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Vs. Rif. arch.:

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FSC Fondo per lo Sviluppo e la Coesione — Piano Operativo Ambiente — MINISTERO DELL'AMBIENTE E DELLA TUTELA DEL TERRITORIO E DEL MARE

# PROGETTO ESECUTIVO

TITOLO COMMESSA

## ADEGUAMENTO DEL DEPURATORE DI GRAVELLONA TOCE ALLE DIRETTIVE COMUNITARIE

Via Trattati di Roma in Comune di Gravellona Toce (VB)

Rif. N° Commessa: W01M - 10030635
CUP: D49E17000030002
RUP: Dott. Ing Barbara Dell'Edera

Data: Maggio 2022 | Rif. archivio: 002.19

Scala

ELABORATO: ST.01.004 H

| Rev. | AGGIORNAMENTI | DATA |
|---|---|---|
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OGGETTO

## FASCICOLO DEI CALCOLI – MANUFATTO PRETRATTAMENTI

Il Responsabile
Dott. Ing. Riccardo ISOLA

Visto

* Riservato all'Amministrazione

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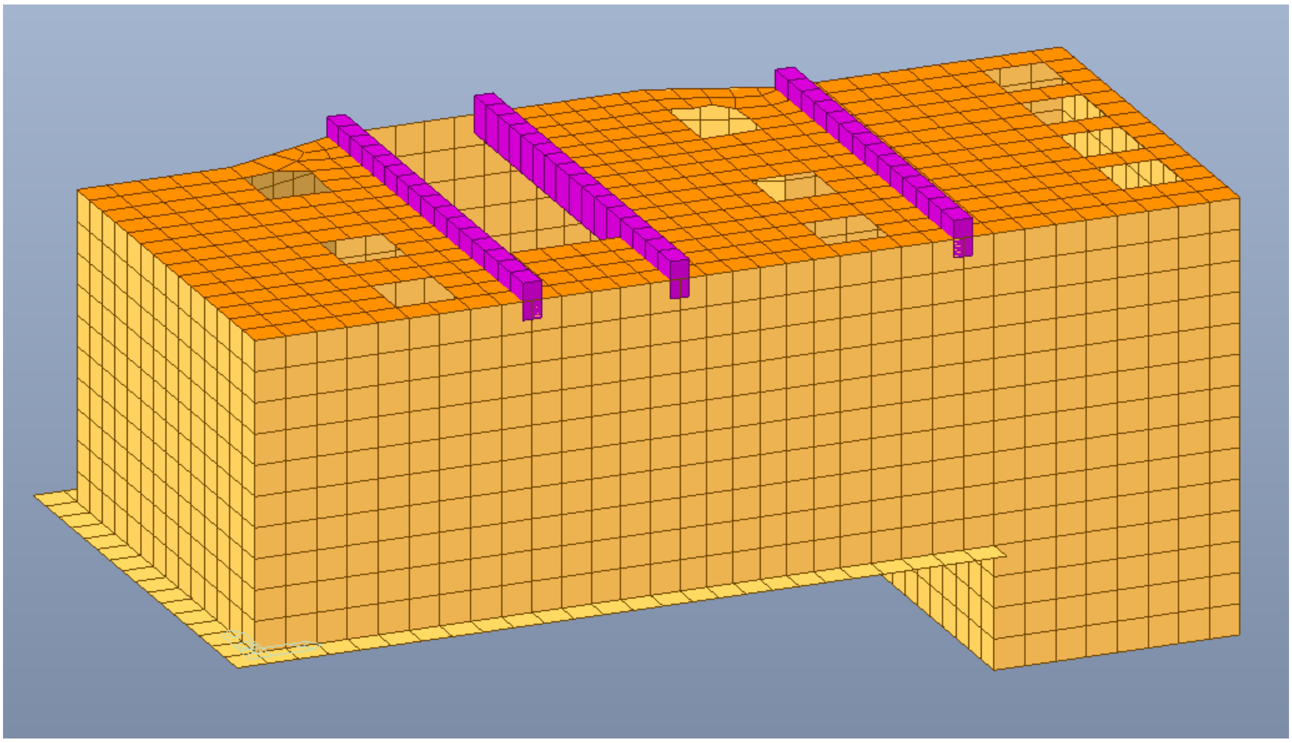
# 1 Fascicolo dei calcoli Manufatto Grigliatura Grossolana e Pompaggio

## 1.1 Dati della modellazione

Nelle immagini seguenti viene riportato il modello di calcolo agli elementi finiti, realizzato con Midas Gen, con evidenziati i vari spessori degli elementi strutturali.
Gli elementi finiti adottati sono di tipo plate per pareti, platea e soletta e beam per le travi di rinforzo della copertura.
In particolare, gli spessori adottati per gli elementi plate sono i seguenti:

- Platee di fondazione, principale e secondaria sp.50 cm;
- Pareti esterne sp.50 cm;
- Soletta di copertura sp.35 cm.



***Modello di Calcolo agli elementi finiti***

L'interazione terreno struttura a livello del piano di fondazione è stata modellata con delle molle alla Winkler con costante di sottofondo media pari a circa 5500 kN/m$^3$, ricavata dalle caratteristiche geotecniche del terreno con la formula di Vesic.
Essendo la struttura quasi interamente interrata, l'analisi sismica è stata effettuata mediante analisi statica equivalente, attribuendo agli elementi strutturali i valori delle sovra spinte sismiche sia del terreno che del liquame; per i calcoli di queste sovraspinte si rimanda all'apposito capitolo della relazione strutturale.

## 1.2 Carichi e combinazioni di carico

Per la determinazione delle azioni sul manufatto si faccia riferimento alla relazione strutturale.

Nel presente paragrafo vengono riportati i carichi assegnati ai vari elementi strutturali, le condizioni di carico elementari considerate e le combinazioni di carico.

Le condizioni di carico adottate nella modellazione della struttura sono le seguenti:

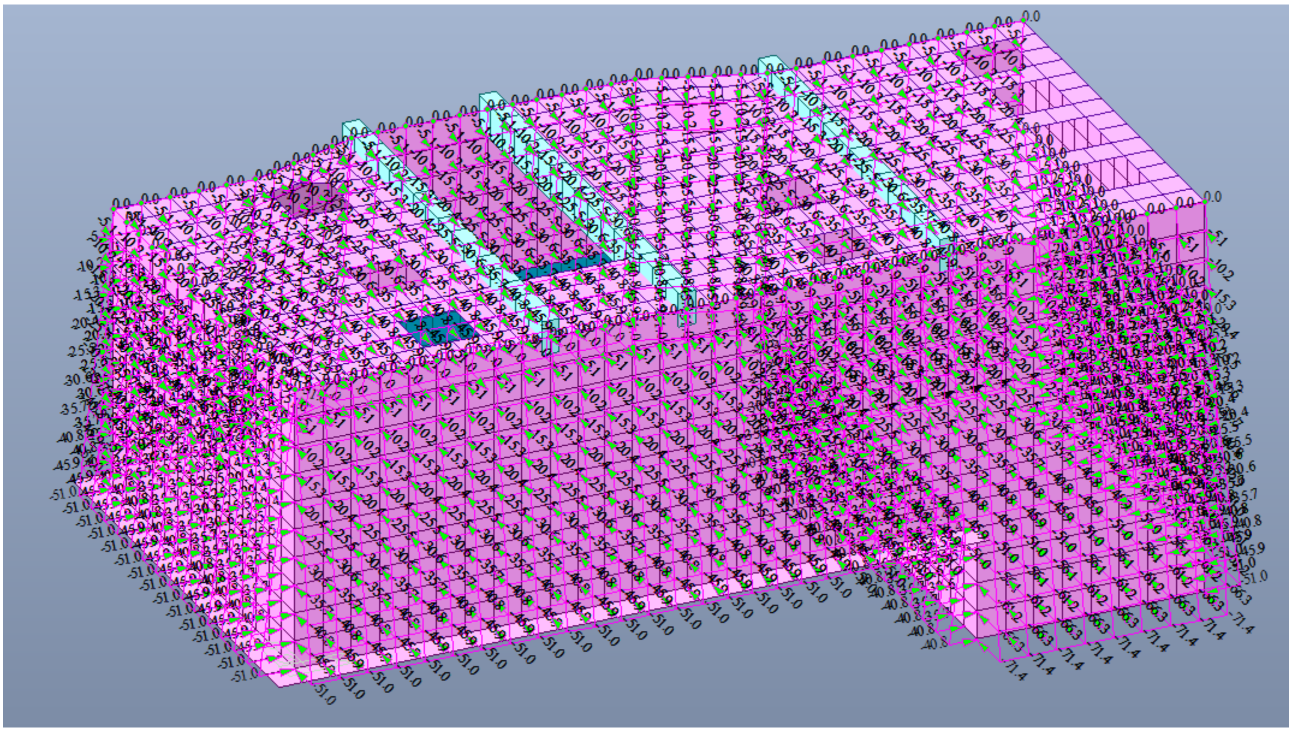
| No | Name | Type | Description |
|---|---|---|---|
| 1 | DL | Dead Load (D) | Peso proprio |
| 2 | SST | Dead Load (D) | Spinta Statica Terreno |
| 3 | SSTF | Dead Load (D) | Spinta Statica Terreno in Falda |
| 4 | SSS | Dead Load (D) | Spinta Statica Sovraccarico |
| 5 | PG | Dead Load (D) | Permanente Griglie |
| 6 | PL | Dead Load (D) | Permanente Liquame |
| 7 | PP | Dead Load (D) | Permanente Pompe e Pendenza |
| 8 | SSP | Dead Load (D) | Spinta dovuta al fabbricato adiace |
| 9 | SGAL | Dead Load (D) | Sottospinta Galleggiamento |
| 10 | P ZAV | Dead Load (D) | Peso Zavorra Terreno |
| 11 | VC1 | Live Load (L) | Variabile Carrabile |
| 12 | VC2 | Live Load (L) | Variabile Carrabile 2 |
| 13 | VC3 | Live Load (L) | Variabile Carrabile 3 |
| 14 | VC4 | Live Load (L) | Variabile Carrabile 4 |
| 15 | ET X | Earthquake (E) | Incremento Sismico Spinta Terreno |
| 16 | ET Y | Earthquake (E) | Incremento Sismico Spinta Terreno |

Le combinazioni delle condizioni di carico elementari, realizzate sulla base delle indicazioni del paragrafo 2.5.3 delle NTC 2018, sono le seguenti:

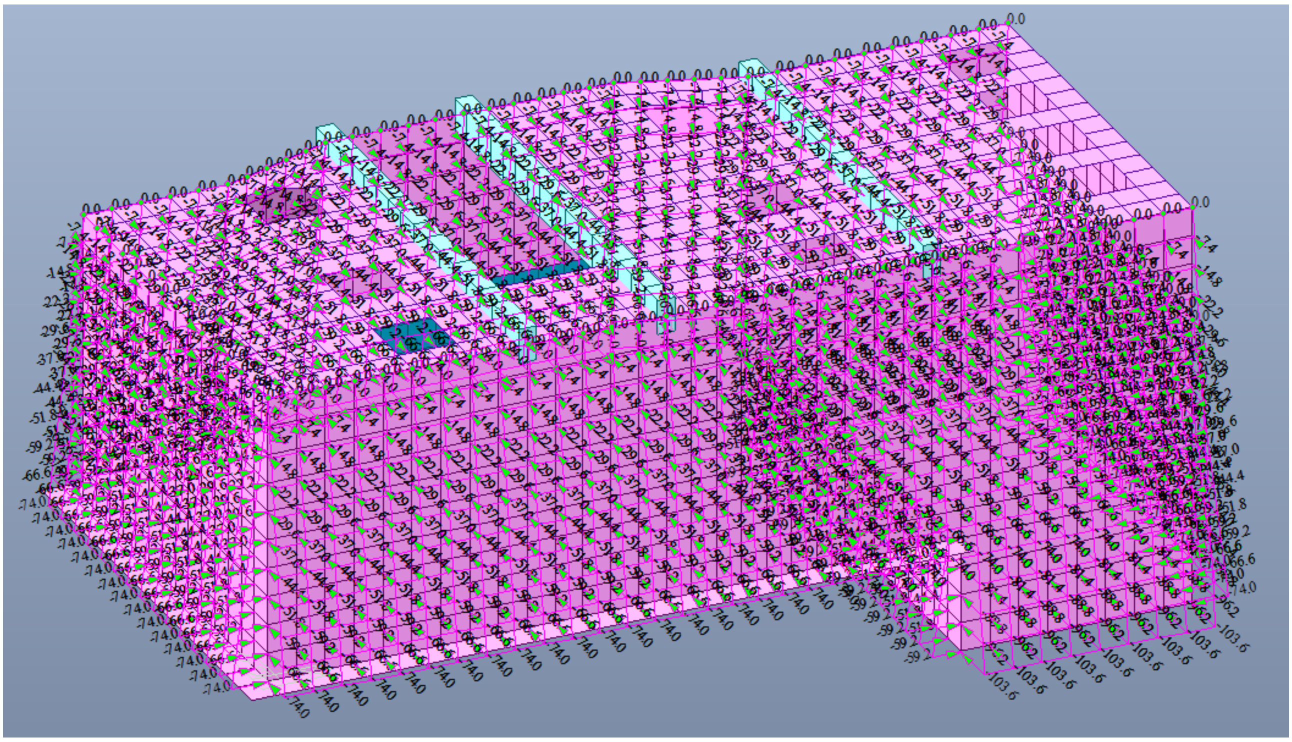
| No | Name | Active | Type | DL(ST) | SST(ST) | SSTF(ST) | SSS(ST) | PG(ST) | PL(ST) | PP(ST) | SSP(ST) | SGAL(ST) | P ZAV(ST) | VC1(ST) | VC2(ST) | VC3(ST) | VC4(ST) | ET X(ST) | ET Y(ST) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SLU1 | Active | Add | 1.3000 | 1.3000 | | | 1.3000 | | 1.3000 | 1.3000 | | | | | | | | |
| 2 | SLU 2 | Active | Add | 1.3000 | 1.3000 | | | 1.3000 | 1.3000 | 1.3000 | 1.3000 | | | | | | | | |
| 3 | SLU 3 | Active | Add | 1.3000 | 1.3000 | | 1.5000 | 1.3000 | 1.3000 | 1.3000 | 1.3000 | | | | | | | | |
| 4 | SLU 4 | Active | Add | 1.3000 | | 1.3000 | | 1.3000 | | 1.3000 | 1.3000 | 1.3000 | 1.3000 | | | | | | |
| 5 | SLU 5 | Active | Add | 1.3000 | 1.3000 | | | 1.3000 | 1.3000 | 1.3000 | 1.3000 | | | 1.5000 | | | | | |
| 6 | SLU 6 | Active | Add | 1.3000 | 1.3000 | | | 1.3000 | 1.3000 | 1.3000 | 1.3000 | | | | 1.5000 | | | | |
| 7 | SLU 7 | Active | Add | 1.3000 | 1.3000 | | | 1.3000 | 1.3000 | 1.3000 | 1.3000 | | | | | 1.5000 | | | |
| 8 | SLU 8 | Active | Add | 1.3000 | 1.3000 | | | 1.3000 | 1.3000 | 1.3000 | 1.3000 | | | | | | 1.5000 | | |
| 9 | SLU 9 | Active | Add | 1.3000 | | 1.3000 | | 1.3000 | | 1.3000 | 1.3000 | | | | | | | | |
| 10 | SLV 1 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | | 1.0000 | 1.0000 | | | | | | | 1.0000 | 0.3000 |
| 11 | SLV 2 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | | 1.0000 | 1.0000 | | | | | | | -1.0000 | 0.3000 |
| 12 | SLV 3 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | | 1.0000 | 1.0000 | | | | | | | 1.0000 | -0.3000 |
| 13 | SLV 4 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | | 1.0000 | 1.0000 | | | | | | | -1.0000 | -0.3000 |
| 14 | SLV 5 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | | 1.0000 | 1.0000 | | | | | | | 0.3000 | 1.0000 |
| 15 | SLV 6 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | | 1.0000 | 1.0000 | | | | | | | -0.3000 | 1.0000 |
| 16 | SLV 7 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | | 1.0000 | 1.0000 | | | | | | | 0.3000 | -1.0000 |
| 17 | SLV 8 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | | 1.0000 | 1.0000 | | | | | | | -0.3000 | -1.0000 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | SLE R1 | Active | Add | 1.0000 | 1.0000 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | | |
| 19 | SLE R2 | Active | Add | 1.0000 | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | | |
| 20 | SLE R3 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | 1.0000 | | | |
| 21 | SLE R4 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | 1.0000 | | |
| 22 | SLE R5 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | 1.0000 | |
| 23 | SLE R6 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | | |
| 24 | SLE F1 | Active | Add | 1.0000 | 1.0000 | | 0.5000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | | |
| 25 | SLE F2 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | 0.5000 | | | |
| 26 | SLE F3 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | 0.5000 | | |
| 27 | SLE F4 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | 0.5000 | |
| 28 | SLE F5 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | | 0.5000 |
| 29 | SLE QP1 | Active | Add | 1.0000 | 1.0000 | | 0.3000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | | |
| 30 | SLE QP2 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | 0.3000 | | | |
| 31 | SLE QP3 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | 0.3000 | | |
| 32 | SLE QP4 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | 0.3000 | |
| 33 | SLE QP5 | Active | Add | 1.0000 | 1.0000 | | | 1.0000 | 1.0000 | 1.0000 | 1.0000 | | | | | | 0.3000 |

Nelle immagini seguenti si riportano le assegnazioni dei carichi:



***Assegnazione spinta statica del terreno (SST) - [kN/mq***

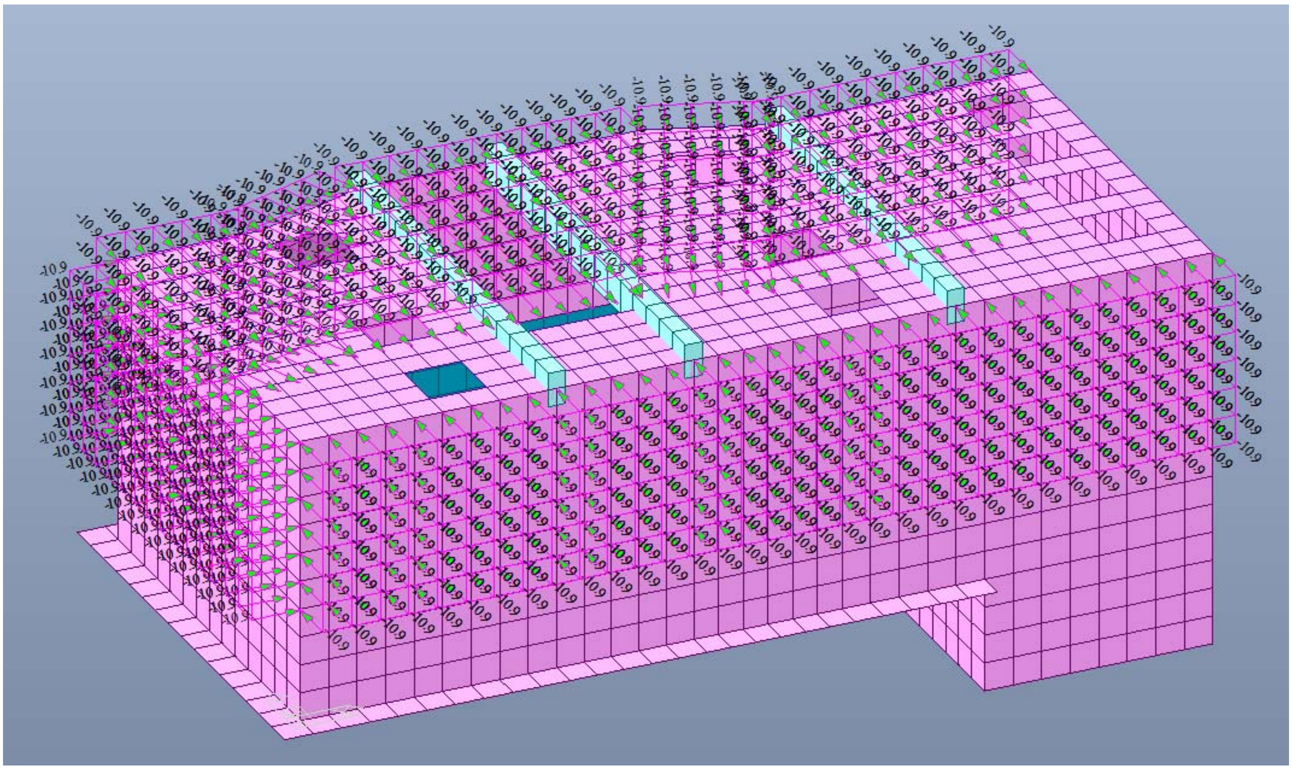


***Assegnazione spinta statica del terreno in falda (SSTF) - [kN/mq]***

***Assegnazione spinta statica del terreno con falda su tutti i lati (SSTF1) - [kN/mq]***

***Assegnazione spinta statica liquame (SSL) - [kN/mq]***

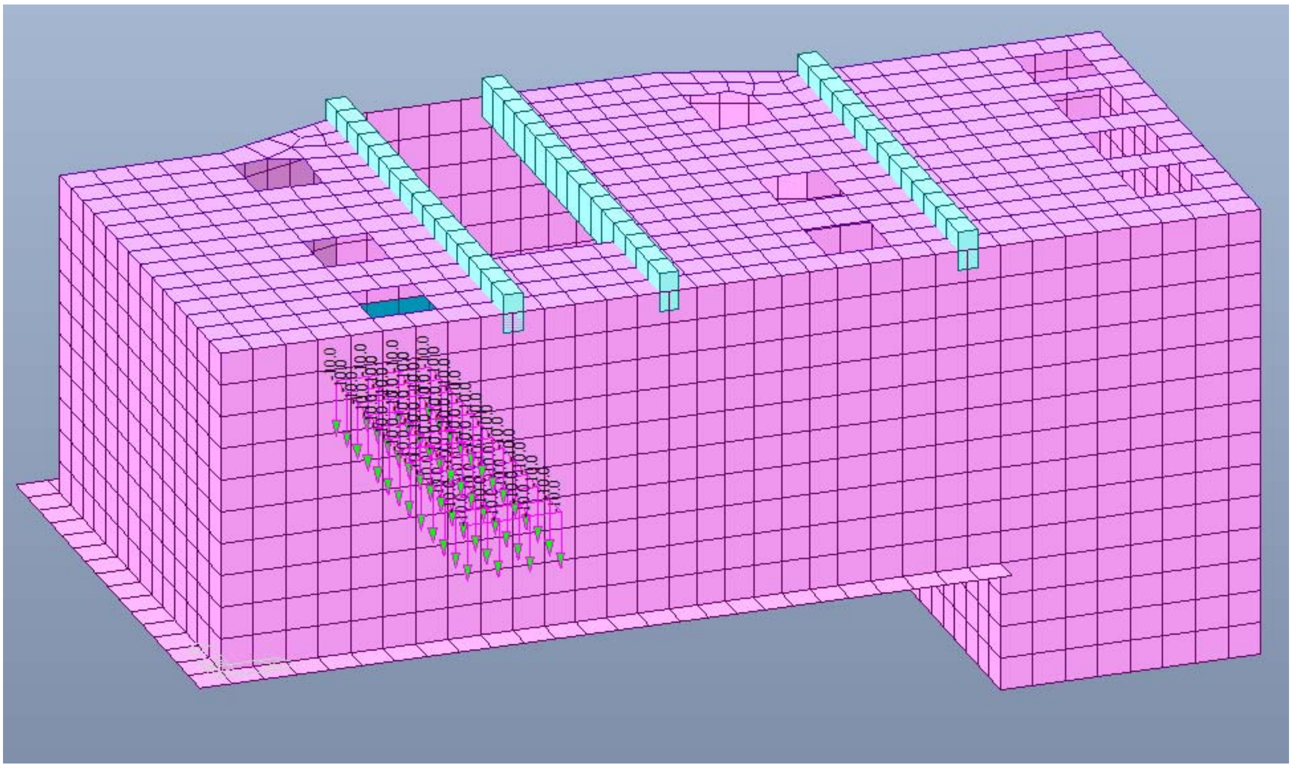
***Assegnazione sottospinta galleggiamento (S GAL) - [kN/mq]***



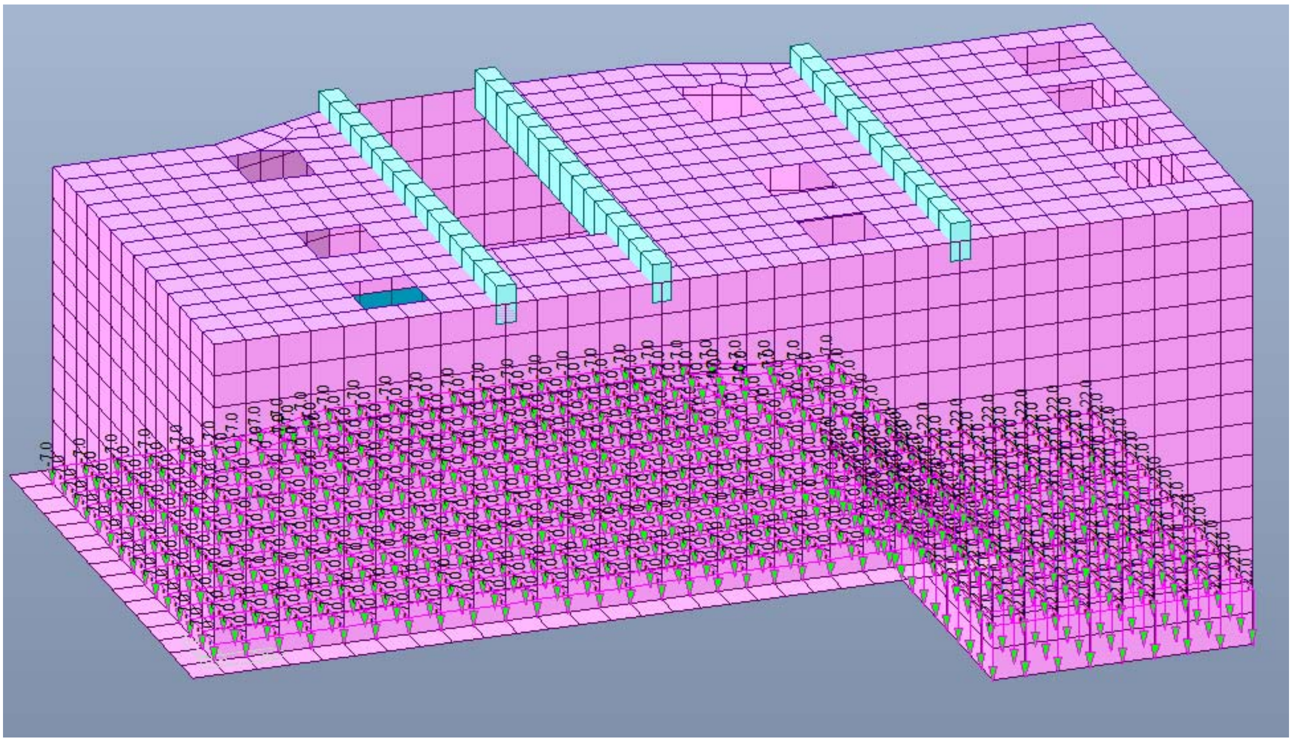
*Assegnazione spinta statica sovraccarico (SSS) - [kN/mq]*

*Assegnazione carico variabile manutenzione (VM) - [kN/mq]*

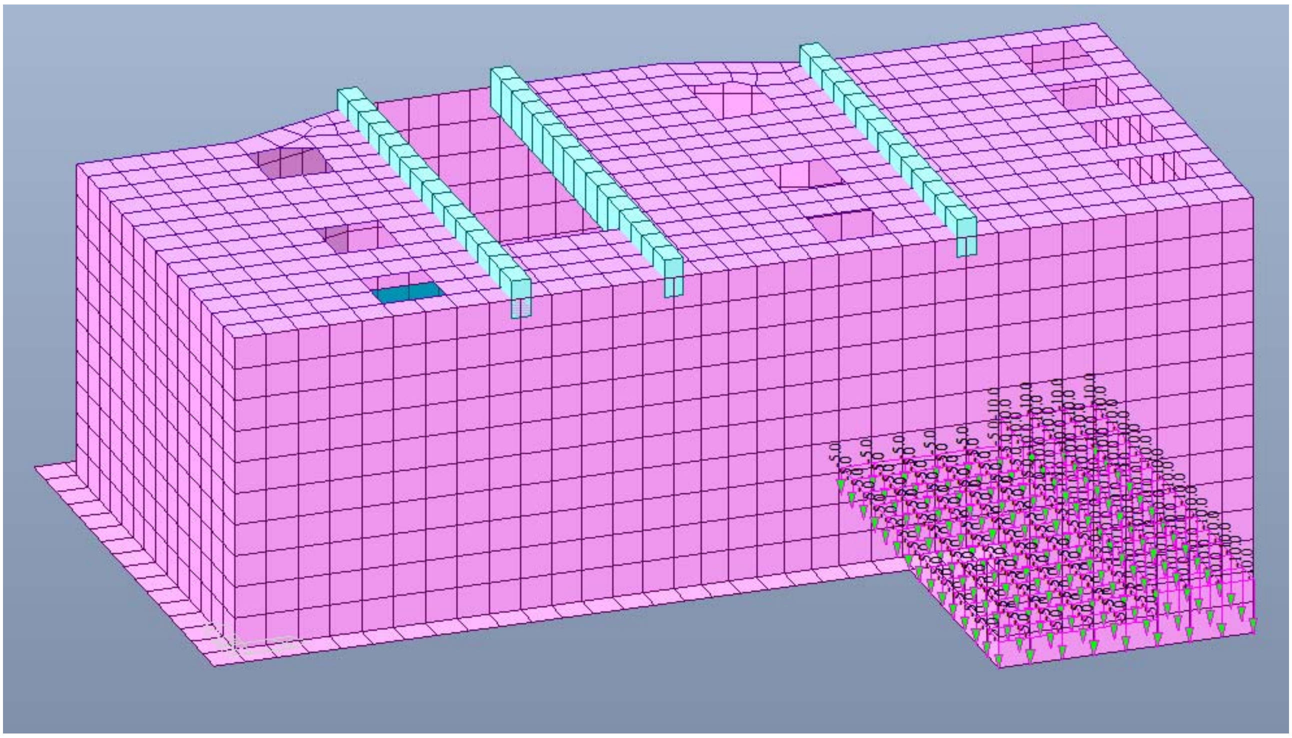
*Assegnazione carico permanente terreno su zoccolo di fondazione (PT) - [kN/mq]*



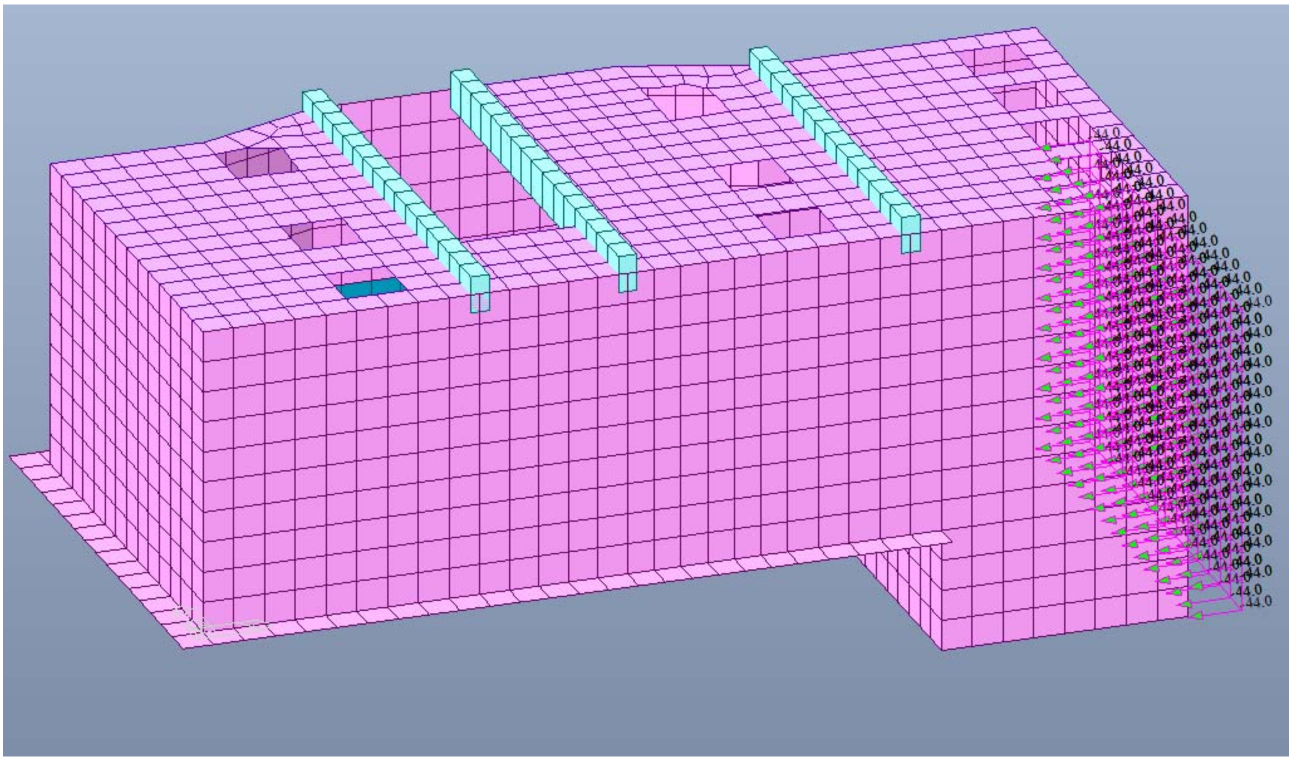
***Assegnazione carico permanente griglie (PG) - [kN/mq]***



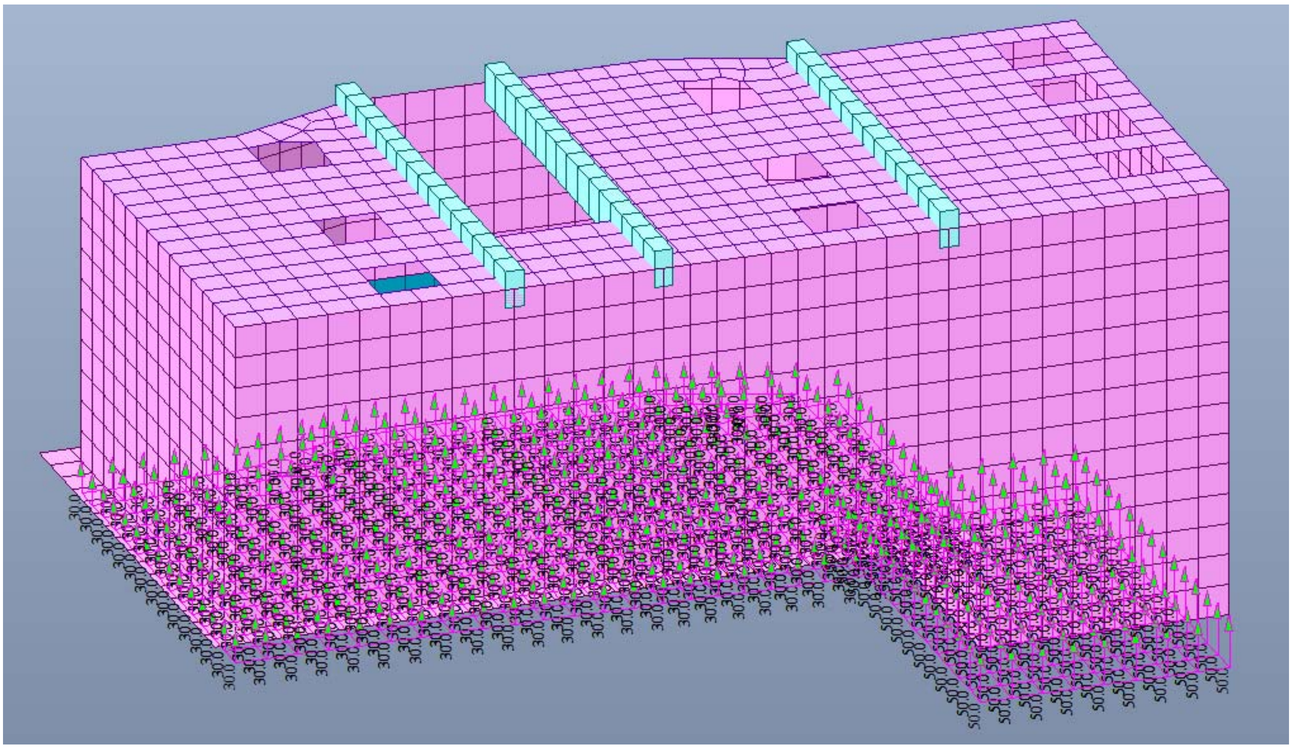
***Assegnazione carico permanente liquame (PL) - [kN/mq]***



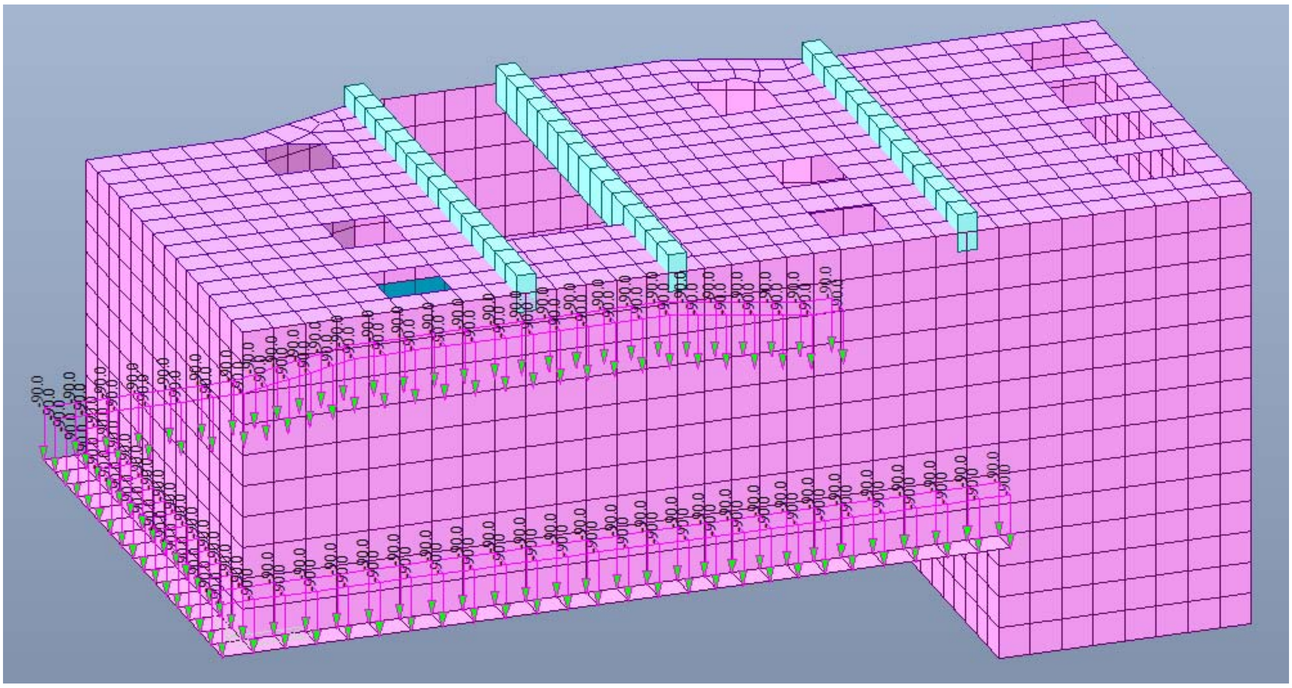
***Assegnazione carico permanente pompe e pendenze (PP) - [kN/mq]***



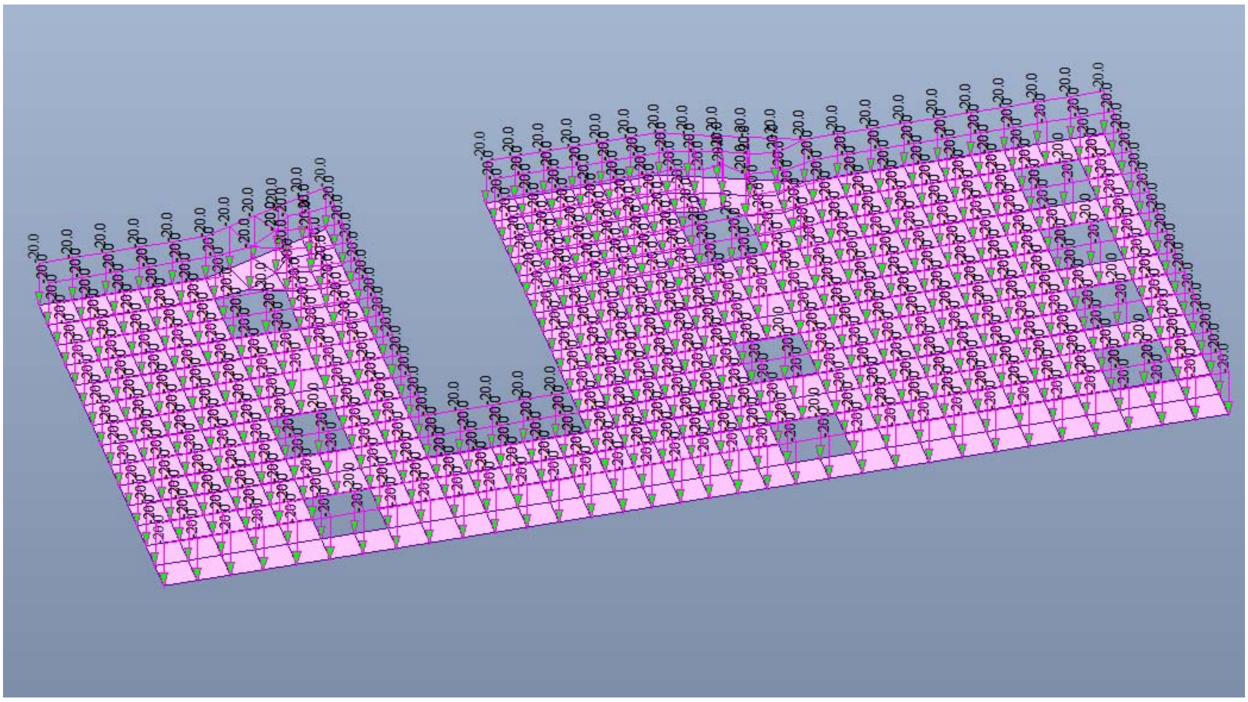
***Assegnazione sovraccarico fabbricato grigliatura fine e dissabbiatura (SSP) - [kN/mq]***



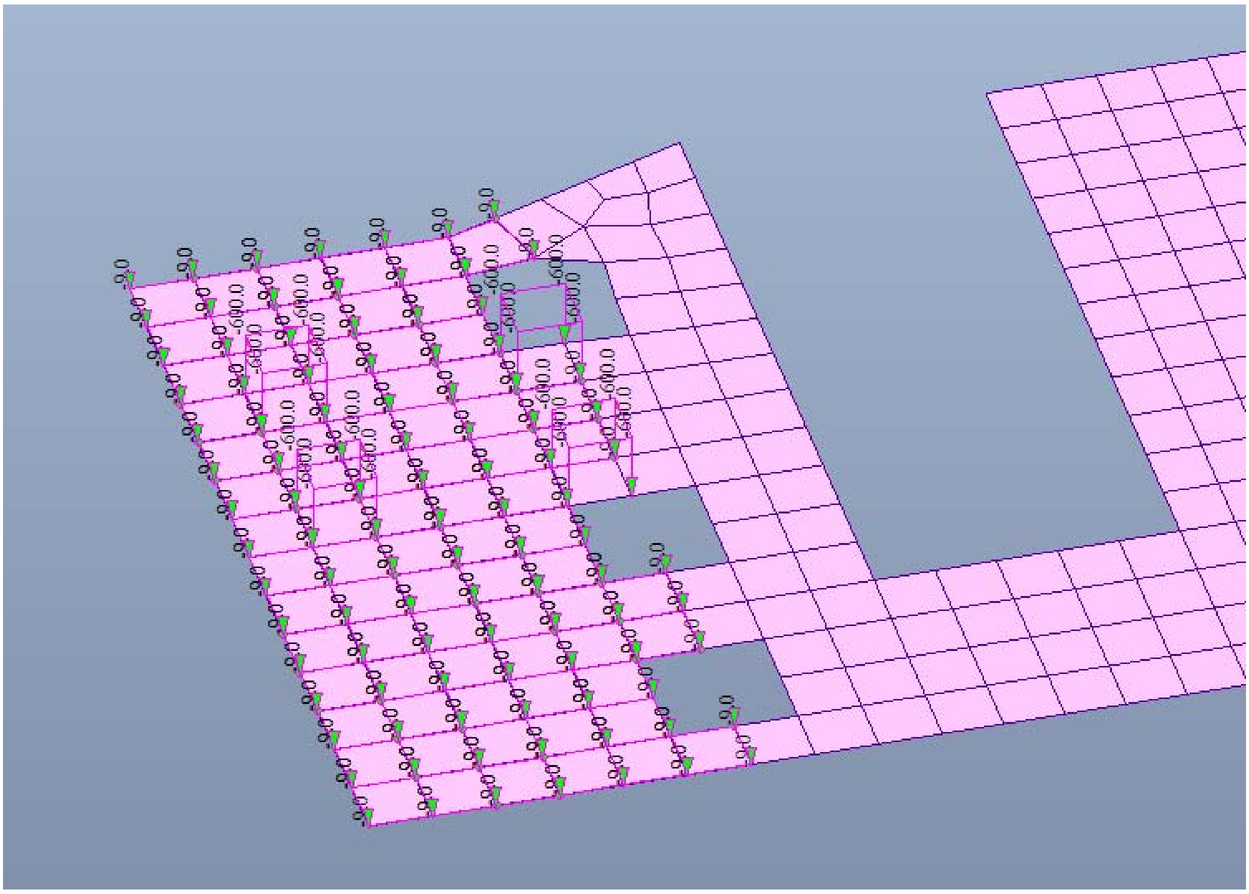
***Assegnazione sotto spinta galleggiamento (S GAL) - [kN/mq]***



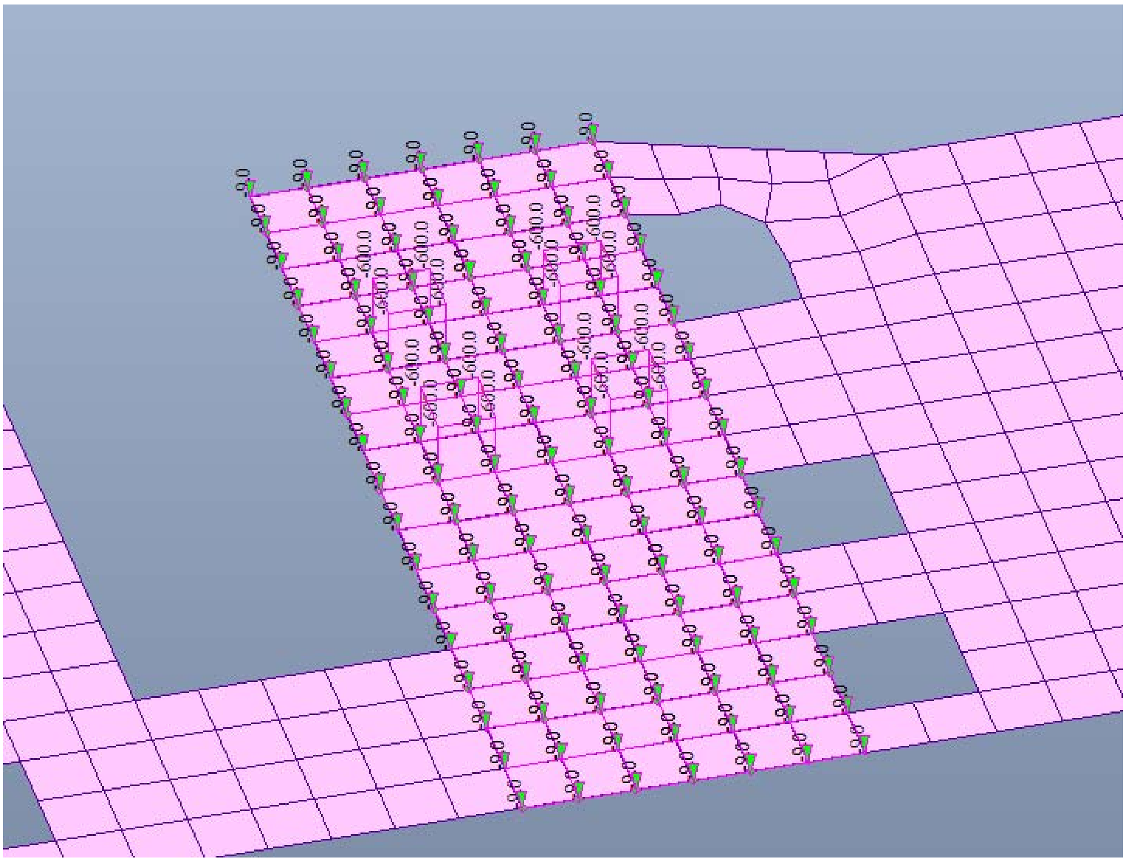
***Assegnazione peso terreno di zavorra (P ZAV) - [kN/mq]***



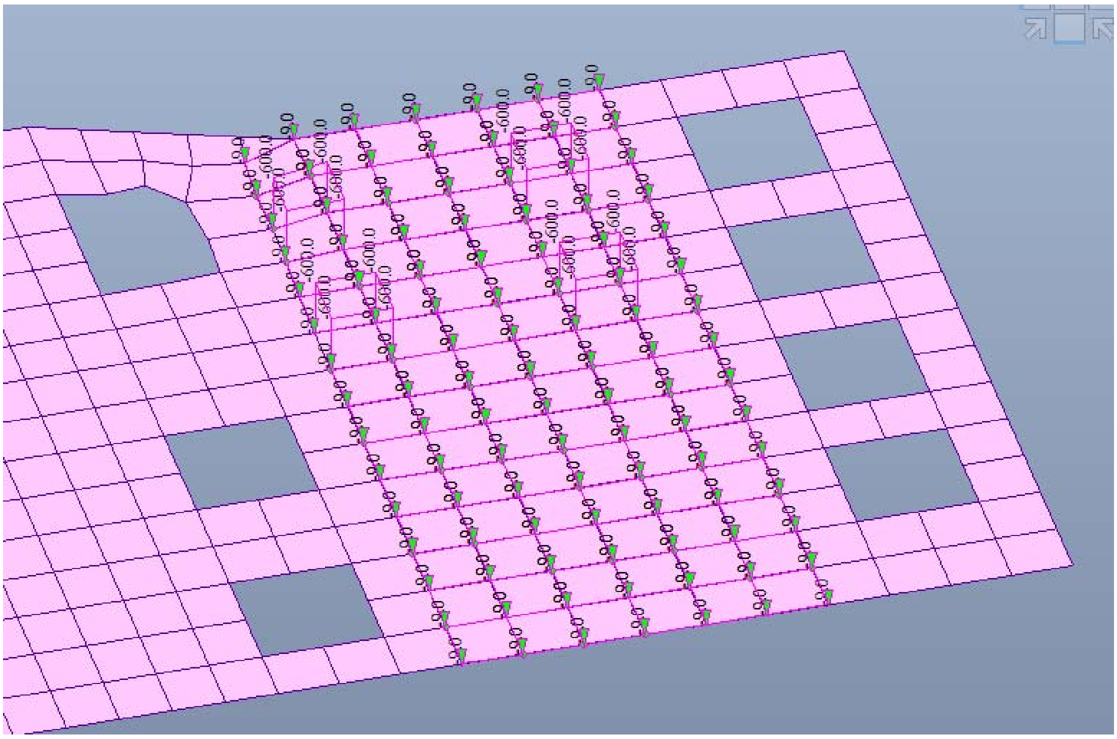
***Assegnazione variabile copertura 1 (VC 1) - [kN/mq]***



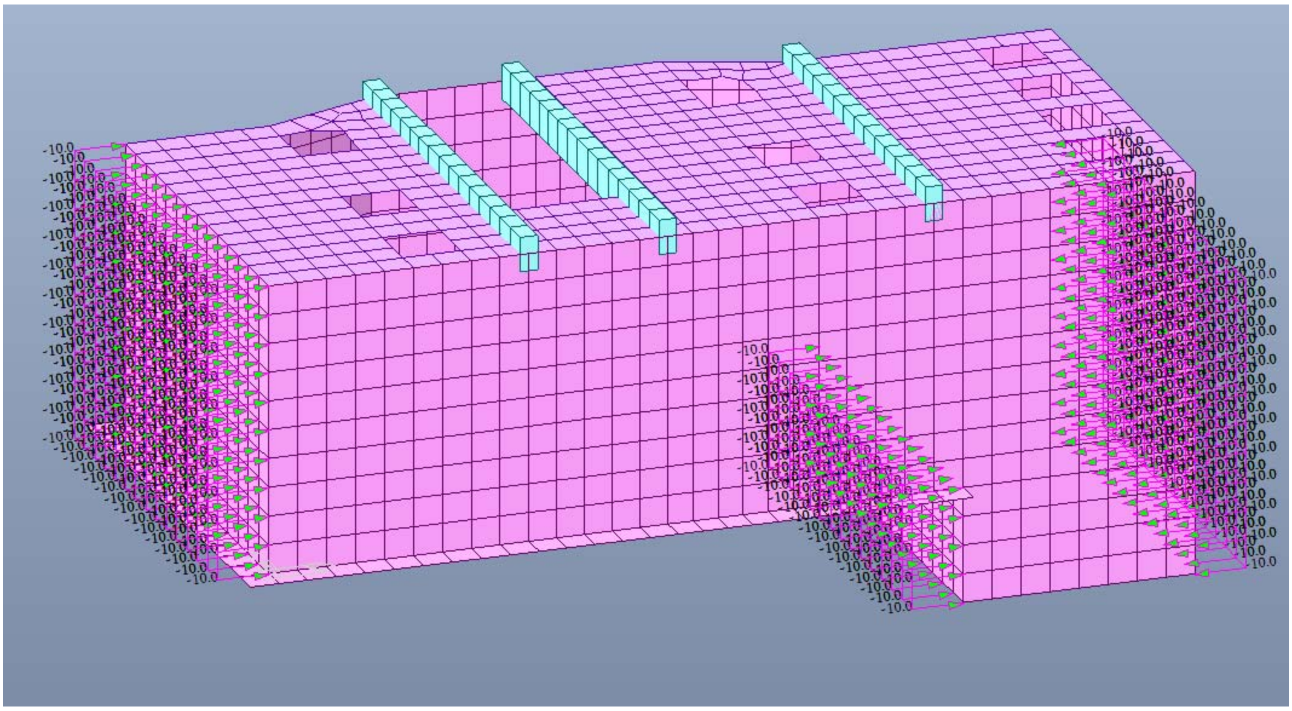
***Assegnazione variabile copertura 2 (VC 2) - [kN/mq]***



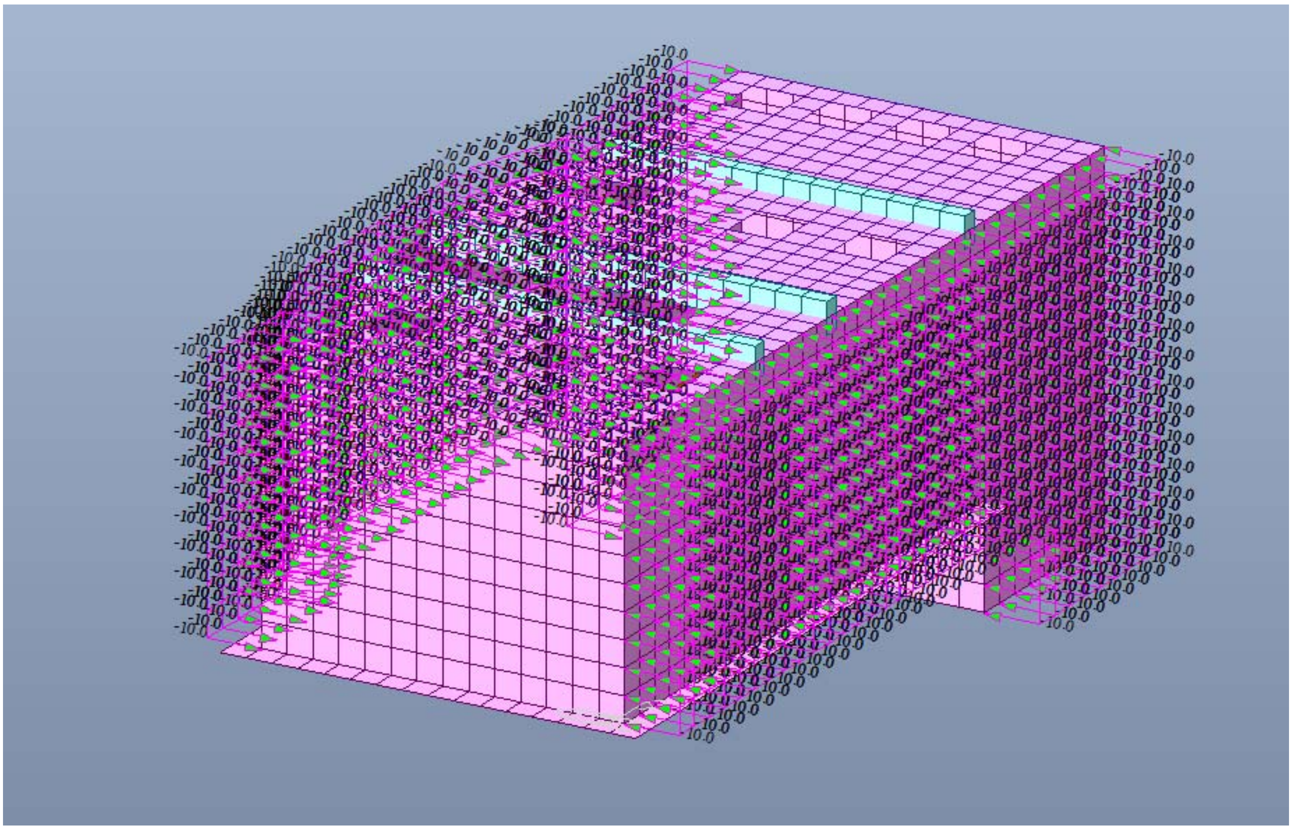
*Assegnazione variabile copertura 3 (VC 3) - [kN/mq]*



*Assegnazione variabile copertura 4 (VC 4) - [kN/mq]*



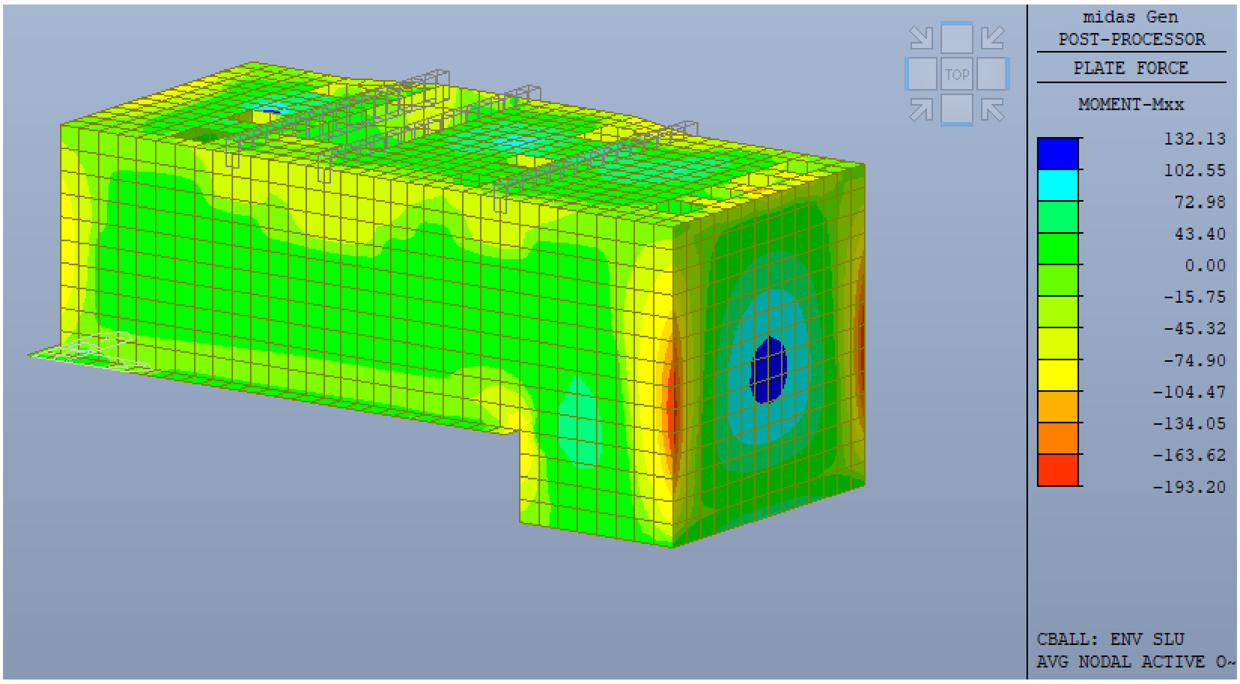
***Assegnazione sovra spinta sismica terreno X (ET X) - [kN/mq]***



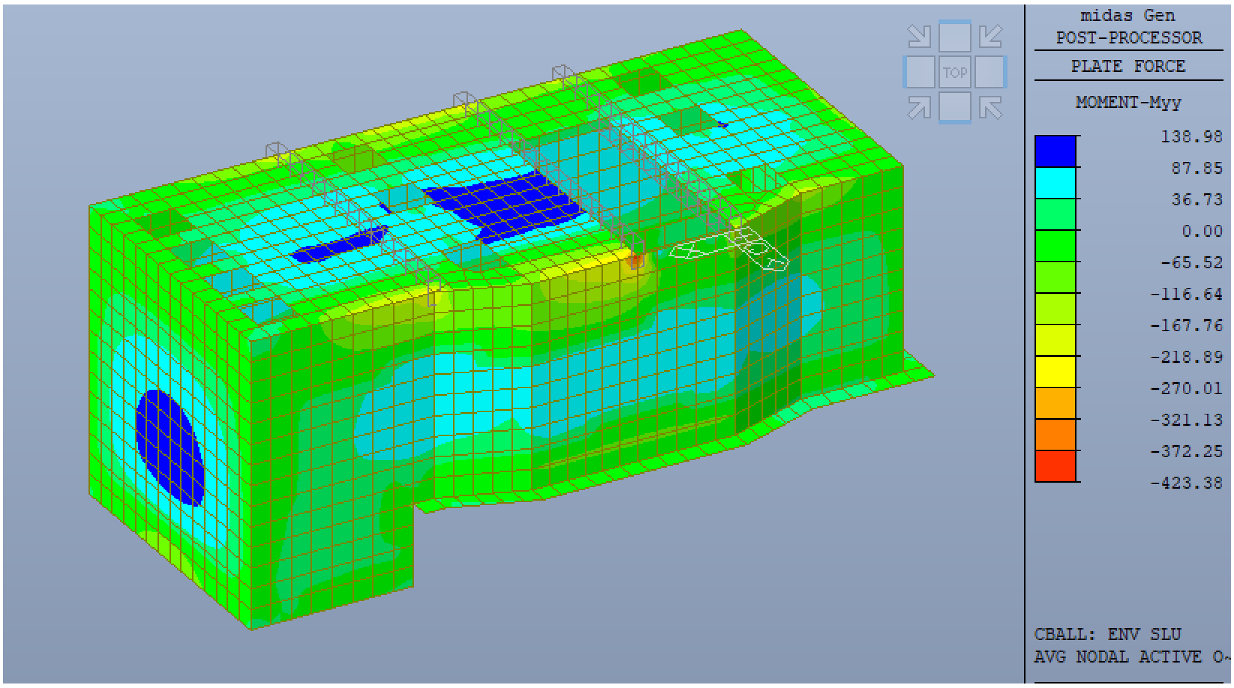
***Assegnazione sovra spinta sismica terreno Y (ET Y) - [kN/mq]***

## 1.3 Sollecitazioni

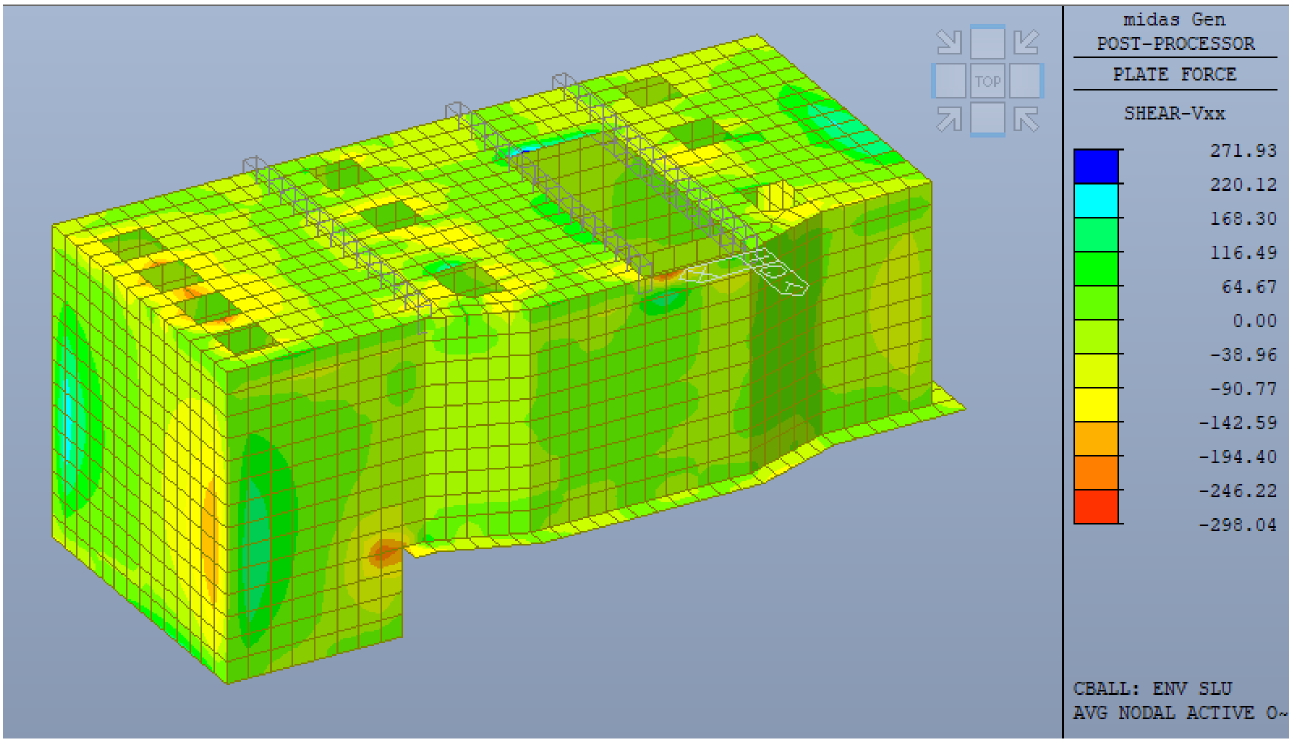
Nel presente paragrafo vengono riportate per via grafica le sollecitazioni sulla struttura indotte dai carichi applicati, per le varie combinazioni di carico statiche e sismiche.



