MANDATARIA:

ISOLA BOASSO
STUDIO DI INGEGNERIA

STUDIO D' INGEGNERIA ASSOCIATO
ISOLA-BOASSO & ASSOCIATI S.r.l.

MANDANTI:

ETATEC STUDIO PAOLETTI

ETATEC STUDIO PAOLETTI

C. & S. DI GIUSEPPE INGEGNERI
ASSOCIATI SRL Socio Unico

CIG: 896704821A

Vs. Rif. arch.:

Ente destinatario:

-

ACQUA NOVARA.VCO S.p.A.

Via Triggiani, 9 - 28100 NOVARA (NO)
Tel. 0321/413111 - Fax. 0321/413196

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 E

Rev.	AGGIORNAMENTI	DATA

OGGETTO

FASCICOLO DEI CALCOLI – MANUFATTO BIOLOGICO

Il Responsabile
Dott. Ing. Riccardo ISOLA

Visto

* Riservato all'Amministrazione

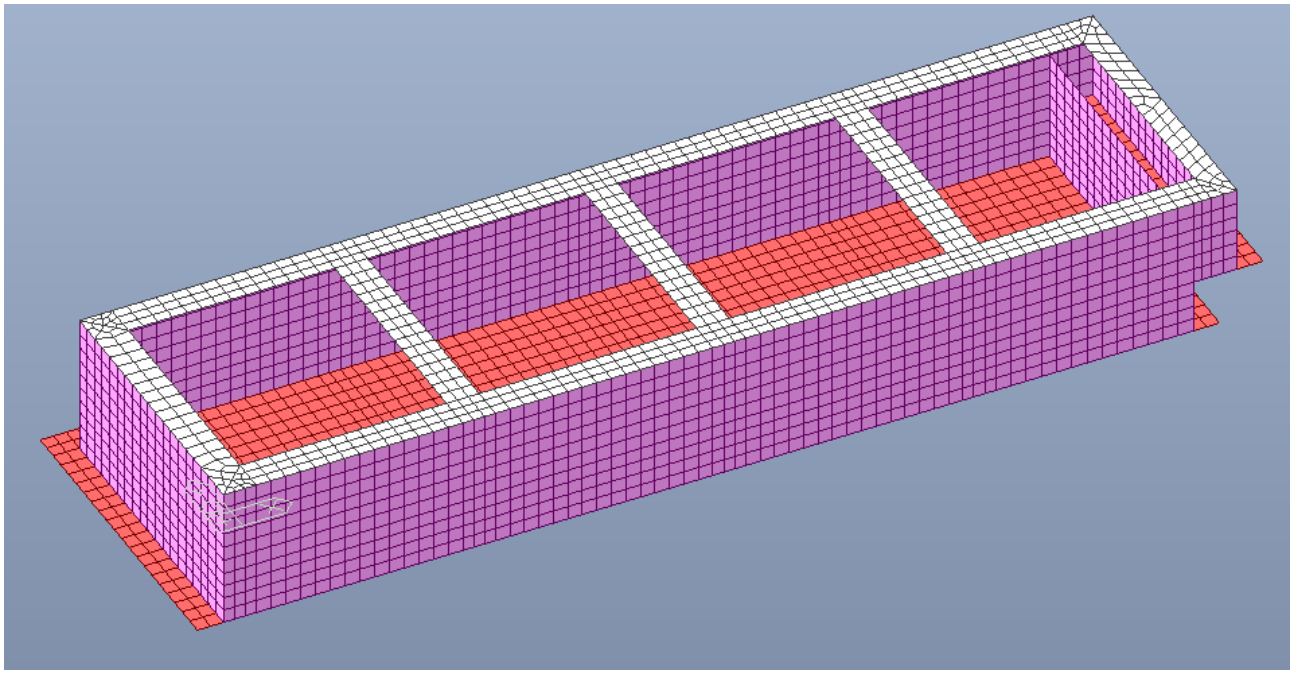
Sommario

1 Fascicolo dei calcoli Manufatto biologico

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 le pareti.
In particolare, gli spessori adottati per gli elementi plate sono i seguenti:

- Platee di fondazione, principale e secondaria sp.70 cm;
- Pareti esterne e parete di sfioro sp.60 cm;
- Camminamento e puntoni superiori sp.40 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 6300 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)	Dead Load
2	SST1	Dead Load (D)	Spinta Statica Terreno 1
3	SST2	Dead Load (D)	Spinta Statica Terreno 2
4	SSTF1	Dead Load (D)	Spinta Statica terreno con Falda 1
5	SSTF2	Dead Load (D)	Spinta Statica terreno con Falda 2
6	SGAL	Dead Load (D)	SottoSpinta Galleggiamento
7	VM	Live Load (L)	Variabile manutenzione
8	PT	Dead Load (D)	Permanente Terreno
9	PP	Dead Load (D)	Permanente Piping
10	SSS	Live Load (L)	Spinta Statica Sovraccarico
11	SSL	Dead Load (D)	Spinta Statica Liquame
12	ET X	Earthquake (E)	Sovraspinta Sisimica Terreno X
13	ET Y1	Earthquake (E)	Sovraspinta Sisimica Terreno Y1
14	ET Y2	Earthquake (E)	Sovraspinta Sisimica Terreno Y2
15	EL X	Earthquake (E)	Sovraspinta Sisimica Liquame X
16	EL Y	Earthquake (E)	Sovraspinta Sisimica Liquame Y

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

Name	Active	Type	DL(ST)	SST1(ST)	SST2(ST)	SSTF1(ST)	SSTF2(ST)	SGAL(ST)	VM(ST)	PT(ST)	PP(ST)	SSS(ST)	SSL(ST)
SLU 1	Active	Add	1.3000	1.3000					1.5000	1.3000	1.3000	1.0500	1.3000
SLU 2	Active	Add	1.3000		1.3000				1.5000	1.3000	1.3000	1.0500	1.3000
SLU 3	Active	Add	1.3000	1.3000					0.4500	1.3000	1.3000	1.5000	1.3000
SLU 4	Active	Add	1.3000		1.3000				0.4500	1.3000	1.3000	1.5000	1.3000
SLU 5	Active	Add	1.3000			1.3000			1.5000	1.3000	1.3000	1.0500	1.3000
SLU 6	Active	Add	1.3000				1.3000		1.5000	1.3000	1.3000	1.0500	1.3000
SLU 7	Active	Add	1.3000			1.3000			0.4500	1.3000	1.3000	1.5000	1.3000
SLU 8	Active	Add	1.3000				1.3000		0.4500	1.3000	1.3000	1.5000	1.3000
SLU 9	Active	Add	1.3000	1.3000					1.5000	1.3000	1.3000	1.0500	
SLU 10	Active	Add	1.3000		1.3000				1.5000	1.3000	1.3000	1.0500	
SLU 11	Active	Add	1.3000	1.3000					0.4500	1.3000	1.3000	1.5000	
SLU 12	Active	Add	1.3000		1.3000				0.4500	1.3000	1.3000	1.5000	
SLU 13	Active	Add	1.3000			1.3000			1.5000	1.3000	1.3000	1.0500	
SLU 14	Active	Add	1.3000				1.3000		1.5000	1.3000	1.3000	1.0500	
SLU 15	Active	Add	1.3000			1.3000			0.4500	1.3000	1.3000	1.5000	
SLU 16	Active	Add	1.3000				1.3000		0.4500	1.3000	1.3000	1.5000	
SLU 17	Active	Add	1.3000			1.3000		1.3000	1.0000	1.3000	1.0000		
SLU 18	Active	Add	1.3000				1.3000	1.3000	1.0000	1.3000	1.0000		
SLU 19	Active	Add	1.3000	1.3000									

Name	Active	Type	DL(ST)	SST1(ST)	SST2(ST)	SSTF1(ST)	SSTF2(ST)	SGAL(ST)	VM(ST)	PT(ST)	PP(ST)	SSS(ST)	SSL(ST)	ET X(ST)	ET Y1(ST)	ET Y2(ST)	EL X(ST)	EL Y(ST)
SLV 1	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	1.0000	0.3000			
SLV 2	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	1.0000	-0.3000			
SLV 3	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	0.3000	1.0000			
SLV 4	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-0.3000	1.0000			
SLV 5	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-1.0000	-0.3000			
SLV 6	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-1.0000	0.3000			
SLV 7	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-0.3000	-1.0000			
SLV 8	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	0.3000	-1.0000			
SLV 9	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	1.0000	0.3000		1.0000	0.3000
SLV 10	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	1.0000	-0.3000		1.0000	-0.3000
SLV 11	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	0.3000	1.0000		0.3000	1.0000
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SLV 13	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-1.0000	-0.3000		-1.0000	-0.3000
SLV 14	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-1.0000	0.3000		-1.0000	0.3000
SLV 15	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-0.3000	-1.0000		-0.3000	-1.0000
SLV 16	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	0.3000	-1.0000		0.3000	-1.0000
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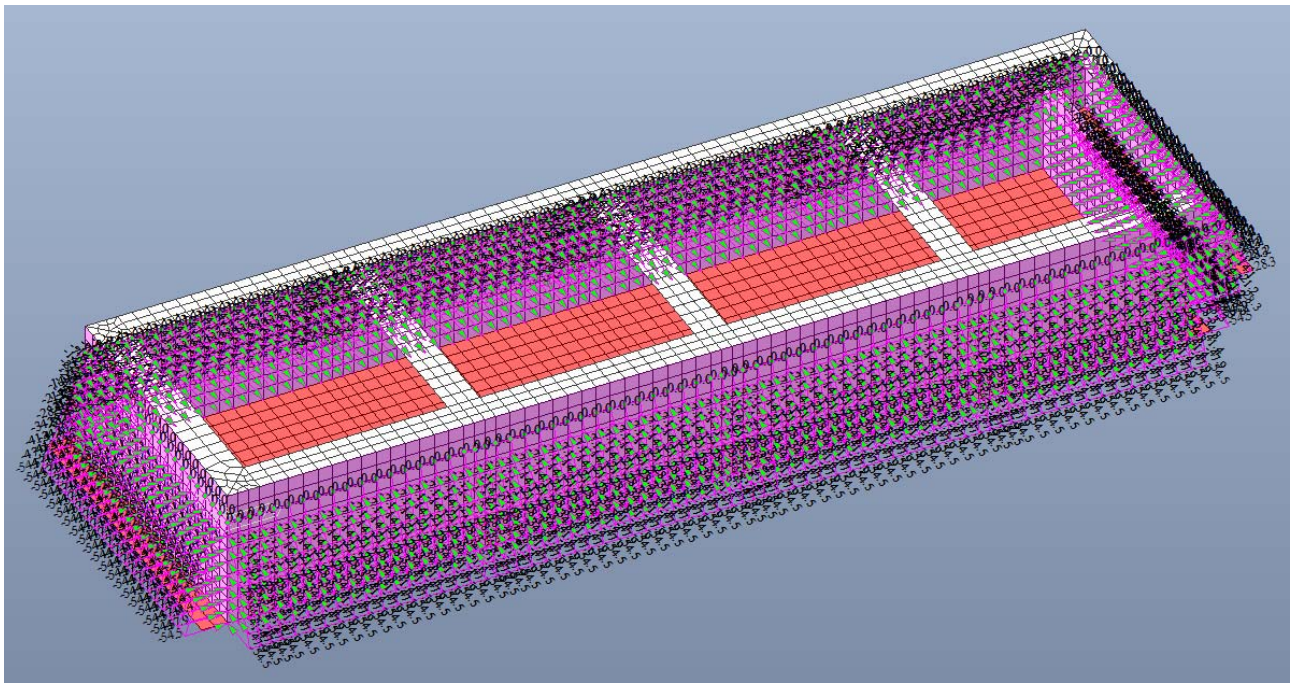
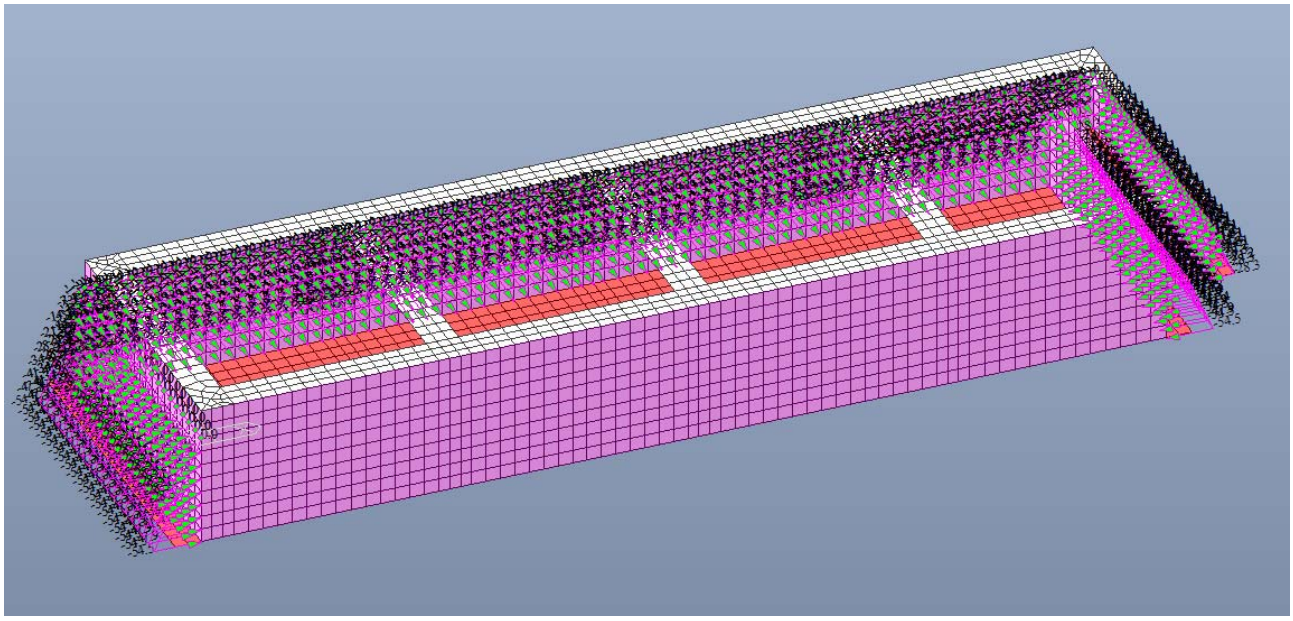
SLV 18	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	1.0000		-0.3000		
SLV 19	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	0.3000		1.0000		
SLV 20	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-0.3000		1.0000		
SLV 21	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-1.0000		-0.3000		
SLV 22	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-1.0000		0.3000		
SLV 23	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-0.3000		-1.0000		
SLV 24	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	0.3000		-1.0000		
SLV 25	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	1.0000		0.3000	1.0000	0.3000
SLV 26	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	1.0000		-0.3000	1.0000	-0.3000
SLV 27	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	0.3000		1.0000	0.3000	1.0000
SLV 28	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-0.3000		1.0000	-0.3000	1.0000
SLV 29	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-1.0000		-0.3000	-1.0000	-0.3000
SLV 30	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-1.0000		0.3000	-1.0000	0.3000
SLV 31	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	-0.3000		-1.0000	-0.3000	-1.0000
SLV 32	Active	Add	1.0000	1.0000						1.0000	1.0000	0.3000	1.0000	0.3000		-1.0000	0.3000	-1.0000

SLE R1	Active	Add	1.0000	1.3000					1.0000	1.0000	1.0000	0.7000	1.0000
SLE R2	Active	Add	1.0000		1.0000				1.0000	1.0000	1.0000	0.7000	1.0000
SLE R3	Active	Add	1.0000	1.0000					0.3000	1.0000	1.0000	1.0000	1.0000
SLE R4	Active	Add	1.0000		1.0000				0.3000	1.0000	1.0000	1.0000	1.0000
SLE R5	Active	Add	1.0000			1.0000			1.0000	1.0000	1.0000	0.7000	1.0000
SLE R6	Active	Add	1.0000				1.0000		1.0000	1.0000	1.0000	0.7000	1.0000
SLE R7	Active	Add	1.0000			1.0000			0.3000	1.0000	1.0000	1.0000	1.0000
SLE R8	Active	Add	1.0000				1.3000		0.3000	1.0000	1.0000	1.0000	1.0000
SLE R9	Active	Add	1.0000	1.0000					1.0000	1.0000	1.0000	0.7000	
SLE R10	Active	Add	1.0000		1.0000				1.0000	1.0000	1.0000	0.7000	
SLE R11	Active	Add	1.0000	1.0000					0.3000	1.0000	1.0000	1.0000	
SLE R12	Active	Add	1.0000		1.0000				0.3000	1.0000	1.0000	1.0000	
SLE R13	Active	Add	1.0000			1.0000			1.0000	1.0000	1.0000	0.7000	
SLE R14	Active	Add	1.0000				1.0000		1.0000	1.0000	1.0000	0.7000	
SLE R15	Active	Add	1.0000			1.0000			0.3000	1.0000	1.0000	1.0000	
SLE R16	Active	Add	1.0000				1.0000		0.3000	1.0000	1.0000	1.0000	
SLE F	Active	Add	1.0000	1.0000						1.0000	1.0000	0.5000	1.0000
SLE Qp	Active	Add	1.0000	1.0000						1.0000	1.0000		1.0000

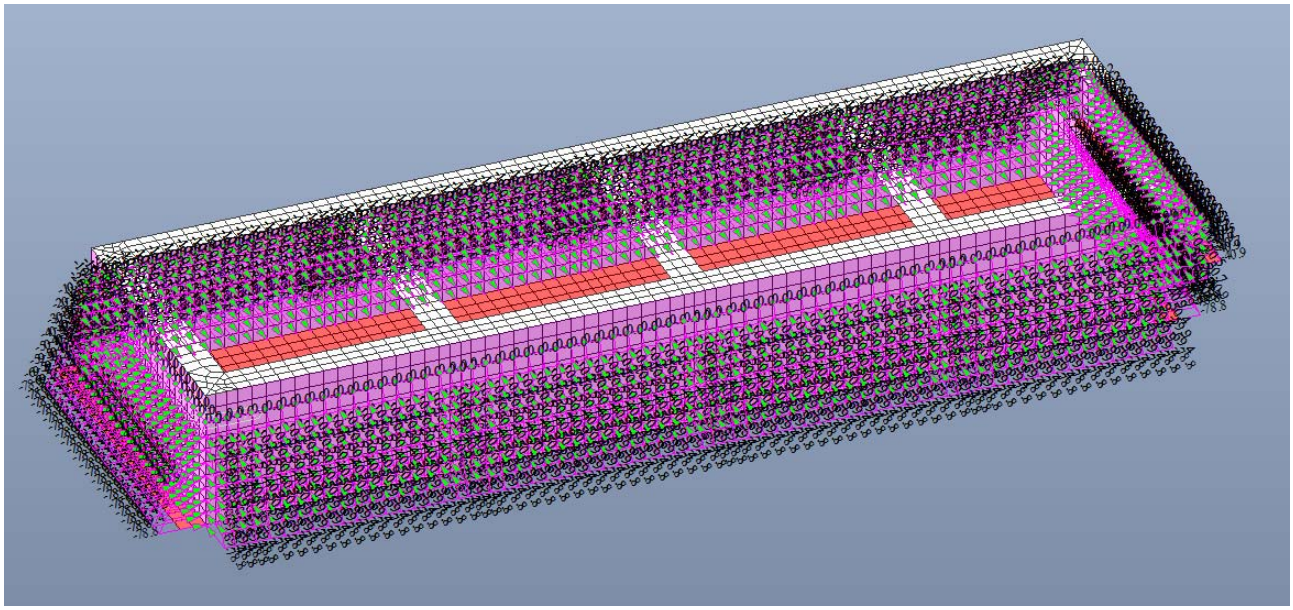
Nelle immagini seguenti si riportano le assegnazioni dei carichi:



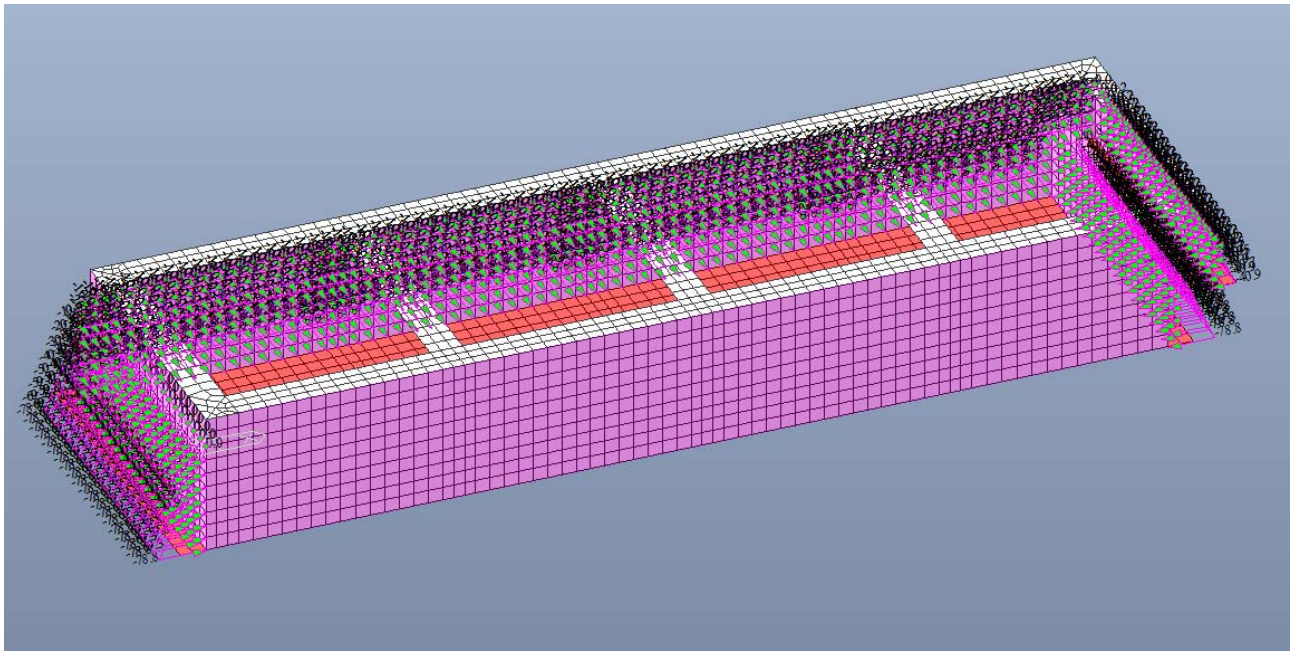
Assegnazione spinta statica del terreno su tutti i lati (SST1) - [kN/mq



Assegnazione spinta statica del terreno su tre lati (SST2) - [kN/mq]



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



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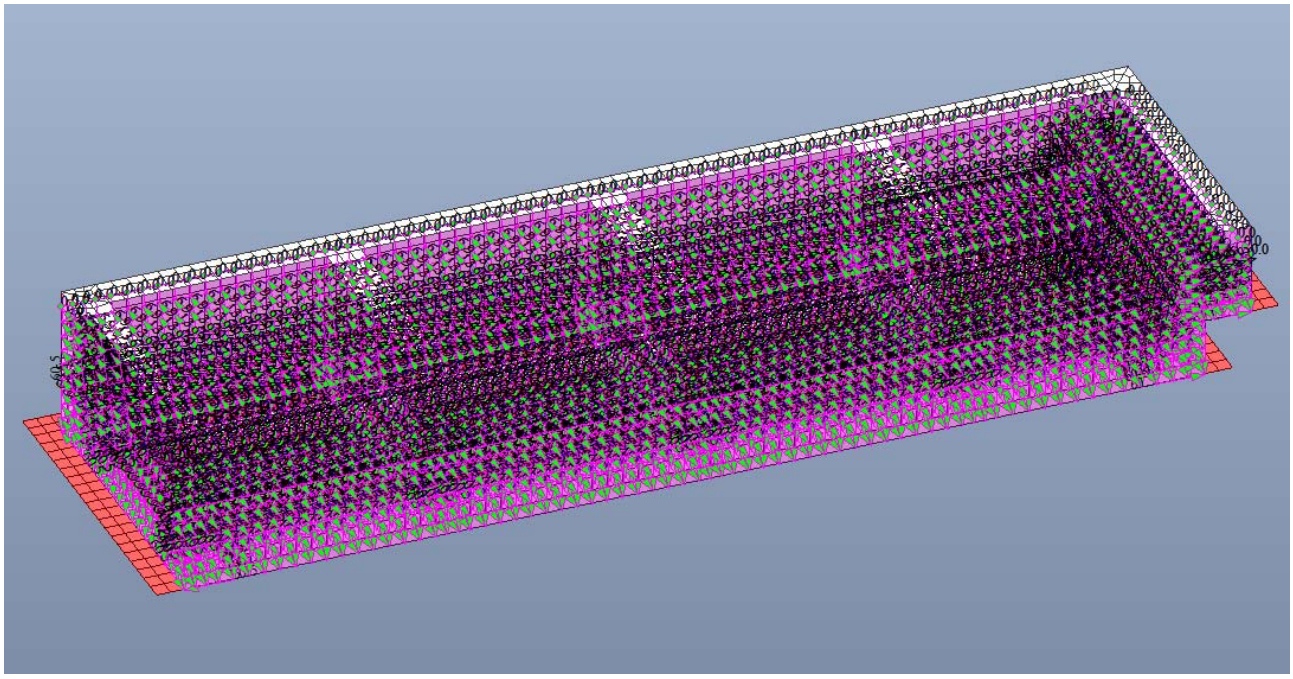
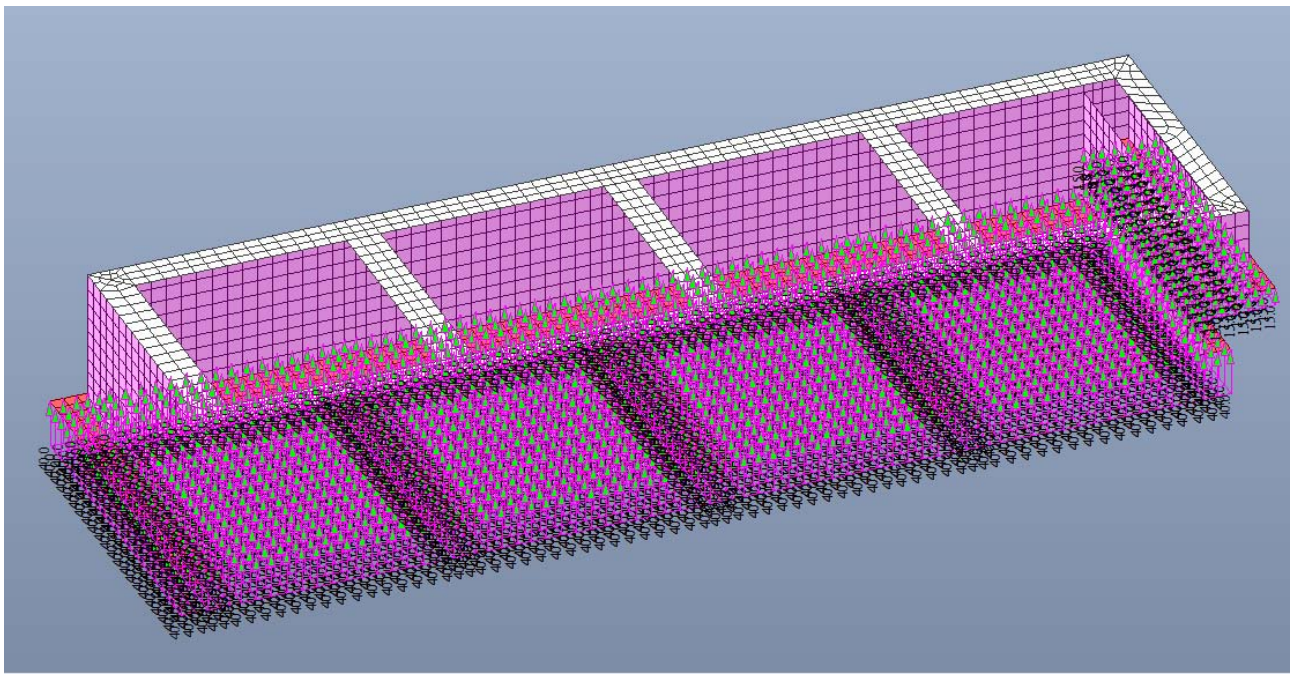
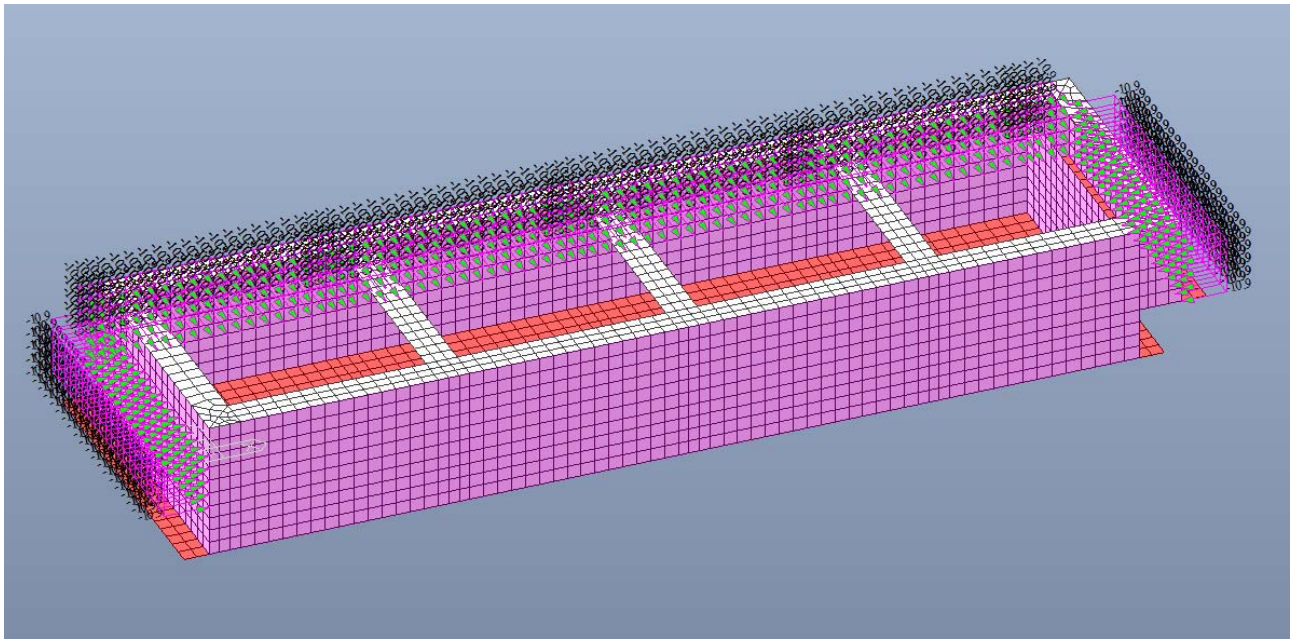


