | |
| Carico trave Centrale = | -0,995 | |
| Carico trave DX = | 2,498 | |

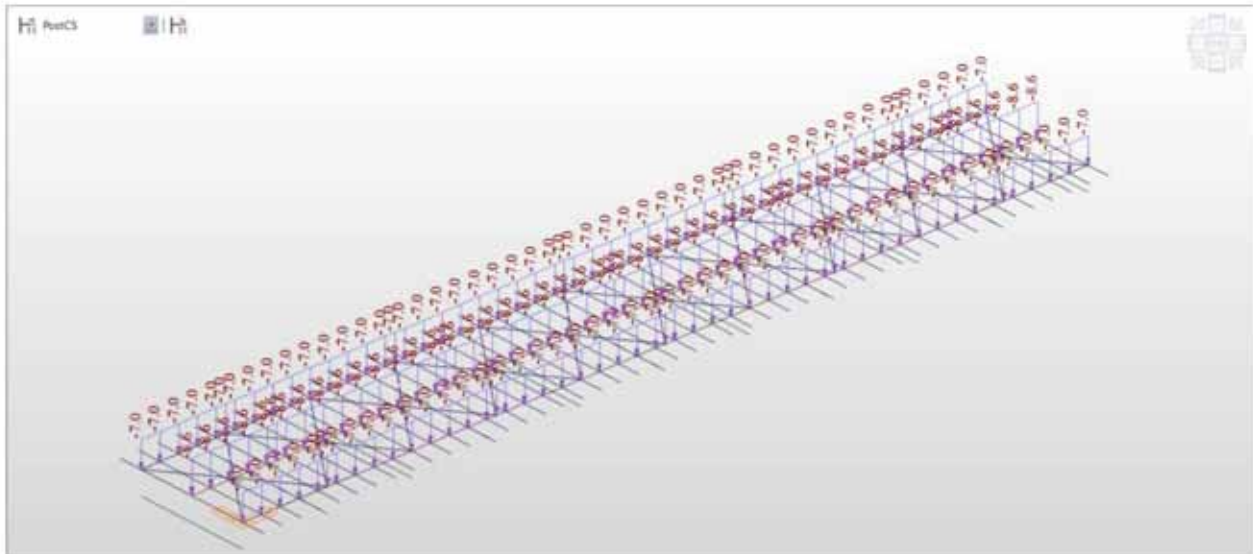


Figura 7 - Peso permanente portato

5.3 AZIONI ACCIDENTALI

5.3.1 Carichi mobili

Le azioni accidentali considerate nei calcoli sono quelle previste dall'attuale D.M. 14.1.2008 per i ponti classificati di prima categoria e calcolate in relazione alla larghezza dell'impalcato.

La carreggiata tra i cordoli ha larghezza di 7,00 m, pertanto sono state considerate ai fini del calcolo 2 corsie da 3,00 m più una parte rimanente di 1,00 m.

Si riporta lo schema di carico 1:

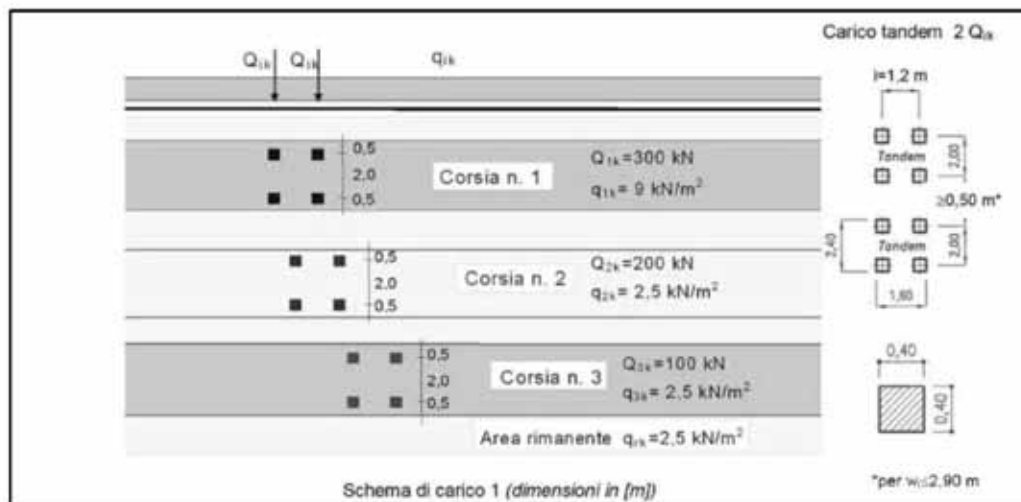


Figura 8 - Schema di carico 1

L'intensità dei carichi da applicare è riportata nella seguente tabella:

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Tabella 5.1.II - Intensità dei carichi Q_k e q_k per le diverse corsie

| Posizione | Carico asse Q_k [kN] | q_k [kN/m ²] |
|-----------------|------------------------|----------------------------|
| Corsia Numero 1 | 300 | 9,00 |
| Corsia Numero 2 | 200 | 2,50 |
| Corsia Numero 3 | 100 | 2,50 |
| Altre corsie | 0,00 | 2,50 |

Le suddette colonne di carico sono state disposte secondo lo schema longitudinale che produce le azioni accidentali più gravose per la struttura in esame.

Si riportano di seguito alcune immagini dei carichi considerati.

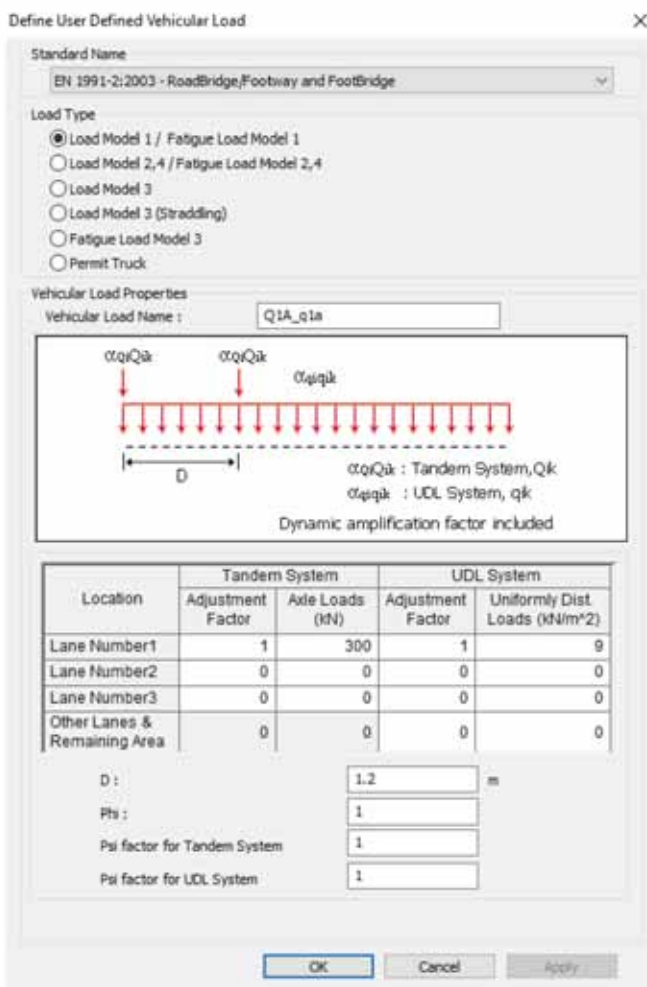


Figura 9 - Colonna di carico 2

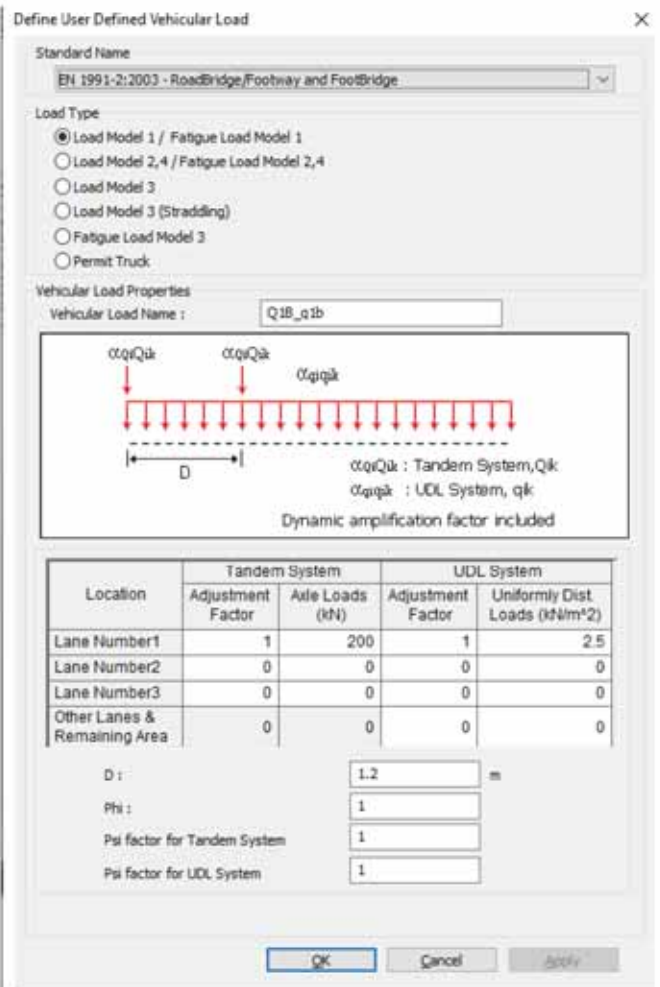


Figura 10 - Colonna di carico 1

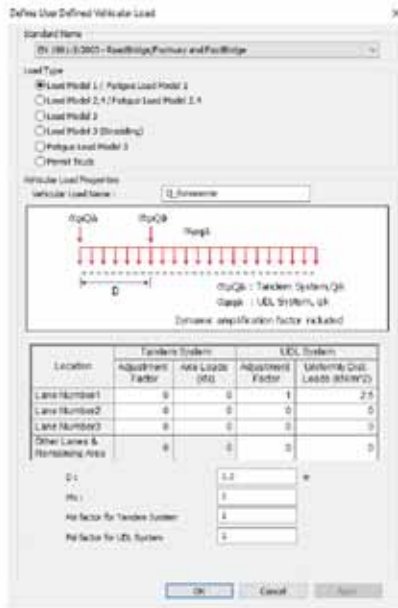


Figura 11 - Colonna di carico 3

5.3.2 Frenamento

FRENATURA

Si considera un'azione longitudinale funzione del carico verticale agente sulla corsia convenzionale n°1

$$Q|k = 0.6 \times (2 \times Q1k) + 0.10 \times q1k \times W1 \times L$$

| | | |
|--------------|---------|----|
| Q k = | 485.550 | kN |
| q k = | 3.481 | kN |

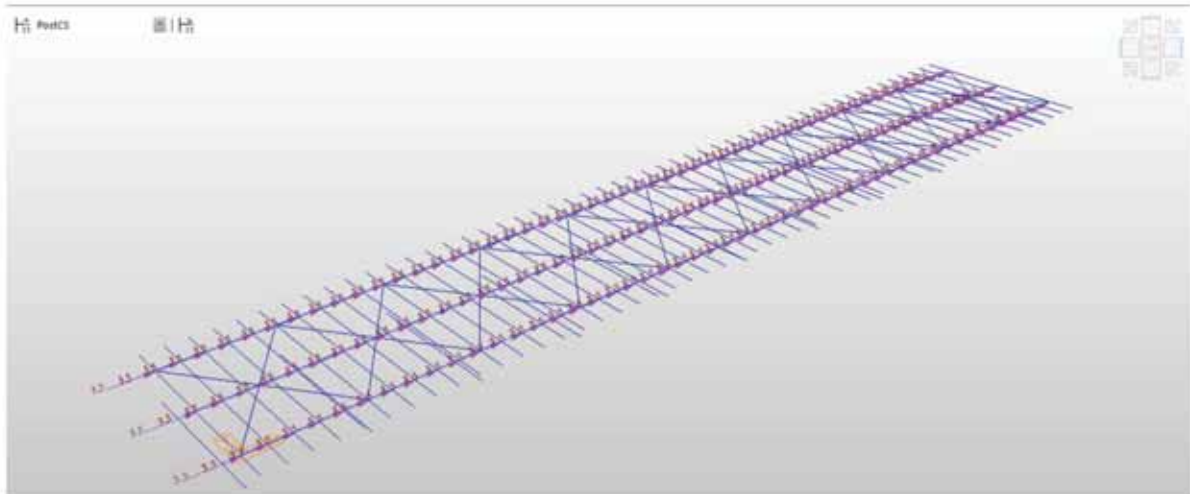
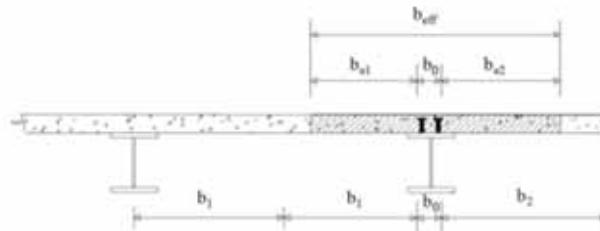


Figura 12 - Frenamento

5.4 CALCOLO SEZIONE COLLABORANTE

La distribuzione delle tensioni normali negli elementi composti è stata determinata mediante un modello che tiene conto della diffusione degli sforzi nelle ali della trave metallica e nella soletta in calcestruzzo. La larghezza efficace, b_{eff} , della soletta in calcestruzzo è stata determinata, in conformità a quanto prescritto dalla normativa, mediante l'espressione: $b_{eff} = b_0 + b_{e1} + b_{e2}$, in cui b_0 è la distanza tra gli assi dei connettori esterni e $b_{ei} = \min (L_e/8, b_i)$ è il valore della larghezza collaborante da ciascun lato della sezione composta.



L_e , nelle travi in semplice appoggio, indica la luce della trave.

Per il caso in esame si ha:

| | | | |
|-------------|-----------------|-------------------------|--|
| $L_e =$ | 45,00 m | | |
| $L_e/8 =$ | 5,625 m | | |
| $b_0 =$ | 0,382 m | | |
| $b_{i2} =$ | 1,059 m | SBALZO | |
| $b_{i1} =$ | 1,4045 m | DISTANZA | |
| $b_{e2} =$ | 1,059 | | |
| $b_{e1} =$ | 1,4045 | | |
| | 2,8455 m | TRAVE PRINCIPALE | |
| $b_{eff} =$ | 2,809 m | TRAVE DI SPINA | |

5.5 AZIONI METEORICHE

5.5.1 Azioni dovute alla neve

Il carico dovuto alla neve, non risulta dimensionante per il tipo di struttura

5.5.2 Azioni dovute al vento

Viene di seguito riportata una tabella di calcolo per la determinazione della pressione del vento da applicare alla struttura

| AZIONE DEL VENTO | | | | |
|--|-------------------------|--|---------------------------|--|
| <i>(Inserire i dati necessari nelle celle campite)</i> | simbolo | valore | unità | formula |
| Altitudine sul livello del mare | $a_s =$ | 630 | [m] | |
| Regione | | Sicilia e Provincia di Reggio Calabria | | |
| | Zona = | 4 | | |
| Parametri tabella 3.3.I | $v_{b0} =$ | 28 | [m/s] | |
| Parametri tabella 3.3.I | $a_0 =$ | 500 | [m] | |
| Parametri tabella 3.3.I | $k_s =$ | 0.360 | [-] | |
| Coefficiente di altitudine | $c_a =$ | 1.094 | [-] | |
| Velocità di riferimento | $v_b =$ | 30.6 | [m/s] | |
| Periodo di ritorno | $T_R =$ | 50 | [anni] | |
| Velocità di riferimento associata a $T_R = 50$ | $v_b =$ | 30.6 | [m/s] | |
| Velocità di riferimento | $v_r =$ | 30.6 | [m/s] | $v_r = v_b \times c_r$ |
| CALCOLO PRESSIONE DEL VENTO | | | | |
| Densità dell'aria | $\rho =$ | 1.25 | [kg/m ³] | |
| Pressione cinetica di riferimento | $q_r =$ | 586.9 | [N/m ²] | $1/2 \times \rho v_r^2$ |
| Categoria di esposizione del terreno | | II | | |
| Parametri per la definizione del coefficiente di esposizione | $k_r =$ | 0.19 | [-] | |
| | $z_0 =$ | 0.05 | [m] | |
| | $z_{min} =$ | 4.00 | [m] | |
| Quota struttura | $z =$ | 9 | [m] | |
| Coefficiente di topografia | $c_t =$ | 1 | | |
| Classe di rugosità | | D | | |
| Coefficiente di esposizione | $c_e =$ | 2.29 | | |
| Coefficiente di forma | $c_p =$ | 1.40 | | |
| Coefficiente dinamico | $c_d =$ | 1 | | |
| Pressione del vento | $p =$ | 1.88 | [kN/m²] | $p = q_b \times c_e \times c_p \times c_d$ |

Sulla base delle caratteristiche geometriche dell'impalcato, sono state determinate le azioni da applicare alle strutture in caso di ponte scarico e ponte carico.

| VENTO A PONTE SCARICO | | |
|-----------------------|--------|-------|
| Fh = | 4.507 | kN/ml |
| Pv = | 0.789 | kN/ml |
| VENTO A PONTE CARICO | | |
| Fh = | 10.142 | kN/ml |
| Pv = | 0.406 | kN/ml |

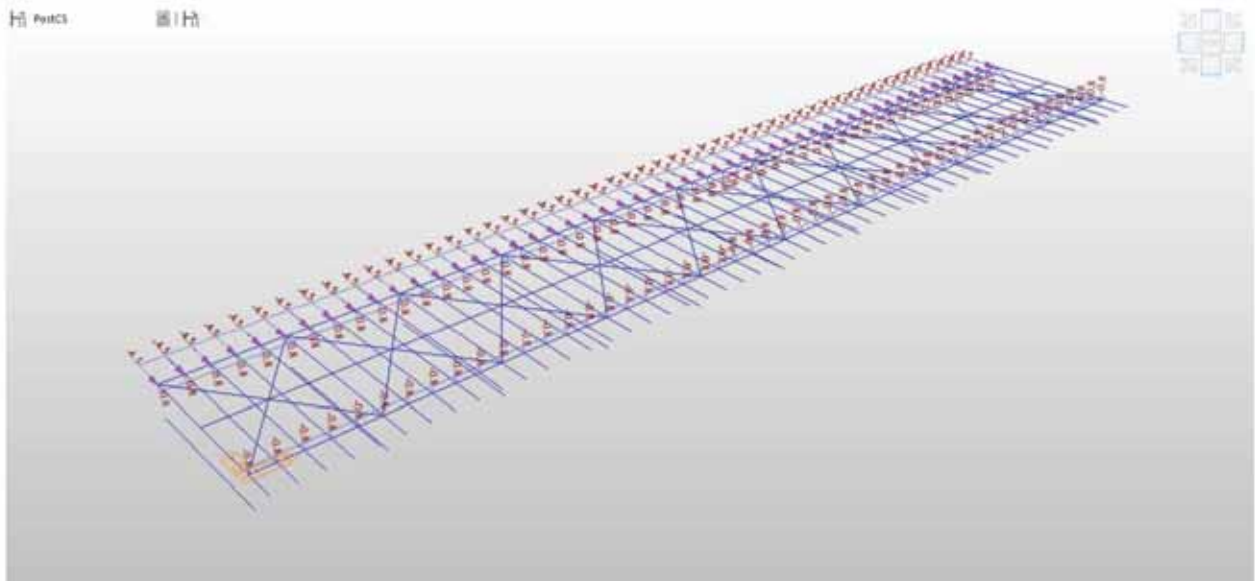


Figura 13 - Vento a ponte scarico

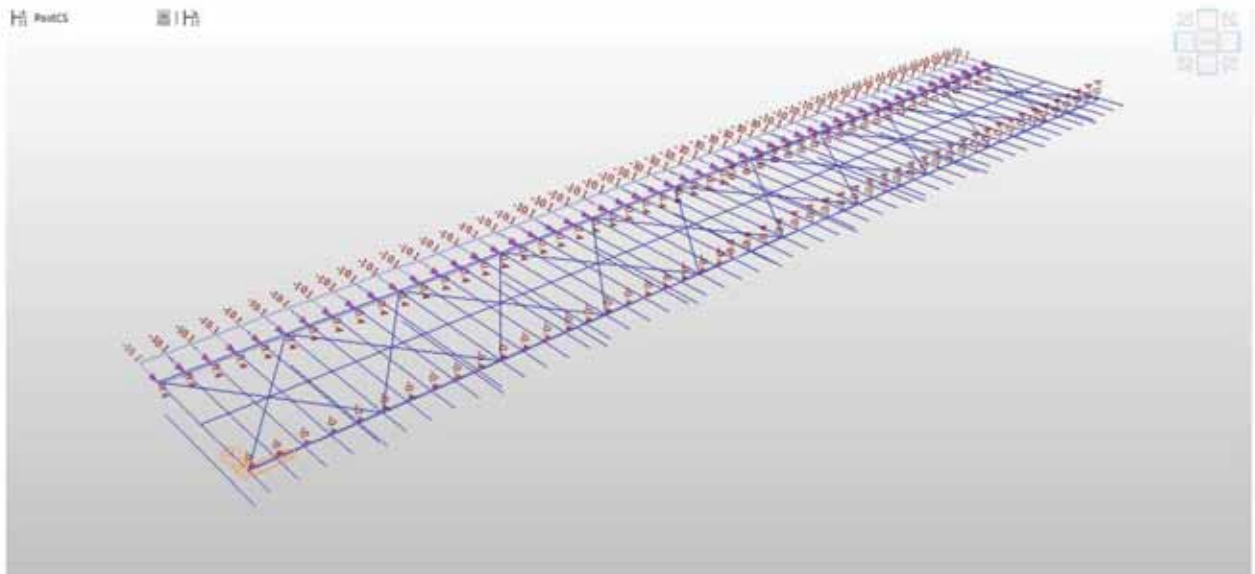
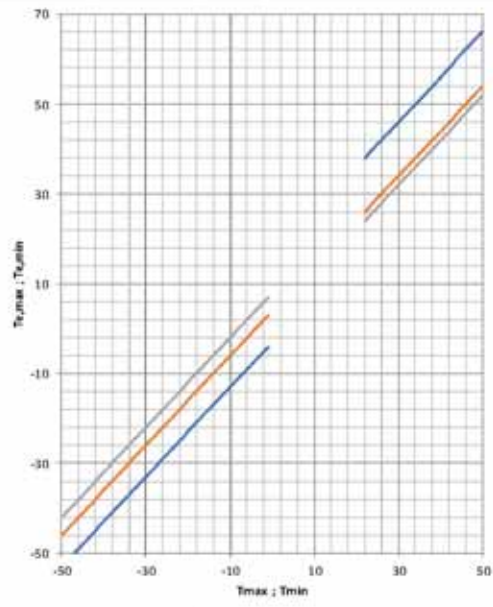


Figura 14 - Vento a ponte carico

5.5.3 Azioni dovute alla temperatura

L'azione termica, sia uniforme che a forma di gradiente, è stata applicata in base a quanto previsto dalla normativa vigente.

| AZIONE DELLA TEMPERATURA | | | | |
|--|--|---------|-------|---|
| <i>Inserire i dati necessari nelle celle campite)</i> | | | | |
| | simbolo | valore | unità | formula |
| Altitudine di riferimento | $a_s =$ | 630 | [m] | |
| Individuazione della zona : | | Zona IV | | |
| <i>Calabria, Sicilia</i> | | | | |
| Temperatura massima estiva dell'aria | $T_{max} =$ | 45 | [°C] | Valore raccomandato in assenza di studi specifici |
| Temperatura minima invernale dell'aria | $T_{min} =$ | -15 | [°C] | Valore raccomandato in assenza di studi specifici |
| <i>I valori di T_{max} e T_{min} sono riferiti ad un periodo di ritorno di 50 anni</i> | | | | |
| <i>Per la valutazione della temperatura uniforme minima/massima del ponte, si considera il grafico riportato sull'eurocodice nella sezione Ponti</i> | | | | |
| Tipologia di impalcato | Tipo 2 | | | |
| | Impalcato a struttura mista | | | |
| | - | | | |
| | $T_0 =$ | 15 | [°C] | Atteso Nazionale A.1(3) |
| Legenda |  | | | |
| 1 - Tipo 1 $T_{c,max} = T_{max} + 16$ | | | | |
| 2 - Tipo 2 $T_{c,max} = T_{max} + 4$ | | | | |
| 3 - Tipo 3 $T_{c,max} = T_{max} + 2$ | | | | |
| 4 - Tipo 1 $T_{c,min} = T_{min} - 3$ | | | | |
| 5 - Tipo 2 $T_{c,min} = T_{min} + 4$ | | | | |
| 6 - Tipo 3 $T_{c,min} = T_{min} + 8$ | | | | |
| Calcolo variazione termica uniforme | | | | |
| Temperatura uniforme del ponte massima | $T_{c,max} =$ | 49 | [°C] | |
| Temperatura uniforme del ponte minima | $T_{c,min} =$ | -11 | [°C] | |
| Variazione termica di espansione | $\Delta T_{N,exp} =$ | 34 | [°C] | |
| Variazione termica di contrazione | $\Delta T_{N,cont} =$ | -26 | [°C] | |
| Calcolo variazione termica lineare | | | | |
| Spessore della superficie | | 100 | [mm] | |
| Coefficiente riduttivo heat | $K_{sur,heat} =$ | 1.00 | [-] | |
| Coefficiente riduttivo cool | $K_{sur,cool} =$ | 1.00 | [-] | |
| Variazione termica lineare (heat) | $\Delta T_{M,heat} =$ | 15 | [°C] | |
| Variazione termica lineare (cool) | $\Delta T_{M,cool} =$ | -18 | [°C] | |

5.6 AZIONE SISMICA

Con riferimento al DM 14.01.2008, sono stati presi in considerazione i seguenti parametri, per il sito in esame:

Vita nominale della costruzione – $VN = 50$ anni

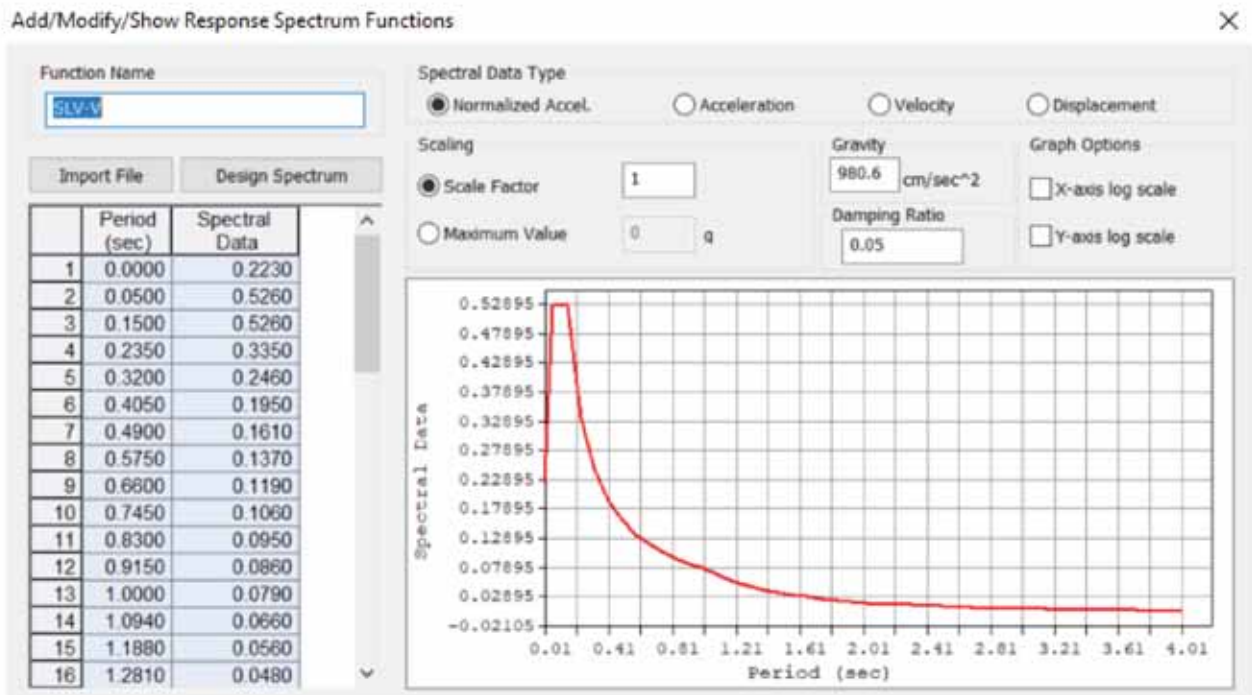
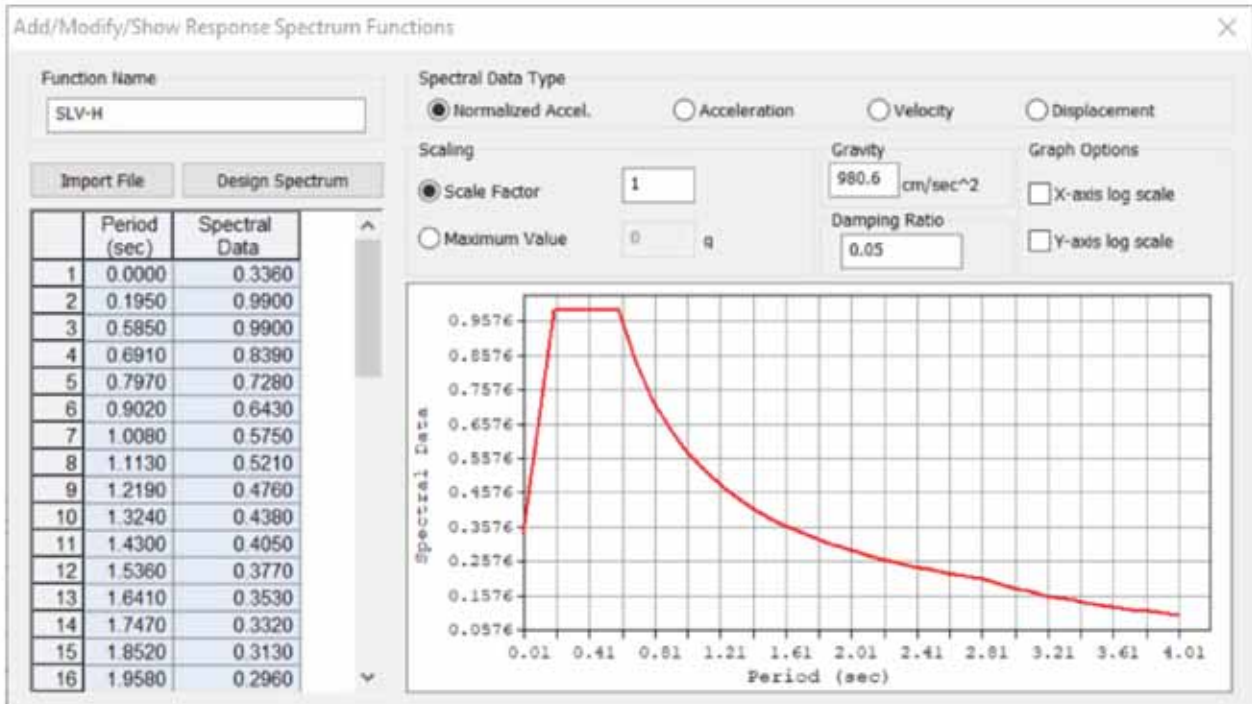
Coefficiente d'uso della costruzione – $cu = 2.0$

Ne deriva un periodo di riferimento per la costruzione $VR=100$ anni.

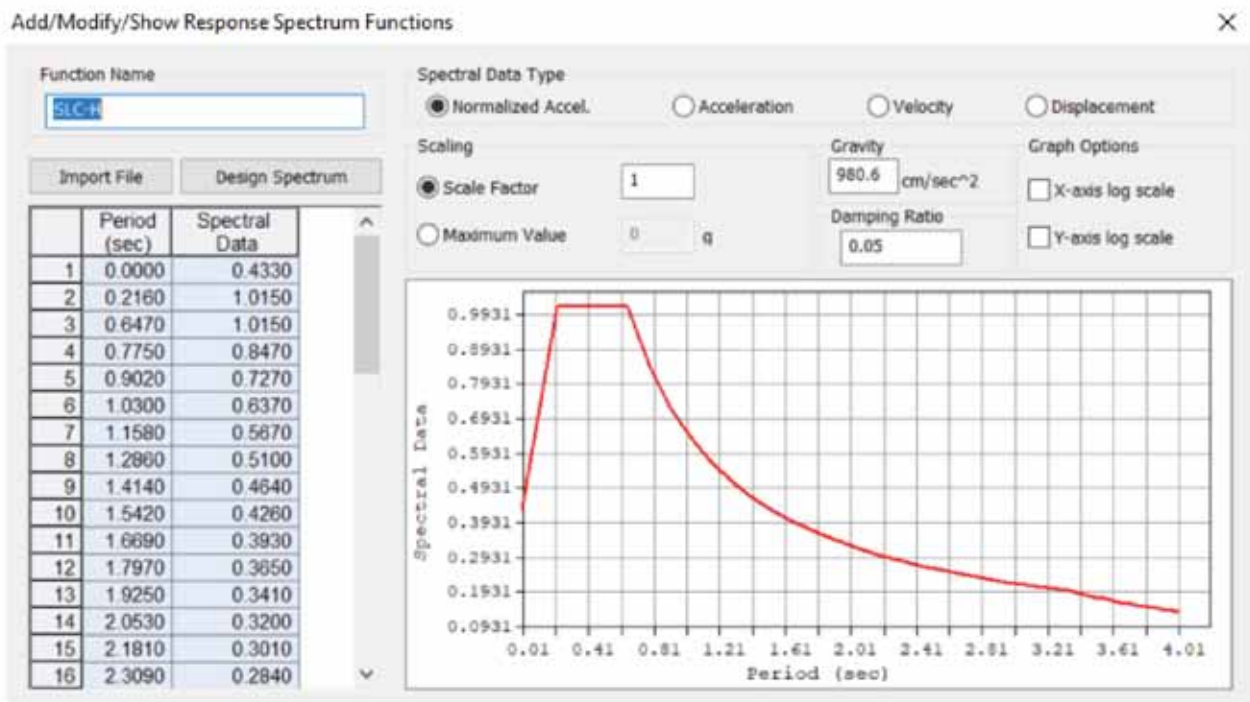
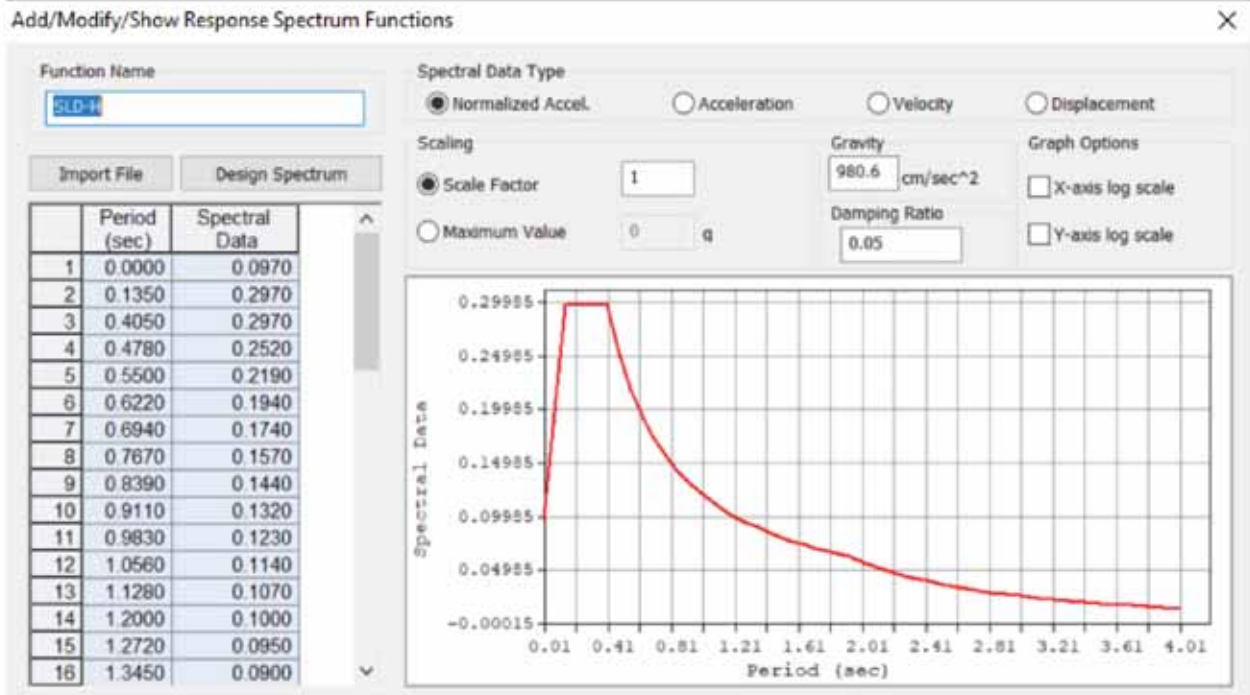
| Chilometrica | Categoria di sottosuolo NTC | Categoria topografica | S_T | S_S | ag | F0 | Tc* | Latitudine | Longitudine |
|--------------|-----------------------------|-----------------------|-------|-------|-------|-------|-------|------------|-------------|
| 1+459 | RSL | T1 | | | | | | | |
| 3+005 | B | T1 | 1.00 | 1.116 | 0.301 | 2.361 | 0.454 | 36.959319 | 14.669724 |
| 5+204 | B | T1 | 1.00 | 1.105 | 0.312 | 2.36 | 0.455 | 36.975768 | 14.67698 |
| 12+235 | RSL | T1 | | | | | | | |
| 15+818 | RSL | T1 | | | | | | | |
| 0+553 | RSL | T1 | | | | | | | |
| 1+259 | B | T1 | 1.00 | 1.087 | 0.332 | 2.355 | 0.456 | 37.091473 | 14.63782 |
| 2+065 | B | T1 | 1.00 | 1.086 | 0.333 | 2.356 | 0.457 | 37.098526 | 14.640441 |
| 2+781 | B | T1 | 1.00 | 1.085 | 0.334 | 2.357 | 0.457 | 37.104181 | 14.643716 |
| 4+182 | B | T1 | 1.00 | 1.081 | 0.337 | 2.36 | 0.458 | 37.114961 | 14.650551 |
| 8+318 | B | T1 | 1.00 | 1.075 | 0.344 | 2.364 | 0.461 | 37.147444 | 14.671512 |
| 8+746 | B | T1 | 1.00 | 1.075 | 0.344 | 2.363 | 0.462 | 37.151077 | 14.673177 |

Gli spettri di risposta utilizzati nel programma di calcolo sono rappresentati nelle figure seguenti:

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO



LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO



LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| Node | Mode | UX | UY | UZ | RX | RY | RZ | | | | | | |
|--|---------|-----------|-------------|----------|-------------|---------|--------|---------|---------|---------|--------|----------|----------|
| EIGENVALUE ANALYSIS | | | | | | | | | | | | | |
| | Mode No | Frequency | | Period | Tolerance | | | | | | | | |
| | | (rad/sec) | (cycle/sec) | (sec) | | | | | | | | | |
| | 1 | 5.877370 | 0.935412 | 1.069047 | 0.0000e+000 | | | | | | | | |
| | 2 | 5.991908 | 0.953842 | 1.048812 | 0.0000e+000 | | | | | | | | |
| | 3 | 10.242801 | 1.630192 | 0.613425 | 0.0000e+000 | | | | | | | | |
| | 4 | 14.799985 | 2.355491 | 0.424540 | 0.0000e+000 | | | | | | | | |
| | 5 | 18.126813 | 2.884972 | 0.346824 | 0.0000e+000 | | | | | | | | |
| MODAL PARTICIPATION MASSES PRINTOUT | | | | | | | | | | | | | |
| | Mode No | TRAN-X | | TRAN-Y | | TRAN-Z | | ROTN-X | | ROTN-Y | | ROTN-Z | |
| | | MASS(%) | SUM(%) | MASS(%) | SUM(%) | MASS(%) | SUM(%) | MASS(%) | SUM(%) | MASS(%) | SUM(%) | MASS(%) | SUM(%) |
| | 1 | 0.00 | 0.00 | 99.95 | 99.95 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2 | 100.00 | 100.00 | 0.00 | 99.95 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3 | 0.00 | 100.00 | 0.00 | 99.95 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 99.99 | 99.99 |
| | 4 | 0.00 | 100.00 | 0.00 | 99.95 | 81.52 | 81.52 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 99.99 |
| | 5 | 0.00 | 100.00 | 0.03 | 99.98 | 0.00 | 81.52 | 79.12 | 79.14 | 0.00 | 0.00 | 0.00 | 99.99 |
| | Mode No | TRAN-X | | TRAN-Y | | TRAN-Z | | ROTN-X | | ROTN-Y | | ROTN-Z | |
| | | MASS | SUM | MASS | SUM | MASS | SUM | MASS | SUM | MASS | SUM | MASS | SUM |
| | 1 | 0.00 | 0.00 | 490.47 | 490.47 | 0.00 | 0.00 | 0.74 | 0.74 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 2 | 490.73 | 490.73 | 0.00 | 490.47 | 0.00 | 0.00 | 0.00 | 0.74 | 0.83 | 0.83 | 0.00 | 0.00 |
| | 3 | 0.00 | 490.73 | 0.00 | 490.47 | 0.00 | 0.00 | 0.00 | 0.74 | 0.00 | 0.83 | 85169.58 | 85169.58 |
| | 4 | 0.00 | 490.73 | 0.00 | 490.47 | 400.05 | 400.05 | 0.00 | 0.74 | 0.00 | 0.83 | 0.00 | 85169.58 |
| | 5 | 0.00 | 490.73 | 0.17 | 490.64 | 0.00 | 400.05 | 2782.99 | 2783.73 | 0.00 | 0.83 | 0.00 | 85169.58 |

E' stata eseguita un'analisi modale a spettro di risposta. Come si nota dall'immagine sopra riportata, avendo introdotto come appoggi degli isolatori, le azioni sismiche orizzontali si dimostrano praticamente disaccoppiate. In altre parole, andando ad analizzare i modi di vibrare che "muovono" maggior quantitativo di masse, si nota che il modo di vibrare numero 1 e 2 muovono massa in direzione rispettivamente Y ed X in modo disaccoppiato.

6 MODELLAZIONE STRUTTURALE

La modellazione strutturale è stata effettuata tramite il programma di calcolo Midas-Civil, schematizzando l'opera come un graticcio equivalente.

Trattandosi di un impalcato a sezione mista acciaio-clt, nell'ambito della modellazione, sono state introdotte le fasi di maturazione del clt necessarie per le verifiche degli elementi portanti e nel dettaglio:

- ✓ Fase1 : Presenza della sola struttura in acciaio soggetta al solo peso proprio strutturale (durata per la sola fase di varo)

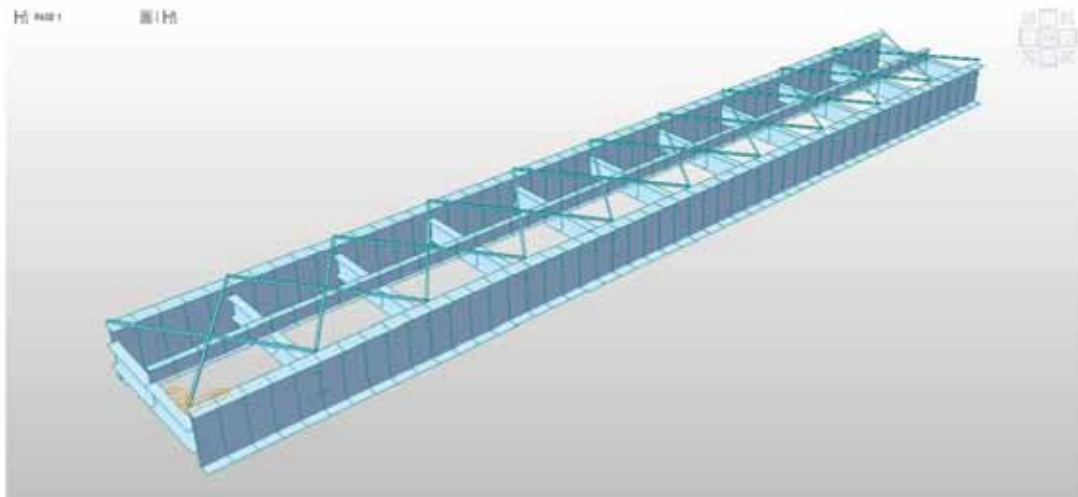


Figura 15 - Schema struttura in Fase 1

- ✓ Fase2: Presenza della struttura in acciaio e della soletta (non ancora collaborante) ma che interviene solo come peso portato (durata della fase 28giorni).
- ✓ Fase 3: Fase in cui hanno corso gli effetti reologici del calcestruzzo e in cui viene posato anche il carico permanente portato (durata giorni – fino alla fine degli effetti reologici).

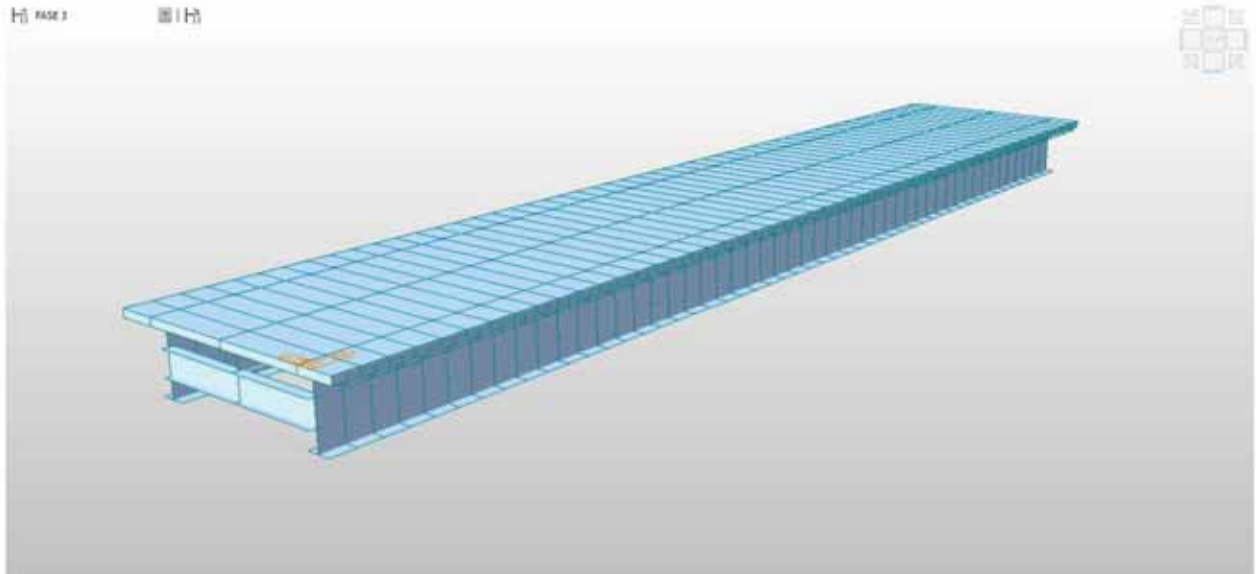


Figura 16 - Schema struttura in Fase 2-3

Inserendo in modo opportuno le varie curve di maturazione e ritiro del calcestruzzo, il programma di calcolo tiene in conto in automatico degli effetti reologici nel tempo. Pertanto, nelle varie fasi di carico, e di maturazione del getto, si instaurano effetti dovuti a ritiro e viscosità che vengono tenuti in conto in automatico dal programma di calcolo nell'ambito delle singole fasi introdotte. La fase 3, che ha una durata effettiva di circa 10000 giorni, ha lo scopo di esaurire tutti gli effetti reologici del calcestruzzo e precede la successiva fase di applicazione dei carichi variabili da traffico e meteorologici.

Construction Stage

| Name | Duration | Date | Step | Result |
|--------|----------|-------|------|--------|
| FASE 1 | 2 | 2 | 0 | Stage |
| FASE 2 | 28 | 30 | 0 | Stage |
| FASE 3 | 10000 | 10030 | 0 | Stage |

Buttons: Add, Insert Prev, Insert Next, Generate, Show, Delete, Close

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Add/Modify Time Dependent Material (Creep / Shrinkage)

Name : C+S Code : European

European

Characteristic compressive cylinder strength of concrete at the age of 28 days (f_{ck}) : 32000 kN/m²

Relative Humidity of ambient environment (40 - 99) : 70 %

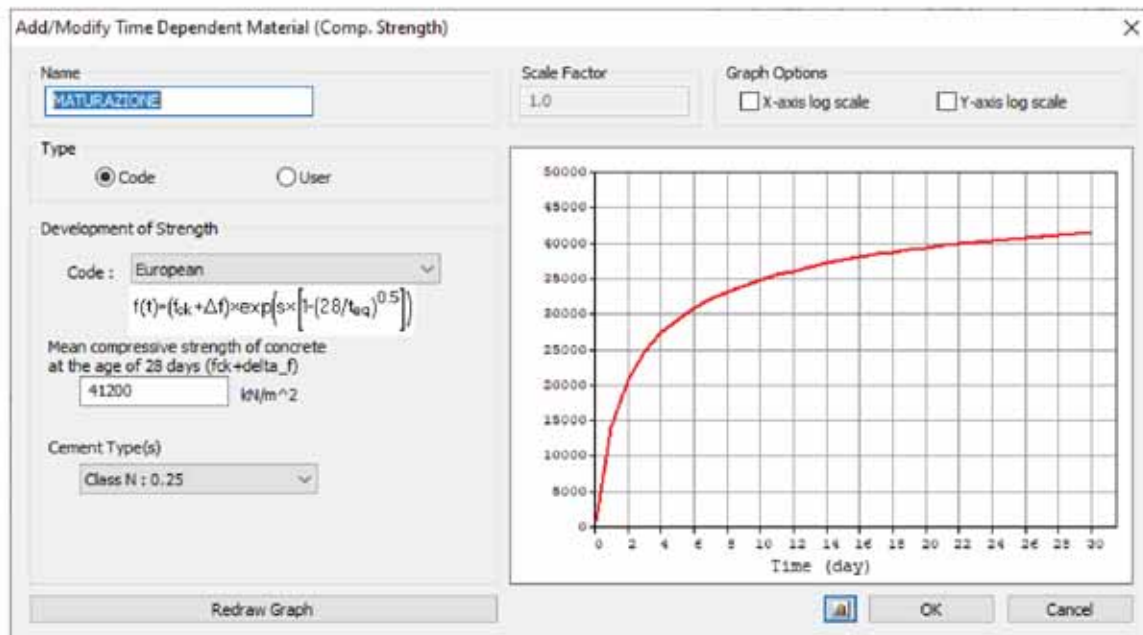
Notional size of member : 0.25 m
h = 2 * A_c / u (A_c : Section Area, u : Perimeter in contact with atmosphere)

Type of cement
 Class S Class N Class R

Type of code
 EN 1992-1 (General Structure)
 EN 1992-2 (Concrete Bridge) Use of silica-fume

Age of concrete at the beginning of shrinkage : 3 day

Show Result... OK Cancel Apply



Per quanto riguarda la soletta, la stessa viene modellata con elementi tipo frame di dimensioni pari all'interasse previsto, e viene utilizzata per l'applicazione in senso trasversale dei carichi mobili. In altre parole, i carichi mobili vengono ripartiti lungo gli elementi principali tramite la soletta.

6.1 COMBINAZIONI DI CARICO

Le combinazioni di carico considerate sono quelle desunte secondo lo schema seguente.

| Gruppo di azioni | Carichi sulla carreggiata | | | | | Carichi su marciapiedi e piste ciclabili |
|--------------------|---|----------------------------------|--|-----------------------|------------------------|---|
| | Carichi verticali | | | Carichi orizzontali | | Carichi verticali |
| | Modello principale (Schema di carico 1, 2, 3, 4, 6) | Veicoli speciali | Folla (Schema di carico 5) | Frenatura q_3 | Forza centrifuga q_4 | |
| 1 | Valore caratteristico | | | | | Carico uniformemente distribuito |
| 2 a | Valore frequente | | | Valore caratteristico | | Schema di carico 5 con valore di combinazione 2.5 kN/m ² |
| 2 b | Valore frequente | | | | Valore caratteristico | |
| 3 ^(*) | | | | | | Schema di carico 5 con valore caratteristico 5.0 kN/m ² |
| 4 ^(**) | | | Schema di carico 5 con valore caratteristico 5.0 kN/m ² | | | Schema di carico 5 con valore caratteristico 5.0 kN/m ² |
| 5 ^(***) | Da definirsi per il singolo progetto | Valore caratteristico o nominale | | | | |

^(*) Ponti di 3^a categoria
^(**) Da considerare solo se richiesto dal particolare progetto (ad es. ponti in zona urbana)
^(***) Da considerare solo se si considerano veicoli speciali

I coefficienti parziali di sicurezza per le combinazioni di carico SLU sono i seguenti.

| | | Coefficiente | EQU ⁽¹⁾ | A1 STR | A2 GEO |
|--|-------------|---|---------------------|---------------------|--------|
| Carichi permanenti | favorevoli | γ_{G1} | 0,90 | 1,00 | 1,00 |
| | sfavorevoli | | 1,10 | 1,35 | 1,00 |
| Carichi permanenti non strutturali ⁽²⁾ | favorevoli | γ_{G2} | 0,00 | 0,00 | 0,00 |
| | sfavorevoli | | 1,50 | 1,50 | 1,30 |
| Carichi variabili da traffico | favorevoli | γ_Q | 0,00 | 0,00 | 0,00 |
| | sfavorevoli | | 1,35 | 1,35 | 1,15 |
| Carichi variabili | favorevoli | γ_{Qi} | 0,00 | 0,00 | 0,00 |
| | sfavorevoli | | 1,50 | 1,50 | 1,30 |
| Distorsioni e presollecitazioni di progetto | favorevoli | γ_{e1} | 0,90 | 1,00 | 1,00 |
| | sfavorevoli | | 1,00 ⁽³⁾ | 1,00 ⁽⁴⁾ | 1,00 |
| Ritiro e viscosità, Variazioni termiche, Cedimenti vincolari | favorevoli | $\gamma_{e2}, \gamma_{e3}, \gamma_{e4}$ | 0,00 | 0,00 | 0,00 |
| | sfavorevoli | | 1,20 | 1,20 | 1,00 |

⁽¹⁾ Equilibrio che non coinvolga i parametri di deformabilità e resistenza del terreno; altrimenti si applicano i valori di GEO.
⁽²⁾ Nel caso in cui i carichi permanenti non strutturali (ad es. carichi permanenti portati) siano compiutamente definiti si potranno adottare gli stessi coefficienti validi per le azioni permanenti.
⁽³⁾ 1,30 per instabilità in strutture con precompressione esterna
⁽⁴⁾ 1,20 per effetti locali

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

I coefficienti ψ per le azioni variabili per i ponti stradali sono i seguenti.

| Azioni | Gruppo di azioni (Tabella 5.1.IV) | Coefficiente ψ_0 di combinazione | Coefficiente ψ_1 (valori frequenti) | Coefficiente ψ_2 (valori quasi permanenti) |
|-------------------------------------|---------------------------------------|---------------------------------------|--|---|
| Azioni da traffico (Tabella 5.1.IV) | Schema 1 (Carichi tandem) | 0,75 | 0,75 | 0,0 |
| | Schemi 1, 5 e 6 (Carichi distribuiti) | 0,40 | 0,40 | 0,0 |
| | Schemi 3 e 4 (carichi concentrati) | 0,40 | 0,40 | 0,0 |
| | Schema 2 | 0,0 | 0,75 | 0,0 |
| | 2 | 0,0 | 0,0 | 0,0 |
| | 3 | 0,0 | 0,0 | 0,0 |
| | 4 (folia) | ---- | 0,75 | 0,0 |
| Vento q_3 | Vento a ponte scarico | | | |
| | SLU e SLE | 0,6 | 0,2 | 0,0 |
| | Esecuzione | 0,8 | ---- | 0,0 |
| | Vento a ponte carico | 0,6 | | |
| Neve q_3 | SLU e SLE | 0,0 | 0,0 | 0,0 |
| | esecuzione | 0,8 | 0,6 | 0,5 |
| Temperatura | T_k | 0,6 | 0,6 | 0,5 |

Si riporta di seguito una tabella raffigurante tutte le combinazioni di carico utilizzate.

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| | | PESO PROPRIO ACCIAIO | PESO PROPRIO SOLETTA | PERMANENTE PORTATO | VENTO PONTE SCARICO | VENTO PONTE CARICO | TERMICA UNIFORME + | TERMICA UNIFORME - | TERMICA GRADIENTE + | TERMICA GRADIENTE - | FREINATURA | LMD1 | LMD2 | LMD3 | SISMA X | SISMA Y | SISMA Z |
|------|---------|----------------------|----------------------|--------------------|---------------------|--------------------|--------------------|--------------------|---------------------|---------------------|------------|--------|--------|--------|---------|---------|---------|
| SLU | SLU1 | 1.35 | 1.35 | 1.35 | 1.5 | 0 | 0.9 | 0 | 0 | 0 | 1.0125 | 1.0125 | 1.0125 | 1.0125 | 0 | 0 | 0 |
| | SLU2 | 1.35 | 1.35 | 1.35 | 1.5 | 0 | 0 | 0.9 | 0 | 0 | 1.0125 | 1.0125 | 1.0125 | 1.0125 | 0 | 0 | 0 |
| | SLU3 | 1.35 | 1.35 | 1.35 | 1.5 | 0 | 0 | 0 | 0.9 | 0 | 1.0125 | 1.0125 | 1.0125 | 1.0125 | 0 | 0 | 0 |
| | SLU4 | 1.35 | 1.35 | 1.35 | 1.5 | 0 | 0 | 0 | 0 | 0.9 | 1.0125 | 1.0125 | 1.0125 | 1.0125 | 0 | 0 | 0 |
| | SLU5 | 1.35 | 1.35 | 1.35 | 0 | 1.5 | 0.9 | 0 | 0 | 0 | 1.0125 | 1.0125 | 1.0125 | 1.0125 | 0 | 0 | 0 |
| | SLU6 | 1.35 | 1.35 | 1.35 | 0 | 1.5 | 0 | 0.9 | 0 | 0 | 1.0125 | 1.0125 | 1.0125 | 1.0125 | 0 | 0 | 0 |
| | SLU7 | 1.35 | 1.35 | 1.35 | 0 | 1.5 | 0 | 0 | 0.9 | 0 | 1.0125 | 1.0125 | 1.0125 | 1.0125 | 0 | 0 | 0 |
| | SLU8 | 1.35 | 1.35 | 1.35 | 0 | 1.5 | 0 | 0 | 0 | 0.9 | 1.0125 | 1.0125 | 1.0125 | 1.0125 | 0 | 0 | 0 |
| | SLU9 | 1.35 | 1.35 | 1.35 | 0.9 | 0 | 0.9 | 0 | 0 | 0 | 1.35 | 1.35 | 0 | 0 | 0 | 0 | 0 |
| | SLU10 | 1.35 | 1.35 | 1.35 | 0.9 | 0 | 0 | 0.9 | 0 | 0 | 1.35 | 1.35 | 0 | 0 | 0 | 0 | 0 |
| | SLU11 | 1.35 | 1.35 | 1.35 | 0.9 | 0 | 0 | 0 | 0.9 | 0 | 1.35 | 1.35 | 0 | 0 | 0 | 0 | 0 |
| | SLU12 | 1.35 | 1.35 | 1.35 | 0.9 | 0 | 0 | 0 | 0 | 0.9 | 1.35 | 1.35 | 0 | 0 | 0 | 0 | 0 |
| | SLU13 | 1.35 | 1.35 | 1.35 | 0 | 0.9 | 0.9 | 0 | 0 | 0 | 1.35 | 1.35 | 0 | 0 | 0 | 0 | 0 |
| | SLU14 | 1.35 | 1.35 | 1.35 | 0 | 0.9 | 0 | 0.9 | 0 | 0 | 1.35 | 1.35 | 0 | 0 | 0 | 0 | 0 |
| | SLU15 | 1.35 | 1.35 | 1.35 | 0 | 0.9 | 0 | 0 | 0.9 | 0 | 1.35 | 1.35 | 0 | 0 | 0 | 0 | 0 |
| | SLU16 | 1.35 | 1.35 | 1.35 | 0 | 0.9 | 0 | 0 | 0 | 0.9 | 1.35 | 1.35 | 0 | 0 | 0 | 0 | 0 |
| | SLU17 | 1.35 | 1.35 | 1.35 | 0.9 | 0 | 0.9 | 0 | 0 | 0 | 1.35 | 1.35 | 1.35 | 1.35 | 0 | 0 | 0 |
| | SLU18 | 1.35 | 1.35 | 1.35 | 0.9 | 0 | 0 | 0.9 | 0 | 0 | 1.35 | 1.35 | 1.35 | 1.35 | 0 | 0 | 0 |
| | SLU19 | 1.35 | 1.35 | 1.35 | 0.9 | 0 | 0 | 0 | 0.9 | 0 | 1.35 | 1.35 | 1.35 | 1.35 | 0 | 0 | 0 |
| | SLU20 | 1.35 | 1.35 | 1.35 | 0.9 | 0 | 0 | 0 | 0 | 0.9 | 1.35 | 1.35 | 1.35 | 1.35 | 0 | 0 | 0 |
| | SLU21 | 1.35 | 1.35 | 1.35 | 0 | 0.9 | 0.9 | 0 | 0 | 0 | 1.35 | 1.35 | 1.35 | 1.35 | 0 | 0 | 0 |
| | SLU22 | 1.35 | 1.35 | 1.35 | 0 | 0.9 | 0 | 0.9 | 0 | 0 | 1.35 | 1.35 | 1.35 | 1.35 | 0 | 0 | 0 |
| | SLU23 | 1.35 | 1.35 | 1.35 | 0 | 0.9 | 0 | 0 | 0.9 | 0 | 1.35 | 1.35 | 1.35 | 1.35 | 0 | 0 | 0 |
| | SLU24 | 1.35 | 1.35 | 1.35 | 0 | 0.9 | 0 | 0 | 0 | 0.9 | 1.35 | 1.35 | 1.35 | 1.35 | 0 | 0 | 0 |
| RARA | RARA_1 | 1 | 1 | 1 | 1 | 0 | 0.6 | 0 | 0 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | RARA_2 | 1 | 1 | 1 | 1 | 0 | 0 | 0.6 | 0 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | RARA_3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0.6 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | RARA_4 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.6 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | RARA_5 | 1 | 1 | 1 | 0 | 1 | 0.6 | 0 | 0 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | RARA_6 | 1 | 1 | 1 | 0 | 1 | 0 | 0.6 | 0 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | RARA_7 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0.6 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | RARA_8 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0.6 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | RARA_9 | 1 | 1 | 1 | 0.6 | 0 | 0.6 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | RARA_10 | 1 | 1 | 1 | 0.6 | 0 | 0 | 0.6 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | RARA_11 | 1 | 1 | 1 | 0.6 | 0 | 0 | 0 | 0.6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | RARA_12 | 1 | 1 | 1 | 0.6 | 0 | 0 | 0 | 0 | 0.6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | RARA_13 | 1 | 1 | 1 | 0 | 0.6 | 0.6 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | RARA_14 | 1 | 1 | 1 | 0 | 0.6 | 0 | 0.6 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | RARA_15 | 1 | 1 | 1 | 0 | 0.6 | 0 | 0 | 0.6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | RARA_16 | 1 | 1 | 1 | 0 | 0.6 | 0 | 0 | 0 | 0.6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| FREQ | FREQ_1 | 1 | 1 | 1 | 0.2 | 0 | 0.5 | 0 | 0 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | FREQ_2 | 1 | 1 | 1 | 0.2 | 0 | 0 | 0.5 | 0 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | FREQ_3 | 1 | 1 | 1 | 0.2 | 0 | 0 | 0 | 0.5 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | FREQ_4 | 1 | 1 | 1 | 0.2 | 0 | 0 | 0 | 0 | 0.5 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | FREQ_5 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | FREQ_6 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | FREQ_7 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | FREQ_8 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0.75 | 0.75 | 0 | 0 | 0 | 0 | 0 |
| | FREQ_9 | 1 | 1 | 1 | 0.2 | 0 | 0.5 | 0 | 0 | 0 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 | 0 |
| | FREQ_10 | 1 | 1 | 1 | 0.2 | 0 | 0 | 0.5 | 0 | 0 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 | 0 |
| | FREQ_11 | 1 | 1 | 1 | 0.2 | 0 | 0 | 0 | 0.5 | 0 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 | 0 |
| | FREQ_12 | 1 | 1 | 1 | 0.2 | 0 | 0 | 0 | 0 | 0.5 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 | 0 |
| | FREQ_13 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 | 0 |
| | FREQ_14 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 | 0 |
| | FREQ_15 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 | 0 |
| | FREQ_16 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0.75 | 0.75 | 0.75 | 0.75 | 0 | 0 | 0 |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| | | | | | | | | | | | | | | | | | | |
|-----------|-------|---|---|---|---|---|-----|-----|-----|-----|---|---|---|---|----|------|------|----|
| QP | QP_1 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | QP_2 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | QP_3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | QP_4 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SISMA SLV | SLV1 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.3 | 0 |
| | SLV2 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0.3 | 0 |
| | SLV3 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -0.3 | 0 |
| | SLV4 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -0.3 | 0 |
| | SLV5 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 1 | 0 |
| | SLV6 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -1 | 0 |
| | SLV7 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 1 | 0 |
| | SLV8 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -1 | 0 |
| | SLV9 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.3 | 0 |
| | SLV10 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0.3 | 0 |
| | SLV11 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -0.3 | 0 |
| | SLV12 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -0.3 | 0 |
| | SLV13 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 1 | 0 |
| | SLV14 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -1 | 0 |
| | SLV15 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 1 | 0 |
| | SLV16 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -1 | 0 |
| | SLV17 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.3 | 0 |
| | SLV18 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0.3 | 0 |
| | SLV19 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -0.3 | 0 |
| | SLV20 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -0.3 | 0 |
| | SLV21 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 1 | 0 |
| | SLV22 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -1 | 0 |
| | SLV23 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 1 | 0 |
| | SLV24 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -1 | 0 |
| | SLV25 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 1 | 0.3 | 0 |
| | SLV26 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | -1 | 0.3 | 0 |
| | SLV27 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 1 | -0.3 | 0 |
| | SLV28 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | -1 | -0.3 | 0 |
| | SLV29 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0.3 | 1 | 0 |
| | SLV30 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0.3 | -1 | 0 |
| | SLV31 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | -0.3 | 1 | 0 |
| | SLV32 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | -0.3 | -1 | 0 |
| | SLV33 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0.3 | 1 |
| | SLV34 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 0.3 | 1 |
| | SLV35 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -0.3 | 1 |
| | SLV36 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -0.3 | 1 |
| | SLV37 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0.3 | 1 |
| | SLV38 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 0.3 | 1 |
| | SLV39 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -0.3 | 1 |
| | SLV40 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -0.3 | 1 |
| | SLV41 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0.3 | 1 |
| | SLV42 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 0.3 | 1 |
| | SLV43 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -0.3 | 1 |
| | SLV44 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -0.3 | 1 |
| | SLV45 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0.3 | -1 |
| | SLV46 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 0.3 | -1 |
| | SLV47 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -0.3 | -1 |
| | SLV48 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -0.3 | -1 |
| | SLV49 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0.3 | -1 |
| | SLV50 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 0.3 | -1 |
| | SLV51 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -0.3 | -1 |
| | SLV52 | 1 | 1 | 1 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -0.3 | -1 |
| | SLV53 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | 0.3 | -1 |
| | SLV54 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | 0.3 | -1 |
| | SLV55 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 | -0.3 | -1 |
| | SLV56 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | -0.3 | -0.3 | -1 |
| SISMA SLD | SLD1 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| | SLD2 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | |
| | SLD3 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| | SLD4 | 1 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | |

6.2 VERIFICHE STRUTTURALI

6.2.1 VERIFICA ELEMENTI DI IMPALCATO

Si riportano di seguito alcune immagini del modello 3D effettuato con la suddivisione in conci delle travi principali.

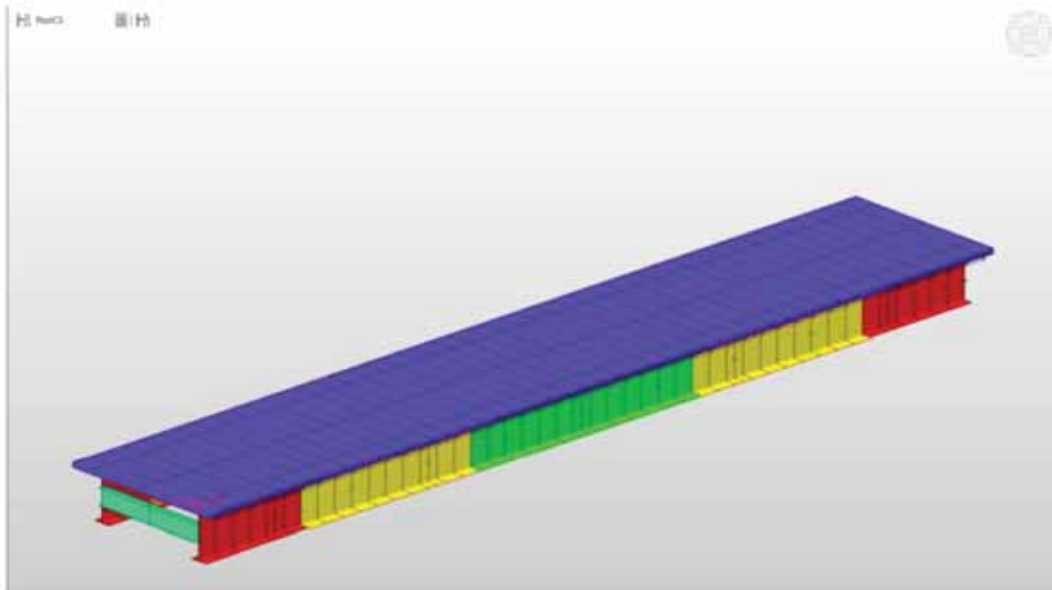


Figura 17 - Immagine modello 3D

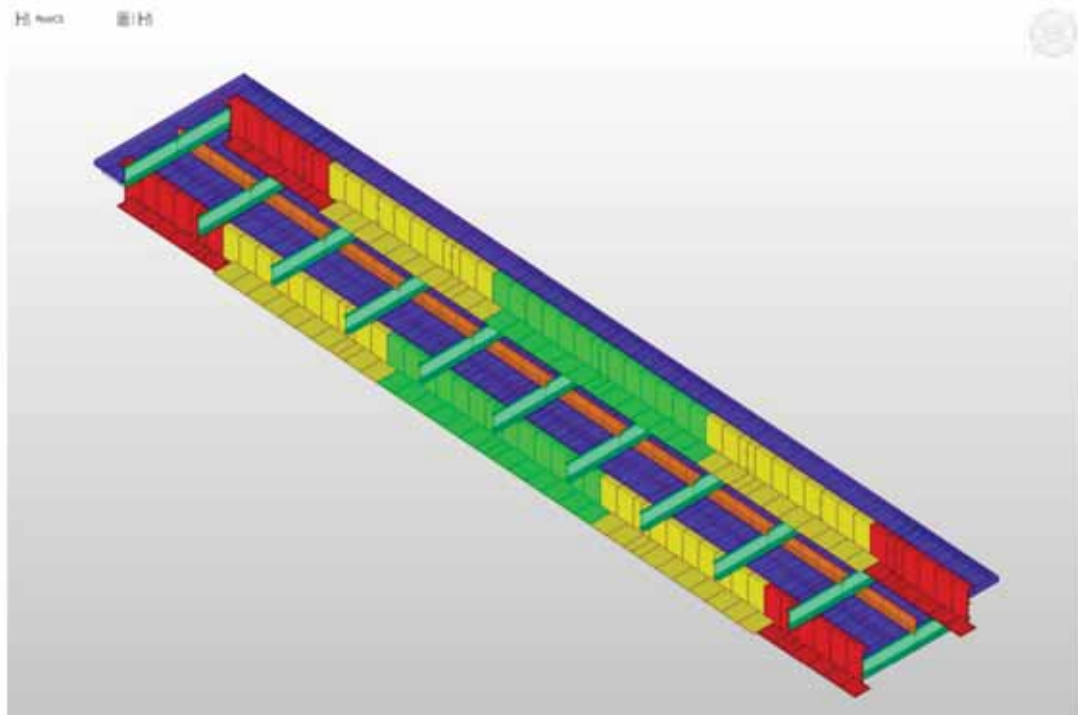
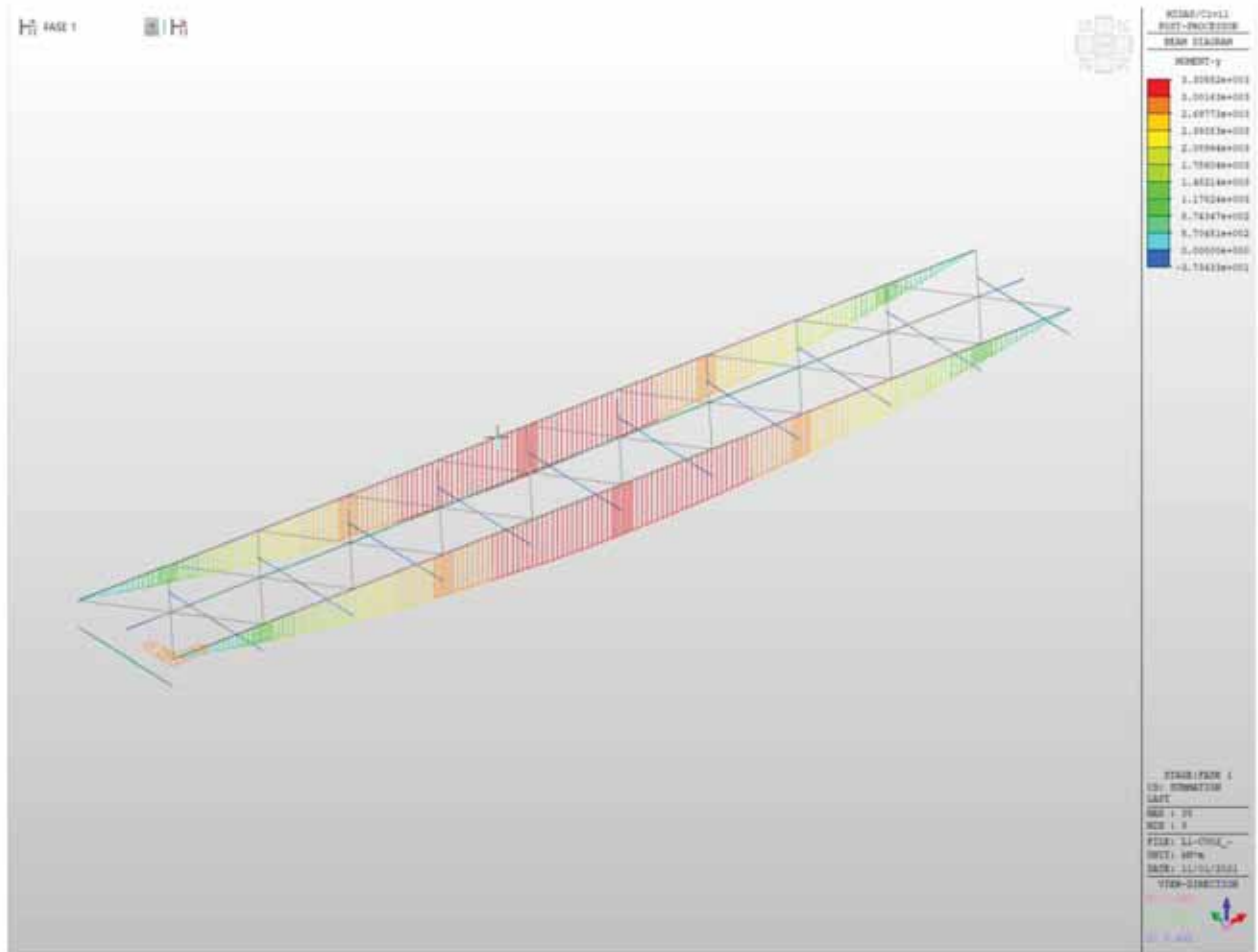


Figura 18 - Immagine modello 3D

Si riportano inoltre i diagrammi delle sollecitazioni M, N e T nelle varie fasi operative.



LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

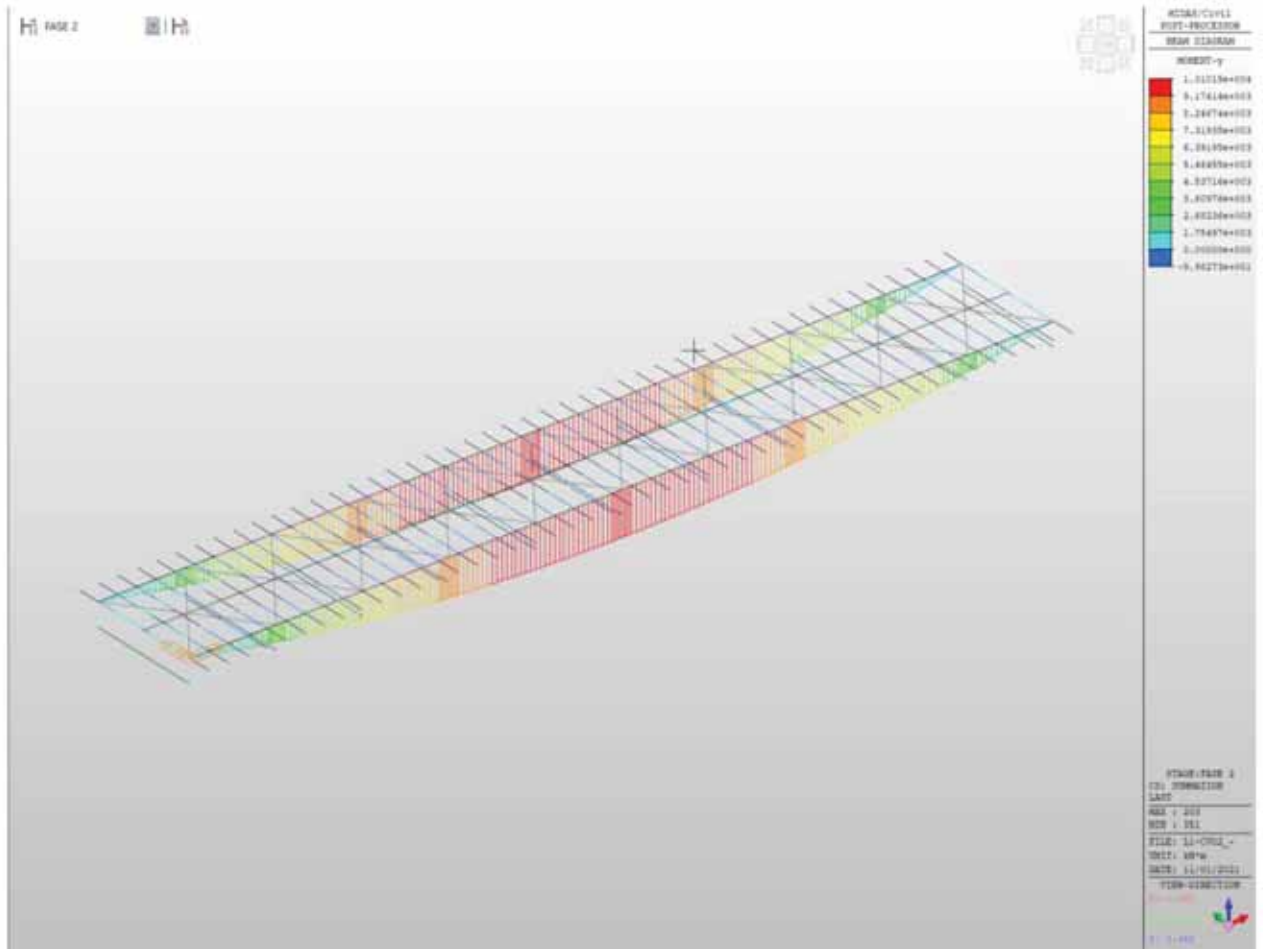


Figura 20 - Diagramma My - Fase 2

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

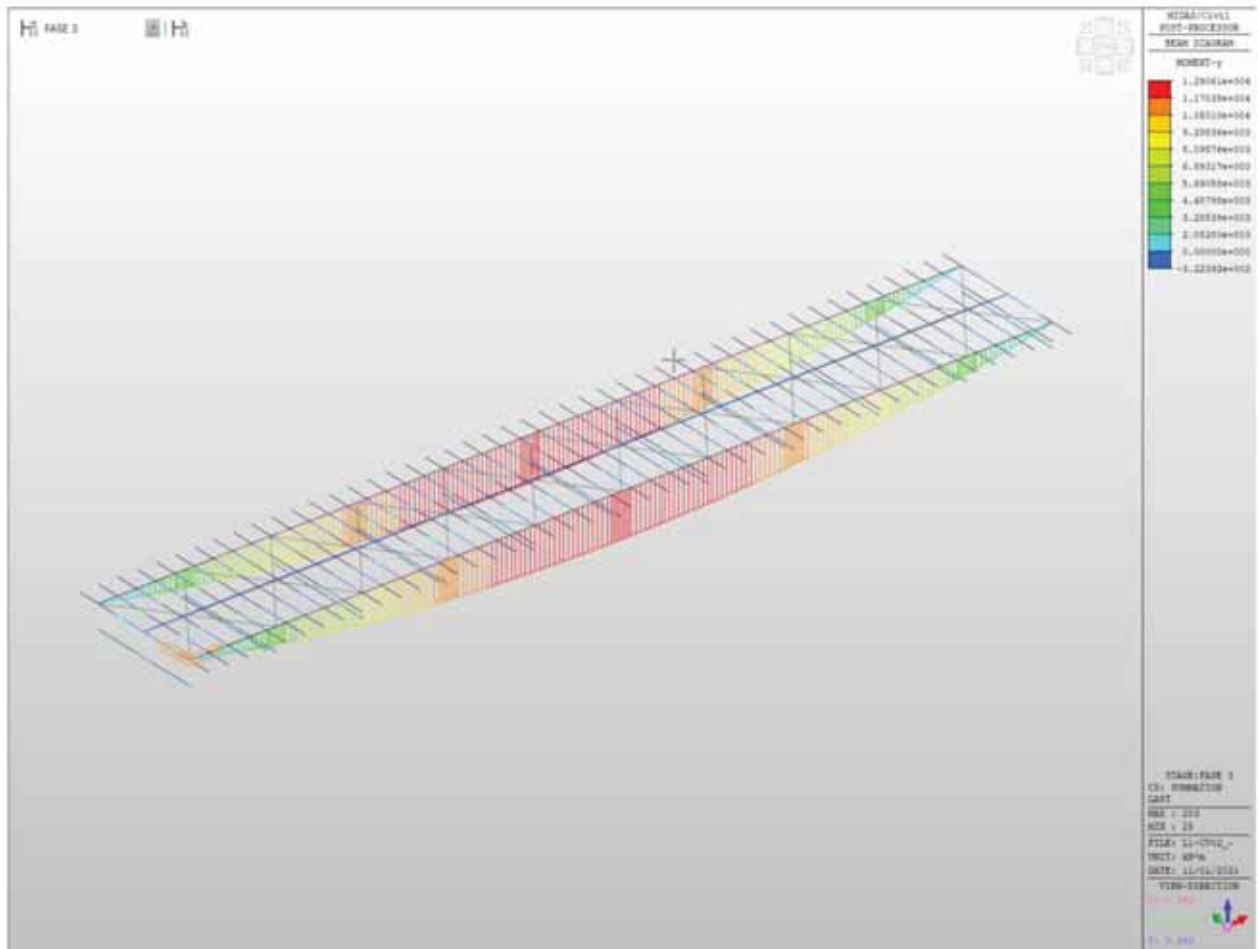


Figura 21 - Diagramma My - Fase 3

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

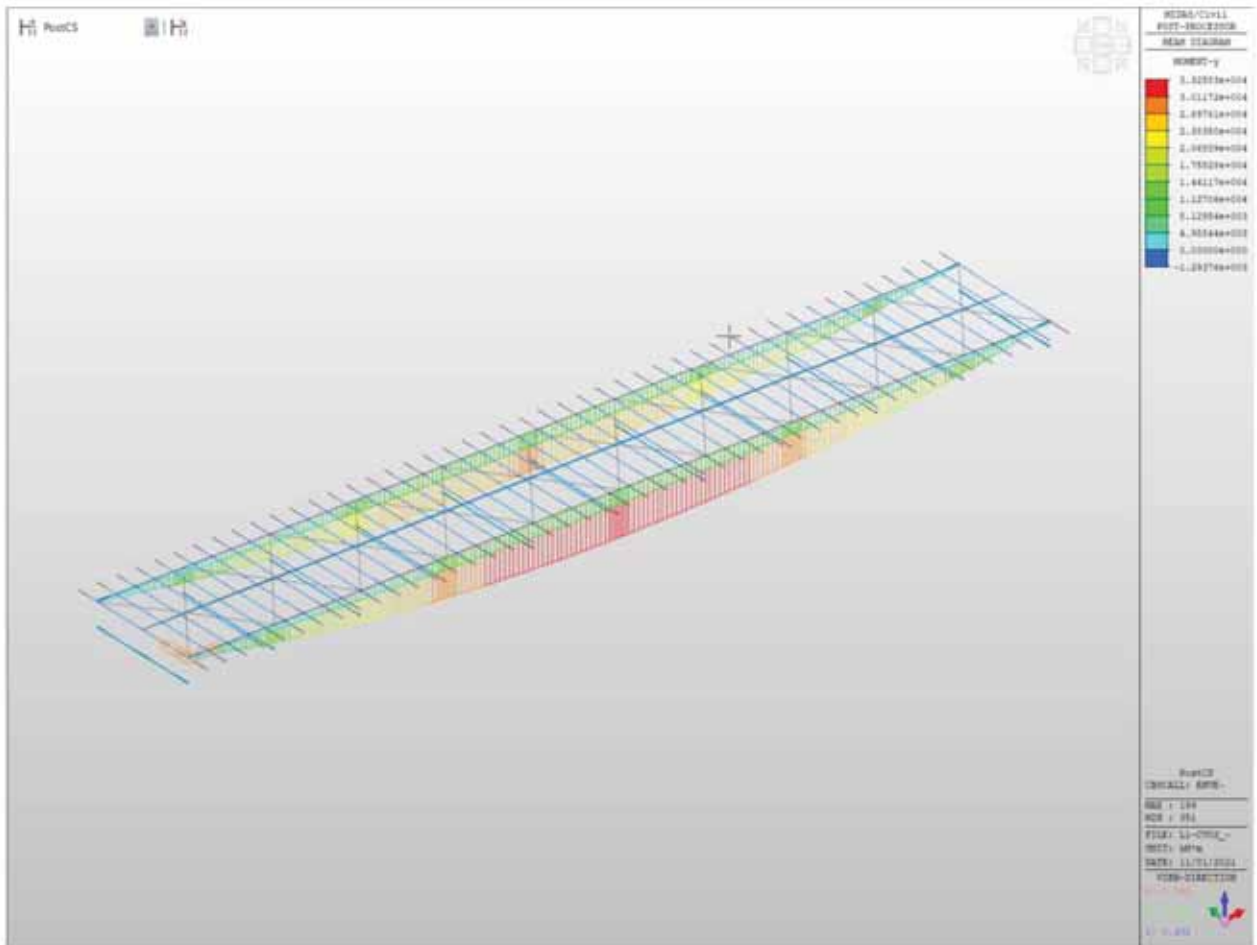


Figura 22 - Diagramma My – Inviluppo SLU-SLV

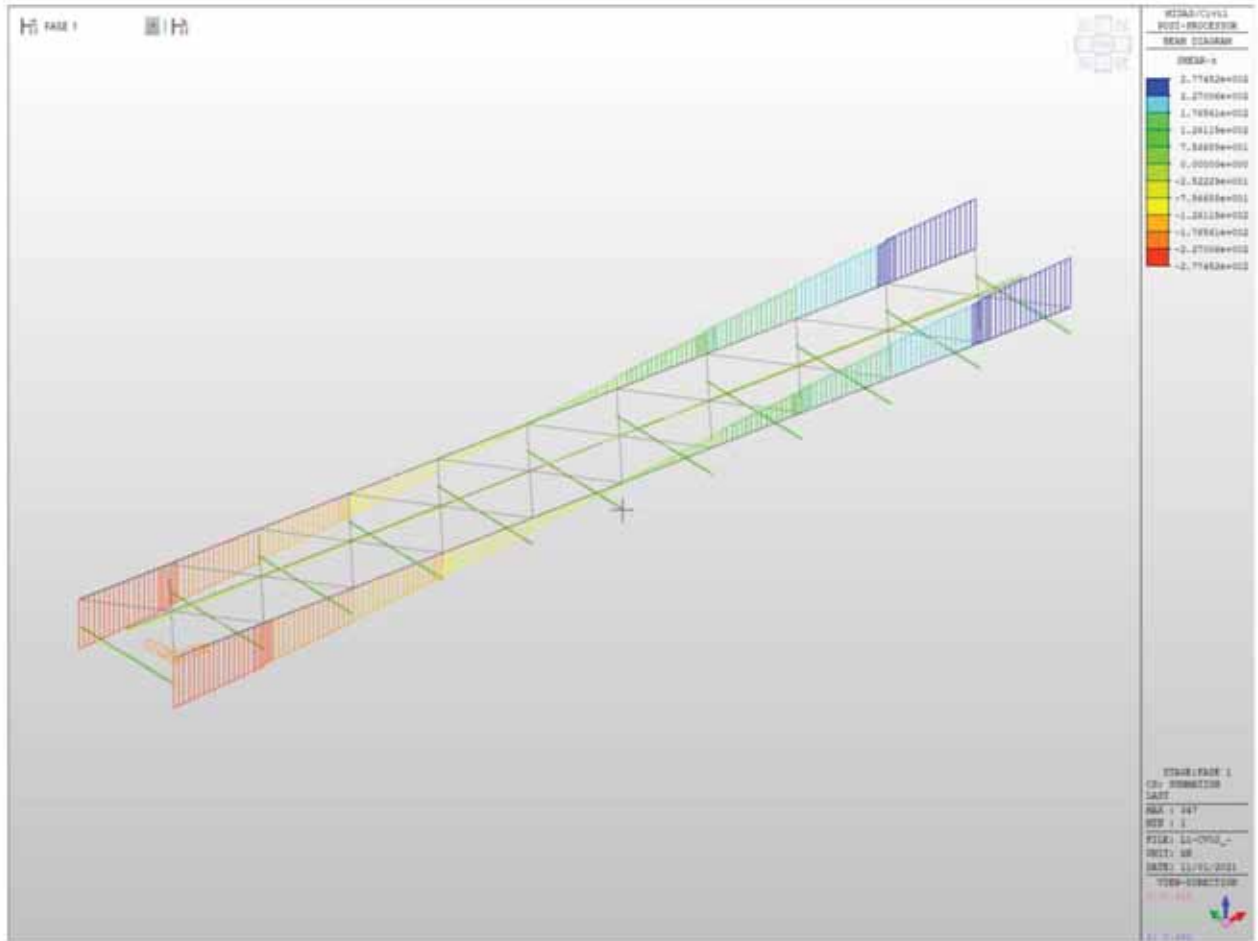


Figura 23 - Diagramma Tz - Fase 1

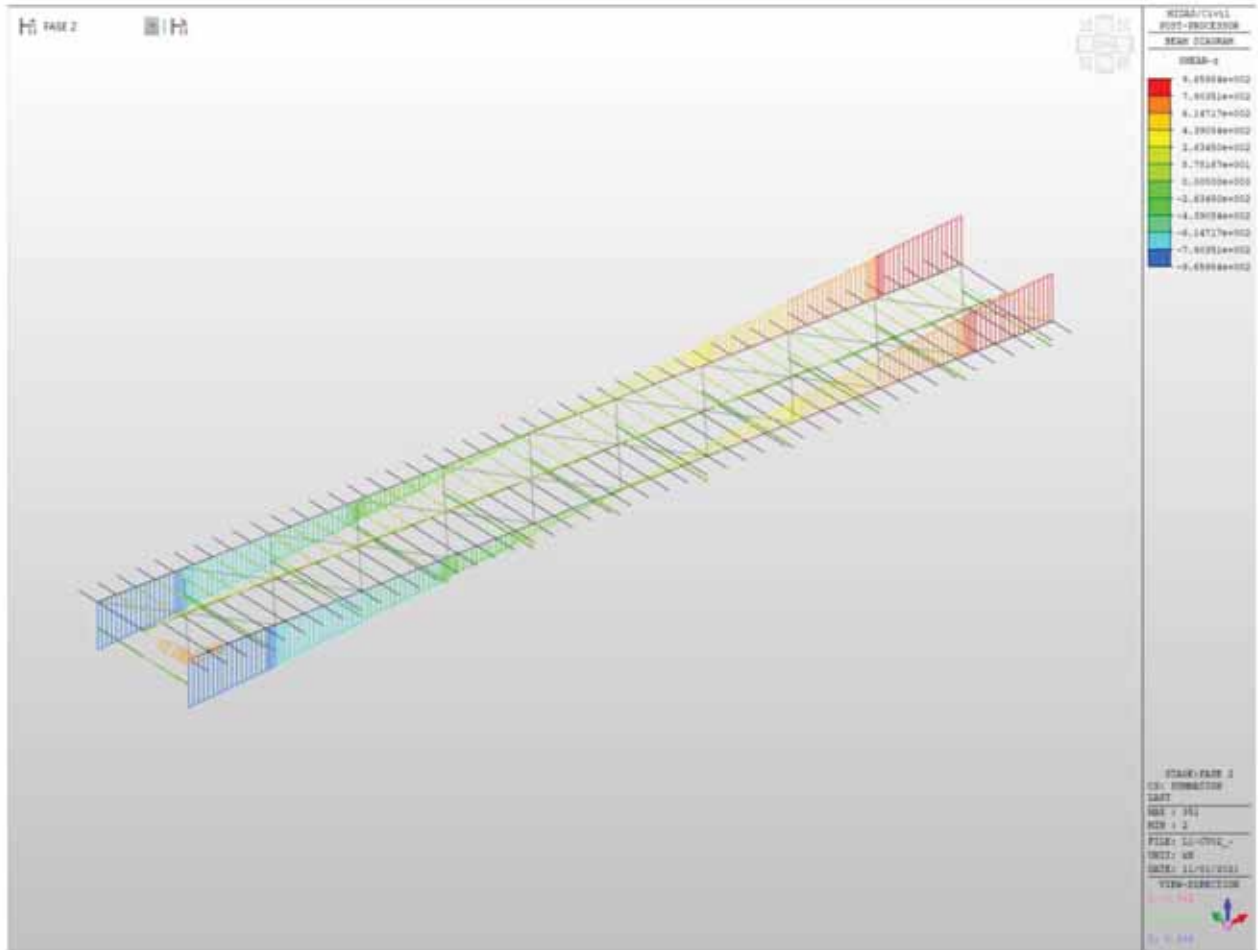


Figura 24 - Diagramma Tz - Fase 2

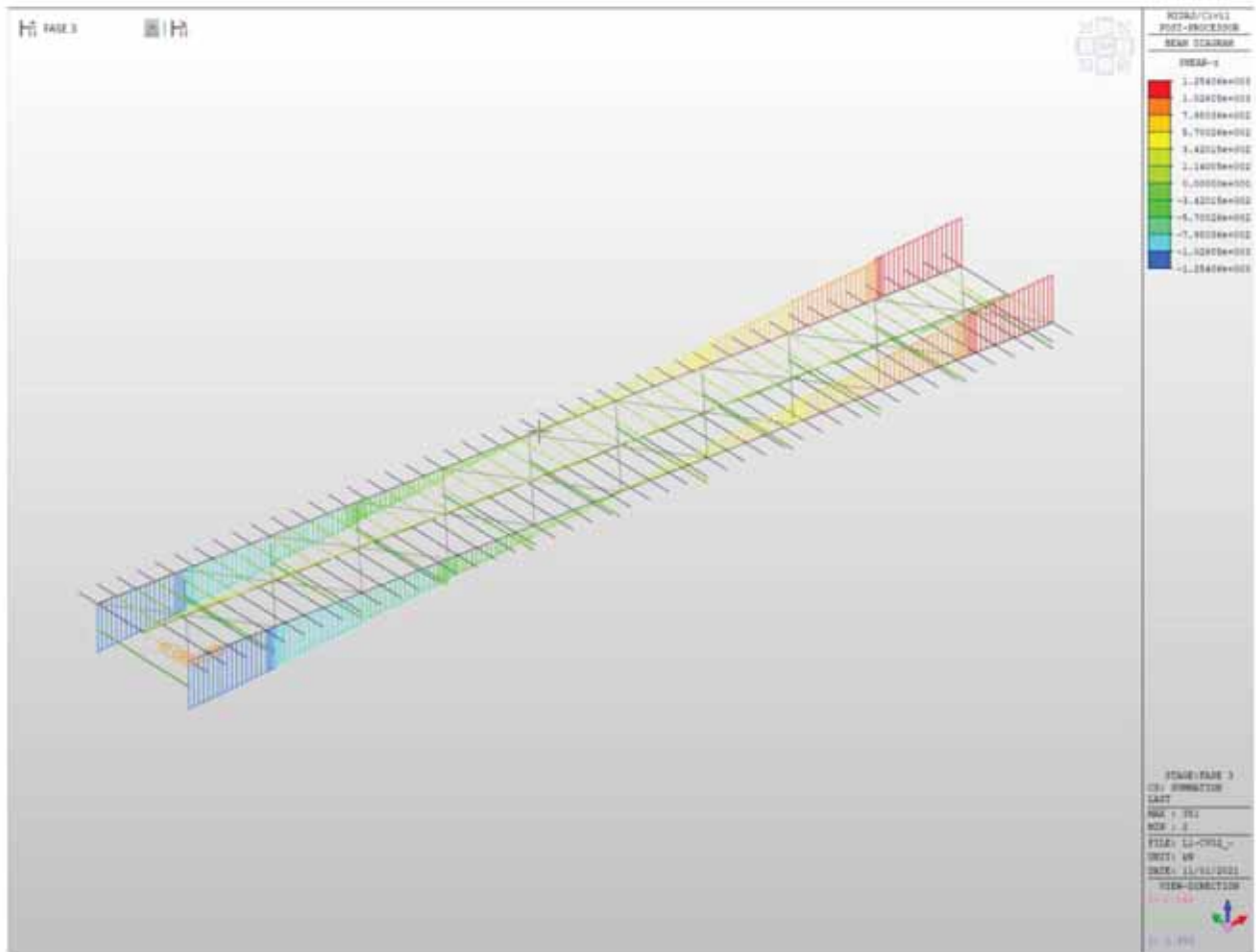


Figura 25 - Diagramma Tz - Fase 3

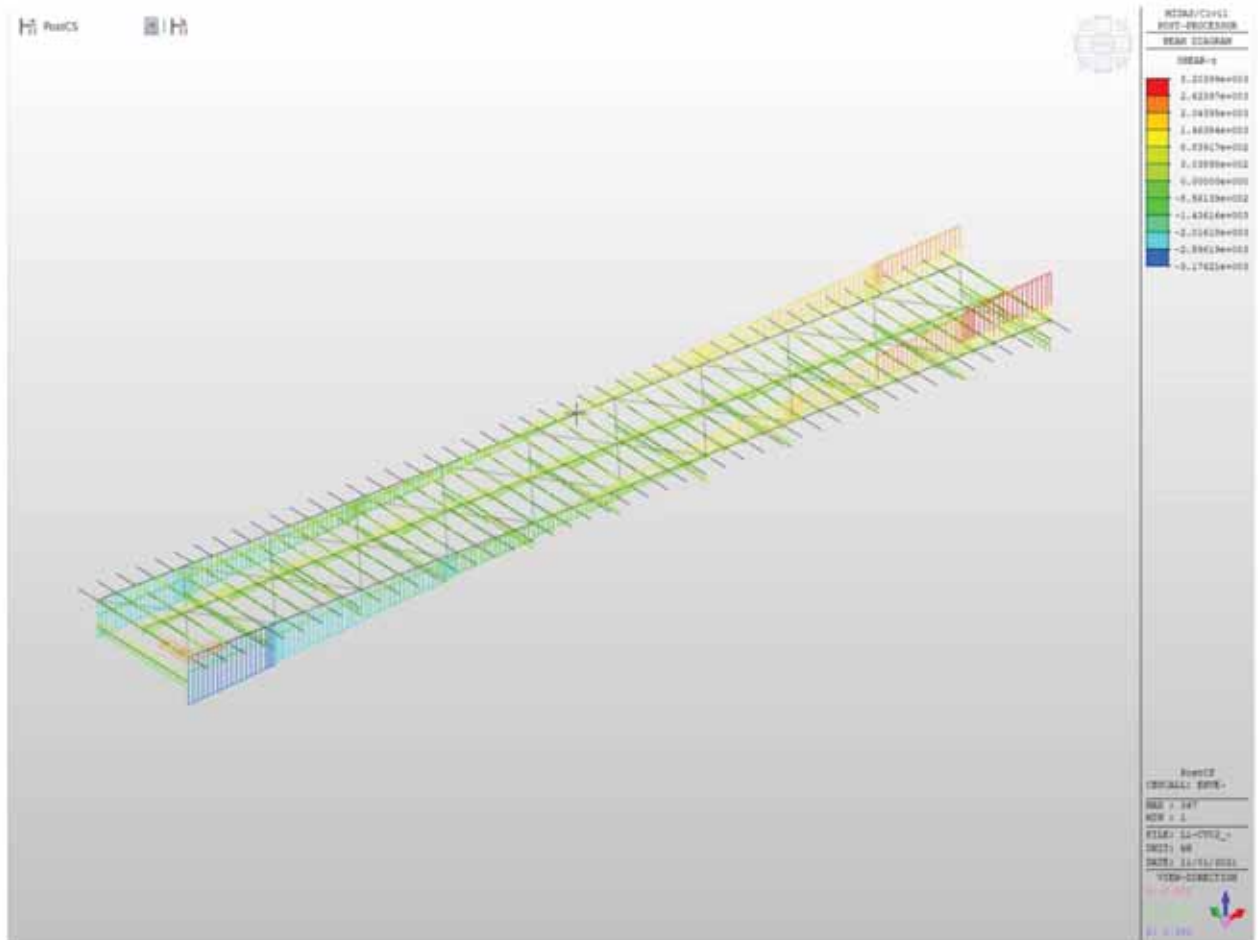


Figura 26 - Diagramma Tz - Involuppo SLU-SLV

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

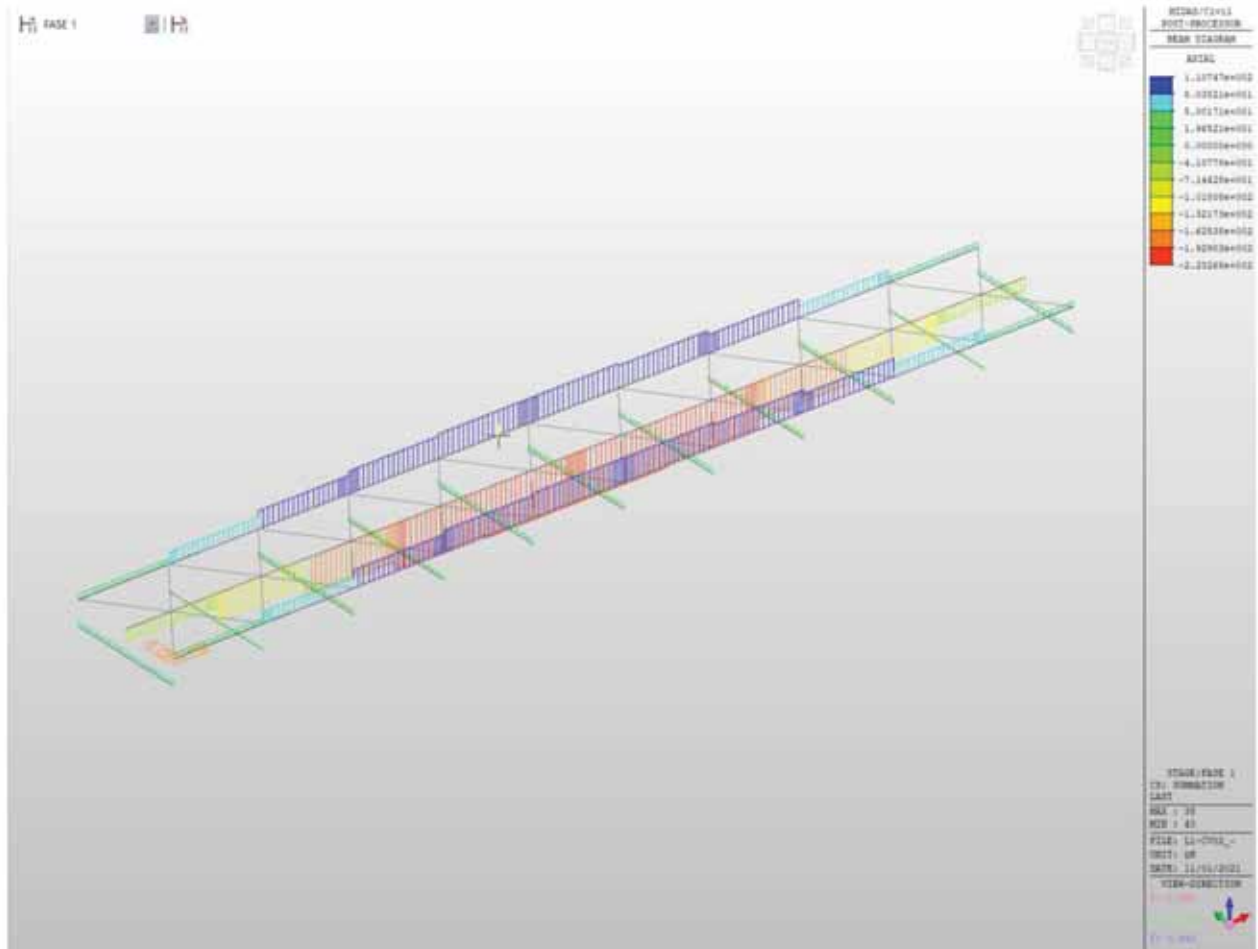


Figura 27 - Diagramma N - Fase 1

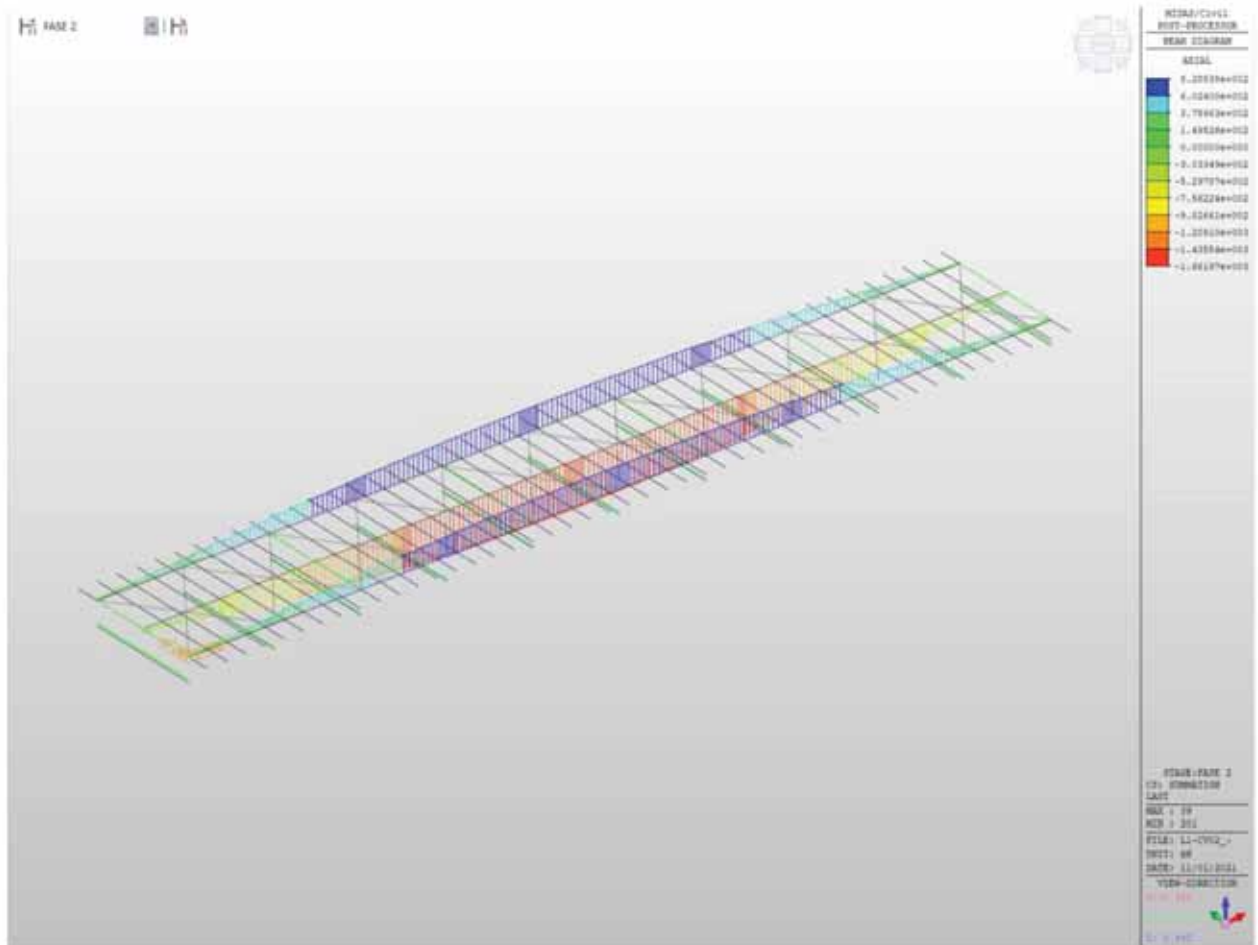


Figura 28 - Diagramma N - Fase 2

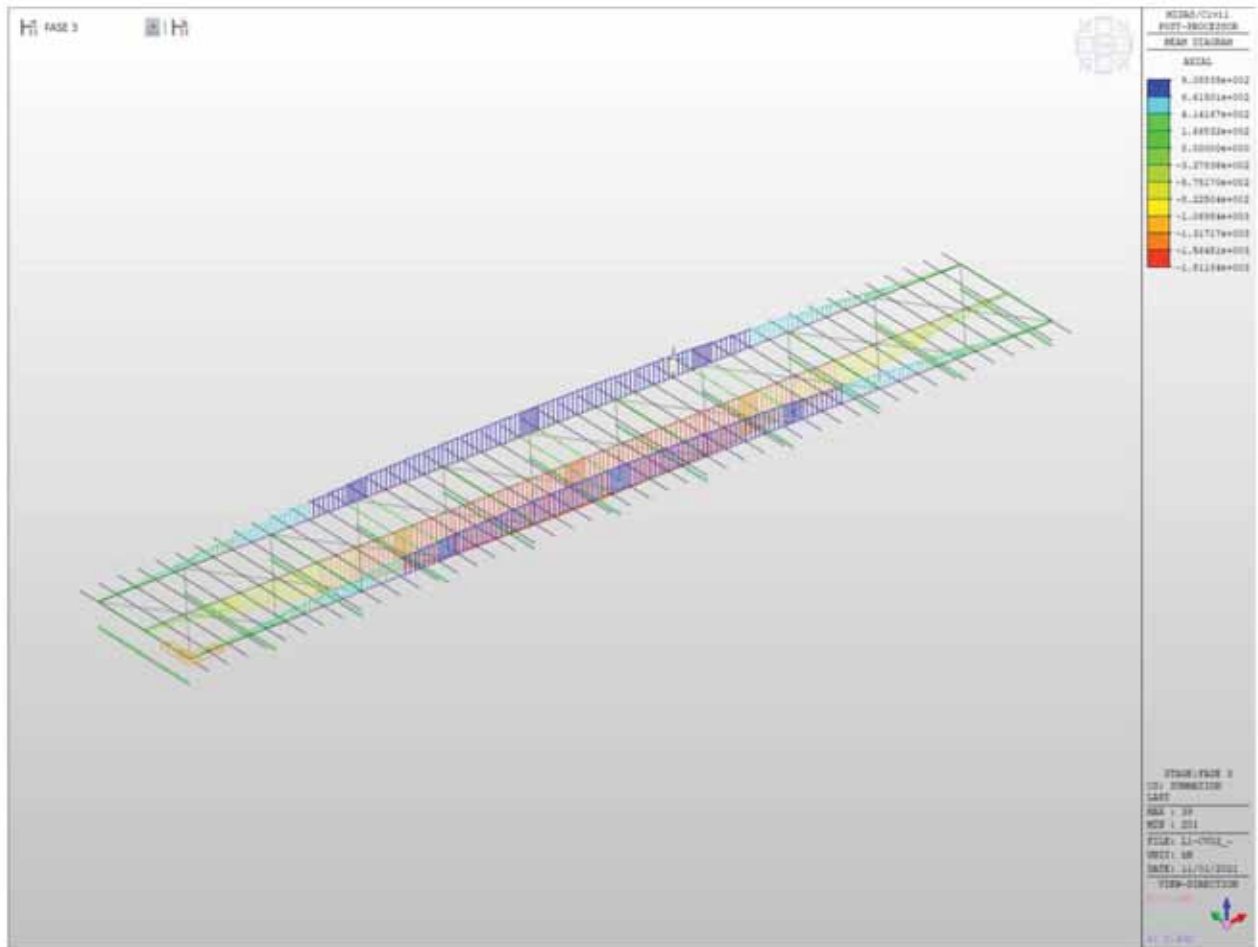


Figura 29 - Diagramma N - Fase 3

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

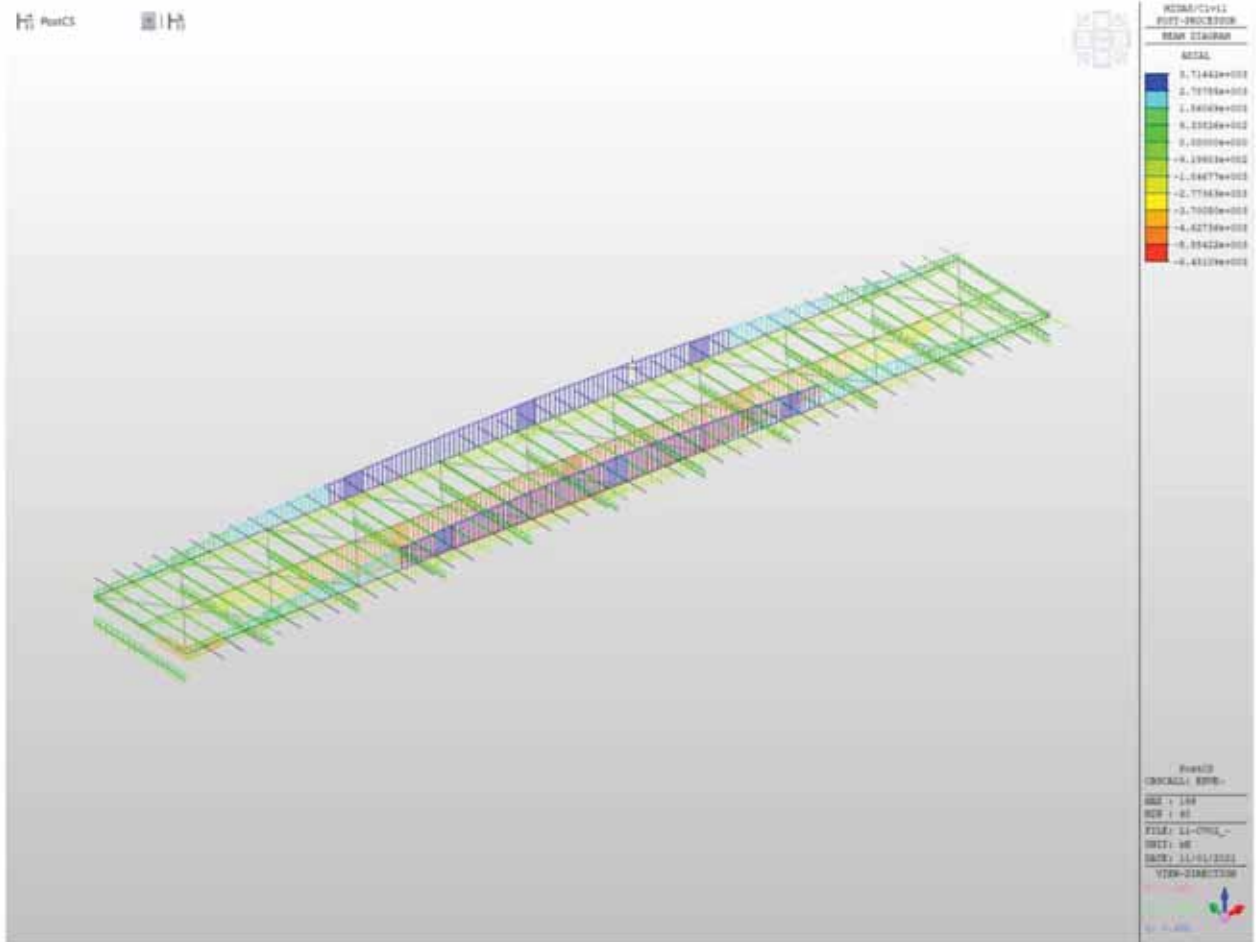


Figura 30 - Diagramma N - Involuppo SLU-SLV

6.2.1.1 TRAVE PRINCIPALE CONCIO 1

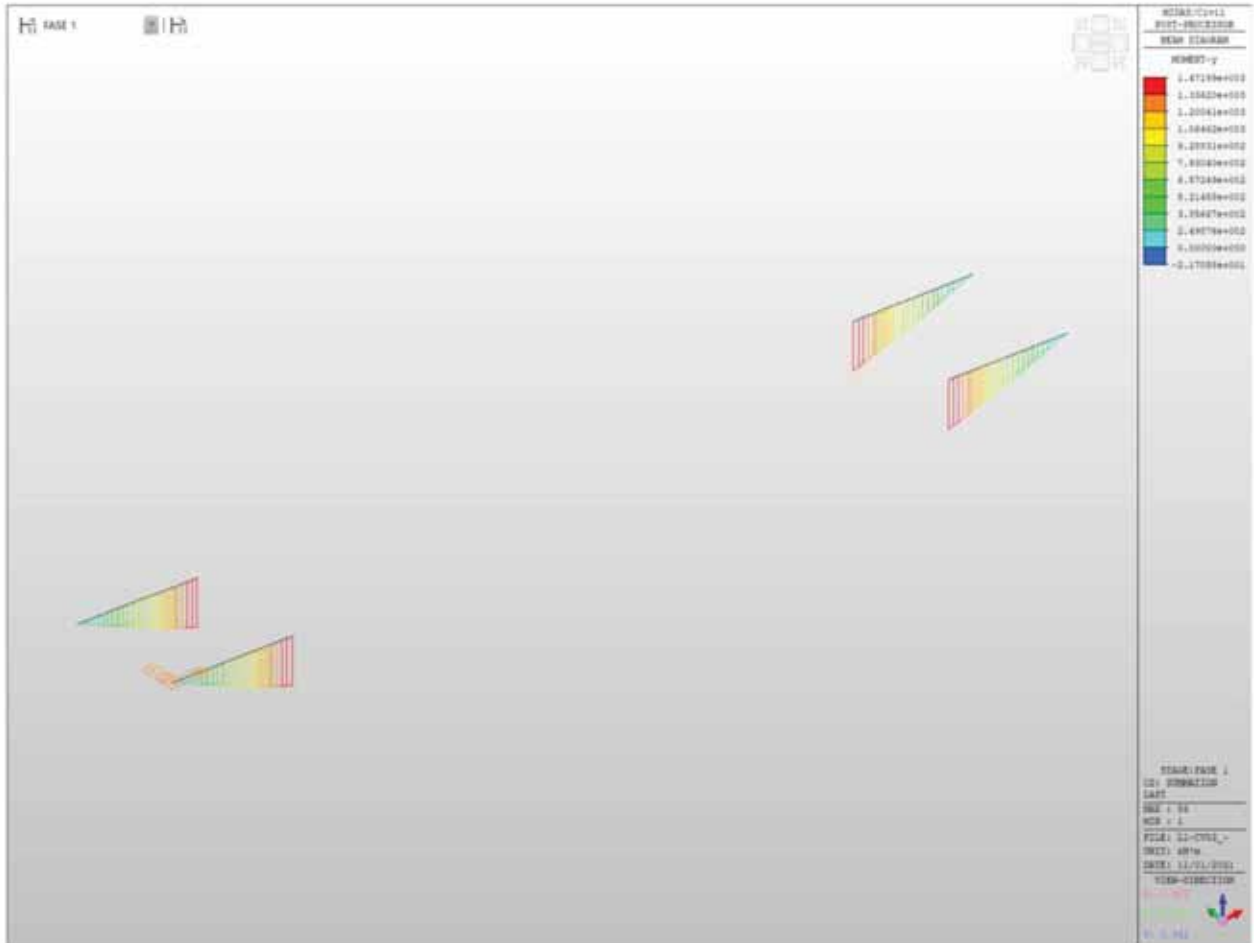


Figura 31 - Concio 1 - Diagramma My - Fase 1

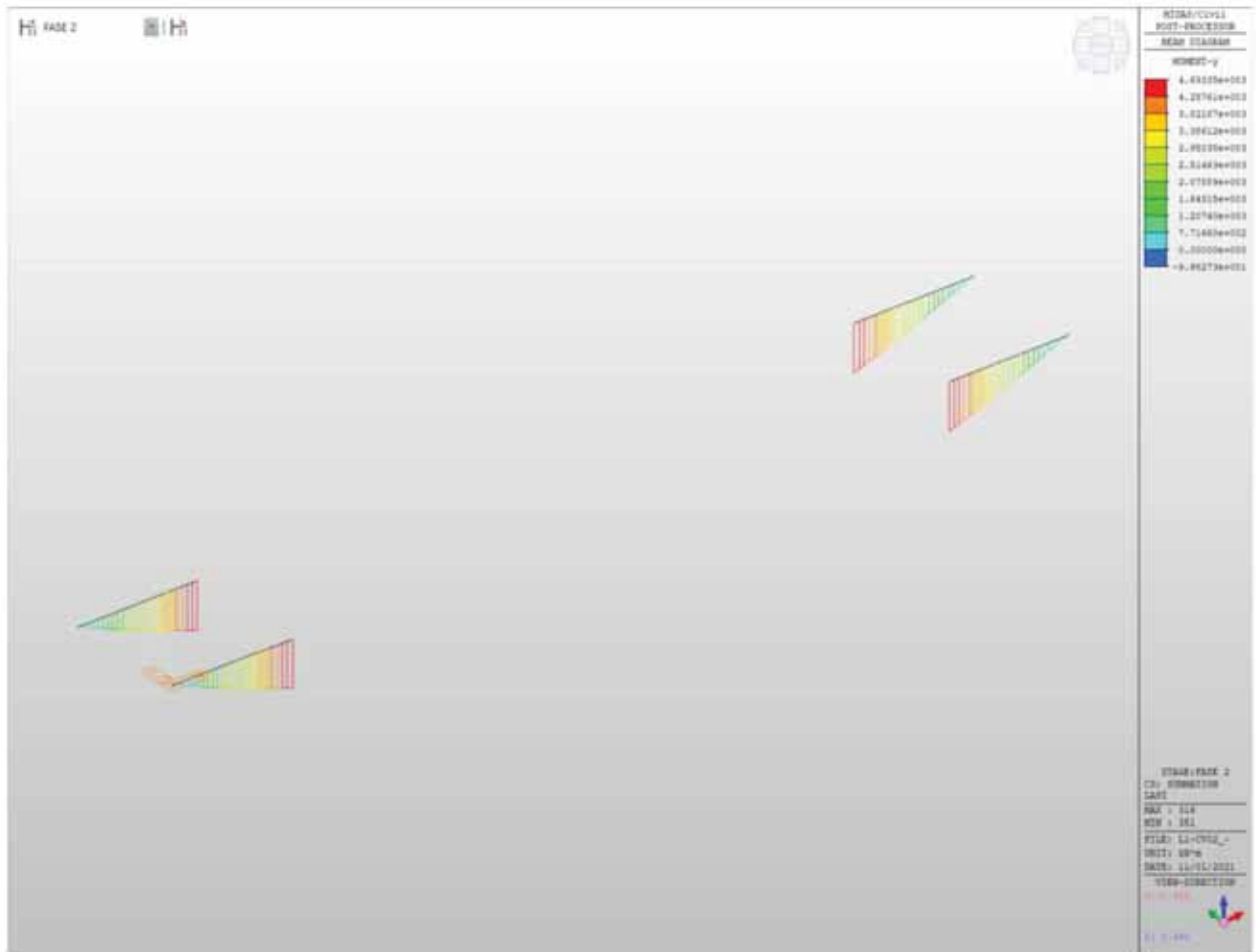


Figura 32 - Concio 1 - Diagramma My - Fase 2

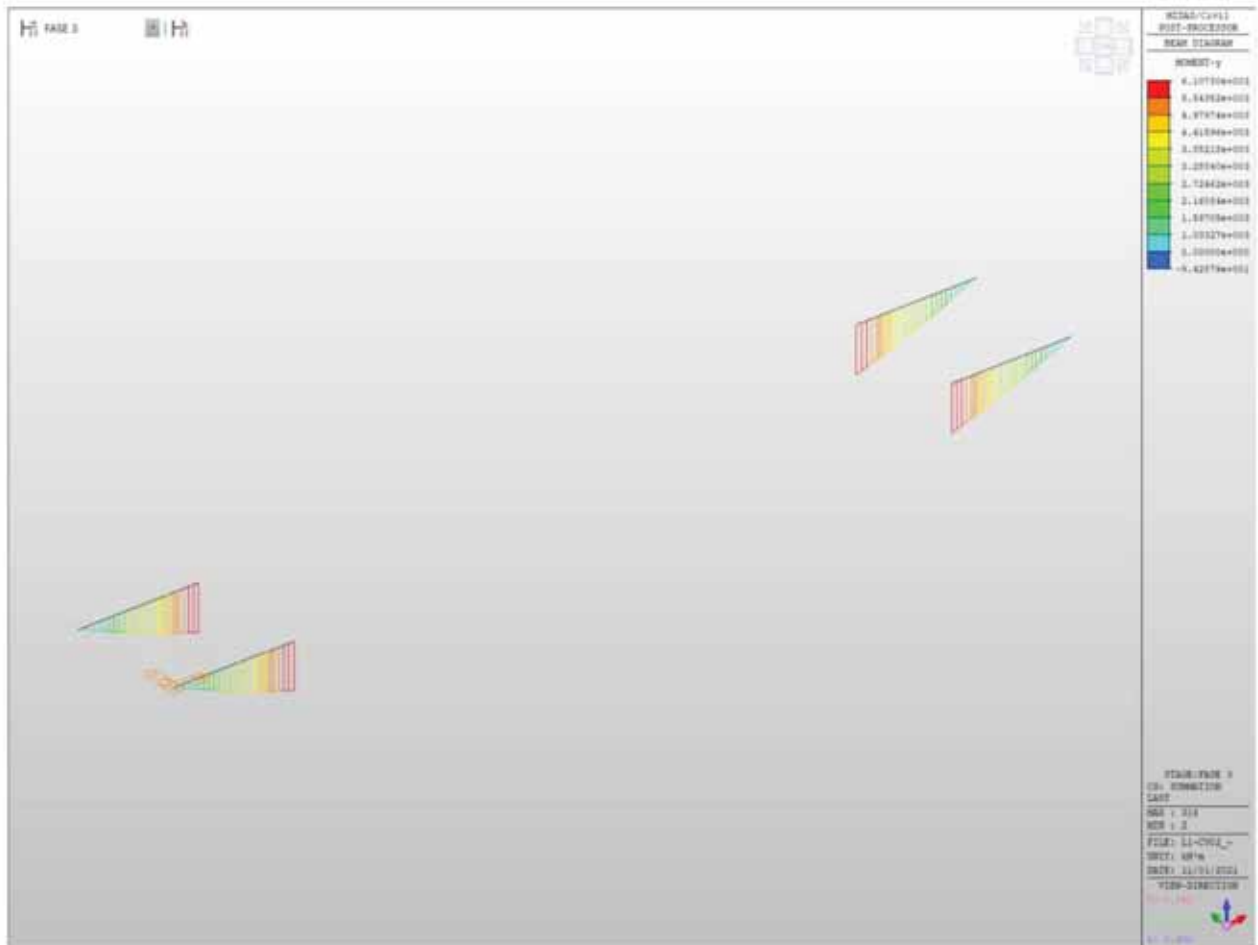


Figura 33 - Concio 1 - Diagramma My - Fase 3

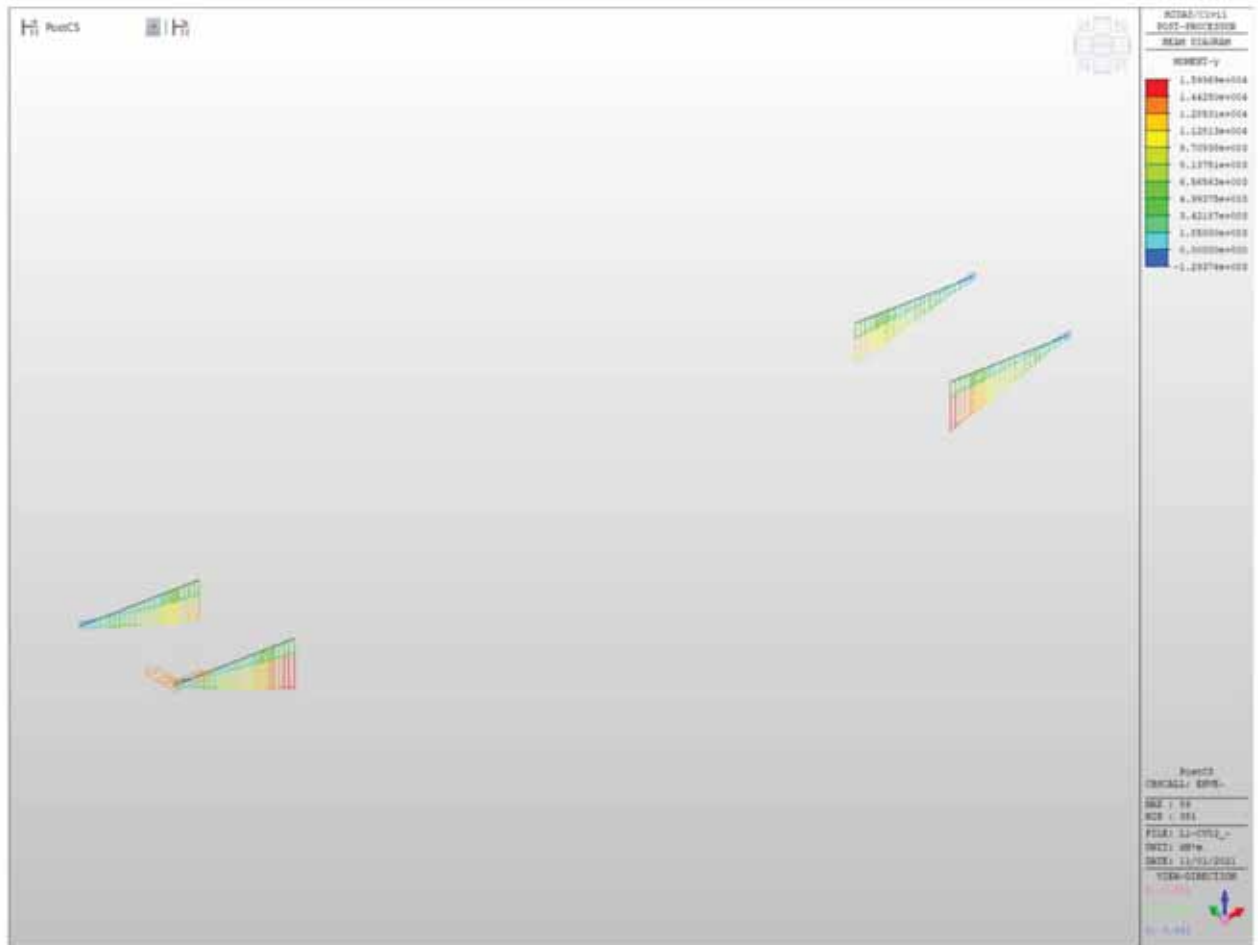


Figura 34 - Concio 1 - Diagramma My - Involuppo SLU-SLV

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

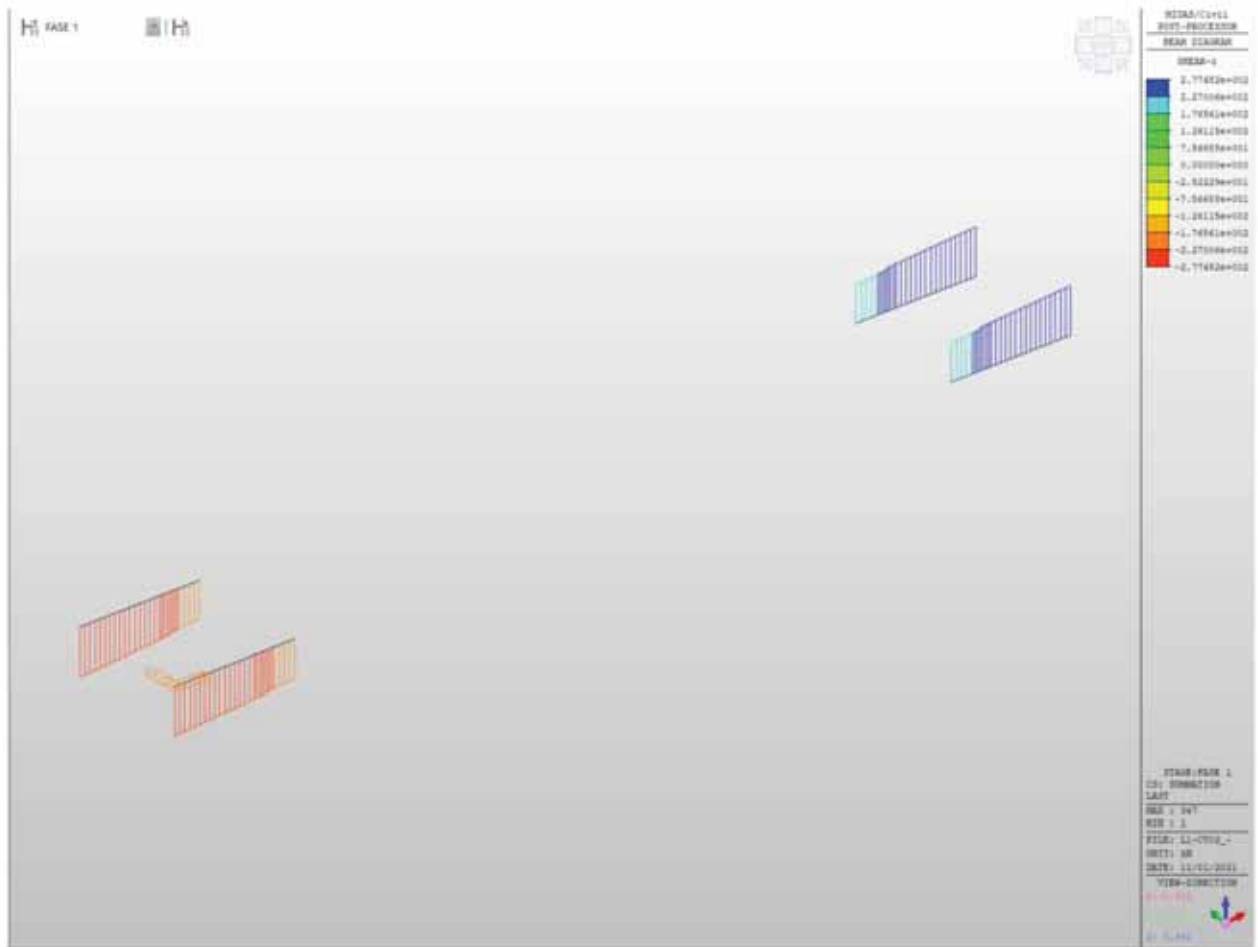


Figura 35 - Concio 1 - Diagramma Tz - Fase 1

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

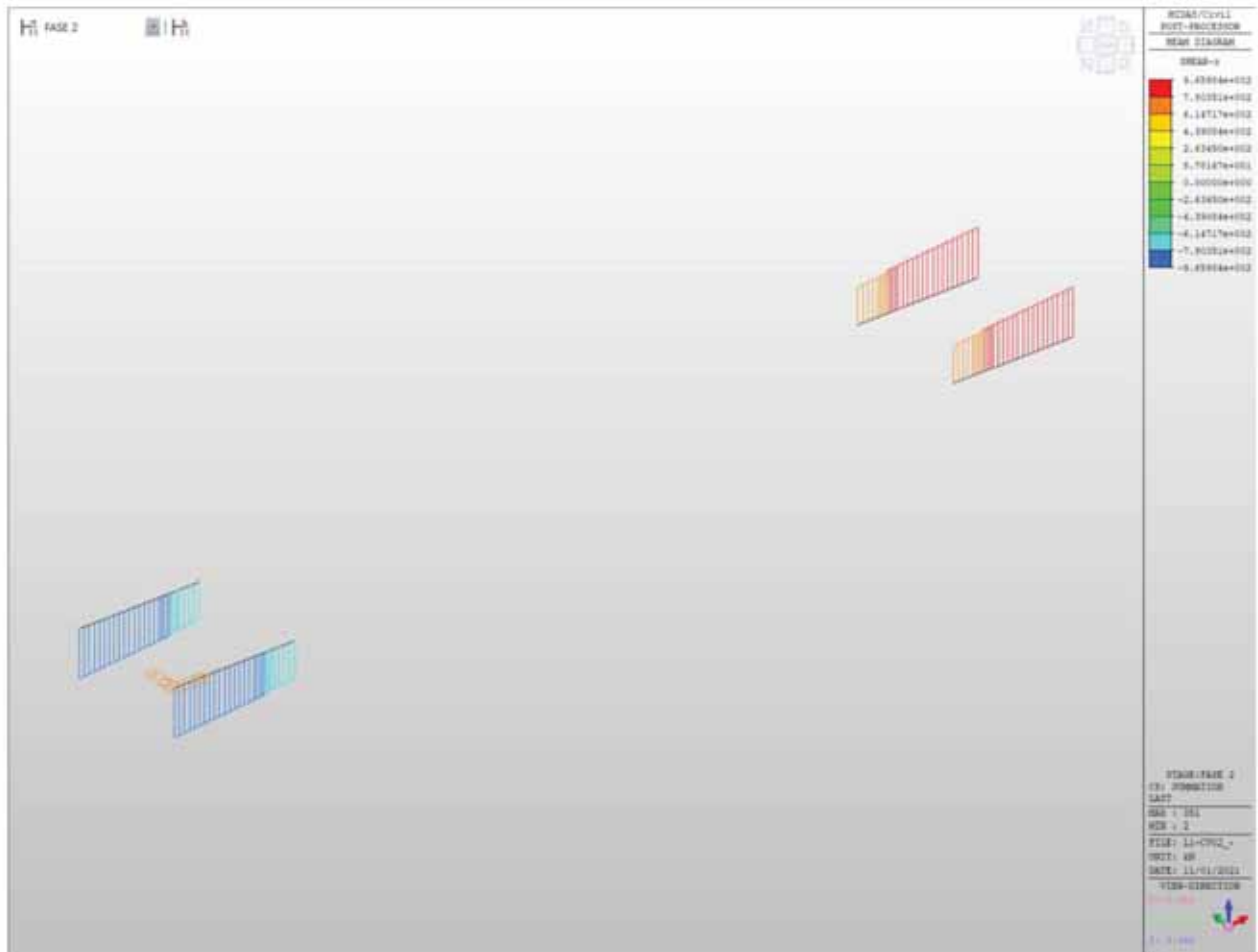


Figura 36 - Concio 1 - Diagramma Tz - Fase 2

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

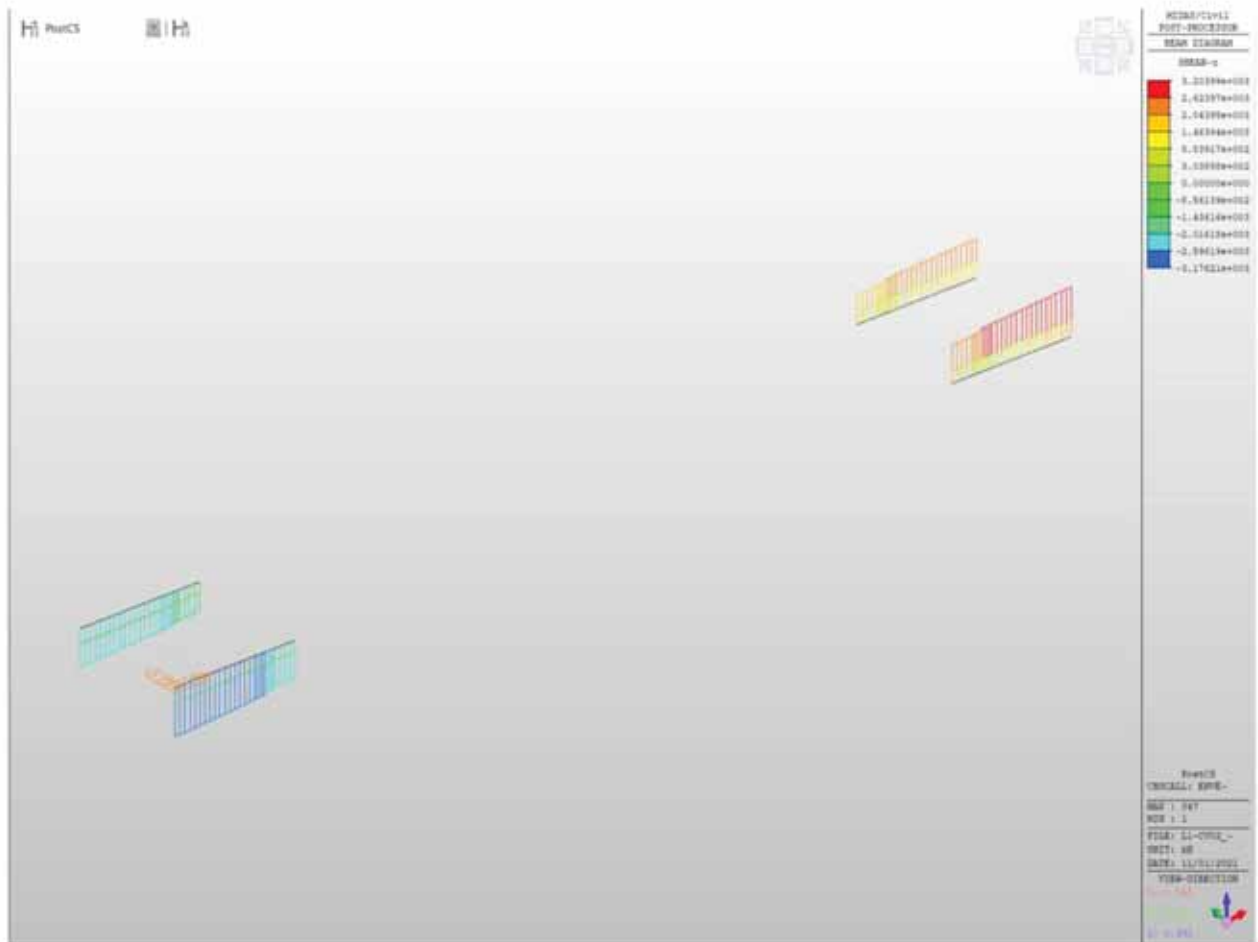


Figura 38 - Concio 1 - Diagramma Tz - Involuppo SLU-SLV

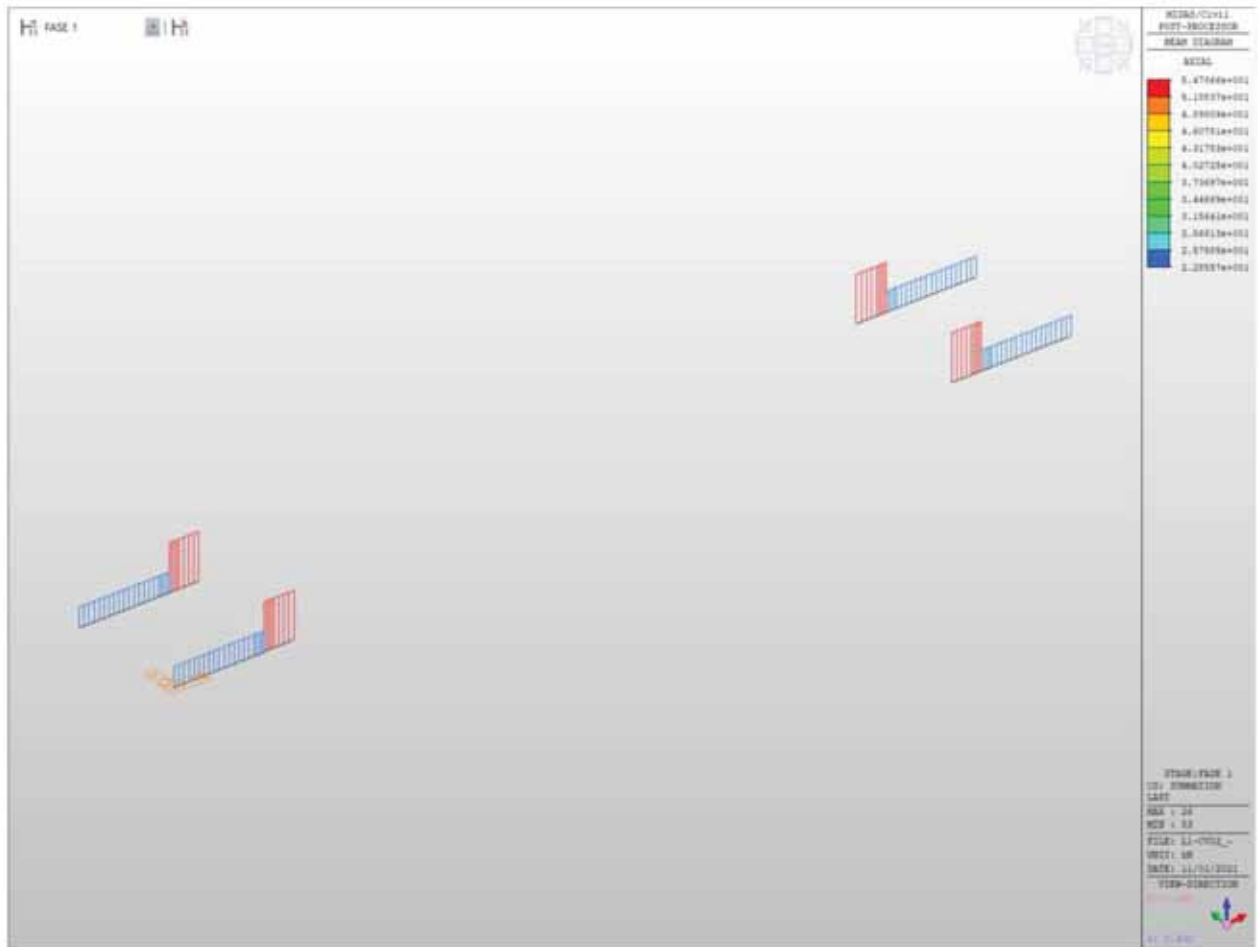


Figura 39 - Concio 1 - Diagramma N - Fase 1

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

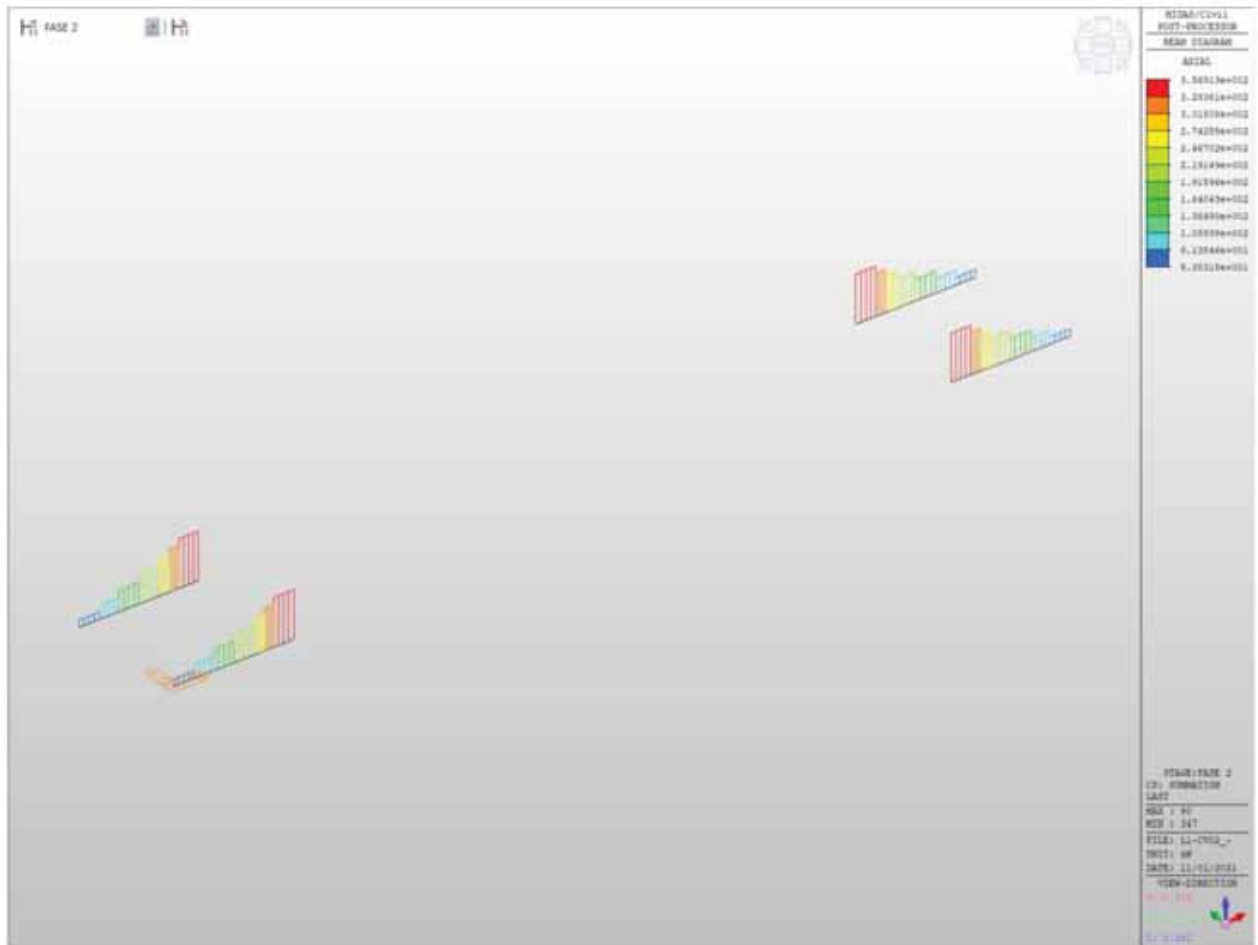


Figura 40 - Concio 1 - Diagramma N - Fase 2

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

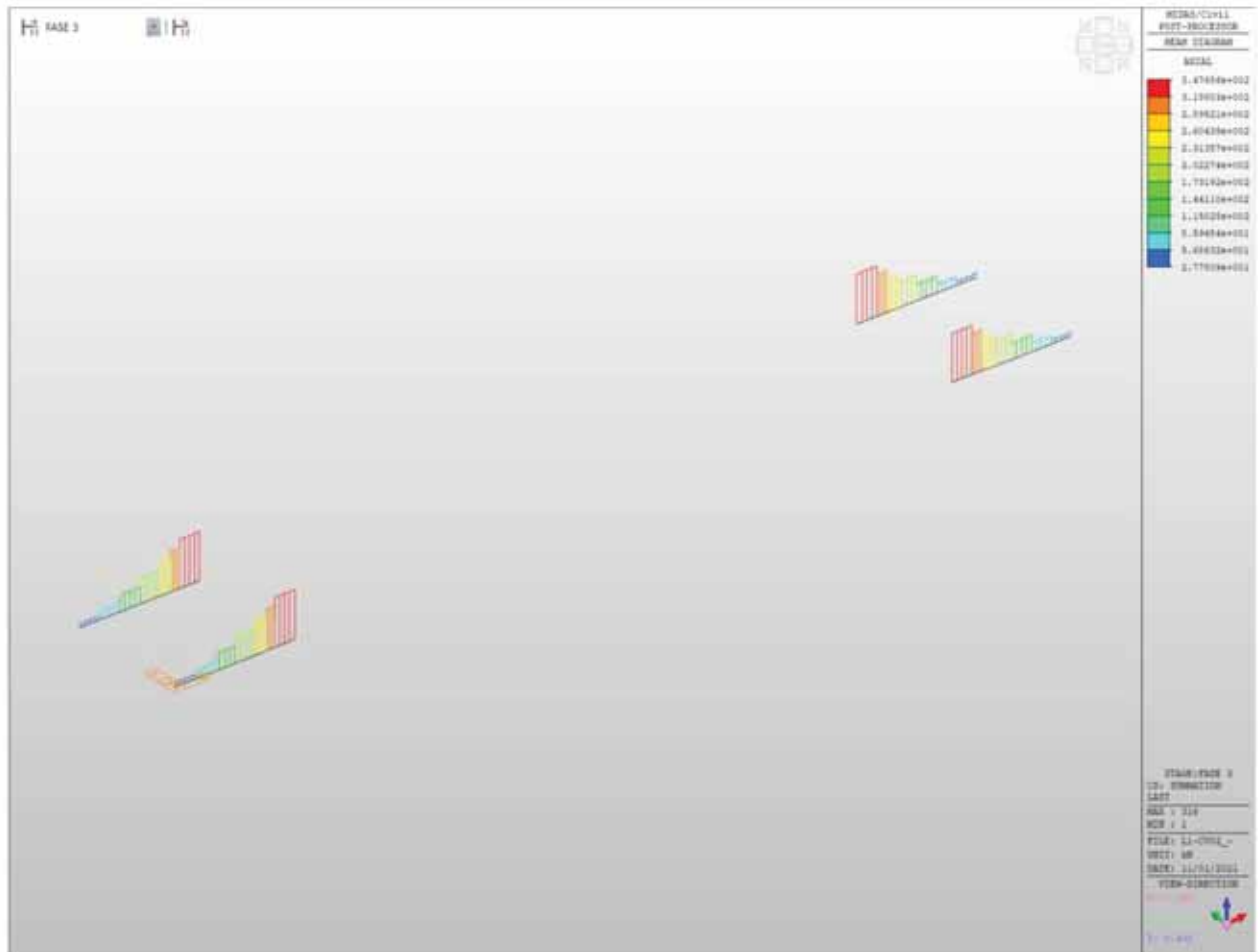
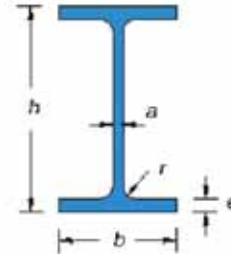


Figura 41 - Concio 1 - Diagramma N - Fase 3



Figura 42 - Concio 1 - Diagramma N - Involuppo SLU-SLV

| <u>VERIFICA SEZIONE IN ACCIAIO COMPOSTA</u> | | | |
|---|---|-------------------|--|
| <u>CARATTERISTICHE PROFILO:</u> | | | |
| Tipo: | S355 | | |
| B _{SUP} = | 750 | mm | |
| t _{f,SUP} = | 25.0 | mm | A _{f,SUP} = 18750.00 mm ² |
| B _{INF} = | 900 | mm | |
| t _{f,INF} = | 30.0 | mm | A _{f,INF} = 27000.00 mm ² |
| H = | 2200 | mm | |
| t _w = a = | 22.0 | mm | A _w = 47190.00 mm ² |
| L = | 4500 | mm | n. traversi: 1 |
| A _{TOT} = | 92940.00 | mm ² | |
| Y _{G,inf} = | 1005.46 | mm | Y _{G,sup} = 1194.54 mm |
| J _{yy} = | 7.12E+10 | mm ⁴ | J _t = 19619570 mm ⁴ |
| J _{zz} = | 2703358383 | mm ⁴ | J _w = 1.069E+09 mm ⁶ |
| W _{el,yy,inf} = | 70839160 | mm ³ | W _{el,yy,sup} = 59626425 mm ³ |
| W _{p,yy} = | 74418483 | mm ³ | |
| W _{p,xx} = | $2 \left[\frac{t_w H^2}{8} + t_f (b - t_w) \frac{H - t_f}{2} + 2r^2 \left(\frac{H}{2} - t_f - \frac{r}{2} \right) - 2 \frac{\pi r^2}{4} \left(\frac{H}{2} - t_f + r + \frac{4r}{3\pi} \right) \right]$ | | |
| ρ _{yy} = | 875.42 | mm | ρ _{xx} = $\sqrt{\frac{J_{xx}}{A}}$ |
| ρ _{zz} = | 170.55 | mm | |
| Peso = | 729.58 | kg/m | |
| E = | 210000 | N/mm ² | modulo elastico |
| ν = | 0.3 | | coeff. poisson |
| G = | 80769 | N/mm ² | G = $\frac{E}{2(1 + \nu)}$ modulo elasticità trasversale |
| α = | 0.000012 | °C ⁻¹ | coeff. espansione termica lineare |
| f _{yk} = | 355 | N/mm ² | tensione snervamento caratteristica |
| f _{tk} = | 510 | N/mm ² | tensione rottura caratteristica |
| γ _{M0} = | 1.05 | | per sezioni classe 1,2,3 e 4 |
| γ _{M1} = | 1.05 | | per instabilità membrature |
| γ _{M1} = | 1.10 | | per instabilità membrature ponti stradali e ferroviari |
| γ _{M2} = | 1.25 | | per sezioni tese indebolite dai fori nei riguardi della frattura |
| <u>SOLLECITAZIONI:</u> | | | |
| N _{t,so} = | 0 | N | caso per trave tesa |
| N _{c,so} = | 357000 | N | caso per trave compressa |
| M _{so} = | 4694000000 | Nmm | caso per trave inflessa in una direzione |
| V _{so} = | 966000 | N | taglio |
| Caso per trave a flessione deviata (Momenti flettenti agenti alle estremità M _B < M _A): | | | |
| M _B = | 998300000 | Nmm | M _A = 4694000000 Nmm |
| Valori del momento massimo e minimo dell'asta: | | | |
| M _{max,y,so} = | 0 | Nmm | M _{max,y,so} = 0 Nmm |
| M _{max,z,so} = | 0 | Nmm | M _{max,z,so} = 0 Nmm |



LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| CLASSE APPARTENENZA PROFILO (NTC2008, 4.2.3.1): | | | | | |
|--|--------------|----------------------|--|--|------------------------|
| ALA SUPERIORE | | ALA INFERIORE | | ANIMA | |
| $C/t_{i,sup} =$ | 14.56 | $C/t_{i,inf} =$ | 14.63 | $C/t_w =$ | 97.50 |
| $\varepsilon =$ | 0.81 | $\varepsilon =$ | 0.81 | $\varepsilon =$ | 0.81 |
| Curva di instabilità "b" (Asse yy): Fattore di imperfezione α : 0.34 | | | | | |
| Curva di instabilità "c" (Asse zz): Fattore di imperfezione a: 0.49 | | | | | |
| SOLLECITAZIONE DELL'ASTA A TAGLIO (NTC2008, 4.2.4.1.2): | | | | | |
| $\frac{V_{sd}}{V_{c,Rd}} \leq 1$ | | | | | |
| Area taglio resistente: | | | $A_v =$ | 47795 | mm ² |
| $V_{c,Rd} = \frac{A_v f_{yk}}{\sqrt{3} \gamma_{M0}}$ | $V_{c,Rd} =$ | 9329554 | N | \Rightarrow | 0.10 OK!(<1) |
| Verifica in presenza di torsione uniforme: | | | | | |
| $\tau_{t,sd} = 0$ N/mm ² | | | | | |
| $V_{c,Rd,red} = \left[1 - \frac{\tau_{t,sd}}{\frac{f_{yk}}{\sqrt{3} \gamma_{M0}}} \right] V_{c,Rd}$ | | | | | |
| $V_{c,Rd,red} =$ | 9329554 | N | \Rightarrow | 0.10 | OK!(<1) |
| Verifica in termini tensionali nel punto più sollecitato: | | | | | |
| $\frac{\tau_{sd}}{\frac{f_{yk}}{\sqrt{3} \gamma_{M0}}} \leq 1 \Rightarrow 0.00$ OK!(<1) | | | | | |
| SOLLECITAZIONE DELL'ASTA A COMPRESSIONE SEMPLICE (NTC2008, 4.2.4.1.2): | | | | | |
| $\frac{N_{sd}}{N_{c,Rd}} \leq 1$ | | | | | |
| $N_{cr} = \frac{\pi^2 EJ}{(\eta l)^2}$ | | 276692659 | N | $N_{c,sd} < 0,04 N_{cr}$ <i>Instabilità trascurabile!</i> | |
| 0.04 Ncr = | | 11067706 N | Instabilità trascurabile se $\lambda < 0.2$ | | |
| Calcolo snellezza membrana (< di 200 per le travature principali e < di 250 per le secondarie): | | | | | |
| $\mu =$ | 1.00 | $l_0 = \mu l =$ | 4500 | mm | |
| $\lambda = l_0 / \rho =$ | 5 | | | | |
| Calcolo resistenza per sezioni in classe 1,2 e 3: | | | | | |
| $N_{c,Rd} = \frac{A f_{yk}}{\gamma_{M0}}$ | $N_{c,Rd} =$ | 31422571 | N | \Rightarrow | 0.01 OK!(<1) |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| STABILITA' DELLE MEMBRATURE (NTC2008, 4.2.4.1.3): | | | |
|--|--------------------------|--|--|
| Curva di instabilità "b" (Asse yy): | | | |
| Fattore di imperfezione α : | 0.49 | | |
| Verifica per sezioni classe 1,2 e 3: | | | |
| $\bar{\lambda} = \sqrt{\frac{A f_{yk}}{N_{cr}}}$ | 0.35 | $\bar{\lambda} > 0.2$ | Serve verifica instabilità! |
| $\Phi = 0.5 [1 + \alpha(\bar{\lambda} - 0.2) + \bar{\lambda}^2]$ | 0.60 | | |
| $\chi = \frac{1}{\Phi + \sqrt{\Phi^2 - \bar{\lambda}^2}}$ | 0.93 | | |
| $N_{b,Rd} = \frac{\chi A f_{yk}}{\gamma_{M1}}$ | 27771396 | N | |
| $\frac{N_{c,ed}}{N_{b,Rd}} \leq 1$ | => | 0.01 | OK!(<1) |
| SOLLECITAZIONE DELL'ASTA A FLESSIONE MONOASSIALE RETTA (NTC2008, 4.2.4.1.2): | | | |
| $\frac{M_{ed}}{M_{e,Rd}} \leq 1$ | | | |
| $V_{sd} < 0.5 V_{c,M}$ | | <i>Il taglio non influisce sulla verifica a flessione!</i> | |
| $\rho = \left[\frac{2V_{sd}}{V_{e,Rd}} - 1 \right]^2$ | 0.62872 | $f_{y,red} = (1 - \rho)f_{yk}$ | 132 N/mm ² |
| | | $f_{yk} =$ | 355 N/mm ² |
| Calcolo resistenza elastica sezione lorda, classe 3: | | | |
| $M_{eI,Rd} = \frac{W_{el,min} f_{yk}}{\gamma_{M0}}$ | $M_{eI,Rd} =$ | 23950382795 Nmm | => 0.20 OK!(<1) |
| n. fori = | | diametro = | mm |
| $\frac{0,9 A_{f,net} f_{tk}}{\gamma_{M2}} \geq \frac{A_f f_{yk}}{\gamma_{M0}}$ | | | <i>Non serve la verifica per la presenza dei fori!</i> |
| TRAVI INFLESSE (NTC2008, 4.2.4.1.3.2): | | | |
| Calcolo snellezza membrana (< di 200 per le travature principali e < di 250 per le secondarie): | | | |
| $\mu =$ | 0.70 | $L_{cr} = L / \mu =$ | 3150 mm |
| $W_{yy} =$ | 70839160 mm ³ | $W_{yy} =$ | 59626425 mm ³ |
| $\psi = 1.75 - 1.05 \frac{M_B}{M_A} + 0.3 \left(\frac{M_B}{M_A} \right)^2$ | | | 1.54 |
| $M_{cr} = \psi \frac{\pi}{L_{cr}} \sqrt{E J_y G J_T} \sqrt{1 + \left(\frac{\pi}{L_{cr}} \right)^2 \frac{E J_0}{G J_T}}$ | | 2.365E+11 Nmm | 0.020 |
| $M_{ed}/M_{cr} =$ | 0.020 | | <i>Risulta < 0.16 Non serve la verifica instabilità</i> |
| $\bar{\lambda}_{LT} = \sqrt{\frac{W_{yy} f_{yk}}{M_{cr}}}$ | 0.30 | | <i>Risulta < 0.4 Non serve la verifica instabilità</i> |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Stabilità dei pannelli soggetti a taglio (NTC2008, 4.2.4.1.3.4.1):

