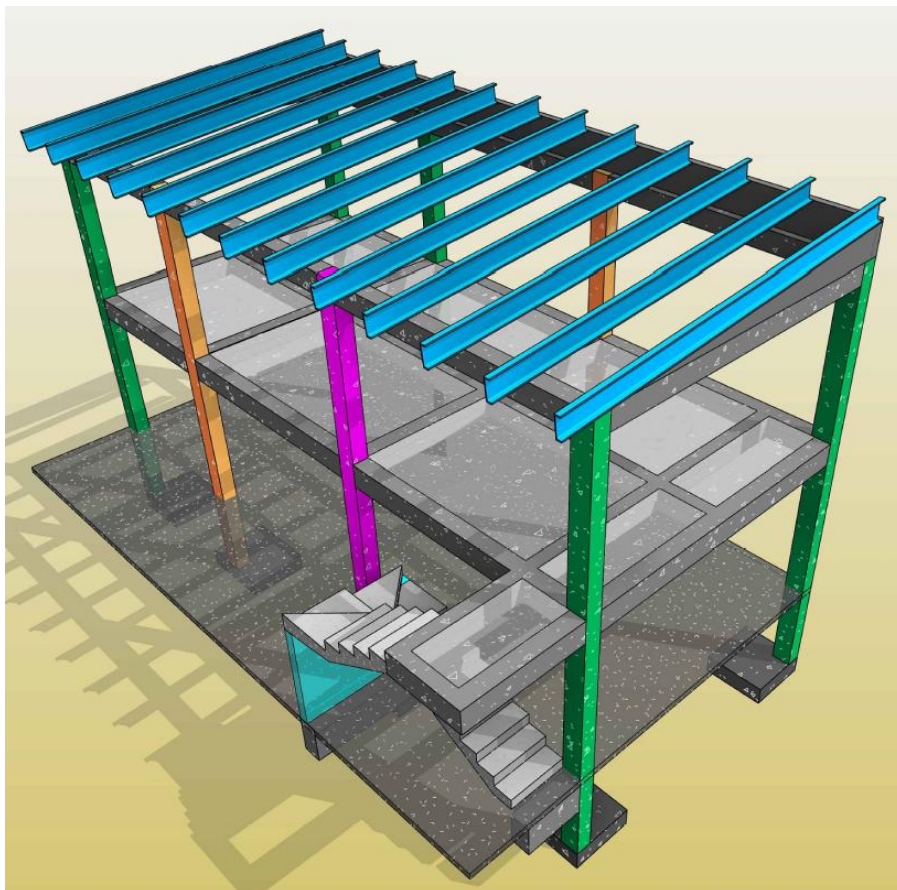


CÁLCULO ESTRUCTURAL DE EDIFICACION (NSR-10)



DISEÑO ESTRUCTURAL MEZZANINE DE DOS NIVELES

ESTACIÓN DE BOMBEROS GUAYABAL CB1

MEDELLÍN - ANTIOQUIA.

PROPIETARIOS:

**DEPARTAMENTO ADMINISTRATIVO DE GESTIÓN DEL RIESGO DE
DESASTRES - SUBDIRECCIÓN DE MANEJO DE DESASTRES**

JUNIO DE 2025

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1. DESCRIPCION DEL PROYECTO

El proyecto contempla el diseño estructural de un Mezanine de dos niveles para la: **ESTACIÓN DE BOMBEROS GUAYABAL CB1 MEDELLÍN, ANTIOQUIA**. El proyecto consta de 2 niveles, el uso que tendrá es de **OFICINAS, LA CUBIERTA Y DIVISIONES DEL SEGUNDO PISO ES LIVIANA**.

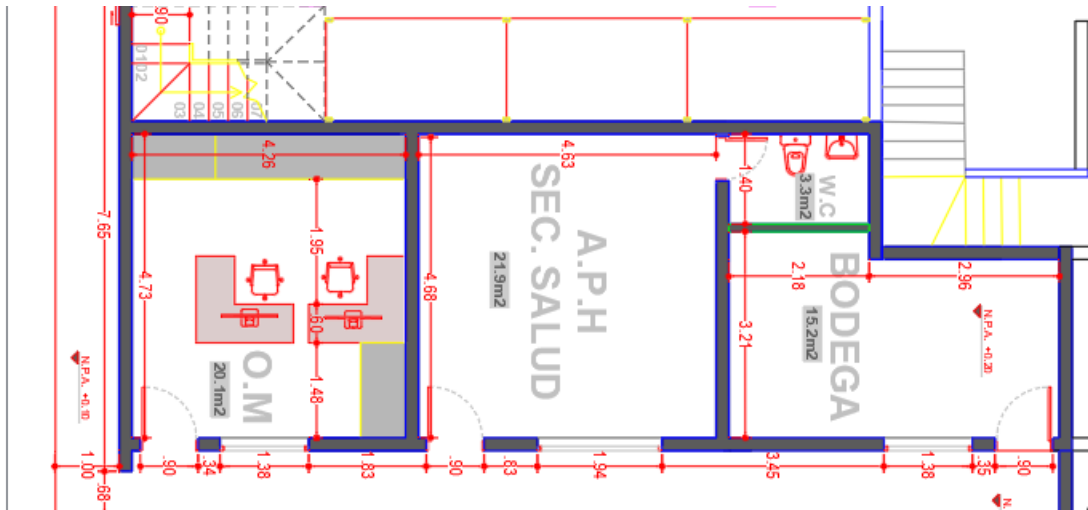


Figura 1. Planta arquitectónica.

La cimentación de la estructura consta de zapatas aisladas, la profundidad de desplante es **-1.2 m**, se empleó una capacidad portante de **15 Tonf/m²**.

La normatividad base empleada para el análisis y diseño de la estructura es la Norma Colombiana de Diseño y Construcción Sismo Resistente de 2010 (NSR-10) de la Asociación Colombiana de Ingeniería Sísmica.

2. METODO DE ANALISIS UTILIZADO

Por la configuración y el tipo de estructura en consideración el método que se debe utilizar para este proyecto es el definido por el título A.3.4.2.2 como *Método del análisis dinámico elástico*.

Para el análisis y diseño estructural se utilizó el software EngSolutions RCBuilding v9.1.2

Para el proceso de análisis y posterior diseño de los elementos que conforman la estructura principal de la edificación se consideración los siguientes casos:

1. Verificación de la rigidez de la estructura, mediante la evaluación de las derivas máximas de cada piso.
2. Evaluación de resistencia, para esta condición el modelo fue considerado en su totalidad, evaluando la estructura para diferentes combinaciones de carga establecidas en la NSR – 10. Considerando las acciones sísmicas de diseño, calculadas a partir del espectro elástico de diseño.

3. DESCRIPCIÓN DEL SOFTWARE

Para el análisis y diseño del proyecto se utilizaron los siguientes programas:

EngSolutions RCB 9.1.2 y Microsoft Excel. Con el primero se obtuvo todo el análisis estructural de la edificación, determinación de fuerzas internas en los elementos, determinación de irregularidades y derivas, al igual que el diseño en concreto reforzado de vigas, columnas, y cimentación.

Con el segundo se realizó el análisis y diseño de los demás elementos estructurales de la edificación. Finalmente, se utilizó el programa AUTOCAD para la presentación de planos.

Al programa EngSolutions RCB, se le suministraron los siguientes datos previamente determinados:

- La topología de la estructura en general (Borde de losa, Ejes de carga)
- Geometría de los elementos estructurales pertenecientes al sistema de resistencia sísmica (Vigas y Columnas).
- Características de los materiales a utilizar en los diferentes elementos estructurales (Resistencia a la compresión del concreto, Modulo de elasticidad del concreto, Esfuerzo de fluencia del acero estructural).
- Cargas verticales que soportan los diferentes elementos, así como las combinaciones de carga estipuladas en la NSR-10.
- Las cargas horizontales (Fuerzas Sísmicas) de la edificación, obtenidas para este caso específico mediante un análisis equivalente espectral, que considera irregularidades en planta y en altura, así como irregularidades torsionales, torsión accidental, análisis de redundancia y el cálculo exacto del periodo fundamental de la estructura mediante la solución directa del problema de valores propios.

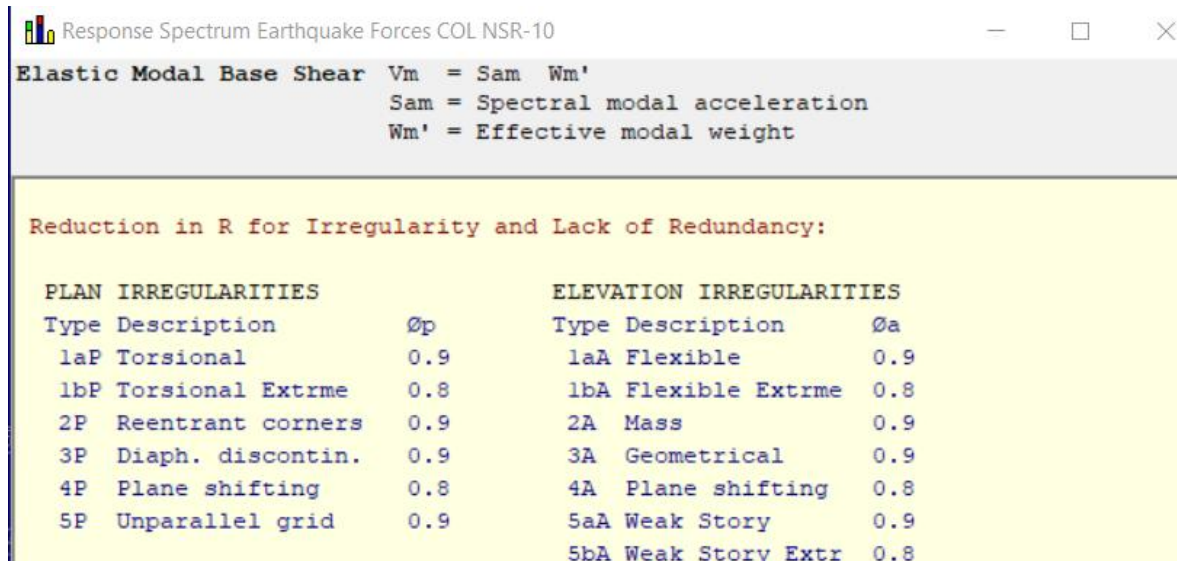
4. DESCRIPCION DEL SISTEMA ESTRUCTURAL

El sistema estructural está concebido como aporticado con una capacidad moderada de disipación de energía (DMO), para estos sistemas el valor de $R_0=5$.

El valor del coeficiente de capacidad de disipación de energía para ser empleado en el diseño corresponde al coeficiente de disipación de energía básico, R_0 , multiplicado por los coeficientes de reducción capacidad de disipación de energía por irregularidades en altura, en planta, y por ausencia de redundancia en el sistema estructural de resistencia sísmica. El coeficiente R está dado por la siguiente expresión:

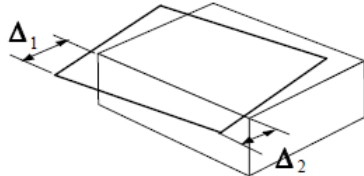
$$R = \phi_a \phi_p \phi_r R_0$$

El software RCB realiza el chequeo de las irregularidades en planta, en altura y por ausencia de redundancia.



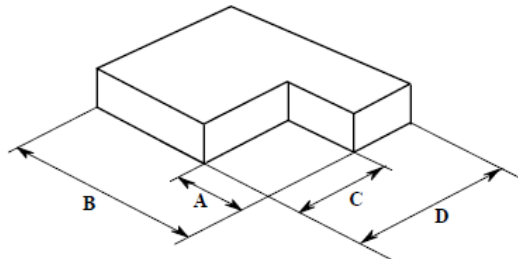
IRREGULARIDADES EN PLANTA

La edificación no presenta irregularidad en planta en ninguno de los sentidos de la edificación.

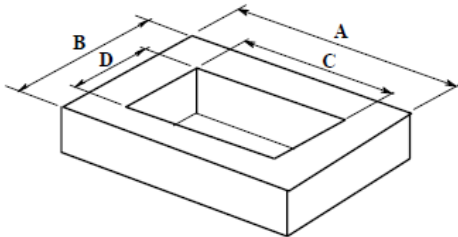
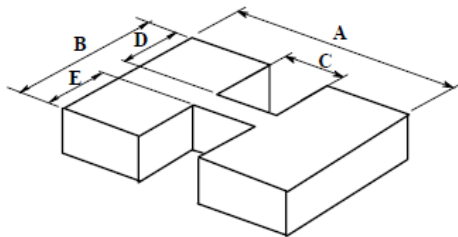
<p>Tipo 1aP — Irregularidad torsional $\phi_p = 0.9$ $1.4 \left(\frac{\Delta_1 + \Delta_2}{2} \right) \geq \Delta_1 > 1.2 \left(\frac{\Delta_1 + \Delta_2}{2} \right)$</p>	<p>Tipo 1bP — Irregularidad torsional extrema $\phi_p = 0.8$ $\Delta_1 > 1.4 \left(\frac{\Delta_1 + \Delta_2}{2} \right)$</p>
	

$\Phi_p = 1$

$\Phi_p = 1$

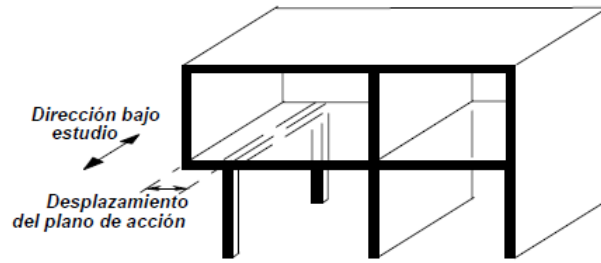
<p>Tipo 2P — Retrocesos en las esquinas — $\phi_p = 0.9$ $A > 0.15B$ y $C > 0.15D$</p>


$\Phi_p = 1$

<p>Tipo 3P — Irregularidad del diafragma — $\phi_p = 0.9$ 1) $C \times D > 0.5 A \times B$</p>	<p>2) $(C \times D + C \times E) > 0.5 A \times B$</p>
	

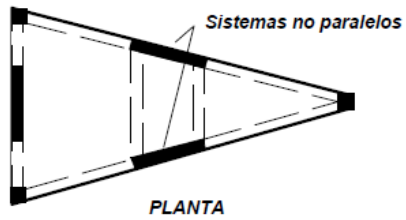
$\Phi_p = 1$

Tipo 4P — Desplazamiento de los planos de Acción — $\phi_p = 0.8$



$\Phi_p = 1$

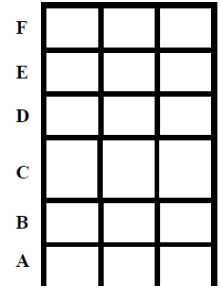
Tipo 5P — Sistemas no paralelos — $\phi_p = 0.9$



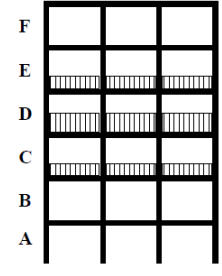
$\Phi_p = 1$

IRREGULARIDADES EN ALTURA

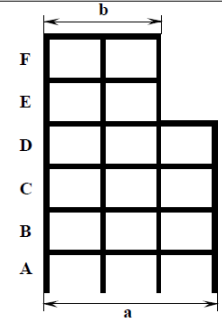
No se presenta irregularidad en altura en ninguno de los sentidos de la edificación.

<p>Tipo 1aA — Piso flexible $\phi_a = 0.9$ $0.60 \text{ Rigidez } K_D \leq \text{Rigidez } K_C < 0.70 \text{ Rigidez } K_D$ o $0.70 (K_D + K_E + K_F) / 3 \leq \text{Rigidez } K_C < 0.80 (K_D + K_E + K_F) / 3$</p>	
<p>Tipo 1bA — Piso flexible extremo $\phi_a = 0.8$ $\text{Rigidez } K_C < 0.60 \text{ Rigidez } K_D$ o $\text{Rigidez } K_C < 0.70 (K_D + K_E + K_F) / 3$</p>	

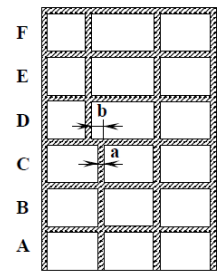
$$\Phi_a (1aA) = 1 \quad \Phi_p (1bA) = 1$$

<p>Tipo 2A — Distribución masa — $\phi_a = 0.9$</p> <p> $m_D > 1.50 m_E$ o $m_D > 1.50 m_C$ </p>	
--	--

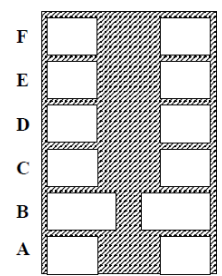
$$\Phi_a = 1$$

<p>Tipo 3A — Geométrica — $\phi_a = 0.9$</p> <p>$a > 1.30 b$</p>	
--	---

$$\Phi_a = 1$$

<p>Tipo 4A — Desplazamiento dentro del plano de acción — $\phi_a = 0.8$</p> <p>$b > a$</p>	
--	---

$$\Phi_a = 1$$

<p>Tipo 5aA — Piso débil $\phi_a = 0.9$</p> <p>$0.65 \text{ Resist. Piso C} \leq \text{Resist. Piso B} < 0.80 \text{ Resist. Piso C}$</p>	
<p>Tipo 5bA — Piso débil extremo $\phi_a = 0.8$</p> <p>$\text{Resistencia Piso B} < 0.65 \text{ Resistencia Piso C}$</p>	

$$\Phi_a (5aA) = 1$$

$$\Phi_a (5bA) = 1$$

IRREGULARIDAD POR AUSENCIA DE REDUNDANCIA

No se presenta irregularidad por ausencia de redundancia en ninguno de los sentidos de la edificación.

REDUNDANCY ANALYSIS

STORY-STRENGTH REDUCTION DUE TO REMOVAL OF CRITICAL ELEMENT

Story	EARTHQUAKE - X				EARTHQUAKE - Y			
	V_i	V_i/V_b	Crit.Element	V_e/V_i	V_i	V_i/V_b	Crit.Element	V_e/V_i
2	1.8	0.31	—	—	1.7	0.27	—	—
1	5.8	1.00	BEM:B(1-2)	0.27	6.1	1.00	BEM:1 (C-D)	0.23
MAXIMA				0.27				0.23

NOTE: Shear values are divided by R

Removal of any critical element on any story supporting more than 35% V_b (Base Shear) would not reduce the story strength by more than 33%. Thus SEISMIC FORCE-RESISTING SYSTEM SEEMS REDUNDANT!!
It should be investigated if removal of critical element would induce Extreme Torsional Irregularity (1bP)

Proposed Reduction Factor for Lack of Redundancy $\phi_{rx} = 1$ $\phi_{ry} = 1$

Teniendo en cuenta los anteriores coeficientes para irregularidad en planta, altura y por ausencia de redundancia, en la tabla de la figura 2 se presenta de manera resumida la tabla con los factores de irregularidad para el cálculo del valor de R.

Coeficiente	Descripción	Dirección	
		X	Y
R_0	Coeficiente básico de capacidad de disipación de energía.	5.0	5.0
ϕ_a	Coeficiente de reducción debido a irregularidades en altura.	1	1
ϕ_p	Coeficiente de reducción debido a irregularidades en planta.	1	1
ϕ_r	Coeficiente de reducción por la ausencia de redundancia.	1	1
R	Coeficiente de capacidad de disipación de energía.	5.0	5.0

Figura 2. Coeficientes de disipación de energía y regularidad.

5. PREDIMENSIONAMIENTO

VIGAS

El predimensionamiento inicial de vigas se realiza de acuerdo con las tablas **C.9.5** de la NSR-10, las cuales presentan los espesores mínimos a utilizar, para que no sea necesario el cálculo de las deflexiones de vigas.

TABLA C.9.5(a) — Alturas o espesores mínimos de vigas no preesforzadas o losas reforzadas en una dirección a menos que se calculen las deflexiones

	Espesor mínimo, h			
	Simplemente apoyados	Con un Extremo continuo	Ambos Extremos continuos	En voladizo
Elementos	Elementos que NO soporten o estén ligados a divisiones u otro tipo de elementos susceptibles de dañarse debido a deflexiones grandes.			
Losas macizas en una dirección	$\frac{\ell}{20}$	$\frac{\ell}{24}$	$\frac{\ell}{28}$	$\frac{\ell}{10}$
Vigas o losas nervadas en una dirección	$\frac{\ell}{16}$	$\frac{\ell}{18.5}$	$\frac{\ell}{21}$	$\frac{\ell}{8}$

Figura 3. Espesor mínimo de viga, h

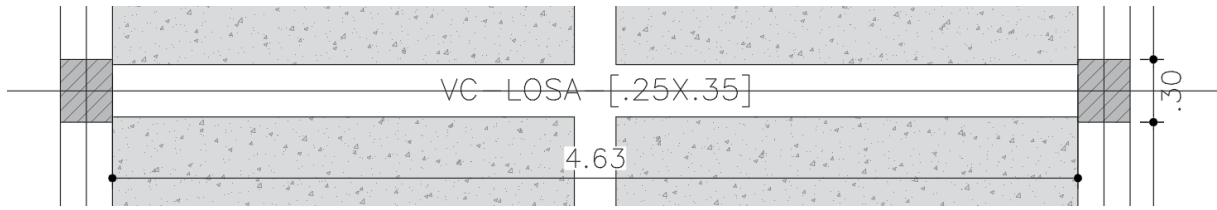


Figura 4. Predimensionamiento de vigas.

El criterio que se adopta para el predimensionamiento según la tabla CR.9.5 (a) es $L/16$

Donde $L = 4.63$ ----- $4.63 \text{ m}/16 = 0.29 \text{ m} = 29 \text{ cm}$

Se diseñan las vigas principales con sección de 25 x 35 cm, vigas secundarias con sección de 20x 35 cm

COLUMNAS

El criterio utilizado para el dimensionado de las columnas está dado en **C.21.3.5.1** donde se especifica que lo siguiente:

C.21.3.5.1 — La dimensión menor de la sección transversal, medida en una línea recta que pasa a través del centroide geométrico, no debe ser menor de 250 mm. Las columnas en forma de T, C o I pueden tener una dimensión mínima de 0.20 m pero su área no puede ser menor de 0.0625 m².

Figura 5. Criterio para pre dimensionamiento de columna.

Donde se adopta un ancho de columna de 25 cm según C.21.3.5.1, se realiza un predimensionamiento y diseño final de las columnas con secciones de 25 x 30 cm.

6. DESCRIPCION DE LOS MATERIALES A USAR Y SUS RESISTENCIAS.

La resistencia del concreto para los elementos estructurales es de **21 MPa** con módulo elástico **E=218.540 Kg/cm²**, dicho valor está basado en la fórmula matemática $4700\sqrt{f_c}$. Por otra parte, la resistencia a la fluencia del acero longitudinal y transversal será de 420 MPa.

A continuación, se presentan las propiedades de los materiales utilizados en el proyecto de acuerdo a la información registrada en los planos estructurales.

Elemento estructural	f'c	Observaciones
	(kgf/cm ²)	
Zapatas	210	Ninguna
Vigas de cimentación	210	Ninguna
Vigas aéreas y losa	210	Ninguna
Columnas	210	

Figura 6. Resistencia del concreto en elementos estructurales.

7. ANALISIS DE CARGAS VERTICALES

A continuación, se detalla las cargas gravitacionales sobreimpuestas en losa de entrepiso y cubierta liviana.