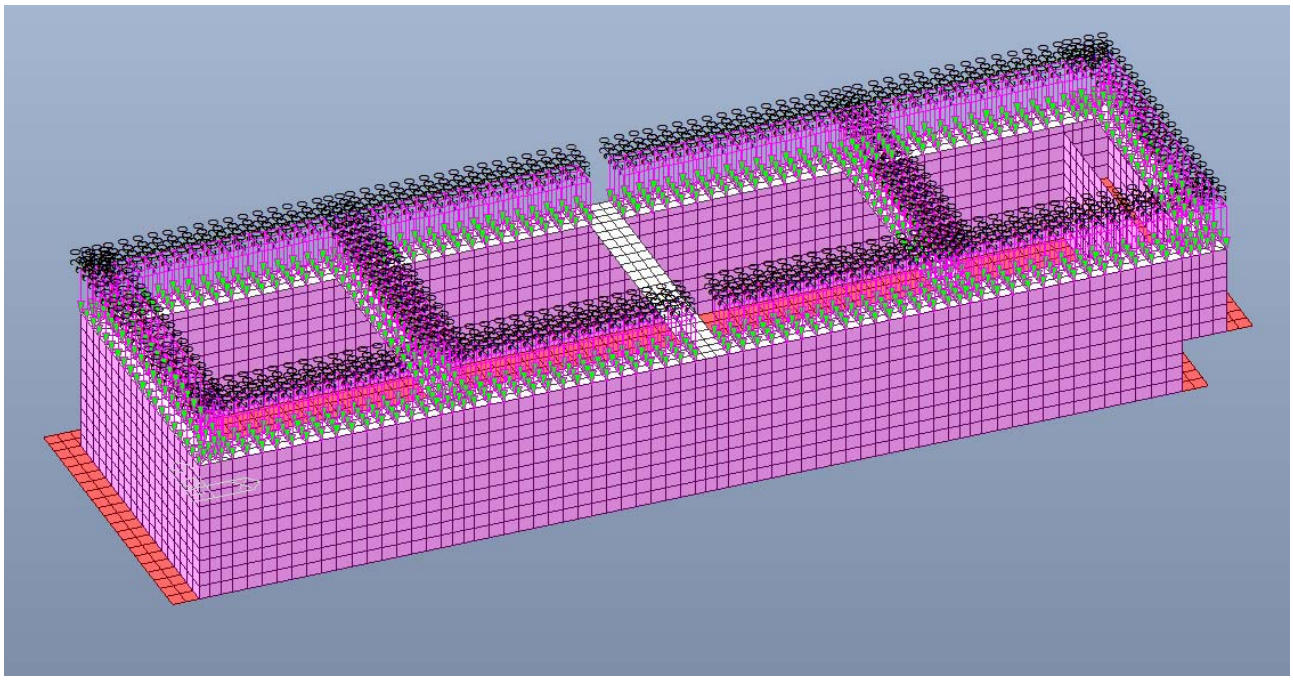
Assegnazione spinta statica liquame (SSL) - [kN/mq]



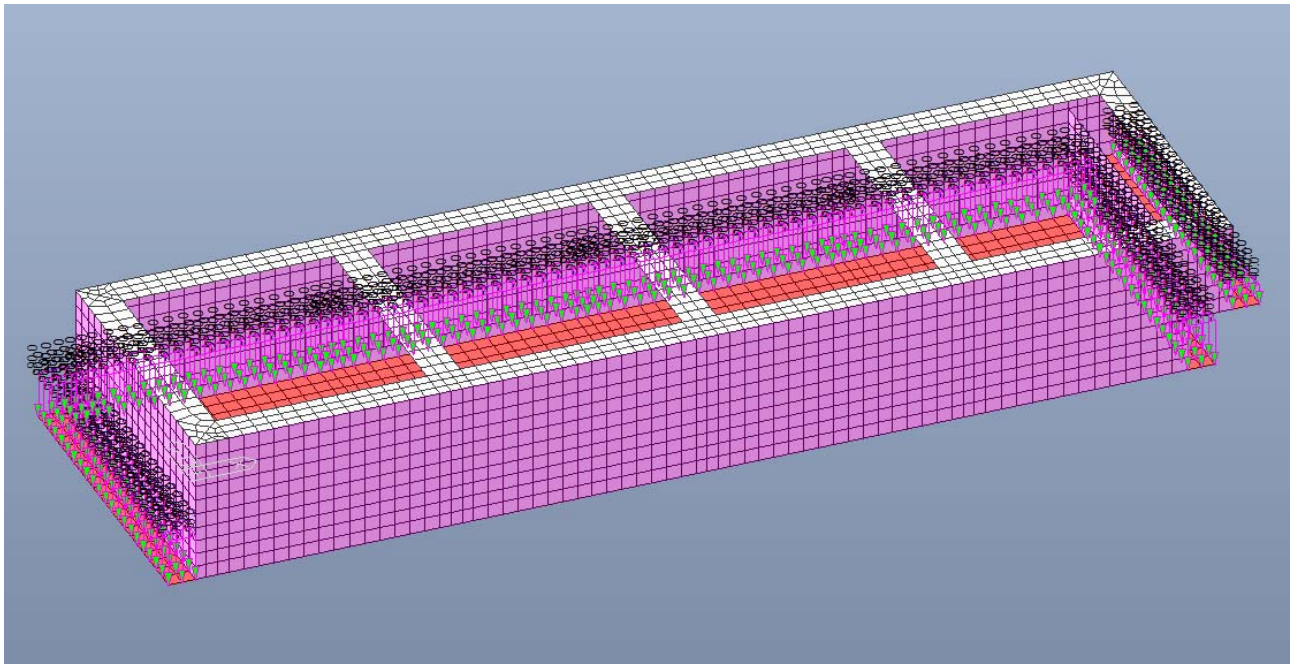
Assegnazione sottospinta galleggiamento (S GAL) - [kN/mq]



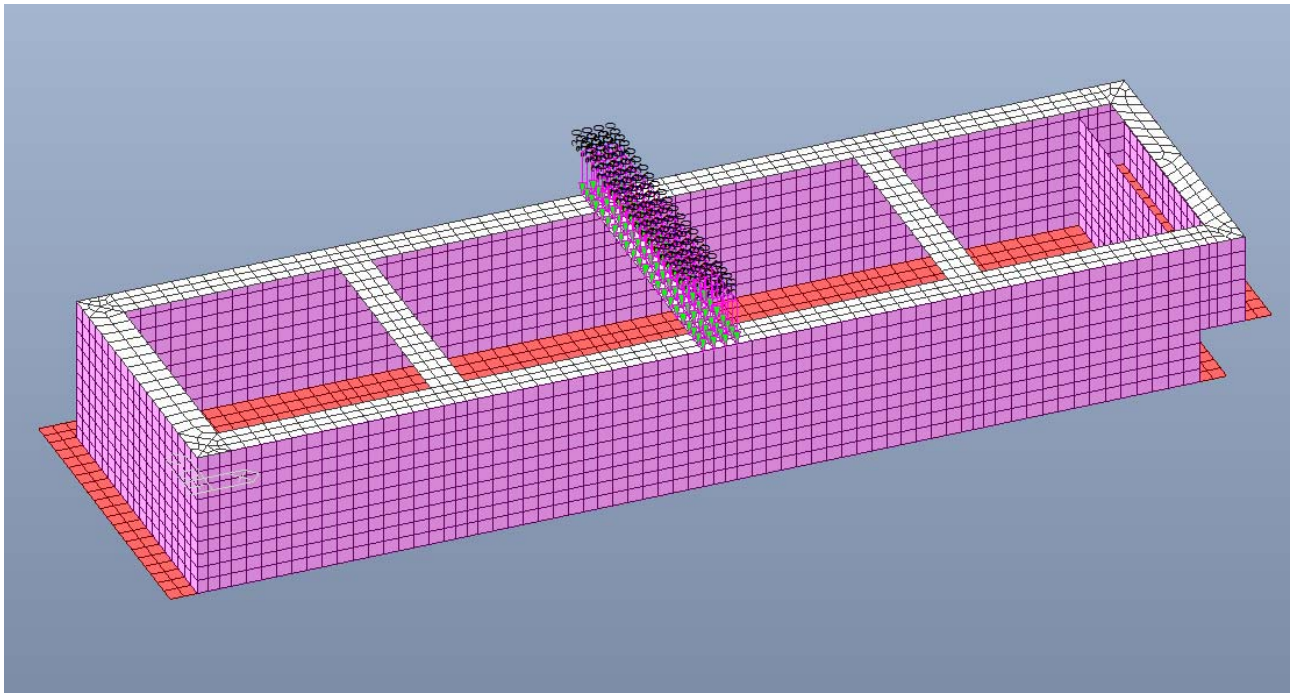
Assegnazione spinta statica sovraccarico (SSS) - [kN/mq]



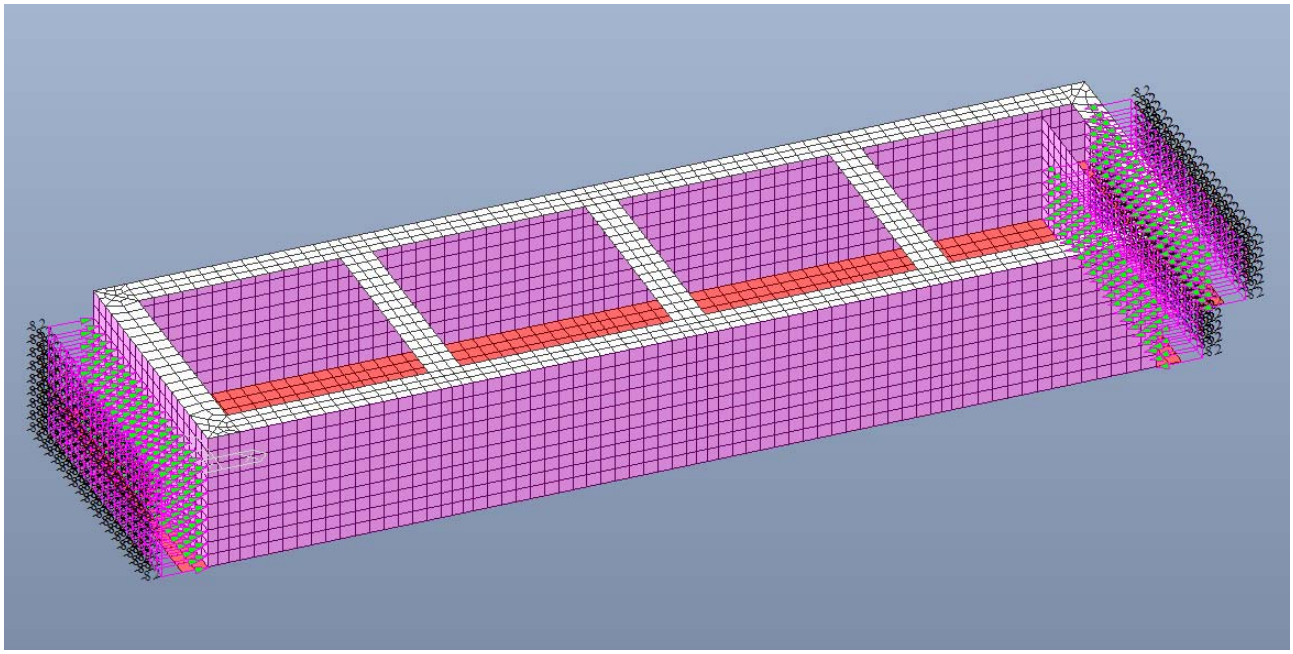
Assegnazione carico variabile manutenzione (VM) - [kN/mq]



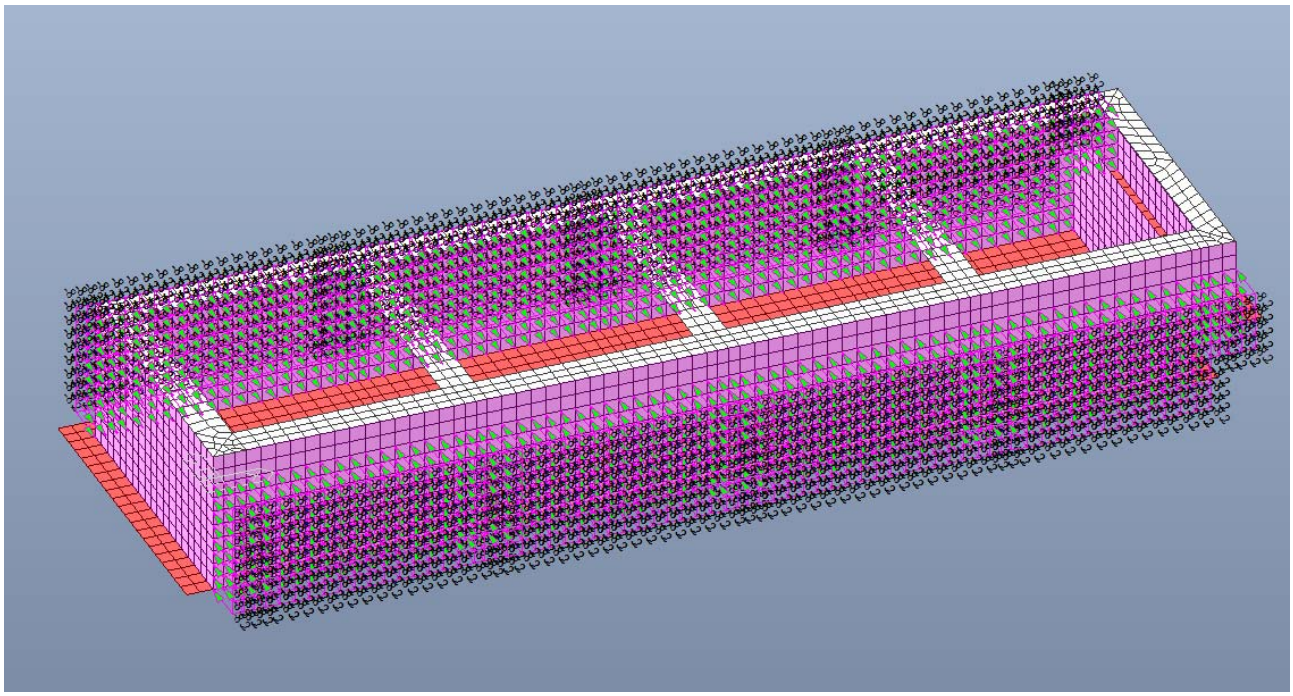
Assegnazione carico permanente terreno su zoccolo di fondazione (PT) - [kN/mq]



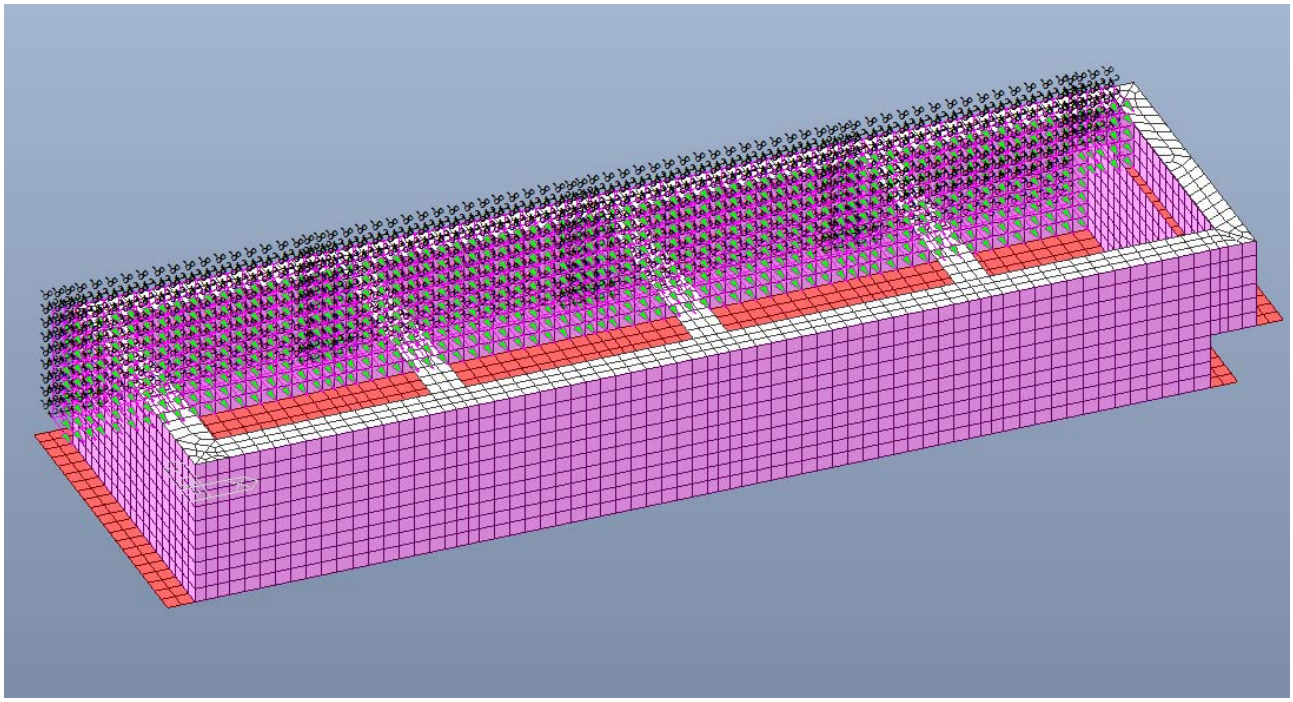
Assegnazione carico permanente piping su camminamento (PP) - [kN/mq]



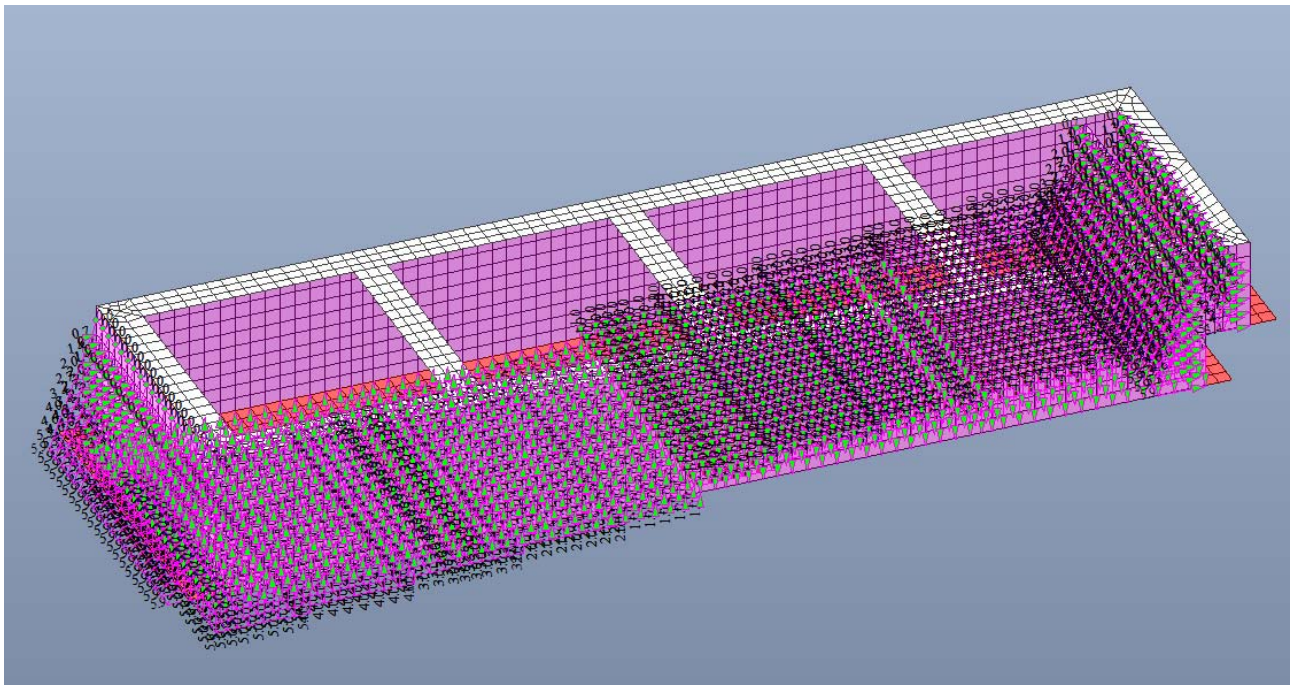
Assegnazione sovra spinta sismica terreno X (ET X) - [kN/mq]



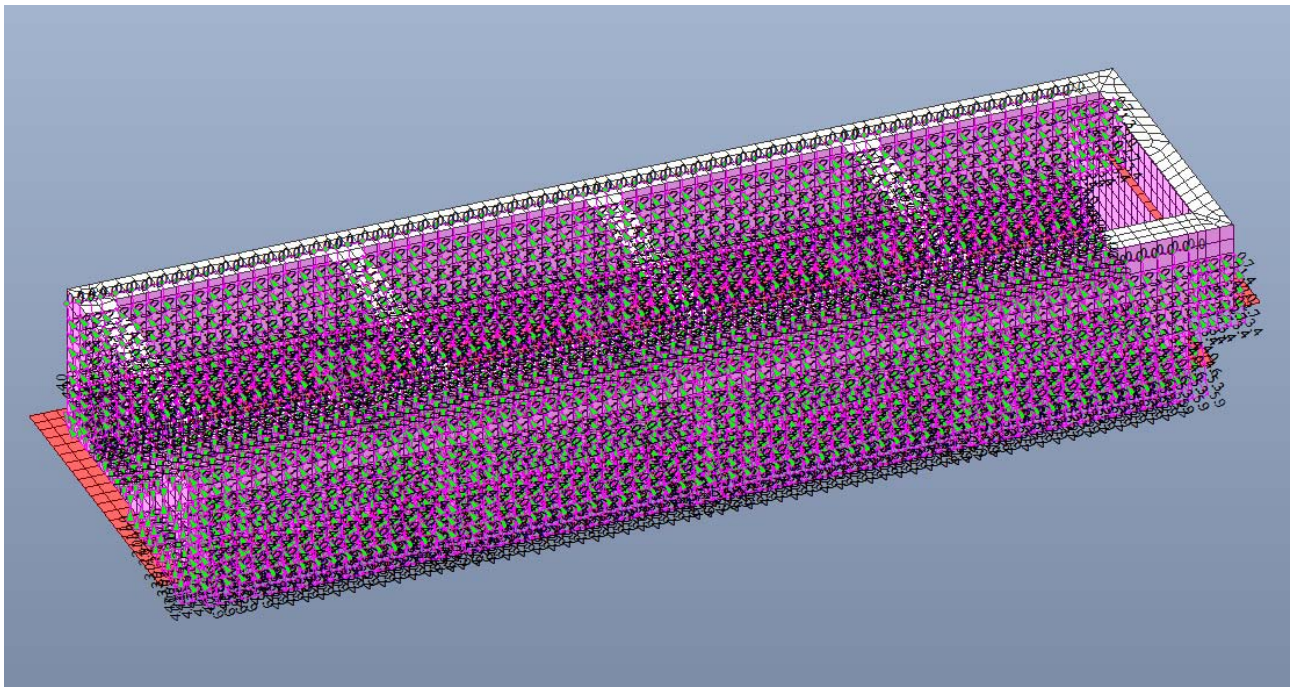
Assegnazione sovra spinta sismica terreno su due lati Y (ET Y1) - [kN/mq]



Assegnazione sovra spinta sismica terreno su un lato Y (ET Y2) - [kN/mq]



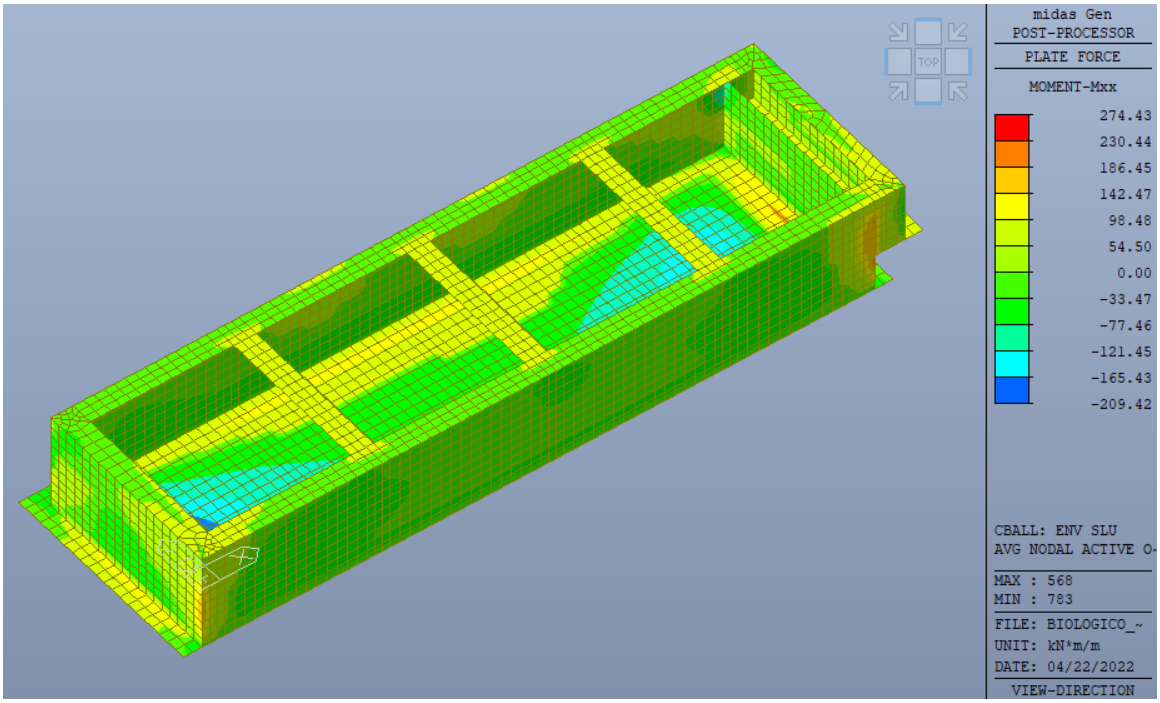
Assegnazione sovra spinta sismica liquame X (EL X) - [kN/mq]



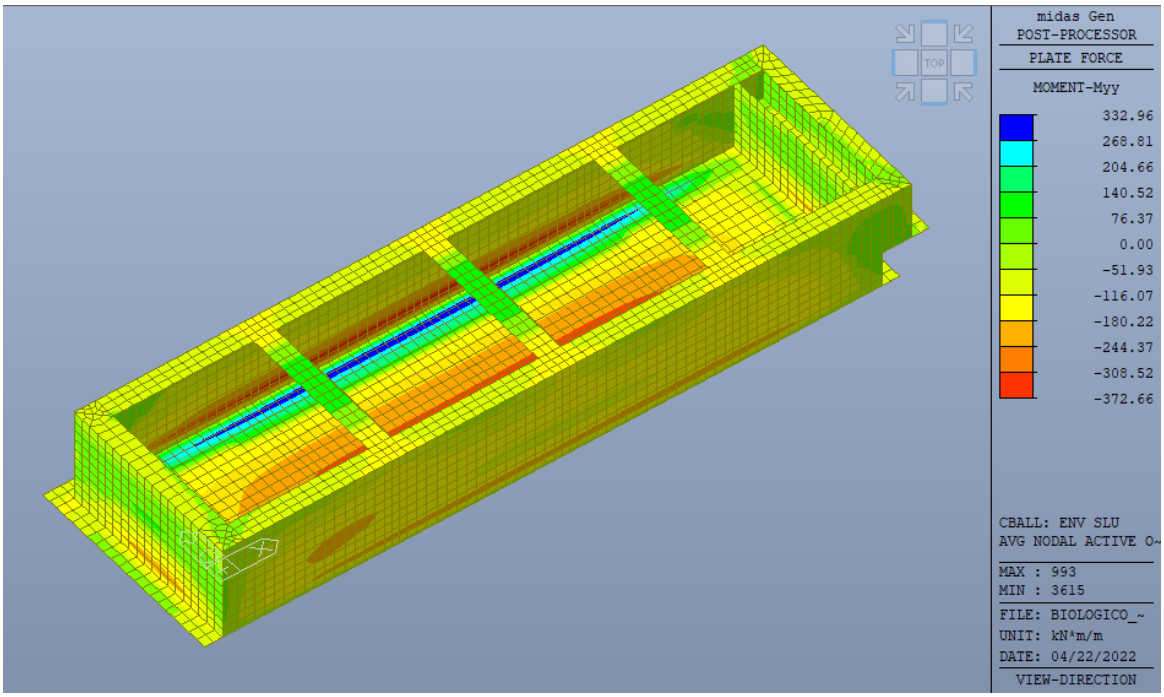
Assegnazione sovra spinta sismica liquame Y (EL Y) - [kN/mq]

1.3 Sollecitazioni

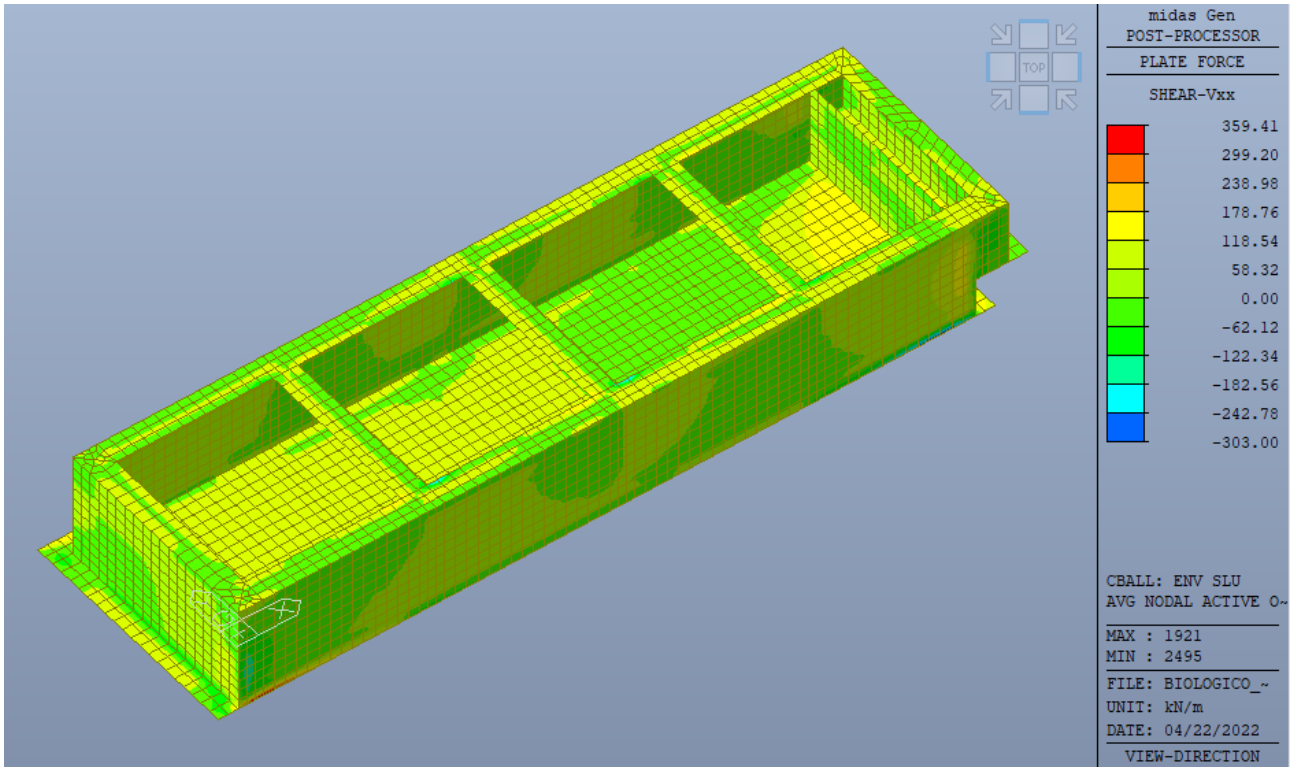
Nel presente paragrafo vengono riportate per via grafica le sollecitazioni sulla struttura indotte dai carichi applicati, per le varie combinazioni di carico statiche e sismiche.



