

ANEXO B

- INDICE DE SOBRESFUERZO A FLEXION - VIGA

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot Fy \left(1 - 0.59 \cdot \rho \cdot \frac{Fy}{f'c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

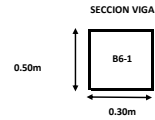
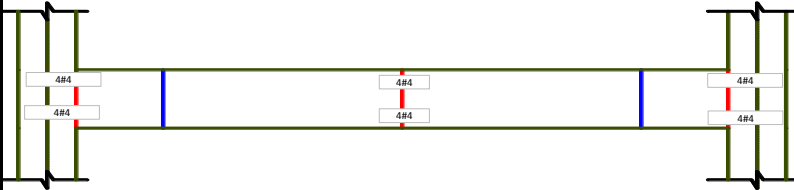
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	-83.08 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION IZQ (-)=	1.39 MAL
1/I.S. FLEXION IZQ (-)=	72%

Mu (-)=	-4.65 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.08 OK
1/I.S. FLEXION C.LUZ (-)=	1282%

Mu (-)=	-71.24 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION DER (-)=	1.19 MAL
1/I.S. FLEXION DER (-)=	84%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	70.67 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION IZQ (+)=	1.19 MAL
1/I.S. FLEXION IZQ (+)=	84%

Mu (+)=	11.89 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.20 OK
1/I.S. FLEXION C.LUZ (+)=	501%

Mu (+)=	53.53 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION DER (+)=	0.90 OK
1/I.S. FLEXION DER (+)=	111%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot Fy \left(1 - 0.59 \cdot \rho \cdot \frac{Fy}{f'c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

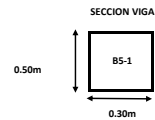
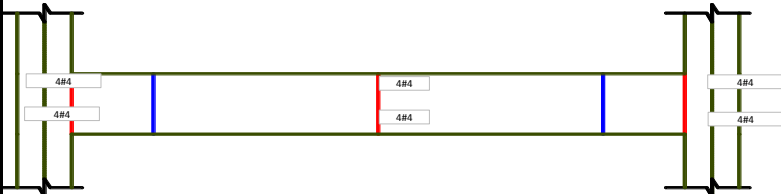
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	3.34 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION IZQ (-)=	0.06 OK
1/I.S. FLEXION IZQ (-)=	1785%

Mu (-)=	2.96 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.05 OK
1/I.S. FLEXION C.LUZ (-)=	2014%

Mu (-)=	5.68 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION DER (-)=	0.11 OK
1/I.S. FLEXION DER (-)=	892%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	10.66 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION IZQ (+)=	0.18 OK
1/I.S. FLEXION IZQ (+)=	559%

Mu (+)=	-0.67 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.01 OK
1/I.S. FLEXION C.LUZ (+)=	8898%

Mu (+)=	9.27 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION DER (+)=	0.16 OK
1/I.S. FLEXION DER (+)=	643%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot Fy \left(1 - 0.59 \cdot \rho \cdot \frac{Fy}{f'c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

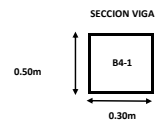
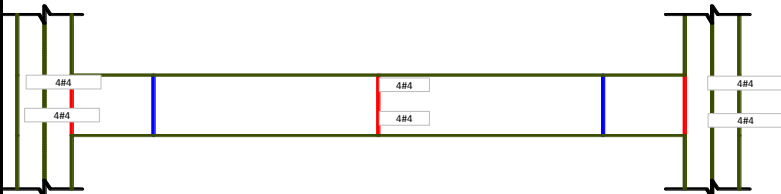
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	-54.13 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION IZQ (-)=	0.91 OK
1/I.S. FLEXION IZQ (-)=	110%

Mu (-)=	-32.4 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.54 OK
1/I.S. FLEXION C.LUZ (-)=	184%

Mu (-)=	-148.7 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION DER (-)=	2.49 MAL
1/I.S. FLEXION DER (-)=	40%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	69.31 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION IZQ (+)=	1.16 MAL
1/I.S. FLEXION IZQ (+)=	86%

Mu (+)=	38.71 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.65 OK
1/I.S. FLEXION C.LUZ (+)=	154%

Mu (+)=	117.2 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex= ϕ Mn	93.15 kn.m
Nef= $\phi_e \cdot \phi_c \cdot Nex$	59.62 kn.m
I.S FLEXION DER (+)=	1.97 MAL
1/I.S. FLEXION DER (+)=	51%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

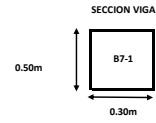
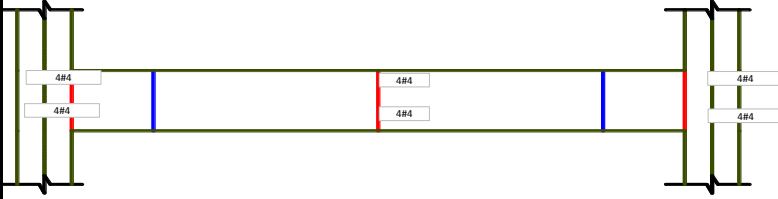
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-86.46 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	1.45 MAL
1/I.S. FLEXION IZQ (-)=	69%

Mu (-)=	-7.36 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.12 OK
1/I.S. FLEXION C.LUZ (-)=	810%

Mu (-)=	-174.1 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	2.92 MAL
1/I.S. FLEXION DER (-)=	34%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	110.28 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	1.85 MAL
1/I.S. FLEXION IZQ (+)=	54%

Mu (+)=	46.74 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.78 OK
1/I.S. FLEXION C.LUZ (+)=	128%

Mu (+)=	122.66 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	2.08 MAL
1/I.S. FLEXION DER (+)=	49%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

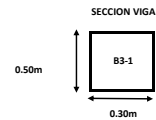
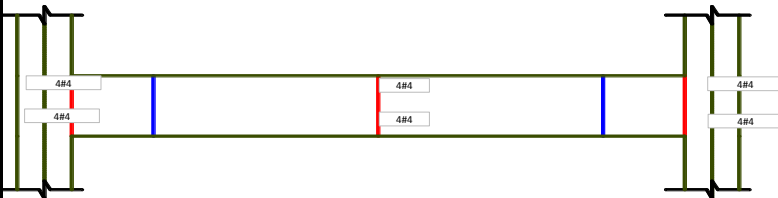
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-144.04 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	2.42 MAL
1/I.S. FLEXION IZQ (-)=	41%

Mu (-)=	-49.32 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.83 OK
1/I.S. FLEXION C.LUZ (-)=	121%

Mu (-)=	-39.38 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	0.66 OK
1/I.S. FLEXION DER (-)=	151%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	121.79 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	2.04 MAL
1/I.S. FLEXION IZQ (+)=	49%

Mu (+)=	39.1 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.66 OK
1/I.S. FLEXION C.LUZ (+)=	152%

Mu (+)=	38.11 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	0.64 OK
1/I.S. FLEXION DER (+)=	156%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

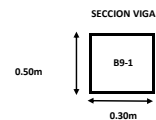
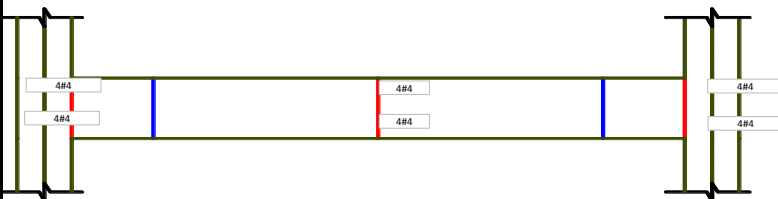
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-117.82 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	1.98 MAL
1/I.S. FLEXION IZQ (-)=	51%

Mu (-)=	2.31 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.04 OK
1/I.S. FLEXION C.LUZ (-)=	2581%

Mu (-)=	-206.37 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	3.46 MAL
1/I.S. FLEXION DER (-)=	29%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	157.53 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	2.64 MAL
1/I.S. FLEXION IZQ (+)=	38%

Mu (+)=	47.38 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.70 OK
1/I.S. FLEXION C.LUZ (+)=	126%

Mu (+)=	158.38 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=phiMn	93.15 kn.m
Nef=phi*phi*c*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	2.66 MAL
1/I.S. FLEXION DER (+)=	38%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

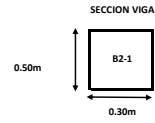
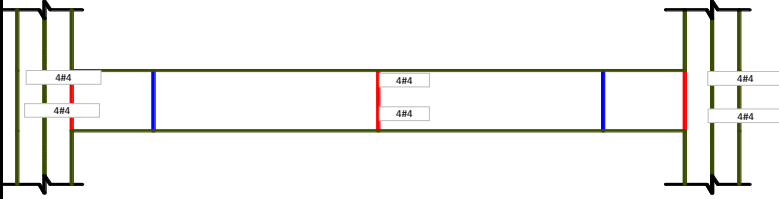
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-155.4 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	2.61 MAL
1/I.S. FLEXION IZQ(-)	38%

$M_u (-)$	8.91 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.15 OK
1/I.S. FLEXION C.LUZ(-)	669%

$M_u (-)$	-176.12 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	2.95 MAL
1/I.S. FLEXION DER(-)	34%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	157.71 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	2.65 MAL
1/I.S. FLEXION IZQ(+)	38%

$M_u (+)$	44.22 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.74 OK
1/I.S. FLEXION C.LUZ(+)	135%

$M_u (+)$	81.54 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.37 MAL
1/I.S. FLEXION DER(+)	73%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

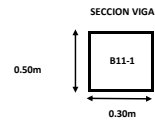
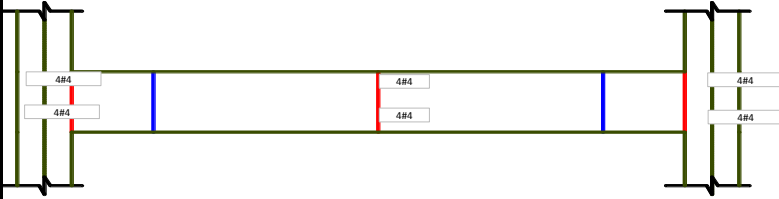
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-246.12 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	4.13 MAL
1/I.S. FLEXION IZQ(-)	24%

$M_u (-)$	10.32 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.17 OK
1/I.S. FLEXION C.LUZ(-)	578%

$M_u (-)$	-268.57 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	4.51 MAL
1/I.S. FLEXION DER(-)	22%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	292.97 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	4.91 MAL
1/I.S. FLEXION IZQ(+)	20%

$M_u (+)$	31.02 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.52 OK
1/I.S. FLEXION C.LUZ(+)	192%

$M_u (+)$	240.5 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	4.03 MAL
1/I.S. FLEXION DER(+)	25%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

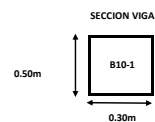
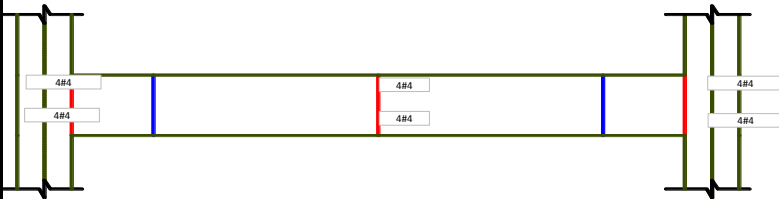
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-6.19 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.10 OK
1/I.S. FLEXION IZQ(-)	963%

$M_u (-)$	-7.7 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.13 OK
1/I.S. FLEXION C.LUZ(-)	774%

$M_u (-)$	-51.98 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.87 OK
1/I.S. FLEXION DER(-)	115%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	10.89 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.18 OK
1/I.S. FLEXION IZQ(+)	547%

$M_u (+)$	3.33 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.06 OK
1/I.S. FLEXION C.LUZ(+)	1790%

$M_u (+)$	48.3 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.81 OK
1/I.S. FLEXION DER(+)	123%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\phi M_n = \phi * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$As = \rho * b * d$$

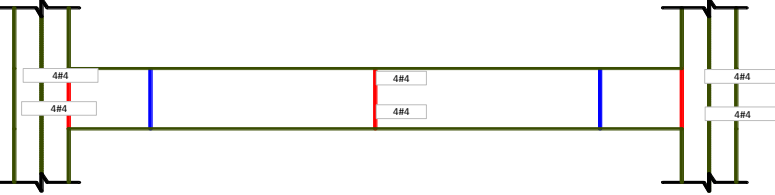
f_c	19	Mpa	b	0,3	cm
f_y	420	Mpa	d	0,5	cm
ϕ	0,9		ϕ_e	0,8	
			ϕ_c	0,8	

	Calidad del diseño y la construcción, o del estado de la edificación		
	Buena	Regular	Malá
ϕ_x o ϕ_y	1.0	0.8	0.6

Mu (-)=	-10,72	kn.m
As (-)=	0,000516	m2
$\rho (-)=$	0,00344	
Nex=φMn	93,15	kn.m
Nef=φe*φc*Nex=	59,62	kn.m
1,5 FLEXION IQQ (-)=	0,18	OK
1/I.S. FLEXION IQQ (-)=	556%	

Mu (-)=	-12,56	kn.m
As(-)=	0,000516	m2
p(-)=	0,00344	
Nex=φMn	93,15	kn.m
Nef=φe*fc*Nex=	59,62	kn.m
I.S FLEXION C.LUZ(-)=	0,21	OK
1/I.S. FLEXION C.LUZ(-)=	475%	

Mu (-)=	-25,9	kn.m	OK
As(-)=	0,000516	m2	
p(-)=	0,00344		
Nex=φMn	93,15	kn.m	
Nef=φe*φc*Nex=	59,62	kn.m	
I.S FLEXION DER(-)=	0,43		
1/I.S. FLEXION DER(-)=	230%		

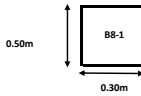


Mu (+)=	3,38	kn.m
As(+)=	0,000516	m2
p(+)=	0,00344	
Nex=φMn	93,15	kn.m
Nef=φe*φc*Nex=	59,62	kn.m
1.5 FLEXION IZQ(+)=	0,06	OK
1/1.5. FLEXION IZQ(+)=	1764%	