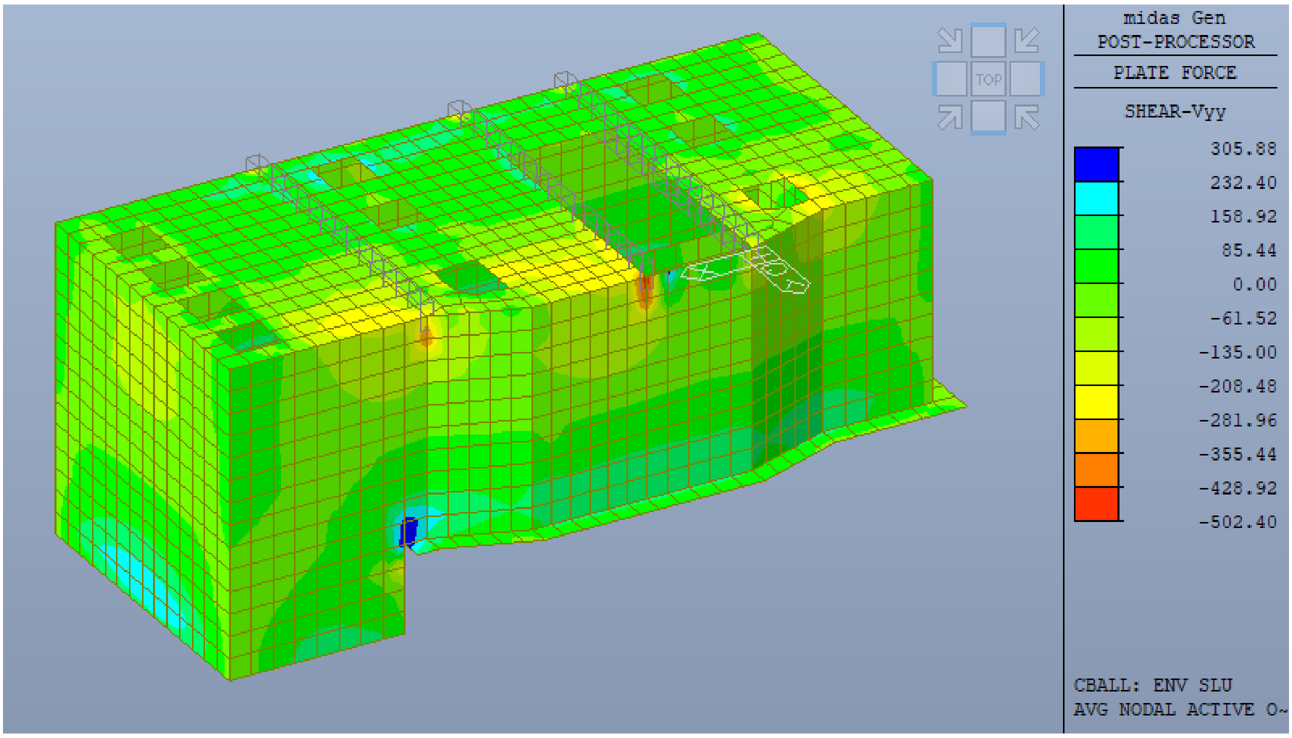

***Momento flettente membranale Mxx – inviluppo SLU [kN*m/m]***



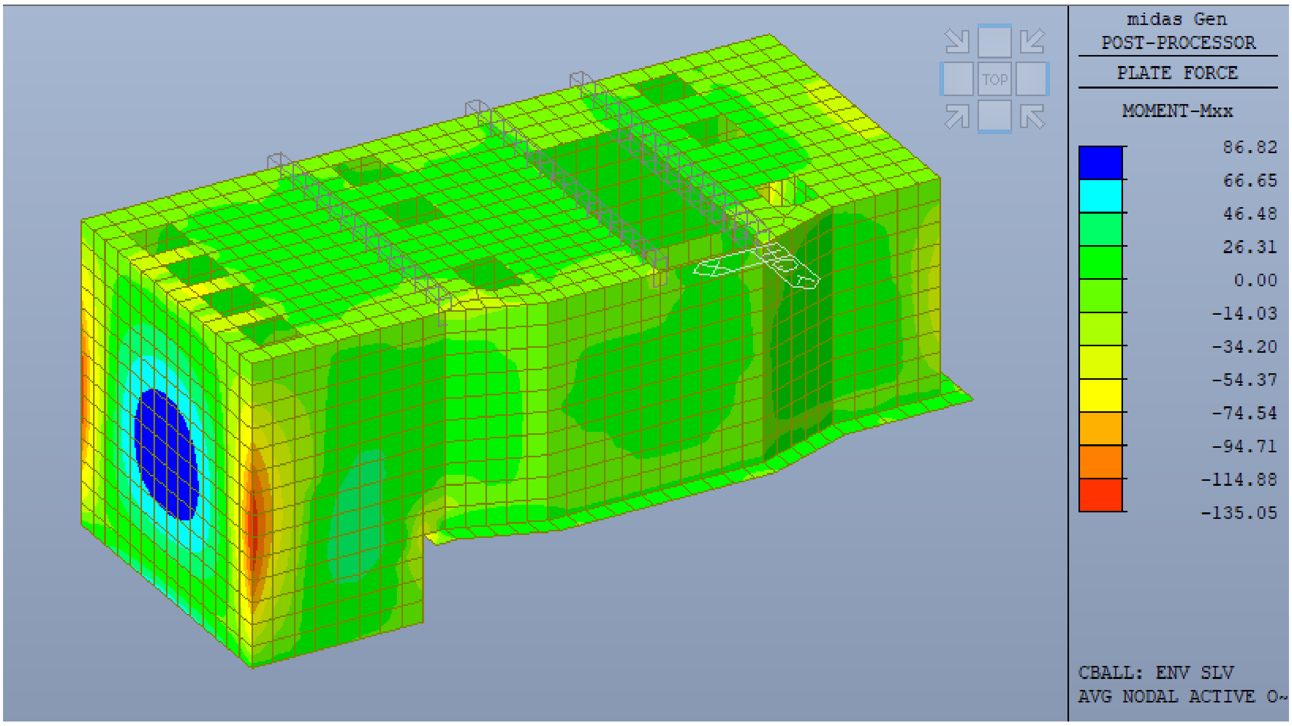

***Momento flettente membranale Myy – inviluppo SLU [kN*m/m]***



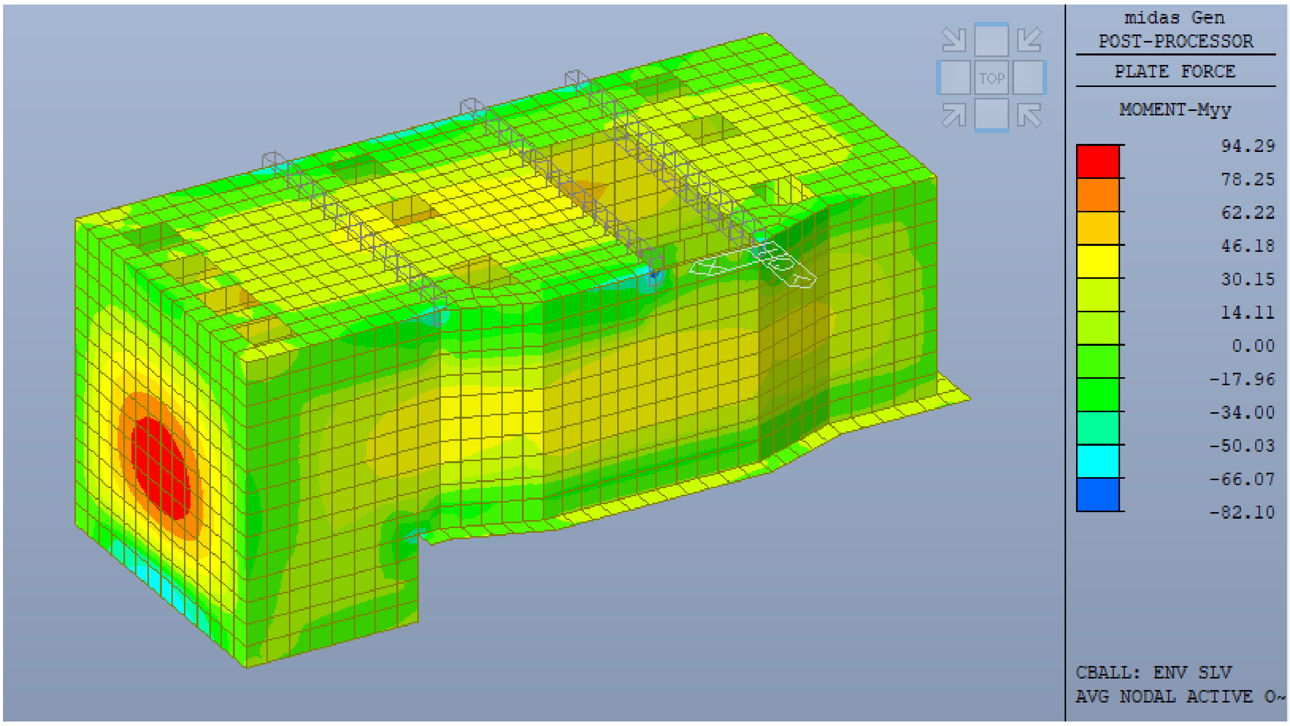

*Sollecitazione tagliante Vxx – inviluppo SLU [kN/m]*



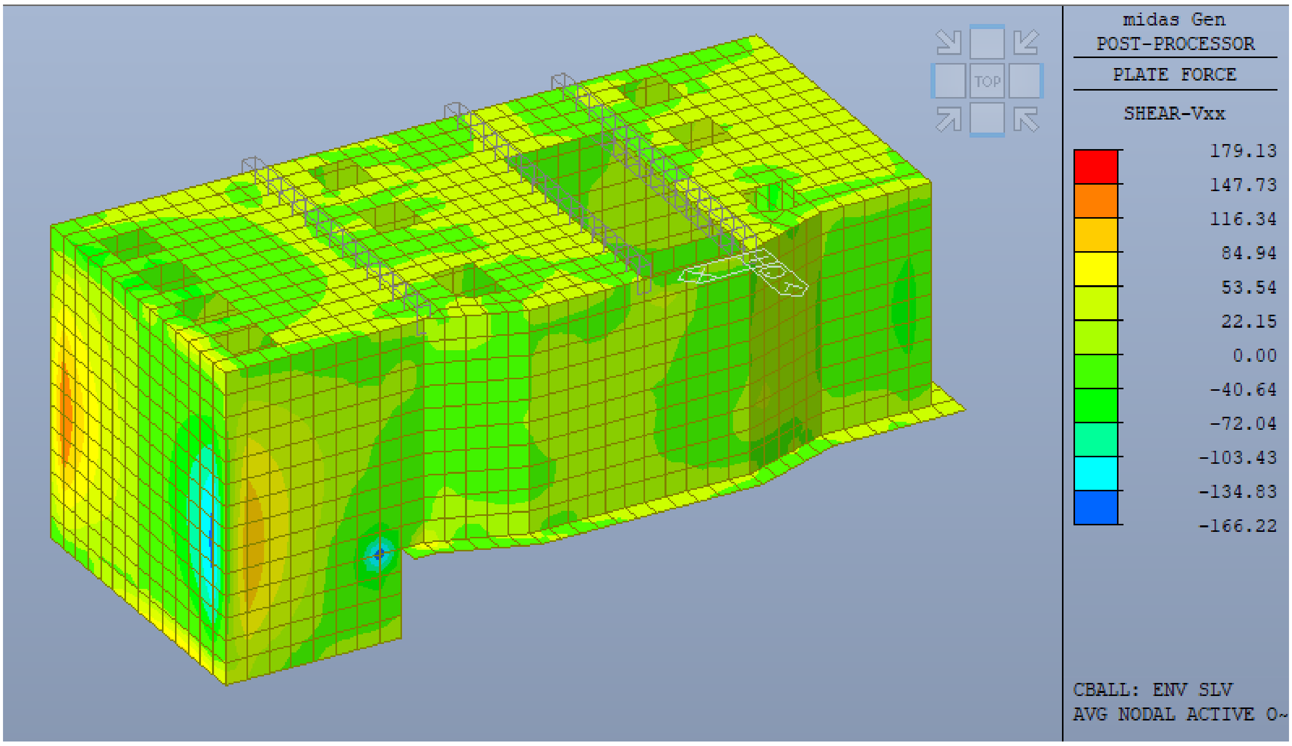

*Sollecitazione tagliante Vyy – inviluppo SLU [kN/m]*



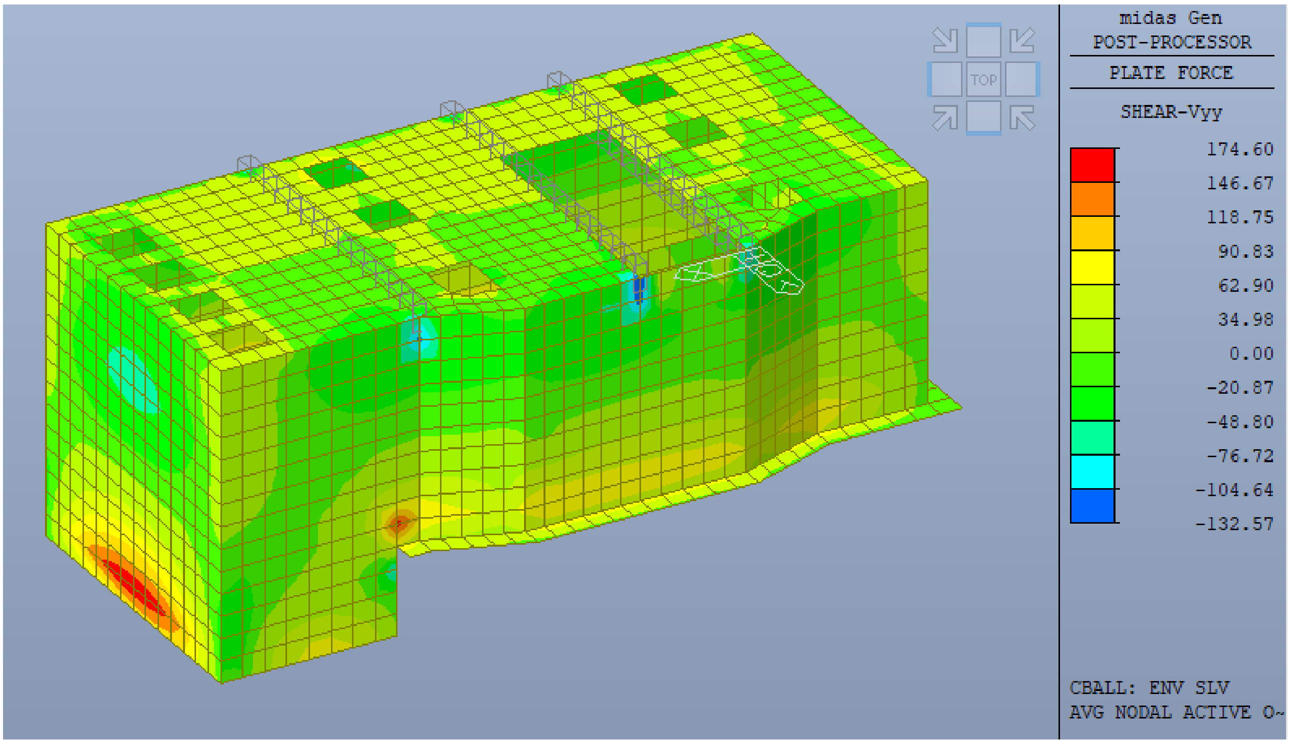

***Momento flettente membranale Mxx – inviluppo SLV [kN*m/m]***



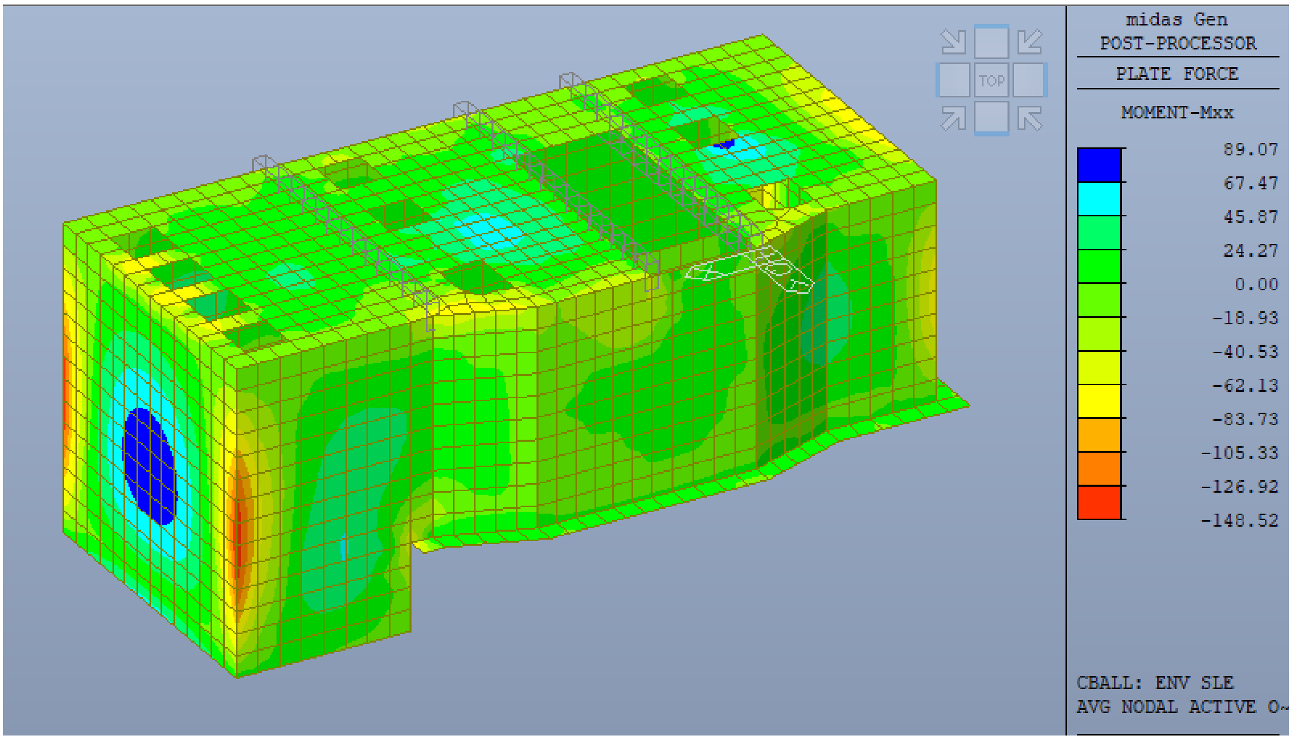

***Momento flettente membranale Myy – inviluppo SLV [kN*m/m]***



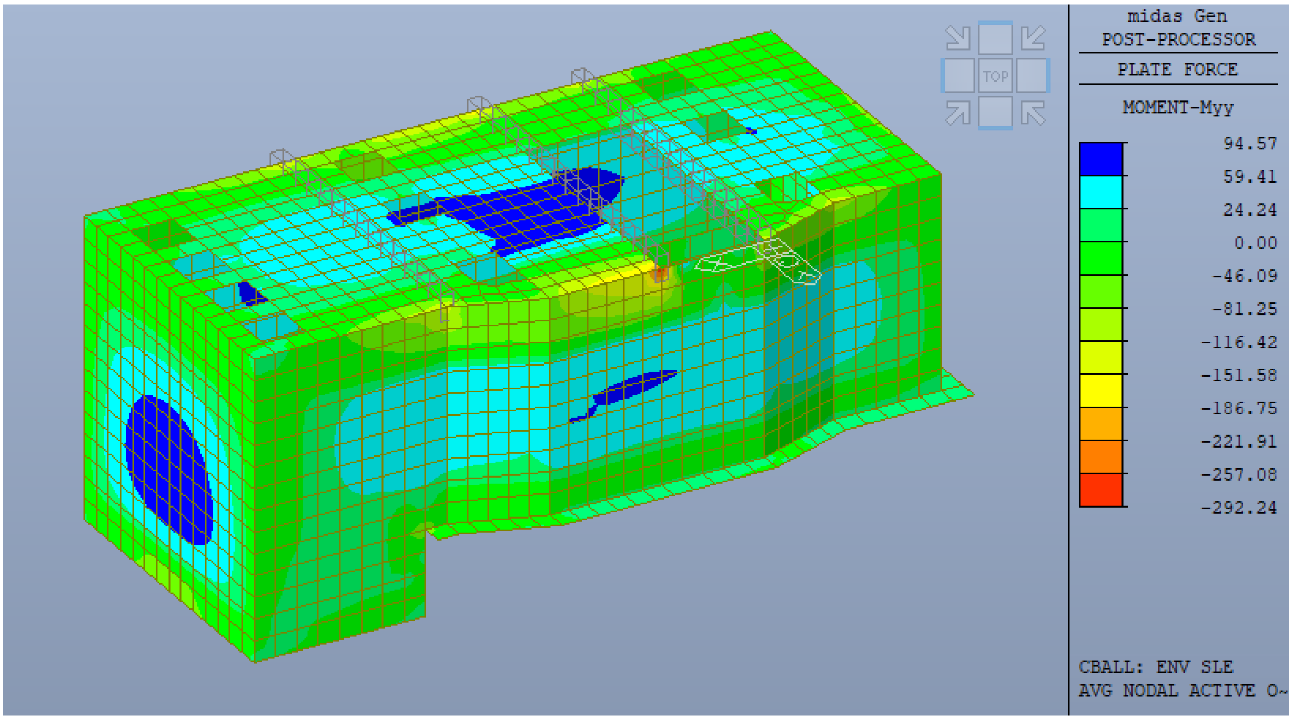

***Sollecitazione tagliante Vxx – inviluppo SLV [kN/m]***



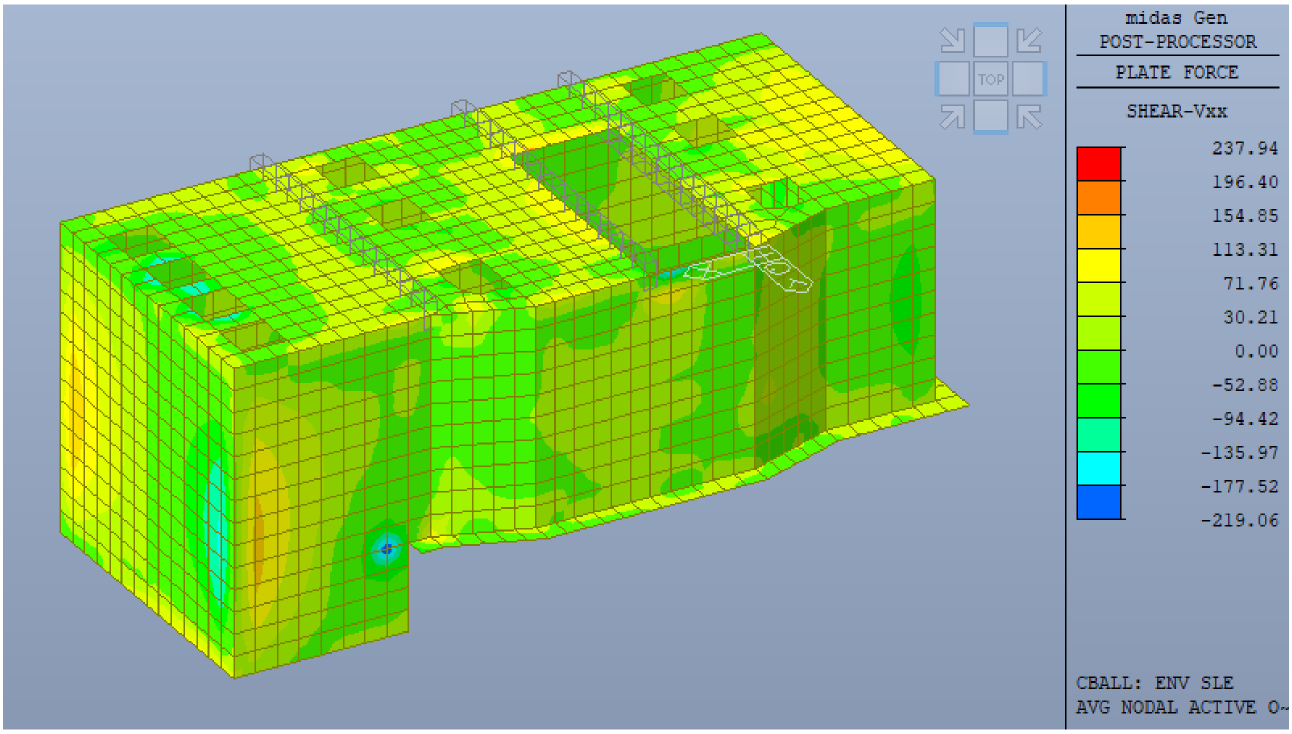

***Sollecitazione tagliante Vyy – inviluppo SLV [kN/m]***



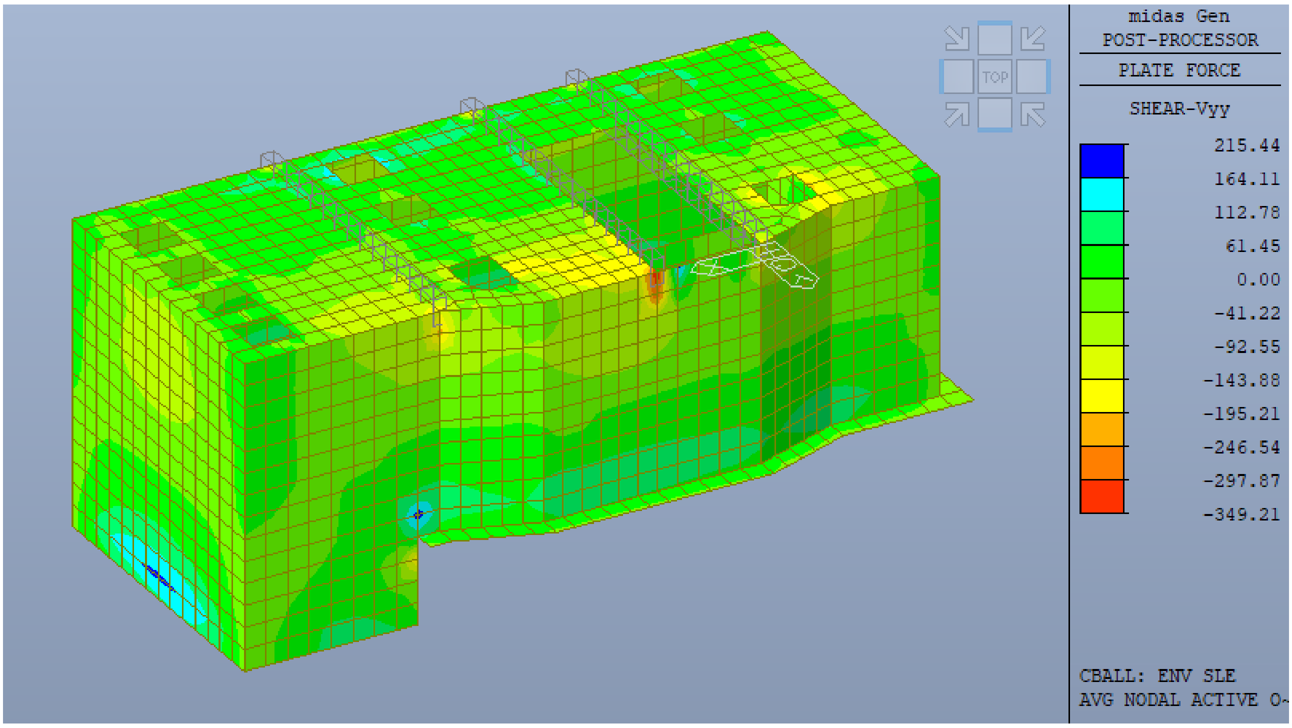

***Momento flettente membranale Mxx – inviluppo SLE [kN*m/m]***




***Momento flettente membranale Myy – inviluppo SLE [kN*m/m]***



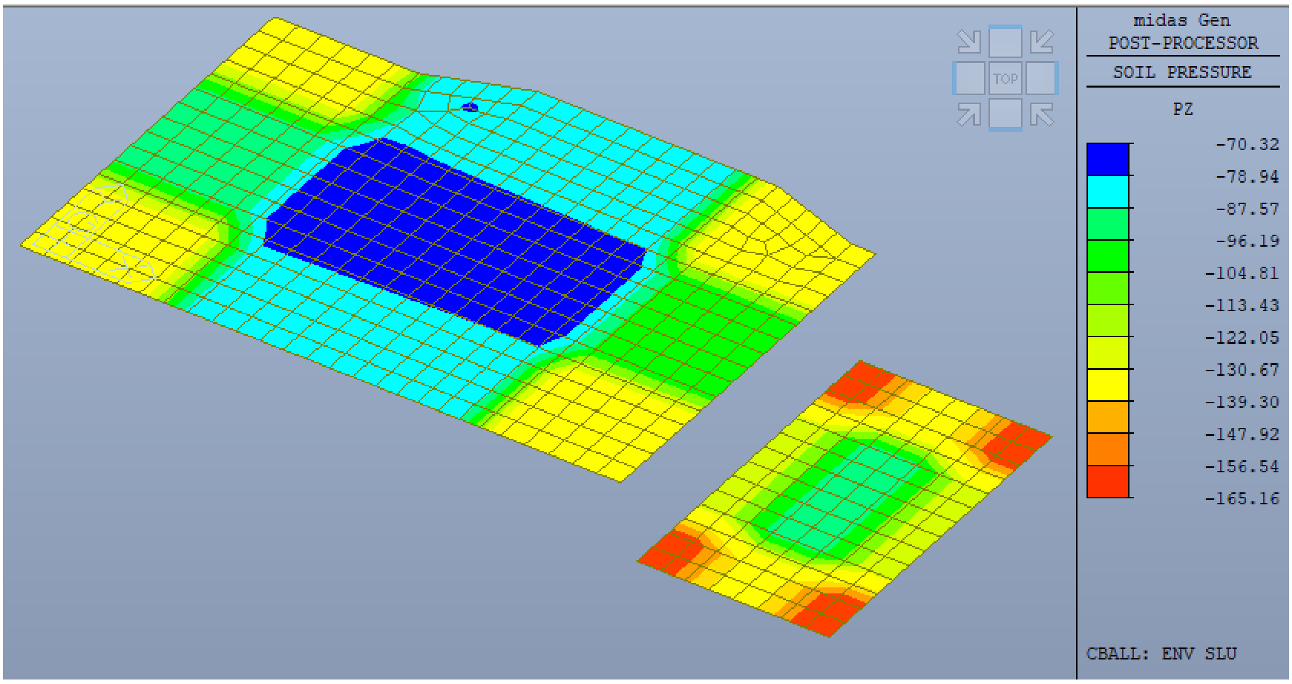

*Sollecitazione tagliante Vxx – inviluppo SLE [kN/m]*



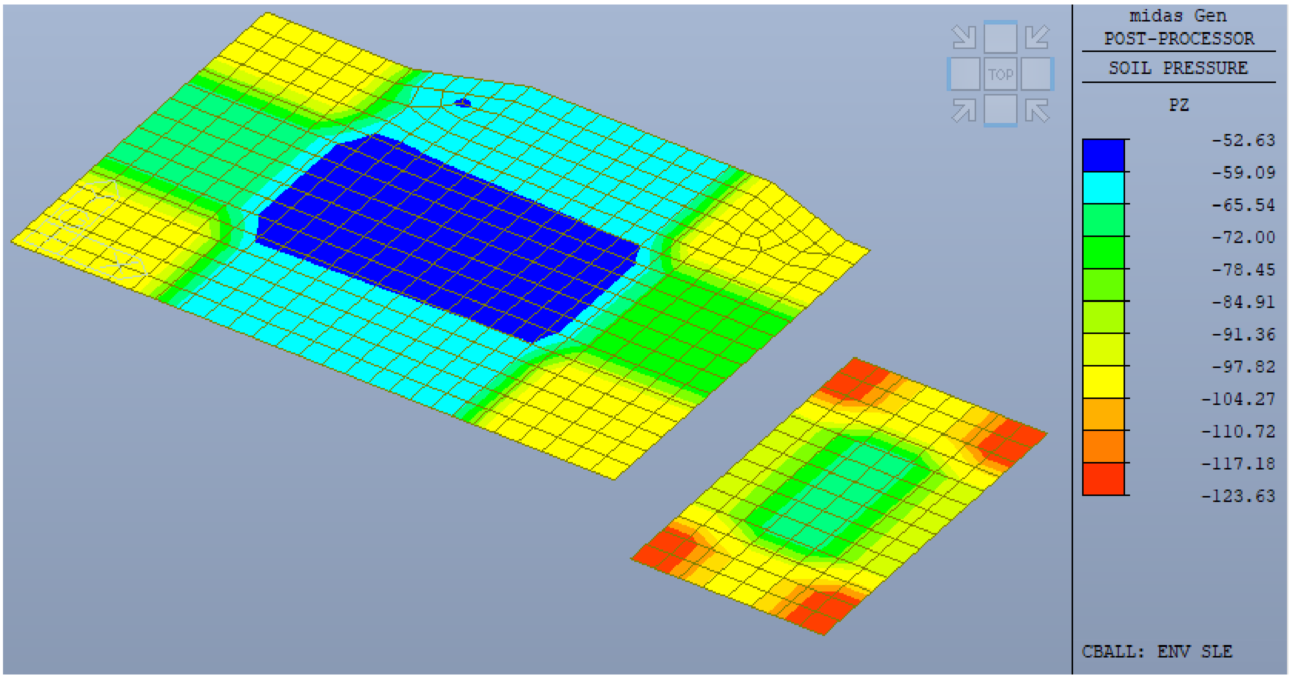

*Sollecitazione tagliante Vyy – inviluppo SLE [kN/m]*

## 1.4 Reazioni vincolari e pressioni sul terreno

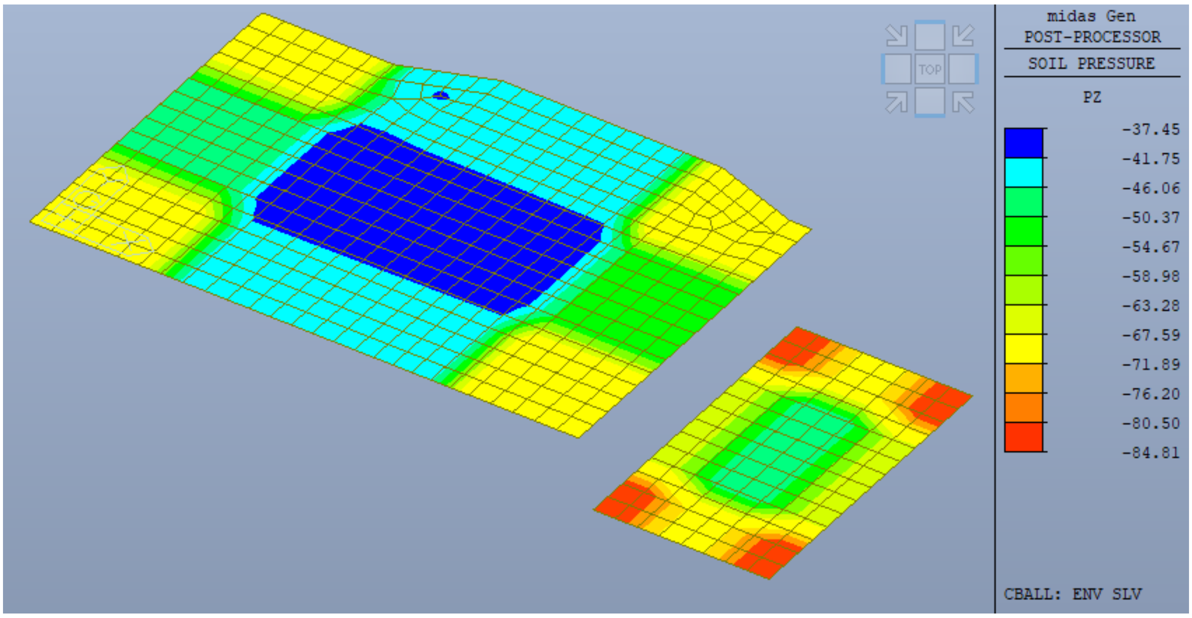
Nel presente paragrafo vengono riportate le reazioni vincolari e le pressioni sul terreno.




***Pressioni sul terreno ENV SLU***




***Pressioni sul terreno ENV SLE***




***Pressioni sul terreno ENV SLV***

| Load | FX (kN) | FY (kN) | FZ (kN) |
|---|---|---|---|
| | SUMMATION OF REACTION FORCES P | | |
| Load | FX (kN) | FY (kN) | FZ (kN) |
| SLU1 | 1445.080000 | -0.000000 | 9229.531042 |
| SLU 2 | 1445.080000 | -0.000000 | 10839.321042 |
| SLU 3 | 1101.100000 | -0.000000 | 10839.321042 |
| SLU 4 | 1193.920000 | 0.000000 | 5824.181042 |
| SLU 5 | 1445.080000 | -0.000000 | 13627.226226 |
| SLU 6 | 1445.080000 | -0.000000 | 11990.762768 |
| SLU 7 | 1445.080000 | -0.000000 | 11844.963899 |
| SLU 8 | 1445.080000 | -0.000000 | 11982.894816 |
| SLU 9 | 1193.920000 | -0.000000 | 9229.531042 |
| SLV 1 | 971.600000 | -0.000000 | 7099.639263 |
| SLV 2 | 1251.600000 | -0.000000 | 7099.639263 |
| SLV 3 | 971.600000 | -0.000000 | 7099.639263 |
| SLV 4 | 1251.600000 | -0.000000 | 7099.639263 |
| SLV 5 | 1069.600000 | -0.000000 | 7099.639263 |
| SLV 6 | 1153.600000 | -0.000000 | 7099.639263 |
| SLV 7 | 1069.600000 | -0.000000 | 7099.639263 |
| SLV 8 | 1153.600000 | -0.000000 | 7099.639263 |
| SLE R1 | 882.280000 | -0.000000 | 8337.939263 |
| SLE R2 | 689.080000 | -0.000000 | 8337.939263 |
| SLE R3 | 1111.600000 | -0.000000 | 10196.542719 |
| SLE R4 | 1111.600000 | -0.000000 | 9105.567081 |
| SLE R5 | 1111.600000 | -0.000000 | 9008.367835 |
| SLE R6 | 1111.600000 | -0.000000 | 8337.939263 |
| SLE F1 | 996.940000 | -0.000000 | 8337.939263 |
| SLE F2 | 1111.600000 | -0.000000 | 9267.240991 |
| SLE F3 | 1111.600000 | -0.000000 | 8721.753172 |
| SLE F4 | 1111.600000 | -0.000000 | 8673.153549 |
| SLE F5 | 1111.600000 | -0.000000 | 8719.130521 |
| SLE QP1 | 1042.804000 | -0.000000 | 8337.939263 |
| SLE QP2 | 1111.600000 | -0.000000 | 8895.520300 |
| SLE QP3 | 1111.600000 | -0.000000 | 8568.227608 |
| SLE QP4 | 1111.600000 | -0.000000 | 8539.067835 |
| SLE QP5 | 1111.600000 | -0.000000 | 8566.654018 |

***Reazioni vincolari***

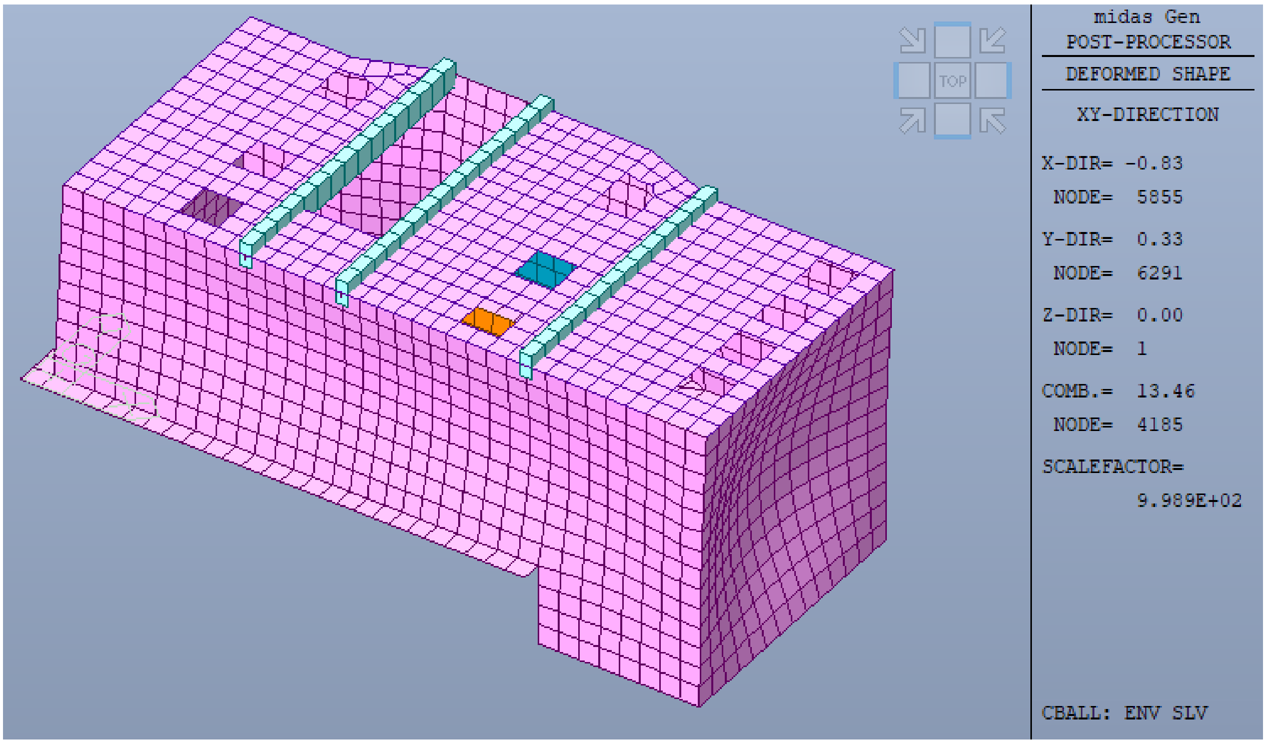
## 1.5 Deformazioni

Per le costruzioni ricadenti in classe d'uso III e IV si deve verificare che l'azione sismica di progetto non produca danni agli elementi costruttivi senza funzione strutturale tali da rendere temporaneamente non operativa la costruzione (rif §7.3.6.1 NTC 2018)

Nel caso delle costruzioni civili e industriali questa condizione si può ritenere soddisfatta quando gli spostamenti interpiano ottenuti dall'analisi in presenza dell'azione sismica di progetto relativa allo SLO siano inferiori ai 2/3 dei seguenti limiti:

- per tamponamenti collegati rigidamente alla struttura che interferiscono con la deformabilità della stessa: dr < 0,005 h
- per tamponamenti progettati in modo da non subire danni a seguito di spostamenti di interpiano drp, per effetto della loro deformabilità intrinseca ovvero dei collegamenti alla struttura: dr ≤ drp ≤ 0,01 h
- per costruzioni con struttura portante in muratura ordinaria: dr < 0,003 h
- per costruzioni con struttura portante in muratura armata: dr < 0,004 h

Premesso che l'opera in oggetto è completamente in c.a. e che quindi anche il superamento di questi limiti non produrrebbe alcun effetto, dall'immagine seguente si evince che lo spostamento massimo sotto l'azione sismica a SLV, quindi ben maggiore di quella a SLO è pari a circa 1 mm, quindi assolutamente trascurabile e testimone dell'elevatissima rigidezza del manufatto.

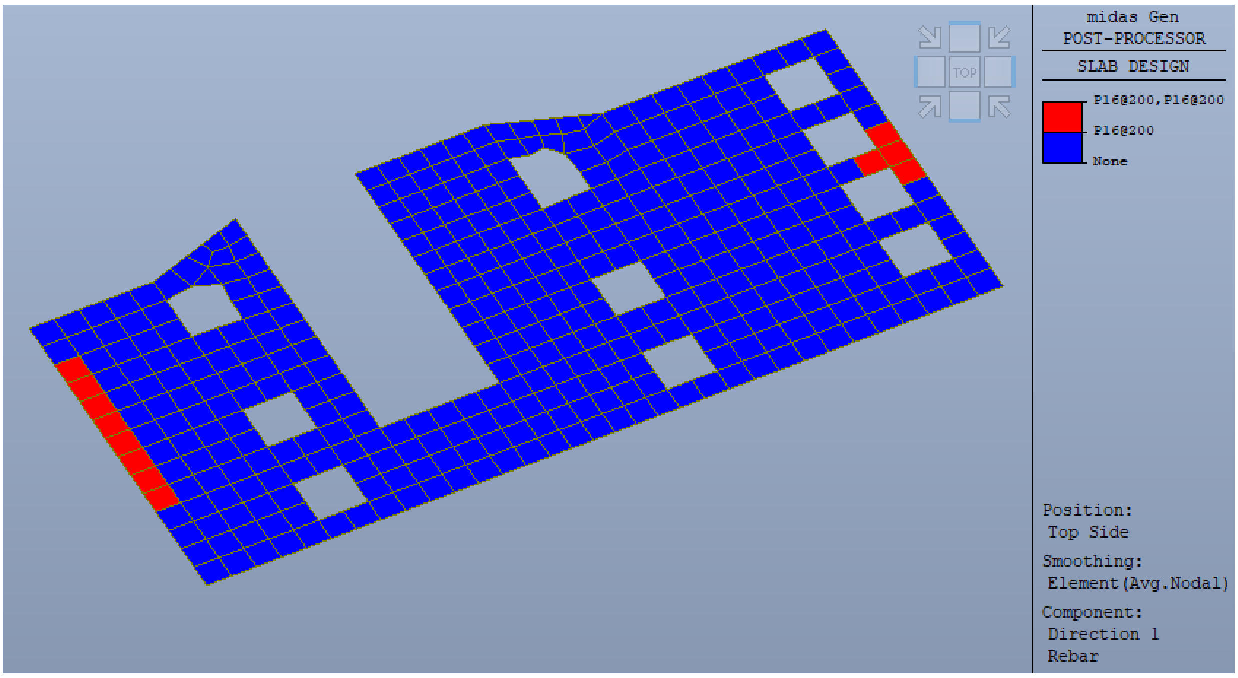



***Massime deformazioni SLV combinata XY [cm]***

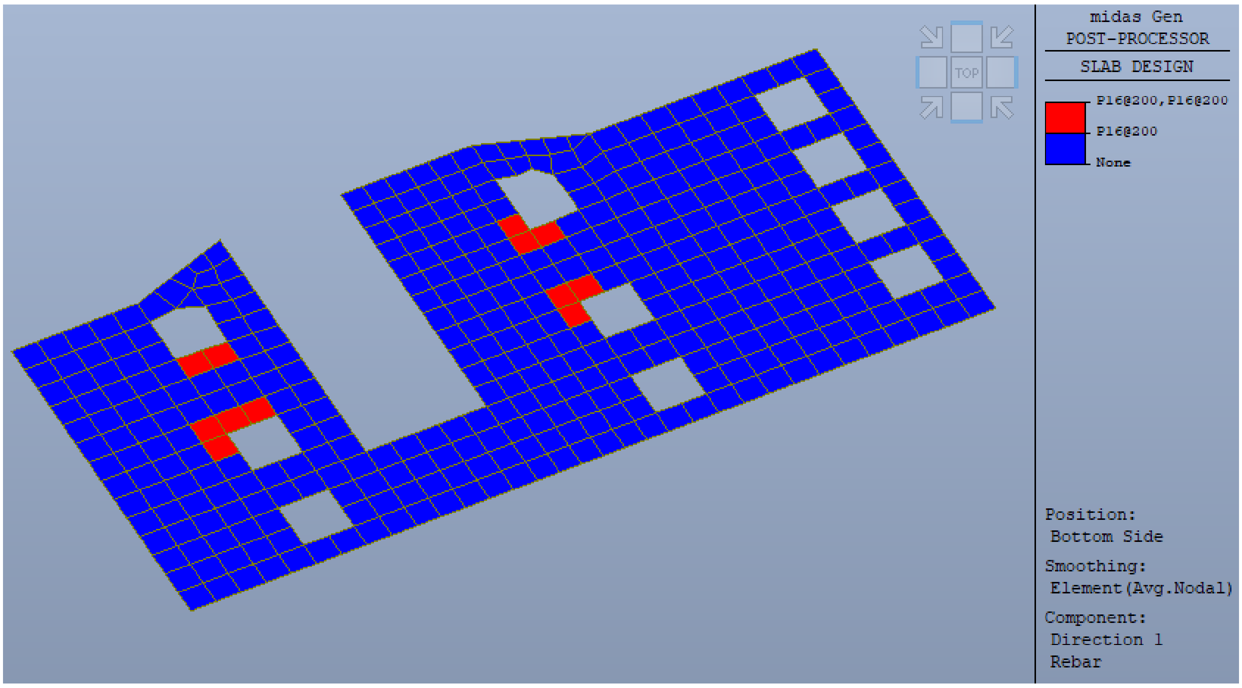
## 1.6 Armature previste

Nelle immagini seguenti vengono riportate le armature richieste per i vari elementi strutturali.

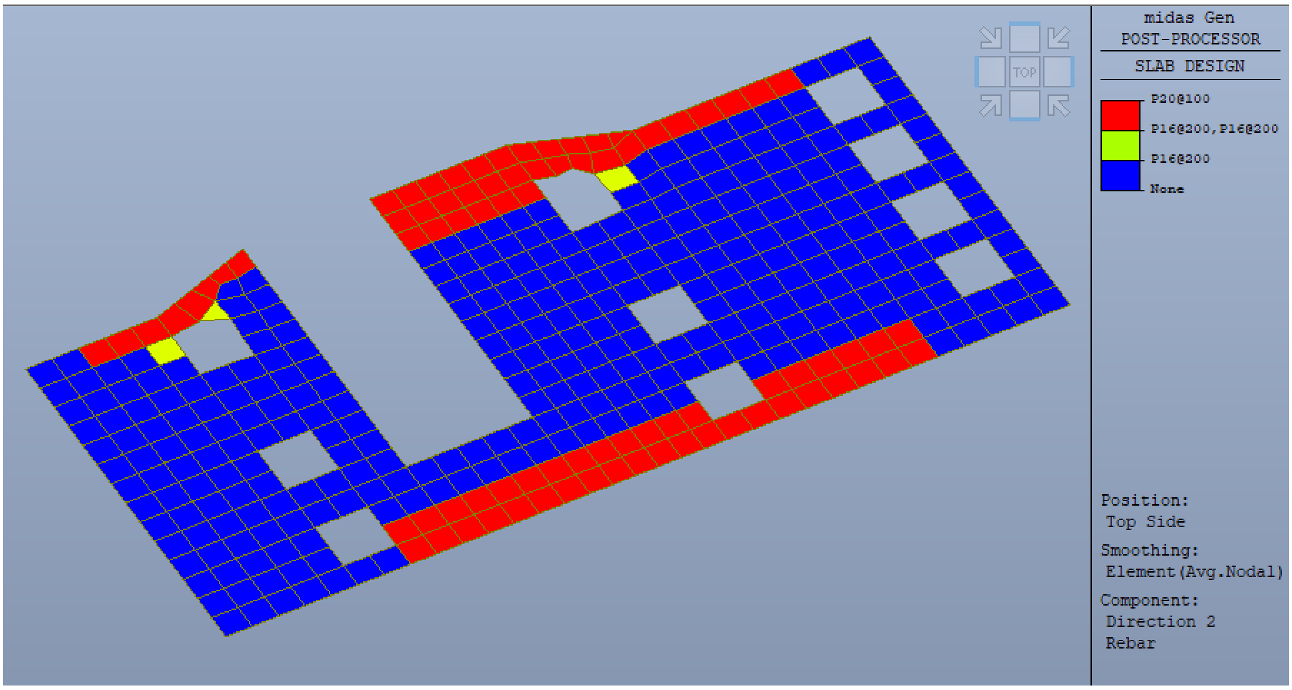
### 1.6.1 Armature Soletta



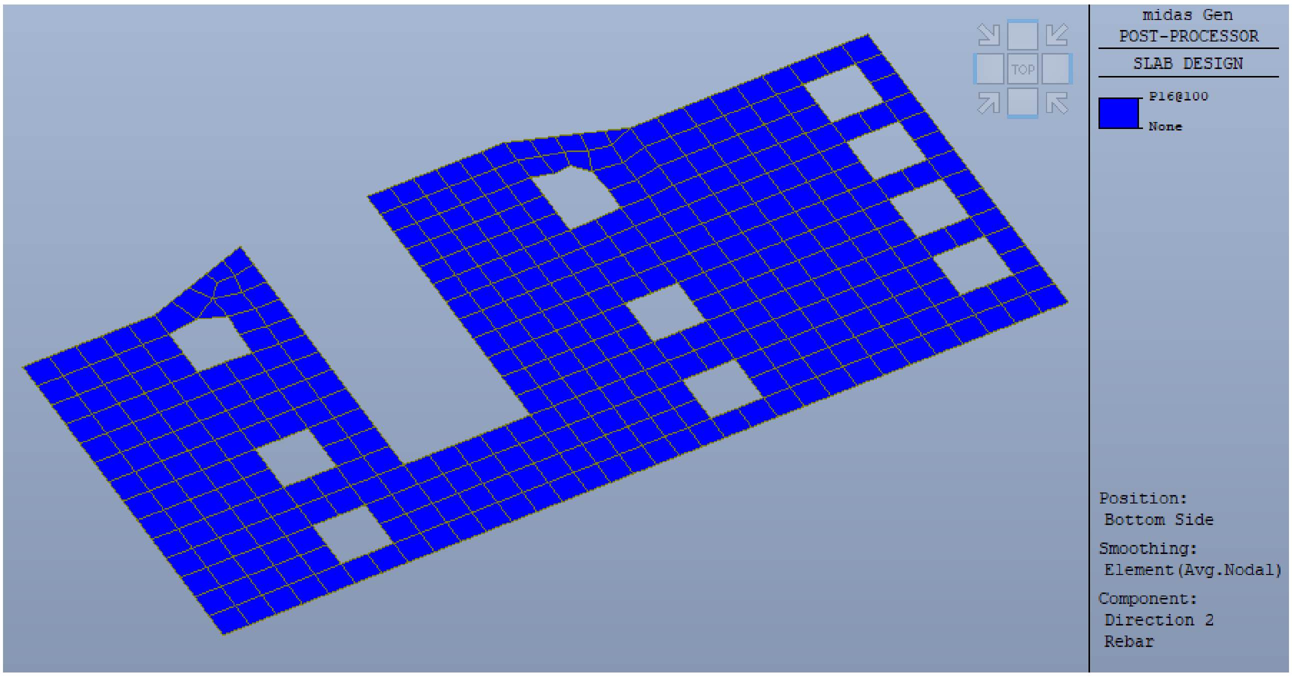

*Armatura soletta – direzione longitudinale X superiore*




*Armatura soletta – direzione longitudinale X inferiore*




***Armatura soletta – direzione trasversale Y superiore***




***Armatura soletta – direzione trasversale Y inferiore***

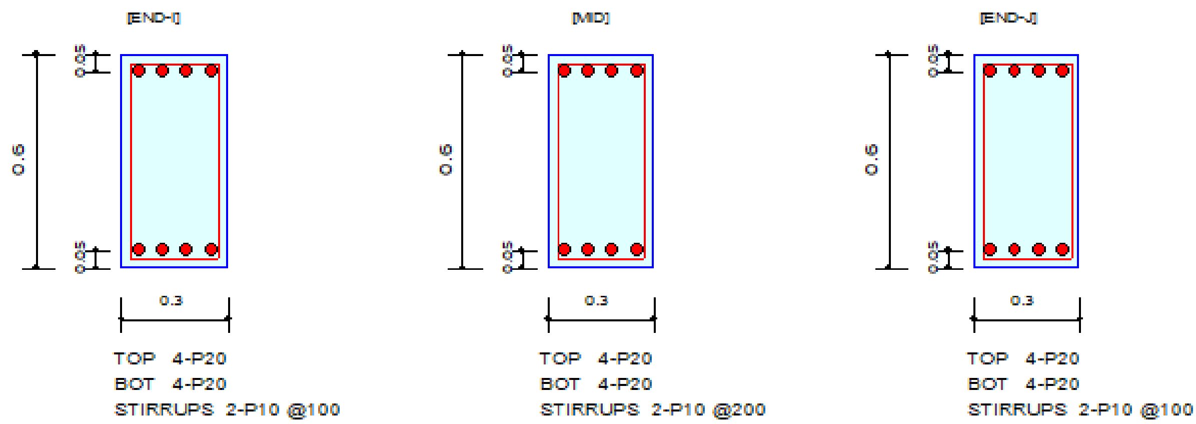
Si riepilogano di seguito le armature effettivamente adottate.

- Armatura superiore direzione longitudinale X: barre correnti $\phi$16/20 con aggiuntivi $\phi$16/20 agli attacchi con le pareti
- Armatura inferiore direzione longitudinale X: barre correnti $\phi$16/20 con aggiuntivi $\phi$16/20 intorno alle aperture;

- Armatura superiore direzione trasversale Y: barre correnti ϕ16/20 che diventano ϕ20/10 agli attacchi con le pareti;
- Armatura inferiore direzione trasversale Y: barre correnti ϕ16/10

### 1.6.2 Armature Travi di rinforzo Soletta di copertura

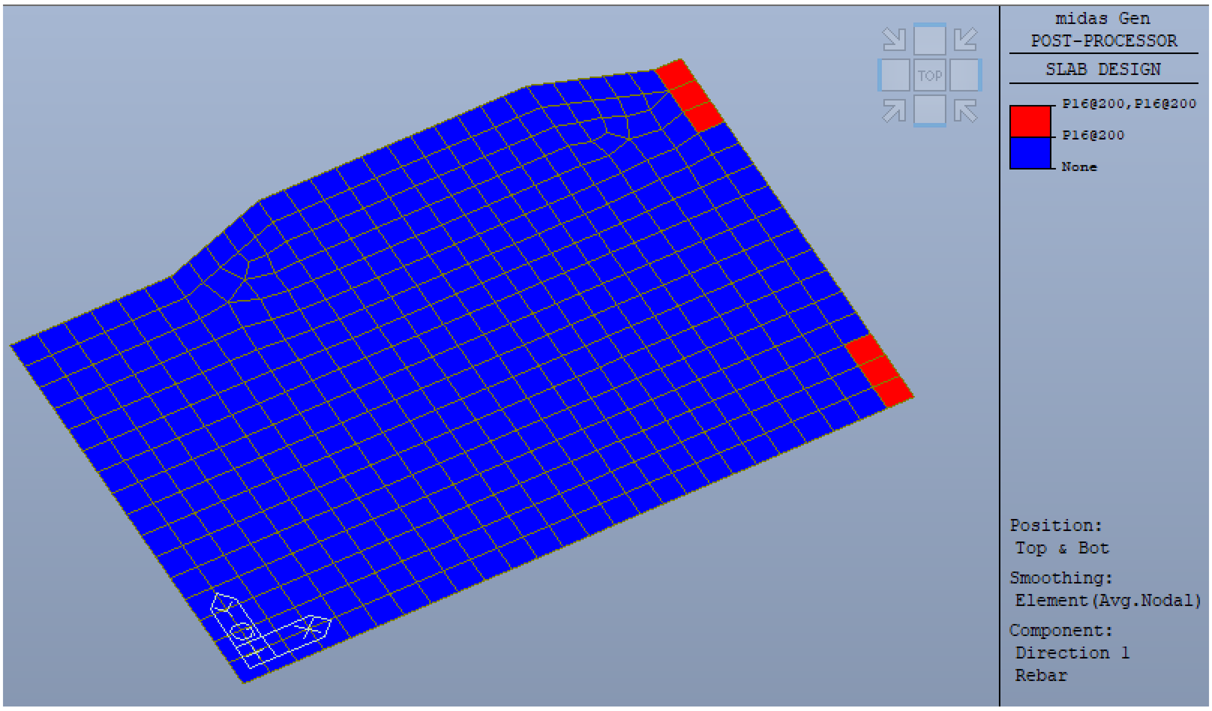
Le tre travi di rinforzo soletta, di sezione B=30 cm x H=60 cm sono armate con 4 correnti ϕ20 superiori e 4 correnti ϕ20 inferiori, mentre le staffe sono ϕ10/10 agli appoggi e ϕ10/20 in mezzeria.



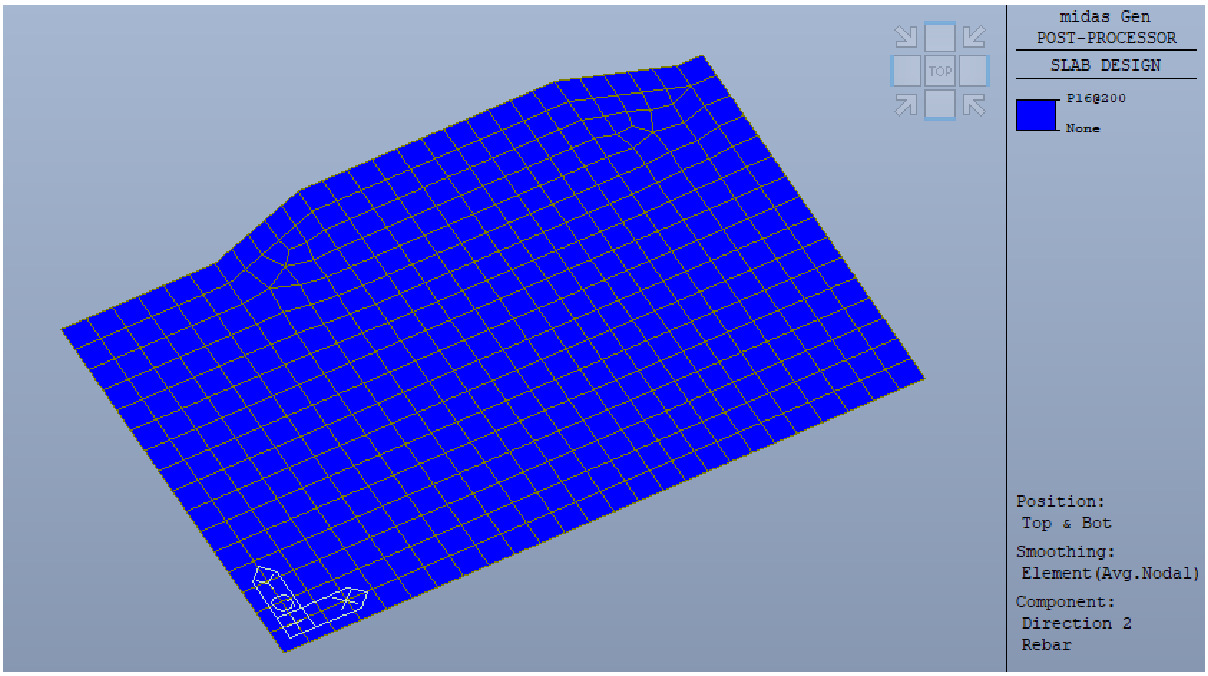

*Armatura travi di rinforzo copertura*

### 1.6.3 Armature Platea Grigliatura

Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.