CARGA MUERTA LOSA METALDECK	(kgf/m ²)
Muros divisorios	120
Cielo raso	10
Puertas	2
Ventanas	3
Ventanales	5
Acabados de piso	130
Instalaciones eléctricas, Hidrosanitarias, voz y datos	10
Metal Deck	180
TOTAL	460

Figura 7. Carga Muerta losa Metaldeck.

CARGA MUERTA CUBIERTA LIVIANA	(kgf/m ²)
Teja	5
Instalaciones y otros	15
Correas	10
TOTAL	30

Figura 8. Carga Muerta Cubierta Liviana.

RESUMEN EVALUACIÓN DE CARGAS

CARGA GRAVITACIONALES LOSA METALDECK DE ENTREPISO	
MUERTA (Kgf/m ²)	460
VIVA OCUPACION (Kgf/m ²)	200

Figura 9. Cargas en losa Metaldeck de entrepiso.

CARGAS EN CUBIERTA LIVIANA	
CARGA MUERTA (Kgf/m ²)	30
CARGA VIVA (Kgf/m ²)	50

Figura 10. Cargas en cubierta liviana.

Nota: En el análisis y diseño de los elementos estructurales el peso propio lo asume automáticamente el software RCB.

8. COMBINACIONES DE CARGA

Los elementos estructurales y no estructurales fueron diseñados para la combinación más crítica de carga, que corresponden a combinaciones de peso propio, carga sobreimpuesta, carga viva y sismo. A continuación, se presentan las combinaciones de carga que se tuvieron en el diseño estructural. Estas combinaciones son tomadas del título B de la norma colombiana NSR-10.

LOAD COMBINATIONS

No	Load combination
1	$1.4D_0 + 1.4DL$
2	$1.2D_0 + 1.2DL + 1.6LL$
3	$1.2D_0 + 1.2DL + .5LL + EQX + .3EQY$
4	$1.2D_0 + 1.2DL + .5LL - EQX - .3EQY$
5	$1.2D_0 + 1.2DL + .5LL + EQX - .3EQY$
6	$1.2D_0 + 1.2DL + .5LL - EQX + .3EQY$
7	$1.2D_0 + 1.2DL + .5LL + .3EQX + EQY$
8	$1.2D_0 + 1.2DL + .5LL - .3EQX - EQY$
9	$1.2D_0 + 1.2DL + .5LL - .3EQX + EQY$
10	$1.2D_0 + 1.2DL + .5LL + .3EQX - EQY$
11	$.9D_0 + .9DL + EQX + .3EQY$
12	$.9D_0 + .9DL - EQX - .3EQY$
13	$.9D_0 + .9DL + EQX - .3EQY$
14	$.9D_0 + .9DL - EQX + .3EQY$
15	$.9D_0 + .9DL + .3EQX + EQY$
16	$.9D_0 + .9DL - .3EQX - EQY$
17	$.9D_0 + .9DL - .3EQX + EQY$
18	$.9D_0 + .9DL + .3EQX - EQY$

Figura 11. Combinaciones de carga para estado limite.

Dónde:

DL = Carga muerta debida a particiones y acabados.

D_0 : Carga debida al peso propio de los elementos estructurales, esta carga lo asume automáticamente el Software RCB cuando se realiza el análisis.

LL = Carga viva debida al uso y ocupación de la edificación.

EQ = Fuerzas sísmicas reducidas de diseño.

9. MODELO Y PLANTAS ESTRUCTURALES

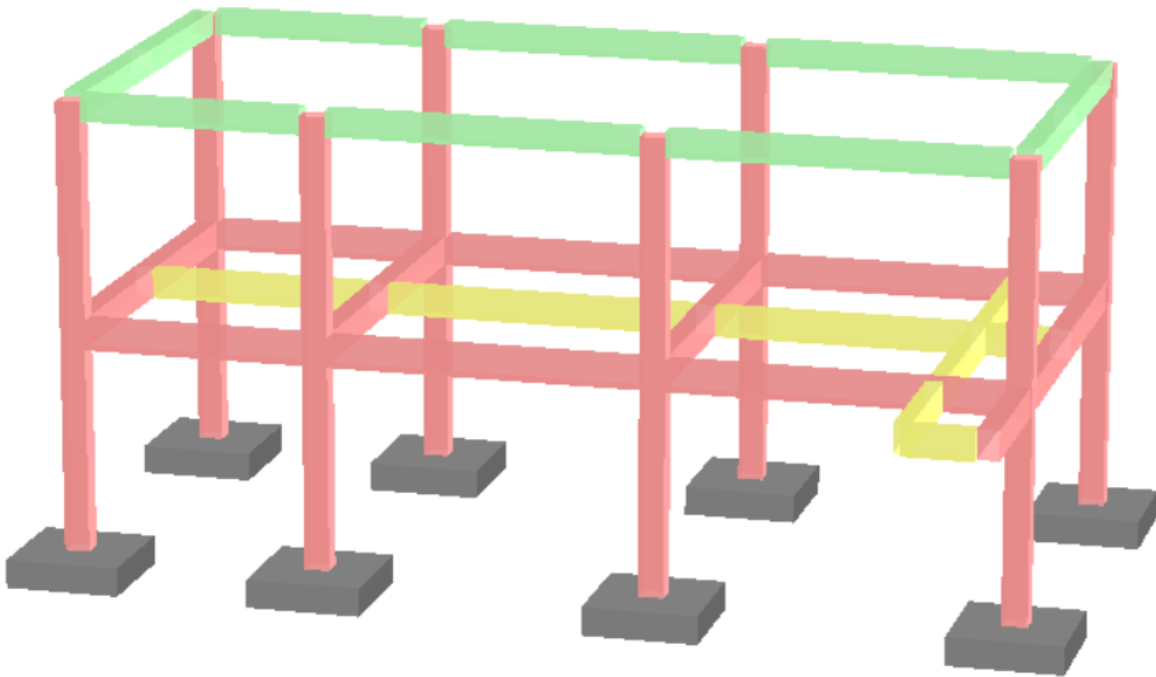


Figura 12. Modelo 3D de la estructura

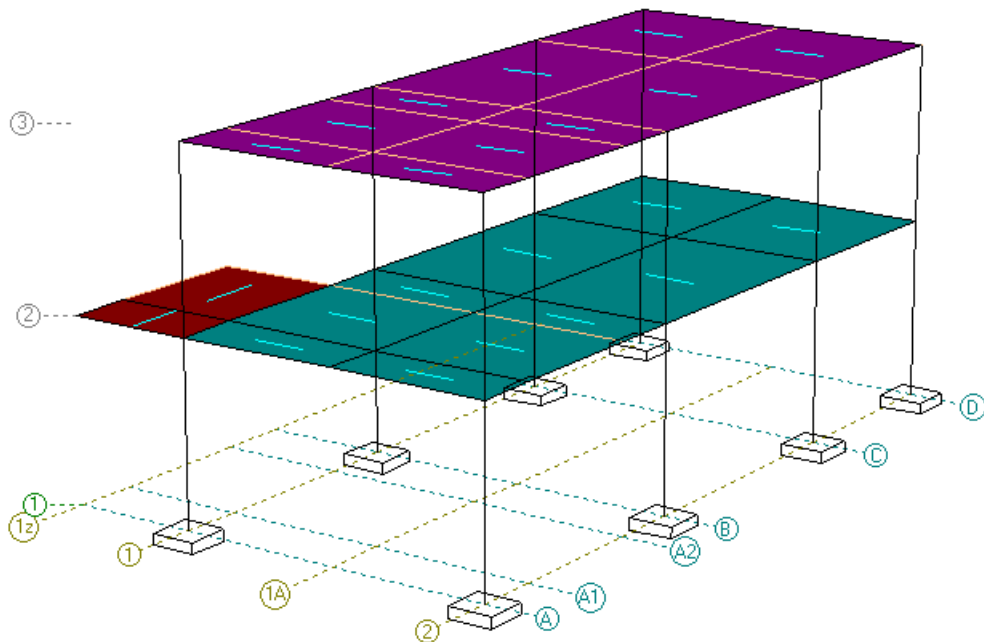


Figura 13. Modelo tridimensional Superestructura.

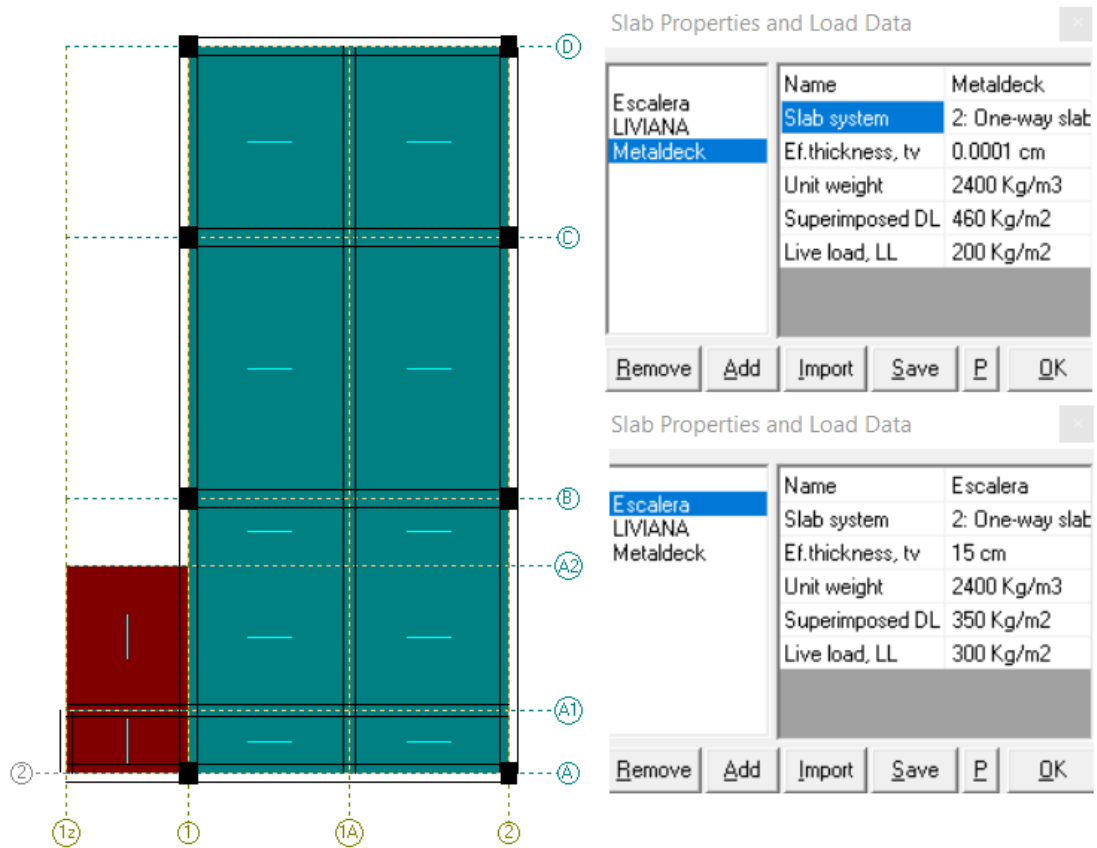


Figura 14. Planta estructural NIVEL 2

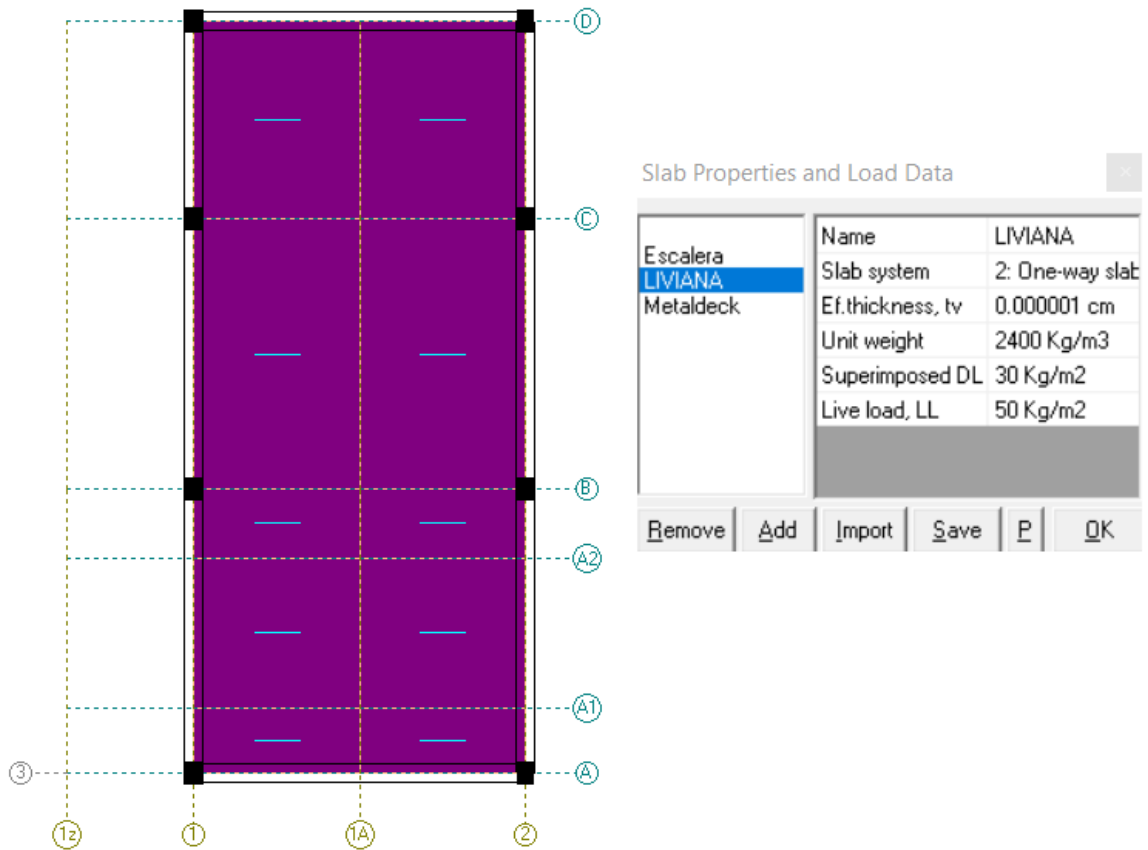


Figura 15. Planta estructural NIVEL 3

Nota: Se anexa diseño de todos los elementos estructurales con esta nomenclatura de ejes, la cual coincide con los planos estructurales.

10. PARAMETROS SISMICOS, FUERZA CORTANTE Y ESPECTRO DE DISEÑO.

10.1 ZONA DE AMENAZA SISMICA

El proyecto se encuentra ubicado en la ciudad de Medellín - Antioquia, para la cual según la figura A.2.3-1 corresponde una zona de amenaza sísmica INTERMEDIA.

Aceleración pico efectiva, **$A_a = 0.15$**

Velocidad pico efectiva, **$A_v = 0.20$**

10.2 EFECTOS LOCALES

El tipo de perfil de suelo empleado en el cálculo estructural es tipo D.

10.3 COEFICIENTE DE IMPORTANCIA

El proyecto se clasifica dentro de las *Estructuras de Ocupación Normal*, y de acuerdo a la tabla A.2.5-1 de la NSR-10 el coeficiente de importa I es igual a 1.0

10.4 DETERMINACION DE Fa Y Fv

Con base en el perfil de suelo y los valores de A_a y A_v se determinó F_a y F_v .

SEISMIC PARAMETERS - NSR-10

Effective peak acceleration, Aa	0.15
Effective peak velocity coeff, Av	0.20
Importance coefficient, I	1.00
Site profile type, S	D
Amplification coefficient, Fa	1.50
Amplification coefficient, Fv	2.00
Limit period, To (sec)	0.17
Limit period, Tc (sec)	0.83
Long-period transition period, Tl (sec)	4.80
Amplified peak acceleration Aa Fa	0.23
Amplified peak veloc. coefficient Av Fv	0.40
Effective Building Weight	55.6 ton
Seismic base level	1

	X - DIRECTION	Y - DIRECTION
	-----	-----
Seismic Force-resisting system	= C: Moment	C: Moment
Fundamental period, T	= 0.280	0.211
Energy Dissipation Coefficient, Ro	= 5.00	5.00
Reduced Energy Dissipation Coefficient, R	= 5.00	5.00
Design base shear, V	= 29.2	30.7

FIGURA 16. Parámetros sísmicos.

10.5 ESPECTRO DE DISEÑO

El espectro de diseño se calculó con base en los coeficientes estructurales y los datos de la estructura.

Tabla A.4.2-1
Valor de los parámetros C_t y α para el cálculo del periodo aproximado T_a

Sistema estructural de resistencia sísmica	C_t	α
Pórticos resistentes a momentos de concreto reforzado que resisten la totalidad de las fuerzas sísmicas y que no están limitados o adheridos a componentes más rígidos, estructurales o no estructurales, que limiten los desplazamientos horizontales al verse sometidos a las fuerzas sísmicas.	0.047	0.9
Pórticos resistentes a momentos de acero estructural que resisten la totalidad de las fuerzas sísmicas y que no están limitados o adheridos a componentes más rígidos, estructurales o no estructurales, que limiten los desplazamientos horizontales al verse sometidos a las fuerzas sísmicas.	0.072	0.8
Pórticos arriostrados de acero estructural con diagonales excéntricas restringidas a pandeo.	0.073	0.75
Todos los otros sistemas estructurales basados en muros de rigidez similar o mayor a la de muros de concreto o mampostería	0.049	0.75
Alternativamente, para estructuras que tengan muros estructurales de concreto reforzado o mampostería estructural, pueden emplearse los siguientes parámetros C_t y α , donde C_w se calcula utilizando la ecuación A.4.2-4.	$\frac{0.0062}{\sqrt{C_w}}$	1.00

FIGURA 17. Parámetros para el calcular el periodo aproximado.

COEFICIENTES ESPECTRALES		DATOS DE LA ESTRUCTURA	
Perfil tipo	D	Masa (tf)	56.00
I	1.00	hn (m)	5.35
Aa	0.15	N	2
Av	0.20	Cu	1.27
Fa	1.50	Ct	0.047
Fv	2.00	Cw	0.1410
To (s)	0.18	α	0.90
Tc (s)	0.85	Ta (s)	0.213
TL (s)	4.80	Cu x Ta (s)	0.27
		Sa [Ta]	0.56g

FIGURA 18. Coeficientes espectrales y datos de la estructura.

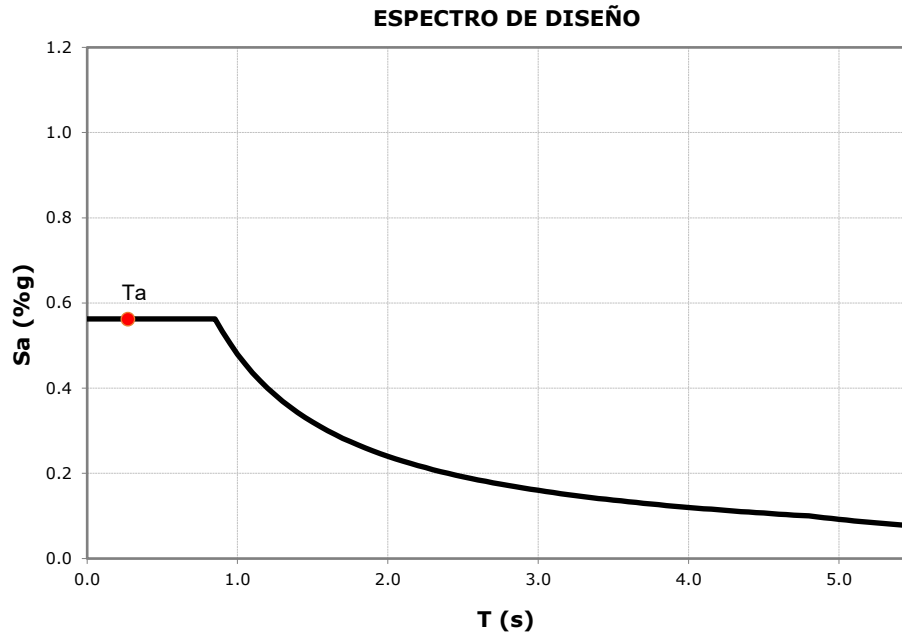


FIGURA 19. Espectro de diseño

10.6 MODOS DE VIBRACIÓN

Para el análisis dinámico elástico del módulo se incluyeron un total de **6** modos de vibración para la estructura que permiten garantizar un porcentaje de participación de masa del 100% en la dirección X y Y , respectivamente, en cumplimiento con la norma NSR-10.

Nota: en el anexo 3 se presentan modos de vibración.

10.7 FUERZA CORTANTE DE DISEÑO

Para el análisis es necesario ajustar los valores de cortante basal de acuerdo con los requisitos presentados en el literal A.5.4.5.

Método de análisis		Dirección	
		X	Y
Fuerza horizontal equivalente (Estático)	V_s (Ton)	26	26
Dinámico espectral	V_e (Ton)	30	31
Fuerza cortante de diseño (Ton)		30	31

FIGURA 20. Fuerza cortante de diseño.

Se compara la fuerza horizontal equivalente con la dinámica espectral y se realiza el análisis y diseño de la estructura con la mayor de estas dos fuerzas. El análisis sísmico detallado se presenta en los anexos de memoria.

11. EVALUACION DE DERIVAS

De acuerdo a la NSR-10 la deriva máxima en cualquier punto del piso **i**, se puede obtener como la diferencia entre los desplazamientos horizontales totales máximos de un punto en el piso **i** y los desplazamientos horizontales totales máximos de un punto localizado en el mismo eje vertical en el piso inmediatamente inferior (**i-1**), por medio de la siguiente ecuación:

$$\Delta_{\max}^i = \sqrt{\sum_{j=1}^2 \left(\delta_{\text{tot},j}^i - \delta_{\text{tot},j}^{i-1} \right)^2}$$

Figura 21. Ecuación para el cálculo de deriva máxima.

Luego la deriva máxima para cualquier piso determinada de acuerdo a este procedimiento no puede exceder los límites establecidos en la siguiente tabla, en la cual la deriva máxima se expresa como un porcentaje de la altura de piso **h_{pi}**

Tabla A.6.4-1
Derivas máximas como porcentaje de h_{pi}

Estructuras de:	Deriva máxima
concreto reforzado, metálicas, de madera, y de mampostería que cumplen los requisitos de A.6.4.2.2	1.0% $\left(\Delta_{\max}^i \leq 0.010 h_{pi} \right)$
de mampostería que cumplen los requisitos de A.6.4.2.3	0.5% $\left(\Delta_{\max}^i \leq 0.005 h_{pi} \right)$

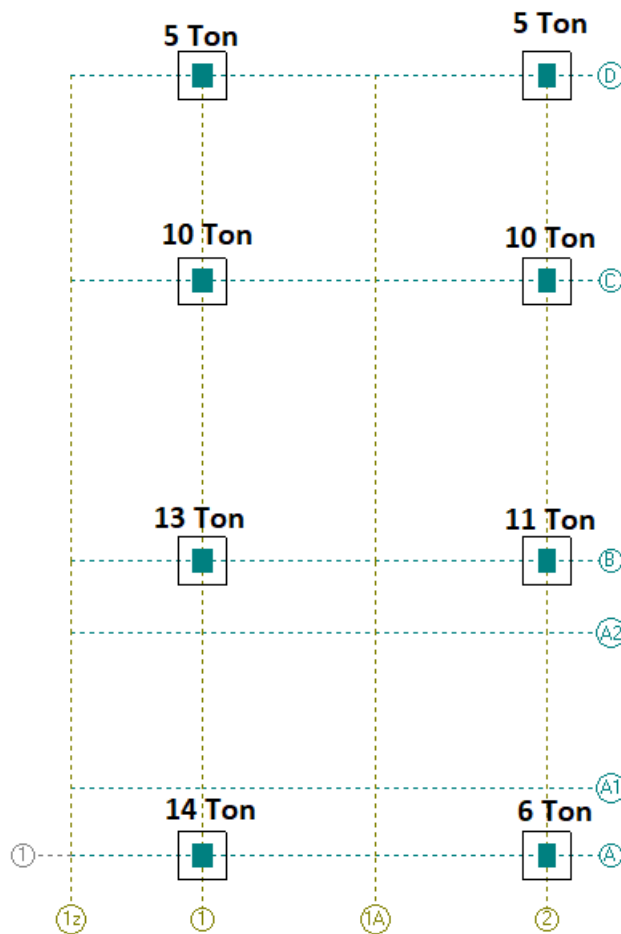
FIGURA 22. Derivas máximas.