Mu (+)=	8,04	kn.m
As(+)=	0,000516	m2
p(+)=	0,00344	
Nex=φMn	93,15	kn.m
Nef=φe*φc*Nex=	59,62	kn.m
I.S FLEXION C.LUZI(-)=	0,13	OK
1/I.S. FLEXION C.LUZI(-)=	741%	

Mu (+)=	28,88	kn.m	OK
As(+)=	0,000516	m2	
p(+)=	0,00344		
Nex=φMn	93,15	kn.m	
Nef=φe*φc*Nex=	59,62	kn.m	
I.S FLEXION DER(-)=	0,48		
1/I.S. FLEXION DER(-)=	206%		

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Rec. Inf.	0,05	m
Rec.sup.	0,05	m

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot Fy \left(1 - 0.59 \cdot \rho \cdot \frac{Fy}{f'c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

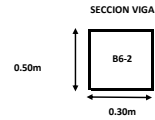
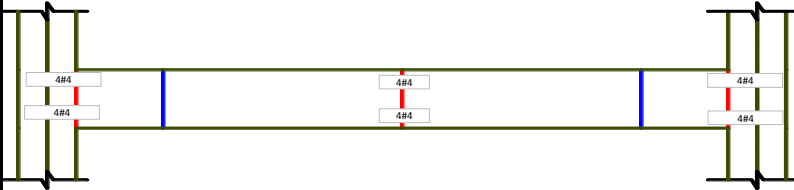
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	-123.74 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	2.08
1/I.S. FLEXION IZQ (-)=	48%

Mu (-)=	-4.19 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.07
1/I.S. FLEXION C.LUZ (-)=	1423%

Mu (-)=	-117.21 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	1.97
1/I.S. FLEXION DER (-)=	51%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	130.7 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	2.19
1/I.S. FLEXION IZQ (+)=	46%

Mu (+)=	20.31 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.34
1/I.S. FLEXION C.LUZ (+)=	294%

Mu (+)=	89.49 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	1.50
1/I.S. FLEXION DER (+)=	67%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot Fy \left(1 - 0.59 \cdot \rho \cdot \frac{Fy}{f'c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

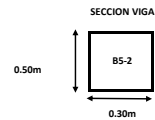
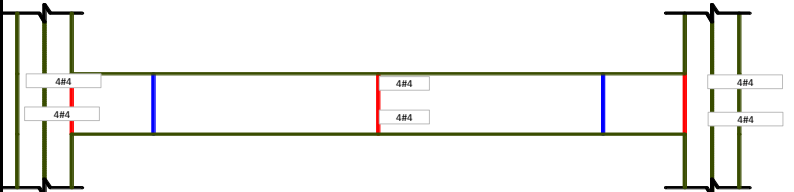
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	-48.81 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	0.82
1/I.S. FLEXION IZQ (-)=	122%

Mu (-)=	-4.12 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.07
1/I.S. FLEXION C.LUZ (-)=	1447%

Mu (-)=	-13.78 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	0.23
1/I.S. FLEXION DER (-)=	433%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	-12.69 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	0.21
1/I.S. FLEXION IZQ (+)=	470%

Mu (+)=	-0.51 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.01
1/I.S. FLEXION C.LUZ (+)=	11689%

Mu (+)=	19.62 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	0.33
1/I.S. FLEXION DER (+)=	304%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot Fy \left(1 - 0.59 \cdot \rho \cdot \frac{Fy}{f'c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

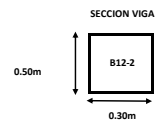
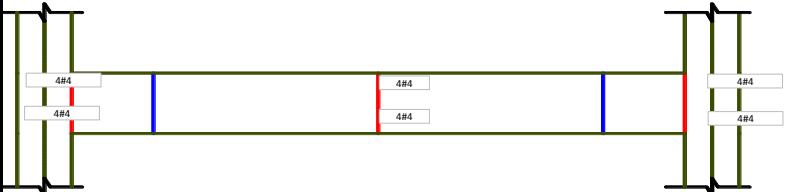
f'c	19 Mpa	b	0.3 m
fy	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	3.7 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	0.06
1/I.S. FLEXION IZQ (-)=	1611%

Mu (-)=	-69.39 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	1.16
1/I.S. FLEXION C.LUZ (-)=	86%

Mu (-)=	-197.51 kn.m
As (-)=	0.000516 m2
$\rho (-)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	3.31
1/I.S. FLEXION DER (-)=	30%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	49.97 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	0.84
1/I.S. FLEXION IZQ (+)=	119%

Mu (+)=	8.67 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.15
1/I.S. FLEXION C.LUZ (+)=	688%

Mu (+)=	32.8 kn.m
As (+)=	0.000516 m2
$\rho (+)$ =	0.00344
Nex=φMn	93.15 kn.m
Nef=φe*φc*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	0.55
1/I.S. FLEXION DER (+)=	181%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

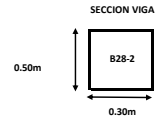
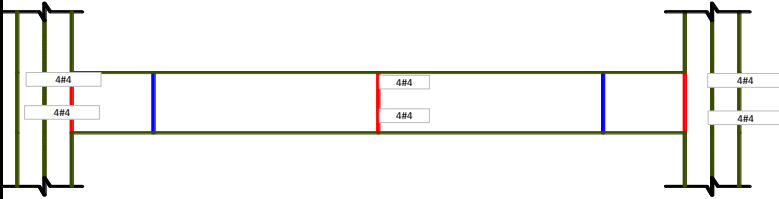
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	13.47 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.23
1/I.S. FLEXION IZQ(-)	443%

$M_u (-)$	-22.6 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.38
1/I.S. FLEXION C.LUZ(-)	264%

$M_u (-)$	-68.75 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	1.15
1/I.S. FLEXION DER(-)	87%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	24.17 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.41
1/I.S. FLEXION IZQ(+)	247%

$M_u (+)$	6.31 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.11
1/I.S. FLEXION C.LUZ(+)	945%

$M_u (+)$	-14.79 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.25
1/I.S. FLEXION DER(+)	403%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

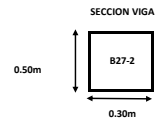
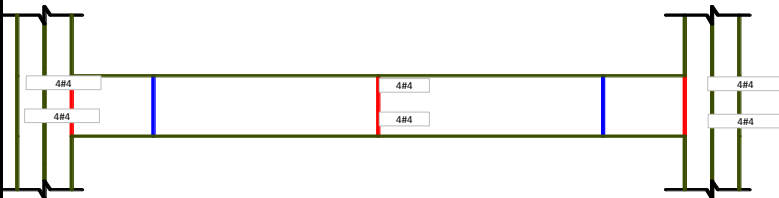
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	16.5 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.28
1/I.S. FLEXION IZQ(-)	361%

$M_u (-)$	0.94 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.02
1/I.S. FLEXION C.LUZ(-)	6342%

$M_u (-)$	-21.59 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.36
1/I.S. FLEXION DER(-)	276%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	36.16 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.61
1/I.S. FLEXION IZQ(+)	165%

$M_u (+)$	34 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.57
1/I.S. FLEXION C.LUZ(+)	175%

$M_u (+)$	28.14 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.47
1/I.S. FLEXION DER(+)	212%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

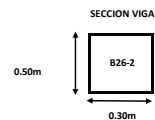
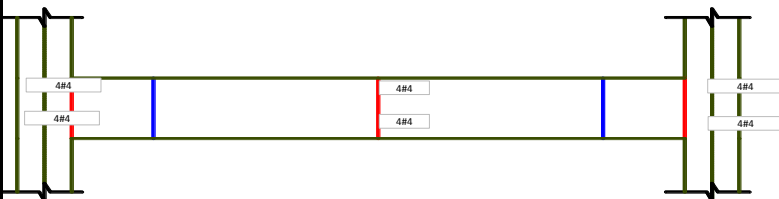
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	27.7 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.46
1/I.S. FLEXION IZQ(-)	215%

$M_u (-)$	-20.04 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.34
1/I.S. FLEXION C.LUZ(-)	297%

$M_u (-)$	-22.21 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.37
1/I.S. FLEXION DER(-)	268%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	49.59 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.83
1/I.S. FLEXION IZQ(+)	120%

$M_u (+)$	22.35 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.37
1/I.S. FLEXION C.LUZ(+)	267%

$M_u (+)$	43.32 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.73
1/I.S. FLEXION DER(+)	138%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

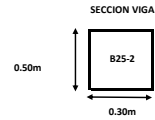
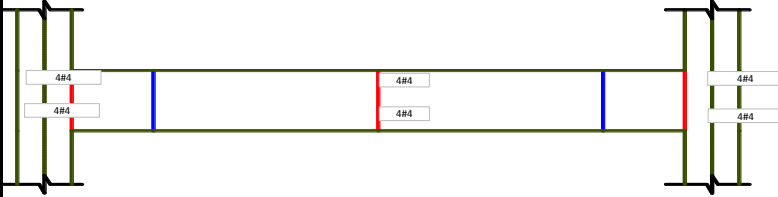
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	5.3 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.09
1/I.S. FLEXION IZQ(-)	1125%

$M_u (-)$	12.77 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.21
1/I.S. FLEXION C.LUZ(-)	486%

$M_u (-)$	3.43 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.06
1/I.S. FLEXION DER(-)	1738%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	18.23 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.31
1/I.S. FLEXION IZQ(+)	327%

$M_u (+)$	33.2 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.56
1/I.S. FLEXION C.LUZ(+)	180%

$M_u (+)$	55.55 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.93
1/I.S. FLEXION DER(+)	107%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

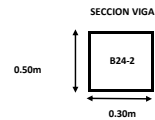
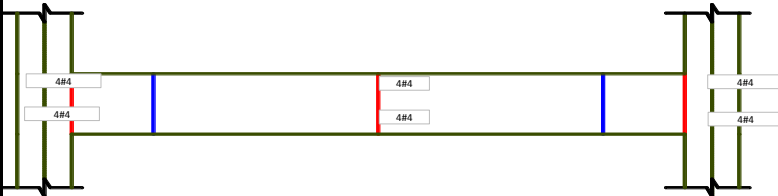
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	42.14 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.71
1/I.S. FLEXION IZQ(-)	141%

$M_u (-)$	13.63 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.23
1/I.S. FLEXION C.LUZ(-)	437%

$M_u (-)$	56.29 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.94
1/I.S. FLEXION DER(-)	106%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	80.07 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.34
1/I.S. FLEXION IZQ(+)	74%

$M_u (+)$	41.86 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.70
1/I.S. FLEXION C.LUZ(+)	142%

$M_u (+)$	19.05 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.32
1/I.S. FLEXION DER(+)	315%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

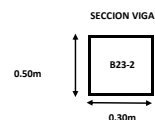
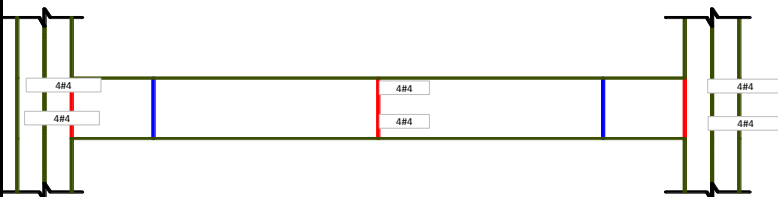
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	45.72 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.77
1/I.S. FLEXION IZQ(-)	130%

$M_u (-)$	45.62 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.77
1/I.S. FLEXION C.LUZ(-)	131%

$M_u (-)$	34.23 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.57
1/I.S. FLEXION DER(-)	174%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	96.28 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.62
1/I.S. FLEXION IZQ(+)	62%

$M_u (+)$	79.52 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	1.33
1/I.S. FLEXION C.LUZ(+)	75%

$M_u (+)$	80.93 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.36
1/I.S. FLEXION DER(+)	74%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

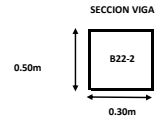
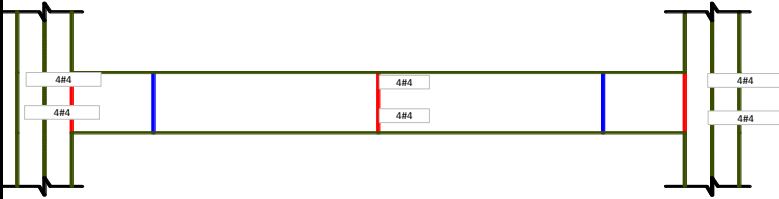
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	36.16 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.61
1/I.S. FLEXION IZQ(-)	165% OK

$M_u (-)$	45.18 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.76
1/I.S. FLEXION C.LUZ(-)	132% OK

$M_u (-)$	45.71 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.77
1/I.S. FLEXION DER(-)	130% OK



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	89.76 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.51
1/I.S. FLEXION IZQ(+)	66% MAL

$M_u (+)$	80.52 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	1.35
1/I.S. FLEXION C.LUZ(+)	74% MAL

$M_u (+)$	88.3 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.48
1/I.S. FLEXION DER(+)	68% MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

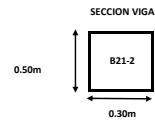
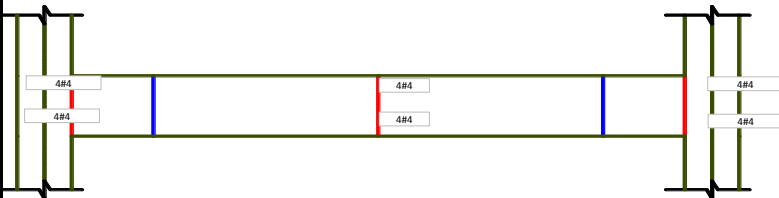
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	2.74 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.05
1/I.S. FLEXION IZQ(-)	2176% OK

$M_u (-)$	30.09 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.50
1/I.S. FLEXION C.LUZ(-)	198% OK

$M_u (-)$	43.78 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.73
1/I.S. FLEXION DER(-)	136% OK