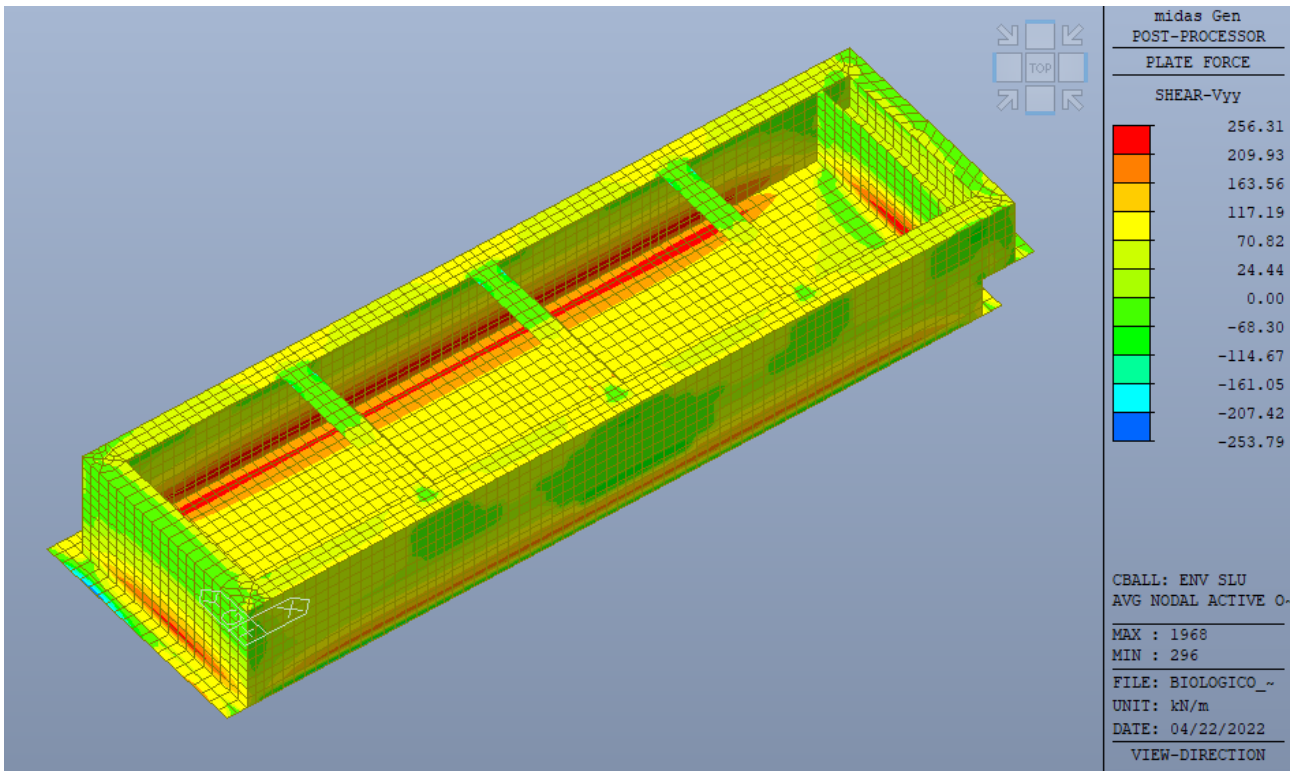
Momento flettente membranale Mxx – inviluppo SLU [kN*m/m]



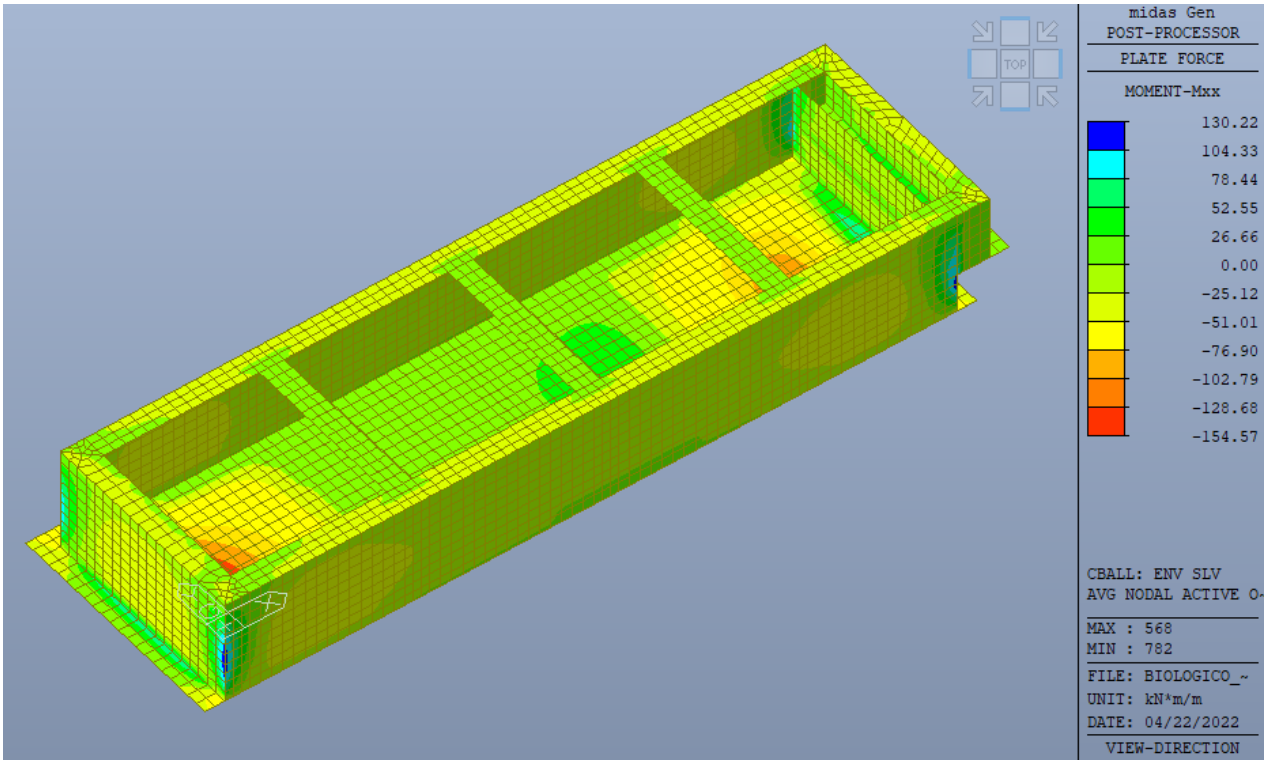
Momento flettente membranale Myy – inviluppo SLU [kN*m/m]



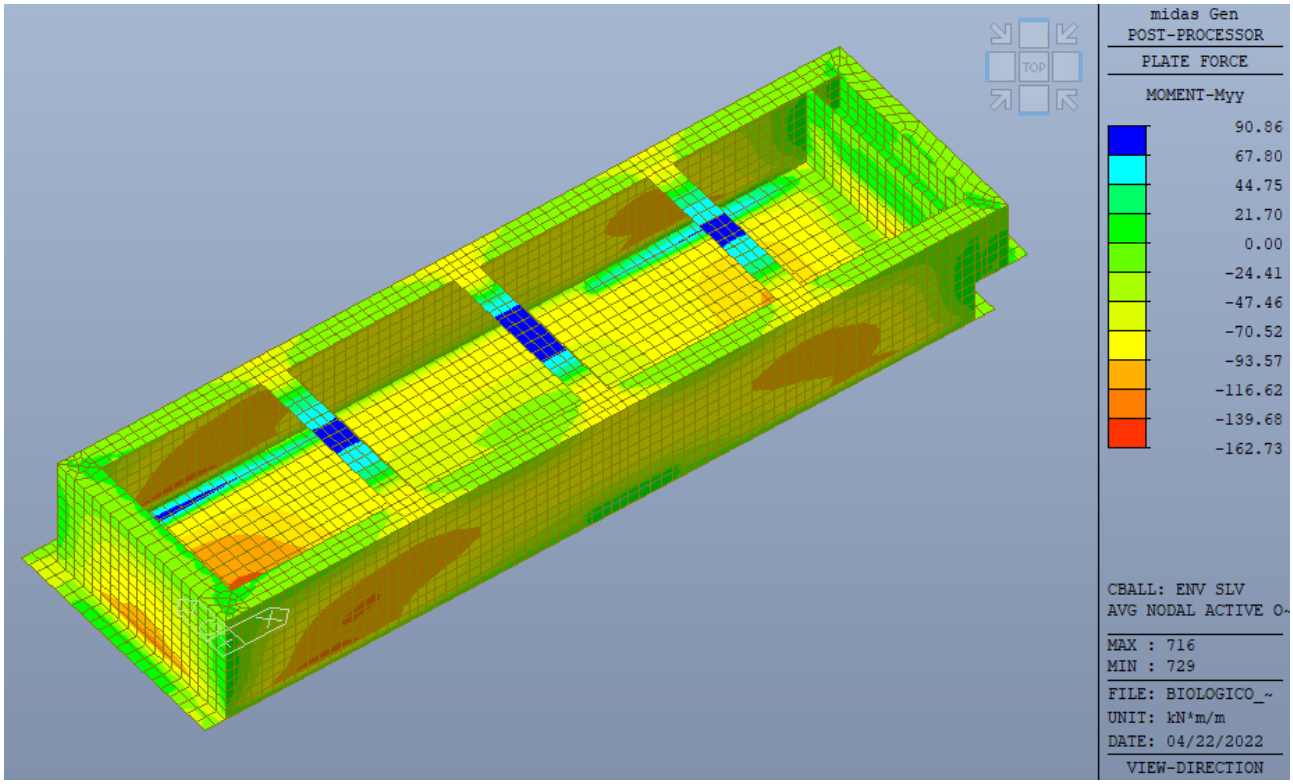
Sollecitazione tagliante Vxx – inviluppo SLU [kN/m]



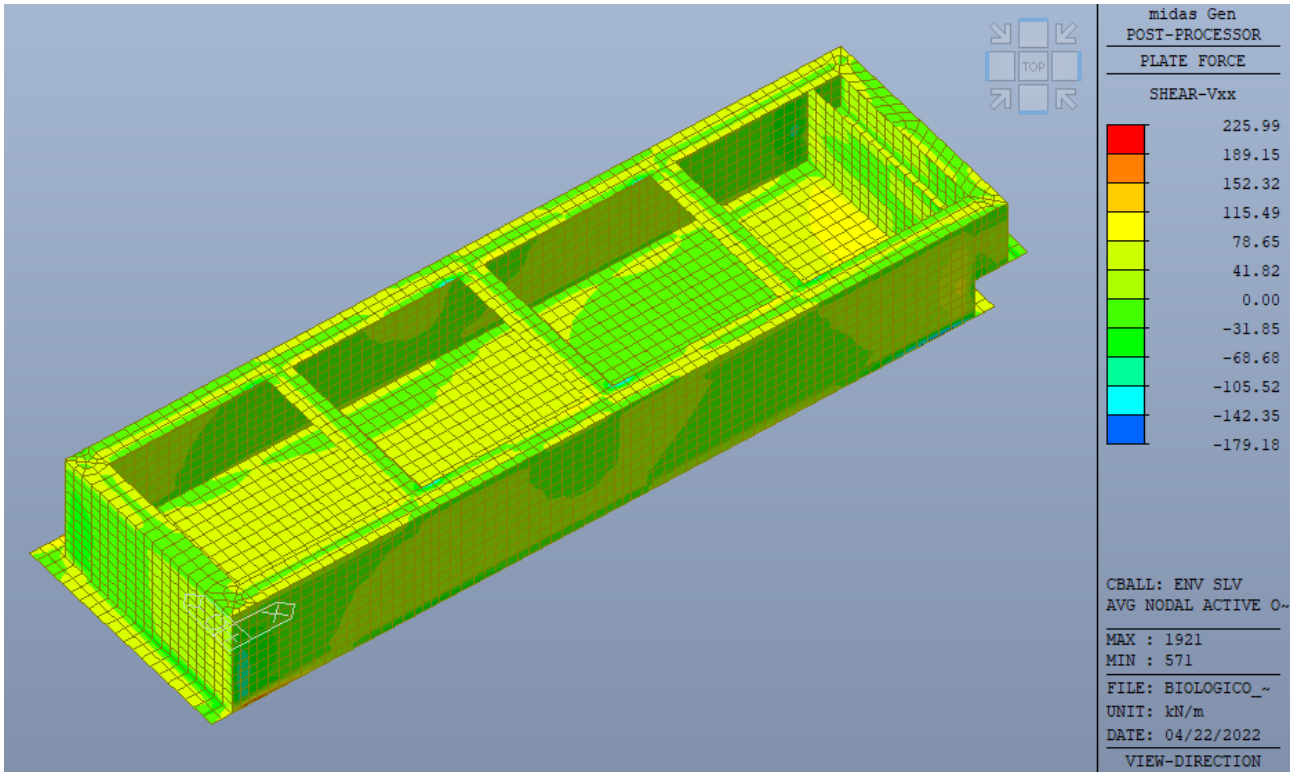
Sollecitazione tagliante Vyy – inviluppo SLU [kN/m]



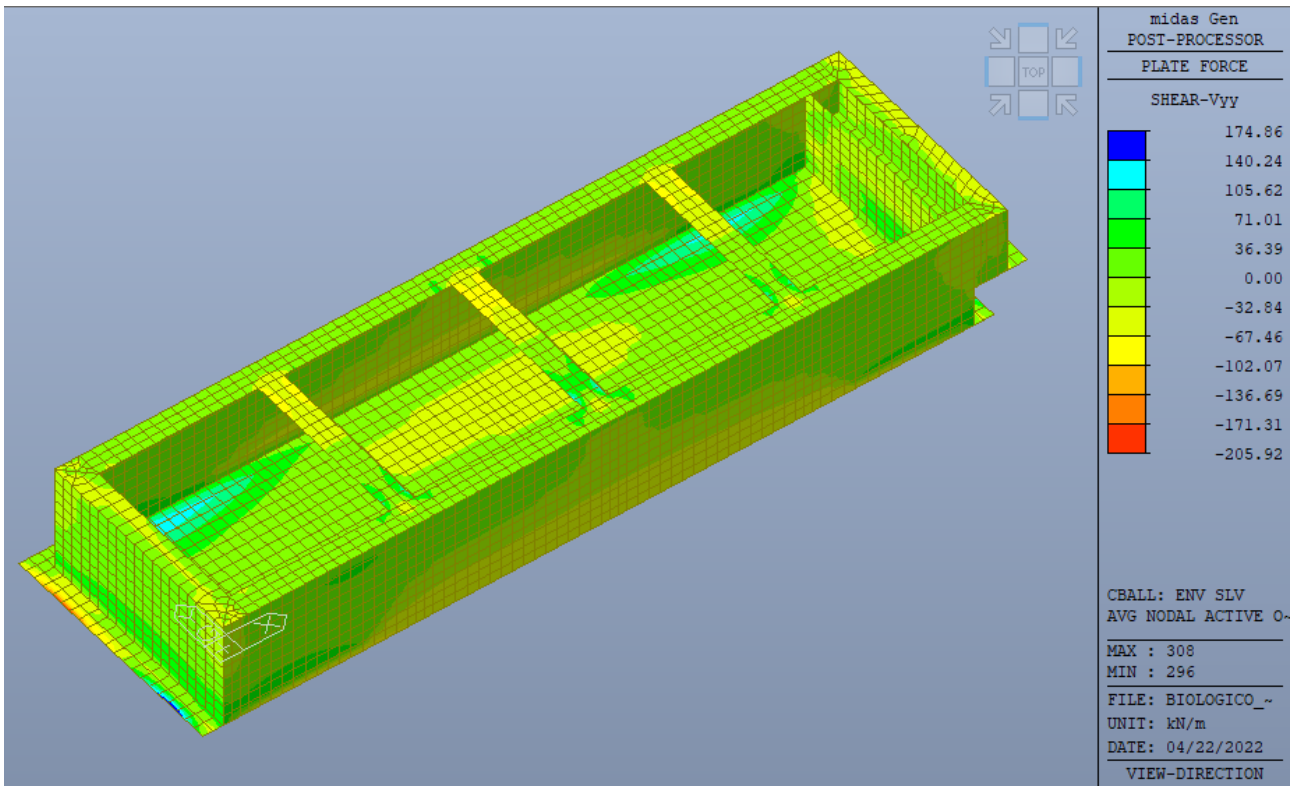
Momento flettente membranale Mxx – inviluppo SLV [kN*m/m]



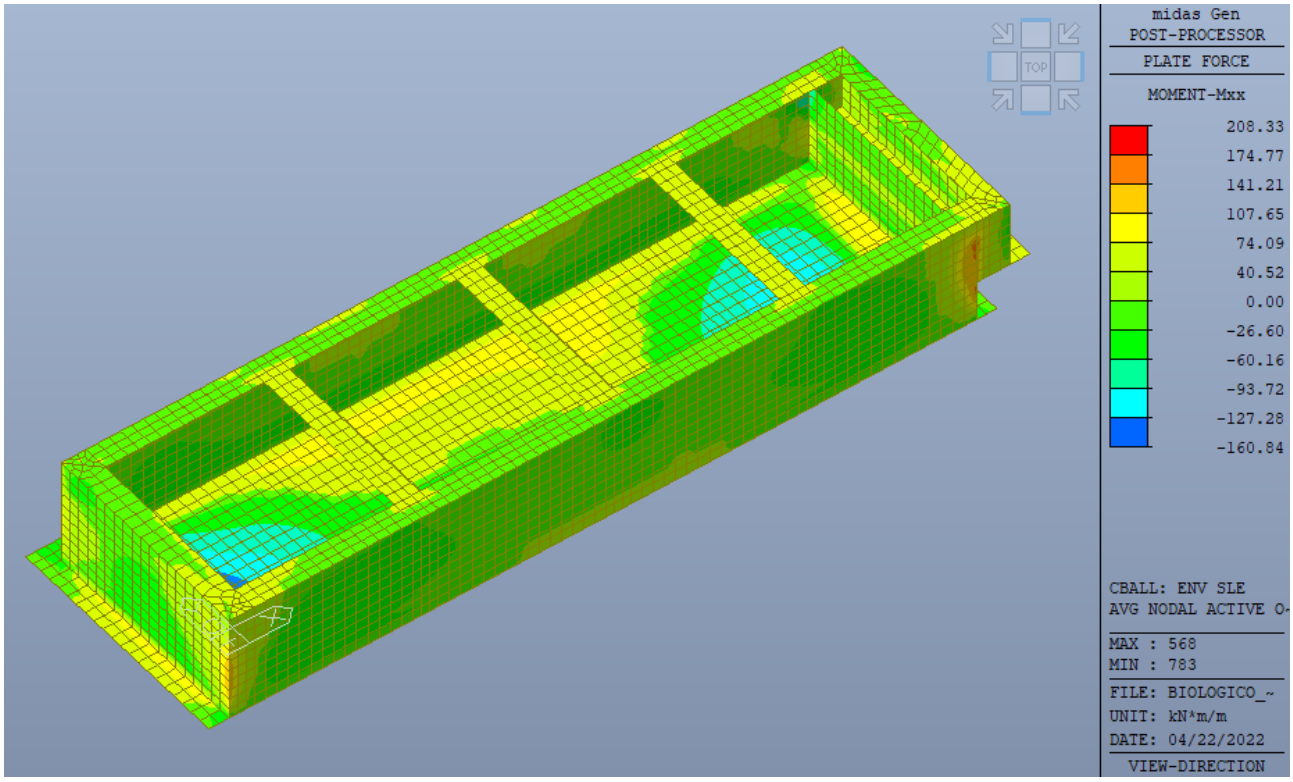
Momento flettente membranale Myy – inviluppo SLV [kN*m/m]



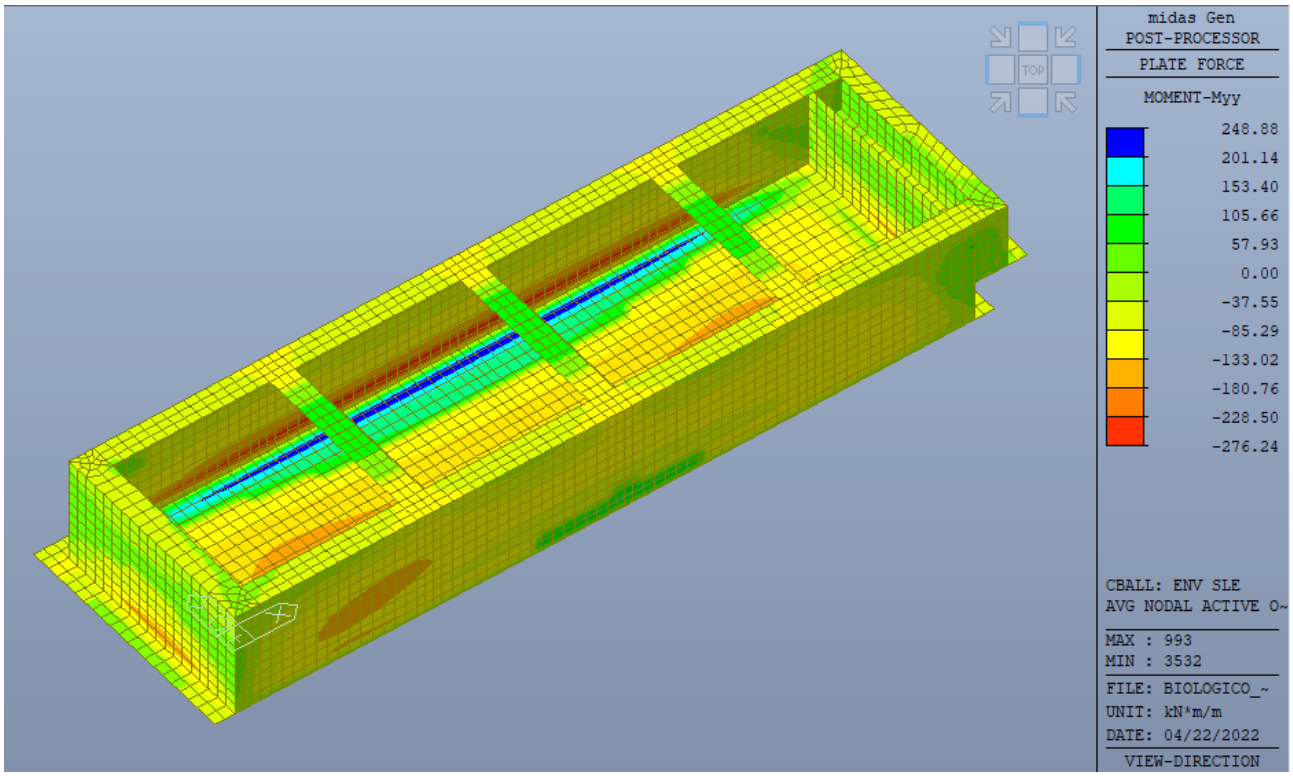
Sollecitazione tagliante Vxx – inviluppo SLV [kN/m]



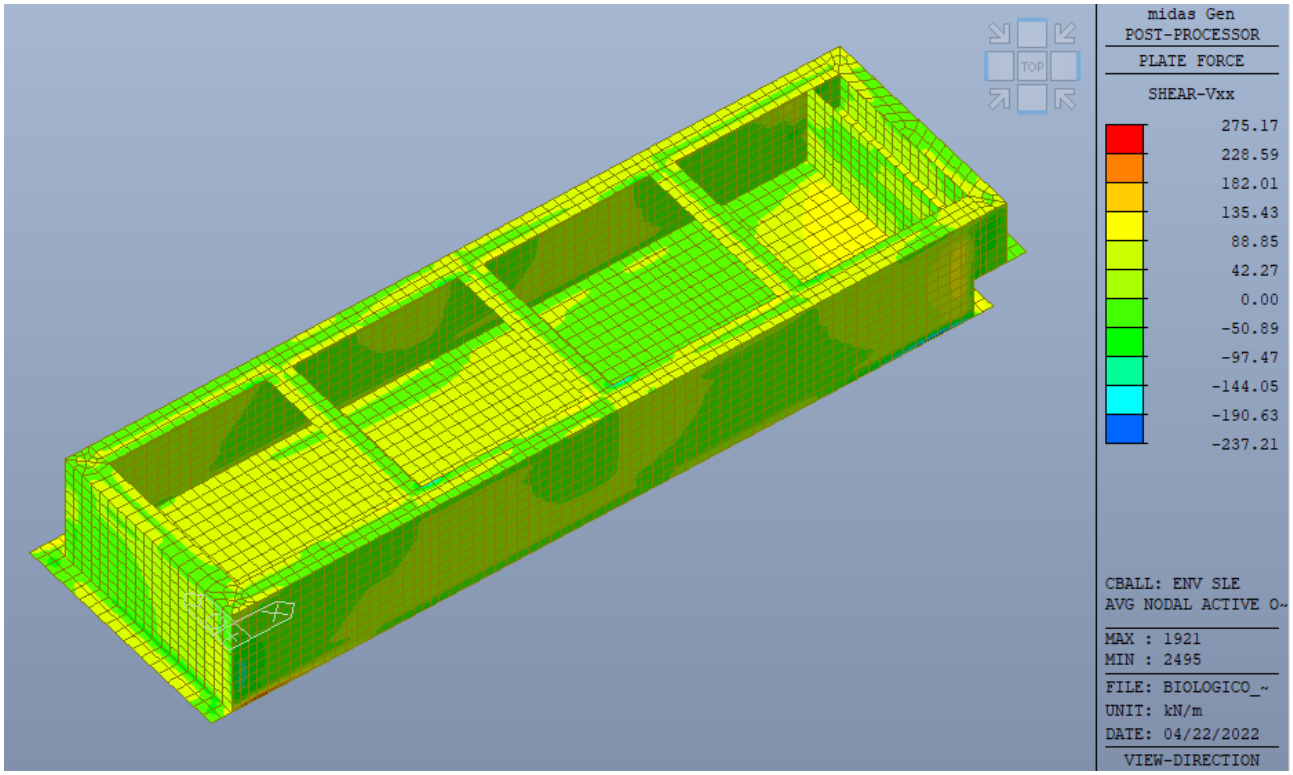
Sollecitazione tagliante Vyy – inviluppo SLV [kN/m]



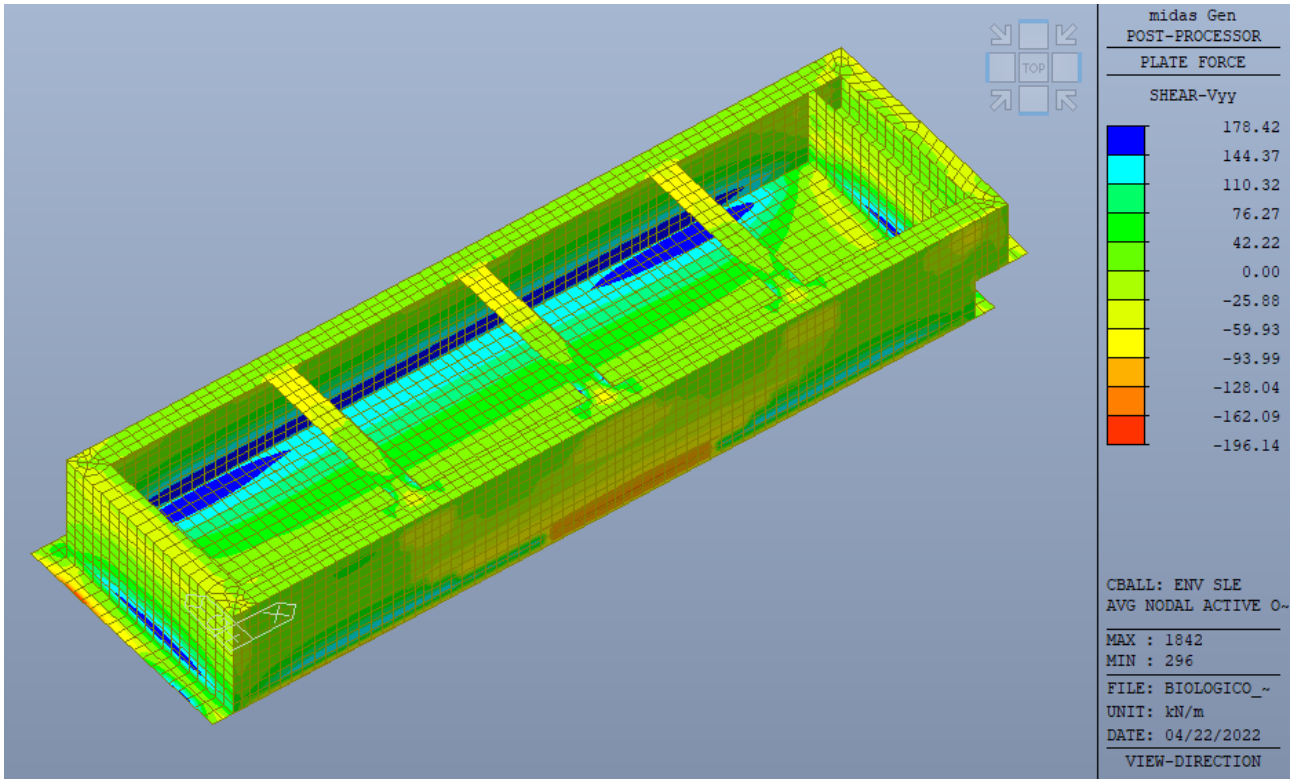
Momento flettente membranale Mxx – inviluppo SLE [kN*m/m]