***Armatura platea grigliatura – direzione longitudinale X ambo i lati***



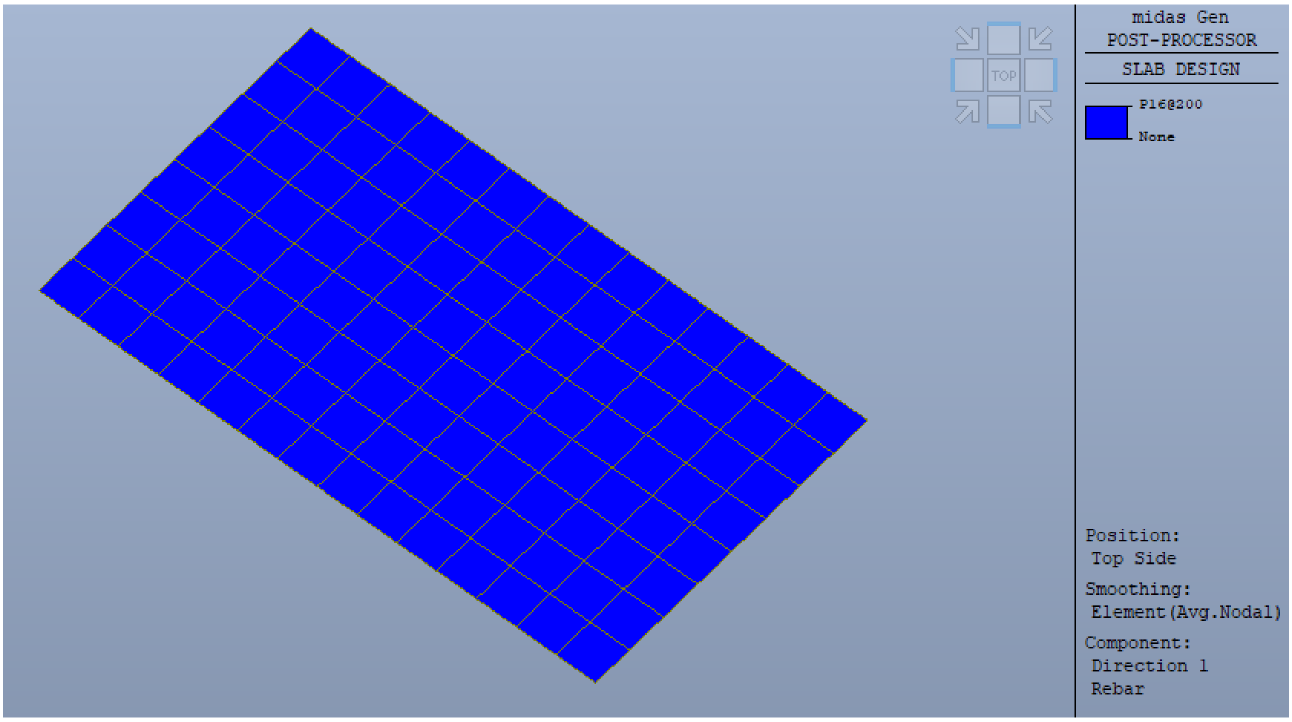

***Armatura platea grigliatura – direzione trasversale Y ambo i lati***

Si riepilogano di seguito le armature effettivamente adottate.

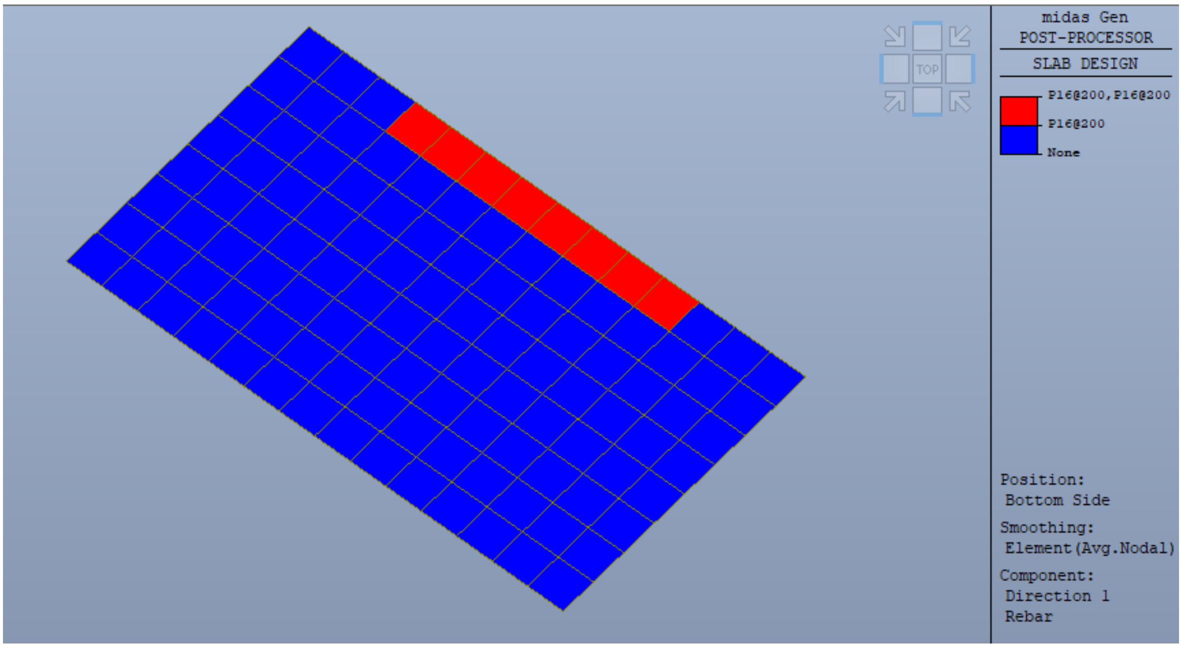
- Armatura direzione longitudinale X, inferiore e superiore: barre correnti ϕ16/20 con aggiuntivi 16/20 all'attacco con il muro del pompaggio;
- Armatura direzione trasversale Y, inferiore e superiore: barre correnti ϕ16/20;

### 1.6.4 Armature Platea Pompaggio

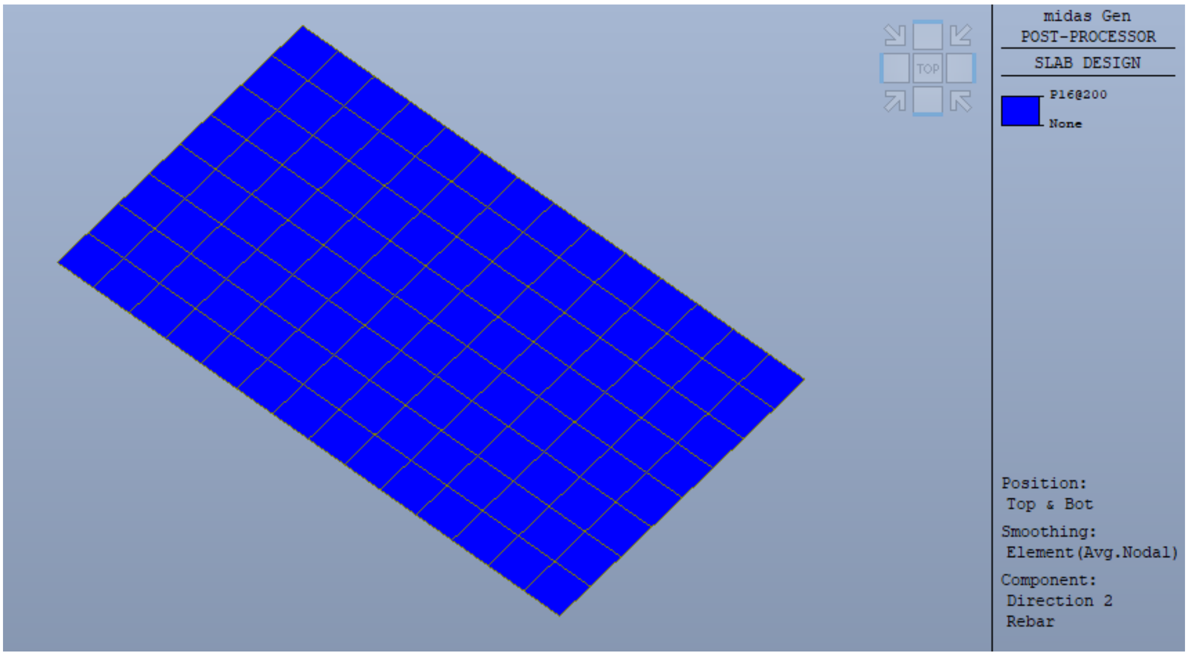
Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.




***Armatura platea pompaggio – direzione longitudinale X superiore***




***Armatura platea pompaggio – direzione longitudinale X inferiore***



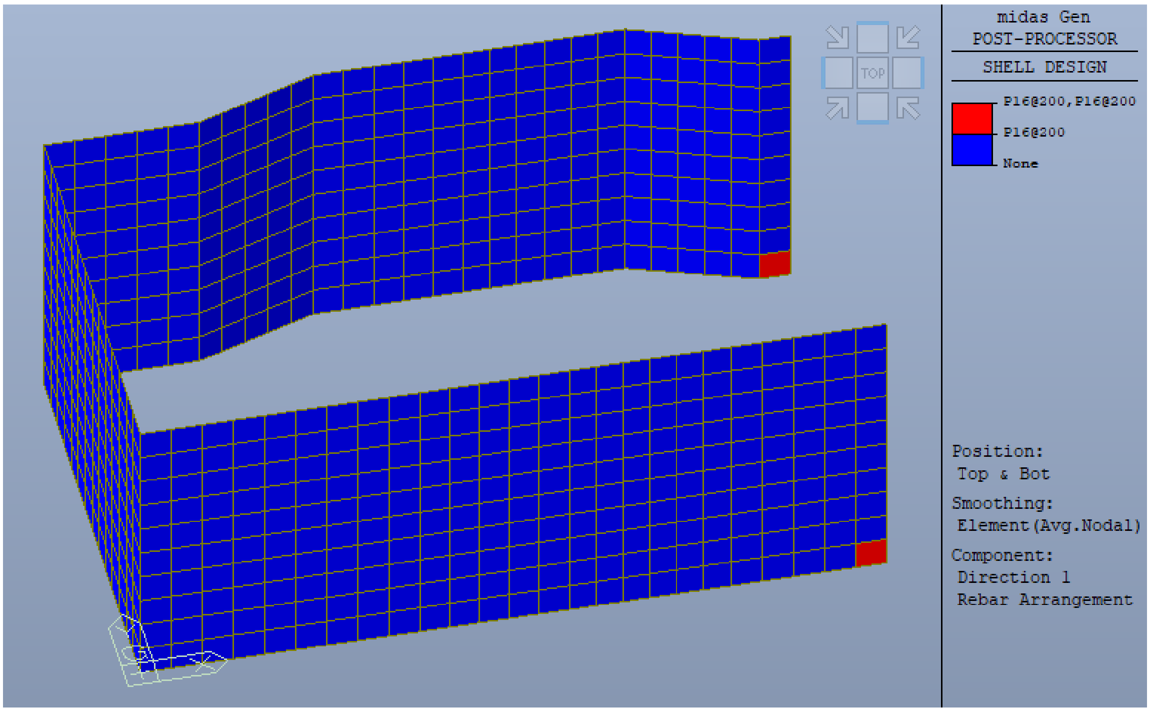

***Armatura platea pompaggio – direzione trasversale Y ambo i lati***

Si riepilogano di seguito le armature effettivamente adottate.

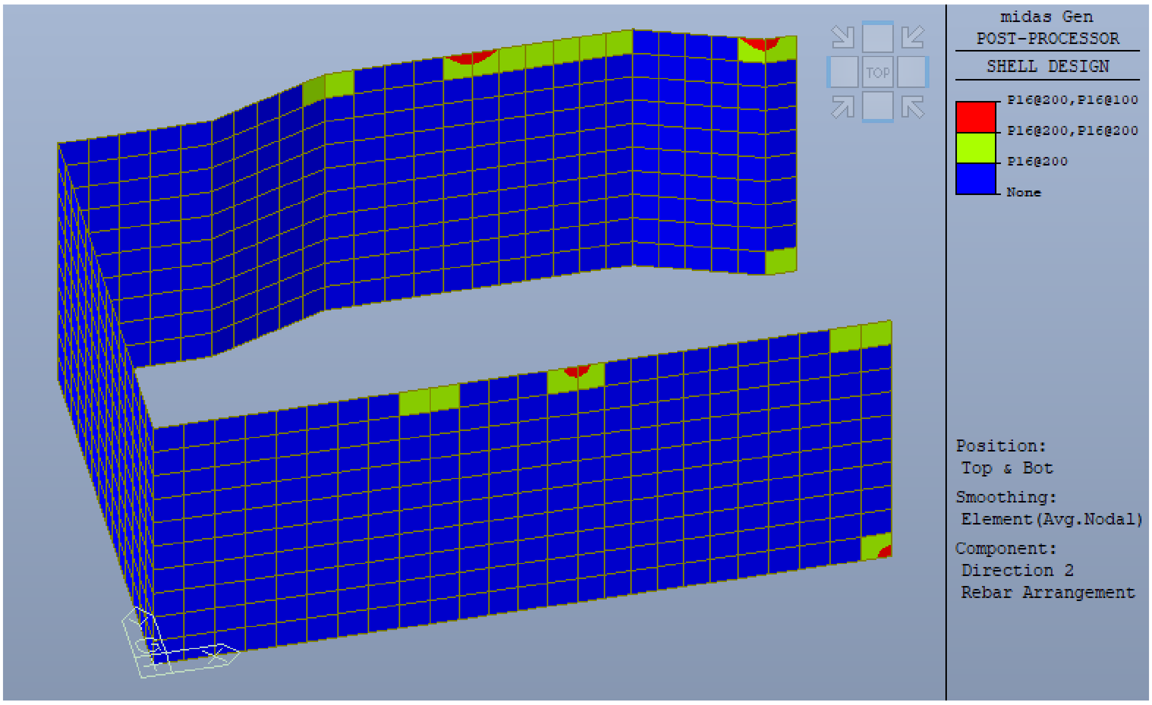
- Armatura direzione longitudinale X, superiore $\phi$16/20 e inferiore $\phi$16/20 con aggiuntivi $\phi$16/20 inferiori sotto alla parete posteriore verso l'edificio grigliatura fine;
- Armatura direzione trasversale Y, inferiore e superiore: barre correnti $\phi$16/20;

### 1.6.5 Armature Pareti Grigliatura

Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.




***Armatura pareti grigliatura – direzione orizzontale, ambo i lati***




***Armatura pareti grigliatura – direzione verticale, ambo i lati***

Si riepilogano di seguito le armature effettivamente adottate.

Le pareti esterne della grigliatura sui lati lunghi saranno armate come segue:

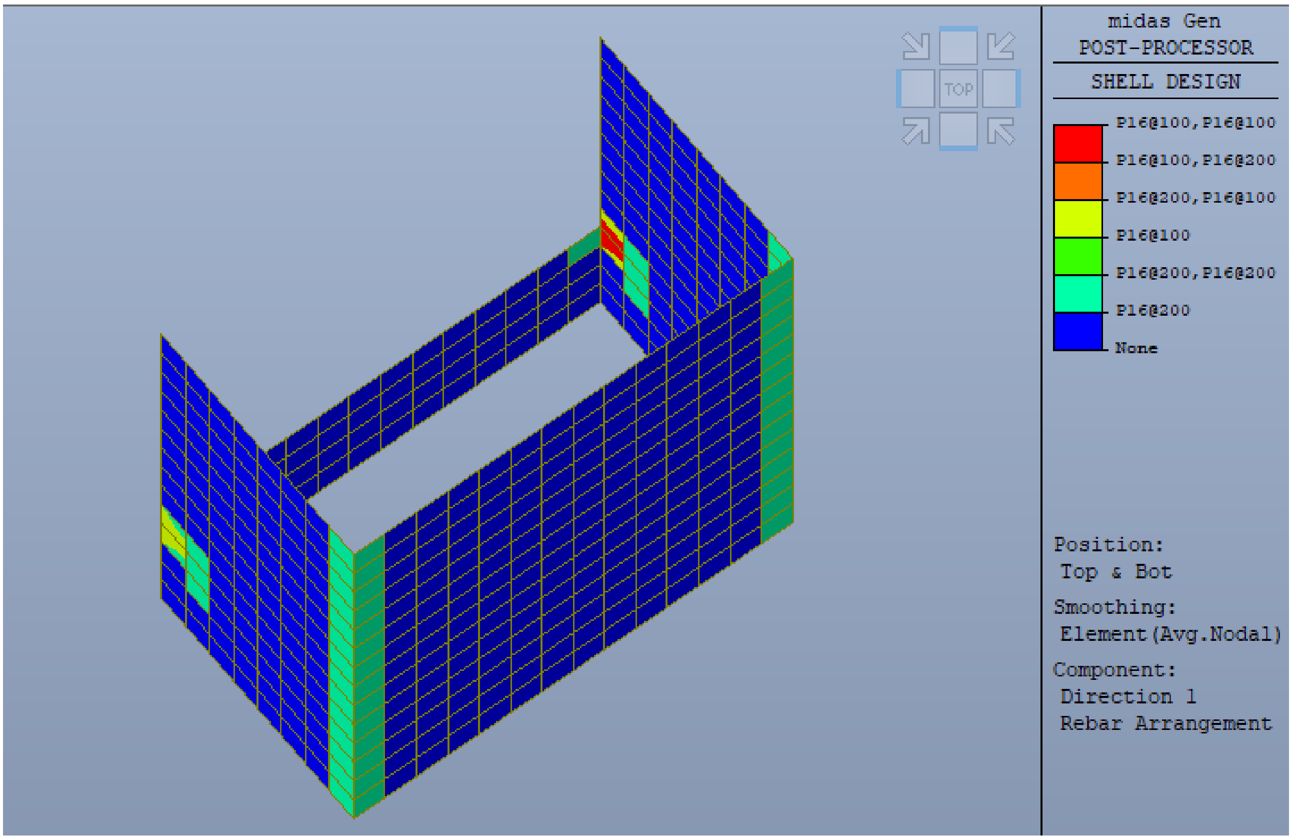
- barre orizzontali ϕ16/20 ambo i lati con aggiuntivi ϕ16/20 alla base all'attacco con il pompaggio; staffoni negli angoli ϕ16/20.
- barre verticali ϕ16/20 con riprese ϕ16/20 e aggiuntivi ϕ20/20 nella zona di attacco delle travi.

La parete esterna sul lato corto della grigliatura è armata come segue:

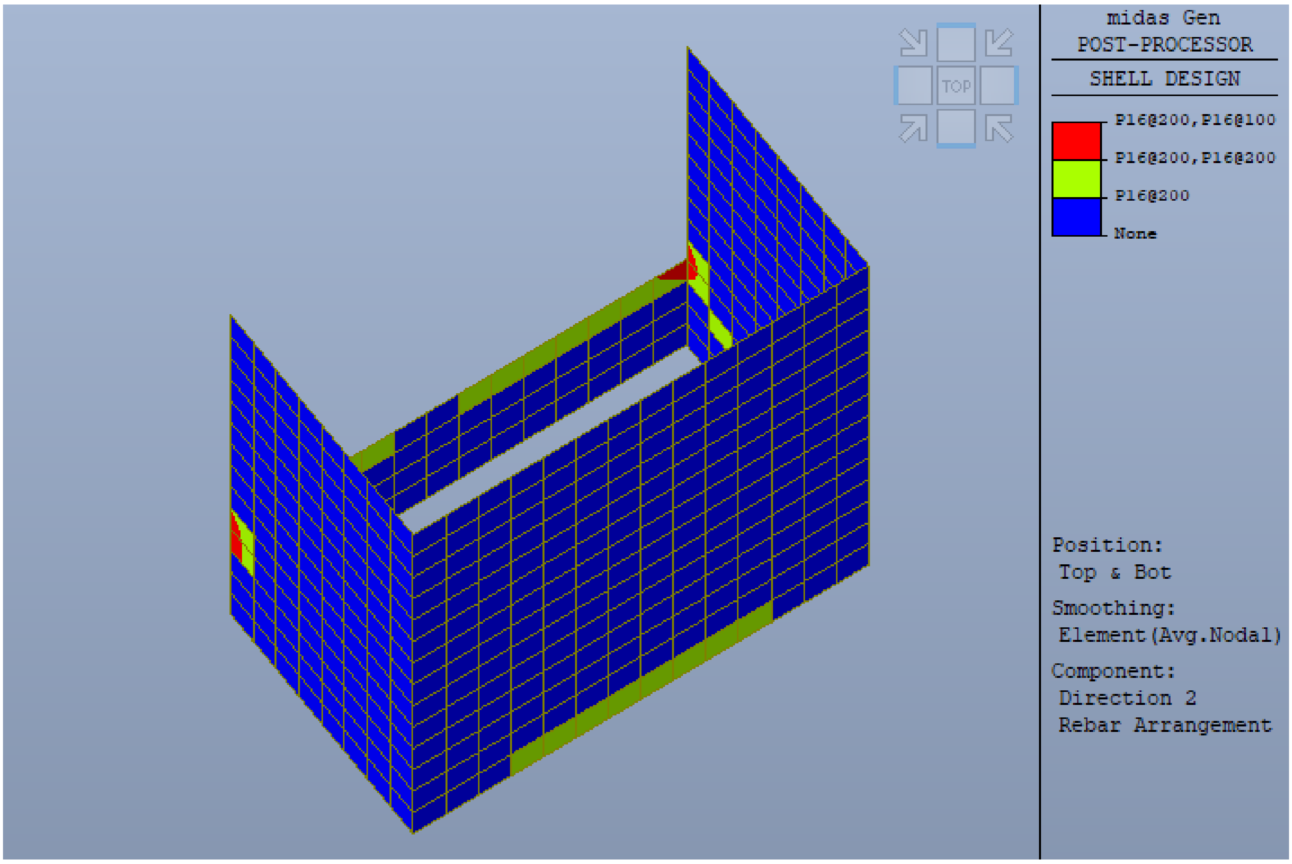
- barre orizzontali ϕ16/20 ambo i lati; staffoni negli angoli ϕ16/20
- barre verticali ϕ16/20 con riprese ϕ16/20

### 1.6.6 Armature Pareti Pompaggio

Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.




***Armatura pareti pompaggio – direzione orizzontale, ambo i lati***




***Armatura pareti pompaggio – direzione verticale, ambo i lati***

Si riepilogano di seguito le armature effettivamente adottate.

Le pareti sui lati corti saranno armate come segue:

- barre orizzontali ϕ16/20 ambo i lati con aggiuntivi ϕ20/20 nella zona di attacco alla platea della grigliatura. Gli staffoni nell'angolo verso la parete posteriore sono ϕ16/10
- barre verticali ϕ16/20 con riprese ϕ16/20.

La parete posteriore verso l'edificio di grigliatura fine è armata come segue:

- barre orizzontali ϕ16/20 ambo i lati; staffoni negli angoli ϕ16/10
- barre verticali ϕ16/20 con riprese ϕ16/10

La parete bassa verso la grigliatura è armata come segue:

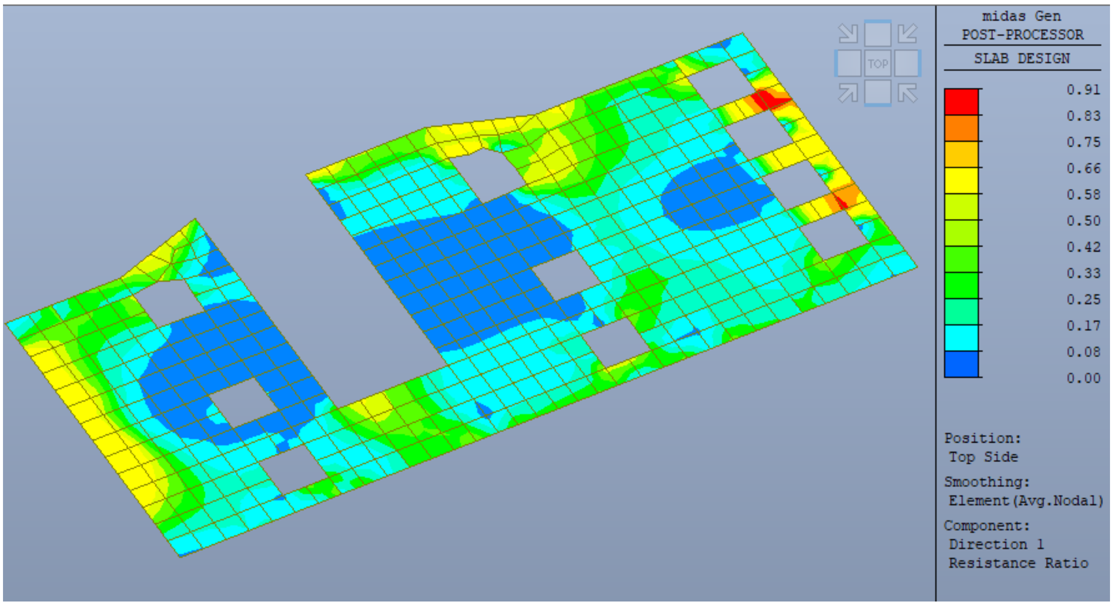
- barre orizzontali ϕ16/20 ambo i lati; staffoni negli angoli ϕ16/20
- barre verticali ϕ16/20 con riprese ϕ16/20 e aggiuntivi ϕ16/20 all'attacco della platea alta.

## 1.7 Verifiche di resistenza SLU grafiche

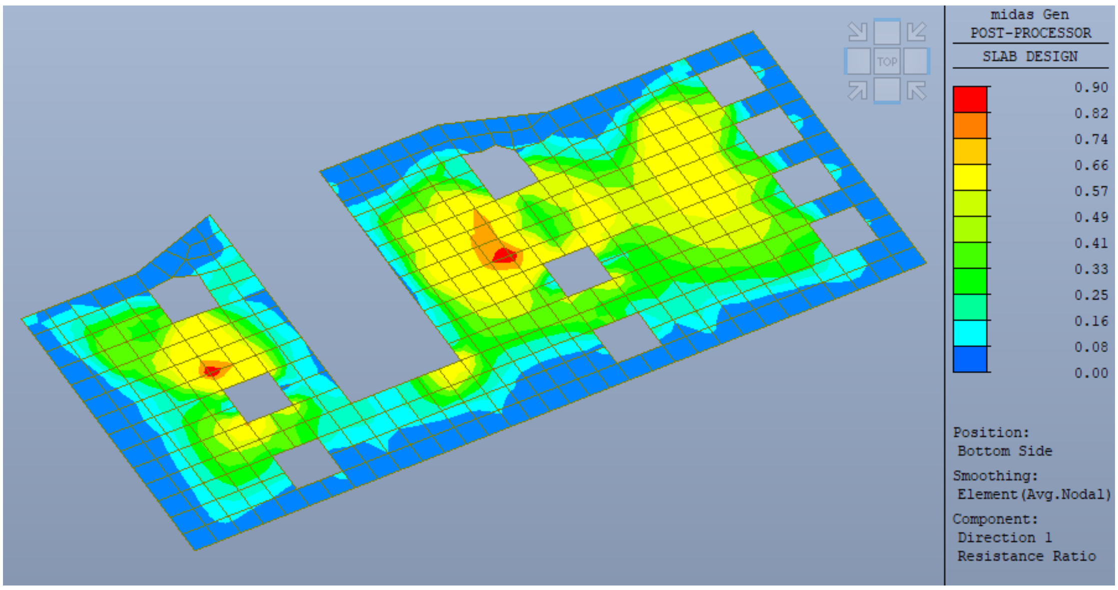
Nelle immagini seguenti vengono riportate le verifiche strutturali per via grafica, come tassi di sfruttamento dell'armatura nelle sezioni di cemento armato, sia per le sollecitazioni flessionali che taglianti:

### 1.7.1 Soletta di copertura

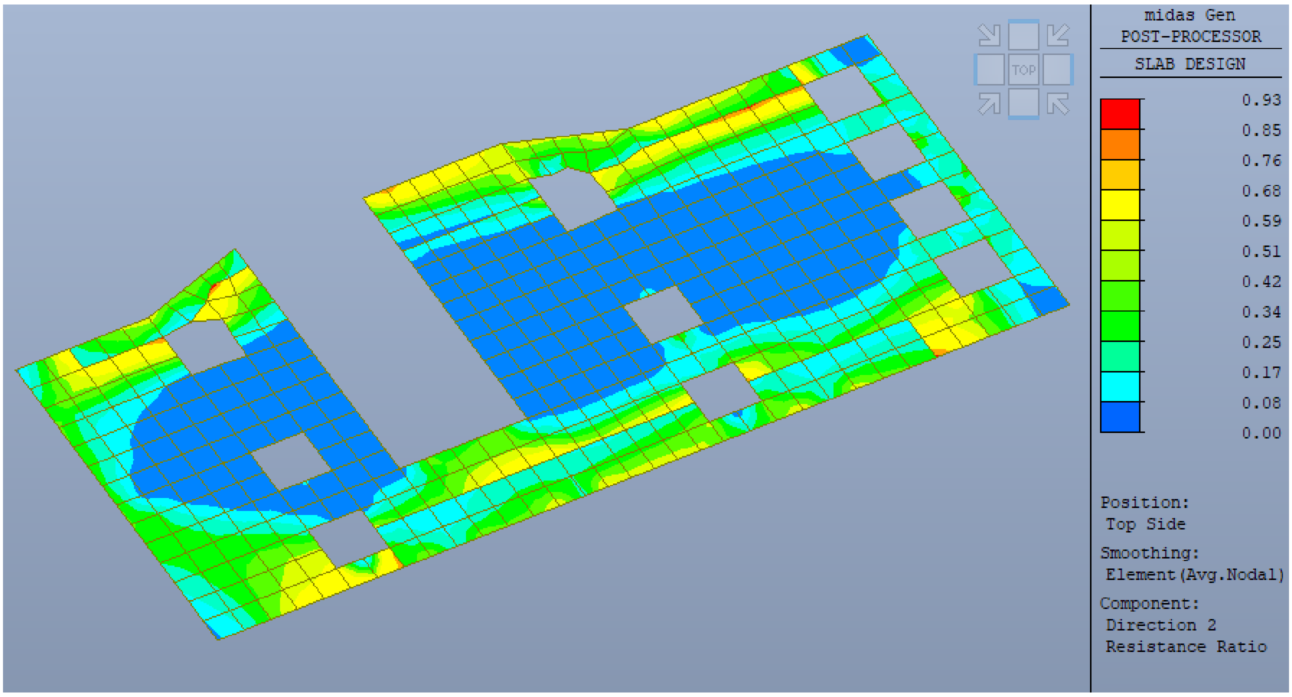
Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.



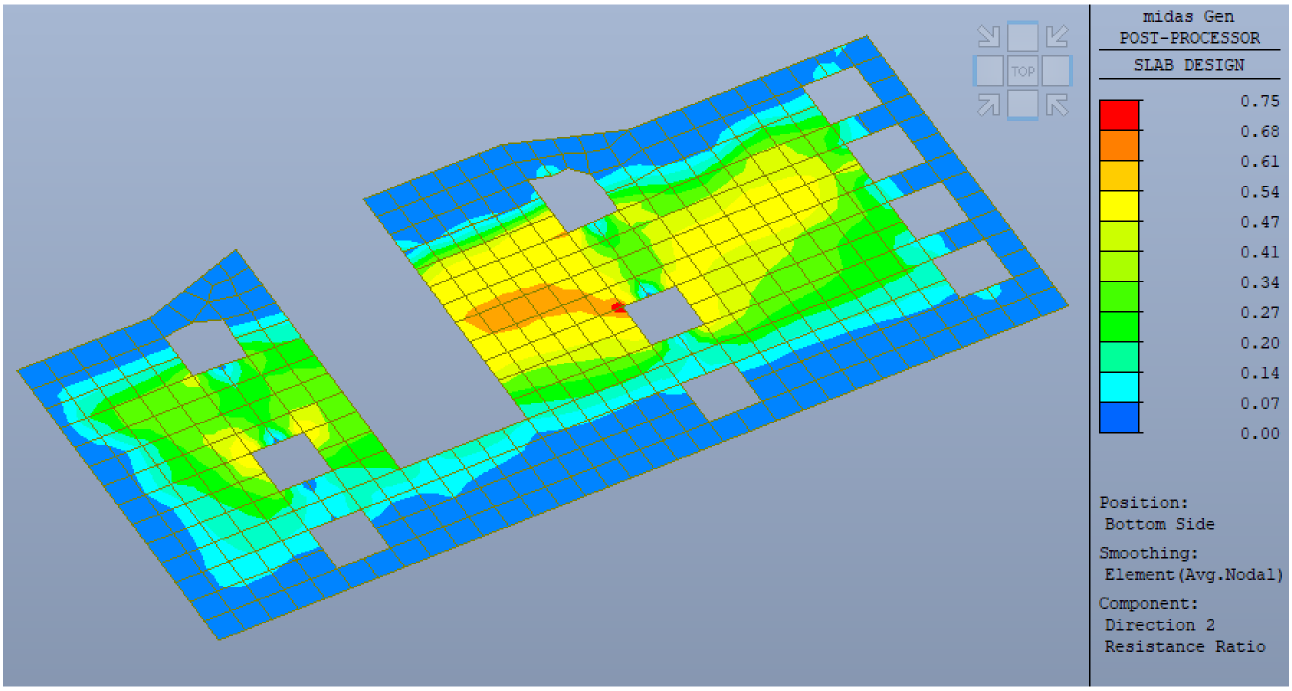

***Soletta di copertura - Indici di resistenza a flessione direzione X superiore***




***Soletta di copertura - Indici di resistenza a flessione direzione X inferiore***

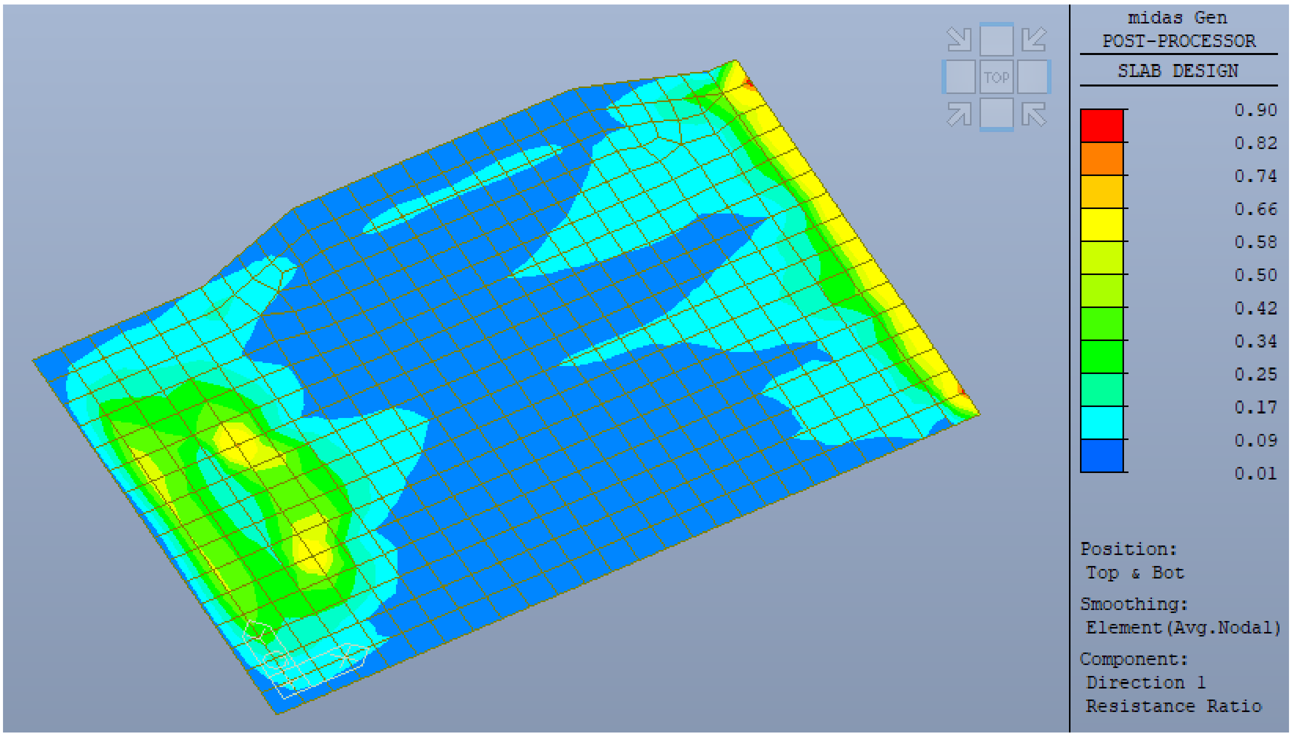



***Soletta di copertura - Indici di resistenza a flessione direzione Y superiore***

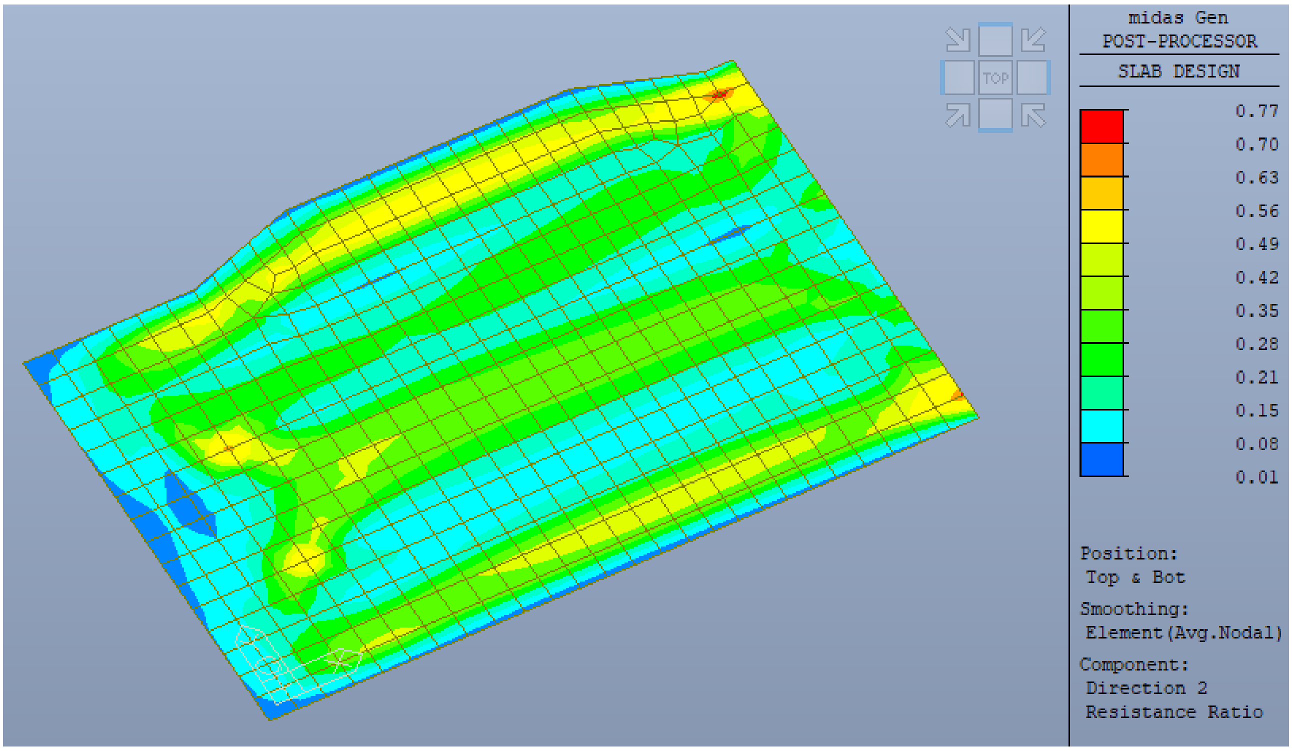



***Soletta di copertura - Indici di resistenza a flessione direzione Y inferiore***

### 1.7.2 Platea Grigliatura

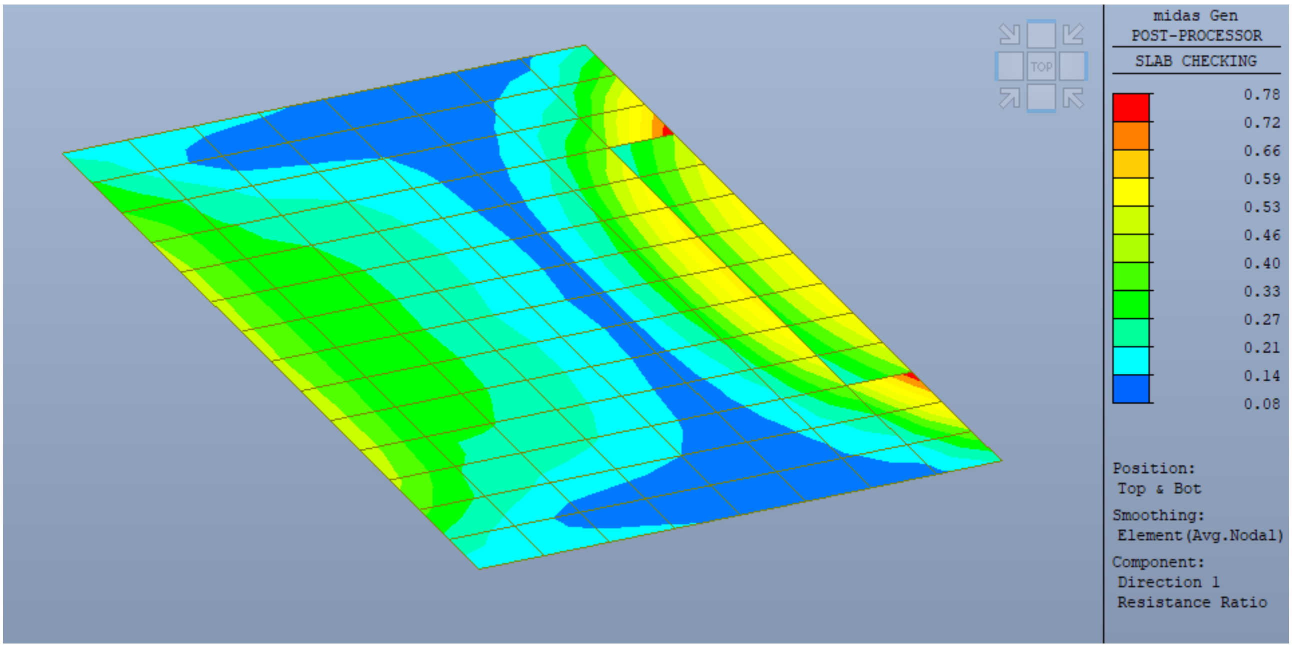



*Platea grigliatura - Indici di resistenza a flessione direzione X superiore e inferiore*

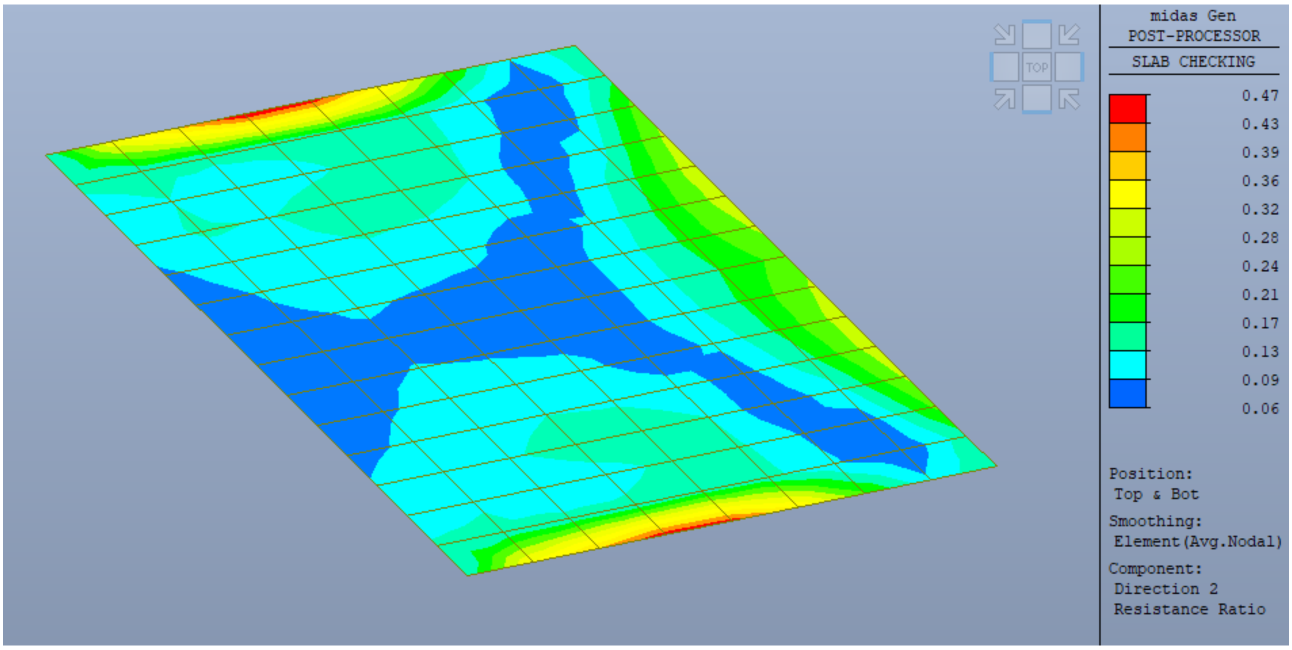



*Platea grigliatura - Indici di resistenza a flessione direzione X superiore e inferiore*

### 1.7.3 Platea Pompaggio

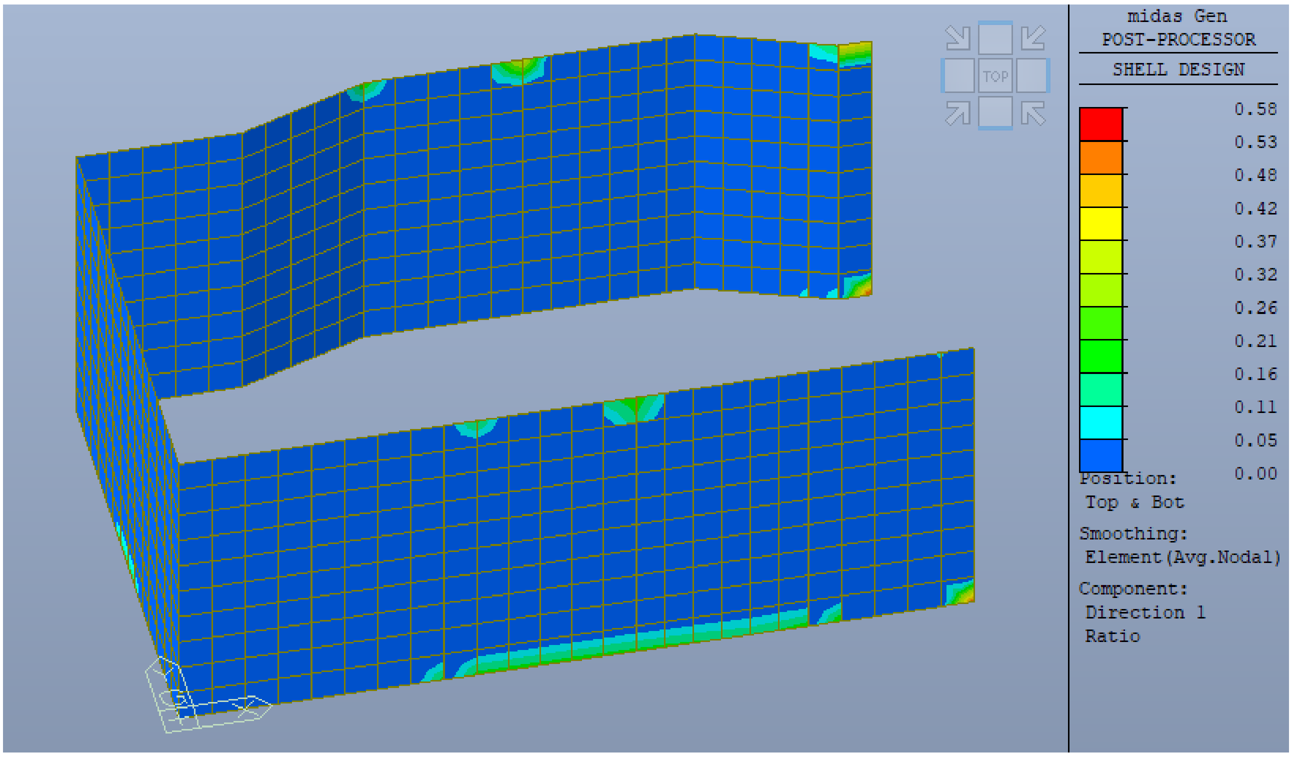



***Platea pompaggio - Indici di resistenza a flessione direzione X ambo i lati***

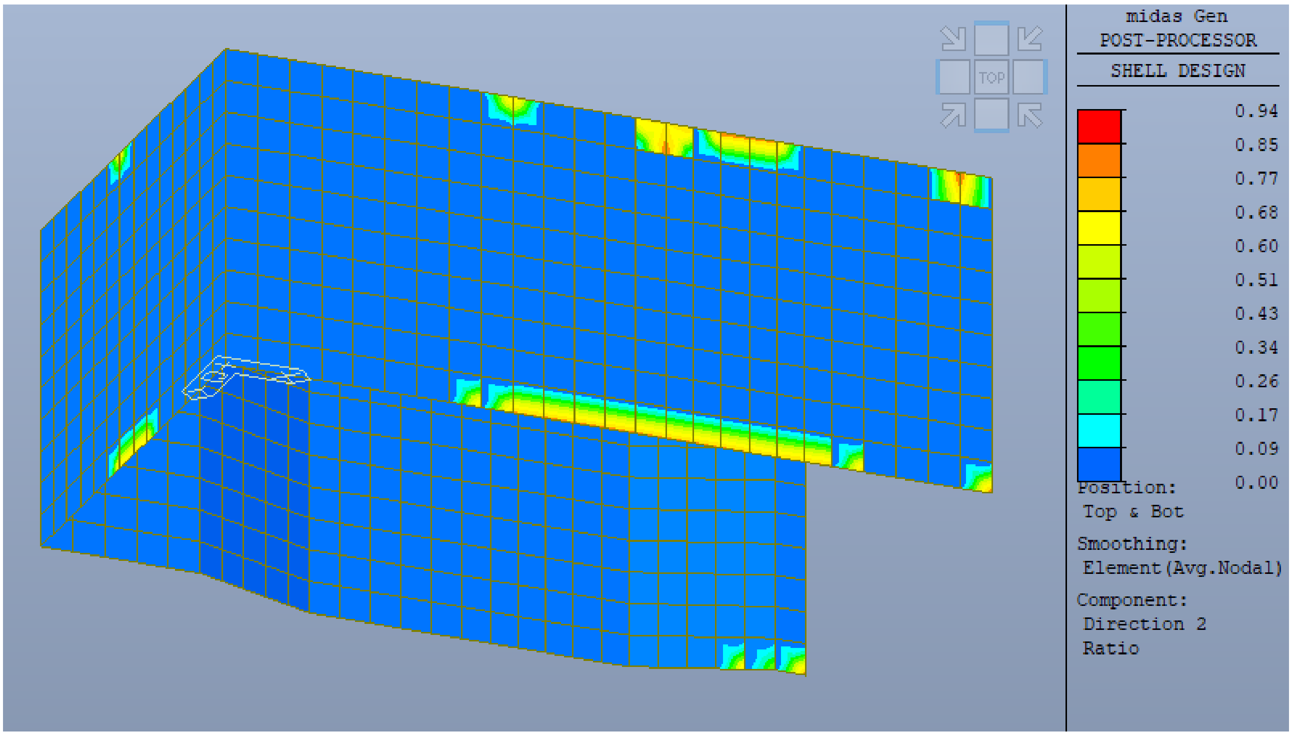



***Platea secondaria - Indici di resistenza a flessione direzione Y ambo i lati***

### 1.7.4 Pareti Grigliatura

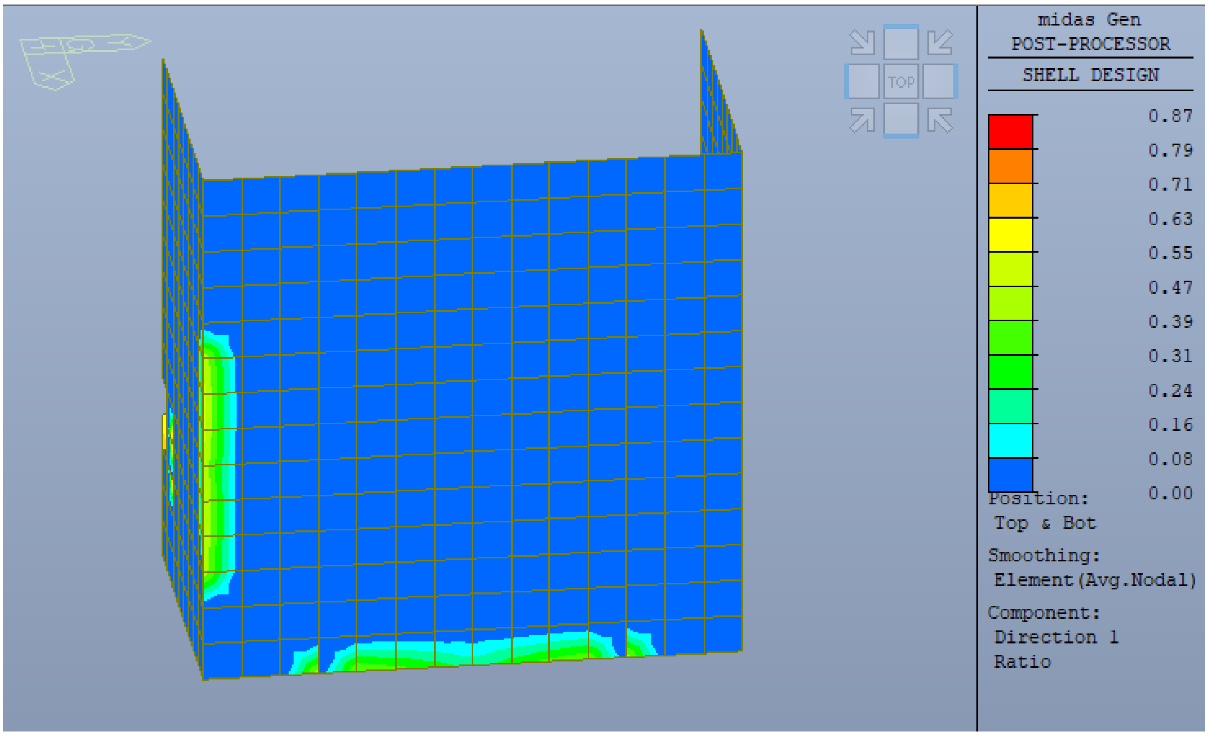



*Pareti - Indici di resistenza a pressoflessione direzione orizzontale*

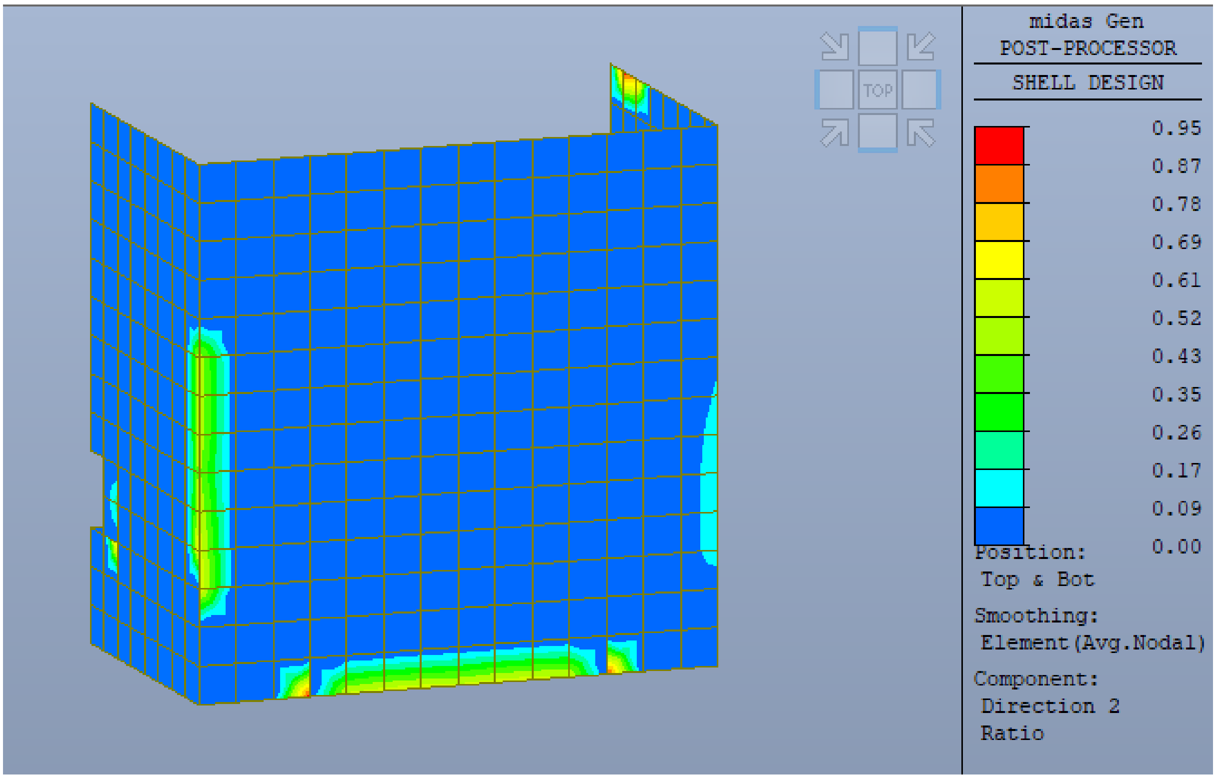



*Pareti - Indici di resistenza a pressoflessione direzione verticale*

### 1.7.5 Pareti Pompaggio




*Pareti pompaggio - Indici di resistenza a pressoflessione direzione orizzontale*




*Pareti pompaggio - Indici di resistenza a pressoflessione direzione verticale*

## 1.8 Verifiche di resistenza SLU analitiche

### 1.8.1 Verifiche a flessione Soletta di Copertura

```
================================================================================
  [[[*]]]   SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta SUP Y, Dir 1.
================================================================================
 --------------------------------------------------------------------
   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 --------------------------------------------------------------------
 0.3500   3382 BOT 0.0005 0.0010 | 44.3897(   7) 113.435 0.391  OK
          3890 TOP 0.0008 0.0010 | 80.6349(   7) 113.435 0.711  OK
 --------------------------------------------------------------------

 << BOTTOM >>

 -. Information of Parameters.
   Elem No.  : 3382
   Thickness :    0.3500 m.
   Materials :  fck =  32000.0000 KPa.
                fcd =  21333.3333 KPa.
                fyk = 450000.0000 KPa.
   Covering  :  dB  =    0.0500 m.
                dT  =    0.0500 m.
   LCB No.   :    7

 -. Information of Design.
   b       =   0.0010 m.  (by Code Unit Length).
   d       =   0.3000 m.
   lambda   =   0.800
   a       = lambda * x  =   0.018 m.
   eta      =   1.000
   Cc      = eta*fcd*b*a =      0.3900 kN.
```

M_Rd = Cc*(d-a/2) = 113.4352 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

M_Ed = 44.3897 kN-m./m.

M_Rd = 113.4352 kN-m./m.

RatM = M_Ed / M_Rd = 0.391 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 3890

Thickness : 0.3500 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 7

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3000 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3900 kN.

M_Rd = Cc*(d-a/2) = 113.4352 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

M_Ed = 80.6349 kN-m./m.

M_Rd = 113.4352 kN-m./m.

RatM = M_Ed / M_Rd = 0.711 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.058

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.058/ 0.450 = 0.130 ---> O.K

==============================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta, Dir 1.

==============================================================================

| Thk | Elem | POS | AsReq | AsUse | M_Ed( LCB) | M_Rd | Rat | CHK |
|---|---|---|---|---|---|---|---|---|
| 0.3500 | 3222 | BOT | 0.0013 | 0.0020 | 133.713( 6) | 219.741 | 0.609 | OK |
| | 3024 | TOP | 0.0015 | 0.0020 | 161.751( 6) | 219.741 | 0.736 | OK |

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 3222

Thickness : 0.3500 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 6

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3000 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7800 kN.

M_Rd = Cc*(d-a/2) = 219.7406 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0013 m^2/m. ( 0.0013 m^2/m.)

M_Ed = 133.7127 kN-m./m.

M_Rd = 219.7406 kN-m./m.

RatM = M_Ed / M_Rd = 0.609 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.097

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.097/ 0.450 = 0.215 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 3024

Thickness : 0.3500 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 6

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3000 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7800 kN.

M_Rd = Cc*(d-a/2) = 219.7406 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0015 m^2/m. ( 0.0015 m^2/m.)

M_Ed = 161.7508 kN-m./m.

M_Rd = 219.7406 kN-m./m.

RatM = M_Ed / M_Rd = 0.736 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.117

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.117/ 0.450 = 0.260 ---> O.K

================================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta SUP Y, Dir 2.

================================================================================

```
--------------------------------------------------------------------
 Thk   Elem POS  AsReq  AsUse |   M_Ed( LCB)   M_Rd   Rat CHK
--------------------------------------------------------------------
0.3500   3890 BOT 0.0005 0.0020 | 39.1153(   7) 212.701 0.184  OK
         3401 TOP 0.0027 0.0031 | 276.228(   7) 318.450 0.867  OK
--------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 3890

Thickness : 0.3500 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 7

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.2900 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7830 kN.

M_Rd = Cc*(d-a/2) = 212.7007 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @100

As_req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

M_Ed = 39.1153 kN-m./m.

M_Rd = 212.7007 kN-m./m.

RatM = M_Ed / M_Rd = 0.184 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 3401

Thickness : 0.3500 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 7

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.2900 m.

lambda = 0.800

a = lambda * x = 0.057 m.

eta = 1.000

Cc = eta*fcd*b*a = 1.2180 kN.

M_Rd = Cc*(d-a/2) = 318.4499 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P20 @100

As_req = 0.0027 m^2/m. ( 0.0027 m^2/m.)

M_Ed = 276.2276 kN-m./m.

M_Rd = 318.4499 kN-m./m.

RatM = M_Ed / M_Rd = 0.867 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.214

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.214/ 0.450 = 0.475 ---> O.K

```
================================================================================
  [[[*]]]  SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta, Dir 2.
================================================================================
 --------------------------------------------------------------------
   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 --------------------------------------------------------------------
 0.3500   3657 BOT 0.0016 0.0020 | 158.743(   7) 212.701 0.746  OK
          3131 TOP 0.0018 0.0020 | 187.916(   6) 212.701 0.883  OK
 --------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 3657

Thickness : 0.3500 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 7

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.2900 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7830 kN.

M_Rd = Cc*(d-a/2) = 212.7007 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @100

As_req = 0.0016 m^2/m. ( 0.0016 m^2/m.)

M_Ed = 158.7425 kN-m./m.

M_Rd = 212.7007 kN-m./m.

RatM = M_Ed / M_Rd = 0.746 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.123

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.123/ 0.450 = 0.273 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 3131

Thickness : 0.3500 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 6

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.2900 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7830 kN.

M_Rd = Cc*(d-a/2) = 212.7007 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0018 m^2/m. ( 0.0018 m^2/m.)

M_Ed = 187.9157 kN-m./m.

M_Rd = 212.7007 kN-m./m.

RatM = M_Ed / M_Rd = 0.883 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.145

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.145/ 0.450 = 0.323 ---> O.K

### 1.8.2 Verifiche a taglio Soletta di Copertura

================================================================================

[[[*]]] MESHED SHELL SHEAR MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta Sup Y.

================================================================================

--------------------------------------------------------------------------------

[*] SHEAR SHEAR MAXIMUM RESULT

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 3243

-. Node No. : 4062

-. LCB No. : 6

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.3500 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Calculate the principal shear of the inner layer.

-. V_Edx = -52.7924 kN/m.

-. V_Edy = 129.0595 kN/m.

-. V_Edo = SQRT[ V_Edx^2 + V_Edy^2 ] = 139.4396 kN/m.

-. tan(Phio) = V_Edy/V_Edx = -2.4447

-. Rhol = Rhox*cos(Phio)^2 + Rhoy*sin(Phio)^2 = 0.0081

( ). Calculate the design shear resistance without shear reinforcement.

-. k = MIN[ 1.0+SQRT(200/d), 2.0 ] = 1.8234

-. C_Rdc = 0.18/Gamma_c = 0.1200

-. Sig_cp = MIN[ N_Ed/Ac, 0.2*fcd ] = 0.0000 KPa.

-. V_Rdc1 = [C_Rdc*k*(100*Rhol*fck)^(1/3) + 0.15*Sig_cp]*d = 191.0034 kN/m.

-. V_Rdc2 = [0.035*k^(3/2)*SQRT(fck) + 0.15*Sig_cp]*d = 143.8081 kN/m.

-. V_Rdc = MAX[ V_Rdc1, V_Rdc2 ] = 191.0034 kN/m.

