

CONSORCIO PSA CONSULTORES.

MEMORIA DE CÁLCULO ESTRUCTURAL

**CENTRO DE DESARROLLO INFANTIL
- TANQUES DE AGUA Y MUROS DE CONTENCION -**

PROPIETARIO: PRESIDENCIA DE LA REPÚBLICA

JOSÉ WILCHES
INGENIERO CALCULISTA

BOGOTA, D.C. DICIEMBRE 31 DE 2.013

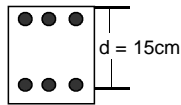
CONSORCIO PSA CONSULTORES.

**CENTRO DE DESARROLLO INFANTIL
- APARTADO. 30M3-**

DISEÑO DE MUROS TANQUE DE AGUA

MOMENTO (MXX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu &= 2.25 \\ \mu &= 225 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0100 \text{ T/cm}^2 \\ \rho &= 0.0027 \\ A_s = \rho b d &= 4.04 \text{ cm}^2 \end{aligned}$$



CORTANTE (QXX)

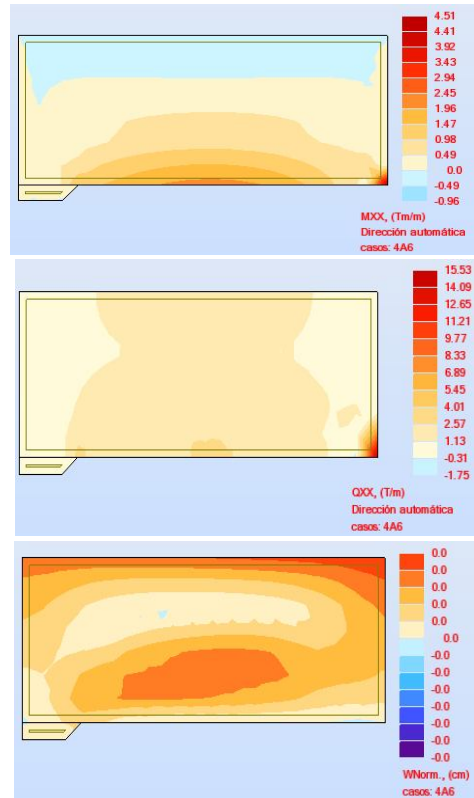
$$\begin{aligned} V_u &= 8.20 \text{ T/m} \\ v_u &= 5.47 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION EN VOLADIZO

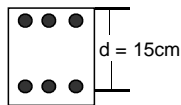
$$\begin{aligned} L &= 4.35 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 8700.00 \text{ Voladizo} \end{aligned}$$

OK



MOMENTO (MYY)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantía} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu &= 2.60 \\ \mu &= 260 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0116 \text{ T/cm}^2 \\ \rho &= 0.0031 \\ A_s = \rho b d &= 4.69 \text{ cm}^2 \end{aligned}$$



CORTANTE (QYY)

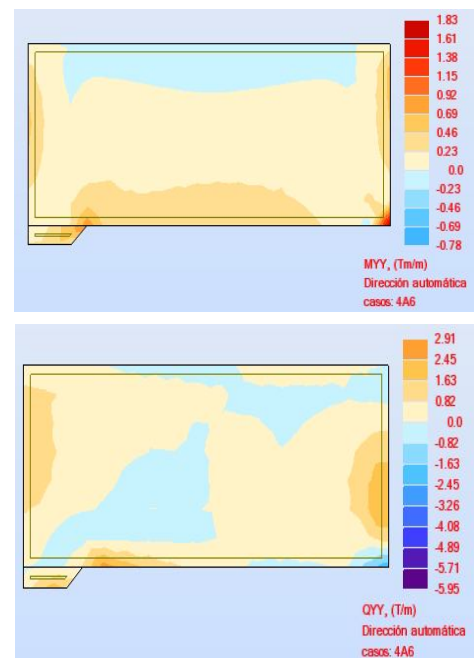
$$\begin{aligned} V_u &= 10.65 \text{ T/m} \\ v_u &= 7.10 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OJO v_u ES MAYOR QUE V_c

DEFLEXION 1/2 DE LUZ

$$\begin{aligned} L &= 4.35 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 4350.00 \end{aligned}$$

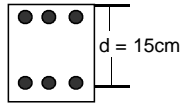
OK



DISEÑO DE PLACA BASE TANQUE DE AGUA

MOMENTO (MXX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu_u &= 2.61 \text{ Tm} \\ \mu_u &= 261 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0116 \text{ T/cm}^2 \\ \rho &= 0.0031 \\ A_s = \rho b d &= 4.71 \text{ cm}^2 \end{aligned}$$



CORTANTE (QXX)

$$\begin{aligned} V_u &= 2.34 \text{ T/m} \\ v_u &= 1.56 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

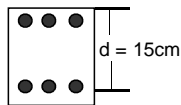
DEFLEXION EN VOLADIZO

$$\begin{aligned} L &= 4.35 \text{ m} \\ \text{Deflexion} &= 0.20 \text{ cm} \\ \text{Luz / deflexion} &= 4350.00 \text{ Voladizo} \end{aligned}$$

OK

MOMENTO (MY)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantia} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu_u &= 3.86 \text{ Tm} \\ \mu_u &= 386 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0172 \text{ T/cm}^2 \\ \rho &= 0.0047 \\ A_s = \rho b d &= 7.12 \text{ cm}^2 \end{aligned}$$



CORTANTE (QY)

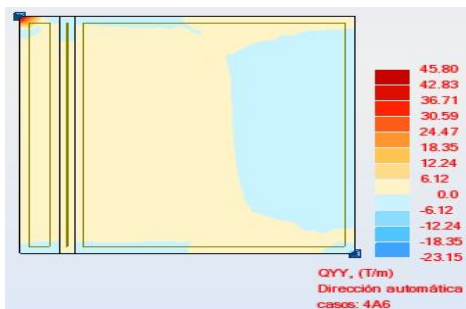
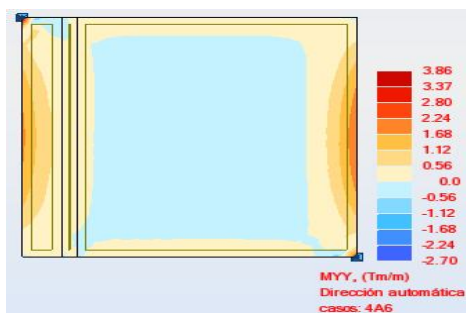
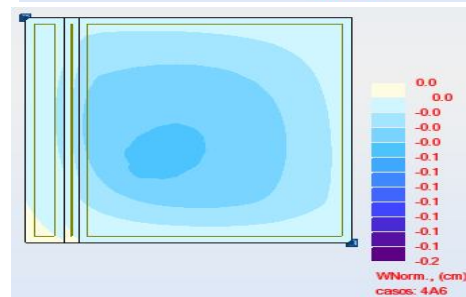
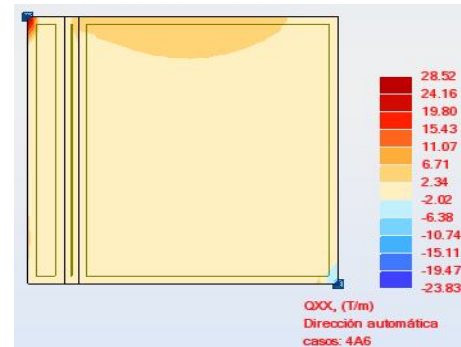
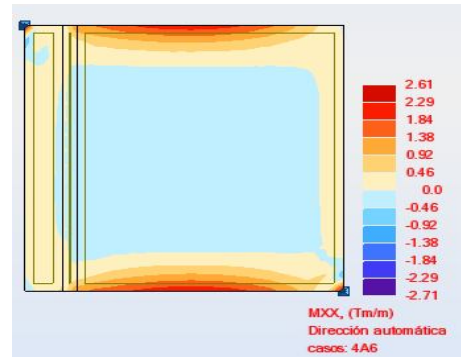
$$\begin{aligned} V_u &= 6.12 \text{ T/m} \\ v_u &= 4.08 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION 1/2 DE LUZ

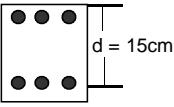
$$\begin{aligned} L &= 4.35 \text{ m} \\ \text{Deflexion} &= 0.20 \text{ cm} \\ \text{Luz / deflexion} &= 2175.00 \end{aligned}$$

OK



DISEÑO DE TAPA TANQUE DE AGUA

MOMENTO (MXX)

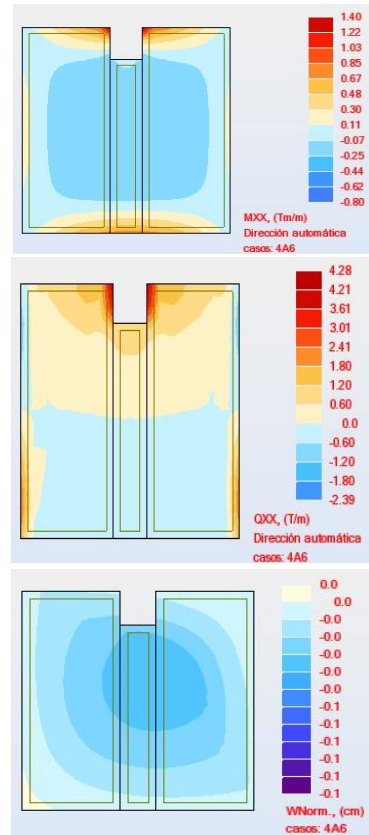
b =	100 cm	
h =	20 cm	
d =	15 cm	
f _y =	4200 Kg/cm ²	
f'c =	210 Kg/cm ²	
Momento resistente con cuantía mínima =	2.70 T-m	
Mu =	1.40 Tm	
Mu =	140 Tcm	
K = Mu / (b d ²) =	0.0062 T/cm ²	
ρ =	0.0017	
As = ρ b d =	2.51 cm ²	

CORTANTE (QXX)

