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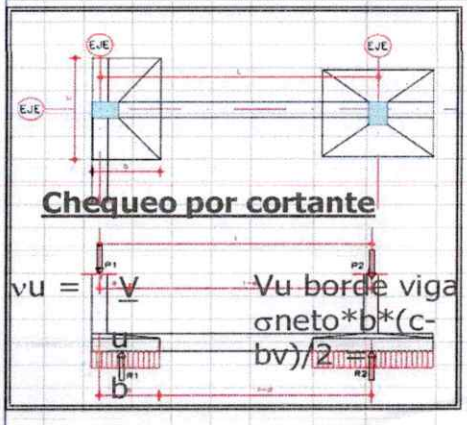
0.40 m

DISEÑO DE ZAPATA EXCENTRICA

0. m 00 m
33 1. **0.40** m

Armadura= 1#5 cada 0.20m

Longitudinales
1#5 cada 0.20m
Transversales

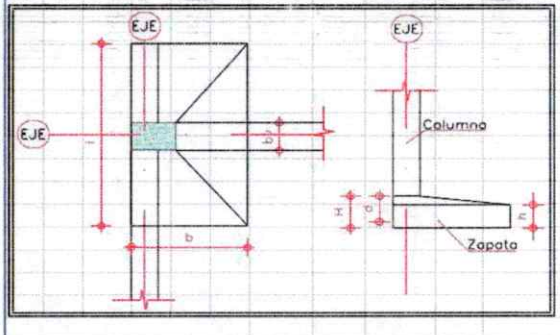


Chequeo por cortante

$\nu u = \frac{V_u - \sigma neto * b * (c - bv)/2}{b * d}$ = 42.78 kN

Vu = 1,7* V borde = 72.72 k N

$\nu u = \frac{\phi \nu c}{}$ = 0.220 MPa 0.649 MPa **OK**



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DISEÑO DE ZAPATA EXCENTRICA

ZAPATA TIPO

Columna	**b c = 30** cm. **t =**	**f'c = 21** MPa **fy = 420** MPa		σ = 0.14	MPa

PREDIMENSIONAMIENTO

c =	0.90 m		**Cargas**		
b =	0.90 m		**Pu =**	72.2 + 2.5 kN	
l-e =	3.70 m			7.22 kN	
d =	0.75 m			100.09 kN	
e =	0.30 m		**mu =**		
L =	**4.00** m		**Pp (10%) =**		
			Σ P1 =		

Area necesaria = $\frac{\Sigma P1}{\sigma}$ = 0.71 m²

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0.71

DISEÑO DE ZAPATA EXCENTRICA c b

x b = 0.50 xc

c =1.191 m **Asumimos** **0.90** m

b =0.60 m **c=** **0.90** m

b=

VALOR DE Δ R

ΔR*(L-e) = 3.70 30.03 k N-m

P1*e = ΔR * = Entonces

c = (P1 + ΔR)/(σ*b) = 0.85 m

Δ **R** = **c** = 8.12 kN 0.90 m

σneto = (Pu+ΔR)/(b*c) = 0.115 MPa **OK**

σ**neto=** 0.115 Mpa

DISEÑO DE VIGA DE CONTRAPESO :

Flexión Donde el cortante es cero (0), el momento es máximo

Md = 26.37 k N-m

ΔR(l-d) = 6 m

Mu = 19.78 k N-m

0.5*1,5 * Md =

h = **0.35** m

b = **0.30** m

v = m

d = 0.28 m

Cuantía 0.0033 0.0033

As 2.80 2.80 cm² cm²

c 5.94OK

5.94OK

Cortante ——— Carga long. Bajo ——— la zapata exterior

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DISEÑO DE ZAPATA EXCENTRICA

ϕ	649		Arma dura =	2	5 1	5 Arriba
v	.19			2	5 1	5 Abajo
c	8	kN /m				
	103. 19		Arma dura =			

Ai = 15.48 kN

V borde de columna = 41.28 kN

Ad= 56.76 kN

Estribos de rama sencilla #3 c/0.15m

V(d) = -20.64 kN

Separación de flejes max **0.14**

min -0.66

DISEÑO DE ZAPATA EXCENTRICA

ZAPATA TIPO

Flexión

Se considera como voladizos en el sentido más largo, soportados en la viga de contrapeso:

σ =	0.115	MPa
M=(σ*b*(c-bv)/2*(c-bv)/2)/2=	4.64	kN-m
Mu = 1,7*M =	7.89	kN-m

ia =

As =

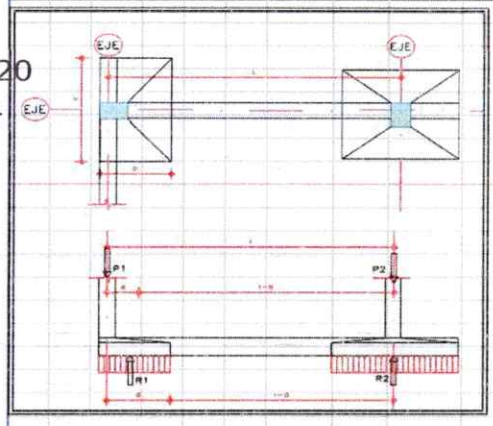
Cuant

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DISEÑO DE ZAPATA EXCENTRICA

0.0020
5.94

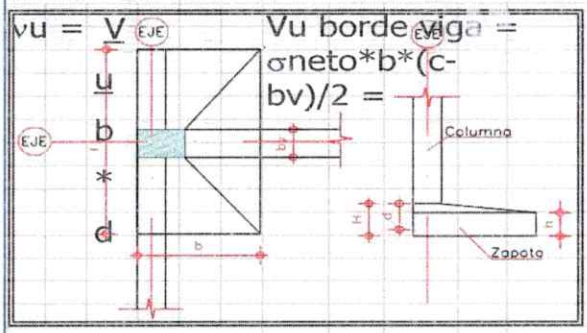


H = 0.40 m
d = 0.30 m
b = 0.90 m
h = 0.40 m

cm²

Armadura= 1#5 cada 0.20m Longitudinales
1#5 cada 0.20m Transversales

Chequeo por cortante



vu = V / (u * b * d)

Vu borde viga = σneto*b*(c-bv)/2 = 30.96 kN

Vu = 1,7* V borde = 52.63 kN

νu = 0.177 MPa

ϕνc = 0.649 MPa **OK**

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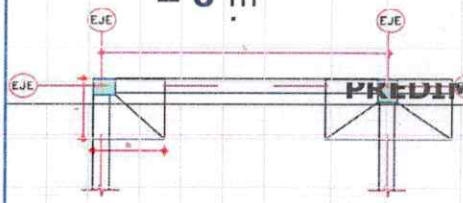
DISEÑO DE ZAPATA ESQUINERA

ZAPATA TIPO

f'c = 21.0 MPa

fy = 420 MPa

σ = 0.14 MPa



PREDIMENSIONAMIENTO

c =	0.500	m
a =	0.500	m
L1 =	3.00	m
a =	0.500	m
e =	0.500	m
L =	3.00	m

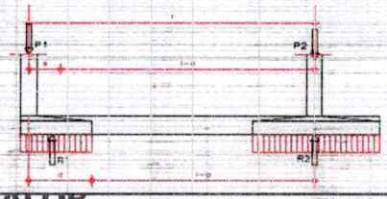
Cargas

PL =	64.6	KN
PD =	2.9	KN
P(%) =	5.4	KN
P1 =	83.95	KN

Area necesaria = P1 / σ = 83.9 / 0.14 = 9.5 m²

X = 0.7 m

Asumimos L = 3.0 m



VALOR DE ΔR

ΔR*(L-e) = P1*e = 10 * 18 = 75.6 KN-m

ΔR = (P1*e)/(σ*b) = 10 * 18 / (0.14 * 3.0) = 4.8 KN

Centro = (PU+ΔR)/(b*c) = 4.8 / (3.0 * 0.5) = 5.4 KPa OK

Centro de cargas = L/2 = 3.0/2 = 1.5 m

σ = 5.4 KPa

DISEÑO DE VIGA DE CONTRAPESO :