Nota: se anexan derivas (ANEXO 9) donde se cumple con el límite establecido en la norma NSR-10.

12. DISEÑO DE CIMENTACION

12.1 DISEÑO DE ZAPATAS

En el diseño de la cimentación se emplearon zapatas aisladas las cuales fueron diseñadas bajo combinaciones últimas y analizadas bajo combinaciones de cargas de servicio, se plantearon **2** tipos de zapatas, la capacidad portante del suelo es de **15 Tonf/m²**. La determinación de las dimensiones y el diseño del refuerzo se hizo con base en la condición más desfavorable.



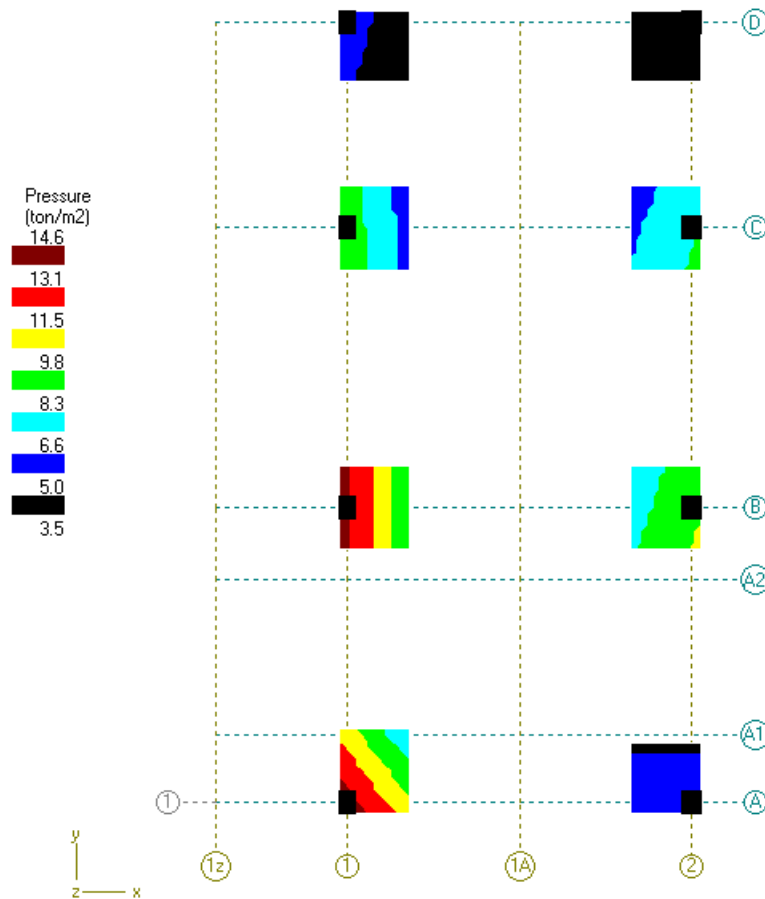


FIGURA 23. Cargas de servicios y Presión de contacto en zapatas.

Nota 1: en el anexo 10 se presenta los resultados del análisis y diseño de zapatas.

13. DISEÑO DE VIGAS Y COLUMNAS

COLUMNAS: Para el diseño se calculan las áreas de acero longitudinal requeridas en cada extremo del elemento, con base en la carga axial y los momentos de flexión biaxial actuantes, en cada combinación de carga de diseño. El programa informa la mayor área de acero calculada, conjuntamente con la combinación de carga que la requiere (combinación crítica de carga). El programa también informa el refuerzo por cortante requerido, considerando todas las combinaciones de carga de diseño.

VIGAS: Para el diseño se calcula y se presenta las áreas de acero requeridas por flexión, cortante y torsión, con base en los momentos y fuerzas de corte de todas las combinaciones

de carga de diseño. Los requerimientos de refuerzo se calculan en 11 secciones igualmente espaciadas, a lo largo de la luz libre de la viga.

Nota: en el anexo 11 se presenta de manera detallada los resultados de diseño para vigas y columnas.

14. COLUMNA FUERTE VIGA DÉBIL

Por equilibrio, en cada nudo de un pórtico la suma de momentos de las columnas es igual a la suma de momentos en las vigas. Para garantizar que la suma de las resistencias a flexión de las columnas sea 1.2 veces mayor que la suma de las resistencias a flexión de las vigas, el software ENGSOLUTIONS RCB eng sol amplifica los momentos últimos de las columnas por un factor de 1.2 y diseña las columnas para esos momentos amplificados.

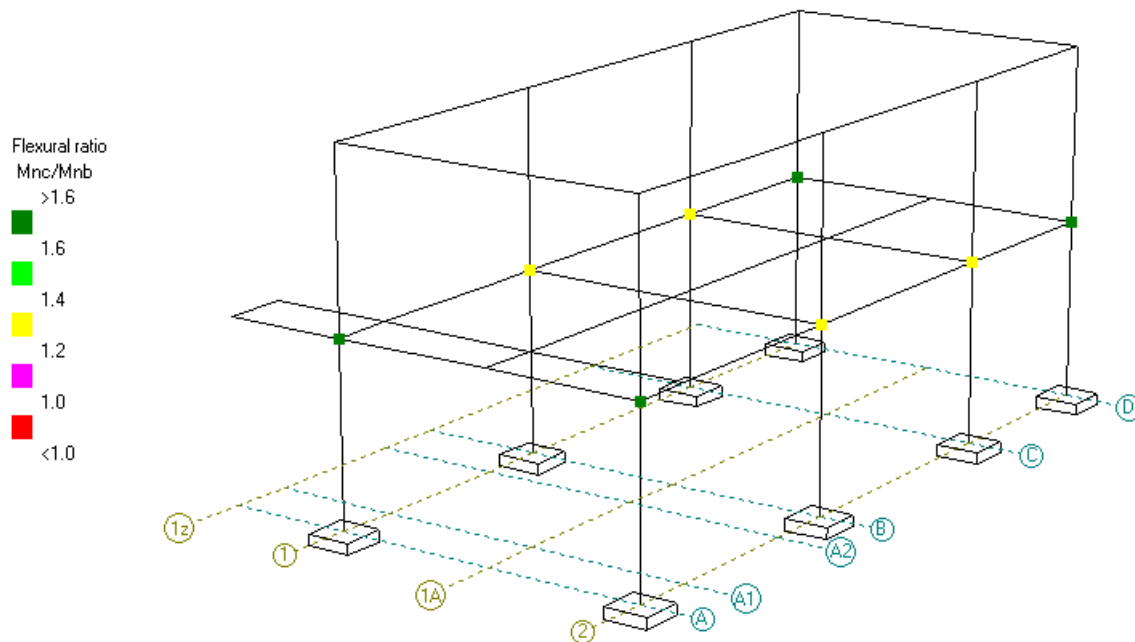


Figura 24. Modelo Columna fuerte-Viga débil.

Nota: en el anexo 12 se presenta de manera detallada los resultados de diseño para el requisito de columna fuerte y viga débil.

15. DISEÑO LOSA METALDECK

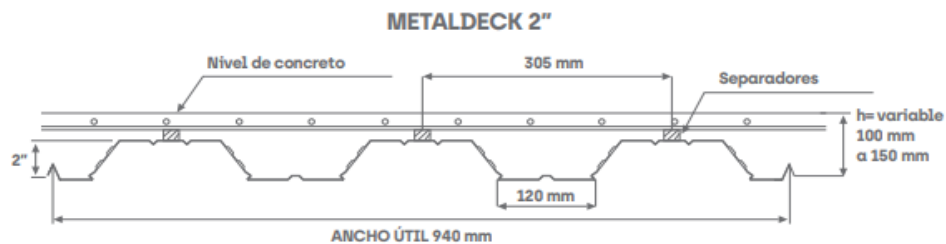
Se tiene una separación máxima libre entre vigas de **2.44 m**, y una carga sobrepuesta de 640 Kgf/m² (280 Kgf/m² + 180 Kgf/m² + 180 Kgf/m²); del manual de ACESCO se obtiene el diseño de la losa donde se tiene un espesor 12 cm que garantiza la resistencia contra el fuego, resistencia y control de vibraciones. En sectores donde la luz sea mayor a 2 metros se requiere apuntalamiento temporal.

640 kf/m² < 967 kfg/m²----- “Cumple”

Especificaciones Técnicas Metaldeck

Metaldeck 2"				
Calibre [Espesor]	22 [0.75 mm]	20 [0.90 mm]	18 [1.20 mm]	16 [1.50 mm]
Peso [kg/m]	7.31	8.74	11.33	14.3
Peso [kg/m ²]	7.77	9.30	12.05	15.21

Consumo Teórico de Concreto						
Espesor total de la losa h (mm)	100	110	120	130	140	150
Consumo de concreto teórico (m ³ /m ²)	0.072	0.082	0.092	0.102	0.112	0.122



Ancho Útil: 940mm. Disponible longitudes especiales de acuerdo con el despiece del proyecto.

Espesor Estandar: 0.75mm. [Cal. 22]

Longitud Estándar: 3.10m, 3.60m, 4.10m, 4.60m, 5.10m, 5.60m, 6.0m, 6.10m, 7.0m, 8.0m, 9.0m y 12.0m.

Espesor Estandar: 0.90mm. [Cal. 20]

Longitud Estándar: 3.10m, 3.60m, 4.10m, 4.60m, 5.10m, 5.60m, 6.10m y 12.0m.

Longitud mínima de fabricación: 1.5m

Longitud máxima de fabricación: 12.0m

Tablas de diseño de Metal Deck grado 40

Resistencia a temperatura ambiente, con cargas sobreimpuestas de servicio, sin incluir el peso propio de la losa.

Revisar además la resistencia al fuego con la Guía con fuego, si no tiene protección pasiva.



GUÍA PARA LA EVALUACIÓN DE LA RESISTENCIA AL FUEGO DE ENTREPISAS CON METALDECK

Grado 40						
Metaldeck 2" (0.75mm)						
	100	110	120	130	140	150
Luz (m)	Carga total sobreimpuesta (Kgf/m²)					
2,0	1006	1118	1209	1280	1331	1362
2,1	958	1065	1151	1219	1268	1297
2,2	915	1016	1099	1164	1210	1238
2,3	875	972	1051	1113	1157	1184
2,4	838	932	1008	1067	1109	1135
2,5	805	894	967	1024	1065	1090
2,6	765	860	930	985	1024	1048
2,7	696	817	896	948	986	1009
2,8	634	746	862	914	951	973
2,9	579	681	788	883	918	939
3,0	529	623	722	824	887	908
3,1		571	661	755	852	879
3,2		523	606	693	782	851
3,3		479	557	637	719	803
3,4			511	585	661	739
3,5			469	538	608	671
3,6			431	495	552	599
3,7				450	493	533
3,8						
3,9						
4,0						
	Luz máxima sin apuntalamiento (m)					
	2,01	1,92	1,84	1,77	1,71	1,66
	Espesor total de losa h (mm)					
	100	110	120	130	140	150
	Luz máxima por vibraciones (m)					
	3,00	3,30	3,60	3,90	4,20	4,50
	Espesor total de losa h (mm)					
	100	110	120	130	140	150
	Consumo teórico de concreto (m³/m²)					
	0,072	0,082	0,092	0,102	0,112	0,122

Figura 25. Tabla de Calculo Losa Steel Deck

16. DISEÑO DE ESCALERAS

Para el análisis se tomará la proyección horizontal del tramo más desfavorable de la escalera, y se realizara el modelo como si se tratase de una viga simplemente apoyada.

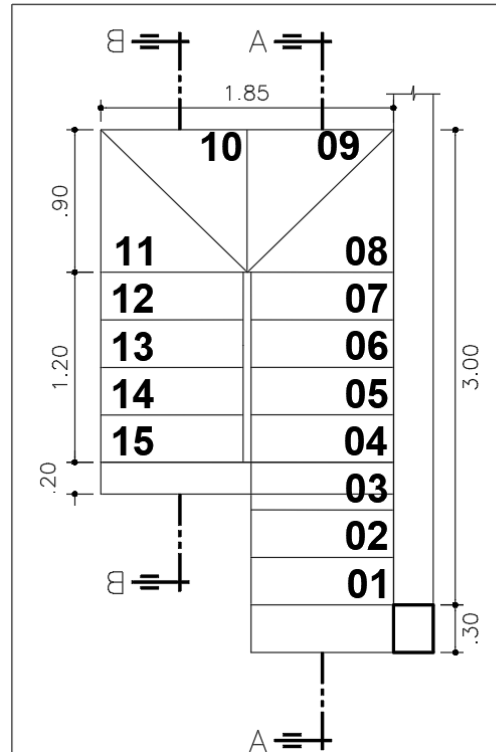


FIGURA 26. Geometría de escalera.

DISEÑO TRAMO DE ESCALERA.

Longitud de diseño = 3.0 m

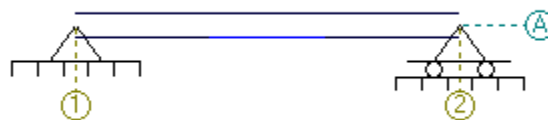
Carga viva = 300 kg/m²

Carga muerta acabados = 160 kg/m²

Carga muerta peldaños = 190 kg/m²

Nota: el peso propio de la losa de escalera (15 cm) lo asume automáticamente el Software al momento de realizar el análisis y diseño.

A continuación, se mostrará el análisis de una viga o franja de losa de 100 cm de ancho y 15 cm de altura.



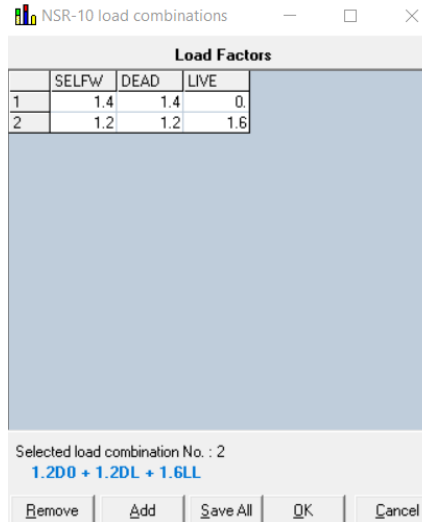


FIGURA 27. Análisis de escalera como viga.

EngSolutions RCB Version 9.1.6 - License No: B13087-A219

Company: INGENIL STRUCTURAL
Project: Untitled

Engineer: NIL SON VASQUEZ ZAPATA
10:00:41 a. m. 17/06/2025

BEAM:A(1-2) FLOOR:1

COL NSR-10

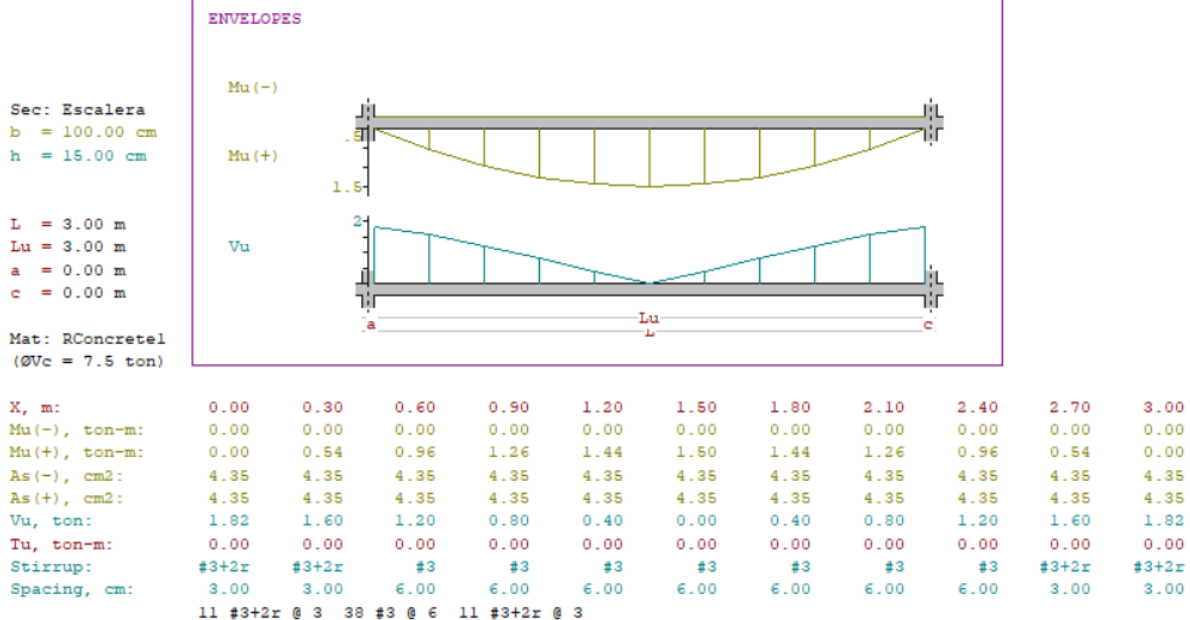


FIGURA 28. Análisis y diseño de escalera.

El acero principal requerido es 4.35 cm² por metro, es decir, 1#4 c/ 0.15 m. El acero perpendicular al refuerzo principal debe cumplir la cuantía de retracción y temperatura de 0.0018, por lo tanto, con 1#3 cada huella se satisface esta cuantía.

ANEXO 1

DATOS DE ENTRADA (PREPROCESO)

Company: INGENIL STRUCTURAL S.A.S

Project: Mezanine Bodega

File: C:\Users\proye\OneDrive\Desktop\INGENIL_TRABAJO\ESTRITORIO Z BOOK\2025\057 Mezanine Bodega Becerra_Yilinson

Engineer: DAVID BECERRA

2:37:14 p. m. 16/06/2025

GENERAL INPUT DATA

Structure type: Three-Dimensional Frame Structure
Number of Floor Grids = 1
Building total length = 6.75 m
Building total width = 11.07 m

STORY INFORMATION

Number of Stories = 2
Total Frame Height = 5.35 m

Floor	Story Height	Grid No
1	2.70	1
2	2.65	1
3	-	1

* Story Height in (m)

STRUCTURAL GRID INFORMATION

GRID No 1

Grid Point	X	Y
A-1z	0.00	0.00
A1-1z	0.00	0.95
A2-1z	0.00	3.17
B-1z	0.00	4.18
C-1z	0.00	8.15
D-1z	0.00	11.07
A-1	1.87	0.00
A1-1	1.87	0.95
A2-1	1.87	3.17
B-1	1.87	4.18
C-1	1.87	8.15
D-1	1.87	11.07
A-1A	4.31	0.00
A1-1A	4.31	0.95
A2-1A	4.31	3.17
B-1A	4.31	4.18
C-1A	4.31	8.15
D-1A	4.31	11.07
A-2	6.75	0.00
A1-2	6.75	0.95
A2-2	6.75	3.17
B-2	6.75	4.18
C-2	6.75	8.15
D-2	6.75	11.07

* Coordinates X & Y are in (m)

NODE DATA

Axis	Floor	X	Y	Z	Axis	Floor	X	Y	Z
A-1	1	1.87	0.00	0.00	B-1	1	1.87	4.18	0.00
C-1	1	1.87	8.15	0.00	D-1	1	1.87	11.07	0.00
A-2	1	6.75	0.00	0.00	B-2	1	6.75	4.18	0.00
C-2	1	6.75	8.15	0.00	D-2	1	6.75	11.07	0.00
A-1z	2	0.00	0.00	2.70	A1-1z	2	0.00	0.95	2.70
A-1	2	1.87	0.00	2.70	A1-1	2	1.87	0.95	2.70
A2-1	2	1.87	3.17	2.70	B-1	2	1.87	4.18	2.70
C-1	2	1.87	8.15	2.70	D-1	2	1.87	11.07	2.70
A-1A	2	4.31	0.00	2.70	A1-1A	2	4.31	0.95	2.70
A2-1A	2	4.31	3.17	2.70	B-1A	2	4.31	4.18	2.70
C-1A	2	4.31	8.15	2.70	D-1A	2	4.31	11.07	2.70

Company: INGENIL STRUCTURAL S.A.S
Project: Mezanine Bodega

Engineer: DAVID BECERRA
2:37:14 p. m. 16/06/2025

Axis	Floor	X	Y	Z	Axis	Floor	X	Y	Z
A-2	2	6.75	0.00	2.70	A1-2	2	6.75	0.95	2.70
A2-2	2	6.75	3.17	2.70	B-2	2	6.75	4.18	2.70
C-2	2	6.75	8.15	2.70	D-2	2	6.75	11.07	2.70
A-1	3	1.87	0.00	5.35	A1-1	3	1.87	0.95	5.35
A2-1	3	1.87	3.17	5.35	B-1	3	1.87	4.18	5.35
C-1	3	1.87	8.15	5.35	D-1	3	1.87	11.07	5.35
A-1A	3	4.31	0.00	5.35	D-1A	3	4.31	11.07	5.35
A-2	3	6.75	0.00	5.35	A1-2	3	6.75	0.95	5.35
A2-2	3	6.75	3.17	5.35	B-2	3	6.75	4.18	5.35
C-2	3	6.75	8.15	5.35	D-2	3	6.75	11.07	5.35

MATERIALS

Number of materials = 1

REINFORCED CONCRETE

Mat	Name	f'c Kg/cm2	fy Kg/cm2	fys1 Kg/cm2	fys2 Kg/cm2	E Kg/cm2	G Kg/cm2	w Kg/m3
1	RConcrete1	210	4200	4200	4200	218540	87430	2400.0

f'c: Compressive strength of concrete
fy: Yield strength of longitudinal reinforcement
fys1: Yiel strength of shear reinforcement, bar sizes <= 3/8"
fys2: Yiel strength of shear reinforcement, bar sizes > 3/8"

MEMBER DATA

Total number of members..... = 58
Number of columns..... = 16
Number of beams = 42
Number of braces = 0

COLUMN SECTIONS

Number of prismatic sections = 1

Sec	Name	Shape	b (cm)	h (cm)	tw (cm)	tf (cm)	P1 (cm)	P2 (cm)	A (cm2)	I2 (cm4)	I3 (cm4)	J (cm4)
1	C25x30	Rectang	25.00	30.00	-	-	-	-	750.0	56250	39062	74219