-. RatV = V_Edo / V_Rdc = 0.7300 ---> O.K.

====================================================================================

[[[*]]] MESHED SHELL SHEAR MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta.

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------------------------------------------------------------------------------------

[*] SHEAR SHEAR MAXIMUM RESULT

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4018

-. Node No. : 5170

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.3500 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Calculate the principal shear of the inner layer.

-. V_Edx = 184.8007 kN/m.

-. V_Edy = -5.4385 kN/m.

-. V_Edo = SQRT[ V_Edx^2 + V_Edy^2 ] = 184.8807 kN/m.

-. tan(Phio) = V_Edy/V_Edx = -0.0294

-. Rhol = Rhox*cos(Phio)^2 + Rhoy*sin(Phio)^2 = 0.0029

( ). Calculate the design shear resistance without shear reinforcement.

-. k = MIN[ 1.0+SQRT(200/d), 2.0 ] = 1.8234

-. C_Rdc = 0.18/Gamma_c = 0.1200

-. Sig_cp = MIN[ N_Ed/Ac, 0.2*fcd ] = 1291.8520 KPa.

-. V_Rdc1 = [C_Rdc*k*(100*Rhol*fck)^(1/3) + 0.15*Sig_cp]*d = 192.3997 kN/m.

-. V_Rdc2 = [0.035*k^(3/2)*SQRT(fck) + 0.15*Sig_cp]*d = 200.9725 kN/m.

-. V_Rdc = MAX[ V_Rdc1, V_Rdc2 ] = 200.9725 kN/m.

-. RatV = V_Edo / V_Rdc = 0.9199 ---> O.K.

### 1.8.3 Verifiche flessione Platea Grigliatura

```
================================================================================
  [[[*]]]  SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platee-Platea grigliatura, Dir 1.
================================================================================
 --------------------------------------------------------------------
   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 --------------------------------------------------------------------
 0.5000   3011 BOT 0.0011 0.0020 | 174.196(   8) 336.741 0.517  OK
          3011 TOP 0.0013 0.0020 | 201.961(   4) 336.741 0.600  OK
 --------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 3011

Thickness : 0.5000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 8

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.4500 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7800 kN.

M_Rd = Cc*(d-a/2) = 336.7406 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0011 m^2/m. ( 0.0011 m^2/m.)

M_Ed = 174.1956 kN-m./m.

M_Rd = 336.7406 kN-m./m.

RatM = M_Ed / M_Rd = 0.517 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.056

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.056/ 0.450 = 0.124 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No.  : 3011

Thickness :    0.5000 m.

Materials :  fck =  32000.0000 KPa.

fcd =  21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering  :  dB  =   0.0500 m.

dT  =   0.0500 m.

LCB No.   :    4

-. Information of Design.

b        =   0.0010 m.  (by Code Unit Length).

d        =   0.4500 m.

lambda   =   0.800

a        = lambda * x  =   0.037 m.

eta      =   1.000

Cc       = eta*fcd*b*a =      0.7800 kN.

M_Rd     = Cc*(d-a/2)  =     336.7406  kN-m./m.

-. Information of Moments and Result.

Rein. Bar :  P16 @200 / P16 @200

As_req =       0.0013 m^2/m.  (       0.0013 m^2/m.)

M_Ed   =     201.9605  kN-m./m.

M_Rd   =     336.7406  kN-m./m.

RatM   = M_Ed / M_Rd =   0.600  <  1.0  ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d        =    0.065

Limit(x/d)  =    0.450  ( fck <= 50 MPa.)

x/d ratio   =    0.065/    0.450 =    0.144  ---> O.K

```
==============================================================================
  [[[*]]]   SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platee-Platea grigliatura, Dir 2.
==============================================================================
 --------------------------------------------------------------------
   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 --------------------------------------------------------------------
 0.5000   4171 BOT 0.0008 0.0010 | 129.494(   4) 169.019 0.766  OK
        3365 TOP 0.0008 0.0010 | 118.320(   4) 169.019 0.700  OK
 --------------------------------------------------------------------

<< BOTTOM >>

-. Information of Parameters.
  Elem No.  : 4171
  Thickness :    0.5000 m.
  Materials :  fck =  32000.0000 KPa.
           fcd =  21333.3333 KPa.
           fyk = 450000.0000 KPa.
  Covering  :  dB  =   0.0600 m.
           dT  =   0.0600 m.
  LCB No.   :    4

-. Information of Design.
  b       =   0.0010 m.  (by Code Unit Length).
  d       =   0.4400 m.
  lambda   =   0.800
  a       = lambda * x  =   0.018 m.
  eta      =   1.000
  Cc       = eta*fcd*b*a =      0.3923 kN.
```

M_Rd = Cc*(d-a/2) = 169.0190 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

M_Ed = 129.4942 kN-m./m.

M_Rd = 169.0190 kN-m./m.

RatM = M_Ed / M_Rd = 0.766 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.044

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.044/ 0.450 = 0.097 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 3365

Thickness : 0.5000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 4

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.4400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3923 kN.

M_Rd = Cc*(d-a/2) = 169.0190 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

M_Ed = 118.3202 kN-m./m.

M_Rd = 169.0190 kN-m./m.

RatM = M_Ed / M_Rd = 0.700 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

### 1.8.4 Verifiche flessione Platea Pompaggio

```
===============================================================================

  [[[*]]]  SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platee-Platea Pompaggio, Dir 1.

===============================================================================

 ------------------------------------------------------------------

   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK

 ------------------------------------------------------------------

 0.5000   2858 BOT 0.0012 0.0020 | 196.617(   4) 336.741 0.584  OK

        2889 TOP 0.0008 0.0010 | 50.5038(   8) 171.935 0.294  OK

 ------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 2858

Thickness : 0.5000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 4

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.4500 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7800 kN.

M_Rd = Cc*(d-a/2) = 336.7406 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0012 m^2/m. ( 0.0012 m^2/m.)

M_Ed = 196.6168 kN-m./m.

M_Rd = 336.7406 kN-m./m.

RatM = M_Ed / M_Rd = 0.584 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.063

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.063/ 0.450 = 0.140 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 2889

Thickness : 0.5000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 8

==============================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platee-Platea Pompaggio, Dir 2.

==============================================================================

| Thk | Elem | POS | AsReq | AsUse | M_Ed( LCB) | M_Rd | Rat | CHK |
|---|---|---|---|---|---|---|---|---|
| 0.5000 | 2941 | BOT | 0.0008 | 0.0010 | 79.2402( 4) | 169.019 | 0.469 | OK |
| | 2939 | TOP | 0.0008 | 0.0010 | 27.2079( 5) | 169.019 | 0.161 | OK |

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 2941

Thickness : 0.5000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 4

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.4400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3923 kN.

M_Rd = Cc*(d-a/2) = 169.0190 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

M_Ed = 79.2402 kN-m./m.

M_Rd = 169.0190 kN-m./m.

RatM = M_Ed / M_Rd = 0.469 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 2939

Thickness : 0.5000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 5

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.4400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3923 kN.

M_Rd = Cc*(d-a/2) = 169.0190 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

M_Ed = 27.2079 kN-m./m.

M_Rd = 169.0190 kN-m./m.

RatM = M_Ed / M_Rd = 0.161 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.4500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3900 kN.

M_Rd = Cc*(d-a/2) = 171.9352 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

M_Ed = 50.5038 kN-m./m.

M_Rd = 171.9352 kN-m./m.

RatM = M_Ed / M_Rd = 0.294 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

### 1.8.5 Verifiche pressoflessione Pareti Grigliatura

===================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Grigliatura 1.

===================================================================================

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 3770

-. Node No. : 4807

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.8000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 111.5754 KPa.

-. Sig2 = Sig,min = -12.6455 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5339

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------          + -------- - 1.0 = -0.9637
           fcm^2          fcm            fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -15.3209 kN/m.

-. NEdy = -85.0364 kN/m.

-. NEdxy = 1.0551 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -12.6455 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd =5.928e-04

----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4059

-. Node No. : 15

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3240.0979 KPa.

-. Sig2 = Sig,min = 335.2474 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5317

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.0692

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -126.9299 kN/m.

-. NEdy = 182.2952 kN/m.

-. NEdxy = 232.3174 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1053.8753 KPa.

-. f'tdy = 4072.2031 KPa.

-. Sigcd = 4646.3488 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0021

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200/P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0040

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7865.2174 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2680

-. Rat,bary = f'tdy/ftdy = 0.5177

-. Rat,conc = Sigcd/Sigcn = 0.4356

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5177 ---> O.K.

---------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

---------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 3856

-. Node No. : 4928

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 172.4981 KPa.

-. Sig2 = Sig,min = -69.6297 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.0156

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 = -0.9444
            fcm^2          fcm              fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -40.3192 kN/m.

-. NEdy = -45.6595 kN/m.

-. NEdxy = -10.2823 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -69.6297 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.003

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 3770

-. Node No. : 4807

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.8000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 111.5754 KPa.

-. Sig2 = Sig,min = -12.6455 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5339

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 = -0.9637
```

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 0.2353 kN/m.

-. NEdy = -15.4994 kN/m.

-. NEdxy = 11.8436 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -327.8149 KPa.

-. alpha = 0.1560(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 21613.2095 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.015

---------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

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( ). Information of Parameters.

-. Elem No. : 3995

-. Node No. : 1027

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 9896.8840 KPa.

-. Sig2 = Sig,min = 340.3342 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5897

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 2.3153

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -30.2340 kN/m.

-. NEdy = 818.2858 kN/m.

-. NEdxy = 17.6432 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 0.0000 KPa.

-. f'tdy = 8503.8640 KPa.

-. Sigcd = 405.2981 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0043

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0022 m^2/m. ( 0.0022 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200/P16 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0030 m^2/m. ( 0.0030 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0060

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 11797.8261 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.0000

-. Rat,bary = f'tdy/ftdy = 0.7208

-. Rat,conc = Sigcd/Sigcn = 0.0380

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7208 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4059

-. Node No. : 15

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3240.0979 KPa.

-. Sig2 = Sig,min = 335.2474 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5317

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------    + -------- - 1.0 =  0.0692
           fcm^2          fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 154.9215 kN/m.

-. NEdy = 393.6621 kN/m.

-. NEdxy = 301.8599 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 4567.8133 KPa.

-. f'tdy = 7029.1429 KPa.

-. Sigcd = 6037.1971 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0023

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0036

-. Asx,req = 0.0012 m^2/m. ( 0.0012 m^2/m.)

-. Asy,req = 0.0018 m^2/m. ( 0.0018 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200/P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0040

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7865.2174 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5808

-. Rat,bary = f'tdy/ftdy = 0.8937

-. Rat,conc = Sigcd/Sigcn = 0.5660

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.8937 ---> O.K.

================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Grigliatura 2.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 4169

-. Node No. : 5382

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 374.3441 KPa.

-. Sig2 = Sig,min = 78.3533 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3062

-. beta = 4.6286

```
        alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------      + -------- - 1.0 = -0.8769
         fcm^2         fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -20.1483 kN/m.

-. NEdy = -113.7915 kN/m.

-. NEdxy = 0.9903 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 4169

-. Node No.  : 5382

-. LCB No.  :  17

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t  =     0.5000 m.

-. Covering  :  dB  =     0.0600 m., dT  =     0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =    374.3441 KPa.

-. Sig2   = Sig,min =     78.3533 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.3062

-. beta   =  4.6286

alpha*J2   lambda*SQRT[J2]      beta*I1

-. PHI    = -------- + ---------------             + -------- - 1.0 = -0.8769

fcm^2          fcm           fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx  =    -20.1483 kN/m.

-. NEdy  =   -113.7915 kN/m.

-. NEdxy =      0.9903 kN/m.

( ). Check the minimum principal stress.

-. Sig,min  =      0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4169

-. Node No. : 5382

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 374.3441 KPa.

-. Sig2 = Sig,min = 78.3533 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3062

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.8769

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -20.1483 kN/m.

-. NEdy = -113.7915 kN/m.

-. NEdxy = 0.9903 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4160

-. Node No. : 3716

-. LCB No. : 4

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3164.9296 KPa.

-. Sig2 = Sig,min = 624.9539 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3406

-. beta = 4.6286

alpha*J2   lambda*SQRT[J2]      beta*I1

-. PHI    = -------- + ---------------            + -------- - 1.0 =  0.0468

fcm^2          fcm           fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx  =     56.9690 kN/m.

-. NEdy  =    279.3686 kN/m.

-. NEdxy =     -2.4203 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx    =    593.8933 KPa.

-. f'tdy    =   2892.0439 KPa.

-. Sigcd    =     48.4068 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] =  0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] =  0.0015

-. Asx,req  =      0.0010 m^2/m.  (      0.0010 m^2/m.)

-. Asy,req  =      0.0007 m^2/m.  (      0.0007 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use  =      0.0010 m^2/m.  (      0.0010 m^2/m.)

-. Asy,use  =      0.0010 m^2/m.  (      0.0010 m^2/m.)

-. rhox,use =  0.0020

-. rhoy,use =  0.0020

-. ftdx     = rhox,use*fyd*(t/ck) =   3932.6087 KPa.

-. ftdy     = rhoy,use*fyd*(t/ck) =   3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1510

-. Rat,bary = f'tdy/ftdy = 0.7354

-. Rat,conc = Sigcd/Sigcn = 0.0045

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7354 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

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( ). Information of Parameters.

-. Elem No. : 4150

-. Node No. : 3717

-. LCB No. : 4

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3179.0856 KPa.

-. Sig2 = Sig,min = 625.3197 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3427

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.0515

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 56.9864 kN/m.

-. NEdy = 283.0339 kN/m.

-. NEdxy = 0.8656 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 578.5199 KPa.

-. f'tdy = 2913.7049 KPa.

-. Sigcd = 17.3110 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0015

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0007 m^2/m. ( 0.0007 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1471

-. Rat,bary = f'tdy/ftdy = 0.7409

-. Rat,conc = Sigcd/Sigcn = 0.0016

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7409 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4169

-. Node No. : 5382

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 374.3441 KPa.

-. Sig2 = Sig,min = 78.3533 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3062

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.8769

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 1.6279 kN/m.

-. NEdy = 4.3028 kN/m.

-. NEdxy = -3.1011 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -784.4249 KPa.

-. alpha = 0.1896(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 22046.2825 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.036

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Grigliatura 3.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4285

-. Node No. : 8

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3862.7064 KPa.

-. Sig2 = Sig,min = 1483.1146 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.4983

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 =  0.2860
           fcm^2          fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 219.7550 kN/m.

-. NEdy = 572.8025 kN/m.

-. NEdxy = 216.7364 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 4364.9138 KPa.

-. f'tdy = 8006.6544 KPa.

-. Sigcd = 4334.7281 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0022

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0041

-. Asx,req = 0.0011 m^2/m. ( 0.0011 m^2/m.)

-. Asy,req = 0.0020 m^2/m. ( 0.0020 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200/P16 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0030 m^2/m. ( 0.0030 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0060

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 11797.8261 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5550

-. Rat,bary = f'tdy/ftdy = 0.6787

-. Rat,conc = Sigcd/Sigcn = 0.4064

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.6787 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4800

-. Node No. : 2893

-. LCB No. : 7

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 8276.9965 KPa.

-. Sig2 = Sig,min = 991.2799 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5084

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------    + -------- - 1.0 =  1.7646
           fcm^2          fcm             fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 73.5831 kN/m.

-. NEdy = 805.3237 kN/m.

-. NEdxy = -1.4185 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 750.0161 KPa.

-. f'tdy = 8279.7225 KPa.

-. Sigcd = 28.3697 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0042

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0021 m^2/m. ( 0.0021 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200/P16 @100

-------------------------------------------------------------------------------------------

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=========================================================================================

( ). Tensile strengths provided by reinforcement.

-. Asx,use =  0.0010 m^2/m. (  0.0010 m^2/m.)

-. Asy,use =  0.0030 m^2/m. (  0.0030 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0060

-. ftdx  = rhox,use*fyd*(t/ck) =  3932.6087 KPa.

-. ftdy  = rhoy,use*fyd*(t/ck) = 11797.8261 KPa.

( ). Concrete strength limit.

-. Sigcn  = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1907

-. Rat,bary = f'tdy/ftdy = 0.7018

-. Rat,conc = Sigcd/Sigcn = 0.0027

-. Rat  = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7018 ---> O.K.

-------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4285

-. Node No. : 8

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3862.7064 KPa.

-. Sig2 = Sig,min = 1483.1146 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.4983

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.2860

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 219.7550 kN/m.

-. NEdy = 572.8025 kN/m.

-. NEdxy = 216.7364 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 4364.9138 KPa.

-. f'tdy = 8006.6544 KPa.

-. Sigcd = 4334.7281 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0022

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0041

-. Asx,req = 0.0011 m^2/m. ( 0.0011 m^2/m.)

-. Asy,req = 0.0020 m^2/m. ( 0.0020 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200/P16 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0030 m^2/m. ( 0.0030 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0060

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 11797.8261 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5550

-. Rat,bary = f'tdy/ftdy = 0.6787

-. Rat,conc = Sigcd/Sigcn = 0.4064

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.6787 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4285

-. Node No. : 8

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3862.7064 KPa.

-. Sig2 = Sig,min = 1483.1146 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.4983

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------    + -------- - 1.0 =  0.2860
          fcm^2         fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -160.8698 kN/m.

-. NEdy = 176.4303 kN/m.

-. NEdxy = 190.2991 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 294.2936 KPa.

-. f'tdy = 3556.0293 KPa.

-. Sigcd = 3805.9829 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0018

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.0748

-. Rat,bary = f'tdy/ftdy = 0.9042

-. Rat,conc = Sigcd/Sigcn = 0.3568

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.9042 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4285

-. Node No. : 8

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3862.7064 KPa.

-. Sig2 = Sig,min = 1483.1146 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.4983

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------   + -------- - 1.0 =  0.2860
           fcm^2          fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -160.8698 kN/m.

-. NEdy = 176.4303 kN/m.

-. NEdxy = 190.2991 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 294.2936 KPa.

-. f'tdy = 3556.0293 KPa.

-. Sigcd = 3805.9829 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0018

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.0748

-. Rat,bary = f'tdy/ftdy = 0.9042

-. Rat,conc = Sigcd/Sigcn = 0.3568

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.9042 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 3899

-. Node No. : 4991

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 183.9876 KPa.

-. Sig2 = Sig,min = -59.7237 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.1874

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9405

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -19.6458 kN/m.

-. NEdy = 1.7298 kN/m.

-. NEdxy = -5.6249 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -59.7237 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.003

### 1.8.6 Verifiche pressoflessione Pareti Pompaggio

==================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Pompaggio RINF.

==================================================================================

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2597

-. Node No. : 3101

-. LCB No. : 4

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3894.4199 KPa.

-. Sig2 = Sig,min = 1015.6451 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.1278

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------          + -------- - 1.0 =  0.2922
          fcm^2        fcm          fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 353.9323 kN/m.

-. NEdy = 156.1953 kN/m.

-. NEdxy = -39.8280 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3937.6025 KPa.

-. f'tdy = 2011.8176 KPa.

-. Sigcd = 796.5595 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5006

-. Rat,bary = f'tdy/ftdy = 0.5116

-. Rat,conc = Sigcd/Sigcn = 0.0747

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5116 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4322

-. Node No. : 3046

-. LCB No. : 4

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3178.4909 KPa.

-. Sig2 = Sig,min = 197.2751 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5740

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.0477

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 244.9846 kN/m.

-. NEdy = 126.7909 kN/m.

-. NEdxy = 105.7640 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3507.4863 KPa.

-. f'tdy = 2391.3942 KPa.

-. Sigcd = 2115.2806 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0012

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P16 @200

----------------------------------------------------------------------------------------

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( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4459

-. Rat,bary = f'tdy/ftdy = 0.6081

-. Rat,conc = Sigcd/Sigcn = 0.1983

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.6081 ---> O.K.

----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4384

-. Node No. : 3100

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3059.4807 KPa.

-. Sig2 = Sig,min = -737.3812 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3496

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------          + -------- - 1.0 =  0.0014
          fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 257.9042 kN/m.

-. NEdy = -218.3096 kN/m.

-. NEdxy = 9.6719 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2583.3269 KPa.

-. f'tdy = 0.0000 KPa.

-. Sigcd = 2187.3808 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3284

-. Rat,bary = f'tdy/ftdy = 0.0000

-. Rat,conc = Sigcd/Sigcn = 0.2051

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.3284 ---> O.K.

---------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

---------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4544

-. Node No. : 3279

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1904.9402 KPa.

-. Sig2 = Sig,min = 382.9403 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3305

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 = -0.3716
           fcm^2          fcm              fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -46.6074 kN/m.

-. NEdy = -50.3420 kN/m.

-. NEdxy = -20.3084 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -2122.6110 KPa.

-. alpha = 0.3480(the ratio between the two principal stress)

```
                      1+3.80*alpha
-. Sig,cdmax = 0.85fcd * -------------- 23175.8981 KPa.
                      (1+alpha)^2
```

-. Rat,con = Sig,min/Sig,cdmax = 0.092

--------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4504

-. Node No. : 3214

-. LCB No. : 4

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3150.1399 KPa.

-. Sig2 = Sig,min = 180.6871 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5774

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------          + -------- - 1.0 =  0.0381
           fcm^2         fcm          fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -112.2488 kN/m.

-. NEdy = 36.6230 kN/m.

-. NEdxy = 43.0062 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 0.0000 KPa.

-. f'tdy = 528.4708 KPa.

-. Sigcd = 1287.2590 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.0000

-. Rat,bary = f'tdy/ftdy = 0.1344

-. Rat,conc = Sigcd/Sigcn = 0.1207

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.1344 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4544

-. Node No. : 3279

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1904.9402 KPa.

-. Sig2 = Sig,min = 382.9403 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3305

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------        + -------- - 1.0 = -0.3716
           fcm^2         fcm            fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx =    -46.6074 kN/m.

-. NEdy =    -50.3420 kN/m.

-. NEdxy =    -20.3084 kN/m.

( ). Check the minimum principal stress.

-. Sig,min   =  -2122.6110 KPa.

-. alpha     =      0.3480(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * --------------  23175.8981 KPa.

(1+alpha)^2

-. Rat,con   = Sig,min/Sig,cdmax =    0.092

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midas Gen - RC-Shell Flexural Design[ Eurocode2:04 & NTC2018 ]           Gen 2021

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[[[*]]]   MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Pompaggio 1.

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[*]   SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 2676

-. Node No.  : 3207

-. LCB No.   :    8

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.5000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3419.2651 KPa.

-. Sig2 = Sig,min = 123.1388 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5891

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------           + -------- - 1.0 =  0.1270
           fcm^2          fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 562.0697 kN/m.

-. NEdy = -13.5489 kN/m.

-. NEdxy = -115.0002 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 6770.6988 KPa.

-. f'tdy = 1033.3518 KPa.

-. Sigcd = 2300.0044 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0035

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0017 m^2/m. ( 0.0017 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.8608

-. Rat,bary = f'tdy/ftdy = 0.2628

-. Rat,conc = Sigcd/Sigcn = 0.2156

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.8608 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

---------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2676

-. Node No. : 3207

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3419.2651 KPa.

-. Sig2 = Sig,min = 123.1388 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5891

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 =  0.1270
            fcm^2          fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 562.0697 kN/m.

-. NEdy = -13.5489 kN/m.

-. NEdxy = -115.0002 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 6770.6988 KPa.

-. f'tdy = 1033.3518 KPa.

-. Sigcd = 2300.0044 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0035

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0017 m^2/m. ( 0.0017 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.8608

-. Rat,bary = f'tdy/ftdy = 0.2628

-. Rat,conc = Sigcd/Sigcn = 0.2156

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.8608 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2674

-. Node No. : 3202

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 217.6595 KPa.

-. Sig2 = Sig,min = -455.3550 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 10.9286

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------          + -------- - 1.0 = -0.9334
          fcm^2          fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -19.2056 kN/m.

-. NEdy = -14.7953 kN/m.

-. NEdxy = -66.3007 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -53.2004 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.002

--------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 2676

-. Node No. : 3207

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3419.2651 KPa.

-. Sig2 = Sig,min = 123.1388 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5891

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.1270

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 410.8690 kN/m.

-. NEdy = -96.0624 kN/m.

-. NEdxy = -125.9271 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5367.9611 KPa.

-. f'tdy = 279.8080 KPa.

-. Sigcd = 2518.5422 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0027

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0014 m^2/m. ( 0.0014 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.6825

-. Rat,bary = f'tdy/ftdy = 0.0712

-. Rat,conc = Sigcd/Sigcn = 0.2361

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.6825 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2718

-. Node No. : 3267

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3930.0865 KPa.

-. Sig2 = Sig,min = -133.1809 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5904

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]     beta*I1
-. PHI  = -------- + ---------------  + -------- - 1.0 =  0.2951
           fcm^2          fcm             fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -100.6034 kN/m.

-. NEdy = 352.2704 kN/m.

-. NEdxy = -20.5987 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 0.0000 KPa.

-. f'tdy = 3658.6930 KPa.

-. Sigcd = 1048.2097 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0019

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200

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( ). Tensile strengths provided by reinforcement.

-. Asx,use =      0.0010 m^2/m.  (      0.0010 m^2/m.)

-. Asy,use =      0.0010 m^2/m.  (      0.0010 m^2/m.)

-. rhox,use =  0.0020

-. rhoy,use =  0.0020

-. ftdx     = rhox,use*fyd*(t/ck) =   3932.6087 KPa.

-. ftdy     = rhoy,use*fyd*(t/ck) =   3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn    = nu*fcd =  10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.0000

-. Rat,bary = f'tdy/ftdy  =  0.9303

-. Rat,conc = Sigcd/Sigcn =  0.0983

-. Rat      = MAX[ Rat,barx, Rat,bary, Rat,conc ] =  0.9303 ---> O.K.

-------------------------------------------------------------------------------------

[*]  SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 2674

-. Node No.  : 3202

-. LCB No.   :   17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 217.6595 KPa.

-. Sig2 = Sig,min = -455.3550 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 10.9286

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------       + -------- - 1.0 = -0.9334
           fcm^2         fcm          fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 0.0666 kN/m.

-. NEdy = -4.5623 kN/m.

-. NEdxy = -40.7931 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -455.3550 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.021

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Pompaggio 2.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 4317

-. Node No. : 3393

-. LCB No. : 4

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3292.2985 KPa.

-. Sig2 = Sig,min = 896.9272 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.0807