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	63.43 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.06
1/I.S. FLEXION IZQ(+)	94% MAL

$M_u (+)$	66.67 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	1.12
1/I.S. FLEXION C.LUZ(+)	89% MAL

$M_u (+)$	76.79 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.29
1/I.S. FLEXION DER(+)	78% MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

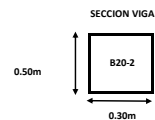
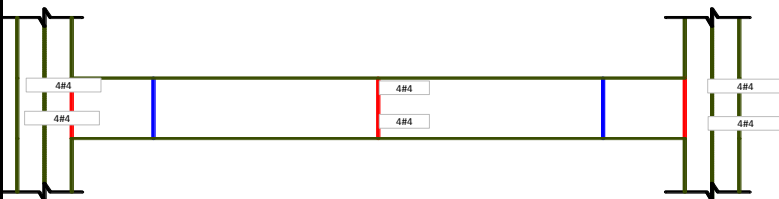
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-19.73 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.33
1/I.S. FLEXION IZQ(-)	302% OK

$M_u (-)$	-42.37 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.71
1/I.S. FLEXION C.LUZ(-)	141% OK

$M_u (-)$	23.22 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.39
1/I.S. FLEXION DER(-)	257% OK



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	20.93 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.35
1/I.S. FLEXION IZQ(+)	285% OK

$M_u (+)$	13.58 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.23
1/I.S. FLEXION C.LUZ(+)	439% OK

$M_u (+)$	45.34 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.76
1/I.S. FLEXION DER(+)	131% OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

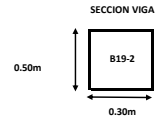
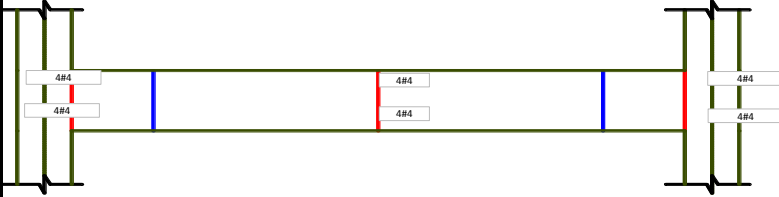
f'_c	19 Mpa	b	0.3 cm
f_y	420 Mpa	d	0.5 cm
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-81.89 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	1.37 MAL
1/I.S. FLEXION IZQ(-)	73%

$M_u (-)$	-60.81 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.02 MAL
1/I.S. FLEXION C.LUZ(-)	98%

$M_u (-)$	-41.66 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.70 OK
1/I.S. FLEXION DER(-)	143%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	-2.15 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.04 OK
1/I.S. FLEXION IZQ(+)	2385%

$M_u (+)$	-4.6 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.08 OK
1/I.S. FLEXION C.LUZ(+)	1296%

$M_u (+)$	-9.09 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.15 OK
1/I.S. FLEXION DER(+)	656%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

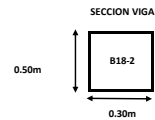
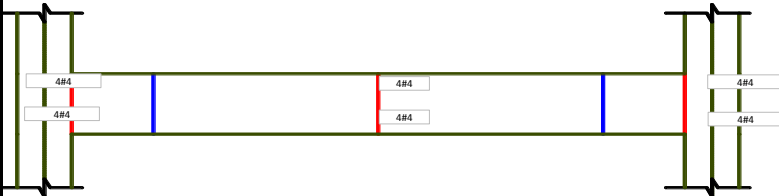
f'_c	19 Mpa	b	0.3 cm
f_y	420 Mpa	d	0.5 cm
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-52.93 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	1.06 MAL
1/I.S. FLEXION IZQ(-)	95%

$M_u (-)$	-50.06 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.84 OK
1/I.S. FLEXION C.LUZ(-)	119%

$M_u (-)$	-40.36 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.68 OK
1/I.S. FLEXION DER(-)	148%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	60.46 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.01 MAL
1/I.S. FLEXION IZQ(+)	99%

$M_u (+)$	61.06 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	1.02 MAL
1/I.S. FLEXION C.LUZ(+)	98%

$M_u (+)$	58.49 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.98 OK
1/I.S. FLEXION DER(+)	102%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

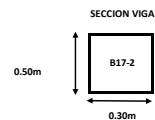
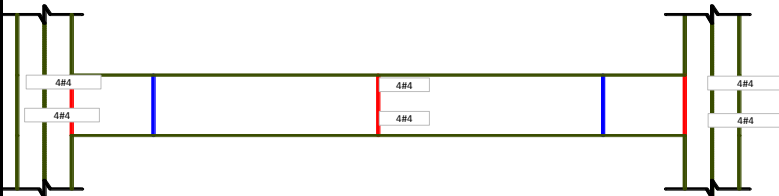
f'_c	19 Mpa	b	0.3 cm
f_y	420 Mpa	d	0.5 cm
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-52.33 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.88 OK
1/I.S. FLEXION IZQ(-)	114%

$M_u (-)$	-120.33 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	2.02 MAL
1/I.S. FLEXION C.LUZ(-)	50%

$M_u (-)$	-146.33 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	2.45 MAL
1/I.S. FLEXION DER(-)	41%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	90.41 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.52 MAL
1/I.S. FLEXION IZQ(+)	66%

$M_u (+)$	18.67 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.31 OK
1/I.S. FLEXION C.LUZ(+)	319%

$M_u (+)$	28.63 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.48 OK
1/I.S. FLEXION DER(+)	208%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

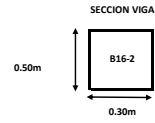
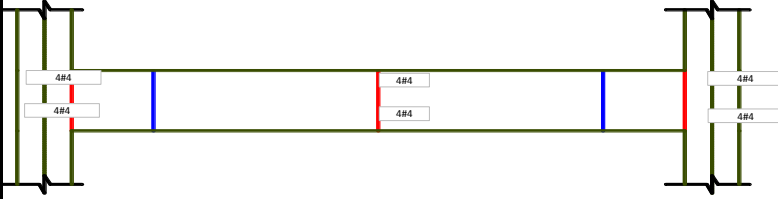
f'c	19 Mpa	b	0.3 cm
Fy	420 Mpa	d	0.5 cm
Φ	0.9	Φe	0.8
		Φc	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_c o ϕ_s	1.0	0.8	0.6

Mu (-)=	-167.75 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	2.81
1/I.S. FLEXION IZQ (-)=	36% MAL

Mu (-)=	-77.7 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	1.30
1/I.S. FLEXION C.LUZ (-)=	77% MAL

Mu (-)=	6 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	0.10
1/I.S. FLEXION DER (-)=	994% OK



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	6.17 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	0.10
1/I.S. FLEXION IZQ (+)=	966% OK

Mu (+)=	8 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.13
1/I.S. FLEXION C.LUZ (+)=	745% OK

Mu (+)=	13.3 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	0.22
1/I.S. FLEXION DER (+)=	448% OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

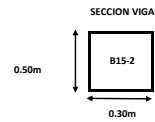
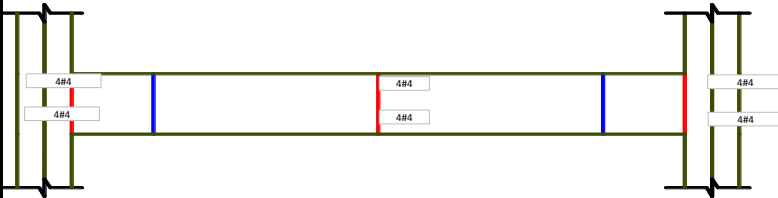
f'c	19 Mpa	b	0.3 cm
Fy	420 Mpa	d	0.5 cm
Φ	0.9	Φe	0.8
		Φc	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_c o ϕ_s	1.0	0.8	0.6

Mu (-)=	-14.59 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	0.25
1/I.S. FLEXION IZQ (-)=	406% OK

Mu (-)=	7.72 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.13
1/I.S. FLEXION C.LUZ (-)=	772% OK

Mu (-)=	-19.99 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	0.34
1/I.S. FLEXION DER (-)=	298% OK



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	43.3 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	0.73
1/I.S. FLEXION IZQ (+)=	138% OK

Mu (+)=	13.78 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.23
1/I.S. FLEXION C.LUZ (+)=	433% OK

Mu (+)=	36.83 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	0.62
1/I.S. FLEXION DER (+)=	162% OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

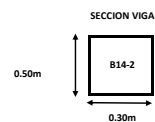
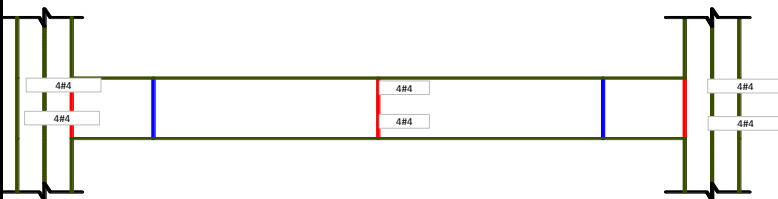
f'c	19 Mpa	b	0.3 cm
Fy	420 Mpa	d	0.5 cm
Φ	0.9	Φe	0.8
		Φc	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_c o ϕ_s	1.0	0.8	0.6

Mu (-)=	7.13 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (-)=	0.12
1/I.S. FLEXION IZQ (-)=	836% OK

Mu (-)=	-31.29 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (-)=	0.52
1/I.S. FLEXION C.LUZ (-)=	191% OK

Mu (-)=	-78.38 kn.m
As (-)=	0.000516 m2
p (-)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION DER (-)=	1.31
1/I.S. FLEXION DER (-)=	76% MAL



Rec. inf.	0.05 m
Rec. sup.	0.05 m

Mu (+)=	16.45 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION IZQ (+)=	0.28
1/I.S. FLEXION IZQ (+)=	362% OK

Mu (+)=	16.6 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION C.LUZ (+)=	0.28
1/I.S. FLEXION C.LUZ (+)=	359% OK

Mu (+)=	20.28 kn.m
As (+)=	0.000516 m2
p (+)=	0.00344
Nex=ΦMn	93.15 kn.m
Nef=Φe*Φc*Nex=	59.62 kn.m
I.S FLEXION DER (+)=	0.34
1/I.S. FLEXION DER (+)=	294% OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

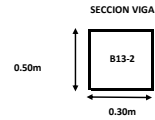
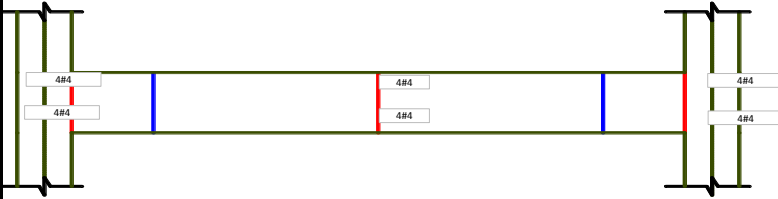
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-14.98 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.25 OK
1/I.S. FLEXION IZQ(-)	399%

$M_u (-)$	-50.51 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.85 OK
1/I.S. FLEXION C.LUZ(-)	118%

$M_u (-)$	-124.24 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	2.08 MAL
1/I.S. FLEXION DER(-)	48%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	22.48 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.38 OK
1/I.S. FLEXION IZQ(+)	265%

$M_u (+)$	19.27 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.32 OK
1/I.S. FLEXION C.LUZ(+)	309%

$M_u (+)$	51.68 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.87 OK
1/I.S. FLEXION DER(+)	115%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

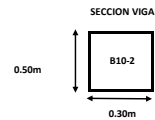
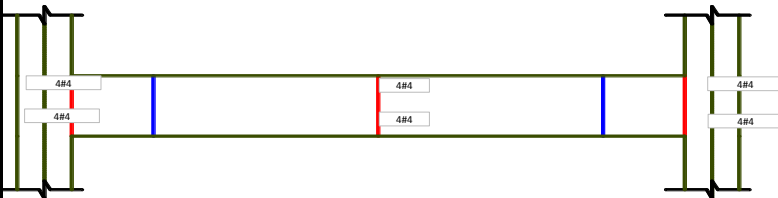
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-46.41 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.78 OK
1/I.S. FLEXION IZQ(-)	128%

$M_u (-)$	-7.36 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.12 OK
1/I.S. FLEXION C.LUZ(-)	810%

$M_u (-)$	-37.91 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.64 OK
1/I.S. FLEXION DER(-)	157%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	15.6 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.26 OK
1/I.S. FLEXION IZQ(+)	382%

$M_u (+)$	2.48 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.04 OK
1/I.S. FLEXION C.LUZ(+)	2404%

$M_u (+)$	32.9 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.55 OK
1/I.S. FLEXION DER(+)	181%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

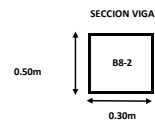
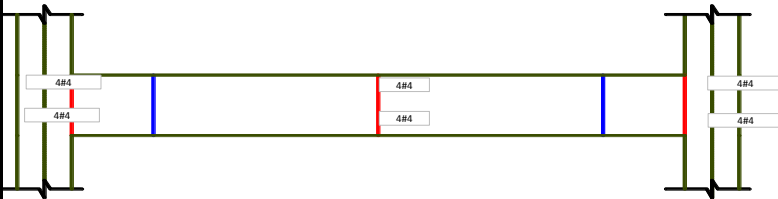
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-13.59 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.23 OK
1/I.S. FLEXION IZQ(-)	439%

$M_u (-)$	-8.41 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.14 OK
1/I.S. FLEXION C.LUZ(-)	709%

$M_u (-)$	-34.52 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.58 OK
1/I.S. FLEXION DER(-)	173%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	2.08 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.03 OK
1/I.S. FLEXION IZQ(+)	2866%

$M_u (+)$	9.20 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.16 OK
1/I.S. FLEXION C.LUZ(+)	642%

$M_u (+)$	41.27 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.69 OK
1/I.S. FLEXION DER(+)	144%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