COLUMNS

Column	Story	L (m)	Lu (m)	a (m)	c (m)	Theta (o)	Sec -	Mat -	System -
D-2	2	2.65	2.35	0.08	0.23	0.0	1	1	G&L
D-2	1	2.70	2.43	0.00	0.28	0.0	1	1	G&L
C-2	2	2.65	2.35	0.08	0.23	0.0	1	1	G&L
C-2	1	2.70	2.43	0.00	0.28	0.0	1	1	G&L
B-2	2	2.65	2.35	0.08	0.23	0.0	1	1	G&L
B-2	1	2.70	2.43	0.00	0.28	0.0	1	1	G&L
A-2	2	2.65	2.35	0.08	0.23	0.0	1	1	G&L
A-2	1	2.70	2.43	0.00	0.28	0.0	1	1	G&L
D-1	2	2.65	2.35	0.08	0.23	0.0	1	1	G&L

Company: INGENIL STRUCTURAL S.A.S
Project: Mezanine Bodega

Engineer: DAVID BECERRA
2:37:14 p. m. 16/06/2025

Column	Story	L	Lu	a	c	Theta	Sec	Mat	System
D-1	1	2.70	2.43	0.00	0.28	0.0	1	1	G&L
C-1	2	2.65	2.35	0.08	0.23	0.0	1	1	G&L
C-1	1	2.70	2.43	0.00	0.28	0.0	1	1	G&L
B-1	2	2.65	2.35	0.08	0.23	0.0	1	1	G&L
B-1	1	2.70	2.43	0.00	0.28	0.0	1	1	G&L
A-1	2	2.65	2.35	0.08	0.23	0.0	1	1	G&L
A-1	1	2.70	2.43	0.00	0.28	0.0	1	1	G&L

BEAM SECTIONS

Number of prismatic sections = 3

Sec	Name	Shape	b (cm)	h (cm)	tw (cm)	tf (cm)	P1 (cm)	P2 (cm)	A (cm2)	I2 (cm4)	I3 (cm4)	J (cm4)
1	V25X35	Rectang	25.00	35.00	-	-	-	-	875.0	89323	45573	100260
2	V20X35	Rectang	20.00	35.00	-	-	-	-	700.0	71458	23333	59733
3	V25X30	Rectang	25.00	30.00	-	-	-	-	750.0	56250	39062	74219

BEAMS

Beam	Floor	L (m)	Lu (m)	a (m)	c (m)	Sec	Mat	System
A(1z-1)	2	1.87	1.75	0.00	0.13	1	1	G&L
A(1-1A)	2	2.44	2.32	0.13	0.00	1	1	G&L
A(1A-2)	2	2.44	2.32	0.00	0.13	1	1	G&L
A1(1z-1)	2	1.87	1.75	0.00	0.13	2	1	G&L
A1(1-1A)	2	2.44	2.32	0.13	0.00	2	1	G&L
A1(1A-2)	2	2.44	2.32	0.00	0.13	2	1	G&L
B(1-1A)	2	2.44	2.32	0.13	0.00	1	1	G&L
B(1A-2)	2	2.44	2.32	0.00	0.13	1	1	G&L
C(1-1A)	2	2.44	2.32	0.13	0.00	1	1	G&L
C(1A-2)	2	2.44	2.32	0.00	0.13	1	1	G&L
D(1-1A)	2	2.44	2.32	0.13	0.00	1	1	G&L
D(1A-2)	2	2.44	2.32	0.00	0.13	1	1	G&L
A(1-1A)	3	2.44	2.32	0.13	0.00	3	1	G&L
A(1A-2)	3	2.44	2.32	0.00	0.13	3	1	G&L
D(1-1A)	3	2.44	2.32	0.13	0.00	3	1	G&L
D(1A-2)	3	2.44	2.32	0.00	0.13	3	1	G&L
1z(A-A1)	2	0.95	0.83	0.13	0.00	2	1	G&L
1(A-A1)	2	0.95	0.80	0.15	0.00	1	1	G&L
1(A1-A2)	2	2.22	2.22	0.00	0.00	1	1	G&L
1(A2-B)	2	1.01	0.86	0.00	0.15	1	1	G&L
1(B-C)	2	3.97	3.67	0.15	0.15	1	1	G&L
1(C-D)	2	2.92	2.62	0.15	0.15	1	1	G&L
1A(A-A1)	2	0.95	0.83	0.13	0.00	2	1	G&L
1A(A1-A2)	2	2.22	2.22	0.00	0.00	2	1	G&L
1A(A2-B)	2	1.01	0.88	0.00	0.13	2	1	G&L
1A(B-C)	2	3.97	3.72	0.13	0.13	2	1	G&L
1A(C-D)	2	2.92	2.67	0.13	0.13	2	1	G&L
2(A-A1)	2	0.95	0.80	0.15	0.00	1	1	G&L
2(A1-A2)	2	2.22	2.22	0.00	0.00	1	1	G&L
2(A2-B)	2	1.01	0.86	0.00	0.15	1	1	G&L
2(B-C)	2	3.97	3.67	0.15	0.15	1	1	G&L
2(C-D)	2	2.92	2.62	0.15	0.15	1	1	G&L
1(A-A1)	3	0.95	0.80	0.15	0.00	3	1	G&L
1(A1-A2)	3	2.22	2.22	0.00	0.00	3	1	G&L
1(A2-B)	3	1.01	0.86	0.00	0.15	3	1	G&L
1(B-C)	3	3.97	3.67	0.15	0.15	3	1	G&L
1(C-D)	3	2.92	2.62	0.15	0.15	3	1	G&L
2(A-A1)	3	0.95	0.80	0.15	0.00	3	1	G&L
2(A1-A2)	3	2.22	2.22	0.00	0.00	3	1	G&L
2(A2-B)	3	1.01	0.86	0.00	0.15	3	1	G&L
2(B-C)	3	3.97	3.67	0.15	0.15	3	1	G&L
2(C-D)	3	2.92	2.62	0.15	0.15	3	1	G&L

Company: INGENIL STRUCTURAL S.A.S

Project: Mezanine Bodega

Engineer: DAVID BECERRA

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Beam	Floor	L	Lu	a	c	Sec	Mat	System
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SLAB PROPERTIES AND FLOOR LOAD DATA

Number of slab sections = 3

Floor Type:

- 1: One-way joist slab
- 2: One-way flat slab
- 3: Two-way joist slab
- 4: Two-way flat slab
- 5: One-way deck on secondary beams

No	Name	Type	tv (cm)	γ (Kg/m3)	Sup.DL (Kg/m2)	LL1 (Kg/m2)	LL2 (Kg/m2)	h (cm)	hf (cm)	bw (cm)	S (cm)
1	Metaldeck	2	0.00	2400.0	460.00	200.00	0.00	-	-	-	-
2	Escalera	2	15.00	2400.0	350.00	300.00	0.00	-	-	-	-
3	LIVIANA	2	0.00	2400.0	30.00	50.00	0.00	-	-	-	-

GROUND SUPPORT DATA

Total number of ground supports = 8

K = Spring constant (ton/cm)									
Characteristics for All Degrees of Freedom									
Value = K Dash = free C = constrained									
Support	Floor	Type	Ux	Uy	Uz	TetX	TetY	TetZ	
A-1	1	Fixed	C	C	C	C	C	C	
B-1	1	Fixed	C	C	C	C	C	C	
C-1	1	Fixed	C	C	C	C	C	C	
D-1	1	Fixed	C	C	C	C	C	C	
A-2	1	Fixed	C	C	C	C	C	C	
B-2	1	Fixed	C	C	C	C	C	C	
C-2	1	Fixed	C	C	C	C	C	C	
D-2	1	Fixed	C	C	C	C	C	C	

SUMMARY QUANTITY OF MATERIALS

COLUMNS

Item	Section	Material	Length m	Weight/Len ton/m	Total Weight ton
1	C25x30	RConcrete1	38.20	0.180	6.88
TOTAL =					6.88

BEAMS

Item	Section	Material	Length m	Weight/Len ton/m	Total Weight ton
1	V25X35	RConcrete1	42.07	0.210	8.83
2	V20X35	RConcrete1	18.15	0.168	3.05
3	V25X30	RConcrete1	30.75	0.180	5.54
TOTAL =					17.42

SLABS

Item	Section	Material	Area m²	Weight/Area ton/m²	Total Weight ton
1	Metaldeck	w =2.4	54.02	0.000	0.00
2	Escalera	w =2.4	5.93	0.360	2.13
3	LIVIANA	w =2.4	54.02	0.000	0.00

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TOTAL = 2.13

ANEXO 2

DATOS DE SALIDA (POSTPROCESO)

Company: INGENIL STRUCTURAL

Engineer: DAVID BECERRA

Project: Mezanine Bodega

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File: C:\Users\INGENIL STRUCTURAL\Desktop\OTROS INGENIL\2025\057 Mezanine Bodega Becerra_Yilinson_Metaldeck\PRIM

P-DELTA ANALYSIS-NODAL DISPLACEMENTS

Location		Load	Displacements (cm)			Rotations (rad)		
Axis	Floor	LdCase	Ux	Uy	Uz	θx	θy	θz
A-1	1	D0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		DL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		LL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B-1	1	D0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		DL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		LL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C-1	1	D0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		DL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		LL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D-1	1	D0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		DL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		LL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
A-2	1	D0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		DL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		LL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B-2	1	D0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		DL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		LL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C-2	1	D0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		DL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		LL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D-2	1	D0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		DL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		LL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQX	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		EQY	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
A-1z	2	D0	-0.0077	0.0064	-0.0273	-0.0001	-0.0002	0.0000
		DL	-0.0241	0.0247	-0.0923	-0.0031	-0.0006	0.0000
		LL	-0.0102	0.0104	-0.0389	-0.0013	-0.0002	0.0000
		EQX	-1.0309	0.1265	-0.4640	0.0032	-0.0023	-0.0003
		EQY	0.0687	-0.6030	0.0212	0.0011	0.0001	0.0001
A1-1z	2	D0	-0.0069	0.0064	-0.0332	-0.0001	-0.0001	0.0000
		DL	-0.0214	0.0247	-0.3855	-0.0031	-0.0018	0.0000
		LL	-0.0090	0.0104	-0.1613	-0.0013	-0.0007	0.0000
		EQX	-1.0031	0.1265	-0.1620	0.0032	-0.0009	-0.0003
		EQY	0.0576	-0.6030	0.1269	0.0011	0.0003	0.0001
A-1	2	D0	-0.0077	0.0049	-0.0059	-0.0001	0.0000	0.0000
		DL	-0.0241	0.0194	-0.0098	-0.0007	-0.0002	0.0000
		LL	-0.0102	0.0081	-0.0044	-0.0003	-0.0001	0.0000
		EQX	-1.0309	0.0718	-0.0063	-0.0002	-0.0026	-0.0003
		EQY	0.0687	-0.5810	-0.0035	0.0015	0.0001	0.0001
A1-1	2	D0	-0.0069	0.0049	-0.0234	-0.0002	0.0001	0.0000
		DL	-0.0214	0.0194	-0.0911	-0.0007	-0.0009	0.0000
		LL	-0.0090	0.0081	-0.0387	-0.0003	-0.0004	0.0000
		EQX	-1.0031	0.0718	-0.0205	0.0000	-0.0005	-0.0003
		EQY	0.0576	-0.5810	0.0758	0.0001	0.0003	0.0001
A2-1	2	D0	-0.0052	0.0049	-0.0148	0.0001	0.0002	0.0000

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Axis	Floor	LdCase	Ux	Uy	Uz	θ_x	θ_y	θ_z
B-1	2	DL	-0.0151	0.0194	-0.0494	0.0006	0.0002	0.0000
		LL	-0.0064	0.0081	-0.0214	0.0002	0.0001	0.0000
		EQX	-0.9382	0.0718	-0.0022	0.0001	-0.0018	-0.0003
		EQY	0.0315	-0.5810	-0.0378	-0.0002	0.0001	0.0001
		D0	-0.0044	0.0049	-0.0053	0.0000	0.0002	0.0000
C-1	2	DL	-0.0122	0.0194	-0.0086	0.0001	0.0007	0.0000
		LL	-0.0051	0.0081	-0.0043	0.0001	0.0003	0.0000
		EQX	-0.9086	0.0718	-0.0038	-0.0001	-0.0022	-0.0003
		EQY	0.0196	-0.5810	0.0007	0.0010	0.0000	0.0001
		D0	-0.0013	0.0049	-0.0045	0.0000	0.0002	0.0000
D-1	2	DL	-0.0009	0.0194	-0.0061	0.0000	0.0007	0.0000
		LL	-0.0004	0.0081	-0.0031	0.0000	0.0003	0.0000
		EQX	-0.7925	0.0718	-0.0029	-0.0001	-0.0020	-0.0003
		EQY	-0.0270	-0.5810	-0.0038	0.0008	-0.0001	0.0001
		D0	0.0010	0.0049	-0.0037	0.0000	0.0001	0.0000
A-1A	2	DL	0.0074	0.0194	-0.0025	0.0000	0.0002	0.0000
		LL	0.0031	0.0081	-0.0012	0.0000	0.0001	0.0000
		EQX	-0.7071	0.0718	-0.0058	-0.0002	-0.0020	-0.0003
		EQY	-0.0613	-0.5810	0.0067	0.0013	-0.0001	0.0001
		D0	-0.0077	0.0030	-0.0338	-0.0003	0.0000	0.0000
A1-1A	2	DL	-0.0241	0.0124	-0.0206	-0.0008	0.0001	0.0000
		LL	-0.0102	0.0052	-0.0096	-0.0004	0.0000	0.0000
		EQX	-1.0309	0.0004	0.0000	0.0001	0.0014	-0.0003
		EQY	0.0687	-0.5524	0.0063	0.0002	-0.0001	0.0001
		D0	-0.0069	0.0030	-0.0583	-0.0002	0.0000	0.0000
A2-1A	2	DL	-0.0214	0.0124	-0.1005	-0.0008	0.0002	0.0000
		LL	-0.0090	0.0052	-0.0446	-0.0004	0.0001	0.0000
		EQX	-1.0031	0.0004	0.0108	0.0001	0.0001	-0.0003
		EQY	0.0576	-0.5524	0.0248	0.0001	0.0000	0.0001
		D0	-0.0052	0.0030	-0.0754	0.0000	0.0000	0.0000
B-1A	2	DL	-0.0151	0.0124	-0.2151	-0.0001	0.0001	0.0000
		LL	-0.0064	0.0052	-0.0944	0.0000	0.0000	0.0000
		EQX	-0.9382	0.0004	0.0094	-0.0001	0.0009	-0.0003
		EQY	0.0315	-0.5524	0.0174	-0.0001	0.0000	0.0001
		D0	-0.0044	0.0030	-0.0716	0.0000	0.0000	0.0000
C-1A	2	DL	-0.0122	0.0124	-0.2280	-0.0003	0.0000	0.0000
		LL	-0.0051	0.0052	-0.0998	-0.0001	0.0000	0.0000
		EQX	-0.9086	0.0004	0.0041	0.0000	0.0012	-0.0003
		EQY	0.0196	-0.5524	0.0069	-0.0001	0.0000	0.0001
		D0	-0.0013	0.0030	-0.0631	0.0001	0.0000	0.0000
D-1A	2	DL	-0.0009	0.0124	-0.2151	0.0004	0.0000	0.0000
		LL	-0.0004	0.0052	-0.0940	0.0002	0.0000	0.0000
		EQX	-0.7925	0.0004	-0.0007	0.0000	0.0011	-0.0003
		EQY	-0.0270	-0.5524	-0.0051	0.0000	0.0000	0.0001
		D0	0.0010	0.0030	-0.0366	0.0001	0.0000	0.0000
A-2	2	DL	0.0074	0.0124	-0.0658	0.0009	0.0000	0.0000
		LL	0.0031	0.0052	-0.0288	0.0004	0.0000	0.0000
		EQX	-0.7071	0.0004	0.0000	0.0000	0.0011	-0.0003
		EQY	-0.0613	-0.5524	0.0082	0.0001	0.0001	0.0001
		D0	-0.0077	0.0011	-0.0043	-0.0001	-0.0001	0.0000
A1-2	2	DL	-0.0241	0.0055	-0.0026	-0.0002	-0.0002	0.0000
		LL	-0.0102	0.0023	-0.0014	-0.0001	-0.0001	0.0000
		EQX	-1.0309	-0.0709	0.0062	0.0002	-0.0027	-0.0003
		EQY	0.0687	-0.5237	-0.0038	0.0014	0.0002	0.0001
		D0	-0.0069	0.0011	-0.0143	-0.0001	-0.0003	0.0000
A2-2	2	DL	-0.0214	0.0055	-0.0255	-0.0002	-0.0006	0.0000
		LL	-0.0090	0.0023	-0.0109	-0.0001	-0.0002	0.0000
		EQX	-1.0031	-0.0709	0.0166	0.0000	-0.0002	-0.0003
		EQY	0.0576	-0.5237	0.0681	0.0001	-0.0003	0.0001
		D0	-0.0052	0.0011	-0.0113	0.0001	-0.0003	0.0000
B-2	2	DL	-0.0151	0.0055	-0.0208	0.0002	-0.0007	0.0000
		LL	-0.0064	0.0023	-0.0093	0.0001	-0.0003	0.0000
		EQX	-0.9382	-0.0709	0.0007	0.0000	-0.0016	-0.0003
		EQY	0.0315	-0.5237	-0.0347	-0.0002	0.0000	0.0001
		D0	-0.0044	0.0011	-0.0051	0.0000	-0.0003	0.0000

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Axis	Floor	LdCase	Ux	Uy	Uz	θx	θy	θz
		DL	-0.0122	0.0055	-0.0072	0.0000	-0.0008	0.0000
		LL	-0.0051	0.0023	-0.0037	0.0000	-0.0003	0.0000
		EQX	-0.9086	-0.0709	0.0038	0.0001	-0.0022	-0.0003
		EQY	0.0196	-0.5237	0.0005	0.0009	0.0001	0.0001
C-2	2	D0	-0.0013	0.0011	-0.0045	0.0000	-0.0002	0.0000
		DL	-0.0009	0.0055	-0.0064	0.0000	-0.0007	0.0000
		LL	-0.0004	0.0023	-0.0032	0.0000	-0.0003	0.0000
		EQX	-0.7925	-0.0709	0.0029	0.0001	-0.0020	-0.0003
		EQY	-0.0270	-0.5237	-0.0033	0.0007	-0.0001	0.0001
D-2	2	D0	0.0010	0.0011	-0.0036	0.0000	-0.0001	0.0000
		DL	0.0074	0.0055	-0.0023	0.0000	-0.0002	0.0000
		LL	0.0031	0.0023	-0.0012	0.0000	-0.0001	0.0000
		EQX	-0.7071	-0.0709	0.0058	0.0001	-0.0020	-0.0003
		EQY	-0.0613	-0.5237	0.0066	0.0012	-0.0001	0.0001
A-1	3	D0	-0.0164	0.0101	-0.0077	0.0000	0.0001	0.0000
		DL	-0.0507	0.0357	-0.0101	0.0002	0.0000	-0.0001
		LL	-0.0214	0.0154	-0.0048	0.0000	0.0000	0.0000
		EQX	-1.8900	0.1020	-0.0080	0.0000	-0.0019	-0.0004
		EQY	0.0957	-0.8941	-0.0043	0.0006	0.0001	0.0002
A1-1	3	D0	-0.0149	0.0101	-0.0139	-0.0001	0.0001	0.0000
		DL	-0.0454	0.0357	0.0006	0.0001	-0.0001	-0.0001
		LL	-0.0191	0.0154	-0.0049	0.0000	0.0000	0.0000
		EQX	-1.8505	0.1020	-0.0088	0.0000	-0.0022	-0.0004
		EQY	0.0801	-0.8941	0.0261	0.0000	0.0000	0.0002
A2-1	3	D0	-0.0115	0.0101	-0.0116	0.0001	-0.0001	0.0000
		DL	-0.0330	0.0357	-0.0016	0.0000	-0.0004	-0.0001
		LL	-0.0139	0.0154	-0.0051	0.0000	-0.0002	0.0000
		EQX	-1.7584	0.1020	-0.0020	0.0000	-0.0031	-0.0004
		EQY	0.0436	-0.8941	-0.0205	-0.0001	0.0000	0.0002
B-1	3	D0	-0.0099	0.0101	-0.0070	0.0000	-0.0001	0.0000
		DL	-0.0273	0.0357	-0.0089	-0.0001	-0.0005	-0.0001
		LL	-0.0115	0.0154	-0.0050	0.0000	-0.0002	0.0000
		EQX	-1.7165	0.1020	-0.0038	0.0000	-0.0035	-0.0004
		EQY	0.0271	-0.8941	0.0006	0.0005	0.0000	0.0002
C-1	3	D0	-0.0037	0.0101	-0.0060	0.0000	-0.0001	0.0000
		DL	-0.0051	0.0357	-0.0065	0.0000	-0.0004	-0.0001
		LL	-0.0021	0.0154	-0.0037	0.0000	-0.0002	0.0000
		EQX	-1.5518	0.1020	-0.0029	0.0000	-0.0033	-0.0004
		EQY	-0.0381	-0.8941	-0.0045	0.0004	0.0000	0.0002
D-1	3	D0	0.0008	0.0101	-0.0052	0.0000	0.0001	0.0000
		DL	0.0113	0.0357	-0.0027	0.0000	-0.0001	-0.0001
		LL	0.0048	0.0154	-0.0015	0.0000	0.0000	0.0000
		EQX	-1.4307	0.1020	-0.0075	-0.0001	-0.0016	-0.0004
		EQY	-0.0861	-0.8941	0.0081	0.0005	0.0000	0.0002
A-1A	3	D0	-0.0164	0.0063	-0.0422	0.0000	0.0000	0.0000
		DL	-0.0507	0.0220	-0.0087	0.0001	0.0000	-0.0001
		LL	-0.0214	0.0096	-0.0061	0.0000	0.0000	0.0000
		EQX	-1.8900	0.0008	0.0021	0.0000	0.0010	-0.0004
		EQY	0.0957	-0.8540	-0.0058	0.0006	0.0000	0.0002
D-1A	3	D0	0.0008	0.0063	-0.0379	0.0000	0.0000	0.0000
		DL	0.0113	0.0220	0.0089	0.0000	0.0000	-0.0001
		LL	0.0048	0.0096	0.0035	0.0000	0.0000	0.0000
		EQX	-1.4307	0.0008	0.0000	0.0000	0.0009	-0.0004
		EQY	-0.0861	-0.8540	0.0078	0.0005	0.0000	0.0002
A-2	3	D0	-0.0164	0.0025	-0.0060	-0.0001	-0.0001	0.0000
		DL	-0.0507	0.0083	-0.0028	0.0000	-0.0001	-0.0001
		LL	-0.0214	0.0039	-0.0017	0.0000	0.0000	0.0000
		EQX	-1.8900	-0.1005	0.0080	0.0000	-0.0018	-0.0004
		EQY	0.0957	-0.8140	-0.0046	0.0006	0.0000	0.0002
A1-2	3	D0	-0.0149	0.0025	-0.0135	-0.0001	-0.0001	0.0000
		DL	-0.0454	0.0083	-0.0031	0.0000	0.0000	-0.0001
		LL	-0.0191	0.0039	-0.0065	-0.0001	0.0000	0.0000
		EQX	-1.8505	-0.1005	0.0092	0.0000	-0.0022	-0.0004
		EQY	0.0801	-0.8140	0.0243	0.0000	0.0000	0.0002
A2-2	3	D0	-0.0115	0.0025	-0.0123	0.0001	0.0000	0.0000