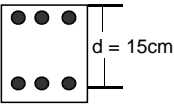
Vu =	4.28 T/m	OK, vu ES MENOR QUE Vc
vu =	2.85 Kg/cm ²	
ϕ Vc =	6.52 Kg/cm ²	

DEFLEXION EN VOLADIZO

L =	4.35 m	OK
Deflexion =	0.36 cm	
Luz / deflexion =	2416.67 Voladizo	



MOMENTO (MYY)

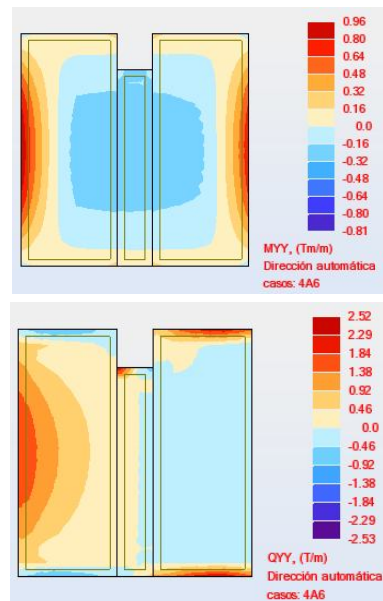
b =	100 cm	
h =	20 cm	
d =	15 cm	
f _y =	4200 Kg/cm ²	
f'c =	210 Kg/cm ²	
Momento maximo con cuantia minima =	2.70 T-m	
Mu =	0.96 Tm	
Mu =	96 Tcm	
K = Mu / (b d ²) =	0.0043 T/cm ²	
ρ =	0.0012	
As = ρ b d =	1.75 cm ²	

CORTANTE (QYY)

Vu =	2.53 T/m	OK, vu ES MENOR QUE Vc
vu =	1.69 Kg/cm ²	
ϕ Vc =	6.52 Kg/cm ²	

DEFLEXION 1/2 DE LUZ

L =	4.35 m	OK
Deflexion =	0.36 cm	
Luz / deflexion =	1208.33	



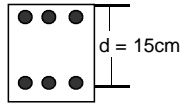
CONSORCIO PSA CONSULTORES.

**CENTRO DE DESARROLLO INFANTIL
- PTO GUZMAN. 29m3.-**

DISEÑO DE MUROS TANQUE DE AGUA

MOMENTO (MXX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu &= 2.25 \text{ Tm} \\ \mu &= 225 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0100 \text{ T/cm}^2 \\ \rho &= 0.0027 \\ A_s = \rho b d &= 4.04 \text{ cm}^2 \end{aligned}$$



CORTANTE (QXX)

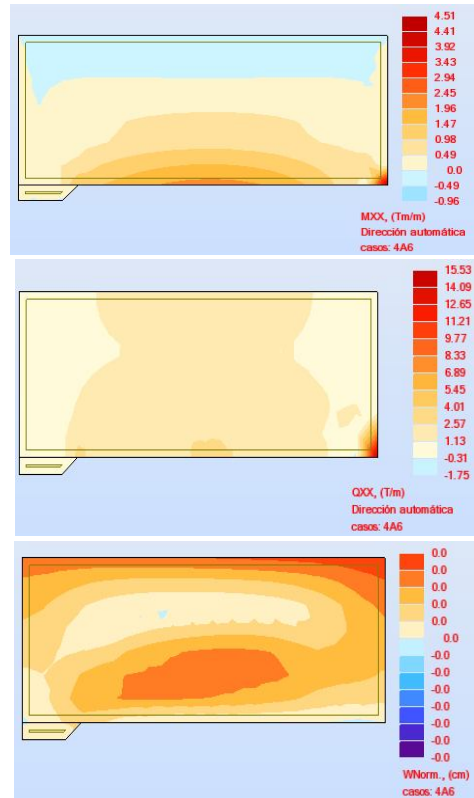
$$\begin{aligned} V_u &= 8.20 \text{ T/m} \\ v_u &= 5.47 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION EN VOLADIZO

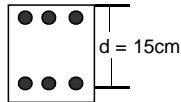
$$\begin{aligned} L &= 4.35 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 8700.00 \text{ Voladizo} \end{aligned}$$

OK



MOMENTO (MYY)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantía} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu &= 2.60 \text{ Tm} \\ \mu &= 260 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0116 \text{ T/cm}^2 \\ \rho &= 0.0031 \\ A_s = \rho b d &= 4.69 \text{ cm}^2 \end{aligned}$$



CORTANTE (QYY)

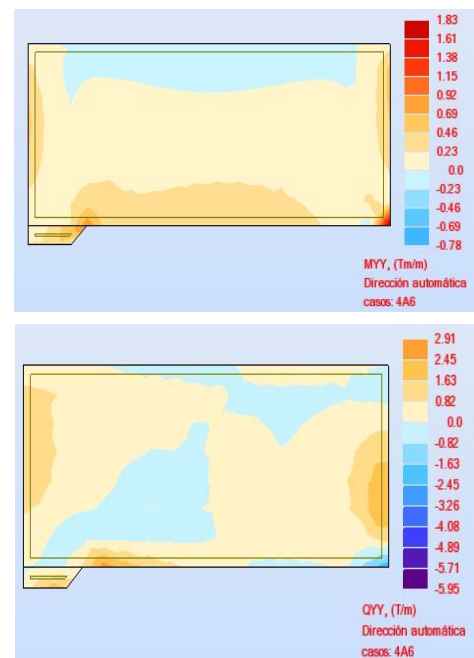
$$\begin{aligned} V_u &= 10.65 \text{ T/m} \\ v_u &= 7.10 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OJO v_u ES MAYOR QUE V_c

DEFLEXION 1/2 DE LUZ

$$\begin{aligned} L &= 4.35 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 4350.00 \end{aligned}$$

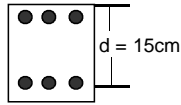
OK



DISEÑO DE PLACA BASE TANQUE DE AGUA

MOMENTO (MXX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu_u &= 2.61 \text{ Tm} \\ \mu_u &= 261 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0116 \text{ T/cm}^2 \\ \rho &= 0.0031 \\ A_s = \rho b d &= 4.71 \text{ cm}^2 \end{aligned}$$



CORTANTE (QXX)

$$\begin{aligned} V_u &= 2.34 \text{ T/m} \\ v_u &= 1.56 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

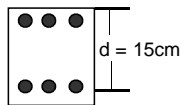
DEFLEXION EN VOLADIZO

$$\begin{aligned} L &= 4.35 \text{ m} \\ \text{Deflexion} &= 0.20 \text{ cm} \\ \text{Luz / deflexion} &= 4350.00 \text{ Voladizo} \end{aligned}$$

OK

MOMENTO (MYY)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantia} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu_u &= 3.86 \text{ Tm} \\ \mu_u &= 386 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0172 \text{ T/cm}^2 \\ \rho &= 0.0047 \\ A_s = \rho b d &= 7.12 \text{ cm}^2 \end{aligned}$$



CORTANTE (QYY)

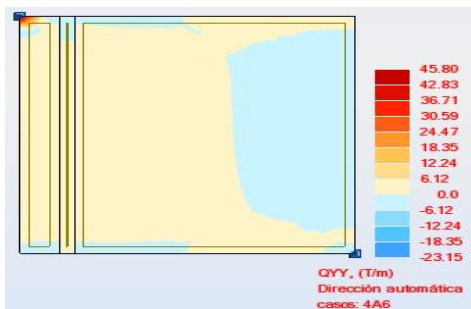
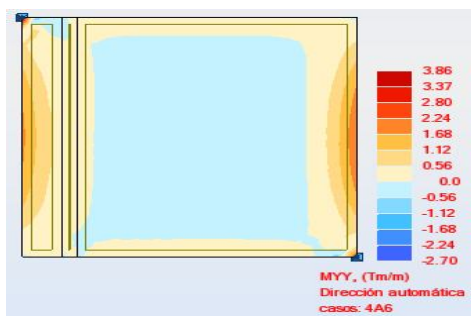
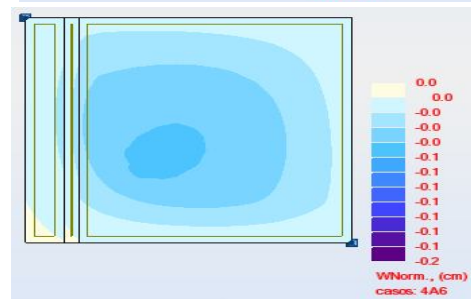
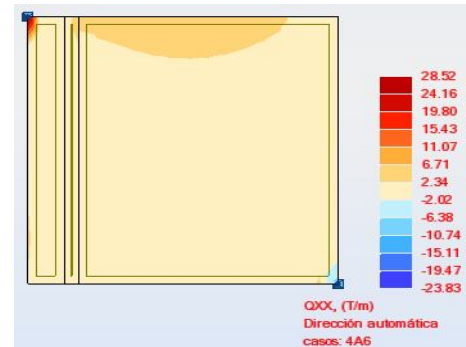
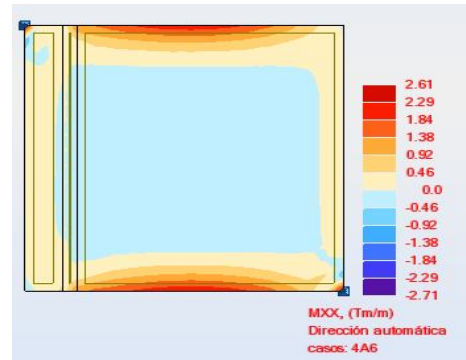
$$\begin{aligned} V_u &= 6.12 \text{ T/m} \\ v_u &= 4.08 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION 1/2 DE LUZ

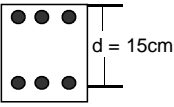
$$\begin{aligned} L &= 4.35 \text{ m} \\ \text{Deflexion} &= 0.20 \text{ cm} \\ \text{Luz / deflexion} &= 2175.00 \end{aligned}$$

OK



DISEÑO DE TAPA TANQUE DE AGUA

MOMENTO (MXX)