Flexion Donde el cortante es cero (0), el momento es máximo

Mu = ΔR(l-d) = 62.9 KN-m

Md = 1,5 * Mu*0,5 = 17.2 KN-m

d = 0.3 m

V = 0.3 m

d = 0.2 m

Cuantía	As		
0.0033	2.80	cm²	5.4 OK
0.0	2.80	cm²	5.4 OK

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Teléfono: (601) 7046932278
Celular: 312- 449 1539

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033 m²

Armadura 25 15 Arriba

Armadura 25 15 Abajo

Cortante

ϕv 649
c .198

Carga long. Bajo la zapata exterior = 48.17 KN/m

Al 3.2 KN

Ad 39. KN

V(d) 26. KN

V borde de columna 49. 17 KN

Estribos de rama sencilla #3 c/0.15 m

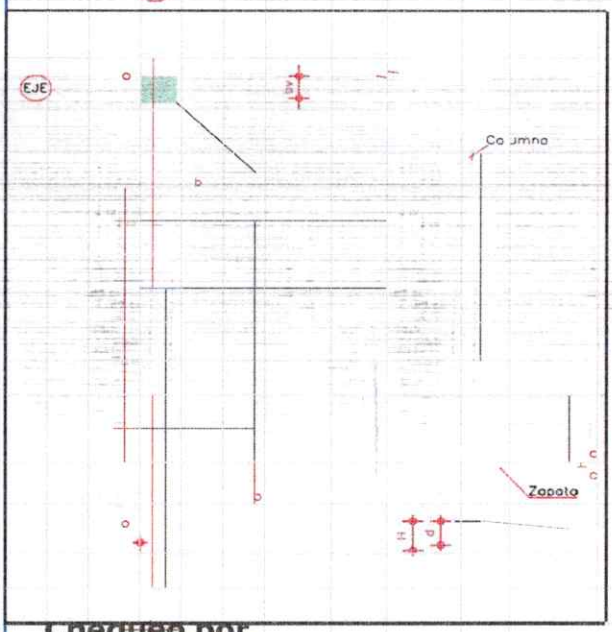
Separación de flejes max 0.14

min 0.63

DISEÑO DE ZAPATA ESQUINERA

ZAPATA TIPO

Flexion Se considera como voladizos en el sentido más largo, soportados en la viga de contrapeso.



Mu = 54 KN-m

Vu=(c+d)*(c-(bv)/2)/2= 7.1 KN-m

Mu*1.7 = 9.6 KN-m

d = 0.4 m

d = 0.3 m

b = 0.9 m

h = 0.4 m

Viga 200

As 4.9 cm²

Armadura 1#5 cada 0.20m en ambos sentidos

Chequeo por cortante

$v_u = \frac{V_u}{\phi d}$ Vu borde viga = (bv)/2 = (c+d)*(c-d) = 45. KN

Vu borde = 74.5 KN

v_u = 0.38 MPa

ϕv = 0.64 MPa

OK

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7. DISEÑO DE ELEMENTOS ESTRUCTURALES

La estructura se modeló en el programa ETABS 2019, con las secciones y medidas estipuladas en los planos y las consideraciones de diseño descritas previamente en estas memorias de cálculo. A lo cual se registra la siguiente información de entrada y salida de datos.

7.1. DISEÑO DE VIGAS Y COLUMNAS POR FLEXIÓN

COMBINACIONES DE DISEÑO

$$1.4(D+F) \quad \text{(B.2.4-1)}$$

$$1.2(D+F+T)+1.6(L+H)+0.5(L_r \text{ ó } G \text{ ó } L_e) \quad \text{(B.2.4-2)}$$

$$1.2D+1.6(L_r \text{ ó } G \text{ ó } L_e)+(L \text{ ó } 0.8W) \quad \text{(B.2.4-3)}$$

$$1.2D+1.6W+1.0L+0.5(L_r \text{ ó } G \text{ ó } L_e) \quad \text{(B.2.4-4)}$$

$$1.2D+1.0E+1.0L \quad \text{(B.2.4-5)}$$

$$0.9D+1.6W+1.6H \quad \text{(B.2.4-6)}$$

$$0.9D+1.0E+1.6H \quad \text{(B.2.4-7)}$$

Del programa de análisis y diseño estructura ETABS 2018 se obtuvo la siguiente información:

RESULTANTES DE COLUMNAS						
Story	Label	Section	Location	P	M Major	M Minor
				kgf	kgf-cm	kgf-cm
N+6.30	C18	COL30X30	Top	641.78	79920.32	75635.3
N+6.30	C18	COL30X30	Bottom	1263.86	-78014.83	-92665.49
N+6.30	C19	COL30X30	Top	3087.12	-121853.06	332630.2
N+6.30	C19	COL30X30	Bottom	4037.52	122229.62	-600293.9
N+6.30	C20	COL30X30	Top	332.56	-87942.9	66452.29
N+6.30	C20	COL30X30	Bottom	954.64	84633.79	-80416.26
N+6.30	C21	COL30X30	Top	2875.9	135349.72	-90392.78
N+6.30	C21	COL30X30	Bottom	3223.37	-220836.06	91370.66
N+6.30	C22	COL30X30	Top	2025.94	-116988.19	76091
N+6.30	C22	COL30X30	Bottom	2635.06	213347.88	-71918.89
N+6.30	C23	COL30X30	Top	3198.95	126214.15	-119417.96

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N+6.30	C23	COL30X30	Bottom	3808.07	-102629.26	140601.43
N+6.30	C24	COL30X30	Top	4160.87	-177829.71	-395382.9
N+6.30	C24	COL30X30	Bottom	5111.27	175072.6	550491.63
N+6.30	C25	COL30X30	Top	773.51	-112281.03	-85912.48
N+6.30	C25	COL30X30	Bottom	1382.63	115877.81	92715.02
N+6.30	C26	COL30X30	Top	1551.74	106755.53	106753.87
N+6.30	C26	COL30X30	Bottom	2160.86	-90981.23	-132618.71
N+6.30	C27	COL30X30	Top	2199.95	-143347.02	123624.18
N+6.30	C27	COL30X30	Bottom	4089.83	151986.69	-149259.31
N+6.30	C28	COL30X30	Top	211.07	-108897.9	-58312.73
N+6.30	C28	COL30X30	Bottom	820.19	97398.42	62489.77
N+6.30	C29	COL30X30	Top	3469.83	183406.56	97444.52
N+6.30	C29	COL30X30	Bottom	4078.95	-266055.5	70169.36
N+6.30	C30	COL30X30	Top	2208.57	-173200.36	94650.75
N+6.30	C30	COL30X30	Bottom	2817.69	260278.43	-142138.36
N+6.30	C32	COL30X30	Top	1996.05	121385.26	-100617.53
N+6.30	C32	COL30X30	Bottom	2605.17	-155846.74	144529.45
N+6.30	C33	COL30X30	Top	1363.77	-126002.01	-70097.9
N+6.30	C33	COL30X30	Bottom	1985.85	175672.14	196780.71
N+3.30	C18	COL30X30	Top	7430.4	181988.1	163583.58
N+3.30	C18	COL30X30	Bottom	8052.48	-239449.51	-193911.49
N+3.30	C19	COL30X30	Top	21016.32	-295100.29	808069.07
N+3.30	C19	COL30X30	Bottom	21988.32	420058.13	-903911.18
N+3.30	C20	COL30X30	Top	2257.44	-184478.9	134863.84
N+3.30	C20	COL30X30	Bottom	2879.52	242617.84	-162451.02
N+3.30	C21	COL30X30	Top	15073.85	321647.09	-147276.87
N+3.30	C21	COL30X30	Bottom	15695.93	-306740.06	187912.69
N+3.30	C22	COL30X30	Top	13162.52	-323311	-122739.85
N+3.30	C22	COL30X30	Bottom	13784.6	312400.14	152658.13
N+3.30	C23	COL30X30	Top	9474.47	144997.02	-193420.92
N+3.30	C23	COL30X30	Bottom	10096.55	-190594.79	214970.86
N+3.30	C24	COL30X30	Top	27457.67	-259574.23	-786067.29
N+3.30	C24	COL30X30	Bottom	28429.67	360845.77	890985.56
N+3.30	C25	COL30X30	Top	10098.68	-171034.76	-140165.49
N+3.30	C25	COL30X30	Bottom	10720.76	213561.13	162879.6
N+3.30	C26	COL30X30	Top	8782.86	132639.16	194840.43
N+3.30	C26	COL30X30	Bottom	9404.94	-176328.66	-212291.23
N+3.30	C27	COL30X30	Top	15772.39	-185040.85	194378.69
N+3.30	C27	COL30X30	Bottom	16394.47	216808.25	-201857.54
N+3.30	C28	COL30X30	Top	6437.9	-133818.84	-119769.45

