

REVISIÓN DE LOS EFECTOS DE ESBELTEZ EN COLUMNAS

Elemento:	L (cm)	b (cm)	h (cm)	I_x (cm ⁴)	I_y (cm ⁴)	A (cm ²)	I_x/L	I_y/L	r_x	r_y
Columna C1	300	30.0	30.0	67,500	67,500	900.0	225.00	225.00	8.66	8.66
Columna C2	300	35.0	35.0	125,052	125,052	1,225.0	416.84	416.84	10.10	10.10
Trabe T1	600	30.0	50.0	312,500	112,500	1,500.0	520.83	187.50	14.43	8.66
Trabe T2	600	40.0	60.0	720,000	320,000	2,400.0	1200.00	533.33	17.32	11.55

Dirección X									
Columna C1									
Nivel	Ψ_{sup}	Ψ_{inf}	k	H'	H' / r	M ₁	M ₂	34-(M ₁ /M ₂)	¿Esbeltéz?
5	0.131	0.262	0.590	177.0	20.44	0.61	0.67	33.09	No
4	0.262	0.262	0.618	185.4	21.41	0.55	0.57	33.04	No
3	0.262	0.262	0.618	185.4	21.41	0.53	0.54	33.02	No
2	0.262	0.262	0.618	185.4	21.41	0.49	0.51	33.04	No
1	0.262	0.262	0.618	185.4	21.41	0.35	0.41	33.15	No
PB	0.262	0.000	0.560	168.0	19.40	0.11	0.22	33.50	No

Dirección X									
Columna C2									
Nivel	Ψ_{sup}	Ψ_{inf}	k	H'	H' / r	M ₁	M ₂	34-(M ₁ /M ₂)	¿Esbeltéz?
5	0.174	0.347	0.610	183.0	21.13	-0.80	-0.96	33.17	No
4	0.347	0.347	0.640	192.0	22.17	-0.66	-0.67	33.01	No
3	0.347	0.347	0.640	192.0	22.17	-0.65	-0.65	33.00	No
2	0.347	0.347	0.640	192.0	22.17	-0.62	-0.63	33.02	No
1	0.347	0.347	0.640	192.0	22.17	-0.36	-0.46	33.22	No
PB	0.347	0.000	0.570	171.0	19.75	-0.10	-0.20	33.50	No

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Dirección Y				Columna C1					
Nivel	Ψ_{sup}	Ψ_{inf}	k	H'	H' / r	M ₁	M ₂	34-(M ₁ /M ₂)	¿Esbeltez?
5	0.312	0.624	0.670	201.0	23.21	0.58	0.66	33.12	No
4	0.624	0.624	0.720	216.0	24.94	0.49	0.49	33.00	No
3	0.624	0.624	0.720	216.0	24.94	0.45	0.47	33.04	No
2	0.624	0.624	0.720	216.0	24.94	0.39	0.41	33.05	No
1	0.624	0.624	0.720	216.0	24.94	0.36	0.36	33.00	No
PB	0.624	0.000	0.600	180.0	20.78	0.13	0.25	33.48	No

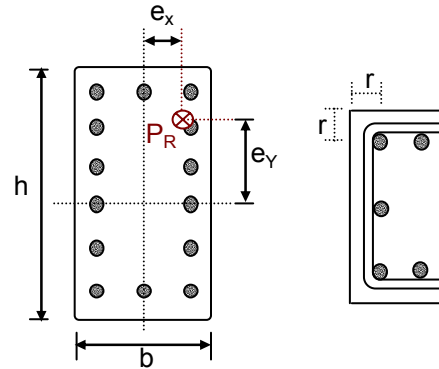
Dirección Y				Columna C2					
Nivel	Ψ_{sup}	Ψ_{inf}	k	H'	H' / r	M ₁	M ₂	34-(M ₁ /M ₂)	¿Esbeltez?
5	0.391	0.782	0.695	208.5	24.08	0.16	0.25	33.36	No
4	0.782	0.782	0.740	222.0	25.63	0.16	0.13	32.77	No
3	0.782	0.782	0.740	222.0	25.63	0.22	0.20	32.90	No
2	0.782	0.782	0.740	222.0	25.63	0.29	0.26	32.88	No
1	0.782	0.782	0.740	222.0	25.63	0.42	0.36	32.83	No
PB	0.782	0.000	0.610	183.0	21.13	0.14	0.30	33.53	No

DISEÑO DE COLUMNAS

Columna: C1

DATOS:

$f'_c =$	300	Kg/cm ²
$f_y =$	4200	Kg/cm ²
$F_R =$	0.7	
$b =$	30.0	cm
$h =$	30.0	cm
$r_l =$	3.0	cm



Se emplearan:

Varillas # 6	($\phi = 19$ mm)	(para refuerzo longitudinal)
Varillas # 8	($\phi = 28.6$ mm)	(para refuerzo longitudinal)
Estribos # 3	($\phi = 9.5$ mm)	(para refuerzo transversal)

CONSTANTES :

$f^*c = 0.8 f'_c$

$f^*c = 240.00 \text{ Kg/cm}^2$

$f'c_1 = 0.85 f^*c$

$f^*c_1 = 204.00 \text{ Kg/cm}^2$

$f^*c < 250 \text{ kg/cm}^2$

$f'c_2 = (1.05 - (f^*c/1250)) * f^*c$

$f^*c_2 = 205.92 \text{ Kg/cm}^2$

$f^*c > 250 \text{ Kg/cm}^2$

$f'c = 204.00 \text{ Kg/cm}^2$

$\rho_{min} = 20/F_y$

$\rho_{min} = 0.0048$

$\rho_{max} = 0.06$

$\rho_{max} = 0.06$

$q_{min} = \rho_{min} * (f_y/f'c)$

$q_{min} = 0.0980$

$q_{max} = \rho_{max} * (f_y/f'c)$

$q_{max} = 1.2353$

$r = r_l + d_e + d_l = 6.00 \text{ cm}$

En la dirección X:

$d = h - r$

$d = 24 \text{ cm}$

$d / h = 0.80$

En la dirección Y:

$d = h - r$

$d = 24 \text{ cm}$

$d / h = 0.80$

Columna:C1**Fuerzas internas**

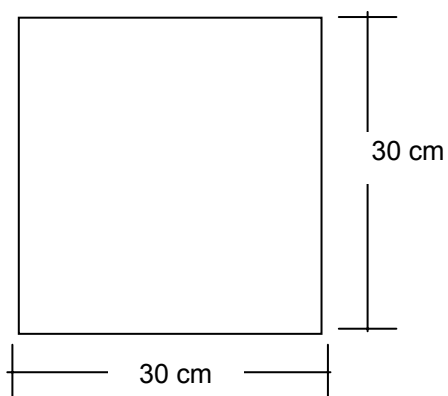
Nivel	Carga	P (Ton)	M _x (Ton-m)	M _y (Ton-m)	P _u (Ton)	M _{ux} (Ton-m)	M _{uy} (Ton-m)	V (Ton)
5	6	6.90	0.61	0.67	9.66	0.85	0.94	0.43
	7	4.56	0.47	0.50	5.02	0.52	0.55	0.32
	8	5.76	0.48	0.54	6.34	0.53	0.59	0.34
4	6	9.72	0.55	0.49	13.61	0.77	0.69	0.37
	7	7.31	0.44	0.35	8.04	0.48	0.39	0.29
	8	7.70	0.43	0.38	8.47	0.47	0.42	0.29
3	6	13.45	0.53	0.45	18.83	0.74	0.63	0.36
	7	10.44	0.42	0.35	11.48	0.46	0.39	0.28
	8	10.53	0.42	0.36	11.58	0.46	0.40	0.28
2	6	18.29	0.49	0.39	25.61	0.69	0.55	0.33
	7	14.40	0.39	0.30	15.84	0.43	0.33	0.26
	8	14.27	0.39	0.31	15.70	0.43	0.34	0.26
1	6	26.73	0.35	0.36	37.42	0.49	0.50	0.25
	7	21.24	0.28	0.28	23.36	0.31	0.31	0.20
	8	20.81	0.28	0.29	22.89	0.31	0.32	0.20
PB	6	55.90	0.11	0.13	78.26	0.15	0.18	0.11
	7	44.60	0.09	0.10	49.06	0.10	0.11	0.09
	8	43.53	0.09	0.09	47.88	0.10	0.10	0.09