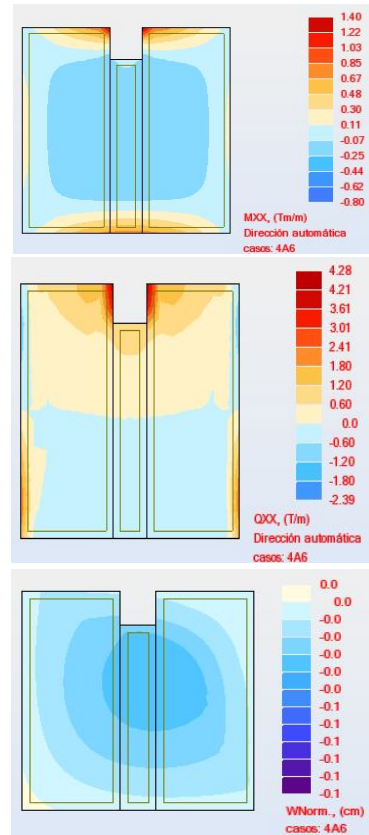
$b =$	100 cm	
$h =$	20 cm	
$d =$	15 cm	
$f_y =$	4200 Kg/cm ²	
$f'_c =$	210 Kg/cm ²	
Momento resistente con cuantía mínima =	2.70 T-m	
$M_u =$	1.40 Tm	
$M_u =$	140 Tcm	
$K = M_u / (b d^2) =$	0.0062 T/cm ²	
$\rho =$	0.0017	
$A_s = \rho b d =$	2.51 cm ²	

CORTANTE (QXX)

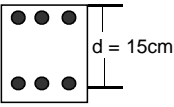
$V_u =$	4.28 T/m	OK, v_u ES MENOR QUE V_c
$v_u =$	2.85 Kg/cm ²	
$\phi V_c =$	6.52 Kg/cm ²	

DEFLEXION EN VOLADIZO

$L =$	4.35 m	OK
Deflexion =	0.36 cm	
Luz / deflexion =	2416.67 Voladizo	



MOMENTO (MYY)

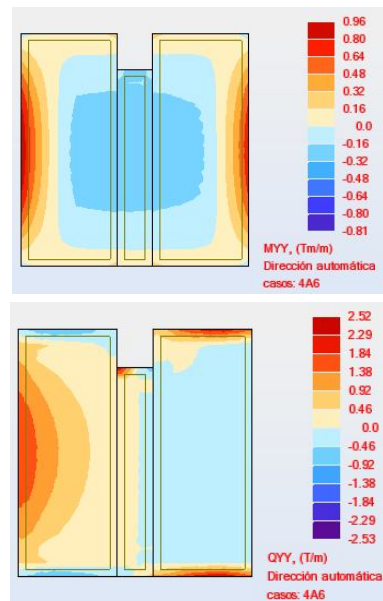
$b =$	100 cm	
$h =$	20 cm	
$d =$	15 cm	
$f_y =$	4200 Kg/cm ²	
$f'_c =$	210 Kg/cm ²	
Momento maximo con cuantia minima =	2.70 T-m	
$M_u =$	0.96 Tm	
$M_u =$	96 Tcm	
$K = M_u / (b d^2) =$	0.0043 T/cm ²	
$\rho =$	0.0012	
$A_s = \rho b d =$	1.75 cm ²	

CORTANTE (QYY)

$V_u =$	2.53 T/m	OK, v_u ES MENOR QUE V_c
$v_u =$	1.69 Kg/cm ²	
$\phi V_c =$	6.52 Kg/cm ²	

DEFLEXION 1/2 DE LUZ

$L =$	4.35 m	OK
Deflexion =	0.36 cm	
Luz / deflexion =	1208.33	



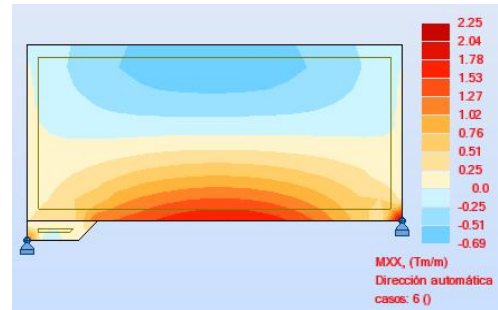
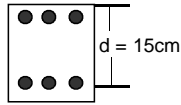
CONSORCIO PSA CONSULTORES.

**CENTRO DE DESARROLLO INFANTIL
- POTOSI. 21M3-**

DISEÑO DE MUROS TANQUE DE AGUA

MOMENTO (MXX)

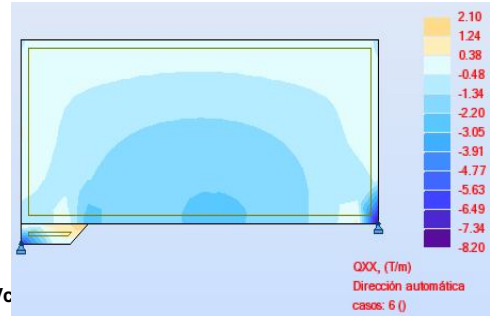
$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu &= 2.25 \\ \mu &= 225 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0100 \text{ T/cm}^2 \\ \rho &= 0.0027 \\ A_s = \rho b d &= 4.04 \text{ cm}^2 \end{aligned}$$



CORTANTE (QXX)

$$\begin{aligned} V_u &= 8.20 \text{ T/m} \\ v_u &= 5.47 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

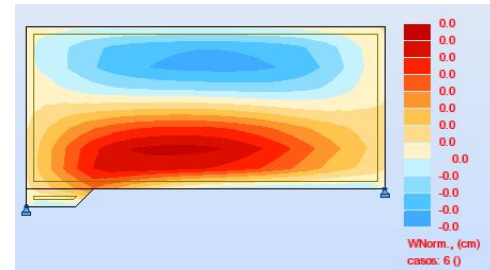
OK, v_u ES MENOR QUE V_c



DEFLEXION EN VOLADIZO

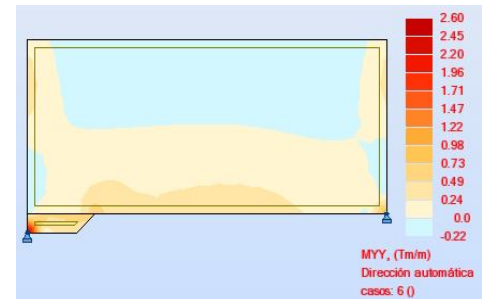
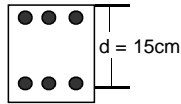
$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 7660.00 \text{ Voladizo} \end{aligned}$$

OK



MOMENTO (MYY)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantía} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu &= 2.60 \\ \mu &= 260 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0116 \text{ T/cm}^2 \\ \rho &= 0.0031 \\ A_s = \rho b d &= 4.69 \text{ cm}^2 \end{aligned}$$



CORTANTE (QYY)

$$\begin{aligned} V_u &= 10.65 \text{ T/m} \\ v_u &= 7.10 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OJO v_u ES MAYOR QUE V_c



DEFLEXION 1/2 DE LUZ

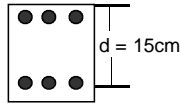
$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 3830.00 \end{aligned}$$

OK

DISEÑO DE PLACA BASE TANQUE DE AGUA

MOMENTO (MXX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu_u &= 1.31 \text{ Tm} \\ \mu_u &= 131 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\ \rho &= 0.0016 \\ A_s = \rho b d &= 2.36 \text{ cm}^2 \end{aligned}$$



CORTANTE (QXX)

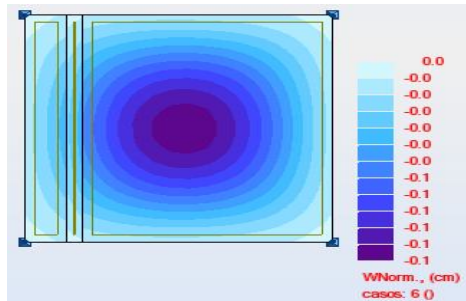
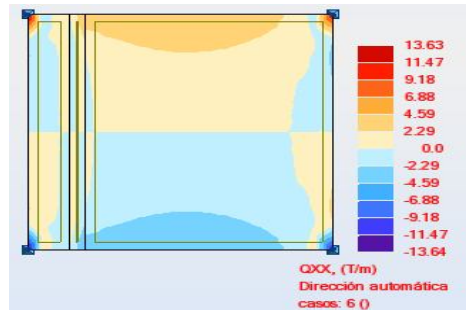
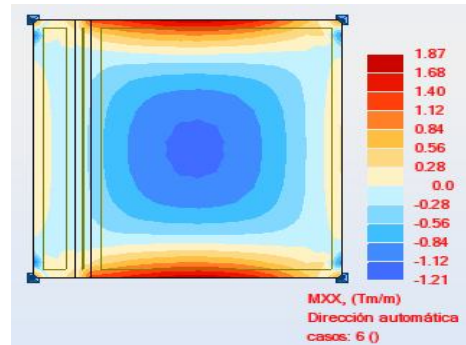
$$\begin{aligned} V_u &= 3.87 \text{ T/m} \\ v_u &= 2.58 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION EN VOLADIZO

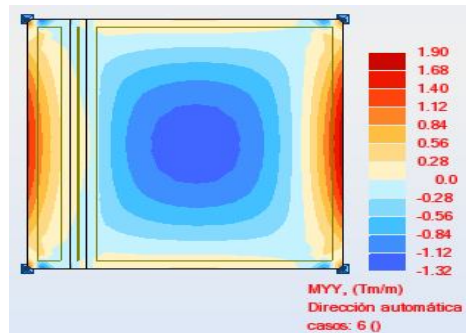
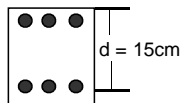
$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.36 \text{ cm} \\ \text{Luz / deflexion} &= 2127.78 \text{ Voladizo} \end{aligned}$$

OK



MOMENTO (MYX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantía} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu_u &= 1.31 \text{ Tm} \\ \mu_u &= 131 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\ \rho &= 0.0016 \\ A_s = \rho b d &= 2.36 \text{ cm}^2 \end{aligned}$$



