

Company: Company

Project: IE HECTOR MANUEL VIDES BALLESTEROS (MÓDULO 1)

File: C:\IE REGIDOR\MOD1.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 acceleration
 W_m' = Effective modal weight

ANALYSIS PARAMETERS

Number of modes to be included ... = 3

	X-direction	Y-direction
Energy dissipation coefficient, R_o =	5	5

SPECTRAL MODAL ACCELERATION

$S_{am} = 2.5 A_a F_a I [0.4 + 0.6 T / T_o]$ For $T_m \leq T_o$
 $S_{am} = 2.5 A_a F_a I$ For $T_o < T_m \leq T_c$
 $S_{am} = 1.2 A_v F_v I / T_m$ For $T_c < T_m < T_l$
 $S_{am} = 1.2 A_v F_v T_l I / T_m^2$ For $T_m > T_l$

Eff. peak acceleration & veloc., $A_a = .15$ $A_v = .15$

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

LOCATION	A_a	A_v	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) = 244.39

Peak Acceleration Coeffi., $A_a F_a$ = .23
 Peak Velocity Coefficient, $A_v F_v$ = .33
 Importance factor, I = 1.25
 Site class, S = D
 Coeff. for upper limit period, C_u = 1.354

	X-direction	Y-direction
Computed Period	= 0.175	0.235
$T_a = C_t (H)^x$	= 0.047 $H^{0.9}$	0.047 $H^{0.9}$
	= 0.147	0.147
$T_{max} = C_u T_a$	= 0.199	0.199
Fundamental Period	= 0.175	0.199
Energ-Disspst coeff, R	= 4	4
$1.2 A_v F_v I / T$	= 2.829	2.487
$2.5 A_a F_a I$	= .719	.719
S_a	= .719	.719
Base Shear, V_o	= 175.66	175.66
Static Shear, $.9V_o$ (ton)	= 158.09	158.09

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

MODE No	PERIOD (sec)	S_a (g)
1	.235	.719
2	.175	.719
3	.124	.66

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		
	S_{ax} (g)	$W'x$ (ton)	Vx (ton)	S_{ay} (g)	$W'y$ (ton)	Vy (ton)
1	.719	0	0	.719	236.2	169.83
2	.719	244.15	175.54	.719	0	0
3	.66	.24	.16	.66	1.19	.78

ELASTIC V_e (combined): 175.54 169.83
 STATIC (IREG) $0.9S_a(T_1)W$ 158.09 158.09

Design Base Shear: 175.54 169.83

Total Building Weight, W = 244.39 ton
 Participating Mass, $\Sigma W'/W$ = 100% in X, 97% 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 $V = (\Sigma V_i^2)^{1/2}$

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

X-direction	Y-direction
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Accidental eccentricity as a
 percentage of building dimension, (%)= 5 5

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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)		
	$\delta\epsilon^{\circ}$ (m)	A_x -	$\delta\epsilon^x$ (m)	$\delta\epsilon^{\circ}$ (m)	A_x -	$\delta\epsilon^y$ (m)
2	1.97	1.00	1.97	0.89	1.57	1.40

A_x : 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
2	23.85	2.01	1.97	3.9898	4.38	0.12	1.40	1.5252

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
2	23.85	2.01	1.97	0.0404	4.38	0.12	1.40	-1.288

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

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Modal nodal force:

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

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

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

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)	
2	244.3	175.5	175.5	246.3

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)	
2	244.3	169.8	169.8	334.8

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
2	3.54	1.33	0.958

Seismic base level = 1
 Height above seismic base, hn = 3.55 m
 Equivalent height, heq = 0.75 hn = 2.66 m
 Ground acceleration, As = Aa Fa I = 0.288
 Spectral acceleration, Sa = 0.718

ax = Sa hx/heq for hx > heq
 ax = As + (Sa -As) hx/heq for hx < heq

Force on structural non-seismic element : Fp = ax Wp / Ro
 Force on nonstructural element : Fp = ax ap Wp / Rp
 > 0.5 Aa I Wp

ap : component amplification factor