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Axis	Floor	LdCase	Ux	Uy	Uz	θx	θy	θz
		DL	-0.0330	0.0083	-0.0072	0.0000	0.0002	-0.0001
		LL	-0.0139	0.0039	-0.0075	0.0000	0.0001	0.0000
		EQX	-1.7584	-0.1005	0.0025	0.0000	-0.0031	-0.0004
		EQY	0.0436	-0.8140	-0.0193	-0.0001	0.0000	0.0002
B-2	3	D0	-0.0099	0.0025	-0.0068	0.0000	0.0001	0.0000
		DL	-0.0273	0.0083	-0.0076	0.0000	0.0003	-0.0001
		LL	-0.0115	0.0039	-0.0044	0.0000	0.0001	0.0000
		EQX	-1.7165	-0.1005	0.0038	0.0000	-0.0035	-0.0004
		EQY	0.0271	-0.8140	0.0005	0.0004	0.0000	0.0002
C-2	3	D0	-0.0037	0.0025	-0.0060	0.0000	0.0001	0.0000
		DL	-0.0051	0.0083	-0.0067	0.0000	0.0003	-0.0001
		LL	-0.0021	0.0039	-0.0038	0.0000	0.0001	0.0000
		EQX	-1.5518	-0.1005	0.0029	0.0000	-0.0033	-0.0004
		EQY	-0.0381	-0.8140	-0.0039	0.0004	0.0000	0.0002
D-2	3	D0	0.0008	0.0025	-0.0052	0.0000	-0.0001	0.0000
		DL	0.0113	0.0083	-0.0025	0.0000	0.0001	-0.0001
		LL	0.0048	0.0039	-0.0014	0.0000	0.0000	0.0000
		EQX	-1.4307	-0.1005	0.0075	0.0001	-0.0016	-0.0004
		EQY	-0.0861	-0.8140	0.0080	0.0005	0.0000	0.0002

P-Delta Analysis- Column End Forces

Units: ton, ton-m

Column	Stry	Load	BOTTOM						TOP					
			Axial	Shear2	Shear3	Torque	Mom-2	Mom-3	Axial	Shear2	Shear3	Torque	Mom-2	Mom-3
D-2	2	D0	1.1	0.2	0.1	0.0	0.1	0.3	1.1	0.2	0.1	0.0	-0.1	-0.3
		DL	0.1	0.1	0.1	0.0	0.1	0.2	0.1	0.1	0.1	0.0	-0.1	0.0
		LL	0.2	0.0	0.1	0.0	0.1	0.1	0.2	0.0	0.1	0.0	-0.1	0.0
		EQX	-0.2	-0.4	0.0	0.0	0.0	-0.4	-0.2	-0.4	0.0	0.0	0.0	0.5
		EQY	-0.2	0.0	-0.2	0.0	-0.1	0.0	-0.2	0.0	-0.2	0.0	0.3	0.0
D-2	1	D0	2.4	0.1	0.0	0.0	0.0	0.1	2.4	0.1	0.0	0.0	0.0	-0.2
		DL	1.5	0.3	0.1	0.0	0.1	0.2	1.5	0.3	0.1	0.0	-0.2	-0.4
		LL	0.8	0.1	0.0	0.0	0.1	0.1	0.8	0.1	0.0	0.0	-0.1	-0.2
		EQX	-0.8	-0.6	-0.1	0.0	-0.1	-0.8	-0.8	-0.6	-0.1	0.0	0.1	0.5
		EQY	-0.9	-0.1	-0.7	0.0	-1.0	-0.1	-0.9	-0.1	-0.7	0.0	0.7	0.1
C-2	2	D0	1.1	0.1	0.0	0.0	0.0	0.2	1.1	0.1	0.0	0.0	-0.1	0.0
		DL	0.2	0.3	0.1	0.0	0.1	0.7	0.2	0.3	0.1	0.0	-0.1	0.1
		LL	0.4	0.1	0.0	0.0	0.1	0.3	0.4	0.1	0.0	0.0	-0.1	0.0
		EQX	0.0	-0.1	0.0	0.0	0.0	-0.2	0.0	-0.1	0.0	0.0	0.0	0.0
		EQY	0.1	0.0	-0.3	0.0	-0.3	0.0	0.1	0.0	-0.3	0.0	0.4	0.0
C-2	1	D0	3.0	0.2	0.0	0.0	0.0	0.2	3.0	0.2	0.0	0.0	0.0	-0.3
		DL	4.3	0.7	0.1	0.0	0.1	0.6	4.3	0.7	0.1	0.0	-0.1	-1.1
		LL	2.2	0.3	0.0	0.0	0.0	0.3	2.2	0.3	0.0	0.0	0.0	-0.5
		EQX	-0.4	-0.7	-0.1	0.0	-0.1	-1.0	-0.4	-0.7	-0.1	0.0	0.1	0.7
		EQY	0.4	0.0	-0.8	0.0	-1.1	0.0	0.4	0.0	-0.8	0.0	0.9	0.0
B-2	2	D0	1.2	0.1	0.0	0.0	0.0	0.2	1.2	0.1	0.0	0.0	0.0	0.0
		DL	0.3	0.3	0.0	0.0	0.1	0.7	0.3	0.3	0.0	0.0	0.0	0.1
		LL	0.5	0.1	0.0	0.0	0.0	0.3	0.5	0.1	0.0	0.0	0.0	0.0
		EQX	0.0	-0.1	0.0	0.0	0.0	-0.2	0.0	-0.1	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.3	0.0	-0.3	0.0	0.0	0.0	-0.3	0.0	0.3	0.0
B-2	1	D0	3.5	0.2	0.0	0.0	0.0	0.2	3.5	0.2	0.0	0.0	0.0	-0.4
		DL	4.9	0.7	0.1	0.0	0.1	0.6	4.9	0.7	0.1	0.0	-0.1	-1.1
		LL	2.5	0.3	0.0	0.0	0.0	0.3	2.5	0.3	0.0	0.0	0.0	-0.5
		EQX	-0.5	-0.8	-0.1	0.0	-0.1	-1.1	-0.5	-0.8	-0.1	0.0	0.1	0.8
		EQY	-0.1	0.0	-0.8	0.0	-1.0	0.0	-0.1	0.0	-0.8	0.0	0.8	0.0
A-2	2	D0	1.2	0.2	-0.2	0.0	-0.2	0.2	1.2	0.2	-0.2	0.0	0.2	-0.2
		DL	0.2	0.0	-0.2	0.0	-0.3	0.0	0.2	0.0	-0.2	0.0	0.1	0.0
		LL	0.2	0.0	-0.1	0.0	-0.2	0.0	0.2	0.0	-0.1	0.0	0.1	0.0
		EQX	-0.3	-0.4	0.0	0.0	0.0	-0.4	-0.3	-0.4	0.0	0.0	0.0	0.5
		EQY	0.1	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.2	0.0

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

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Column	Story	Load	Axial	Shear2	Shear3	Torque	Mom-2	Mom-3	Axial	Shear2	Shear3	Torque	Mom-2	Mom-3
A-2	1	D0	2.9	0.1	-0.1	0.0	-0.1	0.0	2.9	0.1	-0.1	0.0	0.2	-0.1
		DL	1.7	0.0	-0.2	0.0	-0.2	-0.1	1.7	0.0	-0.2	0.0	0.4	0.0
		LL	0.9	0.0	-0.1	0.0	-0.1	0.0	0.9	0.0	-0.1	0.0	0.1	0.0
		EQX	-0.8	-0.9	-0.1	0.0	-0.1	-1.3	-0.8	-0.9	-0.1	0.0	0.1	0.9
		EQY	0.5	0.1	-0.6	0.0	-0.9	0.1	0.5	0.1	-0.6	0.0	0.6	-0.1
D-1	2	D0	1.1	-0.2	0.1	0.0	0.1	-0.3	1.1	-0.2	0.1	0.0	-0.1	0.3
		DL	0.2	-0.1	0.1	0.0	0.2	-0.2	0.2	-0.1	0.1	0.0	-0.1	0.0
		LL	0.2	0.0	0.1	0.0	0.1	-0.1	0.2	0.0	0.1	0.0	-0.1	0.0
		EQX	0.2	-0.4	0.0	0.0	0.0	-0.4	0.2	-0.4	0.0	0.0	0.0	0.5
		EQY	-0.2	0.0	-0.2	0.0	-0.1	0.0	-0.2	0.0	-0.2	0.0	0.3	0.0
D-1	1	D0	2.5	-0.1	0.1	0.0	0.1	-0.1	2.5	-0.1	0.1	0.0	-0.1	0.2
		DL	1.7	-0.2	0.2	0.0	0.3	-0.1	1.7	-0.2	0.2	0.0	-0.3	0.3
		LL	0.8	-0.1	0.1	0.0	0.1	-0.1	0.8	-0.1	0.1	0.0	-0.1	0.1
		EQX	0.8	-0.6	0.1	0.0	0.1	-0.8	0.8	-0.6	0.1	0.0	-0.1	0.5
		EQY	-0.9	-0.1	-0.8	0.0	-1.1	-0.1	-0.9	-0.1	-0.8	0.0	0.8	0.1
C-1	2	D0	1.1	-0.1	0.1	0.0	0.1	-0.2	1.1	-0.1	0.1	0.0	-0.1	0.0
		DL	0.2	-0.3	0.1	0.0	0.2	-0.7	0.2	-0.3	0.1	0.0	-0.2	-0.1
		LL	0.4	-0.1	0.1	0.0	0.1	-0.3	0.4	-0.1	0.1	0.0	-0.1	0.0
		EQX	0.0	-0.1	0.0	0.0	0.0	-0.2	0.0	-0.1	0.0	0.0	0.0	0.0
		EQY	0.1	0.0	-0.3	0.0	-0.3	0.0	0.1	0.0	-0.3	0.0	0.4	0.0
C-1	1	D0	3.0	-0.2	0.0	0.0	0.1	-0.2	3.0	-0.2	0.0	0.0	-0.1	0.4
		DL	4.1	-0.7	0.2	0.0	0.2	-0.6	4.1	-0.7	0.2	0.0	-0.2	1.1
		LL	2.1	-0.3	0.1	0.0	0.1	-0.3	2.1	-0.3	0.1	0.0	-0.1	0.5
		EQX	0.4	-0.7	0.1	0.0	0.1	-1.0	0.4	-0.7	0.1	0.0	-0.1	0.7
		EQY	0.5	0.0	-0.9	0.0	-1.2	0.0	0.5	0.0	-0.9	0.0	1.0	0.0
B-1	2	D0	1.2	-0.1	0.1	0.0	0.1	-0.3	1.2	-0.1	0.1	0.0	-0.1	0.0
		DL	0.2	-0.3	0.2	0.0	0.4	-0.8	0.2	-0.3	0.2	0.0	-0.1	-0.1
		LL	0.5	-0.1	0.1	0.0	0.2	-0.3	0.5	-0.1	0.1	0.0	-0.1	0.0
		EQX	0.0	-0.1	0.0	0.0	0.0	-0.2	0.0	-0.1	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.3	0.0	-0.3	0.0	0.0	0.0	-0.3	0.0	0.4	0.0
B-1	1	D0	3.6	-0.3	0.1	0.0	0.1	-0.2	3.6	-0.3	0.1	0.0	-0.1	0.4
		DL	5.8	-0.8	0.4	0.0	0.4	-0.7	5.8	-0.8	0.4	0.0	-0.6	1.2
		LL	2.9	-0.4	0.2	0.0	0.2	-0.3	2.9	-0.4	0.2	0.0	-0.2	0.5
		EQX	0.5	-0.8	0.1	0.0	0.1	-1.1	0.5	-0.8	0.1	0.0	-0.1	0.8
		EQY	-0.1	0.0	-0.9	0.0	-1.1	0.0	-0.1	0.0	-0.9	0.0	0.9	0.0
A-1	2	D0	1.2	-0.2	-0.2	0.0	-0.3	-0.2	1.2	-0.2	-0.2	0.0	0.2	0.3
		DL	0.2	0.0	-0.5	0.0	-1.1	0.1	0.2	0.0	-0.5	0.0	0.1	0.0
		LL	0.3	0.0	-0.3	0.0	-0.5	0.0	0.3	0.0	-0.3	0.0	0.1	0.0
		EQX	0.3	-0.4	0.0	0.0	0.0	-0.4	0.3	-0.4	0.0	0.0	0.0	0.5
		EQY	0.1	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.2	0.0
A-1	1	D0	4.0	0.0	-0.2	0.0	-0.1	-0.1	4.0	0.0	-0.2	0.0	0.3	0.0
		DL	6.6	0.0	-0.8	0.0	-0.7	0.0	6.6	0.0	-0.8	0.0	1.4	-0.1
		LL	3.0	0.0	-0.3	0.0	-0.3	0.0	3.0	0.0	-0.3	0.0	0.6	0.0
		EQX	0.8	-0.9	0.1	0.0	0.1	-1.3	0.8	-0.9	0.1	0.0	-0.1	0.9
		EQY	0.5	0.1	-0.7	0.0	-1.0	0.1	0.5	0.1	-0.7	0.0	0.7	-0.1

P-Delta Analysis- Beam End Forces

Units: ton, ton-m

Beam	Floor	Load	END I X/L = 0.0						M2(+)max		END J X/L = 1.0					
			Ax1	Shr2	Shr3	Torque	M2	M3	M2	X/L	Ax1	Shr2	Shr3	Torque	M2	M3
A(1z-1)	2	D0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-0.4	0.0
		DL	0.0	0.0	0.2	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.8	-0.1	-0.9	0.0
		LL	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	-0.4	0.0
		EQX	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	1.0	0.0	0.0	-0.1	0.0	0.1	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
A(1-1A)	2	D0	0.0	0.0	-0.7	0.0	-0.7	0.0	0.4	1.0	0.0	0.0	-0.2	0.0	0.4	0.0
		DL	0.0	0.0	-0.6	0.0	-0.8	0.0	0.3	1.0	0.0	0.0	-0.4	0.0	0.3	0.0
		LL	0.0	0.0	-0.3	0.0	-0.4	0.0	0.1	1.0	0.0	0.0	-0.2	0.0	0.1	0.0
		EQX	0.0	0.0	-0.6	0.0	-1.4	0.0	0.0	0.0	0.0	0.0	-0.6	0.0	0.0	0.0
		EQY	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Beam	Floor	Load	Ax1	Shr2	Shr3	Torque	M2	M3	M2	X/L	Ax1	Shr2	Shr3	Torque	M2	M3
A (1A-2)	2	D0	0.0	0.0	0.1	0.0	0.4	0.0	0.4	0.0	0.0	0.0	0.5	0.0	-0.3	0.0
		DL	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0
		LL	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		EQX	0.0	0.0	-0.6	0.0	0.0	0.0	1.4	1.0	0.0	0.0	-0.6	0.0	1.4	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
A1 (1z-1)	2	D0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-0.4	0.0
		DL	0.0	0.0	-0.2	-0.1	0.1	0.0	0.1	.05	0.0	0.0	3.1	-0.1	-2.5	0.0
		LL	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	.05	0.0	0.0	1.3	0.0	-1.1	0.0
		EQX	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A1 (1-1A)	2	D0	0.0	0.0	-0.5	0.0	-0.4	0.0	0.3	1.0	0.0	0.0	-0.1	0.0	0.3	0.0
		DL	0.0	0.0	-1.6	0.0	-2.6	0.0	1.0	1.0	0.0	0.0	-1.4	0.0	1.0	0.0
		LL	0.0	0.0	-0.7	0.0	-1.1	0.0	0.4	1.0	0.0	0.0	-0.6	0.0	0.4	0.0
		EQX	0.0	0.0	-0.1	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	0.0	0.0	0.0	0.0	0.1	0.0
A1 (1A-2)	2	D0	0.0	0.0	-0.1	0.0	0.3	0.0	0.3	.2	0.0	0.0	0.3	0.0	0.0	0.0
		DL	0.0	0.0	0.3	0.0	0.9	0.0	0.9	0.0	0.0	0.0	0.5	0.0	0.0	0.0
		LL	0.0	0.0	0.1	0.0	0.4	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	0.0	0.0	0.0	0.0	0.1	0.0
		EQY	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B (1-1A)	2	D0	0.0	0.0	-0.9	0.0	-0.6	0.0	0.8	1.0	0.0	0.0	-0.4	0.0	0.8	0.0
		DL	0.0	0.0	-2.2	0.0	-2.0	0.0	3.2	1.0	0.0	0.0	-2.2	0.0	3.2	0.0
		LL	0.0	0.0	-1.0	0.0	-0.9	0.0	1.4	1.0	0.0	0.0	-1.0	0.0	1.4	0.0
		EQX	0.0	0.0	-0.5	0.0	-1.1	0.0	0.0	0.0	0.0	0.0	-0.5	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B (1A-2)	2	D0	0.0	0.0	0.4	0.0	0.8	0.0	0.8	0.0	0.0	0.0	0.9	0.0	-0.6	0.0
		DL	0.0	0.0	2.2	0.0	3.2	0.0	3.2	0.0	0.0	0.0	2.2	0.0	-1.8	0.0
		LL	0.0	0.0	0.9	0.0	1.4	0.0	1.4	0.0	0.0	0.0	0.9	0.0	-0.8	0.0
		EQX	0.0	0.0	-0.5	0.0	0.0	0.0	1.2	1.0	0.0	0.0	-0.5	0.0	1.2	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C (1-1A)	2	D0	0.0	0.0	-0.8	0.0	-0.6	0.0	0.7	1.0	0.0	0.0	-0.3	0.0	0.7	0.0
		DL	0.0	0.0	-2.1	0.0	-1.8	0.0	3.0	1.0	0.0	0.0	-2.1	0.0	3.0	0.0
		LL	0.0	0.0	-0.9	0.0	-0.8	0.0	1.3	1.0	0.0	0.0	-0.9	0.0	1.3	0.0
		EQX	0.0	0.0	-0.4	0.0	-1.0	0.0	0.0	1.0	0.0	0.0	-0.4	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
C (1A-2)	2	D0	0.0	0.0	0.3	0.0	0.7	0.0	0.7	0.0	0.0	0.0	0.8	0.0	-0.5	0.0
		DL	0.0	0.0	2.1	0.0	3.0	0.0	3.0	0.0	0.0	0.0	2.1	0.0	-1.8	0.0
		LL	0.0	0.0	0.9	0.0	1.3	0.0	1.3	0.0	0.0	0.0	0.9	0.0	-0.8	0.0
		EQX	0.0	0.0	-0.4	0.0	0.0	0.0	1.0	1.0	0.0	0.0	-0.4	0.0	1.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
D (1-1A)	2	D0	0.0	0.0	-0.6	0.0	-0.4	0.0	0.4	1.0	0.0	0.0	-0.1	0.0	0.4	0.0
		DL	0.0	0.0	-0.6	0.0	-0.5	0.0	0.9	1.0	0.0	0.0	-0.6	0.0	0.9	0.0
		LL	0.0	0.0	-0.3	0.0	-0.2	0.0	0.4	1.0	0.0	0.0	-0.3	0.0	0.4	0.0
		EQX	0.0	0.0	-0.5	0.0	-1.1	0.0	0.0	0.0	0.0	0.0	-0.5	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D (1A-2)	2	D0	0.0	0.0	0.1	0.0	0.4	0.0	0.4	0.0	0.0	0.0	0.6	0.0	-0.4	0.0
		DL	0.0	0.0	0.7	0.0	0.9	0.0	0.9	0.0	0.0	0.0	0.7	0.0	-0.6	0.0
		LL	0.0	0.0	0.3	0.0	0.4	0.0	0.4	0.0	0.0	0.0	0.3	0.0	-0.3	0.0
		EQX	0.0	0.0	-0.5	0.0	0.0	0.0	1.1	1.0	0.0	0.0	-0.5	0.0	1.1	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	0.0	0.0	0.0	0.0	0.1	0.0
A (1-1A)	3	D0	0.0	0.0	-0.4	0.0	-0.3	0.0	0.2	1.0	0.0	0.0	0.0	0.0	0.2	0.0
		DL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		LL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQX	0.0	0.0	-0.3	0.0	-0.6	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A (1A-2)	3	D0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.4	0.0	-0.2	0.0
		DL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		LL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.25	0.0	0.0	0.0	0.0	0.0	0.0
		EQX	0.0	0.0	-0.3	0.0	0.0	0.0	0.6	1.0	0.0	0.0	-0.3	0.0	0.6	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D (1-1A)	3	D0	0.0	0.0	-0.4	0.0	-0.3	0.0	0.2	1.0	0.0	0.0	0.0	0.0	0.2	0.0
		DL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		LL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQX	0.0	0.0	-0.2	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0

