

Company: Company

Project: IE HECTOR MANUEL VIDES BALLESTEROS (MÓDULO 6)

File: C:\IE REGIDOR\MOD6.rcb

Engineer: Name

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SEISMIC DESIGN CODE: COLNSR-10

SEISMIC BASE LEVEL: 1

SEISMIC FORCE RESISTING SYSTEM

System X-Direction: C: Moment Res.Frame

System Y-Direction: C: Moment Res.Frame

Energy dissip capacity: 2: Moderate-DMO

RESPONSE SPECTRUM EARTHQUAKE FORCES COLNSR-10

Elastic Modal Base Shear

 $V_m = S_{am} W_m'$ S_{am} = Spectral modal accelerationW_m' = Effective modal weight

ANALYSIS PARAMETERS

Number of modes to be included ... = 6

	X-direction	Y-direction
Energy dissipation coefficient, R _o =	5	5

SPECTRAL MODAL ACCELERATION

Sam = 2.5 Aa Fa I [0.4+0.6T/To]	For T _m ≤ To
Sam = 2.5 Aa Fa I	For To < T _m ≤ T _c
Sam = 1.2 Av Fv I/T _m	For T _c < T _m < T _l
Sam = 1.2 Av Fv T _l I/T _m ²	For T _m > T _l

Eff. peak acceleration & veloc., Aa = .15 Av = .15

Region:	10	9	8	7	6	5	4	3	2	1
Aa or Av	0.50	0.45	0.40	0.35	0.30	0.25	0.20	0.15	0.10	0.05

LOCATION	Aa	Av	Menace
Barranquilla, Cartagena, San Andres, Valledupar	0.10	0.10	Low
Bogota, Medellin	0.15	0.20	Interm
Armenia, Bucaramanga, Cali, Manizalez, Pereira	0.25	0.25	High
Cucuta, Villavicencio	0.35	0.30	High
Quibdo	0.35	0.35	High

Importance coefficient, I = 1.25

GROUP	COEFFICIENT
IV - Essential facilities	1.50
III- Public assistance facilities	1.25
II - Especial occupancy buildings	1.10
I - Normal occupancy buildings	1.00

Site profile type, S = D

TYPE	SOIL PROFILE TYPE	Shear Wave Velocity
A	Hard Rock	> 1500 m/s
B	Rock	1500 - 760 m/s
C	Very Dense Soil & Soft Rock	760 - 360 m/s
D	Stiff Soil Profile	360 - 180 m/s
E	Soft Soil Profile	< 180 m/s
F	Soils requiring site-specific evaluations	

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$$R = (\emptyset_p \ \emptyset_a) \ \emptyset_r \ R_o$$

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S T A T I C E Q U I V A L E N T B A S E S H E A R

Building Weight, W, (ton) = 307.78

Peak Acceleration Coeffi., Aa Fa = .23
 Peak Velocity Coefficient, Av Fv = .33
 Importance factor, I = 1.25
 Site class, S = D
 Coeff. for upper limit period, Cu = 1.354

	X-direction	Y-direction
	-----	-----
Computed Period	= 0.298	0.184
Ta = Ct (H)^x	= 0.047 H^0.9	0.047 H^0.9
	= 0.243	0.243
Tmax = Cu Ta	= 0.329	0.329
Fundamental Period	= 0.298	0.184
Energ-Disspst coeff, R	= 4.5	4.5
1.2 Av Fv I / T	= 1.661	2.69
2.5 Aa Fa I	= .719	.719
Sa	= .719	.719
Base Shear, Vo	= 221.22	221.22
Static Shear, .9Vo (ton)	= 199.10	199.10

S P E C T R A L A C C E L E R A T I O N

MODE No	PERIOD (sec)	Sa (g)
-----	-----	-----
1	.298	.719
2	.184	.719
3	.136	.696
4	.104	.6
5	.1	.588
6	.046	.426

M O D A L B A S E S H E A R

MODE No	X - D I R E C T I O N			Y - D I R E C T I O N		
	Sax (g)	W'x (ton)	Vx (ton)	Say (g)	W'y (ton)	Vy (ton)
-----	-----	-----	-----	-----	-----	-----
1	.719	261.84	188.26	.719	0	0
2	.719	0	0	.719	296.71	213.34
3	.696	2.14	1.49	.696	5.95	4.14
4	.6	24.78	14.87	.6	.86	.52
5	.588	19.02	11.18	.588	.63	.37
6	.426	0	0	.426	3.49	1.49
-----	-----	-----	-----	-----	-----	-----
ELASTIC Ve (combined):	189.19			213.38		
STATIC (IREG) 0.9Sa(T1)W:	199.1			199.1		
Design Base Shear:	199.1			213.38		