-. beta = 4.6286

```
            alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 =  0.0914
             fcm^2          fcm             fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 47.5608 kN/m.

-. NEdy = 237.6066 kN/m.

-. NEdxy = 127.6500 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1752.1076 KPa.

-. f'tdy = 3748.6863 KPa.

-. Sigcd = 2553.0000 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0019

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

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( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4455

-. Rat,bary = f'tdy/ftdy = 0.9532

-. Rat,conc = Sigcd/Sigcn = 0.2393

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.9532 ---> O.K.

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4425

-. Node No. : 3462

-. LCB No. : 4

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 4475.5176 KPa.

-. Sig2 = Sig,min = 1059.5842 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.2171

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.4859

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 77.0271 kN/m.

-. NEdy = 404.3069 kN/m.

-. NEdxy = 34.2392 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1112.6636 KPa.

-. f'tdy = 4500.8682 KPa.

-. Sigcd = 684.7847 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0023

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0012 m^2/m. ( 0.0012 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200/P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use =  0.0020 m^2/m. (  0.0020 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0040

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7865.2174 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2829

-. Rat,bary = f'tdy/ftdy = 0.5722

-. Rat,conc = Sigcd/Sigcn = 0.0642

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5722 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4349

-. Node No. : 5674

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1086.0689 KPa.

-. Sig2 = Sig,min = 80.7286 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5639

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.6437

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -99.4640 kN/m.

-. NEdy = -75.1927 kN/m.

-. NEdxy = -50.6329 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1281.7183 KPa.

-. alpha = 0.1861(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 22004.0749 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.058

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4349

-. Node No. : 5674

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1086.0689 KPa.

-. Sig2 = Sig,min = 80.7286 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5639

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------   + -------- - 1.0 = -0.6437
           fcm^2          fcm            fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 51.2464 kN/m.

-. NEdy = 31.5844 kN/m.

-. NEdxy = 44.0070 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

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( ). Information of Parameters.

-. Elem No. : 4349

-. Node No. : 5674

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1086.0689 KPa.

-. Sig2 = Sig,min = 80.7286 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5639

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 = -0.6437
           fcm^2         fcm          fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 51.2464 kN/m.

-. NEdy = 31.5844 kN/m.

-. NEdxy = 44.0070 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

---------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

---------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4349

-. Node No. : 5674

-. LCB No. : 17

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1086.0689 KPa.

-. Sig2 = Sig,min = 80.7286 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5639

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.6437

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 51.2464 kN/m.

-. NEdy = 31.5844 kN/m.

-. NEdxy = 44.0070 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Pompaggio 3.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2579

-. Node No. : 3053

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3482.5630 KPa.

-. Sig2 = Sig,min = 40.5437 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5957

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.1474

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 403.3777 kN/m.

-. NEdy = -27.5627 kN/m.

-. NEdxy = -120.2923 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5236.7001 KPa.

-. f'tdy = 926.4898 KPa.

-. Sigcd = 2405.8462 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0027

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0013 m^2/m. ( 0.0013 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.6658

-. Rat,bary = f'tdy/ftdy = 0.2356

-. Rat,conc = Sigcd/Sigcn = 0.2255

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.6658 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2580

-. Node No. : 3074

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3116.3438 KPa.

-. Sig2 = Sig,min = -596.0951 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4324

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.0212

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 257.9247 kN/m.

-. NEdy = -19.1179 kN/m.

-. NEdxy = -262.0919 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5200.1667 KPa.

-. f'tdy = 2414.4193 KPa.

-. Sigcd = 5241.8388 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0027

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0012

-. Asx,req = 0.0013 m^2/m. ( 0.0013 m^2/m.)

-. Asy,req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

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( ). Tensile strengths provided by reinforcement.

-. Asx,use =      0.0020 m^2/m.  (      0.0020 m^2/m.)

-. Asy,use =      0.0010 m^2/m.  (      0.0010 m^2/m.)

-. rhox,use =  0.0040

-. rhoy,use =  0.0020

-. ftdx     = rhox,use*fyd*(t/ck) =   7865.2174 KPa.

-. ftdy     = rhoy,use*fyd*(t/ck) =   3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn    = nu*fcd =  10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.6612

-. Rat,bary = f'tdy/ftdy  =  0.6139

-. Rat,conc = Sigcd/Sigcn =  0.4914

-. Rat      = MAX[ Rat,barx, Rat,bary, Rat,conc ] =  0.6612 ---> O.K.

-----------------------------------------------------------------------------------

[*]   SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 2580

-. Node No.  : 3074

-. LCB No.   :    8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3116.3438 KPa.

-. Sig2 = Sig,min = -596.0951 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4324

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 =  0.0212
          fcm^2          fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 257.9247 kN/m.

-. NEdy = -19.1179 kN/m.

-. NEdxy = -262.0919 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5200.1667 KPa.

-. f'tdy = 2414.4193 KPa.

-. Sigcd = 5241.8388 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0027

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0012

-. Asx,req = 0.0013 m^2/m. ( 0.0013 m^2/m.)

-. Asy,req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.6612

-. Rat,bary = f'tdy/ftdy = 0.6139

-. Rat,conc = Sigcd/Sigcn = 0.4914

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.6612 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2580

-. Node No. : 3074

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3116.3438 KPa.

-. Sig2 = Sig,min = -596.0951 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4324

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 =  0.0212
           fcm^2          fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 389.2318 kN/m.

-. NEdy = 9.1089 kN/m.

-. NEdxy = -292.0858 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 6813.1758 KPa.

-. f'tdy = 3027.2680 KPa.

-. Sigcd = 5841.7165 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0035

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0015

-. Asx,req = 0.0017 m^2/m. ( 0.0017 m^2/m.)

-. Asy,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0040

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 7865.2174 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.8662

-. Rat,bary = f'tdy/ftdy = 0.7698

-. Rat,conc = Sigcd/Sigcn = 0.5477

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.8662 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2580

-. Node No. : 3074

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3116.3438 KPa.

-. Sig2 = Sig,min = -596.0951 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4324

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------       + -------- - 1.0 =  0.0212
          fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 389.2318 kN/m.

-. NEdy = 9.1089 kN/m.

-. NEdxy = -292.0858 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 6813.1758 KPa.

-. f'tdy = 3027.2680 KPa.

-. Sigcd = 5841.7165 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0035

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] =  0.0015

-. Asx,req  =     0.0017 m^2/m.  (     0.0017 m^2/m.)

-. Asy,req  =     0.0008 m^2/m.  (     0.0008 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use  =     0.0020 m^2/m.  (     0.0020 m^2/m.)

-. Asy,use  =     0.0010 m^2/m.  (     0.0010 m^2/m.)

-. rhox,use =  0.0040

-. rhoy,use =  0.0020

-. ftdx    = rhox,use*fyd*(t/ck) =   7865.2174 KPa.

-. ftdy    = rhoy,use*fyd*(t/ck) =   3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn    = nu*fcd =  10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.8662

-. Rat,bary = f'tdy/ftdy  =  0.7698

-. Rat,conc = Sigcd/Sigcn =  0.5477

-. Rat      = MAX[ Rat,barx, Rat,bary, Rat,conc ] =  0.8662 ---> O.K.

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[*]   SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 2580

-. Node No.  : 3074

-. LCB No.  :    8

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.5000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   3116.3438 KPa.

-. Sig2   = Sig,min =   -596.0951 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.4324

-. beta   =  4.6286

alpha*J2   lambda*SQRT[J2]      beta*I1

-. PHI    = -------- + ---------------             + -------- - 1.0 =  0.0212

fcm^2         fcm          fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx  =    389.2318 kN/m.

-. NEdy  =      9.1089 kN/m.

-. NEdxy =   -292.0858 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx    =    6813.1758 KPa.

-. f'tdy    =    3027.2680 KPa.

-. Sigcd    =   5841.7165 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] =  0.0035

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] =  0.0015

-. Asx,req  =      0.0017 m^2/m.  (      0.0017 m^2/m.)

-. Asy,req  =      0.0008 m^2/m.  (      0.0008 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use  =      0.0020 m^2/m.  (      0.0020 m^2/m.)

-. Asy,use  =      0.0010 m^2/m.  (      0.0010 m^2/m.)

-. rhox,use =  0.0040

-. rhoy,use =  0.0020

-. ftdx     = rhox,use*fyd*(t/ck) =   7865.2174 KPa.

-. ftdy     = rhoy,use*fyd*(t/ck) =   3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn    = nu*fcd =  10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.8662

-. Rat,bary = f'tdy/ftdy  =  0.7698

-. Rat,conc = Sigcd/Sigcn =  0.5477

-. Rat      = MAX[ Rat,barx, Rat,bary, Rat,conc ] =  0.8662 ---> O.K.

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[[[*]]]   MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Pompaggio 4.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4248

-. Node No. : 433

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3685.1783 KPa.

-. Sig2 = Sig,min = 735.0777 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3349

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.2203

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -56.6379 kN/m.

-. NEdy = -259.9438 kN/m.

-. NEdxy = -69.4351 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = -380.9069 KPa.

-. f'tdy = 0.0000 KPa.

-. Sigcd = 2784.9100 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

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( ). Concrete strength limit.

-. Sigcn    = nu*fcd =  10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.0969

-. Rat,bary = f'tdy/ftdy  =  0.0000

-. Rat,conc = Sigcd/Sigcn =  0.2611

-. Rat      = MAX[ Rat,barx, Rat,bary, Rat,conc ] =  0.2611 ---> O.K.

------------------------------------------------------------------------------------

[*]   SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 4215

-. Node No.  : 5

-. LCB No.   :   17

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.5000 m.

-. Covering  :  dB  =      0.0600 m., dT  =      0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =    199.1238 KPa.

-. Sig2   = Sig,min =   -171.8886 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.9388

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9367

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -7.6131 kN/m.

-. NEdy = 8.4177 kN/m.

-. NEdxy = 35.0162 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -154.3066 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.007

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4248

-. Node No. : 433

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3685.1783 KPa.

-. Sig2 = Sig,min = 735.0777 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3349

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 =  0.2203
            fcm^2         fcm               fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -56.6379 kN/m.

-. NEdy = -259.9438 kN/m.

-. NEdxy = -69.4351 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = -380.9069 KPa.

-. f'tdy = 0.0000 KPa.

-. Sigcd = 2784.9100 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.0969

-. Rat,bary = f'tdy/ftdy = 0.0000

-. Rat,conc = Sigcd/Sigcn = 0.2611

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.2611 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 4268

-. Node No. : 4653

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3773.4849 KPa.

-. Sig2 = Sig,min = 1099.0681 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9991

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.2528

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 113.4346 kN/m.

-. NEdy = 386.3869 kN/m.

-. NEdxy = -151.6237 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2650.5830 KPa.

-. f'tdy = 5521.6876 KPa.

-. Sigcd = 3032.4738 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0028

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0014 m^2/m. ( 0.0014 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200/P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0040

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7865.2174 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.6740

-. Rat,bary = f'tdy/ftdy = 0.7020

-. Rat,conc = Sigcd/Sigcn = 0.2843

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7020 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4268

-. Node No. : 4653

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3773.4849 KPa.

-. Sig2 = Sig,min = 1099.0681 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9991

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------        + -------- - 1.0 =  0.2528
          fcm^2          fcm          fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 113.4346 kN/m.

-. NEdy = 386.3869 kN/m.

-. NEdxy = -151.6237 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2650.5830 KPa.

-. f'tdy = 5521.6876 KPa.

-. Sigcd = 3032.4738 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0028

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0014 m^2/m. ( 0.0014 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200/P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0040

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7865.2174 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.6740

-. Rat,bary = f'tdy/ftdy = 0.7020

-. Rat,conc = Sigcd/Sigcn = 0.2843

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7020 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 4268

-. Node No. : 4653

-. LCB No. : 8

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3773.4849 KPa.

-. Sig2 = Sig,min = 1099.0681 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9991

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------   + -------- - 1.0 =  0.2528
          fcm^2          fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 113.4346 kN/m.

-. NEdy = 386.3869 kN/m.

-. NEdxy = -151.6237 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2650.5830 KPa.

-. f'tdy = 5521.6876 KPa.

-. Sigcd = 3032.4738 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0028

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0014 m^2/m. ( 0.0014 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P16 @200/P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0020 m^2/m. ( 0.0020 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0040

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7865.2174 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.6740

-. Rat,bary = f'tdy/ftdy = 0.7020

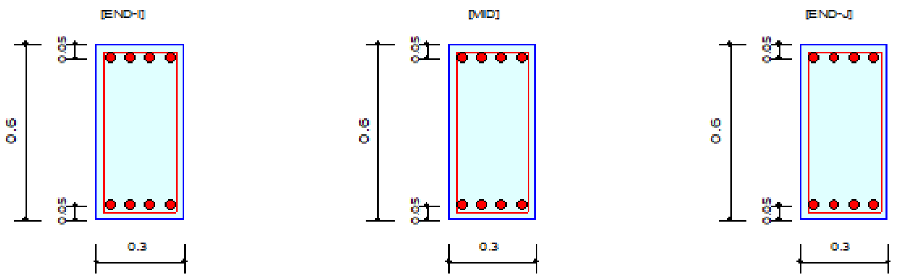
-. Rat,conc = Sigcd/Sigcn = 0.2843

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7020 ---> O.K.

### 1.8.7 Verifiche travi di rinforzo soletta di copertura

## 1. Design Information

| | | | |
|---|---|---|---|
| Design Code | Eurocode2:04 & NTC2018 | Unit System | kN, m |
| Material Data | fck = 32000, fyk = 450000, fyw = 450000 KPa | | |
| Section Property | 30x60 (No : 1) | Beam Span | 7.7m |




| [END-I] | [MID] | [END-J] |
|---|---|---|
| TOP 4-P20 | TOP 4-P20 | TOP 4-P20 |
| BOT 4-P20 | BOT 4-P20 | BOT 4-P20 |
| STIRRUPS 2-P10 @100 | STIRRUPS 2-P10 @200 | STIRRUPS 2-P10 @100 |

## 2. Bending Moment Capacity

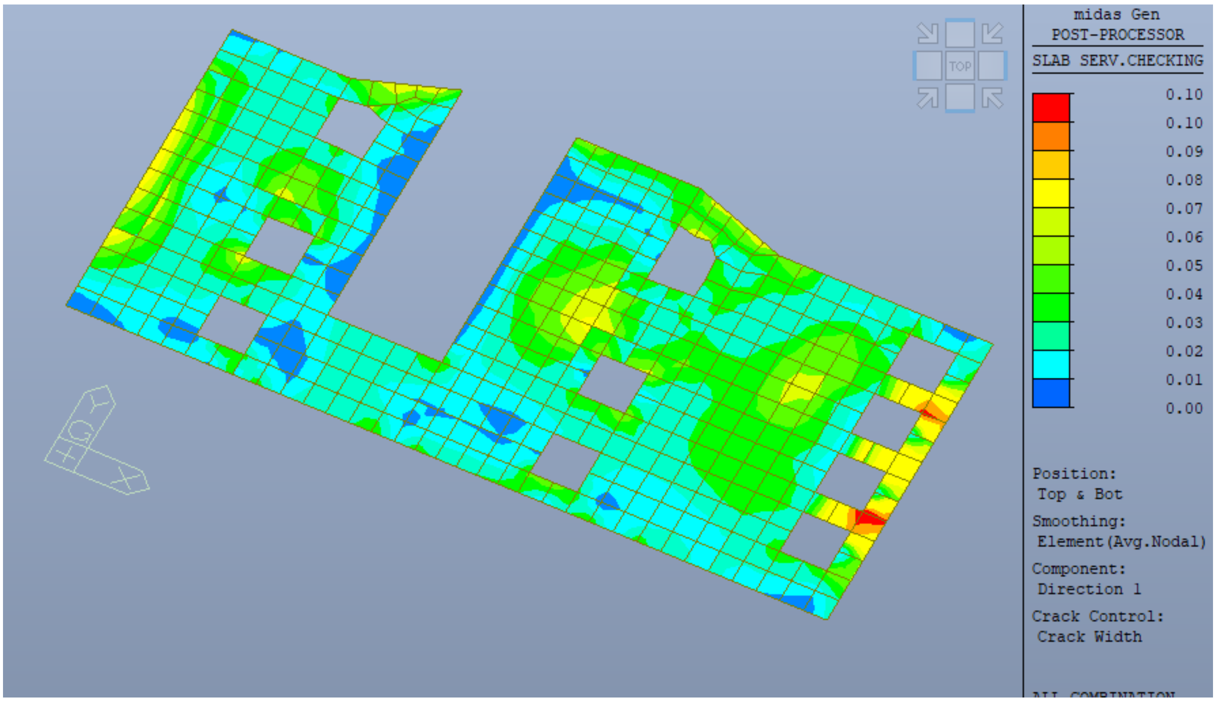
| | END-I | MID | END-J |
|---|---|---|---|
| (-) Load Combination No. | 7 | 7 | 7 |
| Moment (M_Ed) | 97.84 | 23.90 | 181.18 |
| Factored Strength (M_Rd) | 252.10 | 252.10 | 252.10 |
| Check Ratio (M_Ed/M_Rd) | 0.3881 | 0.0948 | 0.7187 |
| Neutral Axis (x/d) | 0.1128 | 0.1128 | 0.1128 |
| (+) Load Combination No. | 5 | 7 | 7 |
| Moment (M_Ed) | 34.01 | 181.51 | 94.57 |
| Factored Strength (M_Rd) | 252.10 | 252.10 | 252.10 |
| Check Ratio (M_Ed/M_Rd) | 0.1349 | 0.7200 | 0.3751 |
| Neutral Axis (x/d) | 0.1128 | 0.1128 | 0.1128 |
| Using Rebar Top (As_top) | 0.0013 | 0.0013 | 0.0013 |
| Using Rebar Bot (As_bot) | 0.0013 | 0.0013 | 0.0013 |

## 3. Shear Capacity

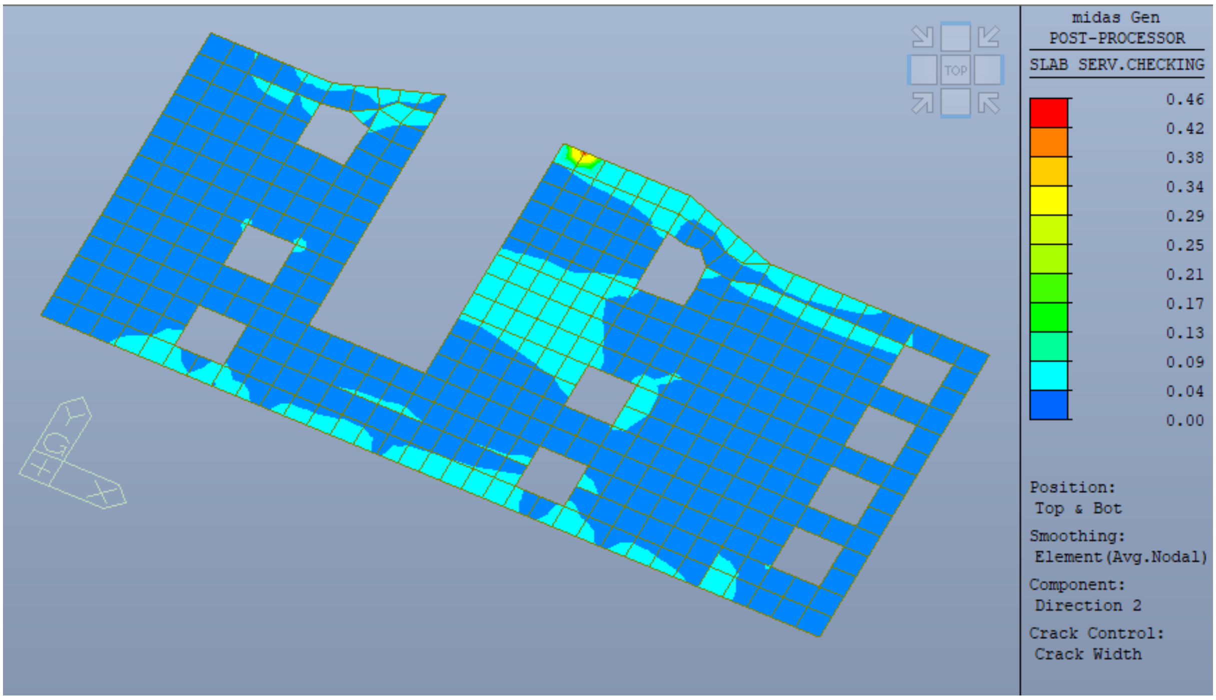
| | END-I | MID | END-J |
|---|---|---|---|
| Load Combination No. | 5 | 5 | 5 |
| Factored Shear Force (V_Ed) | 62.82 | 62.82 | 69.38 |
| V_Rdc | 92.01 | 92.01 | 92.01 |
| V_Rds | 306.04 | 153.02 | 306.04 |
| V_Rdmax | 792.00 | 792.00 | 792.00 |
| Using Shear Reinf. (Asw) | 0.0016 | 0.0008 | 0.0016 |
| Using Stirrups Spacing | 2-P10 @100 | 2-P10 @200 | 2-P10 @100 |
| V_Ed / V_Rdc | 0.6827 | 0.6827 | 0.7541 |
| V_Ed / min(V_Rds, V_Rdmax) | 0.2053 | 0.4105 | 0.2267 |
| Check Ratio | 0.6827 | 0.6827 | 0.7541 |

## 1.9 Verifiche in condizioni di esercizio SLE

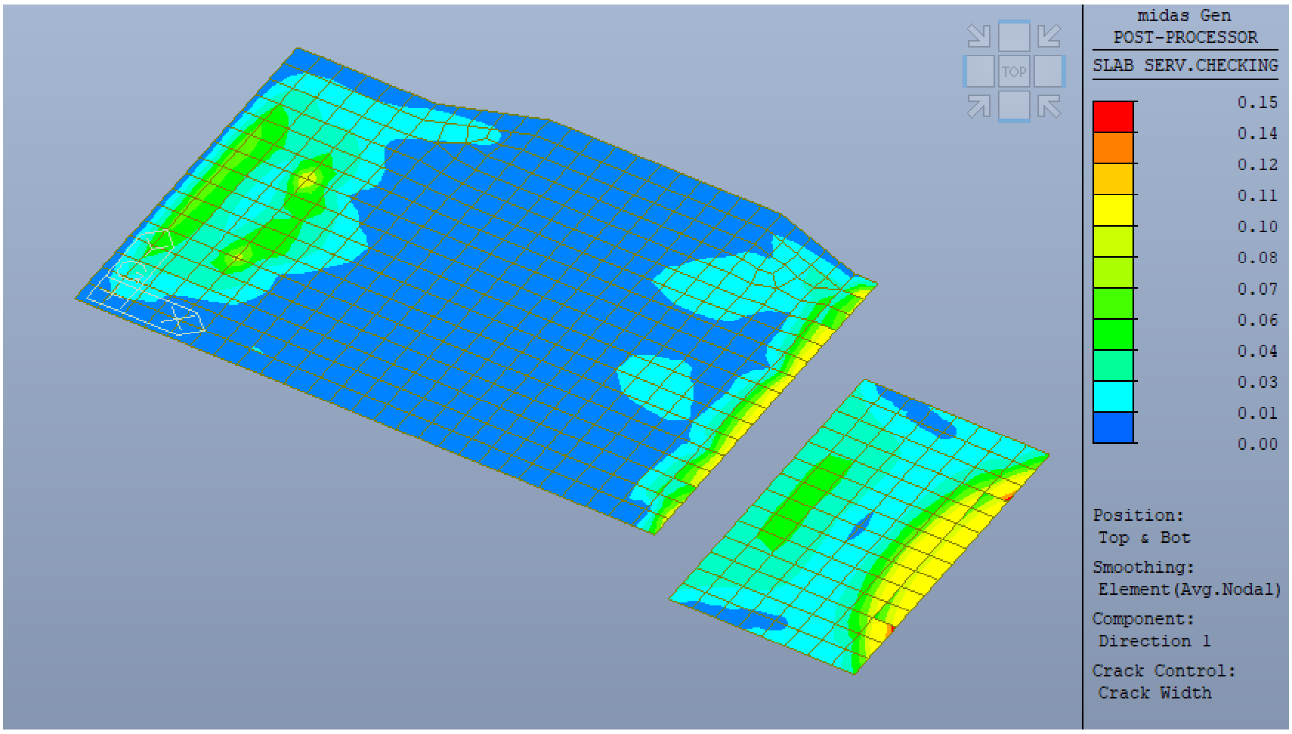
Vengono riportate di seguito le verifiche di fessurazione in forma grafica:



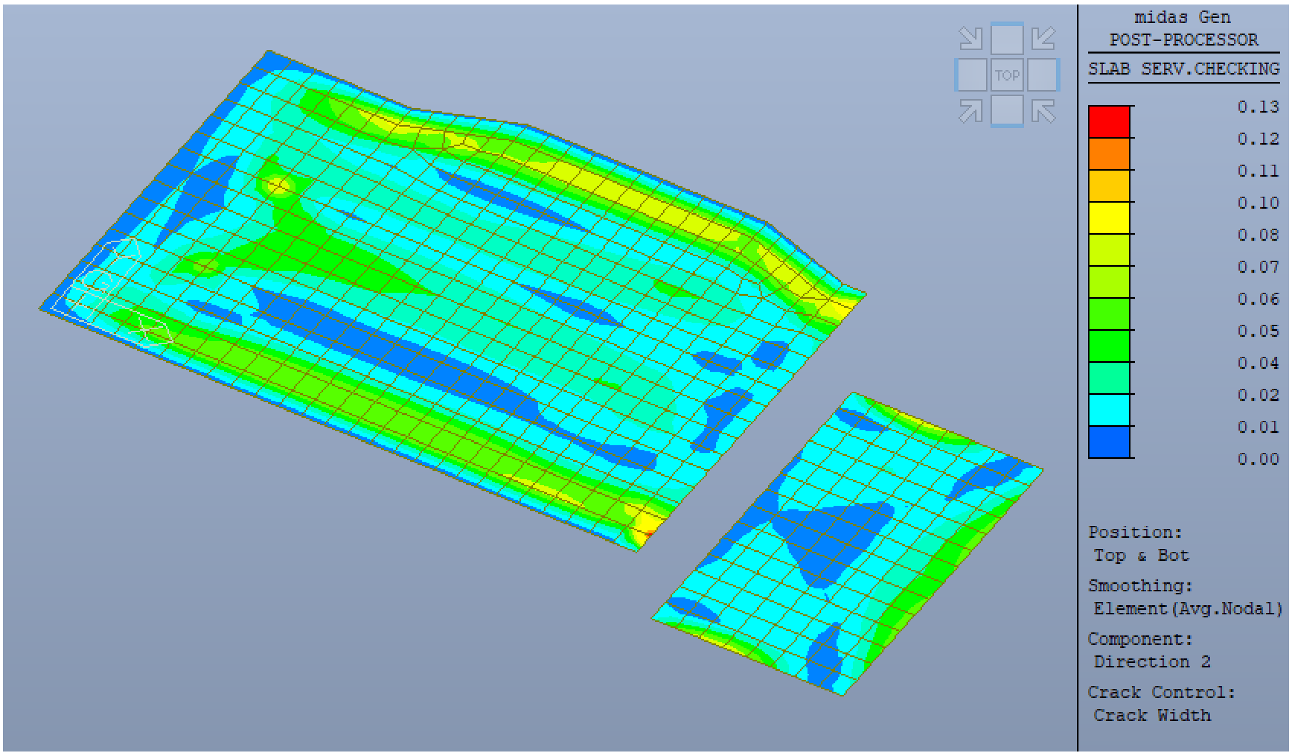

***Soletta – Verifica a fessurazione SLE - ratio direzione X ambo i lati***




***Soletta – Verifica a fessurazione SLE - ratio direzione Y ambo i lati***




***Platee – Verifica a fessurazione SLE - ratio direzione X ambo i lati***



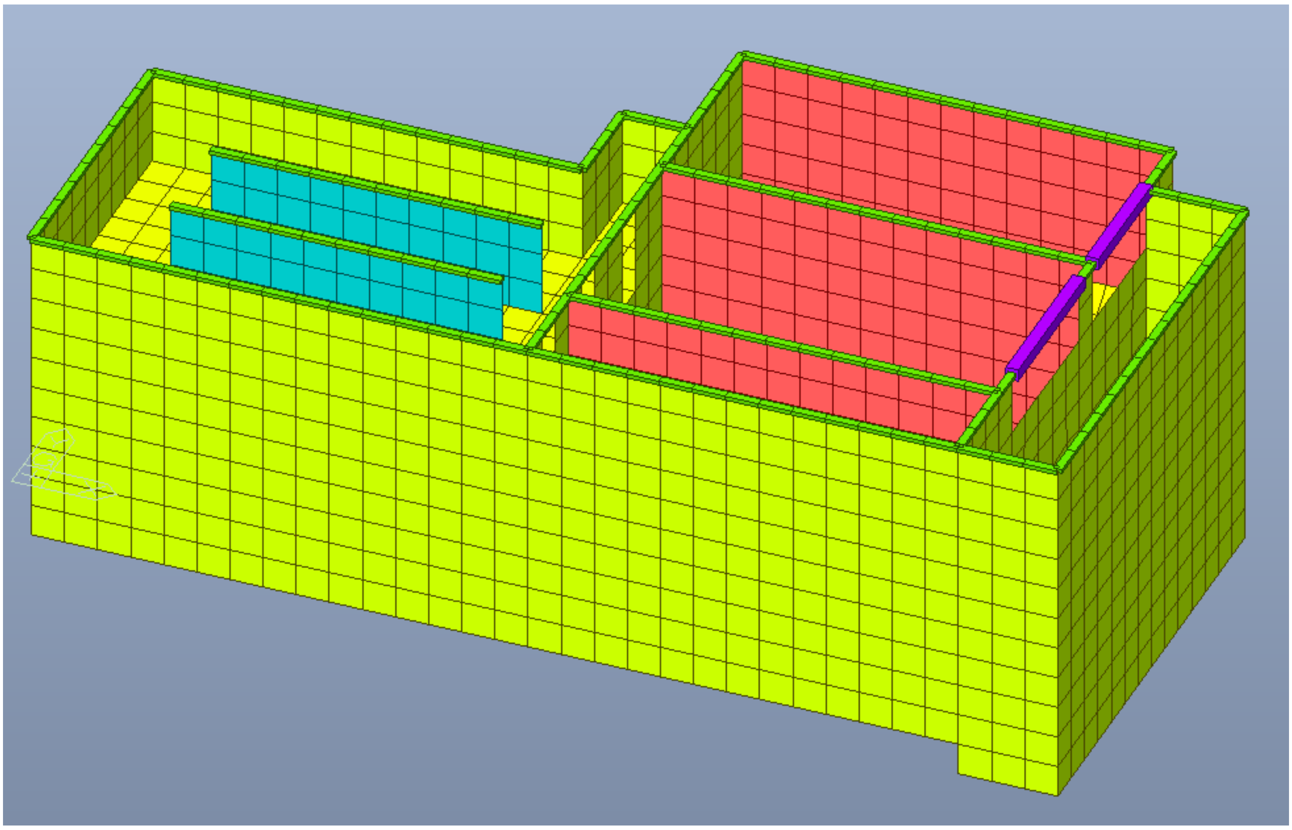

***Platee – Verifica a fessurazione SLE - ratio direzione Y ambo i lati***

# 2 Fascicolo dei calcoli Manufatto Grigliatura Fine e Dissabbiatura

## 2.1 Dati della modellazione

Il manufatto risulta sostanzialmente fuori terra e quindi soggetto principalmente alle azioni dei carichi permanenti dei macchinari (comparto di grigliatura fine) e dei liquidi contenuti (comparto di dissabbiatura), oltre alle azioni sismiche e del vento. Le platee hanno spessore 50 cm, le pareti 40 e 50 cm a seconda dell'ubicazione, mentre le solette sono spesse 40 cm.

Nell'immagine seguente viene rappresentato il modello di calcolo:



*Modello di Calcolo agli elementi finiti*

L'interazione terreno struttura a livello del piano di fondazione è stata modellata con delle molle alla Winkler con costante di sottofondo media pari a circa 7200 kN/m$^3$, ricavata dalle caratteristiche geotecniche del terreno con la formula di Vesic.

Essendo la struttura fuori terra con una piccola parte interrata, l'analisi sismica è stata effettuata mediante analisi dinamica con spettro di risposta a cui sono state aggiunte le sovra spinte sismiche del terreno e dei liquami; per i calcoli di queste sovra spinte si rimanda all'apposito capitolo della relazione strutturale.

L'analisi dinamica è stata effettuata utilizzando gli spettri SLV per le verifiche di resistenza e SLO per le verifiche di deformazione.
La struttura è stata progettata come non dissipativa, con fattore di struttura q=1.

Di seguito vengono riportati i principali risultati dei periodi e delle frequenze dell'analisi dinamica, condotta con i vettori di Ritz per 20 modi.

| Mode | UX | UY | UZ | RX |
|---|---|---|---|---|
| EIGENVALUE ANALYSIS | | | | |
| Mode No | Frequency (rad/sec) | Frequency (cycle/sec) | Period (sec) | Tolerance |
| 1 | 27.2003 | 4.3291 | 0.2310 | 0.0000e+00 |
| 2 | 30.8764 | 4.9141 | 0.2035 | 0.0000e+00 |
| 3 | 31.5886 | 5.0275 | 0.1989 | 0.0000e+00 |
| 4 | 68.9459 | 10.9731 | 0.0911 | 0.0000e+00 |
| 5 | 89.3773 | 14.2248 | 0.0703 | 0.0000e+00 |
| 6 | 92.7011 | 14.7538 | 0.0678 | 0.0000e+00 |
| 7 | 96.3704 | 15.3378 | 0.0652 | 0.0000e+00 |
| 8 | 118.0183 | 18.7832 | 0.0532 | 0.0000e+00 |
| 9 | 121.9888 | 19.4151 | 0.0515 | 0.0000e+00 |
| 10 | 127.8217 | 20.3435 | 0.0492 | 0.0000e+00 |
| 11 | 150.5294 | 23.9575 | 0.0417 | 0.0000e+00 |
| 12 | 156.0554 | 24.8370 | 0.0403 | 0.0000e+00 |
| 13 | 190.3655 | 30.2976 | 0.0330 | 0.0000e+00 |
| 14 | 195.9261 | 31.1826 | 0.0321 | 0.0000e+00 |
| 15 | 237.9319 | 37.8680 | 0.0264 | 0.0000e+00 |
| 16 | 255.1993 | 40.6162 | 0.0246 | 0.0000e+00 |
| 17 | 337.9821 | 53.7915 | 0.0186 | 0.0000e+00 |
| 18 | 352.0375 | 56.0285 | 0.0178 | 0.0000e+00 |