Se irrigiditori trasversali rigido o no,

$$I_{st} = 45000000 \text{ mm}^4 \quad 0.75hwt^3 = 8398511 \text{ mm}^4 \quad \text{Irrigiditore Trasversali rigidi}$$

Coefficiente minimo di instabilità per taglio del pannello (In assenza di irrigiditori longitudinali),

$$a/hw = 2.05 \quad k_{\tau} = 7.30$$

Coefficiente minimo di instabilità per taglio del pannello (irrigiditori longitudinali più di due o $a/hw > 3$),

$$I_{sl} = 0 \text{ mm}^4 \quad k_{\tau l} = 0.00$$

$$a/hw = 2.05 \quad k_{\tau} = 7.30$$

Coefficiente minimo di instabilità per taglio del pannello (irrigiditori longitudinali più di due o $a/hw < 3$),

$$I_{sl} = 0 \text{ mm}^4 \quad a/hw = 2.05 \quad k_{\tau} = 5.61$$

$$k_{\tau} = 7.30$$

$$\eta = 1.2 \quad hw/t = 97.50 \quad \text{Serve la verifica di instabilità}$$

$$\sigma_E = 19 \text{ MPa} \quad \tau_{cr} = 138.62 \quad \lambda_w = 1.22$$

Montanti di appoggio rigidi,

$$\chi_w = 0.71$$

Gli altri casi,

$$\chi_w = 0.68$$

$$V_{bw,Rd} = 6447333 \text{ N}$$

Momento resistente sole piattabande,

$$Y_{G,inf} = 905.37 \text{ mm} \quad Y_{G,sup} = 1294.63 \text{ mm}$$

$$J_{yy} = 52229812526 \text{ mm}^4$$

$$W_{el,yy,inf} = 57688988 \text{ mm}^3 \quad W_{el,yy,sup} = 40343392 \text{ mm}^3$$

$$M_{t,red} = 13325098157 \text{ Nmm}$$

$$bf = 303.75 \text{ mm} \quad V_{bf,Rd} = 36539 \text{ N}$$

$$V_{b,Rd} = 6483871 \text{ N} \quad 0.149 \quad \text{OK! (<1)}$$

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| Stabilità dei pannelli soggetti a Compressione (NTC2008, 4.2.4.1.3.4.1): | | | | | |
|--|----------|-----------------|--------------|-------------------|--------------------------|
| Stress, | | | | | |
| $\sigma_{sup} =$ | 78.72 | MPa | | | |
| $\sigma_{inf} =$ | -66.26 | MPa | | | |
| $\sigma_{ir.} =$ | 45.11 | MPa | | | |
| Irrigidati su entrambi i lati (Anima), | | | | | |
| b = | 2145.0 | mm | (Web bw) | a = | 4500 mm |
| $\sigma_1 =$ | 78.7 | (Max) | | $\sigma_2 =$ | -66.26 (Min) |
| $\psi =$ | -0.8 | | | $k\sigma =$ | 20.03 |
| $\lambda_p =$ | 0.9 | | | $\rho =$ | 1.00 |
| $\sigma_{cr,p} =$ | 400.4 | MPa | | $\sigma_{cr,c} =$ | 4.536 MPa |
| $\zeta =$ | 1.0 | | | $\lambda_c =$ | 8.846 |
| $\alpha =$ | 0.34 | | | $\Phi =$ | 115.523 |
| $\chi_c =$ | 0.004 | | | | |
| $\rho_c =$ | 1.00 | | | | |
| $b_{eff} =$ | 1164.67 | mm | $b_{e1} =$ | 465.87 | mm |
| | | | $b_{e2} =$ | 698.80 | mm |
| $b_t =$ | 980.33 | mm | | | |
| Irrigidati a un lato (Piattebande), | | | | | |
| Piattebanda Superiore, | | | | | |
| b = | 364 | mm | (Flange Sup) | | |
| σ (Irr.) = | 78.7 | | | σ (Lib.) = | 78.72 |
| $k\sigma =$ | 0.43 | | | | |
| $\lambda_p =$ | 1.1 | | | $\rho =$ | 0.76 |
| $b_{eff} =$ | 274.98 | mm | | $b_t =$ | 0 mm |
| Effective Section Properties, | | | | | |
| $A_{c,eff}$ (Piattebanda Sup) = | 13749.1 | mm ² | | | |
| $A_{c,eff}$ (Piattebanda Inf) = | 27000.0 | mm ² | | | |
| $A_{c,eff}$ (Anima) = | 25622.8 | mm ² | | | |
| A_c (Anima tensione) = | 21567.2 | mm ² | | | |
| $A_{c,eff}$ (Total) = | 87939.1 | mm ² | | | |
| $Y_{g,inf} =$ | 938.2 | mm | | $Y_{g,sup} =$ | 1261.8 mm |
| $I_{eff} =$ | 6.59E+10 | mm ⁴ | | | |
| W_{eff} (inf) = | 70244994 | mm ³ | | W_{eff} (sup) = | 52234067 mm ³ |
| e = | 67.22 | mm | | | |
| $\eta =$ | 0.27 | | | | |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Fase 2

Soletta c.a. collaborante

| | | |
|------------------|---------|----------------|
| b_{eff} = | 2.84 | m |
| Altezza soletta: | 0.26 | m |
| Area soletta: | 0.74 | m ² |
| I_{yy} = | 0.00416 | m ⁴ |
| Peso = | 18.46 | kN/m |

Trave acciaio

| | | |
|---------------------|----------|----------------|
| Area trave acciaio: | 0.09294 | m ² |
| H trave acciaio: | 2.20 | m |
| y_G = | 1.005 | m |
| I_{yy} = | 0.071226 | m ⁴ |
| Peso = | 7.30 | kN/m |

Barre armatura soletta

| 1° strato barre (superiore) | | 2° strato barre (inferiore) | |
|-----------------------------|-------------------------|-----------------------------|-------------------------|
| n. Barre: | 14 | n. Barre: | 14 |
| Interasse: | 0.20 m | Interasse: | 0.20 m |
| Diametro: | 0.02 m | Diametro: | 0.02 m |
| Area: | 0.004398 m ² | Area: | 0.004398 m ² |
| y_1 = | 0.05 m | y_2 = | 0.21 m |

n = 18.0

Coeff. omogeneizzazione con viscosità in atto

Materiali

| cls | Barre armature | Acciaio |
|----------------------|-------------------------|-------------------------|
| R_{ck} = 40 MPa | f_{yk} = 450 MPa | f_{yk} = 355 MPa |
| f_{ck} = 33.20 MPa | γ_M = 1.15 | γ_{M0} = 1.05 |
| f_{ed} = 18.81 MPa | $f_{yk,s}$ = 391.30 MPa | $f_{yk,s}$ = 338.10 MPa |
| f_{cm} = 41.2 MPa | | |
| f_{ctm} = 3.10 MPa | | |
| E_{cm} = 33643 MPa | | |

Caratteristiche geometriche

| | |
|---------------------------------------|--|
| A_a = 0.1428 m ² | Area sezione omogeneizzata in area di acciaio |
| A_v = 47795 mm ² | Area taglio sezione di acciaio |
| $y_{G,inf,d}$ = 1.47 m | Asse neutro rispetto lembo inferiore: |
| $y_{G,sup,d}$ = 0.99 m | Asse neutro rispetto lembo superiore |
| $J_{ax,d}$ = 0.128415 m ⁴ | Momento d'inerzia sezione omogeneizzata ad acciaio |
| $W_{inf,d}$ = 0.087495 m ³ | Modulo elastico sezione omogeneizzata ad acciaio |
| $W_{sup,d}$ = 0.129409 m ³ | Modulo elastico sezione omogeneizzata ad acciaio |

Sollecitazioni

| | | |
|-------------------------|-------|----------|
| M_{sd} = 6107.00 kNm | (SLU) | |
| M_{st} = 29581.49 kNm | => | 0.21 ok! |
| T_{sd} = 1254.00 kN | (SLU) | |
| T_{st} = 8885.29 kN | => | 0.14 ok! |

Tensioni

| | | | |
|------------------------------|----|--------------|-------------------------------------|
| σ_t = 2.62 MPa | => | 0.14 ok!(<1) | Tensione al lembo superiore soletta |
| $\sigma_{t,sup}$ = 44.81 MPa | => | 0.11 ok!(<1) | Tensione barre superiori soletta |
| $\sigma_{t,inf}$ = 37.20 MPa | => | 0.10 ok!(<1) | Tensione barre inferiori soletta |
| $\sigma_{a,sup}$ = 34.83 MPa | => | 0.10 ok!(<1) | Tensione acciaio lembo superiore |
| $\sigma_{a,inf}$ = 69.80 MPa | => | 0.21 ok!(<1) | Tensione acciaio lembo inferiore |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Fase 3

Soletta c.a. collaborante

| | | |
|------------------|---------|----------------|
| b_{eff} = | 2.84 | m |
| Altezza soletta: | 0.26 | m |
| Area soletta: | 0.74 | m ² |
| J_{xx} = | 0.00416 | m ⁴ |
| Peso = | 18.46 | kN/m |

Trave acciaio

| | | |
|---------------------|----------|----------------|
| Area trave acciaio: | 0.09294 | m ² |
| H trave acciaio: | 2.20 | m |
| y_G = | 1.005 | m |
| J_{xx} = | 0.071226 | m ⁴ |
| Peso = | 7.30 | kN/m |

Barre armatura soletta

| 1° strato barre (superiore) | | 2° strato barre (inferiore) | |
|-----------------------------|-------------------------|-----------------------------|-------------------------|
| n. Barre: | 14 | n. Barre: | 14 |
| Interasse: | 0.20 m | Interasse: | 0.20 m |
| Diametro: | 0.02 m | Diametro: | 0.02 m |
| Area: | 0.004398 m ² | Area: | 0.004398 m ² |
| y_1 = | 0.05 m | y_2 = | 0.21 m |

n = 6.2 Coeff. omogeneizzazione a tempo infinito

Materiali

| cls | Barre armature | Acciaio |
|----------------------|-------------------------|-------------------------|
| R_{ck} = 40 MPa | f_{yk} = 450 MPa | f_{yk} = 355 MPa |
| f_{ck} = 33.20 MPa | γ_M = 1.15 | γ_{M0} = 1.05 |
| f_{td} = 18.81 MPa | $f_{yk,s}$ = 391.30 MPa | $f_{yk,s}$ = 338.10 MPa |
| f_{cm} = 41.2 MPa | | |
| f_{dm} = 3.10 MPa | | |
| E_{cm} = 33643 MPa | | |

Caratteristiche geometriche

| | | | |
|-----------------|----------|-----------------|--|
| A_{o} = | 0.2208 | m ² | Area sezione omogeneizzata in area di acciaio |
| A_v = | 47795 | mm ² | Area taglio sezione di acciaio |
| $y_{G,inf,d}$ = | 1.77 | m | Asse neutro rispetto lembo inferiore: |
| $y_{G,sup,d}$ = | 0.69 | m | Asse neutro rispetto lembo superiore |
| $J_{o,d}$ = | 0.166384 | m ⁴ | Momento d'inerzia sezione omogeneizzata ad acciaio |
| $W_{inf,d}$ = | 0.093867 | m ³ | Modulo elastico sezione omogeneizzata ad acciaio |
| $W_{sup,d}$ = | 0.242033 | m ³ | Modulo elastico sezione omogeneizzata ad acciaio |

Sollecitazioni

| | | | | |
|------------|----------|-----|-------|----------|
| M_{ed} = | 15996.00 | kNm | (SLU) | |
| M_{td} = | 31735.99 | kNm | => | 0.50 ok! |
| T_{ed} = | 3204.00 | kN | (SLU) | |
| T_{td} = | 8885.29 | kN | => | 0.36 ok! |

Tensioni

| | | | | | |
|--------------------|--------|-----|----|--------------|-------------------------------------|
| σ_c = | 10.66 | MPa | => | 0.57 ok!(<1) | Tensione al lembo superiore soletta |
| $\sigma_{s,up}$ = | 61.28 | MPa | => | 0.16 ok!(<1) | Tensione barre superiori soletta |
| $\sigma_{s,inf}$ = | 45.90 | MPa | => | 0.12 ok!(<1) | Tensione barre inferiori soletta |
| $\sigma_{a,up}$ = | 41.09 | MPa | => | 0.12 ok!(<1) | Tensione acciaio lembo superiore |
| $\sigma_{a,inf}$ = | 170.41 | MPa | => | 0.50 ok!(<1) | Tensione acciaio lembo inferiore |

6.2.1.2 TRAVE PRINCIPALE CONCIO 2

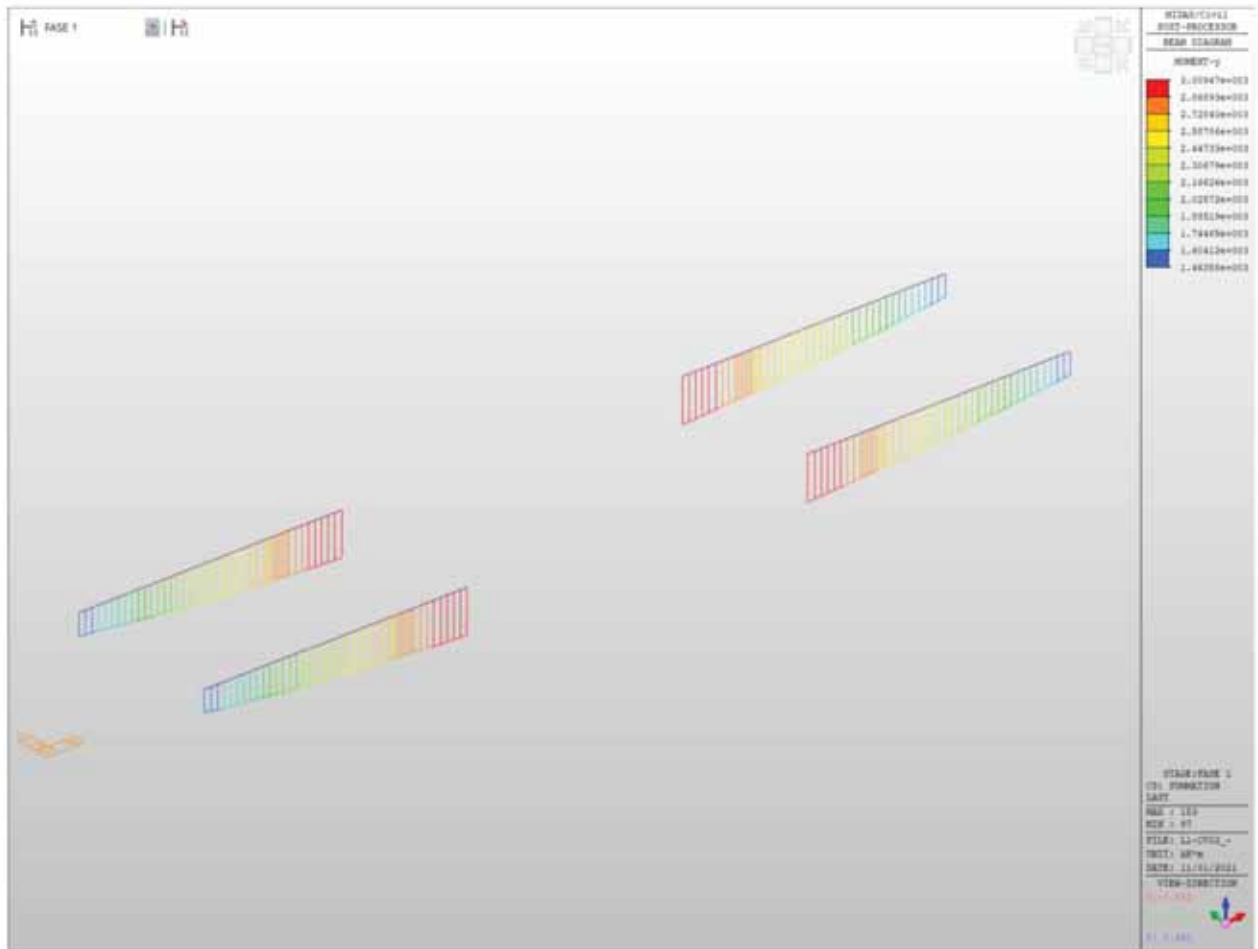


Figura 43 - Concio 2 - Diagramma My - Fase 1

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

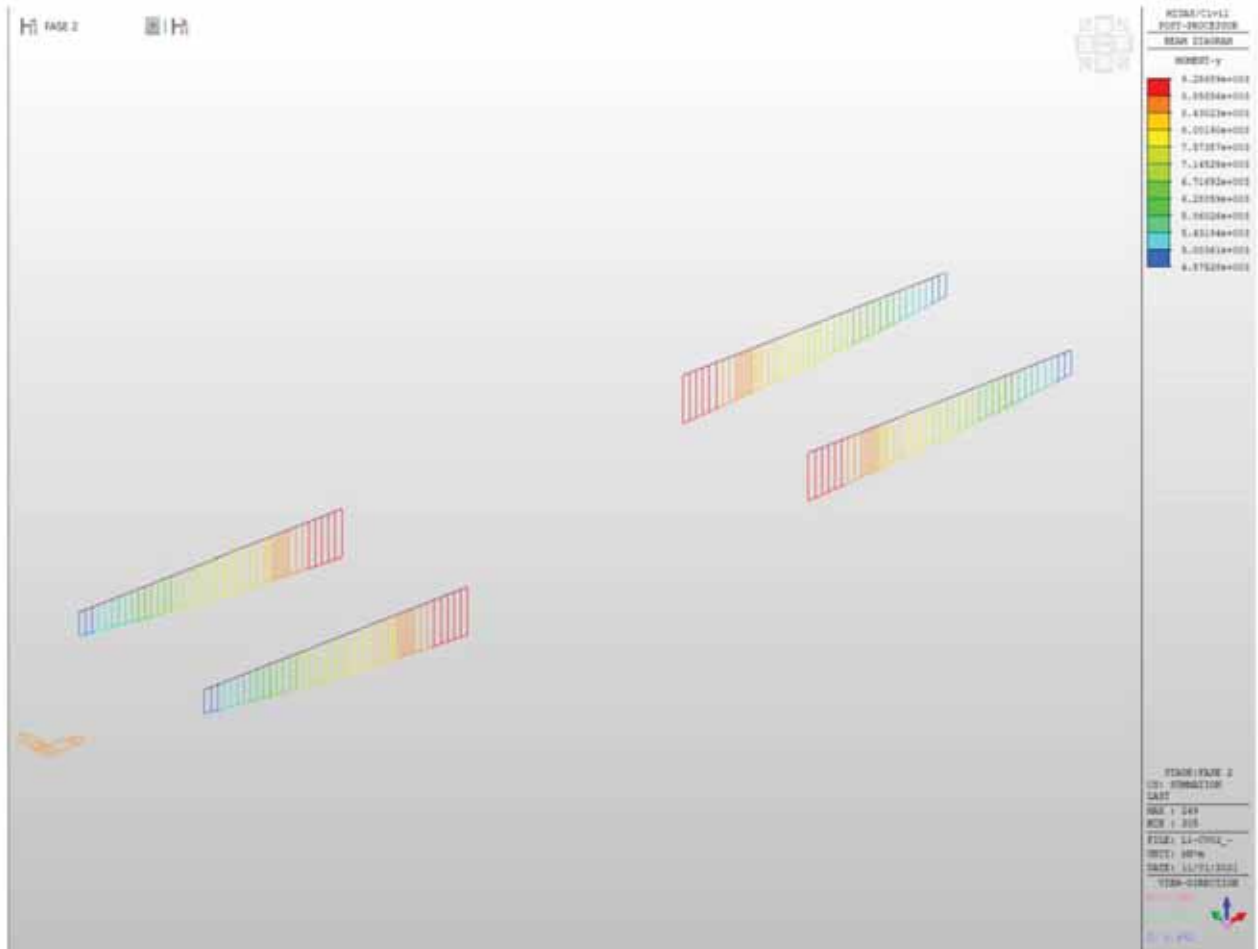


Figura 44 - Concio 2 - Diagramma My - Fase 2

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

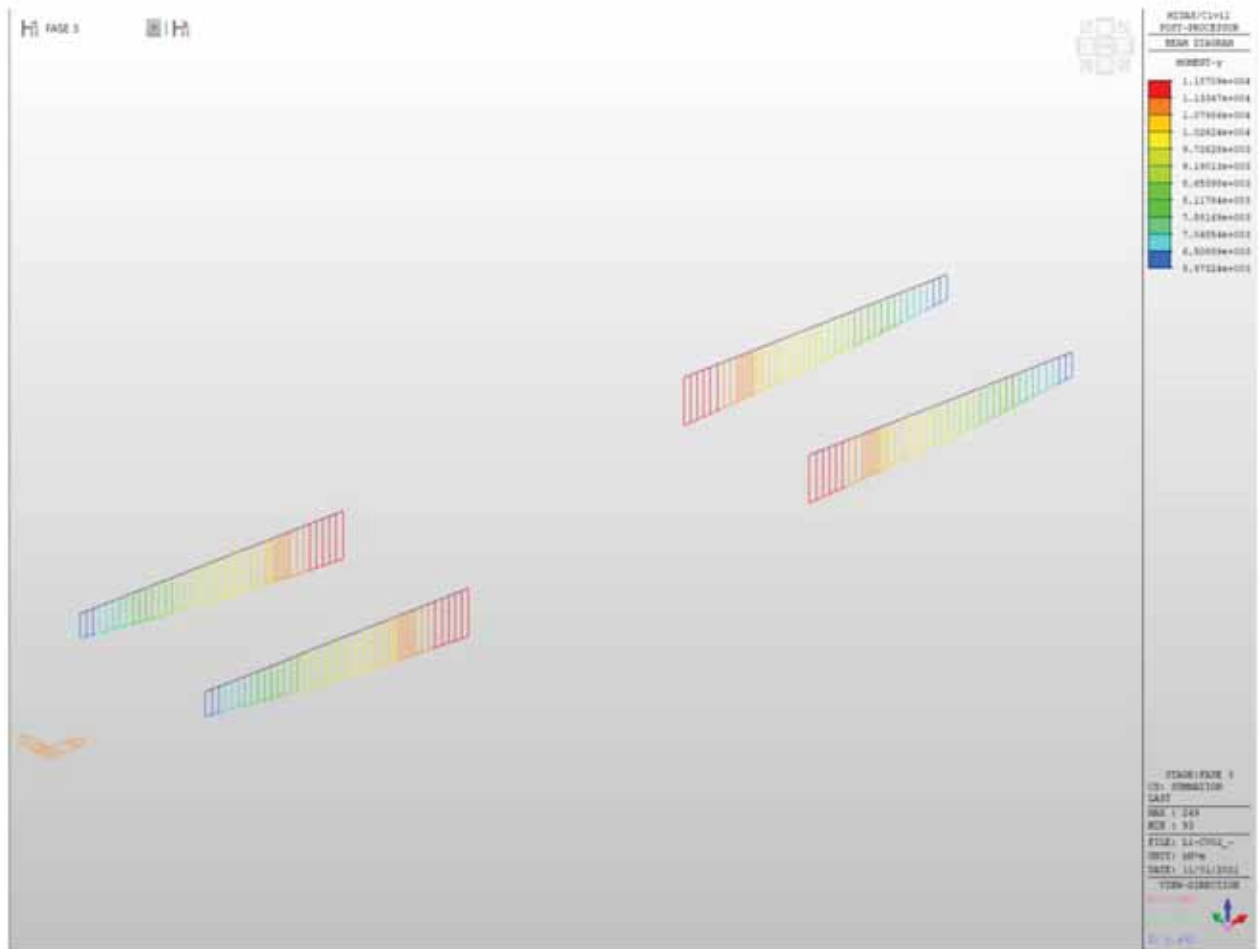


Figura 45 - Concio 2 - Diagramma My - Fase 3

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

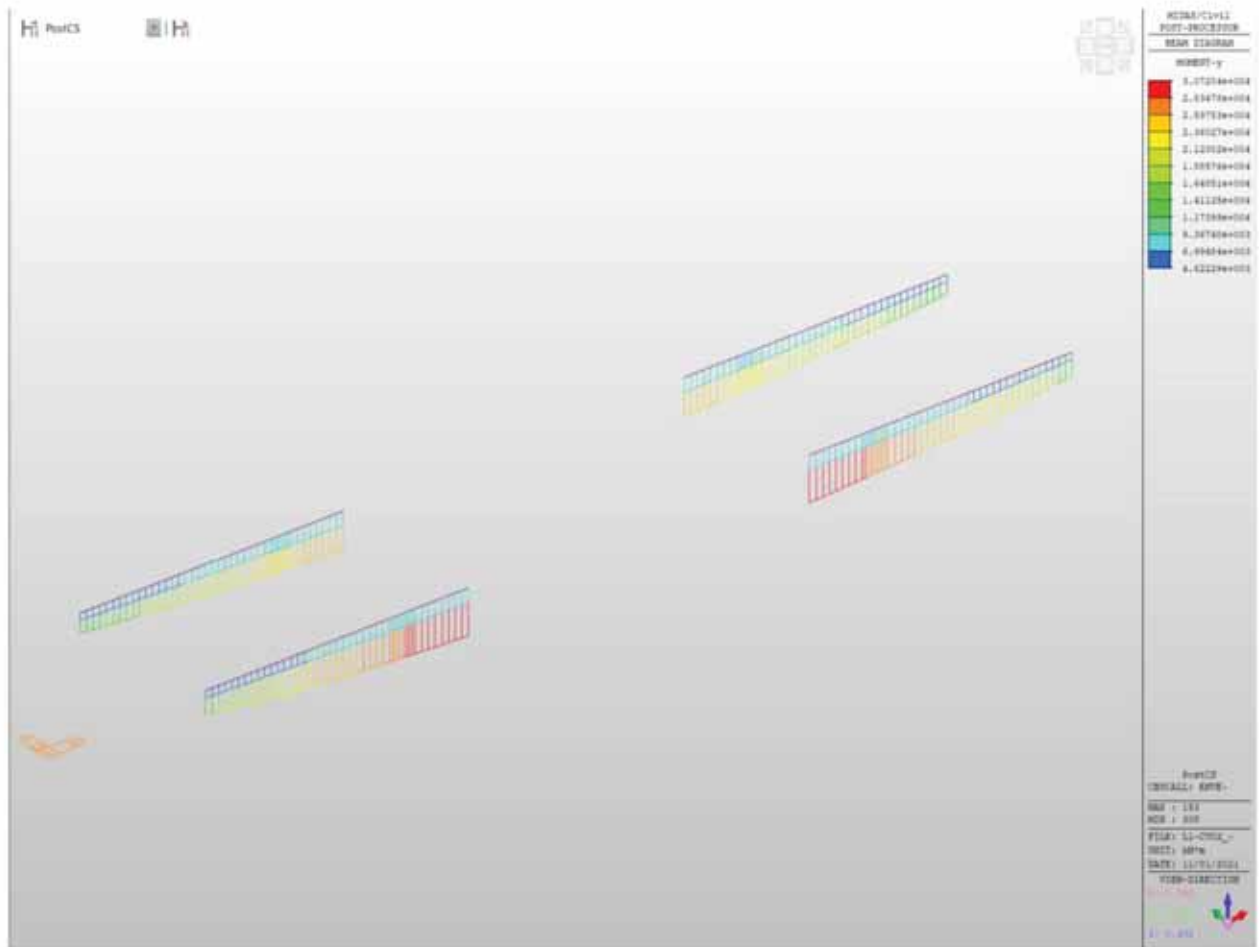


Figura 46 - Concio 2 - Diagramma My - Involuppo SLU-SLV

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

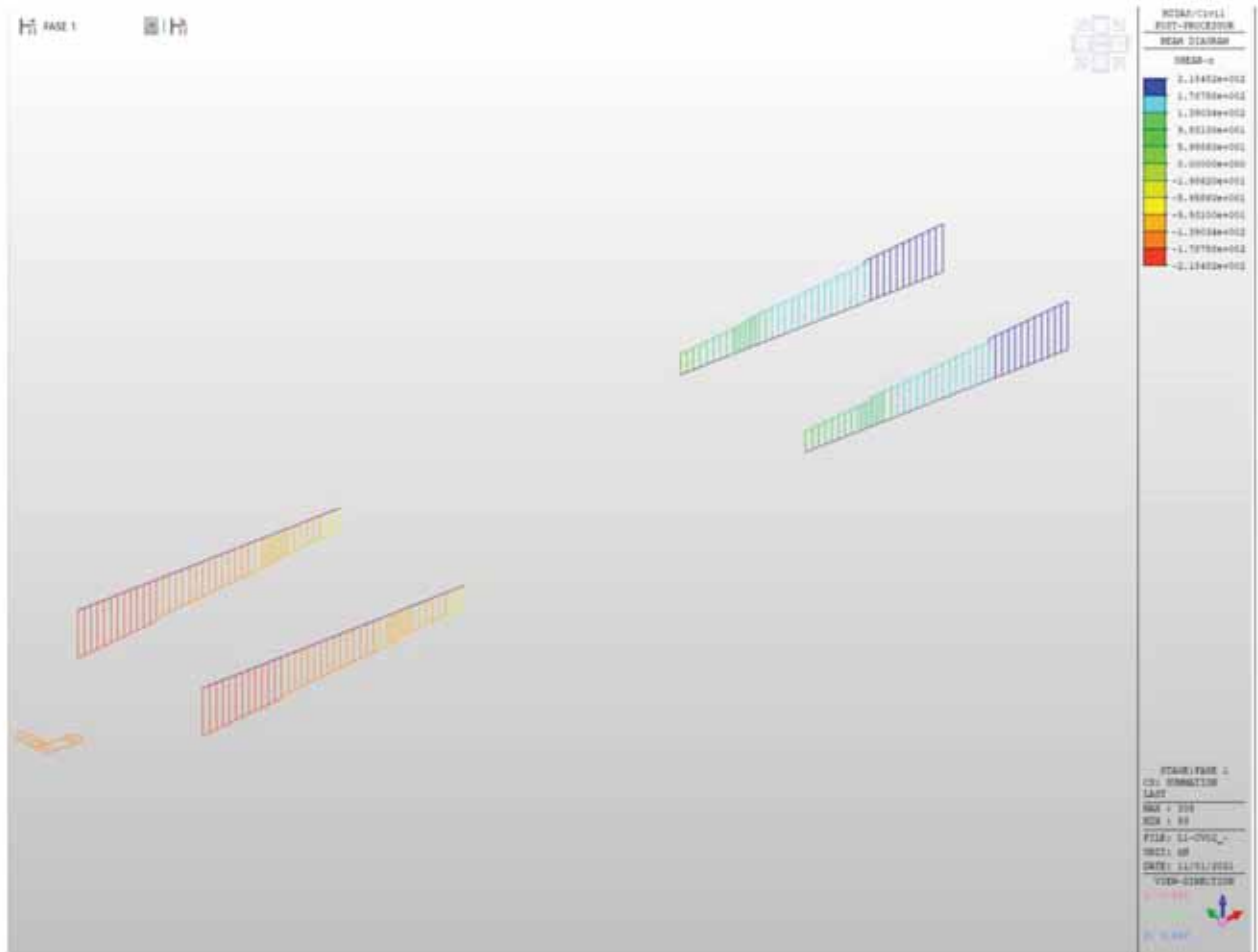


Figura 47 - Concio 2 - Diagramma Tz - Fase 1

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

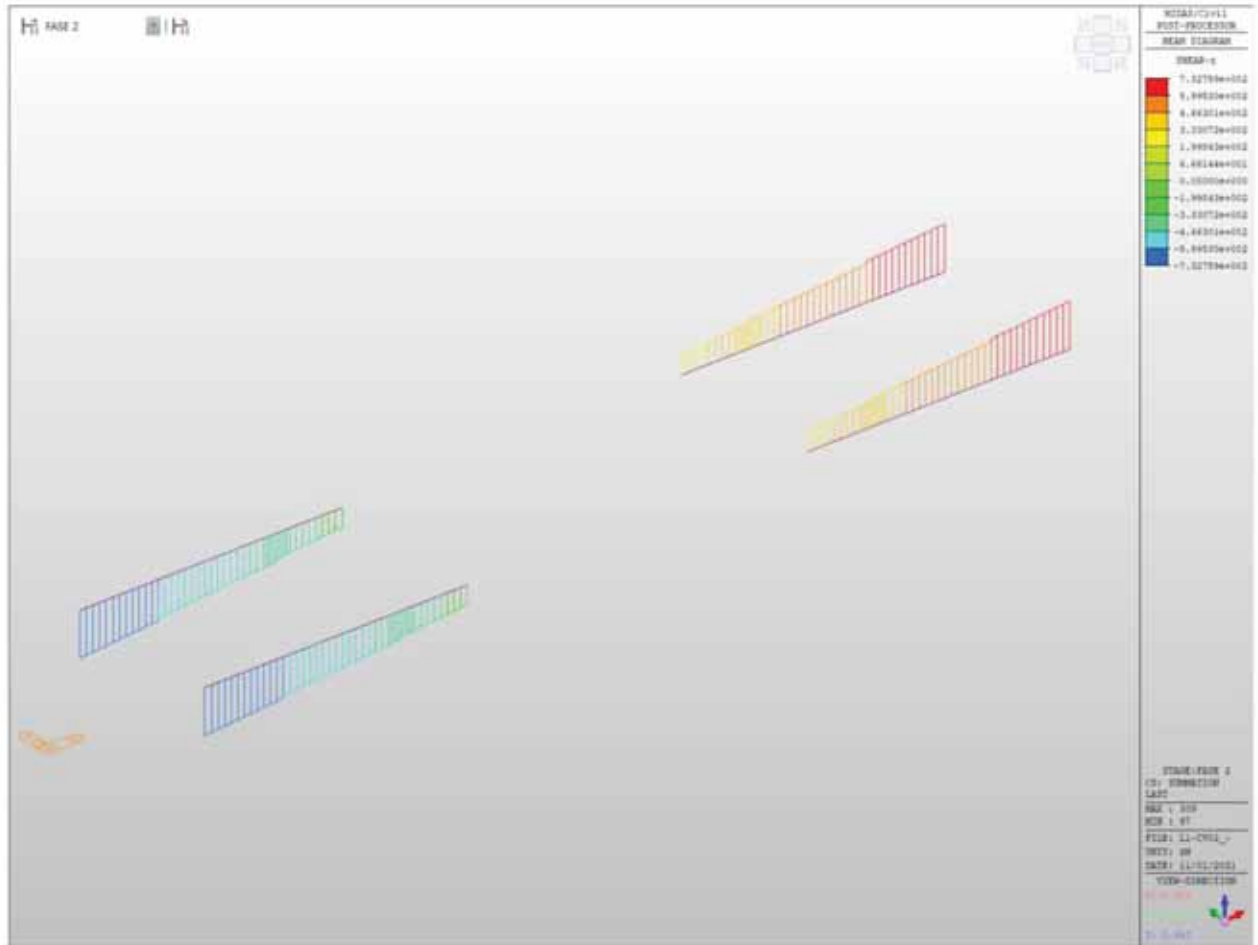


Figura 48 - Concio 2 - Diagramma Tz - Fase 2

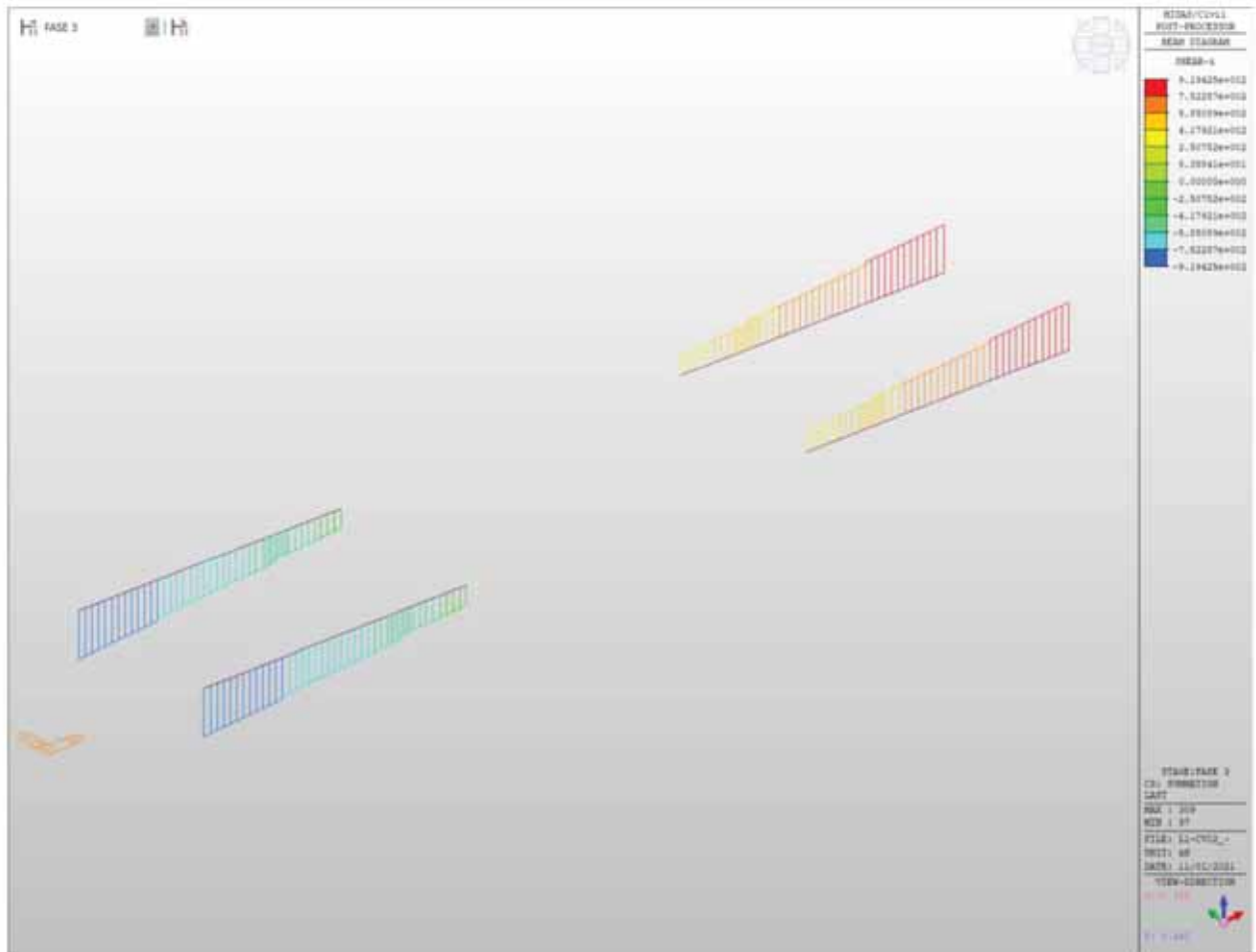


Figura 49 - Concio 2 - Diagramma Tz - Fase 3

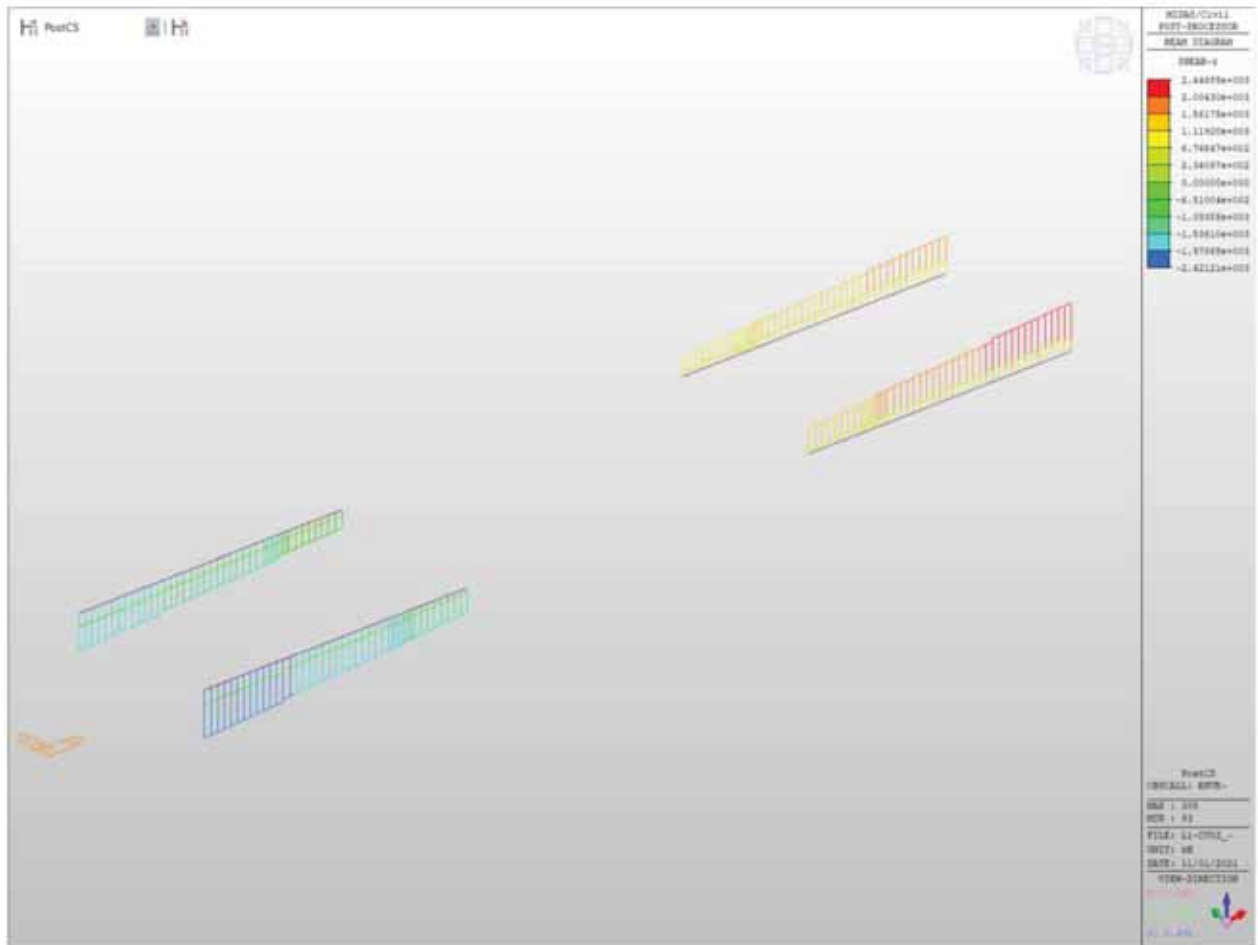


Figura 50 - Concio 2 - Diagramma Tz - Involuppo SLU-SLV

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

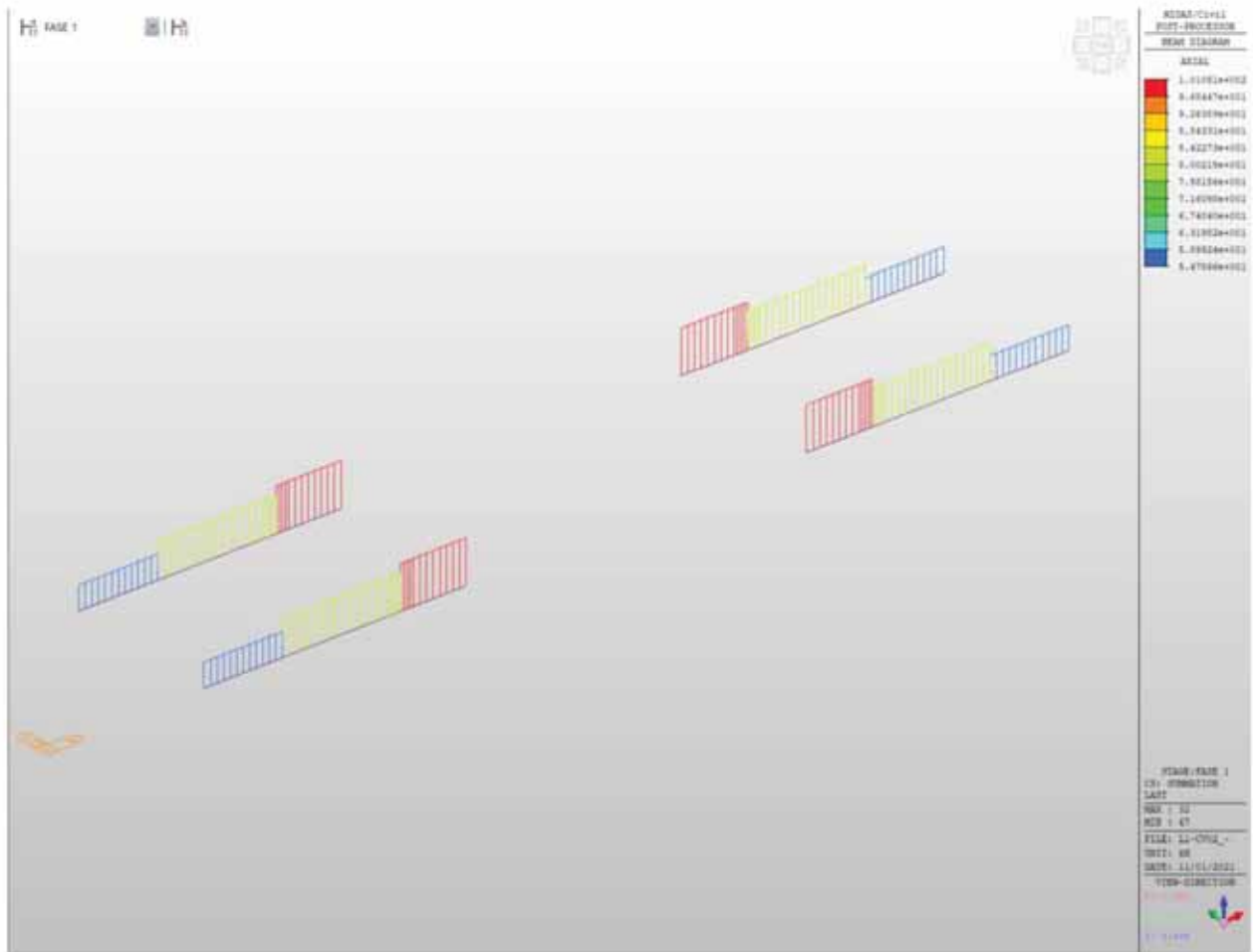


Figura 51 - Concio 2 - Diagramma N - Fase 1

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

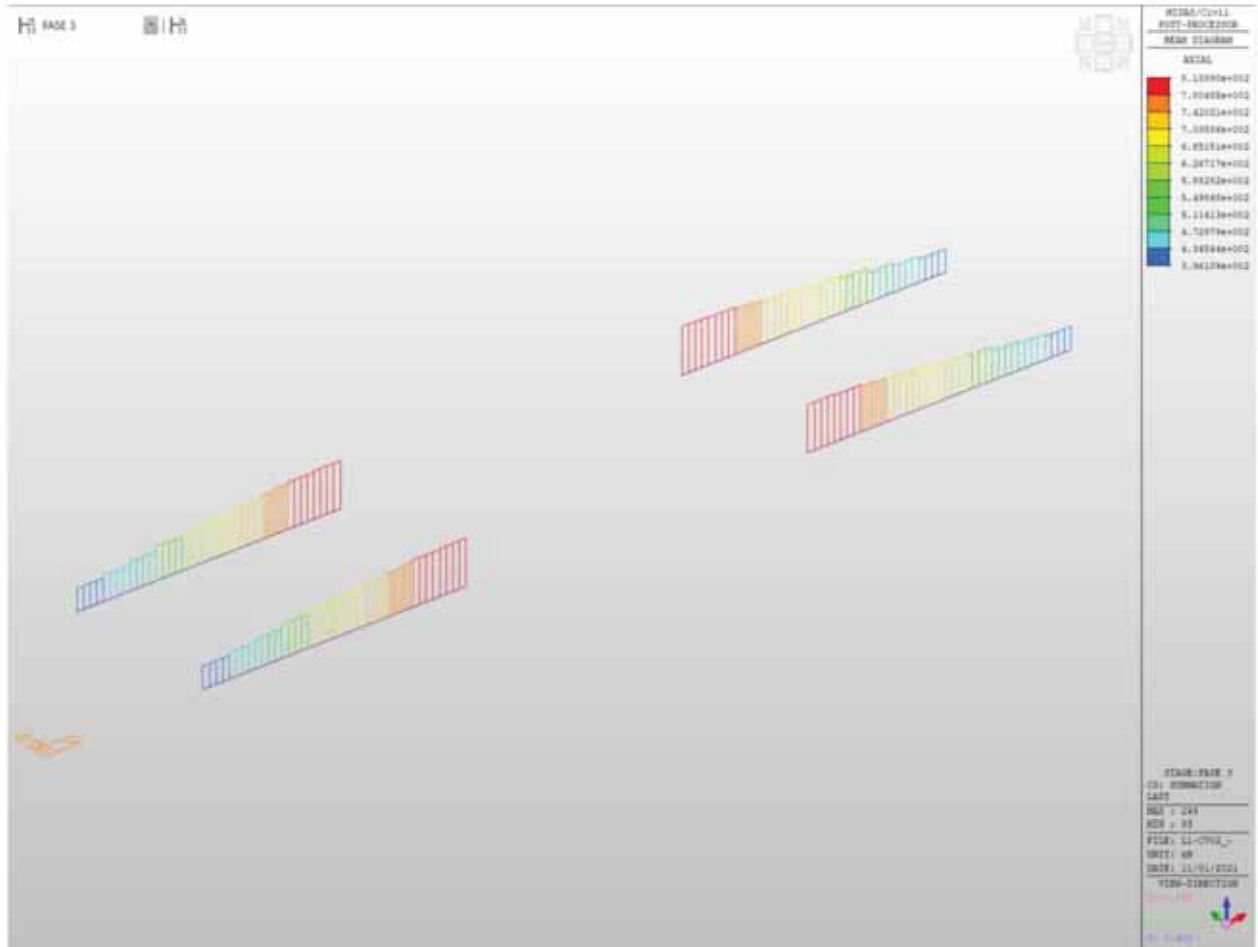


Figura 53 - Concio 2 - Diagramma N - Fase 3

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

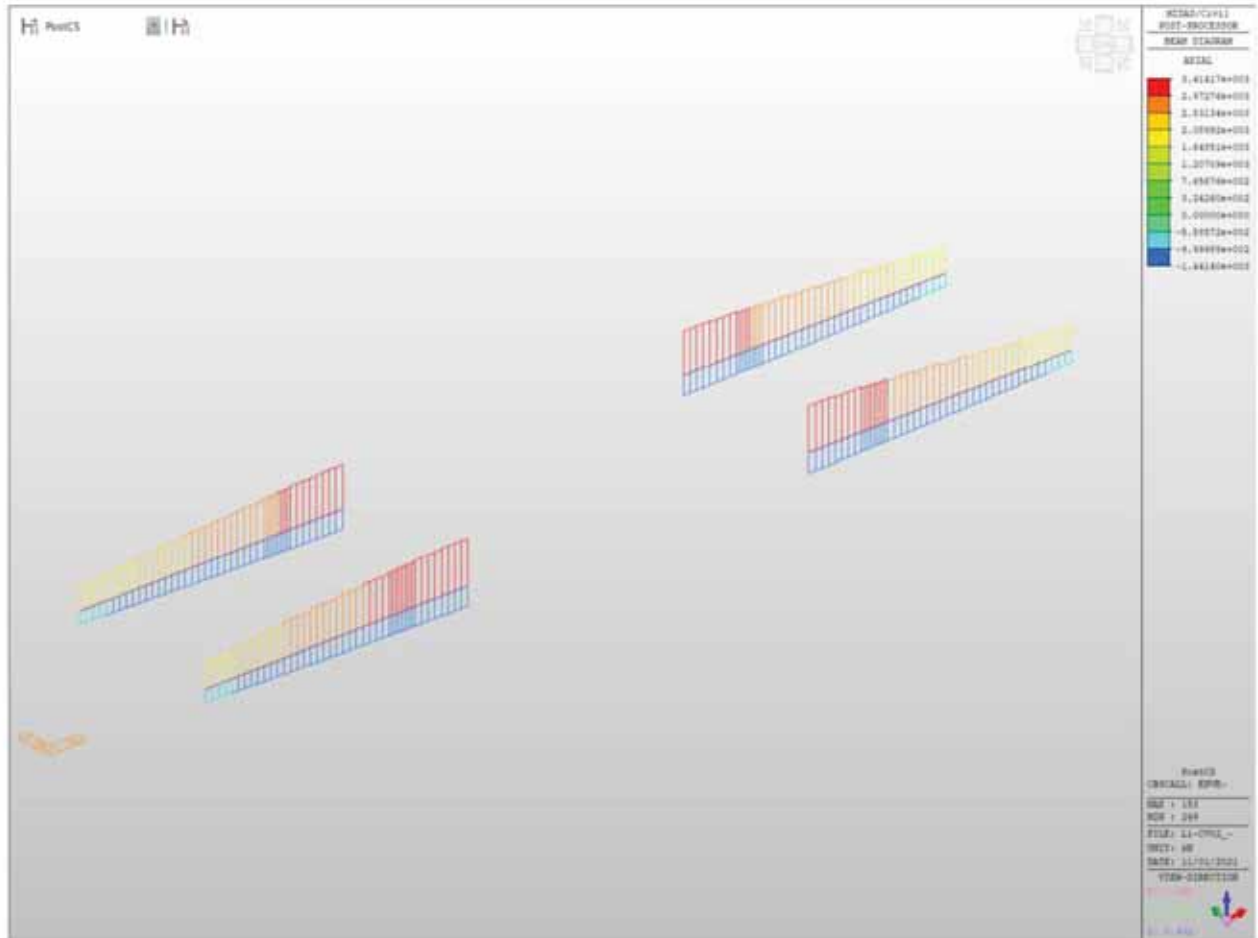
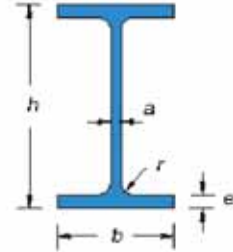


Figura 54 - Concio 2 - Diagramma N - Inviluppo SLU-SLV

VERIFICA SEZIONE IN ACCIAIO COMPOSTA

CARATTERISTICHE PROFILO:

| | | | | | |
|--|------------|--|-------------------------------------|---------------------------|-------------------------------|
| Tipo: | S355 | | | | |
| B _{SUP} = | 750 | mm | | | |
| t _{r,SUP} = | 28.0 | mm | A _{t,sup} = | 21000.00 | mm ² |
| B _{INF} = | 1200 | mm | | | |
| t _{r,INF} = | 40.0 | mm | A _{t,inf} = | 48000.00 | mm ² |
| H = | 2200 | mm | | | |
| t _w = a = | 22.0 | mm | A _w = | 46904.00 | mm ² |
| L = | 4500 | mm | n. traversi: | 1 | |
| A _{TOT} = | 115904.00 | mm ² | | | |
| Y _{G,inf} = | 851.93 | mm | Y _{G,sup} = | 1348.07 | mm |
| J _{yy} = | 9.14E+10 | mm ⁴ | J _t = | 38655179 | mm ⁴ |
| J _{zz} = | 6746327133 | mm ⁴ | J _α = | 1.069E+09 | mm ⁶ |
| W _{el,yy,inf} = | 107283528 | mm ³ | W _{el,yy,sup} = | 67798888 | mm ³ |
| W _{pl,yv} = | 94368039 | mm ³ | | | |
| $W_{pl,xxx} = 2 \left[\frac{t_w H^2}{8} + t_f (b - t_w) \frac{H - t_f}{2} + 2r^2 \left(\frac{H}{2} - t_f - \frac{r}{2} \right) - 2 \frac{\pi r^2}{4} \left(\frac{H}{2} - t_f + r + \frac{4r}{3\pi} \right) \right]$ | | | | | |
| ρ _{yy} = | 888.01 | mm | ρ _{xx} = | $\sqrt{\frac{J_{xx}}{A}}$ | |
| ρ _{zz} = | 241.26 | mm | | | |
| Peso = | 909.85 | kg/m | | | |
| E = | 210000 | N/mm ² | modulo elastico | | |
| ν = | 0.3 | | coeff. poisson | | |
| G = | 80769 | N/mm ² | G = | $\frac{E}{2(1 + \nu)}$ | modulo elasticità trasversale |
| α = | 0.000012 | °C ⁻¹ | coeff. espansione termica lineare | | |
| f _{yk} = | 355 | N/mm ² | tensione snervamento caratteristica | | |
| f _{tk} = | 510 | N/mm ² | tensione rottura caratteristica | | |
| γ _{M0} = | 1.05 | per sezioni classe 1,2,3 e 4 | | | |
| γ _{M1} = | 1.05 | per instabilità membrature | | | |
| γ _{M1} = | 1.10 | per instabilità membrature ponti stradali e ferroviari | | | |
| γ _{M2} = | 1.25 | per sezioni tese indebolite dai fori nei riguardi della frattura | | | |



SOLLECITAZIONI:

| | | | |
|---|------------|-----|--|
| N _{t,sd} = | 0 | N | caso per trave tesa |
| N _{c,sd} = | 754000 | N | caso per trave compressa |
| M _{sd} = | 9287000000 | Nmm | caso per trave inflessa in una direzione |
| V _{sd} = | 733000 | N | taglio |
| Caso per trave a flessione deviata (Momenti flettenti agenti alle estremità M _B < M _A): | | | |
| M _B = | 4575000000 | Nmm | M _A = 9287000000 Nmm |
| Valori del momento massimo e minimo dell'asta: | | | |
| M _{max,y,sd} = | 0 | Nmm | M _{max,y,sd} = 0 Nmm |
| M _{max,z,sd} = | 0 | Nmm | M _{max,z,sd} = 0 Nmm |

| CLASSE APPARTENENZA PROFILO (NTC2008, 4.2.3.1): | | | | | |
|--|--------------|----------------------|---------------|-----------------|------------------------|
| ALA SUPERIORE | | ALA INFERIORE | | ANIMA | |
| $C/t_{sup} =$ | 13.00 | $C/t_{inf} =$ | 14.73 | $C/t_w =$ | 96.91 |
| $\varepsilon =$ | 0.81 | $\varepsilon =$ | 0.81 | $\varepsilon =$ | 0.81 |
| Curva di instabilità "b" (Asse yy): | | | | | |
| Fattore di imperfezione α : | | 0.34 | | | |
| Curva di instabilità "c" (Asse zz): | | | | | |
| Fattore di imperfezione a: | | 0.49 | | | |
| SOLLECITAZIONE DELL'ASTA A TAGLIO (NTC2008, 4.2.4.1.2): | | | | | |
| $\frac{V_{sd}}{V_{c,Rd}} \leq 1$ | | | | | |
| Area taglio resistente: | | $A_v =$ | 47652 | mm ² | |
| $V_{c,Rd} = \frac{A_v f_{yk}}{\sqrt{3} \gamma_{M0}}$ | $V_{c,Rd} =$ | 9301641 | N | \Rightarrow | 0.08 OK!(<1) |
| Verifica in presenza di torsione uniforme: | | | | | |
| $\tau_{t,sd} =$ | 0 | N/mm ² | | | |
| $V_{c,Rd,red} = \left[1 - \frac{\tau_{t,sd}}{\frac{f_{yk}}{\sqrt{3} \gamma_{M0}}} \right] V_{c,Rd}$ | | | | | |
| $V_{c,Rd,red} =$ | 9301641 | N | \Rightarrow | 0.08 | OK!(<1) |
| Verifica in termini tensionali nel punto più sollecitato: | | | | | |
| $\frac{\tau_{sd}}{\frac{f_{yk}}{\sqrt{3} \gamma_{M0}}} \leq 1 \Rightarrow 0.00$ OK!(<1) | | | | | |

SOLLECITAZIONE DELL'ASTA A COMPRESSIONE SEMPLICE (NTC2008, 4.2.4.1.2):

$$\frac{N_{sd}}{N_{c,Rd}} \leq 1 \quad N_{cr} = \frac{\pi^2 EJ}{(\eta l)^2} \quad 690496385 \quad \text{N} \quad N_{c,sd} < 0,04 N_{cr}$$

Instabilità trascurabile!

0.04 Ncr = 27619855 N **Instabilità trascurabile se $\bar{\lambda} < 0.2$**

Calcolo snellezza membrana (< di 200 per le travature principali e < di 250 per le secondarie):

$\mu = 1.00 \quad l_0 = \mu l = 4500 \quad \text{mm}$

$\lambda = l_0 / \rho = 5$

Calcolo resistenza per sezioni in classe 1,2 e 3:

$$N_{c,Rd} = \frac{A f_{yk}}{\gamma_{M0}} \quad N_{c,Rd} = 39186590 \quad \text{N} \quad \Rightarrow \quad 0.02 \quad \text{OK! (<1)}$$

STABILITA' DELLE MEMBRATURE (NTC2008, 4.2.4.1.3):

Curva di instabilità "b" (Asse yy):

Fattore di imperfezione α : 0.49

Verifica per sezioni classe 1,2 e 3:

$$\bar{\lambda} = \sqrt{\frac{A f_{yk}}{N_{cr}}} \quad 0.24 \quad \bar{\lambda} > 0.2$$

Serve verifica instabilità!

$$\Phi = 0.5 \left[1 + \alpha(\bar{\lambda} - 0.2) + \bar{\lambda}^2 \right] \quad 0.54$$

$$\chi = \frac{1}{\Phi + \sqrt{\Phi^2 - \bar{\lambda}^2}} \quad 0.98$$

$$N_{b,Rd} = \frac{\chi A f_{yk}}{\gamma_{M1}} \quad 36566188 \quad \text{N}$$

$$\frac{N_{c,sd}}{N_{b,Rd}} \leq 1 \quad \Rightarrow \quad 0.02 \quad \text{OK! (<1)}$$

SOLLECITAZIONE DELL'ASTA A FLESSIONE MONOASSIALE RETTA (NTC2008, 4.2.4.1.2):

$$\frac{M_{sd}}{M_{c,Rd}} \leq 1$$

$$V_{sd} < 0,5 V_{c,Rd}$$

Il taglio non influisce sulla verifica a flessione!

$$\rho = \left[\frac{2V_{sd}}{V_{c,Rd}} - 1 \right]^2$$

0.70963

$$f_{y,red} = (1 - \rho)f_{yk}$$

103 N/mm²

$$f_{yk} =$$

355 N/mm²

Calcolo resistenza elastica sezione lorda, classe 3:

$$M_{el,Rd} = \frac{W_{el,min} f_{yk}}{\gamma_{M0}}$$

$$M_{c,Rd} = 36272049827 \text{ Nmm}$$

=>

0.26 **OK!(<1)**

n. fori =

diametro =

mm

$$\frac{0,9 A_f n_{ot} f_{tk}}{\gamma_{M2}} \geq \frac{A_f f_{yk}}{\gamma_{M0}}$$

Non serve la verifica per la presenza dei fori!

TRAVI INFLESSE (NTC2008, 4.2.4.1.3.2):

Calcolo snellezza membrana (< di 200 per le travature principali e < di 250 per le secondarie):

$$\mu = 0.70$$

$$L_{cr} = L / \mu = 3150 \text{ mm}$$

$$W_{yy} = 107283528 \text{ mm}^3$$

$$W_{yy} = 67798888 \text{ mm}^3$$

$$\psi = 1.75 - 1.05 \frac{M_B}{M_A} + 0.3 \left(\frac{M_B}{M_A} \right)^2$$

3.86

$$M_{cr} = \psi \frac{\pi}{L_{cr}} \sqrt{E J_y G J_T} \sqrt{1 + \left(\frac{\pi}{L_{cr}} \right)^2 \frac{E J_{\omega}}{G J_T}}$$

9.419E+11

Nmm

0.010

$$M_{sd} / M_{cr} =$$

0.010

Risulta < 0.16 Non serve la verifica instabilità

$$\bar{\lambda}_{LT} = \sqrt{\frac{W_y f_{yk}}{M_{cr}}}$$

0.16

Risulta < 0.4 Non serve la verifica instabilità

Stabilità dei pannelli soggetti a taglio (NTC2008, 4.2.4.1.3.4.1):

Se irrigiditori trasversali rigido o no,

$$I_{st} = 45000000 \text{ mm}^4 \quad 0.75hwt^3 = 8398511 \text{ mm}^4 \quad \text{Irrigiditore Trasversali rigidi}$$

Coefficiente minimo di instabilità per taglio del pannello (In assenza di irrigiditori longitudinali),

$$a/hw = 2.05 \quad k_t = 7.30$$

Coefficiente minimo di instabilità per taglio del pannello (irrigiditori longitudinali più di due o $a/hw > 3$),

$$I_{sl} = 0 \text{ mm}^4 \quad k_{t1} = 0.00$$

$$a/hw = 2.05 \quad k_t = 7.30$$

Coefficiente minimo di instabilità per taglio del pannello (irrigiditori longitudinali più di due o $a/hw < 3$),

$$I_{sl} = 0 \text{ mm}^4 \quad a/hw = 2.05 \quad k_t = 5.61$$

$$k_t = 7.30$$

$$\eta = 1.2 \quad hw/t = 96.91 \quad \text{Serve la verifica di instabilità}$$

$$\sigma_E = 19 \text{ MPa} \quad \tau_{cr} = 138.62 \quad \lambda_w = 1.22$$

Montanti di appoggio rigidi,

$$\chi_w = 0.71$$

Gli altri casi,

$$\chi_w = 0.68$$

$$V_{bw,Rd} = 6447333 \text{ N}$$

Momento resistente sole piattabande,

$$Y_{G,int} = 679.22 \text{ mm} \quad Y_{G,sup} = 1520.78 \text{ mm}$$

$$J_{yy} = 68545285739 \text{ mm}^4$$

$$W_{el,yy,int} = 100918037 \text{ mm}^3 \quad W_{el,yy,sup} = 45072376 \text{ mm}^3$$

$$M_{t,red} = 14746225713 \text{ Nmm}$$

$$bf = 340.2 \text{ mm} \quad V_{bf,Rd} = 29207 \text{ N}$$

$$V_{b,Rd} = 6476539 \text{ N} \quad 0.113 \quad \text{OK! (<1)}$$

Stabilità dei pannelli soggetti a Comoresione (NTC2008, 4.2.4.1.3.4.1):

Stress,

$\sigma_{sup} =$ 136.98 MPa

$\sigma_{inf} =$ -86.57 MPa

$\sigma_{irr.} =$ 85.16 MPa

Irrigidati su entrambi i lati (Anima),

$b =$ 2132.0 mm (Web bw) $a =$ 4500 mm

$\sigma_1 =$ 137.0 (Max) $\sigma_2 =$ -86.57 (Min)

$\psi =$ -0.6 $k\sigma =$ 15.69

$\lambda_p =$ 1.1 $\rho =$ 0.94

$\sigma_{cr,p} =$ 317.4 MPa $\sigma_{cr,c} =$ 4.536 MPa

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| | | | | | | | |
|---|-----------|-----------------|--------------|-------------------|----------|-----------------|-----------|
| $\zeta =$ | 1.0 | | | $\lambda_c =$ | 8.846 | | |
| $\alpha =$ | 0.34 | | | $\Phi =$ | 115.523 | | |
| $\chi_c =$ | 0.004 | | | | | | |
| $\rho_c =$ | 0.94 | | | | | | |
| $b_{eff} =$ | 1228.40 | mm | $b_{e1} =$ | 491.36 | mm | $b_{e2} =$ | 737.04 mm |
| $b_t =$ | 825.60 | mm | | | | | |
| Irrigidati a un lato (Piattebande), Piattabanda Superiore, | | | | | | | |
| $b =$ | 364 | mm | (Flange Sup) | | | | |
| $\sigma (lrr.) =$ | 137.0 | | | $\sigma (Lib.) =$ | 136.98 | | |
| $k\sigma =$ | 0.43 | | | | | | |
| $\lambda_p =$ | 1.1 | | | $\rho =$ | 0.76 | | |
| $b_{eff} =$ | 274.98 | mm | | $b_t =$ | 0 | mm | |
| Effective Section Properties, | | | | | | | |
| $A_{c,eff} (Piattabanda Sup) =$ | 15399.0 | mm ² | | | | | |
| $A_{c,eff} (Piattabanda Inf) =$ | 48000.0 | mm ² | | | | | |
| $A_{c,eff} (Anima) =$ | 27024.8 | mm ² | | | | | |
| $A_c (Anima tensione) =$ | 18163.1 | mm ² | | | | | |
| $A_{c,eff} (Total) =$ | 108586.9 | mm ² | | | | | |
| $Y_{g,inf} =$ | 770.6 | mm | | $Y_{g,sup} =$ | 1429.4 | mm | |
| $I_{eff} =$ | 8.28E+10 | mm ⁴ | | | | | |
| $W_{eff} (inf) =$ | 107444554 | mm ³ | | $W_{eff} (sup) =$ | 57928158 | mm ³ | |
| $e =$ | 81.29 | mm | | | | | |
| $\eta =$ | 0.48 | | | | | | |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Fase 2

Soletta c.a.collaborante

| | | |
|------------------|---------|----------------|
| b_{eff} = | 2.84 | m |
| Altezza soletta: | 0.26 | m |
| Area soletta: | 0.74 | m ² |
| J_{yy} = | 0.00416 | m ⁴ |
| Peso = | 18.46 | kN/m |

Trave acciaio

| | | |
|---------------------|----------|----------------|
| Area trave acciaio: | 0.115904 | m ² |
| H trave acciaio: | 2.20 | m |
| y_G = | 0.852 | m |
| J_{yy} = | 0.091398 | m ⁴ |
| Peso = | 9.10 | kN/m |

Barre armatura soletta

| 1° strato barre (superiore) | | 2° strato barre (inferiore) | |
|-----------------------------|-------------------------|-----------------------------|-------------------------|
| n. Barre: | 14 | n. Barre: | 14 |
| Interasse: | 0.20 m | Interasse: | 0.20 m |
| Diametro: | 0.02 m | Diametro: | 0.02 m |
| Area: | 0.004398 m ² | Area: | 0.004398 m ² |
| y_1 = | 0.05 m | y_2 = | 0.21 m |

n = 18.0 Coeff. omogeneizzazione con viscosità in atto

Materiali

| cls | Barre armature | Acciaio |
|----------------------|---------------------------|--------------------------|
| R_{ck} = 40 MPa | f_{yk} = 450 MPa | f_{yk} = 355 MPa |
| f_{ck} = 33.20 MPa | γ_M = 1.15 | γ_{M0} = 1.05 |
| f_{cd} = 18.81 MPa | $f_{yld,cs}$ = 391.30 MPa | $f_{yld,a}$ = 338.10 MPa |
| f_{cm} = 41.2 MPa | | |
| f_{dm} = 3.10 MPa | | |
| E_{cm} = 33643 MPa | | |

Caratteristiche geometriche

| | | | |
|------------------|----------|-----------------|--|
| A_{oi} = | 0.1657 | m ² | Area sezione omogeneizzata in area di acciaio |
| A_s = | 47652 | mm ² | Area taglio sezione di acciaio |
| $y_{G,inf,oi}$ = | 1.30 | m | Asse neutro rispetto lembo inferiore: |
| $y_{G,sup,oi}$ = | 1.16 | m | Asse neutro rispetto lembo superiore |
| $J_{xx,oi}$ = | 0.167805 | m ⁴ | Momento d'inerzia sezione omogeneizzata ad acciaio |
| $W_{inf,oi}$ = | 0.129454 | m ³ | Modulo elastico sezione omogeneizzata ad acciaio |
| $W_{sup,oi}$ = | 0.144195 | m ³ | Modulo elastico sezione omogeneizzata ad acciaio |

Sollecitazioni

| | | | | |
|--------------|----------|-----|-------|----------|
| $M_{1,oi}$ = | 11871.00 | kNm | (SLU) | |
| $M_{2,oi}$ = | 43767.69 | kNm | => | 0.27 ok! |
| T_{inf} = | 920.00 | kN | (SLU) | |
| T_{sup} = | 8858.71 | kN | => | 0.10 ok! |

Tensioni

| | | | | | |
|--------------------|-------|-----|----|--------------|-------------------------------------|
| σ_c = | 4.57 | MPa | => | 0.24 ok!(<1) | Tensione al lembo superiore soletta |
| $\sigma_{s,sup}$ = | 78.79 | MPa | => | 0.20 ok!(<1) | Tensione barre superiori soletta |
| $\sigma_{s,inf}$ = | 67.47 | MPa | => | 0.17 ok!(<1) | Tensione barre inferiori soletta |
| $\sigma_{s,sup}$ = | 63.93 | MPa | => | 0.19 ok!(<1) | Tensione acciaio lembo superiore |
| $\sigma_{s,inf}$ = | 91.70 | MPa | => | 0.27 ok!(<1) | Tensione acciaio lembo inferiore |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Fase 3

Soletta c.a.collaborante

| | | |
|------------------|---------|----------------|
| b_{eff} = | 2.84 | m |
| Altezza soletta: | 0.26 | m |
| Area soletta: | 0.74 | m ² |
| J_{xx} = | 0.00416 | m ⁴ |
| Peso = | 18.46 | kN/m |

Trave acciaio

| | | |
|---------------------|----------|----------------|
| Area trave acciaio: | 0.115904 | m ² |
| H trave acciaio: | 2.20 | m |
| Y_0 = | 0.852 | m |
| J_{xx} = | 0.091398 | m ⁴ |
| Peso = | 9.10 | kN/m |

Barre armatura soletta

| 1° strato barre (superiore) | | 2° strato barre (inferiore) | |
|-----------------------------|-------------------------|-----------------------------|-------------------------|
| n. Barre: | 14 | n. Barre: | 14 |
| interasse: | 0.20 m | interasse: | 0.20 m |
| Diametro: | 0.02 m | Diametro: | 0.02 m |
| Area: | 0.004398 m ² | Area: | 0.004398 m ² |
| Y_1 = | 0.05 m | Y_2 = | 0.21 m |

n = 6.2 Coeff. omogeneizzazione a tempo infinito

Materiali

| cls | Barre armature | Acciaio |
|----------------------|-------------------------|-------------------------|
| R_{ck} = 40 MPa | f_{yk} = 450 MPa | f_{yk} = 355 MPa |
| f_{ck} = 33.20 MPa | γ_M = 1.15 | γ_{M0} = 1.05 |
| f_{cd} = 18.81 MPa | $f_{yk,1}$ = 391.30 MPa | $f_{yk,2}$ = 338.10 MPa |
| f_{cm} = 41.2 MPa | | |
| f_{ctm} = 3.10 MPa | | |
| E_{cm} = 33643 MPa | | |

Caratteristiche geometriche

| | | | |
|-----------------|----------|-----------------|--|
| A_d = | 0.2438 | m ² | Area sezione omogeneizzata in area di acciaio |
| A_s = | 47652 | mm ² | Area taglio sezione di acciaio |
| $Y_{G,inf,d}$ = | 1.63 | m | Asse neutro rispetto lembo inferiore: |
| $Y_{G,sup,d}$ = | 0.83 | m | Asse neutro rispetto lembo superiore |
| $J_{xx,d}$ = | 0.224959 | m ⁴ | Momento d'inerzia sezione omogeneizzata ad acciaio |
| $W_{pl,d}$ = | 0.13824 | m ³ | Modulo elastico sezione omogeneizzata ad acciaio |
| $W_{pl,d}$ = | 0.270158 | m ³ | Modulo elastico sezione omogeneizzata ad acciaio |

Sollecitazioni

| | | | | |
|------------|----------|-----|-------|----------|
| M_{d1} = | 30720.40 | kNm | (SLU) | |
| M_{d2} = | 46738.25 | kNm | => | 0.66 ok! |
| T_{d1} = | 2450.00 | kN | (SLU) | |
| T_{d2} = | 8858.71 | kN | => | 0.28 ok! |

Tensioni

| | | | | | |
|--------------------|--------|-----|----|--------------|-------------------------------------|
| σ_c = | 18.34 | MPa | => | 0.97 ok!(<1) | Tensione al lembo superiore soletta |
| $\sigma_{s,sup}$ = | 106.88 | MPa | => | 0.27 ok!(<1) | Tensione barre superiori soletta |
| $\sigma_{s,inf}$ = | 85.03 | MPa | => | 0.22 ok!(<1) | Tensione barre inferiori soletta |
| $\sigma_{a,sup}$ = | 78.21 | MPa | => | 0.23 ok!(<1) | Tensione acciaio lembo superiore |
| $\sigma_{a,inf}$ = | 222.23 | MPa | => | 0.66 ok!(<1) | Tensione acciaio lembo inferiore |