Diseño de columnas C1

Nivel	Carga	e _x (cm)	e _y (cm)	e _x /h _x	e _y /h _y	q	K _{rx}	k _{ry}	k _{ro}	k _r
5	6	0.09	0.10	0.00295	0.00324	1.00	2.0141	2.0031	2.00	2.0172
	7	0.10	0.11	0.00344	0.00365	1.00	2.0207	2.0043	2.00	2.0249
	8	0.08	0.09	0.00278	0.00313	1.00	2.0124	2.0043	2.00	2.0167
4	6	0.06	0.05	0.00189	0.00168	1.00	2.0079	2.0013	2.00	2.0092
	7	0.06	0.05	0.00201	0.00160	1.00	2.0087	2.0010	2.00	2.0097
	8	0.06	0.05	0.00186	0.00165	1.00	2.0076	2.0009	2.00	2.0085
3	6	0.04	0.03	0.00131	0.00112	1.00	2.0053	2.0004	2.00	2.0058
	7	0.04	0.03	0.00134	0.00112	1.00	2.0056	2.0003	2.00	2.0059
	8	0.04	0.03	0.00133	0.00114	1.00	2.0055	2.0003	2.00	2.0058
2	6	0.03	0.02	0.00089	0.00071	1.00	2.0036	2.0000	2.00	2.0036
	7	0.03	0.02	0.00090	0.00069	1.00	2.0037	2.0000	2.00	2.0037
	8	0.03	0.02	0.00091	0.00072	1.00	2.0049	2.0000	2.00	2.0049
1	6	0.01	0.01	0.00044	0.00045	1.00	2.0017	2.0007	2.00	2.0025
	7	0.01	0.01	0.00044	0.00044	1.00	2.0017	1.9998	2.00	2.0015
	8	0.01	0.01	0.00045	0.00046	1.00	2.0021	2.0000	2.00	2.0021
PB	6	0.00	0.00	0.00007	0.00008	1.00	2.0003	2.0001	2.00	2.0004
	7	0.00	0.00	0.00007	0.00007	1.00	1.9999	2.0003	2.00	2.0002
	8	0.00	0.00	0.00007	0.00007	1.00	2.0003	1.9999	2.00	2.0002

Nivel	Carga	P_R (Ton)	¿Pasa?	$A_{S_{req}}$ (cm^2)	Varillas (# 6)	Varillas (# 8)	A_s (cm^2)	¿pasa cortante?	$A_{S_{com}}$ (cm^2)	P_v
5	6	259.25	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	7	260.25	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	8	259.18	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
4	6	258.22	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	7	258.29	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	8	258.14	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
3	6	257.78	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	7	257.80	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	8	257.79	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
2	6	257.50	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	7	257.52	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	8	257.67	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
1	6	257.36	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	7	257.24	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	8	257.31	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
PB	6	257.09	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	7	257.07	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150
	8	257.07	Si	43.71	8.00	4.00	43.08	Si	10.77	0.0150

Debido a que la sección pasa las revisiones por flexocompresión y cortante, se aceptan las dimensiones propuestas:



Sección propuesta

UNION VIGA - COLUMNA:

Revisión de refuerzo transversal mínimo

Datos:

Separación máxima de estribos:

$A_{shx} = 2.8 \text{ cm}^2$	$(850/(f_y^{.5}) * \text{diám} * .5 =$	6.23	cm	S = 5.0 cm
$A_{shy} = 2.8 \text{ cm}^2$	$48 * \text{diám} * .5 =$	22.80	cm	
$A_g = 900.0 \text{ cm}^2$	$05 * b * .5 =$	7.50	cm	
$A_c = 729.0 \text{ cm}^2$				
$h_{cx} = 24.0 \text{ cm}$				
$h_{cy} = 24.0 \text{ cm}$				

Dir	0.3[(A _g /A _c)-1]*(f' _c /f _y)*s*h _c	< A _{sh} ?	0.12(f' _c /f _y)*s*h _c	< A _{sh} ?
X	0.6032	Si	1.0286	Si
Y	0.6032	Si	1.0286	Si

Revisión de la fuerza cortante

Datos:

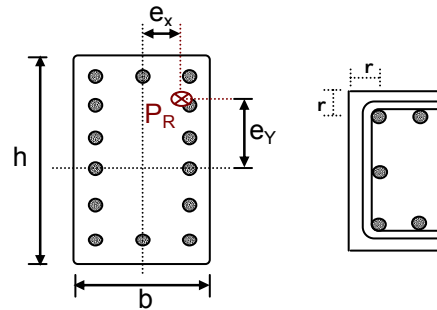
$F_R = 0.8$			
$b_{ex} = 24.0 \text{ cm}$	$V_{RX} = 40.16$	Ton	
$b_{ey} = 24.0 \text{ cm}$	$V_{RY} = 40.16$	Ton	
$h_x = 30.0 \text{ cm}$			
$h_y = 30.0 \text{ cm}$			