N+3.30	C28	COL30X30	Bottom	2171.41	186738.17	150903.54
N+3.30	C29	COL30X30	Top	16680.01	304240.43	-138701.63
N+3.30	C29	COL30X30	Bottom	17302.09	-269503.57	182856.41
N+3.30	C30	COL30X30	Top	19736.06	-299167.38	205676.04
N+3.30	C30	COL30X30	Bottom	20358.14	279209.78	-206393.96
N+3.30	C31	COL30X30	Top	-1207.51	86596.1	64643.84
N+3.30	C31	COL30X30	Bottom	-775.51	98740.24	-78573.1
N+3.30	C32	COL30X30	Top	11758.95	180525.02	-211716.27
N+3.30	C32	COL30X30	Bottom	12381.03	-192296.9	225639.12
N+3.30	C33	COL30X30	Top	11780.67	-201512.86	-302332.04
N+3.30	C33	COL30X30	Bottom	12402.75	221937.14	261997.21
N+3.30	C34	COL30X30	Top	-430.57	-93092.96	-73006.32
N+3.30	C34	COL30X30	Bottom	1.43	105233.95	82175.99
N+3.30	C35	COL30X30	Top	-24.52	53073.89	63811.12
N+3.30	C35	COL30X30	Bottom	416.48	-70152.26	-85263.43
N+3.30	C36	COL30X30	Top	199.44	-94870.82	4468.93
N+3.30	C36	COL30X30	Bottom	640.44	103523.62	40965.16
N+3.30	C37	COL30X30	Top	-941.4	-62973.83	56154.5
N+3.30	C37	COL30X30	Bottom	-500.4	85103.92	-73703

Para el diseño de las columnas se tienen en cuenta las siguientes consideraciones:

- La cuantía mínima es 0.01 * Área de la sección (cm2)
- La cuantía máxima es 0.04 * Área de la sección (cm2)
- El programa ETABS puede mostrar cuantías requeridas inferior a la mínima, para lo cual se toma la mínima.

DISEÑO DE COLUMNAS

Story	Label	DesignSect	Station	DesignOpt	Status	PMMRatio	PMMCombo	AsMin	As
			cm					cm^2	cm^2
N+6.30	C18	COL30X30	0	Check	No Message	0.221	Comb5	9	16
N+6.30	C18	COL30X30	120	Check	No Message	0.051	Comb5	9	16
N+6.30	C18	COL30X30	240	Check	No Message	0.203	Comb5	9	16
N+6.30	C19	COL30X30	0	Check	No Message	0.368	Comb5	15	24
N+6.30	C19	COL30X30	110	Check	No Message	0.123	Comb5	15	24
N+6.30	C19	COL30X30	220	Check	No Message	0.244	Comb5	15	24
N+6.30	C20	COL30X30	0	Check	No Message	0.214	Comb5	9	16
N+6.30	C20	COL30X30	120	Check	No Message	0.04	Comb5	9	16
N+6.30	C20	COL30X30	240	Check	No Message	0.205	Comb5	9	16
N+6.30	C21	COL30X30	0	Check	No Message	0.414	Comb5	9	16
N+6.30	C21	COL30X30	117.5	Check	No Message	0.096	Comb5	9	16
N+6.30	C21	COL30X30	235	Check	No Message	0.291	Comb5	9	16
N+6.30	C22	COL30X30	0	Check	No Message	0.382	Comb5	9	16
N+6.30	C22	COL30X30	117.5	Check	No Message	0.096	Comb5	9	16