6.2.1.3 TRAVE PRINCIPALE CONCIO 3

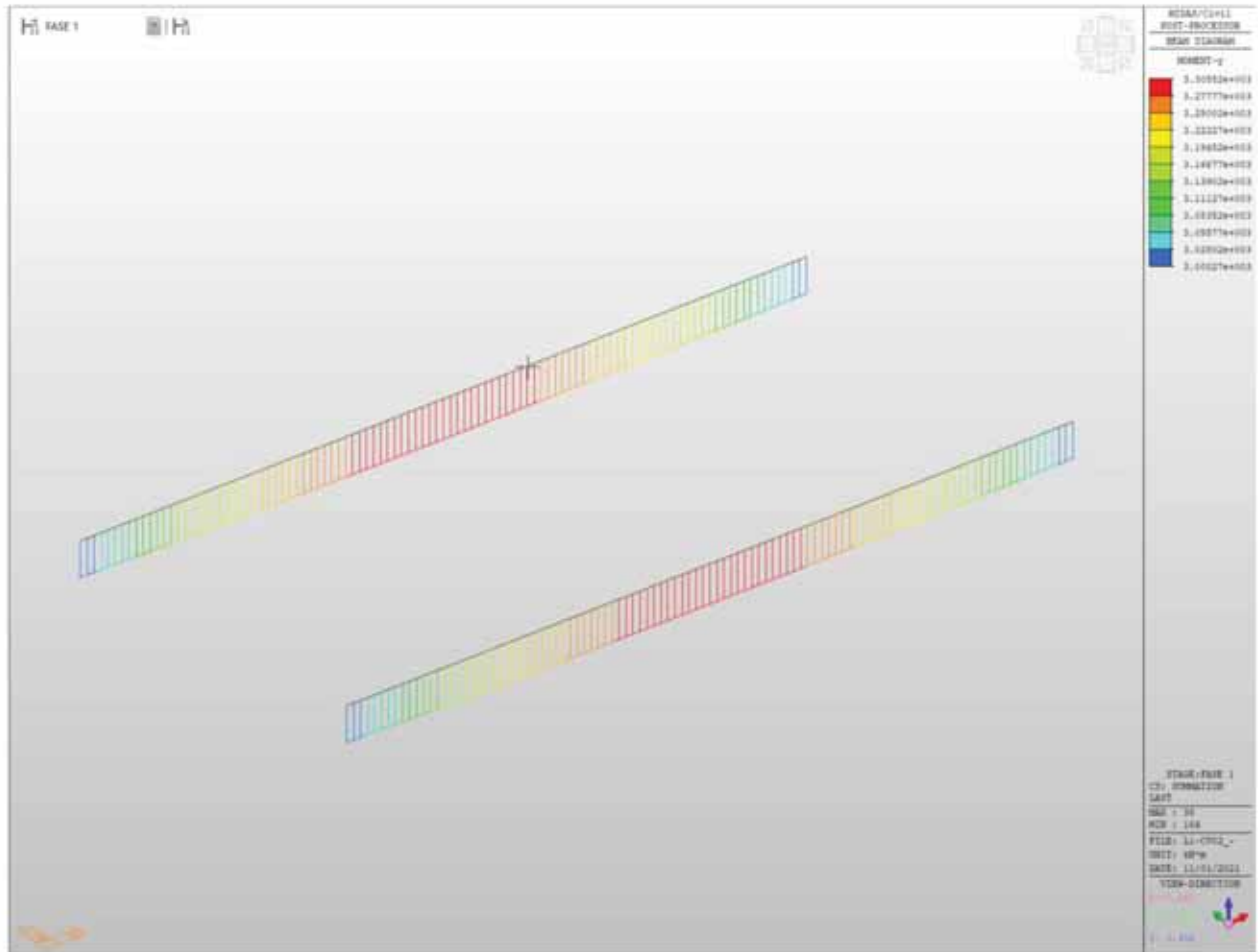


Figura 55 - Concio 3 - Diagramma My - Fase 1

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

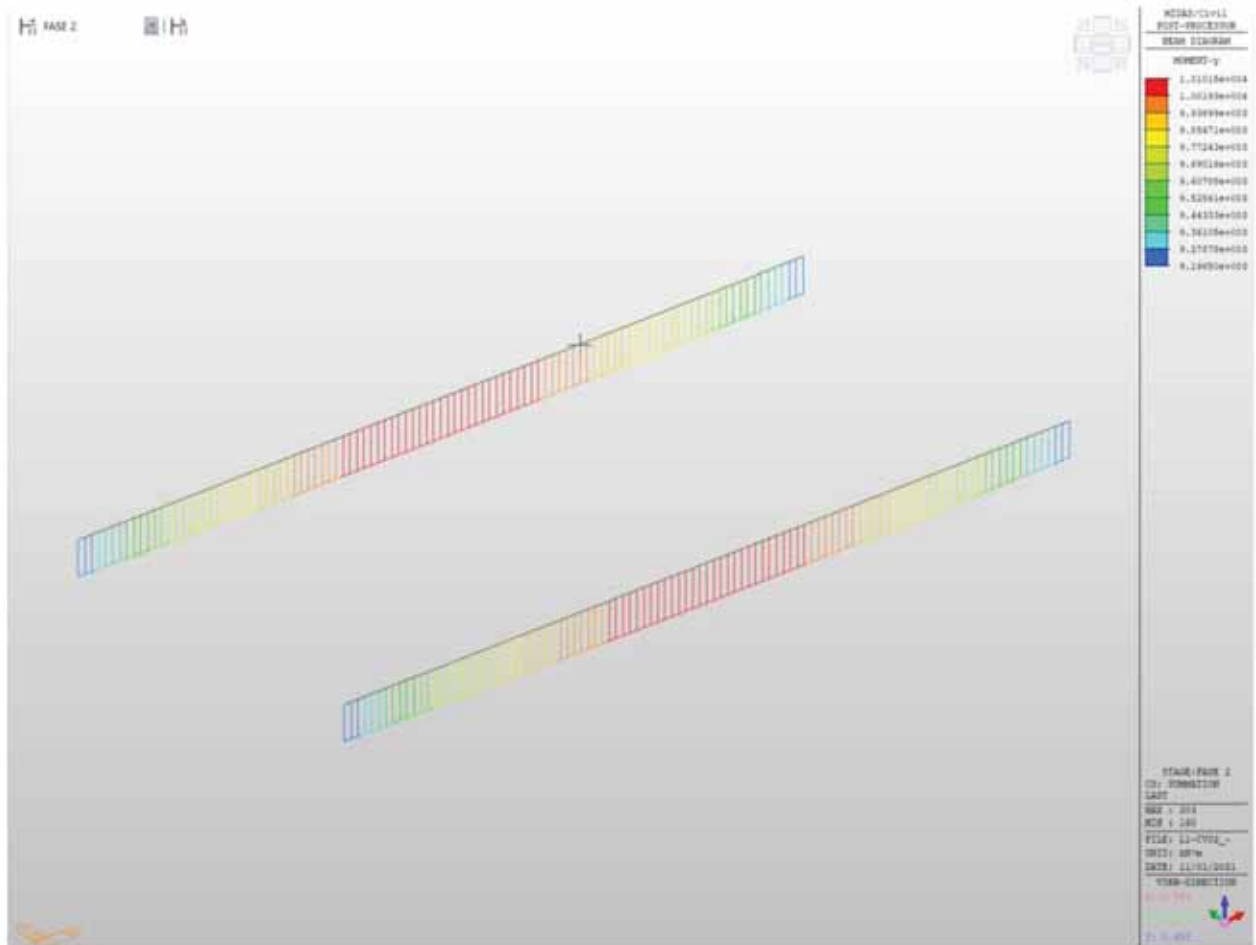


Figura 56 - Concio 3 - Diagramma My - Fase 2

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

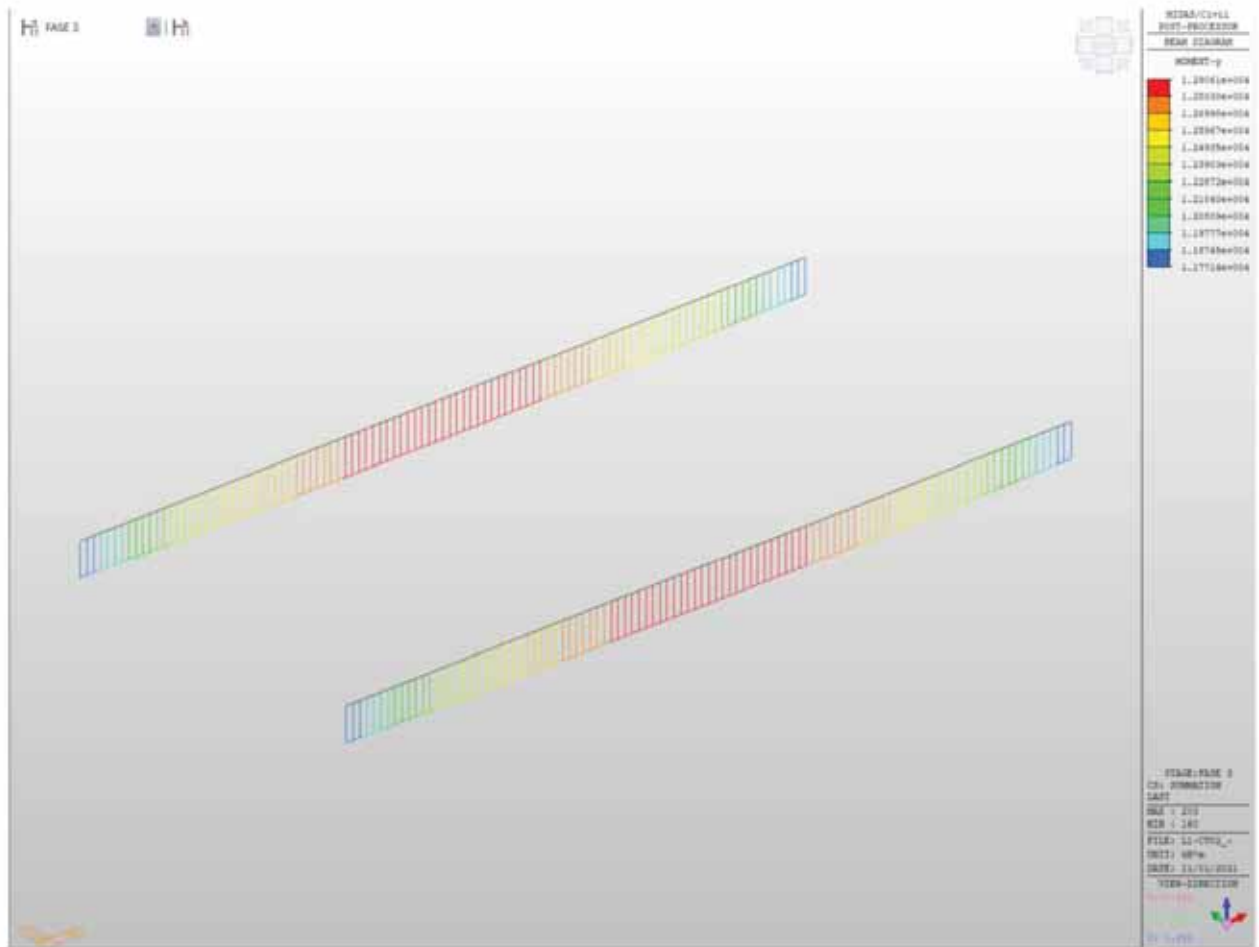


Figura 57 - Concio 3 - Diagramma My - Fase 3

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

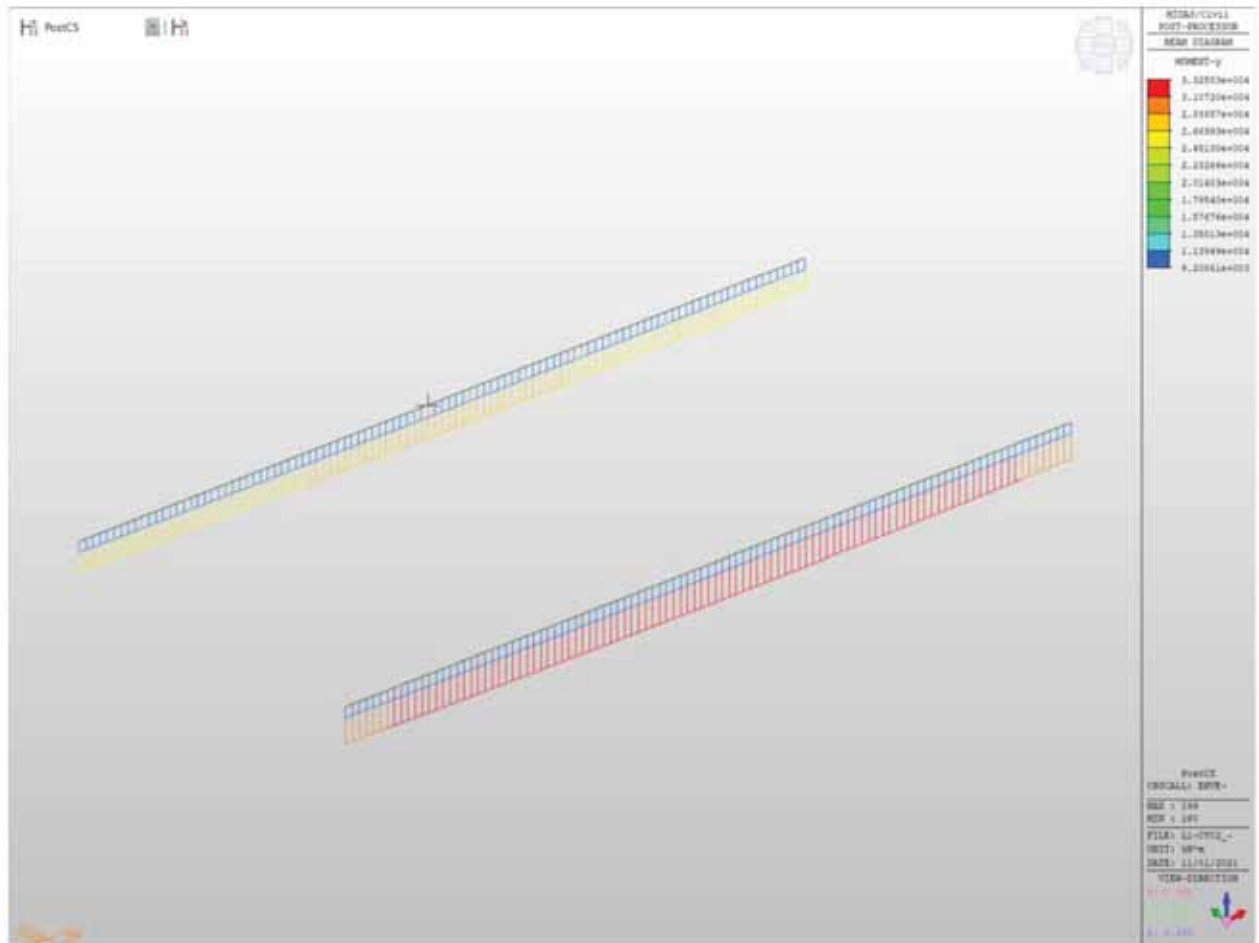


Figura 58 - Concio 3 - Diagramma My - Involuppo SLU-SLV

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

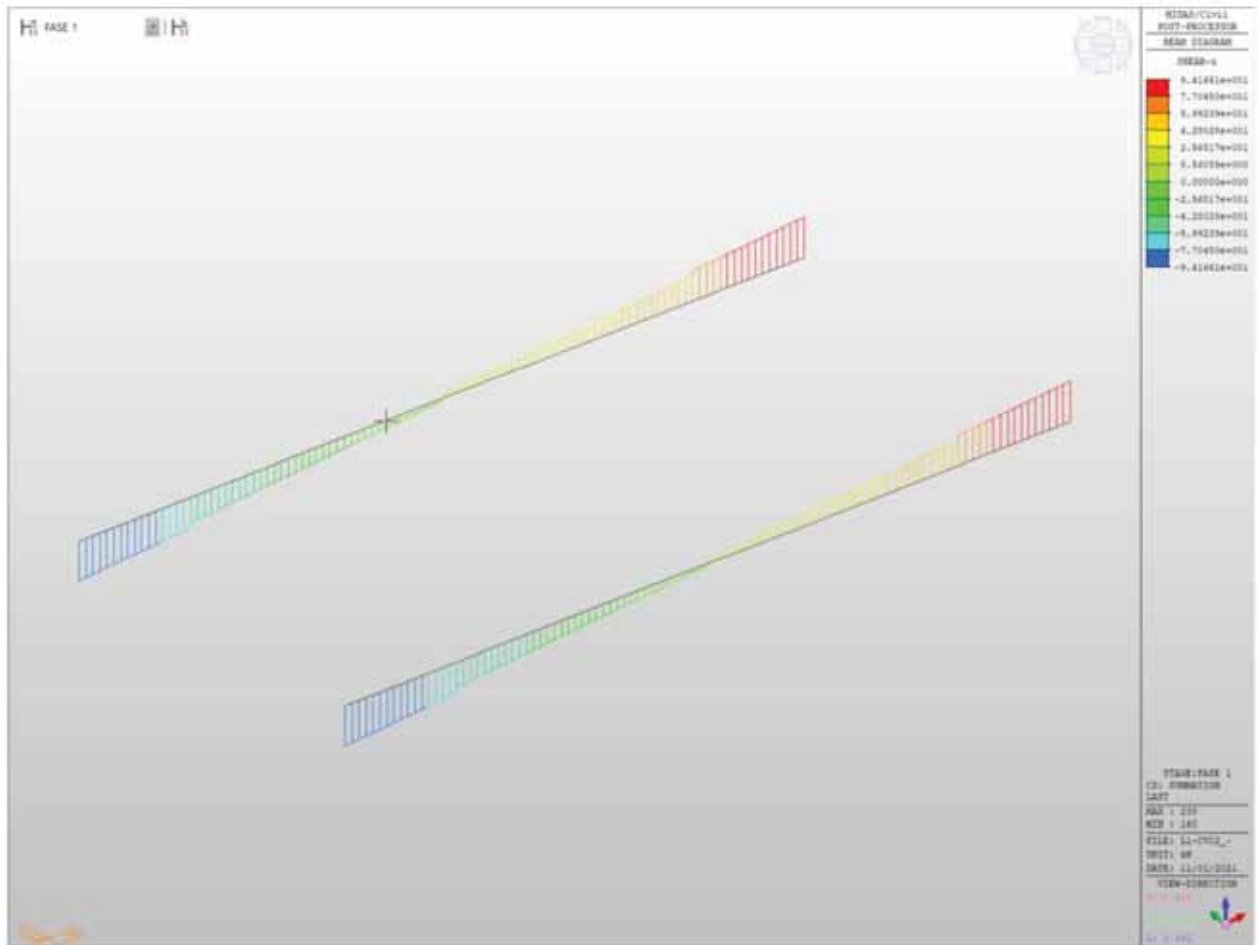


Figura 59 - Concio 3 - Diagramma Tz - Fase 1

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

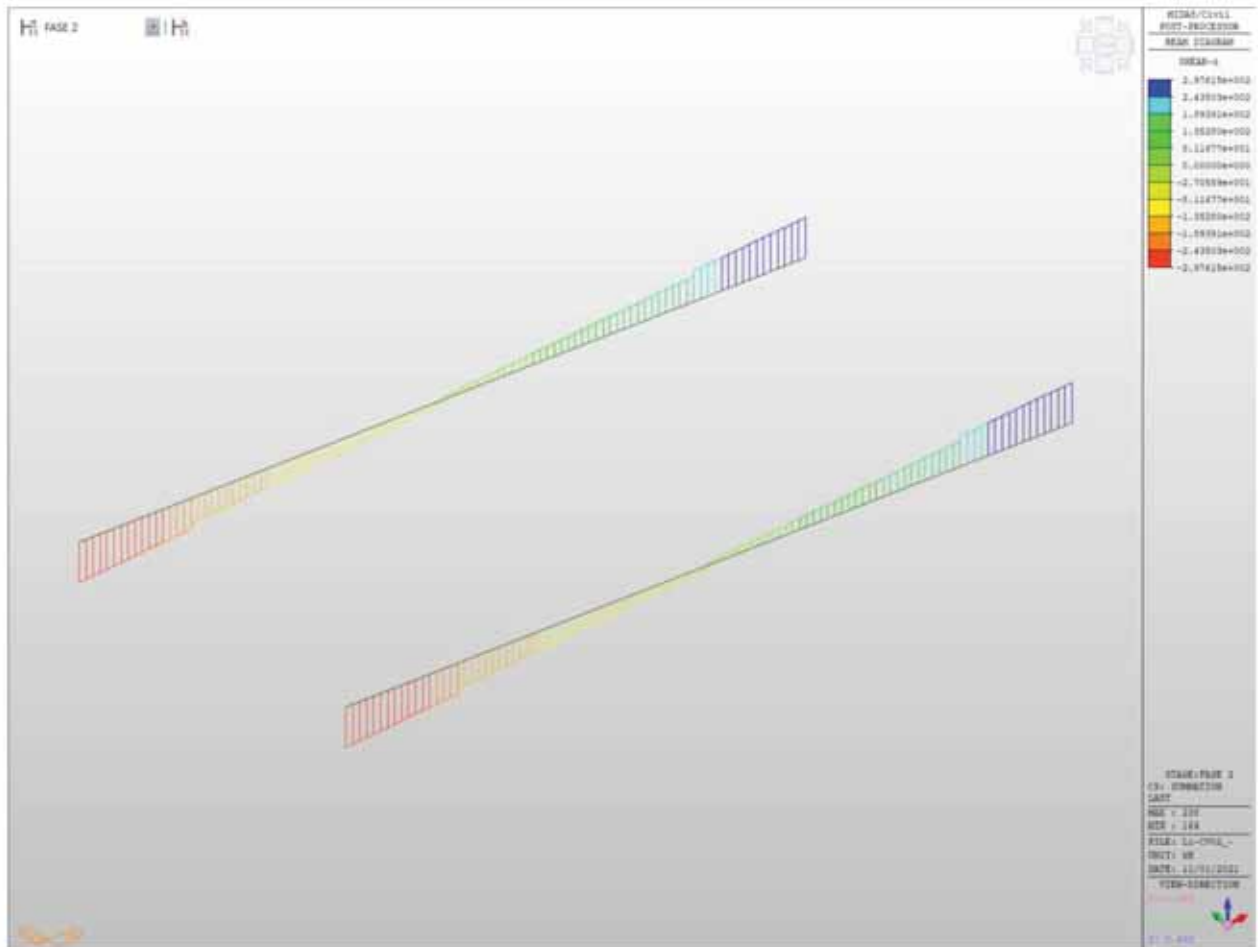


Figura 60 - Concio 3 - Diagramma Tz - Fase 2

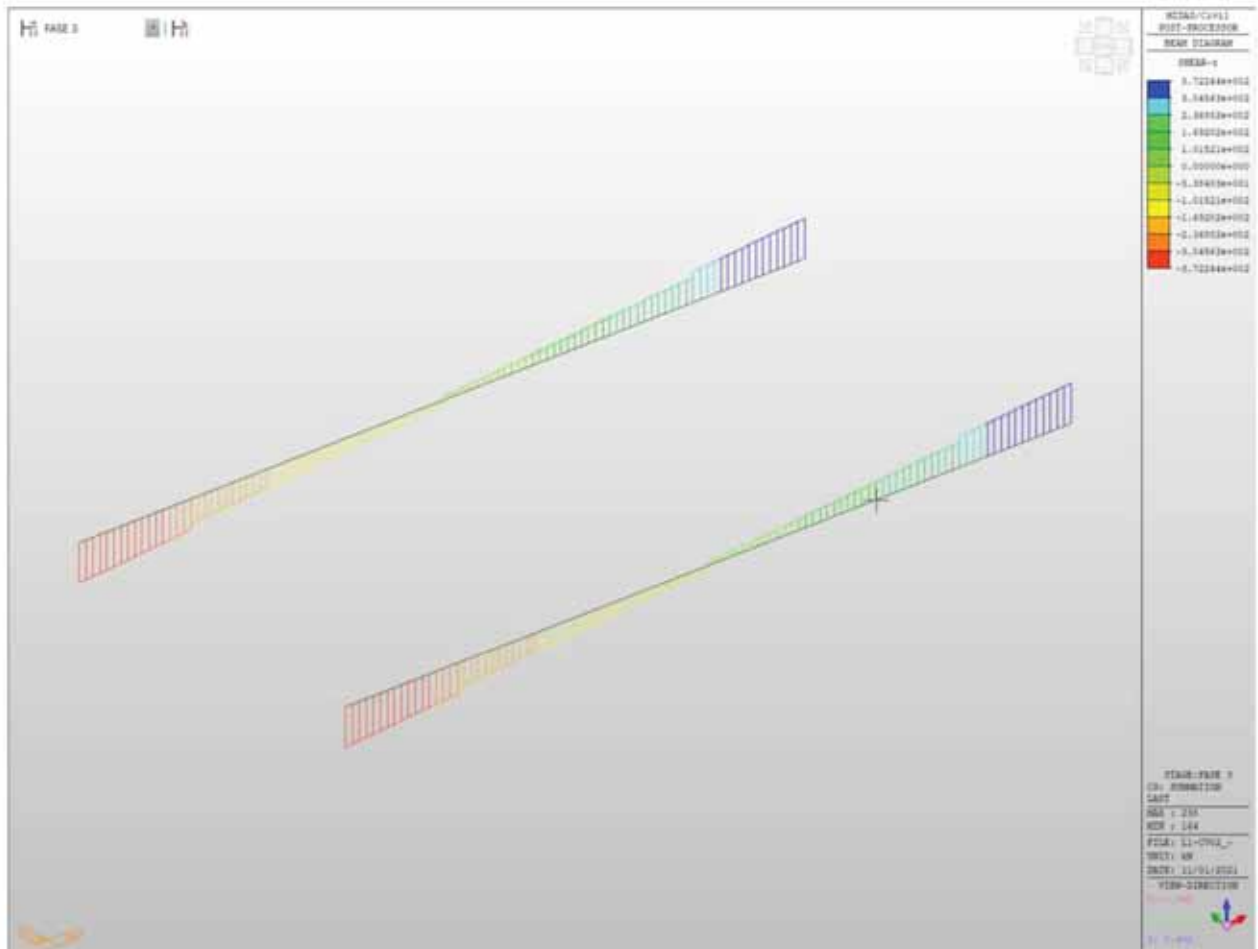


Figura 61 - Concio 3 - Diagramma Tz - Fase 3

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

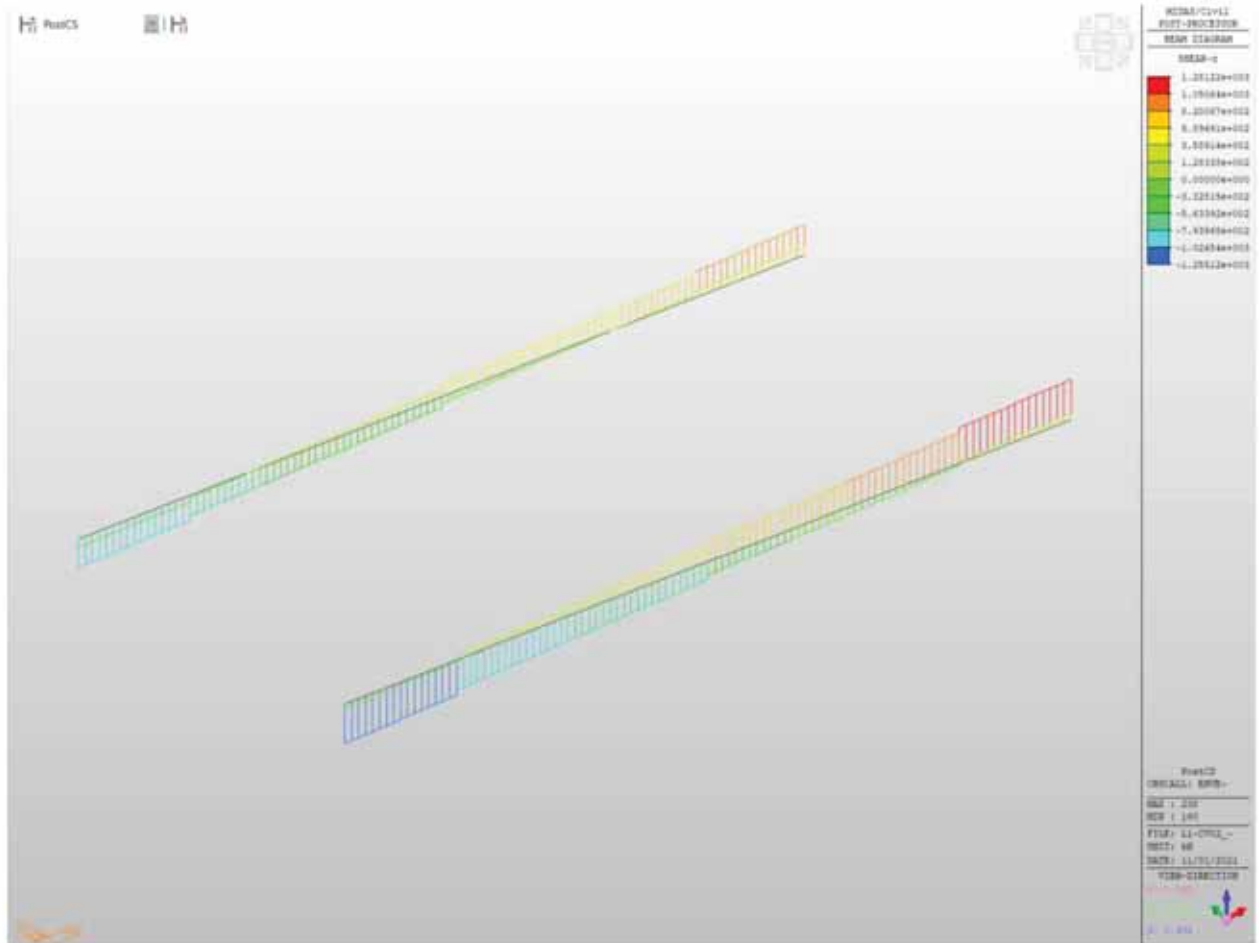


Figura 62 - Concio 3 - Diagramma Tz - Involuppo SLU-SLV

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

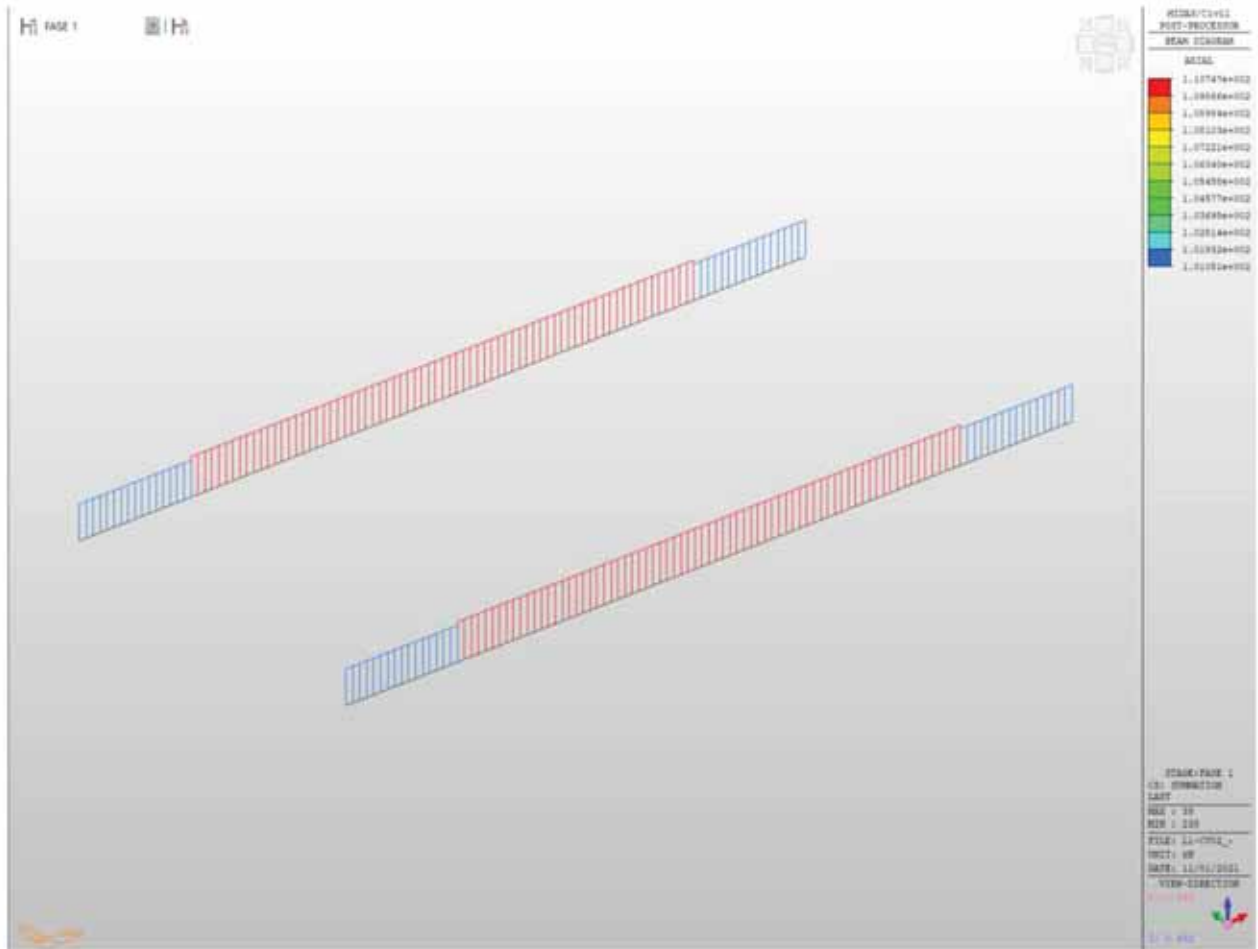


Figura 63 - Concio 3 - Diagramma N - Fase 1

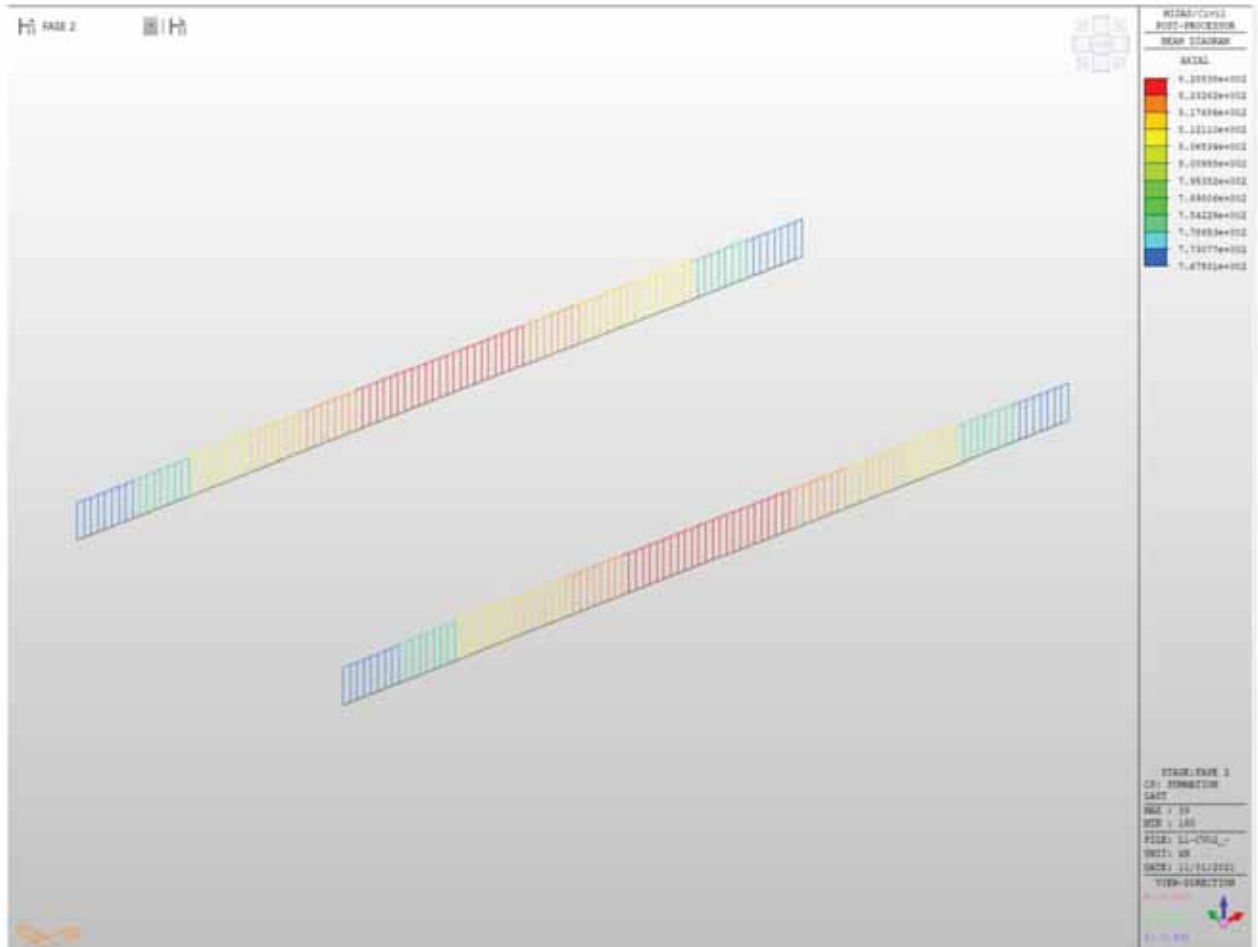


Figura 64 - Concio 3 - Diagramma N - Fase 2

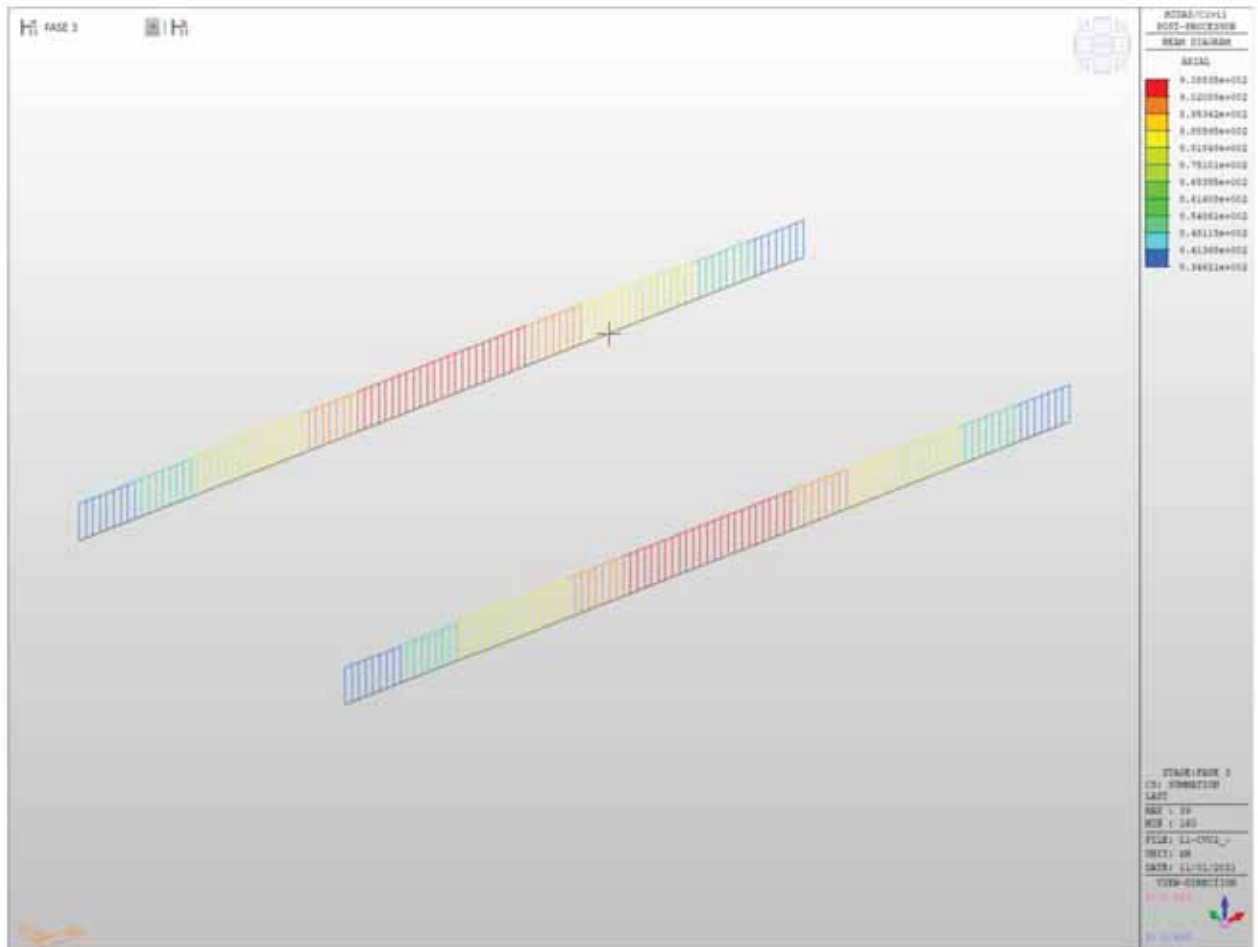


Figura 65 - Concio 3 - Diagramma N - Fase 3

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

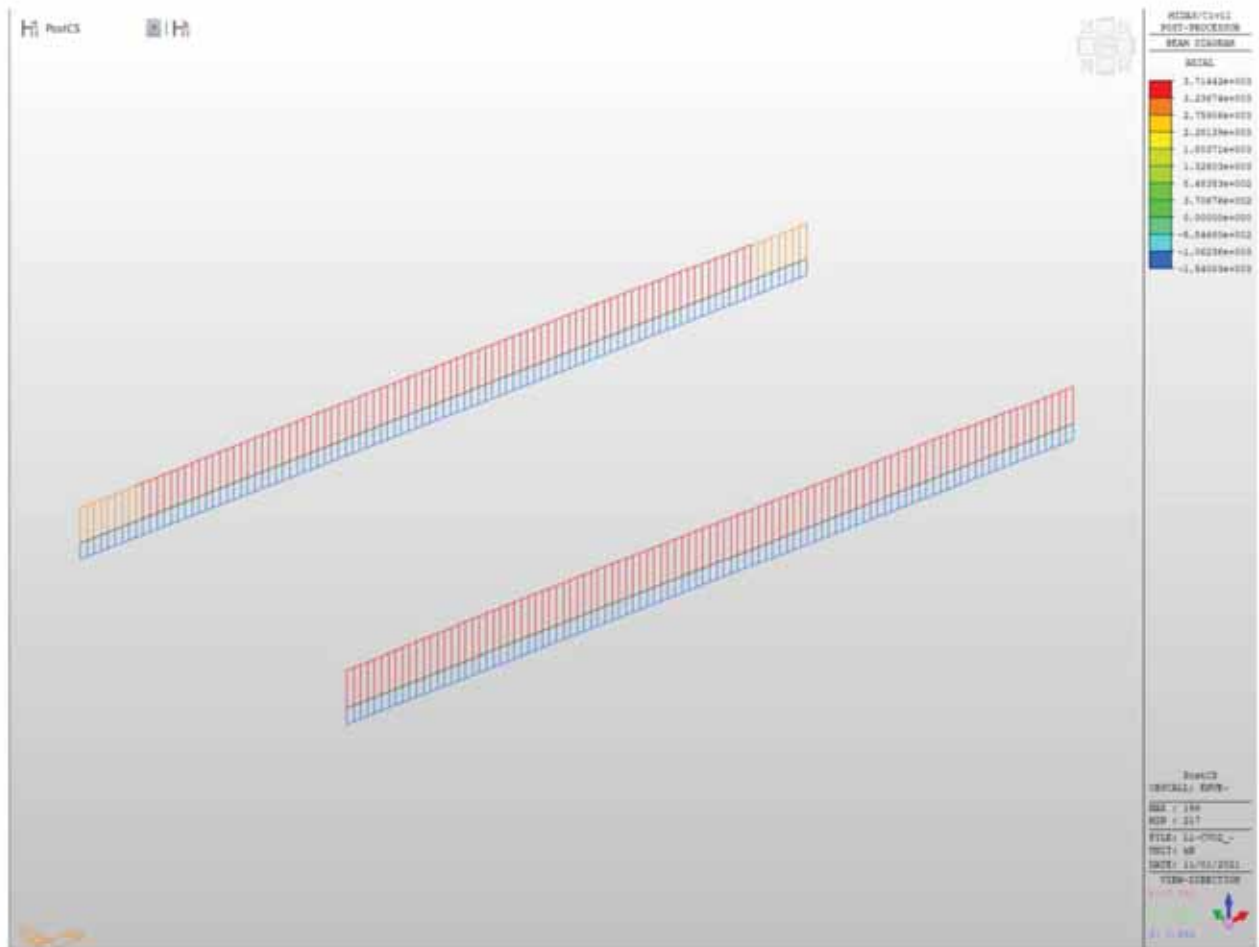
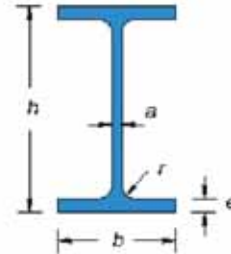


Figura 66 - Concio 3 - Diagramma N - Involuppo SLU-SLV

VERIFICA SEZIONE IN ACCIAIO COMPOSTA

CARATTERISTICHE PROFILO:

| | | | | |
|--|------------|--|--|---------------------------|
| Tipo: | S355 | | | |
| B _{sup} = | 750 | mm | | |
| t _{f, sup} = | 30.0 | mm | A _{f, sup} = | 22500.00 mm ² |
| B _{inf} = | 1200 | mm | | |
| t _{f, inf} = | 55.0 | mm | A _{f, inf} = | 66000.00 mm ² |
| H = | 2200 | mm | | |
| t _w = a = | 22.0 | mm | A _w = | 46530.00 mm ² |
| L = | 4500 | mm | n. traversi: | 1 |
| A _{tot} = | 135030.00 | mm ² | | |
| Y _{G, inf} = | 760.88 | mm | Y _{G, sup} = | 1439.12 mm |
| J _{yy} = | 1.04E+11 | mm ⁴ | J _t = | 80806840 mm ⁴ |
| J _{zz} = | 8976639633 | mm ⁴ | J _w = | 1.069E+09 mm ⁶ |
| W _{el, yy, inf} = | 137007231 | mm ³ | W _{el, yy, sup} = | 72437903 mm ³ |
| W _{pl, yy} = | 107768627 | mm ³ | | |
| $W_{pl, xx} = 2 \left[\frac{t_w H^2}{8} + t_f (b - t_w) \frac{H - t_f}{2} + 2r^2 \left(\frac{H}{2} - t_f - \frac{r}{2} \right) - 2 \frac{\pi r^2}{4} \left(\frac{H}{2} - t_f + r + \frac{4r}{3\pi} \right) \right]$ | | | | |
| ρ _{yy} = | 878.65 | mm | ρ _{xx} = | $\sqrt{\frac{J_{xx}}{A}}$ |
| ρ _{zz} = | 257.83 | mm | | |
| Peso = | 1059.99 | kg/m | | |
| E = | 210000 | N/mm ² | modulo elastico | |
| ν = | 0.3 | | coeff. poisson | |
| G = | 80769 | N/mm ² | $G = \frac{E}{2(1 + \nu)}$ modulo elasticità trasversale | |
| α = | 0.000012 | °C ⁻¹ | coeff. espansione termica lineare | |
| f _{yk} = | 355 | N/mm ² | tensione snervamento caratteristica | |
| f _{tk} = | 510 | N/mm ² | tensione rottura caratteristica | |
| γ _{M0} = | 1.05 | per sezioni classe 1,2,3 e 4 | | |
| γ _{M1} = | 1.05 | per instabilità membrature | | |
| γ _{M1} = | 1.10 | per instabilità membrature ponti stradali e ferroviari | | |
| γ _{M2} = | 1.25 | per sezioni tese indebolite dai fori nei riguardi della frattura | | |



SOLLECITAZIONI:

| | | | |
|---|-------------|-----|--|
| N _{t, sd} = | 0 | N | caso per trave tesa |
| N _{c, sd} = | 829000 | N | caso per trave compressa |
| M _{sd} = | 10102000000 | Nmm | caso per trave inflessa in una direzione |
| V _{sd} = | 298000 | N | taglio |
| Caso per trave a flessione deviata (Momenti flettenti agenti alle estremità M _B < M _A): | | | |
| M _B = | 9196000000 | Nmm | M _A = 10102000000 Nmm |
| Valori del momento massimo e minimo dell'asta: | | | |
| M _{max, y, sd} = | 0 | Nmm | M _{max, y, sd} = 0 Nmm |
| M _{max, z, sd} = | 0 | Nmm | M _{max, z, sd} = 0 Nmm |

CLASSE APPARTENENZA PROFILO (NTC2008, 4.2.3.1):

| ALA SUPERIORE | | ALA INFERIORE | | ANIMA | | | | | |
|-------------------------------------|-------|---------------|-----------------|-------|---|-----------------|-------|---|--|
| $C/t_{sup} =$ | 12.13 | 3 | $C/t_{inf} =$ | 10.71 | 3 | $C/t_w =$ | 96.14 | 3 | |
| $\varepsilon =$ | 0.81 | | $\varepsilon =$ | 0.81 | | $\varepsilon =$ | 0.81 | | |
| Curva di instabilità "b" (Asse yy): | | | | | | | | | |
| Fattore di imperfezione α : | | 0.34 | | | | | | | |
| Curva di instabilità "c" (Asse zz): | | | | | | | | | |
| Fattore di imperfezione a: | | 0.49 | | | | | | | |

SOLLECITAZIONE DELL'ASTA A TAGLIO (NTC2008, 4.2.4.1.2):

| | | | | | |
|--|---------------|-------------------|-------------------|-----------------|------------------------|
| $\frac{V_{sd}}{V_{c,Rd}} \leq 1$ | | | | | |
| Area taglio resistente: | | $A_v =$ | 47465 | mm ² | |
| $V_{c,Rd} = \frac{A_v f_{yk}}{\sqrt{3} \gamma_{M0}}$ | $V_{c,Rd} =$ | 9265138 | N | \Rightarrow | 0.03 OK!(<1) |
| Verifica in presenza di torsione uniforme: | | | | | |
| $\tau_{t,sd} =$ | 0 | N/mm ² | | | |
| $V_{c,Rd,red} = \left[1 - \frac{\tau_{t,sd}}{\frac{f_{yk}}{\sqrt{3} \gamma_{M0}}} \right] V_{c,Rd}$ | | | | | |
| $V_{c,Rd,red} =$ | 9265138 | N | \Rightarrow | 0.03 | OK!(<1) |
| Verifica in termini tensionali nel punto più sollecitato: | | | | | |
| $\frac{\tau_{sd}}{\frac{f_{yk}}{\sqrt{3} \gamma_{M0}}} \leq 1$ | \Rightarrow | 0.00 | OK!(<1) | | |

SOLLECITAZIONE DELL'ASTA A COMPRESSIONE SEMPLICE (NTC2008, 4.2.4.1.2):

$$\frac{N_{sd}}{N_{c,Rd}} \leq 1 \quad N_{cr} = \frac{\pi^2 EJ}{(\eta l)^2} \quad 918772110 \quad \text{N}$$

$N_{c,sd} < 0,04 N_{cr}$
Instabilità trascurabile!

0.04 Ncr = 36750884 N **Instabilità trascurabile se $\bar{\lambda} < 0.2$**

Calcolo snellezza membrana (< di 200 per le travature principali e < di 250 per le secondarie):

$\mu = 1.00 \quad l_0 = \mu l = 4500 \quad \text{mm}$
 $\lambda = l_0 / \rho = 5$

Calcolo resistenza per sezioni in classe 1,2 e 3:

$$N_{c,Rd} = \frac{A f_{yk}}{\gamma_{M0}} \quad N_{c,Rd} = 45653000 \quad \text{N} \quad \Rightarrow \quad 0.02 \quad \text{OK!(<1)}$$

STABILITA' DELLE MEMBRATURE (NTC2008, 4.2.4.1.3):

Curva di instabilità "b" (Asse yy):
Fattore di imperfezione α : 0.49

Verifica per sezioni classe 1,2 e 3:

$$\bar{\lambda} = \sqrt{\frac{A f_{yk}}{N_{cr}}} \quad 0.23 \quad \bar{\lambda} > 0.2 \quad \text{Serve verifica instabilità!}$$

$$\Phi = 0.5 \left[1 + \alpha(\bar{\lambda} - 0.2) + \bar{\lambda}^2 \right] \quad 0.53$$

$$\chi = \frac{1}{\Phi + \sqrt{\Phi^2 - \bar{\lambda}^2}} \quad 0.99$$

$$N_{b,Rd} = \frac{\chi A f_{yk}}{\gamma_{M1}} \quad 42947468 \quad \text{N}$$

$$\frac{N_{c,sd}}{N_{b,Rd}} \leq 1 \quad \Rightarrow \quad 0.02 \quad \text{OK!(<1)}$$

SOLLECITAZIONE DELL'ASTA A FLESSIONE MONOASSIALE RETTA (NTC2008, 4.2.4.1.2):

$$\frac{M_{sd}}{M_{c,Rd}} \leq 1$$

$$V_{sd} < 0,5 V_{c,Rd}$$

Il taglio non influisce sulla verifica a flessione!

$$\rho = \left[\frac{2V_{sd}}{V_{c,Rd}} - 1 \right]^2$$

0.87548

$$f_{y,red} = (1 - \rho)f_{yk}$$

44 N/mm²

$$f_{yk} =$$

355 N/mm²

Calcolo resistenza elastica sezione lorda, classe 3:

$$M_{el,Rd} = \frac{W_{el,min} f_{yk}}{\gamma_{M0}}$$

$$M_{c,Rd} = 46321492376$$

Nmm

=>

0.22

OK!(<1)

n. fori =

diametro =

mm

$$\frac{0,9 A_{f,net} f_{tk}}{\gamma_{M2}} \geq \frac{A_f f_{yk}}{\gamma_{M0}}$$

Non serve la verifica per la presenza dei fori!

TRAVI INFLESSE (NTC2008, 4.2.4.1.3.2):

Calcolo snellezza membrana (< di 200 per le travature principali e < di 250 per le secondarie):

$$\mu = 0.70$$

$$L_{cr} = L / \mu = 3150 \text{ mm}$$

$$W_{yy} = 137007231 \text{ mm}^3$$

$$W_{yy} = 72437903 \text{ mm}^3$$

$$\psi = 1.75 - 1.05 \frac{M_B}{M_A} + 0.3 \left(\frac{M_B}{M_A} \right)^2$$

17.05

$$M_{cr} = \psi \frac{\pi}{L_{cr}} \sqrt{E J_y G J_T} \sqrt{1 + \left(\frac{\pi}{L_{cr}} \right)^2 \frac{E J_\omega}{G J_T}}$$

6.428E+12

Nmm

0.002

$$M_{sd} / M_{cr} =$$

0.002

Risulta < 0.16 Non serve la verifica instabilità

$$\bar{\lambda}_{LT} = \sqrt{\frac{W_y f_{yk}}{M_{cr}}}$$

0.06

Risulta < 0.4 Non serve la verifica instabilità

Stabilità dei pannelli soggetti a taglio (NTC2008, 4.2.4.1.3.4.1):

Se irrigiditori trasversali rigido o no,

$$I_{st} = 45000000 \text{ mm}^4 \quad 0.75hwt^3 = 8398511 \text{ mm}^4 \quad \text{Irrigiditore Trasversali rigidi}$$

Coefficiente minimo di instabilità per taglio del pannello (In assenza di irrigiditori longitudinali),

$$a/hw = 2.05 \quad k_t = 7.30$$

Coefficiente minimo di instabilità per taglio del pannello (irrigiditori longitudinali più di due o $a/hw > 3$),

$$I_{sl} = 0 \text{ mm}^4 \quad k_{t1} = 0.00$$

$$a/hw = 2.05 \quad k_t = 7.30$$

Coefficiente minimo di instabilità per taglio del pannello (irrigiditori longitudinali più di due o $a/hw < 3$),

$$I_{sl} = 0 \text{ mm}^4 \quad a/hw = 2.05 \quad k_t = 5.61$$

$$k_t = 7.30$$

$$\eta = 1.2 \quad hw/t = 96.14 \quad \text{Serve la verifica di instabilità}$$

$$\sigma_E = 19 \text{ MPa} \quad \tau_{cr} = 138.62 \quad \lambda_w = 1.22$$

Montanti di appoggio rigidi,

$$\chi_w = 0.71$$

Gli altri casi,

$$\chi_w = 0.68$$

$$V_{bw,Rd} = 6447333 \text{ N}$$

Momento resistente sole piattabande,

$$Y_{G,inf} = 576.02 \text{ mm} \quad Y_{G,sup} = 1623.98 \text{ mm}$$

$$J_{yy} = 78124395975 \text{ mm}^4$$

$$W_{el,yy,inf} = 135628641 \text{ mm}^3 \quad W_{el,yy,sup} = 48106657 \text{ mm}^3$$

$$M_{f,red} = 15814005529 \text{ Nmm}$$

$$bf = 364.5 \text{ mm} \quad V_{bf,Rd} = 34922 \text{ N}$$

$$V_{b,Rd} = 6482254 \text{ N} \quad 0.046 \quad \text{OK! (<1)}$$

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| Stabilità dei pannelli soggetti a Compressione (NTC2008, 4.2.4.1.3.4.1): | | | | | |
|--|-----------|-----------------|--------------|-------------------|--------------------------|
| Stress, | | | | | |
| $\sigma_{sup} =$ | 139.46 | MPa | | | |
| $\sigma_{inf} =$ | -73.73 | MPa | | | |
| $\sigma_{irr.} =$ | 90.04 | MPa | | | |
| Irrigidati su entrambi i lati (Anima), | | | | | |
| $b =$ | 2115.0 | mm | (Web bw) | $a =$ | 4500 mm |
| $\sigma_1 =$ | 139.5 | (Max) | | $\sigma_2 =$ | -73.73 (Min) |
| $\psi =$ | -0.5 | | | $k\sigma =$ | 13.87 |
| $\lambda_p =$ | 1.1 | | | $\rho =$ | 0.89 |
| $\sigma_{cr,p} =$ | 285.1 | MPa | | $\sigma_{cr,c} =$ | 4.536 MPa |
| $\zeta =$ | 1.0 | | | $\lambda_c =$ | 8.846 |
| $\alpha =$ | 0.34 | | | $\Phi =$ | 115.523 |
| $\chi_c =$ | 0.004 | | | | |
| $\rho_c =$ | 0.89 | | | | |
| $b_{eff} =$ | 1232.91 | mm | $b_{e1} =$ | 493.16 mm | $b_{e2} =$ 739.74 mm |
| $b_t =$ | 731.49 | mm | | | |
| Irrigidati a un lato (Piattebande), Piattebanda Superiore, | | | | | |
| $b =$ | 364 | mm | (Flange Sup) | | |
| $\sigma (Irr.) =$ | 139.5 | | | $\sigma (Lib.) =$ | 139.46 |
| $k\sigma =$ | 0.43 | | | | |
| $\lambda_p =$ | 1.1 | | | $\rho =$ | 0.76 |
| $b_{eff} =$ | 274.98 | mm | | $b_t =$ | 0 mm |
| Effective Section Properties, | | | | | |
| $A_{c,eff} (Piattebanda Sup) =$ | 16498.9 | mm ² | | | |
| $A_{c,eff} (Piattebanda Inf) =$ | 66000.0 | mm ² | | | |
| $A_{c,eff} (Anima) =$ | 27123.9 | mm ² | | | |
| $A_c (Anima tensione) =$ | 16092.7 | mm ² | | | |
| $A_{c,eff} (Total) =$ | 125715.5 | mm ² | | | |
| $Y_{g,inf} =$ | 670.7 | mm | | $Y_{g,sup} =$ | 1529.3 mm |
| $I_{eff} =$ | 9.33E+10 | mm ⁴ | | | |
| $W_{eff} (inf) =$ | 139096795 | mm ³ | | $W_{eff} (sup) =$ | 61009314 mm ³ |
| $e =$ | 90.14 | mm | | | |
| $\eta =$ | 0.49 | | | | |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Fase 2

Soletta c.a.collaborante

| | | |
|------------------|---------|----------------|
| b_{eff} = | 2,84 | m |
| Altezza soletta: | 0,26 | m |
| Area soletta: | 0,74 | m ² |
| J_{yy} = | 0,00416 | m ⁴ |
| Peso = | 18,46 | kN/m |

Trave acciaio

| | | |
|---------------------|----------|----------------|
| Area trave acciaio: | 0,13503 | m ² |
| H trave acciaio: | 2,20 | m |
| Y_G = | 0,761 | m |
| J_{yy} = | 0,104247 | m ⁴ |
| Peso = | 10,60 | kN/m |

Barre armatura soletta

| 1° strato barre (superiore) | | 2° strato barre (inferiore) | |
|-----------------------------|-------------------------|-----------------------------|-------------------------|
| n. Barre: | 14 | n. Barre: | 14 |
| Interasse: | 0,20 m | Interasse: | 0,20 m |
| Diametro: | 0,024 m | Diametro: | 0,024 m |
| Area: | 0,006333 m ² | Area: | 0,006333 m ² |
| Y_1 = | 0,05 m | Y_2 = | 0,21 m |

n = 18,0

Coeff. omogeneizzazione con viscosità in atto

Materiali

| cls | Barre armature | Acciaio |
|----------------------|--------------------------|--------------------------|
| R_{ck} = 40 MPa | f_{yk} = 450 MPa | f_{yk} = 355 MPa |
| f_{ck} = 33,20 MPa | γ_M = 1,15 | γ_{M0} = 1,05 |
| f_{cd} = 18,81 MPa | $f_{ytd,s}$ = 391,30 MPa | $f_{ytd,s}$ = 338,10 MPa |
| f_{ctm} = 41,2 MPa | | |
| f_{ctm} = 3,10 MPa | | |
| E_{cm} = 33643 MPa | | |

Caratteristiche geometriche

| | |
|---------------------------------------|--|
| A_d = 0,1887 m ² | Area sezione omogeneizzata in area di acciaio |
| A_v = 47465 mm ² | Area taglio sezione di acciaio |
| $Y_{G,inf,d}$ = 1,21 m | Asse neutro rispetto lembo inferiore: |
| $Y_{G,sup,d}$ = 1,25 m | Asse neutro rispetto lembo superiore |
| $J_{xx,d}$ = 0,199141 m ⁴ | Momento d'inerzia sezione omogeneizzata ad acciaio |
| $W_{inf,d}$ = 0,16495 m ³ | Modulo elastico sezione omogeneizzata ad acciaio |
| $W_{sup,d}$ = 0,158968 m ³ | Modulo elastico sezione omogeneizzata ad acciaio |

Sollecitazioni

| | | | |
|--------------------------|-------|------|-----|
| $M_{s,d}$ = 12907,00 kNm | (SLU) | | |
| M_{td} = 53746,24 kNm | => | 0,24 | ok! |
| $T_{s,d}$ = 373,00 kN | (SLU) | | |
| T_{td} = 8823,94 kN | => | 0,04 | ok! |

Tensioni

| | | | | |
|------------------------------|----|------|---------|-------------------------------------|
| σ_c = 4,51 MPa | => | 0,24 | ok!(<1) | Tensione al lembo superiore soletta |
| $\sigma_{s,sup}$ = 77,95 MPa | => | 0,20 | ok!(<1) | Tensione barre superiori soletta |
| $\sigma_{s,inf}$ = 67,58 MPa | => | 0,17 | ok!(<1) | Tensione barre inferiori soletta |
| $\sigma_{a,sup}$ = 64,34 MPa | => | 0,19 | ok!(<1) | Tensione acciaio lembo superiore |
| $\sigma_{a,inf}$ = 78,25 MPa | => | 0,23 | ok!(<1) | Tensione acciaio lembo inferiore |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Fase 3

Soletta c.a.collaborante

| | |
|------------------|------------------------|
| b_{eff} = | 2,84 m |
| Altezza soletta: | 0,26 m |
| Area soletta: | 0,7384 m ² |
| J_{ca} = | 0,00416 m ⁴ |
| Peso = | 18,46 kN/m |

Trave acciaio

| | |
|---------------------|-------------------------|
| Area trave acciaio: | 0,13503 m ² |
| H trave acciaio: | 2,2 m |
| Y_G = | 0,760884 m |
| J_{ca} = | 0,104247 m ⁴ |
| Peso = | 10,59986 kN/m |

Barre armatura soletta

| 1° strato barre (superiore) | | 2° strato barre (inferiore) | |
|-----------------------------|-------------------------|-----------------------------|-------------------------|
| n. Barre: | 14 | n. Barre: | 14 |
| Interasse: | 0,20 m | Interasse: | 0,20 m |
| Diametro: | 0,024 m | Diametro: | 0,024 m |
| Area: | 0,006333 m ² | Area: | 0,006333 m ² |
| y_1 = | 0,05 m | y_2 = | 0,21 m |

n = 6,2 Coeff. omogeneizzazione a tempo infinito

Materiali

| cls | Barre armature | Acciaio |
|----------------------|--------------------------|--------------------------|
| R_{ck} = 40 MPa | f_{yk} = 450 MPa | f_{yk} = 355 MPa |
| f_{ck} = 33,20 MPa | γ_M = 1,15 | γ_{M1} = 1,05 |
| f_{td} = 18,81 MPa | $f_{ytd,s}$ = 391,30 MPa | $f_{ytd,s}$ = 338,10 MPa |
| f_{cm} = 41,2 MPa | | |
| f_{ctm} = 3,10 MPa | | |
| E_{cm} = 33643 MPa | | |

Caratteristiche geometriche

| | |
|--|--|
| A_{id} = 0,266794 m ² | Area sezione omogeneizzata in area di acciaio |
| A_w = 47465 mm ² | Area taglio sezione di acciaio |
| $Y_{G,inf,id}$ = 1,535837 m | Asse neutro rispetto lembo inferiore: |
| $Y_{G,sup,id}$ = 0,924163 m | Asse neutro rispetto lembo superiore |
| $J_{ca,id}$ = 0,269194 m ⁴ | Momento d'inerzia sezione omogeneizzata ad acciaio |
| $W_{inf,id}$ = 0,175275 m ³ | Modulo elastico sezione omogeneizzata ad acciaio |
| $W_{sup,id}$ = 0,291284 m ³ | Modulo elastico sezione omogeneizzata ad acciaio |

Sollecitazioni

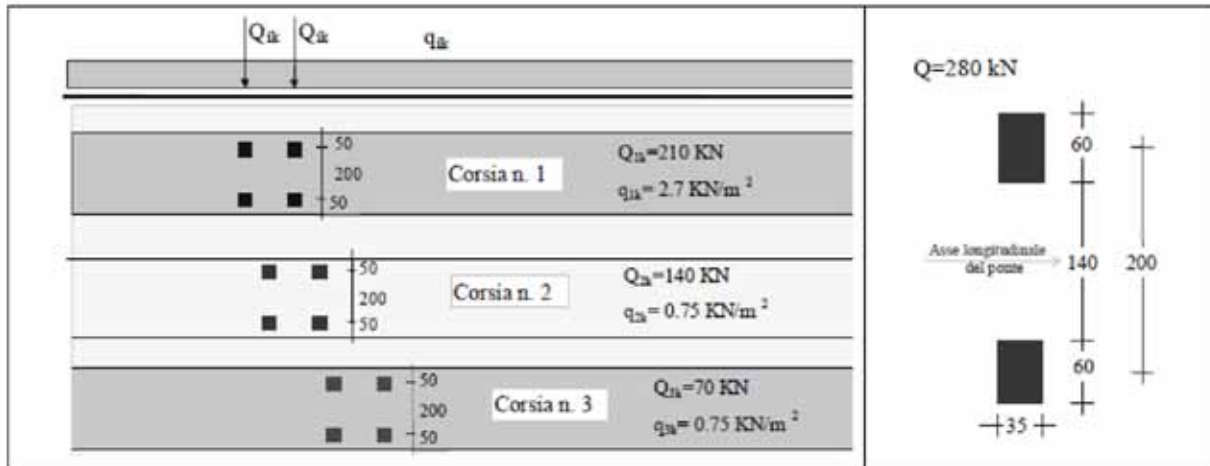
| | | |
|--------------------------|-------|----------|
| $M_{s,d}$ = 33260,00 kNm | (SLU) | |
| M_{d} = 59259,66 kNm | => | 0,56 ok! |
| $T_{s,d}$ = 1282,00 kN | (SLU) | |
| T_{d} = 8823,94 kN | => | 0,15 ok! |

Tensioni

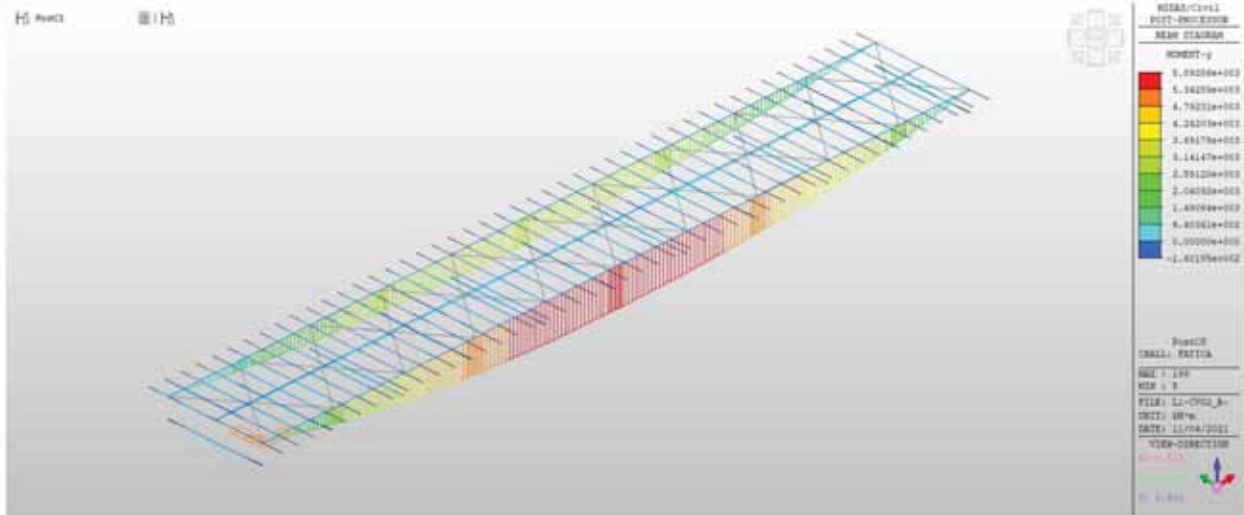
| | | | |
|-------------------------------|----|--------------|-------------------------------------|
| σ_c = 18,42 MPa | => | 0,98 ok!(<1) | Tensione al lembo superiore soletta |
| $\sigma_{s,sup}$ = 108,01 MPa | => | 0,28 ok!(<1) | Tensione barre superiori soletta |
| $\sigma_{s,inf}$ = 88,24 MPa | => | 0,23 ok!(<1) | Tensione barre inferiori soletta |
| $\sigma_{a,sup}$ = 82,06 MPa | => | 0,24 ok!(<1) | Tensione acciaio lembo superiore |
| $\sigma_{a,inf}$ = 189,76 MPa | => | 0,56 ok!(<1) | Tensione acciaio lembo inferiore |

6.2.2 VERIFICA A FATICA

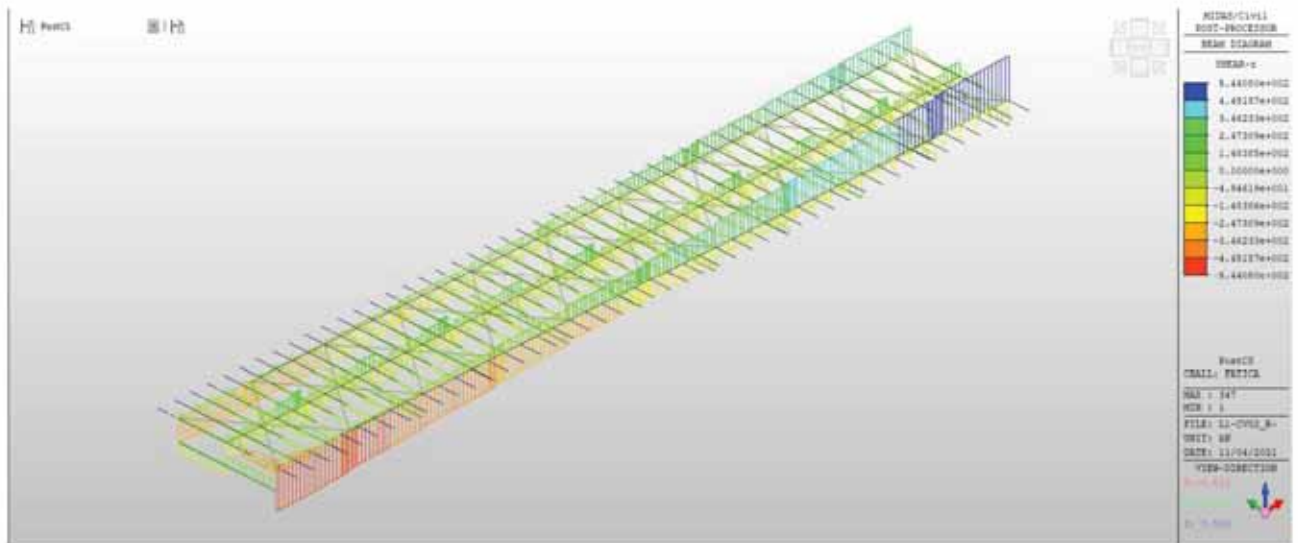
Le verifiche a fatica sono state effettuate considerando il modello di carico che è costituito dallo schema di carico 1 con valori dei carichi concentrati ridotti del 30% e valori dei carichi distribuiti ridotti del 70%.



Si riportano di seguito le sollecitazioni calcolate sulla trave oggetto di verifica soggetta ai carichi suddetti.



LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO



Si procede con il calcolo delle variazioni di tensioni sulla trave in acciaio dovute al transito dei carichi suddetti.

Sollecitazioni

| | | | | | |
|----------|----------|-----|-------|------|-----|
| M_{sd} | 5892,90 | kNm | (SLU) | | |
| M_{rd} | 59259,66 | kNm | => | 0,10 | ok! |
| T_{sd} | 544,08 | kN | (SLU) | | |
| T_{rd} | 8823,94 | kN | => | 0,06 | ok! |

Tensioni

| | | | | | | |
|------------------|-------|-----|----|------|---------|----------------------------------|
| $\sigma_{s,sup}$ | 19,14 | MPa | => | 0,05 | ok!(<1) | Tensione barre superiori soletta |
| $\sigma_{s,inf}$ | 15,63 | MPa | => | 0,04 | ok!(<1) | Tensione barre inferiori soletta |
| $\sigma_{a,sup}$ | 14,54 | MPa | => | 0,04 | ok!(<1) | Tensione acciaio lembo superiore |
| $\sigma_{a,inf}$ | 33,62 | MPa | => | 0,10 | ok!(<1) | Tensione acciaio lembo inferiore |

VERIFICHE PER VITA ILLIMITATA

Le verifiche a fatica per vita illimitata possono essere condotte controllando che il massimo delta di tensione Δs_{max} indotto nel dettaglio stesso dallo spettro di carico risulti minore del limite di fatica del dettaglio stesso:

$$\Delta s_{max,d} = \gamma_{Mf} \Delta s_{max} \leq \Delta s_{\Delta}$$


oppure

$$\Delta t_{max,d} = \gamma_{Mf} \Delta t_{max} < \Delta t_D = \Delta t_L$$

$$\Delta s_D = 0,737 \Delta s_C$$

$\gamma_{Mf} = 1,35$ (strutture sensibili alla rottura per fatica - conseguenze significative)

Travi in composizione saldata

| | | | |
|-----|---|--|--|
| 100 |  | <p>5) Saldatura manuale a cordoni d'angolo o a piena penetrazione 6) Saldatura a piena penetrazione manuale o automatica eseguita da un sol lato, in particolare per travi a cassone</p> | <p>5) e 6) Deve essere assicurato un corretto contatto tra anima e piattabanda. Il bordo dell'anima deve essere preparato in modo da garantire una penetrazione regolare alla radice, senza interruzioni</p> |
|-----|---|--|--|


Delta massimo di tensione attacco anima-ala inf:

$$\Delta S_{max} = 33,62 \text{ MPa}$$

Limiti di fatica ad ampiezza costante: $\Delta S_D = 0,737 \times 100 = 73,70 \text{ MPa}$

Verifica a fatica: $\gamma_{Mf} \Delta S_{max} < \Delta S_D$ $1,35 \times 33,62 = 45,39 \text{ MPa} < 73,70 \text{ MPa} = \Delta S_D$

Saldature di testa trasversali

| | | | |
|-----|--|--|---|
| 112 |  | <p>Saldature senza piatto di sostegno</p> <ol style="list-style-type: none"> Giunti trasversali in piatti e lamiere Giunti di anima e piattabande in travi composte eseguiti prima dell'assemblaggio Giunti trasversali completi di profili laminati, in assenza di lunette di scarico Giunti trasversali di lamiere e piatti con rastremazioni in larghezza e spessore con pendenza non maggiore di 1:4. Nelle zone di transizione gli intagli nelle saldature devono essere eliminati <p>Per spessori $t > 25 \text{ mm}$, si deve adottare una classe ridotta del coefficiente</p> $k_t = (25/t)^{0,2}$ | <p>Saldature effettuate da entrambi i lati, molate in direzione degli sforzi e sottoposte a controlli non distruttivi</p> <p>Le saldature devono essere iniziate e terminate su tacchi d'estremità, da rimuovere una volta completata la saldatura</p> <p>I bordi esterni delle saldature devono essere molati in direzione degli sforzi</p> <p>3) Vale solo per profilati tagliati e risaldati</p> |
|-----|--|--|---|

Delta massimo di tensione attacco anima-ala inf:

$$\Delta S_{max} = 33,62 \text{ MPa}$$

Limiti di fatica ad ampiezza costante: $\Delta S_D = 0,737 \times 112 = 82,54 \text{ MPa}$

Verifica a fatica: $\gamma_{Mf} \Delta S_{max} < \Delta S_D$ $1,35 \times 33,62 = 45,39 \text{ MPa} < 82,54 \text{ MPa} = \Delta S_D$

6.2.3 TRAVE DI SPINA

Si riporta di seguito la verifica della trave di spina. La trave presenta un valore di momento flettente di involuppo positivo e negativo lungo tutto il suo sviluppo per effetto dell'involuppo delle azioni statiche e sismiche. In particolare, le azioni sismiche verticali, producono proprio un effetto di inversione di momento. Per tale motivo a favore di sicurezza si verifica la trave di spina solo come elemento in acciaio trascurando l'effetto della soletta collaborante.

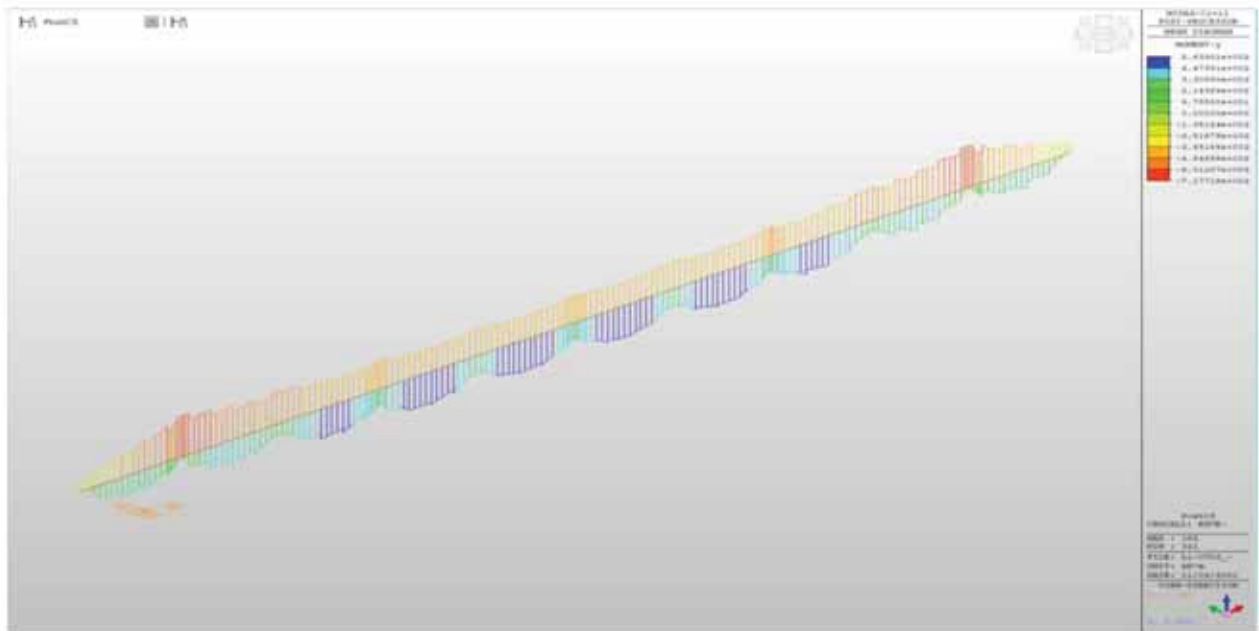


Figura 67 - Trave di spina - Diagramma My - Involuppo SLU-SLV

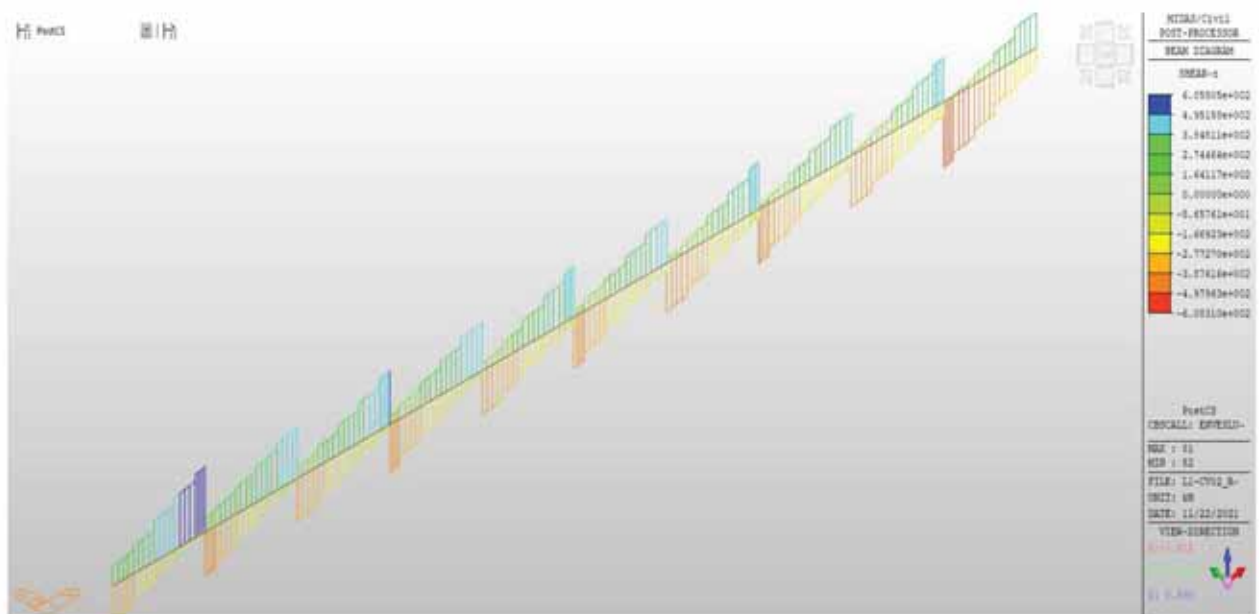
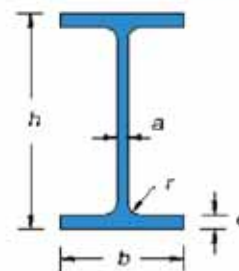


Figura 68 - Trave di spina - Diagramma Tz - Involuppo SLU-SLV

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| CARATTERISTICHE PROFILO: | | | |
|---|-----------------------------------|-------------------|--|
| Tipo: | <input type="text" value="S355"/> | | |
| B _{sup} = | 300 | mm | |
| t _{f, sup} = | 25.0 | mm | A _{f, sup} = 7500.00 mm ² |
| B _{inf} = | 300 | mm | |
| t _{f, inf} = | 25.0 | mm | A _{f, inf} = 7500.00 mm ² |
| H = | 590 | mm | |
| t _w = a = | 13.0 | mm | A _w = 7020.00 mm ² |
| L = | 4100 | mm | n. traversi: 1 |
| A _{TOT} = | 22020.00 | mm ² | |
| Y _{G, inf} = | 295.00 | mm | Y _{G, sup} = 295.00 mm |
| J _{xx} = | 1368461000 | mm ⁴ | J _t = 3520460 mm ⁴ |
| J _{yy} = | 112608019 | mm ⁴ | J _o = 5.070E+11 mm ⁶ |
| W _{el, inf} = | 4638851 | mm ³ | W _{el, sup} = 4638851 mm ³ |
| W _{pl} = | 5185200 | mm ³ | |
| $W_{pl,xx} = 2 \left[\frac{t_w H^2}{8} + t_f (b - t_w) \frac{H - t_f}{2} + 2r^2 \left(\frac{H}{2} - t_f - \frac{r}{2} \right) - 2 \frac{\pi r^2}{4} \left(\frac{H}{2} - t_f + r + \frac{4r}{3\pi} \right) \right]$ | | | |
| ρ _{xx} = | 249.29 | mm | ρ _{xx} = \sqrt{\frac{J_{xx}}{A}}} |
| ρ _{yy} = | 71.51 | mm | |
| Peso = | 172.86 | kg/m | |
| E = | 210000 | N/mm ² | modulo elastico |
| ν = | 0.3 | | coeff. poisson |
| G = | 80769 | N/mm ² | G = \frac{E}{2(1 + \nu)} modulo elasticità trasversale |
| α = | 0.000012 | °C ⁻¹ | coeff. espansione termica lineare |
| f _{yk} = | 355 | N/mm ² | tensione snervamento caratteristica |
| f _{tk} = | 510 | N/mm ² | tensione rottura caratteristica |
| γ _{M0} = | 1.05 | | per sezioni classe 1,2,3 e 4 |
| γ _{M1} = | 1.05 | | per instabilità membrature |
| γ _{M1} = | 1.10 | | per instabilità membrature ponti stradali e ferroviari |
| γ _{M2} = | 1.25 | | per sezioni tese indebolite dai fori nei riguardi della frattura |
| SOLLECITAZIONI: | | | |
| N _{t, sd} = | 0 | N | caso per trave tesa |
| N _{c, sd} = | 0 | N | caso per trave compressa |
| M _{sd} = | 717720000 | Nmm | caso per trave inflessa in una direzione |
| V _{sd} = | 608310 | N | taglio |
| Caso per trave a flessione deviata: | | | |
| M _{y, sd} = | 0 | Nmm | M _{z, sd} = 0 Nmm |
| Valori del momento massimo e minimo dell'asta: | | | |
| M _{max, y, sd} = | 0 | Nmm | M _{max, y, sd} = 0 Nmm |
| M _{max, z, sd} = | 0 | Nmm | M _{max, z, sd} = 0 Nmm |



LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| CLASSE APPARTENENZA PROFILO [NTC2008, 4.2.3.1]: | | | | | |
|--|------|----------------------|------|---------------------------------|-------|
| ALA SUPERIORE | | ALA INFERIORE | | ANIMA | |
| $C/t_{sup} =$ | 5.74 | $C/t_{inf} =$ | 5.74 | $C/t_w =$ | 41.54 |
| $\varepsilon =$ | 0.81 | $\varepsilon =$ | 0.81 | $\varepsilon =$ | 0.81 |
| Curva di instabilità "b": Fattore di imperfezione α : 0.34 | | | | | |
| <input checked="" type="radio"/> Parte soggetta a flessione <input type="radio"/> Parte soggetta a compressione <input type="radio"/> Parte soggetta a flessione ed a compressione | | | | ANIMA Classe 1 | |

| SOLLECITAZIONE DELL'ASTA A TAGLIO [NTC2008, 4.2.4.1.2]: | | | | | |
|---|--------------|---------|------|-----------------|------------------------|
| $\frac{V_{sd}}{V_{c,Rd}} \leq 1$ | | | | | |
| Area taglio resistente: | | $A_v =$ | 7345 | mm ² | |
| $V_{c,Rd} = \frac{A_v f_{yk}}{\sqrt{3} \gamma_{M0}}$ | $V_{c,Rd} =$ | 1433739 | N | \Rightarrow | 0.42 OKI(<1) |

| SOLLECITAZIONE DELL'ASTA A FLESSIONE MONOASSIALE RETTA [NTC2008, 4.2.4.1.2]: | | | | | |
|--|---------------|---|-----|-------------------|------------------------|
| $\frac{M_{sd}}{M_{e,Rd}} \leq 1$ | | | | | |
| $V_{sd} < 0,5 V_{c,Rd}$ | | Il taglio non influisce sulla verifica a flessione! | | | |
| $\rho = \left[\frac{2V_{sd}}{V_{c,Rd}} - 1 \right]^2$ | 0.02293 | $f_{y,Rd} = (1 - \rho) f_{yk}$ | 347 | N/mm ² | |
| | | $f_{yk} =$ | 355 | N/mm ² | |
| Calcolo resistenza plastica sezione lorda, classe 1 e 2: | | | | | |
| $M_{pl,Rd} = \frac{W_{pl} f_{yk}}{\gamma_{M0}}$ | $M_{pl,Rd} =$ | 1753091429 | Nmm | \Rightarrow | 0.41 OKI(<1) |
| Calcolo resistenza elastica sezione lorda, classe 3: | | | | | |
| $M_{el,Rd} = \frac{W_{el,min} f_{yk}}{\gamma_{M0}}$ | $M_{el,Rd} =$ | 1568373382 | Nmm | \Rightarrow | 0.46 OKI(<1) |

6.2.4 TRAVERSO

Si riportano di seguito i diagrammi di sollecitazione e di verifica dei traveri.