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



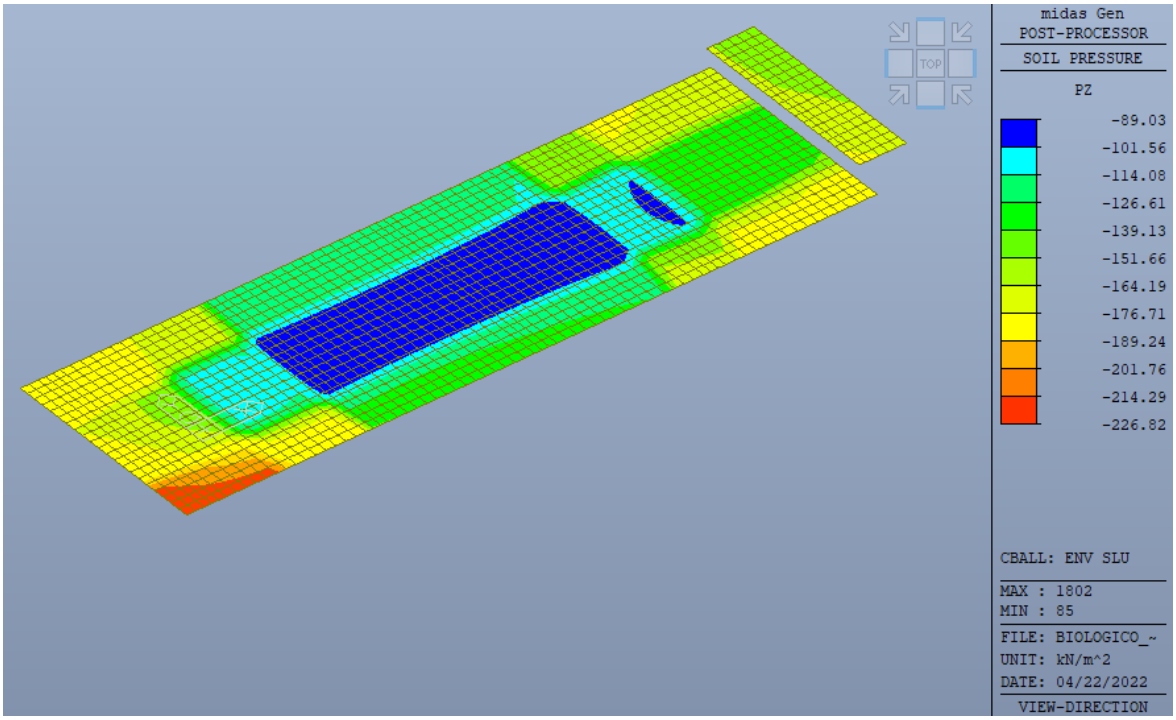
Sollecitazione tagliante Vxx – inviluppo SLE [kN/m]



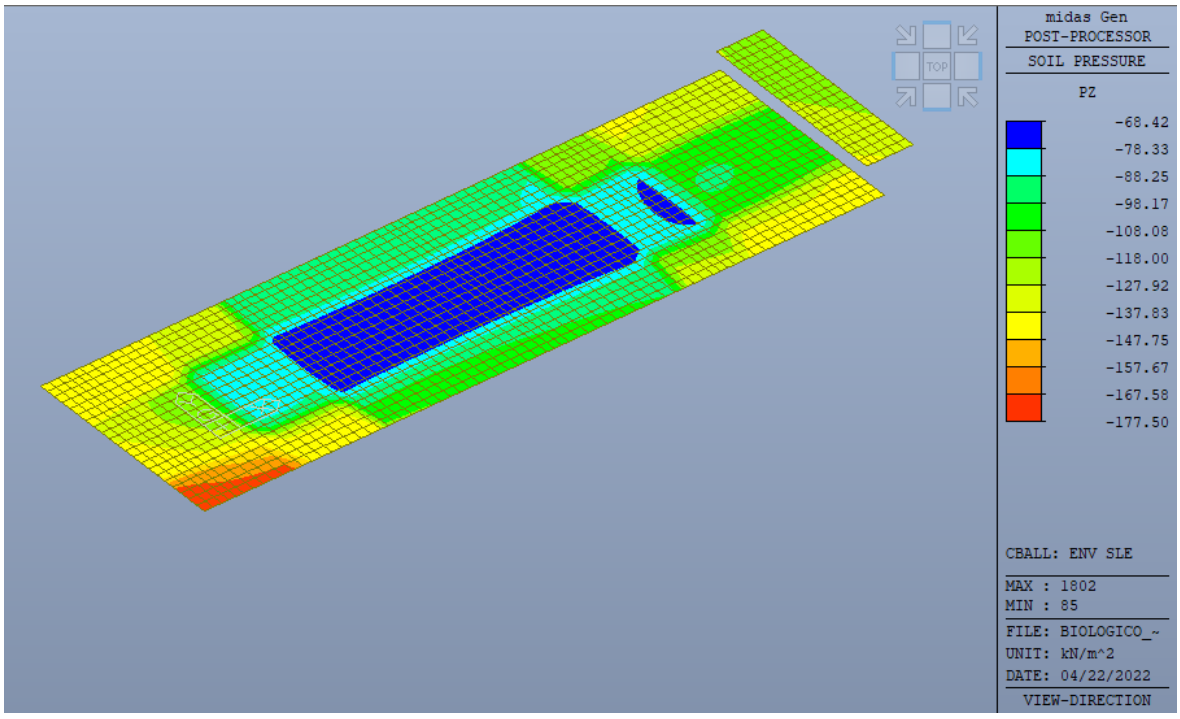
Sollecitazione tagliante Vyy – inviluppo SLE [kN/m]

1.4 Reazioni vincolari e pressioni sul terreno

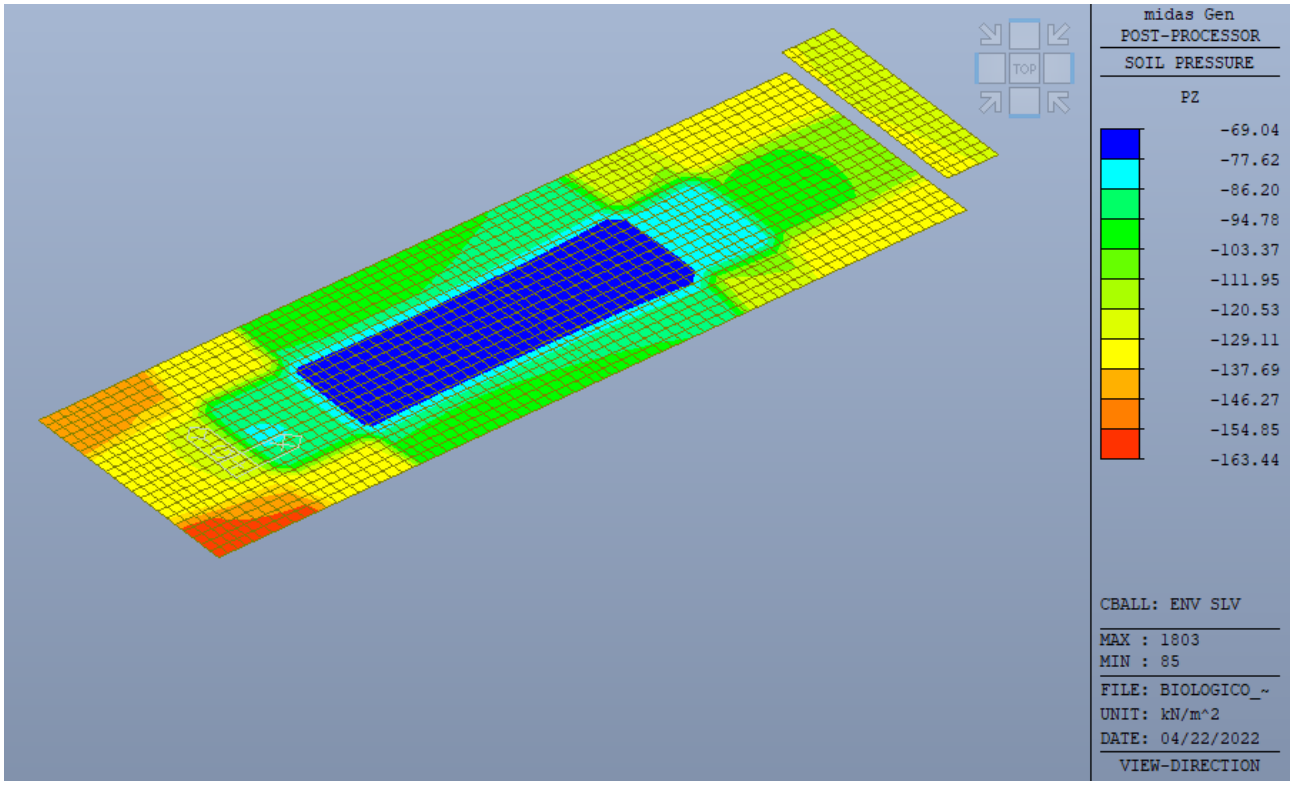
Nel presente paragrafo vengono riportate le reazioni vincolari e le pressioni sul terreno.



Pressioni sul terreno ENV SLU



Pressioni sul terreno ENV SLE



Pressioni sul terreno ENV SLV

Load	FX (kN)	FY (kN)	FZ (kN)
SLU 1	-652.711494	1440.009900	94488.297000
SLU 2	-652.711494	9754.491868	94488.297000
SLU 3	-652.711494	2057.157000	94080.876000
SLU 4	-652.711494	10371.638968	94080.876000
SLU 5	-652.711494	1440.009900	94488.297000
SLU 6	-652.711494	13459.513890	94488.297000
SLU 7	-652.711494	2057.157000	94080.876000
SLU 8	-652.711494	14076.660990	94080.876000
SLU 9	0.000000	1440.009900	46883.740000
SLU 10	0.000000	9754.491868	46883.740000
SLU 11	0.000000	2057.157000	46476.319000
SLU 12	0.000000	10371.638968	46476.319000
SLU 13	0.000000	1440.009900	46883.740000
SLU 14	0.000000	13459.513890	46883.740000
SLU 15	0.000000	2057.157000	46476.319000
SLU 16	0.000000	14076.660990	46476.319000
SLU 17	0.000000	-0.000000	10403.855000
SLU 18	0.000000	12019.503990	10403.855000
SLU 19	0.000000	0.000000	35060.545000
SLV 1	-502.085765	411.431400	72235.590000
SLV 2	-502.085765	411.431400	72235.590000
SLV 3	-502.085765	411.431400	72235.590000
SLV 4	-502.085765	411.431400	72235.590000
SLV 5	-502.085765	411.431400	72235.590000
SLV 6	-502.085765	411.431400	72235.590000
SLV 7	-502.085765	411.431400	72235.590000
SLV 8	-502.085765	411.431400	72235.590000
SLV 9	-1030.831421	-56.948662	72328.478667
SLV 10	-1030.831421	879.811463	72243.464667
SLV 11	-660.709462	-1149.835475	72392.394500
SLV 12	-343.462068	-1149.835475	72362.165500
SLV 13	26.659892	879.811463	72142.701333
SLV 14	26.659892	-56.948662	72227.715333
SLV 15	-343.462068	1972.698275	72078.785500
SLV 16	-660.709462	1972.698275	72109.014500

Load	FX (kN)	FY (kN)	FZ (kN)
SLV 15	-343.462068	1972.698275	72078.785500
SLV 16	-660.709462	1972.698275	72109.014500
SLV 17	-502.085765	995.238600	72235.590000
SLV 18	-502.085765	-172.375800	72235.590000
SLV 19	-502.085765	2357.455400	72235.590000
SLV 20	-502.085765	2357.455400	72235.590000
SLV 21	-502.085765	-172.375800	72235.590000
SLV 22	-502.085765	995.238600	72235.590000
SLV 23	-502.085765	-1534.592600	72235.590000
SLV 24	-502.085765	-1534.592600	72235.590000
SLV 25	-1030.831421	526.858538	72328.478667
SLV 26	-1030.831421	296.004263	72243.464667
SLV 27	-660.709462	796.188525	72392.394500
SLV 28	-343.462068	796.188525	72362.165500
SLV 29	26.659892	296.004263	72142.701333
SLV 30	26.659892	526.858538	72227.715333
SLV 31	-343.462068	26.674275	72078.785500
SLV 32	-660.709462	26.674275	72109.014500
SLE R1	-502.085765	960.006600	72623.610000
SLE R2	-502.085765	7355.761960	72623.610000
SLE R3	-502.085765	1371.438000	72351.996000
SLE R4	-502.085765	7767.193360	72351.996000
SLE R5	-502.085765	960.006600	72623.610000
SLE R6	-502.085765	10205.778900	72623.610000
SLE R7	-502.085765	1371.438000	72351.996000
SLE R8	-502.085765	13390.941990	72351.996000
SLE R9	0.000000	960.006600	36004.720000
SLE R10	0.000000	7355.761960	36004.720000
SLE R11	0.000000	1371.438000	35733.106000
SLE R12	0.000000	7767.193360	35733.106000
SLE R13	0.000000	960.006600	36004.720000
SLE R14	0.000000	10205.778900	36004.720000
SLE R15	0.000000	1371.438000	35733.106000
SLE R16	0.000000	10617.210300	35733.106000
SLE F	-502.085765	685.719000	72235.590000
SLE Qp	-502.085765	0.000000	72235.590000

Reazioni vincolari

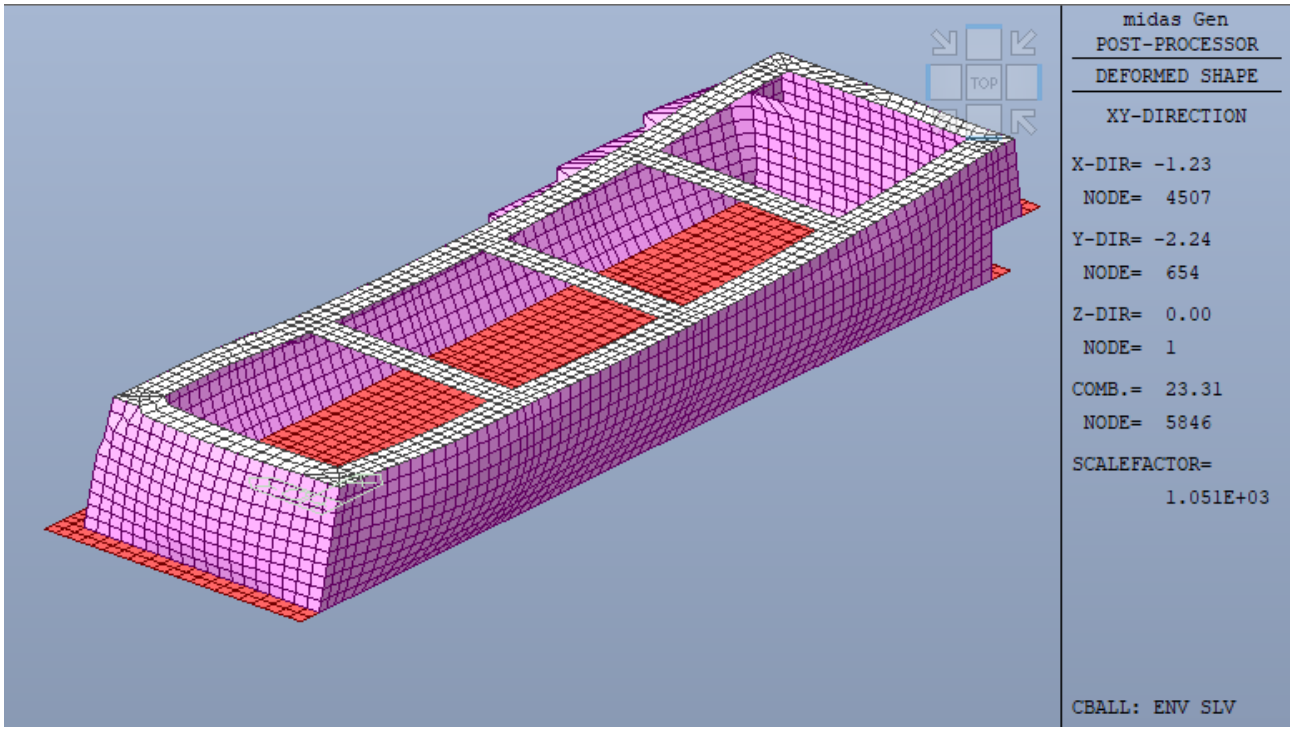
1.5 Deformazioni

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 meno di 3 mm, quindi assolutamente trascurabile e testimone dell'elevatissima rigidezza del manufatto.



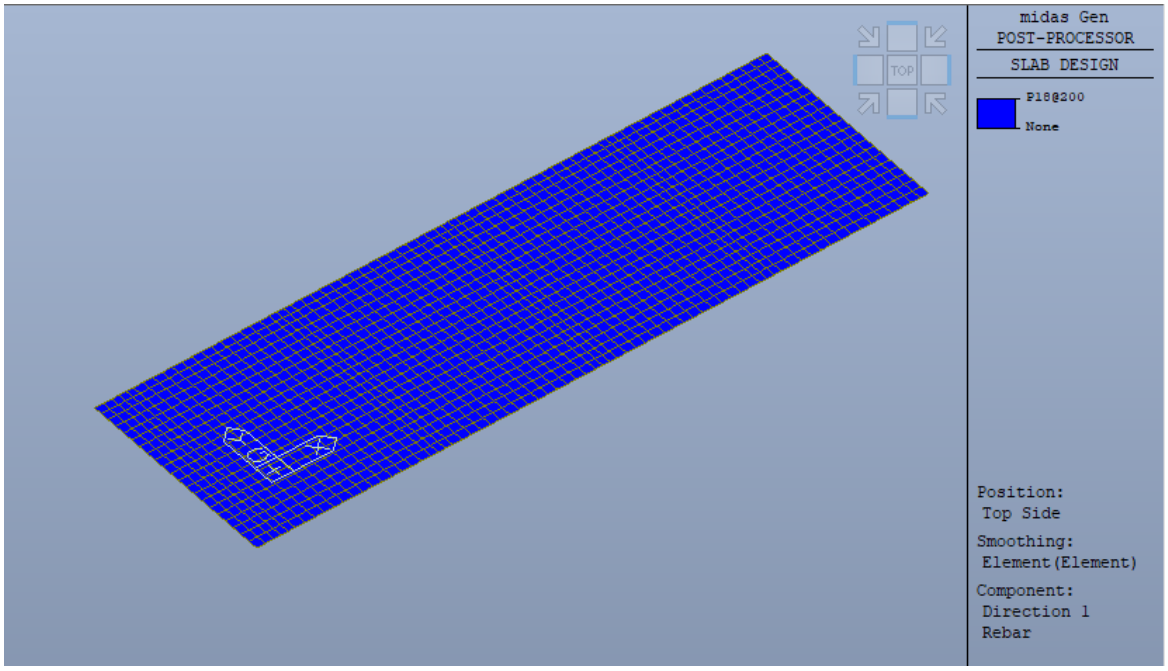
Massime deformazioni SLV combinata XY [cm]

1.6 Armature previste

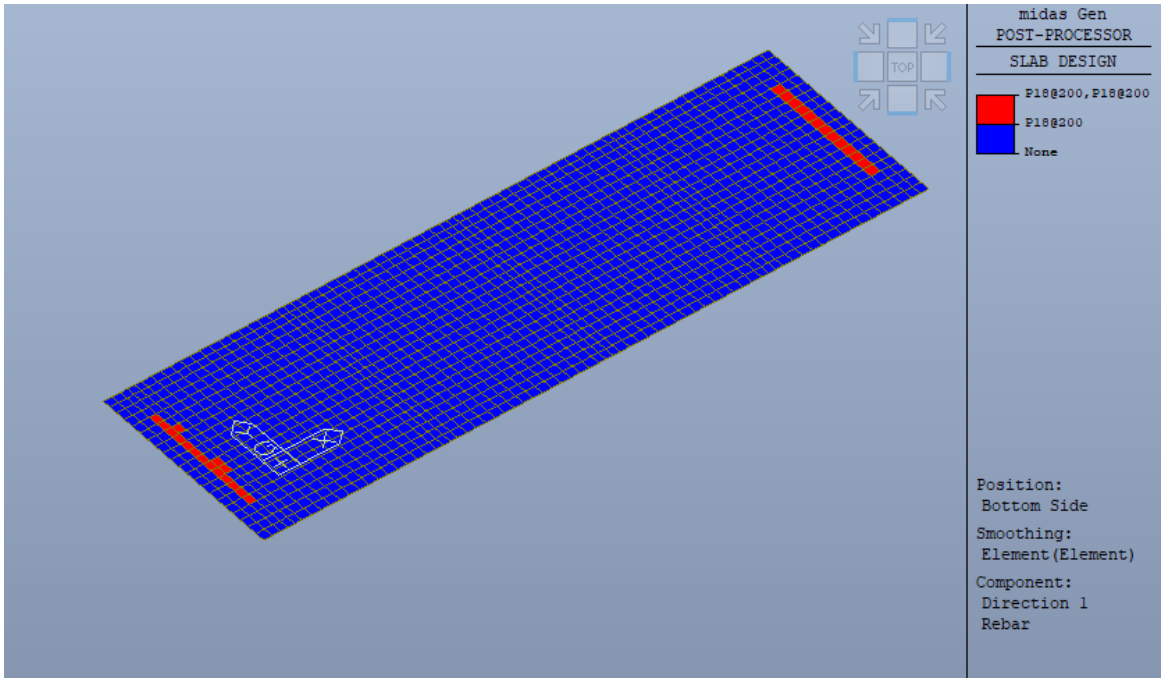
Nelle immagini seguenti vengono riportate le armature previste per i vari elementi strutturali.

1.6.1 Armature Platea principale

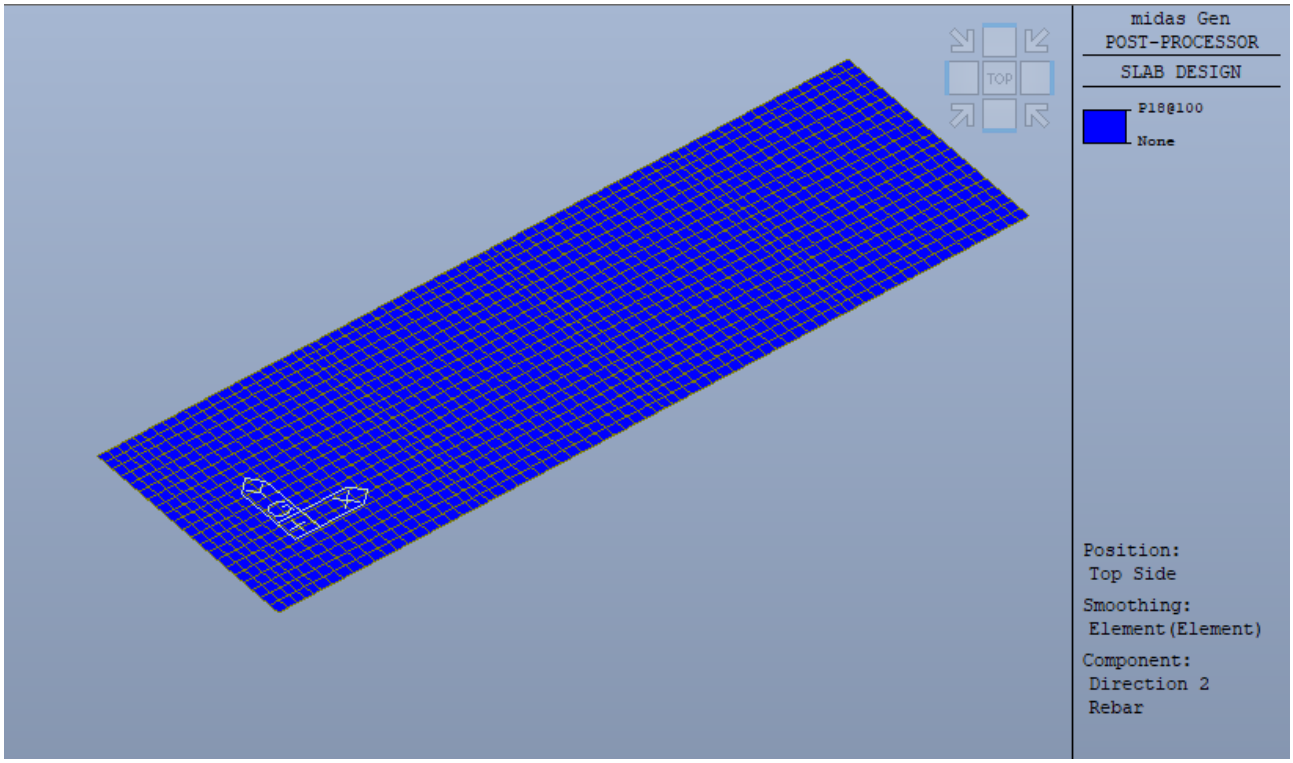
Nelle immagini seguenti vengono riportate graficamente le armature richieste dal dimensionamento strutturale.



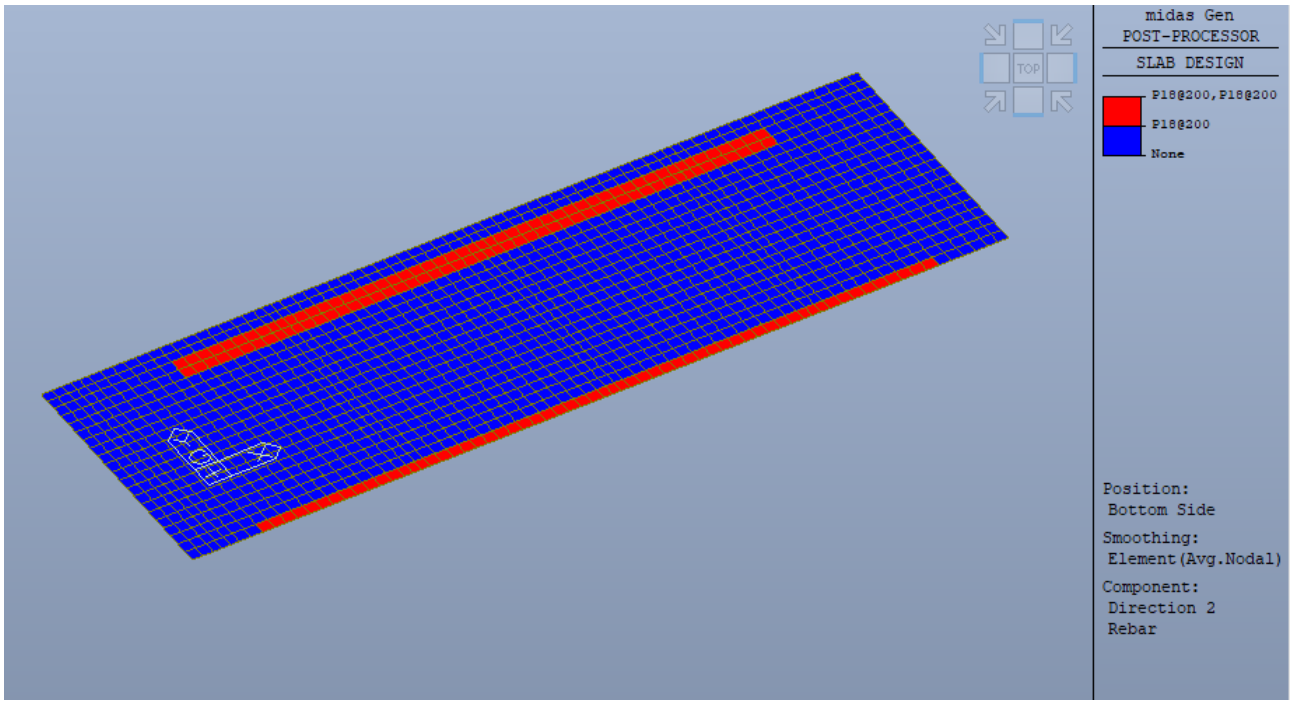
Armatura platea principale – direzione longitudinale X superiore



Armatura platea principale – direzione longitudinale X inferiore



Armatura platea principale – direzione trasversale Y superiore



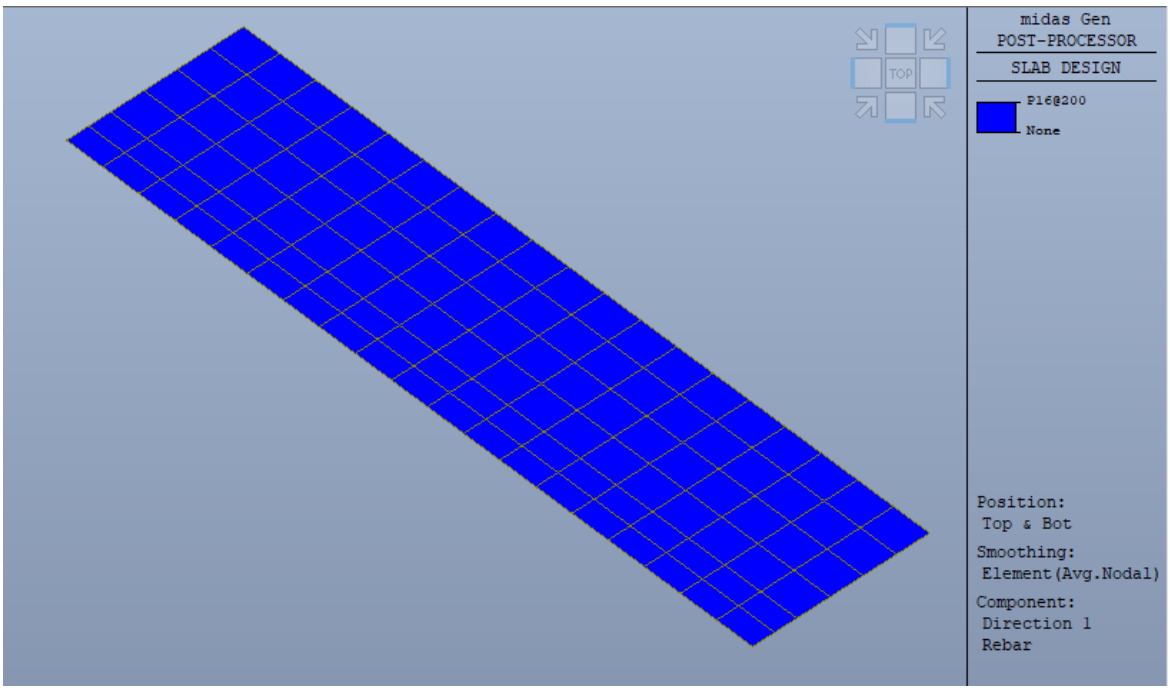
Armatura platea principale – direzione trasversale Y inferiore

Si riepilogano di seguito le armature effettivamente adottate.