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N+6.30	C22	COL30X30	235	Check	No Message	0.249	Comb5	9	16
N+6.30	C23	COL30X30	0	Check	No Message	0.314	Comb5	9	16
N+6.30	C23	COL30X30	117.5	Check	No Message	0.042	Comb5	9	16
N+6.30	C23	COL30X30	235	Check	No Message	0.316	Comb5	9	16
N+6.30	C24	COL30X30	0	Check	No Message	0.384	Comb5	15	24
N+6.30	C24	COL30X30	110	Check	No Message	0.097	Comb5	15	24
N+6.30	C24	COL30X30	220	Check	No Message	0.316	Comb5	15	24
N+6.30	C25	COL30X30	0	Check	No Message	0.271	Comb5	9	16
N+6.30	C25	COL30X30	117.5	Check	No Message	0.027	Comb5	9	16
N+6.30	C25	COL30X30	235	Check	No Message	0.261	Comb5	9	16
N+6.30	C26	COL30X30	0	Check	No Message	0.289	Comb5	9	16
N+6.30	C26	COL30X30	117.5	Check	No Message	0.037	Comb5	9	16
N+6.30	C26	COL30X30	235	Check	No Message	0.275	Comb5	9	16
N+6.30	C27	COL30X30	0	Check	No Message	0.387	Comb5	9	16
N+6.30	C27	COL30X30	117.5	Check	No Message	0.039	Comb5	9	16
N+6.30	C27	COL30X30	235	Check	No Message	0.344	Comb5	9	16
N+6.30	C28	COL30X30	0	Check	No Message	0.211	Comb5	9	16
N+6.30	C28	COL30X30	117.5	Check	No Message	0.023	Comb5	9	16
N+6.30	C28	COL30X30	235	Check	No Message	0.226	Comb5	9	16
N+6.30	C29	COL30X30	0	Check	No Message	0.451	Comb5	9	16
N+6.30	C29	COL30X30	117.5	Check	No Message	0.107	Comb5	9	16
N+6.30	C29	COL30X30	235	Check	No Message	0.363	Comb5	9	16
N+6.30	C30	COL30X30	0	Check	No Message	0.531	Comb5	9	16
N+6.30	C30	COL30X30	117.5	Check	No Message	0.101	Comb5	9	16
N+6.30	C30	COL30X30	235	Check	No Message	0.352	Comb5	9	16
N+6.30	C32	COL30X30	0	Check	No Message	0.385	Comb5	9	16
N+6.30	C32	COL30X30	117.5	Check	No Message	0.076	Comb5	9	16
N+6.30	C32	COL30X30	235	Check	No Message	0.286	Comb5	9	16
N+6.30	C33	COL30X30	0	Check	No Message	0.486	Comb5	9	16
N+6.30	C33	COL30X30	120	Check	No Message	0.138	Comb5	9	16
N+6.30	C33	COL30X30	240	Check	No Message	0.258	Comb5	9	16
N+3.30	C18	COL30X30	0	Check	No Message	0.561	Comb5	9	16
N+3.30	C18	COL30X30	120	Check	No Message	0.115	Comb5	9	16
N+3.30	C18	COL30X30	240	Check	No Message	0.448	Comb5	9	16
N+3.30	C19	COL30X30	0	Check	No Message	0.711	Comb5	15	24
N+3.30	C19	COL30X30	112.5	Check	No Message	0.199	Comb5	15	24
N+3.30	C19	COL30X30	225	Check	No Message	0.577	Comb5	15	24
N+3.30	C20	COL30X30	0	Check	No Message	0.529	Comb5	9	16
N+3.30	C20	COL30X30	120	Check	No Message	0.099	Comb5	9	16
N+3.30	C20	COL30X30	240	Check	No Message	0.416	Comb5	9	16
N+3.30	C21	COL30X30	0	Check	No Message	0.65	Comb5	9	16
N+3.30	C21	COL30X30	120	Check	No Message	0.179	Comb5	9	16
N+3.30	C21	COL30X30	240	Check	No Message	0.62	Comb5	9	16
N+3.30	C22	COL30X30	0	Check	No Message	0.612	Comb5	9	16
N+3.30	C22	COL30X30	120	Check	No Message	0.163	Comb5	9	16
N+3.30	C22	COL30X30	240	Check	No Message	0.591	Comb5	9	16
N+3.30	C23	COL30X30	0	Check	No Message	0.527	Comb5	9	16
N+3.30	C23	COL30X30	120	Check	No Message	0.107	Comb5	9	16