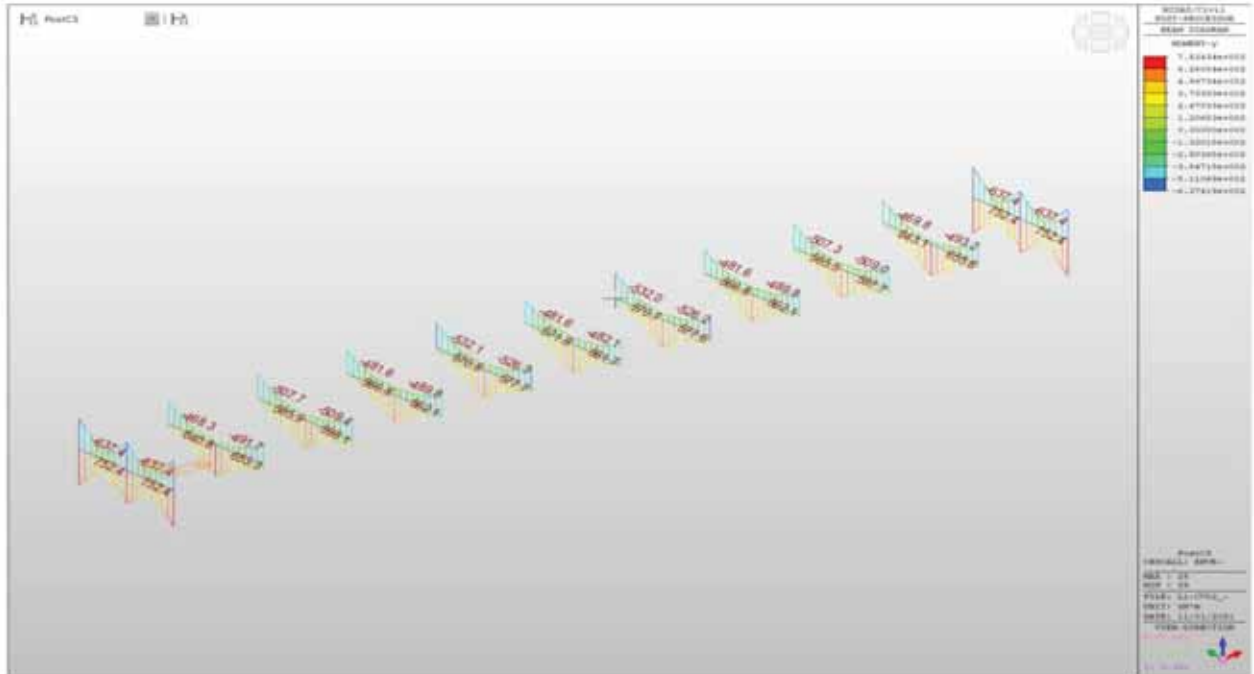


Figura 69 – Traverso - Momento SLU-SLV

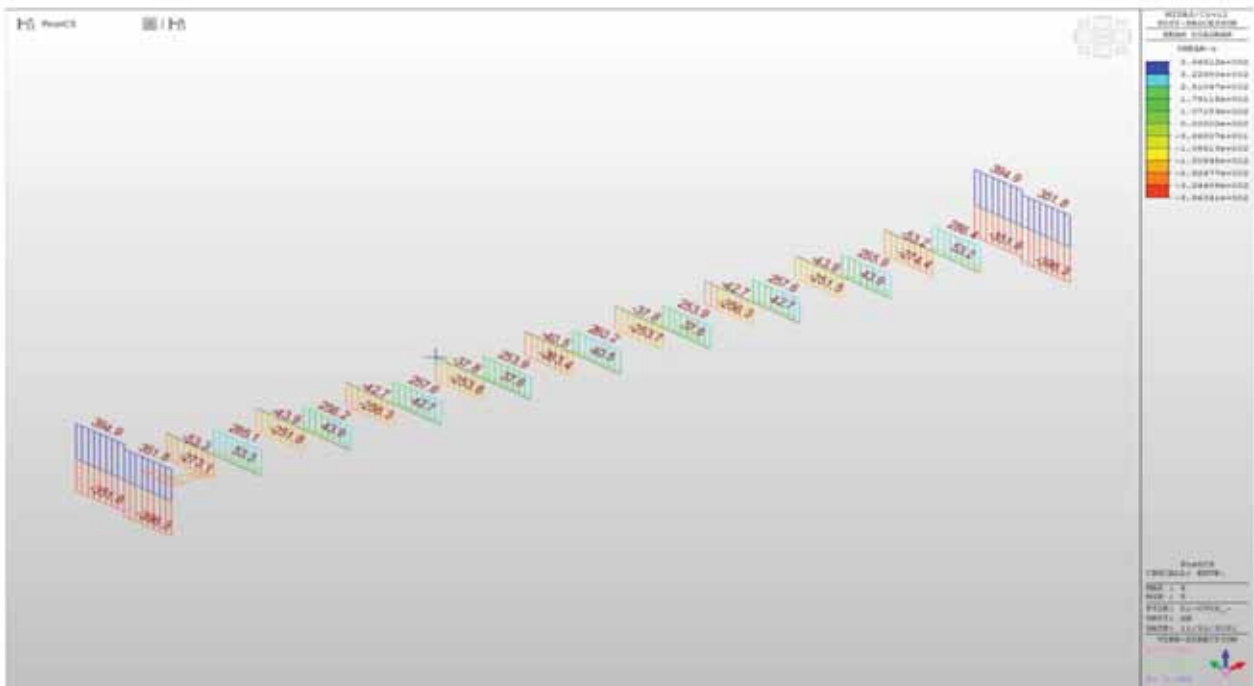
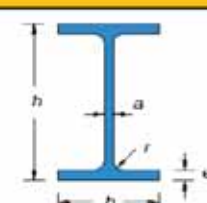


Figura 70 - Traverso - Taglio SLU-SLV

6.2.4.1 VERIFICA TRAVERSO DI CAMPATA

| CARATTERISTICHE PROFILO: | | | |
|---|------------|-------------------|--|
| Tipo: | 5355 | | |
| B _{SUP} = | 350 | mm | |
| t _{SUP} = | 25,0 | mm | A _{e,inf} = 8750,00 mm ² |
| B _{INF} = | 350 | mm | |
| t _{INF} = | 25,0 | mm | A _{e,sup} = 8750,00 mm ² |
| H = | 800 | mm | |
| t _w = a = | 20,0 | mm | A _w = 15000,00 mm ² |
| L = | 4500 | mm | n. traversi: 1 |
| A _{tot} = | 32500,00 | mm ² | |
| Y _{0,inf} = | 400,00 | mm | Y _{0,sup} = 400,00 mm |
| J _{xx} = | 3331770833 | mm ⁴ | J _y = 5645833 mm ⁴ |
| J _{yy} = | 179179167 | mm ⁴ | J _w = 2,731E+14 mm ⁶ |
| W _{el,inf} = | 8329427 | mm ³ | W _{el,sup} = 8329427 mm ³ |
| W _{el} = | 9593750 | mm ³ | |
| $W_{pl,xx} = 2 \left[\frac{t_w H^2}{8} + t_f (b - t_w) \frac{H - t_f}{2} + 2r^2 \left(\frac{H}{2} - t_f - \frac{r}{2} \right) - 2 \frac{\pi r^2}{4} \left(\frac{H}{2} - t_f + r + \frac{4r}{3\pi} \right) \right]$ | | | |
| ρ _{xx} = | 320,18 | mm | ρ _{xx} = \sqrt{\frac{J_{xx}}{A}}} |
| ρ _{yy} = | 74,25 | mm | |
| Peso = | 255,13 | kg/m | |
| E = | 210000 | N/mm ² | modulo elastico |
| ν = | 0,3 | | coeff. poisson |
| G = | 80769 | N/mm ² | G = \frac{E}{2(1 + \nu)} modulo elasticità trasversale |
| α = | 0,000012 | °C ⁻¹ | coeff. espansione termica lineare |
| f _{tk} = | 355 | N/mm ² | tensione snervamento caratteristica |
| f _{tk} = | 510 | N/mm ² | tensione rottura caratteristica |
| γ _{M1} = | 1,05 | | per sezioni classe 1,2,3 e 4 |
| γ _{M1} = | 1,05 | | per instabilità membrature |
| γ _{M1} = | 1,10 | | per instabilità membrature ponti stradali e ferroviari |
| γ _{Ed} = | 1,25 | | per sezioni tese indebolite dai fori nei riguardi della frattura |



| SOLLECITAZIONI: | | | |
|--|-----------|-----|--|
| N _{1,Ed} = | 0 | N | caso per trave tesa |
| N _{2,Ed} = | 0 | N | caso per trave compressa |
| M _{1,Ed} = | 655600000 | Nmm | caso per trave inflessa in una direzione |
| V _{1,Ed} = | 286400 | N | taglio |
| Caso per trave a flessione deviata: | | | |
| M _{x,Ed} = | 0 | Nmm | M _{y,Ed} = 0 Nmm |
| Valori del momento massimo e minimo dell'asta: | | | |
| M _{max,y,Ed} = | 0 | Nmm | M _{max,x,Ed} = 0 Nmm |
| M _{min,y,Ed} = | 0 | Nmm | M _{min,x,Ed} = 0 Nmm |

| CLASSE APPARTENENZA PROFILO (NTC2008, 4.2.3.1): | | | | |
|--|------|----------------------|------|--------------------------|
| ALA SUPERIORE | | ALA INFERIORE | | ANIMA |
| C/t _{SUP} = | 6,60 | C/t _{INF} = | 6,60 | C/t _w = 37,50 |
| c = | 0,81 | c = | 0,81 | c = 0,81 |
| Curva di instabilità "b": | | | | |
| Fattore di imperfezione α: | | 0,34 | | |
| <input checked="" type="radio"/> Parte soggetta a flessione <input type="radio"/> Parte soggetta a compressione <input type="radio"/> Parte soggetta a flessione ed a compressione | | | | ANIMA Classe 1 |

SOLLECITAZIONE DELL'ASTA A TAGLIO (NTC2008, 4.2.4.1.2):

$$\frac{V_{sd}}{V_{c,Rd}} \leq 1$$

Area taglio resistente:

$$A_v = 15500 \text{ mm}^2$$

$$V_{c,Rd} = \frac{A_v f_{yk}}{\sqrt{3} \gamma_{M0}}$$

$$V_{c,Rd} = 3025590 \text{ N}$$

$$N \Rightarrow 0,09 \text{ OK! (<1)}$$

Verifica in presenza di torsione uniforme:

$$\tau_{t,sd} = 0 \text{ N/mm}^2$$

$$V_{c,Rd,red} = \left[1 - \frac{\tau_{t,sd}}{f_{yk}} \right] V_{c,Rd}$$

$$V_{c,Rd,red} = 3025590 \text{ N} \Rightarrow 0,09 \text{ OK! (<1)}$$

Verifica in termini tensionali nel punto più sollecitato:

$$\frac{\tau_{sd}}{f_{yk}} \leq 1 \Rightarrow 0,00 \text{ OK! (<1)}$$

SOLLECITAZIONE DELL'ASTA A FLESSIONE MONOASSIALE RETTA (NTC2008, 4.2.4.1.2):

$$\frac{M_{sd}}{M_{c,Rd}} \leq 1$$

$$V_{sd} < 0,5 V_{c,Rd}$$

Il taglio non influisce sulla verifica a flessione!

$$\rho = \left[\frac{2V_{sd}}{V_{c,Rd}} - 1 \right]^2$$

$$0,65720$$

$$f_{y,red} = (1 - \rho) f_{yk} = 122 \text{ N/mm}^2$$

$$f_{yk} = 355 \text{ N/mm}^2$$

Calcolo resistenza plastica sezione lorda, classe 1 e 2:

$$M_{pl,Rd} = \frac{W_{pl} f_{yk}}{\gamma_{M0}}$$

$$M_{pl,Rd} = 3243601190 \text{ Nmm}$$

$$\Rightarrow 0,20 \text{ OK! (<1)}$$

Calcolo resistenza elastica sezione lorda, classe 3:

$$M_{eL,Rd} = \frac{W_{eLmin} f_{yk}}{\gamma_{M0}}$$

$$M_{eL,Rd} = 2816139633 \text{ Nmm}$$

$$\Rightarrow 0,23 \text{ OK! (<1)}$$

6.2.4.2 VERIFICA TRAVERSO DI TESTATA

| CARATTERISTICHE PROFILO: | | | |
|--|-------------|--------------------------|--|
| Tipo: | S235 | | |
| B _{sup} = | 350 | mm | |
| t _{sup} = | 25,0 | mm | A _{e, sup} = 8750,00 mm ² |
| B _{inf} = | 350 | mm | |
| t _{inf} = | 25,0 | mm | A _{e, inf} = 8750,00 mm ² |
| H = | 1350 | mm | |
| t _w = a = | 20,0 | mm | A _w = 26000,00 mm ² |
| L = | 4500 | mm | n. traversi: 1 |
| A _{tot} = | 43500,00 | mm ² | |
| | | | |
| Y _{0, inf} = | 675,00 | mm | Y _{0, sup} = 675,00 mm |
| J _{xx} = | 11343437500 | mm ⁴ | J _y = 7112500 mm ⁴ |
| J _{yy} = | 179545833 | mm ⁴ | J _{xx} = 2,731E+14 mm ⁴ |
| W _{el, inf} = | 16805093 | mm ³ | W _{el, sup} = 16805093 mm ³ |
| W _{pl} = | 20043750 | mm ³ | |
| $W_{pl, xx} = 2 \left[\frac{t_w H^2}{8} + t_f (b - t_w) \frac{H - t_f}{2} + 2r^2 \left(\frac{H}{2} - t_f - \frac{r}{2} \right) - 2 \frac{r^3}{4} \left(\frac{H}{2} - t_f + r + \frac{4r}{3r} \right) \right]$ | | | |
| r _{xx} = | 510,66 | mm | r _{yy} = $\sqrt{\frac{J_{yy}}{A}}$ |
| r _{yy} = | 64,25 | mm | |
| Peso = | 341,48 | kg/m | |
| E = | 210000 | N/mm ² | modulo elastico |
| ν = | 0,3 | | coeff. poisson |
| G = | 80769 | N/mm ² | G = $\frac{E}{2(1 + \nu)}$ modulo elasticità trasversale |
| α = | 0,000012 | °C ⁻¹ | coeff. espansione termica lineare |
| f _{yk} = | 355 | N/mm ² | tensione snervamento caratteristica |
| f _{tk} = | 510 | N/mm ² | tensione rottura caratteristica |
| γ _{M0} = | 1,05 | | per sezioni classe 1,2,3 e 4 |
| γ _{M1} = | 1,05 | | per instabilità membrature |
| γ _{M1} = | 1,10 | | per instabilità membrature ponti stradali e ferroviari |
| γ _{M2} = | 1,25 | | per sezioni tese indebolite dai fori nei riguardi della frattura |
| SOLLECITAZIONI: | | | |
| N _{1, id} = | 0 | N | caso per trave tesa |
| N _{2, id} = | 0 | N | caso per trave compressa |
| M _{1, id} = | 752430000 | Nmm | caso per trave inflessa in una direzione |
| V _{1, id} = | 397333 | N | taglio |
| Caso per trave a flessione deviata: | | | |
| M _{1, id} = | 0 | Nmm | M _{2, id} = 0 Nmm |
| Valori del momento massimo e minimo dell'asta: | | | |
| M _{max, 1, id} = | 0 | Nmm | M _{max, 2, id} = 0 Nmm |
| M _{max, 2, id} = | 0 | Nmm | M _{max, 1, id} = 0 Nmm |
| CLASSE APPARTENENZA PROFILO (NTC2008, 4.2.3.1): | | | |
| ALA SUPERIORE | | ALA INFERIORE | |
| C/t _{sup} = | 6,60 | C/t _{inf} = | 6,60 |
| ε = | 0,81 | ε = | 0,81 |
| ANIMA | | ANIMA | |
| C/t _w = 65,00 | | C/t _w = 65,00 | |
| ε = 0,81 | | ε = 0,81 | |
| Curva di instabilità "b": | | | |
| Fattore di imperfezione α: 0,34 | | | |
| ANIMA | | | |
| Classe 2 | | | |
| <input checked="" type="radio"/> Parte soggetta a flessione <input type="radio"/> Parte soggetta a compressione <input type="radio"/> Parte soggetta a flessione ed a compressione | | | |

SOLLECITAZIONE DELL'ASTA A TAGLIO (NTC2008, 4.2.4.1.2):

$$\frac{V_{sd}}{V_{c,Rd}} \leq 1$$

Area taglio resistente: $A_v = 26500 \text{ mm}^2$

$$V_{c,Rd} = \frac{A_v f_{yk}}{\sqrt{3} \gamma_{M0}} \quad V_{c,Rd} = 5172783 \text{ N} \quad \Rightarrow \quad 0,08 \quad \text{OK! (<1)}$$

Verifica in presenza di torsione uniforme:

$$\tau_{t,sd} = 0 \text{ N/mm}^2$$

$$V_{c,Rd,red} = \left[1 - \frac{\tau_{t,sd}}{f_{yk}} \frac{1}{\sqrt{3} \gamma_{M0}} \right] V_{c,Rd}$$

$$V_{c,Rd,red} = 5172783 \text{ N} \quad \Rightarrow \quad 0,08 \quad \text{OK! (<1)}$$

Verifica in termini tensionali nel punto più sollecitato:

$$\frac{\tau_{sd}}{f_{yk}} \frac{1}{\sqrt{3} \gamma_{M0}} \leq 1 \quad \Rightarrow \quad 0,00 \quad \text{OK! (<1)}$$

SOLLECITAZIONE DELL'ASTA A FLESSIONE MONOASSIALE RETTA (NTC2008, 4.2.4.1.2):

$$\frac{M_{sd}}{M_{c,Rd}} \leq 1$$

$V_{sd} < 0,5 V_{c,Rd}$ *Il taglio non influisce sulla verifica a flessione!*

$$\rho = \left[\frac{2V_{sd}}{V_{c,Rd}} - 1 \right]^2 \quad 0,71635 \quad f_{y,red} = (1 - \rho) f_{yk} \quad 101 \text{ N/mm}^2$$

$$f_{yk} = 355 \text{ N/mm}^2$$

Calcolo resistenza plastica sezione lorda, classe 1 e 2:

$$M_{pl,Rd} = \frac{W_{pl} f_{yk}}{\gamma_{M0}} \quad M_{pl,Rd} = 6776696429 \text{ Nmm} \quad \Rightarrow \quad 0,11 \quad \text{OK! (<1)}$$

Calcolo resistenza elastica sezione lorda, classe 3:

$$M_{el,Rd} = \frac{W_{el,min} f_{yk}}{\gamma_{M0}} \quad M_{c,Rd} = 5681721781 \text{ Nmm} \quad \Rightarrow \quad 0,13 \quad \text{OK! (<1)}$$

6.2.5 VERIFICA PIOLI

Si riporta nel seguito la verifica del sistema di collegamento fra trave metallica e soletta gettata in opera. Il sistema di connessione è realizzato mediante pioli di tipo Nelson resistenti a taglio, saldati alla piattabanda superiore della trave principale ed annegati nella soletta in calcestruzzo. Si ritiene che l'intera forza di scorrimento sia assorbita solo dalla piolatura predisposta sulle travi principali di impalcato, trascurando, a favore di sicurezza il contributo della piolatura posta sulla trave di spina. Il dimensionamento dei connettori è stato eseguito in riferimento alle prescrizioni indicate dalla normativa. Scegliendo di inserire i pioli a passo costante lungo tutto lo sviluppo della trave, si è scelto di determinare la forza di scorrimento applicata tramite l'integrazione delle tensioni indotte sulla soletta collaborante considerando le tensioni indotte ai lembi della soletta stessa.

La collaborazione tra la trave metallica e la soletta è assicurata mediante pioli elettrosaldati all'ala della trave di acciaio. Per le verifiche si fa riferimento al punto 4.3.4.3.1.2 delle NTC.

$$P_{s.d.s} = 0,8 f_u (\pi d^2 / 4) / \gamma_v \quad [4.3.9]$$

$$P_{s.d.s} = 0,29 \alpha d^2 (f_{ct} E_{cm})^{0,5} / \gamma_v \quad [4.3.10]$$

In cui:

γ_v è il fattore parziale definito al § 4.3.3;

f_{tk} è la resistenza caratteristica a rottura dell'acciaio del piolo (comunque $f_{tk} \leq 500$ MPa);

f_{ck} è la resistenza cilindrica caratteristica del calcestruzzo della soletta;

E_{cm} è il valore medio del modulo elastico secante del calcestruzzo della soletta definito al § 11.2.10.3;

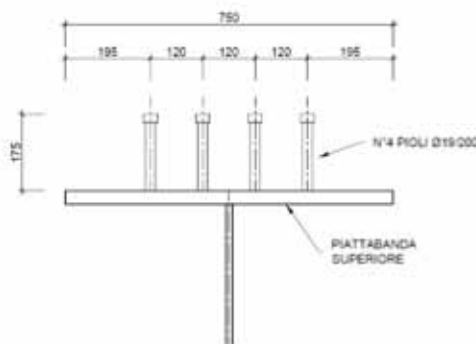
d è il diametro del piolo, compreso tra 16 e 25 mm;

h_{sc} è l'altezza del piolo dopo la saldatura;

$$\alpha = 0,2 (h_{sc} / d + 1) \quad \text{per } 3 \leq h_{sc} / d \leq 4, \quad [4.3.11 a]$$

$$\alpha = 1,0 \quad \text{per } h_{sc} / d > 4. \quad [4.3.11 b]$$

Per il caso in esame si ottiene:



| | | |
|--------------|--------|-----|
| $f_{tk} =$ | 450 | Mpa |
| $f_{ck} =$ | 32 | Mpa |
| $E_{cm} =$ | 33346 | Mpa |
| $\alpha =$ | 1 | |
| $d =$ | 19 | mm |
| $\gamma_v =$ | 1,25 | |
| $Pr_{d,a} =$ | 81,656 | kN |
| $Pr_{d,c} =$ | 86,515 | kN |

Si procedere ora con il calcolo della forza di scorrimento e quindi con il valore di carico massimo determinato per ciascun piolo.

| | | |
|--------------------------------|----------|-----|
| L = | 45 | m |
| Bsol = | 2840 | mm |
| H tot = | 2460 | mm |
| H sol = | 260 | mm |
| Y_{G,sup,id} = | 924,16 | mm |
| σ_{c1} = | 18,42 | Mpa |
| σ_{c2} = | 13,24 | Mpa |
| | | |
| Fv_(L/2) = | 519,3791 | kN |
| | | |
| Δx = | 200 | mm |
| N_{Pioli} = | 4 | |
| Fv_{-(PIOLO)} = | 25,97 | kN |

Fv_Piolo < min (Prd,a ; Prd,c) - Ok Verificato

6.2.6 GIUNTI BULLONATI

Si riporta di seguito la verifica dei giunti bullonati previsti nei traversi di spalla che risultano essere maggiormente sollecitati.

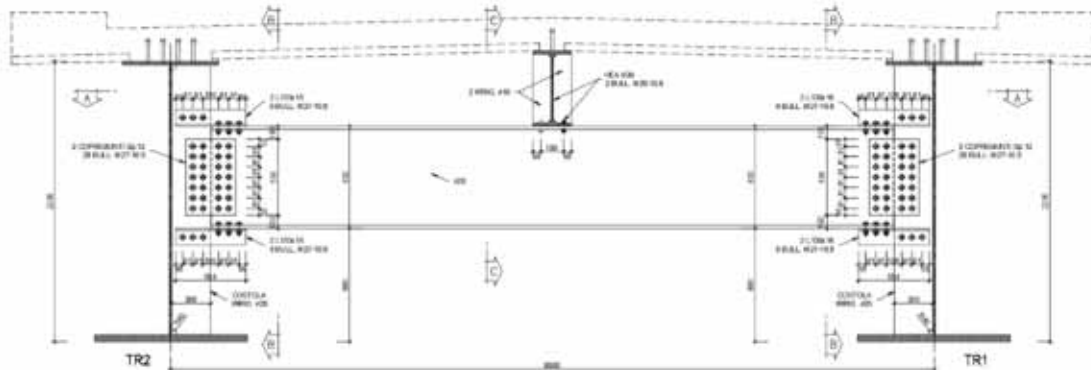


Figura 71 - Traverso di Campata

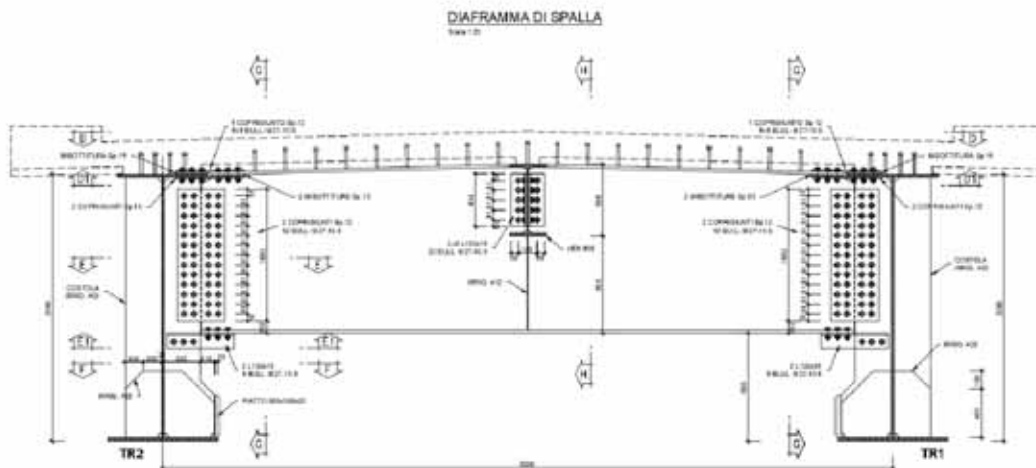


Figura 72 – Traverso di Testata

6.2.6.1 VERIFICA GIUNTO TRAVERSO DI CAMPATA

| | | | | |
|--|---|--|---------------------------|----------|
| $\gamma_{M0} =$ | 1,05 | per sezioni classe 1,2,3 e 4 | | |
| $\gamma_{M1} =$ | 1,05 | per instabilità membrature | | |
| $\gamma_{M1} =$ | 1,10 | per instabilità membrature ponti stradali e ferroviari | | |
| $\gamma_{M2} =$ | 1,25 | per sezioni tese indebolite dai fori nei riguardi della frattura | | |
| Resistenza a taglio bulloni 4.6, 5.6 e 8.8 | | | | |
| 27 | ▼ | 10,9 | ▼ | |
| $F_{V,Rd} =$ | $\frac{0,6 \cdot f_{tb} \cdot A_{res}}{\gamma_{M2}}$ | 220,32 | kN | |
| Resistenza a taglio bulloni 6.8 e 10.9 | | | | |
| $F_{V,Rd} =$ | $\frac{0,5 \cdot f_{tb} \cdot A_{res}}{\gamma_{M2}}$ | 183,6 | kN | |
| Resistenza a rifollamento | | | | |
| $F_{b,Rd} =$ | $\frac{k \cdot \alpha \cdot f_{tk} \cdot d \cdot t}{\gamma_{M2}}$ | 182,87 | kN | di bordo |
| | | 182,87 | kN | interni |
| dove: | | | | |
| d è il diametro nominale del gambo del bullone, | | | | |
| t è lo spessore della piastra collegata, | | | | |
| f_{tk} è la resistenza a rottura del materiale della piastra collegata, | | | | |
| $\alpha = \min (e_1 / (3 d_0) ; f_{tk} / f_t ; 1)$ per bulloni di bordo nella direzione del carico applicato, | | | | |
| $\alpha = \min (p_1 / (3 d_0) - 0,25 ; f_{tk} / f_t ; 1)$ per bulloni interni nella direzione del carico applicato, | | | | |
| $k = \min (2,8 e_2 / d_0 - 1,7 ; 2,5)$ per bulloni di bordo nella direzione perpendicolare al carico applicato, | | | | |
| $k = \min (1,4 p_2 / d_0 - 1,7 ; 2,5)$ per bulloni interni nella direzione perpendicolare al carico applicato, | | | | |
| essendo e_1 , e_2 , p_1 e p_2 indicati in Fig. 4.2.3 e d_0 il diametro nominale del foro di alloggiamento del bullone. | | | | |
| S355 | ▼ | | | |
| d = | 27 | mm | | |
| $f_{tk} =$ | 510 | mm | | |
| $\alpha =$ | 0,50 | mm | | |
| $\alpha =$ | 0,50 | mm | | |
| k = | 1,66 | mm | | |
| k = | 1,66 | mm | | |
| $e_1 =$ | 36 | mm | | |
| $e_2 =$ | 36 | mm | | |
| $p_1 =$ | 66 | mm | | |
| $p_2 =$ | 72 | mm | | |
| $V_{s,d} =$ | 286,40 | kN | taglio assorbito da anima | |
| $M_{s,d} =$ | 532,10 | kNm | | |
| Braccio = | 0,800 | m | | |
| $F_{s,d} =$ | 665,13 | kN | forza alle flange | |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| Resistenza a taglio bulloni (flangia) | | | | | |
|---|--------|-----------------|-------------------------------|--|-----|
| $t_{\text{piastra}} =$ | 20 | mm | | | |
| $h_{\text{piastra}} =$ | 272 | mm | | | |
| $n_{\text{piastre}} =$ | 1 | piastre | | | |
| $n_f =$ | 1 | file | | | |
| $n_{\text{pt}} =$ | 2 | piani di taglio | | | |
| $n_b =$ | 3 | bulloni | | | |
| $F_{V,Rd, \text{anima}} = n \cdot n_b \cdot F_{V,Rd}$ | 1101,6 | kN | | | ok! |
| Resistenza a taglio delle piastre anima: | | | | | |
| $n_f =$ | 2 | file | | | |
| $n_{\text{pt}} =$ | 2 | piani di taglio | | | |
| $n_b =$ | 7 | bulloni | | | |
| $t_{\text{piastra}} =$ | 12 | mm | | | |
| $h_{\text{piastra}} =$ | 596 | mm | | | |
| $n_{\text{piastre}} =$ | 2 | piastre | | | |
| $V_{V,Rd, \text{piastre}} = n_{\text{piastre}} \cdot \frac{f_y \cdot A}{\gamma_{M_b} \cdot \sqrt{3}}$ | 5584 | kN | | | ok! |
| Resistenza a rifollamento flangia | | | | | |
| $F_{V,Ed} =$ | 110,85 | kN | Sollecitazione taglio bullone | | |
| $F_{b,Rd} =$ | 182,87 | kN | ok! | | |
| Resistenza a rifollamento anima | | | | | |
| $F_{V,Ed} =$ | 10,23 | kN | Sollecitazione taglio bullone | | |
| $F_{b,Rd} =$ | 182,87 | kN | ok! | | |

6.2.6.2 VERIFICA GIUNTO TRAVERSO DI TESTATA

| | | | | |
|--|--------|--|---------------------------|----------|
| $\gamma_{M0} =$ | 1,05 | per sezioni classe 1,2,3 e 4 | | |
| $\gamma_{M1} =$ | 1,05 | per instabilità membrature | | |
| $\gamma_{M1} =$ | 1,10 | per instabilità membrature ponti stradali e ferroviari | | |
| $\gamma_{M2} =$ | 1,25 | per sezioni tese indebolite dai fori nei riguardi della frattura | | |
| Resistenza a taglio bulloni 4.6, 5.6 e 8.8 | | | | |
| 27 | | 10,9 | | |
| $F_{V,Rd} = \frac{0,6 \cdot f_{tb} \cdot A_{res}}{\gamma_{M2}}$ | | 220,32 | kN | |
| Resistenza a taglio bulloni 6.8 e 10.9 | | | | |
| $F_{V,Rd} = \frac{0,5 \cdot f_{tb} \cdot A_{res}}{\gamma_{M2}}$ | | 183,6 | kN | |
| Resistenza a rifollamento | | | | |
| $F_{b,Rd} = \frac{k \cdot \alpha \cdot f_{tk} \cdot d \cdot t}{\gamma_{M2}}$ | | 182,87 | kN | di bordo |
| | | 182,87 | kN | interni |
| dove: | | | | |
| d è il diametro nominale del gambo del bullone, | | | | |
| t è lo spessore della piastra collegata, | | | | |
| f_{tk} è la resistenza a rottura del materiale della piastra collegata, | | | | |
| $\alpha = \min (e_1 / (3 d_0) ; f_{tk} / f_t ; 1)$ per bulloni di bordo nella direzione del carico applicato, | | | | |
| $\alpha = \min (p_1 / (3 d_0) - 0,25 ; f_{tk} / f_t ; 1)$ per bulloni interni nella direzione del carico applicato, | | | | |
| $k = \min (2,8 e_2 / d_0 - 1,7 ; 2,5)$ per bulloni di bordo nella direzione perpendicolare al carico applicato, | | | | |
| $k = \min (1,4 p_2 / d_0 - 1,7 ; 2,5)$ per bulloni interni nella direzione perpendicolare al carico applicato, | | | | |
| essendo e_1 , e_2 , p_1 e p_2 indicati in Fig. 4.2.3 e d_0 il diametro nominale del foro di alloggiamento del bullone. | | | | |
| S355 | | | | |
| d = | 27 | mm | | |
| $f_{tk} =$ | 510 | mm | | |
| $\alpha =$ | 0,50 | mm | | |
| $\alpha =$ | 0,50 | mm | | |
| k = | 1,66 | mm | | |
| k = | 1,66 | mm | | |
| $e_1 =$ | 36 | mm | | |
| $e_2 =$ | 36 | mm | | |
| $p_1 =$ | 66 | mm | | |
| $p_2 =$ | 72 | mm | | |
| $V_{s,d} =$ | 397,33 | kN | taglio assorbito da anima | |
| $M_{s,d} =$ | 752,43 | kNm | | |
| Braccio = | 1,260 | m | | |
| $F_{s,d} =$ | 597,17 | kN | forza alle flange | |

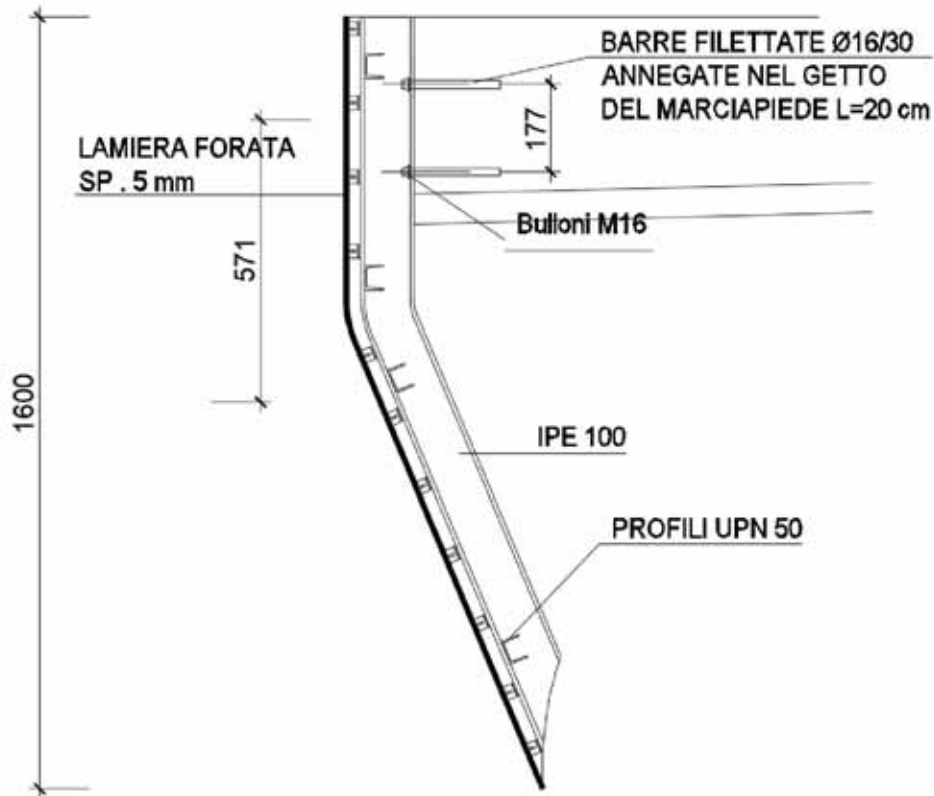
LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| Resistenza a taglio bulloni (flangia) | | | | | |
|--|--------|-----------------|-------------------------------|--|------------|
| $t_{\text{piastra}} =$ | 20 | mm | | | |
| $h_{\text{piastra}} =$ | 272 | mm | | | |
| $n_{\text{piastre}} =$ | 1 | piastre | | | |
| $n_f =$ | 1 | file | | | |
| $n_{\text{pt}} =$ | 2 | piani di taglio | | | |
| $n_b =$ | 6 | bulloni | | | |
| $F_{V,Rd_anima} = n \cdot n_b \cdot F_{V,Rd}$ | 2203,2 | kN | | | ok! |
| Resistenza a taglio delle piastre anima: | | | | | |
| $n_f =$ | 2 | file | | | |
| $n_{\text{pt}} =$ | 2 | piani di taglio | | | |
| $n_b =$ | 13 | bulloni | | | |
| $t_{\text{piastra}} =$ | 12 | mm | | | |
| $h_{\text{piastra}} =$ | 1082 | mm | | | |
| $n_{\text{piastre}} =$ | 2 | piastre | | | |
| $V_{V,Rd_piastre} = n_{\text{piastre}} \cdot \frac{f_y \cdot A}{\gamma_{M_0} \cdot \sqrt{3}}$ | 10138 | kN | | | ok! |
| Resistenza a rifollamento flangia | | | | | |
| $F_{V,Ed} =$ | 49,76 | kN | Sollecitazione taglio bullone | | |
| $F_{b,Rd} =$ | 182,87 | kN | ok! | | |
| Resistenza a rifollamento anima | | | | | |
| $F_{V,Ed} =$ | 7,64 | kN | Sollecitazione taglio bullone | | |
| $F_{b,Rd} =$ | 182,87 | kN | ok! | | |

6.2.7 VERIFICA VELETTA METALLICA

Si riporta di seguito la verifica degli elementi di supporto previsti a sostegno della veletta metallica laterale al cordolo dell'impalcato.

La veletta è composta da elementi di sostegno in acciaio sia trasversali IPE100 che trasversali UPN 50 ed una lamiera forata in alluminio di spessore pari a 5mm.



LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

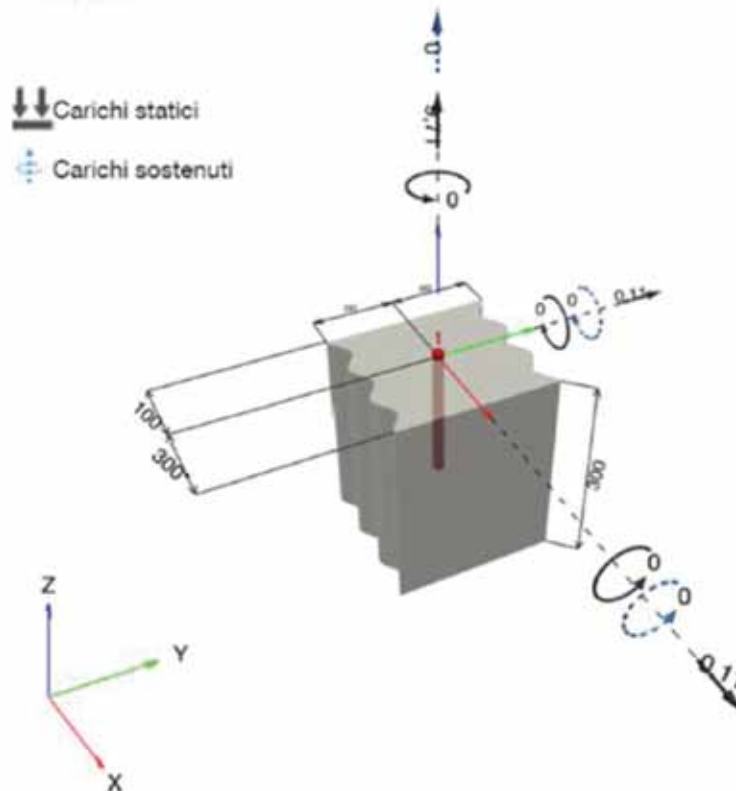
| Peso Proprio Veletta | | |
|--------------------------------|---------------|-------|
| Peso UPN 50 = | 5,59 | kg/ml |
| Peso Totale UPN 50 = | 22,36 | kg/ml |
| Peso IPE 100 = | 8,10 | kg/ml |
| Lunghezza IPE 100 = | 1,40 | m |
| Peso Totale IPE 100 = | 11,34 | kg/ml |
| | | |
| Lunghezza Lamiera alluminio = | 1,65 | ml |
| Spessore Lamiera alluminio = | 0,005 | m |
| % Foratura Lamiera alluminio = | 60% | |
| Peso Lamiera alluminio = | 8,91 | kg/mq |
| Peso Totale = | 42,61 | kg/mq |
| | 0,4261 | kN/ml |
| | | |
| Forza Orizzontale Vento | | |
| ph = | 1,88 | kN/mq |
| H = | 1,6 | m |
| Fv = | 3,008 | kN |
| Braccio Fv = | 0,571 | m |
| Ftrazione = | 6,469 | kN |
| Taglio = | 0,071 | kN |
| | | |
| Ft_d = | 9,704 | kN |
| T_d = | 0,107 | kN |

Si riporta di seguito la verifica di aderenza a trazione della barra filettata $\phi 16$ prevista ammorsata per 20cm all'interno del cordolo laterale.

1 Dati da inserire

| | |
|--|---|
| Tipo e dimensione dell'ancorante: | HIT-RE 500 V4 + HAS-U 5.8 HDG M16 |
| Periodo di ritorno (durata in anni): | 50 |
| Codice articolo: | 2223897 HAS-U 5.8 HDG M16x260 (inserire) / 2287552 HIT-RE 500 V4 (composto indurente) |
| Profondità di posa effettiva: | $h_{eff,act} = 200,0$ mm ($h_{eff,inst} = -$ mm) |
| Materiale: | 5.8 |
| Certificazione No.: | ETA 20/0541 |
| Emesso / Validato: | 04/09/2021 - |
| Prova: | metodo di calcolo EN 1992-4, chimica |
| Fissaggio distanziato: | |
| Profilo: | |
| Materiale base: | non fessurato calcestruzzo, C25/30, $f_{c,cal} = 25,00$ N/mm ² , $h = 300,0$ mm, Temp. Breve/Lungo: 0/0 °C, Coefficiente parziale di sicurezza materiale definito dall'utente $\gamma_c = 1,500$ |
| Installazione: | Foro eseguito con perforatore, Condizioni di installazione: asciutto |
| Armatura: | nessuna armatura o interasse tra le armature ≥ 150 mm (qualunque \emptyset) o ≥ 100 mm ($\emptyset \leq 10$ mm) senza armatura di bordo longitudinale |

Geometria [mm] & Carichi [kN, kNm]



LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

1.1 Combinazione carichi

| Caso | Descrizione | Forze [kN] / Momenti [kNm] | Sismico | Fuoco | Util. max. Tasseello [%] |
|------|----------------|--|---------|-------|--------------------------|
| 1 | Combinazione 1 | N = 9,710; V _x = 0,110; V _y = 0,110; M _x = 0,000; M _y = 0,000; M _z = 0,000; N _{tot} = 0,000; M _{x,tot} = 0,000; M _{y,tot} = 0,000; | no | no | 20 |

2 Condizione di carico/Carichi risultanti sull'ancorante

Carichi sull'ancorante [kN]

Trazione: (+ Trazione, - Compressione)

| Ancorante | Trazione | Taglio | Taglio in dir. x | Taglio in dir. y |
|-----------|----------|--------|------------------|------------------|
| 1 | 9,710 | 0,156 | 0,110 | 0,110 |

Compressione max. nel calcestruzzo: - [%]
Max. sforzo di compressione nel calcestruzzo: - [N/mm²]
risultante delle forze di trazione nel (x/y)=(0,0/0,0): 0,000 [kN]
risultante delle forze di compressione (x/y)=(0,0/0,0): 0,000 [kN]

3 Carico di trazione (EN 1992-4, sezione 7.2.1)

| | Carico [kN] | Resistenza [kN] | Utilizzo β _N [%] | Stato |
|--|-------------|-----------------|-----------------------------|-------|
| Rottura dell'acciaio* | 9,710 | 52,333 | 19 | OK |
| Rottura combinata conica del calcestruzzo e per sfilamento** | 9,710 | 67,984 | 15 | OK |
| Rottura conica del calcestruzzo** | 9,710 | 55,311 | 18 | OK |
| Fessurazione** | 9,710 | 49,893 | 20 | OK |

*ancorante più sollecitato **gruppo di ancoranti (ancoranti sollecitati)

3.1 Rottura dell'acciaio

$$N_{Ed} \leq N_{Rd,s} = \frac{N_{Rp,s}}{\gamma_{M,s}} \quad \text{EN 1992-4, Tabella 7.1}$$

| N _{Rp,s} [kN] | γ _{M,s} | N _{Rd,s} [kN] | N _{Ed} [kN] |
|------------------------|------------------|------------------------|----------------------|
| 78,500 | 1,500 | 52,333 | 9,710 |

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

3.2 Rottura combinata conica del calcestruzzo e per sfilamento

$$N_{Ed} \leq N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{M,c}} \quad \text{EN 1992-4, Tabella 7.1}$$

$$N_{Rk,c} = N_{Rk,c}^0 \cdot \frac{A_{c,N}^0}{A_{c,N}} \cdot \psi_{s,N} \cdot \psi_{s,Nb} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \quad \text{EN 1992-4, Eq. (7.13)}$$

$$N_{Rk,c}^0 = \psi_{s,s} \cdot \tau_{Rk,c} \cdot z \cdot d \cdot h_{ef} \quad \text{EN 1992-4, Eq. (7.14)}$$

$$\psi_{s,s} = 1 \quad \text{EN 1992-4, Eq. (7.14a)}$$

$$s_{cr,Nb} = 7,3 \cdot d \cdot \sqrt{\psi_{s,s} \cdot \tau_{Rk,c}} \leq 3 \cdot h_{ef} \quad \text{EN 1992-4, Eq. (7.15)}$$

$$\psi_{s,Nb} = \psi_{s,Nb}^0 \cdot \left(\frac{s}{s_{cr,Nb}} \right)^{0,5} \cdot (\psi_{s,Nb}^0 - 1) \geq 1,00 \quad \text{EN 1992-4, Eq. (7.17)}$$

$$\psi_{s,Nb}^0 = \sqrt{\bar{n}} \cdot (\sqrt{\bar{n}} - 1) \cdot \left(\frac{\tau_{Rk,c}}{\tau_{Rk,c}^{LS}} \right)^{1,5} \geq 1,00 \quad \text{EN 1992-4, Eq. (7.18)}$$

$$\tau_{Rk,c} = \frac{k_3}{z \cdot d} \cdot \sqrt{h_{ef}} \cdot f_{ct} \quad \text{EN 1992-4, Eq. (7.10)}$$

$$\psi_{s,N} = 0,7 + 0,3 \cdot \frac{c}{c_{cr,Nb}} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.20)}$$

$$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{c1,N}}{s_{cr,Nb}} \right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.21)}$$

$$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{c2,N}}{s_{cr,Nb}} \right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.21)}$$

| | | | | | | |
|-------------------|------------------------|------------------------|------------------------|------------------|-----------------|-------------------|
| $A_{c,N} [mm^2]$ | $A_{c,N}^0 [mm^2]$ | $\tau_{Rk,c} [N/mm^2]$ | $s_{cr,Nb} [mm]$ | $c_{cr,Nb} [mm]$ | $c_{cr,N} [mm]$ | $f_{ct} [N/mm^2]$ |
| 164.117 | 231.018 | 17,00 | 481,6 | 240,8 | 100,0 | 25,00 |
| ψ_s | $\tau_{Rk,c} [N/mm^2]$ | k_3 | $\tau_{Rk,c} [N/mm^2]$ | $\psi_{s,Nb}^0$ | $\psi_{s,Nb}$ | |
| 1,023 | 17,38 | 11,000 | 15,47 | 1,000 | 1,000 | |
| $e_{c1,N} [mm]$ | $\psi_{ec1,N}$ | $e_{c2,N} [mm]$ | $\psi_{ec2,N}$ | $\psi_{s,N}$ | $\psi_{re,N}$ | |
| 0,0 | 1,000 | 0,0 | 1,000 | 0,825 | 1,000 | |
| $\psi_{s,s}^0$ | $\alpha_{s,s}$ | $\psi_{s,s}$ | | | | |
| 0,880 | 0,000 | 1,000 | | | | |
| $N_{Rk,c}^0 [kN]$ | $N_{Rk,c} [kN]$ | $\gamma_{M,c}$ | $N_{Rd,c} [kN]$ | $N_{Ed} [kN]$ | | |
| 174,750 | 101,970 | 1,500 | 67,984 | 0,710 | | |

ID gruppo ancoranti
1

3.3 Rottura conica del calcestruzzo

$$N_{Ed} \leq N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{M,c}} \quad \text{EN 1992-4, Tabella 7.1}$$

$$N_{Rk,c} = N_{Rk,c}^0 \cdot \frac{A_{c,N}^0}{A_{c,N}} \cdot \psi_{s,N} \cdot \psi_{s,Nb} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{MN} \quad \text{EN 1992-4, Eq. (7.1)}$$

$$N_{Rk,c}^0 = k_1 \cdot \sqrt{z} \cdot h_{ef}^{1,5} \quad \text{EN 1992-4, Eq. (7.2)}$$

$$A_{c,N}^0 = s_{cr,N} \cdot s_{cr,N} \quad \text{EN 1992-4, Eq. (7.3)}$$

$$\psi_{s,N} = 0,7 + 0,3 \cdot \frac{c}{c_{cr,N}} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.4)}$$

$$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{c1,N}}{s_{cr,N}} \right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.6)}$$

$$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{c2,N}}{s_{cr,N}} \right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.6)}$$

$$\psi_{MN} = 1 \quad \text{EN 1992-4, Eq. (7.7)}$$

| | | | | | | |
|------------------|--------------------|-----------------|-------------------|-------------------|-----------------|---------------|
| $A_{c,N} [mm^2]$ | $A_{c,N}^0 [mm^2]$ | $c_{cr,N} [mm]$ | $s_{cr,N} [mm]$ | $f_{ct} [N/mm^2]$ | | |
| 240.000 | 360.000 | 300,0 | 600,0 | 25,00 | | |
| $e_{c1,N} [mm]$ | $\psi_{ec1,N}$ | $e_{c2,N} [mm]$ | $\psi_{ec2,N}$ | $\psi_{s,N}$ | $\psi_{re,N}$ | |
| 0,0 | 1,000 | 0,0 | 1,000 | 0,800 | 1,000 | |
| $z [mm]$ | ψ_{MN} | k_1 | $N_{Rk,c}^0 [kN]$ | $\gamma_{M,c}$ | $N_{Rd,c} [kN]$ | $N_{Ed} [kN]$ |
| 0,0 | 1,000 | 11,000 | 155,563 | 1,500 | 55,311 | 0,710 |

ID gruppo ancoranti
1

3.4 Fessurazione

$$N_{Ed} \leq N_{Rd,SP} = \frac{N_{Rk,SP}}{\gamma_{M20}} \quad \text{EN 1992-4, Tabella 7.1}$$

$$N_{Rk,SP} = N_{Rk,SP}^0 \cdot \frac{A_{c,N}}{A_{c,N}^0} \cdot \psi_{s,N} \cdot \psi_{rc,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{h,SP} \quad \text{EN 1992-4, Eq. (7.23)}$$

$$N_{Rk,SP}^0 = \min(N_{Rk,SP}^0, N_{Rk,SP}^0) \quad \text{EN 1992-4, Eq. (7.3)}$$

$$A_{c,N}^0 = s_{cr,SP} \cdot s_{cr,SP} \quad \text{EN 1992-4, Eq. (7.3)}$$

$$\psi_{s,N} = 0,7 + 0,3 \cdot \frac{c}{c_{cr,SP}} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.4)}$$

$$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{c1,N}}{s_{cr,SP}}\right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.6)}$$

$$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{c2,N}}{s_{cr,SP}}\right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.6)}$$

$$\psi_{h,SP} = \left(\frac{h}{h_{ref}}\right)^{2/3} \leq \max\left\{1; \left(\frac{h_{ref} + 1,5 \cdot c_1}{h_{ref}}\right)^{2/3}\right\} \leq 2,00 \quad \text{EN 1992-4, Eq. (7.24)}$$

| $A_{c,N}$ [mm ²] | $A_{c,N}^0$ [mm ²] | $c_{cr,SP}$ [mm] | $s_{cr,SP}$ [mm] | $\psi_{h,SP}$ | $f_{c,eff}$ [N/mm ²] | |
|------------------------------|--------------------------------|------------------|------------------|---------------|----------------------------------|--------|
| 304.000 | 577.600 | 380,0 | 760,0 | 1,173 | 25,00 | |
| $e_{c1,N}$ [mm] | $\psi_{ec1,N}$ | $e_{c2,N}$ [mm] | $\psi_{ec2,N}$ | $\psi_{s,N}$ | $\psi_{R,N}$ | k_1 |
| 0,0 | 1,000 | 0,0 | 1,000 | 0,779 | 1,000 | 11,000 |
| $N_{Rk,SP}^0$ [kN] | γ_{M20} | $N_{Rd,SP}$ [kN] | N_{Ed} [kN] | | | |
| 155,563 | 1,500 | 49,893 | 9,710 | | | |

ID gruppo ancoranti

1

4 Carico di taglio (EN 1992-4, sezione 7.2.2)

| | Carico [kN] | Resistenza [kN] | Utilizzo β_v [%] | Stato |
|--|-------------|-----------------|------------------------|-------|
| Rottura dell'acciaio (senza braccio di leva)* | 0,156 | 37,728 | 1 | OK |
| Rottura dell'acciaio (con braccio di leva)* | N/A | N/A | N/A | N/A |
| Rottura per pryout** | 0,156 | 110,623 | 1 | OK |
| Rottura del bordo del calcestruzzo in direzione x-** | 0,110 | 33,825 | 1 | OK |

*ancorante più sollecitato **gruppo di ancoranti (ancoranti specifici)

4.1 Rottura dell'acciaio (senza braccio di leva)

$$V_{Ed} \leq V_{Rd,s} = \frac{V_{Rd,s}}{\gamma_{M,s}} \quad \text{EN 1992-4, Tabella 7.2}$$

$$V_{Rd,s} = k_7 \cdot V_{Rk,s} \quad \text{EN 1992-4, Eq. (7.35)}$$

| $V_{Rd,s}^0$ [kN] | k_7 | $V_{Rk,s}$ [kN] | $\gamma_{M,s}$ | $V_{Rd,s}$ [kN] | V_{Ed} [kN] |
|-------------------|-------|-----------------|----------------|-----------------|---------------|
| 47,160 | 1,000 | 47,160 | 1,250 | 37,728 | 0,156 |

4.2 Rottura per pryout (cono del calcestruzzo)

$$V_{Ed} \leq V_{Rd,cp} = \frac{V_{Rd,cp}}{\gamma_{M,cp}} \quad \text{EN 1992-4, Tabella 7.2}$$

$$V_{Rd,cp} = k_8 \cdot \min(N_{Rk,c}; N_{Rk,p}) \quad \text{EN 1992-4, Eq. (7.39c)}$$

$$N_{Rk,c} = N_{Rk,c}^0 \cdot \frac{A_{c,N}}{A_{c,N}^0} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{MN} \quad \text{EN 1992-4, Eq. (7.1)}$$

$$N_{Rk,c}^0 = k_1 \cdot \sqrt{f_{ct}} \cdot h_{ef}^{1.5} \quad \text{EN 1992-4, Eq. (7.2)}$$

$$A_{c,N}^0 = s_{cr,N} \cdot s_{cr,N} \quad \text{EN 1992-4, Eq. (7.3)}$$

$$\psi_{s,N} = 0,7 + 0,3 \cdot \frac{c}{c_{cr,N}} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.4)}$$

$$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{v1}}{s_{cr,N}} \right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.6)}$$

$$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{v2}}{s_{cr,N}} \right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.6)}$$

$$\psi_{MN} = 1 \quad \text{EN 1992-4, Eq. (7.7)}$$

| $A_{c,N}$ [mm ²] | $A_{c,N}^0$ [mm ²] | $c_{cr,N}$ [mm] | $s_{cr,N}$ [mm] | k_8 | $f_{ct,eff}$ [N/mm ²] | |
|------------------------------|--------------------------------|-----------------|------------------|---------------|-----------------------------------|-------------|
| 240.000 | 360.000 | 300,0 | 600,0 | 2,000 | 25,00 | |
| e_{v1} [mm] | $\psi_{ec1,N}$ | e_{v2} [mm] | $\psi_{ec2,N}$ | $\psi_{s,N}$ | $\psi_{re,N}$ | ψ_{MN} |
| 0,0 | 1,000 | 0,0 | 1,000 | 0,800 | 1,000 | 1,000 |
| k_1 | $N_{Rk,c}^0$ [kN] | $\gamma_{M,cp}$ | $V_{Rd,cp}$ [kN] | V_{Ed} [kN] | | |
| 11,000 | 155,563 | 1,500 | 110,623 | 0,156 | | |

ID gruppo ancoranti

1

4.3 Rottura del bordo del calcestruzzo in direzione x-

$$V_{Ed} \leq V_{Rd,c} = \frac{V_{Rd,s}}{\gamma_{Mz}} \quad \text{EN 1992-4, Tabella 7.2}$$

$$V_{Rd,c} = k_T \cdot V_{Rd,c}^0 \cdot \frac{A_{c,v}}{A_{c,v}^0} \cdot \psi_{s,v} \cdot \psi_{n,v} \cdot \psi_{ec,v} \cdot \psi_{sv} \quad \text{EN 1992-4, Eq. (7.40)}$$

$$V_{Rd,c}^0 = k_s \cdot d_{nom}^{\alpha} \cdot \rho_l \cdot \sqrt{f_{ctk}} \cdot c_1^{1,5} \quad \text{EN 1992-4, Eq. (7.41)}$$

$$\alpha = 0,1 \cdot \left(\frac{l}{c_1} \right) \quad \text{EN 1992-4, Eq. (7.42)}$$

$$\beta = 0,1 \cdot \left(\frac{d_{nom}}{c_1} \right)^{0,2} \quad \text{EN 1992-4, Eq. (7.43)}$$

$$A_{c,v}^0 = 4,5 \cdot c_1^2 \quad \text{EN 1992-4, Eq. (7.44)}$$

$$\psi_{s,v} = 0,7 + 0,3 \cdot \frac{c_2}{1,5 \cdot c_1} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.45)}$$

$$\psi_{n,v} = \left(\frac{1,5 \cdot c_1}{h} \right)^{0,5} \geq 1,00 \quad \text{EN 1992-4, Eq. (7.46)}$$

$$\psi_{ec,v} = \frac{1}{1 + \left(\frac{2 \cdot e_v}{3 \cdot c_1} \right)} \leq 1,00 \quad \text{EN 1992-4, Eq. (7.47)}$$

$$\psi_{sv} = \sqrt{\frac{1}{(\cos \alpha_v)^2 + (0,5 \cdot \sin \alpha_v)^2}} \geq 1,00 \quad \text{EN 1992-4, Eq. (7.48)}$$

| l [mm] | d_{nom} [mm] | k_s | α | β | f_{ctk} [N/mm ²] |
|-------------------|------------------------------|--------------------------------|-----------------|---------------|--------------------------------|
| 192,0 | 16,00 | 2,400 | 0,139 | 0,069 | 26,00 |
| c_1 [mm] | $A_{c,v}$ [mm ²] | $A_{c,v}^0$ [mm ²] | | | |
| 100,0 | 45.000 | 45.000 | | | |
| $\psi_{s,v}$ | $\psi_{n,v}$ | $\psi_{ec,v}$ | $e_{c,v}$ [mm] | ψ_{sv} | ψ_{sv} |
| 1,000 | 1,000 | 2,000 | 0,0 | 1,000 | 1,000 |
| $V_{Rd,c}^0$ [kN] | k_T | γ_{Mz} | $V_{Rd,c}$ [kN] | V_{Ed} [kN] | |
| 25,369 | 1,0 | 1,500 | 33,825 | 0,110 | |

5 Carichi combinati di trazione e di taglio (EN 1992-4, sezione 7.2.3)

Rottura dell'acciaio

| β_N | β_V | α | Utilizzo $\beta_{N,V}$ [%] | Stato |
|-----------|-----------|----------|----------------------------|-------|
| 0,186 | 0,004 | 2,000 | 4 | OK |

$$\beta_N^2 + \beta_V^2 \leq 1,0$$

Rottura del calcestruzzo

| β_N | β_V | α | Utilizzo $\beta_{N,V}$ [%] | Stato |
|-----------|-----------|----------|----------------------------|-------|
| 0,195 | 0,003 | 1,500 | 9 | OK |

$$\beta_N^2 + \beta_V^2 \leq 1,0$$

6 Spostamenti (ancorante più sollecitato)

Carichi a breve termine:

$$N_{sk} = 7,193 \text{ [kN]} \quad \delta_N = 0,0429 \text{ [mm]}$$

$$V_{sk} = 0,115 \text{ [kN]} \quad \delta_V = 0,0046 \text{ [mm]}$$

$$\delta_{wV} = 0,0432 \text{ [mm]}$$

Carichi a lungo termine:

$$N_{sk} = 7,193 \text{ [kN]} \quad \delta_N = 0,0930 \text{ [mm]}$$

$$V_{sk} = 0,115 \text{ [kN]} \quad \delta_V = 0,0069 \text{ [mm]}$$

$$\delta_{wV} = 0,0933 \text{ [mm]}$$

7 VERIFICA SOLETTA

Si riportano di seguito le verifiche effettuate per il dimensionamento delle solette di impalcato.

7.1 VERIFICA SOLETTA FASE TRANSITORIA

In questa fase di calcolo viene verificata la lastra di predalles con relativi tralicci al fine di sostenere i carichi della soletta, del peso degli operatori e di eventuali barriere di protezione laterali provvisorie per la sicurezza degli operatori.

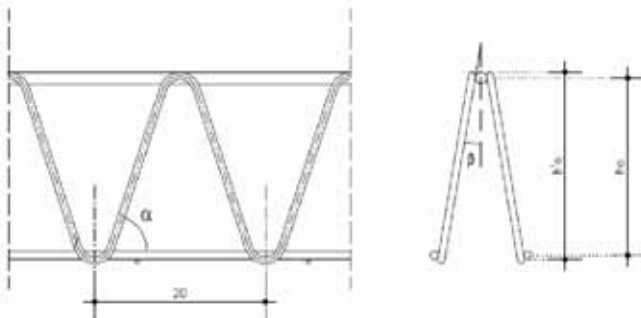
Si riportano di seguito i valori dei carichi utilizzati ed il calcolo delle sollecitazioni in campata ed in appoggio al fine di dimensionare il traliccio da prevedere nel predalles.

7.1.1 ANALISI DEI CARICHI

Si considera il peso proprio della lastra di predalles, il peso del getto della soletta, il peso di un parapetto di protezione e di un mezzo operativo per le varie lavorazioni.

| | | Sp [m] | γ [kN/m ³] | | |
|-----|----------------------|-----------|----------------------------------|------|-------------------|
| Gk1 | Peso Proprio | 0.05 | 25 | 1.25 | kN/m ² |
| Gk2 | Peso Soletta | 0.21 | 25 | 5.25 | kN/m ² |
| Gk2 | Peso Parapetto Sic. | | | 0.4 | kN/m |
| Qk | Peso Mezzo Operativo | | | 1 | kN/m ² |

Le verifiche vengono eseguite facendo riferimento allo Stato Limite Ultimo della sezione. Si verifica che le tensioni sugli elementi metallici che costituiscono il traliccio siano inferiori alla tensione di calcolo e che la stabilità degli elementi compressi risulti soddisfatta. Di seguito si riporta una rappresentazione schematica del traliccio utilizzato.



| | |
|-------------------------------|--------------------------|
| Altezza totale del traliccio: | $h'_0 = 165 \text{ mm}$ |
| Diametro correnti superiori: | $f_{cs} = 16 \text{ mm}$ |
| Diametro correnti inferiori: | $f_{ci} = 14 \text{ mm}$ |
| Diametro staffa: | $f_{ci} = 10 \text{ mm}$ |

7.1.2 VERIFICA A MOMENTO POSITIVO - CAMPATA

Analizzando gli elaborati grafici allegati al presente progetto esecutivo, si evince che la distanza tra le anime delle travi di appoggio è pari a 2.55m e considerando 5 cm di appoggio su entrambe le strutture,

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

si considera una luce di calcolo pari a 2.65m. Si riporta di seguito il calcolo delle sollecitazioni di progetto.

| SEZIONE IN CAMPATA | | | | |
|--------------------|--|------------------------------------|--------------|--------------|
| | LC | 2.65 | | |
| | MOMENTO FLETTENTE | TAGLIO | Med | Ted |
| Gk1 | $1.25 \times 1.20 \times 2.65^2 / 8$ | $1.25 \times 1.20 \times 2.65 / 2$ | 1.32 | 1.99 |
| Gk2 | $5.25 \times 1.20 \times 2.65^2 / 8$ | $5.25 \times 1.20 \times 2.65 / 2$ | 5.53 | 8.35 |
| Qk | $1 \times 1.20 \times 2.65^2 / 8$ | $1 \times 1.20 \times 2.65 / 2$ | 1.05 | 1.59 |
| | Med | | 13.85 | 15.50 |
| | Ted | | | |
| | Ned = (Med / h₀) / 3 | | 30.77 | |

| | | | | |
|-------------------------------|-------|--------|-----------------|--------|
| Altezza totale traliccio | ht= | 16.50 | cm | |
| Larghezza totale traliccio | B= | 9.00 | cm | |
| Interasse tralicci | i= | 40.00 | cm | |
| Numero di tralicci /m | n= | 3 | | |
| Passo traliccio | p= | 20.00 | cm | |
| Quota corrente inferiore | s= | 2.00 | cm | |
| Corrente superiore | 1 | ∅s= | 1.60 | cm |
| Ferro integr sup (I) | 0 | ∅s' = | 0.00 | cm |
| Ferro integr sup (II) | 0 | ∅s" = | 0.00 | cm |
| Corrente inferiore | 2 | ∅i= | 1.40 | cm |
| Diagonale | | ∅d= | 1.00 | cm |
| Altezza utile traliccio | d= | 13.0 | cm | |
| Interasse ferri inferiori | pi= | 7.6 | cm | |
| Interasse trasv. diagonale | bd= | 5.2 | cm | |
| Inclinazione longitudinale | α= | 1.065 | rad | 61.0 ° |
| Inclinazione trasversale | β= | 0.192 | rad | 11.0 ° |
| Area corrente superiore | As= | 2.01 | cm ² | |
| Area ferro integr sup (I) | As' = | 0.00 | cm ² | |
| Area ferro integr sup (II) | As" = | 0.00 | cm ² | |
| Area corrente inferiore | Ai= | 3.08 | cm ² | |
| Area diagonale | Ad= | 0.79 | cm ² | |
| Inerzia corrente superiore | Js= | 0.3217 | cm ⁴ | |
| Inerzia ferro integr sup (I) | Js' = | 0.0000 | cm ⁴ | |
| Inerzia ferro integr sup (II) | Js" = | 0.0000 | cm ⁴ | |
| Inerzia corrente inferiore | Ji= | 0.3771 | cm ⁴ | |
| Inerzia diagonale | Jd= | 0.0491 | cm ⁴ | |

CARATTERISTICHE DI RESISTENZA TRALICCIO

| | Area cm ² | Quota cm | J cm ⁴ | Jtrasp cm ⁴ | J+Jtrasp cm ⁴ |
|----------------------|-------------------------|-------------|----------------------|---------------------------|-----------------------------|
| Corr sup + ferro (I) | 2.01 | 15.7 | 0.322 | 124.3 | 124.7 |
| Ferro (II) | 0.00 | 14.9 | 0.000 | 0.0 | 0.0 |
| Corrente inf | 3.08 | 2.7 | 0.377 | 81.2 | 81.6 |

| | | | |
|---------------------------------|-------|-------|-----------------|
| Quota baricentro | YG= | 7.84 | cm |
| Area totale | Atot= | 5.1 | cm ² |
| Inerzia totale | Jtot= | 206.3 | cm ⁴ |
| Modulo di resistenza c. sup. | Ws= | 26.23 | cm ³ |
| Modulo di resistenza ferro (II) | Ws''= | 29.2 | cm ³ |
| Modulo di resistenza c. inf. | Wi= | 40.2 | cm ³ |

CARATTERISTICHE DI RESISTENZA ALL'INSTABILITÀ TRALICCIO

Corrente superiore

| | | | |
|-----------------------------------|-------------|--------|----|
| Lunghezza asta | L= | 20.0 | cm |
| Coefficiente riduttivo | β = | 0.7 | |
| Lunghezza libera inflessione | L0= | 14.0 | cm |
| Carico critico Euleriano | Ncr= | 340183 | N |
| Snellezza adimensionale | λ = | 0.52 | |
| Fattore di imperfezione | α = | 0.49 | |
| Coefficiente | Φ = | 0.71 | |
| Fattore di riduzione (≤ 1) | χ = | 0.83 | |
| Resistenza asta compressione | NbRd= | -65.6 | kN |

Corrente inferiore

| | | | |
|-----------------------------------|-------------|--------|----|
| Lunghezza asta | L= | 20.0 | cm |
| Coefficiente riduttivo | β = | 0.7 | |
| Lunghezza libera inflessione | L0= | 14.0 | cm |
| Carico critico Euleriano | Ncr= | 199409 | N |
| Snellezza adimensionale | λ = | 0.59 | |
| Fattore di imperfezione | α = | 0.49 | |
| Coefficiente | Φ = | 0.77 | |
| Fattore di riduzione (≤ 1) | χ = | 0.79 | |
| Resistenza asta compressione | NbRd= | -47.7 | kN |

Diagonale

| | | | |
|-----------------------------------|-------------|-------|----|
| Lunghezza asta | L= | 16.6 | |
| Coefficiente riduttivo | β = | 0.7 | |
| Lunghezza libera inflessione | L0= | 11.6 | cm |
| Carico critico Euleriano | Ncr= | 75294 | N |
| Snellezza adimensionale | λ = | 0.69 | |
| Fattore di imperfezione | α = | 0.49 | |
| Coefficiente | Φ = | 0.85 | |
| Fattore di riduzione (≤ 1) | χ = | 0.73 | |
| Resistenza asta compressione | NbRd= | -22.6 | kN |

VERIFICA TRALICCIO

| | | | | |
|---------------------------|------|-------|-----|----------|
| Momento sollecitante | Msd= | 13.85 | kNm | campata |
| Taglio sollecitante | Vsd= | 15.5 | kN | appoggio |
| Momento soll. /traliccio | msd= | 4.62 | kNm | campata |
| Taglio sollec. /traliccio | vsd= | 5.17 | kN | appoggio |

Corrente superiore compresso

Verifica di resistenza

| | | | |
|-----------------------------|-------------------|------|-------------------|
| Tensione limite di calcolo | f _{yd} = | -391 | N/mm ² |
| Tensione corrente superiore | σ_s = | -176 | N/mm ² |
| Coefficiente di sicurezza | c.s.= | 2.22 | VERIFICATO |

Verifica di instabilità

| | | | |
|---------------------------|-------|-------|------------|
| Resistenza asta compressa | NbRd= | -65.6 | kN |
| Compressione | Nsd= | -35.4 | kN |
| Coefficiente di sicurezza | c.s.= | 1.85 | VERIFICATO |

| | | | |
|-------------------------------|--------------|------|------------|
| Corrente inferiore | teso | | |
| Verifica di resistenza | | | |
| Tensione limite di calcolo | $f_{yd} =$ | 391 | N/mm^2 |
| Tensione corrente inferiore | $\sigma_i =$ | 115 | N/mm^2 |
| Coefficiente di sicurezza | $c.s. =$ | 3.40 | VERIFICATO |

| | | | |
|---|-------------|--------|------------|
| Diagonale | | | |
| All'appoggio, per effetto del taglio si ha: | | | |
| Compressione sul diagonale | | -3.0 | kN |
| Verifica di resistenza | | | |
| Tensione limite | $f_{yd} =$ | -391.3 | N/mm^2 |
| Tensione diagonale | $\sigma =$ | -38.3 | N/mm^2 |
| Coefficiente di sicurezza | $c.s. =$ | 10.21 | VERIFICATO |
| Verifica di instabilità | | | |
| Resistenza asta compressa | $N_{bRd} =$ | -22.6 | kN |
| Compressione | $N_{sd} =$ | -3.0 | kN |
| Coefficiente di sicurezza | $c.s. =$ | 7.50 | VERIFICATO |

Si esegue ora la verifica della struttura allo SLU.

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Verifica C.A. S.L.U. - File: TRALICCIO M+

File Materiali Opzioni Visualizza Progetto Sez. Rett. Sismica Normativa: NTC 2008

Titolo : _____

N° figure elementari Zoom N° strati barre Zoom

| N° | b [cm] | h [cm] |
|----|--------|--------|
| 1 | 0.1 | 14 |
| 2 | 120 | 5 |

| N° | As [cm²] | d [cm] |
|----|----------|--------|
| 1 | 6.03 | 0.8 |
| 2 | 9.24 | 16.5 |

Tipo Sezione
 Rettan.re Trapezi
 a T Circolare
 Rettangoli Coord.

Sollecitazioni
 S.L.U. Metodo n

N_{Ed} kN
M_{xEd} kNm
M_{yEd}

P.to applicazione N
 Centro Baricentro cls
 Coord.[cm] xN yN

Tipo rottura
Lato calcestruzzo - Acciaio elastico

Metodo di calcolo
 S.L.U. + S.L.U. -
 Metodo n

Tipo flessione
 Retta Deviata

N° rett.

Calcola MRd Dominio M-N
L₀ cm Col. modello

Precompresso

Materiali

| B450C | | C30/37 | |
|--------------------------------|---------------------------|----------------------------------|--------|
| ε _{su} | 67.5 ‰ | ε _{c2} | 2 ‰ |
| I _{yd} | 391.3 N/mm ² | ε _{cu} | 3.5 ‰ |
| E _s | 200.000 N/mm ² | I _{cd} | 17 |
| E _s /E _c | 15 | I _{cc} /I _{cd} | 0.8 |
| ε _{syd} | 1.957 ‰ | σ _{c,adm} | 11.5 |
| σ _{s,adm} | 255 N/mm ² | τ _{co} | 0.6933 |
| | | τ _{c1} | 2.029 |

M_{xRd} kN m
σ_c N/mm²
σ_s N/mm²
ε_c 3.5 ‰
ε_s 1.286 ‰
d 16.5 cm
x 12.07 x/d 0.7313
δ 1

Med < Mrd Verifica soddisfatta

7.1.3 VERIFICA A MOMENTO NEGATIVO APPOGGIO

Analizzando gli elaborati grafici allegati al presente progetto esecutivo, si evince che la distanza dello sbalzo rispetto all'asse dell'anima della trave di appoggio è pari a 1.25m. Si riporta di seguito il calcolo delle sollecitazioni e la verifica strutturale allo SLU.

| SEZIONE IN APPOGGIO | | |
|--------------------------|--------------------------------------|--------------|
| | LC | 1.25 |
| MOMENTO FLETTENTE | | |
| Gk1 | $1.25 \times 1.20 \times 1.25^2 / 2$ | 1.17 |
| Gk2 | $5.25 \times 1.20 \times 1.25^2 / 2$ | 4.92 |
| Gk2 | $0.4 \times 1.20 \times 1.25$ | 0.60 |
| Qk | $1 \times 1.20 \times 1.25^2 / 2$ | 0.94 |
| | Med | 11.27 |

Si esegue ora la verifica della struttura allo SLU.

Verifica C.A. S.L.U. - File: TRALICCIO M-

File Materiali Opzioni Visualizza Progetto Sez. Rett. Sismica Normativa: NTC 2008 ?

Titolo: _____

N° figure elementari: 2 Zoom N° strati barre: 2 Zoom

| N° | b [cm] | h [cm] | N° | As [cm²] | d [cm] |
|----|--------|--------|----|----------|--------|
| 1 | 0.1 | 14 | 1 | 6.03 | 0.8 |
| 2 | 120 | 5 | 2 | 9.239999 | 16.5 |

Sollecitazioni: S.L.U. Metodo n

N_{Ed} 0 kN
M_{xEd} 0 kNm
M_{yEd} 0 kNm

P.to applicazione N: Centro Baicentro cls
Coord. [cm]: xN 0 yN 0

Tipo rottura: Lato calcestruzzo - Acciaio snervato

Metodo di calcolo: S.L.U. + S.L.U. - Metodo n

Tipo flessione: Retta Deviata

N° rett. 100

Calcola MRd Dominio M-N

L₀ 0 cm Col. modello

Precompresso

Materiali:

| B450C | | C30/37 | |
|------------------|---------------------------|-------------------|--------|
| ϵ_{su} | 67.5 ‰ | ϵ_{c2} | 2 ‰ |
| I_{yd} | 391.3 N/mm ⁴ | ϵ_{cu} | 3.5 ‰ |
| E_s | 200.000 N/mm ² | f_{cd} | 17 |
| E_s / E_c | 15 | f_{cc} / f_{cd} | 0.8 |
| ϵ_{syd} | 1.957 ‰ | $\sigma_{c,adm}$ | 11.5 |
| $\sigma_{s,adm}$ | 255 N/mm ² | τ_{co} | 0.6933 |
| | | τ_{c1} | 2.029 |

M_{xEd} -42.71 kNm

σ_c -17 N/mm²
 σ_s 391.3 N/mm²
 ϵ_c 3.5 ‰
 ϵ_s 26.51 ‰
d 18.2 cm
x 2.122 x/d 0.1166
 δ 0.7

Med < Mrd Verifica soddisfatta

7.2 VERIFICA SOLETTA FASE DEFINITIVA

In questa fase di calcolo viene effettuato il calcolo della soletta considerando i seguenti carichi permanenti compatibilmente a quanto utilizzato per il dimensionamento dell'impalcato metallico.

| PESO SOLETTA | | |
|------------------------------|--------------|-------|
| Hsoletta = | 0.26 | m |
| γ = | 25 | kN/mc |
| peso = | 6.5 | kN/mq |
| CORDOLI | | |
| Hcordoli = | 0.15 | m |
| γ = | 25 | kN/mc |
| peso = | 3.75 | kN/mq |
| PERMANENTE PORTATO | | |
| Hsoletta = | 0.11 | cm |
| γ = | 24 | kN/mc |
| peso = | 2.64 | kN/mq |
| BARRIERE+VELETTE E TUBAZIONI | | |
| Barriere = | 1.5 | kN/ml |
| Tubazioni = | 0.1 | kN/ml |
| Veletta = | 0.4 | kN/ml |
| Totale | 2.000 | kN/ml |

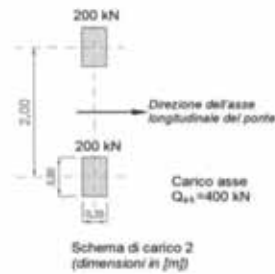
I carichi accidentali considerati sono quelli prescritti dalla normativa ed in particolare lo schema di carico 1, costituito da carichi concentrati su due assi in tandem, applicati su impronte di pneumatico di forma quadrata e lato pari a 0,40 m (Q_{ik}), oltre che da un carico distribuito a metro quadrato (q_{ik}) applicato alla corsia di carico.