DISEÑO DE COLUMNAS

Columna: C2

DATOS:

$f'_c =$	300	Kg/cm ²
$f_y =$	4200	Kg/cm ²
$F_R =$	0.7	
$b =$	35.0	cm
$h =$	35.0	cm
$r_1 =$	3.0	cm



Se emplearan:

Varillas # 6	($\phi = 19$ mm)	(para refuerzo longitudinal)
Varillas # 8	($\phi = 28.6$ mm)	(para refuerzo longitudinal)
Estribos # 3	($\phi = 9.5$ mm)	(para refuerzo transversal)

CONSTANTES :

$f^*c = 0.8 f'_c$

$f^*c = 240.00 \text{ Kg/cm}^2$

$f'c_1 = 0.85 f^*c$

$f^*c_1 = 204.00 \text{ Kg/cm}^2$

$f^*c < 250 \text{ kg/cm}^2$

$f'c_2 = (1.05 - (f^*c/1250)) * f^*c$

$f^*c_2 = 205.92 \text{ Kg/cm}^2$

$f^*c > 250 \text{ Kg/cm}^2$

$f'c = 204.00 \text{ Kg/cm}^2$

$\rho_{min} = 20/F_y$

$\rho_{min} = 0.0048$

$\rho_{max} = 0.06$

$\rho_{max} = 0.06$

$q_{min} = \rho_{min} * (f_y/f'c)$

$q_{min} = 0.0980$

$q_{max} = \rho_{max} * (f_y/f'c)$

$q_{max} = 1.2353$

$r = r_1 + d_e + d_l = 6.00 \text{ cm}$

En la dirección X:

$d = h - r$

$d = 29 \text{ cm}$

$d / h = 0.83$

En la dirección Y:

$d = h - r$

$d = 29 \text{ cm}$

$d / h = 0.83$

Columna: C2

Fuerzas internas

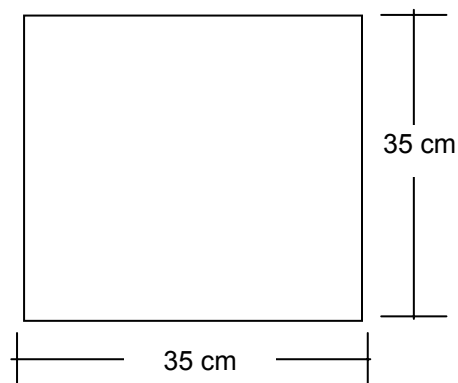
Nivel	Comb. carga	P (Ton)	M _x (Ton-m)	M _y (Ton-m)	P _u (Ton)	M _{ux} (Ton-m)	M _{uy} (Ton-m)	V (Ton)
5	6	19.06	-0.80	0.16	26.68	-1.12	0.22	-0.58
	7	14.84	-0.61	0.12	16.32	-0.67	0.13	-0.45
	8	14.98	-0.62	0.12	16.48	-0.68	0.13	-0.46
4	6	21.32	-0.66	0.16	29.85	-0.92	0.22	-0.44
	7	16.70	-0.52	0.13	18.37	-0.57	0.14	-0.35
	8	16.78	-0.52	0.13	18.46	-0.57	0.14	-0.35
3	6	30.15	-0.65	0.22	42.21	-0.91	0.31	-0.43
	7	23.64	-0.51	0.18	26.00	-0.56	0.20	-0.34
	8	23.68	-0.51	0.17	26.05	-0.56	0.19	-0.34
2	6	39.93	-0.62	0.29	55.90	-0.87	0.41	-0.42
	7	31.34	-0.49	0.23	34.47	-0.54	0.25	-0.33
	8	31.36	-0.49	0.23	34.50	-0.54	0.25	-0.33
1	6	52.56	-0.36	0.42	73.58	-0.50	0.59	-0.27
	7	41.27	-0.29	0.33	45.40	-0.32	0.36	-0.22
	8	41.30	-0.29	0.33	45.43	-0.32	0.36	-0.22
PB	6	87.99	-0.10	0.14	123.19	-0.14	0.20	-0.10
	7	69.13	-0.80	0.11	76.04	-0.88	0.12	-0.08
	8	69.10	-0.80	0.11	76.01	-0.88	0.12	-0.08