Total Building Weight, W = 307.78 ton
 Participating Mass, $\Sigma W'/W = 100\%$ in X, 100% in Y
 $W'_{xm} = \{\Sigma W_j \phi_{xjm}\}^2 / \Sigma W_j \phi_{xjm}^2$ $W'_{ym} = \{\Sigma W_j \phi_{yjm}\}^2 / \Sigma W_j \phi_{yjm}^2$
 Combination of Modal Response: SRSS $V = (\text{Sum } V_i^2)^{1/2}$

A C C I D E N T A L T O R S I O N

X-direction Y-direction

Accidental eccentricity as a
 percentage of building dimension, (%)= 5 5

A C C I D E N T A L E C C E N T R I C I T Y :

Level	X - D I R E C T I O N (EQY)			Y - D I R E C T I O N (EQX)		
	$\delta\epsilon^x_o$ (m)	Ax	$\delta\epsilon^x$ (m)	$\delta\epsilon^y_o$ (m)	Ax	$\delta\epsilon^y$ (m)
3	0.68	1.00	0.68	0.98	1.00	0.98
2	1.23	1.00	1.23	1.09	1.00	1.09

Ax: Amplification factor for accidental eccentricity

EQY: Envelope (1) $E^x = \epsilon^x$ EQX: Envelope (1) $E^y = \epsilon^y$
(2) $E^x = \epsilon^x + \delta\epsilon^x$ (2) $E^y = \epsilon^y + \delta\epsilon^y$
(3) $E^x = \epsilon^x - \delta\epsilon^x$ (3) $E^y = \epsilon^y - \delta\epsilon^y$

D E S I G N E C C E N T R I C I T Y : $E = \epsilon + \delta\epsilon$

Level	X - D I R E C T I O N (EQY)				Y - D I R E C T I O N (EQX)			
	Center Mass CMx	Inherent Eccent. ϵ^x^*	Accident Eccent. $\delta\epsilon^x$	Design Eccent. E^x	Center Mass CMy	Inherent Eccent. ϵ^y^*	Accident Eccent. $\delta\epsilon^y$	Design Eccent. E^y
3	15.87	0.03	0.68	0.7171	9.58	1.18	0.98	2.1616
2	10.97	-3.82	1.23	-5.055	12.23	3.87	1.09	4.9696

Note: * Inherent eccentricity: $\epsilon^x = CMx - CRx$ and $\epsilon^y = CMy - CRy$
All values are in meters

D E S I G N E C C E N T R I C I T Y : $E = \epsilon - \delta\epsilon$

Level	X - D I R E C T I O N (EQY)				Y - D I R E C T I O N (EQX)			
	Center Mass CMx	Inherent Eccent. ϵ^x^*	Accident Eccent. $\delta\epsilon^x$	Design Eccent. E^x	Center Mass CMy	Inherent Eccent. ϵ^y^*	Accident Eccent. $\delta\epsilon^y$	Design Eccent. E^y
3	15.87	0.03	0.68	-0.655	9.58	1.18	0.98	0.2020
2	10.97	-3.82	1.23	-2.599	12.23	3.87	1.09	2.7878

Note: * Inherent eccentricity: $\epsilon^x = CMx - CRx$ and $\epsilon^y = CMy - CRy$
All values are in meters

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Modal nodal force:

$$F_{im} = V_m \quad W_{im} \quad \phi_{im} / \sum W_j \quad \phi_{jm}$$

$$V_m = S_{am} W'_m$$

$$W'_m = \{ \sum W_j \quad \phi_{jm} \}^2 / \sum W_j \quad \phi_{jm}^2$$

C O M B I N E D M O D A L F O R C E

Floor k -	Weight W (ton)	X - DIRECTION		Torsion T=F(E-ε) (ton-m)
		Force F (ton)	Shear V (ton)	
3	72.25	72.51	72.51	71.37
2	235.5	126.5	199.1	138.5

C O M B I N E D M O D A L F O R C E

Floor k -	Weight W (ton)	Y - DIRECTION		Torsion T=F(E-ε) (ton-m)
		Force F (ton)	Shear V (ton)	
3	72.25	64.63	64.63	44.24
2	235.5	148.7	213.3	183.3

ACCELERATIONS ON NON-STRUCTURAL ELEMENTS- NSR-10

F L O O R A C C E L E R A T I O N S

Level	hx	hx/heq	ax
3	6.19	1.33	0.924
2	4.00	0.86	0.637

Seismic base level = 1
 Height above seismic base, hn = 6.20 m
 Equivalent height, heq = 0.75 hn = 4.65 m
 Ground acceleration, As = Aa Fa I = 0.288
 Spectral acceleration, Sa = 0.693

$$ax = Sa \quad hx/heq \quad \text{for } hx > heq$$

$$ax = As + (Sa - As) \quad hx/heq \quad \text{for } hx < heq$$

Force on structural non-seismic element : $F_p = ax \quad W_p / R_o$
 Force on nonstructural element : $F_p = ax \quad a_p \quad W_p / R_p$
 $> 0.5 \quad Aa \quad I \quad W_p$

ap : component amplification factor