| 19 | 602.2703 | 95.8543 | 0.0104 | 0.0000e+00 |
| 20 | 656.0287 | 104.4102 | 0.0096 | 0.0000e+00 |

Di seguito vengono riportate le masse partecipanti:

| 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 | 21.2230 | 21.2230 | 0.4454 | 0.4454 | 2.2098 | 2.2098 | 0.6697 | 0.6697 | 82.7174 | 82.7174 | 0.0247 | 0.0247 |
| 2 | 0.5061 | 21.7291 | 0.0299 | 0.4752 | 97.6465 | 99.8563 | 0.0065 | 0.6763 | 2.5560 | 85.2734 | 0.0009 | 0.0255 |
| 3 | 0.0319 | 21.7610 | 44.3568 | 44.8321 | 0.0143 | 99.8706 | 71.3469 | 72.0232 | 1.4613 | 86.7347 | 0.3713 | 0.3969 |
| 4 | 2.1537 | 23.9147 | 0.0974 | 44.9294 | 0.0014 | 99.8721 | 0.0105 | 72.0338 | 0.6483 | 87.3830 | 0.0054 | 0.4022 |
| 5 | 0.0331 | 23.9478 | 0.4970 | 45.4264 | 0.0002 | 99.8723 | 0.0231 | 72.0568 | 0.0000 | 87.3830 | 4.6241 | 5.0264 |
| 6 | 0.1011 | 24.0489 | 0.0035 | 45.4299 | 0.0141 | 99.8864 | 0.0556 | 72.1124 | 0.0053 | 87.3883 | 0.1549 | 5.1812 |
| 7 | 0.0481 | 24.0971 | 0.0662 | 45.4961 | 0.0008 | 99.8872 | 1.4176 | 73.5300 | 0.0019 | 87.3902 | 4.1652 | 9.3464 |
| 8 | 0.2176 | 24.3147 | 0.0636 | 45.5596 | 0.0107 | 99.8980 | 0.0231 | 73.5531 | 0.0120 | 87.4021 | 0.0622 | 9.4086 |
| 9 | 1.2427 | 25.5574 | 0.1546 | 45.7142 | 0.0284 | 99.9264 | 0.0868 | 73.6400 | 0.0701 | 87.4722 | 1.3268 | 10.7354 |
| 10 | 0.0189 | 25.5763 | 0.0281 | 45.7423 | 0.0014 | 99.9278 | 0.0323 | 73.6723 | 0.0063 | 87.4785 | 2.4070 | 13.1425 |
| 11 | 1.1474 | 26.7237 | 0.0585 | 45.8008 | 0.0001 | 99.9279 | 0.0445 | 73.7168 | 0.2701 | 87.7486 | 1.4065 | 14.5489 |
| 12 | 0.1771 | 26.9008 | 1.2970 | 47.0978 | 0.0016 | 99.9295 | 0.9187 | 74.6354 | 0.0152 | 87.7638 | 17.9496 | 32.4985 |
| 13 | 3.7433 | 30.6440 | 1.1224 | 48.2202 | 0.0113 | 99.9408 | 0.5563 | 75.1917 | 0.8334 | 88.5972 | 1.5256 | 34.0241 |
| 14 | 1.1563 | 31.8003 | 4.2255 | 52.4458 | 0.0090 | 99.9498 | 2.0968 | 77.2885 | 0.3269 | 88.9241 | 0.0256 | 34.0498 |
| 15 | 1.7127 | 33.5130 | 7.5506 | 59.9964 | 0.0000 | 99.9498 | 3.3707 | 80.6592 | 0.2803 | 89.2044 | 6.9932 | 41.0429 |
| 16 | 9.1914 | 42.7044 | 2.9400 | 62.9364 | 0.0053 | 99.9551 | 1.3197 | 81.9789 | 1.3704 | 90.5749 | 0.1415 | 41.1844 |
| 17 | 29.2608 | 71.9652 | 0.0040 | 62.9404 | 0.0005 | 99.9556 | 0.0051 | 81.9840 | 4.9229 | 95.4978 | 0.0127 | 41.1971 |
| 18 | 0.2338 | 72.1989 | 17.2848 | 80.2252 | 0.0003 | 99.9559 | 8.4644 | 90.4485 | 0.0449 | 95.5427 | 8.6834 | 49.8805 |
| 19 | 2.6568 | 74.8558 | 14.2067 | 94.4319 | 0.0000 | 99.9559 | 6.6892 | 97.1377 | 0.4351 | 95.9778 | 0.8898 | 50.7703 |
| 20 | 19.0198 | 93.8755 | 1.4920 | 95.9239 | 0.0006 | 99.9565 | 0.7364 | 97.8740 | 2.9449 | 98.9227 | 0.1075 | 50.8778 |

## 2.2 Carichi e combinazioni di carico

Per la determinazione delle azioni sul manufatto si faccia riferimento alla relazione strutturale.
Nel presente paragrafo vengono riportati i carichi assegnati ai vari elementi strutturali, le condizioni di carico elementari considerate e le combinazioni di carico.

Le condizioni di carico adottate nella modellazione della struttura sono le seguenti:

| No | Name | Type | Description |
|---|---|---|---|
| 1 | DL | Dead Load (D) | Peso Proprio |
| 2 | PG | Dead Load (D) | Permanente Griglie Fini |
| 3 | PC | Dead Load (D) | Permanente Copertura |
| 4 | SST | Dead Load (D) | Spinta Statica terreno |
| 5 | SSLG | Dead Load (D) | Variabile liquame grigliatura |
| 6 | SSLD 1/2 | Dead Load (D) | Variabile liquame dissab mezza |
| 7 | SSLD tot | Dead Load (D) | Variabile liquame dissab entrambe |
| 8 | VM PT | Live Load (L) | Variabile Manutenzione PT |
| 9 | VM 1P | Live Load (L) | Variabile Manutenzione grigliatura |
| 10 | VLF | Dead Load (D) | Variabile liquame pozzetto finale |
| 11 | ET X | Earthquake (E) | Spinta sismica terreno X |
| 12 | ET Y | Earthquake (E) | Spinta sismica terreno Y |
| 13 | EL X | Earthquake (E) | Spinta sismica liquame X |
| 14 | EL Y | Earthquake (E) | Spinta sismica liquame Y |
| 15 | WX + | Wind Load on Structure | Vento direzione X+ |
| 16 | WY + | Wind Load on Structure | Vento direzione Y+ |
| 17 | WX - | Wind Load on Structure | Vento direzione X- |
| 18 | WY - | Wind Load on Structure | Vento direzione Y- |

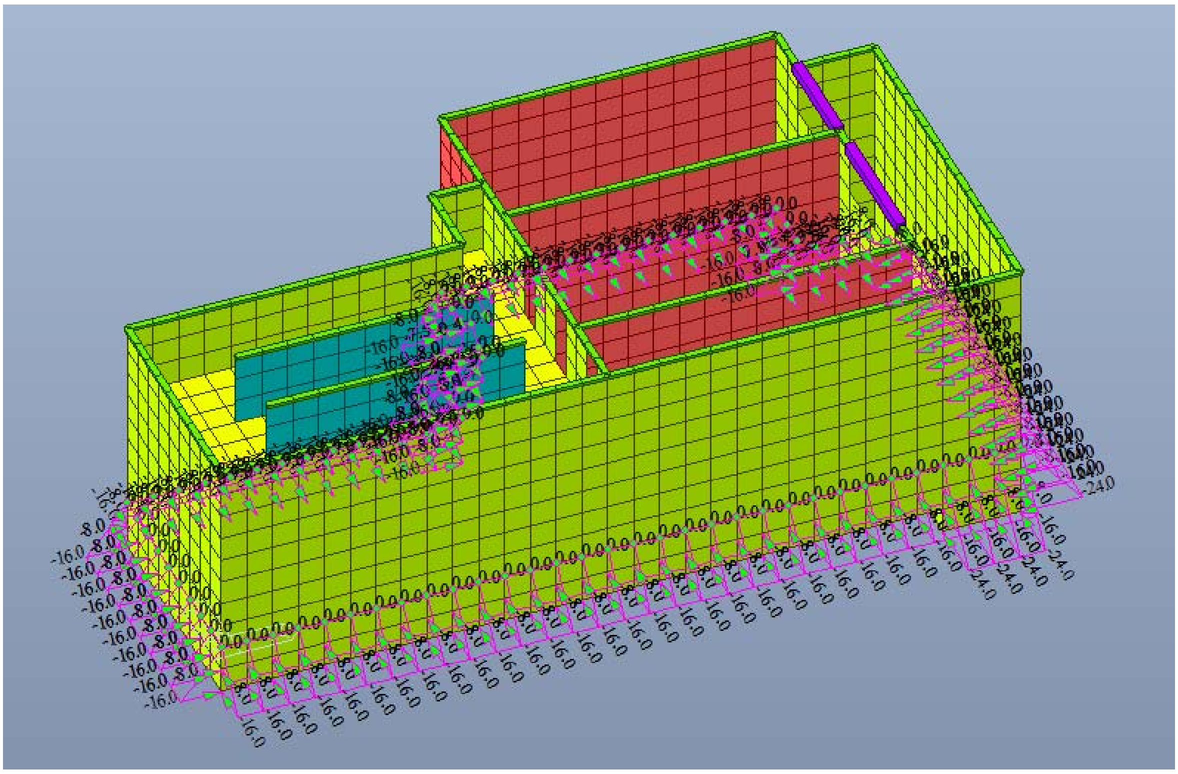
Le combinazioni delle condizioni di carico elementari, realizzate sulla base delle indicazioni del paragrafo 2.5.3 delle NTC 2018, sono le seguenti:

| No | Name | DL | PG | PC | SST | SSLG( | SSLD 1/2 | SSLD tot | VM PT | VM 1P | VLF | ET X | ET Y | EL X | EL Y | WX + | WY + | WX - | WY - | Ex( | Ey( | Ex SLO | Ey SLO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SLU 1 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | 1.3000 | | 1.5000 | 1.0500 | 1.30 | | | | | | | | | | | | |
| 2 | SLU 2 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | | | | | | | | |
| 3 | SLU 3 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.5000 | 1.0500 | 1.30 | | | | | 0.900 | | | | | | | |
| 4 | SLU 4 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.5000 | 1.0500 | 1.30 | | | | | | 0.900 | | | | | | |
| 5 | SLU 5 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.5000 | 1.0500 | 1.30 | | | | | | | 0.90 | | | | | |
| 6 | SLU 6 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.5000 | 1.0500 | 1.30 | | | | | | | | 0.90 | | | | |
| 7 | SLU 7 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | 0.900 | | | | | | | |
| 8 | SLU 8 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | | 0.900 | | | | | | |
| 9 | SLU 9 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | | | 0.90 | | | | | |
| 10 | SLU 10 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | | | | 0.90 | | | | |
| 11 | SLU 11 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.0500 | 1.30 | | | | | 1.500 | | | | | | | |
| 12 | SLU 12 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.0500 | 1.30 | | | | | | 1.500 | | | | | | |
| 13 | SLU 13 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.0500 | 1.30 | | | | | | | 1.50 | | | | | |
| 14 | SLU 14 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.0500 | 1.30 | | | | | | | | 1.50 | | | | |
| 15 | SLU 15 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.5000 | 1.0500 | 1.30 | | | | | -0.90 | | | | | | | |
| 16 | SLU 16 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.5000 | 1.0500 | 1.30 | | | | | | -0.90 | | | | | | |
| 17 | SLU 17 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.5000 | 1.0500 | 1.30 | | | | | | | -0.90 | | | | | |
| 18 | SLU 18 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.5000 | 1.0500 | 1.30 | | | | | | | | -0.90 | | | | |
| 19 | SLU 19 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | -0.90 | | | | | | | |
| 20 | SLU 20 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | | -0.90 | | | | | | |
| 21 | SLU 21 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | | | -0.90 | | | | | |
| 22 | SLU 22 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | 1.30 | | | | | | | | -0.90 | | | | |
| 23 | SLU 23 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.0500 | 1.30 | | | | | -1.50 | | | | | | | |
| 24 | SLU 24 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.0500 | 1.30 | | | | | | -1.50 | | | | | | |
| 25 | SLU 25 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.0500 | 1.30 | | | | | | | -1.50 | | | | | |
| 26 | SLU 26 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.0500 | 1.30 | | | | | | | | -1.50 | | | | |
| 27 | SLU 27 | 1.3 | 1.3 | 1.3 | 1.30 | 1.300 | | 1.3000 | 1.0500 | 1.5000 | | | | | | | | | | | | | |

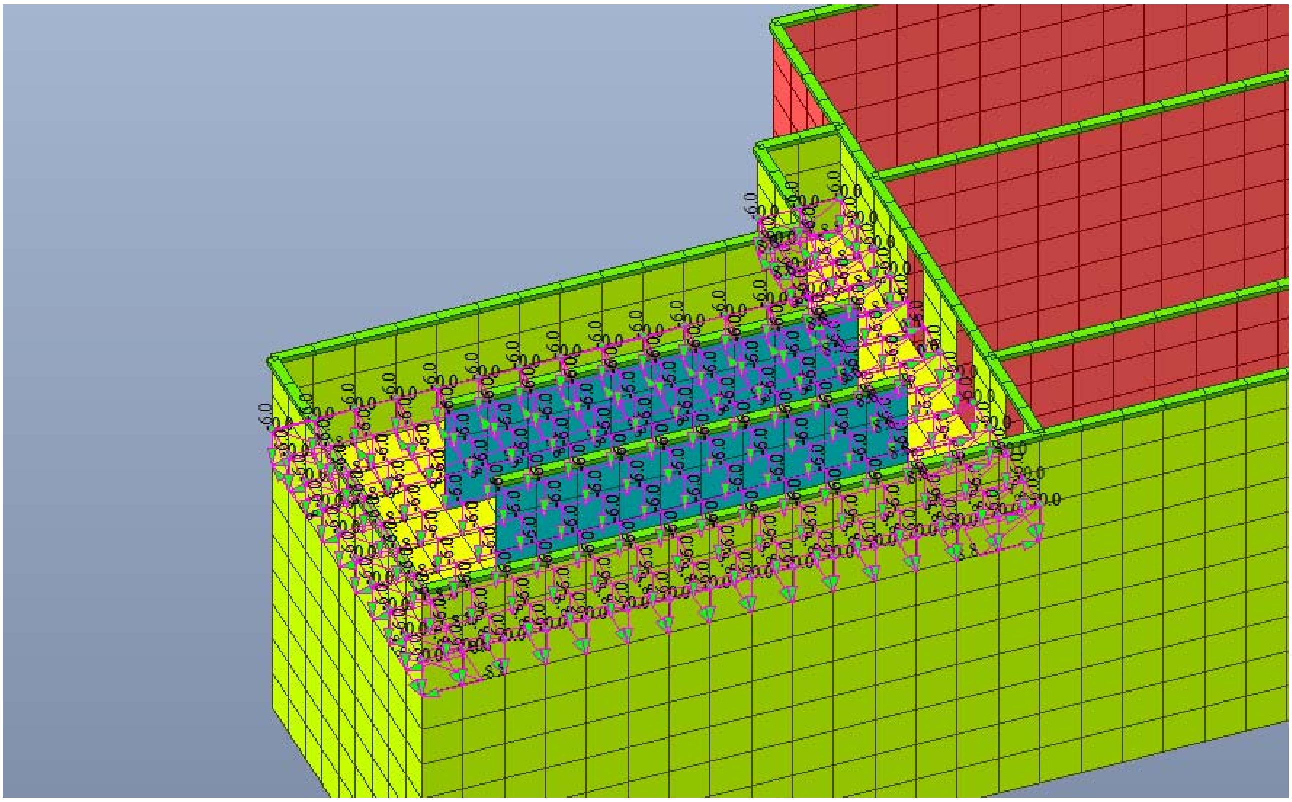
| No | Name | DL | PG | PC | SST | SSLG( | SSLD 1/2 | SSLD tot | VM PT | VM 1P | VLF | ET X | ET Y | EL X | EL Y | WX + | WY + | WX - | WY - | Ex( | Ey( | Ex SLO | Ey SLO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | SLV 1 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | 1.00 | 0.30 | 1.00 | 0.30 | | | | | 1.0 | 0.3 | | |
| 29 | SLV 2 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | 1.00 | -0.30 | 1.00 | -0.3 | | | | | 1.0 | -0.3 | | |
| 30 | SLV 3 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | 0.30 | 1.00 | 0.30 | 1.00 | | | | | 0.3 | 1.0 | | |
| 31 | SLV 4 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | -0.30 | 1.00 | -0.30 | 1.00 | | | | | -0.3 | 1.0 | | |
| 32 | SLV 5 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | -1.00 | -0.30 | -1.00 | -0.3 | | | | | -1.0 | -0.3 | | |
| 33 | SLV 6 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | -1.00 | 0.30 | -1.00 | 0.30 | | | | | -1.0 | 0.3 | | |
| 34 | SLV 7 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | -0.30 | -1.00 | -0.30 | -1.0 | | | | | -0.3 | -1.0 | | |
| 35 | SLV 8 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | 0.30 | -1.00 | 0.30 | -1.0 | | | | | 0.3 | -1.0 | | |
| 36 | SLO 1 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | 0.30 | 0.10 | 0.30 | 0.10 | | | | | | | 1.0000 | 0.3000 |
| 37 | SLO 2 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | 0.30 | -0.10 | 0.30 | -0.1 | | | | | | | 1.0000 | -0.3000 |
| 38 | SLO 3 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | 0.10 | 0.30 | 0.10 | 0.30 | | | | | | | 0.3000 | 1.0000 |
| 39 | SLO 4 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | -0.10 | 0.30 | -0.10 | 0.30 | | | | | | | -0.3000 | 1.0000 |
| 40 | SLO 5 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | -0.30 | -0.10 | -0.30 | -0.1 | | | | | | | -1.0000 | -0.3000 |
| 41 | SLO 6 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | -0.30 | 0.10 | -0.30 | 0.10 | | | | | | | -1.0000 | 0.3000 |
| 42 | SLO 7 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | -0.10 | -0.30 | -0.10 | -0.3 | | | | | | | -0.3000 | -1.0000 |
| 43 | SLO 8 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | 0.10 | -0.30 | 0.10 | -0.3 | | | | | | | 0.3000 | -1.0000 |

| No | Name | DL | PG | PC | SST | SSLG( | SSLD 1/2 | SSLD tot | VM PT | VM 1P | VLF | ET X | ET Y | EL X | EL Y | WX + | WY + | WX - | WY - | Ex( | Ey( | Ex SLO | Ey SLO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44 | SLE R1 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | | | | | | | | |
| 45 | SLE R2 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | | | | | | | | |
| 46 | SLE R3 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | 0.600 | | | | | | | |
| 47 | SLE R4 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | | 0.600 | | | | | | |
| 48 | SLE R5 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | | | 0.60 | | | | | |
| 49 | SLE R6 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | | | | 0.60 | | | | |
| 50 | SLE R7 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | 0.600 | | | | | | | |
| 51 | SLE R8 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | | 0.600 | | | | | | |
| 52 | SLE R9 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | | | 0.60 | | | | | |
| 53 | SLE R10 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | | | | 0.60 | | | | |
| 54 | SLE R11 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | -0.60 | | | | | | | |
| 55 | SLE R12 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | | -0.60 | | | | | | |
| 56 | SLE R13 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | | | -0.60 | | | | | |
| 57 | SLE R14 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 1.0000 | 0.7000 | 1.00 | | | | | | | | -0.60 | | | | |
| 58 | SLE R15 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | -0.60 | | | | | | | |
| 59 | SLE R16 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | | -0.60 | | | | | | |
| 60 | SLE R17 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | | | -0.60 | | | | | |
| 61 | SLE R18 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | 1.00 | | | | | | | | -0.60 | | | | |
| 62 | SLE R19 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 0.7000 | 1.00 | | | | | 1.000 | | | | | | | |
| 63 | SLE R20 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 0.7000 | 1.00 | | | | | | 1.000 | | | | | | |
| 64 | SLE R21 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 0.7000 | 1.00 | | | | | | | 1.00 | | | | | |
| 65 | SLE R22 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 0.7000 | 1.00 | | | | | | | | 1.00 | | | | |
| 66 | SLE R23 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 0.7000 | 1.00 | | | | | -1.00 | | | | | | | |
| 67 | SLE R24 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 0.7000 | 1.00 | | | | | | -1.00 | | | | | | |
| 68 | SLE R25 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 0.7000 | 1.00 | | | | | | | -1.00 | | | | | |
| 69 | SLE R26 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 0.7000 | 1.00 | | | | | | | | -1.00 | | | | |
| 70 | SLE R27 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.7000 | 1.0000 | | | | | | | | | | | | | |
| 71 | SLE R28 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | 1.0000 | | 0.7000 | 1.0000 | 1.00 | | | | | | | | | | | | |
| 72 | SLE F1 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.5000 | 0.3000 | 1.00 | | | | | | | | | | | | |
| 73 | SLE F2 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.5000 | 1.00 | | | | | | | | | | | | |
| 74 | SLE F3 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | 0.200 | | | | | | | |
| 75 | SLE F4 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | | 0.200 | | | | | | |
| 76 | SLE F5 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | | | 0.20 | | | | | |
| 77 | SLE F6 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | | | | 0.20 | | | | |
| 78 | SLE F7 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | -0.20 | | | | | | | |
| 79 | SLE F8 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | | -0.20 | | | | | | |
| 80 | SLE F9 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | | | -0.20 | | | | | |
| 81 | SLE F10 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | | | | -0.20 | | | | |
| 82 | SLE F11 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | 1.0000 | | 0.3000 | 0.3000 | 1.00 | | | | | | | | | | | | |
| 83 | SLE F12 | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | | | | | | | | | | | | | |
| 84 | SLE Qp | 1.0 | 1.0 | 1.0 | 1.00 | 1.000 | | 1.0000 | 0.3000 | 0.3000 | 1.00 | | | | | | | | | | | | |

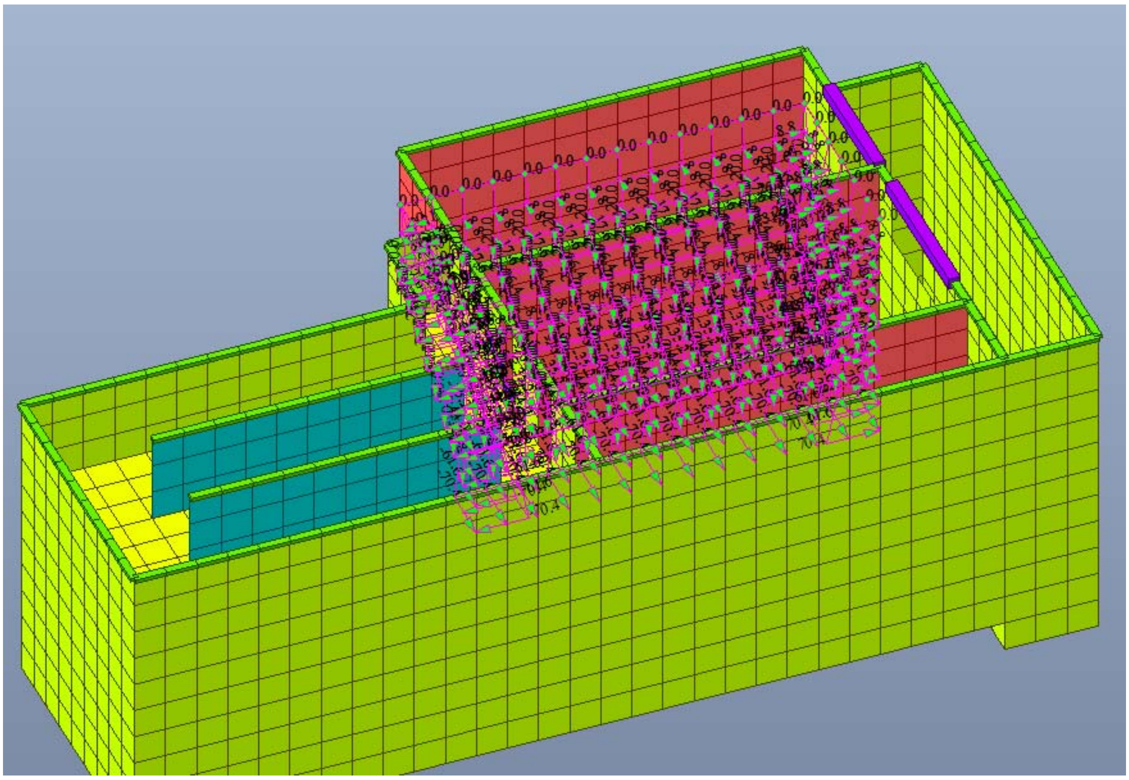
Nelle immagini seguenti si riportano le assegnazioni dei carichi:



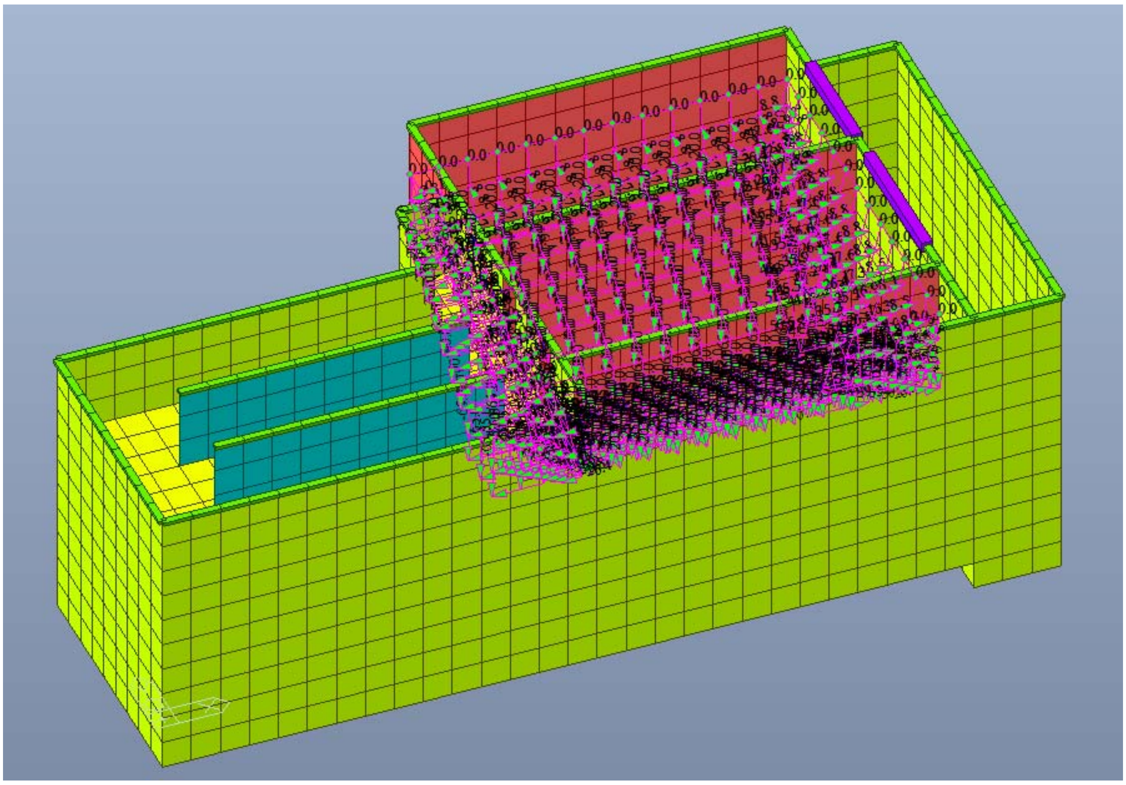
***Assegnazione spinta statica del terreno (SST) - [kN/mq]***



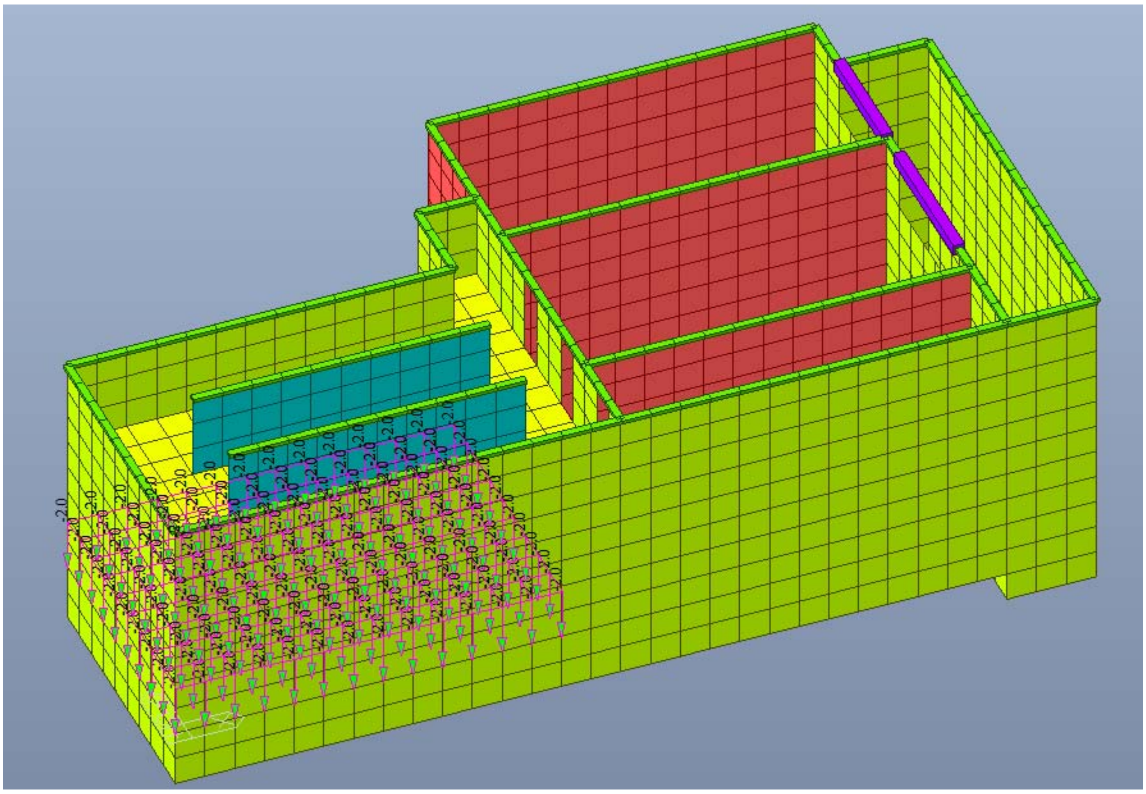
***Assegnazione spinta statica liquame Grigliatura (SSLG) - [kN/mq]***



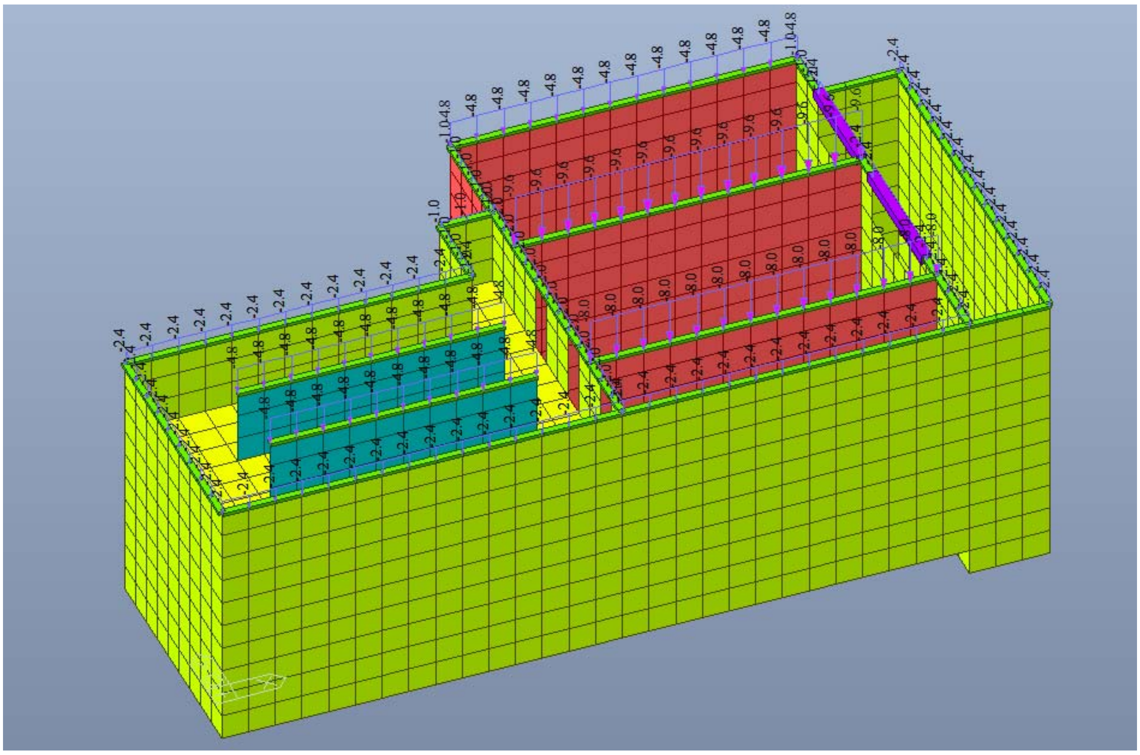
*Assegnazione spinta statica liquame Dissabbiatura solo una linea (SSLD 1/2) - [kN/mq]*



*Assegnazione spinta statica liquame Dissabbiatura entrambe le linee (SSLD tot) - [kN/mq]*



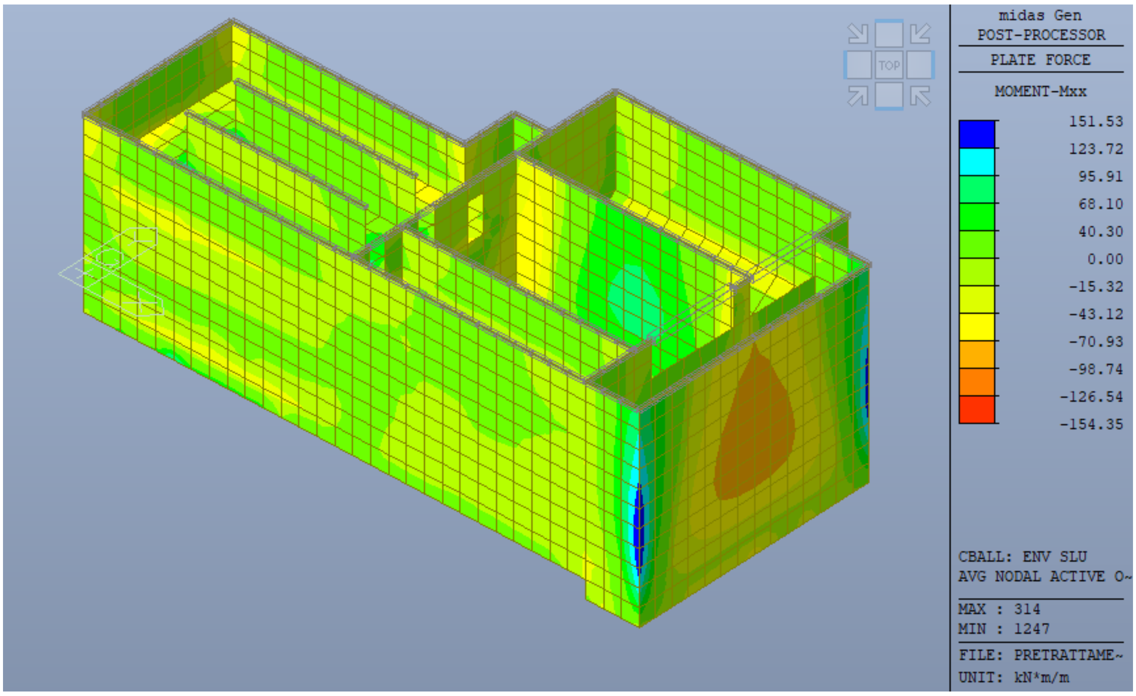
***Assegnazione spinta variabile manutenzione piano terra (VM PT) - [kN/mq]***



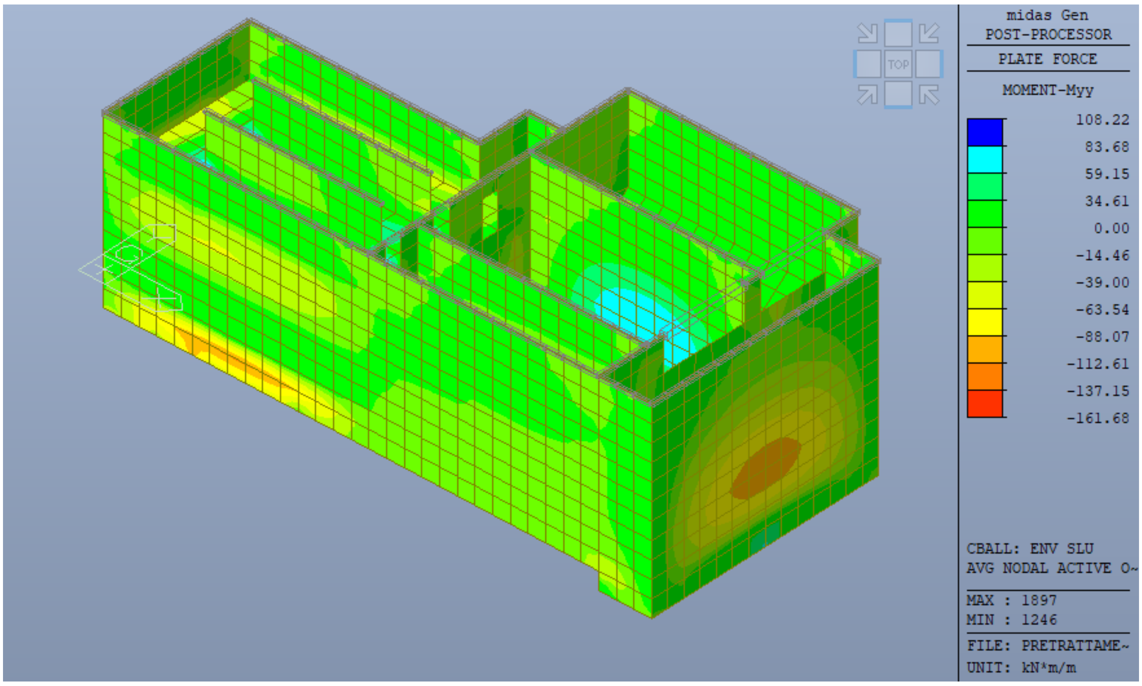
***Assegnazione spinta variabile manutenzione piano primo (VM 1P) - [kN/mq]***

## 2.3 Sollecitazioni

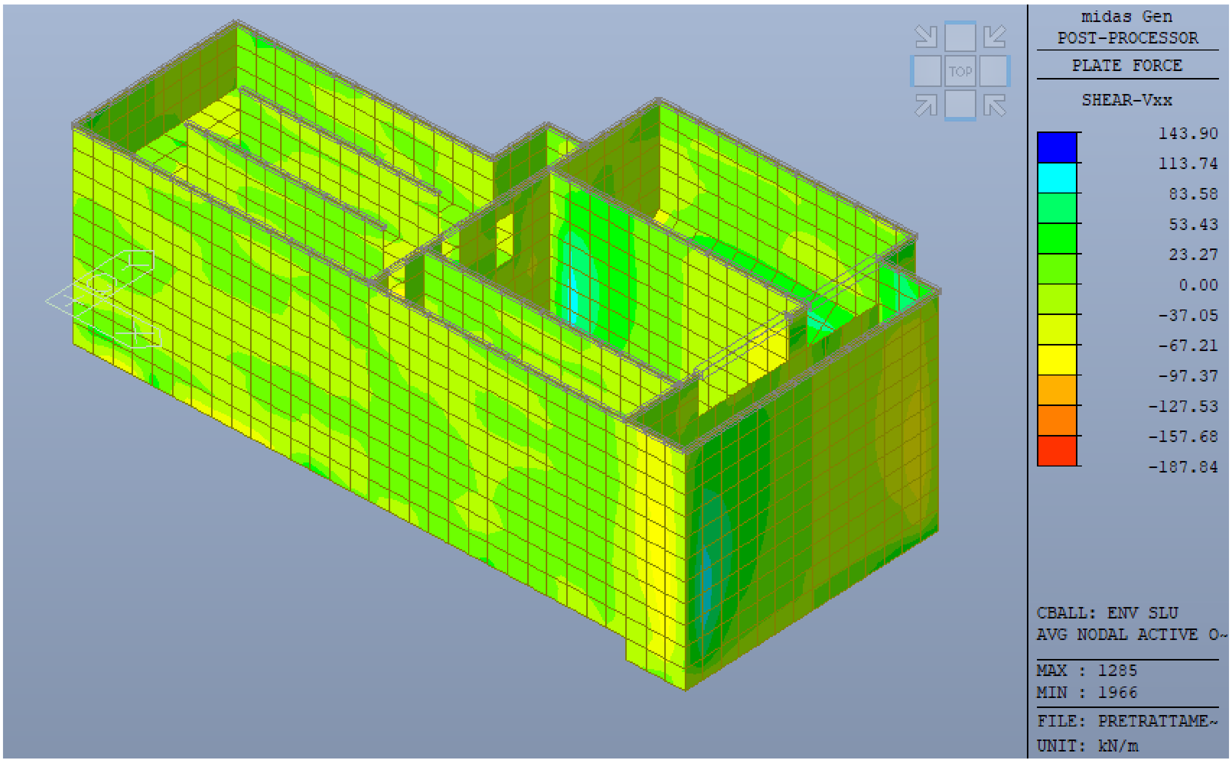
Nel presente paragrafo vengono riportate per via grafica le sollecitazioni sulla struttura indotte dai carichi applicati, per le varie combinazioni di carico statiche e sismiche.



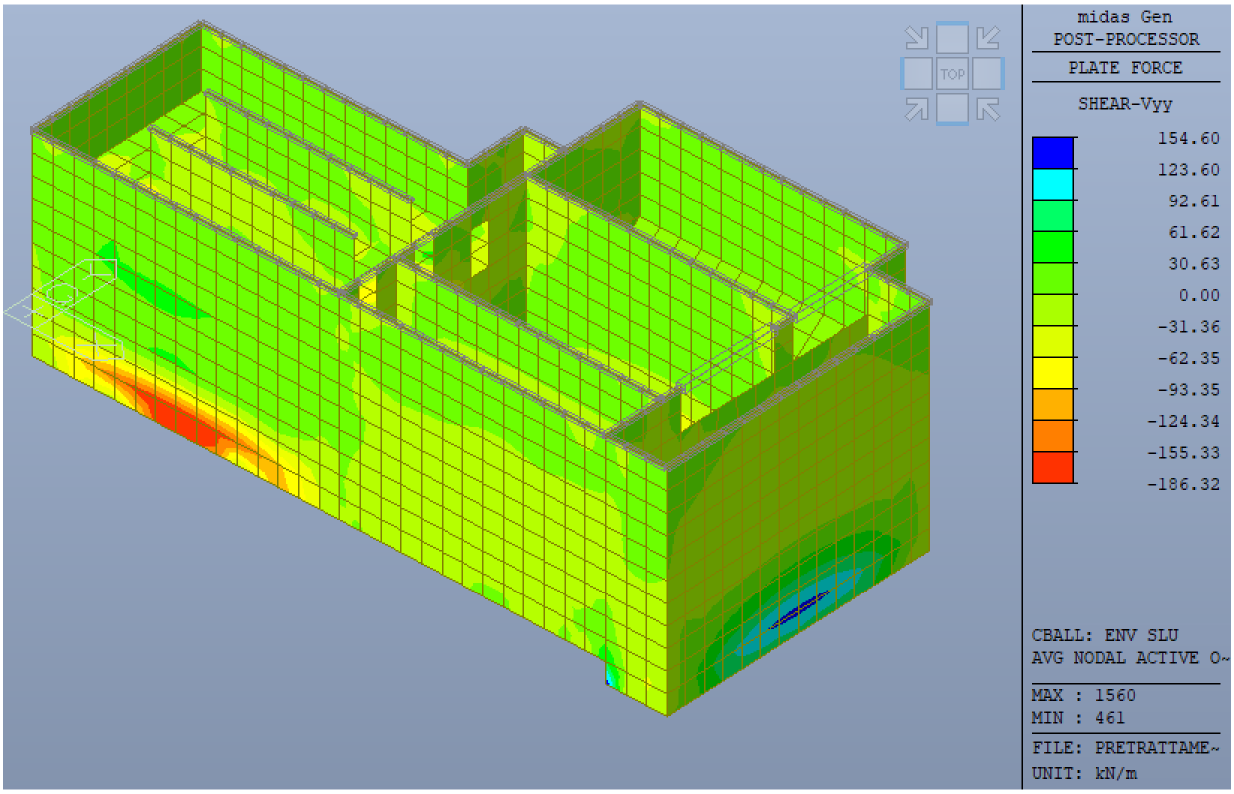

***Momento flettente membranale Mxx – inviluppo SLU [kN*m/m]***



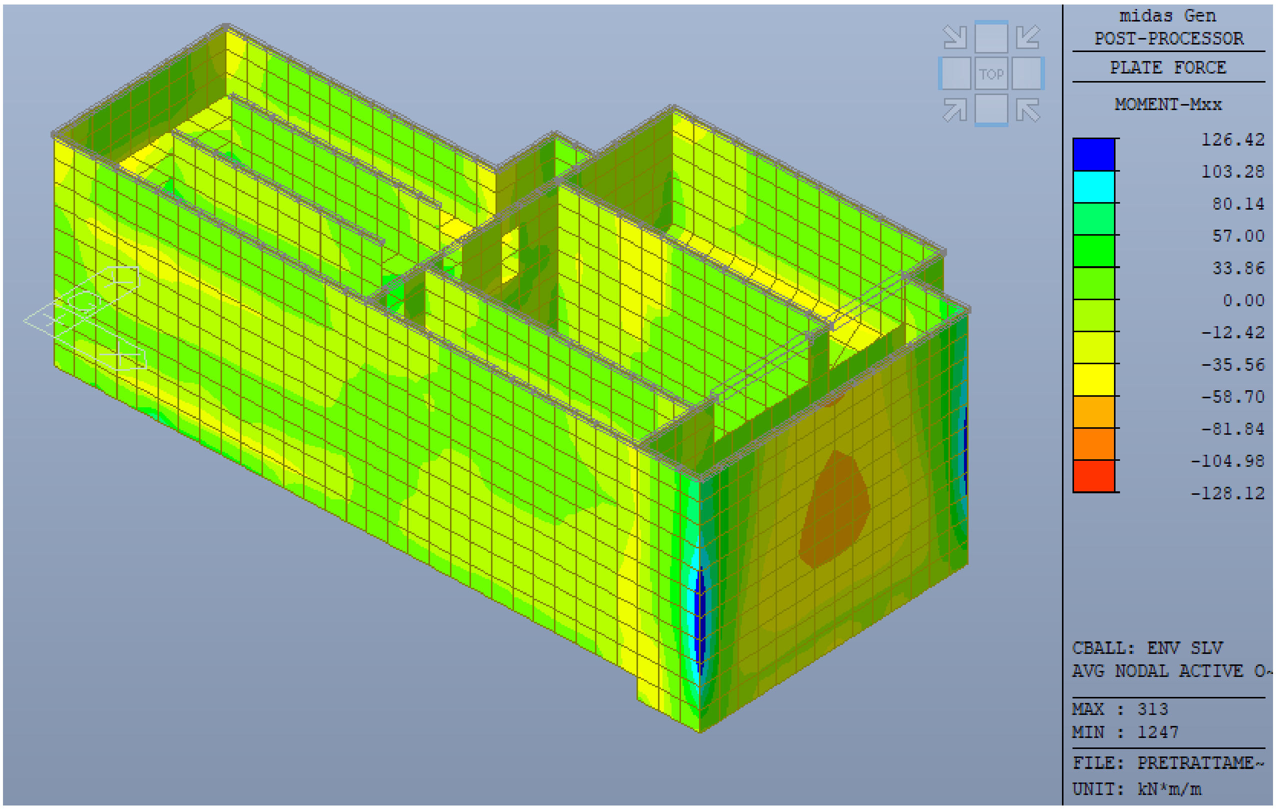

***Momento flettente membranale Myy – inviluppo SLU [kN*m/m]***



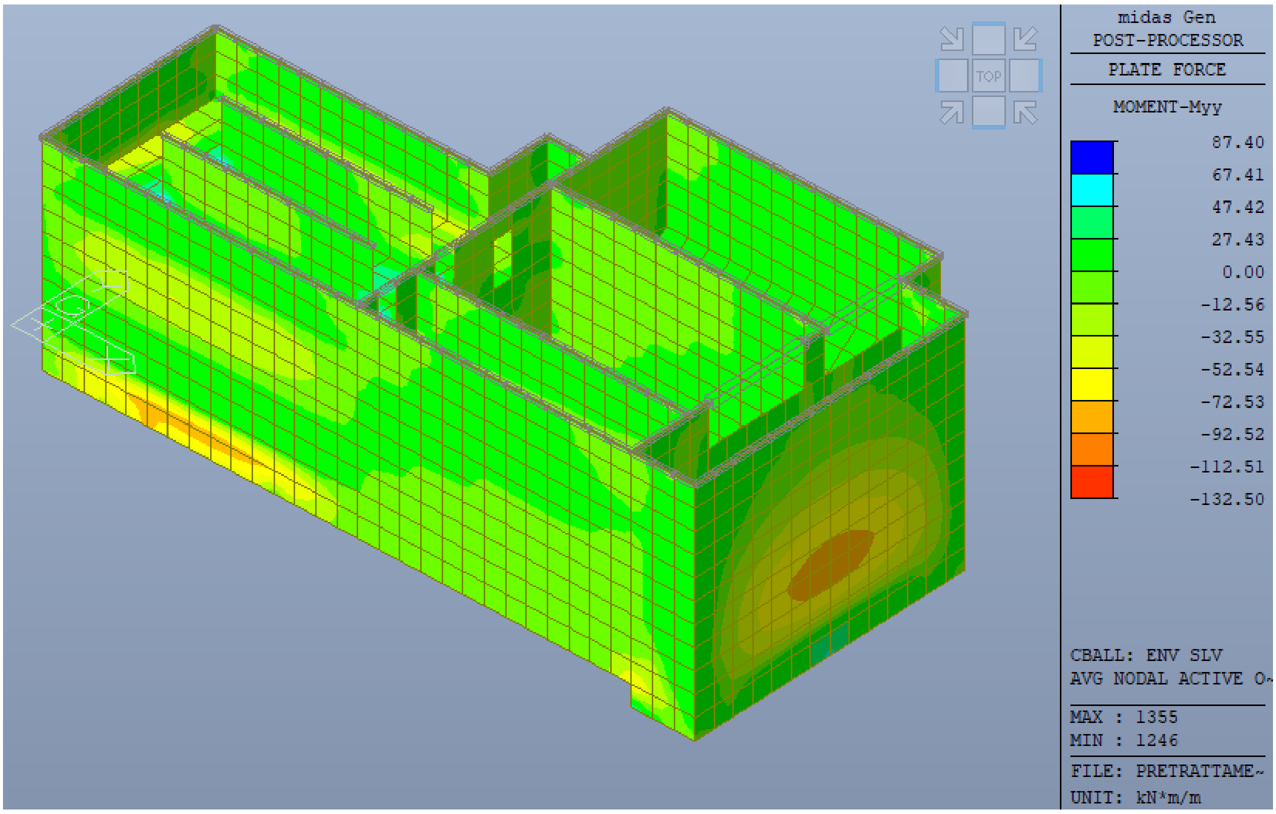

*Sollecitazione tagliante Vxx – inviluppo SLU [kN/m]*



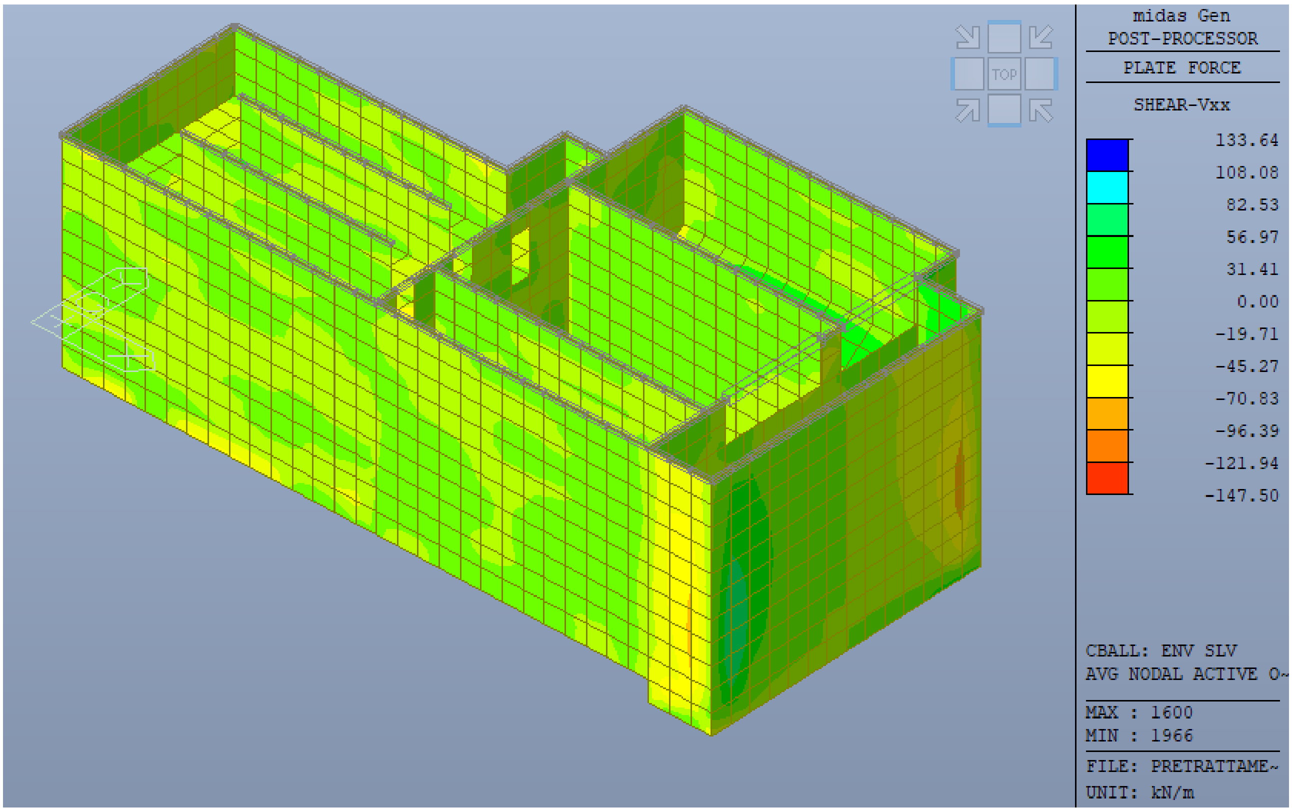

*Sollecitazione tagliante Vyy – inviluppo SLU [kN/m]*



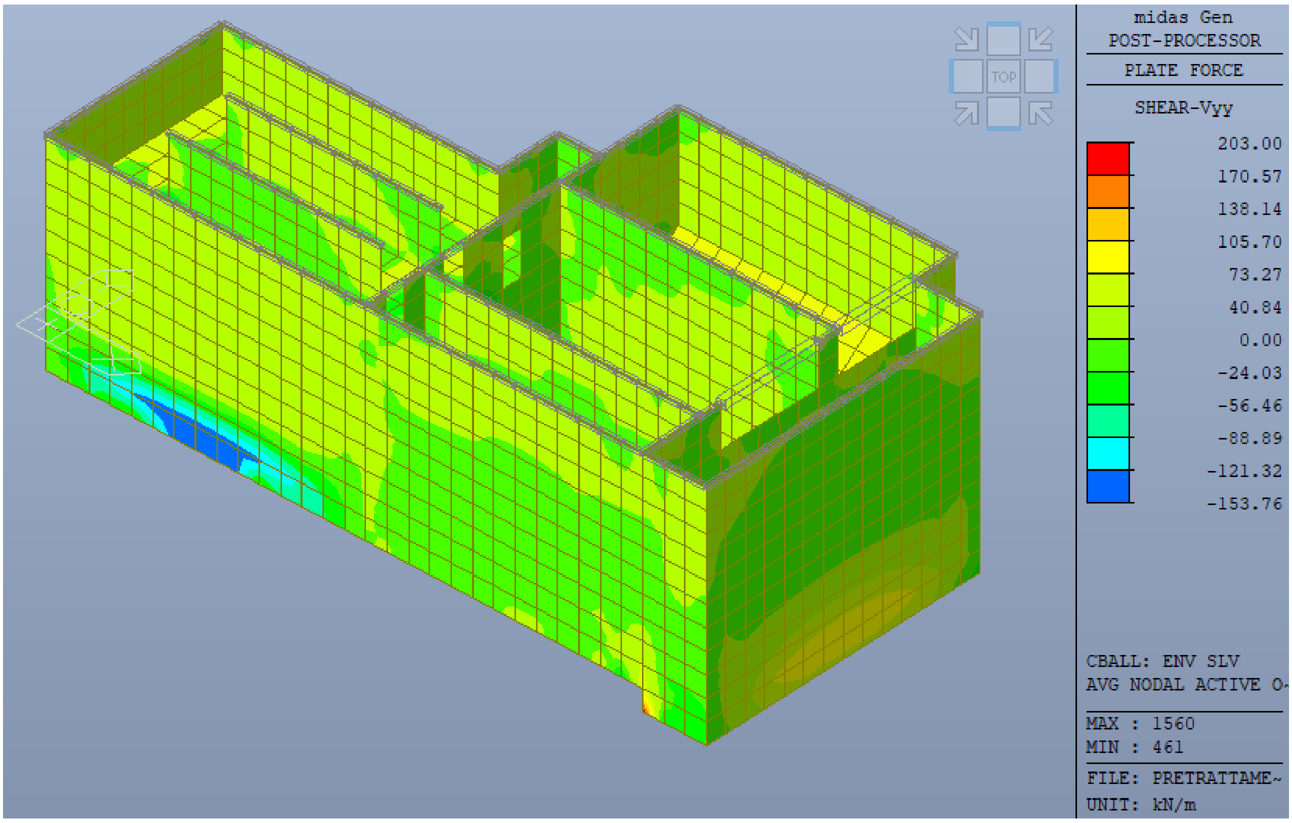

***Momento flettente membranale Mxx – inviluppo SLV [kN*m/m]***



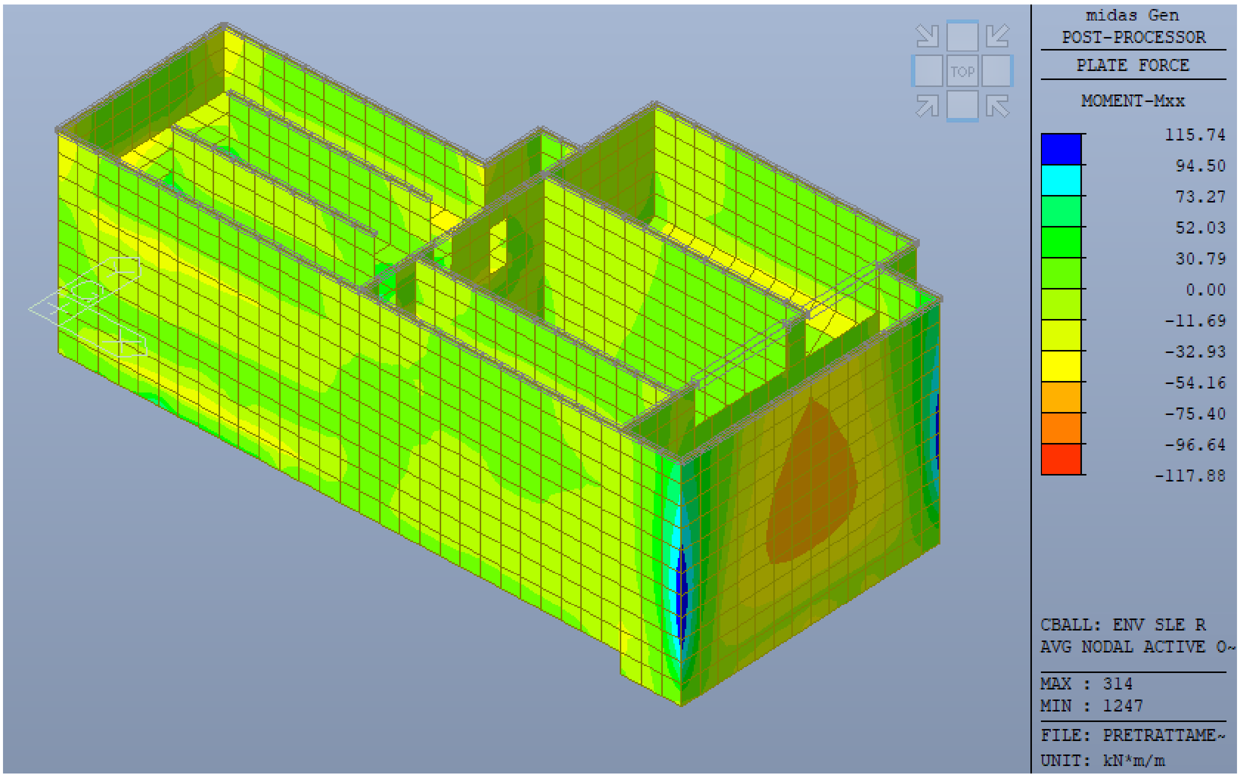

***Momento flettente membranale Myy – inviluppo SLV [kN*m/m]***



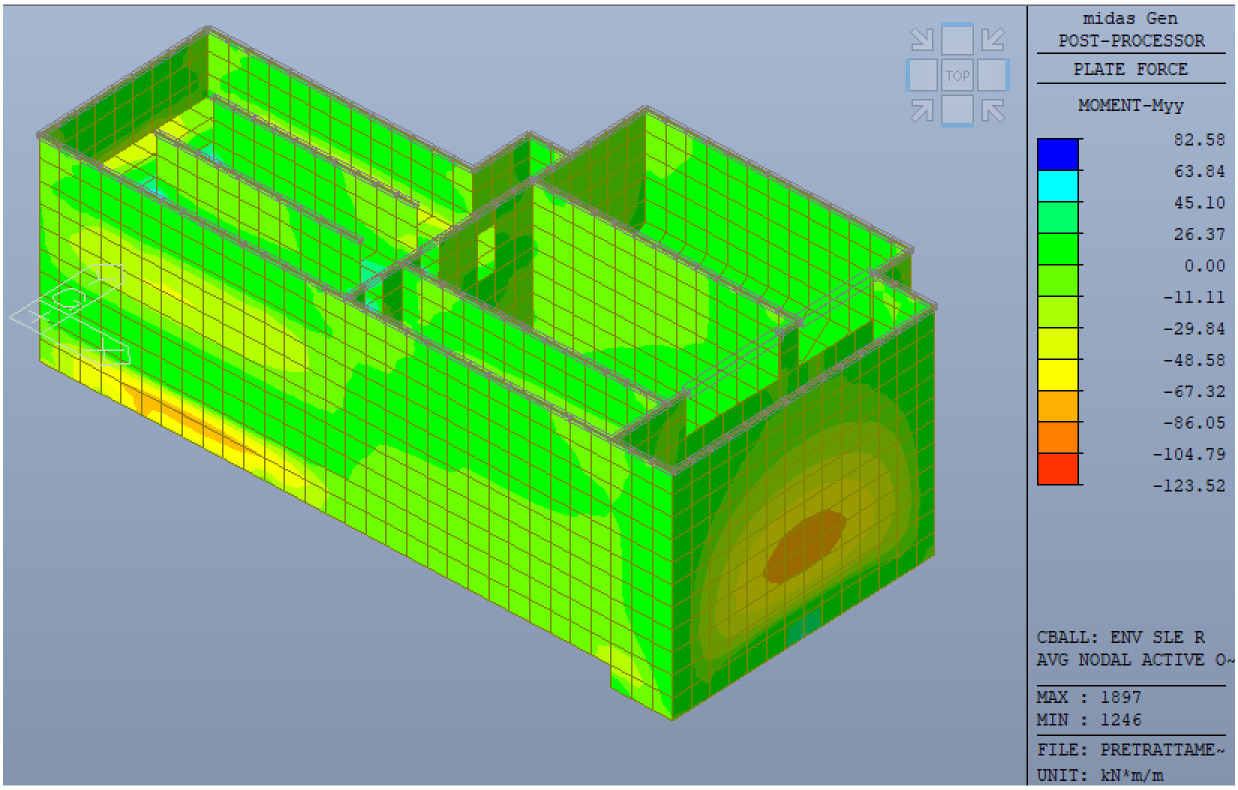

***Sollecitazione tagliante Vxx – inviluppo SLV [kN/m]***



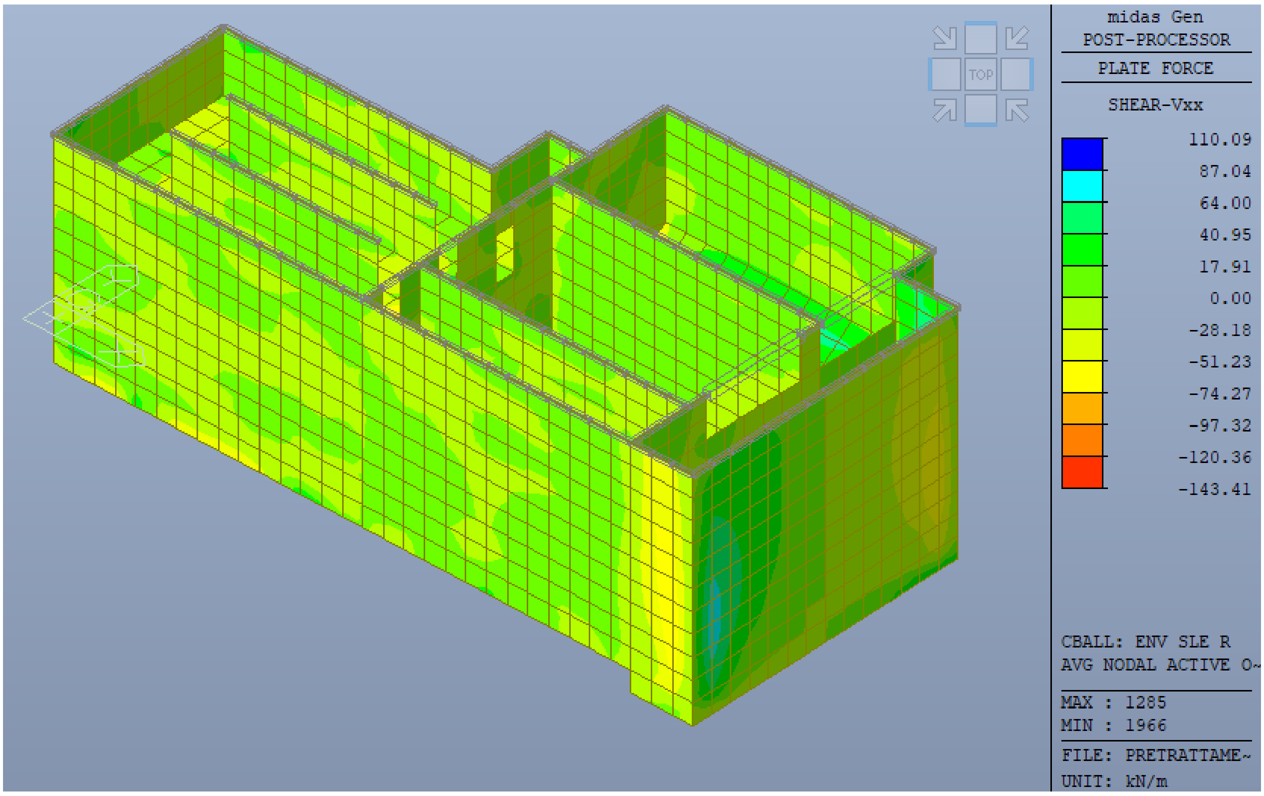

***Sollecitazione tagliante Vyy – inviluppo SLV [kN/m]***



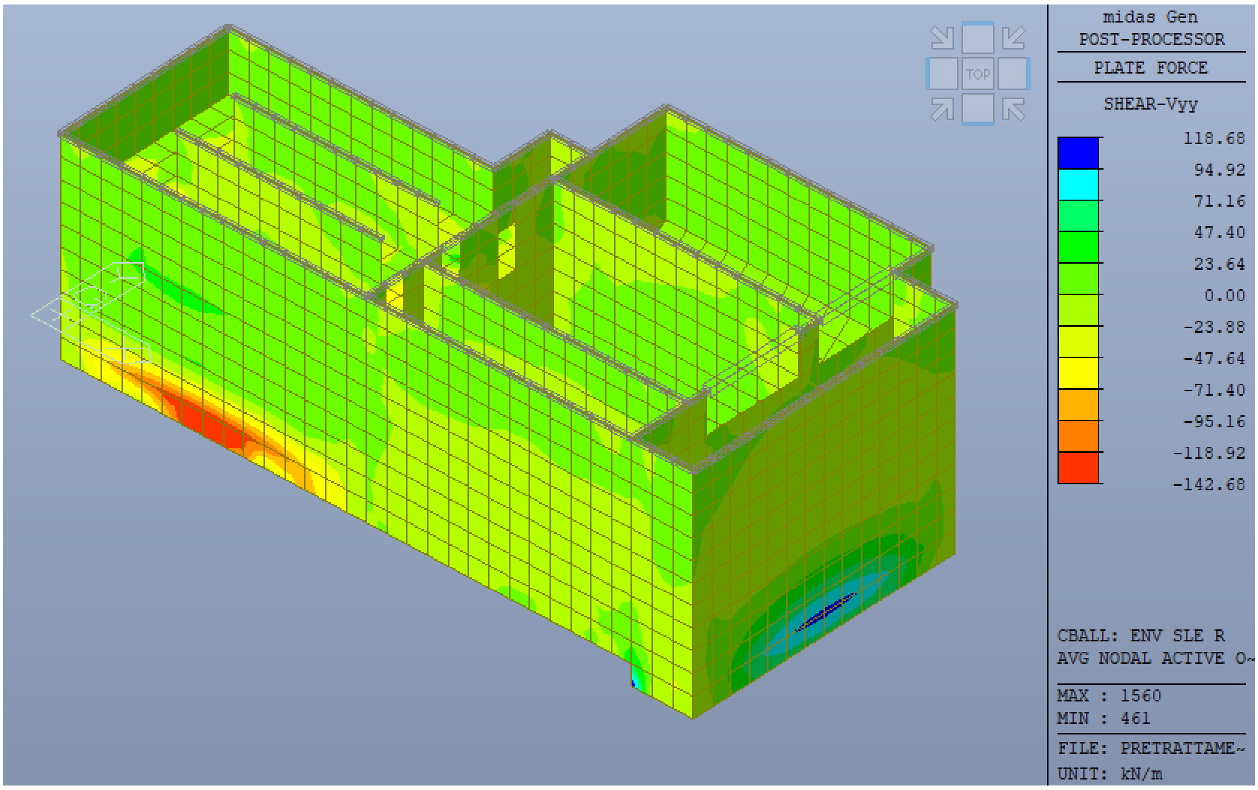

***Momento flettente membranale Mxx – inviluppo SLE [kN*m/m]***




***Momento flettente membranale Myy – inviluppo SLE [kN*m/m]***




***Sollecitazione tagliante Vxx – inviluppo SLE [kN/m]***

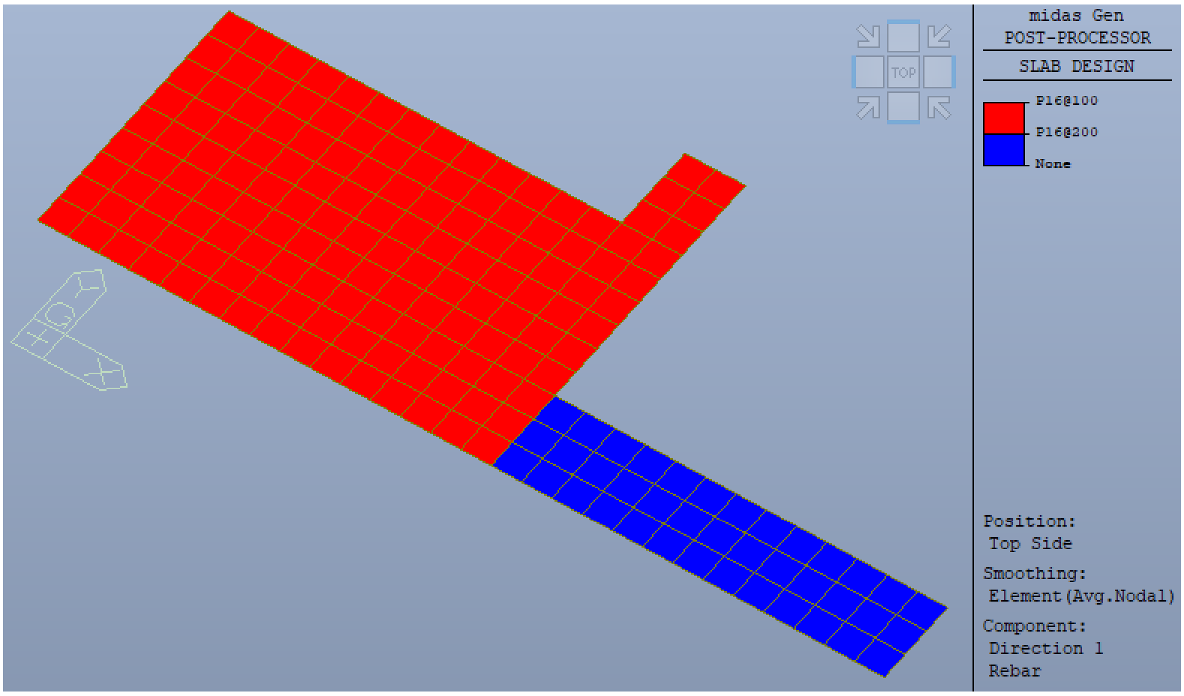



***Sollecitazione tagliante Vyy – inviluppo SLE [kN/m]***

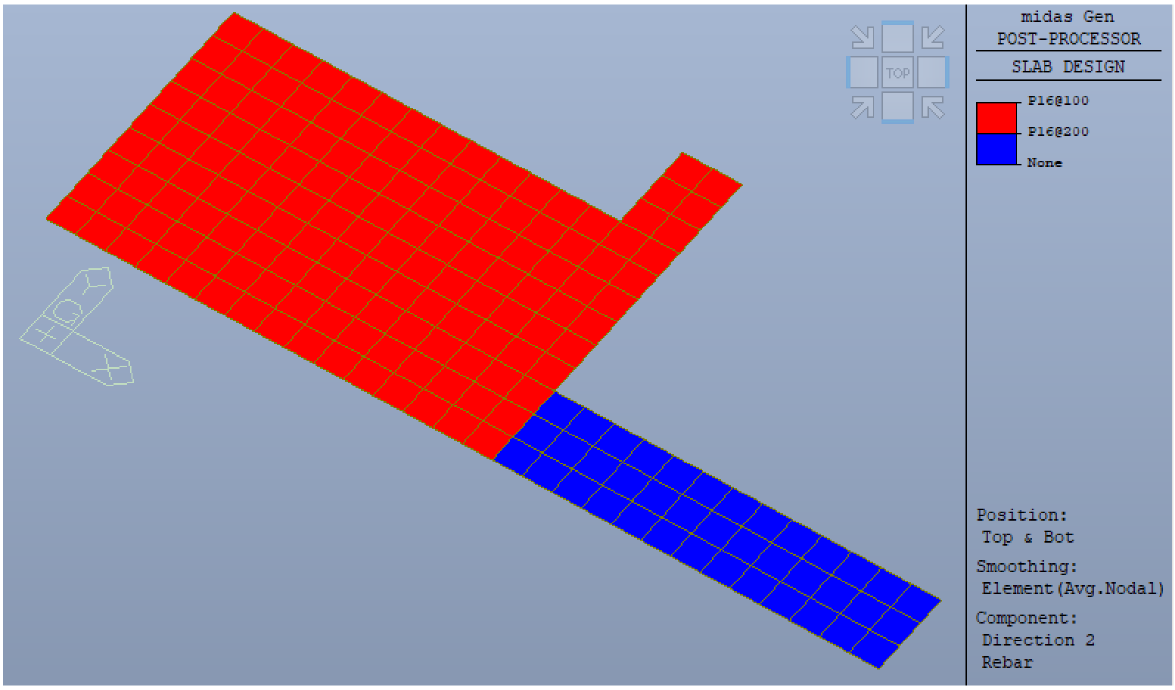
## 2.4 Armature previste

Nelle immagini seguenti vengono riportate le armature richieste per i vari elementi strutturali.

### 2.4.1 Armature Soletta sp. 40 cm




***Armatura soletta sp.40 – direzione longitudinale X ambo i lati***




***Armatura soletta sp.40 – direzione trasversale Y ambo i lati***

Si riepilogano di seguito le armature effettivamente adottate.

SOLETTA ZONA GRIGLIATURA:

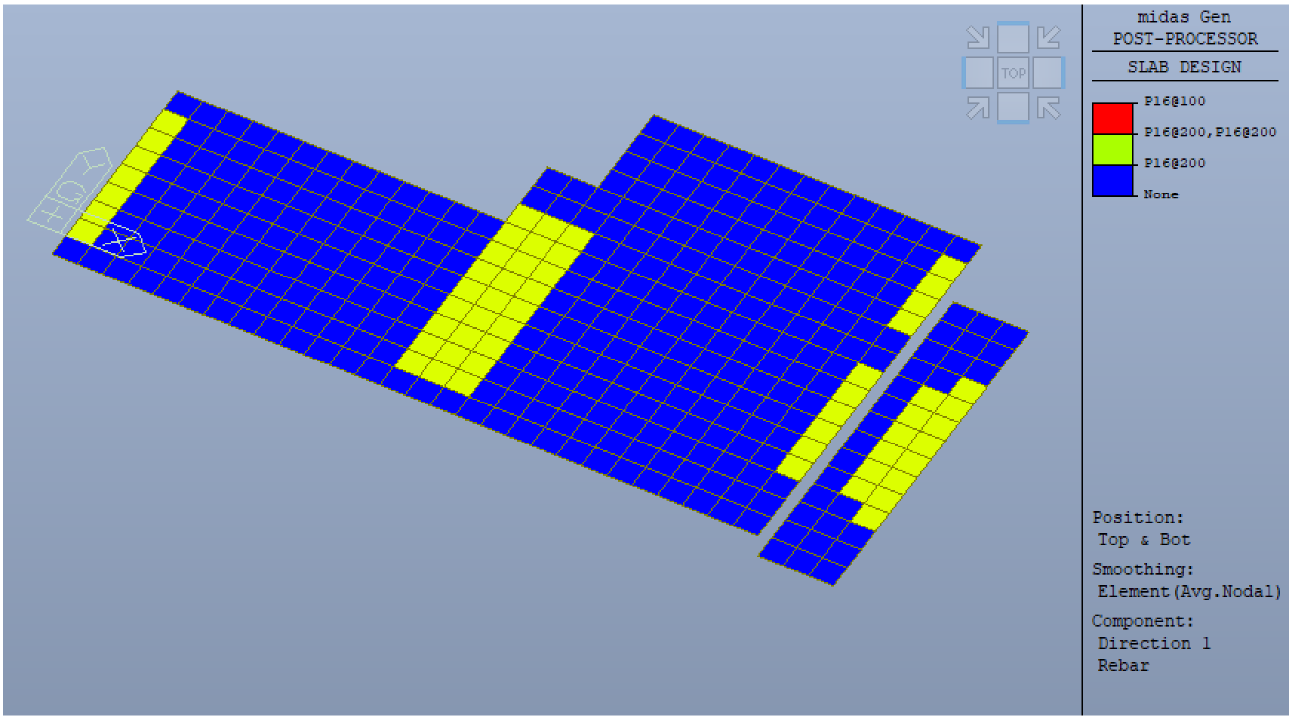
- Armatura direzione longitudinale X: barre correnti $\phi$16/10 superiori e inferiori;
- Armatura direzione trasversale Y: barre correnti $\phi$16/10 superiori e inferiori;

SOLETTA ZONA DISSABBIATURA:

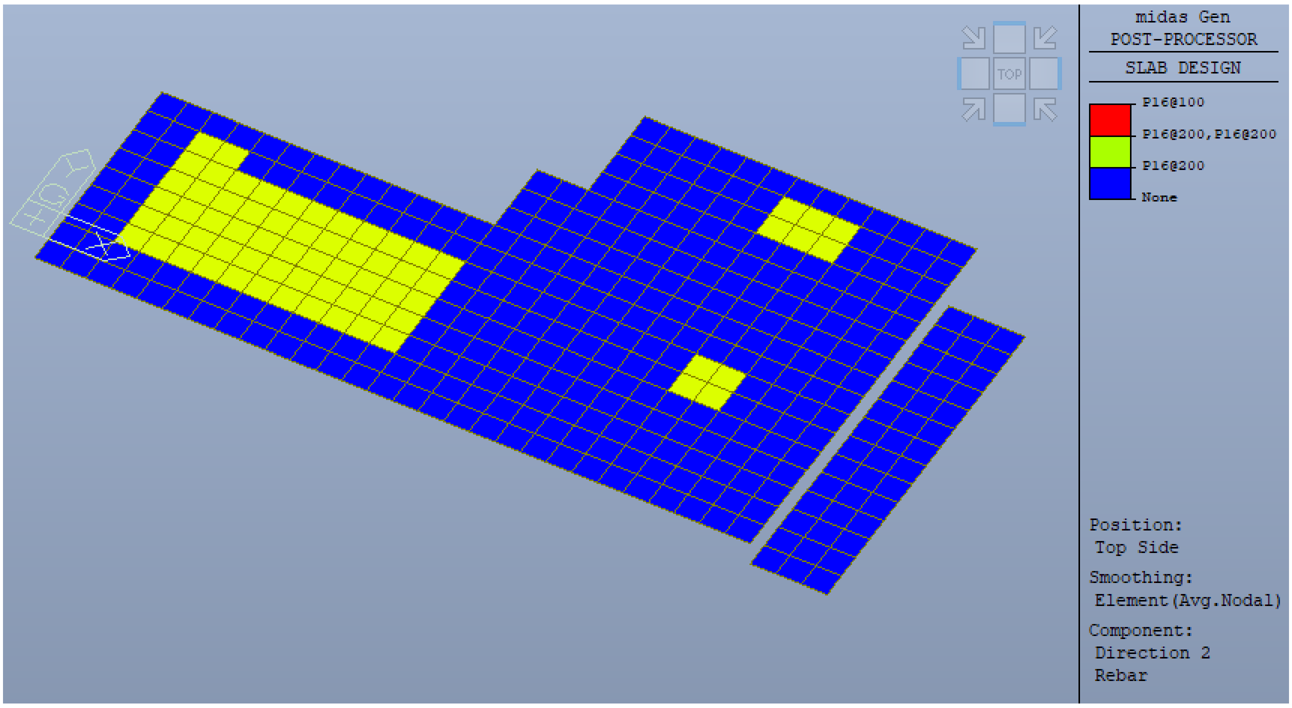
- Armatura direzione longitudinale X: barre correnti $\phi$16/20 superiori e inferiori;
- Armatura direzione trasversale Y: barre correnti $\phi$16/20 superiori e inferiori;

### 2.4.2 Armature Platee sp. 50 cm

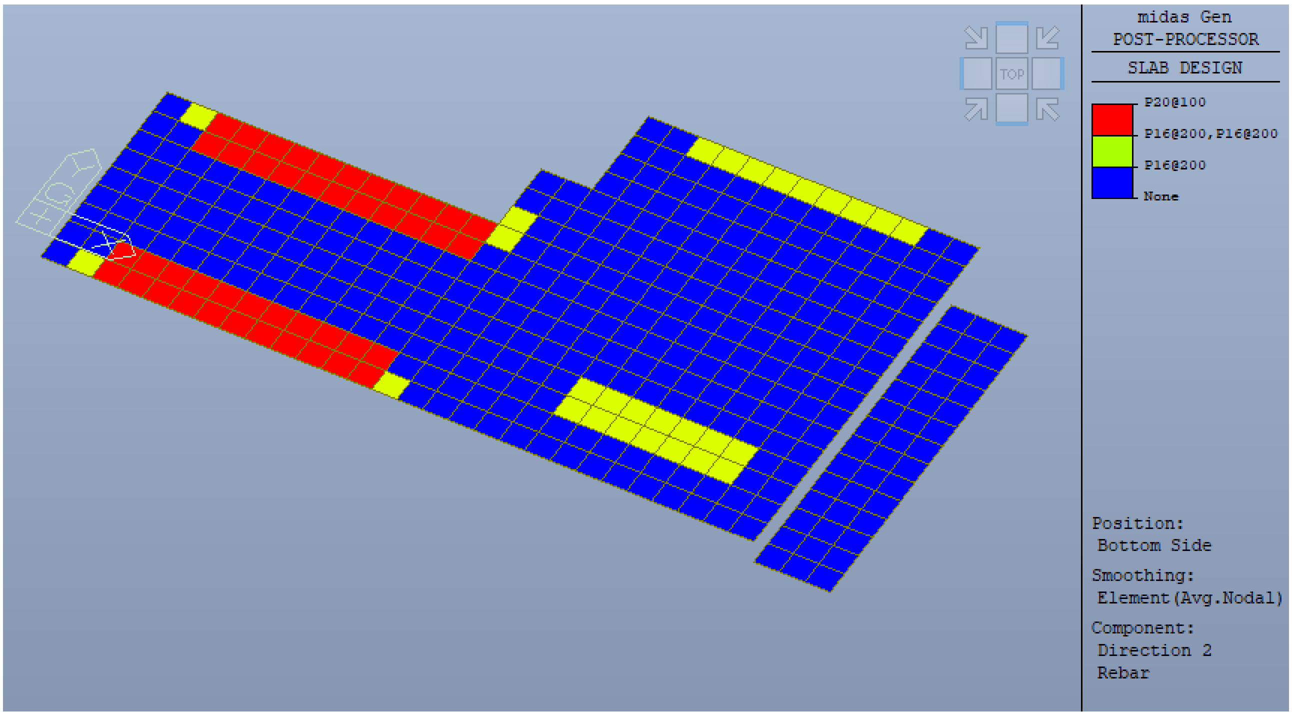
Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.




***Armatura platee – direzione longitudinale X ambo i lati***




***Armatura platee – direzione trasversale Y superiore***



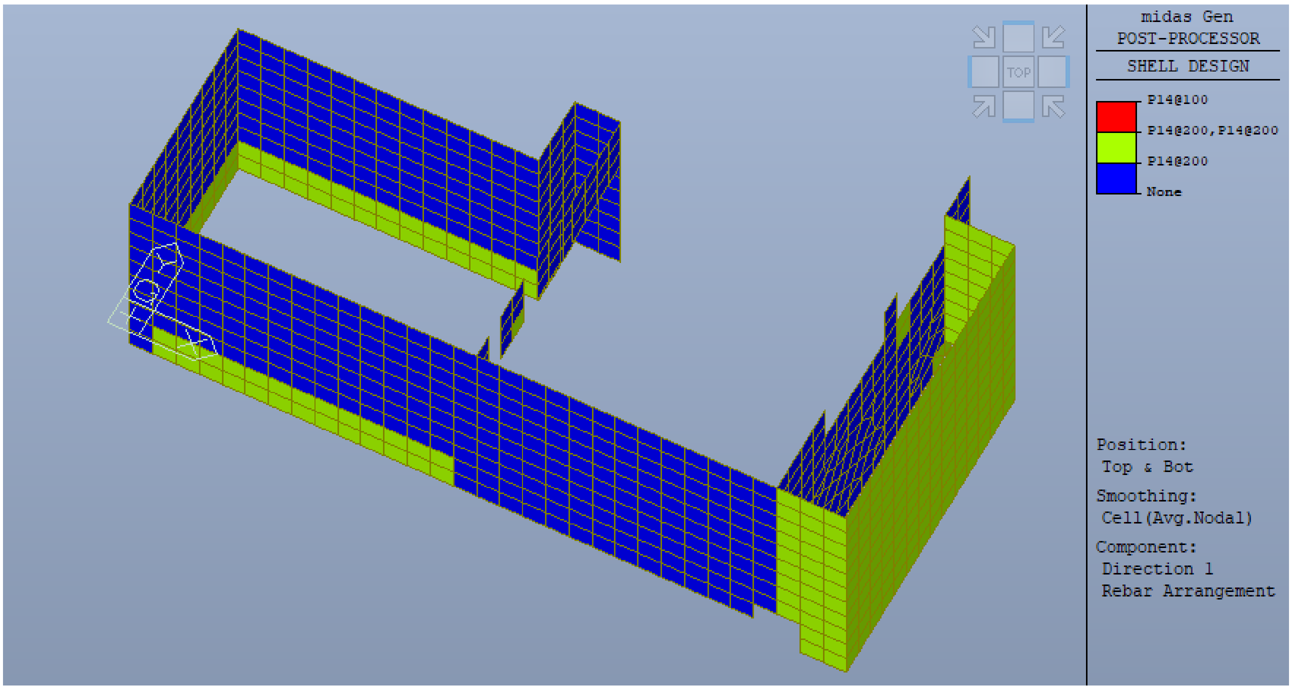

***Armatura platee – direzione trasversale Y inferiore***

Si riepilogano di seguito le armature effettivamente adottate.

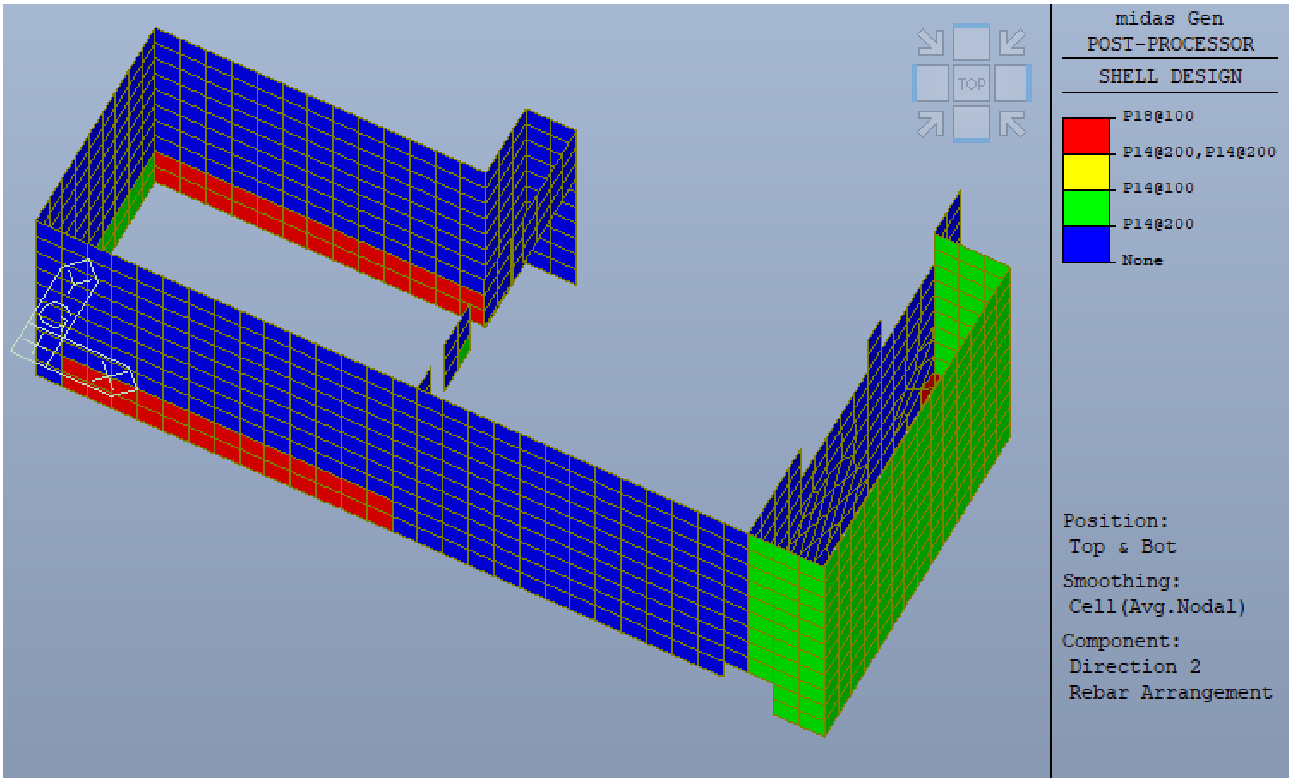
- Armatura direzione longitudinale X, inferiore e superiore: barre correnti ϕ16/20 con aggiuntivi 16/20 nelle zone maggiormente sollecitate;
- Armatura direzione trasversale Y zona dissabbiatura, inferiore e superiore: barre correnti ϕ16/20 con rinforzi ϕ16/20 nelle zone più sollecitate;
- Armatura direzione trasversale Y zona grigliatura, inferiore e superiore: barre correnti ϕ16/20 con rinforzi ϕ16/20 superiori centrali. Sotto ai muri abbiamo barre ϕ20/10;

### 2.4.3 Armature Pareti sp. 40 cm

Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.




***Armatura pareti sp.40 – direzione orizzontale ambo i lati***




***Armatura pareti sp.40 – direzione verticale ambo i lati***

Si riepilogano di seguito le armature effettivamente adottate.

Pareti Zona Grigliatura Grossolana:

- Armatura direzione orizzontale: barre correnti ϕ14/10 alla base (primi 1.50 m) e ϕ14/20 nella parte più alta.
- Armatura direzione verticale: riprese ϕ14/10 sul lato corto e ϕ18/10 sui lati lunghi; barre verticali ϕ14/20.

Pareti Zona Dissabbiatura:

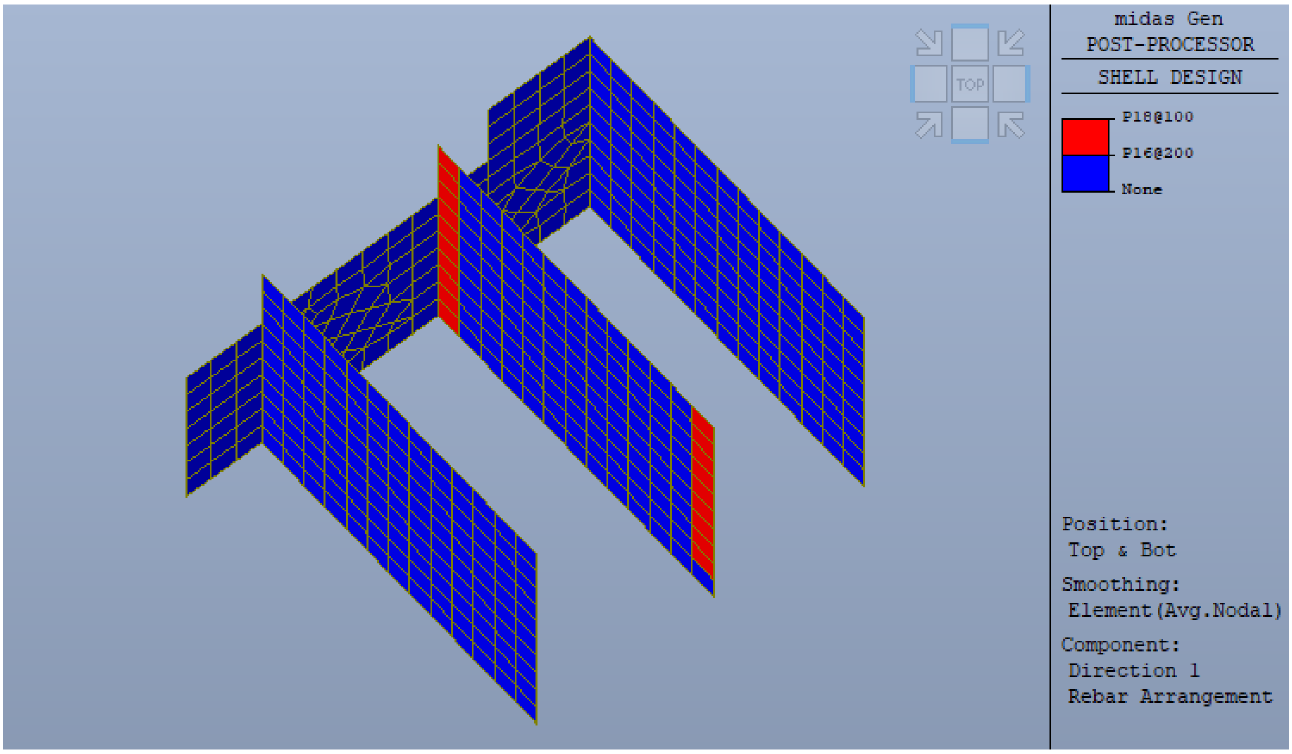
- Armatura direzione orizzontale: barre correnti ϕ14/20 che diventano ϕ14/10 per il pozzetto a valle dello stramazzo finale.
- Armatura direzione verticale: riprese e verticali ϕ14/20 che diventano tutti ϕ14/10 per il pozzetto a valle dello stramazzo finale.

Rinforzi aggiuntivi:

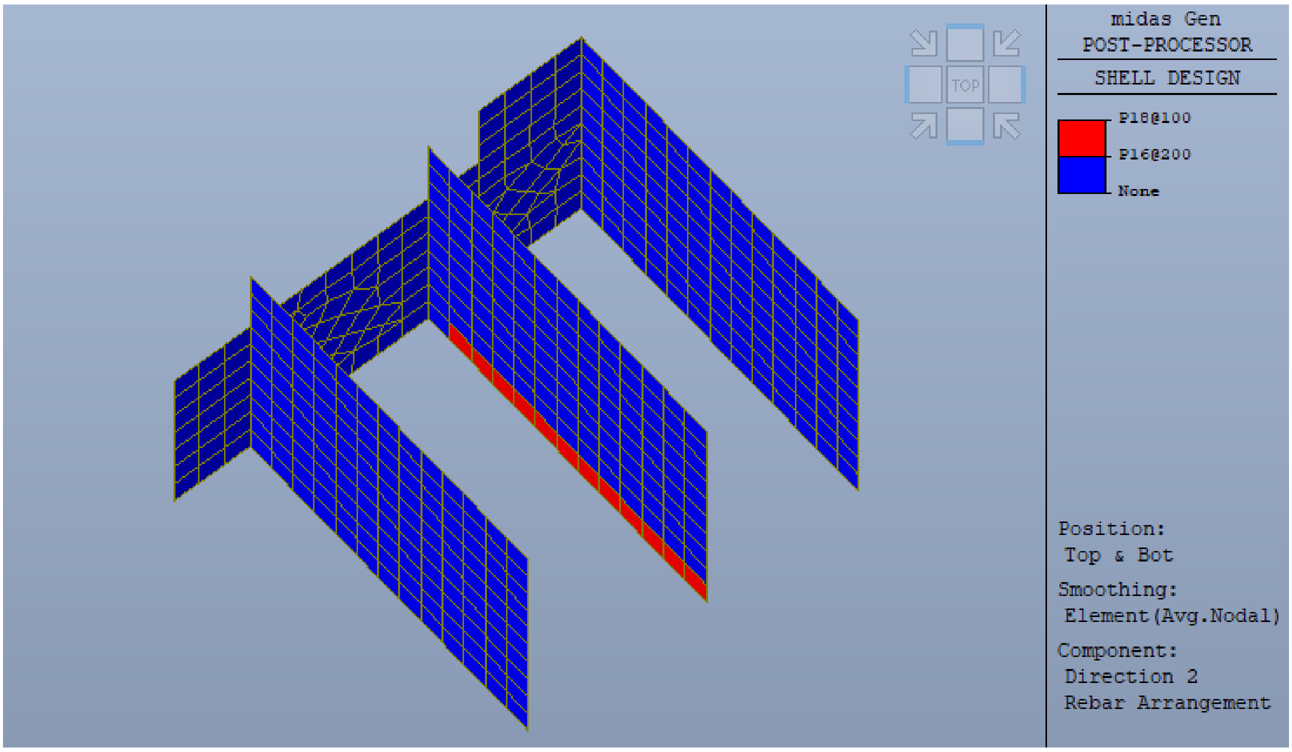
- La parete di salto tra le due platee va armata con ϕ18/10 orizzontali e verticali.
- L'angolo della parete esterna nella zona del salto tra platee va armato con ϕ18/10 orizzontali e verticali.

### 2.4.4 Armature Pareti sp. 50 cm

Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.




***Armatura pareti sp.50 – direzione orizzontale ambo i lati***

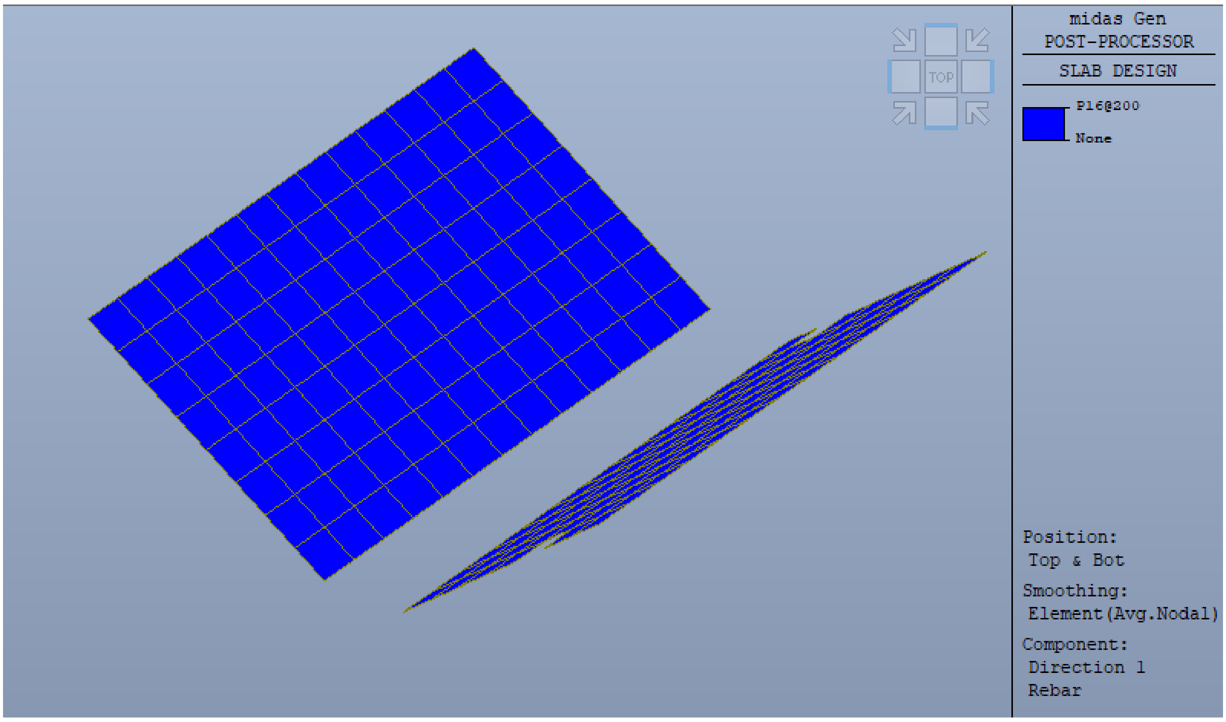



***Armatura pareti sp.50 – direzione verticale ambo i lati***

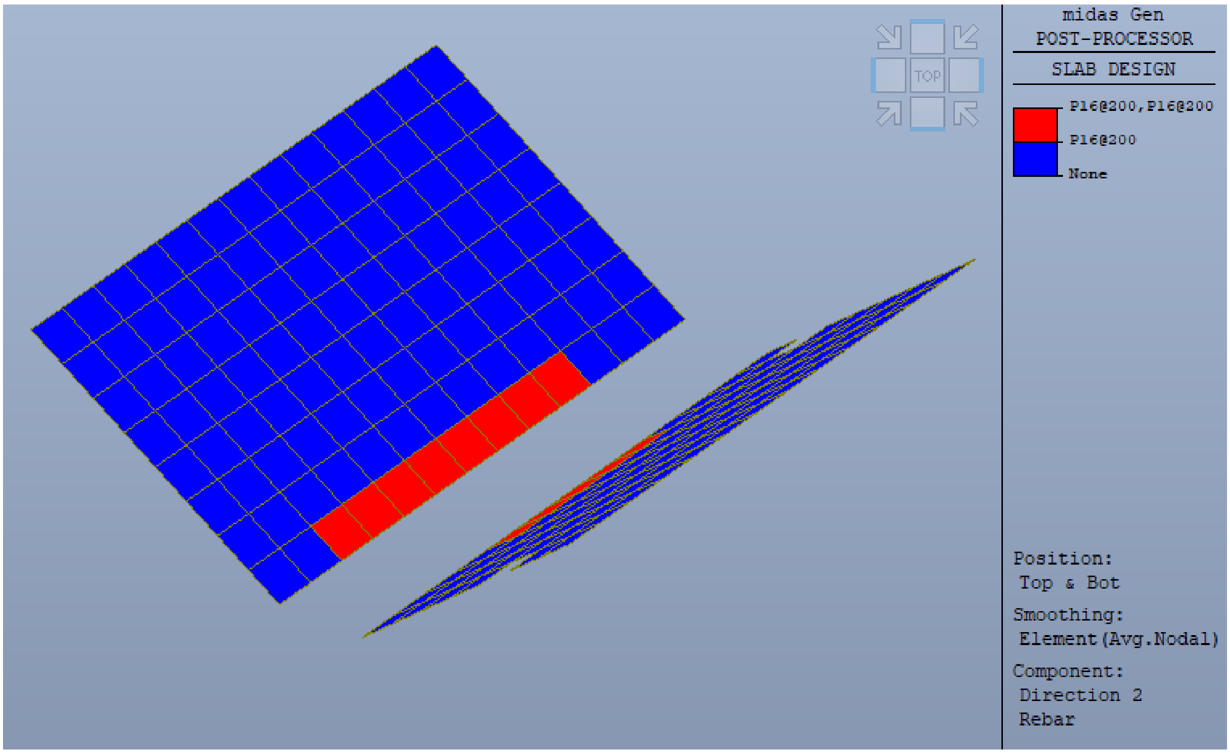
Si riepilogano di seguito le armature effettivamente adottate.

- Armatura direzione orizzontale: barre correnti $\phi$16/20 con staffoni $\phi$18/10 agli angoli.
- Armatura direzione verticale: barre correnti $\phi$16/20 con riprese$\phi$18/10 per la parete centrale tra le due vasche e $\phi$16/20 per le altre.

### 2.4.5 Armature Solette inclinate sp. 40 cm




***Armatura solette inclinate – direzione orizzontale ambo i lati***




***Armatura soletta – direzione verticale ambo i lati***

Si riepilogano di seguito le armature effettivamente adottate.

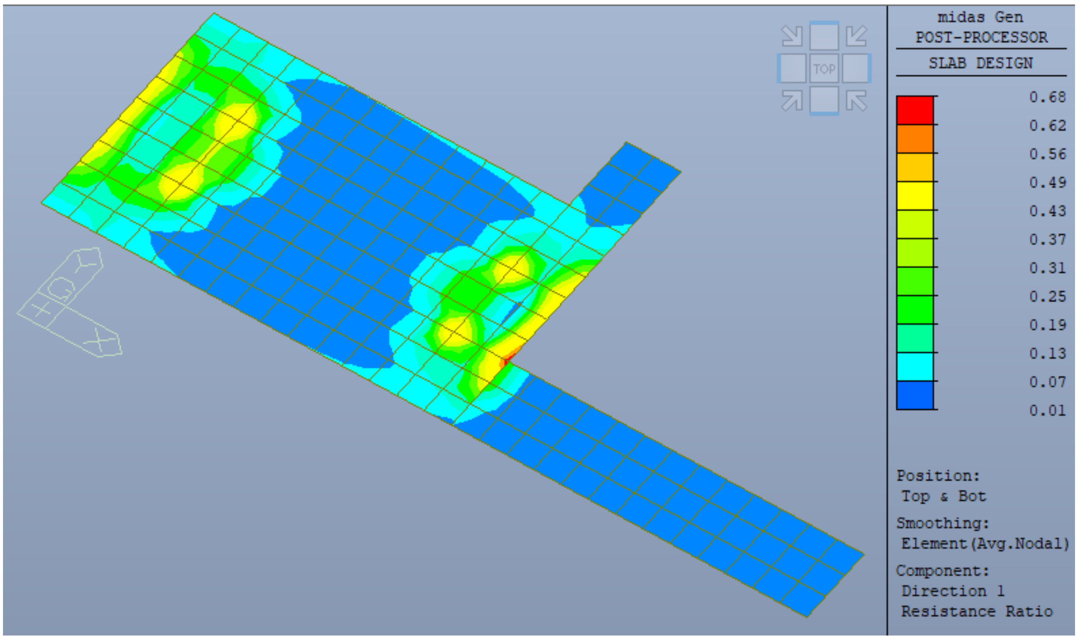
- Armatura direzione orizzontale: barre correnti $\phi$16/20 superiori ed inferiori.

- Armatura direzione verticale: barre correnti $\phi$16/20 con ulteriori $\phi$16/20 di infittimento all’attacco con la platea (sia parte verticale che inizio parte inclinata).

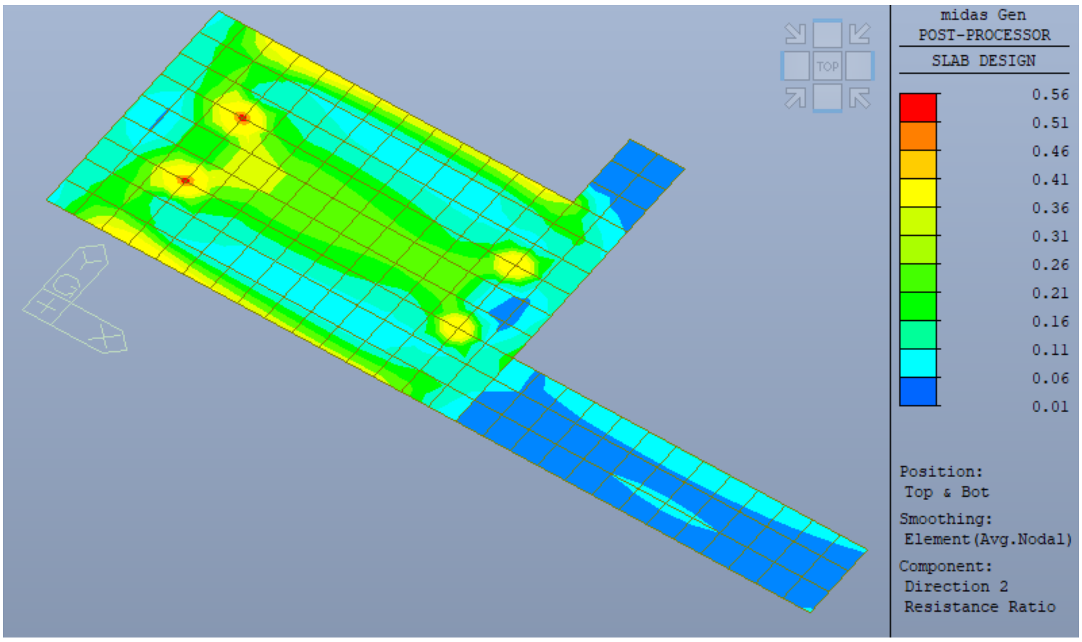
## 2.5 Verifiche di resistenza SLU grafiche

Nelle immagini seguenti vengono riportate le verifiche strutturali per via grafica, come tassi di sfruttamento dell'armatura nelle sezioni di cemento armato, sia per le sollecitazioni flessionali che taglianti:

### 2.5.1 Soletta sp.40 cm

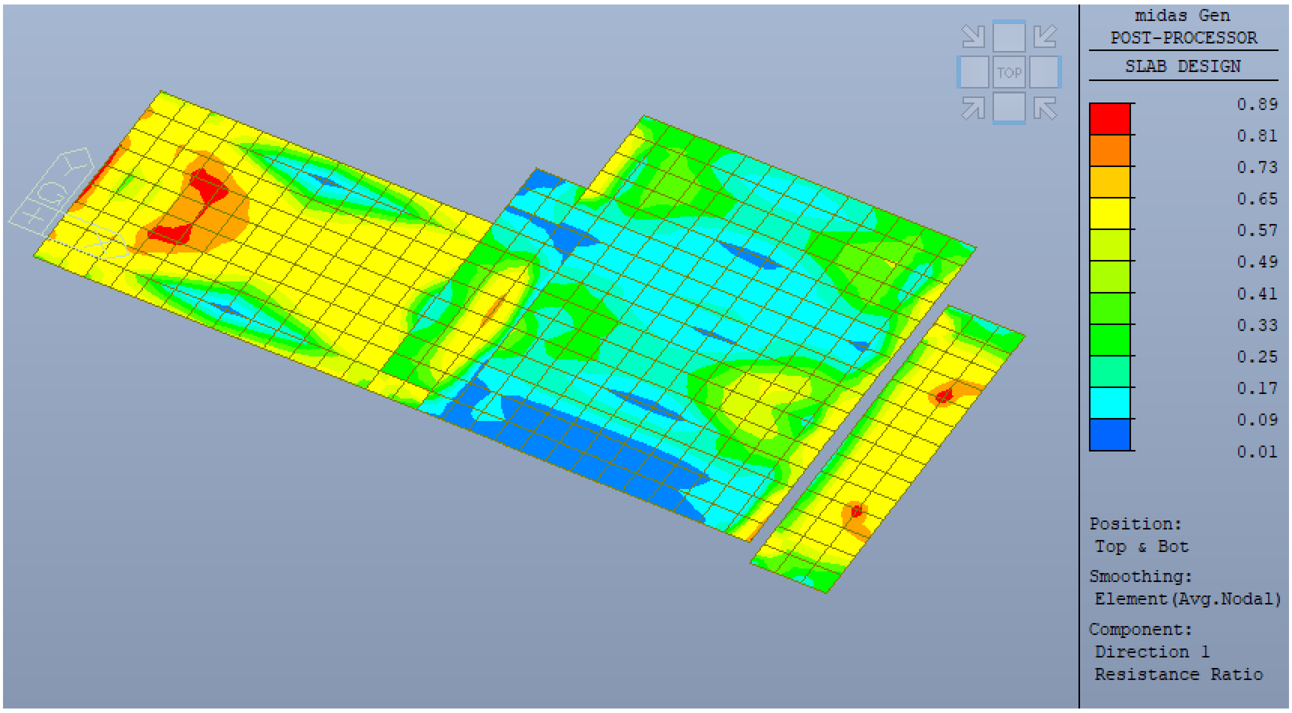



*Solette- Indici di resistenza a flessione direzione longitudinale X ambo i lati*

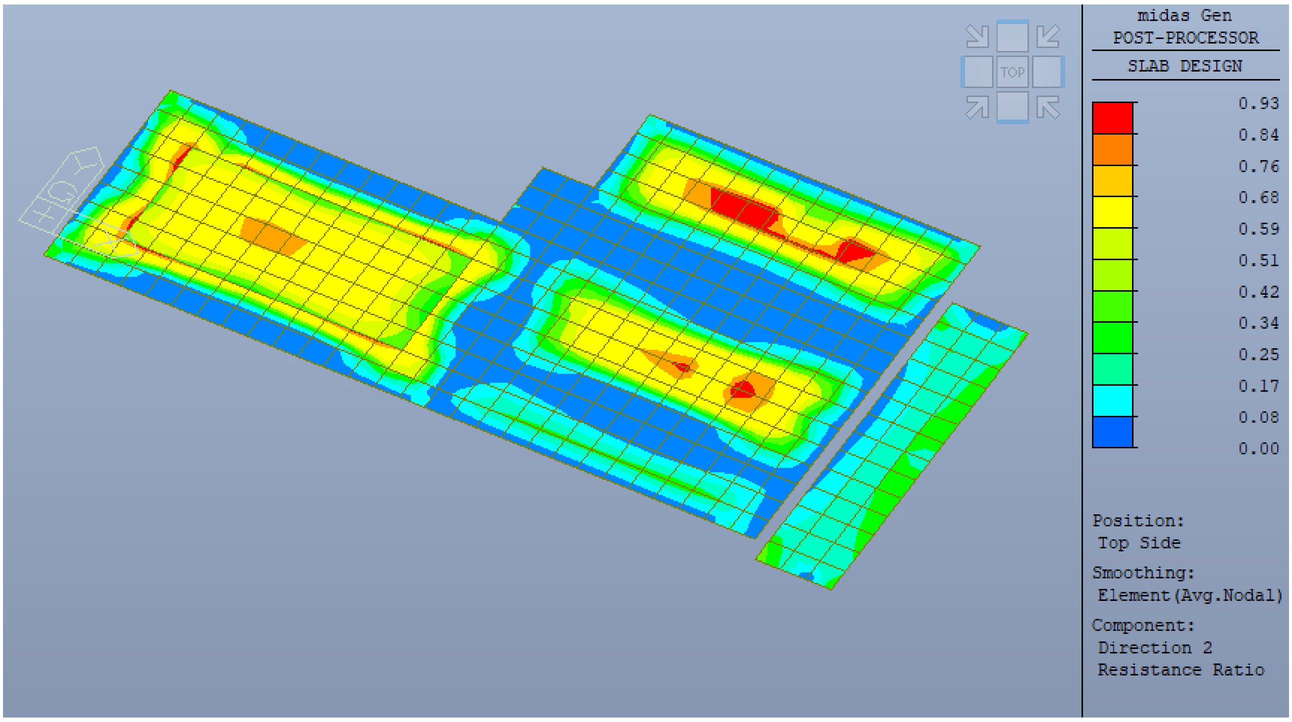



*Solette- Indici di resistenza a flessione direzione trasversale Y ambo i lati*

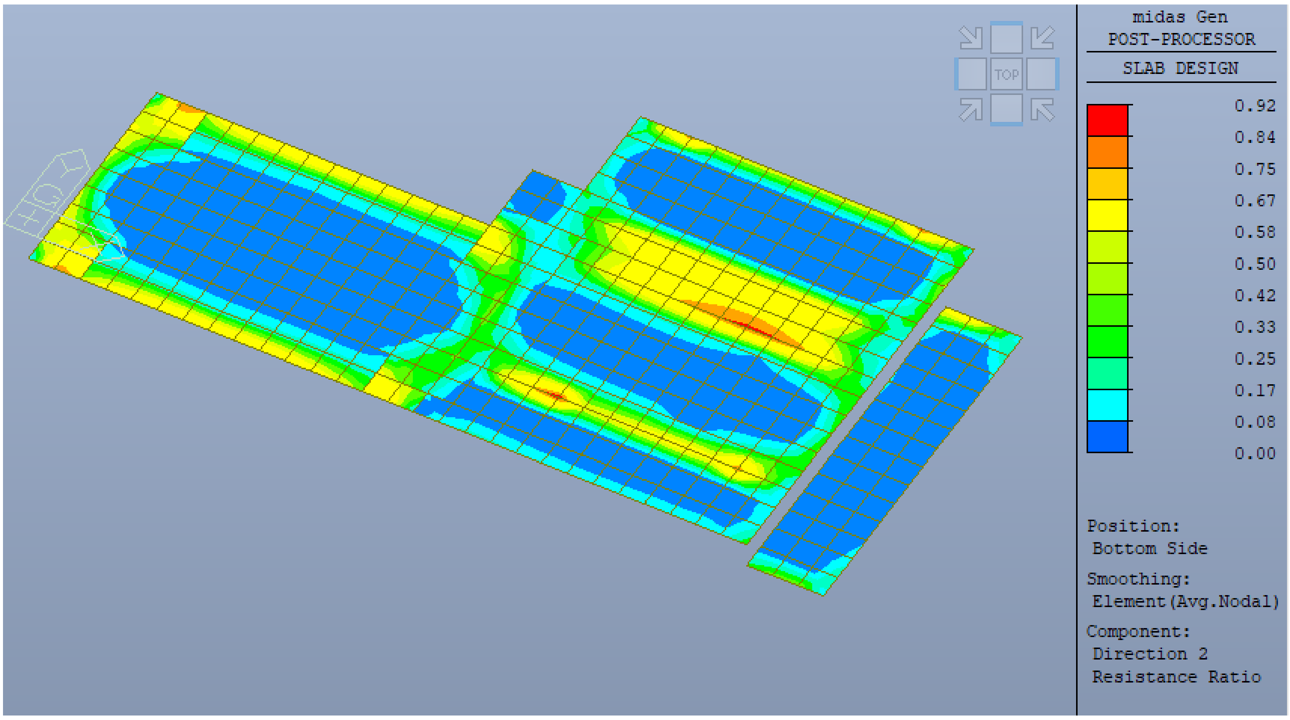
### 2.5.2 Platee sp.50 cm




***Platee- Indici di resistenza a flessione direzione X superiore e inferiore***

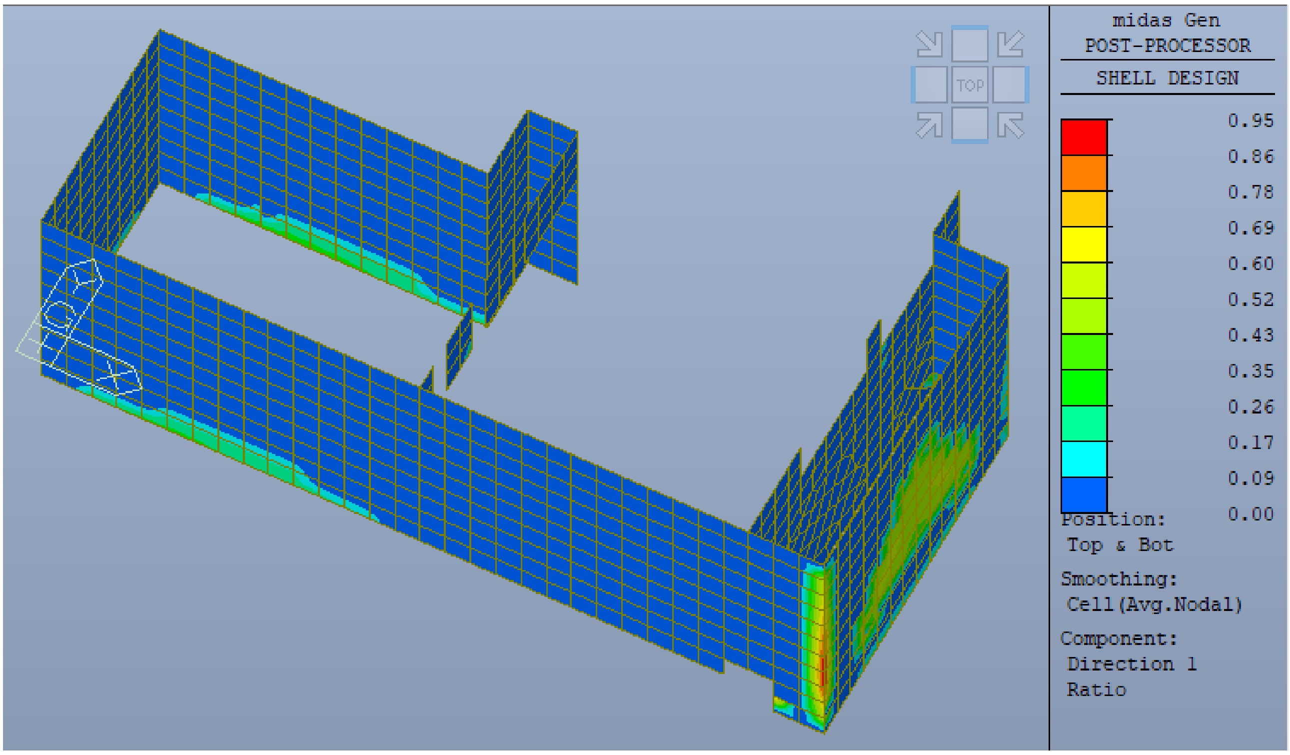



***Platee - Indici di resistenza a flessione direzione Y superiore***

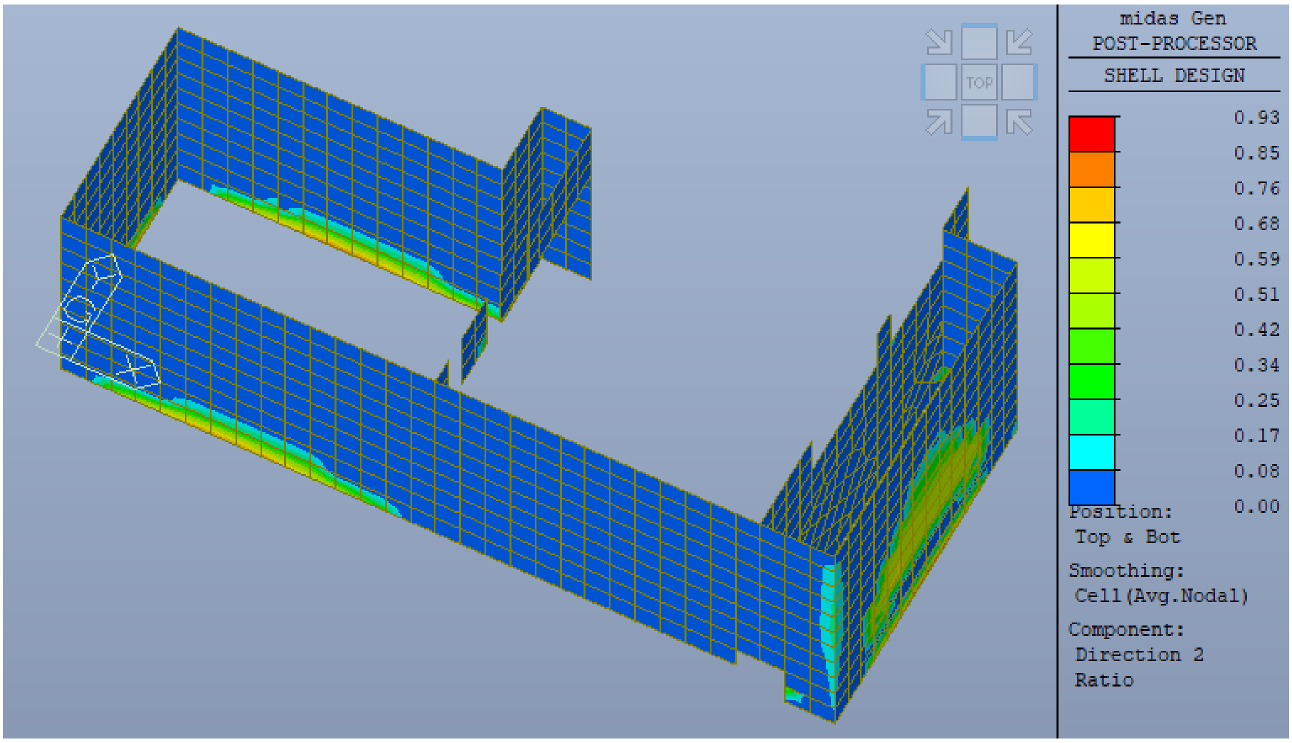



***Platee - Indici di resistenza a flessione direzione Y inferiore***

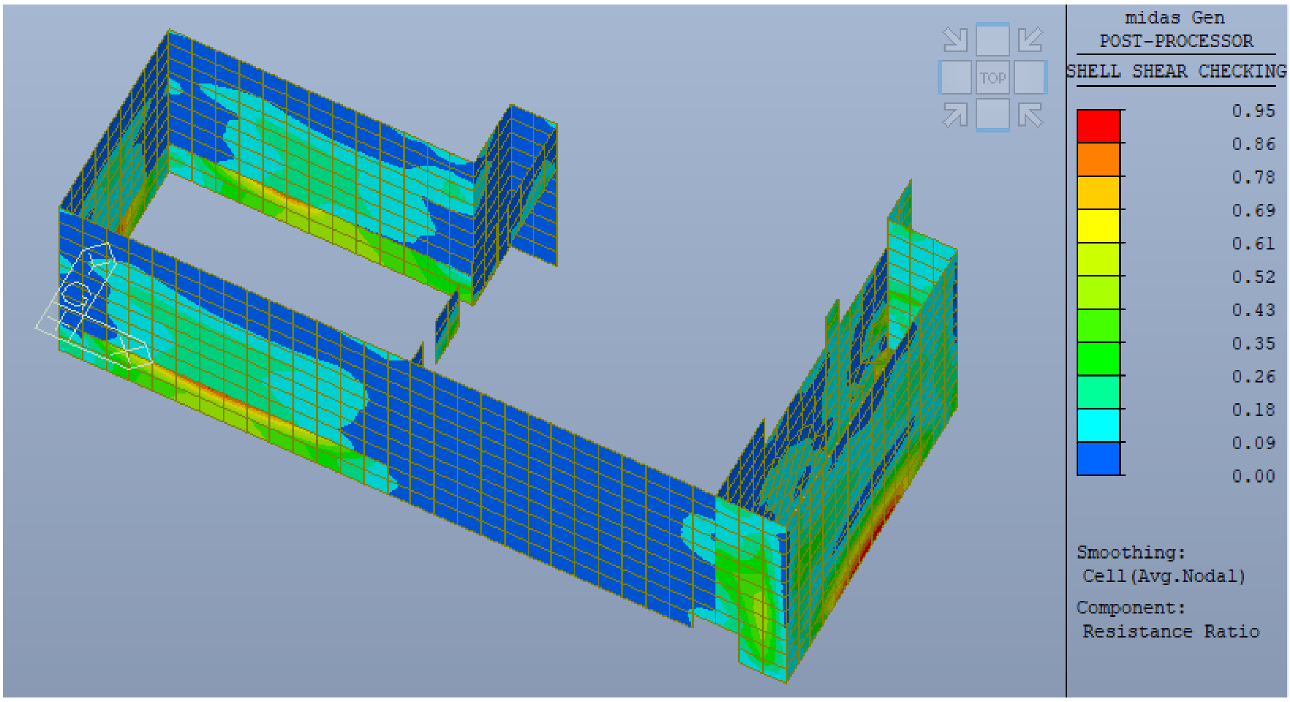
### 2.5.3 Pareti sp.40 cm




*Pareti sp.40 - Indici di resistenza a pressoflessione direzione orizzontale, ambo i lati*

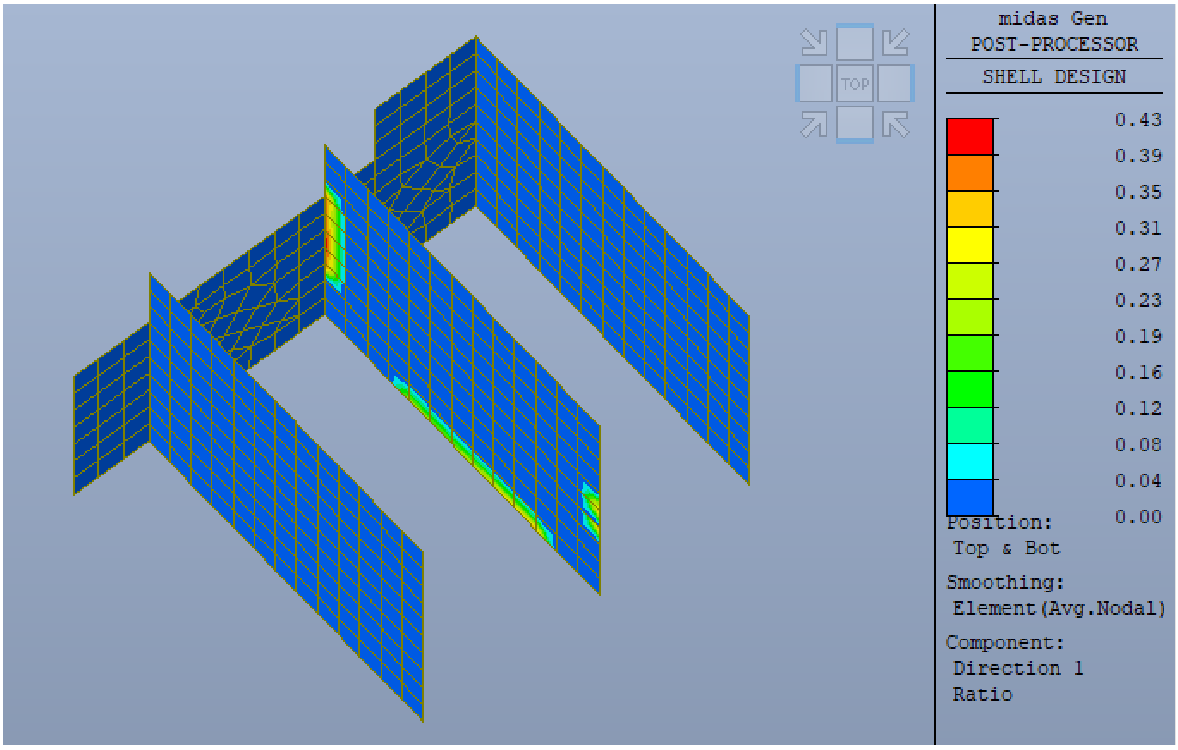



*Pareti sp.40 - Indici di resistenza a pressoflessione direzione verticale, ambo i lati*

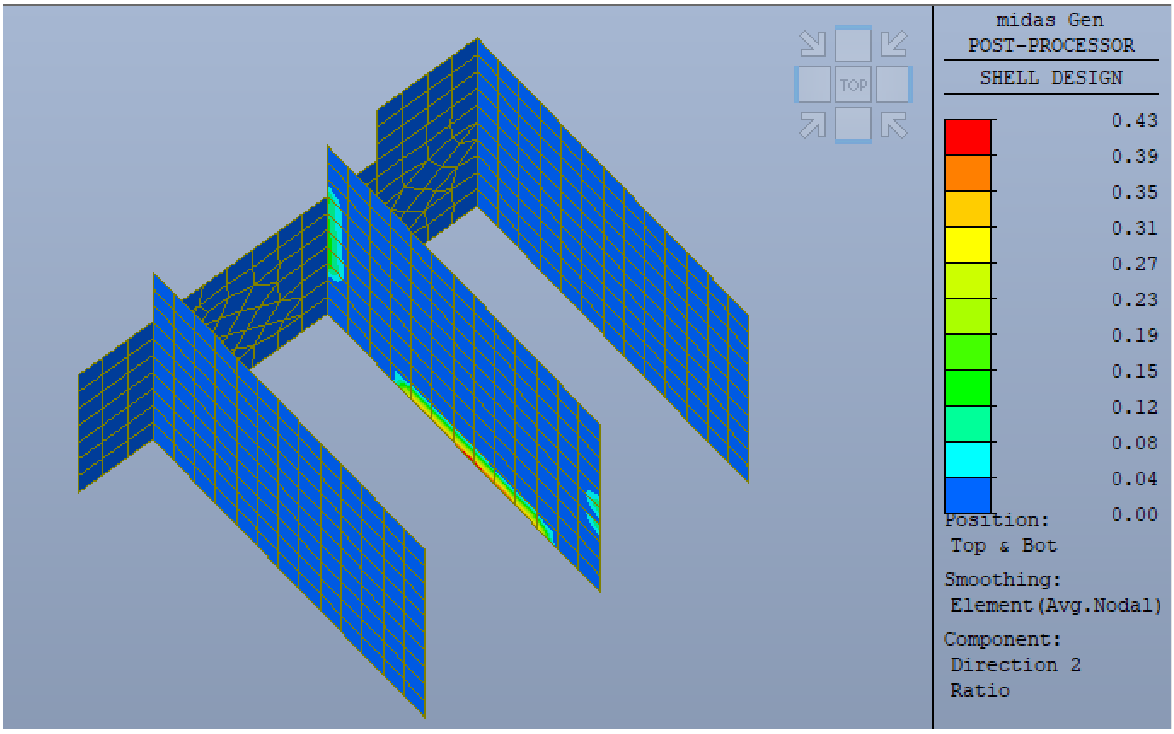



***Pareti sp.40 - Indici di resistenza a taglio***

### 2.5.4 Pareti sp.50 cm

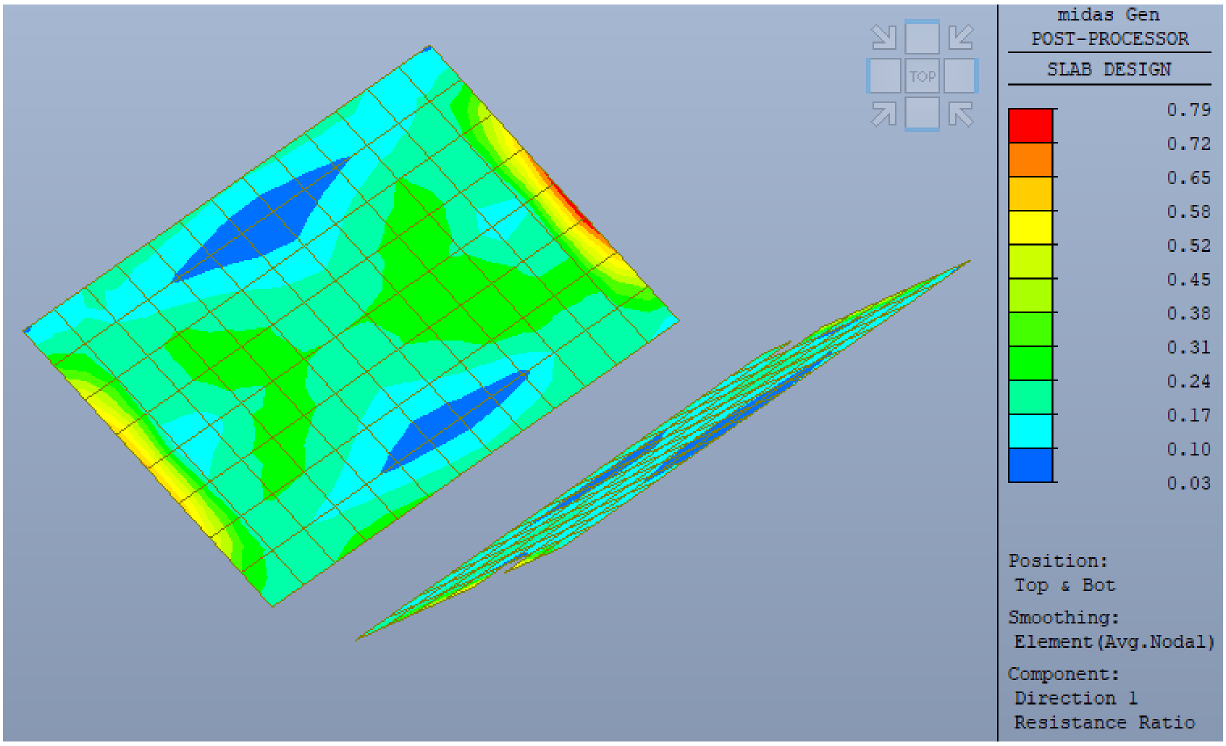



***Pareti sp.50 - Indici di resistenza a pressoflessione direzione orizzontale, ambo i lati***

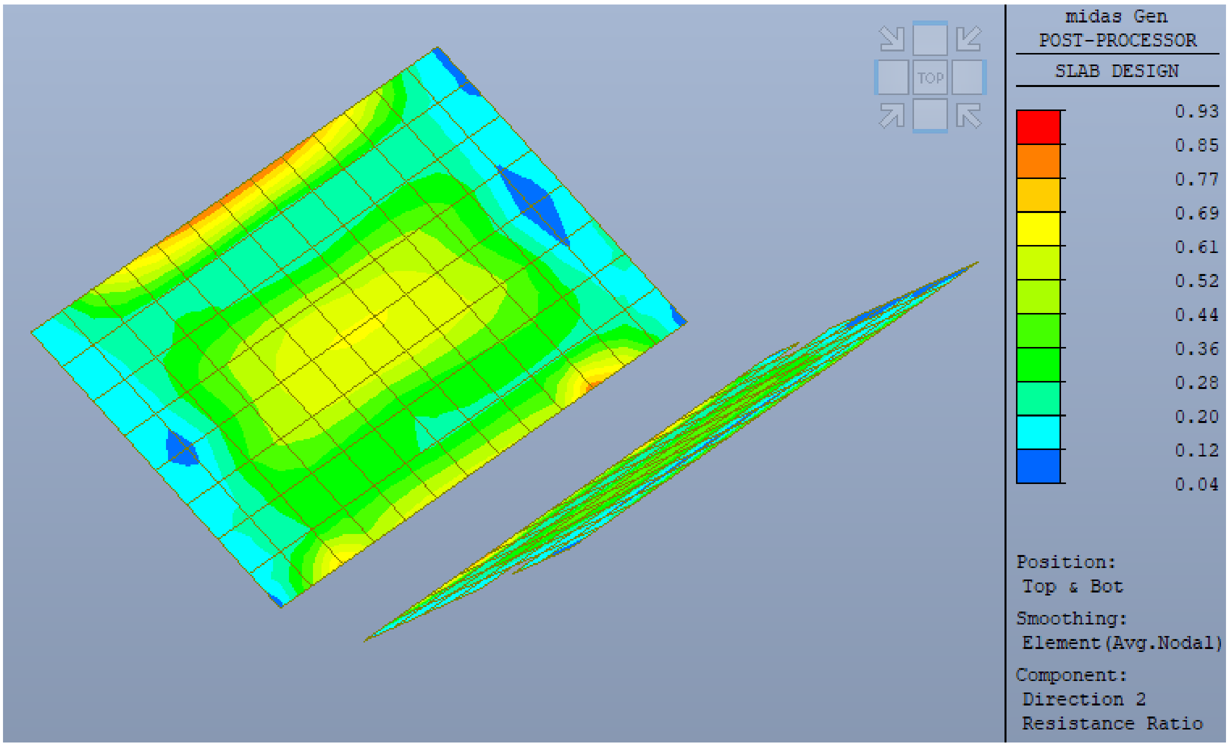



***Pareti sp.50 - Indici di resistenza a pressoflessione direzione verticale, ambo i lati***

### 2.5.5 Solette inclinate sp.40 cm




*Solette inclinate – verifica a flessione in direzione orizzontale*




*Solette inclinate – verifica a flessione in direzione verticale*

## 2.6 Verifiche di resistenza SLU analitiche

### 2.6.1 Verifiche a flessione Solette sp.40 cm