CORTANTE (QYY)

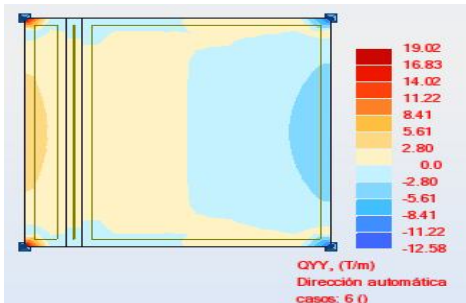
$$\begin{aligned} V_u &= 1.63 \text{ T/m} \\ v_u &= 1.09 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION 1/2 DE LUZ

$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.36 \text{ cm} \\ \text{Luz / deflexion} &= 1063.89 \end{aligned}$$

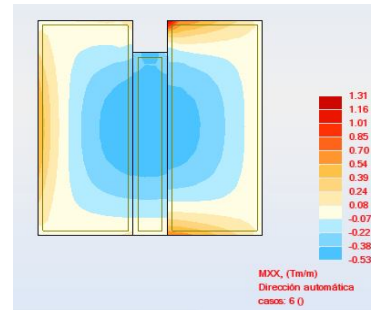
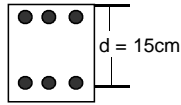
OK



DISEÑO DE TAPA TANQUE DE AGUA

MOMENTO (MXX)

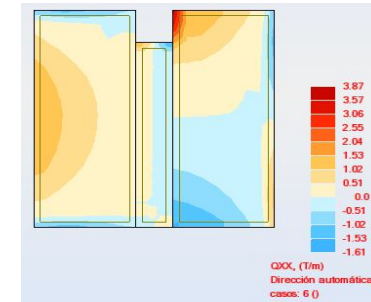
$$\begin{aligned}
 b &= 100 \text{ cm} \\
 h &= 20 \text{ cm} \\
 d &= 15 \text{ cm} \\
 f_y &= 4200 \text{ Kg/cm}^2 \\
 f'_c &= 210 \text{ Kg/cm}^2 \\
 \text{Momento resistente con} \\
 \text{cuantía mínima} &= 2.70 \text{ T-m} \\
 \mu_u &= 1.31 \text{ Tm} \\
 \mu_u &= 131 \text{ Tcm} \\
 K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\
 \rho &= 0.0016 \\
 A_s = \rho b d &= 2.36 \text{ cm}^2
 \end{aligned}$$



CORTANTE (QXX)

$$\begin{aligned}
 V_u &= 3.87 \text{ T/m} \\
 v_u &= 2.58 \text{ Kg/cm}^2 \\
 \phi V_c &= 6.52 \text{ Kg/cm}^2
 \end{aligned}$$

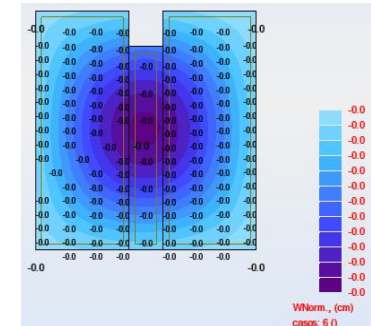
OK, v_u ES MENOR QUE V_c



DEFLEXION EN VOLADIZO

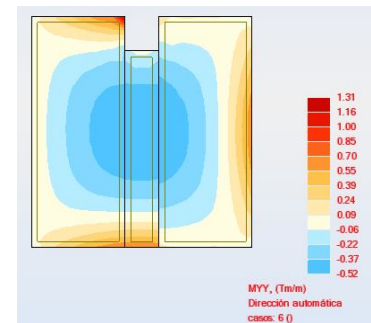
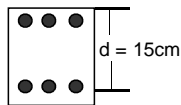
$$\begin{aligned}
 L &= 3.83 \text{ m} \\
 \text{Deflexion} &= 0.36 \text{ cm} \\
 \text{Luz / deflexion} &= 2127.78 \text{ Voladizo}
 \end{aligned}$$

OK



MOMENTO (MYY)

$$\begin{aligned}
 b &= 100 \text{ cm} \\
 h &= 20 \text{ cm} \\
 d &= 15 \text{ cm} \\
 f_y &= 4200 \text{ Kg/cm}^2 \\
 f'_c &= 210 \text{ Kg/cm}^2 \\
 \text{Momento maximo con cuantia} \\
 \text{minima} &= 2.70 \text{ T-m} \\
 \mu_u &= 1.31 \text{ Tm} \\
 \mu_u &= 131 \text{ Tcm} \\
 K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\
 \rho &= 0.0016 \\
 A_s = \rho b d &= 2.36 \text{ cm}^2
 \end{aligned}$$



CORTANTE (QYY)

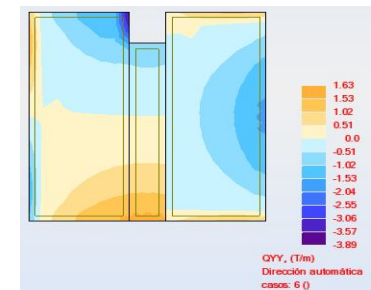
$$\begin{aligned}
 V_u &= 1.63 \text{ T/m} \\
 v_u &= 1.09 \text{ Kg/cm}^2 \\
 \phi V_c &= 6.52 \text{ Kg/cm}^2
 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION 1/2 DE LUZ

$$\begin{aligned}
 L &= 3.83 \text{ m} \\
 \text{Deflexion} &= 0.36 \text{ cm} \\
 \text{Luz / deflexion} &= 1063.89
 \end{aligned}$$

OK



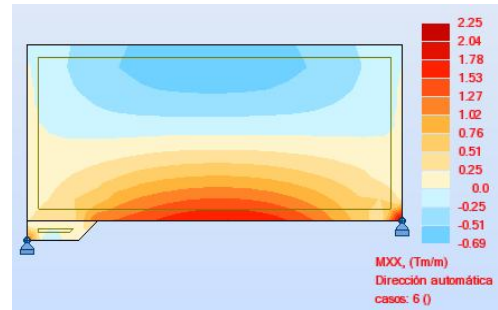
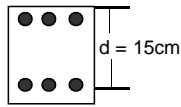
CONSORCIO PSA CONSULTORES.

**CENTRO DE DESARROLLO INFANTIL
- TEBAIDA. 21M3.-**

DISEÑO DE MUROS TANQUE DE AGUA

MOMENTO (MXX)

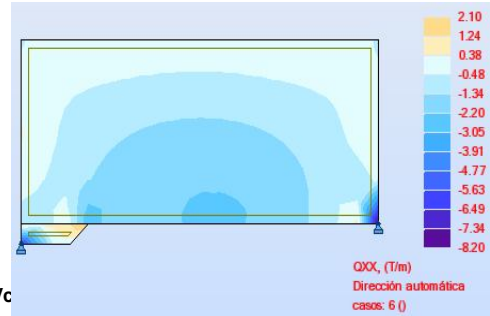
$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu &= 2.25 \text{ Tm} \\ \mu &= 225 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0100 \text{ T/cm}^2 \\ \rho &= 0.0027 \\ A_s = \rho b d &= 4.04 \text{ cm}^2 \end{aligned}$$



CORTANTE (QXX)

$$\begin{aligned} V_u &= 8.20 \text{ T/m} \\ v_u &= 5.47 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

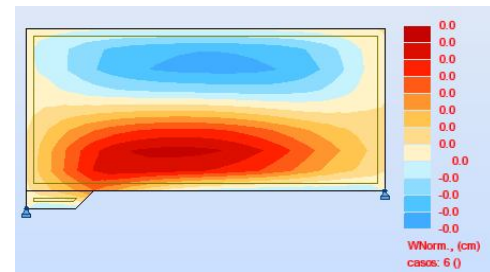
OK, v_u ES MENOR QUE V_c



DEFLEXION EN VOLADIZO

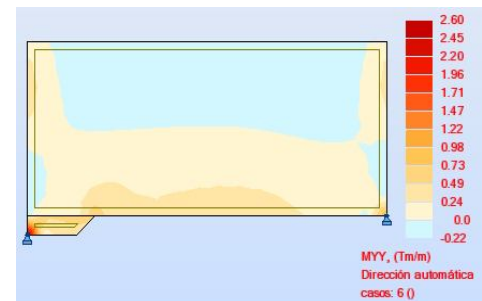
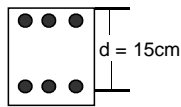
$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 7660.00 \text{ Voladizo} \end{aligned}$$

OK



MOMENTO (MYY)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantía} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu &= 2.60 \text{ Tm} \\ \mu &= 260 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0116 \text{ T/cm}^2 \\ \rho &= 0.0031 \\ A_s = \rho b d &= 4.69 \text{ cm}^2 \end{aligned}$$



CORTANTE (QYY)

$$\begin{aligned} V_u &= 10.65 \text{ T/m} \\ v_u &= 7.10 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OJO v_u ES MAYOR QUE V_c

DEFLEXION 1/2 DE LUZ

$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 3830.00 \end{aligned}$$

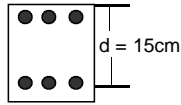
OK



DISEÑO DE PLACA BASE TANQUE DE AGUA

MOMENTO (MXX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu_u &= 1.31 \text{ Tm} \\ \mu_u &= 131 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\ \rho &= 0.0016 \\ A_s = \rho b d &= 2.36 \text{ cm}^2 \end{aligned}$$