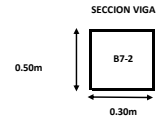
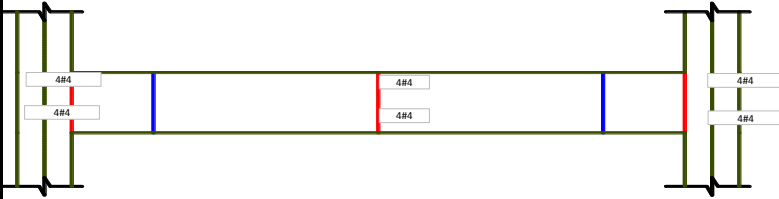
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-334.3 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	5.61 MAL
1/I.S. FLEXION IZQ(-)	18%

$M_u (-)$	-59.53 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.00 OK
1/I.S. FLEXION C.LUZ(-)	100%

$M_u (-)$	-157.01 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	2.63 MAL
1/I.S. FLEXION DER(-)	38%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	-22.53 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.38 OK
1/I.S. FLEXION IZQ(+)	265%

$M_u (+)$	-11.19 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.10 OK
1/I.S. FLEXION C.LUZ(+)	533%

$M_u (+)$	245.32 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	4.12 MAL
1/I.S. FLEXION DER(+)	24%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

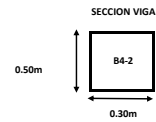
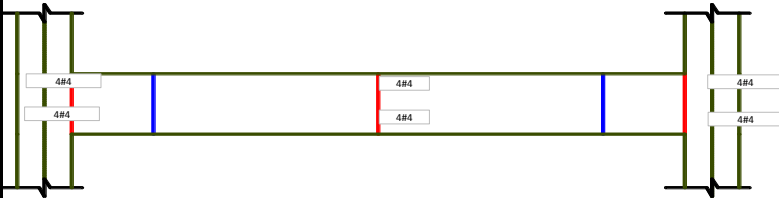
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-53.63 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.90 OK
1/I.S. FLEXION IZQ(-)	111%

$M_u (-)$	-26.20 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.44 OK
1/I.S. FLEXION C.LUZ(-)	227%

$M_u (-)$	-129.48 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	2.17 MAL
1/I.S. FLEXION DER(-)	46%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	49.19 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.83 OK
1/I.S. FLEXION IZQ(+)	121%

$M_u (+)$	40.63 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.68 OK
1/I.S. FLEXION C.LUZ(+)	147%

$M_u (+)$	105.45 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.77 MAL
1/I.S. FLEXION DER(+)	57%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

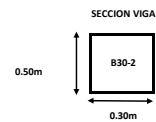
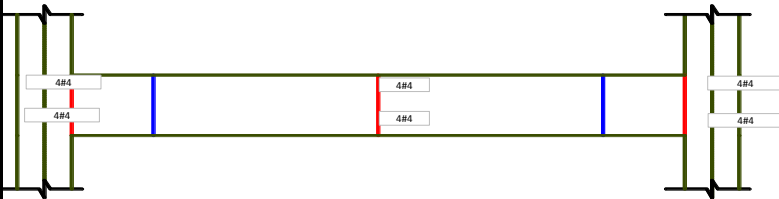
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	51.4 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.86 OK
1/I.S. FLEXION IZQ(-)	116%

$M_u (-)$	-109.15 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.83 MAL
1/I.S. FLEXION C.LUZ(-)	55%

$M_u (-)$	-316.17 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	5.30 MAL
1/I.S. FLEXION DER(-)	19%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	91.63 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.54 MAL
1/I.S. FLEXION IZQ(+)	65%

$M_u (+)$	-10.74 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.18 OK
1/I.S. FLEXION C.LUZ(+)	555%

$M_u (+)$	-126.96 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	2.13 MAL
1/I.S. FLEXION DER(+)	47%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

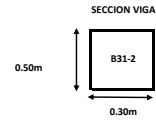
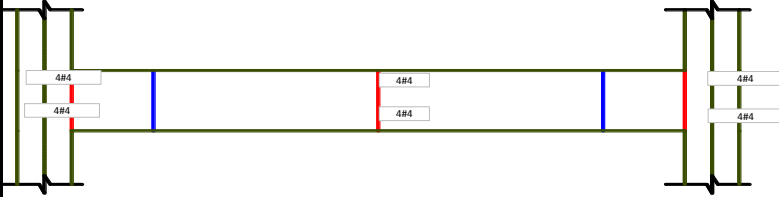
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	100.34 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	1.68 MAL
1/I.S. FLEXION IZQ(-)	59%

$M_u (-)$	-122.98 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	2.06 MAL
1/I.S. FLEXION C.LUZ(-)	48%

$M_u (-)$	-409.48 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	6.87 MAL
1/I.S. FLEXION DER(-)	15%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	186.1 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	3.12 MAL
1/I.S. FLEXION IZQ(+)	32%

$M_u (+)$	-23.57 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.40 OK
1/I.S. FLEXION C.LUZ(+)	253%

$M_u (+)$	-197.05 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	3.31 MAL
1/I.S. FLEXION DER(+)	30%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

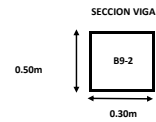
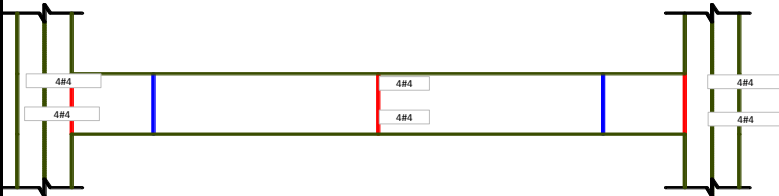
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-401.98 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	6.74 MAL
1/I.S. FLEXION IZQ(-)	15%

$M_u (-)$	-59.07 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.16 MAL
1/I.S. FLEXION C.LUZ(-)	86%

$M_u (-)$	-134.07 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	2.25 MAL
1/I.S. FLEXION DER(-)	44%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	-76.77 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.29 MAL
1/I.S. FLEXION IZQ(+)	78%

$M_u (+)$	-30.7 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.51 OK
1/I.S. FLEXION C.LUZ(+)	194%

$M_u (+)$	245.7 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	4.12 MAL
1/I.S. FLEXION DER(+)	24%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

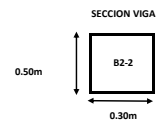
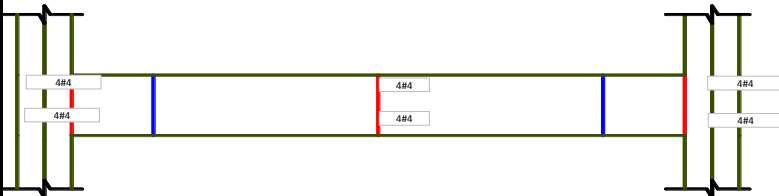
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-227.92 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	3.82 MAL
1/I.S. FLEXION IZQ(-)	26%

$M_u (-)$	6.92 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.12 OK
1/I.S. FLEXION C.LUZ(-)	861%

$M_u (-)$	-114.47 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	1.92 MAL
1/I.S. FLEXION DER(-)	52%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	-52.67 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.05 MAL
1/I.S. FLEXION IZQ(+)	95%

$M_u (+)$	24.02 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.40 OK
1/I.S. FLEXION C.LUZ(+)	248%

$M_u (+)$	54.65 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.92 OK
1/I.S. FLEXION DER(+)	109%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

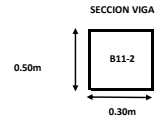
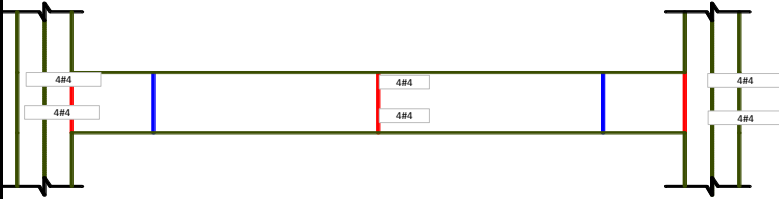
f'_c	19 Mpa	b	0.3 cm
f_y	420 Mpa	d	0.5 cm
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-358.94 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	6.02 MAL
1/I.S. FLEXION IZQ(-)	17%

$M_u (-)$	-48.49 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.81 OK
1/I.S. FLEXION C.LUZ(-)	123%

$M_u (-)$	-172.46 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	2.89 MAL
1/I.S. FLEXION DER(-)	35%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	23.28 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.30 OK
1/I.S. FLEXION IZQ(+)	256%

$M_u (+)$	-24 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.40 OK
1/I.S. FLEXION C.LUZ(+)	248%

$M_u (+)$	229.96 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	3.86 MAL
1/I.S. FLEXION DER(+)	26%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

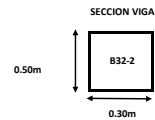
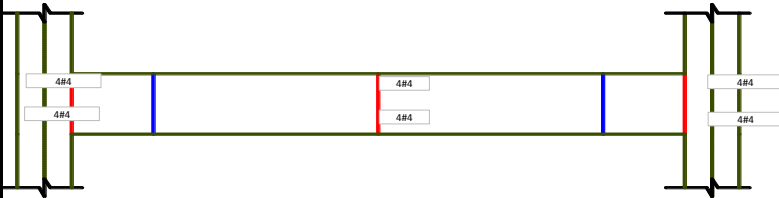
f'_c	19 Mpa	b	0.3 cm
f_y	420 Mpa	d	0.5 cm
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	72.71 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	1.22 MAL
1/I.S. FLEXION IZQ(-)	82%

$M_u (-)$	-88.07 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	1.48 MAL
1/I.S. FLEXION C.LUZ(-)	68%

$M_u (-)$	-290.91 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	4.88 MAL
1/I.S. FLEXION DER(-)	20%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	194.43 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	3.26 MAL
1/I.S. FLEXION IZQ(+)	31%

$M_u (+)$	-12.04 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.20 OK
1/I.S. FLEXION C.LUZ(+)	495%

$M_u (+)$	-161.11 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	2.70 MAL
1/I.S. FLEXION DER(+)	37%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

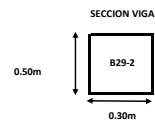
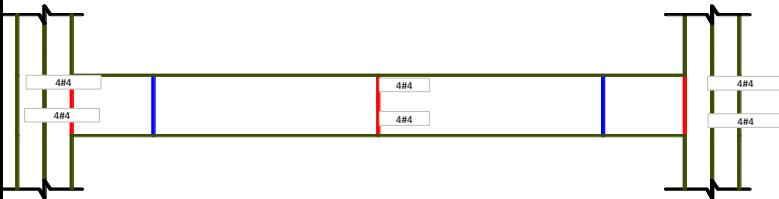
f'_c	19 Mpa	b	0.3 cm
f_y	420 Mpa	d	0.5 cm
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	59.44 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	1.00 OK
1/I.S. FLEXION IZQ(-)	100%

$M_u (-)$	-85.85 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	1.44 MAL
1/I.S. FLEXION C.LUZ(-)	69%

$M_u (-)$	-314.19 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	5.27 MAL
1/I.S. FLEXION DER(-)	19%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	164.89 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	2.77 MAL
1/I.S. FLEXION IZQ(+)	36%

$M_u (+)$	-45.76 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.77 OK
1/I.S. FLEXION C.LUZ(+)	130%

$M_u (+)$	-156.57 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	2.63 MAL
1/I.S. FLEXION DER(+)	38%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\phi M_n = \phi * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

f'c	19	Mpa	b	0.3	m
fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_c	0.8	
			ϕ_s	0.8	

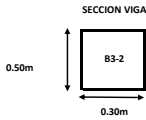
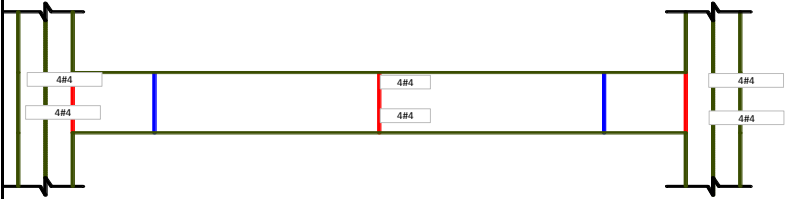
Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

Mu (-)=	-102.31	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_c * \phi_s * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	1.72	MAL
1/I.S. FLEXION IZQ (-)=	58%	

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Mu (-)=	-42.19	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_c * \phi_s * Nex$ =	59.62	kn.m
I.S FLEXION C.IUZI (-)=	0.71	OK
1/I.S. FLEXION C.IUZI (-)=	141%	

Mu (-)=	-5.15	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_c * \phi_s * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.09	OK
1/I.S. FLEXION DER (-)=	1158%	



Rec. inf.	0.05	m
Rec. sup.	0.05	m

Mu (+)=	68.23	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_c * \phi_s * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	1.14	MAL
1/I.S. FLEXION IZQ (+)=	87%	

Mu (+)=	38.56	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_c * \phi_s * Nex$ =	59.62	kn.m
I.S FLEXION C.IUZI (+)=	0.65	OK
1/I.S. FLEXION C.IUZI (+)=	155%	

Mu (+)=	23.28	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_c * \phi_s * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.39	OK
1/I.S. FLEXION DER (+)=	256%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

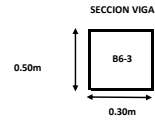
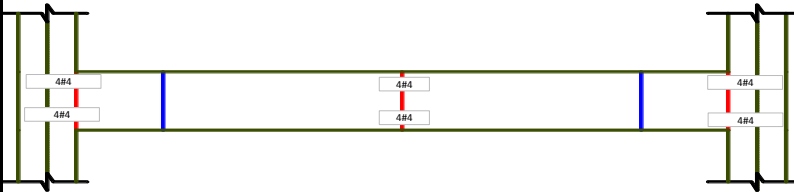
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

$M_u (-)$	-119.02 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	2.00
I/S. FLEXION IZQ(-)	50% MAL

$M_u (-)$	0.25 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.00
I/S. FLEXION C.LUZ(-)	23846% OK

$M_u (-)$	-132.67 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	2.23
I/S. FLEXION DER(-)	45% MAL



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	124.71 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	2.00
I/S. FLEXION IZQ(+)	48% MAL