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Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Beam	Floor	Load	Ax1	Shr2	Shr3	Torque	M2	M3	M2	X/L	Ax1	Shr2	Shr3	Torque	M2	M3
D(1A-2)	3	D0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.4	0.0	-0.3	0.0
		DL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
		LL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQX	0.0	0.0	-0.2	0.0	0.0	0.0	0.5	1.0	0.0	0.0	-0.2	0.0	0.5	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
1z (A-A1)	2	D0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	.35	0.0	0.0	0.1	0.0	0.0	0.0
		DL	0.0	0.0	-0.2	0.1	-0.1	0.0	0.1	1.0	0.0	0.0	-0.2	0.1	0.1	0.0
		LL	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	1.0	0.0	0.0	-0.1	0.0	0.0	0.0
		EQX	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 (A-A1)	2	D0	0.0	0.0	-1.1	0.0	-0.4	0.0	0.4	1.0	0.0	0.0	-1.0	0.0	0.4	0.0
		DL	0.0	0.0	-4.9	0.1	-1.8	0.0	1.9	1.0	0.0	0.0	-4.5	0.1	1.9	0.0
		LL	0.0	0.0	-2.1	0.0	-0.8	0.0	0.8	1.0	0.0	0.0	-1.9	0.0	0.8	0.0
		EQX	0.0	0.0	-0.1	0.0	0.1	0.0	0.1	1.0	0.0	0.0	-0.1	0.0	0.1	0.0
		EQY	0.0	0.0	-0.4	0.0	-0.8	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	-0.5	0.0
1 (A1-A2)	2	D0	0.0	0.0	0.0	0.0	0.4	0.0	0.4	.1	0.0	0.0	0.4	0.0	0.0	0.0
		DL	0.0	0.0	0.4	0.0	2.0	0.0	2.0	0.0	0.0	0.0	1.6	0.0	-0.2	0.0
		LL	0.0	0.0	0.2	0.0	0.8	0.0	0.8	0.0	0.0	0.0	0.7	0.0	-0.1	0.0
		EQX	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
		EQY	0.0	0.0	-0.4	0.0	-0.5	0.0	0.4	1.0	0.0	0.0	-0.4	0.0	0.4	0.0
1 (A2-B)	2	D0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	-0.5	0.0
		DL	0.0	0.0	1.6	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	2.1	0.0	-1.8	0.0
		LL	0.0	0.0	0.7	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.9	0.0	-0.8	0.0
		EQX	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0
		EQY	0.0	0.0	-0.4	0.0	0.4	0.0	0.7	1.0	0.0	0.0	-0.4	0.0	0.7	0.0
1 (B-C)	2	D0	0.0	0.0	-0.4	0.0	-0.3	0.0	0.1	.5	0.0	0.0	0.4	0.0	-0.2	0.0
		DL	0.0	0.0	-1.1	0.0	-0.9	0.0	0.2	.55	0.0	0.0	0.9	0.0	-0.5	0.0
		LL	0.0	0.0	-0.5	0.0	-0.4	0.0	0.1	.55	0.0	0.0	0.4	0.0	-0.2	0.0
		EQX	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
		EQY	0.0	0.0	-0.3	0.0	-0.6	0.0	0.6	1.0	0.0	0.0	-0.3	0.0	0.6	0.0
1 (C-D)	2	D0	0.0	0.0	-0.3	0.0	-0.1	0.0	0.1	.5	0.0	0.0	0.3	0.0	-0.1	0.0
		DL	0.0	0.0	-0.7	0.0	-0.2	0.0	0.2	.45	0.0	0.0	0.8	0.0	-0.4	0.0
		LL	0.0	0.0	-0.3	0.0	-0.1	0.0	0.1	.45	0.0	0.0	0.4	0.0	-0.2	0.0
		EQX	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	-0.1	0.0
		EQY	0.0	0.0	-0.7	0.0	-0.9	0.0	1.0	1.0	0.0	0.0	-0.7	0.0	1.0	0.0
1A (A-A1)	2	D0	0.0	0.0	-0.2	0.0	0.0	0.0	0.2	1.0	0.0	0.0	-0.1	0.0	0.2	0.0
		DL	0.0	0.0	-0.3	0.0	0.0	0.0	0.0	.35	0.0	0.0	0.4	0.0	-0.1	0.0
		LL	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	.4	0.0	0.0	0.2	0.0	0.0	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
1A (A1-A2)	2	D0	0.0	0.0	-0.1	0.0	0.2	0.0	0.2	.4	0.0	0.0	0.2	0.0	0.1	0.0
		DL	0.0	0.0	-1.3	0.0	-0.1	0.0	0.7	.55	0.0	0.0	1.0	0.0	0.3	0.0
		LL	0.0	0.0	-0.6	0.0	0.0	0.0	0.3	.55	0.0	0.0	0.4	0.0	0.1	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1A (A2-B)	2	D0	0.0	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.4	0.0	-0.2	0.0
		DL	0.0	0.0	1.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	2.0	0.0	-1.1	0.0
		LL	0.0	0.0	0.4	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.9	0.0	-0.5	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
1A (B-C)	2	D0	0.0	0.0	-0.3	0.0	-0.2	0.0	0.1	.55	0.0	0.0	0.3	0.0	-0.1	0.0
		DL	0.0	0.0	-2.1	0.0	-1.1	0.0	0.9	.5	0.0	0.0	2.0	0.0	-0.9	0.0
		LL	0.0	0.0	-0.9	0.0	-0.5	0.0	0.4	.5	0.0	0.0	0.9	0.0	-0.4	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
1A (C-D)	2	D0	0.0	0.0	-0.3	0.0	-0.1	0.0	0.1	.6	0.0	0.0	0.2	0.0	0.0	0.0
		DL	0.0	0.0	-1.9	0.0	-0.9	0.0	0.7	.6	0.0	0.0	1.1	0.0	0.1	0.0
		LL	0.0	0.0	-0.8	0.0	-0.4	0.0	0.3	.6	0.0	0.0	0.5	0.0	0.0	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Beam	Floor	Load	Ax1	Shr2	Shr3	Torque	M2	M3	M2	X/L	Ax1	Shr2	Shr3	Torque	M2	M3
2 (A-A1)	2	D0	0.0	0.0	-0.7	0.0	-0.3	0.0	0.2	1.0	0.0	0.0	-0.5	0.0	0.2	0.0
		DL	0.0	0.0	-1.2	0.0	-0.5	0.0	0.3	1.0	0.0	0.0	-0.9	0.0	0.3	0.0
		LL	0.0	0.0	-0.5	0.0	-0.3	0.0	0.1	1.0	0.0	0.0	-0.4	0.0	0.1	0.0
		EQX	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0
		EQY	0.0	0.0	-0.4	0.0	-0.8	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	-0.5	0.0
2 (A1-A2)	2	D0	0.0	0.0	-0.2	0.0	0.2	0.0	0.2	.35	0.0	0.0	0.3	0.0	0.0	0.0
		DL	0.0	0.0	-0.4	0.0	0.3	0.0	0.5	.35	0.0	0.0	0.7	0.0	0.0	0.0
		LL	0.0	0.0	-0.2	0.0	0.1	0.0	0.2	.4	0.0	0.0	0.3	0.0	0.0	0.0
		EQX	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	1.0	0.0	0.0	-0.1	0.0	0.0	0.0
		EQY	0.0	0.0	-0.4	0.0	-0.5	0.0	0.3	1.0	0.0	0.0	-0.4	0.0	0.3	0.0
2 (A2-B)	2	D0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	-0.4	0.0
		DL	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	-0.9	0.0
		LL	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	-0.4	0.0
		EQX	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	1.0	0.0	0.0	-0.1	0.0	0.1	0.0
		EQY	0.0	0.0	-0.4	0.0	0.3	0.0	0.7	1.0	0.0	0.0	-0.4	0.0	0.7	0.0
2 (B-C)	2	D0	0.0	0.0	-0.4	0.0	-0.3	0.0	0.1	.5	0.0	0.0	0.4	0.0	-0.2	0.0
		DL	0.0	0.0	-1.1	0.0	-0.7	0.0	0.3	.5	0.0	0.0	1.0	0.0	-0.6	0.0
		LL	0.0	0.0	-0.5	0.0	-0.3	0.0	0.1	.5	0.0	0.0	0.4	0.0	-0.3	0.0
		EQX	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	1.0	0.0	0.0	0.0	0.0	0.1	0.0
		EQY	0.0	0.0	-0.3	0.0	-0.6	0.0	0.5	1.0	0.0	0.0	-0.3	0.0	0.5	0.0
2 (C-D)	2	D0	0.0	0.0	-0.3	0.0	-0.1	0.0	0.1	.55	0.0	0.0	0.3	0.0	-0.1	0.0
		DL	0.0	0.0	-0.8	0.0	-0.4	0.0	0.2	.55	0.0	0.0	0.7	0.0	-0.2	0.0
		LL	0.0	0.0	-0.3	0.0	-0.2	0.0	0.1	.55	0.0	0.0	0.3	0.0	-0.1	0.0
		EQX	0.0	0.0	-0.1	0.0	-0.1	0.0	0.1	1.0	0.0	0.0	-0.1	0.0	0.1	0.0
		EQY	0.0	0.0	-0.7	0.0	-0.8	0.0	0.9	1.0	0.0	0.0	-0.7	0.0	0.9	0.0
1 (A-A1)	3	D0	0.0	0.0	-0.3	0.0	-0.2	0.0	0.0	1.0	0.0	0.0	-0.2	0.0	0.0	0.0
		DL	0.0	0.0	-0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0
		LL	0.0	0.0	-0.2	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.1	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0
1 (A1-A2)	3	D0	0.0	0.0	-0.2	0.0	0.0	0.0	0.1	.45	0.0	0.0	0.2	0.0	0.0	0.0
		DL	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		LL	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	.5	0.0	0.0	0.1	0.0	0.0	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.1	0.0	-0.1	0.0	0.1	1.0	0.0	0.0	-0.1	0.0	0.1	0.0
1 (A2-B)	3	D0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-0.3	0.0
		DL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0
		LL	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	-0.2	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.1	0.0	0.1	0.0	0.2	1.0	0.0	0.0	-0.1	0.0	0.2	0.0
1 (B-C)	3	D0	0.0	0.0	-0.3	0.0	-0.2	0.0	0.1	.5	0.0	0.0	0.3	0.0	-0.2	0.0
		DL	0.0	0.0	-0.1	0.0	0.1	0.0	0.1	.25	0.0	0.0	0.2	0.0	-0.2	0.0
		LL	0.0	0.0	-0.2	0.0	-0.1	0.0	0.1	.45	0.0	0.0	0.2	0.0	-0.2	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.1	0.0	-0.2	0.0	0.2	1.0	0.0	0.0	-0.1	0.0	0.2	0.0
1 (C-D)	3	D0	0.0	0.0	-0.3	0.0	-0.1	0.0	0.1	.55	0.0	0.0	0.2	0.0	-0.1	0.0
		DL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.15	0.0	0.0	0.2	0.0	-0.1	0.0
		LL	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	.45	0.0	0.0	0.2	0.0	-0.1	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.2	0.0	-0.3	0.0	0.3	1.0	0.0	0.0	-0.2	0.0	0.3	0.0
2 (A-A1)	3	D0	0.0	0.0	-0.3	0.0	-0.2	0.0	0.0	1.0	0.0	0.0	-0.2	0.0	0.0	0.0
		DL	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0
		LL	0.0	0.0	-0.2	0.0	-0.1	0.0	0.0	1.0	0.0	0.0	-0.1	0.0	0.0	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.1	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0
2 (A1-A2)	3	D0	0.0	0.0	-0.2	0.0	0.0	0.0	0.1	.45	0.0	0.0	0.2	0.0	0.0	0.0
		DL	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	.6	0.0	0.0	0.1	0.0	0.0	0.0
		LL	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	.5	0.0	0.0	0.1	0.0	0.0	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.1	0.0	-0.1	0.0	0.1	1.0	0.0	0.0	-0.1	0.0	0.1	0.0
2 (A2-B)	3	D0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-0.3	0.0
		DL	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0
		LL	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	-0.2	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.1	0.0	0.1	0.0	0.2	1.0	0.0	0.0	-0.1	0.0	0.2	0.0

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Beam	Floor	Load	Ax1	Shr2	Shr3	Torque	M2	M3	M2	X/L	Ax1	Shr2	Shr3	Torque	M2	M3
2 (B-C)	3	D0	0.0	0.0	-0.3	0.0	-0.2	0.0	0.1	.5	0.0	0.0	0.3	0.0	-0.2	0.0
		DL	0.0	0.0	-0.1	0.0	-0.1	0.0	0.1	.45	0.0	0.0	0.1	0.0	-0.1	0.0
		LL	0.0	0.0	-0.2	0.0	-0.1	0.0	0.1	.5	0.0	0.0	0.2	0.0	-0.1	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.1	0.0	-0.2	0.0	0.2	1.0	0.0	0.0	-0.1	0.0	0.2	0.0
2 (C-D)	3	D0	0.0	0.0	-0.3	0.0	-0.1	0.0	0.1	.55	0.0	0.0	0.2	0.0	-0.1	0.0
		DL	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	.35	0.0	0.0	0.1	0.0	-0.1	0.0
		LL	0.0	0.0	-0.2	0.0	-0.1	0.0	0.0	.5	0.0	0.0	0.2	0.0	-0.1	0.0
		EQX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
		EQY	0.0	0.0	-0.2	0.0	-0.2	0.0	0.3	1.0	0.0	0.0	-0.2	0.0	0.3	0.0

ANEXO 3

MODOS DE VIBRACIÒN

Company: INGENIL STRUCTURAL

Project: Mezanine Bodega

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MODE - FREQUENCY ANALYSIS

Mass Matrix Combination (Weight / g)

M = (D0 + DL + LL) / g

Total Building Weight: 55.59 ton

Modal Information: frequency, period, participation factors & generalized mass

Mode No	Frequency Hz	Period sec	== X-Direction ==		== Y-Direction ==		== Z-Direction ==	
			Part.Fac	GenMass*	Part.Fac	GenMass*	Part.Fac	GenMass*
1	3.58	0.2800	0.23	1.00	0.00	0.00	0.00	0.00
2	4.74	0.2110	0.00	0.01	-0.23	1.00	0.00	0.00
3	7.33	0.1360	0.02	1.95	0.01	0.55	0.00	0.00
4	8.98	0.1110	0.07	1.29	0.00	0.17	0.00	0.00
5	12.86	0.0780	0.00	0.03	0.05	1.00	0.00	0.00
6	20.00	0.0500	0.00	2.27	0.00	0.73	0.00	0.00

* : ton-sec²/m

Effective Weight and Participating Mass

Mode No	X - D i r e c t i o n			Y - D i r e c t i o n			Z - D i r e c t i o n		
	Weff*	%Mass	[%-Sum]	Weff*	%Mass	[%-Sum]	Weff*	%Mass	[%-Sum]
1	50.71	91.22	[91.2]	0.00	0.00	[0.0]	0.00	0.00	[0.0]
2	0.00	0.00	[91.2]	53.39	96.04	[96.0]	0.00	0.00	[0.0]
3	0.22	0.39	[91.6]	0.16	0.29	[96.3]	0.00	0.00	[0.0]
4	3.26	5.86	[97.5]	0.01	0.01	[96.3]	0.00	0.00	[0.0]
5	0.02	0.03	[97.5]	2.02	3.64	[100.0]	0.00	0.00	[0.0]
6	0.01	0.01	[97.5]	0.01	0.02	[100.0]	0.00	0.00	[0.0]

* : ton

ANEXO 4

INDICE DE ESTABILIDAD

Company: INGENIL STRUCTURAL

Project: Mezanine Bodega

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Engineer: DAVID BECERRA

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STORY STABILITY INDEX, Q

Story	h	P	X - D I R E C T I O N			Y - D I R E C T I O N		
			Shear X	Δcm X	Qx	Shear Y	Δcm Y	Qy
2	2.7	13.4	9.2	0.8079	0.0045	8.4	0.2329	0.0014
1	2.7	70.9	29.2	0.9086	0.0082	30.7	0.5810	0.0050

h: Story height, m
P: Gravity load, ton :(D0 + DL + LL)
V: Shear: Design shear force, ton
Δcm: Drift at center of mass, cm
Q: Story Stability Index: $P \cdot \Delta_{cm} / (V \cdot h)$

NOTE: P-Δ effects are negligible

ANEXO 5

ANÁLISIS DE REDUNDANCIA

Company: INGENIL STRUCTURAL

Project: Mezanine Bodega

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REDUNDANCY ANALYSIS

STORY-STRENGTH REDUCTION DUE TO REMOVAL OF CRITICAL ELEMENT

Story	E A R T H Q U A K E - X				E A R T H Q U A K E - Y			
	Vi	Vi/Vb	Crit.Element	Ve/Vi	Vi	Vi/Vb	Crit.Element	Ve/Vi
2	1.8	0.31	-	-	1.7	0.27	-	-
1	5.8	1.00	BEM:B(1-2)	0.27	6.1	1.00	BEM:1(C-D)	0.23
MAXIMA				0.27				0.23
NOTE: Shear values are divided by R								

Removal of any critial element on any story supporting more than 35% Vb (Base Shear) would not reduce the story strength by more than 33%. Thus SEISMIC FORCE-RESISTING SYSTEM SEEMS REDUNDANT!!
It should be investigated if removal of critical element would induce Extreme Torsional Irregularity (1bP)

Proposed Reduction Factor for Lack of Redundancy: Ørx = 1 Øry = 1

ANEXO 6

IRREGULARIDAD VERTICAL

Company: INGENIL STRUCTURAL

Engineer: DAVID BECERRA

Project: Mezanine Bodega

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DRIFT-BASED FLEXIBLE-STORY CHECK - NSR-10

Story	EARTHQUAKE - X				EARTHQUAKE - Y			
	Δ_{cm}^*	Δ_{cm}/h	Δ_n/Δ_{n+1}	Irregular	Δ_{cm}^*	Δ_{cm}/h	Δ_n/Δ_{n+1}	Irregular
2	0.8079	0.0030	-	-	0.3131	0.0012	-	-
1	0.9086	0.0034	1.1247	NO	0.5810	0.0022	1.8560	?

* Δ_{cm} : Story drift at center of mass (cm) $n/n+1 \Delta/h$: $(\Delta_{cm}/h)_n / (\Delta_{cm}/h)_{n+1}$: Ratio between drift ratio at CM of a story and that of story aboveVertical irregularities type 1a, 1b, 2 and 3 do not apply if drift ratio of each story is less than 1.3 that of next story above (i.e. $n/n+1 \Delta/h < 1.3$). Story drift ratio of top two stories are not considered**Stiffness-based flexible story check is not required!****It can be considered that vertical irregularities type 1aA, 1bA, 2A and 3A DO NOT EXIST !**Use: $\phi_a = 1$ **STORY STIFFNESS -BASED ON DESIGN SHEAR**

Story	X - DIRECTION			Y - DIRECTION		
	Shear X	Δ_{cm} X	Kx	Shear Y	Δ_{cm} Y	Ky
2	9.2	0.8079	11.3	8.4	0.3131	26.7
1	29.2	0.9086	32.1	30.7	0.5810	52.8

Shear: Design Shear, in ton

 Δ_{cm} : Drift at center of mass, in cm

K: Story stiffness, in ton/cm

STIFFNESS-BASED FLEXIBLE-STORY CHECK - NSR-10

Story	EARTHQUAKE - X				EARTHQUAKE - Y			
	Kn	Kn/Kn+1	Kn/Kavg3	Irregular	Kn	Kn/Kn+1	Kn/Kavg3	Irregular
2	11.3	-	-	-	26.7	-	-	-
1	32.1	2.835	-	NO	52.8	1.980	-	NO

Kn: Stiffness of story n, in ton/cm

Kn/Kn+1: Ratio between stiffness of story n and that of store above n

Kn/Kavg3: Ratio between stiffness of story n and average stiffness of three stories above n

Stiffness-soft story irregularity is considered to exist if $Kn/Kn+1 < 0.7$ or $Kn/Kavg3 < 0.8$ Stiffness-EXTreme soft story irregularity is considered to exist if $Kn/Kn+1 < 0.6$ or $Kn/Kavg3 < 0.7$ **Stiffness-flexible story irregularity types 1aA and 1bA do NOT exist.**

Notes:

The determination stiffness-soft story irregularity (vertical structural irregularity types 1a and 1b) is conducted based on story-stiffness computed for the design seismic shear distribution, according to FEMA's NEHRP Recommended Provisions for Seismic Regulations for New Buildings and other Structures, Provisions and Commentary ed. 1994, 1997, 2000, 2003, 2009, which is applicable to the following building codes derived from the above documents: (USA) IBC-03/06, ASCE 7-05/10, CBC-01/07, UBC-97, (COLOMBIA) NSR-10, (PAN) REP-2004/2014/2021 (DOM) R-001, (GUA) NSE10.

WEIGHT (MASS) IRREGULARITY CHECK

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Floor	Wn	Wn/Wn+1	Wn/Wn-1	Irregular
3	10.7	-	0.240	-
2	44.8	-	-	-

Wn: Effective weight of floor n, in ton
Wn/Wn+1: Ratio between weight of floor n and weight of floor above n
Wn/Wn-1: Ratio between weight of floor n and weight of floor below n

Weight (mass) irregularity is considered to exist if effective weight of any floory is more than 1.5 times the effective weight of an adjacent floor. That is, if $W_n/W_{n+1} > 1.5$ or $W_n/W_{n-1} > 1.5$.
A roof that is lighter than the floor below is not considered.

Weight (mass) irregularity (2A) does NOT exist.

ANEXO 7

IRREGULARIDAD TORSIONAL

Company: INGENIL STRUCTURAL

Project: Mezanine Bodega

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Engineer: DAVID BECERRA

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PLAN TORSIONAL IRREGULARITY CHECK - NSR-10

Level	E A R T H Q U A K E - X				E A R T H Q U A K E - Y			
	Δ/h max	Δ/h avg	max/avg Δ/h	Irregular	Δ/h max	Δ/h avg	max/avg Δ/h	Irregular
3	0.0032	0.0030	1.0633	NO	0.0012	0.0012	1.0000	NO
2	0.0038	0.0034	1.1346	NO	0.0022	0.0022	1.0000	NO

Torsional irregularity is considered to exist if Δ/h max > 1.2 Δ/h ave
EXTreme torsional irregularity is considered to exist if Δ/h max > 1.4 Δ/h ave

Torsional irregularities do NOT exist.

Accidental torsion does not have to be amplified

Notes:

The determination of torsional irregularities (plan structural irregularity type 1) and computation of amplification factors for accidental torsion A_x , is conducted according to FEMA's NEHRP Recommended Provisions for Seismic Regulations for New Buildings and other Structures, Provisions and Commentary ed. 1994, 1997, 2000, 2003, 2009, which is applicable to the following building codes derived from the above documents: (USA) IBC-03/06, ASCE 7-05/10, CBC-01/07, UBC-97, (COLOMBIA) NSR-10, and (PAN) REP-2004/2014/2021 (Dom) R-001, (GUA) NSE10.