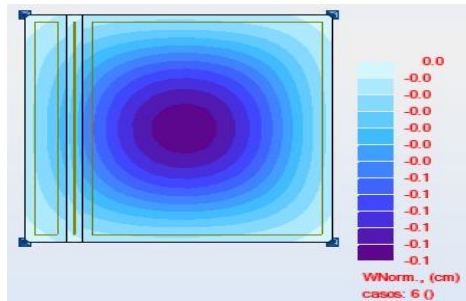
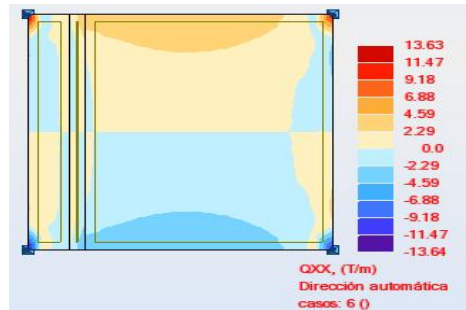
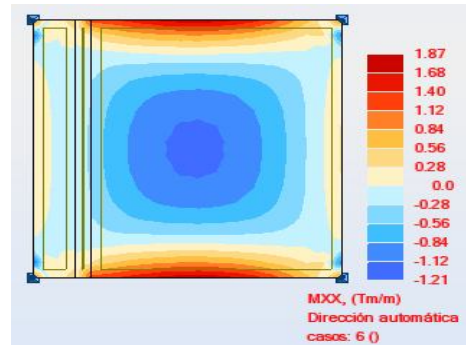


CORTANTE (QXX)

$$\begin{aligned} V_u &= 3.87 \text{ T/m} \\ v_u &= 2.58 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned} \quad \text{OK, } v_u \text{ ES MENOR QUE } V_c$$

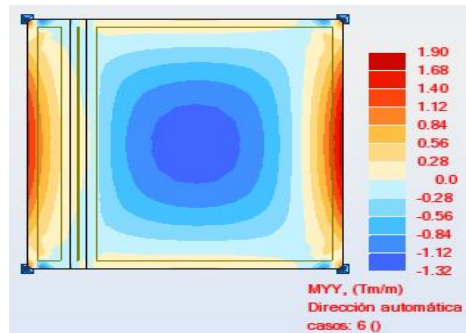
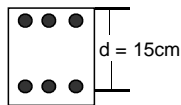
DEFLEXION EN VOLADIZO

$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.36 \text{ cm} \\ \text{Luz / deflexion} &= 2127.78 \text{ Voladizo} \end{aligned} \quad \text{OK}$$



MOMENTO (MYY)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantía} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu_u &= 1.31 \text{ Tm} \\ \mu_u &= 131 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\ \rho &= 0.0016 \\ A_s = \rho b d &= 2.36 \text{ cm}^2 \end{aligned}$$

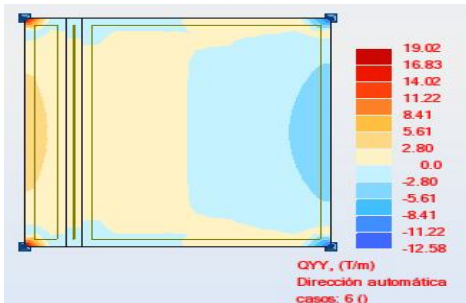


CORTANTE (QYY)

$$\begin{aligned} V_u &= 1.63 \text{ T/m} \\ v_u &= 1.09 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned} \quad \text{OK, } v_u \text{ ES MENOR QUE } V_c$$

DEFLEXION 1/2 DE LUZ

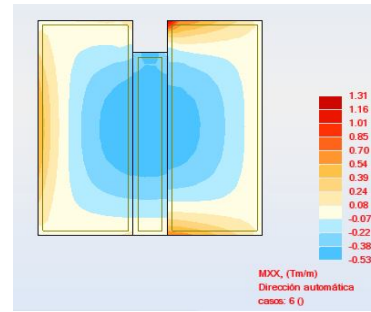
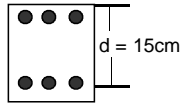
$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.36 \text{ cm} \\ \text{Luz / deflexion} &= 1063.89 \end{aligned} \quad \text{OK}$$



DISEÑO DE TAPA TANQUE DE AGUA

MOMENTO (MXX)

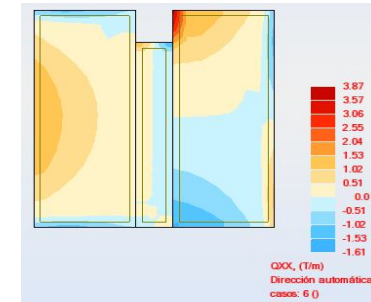
$$\begin{aligned}
 b &= 100 \text{ cm} \\
 h &= 20 \text{ cm} \\
 d &= 15 \text{ cm} \\
 f_y &= 4200 \text{ Kg/cm}^2 \\
 f'_c &= 210 \text{ Kg/cm}^2 \\
 \text{Momento resistente con} \\
 \text{cuantía mínima} &= 2.70 \text{ T-m} \\
 \mu_u &= 1.31 \text{ Tm} \\
 \mu_u &= 131 \text{ Tcm} \\
 K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\
 \rho &= 0.0016 \\
 A_s = \rho b d &= 2.36 \text{ cm}^2
 \end{aligned}$$



CORTANTE (QXX)

$$\begin{aligned}
 V_u &= 3.87 \text{ T/m} \\
 v_u &= 2.58 \text{ Kg/cm}^2 \\
 \phi V_c &= 6.52 \text{ Kg/cm}^2
 \end{aligned}$$

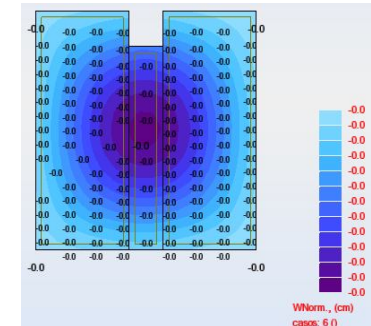
OK, v_u ES MENOR QUE V_c



DEFLEXION EN VOLADIZO

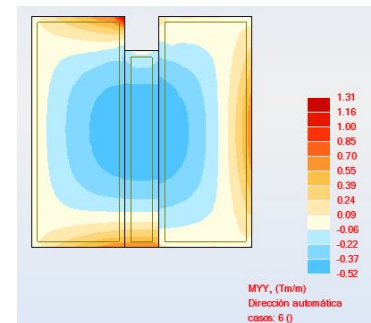
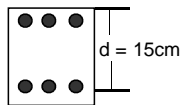
$$\begin{aligned}
 L &= 3.83 \text{ m} \\
 \text{Deflexion} &= 0.36 \text{ cm} \\
 \text{Luz / deflexion} &= 2127.78 \text{ Voladizo}
 \end{aligned}$$

OK



MOMENTO (MYY)

$$\begin{aligned}
 b &= 100 \text{ cm} \\
 h &= 20 \text{ cm} \\
 d &= 15 \text{ cm} \\
 f_y &= 4200 \text{ Kg/cm}^2 \\
 f'_c &= 210 \text{ Kg/cm}^2 \\
 \text{Momento maximo con cuantia} \\
 \text{minima} &= 2.70 \text{ T-m} \\
 \mu_u &= 1.31 \text{ Tm} \\
 \mu_u &= 131 \text{ Tcm} \\
 K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\
 \rho &= 0.0016 \\
 A_s = \rho b d &= 2.36 \text{ cm}^2
 \end{aligned}$$



CORTANTE (QYY)

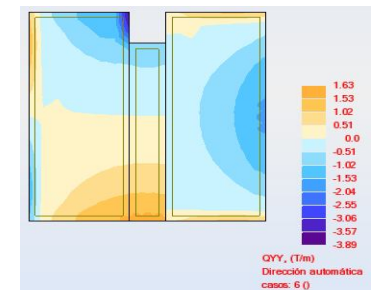
$$\begin{aligned}
 V_u &= 1.63 \text{ T/m} \\
 v_u &= 1.09 \text{ Kg/cm}^2 \\
 \phi V_c &= 6.52 \text{ Kg/cm}^2
 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION 1/2 DE LUZ

$$\begin{aligned}
 L &= 3.83 \text{ m} \\
 \text{Deflexion} &= 0.36 \text{ cm} \\
 \text{Luz / deflexion} &= 1063.89
 \end{aligned}$$

OK



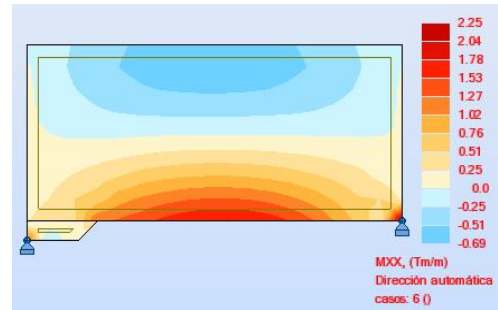
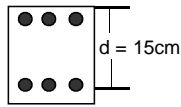
CONSORCIO PSA CONSULTORES.