```
==============================================================================

  [[[*]]]   SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta piccola, Dir 1.

==============================================================================

 --------------------------------------------------------------------

   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK

 --------------------------------------------------------------------

 0.4000   2050 BOT 0.0006 0.0010 | 4.44491(  31) 133.212 0.033  OK

        2058 TOP 0.0006 0.0010 | 41.1100(   1) 133.212 0.309  OK

 --------------------------------------------------------------------


<< BOTTOM >>


-. Information of Parameters.

  Elem No.  : 2050

  Thickness :    0.4000 m.

  Materials : fck =  32000.0000 KPa.

           fcd =  21333.3333 KPa.

           fyk = 450000.0000 KPa.

  Covering  : dB  =   0.0500 m.

           dT  =   0.0500 m.

  LCB No.   :   31


-. Information of Design.

  b       =  0.0010 m.  (by Code Unit Length).

  d       =  0.3500 m.

  lambda   =   0.800

  a       = lambda * x  =   0.018 m.

  eta      =   1.000

  Cc      = eta*fcd*b*a =      0.3908 kN.
```

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 4.4449 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.033 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 2058

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 1

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3908 kN.

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 41.1100 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.309 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

```
================================================================================
  [[[*]]]  SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta principale, Dir 1.
================================================================================
 --------------------------------------------------------------------
   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 --------------------------------------------------------------------
  0.4000   2035 BOT 0.0012 0.0020 | 151.892(  27) 259.263 0.586  OK
           2592 TOP 0.0014 0.0020 | 175.452(   8) 259.263 0.677  OK
 --------------------------------------------------------------------

<< BOTTOM >>
```

-. Information of Parameters.

Elem No.  : 2035

Thickness :    0.4000 m.

Materials :  fck =  32000.0000 KPa.

fcd =  21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering  :  dB  =   0.0500 m.

dT  =   0.0500 m.

LCB No.   :   27

-. Information of Design.

b       =   0.0010 m.  (by Code Unit Length).

d       =   0.3500 m.

lambda   =   0.800

a       = lambda * x  =   0.037 m.

eta      =   1.000

Cc       = eta*fcd*b*a =      0.7817 kN.

M_Rd     = Cc*(d-a/2)  =     259.2630  kN-m./m.

-. Information of Moments and Result.

Rein. Bar :  P16 @100

As_req =      0.0012 m^2/m.  (      0.0012 m^2/m.)

M_Ed   =     151.8922  kN-m./m.

M_Rd = 259.2630 kN-m./m.

RatM = M_Ed / M_Rd = 0.586 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.081

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.081/ 0.450 = 0.179 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 2592

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 8

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7817 kN.

M_Rd = Cc*(d-a/2) = 259.2630 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @100

As_req = 0.0014 m^2/m. ( 0.0014 m^2/m.)

M_Ed = 175.4523 kN-m./m.

M_Rd = 259.2630 kN-m./m.

RatM = M_Ed / M_Rd = 0.677 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.093

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.093/ 0.450 = 0.207 ---> O.K.

================================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta piccola, Dir 2.

================================================================================

| Thk | Elem | POS | AsReq | AsUse | M_Ed( LCB) | M_Rd | Rat | CHK |
|---|---|---|---|---|---|---|---|---|
| 0.4000 | 2054 | BOT | 0.0006 | 0.0010 | 8.92326( 34) | 129.357 | 0.069 | OK |
| | 2040 | TOP | 0.0006 | 0.0010 | 18.1448( 12) | 129.357 | 0.140 | OK |

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 2054

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 34

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3910 kN.

M_Rd = Cc*(d-a/2) = 129.3569 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 8.9233 kN-m./m.

M_Rd = 129.3569 kN-m./m.

RatM = M_Ed / M_Rd = 0.069 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 2040

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 12

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3910 kN.

M_Rd = Cc*(d-a/2) = 129.3569 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 18.1448 kN-m./m.

M_Rd = 129.3569 kN-m./m.

RatM = M_Ed / M_Rd = 0.140 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

==============================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta-Soletta principale, Dir 2.

==============================================================================

--------------------------------------------------------------------

```
  Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
-----------------------------------------------------------------------
 0.4000   2035 BOT 0.0012 0.0020 | 142.043(  27) 251.547 0.565  OK
          1986 TOP 0.0009 0.0020 | 103.938(  22) 251.547 0.413  OK
-----------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No.  : 2035

Thickness :    0.4000 m.

Materials :  fck =  32000.0000 KPa.

fcd =  21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering  :  dB  =   0.0600 m.

dT  =   0.0600 m.

LCB No.   :   27

-. Information of Design.

b       =   0.0010 m.  (by Code Unit Length).

d       =   0.3400 m.

lambda   =   0.800

a       = lambda * x  =   0.037 m.

eta      =   1.000

Cc       = eta*fcd*b*a =      0.7820 kN.

M_Rd     = Cc*(d-a/2)  =     251.5474  kN-m./m.

-. Information of Moments and Result.

Rein. Bar :  P16 @100

As_req = 0.0012 m^2/m. ( 0.0012 m^2/m.)

M_Ed = 142.0432 kN-m./m.

M_Rd = 251.5474 kN-m./m.

RatM = M_Ed / M_Rd = 0.565 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.080

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.080/ 0.450 = 0.178 ---> O.K

### 2.6.2 Verifiche* a flessione Platee sp.50 cm

```
================================================================================
  [[[*]]]  SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platee RINF SUP GRI, Dir 1.
================================================================================
 ---------------------------------------------------------------------
   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 ---------------------------------------------------------------------
 0.4000   1232 BOT 0.0006 0.0010 | 46.0903(  27) 133.212 0.346  OK
          1341 TOP 0.0009 0.0010 | 114.307(  27) 133.212 0.858  OK
 ---------------------------------------------------------------------


 << BOTTOM >>


 -. Information of Parameters.
   Elem No.  : 1232
   Thickness :    0.4000 m.
   Materials :  fck =  32000.0000 KPa.
                fcd =  21333.3333 KPa.
                fyk = 450000.0000 KPa.
   Covering  :  dB  =   0.0500 m.
                dT  =   0.0500 m.
   LCB No.   :   27


 -. Information of Design.
   b       =  0.0010 m.  (by Code Unit Length).
   d       =  0.3500 m.
   lambda  =  0.800
   a       = lambda * x  =   0.018 m.
   eta     =   1.000
   Cc      = eta*fcd*b*a =      0.3908 kN.
```

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 46.0903 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.346 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1341

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3908 kN.

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

M_Ed = 114.3074 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.858 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.061

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.061/ 0.450 = 0.135 ---> O.K

==============================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platee RINF INF GRI, Dir 1.

==============================================================================

| Thk | Elem | POS | AsReq | AsUse | M_Ed( LCB) | M_Rd | Rat | CHK |
|---|---|---|---|---|---|---|---|---|
| 0.4000 | 1286 | BOT | 0.0007 | 0.0010 | 85.9917( 27) | 133.212 | 0.646 | OK |
| | 1335 | TOP | 0.0009 | 0.0010 | 109.317( 27) | 133.212 | 0.821 | OK |

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1286

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3908 kN.

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0007 m^2/m. ( 0.0007 m^2/m.)

M_Ed = 85.9917 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.646 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.046

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.046/ 0.450 = 0.102 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1335

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3908 kN.

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

M_Ed = 109.3171 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.821 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.058

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.058/ 0.450 = 0.129 ---> O.K

================================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platea RINF X Dissabb, Dir 1.

================================================================================

```
--------------------------------------------------------------------
 Thk   Elem POS  AsReq  AsUse |   M_Ed( LCB)   M_Rd   Rat CHK
--------------------------------------------------------------------
0.4000  1479 BOT 0.0017 0.0020 | 210.462(  9) 259.263 0.812  OK
        1332 TOP 0.0007 0.0020 | 80.6215( 19) 259.263 0.311  OK
--------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1479

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 9

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7817 kN.

M_Rd = Cc*(d-a/2) = 259.2630 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @100

As_req = 0.0017 m^2/m. ( 0.0017 m^2/m.)

M_Ed = 210.4616 kN-m./m.

M_Rd = 259.2630 kN-m./m.

RatM = M_Ed / M_Rd = 0.812 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.112

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.112/ 0.450 = 0.249 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1332

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 19

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7817 kN.

M_Rd = Cc*(d-a/2) = 259.2630 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @100

As_req = 0.0007 m^2/m. ( 0.0007 m^2/m.)

M_Ed = 80.6215 kN-m./m.

M_Rd = 259.2630 kN-m./m.

RatM = M_Ed / M_Rd = 0.311 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.043

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.043/ 0.450 = 0.095 ---> O.K

================================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platea Grigliatura, Dir 1.

================================================================================

| Thk | Elem | POS | AsReq | AsUse | M_Ed( LCB) | M_Rd | Rat | CHK |
|---|---|---|---|---|---|---|---|---|
| 0.4000 | 1297 | BOT | 0.0018 | 0.0020 | 226.608( 27) | 259.263 | 0.874 | OK |
| | 1304 | TOP | 0.0008 | 0.0010 | 102.351( 27) | 133.212 | 0.768 | OK |

<< BOTTOM >>

-. Information of Parameters.

Elem No.  : 1297

Thickness :    0.4000 m.

Materials :  fck =  32000.0000 KPa.

fcd =  21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering  :  dB  =   0.0500 m.

dT  =   0.0500 m.

LCB No.   :   27

-. Information of Design.

b       =   0.0010 m.  (by Code Unit Length).

d       =   0.3500 m.

lambda   =   0.800

a       = lambda * x  =   0.037 m.

eta      =   1.000

Cc       = eta*fcd*b*a =      0.7817 kN.

M_Rd     = Cc*(d-a/2)  =     259.2630  kN-m./m.

-. Information of Moments and Result.

Rein. Bar :  P16 @200 / P16 @200

As_req =       0.0018 m^2/m.  (       0.0018 m^2/m.)

M_Ed   =     226.6076  kN-m./m.

M_Rd   =     259.2630  kN-m./m.

RatM   = M_Ed / M_Rd =   0.874  <  1.0  --->  O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.120

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.120/ 0.450 = 0.268 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1304

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3908 kN.

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

M_Ed = 102.3506 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.768 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.054

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.054/ 0.450 = 0.121 ---> O.K

================================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platea Dissabbiatura, Dir 1.

================================================================================

| Thk | Elem | POS | AsReq | AsUse | M_Ed( LCB) | M_Rd | Rat | CHK |
|---|---|---|---|---|---|---|---|---|
| 0.4000 | 2604 | BOT | 0.0015 | 0.0020 | 188.457( 7) | 259.263 | 0.727 | OK |
| | 1558 | TOP | 0.0006 | 0.0010 | 69.8656( 7) | 133.212 | 0.524 | OK |

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 2604

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 7

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7817 kN.

M_Rd = Cc*(d-a/2) = 259.2630 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0015 m^2/m. ( 0.0015 m^2/m.)

M_Ed = 188.4570 kN-m./m.

M_Rd = 259.2630 kN-m./m.

RatM = M_Ed / M_Rd = 0.727 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.100

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.100/ 0.450 = 0.223 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1558

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 7

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3908 kN.

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 69.8656 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.524 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

==============================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platea Finale, Dir 1.

==============================================================================

--------------------------------------------------------------------

Thk Elem POS AsReq AsUse | M_Ed( LCB) M_Rd Rat CHK

--------------------------------------------------------------------

0.4000 1620 BOT 0.0006 0.0010 | 43.5860( 25) 133.212 0.327 OK

1634 TOP 0.0013 0.0020 | 160.747( 25) 259.263 0.620 OK

--------------------------------------------------------------------

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1620

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 25

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3908 kN.

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 43.5860 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.327 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1634

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 25

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7817 kN.

M_Rd = Cc*(d-a/2) = 259.2630 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0013 m^2/m. ( 0.0013 m^2/m.)

M_Ed = 160.7468 kN-m./m.

M_Rd = 259.2630 kN-m./m.

RatM = M_Ed / M_Rd = 0.620 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.085

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.085/ 0.450 = 0.190 ---> O.K

==============================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platee RINF SUP GRI, Dir 2.

==============================================================================

```
 --------------------------------------------------------------------
   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 --------------------------------------------------------------------
 0.4000   1330 BOT 0.0006 0.0010 | 27.4612(  28) 129.357 0.212  OK
          1334 TOP 0.0016 0.0020 | 196.081(  27) 251.547 0.779  OK
 --------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1330

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 28

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3910 kN.

M_Rd = Cc*(d-a/2) = 129.3569 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 27.4612 kN-m./m.

M_Rd = 129.3569 kN-m./m.

RatM = M_Ed / M_Rd = 0.212 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1334

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7820 kN.

M_Rd = Cc*(d-a/2) = 251.5474 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @100

As_req = 0.0016 m^2/m. ( 0.0016 m^2/m.)

M_Ed = 196.0808 kN-m./m.

M_Rd = 251.5474 kN-m./m.

RatM = M_Ed / M_Rd = 0.779 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.110

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.110/ 0.450 = 0.245 ---> O.K

================================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platee RINF INF GRI, Dir 2.

================================================================================

----------------------------------------------------------------------

Thk Elem POS AsReq AsUse | M_Ed( LCB) M_Rd Rat CHK

--------------------------------------------------------------------

0.4000 1314 BOT 0.0024 0.0031 | 288.075( 27) 381.046 0.756 OK

1335 TOP 0.0010 0.0020 | 123.788( 27) 251.547 0.492 OK

--------------------------------------------------------------------

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1314

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.057 m.

eta = 1.000

Cc = eta*fcd*b*a = 1.2240 kN.

M_Rd = Cc*(d-a/2) = 381.0465 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P20 @100

As_req = 0.0024 m^2/m. ( 0.0024 m^2/m.)

M_Ed = 288.0755 kN-m./m.

M_Rd = 381.0465 kN-m./m.

RatM = M_Ed / M_Rd = 0.756 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.162

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.162/ 0.450 = 0.361 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1335

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7820 kN.

M_Rd = Cc*(d-a/2) = 251.5474 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

M_Ed = 123.7879 kN-m./m.

M_Rd = 251.5474 kN-m./m.

RatM = M_Ed / M_Rd = 0.492 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.070

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.070/ 0.450 = 0.155 ---> O.K

```
===============================================================================
 [[[*]]]  SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platea RINF X Dissabb, Dir 2.
===============================================================================
-------------------------------------------------------------------
  Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
-------------------------------------------------------------------
 0.4000   1261 BOT 0.0013 0.0020 | 153.006(   9) 251.547 0.608  OK
          1299 TOP 0.0008 0.0010 | 98.0625(  20) 129.357 0.758  OK
-------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1261

Thickness : 0.4000 m.

------------------------------------------------------------------------------------------

midas Gen - RC-Slab Flexural Design [ Eurocode2:04 & NTC2018 ] Gen 2021

==========================================================================================

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 9

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7820 kN.

M_Rd = Cc*(d-a/2) = 251.5474 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0013 m^2/m. ( 0.0013 m^2/m.)

M_Ed = 153.0057 kN-m./m.

M_Rd = 251.5474 kN-m./m.

RatM = M_Ed / M_Rd = 0.608 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.086

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.086/ 0.450 = 0.191 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1299

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 20

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3910 kN.

M_Rd = Cc*(d-a/2) = 129.3569 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

M_Ed = 98.0625 kN-m./m.

M_Rd = 129.3569 kN-m./m.

RatM = M_Ed / M_Rd = 0.758 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.055

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.055/ 0.450 = 0.123 ---> O.K

================================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platea Grigliatura, Dir 2.

================================================================================

```
--------------------------------------------------------------------
 Thk   Elem POS  AsReq  AsUse |   M_Ed( LCB)   M_Rd   Rat CHK
--------------------------------------------------------------------
0.4000   1291 BOT 0.0016 0.0020 | 188.609(  27) 251.547 0.750  OK
         1322 TOP 0.0010 0.0010 | 120.064(  27) 129.357 0.928  OK
--------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1291

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7820 kN.

M_Rd = Cc*(d-a/2) = 251.5474 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0016 m^2/m. ( 0.0016 m^2/m.)

M_Ed = 188.6090 kN-m./m.

M_Rd = 251.5474 kN-m./m.

RatM = M_Ed / M_Rd = 0.750 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.106

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.106/ 0.450 = 0.236 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1322

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3910 kN.

M_Rd = Cc*(d-a/2) = 129.3569 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

M_Ed = 120.0639 kN-m./m.

M_Rd = 129.3569 kN-m./m.

RatM = M_Ed / M_Rd = 0.928 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.068

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.068/ 0.450 = 0.150 ---> O.K

==============================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platea Dissabbiatura, Dir 2.

==============================================================================

```
----------------------------------------------------------------------
 Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
----------------------------------------------------------------------
0.4000   1474 BOT 0.0013 0.0020 | 150.202(  20) 251.547 0.597  OK
         1519 TOP 0.0010 0.0020 | 120.869(  22) 251.547 0.481  OK
----------------------------------------------------------------------
```

<< BOTTOM >>

-. Information of Parameters.

Elem No.  : 1474

Thickness :    0.4000 m.

Materials :  fck =  32000.0000 KPa.

fcd =  21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering  :  dB  =   0.0600 m.

dT  =   0.0600 m.

LCB No.   :   20

-. Information of Design.

b       =  0.0010 m.  (by Code Unit Length).

d       =  0.3400 m.

lambda   =   0.800

a       = lambda * x  =   0.037 m.

eta     =   1.000

Cc      = eta*fcd*b*a =      0.7820 kN.

M_Rd    = Cc*(d-a/2)  =     251.5474  kN-m./m.

-. Information of Moments and Result.

Rein. Bar :  P16 @200 / P16 @200

As_req =      0.0013 m^2/m.  (      0.0013 m^2/m.)

M_Ed   =    150.2017  kN-m./m.

M_Rd   =    251.5474  kN-m./m.

RatM   = M_Ed / M_Rd =   0.597  <  1.0  --->  O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.085

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.085/ 0.450 = 0.188 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1519

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 22

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.037 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.7820 kN.

M_Rd = Cc*(d-a/2) = 251.5474 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200 / P16 @200

As_req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

M_Ed = 120.8694 kN-m./m.

M_Rd = 251.5474 kN-m./m.

RatM = M_Ed / M_Rd = 0.481 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.068

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.068/ 0.450 = 0.151 ---> O.K

===============================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Platea-Platea Finale, Dir 2.

===============================================================================

| Thk | Elem | POS | AsReq | AsUse | M_Ed( LCB) | M_Rd | Rat | CHK |
|---|---|---|---|---|---|---|---|---|
| 0.4000 | 1632 | BOT | 0.0007 | 0.0010 | 87.8765( 30) | 129.357 | 0.679 | OK |
| | 1597 | TOP | 0.0006 | 0.0010 | 52.5029( 31) | 129.357 | 0.406 | OK |

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1632

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 30

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3910 kN.

M_Rd = Cc*(d-a/2) = 129.3569 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0007 m^2/m. ( 0.0007 m^2/m.)

M_Ed = 87.8765 kN-m./m.

M_Rd = 129.3569 kN-m./m.

RatM = M_Ed / M_Rd = 0.679 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.049

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.049/ 0.450 = 0.110 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1597

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 31

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3910 kN.

M_Rd = Cc*(d-a/2) = 129.3569 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 52.5029 kN-m./m.

M_Rd = 129.3569 kN-m./m.

RatM = M_Ed / M_Rd = 0.406 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

## 2.6.3 Verifiche a pressoflessione Pareti sp.40 cm

```
==================================================================================

   [[[*]]]   MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti Ext X.

==================================================================================



-------------------------------------------------------------------------------------

   [*]   SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-------------------------------------------------------------------------------------


 ( ). Information of Parameters.

   -. Elem No.   : 107

   -. Node No.   : 181

   -. LCB No.    :   43

   -. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

   -. Thickness :  t   =       0.4000 m.

   -. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.


 ( ). Check elements cracked or not.

   [ EN1992-2:2005, Annex LL, (LL.101) ]

   -. Sig1   = Sig,max =   1362.1355 KPa.

   -. Sig2   = Sig,min =    411.0767 KPa.

   -. Sig3   =       0.0000 KPa. (2D Element)

   -. fcm    =  40000.0000 KPa.

   -. alpha  =  4.1292

   -. lambda = 13.9506

   -. beta   =  4.6286

            alpha*J2   lambda*SQRT[J2]      beta*I1

   -. PHI    = -------- + ---------------             + -------- - 1.0 = -0.5499

             fcm^2          fcm            fcm

         ---> UNCRACKED. CHECK CONCRETE STRESS !!!
```

( ). Membrane forces.

-. NEdx = 29.9023 kN/m.

-. NEdy = 18.8105 kN/m.

-. NEdxy = -4.6436 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.5499

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 29.9023 kN/m.

-. NEdy = 18.8105 kN/m.

-. NEdxy = -4.6436 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.5499

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 29.9023 kN/m.

-. NEdy = 18.8105 kN/m.

-. NEdxy = -4.6436 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.5499

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 8.7210 kN/m.

-. NEdy = -87.2518 kN/m.

-. NEdxy = 9.5824 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1911.3164 KPa.

-. alpha = 0.1347(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 21293.0160 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.090

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 = -0.5499
            fcm^2          fcm             fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 8.7210 kN/m.

-. NEdy = -87.2518 kN/m.

-. NEdxy = 9.5824 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1911.3164 KPa.

-. alpha = 0.1347(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 21293.0160 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.090

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.5499

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 8.7210 kN/m.

-. NEdy = -87.2518 kN/m.

-. NEdxy = 9.5824 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1911.3164 KPa.

-. alpha = 0.1347(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 21293.0160 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.090

==================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Parete Ext DY.

==================================================================================

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2502

-. Node No. : 809

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3452.2217 KPa.

-. Sig2 = Sig,min = 594.3952 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4060

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------          + -------- - 1.0 =  0.1418
           fcm^2         fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 229.0131 kN/m.

-. NEdy = 3.6299 kN/m.

-. NEdxy = -28.5443 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3255.6089 KPa.

-. f'tdy = 429.3635 KPa.

-. Sigcd = 713.6064 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @200/P14 @200

-. Rebar,y : P14 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0019

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3766.3043 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4322

-. Rat,bary = f'tdy/ftdy = 0.1140

-. Rat,conc = Sigcd/Sigcn = 0.0669

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4322 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2502

-. Node No. : 809

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3452.2217 KPa.

-. Sig2 = Sig,min = 594.3952 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4060

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 =  0.1418
           fcm^2          fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 229.0131 kN/m.

-. NEdy = 3.6299 kN/m.

-. NEdxy = -28.5443 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3255.6089 KPa.

-. f'tdy = 429.3635 KPa.

-. Sigcd = 713.6064 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] =  0.0010

-. Asx,req  =      0.0008 m^2/m.  (      0.0008 m^2/m.)

-. Asy,req  =      0.0004 m^2/m.  (      0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @200/P14 @200

-. Rebar,y : P14 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use  =      0.0015 m^2/m.  (      0.0015 m^2/m.)

-. Asy,use  =      0.0008 m^2/m.  (      0.0008 m^2/m.)

-. rhox,use =  0.0039

-. rhoy,use =  0.0019

-. ftdx     = rhox,use*fyd*(t/ck) =   7532.6087 KPa.

-. ftdy     = rhoy,use*fyd*(t/ck) =   3766.3043 KPa.

( ). Concrete strength limit.

-. Sigcn    = nu*fcd =  10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.4322

-. Rat,bary = f'tdy/ftdy  =  0.1140

-. Rat,conc = Sigcd/Sigcn =  0.0669

-. Rat      = MAX[ Rat,barx, Rat,bary, Rat,conc ] =  0.4322 ---> O.K.

------------------------------------------------------------------------------------

[*]   SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1164

-. Node No. : 1378

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 167.1386 KPa.

-. Sig2 = Sig,min = -221.9508 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.0081

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 = -0.9476
          fcm^2         fcm            fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 22.7875 kN/m.

-. NEdy = -39.7472 kN/m.

-. NEdxy = -4.4151 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -221.9508 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.010

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2689

-. Node No. : 3195

-. LCB No. : 26

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3195.9440 KPa.

-. Sig2 = Sig,min = 1089.3315 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.7519

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------           + -------- - 1.0 =  0.0613
           fcm^2         fcm          fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 139.0252 kN/m.

-. NEdy = 239.1471 kN/m.

-. NEdxy = -62.0007 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2560.8404 KPa.

-. f'tdy = 4033.2300 KPa.

-. Sigcd = 1550.0181 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0021

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @200/P14 @200

-. Rebar,y : P14 @200/P14 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3400

-. Rat,bary = f'tdy/ftdy = 0.5354

-. Rat,conc = Sigcd/Sigcn = 0.1453

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5354 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2689

-. Node No. : 3195

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3274.1303 KPa.

-. Sig2 = Sig,min = 998.7696 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9352

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 =  0.0863
           fcm^2          fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 119.0804 kN/m.

-. NEdy = 253.8204 kN/m.

-. NEdxy =    -56.3330 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx    =   2225.0803 KPa.

-. f'tdy    =   4153.8401 KPa.

-. Sigcd    =   1408.3244 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] =  0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] =  0.0021

-. Asx,req  =      0.0008 m^2/m.  (      0.0008 m^2/m.)

-. Asy,req  =      0.0008 m^2/m.  (      0.0008 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @200/P14 @200

-. Rebar,y : P14 @200/P14 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use  =      0.0015 m^2/m.  (      0.0015 m^2/m.)

-. Asy,use  =      0.0015 m^2/m.  (      0.0015 m^2/m.)

-. rhox,use =  0.0039

-. rhoy,use =  0.0039

-. ftdx     = rhox,use*fyd*(t/ck) =   7532.6087 KPa.

-. ftdy     = rhoy,use*fyd*(t/ck) =   7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn    = nu*fcd =  10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.2954

-. Rat,bary = f'tdy/ftdy  =  0.5514

-. Rat,conc = Sigcd/Sigcn =  0.1320

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5514 ---> O.K.

-------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1164

-. Node No. : 1378

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 167.1386 KPa.

-. Sig2 = Sig,min = -221.9508 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.0081

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------    + -------- - 1.0 = -0.9476
           fcm^2         fcm               fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 2.9075 kN/m.

-. NEdy = -41.0615 kN/m.

-. NEdxy = -20.7624 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -327.1340 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.015

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT Y Rinf 14/10.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 1561

-. Node No. : 50

-. LCB No. : 34

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3115.5022 KPa.

-. Sig2 = Sig,min = -1231.5442 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.0344

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.0171

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 256.1024 kN/m.

-. NEdy = -118.7681 kN/m.

-. NEdxy = -215.8850 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5941.1758 KPa.

-. f'tdy = 1242.1668 KPa.

-. Sigcd = 5397.1257 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0030

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0012 m^2/m. ( 0.0012 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.7887

-. Rat,bary = f'tdy/ftdy = 0.1649

-. Rat,conc = Sigcd/Sigcn = 0.5060

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7887 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 572

-. Node No. : 713

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3949.7143 KPa.

-. Sig2 = Sig,min = 924.5752 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.2263

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.3098

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 183.5656 kN/m.

-. NEdy = 210.8776 kN/m.

-. NEdxy = -127.8486 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3913.7964 KPa.

-. f'tdy = 4536.5122 KPa.

-. Sigcd = 3196.2160 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0023

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5196

-. Rat,bary = f'tdy/ftdy = 0.6022

-. Rat,conc = Sigcd/Sigcn = 0.2996

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.6022 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 321

-. Node No. : 410

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 918.1149 KPa.

-. Sig2 = Sig,min = 398.3964 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.1596

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.6956

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 85.4318 kN/m.

-. NEdy = 41.0290 kN/m.

-. NEdxy = -3.4323 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -671.8031 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.03

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 543

-. Node No. : 55

-. LCB No. : 25

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 6139.7497 KPa.

-. Sig2 = Sig,min = 1133.2547 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3753

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------  + -------- - 1.0 =  1.0433
           fcm^2         fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 540.5766 kN/m.

-. NEdy = 33.5803 kN/m.

-. NEdxy = 27.5557 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 7158.4502 KPa.

-. f'tdy = 818.7848 KPa.

-. Sigcd = 688.8914 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0037

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9503

-. Rat,bary = f'tdy/ftdy = 0.1087

-. Rat,conc = Sigcd/Sigcn = 0.0646

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.9503 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 361

-. Node No. : 378

-. LCB No. : 27

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 7113.9001 KPa.

-. Sig2 = Sig,min = 1481.1226 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3095

-. beta = 4.6286

```
            alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------    + -------- - 1.0 =  1.3737
             fcm^2          fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 104.5313 kN/m.

-. NEdy = 503.0151 kN/m.

-. NEdxy = -20.9897 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1548.2857 KPa.

-. f'tdy = 7017.9211 KPa.

-. Sigcd = 524.7425 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0036

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0014 m^2/m. ( 0.0014 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2055

-. Rat,bary = f'tdy/ftdy = 0.9317

-. Rat,conc = Sigcd/Sigcn = 0.0492

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.9317 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1561

-. Node No. : 50

-. LCB No. : 32

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3514.7765 KPa.

-. Sig2 = Sig,min = -744.9514 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3995

-. beta = 4.6286

```
        alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------        + -------- - 1.0 =  0.1528
         fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 84.9021 kN/m.

-. NEdy = -78.0728 kN/m.

-. NEdxy = -249.6839 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 4164.3818 KPa.

-. f'tdy = 2090.0898 KPa.

-. Sigcd = 6242.0977 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0021

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0011

-. Asx,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5528

-. Rat,bary = f'tdy/ftdy = 0.2775

-. Rat,conc = Sigcd/Sigcn = 0.5852

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5852 ---> O.K.

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT X RINF Vert.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No.  : 51

-. Node No.  : 26

-. LCB No.   :   27

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.4000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   8938.8261 KPa.

-. Sig2   = Sig,min =   1617.3056 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.3846

-. beta   =  4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------            + -------- - 1.0 =  1.9929
            fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx  =    131.8690 kN/m.

-. NEdy  =    652.3285 kN/m.

-. NEdxy =    -46.8957 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx    =   2210.4433 KPa.

-. f'tdy    =   9364.6105 KPa.

-. Sigcd = 1172.3933 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0048

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0019 m^2/m. ( 0.0019 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2934

-. Rat,bary = f'tdy/ftdy = 0.7538

-. Rat,conc = Sigcd/Sigcn = 0.1099

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7538 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

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( ). Information of Parameters.

-. Elem No. : 71

-. Node No. : 28

-. LCB No. : 27

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 9595.4877 KPa.

-. Sig2 = Sig,min = 1894.7764 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3406

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------          + -------- - 1.0 =  2.2183
          fcm^2          fcm             fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 141.6104 kN/m.

-. NEdy = 705.9634 kN/m.

-. NEdxy = -23.3741 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2036.7542 KPa.

-. f'tdy = 9767.9126 KPa.

-. Sigcd = 584.3517 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0050

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0020 m^2/m. ( 0.0020 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2704

-. Rat,bary = f'tdy/ftdy = 0.7862

-. Rat,conc = Sigcd/Sigcn = 0.0548

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7862 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 441

-. Node No. : 547

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 2313.0992 KPa.

-. Sig2 = Sig,min = 475.9718 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3167

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.2362

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -71.5144 kN/m.

-. NEdy = -348.3272 kN/m.

-. NEdxy = -29.8837 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 481

-. Node No. : 491

-. LCB No. : 27

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 9191.1172 KPa.

-. Sig2 = Sig,min = 1935.0260 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3025

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 2.0806

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 134.6612 kN/m.

-. NEdy = 666.2285 kN/m.

-. NEdxy = -61.7845 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2430.2461 KPa.

-. f'tdy = 9750.1743 KPa.

-. Sigcd = 1544.6122 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0050

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0020 m^2/m. ( 0.0020 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

-----------------------------------------------------------------------------------------

midas Gen - RC-Shell Flexural Design[ Eurocode2:04 & NTC2018 ]          Gen 2021

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( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.3226

-. Rat,bary = f'tdy/ftdy  =  0.7848

-. Rat,conc = Sigcd/Sigcn =  0.1448

-. Rat      = MAX[ Rat,barx, Rat,bary, Rat,conc ] =  0.7848 ---> O.K.

-----------------------------------------------------------------------------------

[*]   SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 461

-. Node No.  : 489

-. LCB No.   :   27

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.4000 m.

-. Covering  :  dB  =      0.0600 m., dT  =      0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   9825.2574 KPa.

-. Sig2   = Sig,min =   1965.9582 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.3332

-. beta = 4.6286

```
            alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 =  2.2971
             fcm^2          fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 144.5981 kN/m.

-. NEdy = 720.6499 kN/m.

-. NEdxy = -38.7129 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2264.6271 KPa.

-. f'tdy = 10170.0377 KPa.

-. Sigcd = 967.8230 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0052

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0021 m^2/m. ( 0.0021 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3006

-. Rat,bary = f'tdy/ftdy = 0.8186

-. Rat,conc = Sigcd/Sigcn = 0.0907

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.8186 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 441

-. Node No. : 547

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 2313.0992 KPa.

-. Sig2 = Sig,min = 475.9718 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3167

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.2362

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 42.8609 kN/m.

-. NEdy = 132.4879 kN/m.

-. NEdxy = -29.6789 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -3446.7000 KPa.

-. alpha = 0.1730(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 21843.0537 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.158

=====================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT Y Rinf 18/10.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 2598

-. Node No.  : 806

-. LCB No.   :   28

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.4000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   3496.8363 KPa.

-. Sig2   = Sig,min =   2051.0052 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 11.8531

-. beta   =  4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------     + -------- - 1.0 =  0.1706
            fcm^2          fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx  =    248.1164 kN/m.

-. NEdy  =     22.7991 kN/m.

-. NEdxy =     49.2989 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx    =   3756.8843 KPa.

-. f'tdy    =    965.5981 KPa.

-. Sigcd    =   1232.4721 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4987

-. Rat,bary = f'tdy/ftdy = 0.0777

-. Rat,conc = Sigcd/Sigcn = 0.1155

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4987 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 806

-. LCB No. : 35

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3240.2132 KPa.

-. Sig2 = Sig,min = 1815.1246 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.1049

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.0833

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 151.1263 kN/m.

-. NEdy = 303.1926 kN/m.

-. NEdxy = -26.2200 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2224.3567 KPa.

-. f'tdy = 4411.7769 KPa.

-. Sigcd = 655.5011 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0023

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2953

-. Rat,bary = f'tdy/ftdy = 0.3551

-. Rat,conc = Sigcd/Sigcn = 0.0615

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.3551 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 11

-. LCB No. : 29

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3147.4562 KPa.

-. Sig2 = Sig,min = 1104.9598 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.6951

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 =  0.0454
           fcm^2          fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = -73.3804 kN/m.

-. NEdy = -404.3679 kN/m.

-. NEdxy = -74.8677 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = -790.5242 KPa.

-. f'tdy = 0.0000 KPa.

-. Sigcd = 5227.8681 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1049

-. Rat,bary = f'tdy/ftdy = 0.0000

-. Rat,conc = Sigcd/Sigcn = 0.4901

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4901 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

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--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 2491

-. Node No.  : 11

-. LCB No.   :   29

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.4000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   3147.4562 KPa.

-. Sig2   = Sig,min =   1104.9598 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 13.6951

-. beta   =  4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------           + -------- - 1.0 =  0.0454
            fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx  =     47.7781 kN/m.

-. NEdy  =    322.6626 kN/m.

-. NEdxy =     -4.3964 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 698.7190 KPa.

-. f'tdy = 4380.2538 KPa.

-. Sigcd = 109.9089 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0022

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P12 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0011 m^2/m. ( 0.0011 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0028

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 5527.1739 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1264

-. Rat,bary = f'tdy/ftdy = 0.3526

-. Rat,conc = Sigcd/Sigcn = 0.0103

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.3526 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 11

-. LCB No. : 29

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3147.4562 KPa.

-. Sig2 = Sig,min = 1104.9598 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.6951

-. beta = 4.6286

```
        alpha*J2   lambda*SQRT[J2]     beta*I1
-. PHI   = -------- + ---------------          + -------- - 1.0 =  0.0454
          fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 47.7781 kN/m.

-. NEdy = 322.6626 kN/m.

-. NEdxy = -4.3964 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 698.7190 KPa.

-. f'tdy = 4380.2538 KPa.

-. Sigcd = 109.9089 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0022

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P12 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0011 m^2/m. ( 0.0011 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0028

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 5527.1739 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1264

-. Rat,bary = f'tdy/ftdy = 0.3526

-. Rat,conc = Sigcd/Sigcn = 0.0103

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.3526 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

---------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2620

-. Node No. : 3055

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 364.5382 KPa.

-. Sig2 = Sig,min = -184.4409 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.7783

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------    + -------- - 1.0 = -0.8827
           fcm^2         fcm              fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 12.4833 kN/m.

-. NEdy = -65.5583 kN/m.

-. NEdxy = 8.6036 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -605.9210 KPa.

-. alpha = 0.6327(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 23157.3249 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.026

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti Ext X.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.5499

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 29.9023 kN/m.

-. NEdy = 18.8105 kN/m.

-. NEdxy = -4.6436 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

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( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   1362.1355 KPa.

-. Sig2   = Sig,min =    411.0767 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 13.9506

-. beta   =  4.6286

alpha*J2   lambda*SQRT[J2]      beta*I1

-. PHI    = -------- + ---------------             + -------- - 1.0 = -0.5499

fcm^2          fcm           fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx  =     29.9023 kN/m.

-. NEdy  =     18.8105 kN/m.

-. NEdxy =     -4.6436 kN/m.

( ). Check the minimum principal stress.

-. Sig,min  =      0.0000 KPa.

-. fcd       =  21333.3333 KPa.

-. Rat,con   = Sig,min/fcd =    0.000

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]     beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 = -0.5499
          fcm^2        fcm          fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 29.9023 kN/m.

-. NEdy = 18.8105 kN/m.

-. NEdxy = -4.6436 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.5499

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 8.7210 kN/m.

-. NEdy = -87.2518 kN/m.

-. NEdxy = 9.5824 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1911.3164 KPa.

-. alpha = 0.1347(the ratio between the two principal stress)

```
                      1+3.80*alpha
-. Sig,cdmax = 0.85fcd * --------------  21293.0160 KPa.
                       (1+alpha)^2
```

-. Rat,con = Sig,min/Sig,cdmax = 0.090

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------    + -------- - 1.0 = -0.5499
           fcm^2         fcm            fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 8.7210 kN/m.

-. NEdy = -87.2518 kN/m.

-. NEdxy = 9.5824 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1911.3164 KPa.

-. alpha = 0.1347(the ratio between the two principal stress)

```
                        1+3.80*alpha
-. Sig,cdmax = 0.85fcd * --------------  21293.0160 KPa.
                        (1+alpha)^2
```

-. Rat,con = Sig,min/Sig,cdmax = 0.090

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 107

-. Node No. : 181

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 1362.1355 KPa.

-. Sig2 = Sig,min = 411.0767 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9506

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 = -0.5499
           fcm^2          fcm              fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 8.7210 kN/m.

-. NEdy = -87.2518 kN/m.

-. NEdxy = 9.5824 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1911.3164 KPa.

-. alpha = 0.1347(the ratio between the two principal stress)

```
                        1+3.80*alpha
-. Sig,cdmax = 0.85fcd * --------------  21293.0160 KPa.
                        (1+alpha)^2
```

-. Rat,con = Sig,min/Sig,cdmax = 0.090

==================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Parete Ext DY.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2502

-. Node No. : 809

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3452.2217 KPa.

-. Sig2 = Sig,min = 594.3952 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4060

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------   + -------- - 1.0 =  0.1418
           fcm^2         fcm             fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 229.0131 kN/m.

-. NEdy = 3.6299 kN/m.

-. NEdxy = -28.5443 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3255.6089 KPa.

-. f'tdy = 429.3635 KPa.

-. Sigcd = 713.6064 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @200/P14 @200

-. Rebar,y : P14 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0019

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3766.3043 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4322

-. Rat,bary = f'tdy/ftdy = 0.1140

-. Rat,conc = Sigcd/Sigcn = 0.0669

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4322 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2502

-. Node No. : 809

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3452.2217 KPa.

-. Sig2 = Sig,min = 594.3952 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4060

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.1418

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 229.0131 kN/m.

-. NEdy = 3.6299 kN/m.

-. NEdxy = -28.5443 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3255.6089 KPa.

-. f'tdy = 429.3635 KPa.

-. Sigcd = 713.6064 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @200/P14 @200

-. Rebar,y : P14 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0019

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3766.3043 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4322

-. Rat,bary = f'tdy/ftdy = 0.1140

-. Rat,conc = Sigcd/Sigcn = 0.0669

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4322 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

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( ). Information of Parameters.

-. Elem No. : 1164

-. Node No. : 1378

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 167.1386 KPa.

-. Sig2 = Sig,min = -221.9508 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.0081

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + ---------------  + -------- - 1.0 = -0.9476

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 22.7875 kN/m.

-. NEdy = -39.7472 kN/m.

-. NEdxy = -4.4151 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -221.9508 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.010

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 2689

-. Node No. : 3195

-. LCB No. : 26

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3195.9440 KPa.

-. Sig2 = Sig,min = 1089.3315 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.7519

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.0613

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 139.0252 kN/m.

-. NEdy = 239.1471 kN/m.

-. NEdxy = -62.0007 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2560.8404 KPa.

-. f'tdy = 4033.2300 KPa.

-. Sigcd = 1550.0181 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0021

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @200/P14 @200

-. Rebar,y : P14 @200/P14 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3400

-. Rat,bary = f'tdy/ftdy = 0.5354

-. Rat,conc = Sigcd/Sigcn = 0.1453

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5354 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2689

-. Node No. : 3195

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3274.1303 KPa.

-. Sig2 = Sig,min = 998.7696 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9352

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------    + -------- - 1.0 =  0.0863
          fcm^2          fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 119.0804 kN/m.

-. NEdy = 253.8204 kN/m.

-. NEdxy = -56.3330 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2225.0803 KPa.

-. f'tdy = 4153.8401 KPa.

-. Sigcd = 1408.3244 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0021

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @200/P14 @200

-. Rebar,y : P14 @200/P14 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2954

-. Rat,bary = f'tdy/ftdy = 0.5514

-. Rat,conc = Sigcd/Sigcn = 0.1320

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5514 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1164

-. Node No. : 1378

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 167.1386 KPa.

-. Sig2 = Sig,min = -221.9508 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.0081

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9476

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 2.9075 kN/m.

-. NEdy = -41.0615 kN/m.

-. NEdxy = -20.7624 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -327.1340 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.015

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT Y Rinf 14/10.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No.  : 1561

-. Node No.  : 50

-. LCB No.   :   34

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.4000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   3115.5022 KPa.

-. Sig2   = Sig,min =  -1231.5442 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.0344

-. beta   =  4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------     + -------- - 1.0 =  0.0171
            fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx =    256.1024 kN/m.

-. NEdy =   -118.7681 kN/m.

-. NEdxy =   -215.8850 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx    =   5941.1758 KPa.

-. f'tdy    =   1242.1668 KPa.

-. Sigcd = 5397.1257 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0030

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0012 m^2/m. ( 0.0012 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.7887

-. Rat,bary = f'tdy/ftdy = 0.1649

-. Rat,conc = Sigcd/Sigcn = 0.5060

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7887 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

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( ). Information of Parameters.

-. Elem No. : 572

-. Node No. : 713

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3949.7143 KPa.

-. Sig2 = Sig,min = 924.5752 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.2263

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 =  0.3098
          fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 183.5656 kN/m.

-. NEdy = 210.8776 kN/m.

-. NEdxy = -127.8486 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3913.7964 KPa.

-. f'tdy = 4536.5122 KPa.

-. Sigcd = 3196.2160 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0023

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5196

-. Rat,bary = f'tdy/ftdy = 0.6022

-. Rat,conc = Sigcd/Sigcn = 0.2996

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.6022 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

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( ). Information of Parameters.

-. Elem No. : 321

-. Node No. : 410

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 918.1149 KPa.

-. Sig2 = Sig,min = 398.3964 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.1596

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 = -0.6956
           fcm^2         fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 85.4318 kN/m.

-. NEdy = 41.0290 kN/m.

-. NEdxy = -3.4323 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -671.8031 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.031

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 543

-. Node No. : 55

-. LCB No. : 25

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 6139.7497 KPa.

-. Sig2 = Sig,min = 1133.2547 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3753

-. beta = 4.6286

```
        alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------         + -------- - 1.0 =  1.0433
         fcm^2          fcm             fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 540.5766 kN/m.

-. NEdy = 33.5803 kN/m.

-. NEdxy = 27.5557 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 7158.4502 KPa.

-. f'tdy = 818.7848 KPa.

-. Sigcd = 688.8914 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0037

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

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=============================================================================================

( ). Check results.

-. Rat,barx = f'tdx/ftdx  =  0.9503

-. Rat,bary = f'tdy/ftdy  =  0.1087

-. Rat,conc = Sigcd/Sigcn =  0.0646

-. Rat      = MAX[ Rat,barx, Rat,bary, Rat,conc ] =  0.9503 ---> O.K.

-------------------------------------------------------------------------------------

[*]   SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 361

-. Node No.  : 378

-. LCB No.   :   27

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.4000 m.

-. Covering  :  dB  =      0.0600 m., dT  =      0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   7113.9001 KPa.

-. Sig2   = Sig,min =   1481.1226 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.3095

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]     beta*I1
-. PHI  = -------- + ---------------   + -------- - 1.0 =  1.3737
           fcm^2        fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 104.5313 kN/m.

-. NEdy = 503.0151 kN/m.

-. NEdxy = -20.9897 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1548.2857 KPa.

-. f'tdy = 7017.9211 KPa.

-. Sigcd = 524.7425 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0036

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0014 m^2/m. ( 0.0014 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2055

-. Rat,bary = f'tdy/ftdy = 0.9317

-. Rat,conc = Sigcd/Sigcn = 0.0492

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.9317 ---> O.K.

--------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1561

-. Node No. : 50

-. LCB No. : 32

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3514.7765 KPa.

-. Sig2 = Sig,min = -744.9514 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3995

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------    + -------- - 1.0 =  0.1528
           fcm^2          fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 84.9021 kN/m.

-. NEdy = -78.0728 kN/m.

-. NEdxy = -249.6839 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 4164.3818 KPa.

-. f'tdy = 2090.0898 KPa.

-. Sigcd = 6242.0977 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0021

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0011

-. Asx,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P14 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0039

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 7532.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5528

-. Rat,bary = f'tdy/ftdy = 0.2775

-. Rat,conc = Sigcd/Sigcn = 0.5852

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.5852 ---> O.K.

================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT X RINF Vert.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 51

-. Node No. : 26

-. LCB No. : 27

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 8938.8261 KPa.

-. Sig2 = Sig,min = 1617.3056 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3846

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------          + -------- - 1.0 =  1.9929
          fcm^2          fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 131.8690 kN/m.

-. NEdy = 652.3285 kN/m.

-. NEdxy = -46.8957 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2210.4433 KPa.

-. f'tdy = 9364.6105 KPa.

-. Sigcd = 1172.3933 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0048

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0019 m^2/m. ( 0.0019 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2934

-. Rat,bary = f'tdy/ftdy = 0.7538

-. Rat,conc = Sigcd/Sigcn = 0.1099

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7538 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 71

-. Node No. : 28

-. LCB No. : 27

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 9595.4877 KPa.

-. Sig2 = Sig,min = 1894.7764 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3406

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 2.2183

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 141.6104 kN/m.

-. NEdy = 705.9634 kN/m.

-. NEdxy = -23.3741 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2036.7542 KPa.

-. f'tdy = 9767.9126 KPa.

-. Sigcd = 584.3517 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0050

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0020 m^2/m. ( 0.0020 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2704

-. Rat,bary = f'tdy/ftdy = 0.7862

-. Rat,conc = Sigcd/Sigcn = 0.0548

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7862 ---> O.K.

-------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 441

-. Node No. : 547

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 2313.0992 KPa.

-. Sig2 = Sig,min = 475.9718 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3167

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------            + -------- - 1.0 = -0.2362
           fcm^2          fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -71.5144 kN/m.

-. NEdy = -348.3272 kN/m.

-. NEdxy = -29.8837 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = 0.0000 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.000

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 481

-. Node No. : 491

-. LCB No. : 27

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 9191.1172 KPa.

-. Sig2 = Sig,min = 1935.0260 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3025

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 =  2.0806
          fcm^2         fcm          fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 134.6612 kN/m.

-. NEdy = 666.2285 kN/m.

-. NEdxy = -61.7845 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2430.2461 KPa.

-. f'tdy = 9750.1743 KPa.

-. Sigcd = 1544.6122 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0050

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0020 m^2/m. ( 0.0020 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3226

-. Rat,bary = f'tdy/ftdy = 0.7848

-. Rat,conc = Sigcd/Sigcn = 0.1448

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.7848 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 461

-. Node No.  : 489

-. LCB No.   :   27

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.4000 m.

-. Covering  :  dB  =      0.0600 m., dT  =      0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   9825.2574 KPa.

-. Sig2   = Sig,min =   1965.9582 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.3332

-. beta   =  4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------            + -------- - 1.0 =  2.2971
           fcm^2          fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx =    144.5981 kN/m.

-. NEdy =    720.6499 kN/m.

-. NEdxy =    -38.7129 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx    =   2264.6271 KPa.

-. f'tdy    =  10170.0377 KPa.

-. Sigcd = 967.8230 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0052

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0021 m^2/m. ( 0.0021 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3006

-. Rat,bary = f'tdy/ftdy = 0.8186

-. Rat,conc = Sigcd/Sigcn = 0.0907

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.8186 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

---------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 441

-. Node No.  : 547

-. LCB No.   :   43

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.4000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =   2313.0992 KPa.

-. Sig2   = Sig,min =    475.9718 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.3167

-. beta   =  4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------            + -------- - 1.0 = -0.2362
           fcm^2          fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx  =     42.8609 kN/m.

-. NEdy  =    132.4879 kN/m.

-. NEdxy =    -29.6789 kN/m.

( ). Check the minimum principal stress.

-. Sig,min   =  -3446.7000 KPa.

-. alpha = 0.1730(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 21843.0537 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.158

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT Y Rinf 18/10.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 2598

-. Node No. : 806

-. LCB No. : 28

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3496.8363 KPa.

-. Sig2 = Sig,min = 2051.0052 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 11.8531

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.1706

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 248.1164 kN/m.

-. NEdy = 22.7991 kN/m.

-. NEdxy = 49.2989 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3756.8843 KPa.

-. f'tdy = 965.5981 KPa.

-. Sigcd = 1232.4721 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0004 m^2/m. ( 0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4987

-. Rat,bary = f'tdy/ftdy = 0.0777

-. Rat,conc = Sigcd/Sigcn = 0.1155

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4987 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 806

-. LCB No. : 35

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3240.2132 KPa.

-. Sig2 = Sig,min = 1815.1246 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.1049

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]     beta*I1
-. PHI   = -------- + ---------------   + -------- - 1.0 =  0.0833
           fcm^2         fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 151.1263 kN/m.

-. NEdy = 303.1926 kN/m.

-. NEdxy = -26.2200 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2224.3567 KPa.

-. f'tdy = 4411.7769 KPa.

-. Sigcd = 655.5011 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0023

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0015 m^2/m. ( 0.0015 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2953

-. Rat,bary = f'tdy/ftdy = 0.3551

-. Rat,conc = Sigcd/Sigcn = 0.0615

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.3551 ---> O.K.

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 11

-. LCB No. : 29

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3147.4562 KPa.

-. Sig2 = Sig,min = 1104.9598 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 13.6951

-. beta   =  4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------            + -------- - 1.0 =  0.0454
           fcm^2          fcm           fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx  =    -73.3804 kN/m.

-. NEdy  =   -404.3679 kN/m.

-. NEdxy =    -74.8677 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx    =   -790.5242 KPa.

-. f'tdy    =      0.0000 KPa.

-. Sigcd    =   5227.8681 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] =  0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] =  0.0010

-. Asx,req  =      0.0008 m^2/m.  (      0.0008 m^2/m.)

-. Asy,req  =      0.0004 m^2/m.  (      0.0004 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P14 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use  =      0.0015 m^2/m.  (      0.0015 m^2/m.)

-. Asy,use  =      0.0025 m^2/m.  (      0.0025 m^2/m.)

-. rhox,use =  0.0039

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 7532.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1049

-. Rat,bary = f'tdy/ftdy = 0.0000

-. Rat,conc = Sigcd/Sigcn = 0.4901

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4901 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 11

-. LCB No. : 29

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3147.4562 KPa.

-. Sig2 = Sig,min = 1104.9598 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.6951

-. beta = 4.6286

```
         alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------  + -------- - 1.0 =  0.0454
          fcm^2          fcm             fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 47.7781 kN/m.

-. NEdy = 322.6626 kN/m.

-. NEdxy = -4.3964 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 698.7190 KPa.

-. f'tdy = 4380.2538 KPa.

-. Sigcd = 109.9089 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0022

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P12 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0011 m^2/m. ( 0.0011 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0028

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 5527.1739 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1264

-. Rat,bary = f'tdy/ftdy = 0.3526

-. Rat,conc = Sigcd/Sigcn = 0.0103

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.3526 ---> O.K.

----------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

----------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 11

-. LCB No. : 29

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3147.4562 KPa.

-. Sig2 = Sig,min = 1104.9598 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.6951

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]     beta*I1
-. PHI  = -------- + ---------------  + -------- - 1.0 =  0.0454
           fcm^2          fcm             fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 47.7781 kN/m.

-. NEdy = 322.6626 kN/m.

-. NEdxy = -4.3964 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 698.7190 KPa.

-. f'tdy = 4380.2538 KPa.

-. Sigcd = 109.9089 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0022

-. Asx,req = 0.0008 m^2/m. ( 0.0008 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P12 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0011 m^2/m. ( 0.0011 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0028

-. rhoy,use = 0.0063

-. ftdx = rhox,use*fyd*(t/ck) = 5527.1739 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 12423.9130 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1264

-. Rat,bary = f'tdy/ftdy = 0.3526

-. Rat,conc = Sigcd/Sigcn = 0.0103

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.3526 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2620

-. Node No. : 3055

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 364.5382 KPa.

-. Sig2 = Sig,min = -184.4409 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.7783

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.8827

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 12.4833 kN/m.

-. NEdy = -65.5583 kN/m.

-. NEdxy = 8.6036 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -605.9210 KPa.

-. alpha = 0.6327(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 23157.3249 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.026

### 2.6.4 Verifiche a taglio Pareti esterne sp.40 cm

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[[[*]]] MESHED SHELL SHEAR MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti Ext X.

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[*] SHEAR SHEAR MAXIMUM RESULT

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( ). Information of Parameters.

-. Elem No. : 11

-. Node No. : 102

-. LCB No. : 27

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Calculate the principal shear of the inner layer.

-. V_Edx = 44.3739 kN/m.

-. V_Edy = -16.1516 kN/m.

-. V_Edo = SQRT[ V_Edx^2 + V_Edy^2 ] = 47.2220 kN/m.

-. tan(Phio) = V_Edy/V_Edx = -0.3640

-. RhoI = Rhox*cos(Phio)^2 + Rhoy*sin(Phio)^2 = 0.0019

( ). Calculate the design shear resistance without shear reinforcement.

-. k = MIN[ 1.0+SQRT(200/d), 2.0 ] = 1.7614

-. C_Rdc = 0.18/Gamma_c = 0.1200

-. Sig_cp = MIN[ N_Ed/Ac, 0.2*fcd ] = 0.0000 KPa.

-. V_Rdc1 = [C_Rdc*k*(100*RhoI*fck)^(1/3) + 0.15*Sig_cp]*d = 133.6745 kN/m.

-. V_Rdc2 = [0.035*k^(3/2)*SQRT(fck) + 0.15*Sig_cp]*d = 159.6777 kN/m.

-. V_Rdc = MAX[ V_Rdc1, V_Rdc2 ] = 159.6777 kN/m.

-. RatV = V_Edo / V_Rdc = 0.2957 ---> O.K.

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[[[*]]] MESHED SHELL SHEAR MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Parete Ext DY.

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[*] SHEAR SHEAR MAXIMUM RESULT

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( ). Information of Parameters.

-. Elem No. : 2689

-. Node No. : 3195

-. LCB No. : 26

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Calculate the principal shear of the inner layer.

-. V_Edx = -32.9520 kN/m.

-. V_Edy = 94.1746 kN/m.

-. V_Edo = SQRT[ V_Edx^2 + V_Edy^2 ] = 99.7732 kN/m.

-. tan(Phio) = V_Edy/V_Edx = -2.8579

-. Rhol = Rhox*cos(Phio)^2 + Rhoy*sin(Phio)^2 = 0.0039

( ). Calculate the design shear resistance without shear reinforcement.

-. k = MIN[ 1.0+SQRT(200/d), 2.0 ] = 1.7614

-. C_Rdc = 0.18/Gamma_c = 0.1200

-. Sig_cp = MIN[ N_Ed/Ac, 0.2*fcd ] = 0.0000 KPa.

-. V_Rdc1 = [C_Rdc*k*(100*Rhol*fck)^(1/3) + 0.15*Sig_cp]*d = 168.4194 kN/m.

-. V_Rdc2 = [0.035*k^(3/2)*SQRT(fck) + 0.15*Sig_cp]*d = 159.6777 kN/m.

-. V_Rdc = MAX[ V_Rdc1, V_Rdc2 ] = 168.4194 kN/m.

-. RatV = V_Edo / V_Rdc = 0.5924 ---> O.K.

==================================================================================

[[[*]]] MESHED SHELL SHEAR MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT Y Rinf 14/10.

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[*] SHEAR SHEAR MAXIMUM RESULT

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( ). Information of Parameters.

-. Elem No. : 1570

-. Node No. : 1846

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Calculate the principal shear of the inner layer.

-. V_Edx = -0.7717 kN/m.

-. V_Edy = 160.0844 kN/m.

-. V_Edo = SQRT[ V_Edx^2 + V_Edy^2 ] = 160.0863 kN/m.

-. tan(Phio) = V_Edy/V_Edx = -207.4321

-. Rhol = Rhox*cos(Phio)^2 + Rhoy*sin(Phio)^2 = 0.0038

( ). Calculate the design shear resistance without shear reinforcement.