$M_u (+)$	3.74 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.06
I/S. FLEXION C.LUZ(+)	1594% OK

$M_u (+)$	111.3 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	1.87
I/S. FLEXION DER(+)	54% MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

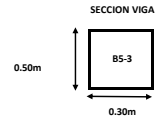
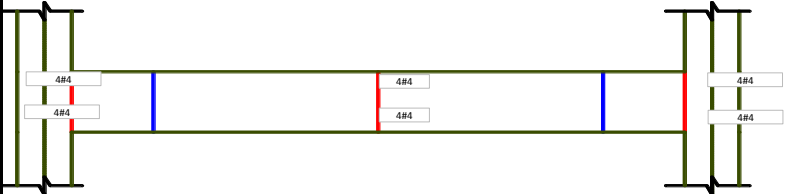
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

$M_u (-)$	-45.53 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.76
I/S. FLEXION IZQ(-)	131% OK

$M_u (-)$	3.51 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.06
I/S. FLEXION C.LUZ(-)	1698% OK

$M_u (-)$	-20.69 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	0.35
I/S. FLEXION DER(-)	288% OK



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	-11.18 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.19
I/S. FLEXION IZQ(+)	533% OK

$M_u (+)$	1.25 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.02
I/S. FLEXION C.LUZ(+)	4769% OK

$M_u (+)$	25.84 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	0.43
I/S. FLEXION DER(+)	231% OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$As = \rho \cdot b \cdot d$$

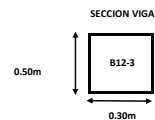
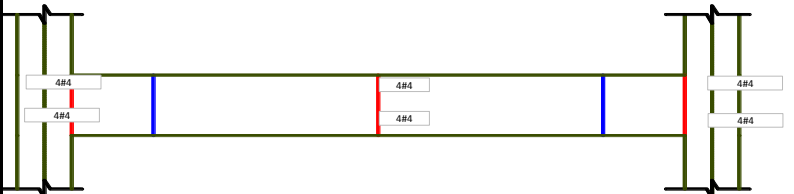
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

$M_u (-)$	-36.79 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.62
I/S. FLEXION IZQ(-)	162% OK

$M_u (-)$	-35.79 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.60
I/S. FLEXION C.LUZ(-)	167% OK

$M_u (-)$	-175.69 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	2.95
I/S. FLEXION DER(-)	34% MAL



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	95.95 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	1.61
I/S. FLEXION IZQ(+)	62% MAL

$M_u (+)$	4.6 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.08
I/S. FLEXION C.LUZ(+)	1296% OK

$M_u (+)$	59.76 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	1.00
I/S. FLEXION DER(+)	100% MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

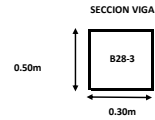
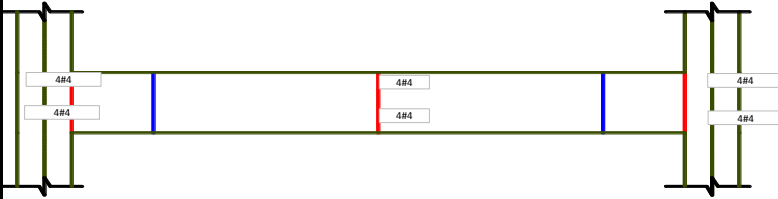
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	13.36 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.22 OK
1/I.S. FLEXION IZQ(-)	446%

$M_u (-)$	-52.07 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.87 OK
1/I.S. FLEXION C.LUZ(-)	114%

$M_u (-)$	-126.66 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	2.12 MAL
1/I.S. FLEXION DER(-)	47%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	22.76 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.38 OK
1/I.S. FLEXION IZQ(+)	262%

$M_u (+)$	13.33 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.22 OK
1/I.S. FLEXION C.LUZ(+)	447%

$M_u (+)$	2.46 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	0.04 OK
1/I.S. FLEXION DER(+)	2423%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

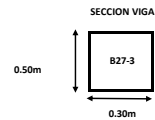
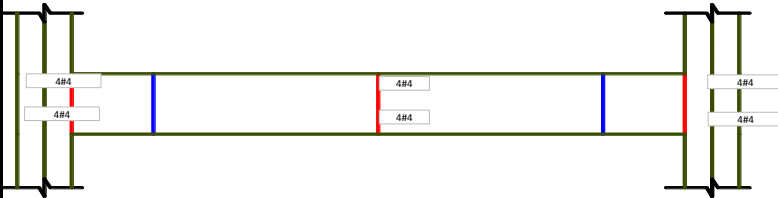
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	20.82 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.35 OK
1/I.S. FLEXION IZQ(-)	286%

$M_u (-)$	-8.9 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.15 OK
1/I.S. FLEXION C.LUZ(-)	670%

$M_u (-)$	-59.76 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	1.00 MAL
1/I.S. FLEXION DER(-)	100%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	38.31 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.64 OK
1/I.S. FLEXION IZQ(+)	156%

$M_u (+)$	34.71 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.58 OK
1/I.S. FLEXION C.LUZ(+)	172%

$M_u (+)$	32.75 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	0.55 OK
1/I.S. FLEXION DER(+)	182%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

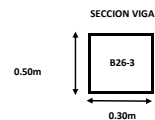
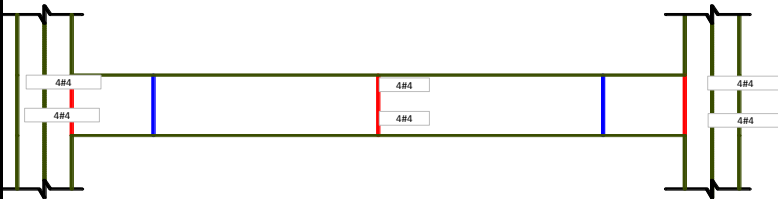
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	24.38 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.41 OK
1/I.S. FLEXION IZQ(-)	245%

$M_u (-)$	3.2 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.05 OK
1/I.S. FLEXION C.LUZ(-)	1863%

$M_u (-)$	-46.76 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	0.78 OK
1/I.S. FLEXION DER(-)	127%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	59.1 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.84 OK
1/I.S. FLEXION IZQ(+)	119%

$M_u (+)$	44.9 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.75 OK
1/I.S. FLEXION C.LUZ(+)	133%

$M_u (+)$	47.88 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	0.80 OK
1/I.S. FLEXION DER(+)	125%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

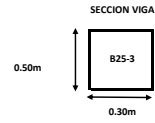
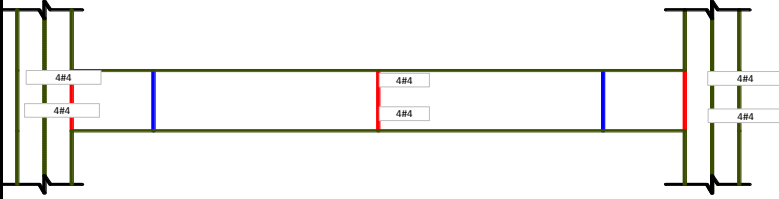
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	24.65 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.41
1/I.S. FLEXION IZQ(-)	242% OK

$M_u (-)$	14.43 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.24
1/I.S. FLEXION C.LUZ(-)	413% OK

$M_u (-)$	-34.71 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.58
1/I.S. FLEXION DER(-)	172% OK



Rec. inf.	0.05 m
Rec.sup.	0.05 m

$M_u (+)$	57.71 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.92
1/I.S. FLEXION IZQ(+)	103% OK

$M_u (+)$	48.89 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.82
1/I.S. FLEXION C.LUZ(+)	122% OK

$M_u (+)$	57.96 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.92
1/I.S. FLEXION DER(+)	103% OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

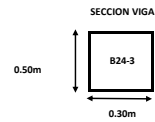
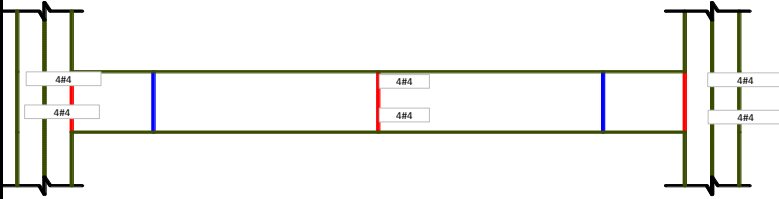
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	39.72 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.67
1/I.S. FLEXION IZQ(-)	150% OK

$M_u (-)$	29.53 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.50
1/I.S. FLEXION C.LUZ(-)	202% OK

$M_u (-)$	-22.29 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.37
1/I.S. FLEXION DER(-)	267% OK



Rec. inf.	0.05 m
Rec.sup.	0.05 m

$M_u (+)$	93.64 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.57
1/I.S. FLEXION IZQ(+)	54% MAL

$M_u (+)$	61.82 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	1.04
1/I.S. FLEXION C.LUZ(+)	96% MAL

$M_u (+)$	65.43 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.10
1/I.S. FLEXION DER(+)	91% MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

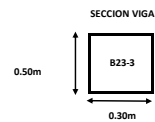
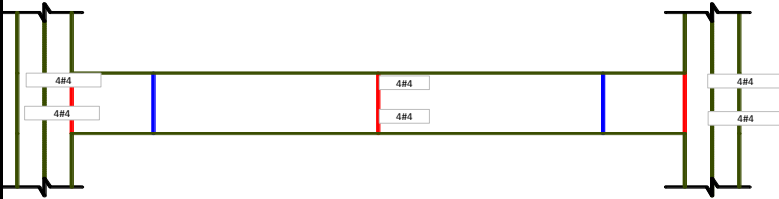
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	145.82 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	2.45
1/I.S. FLEXION IZQ(-)	41% MAL

$M_u (-)$	46.37 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.78
1/I.S. FLEXION C.LUZ(-)	129% OK

$M_u (-)$	21.32 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.36
1/I.S. FLEXION DER(-)	280% OK



Rec. inf.	0.05 m
Rec.sup.	0.05 m

$M_u (+)$	115.85 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.94
1/I.S. FLEXION IZQ(+)	51% MAL

$M_u (+)$	81.4 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	1.37
1/I.S. FLEXION C.LUZ(+)	73% MAL

$M_u (+)$	94.03 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.58
1/I.S. FLEXION DER(+)	63% MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

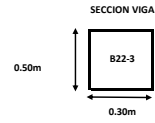
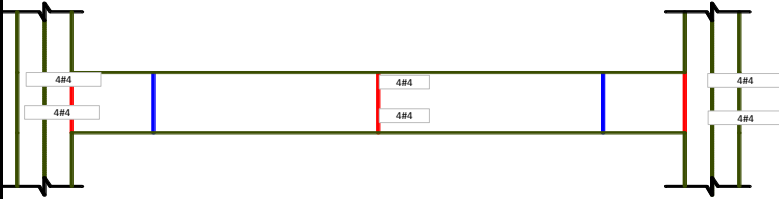
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	30.75 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.52
I/S. FLEXION IZQ(-)	194%

$M_u (-)$	47.28 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.79
I/S. FLEXION C.LUZ(-)	126%

$M_u (-)$	44.75 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	0.75
I/S. FLEXION DER(-)	133%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	109.78 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	1.84
I/S. FLEXION IZQ(+)	54%

$M_u (+)$	85.53 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	1.43
I/S. FLEXION C.LUZ(+)	70%

$M_u (+)$	107.38 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	1.80
I/S. FLEXION DER(+)	56%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

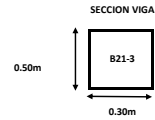
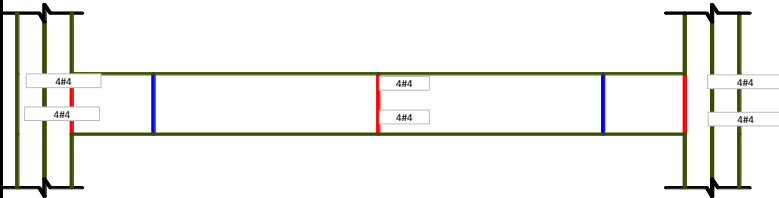
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	18.77 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.31
I/S. FLEXION IZQ(-)	318%

$M_u (-)$	30.11 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.51
I/S. FLEXION C.LUZ(-)	198%

$M_u (-)$	43.87 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	0.74
I/S. FLEXION DER(-)	136%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	77.43 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	1.30
I/S. FLEXION IZQ(+)	77%

$M_u (+)$	70.35 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	1.18
I/S. FLEXION C.LUZ(+)	85%

$M_u (+)$	91.98 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	1.54
I/S. FLEXION DER(+)	65%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

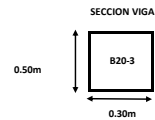
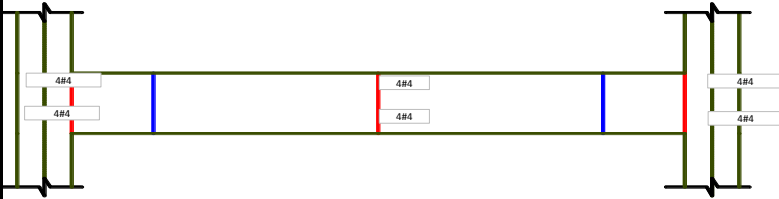
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_s	0.8

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_s o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-75.34 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	1.26
I/S. FLEXION IZQ(-)	79%

$M_u (-)$	-14.24 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.24
I/S. FLEXION C.LUZ(-)	419%

$M_u (-)$	25.43 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	0.43
I/S. FLEXION DER(-)	234%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	42.83 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.72
I/S. FLEXION IZQ(+)	139%

$M_u (+)$	40.91 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.60
I/S. FLEXION C.LUZ(+)	146%

$M_u (+)$	46.16 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_s \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	0.77
I/S. FLEXION DER(+)	129%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

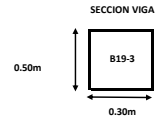
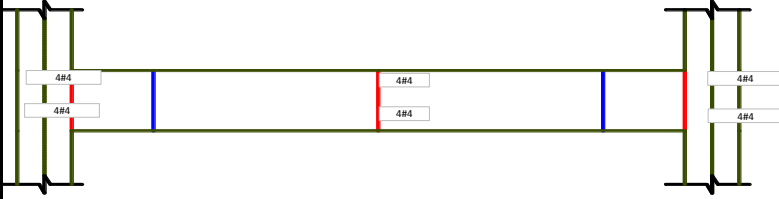
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-121.64 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	2.04
I/S. FLEXION IZQ(-)	49% MAL