**CENTRO DE DESARROLLO INFANTIL
- TESALIA. 21M3..-**

DISEÑO DE MUROS TANQUE DE AGUA

MOMENTO (MXX)

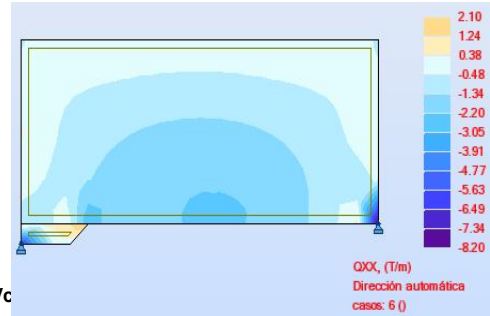
$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu &= 2.25 \text{ Tm} \\ \mu &= 225 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0100 \text{ T/cm}^2 \\ \rho &= 0.0027 \\ A_s = \rho b d &= 4.04 \text{ cm}^2 \end{aligned}$$



CORTANTE (QXX)

$$\begin{aligned} V_u &= 8.20 \text{ T/m} \\ v_u &= 5.47 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

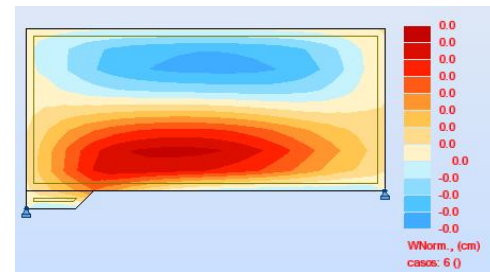
OK, v_u ES MENOR QUE V_c



DEFLEXION EN VOLADIZO

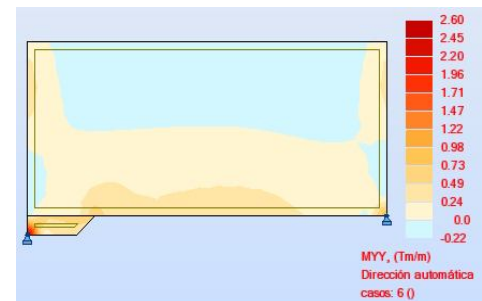
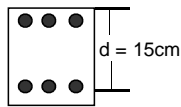
$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 7660.00 \text{ Voladizo} \end{aligned}$$

OK



MOMENTO (MY)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantia} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu &= 2.60 \text{ Tm} \\ \mu &= 260 \text{ Tcm} \\ K = \mu / (b d^2) &= 0.0116 \text{ T/cm}^2 \\ \rho &= 0.0031 \\ A_s = \rho b d &= 4.69 \text{ cm}^2 \end{aligned}$$



CORTANTE (QY)

$$\begin{aligned} V_u &= 10.65 \text{ T/m} \\ v_u &= 7.10 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned}$$

OJO v_u ES MAYOR QUE V_c

DEFLEXION 1/2 DE LUZ

$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.10 \text{ cm} \\ \text{Luz / deflexion} &= 3830.00 \end{aligned}$$

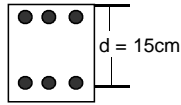
OK



DISEÑO DE PLACA BASE TANQUE DE AGUA

MOMENTO (MXX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento resistente con} \\ \text{cuantía mínima} &= 2.70 \text{ T-m} \\ \mu_u &= 1.31 \text{ Tm} \\ \mu_u &= 131 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\ \rho &= 0.0016 \\ A_s = \rho b d &= 2.36 \text{ cm}^2 \end{aligned}$$

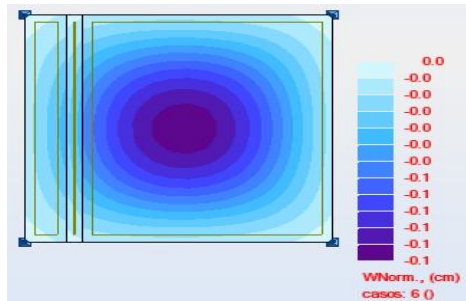
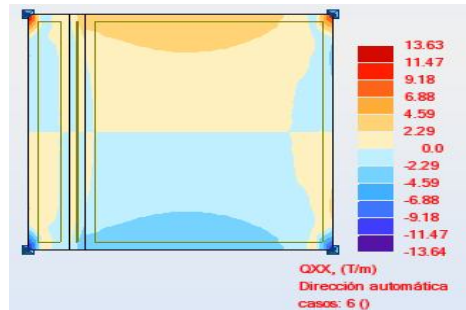
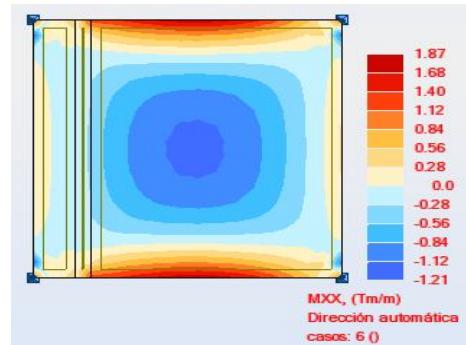


CORTANTE (QXX)

$$\begin{aligned} V_u &= 3.87 \text{ T/m} \\ v_u &= 2.58 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned} \quad \text{OK, } v_u \text{ ES MENOR QUE } V_c$$

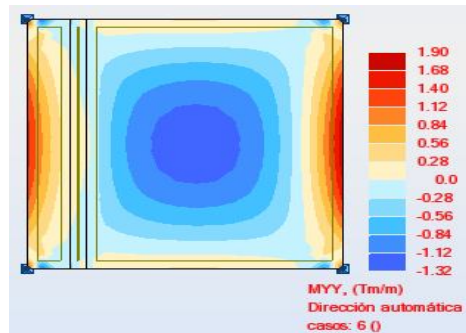
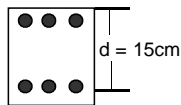
DEFLEXION EN VOLADIZO

$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.36 \text{ cm} \\ \text{Luz / deflexion} &= 2127.78 \text{ Voladizo} \end{aligned} \quad \text{OK}$$



MOMENTO (MYX)

$$\begin{aligned} b &= 100 \text{ cm} \\ h &= 20 \text{ cm} \\ d &= 15 \text{ cm} \\ f_y &= 4200 \text{ Kg/cm}^2 \\ f'_c &= 210 \text{ Kg/cm}^2 \\ \text{Momento maximo con cuantía} \\ \text{minima} &= 2.70 \text{ T-m} \\ \mu_u &= 1.31 \text{ Tm} \\ \mu_u &= 131 \text{ Tcm} \\ K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\ \rho &= 0.0016 \\ A_s = \rho b d &= 2.36 \text{ cm}^2 \end{aligned}$$

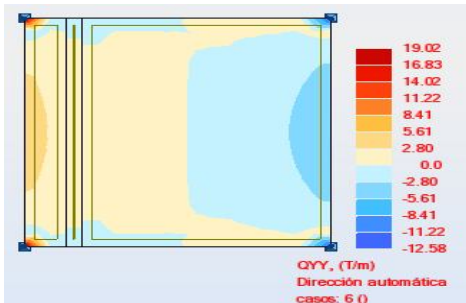


CORTANTE (QYY)

$$\begin{aligned} V_u &= 1.63 \text{ T/m} \\ v_u &= 1.09 \text{ Kg/cm}^2 \\ \phi V_c &= 6.52 \text{ Kg/cm}^2 \end{aligned} \quad \text{OK, } v_u \text{ ES MENOR QUE } V_c$$

DEFLEXION 1/2 DE LUZ

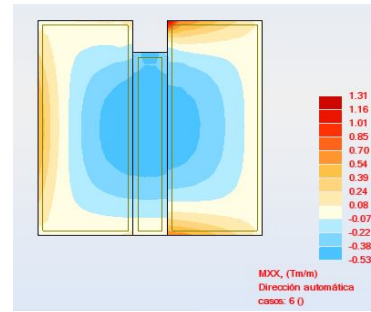
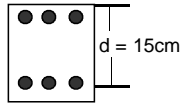
$$\begin{aligned} L &= 3.83 \text{ m} \\ \text{Deflexion} &= 0.36 \text{ cm} \\ \text{Luz / deflexion} &= 1063.89 \end{aligned} \quad \text{OK}$$



DISEÑO DE TAPA TANQUE DE AGUA

MOMENTO (MXX)

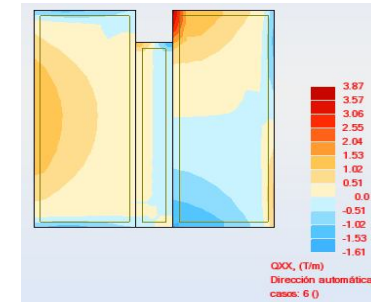
$$\begin{aligned}
 b &= 100 \text{ cm} \\
 h &= 20 \text{ cm} \\
 d &= 15 \text{ cm} \\
 f_y &= 4200 \text{ Kg/cm}^2 \\
 f'_c &= 210 \text{ Kg/cm}^2 \\
 \text{Momento resistente con} \\
 \text{cuantía mínima} &= 2.70 \text{ T-m} \\
 \mu_u &= 1.31 \text{ Tm} \\
 \mu_u &= 131 \text{ Tcm} \\
 K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\
 \rho &= 0.0016 \\
 A_s = \rho b d &= 2.36 \text{ cm}^2
 \end{aligned}$$



CORTANTE (QXX)

$$\begin{aligned}
 V_u &= 3.87 \text{ T/m} \\
 v_u &= 2.58 \text{ Kg/cm}^2 \\
 \phi V_c &= 6.52 \text{ Kg/cm}^2
 \end{aligned}$$

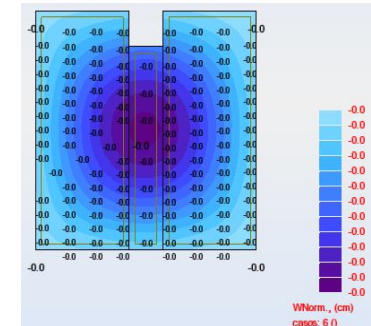
OK, v_u ES MENOR QUE V_c



DEFLEXION EN VOLADIZO

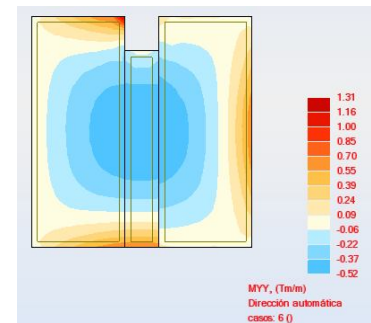
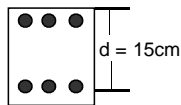
$$\begin{aligned}
 L &= 3.83 \text{ m} \\
 \text{Deflexion} &= 0.36 \text{ cm} \\
 \text{Luz / deflexion} &= 2127.78 \text{ Voladizo}
 \end{aligned}$$

OK



MOMENTO (MYY)

$$\begin{aligned}
 b &= 100 \text{ cm} \\
 h &= 20 \text{ cm} \\
 d &= 15 \text{ cm} \\
 f_y &= 4200 \text{ Kg/cm}^2 \\
 f'_c &= 210 \text{ Kg/cm}^2 \\
 \text{Momento maximo con cuantia} \\
 \text{minima} &= 2.70 \text{ T-m} \\
 \mu_u &= 1.31 \text{ Tm} \\
 \mu_u &= 131 \text{ Tcm} \\
 K = \mu_u / (b d^2) &= 0.0058 \text{ T/cm}^2 \\
 \rho &= 0.0016 \\
 A_s = \rho b d &= 2.36 \text{ cm}^2
 \end{aligned}$$



CORTANTE (QYY)

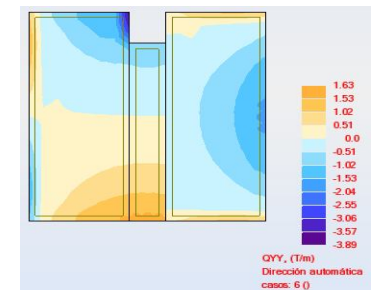
$$\begin{aligned}
 V_u &= 1.63 \text{ T/m} \\
 v_u &= 1.09 \text{ Kg/cm}^2 \\
 \phi V_c &= 6.52 \text{ Kg/cm}^2
 \end{aligned}$$

OK, v_u ES MENOR QUE V_c

DEFLEXION 1/2 DE LUZ

$$\begin{aligned}
 L &= 3.83 \text{ m} \\
 \text{Deflexion} &= 0.36 \text{ cm} \\
 \text{Luz / deflexion} &= 1063.89
 \end{aligned}$$


OK



CONSORCIO PSA CONSULTORES.