- Armatura superiore direzione longitudinale X: barre correnti ϕ18/20;
- Armatura inferiore direzione longitudinale X: barre correnti ϕ18/20 con ulteriori ϕ18/20 di infittimento sotto i muri;
- Armatura superiore direzione trasversale Y: barre correnti ϕ18/10;
- Armatura inferiore direzione trasversale Y: barre correnti ϕ18/20 con ulteriori ϕ18/20 di infittimento sotto i muri.

1.6.2 Armature Platea secondaria

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



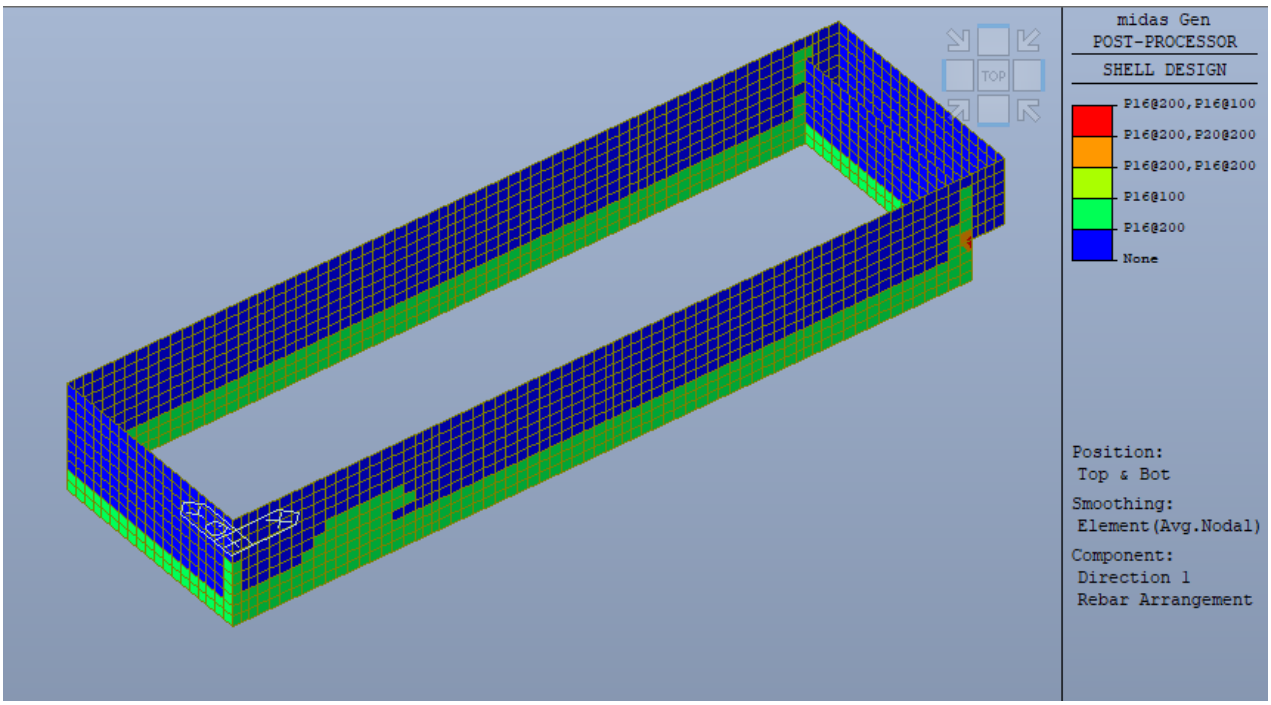
Armatura platea secondaria – direzione longitudinale X e Y ambo i lati

Si riepilogano di seguito le armature effettivamente adottate.

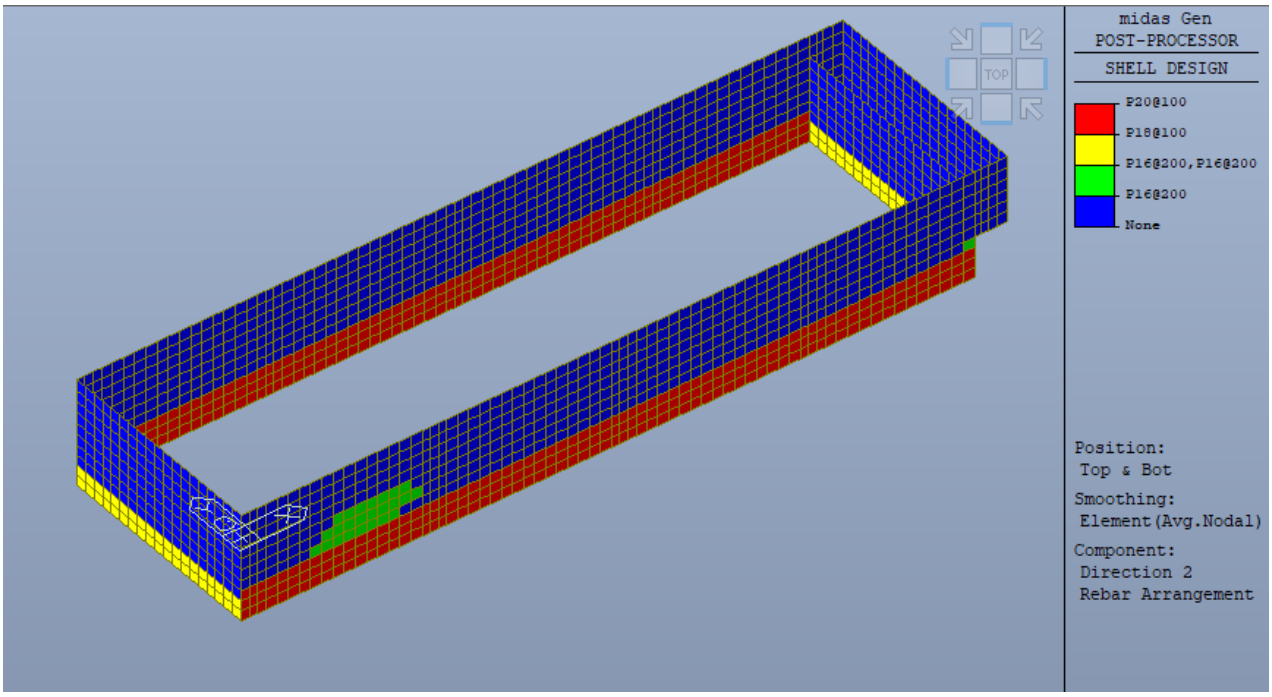
- Armatura direzione longitudinale X, inferiore e superiore: barre correnti ϕ16/20;
- Armatura direzione trasversale Y, inferiore e superiore: barre correnti ϕ16/20;

1.6.3 Armature Pareti

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



Armatura pareti – direzione orizzontale, ambo i lati



Armatura pareti – direzione verticale, ambo i lati

Si riepilogano di seguito le armature effettivamente adottate.

Le pareti esterne sui lati lunghi saranno armate come segue:

- barre orizzontali ϕ16/10 ambo i lati; staffoni negli angoli ϕ16/10
- barre verticali ϕ16/10 con riprese ϕ20/10

La parete esterna sul lato corto e la parete sullo stramazzo saranno armate come segue:

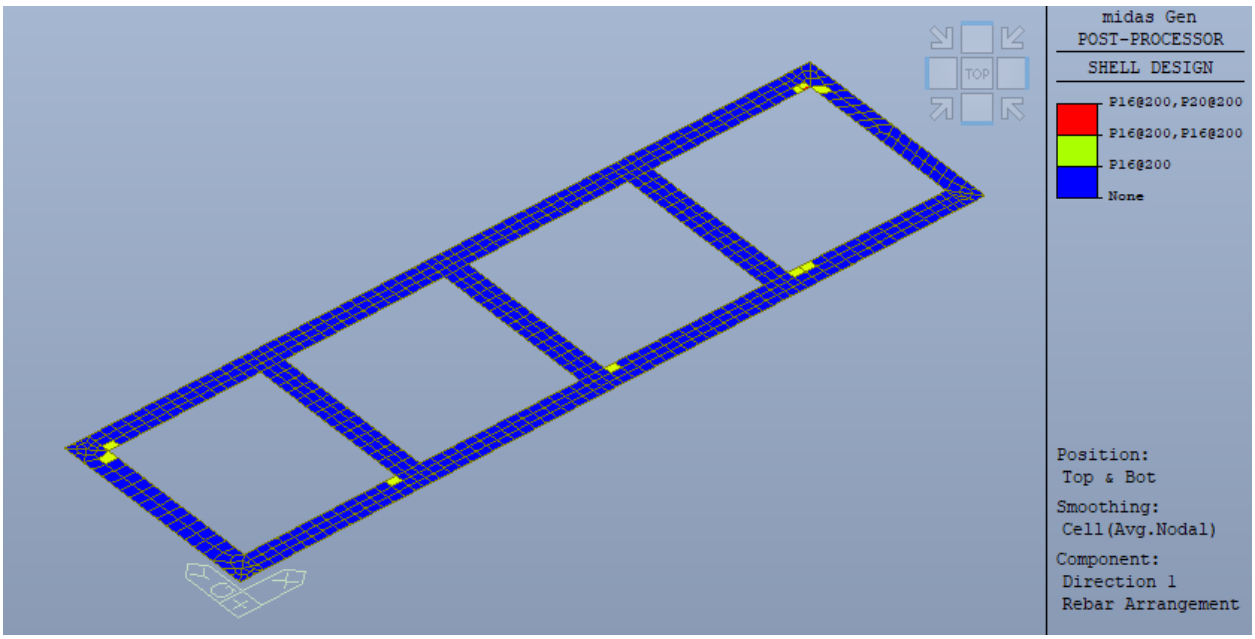
- barre orizzontali ϕ16/20 ambo i lati; staffoni negli angoli ϕ16/10
- barre verticali ϕ16/20 con riprese ϕ18/10

Le pareti esterne della porzione a valle dello stramazzo saranno armate come segue:

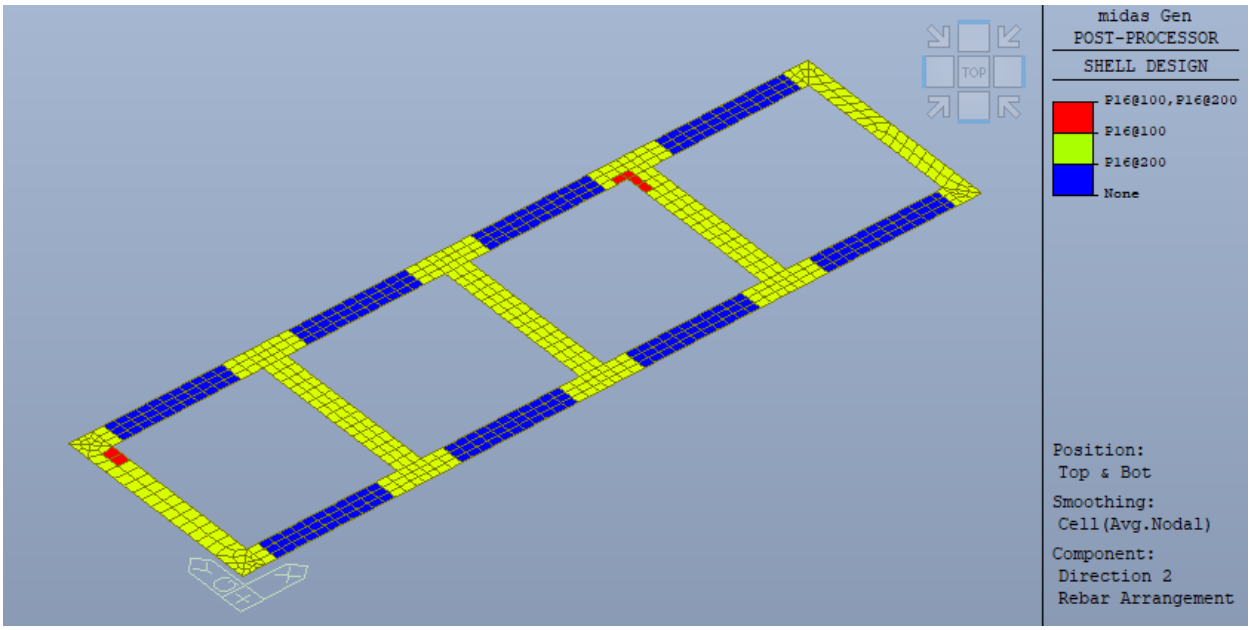
- barre orizzontali ϕ16/20
- barre verticale ϕ16/20

1.6.4 Armature Camminamento e puntoni

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



Armatura camminamento e puntoni – direzione longitudinale X, ambo i lati



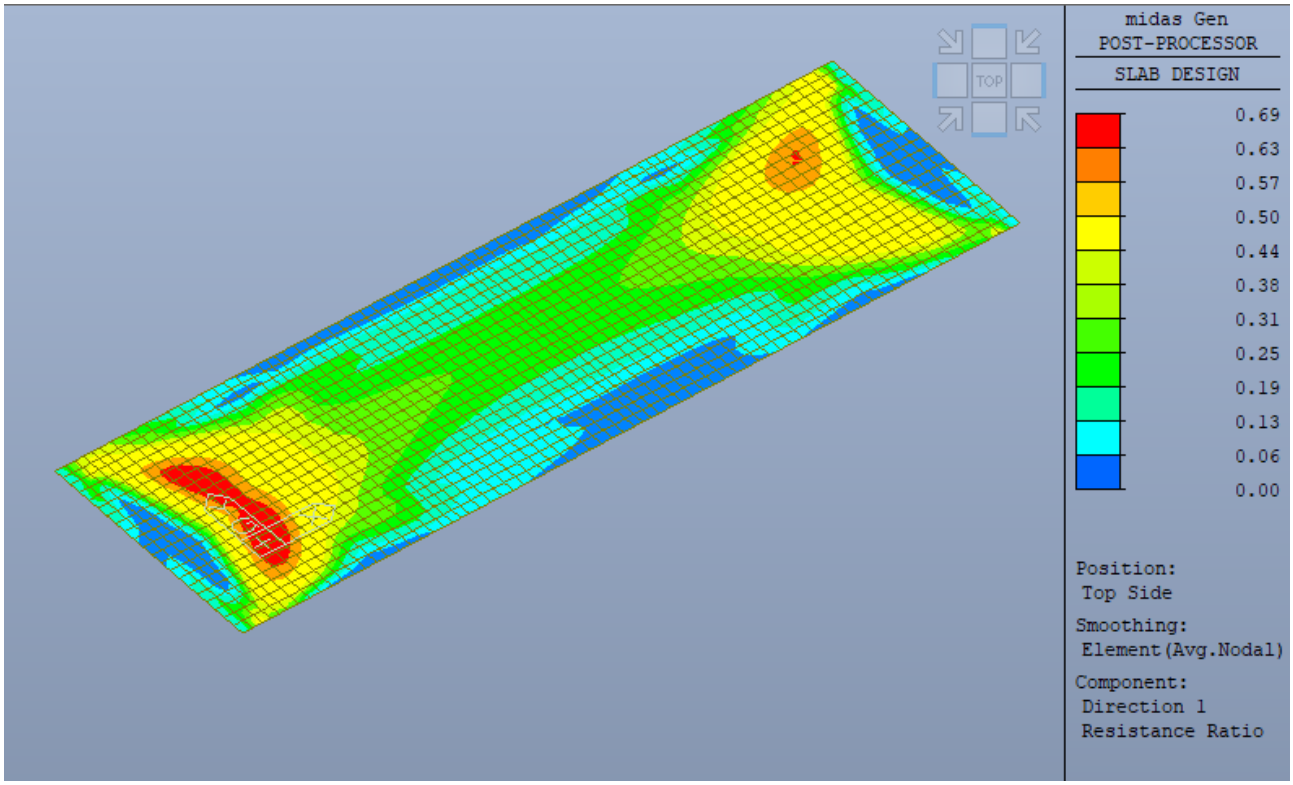
Armatura camminamento e puntoni – direzione trasversale Y, ambo i lati

Si riepilogano di seguito le armature effettivamente adottate.

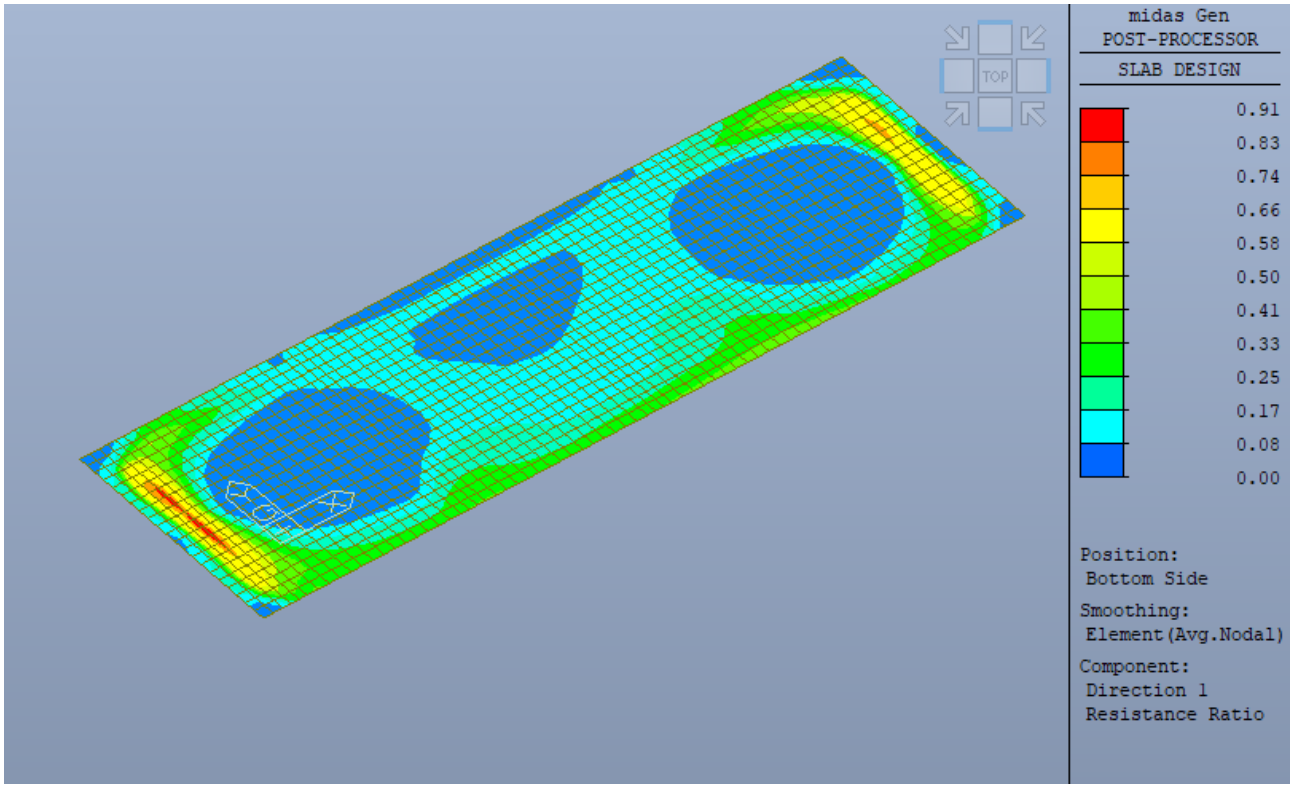
- barre in direzione longitudinale X: ϕ16/20 superiori e inferiori;
- barre in direzione trasversale Y: ϕ16/10 inferiori e superiori sui puntoni e ϕ16/20 inferiori e superiori sui camminamenti.

1.7 Verifiche di resistenza SLU grafiche

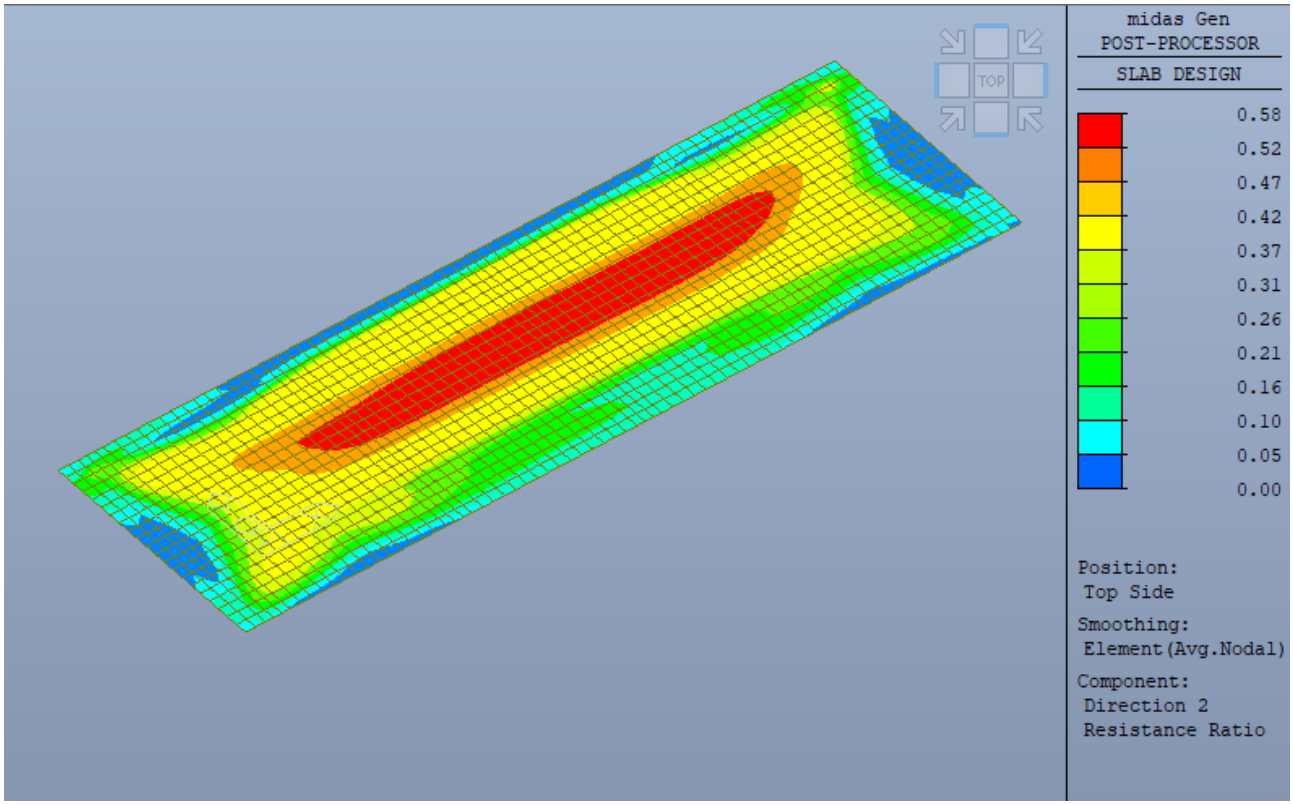
Nelle immagini seguenti vengono riportate le verifiche strutturali per via grafica, come tassi di sfruttamento dell'armatura nelle sezioni di cemento armato, sia per le sollecitazioni flessionali che taglianti:



Platea principale - Indici di resistenza a flessione direzione X superiore

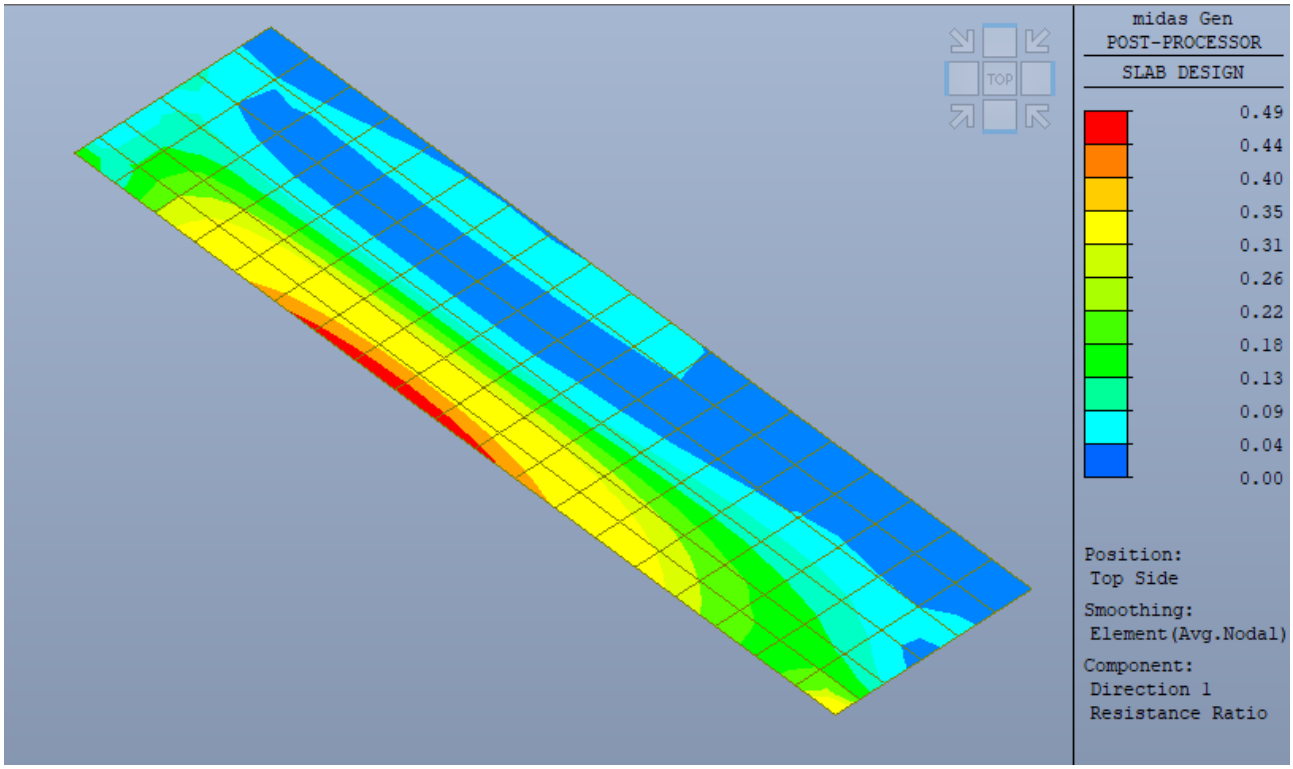


Platea principale - Indici di resistenza a flessione direzione X inferiore

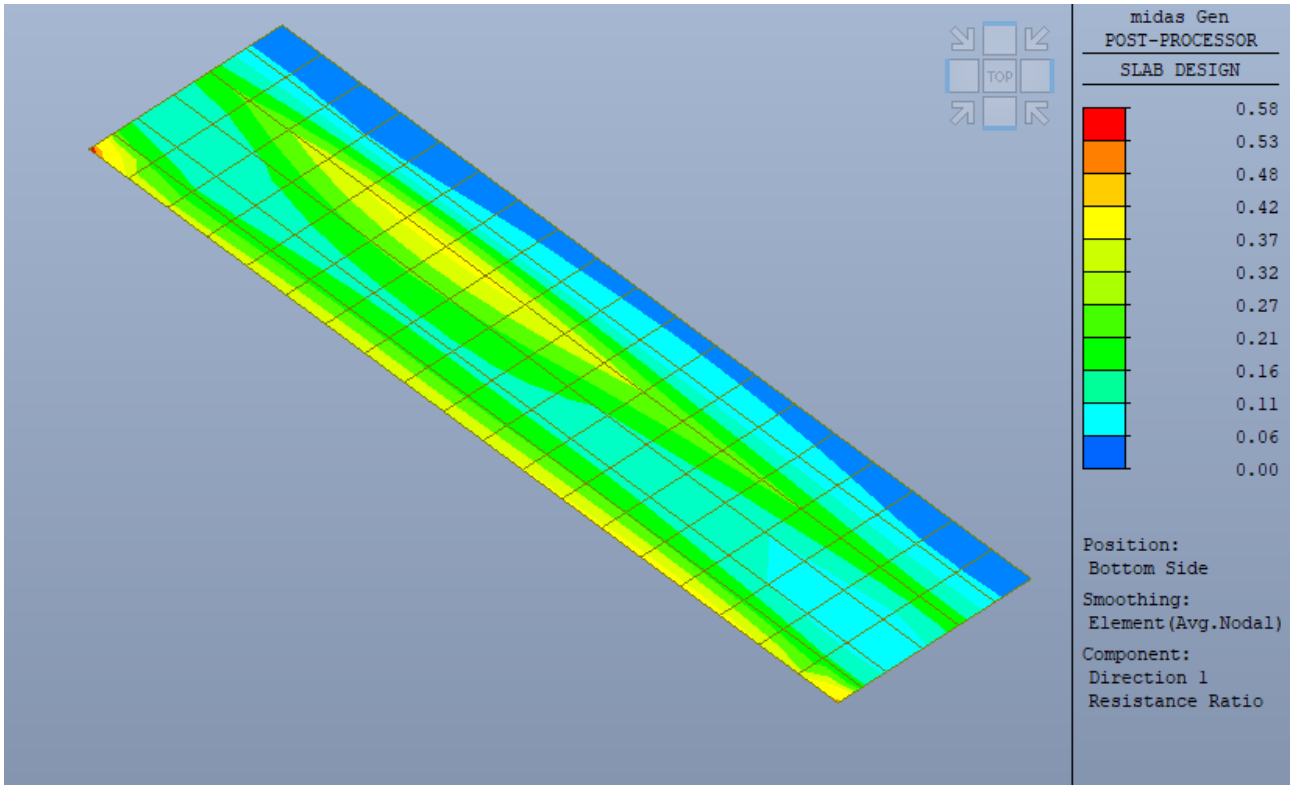


Platea principale - Indici di resistenza a flessione direzione Y superiore

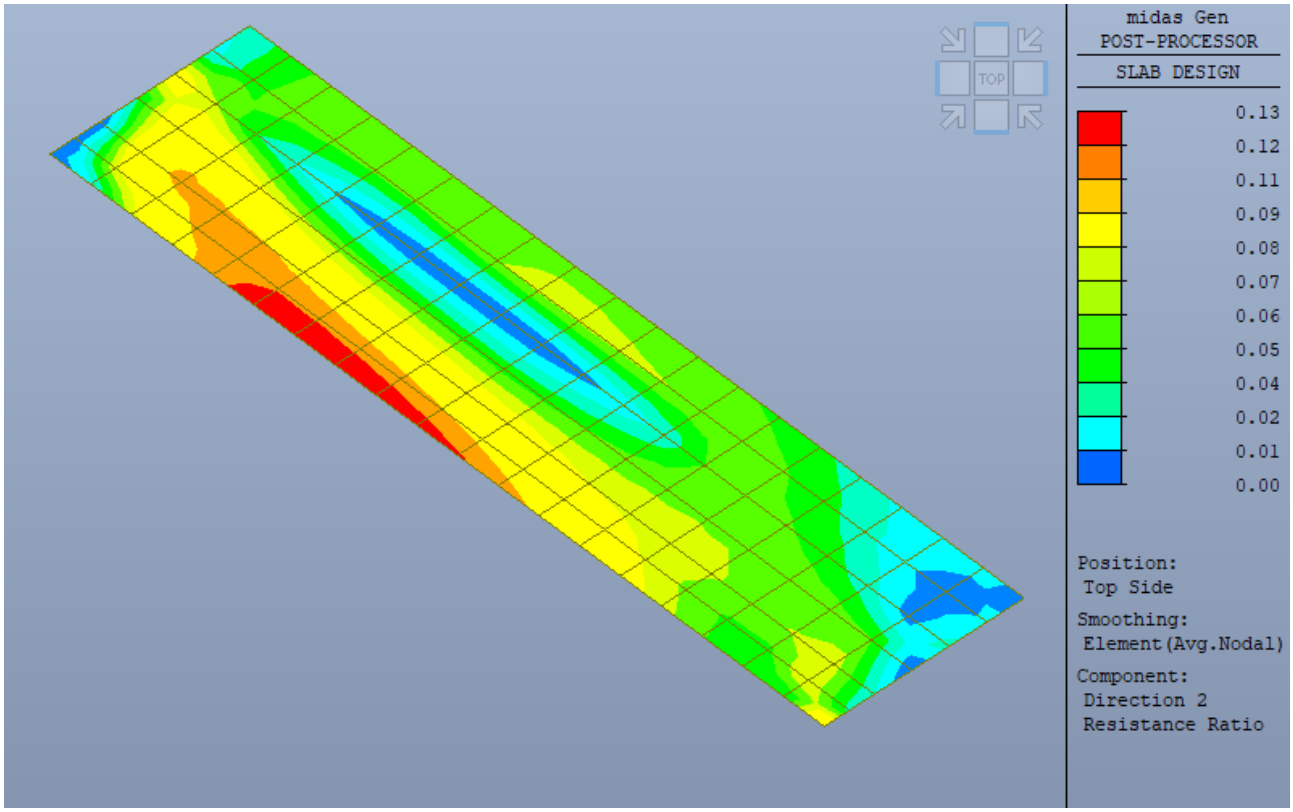
Platea principale - Indici di resistenza a flessione direzione Y inferiore