ANEXO 8

ANÁLISIS SISMICO

Company: INGENIL STRUCTURAL S.A.S

Project: Mezanine Bodega

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Engineer: DAVID BECERRA

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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
Vm = Sam Wm'
Sam = Spectral modal acceleration
Wm' = Effective modal weight

ANALYSIS PARAMETERS

Number of modes to be included ... = 6

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

Company: INGENIL STRUCTURAL S.A.S
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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S P E C T R A L M O D A L A C C E L E R A T I O N

Sam = 2.5 Aa Fa I [0.4+0.6T/To] For Tm <= To
Sam = 2.5 Aa Fa I For To < Tm <= Tc
Sam = 1.2 Av Fv I/Tm For Tc < Tm < Tl
Sam = 1.2 Av Fv Tl I/Tm² For Tm > Tl

Eff. peak acceleration & veloc., Aa = .15 Av = .20

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 = 1.0

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

Sam = 2.5 Aa Fa I [0.4+0.6T/To] For Tm <= To
Sam = 2.5 Aa Fa I For To < Tm <= Tc
Sam = 1.2 Av Fv I/Tm For Tc < Tm < Tl
Sam = 1.2 Av Fv Tl I/Tm² For Tm > Tl
DESIGN SPECTRAL RESPONSE ACCELERATION PARAMETERS

	Short Periods	Long Periods
	-----	-----
Effect. peak acceleration & velc.,	Aa = 0.15	Av = 0.20
Site coefficients (Tables below),	Fa = 1.50	Fv = 2.00
Design response parameters,	Aa Fa = 0.23	Av Fv = 0.40
Long-period transition period, Tl sec =	4.80	(2.4 Fv)

Site Coefficient Fa					
Site Class	Aa<=0.1	Aa=0.2	Aa=0.3	Aa=0.4	Ss>=0.5
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	a	a	a	a	a

Site Coefficient Fv					
Site Class	Av<=0.1	Av=0.2	Av=0.3	Av=0.4	Av>=0.5
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	a	a	a	a	a

a: Site-specific geotechnical investigation required

Reduction in R for Irregularity and Lack of Redundancy:

PLAN IRREGULARITIES			ELEVATION IRREGULARITIES		
Type	Description	Øp	Type	Description	Øa
1aP	Torsional	0.9	1aA	Flexible	0.9
1bP	Torsional Extrme	0.8	1bA	Flexible Extrme	0.8
2P	Reentrant corners	0.9	2A	Mass	0.9
3P	Diaph. discontin.	0.9	3A	Geometrical	0.9
4P	Plane shifting	0.8	4A	Plane shifting	0.8
5P	Unparallel grid	0.9	5aA	Weak Story	0.9
			5bA	Weak Story Extr	0.8

NOTE: EngSolutions RCB assumes irregular but redundant building.
For regular buildings make (Øp . Øa)= 1.0

	X - D I R E C T I O N	Y - D I R E C T I O N
	-----	-----
Reduct. factor, (Øp.Øa) =	1	1
Redundancy factor, Ør =	1	1
R = (Øp Øa) Ør Ro		

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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) = 55.59

Peak Acceleration Coeffi., Aa Fa = .23
Peak Velocity Coefficient, Av Fv = .4
Importance factor, I = 1
Site class, S = D
Coeff. for upper limit period, Cu = 1.27

	X-direction	Y-direction
Computed Period	= 0.280	0.211
Ta = Ct (H)^x	= 0.047 H^0.9	0.047 H^0.9
	= 0.213	0.213
Tmax = Cu Ta	= 0.270	0.270
Fundamental Period	= 0.270	0.211
Energy-Disspst coeff, R	= 5	5
1.2 Av Fv I / T	= 1.778	2.275
2.5 Aa Fa I	= .575	.575
Sa	= .575	.575
Base Shear, Vo	= 31.96	31.96
Static Shear, .8Vo (ton)	= 25.57	25.57

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	.28	.575
2	.211	.575
3	.136	.5
4	.111	.45
5	.078	.385
6	.05	.329

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	.575	50.71	29.16	.575	0	0
2	.575	0	0	.575	53.39	30.7
3	.5	.22	.11	.5	.16	.08
4	.45	3.26	1.47	.45	.01	0
5	.385	.02	.01	.385	2.02	.78
6	.329	.01	0	.329	.01	0
ELASTIC Ve (combined):			29.19			30.71
STATIC 0.8 Sa(T1)W:			25.57			25.57
Design Base Shear:			29.19			30.71

Total Building Weight, W = 55.59 ton
Participating Mass, $\Sigma W'/W = 98\%$ 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 $V = (\text{Sum } V_i^2)^{1/2}$

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ap : component amplification factor

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ANEXO 9

EVALUACIÓN DE DERIVAS

Company: INGENIL STRUCTURAL

Project: Mezanine Bodega

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P-DELTA ANALYSIS - SUMMARY MAXIMUM STORY DRIFT RATIO, Δ/h

Story	Drift-Ratio at CENTER OF MASS			MAXIMUM Corner Story-Drift-Ratio			
	DriftX	DriftY	DriftR	DriftX	DriftY	DriftR	Axis
2	0.0030	0.0012	0.0031	0.0032	0.0012	0.0032	A-1
1	0.0034	0.0022	0.0034	0.0038	0.0022	0.0038	A-1
Maxima	0.0034	0.0022	0.0034	0.0038	0.0022	0.0038	

DriftX = (Δx/h)max
DriftY = (Δy/h)max
DriftR = ([(Δx/h)² + (Δy/h)²]½)max

P-DELTA ANALYSIS - DETAILED MAXIMUM STORY DRIFT RATIO, δ/h

Story	ColAxis	(δx/h)max	(δy/h)max	([(δx/h)² + (δy/h)²]½)max
2	A-1	0.0032	0.0012	0.0032
	B-1	0.0030	0.0012	0.0031
	C-1	0.0029	0.0012	0.0029
	D-1	0.0027	0.0012	0.0027
	A-2	0.0032	0.0011	0.0032
	B-2	0.0030	0.0011	0.0031
	C-2	0.0029	0.0011	0.0029
	D-2	0.0027	0.0011	0.0027
1	A-1	0.0038	0.0022	0.0038
	B-1	0.0034	0.0022	0.0034
	C-1	0.0029	0.0022	0.0029
	D-1	0.0026	0.0022	0.0026
	A-2	0.0038	0.0019	0.0038
	B-2	0.0034	0.0019	0.0034
	C-2	0.0029	0.0019	0.0029
	D-2	0.0026	0.0019	0.0026

Note: Drift amplification factor, D: 1 in X; 1 in Y
MAXIMA DRIFT: (δ/h)x =0.0038; (δ/h)y =0.0022; (δ/h)r =0.0038

ANEXO 10

DISEÑO DE ZAPATAS

Company: INGENIL STRUCTURAL

Project: Mezanine Bodega

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LOAD COMBINATIONS

No	Load combination
1	1.4D0 + 1.4DL
2	1.2D0 + 1.2DL + 1.6LL
3	1.2D0 + 1.2DL + .5LL + EQX + .3EQY
4	1.2D0 + 1.2DL + .5LL - EQX - .3EQY
5	1.2D0 + 1.2DL + .5LL + EQX - .3EQY
6	1.2D0 + 1.2DL + .5LL - EQX + .3EQY
7	1.2D0 + 1.2DL + .5LL + .3EQX + EQY
8	1.2D0 + 1.2DL + .5LL - .3EQX - EQY
9	1.2D0 + 1.2DL + .5LL - .3EQX + EQY
10	1.2D0 + 1.2DL + .5LL + .3EQX - EQY
11	.9D0 + .9DL + EQX + .3EQY
12	.9D0 + .9DL - EQX - .3EQY
13	.9D0 + .9DL + EQX - .3EQY
14	.9D0 + .9DL - EQX + .3EQY
15	.9D0 + .9DL + .3EQX + EQY
16	.9D0 + .9DL - .3EQX - EQY
17	.9D0 + .9DL - .3EQX + EQY
18	.9D0 + .9DL + .3EQX - EQY

Design results - Footings

Footing	Floor	Mat	B m	L m	h cm	Vu1/ØVc1 Vu2/ØVc2	Dir -	Reinforcem	As cm2	Mu ton-m
D-2	1	1	1.00	1.00	35	0.18 0.20	B L	5#4@21 cm 5#4@21 cm	6.300 6.300	1.48 1.42
C-2	1	1	1.00	1.20	35	0.32 0.32	B L	6#4@21 cm 5#4@21 cm	7.560 6.300	3.06 1.03
B-2	1	1	1.00	1.20	35	0.37 0.38	B L	6#4@20 cm 5#4@21 cm	7.560 6.300	3.63 1.21
A-2	1	1	1.00	1.00	35	0.26 0.25	B L	5#4@21 cm 5#4@21 cm	6.300 6.300	2.12 1.80
D-1	1	1	1.00	1.00	35	0.21 0.23	B L	5#4@21 cm 5#4@21 cm	6.300 6.300	1.66 1.60
C-1	1	1	1.00	1.20	35	0.31 0.31	B L	6#4@21 cm 5#4@21 cm	7.560 6.300	2.99 1.04
B-1	1	1	1.00	1.20	35	0.44 0.46	B L	6#4@20 cm 5#4@21 cm	7.560 6.300	4.30 1.47
A-1	1	1	1.00	1.20	35	0.57 0.56	B L	6#4@21 cm 5#4@21 cm	7.585 6.321	4.16 5.11

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Project: Mezanine Bodega

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P-Delta Analysis- Footing Contact Pressures

Footing group		Load	Force (ton)			Moment (ton-m)			Pressure (ton/m2)	
Group	Floor	LdComb	Rx	Ry	Rz	Mx	My	Mz	PcMax	PcMin
D-2	1	1	0.54	0.79	3.47	0.00	-0.05	0.11	3.77	3.17
		2	0.65	0.96	4.16	0.00	-0.05	0.13	4.48	3.84
		3	0.95	0.70	2.60	-0.02	0.13	-0.07	3.52	1.67
		4	0.13	0.88	4.34	0.03	-0.23	0.28	5.86	2.82
		5	0.46	1.17	2.80	-0.10	-0.02	0.27	3.55	2.05
		6	0.63	0.41	4.14	0.11	-0.07	-0.06	5.19	3.08
		7	0.93	0.85	3.33	-0.02	0.09	0.00	3.94	2.71
		8	0.31	0.99	4.65	0.02	-0.19	0.26	5.89	3.41
		9	0.56	1.20	3.48	-0.08	-0.03	0.25	4.15	2.81
		10	0.69	0.63	4.49	0.08	-0.07	0.00	5.37	3.61
		11	0.74	0.38	1.21	-0.02	0.15	-0.11	2.25	0.17
		12	-0.08	0.56	2.95	0.02	-0.21	0.24	4.36	1.55
		13	0.24	0.85	1.41	-0.10	-0.01	0.23	2.05	0.77
		14	0.41	0.09	2.75	0.11	-0.05	-0.10	3.68	1.82
C-2	1	1	0.92	0.29	7.10	-0.08	-0.15	0.11	6.98	4.85
		2	1.16	0.37	9.14	-0.10	-0.19	0.14	8.99	6.24
		3	1.45	0.37	6.36	-0.10	0.08	0.15	6.12	4.48
		4	0.38	0.20	7.84	-0.05	-0.38	0.07	8.67	4.40
		5	0.91	0.94	6.93	-0.25	-0.14	0.35	7.51	4.05
		6	0.92	-0.37	7.27	0.10	-0.16	-0.13	7.26	4.86
		7	1.51	0.42	8.07	-0.11	-0.01	0.16	7.21	6.23
		8	0.70	0.28	9.19	-0.08	-0.36	0.11	9.76	5.55
		9	1.10	0.85	8.50	-0.22	-0.17	0.32	8.89	5.28
		10	1.10	-0.15	8.76	0.04	-0.19	-0.05	8.39	6.20
		11	1.09	0.26	3.52	-0.07	0.14	0.10	3.93	1.94
		12	0.01	0.08	5.00	-0.02	-0.32	0.03	5.87	2.46
		13	0.55	0.83	4.09	-0.22	-0.08	0.31	4.71	2.11
		14	0.55	-0.49	4.43	0.13	-0.10	-0.18	4.72	2.66
B-2	1	1	1.15	0.26	8.30	-0.07	-0.16	0.10	8.01	5.82
		2	1.48	0.35	10.74	-0.10	-0.20	0.14	10.37	7.53
		3	1.76	0.37	7.56	-0.10	0.10	0.14	7.18	5.41
		4	0.54	0.15	9.03	-0.05	-0.41	0.06	9.79	5.26
		5	1.19	0.91	8.60	-0.24	-0.17	0.34	9.03	5.30
		6	1.11	-0.40	7.99	0.10	-0.15	-0.14	7.81	5.51
		7	1.86	0.41	9.57	-0.11	0.00	0.16	8.44	7.51
		8	0.94	0.24	10.69	-0.07	-0.38	0.09	11.13	6.68
		9	1.43	0.82	10.36	-0.22	-0.20	0.31	10.55	6.71
		10	1.37	-0.17	9.90	0.04	-0.18	-0.06	9.33	7.17
		11	1.30	0.26	4.24	-0.07	0.16	0.10	4.61	2.45
		12	0.08	0.04	5.72	-0.02	-0.35	0.02	6.59	2.94
		13	0.73	0.81	5.28	-0.22	-0.10	0.30	5.82	2.98
		14	0.65	-0.50	4.68	0.13	-0.08	-0.18	4.85	2.94
A-2	1	1	1.06	-0.43	4.93	-0.12	-0.01	0.22	5.72	4.14
		2	1.33	-0.48	6.01	-0.15	-0.01	0.29	6.93	5.08
		3	1.68	-0.20	4.04	-0.12	0.22	0.52	6.05	2.02
		4	0.44	-0.67	5.83	-0.11	-0.25	-0.09	8.00	3.65
		5	1.12	-0.04	5.47	-0.22	-0.03	0.38	6.98	3.96
		6	1.00	-0.82	4.39	-0.02	0.00	0.05	4.52	4.27
		7	1.73	-0.29	5.06	-0.14	0.17	0.51	6.91	3.21
		8	0.79	-0.65	6.42	-0.14	-0.19	0.04	8.36	4.47
		9	1.30	-0.18	6.14	-0.22	-0.02	0.40	7.58	4.71
		10	1.22	-0.76	5.33	-0.06	0.01	0.15	5.75	4.92
		11	1.26	-0.02	2.06	-0.07	0.22	0.44	3.84	0.29
		12	0.02	-0.50	3.85	-0.07	-0.24	-0.18	5.72	1.99
		13	0.69	0.13	3.49	-0.17	-0.03	0.29	4.69	2.30
		14	0.58	-0.65	2.42	0.03	0.01	-0.03	2.67	2.17
D-1	1	1	-0.45	0.76	4.13	0.04	0.13	-0.12	5.12	3.14
		2	-0.52	0.92	5.05	0.05	0.16	-0.15	6.28	3.81
		3	-0.04	0.86	4.99	0.06	0.31	-0.30	7.19	2.80
		4	-0.86	0.66	3.27	0.02	-0.05	0.06	3.69	2.84
		5	-0.28	1.19	3.45	-0.07	0.12	-0.34	4.65	2.26
		6	-0.62	0.33	4.81	0.15	0.13	0.10	6.48	3.13
		7	-0.19	0.95	5.47	0.06	0.29	-0.28	7.56	3.38
		8	-0.81	0.80	4.16	0.03	0.01	-0.01	4.42	3.91
		9	-0.38	1.21	4.30	-0.04	0.15	-0.31	5.45	3.16
		10	-0.63	0.55	5.33	0.13	0.15	0.02	7.02	3.64
		11	0.14	0.56	3.34	0.04	0.26	-0.25	5.15	1.54
		12	-0.68	0.36	1.62	0.00	-0.10	0.10	2.25	0.98
		13	-0.10	0.89	1.80	-0.09	0.07	-0.29	2.78	0.82

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Project: Mezanine Bodega

Engineer: DAVID BECERRA
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Group	Floor	LdComb	Rx	Ry	Rz	Mx	My	Mz	PcMax	PcMin
		14	-0.44	0.03	3.16	0.13	0.08	0.15	4.44	1.88
C-1	1	1	-0.57	0.11	7.33	-0.03	0.27	-0.04	7.61	4.61
		2	-0.71	0.13	9.45	-0.04	0.36	-0.04	9.82	5.92
		3	-0.04	0.04	8.07	-0.01	0.51	0.00	9.30	4.14
		4	-1.11	0.19	6.60	-0.05	0.04	-0.07	5.92	5.08
		5	-0.54	0.84	7.20	-0.22	0.28	-0.31	8.29	3.70
		6	-0.61	-0.62	7.47	0.16	0.27	0.24	8.25	4.20
		7	-0.27	0.07	9.47	-0.02	0.51	-0.02	10.55	5.24
		8	-1.08	0.18	8.36	-0.05	0.16	-0.07	7.99	5.95
		9	-0.65	0.68	8.81	-0.18	0.34	-0.25	9.79	4.91
		10	-0.70	-0.43	9.02	0.11	0.34	0.16	9.65	5.39
		11	0.19	-0.01	5.14	0.00	0.40	0.01	6.27	2.29
		12	-0.88	0.14	3.66	-0.04	-0.07	-0.05	3.54	2.56
		13	-0.31	0.80	4.26	-0.21	0.17	-0.29	5.25	1.86
		14	-0.38	-0.67	4.54	0.17	0.16	0.25	5.31	2.25
B-1	1	1	-1.01	-0.20	10.30	0.00	0.37	0.08	10.42	6.74
		2	-1.30	-0.26	13.45	0.00	0.48	0.10	13.63	8.79
		3	-0.42	-0.30	11.05	0.02	0.62	0.12	12.39	6.03
		4	-1.61	-0.10	9.55	-0.02	0.11	0.04	8.62	7.29
		5	-1.09	0.52	10.67	-0.19	0.37	-0.19	11.54	6.23
		6	-0.94	-0.91	9.93	0.19	0.36	0.34	10.85	5.70
		7	-0.78	-0.32	13.23	0.01	0.65	0.13	14.31	7.74
		8	-1.68	-0.17	12.09	-0.02	0.26	0.07	11.46	8.69
		9	-1.28	0.29	12.94	-0.14	0.46	-0.10	13.67	7.89
		10	-1.18	-0.79	12.38	0.14	0.45	0.30	13.15	7.49
		11	-0.01	-0.22	6.93	0.02	0.47	0.09	8.23	3.33
		12	-1.20	-0.02	5.43	-0.02	-0.03	0.01	4.79	4.26
		13	-0.68	0.60	6.55	-0.19	0.23	-0.22	7.37	3.54
		14	-0.54	-0.83	5.81	0.19	0.21	0.31	6.69	3.00
A-1	1	1	-1.63	-1.58	10.03	-0.35	0.32	-0.15	11.41	5.31
		2	-2.09	-1.98	12.89	-0.45	0.41	-0.20	14.70	6.79
		3	-1.00	-1.84	10.93	-0.36	0.60	0.24	13.57	4.64
		4	-2.27	-1.31	9.14	-0.35	0.04	-0.54	9.25	5.99
		5	-1.77	-1.12	10.48	-0.54	0.31	-0.38	12.54	4.93
		6	-1.50	-2.03	9.59	-0.17	0.32	0.08	10.28	5.70
		7	-1.50	-2.08	12.85	-0.43	0.60	0.11	15.51	5.91
		8	-2.46	-1.68	11.50	-0.42	0.18	-0.48	12.24	6.93
		9	-2.08	-1.54	12.51	-0.57	0.39	-0.36	14.73	6.13
		10	-1.88	-2.23	11.84	-0.29	0.39	-0.01	13.02	6.71
		11	-0.35	-1.21	6.92	-0.22	0.47	0.30	9.01	2.52
		12	-1.61	-0.68	5.13	-0.20	-0.09	-0.48	5.57	2.98
		13	-1.12	-0.49	6.47	-0.40	0.19	-0.32	7.97	2.80
		14	-0.85	-1.40	5.57	-0.03	0.19	0.14	5.72	3.57

P-Delta Analysis- Footing Envelopes

Load combinations : Service

Type of contact pressure: Linear, $P_{max}|P_{min} = R_z/A (1 \pm e_b/S_3 \pm e_l/S_2)$

Self weight of footing: 0.10 $R_z (D_0 + D_L + L_L)$

Group	Floor	Rz max ton	Rz min ton	Pc max ton/m2	Pc min ton/m2	Pc/Pa max	Pc/Pa min
D-2	1	5.06	1.63	6.30	0.58	0.41	0.04
C-2	1	10.10	4.43	10.53	2.70	0.69	0.18
B-2	1	11.81	5.31	12.03	3.35	0.78	0.22
A-2	1	7.02	2.66	8.96	0.89	0.58	0.06
D-1	1	5.98	2.12	8.06	1.33	0.53	0.09
C-1	1	10.42	4.61	11.34	2.65	0.74	0.17
B-1	1	14.79	6.77	15.43	4.12	1.01	0.27
A-1	1	14.18	6.41	16.59	3.59	1.08	0.23

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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LOAD COMBINATIONS

No	Load combination
1	D0 + DL
2	D0 + DL + LL
3	D0 + DL + .7EQX
4	D0 + DL - .7EQX
5	D0 + DL + .7EQY
6	D0 + DL - .7EQY
7	D0 + DL + .75LL + .53EQX
8	D0 + DL + .75LL - .53EQX
9	D0 + DL + .75LL + .53EQY
10	D0 + DL + .75LL - .53EQY
11	.6D0 + .6DL + .7EQX
12	.6D0 + .6DL - .7EQX
13	.6D0 + .6DL + .7EQY
14	.6D0 + .6DL - .7EQY

Company: INGENIL STRUCTURAL

Engineer: DAVID BECERRA

Project: Mezanine Bodega

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P-Delta Analysis- Support Reactions

Support		Load	Force (ton)			Moment (ton-m)		
Axis	Floor	LdComb	Fx	Fy	Fz	Mx	My	Mz
A-1	1	1	0.01	1.00	10.60	-0.78	0.08	0.00
		2	-0.01	1.35	13.60	-1.06	0.09	0.00
		3	0.62	0.94	11.19	-0.70	0.97	0.00
		4	-0.61	1.06	10.01	-0.87	-0.81	0.00
		5	-0.04	1.49	10.93	-1.49	0.01	0.00
		6	0.05	0.51	10.26	-0.08	0.15	0.00
		7	0.46	1.22	13.30	-0.93	0.76	0.00
		8	-0.47	1.30	12.40	-1.05	-0.58	0.00
		9	-0.04	1.63	13.10	-1.53	0.04	0.00
		10	0.03	0.89	12.59	-0.45	0.14	0.00
		11	0.62	0.54	6.95	-0.39	0.93	0.00
		12	-0.61	0.66	5.77	-0.55	-0.84	0.00
		13	-0.05	1.09	6.69	-1.18	-0.02	0.00
		14	0.05	0.11	6.02	0.24	0.11	0.00
B-1	1	1	1.08	-0.48	9.42	0.50	0.98	0.00
		2	1.44	-0.65	12.33	0.67	1.30	0.00
		3	1.64	-0.56	9.78	0.61	1.78	0.00
		4	0.53	-0.41	9.06	0.40	0.19	0.00
		5	1.07	0.12	9.36	-0.30	0.96	0.00
		6	1.10	-1.08	9.48	1.30	1.00	0.00
		7	1.77	-0.67	11.87	0.71	1.82	0.00
		8	0.93	-0.55	11.33	0.55	0.62	0.00
		9	1.34	-0.15	11.55	0.02	1.21	0.00
		10	1.36	-1.06	11.65	1.24	1.24	0.00
		11	1.21	-0.37	6.01	0.40	1.38	0.00
		12	0.09	-0.21	5.29	0.20	-0.20	0.00
		13	0.63	0.31	5.59	-0.50	0.57	0.00
		14	0.67	-0.89	5.71	1.10	0.61	0.00
C-1	1	1	0.96	-0.20	7.14	0.26	0.84	0.00
		2	1.28	-0.27	9.25	0.34	1.12	0.00
		3	1.44	-0.28	7.42	0.36	1.53	0.00
		4	0.48	-0.12	6.86	0.15	0.16	0.00
		5	0.98	0.44	7.50	-0.57	0.87	0.00
		6	0.94	-0.83	6.78	1.09	0.82	0.00
		7	1.56	-0.31	8.93	0.40	1.57	0.00
		8	0.83	-0.19	8.52	0.24	0.53	0.00
		9	1.21	0.23	9.00	-0.31	1.07	0.00
		10	1.19	-0.73	8.45	0.95	1.03	0.00
		11	1.06	-0.20	4.56	0.26	1.19	0.00
		12	0.09	-0.04	4.01	0.05	-0.18	0.00
		13	0.60	0.51	4.64	-0.68	0.53	0.00
		14	0.56	-0.75	3.93	0.98	0.48	0.00
D-1	1	1	0.29	-0.27	4.14	0.32	0.24	0.00
		2	0.38	-0.36	4.98	0.42	0.30	0.00
		3	0.68	-0.34	4.68	0.41	0.81	0.00
		4	-0.10	-0.20	3.59	0.22	-0.34	0.00
		5	0.33	0.27	3.50	-0.43	0.29	0.00
		6	0.25	-0.81	4.77	1.06	0.18	0.00
		7	0.65	-0.38	5.18	0.46	0.72	0.00
		8	0.06	-0.28	4.35	0.32	-0.15	0.00
		9	0.38	0.07	4.29	-0.17	0.33	0.00
		10	0.32	-0.74	5.25	0.96	0.24	0.00
		11	0.57	-0.23	3.03	0.28	0.72	0.00
		12	-0.21	-0.09	1.93	0.10	-0.44	0.00
		13	0.22	0.38	1.85	-0.56	0.20	0.00
		14	0.14	-0.70	3.11	0.93	0.09	0.00
A-2	1	1	-0.07	0.32	4.63	-0.26	0.02	0.00
		2	-0.06	0.41	5.57	-0.32	0.04	0.00
		3	0.54	0.38	4.05	-0.34	0.89	0.00
		4	-0.68	0.26	5.22	-0.17	-0.86	0.00
		5	-0.11	0.76	4.99	-0.89	-0.04	0.00
		6	-0.03	-0.12	4.27	0.38	0.08	0.00
		7	0.40	0.43	4.89	-0.37	0.70	0.00
		8	-0.53	0.34	5.78	-0.24	-0.63	0.00
		9	-0.10	0.72	5.61	-0.79	-0.01	0.00
		10	-0.03	0.05	5.06	0.18	0.08	0.00
		11	0.57	0.25	2.19	-0.24	0.89	0.00
		12	-0.65	0.13	3.37	-0.07	-0.87	0.00
		13	-0.08	0.64	3.14	-0.79	-0.05	0.00

Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

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Axis	Floor	LdComb	Fx	Fy	Fz	Mx	My	Mz
		14	0.00	-0.25	2.42	0.48	0.07	0.00
B-2	1	1	-0.96	-0.11	8.35	0.12	-0.79	0.00
		2	-1.27	-0.14	10.86	0.15	-1.06	0.00
		3	-0.39	-0.04	7.99	0.02	0.00	0.00
		4	-1.52	-0.19	8.72	0.22	-1.59	0.00
		5	-0.97	0.43	8.31	-0.60	-0.81	0.00
		6	-0.94	-0.65	8.40	0.84	-0.78	0.00
		7	-0.77	-0.08	9.96	0.07	-0.39	0.00
		8	-1.62	-0.19	10.51	0.22	-1.59	0.00
		9	-1.20	0.27	10.20	-0.40	-1.00	0.00
		10	-1.18	-0.54	10.27	0.69	-0.98	0.00
		11	-0.01	0.01	4.65	-0.03	0.32	0.00
		12	-1.13	-0.14	5.37	0.17	-1.27	0.00
		13	-0.58	0.47	4.97	-0.65	-0.49	0.00
		14	-0.56	-0.61	5.06	0.79	-0.46	0.00
C-2	1	1	-0.95	-0.10	7.34	0.11	-0.82	0.00
		2	-1.26	-0.14	9.52	0.15	-1.10	0.00
		3	-0.47	-0.02	7.06	0.01	-0.14	0.00
		4	-1.43	-0.18	7.62	0.21	-1.51	0.00
		5	-0.93	0.47	7.65	-0.64	-0.80	0.00
		6	-0.96	-0.67	7.03	0.86	-0.85	0.00
		7	-0.82	-0.07	8.77	0.06	-0.51	0.00
		8	-1.55	-0.19	9.19	0.22	-1.55	0.00
		9	-1.17	0.30	9.21	-0.43	-1.01	0.00
		10	-1.20	-0.56	8.74	0.71	-1.05	0.00
		11	-0.09	0.02	4.13	-0.04	0.19	0.00
		12	-1.05	-0.14	4.68	0.17	-1.18	0.00
		13	-0.55	0.51	4.71	-0.68	-0.47	0.00
		14	-0.59	-0.63	4.09	0.81	-0.52	0.00
D-2	1	1	-0.37	-0.15	3.97	0.16	-0.34	0.00
		2	-0.48	-0.20	4.76	0.21	-0.45	0.00
		3	0.02	-0.09	3.42	0.06	0.23	0.00
		4	-0.76	-0.22	4.52	0.25	-0.92	0.00
		5	-0.33	0.33	3.34	-0.51	-0.29	0.00
		6	-0.41	-0.64	4.60	0.83	-0.40	0.00
		7	-0.16	-0.14	4.15	0.12	0.01	0.00
		8	-0.75	-0.24	4.98	0.26	-0.86	0.00
		9	-0.42	0.18	4.09	-0.31	-0.38	0.00
		10	-0.49	-0.56	5.04	0.70	-0.46	0.00
		11	0.17	-0.03	1.84	0.00	0.37	0.00
		12	-0.61	-0.16	2.93	0.19	-0.78	0.00
		13	-0.18	0.39	1.76	-0.58	-0.15	0.00
		14	-0.26	-0.58	3.01	0.76	-0.26	0.00

LOAD COMBINATIONS

No	Load combination
1	D0 + DL
2	D0 + DL + LL
3	D0 + DL + .7EQX
4	D0 + DL - .7EQX
5	D0 + DL + .7EQY
6	D0 + DL - .7EQY
7	D0 + DL + .75LL + .53EQX
8	D0 + DL + .75LL - .53EQX
9	D0 + DL + .75LL + .53EQY
10	D0 + DL + .75LL - .53EQY
11	.6D0 + .6DL + .7EQX
12	.6D0 + .6DL - .7EQX
13	.6D0 + .6DL + .7EQY
14	.6D0 + .6DL - .7EQY

ANEXO 11

DISEÑO DE VIGAS Y COLUMNAS

Company: INGENIL STRUCTURAL

Project: Mezanine Bodega

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LOAD COMBINATIONS

No	Load combination
1	1.4D0 + 1.4DL
2	1.2D0 + 1.2DL + 1.6LL
3	1.2D0 + 1.2DL + .5LL + EQX + .3EQY
4	1.2D0 + 1.2DL + .5LL - EQX - .3EQY
5	1.2D0 + 1.2DL + .5LL + EQX - .3EQY
6	1.2D0 + 1.2DL + .5LL - EQX + .3EQY
7	1.2D0 + 1.2DL + .5LL + .3EQX + EQY
8	1.2D0 + 1.2DL + .5LL - .3EQX - EQY
9	1.2D0 + 1.2DL + .5LL - .3EQX + EQY
10	1.2D0 + 1.2DL + .5LL + .3EQX - EQY
11	.9D0 + .9DL + EQX + .3EQY
12	.9D0 + .9DL - EQX - .3EQY
13	.9D0 + .9DL + EQX - .3EQY
14	.9D0 + .9DL - EQX + .3EQY
15	.9D0 + .9DL + .3EQX + EQY
16	.9D0 + .9DL - .3EQX - EQY
17	.9D0 + .9DL - .3EQX + EQY
18	.9D0 + .9DL + .3EQX - EQY

MATERIALS

Number of materials = 1

REINFORCED CONCRETE

Mat	Name	f'c Kg/cm2	fy Kg/cm2	fys1 Kg/cm2	fys2 Kg/cm2	E Kg/cm2	G Kg/cm2	w Kg/m3
1	RConcretel	210	4200	4200	4200	218540	87430	2400.0

f'c: Compressive strength of concrete
fy: Yield strength of longitudinal reinforcement
fys1: Yiel strength of shear reinforcement, bar sizes <= 3/8"
fys2: Yiel strength of shear reinforcement, bar sizes > 3/8"

COLUMN SECTIONS

Number of prismatic sections = 1

Sec	Name	Shape	b (cm)	h (cm)	tw (cm)	tf (cm)	P1 (cm)	P2 (cm)	A (cm2)	I2 (cm4)	I3 (cm4)	J (cm4)
1	C25x30	Rectang	25.00	30.00	-	-	-	-	750.0	56250	39062	74219

Design Results - Columns (DMO)

Column	Story	L (m)	Lu (m)	Sec Mat	bxh (cm)	TRANSVERSE REINFORCEMENT		LONGITUDINAL REINFORCEMENT						
						TIES	XTIES	Sec	LdCmb critc	Pu (ton)	Mu2 (ton-m)	Mu3 (ton-m)	RHO -	As (cm2)
D-2	2	2.65	2.35	1	25x30	7 #3 @ 8 cm (end)	1 (b)	Top	1	1.73	0.22	0.40	0.0100	7.50
						8 #3 @ 16 cm (ctr)	0 (h)	Bot	4	1.87	0.38	1.26	0.0100	7.50
D-2	1	2.70	2.43	1	25x30	7 #3 @ 8 cm (end)	1 (b)	Top	4	6.21	0.75	1.59	0.0100	7.50
						9 #3 @ 16 cm (ctr)	0 (h)	Bot	4	6.21	0.63	1.31	0.0100	7.50
C-2	2	2.65	2.35	1	25x30	7 #3 @ 8 cm (end)	1 (b)	Top	1	1.82	0.18	0.10	0.0100	7.50
						8 #3 @ 16 cm (ctr)	0 (h)	Bot	4	1.74	0.37	1.74	0.0100	7.50
C-2	1	2.70	2.43	1	25x30	7 #3 @ 8 cm (end)	1 (b)	Top	4	10.16	0.72	3.32	0.0101	7.59
						9 #3 @ 16 cm (ctr)	0 (h)	Bot	4	10.16	0.62	2.11	0.0100	7.50

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Engineer: DAVID BECERRA
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	Length:	L = 3.97 m	a = 0.15 m	Section:	b = 25.0 cm	Sec:	V25X30					
		Lu = 3.67 m	c = 0.15 m		h = 30.0 cm	Mat:	RConcrete1					
X, m:	0.15	0.52	0.88	1.25	1.62	1.99	2.35	2.72	3.09	3.45	3.82	
Mu(-), ton-m:	-0.40	-0.19	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.20	-0.44	-0.73	
Mu(+), ton-m:	0.15	0.17	0.25	0.31	0.35	0.35	0.27	0.17	0.15	0.15	0.24	
As(-), cm2:	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	
As(+), cm2:	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18	
Vu, ton:	0.78	0.74	0.59	0.45	0.31	0.36	0.51	0.65	0.80	0.94	0.98	
Tu, ton-m:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Stirrup:	#3	#3	#3	#3	#3	#3	#3	#3	#3	#3	#3	
Spacing, cm:	6.00	6.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	6.00	6.00	
DESIGN												
	B-1	11 #3 @ 6 18 #3 @ 13 11 #3 @ 6										C-1

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Company: INGENIL STRUCTURAL
Project: Mezanine Bodega

Engineer: DAVID BECERRA
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ANEXO 12

CHEQUEO COLUMNA FUERTE -

VIGA DEBIL

Company: INGENIL STRUCTURAL

Project: Mezanine Bodega

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Engineer: DAVID BECERRA

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STRONG COLUMN WEAK BEAM CHECK

Units: ton-m

Axis	Floor	Direction 2					Direction 3				
		S.Mnc->	S.Mnb->	S.Mnc<-	S.Mnb<-	Ratio	S.Mnc->	S.Mnb->	S.Mnc<-	S.Mnb<-	Ratio
A-1	2	7.0	3.2	7.5	3.7	2.0	9.1	3.2	8.7	4.7	1.9
B-1	2	8.8	3.2	9.3	5.3	1.7	11.3	7.8	10.9	7.9	1.4
C-1	2	7.1	3.2	7.5	4.8	1.6	9.1	6.5	8.9	6.5	1.4
D-1	2	6.7	3.2	6.6	3.2	2.0	8.4	3.2	8.0	3.2	2.5
A-2	2	6.7	3.2	6.7	3.2	2.1	8.4	3.2	8.2	3.2	2.5
B-2	2	7.3	5.0	7.6	3.2	1.5	9.4	6.5	8.9	6.5	1.4
C-2	2	6.9	4.7	7.2	3.2	1.5	8.8	6.5	8.5	6.5	1.3
D-2	2	6.8	3.2	6.5	3.2	2.0	8.4	3.2	8.0	3.2	2.5

S.Mnc: Sum of nominal flexural strengths of columns framing into the joint
S.Mnb: Sum of nominal flexural strengths of beams framing into the joint
--> : Drift +
<-- : Drift -
Ratio: MIN (S.Mnc/SMnb ->, S.Mnc/SMnb ->)
Check: OK If Ratio > 1.2
X If Ratio < 1.2 *

ANEXO 13

DISEÑO ELEMENTOS NO

ESTRUCTURALES

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Force on structural non-seismic element : $F_p = a_x W_p / R_o$
 Force on nonstructural element : $F_p = a_x a_p W_p / R_p$
 $> 0.5 A_a I W_p$

a_p : component amplification factor



PROYECTO		MEZZANINE BODEGA ESTACIÓN DE BOMBEROS		
Aceleracion en el piso (ax)				
<div> <div></div> <div></div> </div>				
ax (g)		= 0.74		
Masa del elemento no estructural (Mp)				
Espeor muro(m) =	0.15			
Altura de piso(m)	2.7			
Y Mamp (kgf/m ³)	1300			
Mp (kg/m)		= 526.5		
Fuerza sismica de diseño				
Aa	0.15	$F_p = \frac{a_x a_p}{R_p} g M_p \geq \frac{A_a I}{2} g M_p$		
I	1			
Rp	1.5			
ap	1			
Fp (Kgf/m)		= 259.7		
Momento maximo				
Mmax (kg-m/m)		<div> <div>= 175.3</div> <div> $M_{max} = \frac{F_p * h_p}{4}$ </div> </div>		
Cortante				
Vmax (kgf/m)		<div> <div>= 129.9</div> <div> $V_{max} = \frac{F_p}{2}$ </div> </div>		
Resistencia				
fy (kgf/cm ²)	4200			
Longitud conector (cm)	10			
Barra	Diametro	M resistente	M diseño	
	(cm)	(kgf-cm)	(kgf-cm)	
1/2"	1.27	844.62	649.35	OK!!
CONCLUSION: El refuerzo longitudinal es 1 Ø 1/2 c/1.5 m				



PROYECTO **MEZZANINE ESTACIÓN DE BOMBEROS - CULATA Y ANTEPECHO (Ap = 2.5)**

Aceleracion en el piso (ax)

$$a_x \text{ (g)} = 0.74$$

Masa del elemento no estructural (Mp)

Espesor muro(m) = 0.15

Altura de piso(m) **1.2**

Y Mamp (kgf/m³) 1300

$$M_p \text{ (kg/m)} = 234$$

Fuerza sismica de diseño

Aa 0.15

I 1

Rp 1.5

ap **2.5**

$$F_p = \frac{a_x a_p}{R_p} g M_p \geq \frac{A_a I}{2} g M_p$$

$$F_p \text{ (Kgf/m)} = 288.6$$

Momento maximo

$$M_{max} \text{ (kg-m/m)} = 86.6$$

$$M_{max} = \frac{F_p * h_p}{4}$$

Cortante

$$V_{max} \text{ (kgf/m)} = 144.3$$

$$V_{max} = \frac{F_p}{2}$$

Resistencia

fy (kgf/cm²) 4200

Longitud conector (cm) 10

Barra	Diametro (cm)	M resistente (kgf-cm)	M diseño (kgf-cm)	
1/2"	1.27	844.62	721.50	OK!!

CONCLUSION: El refuerzo longitudinal es 1 Ø 1/2 c/1.5 m

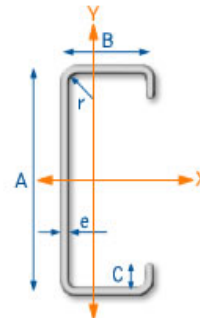
ANEXO 14. DISEÑO DE CORREAS

Tipo de sección: Perlín C

Materiales

Módulo de elasticidad del acero E (kg/cm ²):	2040000
Esfuerzo de fluencia del Perlín Fy (kg/cm ²):	3500
Esfuerzo último del perlín Fu (kg/cm ²):	4570

Número de luces: 1 Luz



Separación correas S(m): 1

Pendiente de la cubierta M (%): 10

Tensores a: Sin tensores

Cargas Sobreimpuestas

Tipo de teja:	Arquitectónica (4.32Kg/m ²)
Elementos varios:	
Carga viva (kg/m ²):	50
Granizo (kg/m ²):	0
Otro adicional a los anteriores (kg/m ²):	30
Viento en succión (kg/m ²):	0.00
Viento en presión (kg/m ²):	0.00

Notas:

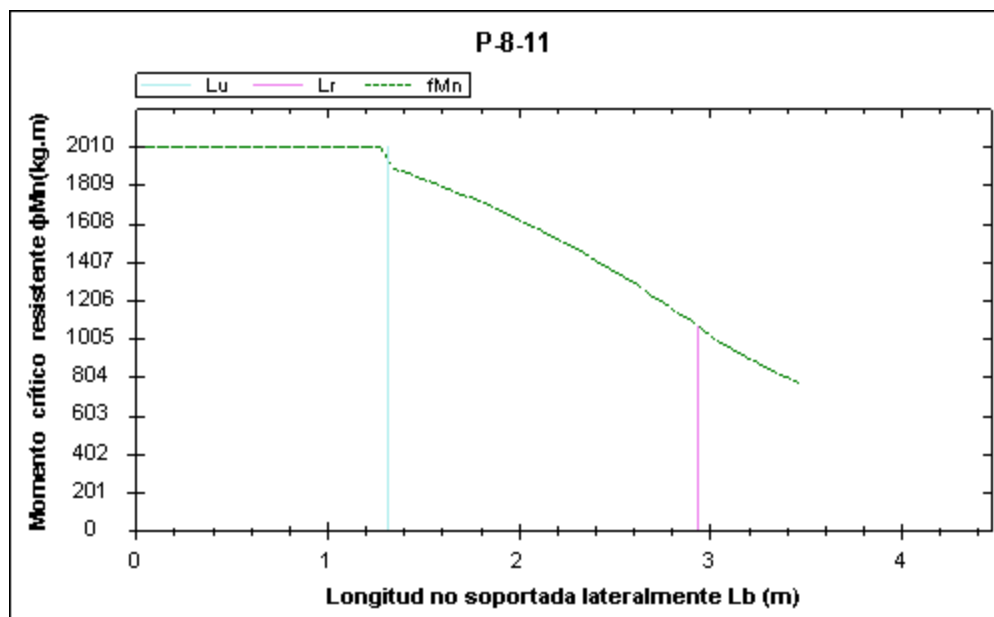
- Viento en succión con signo negativo (-).
-La carga de granizo que aparece por defecto es sugerida por el programa de acuerdo a la pendiente de la cubierta. Recuerde que las regiones ubicadas a menos de 2000m sobre el nivel del mar no se debe tener en cuenta la carga de granizo.

Selección: P-8-11

Designación	Peso negro Kg/m	Momento último Mu (kg-m)	Cortante último Vu (kg)	$(M_{ux}/\phi M_{nx}) + (M_{uy}/\phi M_{ny})$	$(M_{ux}/\phi M_{nx})^2 + (V_{ux}/\phi V_{nx})^2$
P3-10-16	5.01	376.76	308.82	0.96	N/A
P3-12-16	5.61	378.89	310.57	0.81	N/A
P-14-16	5.86	379.78	311.29	1	N/A
P3-8-14	5.88	379.85	311.35	0.96	N/A
P-10-14	6.22	381.06	312.34	0.93	N/A
P3-9-14	6.28	381.27	312.52	0.8	N/A
P3-10-14	6.68	382.69	313.68	0.69	N/A
P-12-14	7.02	383.9	314.67	0.76	N/A
P-9-12	7.28	384.83	315.43	0.88	N/A
P3-8-12	7.35	385.08	315.64	0.77	N/A
P3-12-14	7.48	385.54	316.01	0.57	N/A
P-10-12	7.78	386.6	316.89	0.76	N/A
P-14-14	7.82	386.75	317	0.69	N/A
P3-9-12	7.85	386.85	317.09	0.64	N/A
P-8-11	8.14	387.88	317.94	0.9	N/A
P3-10-12	8.35	388.63	318.55	0.55	N/A
P-9-11	8.73	389.98	319.66	0.67	N/A
P-12-12	8.77	390.12	319.77	0.6	N/A
P3-8-11	8.82	390.3	319.92	0.65	N/A
P-10-11	9.33	392.11	321.4	0.65	N/A
P3-12-12	9.35	392.18	321.46	0.43	N/A
P3-9-11	9.42	392.43	321.67	0.54	N/A
P-14-12	9.77	393.68	322.69	0.51	N/A
P3-10-11	10.02	394.57	323.41	0.46	N/A
P-12-11	10.53	396.38	324.9	0.52	N/A
P3-12-11	11.22	398.83	326.91	0.37	N/A
P-14-11	11.72	400.61	328.37	0.44	N/A

Propiedades Físicas y Geométricas

A (cm):	20.32
B (cm):	6.35
C (cm):	1.91
CALIBRE:	11
ESPESOR, e (cm):	0.3
PESO NEGRO (kg/m):	8.14
PESO GALV (kg/m):	8.22
AREA BRUTA (cm²):	10.30
AREA EFECTIVA (cm²):	8.22
Ix (cm4):	612.97
Iex (cm4):	612.97
Sx (cm³):	60.33
Sxe (cm³):	60.33
Iy (cm4):	50.17
Iey (cm4):	50.17
Sy (cm³):	10.84
Sye (cm³):	10.73
rx (cm):	7.71
ry (cm):	2.21
Xcg (cm):	-4.19
Ycg (cm):	0
J (cm4):	0.31
Cw (cm6):	3994.2



Cargas Gravitacionales

Carga muerta - D (kg/m²):	42.46
Carga viva de cubierta - Lr (kg/m²):	50
Carga de granizo - G (kg/m²):	0
Viento en presión (kg/m²):	0
Viento en succión (kg/m²):	0

Combinaciones Hipótesis de Cargas	Carga Última En Dirección Horizontal Wh(Kg/m)			Carga Última En Dirección Vertical Wv(Kg/m)				
	Wucm = γ_{cd}	W CV = γ (CV)	Wu	Wcm = γ_{cd}	W CV = $\gamma_{...}$	WCWp = γ_{CW}	WCWs = γ_{CW}	Wu
1.4CM+0CV+0W	5.91	0	5.91	59.15	0	0	0	59.15
1.2CM+1.6CV+0W	5.07	7.96	13.03	50.7	79.6	0	0	130.3
1.2CM+1.6CV+0.8W	5.07	7.96	13.03	50.7	79.6	0	0	130.3
1.2CM+0.5CV+1.6W	5.07	2.49	7.56	50.7	24.88	0	0	75.58
1.2CM+1CV+0W	5.07	4.98	10.05	50.7	49.75	0	0	100.45
0.9CM+0CV+1.6W	3.8	0	3.8	38.02	0	0	0	38.02
0.9CM+0CV+0W	3.8	0	3.8	38.02	0	0	0	38.02

Combinaciones Hipótesis de Cargas	Momento Último Mu(kg.m)		Cortante Último Vu(kg)	
	Muy	Mux	Vuy	Vux
1.4CM+0CV+0W	17.61	176.07	7.22	144.32
1.2CM+1.6CV+0W	38.79	387.88	15.9	317.94
1.2CM+1.6CV+0.8W	38.79	387.88	15.9	317.94
1.2CM+0.5CV+1.6W	22.5	224.97	9.22	184.4
1.2CM+1CV+0W	29.9	299.02	12.26	245.1
0.9CM+0CV+1.6W	11.32	113.19	4.64	92.78
0.9CM+0CV+0W	11.32	113.19	4.64	92.78

Mux = 388 kg.m

Muy = 39 kg.m

Vux = 318 kg

Capacidades de la sección

Mnx (kg-m):	2112
Mny (kg-m):	376
Mnrx (kg-m):	1069
Vnx (kg):	10229
Condición de soporte lateral:	1
Lb (m) (Longitud no arriostrada):	4.88
Lu (m):	1.32
Lr (m):	2.94
Cb:	1
Fe (kg/cm ²):	902.72
Fc (kg/cm ²):	902.72
ϕ Mnx (kg-m):	490.17
ϕ Mny (kg-m):	357.2

Análisis De Deflexiones

Inercia de la sección Ixe (cm ⁴):	613	
Δy (cm) CV:	0.295	
Δ_{adm} (cm) CV: L/240=	2.033	OK
Δy (cm) CM+(CV ó G):	0.546	
Δ_{adm} (cm) CM+(CV ó G): L/180=	2.711	OK
Δy (cm) CV en voladizo:	0	
Δ_{adm} (cm) CV en voladizo: L/180=	0	NA
Δy (cm) CM+(CV ó G) en voladizo:	0	
Δ_{adm} (cm) CM+(CV ó G) en voladizo: L/120=	0	NA