$M_u (-)$	-66.88 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.12
I/S. FLEXION C.LUZ(-)	89% MAL

$M_u (-)$	-14.14 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.24
I/S. FLEXION DER(-)	422% OK



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	56.29 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.94
I/S. FLEXION IZQ(+)	106% OK

$M_u (+)$	34.69 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.58
I/S. FLEXION C.LUZ(+)	172% OK

$M_u (+)$	11.29 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.19
I/S. FLEXION DER(+)	528% OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

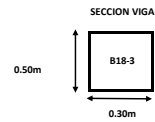
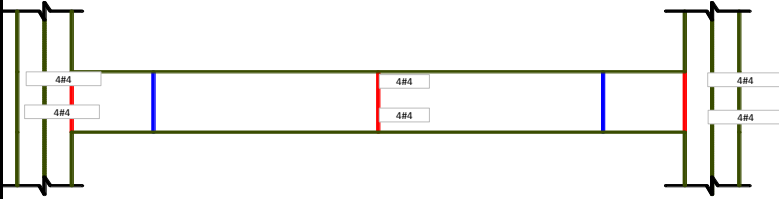
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-76.54 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	1.28
I/S. FLEXION IZQ(-)	78% MAL

$M_u (-)$	-70.4 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.18
I/S. FLEXION C.LUZ(-)	85% MAL

$M_u (-)$	-66.07 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	1.11
I/S. FLEXION DER(-)	90% MAL



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	253.47 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	4.25
I/S. FLEXION IZQ(+)	24% MAL

$M_u (+)$	160.34 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	2.69
I/S. FLEXION C.LUZ(+)	37% MAL

$M_u (+)$	62.67 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.05
I/S. FLEXION DER(+)	95% MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

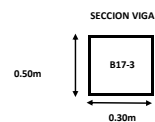
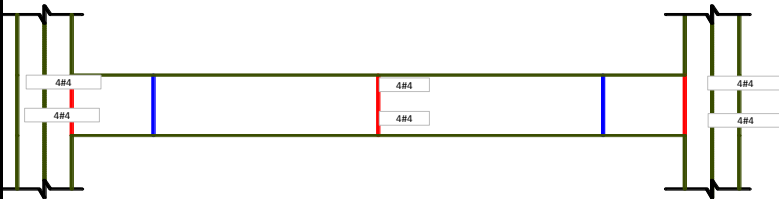
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-94.4 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	1.58
I/S. FLEXION IZQ(-)	63% MAL

$M_u (-)$	-85.06 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.43
I/S. FLEXION C.LUZ(-)	70% MAL

$M_u (-)$	-78.59 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	1.32
I/S. FLEXION DER(-)	76% MAL



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	109.58 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	1.84
I/S. FLEXION IZQ(+)	54% MAL

$M_u (+)$	50.56 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.85
I/S. FLEXION C.LUZ(+)	118% OK

$M_u (+)$	-12.41 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.21
I/S. FLEXION DER(+)	480% OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

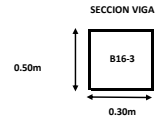
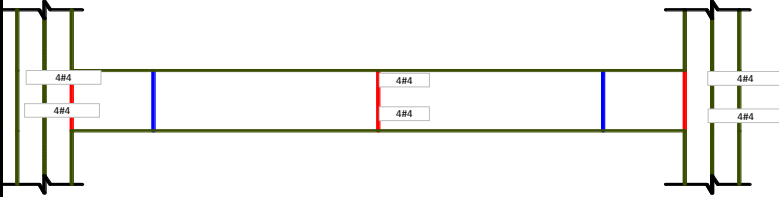
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_c o ϕ_s	1.0	0.8	0.6

$M_u (-)$	-116.22 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	1.95 MAL
1/I.S. FLEXION IZQ(-)	51%

$M_u (-)$	-64.87 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.09 MAL
1/I.S. FLEXION C.LUZ(-)	92%

$M_u (-)$	-25.77 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.43 OK
1/I.S. FLEXION DER(-)	231%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	54.21 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.91 OK
1/I.S. FLEXION IZQ(+)	110%

$M_u (+)$	17.34 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.29 OK
1/I.S. FLEXION C.LUZ(+)	344%

$M_u (+)$	-11.17 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.19 OK
1/I.S. FLEXION DER(+)	534%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

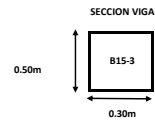
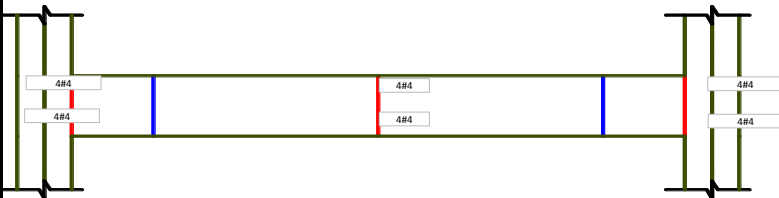
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_c o ϕ_s	1.0	0.8	0.6

$M_u (-)$	-57.52 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.96 OK
1/I.S. FLEXION IZQ(-)	104%

$M_u (-)$	-6.45 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	0.11 OK
1/I.S. FLEXION C.LUZ(-)	924%

$M_u (-)$	-55.83 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	0.94 OK
1/I.S. FLEXION DER(-)	107%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	45.78 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.77 OK
1/I.S. FLEXION IZQ(+)	130%

$M_u (+)$	-2.12 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.04 OK
1/I.S. FLEXION C.LUZ(+)	2812%

$M_u (+)$	43.08 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	0.72 OK
1/I.S. FLEXION DER(+)	138%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

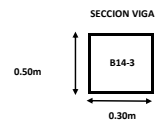
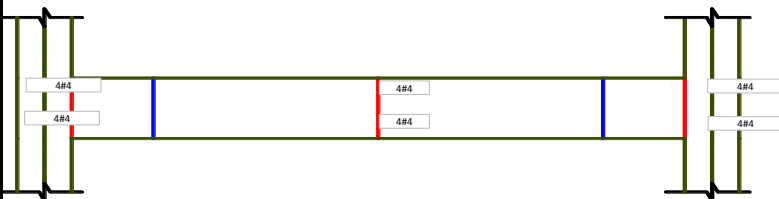
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_c	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_c y ϕ_s			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_c o ϕ_s	1.0	0.8	0.6

$M_u (-)$	-1.12 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(-)	0.02 OK
1/I.S. FLEXION IZQ(-)	5323%

$M_u (-)$	-68.88 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(-)	1.16 MAL
1/I.S. FLEXION C.LUZ(-)	87%

$M_u (-)$	-147.75 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(-)	2.48 MAL
1/I.S. FLEXION DER(-)	40%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	9.44 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ(+)	0.16 OK
1/I.S. FLEXION IZQ(+)	632%

$M_u (+)$	53.7 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ(+)	0.90 OK
1/I.S. FLEXION C.LUZ(+)	111%

$M_u (+)$	107.3 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER(+)	1.80 MAL
1/I.S. FLEXION DER(+)	56%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

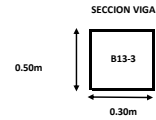
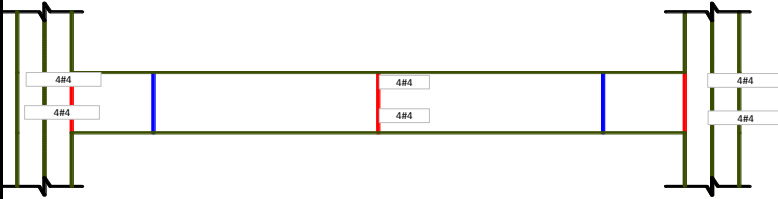
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	2.7 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.05
1/I.S. FLEXION IZQ(-)	2208%

$M_u (-)$	-32.62 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.55
1/I.S. FLEXION C.LUZ(-)	183%

$M_u (-)$	-81.49 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	1.37
1/I.S. FLEXION DER(-)	73%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	18.55 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.31
1/I.S. FLEXION IZQ(+)	321%

$M_u (+)$	19.22 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.32
1/I.S. FLEXION C.LUZ(+)	310%

$M_u (+)$	34.61 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	0.58
1/I.S. FLEXION DER(+)	172%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

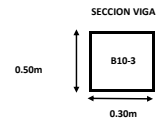
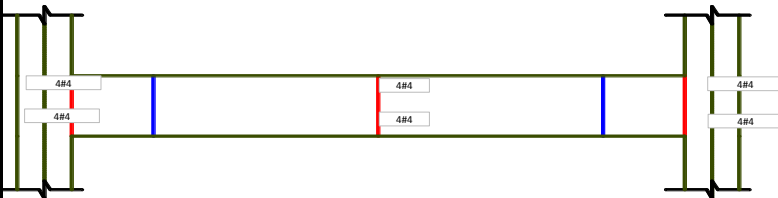
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-31.31 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.53
1/I.S. FLEXION IZQ(-)	190%

$M_u (-)$	-6.35 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.11
1/I.S. FLEXION C.LUZ(-)	939%

$M_u (-)$	-28.74 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	0.48
1/I.S. FLEXION DER(-)	207%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	15.75 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.26
1/I.S. FLEXION IZQ(+)	379%

$M_u (+)$	2.95 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.05
1/I.S. FLEXION C.LUZ(+)	2021%

$M_u (+)$	20.59 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	0.35
1/I.S. FLEXION DER(+)	290%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset M_n = \emptyset \cdot \rho \cdot F_y \left(1 - 0.59 \cdot \rho \cdot \frac{F_y}{f'_c} \right) \cdot b \cdot d^2$$

$$A_s = \rho \cdot b \cdot d$$

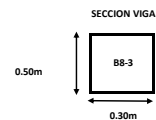
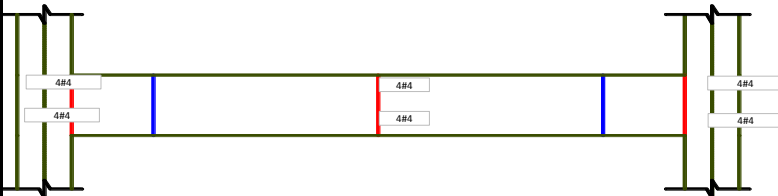
f'_c	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-17.92 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(-)	0.30
1/I.S. FLEXION IZQ(-)	333%

$M_u (-)$	-12.84 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(-)	0.22
1/I.S. FLEXION C.LUZ(-)	464%

$M_u (-)$	-33.89 kn.m
$A_s (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(-)	0.57
1/I.S. FLEXION DER(-)	176%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	3.01 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION IZQ(+)	0.05
1/I.S. FLEXION IZQ(+)	1981%

$M_u (+)$	5.59 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION C.LUZ(+)	0.00
1/I.S. FLEXION C.LUZ(+)	1066%

$M_u (+)$	40.75 kn.m
$A_s (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi M_n$	93.15 kn.m
$N_{ef} = \phi_c \cdot \phi_c \cdot N_{ex}$	59.62 kn.m
I.S. FLEXION DER(+)	0.68
1/I.S. FLEXION DER(+)	146%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy * \left(1 - 0.59 * \rho * \frac{Fy}{f'c}\right) * b * d^2$$

$$As = \rho * b * d$$

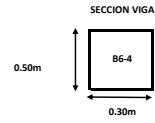
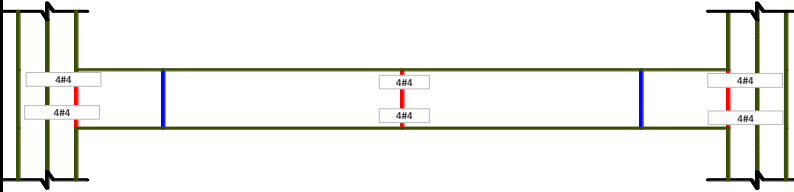
f'c	19	Mpa	b	0.3	m
fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-121.9075	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION IZQ (-)=	2.04	MAL
1/LS. FLEXION IZQ (-)=	49%	

Mu (-)=	0.6812	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION C.LUZ (-)=	0.01	OK
1/LS. FLEXION C.LUZ (-)=	8751%	

Mu (-)=	-138.7291	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION DER (-)=	2.33	MAL
1/LS. FLEXION DER (-)=	43%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	134.1116	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION IZQ (+)=	2.25	MAL
1/LS. FLEXION IZQ (+)=	44%	

Mu (+)=	4.9812	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION C.LUZ (+)=	0.08	OK
1/LS. FLEXION C.LUZ (+)=	1197%	

Mu (+)=	111.57	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION DER (+)=	1.87	MAL
1/LS. FLEXION DER (+)=	53%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy * \left(1 - 0.59 * \rho * \frac{Fy}{f'c}\right) * b * d^2$$

$$As = \rho * b * d$$

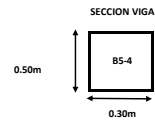
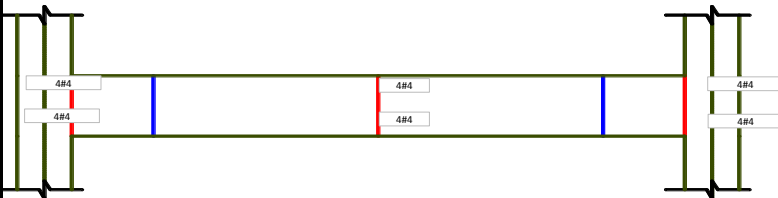
f'c	19	Mpa	b	0.3	m
fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	36.7879	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION IZQ (-)=	0.62	OK
1/LS. FLEXION IZQ (-)=	162%	

Mu (-)=	-2.7883	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION C.LUZ (-)=	0.05	OK
1/LS. FLEXION C.LUZ (-)=	2138%	