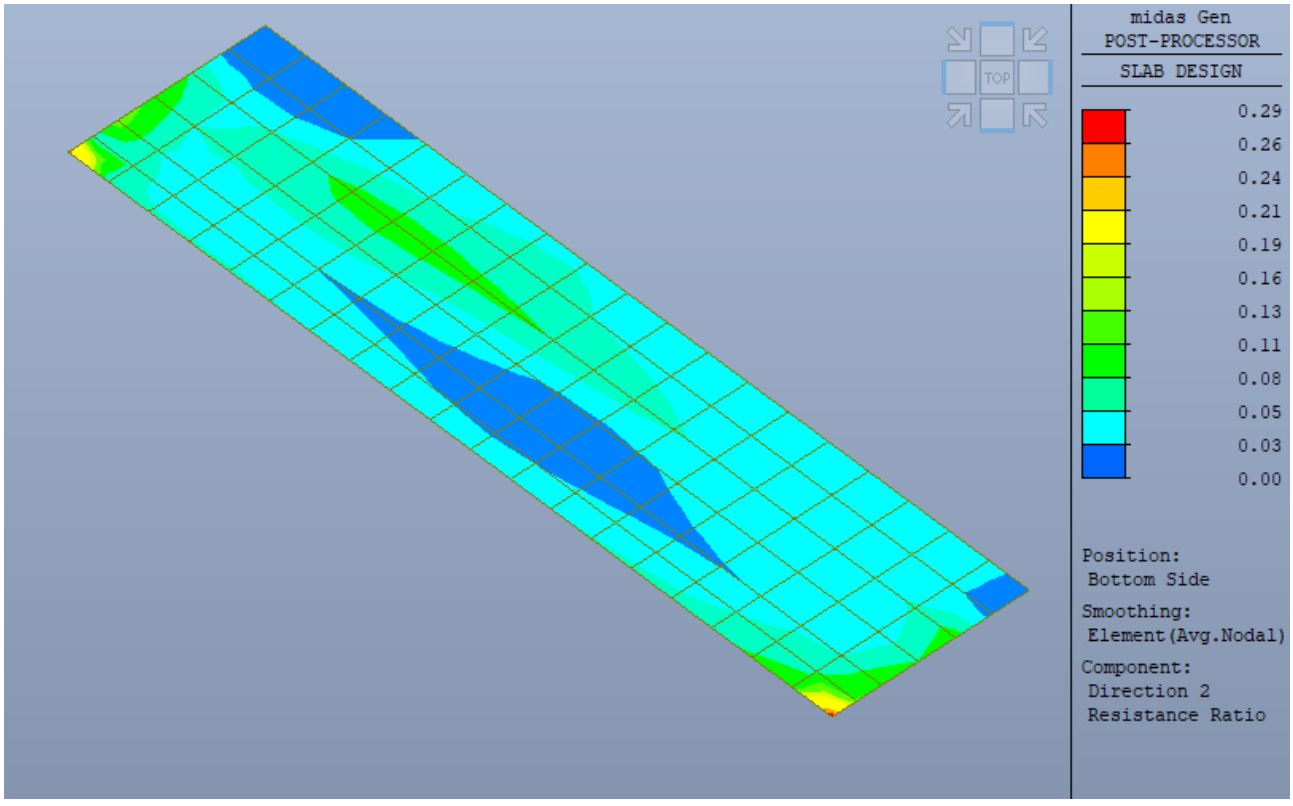
Platea secondaria - Indici di resistenza a flessione direzione X superiore



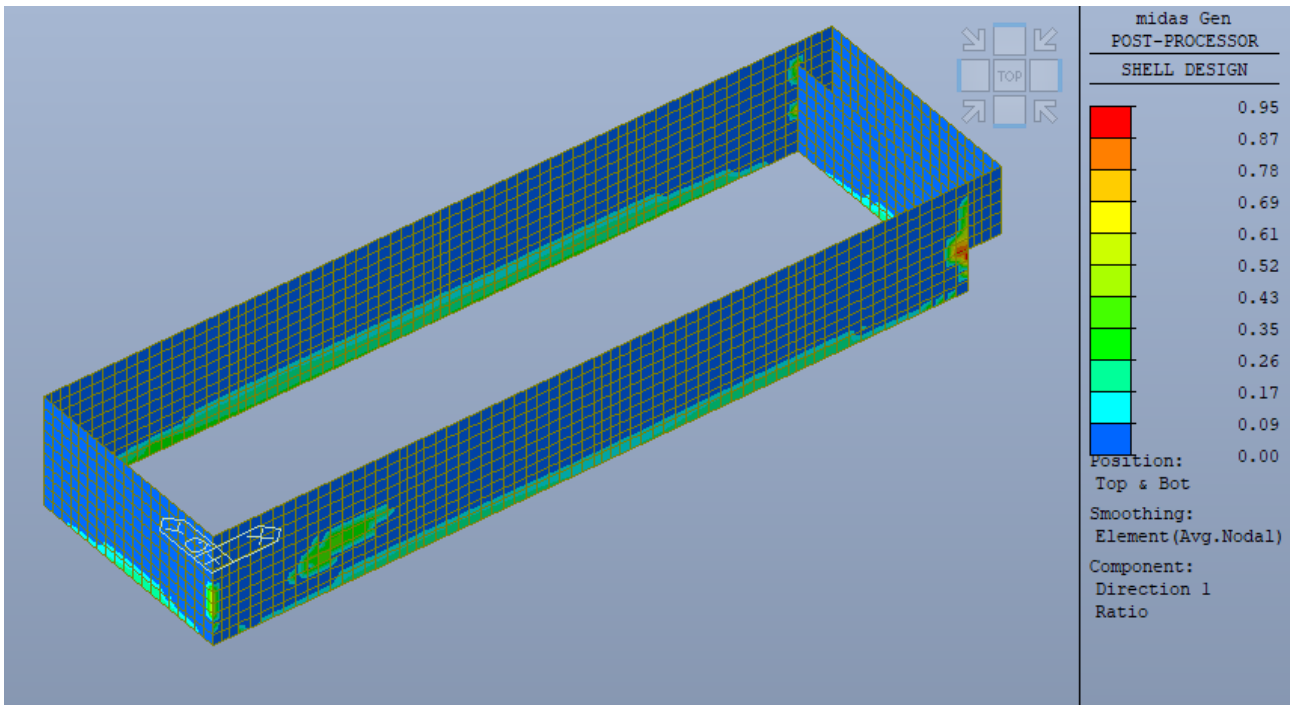
Platea secondaria - Indici di resistenza a flessione direzione X inferiore



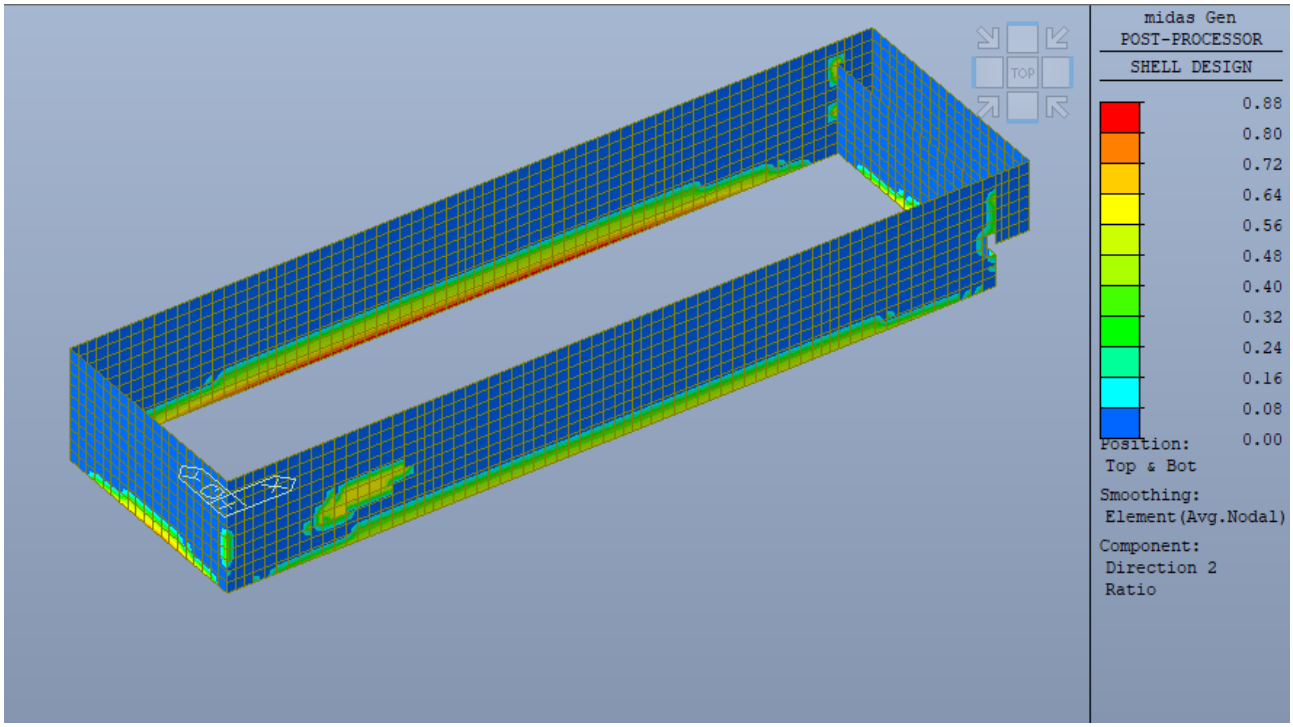
Platea secondaria - Indici di resistenza a flessione direzione Y superiore



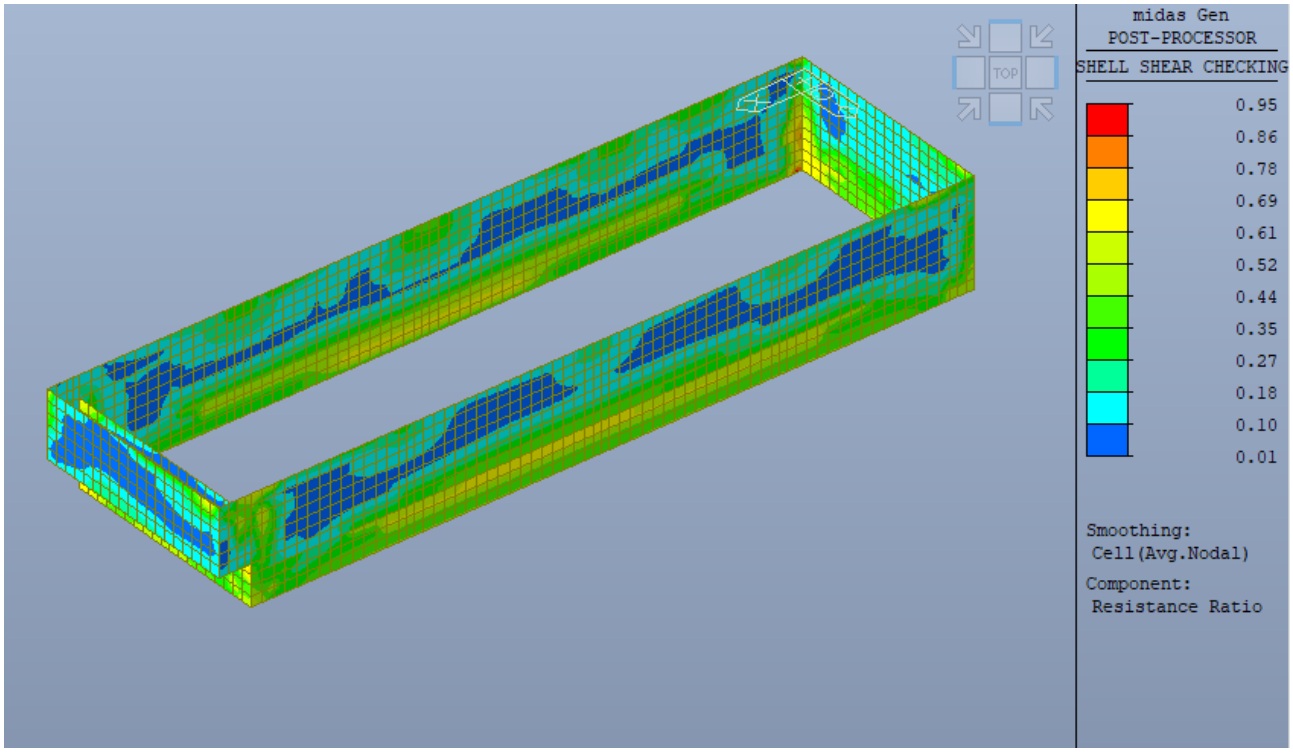
Platea secondaria - Indici di resistenza a flessione direzione Y inferiore



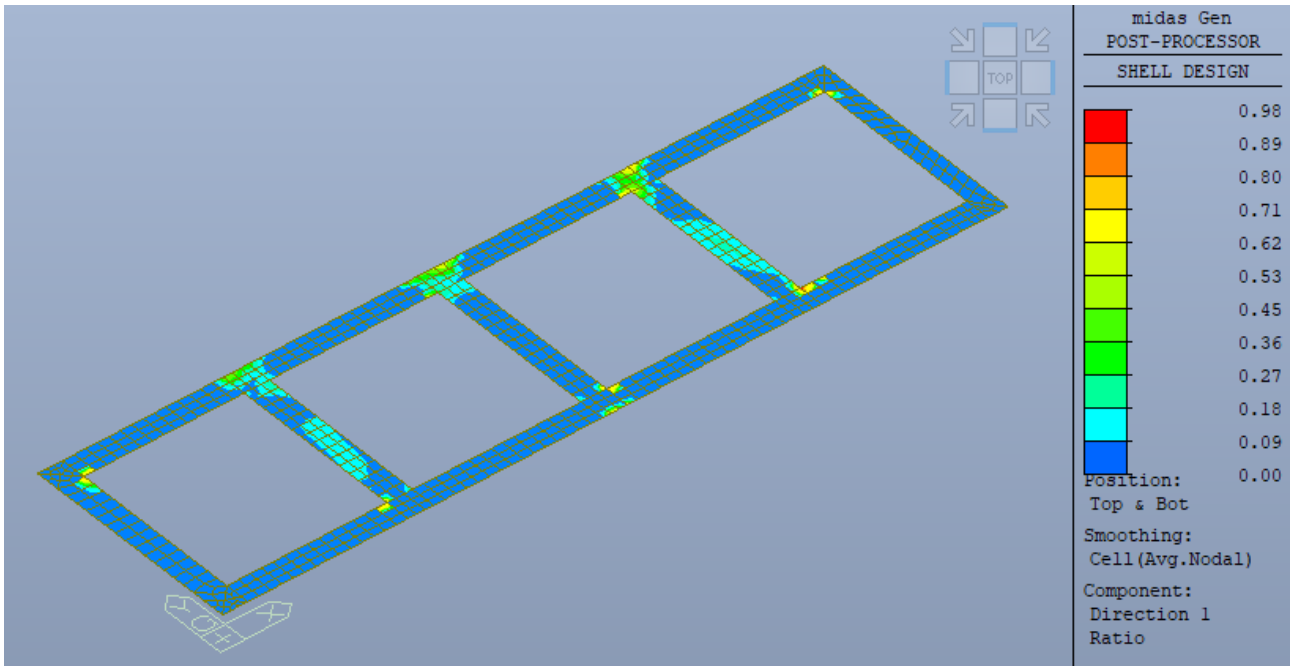
Pareti - Indici di resistenza a pressoflessione direzione orizzontale



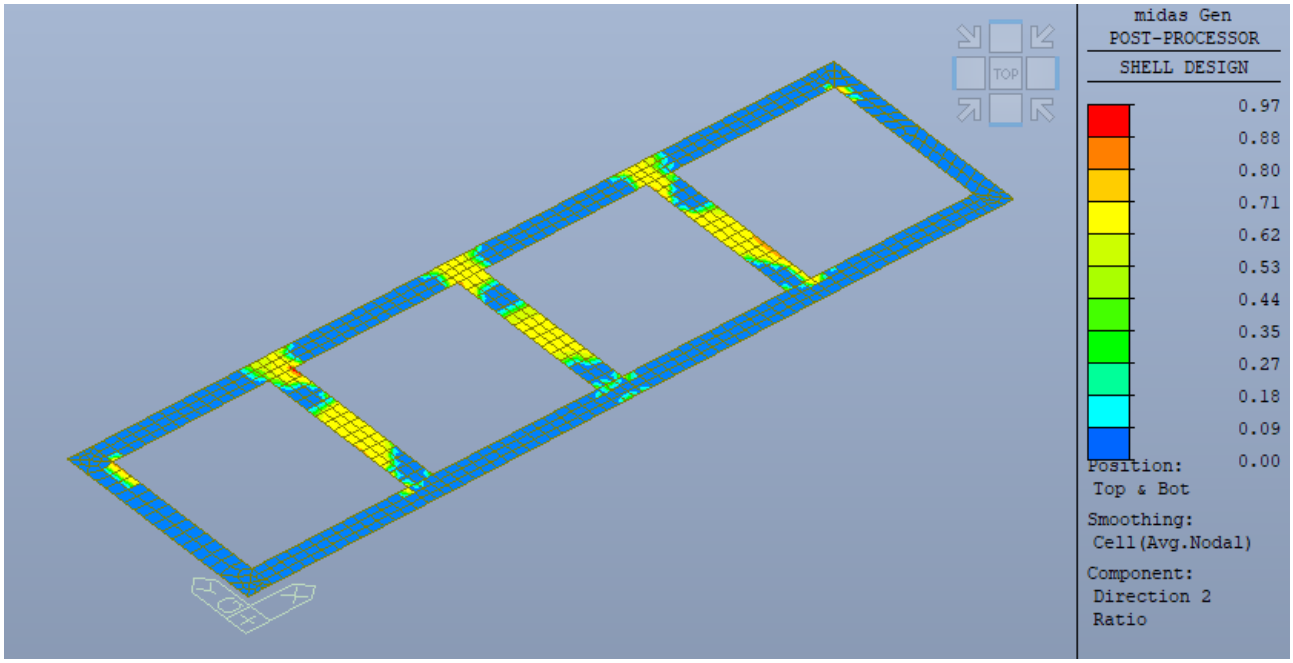
Pareti - Indici di resistenza a pressoflessione direzione verticale



Pareti - Indici di resistenza a taglio



Camminamento e Puntoni - Indici di resistenza a pressoflessione longitudinale X



Camminamento e Puntoni - Indici di resistenza a pressoflessione trasversale Y

1.8 Verifiche di resistenza SLU analitiche

1.8.1 Verifiche flessione Platea Principale

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

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

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

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

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

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

 0.7000   586 BOT 0.0012 0.0013 | 285.940(  16) 314.701 0.909  OK

        804 TOP 0.0010 0.0013 | 217.510(   2) 314.701 0.691  OK

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


<< BOTTOM >>


-. Information of Parameters.

  Elem No.  : 586

  Thickness :   0.7000 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.   :   16


-. Information of Design.

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

  d      =   0.6500 m.