**CENTRO DE DESARROLLO INFANTIL
- MUROS DE CONTENCION-**

MIDAS/Set**Cantilever Retaining Wall [CRW1]**

	Company	CDI	Project Name	Muro 2.10m Potosi, Nariño
	Designer	Jose Wilches	File Name	C:\...\Midas\210muro B03

1. Design Conditions**(1). Design Code and Materials**

- Design Code		: ACI318-02	
- Conc. Comp. Strength	f_c'	: 2987	psi
- Rebar Yield Strength	f_y	: 60000	psi

(2). Backfill

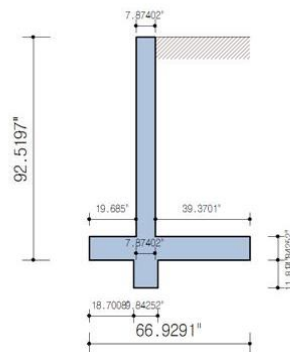
- Angle of Internal Friction	ϕ	: 30	deg.
- Unit Density of Soil	γ	: 120	lb/ft ³
- Surcharge Load(Flat)	W_s	: 368.663	psf

(3). Support Conditions

- Allowable Bearing Pressure	q_s	: 1.74091	ksf
- Undrained Shear Stren.(Cohesion)	c	: 0	ksf
- Angle of Internal Friction at Base	ϕ_o	: 30	deg.

(4). Retaining Wall Data

- Retaining Wall Height	H	: 93	in
- Wall Stem Top Thick.	L_{topw}	: 8	in
- Wall Stem Bot Thick.	L_{botw}	: 8	in
- Rebar Cover Thick.	c_s	: 2	in
- Wall Slope(Front)	Slope = 1	: 0	
- Ftg. Length of Toe Side	L_{toe}	: 20	in
- Ftg. Length of Heel Side	L_{heel}	: 39	in
- Total Ftg. Length	L	: 67	in
- Ftg. Slope Depth	H_{fs}	: 0	in
- Ftg. Depth/Rebar Cover	Depth/ c_o	: 10 /2	in
- Shear Key Location	S_x	: 19	in
- Shear Key HT./Width	$H_k * L_{key}$: 12 *10	in

2. Design Section

MIDAS/Set**Cantilever Retaining Wall [CRW1]**

	Company	CDI	Project Name	Muro 2.10m Potosi, Nariño
	Designer	Jose Wilches	File Name	C:\... \Midas\210muro.B03

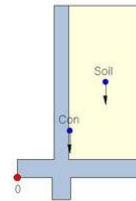
3. Calculate Soil Press.

- Applied Active Soil Press. : Rankine's Active Press.
- Active Soil Coeff. $K_A = 0.3333$
- Active Soil Press. $P_A = 1.19 \text{ kips/ft}$
- Surcharge Press. $P_{A1} = K_A W_s H = 0.95 \text{ kips/ft}$

4. Check Overturning

- Overt. Moment $M_o = P_{A1} \cdot H/2 + P_A \cdot H/3 = 6.71 \text{ ft-k/ft}$
- Resist. Moment M_r

Part	W (kips/ft)	Dist. (ft)	Moment (ft-k/ft)
Con	1.49	2.347	3.49
Soil	2.71	3.937	10.68
W_s	1.21	3.937	4.76
P_{Ay}	0.00	0.000	0.00
Σ	5.41		18.93



$$- M_r/M_o = 2.82 \geq 2.0 \quad \dots \text{O.K.}$$

5. Check Bearing Press.

$$\begin{aligned}
 - \text{Eccentricity } e &= \left| \frac{L}{2} \frac{(M_r - M_o)}{\Sigma W} \right| \\
 &= 0.53 \text{ ft} \leq L/6 = 0.93 \text{ ft} \\
 - q_{\max} &= \frac{\Sigma W}{L} \left(1 + \frac{6 \cdot e}{L} \right) \\
 &= 1.52 \text{ ksf} \leq q_a = 1.74 \text{ ksf} \quad \dots \text{O.K.} \\
 - q_{\min} &= \frac{\Sigma W}{L} \left(1 - \frac{6 \cdot e}{L} \right) = 0.42 \text{ ksf}
 \end{aligned}$$

6. Check Sliding

$$\begin{aligned}
 - \text{Applied Passive Soil Press.} &: \text{Rankine's Passive Soil Press.} \\
 - \text{Passive Soil Press. Coeff. } K_p &= \frac{(1 + \sin \phi_v)}{(1 - \sin \phi_v)} = 3.0000 \\
 - \text{Friction Coeff. } \mu &= \text{Min}[0.6, \tan(\phi_v)] = 0.5774 \\
 - \text{Sliding Force } H &= P_A + P_{A1} = 2.14 \text{ kips/ft} \\
 - \text{Resist. Force } H_r &= C \cdot A_v + \frac{q_1 + q_2}{2} \cdot K_p \cdot H_k + \frac{q_1 + q_2}{2} \cdot B_1 \cdot \mu + \frac{q_3 + q_4}{2} \cdot B_3 \cdot \mu \\
 &= 0.00 + 4.04 + 0.00 + 1.89 = 5.93 \text{ kips/ft} \\
 - H_r/H &= 2.78 \geq 1.5 \quad \dots \text{O.K.}
 \end{aligned}$$

MIDAS/Set**Cantilever Retaining Wall [CRW1]**

	Company	CDI	Project Name	Muro 2.10m Potosi, Nariño
	Designer	Jose Wilches	File Name	C:\... \Midas\210muro.B03

7. Compute Reaction Forces for Section

- Strength Reduction Factor – Flexural $\phi_s : 0.900$
- Strength Reduction Factor – Shear $\phi_s : 0.750$
- Load Comb. : $1.20D + 1.60L + 1.20D_s + 1.60H$
- Total Load $\Sigma W = 6.97$ kips/ft
- Overt. Mom. $M_o = 10.73$ ft-k/ft
- Resist. Mom. $M_r = 24.62$ ft-k/ft
- $q_{u,max} = \frac{\Sigma W}{L} \left(1 + \frac{6 \cdot e}{L} \right) = 2.32$ ksf
- $q_{u,min} = \frac{\Sigma W}{L} \left(1 - \frac{6 \cdot e}{L} \right) = 0.18$ ksf

8. Wall Stem Design**(1). Compute Soil Loading and Check Shear**

Part	HT. (ft)	Wall Thk (in)	Soil Press. (ksf)	Shear (kips/ft)	Shear Stren (kips/ft)	Remark
1	0.00	7.9	0.20	0.00	5.35	OK
2	3.44	7.9	0.42	1.06	5.35	OK
3	6.89	7.9	0.64	2.87	5.35	OK

(2). Design the Reinforcement**A. Vert. Reinf.**

- Front Face of Wall $A_{s,ext} = 0.11$ in²/ft >>> USE #6 @ 18"
- Rear Face of Wall ($A_{s,int}$)

Part	HT. (ft)	Wall Thk (in)	Moment (ft-k/ft)	Req'd Area (in ² /ft)	Rebar (in)
1	0.00	7.9	0.00	0.00	
2	3.44	7.9	1.60	0.07	#7 @ 18
3	6.89	7.9	8.16	0.36	#7 @ 18

B. Horz. Reinf. (Bottom of Wall)

- Front Face of Wall $A_{s,ext} = 0.16$ in²/ft >>> USE #6 @ 18"
- Rear Face of Wall $A_{s,int} = 0.08$ in²/ft >>> USE #6 @ 18"

9. Shear Key Design

- Shear $V_u = \frac{q_s + q_d}{2} \cdot K_o \cdot H_k + \frac{q_s + q_d}{2} \cdot L_{key} \cdot \tan \phi_s$
 $= 6.80$ kips/ft $\leq \phi V_c = 7.28$ kips/ft O.K
- Moment $M_u = 3.55$ ft-k/ft
- Reinf. $A_s = 0.11$ in²/ft >>> USE #7 @ 18"

MIDAS/Set**Cantilever Retaining Wall [CRW1]**

	Company	CDI	Project Name	Muro 2.10m Potosi, Narinó
	Designer	Jose Wilches	File Name	C:\... \Midas\210muro.B03

10. Footing Heel Design

Part	Shear(kips/ft)	Moment(ft-k/ft)	Load Fact.
Conc. Self WT.	0.50	0.80	1.20
Soil WT.	3.26	5.34	1.20
Surcharge	1.94	3.17	1.60
Vert. Soil Press.	0.00	-0.00	1.60
Foundation Reaction	-2.65	-3.22	
Σ	3.04	6.09	

-, Shear $V_u = 3.04$ kips/ft $\leq \phi V_c = 7.28$ kips/ft O.K
 -, Reinf. $A_s = 0.19$ in²/ft >>> USE #7 @ 18"