-. k = MIN[ 1.0+SQRT(200/d), 2.0 ] = 1.7614

-. C_Rdc = 0.18/Gamma_c = 0.1200

-. Sig_cp = MIN[ N_Ed/Ac, 0.2*fcd ] = 0.0000 KPa.

-. V_Rdc1 = [C_Rdc*k*(100*Rhol*fck)^(1/3) + 0.15*Sig_cp]*d = 168.4194 kN/m.

-. V_Rdc2 = [0.035*k^(3/2)*SQRT(fck) + 0.15*Sig_cp]*d = 159.6777 kN/m.

-. V_Rdc = MAX[ V_Rdc1, V_Rdc2 ] = 168.4194 kN/m.

-. RatV = V_Edo / V_Rdc = 0.9505 ---> O.K.

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[[[*]]] MESHED SHELL SHEAR MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT X RINF Vert.

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[*] SHEAR SHEAR MAXIMUM RESULT

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( ). Information of Parameters.

-. Elem No. : 72

-. Node No. : 158

-. LCB No. : 27

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Calculate the principal shear of the inner layer.

-. V_Edx = 1.0987 kN/m.

-. V_Edy = -180.2810 kN/m.

-. V_Edo = SQRT[ V_Edx^2 + V_Edy^2 ] = 180.2843 kN/m.

-. tan(Phio) = V_Edy/V_Edx = -164.0915

-. Rhol = Rhox*cos(Phio)^2 + Rhoy*sin(Phio)^2 = 0.0063

( ). Calculate the design shear resistance without shear reinforcement.

-. k = MIN[ 1.0+SQRT(200/d), 2.0 ] = 1.7614

-. C_Rdc = 0.18/Gamma_c = 0.1200

-. Sig_cp = MIN[ N_Ed/Ac, 0.2*fcd ] = 0.0000 KPa.

-. V_Rdc1 = [C_Rdc*k*(100*Rhol*fck)^(1/3) + 0.15*Sig_cp]*d = 198.9883 kN/m.

-. V_Rdc2 = [0.035*k^(3/2)*SQRT(fck) + 0.15*Sig_cp]*d = 159.6777 kN/m.

-. V_Rdc = MAX[ V_Rdc1, V_Rdc2 ] = 198.9883 kN/m.

-. RatV = V_Edo / V_Rdc = 0.9060 ---> O.K.

==========================================================================================

[[[*]]] MESHED SHELL SHEAR MAXIMUM RESULT DATA : DOMAIN Pareti Esterne-Pareti EXT Y Rinf 18/10.

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[*] SHEAR SHEAR MAXIMUM RESULT

-----------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 806

-. LCB No. : 29

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Calculate the principal shear of the inner layer.

-. V_Edx = 51.5305 kN/m.

-. V_Edy = 160.5642 kN/m.

-. V_Edo = SQRT[ V_Edx^2 + V_Edy^2 ] = 168.6305 kN/m.

-. tan(Phio) = V_Edy/V_Edx = 3.1159

-. Rhol = Rhox*cos(Phio)^2 + Rhoy*sin(Phio)^2 = 0.0061

( ). Calculate the design shear resistance without shear reinforcement.

-. k = MIN[ 1.0+SQRT(200/d), 2.0 ] = 1.7614

-. C_Rdc = 0.18/Gamma_c = 0.1200

-. Sig_cp = MIN[ N_Ed/Ac, 0.2*fcd ] = 0.0000 KPa.

-. V_Rdc1 = [C_Rdc*k*(100*Rhol*fck)^(1/3) + 0.15*Sig_cp]*d = 196.5202 kN/m.

-. V_Rdc2 = [0.035*k^(3/2)*SQRT(fck) + 0.15*Sig_cp]*d = 159.6777 kN/m.

-. V_Rdc = MAX[ V_Rdc1, V_Rdc2 ] = 196.5202 kN/m.

-. RatV = V_Edo / V_Rdc = 0.8581 ---> O.K.

## 2.6.5 Verifiche a pressoflessione Pareti sp.50 cm

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Interne-Pareti Interne Dissabbiatura.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1873

-. Node No. : 2161

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 112.7942 KPa.

-. Sig2 = Sig,min = -83.7671 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.2154

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------      + -------- - 1.0 = -0.9640
           fcm^2          fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx =  16.5523 kN/m.

-. NEdy =  -13.6062 kN/m.

-. NEdxy =  -7.6687 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -97.6936 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.005

---------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

---------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1873

-. Node No. : 2161

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

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( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 112.7942 KPa.

-. Sig2 = Sig,min = -83.7671 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.2154

-. beta = 4.6286

alpha*J2   lambda*SQRT[J2]   beta*I1

-. PHI = -------- + ---------------   + -------- - 1.0 = -0.9640

fcm^2   fcm   fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 16.5523 kN/m.

-. NEdy = -13.6062 kN/m.

-. NEdxy = -7.6687 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -97.6936 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.005

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1873

-. Node No. : 2161

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 112.7942 KPa.

-. Sig2 = Sig,min = -83.7671 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.2154

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 = -0.9640
           fcm^2          fcm             fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 16.5523 kN/m.

-. NEdy = -13.6062 kN/m.

-. NEdxy = -7.6687 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -97.6936 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.005

--------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1873

-. Node No. : 2161

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 112.7942 KPa.

-. Sig2 = Sig,min = -83.7671 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.2154

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9640

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx =     12.2522 kN/m.

-. NEdy =    -16.8550 kN/m.

-. NEdxy =     3.6045 kN/m.

( ). Check the minimum principal stress.

-. Sig,min   =    -83.7671 KPa.

-. fcd       =  21333.3333 KPa.

-. Rat,con   = Sig,min/fcd =    0.004

--------------------------------------------------------------------------------

[*]   SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 1873

-. Node No.  : 2161

-. LCB No.   :   43

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.5000 m.

-. Covering  :  dB  =      0.0600 m., dT  =      0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =    112.7942 KPa.

-. Sig2   = Sig,min =    -83.7671 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 13.2154

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9640

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 12.2522 kN/m.

-. NEdy = -16.8550 kN/m.

-. NEdxy = 3.6045 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -83.7671 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.004

---------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

---------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1873

-. Node No. : 2161

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 112.7942 KPa.

-. Sig2 = Sig,min = -83.7671 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.2154

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------      + -------- - 1.0 = -0.9640
           fcm^2         fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 12.2522 kN/m.

-. NEdy = -16.8550 kN/m.

-. NEdxy = 3.6045 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -83.7671 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.004

==================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Interne-Parete Interna GRI-DIS 50.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No.  : 2421

-. Node No.  : 2999

-. LCB No.   :   43

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.5000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =    286.5562 KPa.

-. Sig2   = Sig,min =   -264.8446 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 12.8038

-. beta   =  4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------            + -------- - 1.0 = -0.9090
          fcm^2          fcm            fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx  =     49.5854 kN/m.

-. NEdy  =    -65.5203 kN/m.

-. NEdxy =      3.9323 kN/m.

( ). Check the minimum principal stress.

-. Sig,min   =   -335.2218 KPa.

-. alpha = 0.2242(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 22407.7818 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.015

--------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2421

-. Node No. : 2999

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 286.5562 KPa.

-. Sig2 = Sig,min = -264.8446 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.8038

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9090

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 49.5854 kN/m.

-. NEdy = -65.5203 kN/m.

-. NEdxy = 3.9323 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -335.2218 KPa.

-. alpha = 0.2242(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 22407.7818 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.015

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2421

-. Node No. : 2999

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 286.5562 KPa.

-. Sig2 = Sig,min = -264.8446 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.8038

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9090

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 49.5854 kN/m.

-. NEdy = -65.5203 kN/m.

-. NEdxy = 3.9323 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -335.2218 KPa.

-. alpha = 0.2242(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 22407.7818 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.015

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2421

-. Node No. : 2999

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 286.5562 KPa.

-. Sig2 = Sig,min = -264.8446 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.8038

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 = -0.9090
           fcm^2         fcm            fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 2.5393 kN/m.

-. NEdy = -82.7265 kN/m.

-. NEdxy = -2.5942 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -264.8446 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.012

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2421

-. Node No. : 2999

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 286.5562 KPa.

-. Sig2 = Sig,min = -264.8446 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.8038

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9090

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 2.5393 kN/m.

-. NEdy = -82.7265 kN/m.

-. NEdxy = -2.5942 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -264.8446 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.012

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 2421

-. Node No. : 2999

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 286.5562 KPa.

-. Sig2 = Sig,min = -264.8446 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.8038

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 = -0.9090
            fcm^2         fcm              fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 2.5393 kN/m.

-. NEdy = -82.7265 kN/m.

-. NEdxy = -2.5942 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -264.8446 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.012

=====================================================================================

[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Interne-Pareti 50 RINF ORIZZ.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1644

-. Node No. : 1394

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 149.7684 KPa.

-. Sig2 = Sig,min = -31.7669 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3992

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9514

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 4.9198 kN/m.

-. NEdy = -10.2556 kN/m.

-. NEdxy = 2.5383 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -31.7669 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.001

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1644

-. Node No. : 1394

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 149.7684 KPa.

-. Sig2 = Sig,min = -31.7669 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3992

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------     + -------- - 1.0 = -0.9514
           fcm^2          fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 4.9198 kN/m.

-. NEdy = -10.2556 kN/m.

-. NEdxy = 2.5383 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -31.7669 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.001

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

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( ). Information of Parameters.

-. Elem No.  : 1644

-. Node No.  : 1394

-. LCB No.   :   43

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.5000 m.

-. Covering  :  dB  =      0.0500 m., dT  =      0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =    149.7684 KPa.

-. Sig2   = Sig,min =    -31.7669 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 14.3992

-. beta   =  4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI    = -------- + ---------------          + -------- - 1.0 = -0.9514
           fcm^2          fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx  =      4.9198 kN/m.

-. NEdy  =    -10.2556 kN/m.

-. NEdxy =      2.5383 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -31.7669 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.001

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 1760

-. Node No. : 1180

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3627.6675 KPa.

-. Sig2 = Sig,min = 404.0795 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5209

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.1985

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 395.6600 kN/m.

-. NEdy = 26.6108 kN/m.

-. NEdxy = 30.6299 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 4262.8994 KPa.

-. f'tdy = 587.4707 KPa.

-. Sigcd = 612.5982 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0022

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0011 m^2/m. ( 0.0011 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P18 @100

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0051

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 9939.1304 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4289

-. Rat,bary = f'tdy/ftdy = 0.1494

-. Rat,conc = Sigcd/Sigcn = 0.0574

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4289 ---> O.K.

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[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

-------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1758

-. Node No. : 1179

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3327.5561 KPa.

-. Sig2 = Sig,min = 556.9702 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4172

-. beta = 4.6286

```
           alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------    + -------- - 1.0 =  0.1001
            fcm^2          fcm              fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 356.4302 kN/m.

-. NEdy = 16.5030 kN/m.

-. NEdxy = 42.3910 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3988.2123 KPa.

-. f'tdy = 604.4387 KPa.

-. Sigcd = 847.8209 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0010

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0005 m^2/m. ( 0.0005 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P18 @100

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. Asy,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. rhox,use = 0.0051

-. rhoy,use = 0.0020

-. ftdx = rhox,use*fyd*(t/ck) = 9939.1304 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3932.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4013

-. Rat,bary = f'tdy/ftdy = 0.1537

-. Rat,conc = Sigcd/Sigcn = 0.0795

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4013 ---> O.K.

------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

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( ). Information of Parameters.

-. Elem No. : 1644

-. Node No. : 1394

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 149.7684 KPa.

-. Sig2 = Sig,min = -31.7669 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3992

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------      + -------- - 1.0 = -0.9514
           fcm^2          fcm            fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = -4.9467 kN/m.

-. NEdy = -1.3294 kN/m.

-. NEdxy = 1.6078 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -142.9047 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.007

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti Interne-Pareti 50 RINF RIPRESE.

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-1

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( ). Information of Parameters.

-. Elem No. : 1736

-. Node No. : 2034

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 240.9223 KPa.

-. Sig2 = Sig,min = -209.1160 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.9282

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------      + -------- - 1.0 = -0.9234
          fcm^2         fcm           fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 10.8888 kN/m.

-. NEdy = -30.4005 kN/m.

-. NEdxy = -34.7171 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -239.6864 KPa.

-. alpha = 0.1474(the ratio between the two principal stress)

```
                          1+3.80*alpha
-. Sig,cdmax = 0.85fcd * --------------  21487.9381 KPa.
                          (1+alpha)^2
```

-. Rat,con = Sig,min/Sig,cdmax = 0.011

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[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, REINFORCEMENT DIR-2

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( ). Information of Parameters.

-. Elem No.  : 1736

-. Node No.  : 2034

-. LCB No.   :   43

-. Materials :  fck =  32000.0000 KPa.,  fyk = 450000.0000 KPa.

-. Thickness :  t   =      0.5000 m.

-. Covering  :  dB  =      0.0600 m., dT  =      0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1   = Sig,max =    240.9223 KPa.

-. Sig2   = Sig,min =   -209.1160 KPa.

-. Sig3   =      0.0000 KPa. (2D Element)

-. fcm    =  40000.0000 KPa.

-. alpha  =  4.1292

-. lambda = 12.9282

-. beta   =  4.6286

alpha*J2   lambda*SQRT[J2]      beta*I1

-. PHI    = -------- + ---------------              + -------- - 1.0 = -0.9234

fcm^2          fcm           fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx  =     10.8888 kN/m.

-. NEdy  =    -30.4005 kN/m.

-. NEdxy =    -34.7171 kN/m.

( ). Check the minimum principal stress.

-. Sig,min   =   -239.6864 KPa.

-. alpha     =      0.1474(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 21487.9381 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.011

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : TOP, CONCRETE STRESS

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1736

-. Node No. : 2034

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 240.9223 KPa.

-. Sig2 = Sig,min = -209.1160 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.9282

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = -0.9234

fcm^2 fcm fcm

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 10.8888 kN/m.

-. NEdy = -30.4005 kN/m.

-. NEdxy = -34.7171 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -239.6864 KPa.

-. alpha = 0.1474(the ratio between the two principal stress)

1+3.80*alpha

-. Sig,cdmax = 0.85fcd * -------------- 21487.9381 KPa.

(1+alpha)^2

-. Rat,con = Sig,min/Sig,cdmax = 0.011

-----------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTTOM, REINFORCEMENT DIR-1

-----------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1666

-. Node No. : 1774

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 3074.5895 KPa.

-. Sig2 = Sig,min = 173.6892 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5780

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI  = -------- + ---------------  + -------- - 1.0 =  0.0130
           fcm^2         fcm            fcm
```

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 53.1506 kN/m.

-. NEdy = 251.8810 kN/m.

-. NEdxy = -84.1863 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1373.3691 KPa.

-. f'tdy = 3449.1118 KPa.

-. Sigcd = 1683.7268 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0018

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0051

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 9939.1304 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3492

-. Rat,bary = f'tdy/ftdy = 0.3470

-. Rat,conc = Sigcd/Sigcn = 0.1578

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.3492 ---> O.K.

--------------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, REINFORCEMENT DIR-2

--------------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1696

-. Node No. : 1830

-. LCB No. : 1

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0600 m., dT = 0.0600 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 4354.6888 KPa.

-. Sig2 = Sig,min = 826.5041 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3616

-. beta = 4.6286

alpha*J2 lambda*SQRT[J2] beta*I1

-. PHI = -------- + --------------- + -------- - 1.0 = 0.4437

fcm^2 fcm fcm

---> CRACKED. A SANDWICH MODEL SHOULD BE USED !!!

( ). Membrane forces.

-. NEdx = 79.4347 kN/m.

-. NEdy = 389.9701 kN/m.

-. NEdxy = -22.1395 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1015.7426 KPa.

-. f'tdy = 4229.5458 KPa.

-. Sigcd = 442.7904 KPa.

-. rhox,req = max[ f'tdx/fyd*(ck/t), rhox,min ] = 0.0020

-. rhoy,req = max[ f'tdy/fyd*(ck/t), rhoy,min ] = 0.0022

-. Asx,req = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,req = 0.0011 m^2/m. ( 0.0011 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0010 m^2/m. ( 0.0010 m^2/m.)

-. Asy,use = 0.0025 m^2/m. ( 0.0025 m^2/m.)

-. rhox,use = 0.0020

-. rhoy,use = 0.0051

-. ftdx = rhox,use*fyd*(t/ck) = 3932.6087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 9939.1304 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2583

-. Rat,bary = f'tdy/ftdy = 0.4255

-. Rat,conc = Sigcd/Sigcn = 0.0415

-. Rat = MAX[ Rat,barx, Rat,bary, Rat,conc ] = 0.4255 ---> O.K.

--------------------------------------------------------------------------------

[*] SHELL FLEXURAL MAXIMUM RESULT : BOTTOM, CONCRETE STRESS

--------------------------------------------------------------------------------

( ). Information of Parameters.

-. Elem No. : 1736

-. Node No. : 2034

-. LCB No. : 43

-. Materials : fck = 32000.0000 KPa., fyk = 450000.0000 KPa.

-. Thickness : t = 0.5000 m.

-. Covering : dB = 0.0500 m., dT = 0.0500 m.

( ). Check elements cracked or not.

[ EN1992-2:2005, Annex LL, (LL.101) ]

-. Sig1 = Sig,max = 240.9223 KPa.

-. Sig2 = Sig,min = -209.1160 KPa.

-. Sig3 = 0.0000 KPa. (2D Element)

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.9282

-. beta = 4.6286

```
          alpha*J2   lambda*SQRT[J2]      beta*I1
-. PHI   = -------- + ---------------  + -------- - 1.0 = -0.9234
           fcm^2          fcm              fcm
```

---> UNCRACKED. CHECK CONCRETE STRESS !!!

( ). Membrane forces.

-. NEdx = 1.2388 kN/m.

-. NEdy = -46.9726 kN/m.

-. NEdxy = -16.1816 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -209.1160 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.010

### 2.6.6 Verifiche a flessione Solette inclinate sp.40 cm

```
===============================================================================
  [[[*]]]  SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta Inclinata-Soletta inclinata, Dir 1.
===============================================================================
 --------------------------------------------------------------------
   Thk   Elem POS  AsReq  AsUse |    M_Ed( LCB)    M_Rd   Rat CHK
 --------------------------------------------------------------------
 0.4000   2302 BOT 0.0006 0.0010 | 39.0577(  27) 133.212 0.293  OK
          2318 TOP 0.0009 0.0010 | 105.747(  27) 133.212 0.794  OK
 --------------------------------------------------------------------


 << BOTTOM >>


 -. Information of Parameters.
   Elem No.  : 2302
   Thickness :    0.4000 m.
   Materials :  fck =  32000.0000 KPa.
               fcd =  21333.3333 KPa.
               fyk = 450000.0000 KPa.
   Covering  :  dB  =   0.0500 m.
               dT  =   0.0500 m.
   LCB No.   :   27


 -. Information of Design.
   b       =  0.0010 m.  (by Code Unit Length).
   d       =  0.3500 m.
   lambda  =  0.800
   a       = lambda * x  =   0.018 m.
   eta     =  1.000
   Cc      = eta*fcd*b*a =     0.3908 kN.
```

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0006 m^2/m. ( 0.0006 m^2/m.)

M_Ed = 39.0577 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.293 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.040

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.040/ 0.450 = 0.089 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 2318

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0500 m.

dT = 0.0500 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3500 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3908 kN.

M_Rd = Cc*(d-a/2) = 133.2116 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0009 m^2/m. ( 0.0009 m^2/m.)

M_Ed = 105.7465 kN-m./m.

M_Rd = 133.2116 kN-m./m.

RatM = M_Ed / M_Rd = 0.794 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.056

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.056/ 0.450 = 0.125 ---> O.K

================================================================================

[[[*]]] SLAB DESIGN MAXIMUM RESULT DATA : DOMAIN Soletta Inclinata-Soletta inclinata, Dir 2.

================================================================================

| Thk | Elem | POS | AsReq | AsUse | M_Ed( LCB) | M_Rd | Rat | CHK |
|---|---|---|---|---|---|---|---|---|
| 0.4000 | 2271 | BOT | 0.0007 | 0.0010 | 80.3371( 27) | 129.357 | 0.621 | OK |
| | 2259 | TOP | 0.0012 | 0.0020 | 142.956( 8) | 251.547 | 0.568 | OK |

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 2271

Thickness : 0.4000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0600 m.

dT = 0.0600 m.

LCB No. : 27

-. Information of Design.

b = 0.0010 m. (by Code Unit Length).

d = 0.3400 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3910 kN.

M_Rd = Cc*(d-a/2) = 129.3569 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P16 @200

As_req = 0.0007 m^2/m. ( 0.0007 m^2/m.)

M_Ed = 80.3371 kN-m./m.

M_Rd = 129.3569 kN-m./m.

RatM = M_Ed / M_Rd = 0.621 < 1.0 ---> O.K !

-. Check ratio of neutral axis depth to effective depth.

x/d = 0.045

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

x/d ratio = 0.045/ 0.450 = 0.101 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No.  : 2259

Thickness :    0.4000 m.

Materials :  fck =  32000.0000 KPa.

fcd =  21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering  :  dB  =   0.0600 m.

dT  =   0.0600 m.

LCB No.   :    8

-. Information of Design.

b       =  0.0010 m.  (by Code Unit Length).

d       =  0.3400 m.

lambda   =  0.800

a       = lambda * x  =   0.037 m.

eta      =   1.000

Cc       = eta*fcd*b*a =      0.7820 kN.

M_Rd     = Cc*(d-a/2)  =     251.5474  kN-m./m.

-. Information of Moments and Result.

Rein. Bar :  P16 @200 / P16 @200

As_req =       0.0012 m^2/m.  (       0.0012 m^2/m.)

M_Ed   =     142.9560  kN-m./m.

M_Rd   =     251.5474  kN-m./m.

RatM   = M_Ed / M_Rd =   0.568  <  1.0  --->  O.K !

-. Check ratio of neutral axis depth to effective depth.

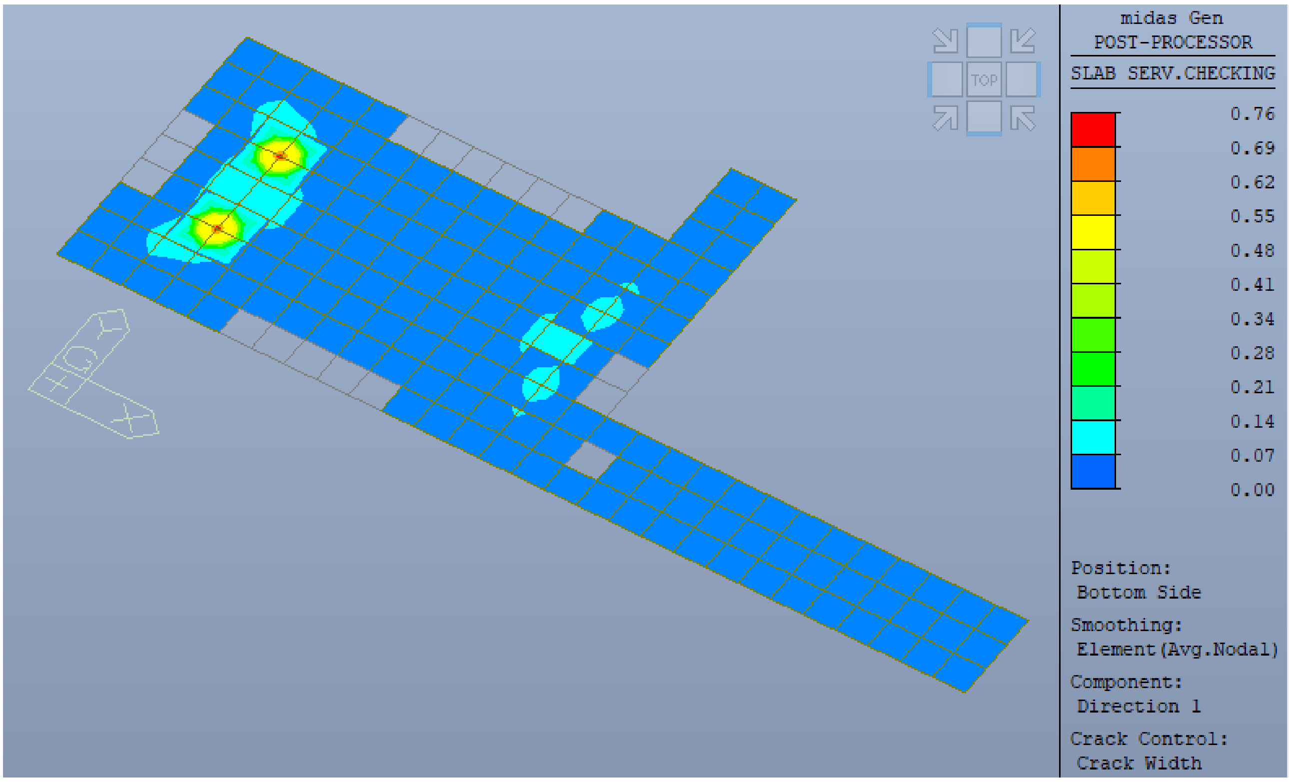
x/d       =    0.081

Limit(x/d) = 0.450 ( fck <= 50 MPa.)

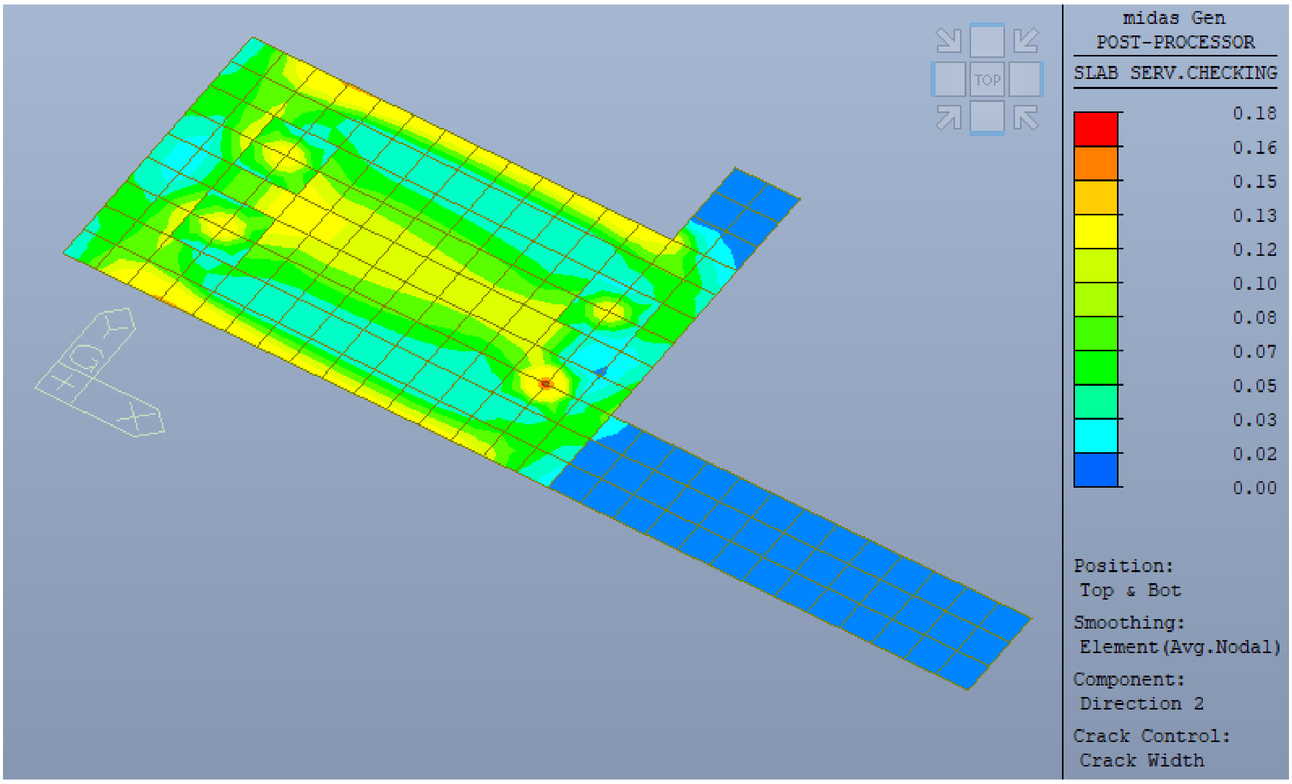
x/d ratio = 0.081/ 0.450 = 0.179 ---> O.K

## 2.7 Verifiche in condizioni di esercizio SLE

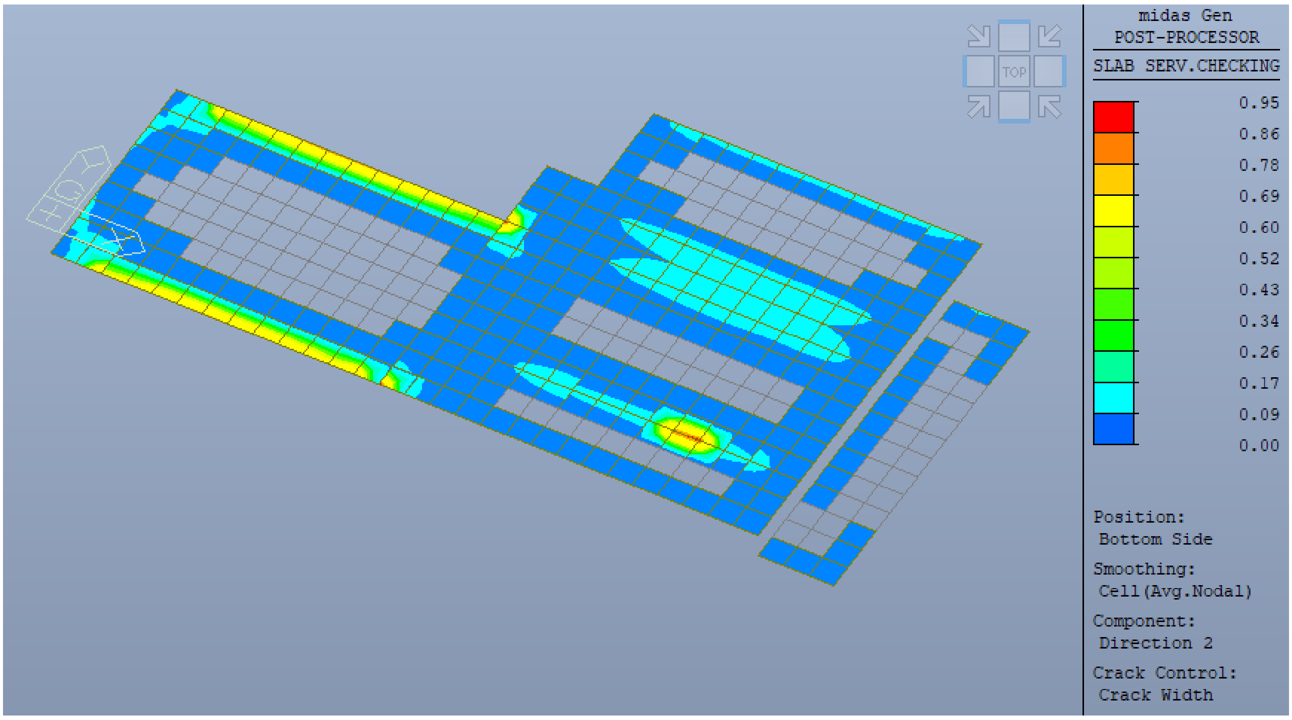
Vengono riportate di seguito le verifiche di fessurazione in forma grafica:



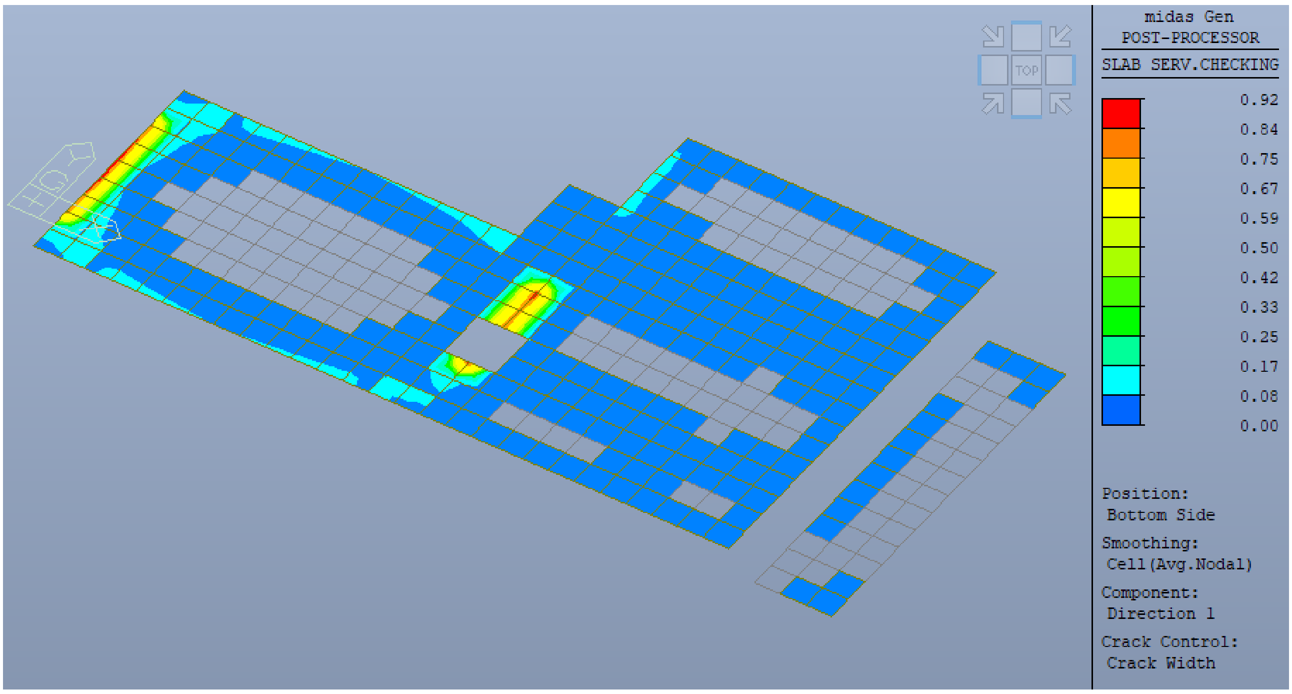

***Soletta sp.40 – Verifica a fessurazione SLE - ratio direzione X inferiore***



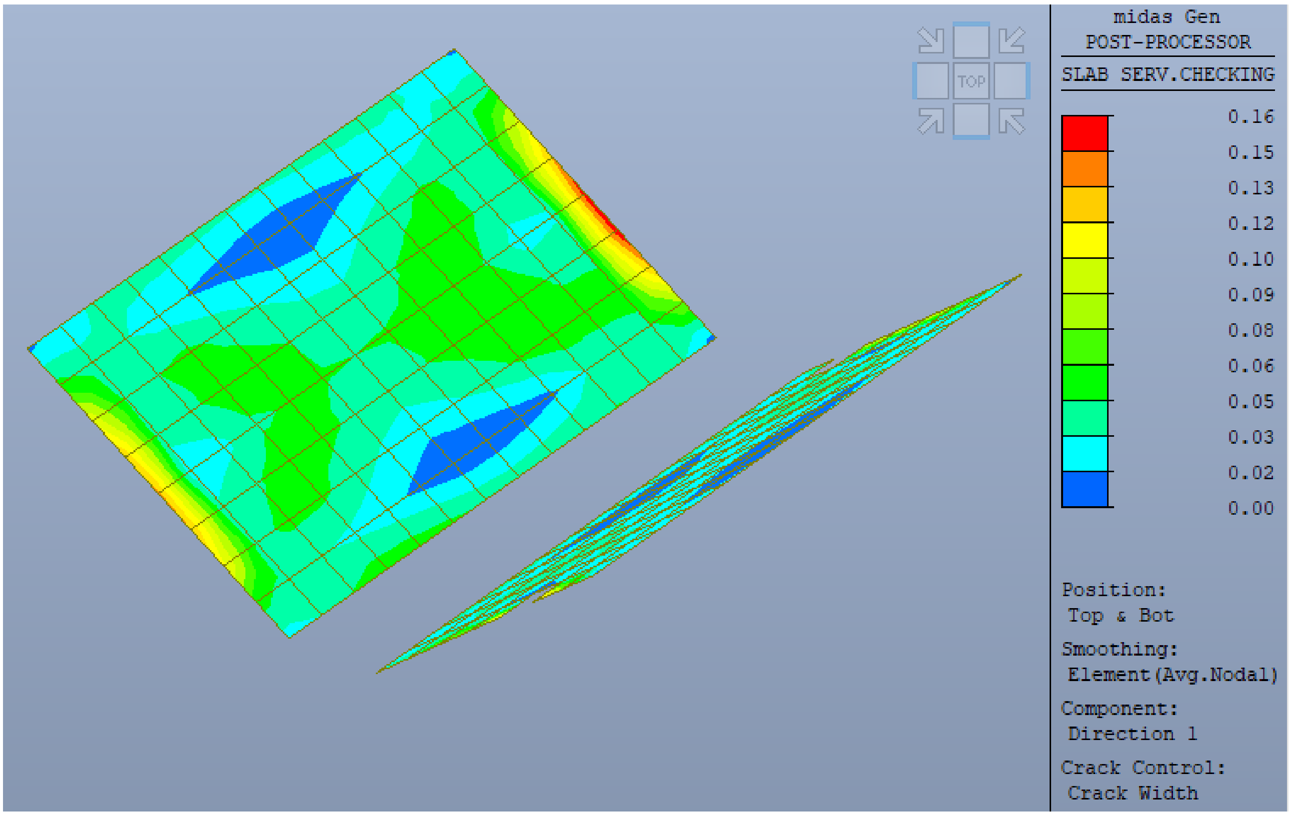
*Soletta sp.40 – Verifica a fessurazione SLE - ratio direzione Y ambo i lati*



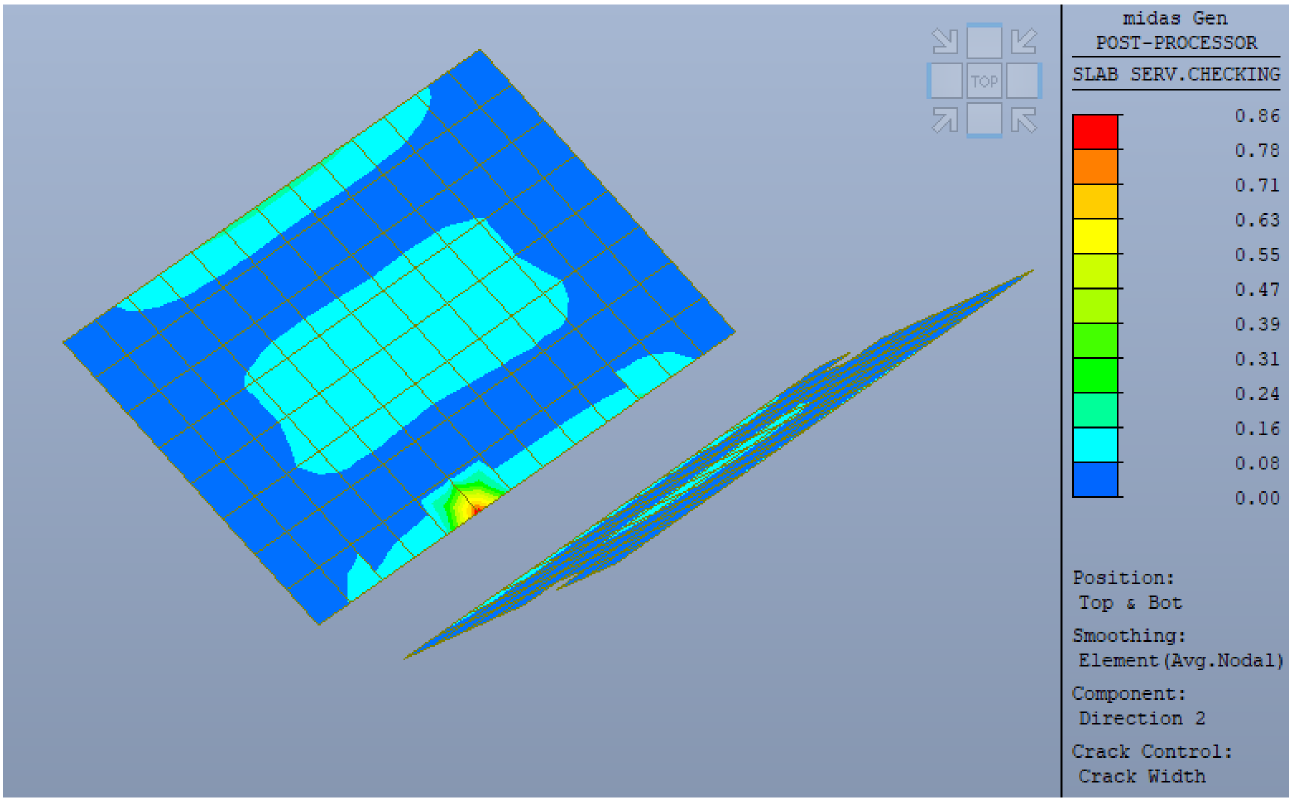

*Platee sp.50 – Verifica a fessurazione SLE - ratio direzione Y*




*Platee sp.50 – Verifica a fessurazione SLE - ratio direzione X*




*Solette inclinate sp.40 – Verifica a fessurazione SLE - ratio direzione orizzontale*




*Solette inclinate sp.40 – Verifica a fessurazione SLE - ratio direzione orizzontale*

**Stato limite di fessurazione**

**Stato limite di apertura delle fessure**
**Sezione rettangolare in C.A. ordinario**

**NTC 2018 - Eurocodice 2**

| | | | | |
|---|---|---|---|---|
| Classe CLS : | 40 | N/mm² | | cubica |
| | 32 | N/mm² | | cilindrica |
| $f_{ct,eff}$ = | 3,02 | N/mm² | | ( $f_{ct,eff} = f_{ctm}$ per verifiche a fessurazione ) |
| $E_{cm}$ = | 33346 | N/mm² | | |
| Larghezza sezione, b : | 1000 | mm | | |
| Altezza sezione, h : | 400 | mm | | |
| Armature tese : | 10 | Ø | 14 | |
| + | 0 | Ø | 0 | |
| Armature compresse : | 10 | Ø | 14 | |
| + | 0 | Ø | 0 | |
| $A_{s,teso}$ = | 1539,4 | mm² | | |
| $Ø_{eq}$ = | 14,0 | mm | | |
| $A_{s,comp.}$ = | 1539,4 | mm² | | |
| spaziatura armatura tesa = | 100 | mm | | ( media = 101 mm ) |
| spaziatura armature di riferimento = | 235,0 | mm | | ( 5·(c+Ø/2) ) |
| $E_s$ = | 210.000 | N/mm² | | |
| Copriferro, c : | 40 | mm | | |
| Interferro $A_{s,teso}$ : | 47 | mm | | Sezione presso-inflessa |
| Interferro $A_{s,comp.}$: | 47 | mm | | asse neutro x : 82,77 mm |
| Altezza utile, d : | 353 | mm | | $\sigma_{CLS\ sup}$ : -4,70 N/mm² |
| $M_d$ : | 95,00 | kNm | | $\sigma_{Acomp}$ : -30,5 N/mm² |
| $N_d$ : | 113,00 | kN | | $\sigma_{Ateso}$ : 230,4 N/mm² |
| $\sigma_s$ = | 230,4 | N/mm² | | $\sigma_{CLS\ inf}$ : trazione |

Calcolo ampiezza fessure : $\mathbf{W_d = S_{r,max} \cdot (\varepsilon_{sm} - \varepsilon_{cm})}$ *(Eurocodice 2-Circ. 2/2/2009 n. 617-C4.1.2.2*

$\varepsilon_{sm}-\varepsilon_{cm} = [\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} \cdot (1+\alpha_e \cdot \rho_{p,eff})\ ] / E_s \geq 0.6 \cdot \sigma_s/E_s$

| | | | |
|---|---|---|---|
| $k_t$ = | 0,4 | | ( $k_t$ = 0,6 per carichi breve durata, $k_t$ = 0,4 per carichi lunga durata ) |
| $\rho_{p,eff}$ = | $A_s/A_{c,eff}$ | | |
| $A_{c,eff}$ = | $b \cdot h_{c,ef}$ | mm² | ( $h_{c,ef}$ = minore di $h_{c,ef1}$ / $h_{c,ef2}$ / $h_{c,ef3}$ ) |
| $h_{c,ef}$ = | 93,3 | mm | $h_{c,ef1}$ = 2,5·(h-d) = 117,5 mm |
| $A_{c,eff}$ = | 93333,333 | mm² | $h_{c,ef2}$ = (h-x)/3 = 93,3 mm ( x=0,3·h ) |
| $\rho_{p,eff}$ = | 1,65 | % | $h_{c,ef3}$ = h/2 = 200,0 mm |
| $\alpha_e$ = | 6,30 | | ( $\alpha_e = E_S/E_{cm}$ ) |
| $[\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} \cdot (1+\alpha_e \cdot \rho_{p,eff})\ ]/E_s$ = | 0,71147 | ‰ | |
| $0.6 \cdot \sigma_s/E_s$ = | 0,65817 | ‰ | |
| $\varepsilon_{sm}-\varepsilon_{cm}$ = | 0,71147 | ‰ | |

spaziatura armatura < spaziatura di riferimento

$S_{r,max} = k_3 \cdot c + k_1 \cdot k_2 \cdot k_4 \cdot Ø/\rho_{p,eff}$

| | | | |
|---|---|---|---|
| $k_1$ = | 0,80 | | ( $k_1$ = 0,8 barre ader. migliorata/1,6 barre lisci |
| $k_2$ = | 0,50 | | ( $k_2$ = 0,5 flessione pura, $k_2$ = 1 trazione pura |
| $k_3$ = | 3,40 | | ( fissato da normativa nazionale ) |
| $k_4$ = | 0,425 | | ( fissato da normativa nazionale ) |
| $S_{r,max}$ = | 280,3 | mm | |

**Calcolo fessura di calcolo $W_d$ = 0,20 mm** ( $w_1$ = 0,2 mm - $w_2$ = 0,3 mm - $w_3$ = 0,4 mm )

***Verifica a fessurazione parete dissabbiatura – apertura fessure direzione orizzontale angolo***

**Stato limite di fessurazione**
**Stato limite di apertura delle fessure**
**Sezione rettangolare in C.A. ordinario**

**NTC 2018 - Eurocodice 2**

| | | | |
|---|---|---|---|
| Classe CLS : | 40 | N/mm² | cubica |
| | 32 | N/mm² | cilindrica |
| $f_{ct,eff}$ = | 3,02 | N/mm² | ( $f_{ct,eff} = f_{ctm}$ per verifiche a fessurazione ) |
| $E_{cm}$ = | 33346 | N/mm² | |
| Larghezza sezione, b : | 1000 | mm | |
| Altezza sezione, h : | 400 | mm | |
| Armature tese : | 10 | Ø 18 | |
| + | 0 | Ø 0 | |
| Armature compresse : | 10 | Ø 18 | |
| + | 0 | Ø 0 | |
| $A_{s,teso}$ = | 2544,7 | mm² | |
| $Ø_{eq}$ = | 18,0 | mm | |
| $A_{s,comp.}$ = | 2544,7 | mm² | |
| spaziatura armatura tesa = | 100 | mm | ( media = 100 mm ) |
| spaziatura armature di riferimento = | 245,0 | mm | ( 5·(c+Ø/2) ) |
| $E_s$ = | 210.000 | N/mm² | |
| Copriferro, c : | 40 | mm | |
| Interferro $A_{s,teso}$ : | 49 | mm | Sezione presso-inflessa |
| Interferro $A_{s,comp.}$: | 49 | mm | asse neutro x : 132,34 mm |
| Altezza utile, d : | 351 | mm | $\sigma_{CLS\ sup}$ : -8,44 N/mm² |
| $M_d$ : | 198,00 | kNm | $\sigma_{Acomp}$ : -79,7 N/mm² |
| $N_d$ : | -229,00 | kN | $\sigma_{Ateso}$ : 209,1 N/mm² |
| $\sigma_s$ = | 209,1 | N/mm² | $\sigma_{CLS\ inf}$ : trazione |

Calcolo ampiezza fessure : $\mathbf{W_d = S_{r,max} \cdot (\varepsilon_{sm} - \varepsilon_{cm})}$ *(Eurocodice 2-Circ. 2/2/2009 n. 617-C4.1.2.2*

$\varepsilon_{sm}-\varepsilon_{cm} = [\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} (1+\alpha_e \cdot \rho_{p,eff})\ ] / E_s \geq 0.6 \cdot \sigma_s / E_s$

| | | | |
|---|---|---|---|
| $k_t$ = | 0,4 | | ( $k_t$ = 0,6 per carichi breve durata, $k_t$ = 0,4 per carichi lunga durata ) |
| $\rho_{p,eff}$ = | $A_s/A_{c,eff}$ | | |
| $A_{c,eff}$ = | $b \cdot h_{c,ef}$ | mm² | ( $h_{c,ef}$ = minore di $h_{c,ef1}$ / $h_{c,ef2}$ / $h_{c,ef3}$ ) |
| $h_{c,ef}$ = | 93,3 | mm | $h_{c,ef1}$ = 2,5·(h-d) = 122,5 mm |
| $A_{c,eff}$ = | 93333,333 | mm² | $h_{c,ef2}$ = (h-x)/3 = 93,3 mm ( x=0,3·h ) |
| $\rho_{p,eff}$ = | 2,73 | % | $h_{c,ef3}$ = h/2 = 200,0 mm |
| $\alpha_e$ = | 6,30 | | ( $\alpha_e = E_S/E_{cm}$ ) |
| $[\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} (1+\alpha_e \cdot \rho_{p,eff})\ ]/E_s$ = | 0,74819 | ‰ | |
| $0.6 \cdot \sigma_s/E_s$ = | 0,59743 | ‰ | |
| $\varepsilon_{sm}-\varepsilon_{cm}$ = | 0,74819 | ‰ | |

spaziatura armatura < spaziatura di riferimento
$S_{r,max} = k_3 \cdot c + k_1 \cdot k_2 \cdot k_4 \cdot Ø/\rho_{p,eff}$

| | | | |
|---|---|---|---|
| $k_1$ = | 0,80 | | ( $k_1$ = 0,8 barre ader. migliorata/1,6 barre lisci |
| $k_2$ = | 0,50 | | ( $k_2$ = 0,5 flessione pura, $k_2$ = 1 trazione pura |
| $k_3$ = | 3,40 | | ( fissato da normativa nazionale ) |
| $k_4$ = | 0,425 | | ( fissato da normativa nazionale ) |
| $S_{r,max}$ = | 248,2 | mm | |

**Calcolo fessura di calcolo $W_d$ = 0,19 mm** ( $w_1$ = 0,2 mm - $w_2$ = 0,3 mm - $w_3$ = 0,4 mm )

***Verifica a fessurazione parete grigliatura fine – apertura fessure direzione verticale alla base***

**Stato limite di fessurazione**

**Stato limite di apertura delle fessure**

**Sezione rettangolare in C.A. ordinario**

**NTC 2018 - Eurocodice 2**

| | | | | |
|---|---|---|---|---|
| Classe CLS : | 40 | N/mm² | | cubica |
| | 32 | N/mm² | | cilindrica |
| $f_{ct,eff}$ = | 3,02 | N/mm² | | ( $f_{ct,eff} = f_{ctm}$ per verifiche a fessurazione ) |
| $E_{cm}$ = | 33346 | N/mm² | | |
| Larghezza sezione, b : | 1000 | mm | | |
| Altezza sezione, h : | 500 | mm | | |
| Armature tese : | 10 | Ø | 18 | |
| + | 0 | Ø | 0 | |
| Armature compresse : | 10 | Ø | 18 | |
| + | 0 | Ø | 0 | |
| $A_{s,teso}$ = | 2544,7 | mm² | | |
| $Ø_{eq}$ = | 18,0 | mm | | |
| $A_{s,comp.}$ = | 2544,7 | mm² | | |
| spaziatura armatura tesa = | 100 | mm | | ( media = 100 mm ) |
| spaziatura armature di riferimento = | 245,0 | mm | | ( 5·(c+Ø/2) ) |
| $E_s$ = | 210.000 | N/mm² | | |
| Copriferro, c : | 40 | mm | | |
| Interferro $A_{s,teso}$ : | 49 | mm | | Sezione interamente tesa |
| Interferro $A_{s,comp.}$: | 49 | mm | | asse neutro x : esterno sup. |
| Altezza utile, d : | 451 | mm | | $\sigma_{CLS\ sup}$ : trazione |
| $M_d$ : | 7,60 | kNm | | $\sigma_{Acomp}$ : 6,1 N/mm² |
| $N_d$ : | 68,70 | kN | | $\sigma_{Ateso}$ : 20,9 N/mm² |
| $\sigma_s$ = | 20,9 | N/mm² | | $\sigma_{CLS\ inf}$ : trazione |

Calcolo ampiezza fessure : $\mathbf{W_d = S_{r,max} \cdot (\varepsilon_{sm} - \varepsilon_{cm})}$ *(Eurocodice 2-Circ. 2/2/2009 n. 617-C4.1.2.2*

$\varepsilon_{sm}-\varepsilon_{cm} = [\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} \cdot (1+\alpha_e \cdot \rho_{p,eff})\ ] / E_s \geq 0.6 \cdot \sigma_s/E_s$

| | | | |
|---|---|---|---|
| $k_t$ = | 0,4 | | ( $k_t$ = 0,6 per carichi breve durata, $k_t$ = 0,4 per carichi lunga durata ) |
| $\rho_{p,eff}$ = | $A_s/A_{c,eff}$ | | |
| $A_{c,eff}$ = | $b \cdot h_{c,ef}$ | mm² | ( $h_{c,ef}$ = minore di $h_{c,ef1}$ / $h_{c,ef2}$ / $h_{c,ef3}$ ) |
| $h_{c,ef}$ = | 116,7 | mm | $h_{c,ef1}$ = 2,5·(h-d) = 122,5 mm |
| $A_{c,eff}$ = | 116666,67 | mm² | $h_{c,ef2}$ = (h-x)/3 = 116,7 mm ( x=0,3·h ) |
| $\rho_{p,eff}$ = | 2,18 | % | $h_{c,ef3}$ = h/2 = 250,0 mm |
| $\alpha_e$ = | 6,30 | | ( $\alpha_e = E_S/E_{cm}$ ) |
| $[\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} \cdot (1+\alpha_e \cdot \rho_{p,eff})\ ]/E_s$ = | -0,20068 | ‰ | |
| $0.6 \cdot \sigma_s/E_s$ = | 0,05979 | ‰ | |
| $\varepsilon_{sm}-\varepsilon_{cm}$ = | 0,05979 | ‰ | |

spaziatura armatura < spaziatura di riferimento

$S_{r,max} = k_3 \cdot c + k_1 \cdot k_2 \cdot k_4 \cdot Ø/\rho_{p,eff}$

| | | | |
|---|---|---|---|
| $k_1$ = | 0,80 | | ( $k_1$ = 0,8 barre ader. migliorata/1,6 barre lisci |
| $k_2$ = | 0,59 | | ( $k_2$ = 0,5 flessione pura, $k_2$ = 1 trazione pura |
| $k_3$ = | 3,40 | | ( fissato da normativa nazionale ) |
| $k_4$ = | 0,425 | | ( fissato da normativa nazionale ) |
| $S_{r,max}$ = | 302,6 | mm | |

**Calcolo fessura di calcolo $W_d$ = 0,02 mm** ( $w_1$ = 0,2 mm - $w_2$ = 0,3 mm - $w_3$ = 0,4 mm )

***Verifica a fessurazione parete dissabbiatura – apertura fessure direzione orizzontale angolo***

**Stato limite di fessurazione**

**Stato limite di apertura delle fessure** — **NTC 2018 - Eurocodice 2**

**Sezione rettangolare in C.A. ordinario**

| | | | | |
|---|---|---|---|---|
| Classe CLS : | 40 | N/mm² | | cubica |
| | 32 | N/mm² | | cilindrica |
| $f_{ct,eff}$ = | 3,02 | N/mm² | | ( $f_{ct,eff} = f_{ctm}$ per verifiche a fessurazione ) |
| $E_{cm}$ = | 33346 | N/mm² | | |
| Larghezza sezione, b : | 1000 | mm | | |
| Altezza sezione, h : | 500 | mm | | |
| Armature tese : | 5 | Ø | 16 | |
| + | 0 | Ø | 0 | |
| Armature compresse : | 5 | Ø | 16 | |
| + | 0 | Ø | 0 | |
| $A_{s,teso}$ = | 1005,3 | mm² | | |
| $Ø_{eq}$ = | 16,0 | mm | | |
| $A_{s,comp.}$ = | 1005,3 | mm² | | |
| spaziatura armatura tesa = | 200 | mm | | ( media = 226 mm ) |
| spaziatura armature di riferimento = | 240,0 | mm | | ( 5·(c+Ø/2) ) |
| $E_s$ = | 210.000 | N/mm² | | |
| Copriferro, c : | 40 | mm | | |
| Interferro $A_{s,teso}$ : | 48 | mm | | Sezione presso-inflessa |
| Interferro $A_{s,comp.}$: | 48 | mm | | asse neutro x : 17,43 mm |
| Altezza utile, d : | 452 | mm | | $\sigma_{CLS\ sup}$ : -0,19 N/mm² |
| $M_d$ : | 13,80 | kNm | | $\sigma_{Acomp}$ : 5,0 N/mm² |
| $N_d$ : | 74,70 | kN | | $\sigma_{Ateso}$ : 71,0 N/mm² |
| $\sigma_s$ = | 71,0 | N/mm² | | $\sigma_{CLS\ inf}$ : trazione |

Calcolo ampiezza fessure : $\mathbf{W_d = S_{r,max} \cdot (\varepsilon_{sm} - \varepsilon_{cm})}$ *(Eurocodice 2-Circ. 2/2/2009 n. 617-C4.1.2.2*

$\varepsilon_{sm}-\varepsilon_{cm} = [\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} \cdot (1+\alpha_e \cdot \rho_{p,eff})\ ] / E_s \geq 0.6 \cdot \sigma_s/E_s$

| | | | |
|---|---|---|---|
| $k_t$ = | 0,4 | | ( $k_t$ = 0,6 per carichi breve durata, $k_t$ = 0,4 per carichi lunga durata ) |
| $\rho_{p,eff}$ = | $A_s/A_{c,eff}$ | | |
| $A_{c,eff}$ = | $b \cdot h_{c,ef}$ | mm² | ( $h_{c,ef}$ = minore di $h_{c,ef1}$ / $h_{c,ef2}$ / $h_{c,ef3}$ ) |
| $h_{c,ef}$ = | 116,7 | mm | $h_{c,ef1}$ = 2,5·(h-d) = 120,0 mm |
| $A_{c,eff}$ = | 116666,67 | mm² | $h_{c,ef2}$ = (h-x)/3 = 116,7 mm ( x=0,3·h ) |
| $\rho_{p,eff}$ = | 0,86 | % | $h_{c,ef3}$ = h/2 = 250,0 mm |
| $\alpha_e$ = | 6,30 | | ( $\alpha_e = E_s/E_{cm}$ ) |
| $[\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} \cdot (1+\alpha_e \cdot \rho_{p,eff})\ ]/E_s$ = | -0,36678 | ‰ | |
| $0.6 \cdot \sigma_s/E_s$ = | 0,20274 | ‰ | |
| $\varepsilon_{sm}-\varepsilon_{cm}$ = | 0,20274 | ‰ | |

spaziatura armatura < spaziatura di riferimento

$S_{r,max} = k_3 \cdot c + k_1 \cdot k_2 \cdot k_4 \cdot Ø/\rho_{p,eff}$

| | | | |
|---|---|---|---|
| $k_1$ = | 0,80 | | ( $k_1$ = 0,8 barre ader. migliorata/1,6 barre lisc |
| $k_2$ = | 0,50 | | ( $k_2$ = 0,5 flessione pura, $k_2$ = 1 trazione pura |
| $k_3$ = | 3,40 | | ( fissato da normativa nazionale ) |
| $k_4$ = | 0,425 | | ( fissato da normativa nazionale ) |
| $S_{r,max}$ = | 451,7 | mm | |

**Calcolo fessura di calcolo $W_d$ = 0,09 mm** ( $w_1$ = 0,2 mm - $w_2$ = 0,3 mm - $w_3$ = 0,4 mm )

***Verifica a fessurazione parete dissabbiatura – apertura fessure direzione orizzontale al centro***

**Stato limite di fessurazione**

**Stato limite di apertura delle fessure**
**Sezione rettangolare in C.A. ordinario**

**NTC 2018 - Eurocodice 2**

| | | | |
|---|---|---|---|
| Classe CLS : | 40 | $N/mm^2$ | cubica |
| | 32 | $N/mm^2$ | cilindrica |
| $f_{ct,eff}$ = | 3,02 | $N/mm^2$ | ( $f_{ct,eff} = f_{ctm}$ per verifiche a fessurazione ) |
| $E_{cm}$ = | 33346 | $N/mm^2$ | |
| Larghezza sezione, b : | 1000 | mm | |
| Altezza sezione, h : | 500 | mm | |
| Armature tese : | 5 | Ø 16 | |
| + | 0 | Ø 0 | |
| Armature compresse : | 5 | Ø 16 | |
| + | 0 | Ø 0 | |
| $A_{s,teso}$ = | 1005,3 | $mm^2$ | |
| $Ø_{eq}$ = | 16,0 | mm | |
| $A_{s,comp.}$ = | 1005,3 | $mm^2$ | |
| spaziatura armatura tesa = | 200 | mm | ( media = 226 mm ) |
| spaziatura armature di riferimento = | 240,0 | mm | ( 5·(c+Ø/2) ) |
| $E_s$ = | 210.000 | $N/mm^2$ | |
| Copriferro, c : | 40 | mm | |
| Interferro $A_{s,teso}$ : | 48 | mm | Sezione presso-inflessa |
| Interferro $A_{s,comp.}$: | 48 | mm | asse neutro x : 146,84 mm |
| Altezza utile, d : | 452 | mm | $\sigma_{CLS\ sup}$ : -4,00 N/mm² |
| $M_d$ : | 92,60 | kNm | $\sigma_{Acomp}$ : -40,4 N/mm² |
| $N_d$ : | -209,00 | kN | $\sigma_{Ateso}$ : 124,7 N/mm² |
| $\sigma_s$ = | 124,7 | $N/mm^2$ | $\sigma_{CLS\ inf}$ : trazione |

Calcolo ampiezza fessure : $\mathbf{W_d = S_{r,max} \cdot (\varepsilon_{sm} - \varepsilon_{cm})}$ *(Eurocodice 2-Circ. 2/2/2009 n. 617-C4.1.2.2*

$$\varepsilon_{sm}-\varepsilon_{cm} = [\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} \cdot (1+\alpha_e \cdot \rho_{p,eff})\ ] / E_s \geq 0.6 \cdot \sigma_s/E_s$$

| | | | |
|---|---|---|---|
| $k_t$ = | 0,4 | | ( $k_t$ = 0,6 per carichi breve durata, $k_t$ = 0,4 per carichi lunga durata ) |
| $\rho_{p,eff}$ = | $A_s/A_{c,eff}$ | | |
| $A_{c,eff}$ = | $b \cdot h_{c,ef}$ | $mm^2$ | ( $h_{c,ef}$ = minore di $h_{c,ef1}$ / $h_{c,ef2}$ / $h_{c,ef3}$ ) |
| $h_{c,ef}$ = | 116,7 | mm | $h_{c,ef1}$ = 2,5·(h-d) = 120,0 mm |
| $A_{c,eff}$ = | 116666,67 | $mm^2$ | $h_{c,ef2}$ = (h-x)/3 = 116,7 mm ( x=0,3·h ) |
| $\rho_{p,eff}$ = | 0,86 | % | $h_{c,ef3}$ = h/2 = 250,0 mm |
| $\alpha_e$ = | 6,30 | | ( $\alpha_e = E_S/E_{cm}$ ) |
| $[\ \sigma_s - k_t \cdot f_{ct,eff}/\rho_{p,eff} \cdot (1+\alpha_e \cdot \rho_{p,eff})\ ]/E_s$ = | -0,11071 | ‰ | |
| $0.6 \cdot \sigma_s/E_s$ = | 0,35638 | ‰ | |
| $\varepsilon_{sm}-\varepsilon_{cm}$ = | 0,35638 | ‰ | |

spaziatura armatura < spaziatura di riferimento

$$S_{r,max} = k_3 \cdot c + k_1 \cdot k_2 \cdot k_4 \cdot Ø/\rho_{p,eff}$$

| | | | |
|---|---|---|---|
| $k_1$ = | 0,80 | | ( $k_1$ = 0,8 barre ader. migliorata/1,6 barre lisci |
| $k_2$ = | 0,50 | | ( $k_2$ = 0,5 flessione pura, $k_2$ = 1 trazione pura |
| $k_3$ = | 3,40 | | ( fissato da normativa nazionale ) |
| $k_4$ = | 0,425 | | ( fissato da normativa nazionale ) |
| $S_{r,max}$ = | 451,7 | mm | |

**Calcolo fessura di calcolo $W_d$ = 0,16 mm** ( $w_1$ = 0,2 mm - $w_2$ = 0,3 mm - $w_3$ = 0,4 mm )

***Verifica a fessurazione parete dissabbiatura – apertura fessure direzione verticale alla base***