  lambda   =   0.800

  a      = lambda * x  =   0.023 m.
```

eta = 1.000

Cc = eta*fcd*b*a = 0.4929 kN.

M_Rd = Cc*(d-a/2) = 314.7013 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P18 @200

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

M_Ed = 285.9401 kN-m./m.

M_Rd = 314.7013 kN-m./m.

RatM = M_Ed / M_Rd = 0.909 < 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 = 0.098 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 804

Thickness : 0.7000 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. : 2

-. Information of Design.

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

d = 0.6500 m.

lambda = 0.800

a = lambda * x = 0.023 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.4929 kN.

M_Rd = Cc*(d-a/2) = 314.7013 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P18 @200

As_req = 0.0010 m^2/m. (0.0010 m^2/m.)

M_Ed = 217.5097 kN-m./m.

M_Rd = 314.7013 kN-m./m.

RatM = M_Ed / M_Rd = 0.691 < 1.0 ---> O.K !

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

x/d = 0.034

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

x/d ratio = 0.034/ 0.450 = 0.074 ---> O.K

==========

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

==========

Thk	Elem	POS	AsReq	AsUse	M_Ed(LCB)	M_Rd	Rat	CHK
0.7000	1378	BOT	0.0023	0.0025	501.931(16)	598.978	0.838	OK
	1019	TOP	0.0016	0.0025	344.747(18)	598.978	0.576	OK

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 1378

Thickness : 0.7000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0700 m.

dT = 0.0700 m.

LCB No. : 16

-. Information of Design.

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

d = 0.6300 m.

lambda = 0.800

a = lambda * x = 0.046 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.9870 kN.

M_Rd = Cc*(d-a/2) = 598.9779 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P18 @200 / P18 @200

As_req = 0.0023 m^2/m. (0.0023 m^2/m.)

M_Ed = 501.9312 kN-m./m.

M_Rd = 598.9779 kN-m./m.

RatM = M_Ed / M_Rd = 0.838 < 1.0 ---> O.K !

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

x/d = 0.082

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

x/d ratio = 0.082/ 0.450 = 0.183 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 1019

Thickness : 0.7000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0700 m.

dT = 0.0700 m.

LCB No. : 18

-. Information of Design.

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

d = 0.6300 m.

lambda = 0.800

a = lambda * x = 0.046 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.9870 kN.

M_Rd = Cc*(d-a/2) = 598.9779 kN-m./m.

-. Information of Moments and Result.

Rein. Bar : P18 @100

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

M_Ed = 344.7470 kN-m./m.

M_Rd = 598.9779 kN-m./m.

RatM = M_Ed / M_Rd = 0.576 < 1.0 ---> O.K !

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

x/d = 0.057

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

x/d ratio = 0.057/ 0.450 = 0.126 ---> O.K

1.8.2 Verifiche flessione Platea Secondaria

==========

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

==========

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

0.7000 2081 BOT 0.0006 0.0010 | 145.400(4) 249.935 0.582 OK

2089 TOP 0.0006 0.0010 | 121.265(18) 249.935 0.485 OK

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 2081

Thickness : 0.7000 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 = 0.6500 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) = 249.9352 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 = 145.4004 kN-m./m.

M_Rd = 249.9352 kN-m./m.

RatM = M_Ed / M_Rd = 0.582 < 1.0 ---> O.K !

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

x/d = 0.023

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

x/d ratio = 0.023/ 0.450 = 0.051 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 2089

Thickness : 0.7000 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. : 18

-. Information of Design.

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

d = 0.6500 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) = 249.9352 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 = 121.2646 kN-m./m.

M_Rd = 249.9352 kN-m./m.

RatM =M_Ed / M_Rd = 0.485 < 1.0 ---> O.K !

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

x/d = 0.023

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

x/d ratio = 0.023/ 0.450 = 0.051 ---> O.K

==========

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

==========

Thk	Elem	POS	AsReq	AsUse	M_Ed(LCB)	M_Rd	Rat	CHK
0.7000	2099	BOT	0.0006	0.0010	70.3662(4)	242.823	0.290	OK
	2088	TOP	0.0006	0.0010	31.2386(18)	242.823	0.129	OK

<< BOTTOM >>

-. Information of Parameters.

Elem No. : 2099

Thickness : 0.7000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0700 m.

dT = 0.0700 m.

LCB No. : 4

-. Information of Design.

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

d = 0.6300 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3911 kN.

M_Rd = Cc*(d-a/2) = 242.8233 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 = 70.3662 kN-m./m.

M_Rd = 242.8233 kN-m./m.

RatM = M_Ed / M_Rd = 0.290 < 1.0 ---> O.K !

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

x/d = 0.023

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

x/d ratio = 0.023/ 0.450 = 0.051 ---> O.K

<< TOP >>

-. Information of Parameters.

Elem No. : 2088

Thickness : 0.7000 m.

Materials : fck = 32000.0000 KPa.

fcd = 21333.3333 KPa.

fyk = 450000.0000 KPa.

Covering : dB = 0.0700 m.

dT = 0.0700 m.

LCB No. : 18

-. Information of Design.

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

d = 0.6300 m.

lambda = 0.800

a = lambda * x = 0.018 m.

eta = 1.000

Cc = eta*fcd*b*a = 0.3911 kN.

M_Rd = Cc*(d-a/2) = 242.8233 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 = 31.2386 kN-m./m.

M_Rd = 242.8233 kN-m./m.

RatM = M_Ed / M_Rd = 0.129 < 1.0 ---> O.K !

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

x/d = 0.023

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

x/d ratio = 0.023/ 0.450 = 0.051 ---> O.K

1.8.3 Verifiche pressoflessione Pareti

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Pareti EXT Base 1.

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

( ). Information of Parameters.

-. Elem No. : 3569

-. Node No. : 1307

-. LCB No. : 8

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

-. Thickness : t = 0.6000 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 = 3193.5920 KPa.

-. Sig2 = Sig,min = 576.9097 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3853

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.0558

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 72.4255 kN/m.

-. NEdy = 366.2833 kN/m.

-. NEdxy = -152.2965 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1827.1003 KPa.

-. f'tdy = 4415.4434 KPa.

-. Sigcd = 2538.2744 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 = 0.0012 m^2/m. (0.0012 m^2/m.)

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

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0025 m^2/m. (0.0025 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0042

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 8282.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2788

-. Rat,bary = f'tdy/ftdy = 0.5331

-. Rat,conc = Sigcd/Sigcn = 0.2380

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.5331 ---> O.K.

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

( ). Information of Parameters.

-. Elem No. : 1965

-. Node No. : 2136

-. LCB No. : 18

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 6018.1470 KPa.

-. Sig2 = Sig,min = 1195.1882 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3374

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 1.0029

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 138.2861 kN/m.

-. NEdy = 688.5109 kN/m.

-. NEdxy = -37.2250 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1469.7622 KPa.

-. f'tdy = 6179.2727 KPa.

-. Sigcd = 620.4163 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0032

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

-. Asy,req = 0.0019 m^2/m. (0.0019 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0025 m^2/m. (0.0025 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0042

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 8282.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2242

-. Rat,bary = f'tdy/ftdy = 0.7461

-. Rat,conc = Sigcd/Sigcn = 0.0582

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7461 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3806

-. Node No. : 5193

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 1254.7390 KPa.

-. Sig2 = Sig,min = -130.7299 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5430

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = -0.5903

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = -72.2979 kN/m.

-. NEdy = -248.2655 kN/m.

-. NEdxy = 154.4009 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -130.7299 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.006

---

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

( ). Information of Parameters.

-. Elem No. : 370

-. Node No. : 374

-. LCB No. : 16

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

-. Thickness : t = 0.6000 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 = 5938.4568 KPa.

-. Sig2 = Sig,min = 1173.7550 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3401

-. beta = 4.6286

$$\text{PHI} = \frac{\text{alpha}*J2}{fcm^2} + \frac{\text{lambda}*\text{SQRT}[J2]}{fcm} + \frac{\text{beta}*I1}{fcm} - 1.0 = 0.9760$$

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

( ). Membrane forces.

-. NEdx = 131.7033 kN/m.

-. NEdy = 657.9304 kN/m.

-. NEdxy = 62.5361 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1628.2122 KPa.

-. f'tdy = 6134.4066 KPa.

-. Sigcd = 1042.2688 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0031

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

-. Asy,req = 0.0019 m^2/m. (0.0019 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0025 m^2/m. (0.0025 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0042

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 8282.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2484

-. Rat,bary = f'tdy/ftdy = 0.7406

-. Rat,conc = Sigcd/Sigcn = 0.0977

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7406 ---> O.K.

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Pareti EXT Base 1.

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

( ). Information of Parameters.

-. Elem No. : 3569

-. Node No. : 1307

-. LCB No. : 8

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

-. Thickness : t = 0.6000 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 = 3193.5920 KPa.

-. Sig2 = Sig,min = 576.9097 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3853

-. beta = 4.6286

$$\text{PHI} = \frac{\text{alpha}*J2}{fcm^2} + \frac{\text{lambda}*\text{SQRT}[J2]}{fcm} + \frac{\text{beta}*I1}{fcm} - 1.0 = 0.0558$$

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

( ). Membrane forces.

-. NEdx = 72.4255 kN/m.

-. NEdy = 366.2833 kN/m.

-. NEdxy = -152.2965 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1827.1003 KPa.

-. f'tdy = 4415.4434 KPa.

-. Sigcd = 2538.2744 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 = 0.0012 m^2/m. (0.0012 m^2/m.)

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

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0025 m^2/m. (0.0025 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0042

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 8282.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2788

-. Rat,bary = f'tdy/ftdy = 0.5331

-. Rat,conc = Sigcd/Sigcn = 0.2380

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.5331 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 1965

-. Node No. : 2136

-. LCB No. : 18

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 6018.1470 KPa.

-. Sig2 = Sig,min = 1195.1882 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3374

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha}*J2}{fcm^2} + \frac{\text{lambda}*\text{SQRT}[J2]}{fcm} + \frac{\text{beta}*I1}{fcm} - 1.0 = 1.0029$$

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

( ). Membrane forces.

-. NEdx = 138.2861 kN/m.

-. NEdy = 688.5109 kN/m.

-. NEdxy = -37.2250 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1469.7622 KPa.

-. f'tdy = 6179.2727 KPa.

-. Sigcd = 620.4163 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0032

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

-. Asy,req = 0.0019 m^2/m. (0.0019 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0025 m^2/m. (0.0025 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0042

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 8282.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2242

-. Rat,bary = f'tdy/ftdy = 0.7461

-. Rat,conc = Sigcd/Sigcn = 0.0582

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7461 ---> O.K.

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

( ). Information of Parameters.

-. Elem No. : 3806

-. Node No. : 5193

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 1254.7390 KPa.

-. Sig2 = Sig,min = -130.7299 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5430

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = -0.5903$$

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

( ). Membrane forces.

-. NEdx = -72.2979 kN/m.

-. NEdy = -248.2655 kN/m.

-. NEdxy = 154.4009 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -130.7299 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.006

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

( ). Information of Parameters.

-. Elem No. : 370

-. Node No. : 374

-. LCB No. : 16

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

-. Thickness : t = 0.6000 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 = 5938.4568 KPa.

-. Sig2 = Sig,min = 1173.7550 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3401

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.9760

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 131.7033 kN/m.

-. NEdy = 657.9304 kN/m.

-. NEdxy = 62.5361 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1628.2122 KPa.

-. f'tdy = 6134.4066 KPa.

-. Sigcd = 1042.2688 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0031

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

-. Asy,req = 0.0019 m^2/m. (0.0019 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P18 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0025 m^2/m. (0.0025 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0042

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 8282.6087 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2484

-. Rat,bary = f'tdy/ftdy = 0.7406

-. Rat,conc = Sigcd/Sigcn = 0.0977

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7406 ---> O.K.

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Pareti EXT Base 2.

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

( ). Information of Parameters.

-. Elem No. : 2305

-. Node No. : 1685

-. LCB No. : 18

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

-. Thickness : t = 0.6000 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 = 7298.6144 KPa.

-. Sig2 = Sig,min = 1332.1435 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.3805

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 1.4351

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 169.9222 kN/m.

-. NEdy = 851.7681 kN/m.

-. NEdxy = -66.4068 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1976.7084 KPa.

-. f'tdy = 7817.7937 KPa.

-. Sigcd = 1106.7806 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0040

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

-. Asy,req = 0.0024 m^2/m. (0.0024 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P20 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0031 m^2/m. (0.0031 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0052

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 10239.1304 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3016

-. Rat,bary = f'tdy/ftdy = 0.7635

-. Rat,conc = Sigcd/Sigcn = 0.1038

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7635 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2329

-. Node No. : 1679

-. LCB No. : 16

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 7653.2096 KPa.

-. Sig2 = Sig,min = 1237.5640 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4299

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 1.5544

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 183.1128 kN/m.

-. NEdy = 917.7223 kN/m.

-. NEdxy = -25.6582 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1745.0207 KPa.

-. f'tdy = 8032.4064 KPa.

-. Sigcd = 427.6370 KPa.

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

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

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

-. Asy,req = 0.0025 m^2/m. (0.0025 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P20 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0031 m^2/m. (0.0031 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0052

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 10239.1304 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2662

-. Rat,bary = f'tdy/ftdy = 0.7845

-. Rat,conc = Sigcd/Sigcn = 0.0401

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7845 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2049

-. Node No. : 834

-. LCB No. : 2

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

-. Thickness : t = 0.6000 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 = 3030.5113 KPa.

-. Sig2 = Sig,min = 743.9833 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.1858

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 0.0033$$

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

( ). Membrane forces.

-. NEdx = 54.7576 kN/m.

-. NEdy = 259.3649 kN/m.

-. NEdxy = -169.9011 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1879.4541 KPa.

-. f'tdy = 3654.9822 KPa.

-. Sigcd = 2831.6843 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 = 0.0012 m^2/m. (0.0012 m^2/m.)

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

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P20 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0031 m^2/m. (0.0031 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0052

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 10239.1304 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.2867

-. Rat,bary = f'tdy/ftdy = 0.3570

-. Rat,conc = Sigcd/Sigcn = 0.2655

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.3570 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2507

-. Node No. : 2120

-. LCB No. : 17

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

-. Thickness : t = 0.6000 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 = 4301.2700 KPa.

-. Sig2 = Sig,min = 570.5030 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4872

-. beta = 4.6286

$$\text{PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.4239$$

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

( ). Membrane forces.

-. NEdx = -136.3845 kN/m.

-. NEdy = -688.6162 kN/m.

-. NEdxy = -138.7865 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = -860.0580 KPa.

-. f'tdy = 0.0000 KPa.

-. Sigcd = 5971.5654 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 = 0.0012 m^2/m. (0.0012 m^2/m.)

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

( ). Rebar Arrangement.

-. Rebar,x : P16 @100

-. Rebar,y : P20 @100

( ). Tensile strengths provided by reinforcement.

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

-. Asy,use = 0.0031 m^2/m. (0.0031 m^2/m.)

-. rhox,use = 0.0034

-. rhoy,use = 0.0052

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 10239.1304 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1312

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

-. Rat,conc = Sigcd/Sigcn = 0.5598

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.5598 ---> O.K.

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

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 2125

-. LCB No. : 70

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 2000.7810 KPa.

-. Sig2 = Sig,min = -369.2280 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4427

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = -0.3466$$

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

( ). Membrane forces.

-. NEdx = -21.8596 kN/m.

-. NEdy = -172.4705 kN/m.

-. NEdxy = 94.1604 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1278.5787 KPa.

-. alpha = 0.4690(the ratio between the two principal stress)

$$\text{-. Sig,cdmax} = 0.85\text{fcd} * \frac{1+3.80*\text{alpha}}{(1+\text{alpha})^2} = 23378.8066 \text{ KPa.}$$

-. Rat,con = Sig,min/Sig,cdmax = 0.055

---

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

( ). Information of Parameters.

-. Elem No. : 2491

-. Node No. : 2125

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 2000.7810 KPa.

-. Sig2 = Sig,min = -369.2280 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4427

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = -0.3466$$

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

( ). Membrane forces.

-. NEdx = -21.8596 kN/m.

-. NEdy = -172.4705 kN/m.

-. NEdxy = 94.1604 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1278.5787 KPa.

-. alpha = 0.4690(the ratio between the two principal stress)

$$\text{Sig,cdmax} = 0.85 f_{cd} * \frac{1+3.80*\text{alpha}}{(1+\text{alpha})^2} = 23378.8066 \text{ KPa.}$$

-. Rat,con = Sig,min/Sig,cdmax = 0.055

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

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

( ). Information of Parameters.

-. Elem No. : 1930

-. Node No. : 2437

-. LCB No. : 2

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

-. Thickness : t = 0.6000 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 = 3078.4800 KPa.

-. Sig2 = Sig,min = 736.0051 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.2089

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.0191

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 145.6215 kN/m.

-. NEdy = 253.4564 kN/m.

-. NEdxy = -112.3283 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2128.4465 KPa.

-. f'tdy = 3114.4715 KPa.

-. Sigcd = 1872.1389 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0016

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

-. Asy,req = 0.0010 m^2/m. (0.0010 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3247

-. Rat,bary = f'tdy/ftdy = 0.9504

-. Rat,conc = Sigcd/Sigcn = 0.1755

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9504 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 1930

-. Node No. : 2437

-. LCB No. : 2

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3078.4800 KPa.

-. Sig2 = Sig,min = 736.0051 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.2089

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.0191

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 145.6215 kN/m.

-. NEdy = 253.4564 kN/m.

-. NEdxy = -112.3283 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2128.4465 KPa.

-. f'tdy = 3114.4715 KPa.

-. Sigcd = 1872.1389 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0016

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

-. Asy,req = 0.0010 m^2/m. (0.0010 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.3247

-. Rat,bary = f'tdy/ftdy = 0.9504

-. Rat,conc = Sigcd/Sigcn = 0.1755

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9504 ---> O.K.

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

( ). Information of Parameters.

-. Elem No. : 1930

-. Node No. : 2435

-. LCB No. : 2

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

-. Thickness : t = 0.6000 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 = 4095.4469 KPa.

-. Sig2 = Sig,min = 1442.8055 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.6881

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.3629

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = -338.4645 kN/m.

-. NEdy = 32.5768 kN/m.

-. NEdxy = -179.0779 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 0.0000 KPa.

-. f'tdy = 1008.1700 KPa.

-. Sigcd = 3610.1052 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 = 0.0012 m^2/m. (0.0012 m^2/m.)

-. Asy,req = 0.0006 m^2/m. (0.0006 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 = 0.0017

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 3277.1739 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

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

-. Rat,bary = f'tdy/ftdy = 0.3076

-. Rat,conc = Sigcd/Sigcn = 0.3384

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.3384 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2970

-. Node No. : 59

-. LCB No. : 8

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

-. Thickness : t = 0.6000 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 = 5334.0816 KPa.

-. Sig2 = Sig,min = 411.8568 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5613

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.7680

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 938.2593 kN/m.

-. NEdy = 106.2093 kN/m.

-. NEdxy = 165.9731 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 9036.7332 KPa.

-. f'tdy = 2301.1357 KPa.

-. Sigcd = 2766.2182 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0046

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

-. Asx,req = 0.0028 m^2/m. (0.0028 m^2/m.)

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

( ). Rebar Arrangement.

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

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

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

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

-. rhox,use = 0.0050

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 9831.5217 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9192

-. Rat,bary = f'tdy/ftdy = 0.7022

-. Rat,conc = Sigcd/Sigcn = 0.2593

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9192 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 1930

-. Node No. : 2435

-. LCB No. : 2

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 4095.4469 KPa.

-. Sig2 = Sig,min = 1442.8055 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.6881

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.3629$$

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

( ). Membrane forces.

-. NEdx = 517.1234 kN/m.

-. NEdy = 217.5893 kN/m.

-. NEdxy = -201.5845 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5959.4564 KPa.

-. f'tdy = 3545.9868 KPa.

-. Sigcd = 3359.7424 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0030

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

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

-. Asy,req = 0.0011 m^2/m. (0.0011 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 = 0.0034

-. rhoy,use = 0.0034

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 6554.3478 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9092

-. Rat,bary = f'tdy/ftdy = 0.5410

-. Rat,conc = Sigcd/Sigcn = 0.3150

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9092 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3022

-. Node No. : 4018

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 468.6222 KPa.

-. Sig2 = Sig,min = -19.1936 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5876

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = -0.8470$$

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

( ). Membrane forces.

-. NEdx = 36.3612 kN/m.

-. NEdy = -14.4312 kN/m.

-. NEdxy = 31.8368 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -223.9659 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.010

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

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

( ). Information of Parameters.

-. Elem No. : 2968

-. Node No. : 3932

-. LCB No. : 16

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

-. Thickness : t = 0.6000 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 = 3627.2514 KPa.

-. Sig2 = Sig,min = -57.8551 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5951

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.1948$$

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

( ). Membrane forces.

-. NEdx = 653.4335 kN/m.

-. NEdy = 16.9447 kN/m.

-. NEdxy = -72.0828 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5987.8729 KPa.

-. f'tdy = 731.4561 KPa.

-. Sigcd = 1201.3792 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0031

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

-. Asx,req = 0.0018 m^2/m. (0.0018 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9136

-. Rat,bary = f'tdy/ftdy = 0.2232

-. Rat,conc = Sigcd/Sigcn = 0.1126

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9136 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 1646

-. Node No. : 25

-. LCB No. : 16

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3983.8627 KPa.

-. Sig2 = Sig,min = 1500.5725 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.5438

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha}*J2}{fcm^2} + \frac{\text{lambda}*\text{SQRT}[J2]}{fcm} + \frac{\text{beta}*I1}{fcm} - 1.0 = 0.3263$$

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

( ). Membrane forces.

-. NEdx = 423.2132 kN/m.

-. NEdy = 221.4570 kN/m.

-. NEdxy = -83.2442 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 4200.1243 KPa.

-. f'tdy = 2594.3764 KPa.

-. Sigcd = 1387.4032 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0013

-. Asx,req = 0.0013 m^2/m. (0.0013 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

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

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

( ). Information of Parameters.

-. Elem No. : 2480

-. Node No. : 3186

-. LCB No. : 16

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

-. Thickness : t = 0.6000 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 = 3583.8333 KPa.

-. Sig2 = Sig,min = 992.9785 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.0612

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.1889

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 633.7757 kN/m.

-. NEdy = 144.4591 kN/m.

-. NEdxy = -89.3666 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5929.2087 KPa.

-. f'tdy = 1990.9071 KPa.

-. Sigcd = 1489.4434 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 = 0.0018 m^2/m. (0.0018 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9046

-. Rat,bary = f'tdy/ftdy = 0.6075

-. Rat,conc = Sigcd/Sigcn = 0.1396

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9046 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2480

-. Node No. : 3186

-. LCB No. : 16

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3583.8333 KPa.

-. Sig2 = Sig,min = 992.9785 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.0612

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.1889

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 633.7757 kN/m.

-. NEdy = 144.4591 kN/m.

-. NEdxy = -89.3666 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5929.2087 KPa.

-. f'tdy = 1990.9071 KPa.

-. Sigcd = 1489.4434 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 = 0.0018 m^2/m. (0.0018 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9046

-. Rat,bary = f'tdy/ftdy = 0.6075

-. Rat,conc = Sigcd/Sigcn = 0.1396

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9046 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2453

-. Node No. : 3054

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 217.3523 KPa.

-. Sig2 = Sig,min = -111.8942 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.7574

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = -0.9301

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 10.3567 kN/m.

-. NEdy = -41.0889 kN/m.

-. NEdxy = -54.1627 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -292.4416 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.014

---

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

( ). Information of Parameters.

-. Elem No. : 2478

-. Node No. : 3185

-. LCB No. : 16

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

-. Thickness : t = 0.6000 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 = 3091.8395 KPa.

-. Sig2 = Sig,min = 957.5295 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9128

-. beta = 4.6286

$$\text{PHI} = \frac{\text{alpha}*J2}{fcm^2} + \frac{\text{lambda}*\text{SQRT}[J2]}{fcm} + \frac{\text{beta}*I1}{fcm} - 1.0 = 0.0256$$

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

( ). Membrane forces.

-. NEdx = 143.2635 kN/m.

-. NEdy = -105.2903 kN/m.