I valori adottati per i carichi variano in base alla corsia di carico, secondo lo schema di normativa riportato nel seguito.



Oltre a questo, è stato adottato anche lo schema di carico 2, costituito da un singolo asse applicato su specifiche impronte di pneumatico di forma rettangolare, con larghezza 0,60 m ed altezza 0,35 m. Nel seguito l'immagine estratta dalla normativa.

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO



In aggiunta a quanto sopra, occorre tenere in conto anche l'urto di veicoli in svio (q_8). La normativa, a tal proposito, indica che le forze causate da collisioni accidentali sugli elementi di sicurezza, possono essere considerate attraverso una forza orizzontale equivalente di collisione pari a 100 kN. Tale forza è da intendersi applicata trasversalmente ed orizzontalmente 100 mm sotto la sommità dell'elemento su cui insiste, oppure, 1,0 m sopra il piano di marcia, a seconda di quale sia il minore per una striscia di 0.5m. Ai fini dell'applicazione di tale forza alla soletta di impalcato, è stata considerata una diffusione a terra ottenendo una larghezza di carico pari a $1.00 + 0.50 + 1.00$ ottenendo un effetto torcente sul bordo della soletta pari a $M_t = 100 \text{ kN}/2.5\text{m} = 40 \text{ kNm/m}$. I carichi concentrati previsti nei casi di carico, sono stati applicati tenendo in considerazione dell'effettiva geometria della mesh di calcolo utilizzata e considerando (come previsto dalla norma) una diffusione di carico a 45° fino al baricentro della soletta in cls.

Si riportano di seguito alcune immagini relative al modello e ai carichi applicati.

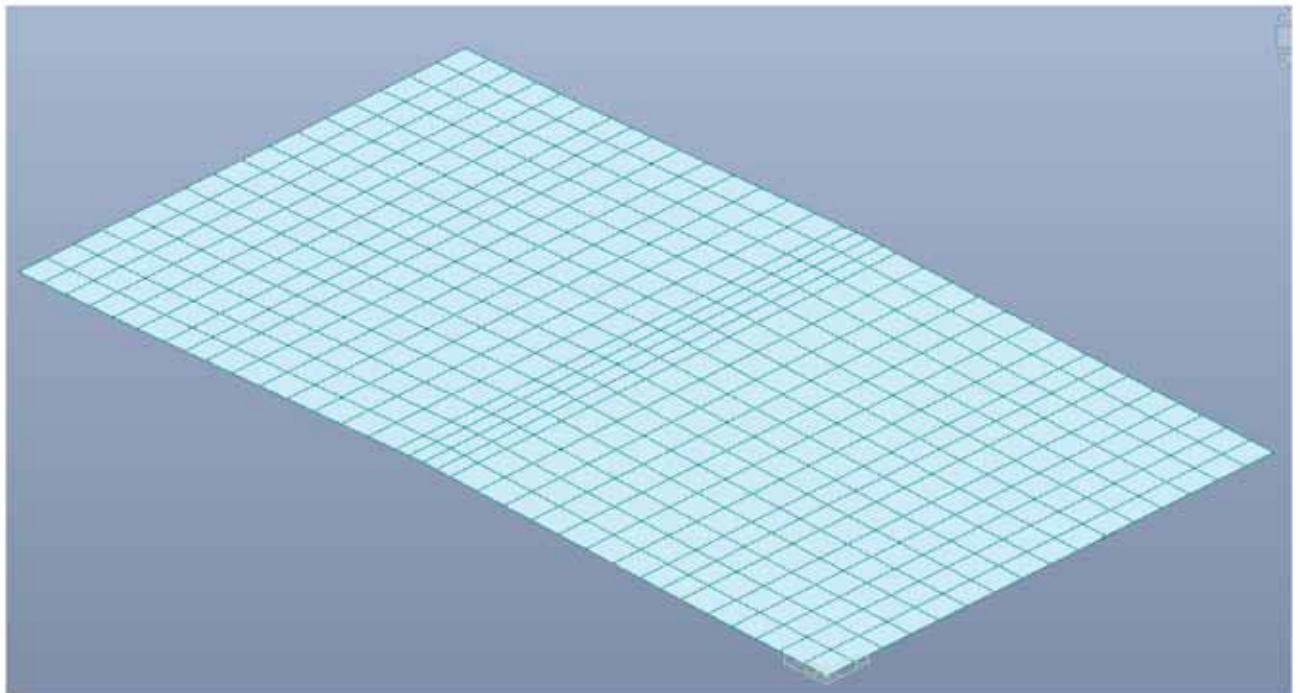


Figura 73 - Modello di calcolo

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

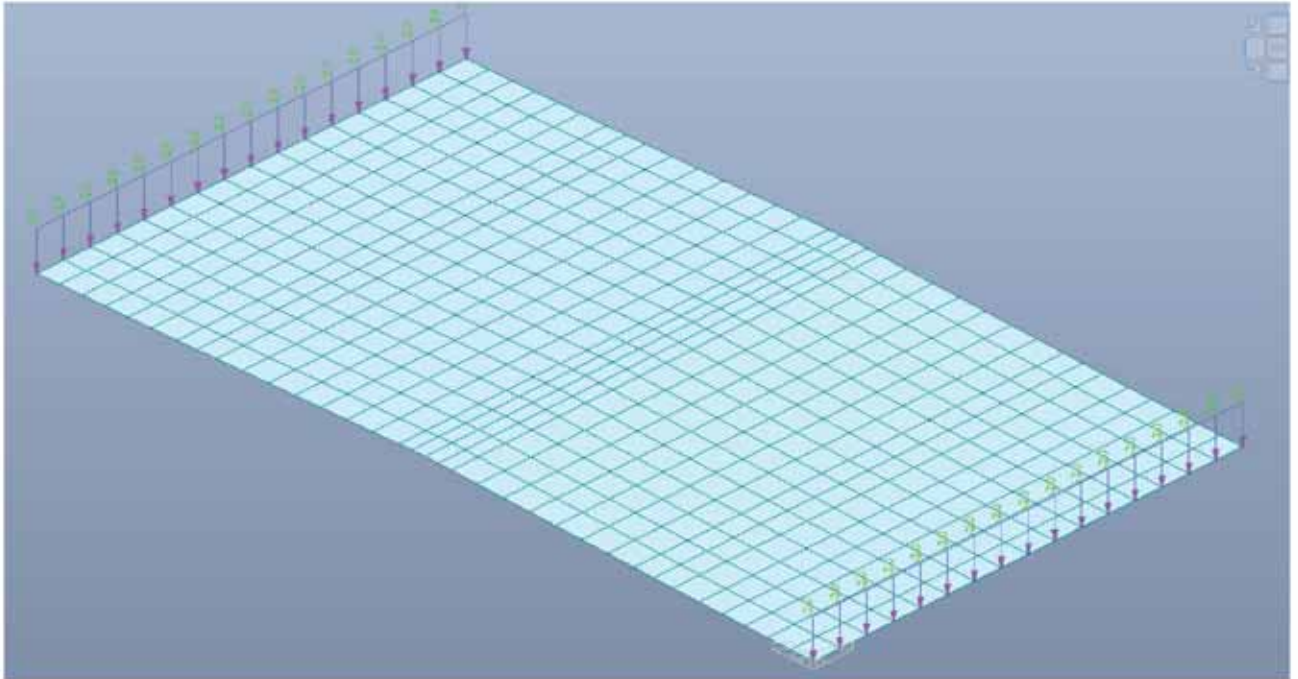


Figura 74 – Peso Barriera + Veletta + Tubazioni

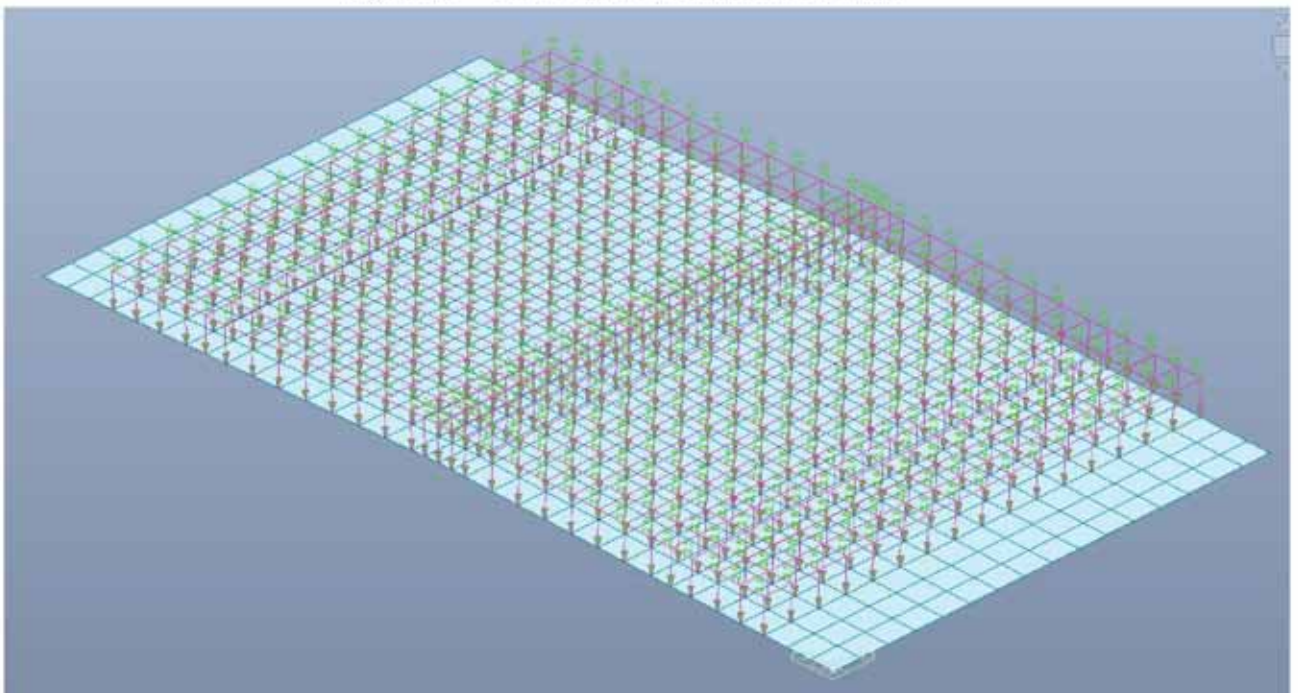


Figura 75 - Peso permanente portato

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

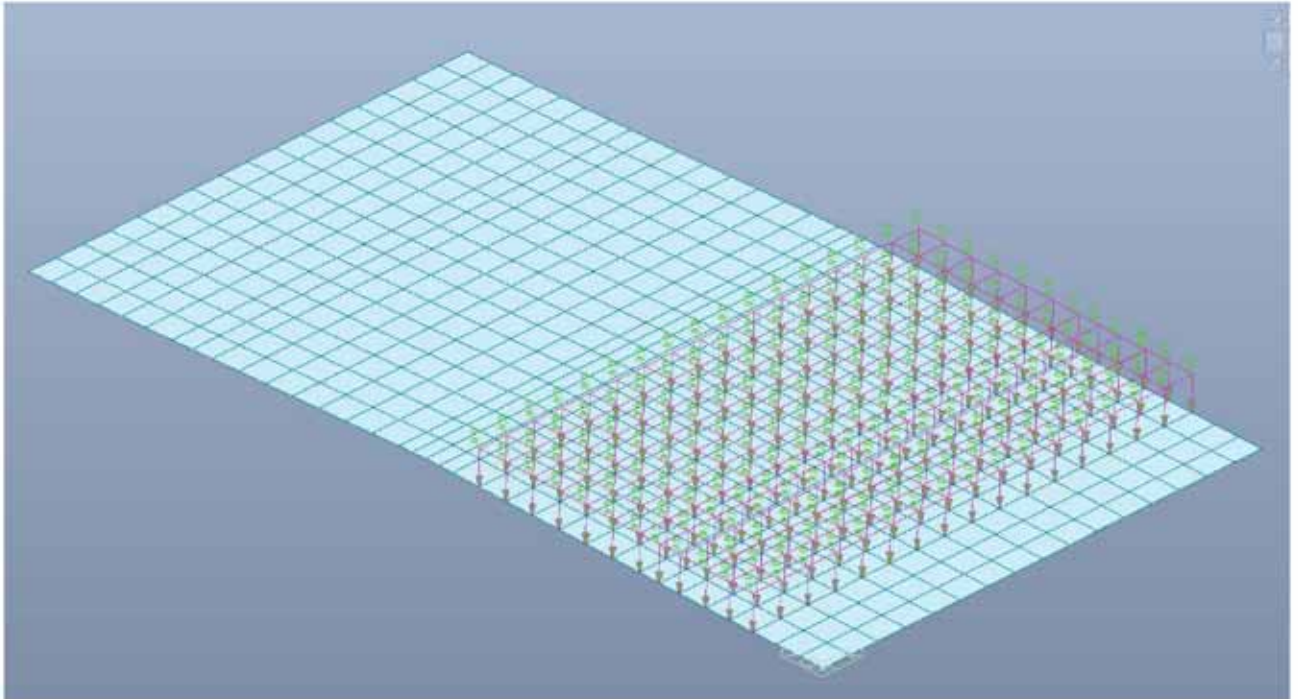


Figura 76 - Carico Distribuito prima colonna di carico

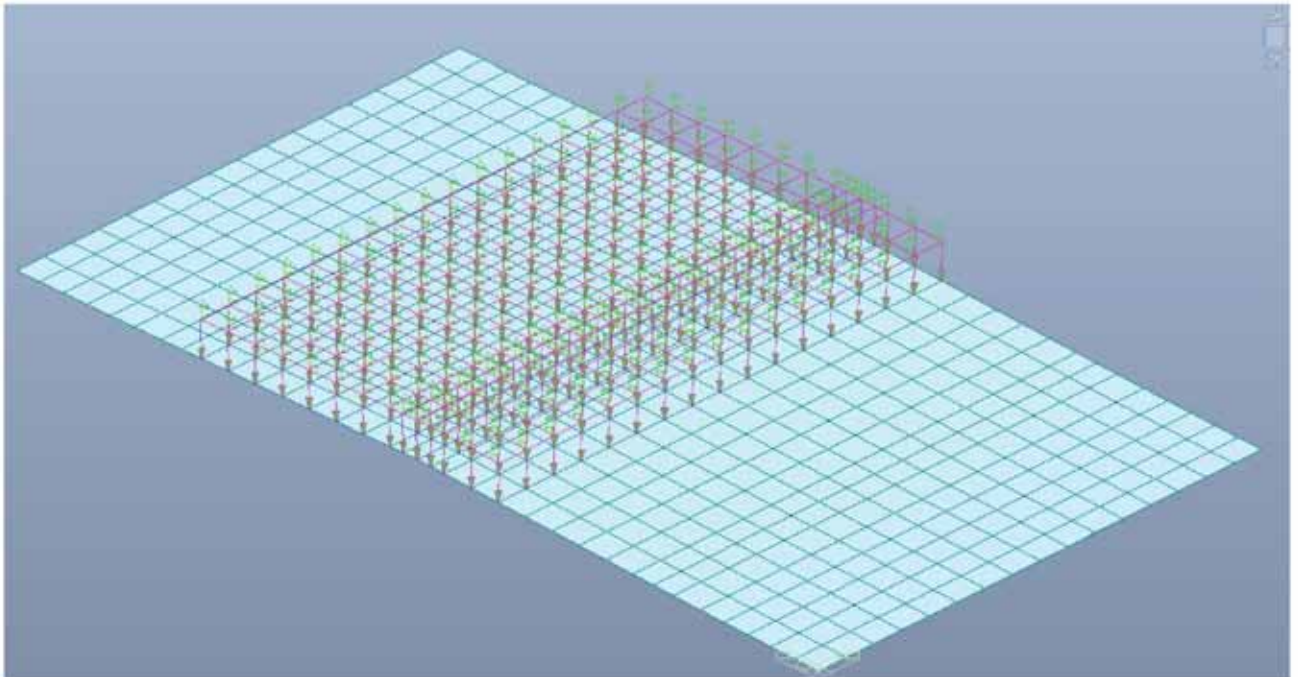


Figura 77 - Carico Distribuito seconda colonna di carico

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

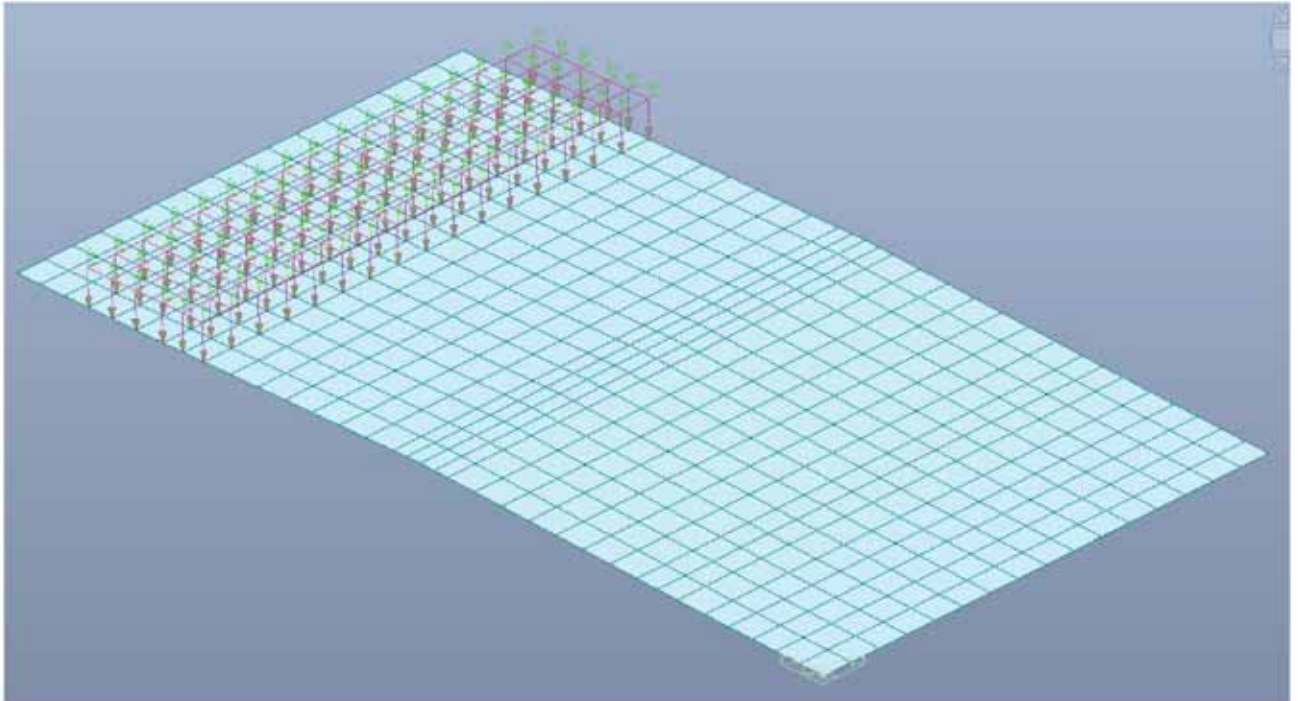


Figura 78 - Carico Distribuito terza colonna di carico

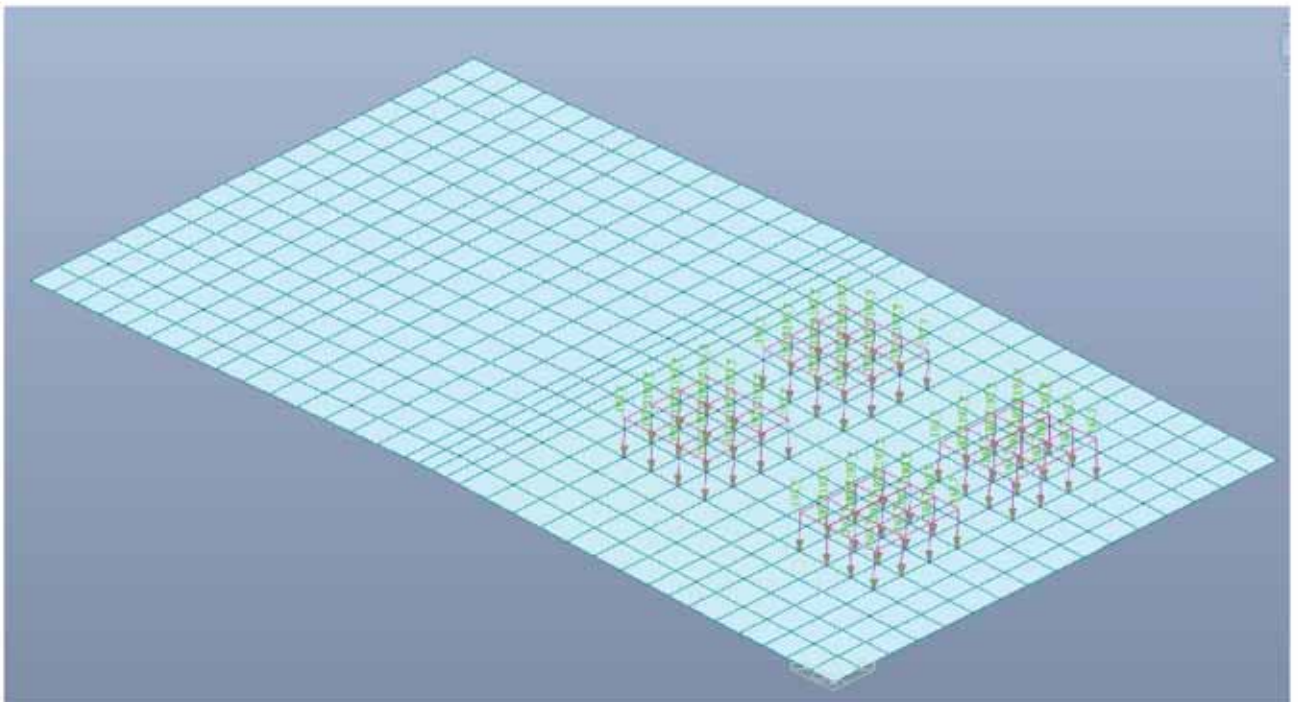


Figura 79 – Carico Q1a

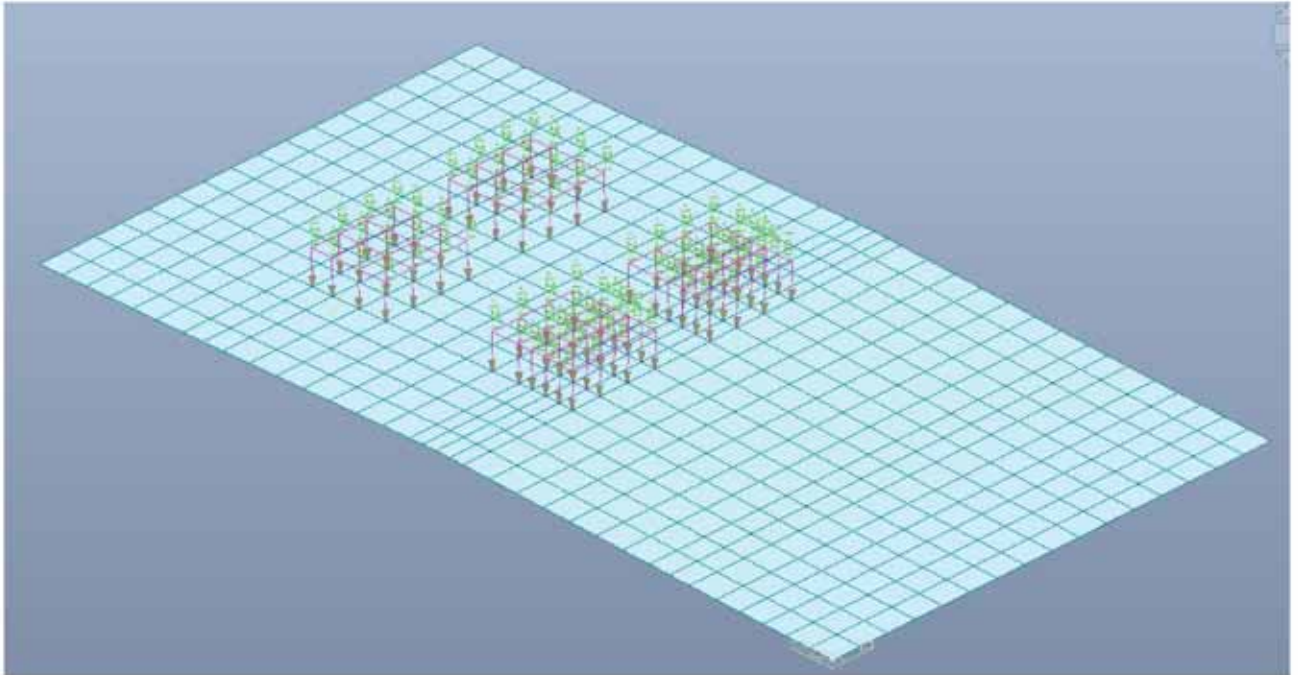


Figura 80 – Carico Q1b

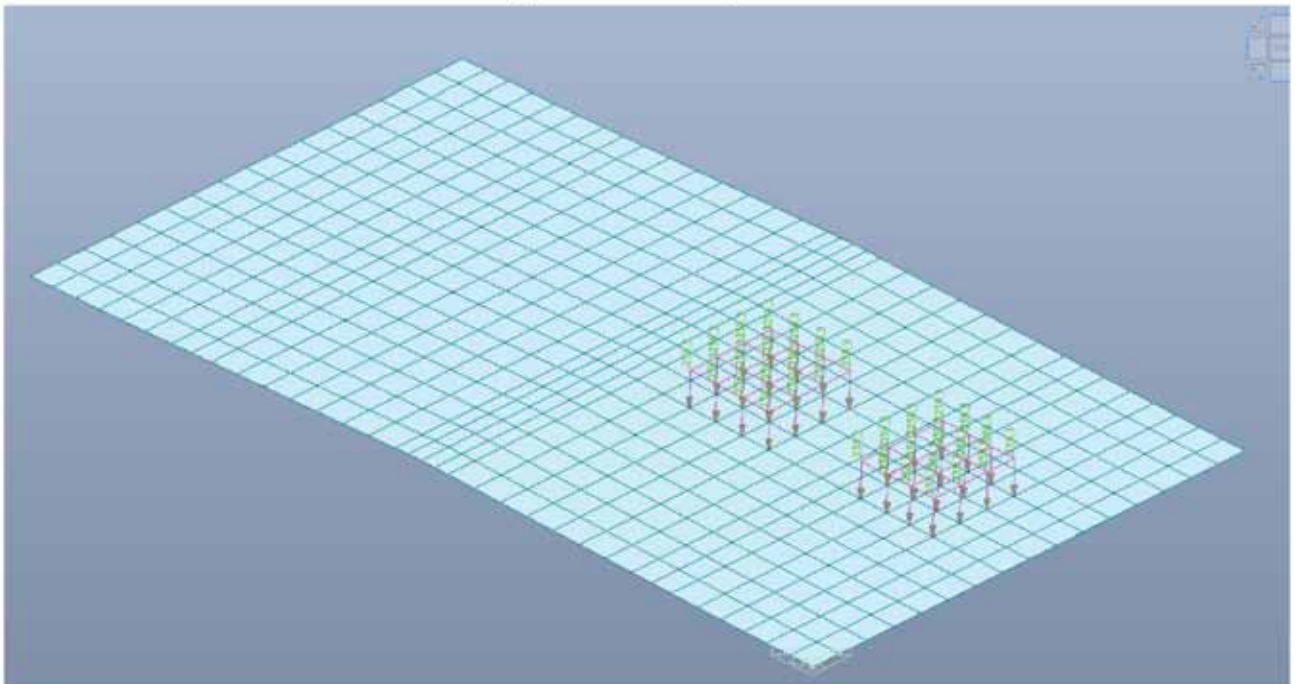


Figura 81 - Carico Schema 2

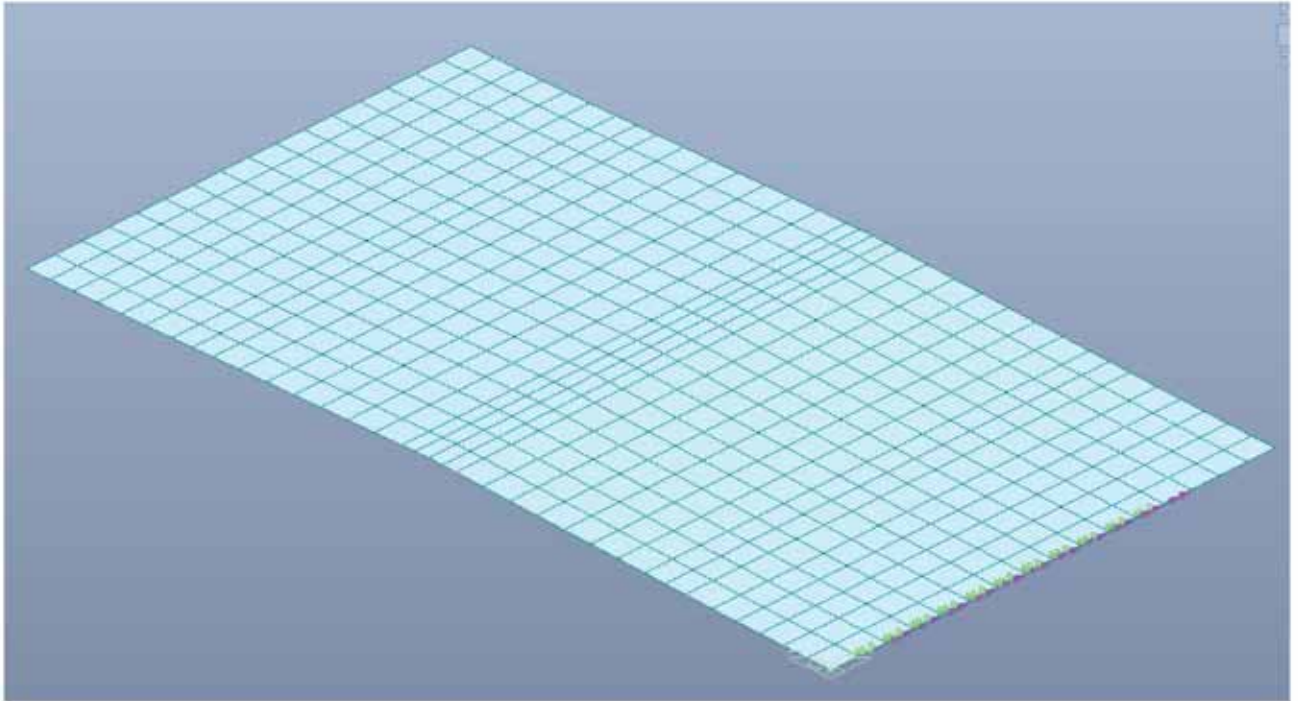


Figura 82 - Momento torcente che simula l'effetto dell'urto

Di riporta di seguito i diagrammi delle sollecitazioni ottenute sia agli Stati limiti Ultimi che agli Stati limiti di esercizio con le relative verifiche strutturali.

7.2.1 Verifica STRUTTURALE soletta

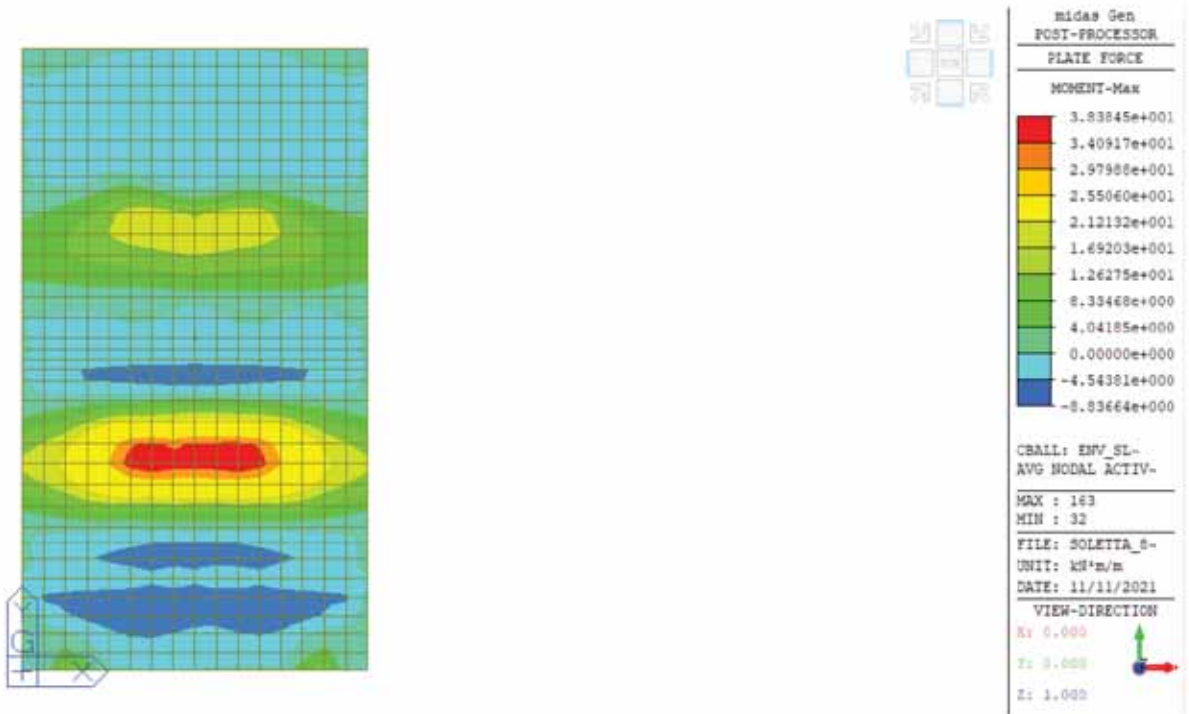


Figura 83 - Max Momento SLU

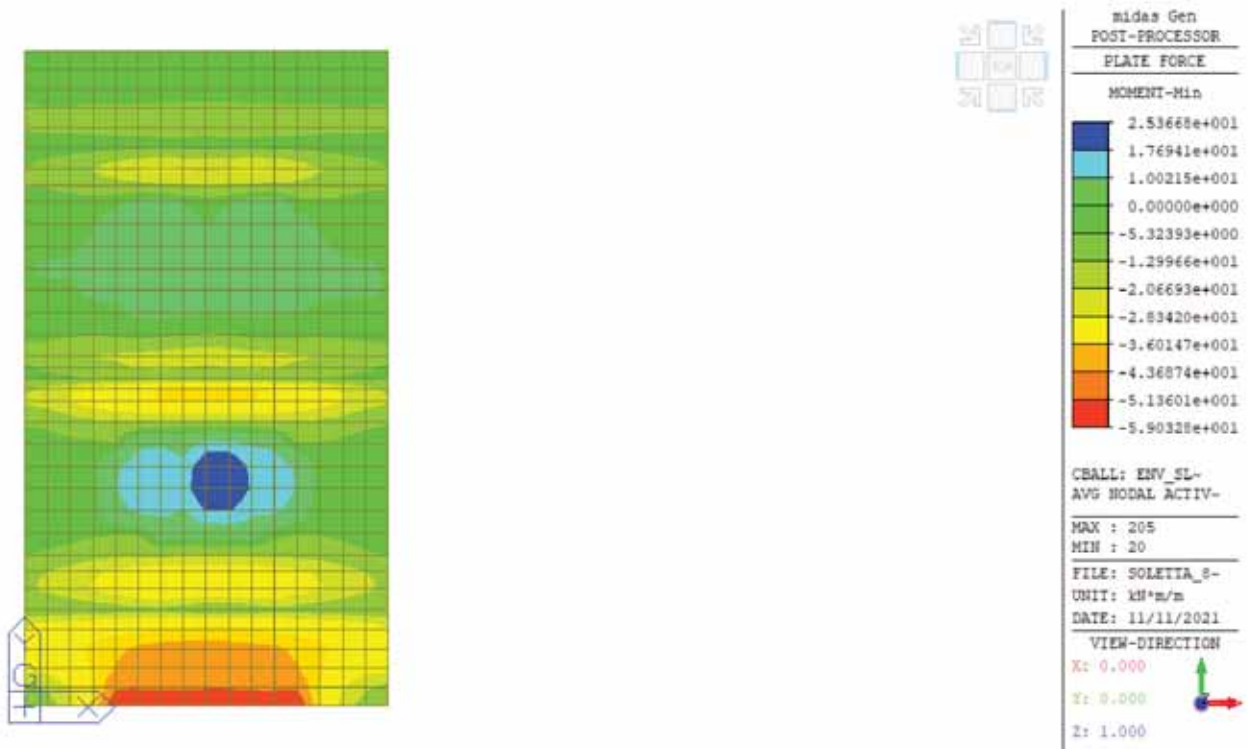


Figura 84 - Min Momento SLU

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

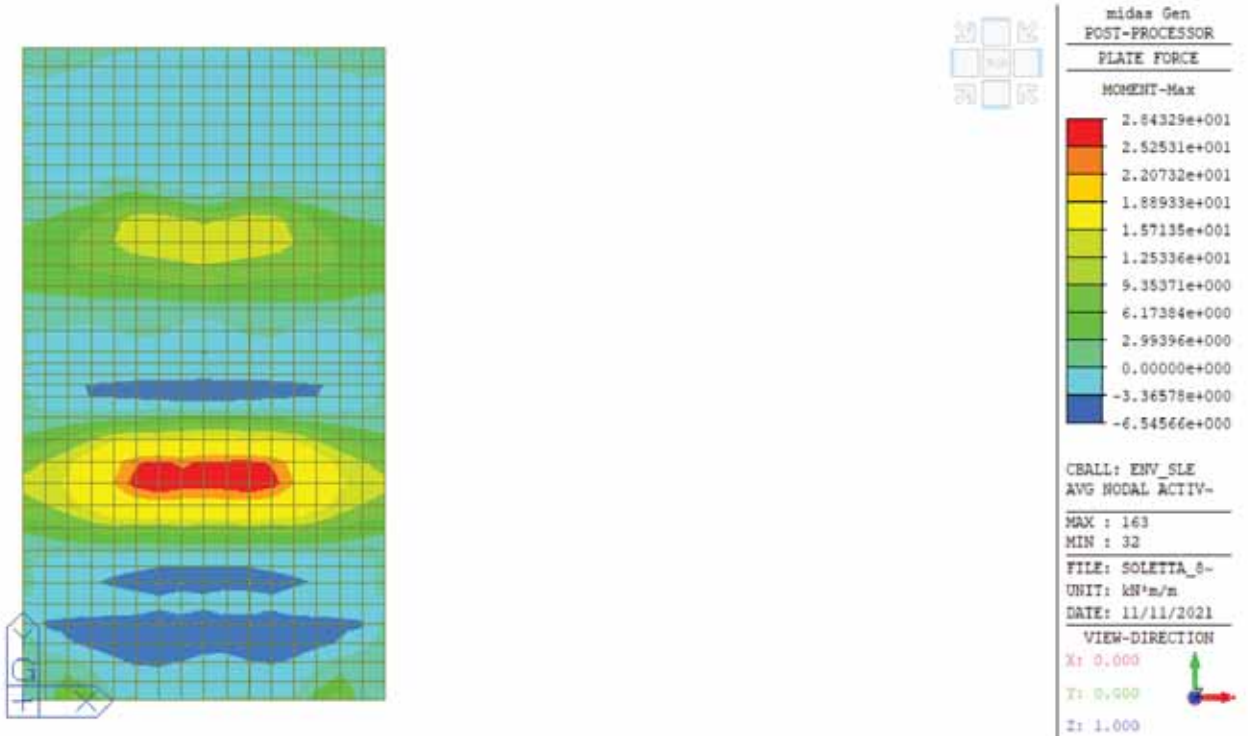


Figura 85 - Max Momento SLE

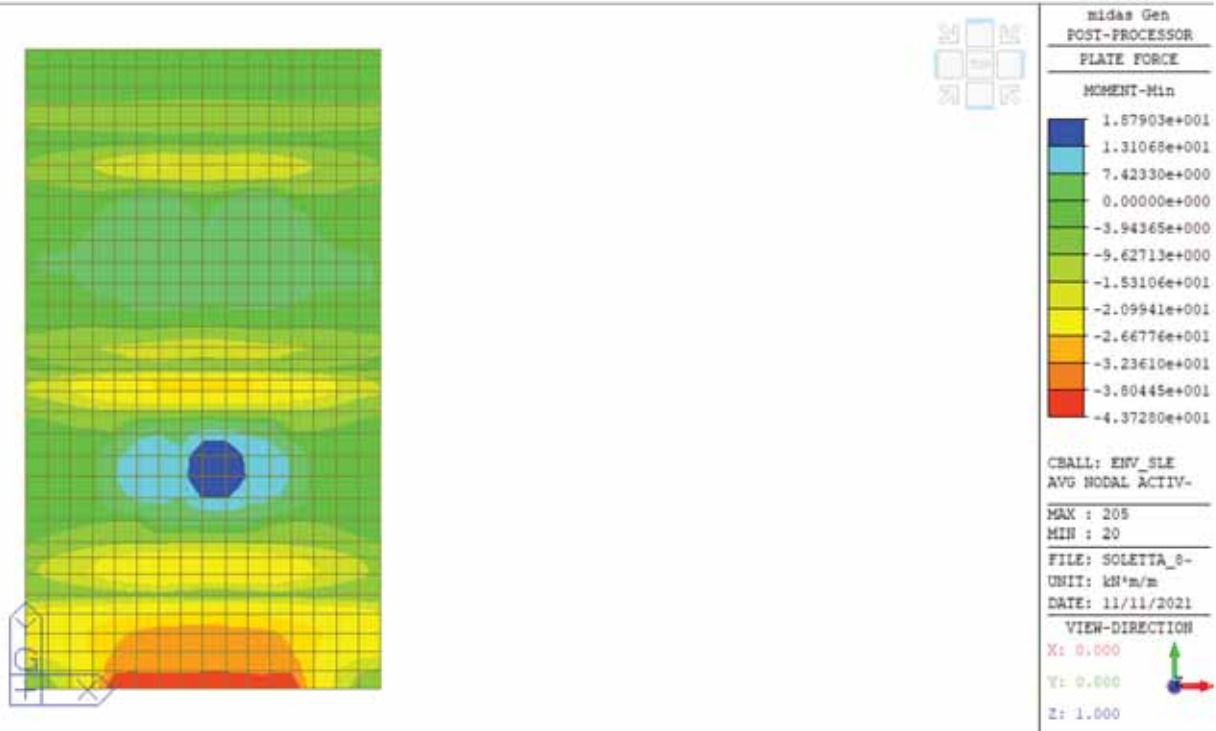


Figura 86 - Min Momento SLE

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

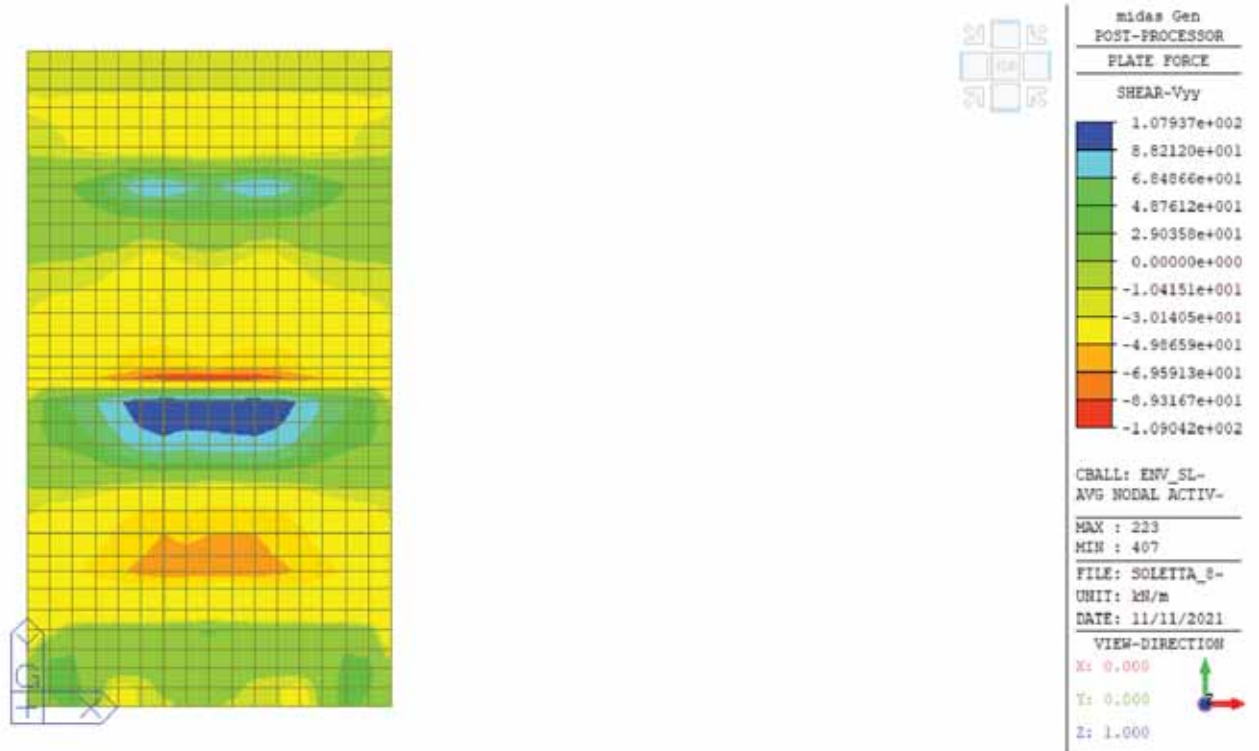
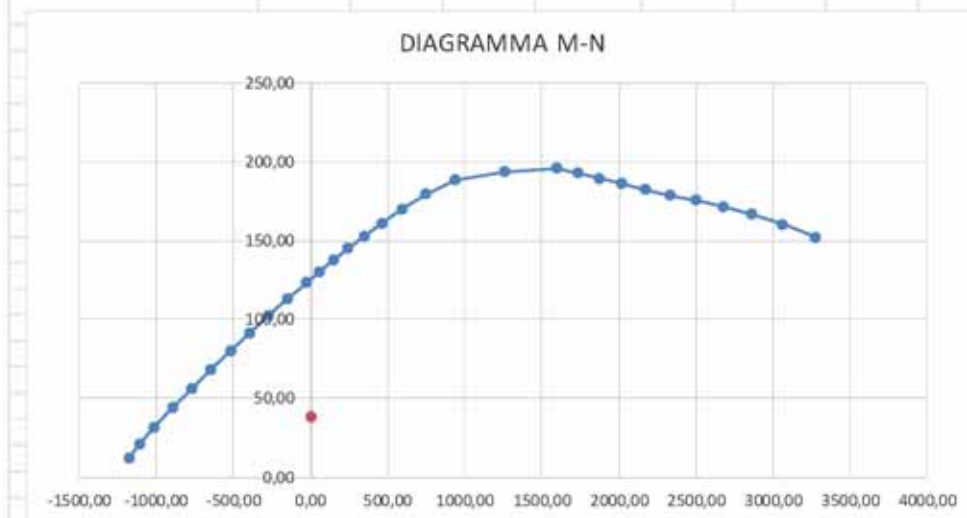


Figura 87 - Taglio SLU

VERIFICA FLESSIONALE MOMENTO POSITIVO

| RIEPILOGO SOLLECITAZIONI | | | RIEPILOGO ARMATURE | | | RIEPILOGO GEOMETRIA | | | RIEPILOGO MATERIALI | | |
|--------------------------|-------|-----|--------------------|--------|------|---------------------|-----|----|---------------------|-------|-------------------|
| | M | N | n° | φ (mm) | y | B = | 100 | cm | fck | 33,2 | N/mm ² |
| | kNm | kN | | (mm) | (cm) | H = | 26 | cm | Rck | 40 | N/mm ² |
| SLU/SLV | 38,38 | 0,0 | | | | | | | fcd = | 18,81 | |
| RARA | 28,43 | 0,0 | 5 | 16 | 5 | | | | c | 5 | cm |
| FREQUENTE | 28,43 | 0,0 | 1 | 0 | 0 | | | | fmax | 16 | mm |
| QUASI PERMANENTE | 28,43 | 0,0 | 5 | 16 | 21 | | | | i | 10 | cm |
| | | | 5 | 16 | 21 | | | | i' | 0 | cm |
| | | | | | | | | | fyk | 450 | N/mm ² |



| VERIFICHE TENSIONALI | RARA | QUASI PERMANENTE | σc N/mm2 | σs N/mm2 | σcmax N/mm2 | σsmax N/mm2 |
|----------------------|------|------------------|-------------|-------------|----------------|----------------|
| | | | 3,37 | 78,65 | 19,92 | 360,00 |
| | | | 3,37 | | 14,94 | |

| VERIFICHE A FESSURAZIONE | QUASI PERMANENTE | FREQUENTE | Wk mm | Mf kNm | M kNm | Wklim | |
|--------------------------|------------------|-----------|----------|-----------|----------|-------|----------|
| | | | 0,0275 | 43,28 | 36,36 | 0,2 | Ms < M1f |
| | | | 0,0275 | 43,28 | 36,36 | 0,3 | Ms < M1f |

VERIFICA TENSIONALE COMBINAZIONE QUASI PERMANENTE :

M = 28,43 kNm

N = 0 kN

H/6 = 4,33 cm

B = 100 cm

H = 26 cm

Verifica:

n = 15

x = 8,21 cm

s-c = 3,37 N/mm²

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

$s-a = -19,76 \text{ N/mm}^2$ ($y = 5 \text{ cm}$: 5 f 16, $A_a = 10,05 \text{ cm}^2$, passo 20,0 cm)

$s-a' = 78,65 \text{ N/mm}^2$ ($y = 21 \text{ cm}$: 5 f 16, $A_{a'} = 10,05 \text{ cm}^2$, passo 20,0 cm)

$s-a'' = 78,65 \text{ N/mm}^2$ ($y = 21 \text{ cm}$: 5 f 16, $A_{a''} = 10,05 \text{ cm}^2$, passo 20,0 cm)

VERIFICA TENSIONALE COMBINAZIONE RARA :

$M = 28,43 \text{ kNm}$

$N = 0 \text{ kN}$

$H/6 = 4,33 \text{ cm}$

$B = 100 \text{ cm}$

$H = 26 \text{ cm}$

Verifica:

$n = 15$

$x = 8,21 \text{ cm}$

$s-c = 3,37 \text{ N/mm}^2$

$s-a = -19,76 \text{ N/mm}^2$ ($y = 5 \text{ cm}$: 5 f 16, $A_a = 10,05 \text{ cm}^2$, passo 20,0 cm)

$s-a' = 78,65 \text{ N/mm}^2$ ($y = 21 \text{ cm}$: 5 f 16, $A_{a'} = 10,05 \text{ cm}^2$, passo 20,0 cm)

$s-a'' = 78,65 \text{ N/mm}^2$ ($y = 21 \text{ cm}$: 5 f 16, $A_{a''} = 10,05 \text{ cm}^2$, passo 20,0 cm)

VERIFICA A FESSURAZIONE COMBINAZIONE QUASI PERMANENTE :

$M = 28,43 \text{ kNm}$

$N = 0 \text{ kNm}$

$R_{ck} = 40 \text{ N/mm}^2$

$f_{ctm} = 3,16 \text{ N/mm}^2$ ($0,27 \times R_{ck}^{2/3}$)

$B = 100 \text{ cm}$ (larghezza sezione)

$H = 26 \text{ cm}$ (altezza sezione)

$y = 5 \text{ cm}$ (posizione di armatura)

$A_a = 10,05 \text{ cm}^2$ (n_i 5 f 16 passo 20 cm)

$y' = 21 \text{ cm}$ (posizione di armatura)

$A_{a'} = 10,05 \text{ cm}^2$ (n_i 5 f 16 passo 10 cm)

$y'' = 21 \text{ cm}$ (posizione di armatura)

$A_{a''} = 10,05 \text{ cm}^2$ (n_i 5 f 16 passo 20 cm)

STADIO NON FESSURATO

$n = 15$ (coeff. omogeneizzazione)

$J_{id}(I) = 173'070 \text{ cm}^4$

$A_{id} = 3'022 \text{ cm}^2$

$x(I) = 13,373 \text{ cm}$ (asse neutro stato I, dal lembo compresso)

$M = 36,36 \text{ kNm}$ (Momento di formazione fessura $f_{cfk} = 0,7 \times 1,2 \times f_{ctm}$)

$M_f = 43,28 \text{ kNm}$ (Momento di fessurazione f_{ctm})

Momento d'esercizio inferiore al momento di fessurazione quindi non serve calcolare l'ampiezza delle fessure

VERIFICA A FESSURAZIONE COMBINAZIONE FREQUENTE :

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

$$M = 28,43 \text{ kNm}$$

$$N = 0 \text{ kNm}$$

$$R_{ck} = 40 \text{ N/mm}^2$$

$$f_{ctm} = 3,16 \text{ N/mm}^2 (0,27 \times R_{ck}^{2/3})$$

$$B = 100 \text{ cm (larghezza sezione)}$$

$$H = 26 \text{ cm (altezza sezione)}$$

$$y = 5 \text{ cm (posizione di armatura)}$$

$$A_a = 10,05 \text{ cm}^2 (n_i \ 5 \ f \ 16 \ \text{passo } 20 \text{ cm})$$

$$y' = 21 \text{ cm (posizione di armatura)}$$

$$A_a' = 10,05 \text{ cm}^2 (n_i \ 5 \ f \ 16 \ \text{passo } 10 \text{ cm})$$

$$y'' = 21 \text{ cm (posizione di armatura)}$$

$$A_a'' = 10,05 \text{ cm}^2 (n_i \ 5 \ f \ 16 \ \text{passo } 20 \text{ cm})$$

STADIO NON FESSURATO

$$n = 15 \text{ (coeff. omogeneizzazione)}$$

$$J_{id}(I) = 173'070 \text{ cm}^4$$

$$A_{id} = 3'022 \text{ cm}^2$$

$$x(I) = 13,373 \text{ cm (asse neutro stato I, dal lembo compresso)}$$

$$M = 36,36 \text{ kNm (Momento di formazione fessura } f_{cfk} = 0,7 \times 1,2 \times f_{ctm})$$

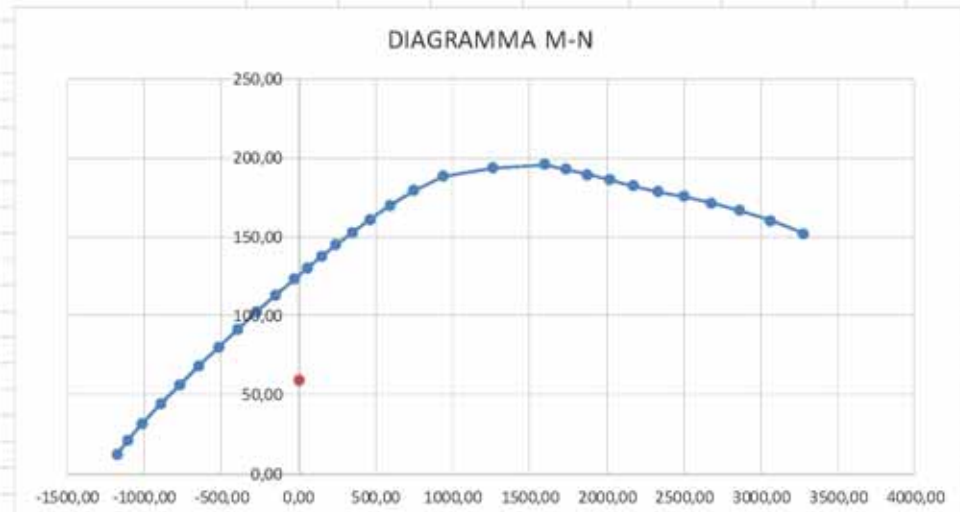
$$M_f = 43,28 \text{ kNm (Momento di fessurazione } f_{ctm})$$

Momento d'esercizio inferiore al momento di fessurazione quindi non serve calcolare l'ampiezza delle fessure

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

VERIFICA FLESSIONALE MOMENTO NEGATIVO

| RIEPILOGO SOLLECITAZIONI | | RIEPILOGO ARMATURE | | | RIEPILOGO GEOMETRIA | | | RIEPILOGO MATERIALI | | | |
|--------------------------|-------|--------------------|----|-------------|---------------------|-----|-----|---------------------|-------|-------|-------------------|
| | M | N | n° | ϕ (mm) | y | B = | 100 | cm | fck | 33,2 | N/mm ² |
| | kNm | kN | | (mm) | (cm) | H = | 26 | cm | Rck | 40 | N/mm ² |
| SLU/SLV | 59,03 | 0,0 | | | | | | | fcd = | 18,81 | |
| RARA | 43,73 | 0,0 | 5 | 16 | 5 | | | | c | 5 | cm |
| FREQUENTE | 43,73 | 0,0 | 1 | 0 | 0 | | | | fmax | 16 | mm |
| QUASI PERMANENTE | 43,73 | 0,0 | 5 | 16 | 21 | | | | i | 10 | cm |
| | | | 5 | 16 | 21 | | | | i' | 0 | cm |
| | | | | | | | | | fyk | 450 | N/mm ² |



| VERIFICHE TENSIONALI | | σ_c | σ_s | σ_{cmax} | σ_{smax} |
|----------------------|------------------|-------------------|-------------------|-------------------|-------------------|
| | | N/mm ² | N/mm ² | N/mm ² | N/mm ² |
| | RARA | 5,18 | 120,97 | 19,92 | 360,00 |
| | QUASI PERMANENTE | 5,18 | | 14,94 | |

| VERIFICHE A FESSURAZIONE | | Wk | Mf | M | Wlim | |
|--------------------------|------------------|--------|-------|-------|------|--------------|
| | | mm | kNm | kNm | | |
| | QUASI PERMANENTE | 0,0539 | 43,28 | 36,36 | 0,2 | Controllo Wk |
| | FREQUENTE | 0,0539 | 43,28 | 36,36 | 0,3 | Controllo Wk |

VERIFICA TENSIONALE COMBINAZIONE QUASI PERMANENTE :

M = 43,73 kNm

N = 0 kN

H/6 = 4,33 cm

B = 100 cm

H = 26 cm

Verifica:

n = 15

x = 8,21 cm

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

$$s-c = 5,18 \text{ N/mm}^2$$

$$s-a = -30,39 \text{ N/mm}^2 \text{ (} y = 5 \text{ cm: } 5 \text{ f } 16, A_a = 10,05 \text{ cm}^2, \text{ passo } 20,0 \text{ cm)}$$

$$s-a' = 120,97 \text{ N/mm}^2 \text{ (} y = 21 \text{ cm: } 5 \text{ f } 16, A_{a'} = 10,05 \text{ cm}^2, \text{ passo } 20,0 \text{ cm)}$$

$$s-a'' = 120,97 \text{ N/mm}^2 \text{ (} y = 21 \text{ cm: } 5 \text{ f } 16, A_{a''} = 10,05 \text{ cm}^2, \text{ passo } 20,0 \text{ cm)}$$

VERIFICA TENSIONALE COMBINAZIONE RARA :

$$M = 43,73 \text{ kNm}$$

$$N = 0 \text{ kN}$$

$$H/6 = 4,33 \text{ cm}$$

$$B = 100 \text{ cm}$$

$$H = 26 \text{ cm}$$

Verifica:

$$n = 15$$

$$x = 8,21 \text{ cm}$$

$$s-c = 5,18 \text{ N/mm}^2$$

$$s-a = -30,39 \text{ N/mm}^2 \text{ (} y = 5 \text{ cm: } 5 \text{ f } 16, A_a = 10,05 \text{ cm}^2, \text{ passo } 20,0 \text{ cm)}$$

$$s-a' = 120,97 \text{ N/mm}^2 \text{ (} y = 21 \text{ cm: } 5 \text{ f } 16, A_{a'} = 10,05 \text{ cm}^2, \text{ passo } 20,0 \text{ cm)}$$

$$s-a'' = 120,97 \text{ N/mm}^2 \text{ (} y = 21 \text{ cm: } 5 \text{ f } 16, A_{a''} = 10,05 \text{ cm}^2, \text{ passo } 20,0 \text{ cm)}$$

VERIFICA A FESSURAZIONE COMBINAZIONE QUASI PERMANENTE :

$$M = 43,73 \text{ kNm}$$

$$N = 0 \text{ kNm}$$

$$R_{ck} = 40 \text{ N/mm}^2$$

$$f_{ctm} = 3,16 \text{ N/mm}^2 \text{ (} 0,27 \times R_{ck}^{2/3} \text{)}$$

$$B = 100 \text{ cm (larghezza sezione)}$$

$$H = 26 \text{ cm (altezza sezione)}$$

$$y = 5 \text{ cm (posizione di armatura)}$$

$$A_a = 10,05 \text{ cm}^2 \text{ (} n_i \text{ } 5 \text{ f } 16 \text{ passo } 20 \text{ cm)}$$

$$y' = 21 \text{ cm (posizione di armatura)}$$

$$A_{a'} = 10,05 \text{ cm}^2 \text{ (} n_i \text{ } 5 \text{ f } 16 \text{ passo } 10 \text{ cm)}$$

$$y'' = 21 \text{ cm (posizione di armatura)}$$

$$A_{a''} = 10,05 \text{ cm}^2 \text{ (} n_i \text{ } 5 \text{ f } 16 \text{ passo } 20 \text{ cm)}$$

STADIO NON FESSURATO

$$n = 15 \text{ (coeff. omogeneizzazione)}$$

$$J_{id}(I) = 173'070 \text{ cm}^4$$

$$A_{id} = 3'022 \text{ cm}^2$$

$$x(I) = 13,373 \text{ cm (asse neutro stato I, dal lembo compresso)}$$

$$M = 36,36 \text{ kNm (Momento di formazione fessura } f_{cfk} = 0,7 \times 1,2 \times f_{ctm} \text{)}$$

$$M_f = 43,28 \text{ kNm (Momento di fessurazione } f_{ctm} \text{)}$$

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

STADIO FESSURATO (II)

$n = 15$ (coeff. omogeneizzazione)

$x(II) = 8,2$ cm (asse neutro stato II)

$Jid(II) = 69'336$ cm²

$s_s = 120,97$ N/mm² (M,N)

$e_s = 0,000576$

Geometria tirante ideale

$b = 100$ cm

$h' = 17,8$ cm ($c + f/2 + i' + 7,5xf$)

$A_s = 20,11$ cm²

$A_c = 1780,00$ cm²

$A_s/A_c = 0,0113$

Distanza media fessure:

$c = 5$ cm (copriferro, da estradosso cls ad estradosso barra)

$i = 10,0$ cm (interasse ferri in orizzontali)

$i' = 0$ cm (interasse ferri verticale, nel caso di due strati di barre)

$f_{max} = 16$ mm diametro massimo barre

$r = 0,0113$ (A_s/A_c tirante ideale)

$k_1 = 0,4$ (barre a.m.)

$k_2 = 0,074$ ($0,25x[1-h'/(2x(H-x1))]$)

$s_m = 16,18$ cm ($2x(c+i/10)+k_1xk_2xf/r$)

Deformazione media:

$b_1 = 1$ (barre a.m.)

$b_2 = 0,5$ (carichi di lunga durata o numerosi cicli di carico)

$s_{sr} = 119,74$ N/mm² (stato II, Mf)

$s_{ss} = 120,97$ N/mm² (stato II, Magente)

$e_{sm} = 0,000294$ ($ss/Esx(1-b_1xb_2x(ssr/ss)^2)$)

Ampiezza teorica di fessura:

$w_k = 0,081$ mm ($1,7x e_{sm} x s_m$)

VERIFICA A FESSURAZIONE COMBINAZIONE FREQUENTE :

$M = 43,73$ kNm

$N = 0$ kNm

$R_{ck} = 40$ N/mm²

$f_{ctm} = 3,16$ N/mm² ($0,27xR_{ck}^{2/3}$)

$B = 100$ cm (larghezza sezione)

$H = 26$ cm (altezza sezione)

$y = 5$ cm (posizione di armatura)

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

$$Aa = 10,05 \text{ cm}^2 \text{ (nj 5 f 16 passo 20 cm)}$$

$$y' = 21 \text{ cm (posizione di armatura)}$$

$$Aa' = 10,05 \text{ cm}^2 \text{ (nj 5 f 16 passo 10 cm)}$$

$$y'' = 21 \text{ cm (posizione di armatura)}$$

$$Aa'' = 10,05 \text{ cm}^2 \text{ (nj 5 f 16 passo 20 cm)}$$

STADIO NON FESSURATO

$$n = 15 \text{ (coeff. omogeneizzazione)}$$

$$Jid(I) = 173'070 \text{ cm}^4$$

$$Aid = 3'022 \text{ cm}^2$$

$$x(I) = 13,373 \text{ cm (asse neutro stato I, dal lembo compresso)}$$

$$M = 36,36 \text{ kNm (Momento di formazione fessura } f_{ck} = 0,7 \times 1,2 \times f_{ctm})$$

$$M_f = 43,28 \text{ kNm (Momento di fessurazione } f_{ctm})$$

STADIO FESSURATO (II)

$$n = 15 \text{ (coeff. omogeneizzazione)}$$

$$x(II) = 8,2 \text{ cm (asse neutro stato II)}$$

$$Jid(II) = 69'336 \text{ cm}^4$$

$$s_s = 120,97 \text{ N/mm}^2 \text{ (M,N)}$$

$$e_s = 0,000576$$

Geometria tirante ideale

$$b = 100 \text{ cm}$$

$$h' = 17,8 \text{ cm (c + f/2 + i' + 7,5xf)}$$

$$A_s = 20,11 \text{ cm}^2$$

$$A_c = 1780,00 \text{ cm}^2$$

$$A_s/A_c = 0,0113$$

Distanza media fessure:

$$c = 5 \text{ cm (copriferro, da estradosso cls ad estradosso barra)}$$

$$i = 10,0 \text{ cm (interasse ferri in orizzontali)}$$

$$i' = 0 \text{ cm (interasse ferri verticale, nel caso di due strati di barre)}$$

$$f_{\max} = 16 \text{ mm diametro massimo barre}$$

$$r = 0,0113 \text{ (} A_s/A_c \text{ tirante ideale)}$$

$$k_1 = 0,4 \text{ (barre a.m.)}$$

$$k_2 = 0,074 \text{ (} 0,25 \times [1 - h' / (2x(H-x))] \text{)}$$

$$s_m = 16,18 \text{ cm (} 2x(c+i/10) + k_1 k_2 x f / r \text{)}$$

Deformazione media:

$$b_1 = 1 \text{ (barre a.m.)}$$

$$b_2 = 0,5 \text{ (carichi di lunga durata o numerosi cicli di carico)}$$

$$s_{sr} = 119,74 \text{ N/mm}^2 \text{ (stato II, } M_f)$$

$$s_{ss} = 120,97 \text{ N/mm}^2 \text{ (stato II, Magente)}$$

$$e_{sm} = 0,000294 (ss/E_s x (1 - b_1 x b_2 x (ssr/ss)^2))$$

Ampiezza teorica di fessura:

$$w_k = 0,081 \text{ mm } (1,7 x e_{sm} x s_m)$$

8 VERIFICA ELEMENTI DI APPOGGIO

Si riporta di seguito l'andamento degli spostamenti orizzontali necessari per il dimensionamento dei varchi, nonché gli scarichi necessari per il dimensionamento dei baggioli e dei ritegni sismici.

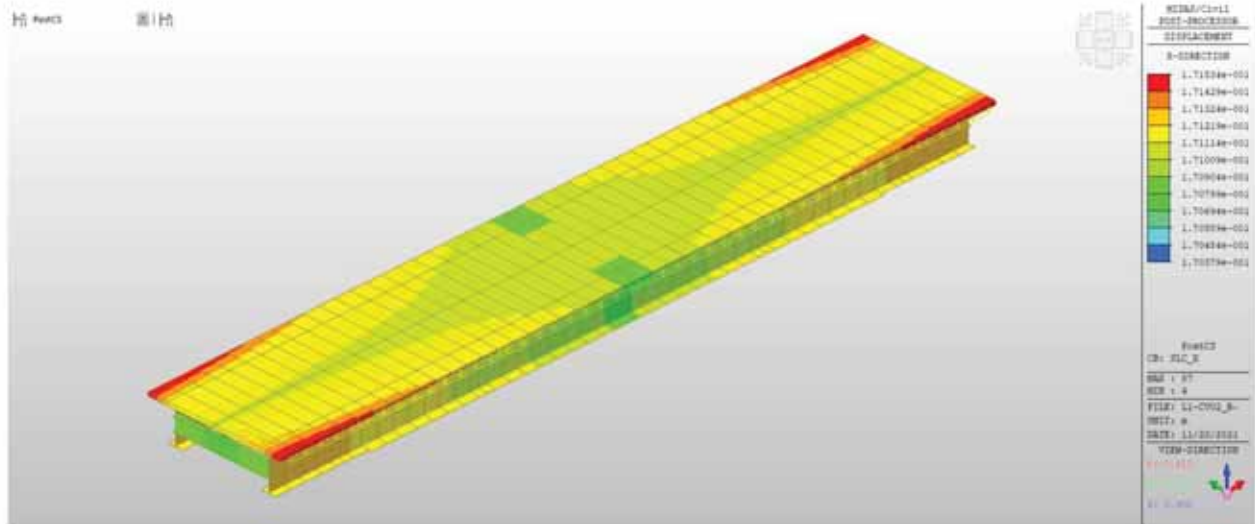


Figura 88 – Spostamenti Stato Limite Collasso X (SISMAX+0.30SISMAY)

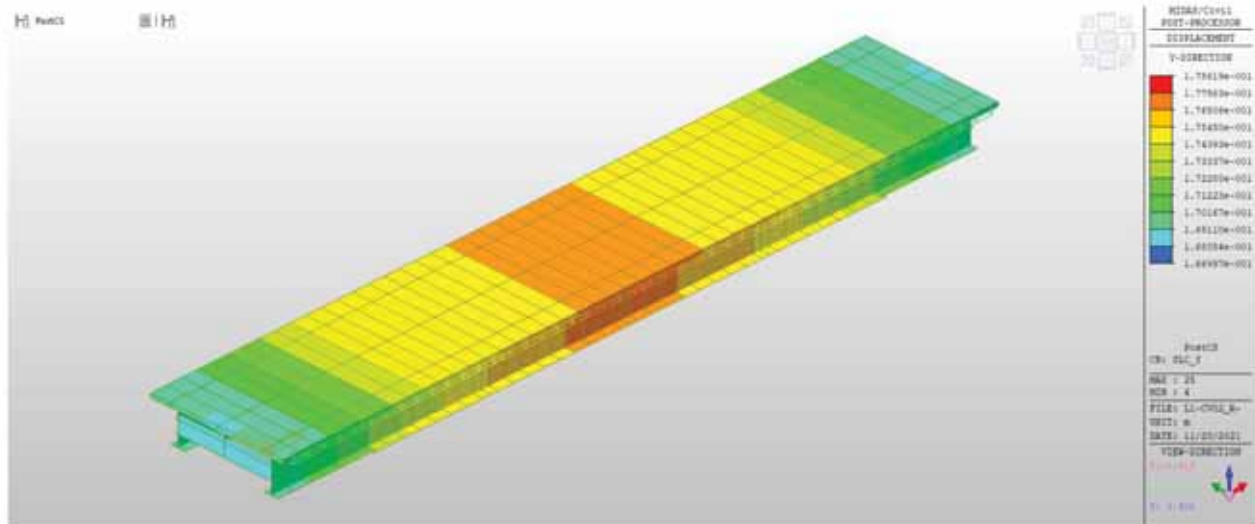


Figura 89 - Spostamenti Stato Limite Collasso Y (SISMAY+0.30SISMAX)

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

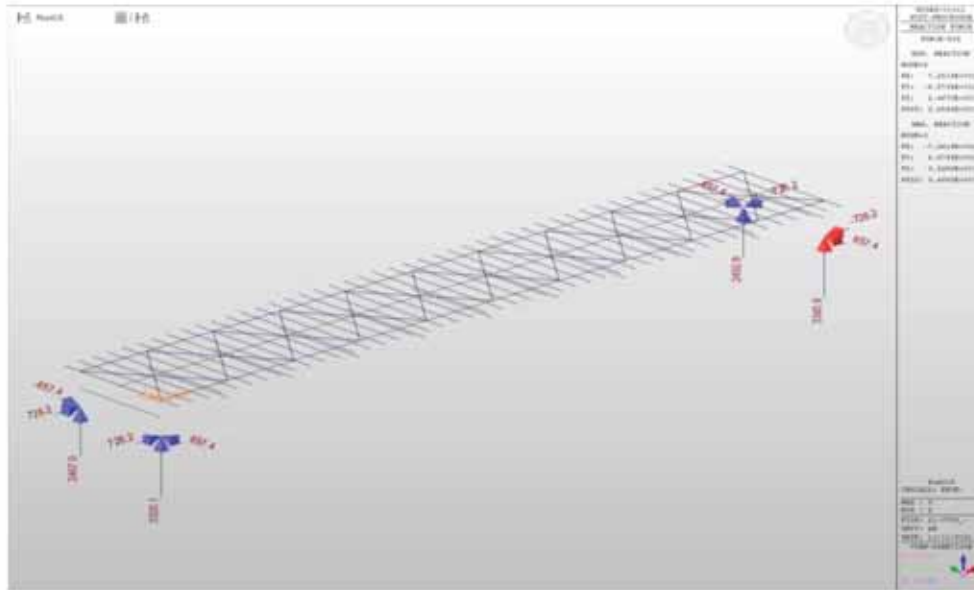


Figura 90 – Reazioni agli appoggi

| | | | | |
|---|---------------------|-----------|-----------|-------------|
| 1 | FASE 3 | 42.488433 | 0.728916 | 1234.884128 |
| 2 | FASE 3 | 42.488433 | -0.728916 | 1234.884128 |
| 1 | VENTO PONTE SCARICO | 0.198 | 50.696 | 44.873 |
| 2 | VENTO PONTE SCARICO | -0.198 | 50.712 | -44.873 |
| 1 | VENTO PONTE CARICO | -0.154 | 114.080 | 70.163 |
| 2 | VENTO PONTE CARICO | 0.154 | 114.115 | -70.163 |
| 1 | TERMICA UNIFORME + | 36.720 | 9.077 | 0.000 |
| 2 | TERMICA UNIFORME + | 36.720 | -9.077 | 0.000 |
| 1 | TERMICA UNIFORME - | -34.351 | -8.491 | 0.000 |
| 2 | TERMICA UNIFORME - | -34.351 | 8.491 | 0.000 |
| 1 | TERMICA GRADIENTE + | -11.747 | 0.031 | 0.000 |
| 2 | TERMICA GRADIENTE + | -11.747 | -0.031 | 0.000 |
| 1 | TERMICA GRADIENTE - | 14.097 | -0.037 | 0.000 |
| 2 | TERMICA GRADIENTE - | 14.097 | 0.037 | 0.000 |
| 1 | FRENATURA | -117.484 | 0.001 | -9.523 |
| 2 | FRENATURA | -117.484 | -0.001 | -9.523 |
| 1 | EX(RS) | 665.077 | 0.009 | 63.746 |
| 2 | EX(RS) | 665.077 | 0.009 | 63.746 |
| 1 | EY(RS) | 0.797 | 652.084 | 469.687 |
| 2 | EY(RS) | 0.797 | 652.084 | 469.687 |
| 1 | EZ(RS) | 5.302 | 0.049 | 182.389 |
| 2 | EZ(RS) | 5.302 | 0.049 | 182.389 |
| 1 | DX(RS) | 138.171 | 0.002 | 13.243 |
| 2 | DX(RS) | 138.171 | 0.002 | 13.243 |
| 1 | CX(RS) | 752.812 | 0.011 | 72.155 |
| 2 | CX(RS) | 752.812 | 0.011 | 72.155 |
| 1 | LM01(all) | 19.315 | 0.750 | 999.411 |
| 2 | LM01(all) | 5.945 | -0.717 | 200.089 |
| 1 | LM02(all) | 4.058 | 0.722 | 187.758 |
| 2 | LM02(all) | 7.011 | -0.731 | 375.659 |
| 1 | LM03(all) | 0.135 | 0.008 | 0.017 |
| 2 | LM03(all) | 1.222 | -0.011 | 56.245 |

8.1 VERIFICA BAGGIOLI

| DATI DI INPUT | | |
|---|--|---------|
| Forza orizzontale | V_{Sd} [kN] = | 727 |
| Forza verticale (+ se di trazione) | $N_{Sd} / 4$ [kN] = | -836.45 |
| Altezza di applicazione forza orizzontale | a [m] = | 0.41 |
| Base baggiolo | h [m] = | 1.05 |
| Copriferro | c [m] = | 0.05 |
| Altezza utile | d [m] = | 0.875 |
| Profondità di incastro assunta | h' [m] = | 0.00 |
| Luce di calcolo mensola | L [m] = | 0.15 |
| Profondità baggiolo | b [m] = | 1.00 |
| Angolo inclinazione traliccio [°] | α [°] = | 10.78 |
| Angolo inclinazione traliccio [rad] | α [rad] = | 0.19 |
| Angolo inclinazione traliccio [°] | ψ [°] = | 79.22 |
| Angolo inclinazione traliccio [rad] | ψ [rad] = | 1.38 |
| VERIFICA CORRENTE TESO | | |
| Trazione sulle barre d'armatura corrente teso | Z_{Sd} [kN] = | -698.07 |
| Classe acciaio | | B450C |
| Resistenza a snervamento armatura | f_{yd} [MPa] = | 391.3 |
| Area armatura necessaria | A_{nec} [cm ²] = | 17.8 |
| Diametro armatura 1 | $\varnothing 1$ [mm] = | 16 |
| Diametro armatura 2 | $\varnothing 2$ [mm] = | 0 |
| Numero ferri $\varnothing 1$ | $n_{\varnothing 1}$ [-] = | 9 |
| Numero ferri $\varnothing 2$ | $n_{\varnothing 2}$ [-] = | 0 |
| Area armatura 1 (singola barra) | A_{s1} [cm ²] = | 2.01 |
| Area armatura 2 (singola barra) | A_{s2} [cm ²] = | 0.00 |
| Area armatura totale | A_{sTOT} [cm ²] = | 18.1 |
| Resistenza corrente teso | Z_{Rd} [kN] = | 708.09 |
| Coefficiente di sicurezza | $Z_{Rd} / Z_{Sd} = c.s.$ = | 1.01 |
| VERIFICA PUNTONE CLS COMPRESSO | | |
| Resistenza cubica caratteristica | R_{ck} [MPa] = | 40 |
| Resistenza cilindrica caratteristica | f_{ck} [MPa] = | 32 |
| Coefficiente parziale di sicurezza | γ_c [-] = | 1.50 |
| Resistenza di calcolo a compressione | f_{cd} [MPa] = | 18.13 |
| Presenza di staffe | | Si |
| Coefficiente presenza staffe (1 senza staffe; 1.5 con staffe) | c [-] = | 1.50 |
| Pendenza del puntone di calcestruzzo | $\cotg\psi = \tg\alpha = \lambda$ = | 0.19 |
| Altezza puntone | $0.4 \cdot c \cdot d \cdot \sen\psi = hp$ [m] = | 0.516 |
| Compressione nel puntone | C_{Sd} [kN] = | 3730.75 |
| Resistenza del puntone di calcestruzzo | $0.4 \cdot b \cdot d \cdot f_{cd} \cdot c / (1 + \lambda^2) = C_{Rd}$ [kN] = | 9187 |
| Coefficiente di sicurezza | $C_{Rd} / C_{Sd} = c.s.$ = | 2.46 |

8.2 ISOLATORI – EFFETTO VARIABILITA' RIGIDEZZA

Si riportano di seguito le caratteristiche degli isolatori individuati.

| V | Fzd | Ke | ξ_e | Kv | Dg | te | h | H | Z |
|---------|---|-------|---------|-------|------|-----|-----|-----|------|
| kN | kN | kN/mm | % | kN/mm | mm | mm | mm | mm | mm |
| 20940 | 33970 | 4,42 | 19 | 4489 | 1000 | 153 | 277 | 357 | 1050 |
| V | Carico verticale massimo agente in presenza del sisma allo SLC | | | | | | | | |
| Fzd | Carico verticale massimo in assenza di SISMA e spostamento 10mm | | | | | | | | |
| Ke | Rigidezza orizzontale equivalente | | | | | | | | |
| ξ_e | Coefficiente di smorzamento viscoso equivalente | | | | | | | | |
| Kv | Rigidezza verticale | | | | | | | | |
| Dg | Diametro elastomero | | | | | | | | |
| te | Spessore totale gomma | | | | | | | | |
| h | Altezza escluse piastre di ancoraggio | | | | | | | | |
| H | Altezza totale incluse piastre di ancoraggio | | | | | | | | |
| Z | Lato piastre di ancoraggio | | | | | | | | |

Il valore di $F_z \max = 3345.8$ kN inferiore ai limiti previsti per l'isolatore introdotto ($F_{zd} = 33970$ kN). Nel caso specifico, sono stati scelti isolatori elastomerici a nucleo di piombo e nell'ambito della rigidezza è stata effettuata una simulazione (che ha fornito sostanzialmente i medesimi risultati in termini di spostamento e reazioni agli appoggi) modificando la rigidezza dell'isolatore di +/-20% così come previsto dalle NTC2008 al punto 11.9.7.