Carrera 68D No. 25-86 To A of 715
Bogotá-Colombia interproyint@gmail.com
Teléfono: (601) 7046932
Celular: 312- 449 1539

N+3.30	C23	COL30X30	240	Check	No Message	0.442	Comb5	9	16
N+3.30	C24	COL30X30	0	Check	No Message	0.671	Comb5	15	24
N+3.30	C24	COL30X30	112.5	Check	No Message	0.197	Comb5	15	24
N+3.30	C24	COL30X30	225	Check	No Message	0.553	Comb5	15	24
N+3.30	C25	COL30X30	0	Check	No Message	0.492	Comb5	9	16
N+3.30	C25	COL30X30	120	Check	No Message	0.1	Comb5	9	16
N+3.30	C25	COL30X30	240	Check	No Message	0.408	Comb5	9	16
N+3.30	C26	COL30X30	0	Check	No Message	0.505	Comb5	9	16
N+3.30	C26	COL30X30	120	Check	No Message	0.105	Comb5	9	16
N+3.30	C26	COL30X30	240	Check	No Message	0.428	Comb5	9	16
N+3.30	C27	COL30X30	0	Check	No Message	0.552	Comb5	9	16
N+3.30	C27	COL30X30	120	Check	No Message	0.143	Comb5	9	16
N+3.30	C27	COL30X30	240	Check	No Message	0.501	Comb5	9	16
N+3.30	C28	COL30X30	0	Check	No Message	0.44	Comb5	9	16
N+3.30	C28	COL30X30	120	Check	No Message	0.078	Comb5	9	16
N+3.30	C28	COL30X30	240	Check	No Message	0.33	Comb5	9	16
N+3.30	C29	COL30X30	0	Check	No Message	0.598	Comb5	9	16
N+3.30	C29	COL30X30	120	Check	No Message	0.19	Comb5	9	16
N+3.30	C29	COL30X30	240	Check	No Message	0.59	Comb5	9	16
N+3.30	C30	COL30X30	0	Check	No Message	0.643	Comb5	9	16
N+3.30	C30	COL30X30	120	Check	No Message	0.187	Comb5	9	16
N+3.30	C30	COL30X30	240	Check	No Message	0.667	Comb5	9	16
N+3.30	C31	COL30X30	0	Check	No Message	0.514	Comb5	6.25	8
N+3.30	C31	COL30X30	120	Check	No Message	0.072	Comb5	6.25	8
N+3.30	C31	COL30X30	240	Check	No Message	0.444	Comb5	6.25	8
N+3.30	C32	COL30X30	0	Check	No Message	0.546	Comb5	9	16
N+3.30	C32	COL30X30	120	Check	No Message	0.151	Comb5	9	16
N+3.30	C32	COL30X30	240	Check	No Message	0.513	Comb5	9	16
N+3.30	C33	COL30X30	0	Check	No Message	0.63	Comb5	9	16
N+3.30	C33	COL30X30	120	Check	No Message	0.157	Comb5	9	16
N+3.30	C33	COL30X30	240	Check	No Message	0.656	Comb5	9	16
N+3.30	C34	COL30X30	0	Check	No Message	0.535	Comb5	6.25	8
N+3.30	C34	COL30X30	120	Check	No Message	0.048	Comb7	6.25	8
N+3.30	C34	COL30X30	240	Check	No Message	0.479	Comb5	6.25	8
N+3.30	C35	COL30X30	0	Check	No Message	0.439	Comb5	6.25	8
N+3.30	C35	COL30X30	122.5	Check	No Message	0.102	Comb5	6.25	8
N+3.30	C35	COL30X30	245	Check	No Message	0.334	Comb5	6.25	8
N+3.30	C36	COL30X30	0	Check	No Message	0.412	Comb5	6.25	8
N+3.30	C36	COL30X30	122.5	Check	No Message	0.087	Comb7	6.25	8
N+3.30	C36	COL30X30	245	Check	No Message	0.348	Comb5	6.25	8
N+3.30	C37	COL30X30	0	Check	No Message	0.458	Comb5	6.25	8
N+3.30	C37	COL30X30	122.5	Check	No Message	0.07	Comb7	6.25	8
N+3.30	C37	COL30X30	245	Check	No Message	0.35	Comb5	6.25	8