11. Footing Toe Design


Part	Shear(kips/ft)	Moment(ft-k/ft)	Load Fact.
Conc. Self WT.	-0.26	-0.20	1.20
Foundation Reaction	3.29	2.84	
Σ	3.04	2.64	

-, Shear at Critical Sect. = $-0.20 + 2.75$ (Check @ : d/2 = 3.70 in)
 $V_{u,critical} = 2.56$ kips/ft $\leq \phi V_c = 7.28$ kips/ft O.K
 -, Reinf. $A_s = 0.08$ in²/ft >>> USE #7 @ 18"

12. Design the Temp. Reinforcement of Footing

-, Reinf. $A_s = 0.21$ in²/ft >>> USE #6 @ 18"

MIDAS/Set**Cantilever Retaining Wall [CRW1]**

	Company	CDI	Project Name	Muro 2.60m Potosi, Nariño
	Designer	Jose Wilches	File Name	C:\...\Midas\260muro.B03

1. Design Conditions**(1). Design Code and Materials**

- Design Code		: ACI318-02	
- Conc. Comp. Strength	f_c'	: 2987	psi
- Rebar Yield Strength	f_y	: 60000	psi

(2). Backfill

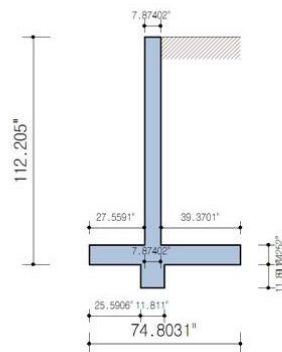
- Angle of Internal Friction	ϕ	: 30	deg.
- Unit Density of Soil	γ	: 120	lb/ft ³
- Surcharge Load(Flat)	W_s	: 368.663	psf

(3). Support Conditions

- Allowable Bearing Pressure	q_s	: 1.74091	ksf
- Undrained Shear Stren.(Cohesion)	c	: 0	ksf
- Angle of Internal Friction at Base	ϕ_o	: 30	deg.

(4). Retaining Wall Data

- Retaining Wall Height	H	: 112	in
- Wall Stem Top Thick.	L_{topw}	: 8	in
- Wall Stem Bot Thick.	L_{botw}	: 8	in
- Rebar Cover Thick.	c_s	: 2	in
- Wall Slope(Front)	Slope = 1	: 0	
- Ftg. Length of Toe Side	L_{toe}	: 28	in
- Ftg. Length of Heel Side	L_{heel}	: 39	in
- Total Ftg. Length	L	: 75	in
- Ftg. Slope Depth	H_{fs}	: 0	in
- Ftg. Depth/Rebar Cover	Depth/ c_o	: 10 /2	in
- Shear Key Location	S_x	: 26	in
- Shear Key HT./Width	$H_k * L_{key}$: 12 *12	in

2. Design Section

MIDAS/Set**Cantilever Retaining Wall [CRW1]**

	Company	CDI	Project Name	Muro 2.60m Potosi, Narino
	Designer	Jose Wilches	File Name	C:\... \Midas\260muro.B03

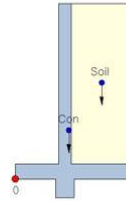
3. Calculate Soil Press.

- Applied Active Soil Press. : Rankine's Active Press.
- Active Soil Coeff. $K_A = 0.3333$
- Active Soil Press. $P_A = 1.75 \text{ kips/ft}$
- Surcharge Press. $P_{A1} = K_A W_s H = 1.15 \text{ kips/ft}$

4. Check Overturning

- Overt. Moment $M_o = P_{A1} \cdot H/2 + P_A \cdot H/3 = 10.82 \text{ ft-k/ft}$
- Resist. Moment M_r

Part	W (kips/ft)	Dist. (ft)	Moment (ft-k/ft)
Con	1.75	2.840	4.98
Soil	3.36	4.593	15.43
W_s	1.21	4.593	5.56
P_{A1}	0.00	0.000	0.00
Σ	6.32		25.96



$$- M_r/M_o = 2.40 \geq 2.0 \quad \dots \text{O.K.}$$

5. Check Bearing Press.

$$\begin{aligned}
 - \text{Eccentricity } e &= \left| \frac{L}{2} \frac{(M_r - M_o)}{\Sigma W} \right| \\
 &= 0.72 \text{ ft} \leq L/6 = 1.04 \text{ ft} \\
 - Q_{\max} &= \frac{\Sigma W}{L} \left(1 + \frac{6 \cdot e}{L} \right) \\
 &= 1.72 \text{ ksf} \leq q_a = 1.74 \text{ ksf} \quad \dots \text{O.K.} \\
 - Q_{\min} &= \frac{\Sigma W}{L} \left(1 - \frac{6 \cdot e}{L} \right) = 0.31 \text{ ksf}
 \end{aligned}$$

6. Check Sliding

$$\begin{aligned}
 - \text{Applied Passive Soil Press.} &: \text{Rankine's Passive Soil Press.} \\
 - \text{Passive Soil Press. Coeff. } K_p &= \frac{(1 + \sin \phi_v)}{(1 - \sin \phi_v)} = 3.0000 \\
 - \text{Friction Coeff. } \mu &= \text{Min}[0.6, \tan(\phi_v)] = 0.5774 \\
 - \text{Sliding Force } H &= P_A + P_{A1} = 2.90 \text{ kips/ft} \\
 - \text{Resist. Force } H_r &= C \cdot A_v + \frac{q_1 + q_2}{2} \cdot K_p \cdot H_k + \frac{q_1 + q_2}{2} \cdot B_1 \cdot \mu + \frac{q_3 + q_4}{2} \cdot B_3 \cdot \mu \\
 &= 0.00 + 4.22 + 0.41 + 1.83 = 6.46 \text{ kips/ft} \\
 - H/H_r &= 2.23 \geq 1.5 \quad \dots \text{O.K.}
 \end{aligned}$$

MIDAS/Set**Cantilever Retaining Wall [CRW1]**

	Company	CDI	Project Name	Muro 2.60m Potosi, Nariño
	Designer	Jose Wilches	File Name	C:\... \Midas\260muro.B03

7. Compute Reaction Forces for Section

- . Strength Reduction Factor – Flexural $\phi_s : 0.900$
- . Strength Reduction Factor – Shear $\phi_s : 0.750$
- . Load Comb. : $1.20D + 1.60L + 1.20D_s + 1.60H$
- . Total Load $\Sigma W = 8.07$ kips/ft
- . Overt. Mom. $M_o = 17.32$ ft-k/ft
- . Resist. Mom. $M_i = 33.37$ ft-k/ft
- . $q_{u,max} = \frac{2\Sigma W}{3B(L/2 - e)} = 2.70$ ksf

8. Wall Stem Design**(1). Compute Soil Loading and Check Shear**

Part	HT. (ft)	Wall Thk (in)	Soil Press. (ksf)	Shear (kips/ft)	Shear Stren (kips/ft)	Remark
1	0.00	7.9	0.20	0.00	5.35	OK
2	4.27	7.9	0.47	1.42	5.35	OK
3	8.53	7.9	0.74	4.01	5.35	OK

(2). Design the Reinforcement**A. Vert. Reinf.**

- . Front Face of Wall $A_{s,ext} = 0.11$ in²/ft >>> USE #6 @ 18"
- . Rear Face of Wall ($A_{s,int}$)

Part	HT. (ft)	Wall Thk (in)	Moment (ft-k/ft)	Req'd Area (in ² /ft)	Rebar (in)
1	0.00	7.9	0.00	0.00	
2	4.27	7.9	2.62	0.11	#7 @ 18
3	8.53	7.9	13.77	0.64	#7 @ 11

B. Horz. Reinf. (Bottom of Wall)

- . Front Face of Wall $A_{s,ext} = 0.16$ in²/ft >>> USE #6 @ 18"
- . Rear Face of Wall $A_{s,int} = 0.08$ in²/ft >>> USE #6 @ 18"

9. Shear Key Design

- . Shear $V_u = \frac{q_s + q_d}{2} * K_o * H_k + \frac{q_s + q_d}{2} * L_{key} * \tan \phi_s$
 $= 7.13$ kips/ft $\leq \phi V_c = 9.22$ kips/ft O.K
- . Moment $M_u = 3.75$ ft-k/ft
- . Reinf. $A_s = 0.09$ in²/ft >>> USE #7 @ 18"

MIDAS/Set**Cantilever Retaining Wall [CRW1]**

	Company	CDI	Project Name	Muro 2.60m Potosi, Nariño
	Designer	Jose Wilches	File Name	C:\... \Midas\260muro.B03

10. Footing Heel Design

Part	Shear(kips/ft)	Moment(ft-k/ft)	Load Fact.
Conc. Self WT.	0.51	0.80	1.20
Soil WT.	4.03	6.61	1.20
Surcharge	1.94	3.17	1.60
Vert. Soil Press.	0.00	-0.00	1.60
Foundation Reaction	-2.06	-2.07	
Σ	4.42	8.51	

-, Shear $V_u = 4.42 \text{ kips/ft} \leq \phi V_c = 7.28 \text{ kips/ft} \dots \text{O.K}$
 -, Reinf. $A_s = 0.26 \text{ in}^2/\text{ft} >>> \text{USE \#7 @ 18"}$

11. Footing Toe Design

Part	Shear(kips/ft)	Moment(ft-k/ft)	Load Fact.
Conc. Self WT.	-0.37	-0.39	1.20
Foundation Reaction	5.01	6.21	
Σ	4.64	5.82	

-, Shear at Critical Sect. $= -0.29 + 4.48 \text{ (Check @ : } d/2 = 3.70 \text{ in)}$
 $V_{u,critical} = 4.18 \text{ kips/ft} \leq \phi V_c = 7.28 \text{ kips/ft} \dots \text{O.K}$
 -, Reinf. $A_s = 0.18 \text{ in}^2/\text{ft} >>> \text{USE \#7 @ 18"}$

12. Design the Temp. Reinforcement of Footing

-, Reinf. $A_s = 0.21 \text{ in}^2/\text{ft} >>> \text{USE \#6 @ 18"}$