8.3 VERIFICA GIUNTI

Per la determinazione dei varchi e quindi l'individuazione dei corretti giunti da utilizzare, sono stati considerati gli spostamenti sia dovuti alle azioni statiche che sismiche.

Nel dettaglio si nota che lo spostamento massimo, dovuto all'azione sismica in condizione SLC è pari a $d_{max} = 17.15$ cm. Si introduce quindi un giunto tipo GPE400 che permetta uno spostamento pari a +/-20cm.

8.4 VERIFICA RITEGNI SISMICI.

Il presente cavalcavia presenta come appoggi 4 isolatori di appoggio che permettono uno spostamento massimo orizzontale pari a 200mm. Si è scelto di introdurre comunque dei ritegni sismici per bloccare lo spostamento trasversale dell'impalcato in conseguenza dei valori di spostamento generati dal sisma. Si è scelto di permettere uno spostamento trasversale maggiore o comunque prossimo al valore riferito al sisma SLV e di dimensionare il ritegno con la forza che deriva dalla differenza di spostamento tra lo SLC ed il varco previsto.

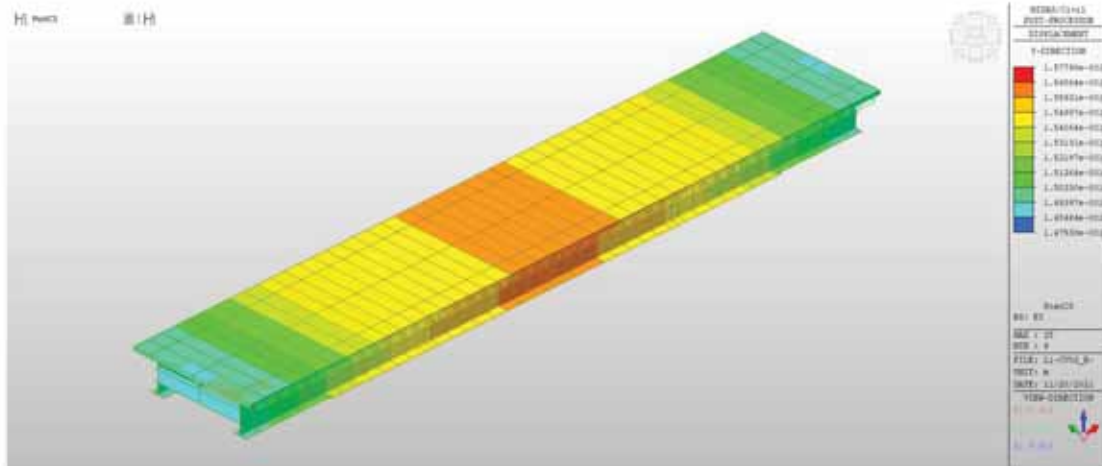
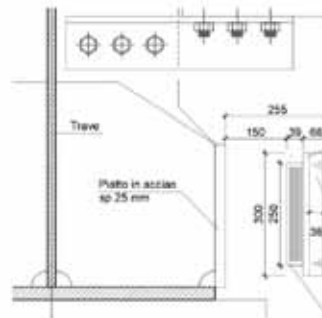


Figura 91 Spostamento Y SLV (SISMA Y + 0.3 SISMA X)



$$\text{Spostamento residuo} = 17.86 - 15.00 = 2.86\text{cm}$$

$$K_{\text{isolatore}} = 4.420 \text{ kN/mm}$$

$$F_{\text{residua}} = 126.41 \text{ kN}$$

Con tale forza vengono dimensionate le armature dei ritegni sismici

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

| DATI DI INPUT | | |
|---|--|--------|
| Forza orizzontale | V_{sd} [kN] = | 252.82 |
| Forza verticale (+ se di trazione) | $N_{sd} / 4$ [kN] = | 0 |
| Altezza di applicazione forza orizzontale | a [m] = | 0.96 |
| Base baggio | h [m] = | 1.00 |
| Copriferro | c [m] = | 0.05 |
| Altezza utile | d [m] = | 0.825 |
| Profondità di incastro assunta | h' [m] = | 0.00 |
| Luce di calcolo mensola | L [m] = | 0.96 |
| Profondità baggio | b [m] = | 1.00 |
| Angolo inclinazione traliccio [°] | α [°] = | 52.28 |
| Angolo inclinazione traliccio [rad] | α [rad] = | 0.91 |
| Angolo inclinazione traliccio [°] | ψ [°] = | 37.72 |
| Angolo inclinazione traliccio [rad] | ψ [rad] = | 0.66 |
| VERIFICA CORRENTE TESO | | |
| Trazione sulle barre d'armatura corrente teso | Z_{sd} [kN] = | 326.88 |
| Classe acciaio | | B450C |
| Resistenza a snervamento armatura | f_{yd} [MPa] = | 391.3 |
| Area armatura necessaria | A_{nec} [cm ²] = | 8.4 |
| Diametro armatura 1 | $\phi 1$ [mm] = | 16 |
| Diametro armatura 2 | $\phi 2$ [mm] = | 0 |
| Numero ferri $\phi 1$ | $n_{\phi 1}$ [-] = | 9 |
| Numero ferri $\phi 2$ | $n_{\phi 2}$ [-] = | 0 |
| Area armatura 1 (singola barra) | A_{s1} [cm ²] = | 2.01 |
| Area armatura 2 (singola barra) | A_{s2} [cm ²] = | 0.00 |
| Area armatura totale | A_{sTOT} [cm ²] = | 18.1 |
| Resistenza corrente teso | Z_{rd} [kN] = | 708.09 |
| Coefficiente di sicurezza | $Z_{rd} / Z_{sd} = c.s. =$ | 2.17 |
| VERIFICA PUNTO CLS COMPRESSO | | |
| Resistenza cubica caratteristica | R_{ck} [MPa] = | 40 |
| Resistenza cilindrica caratteristica | f_{ck} [MPa] = | 32 |
| Coefficiente parziale di sicurezza | γ_c [-] = | 1.50 |
| Resistenza di calcolo a compressione | f_{cd} [MPa] = | 18.13 |
| Presenza di staffe | | SI |
| Coefficiente presenza staffe (1 senza staffe; 1.5 con staffe) | c [-] = | 1.50 |
| Pendenza del puntone di calcestruzzo | $\cotg\psi = \tan\alpha = \lambda =$ | 1.29 |
| Altezza puntone | $0.4 \cdot c \cdot d \cdot \sin\psi = h_p$ [m] = | 0.303 |
| Compressione nel puntone | C_{sd} [kN] = | 413.24 |
| Resistenza del puntone di calcestruzzo | $0.4 \cdot b \cdot d \cdot f_{cd} \cdot c / (1 + \lambda^2) = C_{rd}$ [kN] = | 3360 |
| Coefficiente di sicurezza | $C_{rd} / C_{sd} = c.s. =$ | 8.13 |

8.5 VERIFICA DEFORMAZIONI

Si riportano di seguito le deformazioni dell'impalcato dovuto al peso proprio, soletta e permanente, nonché la freccia in condizioni di esercizio.

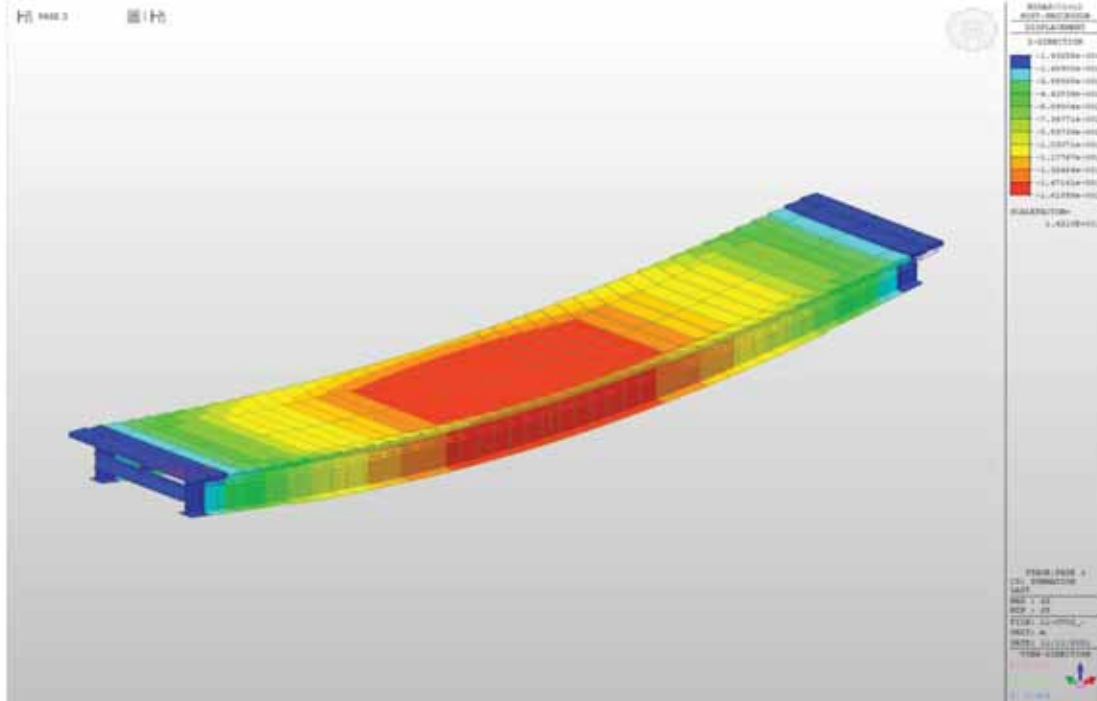


Figura 92 – Deformate - Fase 3

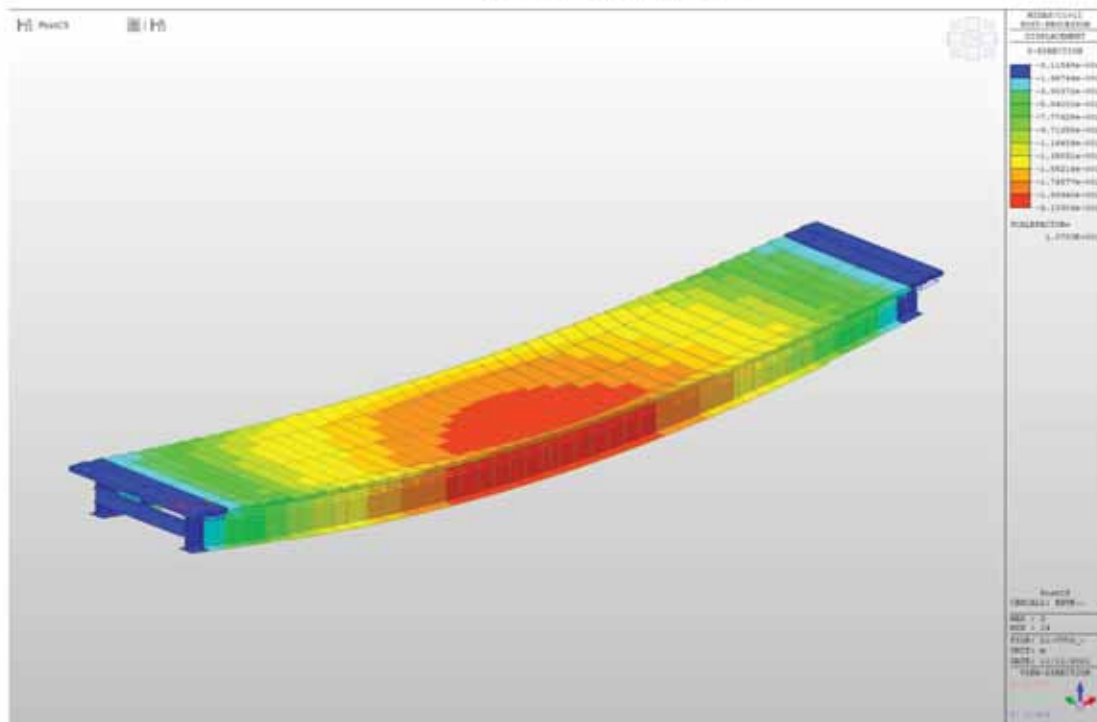


Figura 93 – Deformate - Inviluppo SLE

LOTTO 1 – CAVALCAVIA AL KM. 3+005 - RELAZIONE DI CALCOLO IMPALCATO

Per effetto del peso proprio dell'impalcato, della soletta e dei permanenti portati, si ottiene uno spostamento in mezzera pari a circa 16.19cm (monta da applicare in fase di costruzione).

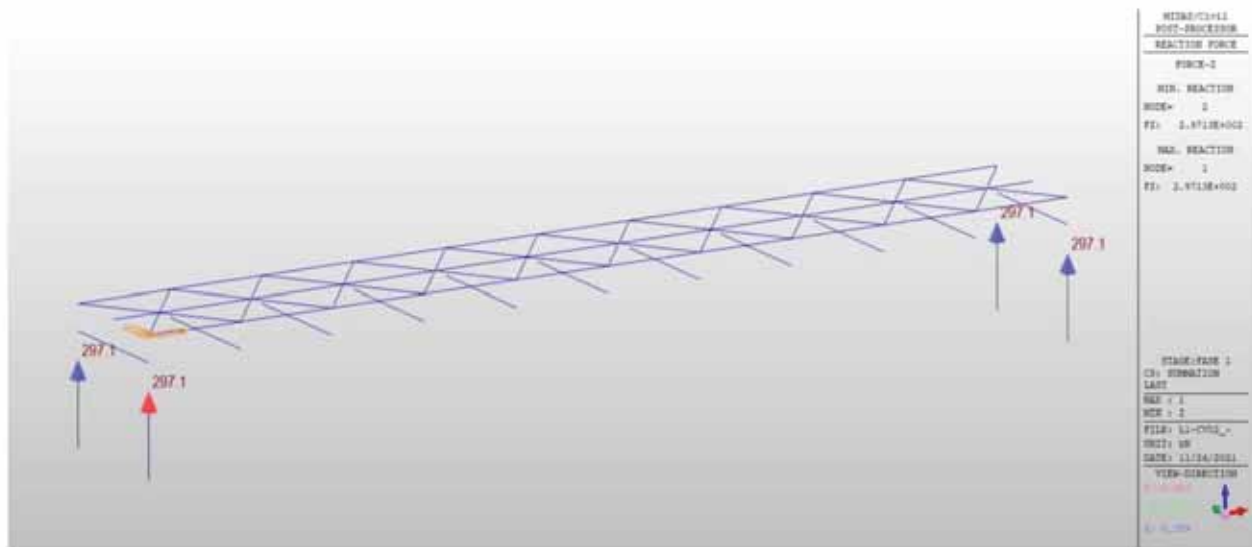
Considerando quindi tale valore come monta iniziale dai imporre all'impalcato, in condizione di esercizio si ottiene il seguente valore di freccia.

$$f = 21.33\text{cm} - 16.19\text{cm} = 5.14\text{cm}.$$

9 VALIDAZIONE CODICE DI CALCOLO

Per effettuare la validazione del codice di calcolo, è stato determinato il peso della struttura ed è stato confrontato con gli scarichi derivanti dal modello dovuto ai soli pesi propri.

In base al punto 10.2 delle norme per le costruzioni NTC2008, qualora per la determinazione delle sollecitazioni di progetto si ricorra all'utilizzo di codici di calcolo, dovrà essere verificata l'attendibilità dei risultati tramite una validazione del modello di carico. Si riporta pertanto di seguito la validazione del modello andando a confrontare le reazioni vincolari per effetto del peso proprio della struttura ottenuti dal modello di calcolo e manualmente calcolando i singoli Pesì strutturali.



Calcolando i pesi in modo manuale e considerando l'incremento del peso proprio dovuto alla presenza delle piastre varie si ottiene:


| | LUNGHEZZA CONCIO | | PIATTABANDA SUP | | PIATTABANDA INF | | ANIMA | | | AREA mq | VOLME mc | PESO kg | |
|----------------|------------------|--------|-----------------|----------|-----------------|----------|--------------|---------|----------|------------|-------------|------------|-----------------------|
| | mm | NUMERO | B mm | Sp mm | B mm | Sp mm | Htrave mm | B mm | Sp mm | | | | |
| C1 | 6750 | 1 | 750 | 25 | 900 | 30 | 2200 | 2145 | 22 | 0.09294 | 0.627345 | 4924.658 | |
| C2 | 10000 | 1 | 750 | 28 | 1200 | 40 | 2200 | 2132 | 22 | 0.115904 | 1.15904 | 9098.464 | |
| C3 | 13000 | 1 | 750 | 30 | 1200 | 55 | 2200 | 2115 | 22 | 0.13503 | 1.75539 | 13779.81 | 41826.06 |
| C4 | 9600 | 1 | 750 | 28 | 1200 | 40 | 2200 | 2132 | 22 | 0.115904 | 1.15904 | 9098.464 | |
| C5 | 7250 | 1 | 750 | 25 | 900 | 30 | 2200 | 2145 | 22 | 0.09294 | 0.627345 | 4924.658 | 83652.11 |
| TRAVE DI SPINA | 46500 | 1 | 300 | 25 | 300 | 25 | 590 | 2132 | 13 | 0.115904 | 1.15904 | 9098.464 | 9098.464 |
| TRAVERSI | 5400 | 11 | 350 | 25 | 350 | 25 | 800 | 750 | 20 | 0.3575 | 1.9306 | 15154.43 | 15154.43 |
| | | | | | | | | | | | | | Peso tot 107905 |
| | | | | | | | | | | | | | Reazione 26976.25 |
| | | | | | | | | | | | | | 269.7625 MN |
| | | | | | | | | | | | | | 12% 302.134 MN |

La reazione vincolare ottenuta risulta essere compatibile con quella calcolata manualmente.

10 ALLEGATO 1 - TABULATO MIDAS

MIDAS

PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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-----  
; MIDAS/Civil Text (MCT) File.  
; Date : 2021/11/22  
-----
```

*VERSION
8.7.5

*UNIT ; Unit System
; FORCE, LENGTH, HEAT, TEMPER
KN , M, BTU, C


*PROJINFO ; Project Information
USER=.
ADDRESS=.

*STRUCTYPE ; Structure Type
; iSTYP, iMASS, iSMAS, bMASSOFFSET, bSELFWEIGHT, GRAV, TEMPER, bALIGNBEAM, bALIGNSLAB,
bROTRIGID
0, 1, 1, NO, YES, 9.806, 18, NO, NO, NO

*REBAR-MATL-CODE ; Rebar Material Code
; CONC_CODE, CONC_MDB, SRC_CODE, SRC_MDB
NTC08(RC), B450C, ASTM(RC), Grade 60

*NODE ; Nodes
; iNO, X, Y, Z
1, 0, 0, -2.46
2, 0, 6, -2.46
3, 45, 0, -2.46
4, 45, 6, -2.46
9, 0, 0, -1.2
10, 4.5, 0, -1.2
11, 9, 0, -1.2
12, 13.5, 0, -1.2
13, 18, 0, -1.2
14, 22.5, 0, -1.2
15, 27, 0, -1.2
16, 31.5, 0, -1.2
17, 36, 0, -1.2
18, 40.5, 0, -1.2
19, 45, 0, -1.2
20, 0, 3, -1.2
21, 4.5, 3, -1.2
22, 9, 3, -1.2
23, 13.5, 3, -1.2
24, 18, 3, -1.2
25, 22.5, 3, -1.2
26, 27, 3, -1.2
27, 31.5, 3, -1.2
28, 36, 3, -1.2
29, 40.5, 3, -1.2
30, 45, 3, -1.2
31, 0, 6, -1.2
32, 4.5, 6, -1.2
33, 9, 6, -1.2
34, 13.5, 6, -1.2
35, 18, 6, -1.2
36, 22.5, 6, -1.2
37, 27, 6, -1.2
38, 31.5, 6, -1.2
39, 36, 6, -1.2


PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

40, 40.5, 6, -1.2
41, 45, 6, -1.2
42, 0, -1.25, 0
43, 1, -1.25, 0
44, 2, -1.25, 0
45, 3, -1.25, 0
46, 4, -1.25, 0
47, 5, -1.25, 0
48, 6, -1.25, 0
49, 7, -1.25, 0
50, 8, -1.25, 0
51, 9, -1.25, 0
52, 10, -1.25, 0
53, 11, -1.25, 0
54, 12, -1.25, 0
55, 13, -1.25, 0
56, 14, -1.25, 0
57, 15, -1.25, 0
58, 16, -1.25, 0
59, 17, -1.25, 0
60, 18, -1.25, 0
61, 19, -1.25, 0
62, 20, -1.25, 0
63, 21, -1.25, 0
64, 22, -1.25, 0
65, 23, -1.25, 0
66, 24, -1.25, 0
67, 25, -1.25, 0
68, 26, -1.25, 0
69, 27, -1.25, 0
70, 28, -1.25, 0
71, 29, -1.25, 0
72, 30, -1.25, 0
73, 31, -1.25, 0
74, 32, -1.25, 0
75, 33, -1.25, 0
76, 34, -1.25, 0
77, 35, -1.25, 0
78, 36, -1.25, 0
79, 37, -1.25, 0
80, 38, -1.25, 0
81, 39, -1.25, 0
82, 40, -1.25, 0
83, 41, -1.25, 0
84, 42, -1.25, 0
85, 43, -1.25, 0
86, 44, -1.25, 0
87, 45, -1.25, 0
88, 0, 0, 0
89, 1, 0, 0
90, 2, 0, 0
91, 3, 0, 0
92, 4, 0, 0
93, 4.5, 0, 0
94, 5, 0, 0
95, 6, 0, 0
96, 7, 0, 0
97, 8, 0, 0
98, 9, 0, 0
99, 10, 0, 0
100, 11, 0, 0
101, 12, 0, 0


MIDAS

PROJECT TITLE :

|  | Company | Client |
|---|---------|-----------|
| | Author | File Name |


102, 13, 0, 0
103, 13.5, 0, 0
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106, 16, 0, 0
107, 17, 0, 0
108, 18, 0, 0
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112, 22, 0, 0
113, 22.5, 0, 0
114, 23, 0, 0
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124, 32, 0, 0
125, 33, 0, 0
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132, 40, 0, 0
133, 40.5, 0, 0
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135, 42, 0, 0
136, 43, 0, 0
137, 44, 0, 0
138, 45, 0, 0
139, 0, 3, 0
140, 1, 3, 0
141, 2, 3, 0
142, 3, 3, 0
143, 4, 3, 0
144, 4.5, 3, 0
145, 5, 3, 0
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147, 7, 3, 0
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149, 9, 3, 0
150, 10, 3, 0
151, 11, 3, 0
152, 12, 3, 0
153, 13, 3, 0
154, 13.5, 3, 0
155, 14, 3, 0
156, 15, 3, 0
157, 16, 3, 0
158, 17, 3, 0
159, 18, 3, 0
160, 19, 3, 0
161, 20, 3, 0
162, 21, 3, 0
163, 22, 3, 0

PROJECT TITLE :

|  | Company | Client |
|---|---------|-----------|
| | Author | File Name |

164, 22.5, 3, 0
165, 23, 3, 0
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167, 25, 3, 0
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169, 27, 3, 0
170, 28, 3, 0
171, 29, 3, 0
172, 30, 3, 0
173, 31, 3, 0
174, 31.5, 3, 0
175, 32, 3, 0
176, 33, 3, 0
177, 34, 3, 0
178, 35, 3, 0
179, 36, 3, 0
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181, 38, 3, 0
182, 39, 3, 0
183, 40, 3, 0
184, 40.5, 3, 0
185, 41, 3, 0
186, 42, 3, 0
187, 43, 3, 0
188, 44, 3, 0
189, 45, 3, 0
190, 0, 6, 0
191, 1, 6, 0
192, 2, 6, 0
193, 3, 6, 0
194, 4, 6, 0
195, 4.5, 6, 0
196, 5, 6, 0
197, 6, 6, 0
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200, 9, 6, 0
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202, 11, 6, 0
203, 12, 6, 0
204, 13, 6, 0
205, 13.5, 6, 0
206, 14, 6, 0
207, 15, 6, 0
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209, 17, 6, 0
210, 18, 6, 0
211, 19, 6, 0
212, 20, 6, 0
213, 21, 6, 0
214, 22, 6, 0
215, 22.5, 6, 0
216, 23, 6, 0
217, 24, 6, 0
218, 25, 6, 0
219, 26, 6, 0
220, 27, 6, 0
221, 28, 6, 0
222, 29, 6, 0
223, 30, 6, 0
224, 31, 6, 0
225, 31.5, 6, 0

PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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 229, 35, 6, 0
 230, 36, 6, 0
 231, 37, 6, 0
 232, 38, 6, 0
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 234, 40, 6, 0
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 236, 41, 6, 0
 237, 42, 6, 0
 238, 43, 6, 0
 239, 44, 6, 0
 240, 45, 6, 0
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 243, 2, 7.25, 0
 244, 3, 7.25, 0
 245, 4, 7.25, 0
 246, 5, 7.25, 0
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 267, 26, 7.25, 0
 268, 27, 7.25, 0
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 276, 35, 7.25, 0
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 284, 43, 7.25, 0
 285, 44, 7.25, 0
 286, 45, 7.25, 0


PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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*ELEMENT      ; Elements
; iEL, TYPE, iMAT, iPRO, iN1, iN2, ANGLE, iSUB, EXVAL, iOPT(EXVAL2) ; Frame Element
; iEL, TYPE, iMAT, iPRO, iN1, iN2, ANGLE, iSUB, EXVAL, EXVAL2, bLMT ; Comp/Tens Truss
; iEL, TYPE, iMAT, iPRO, iN1, iN2, iN3, iN4, iSUB, iWID, LCAXIS ; Planar Element
; iEL, TYPE, iMAT, iPRO, iN1, iN2, iN3, iN4, iN5, iN6, iN7, iN8 ; Solid Element
1, BEAM , 1, 9, 88, 89, 0, 0
2, BEAM , 1, 9, 190, 191, 0, 0
3, BEAM , 1, 3, 139, 140, 0, 0
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5, BEAM , 1, 4, 20, 9, 0, 0
6, BEAM , 1, 4, 32, 21, 0, 0
7, BEAM , 1, 4, 21, 10, 0, 0
8, BEAM , 1, 4, 33, 22, 0, 0
9, BEAM , 1, 4, 22, 11, 0, 0
10, BEAM , 1, 4, 34, 23, 0, 0
11, BEAM , 1, 4, 23, 12, 0, 0
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16, BEAM , 1, 4, 37, 26, 0, 0
17, BEAM , 1, 4, 26, 15, 0, 0
18, BEAM , 1, 4, 38, 27, 0, 0
19, BEAM , 1, 4, 27, 16, 0, 0
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22, BEAM , 1, 4, 40, 29, 0, 0
23, BEAM , 1, 4, 29, 18, 0, 0
24, BEAM , 1, 4, 41, 30, 0, 0
25, BEAM , 1, 4, 30, 19, 0, 0
26, BEAM , 1, 9, 93, 94, 0, 0
27, BEAM , 1, 9, 195, 196, 0, 0
28, BEAM , 1, 3, 144, 145, 0, 0
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30, BEAM , 1, 8, 200, 201, 0, 0
31, BEAM , 1, 3, 149, 150, 0, 0
32, BEAM , 1, 8, 103, 104, 0, 0
33, BEAM , 1, 8, 205, 206, 0, 0
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37, BEAM , 1, 3, 159, 160, 0, 0
38, BEAM , 1, 7, 113, 114, 0, 0
39, BEAM , 1, 7, 215, 216, 0, 0
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46, BEAM , 1, 3, 174, 175, 0, 0
47, BEAM , 1, 8, 128, 129, 0, 0
48, BEAM , 1, 8, 230, 231, 0, 0
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50, BEAM , 1, 9, 133, 134, 0, 0
51, BEAM , 1, 9, 235, 236, 0, 0
52, BEAM , 1, 3, 184, 185, 0, 0
53, BEAM , 3, 6, 42, 88, 0, 0
54, BEAM , 3, 6, 88, 139, 0, 0
55, BEAM , 3, 6, 139, 190, 0, 0
56, BEAM , 3, 6, 190, 241, 0, 0
57, BEAM , 3, 6, 43, 89, 0, 0
    
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|  | Company | | | Client |
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| 58, BEAM , 1, 9, 89, 90, 0, 0 |
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| 61, BEAM , 3, 6, 140, 191, 0, 0 |
| 62, BEAM , 1, 9, 191, 192, 0, 0 |
| 63, BEAM , 3, 6, 191, 242, 0, 0 |
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| 65, BEAM , 1, 9, 90, 91, 0, 0 |
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| 67, BEAM , 1, 3, 141, 142, 0, 0 |
| 68, BEAM , 3, 6, 141, 192, 0, 0 |
| 69, BEAM , 1, 9, 192, 193, 0, 0 |
| 70, BEAM , 3, 6, 192, 243, 0, 0 |
| 71, BEAM , 3, 6, 45, 91, 0, 0 |
| 72, BEAM , 1, 9, 91, 92, 0, 0 |
| 73, BEAM , 3, 6, 91, 142, 0, 0 |
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| 75, BEAM , 3, 6, 142, 193, 0, 0 |
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| 79, BEAM , 1, 9, 92, 93, 0, 0 |
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| 85, BEAM , 3, 6, 47, 94, 0, 0 |
| 86, BEAM , 1, 9, 94, 95, 0, 0 |
| 87, BEAM , 3, 6, 94, 145, 0, 0 |
| 88, BEAM , 1, 3, 145, 146, 0, 0 |
| 89, BEAM , 3, 6, 145, 196, 0, 0 |
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| 91, BEAM , 3, 6, 196, 246, 0, 0 |
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| 93, BEAM , 1, 8, 95, 96, 0, 0 |
| 94, BEAM , 3, 6, 95, 146, 0, 0 |
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| 98, BEAM , 3, 6, 197, 247, 0, 0 |
| 99, BEAM , 3, 6, 49, 96, 0, 0 |
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| 101, BEAM , 3, 6, 96, 147, 0, 0 |
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| 104, BEAM , 1, 8, 198, 199, 0, 0 |
| 105, BEAM , 3, 6, 198, 248, 0, 0 |
| 106, BEAM , 3, 6, 50, 97, 0, 0 |
| 107, BEAM , 1, 8, 97, 98, 0, 0 |
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| 109, BEAM , 1, 3, 148, 149, 0, 0 |
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| 111, BEAM , 1, 8, 199, 200, 0, 0 |
| 112, BEAM , 3, 6, 199, 249, 0, 0 |
| 113, BEAM , 3, 6, 51, 98, 0, 0 |
| 114, BEAM , 3, 6, 98, 149, 0, 0 |
| 115, BEAM , 3, 6, 149, 200, 0, 0 |
| 116, BEAM , 3, 6, 200, 250, 0, 0 |
| 117, BEAM , 3, 6, 52, 99, 0, 0 |
| 118, BEAM , 1, 8, 99, 100, 0, 0 |
| 119, BEAM , 3, 6, 99, 150, 0, 0 |


MIDAS

PROJECT TITLE :

|  | Company | | | Client |
|---|---------|--|--|---------------------|
| | Author | | | File Name |
| | | | | L1-CV02_REVISIONE_2 |

| |
|----------------------------------|
| 120, BEAM , 1, 3, 150, 151, 0, 0 |
| 121, BEAM , 3, 6, 150, 201, 0, 0 |
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| 123, BEAM , 3, 6, 201, 251, 0, 0 |
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| 126, BEAM , 3, 6, 100, 151, 0, 0 |
| 127, BEAM , 1, 3, 151, 152, 0, 0 |
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| 137, BEAM , 3, 6, 203, 253, 0, 0 |
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| 151, BEAM , 3, 6, 206, 255, 0, 0 |
| 152, BEAM , 3, 6, 57, 105, 0, 0 |
| 153, BEAM , 1, 8, 105, 106, 0, 0 |
| 154, BEAM , 3, 6, 105, 156, 0, 0 |
| 155, BEAM , 1, 3, 156, 157, 0, 0 |
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| 158, BEAM , 3, 6, 207, 256, 0, 0 |
| 159, BEAM , 3, 6, 58, 106, 0, 0 |
| 160, BEAM , 1, 7, 106, 107, 0, 0 |
| 161, BEAM , 3, 6, 106, 157, 0, 0 |
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| 165, BEAM , 3, 6, 208, 257, 0, 0 |
| 166, BEAM , 3, 6, 59, 107, 0, 0 |
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| 178, BEAM , 1, 7, 109, 110, 0, 0 |
| 179, BEAM , 3, 6, 109, 160, 0, 0 |
| 180, BEAM , 1, 3, 160, 161, 0, 0 |
| 181, BEAM , 3, 6, 160, 211, 0, 0 |


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| |
|----------------------------------|
| 182, BEAM , 1, 7, 211, 212, 0, 0 |
| 183, BEAM , 3, 6, 211, 260, 0, 0 |
| 184, BEAM , 3, 6, 62, 110, 0, 0 |
| 185, BEAM , 1, 7, 110, 111, 0, 0 |
| 186, BEAM , 3, 6, 110, 161, 0, 0 |
| 187, BEAM , 1, 3, 161, 162, 0, 0 |
| 188, BEAM , 3, 6, 161, 212, 0, 0 |
| 189, BEAM , 1, 7, 212, 213, 0, 0 |
| 190, BEAM , 3, 6, 212, 261, 0, 0 |
| 191, BEAM , 3, 6, 63, 111, 0, 0 |
| 192, BEAM , 1, 7, 111, 112, 0, 0 |
| 193, BEAM , 3, 6, 111, 162, 0, 0 |
| 194, BEAM , 1, 3, 162, 163, 0, 0 |
| 195, BEAM , 3, 6, 162, 213, 0, 0 |
| 196, BEAM , 1, 7, 213, 214, 0, 0 |
| 197, BEAM , 3, 6, 213, 262, 0, 0 |
| 198, BEAM , 3, 6, 64, 112, 0, 0 |
| 199, BEAM , 1, 7, 112, 113, 0, 0 |
| 200, BEAM , 3, 6, 112, 163, 0, 0 |
| 201, BEAM , 1, 3, 163, 164, 0, 0 |
| 202, BEAM , 3, 6, 163, 214, 0, 0 |
| 203, BEAM , 1, 7, 214, 215, 0, 0 |
| 204, BEAM , 3, 6, 214, 263, 0, 0 |
| 205, BEAM , 3, 6, 65, 114, 0, 0 |
| 206, BEAM , 1, 7, 114, 115, 0, 0 |
| 207, BEAM , 3, 6, 114, 165, 0, 0 |
| 208, BEAM , 1, 3, 165, 166, 0, 0 |
| 209, BEAM , 3, 6, 165, 216, 0, 0 |
| 210, BEAM , 1, 7, 216, 217, 0, 0 |
| 211, BEAM , 3, 6, 216, 264, 0, 0 |
| 212, BEAM , 3, 6, 66, 115, 0, 0 |
| 213, BEAM , 1, 7, 115, 116, 0, 0 |
| 214, BEAM , 3, 6, 115, 166, 0, 0 |
| 215, BEAM , 1, 3, 166, 167, 0, 0 |
| 216, BEAM , 3, 6, 166, 217, 0, 0 |
| 217, BEAM , 1, 7, 217, 218, 0, 0 |
| 218, BEAM , 3, 6, 217, 265, 0, 0 |
| 219, BEAM , 3, 6, 67, 116, 0, 0 |
| 220, BEAM , 1, 7, 116, 117, 0, 0 |
| 221, BEAM , 3, 6, 116, 167, 0, 0 |
| 222, BEAM , 1, 3, 167, 168, 0, 0 |
| 223, BEAM , 3, 6, 167, 218, 0, 0 |
| 224, BEAM , 1, 7, 218, 219, 0, 0 |
| 225, BEAM , 3, 6, 218, 266, 0, 0 |
| 226, BEAM , 3, 6, 68, 117, 0, 0 |
| 227, BEAM , 1, 7, 117, 118, 0, 0 |
| 228, BEAM , 3, 6, 117, 168, 0, 0 |
| 229, BEAM , 1, 3, 168, 169, 0, 0 |
| 230, BEAM , 3, 6, 168, 219, 0, 0 |
| 231, BEAM , 1, 7, 219, 220, 0, 0 |
| 232, BEAM , 3, 6, 219, 267, 0, 0 |
| 233, BEAM , 3, 6, 69, 118, 0, 0 |
| 234, BEAM , 3, 6, 118, 169, 0, 0 |
| 235, BEAM , 3, 6, 169, 220, 0, 0 |
| 236, BEAM , 3, 6, 220, 268, 0, 0 |
| 237, BEAM , 3, 6, 70, 119, 0, 0 |
| 238, BEAM , 1, 7, 119, 120, 0, 0 |
| 239, BEAM , 3, 6, 119, 170, 0, 0 |
| 240, BEAM , 1, 3, 170, 171, 0, 0 |
| 241, BEAM , 3, 6, 170, 221, 0, 0 |
| 242, BEAM , 1, 7, 221, 222, 0, 0 |
| 243, BEAM , 3, 6, 221, 269, 0, 0 |


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|----------------------------------|
| 244, BEAM , 3, 6, 71, 120, 0, 0 |
| 245, BEAM , 1, 8, 120, 121, 0, 0 |
| 246, BEAM , 3, 6, 120, 171, 0, 0 |
| 247, BEAM , 1, 3, 171, 172, 0, 0 |
| 248, BEAM , 3, 6, 171, 222, 0, 0 |
| 249, BEAM , 1, 8, 222, 223, 0, 0 |
| 250, BEAM , 3, 6, 222, 270, 0, 0 |
| 251, BEAM , 3, 6, 72, 121, 0, 0 |
| 252, BEAM , 1, 8, 121, 122, 0, 0 |
| 253, BEAM , 3, 6, 121, 172, 0, 0 |
| 254, BEAM , 1, 3, 172, 173, 0, 0 |
| 255, BEAM , 3, 6, 172, 223, 0, 0 |
| 256, BEAM , 1, 8, 223, 224, 0, 0 |
| 257, BEAM , 3, 6, 223, 271, 0, 0 |
| 258, BEAM , 3, 6, 73, 122, 0, 0 |
| 259, BEAM , 1, 8, 122, 123, 0, 0 |
| 260, BEAM , 3, 6, 122, 173, 0, 0 |
| 261, BEAM , 1, 3, 173, 174, 0, 0 |
| 262, BEAM , 3, 6, 173, 224, 0, 0 |
| 263, BEAM , 1, 8, 224, 225, 0, 0 |
| 264, BEAM , 3, 6, 224, 272, 0, 0 |
| 265, BEAM , 3, 6, 74, 124, 0, 0 |
| 266, BEAM , 1, 8, 124, 125, 0, 0 |
| 267, BEAM , 3, 6, 124, 175, 0, 0 |
| 268, BEAM , 1, 3, 175, 176, 0, 0 |
| 269, BEAM , 3, 6, 175, 226, 0, 0 |
| 270, BEAM , 1, 8, 226, 227, 0, 0 |
| 271, BEAM , 3, 6, 226, 273, 0, 0 |
| 272, BEAM , 3, 6, 75, 125, 0, 0 |
| 273, BEAM , 1, 8, 125, 126, 0, 0 |
| 274, BEAM , 3, 6, 125, 176, 0, 0 |
| 275, BEAM , 1, 3, 176, 177, 0, 0 |
| 276, BEAM , 3, 6, 176, 227, 0, 0 |
| 277, BEAM , 1, 8, 227, 228, 0, 0 |
| 278, BEAM , 3, 6, 227, 274, 0, 0 |
| 279, BEAM , 3, 6, 76, 126, 0, 0 |
| 280, BEAM , 1, 8, 126, 127, 0, 0 |
| 281, BEAM , 3, 6, 126, 177, 0, 0 |
| 282, BEAM , 1, 3, 177, 178, 0, 0 |
| 283, BEAM , 3, 6, 177, 228, 0, 0 |
| 284, BEAM , 1, 8, 228, 229, 0, 0 |
| 285, BEAM , 3, 6, 228, 275, 0, 0 |
| 286, BEAM , 3, 6, 77, 127, 0, 0 |
| 287, BEAM , 1, 8, 127, 128, 0, 0 |
| 288, BEAM , 3, 6, 127, 178, 0, 0 |
| 289, BEAM , 1, 3, 178, 179, 0, 0 |
| 290, BEAM , 3, 6, 178, 229, 0, 0 |
| 291, BEAM , 1, 8, 229, 230, 0, 0 |
| 292, BEAM , 3, 6, 229, 276, 0, 0 |
| 293, BEAM , 3, 6, 78, 128, 0, 0 |
| 294, BEAM , 3, 6, 128, 179, 0, 0 |
| 295, BEAM , 3, 6, 179, 230, 0, 0 |
| 296, BEAM , 3, 6, 230, 277, 0, 0 |
| 297, BEAM , 3, 6, 79, 129, 0, 0 |
| 298, BEAM , 1, 8, 129, 130, 0, 0 |
| 299, BEAM , 3, 6, 129, 180, 0, 0 |
| 300, BEAM , 1, 3, 180, 181, 0, 0 |
| 301, BEAM , 3, 6, 180, 231, 0, 0 |
| 302, BEAM , 1, 8, 231, 232, 0, 0 |
| 303, BEAM , 3, 6, 231, 278, 0, 0 |
| 304, BEAM , 3, 6, 80, 130, 0, 0 |
| 305, BEAM , 1, 8, 130, 131, 0, 0 |

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|-----------------------------------|
| 306, BEAM , 3, 6, 130, 181, 0, 0 |
| 307, BEAM , 1, 3, 181, 182, 0, 0 |
| 308, BEAM , 3, 6, 181, 232, 0, 0 |
| 309, BEAM , 1, 8, 232, 233, 0, 0 |
| 310, BEAM , 3, 6, 232, 279, 0, 0 |
| 311, BEAM , 3, 6, 81, 131, 0, 0 |
| 312, BEAM , 1, 9, 131, 132, 0, 0 |
| 313, BEAM , 3, 6, 131, 182, 0, 0 |
| 314, BEAM , 1, 3, 182, 183, 0, 0 |
| 315, BEAM , 3, 6, 182, 233, 0, 0 |
| 316, BEAM , 1, 9, 233, 234, 0, 0 |
| 317, BEAM , 3, 6, 233, 280, 0, 0 |
| 318, BEAM , 3, 6, 82, 132, 0, 0 |
| 319, BEAM , 1, 9, 132, 133, 0, 0 |
| 320, BEAM , 3, 6, 132, 183, 0, 0 |
| 321, BEAM , 1, 3, 183, 184, 0, 0 |
| 322, BEAM , 3, 6, 183, 234, 0, 0 |
| 323, BEAM , 1, 9, 234, 235, 0, 0 |
| 324, BEAM , 3, 6, 234, 281, 0, 0 |
| 325, BEAM , 3, 6, 83, 134, 0, 0 |
| 326, BEAM , 1, 9, 134, 135, 0, 0 |
| 327, BEAM , 3, 6, 134, 185, 0, 0 |
| 328, BEAM , 1, 3, 185, 186, 0, 0 |
| 329, BEAM , 3, 6, 185, 236, 0, 0 |
| 330, BEAM , 1, 9, 236, 237, 0, 0 |
| 331, BEAM , 3, 6, 236, 282, 0, 0 |
| 332, BEAM , 3, 6, 84, 135, 0, 0 |
| 333, BEAM , 1, 9, 135, 136, 0, 0 |
| 334, BEAM , 3, 6, 135, 186, 0, 0 |
| 335, BEAM , 1, 3, 186, 187, 0, 0 |
| 336, BEAM , 3, 6, 186, 237, 0, 0 |
| 337, BEAM , 1, 9, 237, 238, 0, 0 |
| 338, BEAM , 3, 6, 237, 283, 0, 0 |
| 339, BEAM , 3, 6, 85, 136, 0, 0 |
| 340, BEAM , 1, 9, 136, 137, 0, 0 |
| 341, BEAM , 3, 6, 136, 187, 0, 0 |
| 342, BEAM , 1, 3, 187, 188, 0, 0 |
| 343, BEAM , 3, 6, 187, 238, 0, 0 |
| 344, BEAM , 1, 9, 238, 239, 0, 0 |
| 345, BEAM , 3, 6, 238, 284, 0, 0 |
| 346, BEAM , 3, 6, 86, 137, 0, 0 |
| 347, BEAM , 1, 9, 137, 138, 0, 0 |
| 348, BEAM , 3, 6, 137, 188, 0, 0 |
| 349, BEAM , 1, 3, 188, 189, 0, 0 |
| 350, BEAM , 3, 6, 188, 239, 0, 0 |
| 351, BEAM , 1, 9, 239, 240, 0, 0 |
| 352, BEAM , 3, 6, 239, 285, 0, 0 |
| 353, BEAM , 3, 6, 87, 138, 0, 0 |
| 354, BEAM , 3, 6, 138, 189, 0, 0 |
| 355, BEAM , 3, 6, 189, 240, 0, 0 |
| 356, BEAM , 3, 6, 240, 286, 0, 0 |
| 357, TRUSS , 1, 5, 190, 93, 0, 0 |
| 358, TRUSS , 1, 5, 88, 195, 0, 0 |
| 359, TRUSS , 1, 5, 195, 98, 0, 0 |
| 360, TRUSS , 1, 5, 93, 200, 0, 0 |
| 361, TRUSS , 1, 5, 200, 103, 0, 0 |
| 362, TRUSS , 1, 5, 98, 205, 0, 0 |
| 363, TRUSS , 1, 5, 205, 108, 0, 0 |
| 364, TRUSS , 1, 5, 103, 210, 0, 0 |
| 365, TRUSS , 1, 5, 210, 113, 0, 0 |
| 366, TRUSS , 1, 5, 108, 215, 0, 0 |
| 367, TRUSS , 1, 5, 215, 118, 0, 0 |

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368, TRUSS , 1, 5, 113, 220, 0, 0
369, TRUSS , 1, 5, 220, 123, 0, 0
370, TRUSS , 1, 5, 118, 225, 0, 0
371, TRUSS , 1, 5, 225, 128, 0, 0
372, TRUSS , 1, 5, 123, 230, 0, 0
373, TRUSS , 1, 5, 230, 133, 0, 0
374, TRUSS , 1, 5, 128, 235, 0, 0
375, TRUSS , 1, 5, 235, 138, 0, 0
376, TRUSS , 1, 5, 133, 240, 0, 0

```

*GROUP ; Group

; NAME, NODE_LIST, ELEM_LIST, PLANE_TYPE

```

FASE 1 , 1to4 9to41 88to240, 1to52 58to107by7 60to109by7 62to167by7 \
120to169by7 122to227by7 180to229by7 182to287by7 240to289by7 242to347by7 \
300to349by7 302to351by7 357to376, 0
FASE 2 , 42to92 94to102 104to112 114to122 124to132 134to143 145to153 \
155to163 165to173 175to183 185to194 196to204 206to214 216to224 226to234 \
236to286, 53to57 59to299by60 61to301by60 63to303by60 64to106by7 \
66to108by7 68to110by7 70to112by7 113to117 124to166by7 126to168by7 \
128to170by7 130to172by7 173to177 184to226by7 186to228by7 188to230by7 \
190to232by7 233to237 244to286by7 246to288by7 248to290by7 250to292by7 \
293to297 304to346by7 306to348by7 308to350by7 310to352by7 353to356, 0

```

*BNDR-GROUP ; Boundary Group

; NAME, AUTOTYPE

FASE 1, 0

*LOAD-GROUP ; Load Group

; NAME

FASE 1
FASE 2
FASE 3

*MATERIAL ; Material

; iMAT, TYPE, MNAME, SPHEAT, HEATCO, PLAST, TUNIT, bMASS, DAMPRATIO, [DATA1]

; STEEL, CONC, USER

; iMAT, TYPE, MNAME, SPHEAT, HEATCO, PLAST, TUNIT, bMASS, DAMPRATIO, [DATA2], [DATA2]

; SRC

; [DATA1] : 1, DB, NAME, CODE, USEELAST, ELAST

; [DATA1] : 2, ELAST, POISN, THERMAL, DEN, MASS

; [DATA1] : 3, Ex, Ey, Ez, Tx, Ty, Tz, Sxy, Sxz, Syz, Pxy, Pxz, Pyz, DEN, MASS

; Orthotropic

; [DATA2] : 1, DB, NAME, CODE, USEELAST, ELAST or 2, ELAST, POISN, THERMAL, DEN, MASS

```

1, STEEL, S355 , 0, 0, , C, NO, 0.02, 1, EN05-PS(S) , , S3
55 , NO, 2.1e+008
2, CONC , C32/40 , 0, 0, , C, YES, 0.05, 2, 3.3345e+007, 0.2, 1.0000e
-005, 0, 0
3, CONC , C32/40_NOP , 0, 0, , C, YES, 0.05, 2, 3.3345e+007, 0.2, 1.0000e
-005, 0, 0

```

*MATL-COLOR

; iMAT, W_R, W_G, W_B, HF_R, HF_G, HF_B, HE_R, HE_G, HE_B, bBLEND, FACT

```

1, 115, 0, 0, 255, 87, 87, 115, 0, 0, NO, 0.5
2, 0, 66, 45, 0, 192, 128, 0, 66, 45, NO, 0.5
3, 38, 57, 0, 128, 192, 0, 38, 57, 0, NO, 0.5

```

*TDM-TYPE ; Time Dependent Material

; NAME=NAME, CODE, STR, HU, VOL, AGE, CFACTA, CFACTB, TYPE, [ACI1 or ACI2] ; CODE=ACI


; NAME=NAME, CODE, STR, HU, MSIZE, CTYPE, AGE ; CODE=

CEB1990,KS,CEB1978,KSCE 2010,KCI-USD12

; NAME=NAME, CODE, N1, PHI1, N2, PHI2 ; CODE=

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MEM
; NAME=NAME, CODE, STR, HU, USS, UCS, VOL, RR, MOD ; CODE=
PCA
; NAME=NAME, CODE, STR, HU, VOL, UCS, VSR1, LAF, US, VSR, PST, bRCE, RR, MOD ; CODE=
COMBINED
; NAME=NAME, CODE, STR, HTYPE, HU, MSIZE, CTYPE, AGE, CM ; CODE=
JAPAN
; NAME=NAME, CODE, ELAST, HU, VOL, CC, WC, AGE ; CODE=
JSCE
; NAME=NAME, CODE, STR, HTYPE, HU, MSIZE, AGE ; CODE=
CHINA
; NAME=NAME, CODE, STR, HU, MSIZE, BSC, AGE ; CODE=
JTG
; NAME=NAME, CODE, STR, HU, VSR, AGE, bEXPOSE ; CODE=
AASHTO
; NAME=NAME, CODE, STR, HU, MSIZE, AGE ; CODE=
INDIA(IRC:18-2000)
; NAME=NAME, CODE, STR, HU, MSIZE, CTYPE, AGE ; CODE=
INDIA(IRC:112-2011)
; NAME=NAME, CODE, STR, HU, MSIZE, CTYPE, AGE, TCode, bSILICA ; CODE=
European
; NAME=NAME, CODE, STR, EE(Not Use), FS, HT, DSE, DSC, AGE ; CODE=
NZ Bridge(SP/M/022)
; NAME=NAME, CODE, STR, HU, AGE, M, CMETH, CTYPE, CREEP, CONCT, W, MAXS, A, PZ ; CODE=
Russian
; NAME=NAME, CODE, STR, HU, MSIZE, BSC, AGE, FLYASH ; CODE=
China(JTG D62-2016)
; NAME=NAME, CODE, STR, EE, HT, DSC, AGE ; CODE=
Australia
; NAME=NAME, CODE, bSSF, SSFNAME ; CODE=
USER(line1)
; CREEPFUNC1, AGE1, CREEPFUNC2, AGE2, ... ; USER(
from line 2)
; [ACI1] : CURE, SLUMP, FAP, AIR, CC
; [ACI2] : UCC, USS
NAME=C+S, European, 35000, 70, 0.25, Class N, 3, 1, NO

*TDM-ELAST ; Time Dependent Material(Comp. Strength)
; NAME=NAME, TYPE, CODE, STRENGTH, A, B ; TYPE=CODE(Korean St
andard, ACI)
; NAME=NAME, TYPE, CODE, STRENGTH, iCTYPE ; TYPE=CODE(CEB-FIP,
Ohzagi)
; NAME=NAME, TYPE, CODE, STRENGTH ; TYPE=CODE(Chinese S
tandard)
; NAME=NAME, TYPE, CODE, STRENGTH, bUSE, [DATA] ; TYPE=CODE(Japan(Hyd
ration))
; NAME=NAME, TYPE, CODE, STRENGTH, iTYPE ; TYPE=CODE(Japan(Ela
stic))
; NAME=NAME, TYPE, CODE, STRENGTH ; TYPE=CODE(INDIA(IRC
:18-2000))
; NAME=NAME, TYPE, CODE, STRENGTH, iCTYPE ; TYPE=CODE(INDIA(IRC
:112-2011))
; NAME=NAME, TYPE, CODE, STRENGTH, iCTYPE ; TYPE=CODE(European)

; NAME=NAME, TYPE, CODE, STRENGTH, ; TYPE=CODE(CEB-FIP(1
978))
; NAME=NAME, TYPE, CODE, STRENGTH, TYPE, CMETH, CTYPE, MAXS, PZ ; TYPE=CODE(Russian))

; NAME=NAME, TYPE, CODE, STRENGTH, ; CODE=Australia
; NAME=NAME, TYPE, SCALE ; TYPE=USER(line 1)
; DAY1, COMPL, TENS1, ELAST1, DAY2, COMP2, ... ; USER(from line
2)

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; [DATA] : A, B, D, TSF or iCTYPE, TSF
NAME=MATURAZIONE, CODE, EUROPEAN, 43000, 2

*TDM-LINK ; Time Dependent Material Link
; iMAT, TDM-TYPE1 (CREEP/SHRINKAGE), TDM-TYPE2 (ELASTICITY)
2, C+S, MATURAZIONE

*SECTION ; Section
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, [DATA1], [DATA2] ;
1st line - DB/USER
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, BLT, D1, ..., D8, iCEL ;
1st line - VALUE
; AREA, ASy, ASz, Ixx, Iyy, Izz ;
2nd line
; CyP, CyM, CzP, CzM, QyB, QzB, PERI_OUT, PERI_IN, Cy, Cz ;
3rd line
; Y1, Y2, Y3, Y4, Z1, Z2, Z3, Z4, Zyy, Zzz ;
4th line
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, ELAST, DEN, POIS, POIC, SF, THERMAL ;
1st line - SRC
; D1, D2, [SRC] ;
2nd line
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, 1, DB, NAME1, NAME2, D1, D2 ;
1st line - COMBINED
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, 2, D11, D12, D13, D14, D15, D21, D22,
D23, D24
; iSEC, TYPE, SNAME, [OFFSET2], bSD, bWE, SHAPE, iyVAR, izVAR, STYPE ;
1st line - TAPERED
; DB, NAME1, NAME2 ;
2nd line (STYPE=DB)
; [DIM1], [DIM2] ;
2nd line (STYPE=USER)
; D11, D12, D13, D14, D15, D16, D17, D18 ;
2nd line (STYPE=VALUE)
; AREA1, ASy1, ASz1, Ixx1, Iyy1, Izz1 ;
3rd line (STYPE=VALUE)
; CyP1, CyM1, CzP1, CzM1, QyB1, QzB1, PERI_OUT1, PERI_IN1, Cy1, Cz1 ;
4th line (STYPE=VALUE)
; Y11, Y12, Y13, Y14, Z11, Z12, Z13, Z14, Zyy1, Zyy2 ;
5th line (STYPE=VALUE)
; D21, D22, D23, D24, D25, D26, D27, D28 ;
6th line (STYPE=VALUE)
; AREA2, ASy2, ASz2, Ixx2, Iyy2, Izz2 ;
7th line (STYPE=VALUE)
; CyP2, CyM2, CzP2, CzM2, QyB2, QzB2, PERI_OUT2, PERI_IN2, Cy2, Cz2 ;
8th line (STYPE=VALUE)
; Y21, Y22, Y23, Y24, Z21, Z22, Z23, Z24, Zyy2, Zzz2 ;
9th line (STYPE=VALUE)
; OPT1, OPT2, [JOINT] ; 2nd l
ine (STYPE=PSC) ;
; ELAST, DEN, POIS, POIC, THERMAL ; 2nd l
ine (STYPE=PSC-CMPW) ;
; bSHEARCHK, [SCHK-I], [SCHK-J], [WT-I], [WT-J], WI, WJ, bSYM, bSIDEHOLE ; 3rd l
ine (STYPE=PSC) ;
; bSHEARCHK, bSYM, bHUNCH, [CMPWEB-I], [CMPWEB-J] ; 3rd l
ine (STYPE=PSC-CMPW) ;
; bUSERDEFMESH SIZE, MESH SIZE, bUSERINPSTIFF, [STIFF-I], [STIFF-J] ; 4th l
ine (STYPE=PSC) ;
; [SIZE-A]-i ; 5th l
ine (STYPE=PSC) ;
; [SIZE-B]-i ; 6th l
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ine (STYPE=PSC)
; [SIZE-C]-i ; 7th l
ine (STYPE=PSC)
; [SIZE-D]-i ; 8th l
ine (STYPE=PSC)
; [SIZE-A]-j ; 9th l
ine (STYPE=PSC)
; [SIZE-B]-j ; 10th
line (STYPE=PSC)
; [SIZE-C]-j ; 11th
line (STYPE=PSC)
; [SIZE-D]-j ; 12th
line (STYPE=PSC)
; GN, CTC, Bc, Tc, Hh, EsEc, DsDc, Ps, Pc, bMULTI, EsEc-L, EsEc-S ; 2nd l
ine (STYPE=CMP-B/I)
; SW i, Hw i, tw_i, B_i, Bf1_i, tf1_i, B2_i, Bf2_i, tf2_i ; 3rd l
ine (STYPE=CMP-B/I)
; SW_j, Hw_j, tw_j, B_j, Bf1_j, tf1_j, B2_j, Bf2_j, tf2_j ; 4th l
ine (STYPE=CMP-B/I)
; N1, N2, Hr, Hr2, tr1, tr2 ; 5th l
ine (STYPE=CMP-B)
; GN, CTC, Bc, Tc, Hh, EgdEsb, DgdDsb, Pgd, Psb, bSYM, SW_i, SW_j ; 2nd l
ine (STYPE=CMP-CI/CT)
; OPT1, OPT2, [JOINT] ; 3rd l
ine (STYPE=CMP-CI/CT)
; [SIZE-A]-i ; 4th l
ine (STYPE=CMP-CI/CT)
; [SIZE-B]-i ; 5th l
ine (STYPE=CMP-CI/CT)
; [SIZE-C]-i ; 6th l
ine (STYPE=CMP-CI/CT)
; [SIZE-D]-i ; 7th l
ine (STYPE=CMP-CI/CT)
; [SIZE-A]-j ; 8th l
ine (STYPE=CMP-CI/CT)
; [SIZE-B]-j ; 9th l
ine (STYPE=CMP-CI/CT)
; [SIZE-C]-j ; 10th
line (STYPE=CMP-CI/CT)
; [SIZE-D]-j ; 11th
line (STYPE=CMP-CI/CT)
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, STYPE1, STYPE2 ; 1st l
ine - CONSTRUCT
; SHAPE, ... (same with other type data from shape) ; Befor
e (STYPE1)
; SHAPE, ... (same with other type data from shape) ; After
(STYPE2)
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE ; 1st l
ine - COMPOSITE-SB
; Hw, tw, B, Bf1, tf1, B2, Bf2, tf2 ; 2nd l
ine
; N1, N2, Hr, Hr2, tr1, tr2 ; 3rd l
ine
; SW, GN, CTC, Bc, Tc, Hh, EsEc, DsDc, Ps, Pc, bMulti, Elong, Esh ; 4th l
ine
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE ; 1st l
ine - COMPOSITE-SI
; Hw, tw, B, tf1, B2, tf2 ; 2nd l
ine
; SW, GN, CTC, Bc, Tc, Hh, EsEc, DsDc, Ps, Pc, bMulti, Elong, Esh ; 3rd l
ine
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE ; 1st l

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ine - COMPOSITE-CI/CT
; OPT1, OPT2, [JOINT] ; 2nd l
ine
; [SIZE-A] ; 3rd l
ine
; [SIZE-B] ; 4th l
ine
; [SIZE-C] ; 5th l
ine
; [SIZE-D] ; 6th l
ine
; SW, GN, CTC, Bc, Tc, Hh, EgdEsb, DgdDsb, Pgd, Psb ; 7th l
ine
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE ; 1st l
ine - PSC
; OPT1, OPT2, [JOINT] ; 2nd l
ine
; bSHEARCHK, [SCHK], [WT], WIDTH, bSYM, bSIDEHOLE ; 3rd l
ine
; bUSERDEFMESH SIZE, MESH SIZE, bUSERINPSTIFF, [STIFF] ; 4th l
ine
; bWE, [WARPING POINT]-i, [WARPING POINT]-j ; 5th l
ine
; [SIZE-A] ; 6th l
ine
; [SIZE-B] ; 7th l
ine
; [SIZE-C] ; 8th l
ine
; [SIZE-D] ; 9th l
ine
; [DATA1] : 1, DB, NAME or 2, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10
; [DATA2] : CCSHAPE or iCEL or iN1, iN2
; [SRC] : 1, DB, NAME1, NAME2 or 2, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, iN1, iN2

; [DIM1], [DIM2] : D1, D2, D3, D4, D5, D6, D7, D8
; [OFFSET] : OFFSET, iCENT, iREF, iHORZ, HUSER, iVERT, VUSER
; [OFFSET2]: OFFSET, iCENT, iREF, iHORZ, HUSERI, HUSERJ, iVERT, VUSERI, VUSERJ
; [JOINT] : 8(1CELL, 2CELL), 13(3CELL), 9(PSCM), 8(PSCH), 9(PSCT), 2(PSCB), 0(nCE
LL), 2(nCEL2)
; [SIZE-A] : 6(1CELL, 2CELL), 10(3CELL), 10(PSCM), 6(PSCH), 8(PSCT), 10(PSCB), 5(nCE
LL), 11(nCEL2)
; [SIZE-B] : 6(1CELL, 2CELL), 12(3CELL), 6(PSCM), 6(PSCH), 8(PSCT), 6(PSCB), 8(nCE
LL), 18(nCEL2)
; [SIZE-C] : 10(1CELL, 2CELL), 13(3CELL), 9(PSCM), 10(PSCH), 7(PSCT), 8(PSCB), 0(nCE
LL), 11(nCEL2)
; [SIZE-D] : 8(1CELL, 2CELL), 13(3CELL), 6(PSCM), 7(PSCH), 8(PSCT), 5(PSCB), 0(nCE
LL), 18(nCEL2)
; [STIFF] : AREA, ASy, ASz, Ixx, Iyy, Izz
; [SCHK] : bAUTO_Z1, Z1, bAUTO_Z3, Z3
; [WT] : bAUTO_TOR, TOR, bAUTO_SHR1, SHR1, bAUTO_SHR2, SHR2, bAUTO_SHR3, SHR3
; [CMPWEB] : EFD, LRF, A, B, H, T
; [WARPING POINT] : nWarpingCheck, X1,X2,X3,X4,X5,X6, Y1,Y2,Y3,Y4,Y5,Y6
3, COMPOSITE , TRAVE SPINA , CT, 0, 0, 0, 0, 0, 0, YES, NO, I
0.54, 0.013, 0.3, 0.025, 0.3, 0.025
0, 0, 0, 0, 0, 0
0
0
0
2.8, 1, 2.8, 2.8, 0.26, 0, 6.16251, 3.0792, 0.3, 0.2, 1.2, NO, ,
4, DBUSER , TRAVERSO , CC, 0, 0, 0, 0, 0, 0, YES, NO, H , 2, 0.8, 0.3
5, 0.02, 0.028, 0.35, 0.028, 0, 0, 0, 0

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5, DBUSER , CONTROVENTI , CC, 0, 0, 0, 0, 0, 0, 0, YES, NO, L , 1, UNI, L70
x7
6, DBUSER , SOLETTA , CC, 0, 0, 0, 0, 0, 0, 0, YES, NO, SB , 2, 0.25, 1,
0, 0, 0, 0, 0, 0, 0, 0
7, COMPOSITE , CONCIO C3 , CT, 0, 0, 0, 0, 0, 0, 0, YES, NO, I
2.115, 0.022, 0.75, 0.03, 1.2, 0.055
0, 0, 0, 0, 0, 0
0
0
0
2.84, 1, 2.84, 2.84, 0.26, 0, 6.16251, 3.0792, 0.3, 0.2, 1.2, NO, ,
8, COMPOSITE , CONCIO C2 , CT, 0, 0, 0, 0, 0, 0, 0, YES, NO, I
2.132, 0.022, 0.75, 0.028, 1.2, 0.04
0, 0, 0, 0, 0, 0
0
0
0
2.84, 1, 2.84, 2.84, 0.26, 0, 6.16251, 3.0792, 0.3, 0.2, 1.2, NO, ,
9, COMPOSITE , CONCIO C1 , CT, 0, 0, 0, 0, 0, 0, 0, YES, NO, I
2.145, 0.022, 0.75, 0.025, 0.9, 0.03
0, 0, 0, 0, 0, 0
0
0
0
2.84, 1, 2.84, 2.84, 0.26, 0, 6.16251, 3.0792, 0.3, 0.2, 1.2, NO, ,

```

*SECT-COLOR

```

; iSEC, W_R, W_G, W_B, HF_R, HF_G, HF_B, HE_R, HE_G, HE_B, bBLEND, FACT
3, 108, 54, 0, 255, 128, 0, 108, 54, 0, NO, 0.5
4, 0, 66, 45, 0, 192, 128, 0, 66, 45, NO, 0.5
5, 19, 0, 64, 78, 0, 255, 19, 0, 64, NO, 0.5
6, 19, 0, 64, 78, 0, 255, 19, 0, 64, NO, 0.5
7, 38, 57, 0, 128, 192, 0, 38, 57, 0, NO, 0.5
8, 100, 0, 100, 192, 0, 192, 100, 0, 100, NO, 0.5
9, 0, 13, 13, 0, 128, 128, 0, 13, 13, NO, 0.5

```

*COMP-GEN-SECT-PSC-DESIGN ; Composite Section for PSC Design

```

; SECT, bCompPSC, (Z1, Z2, Z3, t1, t2, t3, TotT)-I, (Z1, Z2, Z3, t1, t2, t3, TotT)-J
3, NO, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
7, NO, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
8, NO, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
9, NO, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0

```

*DGN-SECT


```

; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, [DATA1], [DATA2] ;
1st line - DB/USER ;
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, BLT, D1, ..., D8, iCEL ;
1st line - VALUE ;
; AREA, ASy, ASz, Ixx, Iyy, Izz ;
2nd line ;
; CyP, CyM, CzP, CzM, QyB, QzB, PERI_OUT, PERI_IN, Cy, Cz ;
3rd line ;
; Y1, Y2, Y3, Y4, Z1, Z2, Z3, Z4, Zyy, Zzz ;
4th line ;
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, ELAST, DEN, POIS, POIC, SF, THERMAL ;
1st line - SRC ;
; D1, D2, [SRC] ;
2nd line ;
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, 1, DB, NAME1, NAME2, D1, D2 ;
1st line - COMBINED ;
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE, 2, D11, D12, D13, D14, D15, D21, D22,
D23, D24 ;

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; iSEC, TYPE, SNAME, [OFFSET2], bSD, bWE, SHAPE, iyVAR, izVAR, STYPE ;
1st line - TAPERED ;
; DB, NAME1, NAME2 ;
2nd line(STYPE=DB) ;
; [DIM1], [DIM2] ;
2nd line(STYPE=USER) ;
; D11, D12, D13, D14, D15, D16, D17, D18 ;
2nd line(STYPE=VALUE) ;
; AREA1, ASy1, ASz1, Ixx1, Iyy1, Izz1 ;
3rd line(STYPE=VALUE) ;
; CyP1, CyM1, CzP1, CzM1, QyB1, QzB1, PERI_OUT1, PERI_IN1, Cy1, Cz1 ;
4th line(STYPE=VALUE) ;
; Y11, Y12, Y13, Y14, Z11, Z12, Z13, Z14, Zyy1, Zyy2 ;
5th line(STYPE=VALUE) ;
; D21, D22, D23, D24, D25, D26, D27, D28 ;
6th line(STYPE=VALUE) ;
; AREA2, ASy2, ASz2, Ixx2, Iyy2, Izz2 ;
7th line(STYPE=VALUE) ;
; CyP2, CyM2, CzP2, CzM2, QyB2, QzB2, PERI_OUT2, PERI_IN2, Cy2, Cz2 ;
8th line(STYPE=VALUE) ;
; Y21, Y22, Y23, Y24, Z21, Z22, Z23, Z24, Zyy2, Zzz2 ;
9th line(STYPE=VALUE) ;
; OPT1, OPT2, [JOINT] ; 2nd l
ine(STYPE=PSC) ;
; ELAST, DEN, POIS, POIC, THERMAL ; 2nd l
ine(STYPE=PSC-CMPW) ;
; bSHEARCHK, [SCHK-I], [SCHK-J], [WT-I], [WT-J], WI, WJ, bSYM, bSIDEHOLE ; 3rd l
ine(STYPE=PSC) ;
; bSHEARCHK, bSYM, bHUNCH, [CMPWEB-I], [CMPWEB-J] ; 3rd l
ine(STYPE=PSC-CMPW) ;
; bUSERDEFMESH SIZE, MESH SIZE, bUSERINPSTIFF, [STIFF-I], [STIFF-J] ; 4th l
ine(STYPE=PSC) ;
; [SIZE-A]-i ; 5th l
ine(STYPE=PSC) ;
; [SIZE-B]-i ; 6th l
ine(STYPE=PSC) ;
; [SIZE-C]-i ; 7th l
ine(STYPE=PSC) ;
; [SIZE-D]-i ; 8th l
ine(STYPE=PSC) ;
; [SIZE-A]-j ; 9th l
ine(STYPE=PSC) ;
; [SIZE-B]-j ; 10th
line(STYPE=PSC) ;
; [SIZE-C]-j ; 11th
line(STYPE=PSC) ;
; [SIZE-D]-j ; 12th
line(STYPE=PSC) ;
; GN, CTC, Bc, Tc, Hh, EsEc, DsDc, Ps, Pc, bMULTI, EsEc-L, EsEc-S ; 2nd l
ine(STYPE=CMP-B/I) ;
; SW_i, Hw_i, tw_i, B_i, Bf1_i, tf1_i, B2_i, Bf2_i, tf2_i ; 3rd l
ine(STYPE=CMP-B/I) ;
; SW_j, Hw_j, tw_j, B_j, Bf1_j, tf1_j, B2_j, Bf2_j, tf2_j ; 4th l
ine(STYPE=CMP-B/I) ;
; N1, N2, Hr, Hr2, tr1, tr2 ; 5th l
ine(STYPE=CMP-B) ;
; GN, CTC, Bc, Tc, Hh, EgdEsb, DgdDsb, Pgd, Psb, bSYM, SW_i, SW_j ; 2nd l
ine(STYPE=CMP-CI/CT) ;
; OPT1, OPT2, [JOINT] ; 3rd l
ine(STYPE=CMP-CI/CT) ;
; [SIZE-A]-i ; 4th l
ine(STYPE=CMP-CI/CT)

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; [SIZE-B]-i ; 5th 1
ine (STYPE=CMP-CI/CT)
; [SIZE-C]-i ; 6th 1
ine (STYPE=CMP-CI/CT)
; [SIZE-D]-i ; 7th 1
ine (STYPE=CMP-CI/CT)
; [SIZE-A]-j ; 8th 1
ine (STYPE=CMP-CI/CT)
; [SIZE-B]-j ; 9th 1
ine (STYPE=CMP-CI/CT)
; [SIZE-C]-j ; 10th
line (STYPE=CMP-CI/CT)
; [SIZE-D]-j ; 11th
line (STYPE=CMP-CI/CT)
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, STYPE1, STYPE2 ; 1st 1
ine - CONSTRUCT
; SHAPE, ...(same with other type data from shape) ; Befor
e (STYPE1)
; SHAPE, ...(same with other type data from shape) ; After
(STYPE2)
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE ; 1st 1
ine - COMPOSITE-SB
; Hw, tw, B, Bf1, tf1, B2, Bf2, tf2 ; 2nd 1
ine
; N1, N2, Hr, Hr2, tr1, tr2 ; 3rd 1
ine
; SW, GN, CTC, Bc, Tc, Hh, EsEc, DsDc, Ps, Pc, bMulti, Elong, Esh ; 4th 1
ine
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE ; 1st 1
ine - COMPOSITE-SI
; Hw, tw, B, tf1, B2, tf2 ; 2nd 1
ine
; SW, GN, CTC, Bc, Tc, Hh, EsEc, DsDc, Ps, Pc, bMulti, Elong, Esh ; 3rd 1
ine
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE ; 1st 1
ine - COMPOSITE-CI/CT
; OPT1, OPT2, [JOINT] ; 2nd 1
ine
; [SIZE-A] ; 3rd 1
ine
; [SIZE-B] ; 4th 1
ine
; [SIZE-C] ; 5th 1
ine
; [SIZE-D] ; 6th 1
ine
; SW, GN, CTC, Bc, Tc, Hh, EgdEsb, DgdDsb, Pgd, Psb ; 7th 1
ine
; iSEC, TYPE, SNAME, [OFFSET], bSD, bWE, SHAPE ; 1st 1
ine - PSC
; OPT1, OPT2, [JOINT] ; 2nd 1
ine
; bSHEARCHK, [SCHK], [WT], WIDTH, bSYM, bSIDEHOLE ; 3rd 1
ine
; bUSERDEFMESH SIZE, MESH SIZE, bUSERINPSTIFF, [STIFF] ; 4th 1
ine
; bWE, [WARPING POINT]-i, [WARPING POINT]-j ; 5th 1
ine
; [SIZE-A] ; 6th 1
ine
; [SIZE-B] ; 7th 1
ine

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; [SIZE-C] ; 8th 1
ine
; [SIZE-D] ; 9th 1
ine
; [DATA1] : 1, DB, NAME or 2, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10
; [DATA2] : CCSHAPE or iCEL or iN1, iN2
; [SRC] : 1, DB, NAME1, NAME2 or 2, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, iN1, iN2

; [DIM1], [DIM2] : D1, D2, D3, D4, D5, D6, D7, D8
; [OFFSET] : OFFSET, iCENT, iREF, iHORZ, HUSER, iVERT, VUSER
; [OFFSET2]: OFFSET, iCENT, iREF, iHORZ, HUSERI, HUSERJ, iVERT, VUSERI, VUSERJ
; [JOINT] : 8(1CELL, 2CELL), 13(3CELL), 9(PSCM), 8(PSCH), 9(PSCT), 2(PSCB), 0(nCELL), 2(nCEL2)
; [SIZE-A] : 6(1CELL, 2CELL), 10(3CELL), 10(PSCM), 6(PSCH), 8(PSCT), 10(PSCB), 5(nCELL), 11(nCEL2)
; [SIZE-B] : 6(1CELL, 2CELL), 12(3CELL), 6(PSCM), 6(PSCH), 8(PSCT), 6(PSCB), 8(nCELL), 18(nCEL2)
; [SIZE-C] : 10(1CELL, 2CELL), 13(3CELL), 9(PSCM), 10(PSCH), 7(PSCT), 8(PSCB), 0(nCELL), 11(nCEL2)
; [SIZE-D] : 8(1CELL, 2CELL), 13(3CELL), 6(PSCM), 7(PSCH), 8(PSCT), 5(PSCB), 0(nCELL), 18(nCEL2)
; [STIFF] : AREA, ASy, ASz, Ixx, Iyy, Izz
; [SCHK] : bAUTO_Z1, Z1, bAUTO_Z3, Z3
; [WT] : bAUTO_TOR, TOR, bAUTO_SHR1, SHR1, bAUTO_SHR2, SHR2, bAUTO_SHR3, SHR3
; [CMPWEB] : EFD, LRF, A, B, H, T
; [WARPING POINT] : nWarpingCheck, X1,X2,X3,X4,X5,X6, Y1,Y2,Y3,Y4,Y5,Y6
3, COMPOSITE, TRAVE SPINA, CT, 0, 0, 0, 0, 0, 0, YES, NO, I
0.54, 0.013, 0.3, 0.025, 0.3, 0.025
0, 0, 0, 0, 0, 0
0
0
0
2.8, 1, 2.8, 2.8, 0.26, 0, 6.16251, 3.0792, 0.3, 0.2, 1.2, NO, ,
4, DBUSER, TRAVERSO, CC, 0, 0, 0, 0, 0, 0, YES, NO, H, 2, 0.8, 0.3
5, 0.02, 0.028, 0.35, 0.028, 0, 0, 0, 0
5, DBUSER, CONTROVENTI, CC, 0, 0, 0, 0, 0, 0, YES, NO, L, 1, UNI, L70
x7
6, DBUSER, SOLETTA, CC, 0, 0, 0, 0, 0, 0, YES, NO, SB, 2, 0.25, 1,
0, 0, 0, 0, 0, 0, 0, 0
7, COMPOSITE, CONCIO C3, CT, 0, 0, 0, 0, 0, 0, YES, NO, I
2.115, 0.022, 0.75, 0.03, 1.2, 0.055
0, 0, 0, 0, 0, 0
0
0
0
2.84, 1, 2.84, 2.84, 0.26, 0, 6.16251, 3.0792, 0.3, 0.2, 1.2, NO, ,
8, COMPOSITE, CONCIO C2, CT, 0, 0, 0, 0, 0, 0, YES, NO, I
2.132, 0.022, 0.75, 0.028, 1.2, 0.04
0, 0, 0, 0, 0, 0
0
0
0
2.84, 1, 2.84, 2.84, 0.26, 0, 6.16251, 3.0792, 0.3, 0.2, 1.2, NO, ,
9, COMPOSITE, CONCIO C1, CT, 0, 0, 0, 0, 0, 0, YES, NO, I
2.145, 0.022, 0.75, 0.025, 0.9, 0.03
0, 0, 0, 0, 0, 0
0
0
0
2.84, 1, 2.84, 2.84, 0.26, 0, 6.16251, 3.0792, 0.3, 0.2, 1.2, NO, ,

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*STLDCASE      ; Static Load Cases
; LCNAME, LCTYPE, DESC
  PESO PROPRIO ACCIAIO, CS, PESO PROPRIO ACCIAIO
  PESO PROPRIO SOLETTA, CS, PESO PROPRIO SOLETTA
  PERMANENTE PORTATO, CS, PERMANENTE PORTATO
  VENTO PONTE SCARICO, W , VENTO PONTE SCARICO
  VENTO PONTE CARICO, WL, VENTO PONTE CARICO
  TERMICA UNIFORME +, T , TERMICA UNIFORME +
  TERMICA UNIFORME -, T , TERMICA UNIFORME -
  TERMICA GRADIENTE +, TPG, TERMICA GRADIENTE +
  TERMICA GRADIENTE -, TPG, TERMICA GRADIENTE -
  FRENATURA, BRK, FRENATURA

*SPRING      ; Point Spring Supports
; NODE LIST, Type, SDx, SDy, SDz, SRx, SRY, SRz, GROUP, FROMTYPE, EFFAREA, Kx, Ky, Kz
; LINEAR
; NODE_LIST, Type, Direction, Vx, Vy, Vz, Stiffness, GROUP, FROMTYPE, EFFAREA
; COMP, TENS
; NODE_LIST, Type, Multi-Linear Type, Direction, Vx, Vy, Vz, ax, ay, bx, by, cx, cy, d
x, dy, ex, ey, fx, fy, GROUP, FROMTYPE, EFFAREA ; MULTI
  1to4, LINEAR, 4420, 4420, 4.489e+006, 0, 0, 0, NO, 0, 0, 0, 0, 0, 0, 0, FASE 1, 0, 0,
0, 0, 0

*RIGIDLINK    ; Rigid Link
; KEY, M-NODE, DOF, S-NODE LIST, GROUP
  2, 1, 111111, 9 88, FASE 1
  1, 2, 111111, 31 190, FASE 1
  4, 3, 111111, 19 138, FASE 1
  3, 4, 111111, 41 240, FASE 1
  5, 10, 111111, 93, FASE 1
  6, 11, 111111, 98, FASE 1
  7, 12, 111111, 103, FASE 1
  8, 13, 111111, 108, FASE 1
  9, 14, 111111, 113, FASE 1
  10, 15, 111111, 118, FASE 1
  11, 16, 111111, 123, FASE 1
  12, 17, 111111, 128, FASE 1
  13, 18, 111111, 133, FASE 1
  33, 20, 111111, 139, FASE 1
  24, 21, 111111, 144, FASE 1
  25, 22, 111111, 149, FASE 1
  26, 23, 111111, 154, FASE 1
  27, 24, 111111, 159, FASE 1
  28, 25, 111111, 164, FASE 1
  29, 26, 111111, 169, FASE 1
  30, 27, 111111, 174, FASE 1
  31, 28, 111111, 179, FASE 1
  32, 29, 111111, 184, FASE 1
  23, 30, 111111, 189, FASE 1
  22, 32, 111111, 195, FASE 1
  21, 33, 111111, 200, FASE 1
  20, 34, 111111, 205, FASE 1
  19, 35, 111111, 210, FASE 1
  18, 36, 111111, 215, FASE 1
  17, 37, 111111, 220, FASE 1
  16, 38, 111111, 225, FASE 1
  15, 39, 111111, 230, FASE 1
  14, 40, 111111, 235, FASE 1