-. NEdxy = 21.5879 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1305.9293 KPa.

-. f'tdy = 0.0000 KPa.

-. Sigcd = 914.3046 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 = 0.0012 m^2/m. (0.0012 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1992

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

-. Rat,conc = Sigcd/Sigcn = 0.0857

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.1992 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2453

-. Node No. : 3054

-. LCB No. : 70

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 217.3523 KPa.

-. Sig2 = Sig,min = -111.8942 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.7574

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha}*J2}{fcm^2} + \frac{\text{lambda}*\text{SQRT}[J2]}{fcm} + \frac{\text{beta}*I1}{fcm} - 1.0 = -0.9301$$

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

( ). Membrane forces.

-. NEdx = 41.5614 kN/m.

-. NEdy = -38.3603 kN/m.

-. NEdxy = -23.4744 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -111.8942 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.005

---

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

( ). Information of Parameters.

-. Elem No. : 2453

-. Node No. : 3054

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 217.3523 KPa.

-. Sig2 = Sig,min = -111.8942 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.7574

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = -0.9301$$

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

( ). Membrane forces.

-. NEdx = 41.5614 kN/m.

-. NEdy = -38.3603 kN/m.

-. NEdxy = -23.4744 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -111.8942 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.005

( ). 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.6408

-. Rat,bary = f'tdy/ftdy = 0.7917

-. Rat,conc = Sigcd/Sigcn = 0.1301

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7917 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2668

-. Node No. : 3512

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 830.6600 KPa.

-. Sig2 = Sig,min = -827.9633 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.6480

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = -0.7357$$

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

( ). Membrane forces.

-. NEdx = -274.6446 kN/m.

-. NEdy = 85.8123 kN/m.

-. NEdxy = -20.0512 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -827.9633 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.039

---

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

( ). Information of Parameters.

-. Elem No. : 2484

-. Node No. : 36

-. LCB No. : 50

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

-. Thickness : t = 0.6000 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 = 4304.9666 KPa.

-. Sig2 = Sig,min = 1329.4701 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.9170

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.4315$$

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

( ). Membrane forces.

-. NEdx = 617.3359 kN/m.

-. NEdy = 176.3024 kN/m.

-. NEdxy = 86.6993 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5786.9213 KPa.

-. f'tdy = 2220.3736 KPa.

-. Sigcd = 1444.9890 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0030

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0011

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

-. Asy,req = 0.0007 m^2/m. (0.0007 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.8829

-. Rat,bary = f'tdy/ftdy = 0.6775

-. Rat,conc = Sigcd/Sigcn = 0.1355

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.8829 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2484

-. Node No. : 36

-. LCB No. : 70

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3739.0321 KPa.

-. Sig2 = Sig,min = 1050.7034 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.0444

-. beta = 4.6286

$$\text{PHI} = \frac{\text{alpha}*J2}{fcm^2} + \frac{\text{lambda}*\text{SQRT}[J2]}{fcm} + \frac{\text{beta}*I1}{fcm} - 1.0 = 0.2409$$

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

( ). Membrane forces.

-. NEdx = 548.3799 kN/m.

-. NEdy = 182.9732 kN/m.

-. NEdxy = 111.5608 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 5440.1591 KPa.

-. f'tdy = 2482.1056 KPa.

-. Sigcd = 1859.3475 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0028

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0013

-. 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.8300

-. Rat,bary = f'tdy/ftdy = 0.7574

-. Rat,conc = Sigcd/Sigcn = 0.1743

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.8300 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 2668

-. Node No. : 3512

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 830.6600 KPa.

-. Sig2 = Sig,min = -827.9633 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 12.6480

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = -0.7357$$

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

( ). Membrane forces.

-. NEdx = -306.4542 kN/m.

-. NEdy = -143.2137 kN/m.

-. NEdxy = -20.6531 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1145.6581 KPa.

-. alpha = 0.8446(the ratio between the two principal stress)

-. Sig,cdmax = 0.85fcd * $\frac{1+3.80*alpha}{(1+alpha)^2}$ 22433.5690 KPa.

-. Rat,con = Sig,min/Sig,cdmax = 0.051

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

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

( ). Information of Parameters.

-. Elem No. : 168

-. Node No. : 78

-. LCB No. : 2

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

-. Thickness : t = 0.6000 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 = 6059.1721 KPa.

-. Sig2 = Sig,min = 1407.4222 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.2325

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 1.0183

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 894.6239 kN/m.

-. NEdy = 249.9331 kN/m.

-. NEdxy = 107.0622 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 8216.3699 KPa.

-. f'tdy = 3015.4896 KPa.

-. Sigcd = 1784.3696 KPa.

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

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

-. Asx,req = 0.0025 m^2/m. (0.0025 m^2/m.)

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

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P20 @200

-. Rebar,y : P16 @200

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0026 m^2/m. (0.0026 m^2/m.)

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

-. rhox,use = 0.0043

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 8396.7391 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9785

-. Rat,bary = f'tdy/ftdy = 0.9201

-. Rat,conc = Sigcd/Sigcn = 0.1673

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9785 ---> O.K.

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

( ). Information of Parameters.

-. Elem No. : 3760

-. Node No. : 2435

-. LCB No. : 2

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3814.4609 KPa.

-. Sig2 = Sig,min = 197.3090 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5810

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.2590

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 553.5431 kN/m.

-. NEdy = 209.1594 kN/m.

-. NEdxy = 230.6399 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 6421.1787 KPa.

-. f'tdy = 3680.7290 KPa.

-. Sigcd = 3843.9977 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0033

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

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

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

( ). Rebar Arrangement.

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

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

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Pareti-Parete Ext 4.

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

( ). Information of Parameters.

-. Elem No. : 470

-. Node No. : 64

-. LCB No. : 2

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

-. Thickness : t = 0.6000 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 = 3091.4505 KPa.

-. Sig2 = Sig,min = 977.4302 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.8809

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 0.0256$$

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

( ). Membrane forces.

-. NEdx = 432.8162 kN/m.

-. NEdy = 123.2096 kN/m.

-. NEdxy = -12.7150 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3680.9752 KPa.

-. f'tdy = 1149.6053 KPa.

-. Sigcd = 211.9165 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 = 0.0012 m^2/m. (0.0012 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5616

-. Rat,bary = f'tdy/ftdy = 0.3508

-. Rat,conc = Sigcd/Sigcn = 0.0199

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.5616 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 470

-. Node No. : 64

-. LCB No. : 2

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3091.4505 KPa.

-. Sig2 = Sig,min = 977.4302 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.8809

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 0.0256$$

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

( ). Membrane forces.

-. NEdx = 432.8162 kN/m.

-. NEdy = 123.2096 kN/m.

-. NEdxy = -12.7150 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 3680.9752 KPa.

-. f'tdy = 1149.6053 KPa.

-. Sigcd = 211.9165 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 = 0.0012 m^2/m. (0.0012 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.5616

-. Rat,bary = f'tdy/ftdy = 0.3508

-. Rat,conc = Sigcd/Sigcn = 0.0199

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.5616 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 392

-. Node No. : 529

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 746.1032 KPa.

-. Sig2 = Sig,min = -477.7690 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.4575

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = -0.7604$$

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

( ). Membrane forces.

-. NEdx = 127.7032 kN/m.

-. NEdy = -60.3454 kN/m.

-. NEdxy = -73.2843 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -345.9754 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.016

---

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

( ). Information of Parameters.

-. Elem No. : 392

-. Node No. : 529

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 746.1032 KPa.

-. Sig2 = Sig,min = -477.7690 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.4575

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = -0.7604

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = -16.7475 kN/m.

-. NEdy = 26.6878 kN/m.

-. NEdxy = -46.9800 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -477.7690 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.022

---

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

( ). Information of Parameters.

-. Elem No. : 470

-. Node No. : 64

-. LCB No. : 2

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3091.4505 KPa.

-. Sig2 = Sig,min = 977.4302 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.8809

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = 0.0256

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = -242.1101 kN/m.

-. NEdy = 7.0071 kN/m.

-. NEdxy = -92.8759 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 0.0000 KPa.

-. f'tdy = 338.3939 KPa.

-. Sigcd = 2314.4855 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 = 0.0012 m^2/m. (0.0012 m^2/m.)

-. Asy,req = 0.0006 m^2/m. (0.0006 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 = 0.0017

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 3277.1739 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

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

-. Rat,bary = f'tdy/ftdy = 0.1033

-. Rat,conc = Sigcd/Sigcn = 0.2170

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.2170 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 392

-. Node No. : 529

-. LCB No. : 70

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

-. Thickness : t = 0.6000 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 = 746.1032 KPa.

-. Sig2 = Sig,min = -477.7690 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 13.4575

-. beta = 4.6286

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

-. PHI = -------- + ---------- + -------- - 1.0 = -0.7604

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = -16.7475 kN/m.

-. NEdy = 26.6878 kN/m.

-. NEdxy = -46.9800 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -477.7690 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.022

( ). 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 = 0.0034

-. rhoy,use = 0.0034

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 6554.3478 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9797

-. Rat,bary = f'tdy/ftdy = 0.5616

-. Rat,conc = Sigcd/Sigcn = 0.3604

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9797 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3760

-. Node No. : 2435

-. LCB No. : 2

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

-. Thickness : t = 0.6000 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 = 3814.4609 KPa.

-. Sig2 = Sig,min = 197.3090 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5810

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 0.2590$$

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

( ). Membrane forces.

-. NEdx = 553.5431 kN/m.

-. NEdy = 209.1594 kN/m.

-. NEdxy = 230.6399 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 6421.1787 KPa.

-. f'tdy = 3680.7290 KPa.

-. Sigcd = 3843.9977 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0033

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

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

-. Asy,req = 0.0011 m^2/m. (0.0011 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 = 0.0034

-. rhoy,use = 0.0034

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 6554.3478 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.9797

-. Rat,bary = f'tdy/ftdy = 0.5616

-. Rat,conc = Sigcd/Sigcn = 0.3604

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.9797 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 168

-. Node No. : 196

-. LCB No. : 2

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

-. Thickness : t = 0.6000 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 = 3249.0112 KPa.

-. Sig2 = Sig,min = 184.1513 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5778

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 0.0710$$

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

( ). Membrane forces.

-. NEdx = 187.1738 kN/m.

-. NEdy = -84.7304 kN/m.

-. NEdxy = 161.3962 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2959.3935 KPa.

-. f'tdy = 639.5247 KPa.

-. Sigcd = 2689.9374 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 = 0.0012 m^2/m. (0.0012 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4515

-. Rat,bary = f'tdy/ftdy = 0.1951

-. Rat,conc = Sigcd/Sigcn = 0.2522

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.4515 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3760

-. Node No. : 2435

-. LCB No. : 4

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

-. Thickness : t = 0.6000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3790.5199 KPa.

-. Sig2 = Sig,min = 199.5135 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5805

-. beta = 4.6286

$$\text{PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.2510$$

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

( ). Membrane forces.

-. NEdx = -183.2931 kN/m.

-. NEdy = 66.0582 kN/m.

-. NEdxy = 287.4997 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 980.9406 KPa.

-. f'tdy = 2931.2168 KPa.

-. Sigcd = 4791.6620 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 = 0.0012 m^2/m. (0.0012 m^2/m.)

-. Asy,req = 0.0009 m^2/m. (0.0009 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1497

-. Rat,bary = f'tdy/ftdy = 0.8944

-. Rat,conc = Sigcd/Sigcn = 0.4492

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.8944 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3760

-. Node No. : 2435

-. LCB No. : 8

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

-. Thickness : t = 0.6000 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 = 3635.3557 KPa.

-. Sig2 = Sig,min = 147.9754 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5870

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.1990$$

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

( ). Membrane forces.

-. NEdx = -186.8048 kN/m.

-. NEdy = 52.3042 kN/m.

-. NEdxy = 290.5591 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 972.2490 KPa.

-. f'tdy = 2843.8609 KPa.

-. Sigcd = 4842.6523 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 = 0.0012 m^2/m. (0.0012 m^2/m.)

-. Asy,req = 0.0009 m^2/m. (0.0009 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 = 0.0034

-. rhoy,use = 0.0017

-. ftdx = rhox,use*fyd*(t/ck) = 6554.3478 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 3277.1739 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.1483

-. Rat,bary = f'tdy/ftdy = 0.8678

-. Rat,conc = Sigcd/Sigcn = 0.4540

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.8678 ---> O.K.

1.8.4 Verifiche pressoflessione Camminamento e Puntoni

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Camminamento-cammin 40.

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

( ). Information of Parameters.

-. Elem No. : 3508

-. Node No. : 4766

-. LCB No. : 16

-. 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 = 3306.3154 KPa.

-. Sig2 = Sig,min = 75.3330 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5935

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.0891$$

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

( ). Membrane forces.

-. NEdx = 522.5225 kN/m.

-. NEdy = 15.8109 kN/m.

-. NEdxy = -41.2020 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 7029.2867 KPa.

-. f'tdy = 765.1558 KPa.

-. Sigcd = 1030.0497 KPa.

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

-. 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 = 0.0004 m^2/m. (0.0004 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 = 0.0050

-. rhoy,use = 0.0025

-. ftdx = rhox,use*fyd*(t/ck) = 9831.5217 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 4915.7609 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.7150

-. Rat,bary = f'tdy/ftdy = 0.1557

-. Rat,conc = Sigcd/Sigcn = 0.0966

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7150 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3508

-. Node No. : 4766

-. LCB No. : 16

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

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3306.3154 KPa.

-. Sig2 = Sig,min = 75.3330 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5935

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 0.0891$$

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

( ). Membrane forces.

-. NEdx = 522.5225 kN/m.

-. NEdy = 15.8109 kN/m.

-. NEdxy = -41.2020 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 7029.2867 KPa.

-. f'tdy = 765.1558 KPa.

-. Sigcd = 1030.0497 KPa.

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

-. 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 = 0.0004 m^2/m. (0.0004 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 = 0.0050

-. rhoy,use = 0.0025

-. ftdx = rhox,use*fyd*(t/ck) = 9831.5217 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 4915.7609 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.7150

-. Rat,bary = f'tdy/ftdy = 0.1557

-. Rat,conc = Sigcd/Sigcn = 0.0966

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7150 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3269

-. Node No. : 4400

-. LCB No. : 70

-. 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 = 249.0125 KPa.

-. Sig2 = Sig,min = -1113.0400 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 9.3615

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = -0.9289$$

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

( ). Membrane forces.

-. NEdx = -229.4870 kN/m.

-. NEdy = 22.3969 kN/m.

-. NEdxy = -3.0037 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1113.0400 KPa.

-. fcd = 21333.3333 KPa.

-. Rat,con = Sig,min/fcd = 0.052

---

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

( ). Information of Parameters.

-. Elem No. : 3508

-. Node No. : 4766

-. LCB No. : 16

-. 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 = 3306.3154 KPa.

-. Sig2 = Sig,min = 75.3330 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5935

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.0891$$

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

( ). Membrane forces.

-. NEdx = 602.0312 kN/m.

-. NEdy = 17.4765 kN/m.

-. NEdxy = 3.1401 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 7581.9109 KPa.

-. f'tdy = 205.2123 KPa.

-. Sigcd = 78.5023 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0039

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

-. Asx,req = 0.0016 m^2/m. (0.0016 m^2/m.)

-. Asy,req = 0.0004 m^2/m. (0.0004 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 = 0.0050

-. rhoy,use = 0.0025

-. ftdx = rhox,use*fyd*(t/ck) = 9831.5217 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 4915.7609 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.7712

-. Rat,bary = f'tdy/ftdy = 0.0417

-. Rat,conc = Sigcd/Sigcn = 0.0074

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7712 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3508

-. Node No. : 4766

-. LCB No. : 16

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

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3306.3154 KPa.

-. Sig2 = Sig,min = 75.3330 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5935

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{} + \frac{lambda*SQRT[J2]}{} + \frac{beta*I1}{} - 1.0 = 0.0891$$

fcm^2 fcm fcm

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

( ). Membrane forces.

-. NEdx = 602.0312 kN/m.

-. NEdy = 17.4765 kN/m.

-. NEdxy = 3.1401 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 7581.9109 KPa.

-. f'tdy = 205.2123 KPa.

-. Sigcd = 78.5023 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0039

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

-. Asx,req = 0.0016 m^2/m. (0.0016 m^2/m.)

-. Asy,req = 0.0004 m^2/m. (0.0004 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 = 0.0050

-. rhoy,use = 0.0025

-. ftdx = rhox,use*fyd*(t/ck) = 9831.5217 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 4915.7609 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.7712

-. Rat,bary = f'tdy/ftdy = 0.0417

-. Rat,conc = Sigcd/Sigcn = 0.0074

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7712 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3269

-. Node No. : 4400

-. LCB No. : 70

-. 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 = 249.0125 KPa.

-. Sig2 = Sig,min = -1113.0400 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 9.3615

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = -0.9289$$

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

( ). Membrane forces.

-. NEdx = -246.9367 kN/m.

-. NEdy = -19.8882 kN/m.

-. NEdxy = 9.5725 kN/m.

( ). Check the minimum principal stress.

-. Sig,min = -1295.3585 KPa.

-. alpha = 0.1743(the ratio between the two principal stress)

$$\text{Sig,cdmax} = 0.85 f_{cd} * \frac{1+3.80*\text{alpha}}{(1+\text{alpha})^2} = 21859.0675 \text{ KPa.}$$

-. Rat,con = Sig,min/Sig,cdmax = 0.059

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[[[*]]] MESHED SHELL DESIGN MAXIMUM RESULT DATA : DOMAIN Camminamento-Puntoni.

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

( ). Information of Parameters.

-. Elem No. : 3511

-. Node No. : 4766

-. LCB No. : 16

-. 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 = 4191.6659 KPa.

-. Sig2 = Sig,min = 605.8993 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4653

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 0.3877$$

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

( ). Membrane forces.

-. NEdx = 627.7348 kN/m.

-. NEdy = 216.1433 kN/m.

-. NEdxy = -177.8551 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 10047.9595 KPa.

-. f'tdy = 4961.6070 KPa.

-. Sigcd = 4446.3775 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0051

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0025

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

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

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P20 @200

-. Rebar,y : P16 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0026 m^2/m. (0.0026 m^2/m.)

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

-. rhox,use = 0.0064

-. rhoy,use = 0.0050

-. ftdx = rhox,use*fyd*(t/ck) = 12595.1087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 9831.5217 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.7978

-. Rat,bary = f'tdy/ftdy = 0.5047

-. Rat,conc = Sigcd/Sigcn = 0.4168

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.7978 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 150

-. Node No. : 142

-. LCB No. : 16

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

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 6379.9247 KPa.

-. Sig2 = Sig,min = -218.9673 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5902

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 1.1164$$

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

( ). Membrane forces.

-. NEdx = -29.0870 kN/m.

-. NEdy = 879.6453 kN/m.

-. NEdxy = -28.6372 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 0.0000 KPa.

-. f'tdy = 12061.9899 KPa.

-. Sigcd = 716.0180 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0062

-. Asx,req = 0.0008 m^2/m. (0.0008 m^2/m.)

-. Asy,req = 0.0025 m^2/m. (0.0025 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

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

( ). 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 = 0.0025

-. rhoy,use = 0.0075

-. ftdx = rhox,use*fyd*(t/ck) = 4915.7609 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 14747.2826 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

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

-. Rat,bary = f'tdy/ftdy = 0.8179

-. Rat,conc = Sigcd/Sigcn = 0.0671

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.8179 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 158

-. Node No. : 150

-. LCB No. : 18

-. 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 = 3406.6142 KPa.

-. Sig2 = Sig,min = 26.9779 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5961

-. beta = 4.6286

$$\text{PHI} = \frac{\text{alpha}*J2}{fcm^2} + \frac{\text{lambda}*\text{SQRT}[J2]}{fcm} + \frac{\text{beta}*I1}{fcm} - 1.0 = 0.1221$$

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

( ). Membrane forces.

-. NEdx = -1.9326 kN/m.

-. NEdy = -403.3081 kN/m.

-. NEdxy = -35.2830 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 1.3447 KPa.

-. f'tdy = 0.0000 KPa.

-. Sigcd = 5079.9349 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 : P16 @200

-. Rebar,y : P16 @100

( ). 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 = 0.0025

-. rhoy,use = 0.0050

-. ftdx = rhox,use*fyd*(t/ck) = 4915.7609 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 9831.5217 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.0003

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

-. Rat,conc = Sigcd/Sigcn = 0.4762

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.4762 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 3511

-. Node No. : 4766

-. LCB No. : 16

-. 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 = 4191.6659 KPa.

-. Sig2 = Sig,min = 605.8993 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4653

-. beta = 4.6286

$$PHI = \frac{alpha*J2}{fcm^2} + \frac{lambda*SQRT[J2]}{fcm} + \frac{beta*I1}{fcm} - 1.0 = 0.3877$$

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

( ). Membrane forces.

-. NEdx = 700.7394 kN/m.

-. NEdy = 211.1593 kN/m.

-. NEdxy = -157.4443 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 10749.2101 KPa.

-. f'tdy = 4570.9176 KPa.

-. Sigcd = 3936.1077 KPa.

-. rhox,req = max[f'tdx/fyd*(ck/t), rhox,min] = 0.0055

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

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

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

( ). Rebar Arrangement.

-. Rebar,x : P16 @200/P20 @200

-. Rebar,y : P16 @100

( ). Tensile strengths provided by reinforcement.

-. Asx,use = 0.0026 m^2/m. (0.0026 m^2/m.)

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

-. rhox,use = 0.0064

-. rhoy,use = 0.0050

-. ftdx = rhox,use*fyd*(t/ck) = 12595.1087 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 9831.5217 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.8534

-. Rat,bary = f'tdy/ftdy = 0.4649

-. Rat,conc = Sigcd/Sigcn = 0.3690

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.8534 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 4113

-. Node No. : 5626

-. LCB No. : 8

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

-. Thickness : t = 0.4000 m.

-. Covering : dB = 0.0700 m., dT = 0.0700 m.

( ). Check elements cracked or not.

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

-. Sig1 = Sig,max = 3681.2422 KPa.

-. Sig2 = Sig,min = -125.4718 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.5903

-. beta = 4.6286

$$\text{PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.2123$$

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

( ). Membrane forces.

-. NEdx = 25.3843 kN/m.

-. NEdy = 906.6007 kN/m.

-. NEdxy = 141.5954 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 2101.2010 KPa.

-. f'tdy = 13247.1888 KPa.

-. Sigcd = 3539.8854 KPa.

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

-. rhoy,req = max[f'tdy/fyd*(ck/t), rhoy,min] = 0.0068

-. Asx,req = 0.0008 m^2/m. (0.0008 m^2/m.)

-. Asy,req = 0.0027 m^2/m. (0.0027 m^2/m.)

( ). Rebar Arrangement.

-. Rebar,x : P16 @200

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

( ). 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 = 0.0025

-. rhoy,use = 0.0075

-. ftdx = rhox,use*fyd*(t/ck) = 4915.7609 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 14747.2826 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.4274

-. Rat,bary = f'tdy/ftdy = 0.8983

-. Rat,conc = Sigcd/Sigcn = 0.3319

-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.8983 ---> O.K.

---

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

( ). Information of Parameters.

-. Elem No. : 4246

-. Node No. : 5834

-. LCB No. : 16

-. 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 = 3233.9433 KPa.

-. Sig2 = Sig,min = -653.5606 KPa.

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

-. fcm = 40000.0000 KPa.

-. alpha = 4.1292

-. lambda = 14.4155

-. beta = 4.6286

$$\text{-. PHI} = \frac{\text{alpha*J2}}{\text{fcm}^2} + \frac{\text{lambda*SQRT[J2]}}{\text{fcm}} + \frac{\text{beta*I1}}{\text{fcm}} - 1.0 = 0.0600$$

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

( ). Membrane forces.

-. NEdx = 32.9029 kN/m.

-. NEdy = -684.7322 kN/m.

-. NEdxy = 19.7212 kN/m.

( ). Necessary reinforcement and concrete stress.

-. f'tdx = 405.4625 KPa.

-. f'tdy = 0.0000 KPa.

-. Sigcd = 8566.2531 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 : P16 @200

-. Rebar,y : P16 @100

( ). 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 = 0.0025

-. rhoy,use = 0.0050

-. ftdx = rhox,use*fyd*(t/ck) = 4915.7609 KPa.

-. ftdy = rhoy,use*fyd*(t/ck) = 9831.5217 KPa.

( ). Concrete strength limit.

-. Sigcn = nu*fcd = 10666.6667 KPa.

( ). Check results.

-. Rat,barx = f'tdx/ftdx = 0.0825

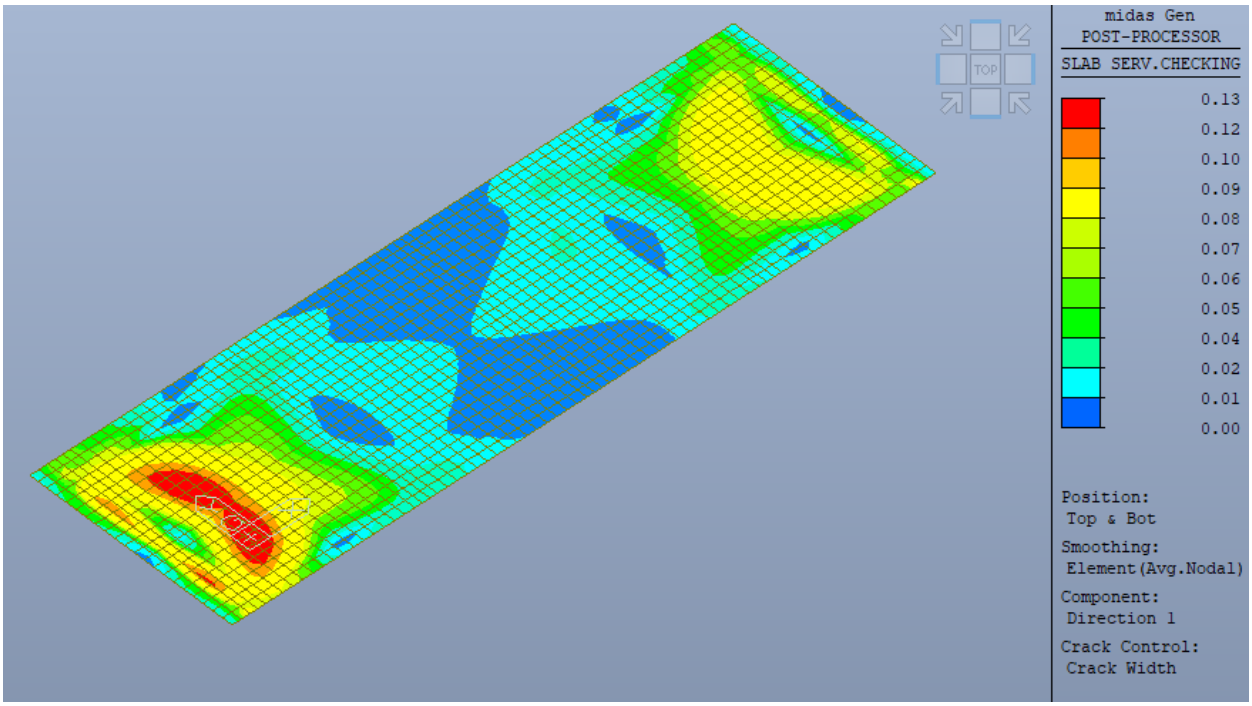
-. Rat,bary = f'tdy/ftdy = 0.0000

-. Rat,conc = Sigcd/Sigcn = 0.8031

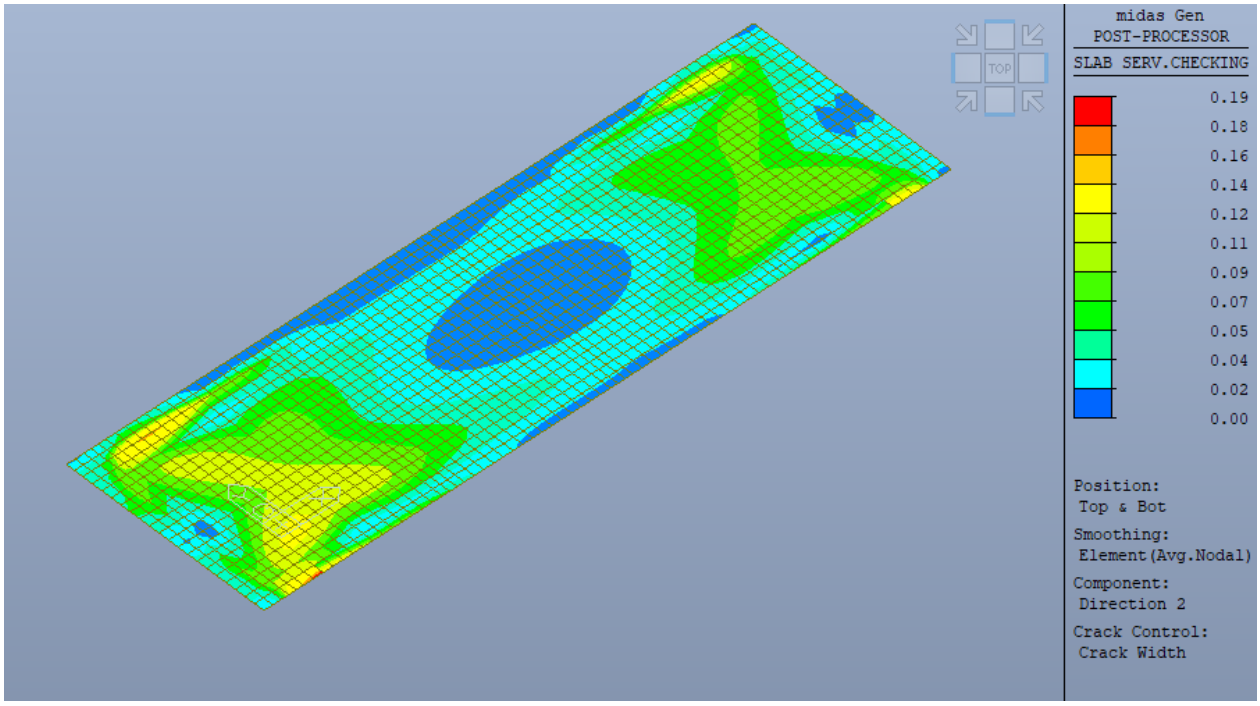
-. Rat = MAX[Rat,barx, Rat,bary, Rat,conc] = 0.8031 ---> O.K.

1.9 Verifiche in condizioni di esercizio SLE

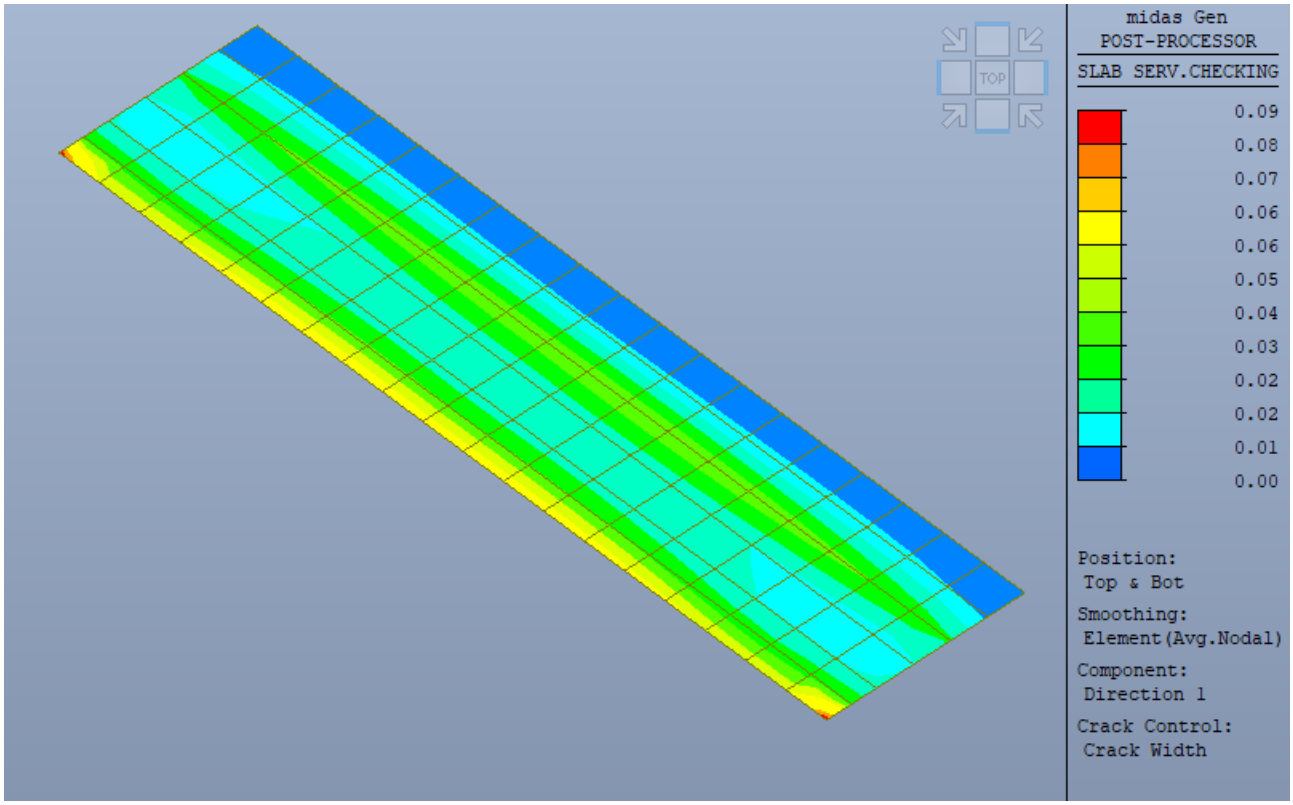
Vengono riportate di seguito le verifiche di fessurazione in forma grafica:



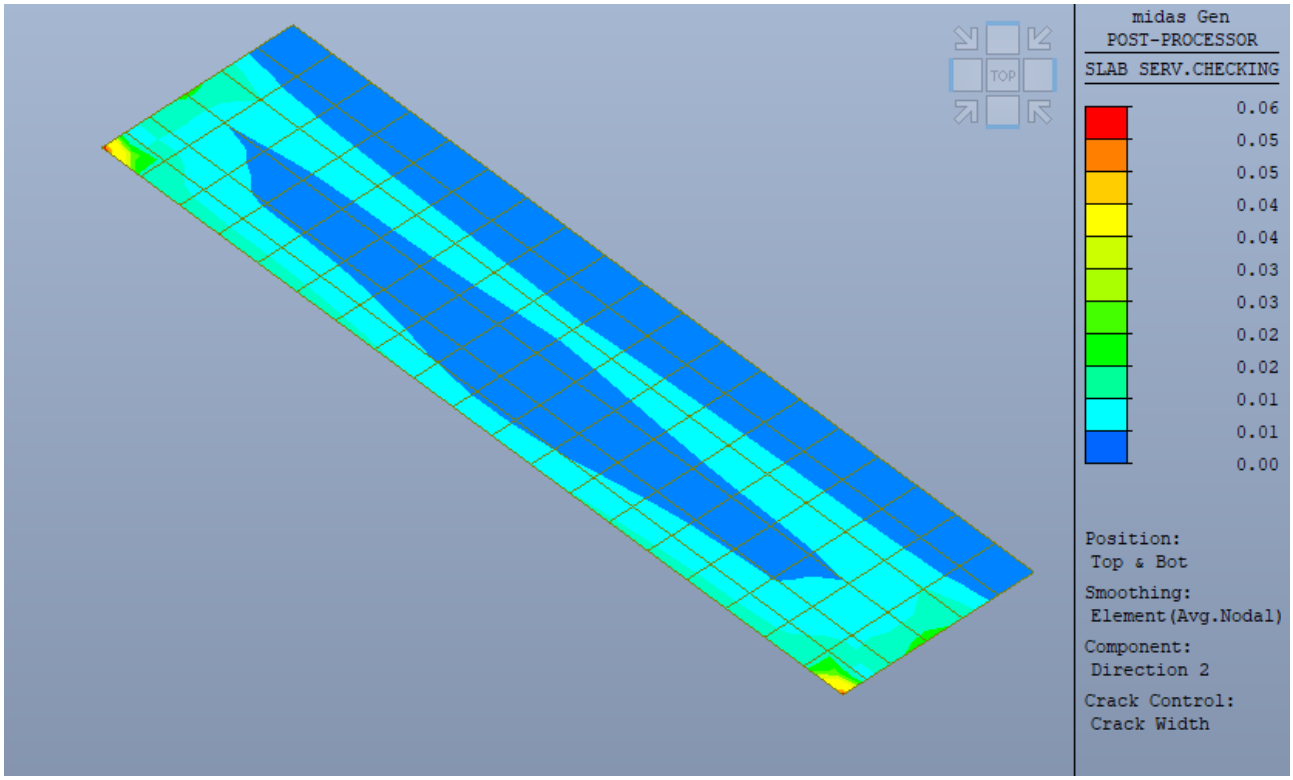
Platea Principale – Verifica a fessurazione SLE - ratio direzione X ambo i lati



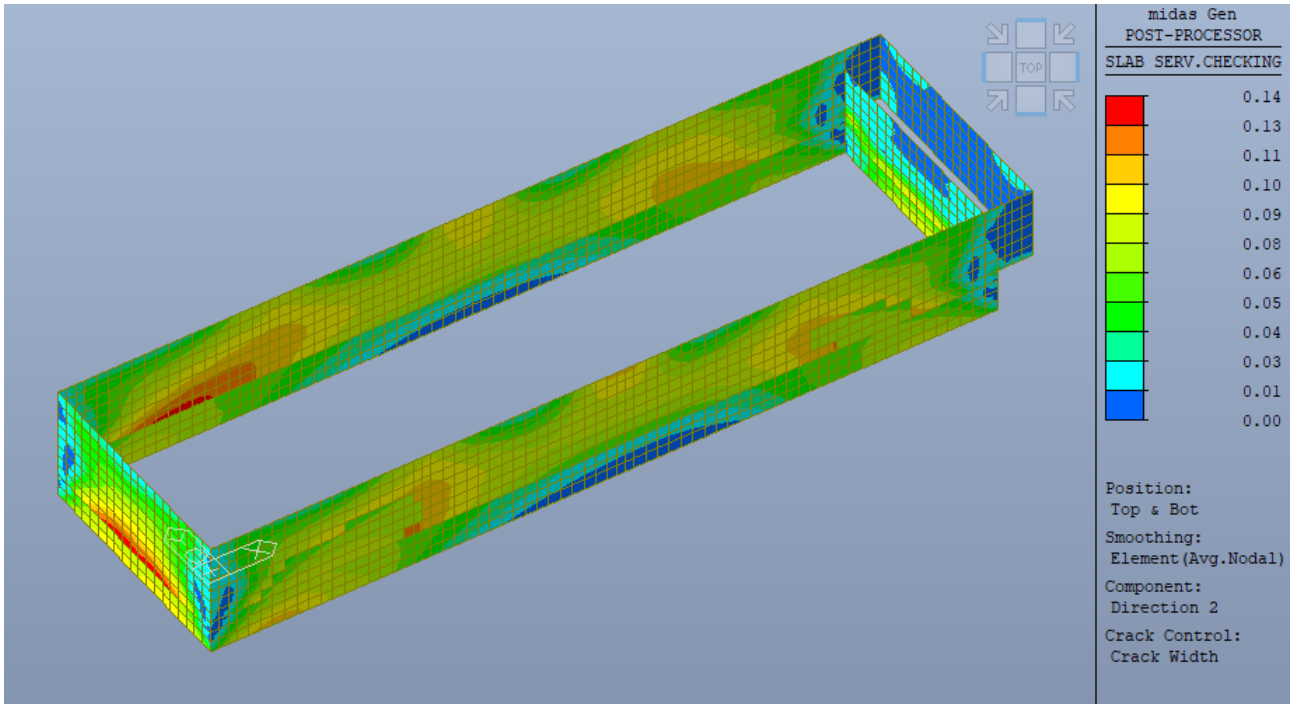
Platea Principale – Verifica a fessurazione SLE - ratio direzione Y ambo i lati



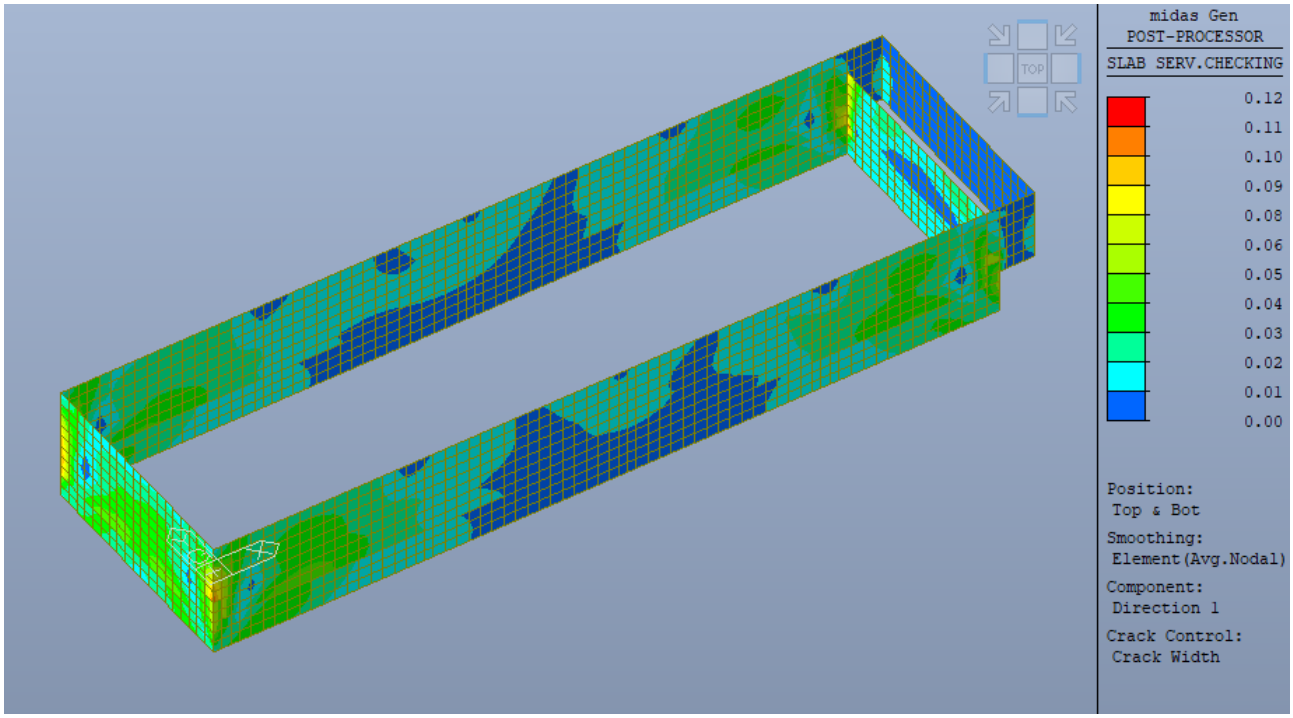
Platea Secondaria – Verifica a fessurazione SLE - ratio direzione X ambo i lati



Platea Secondaria – Verifica a fessurazione SLE - ratio direzione Y ambo i lati



Pareti – Verifica a fessurazione SLE - ratio direzione Verticale ambo i lati



Pareti – Verifica a fessurazione SLE - ratio direzione orizzontale ambo i lati