Diseño de columnas C2

Nivel	Comb. carga	e _x (cm)	e _y (cm)	e _x /h _x	e _y /h _y	q	K _{rx}	k _{ry}	k _{ro}	k _r
5	6	0.0420	0.0084	0.0012	0.0002	1.20	2.1952	2.1894	2.20	2.185
	7	0.0411	0.0081	0.0012	0.0002	1.20	2.1950	2.1892	2.20	2.184
	8	0.0414	0.0080	0.0012	0.0002	1.20	2.1953	2.1900	2.20	2.185
4	6	0.0310	0.0075	0.0009	0.0002	1.20	2.1934	2.1886	2.20	2.182
	7	0.0311	0.0078	0.0009	0.0002	1.20	2.1944	2.1886	2.20	2.183
	8	0.0310	0.0077	0.0009	0.0002	1.20	2.1934	2.1888	2.20	2.182
3	6	0.0216	0.0073	0.0006	0.0002	1.20	2.1888	2.1886	2.20	2.177
	7	0.0216	0.0076	0.0006	0.0002	1.20	2.1887	2.1886	2.20	2.177
	8	0.0215	0.0072	0.0006	0.0002	1.20	2.1887	2.1886	2.20	2.177
2	6	0.0155	0.0073	0.0004	0.0002	1.20	2.1907	2.1889	2.20	2.180
	7	0.0156	0.0073	0.0004	0.0002	1.20	2.1908	2.1889	2.20	2.180
	8	0.0156	0.0073	0.0004	0.0002	1.20	2.1908	2.1889	2.20	2.180
1	6	0.0068	0.0080	0.0002	0.0002	1.20	2.1893	2.1892	2.20	2.179
	7	0.0070	0.0080	0.0002	0.0002	1.20	2.1894	2.1892	2.20	2.179
	8	0.0070	0.0080	0.0002	0.0002	1.20	2.1894	2.1891	2.20	2.178
PB	6	0.0011	0.0016	0.0000	0.0000	1.20	2.1887	2.1886	2.20	2.177
	7	0.0116	0.0016	0.0003	0.0000	1.20	2.1887	2.1887	2.20	2.177
	8	0.0116	0.0016	0.0003	0.0000	1.20	2.1887	2.1887	2.20	2.177

Nivel	Comb. carga	P_R (Ton)	¿Pasa?	$A_{S_{req}}$ (cm ²)	Varillas (# 6)	Varillas (# 8)	A_s (cm ²)	¿pasa cortante?	$A_{S_{com}}$ (cm ²)	p_v
5	6	382.15	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	7	382.08	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	8	382.29	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
4	6	381.70	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	7	381.86	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	8	381.73	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
3	6	380.89	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	7	380.88	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	8	380.88	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
2	6	381.28	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	7	381.30	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	8	381.30	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
1	6	381.09	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	7	381.10	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	8	381.08	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
PB	6	380.89	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	7	380.89	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178
	8	380.89	Si	71.40	4.00	12.00	72.24	Si	18.06	0.0178

Debido a que la sección pasa las revisiones por flexocompresión y cortante, se aceptan las dimensiones propuestas:



Sección propuesta

Revisión de refuerzo transversal mínimo

Datos:

Separación máxima de estribos:

$$A_{shx} = 2.8 \text{ cm}^2$$

$$A_{shy} = 2.8 \text{ cm}^2$$

$$A_g = 1,225 \text{ cm}^2$$

$$A_c = 1,024 \text{ cm}^2$$

$$h_{cx} = 29.0 \text{ cm}$$

$$h_{cy} = 29.0 \text{ cm}$$

$$(850/(f_y^{.5}) * \text{diám} * .5 = 6.23 \text{ cm}$$

$$48 * \text{diám} * .5 = 22.80 \text{ cm}$$

$$05 * b * .5 = 7.50 \text{ cm}$$

$$S = 5.0 \text{ cm}$$

Dir	$0.3[(A_g/A_c)-1]*(f'_c/f_y)*s*h_c$	< A_{sh} ?	$0.12(f'_c/f_y)*s*h_c$	< A_{sh} ?
X	0.6099	Si	1.2429	Si
Y	0.6099	Si	1.2429	Si

Revisión de la fuerza cortante

Datos:

$$F_R = 0.8$$

$$b_{ex} = 24.0 \text{ cm}$$

$$b_{ey} = 24.0 \text{ cm}$$

$$h_x = 35.0 \text{ cm}$$

$$h_y = 35.0 \text{ cm}$$

$$V_{RX} = 46.84761 \text{ Ton}$$

$$V_{RY} = 46.84761 \text{ Ton}$$