; *LOADTOMASS, DIR, bNODAL, bBEAM, bFLOOR, bPRES, GRAV
; LCNAME1, FACTOR1, LCNAME2, FACTOR2, ... ; from line 1

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*LOADTOMASS, XYZ, YES, YES, YES, YES, 9.806
 PESO PROPRIO SOLETTA, 1, PERMANENTE PORTATO, 1

*USE-STLD, PESO PROPRIO ACCIAIO

; *SELFWEIGHT, X, Y, Z, GROUP
 *SELFWEIGHT, 0, 0, -1.12, FASE 1


; End of data for load case [PESO PROPRIO ACCIAIO] -----

*USE-STLD, PESO PROPRIO SOLETTA

```
*BEAMLOAD ; Element Beam Loads
; ELEM_LIST, CMD, TYPE, DIR, bPROJ, [ECCEN], [VALUE], GROUP
; ELEM_LIST, CMD, TYPE, TYPE, DIR, VX, VY, VZ, bPROJ, [ECCEN], [VALUE], GROUP
; [VALUE] : D1, P1, D2, P2, D3, P3, D4, P4
; [ECCEN] : bECCEN, ECCDIR, I-END, J-END, bJ-END
; [ADDITIONAL] : bADDITIONAL, ADDITIONAL_I-END, ADDITIONAL_J-END, bADDITIONAL_J-END
1, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, -22.013, 1, -22.013, 0, 0, 0,
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2, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, -22.013, 1, -22.013, 0, 0, 0,
0, FASE 2, NO, 0, 0, NO,
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26, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, -22.013, 1, -22.013, 0, 0, 0,
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27, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, -22.013, 1, -22.013, 0, 0, 0,
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29, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, -22.013, 1, -22.013, 0, 0, 0,
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30, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, -22.013, 1, -22.013, 0, 0, 0,
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0, FASE 2, NO, 0, 0, NO,
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192, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, -22.013, 1, -22.013, 0, 0, 0,
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268, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -16.85, 1, -16.85, 0, 0, 0, 0
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344, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -22.013, 1, -22.013, 0, 0, 0,
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; End of data for load case [PESO PROPRIO SOLETTA] -----

*USE-STLD, PERMANENTE PORTATO


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*BEAMLOAD ; Element Beam Loads
; ELEM_LIST, CMD, TYPE, DIR, bPROJ, [ECCEN], [VALUE], GROUP
; ELEM LIST, CMD, TYPE, TYPE, DIR, VX, VY, VZ, bPROJ, [ECCEN], [VALUE], GROUP
; [VALUE] : D1, P1, D2, P2, D3, P3, D4, P4
; [ECCEN] : bECCEN, ECCDIR, I-END, J-END, bJ-END
; [ADDITIONAL] : bADDITIONAL, ADDITIONAL_I-END, ADDITIONAL_J-END, bADDITIONAL_J-END
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; End of data for load case [PERMANENTE PORTATO] -----

*USE-STLD, VENTO PONTE SCARICO

```
*BEAMLOAD ; Element Beam Loads
; ELEM LIST, CMD, TYPE, DIR, bPROJ, [ECCEN], [VALUE], GROUP
; ELEM LIST, CMD, TYPE, TYPE, DIR, VX, VY, VZ, bPROJ, [ECCEN], [VALUE], GROUP
; [VALUE] : D1, P1, D2, P2, D3, P3, D4, P4
; [ECCEN] : bECCEN, ECCDIR, I-END, J-END, bJ-END
; [ADDITIONAL] : bADDITIONAL, ADDITIONAL_I-END, ADDITIONAL_J-END, bADDITIONAL_J-END
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; End of data for load case [VENTO PONTE SCARICO] -----

*USE-STLD, VENTO PONTE CARICO


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*BEAMLOAD ; Element Beam Loads
; ELEM_LIST, CMD, TYPE, DIR, bPROJ, [ECCEN], [VALUE], GROUP
; ELEM_LIST, CMD, TYPE, TYPE, DIR, VX, VY, VZ, bPROJ, [ECCEN], [VALUE], GROUP
; [VALUE] : D1, P1, D2, P2, D3, P3, D4, P4
; [ECCEN] : bECCEN, ECCDIR, I-END, J-END, bJ-END
; [ADDITIONAL] : bADDITIONAL, ADDITIONAL_I-END, ADDITIONAL_J-END, bADDITIONAL_J-END
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167, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0,
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171, BEAM , UNILoad, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0,
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171, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0,
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178, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0,
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182, BEAM , UNILoad, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0,
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182, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0,
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189, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0,

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PROJECT TITLE :

|  | Company | Client |
|---|---------|---------------------|
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  263, BEAM , UNILOAD, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0,

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0, , NO, 0, 0, NO,
 266, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0
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 270, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0
, NO, 0, 0, NO,
 270, BEAM , UNILoad, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0, 0
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 273, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0
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 277, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0
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 277, BEAM , UNILoad, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0, 0
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 284, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0
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 284, BEAM , UNILoad, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0, 0
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 287, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0
, , NO, 0, 0, NO,
 291, BEAM , UNILoad, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0, 0
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 291, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0
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 298, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0
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 302, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0
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 302, BEAM , UNILoad, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0, 0
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 305, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0
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 309, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0
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 309, BEAM , UNILoad, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0, 0
0, , NO, 0, 0, NO,
 312, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0
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 316, BEAM , UNILoad, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0
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PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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, , NO, 0, 0, NO,
344, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0,
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344, BEAM , UNILOAD, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0,
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347, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, -0.406, 1, -0.406, 0, 0, 0, 0
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351, BEAM , UNILOAD, GZ, NO , NO, aDir[1], , , , 0, 0.406, 1, 0.406, 0, 0, 0, 0,
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351, BEAM , UNILOAD, GY, NO , NO, aDir[1], , , , 0, -10.142, 1, -10.142, 0, 0, 0,
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; End of data for load case [VENTO PONTE CARICO] -----


*USE-STLD, TERMICA UNIFORME +

*ELTEMPER ; Element Temperatures

; ELEM_LIST, TEMPER, GROUP


- 1, 49,
- 2, 49,
- 3, 49,
- 4, 49,
- 5, 49,
- 6, 49,
- 7, 49,
- 8, 49,
- 9, 49,
- 10, 49,
- 11, 49,
- 12, 49,
- 13, 49,
- 14, 49,
- 15, 49,
- 16, 49,
- 17, 49,
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- 36, 49,
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- 41, 49,
- 42, 49,
- 43, 49,
- 44, 49,

PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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187, 49,
189, 49,


PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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340, 49,
342, 49,

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PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

344, 49,
347, 49,
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351, 49,

; End of data for load case [TERMICA UNIFORME +] -----

*USE-STLD, TERMICA UNIFORME -

*ELTEMPER ; Element Temperatures

; ELEM_LIST, TEMPER, GROUP


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PROJECT TITLE :

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|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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206, -11,


PROJECT TITLE :

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|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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351, -11,

; End of data for load case [TERMICA UNIFORME -] -----

PROJECT TITLE :


| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

*USE-STLD, TERMICA GRADIENTE +

```

*THERGRAD      ; Temperature Gradient
; ELEM_LIST, iETYP, TZ, bUSEHZ, HZ, TY, bUSEHY, HY, GROUP
; ELEM_LIST, iETYP, TZ, bUSEHZ, HZ, GROUP
  1, 1, 15, YES, 0, 0, YES, 0,
  2, 1, 15, YES, 0, 0, YES, 0,
  3, 1, 15, YES, 0, 0, YES, 0,
  4, 1, 0, YES, 0, 15, YES, 0,
  5, 1, 0, YES, 0, 15, YES, 0,
  6, 1, 0, YES, 0, 15, YES, 0,
  7, 1, 0, YES, 0, 15, YES, 0,
  8, 1, 0, YES, 0, 15, YES, 0,
  9, 1, 0, YES, 0, 15, YES, 0,
 10, 1, 0, YES, 0, 15, YES, 0,
 11, 1, 0, YES, 0, 15, YES, 0,
 12, 1, 0, YES, 0, 15, YES, 0,
 13, 1, 0, YES, 0, 15, YES, 0,
 14, 1, 0, YES, 0, 15, YES, 0,
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 21, 1, 0, YES, 0, 15, YES, 0,
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 62, 1, 15, YES, 0, 0, YES, 0,
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 67, 1, 15, YES, 0, 0, YES, 0,
    
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PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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153, 1, 15, YES, 0, 0, YES, 0,
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171, 1, 15, YES, 0, 0, YES, 0,
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PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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349, 1, 15, YES, 0, 0, YES, 0,
351, 1, 15, YES, 0, 0, YES, 0,

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; End of data for load case [TERMICA GRADIENTE +] -----


*USE-STLD, TERMICA GRADIENTE -

```

*THERGRAD ; Temperature Gradient
; ELEM_LIST, iETYP, TZ, bUSEHZ, HZ, TY, bUSEHY, HY, GROUP
; ELEM_LIST, iETYP, TZ, bUSEHZ, HZ, GROUP
1, 1, -18, YES, 0, 0, YES, 0,


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PROJECT TITLE :

|  | Company | Client |
|---|---------|---------------------|
| | Author | File Name |
| | | L1-CV02_REVISIONE_2 |


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44, 1, -18, YES, 0, 0, YES, 0,
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PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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111, 1, -18, YES, 0, 0, YES, 0,
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143, 1, -18, YES, 0, 0, YES, 0,
146, 1, -18, YES, 0, 0, YES, 0,
148, 1, -18, YES, 0, 0, YES, 0,
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192, 1, -18, YES, 0, 0, YES, 0,
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206, 1, -18, YES, 0, 0, YES, 0,
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210, 1, -18, YES, 0, 0, YES, 0,
213, 1, -18, YES, 0, 0, YES, 0,
215, 1, -18, YES, 0, 0, YES, 0,
217, 1, -18, YES, 0, 0, YES, 0,
220, 1, -18, YES, 0, 0, YES, 0,
222, 1, -18, YES, 0, 0, YES, 0,
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229, 1, -18, YES, 0, 0, YES, 0,
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PROJECT TITLE :

| | | | | |
|---|---------|--|-----------|---------------------|
|  | Company | | Client | |
| | Author | | File Name | L1-CV02_REVISIONE_2 |

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240, 1, -18, YES, 0, 0, YES, 0,
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287, 1, -18, YES, 0, 0, YES, 0,
289, 1, -18, YES, 0, 0, YES, 0,
291, 1, -18, YES, 0, 0, YES, 0,
298, 1, -18, YES, 0, 0, YES, 0,
300, 1, -18, YES, 0, 0, YES, 0,
302, 1, -18, YES, 0, 0, YES, 0,
305, 1, -18, YES, 0, 0, YES, 0,
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351, 1, -18, YES, 0, 0, YES, 0,

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; End of data for load case [TERMICA GRADIENTE -] -----

*USE-STLD, FRENATURA

*BEAMLOAD ; Element Beam Loads

; ELEM_LIST, CMD, TYPE, DIR, bPROJ, [ECCEN], [VALUE], GROUP

; ELEM_LIST, CMD, TYPE, TYPE, DIR, VX, VY, VZ, bPROJ, [ECCEN], [VALUE], GROUP

; [VALUE] : D1, P1, D2, P2, D3, P3, D4, P4

; [ECCEN] : bECCEN, ECCDIR, I-END, J-END, bJ-END

; [ADDITIONAL] : bADDITIONAL, ADDITIONAL_I-END, ADDITIONAL_J-END, bADDITIONAL_J-END

1, BEAM, UNILOAD, LX, NO, NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,

, NO, 0, 0, NO,

2, BEAM, UNILOAD, LX, NO, NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,

MIDAS

PROJECT TITLE :

|  | Company | Client |
|---|---------|---------------------|
| | Author | File Name |
| | | L1-CV02_REVISIONE_2 |


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3, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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51, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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52, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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58, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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60, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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62, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
, NO, 0, 0, NO,

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65, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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67, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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69, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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72, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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74, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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76, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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141, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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143, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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, NO, 0, 0, NO,

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217, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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220, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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259, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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261, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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263, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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266, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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268, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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270, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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273, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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298, BEAM , UNILOAD, LX, NO , NO, aDir[1], , , , 0, 3.481, 1, 3.481, 0, 0, 0, 0,
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, NO, 0, 0, NO,

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; End of data for load case [FRENATURA] -----


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*STAGE ; Define Construction Stage
; NAME=NAME, DURATION, bSAVESTAGE, bSAVESTEP, bINCRESTEP, INCRESTEP ; line 1
; STEP=DAY1, DAY2, ... ; line 2
; AELEM=GROUP1, AGE1, GROUP2, AGE2, ... ; line 3
; DELEM=GROUP1, REDIST1, GROUP2, REDIST2, ... ; line 4
; ABNDR=BGROUP1, POS1, BGROUP2, POS2, ... ; line 5
; DBNDR=BGROUP1, BGROUP2, ... ; line 6
; ALOAD=LGROUP1, DAY1, LGROUP2, DAY2, ... ; line 7
; DLOAD=LGROUP1, DAY1, LGROUP2, DAY2, ... ; line 8
NAME=FASE 1, 2, YES, NO, NO, 5
AELEM=FASE 1, 0

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ABNDR=FASE 1, DEFORMED
ALOAD=FASE 1, FIRST
NAME=FASE 2, 28, YES, NO, NO, 5
AELEM=FASE 2, 0
ALOAD=FASE 2, FIRST
NAME=FASE 3, 10000, YES, NO, NO, 5
ALOAD=FASE 3, FIRST

```

```

*SFUNCTION      ; Spectrum Function
; FUNC=NAME, iTYPE, iMETHOD, SCALE/MAX, GRAV, DRATIO, DESC, RMF      ; line 1
; SPEC_CODE, [CODE_DATA]                                           ; line 2
; PERIOD1, VALUE1, PERIOD2, VALUE2, ...                             ; from line 3
; [CODE_DATA] : NSC, SFI, SC, EQ, TG, DP, MaxEQ
; CH2001
; [CODE_DATA] : NSC, SFI, SC, EQ, TG, DP, MaxEQ, nLForce           ; CH2010
; [CODE_DATA] : SFI, SC, EQ, TG, DP, MaxEQ                         ; CHSH2003
; [CODE_DATA] : DIV, SC, SFI, EQ, TG, G                           ; GB50111_2006
; [CODE_DATA] : BT, ZM, ST, SI, SC, TG, CI, CS, CD, EPA, SMAX, PERIOD ; JTG/T B02-01-20
08
; [CODE_DATA] : iSPE, SParam, TB, TC, TD, AG, Q, IF, FPX, FPY      ; P100-1(2013)
  FUNC=SLV-H, 1, 0, 1, 9.806, 0.05, , 1.000000
  USER
    0.000000,      0.336,      0.195000,      0.99
    0.585000,      0.99,      0.691000,      0.839
    0.797000,      0.728,      0.902000,      0.643
    1.008000,      0.575,      1.113000,      0.521
    1.219000,      0.476,      1.324000,      0.438
    1.430000,      0.405,      1.536000,      0.377
    1.641000,      0.353,      1.747000,      0.332
    1.852000,      0.313,      1.958000,      0.296
    2.064000,      0.281,      2.169000,      0.267
    2.275000,      0.255,      2.380000,      0.244
    2.486000,      0.233,      2.592000,      0.224
    2.697000,      0.215,      2.803000,      0.207
    2.860000,      0.199,      2.917000,      0.191
    2.974000,      0.184,      3.031000,      0.177
    3.088000,      0.17,      3.145000,      0.164
    3.202000,      0.158,      3.259000,      0.153
    3.316000,      0.148,      3.373000,      0.143
    3.430000,      0.138,      3.487000,      0.134
    3.544000,      0.129,      3.601000,      0.125
    3.658000,      0.121,      3.715000,      0.118
    3.772000,      0.114,      3.829000,      0.111
    3.886000,      0.108,      3.943000,      0.105
    4.000000,      0.102
  FUNC=SLV-V, 1, 0, 1, 9.806, 0.05, , 1.000000
  USER
    0.000000,      0.223,      0.050000,      0.526
    0.150000,      0.526,      0.235000,      0.335
    0.320000,      0.246,      0.405000,      0.195
    0.490000,      0.161,      0.575000,      0.137
    0.660000,      0.119,      0.745000,      0.106
    0.830000,      0.095,      0.915000,      0.086
    1.000000,      0.079,      1.094000,      0.066
    1.188000,      0.056,      1.281000,      0.048
    1.375000,      0.042,      1.469000,      0.037
    1.563000,      0.032,      1.656000,      0.029
    1.750000,      0.026,      1.844000,      0.023
    1.938000,      0.021,      2.031000,      0.019
    2.125000,      0.017,      2.219000,      0.016
    2.313000,      0.015,      2.406000,      0.014
    2.500000,      0.013,      2.594000,      0.012

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2.688000,      0.011,      2.781000,      0.01
2.875000,      0.01,        2.969000,      0.009
3.063000,      0.008,      3.156000,      0.008
3.250000,      0.007,      3.344000,      0.007
3.438000,      0.007,      3.531000,      0.006
3.625000,      0.006,      3.719000,      0.006
3.813000,      0.005,      3.906000,      0.005
4.000000,      0.005

```

FUNC=SLD-H, 1, 0, 1, 9.806, 0.05, , 1.000000
 USER

```

0.000000,      0.097,      0.135000,      0.297
0.405000,      0.297,      0.478000,      0.252
0.550000,      0.219,      0.622000,      0.194
0.694000,      0.174,      0.767000,      0.157
0.839000,      0.144,      0.911000,      0.132
0.983000,      0.123,      1.056000,      0.114
1.128000,      0.107,      1.200000,      0.1
1.272000,      0.095,      1.345000,      0.09
1.417000,      0.085,      1.489000,      0.081
1.561000,      0.077,      1.634000,      0.074
1.706000,      0.071,      1.778000,      0.068
1.851000,      0.065,      1.923000,      0.063
2.022000,      0.057,      2.121000,      0.052
2.220000,      0.047,      2.318000,      0.043
2.417000,      0.04,      2.516000,      0.037
2.615000,      0.034,      2.714000,      0.031
2.813000,      0.029,      2.912000,      0.027
3.011000,      0.026,      3.110000,      0.024
3.209000,      0.023,      3.308000,      0.021
3.407000,      0.02,      3.505000,      0.019
3.604000,      0.018,      3.703000,      0.017
3.802000,      0.016,      3.901000,      0.015
4.000000,      0.014

```

FUNC=SLC-H, 1, 0, 1, 9.806, 0.05, , 1.000000
 USER

```


0.000000,      0.433,      0.216000,      1.015
0.647000,      1.015,      0.775000,      0.847
0.902000,      0.727,      1.030000,      0.637
1.158000,      0.567,      1.286000,      0.51
1.414000,      0.464,      1.542000,      0.426
1.669000,      0.393,      1.797000,      0.365
1.925000,      0.341,      2.053000,      0.32
2.181000,      0.301,      2.309000,      0.284
2.437000,      0.269,      2.564000,      0.256
2.692000,      0.244,      2.820000,      0.233
2.948000,      0.223,      3.076000,      0.213
3.204000,      0.205,      3.332000,      0.197
3.363000,      0.193,      3.395000,      0.19
3.427000,      0.186,      3.459000,      0.183
3.491000,      0.179,      3.523000,      0.176
3.554000,      0.173,      3.586000,      0.17
3.618000,      0.167,      3.650000,      0.164
3.682000,      0.161,      3.714000,      0.159
3.745000,      0.156,      3.777000,      0.153
3.809000,      0.151,      3.841000,      0.148
3.873000,      0.146,      3.905000,      0.143
3.936000,      0.141,      3.968000,      0.139
4.000000,      0.137

```

*SPLDCASE ; Spectrum Load Cases
 ; TYPE, bADDSIGN, iSIGNTYPE
 ; NAME=NAME, DIR, ANGLE, SCALE, PMFT, bDAMP, bECC, INTERP, DESC, ; line 1

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;          COMTYPE, bADDSIGN, iSIGNTYPE, bMODE                ; line 2
;          FUNC1, FUNC2, FUNC3, ...                          ; line 3
;          bUSE1, dFACTOR1, bUSE2, dFACTOR2, ..., bUSEn, dFACTORn ; line 4 (bMODE
=YES)
;          bCDR, [DR-DC]                                     ; line 5 (bDAMP
=YES)
; [DR-DC] : iMDTYPE, DALL, iMODE1, DAMPING1, iMODE2, DAMPING2, ... ; iMDTYPE=1
;          : iMDTYPE, iCOEF, bMASSP, MASSC, bSTIFFP, STIFFC    ; iMDTYPE=2, iC
OEF=1
;          : iMDTYPE, iCOEF, iCALC, bMASSP, FP1, DR1, bSTIFFP, FP2, DR2 ; iMDTYPE=2, iC
OEF=2
NAME=EX, XY, 0, 1, 1, NO, NO, LOG, SISMAX
CQC, NO, 0, YES
SLV-H
YES, 1, YES, 1, YES, 1, YES, 1, YES, 1
NAME=EY, XY, 90, 1, 1, NO, NO, LOG, SISMAX
CQC, NO, 0, YES
SLV-H
YES, 1, YES, 1, YES, 1, YES, 1, YES, 1
NAME=EZ, Z, 0, 1, 1, NO, NO, LOG, SISMAZ
CQC, NO, 0, YES
SLV-V
YES, 1, YES, 1, YES, 1, YES, 1, YES, 1
NAME=DX, XY, 0, 1, 1, NO, NO, LOG, SISMA_D_X
CQC, NO, 0, YES
SLD-H
YES, 1, YES, 1, YES, 1, YES, 1, YES, 1
NAME=CX, XY, 0, 1, 1, NO, NO, LOG, CX
CQC, NO, 0, YES
SLC-H
YES, 1, YES, 1, YES, 1, YES, 1, YES, 1
NAME=CY, XY, 90, 1, 1, NO, NO, LOG, CY
CQC, NO, 0, YES
SLC-H
YES, 1, YES, 1, YES, 1, YES, 1, YES, 1

*MVLDCODE      ; Moving Load Code
; CODE=CODE
CODE=EUROCODE

*LINELANE      ; Traffic Line Lanes
; NAME=NAME, LDIST, GROUP, SKEWS, SKEWE, MOVING, LW, WS, bLANEOPT, ALLOWWIDTH ; line
1
;          iELEM1, ECC1, FACT1, bSPAN1, ECCVL...            ; from
line 2
NAME=LC01, CROSS, FASE 2, 0, 0, BOTH, 3, 2, NO, 3
1, -1, 0, NO, 0, 58, -1, 0, NO, 0, 65, -1, 0, NO, 0
72, -1, 0, NO, 0, 79, -1, 0, NO, 0, 26, -1, 0, NO, 0
86, -1, 0, NO, 0, 93, -1, 0, NO, 0, 100, -1, 0, NO, 0
107, -1, 0, NO, 0, 29, -1, 0, NO, 0, 118, -1, 0, NO, 0
125, -1, 0, NO, 0, 132, -1, 0, NO, 0, 139, -1, 0, NO, 0
32, -1, 0, NO, 0, 146, -1, 0, NO, 0, 153, -1, 0, NO, 0
160, -1, 0, NO, 0, 167, -1, 0, NO, 0, 35, -1, 0, NO, 0
178, -1, 0, NO, 0, 185, -1, 0, NO, 0, 192, -1, 0, NO, 0
199, -1, 0, NO, 0, 38, -1, 0, NO, 0, 206, -1, 0, NO, 0
213, -1, 0, NO, 0, 220, -1, 0, NO, 0, 227, -1, 0, NO, 0
41, -1, 0, NO, 0, 238, -1, 0, NO, 0, 245, -1, 0, NO, 0
252, -1, 0, NO, 0, 259, -1, 0, NO, 0, 44, -1, 0, NO, 0
266, -1, 0, NO, 0, 273, -1, 0, NO, 0, 280, -1, 0, NO, 0
287, -1, 0, NO, 0, 47, -1, 0, NO, 0, 298, -1, 0, NO, 0
305, -1, 0, NO, 0, 312, -1, 0, NO, 0, 319, -1, 0, NO, 0
50, -1, 0, NO, 0, 326, -1, 0, NO, 0, 333, -1, 0, NO, 0

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340, -1, 0, NO, 0, 347, -1, 0, NO, 0
NAME=LC02, CROSS, FASE 2, 0, 0, BOTH, 3, 2, NO, 3
  1, -4, 0, NO, 0, 58, -4, 0, NO, 0, 65, -4, 0, NO, 0
  72, -4, 0, NO, 0, 79, -4, 0, NO, 0, 26, -4, 0, NO, 0
  86, -4, 0, NO, 0, 93, -4, 0, NO, 0, 100, -4, 0, NO, 0
107, -4, 0, NO, 0, 29, -4, 0, NO, 0, 118, -4, 0, NO, 0
125, -4, 0, NO, 0, 132, -4, 0, NO, 0, 139, -4, 0, NO, 0
  32, -4, 0, NO, 0, 146, -4, 0, NO, 0, 153, -4, 0, NO, 0
160, -4, 0, NO, 0, 167, -4, 0, NO, 0, 35, -4, 0, NO, 0
178, -4, 0, NO, 0, 185, -4, 0, NO, 0, 192, -4, 0, NO, 0
199, -4, 0, NO, 0, 38, -4, 0, NO, 0, 206, -4, 0, NO, 0
213, -4, 0, NO, 0, 220, -4, 0, NO, 0, 227, -4, 0, NO, 0
  41, -4, 0, NO, 0, 238, -4, 0, NO, 0, 245, -4, 0, NO, 0
252, -4, 0, NO, 0, 259, -4, 0, NO, 0, 44, -4, 0, NO, 0
266, -4, 0, NO, 0, 273, -4, 0, NO, 0, 280, -4, 0, NO, 0
287, -4, 0, NO, 0, 47, -4, 0, NO, 0, 298, -4, 0, NO, 0
305, -4, 0, NO, 0, 312, -4, 0, NO, 0, 319, -4, 0, NO, 0
  50, -4, 0, NO, 0, 326, -4, 0, NO, 0, 333, -4, 0, NO, 0
  340, -4, 0, NO, 0, 347, -4, 0, NO, 0
NAME=LC03, CROSS, FASE 2, 0, 0, BOTH, 1, 1, NO, 3
  2, 0, 0, NO, 0, 62, 0, 0, NO, 0, 69, 0, 0, NO, 0
  76, 0, 0, NO, 0, 83, 0, 0, NO, 0, 27, 0, 0, NO, 0
  90, 0, 0, NO, 0, 97, 0, 0, NO, 0, 104, 0, 0, NO, 0
111, 0, 0, NO, 0, 30, 0, 0, NO, 0, 122, 0, 0, NO, 0
129, 0, 0, NO, 0, 136, 0, 0, NO, 0, 143, 0, 0, NO, 0
  33, 0, 0, NO, 0, 150, 0, 0, NO, 0, 157, 0, 0, NO, 0
164, 0, 0, NO, 0, 171, 0, 0, NO, 0, 36, 0, 0, NO, 0
182, 0, 0, NO, 0, 189, 0, 0, NO, 0, 196, 0, 0, NO, 0
203, 0, 0, NO, 0, 39, 0, 0, NO, 0, 210, 0, 0, NO, 0
217, 0, 0, NO, 0, 224, 0, 0, NO, 0, 231, 0, 0, NO, 0
  42, 0, 0, NO, 0, 242, 0, 0, NO, 0, 249, 0, 0, NO, 0
256, 0, 0, NO, 0, 263, 0, 0, NO, 0, 45, 0, 0, NO, 0
270, 0, 0, NO, 0, 277, 0, 0, NO, 0, 284, 0, 0, NO, 0
291, 0, 0, NO, 0, 48, 0, 0, NO, 0, 302, 0, 0, NO, 0
309, 0, 0, NO, 0, 316, 0, 0, NO, 0, 323, 0, 0, NO, 0
  51, 0, 0, NO, 0, 330, 0, 0, NO, 0, 337, 0, 0, NO, 0
344, 0, 0, NO, 0, 351, 0, 0, NO, 0

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*VEHICLE ; Vehicles
; if Moving Load Code is China
; NAME=NAME, 1, TYPE-NAME, CODE
; standard
; NAME=NAME, 2, LTYPE, [TRUCK/LANE] or [TRAIN/SUBWAY] or [CROWD]
; user: line 1
; LOAD1, DIST1, LOAD2, DIST2, ...
; user: from line 2
; [TRUCK/LANE] : 1, P, Qm, Qq
; truck(JTG)
; [TRUCK/LANE] : 2, P, Qm, Qq
; lane load1
; [TRUCK/LANE] : 3, Qk, Pk1, L1, Pk2, L2
; lane load2
; [TRUCK/LANE] : 4, dW, dD
; crawler type
; [TRUCK/LANE] : 5
; GC type load
; [TRAIN/SUBWAY] : iTYPE, W1, D1, W2, D2
; train-type1,3
; [TRAIN/SUBWAY] : iTYPE, DD, FD, BD, MAINCOUNT
; train-type2
; [TRAIN/SUBWAY] : 4, P1, D1, P2, D2, P3, D3, P4, dD, Po, n, IFR
; subway

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; [CROWD] : 1, dw1
; crowd-type1
; [CROWD] : 2, dw1, dL1, dw2, dL2, WIDTH
; crowd-type2
; if Moving Load Type is India
; NAME=NAME, 1, TYPE-NAME, CODE
; standard
; NAME=NAME, 2, bWTB, P, D, Pb, Db, dD1, dD2, NDIST
; user: line 1
; NAME=NAME, 2, bWTB, dD1, dD2, NDIST
; user: line 1
;     LOAD1, DIST1, LOAD2, DIST2, ...
; user: from line 2
; if Moving Load Code is CANADA
; NAME=NAME, 1, TYPE-NAME, DLA, CODE, [DYNA]
; standard
; NAME=NAME, 2, bTRAIN, W(W1), PL(D1), PLM(W2), PLV(D2), NDIST, [DYNA]
; user: line 1
;     LOAD1, DIST1, LOAD2, DIST2, ...
; user: from line 2
; [DYNA] : nDYNA, FACT1AXLE, FACT2AXLE, FACT3AXLE
; Dynamic Load Allowance
; if Moving Load Code is BS
; NAME=NAME, 1, TYPE-NAME, CODE, UNITNUM
; standard
; NAME=nLane, FACTOR1, FACTOR2, FACTOR3, FACTOR4, ADDDATA, AL, CA, LL
; HA, HA & HB, HA & HB(Auto)
; NAME=NAME, 2, iSTYPE, W1, W2, W3, L, Pa, Pb, D1, D2, d, UNITNUM
; user(BS 5400)
; NAME=NAME, 2, iSTYPE, [BD37/01-HA], [BS-DATA-LF]
; user(HA)
; NAME=NAME, 2, iSTYPE, [BS-DATA-HB]
; user(HB)
; NAME=NAME, 2, iSTYPE, [BD37/01-HA2], [BS-DATA-HB2], [BS-DATA-LF]
; user(HA&HB)
; NAME=NAME, 2, iSTYPE, [BD37/01-HA], [BD37/01-HB], [BS-DATA-LF]
; user(HA&HB(AUTO))
; NAME=NAME, 2, iSTYPE, W, L
; user(Pedestrian)
; NAME=NAME, 2, iSTYPE, V, AN, MINS, MAXS, P1, D1, P2, D2, ...
; user(Special Vehicle)
; [BS-DATA-HA] : W1, W2, W3, EXP, EXP2, L1, L2, Pa
; [BS-DATA-HA2] : W1, W2, W3, EXP, EXP2, L1, L2
; [BS-DATA-HB] : Pb, D1, D2, d, UNITNUM
; [BS-DATA-HB2] : Pb, D1, D2, d, dd, UNITNUM
; [BS-DATA-LF] : nLT, LF1, LF2, LF3, LF4
; if Moving Load Code is EUROCODE
; NAME=NAME, 1, iTYPE, TYPE-NAME, PSY1, PSY2, PHI, [AF7]
; standard (LM1, FLM1)
; NAME=NAME, 1, iTYPE, TYPE-NAME, bDF, bU, PHI, PSY, ADJ, IN
; standard (others)
; NAME=NAME, 2, 1, [AF7]
; user(Type 1)
;     [LOAD7], D, PHI, TPSY, UPSY
; user(Type 1): line 2
; NAME=NAME, 2, 2, ALP, TPSY, W, BET, LPSY, P1, D1, P2, D2, ...
; user(Type 2)
; NAME=NAME, 2, 3
; user(Type 3)
;     [LOADCASE1]
; user(Type 3): line 2
;     [LOADCASE2]
```

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; user(Type 3): line 3
; [LOADCASE3]
; user(Type 3): line 4
; NAME=NAME, 2, 4, WS, V, AN, MINS, MAXS, DYF, UI, F, P1, D1, P2, D2, ...
; user(Type 4)
; NAME=NAME, 2, 5, INT, bPHI1, PHI1, bPHI2, PHI2
; user(Type 5)
; [VEHICLE1]
; user(Type 5): line 2
; [VEHICLE2]
; user(Type 5): line 3
; [VEHICLE3]
; user(Type 5): line 4
; [AF7] : TF1, TF2, TF3, UF1, UF2, UF3, UF4
; adjustment factor
; [LOAD7] : TL1, TL2, TL3, UL1, UL2, UL3, UL4
; tandem/udl loads
; [LOADCASE] : bUSE, N, bDF, bUI, PHI, P1, L1, P2, L2, ...
; load case
; [VEHICLE] : bUSE, N, P1, L1, P2, L2, ...
; vehicle
; if Moving Load Code is RUSSIA
; NAME=NAME, 1, iTYPE, K, nDYNAFAC, dDYNAFAC, bFATI, nLOADFAC, dLOADFAC
; standard (SK)
; NAME=NAME, 1, iTYPE, K, nDYNAFAC, dDYNAFAC, bFATI, nLOADFAC, dLOADFAC
; standard (SK FATIGUE)
; NAME=NAME, 1, iTYPE, K, nDYNAFAC, dDYNAFAC, dDYNAFAC_UDL
;
; bFATI, nLOADFAC, dLOADFAC, dLOADFAC_UDL, s1[3], s1_UDL[3]
; standard (AK)
; NAME=NAME, 1, iTYPE, K, nDYNAFAC, dDYNAFAC, nLOADFAC, dLOADFAC,
;
; bTWOVEHI, TWOVEHI_FACT, b2NDREDUC, 2NDREDUC_FACT
; standard (N14)
; NAME=NAME, 1, iTYPE, K, nDYNAFAC, dDYNAFAC, nLOADFAC, dLOADFAC,
;
; bTWOVEHI, TWOVEHI_FACT, b2NDREDUC, 2NDREDUC_FACT
; standard (N11)
; NAME=NAME, 1, iTYPE, nDYNAFAC, dDYNAFAC, dEMPTYCAR
;
; bFATI, nLOADFAC, dLOADFAC,
; standard (SUBWAY TRAINS)
; NAME=NAME, 1, iTYPE, VARIABLE, nDYNAFAC, dDYNAFAC, dEMPTYCAR
;
; bFATI, nLOADFAC, dLOADFAC,
; standard (TRAMCARS)
; NAME=NAME, 1, iTYPE, nDYNAFAC, dDYNAFAC, bFATI, nLOADFAC, dLOADFAC
; standard (NK-80)
; NAME=NAME, 1, iTYPE, W, D, nDYNAFAC, dDYNAFAC, bFATI, nLOADFAC, dLOADFAC
; standard (NG-60)
; NAME=NAME, 1, iTYPE, BRIDGETYPE, W, bFATI, nLOADFAC, dLOADFAC
; standard (UNIFORM LOAD)
; NAME=NAME, 1, iTYPE, BRIDGETYPE, W, bFATI, nLOADFAC, dLOADFAC
; standard (UNIFORM LOAD (W/O OTHER LOADS))
; NAME=NAME, 1, iTYPE, BRIDGETYPE, P
; standard (CONCENTRATED LOAD (W/O OTHER LOADS))
; NAME=NAME, 2, iTYPE, W, nDYNAFAC, dDYNAFAC, dDYNAFAC_UDL
;
; bFATI, nLOADFAC, dLOADFAC, dLOADFAC_UDL, s1[3], s1_UDL[3]
; user (Type 1)
; NAME=NAME, 2, iTYPE, nDYNAFAC, dDYNAFAC, dEMPTYCAR
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;          bFATI, nLOADFAC, dLOADFAC,
; user (Type 2)
; NAME=NAME, 2, iTYPE, Variable, nDYNAFAC, dDYNAFAC, dEMPTYCAR

;          bFATI, nLOADFAC, dLOADFAC,
; user (Type 3)
; NAME=NAME, 2, iTYPE, nDYNAFAC, dDYNAFAC, nLOADFAC, dLOADFAC

;          bTWOVEHI, TWOVEHI_FACT, b2NDREDUC, 2NDREDUC_FACT
; user (Type 4)
; NAME=NAME, 2, iTYPE, nDYNAFAC, dDYNAFAC, nLOADFAC, dLOADFAC

;          bTWOVEHI, TWOVEHI_FACT, b2NDREDUC, 2NDREDUC_FACT
; user (Type 5)
; NAME=NAME, 2, iTYPE, W, D, nDYNAFAC, dDYNAFAC, bFATI, nLOADFAC, dLOADFAC
; user (Type 6)
; NAME=NAME, 2, iTYPE, P, W, bFATI, nLOADFAC, dLOADFAC
; user (Type 7)
; if Moving Load Code is KSCE-LSD15
; NAME=NAME, 1, TYPE-NAME, nLANETYPE, dDYNAFAC, CODE, nLANELOAD, L, CONVERTDIST
; standard
; NAME=NAME, 2, 8, L1, W1, W2, EXP, dDYNAFAC, nLANELOAD, L, CONVERTDIST
; user: line 1 (Type 1)
; NAME=NAME, 2, 1, W1, W2, D1, D2, 0, 0, 0, NO
; user: line 1 (Type 2)
; NAME=NAME, 2, 6, LOADNUM, DIST, W, L, 0, 0, 0, NO
; user: line 1 (Type 3)
;   LOAD1, DIST1, (DIST2_1), LOAD2, DIST2, (DIST2_2), ...
; user: from line 2
; if Moving Load Code is South Africa
; NAME=NAME, 1, TYPE-NAME, CODE, bINCREL, dINCREL
; standard NA
; NAME=NAME, 1, TYPE-NAME, CODE, UNITNUM
; standard NB
; NAME=NAME, 1, TYPE-NAME, CODE, OPPOSITE
; standard NC
; NAME=NAME, 2, TYPE, W1, L, W2, W3, PA, bINCREL, dINCREL
; user NA
; NAME=NAME, 2, TYPE, PB, UNITNUM, DELTA, D1, D2
; user NB
; NAME=NAME, 2, TYPE, P, OPPOSITE, NUM1, NUM2, NUM3 [DIST1], [DIST2], [DIST3]
; user NC
; if Load Type is Permit Truck
; NAME=NAME, 3, AXLE-TYPE-NUM, IMP-FACTOR
; user(Permit Truck)
;   AXLE-TYPE-NAME1, bEDWL1, bSV1, P1, D1, P2, D2, ..., Pn, Dn
; user(from line 2)
;   ...
;   AXLE-TYPE-NAMEn, bEDWLn, bSVn, P1, D1, P2, D2, ..., Pn, Dn
;   AXLE-TYPE1, SPACING1, bVS1, AXLE-TYPE2, SPACING2, bVS2 ...
; line 2+AXLE-TYPE-NUM
; if Moving Load Code is not one of those specified above.
; NAME=NAME, 1, TYPE-NAME, DLA, CODE
; standard
; NAME=NAME, 2, bTRAIN, W(W1), PL(D1), PLM(W2), PLV(D2), NDIST
; user: line 1
;   LOAD1, DIST1, LOAD2, DIST2, ...
; user: from line 2
NAME=Q1A_q1a, 2, 1, 1, 0, 0, 1, 0, 0, 0
    300, 0, 0, 9, 0, 0, 0, 1.2, 1, 1, 1
NAME=Q1B_q1b, 2, 1, 1, 0, 0, 1, 0, 0, 0
    200, 0, 0, 2.5, 0, 0, 0, 1.2, 1, 1, 1

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NAME=Q_Rimanente, 2, 1, 0, 0, 0, 1, 0, 0, 0
0, 0, 0, 2.5, 0, 0, 0, 1.2, 1, 1, 1

```
*MVLDCASE(EURO) ; Moving Load Cases
; NAME=NAME, bOPTIM, iTYPE, DESC, VHL1, VHL2, bLEAD, SERIAL
; type 1, 3
; nType, SLN1, SLN2, SLN3, ...
; line 2 (nType=1)
; nType, SRA1, SRA2, SRA3, ...
; line 2/3 (nType=2)
; nType, FLN1, FLN2, FLN3, ...
; line 4 (nType=3)
; NAME=NAME, bOPTIM, iTYPE, DESC, iOPT, bLEAD, SERIAL
; type 2
; [SUB1]
; line 2
; ...
; [SUBn]
; line n+1
; [SUB] : VCLA, SCA, MIN, MAX, SLN1, SLN2, ...
; sub-loadcase
; NAME=NAME, bOPTIM, iTYPE, DESC, iOPT, bLEAD, SERIAL
; type 4
; 0, SLN1, SLN2, SLN3, ...
; line 2
; 1, SRA1, SRA2, SRA3, ...
; line 3
; 2, STRadd1, STRadd2, STRadd3, ...
; line 4
; NAME=NAME, bOPTIM, iTYPE, DESC, iOPT, SF1, SF2, SF3, bPSI1, MULF1, MULF2, MULF3, SERIAL
; type 5
; [SUB1]
; line 2
; ...
; [SUBn]
; line n+1
; //////////////////////////////////////
; Moving Load Optimization
;
; NAME=NAME, bOPTIM, iTYPE, DESC, VHL1, VHL2, bLEAD, MINVEHL, LANEOP, LOADEDLANE, SERIAL
; type 1, 3
; nType, SRA1, SRA2, SRA3, ...
; line 2 (nType=2)
; nType, FLN1, FLN2, FLN3, ...
; line 3 (nType=3)
; NAME=NAME, bOPTIM, iTYPE, DESC, iOPT, bLEAD, MINVEHL, LANEOP, MIN, MAX, SERIAL
; type 2
; [ASSGNVEHL1]
; line 2
; ...
; [ASSGNVEHLn]
; line n+1
; [ASSGNVEHL] : VC, VCLA, SCA ...
; Assignment-Vehicle
; NAME=NAME, bOPTIM, iTYPE, DESC, iOPT, bLEAD, MINVEHL, LANEOP, LOADEDLANE, SERIAL
; type 4
; 1, SRA1, SRA2, SRA3, ...
; line 3
```

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; NAME=NAME, bOPTIM, iTYPE, DESC, iOPT, SF1, SF2, SF3, bPSI1, MULF1, MULF2, MULF3, MIN
VEHL, LANEOP, MIN, MAX, SERIAL ; type 5
; [ASSGNVEHL1]
; line 2
; ...
; [ASSGNVEHLn]
; line n+1
NAME=LM01, NO, 1, , Q1A_q1a, , YES, 1
1, LC01
NAME=LM02, NO, 1, , Q1B_q1b, , YES, 2
1, LC02
NAME=LM03, NO, 1, , Q_Rimanente, , YES, 3
1, LC03


*CPOSECT4CS ; Composite Section for Construction Stage
; SEC=SEC, ASTAGE, TYPE, bTAP //
line 1
; [PART-INFO]-1 //
from line 2
; ...
; [PART-INFO]-n
; [PART-INFO] : [COMMON], [SCALE], H, VS //
TYPE=A,B,NORMAL
; [COMMON], [SCALE], CY, CZ, [STIFF], H, VS //
TYPE=USER
; [COMMON], [SCALE], CYI, CZI, CYJ, CZJ, [STIFF]-I, [STIFF]-J, H, VS //
TYPE=USER, bTAP=YES
; [COMMON]: PART, MTYPE, MAT, CSTAGE, AGE
; [SCALE] : AREA, ASY, ASZ, IXX, IYY, IZZ, WAREA
; [STIFF] : AREA, ASY, ASZ, IXX, IYY, CYP, CYM, CZP, CZM, QYB, QZB, \
; X1, X2, X3, X4, Y1, Y2, Y3, Y4
SEC=3, FASE 1, NORMAL, NO
1, ELEM, , , 0, 1, 1, 1, 1, 1, 1, 1, 1, 0.0187086, 0
2, MATL, 2, FASE 3, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0.230769, 0
SEC=7, FASE 1, NORMAL, NO
1, ELEM, , , 0, 1, 1, 1, 1, 1, 1, 1, 1, 0.0327108, 0
2, MATL, 2, FASE 3, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0.227273, 0
SEC=9, FASE 1, NORMAL, NO
1, ELEM, , , 0, 1, 1, 1, 1, 1, 1, 1, 1, 0.024279, 0
2, MATL, 2, FASE 3, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0.227273, 0
SEC=8, FASE 1, NORMAL, NO
1, ELEM, , , 0, 1, 1, 1, 1, 1, 1, 1, 1, 0.0280775, 0
2, MATL, 2, FASE 3, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0.227273, 0

*STAGE-COLOR ; Diagram Color for Construction Stage
; STAGENAME, iR(COLOR), iG(COLOR), iB(COLOR)
FASE 1, 255, 192, 87
FASE 2, 85, 0, 192
FASE 3, 192, 128, 0

*LOADCOMB ; Combinations
; NAME=NAME, KIND, ACTIVE, bES, iTYPE, DESC, iSERV-TYPE, nLCOMTYPE ; line 1
; ANAL1, LCNAME1, FACT1, ... ; from line 2
NAME=SLU1, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA UNIFORME +, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU2, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA UNIFORME -, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35

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NAME=SLU3, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU4, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU5, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 1.5, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU6, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 1.5, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU7, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 1.5, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU8, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 1.5, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU9, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU10, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU11, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU12, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU13, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU14, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU15, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU16, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU17, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU18, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU19, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU20, GEN, ACTIVE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9

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ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU21, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU22, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU23, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU24, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLV1, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV2, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV3, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV4, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV5, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV6, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV7, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV8, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV9, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV10, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV11, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV12, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV13, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV14, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV15, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV16, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV17, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV18, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV19, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV20, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -1, RS, EY, -0.3
CS, Summation, 1
NAME=SLV21, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV22, GEN, ACTIVE, 0, 0, , 0, 0

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ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV23, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV24, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -1
CS, Summation, 1
NAME=SLV25, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 1, RS, EY, 0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV26, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -1, RS, EY, 0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV27, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 1, RS, EY, -0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV28, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -1, RS, EY, -0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV29, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 0.3, RS, EY, 1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV30, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 0.3, RS, EY, -1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV31, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -0.3, RS, EY, 1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV32, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -0.3, RS, EY, -1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV33, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV34, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV35, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV36, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV37, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV38, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV39, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV40, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV41, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV42, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV43, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1

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CS, Summation, 1
NAME=SLV44, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV45, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV46, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV47, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV48, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV49, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV50, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV51, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV52, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV53, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV54, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV55, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV56, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=RARA_1, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_2, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_3, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_4, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_5, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_6, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_7, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_8, GEN, ACTIVE, 0, 0, , 0, 0
    
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ST, VENTO PONTE CARICO, 1, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_9, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_10, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_11, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_12, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_13, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_14, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_15, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_16, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=FREQ_1, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_2, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_3, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_4, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_5, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_6, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_7, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_8, GEN, ACTIVE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_9, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_10, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_11, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_12, GEN, ACTIVE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1

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NAME=FREQ_13, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
  MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_14, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
  MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_15, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
  MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_16, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
  MV, LM02, 0.75, CS, Summation, 1
NAME=QP_1, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, CS, Summation, 1
NAME=QP_2, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, CS, Summation, 1
NAME=QP_3, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, CS, Summation, 1
NAME=QP_4, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE -, 0.5, CS, Summation, 1
NAME=SLD1, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, DX, 1, CS, Summation, 1
NAME=SLD2, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, DX, -1, CS, Summation, 1
NAME=SLD3, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, DX, 1, CS, Summation, 1
NAME=SLD4, GEN, ACTIVE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, DX, -1, CS, Summation, 1
NAME=ENVESLU-SLV, GEN, ACTIVE, 0, 1, , 0, 0
  CB, SLU1, 1, CB, SLU2, 1, CB, SLU3, 1, CB, SLU4, 1, CB, SLU5, 1
  CB, SLU6, 1, CB, SLU7, 1, CB, SLU8, 1, CB, SLU9, 1, CB, SLU10, 1
  CB, SLU11, 1, CB, SLU12, 1, CB, SLU13, 1, CB, SLU14, 1, CB, SLU15, 1
  CB, SLU16, 1, CB, SLU17, 1, CB, SLU18, 1, CB, SLU19, 1, CB, SLU20, 1
  CB, SLU21, 1, CB, SLU22, 1, CB, SLU23, 1, CB, SLU24, 1, CB, SLV1, 1
  CB, SLV2, 1, CB, SLV3, 1, CB, SLV4, 1, CB, SLV5, 1, CB, SLV6, 1
  CB, SLV7, 1, CB, SLV8, 1, CB, SLV9, 1, CB, SLV10, 1, CB, SLV11, 1
  CB, SLV12, 1, CB, SLV13, 1, CB, SLV14, 1, CB, SLV15, 1, CB, SLV16, 1
  CB, SLV17, 1, CB, SLV18, 1, CB, SLV19, 1, CB, SLV20, 1, CB, SLV21, 1
  CB, SLV22, 1, CB, SLV23, 1, CB, SLV24, 1, CB, SLV25, 1, CB, SLV26, 1
  CB, SLV27, 1, CB, SLV28, 1, CB, SLV29, 1, CB, SLV30, 1, CB, SLV31, 1
  CB, SLV32, 1, CB, SLV33, 1, CB, SLV34, 1, CB, SLV35, 1, CB, SLV36, 1
  CB, SLV37, 1, CB, SLV38, 1, CB, SLV39, 1, CB, SLV40, 1, CB, SLV41, 1
  CB, SLV42, 1, CB, SLV43, 1, CB, SLV44, 1, CB, SLV45, 1, CB, SLV46, 1
  CB, SLV47, 1, CB, SLV48, 1, CB, SLV49, 1, CB, SLV50, 1, CB, SLV51, 1
  CB, SLV52, 1, CB, SLV53, 1, CB, SLV54, 1, CB, SLV55, 1, CB, SLV56, 1
NAME=ENVE-RARA, GEN, ACTIVE, 0, 1, , 0, 0
  CB, RARA_1, 1, CB, RARA_2, 1, CB, RARA_3, 1, CB, RARA_4, 1
  CB, RARA_5, 1, CB, RARA_6, 1, CB, RARA_7, 1, CB, RARA_8, 1
  CB, RARA_9, 1, CB, RARA_10, 1, CB, RARA_11, 1, CB, RARA_12, 1
  CB, RARA_13, 1, CB, RARA_14, 1, CB, RARA_15, 1, CB, RARA_16, 1
NAME=ENVE-FREQ, GEN, ACTIVE, 0, 1, , 0, 0
  CB, FREQ_1, 1, CB, FREQ_2, 1, CB, FREQ_3, 1, CB, FREQ_4, 1
  CB, FREQ_5, 1, CB, FREQ_6, 1, CB, FREQ_7, 1, CB, FREQ_8, 1
  CB, FREQ_9, 1, CB, FREQ_10, 1, CB, FREQ_11, 1, CB, FREQ_12, 1
  CB, FREQ_13, 1, CB, FREQ_14, 1, CB, FREQ_15, 1, CB, FREQ_16, 1
NAME=ENVE-QP, GEN, ACTIVE, 0, 1, , 0, 0
  CB, QP_1, 1, CB, QP_2, 1, CB, QP_3, 1, CB, QP_4, 1
NAME=ENVE-SLD, GEN, ACTIVE, 0, 1, , 0, 0
  CB, SLD1, 1, CB, SLD2, 1, CB, SLD3, 1, CB, SLD4, 1
NAME=SLC_X, GEN, ACTIVE, 0, 0, , 0, 0
  RS, CX, 1, RS, CY, 0.3
NAME=SLC_Y, GEN, ACTIVE, 0, 0, , 0, 0

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RS, CX, 0.3, RS, CY, 1
NAME=SLU1, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA UNIFORME +, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU2, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA UNIFORME -, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU3, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA GRADIENTE +, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU4, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA GRADIENTE -, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU5, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1.5, ST, TERMICA UNIFORME +, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU6, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1.5, ST, TERMICA UNIFORME -, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU7, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1.5, ST, TERMICA GRADIENTE +, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU8, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1.5, ST, TERMICA GRADIENTE -, 0.9
ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU9, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU10, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU11, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU12, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU13, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU14, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU15, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU16, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU17, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU18, STEEL, STRENGTH, 0, 0, , 0, 0

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ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU19, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU20, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU21, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU22, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU23, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLU24, STEEL, STRENGTH, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
CS, Summation, 1.35
NAME=SLV1, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV2, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV3, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV4, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV5, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV6, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV7, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV8, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV9, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV10, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV11, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV12, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV13, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV14, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV15, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV16, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV17, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV18, STEEL, STRENGTH, 0, 0, , 0, 0
    
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ST, TERMICA GRADIENTE +, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV19, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV20, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -1, RS, EY, -0.3
CS, Summation, 1
NAME=SLV21, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV22, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV23, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV24, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -1
CS, Summation, 1
NAME=SLV25, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 1, RS, EY, 0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV26, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -1, RS, EY, 0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV27, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 1, RS, EY, -0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV28, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -1, RS, EY, -0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV29, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 0.3, RS, EY, 1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV30, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 0.3, RS, EY, -1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV31, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -0.3, RS, EY, 1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV32, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -0.3, RS, EY, -1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV33, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV34, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV35, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV36, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV37, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV38, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV39, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV40, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1

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CS, Summation, 1
NAME=SLV41, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV42, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV43, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV44, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV45, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV46, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV47, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV48, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV49, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV50, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV51, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV52, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV53, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV54, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV55, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=SLV56, STEEL, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
CS, Summation, 1
NAME=RARA_1, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_2, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_3, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_4, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_5, STEEL, SERVICE, 0, 0, , 0, 0

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ST, VENTO PONTE CARICO, 1, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_6, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_7, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_8, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_9, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_10, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_11, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_12, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_13, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_14, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_15, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_16, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=FREQ_1, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_2, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_3, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_4, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_5, STEEL, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_6, STEEL, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_7, STEEL, SERVICE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_8, STEEL, SERVICE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_9, STEEL, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
    
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NAME=FREQ_10, STEEL, SERVICE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME -, 0.5
  ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_11, STEEL, SERVICE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE +, 0.5
  ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_12, STEEL, SERVICE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE -, 0.5
  ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_13, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
  MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_14, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
  MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_15, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
  MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_16, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
  MV, LM02, 0.75, CS, Summation, 1
NAME=QP_1, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, CS, Summation, 1
NAME=QP_2, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, CS, Summation, 1
NAME=QP_3, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, CS, Summation, 1
NAME=QP_4, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE -, 0.5, CS, Summation, 1
NAME=SLD1, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, DX, 1, CS, Summation, 1
NAME=SLD2, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, DX, -1, CS, Summation, 1
NAME=SLD3, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, DX, 1, CS, Summation, 1
NAME=SLD4, STEEL, SERVICE, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, DX, -1, CS, Summation, 1
NAME=ENVESLU-SLV, STEEL, STRENGTH, 0, 1, , 0, 0
  CBS, SLU1, 1, CBS, SLU2, 1, CBS, SLU3, 1, CBS, SLU4, 1, CBS, SLU5, 1
  CBS, SLU6, 1, CBS, SLU7, 1, CBS, SLU8, 1, CBS, SLU9, 1, CBS, SLU10, 1
  CBS, SLU11, 1, CBS, SLU12, 1, CBS, SLU13, 1, CBS, SLU14, 1
  CBS, SLU15, 1, CBS, SLU16, 1, CBS, SLU17, 1, CBS, SLU18, 1
  CBS, SLU19, 1, CBS, SLU20, 1, CBS, SLU21, 1, CBS, SLU22, 1
  CBS, SLU23, 1, CBS, SLU24, 1, CBS, SLV1, 1, CBS, SLV2, 1, CBS, SLV3, 1
  CBS, SLV4, 1, CBS, SLV5, 1, CBS, SLV6, 1, CBS, SLV7, 1, CBS, SLV8, 1
  CBS, SLV9, 1, CBS, SLV10, 1, CBS, SLV11, 1, CBS, SLV12, 1
  CBS, SLV13, 1, CBS, SLV14, 1, CBS, SLV15, 1, CBS, SLV16, 1
  CBS, SLV17, 1, CBS, SLV18, 1, CBS, SLV19, 1, CBS, SLV20, 1
  CBS, SLV21, 1, CBS, SLV22, 1, CBS, SLV23, 1, CBS, SLV24, 1
  CBS, SLV25, 1, CBS, SLV26, 1, CBS, SLV27, 1, CBS, SLV28, 1
  CBS, SLV29, 1, CBS, SLV30, 1, CBS, SLV31, 1, CBS, SLV32, 1
  CBS, SLV33, 1, CBS, SLV34, 1, CBS, SLV35, 1, CBS, SLV36, 1
  CBS, SLV37, 1, CBS, SLV38, 1, CBS, SLV39, 1, CBS, SLV40, 1
  CBS, SLV41, 1, CBS, SLV42, 1, CBS, SLV43, 1, CBS, SLV44, 1
  CBS, SLV45, 1, CBS, SLV46, 1, CBS, SLV47, 1, CBS, SLV48, 1
  CBS, SLV49, 1, CBS, SLV50, 1, CBS, SLV51, 1, CBS, SLV52, 1
  CBS, SLV53, 1, CBS, SLV54, 1, CBS, SLV55, 1, CBS, SLV56, 1
NAME=ENVE-RARA, STEEL, STRENGTH, 0, 1, , 0, 0
  CBS, RARA_1, 1, CBS, RARA_2, 1, CBS, RARA_3, 1, CBS, RARA_4, 1
  CBS, RARA_5, 1, CBS, RARA_6, 1, CBS, RARA_7, 1, CBS, RARA_8, 1
  CBS, RARA_9, 1, CBS, RARA_10, 1, CBS, RARA_11, 1, CBS, RARA_12, 1
  CBS, RARA_13, 1, CBS, RARA_14, 1, CBS, RARA_15, 1, CBS, RARA_16, 1

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NAME=ENVE-FREQ, STEEL, STRENGTH, 0, 1, , 0, 0
  CBS, FREQ_1, 1, CBS, FREQ_2, 1, CBS, FREQ_3, 1, CBS, FREQ_4, 1
  CBS, FREQ_5, 1, CBS, FREQ_6, 1, CBS, FREQ_7, 1, CBS, FREQ_8, 1
  CBS, FREQ_9, 1, CBS, FREQ_10, 1, CBS, FREQ_11, 1, CBS, FREQ_12, 1
  CBS, FREQ_13, 1, CBS, FREQ_14, 1, CBS, FREQ_15, 1, CBS, FREQ_16, 1
NAME=ENVE-QP, STEEL, STRENGTH, 0, 1, , 0, 0
  CBS, QP_1, 1, CBS, QP_2, 1, CBS, QP_3, 1, CBS, QP_4, 1
NAME=ENVE-SLD, STEEL, STRENGTH, 0, 1, , 0, 0
  CBS, SLD1, 1, CBS, SLD2, 1, CBS, SLD3, 1, CBS, SLD4, 1
NAME=SLU1, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU2, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU3, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU4, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 1.5, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU5, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 1.5, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU6, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 1.5, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU7, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 1.5, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU8, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 1.5, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.0125, MV, LM01, 1.0125, MV, LM02, 1.0125
  MV, LM03, 1.0125, CS, Summation, 1.35
NAME=SLU9, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU10, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU11, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU12, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU13, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU14, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU15, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35

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NAME=SLU16, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, CS, Summation, 1.35
NAME=SLU17, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU18, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU19, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU20, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU21, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU22, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA UNIFORME -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU23, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE +, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLU24, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, VENTO PONTE CARICO, 0.9, ST, TERMICA GRADIENTE -, 0.9
  ST, FRENATURA, 1.35, MV, LM01, 1.35, MV, LM02, 1.35, MV, LM03, 1.35
  CS, Summation, 1.35
NAME=SLV1, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV2, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV3, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV4, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, -1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV5, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV6, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV7, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV8, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV9, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV10, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV11, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV12, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, -1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV13, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV14, STLCOMP, STRENGTH, 0, 0, , 0, 0

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ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV15, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV16, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV17, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV18, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -1, RS, EY, 0.3, CS, Summation, 1
NAME=SLV19, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 1, RS, EY, -0.3, CS, Summation, 1
NAME=SLV20, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -1, RS, EY, -0.3
CS, Summation, 1
NAME=SLV21, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV22, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -1, CS, Summation, 1
NAME=SLV23, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 1, CS, Summation, 1
NAME=SLV24, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -1
CS, Summation, 1
NAME=SLV25, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 1, RS, EY, 0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV26, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -1, RS, EY, 0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV27, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 1, RS, EY, -0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV28, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -1, RS, EY, -0.3, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV29, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 0.3, RS, EY, 1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV30, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, 0.3, RS, EY, -1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV31, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -0.3, RS, EY, 1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV32, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, RS, EX, -0.3, RS, EY, -1, MV, LM03, 0.75
CS, Summation, 1
NAME=SLV33, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV34, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV35, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV36, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1
CS, Summation, 1
NAME=SLV37, STLCOMP, STRENGTH, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
CS, Summation, 1

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NAME=SLV38, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
  CS, Summation, 1
NAME=SLV39, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1
  CS, Summation, 1
NAME=SLV40, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1
  CS, Summation, 1
NAME=SLV41, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, 1
  CS, Summation, 1
NAME=SLV42, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, 1
  CS, Summation, 1
NAME=SLV43, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, 1
  CS, Summation, 1
NAME=SLV44, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, 1
  CS, Summation, 1
NAME=SLV45, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV46, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV47, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV48, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV49, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV50, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV51, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV52, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA UNIFORME -, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV53, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, 0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV54, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, 0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV55, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, RS, EX, 0.3, RS, EY, -0.3, RS, EZ, -1
  CS, Summation, 1
NAME=SLV56, STLCOMP, STRENGTH, 0, 0, , 0, 0
  ST, TERMICA GRADIENTE +, 0.5, RS, EX, -0.3, RS, EY, -0.3, RS, EZ, -1
  CS, Summation, 1
NAME=RARA_1, STLCOMP, SERVICE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 1, ST, TERMICA UNIFORME +, 0.6
  ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_2, STLCOMP, SERVICE, 0, 0, , 0, 0
  ST, VENTO PONTE SCARICO, 1, ST, TERMICA UNIFORME -, 0.6

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ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_3, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_4, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 1, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_5, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_6, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_7, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_8, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 1, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=RARA_9, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_10, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_11, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_12, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.6, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_13, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA UNIFORME +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_14, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA UNIFORME -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_15, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA GRADIENTE +, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=RARA_16, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE CARICO, 0.6, ST, TERMICA GRADIENTE -, 0.6
ST, FRENATURA, 1, MV, LM01, 1, CS, Summation, 1
NAME=FREQ_1, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_2, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_3, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_4, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, CS, Summation, 1
NAME=FREQ_5, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_6, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_7, STLCOMP, SERVICE, 0, 0, , 0, 0

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ST, TERMICA GRADIENTE +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_8, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
CS, Summation, 1
NAME=FREQ_9, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_10, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA UNIFORME -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_11, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE +, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_12, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, VENTO PONTE SCARICO, 0.2, ST, TERMICA GRADIENTE -, 0.5
ST, FRENATURA, 0.75, MV, LM01, 0.75, MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_13, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_14, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_15, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, ST, FRENATURA, 0.75, MV, LM01, 0.75
MV, LM02, 0.75, CS, Summation, 1
NAME=FREQ_16, STLCOMP, SERVICE, 0, 0, , 0, 0
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MV, LM02, 0.75, CS, Summation, 1
NAME=QP_1, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, CS, Summation, 1
NAME=QP_2, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME -, 0.5, CS, Summation, 1
NAME=QP_3, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE +, 0.5, CS, Summation, 1
NAME=QP_4, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA GRADIENTE -, 0.5, CS, Summation, 1
NAME=SLD1, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, DX, 1, CS, Summation, 1
NAME=SLD2, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, DX, -1, CS, Summation, 1
NAME=SLD3, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, DX, 1, CS, Summation, 1
NAME=SLD4, STLCOMP, SERVICE, 0, 0, , 0, 0
ST, TERMICA UNIFORME +, 0.5, RS, DX, -1, CS, Summation, 1
NAME=ENVESLU-SLV, STLCOMP, STRENGTH, 0, 1, , 0, 0
CBSC, SLU1, 1, CBSC, SLU2, 1, CBSC, SLU3, 1, CBSC, SLU4, 1
CBSC, SLU5, 1, CBSC, SLU6, 1, CBSC, SLU7, 1, CBSC, SLU8, 1
CBSC, SLU9, 1, CBSC, SLU10, 1, CBSC, SLU11, 1, CBSC, SLU12, 1
CBSC, SLU13, 1, CBSC, SLU14, 1, CBSC, SLU15, 1, CBSC, SLU16, 1
CBSC, SLU17, 1, CBSC, SLU18, 1, CBSC, SLU19, 1, CBSC, SLU20, 1
CBSC, SLU21, 1, CBSC, SLU22, 1, CBSC, SLU23, 1, CBSC, SLU24, 1
CBSC, SLV1, 1, CBSC, SLV2, 1, CBSC, SLV3, 1, CBSC, SLV4, 1
CBSC, SLV5, 1, CBSC, SLV6, 1, CBSC, SLV7, 1, CBSC, SLV8, 1
CBSC, SLV9, 1, CBSC, SLV10, 1, CBSC, SLV11, 1, CBSC, SLV12, 1
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CBSC, SLV17, 1, CBSC, SLV18, 1, CBSC, SLV19, 1, CBSC, SLV20, 1
CBSC, SLV21, 1, CBSC, SLV22, 1, CBSC, SLV23, 1, CBSC, SLV24, 1
CBSC, SLV25, 1, CBSC, SLV26, 1, CBSC, SLV27, 1, CBSC, SLV28, 1
CBSC, SLV29, 1, CBSC, SLV30, 1, CBSC, SLV31, 1, CBSC, SLV32, 1
CBSC, SLV33, 1, CBSC, SLV34, 1, CBSC, SLV35, 1, CBSC, SLV36, 1
CBSC, SLV37, 1, CBSC, SLV38, 1, CBSC, SLV39, 1, CBSC, SLV40, 1
    
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CBSC, SLV41, 1, CBSC, SLV42, 1, CBSC, SLV43, 1, CBSC, SLV44, 1
CBSC, SLV45, 1, CBSC, SLV46, 1, CBSC, SLV47, 1, CBSC, SLV48, 1
CBSC, SLV49, 1, CBSC, SLV50, 1, CBSC, SLV51, 1, CBSC, SLV52, 1
CBSC, SLV53, 1, CBSC, SLV54, 1, CBSC, SLV55, 1, CBSC, SLV56, 1
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CBSC, RARA_1, 1, CBSC, RARA_2, 1, CBSC, RARA_3, 1, CBSC, RARA_4, 1
CBSC, RARA_5, 1, CBSC, RARA_6, 1, CBSC, RARA_7, 1, CBSC, RARA_8, 1
CBSC, RARA_9, 1, CBSC, RARA_10, 1, CBSC, RARA_11, 1, CBSC, RARA_12, 1
CBSC, RARA_13, 1, CBSC, RARA_14, 1, CBSC, RARA_15, 1, CBSC, RARA_16, 1
NAME=ENVE-FREQ, STLCOMP, STRENGTH, 0, 1, , 0, 0
CBSC, FREQ_1, 1, CBSC, FREQ_2, 1, CBSC, FREQ_3, 1, CBSC, FREQ_4, 1
CBSC, FREQ_5, 1, CBSC, FREQ_6, 1, CBSC, FREQ_7, 1, CBSC, FREQ_8, 1
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CBSC, FREQ_13, 1, CBSC, FREQ_14, 1, CBSC, FREQ_15, 1, CBSC, FREQ_16, 1
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NAME=ENVE-SLD, STLCOMP, STRENGTH, 0, 1, , 0, 0
CBSC, SLD1, 1, CBSC, SLD2, 1, CBSC, SLD3, 1, CBSC, SLD4, 1
    
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*LC-COLOR ; Diagram Color for Load Case

; ANAL, LCNAME, iR1(ALL), iG1(ALL), iB1(ALL), iR2(MIN), iG2(MIN), iB2(MIN), iR3(MAX), iG2(MAX), iB2(MAX)

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CS, Dead Load, 255, 0, 128, 192, 192, 0, 255, 255, 87
CS, Erection Load 1, 255, 87, 128, 0, 128, 192, 255, 192, 160
CS, Erection Load 2, 0, 128, 255, 163, 255, 160, 192, 0, 192
CS, Erection Load 3, 0, 157, 192, 255, 87, 87, 146, 0, 255
CS, Tendon Primary, 192, 128, 0, 192, 128, 0, 0, 128, 57
CS, Tendon Secondary, 0, 128, 192, 163, 160, 255, 85, 192, 0
CS, Creep Primary, 192, 72, 0, 85, 0, 192, 255, 255, 255
CS, Creep Secondary, 210, 210, 210, 255, 0, 128, 255, 87, 128
CS, Shrinkage Primary, 255, 87, 128, 163, 255, 160, 128, 192, 0
CS, Shrinkage Secondary, 0, 128, 128, 255, 192, 160, 0, 192, 192
CS, Summation, 0, 128, 57, 192, 72, 0, 146, 0, 255
ST, PESO PROPRIO ACCIAIO, 163, 255, 160, 146, 0, 255, 255, 0, 192
ST, PESO PROPRIO SOLETTA, 255, 160, 255, 0, 192, 128, 160, 255, 255
ST, PERMANENTE PORTATO, 85, 192, 0, 255, 87, 87, 192, 192, 192
ST, VENTO PONTE SCARICO, 160, 192, 255, 78, 0, 255, 0, 128, 192
ST, VENTO PONTE CARICO, 78, 0, 255, 192, 192, 0, 192, 128, 0
ST, TERMICA UNIFORME +, 128, 192, 0, 160, 192, 255, 78, 0, 255
ST, TERMICA UNIFORME -, 148, 87, 255, 160, 255, 255, 0, 128, 128
ST, TERMICA GRADIENTE +, 0, 192, 192, 255, 87, 128, 163, 160, 255
ST, TERMICA GRADIENTE -, 255, 192, 160, 255, 192, 87, 78, 0, 255
ST, FRENATURA, 192, 192, 0, 192, 72, 0, 160, 255, 255
MV, LM01, 192, 128, 0, 148, 87, 255, 85, 192, 0
MV, LM02, 255, 0, 192, 93, 255, 87, 212, 160, 255
MV, LM03, 192, 128, 0, 148, 87, 255, 0, 128, 128
RS, EX, 255, 128, 0, 0, 157, 192, 148, 87, 255
RS, EY, 0, 192, 128, 255, 0, 192, 85, 192, 0
RS, EZ, 255, 128, 0, 93, 255, 87, 192, 192, 192
RS, DX, 163, 255, 160, 210, 210, 210, 192, 192, 0
RS, CX, 0, 157, 192, 0, 128, 192, 255, 192, 87
CB, SLU1, 85, 0, 192, 0, 128, 128, 192, 0, 128
CB, SLU2, 163, 160, 255, 255, 0, 192, 0, 128, 57
CB, SLU3, 128, 192, 0, 85, 0, 192, 192, 0, 192
CB, SLU4, 192, 0, 192, 160, 192, 255, 255, 87, 87
CB, SLU5, 85, 0, 192, 255, 87, 128, 255, 0, 192
CB, SLU6, 160, 255, 255, 210, 210, 210, 192, 72, 0
CB, SLU7, 0, 192, 192, 78, 0, 255, 210, 210, 210
CB, SLU8, 192, 0, 128, 128, 192, 0, 192, 0, 128
CB, SLU9, 0, 157, 192, 163, 160, 255, 255, 255, 255
CB, SLU10, 210, 210, 210, 255, 87, 87, 255, 128, 0
CB, SLU11, 163, 160, 255, 128, 192, 0, 192, 72, 0
    
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CB, SLU12, 212, 160, 255, 0, 157, 192, 160, 255, 255
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 CB, SLU15, 192, 0, 192, 163, 160, 255, 192, 192, 0
 CB, SLU16, 148, 87, 255, 78, 0, 255, 160, 192, 255
 CB, SLU17, 78, 0, 255, 148, 87, 255, 255, 160, 255
 CB, SLU18, 192, 192, 192, 192, 192, 192, 255, 0, 128
 CB, SLU19, 0, 128, 128, 255, 128, 0, 255, 192, 160
 CB, SLU20, 148, 87, 255, 210, 210, 210, 93, 255, 87
 CB, SLU21, 160, 192, 255, 85, 192, 0, 192, 0, 128
 CB, SLU22, 0, 128, 128, 148, 87, 255, 255, 255, 255
 CB, SLU23, 192, 0, 128, 255, 160, 255, 160, 192, 255
 CB, SLU24, 148, 87, 255, 163, 160, 255, 78, 0, 255
 CB, SLV1, 255, 255, 87, 255, 192, 160, 163, 160, 255
 CB, SLV2, 192, 192, 192, 0, 157, 192, 255, 192, 87
 CB, SLV3, 0, 192, 192, 255, 0, 192, 210, 210, 210
 CB, SLV4, 163, 160, 255, 255, 128, 0, 163, 255, 160
 CB, SLV5, 255, 192, 160, 163, 255, 160, 212, 160, 255
 CB, SLV6, 163, 160, 255, 160, 255, 255, 128, 192, 0
 CB, SLV7, 128, 192, 0, 255, 160, 255, 0, 128, 57
 CB, SLV8, 192, 128, 0, 192, 192, 0, 93, 255, 87
 CB, SLV9, 160, 192, 255, 0, 128, 192, 0, 128, 255
 CB, SLV10, 0, 192, 128, 160, 255, 255, 192, 192, 192
 CB, SLV11, 192, 0, 128, 255, 192, 87, 0, 128, 255
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 CB, SLV13, 163, 160, 255, 148, 87, 255, 0, 128, 57
 CB, SLV14, 0, 128, 255, 255, 255, 87, 255, 0, 128
 CB, SLV15, 255, 255, 87, 192, 0, 192, 255, 87, 87
 CB, SLV16, 192, 128, 0, 192, 72, 0, 192, 0, 128
 CB, SLV17, 192, 192, 192, 255, 87, 87, 85, 192, 0
 CB, SLV18, 85, 192, 0, 192, 0, 128, 192, 192, 192
 CB, SLV19, 0, 192, 192, 160, 192, 255, 192, 0, 192
 CB, SLV20, 0, 128, 128, 255, 128, 0, 160, 255, 255
 CB, SLV21, 0, 128, 255, 255, 192, 160, 255, 87, 128
 CB, SLV22, 163, 255, 160, 255, 160, 255, 0, 157, 192
 CB, SLV23, 85, 192, 0, 0, 128, 128, 255, 0, 192
 CB, SLV24, 146, 0, 255, 255, 87, 87, 210, 210, 210
 CB, SLV25, 212, 160, 255, 148, 87, 255, 255, 255, 87
 CB, SLV26, 0, 128, 128, 128, 192, 0, 212, 160, 255
 CB, SLV27, 192, 192, 192, 210, 210, 210, 0, 192, 128
 CB, SLV28, 255, 255, 87, 93, 255, 87, 0, 128, 255
 CB, SLV29, 192, 0, 192, 255, 255, 255, 255, 0, 128
 CB, SLV30, 192, 72, 0, 85, 0, 192, 255, 160, 255
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 CB, SLV35, 192, 128, 0, 255, 160, 255, 255, 0, 128
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 CB, SLV37, 93, 255, 87, 192, 128, 0, 255, 255, 87
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 CB, SLV40, 0, 192, 192, 0, 128, 128, 255, 160, 255
 CB, SLV41, 255, 0, 192, 146, 0, 255, 192, 192, 192
 CB, SLV42, 78, 0, 255, 0, 128, 57, 163, 255, 160
 CB, SLV43, 160, 192, 255, 163, 160, 255, 0, 128, 192
 CB, SLV44, 78, 0, 255, 192, 0, 192, 0, 157, 192
 CB, SLV45, 255, 87, 87, 255, 255, 87, 192, 0, 192
 CB, SLV46, 0, 192, 128, 0, 128, 57, 255, 0, 128
 CB, SLV47, 192, 0, 128, 85, 192, 0, 192, 192, 192
 CB, SLV48, 192, 0, 128, 255, 192, 87, 255, 192, 160
 CB, SLV49, 128, 192, 0, 255, 192, 160, 210, 210, 210

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CB, SLV50, 255, 87, 128, 148, 87, 255, 192, 192, 0
 CB, SLV51, 85, 0, 192, 255, 255, 255, 0, 157, 192
 CB, SLV52, 0, 128, 128, 255, 160, 255, 192, 0, 192
 CB, SLV53, 93, 255, 87, 78, 0, 255, 146, 0, 255
 CB, SLV54, 192, 72, 0, 255, 128, 0, 85, 192, 0
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 CB, SLV56, 0, 128, 255, 255, 255, 87, 192, 192, 0
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 CB, RARA_2, 85, 0, 192, 192, 0, 192, 85, 192, 0
 CB, RARA_3, 160, 255, 255, 255, 160, 255, 255, 0, 192
 CB, RARA_4, 255, 160, 255, 192, 0, 192, 255, 0, 192
 CB, RARA_5, 255, 0, 192, 0, 157, 192, 210, 210, 210
 CB, RARA_6, 255, 192, 160, 0, 192, 128, 0, 128, 192
 CB, RARA_7, 255, 128, 0, 255, 255, 255, 255, 0, 192
 CB, RARA_8, 255, 87, 87, 192, 0, 128, 210, 210, 210
 CB, RARA_9, 0, 157, 192, 210, 210, 210, 255, 128, 0
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 CB, FREQ_11, 160, 255, 255, 255, 0, 128, 255, 87, 128
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 CB, FREQ_15, 0, 128, 255, 148, 87, 255, 192, 72, 0
 CB, FREQ_16, 0, 192, 192, 0, 128, 192, 212, 160, 255
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 CB, QP_3, 85, 0, 192, 0, 128, 57, 255, 0, 192
 CB, QP_4, 255, 0, 192, 255, 192, 160, 163, 160, 255
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 CB, SLD2, 160, 192, 255, 192, 192, 192, 0, 128, 128
 CB, SLD3, 192, 128, 0, 0, 192, 128, 128, 192, 0
 CB, SLD4, 0, 128, 192, 255, 255, 87, 0, 128, 192
 CB, ENVESLU-SLV, 192, 128, 0, 255, 87, 87, 0, 157, 192
 CB, ENVE-RARA, 128, 192, 0, 78, 0, 255, 212, 160, 255
 CB, ENVE-FREQ, 163, 255, 160, 146, 0, 255, 0, 157, 192
 CB, ENVE-QP, 85, 192, 0, 192, 0, 192, 255, 160, 255
 CB, ENVE-SLD, 192, 0, 128, 212, 160, 255, 255, 128, 0
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 CBS, SLU2, 255, 255, 255, 192, 0, 128, 163, 255, 160
 CBS, SLU3, 0, 128, 128, 0, 128, 192, 128, 192, 0
 CBS, SLU4, 128, 192, 0, 148, 87, 255, 0, 128, 128
 CBS, SLU5, 0, 128, 128, 0, 157, 192, 160, 255, 255
 CBS, SLU6, 255, 255, 87, 0, 128, 192, 78, 0, 255
 CBS, SLU7, 210, 210, 210, 255, 87, 128, 255, 0, 128
 CBS, SLU8, 192, 192, 0, 255, 87, 87, 85, 192, 0
 CBS, SLU9, 255, 0, 192, 0, 192, 192, 146, 0, 255
 CBS, SLU10, 0, 192, 192, 255, 192, 87, 0, 192, 192

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 CBS, SLU16, 78, 0, 255, 78, 0, 255, 85, 0, 192
 CBS, SLU17, 192, 0, 192, 0, 192, 128, 255, 0, 128
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 CBS, SLV3, 0, 128, 57, 0, 128, 57, 163, 255, 160
 CBS, SLV4, 255, 192, 160, 255, 255, 87, 146, 0, 255
 CBS, SLV5, 128, 192, 0, 85, 192, 0, 192, 0, 128
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 CBS, SLV8, 255, 0, 192, 160, 255, 255, 0, 157, 192
 CBS, SLV9, 192, 128, 0, 0, 157, 192, 93, 255, 87
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 CBS, SLV13, 93, 255, 87, 146, 0, 255, 255, 87, 87
 CBS, SLV14, 192, 0, 128, 0, 128, 57, 0, 192, 192
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 CBS, SLV19, 255, 160, 255, 212, 160, 255, 93, 255, 87
 CBS, SLV20, 255, 87, 87, 0, 128, 255, 255, 87, 87
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 CBS, SLV22, 255, 255, 255, 255, 0, 128, 0, 128, 57
 CBS, SLV23, 0, 128, 255, 255, 192, 160, 212, 160, 255
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 CBS, SLV27, 93, 255, 87, 148, 87, 255, 160, 192, 255
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 CBS, SLV29, 163, 160, 255, 192, 0, 128, 128, 192, 0
 CBS, SLV30, 212, 160, 255, 160, 255, 255, 192, 0, 128
 CBS, SLV31, 0, 128, 57, 192, 128, 0, 85, 0, 192
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 CBS, SLV47, 160, 255, 255, 255, 255, 255, 78, 0, 255
 CBS, SLV48, 160, 255, 255, 255, 0, 128, 160, 192, 255

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 CBS, RARA_4, 255, 87, 87, 0, 128, 255, 192, 128, 0
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CBS, ENVE-RARA, 93, 255, 87, 192, 192, 0, 255, 128, 0
CBS, ENVE-FREQ, 163, 255, 160, 0, 128, 57, 255, 255, 87
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CB, SLC_Y, 0, 128, 128, 192, 192, 192, 0, 192, 192

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*EIGEN-CTRL ; Eigenvalue Analysis Control
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; TYPE, bINCNL, iGNUM ; TYPE=RITZ(line 1)
; KIND1, CASE1/GROUND1, iNOG1, ... ; TYPE=RITZ(from line

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