Mu (-)=	-21.6948	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION DER (-)=	0.36	OK
1/LS. FLEXION DER (-)=	276%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	-10.609	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION IZQ (+)=	0.18	OK
1/LS. FLEXION IZQ (+)=	562%	

Mu (+)=	0.5763	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION C.LUZ (+)=	0.01	OK
1/LS. FLEXION C.LUZ (+)=	10344%	

Mu (+)=	27.3052	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
LS FLEXION DER (+)=	0.46	OK
1/LS. FLEXION DER (+)=	218%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

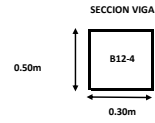
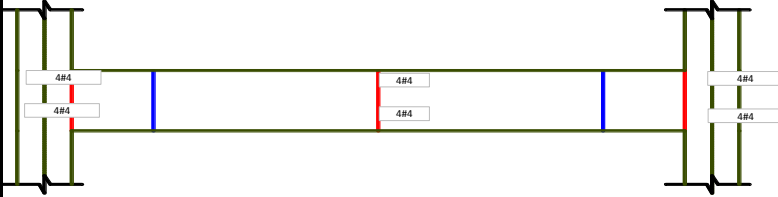
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	27.4025	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION IZQ (-)=	0.46	OK
1/I.S. FLEXION IZQ (-)=	218%	

Mu (-)=	-31.38	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.53	OK
1/I.S. FLEXION C.LUZ (-)=	190%	

Mu (-)=	-136.92	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION DER (-)=	2.30	MAL
1/I.S. FLEXION DER (-)=	44%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	67.34	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION IZQ (+)=	1.12	MAL
1/I.S. FLEXION IZQ (+)=	89%	

Mu (+)=	-7.088	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.12	OK
1/I.S. FLEXION C.LUZ (+)=	841%	

Mu (+)=	-51.903	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION DER (+)=	0.87	OK
1/I.S. FLEXION DER (+)=	115%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

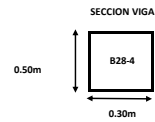
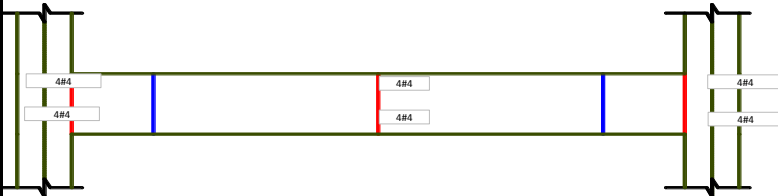
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	10.31	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION IZQ (-)=	0.17	OK
1/I.S. FLEXION IZQ (-)=	578%	

Mu (-)=	-52.08	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.87	OK
1/I.S. FLEXION C.LUZ (-)=	114%	

Mu (-)=	-119.71	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION DER (-)=	2.01	MAL
1/I.S. FLEXION DER (-)=	50%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	21.79	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION IZQ (+)=	0.37	OK
1/I.S. FLEXION IZQ (+)=	274%	

Mu (+)=	8.36	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.14	OK
1/I.S. FLEXION C.LUZ (+)=	713%	

Mu (+)=	-6.84	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex=phiMn	93.15	kn.m
Nef=phi*phi*c*Nex=	59.62	kn.m
I.S FLEXION DER (+)=	0.11	OK
1/I.S. FLEXION DER (+)=	872%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

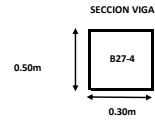
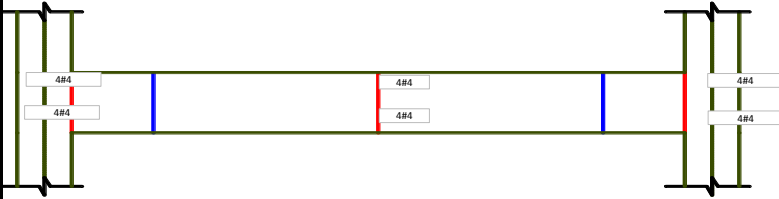
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	22.23	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.37	OK
1/I.S. FLEXION IZQ (-)=	268%	

Mu (-)=	-11.92	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.20	OK
1/I.S. FLEXION C.LUZ (-)=	500%	

Mu (-)=	-67.04	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	1.12	MAL
1/I.S. FLEXION DER (-)=	89%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	40.63	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	0.68	OK
1/I.S. FLEXION IZQ (+)=	147%	

Mu (+)=	34.20	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.58	OK
1/I.S. FLEXION C.LUZ (+)=	174%	

Mu (+)=	28.31	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.47	OK
1/I.S. FLEXION DER (+)=	211%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

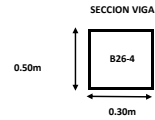
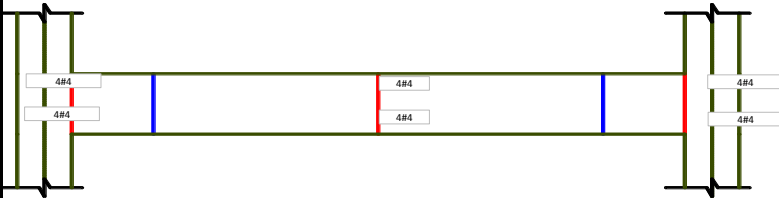
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	26.99	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.45	OK
1/I.S. FLEXION IZQ (-)=	221%	

Mu (-)=	5.48	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.09	OK
1/I.S. FLEXION C.LUZ (-)=	1088%	

Mu (-)=	-41.59	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.70	OK
1/I.S. FLEXION DER (-)=	143%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	52.42	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	0.88	OK
1/I.S. FLEXION IZQ (+)=	114%	

Mu (+)=	47.06	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.79	OK
1/I.S. FLEXION C.LUZ (+)=	127%	

Mu (+)=	47.37	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.79	OK
1/I.S. FLEXION DER (+)=	126%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

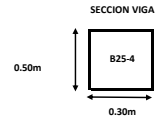
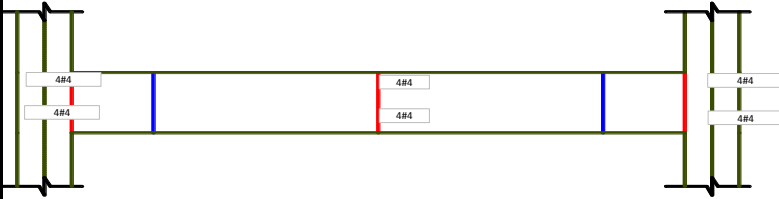
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	31.3	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION IZQ (-)=	0.53	
1/I.S. FLEXION IZQ (-)=	190%	OK

Mu (-)=	20.38	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.34	
1/I.S. FLEXION C.LUZ (-)=	293%	OK

Mu (-)=	-30.83	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION DER (-)=	0.52	
1/I.S. FLEXION DER (-)=	193%	OK



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	67.91	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION IZQ (+)=	1.14	
1/I.S. FLEXION IZQ (+)=	88%	MAL

Mu (+)=	55.01	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.92	
1/I.S. FLEXION C.LUZ (+)=	108%	OK

Mu (+)=	60.06	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION DER (+)=	1.01	
1/I.S. FLEXION DER (+)=	99%	MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

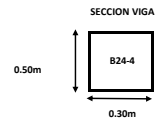
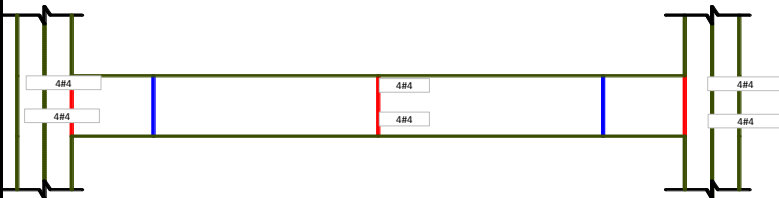
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	39.16	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION IZQ (-)=	0.66	
1/I.S. FLEXION IZQ (-)=	152%	OK

Mu (-)=	32.56	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.55	
1/I.S. FLEXION C.LUZ (-)=	183%	OK

Mu (-)=	-10.77	kn.m
As (-)=	0.000516	m2
ρ (-)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION DER (-)=	0.18	
1/I.S. FLEXION DER (-)=	554%	OK



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	91.81	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION IZQ (+)=	1.54	
1/I.S. FLEXION IZQ (+)=	65%	MAL

Mu (+)=	65.07	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION C.LUZ (+)=	1.09	
1/I.S. FLEXION C.LUZ (+)=	92%	MAL

Mu (+)=	73.4	kn.m
As (+)=	0.000516	m2
ρ (+)=	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$	59.62	kn.m
I.S FLEXION DER (+)=	1.23	
1/I.S. FLEXION DER (+)=	81%	MAL

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

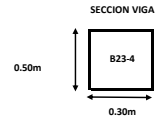
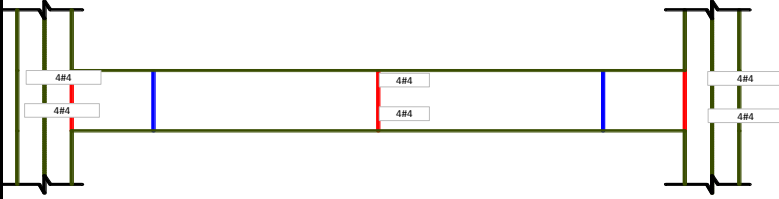
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	41.57	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.70	OK
1/I.S. FLEXION IZQ (-)=	143%	

Mu (-)=	43.51	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.73	OK
1/I.S. FLEXION C.LUZ (-)=	137%	

Mu (-)=	21.32	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.36	OK
1/I.S. FLEXION DER (-)=	280%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	107.55	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	1.80	MAL
1/I.S. FLEXION IZQ (+)=	55%	

Mu (+)=	76.87	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	1.20	MAL
1/I.S. FLEXION C.LUZ (+)=	78%	

Mu (+)=	91.63	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	1.54	MAL
1/I.S. FLEXION DER (+)=	65%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

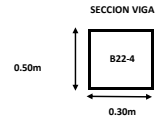
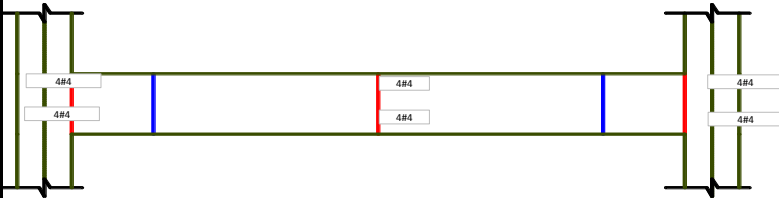
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
1.0	0.8	0.6	

Mu (-)=	26.14	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.44	OK
1/I.S. FLEXION IZQ (-)=	228%	

Mu (-)=	43.54	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.73	OK
1/I.S. FLEXION C.LUZ (-)=	137%	

Mu (-)=	40.87	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.69	OK
1/I.S. FLEXION DER (-)=	146%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	103.25	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	1.73	MAL
1/I.S. FLEXION IZQ (+)=	58%	

Mu (+)=	78.91	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	1.32	MAL
1/I.S. FLEXION C.LUZ (+)=	76%	

Mu (+)=	100.35	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	1.68	MAL
1/I.S. FLEXION DER (+)=	59%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

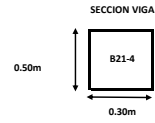
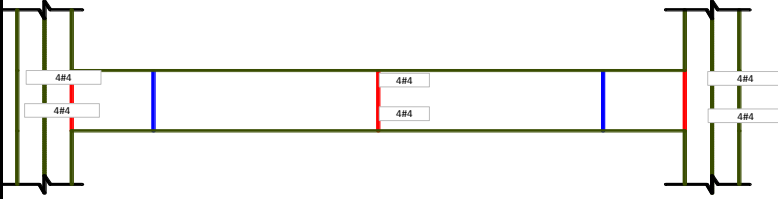
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-15.98	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.27	OK
1/I.S. FLEXION IZQ (-)=	373%	

Mu (-)=	-29.76	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.50	OK
1/I.S. FLEXION C.LUZ (-)=	200%	

Mu (-)=	-41.34	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.69	OK
1/I.S. FLEXION DER (-)=	144%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	79.13	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	1.32	MAL
1/I.S. FLEXION IZQ (+)=	75%	

Mu (+)=	69.51	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	1.12	MAL
1/I.S. FLEXION C.LUZ (+)=	86%	

Mu (+)=	84.75	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	1.42	MAL
1/I.S. FLEXION DER (+)=	70%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

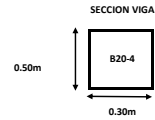
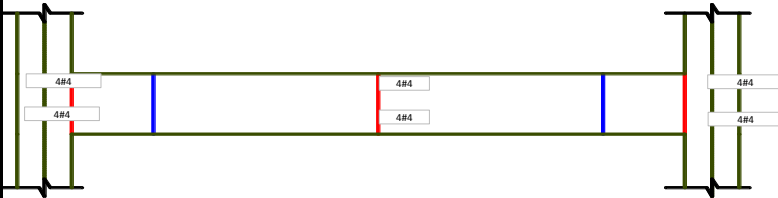
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-55.53	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	1.10	MAL
1/I.S. FLEXION IZQ (-)=	91%	

Mu (-)=	-6.40	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.11	OK
1/I.S. FLEXION C.LUZ (-)=	919%	

Mu (-)=	-28.03	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.47	OK
1/I.S. FLEXION DER (-)=	213%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	51.24	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	0.86	OK
1/I.S. FLEXION IZQ (+)=	116%	

Mu (+)=	47.92	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.80	OK
1/I.S. FLEXION C.LUZ (+)=	124%	

Mu (+)=	48.83	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.82	OK
1/I.S. FLEXION DER (+)=	122%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

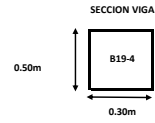
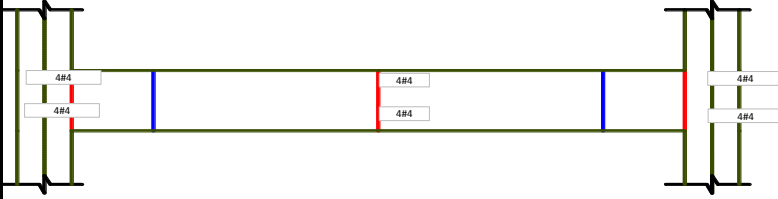
$f'c$	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-122.28 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ (-)	2.05 MAL
1/I.S. FLEXION IZQ (-)	49%

$M_u (-)$	-62.43 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ (-)	1.05 MAL
1/I.S. FLEXION C.LUZ (-)	95%

$M_u (-)$	-4.57 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER (-)	0.08 OK
1/I.S. FLEXION DER (-)	1304%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	33.23 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ (+)	0.56 OK
1/I.S. FLEXION IZQ (+)	179%

$M_u (+)$	28.42 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ (+)	0.48 OK
1/I.S. FLEXION C.LUZ (+)	210%

$M_u (+)$	22.13 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER (+)	0.37 OK
1/I.S. FLEXION DER (+)	269%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

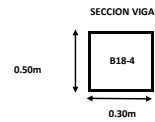
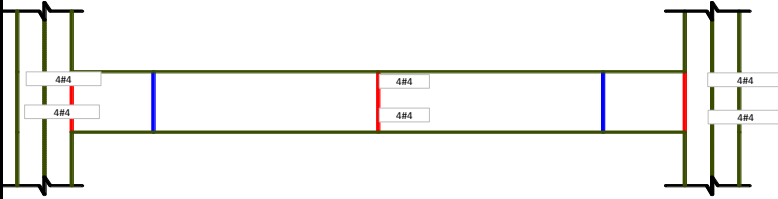
$f'c$	19 Mpa	b	0.3 m
f_y	420 Mpa	d	0.5 m
ϕ	0.9	ϕ_e	0.8
		ϕ_c	0.8

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

$M_u (-)$	-58.28 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ (-)	1.15 MAL
1/I.S. FLEXION IZQ (-)	87%

$M_u (-)$	-52.39 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ (-)	1.05 MAL
1/I.S. FLEXION C.LUZ (-)	96%

$M_u (-)$	-58.52 kn.m
$As (-)$	0.000516 m ²
$\rho (-)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER (-)	0.98 OK
1/I.S. FLEXION DER (-)	102%



Rec. inf.	0.05 m
Rec. sup.	0.05 m

$M_u (+)$	203.01 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION IZQ (+)	3.41 MAL
1/I.S. FLEXION IZQ (+)	29%

$M_u (+)$	134.92 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION C.LUZ (+)	2.26 MAL
1/I.S. FLEXION C.LUZ (+)	44%

$M_u (+)$	65.03 kn.m
$As (+)$	0.000516 m ²
$\rho (+)$	0.00344
$N_{ex} = \phi Mn$	93.15 kn.m
$N_{ef} = \phi_e * \phi_c * N_{ex}$	59.62 kn.m
I.S FLEXION DER (+)	1.09 MAL
1/I.S. FLEXION DER (+)	92%

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

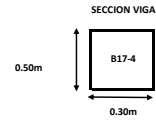
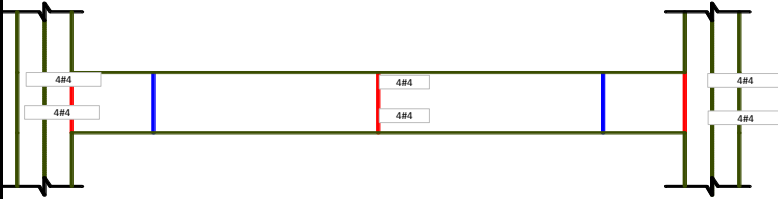
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-81.74	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	1.37	MAL
1/I.S. FLEXION IZQ (-)=	73%	

Mu (-)=	-65.47	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	1.10	MAL
1/I.S. FLEXION C.LUZ (-)=	91%	

Mu (-)=	-53.01	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.89	OK
1/I.S. FLEXION DER (-)=	112%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	111.9	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	1.88	MAL
1/I.S. FLEXION IZQ (+)=	53%	

Mu (+)=	61.22	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	1.03	MAL
1/I.S. FLEXION C.LUZ (+)=	97%	

Mu (+)=	5.42	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.09	OK
1/I.S. FLEXION DER (+)=	1100%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

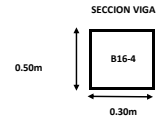
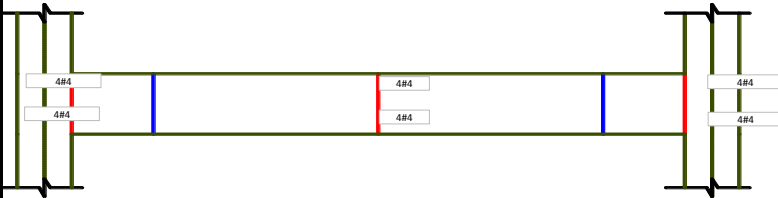
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-84.69	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	1.42	MAL
1/I.S. FLEXION IZQ (-)=	70%	

Mu (-)=	-48.18	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.81	OK
1/I.S. FLEXION C.LUZ (-)=	124%	

Mu (-)=	-26.33	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.44	OK
1/I.S. FLEXION DER (-)=	226%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	68.28	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	1.15	MAL
1/I.S. FLEXION IZQ (+)=	87%	

Mu (+)=	23.23	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.39	OK
1/I.S. FLEXION C.LUZ (+)=	257%	

Mu (+)=	-11.56	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.19	OK
1/I.S. FLEXION DER (+)=	516%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

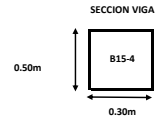
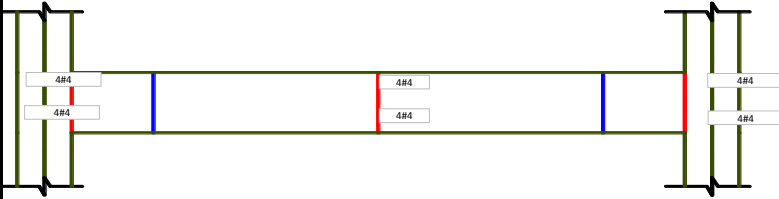
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-52.44	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.88	OK
1/I.S. FLEXION IZQ (-)=	114%	

Mu (-)=	-10.52	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.18	OK
1/I.S. FLEXION C.LUZ (-)=	567%	

Mu (-)=	-62.47	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	1.05	MAL
1/I.S. FLEXION DER (-)=	95%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	41.15	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	0.60	OK
1/I.S. FLEXION IZQ (+)=	145%	

Mu (+)=	-4.3	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.02	OK
1/I.S. FLEXION C.LUZ (+)=	1386%	

Mu (+)=	31.29	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.52	OK
1/I.S. FLEXION DER (+)=	191%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

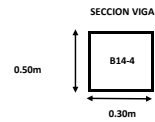
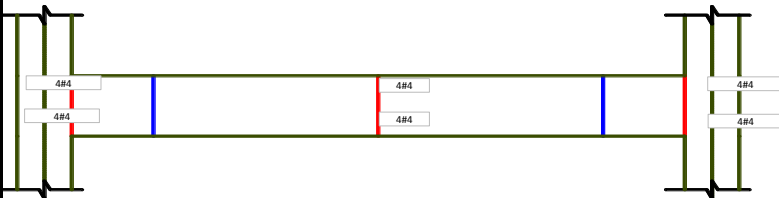
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	7.56	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.13	OK
1/I.S. FLEXION IZQ (-)=	778%	

Mu (-)=	-53.40	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	1.06	MAL
1/I.S. FLEXION C.LUZ (-)=	94%	

Mu (-)=	-131.17	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	2.20	MAL
1/I.S. FLEXION DER (-)=	45%	



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	1.05	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	0.02	OK
1/I.S. FLEXION IZQ (+)=	5678%	

Mu (+)=	35.6	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.60	OK
1/I.S. FLEXION C.LUZ (+)=	167%	

Mu (+)=	76.88	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	1.29	MAL
1/I.S. FLEXION DER (+)=	78%	

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

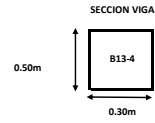
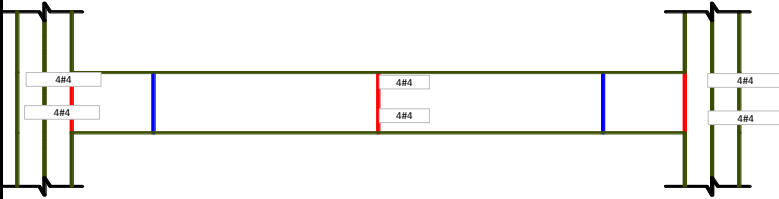
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	-5.06	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.08	
1/I.S. FLEXION IZQ (-)=	1178%	OK

Mu (-)=	-26.98	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.45	
1/I.S. FLEXION C.LUZ (-)=	221%	OK

Mu (-)=	-67.47	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	1.13	
1/I.S. FLEXION DER (-)=	88%	MAL



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	13.19	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	0.22	
1/I.S. FLEXION IZQ (+)=	452%	OK

Mu (+)=	15.78	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.26	
1/I.S. FLEXION C.LUZ (+)=	378%	OK

Mu (+)=	35.48	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.60	
1/I.S. FLEXION DER (+)=	168%	OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\emptyset Mn = \emptyset * \rho * Fy \left(1 - 0.59 * \rho * \frac{Fy}{f'c} \right) * b * d^2$$

$$As = \rho * b * d$$

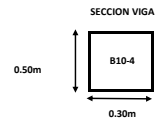
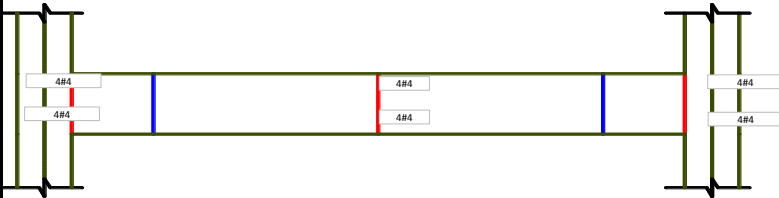
f'c	19	Mpa	b	0.3	m
Fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_e	0.8	
			ϕ_c	0.8	

Tabla A.10.4-1 Valores de ϕ_e y ϕ_c			
Calidad del diseño y la construcción, o del estado de la edificación			
Buena	Regular	Mala	
ϕ_e o ϕ_c	1.0	0.8	0.6

Mu (-)=	23.9	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (-)=	0.40	
1/I.S. FLEXION IZQ (-)=	249%	OK

Mu (-)=	4.32	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.07	
1/I.S. FLEXION C.LUZ (-)=	1380%	OK

Mu (-)=	-12.15	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (-)=	0.20	
1/I.S. FLEXION DER (-)=	491%	OK



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	12.87	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION IZQ (+)=	0.22	
1/I.S. FLEXION IZQ (+)=	463%	OK

Mu (+)=	-1.86	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.03	
1/I.S. FLEXION C.LUZ (+)=	3205%	OK

Mu (+)=	6.51	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= $\phi_e * \phi_c * Nex$ =	59.62	kn.m
I.S FLEXION DER (+)=	0.11	
1/I.S. FLEXION DER (+)=	916%	OK

CALCULO DEL INDICE DE SOBRESFUERZO A FLEXIÓN (+) Y (-) EN VIGAS

$$\phi M_n = \phi * \rho * F_y \left(1 - 0.59 * \rho * \frac{F_y}{f'_c} \right) * b * d^2$$

$$A_s = \rho * b * d$$

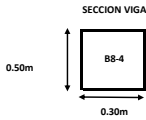
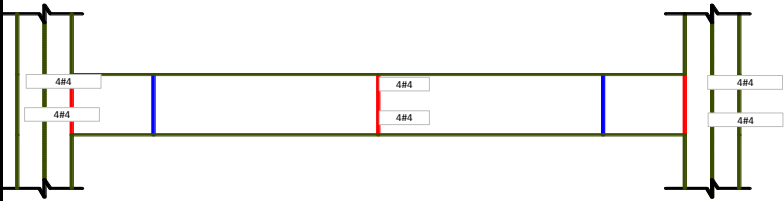
f'c	19	Mpa	b	0.3	m
fy	420	Mpa	d	0.5	m
ϕ	0.9		ϕ_c	0.8	
			ϕ_s	0.8	

Tabla A.10.4-1 Valores de ϕ_s y ϕ_c		
Calidad del diseño y la construcción, o del estado de la edificación		
Buena	Regular	Mal
1.0	0.8	0.6

Mu (-)=	-23.9	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= ϕ_c * ϕ_c *Nex=	59.62	kn.m
I.S FLEXION IZQ (-)=	0.40	
1/I.S. FLEXION IZQ (-)=	249%	OK

Mu (-)=	-4.32	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= ϕ_c * ϕ_c *Nex=	59.62	kn.m
I.S FLEXION C.LUZ (-)=	0.07	
1/I.S. FLEXION C.LUZ (-)=	1380%	OK

Mu (-)=	-12.15	kn.m
As (-)=	0.000516	m2
$\rho (-)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= ϕ_c * ϕ_c *Nex=	59.62	kn.m
I.S FLEXION DER (-)=	0.20	
1/I.S. FLEXION DER (-)=	491%	OK



Rec. inf.	0.05	m
Rec.sup.	0.05	m

Mu (+)=	12.87	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= ϕ_c * ϕ_c *Nex=	59.62	kn.m
I.S FLEXION IZQ (+)=	0.22	
1/I.S. FLEXION IZQ (+)=	463%	OK

Mu (+)=	-1.86	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= ϕ_c * ϕ_c *Nex=	59.62	kn.m
I.S FLEXION C.LUZ (+)=	0.03	
1/I.S. FLEXION C.LUZ (+)=	3205%	OK

Mu (+)=	6.51	kn.m
As (+)=	0.000516	m2
$\rho (+)$ =	0.00344	
Nex= ϕ Mn	93.15	kn.m
Nef= ϕ_c * ϕ_c *Nex=	59.62	kn.m
I.S FLEXION DER (+)=	0.11	
1/I.S. FLEXION DER (+)=	916%	OK